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For related information see also *Astronautics*.

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83 ECONOMICS AND COST ANALYSIS 132
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 133
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 133
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 135
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 135
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 136
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 137
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 137
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 137

Note: N.A. means that no abstracts were assigned to this category for this issue.

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TYPICAL CITATION AND ABSTRACT

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NASA ACCESSION NUMBER → N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif ← CORPORATE SOURCE

TITLE → STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

PUBLICATION DATE

AUTHOR → D J Mourey 3 Sep 1979 409 p refs

CONTRACT OR GRANT → (Contract NAS1-15624)

AVAILABILITY SOURCE

REPORT NUMBER → (NASA-CR-159149) Avail NTIS HC A18/MF A01

CSCL 01C ← COSATI CODE

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined A preliminary design of the aeroelastically tailored forward swept wing is presented

A.W.H

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, HELMET MOUNTED DISPLAY (HMD)
R. Lohmann, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DN881383; N62269-77-C-0504)

Conduct a three-phase development of an HMD that will have more efficient aircraft weapon control and delivery capability than conventional aircraft weapon control systems. This contract supports work unit ZA601, Agency Accession No. DN681080.

Phase one will demonstrate the feasibility and advantages of a binocular, stereoscopic HMD in order to eliminate retinal rivalry and suppression of display image as may occur in a monocular display, and to add a new dimension of true depth perception in displays. The second phase will involve verification of the concepts developed in phase one and will interface helmet and electronic design with weapon systems. Phase three will be a full-scale development of the improved system.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0002, IMPROVED SYSTEMS FOR POSITIONING AND RESTRAINT FOR EJECTION SEATS
N. Bice, Pacific Scientific Co., *Anaheim, California* 92803 (DN881138; N62269-77-R-0122)

Investigate and develop systems and/or devices to provide improved restraint and pre-positioning for proper body positioning during ejection. This contract supports work unit ZA601, Agency Accession No. DN681080.

A contract has been let to Pacific Scientific Corp. for the design and manufacture of prototype hardware for lower lap belt thrusters, head and neck restraint actuation and separation cutter as an integrated system, developed primarily for the MPES.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0003, DEVELOPMENT AND EVALUATION OF ADVANCED PARACHUTE CANOPY DESIGNS
J.D. Boone, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN937028)

To improve consistency of parachute canopy operation, simplify manufacturing procedures, improve quality control, reduce opening shock loads, reduce weight and bulk and improve operational envelope as a result of basic design capability. More specifically, a parachute canopy consisting of much less than the approx. 130 pieces in the present 28-ft. flat canopy; reduction in operating forces by use of variable porosity and energy absorbing materials; maintain, as a minimum, the present capabilities; reduce weight and bulk by 20%.

Bulk and weight to be reduced by use of wider fabric and new design and construction to reduce number of seams and reinforcing tapes. New materials to be used where same performance can be obtained with weight and bulk savings. Energy absorbers (peak load limiters) to be used to reduce strength requirements and therefore weight and bulk.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0004, IMPROVED HARNESS RESCUE LINK
D. Goodrich, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN895416)

Design and qualify a helicopter pick-up link for use on the MA-2 torso harness which incorporates fleet requirements regarding versatility, strength and non-interference on the other aircrew equipment.

Use surveys, interviews, and on-site inspections and UR data to define specific fleet requirements. Design and test appropriate prototype configurations. Select superior configurations and prepare design specifications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0005, STUDY OF EXPERIMENTS ON CONDENSATION OF NITROGEN BY HOMOGENEOUS NUCLEATION AT STATES MODELLING THOSE OF NATIONAL TRANSONIC FACILITY
P.P. Wegener, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (NSG 1612)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0006, HIGH PERFORMANCE COMPOSITES AND ADHESIVES FOR V/STOL AIRCRAFT
L.B. Lockhart, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680029)

The program objective is to develop high-toughness, high-temperature stable resins for use in graphite-fiber composites and as adhesives in V/STOL aircraft, to characterize these materials for quality control and reliability, and to utilize the materials property data for optimized design of a prototype V/STOL structural element.

Developmental and commercial resins that promise to meet the requirements for V/STOL application will be characterized by spectroscopic and thermomechanical analysis. The mechanical performance and fracture behavior of these resins and of the adhesives and composites fabricated from them will be determined. The data will be used for (a) the design optimization of a V/STOL composite and adhesive-bonded structural element, (b) guidance for further improvements in resins, adhesives and composites, and (c) development of quality control parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0007, AIRCRAFT/STORE SEPARATION ANALYSIS
C.W. Pinney, U.S. Dept. of Defense, Air Force, Armament Lab., *Eglin Air Force Base, Florida* 32542 (DF626640)

Air Force function - air delivered weapons. Deficiency or opportunity currently the only known approach to this problem is actual flight tests backed up by limited 'free-drop' wind tunnel testing. The conventional method of wind tunnel store separation testing, the captive trajectory system, cannot be used for multiple bombracks because their geometry preculudes adequate installation of mounting hardware and sensing devices to measure the aerodynamic loads. Flight testing to establish multiple bomb rack jettison envelopes is by far the most dangerous of all separation testing especially if adequate predictions and trends are not established prior to the flight tests. At lease one aircraft has been lost during jettison tests. Historically, 'free-drop' wind tunnel tests preceeding flight tests have been limited as this extremely expensive technique requires dynamically-scaled models which are released in the wind tunnel and only about one trajectory can be obtained per hour of wind tunnel testing. As a result of these incomplete investigations multiple bombrack jettison envelopes published for operational use are usually limited to a maximum release speed of 250 to 275 KCAS. This requires that the pilot slow down from normal combat speeds if it becomes necessary to jettison his bomb load, thereby placing the aircraft in a vulnerable position. Objective - to develop a cost-effective semi-empirical computer simulation technique to accurately predict the trajectories of multiple bombracks (empty and with various weapon configurations) jettisoned from high performance aircraft. How work contributes - if successful, this effort will provide a cost-effective method of thoroughly analyzing multiple bombrack separation characteristics throughout the complete aircraft flight envelope, thus enhancing flight safety of jettison testing and possibly expanding jettison envelopes for increased combat effectiveness.

The semi-empirical computer simulation technique that will be used to predict the trajectory of a jettisoned multicarriage bombrack incorporates a six-degree-of-freedom computer program based on the equations of motion and the loads which the bombrack encounters as it passes through the aircraft flow field. These loads are expressed as force and moment coefficients (both free stream and interference) and serve as external inputs to the computer program. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0008, ADVANCED ENGINE CONTROL/DIAGNOSTICS INTEGRATION AND DEMONSTRATION

J. Weber, General Motors Corp., Detroit Diesel Allison Div, *4700 W. 10th St., Indianapolis, Indiana* 46206 (DN889783; N00140-78-C-0027)

The objectives of this program are to develop, verify and demonstrate computer software (control logic) capable of closed-loop control of an advanced variable cycle engine (VCE). The logic developed for demonstration on the joint technology demonstrator (JTD) engine will provide closed-loop control of all engine variables and will provide gradual transients because of the experimental nature of this engine. The control logic will be programmed into the Bendix EH-K1 engine-mounted digital controller for the demonstration. Alternate control logic will be developed for verification via hybrid computer simulation, which will fully demonstrate the VCE features, such as airflow regulation, specific fuel consumption (SFC) optimization, thrust response optimization, etc. The logic will include control system diagnosis as well as some sensor, actuator and engine performance/ condition monitoring.

This program is planned as a two-phase effort of approximately 30 months duration. Phase 1 consists of control logic development, input signal characterization, control diagnostics and engine condition monitoring logic development, software coding and checkout on the hybrid computer, and finally on-engine demonstration during the build-up (BU) 1 test of the JTD engine. Phase 2 will consist of the updating of the control and diagnostic logic, updating and recording the software, and demonstration on the BU 1a test of the JTD engine.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0009, THREE-DIMENSIONAL AERODYNAMICS OF TURBOMACHINES

S. Fleeter, Purdue University, Graduate School, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 3285)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0010, STRUCTURAL DESIGN OF HELICOPTER AND BALLISTIC SURVIVABILITY

D.F. Haskell, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Modeling Div., *Aberdeen Proving Ground, Maryland* 21005 (DA0P4473)

To develop an anlytical method for predicting the structural dynamic response of fragment-damaged line and panel composite elements subjected to blast loading.

An optimum structural design technique for helicopter survivability will be developed. Both undamaged and damaged line and panel composite elements will be modeled and their response to blast loading will be calculated. These line and panel elements will then be used to analytically build a composite helicopter primary structural component and study its structural dynamics behavior in the undamaged and damaged conditions.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

1.0011, SELF-CONTAINED CARTRIDGE FOR ADVANCED EJECTOR SYSTEMS

W.P. Peck, U.S. Dept. of Defense, Navy, Naval Ordnance Station, *Indian Head, Maryland* 20640 (DN896203)

To investigate self-contained cartridge concepts and apply the resulting technology to advanced ejector systems. The objective is to decrease stores release/ejection equipment maintenance and thus reduce aircraft turn-around time and increase aircraft operational readiness.

A self-contained cartridge design will be investigated which will encapsulate all propellant combustion products. This will provide a totally clean power source for stores release/ejection equipment. The cartridges will be tested in a breadboard ejector system. During FY 78 a cartridge case design will be investigated. Materials will be evaluated for adaptability to deep drawing techniques and the high stress/fatigue encountered during operation. Effort in FY 79 will include finalizing case design concepts based upon FY 78 initial feasibility testing, and investigating propellant formulations which will meet self-contained cartridge performance requirements. New/modified propellant compositions will be evaluated to attain the formation of a high percentage of condensables upon functioning to result in low residual internal cartridge pressure. In FY 80, self-contained cartridge and propellant designs will be optimized and the design feasibility testing program conducted.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0012, THEORETICAL INVESTIGATION OF HIGH-LIFT AERODYNAMICS

A.G. Bennett, Mississippi State University, School of Engineering, Dept. of Aerophysics & Aerospace Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (NSG 1623)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0013, PAVEMENT DETERIORATION ANALYSIS

V.C. Barber, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0T8181)

To develop methodolgy for the analysis of and prediction of functional and structural deterioration and the resultant attrition of serviceability of airfields and roads. To define all pertinent modes of deterioration, their respective mechanisms and rates and influence upon pavement system deterioration. To develop methodology for incorporation of these developments into

design, maintenance, and evaluation procedures in a manner to provide for pavement life-cycle management.

This effort is structured on a five-year basis with intermediate milestones. The approach for the remaining years consists of collecting data for validation of the deterioration analysis and reliability analysis procedures developed during FY 77. The deterioration and reliability analysis procedures developed will be published during FY 78 in the first-generation form and validated versions will be published as they become available. The work herein is applicable to all pavement types and is contingent upon the availability of data.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

1.0014, INVESTIGATION OF SOLID STATE DEPOSITION TECHNOLOGY APPLIED TO AERODYNAMIC INSTRUMENTATION
W.C. Rose, University of Nevada, Reno Campus, Graduate School, *Reno, Nevada* 89507 (NSG 2395)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0015, ANALYSIS & MODELING OF AIR TRAFFIC CONTROL SYSTEM PERFORMANCE MEASURES
Unknown, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (FA78NA-5060; FA161451 (TRAIS NO.))

This contract addresses the statistical analysis and modeling of air traffic control (ATC) system performance measures. Its purpose is to develop analytical solutions and simulation/modeling which will more adequately describe the 'real' physical environment. The models will be both descriptive and predictive. To fulfill the contract, it is necessary that data are collected and analytical routines are developed to ensure that numerical/statistical individual data set is analyzed. At least one of the by-products of this modeling will be the determination of an estimate of collision risk.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0016, PRELIMINARY INVESTIGATION OF THE EXTERNAL FLOW ANALYSIS FOR DENSITY MEASUREMENTS AT HIGH ALTITUDE
G.K. Bienkowski, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (NSG 1630)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0017, FREE STREAM DISTURBANCES, CONTINUUM EIGENFUNCTIONS, BOUNDARY LAYER INSTABILITY AND TRANSITION
H. Salwen, Stevens Inst. of Technology, Graduate School, Dept. of Physics & Engineering Physics, *Castle Point Station, Hoboken, New Jersey* 07030 (NSG 1619)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0018, X-22A TASK - V/STOL FLIGHT RESEARCH PROGRAM
J.L. Beilman, Calspan Corp., Dept. of Aerodynamic Research, *1422 Genesee Ave., P.O. Box 235, Buffalo, New York* 14221 (DN881490; N62269-78-C-0043)

To flight-validate emerging new V/STOL flying qualities criteria with emphasis on the hover low speed and transition flight characteristics. This contract supports work unit ZA601, Agency Accession No. DN6810809.

This is a 2-year program divided into four subtasks each of which deals with a high priority segment of V/STOL flying qualities. Subtask A addresses hover low speed translational rate control flying qualities criteria in VFR flight. Flight experiments will be performed with turbulence control power and equivalent system form as elements of the experiment matrix. Pilot opinion ratings will be obtained, results analyzed and a final technical report issued. Remaining subtasks will be defined pending results of subtask A.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0019, INVESTIGATION OF PASSIVE SHOCK WAVE-BOUNDARY LAYER CONTROL FOR TRANSONIC AIRFOIL DRAG REDUCTION
H.T. Nagamatsu, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Mechanical Engin Aeronautical Engin & Mechanics, *110 8th St., Troy, New York* 12181 (NSG 1624)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0020, VISCOUS INTERACTION EFFECTS ON AIRFOIL PERFORMANCES
O.R. Burggraf, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NSG 1622)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0021, AIRCRAFT/WEAPON SYSTEM OPTIMIZATION
R.D. Dyer, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140170)

Air-to-ground attack aircraft can experience severe degradation of performance when carrying weapons externally. Internal carriage results in volumetric penalties to the aircraft and presents a difficult design problem for the weapons bay, bay doors and for weapon separation at supersonic speeds. Advanced forms of weapons carriage such as tangent/conformal mount minmize the adverse effects of external carriage and also show promise for providing a better launch environment. The objective of this effort is to develop prediction techniques and design criteria for external and internal carriage of weapons on current and future tactical aircraft to minimize the clean aircraft performance degradation and to reduce operating costs through fuel savings.

Experimental program will be initiated to acquire basic data on aircraft/store compatibility. These data will include aeroacoustic data in weapon bay cavities with and without suppression devices and isolated store force data. The aircraft/external store interference prediction technique generated under contract F33615-73-C-3018 will be computerized and evaluated using available experimental data. Technical problems lie in the complex interference flow conditions in the transonic speed range which force reliance on experimental data as the basis for prediction of method development.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, NAVIGATION/FLIGHT CONTROL INTERFACE
J.A. Kocher, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF134830)

The Air Force function for this effort is to examine tradeoffs between pilot workload and tracking performance for flight paths of varying complexity, and recommend techniques for reducing pilot workload. With the impending imposition of area navigation upon the civil and military fleet, no definition has been given to the control techniques and accuracy requirements to comply with future National Airspace System (NAS) criteria. The objective of this effort is to document pilot workload difficulties associated with real-time flight path modifications and develop new methods for trajectory management. This development will provide the Air Force with information contributing to precise spatial control of military flight vehicles while maintaining NAS compatibility.

A commercial area navigation system is installed in a C-135 test aircraft. Hardware and software modifications to the basic system will be performed under contract. A flight test study will

be conducted to measure path tracking performance for several flight test profiles of varying complexity. A set of recommendations will be generated to indicate areas of possible pilot workload savings and performance improvements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, AIRCRAFT LINEAR AND ANGULAR VIBRATION PREDICTION

M.W. Obal, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136760)

Due to the inadequacy of present prediction techniques for aircraft vibration environments, many complex and expensive avionics and weapons systems are unreliable or overdesigned. The performance of electro-optical and inertial sensing systems is dependent on angular as well as linear vibration, but very little is known about this environment. Present vibration prediction methods will be improved with an empirical prediction technique for the vibration induced by the noise environment of fighter aircraft and the vibration transmission paths to internal equipment mounting locations. A compendium of angular vibration data from flight tests on fighter, transport, and bomber aircraft will be produced, and this data used to formulate an empirical prediction technique for angular vibration.

This effort will be approached in two phases. First, external acoustic excitation will be correlated with acceleration response at equipment mounting locations in an RF-4C at several flight conditions. Statistical regression analysis will be conducted on the flight test data to relate responses and excitations, and confidence intervals about the regression lines will be established. Concurrently, angular vibration measurements will be made on the RF-4C and other types of aircraft to provide a compendium of angular vibration data. Since angular vibration transducers for these measurements are not readily available, the second phase will begin with a comprehensive investigation into angular transducers and their calibration techniques. An empirical prediction technique will be developed from the flight data with special emphasis on relating angular and linear vibration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0024, DEVELOP NEW TECHNOLOGY CONCEPTS FOR AERODYNAMIC GROUND TESTING

D.M. Parobek, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141810)

In the development of advanced tactical and V/STOL fighters, transonic transports, experimental hypersonic cruise aircraft, as well as other hypersonic strategic weapons systems, subsonic and transonic aerodynamic characteristics are particularly problematic and must be studied extensively in a quality test flow. The Aeromechanics Division has no such in-house facility to carry out this mission because of conversion to space-oriented facilities in the early 1960's. The objective of this effort is to develop new concepts for aerodynamic ground testing up through the transonic regime and also the hypersonic regime, to more effectively impact development of current and future weapons systems.

Analytical and prototype experimental studies will be performed for an advanced transonic test section design for a new gas-dynamic facility. Advanced capabilities and test concepts for high energy flow test facilities will be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, CLOSED ENVIRONMENTAL CONTROL SYSTEM EVALUATION

R.W. Watts, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141540)

Future high performance military aircraft will encounter severe mission penalties if conventional approaches to the environmental control system (ECS) are used. Reduction of significant mission take-off-gross-weight (TOGW) penalties is possible through development of a closed-loop ECS. This ECS concept can reduce engine bleed air and ram air penalties by approximately 80 percent. Additional reliability and cost savings are attainable through new designs. The objective of this effort is to develop criteria for the most important elements of the closed-loop ECS (the air cycle machine (ACM), drive system, expansion devices).

Test those elements of a closed-loop ECS that are needed to improve the life cycle cost of advanced aircraft. These elements would include the Rovac models 607 and 608 ACM, a closed-loop hydraulic drive, and various expansion and refrigeration machines which will enhance closed-loop ECS performance. Initiate analysis programs to determine the stability and control characteristics of various closed-loop ECS configurations. For example, a model shall be constructed on the 'easy' dynamics program to study closed-loop arrangements under dynamic inputs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, AERODYNAMIC PREDICTIONS FOR ANALYSIS AND DESIGN

T.M. Weeks, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF131990)

Aerodynamic prediction methods for analysis and design are required throughout the subsonic, transonic, and supersonic speed range of advanced technology military aircraft. The objective is to obtain for in-house use both quick turn-around programs (level 1) and more comprehensive programs providing much greater accuracy (level 2). Computer programs for handling arbitrary configurations will be obtained and appropriate theoretical and experimental investigations will insure their validity. These programs are necessary to prevent technological deficiencies and reduce development cost.

Existing level 1 programs will be extended to handle advanced technology concepts. Capabilities of current level 2 programs will be identified, obtained/extended where possible and new programs developed. Analytical efforts and experimental investigations will provide validation of key features of computer programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, FINITE ELEMENTS FOR ROTOR/STATOR INTERACTIVE FORCES IN GENERAL ENGINE DYNAMIC SIMULATOR

M.L. Adams, University of Akron, School of Engineering, Dept. of Mechanical Engineering, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NSG 3283)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0028, STUDY OF BOUNDARY LAYER TRANSITION USING TRANSONIC-CONE PRESTON-TUBE DATA

P.M. Moretti, Oklahoma State University, Graduate School, Dept. of Mechanical/Aerospace Engineering, *211-215 Whitehurst Hall, Stillwater, Oklahoma* 74075 (NSG 2396)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0029, COCKPIT MOTION SYSTEM TESTING

C. Negron, ARC Corp., *1300 Industrial Hwy., Southampton, Pennsylvania* 18966 (DN994020; N61339-79-C-0020)

Provide goods and software services necessary to satisfy the requirements of project 9732, motion system testing. Support includes software assembly and testing software, and field testing on operaional system.

Develop testing plan, write software for plan, determine computer sizing requirements, test software, systems integration, local testing, field testing.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

1.0030, DEMONSTRATION OF ADVANCED CARGO RESTRAINT HARDWARE FOR COD AIRCRAFT
J. Shefrin, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DN881347; N62269-77-C-0429)

This effort is intended to demonstrate advanced cargo restraint hardware components and the integrated restraint of a unit of cargo. The demonstration hardware and dynamic testing is part of a program of hardware/system concept assessment for Navy COD and VOD type aircraft. The objectives of an advanced cargo restraint system for COD aircraft include reduced turnaround time (for cargo handling, tiedown, release, reconfiguration) and minimum cost. Energy management design technology will be applied to enhance system integrity and crew/passenger survivability under aircraft crash conditions. Supports work unit ZA601, DN681080.

Demonstration restraint hardware will be provided for installation and dynamic testing at a horizontal accelerator facility. The effort will include analysis, design, and fabrication of adjustable restraint tension members and load limiters, and supply of tiedown hardware for restraint of a unit of cargo. An installation and test plan will be provided. Hardware installation and testing will be accomplished in accordance with the approved installation/test plan under the direction of the contractor.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0031, THE BOUNDARY LAYER ON COMPRESSOR CASCADE BLADES
I. Kubo, Pennsylvania State University, University Park Campus, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (NSG 3264)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0032, ANALYTICAL AND NUMERICAL GAS DYNAMICS
L. Sirovich, Brown University, Undergraduate School, Dept. of Applied Mathematics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NSG 1617)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0033, INTERNAL COMPUTATIONAL FLUID MECHANICS PROGRAM FOR TURBOMACHINERY
M. Kurosaka, University of Tennessee, Knoxville Campus, Graduate School, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NSG 3287)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0034, HT RM 78-28 - ANALYSIS OF HIGH-FREQUENCY VIBRATION DATA
R. Hunthausen, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3815)

To investigate the feasibility of using high-frequency vibration data to diagnose the condition of helicopter drive train components.

Using vibration data acquired on known discrepant parts during the AIDAPS program, apply latest and most advanced techniques of analysis and attempt to establish correlation between the analysis results and the known part condition.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0035, HT RM 78-22 - ANALYSIS OF INCREMENTAL CHANGES IN USEFUL LOADS
Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3829)

After an aircraft is in the Army inventory, minor changes are made which alter the useful load of the aircraft. Such changes affect the ability of the aircraft to meet its mission, so the cost of additional resources necessary to accomplish a given task must be assessed. The objective of this program is to develop a technique to use when analyzing the cost, in terms of meeting a constant objective, of incremental reduction in useful load in fielded aircraft.

The technical objective will be accomplished in seven steps: (1) literature search; (2) definition of parameters to be studied; (3) development of analysis technique (measures of worth); (4) data definition and collection plan (r and m cost); (5) definition of aircraft operating environment; (6) detailed analysis of aircraft operating characteristics; and (7) preliminary example study.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0036, LIGHTPLANE HANDLING QUALITIES STUDY AND FLIGHT TESTS
R. Shade, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Langley Research Center, *Hampton, Virginia* 23665 (FA77WAI-797; FA161236 (TRAIS NO.))

Equipment loan and transfer of accountability from the FAA to the NASA Langley Research Center, during the lightplane handling qualities study and flight tests being conducted at and by Princeton Universtity under NASA contract.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, PIONEER VENUS DATA ANALYSIS
M.B. McElroy, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAS 2-10249)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

2.0002, TECHNOLOGY SUPPORT FOR TARGETING THE REENTRY OF SKYLAB
Unknown, Pennsylvania State University, University Park Campus, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (NASW 3256)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, HOMOGENEOUS AND HETEROGENEOUS TERNARY COMPLEXES INVOLVING NUCLEOTIDES, METAL CATIONS AND AMINO ACIDS
J. Orenberg, California State University & Colleges, San Francisco State University, School of Science, Dept. of Chemistry, *1600 Holloway Ave., San Francisco, California* 94132 (NCA2-660902)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0002, INVESTIGATION OF CONTROLLED NUCLEATION THERMOCHEMICAL DEPOSITION (CNTD) MECHANISM AND PROPERTIES

R.A. Holzl, Chemetel Corp., *Pacoima, California* 91331 (DF047780; F49620-77-C-0086)

AF function - ceramic materials are being developed for a variety of components (e.g. blades, vanes, combustors, bearings and seals) in future gas turbine engines and for a variety of electronic and optical components in aircraft. Opportunity - a new CVD-like process known as CNTD (controlled nucleation thermochemical deposition) has been developed for producing very fine-grained materials having superior mechanical properties. Objective - the objective of this research is to study the mechanism and deposition parameters of CNTD for fine-grained high-strength silicon carbides. How work contributes - silicon carbide and silicon nitride filaments, films and monolithic shapes are needed for rocket nozzles, turbine components, and radome applications. Silicon carbide was selected for the initial studies in order to utilize the extensive experience in conventional vapor deposition of SiC.

The optimum deposition parameters for CNTD will be established to produce fine-grain, high-strength SiC. Microstructure and mechanical testing data will be used in an iterative development cycle for optimizing the process.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, A KINETICS STUDY OF THE REACTION OF METHYLPEROXY RADICALS WITH NITROGEN DIOXIDE

Unknown, Georgia Tech Research Inst., *Atlanta, Georgia* 30332 (FA78WA-4259; FA161585 (TRAIS NO.))

This study is to measure by direct observation of reactants and/or products over the relevant range of tropospheric temperature and pressure the absolute reaction rate of peroxy methyl radicals (CH3O2) with nitrogen dioxide (NO2).

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

3.0004, FLOW LEADING TO FRACTURE

P.P. Gillis, University of Kentucky, School of Engineering, Dept. of Metallurgical Engineering, *Limestone & Euclid, Lexington, Kentucky* 40506 (DF049330; AFOSR-77-3379)

AF function - improved quality of aerospace vehicle structures can lead to enhanced durability. Deficiency - the basic understanding of the mechanics of metal deformation during processing does not exist to the degree which can lead to improved quality of structures. Objective - the objective of the research is to understand the stress and deformation states of a metallic material as it is processed and the relationship of these states to fracture. How work contributes - this research contributes to the basic understanding of metal deformation processes which can affect AF manufacturing technology efforts.

Based on a material constitutive law which considers both the hardening and strain rate effects, a theory is being investigated which will predict the regions of material flow (yielding) and the kinematic boundaries. This theory was applied to one-dimensional problems during the past year. Extension of this theory to two dimensions will be the central focus of the present research. Also, material phase transformations will be studied for possible modifications to the basic constitutive behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, MATERIALS SUPPORT TECHNOLOGY - ADVANCED ALUMINUM ALLOYS BASED ON RAPIDLY-SOLIDIFIED POWDERS

N.J. Grant, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN875330; N00014-78-C-0385)

This research addresses a possible method for producing high specific strength aluminum alloys for use in advanced Navy systems. Such alloys are needed for missile, aircraft and surface ship components where fatigue and/or creep are major design considerations.

The investigators will prepare rapidly-solidified powders by the roll-quenching and ultrasonic atomization techniques. The aluminum-lithium alloy system will be emphasized with controlled additions of Cd, Cr, Be and Mn. Powders will be canned, extruded and then various heat treatments applied to optimize properties. Structure will be determined by transmission and scanning electron microscopy. Mechanical properties of interest to be measured include tensile properties, fatigue, toughness and creep rupture resistance.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0006, CREEP AND FATIGUE OF AIRCRAFT ENGINE ALLOYS

F.S. Hodi, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0F4741)

To investigate the degradation of mechanical properties of aircraft engine alloys as a function of temperature and time. Specifically the interaction of creep and fatigue in titanium alloys will be studied.

Testing to study the creep-fatigue interaction of an alpha alloy will continue. These results will assist in determining an acceptable design standard to incorporate both phenomena at temperatures 700-900 degrees F. Strain-controlled fatigue tests will be conducted at high frequency so that creep will be excluded from the deformation. To simulate gas bending forces, rotating beam equipment has been adapted for elevated temperature testing.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0007, ALTERNATE FUELS NITROGEN CHEMISTRY

J.W. Frankenfeld, Exxon Research & Engineering Co., Government Research Labs, *1600 Linden Ave., Linden, New Jersey* 07036 (DN890054; N00019-78-C-0177)

The objective of the program is to find the effect of the presence of nitrogen compounds in shale-derived alternate jet fuels on the storage stability of the fuel.

Deposit formation will be studied as a function of pyrrole, indole and carbazole compounds in n-decane. Effects of trace materials which inhibit sedimentation will be studied. The kinetics and mechanisms of formation of deposits will be studied and the structures characterized.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0008, THEORETICAL DETERMINATION OF STRUCTURES, BENDING ENERGIES AND VIBRATIONAL FREQUENCIES

A.B. Anderson, Case Western Reserve University, Graduate School, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NSG 5392)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

3.0009, OPTICAL STUDIES OF LUBRICATION AND TRANSFER FILMS FOR PROSTHETIC DEVICES

B.D. Cahan, Case Western Reserve University, School of Science, Dept. of Chemistry, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (NSG 3288)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0010, NON-DESTRUCTIVE TEST TECHNIQUE

A. Mahon, Qual X Inc., *4065 N. Leap Rd., Hilliard, Ohio* 43026 (DN789758; N00019-76-C-1142)

To KET inspect engine hardware and test materials supplied by the Naval Air Propulsion Test Center and the Naval Air Systems Command (Air-330A).

To develop KET standards and specifications and trouble shoot service problems. Apply KET to key components.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0011, A STUDY OF OPTIMAL ELECTRODE PREPARATION FOR THE ELECTROCHEMICAL CONCENTRATION CELL OZONESONDE
D.C. Thornton, Drexel University, School of Science, Dept. of Chemistry, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NSG 6035)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

3.0012, THE LONG WAVELENGTH INFRARED ABSORPTION BY SO2 AND ITS IMPORTANCE IN FORMING VENUS' GREENHOUSE
R.W. Lovejoy, Lehigh University, Graduate School, Dept. of Chemistry, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (NCA 2-380901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0013, NAVY VEHICLE DESIGN AND CONSTRUCTION - FRACTURE OF METALS AND ALLOYS
H.G. Wilsdorf, University of Virginia, School of Engineering & Applied Science, Dept. of Materials Science, *Garrett Hall, Charlottesville, Virginia* 22903 (DN023110; N00014-75-C-0855)

The goal of this research is to gain a better understanding of crack propagation and fracture processes occurring in metals and alloys. This knowledge will be useful in the development of reliable, crack-resistant alloys needed in advanced naval systems such as high performance aircraft and deep diving submarines.

Crack propagation and fracture of various metals and alloys is being observed directly in a 500kV electron microscope. This allows dislocation interactions and fracture processes to be observed on a near atomic scale in specimens which exhibit bulk rather than thin film behavior. Correlation of experimental observations with theoretical fracture analyses is being undertaken.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0014, CALCULATION AND ASSESSMENT OF INTERLAMINAR STRESSES IN LAYERED COMPOSITE MATERIALS
N.J. Salamon, University of Wisconsin, Milwaukee Campus, School of Engineering & Applied Science, Dept. of Mechanics, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (DF053310; AFOSR-78-3680)

AF function - advanced lightweight flight vehicles will use composite materials to improve their structural efficiency. Deficiency - the interlaminar failure mode of composite laminates is not predictable within the desired confidence level. Objective - to develop improved methods for the prediction of interlaminar stresses in laminates and the associated failure strength. How work contributes -research results will aide in fully understanding the failure of complex laminates.

Initial studies will focus on the analytical and numerical methods which can be used to predict the singular stress behavior. Both solution accuracy and efficiency will be considered in assessing the feasibility of the solution methods. In addition, an experimental investigation will be conducted in order to achieve verification of the predicted behavior. Both damage initiation and growth will be studied in the laboratory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0015, TRANSPORT AND RECOMBINATION PROPERTIES OF LEAD TIN TELLURIDE ALLOYS
K. Weiser, Technion, *Haifa, Israel* (DF050450; AFOSR-78-3509)

AF function - secure space communications and cover optical electronics require devices which exploit special properties and interactions of materials with FAR infrared radiation. Opportunity -infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - this research involves the film growth of lead tin telluride alloy compositions, and characterization and study of fundamental optical properties and electronic structure of these IV-VI compound semiconductors when subjected to tunable CO2 laser pulses. How work contributes - the IV-VI semiconducting compounds are potentially useful as infrared detectors in the 8 to 14 micrometer and 20 to 30 micrometer ranges of the electromagnetic spectrum. The shorter wavelength interval is the primary spectral region for thermal imagery of terrain and ambient temperature objects, whereas the longer interval is of interest for detecting objects against cold-space backgrounds.

Large single crystal films are produced by unique epitaxial vapor phase techniques. The size, thickness and stoichiometry are more easily controlled and tailored to produce homojunctions, heterojunctions of the same or opposite carrier type, graded energy gap junctions or Schottky barriers without resorting to diffusion processes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AERO DESIGN, SIMULATION AND DATA INVESTIGATION OF DEMO ROCKET
J.W. Wallace, U.S. Dept. of Defense, Army, Missile Research & Development Command, Aeroballistics Directorate, *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1014)

To improve the accuracy and reduce the cost of surface-to-surface free flight rockets through aerodynamic techniques.

The aerodynamic configuration design will be established for the demonstration low cost motor vehicle. Work will include wind tunnel tests, final configuration, and related aerodynamic coefficients. Simulations will be conducted using existing rigid body six-degree-of-freedom trajectory digital simulation programs which will be modified to include particulars of the demonstration rocket. Flight data investigations support will be provided to the free flight rocket technology program for the determination of aerodynamic coefficients and exterior ballistic performance.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Free Flight Rocket Technical Office

4.0002, PROPAGATION OF SHOCK WAVES IN RANDOM MEDIA
B. Sturtevant, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (ENG7822089)

Experimental studies will be conducted on the interactions between shock waves and random media. Attention will be directed on the effects of turbulence on shock wave propagation, including scattering and random focusing, and on the effect of shock wave compression on random media, such as vorticity generation, enhanced mixing and subsequent turbulent decay. New optical diagnostic techniques will be developed and information about the propagation of laser light through random media will be obtained as a bonus.

In the long run the results of this research could contribute to, for example, increased understanding of combustion instability and burning rate in burners; the achievement of higher energy release and increased efficiency in high-energy chemical and gas-dynamic lasers; better understanding of transonic shock-boundary-layer interactions, wave drag and boundary-layer separation; and to improve methods for laser transmission.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0003, DELAY OF SEPARATION WITH FREE STREAM TURBULENCE

J.A. Hoffmann, California State University & Colleges, California Polytechnic State University, School of Engineering & Technology, Dept. of Aeronautical Engineering, *San Luis Obispo, California* 93407 (NSG 2391)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0004, THREE-DIMENSIONAL UNSTEADY FLOW THEORY

S.S. Stahara, Nielsen Engineering & Research Inc., *850 Maude Ave., Mountain View, California* 94040 (DN323079; N00014-73-C-0379)

The prediction of aircraft performance during rapid maneuvering, while encountering gusty environments, or to avoid flutter requires a knowledge of unsteady aerodynamic forces. The purpose of this task is to develop an accurate 'analytical' method for calculating the unsteady pressures, forces and moments on broad classes of three-dimensional configurations (wings, slender bodies and wing-body combinations) at transonic speeds.

Though rapid advances have been made in the numerical solution of complex flow fields, the calculation of unsteady aerodynamic flows about three-dimensional configurations by finite difference techniques remains a distant goal because of the computing time involved. In the research under investigation, an analysis of oscillatory motion at transonic speeds will be undertaken. In this analysis it will be assumed that the oscillatory flow is a small perturbation on a basic nonlinear steady flow, which can be obtained theoretically or experimentally. The resultant equation for the oscillatory flow will be solved by the method of local linearization to predict the characteristics of three-dimensional configurations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, THE BEHAVIOR OF SUB-GRID SCALE MOTIONS IN TURBULENT SHEAR FLOW

B. Cantwell, Stanford University, Graduate School, *Stanford, California* 94305 (NSG 2392)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0006, DEVELOPMENT OF TUNABLE LASER ABSORPTION SPECTROSCOPY AND APPLICATIONS TO HIGH TEMPERATURE STUDIES OF NO-NH3 KINETICS

R.K. Hanson, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (ENG7826158)

Research is conducted in four areas related to diagnostics and high-temperature chemical kinetics for combustion. They are: 1. Tunable Diode Laser: Modify optical/electronic arrangement of existing tunable diode laser system for the measurement of minority species. Select wavelengths and optimize system for measurement of nitrogen monoxide and nitrogen oxide. 2. Tunable Dye Laser: Develop dye laser system for tunable laser absorption spectroscopy of specific radical species. Optimize for fixed-wavelength probing of shock-heated flows and for high-resolution modulation spectroscopy of flat flame experiments. 3. Shock Tube Studies of Nitrogen Oxide-Ammonia Kinetics: Conduct shock tube experiments in specific gas mixtures at temperatures of about 1500-3000 degrees K. Analyze data to define a consistent kinetic mechanism and determine rate constants. 4. Flat Flame Studies of Nitrogen Oxide-Ammonia: Modify existing flat flame facility for postflame injection of diluted ammonia. Measure nitrogen oxide and ammonia by microprobe and chemiluminescent analysis, nitrogen oxide and nitrogen monoxide by tunable infrared laser absorption, and other components by tunable ultraviolet/visible laser absorption. Analyze data for mechanism constants with shock tube experiments and determine relevant rate constants.

The research is a continuation in part of research done under NSF Grant ENG76-08279.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0007, NAVY VEHICLE DESIGN AND CONSTRUCTION - FREQUENCY DOMAIN TECHNIQUES FOR DIRECT SYNTHESIS OF DIGITAL CONTROL SYSTEM

R. Whitbeck, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DN875390; N00014-78-C-0391)

The objective of this research effort is to develop a closed-loop solution for direct digital control of continuous plants which is optimal with respect to a continuous cost function. Present control theory does not treat this case. This solution is needed to evolve efficient and successful synthesis of digital control laws for future Navy aircraft and missile flight control systems.

The approach being pursued is to use modern matrix Wiener-Hopf frequency domain techniques to develop an optimal closed-loop solution for direct digital control of continuous plants using a continuous cost function. Indications are that the optimal solution via the Wiener-Hopf approach will specify both the control law and the optimal form of the digital to analog coupler.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, PRECISION BURN-RATE DETERMINATION (PBR)

B.B. Goshgarian, U.S. Dept. of Defense, Air Force, Rocket Propulsion Lab., *Edwards A.F.B., California* 93523 (DF348370)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rocket Propulsion Lab.

4.0009, THREE-INCH DIMENSIONAL BISPECTRA AND THE MEAN RATE OF TRANSFER OF ENERGY IN TURBULENCE

M. Rosenblatt, University of California, San Diego Campus, Graduate School, Dept. of Mathematics, *P.O. Box 109, La Jolla, California* 92037 (NSG 2376)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0010, STUDIES OF OPTICAL-BEAM PHASE-CONJUGATION BY NONLINEAR REFRACTION

R.W. Hellwarth, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF051200; AFOSR-78-3479)

AF function - the University of Southern California has proposed a concept that could have tremendous impact on adaptive optics approaches to Air Force laser systems. These currently involve scanning detectors, interferometers, computers, servosystems and deformable mirrors. All of this hardware could be replaced by a nonlinear element at low power if the nonlinear refractive idea succeeds. Opportunity - nonlinear refraction may be able to generate an output optical beam which has conjugate phase from that of the input beam and the same frequency as the input beam. The important point is that if a laser beam is propagated through an atmosphere and reflected back to the receiver, then it will be subjected to an aberration by the optical path that it traversed. If this aberrated return is used as the signal into the nonlinear refractor the refracted signal would be the phase conjugate of the aberration. This could be injected into a high power laser and phase locked so that the laser generates a beam at high power with conjugate phase of the aberrations in the optical path. Objective - to demonstrate 'proof-of-principle' in the visible using existing nonlinear materials. Contributions - the work provides an alternative to the adaptive optics approach to correcting distortions.

Efforts will be made to reduce pump power requirements from megawatts to kilowatts by both exploring resonant enhancement of the nonlinear index and modifications of beam interaction geometry. It is proposed that a narrow-band dye laser, to be pumped by a repetitive pulsed nitrogen laser, will be built and

tuned near the resonances of various atomic vapors. They will build cells appropriate for containing sodium, rubidium, and potassium vapors as these appear to be the most promising media for experimentation in the visible.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, STUDY OF THE GLOBAL POSITIONING SYSTEM FOR MARITIM CONCEPTS
B.W. Parkenson, Colorado State University, Graduate School, *Fort Collins, Colorado* 80523 (NSG 5352)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0012, DELTA-K RADAR DEVELOPMENT PROGRAM
D.L. Schuler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN480008)

The purpose of this research project is to determine the effectiveness of a coherent dual frequency correlation radar for achieving (a) improved target detection, (b) target classification, and (c) remote sensing of ocean waves and surface currents.

The Delta-K Radar transmits two closely-spaced RF frequencies and, upon reception, cross-correlates the coherently-detected backscattered EM fields to achieve improved detection and classification for both fixed- and moving-ship targets. Target classification is possible because the swept-frequency output of the radar contains target resonances which are similar to those obtained with an hf radar. These characteristic resonances are not overly aspect-angle-dependent and temporal scintillations occur at much lower rates than might be expected for a conventional 1-band system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0013, DELTA-K RADAR DEVELOPMENT PROGRAM
D.L. Schuler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN480224)

The purpose of this research project is to determine the effectiveness of a coherent dual-frequency correlation radar for achieving (a) target classification, and (b) remote sensing of ocean waves and surface currents.

The Delta-K Radar transmits two closely-spaced RF frequencies and, upon reception, cross-correlates the coherently-detected backscattered EM fields to achieve an output which has many of the characteristics of HF return from ships and the sea. Target classification is implemented through swept-frequency measurement of target resonances which occur at the difference frequency. These resonances fluctuate less, and are much less aspect-angle-sensitive than similar resonances obtained using the 1-band carrier itself. Sea spectra and ocean surface currents are remotely sensed by measuring the position and amplitude of the Bragg resonant Doppler line which is present in the spectrum of returns from the sea surface.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0014, COMMUNICATIONS - ATOMIC CROSS-SECTIONS AND HIGH-FREQUENCY COMMUNICATIONS
T.L. Bailey, State University System of Florida, University of Florida, School of Engineering, Dept. of Electrical Engineering, *220 Black Hall, Gainesville, Florida* 32611 (DN623260; N00014-76-C-0127)

The purpose is to study ion-neutral collisions including multiple charge exchange at low energies and determine the cross-sections for these processes. These are of interest to naval communications since these processes occur in various gaseous electronic devices and the ionosphere.

The contractor will evaluate his new high-energy and angle resolution scattering chamber by studying excitation of Ne, Ar, and Xe by protons. He will then determine high resolution differential cross-sections for He(2plus), Ne(2plus), and Ar(2plus) in various gases. Total cross-section for He(2plus), Ne(2plus), CO(2plus), and Ar(2plus) with various atomic a molecular targets will also be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0015, MODULAR THEORY OF INVERSE SYSTEMS
M.K. Sain, University of Notre Dame, School of Engineering, Dept. of Electrical Engineering, *Notre Dame, Indiana* 46556 (NSG 2388)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0016, STRUCTURAL DAMAGE DUE TO HYDRODYNAMIC RAM
K. Kimsey, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0N4441)

The objective of this task is to develop analytical methodologies to predict the structural damage inflicted on in-flight maneuvering aircraft by blast and fragments. The methodologies would be developed for ultimate use as tools for vulnerability assessment and hardening redesign.

Hydrocode solutions will provide tank wall loadings for a K.E. projectile penetrating a water-filled cylinder. These pressure distributions will be employed in structural response and wave propagation programs to quantify the detrimental effects of hydrodynamic RAM and assess the energy-absorbing capacity of candidate RAM mitigators.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0017, DYNAMIC BALLISTIC TESTING-FLIGHT DYNAMICS AND BALLISTIC TECHNOLOGY
L.C. MacAllister, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0A4562)

This project includes ballistic range instrumentation and data analysis improvement and full range projectile dynamics. These applied research programs in the fields of aerodynamics and flight mechanics contribute to the design of, evaluation of, and data base for artillery shell, small arms, missiles and rockets. Tasks covered are the design and test of a projectile with the non-conical boat-tail concept in full-scale artillery calibers including usual real features such as rotating band and fuzing details, the design and procurement of improved optics for range shadowgraphic instrumentation and improved time-based investigations characterizing launch yaw for artillery shell-weapon combinations.

Range and data analysis improvements are pursued by monitoring new developments and implementing applicable ones as well as in-house development. Flight test programs are conducted at the BRL and at other test facilities, and the results analyzed to support the projectile dynamics and non-conical boat-tail objectives.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0018, STRUCTURAL MODEL EVALUATION
J.M. Santiago, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0K4494)

A comparison of good quality experimental structural response data for large plastic deformations with BRL-developed computer code results. Decide on the most suitable code to use for the analysis of the blast response of helicopters, aircraft and tank bottoms.

Strain and deflection measurements made on structural elements that are shock-loaded by air and chemically-driven shock tubes will be compared with results produced by codes that are

designed to predict such respones. Edge conditions and types of engineering materials will be varied in order to fully exercise the capabilities of the codes selected for evaluation. The program will focus on the ability of the code to perform in the elasto-plastic to fracture stress region.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0019, DEVELOPMENT OF ADVANCED SYSTEM IDENTIFICATION TECHNOLOGY

R.A. Burton, U.S. Dept. of Defense, Navy, Naval Air Test Center, *Patuxent River, Maryland* 20670 (DN793171)

The objective of this research program is to develop more cost-effective flight testing procedures that reduce the cost of flight tests and/or provide for a more comprehensive data analysis.

The technical objective of this program is being achieved through the development of advanced systems identification technology. This includes the development of both state and parameter identification algorithms as well as the proper flight testing procedures. These computer algorithms are based on 'optimal filtering theory' and employ advanced statistical concepts such as the 'likelihood principle' from statistical inference theory. Specifically, the parameter identification algorithms being developed are primarily based on the maximum likelihood principle. The state estimation techniques developed are based on derivatives of Kalman filter technology. Data for verification of the accuracy and utility of these computer programs is obtained through specific flight tests conducted at the Naval Air Test Center. These advanced statistical algorithms are being complemented with the development of classical systems analysis techniques, such as root locus analysis to formulate a total system identification.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0020, REFRACTION/SCINTILLATION

R.K. Craine, Environmental Research & Technology Inc., *696 Virginia Rd., Concord, Massachusetts* 01742 (DF902510; F19628-77-C-0074)

AF radar and communications systems operating at low elevation angles are affected by the refractive index structure of the tropospheric propagation medium. Signal level, signal phase and pointing angles change on time scales ranging from seconds to months. Indications are that short-term fluctuations of one hour or less may exist of such magnitudes as to limit the usefulness of long-range correction models based on surface meteorological data, radiosondes, or radiometric measurements. Available data will be investigated and a future study program will be outlined.

Precision tracking data for orbiting spheres have been generated by the Millstone Radar, which will be analyzed to determine instantaneous refraction errors in pointing, cross-section, and phase versus elevation angle. This data plus scintillation measurements at the Haystack and Millstone sites will aid in the design of a measurement program for the LES 8/9 satellite system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0021, ENGINEERING SUPPORT ON THE BCAS PROGRAM

Unknown, Massachusetts Inst. of Technology, Lincoln Lab., *244 Wood St., Lexington, Massachusetts* 02173 (FA77WAI-817; FA161203 (TRAIS NO.))

The purpose of this agreement is to provide Lincoln Laboratory engineering support to the FAA, per Article II, on the BCAS program. Analyze the results of air-to-air measurements and link tests and use the analyses to provide guidance to the hardware and sofware design and experimental activities involved in this program. Conduct flight tests using Lincoln Laboratory Airborne Measurements Facility (AMF) in a DABS mode BCAS interrogation and data-gathering mode. Procure 4 DABS general aviation diversity transponders similar to those previously procured for DABS link testing. Add a rugged airborne computer and a modified IVSI display to the AMF to provide a real-time DABS mode BCAS processing capability.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0022, DEVELOPMENT OF A COMPREHENSIVE NDE (NON-DESTRUCTIVE EVALUATION) EXPLORATORY AND ADVANCED RESEARCH PROGRAM FOR NAVAL AIRCRAFT SYSTEMS

R.C. Deitrich, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696012)

Develop the concepts and follow-on prototype systems to meet future inspection requirements for NDE within the Navy's intermediate and organizational levels of maintenance.

Investigate complexities of various state-of-the-art technologies to develop viable NDE equipment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0023, PROPULSION RESEARCH COORDINATION AND INDEPENDENT RESEARCH AND DEVELOPMENT (IRAD) ACTIVITY

D.F. Brunda, U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center, *Trenton, New Jersey* 08628 (DN789759)

To provide technical and management assistance for the Navy's review and evaluation of IRAD effort, and maintain interest with Navy propulsion activity in research (6.1). This work guides contractor-performed IRAD towards the present and future specific needs of the Navy in propulsion, fuels and lubricants and assures that the state-of-the-art is advanced.

NAPC personnel review, evaluate and perform computer analysis of technical plan brochures and participate in contractor on-site reviews, interact with Navy propulsion research activities and industry/university/government research and technical meetings such as combustion institutes, AIAA, ASME and Project SQUID. Consultation and equipment support is provided to the Virginia Polytechnic Institute (VPI) for its gas turbine research facility.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0024, MOM/BMI SOLUTION CAPABILITIES INVESTIGATION

R.J. Balestri, Braddock Dunn & McDonald Corp., *5301 Central Ave. N.E., Albuquerque, New Mexico* 87108 (DF912370; F30602-78-C-0096)

The objective of this effort is to investigate three methods which may extend the range of the electromagnetic spectrum over which the general electromagnetic analysis for complex systems (GEMACS) computer code can be used to analyze the electromagnetic phenomena associated with radiating and scattering systems and subsystems. The three methods include the use of structure symmetry to reduce the size of the matrix equation to be solved, the use of the magnetic field integral equation to model a structure by a set of patches and the use of the geometrical theory of diffraction to treat bodies with surface areas on the order of hundreds of square wavelengths.

The contractor will use existing algorithms and computer codes to implement the methods into the RADC code, GEMACS. The effect of each method on the efficiency of the banded matrix iteration (BMI) solution technique, in GEMACS, will be investigated. If this method does not seriously degrade the efficiency and applicability of the BMI technique, the change to the GEMACS code will become permanent, and the appropriate code documentation will be generated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0025, MAGNETIC TAPE RECORDING SYSTEMS (FIVE)
J. Bradley, Scientific Recording Systems Inc., *Albuquerque, New Mexico* (DN681278; N62269-75-F-6434)

Fabricate three (3) Mark IIB data acquisition systems. The magnetic tape recording system, model 2311S, is used in the system to record flight loads information. These data are used to update aircraft design criteria. This contract supports work unit ZA101, Agency Accession No. DN681080.

These recording units are production models and have been flight-tested by NADC. The tape outputs are computer compatible. Each unit can record up to 40 channels of data.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0026, DEVELOP A DETAILED PLAN FOR A COMPREHENSIVE FIELD SURVEY ON COMMUNITY RESPONSE TO NOISE
P.N. Borsky, Columbia University, School of Public Health, Dept. of Environmental Health Science, *600 W. 168th St., New York, New York* 10032 (NSG 1616)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0027, AN EVALUATION OF MOSFETS AND METAL SEMICONDUCTOR FET DEVICES AS PREAMPLIFIERS AT LIQUID HELIUM TEMPERATURES (ABBREV)
C.A. Lee, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (NSG 2389)

An evaluation of metal oxide semiconductor field effect transistor and metal semiconductor field effect transistor devices as preamplifiers at liquid helium temperatures.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0028, FINITE-ELEMENT TECHNIQUES FOR AERODYNAMIC COMPUTATIONS OF COMPLEX CONFIGURATIONS
S.F. Shen, Cornell University, Ithaca Campus, Sibley School of Aerospace & Mechanical Engineering, *Ithaca, New York* 14850 (DN223121; N00014-75-C-0375)

The development of accurate and rapid methods for the prediction of the flows about complex configurations is essential for the design and optimization of naval aircraft and missiles. This task will provide for a systematic study of finite-element methods as applied to such flows.

The computation of the flows about complex configurations in aeronautics now tax, and will continue to tax for the foreseeable future, the capabilities of the most advanced computing machines. Hence there is a continuing need to explore and develop new and more efficient methodologies for complicated flows. The major numerical method to date has centered about finite difference approximations to the governing partial differential equations. Alternate procedures are being developed based on finite-element approximations; approximations which appear to be more practical for complex geometries. These finite-element methods may or may not employ variational principles. This research will systematically examine various aspects of the finite-element method. Initially, inviscid incompressible flow will be studied, utilizing a variational principle, with emphasis on the body geometry. These results will be assessed against exact solutions. The major emphasis will be devoted to a study of inviscid compressible aerodynamic problems including transonic flows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0029, SUGGESTED PROGRAMS FOR UNSTEADY TURBINE HEAT TRANSFER
R.E. Mayle, Rensselaer Polytechnic Inst., Graduate School, *110 8th, Troy, New York* 12181 (NSG 3262)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0030, CONFORMAL ARRAYS AND HEMISPHERICAL COVERAGE ARRAYS
J. McIlvenna, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903720)

To develop lightweight, inexpensive, flush-mounted and conformal antenna elements and arrays for aerospace use. Designs are specialized to offer enhanced scanning coverage over the full hemisphere.

To design and test elements and arrays in microstrip that provide increased pattern performance in the end-fire directions. To utilize new array geometries, such as the tent redome concept, in low-drag designs, for airborne communication links.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0031, IONOSPHERIC PROPAGATION SIMULATION
G. Sales, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF902790)

AF function - long-range detection. Deficiency/opportunity - models for simulating HF propagation in the Arctic (auroral) environment are not sufficient to adequately predict the performance of Air Force systems or provide information for the design of new techniques to improve operational capabilities. Objective - development of new theoretical and numerical models of ionospheric characteristics which influence radio wave propagation and the design of improved ray-tracing techniques. Development of a better understanding of radio propagation through small-scale irregularities in the ionosphere, and improvement of state-of-the-art of radio signal detection in the presence of fading and clutter due to propagation through an inhomogeneous ionosphere. How research contributes - this research is directed at improving the inputs to a realistic model of HF propagation particularly in the auroral region of the ionosphere. These new models in conjunction with fast and accurate ray-tracing will allow assessment of system performance to be made in near real-time and with models of auroral HF clutter allow for both prediction of system performance and improved operational capabilities of existing systems.

New and improved ionospheric modelling techniques will be developed primarily on the basis of analysis of existing radio propagation data. Data which in the past could not be used for this purpose (oblique backscatter data) will be incorporated by the use of newly-developed ray-tracing and computational techniques. Data from experimental OTH radars will be used to develop an auroral clutter model. The new ray-tracing techniques will be developed primarily from theoretical considerations, although full advantage will be taken of improvements in the size and speed of modern digital computers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0032, X-RAY DIFFRACTION, INTERFERENCE AND HOLOGRAPHY
N. George, University of Rochester, Graduate School, *Administration Bldg., Rochester, New York* 14627 (DF051510; AFOSR-78-3563)

AF function - non-destructive testing of structural members of aerospace vehicles could benefit greatly from the development of three-dimensional x-ray holography. Deficiency - holographic techniques are highly developed for electromagnetic radiation in the visible spectrum. X-ray holographic techniques, however, have not been developed and little, if any, research has been attempted to develop them. Objective - the objective of this research is to develop x-ray holographic techniques that can be utilized to evaluate non-destructively the interior of structural members of aerospace vehicles. How work contributes - this research could lead to the above objective.

Basic studies will be conducted in x-ray optics directed toward a critical evaluation of the feasibility of x-ray holography. The theory of partial coherence will be used to analyze interference methods for the characterizations of x-ray sources, including Das Gupta's narrow line sources. Related studies of recoding media, microscopy, zone place imaging, speckle and photomixing will be performed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, DESIGN AND TESTING OF SMALL COMPOSITE SPECIMENS

A.V. Sharma, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Mechanical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 1631)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0034, COMMUNICATIONS - ELECTRICAL PROPERTIES OF ION-IMPLANTED GALLIUM ARSENIDE

M.A. Littlejohn, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Electrical Engineering, *Raleigh, North Carolina* 27607 (DN475218; N00014-75-C-0827)

Advanced Navy electronic systems will use components fabricated from materials using new techniques. Gallium arsenide is a semiconductor which offers increased capability in electron devices and the technology and physics must be understood and developed for fabricating devices in this material using ion implantation.

Following the implantation of various impurity ions into gas substrates, different surface encapsulants are applied and thermal annealing of lattice damage is carried out. At each stage, transmission electron microscopy (TEM) or diffraction (TED) measurements are made. Identification is made of vacancy segregations, or interstitial segregations, or impurity precipitates or chemical precipitates, as a function of distance from the surface. The resultant defect profiles are correlated with electrical properties of the implanted samples. Silicon dioxide and silicon nitride are used as encapsulants. They are the most commonly used materials and produce different results in almost all cases. Experiments using co-implantation of gallium or arsenic atoms will be carried out to try to understand the effects on the redistribution of impurities seen in previous experiments. Substrate temperature will also be varied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0035, REDUCTION IN INTERMODULATION DISTORTION IN OPTICAL FIBER COMMUNICATION USING PREDISTORTION

D.A. Smith, North Dakota State University, School of Engineering & Architecture, Dept. of Electrical & Electronic Engineering, *Fargo, North Dakota* 58102 (DF051690; AFOSR-78-3554)

AF function - communications processors in support of our tactical air forces must be capable of handling large volumes of voice, image, and digital data in a rapid, secure manner. In addition, tactical communication systems have requirements for low weight, small size, noise immunity, and elimination of cross-talk. Opportunity -communication via light beams offers an effective and economical satisfaction of these requirements; however, the full advantage of optical communications will not be realized until techniques are found for realizing low-distortion, high signal-to-noise fiber optics communications. Objective - the research will seek techniques for the compensation of nonlinearities in the modulation characteristics encountered in optical modulation used in optical fiber communication. How work contributes - the effort will advance optical communications for military command and control systems.

This investigation will concentrate on predistortion techniques for nonlinearity compensation. Nonlinearities encountered in both light-emitting diodes and optical waveguide modulators will be investigated. Experimental circuits for the compensation of the nonlinear effects encountered in light-emitting diodes will be developed and investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, PREDICTION OF SYSTEM INVARIANTS IN THE PRESENCE OF FAILURE

C.F. Martin, Case Western Reserve University, Graduate School, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NSG 2384)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0037, THERMAL FATIGUE BEHAVIOR OF DIES FOR ALUMINUM DIE-CASTING AFTER DEPOSITION OF VARIOUS ION-SPUTTERED COATINGS

J.F. Wallace, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NSG 3279)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0038, INVESTIGATION OF THRUST RECOVERY FOR POWERED LIFT SYSTEMS

P. Bevilaqua, Rockwell International Corp., *4300 E. 5th Ave., Columbus, Ohio* 43216 (DF052320; F49620-78-C-0069)

AF function - advanced aerospace vehicles. Deficiency - lack of experimental data and a theoretical model for jet thrust recovery for powered lift vehicles in the low speed range representative of takeoff and landing. Objective - evaluate a new thrust recovery hypothesis by comparing predictions from a mathematical model based on the hypothesis with experimental data which must be generated. How work contributes -verification of the thrust recovery hypothesis will identify the mechanism involved and provide a theoretical method for predicting and comparing the performance of various powered lift systems. New methods for improving powered lift systems will likely result once understanding of the basic phenomenon of thrust recovery is obtained. Also, data will be generated for an important range of flight speeds where no data is presently available.

A mathematical model for thrust recovery will be formulated for a generalized, two-dimensional powered lift system based on the hypothesis that the thrust recovery results from the interaction between the circulation around the wing section and the vorticity in the jet sheet. The aerodynamic forces and moments predicted by this model will be compared with the results of classical analytical methods, limited existing data for low jet thrust coefficients, and new data to be generated in tests at large thrust coefficients and at large deflection angles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0039, EQUIPMENT MAINTENANCE

R. Mahone, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF112510)

RWI is conducting EO sensor experimental and test programs under task 200405, targeting systems characterization. These are documented under 20040533 targeting systems characterization facility, 20040547 laser measurements, 20040552 EO sensor/ATMOS correlation, and 20040553 broadband atmospheric transmission measurements. A considerable amount of in-house automated data handling computer equipment is required to support these efforts. Some is already on-site and in operation and the remainder is being acquired under work unit 20040533. This work unit is to establish a preventive maintenance program for all of the data handling equipment in the building 622 electro-optical facility and the targetings systems characterization facility in area B.

Submission of AF form 9S to base procurement to initiate multiple sole source maintenance contracts with the individual equipment manufacturers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0040, IR THREAT WARNING RECEIVER CONCEPTS DEVELOPMENT PROGRAM

R.B. Sanderson, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF098240)

The objective of this effort is to provide the AF with an independent test and evaluation capability for advanced IR warning receivers and to support IR background and target signature measurements. The facility will have the capability of simulating several possible threats and background phenomena to (1) obtain baseline data prior to and during flight test and (2) to assist in establishing guidelines for future development. Current capability is limited to evaluation of IR sensors/systems in a static, benign, single threat environment.

Missile launch and separation will be simulated by movement of a beamsplitter transmitting the IR energy from two blackbody sources onto an off-axis parabolic collimator. Signal-to-noise ratio and sky background can be simulated by controlling the temperature of a screen or fluid tank covering the field of view of the IR sensor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0041, AN INVESTIGATION OF THE HIGH-FREQUENCY PERFORMANCE OF SERIES RESONANT INVERTERS

T.A. Stuart, University of Toledo, Graduate School, *2801 W. Bancroft St., Toledo, Ohio* 43606 (NSG 3281)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0042, ASTROGEODETIC MEASUREMENT OF VERTICAL DEFLECTION WITH GPS AND ADVANCED INS

L. Chin, U.S. Dept. of Defense, Navy, Naval Air Development Center, Communication Navigation Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881606)

Determine feasibility of improving vertical deflection measurement techniques developed in the late sixties. Although successful, this earlier work could only provide gross measurements. It may now be possible to obtain more accurate measurements by using new systems such as advanced inertial navigation system (INS) and global positioning system (GPS). These new systems provide precise astronomical (INS) and geodetic (GPS) navigation information which may be used to obtain astrogeodetic measurements directly and continuously. This would significantly reduce the time currently required for gravity surveys and might also provide an on-board capability to enhance submarine navigation accuracy in unmapped areas.

Perform theoretical analysis of advanced INS and NAVSTAR GPS output as a means to detect/identify deflection of the vertical (problem involves separating the desired output from INS errors and from geodetic reference errors). The following steps will be taken: a. Consider INS/GPS configurations and develop algorithms for vertical deflection measurement in conjunction with the normal INS data processing procedure (e.g., optimal filtering). b. Write a simulation computer program using the algorithm developed in step a. This will use both artificial and real data (as available). c. Perform computer simulation and ascertain accuracy of Vertical deflection measurement and INS error reduction. d. Investigate real time implementation requirements and requirements for operational system changes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0043, SIMULATION DISPLAYS - WIDE FIELD OF VIEW

R.L. Jones, U.S. Dept. of Defense, Navy, Naval Air Development Center, Systems Directorate, *Warminster, Pennsylvania* 18974 (DN781476)

The general objective of this task is to examine the state-of-the-art concepts for generating wide field-of-view displays and to consider their applications to out-the-window scene generation for flight simulators. Recent advancements in computer-generated imagery, video projection systems, electro-optics and large diameter cathode ray tubes have given impetus to the development of a broad spectrum of display systems. The application of this technology to flight simulators and the presentation of visual cues to flight crew is the specific objective of this task.

Survey the state-of-the-art in the technologies of electro-optics, computer-generated imagery, optical projection systems and multi-cathode ray tube display systems. A paper study and design concept will follow which will address the future display requirements for NavAirDevCen simulators. The design concept and the resulting document will signify the completion of the first phase of this project. The second phase of this task will be to design a wide field of view visual display system utilizing the requirements and design concept obatined in phase 1 of this study. The phase 3 effort of this study is to explore the electronic interface requirements and resulting alternative designs for the display system. The research which led to the design concept of the first phase identified some unique electronic synchronization and modulation problems. Design concepts which address these problems will be explored in phase 3.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0044, METHODOLOGIES FOR OPTIMIZING MAINTENANCE MODELS FOR ADVANCED AVIONICS CONTROL SYSTEMS

M.K. Shaefer, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Economics, *Ewell Hall, Williamsburg, Virginia* 23185 (NSG 1625)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0045, ORDER REDUCTION OF STRUCTURAL DYNAMIC EIGENVALUE PROBLEMS

L.R. Anderson, Virginia Polytechnic Inst. & State University, *Blacksburg, Virginia* 24061 (NSG 1627)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0046, DAIS EXECUTIVE SOFTWARE APPLICATIONS TO TRANSPORT NAVIGATION

R. Bousley, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF109830; F33615-77-C-1233)

To provide an independent contractor assessment of the DAIS executive software, industry exposure to the J-73 level one compiler and DAIS software development tools and a definition of the interface between DAIS and integrated navigation systems. A combination of unique operational tactics, together with an available inexpensive ground map radar, TACAN, Omega, INS and reliance on visual fix points, will be used to demonstrate the usefulness of the DAIS/integrated navigation system for tactical air-drop and terminal area operations with transport aircraft.

Boeing aerospace lab simulation, jointly managed by AFAL and Boeing, will be conducted for the purposes of evaluating the DAIS/integrated navigation system software performance capabilities in a series of simulated tactical air-drop and terminal area navigation flight profiles. This 'hot bench' simulation will be conducted using contractor-developed sensor software modules and navigation filter, and the DAIS executive software and processing hardware. Where available, actual sensors (i.e., IMU and Omega receiver) will also be used. AFAL will transfer the DAIS compiler, support software, and executive software along with two each GFE DAIS computers, bus control interface units (BCIUS) and console intelligence units (CIUs) to Boeing for the demonstration. The GFE hardware will be returned to AFAL upon completion of the demonstration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0047, VISUALIZATION STUDY OF TURBULENT SPOTS

J.J. Riley, Flow Industires Inc., *21414 68th Ave. S., Kent, Washington* 98031 (DF052140; F49620-78-C-0062)

AF function - aerospace vehicles. Opportunity - provide a better understanding of the coherent structures in a turbulent boundary layer and the events leading to transition to turbulence. Objective - visually observe a flat plate boundary layer with turbulence and turbulent spots imbedded within to provide information

and understanding of the physical processes of transition to turbulence and maintenance of turbulence. How work contributes - the AF is interested in boundary layer control to reduce or control the effects of drag and flow separation. As yet what triggers transition to turbulence, how best to maintain laminar flow or prevent separation of the structure of a turbulent boundary layer are not known or fully understood. This research will provide visual insight into these problems to aid the design of future aerospace vehicles.

Flow visualization techniques of fluorescent dye layers, dye injections and shadowgraph of flow over a flat plate in a tow tank will be used to study the structure of turbulent spots and their interactions in a laminar boundary layer. The characteristics of a fully turbulent boundary layer will be studied using the same techniques. In the second year the Tollmien-Schlicting waves and the detailed velocity field will be investigated quantitatively.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0048, STRUCTURAL OPTIMIZATION BY FINITE ELEMENTS

G. Sander, Universite de lEtat a Liege, *Rue des Bonnes Villes 1, Liege, Belgium* (DF052830; AFOSR-78-3652)

AF function - improved structural efficiency can enhance the performance of future Air Force flight vehicles. Opportunity - new digital computer systems make possible the study of analysis methods used to achieve minimum weight high performance designs. Objective - to develop efficient and accurate analysis methods in order to develop minimum weight aircraft designs. How work contributes - integrated methods to improve the design of aircraft structures will directly assist future light-weight vehicles.

Research will extend the previous efforts to develop rigorous solution procedures to minimum weight structural design problems using a mixed method which involves both optimality criteria and mathematical programming. Development of an efficient and accurate algorithm to control the convergence of the method will be studied in order to select critical constraints, particularly stresses, that require exact linearization. Extension of the mixed method approach will study dynamic constraints on mode shapes, frequencies and stress levels.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, ANALYSIS OF VIKING INFRARED THERMAL MAPPING DATA OR MARS - MARS ORBITER AND COMET MISSIONS

D.O. Muhleman, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Science, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 7565)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0002, ATMOSPHERIC DYNAMICS FROM VIKING LANDER DATA

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0003, MASS AND ENERGY TRANSPORT BY INTERNAL GRAVITY WAVES

P.F. Lester, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (ATM7712246A03)

Previous results have demonstrated a significant vertical transport of mass and energy across stable atmospheric layers in the San Francisco, Pacific Ocean region. This research will attempt to quantify this transport, to verify the physical model that has been suggested and to formulate these fluxes in terms of commonly measured atmospheric quantities. The instrumented Mt. Sutro Tower, along with aircraft and an ocean vessel, will be used to obtain the measurements.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0004, NAVY ENVIRONMENT - INFRARED ATMOSPHERIC PROFILING

C.R. Claysmith, General Dynamics Corp., Convair Aerospace Division, *P.O. Box 1950, San Diego, California* 92112 (DN575314; N00014-75-C-0940)

Operation of Navy aircraft near the sea surface and naval combatants on the sea surface require accurate and timely environmental information which will allow the operational commander to fully assess his options. The paucity of available environmental information over the oceans compounds the Navy's problem of accurately forecasting atmospheric conditions. An infrared profiler will provide a reliable, easily maintained, automatic remote sensor for the measurement of water vapor and temperature in the vertical from the surface up to 7 km.

The remote infrared atmospheric profiling system (RIAPS) is presently at the contractor's facility. This work consists of an examination of the software associated with the RIAPS computer, looking to the incorporating statistical models based on available meteorological data of a particular location. This will reduce computer running-time and improve the accuracy of the retrieved temperature and humidity profiles.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0005, REMOTE SENSING AND EVALUATION OF MARINE ENVIRONMENT AND MATERIALS

T.R. Kretschmer, U.S. Dept. of Defense, Navy, Civil Engineering Lab., *Port Hueneme, California* 93043 (DN687120)

To develop a technique to allow the in-situ continuous monitoring of marine materials. This method will allow continuous monitoring of such things as leaching rates of underwater antifouling materials, decomposition of paint matrix, fouling rates on submerged surfaces, scale build-up on inaccessible surfaces, etc.

The basic principle which will be used is that the heat transfer out of a heated thermal element is affected by the thermal conductivity of various layers which build up on or are removed from submerged surfaces. Effects on materials such as fouling rates and scale buildup will be determined by the effect they produce on the rate of heat transfer. The thermal current sensor and associated electronics being developed under work unit number 3.1110-1 - current measurement system for ocean engineering, will be used to perform both laboratory and ocean experiments to evaluate this approach to the remote sensing problem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Civil Engineering Lab.

5.0006, NAVY ENVIRONMENT - MERGING SATELLITE AND CONVENTIONAL OCEANOGRAPHIC DATA

R.L. Bernstein, University of California, San Diego Campus, Scripps Inst. of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (DN775736; N00014-75-C-0152)

Fleet activities and ASW require a knowledge of surface wind and ocean wave and thermal conditions over broad areas. This is possible only with quantitative remote sensing. In order to scientifically understand and process the remote sensing data, it must be made available to competent oceanographers for physical analysis and correlation.

This work unit will allow Scripps to study the hardware, software, and scientific requirements necessary to gain a significant satellite capability and to demonstrate to appropriate funding

sources their need for such data and a rational program for exploiting the data with high-quality basic oceanography. The use of satellite-observed sea surface temperature, P-3, AXBT data and NORPAX TRANSPAC data will be field-tested in conjunction with a U.S. naval oceanographic office experiment in the mid-latitude north Pacific during the period July to September 1977. This experiment will lay the ground work for Navy and academic collection of data for forecasting in the ocean research experiment (FORE), an experiment in ocean fronts forecasting planned for the summer of 1978.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0007, INITIAL STUDIES OF MIDDLE AND UPPER TROPOSPHERIC STRATIFORM CLOUDS
S.K. Cox, Colorado State University, School of Science, Dept. of Atmospheric Science, *Fort Collins, Colorado* 80523 (NSG 5357)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0008, REMOTE LASER MEASUREMENT
Batlin, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA74278)

PROJECT OBJECTIVE: To investigate the possibilities for practical remote temperature measurements in the atmosphere on the basis of the Doppler broadening of the molecular spectrum. The basic principle is to measure the broadening of laser light scattered by molecules.

CURRENT YEAR PLAN: Operate a system which should be able to provide data which can be compared with theoretical predictions of the spectra from the lower part of the atmosphere for the effect of collective phenomena. The system is based on scanning both in height and in frequency.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0009, THEORETICAL STUDIES OF ODD NITROGEN IN THE MESOSPHERE AND LOWER THERMOSPHERE
D.W. Rusch, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NSG 5372)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0010, MEASUREMENT OF SOLAR SPECTRAL IRRADIANCES AT WAVELENGTHS BETWEEN 40 AND 3100 ANGSTROMS
J.G. Timothy, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NSG 7559)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0011, NAVY ENVIRONMENT - HEAT AND MASS TRANSFER IN THE UPPER OCEAN
J.A. Kaiser, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN580046)

The objective of this work is to develop predictive models of temperature, salinity and currents in the boundary layers of the ocean. These fundamental variables and their interactions with other environmental factors are of great importance in the design, development and optimization of naval weapons and surveillance systems and in remote sensing.

Ocean boundary layers are examined with at-sea and laboratory experiments and with theoretical models. The field program for the upper ocean is primarily concerned with the study of heat-transfer processes and small scale variability in the upper ocean layer with emphasis on the processes directly related to the ocean skin temperature. The Benthic boundary layer studies of structure and variability are executed with a CTD and implanted current meters. Joint experiments with G01-07, G01-19 and G01-20 are executed when appropriate.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0012, INTERPRETATION OF ARCTIC AIRBORNE GEOPHYSICAL INVESTIGATION
L.C. Kovacs, U.S. Dept. of Defense, Navy, Naval Research Lab., Acoustics Div., *Washington, District of Columbia* 20375 (DN780029)

To combine the various aeromagnetic and bathymetric data sets acquired by the U.S. Naval Oceanographic Office and Naval Research Laboratory into a single data format; to display these and other data on standard Arctic projections using digital plotters. Displays will include (a) profiles of residual intensity along the track; (b) residual annotated along track and contoured; and (c) bathymetric contour charts. To compare U.S. Navy data with Soviet 'zebra-stripe' depictions; to assess the accuracy and data density of Soviet work. To develop or adapt software for computing depth to magnetic basement, magnetization times layer thickness and rotation of crustal isochrons defined by magnetic lineations; to apply these techniques to the Arctic data set.

Since large amounts of graphic output are needed, the approach will be to massage and display the data on-line using mini-computers. The first step will be to convert all software and Arctic data tapes and digitize analog records as required. If possible, existing programs will be acquired from other agencies doing comparable work.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0013, GEOPHYSICS AND THERMAL EVOLUTION OF SMALL PLANETARY OBJECTS
Unknown, University of Hawaii System, Manoa Campus, Graduate School, *Spalding Hall, Room 359, Honolulu, Hawaii* 96822 (NSG 7597)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

5.0014, MARS SURFACE UNIT DEFINITION CHARACTERIZATION
Unknown, University of Hawaii System, Manoa Campus, Graduate School, *Spalding Hall, Room 359, Honolulu, Hawaii* 96822 (NSG 7590)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

5.0015, CHARACTERIZATION AND EVOLUTION OF APOLLO 15 DRILL CORE SOILS, AND THE ORIGIN OF GREEN GLASS VITROPHYRES
A. Basu, Indiana University, Bloomington Campus, Graduate School, *2805 E. 10th, Bloomington, Indiana* 47401 (NSG 9077)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Johnson Space Center

5.0016, SECOND-ORDER CLOSURE SCHEMES FOR PLANT CANOPY AERODYNAMICS
R.H. Shaw, Purdue University, School of Agriculture, Dept. of Agronomy, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (ATM7819252)

Agricultural crops, forests, and other natural vegetation create and inhabit an environment critical to a diversity of biological and physical processes. While it is not often possible to manipulate the structure of a plant canopy in order to adjust this microclimate to advantage, it is important that an understanding be gained of the nature of the environment in which these processes occur.

When relatively homogeneous canopies create a very complex aerial environment which does not lend itself readily to com-

putational analysis because the flow is turbulent and yet the turbulent quantities are, in general, not determined locally. For this reason, the traditional approach using K-theory is not considered adequate and this proposal has as its main objective the development of a mathematical model for canopy aerodynamics based on second-order closure techniques. Schemes for closure at this level have been devised elsewhere for boundary-layer flows. These techniques are likely to be equally valid for the rough sublayer although there are problems peculiar to this layer that will be investigated. The sensitivity of the calculated flow to the closure assumptions will be evaluated and the canopy flow model will be used to investigate the transport of a variety of quantities in the canopy environment, again using second-order closure principles.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0017, SATELLITE ALTIMETRY

B. Chovitz, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey, Geodetic Research & Development Lab., *6001 Executive Blvd., Rockville, Maryland* 20852 (836950A5)

Measurements of altitude to the ocean surface from a satellite will provide, in the first approximation, information on the shape of the geoid assuming that sea level corresponds to the geoid, and in the second approximation information on tides, currents, salinity, and sea state which are deviations of sea level from an equipotential surface. The first use of satellite altimetry will therefore be geodetic and serve as a basis for the later oceanographic applications. The altimetry will provide direct dense measurements of geoidal heights on a global scale not possible by any other means. It will also aid in improving the figure of the Earth as a whole in combination with other data.

Technical objective is to carry out analyses and provide computer programs in anticipation of data to be received from satellite altimetry. These programs not only handle altimetry, but provide a precise ephemeris of the satellite, which is required to exploit the precision of the altimetry.

Task is of ongoing nature. It is anticpated that a continuously-improving flow of data from successive NASA satellites will be forthcoming through this decade. Technical reports of progress will be issued when significant results have been achieved.

SUPPORTED BY U.S. Dept. of Commerce, National Ocean Survey, Office of Marine Technology

5.0018, AQUATIC VASCULAR PLANTS AND ALGAE AS POTENTIAL BIOLOGICAL COMPONENTS OF CLOSED ECOLOGICAL LIFE SUPPORT SYSTEMS

G.C. Gupta, University of Maryland, Eastern Shore, Undergraduate School, *Princess Anne, Maryland* 21853 (NSG 6034)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0019, ELECTRONIC SPECTRA OF HEATED LUNAR MATERIALS - QUANTIFYING REMOTE SENSED SPECTRA OF HOT PLANETARY SURFACES

R.G. Burns, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 7604)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0020, UV PHOTOABSORPTION INVESTIGATIONS RELATED TO DISTURBED ATMOSPHERES

R.E. Huffman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249710)

AF function - communication, surveillance, detection, tracking. Deficiency - predictive capability for electron concentrations and optical atmospheric properties following atmospheric nuclear bursts. Objective - calculations of photodissociation and photoionization rates in the atmosphere, including effects due to nuclear detonation UV fireball radiation. How research contributes - results will be used in computer codes (ROSCOE, RANC IV, OPTIR) employed to predict atmospheric effects and select operating frequencies.

This work unit will lead to revision of chapter 13 in the DNA reaction rate handbook presently entitled 'photochemical processes -solar photoionization rate constants and ultraviolet intensities'. This revision will be accomplished in two steps. The first step is to obtain photodissociation rates, which are not included in the present handbook. The next step is to incorporate the photodissociation rates into a revised chapter. This new chapter will also involve a revision of the photoionization rates to include new measurements. The work will be coordinated with the editors of the DNA reaction handbook. The approach to producing these reports is divided into two phases. In the initial phase, the various geophysical and technical inputs are reviewed separately to be sure that the best current values are utilized for items such as solar flux, atmospheric model, and cross-sections. A central problem in atmospheric photoabsorption is the absorption by molecular oxygen in the region of the Schumann-Runge band structure. New models of this wavelength region will be obtained for use in these reports. The second phase is to produce the draft manuscript from the data acquired in the first phase.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, NAVPAC 1-2 AND 3 AND S77-2 SATELLITE DRAG MEASUREMENTS

F.A. Marcos, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581190)

AF function - airborne surveillance, target acquisition. Deficiency or opportunity - atmospheric density variations with time and space cannot be adequately predicted. Objective - direct density measurements with new satellite-borne accelerometers. Results are analyzed to obtain improved density data as a function of geomagnetic activity and solar flux. How research contributes - in-flight accelerometer drag measurements permit accurate determination of Air Force system satellite ephemerides. Development of more accurate models permits improved satellite surveillance capability.

New SETA (satellite electrostatic triaxial accelerometer) instruments will be launched on AF satellites. The SETA instrument uses a single proof mass to measure accelerations in three orthogonal directions. This is a completely new development and supersedes the earlier technique of flying three orthogonal uniaxial MESA instruments. Density data will be obtained by determining the drag component along the velocity vector. Attitude will be determined from drag components measured by all three axes. The instrument will also be used to monitor spacecraft orbit-adjust thrusts. Data from the ROCA (rotatable calibration accelerometer) experiment on the S77-2 satellite will be reduced and analyzed to obtain aerodynamic drag measurements in near-circular orbits. The ROCA accelerometer is a single axis instrument with the capability to rotate the sensitive axis perpendicular to the velocity vector. This technique permits the determination and removal of inherent bias errors and leads to improved accuracy drag measurements. The accelerometer data will be analyzed to determine variability related to geomagnetic activity at a constant local time and the dependence of density on solar flux during a period of increasing solar activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, DEVELOPMENT OF STATISTICAL TECHNIQUES FOR FLARE PREDICTION USING OPTICAL AND RADIO OBSERVATIONS

D.F. Neidig, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580820)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. To develop techniques for the interpretation of optical and radio data in order to improve predictions of solar flares and their associated geophysical disturbances. How research contributes - reliable prediction of

flare-induced geophysical disturbances is needed to assure optimum performance and design criteria for AF communication, detection, and navigation systems. The effort in this in-house work unit is directed toward the identification and early detection of the solar conditions leading to flares.

To predict solar flares and their associated geophysical disturbances requires: (1) identification of solar active regions which will be flare productive, (2) detection and early recognition of flare phenomena (before geophysically-significant emissions occur), (3) real-time evaluation of flare characteristics which lead to geophysical effects. Observable parameters relating to these areas, collected from optical and radio data, will be systematically evaluated in order to determine the parameters which are most significant in predicting both the occurrence of flares and their geophysical importance. The procedure will use a multivariant discriminant analysis (MVDA) which, in addition to identifying the significant parameters, is also capable of making flare predictions from active region data. Optical data from the AWS/SOON network, as well as microwave data from supporting contracts, will be incorporated with observations made at Sacramento Peak Observatory in order to determine the significance of suggested prediction parameters. ACWU entitled 'sunspot dynamics' will provide flare parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, S3-TRAPPED PROTON FLUX MEASUREMENT
A.G. Rubin, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF248920)

AF function - reliability, cost-effectiveness, lifetime and survivability of operations space systems. Deficiency - knowledge of the energetic particle environment necessary to adequately predict the reliability and lifetime of space systems. Objective - to determine the transient and steady state energetic particle environment and to indicate possible effects on spacecraft performance and lifetimes. How research contributes - an extended data base from AF satellites will be used to construct realistic static and dynamic models of the near-earth particle environment.

Data from the S3-3 satellite currently on magnetic tapes will be sorted according to magnetic field, location, and time. After background correction, particle population will be compared to previously available data. Since S3-3 data is collected from higher altitudes than previous satellites, data will be available for some regions and at same energy ranges not previously available. For previously unobserved phenomena, comparisons will be carried out employing magnetospheric dynamical theories.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, FEASIBILITY OF SENSING ATMOSPHERIC OPTICAL PARAMETERS AT TACTICAL ALTITUDES
R. Toolin, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580240)

AF function - electro-optical offensive/defensive weapon delivery, optical guidance, communications. Deficiency - insufficiency of IR optical atmospheric profiles to verify and to improve transmission and scattering codes. Objectives - to define and to specify the mobile field instrumentation and operational techniques necessary to obtain from-the-ground vertical profiles of the optical characteristics of the atmosphere to tactical operating heights of 3-5 km. How research contributes - by improving the definition of the atmosphere as the optical medium in which the increasingly sophisticated AF electro-optical systems will operate.

Specification of the system will be developed from a literature survey, both technical reports and manufacturers, brochures, from limited laboratory tests to verify potential techniques and instrumentation. The results will be controlled by factors projected, technical and operational value of the data, resource requirements, system mobility, and existing technology only.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, STRUCTURAL EVOLUTION AND STRESS HISTORY OF THE THARSIS REGION OF MARS
D. Wise, University of Massachusetts, Amherst Campus, Graduate School, Dept. of Geology, *Amherst, Massachusetts* 01002 (NSG 7571)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0026, THE DYNAMICS OF SMALL CUMULI
J.W. Telford, University of Nevada, System Office, Desert Research Inst., *Reno, Nevada* 89507 (ATM7623361A02)

This proposal describes the recent development in cumulus cloud dynamics arising from the author's work with airborne measurements of airmotion near cumulus clouds. The departures from the previous models are discussed in detail and the conceptual basis of the new ideas are laid-out for consideration. Theoretical work using concepts derived from the interpretation of past measurements seems to offer the best interpretation of the facts known to date. The role of airmotion measurements in several crucial tests are discussed and it is proposed that such measurements can be made with available equipment. The proposal offers the use of the airborne measurement equipment developed at the Desert Research Institute (DRI), using the Litton LN15D inertial platform and the DRI aircraft, to obtain the necessary measurement data.

If this theory is confirmed it will offer a major new insight into the dynamics of small cumuli.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0027, ICE FOG - SUPPRESSION AND GENERATION
T.T. McFadden, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (DA0E8144)

To develop equipment and techniques for suppressing fog generation caused by military operations. To develop ways to eliminate fog from winter operations where its presence shows strategic positions for miles. To develop effective means of generating the fog for concealment or decoy techniques.

Fog suppression by condensation of exhaust effluents has met with limited success. Most of the problems are within present technological capabilities. Devices for eliminating fog from vehicle exhausts will be constructed and tested on military vehicles. Modifications and redesigns will develop the devices into practical working economically-feasible accessories for current vehicles. Fog generation will be accomplished using mist generation techniques combined with air movement devices.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0028, NAVY ENVIRONMENT - ARCTIC OCEAN TECHNOLOGY
R.W. Corell, University System of New Hampshire, School of Technology, Dept. of Mechanical Engineering, *James Hall, Durham, New Hampshire* 03824 (DN475501; N00014-75-C-0929)

This task is to develop a new technology with the view of developing an aircraft-deliverable coring system which can increase the geographical distribution of sediment cores in the Arctic basin and which decreases the time required to obtain individual cores.

The contractor has designed, built and tested a prototype coring system. The tests performed will be analyzed to determine if this coring system will meet the objective or if another system must be designed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0029, CATALYTICALLY-SUPPORTED THERMAL COMBUSTION OF COAL-DERIVED LOW BTU GAS
J. Releford, Engelhard Industries Inc., Engelhard Industries Division, *430 Mountain Ave., New Providence, New Jersey* 07974 (BA-04-01; EF-77-C-01-2683)

Evaluation of catalyst systems designs and demonstration that a range of low-BTU coal gas fuels can be combusted with low emissions and high combustion efficiency with acceptable pressure losses at industrial turbine operating conditions. Emission requirements will be made of carbon monoxide (CO), carbon dioxide (CO2), unburned hydrocarbons (UHC), and oxides of nitrogen (NOX). This will be performed according to standard procedures as PRE SAE-ARP-1256, Procedures for Continuous Sampling and Measurement of Gaseous Emissions from Aircraft Turbine Instruments.

SUPPORTED BY U.S. Dept. of Energy, Office of Fossil Energy

5.0030, THE ORIGIN OF MAGHEMITE ON MARS
R.B. Hargraves, Princeton University, Graduate School, Dept. of Geological & Geophysical Science, *205 Nassau Hall, Princeton, New Jersey* 08540 (NSG 7602)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0031, CONVECTION IN SPHERICAL SHELLS
A. Zebib, Rutgers the State University of New Jersey, New Brunswick Campus, Graduate School, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (NSG 7601)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0032, VARIABILITY AND REAL-TIME MEASUREMENTS OF METEOROLOGICAL PARAMETERS
B.W. Kennedy, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Atmospheric Sciences Lab., *White Sands M.R., Las Cruces, New Mexico* 88002 (DA0F1768)

Determine variability of tropical and mid-latitude atmosphere above 30 km. Extend usable measurement altitude of robin sphere to 100 km. Test an inflatable radar calibration sphere. Test range rate program for application to Kwajalein Missile Range and White Sands Missile Range sphere missions.

Actively participate in diurnal variability programs at KMR and WSMR and elsewhere. Launch light robin sphere at WSMR and KMR. Launch 12-inch diameter spheres at WSMR and KMR. Run range rate program on robin spheres at WSMR and evaluate results. Act as consultant to Air Force on atmospheric density measurements in support of reentry programs.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0033, ARTIFICIAL FOG STABILIZATION
E.J. Mack, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DN890087; N00019-78-C-0349)

A laboratory investigation will determine: (a) the efficiency of pyrotechnically-generated, hygroscopic aerosols in producing conditions of restricted visible and infrared wavelength transmission and, (b) the persistence of these fogs using evaporation retardants.

Aerosol size spectra and extinction coefficients of aerosol fogs will be made as functions of aerosol concentration and relative humidity.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0034, PARTICIPATION IN THE MARS DATA ANALYSIS PROGRAM - ANALYSIS OF CLOUD FORMS IN VIKING AND MARINER 9 IMAGES
P.J. Gierasch, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Astronomy, *Ithaca, New York* 14850 (NSG 7612)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0035, PARTICIPATION IN THE MARS DATA ANALYSIS PROGRAM - GLOBAL & REGIONAL STUDIES OF WIND-INDICATORS ON THE SURFACE OF MARS
J. Veverka, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Astronomy, *Ithaca, New York* 14850 (NSG 7546)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0036, PARTICIPATION IN THE MARS DATA ANALYSIS COMPARATIVE STUDY OF THE SURFACE OF PHOBOS AND DEIMOS
J. Veverka, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Astronomy, *Ithaca, New York* 14850 (NSG 7547)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

5.0037, EFFECTS OF PHOTOMETRIC GEOMETRY ON SPECTRAL REFLECTANCE MEASUREMENTS
J. Veverka, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Astronomy, *Ithaca, New York* 14850 (NSG 7606)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0038, DYNAMICAL STUDIES OF PHOBOS AND DEIMOS
J.A. Burns, Cornell University, Ithaca Campus, School of Engineering, Dept. of Theoretical & Applied Mechanics, *242 Carpenter Hall, Ithaca, New York* 14853 (NSG 7593)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0039, MODELING THE VIKING BOUNDARY LAYER AND SOIL THERMAL MEASUREMENTS ON MARS
M.I. Hoffert, New York University, Washington Square & University College of Arts & Sciences, Dept. of Applied Science, *421 1st Ave., New York, New York* 10012 (NSG 7591)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0040, IDENTIFICATION OF TROPOSPHERIC AND STRATOSPHERIC AIR BY TRACER
A.L. Lazrus, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (NSG 2386)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0041, SURFACE PROCESSES ON MARS AND ITS SATELLITES WITH EMPHASIS ON CRATERING, VOLCANISM AND THE EVOLUTION OF VALLES MARINERIS
J.W. Head, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NSG 7570)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0042, ANALYSIS OF ROCKS AND SUBSTRATE AS REVEALED IN VIKING LANDER IMAGES
T.A. Mutch, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NSG 7569)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0043, ENDOGENIC PROCESSES EFFECT IN THE SURFACES OF GANYMEDE AND CALLISTO
E.M. Parmentier, Brown University, Graduate School, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NSG 7605)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0044, EXPERIMENTAL INVESTIGATION OF BASALT-C-O-H-S GAS EQUILIBRIA AND FUMAROLIC ALTERATION ON MARS
M.J. Rutherford, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NSG 7589)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0045, RESEARCH OF THE GENESIS OF TORNADOES ASSOCIATED WITH HURRICANES
R.G. Gentry, Clemson University, College of Sciences, Dept. of Physics, *Long Hall, Clemson, South Carolina* 29631 (NSG 5350)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0046, TERRESTRIAL RADIOISOTOPE APPLICATIONS DEVELOPMENT
E. Lamb, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (AG-04-06-02-3; W7405-ENG-26)

The task objective is to provide technical support and development for use of byproduct radionuclides in those applications where radiation, heat or other unique properties of materials recovered from nuclear wastes can be used to conserve energy or natural resources, contribute to the long-term management of nuclear waste, and provide economic or national security benefits. Byproduct fission products will require some type of custodial care for long periods of time. Useful application of these materials can provide this care in addition to making a significant contribution to the economic welfare of the country. In the case of gamma radiation and heat production, byproduct radionuclides are unique and can be used in destruction of water pollutants, radiation processing for sterilization, and as compact, reliable sources of electricity and heat for use in special situations. The fission product stable nuclides of the platinum metal group provide a source of these metals to the United States which may be of strategic importance due to the fact that the country is in a deficient raw material position with regard to these metals. Supplies of krypton-85 are essential to the solid state electronic industry and new uses are being developed for component testing and process control that can provide significant dollar savings in military and commercial aircraft engine operation. Stable xenon, essentially free of radioactivity, can be produced in large quantities and made available to medical, electronic, and lighting industry. (ORNL/CF-78/108)

SUPPORTED BY U.S. Dept. of Energy

5.0047, NAVY ENVIRONMENT - CLOUD ELECTRIFICATION
D.R. Tompkins, Terrene Corp., *Refugio, Texas* 78377 (DN223331; N00014-76-C-0404)

In behalf of in- and through-cloud naval operations involving cloud penetration by vehicles and missiles, the objective of this research is to detect and measure in real time the strength of the in-cloud electric fields.

The complete determination of the vector electric field along the shower axis requires three sets of four phased antennas. This is a mathematical consequence of the inverse solution where each set of four phased antennas acts as a single antenna. Thus a full station actually requires twelve antennas. However, a station with four phased antennas has enough sensitivity to make it possible to evaluate the radio method of measuring atmospheric electrical fields and that is our immediate objective and the approach used in this research.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0048, INVESTIGATION OF MULTIZONED CHONDRULES AND DARK RIM MATERIALS IN ORDINARY AND CARBONACEOUS CHONDRITES
E.A. King, University of Houston, School of Arts & Sciences, Dept. of Geology, *3801 Cullen Blvd., Houston, Texas* 77004 (NSG 7617)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0049, CONTINUED ANALYSIS OF DATA FROM THE VIKING RETARDING POTENTIAL ANALYZER (RPA'S)
W.B. Hanson, University of Texas, Health Science Center at Dallas, Graduate School, Dept. of Physics, *Dallas, Texas* 75230 (NSG 7599)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0050, STUDY OF LAYERED DEPOSITS AND PALEOCLIMATES ON MARS
A. Howard, University of Virginia, School of Arts & Sciences, Dept. of Environmental Science, *Garrett Hall, Charlottesville, Virginia* 22903 (NSG 7572)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0051, INVESTIGATIONS OF MARTIAN METEOROLOGICAL PROCESSES USING VIKING METEOROLOGICAL DATA
C.B. Leovy, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (NSG 7611)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0052, SUMMER MONSOON WINDSETS DERIVED FROM THE GEOSTATIONARY SATELLITE DATA OVER THE INDIAN OCEAN
J.A. Young, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Meterology, *Agriculture Hall, Madison, Wisconsin* 53706 (ATM7821873)

During 1979 a U.S. Geostationary Meteorological Satellite over the Indian Ocean will give scientists the first opportunity to view the entire atmospheric monsoon circulation system during one complete annual cycle. The objective of this project is to take advantage of this unique opportunity to obtain complete large-scale wind coverage for the summer monsoon at two heights in the atmosphere. This coverage will include the two experimental areas of Summer MONEX (Arabian Sea and the Bay of Bengal), as well as the southern equatorial Indian Ocean during both the 'onset' and 'established' periods of evolution of the atmospheric monsoonal circulation. MONEX, for Monsoon Experiment, is a regional subprogram of the Global Atmospheric Research Program (GARP) to be carried out concurrently with the First GARP Global Experiment (FGGE) in FY 1979.

This basic satellite cloud-tracking effort will augment the FGGE satellite wind set by providing additional wind vector estimates of two times per day. Each set will be of relatively high resolution in selected, weather significant areas. The data will form an essential part of an eventual comprehensive MONEX wind set as well as augment the FGGE data set. The data will be made available to MONEX researchers in the following forms: (1) basic 'raw' wind set on computer tape, (2) analysis and gridded wind set on computer tape, and (3) a published atlas from (2).

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0053, NAVY ENVIRONMENT - EFFECT OF WHITECAPS ON THE MARINE ATMOSPHERE
E.C. Monahan, National University of Ireland, University College at Galway, *Galway, Ireland* (DN875444; N00014-78-G-0052)

The objective of this research is to relate various physical properties of the lowest 20 meters of the marine atmosphere to whitecap coverage. These atmospheric properties include electrostatic charge concentration, electrostatic potential gradient, sea salt concentration, sea salt gradient, size distribution of sea salt giant nuclei and Aitkin nuclei concentration. The results of this research, as they become available, will be utilized by other investigators attempting to improve the prediction of the vertical distribution of marine aerosols. This in turn will affect the Navy's capability to forecast optical and infrared properties in the marine boundary layer.

This research will involve two complementary experiments, one in the laboratory and one in the field at an exposed maritime location. The laboratory experiment will utilize a whitecap simulation tank for examining whitecap action both visually (photography) and electrostatically. The field experiment will sample unpolluted air as it blows in from the west. Whitecap coverage will be examined in addition to other marine properties.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, SKILL DEGRADATION
G.B. Reid, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223340)

To monitor the decline in performance on a high fidelity aircraft simulator during extended periods of non-practice.

Pilots currently in non-flying jobs will be used as subjects. Subjects will be trained to a predetermined performance level on the advanced simulator for pilot training (ASPT). Rechecks will be conducted in ASPT after varying levels of non-practice to determine rate of skill degradation. The performance will be evaluated in respect to such pilot factors as amount of flying time, type of aircraft flown, and most recent aircraft currency.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, LOCALIZATION OF TRIPEPTIDYL AMINOPEPTIDASE AND CARBONIC ANHYDRASE III IN RAT MUSCLES BY LIGHT AND ELECTRON MICROSCOPY
D.A. Riley, University of California, San Francisco Campus, School of Medicine, Dept. of Anatomy, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665903)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, CLINICAL APPLICATIONS OF THE LEXISCOPE
H.C. Press, Howard University, Graduate School, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 5378)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

6.0004, EVALUATION OF ION BEAM SPUTTERED BIOGLASS COATINGS OF PROSTHETIC DEVICES
L.L. Hench, State University System of Florida, University of Florida, School of Medicine, Dept. of Surgery, *1600 Archer Rd., Gainesville, Florida* 32610 (NSG 3273)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

6.0005, VIRTUAL IMAGE DISPLAY DEVICE
G. Derderian, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Physical Sciences Lab., *Orlando, Florida* 32813 (DA0M4995)

An efficient, light-weight, compact, low-cost virtual image display device is needed for future flight trainers and vehicle crew trainers. This device should meet tri-service requirements with specific US Army applications in synthetic flight trainers and tank driver simulators.

The approach is to design and breadboard a system of fresnel lenses on thin plastic plates designed for chromatic correction. Following appropriate testing, a specification will be prepared for future visual system procurements.

SUPPORTED BY U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command

6.0006, PHYSIOLOGICAL EFFECTS OF SHIP MOTION ON CREW MEMBERS
C.L. Ewing, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Bioengineering Sciences Dept., *New Orleans, Louisiana* 70189 (DN141828)

To determine the physiological effects of ship motion on crew members as induced by high speed vessels and/or aircraft.

Measured ship motion as well as mathematical simulations of advanced surface platforms will be reproduced in the laboratory and then used to stimulate both instrumented human volunteers and large primate subjects on whom physiological and pathological effects will be measured. The data are necessary in the development of medical crew selection and operational criteria for such vehicles and in determining effects of the specific vehicular motion on crew and passengers alike. The tolerance of the human being and primate analog to various durations and intensities of the measured motion will be determined in various postural modes and with various items of equipment.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0007, INVESTIGATION OF ASPERGILLUS FLAVUS
Unknown, University of Maryland, Eastern Shore, Undergraduate School, *Princess Anne, Maryland* 21853 (NSG 6033)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

6.0008, SOIL STABILIZATION BY A PROKARYOTIC TERRESTRIAL MAT IN THE SOUTHWESTERN UNITED STATES - IMPLICATIONS FOR PRECAMBRIAN TERRESTRIAL BIOTA
S. Golubic, Boston University, School of Medicine, Dept. of Biology, *80 E. Concord St., Boston, Massachusetts* 02215 (NSG 7588)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0009, ALLEVIATION OF HEAT STRESS IN AIR CREW COMPARTMENTS (22)
R.F. Goldman, U.S. Dept. of Defense, Army, Medical Research & Development Command, Research Inst. of Environmental Medicine, *Natick, Massachusetts* 01760 (DA0C6130)

Evaluate simple auxiliary cooling approaches to alleviate heat stress fatigue during flights when there is no aircraft cooling system or when use of the environmental control system (ECS) in Army aircraft is prohibited because of high exhaust gas temperatures (e.g. AH-1 helicopters when exhaust temperatures remain above 610 degrees C).

Multipocketed vests, fitted with plastic water containers, have been developed for use in alleviating the heat stress during work in the heat and high humidity of deep mines. The vests, kept in a freezer or donned just prior to entry into the mine, are worn under the outer garments and over underclothing. They are reported to provide 4 to 6 hours of effective working time with

minimum discomfort. Such vests will initially be evaluated on the heated, sweating copper man to measure the actual cooling provided and thereby assess the environmental range and time duration of probable utility. Thereafter, collaborative studies with USAAMRL (Ft. Tucker) will be carried out, first on test subjects in climatic chambers at USARIEM and then, if warranted, during actual flight operations using air crew as subjects.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Research Inst. of Environmental Medicine

6.0010, VENTILATORY CONTROL MECHANISMS AT HIGH ALTITUDE (22)

J.T. Maher, U.S. Dept. of Defense, Army, Medical Research & Development Command, Research Inst. of Environmental Medicine, *Natick, Massachusetts* 01760 (DA0B6132)

The physiologic processes which control the ventilation of man at high altitude are not fully understood. The objective of this work unit is to gain new knowledge of ventilatory control, with emphasis on adaptations within the control system during exposure to chronic hypoxemia, as experienced during sojourn at high terrestrial altitudes. A thorough understanding of this aspect of altitude physiology is essential in defining new approaches for enhancing the adaptation of the soldier to high terrestrial elevations.

An integrated program is under way to analyze the contributions of both the carotid boyd and medullary chemoreceptors to the ventilatory adaptations of man to hypocapnic hypoxia, including interactions between the two chemoreceptors. Techniques which would allow the identification stage, additional studies to determine the relationship between the ventilatory controller and effector, as exemplified by influences of increased inspriatory flow resistance on the ventilatory response of man to hypoxia or hypercapnia are included.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Research Inst. of Environmental Medicine

6.0011, BEHAVIORAL MODIFICATION AS AN APPROACH TO WEIGHT CONTROL IN THE AIR FORCE

O. Maller, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0H4365)

To develop an effective, integrated, individualized and prototypic program for the self attainment and maintenance of military standards of body weight for AF flying personnel. This program will make available to personnel those techniques which have demonstrated to be effective in the self-management of food habits and physical activity patterns.

Quantify and measure food selection and consumption patterns, and physical activity patterns of target population before and following the introduction of weight loss and maintenance programs. The techniques of behavior modification will be evaluated and then selected on the basis of the efficacy for individualized use to attain and maintain body weight standards of the Air Force.

SUPPORTED BY- U.S. Dept. of Defense, Army, Natick Research & Development Command

6.0012, AUTOMATICITY AND SKILL ACQUISITION IN A MULTIPLE TASK

J.E. Regan, University of North Carolina, Chapel Hill Campus, Graduate School, *Chapel Hill, North Carolina* 27514 (NSG 2390)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0013, INFLUENCE OF SURFACE MORPHOLOGY MODIFICATION BY ION BEAM SPUTTERING ON TISSUE RESPONSE TO PERCUTANEOUS IMPLANTS OF VARIOUS COMPOSITIONS

D.F. Gibbons, Case Western Reserve University, School of Engineering, Dept. of Biomedical Engineering, *University Cir., Cleveland, Ohio* 44106 (NSG 3282)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

6.0014, BIODYNAMIC DESIGN CRITERIA FOR EMERGENCY ESCAPE SYSTEMS

J.W. Brinkley, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF312330)

To develop acceleration exposure limits and protection equipment requirements for operational and advanced ejection seats and crew escape modules. The effort will result in the development of new escape system specifications and upgrading of existing specifications in the U.S. Air Force aerospace systems development program in order to minimize personnel injury during emergency escape.

Acceleration and windblast environments currently experienced with operational escape systems or predicted for advanced systems will be studied analytically and experimentally to develop human exposure limits. The exposure limits will be expressed in terms of mathematical analogs and verified by comparison with current operational injury rates associated with specific environments and by tests using human subjects. The resulting analogs will be used to study the degree of protection or hazard provided by specific personnel equipment configurations. The study results will be verified experimentally.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0015, HUMAN PHYSICAL CAPABILITIES FOR AF JOBS

J.W. McDaniel, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320950)

To improve the data base for describing the mobility, strength, and endurance variability of AF men and women where existing data are inadequate for the design, operation, and maintenance of AF systems. To improve systems effectiveness by developing designs for controls comparable with the operator's capabilities. To assess the adequacy of female strength and endurance characteristics for assignment to the role of aircrew members. To improve the design and placement of aircraft controls to minimize performance degradation from acceleration.

Methods are being employed to measure static strength and body mobility characteristics (FY 77-78). New methods for measuring dynamic strength and endurance are being investigated in FY 78-80. Equipment and procedures are being developed to measure and record the human operator configuration while performing aircrew-related tasks. To provide control design recommendations directly to procuring activities or through technical reports or design standards to improve the efficiency and operability of AF systems. Design complex controls based on the biomechanical characteristics of the hand to reduce the incompatibility between the precise operation of a control and its secondary control. Activation of controls in conventional and high acceleration cockpits is being investigated. The effects of encumbering and restrictive equipment and clothing on operator performance is being investigated. A methodology will be developed in FY 77 for use by AFFTC to evaluate flight control resistance characteristics of new systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, EVALUATION OF HEARING PROTECTORS USING ANSI REAT METHOD

M.R. Stephenson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321330)

AMRL/BBA is responsible for evaluating personal hearing protectors for use in AF hazardous-noise environments. The objective of this effort is to maintain our on-going program of investigating hearing protection performance of helmets, head-sets and other sound protective devices. Hearing protectors submitted for evaluation will be measured for compliance with criteria established for acceptance on the Air Force qualified products list

(mil spec 38268B) and considered for potential widespread or special purpose use in AF noise environs.

Human subjects will be employed in the laboratory evaluation of a hearing protector's sound attenuation characteristics as measured by the American National Standard Institute (ANSI) real ear attenuation at threshold (REAT) method. Results of these evaluations will be used to formulate recommendations to the office of the AF Surgeon General concerning potential application for AF use. Data will be processed and prepared in formats consistent with general methods used by the scientific community as well as the AF for estimation of noise reduction in operational situations. This effort assures that our data base is current by evaluation of the many modified and new devices appearing on the commercial market in increasing numbers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, EJECTION SEAT CATAPULT TESTING UNDER HIGH G

C.G. Toler, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF324420)

The design, manufacture and acceptance of ejection seat catapults are based entirely upon the performance during qualification tests under 0 g or 1 g conditions. However, both current and future aircraft with full authority flight control systems increase the probability that the aircraft will be under high g maneuvering loads or under high loads after departure from controlled flight at the time of ejection initiation. The ejection forces produced by the escape system under these conditions cannot be predicted on the basis of the available data at 0 and 1 g. Without measurements or prediction of these forces it is impossible to predict the injury potential associated with ejection under these conditions or the nature of catapult redesign that might be required. The objective of this research effort is to obtain experimental data on the behavior of several ejection seat catapults while they are under an acceleration field. The dynamic performance of 36 ejection seat catapults will be measured while the catapults are subjected to varied acceleration fields. The acceleration fields will be created using AMRL horizontal impact facilities. A payload sled (weighing 300 to 450 pounds) will be ejected from the accelerated impact sled of the facility using several different catapult types. The resulting data will be used to develop and validate mathematical models of ejection catapults that can be used to predict their performance under operational high g conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0018, PILOT WINDSCREEN FACTORS

W.L. Welde, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321100)

The objective of this effort is to (1) obtain empirical field data on the visual effects that are observed in various operational aircraft windscreens by the aircrews, (2) define the critical visual tasks that may be affected by degraded optical windscreen qualities, (3) relate task requirements to specific areas of the windscreen as appropriate for each aircraft, (4) acquire quantitative and qualitative flight and simulation experimental data of specific optical effects upon pilot visual task performance, and (5) correlate pilot visual task performance with existing and laboratory-developed windscreen distortion measures.

The initial effort will consist of evolving methodologies for accomplishing each of the objectives previously outlined. This will result in the development of an interview technique and questionnaires for obtaining detailed information from aircrews related to what visual aberrations are observable in various aircraft windscreens, their location and effect upon critical visual tasks. Experience and knowledge will be gained on windscreen optical effects and pilot visual tasks by interacting directly with the aircrews at operational bases and test centers and, whenever possible, participating in tactical training flights in the appropriate aircraft. An analysis of critical visual tasks will be directed primarily towards visual tasks encountered by pilots flying the F-111, FB-111, and the F-16 aircraft because of the requirement for low-altitude high-speed flight and the ever-present birdstrike hazard in this flight regime. An inflight investigation will be conducted with the AFFDL C-13LH TIFS (total inflight simulator) aircraft operated by CALSPAN to determine if selected PPG distortion panels affect safety, fatigue, and pilot visual task performance levels.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0019, IMPROVED WINDSCREENS

C.P. Hatsell, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322650)

Specify optical design and quality control criteria for multilayer aircraft windscreens to optimize system safety and effectiveness.

Apply techniques of geometrical optics and optical physics to develop methods of and devices for quantifying windscreen distortion, and relate these distortion measures to windscreen geometry and materials. Determine the feasibility and materials specifications for antireflectant coatings to reduce multiple imaging phenomena in thick windscreens of complex geometry. These measures and specifications will direct materials and manufacturing technology toward windscreen improvement for enhanced operational capability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0020, AVIATOR'S BREATHING OXYGEN CONTAMINANT ANALYZER

K.G. Ikels, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322290)

Headquarters, Air Training Command, issued required operational capability NR. ATC 2-72 in June 1972 for a portable oxygen contaminant analyzer. This ROC is for an immediate analysis capability for oxygen samples taken from aircraft following an inflight physiological incident where aviator's breathing oxygen is implicated. The ATC ROC was validated by HQ USAF on PMD NR. R-Q-3-013-(1), dated 21 July 1972. The objective of this effort is to develop a portable contaminant detector for base level personnel to perform oxygen analysis in accordance with use limits specified in T. O. 42B6-1-1.

Feasibility of a miniaturized portable infrared analyzer for field detection of use limit contaminants was demonstrated in OT and E program conducted in FY 74. The instrument transitioned to engineering development in late FY 74 and is now managed by the ASD/AEL under endeavor AO258. Major effort in FY 76 was the design modification and systems procurement. Operational T and E will be conducted in FY 77 and initial inventory deployment in FY 78. Previous accomplishments in this work area are documented under work unit 71641601. This effort is being transferred to implement a new technology planning objective as directed by HQ Aerospace Medical Division.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0021, THERMAL STRESS INSTRUMENTATION

R.F. Stribley, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF320100)

The purpose of this project is to design and construct a modified miniature environmental monitor (MEM) for use by the USAFEHL in conducting field thermal stress studies. Instrumentation presently available for thermal stress surveys are behind current technology, require frequent calibration, are of questionable precision, and do not measure all of the variables affecting the heat transfer of bodies within an environment. This joint effort will augment existing USAFSAM capabilities of field data collection and provide additional input, as a data base, to the thermal stress program.

In order to meet the Environmental Health Laboratory's needs, USAFSAM/VNT plans to modify the design of the existing MEM to include multiple black globes and temperature sensors. Also, a digital recording system will be utilized to increase total system accuracy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0022, USAF CENTRALIZED WAIVER REPOSITORY (WAVR FILE)

G.O. Tolan, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322050)

To tabulate in a readily-available computerized form the essential medical data on rated personnel who receive waivers for medical defects in order to continue flying duties. To provide to the Surgeon General, USAF, and to the surgeons of the major air commands, on a periodic basis, the information required to assure timely administrative review of waivers and appropriate evaluation or reevaluation of significant medical problems in flying personnel.

AFM 160-1, paragraph 3-6D(6), requires submission of identification and medical data to USAFSAM by waiver authorities every three months. Information from the USAF Military Personnel Center regarding changes in base and command of assignment is also entered. Publication of the file is also accomplished on a quarterly basis. In addition to a master file, or complete list, sent to the Surgeon General's office, each major Air Command Surgeon's office is furnished with a list of individuals within that command and a suspense list (by waiver expiration date) for the following three months. Capability will be maintained for searching the file for any diagnostic or other medical terms and will be responsive to requests from the major Air Command or Surgeon General's office to provide information as required. Work was formerly documented under work unit 7755-14-02.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, STEREO ACUITY

T.J. Tredici, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323040)

The traditional decision-point in ophthalmologic considerations regarding flying status has been differentiating those individuals with a phoria from those with a manifest deviation or tropia. Those with tropias (crossed eye) have not been qualified for flying status because of defective stereoscopic vision and their almost universal failure of the depth perception tests. A distinct category of patients between these two extremes has not been identified in the patient population of the aeromedical consulation service. These individuals do indeed have a tropia but one of extremely small degree. These individuals do retain some degree of stereoscopic vision, and many can pass one of the USAF depth perception tests. The term developed for this type of disorder is 'microtropia.' Following a battery of motility testing procedures, a number of USAF flying personnel have been recommended for waiver for continued flying status. Since this is a totally new entity in the ophthalmologic field, the true nature of the process, its causes and ultimate prognosis -- i.e., progression to greater visual disability--are not yet clearly delineated. The objective of this work unit is to continue to follow such patients over time to provide the presently lacking new knowledge and to validate the established policy of continued flying for individuals with this condition. New stereoscopic testing equipment needs to be developed. Presently available testing devices are not sufficiently sensitive to carry-out some of the tests desired.

Those USAF aircrew members referred to the Ophthalmology Branch, Clinical Sciences Division, who have failed the USAF stereoscopic depth perception test will be put through an extensive battery of diagnostic tests to determine the cause of their failure. If the etiology of their failure is microtropia, they will be followed under this unit for aeromedical assessment regarding stability or progression. As new knowledge regarding this entity is developed, it will be transmitted to the field for utilization in all Air Force medical facilities and further disseminated to civilian and military ophthalmological community through publication of scientific papers. An attempt will be made to develop new and more refined stereoscopic testing devices by contractual effort. Work was formerly conducted under work unit 77550905.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0024, CLINICAL EVALUATION OF G-SENSITIVE MEDICAL CONDITIONS IN AIRCREW

J.E. Whinnery, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323590)

Assessment of the plus GZ tolerance of aircrew members having various medical abnormalities in an effort to determine their ability to perform safely and effectively in an increased plus GZ environment. Establishment and refinement of plus GZ tolerance norms for clinical aeromedical use. Determination of the effects of specific medical therapeutics on plus GZ tolerance.

Asymptomatic aircrew members referred to the USAFSAM Aeromedical Consultation Service for evaluation of certain medical abnormalities (e.g. cardiac vascular abnormalities, cardiac arrhythmias, hypertension, abnormal exercise tolerance tests, unexplained syncope and loss of consciousness in flight) will be subjected to specific plus GZ stress profiles on the USAFSAM human centrifuge. G tolerance will be measured to determine if their medical abnormalities significantly affect their plus GZ tolerance. Establishment of a USAFSAM acceleration repository for input of all g-tolerance data has been accomplished so that easy retrieval and more formalized reporting of this information will be available. Further study into the validity of the specific g-test profiles will continue and will be compared with results of other clinical tests. Relaxed g-tolerance norms using a specific medical evaluation protocol have been established.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, CRITERIA FOR ABNORMAL ECG RESPONSE TO EXERCISE STRESS TESTING USING 3-DIMENSIONAL ANALYSIS OF ORTHOGONAL LEAD SYSTEMS

R. Wolthuis, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321830)

Less than 50 percent of aircrew members subjected to coronary arteriography because of an abnormal electrocardiographic response to exercise stress testing have obstructive coronary artery disease. This effort will better define normal versus abnormal criteria of interpreting electrocardiographic responses to exercise stress testing using widely-accepted orthogonal lead systems to establish a more reliable immediate risk identification of aircrew members with potential coronary artery disease.

Orthogonal electrocardiograms will be recorded during exercise stress testing and subjected to automated three-dimensional analyses. Results will be correlated with clinical evaluations including coronary arteriography and the cardiopulmonary responses to exercise stress testing. Noninvasive methods for evaluating the circulatory responses (e.g. echocardiography) and the effect of drugs (e.g. propanalol) on the repolarization response to exercise will be utilized and correlated with the results of left ventricular angiography and coronary arteriography. This work was formerly documented under 7755-01-05.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, ESTABLISHMENT OF STANDARDIZED EXERCISE STRESS TESTS FOR DETECTION OF CORONARY ARTERY DISEASE IN AIRCREW MEMBERS

R.A. Wolthuis, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321620)

The leading medical cause for removal of aircrew members from flying status is disease involving the circulatory system. This effort is to determine the value of exercise stress testing in the early detection of cardiopulmonary disease and in quantifying the

significance of such disease to the flyer, and to establish a standardized reliable exercise stress test that can be used in the field.

Aircrew members are studied during maximal exertion to provide better understanding of the normal/abnormal circulatory and electrocardiographic responses and the influence of disease and physical conditioning on these responses. Studies of exercise stress testing procedures and monitoring methods including automated ECG analysis as well as the development of better methods for measuring work performance will continue. This work was formerly documented under 7755-01-02.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, VECTORIZING TRANSONIC CODES FOR USE ON ADVANCED COMPUTERS
M.D. Vandyke, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCA 2-745909)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0002, MATHEMATICAL MODELS OF MANNING UTILIZATION
S.E. Bowser, U.S. Dept. of Defense, Navy, Personnel Research & Development Center, *San Diego, California* 92152 (DN897512)

To develop and demonstrate a mathematical simulation model as an alternative to shipboard testing for evaluating the effects of variations in manning on operational performance of Navy ships and aircraft.

An existing large-scale ship simulation model, (ship II) and an analytic compilation of existing manpower models will be built upon. There will be six phases: (1) criteria for the manpower reduction model will be developed, (2) existing models will be analyzed to identify techniques and procedures which could be utilized and adapted, (3) the model will be designed, (4) needed data will be specified and collected, (5) the model will be tested to validate and demonstrate the adequacy and accuracy of its simulation, and (6) manpower reduction methods will be developed. The model will be used to demonstrate the effects of the various methods.

SUPPORTED BY U.S. Dept. of Defense, Navy, Personnel Research & Development Center

7.0003, JOINT USE OF RESOURCES FOR IMPROVED LANDSAT DATA PROCESSING CAPABILITY
R.J. Murray, Oregon State Higher Education System, Oregon State University, Computer Center, *126 Agriculture Hall, Corvallis, Oregon* 97331 (NCA 2-586901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0004, INVESTIGATION OF PORTABILITY TECHNIQUES FOR A LARGE FLIGHT-ORIENTED PROGRAMMING LANGUAGE
S. Feyock, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Mathematics & Computer Science, *Ewell Hall, Williamsburg, Virginia* 23185 (NSG 1626)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, NUMERICAL SIMULATION OF THE TURBULENT CASCADE AND VOLTAGE AMPLIFICATION MECHANISM IN THE MAGNETOSPHERE
O.W. Swift, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (NSG 7625)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0002, LABORATORY INFRARED REFLECTANCE STUDIES
Unknown, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (NSG 7607)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

8.0003, LASER SPECTROSCOPY AND COLLISION STUDIES OF MOLECULAR IONS
W.H. Wing, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (10233-AC6)

This proposal concerns high-precision spectroscopy of vibration-rotational frequencies of molecular ions, employing a novel ion beam-infrared laser resonance method which has recently produced the first observed infrared spectrum of the hydrogen molecular ion, nature's simplest molecule. This result has opened the possibility of a wide range of molecular ion studies producing highly accurate and detailed measurements both of internal structure and of collision cross-sections of molecular ions in individual vibrational states. Such spectroscopic data are at present nonexistent for most molecular ions except from estimates or theoretical predictions. Similarly most measured cross-sections are averages over internal-state distributions.

If successful, the program would establish energy levels of molecular ions to at least the precision with which levels of neutral molecules are now known. Thus the results will be of great importance to quantum chemistry, molecular theory, astrophysics, and the description of high-temperature gaseous and plasma processes.

SUPPORTED BY American Chemical Society

8.0004, STUDIES ON LASERS AND LASER DEVICES
S.E. Harris, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (NSG 7619)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

8.0005, THEORETICAL SOLID STATE PHYSICS
M. Cohen, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720

Theoretical analyses aided by computer calculations are used to explain existing experimental phenomena and to predict new properties of materials such as surface states on clean semiconductors; electrons at steps; vacancies and adsorbates on semiconductors; microscopic theory of metal-semiconductor interfaces (Schottky barriers); electronic structure of transition metal surfaces; bulk electronic and optical properties of solids; and superconducting transition temperatures for arbitrary electron-lattice coupling. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0006, IMPROVEMENT OF THE ELECTRON-PHONON INTERACTION AS A FINAL MAJOR STEP FOR CALCULATING THE SUPERCONDUCTING TRANSITION TEMPERATURE IN NIOBIUM
C.Y. Fong, University of California, Davis Campus, School of Letters & Science, Dept. of Physics, *Davis, California* 95616 (NSG 2383)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0007, BEAM-PLASMA INTERACTIONS IN A LARGE LABORATORY PLASMA
R.L. Stenzel, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 7616)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0008, SURVEILLANCE AND COMMUNICATION - SUPERCONDUCTING SEMICONDUCTOR DEVICES
H. Suhl, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DN875260; N00014-78-C-0029)

The contract shall study the properties of planar Josephson junctions fabricated on semiconductor substrates. The resultant new class of superconducting devices is of direct interest to the Navy for use in its communication, signal processing and ASW systems.

Magnetoresistance and Hall-type measurements will be performed on P-InAs to determine electron density, mobility and the width of the N-type surface layer. Characterization of the 'free' surface and the surface under the superconducting electrodes will be attempted. Initially the penetration of the superconducting order parameter of a lead contact into an inverted surface region in P-type InAs will be investigated. Among the parameters to be varied are the thickness and carrier concentration in the inverted region. Effects of temperature and magnetic field will also be explored.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0009, ELECTROOPTIC BEAM DEFLECTOR
T. Litovitz, Catholic University of America, School of Arts & Sciences, Dept. of Physics, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (DN780286)

To investigate thin film optical beam deflectors for use in high speed optical A/D converters. Several approaches to thin film beam deflection have been demonstrated to date. The best of these approaches using electrooptic prism arrays will be investigated and designed for optimum performance. Emphasis will be placed on the reduction of beam distortion, and the suppression of sidelobes in order to obtain the maximum number of resolvable spots. The design will also be optimized for GHZ deflection speeds and will be incorporated into a miniaturized optical system to separate the beams. The Navy has a continuing requirement for new and/or improved device performance for use in signal-processing applications.

The various approaches to optical beam deflection in thin films will be investigated and the optimum design will be chosen. Theoretical analysis will be performed to determine the best electrode configuration from the point of view of speed, beam distortion and sidelobe suppression. Several devices will be fabricated and tested. Efforts to incorporate the deflector into a microoptic circuit will also be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0010, MOLECULAR RADIATION PHYSICS--FUNDAMENTAL RADIATION PHYSICS AND CHEMISTRY AGENCY
J.L. Dehmer, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (ANL 67100; ERDA RK-02-04-02)

This research is directed principally toward detailed understanding of the primary and secondary events in the interaction of ionizing radiations with matter. These early events are equally relevant to physical, chemical, and biological action of radiations. The methods are entirely theoretical, but utilize a great deal of experimental information. One important task of this research is to coordinate experimental efforts of the Fundamental Molecular Physics and Chemistry section through theoretical interpretation and analysis.

SUPPORTED BY U.S. Dept. of Energy

8.0011, MICROSCOPIC THEORY OF NUCLEI, NUCLEAR, AND NEUTRON STAR MATTER
V.R. Pandharipande, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (PHY7826582)

This proposal is in the field of theoretical physics, with emphasis on studies of properties of nuclear matter and of quantum fluids. Specific topics to be examined include: A. Theory of simple quantum fluids like helium liquids, electron gas, etc., in which the two-body interaction is a spherically symmetric function of the interparticle distance. B. Variational theory of nuclear and neutron-star matter: The main interest here is to develop theories to treat the important spin, isospin, tensor and spin-orbit correlations in these fluids. C. A study of nucleon-nucleon interaction models which are the essential ingredients for a microscopic theory of dense matter. D. A study of possible phases of matter at super-nuclear densities, particularly pion condensates and quark matter. E. Calculation of neutron-star models and their observable properties. F. Microscopic calculations of the structure of finite nuclei.

First of a 3-year continuing grant, renewal of PHy76-22147AO2.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0012, SUPERCONDUCTIVITY
K.A. Gschneidner, U.S. Dept. of Energy, Ames Lab., *Ames, Iowa* 50010

Low-temperature, high-magnetic field heat capacity studies are made of 4f-type superconductors, La3In, LaOS2 and La3S4. Preparation of superconducting composite materials by directional solidification is studied. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0013, INVESTIGATION OF CHARGED PARTICLE ACCELERATION MECHANISMS IN SPACE PLASMAS
G.R. Joyce, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (NSG 7632)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0014, RADIO-FREQUENCY SIZE EFFECT MEASUREMENTS IN METALS
R.G. Goodrich, Louisiana State University, Agricultural & Mechanical College, Graduate School, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (DMR7681866A02)

The research program of radio-frequency size effect measurements in high purity metals and the calculations necessary to interpret the measurements which previously were supported by NSF grant DMR73-02427AO2 will be continued. This research program has three parts: The Fermi surfaces of rhenium and other metals will be accurately determined; relaxation processes involving the electronic carriers in gold, silver and in other metals will be investigated; and detailed computer calculations will be performed to aid in the interpretation of the measurements.

This is the lst year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0015, ELECTRICAL NATURE OF DISLOCATIONS IN SEMICONDUCTORS
J.S. Ahearn, Martin Marietta Corp., Martin Marietta Laboratories, *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DMR78-05717)

This project will be a study to determine the nature of the defect state that is introduced into semiconducting materials by dislocations. It is known that dislocations degrade the performance and reliability of semiconductor devices. The objective will be to understand the mechanisms whereby this performance degradation occurs.

Materials to be studied will include single crystals of silicon and zinc oxide, which is a wide band gap semiconductor. The semiconductor will be the working electrode of an electrolyte cell. The charge residing in the dislocation level(s), other defect levels, the conduction band, and the valence band will be altered by changing the cell potential. The effects of altering the charge on these levels will be detected by current-potential, capacitance-potential, and dislocation velocity measurements.

Dislocations will be introduced by deformation, transmission electron microscopy will establish the dislocation density and type, and stress pulse techniques and etch-pitting will be used to determine dislocation velocities.

This research is a continuation of studies initiated under NSF Grant DMR75-05443 A03.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0016, INFRARED NONLINEAR OPTICS IN SEMICONDUCTORS

P.A. Wolff, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF041830; AFOSR-76-2894)

AF function - secure space communications and covert optical electronics require devices which exploit special properties and interactions of materials with far infrared radiation. Opportunity -infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - this effort combines theory and experiment to investigate a variety of infrared nonlinear optical energy transfer processes in narrow band-gap semiconductors for generating coherent far infrared tunable sources of radiation. How work contributes - these interactions and unique phenomena should provide a basis for developing useful tunable, infrared sources for communications and radars and diagnostics of rocket plumes and exhausts.

The following nonlinear processes involving mobile and weakly-bound electrons in semiconductors are being studied: stimulated impurity RAMAN scattering in N-Ge and N-Si, resonant, field-induced nonlinearities due to impurities, radiation from parametrically-excited plasma waves, resonant, spin-flip scattering in InSb and (Cd,Hg)Te, stimulated, far infrared spin flip scattering, resonant, spin-induced difference frequency generation, stimulated, bulk plasma-wave scattering, and sideband generation via spin precession. These theoretical and experimental studies should yield new insights concerning electron dynamics in semiconductors and the probable generation of coherent, far infrared sources of radiation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0017, LOCAL FIELD EFFECTS AND THE OPTICAL PROPERTIES OF INSULATORS

D.L. Johnson, Northeastern University, Graduate School, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR78-12001)

The optical properties of solids are conventionally analyzed under the assumption that the polarizable valence charge density is homogeneous on a microscopic scale - the justification being that the wavelength of light is much larger than the interatomic distances and so the latter fluctuations average out as far as the former is concerned. The extent to which this is not a valid assumption is called the local field effect. This research will carry out a plan for theoretically calculating the local field effect in insulators by means of relatively simple models with no adjustable parameters. The most significant successful experiment bearing directly on local field of refraction for light propagating in a low symmetry direction actually depends slightly on the direction of polarization of the light. This is because the cubic symmetry of the crystal is lower than isotropic symmetry; the effect is absent in an assumed isotropic dielectric, likewise for propagation in high symmetry directions. There is at present no quantum mechanical theory of this effect and it is one of the principal aims of this research to calculate it.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0018, OPTICAL CONSTANTS OF TRANSITION METALS

R.W. Christy, Dartmouth College, School of Arts & Sciences, Dept. of Physics & Astronomy, *P.O. Box 833, Hanover, New Hampshire* 03755 (NSG 2397)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0019, EFFECTS OF LARGE AMPLITUDE ION ACOUSTIC WAVES ON THE BEAM PLASMA INSTABILITY

J. Walsh, Dartmouth College, School of Arts & Sciences, Dept. of Physics, *P.O. Box 833, Hanover, New Hampshire* 03755 (DF049590; AFOSR-77-3410)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand advanced equipment unavailable to date. Deficiency - present day information is inadequate to design the aforementioned equipment. Such information may be obtained from experimental and theoretical work on beam-plasma nonlinear interactions. Objective - this project will investigate the effects of large amplitude ion acoustic waves on the beam-plasma instability. Contribution - this work is a part of a comprehensive program on plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications and the development of countermeasures.

This project will perform experimental and theoretical research on two beams - a. A fast electron beam which is propagated in a plasma containing large amplitude short wavelength ion acoustic waves. In this experiment the following processes appear: 1. The beam drives a long wavelength plasma wave unstable. 2. This wave couples its energy strongly to a much shorter wavelength plasma wave. The main objective is to isolate the effect of the large amplitude ion acoustic wave upon the beam-plasma processes of interaction of the relativistic beam with a plasma specifically the generation of microwave radiation. This may be accomplished by 1. Stimulated Cerenkov radiation of which considerable evidence exists and 2. Stimulated Raman-Cerenkov radiation of which there is no experimental evidence. To accomplish the foregoing they will explore - 1. The capability of the basic stimulated Cerenkov oscilliator-amplifier. 2. The possibility of driving coupled dielectric resonators and other dielectric structures and 3. The characteristics of various stimulated Raman-Cerenkov sources.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0020, EXPERIMENTS ON SUPERFLUID HELIUM THREE AND DISORDERED SOLIDS

K. Deconde, Princeton University, Graduate School, Dept. of Physics, *205 Nassau Hall, Princeton, New Jersey* 08540 (DMR7904141)

This research is a continuation of work initiated under NSF Grant No. DMR77-10636. A newly established ultra-low temperature facility will be used in an experimental program involving two diverse areas of low temperature physics. A helium-3, helium-4 dilution refrigerator, capable of producing temperatures as low as 0.013K, will be used in a study of the low temperature thermal, magnetic and transport properties of disordered solids. Of particular interest are systems of dilute, randomly positioned, dipolar impurities in a host solid. It has been suggested that the low temperature properties of such systems should obey predictions based on a two-level tunneling model. In order to test this suggestion, measurements of the ultrasonic attenuation of doped

crystalline solids and the time dependence of the dielectric constant of similarly doped glasses will be performed. Upon completion of a nuclear cooling stage capable of attaining temperatures as low as 0.0007K, a study of the spin-polarization properties of the A1 phase of superfluid helium-3 will be undertaken. Measurements of the direction of the spin-polarization, the spin-lattice relaxation times and the dependence of the superfluid transition temperature on the bulk polarization will be performed. This research is important for our fundamental knowledge of quantum fluids and solids--systems of prime importance to the low-temperature physics program.

First year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0021, RESEARCH STUDY ON THE EFFECTS OF RADIATION ON THE ELECTRICAL PROPERTIES OF INSULATOR MATERIALS IN MOS DEVICES (Z99QAXTA007-DNA)

G.W. Hughes, Radio Corp. of America, David Sarnoff Research Center, *Washington Rd., Princeton, New Jersey* 08540 (DA0F5733; DAAG39-77-C-0159)

To investigate the nature of charge traps in SiO2 films (both dry and wet thermally grown) employed as the gate insulator in MOS devices as a function of changes in processing variables.

Charges generated by vacuum ultraviolet radiation and subsequently trapped near the gate and semiconductor interfaces will be studied both via tunnel injection currents induced by the trapped charge and by conventional C-V techniques.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Harry Diamond Lab.

8.0022, LASER-INDUCED LIGHTNING INVESTIGATION

C.B. Moore, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (DF053590; AFOSR-78-3722)

AF function - aircraft, weapons stores and missiles are susceptible to direct or nearly direct lightning strikes. The AFFDL is the AF focal point for natural EMP. Deficiency - the inability of new composite materials to transfer lightning-induced charges and the increased susceptibility of flight control, avionics, and weapon guidance electronics due to the use of mini and microelectronics require a more complete knowledge of the frequency content and power levels of lightning. Objective - to test and analyze the use of a high-power laser system to enhance the probability of triggering a natural lightning discharge. Also to measure and diagnose the resultant lightning strikes. How work contributes - ground-based measurements would obviate the need for costly flight operations and overcome the space/weight limitations for receiver/diagnostic equipment and flight safety problems inherent in an aircraft test bed. Lightning location and time history will be better measured. The measured power level and frequency content will then be more knowledgeably modelled and understood.

The university investigators will supply the measurements of electric fields necessary for management of the laser discharge. The acoustics and video diagnostics of the lightning origins and path will also be provided by New Mexico Tech. The AFFDL will provide and operate the laser. Joint analysis of the triggering techniques and resultant lightning will be performed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0023, BASIC RESEARCH ON THE ELECTROMAGNETIC SPECTRUM 14979-EL

W. Happer, Columbia University, School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (DA0F9006; DAAG29 77 C 0019)

Research studies and investigations directed toward extending the useful range of the electromagnetic spectrum, in order to attain new fundamental knowledge to exploit the use of extremely short electromagnetic waves, extending the region of visible light and beyond.

Theoretical and experimental studies will be conducted in the following technologies - quantum electronics plus optics, electronic materials and gaseous electronics and antennas and microwave divices.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0024, CHEMISORPTION AND CATALYSIS ON MODIFIED SINGLE CRYSTALS AND MICROPARTICLES OF TRANSITION METALS

T.N. Rhodin, Cornell University, Ithaca Campus, School of Engineering, Dept. of Engineering & Applied Physics, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR7825261)

The long range goal of the present work is to understand the nature of the chemical bonding of atoms and molecules absorbed on surfaces. Such studies underlie better understanding of the performance of catalytic and related materials.

Experimental methods include programmed thermal desorption spectroscopy, low energy electron diffraction (LEED), and Auger electron spectroscopy (AES). The principal method is vacuum ultraviolet and soft X-ray angle resolved photoemission spectroscopy. Some of the measurements require the wide spectral range of intense polarized light available at the Stoughton, Wisconsin, synchrotron light source. Diffraction of photoelectrons by the ordered overlayers is explored as a possible new tool for surface crystallography. Systems chosen as model substrates are single crystal surfaces such as iron (110) and nickel (111). Absorbed species include atoms of oxygen, sulfur, selenium, and tellurium as well as molecules of carbon monoxide (CO) and ammonia (NH3). These particular substrates and adsorbates are related to catalytically important systems. As their surface coverages are increased, series of ordered overlayer structures are formed. The present work is directed toward understanding the adsorbate-substrate and adsorbate-adsorbate interactions that give rise to these structures.

This is a continuation of work supported by DMR 77-05078.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0025, COMMUNICATIONS - VARIATIONAL TECHNIQUES FOR COMPUTATION OF ATOMIC PROCESSES

L. Spruch, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (DN823378; N00014-76-C-0317)

The objective of this work is to construct theoretical variational expressions for the computation of cross-sections for atomic processes and expectation values of certain atomic operators. These would permit very precise computation of the relevant atomic processes. These atomic processes and atomic properties are important to the Navy since they occur in such systems as lasers, the atmosphere, gaseous electronic devices, etc., which are important to naval communications and surveillance.

A newly-derived variational principle for scattering lengths is being tested for scattering of positrons by hydrogen atoms. Previously derived extremum principles for the calculation of multiphoton ionization probabilities are being generalized to take into account the effect of a stong radiation field on the continuum states. Power series expansions in inverse powers of the magnitude of the wave vector are being derived for generalized oscillator strengths and charge transfer collisions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0026, ACOUSTIC WAVE EVALUATION OF SEMICONDUCTORS

P.K. Das, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Electrical Engineering, *110 8th St., Troy, New York* 12181 (DF049830; AFOSR-77-3426)

AF function - solid state microwave devices are essential components of Air Force command, control, communications and surveillance systems. Opportunity - methods for non-destruc-

tive testing microwave materials are presently inadequate. Objective s it is the objective of this research to develop and to perform non-destructive evaluation of 3-5 semiconductor materials using surface acoustic wave techniques. How work contributes - this research should provide a method to use routinely in testing non-destructively electronic materials after each step in device fabrication.

The interaction of acoustic surface waves in a piezoelectric substrate in the proximity of semiconductor charge carriers will be utilized to determine trap locations, surface and interface states, bulk and surface conductivity and mobility, and trap lifetimes by studying the attenuated output, and transverse acoustic-electric voltage in the presence of applied DC bias and different light wavelengths illuminating the semiconductor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0027, EXPERIMENTAL RESEARCH - SUPERCONDUCTIVITY

M. Strongin, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973

The following subjects are being studied: superconductivity in A-15 films; normal-state resistivity of Nb3Ge and Nb3Sn films; effects of alpha-particle and electron irradiation on the transition temperature and density of states; code-position of elements to study metastable phases in alloy films; and hydrogen in amorphous silicon films. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0028, PROPERTIES OF FLUID HELIUM NEAR CRITICAL POINT

H. Meyer, Duke University, Trinity College of Arts & Sciences, Dept. of Physics, *Durham, North Carolina* 27706 (DF046080; AFOSR-77-3119)

AF function - this proposed research primarily falls in the 5.3 research objectives which deal with electrical power for manned and unmanned aircraft, satellites and space stations as well as electrical power for unattended ground based systems. Research is required in the generation of usable electric power from non-nuclear energy sources, distribution and conditioning of the power and the attendant material requirements. The development of superconductive rotating electrical power generators and pulsed superconductive energy storage systems require that these systems be kept below their normal transition temperature. Deficiency - research is needed in making more efficient heat transport helium systems. As an example of the need, over 90 percent of the system weight of a superconductive energy storage system results from the cryogenic coolant and its storage container. This causes severe weight, volume and reliability penalties in the helium refrigeration systems. It does not appear that high temperature superconductors (TC 25 degrees K) will be developed. Objective - the program is based on high resolution dielectric constant measurements from which the PI can determine very sensitively the changes in the dielectric constant and also changes in the number density in the fluid with temperature and as a function of height in the cell. These results are used to obtain values of thermodynamic parameters of liquid helium (3) and (4) mixtures near the critical point. Contribution - this research is a part of a comprehensive program in superfluids and superconductors.

High resolution dielectric constant measurements are made to investigate thermodynamic characteristics of He(3) and He(4) mixtures near the critical point. More specifically the concentration susceptibility for a mixture ratio of .8 will be measured near the liquid vapor critical point and compared with theory. In addition the thermal diffusivity ratio, thermal conductivity and mass diffusion coefficient will be measured for concentrated mixtures near the superfluid transition. These measurements will be interesting since renormalization group theory and scaling theory predict differing behaviors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0029, EVALUATION OF TURBULENCE-INDUCED NOISE IN COHERENT ANTI-STOKES RAMAN SCATTERING

R.A. Elliott, Oregon Graduate Center, Graduate School, *19600 N.W. Walker Rd., Beaverton, Oregon* 97005 (NSG 2387)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0030, COMMUNICATIONS - ATOMIC AND MOLECULAR INTERACTIONS

R.M. Herman, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DN723885; N00014-75-C-0741)

Optical communications are of interest to the Navy. The objective of this work is to examine some of the problems assoicated with optical frequency standards in atomic systems.

The approach used will be to theoretically study the effects of pressure on quantum beat spectroscopy and to arrive at an understanding of how intraatomic coherence may be destroyed or transferred in atomic collisions following sudden excitation. The theoretical techniques used will be the resolvent operator and density matrix formalism of quantum mechanics and the radiation field will be treated quantum electrodynamically. The results of this study are expected to provide new information on processes affecting precision spectrosopic studies of atomic systems on the interatomic forces affecting various excited state atomic properties, and on spin exchange processes in excited atomic systems. Of special interest is the newly discovered phenomenon of collisional transfer of quantum beats to transitions in which none would be allowd in the absence of collisions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0031, ATOMIC COLLISIONS AND PLASMA PHYSICS 15740-P

M.A. Biondi, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DA0F9142; DAAG29-78-G-0044)

To study atomic collisions related to the upper atmosphere. This research provides basic information for ballistic missile defense systems, and has the potential for contributing parameters for studies of laser propagation in the atmosphere.

Experimental investigations of ion-molecule reactions and electron-ion recombination under conditions, and for species, of interest to DNA.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0032, APPLICATION OF POSITION-SENSITIVE DETECTION TO CYLINDRICALLY SYMMETRIC CHARGED-PARTICLE SPECTROMETERS

I. Sellin, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (PHY7820339)

This project will develop new detectors of atomic fragments, which will find use in detecting the reaction products from atom-atom interactions or the scattering of atoms from surfaces. Alternate schemes for carrying out two-dimensional position analysis of charged particle distributions at the exit of several cylindrically-symmetric spectrometers will be evaluated, and the most attractive scheme for use in basic physics experiments implemented. Basic research will benefit by making such low gathering-power, high-resolution, dispersive devices significantly more useful by virtue of multiplying data acquisition rates in short runs at major accelerator facilities (where time is tightly scheduled and expensive) by factors greater than 50. Because similar charged particle spectrometers have come into wide use as analytical tools for surface and chemical analysis in broad areas of materials science (for example, metallurgy), chemistry (for example surface catalysis), and applied physics (for example, chemical analysis of atmospheric gases), there will be significant impact of this research of several other technologies.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0033, MATERIAL SUPPORT TECHNOLOGY - INVESTIGATION OF OPTICAL BIASING ON THE QUANTUM TRANSPORT PROPERTIES OF SEMICONDUCTORS
D.G. Seiler, North Texas State University, School of Arts & Sciences, Dept. of Physics, *N. Texas Station, Box 13707, Denton, Texas* 76203 (DN675241; N00014-76-C-0319)

To investigate transient and non-equilibrium effects in quantum transport properties of electrons and holes in semiconductors that find application in naval electronic systems.

The investigation will study the quantum transport of electrons and holes generated by optical irradiation in the presence of high electric and magnetic fields. During this study, new tools will be developed and utilized to provide information on determination of the non-equilibrium electron temperature and the effect of laser irradiation upon this temperature, to determine the transient effects of the Shubnikov-de Haas and magnetophonon resonance effects in pulsed electric fields and the corresponding energy relaxation times, and to study the properties of the non-equilibrium carriers through spin-splitting of the Shubnikov-de Haas effect.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0034, MATRIX ISOLATION STUDIES OF BIMETALLIC CLUSTERS
P.A. Montano, West Virginia University, School of Arts & Sciences, Dept. of Physics, *Morgantown, West Virginia* 26506 (DMR7611113A01)

The study of metal clusters isolated in rare gas matrices using optical spectroscopy and electron spin resonance has opened a new area of research with long-range applications to areas such as nucleation, and heterogeneous catalysis. In the present, Mossbauer spectroscopy will be used to study matrix-isolated bimetallic clusters. This technique will help elucidate many of these clusters' properties, not measurable by other methods. Moreover, extended X-ray absorbtion fine structure (EXAFS) will be used to determine the interatomic distances for the matrix-isolated bimetallic molecules.

Simple bimetallic clusters of iron with Pt, Cr, Ti, and Ag are studied using Mossbauer spectroscopy and EXAFS. In this work the interest is in characterizing the molecules, finding their ground electronic properties of metal-metal bonds.

A study of the reactions of simple gases like CO, N2, CH4 with FeCu and FePt bimetallic clusters also will be undertaken.

This is a continuation of work supported by DMR76-11113.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0035, POLYMER SURFACE COATINGS FOR DOWNCONVERSION OF UV RADIATION AND INHIBITION
W.M. Yen, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706

This project focuses on the development and optical evaluation of surface coatings on polymeric substrates which will downconvert the UV component of solar radiation into the visible region and will simultaneously inhibit photodegradation of the plastic glazings. Coatings will be developed to adhere lanthanide trivalent ions on plastic substrates. They will then be tested, evaluated and compared to the optical and mechanical properties of coated systems. Solarization testing and development of an experimental methodology to assay the absolute and relative performance will also be performed. Cost-effectiveness analyses with the purpose of settling on optimum coatant, coating method and substrate will follow. Finally, a scale-up of the coating operation to commercial scale will be investigated. This project is under negotiation. (DOE/CS-0010)

SUPPORTED BY U.S. Dept. of Energy, Office of Conservation & Solar Applications, Div. of Solar Applications

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, THE ANNOYANCE OF IMPULSIVE HELICOPTER NOISE
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NSG 2393)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, STUDIES OF PLANETARY EXTENDED ATMOSPHERES
R.A. Brown, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (NSG 7634)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0002, STUDY OF THE HOTTEST WHITE DWARFS FROM THE PALOMER--GREEN SURVEY
R.F. Green, California Inst. of Technology, Graduate School, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 5385)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0003, SUPPORT OF RESEARCH INVOLVING INTERNATIONAL ULTRAVIOLET EXPERIMENT (IUE) SATELLITE
J.L. Greenstein, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 5181)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0004, ULTRAVIOLET OBSERVATIONS OF YOUNG STELLAR POPULATIONS
D.L. Meier, California Inst. of Technology, Graduate School, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 5384)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0005, RESEARCH OF INTERSTELLAR LINES IN THE GALACTIC HALO
W.L. Sargent, California Inst. of Technology, Graduate School, Dept. of Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 5369)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0006, ULTRAVIOLET OBSERVATIONS OF STARS - A COSMOLOGICAL COMPARISON
H. Spinrad, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NSG 5360)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0007, THE ACCRETION OF MASS ONTO COMPACT STELLAR OBJECTS

J.I. Katz, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (AST7815431)

This project will involve research on the accretion of mass onto compact stellar objects such as white dwarf or neutron stars. The problems will deal with the consequences of mass accretion and the conditions under which accretion can take place. Three specific problems will be analyzed: (1) There will be a calculation of the rate of accretion onto a compact stellar object moving through an inhomogeneous medium. (2) There will be a calculation of mass loss from a star in a close passage by a compact object and of accretion onto that object. (3) There will be development of improved techniques of data analysis for searching for a secondary spectrum (of another star) in a single-lined spectroscopic binary.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0008, OBSERVATIONS OF INTERSTELLAR ZINC

M.A. Jura, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 5377)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0009, STUDIES OF CIRCUMSTELLAR AND INTERSTELLAR GRAINS

M.A. Jura, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 7621)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0010, THEORETICAL LYMAN-ALPHA AND BALMER-ALPHA SPECTRA FOR PUBLISHED CHROMOSPHERIC FLARE MODELS

R.C. Canfield, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (DF044440; AFOSR-76-3071)

AF function - Air Force communications and spacecraft operations are affected by disruption in near-earth space produced by solar flares. Deficiency - improved prediction of solar flares is required. Objective - to understand the physical processes taking place on the sun during solar flares. Contribution - understanding the physical conditions in solar flares is a necessary condition to improving their prediction.

Present theoretical models of the solar flare atmosphere will be tested by computing profiles of the hydrogen radiation and comparing them with observations. The radiation will include Lyman-alpha, Balmer-alpha and Lyman continuum. The specific objective is to determine whether the models are physically self-consistent and compatible with the observed flare radiation. Development of improved steady-state and dynamic flare models will be begun. Numerical calculations will use the previously-developed probabilistic radiation transfer code to treat optically thick regions like the chromosphere. The specific objective is to develop physically-consistent models of the solar flare over a temperature range of ten thousand to ten million degrees K.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

10.0011, ULTRAVIOLET SPECTROSCOPY OF TAURI STARS

G.H. Herbig, University of California, Santa Cruz Campus, Graduate School, Dept. of Astronomy & Astrophysics, *Santa Cruz, California* 95060 (NSG 5361)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0012, INTERNATIONAL ULTRAVIOLET EXPERIMENT OBSERVATIONS OF MARS

A.L. Lane, University of Colorado, Denver Campus, Graduate School, *1100 14th St., Denver, Colorado* 80202 (NSG 5394)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0013, GALACTIC EVOLUTION AND RELATED STUDIES

B.M. Tinsley, Yale University, Graduate School, Dept. of Astronomy, *206 Elm, New Haven, Connecticut* 06520 (AST7723566A01)

Theoretical research on the evolution of galaxies and related topics will be carried out. The major projects are studies of field galaxies as probes in cosmology, rates of star formation in normal and peculiar galaxies, and nucleochronologies as constraints on chemical evolution in the solar neighborhood. Specific projects will include a study of chemical evolution in collapse models for the formation of disk galaxies and detailed population models for elliptical galaxies. An analysis of the Hubble diagram and related cosmological parameters will be done taking into account recent theories of galactic evolution. Previous results will be extended in the context of new data and related theories.

This research is a continuation of grant AST-7723566.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0014, PHOSPHORUS IN COARSE-STRUCTURED IRON METEORITES

R.S. Clarke, Smithsonian Institution, Div of Meteorites, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560 (3370-49)

The relationship of phosphide precipitation to the development of the Widmanstatten pattern in coarse-structured iron meteorites is under study. The distribution of nickel and phosphorus within Schreibersite and kamacite and taenite is being used as a tool in study of the cooling history of these meteorites.

SUPPORTED BY Smithsonian Institution, National Museum of Natural History

10.0015, NASA LOW-GRAVITY EXPERIMENTS

M.R. Moldover, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (2214441)

PROJECT OBJECTIVE: To assist NASA in the development of experiments in which gravity plays a key role. These experiments will be prime candidates for inclusion in the unique zero gravity environment of the NASA space laboratory.

PROJECT APPROACH: Various potential experiments for studying phase transitions in a low-g environment are being analyzed. The quantitative effect of gravity on the measurements is being determined. Of these, those experiments which might best exploit the low gravity environment of an orbiting laboratory are being identified. Where appropriate, those experiments at earth gravity which are necessary for final selection of low-g experiments for the space laboratory, or which are necessary for establishing a baseline against which to compare future results in the space lab are being carried out in our laboratory.

PRIOR YEAR ACCOMPLISHMENTS: 10 microkelvin thermostats designed and fabricated. Thin cell for dielectric constant experiment designed.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

10.0016, OBSERVING COMPACT OBJECTS - WORKSHOP

D. Pines, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (NSG 7598)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0017, STUDIES OF SUSPECTED HIGH CARBON ABUNDANCE PLANETARY NEBULAE
J.P. Harrington, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NSG 5390)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0018, DEVELOPMENT OF COMPUTER MODELS FOR THE ANALYSIS OF ULTRAVIOLET AND OPTICAL STELLAR SPECTRA
L.W. Kamp, Boston University, School of Liberal Arts, Dept. of Astronomy, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (NSG 5389)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0019, ULTRAVIOLET STUDIES OF ASTRONOMICAL SOURCES
A.K. Dupree, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NSG 5370)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0020, INTERNATIONAL ULTRAVIOLET EXPERIMENT (IUE) OBSERVATIONS OF INTERSTELLAR CARBON
A.K. Dupree, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NSG 5380)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0021, INVESTIGATION OF CARBON DIOXIDE ABSORPTION ON MARS AND VENUS
N.P. Carleton, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (NGR 09-015-047)

High-resolution spectroscopy (with a Fabry-Perot spectrometer of the PEPSIOS type) of planetary absorption lines is being performed. This work is directed toward obtaining abundances and temperatures of various atmospheric constituents and toward understanding the distribution of clouds, on Venus and Jupiter in particular. The original scope of this work has been extended to include successful detection of oxygen and (possibly) ozone on Mars, a search for oxygen and water vapor on Venus, detection of HD on Jupiter, and a study of line formation in the atmospheres of Venus and Jupiter.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0022, A SEARCH FOR NEUTRINOS IN NATURE
E.L. Fireman, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (450107)

One of the newest branches of astronomy is neutrino astrophysics -the study of neutrinos generated by celestial objects. Although neutrinos carry unique information that is unobtainable from other types of observations, attempts at their detection have heretofore been difficult and costly. SAO has developed and tested an inexpensive detector using potassium acetate and now proposes to continue measurements designed to determine the neutrino fluxes from various sources.

The present detector, which has been reliably operated under approximately 1000 feet of rock in the Hoosac Tunnel in Western Massachusetts for approximately 6 months, consists of 90 kilograms of potassium acetate. Limits for the neutrino and associated muon fluxes obtained with this detector are of scientific interest and were reported at the 13th International Cosmic Ray Conference on August 10, 1973; however, results of greater astrophysical significance should be obtainable with two 1000 kilogram potassium acetate units that are being constructed. One of these units will be installed at the Homestake Gold Mine in South Dakota and the other is planned for the Kolar Gold Mine in India.

SUPPORTED BY Smithsonian Institution, Office of Fellowships & Grants

10.0023, STELLAR SPECTROPHOTOMETRY
D.W. Latham, Smithsonian Institution, Astrophysical Observatory, Optical & Infrared Div, *60 Garden St., Cambridge, Massachusetts* 02138 (310-4050-08)

This is research in stellar spectroscopy. Part of it is medium-resolution high-accuracy spectrophotometry between 3200 and 10,800A, including a new absolute flux calibration of Vega. Part is high-resolution spectrophotometry using an echelle spectrograph. Recent efforts have centered on the microphotometry of echellograms and abundance analyses.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0024, CONTINUATION OF THE UTTAR PRADESH STATE OBSERVATORY/SMITHSONIAN ASTROPHYSICAL OBSERVING STATION AT NAINI TAL, INDIA
G.C. Weiffenbach, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (FR5-46242)

SAO operates a network of astrophysical observing stations under NASA Satellite-Tracking Program Grant NGR 09-015-002 to track satellites in support of SAO and NASA research programs. The network has provided data for geodesy, geophysics and celestial mechanics since 1958. Observational data for comet and flare-star research have also been provided.

In geodesy and geophysics, the data are being used at SAO to develop accurate mathematical descriptions of the earth's size, shape, and gravity field. This information is fundamental to the understanding of the composition and structure of the earth. Models developed and published by SAO are used by investigators in geodesy and geophysics around the world as standard references. As a part of the NASA-sponsored Earth and Oceans Physics Applications Program (EOPAP), we are now embarking on a new program to measure the dynamic properties of the solid earth and the oceans.

Under this program, phenomena such as crustal and polar motion, earth and ocean tides, earth rotation, and ocean surface topography will be measured with satellite techniques to support research in earthquake mechanisms, earth crustal structure, ocean circulation, and the general air-sea interaction, which has a large influence on weather and climate.

In atmospheric research, the data are used to develop models of upper atmospheric densites, composition, and dynamic properties. These models are also used world-wide as standard references by investigators in atmospheric physics, solar physics, and the many areas in space science.

The data have revealed correlations between solar activity and satellite drag, caused by solar heating of the upper atmosphere, that show that atmospheric density variations are related to a number of separate but related solar phenomena.

Because of its worldwide distribution and unique optical equipment, the network has been able to support research in flare stars, comets, and other astronomical phenomena.

The station at Naini Tal, India, is one of the SAO network's 11 photographic observing sites. Because of its geographical location this station is a unique and valuable source of observational data for the global network. It has been operated in cooperation with the Uttar Pradesh State Observatory since 1958.

SUPPORTED BY Smithsonian Institution, Office of Fellowships & Grants

10.0025, AN INVESTIGATION OF HALOS SURROUNDING SPIRAL GALAXIES
D.J. Hegyi, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Astronomy, *Ann Arbor, Michigan* 48104 (NSG 7608)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0026, RESEARCH OF SUPERNOVA REMNANTS AND NUCLEOSYNTHESIS
R.P. Kirshner, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Astronomy, *Ann Arbor, Michigan* 48104 (NSG 5366)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0027, ULTRAVIOLET SPECTROPHOTOMETRY OF CEPHEIDS
E.G. Schmidt, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (NSG 5391)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0028, VELOCITY DISTRIBUTION OF INTERSTELLAR CLOUDS IN DISTANT SPIRAL ARMS AND IN MAGELLANIC CLOUDS
D.G. York, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (NSG 5382)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0029, THEORETICAL STUDIES IN ASTROPHYSICS
S.L. Shapiro, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Astronomy, *Ithaca, New York* 14850 (AST7820708)

A number of topics in astrophysics will be investigated: (1) Stellar structure and evolution; (2) stars and their environments; (3) the interstellar medium; (4) globular clusters and galaxies, and (5) computational techniques applicable to astrophysical problems. In the area of stellar structure and evolution the formation of a compact object in a supernova explosion will be studied using fully relativistic numerical methods. There will be studies of accretion onto a neutron star in the presence of a magnetic field. The effect of planetary nebulae and supernovae on ionizing and heating the interstellar medium will be investigated theoretically and compared with radio observations of neutral hydrogen in the solar vicinity and in external galaxies. The dynamics of globular clusters which contain a massive central black hole will be studied. Star formation in galaxies, and the motion of gas in a galaxy will be examined. There will be numerical methods developed for the treatment of convection in stellar interiors.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0030, RESEARCH OF BINARY SYSTEMS AND COMPOSITE SOURCES INVOLVING COOL AND HOT COMPONENTS
R.F. Wing, Ohio State University, Columbus Campus, School of Arts & Sciences, Dept. of Astronomy, *190 N. Oval Dr., Columbus, Ohio* 43210 (NSG 5368)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0031, ULTRAVIOLET OBSERVATIONS OF VARIOUS TYPE SUPERGIANTS
N.D. Morrison, University of Toledo, Graduate School, *2801 W. Bancroft St., Toledo, Ohio* 43606 (NSG 5359)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0032, ULTRAVIOLET OBSERVATIONS OF HOT WHITE DWARFS IN BINARY SYSTEMS
E.M. Sion, Villanova University, School of Liberal Arts & Sciences, Dept. of Astronomy, *Villanova, Pennsylvania* 19085 (NSG 5375)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0033, OBSERVATIONS OF THE ULTRAVIOLET SPECTRA OF MAGELLANIC CLOUDS
R.J. Dufour, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (NSG 5364)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0034, ULTRAVIOLET-OPTICAL SPECTROPHOTOMETRY OF INTERESTING QUASI-STELLAR OBJECTS
B.J. Wills, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NSG 5387)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0035, PHOTOMETRIC AND SPECTROGRAPHIC INVESTIGATIONS OF DWARF CEPHEID STARS
D.H. McNamara, Brigham Young University, School of Engineering Science & Technology, Dept. of Physics, *B-166 A S B, Provo, Utah* 84601 (AST78-17954)

This project will provide support for studies of a class of variable stars known as Cepheids. Photometric observations will be obtained of (1) classical Cepheid stars in our galaxy and in the large and small magellanic clouds, and (2) double-mode Cepheid stars in the galaxy.

1. Intermediate-band photometry will be secured of Cepheids in the large magellanic cloud to determine differences in the chemical composition of Cepheids in the clouds as compared with Cepheids in the solar environment. The new magnitude data on the Cepheids will also be utilized to redetermine the period-luminosity relations in the large and small magellanic clouds to see if they differ and are functions of the chemical composition.

Classical Cepheids in the direction of the galactic center and anticenter will be studied in order to determine the variation of heavy element abundances as a function of distance from the galactic center.

The heavy-element-abundance determined from observations of Cepheids in the small magellanic cloud and large magellanic cloud and galaxy will be correlated with the mean period of the variables.

2. Photometry of the double-mode Cepheids should yield surface temperatures, relative surface gravity values, and metal abundances of each variable. This investigation should provide an observational framework to test the theoretical interpretations of these stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0036, OBSERVATION OF CIRCUMSTELLAR SHELLS AROUND COOL GIANTS AND SUPERGIANTS
M. Kafatos, George Mason University, School of Arts & Sciences, Dept. of Astronomy, *400 University Dr., Fairfax, Virginia* 22030 (NSG 5371)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0037, OBSERVATIONS OF PLANETARY NEBULA SHELLS AND CENTRAL STARS
J.H. Lutz, Washington State University, School of Arts & Sciences, Dept. of Pure & Applied Mathematics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (NSG 5383)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0038, STUDIES OF THE ULTRAVIOLET SPECTRA OF ASTRONOMICAL SOURCES
J.P. Cassinelli, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Astronomy, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NSG 5363)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

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01 AERONAUTICS (GENERAL)

N80-10001 Allerton Press, Inc., New York, N. Y.
SOVIET AERONAUTICS, VOLUME 21, NO. 3
A. V. Talantov, ed., A. I. Bogomolov, ed., B. S. Vinogradov, ed., and A. F. Gurov, ed. 1978 132 p refs Transl. into ENGLISH from Izv. Uyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 5-167
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

Factors related to the efficient operation of axial flow turbines and gas turbine engines are examined. Topics cover gas dynamics, flow distribution, jet mixing flow, heat transfer, turbulent diffusion, thermal protection materials, film cooling, and liquid bearings. For individual titles, see N80-10002 through N80-10030.

N80-10002 Allerton Press, Inc., New York, N. Y.
APPLICATION OF THE GAS FLOW DIMENSIONLESS CHARACTERISTICS METHOD FOR EXPERIMENTAL STUDY OF SONIC NOZZLES **c02**
G. V. Abalakov, B. S. Vinogradov, and A. P. Gerasimov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 1-5 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 5-11 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

A technique for quantitative description of gasdynamic flows requires measurement of the parameters at two sections: the initial section and the section being studied. Any channel section with area equal to the actual geometric section area or an arbitrarily adopted area can be used as the initial section. Each parameter at the initial section is measured only at those points at which the sensing element of the corresponding measuring instruments are installed permanently and invariably. The distribution of the parameters are measured over the area of the subject section. The correctness of the method is demonstrated experimentally in a study of the gasdynamic characteristics of a sonic nozzle. The principle governing the determination of the averaged values of the coefficients as functions of nonadditive parameters is examined. A.R.H.

N80-10003 Allerton Press, Inc., New York, N. Y.
PARAMETRIC METHOD OF AIRCRAFT ENGINE STATUS DIAGNOSTICS BASED ON LIMITED INFORMATION **c07**
A. M. Akhmedzyanov, A. P. Tunakov, Kh. S Gumerov, Yu. D. Degtyarev, and E. I. Morkovnikova *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 6-11 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 12-18 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

An algorithm was developed for engine flow path diagnostics based on limited information on the thermogasdynamic parameters. A mathematical model of the engine is used as the diagnostic communication channel. A.R.H.

N80-10004 Allerton Press, Inc., New York, N. Y.
STUDY OF SELF-OSCILLATORY LIQUID FILM FLOW REGIME IN COAXIAL AIR STREAM **c34**
V. G. Bazarov and L. A. Lyulka *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 12-15 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 19-24 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

The unsteady flow of liquid film in the coaxial air stream in coaxial gas-liquid injectors with centrifugal positioning of the centrifugal liquid stage was studied theoretically and experimentally. It is shown that, for the ratio of the liquid dynamic heads from 0.1 to 1.0, with recessing of the nozzle exit (delta = 0.5 to 1.2 times the diameter of the latter), self-oscillatory flow associated with the interaction of the gas and liquid streams develops in the injectors. Recommendations are made for obtaining intense self-oscillations in order to intensify mixture formation for stabilizing the flow process, and to prevent undesirable influence on the combustion process in high heat release rate combustion chambers. Author

N80-10005 Allerton Press, Inc., New York, N. Y.
DYNAMIC CHARACTERISTICS OF LIQUID FILM IN HYBRID HYDROSTATIC BEARING **c34**
A. I. Belousov and Yu. A. Ravikovich *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 16-19 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 25-29 (For primary document see N80-10001 01-01)
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Relations for the forces arising in the liquid film of hybrid hydrostatic bearings are obtained in explicit form as functions of journal eccentricity and velocity in the bearing. This representation of the forces makes it possible to solve the dynamic problems of rotors on hydrostatic bearings in the nonlinear formulation by analytic methods. The numerical solutions of the problems are simplified. It is also possible to represent results in the form of dynamic coefficients. Comparison of the latter with the experimental data show satisfactory agreement. Author

N80-10006 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF GAS TURBINE ENGINE COMBUSTION CHAMBERS GEOMETRIC PARAMETERS ON MIXTURE FORMATION CHARACTERISTICS **c07**
P. P. Grigorenko, Yu. A. Spiridonov, and A. V. Talantov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 20-24 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats Tekh. (USSR), v. 21, no. 3, 1978 p 30-37 (For primary document see N80-10001 01-01)
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Results are presented of a study of the number of rows, number n of holes, and area ratio f of a mixer on the mixing quality theta. It is shown that increase of n and f leads to

increase of the required flowrate G3 at the singular point, characterized by the jet penetration depth h - approximately 0.3d(k). A design diagram is proposed for selecting the optimal mixer parameters corresponding to minimal temperature field nonuniformity. Author

N80-10007 Allerton Press, Inc., New York, N. Y.
ON THE STUDY OF HEAT TRANSFER WITH THE AID OF A LOCAL HEAT FLUX SENSOR **c34**
Yu. F. Gortyshov, I. M. Varfolomeev, and R. A. Yaushev. *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 25-27 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 38-41 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

A sensor for measuring the convective heat flux distribution on a limited area based on the thin disc method is discussed. The experimental setup connection between the heat flux and the signal of the corresponding sensor sensitive element is described. The sensor is used for experimental measurement of the local heat transfer during supersonic flow of air in a channel of rectangular section. K.L.

N80-10008 Allerton Press, Inc., New York, N. Y.
ON THE QUESTION OF SELECTING THE CHARACTERISTIC QUANTITY GOVERNING FUEL SELF-IGNITION IN A STREAM **c28**
V. N. Gruzdev, N. A. Malishevskaya, and M. D. Tauger. *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 28-30 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 42-45 (For primary document see N80-10001 01-01)
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The self ignition of liquid fuel injected into a hot gas stream is discussed. Plotting the logarithm of the ignition delay time versus temperature allows the activation energy of kerosene to be determined with account for active center concentration variation, under the condition of constant distance from the injection point to the ignition point. However, with change of the distance from the injection point to the ignition point, the delay time varies nearly in proportion to this distance and consequently does not correlate the influence of all the system parameters. It is proposed that the critical flow speed be taken as the governing quantity. K.L.

N80-10009 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF THE GASDYNAMIC CHARACTERISTICS OF A STATOR CASCADE WITH COOLING AIR DISCHARGE THROUGH THE VANE SURFACE **c34**
O. N. Emin, I. I. Kutysh, and P. I. Shvartsman. *In its* Soviet Aeron., Vol. 21, No. 3, 1978 p 31-36 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 46-53 (For primary document see N80-10001 01-01)
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The gas dynamic characteristics of perforated turbine stator vanes with air discharge through the vane surface were studied for wide ranges of variation of primary flow velocity and injection intensity. The experimental data were analyzed and compared with various vane film cooling techniques. Film cooling allows the turbine engine inlet gas temperature to be increased significantly with acceptable values of the relative coolant flow rate. However, discharge of the coolant through the vane surface in order to organize film cooling is characterized by increased profile losses. K.L.

N80-10010 Allerton Press, Inc., New York, N. Y.
ON THE INFLUENCE OF LIQUID OSCILLATIONS IN FUEL LINE ON THE HEAD OF A PUMP OPERATING IN REGIMES WITH REVERSE FLOW **c34**
V. G. Kinelev. *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 37-39 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 54-57 (For primary document see N80-10001 01-01)
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Liquid oscillations are studied in a fuel line with separated flow at the entrance to the pump and in the pump flow passages. The influence of the oscillations on the shape of the pump head characteristic are analyzed. K.L.

N80-10011 Allerton Press, Inc., New York, N. Y.
DETERMINATION OF TURNING ANGLE OF A JET IMPINGING ON A BUCKET WITH VISOR **c07**
L. M. Kotlyar, S. G. Margulis, and E. D. Nesterov. *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 40-43 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 58-62 (For primary document see N80-10001 01-01)
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The problem of jet impingment on a bucket with a visor is solved by the singular point method. The dependence of the jet turning angle on several geometric parameters of the bucket is determined. Calculations made on an M-222 computer are compared to experimental results and recommendations are given on estimation of the flow exit angle. K.L.

N80-10012 Allerton Press, Inc., New York, N. Y.
MOST RATIONAL LINEARIZATION OF NONLINEAR UNSTEADY HEAT CONDUCTION PROBLEMS **c34**
N. L. Menshikh. *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 44-47 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 63-67 (For primary document see N80-10001 01-01)
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The correspondence between nonlinear and linearized heat conduction problems is proved from the viewpoint of singularity theory. The most rational technique for linearizing nonlinear unsteady heat conduction problems is developed using the dependence of the thermophysical characteristics on temperature and radiant heat exchange, and approximate solutions of nonlinear conduction problems are obtained. K.L.

N80-10013 Allerton Press, Inc., New York, N. Y.
ON THE FLAME STABILIZATION MECHANISM IN TWO-PHASE FUEL-AIR MIXTURE FLOW **c25**
B. G. Mingazov, V. A. Shchukin, A. V. Talantov, and I. N. Dyatlov. *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 48-52 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats Tekh. (USSR), v. 21, no. 3, 1978 68-74 (For primary document see N80-10001 01-01)
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Flame stabilization was examined with the aid of recirculation zones formed downstream of fuel-air jets and downstream of bluff bodies in the case of high speed gas-air flow around them. The approximate flame stabilization mechanism was identified for combustion of a mixture which is nonhomogeneous with respect to phase. On the basis of the Williams thermal theory, a criterial relation was obtained for determining the two phase mixture stable combustion limits. The obtained experimental data were correlated. R.E.S.

N80-100 1 Allerton Press, Inc., New York, N. Y.
ON THE INFLUENCE OF RELATIVE PITCH IN THE SUBSONIC TURBINE CASCADE **c07**
V. G. Nesterenko and G. L. Podvidz. *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 53-56 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 75-80 (For primary document see N80-10001 01-01)
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Flow past a profile in a subsonic turbine cascade with large flow turning angle with relative pitch variation was examined. Calculation of ideal compressible fluid flow in the cascade interblade channel was compared with the results of an experimental study. Two types of separated flow arising with increase of the cascade relative pitch above its limit value were identified. It was found that depending on the curvature of the back of the profile, the separated flow may reattach to the

profile in the exit plane region or for the same relative pitch may not reattach to the profile. R.E.S.

N80-10015 Allerton Press, Inc., New York, N. Y.
STATISTICAL OPTIMIZATION OF STRUCTURAL THERMAL PROTECTION MATERIAL THICKNESS c24
D. D. Nikozakov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 57-60 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 81-84 (For primary document see N80-10001 01-01)
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The optimal thickness of thermal protection materials used for thermal isolation of structural surfaces subject to the action of random high temperature fields was determined on the basis of experimental data from system tests with sampled, statistical information on the magnitudes of the material erosion. A thermal protection thickness statistical optimization problem was formulated. The necessary computational relations for determining the optimal thickness with high reliability indices and normal erosion magnitude distribution law was obtained and the influence of the erosion magnitude correlation coefficient on the calculation results was studied. The effectiveness of practical use of statistical optimization is illustrated by an example. R.E.S.

N80-10016 Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF COMPLEX SYSTEMS, II c31
T. K. Sirazetdinov and A. I. Bogomolov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 61-65 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 85-91 (For primary document see N80-10001 01-01)
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A mathematical formulation of the system analytic design problem is presented and its place in the overall design process is discussed. An approach to analytic design from the viewpoint of the basic control problem is proposed. A survey is presented of studies in which this approach was used to solve specific engineering design problems. R.E.S.

N80-10017 Allerton Press, Inc., New York, N. Y.
ANALYSIS OF FLAME STABILIZATION CONDITIONS USING THE HOMOGENEOUS REACTOR MODEL c25
A. V. Talantov *In its* Soviet Aeron., Vol. 21, No. 3 1979 p 66-71 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 92-99 (For primary document see N80-10001 01-01)
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Flame stabilization relations were derived using the homogeneous reactor model and the conditions of termination of the process in the reactor and the corresponding conditions of flame blowoff from the stabilizer were examined. Characteristics of the obtained blowoff criterion account for the degree of turbulence. The role of turbulence in determining the optimal degree of section blockage was evaluated and the influence of pressure analyzed. R.E.S.

N80-10018 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF THE TURBULENT WAKE DOWNSTREAM OF A FAN JET c02
O. A. Khachaturyan *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 72-77 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats Tekh. (USSR), v. 21, no. 3, 1978 p 100-107 (For primary document see N80-10001 01-01)
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The flow in the wake of a fan jet is shown to be analogous to the wake of a bluff body of revolution. Relations are proposed which make it possible to calculate from the initial fan jet and stream parameters the temperature and velocity at any section of the wake. R.E.S.

N80-10019 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF TURBULENCE ENERGY BALANCE COMPONENTS IN THE SECTION OF A RETARDED TURBULENT BOUNDARY LAYER c34
E. V. Shishov, P. S. Roganov, V. M. Belov, and V. N. Afanasev *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 78-81 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 108-112 (For primary document see N80-10001 01-01)
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The results of an experimental study of the turbulence energy balance components in a strongly decelerated equilibrium turbulent boundary layer are presented. The experiments were conducted in an open subsonic windtunnel where the basic parameters of the studied turbulent boundary layer were also presented. All the measurements were made with the aid of a DISA hot-ware anemometer system. The studies were made at the section X = 1410 mm from the virtual origin, where the turbulent boundary layer remained practically equilibrium. The nature of turbulence energy production and dissipation distribution in the boundary layer section confirms the previously mentioned assumption of the existence of two independent regions of intense turbulence energy production. Just as in the case of flow over a flat plate, one region is located at the edge of the viscous sublayer while the other is located in the outer part of the decelerated turbulent boundary layer. M.M.M.

N80-10020 Allerton Press, Inc., New York, N. Y.
THE TURBULENT BOUNDARY LAYER ON A CURVILINEAR SURFACE c34
A. V. Shchukin *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 82-87 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 113-120 (For primary document see N80-10001 01-01)
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An integral method is proposed for calculating the turbulent boundary layer on curvilinear surfaces of constant radius in the absence of a longitudinal pressure gradient. The method is based on polynomial representation of the tangential stress profile and use of the Bradshaw formula to account for the influence of curvature on the mixing length. In order to verify the method the velocity profiles and Stanton numbers were calculated and compared with the experimental values. M.M.M.

N80-10021 Allerton Press, Inc., New York, N. Y.
CORRELATION OF EXPERIMENTAL DATA ON TWO-PHASE-FLOW HEAT TRANSFER IN CONVERGENT PART OF A NOZZLE c34
V. K. Shchukin, A. I. Mironov, V. A. Filin, and N. N. Kovalnogov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 88-92 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 121-126 (For primary document see N80-10001 01-01)
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Results are presented of correlation of experimental data on gas-particle-flow heat transfer in the convergent part of a nozzle and an approximate technique is examined for a computational estimate of the heat transfer intensification due to the aerodynamic and thermal influences of the condensed particles on the gaseous phase in the zone near the wall. Author

N80-10022 Allerton Press, Inc., New York, N. Y.
STUDY OF HEAT-PIPE HEAT EXCHANGER IN THE SMALL GAS TURBINE ENGINE SYSTEM c07
V. K. Shchukin, I. I. Mosin, N. V. Lokai, and Yu. V. Matveev *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 93-96 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 127-132 (For primary document see N80-10001 01-01)
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A theoretical optimization of the elements of heat-pipe heat exchangers in application to small gas turbine engines (SGTE), is presented in order to study the possibility of using this type of heat exchanger as a SGTE regenerator. The regeneration ratio sigma sub p approximately 0.82 with admissible pressure losses in the heat exchanger passages delta P = 6% was obtained. In order to confirm the validity of the theoretical results, an experimental study was made of a heat exchanger matrix

consisting of 49 ribbed sodium heat pipes on a specially developed test stand simulating SGTE regenerator operating conditions. This study confirms the possibility of using the heat-pipe heat exchanger as an SGTE regenerator. M.M.M.

N80-10023 Allerton Press, Inc., New York, N. Y.
MATHEMATICAL MODELS OF THE PROCESS OF VIBRO-ABRASIVE GRINDING OF PARTS WITH AUTONOMOUS VIBRATIONS IN THE VIBROMACHINE CONTAINER c37
F. S. Yunusov, V. G. Gazizov, N. P. Zinovev, A. A. Nazipov, and V. V. Yakunin *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 97-103 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 133-141 (For primary document see N80-10001 01-01)
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The interactions of autonomous vibrations of a granular medium and a part in a U-shaped vibromachine container is presented. The method of breaking down the motions into transport and relative are used in constructing the mathematical models. The transport motion in the engine system and the relative and absolute motions of the abrasive granules in the container are examined as the interaction of the two mass centers. The model of the vibrations of a part in a granular medium is obtained from the condition of maximal energy of collision of the part with the abrasive granules. Experimental data are presented confirming the conclusions obtained on the basis of analysis of the mathematical models. M.M.M.

N80-10024 Allerton Press, Inc., New York, N. Y.
ANALYTIC REPRESENTATION OF TURBINE CHARACTERISTICS IN FORM CONVENIENT FOR COMPUTER CALCULATION OF GTE PARAMETERS c07
V. I. Bakulev, K. A. Malinovskii, and V. S. Yakushev *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 104-110 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 142-144 (For primary document see N80-10001 01-01)
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A method is proposed for representing turbine characteristics in a form convenient for computer calculation of gas turbine engine parameters. The method makes it possible to specify the turbine characteristic completely by two functions. The form of the functions is approximated well by polynomials, which makes it possible to specify simply the turbine operating field region and is convenient for computer calculation of GTE characteristics. Author

N80-10025 Allerton Press, Inc., New York, N. Y.
STUDY OF RADIAL DIFFUSORS WITH FLOW SWIRL c02
V. T. Volov and V. G. Shakhov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 111-112 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 148-150 (For primary document see N80-10001 01-01)
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The solution in quadratures for determining the profile of an isogradient vaneless diffusor is obtained for a compressible inviscid fluid. A method for selecting the isogradient diffusor which is equivalent to the vaneless diffusor is discussed. The pressure recovery factor of the isogradient diffusor is determined. The relationship of the dimensions of plane diffusors and of the equivalent isogradient diffusors is presented and a comparison of the combined operation of a profiled diffusor with a self evacuating tube in the quality of operation is reported. A.W.H.

N80-10026 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF CURVILINEAR SURFACE FILM COOLING EFFECTIVENESS c34
V. I. Lokai, A. V. Skchukin, and R. M. Khairutdinov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 113-115 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 150-153 (For primary document see N80-10001 01-01)
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The influence of surface longitudinal curvature on film cooling effectiveness is studied. Corrections for the influence of surface longitudinal curvature on the effectiveness of film cooling on the convex or concave part of turbine blade profiles is introduced. Temperature profiles on the surfaces due to flow mixing and particle separation are determined. The influence of the centrifugal mass force associated with variation of the momentum in curvilinear flows is discussed. A.W.H.

N80-10027 Allerton Press, Inc., New York, N. Y.
LONG-LIFT GTE OPERATION BASED ON TECHNICAL CONDITION c07
A. A. Mukhin, A. A. Kovalev, and A. A. Kornoukhov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 116-118 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 153-156 (For primary document see N80-10001 01-01)
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Methods for evaluating turbine rotor blade technical condition during operation of the loads on aircraft engines are examined. Methods include using a service life counter, manual recordings and a computer, and a magnetic flight data recorder to record the accumulated time of operation at takeoff and other operating regimes such as number of takeoffs and landings, the number of transient regimes, and the maximum gas temperature in the turbine inlet under flight conditions. A.W.H.

N80-10028 Allerton Press, Inc., New York, N. Y.
USE OF THE METHOD OF VARIABLE DIRECTIONS FOR NUMERICAL STUDY OF THE TEMPERATURE STATES OF A TURBINE DISK WITH BLADES c07
A. M. Polyakov, V. S. Petrovskii, and V. I. Krichakin *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 119-122 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 156-160 (For primary document see N80-10001 01-01)
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The system of two dimensional unsteady heat conduction equations for a turbine blade and disk is presented. The disk profile, specified by arbitrary functions bounding the side surface contour, is analyzed. The transformation of the curvilinear disk region contour into a rectangular region using linear transformation is described. A.W.H.

N80-10029 Allerton Press, Inc., New York, N. Y.
CHARACTERISTICS OF AFTERBURNING BYPASS TURBOJET ENGINE WITH OXYGEN INJECTION INTO THE AFTERBURNER CHAMBER c07
B. D. Fishbein *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 123-126 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 160-164 (For primary document see N80-10001 01-01)
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The thermodynamic effectiveness of increasing the augmentation ratio and thrust of the afterburning bypass turbojet engine with oxygen injection into the afterburner chamber under flight conditions is investigated. The thermodynamic characteristics of the air, mixture of air and oxygen, and products of complete combustion of kerosene in air and in a mixture of air and oxygen are presented. The kerosene flow rate in the turbine and afterburner combustion chambers is determined and the kerosene expansion in the propulsive nozzle is calculated using the temperature dependence of the working fluid specific heat. A.W.H.

N80-10030 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL DETERMINATION OF HEAT TRANSFER COEFFICIENT WHEN EMPTYING GAS VESSELS c34
L. G. Chirva, A. V. Polshin, and V. S. Kostenko *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 127-129 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 165-167 (For primary document see N80-10001 01-01)
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A determination of the heat transfer coefficient for gas vessels being emptied is presented. Transient processes in satellite

pneumatic systems are discussed. The validity of using the Mikheev formula to calculate emptying processes, with a refinement to the heat transfer coefficient, is reported. A.W.H.

N80-10031 Allerton Press, Inc., New York, N. Y.
SOVIET AERONAUTICS, VOLUME 21, NO. 4
A. V. Talantov, ed. 1978 151 p Transl. into ENGLISH of Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 1-151
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Reports concerning flight control and stability, aerodynamic modeling, structural and stress analysis are presented. For individual titles, see N80-10032 through N80-10060.

N80-10032 Allerton Press, Inc., New York, N. Y.
THE INVERSE PROBLEM OF CONTROL SYSTEM GUARANTEED SENSITIVITY **c08**
Yu. V. Aleksandrov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 1-5 refs Transl. into ENGLISH of Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 5-10 (For primary document see N80-10031 01-01)
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The problem is examined of determining the automatic control system parameter scatter regions which guarantee deterioration of the system quality by no more than a specified magnitude. Parameter scatter is defined as the region of their deviations relative to the known nominal values for the system being designed. This is an inverse sensitivity theory problem. For linear stationary systems nonlocal methods for solving this problem are described which are intended for high-order systems and computers. F.O.S.

N80-10033 Allerton Press, Inc., New York, N. Y.
MATHEMATICAL MODEL AND STABILITY OF HYDRAULIC SERVO DRIVE WITH JET-THROTTLE REGULATION **c34**
A. I. Bazhenov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 6-9 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 11-15 (For primary document see N80-10031 01-01)
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The characteristics of hydrodynamic force action on a jet tube are examined for various drive operating regimes, and its dynamic block diagram which accounts for the secondary feedbacks from hydrodynamic force action on the jet tube, is presented. For solution of the problem of the stability and self-oscillations of the system, the results of theoretical and experimental studies are used. The logarithmic frequency characteristics method is applied to the contruction of the phase stability boundary. F.O.S.

N80-10034 Allerton Press, Inc., New York, N. Y.
ON STABILITY OF OPERATION OF LIQUID ROCKET ENGINE WITH TUBOPUMP ASSEMBLY (TPA) **c20**
F. D. Bairamov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 10-15 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 16-22 (For primary document see N80-10031 01-01)
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The Lyapunov second method is used to study the technical stability of the nominal operating regime of a bipropellant LRE with TPA. Two typical LRE schemes: with gas generator fed by separate propellant; and with gas generator operating on the primary propellant components. The sufficient stability (arbitrary finite) time intervals and for the second scheme only for an infinite (arbitrary finite) time interval. F.O.S.

N80-10035# Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF REGULATORS FOR CONTROLLING ELASTIC FLIGHT VEHICLE ROTATION ABOUT THE LONGITUDINAL AXIS **c08**
A. A. Baloev *In its* Soviet Aeron., v. 21, no. 4, 1978 p 16-21 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 23-28 (For primary document see N80-10031 01-01)
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On the basis of classical variational calculus an algorithm is developed for synthesis of the optimal control of elastic flight vehicle rotation about the longitudinal axis. The known analogous algorithms developed on the basis of the dynamic programming method are more tedious, since their application requires solution of nonlinear Riccatti-type equations. F.O.S.

N80-10036 Allerton Press, Inc., New York, N. Y.
ON THE LAMINAR BOUNDARY ON THE SURFACE OF A CYLINDER MOVING IN A FLUID **c34**
V. A. Bashkin and G. M. Dzhamgarov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 22-26 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 29-35 (For primary document see N80-10031 01-01)
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In the framework of laminar boundary layer theory, the flow pattern and heat transfer of a circular cylinder advancing with constant velocity into a resting fluid are described. The nature of the solution behavior near the outer and inner edges of the boundary layer was studied. On the basis of these results the correctness of using functional and asymptotic series for solution of the subject problem is examined. F.O.S.

N80-10037 Allerton Press, Inc., New York, N. Y.
OPTIMAL CONTROL OF FLIGHT VEHICLE WITH ELASTIC ELEMENTS **c08**
V. V. Vatolin, G. L. Degtyarev, and N. K. Yunusov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 27-31 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 36-42 (For primary document see N80-10031 01-01)
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The problem is examined of synthesizing an optimal control as is a function of the measured variables. The optimality criterion is the value of a quadratic form of the observed variables at the current instant of time. An analytic expression is obtained for the optimal control and the condition which the flight vehicle state measurement technique must satisfy and analyze the influence of measurement sensor location on controlled motion quality. F.O.S.

N80-10038 Allerton Press, Inc., New York, N. Y.
ANALOG MODELING IN STUDYING SUPERSONIC FLOW AROUND A WING AND ITS GOVERNING ANALOG-CRITERIA **c02**
R. I. Vinogradov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 32-37 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 43-48 (For primary document see N80-10031 01-01)
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In examining the gas-hydraulic analogy, no systematic study has been made of the questions for determining the criteria which ensure proper analog modeling. The mathematical similitude analog-criterion concept is introduced. Recommendations are given on the conduct of mixed analog-physical modeling when conducting experiments to study the flow patterns around an oscillating wing by the gas-hydraulic analogy method. F.O.S.

N80-10039 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF INITIAL DEFLECTIONS ON BUCKLING OF CYLINDRICAL SHELLS UNDER CREEP CONDITIONS WITH COMBINED ACTION OF AXIAL COMPRESSION AND INTERNAL PRESSURE **c39**
Yu. P. Vorotilin and L. M. Kurshin *In its* Soviet Aeron., v. 21, no. 4, 1978 p 38-42 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 49-54 (For primary document see N80-10031 01-01)
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Initial deflection of general forms which account for the symmetrics and asymmetric components is introduced into cylindrical shell analysis. The problem of determining the critical deformation is solved with the aid of the Sanders-McComb-

Schlechte theorem for geometric and physical nonlinearity. The stress distribution through the shell thickness is taken to be linear. Comparison of the results is made with an analysis based on the linearized equations. F.O.S.

N80-10040# Allerton Press, Inc., New York, N. Y.
FIELD STATE ESTIMATION BY LEAST SQUARES c65
G. L. Degtyarev *In its* Soviet Aeron., v. 21, no. 4, 1978 p 43-47 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats Tekh., (USSR), v. 21, no. 4, 1978 p 43-47 (For primary document see N80-10031 01-01)
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A recurrence relation is obtained for estimating the state of a statistical field using a measured variable containing measurement errors with known statistical characteristics. The equation is found for determining the aposteriori estimate and an approximate method for solving the obtained equations is given. F.O.S.

N80-10041# Allerton Press, Inc., New York, N. Y.
SELF-SIMILAR SOLUTIONS IN THE DESTRUCTION AND MELTING PROBLEM WITH ACCOUNT FOR ABRUPT DENSITY CHANGE c24
G. V. Druzhinin and V. G. Pavlov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 48-52 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 61-67 (For primary document see N80-10031 01-01)
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Self-similar solutions are applied to unsteady heat transfer problems for composite thermoprotective coatings. A solid body under the influence of temperature is examined for the case when part of the material undergoes physical or chemical transformation into a gas or liquid while the remainder transforms into a porous medium. It is shown that self-similar solutions accelerate the numerical calculation, correlate the experimental results, and serve as a standard for comparison of approximate calculation results. J.M.S.

N80-10042 Allerton Press, Inc., New York, N. Y.
BASIC PROBLEM OF AIRCRAFT GAS TURBINE ENGINE ANALYTIC DESIGN, PART 1 c07
Yu. V. Kozhevnikov, V. O. Borovik, V. S. Ivanov, V. A. Talyzin, Agliullin, and Ya. V. Melusov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 53-57 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 68-74 (For primary document see N80-10031 01-01)
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The general problem of gas turbine engine design is considered. The problem of modeling and optimizing the engine thermodynamic and gasdynamic parameters is defined as the basic problem; the solution yields the system of basic data for constructive detail design of the gas turbine engine elements. A formulation of the basic analytic design problem is presented accounting for the effect of random factors and the multi-regime nature of engine operation. J.M.S.

N80-10043 Allerton Press, Inc., New York, N. Y.
ANALYSIS OF THIN-WALL BEAMS BY THE METHOD OF SEGMENTS c39
A. S. Kretov and V. G. Shataev *In its* Soviet Aeron., v. 21, no. 4, 1978 p 58-61 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 75-80 (For primary document see N80-10031 01-01)
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The stress-strain state of thin wall structures such as a flight vehicle wing or body having an irregular structural scheme is examined. It is assumed that the cross-section contour does not change in the deformation process, the skin works in shear, and the stringers work in tension-compression. The structure is broken down into several segments of variable section, which are analyzed numerically by a finite sum method. An algorithm is proposed for constructing the segment coupling matrix equations. The solution is realized in the form of an ALGOL program and the analysis results are compared with experimental data. J.M.S.

N80-10044 Allerton Press, Inc., New York, N. Y.
SELECTING THE GEOMETRIC PARAMETERS AND POSITION OF A NOSE FLAP ON THE ROOT PROFILE OF A SWEPT WING USING TUNNEL TEST DATA, PART 2 c05
A. I. Matyah, V. A. Sterlin, V. A. Popov, V. V. Isaev, and G. A. Cheremukhin *In its* Soviet Aeron., vol. 21, no. 4, 1978 p 62-66 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 81-87 (For primary document see N80-10031 01-01)
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The installation of a nose flap on the swept wing of a transport airplane is analyzed. The aerodynamic effects associated with installation of the flap are identified and evaluated on the basis of data from wind tunnel tests of a full-scale airplane model. It is shown that the use on the nose of the swept wing of combined mechanization in the form of a slat on the outer part of the wing and a nose flap at the root improves the aerodynamic characteristics in the region of both moderate and high angles of attack. Some questions of design nature which may arise when installing a nose flap are included. J.M.S.

N80-10045 Allerton Press, Inc., New York, N. Y.
LAMINAR BOUNDARY LAYER CALCULATION FROM EXPERIMENTAL PRESSURE DISTRIBUTION c02
V. D. Osorgin, A. N. Popkov, O. P. Sidorov, and S. O. Sidorova *In its* Soviet Aeron., v. 21, no. 4, 1978 p 67-71 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 88-93 (For primary document see N80-10031 01-01)
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A technique for calculating the laminar boundary layer from an experimental pressure distribution is presented. For this the discrete experimental wing profile surface pressure function is approximated by a spline function which is continuous together with its first derivative. A single-parameter method is used to calculate the boundary layer at a profile specified in tabular form and the calculation results are presented. J.M.S.

N80-10046 Allerton Press, Inc., New York, N. Y.
ON MODELING SENSITIVITY OF A LINEAR SYSTEM TO REDUCTION OF ITS ORDER BY THE INFINITESIMAL TRANSFORMATION METHOD IN THE YAW MOTION CONTROL PROBLEM c08
V. G. Pavlov *In its* Soviet Aeron., v. 21, no. 4 1978 p 72-75 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats Tekh., (USSR), v. 21, no. 4, 1978 p 94-98 (For primary document see N80-10031 01-01)
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A method based on the use of some concepts of continuous group theory is proposed for solving the problem of linear system sensitivity to reduction of its order. The basic idea is that the original process is embedded in a continuous ensemble obtained by transformation of the nominal process. A system of lower order is taken as the original system. The entire process ensemble corresponding to higher-order systems is obtained by transformation of the original system. Use of this method is examined in the yaw motion control problem. It is shown that the sensitivity study can be modeled by a continuous transformation group defined by the Lie algebra of three basis operators. A precise estimate of system sensitivity to reduction of its order is obtained. J.M.S.

N80-10047 Allerton Press, Inc., New York, N. Y.
ON THE EMPENNAGE SNAP-THROUGH PROBLEM c08
V. A. Pavlov and S. K. Chernikov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 76-80 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved Aviats Tekh., (USSR), v. 21, no. 4, 1978 p 99-104 (For primary document see N80-10031 01-01)
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The structural stability of flight vehicle empennage-type structures is examined. A mathematical model made up of a

system on nonlinear integral-differential equations is obtained and solved by the successive loading method with refinement of the roots using the Newton-Kantorovich method. Results of calculations are presented and are confirmed by experiments.
J.M.S.

N80-10048 Allerton Press, Inc., New York, N. Y.
ELECTRICAL CHARGING OF FABRIC AND FILM MATERIALS **c33**
B. G. Popov, V. N. Baklygin, and I. I. Chistyakov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 81-86 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 105-111 (For primary document see N80-10031 01-01)
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The mechanism of fabric and film material electrification during contact with one another is examined. Results of an analytic and experimental study are presented which establish the connection between the charge formed on the surface and the properties of the materials and the intensity of their mutual contact.
J.M.S.

N80-10049 Allerton Press, Inc., New York, N. Y.
PROPULSIVE NOZZLE ELECTRIFICATION **c33**
G. P. Potapov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 87-91 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 p 112-116 (For primary document see N80-10031 01-01)
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The electrostatic potential of an operating propulsive nozzle, represented by an electrical current generator is determined. Qualitative and quantitative data are obtained on the rocket engine electrical capacitance charging mechanism accounting for the thermodynamic and thermophysical properties of the ionized gaseous stream and the properties of the equilibrium wall-plasma system.
J.M.S.

N80-10050 Allerton Press, Inc., New York, N. Y.
MOTION OF RECTANGULAR WING BETWEEN PARALLEL WALLS **c02**
K. V. Rozhdestvenskii *In its* Soviet Aeron., v. 21, no. 4, 1978 p 92-97 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no 4, 1978 p 117-123 (For primary document see N80-10031 01-01)
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The method of matched decompositions is used to find the asymptotic expression for the potential of the flow around a rectangular wing between parallel walls. Formulas for the lift coefficient are obtained and numerical results are presented illustrating the influence of the walls on the lift force for various wing aspect ratios and distances between the walls. The results are valid for small relative distance of the wing from the lower wall.
Author

N80-10051 Allerton Press, Inc., New York, N. Y.
ON MINIMIZING INTEGRAL QUADRATIC ESTIMATES **c64**
L. G. Romanenko *In its* Soviet Aeron., v. 21, no. 4, 1978 p 98-102 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 124-129 (For primary document see N80-10031 01-01)
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To ensure optimal transient process behavior in a regulation system the selection of the closed loop system transfer function denominator polynomial coefficients are related with integral quadratic estimates minimization. Minimization of complex estimates and estimates for the regulated quantities with zeros of the transfer functions are discussed. The problem of selecting the gains of an autopilot for stabilizing flight vehicle altitude is presented as an example.
A.W.H.

N80-10052 Allerton Press, Inc., New York, N. Y.
CREEP ANALYSIS OF THIN-WALL STRUCTURES SUBJECT TO TRANSIENT HEATING AND LOADING **c39**
V. G. Shataev, Yu. A. Kashfraziev, and A. G. Samartsev *In its* Soviet Aeron., v. 21, no. 4 1978 p 103-105 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 130-132 (For primary document see N80-10031 01-01)
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The strength and stiffness design of the thin wall structures of a flight vehicle wing or body type under unsteady creep conditions with time varying loads and temperatures is examined. A solution algorithm for analyzing the thin wall structures is proposed. The unsteadiness of loading and aerodynamic heating are discussed in relation to their influence on the stress-strain state of the structure.
A.W.H.

N80-10053 Allerton Press, Inc., New York, N. Y.
STRUCTURAL ANALYSIS OF VARIABLE-SWEEP WINGS **c05**
N. A. Shelomov and N. A. Gorozhankin *In its* Soviet Aeron., v. 21, no. 4, 1978 p 106-113 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 133-141 (For primary document see N80-10031 01-01)
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A technique based on a combined system model in the differential formulation is presented for structural analysis of variable sweep wings. The problem is examined for momentless conical and cylindrical skewed shells located between the wing ribs. The differential equations of equilibrium of a skewed momentless shell element are discussed.
A.W.H.

N80-10054 Allerton Press, Inc., New York, N. Y.
DETERMINATION OF STRAIN FIELDS NEAR CONCENTRATORS FROM STRAIN GAGE INDICATORS **c39**
A. L. Brushkovskii *In its* Soviet Aeron., v. 21, no. 4, 1978 p 142-144 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aeron. Tekh., (USSR), v. 21, no. 4, 1978 p 114-116 (For primary document see N80-10031 01-01)
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A technique is presented for determining the strain fields in stress concentrator zones from strain gage indications without account for, and with partial or complete account for, the design schemes of the objects. The strain determination algorithms (without account for the design schemes of the elements) are discussed due to their poor sensitivity to changes of the field outside the comparison nodes. Methods to account for the physical aspect of the error in the algorithm are described.
A.W.H.

N80-10055 Allerton Press, Inc., New York, N. Y.
STRESS-STRAIN DIAGRAM APPROXIMATION **c39**
I. U. Vyshedkevich *In its* Soviet Aeron., v. 21, no. 4, 1978 p 117-119 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 144-147 (For primary document see N80-10031 01-01)
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Stress-strain diagram approximation for spherical and infinitely long cylindrical shells is described. The influence of the magnitude of the tension diagram approximating function upon the accuracy of the solution in a large strain region is examined.
A.W.H.

N80-10056 Allerton Press, Inc., New York, N. Y.
SPECTRAL ANALYSIS OF SURFACE IRREGULARITIES AND VIBRATIONS OF 'SPID' SYSTEM ELEMENTS DURING BURNISHING OPERATIONS **c31**
A. A. Naryshkin and D. A. Zhuravlev *In its* Soviet Aeron., v. 21, no. 4, 1978 p 120-123 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 147-150 (For primary document see N80-10031 01-01)
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Spectral analysis of surfaces burnished with a diamond tool, taking into account the vibration of the SPID system elements is discussed. The normed energy spectral densities are determined.
A.W.H.

N80-10057 Allerton Press, Inc., New York, N. Y.
ON THIN-WALL BEAM EFFECTIVE STIFFNESS c39
V. A. Pavlov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 124-128 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 151-155 (For primary document see N80-10031 01-01)
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The bending stiffness of a thin wall beam in a constrained, deplanation zone is analyzed. A condition of the analysis, that the law of planar distribution of the relative elongation is violated, is described. The bending stiffness of a thin wall beam determined from the Odinakov theory is presented. A.W.H.

N80-10058 Allerton Press, Inc., New York, N. Y.
APPLICATION OF THE FACTOR INTERPOLATION METHOD IN FLIGHT VEHICLE LANDING GEAR ANALYTIC DESIGN c05
A. V. Svilin *In its* Soviet Aeron., v. 21, no. 4, 1978 p 129-131 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 155-158 (For primary document see N80-10031 01-01)
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A technique for solving the problem of landing gear analytic design with random inputs is presented. The probabilities that the landing gear quality indices will lie in given regions with respect to the values of their mathematical expectations and dispersions are discussed. The mathematical expectations and dispersions of the landing gear quality indices are determined using the factor interpolation method. A.W.H.

N80-10059 Allerton Press, Inc., New York, N. Y.
PARACHUTE-ROCKET DECELERATION SYSTEM DESIGN c02
V. N. Semenov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 132-134 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviat. Tekh., (USSR), v. 21, no. 4, 1978 p 158-162 (For primary document see N80-10031 01-01)
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The design of a parachute rocket deceleration system is examined. The design stage which admits the formal approach is identified. An algorithm for solving the problem in this stage is proposed and calculation results are presented. A.W.H.

N80-10060 Allerton Press, Inc., New York, N. Y.
FLOW-AROUND SMALL-ASPECT-RATIO DELTA WING WITH VORTEX 'BURSTING' c02
G. A. Cheremukhin, E. A. Truneva, and E. Ya. Pivkin *In its* Soviet Aeron., v. 21, no. 4, 1978 p 135-140 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 162-167 (For primary document see N80-10031 01-01)
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The vortex flow around a delta wing of small aspect ratio is discussed. The connection between the state of the vortex and the flow over the surface of the wing is examined. Influences on the pressure distribution and the aerodynamic characteristics, due to the appearance of the vortex bursting above the wing surface are reported. A.W.H.

N80-10061 Allerton Press, Inc., New York, N. Y.
SOVIET AERONAUTICS, VOLUME 22, NO. 1
A. V. Talantov, ed., A. I. Bogomolov, ed., B. S. Vinogradov, ed., and A. F. Gurov, ed. 1979 119 p refs Transl. into ENGLISH of Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 126 p
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The aerodynamics of gas turbine engines is considered. Topics covered include heat transfer in turbulent flows, stationary temperature fields in air cooled turbine rotor blades, diesel fuel combustion in turbulent flow, and mass exchange between primary zone and secondary air jets in gas turbine engine combustion chambers. For individual titles, see N80-10062 through N80-10091.

N80-10062 Allerton Press, Inc., New York, N. Y.
CALCULATION OF WORKING PROCESS IN SLOW-COMPRESSION PISTON-TYPE AERODYNAMIC TUBE c02
A. B. Berezovskii and V. B. Panfilovich *In its* Soviet Aeron., v. 22, no. 1 1979 p 1-5 refs Transl. into ENGLISH from Izu. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 3-10 (For primary document see N80-10061 01-01)
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The gasdynamic and thermal processes during high enthalpy gas flow in the passages of aeroengine elements and gas flow at high Mach numbers around bodies are studied in the 'slow-compression' aerodynamic tube. The desired parameters in the tube are achieved by compressing the working gas by a free piston. The working gas compression process is examined numerically under the following assumptions: (1) the process is quasi-stationary; (2) the gas is ideal; (3) the piston is massless; (4) the heat exchange between the gas and the ambient medium is neglected; and (5) there is no piston friction on the compression tube walls. J.M.S.

N80-10063 Allerton Press, Inc., New York, N. Y.
GAS CURTAINS IN GAS TURBINE ENGINES c07
I. S. Varganov *In its* Soviet Aeron., v. 22, no. 1 1979 p 6-10 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 11-16 (For primary document see N80-10061 01-01)
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The application of gas curtains for thrust reversal in gas turbine engines is numerically examined. The use of gas curtains in the fan flow makes it possible to vary the flow rate ratio as a function of flight regime. The energy capabilities of this reversal technique are determined in terms of the relative required flow rate. J.M.S.

N80-10064 Allerton Press, Inc., New York, N. Y.
HEAT TRANSFER IN TURBULENT GAS FLOWS WITH HIGH-FREQUENCY PRESSURE OSCILLATIONS c34
B. M. Galitseiskii *In its* Soviet Aeron., v. 22, no. 1 1979 p 11-15 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 17-23 (For primary document see N80-10061 01-01)
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The results of experimental studies conducted to determine the conditions under which the maximal intensity of the heat exchange process is realized with resonant oscillations of turbulent gas flow in channels are reported. It is shown that intense resonant acoustic oscillations of turbulent gas streams in channels can significantly influence the heat transfer process. J.M.S.

N80-10065 Allerton Press, Inc., New York, N. Y.
STUDY OF HOMOGENEOUS COMBUSTION CHAMBER TEMPERATURE FIELD NONUNIFORMITY WITH PRIMARY ZONE PARAMETER VARIATION c07
O. A. Evin, V. M. Yankovskii, and I. N. Pyatlov *In its* Soviet Aeron., v. 22, no. 1 1979 p 16-19 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 24-29 (For primary document see N80-10061 01-01)
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The influence of the primary zone parameters on the temperature field nonuniformity of homogeneous combustion chambers was studied using a flame tube of a production combustion chamber. Results are discussed. J.M.S.

N80-10066 Allerton Press, Inc., New York, N. Y.
MEASUREMENT OF LIQUID PUMP TORQUE IN THE STARTING REGIME c37
N. S. Ershov, V. V. Ramodina, and V. V. Chervakov *In its* Soviet Aeron., v. 22, no. 1 1979 p 20-25 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 12, no. 1, 1979 p 30-35 (For primary document see N80-10061 01-01)
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A technique for experimental determination of the torque required by the pump in the transient and unsteady regimes was developed in order to verify the theoretical calculations and evaluate the magnitude of the dynamic component of the torque. R.E.S.

N80-10067 Allerton Press, Inc., New York, N. Y.
COMPUTER CALCULATION OF STATIONARY TEMPERATURE FIELDS IN AIR-COOLED TURBINE ROTOR BLADES c07
V. I. Lokai, Yu. N. Ivanshin, and Sh. Sh. Abdrakhmanov *In its* Soviet Aeron., v. 22, no. 1 1979 p 26-29 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 36-40 (For primary document see N80-10061 01-01)
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A simple engineering method is presented for computer calculation of the stationary temperature fields in turbine blades with longitudinal cooling passages with variable boundary conditions on the gas and coolant sides, with account for variation of the blade cross section area and the temperature dependence of the material thermal conductivity. The method is based on breaking the blade down into segments and applying to each segment the solution of the one dimensional heat conduction problem (along the radius) with matching of the solutions at the junctures. R.E.S.

N80-10068 Allerton Press, Inc., New York, N. Y.
SELECTION OF OPTIMAL PARAMETERS OF HEAT-PIPE HEAT EXCHANGER FOR A GAS TURBINE ENGINE c07
N. V. Lokai and I. I. Mosin *In its* Soviet Aeron., v. 22, no. 1 1979 p 30-34 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 41-46 (For primary document see N80-10061 01-01)
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Requirements that assist in achieving the maximal heat exchanger degree of regeneration are examined. It is shown that in a specific gas turbine engine equipped with a heat exchanger the degree of regeneration can be improved by observing the following conditions: (1) The heat transfer capacity of the heat exchanger heat pipes must exceed the rate of heat transfer from the gas and air sides; (2) the condition of equality of certain dimensionless groupings on the hot and cold sides of the heat exchanger must be satisfied. R.E.S.

N80-10069 Allerton Press, Inc., New York, N. Y.
COMPUTER CALCULATION OF STATIONARY TEMPERATURE FIELDS IN COOLED TURBINE DISCS c07
V. I. Lokai, V. V. Zhuikov, and R. D. Fakhrutdinov *In its* Soviet Aeron., v. 22, no. 1 1979 p 35-38 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 47-50 (For primary document see N80-10061 01-01)
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A method is presented which can be used to calculate the temperature distribution along the radius of a turbine disk which is cooled on both sides. R.E.S.

N80-10070 Allerton Press, Inc., New York, N. Y.
METHOD FOR CALCULATING OPTIMAL PARAMETERS OF HIGH-PRESSURE PNEUMATIC DRIVES c37
M. Ya. Panov, A. M. Kurganov, and V. P. Kozelkov *In its* Soviet Aeron., v. 22, no. 1 1979 p 39-43 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 51-56 (For primary document see N80-10061 01-01)
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A method for calculating pneumatic drive optimization for turbines is presented. R.E.S.

N80-10071 Allerton Press, Inc., New York, N. Y.
SYSTEMATIZATION OF SIMPLE DETAIL PARTS OF REGULABLE NOZZLE OF GAS TURBINE ENGINE c07
I. E. Sapozhkov and E. D. Stenkin *In its* Soviet Aeron., v. 22, no. 1 1979 p 44-49 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 57-63 (For primary document see N80-10061 01-01)
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A subsystem principle of studying gas turbine design which accounts for the characteristics of the working process and which can be used in studying various mechanical systems is proposed. The structural schemes and 'typizations' of gas turbine engine regulable nozzle details were determined. These schemes are necessary in developing optimal design methods and their computer formalization. M.M.M.

N80-10072 Allerton Press, Inc., New York, N. Y.
LIQUID EJECTOR WITH PERFORATED NOZZLE c34
A. A. Stolyarov *In its* Soviet Aeron., v. 22, no. 1 1979 p 50-53 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Techn. (USSR), v. 22, no. 1, 1979 p 64-68 (For primary document see N80-10061 01-01)
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The characteristics of the single stage gas ejector with perforated nozzle with perforation permeability coefficient 0.1 to 0.2 (ratio of whole area to lateral surface area) of the perforated nozzle segment are close to the characteristics of the multistage supersonic ejectors. It was concluded that it is advisable to use perforated nozzle liquid ejectors primarily with large ejecting and ejected pressure differentials. M.M.M.

N80-10073 Allerton Press, Inc., New York, N. Y.
GENERALIZED HEAT AND MASS TRANSFER LAW FOR INTERNAL FLOWS c34
A. A. Khalatov *In its* Soviet Aeron., v. 22, no. 1 1979 p 54-57 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 69-72 (For primary document see N80-10061 01-01)
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The integral swirl parameter, which is the ratio of the flow of rotational momentum to the axial momentum in a channel linear dimension was used to characterize the mass and heat transfer coefficients. Analysis of the mathematical formulation shows that the governing parameters for the case are the local maximal axial velocity and the instantaneous swirl intensity. M.M.M.

N80-10074 Allerton Press, Inc., New York, N. Y.
DYNAMICS OF DIESEL FUEL COMBUSTION IN TURBULENT FLOW c25
F. A. Khamidullin, A. F. Kuzin, O. V. Strogonov, Yu. V. Troitskii, and A. V. Talantov *In its* Soviet Aeron., v. 22, no. 1 1979 p 58-63 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 73-80 (For primary document see N80-10061 01-01)
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A study of diesel fuel and also TS-1 kerosene and B-70 gasoline combustion in a turbulent stream is presented. These fuels are compared and the dependence of the combustion zone length and the combustion time on mixture composition, velocity, and initial temperature under the model combustion chamber conditions was established. M.M.M.

N80-10075 Allerton Press, Inc., New York, N. Y.
STUDY OF MASS EXCHANGE BETWEEN PRIMARY ZONE AND SECONDARY AIR JETS IN GAS TURBINE ENGINE COMBUSTION CHAMBERS c07
V. G. Shumachenko, V. M. Yankovskii, and A. V. Stalantov *In its* Soviet Aeron., v. 22, no. 1 1979 p 64-67 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 81-85 (For primary document see N80-10061 01-01)
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The experimental and theoretical determination of the secondary air jets G sub pz in application to combustion chambers is presented as well as the flow structure in the primary zone which is formed by the secondary air jets of the first row of

holes. In such combustion chambers, the air flow rate through the front end assembly G sub pz does not exceed 5-10% of the overall air flow rate through the chamber, and most of the air enters the primary zone from the secondary air jets. M.M.M.

N80-10076 Allerton Press, Inc., New York, N. Y.
APPROXIMATE CALCULATION OF THE LAMINAR BOUNDARY LAYER IN MICRONOZZLES **c34**
F. A. Akhmedyanova, A. A. Vaindiner, P. G. Danilaev, and N. F. Salikhov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 68-70, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 86-88. (For primary document see N80-10061 01-01)
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The laminar boundary layer arising during perfect gas flow in a two dimensional Laval micronozzle with a thermally insulated wall is approximated by a simple method for a Prandtl number of one. The solution is compared to results obtained by solving the transformed system of laminar boundary layer equations by the finite difference method. The integral characteristics of the approximate solution agree well with the exact solution results, but the approximate method does not yield high accuracy in constructing the velocity profile. The approximate method allows the use of a Nairi type computer for the calculations and is very efficient. Calculation by the finite difference method on the M-222 computer required 30 times more computer time. It is advised that the approximate method be used for engineering calculations. K.L.

N80-10077 Allerton Press, Inc., New York, N. Y.
AERODYNAMIC EFFICIENCY OF GAS TURBINE INTAKE DUCT **c02**
I. G. Gogolev, P. V. Korolev, Yu. D. Kudashev, V. A. Magala, and B. A. Shifrin. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 71-73. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 88-91. (For primary document see N80-10061 01-01)
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Cold flow tests were conducted on an aerodynamic stand for a small transport gas turbine power plant segment consisting of a combustion chamber, an intake duct, and a stator cascade. Pneumometric probes were used to measure static pressure, total pressure, and flow angles in the radial and tangential directions at the segment control sections. Velocity fields, mass rate distributions and the streamline shape were found. Energy losses in the segment elements were determined separately and their mutual influence during combined operation was analyzed. Increasing the radius of curvature of the intake duct surface was found to eliminate flow separation and reduce nonuniformity in the radial and circumferential flow parameter distribution. Although the stator cascade efficiency remained unchanged, the efficiency of the entire segment was increased as a result of elimination of energy losses in the flow entering the cascade. K.L.

N80-10078 Allerton Press, Inc., New York, N. Y.
CENTRIPETAL TURBINE FABRICATION TECHNOLOGY **c07**
L. P. Goldun and A. A. Polyakov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 74-75. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 91-93. (For primary document see N80-10061 01-01)
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A simple technology for fabricating model turbine wheels under laboratory conditions is presented. With this technology, the required number of models of blades with different geometric shapes are fabricated from a single master casting of the rotor or stator flow passage model. K.L.

N80-10079 Allerton Press, Inc., New York, N. Y.
DESIGN OF BOUNDARY-LAYER AIR INTAKES **c02**
V. T. Kalugin, T. V. Klebanova, Yu. I. Kozlov, and V. N. Koshevoi. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 76-79, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 93-96. (For primary document see N80-10061 01-01)
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A technique for calculating the flow parameters of an air intake in which the entrance height is commensurate with the boundary layer thickness is presented. In the absence of air inflow a highly developed separated stagnant zone forms ahead of the air intake inlet. Comparison of theoretical and experimental results shows that the proposed technique is suitable for calculating the flow parameters at various degrees of throttling. K.L.

N80-10080 Allerton Press, Inc., New York, N. Y.
APPLICATION OF GRADIENT METHOD TO STUDY OF HEAT TRANSFER IN AXISYMMETRIC CHANNELS OF DIFFERENT CONFIGURATION **c34**
N. N. Kovalnogov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 80-83, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 96-100. (For primary document see N80-10061 01-01)
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Standardized relations are obtained for calculating heat transfer coefficients by the gradient method in axisymmetric channels of constant wall thickness and different configurations. Methods of minimizing the required computer time without reducing the accuracy of the heat transfer coefficient determinations are examined. K.L.

N80-10081 Allerton Press, Inc., New York, N. Y.
UNLOADING THE DRIVE OF GAS DISTRIBUTER VALVES OPERATING AT HIGH PRESSURES **c37**
I. A. Krivosheev, A. M. Rusak, I. M. Urakev, and Z. G. Shaikhutdinov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 84-86, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 100-102. (For primary document see N80-10061 01-01)
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The load reduction on the drive of gas distributer valves which operate at high inlet pressures in the supercritical regime is discussed. The use of the discharging gas reaction for unloading the valve, when critical gas flow is maintained in the narrowest flow section of the valve is described, utilizing gas dynamic relations. Various valve schemes are compared and their static force characteristics are derived. A.W.H.

N80-10082 Allerton Press, Inc., New York, N. Y.
APPLICATION FACTOR OF TWO-DIMENSIONAL TRANSVERSE SONIC JET INTERACTING WITH SUPERSONIC STREAM **c02**
V. I. Krishtal. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 87-89, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 102-105. (For primary document see N80-10061 01-01)
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The amplification factor for injection of a planar sonic jet at a 90 degree angle into a supersonic stream with turbulent boundary layer is determined. The dependence of the amplification factor on the geometric characteristics of the injection system, on the gas dynamic parameters of the jet, and on the primary flow is discussed. The amplification factor as a function of undisturbed flow Mach numbers is presented. A.W.H.

N80-10083 Allerton Press, Inc., New York, N. Y.
ON THE INFLUENCE OF SHORT SHROUD PLATFORMS ON TURBINE STAGE OPERATION **c07**
R. V. Kuzmichev and G. V. Proskuryakov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 90-92, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 105-107. (For primary document see N80-10061 01-01)
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Techniques for improving the efficiency of unshrouded turbine stages using short shroud platforms are examined. Two air turbine engine models were tested for the overall improvement in stage efficiency. The use of short one sided and two sided shroud

platforms on the performance of the rotor blades, the blade tips, and the flow structure near the periphery is discussed. Stage efficiency improvement in the limits of the inter row clearance and radial clearance is determined. A.W.H.

N80-10084 Allerton Press, Inc., New York, N. Y.
SEMI-EMPIRICAL METHOD FOR DETERMINING LOCAL HEAT TRANSFER COEFFICIENTS FOR FLOW AROUND A SPHERE **c34**
L. I. Kudryashev and N. I. Klyuev. *In its* Soviet Aeron., v. 22, no. 1 1979 p 93-95 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 107-109 (For primary document see N80-10061 01-01)
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The cooling of a heated solid sphere in a subsonic gas stream is examined. The local heat transfer coefficients, determined on the basis of the temperature distribution in the vicinity of the surface points of the sphere, are calculated. The heat transfer coefficients are presented as functions of polar angle and time. A.W.H.

N80-10085 Allerton Press, Inc., New York, N. Y.
STUDY OF COMBINED OPERATION OF SELF-EVACUATING VORTEX TUBE WITH DIFFUSER **c02**
A. P. Merkulov and V. T. Volov. *In its* Soviet Aeron., v. 22, no. 1 1979 p 96-98 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 109-112 (For primary document see N80-10061 01-01)
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The effect created by the self evacuating vortex tube (SEVT) and the cooling of the near axis SEVT layers in certain operating regimes is examined. An isogradient radially symmetric diffuser which transforms the kinetic energy of the gas entering the diffuser into pressure energy is described. The reduction of SEVT dimensions for use in aircraft equipment is discussed. A.W.H.

N80-10086 Allerton Press, Inc., New York, N. Y.
ON AXIAL TURBINE STAGE ROTOR BLADE TWIST WITH TANGENTIAL TILT OF THE STATOR VANES **c07**
Yu. I. Mityushkin, A. V. Perevoznikov, and V. P. Yakovlev. *In its* Soviet Aeron., v. 22, no. 1 1979 p 99-101 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 112-115 (For primary document see N80-10061 01-01)
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The tangential tilt of the stator vanes (TTSV) in the axial turbine stage, serves as an effective means for reducing the reactivity gradient along the rotor blade, significantly redistributes the flow parameters along the flow path height, and imposes definite limitations on rotor blade twist. Tests were made of nine turbine stages with nozzle exit velocities M(c1) = 0.48 to 0.5 and Reynolds numbers Re(c1) = (5 to 5.7) X 10 to the 5th power to study the influence of rotor blade trailing edge twist on the efficiency of turbine stages with TTSV. A.R.H.

N80-10087 Allerton Press, Inc., New York, N. Y.
WARMUP OF LRE CHAMBERS WITH REGENERATIVE COOLING **c20**
V. V. Orlov. *In its* Soviet Aeron., v. 22, no. 1 1979 p 102-104 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 115-117 (For primary document see N80-10061 01-01)
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A technique developed for calculating the unsteady temperature regimes of chambers with regenerative cooling, based on the one-dimensional model of the heat propagation process in the chamber structural elements is reviewed and used with a M-220M computer to study the warmup of chambers of different construction during engine startup. Analysis of the results obtained made it possible to detect certain chamber thermal loading characteristics in the startup regime which influence the stress-strain state of the chamber structural elements. Information on the chamber temperature status during startup is necessary for evaluating chamber functioning in the launch regime of liquid propellant rockets. A.R.H.

N80-10088 Allerton Press, Inc., New York, N. Y.
STUDY OF SIZE DISTRIBUTION OF OIL DROPS FORMED IN GTE OIL **c37**
P. G. Petrov and O. A. Povarov. *In its* Soviet Aeron., v. 22, no. 1 1979 p 105-107 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 117-119 (For primary document see N80-10061 01-01)
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The replica method was used to study the oil drop size distribution. A probe was installed in the air-oil separator housing ahead of the impeller. After reaching steady-state conditions and complete stabilization of the parameters, the sample was taken (measurement time 0.06 to 0.1 sec). Then the drop 'replicas' were photographed through a microscope. Photography of a calibrated wire with identical magnification was used to determine the dimensions of the oil drop replicas. Results show that the air-oil mixture which forms in the oil system lines has a very broad oil drop size spectrum with the maximum number of drops (about 20%) being on the order to 10 microns in diameter. A.R.H.

N80-10089 Allerton Press, Inc., New York, N. Y.
NONSTATIONARITY OF HEAT TRANSFER IN AXIAL TURBINE BLADING DURING ENGINE STARTUP **c07**
A. M. Polyakov, V. S. Petrovskii, and V. I. Krichakin. *In its* Soviet Aeron., v. 22, no. 1 1979 p 108-111 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 119-123 (For primary document see N80-10061 01-01)
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In all gas turbine element temperature calculations, the coefficient of heat transfer are assumed to be independent of the nonstationarity of the heat transfer process. Of interest are the time dependence of the local coefficient of heat transfer on axial gas turbine rotor blade surfaces found from the results of temperature survey during startup. The first-stage and second-stage rotor blade temperatures at the mean diameter of the turbine of an aircraft auxiliary power unit engine were continuously recorded. The temperature values through the blade thickness were averaged. A.R.H.

N80-10090 Allerton Press, Inc., New York, N. Y.
LASER DOPPLER VELOCIMETER (LDV) STUDY OF SECONDARY FLOWS IN TURBINE CASCADE **c07**
A. M. Topunov, B. Tikhomirov, and L. L. Chernyshev. *In its* Soviet Aeron., v. 22, no. 1 1979 p 112-114 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 123-126 (For primary document see N80-10061 01-01)
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The development of secondary flows in the blade-row passages and the effectiveness of the techniques for controlling the flow are determined by a large number of factors, specifically by the vorticity and turbulence characteristics of the flow at the entrance and the magnitude of the Reynolds number. The secondary flows have an unsteady nature because of periodic separation of the decelerated flow medium in the region of the corner formed by the back of the blade and the end wall. The influences of these factors on the secondary flow characteristics were studied using a stand consisting of a straight profile cascade with closed air flow system and a Laser Doppler Velocimeter (LDV). The LDV instrumentation system, utilizing the differential scheme is described and the energy loss coefficients obtained are analyzed. A.R.H.

N80-10091 Allerton Press, Inc., New York, N. Y.
PNEUMATIC DISTRIBUTOR FOR TURBOJET ENGINE CONTROL SYSTEM **c07**
M. G. Khabibullin. *In its* Soviet Aeron., v. 22, no. 1 1979 p 115-116 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 126-127 (For primary document see N80-10061 01-01)

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A distributor, introduced into the thrust reverser control system of the NK-8-2U TJE for the Tu-154 airplane, consists of the housing with sleeve, in the bore of which the spool is installed. The central port in the housing is for air entry from the pressure source - the cavity downstream of the TJE compressor. There are two ports for air supply to the actuator, and two others for discharge of the used air into the atmosphere. The support lands are made from graphite-impregnated metal to ensure small dry-friction forces during displacement, since the graphite-impregnated metal acts as a lubricant for the contacting surfaces and eliminates the possibility of spool binding. The middle distributing land is metal, is integral with the spool and its width is considerably less than the width of the supporting lands, which makes it possible to reduce the spool working travel and the overall dimensions of the unit. In order to eliminate the possibility of contact of the land with the sleeve, since the metal-metal friction pair would not operate satisfactorily under dry-friction conditions, the diameter of the land is less than the diameter of the supporting lands by 0.01 to 0.02 mm with allowance for thermal expansion. A.R.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-10092 California Univ., Los Angeles.
TWO-DIMENSIONAL FLOW PAST CONVEX AND CONCAVE CORNERS AT TRANSONIC SPEED AND TWO-DIMENSIONAL FLOW AROUND A PARABOLIC NOSE AT SUBSONIC AND TRANSONIC SPEEDS Ph.D. Thesis
Kazuhiro Kusunose 1979 150 p
Avail: Univ. Microfilms Order No. 7921431

Two dimensional flows past a Prandtl-Meyer expansion corner and an infinite wedge at transonic speeds which have exact solutions, and the nose solution for a two dimensional finite leading edge radius airfoil which has a singularity at the nose under the small disturbance approximations are discussed. Lift and drag acting on the parabolic nose in the subsonic flow which can include the incompressible flow case as a special case are obtained. For the transonic case the nose equation with a body surface boundary condition and appropriate far field boundary conditions which can match to the outer transonic small disturbance solutionance solution is solved numerically to get a pressure distribution in the nose region. Using the outer transonic solution and the nose solution a uniformly valid pressure distribution on the entire body surface of a finite leading radious airfoil for the transonic flow is obtained. Dissert. Abstr.

N80-10093 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
PREDICTION OF AERODYNAMIC FORCES ON A CIRCULAR CYLINDER AND THIN AIRFOIL IN A TRANSONIC AIR-STREAM BY THE FINITE ELEMENT METHOD Ph.D. Thesis
James Edward Marsh 1979 184 p
Avail: Univ. Microfilms Order No. 7920914

The finite element method was used to solve the nonlinear, small disturbance, transonic, velocity potential equation for problems of steady flow over a circular cylinder and over a thin airfoil in a uniform steady airstream. Three subproblems were investigated for the circular cylinder. First, three different types of trial functions were investigated to approximate the solution for the velocity potential function for the case of incompressible flow without circulation. The second subproblem for the cylinder was to use the two conforming elements to obtain solutions for incompressible flow with circulation. The third subproblem for the cylinder was to solve the compressible flow problem without circulation using the new element. Convergence of iterative finite element solution schemes for transonic (mixed elliptic hyperbolic) flows was investigated for the airfoil problem. Dissert. Abstr.

N80-10094 Cincinnati Univ., Ohio.
CALCULATION OF OPTIMAL COORDINATES FOR TWO-DIMENSIONAL INCOMPRESSIBLE FLOW Ph.D. Thesis
Rabindra Kumar Rout 1979 198 p
Avail: Univ. Microfilms Order No. 7922618

Two dimension steady symmetric incompressible laminar flow past a class of blunt and sharp nosed bodies is investigated in optimal coordinates. The analysis is carried out for different problem parameters and the solution is specialized for the cases of the parabola, a semi-infinite thin flat plate and the flow against a vertical wall. The problem is formulated by mapping the body from a Cartesian plane into a conformal plane by applying a Schwarz-Christoffel transformation. This type of transformation maps the flow field into a stagnation point flow in the conformal plane. The governing differential equations are developed in an optimal coordinate system. A boundary layer and parabolized Navier-Stokes analysis is used for the solution procedure in the optimal coordinate system. Dissert. Abstr.

N80-10095 California Inst. of Tech., Pasadena.
SOME MEASUREMENTS IN SYNTHETIC TURBULENT BOUNDARY LAYERS Ph.D. Thesis
Oemer Savas 1979 138 p
Avail: Univ. Microfilms Order No. 7972055

Synthetic turbulent boundary layers, constructed on a flat plate by generating systematic moving patterns of turbulent spots in a laminar flow, are investigated. Spots which were generated periodically in space and time near the leading edge to form a regular hexagonal pattern are examined. The measured variable was local intermittency; i.e., the probability of observing turbulent flow at a particular point in space and time. The evolution of various synthetic flows along the plate are reported and illustrated using X-T diagrams. Dissert. Abstr.

N80-10096 Ohio State Univ., Columbus.
AN EXPERIMENTAL INVESTIGATION OF FORCED MIXING OF A TURBULENT BOUNDARY LAYER IN AN ANNULAR DIFFUSER Ph.D. Thesis
Robert Joseph Shaw 1979 179 p
Avail: Univ. Microfilms Order No. 7922556

The physical details of the forced mixing process of a turbulent boundary layer in an axisymmetric annular diffuser is investigated. Conventional wing like vortex generators were used as the forced mixing device. Flow field measurements made at four axial locations downstream of the vortex generators are presented. Total pressure profiles measured to determine boundary layer profiles and vortex positions are discussed along with yaw angularity measurements made at two axial locations. Three vortex generator configurations were tested. The difference between configurations involved changes in size and relative vortex generator positions. All three vortex generator configurations tested provided increases in diffuser performance. Dissert. Abstr.

N80-10097 Engineering Sciences Data Unit, London (England).
WING-BODY YAWING MOMENT AND SIDEFORCE DERIVATIVES DUE TO SIDESLIP: Nv AND Yv
1979 14 p
(ESDU-79006; ISBN-0-85679-251-9; ISSN-0141-397X) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $386.50

A means is provided for estimating the yawing moment and sideforce derivatives due to sideslip for wing-body combinations at small angles of attack and sideslip at subsonic speeds. For stability calculations, an accurate prediction is more important for Nv than for Yv. The data are primarily intended for predicting Nv. Because Nv is dependent on the choice of yaw axis position, a knowledge of Yv is needed to convert Nv from one axis position to another. An accurate estimate of Yv is difficult and the method given may involve substantial errors for certain configurations, but it is considered adequate in allowing for changes in yaw axis position between 0.41(b) and 0.61(b) as, subject to that limitation, quite large uncertainties in Yv do not give rise to significant errors in Nv. ESDU

N80-10098 Texas Univ. at Arlington.
CROSS FLOW FAN EXPERIMENT DEVELOPMENT AND FINITE ELEMENT MODELING Ph.D. Thesis
Gary James Harloff 1979 230 p
Avail: Univ. Microfilms Order No. 7922981

A compressible one dimensional finite element differential analysis is presented which accounts for area changes, rotor lumped blade forces, turbulent wall friction, and heat input. The analysis permits integration through the rotors. Good agreement with test data is obtained. The analysis indicates that appreciable heating of the through flow occurs. The heat input is due to viscous dissipation in the airfoils. This heat input causes thermal choking in the second stage rotor fan. An incompressible two dimensional finite element analysis is also presented which also permits integration through the rotors. The flow outside the rotors is treated as potential flow and the flow inside the rotors is treated as rotational flow. Good agreement with low speed test data is obtained. Maximum velocities of twice the rotor tip speed are predicated inside the outlet rotor. Dissert. Abstr.

N80-10099 Cincinnati Univ., Ohio.
INTEGRAL SOLUTIONS OF THE HIGH REYNOLDS NUMBER SMALL SEPARATION PROBLEM Ph.D. Thesis
Surinder Khullar 1979 131 p
Avail: Univ. Microfilms Order No. 7922904

Two Different integral techniques are developed to solve the high Reynolds number small separation problem. The small separation problem, according to the Triple Deck theory, is defined here as one where the separated region is restricted to the lower deck. Numerical solutions to the steady state form of the integral equations are obtained using a fourth order accurate Runge Kutta method for the supersonic free interaction cases and supersonic flow over properly scaled flat plate/ramp combinations. Several different velocity profiles are tried to improve the integral solutions. Results obtained by these approximate methods compare well with more exact numerical solutions when an appropriate velocity profile is used. Solutions to the unsteady form of the developed integral equations are obtained by an implicit finite difference method for the case of supersonic flow over expansion ramps. Dissert. Abstr.

N80-10100 Houston Univ., Tex.
FLOW AROUND AXISYMMETRIC BODIES: THE DIRECT AND INVERSE PROBLEMS Ph.D. Thesis
Mohamed Fouad Zedan 1979 258 p
Avail: Univ. Microfilms Order No. 7922438

A new method was developed to solve the inverse problem for incompressible axisymmetric potential flow about a body of revolution. The method was developed initially for elements of constant intensity utilizing two equivalent conditions: the tangency condition in the form $dr/dx = v/u$, and the condition of zero stream function over the body surface. Higher order axial singularity distributions were also developed for the solution of the direct problem. Substantial improvements in the accuracy and numerical efficiency over the von Karman method (base method for direct problem) were attained without significant sacrifice of simplicity or increase in the computation time and storage requirements. The method has comparable accuracy to the sophisticated and numerically involved surface singularity Douglas-Neumann method, for most body shapes. Dissert. Abstr.

N80-10101*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECT OF WINGLETS ON A FIRST-GENERATION JET TRANSPORT WING. 6: STABILITY CHARACTERISTICS FOR A FULL-SPAN MODEL AT SUBSONIC SPEEDS
Stuart G. Flechner Oct. 1979 69 p refs
(NASA-TP-1330; L-12514) Avail: NTIS HC A04/MF A01 CSCL 01A

A wind tunnel investigation to identify changes in stability and control characteristics of a model KC-135A due to the addition of winglets is presented. Static longitudinal and lateral-directional aerodynamic characteristics were determined for the model with and without winglets. Variations in the aerodynamic characteristics at various Mach numbers, angles of attack, and angles of sideslip are discussed. The effect of the winglets on the drag and lift coefficients are evaluated and the low speed and high speed characteristics of the model are reported. A.W.H.

N80-10102*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL INVESTIGATION OF THE VALIDITY OF A SONIC-BOOM-MINIMIZATION CONCEPT
Robert J. Mack and Christine M. Darden Oct. 1979 47 p refs
(NASA-TP-1421; L-12661) Avail: NTIS HC A03/MF A01 CSCL 01A

The Langley unitary plan unitary plan wind tunnel was used to determine the validity of a sonic-boom-minimization theory. Five models - two reference and three low-boom constrained - were tested at design Mach numbers of 1.5 and 2.7. Results show that the pressure signatures generated by the low-boom models had significantly lower overpressure levels than those produced by the reference models and that small changes in the Mach number and/or the lift caused relatively small changes in the signature shape and overpressure level. Boundary-layer effects were found in the signature shape and overpressure level. Boundary-layer effects were found to be sizable on the low-boom models, and when viscous corrections were included in the analysis, improved agreement between the predicted and the measured signatures was noted. Since this agreement was better at Mach 1.5 than at Mach 2.7, it was concluded that the minimization method was definitely valid at Mach 1.5 and was probably valid at Mach 2.7, with further work needed to resolve the uncertainty. A.R.H.

N80-10103*# Johns Hopkins Univ., Laurel, Md.
ADVANCED MISSILE TECHNOLOGY. A REVIEW OF TECHNOLOGY IMPROVEMENT AREAS FOR CRUISE MISSILES Final Report
L. L. Cronvich and H. P. Liepman Washington Oct. 1979 66 p refs
(NASA Order L-75242A)
(NASA-CR-3187; BFD-0-79-001) Avail: NTIS HC A04/MF A01 CSCL 01A

Technology assessments in the areas of aerodynamics, propulsion, and structures and materials for cruise missile systems are discussed. The cruise missiles considered cover the full speed, altitude, and target range. The penetrativity, range, and maneuverability of the cruise missiles are examined and evaluated for performance improvements. A.W.H.

N80-10104*# National Aeronautics and Space Administration, Washington, D. C.
THE SIGNIFICANCE OF WING END CONFIGURATION IN AIRFOIL DESIGN FOR CIVIL AVIATION AIRCRAFT
H. Zimmer Oct. 1979 35 p refs Transl. into ENGLISH of "Die Bedeutung der Fluecelendformen Tragfluecelentwurf fuer Flugzeuge der Zivilen Luftfahrt", paper-77-030 Deutsche Gesellschaft fuer Luft-und Raumfahrt, Jahrestagung 10th, Berlin, 15 Sep. 1977 40 p Transl. by Leo Kanner Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75711; Paper-77-030) Avail: NTIS HC A03/MF A01 CSCL 01A

Lift-dependent induced drag in commercial aviation aircraft is discussed, with emphasis on the necessary compromises between wing and configuration modifications which better lift performance and the weight gains accompanying such modifications. Triangular, rectangular and elliptical configurations for wing ends are considered; attention is also given to airfoil designs incorporating winglets. Water tunnel tests of several configurations are reported. In addition, applications of wing and modifications to advanced technology commercial aviation aircraft and the Airbus A-300 are mentioned. Author

N80-10105*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ESTIMATION OF ATTAINABLE LEADING-EDGE THRUST FOR WINGS AT SUBSONIC AND SUPERSONIC SPEEDS
Harry W. Carlson, Robert J. Mack, and Raymond L. Barger 1979 62 p refs
(NASA-TP-1500; L-13032) Avail: NTIS HC A04/MF A01 CSCL 01A

The factors which place limits on the theoretical leading edge thrust are identified. An empirical method for the estimation of attainable thrust is presented. The method is based on

the use of simple sweep theory to permit a two dimensional analysis, the use of theoretical airfoil programs to define thrust dependence on local geometric characteristics, and the examination of experimental two dimensional airfoil data to define limitations imposed by local Mach numbers and Reynolds numbers. Comparisons of theoretical and experimental aerodynamic characteristics for a series of wing body configurations are examined. A.W.H.

N80-10106*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECT OF SEVERAL AIRFRAME/NOZZLE MODIFICATIONS ON THE DRAG OF A VARIABLE-SWEEP BOMBER CONFIGURATION
Richard J. Re and David E. Reubush Washington 1979 171 p ref
(NASA-TM-80129; L-13043) Avail: NTIS HC A08/MF A01 CSCL 01A

A variable sweep bomber aircraft model was investigated to identify modifications for drag reduction. Modifications included simulated two dimensional nozzles, staggered and extended nozzles; short, long, and no interfairings between the nozzles; partial and complete wing-glove fairings; glove-fuselage sidefairing; fuselage underfairing; and wing pods. The variable wing sweep and variable exhaust nozzles of the scale model are discussed. A.W.H.

N80-10107*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WORKSHOP ON THRUST AUGMENTING EJECTORS
A. E. Lopez, ed., D. G. Koenig, ed., D. S. Green, ed. (Naval Air Development Center, Warminster, Penn.), and K. S. Nagaraja, ed. (Air Force Flight Dynamics Lab) Sep. 1979 509 p Conf. held at Moffett Field, Calif., 28-29 Jun. 1978; Sponsored by NADC and AFFDL
(NASA-CP-2093; A-7887) Avail: NTIS HC A22/MF A01 CSCL 01A

The state of the art of ejector technology is assessed and the desired direction of future studies in all aspects of ejector thrust augmenting systems is deliniated. For individual titles, see N80-10108 through N80-10133.

N80-10108*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
RECENT DEVELOPMENTS IN EJECTOR TECHNOLOGY IN THE AIR FORCE: AN OVERVIEW
K. S. Nagaraja *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 1-22 refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

Basic and applied studies in thrust augmentation conducted at the Aerospace Research Laboratory at Wright-Patterson AFB which led to an effective configuration of the jet flap diffuser ejector, are reviewed. A method for compressible ejector flow analysis, developed in support of the preliminary design of an ejector thrust aircraft, is discussed and applied to single- and two-stage ejectors. A.R.H.

N80-10109*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA OVERVIEW
David G. Koenig *In its* Workshop on Thrust Augmenting Ejectors Sep. 1979 p 23-40 refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The history of NASA efforts at Ames Research Center in researching the performance and application of thrusting augmentors is reviewed. Current objectives include: (1) parametric description of thrust augmentor application to STOL and V/STOL; (2) the use of theoretical and empirical data; (3) aircraft-augmentor integration; and (4) key design considerations for STOL transport and V/STOL fighter aircraft. Test facilities are described and ejector development and performance are assessed. A.R.H.

N80-10110*# Naval Air Development Center, Warminster, Pa.
AN OVERVIEW OF CURRENT NAVY PROGRAMS TO DEVELOP THRUST AUGMENTING EJECTORS
K. A. Green *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 41-54 refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The primary objective of Navy sponsored research in thrust augmentation is the development of an improved augmenter for V/STOL application. In support of this goal, a data base is being established to provide an accurate prediction capability for use in ejector design. A general technology development of ejectors and associated effects presently is split into the more specific areas of lift and control, since thrust augmenting ejectors may be suitable for both. Research areas examined include advanced diffuser and end wall design; advanced primary nozzles; analytic studies; augmenting reaction controls; and nozzle design. A.R.H.

N80-10111*# Boeing Military Airplane Development, Seattle, Wash.
NUMERICAL PREDICTION OF 3-D EJECTOR FLOWS
Donald W. Roberts and Gerald C. Paynter *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 55-70 refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The use of parametric flow analysis, rather than parametric scale testing, to support the design of an ejector system offers a number of potential advantages. The application of available 3-D flow analyses to the design ejectors can be subdivided into several key elements. These are numerics, turbulence modeling, data handling and display, and testing in support of analysis development. Experimental and predicted jet exhaust for the Boeing 727 aircraft are examined. A.R.H.

N80-10112*# Rockwell International Corp., Columbus, Ohio. Columbus Aircraft Div.
VISCID/INVISCID INTERACTION ANALYSIS OF THRUST AUGMENTING EJECTORS
P. M. Bevilacqua and A. D. DeJoode *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 71-84 refs Sponsored by ONR (For primary document see N80-10107 01-02)
(Contract N00014-77-C-0271)
Avail: NTIS HC A22/MF A01 CSCL 01A

A method was developed for calculating the static performance of thrust augmenting ejectors by matching a viscous solution for the flow through the ejector to an inviscid solution for the flow outside the ejector. A two dimensional analysis utilizing a turbulence kinetic energy model is used to calculate the rate of entrainment by the jets. Vortex panel methods are then used with the requirement that the ejector shroud must be a streamline of the flow induced by the jets to determine the strength of circulation generated around the shroud. In effect, the ejector shroud is considered to be flying in the velocity field of the jets. The solution is converged by iterating between the rate of entrainment and the strength of the circulation. This approach offers the advantage of including external influences on the flow through the ejector. Comparisons with data are presented for an ejector having a single central nozzle and Coanda jet on the walls. The accuracy of the matched solution is found to be especially sensitive to the jet flap effect of the flow just downstream of the ejector exit. Author

N80-10113*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Flight Control Div.
INTERNAL-EXTERNAL FLOW INTEGRATION FOR A THIN EJECTOR-FLAPPED WING SECTION
Henry W. Woolard *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

Thin airfoil theories of an ejector flapped wing section are reviewed. The global matching of the external airfoil flow with the ejector internal flow and the overall ejector flapped wing section aerodynamic performance are examined. Mathematical models of the external and internal flows are presented. The delineation of the suction flow coefficient characteristics are discussed. The idealized lift performance of an ejector flapped wing relative to a jet augmented flapped wing are compared. A.W.H.

N80-10114*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
ON THE RATIONAL DESIGN OF COMPRESSIBLE FLOW EJECTORS
P. J. Ortwerth *In* NASA. Ames Res. Center. Workshop on Thrust Augmenting Ejectors Sep. 1979 p 109-139 refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

A fluid mechanics review of chemical laser ejectors is presented. The characteristics of ejectors with single and multiple driver nozzles are discussed. Methods to compute an optimized performance map in which secondary Mach number and performance are computed versus mass ratio, to compute the flow distortion at each optimized condition, and to determine the thrust area for the design point to match diffuser impedence are examined. A.W.H.

N80-10115*# Rockwell International Science Center, Thousand Oaks, Calif.
A COMPUTATIONAL MODEL FOR THREE-DIMENSIONAL INCOMPRESSIBLE WALL JETS WITH LARGE CROSS FLOW
W. D. Murphy, V. Shankar, and N. D. Malmuth *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 141-166 refs (For primary document see N80-10107 01-02)
(Contract N62269-77-C-0412)
Avail: NTIS HC A22/MF A01 CSCL 01A

A computational model for the flow field of three dimensional incompressible wall jets prototypic of thrust augmenting ejectors with large cross flow is presented. The formulation employs boundary layer equations in an orthogonal curvilinear coordinate system. Simulation of laminar as well as turbulen wall jets is reported. Quantification of jet spreading, jet growth, nominal separation, and jet shrink effects due to corss flow are discussed. A.W.H.

N80-10116*# Rockwell International Corp., Columbus, Ohio.
COMPUTER AIDED DESIGN STUDY OF HYPERMIXING NOZZLES
L. A. Mefferd and P. M. Bevilacqua *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 167-186 refs (For primary document see N80-10107 01-02)
(Contract N00019-77-C-0527)
Avail: NTIS HC A22/MF A01 CSCL 01A

The development of a nozzle which combines the hypermixing and lobe mechanisms to achieve further increases in jet entrainment and ejector performance is investigated. A computer program which incorporates a two equation turbulence model and is used to predict and compare the evolution of jets from various nozzle designs is discussed. Increasing the length of the nozzle lobes and an alternating lobe nozzle are a methods examined for increasing the entrainment rate. A.W.H.

N80-10117*# George Washington Univ., Washington, D. C.
NONSTEADY-FLOW THRUST AUGMENTING EJECTORS
Joseph V. Foa *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 187-203 refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

Ejector augmenters in which the transfer of mechanical energy from the primary to the secondary flow takes place through the work of interface pressure forces are investigated. Nonsteady flow processes are analyzed from the standpoint of energy transfer efficiency and a comparison of a rotary jet augmenter to an ejector is presented. A.W.H.

N80-10118*# Wright State Univ., Dayton, Ohio.
LINEARIZED UNSTEADY JET ANALYSIS
Herman Viets and Michael Piatt *In* NASA. Ames Res. Center, Workshop on Thrust Augmenting Ejectors Sep. 1979 p 205-223 refs (For primary document see N80-10107 01-02)
(Grant AF-AFOSR-3525-78)
Avail: NTIS HC A22/MF A01 CSCL 01A

The introduction of a time dependency into a jet flow to change the rate at which it mixes with a coflowing stream or ambient condition is investigated. The advantages and disadvantages of the unsteady flow are discussed in terms of steady state mass and momentum transfer. A linear system which is not limited by frequency constraints and evolves through a simplification of the equations of motion is presented for the analysis of the unsteady flow field generated by the time dependent jet. A.W.H.

N80-10119*# Duvvuri Research Associates, Chula Vista, Calif.
INTEGRATION OF EJECTORS INTO HIGH-SPEED AIRCRAFT
Tirumalesa Duvvuri *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 225-238 (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The integration of ejectors into forebodies is considered for transonic and supersonic flight. Topics discussed include mixing flow in ducts, prediction of flow fields and external aerodynamics. K.L.

N80-10120*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
SOME TESTS ON SMALL-SCALE RECTANGULAR THROAT EJECTOR
W. N. Dean, Jr. (Air Force Flight Test Center) and M. E. Franke *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 239-251 refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

A small scale rectangular throat ejector with plane slot nozzles and a fixed throat area was tested to determine the effects of diffuser sidewall length, diffuser area ratio, and sidewall nozzle position on thrust and mass augmentation. The thrust augmentation ratio varied from approximately 0.9 to 1.1. Although the ejector did not have good thrust augmentation performance, the effects of the parameters studied are believed to indicate probable trends in thrust augmenting ejectors. Author

N80-10121*# Vought Corp., Dallas, Tex.
AUGMENTING EJECTOR ENDWALL EFFECTS
J. L. Porter and R. A. Squyers *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 253-271 refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

Rectangular inlet ejectors which had multiple hypermixing nozzles for their primary jets were investigated for the effects of endwall blowing on thrust augmentation performance. The ejector configurations tested had both straight wall and active boundary layer control type diffusers. Endwall flows were energized and controlled by simple blowing jets suitably located in the ejector. Both the endwall and boundary layer control diffuser blowing rates were varied to determine optimum performance. High area ratio diffusers with insufficient endwall blowing showed endwall separation and rapid degradation of thrust performance. Optimized values of diffuser boundary layer control and endwall nozzle blowing rates in an ejector augmenter were shown to achieve high levels of augmentation performance for maximum compactness. K.L.

N80-10122*# Rockwell International Corp., Columbus, Ohio. Columbus Aircraft Div.
AN INVESTIGATION OF CORNER SEPARATION WITHIN A THRUST AUGMENTER HAVING COANDA JETS Final Report
M. R. Seiler *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 273-293 refs (For primary document see N80-10107 01-02)
(Contract N62269-76-C-0402)
(NADC-76153-30) Avail: NTIS HC A22/MF A01 CSCL 01A

The development of separation in corners of thrust augmentor wings having Coanda jets was investigated using hot film surface sensors and pressure transducers. Separation on the test augmentor began at a corner very close to the augmentor exit and then rapidly proceeded upstream. Measurements of the pressure fields in the corner region indicated that a modified form of the Stratford criterion could be used to predict the onset of separation. Testing was conducted over a range of nozzle pressure ratios, aspect ratios, diffuser angles, and designs of the boundary layer and Coanda nozzles. K.L.

N80-10123*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LARGE-SCALE TURBULENT STRUCTURES IN JETS AND IN FLOWS OVER CAVITIES AND THEIR RELATIONSHIP TO ENTRAINMENT AND MIXING
V. Sarohia and P. F. Massier. *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors. Sep. 1979. p 295-309. refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

Large scale structures in jets and in flows over cavities were investigated experimentally to determine their role in entrainment, mixing, and noise production. The presence of these structures resulted in growth of the shear layer and entrainment. Merging of adjacent large scale structures caused the near field pressure signal in excited flows. It is believed that both the entrained fluid as well as its eventual mixing with the jet flow can be controlled by introducing pulsation in the jet flow at a frequency for which the flow is most unstable. K.L.

N80-10124*# Naval Postgraduate School, Monterey, Calif.
ENTRAINMENT CHARACTERISTICS OF UNSTEADY SUBSONIC JETS
M. F. Platzer, J. M. Simmons (Queensland Univ., Brisbane, Australia), and K. Bremhorst (Queensland Univ., Brisbane, Australia). *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors. Sep. 1979. p 311-324. refs. Submitted for publication (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The effectiveness of jet unsteadiness in enhancing flow entrainment was assessed. It was conducted that entrainment depends on the type and amount of jet unsteadiness. Apparently, the mere introduction of jet unsteadiness by small sinusoidal flow angle variations is insufficient to enhance entrainment but, it should be noted that the results were obtained at measuring stations which are all many nozzle widths downstream of the jet nozzle. Thus, no fully conclusive statement can be made at this time about the entrainment close to the nozzle. The high entrainment of the fluidically oscillated jet was caused by the high-frequency content of this square wave type of oscillation but more detailed measurements are clearly needed, in particular for the fluidically oscillated and the pulsed jets. Practical ejector application requires the proper trade-off between entrainment and primary nozzle thrust efficiency. M.M.M.

N80-10125*# Calgary Univ. (Alberta). Dept. of Mechanical Engineering.
A SIMPLE APPARATUS FOR THE EXPERIMENTAL STUDY OF NON-STEADY FLOW THRUST-AUGMENTER EJECTOR CONFIGURATIONS
J. M. Khare and J. A. C. Kentfield. *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejector. Sep. 1979. p 325-349. refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

A flexible, and easily modified, test rig is described which allows a one dimensional nonsteady flow stream to be generated, economically from a steady flow source of compressed air. This nonsteady flow is used as the primary stream in a nonsteady flow ejector constituting part of the test equipment. Standard piezo-electric pressure transducers etc. allow local pressures to be studied, as functions of time, in both the primary and secondary (mixed) flow portions of the apparatus. Provision is also made for measuring the primary and secondary mass flows and the thrust generated. Sample results obtained with the equipment are presented. M.M.M.

N80-10126*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
PRESSURE AND VELOCITY MEASUREMENTS IN A THREE-DIMENSIONAL WALL JET
G. D. Catalano, J. B. Morton (Virginia Univ.), and R. R. Humphris (Virginia Univ.). *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors. Sep. 1979. p 357-362. refs. Presented at the AIAA 17th Aerospace Sciences Meeting, New Orleans, 15-17 Jan. 1979 (For primary document see N80-10107 01-02)
(Grants NGR-47-005-219; NSF 7522488)
Avail: NTIS HC A22/MF A01 CSCL 01A

The effects on the flow fields of varying the ratio of the velocity at the exit plane of the nozzle to the outer tunnel flow are reported. The pressure-velocity correlations are taken and some trends are discussed. Emphasis is placed on comparing the coherence between the fluctuating pressure and velocity fields at various locations in the different flow configurations. M.M.M.

N80-10127*# Flight Dynamics Research Corp., Van Nuys, Calif.
CONSIDERATIONS OF SOME CRITICAL EJECTOR PROBLEMS
Morton Alperin and Jiunn-Jeng Wu. *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors. Sep. 1979. p 363-384. refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

Some aspects of ejector design and application, including, three dimensional effects and cross flow effects are presented. M.M.M.

N80-10128*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COANNULAR SUPERSONIC EJECTOR NOZZLES
Allan R. Bishop. *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors. Sep. 1979. p 385-396. refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The nozzles described exhibit a flow field which is supersonic except for the initial flow region, and the secondary mass flow is typically about five percent of the primary core flow. The features to improve the accuracy of the performance calculations are discussed. A special calculation is made to get as realistic a sonic line as possible for this geometry, using an analysis developed by Brown. The mixing between the secondary and core flows is treated to account for entrainment of the secondary flow into core. Both of these phenomena directly affect the pressure distribution on the shroud and therefore, the thrust that the nozzle produces. The importance of using a realistic sonic line and a mixing analysis is stressed. M.M.M.

N80-10129*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Aeromechanics Div.
INTERFACE CONCERNS OF EJECTOR INTEGRATION IN V/STOL AIRCRAFT
Randall B. Lowry. *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors. Sep. 1979. p 397-415 (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

A number of areas which have in the past contributed to weight, complexity, and thrust losses in the ejector-powered V/STOL vehicle were identified. Most of these interfaces taken singly do not represent a severe compromise to the vehicle; however, the bottom line is that the sum of compromises and the subsequent effects on performance, flight operations and maintenance have rendered the ejector V/STOL aircraft unattractive. In addition to some of the unique ejector/aircraft integration problems, the vehicle by virtue of having a V/STOL capability, is compromised in other areas. To be successful and acceptable, the advantages must outweight the disadvantages and simplicity with minimum penalties must be the rule. It is concluded that more emphasis must be placed on the ejector/aircraft interface for the concept to be successful. R.E.S.

N80-10130*# Lockheed-California Co., Burbank.
REACTION CONTROL SYSTEM AUGMENTATION FOR V/STOL AIRCRAFT
H. G. Streiff and R. E. Donham. *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors. Sep. 1979. p 417-436. ref (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

Advantages and problems associated with augmentation of reaction controls are discussed. The current status of compact ejector technology and the expected performance of known efficient designs for reaction control applications are presented. R.E.S.

N80-10131*# Rockwell International Corp., Columbus, Ohio. Columbus Aircraft Div.
DESIGN AND TEST OF A PROTOTYPE SCALE EJECTOR WING
L. A. Mefferd, R. E. Alden, and P. M. Bevilacqua. *In* NASA.

Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 437-448 (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

A two dimensional momentum integral analysis was used to examine the effect of changing inlet area ratio, diffuser area ratio, and the ratio of ejector length to width. A relatively wide range of these parameters was considered. It was found that for constant inlet area ratio the augmenation increases with the ejector length, and for constant length: width ratio the augmentation increases with inlet area ratio. Scale model tests were used to verify these trends and to examine th effect of aspect ratio. On the basis of these results, an ejector configuration was selected for fabrication and testing at a scale representative of an ejector wing aircraft. The test ejector was powered by a Pratt-Whitney F401 engine developing approximately 12,000 pounds of thrust. The results of preliminary tests indicate that the ejector develops a thrust augmentation ratio better than 1.65. R.E.S.

N80-10132*# De Havilland Aircraft Co. of Canada Ltd., Ottawa (Ontario).
THE EXTERNAL AUGMENTOR CONCEPT FOR V/STOL AIRCRAFT
D. C. Whittely *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 449-471 refs (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The beneficial aspects of an ejector powered V/STOL concept were reviewed. The feasibility of satisfactorily incorporating an ejector system in a high performance V/STOL aircraft was investigated. The external augmentor concept, based on the use of chordwise ejector slots, is presented. It is concluded that the external augmentor concept has a basic inherent simplicity and a sufficient augmentor performance potential to make feasible a high performance V/STOL aircraft based on ejectors. R.E.S.

N80-10133*# Naval Air Systems Command, Washington, D. C.
THE XFV-12A THRUST-AUGMENTED WING (TAW) PROTOTYPE AIRCRAFT
Ron Murphy and Ernest L. Lewis *In* NASA. Ames Res. Center Workshop on Thrust Augmenting Ejectors Sep. 1979 p 473-480 (For primary document see N80-10107 01-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The XFV-12A, a unique V/STOL technology prototype aircraft being developed for the Navy, is described. The innovative design features a thrust augmented wing and a canard ejector. Structural, functional, and control test performances are discussed. Static tether test results are also discussed. Assessment of test results are given along with projections for future modification areas. R.E.S.

N80-10134*# Douglas Aircraft Co., Inc., Long Beach, Calif.
AN EFFICIENT USER-ORIENTED METHOD FOR CALCULATING COMPRESSIBLE FLOW IN AN ABOUT THREE-DIMENSIONAL INLETS Final Report, Nov. 1977 - Apr. 1979
John I. Hess, Dun-Pok Mack, and Norbert O. Stockman (NASA. Lewis Res. Center) Apr. 1979 117 p refs
(Contract NAS3-21135)
(NASA-CR-159578; MDC-J7733) Avail: NTIS HC A06/MF A01 CSCL 01A

A panel method is used to calculate incompressible flow about arbitrary three-dimensional inlets with or without centerbodies for four fundamental flow conditions: unit onset flows parallel to each of the coordinate axes plus static operation. The computing time is scarcely longer than for a single solution. A linear superposition of these solutions quite rigorously gives incompressible flow about the inlet for any angle of attack, angle of yaw, and mass flow rate. Compressibility is accounted for by applying a well-proven correction to the incompressible flow. Since the computing times for the combination and the compressibility correction are small, flows at a large number of inlet operating conditions are obtained rather cheaply. Geometric input is aided by an automatic generating program. A number of graphical output features are provided to aid the user, including surface streamline tracing and automatic generation of curves of curves of constant pressure, Mach number, and flow inclination at selected inlet cross sections. The inlet method and use of the program are described. Illustrative results are presented. A.R.H.

N80-10135*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOW-SPEED WIND-TUNNEL TESTS OF A 1/10-SCALE MODEL OF AN ADVANCED ARROW-WING SUPERSONIC CRUISE CONFIGURATION DESIGNED FOR CRUISE AT MACH 2.2
Long P. Yip Aug. 1979 265 p refs
(NASA-TM-80152) Avail: NTIS HC A12/MF A01 CSCL 01A

The low-speed longitudinal and lateral-directional characteristics of a scale model of an advanced arrow-wing supersonic cruise configuration were investigated in tests conducted at a Reynolds number of 4.19 x 10 to the 6th power based on the mean aerodynamic chord, with an angle of attack range from -6 deg to 23 deg and sideslip angle range from -15 deg to 20 deg. The effects of segmented leading-edge flaps, slotted trailing-edge flaps, horizontal and vertical tails, and ailerons and spoilers were determined. Extensive pressure data and flow visualization pictures with non-intrusive fluorescent mini-tufts were obtained. A.R.H.

N80-10136*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A FLIGHT INVESTIGATION OF PERFORMANCE AND LOADS FOR A HELICOPTER WITH NLR-1T MAIN-ROTOR BLADE SECTIONS
Charles E. K. Morris, Jr., Robert L. Tomaine, and Dariene D. Stevens Oct. 1979 176 p refs Prepared in cooperation with Army Research and Technology Labs., Hampton, Va.
(DA Proj. 1L2-62209-AH-76)
(NASA-TM-80165) Avail: NTIS HC A09/MF A01 CSCL 01A

Data on performance and rotor loads for a teetering-rotor, AH-1G helicopter flown with a main rotor that had the NLR-1T airfoil as the blade-section contour are presented. The test envelope included hover, forward-flight speed sweeps from 35 to 85 m/sec, and collective-fixed maneuvers at about 0.25 tip-speed ratio. The data set for each test point described vehicle flight state, control positions, rotor loads, power requirements, and blade motions. Rotor loads are reviewed primarily in terms of peak-to-peak and harmonic content. Lower frequency components predominated for most loads and generally increased with increased airspeed, but not necessarily with increased maneuver load factor. M.M.M.

N80-10137*# Michigan Univ., Ann Arbor Dept. of Aerospace Engineering.
MATH MODELING AND COMPUTER MECHANIZATION FOR REAL TIME SIMULATION OF ROTARY-WING AIRCRAFT Final Report, 1 Jun. 1977 - 31 Mar. 1979
Robert M. Howe Mar. 1979 21 p refs
(Grant NsG-2245)
(NASA-CR-162400) Avail: NTIS HC A02/MF A01 CSCL 01A

Mathematical modeling and computer mechanization for real time simulation of rotary wing aircraft is discussed. Error analysis in the digital simulation of dynamic systems, such as rotary wing aircraft is described. The method for digital simulation of nonlinearities with discontinuities, such as exist in typical flight control systems and rotor blade hinges, is discussed. A.W.H.

N80-10138# Naval Surface Weapons Center, White Oak, Md.
OBSERVATIONS ON PARACHUTE SCALE FACTORS FOR MODELING PARACHUTE DEPLOYMENT AND STEADY STATE PERFORMANCE Final Report, 1978
William P. Ludtke 9 May 1979 64 p
(AD-A070571; NSWC/WOL/TR-78-189) Avail: NTIS HC A04/MF A01 CSCL 01/3

A new approach to the scaling of parachute performance is presented, based upon variables inherent in the inflation process such as weight, time, geometry, etc. Limitations of conventional scaling parameters such as Reynold's, Froude, and Mach numbers as applied to parachutes are discussed. Examples of parachute inflation and steady state performance are correlated

with a scale factor designated as a Mass Ratio, which is the ratio of the system mass to a mass of atmosphere associated with the parachute size, inflation time, altitude and deployment velocity. For advanced opening shock analyses, the concept of variable mass ratio during canopy inflation is proposed, and the effects of partial canopy inflation at suspension line stretch are discussed. Although, the solid cloth types of parachutes are primarily used as examples, the ideas of mass ratio, initial area, and analysis techniques are applicable to all types of parachutes. GRA

N80-10139# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science and Mechanics.
USE OF WAGNER FUNCTIONS IN AIRFOIL DESIGN OPTIMIZATION Final Report, 20 Mar. 1978 - 19 Mar. 1979
Vireshwar Sahai and Chen-Pierce Tsao May 1979 57 p refs
(Grant AF-AFOSR-3543-78; AF PROJ. 2307)
(AD-A072634; TTU-ESM-79-2; AFOSR-79-0903TR) Avail: NTIS HC A04/MF A01 CSCL 01/3

The feasibility of using a series of Wagner functions to represent airfoil contours in design procedures was investigated. It was demonstrated that a large class of airfoils can be adequately described by a relatively small number of terms. A least squares type of procedure was used to determine the unknown coefficients in the series representation. The use of Wagner function representation in thin symmetrical airfoil design was investigated. Both the direct method of analysis in which the velocity distribution is calculated for a known shape and the inverse method of design in which the airfoil shape corresponding to a specified velocity distribution is determined were considered. Standard airfoil data was used to test the suitability of the Wagner function representation, and the results were found to be satisfactory. Rapid calculations were possible even in the inverse mode since the use of Wagner functions allowed the determination of all the improper integrals that appear in thin airfoil theory in closed form. GRA

N80-10140# Analytical Methods, Inc., Bellevue, Wash.
PREDICTION OF AERODYNAMIC CHARACTERISTICS OF FIGHTER WINGS AT HIGH LIFT Interim Report, 1 Jan. - 31 Dec. 1978
Balusu M. Rao, Brian Maskew, and Frank A. Dvorak 31 Dec. 1978 57 p refs
(Contract N00014-78-C-0128; RR0141184)
(AD-A072630; ONR-CR215-258-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

A basic viscous/potential flow iterative technique is developed for calculating flow on finite wings up to and beyond the stall. The procedure used is a direct adaptation and extension of successfully validated Analytical Methods, Inc. (AMI) two-dimensional CLMAX separation model to three-dimensional flows. In the potential flow program, the lifting surface is divided into a number of panels with linear and constant vorticity distributions along the chordwise and spanwise directions, respectively. The separation region is modeled in the potential flow analysis using force-free vortex sheets which require an inner iteration to establish their shapes. The program generates a new wake shape using the new separation locations together with the information from the previous iteration and the process is repeated until a convergent solution is obtained. In order to expedite the development process, several simplifying assumptions are made. However, these assumptions do not conflict with the primary objective of the present investigation which is to demonstrate the feasibility of extending the two-dimensional CLMAX separation model to three-dimensional flows. The separation flow model and the developed computer program are validated by comparing the results with wind tunnel test data for some simple cases. GRA

N80-10141# Dayton Univ. Research Inst., Ohio.
THE MARTIN-LOMAX ITERATION FOR THE COMPUTATIONS OF TRANSONIC FLOW FIELDS: SOME OBSERVATIONS Interim Report, Apr. - Nov. 1978
Karl G. Guderley and Donald S. Clemm Wright-Patterson AFB, Ohio AFFDL Apr. 1979 56 p refs
(Grant AF-AFOSR-78-3524; AF Proj. 2304)
(AD-A072523; AFFDL-TR-79-3023) Avail: NTIS HC A04/MF A01 CSCL 20/4

The iteration method of Martin and Lomax for the computation of transonic flow fields is applied to some linear examples (subsonic flows, supersonic flows, and flows with a shock). In these examples a Fourier decomposition can be made in one coordinate direction, and one is left with a one-dimensional difference equation. The question of compatibility of the boundary conditions pertaining to the elliptic operator used in the Martin-Lomax iteration, with those of a hyperbolic problem is discussed. The one-dimensional difference procedure gives rise to a linear eigenvalue problem. The distribution of the eigenvalues and the form of the eigenvectors explains the convergence behavior of solutions obtained with different initial which occur in the influence of certain arbitrary parameters which occur in the Martin-Lomax procedure is briefly discussed. An attempt is made to improve the convergence of the iterations by the application of Aitken-Shanks formulae of different orders. A direct derivation of the concept underlying these formulae is given. In the present examples, the Aitken-Shanks extrapolation failed to accelerate the convergence. GRA

N80-10142# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
ACCELERATION OF TRANSONIC POTENTIALS FLOW CALCULATIONS ON ARBITRARY MESHES BY THE MULTIPLE GRID METHOD
Antony Jameson 1979 33 p refs Presented at the AIAA Computational Fluid Dynamics Conf., Williamsburg, 4 Jul. 1979
(Contract N00014-77-C-0032)
(AD-A072301) Avail: NTIS HC A03/MF A01 CSCL 20/4

The paper describes a multiple grid method for transonic flow calculations. The proposed scheme incorporates a generalized alternating direction method as the smoothing algorithm. Numerical experiments with this multigrid alternating direction (MAD) method indicate that it is both fast and reliable. GRA

N80-10143# Aeronautical Research Inst. of Sweden, Stockholm.
INVESTIGATION OF THE BOUNDARY CONDITION AT A WIND TUNNEL TEST SECTION WALL FOR A LIFTING WING-BODY MIDEL AT LOW SUPERSONIC SPEED Final Report, 1 Apr. 1977 - 31 Mar. 1979
Sven-Grik Nyuberg, Sevn G. Hedman, Arthur Rizzi, and Hans Sorenson May 1979 99 p refs
(Grant AF-AFOSR-3282-77; AF Proj. 2307)
(AD-A072098; AFOSR-79-0868TR) Avail: NTIS HC A05/MF A01 CSCL 01/3

The purpose of the investigation is to study theoretically and experimentally at low supersonic speed the interference-free flow field around a lifting wing-body wind tunnel model at locations where the tunnel walls are normally situated. The undisturbed flow properties are used to establish criteria for cross flow characteristics of wave-attenuating ventilated wind tunnel walls. The flow field has been calculated theoretically by a relaxation method based on the transonic small perturbation (TSP) equation and for one sample case for the body alone with a method based on the solution of the full gas dynamic equations (the Euler equations) in a time-dependent finite volume formulation. A survey of the flow has been made experimentally with a probe in wind tunnel tests. Pressure and flow deflection in the flow field near a delta-wing-body configuration have been calculated at free stream Mach number 1.2 and at angles of attack of 0 deg and 5 deg. The same properties have been determined in wind tunnel tests at Mach number 1.15, 1.20 and 1.30 and at nominal angles of attack 0 deg, 5 deg, 15 deg and 25 deg. The theoretical results obtained using the TSP method show only qualitative agreement with experimental data and the shocks are smeared out. Theoretical results obtained by the time-dependent finite volume method for the body alone show promising agreement with experiments. GRA

N80-10144# Sandia Labs., Albuquerque, N. Mex.
ACCELERATED AGING OF PARACHUTE MATERIALS
J. A. Wagner, K. E. Mead, I. Auerbach, and R. H. Ericksen 1979 6 p refs Presented at JOWOG-28, Albuquerque, N. Mex., 11 Jun. 1979
(Contract DE-AC04-76DP-00789)
(SAND-79-0894C; Conf-790632-3) Avail: NTIS HC A02/MF A01

Parachutes with intended lifetimes of twenty to twenty-five years are tested for real time life storage. An accelerated aging program to test the nylon and Kevlar yarns used in the manufacture of parachute materials is described. The yarns were tested for breaking strength in humidity, ozone, and smog environments.
A.W.H.

N80-10145# New Mexico Univ., Albuquerque. Technology Application Center.
BOUNDARY LAYER CONTROL. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Report, 1974 - Jul. 1979
Samuel C. Mauk Springfield, Va. NTIS Aug. 1979 34 p Sponsored by NTIS
(NTIS/PS-79/0812/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 01A
Citations to the international literature concerning boundary layer control are reported. Topics covered include suction, blowing, shock wave interaction, magnetohydrodynamic flow, laminar boundary layer cooling, gas and fluid inuection, and circulation control as methods of boundary layer control. This bibliography contains 134 citations. GRA

N80-10146# New Mexico Univ., Albuquerque. Technology Applications Center.
BOUNDARY LAYER SEPARATION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Report, 1976 - Jul. 1979
Samuel C. Mauk Springfield, Va. NTIS Aug. 1979 54 p Sponsored by NTIS
(NTIS/PS-79/0813/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 01A
Citations to the international literature concerning boundary layer separation in both laminar and turbulent boundary layers are reported. Articles covering incompressible, transonic and supersonic flown conditions are included. Also included are articles concerning separated flow, shock wave interaction boundary layer equations, pressure gradients, and three dimensional boundary layers. Contained are 217 citations. GRA

N80-10147# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SYMPOSIUM ON HIGH ANGLE OF ATTACK AERODYNAMICS
Edward C. Polhamus Aug. 1979 20 p refs Symp. held at Sandefjord, Norway, 4-6 Oct. 1978 Prepared in cooperation with NASA, Langley Res. Center
(AGARD-AR-145; ISBN-92-835-1334-7) Avail: NTIS HC A02/MF A01
An overview is presented of 32 formal papers and 7 open session papers. Topics covered include: (1) studies of configurations of practical interest; (2) mathematical modelling and supporting investigations of slender wings, bodies of revolution, and body-wing configurations; (3) design methods; and (4) air intakes. A.R.H.

N80-10002 Allerton Press, Inc., New York, N. Y.
APPLICATION OF THE GAS FLOW DIMENSIONLESS CHARACTERISTICS METHOD FOR EXPERIMENTAL STUDY OF SONIC NOZZLES
G. V. Abalakov, B. S. Vinogradov, and A. P. Gerasimov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 1-5 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 5-11 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10018 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF THE TURBULENT WAKE DOWNSTREAM OF A FAN JET
O. A. Khachaturyan *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 72-77 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats Tekh. (USSR), v. 21, no. 3, 1978 p 100-107 (For primary document see N80-10001 01-01)
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N80-10025 Allerton Press, Inc., New York, N. Y.
STUDY OF RADIAL DIFFUSORS WITH FLOW SWIRL
V. T. Volov and V. G. Shakhov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 111-112 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 148-150 (For primary document see N80-10001 01-01)
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N80-10038 Allerton Press, Inc., New York, N. Y.
ANALOG MODELING IN STUDYING SUPERSONIC FLOW AROUND A WING AND ITS GOVERNING ANALOG-CRITERIA
R. I. Vinogradov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 32-37 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 43-48 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10045 Allerton Press, Inc., New York, N. Y.
LAMINAR BOUNDARY LAYER CALCULATION FROM EXPERIMENTAL PRESSURE DISTRIBUTION
V. D. Osorgin, A. N. Popkov, O. P. Sidorov, and S. O. Sidorova *In its* Soviet Aeron., v. 21, no. 4, 1978 p 67-71 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 88-93 (For primary document see N80-10031 01-01)
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N80-10050 Allerton Press, Inc., New York, N. Y.
MOTION OF RECTANGULAR WING BETWEEN PARALLEL WALLS
K. V. Rozhdestvenskii *In its* Soviet Aeron., v. 21, no. 4, 1978 p 92-97 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 117-123 (For primary document see N80-10031 01-01)
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N80-10059 Allerton Press, Inc., New York, N. Y.
PARACHUTE-ROCKET DECELERATION SYSTEM DESIGN
V. N. Semenov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 132-134 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviat. Tekh., (USSR), v. 21, no. 4, 1978 p 158-162 (For primary document see N80-10031 01-01)
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N80-10060 Allerton Press, Inc., New York, N. Y.
FLOW-AROUND SMALL-ASPECT-RATIO DELTA WING WITH VORTEX 'BURSTING'
G. A. Cheremukhin, E. A. Truneva, and E. Ya. Pivkin *In its* Soviet Aeron., v. 21, no. 4, 1978 p 135-140 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 162-167 (For primary document see N80-10031 01-01)
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N80-10062 Allerton Press, Inc., New York, N. Y.
CALCULATION OF WORKING PROCESS IN SLOW-COMPRESSION PISTON-TYPE AERODYNAMIC TUBE
A. B. Berezovskii and V. B. Panfilovich *In its* Soviet Aeron., v. 22, no. 1 1979 p 1-5 refs Transl. into ENGLISH from Izu. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 3-10 (For primary document see N80-10061 01-01)
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N80-10077 Allerton Press, Inc., New York, N. Y.
AERODYNAMIC EFFICIENCY OF GAS TURBINE INTAKE DUCT
I. G. Gogolev, P. V. Korolev, Yu. D. Kudashev, V. A. Magala, and B. A. Shifrin *In its* Soviet Aeron., v. 22, no. 1 1979 p 71-73 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 88-91 (For primary

document see N80-10061 01-01)
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N80-10079 Allerton Press, Inc., New York, N. Y.
DESIGN OF BOUNDARY-LAYER AIR INTAKES
V. T. Kalugin, T. V. Klebanova, Yu. I. Kozlov, and V. N. Koshevoi *In its* Soviet Aeron., v. 22, no. 1 1979 p 76-79 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 93-96 (For primary document see N80-10061 01-01)
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N80-10082 Allerton Press, Inc., New York, N. Y.
APPLICATION FACTOR OF TWO-DIMENSIONAL TRANSVERSE SONIC JET INTERACTING WITH SUPERSONIC STREAM
V. I. Krishtal *In its* Soviet Aeron., v. 22, no. 1 1979 p 87-89 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 102-105 (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

N80-10085 Allerton Press, Inc., New York, N. Y.
STUDY OF COMBINED OPERATION OF SELF-EVACUATING VORTEX TUBE WITH DIFFUSER
A. P. Merkulov and V. T. Volov *In its* Soviet Aeron., v. 22, no. 1 1979 p 96-98 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 109-112 (For primary document see N80-10061 01-01)
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03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-10148*# Northwestern Univ., Evanston, Ill. Transportation Center.
FACTORS AFFECTING THE RETIREMENT OF COMMERCIAL TRANSPORT JET AIRCRAFT
Frank A. Spencer Aug. 1979 296 p refs
(Grant NsG-2149)
(NASA-CR-152308) Avail: NTIS HC A13/MF A01 CSCL 01C

The historical background of the technology and economics of aircraft replacement and retirement in the prejet era is reviewed in order to determine whether useful insights can be obtained applicable to the jet era. Significant differences between the two periods are noted. New factors are identified and examined. Topics discussed include concern over current policies regarding deregulation, regulatory reform, and retroactive noise regulations; financing and compliance legislation; aging; economic environment and inflation; technological progress; fuel efficiency and cost; and a financial perspective of replacement decisions. A.R.H.

N80-10149*# Douglas Aircraft Co., Inc., Long Beach, Calif.
CARGO LOGISTICS AIRLIFT SYSTEMS STUDY (CLASS). VOLUME 4: FUTURE REQUIREMENTS OF DEDICATED FREIGHTER AIRCRAFT TO YEAR 2008
R. J. Burby Oct. 1979 259 p refs
(Contract NAS1-14948)
(NASA-CR-158950-Vol-4) Avail: NTIS HC A12/MF A01 CSCL 01C

The 1978 fleet operations are extended to the year 1992, thus providing an evaluation of current aircraft types in meeting the ensuing increased market demand. Possible changes in the fleet mix and the resulting economic situation are defined in terms of the number of units of each type aircraft and the resulting growth in operational frequency. Among the economic parameters considered are the associated investment required by the airline, the return on investment to the airline, and the accompanying levels of cash flow and operating income. Against this background the potential for a derivative aircraft to enter fleet operations in 1985 is defined as a function of payload size and as affected by 1980 technology. In a similar manner, the size and potential for a new dedicated 1990 technology, freighter aircraft to become operational in 1995 is established. The resulting aircraft and fleet operational and economic characteristics are evaluated over the period 1994 to 2008. The impacts of restricted growth in operational frequency, reduced market demand, variations in aircraft configurations, and military participation, are assessed. A.R.H.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-10150*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NAVIGATION AND METEOROLOGICAL ERROR EQUATIONS FOR SOME AERODYNAMIC PARAMETERS
Michael J. Krikorian, John Rice, and Paul Mitchell Aug. 1979 37 p
(NASA-TM-80804; Rept-79-FM-30; JSC-16074) Avail: NTIS HC A03/MF A01 CSCL 17G

Mathematical equations for the analysis of the errors that are expected in a set of postflight aerodynamic parameters are presented. The errors are due to inaccuracies in the Shuttle best estimate trajectory and in the meteorological data obtained in support of the flights. The error analysis shows that the parameter vector, Z, and its associated error covariance matrix, C sub Z, is calculated from a given state vector, X, and its associated covariance matrix, C sub X. A.W.H.

N80-10151# Civil Aeromedical Inst., Oklahoma City, Okla.
PILOT PERFORMANCE DURING SIMULATED APPROACHES AND LANDINGS MADE WITH VARIOUS COMPUTER-GENERATED VISUAL GLIDEPATH INDICATORS
Mark F. Lewis and Henry W. Mertens Sep. 1978 58 p refs
(AD-A066220; FAA-AM-79-4) Avail: NTIS HC A04/MF A01 CSCL 17/7

The effectiveness, in terms of pilot performance, of four different visual glidepath indicator systems in severely reduced nighttime visual environment is discussed. An aircraft simulator was used with a computer generated image visual system attached for visual simulation of the airport scene. The flight path profile with regard to altitude deviations from a 3 degree path as a function of distance is examined. The instability in approach paths flown with the different types of glidepath indicators is studied. Altitude deviations from the 3 degree glidepath as a function of indicator type, trials, and subjects are analyzed. A.W.H.

N80-10152*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ALGORITHMS AND LOGIC FOR INCORPORATING ILS NASA TCV B-737 AIRPLANE AREA NAVIGATION SYSTEM
Charles E. Knox Sep. 1979 23 p refs
(NASA-TM-80167) Avail: NTIS HC A02/MF A01 CSCL 17G

The algorithms and logic for use in the implementation of instrument landing system (ILS) localizer deviation signals for the generation of navigation and guidance information are presented. The navigation position estimates, based on range information from a randomly chosen distance measuring

equipment (DME) and ILS localizer deviation information, are illustrated. The ILS volumetric coverage and DME geometric checks are described and their addition to area navigation systems with minimum software modification are discussed. A.W.H.

N80-10153# Federal Aviation Administration, Washington, D. C. Office of Aviation Policy.

IFR AIRCRAFT HANDLED FORECAST BY AIR ROUTE TRAFFIC CONTROL CENTER, FISCAL YEARS 1979-1990

Bernard Hannan Apr. 1979 54 p
(AD-A070786; FAA-AVP-79-1) Avail: NTIS HC A04/MF A01 CSCL 01/2

The forecasts of instrument flight rule aircraft handled by air route traffic control centers. The forecasts show that total aircraft handled will increase from 28.1 million in 1978 to 45.6 million in 1990. These numbers along with those for the intervening years are broken down by region and by each air route traffic control center. A.W.H.

N80-10154# Advisory Group for Aerospace Research and Development, Paris (France).

PRINCIPLES AND OPERATIONAL ASPECTS OF PRECISION POSITION DETERMINATION SYSTEMS

Cornelius T. Leondes, ed. (Calif. Univ., Los Angeles.) Jul. 1979 472 p refs
(AGARD-AG-245; ISBN-92-835-1330-4) Avail: NTIS HC A20/MF A01

Reports are presented concerning the current status of radio navigation, the Global Positioning System, and the Joint Tactical Information Distribution System. For individual titles, see N80-10155 through N80-10191.

N80-10155# Systems Control, Inc., Palo Alto, Calif.

RADIO NAVIGATION SYSTEMS: CURRENT STATUS

James S. Tyler and Fred G. Karkalik *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 35 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The life-cycle costs, user requirements, and current system capabilities of radio navigation systems are addressed. The life-cycle costs of several system scenarios are first presented for a limited segment of civil air users in order to illustrate the large magnitude of the costs involved. Current user requirements are summarized for air and marine civil users. Finally, the technical characteristics and operational status of several current systems are presented, namely, Loran-A, Loran-C, Omega, Decca, VOR/DME, and TACAN. F.O.S.

N80-10156# Magnavox Government and Industrial Electronics Co., Torrance, Calif. Advanced Products Div.

TRANSIT: THE CURRENT SATELLITE NAVIGATION SYSTEM

Thomas A. Stansell, Jr. *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 41 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

An in-depth review is provided of Transit, the Navy Navigation Satellite System, from the user's point of view. After a brief system description, a spectrum of diverse applications is described, ranging from the navigation of fishing boats to guiding submarines. Next, the Transit system status and its vitality are discussed. It becomes clear that the system is exceptionally reliable and trustworthy, that the use of and the investment in Transit equipment is growing at a remarkable rate, and that the basic system is about to be improved by the addition of a new generation of NOVA satellites. A technical description is presented of the position fix process and of the factors which influence accuracy. The satellite signal structure, the meaning of the navigation message, and the interpretation of the Doppler measurements are covered in detail, followed by an overview of the fix calculation process. Finally, a thorough review of the system accuracy potential and of the factors which determine accuracy performance is given. F.O.S.

N80-10157# Naval Research Lab., Washington, D. C. Space Applications Branch.

THE TIMATION NAVIGATION SATELLITES

Roger L. Easton *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 3 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The development of stable RF oscillators in the two post World War II decades was essential to the design of passive ranging navigation systems. Early involvement of the U. S. Naval Research Laboratory in this method of time synchronized navigation is outlined. The first NRL satellite used to validate the concept was launched in 1967. Both, it and the second satellite used quartz crystal oscillators. The two following satellites use rubidium and cesium standards, respectively. The lessons learned from the early satellites are summarized, and the merger of TIMATION into the NAVSTAR Global Positioning System Program is described. Selected experimental results from NTS-1 and 2 are analyzed and the plans for NTS-3 are outlined. Author

N80-10158# Rockwell International Corp., Downey, Calif. Space Div.

PRINCIPLE OF OPERATION OF NAVSTAR AND SYSTEM CHARACTERISTICS

Robert J. Milliken and Curt J. Zoller *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 12 p ref (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The NAVSTAR/Global Positioning System (GPS) will provide extremely accurate three-dimensional position and velocity information to users anywhere in the world. The position determinations are based on the measurement of the transit time of RF signals from four satellites of a total constellation of 24. Accuracies on the order of 10 meters may be anticipated. The basic technique by which the system operates, the navigation signal, the measurement of the transit time, error sources, accuracies, and other characteristics of the system are discussed. F.O.S.

N80-10159# Stanford Telecommunications, Inc., Sunnyvale, Calif.

GLOBAL POSITIONING SYSTEM: SIGNAL STRUCTURE AND PERFORMANCE CHARACTERISTICS

James J. Spilker, Jr. *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 35 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

Details of the Global Positioning System (GPS) signal structure are discussed in relation to the signal generation and the performance of the navigation system. The GPS performance objectives, orbit geometry, and propagation effects are summarized in order to gain better understanding of the signal and what characteristics it must provide. With these performance objectives as a preface, the details of the signal are described, showing the details of the dual frequency transmission and both the precise (P) and clear/acquisition (C/A) codes and their characteristics. Finally, the basic performance of simplified receivers operating on this received signal is discussed in order to show compatibility with the original performance objectives and typical receiver operation. It is shown that an rms position error of less than 10 meters is well within the achievable performance bounds of the system. J.M.S.

N80-10160# ADVAND Systems Engineering, San Diego, Calif.

THE GPS NAVIGATION MESSAGE

A. J. VanDierendonck, S. S. Russell (Gen. Dyn./Electron., San Diego, Calif.), and E. R. Kopitske (Magnavox Res. Labs., Torrance, Calif.) *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 21 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The Global Positioning System (GPS) navigation message design process included numerous trade studies which weighed various representations and algorithms against variables such as message size, accuracy, update frequency, user computational requirements, and legacy for the operational GPS. Other factors such as graceful degradation and future user requirements were also considered. Finally, upon selecting the appropriate design structure, the design was fine tuned to its final form and user algorithm implementation trade-offs were performed. The

representational algorithms and user algorithms were jointly tested using a simulated space vehicle ephemeris trajectory and space vehicle clock. The results of these tests demonstrate that the user models represent the simulated ephemeris and clock to within 0.01 meters with precise parameters, and to within 0.1 meters with truncated parameters. J.M.S.

N80-10161# Naval Research Lab., Washington, D. C. Space Systems Div.
CLOCKS: EVOLUTION OF FREQUENCY STANDARDS
C. A. Bartholomev *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 11 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The development of clock technology to meet the changing requirements of satellite navigation systems is discussed. The sequence of flight experiments from Timation 1 launched in 1967 to the multihundred watt Navigation Technology Satellites 1, 2, and 3 of the Global Positioning System is traced. J.M.S.

N80-10162# ADVAND Systems Engineering, San Diego, Calif.
GPS TIME
A. J. VanDierendonck *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 10 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The control and distribution of Global Positioning System (GPS) time measurements is discussed. Compatibility with other timing and navigation systems, 'fast' user acquisition of GPS 'P' signals, and continuous user navigation accuracy are among the factors included. J.M.S.

N80-10163# General Dynamics/Electronics, San Diego, Calif.
MASTER CONTROL STATION
M. J. Hurley, J. L. Kramer, and D. D. Thornburg *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 8 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

Phase 1 of the GPS navigation satellite effort is described. The control segment generates the data required by the user to obtain a navigation solution, uploads this data into the satellite processor for transmission to the user, and collects the satellite ranging data required to determine the satellite ephemeris and clock performance parameters. The control segment software mechanization to perform these functions is a file-based, multi-tasked architecture. This architecture and its legacy to future phases of GPS are described. J.M.S.

N80-10164# General Dynamics/Electronics, San Diego, Calif.
GPS MASTER CONTROL STATION OPERATIONS
H. C. Johnson *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 3 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The operation and function of the control segment of the Global Positioning System is discussed. Satellite tracking, range measurements, estimates of the satellite's ephemerides, and periodic uploads of current data and downlink-formatting instructions to the satellite's onboard computer are among the factors covered. Performance of the computer system is evaluated. J.M.S.

N80-10165# General Dynamics/Electronics, San Diego, Calif.
MONITOR STATIONS
R. L. Harrington, W. A. Fabrizio, and E. Salinas *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 9 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

Monitor stations (MS) which are fixed tracking stations in the GPS control segment are described. Monitor stations collect space vehicle (SV) tracking data, downlink navigation message data, and station health and status. The functional relationship of the monitor stations to other parts of the system is discussed. GPS concept validation monitor stations are located at Vandenburg Air Force Base, Hawaii, Guam, and Alaska. R.E.S.

N80-10166# General Dynamics/Electronics, Vandenburg AFB, Calif.
THE GPS UPLOAD STATION
W. H. Harbour and M. Rochette *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 5 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The GPS Upload Station (ULS) which provides the master control station (MCS) space uplink for the transmission of the navigation data payload to the GPS navigation satellites, is described. The ULS receives upload data messages from the MCS as well as additional data necessary to point the ULS antenna properly at the space vehicle selected for upload. The ULS computer hardware and software are described. R.E.S.

N80-10167# Stanford Telecommunications, Inc., Sunnyvale, Calif.
A TIME TRANSFER UNIT FOR GPS
Jackson T. Witherspoon and Leonard Schuchman *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 6 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

A time transfer unit for use with NAVSTAR satellites of the global positioning system (GPS) is described. This unit can provide worldwide time transfer with an accuracy of better than 100 nanoseconds relative to GPS system time. Techniques used for GPS signal processing and data reduction are summarized, and potential applications are discussed. R.E.S.

N80-10168# General Dynamics/Electronics, San Diego, Calif.
EPHEMERIS AND CLOCK DETERMINATION IN GPS
J. H. Schaibly and E. L. Lasley *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 7 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The data processing performed at the GPS 'master control station' is described. Estimation/prediction techniques are given for determining satellite ephemeris and clock behavior. The evaluation ot the techniques is also described. R.E.S.

N80-10169# Texas Instruments, Inc., Dallas.
TEXAS INSTRUMENTS PHASE 1 GPS USER EQUIPMENT
M. J. Borel, J. N. Damoulakis, D. R. Delzer, T. D. Fuchser, J. H. Hinderer, C. R. Johnson, and D. J. Pinkos *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 15 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The design and fabrication of the Global Positioning System user equipment sets is described. The system concept and design permits maximum commonality between various system designs through the use of different quantities of common modules to satisfy specific performance requirements. Also, because of the functional nature of the modules, improvements to accommodate performance requirements were incorporated with minimum impact. Global positioning system user equipment consists of three different system types: the high dynamic user equipment used in high performance aircraft; the missile-borne receiver set used in the Minuteman missile test program; and the manpack/vehicular user equipment used in manned vehicles such as trucks, tanks, and jeeps. A comparison of the major performance requirements of these systems is presented. Additional information regarding the three systems is presented following a discussion of the receiver, the processor, and the navigation filter. R.E.S.

N80-10170# Magnavox Government and Industrial Electronics Co., Torrance, Calif. Advanced Products Div.
GPS RECEIVER OPERATION
Burton G. Glazer *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 5 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

Different receiver configurations which are suitable for applications having differing levels of dynamics of the most vehicle and interference environments, are described. All configurations are capable of accomplishing certain fundamental operations: satellite selection, signal acquisition, tracking and measurement

and data recovery. After correction for propagation effects, signal time-of-arrival measurements are used to obtain the navigation solution. The limits of the performance of the receivers are described. R.E.S.

N80-10171# Aerospace Corp., Los Angeles, Calif.
PHASE 2 GPS RECEIVER DESIGN PHILOSOPHY
Frank E. Butterfield and Robert E. Sung *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 9 p ref (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The development of the Global Positioning System (GPS) User System Segment is discussed as well as the development objectives, program plan and a brief review of development activities. A discussion of user requirements, host vehicle interfaces and integration, definition of user equipment set configurations and the elements of a Design to Cost (DTC)/Life Cycle Cost (LCC) program is presented. The GPS Phase 2 User Equipment (UE) DTC/LCC program objectives and tasks required to accomplish these objectives are described. The modular design concept, which embraces the use of a limited inventory of standard function replaceable hardware and computer program or software modules to implement specific operational building blocks, to be uniquely arranged for the synthesis of differing UE sets, is presented along with the flexible interface module concept and the form, fit and function approach to integration. M.M.M.

N80-10172# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PERFORMANCE ENHANCEMENT OF THE GPS RECEIVER BY DATA-FREE OPERATION
J. R. Sklar and L. L. Horowitz *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems Jul. 1979 6 p refs Sponsored by AF (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The operation of a receiver designed to receive the signal transmitted by a Global Positioning System (GPS) satellite in the dynamic environment experienced by a high-performance tactical aircraft is presented. Because the GPS signal is modulated with system data, the signal energy is spread over a 50 Hz band; as a result, there is a limit to the noise filtering that can be performed. If this data were removed, or (equivalently) stored in the receiver, additional filtering could be employed and other changes made in the receiver to improve the noise (and/or jamming) immunity. The quantitative effects of these changes are derived. M.M.M.

N80-10173# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
INTEGRATION OF GPS WITH INERTIAL NAVIGATION SYSTEMS
Duncan B. Cox, Jr. *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 10 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

Benefits and means of integrating GPS and inertial systems are described. Emphasis was placed on the data to be transferred and the operations to be performed in attaining varying degrees of integration. An understanding of the mechanisms and degrees of complexities involved was given, as well as a perspective on the technical issues that are involved in the integration problem. It was concluded that very substantial performance improvements can be obtained through integration of GPS and inertial systems in comparison to what can be achieved by either system alone. Some of the improvements are only achieved through substantial increases in system complexity. M.M.M.

N80-10174# Teledyne Systems Co., Northridge, Calif.
APPLICATION OF GPS TO LOW COST TACTICAL WEAPONS
A. F. Schmitt and J. J. Bowden *In* AGARD Principles and Operational Aspects of Precision Position Determinational Systems 1979 10 p refs (For primary document see N80-10154 01-04) (Contract F08635-76-C-0343)
Avail: NTIS HC A20/MF A01

A navigation receiver employing the Global Positioning System (GPS) navigation satellites' signals is described which capitalizes upon initialization at the launch point so as to achieve considerable simplification, and hence, low unit cost. An excellent application of such a 'mother-daughter' design is to the guidance of tactical weapons wherein the launch facility (ground launcher or aircraft) is presumed equipped with a full-capability GPS navigation set suitable for the initialization of the simplified receiver. Once initialized with GPS data (satellite orbital parameters and clock corrections) and synchronized to track the received signals, this receiver is thereafter fully capable of autonomous navigation including signal reacquisition following any signal outage periods. Mission time following launch must be limited to no more than an hour or so to minimize degradations in accuracy - a constraint of little concern in most tactical applications. M.M.M.

N80-10175# Gilbert (Glen A.) and Associates, Washington, D. C.
CIVIL APPLICATIONS OF NAVSTAR GPS
Glen A. Gilbert, E. H. Martin (Magnavox Government and Industrial Electronics Co., Silver Spring, Md.), Denis Symes (Urban Mass Transportation Adminstration), and Carl Matthews (Maritime Administration) *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 26 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

Various aspects of potential civil applications of the U.S. Department of Defense satellite based NAVSTAR Global Positioning System (GPS) are discussed. Land, sea and air applications are covered. It was concluded that the GPS offers many promising potential civil applications. However, certain questions need to be resolved before international civil application of GPS can be implemented. M.M.M.

N80-10176# Rockwell International Corp., Downey, Calif. Space Div.
LAUNCH VEHICLES
William Nissim and Curt J. Zoller *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 15 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The launch vehicles and upper stages are described. The physical and performance characteristics and the expected operational procedure, based on data obtained from various Rockwell International publications (for shuttle), and from representatives of General Dynamics (for Atlas) and Fairchild (for the stage vehicle) are included. Potential system improvements for the operational phase which are expected to result in satellite weight growth, can be accommodated by launch and stage vehicle growth options. M.M.M.

N80-10177# California Univ., Los Angeles. School of Engineering and Applied Science.
ALTERNATE CONSTELLATIONS FOR THE GLOBAL POSITIONING SYSTEM
Hosam E. Emara-Shabaik *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 37 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

Different satellite constellations were studied comparatively with the base line constellation, considering both coverage and precision requirements. Increasing the orbital period provided better satellite visibility and higher accuracy of navigation. Higher orbital inclination angles moved the better covered areas to higher latitudes. Increasing the number of orbital planes is thought to be more effective in gaining better performance than increasing the number of satellites per plane. General directions and guidelines to be followed for designing constellations for the Global Positioning System are presented. K.L.

N80-10178# California Univ., Los Angeles. School of Engineering and Applied Science.
ON THE OPTIMAL SELECTION OF SATELLITES IN GPS
Katsumi Ohnishi *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 5 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

An analytical method is given for the optimal selection of four satellites for estimation of the user's position in global positioning systems (GPS). The problem is discussed completely within the framework of linear estimation theory which converts

the optimal selection of satellites into the optimal orientation of four antennas. An estimator equation is presented which is shown to give good estimation results. The four satellites to be selected are obtained by directly minimizing the determinant of the covariance of the estimation error. K.L.

N80-10179# Naval Air Development Center, Warminster, Pa. Sensors and Avionics Technology Directorate.
THE EVOLUTION OF JTIDS
Ronald S. Vaugh *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 3 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The genesis of predecessor programs to the Joint Tactical Information Distribution System (JTIDS) is traced and the reasons for merging them into a joint services development program are given. In addition, the major technology evolution affecting the JTIDS engineering approach is discussed. K.L.

N80-10180# JTIDS Program Office, Hanscom AFB, Mass. Engineering Div.
JTIDS SYSTEM OVERVIEW
Roy L. Eisenberg *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 6 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The navigation, communications, and identification functions of JTIDS are described. The JTIDS development program and implementation concepts are discussed and operational requirements are summarized. K.L.

N80-10181# Naval Air Development Center, Warminster, Pa. Communications and Navigation Technology Directorate.
NAVIGATION ARCHITECTURE
Lawrence Newman, ed. *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 17 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The JTIDS relative navigation capability is discussed. The relative navigation system establishes the tactical grid, resolves the grid lock problem, improves on board system accuracy, and shares community navigation resources. Potential applications of the advanced development model system and technological issues of JTIDS architecture are explored. K.L.

N80-10182# Naval Air Development Center, Warminster, Pa.
INTEGRATED TACTICAL NAVIGATION SYSTEMS (ITNS)
Edward Dinter and James D. Bivin *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 7 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

An integrated tactical navigation systems (ITNS), which combines range measurements between vehicles, with self contained dead reckoning, to achieve accurate tactical navigation in spite of geographic navigation error, is examined. The five demonstration tests performed and their associated results are discussed. The feasibility of the ITNS concept, the operational performance and tactical utility of the ITNS concept, and the benefits of the ITNS to the sea control ships and flight control operations are determined. A.W.H.

N80-10183# ITT Avionics, Nutley, N.J. CNI Systems Dept.
JTIDS: THE ISSUE OF FREQUENCY SELECTION
Jack Rubin and Sven H. Dodington *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 5 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The joint tactical information distribution system (JTIDS) which features spread spectrum, frequency hopping, high performance, digital communications, is discussed in relation to the electromagnetic spectrum (960 to 1215 MHz) proposed for its operation. The compatibility of the JTIDS with existing navigation services in this frequency band is examined. The interference effects of existing Tacan/DME and IFF/ATCRBS signals on JTIDS operations is studied. A.W.H.

N80-10184# Naval Air Development Center, Warminster, Pa. Communication Navigation Technology Directorate.
JTIDS SIGNAL STRUCTURE
Gerald J. Palatucci *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 3 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The joint tactical information distribution systems (JTIDS) signal structure is described in terms of a hybrid frequency hopping, time hopping, and direct sequence pseudo noise spread spectrum system for communication, navigation, and identification applications. The primary design constraints, classified as either fundamental bounds or requirements bounds, on the system at the outset of the waveform design are described. The characteristics of the signal structure, such as channel coding, data modulation, and RF modulation are discussed. A.W.H.

N80-10185# Hughes Aircraft Co., Fullerton, Calif.
COMMAND AND CONTROL TERMINALS
Ara N. Boyajian *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 4 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The systems configuration of the command and control terminals in the joint tactical information distribution system (JTIDS) is discussed. The units that comprise the JTIDS system and the interrelationship between the units are described. The units include the digital computer, the radio set control, the signal data converter, the antenna coupler, and the high power amplifier. Technology improvements in the JTIDS system are discussed including areas of error detection and correction, surface acoustic wave devices, and L band power amplifiers. A.W.H.

N80-10186# Singer-Kearfott, Wayne, N. J.
AN/URQ-28 JTIDS CLASS 2 TACTICAL TERMINAL
R. Aughey and G. Solowey *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 13 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The performance characteristics of the JTIDS tactical aircraft terminal AN/URQ-28, a low detectability, cryptographically secure, antijam, integrated communication and relative navigation system are described. The time division multiple access processing function and the TACAN processing functions are examined. The navigation processing and capability of the AN/URQ-28 is discussed. The mechanical design and the application of each unit in the AN/URQ-28 is reported. A.W.H.

N80-10187# IBM Federal Systems Div., Owego, N. Y.
JTIDS EXPENDABLE/LOW COST TERMINAL DEVELOPMENT
P. D. Danker, R. J. Giannini, and I. S. Glickstein *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 13 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

Applications for low cost, expendable, JTIDS compatible terminals are discussed. These include weapon and RPV guidance and control, remote sensors and beacons, and range instrumentation. Expendable terminals are examined as extensions for the other JTIDS class terminals where expendability and unmanned operations are required and system communications/control resides with the JTIDS Class 1, 2, or 3 terminal. A.W.H.

N80-10188# Naval Ocean Systems Center, San Diego, Calif.
INTEGRATION DEVELOPMENTS
Albert Wunsch *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 9 p refs (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The integration of JTIDS into a platform is described. The nature and scope of the interface required between JTIDS and the system(s) it must service on various platforms is defined. Aspects of system integration with the tactical data system are discussed. A.W.H.

N80-10189# ITT Avionics, Nutley, N.J. CNI Systems Dept.
DISTRIBUTED TDMA: AN APPROACH TO JTIDS PHASE 2
Jack Rubin *In* AGARD Principles and Operational Aspects of

Precision Position Determination Systems 1979 14 p refs
(For primary document see N80-10154 01-04)
(Contract N62269-76-C-0105)
Avail: NTIS HC A20/MF A01

The joint tactical information distribution system (JTIDS), a triservice, multichannel, multifunction system is reviewed. A time division multiple access (TDMA) channel (JTIDS 1) is introduced to handle total connectivity information distribution for digital communications and relative navigation. The development of a channel architecture by DTAMA to permit a single terminal to participate concurrently in multiple independent functions or network, which have the flexibility to be structured and organized in a manner to efficiently meet the broad spectrum of tactical information distribution operational requirements, is examined.
A.W.H.

N80-10190# ITT Avionics, Nutley, N.J. CNI Systems Dept.
JTIDS II/DTDMA - COMMAND AND CONTROL TERMINALS
Jack Rubin and Joseph Heinen *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 7 p (For primary document see N80-10154 01-04)
Avail: NTIS HC A20/MF A01

The development of a command and control terminal employing the JTIDS 2/DTDMA architecture is described. The functions of the power amplifier unit, the receiver/transmitter unit, the signal processor unit, and the terminal processor unit are examined. The grouping of the time scheduling, pseudo-random control, and transmission/reception control are presented.
A.W.H.

N80-10191# ITT Avionics, Nutley, N.J. CNI Systems Dept.
JTIDS II/DTDMA TACTICAL TERMINAL
Joseph Heinen and Jack Rubin *In* AGARD Principles and Operational Aspects of Precision Position Determination Systems 1979 6 p ref (For primary document see N80-10154 01-04)
(Contract N62269-76-C-0105)
Avail: NTIS HC A20/MF A01

The JTIDS 2 tactical terminal which provides antijam, digital data/voice communications, and relative navigation in the DTDMA and TDMA architectures, is examined. The functions and capabilities, the overall design, the integration and installation into airborne platforms, and the projected production configuration of the terminal are described.
A.W.H.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-10192 North Carolina State Univ. at Raleigh.
STRUCTURAL STIFFENING AS AN INTERIOR NOISE CONTROL TECHNIQUE FOR LIGHT TWIN-ENGINE AIRCRAFT Ph.D. Thesis
Clyde Kearney Barton 1979 102 p
Avail: Univ. Microfilms Order No. 7923034

Cabin noise levels in light aircraft due to the transmission of low frequency propeller noise through the fuselage sidewall is examined. The concept of adding stiffness to a light, twin engine aircraft to reduce cabin noise levels is investigated. The attenuation provided by the fuselage sidewall before and after the installation of a suitable treatment is determined. A mass treatment was added and a comparison is presented.
Dissert. Abstr.

N80-10193*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTS IN SENSING TRANSIENT ROTATIONAL ACCELERATION CUES ON A FLIGHT SIMULATOR
Russell V. Parrish Oct. 1979 24 p refs
(NASA-TP-1537; L-13030) Avail: NTIS HC A02/MF A01 CSCL 01C

Results are presented for two transient motion sensing experiments which were motivated by the identification of an anomalous roll cue (a 'jerk' attributed to an acceleration spike) in a prior investigation of realistic fighter motion simulation. The experimental results suggest the consideration of several issues for motion washout and challenge current sensory system modeling efforts. Although no sensory modeling effort is made it is argued that such models must incorporate the ability to handle transient inputs of short duration (some of which are less than the accepted latency times for sensing), and must represent separate channels for rotational acceleration and velocity sensing.
A.R.H.

N80-10194# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
FLYING QUALITIES RESEARCH FOR HIGHLY AUGMENTED AIRCRAFT
H. T. Breul and R. C. Weston Aug. 1979 104 p refs
(RE-582) Avail: NTIS HC A06/MF A01

An introductory, single degree of freedom experimental study of aircraft roll control was performed to demonstrate the feasibility of doing flying qualities research via direct manipulation of an aircraft's step response on a flight simulator. This is a very attractive approach for studying the flying qualities requirements of modern aircraft that is expected to incorporate new and sophisticated digital fly by wire control schemes for coordinating all control forces to produce nonclassical responses to pilot commands. The development of a digital simulation technique, based on the mathematical concept of convolution, that provides the means for easy manipulation of the simulated vehicle's step-response characteristics is presented. Two experiments were performed that examined several basic characteristics of an aircraft's roll-rate step-response in a simulated tracking task.
M.M.M.

N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey 3 Sep. 1979 409 p refs
(Contract NAS1-15624)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01 CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

N80-10196# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A STUDY TO DEVELOP OPTIMIZATION ALGORITHMS FOR AIRCRAFT WING STRUCTURES M.S. Thesis
Gerald W. Abbott and Robert A. McNamara, Jr. Jun. 1979 135 p refs
(AD-A072668; AFIT-LSSR-23-79A) Avail: NTIS HC A07/MF A01 CSCL 01/3

Increasing cost and complexity of major weapon systems have resulted in many methods that constrain cost while assuring development of weapon systems that meet the military need. Among these methods, the use of cost estimating relationships embodied in computerized mathematical modeling has come to the forefront. This research uses the Vehicle Design Evaluation Program (VDEP), a model which designs a least-weight aircraft. Since a least-weight aircraft may not be a least-cost aircraft, this research examined the feasibility of developing algorithms to relate least-cost to design using VDEP. Various graphic and statistical techniques failed to yield meaningful relationships. Additional analysis revealed apparent discrepancies in VDEP structural synthesis routines. Further research is recommended using more advanced design/cost models which incorporate revised structural synthesis routines. These models should first be validated for proper design/cost estimating properties. Then research should be conducted to identify cost driving parameters and detailed variable relationships. In this way the attainment of minimum cost aircraft structures which meet mission needs will materialize.
GRA

N80-10197# Anamet Labs., Inc., San Carlos, Calif. Applied Mechanics Div.
ANGULAR VIBRATION OF AIRCRAFT. VOLUME 1: EXECUTIVE SUMMARY Final Report, Aug. 1977 - Apr. 1979
Conor D. Johnson, Warren C. Gibson, David A. Kienholz, and Ernest B. Paxson. Wright-Patterson AFB, Ohio AFFDL. Apr. 1979. 52 p. refs. 2 Vol.
(Contract F33615-77-C-3050; AF Proj. 2401)
(AD-A071895; AFFDL-TR-79-3045-Vol-1) Avail: NTIS
HC A04/MF A01 CSCL 20/11

This report describes development work in several distinct areas, all related to prediction of angular vibration of aircraft structures. Angular vibration in this context refers to dynamic rotations or changes in slope at specific points on a vibrating structure. It is of interest primarily in connection with high resolution optical and electro-optical systems. Efforts were directed at both low frequency vibration, where individual normal modes are known, as well as high frequency vibration where they are not. For low frequency predictions, improved accuracy per unit cost was sought by an evolutionary improvement to an existing finite element code. A state-of-the-art shell element, the Semi-Loof, was incorporated into NASTRAN by means of pre- and post-processors and DMAP instructions. Its accuracy is tested against both closed form solutions for simple cases and experiment for an actual fuselage. For high frequency predictions the method of Statistical Energy Analysis was pursued. A demonstration case involving two coupled plates is presented to show how SEA may be used to predict angular vibration in a situation where normal modes are too numerous to be predicted individually. Relationships between linear and angular vibration were developed for various structural forms. Theoretical error bounds are also derived for spectral measurements of angular vibration which are obtained by differencing of signals from translational sensors. GRA

N80-10198# Anamet Labs., Inc., San Carlos, Calif. Applied Mechanics Div.
ANGULAR VIBRATION OF AIRCRAFT. VOLUME 2: PREDICTION METHODS FOR ANGULAR VIBRATION Final Report, Aug. 1977 - Apr. 1979
Conor D. Johnson, Warren C. Gibson, David A. Kienholz, and Ernest B. Paxson. Wright-Patterson AFB, Ohio AFFDL. Apr. 1979. 459 p. refs. 2 Vol.
(Contract F33615-77-C-3050; AF Proj. 2401)
(AD-A071749; AFFDL-TR-TA-3045-Vol-2) Avail: NTIS
HC A04/MF A01 CSCL 01/3

This report describes development work in several distinct areas, all related to prediction of angular vibration of aircraft structures. Angular vibration in this context refers to dynamic rotations or changes in slope at specific points on a vibrating structure. It is of interest primarily in connection with high resolution optical and electro-optical systems. Efforts were directed at both low frequency vibration, where individual normal modes are known, as well as high frequency vibration where they are not. For low frequency predictions, improved accuracy per unit cost was sought by an evolutionary improvement to an existing finite element code. For high frequency predictions the method of Statistical Energy Analysis was pursued. GRA

N80-10199# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.
A LITERATURE SEARCH AND REVIEW OF THE DYNAMICS OF AIRCRAFT-SURFACE INTERACTION Final Report, 1 Oct. 1977 - 31 May 1978
Joseph J. Cox, Jr. (USAF Academy, Colo.), William M. Hanghold (USAF Academy, Colo.), and John J. Russell (USAF Academy, Colo.). Jun. 1979. 61 p. refs.
(AF Proj. 2104)
(AD-A070940; CEEDO-TR-78-39) Avail: NTIS
HC A04/MF A01 CSCL 01/5

This report presents a literature survey and review of the research concerned with the dynamics of aircraft-surface interaction. Of primary concern is the determination of surface roughness criteria based on how rough the surface can be without inducing structural damage in the aircraft. Attention is concentrated on analytical research in the form of computer simulation that deals with the aircraft response as a function of the input (external excitation), vehicle model, and the output. Basic conclusions include the fact that no current computer code is satisfactory, but that one could be formulated within the state-of-the-art, to correlate with on-going actual aircraft tests. To facilitate correlation the roll, yaw, and lateral degrees of freedom should be included and a fatigue analysis for the test aircraft should be made. GRA

N80-10200# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
LEXICON OF AIRCRAFT TRANSPARENCY TERMS
Clatus J. Muick. Dec. 1978. 65 p. refs.
(AF Proj. 7184)
(AD-A071319; AMRL-TR-78-122) Avail: NTIS
HC A04/MF A01 CSCL 01/3

This lexicon deals with terms and definitions peculiar to personnel working with aircraft transparent enclosures. All types of material currently used in the fabrication of transparent enclosures (acrylic, glass, polycarbonate) is addressed. Terms are either specific or general when applied to materials; and vision /optics terms, in most instances, are common to windscreens, canopies, and windows. GRA

N80-10201# Air Force Weapons Lab., Kirtland AFB, N. Mex.
AIRBLAST VULNERABILITY ENVELOPES FOR SUPERSONIC AEROSPACE VEHICLES Final Report
Gerald M. Campbell. Mar. 1979. 30 p.
(AF Proj. 8809)
(AD-A072247; AD-E200312; AFWL-TR-78-187) Avail: NTIS
HC A09/MF A01 CSCL 19/4

A procedure for constructing airblast vulnerability envelopes for supersonic vehicles has been derived which enables the analyst to determine which portions of the envelope are valid. For simplicity, an overpressure of 1 lb/sq in. is used as a damage criterion throughout this report and nonhomogeneous atmosphere effects are ignored. Maximum and minimum shock front velocities are derived for the catching curve as well as the lower limit for the detonation orientation angle theta. GRA

N80-10202# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AGARD TWO-DIMENSIONAL AEROELASTIC CONFIGURATIONS
S. R. Bland. Comp. Aug. 1979. 18 p. refs. Submitted for publication. Prepared in cooperation with NASA Langley Res. Center.
(AGARD-AR-156) Avail: NTIS HC A02/MF A01

The development of reliable, efficient methods for the calculation of unsteady aerodynamic forces in the frequency-critical transonic speed regime can be enhanced by the availability of a limited number of test cases for the comparison of competing methods. Seven test cases are presented for airfoils with thickness from 6.0% to 16.9%: a biconvex parabolic arc airfoil, three conventional airfoils, and three cambered supercritical airfoils. The aerodynamic conditions such as Mach number, mean angle of attack, and oscillation amplitude and frequency are also given. Recommendations are made for uniformity in definition and reporting to enhance desired comparison for the aeroelastician. A.R.H.

N80-10203# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
MANOEUVRE LIMITATIONS OF COMBAT AIRCRAFT
Aug. 1979. 33 p. refs.
(AGARD-AR-155A; ISBN-92-835-1336-3) Avail: NTIS
HC A03/MF A01

The choice of aircraft detail arrangement and configuration is closely related to desired flight speed, altitude and maneuverability. The maneuver limitations that are directly related to configuration, flight speed and attitude are reasonably independent of airplane size and engine thrust. These limiting flight characteristics include pitchup, wing rock, wing drop, nose slice, and buffeting. These configuration and detail-sensitive limitations and the aircraft characteristics that cause them are discussed for 15 NATO aircraft. A.R.H.

N80-10044 Allerton Press, Inc., New York, N. Y.
SELECTING THE GEOMETRIC PARAMETERS AND POSI-

TION OF A NOSE FLAP ON THE ROOT PROFILE OF A SWEPT WING USING TUNNEL TEST DATA, PART 2
A. I. Matyah, V. A. Sterlin, V. A. Popov, V. V. Isaev, and G. A. Cheremukhin *In its* Soviet Aeron., vol. 21, no. 4, 1978 p 82-86 refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 81-87 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10063 Allerton Press, Inc., New York, N. Y.
STRUCTURAL ANALYSIS OF VARIABLE-SWEEP WINGS
N. A. Shalomov and N. A. Gorshenkov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 106-113 refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 133-141 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10068 Allerton Press, Inc., New York, N. Y.
APPLICATION OF THE FACTOR INTERPOLATION METHOD IN FLIGHT VEHICLE LANDING GEAR ANALYTIC DESIGN
A. V. Svilin *In its* Soviet Aeron., v. 21, no. 4, 1978 p 129-131 refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 155-158 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices, and flight instruments.

For related information see also 19 Spacecraft Instrumentation and 35 Instrumentation and Photography.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors, and on-board auxiliary power plants for aircraft.

For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

N80-10204*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
AERO-ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN EXHAUST NOZZLES
Hilary Kosiowski and Allan B. Packman Jul. 1978 142 p refs
(Contract NAS3-17866)
(NASA-CR-162254; PWA-5296) Avail: NTIS HC A07/MF A01 CSCL 01E

The acoustic and aerodynamic characteristics of several exhaust systems suitable for duct burning turbofan engines are evaluated. Scale models representing unsuppressed coannular exhaust systems are examined statically under varying exhaust conditions. Ejectors with both hardwall and acoustically treated inserts are investigated. A.W.H.

N80-10205*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION 1979
1979 464 p Proceedings of conf. held at Cleveland, Ohio, 1-16 May 1979
(NASA-CP-2092; E-079) Avail: NTIS HC A20/MF A01 CSCL 21E

State of the art technology in aeronautical propulsion is assessed. Noise and air pollution control techniques, advances in supersonic propulsion for transport aircraft, and composite materials and structures for reliable engine components are covered along with engine design for improved fuel consumption. For individual titles, see N80-10206 through N80-10219.

N80-10206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRCRAFT ENERGY EFFICIENCY (ACEE) STATUS REPORT
Donald L. Nored, James F. Dugan, Jr., Neal T. Saunders, and Joseph A. Ziemianski *In its* Aeropropulsion 1979 1979 p 1-58 refs (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Fuel efficiency in aeronautics, for fuel conservation in general as well as for its effect on commercial aircraft operating economics is considered. Projects of the Aircraft Energy Efficiency Program related to propulsion are emphasized. These include: (1) engine component improvement, directed at performance improvement and engine diagnostics for prolonged service life; (2) energy efficient engine, directed at proving the technology base for the next generation of turbofan engines; and (3) advanced turboprop, directed at advancing the technology of turboprop powered aircraft to a point suitable for commercial airline service. Progress in these technology areas is reported. J.M.S.

N80-10207*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMISSION REDUCTION
Donald A. Petrash, Larry A. Diehl, Robert E. Jones, and Edward J. Mularz *In its* Aeropropulsion 1979 1979 p 59-84 (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Control of the gaseous pollutant emissions of aircraft engines is considered in terms of the emission standards for six classes of aircraft engines. Emphasis is placed on combustor design concepts to significantly reduce emissions levels and lean-burning techniques to lower flame temperature, to reduce the oxides of nitrogen in the gaseous emissions. J.M.S.

N80-10208*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE REDUCTION
Charles E. Feiler, John F. Groeneweg, Francis J. Montegani, John P. Raney (NASA. Langley Research Center), Edward J. Rice, and James R. Stone *In its* Aeropropulsion 1979 1979 p 85-128 refs (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

The turbofan engine's noise-producing components are discussed in terms of efficient and economical noise reduction techniques that do not penalize the engine performance or weight significantly. Specific topics covered include fan noise, acoustic suppression, jet noise technology, combustor noise, and aircraft noise prediction. J.M.S.

N80-10209*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALTERNATIVE JET AIRCRAFT FUELS
Jack Grobman *In its* Aeropropulsion 1979 1979 p 129-148 refs (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Potential changes in jet aircraft fuel specifications due to shifts in supply and quality of refinery feedstocks are discussed with emphasis on the effects these changes would have on the performance and durability of aircraft engines and fuel systems. Combustion characteristics, fuel thermal stability, and fuel pumpability at low temperature are among the factors considered. Combustor and fuel system technology needs for broad specification fuels are reviewed including prevention of fuel system fouling and fuel system technology for fuels with higher freezing points. J.M.S.

N80-10210*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATERIALS AND STRUCTURES TECHNOLOGY
Robert A. Signorelli, Thomas K. Glasglow, Gary R. Halford, and

Stanley R. Levine. *In its* Aeropropulsion 1979 1979 p 149-186 refs (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Materials and structures performance limitations, particularly for the hot section of the engine in which these limitations limit the life of components, are considered. Failure modes for components such as blades, vanes, and combustors and how they are affected by the environment for such components are discussed. Methods used to improve the materials used for such components are: (1) application of directional structures to turbine components for high strength at high temperatures; (2) improved coatings to increase oxidation and corrosion resistance; (3) increase strength and stiffness with reduced weight by applying higher specific properties of composite materials; and (4) cost effective processing such as near net shape powder methods applied to disks. Life prediction techniques developed to predict component life accurately in advance of service and progress in improving the intermediate and cold section components of turbine engines are covered. J.M.S.

N80-10211*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTATIONAL FLUID MECHANICS OF INTERNAL FLOW
David N. Bowditch, William D. Mcnally, Bernhard H. Anderson, John J. Adamczyk, and Peter M. Sockol. *In its* Aeropropulsion 1979 1979 p 187-230 refs (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Major solution techniques for internal computational fluid mechanics are discussed and some examples are presented. The major steps involved in developing a large computer code are then discussed. R.E.S.

N80-10212*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBOMACHINERY TECHNOLOGY
Cavour H. Hauser, Jeffrey E. Haas (U.S. Army Res. and Technol. Labs., Cleveland, Ohio), Lonnie Reid, and Francis S. Stepka. *In its* Aeropropulsion 1979 1979 p 231-272 (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

A technology assessment of turbomachinery is presented. The design of the fan, compressor, and turbine components for future advanced aircraft engines is discussed. Basic flow characteristics in compressors and turbines and the heat transfer phenomena in cooled turbines are also discussed. R.E.S.

N80-10213*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL COMPONENTS
William J. Anderson, Robert C. Bill, John J. Coy, and David Fleming. *In its* Aeropropulsion 1979 1979 p 273-308 ref (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Research on bearings, gears, seals, and rotor dynamics (specifically high speed balancing and dampers) is presented. The research pertains to problems in both aircraft turbine engines and helicopter transmissions. R.E.S.

N80-10214*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INSTRUMENTATION TECHNOLOGY
William C. Nieberding, David R. Englund, Jr., and George E. Glawe. *In its* Aeropropulsion 1979 1979 p 309-328 refs (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Some of the efforts made in applying technologically new tools to today's propulsion measurement problems are described. They include: (1) a blade-tip clearance system; (2) a pulsed thermocouple system used to measure gas temperature with a thermocouple at temperatures above the melting point of the thermocouple; (3) an optical technique for measuring blade flutter; (4) a probe for dynamic flow and flow angle measurement; and (5) a laser anemometer system for rapidly mapping the flow profiles between the blades of a rotating compressor. R.E.S.

N80-10215*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROL TECHNOLOGY
John R. Szuch. *In its* Aeropropulsion 1979 1979 p 329-344 refs (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

An overview of engine control technology is presented with emphasis on gas turbine engine controls. The role of the government, and NASA in particular, in advancing this technology is discussed. R.E.S.

N80-10216*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERSONIC PROPULSION TECHNOLOGY
Albert G. Powers, Robert E. Coltrin, Leonard E. Stitt, Richard J. Weber, and John B. Whitlow, Jr. *In its* Aeropropulsion 1979 1979 p 345-386 (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Propulsion concepts for commercial supersonic transports are discussed. It is concluded that variable cycle engines, together with advanced supersonic inlets and low noise coannular nozzles, provide good operating performance for both supersonic and subsonic flight. In addition, they are reasonably quiet during takeoff and landing and have acceptable exhaust emissions. K.L.

N80-10217*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYPERSONIC PROPULSION
H. Lee Beach, Jr. *In its* Aeropropulsion 1979 1979 p 387-408 refs (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Research on hydrogen fueled scramjet engines for hypersonic flight is reviewed. Component developments, computational methods, and preliminary ground tests of subscale scramjet engine modules at Mach 4 and 7 are emphasized. Airframe integration, structures, and flow diagnostics are also discussed. It is shown that mixed-mode perpendicular and parallel fuel injection controls heat release over a wide Mach range and the fixed geometry inlet gives good performance over a wide range of Mach numbers. K.L.

N80-10218*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VERTICAL TAKEOFF AND LANDING (VTOL) PROPULSION TECHNOLOGY
Carl C. Ciepluch, John M. Abbott, Royce D. Moore, and James F. Sellers. *In its* Aeropropulsion 1979 1979 p 409-444 refs (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Propulsion problems and advanced technology requirements of VTOL aircraft are discussed. Specific topics covered include inlets with high angle of attack capability, rapid thrust modulation fans, and propulsion-system/aircraft-control integration. K.L.

N80-10219*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-PERFORMANCE-VEHICLE TECHNOLOGY
Louis A. Povinelli. *In its* Aeropropulsion 1979 1979 p 445-462 refs (For primary document see N80-10205 01-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Propulsion needs of high performance military aircraft are discussed. Inlet performance, nozzle performance and cooling, and afterburner performance are covered. It is concluded that nonaxisymmetric nozzles provide cleaner external lines and enhanced maneuverability, but the internal flows are more complex. Swirl afterburners show promise for enhanced performance in the high altitude, low Mach number region. K.L.

N80-10220*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
FLIGHT EFFECTS ON THE AERO/ACOUSTIC CHARACTERISTICS OF INVERTED PROFILE COANNULAR NOZZLES
Hilary Kozlowski and Allan B. Packman. Feb. 1978 195 p refs
(Contract NAS3-17866)
(NASA-CR-162419; PWA-5501) Avail: NTIS HC A09/MF A01 CSCL 21E

The effect of simulated flight speed on the acoustic and

aerodynamic characteristics of coannular nozzles is examined. The noise and aerodynamic performance of the coannular nozzle exhaust systems over a large range of operating flight conditions is presented. The jet noise levels of the coannular nozzles are discussed. The impact of fan to primary nozzle area ratio and the presence of an ejector on flight effects are investigated. The impact of flight speed on the individual components of the coannular jet noise was ascertained. A.W.H.

N80-10221*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
EXPERIMENTAL EVALUATION OF A LOW EMISSIONS HIGH PERFORMANCE DUCT BURNER FOR VARIABLE CYCLE ENGINES (VCE) Final Report
R. P. Lohman and R. J. Mador 1979 117 p refs
(Contract NAS3-20602)
(NASA-CR-159694; PWA-5513-32) Avail: NTIS HC A05/MF A01 CSCL 21E

A three-stage Vorbix duct burner was evaluated to determine the performance and emissions characteristics of this concept and to refine the configuration to provide acceptable durability and operational characteristics for its use in the VCE Testbed Program. The tests were conducted at representative takeoff, transonic climb and supersonic cruise inlet conditions for the VSCE-502B study engine. The carbon monoxide and unburned hydrocarbon emissions were low at all three operating conditions with combustion efficiencies in excess of 99.7 percent, as compared to the goal of 99.0 percent. Nitric oxide emissions were moderate but in excess of the program goal of 1 gm/kg at takeoff. The thrust efficiency exceeded the goal level of 94.5 percent reaching a value of 97 percent at supersonic cruise. Soft ignition, the absence of combustion generated acoustic instabilities and liner temperature levels acceptable for experimental hardware were also demonstrated. The total pressure loss across the duct burner, at 6.76 the loss mechanisms have been indentified and, in one configuration 40 percent of this excess loss was eliminated without comprising the emissions or thrust efficiency. A.R.H.

N80-10222*# Pratt and Whitney Aircraft, East Hartford, Conn. Chemical Products Div.
VSCE TECHNOLOGY DEFINITION STUDY Final Report
R. A. Howlett and R. B. Hunt Aug. 1979 114 p refs
(Contract NAS3-21389)
(NASA-CR-159730; PWA-5630-11) Avail: NTIS HC A06/MF A01 CSCL 21E

Refined design definition of the variable stream control engine (VSCE) concept for advanced supersonic transports is presented. Operating and performance features of the VSCE are discussed, including the engine components, thrust specific fuel consumption, weight, noise, and emission system. A preliminary engine design is presented. A.W.H.

N80-10223# Southwest Research Inst., San Antonio, Tex.
MECHANISM OF TURBINE ENGINE LUBRICANT DEPOSITION Final Report, 31 Mar. 1978 - 2 Feb. 1979
J. P. Cuellar, Jr. May 1979 64 p refs
(Contract F33615-76-C-2020; AF PROJ. 3048)
(AD-A072557; SwRI-RS-662; AFAPL-TR-79-2037) Avail: NTIS HC A04/MF A01 CSCL 11/8

An investigation of the degradation and deposition mechanisms for inhibited polyol ester and diester lubricant basestocks is described. Basestocks trimethylolpropane triheptanoate and di(2-ethylhexyl) adipate containing antioxidants p, p,p' dioctyldiphenylamine and/or phenyl-alpha-naphtylamine were studied in a dynamic thin-film condition with a moist-air atmosphere. Experiments were conducted with a device known as the rotating cylinder rig for the formation of controlled-thickness thin films (0.004 in.) at temperatures in the range of 350 to 550 F. Analytical techniques for detection of lubricant or additive consumption and degradation products included gas liquid chromatography, principally, and gas chromatography/mass spectroscopy. Experiments showed that the antioxidants effectively retarded oxidation and deposition for both ester basestocks up to the time of complete additive consumption. A beneficial synergistic effect on deposition was noted at one concentration using the antioxidants in combination. Findings strongly suggest that an interaction between the ester oxidation products and system wearmetals is a significant factor in the deposition mechanism for both ester types. GRA

N80-10003 Allerton Press, Inc., New York, N. Y.
PARAMETRIC METHOD OF AIRCRAFT ENGINE STATUS DIAGNOSTICS BASED ON LIMITED INFORMATION
A. M. Akhmedzyanov, A. P. Tunakov, Kh. S. Gumerov, Yu. D. Degtyarev, and E. I. Morkovnikova *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 6-11 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 12-18 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10006 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF GAS TURBINE ENGINE COMBUSTION CHAMBERS GEOMETRIC PARAMETERS ON MIXTURE FORMATION CHARACTERISTICS
P. P. Grigorenko, Yu. A. Spiridonov, and A. V. Talantov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 20-24 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 30-37 (For primary document see N80-10001 01-01)
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N80-10011 Allerton Press, Inc., New York, N. Y.
DETERMINATION OF TURNING ANGLE OF A JET IMPINGING ON A BUCKET WITH VISOR
L. M. Kotlyar, S. G. Margulis, and E. D. Nesterov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 40-43 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 58-62 (For primary document see N80-10001 01-01)
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N80-10014 Allerton Press, Inc., New York, N. Y.
ON THE INFLUENCE OF RELATIVE PITCH IN THE SUBSONIC TURBINE CASCADE
V. G. Nesterenko and G. L. Podvidz *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 53-56 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 75-80 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10022 Allerton Press, Inc., New York, N. Y.
STUDY OF HEAT-PIPE HEAT EXCHANGER IN THE SMALL GAS TURBINE ENGINE SYSTEM
V. K. Shchukin, I. I. Mosin, N. V. Lokai, and Yu. V. Matveev *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 93-96 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 127-132 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10024 Allerton Press, Inc., New York, N. Y.
ANALYTIC REPRESENTATION OF TURBINE CHARACTERISTICS IN FORM CONVENIENT FOR COMPUTER CALCULATION OF GTE PARAMETERS
V. I. Bakulev, K. A. Malinovskii, and V. S. Yakushev *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 104-110 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 142-144 (For primary document see N80-10001 01-01)
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N80-10027 Allerton Press, Inc., New York, N. Y.
LONG-LIFT GTE OPERATION BASED ON TECHNICAL CONDITION
A. A. Mukhin, A. A. Kovalev, and A. A. Kornoukhov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 116-118 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 153-156 (For primary document see N80-10001 01-01)

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N80-10028 Allerton Press, Inc., New York, N. Y.
USE OF THE METHOD OF VARIABLE DIRECTIONS FOR NUMERICAL STUDY OF THE TEMPERATURE STATES OF A TURBINE DISK WITH BLADES
A. M. Polyakov, V. S. Petrovskii, and V. I. Krichakin. *In its* Soviet Aeron., Vol. 21, No. 3, 1978, p 119-122, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978, p 156-160 (For primary document see N80-10001 01-01)
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N80-10029 Allerton Press, Inc., New York, N. Y.
CHARACTERISTICS OF AFTERBURNING BYPASS TURBOJET ENGINE WITH OXYGEN INJECTION INTO THE AFTERBURNER CHAMBER
B. D. Fishbein. *In its* Soviet Aeron., Vol. 21, No. 3, 1978, p 123-126, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978, p 160-164 (For primary document see N80-10001 01-01)
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N80-10042 Allerton Press, Inc., New York, N. Y.
BASIC PROBLEM OF AIRCRAFT GAS TURBINE ENGINE ANALYTIC DESIGN, PART 1
Yu. V. Kozhevnikov, V. O. Borovik, V. S. Ivanov, V. A. Talyzin, Agliullin, and Ya. V. Melusov. *In its* Soviet Aeron., v. 21, no. 4, 1978, p 53-57, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978, p 68-74 (For primary document see N80-10031 01-01)
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N80-10063 Allerton Press, Inc., New York, N. Y.
GAS CURTAINS IN GAS TURBINE ENGINES
I. S. Varganov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 6-10, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p 11-16 (For primary document see N80-10061 01-01)
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STUDY OF HOMOGENEOUS COMBUSTION CHAMBER TEMPERATURE FIELD NONUNIFORMITY WITH PRIMARY ZONE PARAMETER VARIATION
O. A. Evin, V. M. Yankovskii, and I. N. Pyatlov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 16-19, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p 24-29 (For primary document see N80-10061 01-01)
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N80-10067 Allerton Press, Inc., New York, N. Y.
COMPUTER CALCULATION OF STATIONARY TEMPERATURE FIELDS IN AIR-COOLED TURBINE ROTOR BLADES
V. I. Lokai, Yu. N. Ivanshin, and Sh. Sh. Abdrakhmanov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 26-29, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p 36-40 (For primary document see N80-10061 01-01)
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N80-10068 Allerton Press, Inc., New York, N. Y.
SELECTION OF OPTIMAL PARAMETERS OF HEAT-PIPE HEAT EXCHANGER FOR A GAS TURBINE ENGINE
N. V. Lokai and I. I. Mosin. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 30-34, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p 41-46 (For primary document see N80-10061 01-01)
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N80-10069 Allerton Press, Inc., New York, N. Y.
COMPUTER CALCULATION OF STATIONARY TEMPERATURE FIELDS IN COOLED TURBINE DISCS
V. I. Lokai, V. V. Zhuikov, and R. D. Fakhrutdinov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 35-38, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p 47-50 (For primary document see N80-10061 01-01)
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N80-10071 Allerton Press, Inc., New York, N. Y.
SYSTEMATIZATION OF SIMPLE DETAIL PARTS OF REGULABLE NOZZLE OF GAS TURBINE ENGINE
I. E. Sapozhkov and E. D. Stenkin. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 44-49, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p 57-63 (For primary document see N80-10061 01-01)
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N80-10075 Allerton Press, Inc., New York, N. Y.
STUDY OF MASS EXCHANGE BETWEEN PRIMARY ZONE AND SECONDARY AIR JETS IN GAS TURBINE ENGINE COMBUSTION CHAMBERS
V. G. Shumachenko, V. M. Yankovskii, and A. V. Stalantov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 64-67, ref. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p 81-85 (For primary document see N80-10061 01-01)
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N80-10078 Allerton Press, Inc., New York, N. Y.
CENTRIPETAL TURBINE FABRICATION TECHNOLOGY
L. P. Goldun and A. A. Polyakov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 74-75. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats Tekhn. (USSR), v. 22, no. 1, 1979, p 91-93 (For primary document see N80-10061 01-01)
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N80-10083 Allerton Press, Inc., New York, N. Y.
ON THE INFLUENCE OF SHORT SHROUD PLATFORMS ON TURBINE STAGE OPERATION
R. V. Kuzmichev and G. V. Proskuryakov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 90-92, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p 105-107 (For primary document see N80-10061 01-01)
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N80-10088 Allerton Press, Inc., New York, N. Y.
ON AXIAL TURBINE STAGE ROTOR BLADE TWIST WITH TANGENTIAL TILT OF THE STATOR VANES
Yu. I. Mityushkin, A. V. Perevoznikov, and V. P. Yakovlev. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 99-101, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p 112-115 (For primary document see N80-10061 01-01)
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N80-10089 Allerton Press, Inc., New York, N. Y.
NONSTATIONARITY OF HEAT TRANSFER IN AXIAL TURBINE BLADING DURING ENGINE STARTUP
A. M. Polyakov, V. S. Petrovskii, and V. I. Krichakin. *In its* Soviet Aeron., v. 22, no. 1, 1979, p 108-111, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p 119-123 (For primary document see N80-10061 01-01)
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N80-10090 Allerton Press, Inc., New York, N. Y.
LASER DOPPLER VELOCIMETER (LDV) STUDY OF SECONDARY FLOWS IN TURBINE CASCADE
A. M. Topunov, B. Tikhomirov, and L. L. Chernyshev. *In its*

Soviet Aeron., v. 22, no. 1 1979 p 112-114 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 123-126 (For primary document see N80-10061 01-01)
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N80-10091 Allerton Press, Inc., New York, N. Y.
PNEUMATIC DISTRIBUTOR FOR TURBOJET ENGINE CONTROL SYSTEM
M. G. Khibbullin *In its* Soviet Aeron., v. 22, no. 1 1979 p 115-116 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 126-127 (For primary document see N80-10061 01-01)
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08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-10224*# Delco Electronics, Santa Barbara, Calif.
ELECTROMECHANICAL FLIGHT CONTROL ACTUATOR Final Report
Feb. 1979 129 p
(Contract NAS9-14952)
(NASA-CR-160348; R79-2) Avail: NTIS HC A07/MF A01 CSCL 01C

The feasibility of using an electromechanical actuator (EMA) as the primary flight control equipment in aerospace flight is examined. The EMA motor design is presented utilizing improved permanent magnet materials. The necessary equipment to complete a single channel EMA using the single channel power electronics breadboard is reported. The design and development of an improved rotor position sensor/tachometer is investigated. A.W.H.

N80-10225*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
COMPARISON OF STABILITY AND CONTROL PARAMETERS FOR A LIGHT, SINGLE-ENGINE, HIGH-WINGED AIRCRAFT USING DIFFERENT FLIGHT TEST AND PARAMETER ESTIMATION TECHNIQUES
William T. Suit and Robert L. Cannaday Sep. 1979 54 p refs
(NASA-TM-80163) Avail: NTIS HC A04/MF A01 CSCL 01C

The longitudinal and lateral stability and control parameters for a high wing, general aviation, airplane are examined. Estimations using flight data obtained at various flight conditions within the normal range of the aircraft are presented. The estimations techniques, an output error technique (maximum likelihood) and an equation error technique (linear regression), are presented. The longitudinal static parameters are estimated from climbing, descending, and quasi steady state flight data. The lateral excitations involve a combination of rudder and ailerons. The sensitivity of the aircraft modes of motion to variations in the parameter estimates are discussed. A.W.H.

N80-10226# Salford Univ. (England). Dept. of Aeronautical and Mechanical Engineering.
MULTIVARIABLE DIGITAL CONTROL SYSTEMS Final Report, 1 Jun. 1976 - 31 May 1979
B. Porter Jun. 1979 180 p refs
(Grant AF-AFOSR-3005-76)
(AD-A071662; USAME/DC/101/79) Avail: NTIS HC A09/MF A01 CSCL 09/2

The fundamental system-theoretic research and the parallel development of design techniques which have led to the production of the comprehensive software package EIGENFORTRAC are outlined. The capability of EIGENFORTRAC in relation to the computer-aided design of high-performance digital control systems whose functions are simultaneously to reject the unmeasurable disturbances and to track multiple command inputs is described. Numerous references are provided to the system-theoretic research and to the computer algorithms embodied in EIGENFORTRAC GRA

N80-10227# California Univ., Los Angeles. School of Engineering and Applied Science.
METHOD OF CONJUGATE GRADIENTS FOR OPTIMAL CONTROL PROBLEMS WITH STATE VARIABLE CONSTRAINTS Final Report, May 1977 - May 1978
T. S. Fong and C. T. Leondes Jul. 1976 94 p refs
(Contracts F33615-77-C-3013; AF Proj. 3207)
(AD-A072258; AFFDL-TR-78-85) Avail: NTIS HC A05/MF A01 CSCL 12/1

A review of the computational method of conjugate gradients for linear and nonlinear operator equations is given with emphasis in applying this technique to state variable constraint control problems. The first and second Frechet derivatives of the performance functional are derived. The search directions generated in the iteration process for the optimal control are locally conjugate with respect to the second Frechet derivative. The convergence is along the expanding sequence of sets, the intersection of the linear spaces spanned by the search directions and the set of admissible controls. The computational technique is applied to two state variable constraint problems, in one of which a penalty function is employed to convert the constraint problem to an unconstrained one in addition to the approach considering the constraints directly. For this same problem the method of steepest descent also is studied, and comparison of the results obtained is made and discussed. GRA

N80-10228# Kaman Aerospace Corp., Bloomfield, Conn.
DESIGN CRITERIA FOR DRY LUBRICATED FLIGHT CONTROL BEARINGS Final Report, 22 Jun. 1976 - Mar. 1978
Edward J. Nagy May 1979 180 p
(Contract DAAJ02-76-C-0035; DA Proj. 1F2-62209-AH-76)
(AD-A071322; R-1456; USARTL-TR-79-17) Avail: NTIS HC A09/MF A01 CSCL 01/3

The objective of this program was to develop analytical methods for the selection of dry lubricated helicopter control bearings for specific conditions of use. The conditions of use include static radial pressure, cyclic radial pressure, speed of ball oscillation, angle of ball oscillation, static axial load, contamination, and combinations of these variables. Performance was measured by radial clearance which was directly related to wear. Sixty-one bearings were tested in three wear test rigs. The wear test results were used to develop wear life equations. Three approaches to equation development were utilized in this report: empirical, deterministic, and theoretical. GRA

N80-10229# California Univ., Los Angeles. School of Engineering and Applied Science.
MAXIMUM LIKELIHOOD IDENTIFICATION OF LINEAR DISCRETE STOCHASTIC SYSTEMS Final Report, May 1977 - May 1978
A. J. Glassman and C. T. Leondes Wright-Patterson AFB, Ohio AFFDL Jul. 1978 205 p refs
(Contract F33615-77-C-3013; AF Proj. 2307)
(AD-A072147; AFFDL-TR-78-84) Avail: NTIS HC A10/MF A01 CSCL 12/2

The method of maximum likelihood is applied to the identification of parameters in systems described by linear difference equations. The equations are assumed to be completely known except for the state variable coefficients, i.e., the state transition matrix, and, in certain situations, the initial conditions. The estimates are based on known normal operating input and on output measurements corrupted by additive Gaussian noise. Maximum likelihood estimators of the parameters are developed for the following four cases: initial condition known, initial condition unknown parameter, initial condition unknown random variable, and an equivalent equation-error model configuration. Finite sample and asymptotic properties of the estimators as well as computational aspects are investigated. The study is oriented toward real time applications. Application of maximum likelihood to the above four cases differs from the classical situation in statistics because the measurements are not identically

distributed, or are not independent, or both. The resulting estimates are roots or cumbersome nonlinear equations. GRA

N80-10032 Allerton Press, Inc., New York, N. Y.
THE INVERSE PROBLEM OF CONTROL SYSTEM GUARANTEED SENSITIVITY
Yu. V. Aleksandrov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 1-5 refs Transl. into ENGLISH of Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 5-10 (For primary document see N80-10031 01-01)
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N80-10035# Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF REGULATORS FOR CONTROLLING ELASTIC FLIGHT VEHICLE ROTATION ABOUT THE LONGITUDINAL AXIS
A. A. Baloev *In its* Soviet Aeron., v. 21, no. 4, 1978 p 16-21 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 23-28 (For primary document see N80-10031 01-01)
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N80-10037 Allerton Press, Inc., New York, N. Y.
OPTIMAL CONTROL OF FLIGHT VEHICLE WITH ELASTIC ELEMENTS
V. V. Vatolin, G. L. Degtyarev, and N. K. Yunusov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 27-31 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 36-42 (For primary document see N80-10031 01-01)
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N80-10046 Allerton Press, Inc., New York, N. Y.
ON MODELING SENSITIVITY OF A LINEAR SYSTEM TO REDUCTION OF ITS ORDER BY THE INFINITESIMAL TRANSFORMATION METHOD IN THE YAW MOTION CONTROL PROBLEM
V. G. Pavlov *In its* Soviet Aeron., v. 21, no. 4 1978 p 72-75 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats Tekh., (USSR), v. 21, no. 4, 1978 p 94-98 (For primary document see N80-10031 01-01)
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N80-10047 Allerton Press, Inc., New York, N. Y.
ON THE EMPENNAGE SNAP-THROUGH PROBLEM
V. A. Pavlov and S. K. Chernikov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 76-80 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved Aviats Tekh., (USSR), v. 21, no. 4, 1978 p 99-104 (For primary document see N80-10031 01-01)
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09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N80-10230# Illinois Univ., Urbana. Dept. of Civil Engineering.
LONGITUDINAL JOINT SYSTEMS IN SLIP-FORMED RIGID PAVEMENTS. VOLUME 1: LITERATURE SURVEY AND FIELD INSPECTION Interim Report
Ernest J. Barenberg and Roger E. Smith Jan. 1979 143 p refs
(Contract DOT-FH-11-8474)
(AD-A066320; FAA-RD-79-4-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 01/5

The cost effectiveness of various load transfer systems across longitudinal joints in slip formed concrete pavements are determined. A literature survey and field inspections of existing pavements with keyed load transfer systems and of construction of pavements with slip form pavers are discussed. Alternate joint systems developed are described. A.W.H.

N80-10231*# Southampton Univ. (England).
CRYOGENIC WIND TUNNEL ACTIVITIES AT THE UNIVERSITY OF SOUTHAMPTON
M. J. Goodyear Hampton, Va. NASA Sep. 1979 10 p refs (Grant NsG-7523)
(NASA-CR-159144) Avail: NTIS HC A02/MF A01 CSCL 14B

The characteristics and behavior of a 0.3m transonic cryogenic wind tunnel are discussed. The wide band of usable Reynolds numbers is analyzed along with a flow visualization technique using propane. The combination of magnetic suspension with the cryogenic wind tunnel is described. An outline of the circuit showing the locations of the magnet system and the features of the tunnel are presented. A.W.H.

N80-10232# Royal Aircraft Establishment, Farnborough (England).
DEVELOPMENT OF AN AIR HEATER FOR A MIXTURE FORMATION TEST RIG
H. D. Distelrath May 1979 24 p refs Transl. into ENGLISH of report IB-351-77/36 (West Germany), DVL, Aachen, Dec. 1977 24 p
(RAE-Trans-2012; BR70095) Avail: NTIS HC A02/MF A01

The design and development of a 400 kW air heater for a mixture formation test rig is described. Temperature requirements, the metal chosen for the heat conductor, the heating coils, and the thermal insulation are assessed. Electrical heaters used to heat air for hypersonic wind tunnels are discussed. A.W.H.

N80-10233# Air Force Human Resources Lab., Brooks AFB, Tex.
ADVANCED SIMULATOR FOR PILOT TRAINING (ASPT): G-SEAT OPTIMIZATION Interim Report, May 1977 - Apr. 1978
Dan C. McGuire (Williams AFB, Ariz.) and David R. Lee (Williams AFB, Ariz.) Feb. 1979 35 p refs
(AF Proj. 1123)
(AD-A068475; AFHRL-TR-78-92) Avail: NTIS HC A03/MF A01 CSCL 05/9

This report documents Phase I (of III) of a project to optimize the effectiveness of the ASPT g-seat in terms of both hardware and software performance. The transport lag was reduced to 20 ms by moving the Conoflow valves to the platform and using higher diameter hoses. The time constant was reduced to 150 ms by using larger diameter hoses, changing the needle valve location, and optimizing the settings of the booster and needle valve adjustments. The software has been reorganized, improved, streamlined and documented so that it may be more readily used to determine the most effective drive techniques. The optimized system will be used in a Phase II to determine the most effective drive technique and in a Phase III which will emulate new g-cueing devices, geometries, and drive schemes. GRA

N80-10234# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. System Avionics Div.
VIDEO CONTROL CENTER AND COCKPIT SIMULATOR Final Report, 1 Oct. 1976 - 30 Sep. 1978
Darryl A. Williams Apr. 1979 23 p
(AF Proj. 2003)
(AD-A071313; AFAL-TR-79-1081) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report is intended to be for general information on the cockpit simulator design. The report gives the basic concepts for the use of the system but does not give all circuitry details. The system is designed for flexibility. A user is presented with 24 pin connectors for switches and lamps. His task is to physically configure his keyboards, readouts, etc., and meet the signal requirements of the system; specifically, that switches supply -5 volts and that lamps select the appropriate supply voltage

from the connector. For analog inputs a set of analog to digital converters will be interfaced to the PDP-11 and appropriate input ports made available. The user's only restriction is the signal compatibility. The characteristics of the system are then controlled by software. By having the hardware in the console the cockpit per se could be replaced or even a second cockpit or crew station added by simply plugging in. It is assumed that the design is flexible enough for most requirements. The system allows for easy expansion or modifications. The purpose of the system is a simulation tool which changes with needs and does not become obsolete. GRA

N80-10235# Systems Technology, Inc., Hawthorne, Calif.
MANNED ENGINEERING FLIGHT SIMULATION VALIDATION, PART 1. SIMULATION REQUIREMENTS AND SIMULATOR MOTION SYSTEM PERFORMANCE Final Report, Aug. 1977 - Nov. 1978
L. G. Hoffman and Susan A. Riedel Feb. 1979 209 p
(Contract F33615-77-C-2065)
(AD-A071394; AFFDL-TR-78-192-Pt-1; STI-TR-1110-1) Avail: NTIS CSCL 14/2

The goal of this research is to establish an orderly, relatively simple method for optimizing the presentation of motion cues in moving base simulations. This is accomplished via choice of the drive logic parameters for a given simulator and flying task. The method developed here is based upon use of motion fidelity criteria. It has been applied to optimize the LAMARS motion base drive logic parameters for an air-to-ground scenario. The methods and procedures of this report can be applied for any given motion base and any desired scenario. Criteria for discerning fidelity of motion reproduction are developed. These criteria are composed of various mean-square error measures which reflect differences between simulated and actual in-flight motion. The criteria can be used to answer three questions which arise for every motion base simulation program: is moving base simulation appropriate for the flying tasks to be investigated, how can motion base drive logic parameters be optimized for the flying tasks to be investigated, and will this set of motion drive logic parameters result in motion within simulator capabilities for the flying tasks to be investigated. GRA

N80-10236# Army Research Inst. for the Behavioral and Social Sciences, Arlington, Va.
TRAINING EFFECTIVENESS OF THE CH-47 FLIGHT SIMULATORS
Garvin L. Holman May 1979 91 p refs
(DA Proj. 2Q2-63743-A-772)
(AD-A072317; ARI-RR-1209) Avail: NTIS HC A05/MF A01 CSCL 05/9

The training effectiveness of the CH-47 helicopter flight simulator was evaluated in two parts: Part I used a classical two-group transfer-of-training design using aviators undergoing transition training to the CH-47 helicopter, and Part II assessed the training benefits of periodic training of operational CH-47 aviators in the CH-47 flight simulator using a pretest-train-post test design. Cumulative transfer effectiveness ratios and learning curves are presented for 24 maneuvers taught in the simulator and the aircraft. It was concluded that the CH-47 flight simulator is an effective training device for all maneuvers tested except for those, such as hovering maneuvers, that require extensive visual group referencing at very low altitudes. The simulator was also found to be inadequate for training night operations and terrain flights. GRA

N80-10237# Air Force Human Resources Lab., Brooks AFB, Tex.
SIMULATOR FOR AIR-TO-AIR COMBAT MOTION SYSTEM INVESTIGATION Final Report
John A. Seevers (Calif. State Polytech. Univ., Pomona) and Robert L. Makinney (Williams AFB, Ariz.) Jul. 1979 19 p refs
(AF Proj. 1123)
(AD-A072612; AFHRL-TR-79-18) Avail: NTIS HC A02/MF A01 CSCL 05/9

This investigation was conducted to evaluate the Simulator for Air-to-Air Combat (SAAC) motion system response to known input signals, to observe platform movements, to measure leg extension velocities and accelerations, and to establish delay lags through the system electronics and hydraulics. Signal voltages at pre-established levels were input by a signal generator at the analog-to-digital converter simulating pilot's control stick movements. Resulting platform movement was recorded on strip chart recorder measuring accelerations and final positioning from six linear and angular accelerometers mounted beneath the motion platform. Several noticeable factors were revealed that contribute to the status of the motion platform being less than representative of motion of the aircraft. First, the motion platform lags the input command by a noticeable amount. The platform's motion is about a multiple set of axes rather than a single axis as the command would direct. Also, because of physical constraints on the size of the system, the magnitude and deviation of the motion are limited. A fourth major problem is that when the excursion is near the maximum allowable, the motion is stopped too abruptly, and this stopping is readily perceived by the pilot (the washout problem). GRA

N80-10238# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
DYNAMIC CHARACTERISTICS OF FLIGHT SIMULATOR MOTION SYSTEMS
Sep. 1979 40 p refs
(AGARD-AR-144; ISBN-92-835-1338-X) Avail: NTIS HC A03/MF A01

A uniform method of measuring and reporting motion performance characteristics is presented. Such a uniform method, in addition to aiding system comparison, can assist in system diagnosis and might be used in writing performance specifications. The definitive characteristics selected for system description are excursion limits, describing function, linearity and acceleration noise, hysteresis, and dynamic threshold, definitions and methods of measurement and display are given, illustrated by measurements on particular motion systems. R.E.S.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-10239*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PIONEER SATURN ENCOUNTER
Sep. 1979 29 p Original contains color illustrations
(NASA-TM-80807) Avail: NTIS HC A03/MF A01 CSCL 22A

The Pioneer Saturn Spacecraft, which began its journey as Pioneer 11, provided the first close view of the rings of Saturn as well as its system of moons. Its payload of 11 operating instruments obtained or confirmed data about the mass, temperature, composition, radiation belts, and atmosphere of the planet and its larger satellite, Titan. It made photometric and polarization measurements of Iapetus, Rhea, Dione, and Tethys, as well as discovered additional rings. Scientific highlights of the mission are summarized. Color imagery provided by the photopolarimeter is included along with illustrations of the planet's magnetic field and radiation belts. A.R.H.

N80-10240*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Jul. - Aug. 1979
15 Oct. 1979 185 p refs
(Contract NAS7-100)
(NASA-CR-162414; DSN-PR-42-53) Avail: NTIS HC A09/MF A01 CSCL 14B

Progress is reported in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations. The functions and facilities of the Deep Space Network are emphasized. For individual titles, see N80-10241 through N80-10264.

N80-10241*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Oct. 1979 p 1-3 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep

Space Network are summarized. Deep space station, ground communication, and network operations control capabilities are described. J.M.S.

N80-10242*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER SUPPORT **c14**
J. E. Allen and H. E. Nance *In its* The Deep Space Network 15 Oct. 1979 p 4-9 ref (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

Tracking and data acquisition for the Voyager project is reported. The post-encounter period for Voyager 1 and the encounter period for Voyager 2, from April 1979 through July 1979, are included. J.M.S.

N80-10243*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER 11 SATURN ENCOUNTER SUPPORT **c14**
G. M. Rockwell *In its* The Deep Space Network 15 Oct. 1979 p 10-20 ref (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The preparation of the Deep Space Network (DSN) for support of Pioneer 11 Saturn encounter operations is discussed. The encounter's main objectives, DSN testing, special DSN configurations and procedures, radio science activities, and any other mission-related activities are included. J.M.S.

N80-10244*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO ASTRONOMY **c89**
R. J. Fehnestock and R. M. Taylor *In its* The Deep Space Network 15 Oct. 1979 p 21-23 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 03A

The Deep Space Network 26 and 64 meter antenna stations operations in support of radio astronomy experiments is discussed. Experiments to study the effects of solar corona on radio signals and to observe radio emissions from X-ray sources are included. J.M.S.

N80-10245*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A VOLTAGE-CONTROLLED OPTICAL RADIO FREQUENCY-PHASE SHIFTER **c74**
K. Y. Lau *In its* The Deep Space Network 15 Oct. 1979 p 24-32 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20F

The problem of stabilizing an optical-fiber link, in which an RF-modulated optical wave is used for frequency standard transmission, is investigated. Higher reliability is expected if RF phase-shifting, phase error detection, etc., can be done directly on the modulated optical signal. A variable optical phase shifter for the above purpose is proposed, and its properties are illustrated. J.M.S.

N80-10246*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A POINT DESIGN FOR A GYROTRON TRAVELING WAVE TUBE AMPLIFIER **c33**
A. Kupiszewski *In its* The Deep Space Network 15 Oct. 1979 p 33-39 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 09A

A point design for a gyro-TWT amplifier is presented. Steps for deriving the growth rate are explained and design results presented. Parameters for some support equipment are given and consequences of potential design parameter changes are examined. J.M.S.

N80-10247*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEMONSTRATION OF REMOTE CLOCK MONITORING BY VLBI, WITH THREE BASELINE CLOSURE **c14**
C. M. Cheetham, W. J. Hurd, J. W. Layland, G. A. Madrid, and T. P. Yunck *In its* The Deep Space Network 15 Oct. 1979 p 40-53 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The capability of very long baseline interferometry (VLBI) to monitor the stability of remotely-located hydrogen maser frequency standards was demonstrated by a series of experiments between Deep Space Stations in Australia, Spain, and California. The measured stabilities of the clock systems, over approximately 10-day intervals, were 1 to 3 parts in 10 to the 13th power, with the instabilities due to the oscillators, the clock distribution systems, the receiving system delays, and the VLBI measurement error. Experiments were conducted independently using two different systems (BLOCKS 0 and WBDAS). Later comparison shows agreement in the order of 1 part in 10 to the 13th power. Closure was demonstrated on three separate occasions to 33, 10, and 13 ns with an error uncertainty of + or - 42 ns. The resolution and consistency of VLBI measurements were demonstrated. M.M.M.

N80-10248*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROJECTED STATE-OF-THE-ART FOR FREQUENCY STANDARDS FOR THE DSN IN THE 1982 - 1990 TIME FRAME **c32**
W. Higa and R. Sydnor *In its* The Deep Space Network 15 Oct. 1979 p 54-61 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

A study was made of frequency standards that are potentially useful to the DSN in the 1980s. A combination of several devices that have inherently good performance over different averaging time regimes is recommended. This combination consists of a quartz oscillator for short-term, either a quartz oscillator or active hydrogen maser for medium-term, and a passive hydrogen maser or cesium standard for long-term stability. M.M.M.

N80-10249*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE R SUB 0 PARAMETER FOR OPTICAL COMMUNICATION USING PHOTON COUNTING **c74**
R. J. McEliece *In its* The Deep Space Network 15 Oct. 1979 p 62-65 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20F

It was shown that even under ideal conditions (no thermal noise or dark current, continuously-variable intensity lasers, perfectly accurate photon counters), R sub zero is, at most, one nat per photon in optical systems which use photon counting techniques. A definition is given of R sub zero which applies to any memoryless time-discrete channel whose output alphabet is finite or countable along with a simple upper bound on R sub zero which applies to any such channel. This bound was applied to the specific channel model appropriate for noiseless optical communication to show that R sub zero is less or equal to 1 nat per photon. M.M.M.

N80-10250*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DENSITY AND RELIABILITY PREDICTIONS FOR A GENERAL LOGIC STRUCTURE FOR CUSTOM LSI **c33**
M. Sievers *In its* The Deep Space Network 15 Oct. 1979 p 66-73 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

A reliabilty model is presented that includes the possibility of undetected manufacturing flaws. This model is more accurate than models that consider only so-called wear-out failures. It may be used to indicate how much preinstallation test coverage is necessary to guarantee a given installed reliability. M.M.M.

N80-10251*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FREQUENCY DOWN-CONVERTERS AS APPLIED TO VLBI **c32**
N. C. Ham *In its* The Deep Space Network 15 Oct. 1979 p 74-82 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The frequency conversion of a received radio frequency spectrum, from an extra galactic radio source down to video-band frequencies to facilitate data recording or transmission is described. A converter design is shown to minimize error contribution to the received information through the use of combination analog and digital circuitry. M.M.M.

N80-10252*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE NOCC RADIO SCIENCE SUBSYSTEM: SYSTEM PERFORMANCE VALIDATION FOR THE DSN RADIO SCIENCE AND VERY LONG BASELINE INTERFEROMETRY (VLBI) SYSTEMS **c32**
A. L. Berman *In its* The Deep Space Network 15 Oct. 1979 p 83-92 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

A functional description of the key characteristics, require-

ments, and operation of the Network Operation Control Center Radio Science Subsystem is provided. M.M.M.

N80-10253*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN OF A QUICK-LOOK DECODER FOR THE DSN (7,1/2) CONVOLUTIONAL CODE **c32**
C. A. Greenhall and R. L. Miller *In its* The Deep Space Network 15 Oct. 1979 p 93-101 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

The decoder proposed for a 1200 bit/s telemetry link that will operate while the TDRSS is relaying the signal from the Galileo spacecraft is discussed. Design parameters and performance figures for the three functions of the decoder: acquisition of node synchronization, generation of the decoded bits, and estimation of channel quality. A.R.H.

N80-10254*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A REED-SOLOMON DEEDING PROGRAM FOR CORRECTING BOTH ERRORS AND ERASURES **c61**
R. L. Miller, T. K. Truong, B. Benjauthrit, and I. S. Reed *In its* The Deep Space Network 15 Oct. 1979 p 102-107 refs (For primary document see N80-10240 01-12)
(Grant AF-AFOSR-1798-75)
Avail: NTIS HC A09/MF A01 CSCL 09B

The software implementation of a simplified algorithm for decoding errors and erasures of Reed-Solomon (R-S) code words using the techniques of finite field transforms and continued fractions is described. In particular, random code words from the (255, 223, 33) R-S code over GF(2 to th 8th power) are corrupted by random error and erasure patterns, and decoded whenever theoretically possible. A matrix of execution times of this decoder under varying sets of errors and erasure patterns is also included. This matrix demonstrates the relative amounts of time required for decoding different error and erasure patterns, as well as the correctness of the algorithms and the software implementation. Author

N80-10255*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TRACKING SYSTEM UPLINK FREQUENCY CONTROL **c32**
G. L. Spradlin *In its* The Deep Space Network 15 Oct. 1979 p 108-112 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

The failure of the Voyager 2 spacecraft receiver requires that the DSN maintain the communications link to the spacecraft by constantly tuning the uplink frequency to null the effects of Doppler. An implementation within the DSN Tracking System will provide automated uplink frequency control by using electrical interfaces to control the transmitted frequency directly from predictions. A.R.H.

N80-10256*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN CONSCAN: A VECTOR NOMENCLATURE AND METHOD FOR DETERMINING PARAMETER VALUES **c61**
T. H. Taylor and J. LuValle *In its* The Deep Space Network 15 Oct. 1979 p 113-122 ref (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 09B

For proper operation, CONSCAN requires the specification of four parameter values: The CONSCAN radius, the scan period, the loop phase angle, and CONSCAN gain. These values are manually entered into the antenna pointing subsystem computer prior to CONSCAN tracking. The values vary from station to station and are different for different tracking configurations at a single station. There is presently no standard procedure for determining these values. A vector system is developed and used to describe a procedure for determining CONSCAN parameter values. Vector notation expresses the CONSCAN algorithm in a neat, consistent package with the two vector components on an equal footing. Vector relations are more easily visualized than their algebraic equivalents. A.R.H.

N80-10257*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANTENNA AZIMUTH BEARING MODEL EXPERIMENT **c37**
H. McGinness *In its* The Deep Space Network 15 Oct. 1979 p 123-131 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 13I

A reduced scale model was constructed of an antenna wheel and track azimuth bearing in which the supporting wheels are attached to the alidade base and the track is grouted onto a concrete foundation. Tests were conducted to determine wheel and track resistance to contact surface failure, grout strength, circumferential movement of track on its supporting grout, effect of a large temperature difference between the wheel supporting structure and the track, and the amount of the rolling resistance torque. The model was designed to produce a wheel cyclic loading approximately 3200 times as fast as that of an antenna prototype. Results are discussed. A.R.H.

N80-10258*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO FREQUENCY PERFORMANCE OF DSS 14 64-m ANTENNA AT X-BAND USING A DUAL HYBRID MODE FEED **c32**
A. J. Freiley *In its* The Deep Space Network 15 Oct. 1979 p 132-140 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The 64 meter antenna X-band system at DSS 14 was evaluated to determine the performance with the new dual hybrid mode feed. The peak system efficiency increased from 42.0 to 45.6 percent resulting in a 0.36 dB increase in antenna gain. The new measured gain is 71.6 dB. Antenna pointing, beamwidth, optimum subreflector focusing, and operating system temperature were unchanged from the previous feed. Some evidence of antenna aging is apparent (from the 1973 measurements reported earlier) both in peak gain and in the pointing angle at which the peak occurs. Author

N80-10259*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF ANTENNA POINTING ERRORS ON RANGE DELAYS **c32**
T. Y. Otoshi and T. H. Taylor *In its* The Deep Space Network 15 Oct. 1979 p 141-147 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The effect of antenna pointing errors on range and VLBI time delay measurements is investigated. A collimation tower is tested for the effects from ground multipath and near field errors. The causes for time delay changes occurring when the antenna pointing goes from boresight to off boresight are discussed. Near field effects and differences in antenna phase versus frequency responses at different look angles are examined. A.W.H.

N80-10260*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S-BAND ULTRALOW-NOISE TRAVELING-WAVE MASER **c36**
D. Trowbridge and J. Loreman *In its* The Deep Space Network 15 Oct. 1979 p 148-154 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20E

Two S band traveling wave maser systems (TWM) with effective input noise temperatures of 2.0K at 2295 MHz are evaluated. The cooled signal input transmission lines, superconducting magnets, and solid state pump which improved stability performance on the TWMs are described. Support equipment and instrumentation, including the operating controls and indicators, are examined and the performance requirements are discussed. A.W.H.

N80-10261*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN IMPROVEMENT IN FOURIER TRANSFORM ACCURACY **c64**
R. C. Bunce *In its* The Deep Space Network 15 Oct. 1979 p 155-160 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01

Component summation addition to existing Fourier transform algorithms is described as a minor tool for accuracy improvement. The behavior of the process is demonstrated with a statistical model and the accuracy advantage is discussed. A.W.H.

N80-10262*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS RECEIVER THERMAL NOISE MODEL COMPARISONS **c33**
R. C. Bunce *In its* The Deep Space Network 15 Oct. 1979 p 161-168 (For primary document see N80-10240 01-12)

Avail: NTIS HC A09/MF A01 CSCL 09C

Three DSS receiver thermal noise models are compared to determine if changes in the test algorithm are required. The linear spectral density approximation, the EXACT algorithm, and the exponential approximation are the models investigated.

A.W.H.

N80-10263*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP SPACE NETWORK FEASIBILITY STUDY OF TERMINATING SOUTHERN CALIFORNIA EDISON ELECTRICAL SERVICE TO GOLDSTONE **c14**
J. L. Koh *In its* The Deep Space Network 15 Oct. 1979 p 169-175 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

A cost comparison of purchased power versus generated power is discussed. Methods for waste energy recovery are examined and applications for the use of waste energy in heating and cooling systems are presented.

A.W.H.

N80-10264*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
X-BAND SAMPLING BY THE OCCULTATION DATA ASSEMBLY **c32**
R. B. Roth *In its* The Deep Space Network 15 Oct. 1979 p 176-179 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

Extraneous peaks which appear in the power spectrum of X band radio data are investigated. The effects of the peaks on a carrier signal and on the filter bandpass characteristics are examined.

A.W.H.

N80-10265*# National Aeronautics and Space Administration, Washington, D. C.
SHORT DESCRIPTION OF MATHEMATICAL SUPPORT PROGRAMS FOR SPACE EXPERIMENTS IN THE INTERKOSMOS PROGRAM
P. Ye. Elyasberg Jun. 1979 25 p Transl. into ENGLISH of "Kratkoye Opisaniye Programm Matematicheskogo Obespecheniya Kosmicheskikh Eksperimentov v Ramkakh Programmy "Interkosmos", Rept. Pr-431 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-32 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75629) Avail: NTIS HC A02/MF A01 CSCL 22A

A synopsis of programs of mathematical support designed at the Institute for Cosmic Research of the USSR Academy of Sciences for cosmic experiments being conducted in the Interkosmos Program is presented. A short description of the appropriate algorithm is given.

Author

N80-10266*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
FEASIBILITY OF COMMERCIAL SPACE MANUFACTURING, PRODUCTION OF PHARMACEUTICALS. VOLUME 1: EXECUTIVE SUMMARY Final Report
9 Nov. 1978 228 p
(Contract NAS8-31353)
(NASA-CR-161324; MDC-E2104-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 22A

The feasibility of the commercial manufacturing of pharmaceuticals in space is examined. The method of obtaining pharmaceutical company involvement, laboratory results of the separation of serum proteins by the continuous flow electrophoresis process, the selection and study of candidate products, and their production requirements is presented. Antihemophilic factor, beta cells, erythropoietin, epidermal growth factor, alpha-1-antitrypsin and interferon were studied. Production mass balances for antihemophilic factor, beta cells, and erythropoietin were compared for space verus ground operation.

A.W.H.

N80-10267*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
FEASIBILITY OF COMMERCIAL SPACE MANUFACTURING, PRODUCTION OF PHARMACEUTICALS. VOLUME 2: TECHNICAL ANALYSIS Final Report
9 Nov. 1978 37 p refs
(Contract NAS8-31353)
(NASA-CR-161325; MDC-E2104-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 22A

A technical analysis on the feasibility of commercial manufacturing of pharmaceuticals in space is presented. The method of obtaining pharmaceutical company involvement, laboratory results of the separation of serum proteins by the continuous flow electrophoresis process, the selection and study of candidate products, and their production requirements is described. The candidate products are antihemophilic factor, beta cells, erythropoietin, epidermal growth factor, alpha-1-antitrypsin and interferon. Production mass balances for antihemophelic factor, beta cells, and erythropoietin were compared for space versus ground operation. A conceptual description of a multiproduct processing system for space operation is discussed. Production requirements for epidermal growth factor of alpha-1-antitrypsin and interferon are presented.

A.W.H.

N80-10268*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
FEASIBILITY OF COMMERCIAL SPACE MANUFACTURING, PRODUCTION OF PHARMACEUTICALS. VOLUME 3: PRODUCT DATA Final Report
9 Nov. 1978 191 p refs
(Contract NAS8-31353)
(NASA-CR-161326; MDC-E2104-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 22A

The feasibility of commercial manufacturing of pharmaceuticals in space is analyzed and the study results are presented. The chronology of the study process is discussed. The separation of serum proteins by the continuous flow electrophoresis process is investigated. The production requirements of twelve candidate products including antihemophilic factor, beta cells, erythropoietin, epidermal growth factor, alpha-1-antitrypsin, and interferon are evaluated.

A.W.H.

N80-10269# Joint Publications Research Service, Arlington, Va.
GEOPHYSICS, ASTRONOMY AND SPACE, NO. 452
4 Sep. 1979 22 p Transl. into ENGLISH from various Russian articles
(JPRS-74125) Avail: NTIS HC A02/MF A01

Abstracts of scientific articles on astronomy, meteorology, oceanography, terrestrial geophysics, upper atmosphere and space research are presented. The space processing of intermetallics is examined. For individual titles, see N80-10270 through N80-10270.

N80-10270# Joint Publications Research Service, Arlington, Va.
ALLOYS OBTAINED IN A STATE OF WEIGHTLESSNESS
Ye. Savitskiy, L. Ivanov, and V. Zemskov *In its* Geophys., Astronomy and Space, No. 452 (JPRS-74125) 4 Sep. 1979 p 15-18 Transl. into ENGLISH from Aviasiya i Kosmonavtika (Moscow), no. 7, 1979 p 42-43 (For primary document see N80-10269 01-12)
Avail: NTIS HC A02/MF A01

The Splav-01 series of experiments conducted on Salyut-6 to study the processes melting and crystallization of semiconductor materials, metallic alloys, and glasses under weightlessness conditions are discussed. The processing of solid solutions of cadmium and mercury tellurides, of indium antimonide with bismuth, and of bismuth with antimony by direct crystallization yielded high microhomogeneity. Analysis of the microstructure of metallic alloys shows that under weightlessness liquation by weight is suppressed. The primary crystals of these phases are larger than terrestrial crystals and have more perfect faceting. A metallic material formed from aluminum and bismuth revealed a structure which differs from that obtained on Earth. The liquation process, phase formation, and the interaction of metal melts with metals in the solid state which have a higher melting point were investigated for the following compositions: aluminum with solid tungsten and with solid copper, and tin with solid copper. By controlling liqation processes, glasses can be produced with more uniform composition and properties, or vice versa.

A.R.H.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-10271# California Univ., Santa Barbara. Marine Science Inst.
A LOW VELOCITY WATER TUNNEL FOR BIOLOGICAL RESEARCH
A. C. Charters and S. Miles Anderson 3 Apr. 1979 29 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Hydronautics in Jan. 1980
(Grant NSF ENG-76-22720)
Avail: NTIS HC A03/MF A01

A water tunnel, developed for studies of the effects of water motion on the life processes of marine plants, produces a low-turbulence, uniform flow through the velocity range of 3 to 30 cm/sec, typical of oceanic water motions, in a working section 10 cm in diamter by 100 cm long, a size adequate for tests of most benthic algae. It is instrumented for recording flow field streamlines and for measuring velocity and turbulence. The design and operating characteristics of the tunnel and its instrumentation are discussed. Photographs of the flow over various test bodies and around a marine plant are included. A.R.H.

N80-10241*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Oct. 1979 p 1-3 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N80-10242*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER SUPPORT
J. E. Allen and H. E. Nance *In its* The Deep Space Network 15 Oct. 1979 p 4-9 ref (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N80-10243*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER 11 SATURN ENCOUNTER SUPPORT
G. M. Rockwell *In its* The Deep Space Network 15 Oct. 1979 p 10-20 ref (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N80-10247*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEMONSTRATION OF REMOTE CLOCK MONITORING BY VLBI, WITH THREE BASELINE CLOSURE
C. M. Cheetham, W. J. Hurd, J. W. Layland, G. A. Madrid, and T. P. Yunck *In its* The Deep Space Network 15 Oct. 1979 p 40-53 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N80-10263*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP SPACE NETWORK FEASIBILITY STUDY OF TERMINATING SOUTHERN CALIFORNIA EDISON ELECTRICAL SERVICE TO GOLDSTONE
J. L. Koh *In its* The Deep Space Network 15 Oct. 1979 p 169-175 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-10272*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACELAB PAYLOAD ACCOMMODATION HANDBOOK. APPENDIX B: STRUCTURE INTERFACE DEFINITION MODULE
31 Jul. 1978 354 p
(NASA-TM-80808; ESA-SLP/2104-2-Issue-1) Avail: NTIS HC A16/MF A01 CSCL 22B

The mechanical interfaces between Spacelab and its payload are defined. The envelopes available for mounting payload hardware are specified together with the standard structural attachment interfaces. Overall load capabilities and the local load capabilities for individual attachment interfaces are defined for the standard mounting locations. The mechanical environment is defined and the mechanical interfaces between the payload and the EPDS, CDMS and ECS are included. A.W.H.

N80-10273*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF PERIODIC MOTIONS OF A SATELLITE WITH A MAGNETIC DAMPER
Yu. A. Sadov and A. D. Teterin Aug. 1979 29 p refs Transl. into ENGLISH of Preprint no. 35 (Moscow), 1979 32 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-75667) Avail: NTIS HC A03/MF A01 CSCL 22A

The motion of a satellite with a magnetic damper in the plane of a circular polar orbit is studied. The asymptotics of periodic solutions are constructed for a satellite close to axisymmetric and the radius of convergence is evaluated for the power series obtained. In a broad range of values of parameters, a periodic solution is obtained by numerical integration of equations of motion of the satellite. The asymptotics of a bifurcated curve obtained (the curve on which origin of a pair of periodic solutions occurs) in the space of the parameters agrees well with the results of numerical computation with all physical values of these parameters. A breakdown is made of the space of the initial data of phase variables in the field of effect of different types of periodic motion. Author

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-10274# Committee on Science and Technology (U. S. House).
OVERSIGHT: SPACE SHUTTLE COST, PERFORMANCE, AND SCHEDULE REVIEW
Washington GPO 1979 214 p Hearing before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 28 Jun. 1979
(GPO-50-365) Avail: Subcomm. on Space Sci. and Applications

A congressional report on the space shuttle cost, performance, and schedule review is presented. Cost estimates and analysis of the space shuttle program is discussed. Budget appropriations are examined. A.W.H.

N80-10275*# Axiomatix, Los Angeles, Calif.
SHUTTLE ORBITER KU-BAND RADAR/COMMUNICATIONS SYSTEM DESIGN EVALUATION: HIGH GAIN ANTENNA/WIDEBEAM HORN Interim Report

R. Iwasaki, J. Dodds, and P. Broad 31 Aug. 1979 52 p ref
(Contract NAS9-15795)
(NASA-CR-160316; R7908-5) Avail: NTIS HC A04/MF A01 CSCL 22B

The physical characteristics of the high gain antenna reflector and feed elements are described. Deficiencies in the sum feed are discussed, and lack of atmospheric venting is posed as a potential problem area. The measured RF performance of the high gain antenna is examined and the high sidelobe levels measured are related to the physical characteristics of the antenna. An examination of the attributes of the feed which might be influenced by temperature extremes shows that the antenna should be insensitive to temperature variations. Because the feed support bipod structure is considered a significant contributor to the high sidelobe levels measured in the azimuth plane, pod relocation, material changes, and shaping are suggested as improvements. Alternate feed designs are presented to further improve system performance. The widebeam horn and potential temperature effects due to the polarizer are discussed as well as in the effects of linear polarization on TDRS acquisition, and the effects of circular polarization on radar sidelobe avoidance. The radar detection probability is analyzed as a function of scan overlap and target range. A.R.H.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-10276*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SHUTTLE ORBITER RADAR CROSS-SECTIONAL ANALYSIS
Dale W. Cooper and Robert James (James and Associates) Oct. 1979 44 p refs
(Contract NAS4-2460)
(NASA-TM-72870; H-1095) Avail: NTIS HC A03/MF A01 CSCL 17I

Theoretical and model simulation studies on signal to noise levels and shuttle radar cross section are described. Pre-mission system calibrations, system configuration, and postmission system calibration of the tracking radars are described. Conversion of target range, azimuth, and elevation into radar centered east north vertical position coordinates are evaluated. The location of the impinging rf energy with respect to the target vehicles body axis triad is calculated. Cross section correlation between the two radars is presented. A.W.H.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-10277*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
IMPLICATIONS OF POSSIBLE SHUTTLE CHARGING
William W. L. Taylor Oct. 1979 16 p refs
(Contract NAS8-32580)
(NASA-CR-161283; Rept-30387-6016-RU-00) Avail: NTIS HC A02/MF A01 CSCL 22B

Shuttle charging is discussed and two analyses of shuttle charging are performed. The first predicts the effective collecting area of a wire grid, biased with the respect to the potential of the magnetoplasma surrounding it. The second predicts the intensity of broadband electromagnetic noise that is emitted when surface electrostatic discharges occur between the beta cloth and the wire grid sewn on it. A.W.H.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-10278* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PASSIVE PROPELLANT SYSTEM Patent
Donald A. Hess (McDonnell-Douglas Corp., St. Louis), William W. Regnier (McDonnell-Douglas Corp., St. Louis), and Virgil L. Jacobs, inventors (to NASA) (McDonnell-Douglas Corp., St. Louis) Issued 25 Sep. 1979 6 p Filed 11 Jul. 1978 Sponsored by NASA
(NASA-Case-MFS-23642-1; US-Patent-4,168,718; US-Patent-Appl-SN-923758; US-Patent-Class-137-177; US-Patent-Class-137-590; US-Patent-Class-137-574; US-Patent-Class-137-576; US-Patent-Class-137-209; US-Patent-Class-244-135R) Avail: US Patent and Trademark Office CSCL 21H

A passive propellant acquisition and feed system is disclosed which acquires and feeds gas-free propellant in low or zero-g environments during orbital maneuvers and retains this propellant under high axially directed acceleration such as may be experienced during launch of a space vehicle and orbit-to-orbit transfer is described. The propellant system includes a dual compartment propellant tank with independent surface tension acquisition channels in each compartment to provide gas-free flow of pressurized liquid propellant from one compartment to the other in one direction only.

Official Gazette of the U.S. Patent and Trademark Office

N80-10279# California Univ., Livermore. Lawrence Livermore Lab.
PROPELLANT DRIVEN TURBULENT INTERIOR BALLISTICS AND WALL EROSION
A. C. Buckingham Nov. 1978 31 p refs Presented at the AIAA Aerospace Sciences Meeting, New Orleans, 15-17 Jan. 1979
(Contract W-7405-eng-48)
(UCRL-81289; Conf-790102) Avail: NTIS HC A03/MF A01

Numerical simulations of the multidimensional, unsteady, erosive hot flow environment in a gun barrel are discussed. Turbulence, gas phase and gas surface thermochemistry, radial flow nonuniformities, and gas-borne particulates are considered in the computational models. Initial conditions include finite turbulence distributions inferred from direct turbulence computations and experiments. The turbulence modeling discussed is, however, restricted to two equation closure in conjunction with the time-averaged Navier-Stokes equations. Finite rate and equilibrium gas phase and gas surface chemical kinetics are included in the modeling of the erosion mechanisms active near bare and protectively coated gun tube walls. Particular features

suggested by the simulations, including the effects of radial nonuniformities and the coupling of core flow and boundary layer turbulence are summarized. DOE

N80-10280# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE PROPULSION AND ENERGETICS PANEL 53RD SYMPOSIUM ON SOLID ROCKET MOTOR TECHNOLOGY
M. Barrere (ONERA, Chatillon sous Bagneux, France), W. H. Desinger (Dynamit Nobel AG, Cologne), and A. Homburg (Dynamit Nobel AG, Cologne) Sep. 1979 14 p refs
(AGARD-AR-151) Avail: NTIS HC A02/MF A01

The present situation in the field of solid propellant rocketry is discussed with focus on propellant steady state burning, propellant unsteady burning, and rocket motor technology, topics covered include (1) ignition, extinction and internal ballistics; (2) burn rate modelling and combustion of metal; (3) New Propellants; (4) combustion instability; (5) heat transfer and materials; and (6)testing and instrumentation. A.R.H.

N80-10281# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
SOLID ROCKET MOTOR TECHNOLOGY
Jul. 1979 523 p refs In ENGLISH; partly in FRENCH Presented at the 53d Meeting of the AGARD Propulsion and Energetics Panel, Oslo, 2-5 Apr. 1979
(AGARD-CP-259; ISBN-92-835-0243-4) Avail: NTIS HC A22/MF A01

The reports presented at the conference are presented. Topics discussed include: (1) ignition, extinction and internal ballistics, (2) burn rate modeling, (3) combustion instability, (4) heat transfer and materials, and (5) testing and instrumentation. For individual titles, see N80-10282 through N80-10316.

N80-10282# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESEARCH IN THE FIELD OF SOLID PROPELLANT ROCKETS: A SURVEY
Marcel Barrere *In* AGARD Solid Rocket Motor Technol. Jul. 1979 28 p refs In FRENCH; ENGLISH summary (For primary document see N80-10281 01-20)
Avail: NTIS HC A22/MF A01

Current research of interest to solid propellant rocket manufacturers for military applications are reviewed. The analysis deals mainly with the combustion of propellants and the nature of burned products, as well as their impact on performances and the behavior of nozzles and casings. The combustion research is divided into two parts: the steady and the unsteady regime of the combustion chamber. The burning rate is studied of the propellant which plays an important role in the optimization of the propulsion system, in particular its level, its evolution with the pressure and its sensivity to the grain temperature. The influence of the gas velocity along the surface and acceleration effects are also dealt. The flame propagation in cracks and their initiation are analyzed. In the unsteady regime of combustion, the response of the propellant to pressure and velocity fluctuations are studied. Experimental and theoretical works on the determination of the transfer function are dealt with. F.O.S.

N80-10283# Hercules, Inc., McGregor, Tex.
SOLID ROCKET MOTOR DESIGN AUTOMATION TECHNOLOGY
W. G. Haymes, J. E. Williamson, S. E. McClendon, and W. T. Brooks *In* AGARD Solid Rocket Motor Technol. Jul. 1979 15 p refs (For primary document see N80-10281 01-20)
Avail: NTIS HC A22/MF A01

The status of Solid Rocket Motor Design Automation Technology is reported. The total scope is reviewed, from initial preliminary design techniques to optimize rocket motor performance, mass, and envelope characteristics to those procedures used in final design activity. The latter include internal ballistics and grain design, combustion stability prediction; structural, thermal, and mass property analyses, and the like. The direction of current work in the United States of America is outlined. F.O.S.

N80-10284# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
IGNITION AND EXTINCTION OF SOLID PROPELLANTS
Guy Langelle, Pierre Mentre, Joel Guernigou, Alain Bizot, and Yves Maisonneuve *In* AGARD Solid Rocket Motor Technol. Jul. 1979 16 p refs In FRENCH; ENGLISH summary (For primary document see N80-10281 01-20)
Avail: NTIS HC A22/MF A01

Activities are reported which were carried out at ONERA on ignition and extinction relative both to the propellant per se and to the motor grain with a given type of igniter. The ignition characteristics of composite and double base propellants were investigated by exposing samples to arc generated neutral gas jet as well as to aluminized, propellant motor exhaust. The means used to detect ignition were visualization, I.R. pyrometer and ultrasonic transducers continuously monitoring the thickness of the sample. With the various types of heating (convection - conduction, particles impact) it was found that the ignition laws remain the same, controlled by the degradation characteristics of the propellant components. The various experimental techniques used in scaled motors for the investigation of propellant ignition and of flame spreading are described, particularly fluxmeters. Examples of applications of these techniques to the study of the ignition of motors with composite as well as double based propellant grains, are presented. The extinction characteristics, low pressure deflagration limit and extinction under depressurization, of various composite propellants were studied revealing the influence of the composition parameters: particles size, nature of the binder, presence of additives. F.O.S.

N80-10285# Politecnico di Milano (Italy).
IGNITION AND EXTINCTION OF SOLID ROCKET PROPELLANTS
L. DeLuca, L. Galfetti, and C. Zanotti *In* AGARD Solid Rocket Motor Technol. Jul. 1979 14 p refs (For primary document see N80-10281 01-20)
Avail: NTIS HC A22/MF A01

Dynamic burning effects associated with ignition and extinction of solid rocket propellants are examined within the framework of a thermal theory of heterogeneous combustion and for quasi-steady gas phase. A nonlinear burning stability analysis was carried out via an integral method. This predicts that, for a given set of operating conditions, a well defined critical surface temperature exists below which extinction of a burning propellant necessarily follows independently on its past history. These critical surface temperature values define a lower dynamic stability boundary strictly depending on the propellant nature, but affected by the operating conditions. The analysis is based on an asymptotic stability criterion always valid for static (random disturbances) stability problems, but restricted to forcing functions levelling off in time for dynamic (external disturbances) stability. Under these circumstances, the lower dynamic stability boundary is independent on the nature of the transient (pressure or radiation driven), the shape in time of the forcing function (linear, exponential, parabolic, etc.) and the rate of change of the forcing function (even variable). The relevance of the lower dynamic stability boundary to ignition transients is discussed. Computer simulated runs show a very good agreement with the analytical predictions. Author

N80-10286# Aerospace Corp., El Segundo, Calif.
SOLID PROPELLANT SPECIFIC IMPULSE PREDICTION
Ellis M. Landsbaum and Manuel P. Salinas *In* AGARD Solid Rocket Motor Technol. Jul. 1979 11 p refs (For primary document see N80-10281 01-20)
Avail: NTIS HC A22/MF A01

The methods for the theoretical prediction of delivered specific impulse are relatively well-known. They involve computing the losses due to two-phase flow, divergence, boundary layer, kinetics, nozzle submergence and combustion efficiency. The largest computed loss in typical aluminized solid propellants is the two-phase flow loss; this computation also has the largest uncertainty because the particle size and distribution are not known precisely. A correlation of mean particle diameter versus throat diameter from experimental data was used with the solid rocket performance prediction program (SPP) to predict the propellant specific impulse of a number of motors. These predictions are compared to the experimental values. The results

indicate that the specific impulse efficiency appears to be an inherent property of the propellant. In addition, the experimental specific impulse and specific impulse efficiency were statistically correlated against throat diameter and expansion ratio for propellants of similar oxidizer and aluminum content. These correlations are as accurate as the longer, more expensive, theoretical analysis. In addition to specific impulse prediction, the equations are useful in optimization of motor design. Author

N80-10287# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
A SIMPLE METHOD TO ESTIMATE THE INFLUENCE OF A SMALL VARIATION IN THE THROAT AREA ON THE PERFORMANCE OF SOLID ROCKETS
H. F. R. Schoyer. *In* AGARD. Solid Rocket Motor Technol. Jul. 1979. 7 p. refs (For primary document see N80-10281 01-20)
Avail: NTIS. HC A22/MF A01

A technique is presented for the rapid estimation of rocket performance for different nozzle throat areas and the mutual dependence of motor parameters. The method is based on linearization of the mean ballistic variables with respect to the variation in throat area. The variation of the thrust, specific impulse, burning time, mass flow, and total impulse are predicted. These predictions are compared with predictions by a computer program for the internal ballistics of solid rocket motors and show good agreement. J.M.S.

N80-10288# Dynamit Nobel A.G., Cologne (West Germany).
INTERNAL BALLISTIC PROBLEMS OF HELMUT HIGHLY ACCELERATED SOLID PROPELLANT ROCKETS
Walter Diesinger. *In* AGARD. Solid Rocket Motor Technol. Jul. 1979. 11 p. refs (For primary document see N80-10281 01-20)
Avail: NTIS. HC A22/MF A01

The state of the art in the field of internal ballistics in an accelerated (> 1g) environment is given. It is shown how problems arising with high acceleration may be solved. J.M.S.

N80-10289# Dynamit Nobel A.G., Troisdorf (West Germany).
PROPELLANT IGNITER DEVELOPMENT PROBLEMS
Hans Flonn. *In* AGARD. Solid Rocket Motor Technol. Jul. 1979. 24 p. (For primary document see N80-10281 01-20)
Avail: NTIS. HC A22/MF A01

Igniters for propelling charges are described. The light artillery rocket and anti-submarine training rocket serve as examples of the electric and internal ballistics data of igniters. Special attention is given to the corresponding safety requirements. The mechanical and electrostatic safety is covered in connection with the general environmental compatibility. Some EMC tests of igniters are included. J.M.S.

N80-10290# Propellants, Explosives and Rocket Motor Establishment, Westcott (England).
SOME MEASUREMENTS OF IGNITION DELAY AND HEAT TRANSFER WITH PYROGEN IGNITERS
A. R. Hall, G. R. Southern, and D. Sutton. *In* AGARD. Solid Rocket Motor Technol. Jul. 1979. 9 p. refs (For primary document see N80-10281 01-20)
Avail: NTIS. HC A22/MF A01

Measurements were made of ignition delay and the corresponding heat flux with a range of single orifice pyrogens charge with propellant and fired axially in small motors in order to elucidate design principles. Ignitions were inferred from pressure-time records of both pyrogen and main motor and mean heat flux with a range of single orifice pyrogens charged with propellant and fired axially in small motors in order to elucidate design principles. Ignitions were inferred from pressure-time records of both pyrogen and main motor and mean heat fluxes were calculated from the total temperature rise of copper capsules set in dummy motor charges. The motor ignition delay, the mass rate of pyrogen discharge, and the mean heat flux were correlated. Comparison of igniters at the same values of the mass rate of pyrogen discharge revealed that ignition delays tended to be longer if igniter products contained condensed phase and pyrogens performed as well as pyrotechnics. J.M.S.

N80-10291# Propellants, Explosives and Rocket Motor Establishment, Westcott (England). Solid Propellant Motors Div.
BOUNDARY LAYER MODELS OF EROSIVE BURNING
R. C. Parkinson and P. D. Penny. *In* AGARD. Solid Rocket Motor Technol. Jul. 1979. 13 p. refs (For primary document see N80-10281 01-20)
Avail: NTIS. HC A22/MF A01

It is shown that erosive burning can be correlated by a boundary layer 'blow off' criterion. A momentum integral boundary layer theory is used to predict the boundary layer reattachment point in a rocket motor conduit, with acceleration of the combustion gases in the conduit as an important modifying force. The energy balance in the boundary layer is considered providing a means of relating boundary layer thickness with burning rate. Both normal and erosive burning effects are included. J.M.S.

N80-10292# Cohen (Norman) Professional Services, Redlands, Calif.
COMPOSITE PROPELLANT BURN RATE MODELING
Norman S. Cohen. *In* AGARD. Solid Rocket Motor Technol. Jul. 1979. 21 p. refs (For primary document see N80-10281 01-20)
Avail: NTIS. HC A22/MF A01

The current status of the steady-state combustion modeling of composite solid propellants is reviewed. Emphasis is placed upon revisions of original Beckstead-Derr-Price (BDP) model premises as applicable to simple monomodal AP propellants. Extensions to more complicated propellants (multimodal, etc.) are discussed. Results are presented which show parametric trends and comparisons with data. Areas of agreement and disagreement, deficiencies, and continuing developments are pointed out. J.M.S.

N80-10293# Bayern-Chemie G.m.b.H., Ottobrunn (West Germany).
EROSIVE AND TRANSIENT BURNING EFFECTS ON PERFORMANCE PREDICTION ACCURACY OF TACTICAL ROCKETS
H. P. Sauerwein, A. Lampert, and R. H. Schmucker. *In* AGARD. Solid Rocket Motor Technol. Jul. 1979. 11 p. refs (For primary document see N80-10281 01-20)
Avail: NTIS. HC A22/MF A01

An erosive burning model which allows performance prediction without additional empirical parameters is presented. A sensitivity analysis which uses the data of small tactical rockets shows the effects of the various geometric and ballistic parameters and the variation of pressure and thrust history due to transient effects. M.M.M.

N80-10294# Princeton Univ., N. J.
ALUMINUM COMBUSTION UNDER ROCKET MOTOR CONDITIONS
Leonard H. Caveny and Alan Gany. *In* AGARD. Solid Rocket Motor Technol. Jul. 1979. 13 p. refs (For primary document see N80-10281 01-20)
(Grant AF-AFOSR-3104-76)
Avail: NTIS. HC A22/MF A01

Combustion processes of aluminum particles emitted from the surface of solid propellants were studied under rocket motor, cross-flow conditions as well as strand burning conditions. High-speed, color photographs were taken of Al2O3 agglomerates forming on the surface, moving along the surface, entering the flow field, and breaking-up in nozzles. Experiments were conducted for cross-flow velocities as high as 30 m/s and pressures between 2 and 10 MPa. Agglomerate size distributions were obtained by direct measurements from the films. Analysis of size distributions of the agglomerates leaving the surface reveals that the following parameters decrease with increasing pressure: collision frequency on the surface, the agglomerate stay time on the surface, and mean agglomerate size. Increasing the cross-flow velocity decreases the mean agglomerate size. However, chamber pressure has the most pronounced effect on agglomerate size. M.M.M.

N80-10295# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
COMBUSTION OF ALUMINUM IN SOLID PROPELLANT FLAMES
E. W. Price. *In* AGARD. Solid Rocket Motor Technol. Jul. 1979. 15 p. refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

The behavior of aluminum in the combustion zone, the mechanisms causing this behavior, and the significance to motor performance, with particular emphasis on ammonium perchlorate-hydrocarbon binder-aluminum propellants are described. The features of aluminum behavior involve retention, concentration, sintering and coalescence of most particles on the propellant burning surface. This is followed by detachment and ignition of the agglomerate material, burning in the combustor cavity with formation of a characteristic population of oxide droplets in a diameter distribution with most droplets 0.1 < D < 50 micrometers. M.M.M.

N80-10296# Naval Weapons Center, China Lake, Calif. Aerothermochemistry Div.

THE ROLE OF PARTICULATE DAMPING IN THE CONTROL OF COMBUSTION INSTABILITY BY ALUMINUM COMBUSTION

Karl J. Kraeutle, H. B. Mathes, and Ronald L. Derr. *In* AGARD Solid Rocket Motor Technol. Jul. 1979. 14 p. refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

Methods used to minimize the risk of combustion instability in rocket motors by tailoring the oxide particle production are summarized. A brief discussion of particulate damping theory is given. Damping measurement with the T-burner and the procedure of damping calculation presently in use at the Naval Weapons Center are presented. The importance of particle size analysis for damping calculations is discussed. Particle size analysis methods are described which consider the peculiarities of combustion residues. Examples of size distributions and damping calculations are given. The results show that the theory adequately describes damping by aluminum oxide particles and that damping calculations supply information necessary for tailoring of aluminum oxide particle sizes toward increased damping. M.M.M.

N80-10297# Bayern-Chemie G.m.b.H., Aschau (West Germany).

GAS GENERATOR PROPELLANTS FOR AIR-TO-AIR MISSILES

R. A. H. Strecker and D. Linde. *In* AGARD Solid Rocket Motor Technol. Jul. 1979. 11 p. ref (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

NB 410-propellants, representative of gas generator propellants which are superior to propellants containing unstabilized ammonium nitrate are presented. These NB 410-propellants are especially suited for applications where systems are exposed to a large temperature range and frequent temperature cycling such as air-to-air missiles. M.M.M.

N80-10298# Naval Surface Weapons Center, White Oak, Md.

NEW BINDER SYSTEM FOR COMPOSITE SOLID PROPELLANTS

Carl Gotzmer and Nat Sexton (Naval Ordnance Station, Indian Head, Md.). *In* AGARD Solid Rocket Motor Technol. Jul. 1979. 12 p. (For primary document see N80-10281 01-20) (SF131332307)

Avail: NTIS HC A22/MF A01

A binder system for application to both castable and extrudable composite solid propellants as developed and tested for several motor sizes at typical service temperatures. The binder system consists of a low acrylonitrile type carboxy terminated polybutadiene acrylonitrile liquid copolymer which is crosslinked with di- and tri-epoxides. A dual epoxide crosslinking system is employed to permit broad adjustment of propellant modulus for various applications. This binder system provides propellants with relative insensitivity to atmospheric moisture during processing and a generous pot life. Propellant costs are fully competitive with those of carboxy or hydroxy terminated polybutadiene binder propellants. K.L.

N80-10299# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).

THE AGEING BEHAVIOUR OF SOLID ROCKET PROPELLANTS REGARDING THEIR MECHANICAL PROPERTIES

D. Schmidt. *In* AGARD Solid Rocket Motor Technol. Jul. 1979. 8 p. (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

Composite and double base rocket propellant samples were aged at elevated temperatures to determine the effects of aging on tensile strength and deformation properties. Results were extrapolated to service temperatures for double base propellants. In composite propellants aging resulted in a change of the viscoelastic properties which manifested itself like the embrittlement of a material: strength increased as deformation properties decreased. This change in mechanical properties decreased from the outside to the inside. Hence, particular attention must be given to surface aging. K.L.

N80-10300# Centre de Recherches du Bouchet, Vert de Petit (France).

IMPROVING THE ALL WEATHER BALLISTIC AND MECHANICAL PROPERTIES OF SMOKELESS PROPERGOLS [AMELIORATION DES PROPRIETES BALISTIQUES ET DES PROPRIETES MECANIQUES TOUS TEMPS DES PROPERGOLS SANS FUMEE]

A. Davenas. *In* AGARD Solid Rocket Motor Technol. Jul. 1979. 14 p. refs. In FRENCH (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

The effect of RDX and HMX as well as the effect of the ratio of energetic plasticizers and of reticulation on the thermodynamic, kinematic, and mechanical properties of cast double-base propellants was investigated. Results are compared with the properties of composite propellants with hydrocarbon and HMX binders. The present characteristics of the propellants and the desired improvements are described. Transl. by A.R.H.

N80-10301*# California Inst. of Tech., Pasadena.

SOME PROBLEMS OF NONLINEAR WAVES IN SOLID PROPELLANT ROCKET MOTORS

F. E. C. Culick. *In* AGARD Solid Rocket Motor Technol. Jul. 1979. 15 p. refs (For primary document see N80-10281 01-20) (Contract NAS7-100)

Avail: NTIS HC A22/MF A01

An approximate technique for analyzing nonlinear waves in solid propellant rocket motors is presented which inexpensively provides accurate results up to amplitudes of ten percent. The connection with linear stability analysis is shown. The method is extended to third order in the amplitude of wave motion in order to study nonlinear stability, or triggering. Application of the approximate method to the behavior of pulses is described. K.L.

N80-10302# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

RECENT ONERA STUDIES ON COMBUSTION INSTABILITIES IN SOLID PROPELLANT ROCKET MOTORS

Paul Kuentzman. *In* AGARD Solid Rocket Motor Technol. Jul. 1979. 24 p. refs. In FRENCH; ENGLISH summary (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

Experimental and numerical techniques to solve the problem created by combustion instabilities in solid propellant motors are reviewed. A study of the similarity of combustion instabilities carried out on large size engines with geometrically complex grain revealed some instabilities. In view of the poor agreement between the observed and predicted phenomena characteristics, it was proposed to conduct tests on a reduced scale. The main results obtained and the limitation of this method are presented. K.L.

N80-10303# Naval Weapons Center, China Lake, Calif. Aerothermochemistry Div.

APPLICATION OF COMBUSTION INSTABILITY RESEARCH TO SOLID PROPELLANT ROCKET MOTOR PROBLEMS

Ronald L. Derr, H. B. Mathes, and James E. Crump. *In* AGARD Solid Rocket Motor Technol. Jul. 1979. 12 p. refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

Experimental and analytical tools for minimizing the risk of combustion instability in solid rocket motors are reviewed and examples of practical application to motors are discussed. Both successful and unsuccessful examples are described for large and small rocket motors. Laboratory characterization of practice

damping associated with a metallized propellant and optimization of particle damping to eliminate pressure oscillations in a tactical solid rocket motor are discussed. In addition, prediction of motor behavior and comparison with motor firing results are presented for solid rocket motors used in the NASA Space Shuttle system. The practical state of the art of combustion instability technology is assessed. K.L.

N80-10304# Politecnico di Milano (Italy). Centro di Studio per Ricerche sulla Propulsione e sullaEnergetica.

SELF-SUSTAINED OSCILLATORY COMBUSTION OF SOLID ROCKET PROPELLANTS

L. DeLuca *In* AGARD Solid Rocket Motor Technol. Jul. 1979 14 p refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

Self-sustained oscillatory burning of solid rocket propellants is considered, within the framework of a thermal theory of heterogeneous combustion and for quasi-steady gas phase. A nonlinear burning stability analysis, carried out via an integral method, predicts the existence of three well defined static regimes: stationary, self-sustained oscillatory, and extinguished. The self-sustained oscillatory solution is related to large values of surface heat release; these values increase with pressure. The burning rate oscillations are of thermokinetic nature and feature characteristic spikes. The existence and the properties of these oscillations can be analytically predicted; they strictly depend on the operating conditions. Computer simulated runs show a very good agreement with the analytical expectations. Identical self-sustained oscillations were observed following different transients to the same final set of operating conditions. Frequencies, increasing with pressure, of the order of 100 Hz were found at pressures of the order of 10 atm; amplitudes were found to decrease with pressure. The same basic features can be observed for different flame models. R.E.S.

N80-10305# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

LOW FREQUENCY OSCILLATORY COMBUSTION: EXPERIMENTS AND RESULTS

H. F. R. Schoeyer *In* AGARD Solid Rocket Motor Technol. Jul. 1979 16 p refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

Combustion experiments were carried out with double base and composite propellants. There were noticeable differences between the oscillatory combustion of the double base and the composite propellant. Chuffing was frequently observed with the double base propellants, while dp/dt extinguishment was observed in the majority of cases of oscillatory combustion of the composite propellant. Both propellants displayed a relation between the frequency of the oscillations and the mean pressure. From the experiments, stability boundaries were estimated for both types of propellants. In addition, the imaginary part of the response function was estimated for the composite propellant. A computer program was developed and applied successfully for digital data reduction of the experimental results. R.E.S.

N80-10306# Defence Research Establishment Valcartier (Quebec). Centre de Recherches pour la Defense.

NONLINEAR COMBUSTION INSTABILITY IN SOLID PROPELLANT ROCKET MOTORS: INFLUENCE OF GEOMETRY AND PROPELLANT FORMULATION

P. M. Hughes and D. L. Smith *In* AGARD Solid Rocket Motor Technol. Jul. 1979 26 p refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

The characteristics of the longitudinal nonlinear (or steep-fronted shock) mode of instability were compared in a single size of motor for three different grain cross sections (cylindrical, star and slotted tubular) and three propellant formulations. The formulations were all based on a hydroxy-terminated polybutadiene binder, containing no aluminum and varying only in the level of burning rate catalyst and oxidizer distribution. It was found that the degree of instability decreased with increasing burning rate and was affected by the number of waves propagating. No correlation could be established between the strength of the unstable wave and either the formulation or grain cross section. A low level acoustic wave form was observed to transition naturally into a steep fronted, shock type waveform. The growth of the shock waveform was studied from initiation to steady state and it was found that the growth rate generally increased with decreasing propellant burning rate. The growth mechanism tended to be a complicated one in the earlier stages of a particular firing (before expending 50% of its propellant mass); however, it can generally be stated that a pulse will grow at a faster rate in the later stages of a firing. R.E.S.

N80-10307# Imperial Metal Industries Ltd., Kidderminster (England).

THE SUPPRESSION OF COMBUSTION INSTABILITY BY PARTICULATE DAMPING IN SMOKELESS SOLID PROPELLANT MOTORS

G. I. Evans and P. K. Smith *In* AGARD Solid Rocket Motor Technol. Jul. 1979 11 p refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

An approach to the practical resolution of the problem of acoustic combustion instability without sacrificing performance in smokeless rocket motors is described. Experimental work shows that small quantities of refractory powder are very successful in suppressing combustion instability but that a wider range of particle sizes than is theoretically predicted proves to be effective. Manipulation of the size density function was shown to be an effective means of achieving maximum combustion stability with minimum amounts of exhaust smoke. R.E.S.

N80-10308# Bayern-Chemie G.m.b.H., Ottobrunn (West Germany).

MATERIAL PROBLEMS IN JET VANE THRUST VECTOR CONTROL SYSTEMS

D. Kampa, A. Weib, and R. H. Schmucker *In* AGARD Solid Rocket Motor Technol. Jul. 1979 10 p refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

Five different refractory material types were studied using a highly aluminized HTPB composite propellant. Of these, pure and composite ceramics exhibited insufficient thermal shock resistance, pure carbon showed extreme ablation and erosion. Specifically selected graphite, covered with a tungsten layer and reinforced by a tip of this material, performed well, but the data available were not adequate for systems' use. The best results were obtained with pure tungsten vanes, covered with a layer of low thermal conductivity to maintain structural rigidity. Tests with low aluminum loading propellants showed less severe problems so that molybdenum was sufficient. The results were applied to an experimental thrust vector control system with a low primary smoke HTPB composite propellant. By proper vane shaping, heat shielding and surface coating, a functional system was attained. R.E.S.

N80-10309# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).

COMPOSITES IN FUTURE MOTOR HARDWARE: A RESEARCH VIEW

N. J. Parratt *In* AGARD Solid Rocket Motor Technol. Jul. 1979 10 p refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

The move from traditional materials to more recent concepts such as dual function composites and integrated construction in tactical motor design is traced. The question is then reviewed as to whether in fact the best use is being made of available materials, particularly in reducing weight and cost together. Suggestions as to how this might be done are then presented. It is concluded that particularly in the construction of motor cases, significant improvements can be made immediately with only minor changes in design, if supported by adequate measurement and prediction of any deterioration. R.E.S.

N80-10310# Societe Europeenne de Propulsion, Bordeaux (France).

PREDICTING THE BEHAVIOR OF PHENOLIC ABLATIVE MATERIALS [PREDICTION DU COMPORTEMENT DES MATERIAUX PHENOLIQUES ABLATIFS]

Claude Bonnet *In* AGARD Solid Rocket Motor Technol. Jul. 1979 16 p refs In FRENCH (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

Requirements for predicting the behavior of parts of a blast pipe made of phenolic materials throughout burn, the methods of fabricating composite materials and structures must be improved so that better reproductibility may be achieved. New analysis methods and computer programs must be used to reliably predict the mechanical and thermodynamic behavior of blast pipes under fire. The materials and temperatures under which they are used (ambient to 2500 C) must be characterized. Transl. by A.R.H.

N80-10311# Politecnico di Milano (Italy).

GAS PHASE VELOCITY MEASUREMENTS IN SOLID ROCKET PROPELLANTS BY LASER DOPPLER ANEMOMETRY

A. Coghe, L. DeLuca, G. L. Sensalari, and A. Volpi *In* AGARD Solid Rocket Motor Technol. Jul. 1979 14 p refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

A laser Doppler velocimetry (LDV) technique is described which performs velocity measurements in the gaseous region near the combustion surface of a burning solid rocket propellant. Several laser based optical techniques are examined which measure the condensed phase burning rate and the size of the particles carried away by the gas in the plume of the burning solid propellant. A steady state strand burner, with two symmetrical and opposite optical windows, developed for the LDV experiments, is described. The apparatus was applied to steady burning solid propellant. The application of the apparatus for unsteady situations is discussed. A.W.H.

N80-10312# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.

PRESSURE AND VELOCITY RESPONSE FUNCTION MEASUREMENTS BY THE ROTATING VALVE METHOD

R. S. Brown and R. C. Wawgh *In* AGARD Solid Rocket Motor Technol. Jul. 1979 17 p refs (For primary document see N80-10281 01-20)

(Contracts F04611-72-C-0007; F04611-74-74-C-0045; F49620-77-C-0048)

Avail: NTIS HC A22/MF A01

The rotating valve method which measures the pressure and velocity coupled response functions of solid propellants is discussed. The method which is based on producing pressure or velocity oscillations in a small combustion chamber by varying the area of one or two secondary exhaust nozzles in a periodic manner, is described. Analytical studies are described in which the relationship between the propellant combustion response characteristics and the dynamic chamber ballistics is developed. An experimental rotating valve apparatus was constructed and its performance compared with predictions under cold flow conditions. A.W.H.

N80-10313# Propellants, Explosives and Rocket Motor Establishment, Westcott (England).

ULTRASONIC IMAGING AS APPLIED TO NONDESTRUCTIVE TESTING OF ROCKET PROPELLANTS

D. S. Dean and D. T. Green *In* AGARD Solid State Rocket Motor Technol. Jul. 1979 13 p (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

An ultrasonic imaging technique, which is interface sensitive rather than dependent upon the amount of material missing, for nondestructive testing of rocket propellants is examined. A focused image obtained by holographic encoding or computational manipulation of the phase information of the ultrasonic field is used to determine defects in solid propellant charges. The holographic method, which uses parallel processing of information to produce a near real time image is described. The use of large scale integrated circuits and minicomputers in the imaging technique is evaluated. A.W.H.

N80-10314# Aerospace Corp., Los Angeles, Calif.

A GENERALIZED SOLID MOTOR DEVELOPMENT TEST APPROACH WITH APPLICATION TO IUS

Ernst Stampfl and D. H. May (Space and Missile Systems Organ., Los Angeles, Calif.) *In* AGARD Solid Rocket Motor Technol. Jul. 1979 14 p refs (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

The aspects of the inertial upper stage (IUS) solid motor propulsion test program are described, including the background and rationale leading to the baseline test approach that relies on overtesting. The background for the test approach is presented and a general description of IUS and its solid motors is given along with a delineation of system, motor, component, and material requirements. An overall perspective of the various test phases and their integration with each other and with the design requirements is given. Objectives, test approaches, and a summary of available results of the various test phases are discussed, including their correlation with requirements. Author

N80-10315# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.

THE USE OF STANDARDIZED TEST MOTORS AND LABORATORY TOOLS IN THE DEVELOPMENT OF MISSILE PROPULSION TECHNOLOGY

Richard R. Weiss *In* AGARD Solid Rocket Motor Technol. Jul. 1979 14 p (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

The development of standardized test motors and laboratory tools for the evaluation of solid rocket motor component capabilities and propellant behavior is discussed. The advantages and disadvantages offered by the use of standardized motors and laboratory tools are examined. The test motor families and combustion tools used at engine testing laboratories for missile propulsion technology development are reviewed. The rationale for their selection, design and use is provided along with a description of the devices themselves. A.W.H.

N80-10316# Propellants, Explosives and Rocket Motor Establishment, Westcott (England).

MEASUREMENT OF THRUST TRANSIENTS IN ROCKET MOTORS

D. S. Dean *In* AGARD Solid Rocket Motor Technol. Jul. 1979 12 p (For primary document see N80-10281 01-20)

Avail: NTIS HC A22/MF A01

Two systems for measuring the thrust transients in rocket motors are examined. Construction and calibration of the systems are described. The first system is designed to measure starting transients of large rocket motor if there is no significant change in the mass. The second system is designed for use with short burning time motors if the moving mass and its distance of free travel are kept within practical bounds. A.W.H.

N80-10034 Allerton Press, Inc., New York, N. Y.

ON STABILITY OF OPERATION OF LIQUID ROCKET ENGINE WITH TUBOPUMP ASSEMBLY (TPA)

F. D. Bairamov *In its* Soviet Aeron., v. 21, no. 4 1978 p 10-15 refs Transl. into ENGLISH from Izv. Vysshi. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 16-22 (For primary document see N80-10031 01-01)

Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N.Y. 10011; $45.00

N80-10087 Allerton Press, Inc., New York, N. Y.

WARMUP OF LRE CHAMBERS WITH REGENERATIVE COOLING

V. V. Orlov *In its* Soviet Aeron., v. 22, no. 1 1979 p 102-104 ref Transl. into ENGLISH from Izv. Vysshi. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 115-117 (For primary document see N80-10061 01-01)

Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N80-10317*# National Aeronautics and Space Administration, Washington, D. C.
THE SCATTER OF MECHANICAL VALUES OF CARBON FIBER COMPOSITES AND ITS CAUSES
S. Roth Sep. 1979 19 p Transl. into ENGLISH of Paper 78-186 (West Germany), 1978 20 p Presented at Symp. uber Ermudungsfestigkeit von Flugzeugen und Modernen Bauweisen, Darmstadt, West Germany, 22 Sep. 1978 Original language doc. announced as A79-20488 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Deutsche Gesellschaft fur Luft- und Raumfahrt, West Germany
(Contract NASw-3198)
(NASA-TM-75698) Avail: NTIS HC A02/MF A01 CSCL 11D

The scatter of experimental data obtained in an investigation of the parameters of structural components was investigated. Strength parameters which are determined by the resin or the adhesion between fiber and resin were included. The statistical characteristics of the mechanical parameters of carbon fiber composites, and the possibilities which exist to reduce this scatter were emphasized. It is found that quality control tests of fiber and resin are important for such a reduction. J.M.S

N80-10318*# Avco Systems Div., Wilmington, Mass.
IMPROVING THE STRESS RUPTURE AND CREEP OF SILICON NITRIDE Final Report
T. Vasilos, R. M. Cannon, Jr., and B. J. Wuensch 30 Mar. 1979 68 p refs
(Contract NAS3-20088)
(NASA-CR-159585) Avail: NTIS HC A04/MF A01 CSCL 11D

Yttria-stabilized zirconium oxide (Zyttrite) additions to purified silicon nitride markedly improved the high temperature strength, stress rupture and creep properties of hot pressed samples. Room temperature bend strengths, however, of four (4) compositions evaluated were each about one-third lower than the NC-132 silicon nitride composition. This difference decreased with increasing temperature until at 1200 C, there was reasonable equivalence between most of the zyttrite containing compositions and NC-132 in terms of short time bend strength measurements. At 1370 C, the 10 and 20 wt. % containing zyttrite compositions showed bend strengths as much as double the NC-132 material. Bend stress rupture results for 10 and 20 wt. % zyttrite containing compositions showed a strong stress sensitivity at the 176 MN/sq m (40 Kpsi) level above 1200 C. Creep in bending measurements showed that at 1370 C, zyttrite containing compositions exhibited creep rates that were about two orders of magnitude lower than NC-132 material samples. All compositions appeared to follow deformation kinetics related to a visco-elastic mechanism, i.e., glassy phase diffusional creep or grain boundary sliding. A.R.H.

N80-10319*# United Technologies Research Center, East Hartford, Conn.
DEVELOPMENT OF SILICON NITRIDE OF IMPROVED TOUGHNESS Final Report
J. J. Brennan 2 Oct. 1979 111 p refs
(Contract NAS3-21375)
(NASA-CR-159676; R79-914364-12) Avail: NTIS HC A06/MF A01 CSCL 11D

The application of reaction sintered Si2N4 energy absorbing surface layers to hot-pressed Si3N4 was investigated. The surface layer was formed by in-place nitridation of silicon powder. It was found that reaction sintered Si3N4 layers of 1 mm thickness, fabricated from either -100, +200, -200, or -325 mesh Si powder and nitrided in 96% N2/4% H2 so that approximately 20-25 vol % unnitrided Si remained in the layer, resulted in a sevenfold increase in ballistic impact resistance of a 0.64 cm thick hot-pressed SI3N4 substrate from RT 1370 C. Both NC-132 SI3N4, with MgO additive, and NCX-34 Si3N4, with Y2O3 additive, were evaluated as substrate material. The finer grain size -200 and -325 mesh nitrided Si layers were for their smoothness and relatively high density. It was found that nitriding in N2/H2 mixtures, rather than pure N2, resulted in a microstructure that did not substantially degrade the strength of the hot-pressed Si3N4 substrate. Thermal cycling tests on the RSSN/HPSN combinations from 200 C to 1370 C for 75 cycles in air did not degrade the impact resistance nor the interfacial bonding, although a large amount of internal silica formation occurred within the RSSN layer. Mach 0.8, 5 hr, hot gas erosion tests showed no surface recession of RSSN layers at 1200 C and slight surface recession at 1370 C. M.M.M.

N80-10320# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
ANALYSES OF PLATES CONSTRUCTED OF FIBRE-REINFORCED BIMODULUS COMPOSITE MATERIALS
J. N. Reddy and C. W. Bert Jun. 1979 20 p refs
(Contract N00014-78-C-0647)
(AD-A071377; OU-AMNE-79-8; TR-2) Avail: NTIS HC A02/MF A01 CSCL 11/4

To implement the structural application of the recently introduced fiber-governed symmetric compliance model for bimodulus composite materials, both classical closed-form and finite-element solutions are being developed. This paper summarizes the results obtained for deflection of single-layer orthotropic and two-layer, cross-ply plates of the following configurations and loadings: (1) Thin elliptic plates clamped on the boundary and subjected to uniform pressure. (2) Moderately thick rectangular plate freely supported on the boundary and subjected to sinusoidally distributed pressure. GRA

N80-10321# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
FINITE-ELEMENT ANALYSIS OF LAMINATED COMPOSITE-MATERIAL PLATES
J. N. Reddy Jun. 1979 39 p refs
(Contract N00014-78-C-0647)
(AD-A071390; OU-AMNE-79-9; TR-3) Avail: NTIS HC A03/MF A01 CSCL 11/4

A finite-element formulation of the equations governing the laminated anisotropic plate theory of Yang, Norris and Stavsky, is presented. The theory is a generalization of Mindlin's theory for isotropic plates to laminated anisotropic plates and includes shear deformation and rotary inertia effects. Finite-element solutions are presented for rectangular plates of antisymmetric angle-ply laminates having material properties that are typical of a highly anisotropic composite material. Two sets of material properties that are typical of advanced fiber-reinforced composites are used to show the parametric effects of plate aspect ratio, length-to-thickness ratio, number of layers, and lamination angle. The element is also employed to study the bending of laminated, anisotropic bimodulus material-plates. Results are presented for single-layer and two-layer cross-ply rectangular plates subjected to sinusoidal loading. The report also presents a C deg. finite element for the von Karman equations of thin elastic plates. GRA

N80-10322# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
RECENT RESEARCH IN COMPOSITE AND SANDWICH PLATE DYNAMICS Technical Report
Charles W. Bert Jul. 1979 13 p refs
(Contract N00014-78-C-0647)
(AD-A072277; OU-AMNE-79-11) Avail: NTIS HC A01/MF A01 CSCL 20/11

This paper is a survey of literature concerning dynamics of plate-type structural elements of either composite material or sandwich construction. Papers which appeared from late 1976 through early 1979 are reviewed. Special attention is given to anisotropic plates, laminated plates, thick and sandwich plates, and nonlinearities. Free vibration and various kinds of forced vibration are treated, as well as classical and finite-element methods of analysis. GRA

N80-10323# Brookhaven National Lab., Upton, N. Y.
IMPROVEMENT OF WEAR-RESISTANCE PROPERTIES OF NATURAL AGGREGATES BY MATERIALS IMPREGNATION
Ronald P. Webster and J. J. Fontana Sep. 1978 36 p Presented at the FCP Review Conf., College Park, Md., 3 Oct. 1978

(Contract EY-76-C-02-0016)
(BNL-25396; Conf-7810178-1) Avail: NTIS HC A03/MF A01

Impregnation materials and techniques were investigated to improve the wear resistance properties of natural aggregates, thereby making them acceptable for use in pavement surfacing systems. Test results obtained during this phase of the research program are discussed. DOE

N80-10324# National Technical Information Service, Springfield, Va.
METAL MATRIX COMPOSITES. VOLUME 2: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - 1977
Mona F. Smith Jul. 1979 258 p
(NTIS/PS-79/0680/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

Fabrication, casting, mechanical properties, and testing of metal matrix composites including eutectic, particulate, and whisker composites are included in this report of Federally-funded research. Studies on reinforcing materials, fatigue, failure, and structure are also reported. Most of this research is applied to aircraft and spacecraft components and superconducting machinery. This updated bibliography contains 250 abstracts, none of which are new entries to the previous edition. GRA

N80-10325# National Technical Information Service, Springfield, Va.
METAL MATRIX COMPOSITES, VOLUME 3: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - Jun. 1979
William E. Reed Jul. 1979 55 p Supersedes NTIS/PS-78/0684; NTIS/PS-77/0612; NTIS/PS-76/0513; NTIS/PS-75/422; COM-74-10831
(NTIS/PS-79/0681/1; NTIS/PS-78/0684; NTIS/PS-77/0612; NTIS/PS-76/0513; NTIS/PS-75/422; COM-74-1083) Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

Fabrication, casting, mechanical properties, and testing of metal matrix composites are covered along with eutectic, particulate, and whisker composites. Reinforcing materials, fatigue, failure, and structure are among the topics studied. This updated bibliography contains 57 abstracts of Federally-funded research, 39 of which are new entries to the previous edition. GRA

N80-10015 Allerton Press, Inc., New York, N. Y.
STATISTICAL OPTIMIZATION OF STRUCTURAL THERMAL PROTECTION MATERIAL THICKNESS
D. D. Nikozakov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 57-60 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 81-84 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10041# Allerton Press, Inc., New York, N. Y.
SELF-SIMILAR SOLUTIONS IN THE DESTRUCTION AND MELTING PROBLEM WITH ACCOUNT FOR ABRUPT DENSITY CHANGE
G. V. Druzhinin and V. G. Pavlov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 48-52 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 61-67 (For primary document see N80-10031 01-01)
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25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-10326 Houston Univ., Tex.
FISCHER-TROPSCH SYNTHESIS OVER NICKEL CATALYSTS Ph.D. Thesis
Georghios Agamemnonos Hadjigeorghiou 1979 330 p
Avail: Univ. Microfilms Order No. 7922436

The Fischer-Tropsch synthesis of hydrocarbons over nickel catalysts was studied. Highly active and selective catalysts were developed that operated at 100% conversion, with 70% selectivity to C2-C8 hydrocarbons. The selectivity at lower conversions is reported. Steady state multiplicity that occurs under typical reaction conditions is discussed and a reactor design that does not yield multiple steady states is described. The effect of catalyst and process variables, as well as the effect of promoters, were investigated for several hundred catalysts. A mechanism for the reaction is examined and the role of the various promoters, such as transition metals, rare earths, thoria, etc., and how they affect the mechanism is discussed. Dissert. Abstr.

N80-10327 Delaware Univ., Newark.
MULTIPLE STEADY STATES OF THE OXIDATION OF CARBON MONOXIDE ON A SUPPORTED PLATINUM CATALYST Ph.D. Thesis
Brent Alan Tennant 1979 227 p
Avail: Univ. Microfilms Order No. 7921829

The oxidation of carbon monoxide was investigated in nearly isothermal single pellet differential reactors. Two steady states were observed to occur over a carbon monoxide concentration domain as large as an order of magnitude, with a maximum rate difference of rate 100 times. This concentration domain and the difference in the rates for the two steady states increased when the temperature was lowered, when the platinum loading was decreased, or when the pellet thickness was decreased. The bimolecular Langmuir-Hinshelwood kinetics with intraparticle diffusion was unable to predict the above results. The data from four pellet reactors are consistent with a kinetics which is first order at low carbon monoxide concentrations and negative order at high carbon monoxide concentrations. The kinetics is postulated to have two different rates in the region of carbon monoxide concentrations between 0.0016 and 0.014 mole fraction at 200 C and 20 percent oxygen. Dissert. Abstr.

N80-10328 North Carolina State Univ. at Raleigh.
A TWO-DIMENSIONAL MODEL OF THE INTERACTION OF A TRANSVERSE JET IN A SUPERSONIC STREAM WITH APPLICATION TO SUPERSONIC COMBUSTION Ph.D. Thesis
Ruben Clayton Rogers 1979 116 p
Avail: Univ. Microfilms Order No. 7923066

The ability of the present model to approximate the elliptic flow in the transverse jet region is evaluated by comparison of the predictions from the numerical calculation with experimental data. These data were obtained for the mixing and reaction downstream of a transverse hydrogen jet in a supersonic reacting flow configuration representative of a supersonic combustor. The generally favorable agreement in the trend of these data and the theoretical predictions indicate that the present model can provide the needed computational tool for the analysis and design of supersonic combustors with transverse fuel injection. Dissert. Abstr.

N80-10329# Grumman Aerospace Corp., Bethpage, N.Y.
THE JET MEMBRANE PROCESS FOR URANIUM SEPARATION AND ENRICHMENT
John W. Brook and Vincent Calia Sep. 1979 145 p refs
(RE-586) Avail: NTIS HC A07/MF A01

Isotopic enrichment of both SF6 and UF6 was successfully achieved using a scheme in which the working or carrier fluid is a condensible vapor, which can be thermally, rather than mechanically, pumped. The energy supply can be waste heat or solar energy. The process gas (UF6) is introduced into a chamber in which a heavy condensible gas (the jet) flows. Due to preferential penetration of the UF6 into the jet, the lighter species (U-235)F6 is enriched relative to the heavy species (U-238)F6. The enriched UF6 is collected by a probe facing downstream in the jet and is passed to another unit for further enrichment or to a mass spectrometer for analysis. Laboratory experiments were conducted using a variety of gas combinations to investigate system parameters that were identified as major capital and energy cost drivers. A theoretical study aided in the analysis of data and in providing scaling laws. Cost analysis, based upon the measured

UF6 results and the supporting experiments, indicates that the jet membrane is a viable concept for enriching uranium industrially. A.R.H.

N80-10330*# Trenton State Coll., N. J.
ANALYTICAL MODELING OF FLASH-BACK PHENOMENA
C. C. Feng 1 Nov. 1979 17 p refs
(Grant NsG-3180)
(NASA-CR-162389) Avail: NTIS HC A02/MF A01 CSCL 21B

To understand the flame flash-back phenomena more extensively, an analytical model was formed and a numerical program was written and tested to solve the set of differential equations describing the model. Results show that under a given set of conditions flame propagates in the boundary layer on a flat plate when the free stream is at or below 1.8 m/s. J.M.S.

N80-10331# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
MEASUREMENTS OF ANOMALOUS DISPERSION OF HF IN ABSORPTION Interim Report
Rolf W. F. Gross, Richard A. Chodzko, Eugene B. Turner, and John G. Coffer 15 Jun. 1979 51 p refs
(Contract F0470-78-C-0079)
(AD-A071044; TR-0079(4764)-2; SAMSO-TR-79-44) Avail: NTIS HC A04/MF A01 CSCL 07/4

The quantitative measurement of the anomalous dispersion of the P1(6), P1(7), and P1(8) vibration-rotation transitions of hydrogen-fluoride (HF) in absorption are reported. The measurements were performed with a small, line-selectable HF laser equipped with a piezoelectrically frequency-scanned cavity that illuminated a Mach-Zehnder interferometer, one arm of which contained the HF absorption cell. The fringes produced by the interferometer and their dispersion-induced shift were observed directly with the help of a rotating mirror and an ir detector. This interferometer technique has an ultimate noise-limited sensitivity of 0.02 of a fringe spacing at 2.7 micron. Measurements also are given for the absorption coefficient at line center for the same three P1 lines of HF. Both dispersion and absorption measurements are for a pressure range of 0.05 to 10 Torr of pure HF at room temperature, so the absorption lines were Doppler broadened. The measured values for the absorption coefficient and the slope of the dispersion curve at line center and for the maximum excursion of the anomalous refractive index are in excellent agreement with calculated values for these quantities. GRA

N80-10332# Aerodyne Research, Inc., Bedford, Mass. Center for Chemical and Environmental Physics.
QUANTITATIVE SPECTROSCOPIC STUDIES OF BORON OXIDES AND FLUORIDES Final Report, 1 Apr. 1978 - 31 Mar. 1979
Michael E. Gersh and Charles E. Kolb May 1979 24 p refs
(Contract F49620-77-C-0075; AF Proj. 2303)
(AD-A070997; ARI-RR-164; AFOSR-79-0737TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The objective of this study is the measurement of the infrared absorption coefficients and absorption line spacings of several boron compounds in the gas phase over the temperature range of 300 to 1500 K. In particular, the species of interest are BF3, BF, OBF, BO2, and HBO2. In the past year, the following technical progress was made. The high temperature flow reactor was developed to the point where it ran reliably at temperatures up to 1500 K. The optical system was tested and operated at its design specifications. The flow reactor was interfaced to the molecular beam quadrupole mass spectrometer. A prototype discharge flow system for producing the IR active species of interest was tested. Finally, the absorption coefficients of the NU-3 band of BF3 have been measured from approximately 300 to 1500 K. GRA

N80-10333# Virginia Univ., Charlottesville Dept. of Chemistry.
LINKED AND MERCURY-BRIDGED NIDO-CARBORANES. HIGH YIELD SYNTHESIS OF MU, MU PRIME-[(CH3)2C2B4H5]2Hg, CONVERSION TO 5,5PRIME-[(CH3)2C2-B4H5]2, CLEAVAGE, AND OXIDATIVE ADDITION OF BENZENE. SYNTHESIS OF MU,MU PRIME-(B5H8)2Hg
Narayan S. Hosmane and Russell N. Grimes Jun. 1979 29 p refs Submitted for publication
(Contract N00014-75-C-0305; NR Proj. 053-569)
(AD-A070777; TR-29) Avail: NTIS HC A03/MF A01 CSCL 07/3

The nido-carborane anion (2,3-(CH3)2C2B4H5)(-) reacts readily with anhydrous HgCl2 in THF at room temperature, producing the bis(carboranyl) mercury(II) complex mu,mu'-((CH3)2C2B4H5)2Hg in which the metal is bound to two carborane ligands via B-Hg-B three-center, two-electron bridge bonds. On heating at 180 deg. in benzene, this compound quantitatively expels free mercury and forms the B-B linked nido-carborane 5,5'-((CH3)2C2B4H5)2 as a single pure isomer. Air oxidation of the linked carborane in benzene solution results in cleavage of the carborane-carborane B-B bond and oxidative addition of benzene to give 4-C6H5-2,3-(CH3)2C2B4H5, an apparently air-stable derivative of nido-2,3-C2B4H8. Similar treatment of the linked carborane in C6D6 gives the corresponding hexadeuterated carborane product. The reaction of B5H8 - ion with HgCl2 in THF produces mu,mu-(B5H8)2Hg, a stable solid in which mercury is evidently bridge-bonded to two pentaborane ligands. GRA

N80-10334# IBM Research Lab., Yorktown Heights, N. Y.
NONLINEAR SPECTROSCOPY Final Report, 1 Jan. 1972 - 31 Dec. 1977
Richard G. Brewer 7 Feb. 1978 671 p refs
(Contract N00014-72-C-0153)
(AD-A071282) Avail: NTIS HC A99/MF A01 CSCL 07/4

This research included the development of novel laser techniques which allow fundamental studies of atoms, molecules and solids, especially relaxation phenomena in the time domain. The stark and laser frequency switching techniques were examples which bring the coherence methods of pulsed NMR spin transients to the optical region. Decay time measurements on a millisecond to a picosecond timescale appeared feasible. GRA

N80-10335# Los Alamos Scientific Lab., N. Mex.
PHOTOIONIZATION MASS SPECTROMETRIC STUDIES OF SELECTED COMPOUNDS IN A MOLECULAR BEAM
Wayne Merle Trott (Sandia Labs.) Mar. 1979 240 p refs
(Contract W-7405-eng-36)
(LA-7727-T) Avail: NTIS HC A11/MF A01

Photoionization efficiency curves were measured at moderate to high resolution for several species produced in supersonic molecular beams of acetone, acetone-d6 and CS2. The molecular beam photoionization mass spectrometer which has been assembled for this work is described. The performance of this instrument was characterized by a number of experiments and calculations. DOE

N80-10336# Sandia Labs., Albuquerque, N. Mex. Surface Physics Div.
ELECTRONIC REDUCTION OF HIGH SPEED MASS SPECTRAL DATA
J. R. Lee Apr. 1979 19 p
(Contract EY-76-C-04-0789)
(SAND-79-0709) Avail: NTIS HC A02/MF A01

A window and peak height converter circuit was designed and built that extracts a single mass peak (or group of peaks) from a set of mass spectra repetitive in time and produces a time profile of that mass. The response time of the circuit is such that one has the capability of real-time operation and of operation on mass spectral data that was prerecorded on analog tape. The use of analog recording of data allows a great deal of flexibility in recording and playback speeds, and more importantly produces a permanent record of all information contained in the mass spectral data. DOE

N80-10337# Westgate Research Corp., Marina Del Rey, Calif.
INVESTIGATION INTO THE CHEMISTRY OF THE UV-OZONE PURIFICATION PROCESS Annual Report
Eriks Leitis Jan. 1979 137 p refs
(PB-296485/6; NSF/RA-790038) Avail: NTIS HC A07/MF A01 CSCL 07D

A study of the synergistic effect of ozone and UV light in the decomposition of organic compounds in water is described. Hypotheses were formulated from experiments on model organic

compounds in water solution involving ozonation with and without UV light and treatment with reagents which generate OH radicals. It was determined that ozonation and UV-ozonation of nitrobenzene, selected as a primary model compound, followed identical sequence of reactions via mono-,di-, and trihydroxylation of the benzene ring; the major stable intermediates were oxalic acid, formic acid, and glyoxal. For all oxidation systems and all model compounds, the kinetics were pseudo-first order. GRA

N80-10338# Rockwell International Corp., Creve Couer, Mo. Air Monitoring Center.
REGIONAL AIR POLLUTION STUDY. DICHOTOMOUS AEROSOL SAMPLING SYSTEM Final Report
E. Nelson Apr. 1979 50 p
(Contract EPA-68-02-2093)
(PB-297310/5; EPA-600/4-79-024) Avail: NTIS HC A04/MF A01 CSCL 14B

Ten of twenty-five stations making up the Regional Air Monitoring System (RAMS) in St. Louis were equipped with dichotomous samplers and high volume filter samplers for aerosol measurements. The dichotomous samplers were designed for automatic operation and were capable of collecting up to 36 samples in each of two size fractions before filter stacks must be changed. Sample were analyzed for determination of aerosol mass in each size fraction, as well as determination by X-ray fluorescence of the concentrations of the following elements: A, Si, P, C, K, Cr, Mn, Ga, Rb, Sr, Sn, Sb, Ba, Hg, S, Ca, Ti, V, Fe, Ni, Co, Zn, As, Se, Br, Cd, and Pb. GRA

N80-10013 Allerton Press, Inc., New York, N. Y.
ON THE FLAME STABILIZATION MECHANISM IN TWO-PHASE FUEL-AIR MIXTURE FLOW
B. G. Mingazov, V. A. Shchukin, A. V. Talantov, and I. N. Dyatlov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 48-52 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats Tekh. (USSR), v. 21, no. 3, 1978 68-74 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10017 Allerton Press, Inc., New York, N. Y.
ANALYSIS OF FLAME STABILIZATION CONDITIONS USING THE HOMOGENEOUS REACTOR MODEL
A. V. Talantov *In its* Soviet Aeron., Vol. 21, No. 3 1979 p 66-71 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 92-99 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10074 Allerton Press, Inc., New York, N. Y.
DYNAMICS OF DIESEL FUEL COMBUSTION IN TURBULENT FLOW
F. A. Khamidullin, A. F. Kuzin, O. V. Strogonov, Yu. V. Troitskii, and A. V. Talantov *In its* Soviet Aeron., v. 22, no. 1 1979 p 58-63 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 73-80 (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-10339 Texas Univ. at Arlington.
THE EFFECT OF POINT CONTACT SURFACE DAMAGE ON THE WORK HARDENING OF COPPER CRYSTALS Ph.D. Thesis
Harry Michael Siegel 1979 295 p
Avail: Univ. Microfilms Order No. 7922986

The effect of various combinations of multiple point contact surface damage and subsequent thermal processing on the flow stress curves of high purity copper single crystals was investigated. Two types of changes were produced in the flow stress curves of the crystals. Samples which received a 70 hour isothermal anneal following point contact surface damage of the (1(-1)1) faces displayed an average increase of 57% over the control samples in the extent of stage 1. It is proposed that this increase in the extent of stage 1 is caused by a depletion in the number of secondary sources. Samples which were damaged on their ((-3)(-2)1) faces and received little or no annealing possessed two linear segments in stage 2 in contrast to the single linear segment observed in the other samples. Dissert. Abstr.

N80-10340 Stanford Univ., Calif.
THE DEVELOPMENT OF ALUMINUM-ALUMINUM OXIDE ALLOYS BY MECHANICAL ALLOYING Ph.D. Thesis
Paul Sandford Gilman 1979 288 p
Avail: Univ. Microfilms Order No. 7917234

Two aspects of oxide dispersion metal processing were investigated: the production of a fine homogeneous aluminum oxide distribution in aluminum via mechanical alloying and the effects of deformation processing on the subsequent recrystallization and elongated grain formation in a model oxide dispersion strengthened metal, Al-1%Si. The development of Al-Al2O3 composite powders by mechanical alloying was studied by observing the microstructural, morphological, and chemical changes that occur in the constituent powders after mechanical alloying in a high speed mill. The strengths, ductilities, and electrical conductivities of vacuum hot pressed, mechanically alloyed Al-Al2O3 alloys with and without additional thermal mechanical processing were evaluated. Dissert. Abstr.

N80-10341 Engineering Sciences Data Unit, London (England).
FATIGUE CRACK PROPAGATION IN HIGH ALLOY AND CORROSION RESISTANT (STAINLESS) STEEL PLATE, BAR AND FORGINGS
1979 33 p Also Publ. as ISSN-0141-3996 and ISSN-0141-4089
(ESDU-79003; ISBN-0-85679-250-0; ISSN-0141-3996; ISSN-0141-4089) Copyright. For information on availabity of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC$578.50

The fatigue crack propagation rate in terms of linear elastic fracture mechanics is presented. The chemical composition and mechanical properties of the materials are given. ESDU

N80-10342 Rensselaer Polytechnic Inst., Troy, N. Y.
THE EFFECT OF ENVIRONMENTAL VARIABLES ON THE STRESS CORROSION CRACKING BEHAVIOR OF TYPE 304 STAINLESS STEEL IN HIGH TEMPERATURE WATER ENVIRONMENTS Ph.D. Thesis
Peter Louis Andresen 1979 185 p
Avail: Univ. Microfilms Order No. 7922223

The metallurgical condition, chloride ion concentration, dissolved oxygen concentration, and applied potential are the variables in the tests performed. No stress corrosion cracking was observed in any of the metallurgical conditions when tested in solution containing up to 1000 ppm chloride unless dissolved oxygen was introduced or applied potentials were impressed. Straining electrode experiments indicated that the repassivation rate increases with temperature. The influence of the passive film on pitting and cracking behavior is minimal at temperatures above 220 C, which correlates with a change in film structure from p-type to n-type conductivity. The latter structure has a higher anionic vacancy concentration and therefore, transport of chloride occurs more readily. Pitting and transgranular stress corrosion cracking results are interpreted based on the adsorption of a critical amount of chloride, and its effect on dissolution and localized lattice ductility. Dissert. Abstr.

N80-10343 Florida Univ., Gainesville.
THE RELATIONSHIPS OF THE PROCESS VARIABLES AND MATERIAL PROPERTIES ON CLAD-ROLLED METALS Ph.D. Thesis
Herbert Arthur Joseph Chin 1979 548 p
Avail: Univ. Microfilms Order No. 7921918

A fundamental study of sandwich rolling was conducted. Of principal concern were (1) the mechanics of the deformation process, (2) the development of preferred orientation, (3) the evolution of grain shape anisotropy, and (4) roll bonding of dissimilar metals. For the moderate friction conditions utilized,

the analytical models were poor predictors of the deformation process. This has been rationalized in terms of the inherent assumptions in those models. Roll bonding by multipass reduction was inferior to a single pass reduction of equal magnitude if the first pass is less than the critical reduction to initiate bonding, regardless of compact variables. Dissert. Abstr.

N80-10344*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF THE RESPONSE OF A THERMAL BARRIER COATING TO SODIUM AND VANADIUM DOPED COMBUSTION GASES
Robert A. Miller 1979 23 p refs Presented at 8th Midwest High Temperature Chemistry Conf., Milwaukee, Wis., 4-6 Jun. 1979 Sponsored in part by DOE
(Contract EF-77-A-01-2593)
(NASA-TM-79205; DOE/NASA/2593-79/7; E-090) Avail: NTIS HC A02/MF A01 CSCL 11F
Published data on the behavior of zirconia-based thermal barrier coatings exposed to combustion gases doped with sodium and vanadium were analyzed with respect to calculated condensate dew points and melting points. Coating temperatures, failure locations, and depths were reasonably well correlated. Author

N80-10345# Virginia Univ., Charlottesville. Dept. of Chemistry
NICKEL BORON HYBRID CLUSTERS: SYNTHESIS OF POLYHEDRAL NICKELABORANES AND NICKELACARBORANES FROM SMALL BORANE AND CARBORANE ANION. CRYSTAL STRUCTURE OF (ETA5-C5H5)4Ni4B4H4
James R. Bowser, Alan Bonny, J. Robert Pipal, and Russell N. Grimes Jun. 1979 47 p refs Submitted for publication
(Contract N00014-75-C-0305)
(AD-A070926; TR-30) Avail: NTIS HC A03/MF A01 CSCL 07/3
Insertion of two to four nickel atoms into polyborane cages has been accomplished by reactions of metal reagents with the B5H8(-) and (CH3)2C2B4H5(-) ions in tetrahydrofuran followed by air oxidation. Treatment of NaB5H8 with NiBr2 and NaC5H5 generates closo-1,6-(Eta 5-C5H5)2Ni2B8H8 and closo-1,7-(Eta 5-C5H5)2Ni2B10H10, and the reaction of NaB5H8 with (Eta 5-C5H5)2Ni and sodium amalgam gives closo-(Eta 5-C5H5) 4Ni4B4H4 and nido-(Eta 5-C5H5)4Ni4B5H5. Nickelocene and Na (CH3)2C2B4H5 yield closo-(Eta 5-C5H5)2Ni2(CH3)2C2B4H4 and nido-(Eta 5-C5H5)2Ni2(CH3)2C2B5H5. The new compounds were structurally characterized from their (11)B and (1)H pulse Fourier transform NMR, ir, and low-and-high-resolution mass spectra, and an X-ray crystal structure determination on (Eta 5-C5H5)4Ni4 B4H4. GRA

N80-10346# Wright State Univ., Dayton, Ohio. Dept. of Engineering
DETERMINATION OF CONSTITUTIVE EQUATIONS FOR HIGH STRENGTH ALUMINUM AND TITANIUM ALLOYS APPLICABLE TO SHEET METAL FORMABILITY Final Report, 23 Sep. 1977 - 23 Sep. 1978
Joseph F. Thomas, Jr. Apr. 1979 98 p refs Prepared in cooperation with Battelle Columbus Labs., Ohio
(Contracts F33615-77-C-5260; F33615-77-C-5059; Grant AF-AFOSR-3252-77; AF Proj. 2306)
(AD-A072121; AFML-TR-79-4042) Avail: NTIS HC A05/MF A01 CSCL 11/6
The formability of sheet metal can be investigated by the calculation of a forming limit curve (FLC) which gives the locus of principal strains beyond which failure is expected. For failure by plastic instability, the FLC depends upon material formability indices including the strain hardening coefficient and strain rate sensitivity. If a yield surface can be assumed, the material parameters needed to calculate the FLC can be obtained from uniaxial tensile data. This approach has been adopted to investigate the formability of certain high strength aerospace sheet alloys. GRA

N80-10347# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
THE DEVELOPMENT OF AMLGUARD, A CLEAR, WATER DISPLACING, CORROSION PREVENTIVE COMPOUND Final Report
Gabriel J. Pilla 11 May 1979 69 p refs
(AD-A071617; NADC-78220-60) Avail: NTIS HC A04/MF A01 CSCL 11/6
Previous corrosion control treatment used on exposed corrodible surfaces of naval aircraft required the application of two materials a water displacing, corrosion preventive compounds, MIL- C-81309 a brown, thin film material, followed by the application of corrosion preventive compound MIL- C-16173, Grade 4 a brown, tack material. This combination provided adequate corrosion protection, but deposited a rather unsightly brown, dirt attracting film. The need to develop a compound with water displacing, corrosion preventive properties resulting in the deposit of a clear, dry, flexible film was essential. The recently developed compound AMLGUARD, designed with the above characteristics, fulfilled these objectives and performed successfully during laboratory tests and fleet evaluations. Military Specification MIL- C-85054 as Titled, Corrosion Preventive Compound, Water Displacing, Clear AMLGUARD was issued 23 March 1977. National stock numbers, 8030-01-041-1596 and 8030-01-045-4780 have been issued for the 16 ounce aerosol containers and the one quart bulk containers, respectively. GRA

N80-10348# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
QUASI-STATIC CRACK GROWTH IN METALS AT ELEVATED TEMPERATURE, A REVIEW Final Report, Jun. 1977 - Sep. 1978
L. S. Fu Mar. 1979 55 p refs
(AF Proj. 2307)
(AD-A072347; AFML-TR-78-136) Avail: NTIS HC A04/MF A01 CSCL 20/11
The literature on fatigue and sustained load crack growth in metals at elevated temperature is examined within the framework of fracture mechanics. Fatigue crack growth (FCG) rates are found to be frequency dependent. A transition from transgranular to intergranular failure modes is noted as frequency decreases. The time-dependent effect on FCG rates comes from oxidation damage and creep crack growth. In extrapolating the low-cycle fatigue laboratory test data to service conditions, the interaction with creep and oxidation can drastically modify the predicted behavior. Quasi-static crack growth is observed at elevated temperature at stress intensity levels well below the materials fracture toughness. Empirical results and theoretical models for prediction of initiation and growth of cracks are critically reviewed. Results are not conclusive as to which fracture parameter should be used for prediction. Guidelines are given for further studies in this area. GRA

N80-10349# Army Construction Engineering Research Lab., Champaign, Ill.
FRACTURE CHARACTERISTICS OF STRUCTURAL STEELS, REFERENCE MANUAL Final Report
J. Aleszka, Y. Kim, J. Scott, and A. Kumar Apr. 1979 325 p refs
(AD-A072054; CERL-TR-M-258) Avail: NTIS HC A14/MF A01 CSCL 11/6
This report presents the findings of a scanning electron microscope (SEM) study of tensile, fatigue, and impact fracture characteristics of structural steels used in Army Corps of Engineers facilities and components. Steels investigated were ASTM A-36, ASTM A-514 AX-110 weld, HY-130, ASTM A-588, ASTM A-242, AISI 416, 17-4 PH, ASTM A-516, and ASTM A-607. Specimens were tested in as-received, hydrogen-embrittled, and temper-embrittled conditions. The failure mode of embrittled and unembrittled AX-110 weldments containing induced weld defects was also studied. The information contained in this reference manual will provide a basis for comparison of fracture characteristics to determine the mode of failure in analysis of components failure. Four examples of inservice failures in which the SEM provided valuable information are also presented. GRA

N80-10350# Florida Atlantic Univ., Boca Raton. Dept. of Ocean Engineering
FATIGUE AND CORROSION FATIGUE OF HY-80 STEEL, AS APPLICABLE TO ANCHOR BOLT FAILURES Final Report
W. H. Hartt and J. J. Adamson 7 Jul. 1979 28 p refs

(Contract N00014-78-C-0307)
(AD-A072067) Avail: NTIS HC A03/MF A01 CSCL 11/6

The fatigue crack growth rate behavior of compact tension specimens of HY-80 steel have been determined for low stress intensity ranges. Tests were performed in laboratory air and sea water, both freely corroding and cathodically polarized to -0.85 volts (cu-CuSO4), and at stress ratios, R, of 0.1 and 0.8. For the lowest stress intensity ranges investigated apparent thresholds for tests in air were less than in sea water at both stress ratios. Comparison of the present results with those upon other steels of various strength levels suggests that improved fatigue crack growth resistance should result from selection of HY-80 for low stress intensity range, high mean stress intensity applications. GRA

N80-10351# Sandia Labs., Albuquerque, N. Mex.
STRESSES IN SPUTTER DEPOSITED NICKEL AND COPPER OXIDE THIN FILMS
P. V. Plunkett, R. M. Johnson (Univ. of Tex. at Arlington), and C. D. Wiseman (Univ. of Tex. at Arlington) 1979 13 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 23 Apr. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0045C; Conf-790442-2) Avail: NTIS HC A02/MF A01

The total induced stresses were determined in thin film deposited on copper substrates by sputtering. For nickel films, the stresses were determined as a function of film thickness and initial substrated temperature. For copper oxide films, stresses were determined as a function of film thickness and oxygen partial pressure during the deposition cycle. Nickel films exhibited tensile stresses in all cases; however, stresses decreased by 50% for initial substrate temperatures of 673 K compared to deposition at ambient temperatures. Copper oxide films could readily be produced in tension or compression depending on the amount of oxygen present during deposition. Both nickel and copper oxide films approached constant stress values for films thicker than approximately 0.7 micrometers. DOE

N80-10352# McElroy (Ralph) Co., Austin, Tex.
ELECTROCHEMICAL COPPER COATINGS FOR SURFACE FINISHING OF hf RESONATORS
W. D. Weiss 1979 23 p Transl. into ENGLISH of German report, "Galvanische kupferschichten zur oberlachenveredelung con hf-resonatoren" Prepared for Los Alamos Scientific Lab.
(Contract W-7405-eng-36)
(LA-TR-79-10) Avail: NTIS HC A02/MF A01

The finishing of the resonators for the UNILAC will take place in bright copper plating baths. The following demands are made of the copper coatings: (1) low surface roughness; (2) homogeneous layer (no pits or pores); (3) good conductivity (high frequency conductivity); (4) low outgas rate; (5) good adhesion; (6) uniform coating thickness distribution. The properties of the coatings which are produced from acid bright copper plating baths as a rule fulfill conditions 1, 2, 4, and 6. Because there was strong scatter in the conductivities of coatings which were deposited in baths from different producers, an attempt was made to explain the causes of this scatter through systematic bath investigations and to prepare baths from which coatings with the highest possible conductivity could be produced. DOE

N80-10353# Argonne National Lab., Ill.
MODULATED STRUCTURES IN INORGANIC ONE-DIMENSIONAL METALS
Jack M. Williams and A. J. Schultz 1979 8 p refs Presented at Intern. Conf. on Modulated Structures, Kailua-Kona, Hawaii, 22 Mar. 1979
(Contract W-31-109-eng-38)
(CONF-790341-7) Avail: NTIS HC A02/MF A01

The formation and nature of modulated structures in one-dimensional inorganic metals are discussed. Partially oxidized tetracyanoplatinate and bisoxalatoplatinate complexes comprise a class of inorganic materials known for their highly one-dimensional (1-D) electrical conductivity. Their crystal structures derive basically from linear, or nearly linear, stacks of square planar [Pt(CN)4]/sup -x/ or [Pt(C2O4)]/sup -y/ groups (x = 1.6 to 1.75, y = 1.60 to 1.65) in which overlapping Pt d/sub z/2 orbitals form a 1-D metallic band. In all cases, a characteristic feature of these 1-D metals is the existence of a modulated structure. This structural feature derives from a modulation of the average atomic positions which arises from electron-phonon coupling, and the study of this phenomena provides important insight into the underlying conduction band properties of the material. DOE

N80-10354# Oak Ridge National Lab., Tenn.
DUCTILITY IN BENDING OF MOLYBDENUM ALLOYS IRRADIATED BETWEEN 425 AND 1000C
B. L. Cox and F. W. Wiffen 1979 15 p Presented at 1st Topical Meeting on Fusion Reactor Materials, Miami Beach, Fla., 29 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790125-53) Avail: NTIS HC A02/MF A01

Molybdenum and the alloys Mo-0.5% Ti and TZM were irradiated at four temperatures between 425 and 1000 C, to a displacement level of 11 dpa at a fluence of 2.5 x 10 to the 26th power n m/2 (>0.1 MeV). Vacuum bend tests at elevated temperatures showed the ductile-to-brittle transition temperature (DBTT) to be above room temperature for all irradiation temperatures. Irradiation at 585 C produced the highest DBTT, 550 to 700 C. Differences among the three materials were minor. DOE

N80-10355# Oak Ridge National Lab., Tenn.
TENSILE PROPERTIES OF TYPE 316 STAINLESS STEEL IRRADIATED IN A SIMULATED FUSION REACTOR ENVIRONMENT
M. L. Grossbeck and P. J. Maziasz 1979 5 p refs Presented at the 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790125-50) Avail: NTIS HC A02/MF A01

Tensile and fracture properties of type 316 stainless steel in neutron fluences producing 16 dpa and 1000 at. ppM He resulting from irradiation in the High Flux Isotope Reactor. Tensile elongations remained above 6% at 350 and 450 C and 4% at 575 C. Fracture behavior has been examined in the 20% cold-worked material. At 350 C the fracture mode is unchanged by irradiation and is characterized by ductile tearing. At 450 C irradiation causes the fracture mode to change from ductile tearing to crystallographic fracture which may occur along the slip bands introduced by the cold working. At 575 C the fracture is changed from ductile transgranular to intergranular. The tensile properties observed are believed to be adequate for fusion reactor service within the values of damage parameters investigated. DOE

N80-10356# Brookhaven National Lab., Upton, N. Y.
HYDROGEN DIFFUSION AND TRAPPING IN bcc AND fcc METALS
D. Richter 1979 13 p refs
(Contract EY-76-C-02-0016)
(BNL-26132) Avail: NTIS HC A02/MF A01

Representative fcc and bcc metals for dilute H-solutions are surveyed. The nature of the elementary step in H-diffusion is described. Here the temperature and isotope dependence of the H-diffusion coefficient gives hints to the mechanism involved. The experimental results are discussed in terms of semiclassical and quantum mechanical diffusion theories. DOE

N80-10357# Oak Ridge National Lab., Tenn.
CREEP BEHAVIOR OF HASTELLOY X, 21/4 Cr-1 Mo STEEL, AND OTHER ALLOYS IN SIMULATED HTGR HELIUM
H. E. McCoy, Jr. Jun. 1979 58 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6822) Avail: NTIS HC A04/MF A01

Creep tests on several materials both in environments of air and in helium containing small amounts of H2, CH4, CO and H2O are reported. Tests have been run on Hastelloy X at 650 to 870 C for times to 20,000 h, and although it does carburize in helium, its creep properties are very similar in both environments. Tests have been run on 2 1/4 Cr-1 Mo steel at 482 to 650 C for times to 20,000 h, and its creep strength is less in helium than in air, likely because of the decarburization that occurs in helium. Limited creep tests have been run on 9 Cr-1 Mo steel, alloy 800H, Hastelloy S, and alloy 617. The results show no large environmental creep effects but are insufficient

to conclude that such effects do not exist. A test sample of Ni-7% Cr-12% Mo-4% Fe-2% Ti completely resisted carburization under conditions where Hastelloy X increased in carbon content from 0.0993 to 0.436%. Most of the creep tests described in this report are continuing. Samples of Hastelloy X and alloy 617 for subsequent testing are aging; one set has accumulated 17,000 h in air, and one set has accumulated 7000 h in helium. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-10358* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
COMPOUND OXIDIZED STYRYLPHOSPHINE Patent
Kazimiera J. L. Paciorek, inventor (to NASA) (Ultrasystems, Inc., Irvine, Calif.) Issued 18 Sep. 1979 13 p Filed 19 May 1978 Supersedes N78-25216 (16 - 16, p 2093) Division of US-Patent-Appl-SN-706424, Filed 19 Jul. 1976, US-Patent-4,092,466; sponsored by NASA
(NASA-Case-MSC-14903-2; US-Patent-4,168,287; US-Patent-Appl-SN-907435; US-Patent-Class-260-926; US-Patent-Appl-SN-706424; US-Patent-4,092,466) Avail: US Patent and Trademark Office CSCL 07C

A process is described for preparing flame resistant, nontoxic vinyl polymers which contain phosphazene groups and which do not emit any toxic or corrosive products when they are oxidatively degraded. Homopolymers, copolymers, and terpolymers of a styrene based monomer are prepared by polymerizing at least one oxidized styrylphosphine monomer from a group of organic azides, or by polymerizing p-diphenylphosphinestyrene and then oxidizing that monomer with an organoazide from the group of (C6H5)2P(O)N3, (C6H5O)2P(O)N3, (C6H5)2C3N3(N3), and C6H5C3N3(N3)2. Copolymers can also be prepared by copolymerizing styrene with at least one oxidized styrylphosphine monomer. Official Gazette of the U.S. Patent and Trademark Office

N80-10359 Rochester Univ., N. Y.
CREEP AND RECOVERY OF AMORPHOUS POLYMERS Ph.D. Thesis
Randy Wu Tung 1979 176 p
Avail: Univ. Microfilms Order No. 7922968

Creep and recovery phenomena of amorphous polymers are investigated. A correlation between the two phenomena from the viewpoint of thermally activated rate processes is examined. The temperature change method was employed to obtain the temperature dependence of creep rate. The creep behavior for polycarbonate was studied in the temperature range of 323 to 420 K and stress range of 4 to 45 MN/sq m. The activation enthalpy for the creep process was in the range of 40 to 180 Kcal/mole. The temperature and stress ranges under which creep was studied for PMMA was 303 to 378 K and 2 to 35 MN/sq m respectively. Values ranging from 27 to 108 Kcal/mole were obtained for the activation enthalpies. Dissert. Abstr.

N80-10360 Washington State Univ., Pullman.
ELECTROPOLYMERIZATION IN STATIONARY CELLS AND IN PACKED AND FLUIDIZED BED ELECTRODE CELLS Ph.D. Thesis
Edward Fon San Teng 1979 165 p
Avail: Univ. Microfilms Order No. 7923517

Metal surfaces were polymer coated through electropolymerization in stationary and fluidized bed electrode cells. The polymer yield was a function of current density, time, monomer concentration, electrode material, electrolyte, and fluidization condition. In the stationary cell, the rate of polymerization based on a free radical mechanism was a function of monomer concentration and an initiation efficiency parameter dependent on the hydrogen overvoltage of the cathode material. It was postulated that the depostion rate was initially controlled by chemical reaction and that subsequently, both pore diffusion and chemical reaction were controlling steps. In the fluidized bed, both chemical reaction and mass transfer seemed to control the amount of polymer formed at low flow rates, while only chemical reaction was controlling at high flow rates. Dissert. Abstr.

N80-10361*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MOLTEN SALT PYROLYSIS OF LATEX Patent Application
Albert J. Bauman, inventor (to NASA) (JPL) Filed 27 Apr. 1978 11 p Sponsored by NASA
(NASA-Case-NPO-14315-1; US-Patent-Appl-SN-900659) Avail: NTIS HC A02/MF A01 CSCL 07C

The production of synthetic hydrocarbon liquid fuel from latex rich plants is reported. The pyrolysis of high isoprene latex plants such as Guayule, or extracts thereof, in a molten inorganic salt at temperatures above 300 C is described. The pyrolysis process is examined using a number of inorganic salts and a reactor is described for the hydrogen fuel production. A.W.H.

N80-10362# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
THE RELATIONSHIP BETWEEN EXCITATION INTENSITY AND PHOTOCHROMIC GLASS KINETICS
Herbert D. Kivlighn and Richard Delasi Sep. 1979 20 p refs (PM-692) Avail: NTIS HC A02/MF A01

Two model photochromic glasses were prepared. Each glass contains silver chloride as the photolytic species, but one of the compositions also contains copper as a catalyst. The response of these glasses to excitation levels up to 108 mw/squared cm in the 0.3-0.4 micrometer band was investigated. The effect of glass heat treatment and excitation intensity on the steady state degree of darkening and on the darkening and fading rates are described. Author

N80-10363# Princeton Univ., N. J. Dept. of Chemical Engineering.
INVESTIGATION OF THE T SUB LL (>T SUB G) RELAXATION OF HOMOPOLYMERS AND BLOCK COPOLYMERS OF STYRENE BY TORSIONAL BRAID ANALYSIS Progress Report, Jun. 1977 - Jun. 1979
J. K. Gillham Jul. 1979 36 p
(Contract N00014-76-C-0200; NR Proj. 356-504)
(AD-A072075; TR-17) Avail: NTIS HC A03/MF A01 CSCL 07/4

Investigation of the T (II) (= T(g)) relaxation in amorphous polymers of styrene by the technique of torsional braid analysis is reviewed. For the most part the relaxation behaves like the glass transition in its dependence on molecular weight, on average molecular weight in binary polystyrene blends, and on composition in a polystyrene homogeneously plasticized throughout the range of composition. Diblock and triblock copolymers also display a T = T(g) relaxation above the T(g) of the polystyrene phase. Unlike the glass transition, the T(II) relaxation appears to depend on the nature of the substrate. Two results in particular suggest that the T(II) relaxation is molecularly based. (1) The T(II) temperature is determined by the number average molecular weight for binary blends of polystyrene when both components have molecular weights below M(c) (the critical molecular weight for chain entanglements). (2) Homopolymers, and diblock and triblock copolymers of styrene, have a T = T(g) relaxation at approximately the same temperature when the molecular weight of the styrene block is equal to that of the homopolymer. GRA

N80-10364# Illinois Univ. at Urbana-Champaign. Dept. of Chemistry.
PREPARATION AND CHARACTERIZATION OF POLYMER-BOUND POLYDENTATE AMINES Interim Report
Russell S. Drago and John H. Gaul 10 Jul. 1979 9 p refs Submitted for publication
(Contract N00014-78-C-0245)
(AD-A071150; ONR-TR-2) Avail: NTIS HC A02/MF A01 CSCL 07/3

Synthetic procedures for attaching multidentate amines to organic polymers are described. These materials form the basis for the preparation of wide variety of macrocyclic and chelating ligands that can be covalently attached to polymers. The reaction to produce Schiff base chelates is described and a series of covalently attached metal complexes prepared and identified.

These systems have potential as catalysts for organic oxidations.
GRA

N80-10365# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
THERMOGRAVIMETRIC ANALYSIS OF POLYMERS IN AIR Final Report, Nov. 1977 - Feb. 1978
Gerhard F. L. Ehlers and Edward J. Solodki Aug. 1978 116 p (AF Proj. 2419)
(AD-A070669; AFML-TR-78-64) Avail: NTIS HC A06/MF A01 CSCL 07/3

This report is concerned with the weight loss curves of 107 polymers, representative of a wide range of systems such as aliphatic, fluoroaliphatic, aromatic, heterocyclic and semiorganic, are presented. The data have been obtained in a DuPont 951 Thermogravimetric Analyzer in air at a heating rate of 20 deg. C/min.
GRA

N80-10366# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
FLAMMABILITY AND THERMAL STABILITY OF POLYPHOSPHAZENES COPOLYMERS, PART 1 Interim Report
S. V. Peddada and J. H. Magill 19 Jul. 1979 41 p refs
(AD-A072114; SETES-MME-79-39; TR-2) Avail: NTIS HC A03/MF A01 CSCL 07/3

Flame spread and thermal stability measurements have been made on filled and unfilled poly(fluoroalkoxyphosphazenes) (PNF sheet) and poly(aryloxyphosphazene) (APN sheet and foam materials). The PNF samples were also filled with silica or carbon black and the APN with aluminum trihydrate. Burn velocity measurements were made under steady state conditions in a vertically downward burning mode at different oxygen/nitrogen concentrations. The effect of sample thickness on burn rate was also studied for the foam specimens. Relative smoke density measurements were made using a photocell assembly, and limiting oxygen index (L.O.I) determinations were carried out in accordance with standard ASTM procedures. Thermal stabilities were measured in air and nitrogen using a Perkin Elmer TGS-2 apparatus at heating rates varying from 2.5 to 80 C min. A temperature span of 50 to 650 C was covered in both thermogravimetric and differential thermogravimetric measurements. Activation energies for degradation were determined from these data. The effect of fillers on thermal stability and flammability characteristics were determined. Glass transition temperature were also measured as an aid to polymer characterization.
GRA

N80-10367# Union Carbide Corp., Tarrytown, N.Y. Chemicals and Plastics Div.
FLUORODINITRO SILICON COMPOUNDS AND HIGH ENERGY ELASTOMERIC POLYMERS Final Report, 1 Apr. 1975 - 30 Apr. 1979
Robert S. Neale 31 May 1979 154 p
(Contract N00014-75-C-0791)
(AD-A072559) Avail: NTIS HC A08/MF A01 CSCL 19/1

High energy (HE) orgnosilane esters were prepared from 2, 2, 2-fluorodinitroethanol (ROH) and chlorosilanes in 85-90% yields. Physical property, shock sensitivity, and multinuclear NMR data are reported for the monomeric silanes (RO)(x)SiMe(4-x)(X = 2-4) and the disiloxane Me(RO)2SiOSi(OR) 2Me, along with calculated heat contents and detonation properties. A general hydrolytic sensitivity was observed which increased regularly with the number of RO- groups per Si. Overall, the physical and thermochemical properties of the trisester (RO)3SiMe most closely resembled those of the reference plasticizer FEFO, except for a desirably higher bp. Aminoalkyl (methyl) polysiloxane homopolymers were prepared by hydrolysis of the dialkoxysilanes (R(1)O) 2MeSi-Z-NH2, with R(1) = Et or Me and Z = CH2, (CH2)3, (CH2)3NHCH2CH2, or (CH2)4, and analyzed by Si29 NMR. The products could be varied to contain up to approx. 85% linear siloxy units, with the balance as mainly 4 and 5 unit cycles.
GRA

N80-10368# Queen Mary Coll., London (England).
FRACTURE MECHANICS OF INELASTIC POLYMERS Final Technical Report, 11 Apr. 1975 - 1 Oct. 1978
E. H. Andrews Apr. 1979 20 p refs
(Grant DA-ERO-75-G-049)
(AD-A072615) Avail: NTIS HC A02/MF A01 CSCL 11/9

The author's Generalized Theory of Fracture Mechanics has been applied to several quite different polymeric materials which have in common a nonlinear and inelastic deformation behavior. Thus, the normal Linear Elastic Fracture Mechanics cannot be applied. When applied to experimental data the theory provides a unique characterization of fracture resistance and also sheds light on the molecular or microscopic fracture mechanisms of the material concerned.
GRA

N80-10369# General Electric Co., Schenectady, N. Y.
INVESTIGATION OF MICROTUBULAR CERAMIC STRUCTURES Final Report, 1 Jul. 1976 - Jan. 1978
Robert L. Fulman Feb. 1979 96 p refs
(Contract N00014-76-C-1047)
(AD-A072144; SRD-79-018) Avail: NTIS HC A05/MF A01 CSCL 11/2

Calculations and experiments were conducted to explore the feasibility of producing very compact high-temperature heat exchangers via microtubular ceramic structures. Such microtubular ceramic structures consist of multiple interconnected ceramic tubes with very thin walls, small diameters, and modest ratios of length to diameter. As a result, they should have reasonable strength, as well as very high specific area. The investigation included: calculations of expected volume requirements and heat-exchange performance for microtubular ceramic heat exchangers compared to one of conventional dimensions; experiments seeking to define means for preparing leak-tight microtubular ceramic structures; preliminary exploration of means to provide separate manifolds to the interior and exterior of the microtubes; and a leak test of one experimental manifold microtubular ceramic structure.
GRA

N80-10370# Sandia Labs., Albuquerque, N. Mex.
MORPHOLOGY OF RUBBER MODIFIED EPOXY ENCAPSULANTS
J. A. Sayre 1979 12 p refs Presented at US/UK Symp. on Neutron Generators, Albuquerque, N. M., 21 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-0158C; Conf-790518-5) Avail: NTIS HC A02/MF A01

Examination of rubber modified epoxy, cured with diethanol amine, via the transmission electron microscope has shown that a broad distribution of rubber particle sizes exists. The average particle size for particles greater than .1 um was found to be .8 um. A significant population of particles was found whose diameters are less than .1 um. Examination of the particle interface showed that the interface between the dispersed phase and the epoxy matrix was sharp within the accuracy of the method used. The morphology observed was compared against morphologies which have been purported to result in toughening via shear banding and crazing. It was found that the observed particle size distribution did not preclude toughening by these mechanisms.
DOE

N80-10371# National Bureau of Standards, Washington, D. C. Structures and Materials Div.
STUDIES ON THE PHOTODEGRADATION OF POLY (METHYL METHACRYLATE) Final Report
Mohamed Abouelezz and P. F. Waters Jun. 1979 53 p refs
Prepared in cooperation with American Univ., Washington, D. C.
(PB-297793/2; NBSIR-79-1766) Avail: NTIS HC A04/MF A01 CSCL 11I

The effect of the radiation from the upper part of the ultraviolet, UV, and the visible regions on poly methyl methacrylate (PMMA) was studied. The mechanism(s) of degradation induced by the radiation were identified. Thin films of PMMA were irradiated in air with upper UV, upper UV-visible, upper UV-visible-near infrared and 436 and 546 nm radiation. Exposure to either the upper UV or visible radiation caused degradation of the polymer. The data show that both random scission and unzipping of the polymer chain are operative in the degradation. Unzipping becomes increasingly important with incident radiation of increasing wavelength.
GRA

N80-10372# National Bureau of Standards, Washington, D. C. Polymer Science and Standards Div.
MODELS FOR THE MIGRATION OF PARAFFINIC ADDI-

TIVES IN POLYETHYLENE Annual Report, 1 Oct. 1977 - 30 Sep. 1978
L. E. Smith, I. C. Sanchez, S. S. Chang, and F. L. McCrackin. Jan. 1979. 102 p. refs. Sponsored in part by Food and Drug Administration.
(PB-297671/0; NBSIR-79-1598) Avail: NTIS. HC A06/MF A01. CSCL 11I.

Using a modified equation of state approach, models were developed for estimating the equilibrium partitioning of a diffusant in a polymer at a temperature above its glass transition in contact with a finite volume of solvent. Some possible new approaches to a diffusion theory based on volume fluctuations were outlined. Model calculations using diffusion equations were made for the extraction of additives from polymers with concomitant solvent absorption and for finding a constant extraction temperature equivalent to migration under varying temperature conditions. The migration of an oligomer, 14C-labeled octadecane, from high density linear polyethylene into various solvents at different temperatures was measured in order to elucidate the effects of thickness, temperature, concentration, and solvent. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling, and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N80-10373 Colorado Univ. at Boulder
TRANSIENT PHENOMENA IN THERMAL EXPLOSION OF CONFINED GASES. Ph.D. Thesis
Justin Harold Poland. 1979. 205 p.
Avail: Univ. Microfilms. Order No. 7923273.

The thermal explosion of a combustible mixture of gases in a vessel is treated first as a transient heat conduction problem and second as a gasdynamics problem. Both the transient heat conduction problem and the gasdynamic problem are found to have the same basic three stage pattern of development. Perturbation methods are used to simplify the full field equations and to isolate the dominant physical phenomena at each stage in the development of the explosion. Approximate analytical solutions to the resulting equations are obtained wherever possible, and numerical solutions are obtained otherwise. Dissert. Abstr.

N80-10374* National Aeronautics and Space Administration. Pasadena Office, Calif.
START UP SYSTEM FOR HYDROGEN GENERATOR USED WITH AN INTERNAL COMBUSTION ENGINE. Patent
John Houseman (JPL) and Donald J. Cerini, inventors (to NASA) (JPL). Issued 5 Jul. 1977. 13 p. Filed 22 Mar. 1976. Sponsored by NASA.
(NASA-Case-NPO-13849-1; NASA-Case-NPO-13907-1; US-Patent-4,033,133; US-Patent-Appl-SN-668783; US-Patent-Class-60-606; US-Patent-Class-23-288R; US-Patent-Class-48-61; US-Patent-Class-48-102A; US-Patent-Class-48-10-3; US-Patent-Class-48-107; US-Patent-Class-48-117; US-Patent-Class-48-DIG 8; US-Patent-Class-60-300; US-Patent-Class-123-3; US-Patent-Class-123-179R; US-Patent-Class-123-DIG 12; US-Patent-Class-423-650) Avail: US Patent and Trademark Office. CSCL 21D.

A hydrogen generator provides hydrogen rich product gases which are mixed with the fuel being supplied to an internal combustion engine for the purpose of enabling a very lean mixture of that fuel to be used, whereby nitrous oxides emitted by the engine are minimized. The hydrogen generator contains a catalyst which must be heated to a pre-determined temperature before it can react properly. To simplify the process of heating up the catalyst at start-up time, either some of the energy produced by the engine such as engine exhaust gas, or electrical energy produced by the engine, or the engine exhaust gas may be used to heat up air which is then used to heat the catalyst. Official Gazette of the U.S. Patent and Trademark Office

N80-10375 Pennsylvania State Univ., University Park.
FUELS BY ALGAE HYDROGENATION. Ph.D. Thesis
Lih-yen Chin. 1979. 143 p.
Avail: Univ. Microfilms. Order No. 7922274.

A hydrogenation process which permitted the conversion of algae (Chlorella pyrenoidosa) to liquid products was developed and studied. The algae hydrogenation was carried out in a batch autoclave at high temperatures and operating pressures in the presence of a catalyst and a solvent. High yields of oil were achieved over a wide range of process conditions and useful ammonium carbonates and hydrocarbon-rich gases were also produced as by-products. A procedure was developed to characterize and analyze algae-derived products. Generally, algae-derived products can be divided into six categories: algae oil, asphaltene, benzeneinsolubles, water, ammonium carbonates, and gases. Temperature-programmed gas chromatography was useful for analyzing the algae oil fractions. A clay percolation method was of value in separating algae oils into hydrocarbons and polar compounds. Asphaltene was characterized by means of gel permeation chromatography. The composition of gases was determined by gas chromatography. Dissert. Abstr.

N80-10376 Missouri Univ., Rolla.
THE BIOLOGICAL CONVERSION OF CORN RESIDUE INTO ETHYL ALCOHOL USING AN IMMOBILIZED CELL REACTOR. Ph.D. Thesis
Oliver Clifford Sitton. 1979. 158 p.
Avail: Univ. Microfilms. Order No. 7921536.

Saccharomyces cerevisiae was immobilized to a fixed support in order to achieve an ethanol productivity from sugars that was up to nine times the maximum productivity achieved in a conventional, stirred tank reactor. Dilution rates up to six times the washout rate in a stirred tank reactor were obtained. Using hydrolyzed corn residue as a glucose source reduced maximum ethyl alcohol productivity from 1.75g/l-hour to 1 g/l-hour in the stirred tank reactor. However, when using hydrolyzate material in the immobilized cell columm the productivity was only slightly reduced. Glucose concentrations of 30 g/l and 60 g/l and residence times of 4.1, 2.4 and 1.3 hours were tested in the immobilized cell reactor. A plug flow first order reaction model described the data in these tests and allowed calculations of apparent rate constants. Dissert. Abstr.

N80-10377*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CONTINUOUS COAL PROCESSING METHOD AND MEANS. Patent Application
Porter R. Ryason, inventor (to NASA) (JPL). Filed 28 Sep. 1976. 31 p. Sponsored by NASA.
(NASA-Case-NPO-13758-2; US-Patent-Appl-SN-727444) Avail: NTIS. HC A03/MF A01. CSCL 21D.

A coal pump is provided in which solid coal is heated in the barrel of an extruder under pressure to a temperature at which the coal assumes plastic properties. The coal is continuously extruded, without static zones, using, for example, screw extrusion preferably without venting through a reduced diameter die to form a dispersed spray. The dispersed coal may be continuously injected into vessels or combustors at any pressure up to the maximum pressure developed in the extrusion device. The coal may be premixed with other materials such as desulfurization aids or reducible metal ores so that reactions occur, during or after conversion to its plastic state. Alternatively, the coal may be processed and caused to react after extrusion, through the die, with liquid oxidizers, whereby a coal reactor is provided. Alternative utilization of the device may be to secure continuous pyrolysis of the coal or to feed the extruded coal into furnaces operating at pressures near ambient. NASA

N80-10378*# Aerojet Liquid Rocket Co., Sacramento, Calif.
PHOTOGRAPHIC COMBUSTION CHARACTERIZATION OF LOX/HYDROCARBON TYPE PROPELLANTS
D. Craig Judd. 27 Jul. 1979. 84 p. refs.
(NASA-CR-160318; DMT-113T-1) Avail: NTIS. HC A05/MF A01. CSCL 21I.

Single element injectors and two fuels were tested with the aim of photographically characterizing observed combustion phenomena. The three injectors tested were the O-F-O triplet, the transverse like on like (TLOL), and the rectangular unlike doublet (RUD). The fuels tested were RP-1 and propane. The hot firings were conducted in a specifically constructed chamber

best copy available

fitted with quartz windows for photographically viewing the impingement spray field. All LOX/HC testing demonstrated coking with the RP-1 fuel leaving far more soot than the propane fuel. No fuel freezing or popping was experienced under the test conditions evaluated. Carbon particle emission and combustion light brilliance increased with Pc for both fuels although RP-1 was far more energetic in this respect. The RSS phenomena appear to be present in the high Pc tests as evidenced by striations in the spray pattern and by separate fuel rich and oxidizer rich areas. The RUD element was also tested as a fuel rich gas generator element by switching the propellant circuits. Excessive sooting occurred at this low mixture ratio (0.55), precluding photographic data. J.M.S.

N80-10379*# BDM Corp., McLean, Va.
COAL CONVERSION PROCESSES AND ANALYSIS METHODOLOGIES FOR SYNTHETIC FUELS PRODUCTION Final Report
5 Oct. 1979 285 p refs
(Contract NAS8-33608)
(NASA-CR-161322; BDM/W-79-548-TR) Avail: NTIS HC A13/MF A01 CSCL 21D

Information to identify viable coal gasification and utilization technologies is presented. Analysis capabilities required to support design and implementation of coal based synthetic fuels complexes are identified. The potential market in the Southeast United States for coal based synthetic fuels is investigated. A requirements analysis to identify the types of modeling and analysis capabilities required to conduct and monitor coal gasification project designs is discussed. Models and methodologies to satisfy these requirements are identified and evaluated, and recommendations are developed. Requirements for development of technology and data needed to improve gasification feasibility and economies are examined. A.W.H.

N80-10380# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
X-RAY SPECTROSCOPY AS A DIAGNOSTIC TOOL IN SOLID PROPELLANT COMBUSTION FLOWS Technical Report, Feb. 1977 - Feb. 1978
W. K. McGregor May 1979 49 p refs
(AF Proj. 2308)
(AD-A070796; AFRPL-TR-78-61) Avail: NTIS HC A03/MF A01 CSCL 21/2

X-ray spectroscopy offers a potential method for the measurement of composition, elemental density, and particle mass in the gas/particle flows of solid propellant rockets. A theoretical analysis was performed from which it was concluded that both transmittance and fluorescence measurements in the 1 to 10 keV photon energy range will yield elemental densities of Al and Cl and transmittance can possibly give O, N and C densities, although sensitivity for the latter three elements to transmittance is poor. The sensitivity of the K(alpha) fluorescence measurement to Al and Cl density changes is much greater than the sensitivity of transmittance measurements. However, the latter are required in order to determine densities directly from fluorescence rates. Hence, a combined transmittance and fluorescence measurement system is warranted. An investigation of commercially available hardware indicated that adequate detection systems exist, but insufficient data on photon flux rates from typical X-ray generating tubes was available to assess the adequacy of X-ray beam sources. Recommendations for proof-of-principle experiments are made, and a rocket test scenario is described for application to solution of the two-phase flow loss problem in solid propellant rockets. GRA

N80-10381# Los Alamos Scientific Lab., N. Mex.
STORAGE STABILITY OF KRATON-BONDED HMX-BASED EXPLOSIVES
E. D. Loughran and H. L. Flaugh 1978 20 p Presented at 6th DOE Compatibility Meeting, Golden, Colo., 17 Oct. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2720; Conf-781067-2) Avail: NTIS HC A02/MF A01

Pressed pieces of X-0287 and X-0298 were stored for various time intervals at oven temperatures ranging from 40 C to 90 C. Amount of evolved gas, polymer molecular weight changes, and tensile property differencies were used to assess the storage stability of the explosives. After one yr in open containers at 60 C, the molecular weight of the Kraton polymer in X-0287 decreased by 15% to 30% and the tensile strength dropped correspondingly. However, no significant change in these properties was observed for X-0298 pieces stored at the same temperature for one yr in sealed containers. Gas evolution from small cylinders of X-0298 stored at 90 C in sealed glass ampoules for 68 weeks amounted to only 2 cu cm/g, and was due mainly to HMX decomposition. No significant change in polymer molecular weight was observed. It is concluded that X-0298 is exceptionally stable when stored under the conditions of this test. DOE

N80-10382# Battelle Pacific Northwest Labs., Richland, Wash.
ASSESSMENT OF SYNFUEL TRANSPORTATION TO YEAR 2000
W. Wakamiya, K. B. Sebelien, and M. A. Parkhurst Mar. 1979 113 p refs
(Contract EY-76-C-06-1830)
(PNL-2768) Avail: NTIS HC A06/MF A01

The potential problems in the transportation of synthetic fuels (synfuels) are discussed and identified. The emergence of transportation-related problems in shale oil and coal synfuel development expected to be highly dependent upon their chemical similitude with analagous fossil fuels. Definitive resolution of the question of whether new transportation problems exist is dependent upon clear characterization of the synfuels chemical composition. Hydrogen and methanol represent unique cases since these materials are already in commercial production. The major transportation problem identified with fuel economics based on these materials is related to bulk use. To date, shipment volumes are relatively small and, in the case of hydrogen, can be accommodated with costly, more specialized packaging. Scale-up for major energy use may introduce a new set of transportation problems. DOE

N80-10383# Escher Technology Associates, St. Johns, Mich.
SURVEY OF LIQUID HYDROGEN CONTAINER TECHNIQUES FOR HIGHWAY VEHICLE FUEL SYSTEM APPLICATIONS
W. J. D. Escher Nov. 1978 66 p refs
(Contract EC-77-X-01-2752)
(HCP/M2752-01) Avail: NTIS HC A04/MF A01

The design and operational features of four different liquid hydrogen container types, three of which have served operationally as vehicle fuel tanks, and rough production-lot cost estimates for a nominal 50 gallon horizontal cylindrical liquid hydrogen container applicable to vehicle service are reported. A unique semiautomatic liquid hydrogen service station developed in Germany is described. A general assessment of the state of technology of vehicle hydrogen containers and associated systems is given, including the identification of pacing items recommended to be addressed initially in prospective R and D activities in this field. DOE

N80-10384# Sandia Labs., Livermore, Calif.
APPLICATIONS ANALYSIS OF FIXED SITE HYDROGEN STORAGE
J. J. Iannucci and S. L. Robinson May 1979 23 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8272) Avail: NTIS HC A02/MF A01

The potential applications and requirements for fixed site storage in a scenario of wide spread hydrogen use are examined and quantified. An envisioned hydrogen production/distribution/end-use cycle is scrutinized to identify the storage needs for both continuous and intermittent sources including solar. The most pressing need for storage is at the distribution point, in concurrence with current natural gas practice. Caverns and similar underground storage techniques are the most promising modes due to their low cost relative to all other options examined. Since a large volume of natural gas storage is presently in service, a pressing need to develop fixed site hydrogen storage technology (beyond the conversion of this underground storage to hydrogen) was not identified. DOE

N80-10385# California Univ., Livermore. Lawrence Livermore Lab.
MODELING OF FLAME PROPERTIES OF METHANOL

Charles K. Westbrook and Frederick L. Dryer. Mar. 1979. 12 p. refs. Presented at the Alcohol Fuels Technol. 3d Intern. Symp., Monterey, Calif., 28-31 May 1979.
(Contract W-7405-eng-48)
(UCRL-82434; Conf-790520) Avail: NTIS HC A02/MF A01

Computational flame modeling, using a recently developed chemical kinetic mechanism for methanol oxidation, provides a means of obtaining much data on the structure and propagation of methanol flames. The effects of stoichiometry, pressure, unburned gas temperature, and trace constituents, such as water vapor on flame speed and flammability, are determined and discussed. In each distinct physical regime, different elementary reactions tend to dominate the reaction mechanism, and in each case the interactions between fluid mechanical and chemical kinetic processes are responsible for the observed behavior. DOE

N80-10386# Department of Energy, Morgantown, W. Va. Energy Technology Center.
FLUIDIZED-BED COMBUSTION OF HIGH SULFUR COALS
J. S. Mei, J. S. Halow, U. Grimm, and R. L. Rice. Apr. 1979. 149 p. refs.
(METC/RI-79/4) Avail: NTIS HC A07/MF A01

The sulfur retention capability of an atmospheric fluidized-bed combustor (AFBC) burning a high sulfur coal was evaluated in light of the EPA proposed New Source Performance Standards and their potential impact on AFBC technology. A high volatile bituminous Pittswick coal with 4.52 percent sulfur content was selected and Greer limestone and Tymochtee dolomite were used as sulfur sorbents. Combustion tests were carried out at various operating conditions to develop AFBC engineering and emissions data on this high sulfur coal. Ninety or greater percent of sulfur retention was attained in 9 of the 19 balance periods. Eighty-five or greater percent sulfur retention was attained in 14 of the 19 balance periods. Results demonstrate that the proposed new standards for sulfur dioxide emissions can be met by AFBC's. DOE

N80-10387# TRW Energy Systems Planning Div., McLean, Va.
METHANE RECOVERY FROM COALBEDS. Annual Report, Dec. 1977 - Dec. 1978
1978. 29 p.
(Contract DE-AC21-78MC-08089)
(DOE/MC-08089-T1) Avail: NTIS HC A03/MF A01

Work done in the engineering and integration effort in the Morgantown Energy Technology Center program to recover and utilize methane from coalbeds is summarized. The contract requirements and approach are outlined. The work accomplished includes the development of the Unminable Drilling Plan, performance of testing and data analysis for wells into coal seams, development of three conceptual recovery and utilization designs. Milestone and expenditure charts are provided. DOE

N80-10388# Mobil Research and Development Corp., Princeton, N. J.
RESEARCH GUIDANCE STUDIES TO ASSESS GASOLINE FROM COAL BY METHANOL-TO-GASOLINE AND SASOL-TYPE FISCHER-TROPSCH TECHNOLOGIES. Final Report
Max Schreiner. Aug. 1978. 324 p. refs.
(FE-2447-13) Avail: NTIS HC A14/MF A01

A technical and economic comparison between the new Mobil methanol-to-gasoline technology under development and the commercially available Fischer-Tropsch technology for the production of motor gasoline meeting U.S. quality standards is presented. Except for the Mobil process, processes used are commercially available. Coproduction of products, namely SNG, LPG and gasoline, is practiced. Four sensitivity cases were also developed in less detail from the two base cases. In all areas, the Mobil technology is superior to Fischer-Tropsch: process complexity, energy usage, thermal efficiency, gasoline selectivity, gasoline quality, investment and gasoline selectivity, investment and gasoline cost. Principal advantages of the Mobil process are its selective yield of excellent quality gasoline with minimum ancillary processing. DOE

N80-10389# Mitre Corp., McLean, Va.
NEAR TERM POTENTIAL OF WOOD AS A FUEL
Jan. 1979. 71 p. refs.
(Contract EG-77-C-01-4101)
(HCP/C4101) Avail: NTIS HC A04/MF A01

The sources of wood as a fuel are cited. Technologies available to expand the near-term use of wood fuel include direct combustion, low-Btu gasification in the presence of air, pyrolysis to char, liquid fuel, and low-Btu gas in the absence of air, and densification. Life-Cycle costs were evaluated for these technologies. Incentives to increase the use of wood fuel in the near term are identified. Systems, manufactures, architecture and engineering firms, and users are listed. DOE

N80-10390# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF COMBUSTION DATA TO UTILIZE LOW BTU GASES AS INDUSTRIAL PROCESS FUELS. PROJECT 61004. SPECIAL REPORT NO. 4: HIGH-FORWARD-MOMENTUM BURNER
R. T. Waibel and E. S. Fleming. Nov. 1978. 42 p. refs.
(Contract EX-76-C-01-2489)
(FE-2489-33) Avail: NTIS HC A03/MF A01

Data were gathered to determine the performance of a high-forward-momentum burner when retrofit with three low-to-medium-Btu gases. The burner was fired on the IGT pilot-scale test furnace with a load simulating one zone of a continuous refractory kiln or one instant during the heat-up of a batch kiln. The low- and medium-Btu gases simulated for these combustion trials were Koppers-Totzek oxygen, Wellman-Galusha air, and Winkler air fuel gases. All of the substitute fuels exhibited stable flames when directly retrofit on the burner. Koppers-Totzek oxygen gave a thermal efficiency slightly greater than that for natural gas, but Wellman-Galusha and Winkler air fuel gases each had lower efficiencies. Koppers-Totzek oxygen and Wellman-Galusha air fuel gases had flame lengths longer than that for natural gas, whereas Winkler air fuel gas had a flame length comparable to the natural gas flame. DOE

N80-10391# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF GAS TURBINE FUELS AND COMBUSTION; AN OVERVIEW
A. A. Fejer. 1979. 12 p. refs. Presented at New Fuels and Advances in Combustion Technologies, New Orleans, 26-30 Mar. 1979.
(Contract EX-76-C-01-2433)
(CONF-790337-4) Avail: NTIS HC A02/MF A01

The characteristic features of gas turbine engines are described contrasting them with their chief competitor, the steam cycle. The focus is on the aerodynamic processes in the combustion chambers of traditional engines and includes an outline of the changes that are to be expected with the introduction of the synthetic and coal derived fuels. DOE

N80-10392# Institute of Gas Technology, Chicago, Ill.
COAL CONVERSION SYSTEMS: TECHNICAL DATA BOOK
1978. 585 p.
(Contract EX-76-C-01-2286)
(HCP/T2286-01; LC-78-606163; TP759.C52) Avail: NTIS HC A25/MF A01

Technical information necessary for the design and operation of coal conversion facilities is provided. Such facilities include the conversion of coal to environmentally acceptable fuel forms, or to electric power by way of advanced technologies. Physical, chemical, thermodynamic data, and correlations are included along with procedures necessary to develop a new process or to design, build, and operate a coal conversion plant. DOE

N80-10393# Mitre Corp., McLean, Va. METREK Div.
BIOMASS-BASED ALCOHOL FUELS: THE NEAR-TERM POTENTIAL FOR USE WITH GASOLINE
W. Park, G. Price, and D. J. Salo. Aug. 1978. 84 p. refs.
(Contract EG-77-C-01-4101)
(HCP/T4101-03) Avail: NTIS HC A05/MF A01

The requirements and prospects for a nationwide alcohol-gasoline fuel system based on alcohols derived from biomass resources are assessed. Technological and economic factors of the production and use of biomass-based methanol and ethanol fuels are evaluated relative to achieving 5 or 10 percent alcohol-gasoline blends by 1990. It is concluded the maximum attainable is a nationwide 5 percent methanol or ethanol-gasoline

system replacing gasoline by 1990. Relative to existing gasoline systems, costs of alcohol-gasoline systems will be substantial. DOE

N80-10394# Mitre Corp., McLean, Va.
DESIGN OF A PILOT SILVICULTURAL BIOMASS FARM AT THE SAVANNAH RIVER PLANT
D. J. Salo, F. F. Henry, and R. E. Inman. Mar. 1979. 132 p. refs.
(Contract EG-77-C-01-4101)
(HCP/T4101-01) Avail: NTIS HC A07/MF A01
A detailed plan for the establishment and operation of the farm at the Savannah River Plant, Aiken, South Carolina includes a discussion of possible sites, layout and design, and installation and operation. The estimated costs of installation and operation are also presented. DOE

N80-10395# Battelle Columbus Labs., Ohio.
SUGAR CROPS AS A SOURCE OF FUELS. VOLUME 1: AGRICULTURAL RESEARCH. Final Report
E. S. Lipinsky, S. Kresovich, T. A. McClure, D. R. Jackson, W. T. Lawhon, A. A. Kayloncu, and E. L. Daniels. 31 Jul. 1978. 222 p. refs.
(Contract W-7405-eng-92)
(TID-29400/1) Avail: NTIS HC A10/MF A01
Narrow-row spacing experiments were conducted. They promote more rapid canopy closure which helps a short season location more than a long season location. Sweet sorghum experiments indicate favorable yields compared with sugarcane, and yield increases with close spacing in all areas. The project team concludes that sweet sorghum has considerable fuel potential, based on its ability to grow wherever corn or soybeans grow. Initial evaluation of the Tilby cane separator process, which separates the pith from the rind fiber without crushing and grinding, indicates that the process is promising as a means of obtaining fermentable sugars at low cost. The advantages of the Tilby process are low energy consumption, high value for the rind fiber coproducts in products that perform like plywood, pulp or paper making, and ability to use high fiber sugarcane or sweet sorghum. DOE

N80-10396# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
BIOMASS ENERGY ENHANCEMENT: A REPORT TO THE PRESIDENT'S COUNCIL ON ENVIRONMENTAL QUALITY. Final Report
Michael Jerry Antal, Jr. Jul. 1978. 140 p. refs.
(Contract EQSAD499; Grant EPA-R-804836)
(PB-296624/0) Avail: NTIS HC A07/MF A01 CSCL 21D
The technical and economic potential for enhancing the energy value of biomass is examined and the feasibility of using solar heat to gasify biomass is developed. With improved technology, this would permit the energy carried by the synthetic fuel leaving the conversion facility to exceed or equal the biomass fuel input. The potential impact of biomass energy enhancement technologies is examined in a case study for New Jersey. The outcome is favorable for solar heat. GRA

N80-10397# New Mexico Univ., Albuquerque. Technology Application Center.
HYDROGEN AS A FUEL. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE. Progress Report, 1977 - Jul. 1979
Gerald F. Zollars. Aug. 1979. 24 p. Sponsored in part by NTIS.
(NTIS/PS-79/0771/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D
The 219 citations concern the use of hydrogen as a fuel for aircraft and automobiles. Topics covered include storage, fuel combustion studies, gas mixtures, and energy conversion efficiency. GRA

N80-10398# Wisconsin Univ. Center System, Rice Lake.
ENERGY AND ECONOMIC ASSESSMENT OF ANAEROBIC DIGESTERS AND BIOFUELS FOR RURAL WASTE MANAGEMENT. Final Report
Tom P. Abeles, David Freedman, Laura A. DeBaere, and David A. Ellsworth. Dec. 1978. 176 p. refs.
(Grant EPA-R-804457)
(PB-296523/4; EPA-600/7-78-174) Avail: NTIS HC A09/MF A01 CSCL 21D
A technological and socioeconomic assessment of anaerobic digester feasibility for small to midsize livestock operations was undertaken. Three full scale digesters and one pilot scale facility were under various degrees of monitoring and evaluation to assess design and operational problems as they affect the adoption and establishment of farm scale anaerobic digestors. Materials handling presented the greatest obstacle to satisfactory operation of the full scale systems. The system becomes more economical if the biogas can be used on site for direct thermal loads, suggesting that the economic feasibility of anaerobic digesters is site specific and should be closely integrated with the total farming operation. GRA

N80-10399# Tracor Jitco, Inc., Rockville, Md.
A SAFETY PRACTICES MANUAL FOR THE MANUFACTURING, TRANSPORTATION, STORAGE, AND USE OF PYROTECHNICS
Joanna M. Fringer, James B. Willis, Sally W. Snyder, and Pamela H. Errico. 1979. 194 p. refs.
(Contract DHEW-210-77-0145)
(PB-297807/0) Avail: NTIS HC A09/MF A01 CSCL 19A
A compilation of existing regulations, consensus standards, and professional recommendations for the protection of persons involved in the manufacture, transport, storage, use, and field mixing of pyrotechnics is presented. GRA

N80-10400# Economics, Statistics and Cooperatives Service, Washington, D. C. Natural Resource Economics Div.
GROWING ENERGY: LAND FOR BIOMASS FARMS. Final Report
Kathryn A. Zeimetz. Jun. 1979. 41 p. refs.
(PB-296650/5; AER-425) Avail: NTIS HC A03/MF A01 CSCL 21D
The utilization of high quality land to maximize energy gain and minimize environmental hazards are considered. It was concluded that alternate sources of food and fiber production must be allocated as some lands are diverted to energy farms. GRA

N80-10401# New Mexico Univ., Albuquerque. Technology Application Center.
HYDROGEN PRODUCTION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE. Report, 1977 - Jul. 1979
Gerald F. Zollars. Springfield, Va. NTIS. Aug. 1979. 45 p. Sponsored by NTIS.
(NTIS/PS-79/0773/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D
This bibliography cites 169 articles from the international literature concerning hydrogen production. Techniques examined include solar energy conversion, coal gasification, thermal dissociation, and water electrolysis. GRA

N80-10402# New Mexico Univ., Albuquerque. Technology Application Center.
HYDROGEN STORAGE AS A HYDRIDE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE. Report, 1975 - Jul. 1979
Gerald F. Zollars. Springfield, Va. NTIS. Aug. 1979. 29 p. Sponsored by NTIS.
(NTIS/PS-79/0772/8) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D
Articles from the international literature concerning the storage of hydrogen in various metal hydrides are cited. Binary and intermetallic hydrides are considered. Specific alloys discussed are iron-titanium, lanthanum-nickel, magnesium-copper, and magnesium-nickel among others. This bibliography contains 97 entries. GRA

N80-10008 Allerton Press, Inc., New York, N. Y.
ON THE QUESTION OF SELECTING THE CHARACTERISTIC QUANTITY GOVERNING FUEL SELF-IGNITION IN A STREAM
V. N. Gruzdev, N. A. Malishevskaya, and M. D. Tauger. *In its* Soviet Aeron., Vol. 21, No. 3. 1978. p. 28-30. refs. Transl.

into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 42-45 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-10403 California Inst. of Tech., Pasadena.
LEADING EDGE FLUTTER OF A SUPERCAVITATING HYDROFOIL Ph.D. Thesis
Kiam Thian Oey 1979 149 p
Avail: Univ. Microfilms Order No. 7922053

Flat plate hydrofoils were tested for leading edge flutter. The phenomenon is considered a complex function of speed, angle of attack, cavitation number and mass ratio. Leading edge flutter was observed to cause cavity pinching. Two mathematical models are presented. The first one models the flexible chord foil as a rigid chord foil hinged at the trailing edge; the second model treats the fluid structure interaction problem of a flexible chord foil cantilevered at the trailing edge. Dissert. Abstr.

N80-10404# Army Construction Engineering Research Lab., Champaign, Ill.
THE BUILDING LOADS ANALYSIS AND SYSTEM THERMODYNAMICS BLAST PROGRAM, VERSION 2.0: USERS MANUAL, VOLUME 2 Final Report
Douglas C. Hittle Jun. 1979 166 p ref Supersedes CERL-TR-E-119-Vol-1
(AD-A072273; CERL-TR-E-153-Vol-2) Avail: NTIS
HC A08/MF A01 CSCL 09/2

The Building Loads Analysis and System Thermodynamics (BLAST) program is a comprehensive set of subprograms for predicting energy consumption in buildings. There are three major subprograms: (1) the space load predicting subprogram, which computes hourly space loads in a building or zone based on user input and hourly weather data; (2) the air distribution system simulation subprogram, which uses the computed space load and user inputs describing the building air-handling system to calculate hot water or steam, chilled water, and electric demands; and (3) the central plant simulation program, which simulates boilers, chillers, onsite power generating equipment and solar energy systems and computes monthly and annual fuel and electrical power consumption and plant life cycle cost. GRA

N80-10405# National Bureau of Standards, Washington, D. C.
DIMENSIONS/NBS. VOLUME 63, NUMBER 3, MARCH 1979
Mar. 1979 33 p refs
(PB-296733/9; NBS-DIM-63-3) Avail: NTIS
HC A03/MF A01 CSCL 14B

Technical developments are highlighted, NBS publications are listed, and major statements by NBS management are summarized. Topics featured include: (1) microwave measurements on snow packs; (2) measurement services for ultrasonic nondestructive evaluation; (3) national load standard revisions; (4) X-ray image magnetification; (5) evaluating pipeline welds; and (6) determination of molybdenum ion spectrum. K.L.

N80-10406# National Bureau of Standards, Washington, D. C.
THE CALIBRATION OF A ROUNDNESS STANDARD Final Report
Charles P. Reeve Jun. 1979 23 p refs
(PB-297708/0; NBSIR-79-1758) Avail: NTIS
HC A02/MF A01 CSCL 14B

For the past decade the National Bureau of Standards has been making high precision roundness measurements using an algorithm which allows the spindle out-of-roundness to be separated from the true profile of the workpiece. The algorithm requires multiple traces on a roundness measuring instrument, and the resulting redundancy provides an estimate of the measurement precision. The mathematical model used for this measurement process is described. Some related topics are discussed briefly and an example is given. GRA

N80-10407# National Bureau of Standards, Washington, D. C. Office of Engineering Standards.
STANDARDS SYSTEM IN CANADA, THE UK, WEST GERMANY, AND DENMARK: AN OVERVIEW Final Report
David Hemenway Apr. 1979 196 p refs
(PB-296912/9; NBS/GCR-79/172) Avail: NTIS
HC A05/MF A01 CSCL 14A

The subjects discussed are: (1) history; (2) organization and finances; (3) standards development; (4) certification and accreditation; (5) international standards work; (6) consumer and labor participation; (7) metric conversion;(8) antitrust aspects; (9) research into economic impacts; (10) the government's use of standards and its role in standards work; and (11) other activities. GRA

N80-10408# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
THERMAL AND LIGHTING EFFICIENCY STANDARDS Final Report
7 Dec. 1978 196 p refs Revised Sponsored by Washington State Energy Office
(PB-297429/3; MSNW-78-3043-2-R-2) Avail: NTIS
HC A09/MF A01 CSCL 13M

An energy code is recommended for new building construction that meets or exceeds the intent of ASHRAE 90-75, a national consensus standard for energy conservation adopted by the American Society of Heating, Refrigeration and Air Conditioning Engineers. Four building prototypes in three Washington locations were studied to determine energy savings and cost-effectiveness for different construction standards. It was shown that the proposed standards do indeed save energy, and that they are economically justified and in some cases can result in lower initial costs. A rough estimate of state-wide cumulative savings is nearly 65 trillion Btu's for the period 1979 through 1985 if the proposed code is enacted. This savings is equivalent to 11.15 million barrels of oil or 18.95 billion kilowatt-hours. GRA

N80-10016 Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF COMPLEX SYSTEMS, II
T. K. Sirazetdinov and A. I. Bogomolov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 61-65 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 85-91 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10056 Allerton Press, Inc., New York, N. Y.
SPECTRAL ANALYSIS OF SURFACE IRREGULARITIES AND VIBRATIONS OF 'SPID' SYSTEM ELEMENTS DURING BURNISHING OPERATIONS
A. A. Naryshkin and D. A. Zhuravlev *In its* Soviet Aeron., v. 21, no. 4, 1978 p 120-123 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 147-150 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N80-10409 California Univ., Los Angeles.
ERROR CONTROL SYSTEMS FOR MULTI-ACCESS COMMUNICATION CHANNELS Ph.D. Thesis
Billy Hitoshi Saeki 1979 294 p
Avail: Univ. Microfilms Order No. 7921453

Error control systems for multiaccess communication channels

are investigated. Error detection and retransmission techniques, which are integrated with basic channel access control disciplines are discussed. The channel access disciplines which coordinate the transmissions by the distributed stations of the communication network to avoid simultaneous transmissions over the shared channel are examined. Performance indices such as channel throughput and message delay are analyzed through a queueing theoretic approach for network stations. A stationary transmission error process model is developed to evaluate the operation of the channel under random noise errors. Dissert. Abstr.

N80-10410 Columbia Univ. Teachers Coll., New York.
SATELLITE DIRECT BROADCASTING: THE PROSPECTS FOR DEVELOPMENT Ph.D. Thesis
Richard Denny Taylor 1978 570 p
Avail: Univ. Microfilms Order No. 7810900

The issues which accompany the development of broadcasting programs directly from artificial satellites to individual television receivers is discussed. The technical, legal, political, social and economic considerations relevant to satellite direct television broadcasting are examined. The historical development is reviewed, the present situation is summarized, and observations regarding probable future developments are made. Dissert. Abstr.

N80-10411 California Univ., Los Angeles.
COMMUNICATION NETWORK SYNCHRONIZATION IN THE PRESENCE OF NOISE Ph.D. Thesis
Gilbert Lieberman 1979 531 p
Avail: Univ. Microfilms Order No. 7921434

The effects of noise and systematic error on the analysis and design of communication network synchronization systems is discussed. The emphasis is on the analytical prediction of system performance using realistic models of clock instabilities, propagation delay variability and communication channel noises. Applications to Time-Division Multiplexing (TDM), Time-Division Multiple Access (TDMA) and to phase-noise prediction in satellite communications are described. Dissert. Abstr.

N80-10412 Houston Univ., Tex.
ELECTROMAGNETIC FIELDS OF UNDERGROUND ANTENNAS Ph.D. Thesis
Faramarz Vaziri 1979 174 p
Avail: Univ. Microfilms Order No. 7922437

A formulation of the components of the electric and magnetic fields due to infinitestimal source dipoles, electric or magnetic, vertical or horizontal, situated in one of the two arbitrary general media is presented. The field components in both media are expressed in terms of single integrals with branch cuts and poles clearly defined in all cases. Numerical techniques are developed to evaluate the complex field integrals for a wide range of parameters. The relative merits of the four types of source dipoles are studied for media with different electromagnetic properties and at different frequencies. The proper choice of the source dipole is suggested for a broad range of applications in subsurface communications. Field patterns of the buried antenna are presented with the receiver being above the earth. The relative strengths of the electric field components, measured as functions of the radial distance from the source and compared with the theoretical results are discussed. Dissert. Abstr.

N80-10413*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SELF-CALIBRATING THRESHOLD DETECTOR Patent Application
James Richard Barnes (TRW Systems Group, Redondo Beach, Calif.) and Marshall Yu Huang, inventors (to NASA) (TRW Systems Group, Redondo Beach, Calif.) Filed 27 Jul. 1979 16 p
Sponsored by NASA
(NASA-Case-MSC-16370-1; US-Patent-Appl-SN-061556) Avail: NTIS HC A02/MF A01 CSCL 17B

A self calibrating threshold detector for use with receivers is described. The threshold detector is adapted to receive an incoming transmitted signal carrying a prescribed code. The detector comprises a single demodulating channel which includes a mixer having one input receiving the incoming signal and another input receiving a local replica code. The detector relates generally to signal detecting systems and more particularly to receivers employing an auxiliary detector for detecting the arrival of an expected transmitted signal by correlating the phase of a local phase coded signal, produced by a local replica generator, with the phase of the transmitted signal. A.W.H.

N80-10414# Grumman Aerospace Corp., Bethpage, N.Y. System Sciences.
MINIMUM COST TRANSMITTER-RECEIVER ANTENNA PAIRS
G. Moyer and H. Hinz Sep. 1979 26 p refs
(RM-690) Avail: NTIS HC A03/MF A01

There are two types of solutions when applying the optimal control theory to antenna design. The cost (C) is an arbitrary function of the radii of the receiver (R sub 0) and of the transmitter (R sub 1). When the received power (W sub 0) divided by the area is small, as happens in the proposed satellite solar power station (SSPS), the value of the power density at the center of the receiver should be left open. Then the problem simplifies to such an extent that it can be solved with considerable accuracy using only ordinary calculus and graphs provided. The product (R sub 0) (R sub 1) depends only on the power ratio (W sub 0) (W sub 1) and can be obtained from a graph. The radius of the transmitter can then be replaced in the cost function and the best value of the radius of the receiver can be found from dC/d (R sub 0) = 0. The transmitter and receiver power density distributions are proportional and resemble a truncated Gaussian distribution. As W sub 0/sq pi (R sub 0) becomes larger the power density at the center of the receiver reaches its upper limit. After this point the problem must be solved with an additional state variable and constraint using a computer program. Numerical results are presented for the SSPS. A.R.H.

N80-10415*# TRW, Inc., Redondo Beach, Calif. Space Systems Div.
THE 30/20 GHz MIXED USER ARCHITECTURE DEVELOPMENT STUDY Final Report
Oct. 1979 216 p refs
(Contract NAS3-21933)
(NASA-CR-159686) Avail: NTIS HC A10/MF A01 CSCL 17B

A mixed-user system is described which provides cost-effective communications services to a wide range of user terminal classes, ranging from one or two voice channel support in a direct-to-user mode, to multiple 500 mbps trunking channel support. Advanced satellite capabilities are utilized to minimize the cost of small terminals. In a system with thousands of small terminals, this approach results in minimum system cost. Author

N80-10416*# TRW, Inc., Redondo Beach, Calif. Space Systems Div.
THE 30/20 GHz MIXED USER ARCHITECTURE DEVELOPMENT STUDY: EXECUTIVE SUMMARY
Sep. 1979 24 p
(Contract NAS3-21933)
(NASA-CR-159687) Avail: NTIS HC A02/MF A01 CSCL 17B

The baseline 30/30 GHz satellite communication system, designed for cost-effective communications in the years 1990 to 2000, incorporates on-board satellite demodulation and routing of individual 64 kbps digital voice-grade circuits. This level of routing flexibility is necessary to provide efficient communications to the large number of direct-to-user terminals (DTU) projected. The circuit interfacing hardware is distributed among all the DTU and master control stations. The switching circuitry which provides full interconnectivity between 30 to 45 thousand circuits is in the satellite. The DTU terminal cost, perhaps the largest element in the system cost, represents the largest economic value element of the system because it avoids using terrestrial signal distribution and routing and the charges associated with these functions. Satellite baseline design and power requirements for the system are examined. A.R.H.

N80-10417# Lincoln Lab., Mass. Inst. of Tech., Lexington.
QUASI-THREE-DIMENSIONAL DISPLAY OF INFRARED RADAR IMAGES USING RANGE/INTENSITY COLOR MAPPING
Robert C. Harvey, James S. Martin, and Dorothy R. Sullivan 6 Dec. 1978 32 p refs
(Contract F19628-78-C-0002; AF Proj. 649L)

(AD-A070671; TN-1978-44; ESD-TR-78-362) Avail: NTIS HC A03/MF A01 CSCL 05/8

By mapping range information into different hues and intensity information into different apparent brightness levels of each hue on a color display, a three-dimensional quality can be imparted to infrared radar images. A computer algorithm for implementing this range/intensity color mapping is described and several infrared radar images demonstrating the technique are presented. Possible improvements to the current algorithm and areas requiring additional study are also discussed. GRA

N80-10418# Michigan Univ., Ann Arbor. Radiation Lab.
THEORY OF DIELECTRIC-FILLED EDGE-SLOT ANTENNAS Final Report, 1 Jun. 1977 - 31 May 1979
Dipak L. Sengupta and Luis F. Martins-Camelo. Jun. 1979. 11 p. refs.
(Grant DAAG29-77-G-0152)
(AD-A071843; ARO-14808.2-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

A theory has been developed for the performance of a DFES antenna mounted on a conducting cylinder. It explains accurately the experimental results, furnished by HDL, for basic, two-element, and single ring DFES antennas, containing an arbitrary number of tuning posts. For such antennas, detailed computations have been carried out for arbitrary variations of the relavant parameters of the DFES antenna. These results will clearly be of help in the future design of this type of antenna allowing a choice of parameters to be made beforehand in order to achieve a desired frequency response. For DFES antennas having more than two elements or one ring, the theory breaks down when the total number of tuning posts used exceeds some value dependent on the radius of the antenna and when the innermost ring of posts is placed too close to the exciting post. For such antennas, more thorough analysis is needed, involving higher order modes and terms which have been neglected in the present theory. GRA

N80-10419# Stanford Univ., Calif. Information Systems Lab.
RESEARCH ON ADAPTIVE ANTENNA TECHNIQUES 2 Final Report
Bernard Widrow, R. Chestek, and T. Saxe. 14 Mar. 1978. 78 p. refs.
(Contract N00019-77-C-0194)
(AD-A071338) Avail: NTIS HC A05/MF A01 CSCL 17/4

The concept of adaptive power separation for single channel applications based on the 'leaky' LMS algorithm has now been extended for adaptive array applications. A new algorithm designated as 'scheme 6A' has been shown to be potentially highly effective for nulling strong jamming signals in an aircraft receiving environment. The new scheme is substantially less noisy and more simple to implement than 'scheme 6' which was analysed during our previous year's effort. All real-time adaptive processes experience noise in the adaptive parameters. The amount of noise depends on the nature of the adaptive algorithm, on the number of parameters, and on the speed of convergence. A fundamental study of parameter noise and its effects on the output signal has been undertaken for stochastic and deterministic inputs to weight-controlled adaptive filters driven by the leaky LMS algorithm. Weight noise has been determined for the case of an input consisting of a sinusoidal signal plus white noise, for wide ranges of SNR and frequency relative to Nyquist. Broad operating regions have been found where the output power due to weight noise is less than 5% of the output signal power. GRA

N80-10420# Ohio State Univ., Columbus. Electroscience Lab.
SWEPT FREQUENCY SCATTERING MEASUREMENTS OF AIRCRAFT
K. A. Shubert and D. L. Moffatt. May 1979. 127 p. refs.
(Contract F19628-77-C-0125; AF Proj. 2305)
(AD-A071474; RADC-TR-79-110) Avail: NTIS HC A07/MF A01 CSCL 20/14

Measured swept frequency complex scattering data are presented for six 1/72 scale models of aircraft and one model of a typical pencil or aerospace vehicle-type target with various vertical stabilizer and simple cavity attachments. The measured data span the model frequency bands 2.2 to 4.0 GHz and/or 4.0 to 7.6 GHz. The measured data are predominantly for vertical polarization (perpendicular to a horizontal plane containing the wings and fuselage of the aircraft) at selected sparse aspects. The measurement system, which utilizes somewhat unique background subtraction techniques, has a bistatic angle of either 30 degrees (most targets) or eight degrees (a few pencil-type target orientations). Synthetic pulse response waveforms (only pulse envelopes are shown) are generated from the measured spectral data. Features of both the spectral and temporal responses are used to extrapolate the potential of substructure target features such as tail stabilizers and cavities in prediction-correlation type identification schemes. GRA

N80-10421# Columbia Univ., New York. Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report, 1 Apr. 1978 - 31 Mar. 1979
George W. Flynn. 31 Mar. 1979. 145 p. refs.
(Contract DAAG29-77-C-0019)
(AD-A071664; PR-29) Avail: NTIS HC A07/MF A01 CSCL 05/1

Contents: Relaxation and Energy Transfer In Alkali Metals; Relaxation and Energy Transfer in Small Polyatomic Molecules; Generation and Control of Radiation; Quantum Detection and Sensing of Radiation; Physical Properties and Effects of Electronic Materials. GRA

N80-10422# California Univ., Los Angeles. School of Engineering and Applied Science.
THE DESIGN OF AN OPTIMAL OBSERVER FOR LINEAR DISCRETE TIME DYNAMICAL SYSTEMS Final Report, May 1977 - May 1978
L. M. Novak and C. T. Leondes. Jul. 1978. 112 p. refs.
(Contract F33615-77-C-3013; AF Proj. 2307)
(AD-A072068; AFFDL-TR-78-86) Avail: NTIS HC A06/MF A01 CSCL 17/9

This report investigates the idea of utilizing Luenberger's minimal-order observer as an alternate to the Kalman filter for obtaining state estimates in linear discrete time stochastic systems. More specifically, this dissertation presents a solution to the problem of construction as optimal minimal order observer for linear discrete time stochastic systems where optimality is in the mean square sense. The approach taken in this report leads to a completely unified theory for the design of optimal minimal-order observers and is applicable to both time-varying and time-invariant linear systems. To illustrate the theory and application of the observer designs developed in the dissertation, the problem of designing a radar tracking system is considered. Examples are included which illustrate clearly the practicality and usefulness of the proposed optimal observer design technique. Finally, a host of topics for future research is presented in the hope of stimulating further research in the domain of observer theory. GRA

N80-10423# Stanford Univ., Calif.
COMPUTER CALCULATIONS OF TRAVELING-WAVE PERIODIC STRUCTURE PROPERTIES
G. A. Loew, R. H. Miller, R. A. Early, and K. L. Bane. Mar. 1979. 4 p. refs. Presented at the IEEE Particle Accelerator Conf., San Francisco, 12-14 Mar. 1979
(Contract EY-76-C-03-0515)
(SLAC-PUB-2295; Conf-790327-123) Avail: NTIS HC A02/MF A01

The conversion of standing waves to traveling waves is accomplished using the SUPERFISH program. The ambiguities between the properties of these two types of waves is described. Good agreement is found between calculated results and values obtained earlier. DOE

N80-10424# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
ELECTROMAGNETIC SCATTERING BY A TWO-DIMENSIONAL INHOMOGENEITY DUE TO AN OSCILLATING MEGNETIC DIPOLE Ph.D. Thesis
K. H. Lee. Sep. 1978. 89 p. refs.
(Contract W-7405-eng-48)
(LBL-8275) Avail: NTIS HC A05/MF A01

A numerical method of computing the electromagnetic response of two dimensional earth models to an oscillating magnetic dipole is presented. The generalized electromagnetic variational integral was reduced to a sum of two dimensional variational integrals by Fourier transformation. Discretization of each two dimensional integral was carried out in terms of the secondary electric fields by using the finite element method. After inversely Fourier transforming the secondary electric and magnetic fields, the total fields are finally obtained by adding the analytically calculated primary fields. The quality of the solution for the horizontal magnetic dipole is found to be relatively poor compared to that for the vertical magnetic dipole. As an alternative the solutions for two dimensional models were compared to those for some elongated three dimensional models whose cross sections correspond to the two dimensional models. DOE

N80-10248*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROJECTED STATE-OF-THE-ART FOR FREQUENCY STANDARDS FOR THE DSN IN THE 1982 - 1990 TIME FRAME
W. Higa and R. Sydnor. *In its* The Deep Space Network, 15 Oct. 1979, p. 54-61, refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N80-10251*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FREQUENCY DOWN-CONVERTERS AS APPLIED TO VLBI
N. C. Ham. *In its* The Deep Space Network, 15 Oct. 1979, p. 74-82, refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-10252*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE NOCC RADIO SCIENCE SUBSYSTEM: SYSTEM PERFORMANCE VALIDATION FOR THE DSN RADIO SCIENCE AND VERY LONG BASELINE INTERFEROMETRY (VLBI) SYSTEMS
A. L. Berman. *In its* The Deep Space Network, 15 Oct. 1979, p. 83-92, refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N80-10253*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN OF A QUICK-LOOK DECODER FOR THE DSN (7,1/2) CONVOLUTIONAL CODE
C. A. Greenhall and R. L. Miller. *In its* The Deep Space Network, 15 Oct. 1979, p. 93-101, refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N80-10255*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TRACKING SYSTEM UPLINK FREQUENCY CONTROL
G. L. Spradlin. *In its* The Deep Space Network, 15 Oct. 1979, p. 108-112 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N80-10258*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO FREQUENCY PERFORMANCE OF DSS 14 64-m ANTENNA AT X-BAND USING A DUAL HYBRID MODE FEED
A. J. Freiley. *In its* The Deep Space Network, 15 Oct. 1979, p. 132-140, refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-10259*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF ANTENNA POINTING ERRORS ON RANGE DELAYS
T. Y. Otoshi and T. H. Taylor. *In its* The Deep Space Network, 15 Oct. 1979, p. 141-147, refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-10264*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
X-BAND SAMPLING BY THE OCCULTATION DATA ASSEMBLY
R. B. Roth. *In its* The Deep Space Network, 15 Oct. 1979, p. 176-179 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-10755# Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF USING BONE CONDUCTION IN AVIATION RADIO COMMUNICATION
E. V. Lapayev, V. S. Kuznetsov, G. I. Tarasenko, and M. I. Katalov. *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979, p. 19-25, refs. Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979, p. 14-19 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10756# Joint Publications Research Service, Arlington, Va.
SPEECH ILLUSIONS AND SIGNIFICANCE THEREOF TO AEROSPACE PRACTICE
I. Shults and M. Moravek. *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979, p. 26-29, refs. Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979, p. 19-21 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors, microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-10425 Houston Univ., Tex.
DESIGN AND EVALUATION OF DECENTRALIZED FILTERS FOR LARGE SCALE INTERCONNECTED SYSTEMS Ph.D. Thesis
Robert Yu-Soung Ling, 1979, 117 p.
Avail: Univ. Microfilms Order No. 7922246

The design decentralized filters for large scale interconnected systems is considered. Decentralized filters, two different information patterns, are evaluated using matrix maximum principle. Two filters having specific structures which allow information exchange to occur over noisy channels are studied. An approximate aggregation method for obtaining approximate reduced order representation for the interaction processes of large scale interconnected systems is introduced. A filter which trades off some of the performance for a lower filter order is designed using the interaction model and its performance is evaluated. The algorithms are illustrated via an application to dynamic state estimation for multiarea power system models. Dissert. Abstr.

N80-10426 California Univ., Los Angeles.
A THEORY AND AN ALGORITHM FOR ANALOG CIRCUIT FAULT DIAGNOSIS Ph.D. Thesis
Nasrollah Navid, 1979, 169 p.
Avail: Univ. Microfilms Order No. 7921442

Conditions are presented such that the value of each of the network elements studied is uniquely determinable from the network's behavior as seen from its external terminals. It is shown how one can determine--considering only the topology of the network--whether or not it is possible to compute the element values of a resistive network from the test terminal measurements, before going through the process of actually attempting to solve for element values. This provides guidance in selecting the optimal location, and minimum number, of test terminals. The implications of the results are extended to networks containing solid-state devices such as diodes, bipolar transistors and field-effect transistors. An algorithm for the actual computation of the element values is proposed and its global convergence is proved. Dissert. Abstr.

N80-10427 California Univ., Los Angeles.
THEORY, ANALYSIS, AND DESIGN OF A NEW TYPE OF STRIP-FED SLOT ARRAY Ph.D. Thesis
Pyong Kiel Park, 1979, 71 p.

Avail: Univ. Microfilms Order No. 7921444

An analytical design method for a linear slot array fed by a boxed stripline is developed. The modified residue calculus technique is used to derive the electromagnetic field configuration in the boxed stripline. The geometric theory of diffraction is used to calculate the external mutual coupling of the slot elements. A novel method is used to constrain resonant slot lengths to practical values. An array of collinear slots on the center line of a boxed stripline wall was constructed to test the theory. The array test results were in close agreement with the prediction.

Dissert. Abstr.

N80-10428 University of South Florida, Tampa.

THE NOISE PROPERTIES OF THICK FILM RESISTORS Ph.D. Thesis

Joong-Geun Rhee 1979 156 p

Avail: Univ. Microfilms Order No. 7922886

A study was made for better understanding of the properties of the two noise sources in the resistor. A technique of calculating current noise, based on the DC current distribution, was developed to determine the dependence of the noise index on the shape of the resistor. This technique can be used in predicting the current noise increase in a resistor after trimming without time consuming experimental noise measurements. The annealing process which was adopted in this study improved the current noise properties and reduced noise level of the trimmed resistor to approximately the calculated value. However, the process did not eliminate the burst noise phenomenon which was found in some of the trimmed resistors. While tunneling current is temperature independent, current noise showed a temperature dependence at low temperatures.

Dissert. Abstr.

N80-10429 Auburn Univ., Ala.

NON-RECTANGULAR MOS FIELD EFFECT DEVICES Ph.D. Thesis

Imtiaz Tarique 1979 353 p

Avail: Univ. Microfilms Order No. 7923384

Arbitrarily shaped (nonrectangular) channel and arbitrary topology gate field effect transistors are designed, analyzed and studied. Various nonrectangular geometry devices are analyzed, characterized and compared with a standard rectangular device. Several nonrectangular geometry devices are fabricated to compare the theoretical work with the actual device performance.

Dissert. Abstr.

N80-10430 Washington State Univ., Pullman.

EXCITATION OF CURRENTS ON INFINITE WIRES BY VERTICAL AND HORIZONTAL ELECTRIC DIPOLES IN THE PRESENCE OF A DISSIPATIVE EARTH Ph.D. Thesis

Mohamed Arabi Usta 1979 128 p

Avail: Univ. Microfilms Order No. 7923520

The current induced on a horizontal wire above earth by an arbitrarily located Hertzian electric dipole is investigated. Three dipole orientations are considered: vertical electric dipole, horizontal electric dipole parallel to both the wire and the interface between the two media, and horizontal electric dipole parallel to the interface, but normal to the wire. The three cases are combined to give the solution for an arbitrarily oriented dipole. Computational algorithms to evaluate the induced currents are developed and numerical results for the vertical electric dipole case are discussed.

Dissert. Abstr.

N80-10431 Florida Univ., Gainesville.

STUDY OF THE OPTIMUM CHARGE-TRANSFER IMAGE SENSOR Ph.D. Thesis

Hsin-Fu Tseng 1979 176 p

Avail: Univ. Microfilms Order No. 7921945

The optimum structure for a solid state image sensor is investigated. The optimum structure consists of diffused diodes for photosensing, and either a bucket brigade or charge coupled transfer register for signal readout. A matrix array with two tetrode bucket brigade readout registers is studied and models describing the operating mechanisms of the bucket brigade and image sensor devices are developed.

Dissert. Abstr.

N80-10432 Houston Univ., Tex.

FREQUENCY-DOMAIN APPROACHES TO LINEAR MULTI-VARIABLE CONTROL SYSTEMS DESIGNS Ph.D. Thesis

Ying-Jyi Paul Wei 1979 148 p

Avail: Univ. Microfilms Order No. 7922248

An effective method for multivariable control system designs is developed. Modeling control systems using industrial control specifications and model reduction using the mixed methods are described. Relationships between the classical control specifications and the optimal weighting factors and multivariable control system design using a noninteractive method are discussed.

Dissert. Abstr.

N80-10433*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DIGITAL PSK TO BiO-L DEMODULATOR FOR 2 SUP Nx(BIT RATE) CARRIER

Thomas A. Shull Aug. 1979 8 p

(NASA-TM-80159) Avail: NTIS HC A02/MF A01 CSCL 09C

A phase shift key (PSK) to BiO-L demodulator which uses standard digital integrated circuits is discussed. The demodulator produces NRZ-L, bit clock, and BiO-L outputs from digital PSK input signals for which the carrier is a 2 to the Nth multiple of the bit rate. Various bit and carrier rates which are accommodated by changing various component values within the demodulator are described. The use of the unit for sinusoidal inputs as well as digital inputs is discussed.

A.W.H.

N80-10434*# Bionetics Corp., Hampton, Va.

THE POTENTIAL OF CARBON FIBER INDUCED SHOCK HAZARDS IN HOUSEHOLD TOASTERS

Jerome A. Meyers Sep. 1979 24 p

(Contract NAS1-15238)

(NASA-CR-159147) Avail: NTIS HC A02/MF A01 CSCL 09C

The average exposure to carbon fibers which produced a short and potential shock hazard in a household toaster was determined. Toasters are normally in the off state. They are used for brief periods during the day and have timed cycles during which power is applied. The possibility of a short occurring from the heating element to the case was investigated to find the exposure levels at which a potential shock hazard could appear. The short produced was tested to determine its importance.

J.M.S.

N80-10435*# National Aeronautics and Space Administration, Washington, D. C.

TWO-DIMENSIONAL NONSTATIONARY MODEL OF THE PROPAGATION OF AN ELECTRON BEAM IN A VACUUM

S. L. Ginzburg and V. F. Dyachenko Oct. 1979 14 p refs Transl. into ENGLISH of Dvimernaya Nestatsionarnaya Model Rasprostraneniya Elektronnogo Puchka v Vakuume (Moscow), Preprint no. 51, 1979 22 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Academy of Sciences (USSR), Moscow

(Contract NASw-3199)

(NASA-TM-75693) Avail: NTIS HC A02/MF A01 CSCL 09C

A two dimensional nonstationary model of the propagation of a relativistic electron beam injected into a vacuum is considered. Collision effects are ignored and there are no external fields. Two types of the electron current propagation are shown from the computer simulation of the Maxwell-Vlasov equations.

A.W.H.

N80-10436# Royal Aircraft Establishment, Farnborough (England).

WEAR OF MODIFIED ELECTRICAL BRUSH MATERIAL IN VACUUM

M. Maillat, H. R. Kocher, and H. E. Hintermann Feb. 1979 35 p Transl. into ENGLISH of Rept-980-2.1, Lab. Suisse de Recherches Horlogeres, Neuchatel, 15 Jan. 1978 35 p

(RAE-Trans-2007; BR70073) Avail: NTIS HC A03/MF A01

Friction tests were carried out in a high vacuum, without any electrical current, and in one position, only, with respect to the structural orientation of the material on the electrical contacts. The wear is greater in the brushes with a composition of 84 Ag, 15 MOS2, 1 Cu by weight, than in the case of the brushes studied originally and it varies considerably from one sample to another.

M.M.M.

N80-10437*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
NUMERICAL SIMULATION OF DYNAMICS OF BRUSHLESS DC MOTORS FOR AEROSPACE AND OTHER APPLICATIONS. VOLUME 1: MODEL DEVELOPMENT AND APPLICATIONS, PART A Final Report
N. A. O. Demerdash and T. W. Nehl 1979 188 p refs
(Contract NAS9-15091)
(NASA-CR-160349) Avail: NTIS HC A09/MF A01 CSCL 09A

The development, fabrication and evaluation of a prototype electromechanical actuator (EMA) is discussed. Application of the EMA as a motor for control surfaces in aerospace flight is examined. A mathematical model of the EMA is developed for design optimization. Nonlinearities which complicate the mathematical model are discussed. The dynamics of the EMA from the underlying physical principles are determined and a discussion of similating the control logic by means of equivalent boolean expressions is presented. A.W.H.

N80-10438# California Univ., Berkeley.
JOINT SERVICES ELECTRONICS PROGRAM Final Report, 1 May 1976 - 30 Apr. 1979
D. J. Angelakos and J. R. Whinnery 30 Jun. 1979 30 p refs
(Contract F44620-76-C-0100; AF Proj. 2305)
(AD-A072076; UCB/ERL-79/1; AFOSR-79-0981TR) Avail: NTIS HC A03/MF A01 CSCL 09/5

The Joint Services Electronics Program includes research in four major areas: quantum and optical electronics; solid state phenomenon and semiconductor devices; electromagnetics; and information systems including integrated circuits. This report constitutes a summary (for the entire three-year period) of the salient parts of the research. The research conducted for the contract period May 1, 1976, through April 30, 1979 is summarized in the following Interim Reports: Report no. ERL-76-2, 30 September 1976, Report no. UCB/ERL-77/1, 30 September 1977, and Report no. UCB/ERL-78/1, 30 September 1978. GRA

N80-10439# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
PROGRAM FOR THE DEVELOPMENT OF A SUPERCONDUCTING GENERATOR, PHASE 2 AND 3 Final Report, Jan. 1974 - Jan. 1979
J. L. McCabria Feb. 1979 327 p refs
(Contract F33615-71-C-1591; AF Proj. 3145)
(AD-A072093; AFAPL-TR-79-2012) Avail: NTIS HC A15/MF A01 CSCL 10/2

This report summarizes work completed in Phase II and Phase III of a Program for the Development of a Superconducting Generator. A 5MW, 400 Hz, 12000 rpm generator was designed and built during Phase II. The oil cooled stator contained a 3-phase, wye connected, 5 kV, flooded winding within a laminated iron shield. The rotor contained a winding of 0.094 cm x 0.14 cm wire with 438 36 micrometers filaments of Nb-Ti superconducting alloy. A rotating dewar with a cold electro-thermal shield was used. The Phase III work consisted of a warm spin-up of the generator to design speed followed by cool-downs of the rotor. A superconducting state was not obtained in a generator configuration due to high pressure in the vacuum space which resulted in excessive gas conduction into the field winding compartment. A continuous pump-down system was incorporated into the test set-up but the helium leakage rate exceeded the capability of this system. Partial disassembly of the rotor was performed to define the areas of leakage. Further disassembly and work is required to correct this problem. GRA

N80-10440# California Univ., Livermore. Lawrence Livermore Lab.
EMITTANCE MEASUREMENTS ON FIELD EMITTER DIODES
B. Kulke and R. Kihara 5 Apr. 1979 40 p Presented at the Pulsed Power Conf., Lubbock, Tex., 12-14 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82533; Conf-790662) Avail: NTIS HC A03/MF A01

On the basis of time-integrated emittance measurements, several different types of field emitter diodes were characterized at 1 to 3 kA, 1 MeV. These measurements were part of the design effort for the injector system of a linear induction accelerator, to be used as a flash X-ray source at Lawrence Livermore Laboratory. The experimental parameters were the cathode type, the anode mesh texture, the diode spacing and voltage, and the level of collimation of the emerging beam. Experimental results presented show that over a wide range, the emittance was proportional to the level of collimation. For any one diode, with the spacing left fixed, the emittance was essentially independent of the diode voltage and current. Differential focusing of different energy beam components affects most strongly the peripheral components of the beam, and strong collimation was found to minimize the effects of momentum spread on the emittance. DOE

N80-10441# Brookhaven National Lab., Upton, N. Y.
AC SUPERCONDUCTING CABLES
E. B. Forsyth 1979 26 p refs Presented at Workshop on Public Policy Aspects of High Capacity Electric Power Transmission, Aspen, Colo., 14 May 1979
(Contract EU-76-C-02-0016)
(BNL-26016; Conf-790527-2) Avail: NTIS HC A03/MF A01

The characteristics and economics of superconducting power transmission cables are described. At present Austria is the only European country continuing this research. The USSR has an active program and U.S. efforts are concentrated at the Brookhaven Laboratory which is constructing a 100 m long 138 kV test facility. DOE

N80-10442# Bendix Corp., Kansas City, Mo.
ELECTRICAL MEASUREMENT OF PLATING THICKNESS Final Report
J. B. Mustapha Dec. 1978 21 p ref
(Contract EY-76-C-04-0613)
(BDX-613-1942-Rev) Avail: NTIS HC A02/MF A01

A resistance-measuring system using a commercial microhmmeter and four-point probes effectively determines the thickness of copper foil and plating on samples with surface dimensions large in comparison to probe spacing. Individual probe-calibration conductance curves are required. Although comparable in resolution to beta-backscatter measurements, the measuring system is faster, easier to calibrate, less expensive, and requires less operator training time. DOE

N80-10443# Los Alamos Scientific Lab., N. Mex.
THE 50kA FLUX PUMP FOR THE SUPERCONDUCTING TRANSMISSION LINE TEST BED
Stefan L. Wipf Aug. 1978 13 p refs
(Contract W-7405-eng-36)
(LA-6953-MS) Avail: NTIS HC A02/MF A01

A 50 kA, rotating field-type flux pump is suggested as a power supply for the superconducting transmission line test bed. A basic design was developed as an extension to a previous 12 kA pump. The important design principles are explained. Special emphasis is given to the less-certain aspects of the extrapolation and eight improvements are suggested. The three most important ones are choosing the material for a pump sheet, making the pump sheet out of a specially designed wire cloth, and arranging the return leads adjacent to the pump sheet through the pole gap. Other improvements easily incorporated into the basic design are shading poles, rare earth pole pieces, and superconducting outside windings. DOE

N80-10444# Princeton Univ., N. J. Plasma Physics Lab.
TRANSIENT EDDY CURRENTS ON FINITE PLANE AND TOROIDAL CONDUCTING SURFACES
D. W. Weissenburger and U. R. Christensen Apr. 1979 61 p refs
(Contract EY-76-C-02-3073)
(PPPL-1517) Avail: NTIS HC A04/MF A01

A previously presented mesh analysis method is used to calculate transient eddy currents in conducting surfaces. Example calculations are presented for a planar conducting sheet of finite dimensions and also for a toroidal conducting surface which represents the vacuum vessel of the TFTR. For the toroidal sheet, branch inductances are initially calculated by numerically intergating the vector potential function, then the branch matrix. For the flat sheet, an analytic expression is given which enables

direct calculation of the mesh inductance matrix. Streamline plots of the eddy current distribution are shown at successive time steps for each example. DOE

N80-10445# National Technical Information Service, Springfield, Va.
STRIP TRANSMISSION LINES, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Report, Mar. 1976 - May 1979
William E. Reed Jun. 1979 270 p Supersedes NTIS/PS-78/0298; NTIS/PS-77/0288; NTIS/PS-76/0254; NTIS/PS-75/239
(NTIS/PS-79/0618/3; NTIS/PS-78/0298; NTIS/PS-77/0288; NTIS/PS-76/0254; NTIS/PS-75/239) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

The technology and applications of strip transmission lines are presented. Included are: amplifiers, antennas, microstrip, integrated circuits, and couplers. (This bibliography contains 261 abstracts, 79 of which are new entries to the previous edition.) GRA

N80-10446# National Technical Information Service, Springfield, Va.
STRIP TRANSMISSION LINES. VOLUME 3: CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1978 - May 1979
William E. Reed Jun. 1979 229 p Supersedes NTIS/PS-78/0299; NTIS/PS-77/0290; NTIS/PS-76/0255
(NTIS/PS-79/0620/9; NTIS/PS-78/0299; NTIS/PS-77/0290; NTIS/PS-76/0255) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

Articles are presented on various technological aspects of strip transmission lines along with its applications in the design of microwave equipment, antennas, and integrated circuits. This updated bibliography contains 267 abstracts, all of which are new entries to the previous edition. GRA

N80-10447# National Technical Information Service, Springfield, Va.
STRIP TRANSMISSION LINES. VOLUME 2: CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Mar. 1976 - May 1979
William E. Reed Jun. 1979 274 p
Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

Research reports from worldwide literature are cited covering the technology, design, and applications of strip transmission lines. The applications include antennas, integrated circuits, microstrip devices, and microwave components. This updated bibliography contains 220 abstracts, none of which is new to the previous edition. GRA

N80-10048 Allerton Press, Inc., New York, N. Y.
ELECTRICAL CHARGING OF FABRIC AND FILM MATERIALS
B. G. Popov, V. N. Baklygin, and I. I. Chistyakov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 81-86 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 105-111 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10049 Allerton Press, Inc., New York, N. Y.
PROPULSIVE NOZZLE ELECTRIFICATION
G. P. Potapov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 87-91 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 p 112-116 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10246*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A POINT DESIGN FOR A GYROTRON TRAVELING WAVE TUBE AMPLIFIER
A. Kupiszewski *In its* The Deep Space Network 15 Oct. 1979 p 33-39 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 09A

N80-10250*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DENSITY AND RELIABILITY PREDICTIONS FOR A GENERAL LOGIC STRUCTURE FOR CUSTOM LSI
M. Sievers *In its* The Deep Space Network 15 Oct. 1979 p 66-73 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

N80-10262*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS RECEIVER THERMAL NOISE MODEL COMPARISONS
R. C. Bunce *In its* The Deep Space Network 15 Oct. 1979 p 161-168 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-10448 Pennsylvania State Univ., University Park.
TRANSIENT ASPECT OF HYDROPLANING: HYDROPLANING PHENOMENON DURING SUDDEN CHANGES IN THE FLUID LAYER ON A PAVEMENT Ph.D. Thesis
Satish Kumar Agrawal 1979 225 p
Avail: Univ. Microfilms Order No. 7922260

The transition from a nonhydroplaning to a hydroplaning condition is investigated. The transition from a nonhydroplaning to a hydroplaning condition takes no more than 65 milliseconds under any set of operating conditions, i.e., speed, film thickness, inflation pressure, load on the tire, and the texture. A fluid flow model, and a tire deformation model are developed. Simplifications in both the models are obtained by assuming that the contacting surfaces are smooth. The fluid flow model utilizes the theory for flow between the clearance spaces in bearing problems. An experimentally measured tire belt gap distribution is supplied to the flow model which predicts the hydrodynamic pressure distribution. An independent tire deformation model is developed by assuming the tire surface to be a semiinfinite solid. A tire deformation geometry is obtained from the tire deformation model using the hydrodynamic pressure distribution predicted by the flow model. Dissert. Abstr.

N80-10449 Kentucky Univ., Lexington.
MASS TRANSFER AND LIQUID-LIQUID DISPERSION IN AGITATED VESSELS Ph.D. Thesis
Jai Moon Lee 1978 168 p
Avail: Univ. Microfilms Order No. 7921509

The effects of impeller type, speed, size, and location, and of liquid properties on the degree of mixing of two immiscible liquids in a baffled vessel are examined. A correlation of droplet size and continuous phase mass transfer coefficients in agitated vessels with operating variables and physical properties in liquid-liquid systems are investigated. In correlating mass transfer coefficients, a realistic mechanism was developed, involving periodically varying rates of surface renewal associated with droplet circulation through varying degrees of turbulence around the agitated vessel. Dissert. Abstr.

N80-10450 Northeastern Univ., Boston, Mass.
VARIABLE SAMPLE TIME ALGORITHMS FOR MICROCOMPUTER CONTROL OF DISTRIBUTED PARAMETER SYSTEMS Ph.D. Thesis
Neil Gordon Sweerus 1979 123 p
Avail: Univ. Microfilms Order No. 7923542

The processes considered are the flow forced heat exchanger, the flow forced tubular reactor, and the wall temperature forced heat exchanger. The control algorithms, based on the steady state solution of the describing dynamic equation, exhibit good controlled response to changes of setpoint and load upsets in the presence of process parameter shifts. The variable sample time control algorithms are implemented via microcomputer on a laboratory flow forced heat exchanger. The control algorithm,

when modified to include thermocouple dynamics, responds well to setpoint changes and unmodelled load upsets of varying pipe wall temperatures. The experiment data agrees well with the simulated data. Dissert. Abstr.

N80-10451 California Inst. of Tech., Pasadena.
EXPERIMENTAL INVESTIGATION OF FIRST AND SECOND-SOUND SHOCK WAVES IN LIQUID HELIUM II Ph.D. Thesis
Jack Leroy Wise 1979 140 p
Avail: Univ. Microfilms Order No. 7922057

A gasdynamic shock which propagates through saturated helium vapor and subsequently reflects from the upper surface of a column of LHell is studied. Highly repeatable arrival time data for the incident gasdynamic shock and the resultant first and second sound shocks in the liquid are discussed. Theoretical predictions that the temperature decreases through the pressure shock and increases through the temperature shock are evaluated. Amplitude measurements based on static detector calibrations are discussed along with temperature jump measurements for the coupled second sound shock. Dissert. Abstr.

N80-10452 State Univ. of New York at Buffalo.
ANALYTICAL SOLUTIONS FOR HEAT CONDUCTION IN ANISOTROPIC MEDIA HOMOGENEOUS IN CYLINDRICAL COORDINATES AT REST AND IN MOTION Ph.D. Thesis
Kin Chung Poon 1979 252 p
Avail: Univ. Microfilms Order No. 7921893

The heat conduction in anisotropic media which is homogeneous in circular cylindrical coordinates is investigated analytically. Both steady and unsteady states with the medium at rest or in motion are considered. Problems are limited to those of the so-called first class: free space, free space internally bounded by a cylindrical surface, infinite solid and hollow cylinders. Boundary conditions of the first, second and third kinds are considered. Green's functions are constructed whenever they are needed for the solution of inhomogeneous differential equations. Dissert. Abstr.

N80-10453 Pennsylvania State Univ., University Park.
EVALUATION OF A LOCALLY HOMOGENEOUS FLOW MODEL OF SPRAY EVAPORATION Ph.D. Thesis
Albert James Shearer 1979 152 p
Avail: Univ. Microfilms Order No. 7922346

A model of spray evaporation based on the locally homogeneous flow assumption and a second order turbulence model was developed and evaluated against a wide range of experimental conditions. The turbulence was represented by a k-epsilon-g model employing a clipped Gaussian probability density function for mixture fraction fluctuations. Profiles of mean velocity, temperature, composition, and drop size distribution are presented. An estimation of single phase jet measurements is provided. Characteristics of the spray which were predicted by the model e.g., flow width, radial profiles, turbulence quantities and the axial rate of velocity decay and mixture fraction defect are discussed. Dissert. Abstr.

N80-10454 California Inst. of Tech., Pasadena.
STUDIES ON THE MIXING IN A DENSITY-STRATIFIED SHEAR FLOW Ph.D. Thesis
Gregory Gartrell, Jr. 1979 531 p
Avail: Univ. Microfilms Order No. 7922048

The mixing in a two-layered density-stratified shear flow in a flume 40-meters long, with a cross-section of 110 cm wide by 60 cm deep was measured. The relative density difference between the layers was 0.001 or less. The initial mixing layer which developed at the inlet was found to be dominated by large, two-dimensional vortex structures. Much less turbulent mixing took place in the stratified flows than homogeneous flows. The turbulence was dominated by large turbulent bursts, during which the vertical turbulent transport of momentum, heat and turbulent kinetic energy are many times larger than their mean values. These bursts were responsible for most of the total turbulent transport of momentum, heat and turbulent kinetic energy, even though the bursts were found only intermittently. In almost all cases, the rate at which the potential energy of the fluid increased due to turbulent mixing was much less than the estimated rate of viscous dissipation of turbulent kinetic energy. Dissert. Abstr.

N80-10455 Vanderbilt Univ., Nashville, Tenn.
PROPERTIES OF STEADY, VISCOSITY STRATIFIED FLOW TO A LINE SINK Ph.D. Thesis
Thomas Michael Walski 1979 160 p
Avail: Univ. Microfilms Order No. 7922192

A mathematical model to predict velocity distribution for steady, Newtonian, slow, laminar, two dimensional viscosity stratified flow to a line sink is presented. Three flumes using sugar and carboxy methyl cellulose to create density and viscosity gradients are described. Criteria to determine when velocity profiles are skewed are discussed. Three dimensionless parameters: (1) dimensionless viscosity gradient, (2) ratio of buoyancy to viscous forces, and (3) dimensionless distance from sink are developed to show the existence of skewness. Dissert. Abstr.

N80-10456 North Carolina State Univ. at Raleigh.
AN INVESTIGATION OF THE EFFECTS OF INTERNAL SOLIDIFICATION ON TURBULENT-FLOW HEAT TRANSFER AND PRESSURE DROP IN A HORIZONTAL TUBE Ph.D. Thesis
Samuel Boyce Thomason 1979 189 p
Avail: Univ. Microfilms Order No. 7923075

A quasi steady analysis is developed to predict the transient heat transfer and pressure drop response when freezing occurs on the wall of a tube containing turbulent flow. Steady state and transient experimental data are presented for comparison. Uniform tube wall temperature distributions are discussed. Analytical predictions of heat transfer and pressure drop when the tube wall temperature distribution in the apparatus exhibited significant nonuniformity are evaluated. Dissert. Abstr.

N80-10457*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
EFFECTS OF TRUNCATION IN MODAL REPRESENTATIONS OF THERMAL CONVECTION
Philip S. Marcus Nov. 1979 35 p refs
(Grants NGR-33-010-186; NSF ATM-76-10424; NSF AST-78-20708)
(NASA-CR-162251; CRSR-730) Avail: NTIS HC A03/MF A01 CSCL 20D

The Galerkin (including single-mode and Lorenz) equations were examined for convection in a sphere to determine which physical processes are neglected when the equations of motion are truncated too severely. The conclusions were tested by calculating solutions to the equations of motion for different values of the Rayleigh number and for different values of the limit of the horizontal spatial resolution. It was shown that the transitions from steady state to periodic, then to aperiodic convection depend not only on the Rayleigh number but also very strongly on the horizontal resolution. One of the effects of truncation is to enhance the high wavenumber end of the kinetic energy and thermal variance spectra. The numerical examples indicate that as long as the kinetic energy spectrum decreases with wavenumber, a truncation gives a qualitatively correct solution. M.M.M.

N80-10458*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN EXPERIMENTAL INVESTIGATION TO DETERMINE THE EFFECT OF WINDOW COOLING BY MASS INJECTION FOR THE SHUTTLE INFRARED LEESIDE TEMPERATURE SENSING (SILTS) EXPERIMENT
Pamela F. Bradley Sep. 1979 44 p refs
(NASA-TM-80170) Avail: NTIS HC A03/MF A01 CSCL 20D

The effect of mass injection on the shuttle infrared leeside temperature sensing (SILTS) pod window surfaces in reducing window heating and minimizing window lens radiation during the reentry data taking period is investigated. Heat transfer coefficients on and around the simulated windows and window cavities are determined. Heat transfer rates and window coolant flow rates are reported for the SILTS configuration. A comparison of two windows' geometries and their effects on the heat transfer rate is discussed and oil flow photographs are presented to

indicate how mass injection affects the flow field near the SILTS window. A.W.H.

N80-10459*# National Aeronautics and Space Administration, Washington, D. C.
FUNDAMENTALS OF HEAT MEASUREMENT
O. A. Gerashchenko Aug. 1979 234 p refs Transl. into ENGLISH of "Osnovy Teplometrii" (Kiev), Naukova Dumka Press, 1971 p 1-192 Original language document was announced as A72-35495 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75490) Avail: NTIS HC A11/MF A01 CSCL 20D

Various methods and devices for obtaining experimental data on heat flux density over wide ranges of temperature and pressure are examined. Laboratory tests and device fabrication details are supplemented by theoretical analyses of heat-conduction and thermoelectric effects, providing design guidelines and information relevant to further research and development. A theory defining the measure of correspondence between transducer signal and the measured heat flux is established for individual (isolated) heat flux transducers subject to space and time-dependent loading. An analysis of the properties of stacked (series-connected) transducers of various types (sandwich-type, plane, and spiral) is used to derive a similarity theory providing general governing relationships. The transducers examined are used in 36 types of derivative devices involving direct heat loss measurements, heat conduction studies, radiation pyrometry, calorimetry in medicine and industry and nuclear reactor dosimetry. Author

N80-10460*# Battelle Columbus Labs., Ohio.
SPRAY NOZZLE DESIGNS FOR AGRICULTURAL AVIATION APPLICATIONS Final Report, Oct. 1978 - Sep. 1979
K. W. Lee, A. A. Putnam, J. A. Gieseke, M. N. Golovin, and J. A. Hale 18 Sep. 1979 105 p refs
(Contract NAS3-21581)
(NASA-CR-159702) Avail: NTIS HC A06/MF A01 CSCL 20D

Techniques of generating monodisperse sprays and information concerning chemical liquids used in agricultural aviation are surveyed. The periodic dispersion of liquid jet, the spinning disk method, and ultrasonic atomization are the techniques discussed. Conceptually designed spray nozzles for generating monodisperse sprays are assessed. These are based on the classification of the drops using centrifugal force, on using two opposing liquid laden air jets, and on operating a spinning disk at an overloaded flow. Performance requirements for the designs are described and estimates of the operational characteristics are presented. A.W.H.

N80-10461*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
FLOW ON MAGNETIZABLE PARTICLES IN TURBULENT AIR STREAMS Ph.D. Thesis
Kent Ritter Davey Aug. 1979 265 p
(Grant NsG-1453)
(NASA-CR-162418) Avail: NTIS HC A12/MF A01 CSCL 20D

The flow of magnetizable particles in a turbulent air stream in the presence of an imposed magnetic field and the phenomenon of drag reduction produced by the introduction of particles in turbulent boundary layer are investigated. The nature of the particle magnetic force is discussed and the inherent difference between electric and magnetic precipitation is considered. The incorporation of turbulent diffusion theory with an imposed magnetic migration process both with and without inertia effects is examined. A.W.H.

N80-10462# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FORCED RESPONSE OF A BLASIUS FLAT-PLATE BOUNDARY LAYER TO AN EXTERNAL VORTEX STREET Interim Report
J. W. Ellinwood 5 Jul. 1979 67 p refs
(Contract F04701-78-C-0079)
(AD-A072486; TR-0079(4940-01)-5; SAMSO-TR-79-65) Avail: NTIS HC A04/MF A01 CSCL 20/4

An asymptotic theory is presented for two-dimensional disturbances in the wake of an oscillating shedding-vortex line source and in the local presence of a semi-infinite flat plate and its boundary layer. No instabilities were sought or excited. The very large parameter is a Reynolds number; the shedding frequency is moderate. The boundary layer is comprised of three sublayers. In the outer 'edge' sublayer, where the Blasius variable is logarithmically large, the disturbance velocities are described analytically by Kelvin functions. Results compare qualitatively with previous numerical and experimental findings and indicate that the boundary layer effectively suppresses the external disturbances. Those disturbances that remain in the boundary layer peak at a finite (large) Reynolds number and finite frequency. GRA

N80-10463# Dynamics Technology, Inc., Torrance, Calif.
RE-ESTABLISHMENT OF LAMINAR FLOW ON A HEATED SUBMERGED VEHICLE
E. Reshotko, R. L. Gran, and K. T. S. Tzou Jul. 1979 59 p refs
(Contract N00014-77-C-0005)
(AD-A072566; DT-7802-10) Avail: NTIS HC A04/MF A01 CSCL 20/4

In order to study the process by which laminar flow is re-established after a heated submerged vehicle encounters a patch of turbulent flow, an analytical model has been formulated which simulates the heat transfer characteristics of the external skin and internal heating passage of such a vehicle. This model considers the energy equations for the external skin and for the internal heating passage and the coupling between them due to heat transfer to the external flow. Numerical solutions to this coupled set of equations for a number of turbulent patch scenarios have been obtained by an explicit finite-difference procedure for a two-dimensional flat-plate example that quantitatively simulates the characteristics of a typical tow-tank test vehicle. GRA

N80-10464# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
EXPERIMENTAL INVESTIGATION OF ANNULAR CASCADE PERFORMANCE Final Technical Report, 1 Jan. 1974 - 31 Jul. 1978
B. L. McFadden May 1979 248 p refs
(AD-A072442; AFAPL-TR-79-2048) Avail: NTIS HC A11/MF A01 CSCL 20/4

The purpose of this experiment was to verify the analysis of radial equilibrium for compressible flow through a stationary cascade, where radial equilibrium is defined as uniform axial mass flow. Experimental determination of the effect of compressibility on analytical predictions of flow angle was of primary importance. Previous analytical work is summarized and those results shown. A specially designed annular flow test apparatus was constructed for this work and its features are described in detail. Finally, the results of detailed flow field surveys using three different blade angle settings are summarized and compared with both the free vortex and the Engelman analysis. In order to aid visualization of the real flow field as measured, various computerized graphical presentations of the data are shown. In addition, these survey results are compared with analytical predictions from a two-dimensional computer program developed by the General Electric Company and a three-dimensional computer program developed by AiResearch Manufacturing Company of Arizona. GRA

N80-10465# California State Univ., Long Beach. Dept. of Mechanical Engineering.
PREDICTION OF UNSTEADY TURBULENT BOUNDARY LAYERS WITH FLOW REVERSAL
Tuncer Cebeci, Lawrence W. Carr, and Peter Bradshaw 1979 7 p refs Presented at the 2d Symp. on Turbulent Shear Flows, London, 2-4 Jul. 1979
(Contract N00019-78-M-0466)
(AD-A072548) Avail: NTIS HC A02/MF A01 CSCL 20/4

The prediction of unsteady turbulent boundary layers with flow reversal is of importance in a number of aerodynamic problems, notably in dynamic stall, buffeting and gust studies. However, some of the more popular turbulence models implicitly assume that the wall shear is positive and their extension to unsteady flows with flow reversal is not easy. It requires a modification of the functional form of the law of the wall and

the manner in which the wall shear is determined. Two near-wall assumptions are considered here. In the first, the near wall grid point is located in the logarithmic region and the law of the wall is used to link the flow properties at this grid point to the wall. In the second, a Van Driest formulation due to Cebeci and Smith is used and implies that the grid point closest to the wall will occur in the viscous sublayer. GRA

N80-10466# Sandia Labs., Albuquerque, N. Mex.
HEAT TRANSFER INTO THE INFINITE REGION EXTERNAL TO A CYLINDER
D. E. Amos Nov. 1978 17 p refs
(Contract EX-76-C-04-0789)
(SAND-78-1942) Avail: NTIS HC A02/MF A01

Numerical procedures for evaluation of the transient heat flux from a cylinder, across a barrier, into the exterior region are described for the case of zero initial temperature with constant physical properties. These include the evaluation of an integral representation and an asymptotic expansion in time for t as it approaches o, uniform in the dimensionless heat tranfer coefficient. The analysis is implemented in a computer subroutine HFLUX. DOE

N80-10467# Los Alamos Scientific Lab., N. Mex.
HEAT PIPE THERMAL CONTROL OF SLENDER OPTICS PROBES
F. C. Prenger, Jr. 1979 20 p Presented at the AIAA Terrestrial Energy Systems Conf., Orlando, Fla., 4 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-78-3169; Conf-790611-1) Avail: NTIS HC A02/MF A01

The thermal design for a stereographic viewing system is presented. The design incorporates an annular heat pipe and thermal isolation techniques. Test results are compared with design predictions for a prototype configuration. Test data obtained during heat pipe startup showing temperature gradients along the evaporator wall are presented. Correlations relating maximum well temperature differences to a liquid Reynolds number were obtained at low power levels. These results are compared with Nusselt's falling film theory. DOE

N80-10468# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.
ONE-DIMENSIONAL MODEL OF VAPOR GENERATION IN STEADY FLASHING FLOW
B. J. C. Wu, P. Saha, N. Abuaf, and O. C. Jones, Jr 1979 11 p refs Presented at the ANS annual meeting, Atlanta, Ga., 3 Jun. 1979
(Contract EY-76-C-02-0016)
(BNL-NUREG-25616; Conf-790602-6) Avail: NTIS HC A02/MF A01

A nonequilibrium vapor generation model is described and applied to results of flashing experiments. The transition from liquid to two phase flow must be understood in order to predict the critical flow rates of a vapor-liquid mixture discharging into a low pressure environment. DOE

N80-10469# Idaho National Engineering Lab., Idaho Falls.
MEASUREMENT OF PHASE VELOCITIES IN MIST FLOWS USING STAGNATION PROBES
J. R. Fincke and V. A. Deason Mar. 1979 41 p refs
(Contract EY-76-C-07-1570)
(NUREG-CR-0648; TREE-1350) Avail: NTIS HC A03/MF A01

Details of techniques required to determine local phase velocities and drop size are presented along with a sampling technique for obtaining liquid flow rate. Requirements for the successful probe design are discussed. The details of operation in steady state flows are given, as well as recomendations concerning extrapolation to transient flows. Experimental results obtained in steady state airwater mist flows are detailed. The ratio of mass flow rate of gas to liquid was varied from 1.0 to 8.0, and the superficial gas velocity was varied from 35 to 80 m/s. Flow regimes covered are annular mist, dispersed mist, and stratified mist. Local slip ratios between 1.0 and 6.0 were measured, with most measured slip ratios lying between 1.0 and 2.0. DOE

N80-10470# Los Alamos Scientific Lab., N. Mex.
VNAP: A COMPUTER PROGRAM FOR COMPUTATION OF TWO-DIMENSIONAL, TIME-DEPENDENT COMPRESSIBLE, VISCOUS, INTERNAL FLOW
M. C. Cline Nov. 1978 177 p refs
(Contract W-7405-eng-36)
(LA-7326) Avail: NTIS HC A09/MF A01

A computer program, VNAP, for calculating viscous, as well as inviscid, steady and unsteady, internal flow is presented. The Navier-Stokes equations for two dimensional, time dependent, compressible flow are solved using the second-order accurate MacCormack finite difference scheme. The boundary mesh points, except no-slip wall points, are calculated using a characteristic scheme with the viscous terms treated as source functions. The no-slip wall points are computed using the MacCormack scheme with the derivatives normal to the wall approximated by one-sided differences. An explicit artificial viscosity is included for shock calculations, and a mixing length model is included for turbulent flows. The fluid is assumed to be a perfect gas. The steady-state solution is obtained as the asymptotic solution for large time. The flow boundaries may be arbitrary curved solid walls or free jet envelopes. Typical problems that can be solved are flow in pipes and ducts; converging, converging-diverging, and plug nozzles; subsonic and supersonic inlets; and free jet expansions. DOE

N80-10471# California Univ., Livermore. Lawrence Livermore Lab.
INTRODUCTION TO HYDRODYNAMICS
M. L. Wilkins 9 Jan. 1979 43 p refs
(Contract W-7405-eng-48)
(UCID-18016) Avail: NTIS HC A03/MF A01

Various aspects of hydrodynamics and elastic-plastic flow are introduced for the purpose of defining hydrodynamic terms and explaining what some of the important hydrodynamic concepts are. Included are views on the hydrodynamic theory along with some fundamental hydrodynamic equations, discontinuities, and shock, detonation, and elastic-plastic waves. Applications of hydrodynamic theory to material equations of state, spall, Taylor instabilities, and detonation pressure measurements are discussed. DOE

N80-10472# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE LIMITS FOR LIQUID-METAL HEAT PIPES CONTAINING LONG ADIABATIC SECTIONS
F. Coyne Prenger, Jr. and J. E. Kemme 1979 6 p refs Presented at 14th Intersociety Energy Conversion Conf., Boston, 5-10 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1241) Avail: NTIS HC A02/MF A01

Analytical and experimental investigation of the performance limits of liquid-metal heat pipes containing long adiabatic sections were made. An analytical model describing the vapor flow and including the effects of wall friction and compressibility is presented. Performance limits and axial temperature profiles of a sodium-filled, stainless steel heat pipe were measured for comparison with the analytical results. Complete validation of the analytical model requires further experiments. The results show that a transition from laminar turbulent vapor flow occurs in the adiabatic section with an accompanying decrease in the heat pipe performance limit. The reduced performance results from an increased wall friction factor for the turbulent flow. DOE

N80-10473# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
UNSTEADY LAMINAR-FLOW SEPARATION IN TUBES. 2: THE EFFECT OF VARIATIONS IN THE FREQUENCY AND AMPLITUDE OF FLOW OSCILLATIONS Final Report, 1 Sep. 1974 - 30 Nov. 1977
Daniel J. Schneck and Frederic J. Walburn Jun. 1979 138 p refs
(Grant NSF ENG-74-20142)
(PB-296968/1; VPI-E-79-21) Avail: NTIS HC A07/MF A01 CSCL 20D

A laser Doppler anemometer technique was developed and used to study steady and unsteady flow through rigid circular tubes. Investigation of the symmetry of the separation pattern revealed a marked dependence on the Reynolds number. The

trajectory of the point of flow separation as a function of the unsteady Reynolds number is reported. Finally, applicability of current flow separation criteria are discussed in view of fluid behavior upstream of the separation point. GRA

N80-10474# National Bureau of Standards, Washington, D. C.
A LINEARIZED FINITE DIFFERENCE COMPUTATION OF FLUID HEATING IN AN ENCLOSURE Interim Report
Ronald G. Rehm, Martin R. Cordes, Howard R. Baum, and John Lewis May 1979 78 p refs Prepared in cooperation with Boeing Computer Services, Inc., Seattle, Wash.
(PB-298053/0; NBSIR-79-1754) Avail: NTIS HC A05/MF A01 CSCL 13M

In an earlier paper, approximate equations of motion were derived which are applicable to nondissipative, very nonadiabatic, buoyant flows of a perfect gas. In the present paper, these approximate equations are recast in a form in which they can be integrated by finite difference techniques. Results of some computations are presented using computer-generated plots. A discussion is given of the software required to generate these plots. The principal application of interest to the authors is buoyant convection induced in room fires. GRA

N80-10004 Allerton Press, Inc., New York, N. Y.
STUDY OF SELF-OSCILLATORY LIQUID FILM FLOW REGIME IN COAXIAL AIR STREAM
V. G. Bazarov and L. A. Lyulka *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 12-15 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 19-24 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10005 Allerton Press, Inc., New York, N. Y.
DYNAMIC CHARACTERISTICS OF LIQUID FILM IN HYBRID HYDROSTATIC BEARING
A. I. Belousov and Yu. A. Ravikovich *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 16-19 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 25-29 (For primary document see N80-10001 01-01)
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N80-10007 Allerton Press, Inc., New York, N. Y.
ON THE STUDY OF HEAT TRANSFER WITH THE AID OF A LOCAL HEAT FLUX SENSOR
Yu. F. Gortyshov, I. M. Varfolomeev, and R. A. Yaushev *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 25-27 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 38-41 (For primary document see N80-10001 01-01)
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N80-10009 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF THE GASDYNAMIC CHARACTERISTICS OF A STATOR CASCADE WITH COOLING AIR DISCHARGE THROUGH THE VANE SURFACE
O. N. Emin, I. I. Kutysh, and P. I. Shvartsman *In its* Soviet Aeron., Vol. 21, No. 3, 1978 p 31-36 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 46-53 (For primary document see N80-10001 01-01)
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N80-10010 Allerton Press, Inc., New York, N. Y.
ON THE INFLUENCE OF LIQUID OSCILLATIONS IN FUEL LINE ON THE HEAD OF A PUMP OPERATING IN REGIMES WITH REVERSE FLOW
V. G. Kinelev *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 37-39 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 54-57 (For primary document see N80-10001 01-01)
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N80-10012 Allerton Press, Inc., New York, N. Y.
MOST RATIONAL LINEARIZATION OF NONLINEAR UNSTEADY HEAT CONDUCTION PROBLEMS
N. L. Menshikh *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 44-47 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 63-67 (For primary document see N80-10001 01-01)
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N80-10019 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF TURBULENCE ENERGY BALANCE COMPONENTS IN THE SECTION OF A RETARDED TURBULENT BOUNDARY LAYER
E. V. Shishov, P. S. Roganov, V. M. Belov, and V. N. Afanasev *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 78-81 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 108-112 (For primary document see N80-10001 01-01)
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N80-10020 Allerton Press, Inc., New York, N. Y.
THE TURBULENT BOUNDARY LAYER ON A CURVILINEAR SURFACE
A. V. Shchukin *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 82-87 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 113-120 (For primary document see N80-10001 01-01)
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N80-10021 Allerton Press, Inc., New York, N. Y.
CORRELATION OF EXPERIMENTAL DATA ON TWO-PHASE-FLOW HEAT TRANSFER IN CONVERGENT PART OF A NOZZLE
V. K. Shchukin, A. I. Mironov, V. A. Filin, and N. N. Kovalnogov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 88-92 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 121-126 (For primary document see N80-10001 01-01)
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N80-10026 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF CURVILINEAR SURFACE FILM COOLING EFFECTIVENESS
V. I. Lokai, A. V. Skchukin, and R. M. Khairutdinov *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 113-115 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 150-153 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10030 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL DETERMINATION OF HEAT TRANSFER COEFFICIENT WHEN EMPTYING GAS VESSELS
L. G. Chirva, A. V. Polshin, and V. S. Kostenko *In its* Soviet Aeron., Vol. 21, No. 3 1978 p 127-129 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978 p 165-167 (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10033 Allerton Press, Inc., New York, N. Y.
MATHEMATICAL MODEL AND STABILITY OF HYDRAULIC SERVO DRIVE WITH JET-THROTTLE REGULATION
A. I. Bazhenov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 6-9 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 11-15 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10036 Allerton Press, Inc., New York, N. Y.
ON THE LAMINAR BOUNDARY ON THE SURFACE OF A

CYLINDER MOVING IN A FLUID
V. A. Bashkin and G. M. Dzhamgarov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 22-26 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4 1978 p 29-35 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10064 Allerton Press, Inc., New York, N. Y.
HEAT TRANSFER IN TURBULENT GAS FLOWS WITH HIGH-FREQUENCY PRESSURE OSCILLATIONS
B. M. Galitseiskii *In its* Soviet Aeron., v. 22, no. 1 1979 p 11-15 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 17-23 (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

N80-10072 Allerton Press, Inc., New York, N. Y.
LIQUID EJECTOR WITH PERFORATED NOZZLE
A. A. Stolyarov *In its* Soviet Aeron., v. 22, no. 1 1979 p 50-53 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Techn. (USSR), v. 22, no. 1, 1979 p 64-68 (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

N80-10073 Allerton Press, Inc., New York, N. Y.
GENERALIZED HEAT AND MASS TRANSFER LAW FOR INTERNAL FLOWS
A. A. Khalatov *In its* Soviet Aeron., v. 22, no. 1 1979 p 54-57 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 69-72 (For primary document see N80-10061 01-01)
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N80-10076 Allerton Press, Inc., New York, N. Y.
APPROXIMATE CALCULATION OF THE LAMINAR BOUNDARY LAYER IN MICRONOZZLES
F. A. Akhmedyanova, A. A. Vaindiner, P. G. Danilaev, and N. F. Salikhov *In its* Soviet Aeron., v. 22, no. 1 1979 p 68-70 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 86-88 (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011, $50.00

N80-10080 Allerton Press, Inc., New York, N. Y.
APPLICATION OF GRADIENT METHOD TO STUDY OF HEAT TRANSFER IN AXISYMMETRIC CHANNELS OF DIFFERENT CONFIGURATION
N. N. Kovalnogov *In its* Soviet Aeron., v. 22, no. 1 1979 p 80-83 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 96-100 (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

N80-10084 Allerton Press, Inc., New York, N. Y.
SEMI-EMPIRICAL METHOD FOR DETERMINING LOCAL HEAT TRANSFER COEFFICIENTS FOR FLOW AROUND A SPHERE
L. I. Kudryashev and N. I. Klyuev *In its* Soviet Aeron., v. 22, no. 1 1979 p 93-95 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979 p 107-109 (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-10475 California Univ., Santa Barbara.
DIGITAL RECONSTRUCTION OF ACOUSTIC HOLOGRAMS Ph.D. Thesis
Nie But Tse 1979 122 p
Avail: Univ. Microfilms Order No. 7921049

Computer processing of holograms from a specific holographic system is investigated. The system consists of a linear array of receiving elements which scan a holographic plane in conjunction with a perpendicularly oriented insonifying transducer, an electronic system for demodulating received signals and a digital computer for data processing. The processing includes image reconstruction and motion correction. Two image reconstruction algorithms are discussed. A technique for reducing image degradation due to motion is presented. The motion correction is discussed for the near field and the Fresnel regions. The modification of the laboratory holographic system to improve image quality and processing speed is examined. An optimized processing procedure is developed and computer simulations are presented. Dissert. Abstr.

N80-10476*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
STUDY OF A STEREO ELECTRO-OPTICAL TRACKER SYSTEM FOR THE MEASUREMENT OF MODEL DEFORMATIONS AT THE NATIONAL TRANSONIC FACILITY Final Report
Richard J. Hertel Oct. 1979 82 p refs
(Contract NAS1-15629)
(NASA-CR-159146) Avail: NTIS HC A05/MF A01 CSCL 14B

An electro-optical method to measure the aeroelastic deformations of wind tunnel models is examined. The multi-target tracking performance of one of the two electronic cameras comprising the stereo pair is modeled and measured. The properties of the targets at the model, the camera optics, target illumination, number of targets, acquisition time, target velocities, and tracker performance are considered. The electronic camera system is shown to be capable of locating, measuring, and following the positions of 5 to 50 targets attached to the model at measuring rates up to 5000 targets per second. A.W.H.

N80-10477*# National Aeronautics and Space Administration, Washington, D. C.
SEMICONDUCTOR MILLIMETER AND CENTIMETER WAVE RADIOMETER FOR THE STUDY OF THE RADIATION OF AN UNDERLYING SURFACE
G. S. Bordonskiy, A. N. Zazinov, Yu. A. Kirsanov, M. K. Kravchenko, Yu. B. Khapin, A. N. Sharapov, and V. S. Etkin Oct. 1979 25 p refs Transl. into ENGLISH of Report Pr-321 (Moscow), 1977 25 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-75671; Pr-321) Avail: NTIS HC A02/MF A01 CSCL 14B

A theoretical and experimental investigation of a superheterodyne radiometer system with input frequency converter and intermediate frequency modulation is presented. Conditions are found, at which the temperature sensitivity of the device does not deteriorate. A sensitivity function to external parameters (temperature, heterodyne power) of a radiometer system with intermediate frequency modulation and a Schottky diode frequency converter is presented and calculated. Use of a frequency converter at the second harmonic of the heterodyne permitted simplication of the radiometer design and the use of a semiconductor heterodyne. A 3 cm range intermediate frequency amplifier permitted the use of centimeter wave radiometer signals.

Fluctuation sensitivity of radiometers with a 1 sec time constant is 0.3 K at 3.4 mm and 0.06 K at 3 cm. Author

N80-10478*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL STUDY OF THE VIDICON SYSTEM FOR INFORMATION RECORDING USING THE WIDE-GAP SPARK CHAMBER OF GAMMA - TELESCOPE GAMMA-I
V. V. Akimov, R. Bazer-Bashv, S. A. Voronov, A. M. Galper, M. Gro, L. F. Kalinkin, P. Kerl, V. D. Kozlov, F. Koten, and D. Kretol Sep. 1979 19 p refs Transl. into ENGLISH of "Eksperimental'noye Issledovaniye Vidikonnoy Sistemy dlya S'yema Informatsii s Shirokozazornykh Iskrovykh Kamer Gamma-Telescopa 'Gamma-I'", Rept. Pr-436 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-22 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75644; Pr-436) Avail: NTIS HC A02/MF A01 CSCL 14E

The development of the gamma ray telescope is investigated. The wide gap spark chambers, used to identify the gamma quanta and to determine the directions of their arrival, are examined. Two systems of information recording with the spark chambers photographic and vidicon system are compared. A.W.H.

N80-10479# Terra Tek, Inc., Salt Lake City, Utah.
HIGH-TEMPERATURE STRAIN INSTRUMENTATION FEASIBILITY STUDY Final Report
Lynn M. Barker May 1979 41 p
(Contract DAAG46-78-C-0033)
(AD-A072443; AMMRC-TR-79-30) Avail: NTIS HC A03/MF A01 CSCL 20/11

The problem of instrumenting the strain in all three coordinate directions on a body whose surface temperature is 1100 to 1650 C was addressed. No pre-existing satisfactory solution was found in the literature. A new needle and pivot point (NAPP) mechanism for strain instrumentation is therefore proposed. Calculations of the thermal and mechanical performance of the device indicate that it should satisfy the desired instrumentation characteristics. The device could be used to measure triaxial strains simultaneously at 40 or more different locations on a test structure. GRA

N80-10480# Brookhaven National Lab., Upton, N. Y.
HEAT OF VAPORIZATION SPECTROMETER
D. Edwards, Jr. 1979 14 p refs Presented at the 25th Natl. Vacuum Symp., San Francisco, 27 Nov. 1978
(Contract EY-76-C-02-0016)
(BNL-24973; Conf-781130-3) Avail: NTIS HC A02/MF A01

Multilayer desorption measurements of various substances adsorbed on a stainless steel substrate were taken. They showed desorption profiles consistent with a zeroth order desorption model. The singleness of the desorption transients together with their narrow peak widths makes the technique ideally suited for a heat of vaporization spectrometer for either substance analysis or identification. DOE

N80-10481# Sandia Labs., Albuquerque, N. Mex. Systems Research Div.
CODED APERTURE IMAGING: A COMPARISON BETWEEN FRESNEL ZONE APERTURES AND UNIFORMLY REDUNDANT ARRAY APERTURES
K. W. Chu Oct. 1978 61 p refs
(Contract EX-76-C-04-0789)
(SAND-78-1625) Avail: NTIS HC A04/MF A01

Using computer simulations, comparisons were made between a one dimensional Fresnel zone aperture and a one dimensional uniformly redundant array aperture. In the former case, artifacts may produce severe distortions in the reconstructed image, and an iterative technique to remove these artifacts is described. In comparison to the Fresnel zone aperture, images reconstructed from uniformly redundant array apertures had few artifacts. A quantum noise analysis for the uniformly redundant array is presented to indicate the conditions under which a uniformly redundant array will produce a signal noise advantage compared to an equivalent pinhole aperture. DOE

N80-10482# Idaho National Engineering Lab., Idaho Falls.
HIGH TEMPERATURE TUNGSTEN-RHENIUM THERMOCOUPLES WITH MOLYBDENUM-RHENIUM SHEATHS
S. C. Wilkins Oct. 1978 51 p refs
(Contract EY-76-C-07-1570)
(TFBP-TR-285) Avail: NTIS HC A04/MF A01

A W5Re/W26Re thermocouple with a molybdenum-rhenium alloy sheath for short term in-pile temperature measurement is described. Details of special measuring junction fabrication and of a laser-welded, strain-relieved splice to a compensating extension cable are included. Results of laboratory testing up to 2430 C are presented and recommendations for improved performance and longer lifetime are discussed. DOE

N80-10483# California Univ., Berkeley. Lawrence Berkeley Lab.
NOISE CONSIDERATIONS IN MILLIMETER-WAVE SPECTROMETERS
W. D. Zoellner, W. F. Kolbe, and B. Leskovar Dec. 1978 28 p refs
(Contract W-7405-eng-48)
(LBL-7294) Avail: NTIS HC A03/MF A01

An improved version of a microwave spectrometer operating in the vicinity of 70 GHz is described. The spectrometer, which incorporates a Fabry-Perot resonator superheterodyne detection for high sensitivity is designed for the detection of gaseous pollutants and other atmospheric constituents. The instrument is capable of detecting polar molecules with absorption coefficients as small as 2 x 10 to the minus 9th power/cm. For sulphur dioxide diluted in air, this sensitivity corresponds to a detection limit of 1.2 ppm without preconcentration and with a time constant of 1 second. Measurements and analysis of the noise contributions limiting the sensitivity are presented. DOE

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-10484 Rochester Univ., N. Y.
SCALAR DIFFRACTION ANALYSIS OF LIGHT SCATTERING BY EPITHELIAL CELLS FROM A LINE FOCUSED LASER BEAM Ph.D. Thesis
James Alan Hardy 1979 211 p
Avail: Univ. Microfilms Order No. 7922935

The scattering of light from a line focused laser beam by biological cells is investigated as a source of structural information about the cells. The line focus irradiation scheme and the nature of the information sought are determined by the intended implementation of developed techniques in a rapid cell analysis instrument. Cell orientation, shape and the presence of cytoplasmic and nuclear boundaries within the line focus are investigated. The Fraunhofer approximation to scalar diffraction theory is appropriate to describe scattering from epithelial cells. Computer simulations based upon a fast Fourier transform algorithm are used to model scattering from simple geometrical figures such as circles, ellipses and squares. The results of the simulations are used both to suggest and interpret experiments carried out on several test objects in addition to epithelial cells.
Dissert. Abstr.

N80-10485 Rochester Univ., N. Y.
MULTIPLE PHOTON PROCESS IN SF6 Ph.D. Thesis
Mordekhay Rothschild 1979 140 p
Avail: Univ. Microfilms Order No. 7922960

An investigation of multiple-photon phenomena which may occur during the interaction of certain polyatomic molecules with powerful infrared lasers is presented. The basic mechanisms involved in the multiple photon absorption (MPA) and multiple photon dissociation (MPD) in these molecules were elucidated. During MPA some molecules absorb more than one photon, whose frequency is close to that of a vibrational normal mode of the molecule. In certain instances, if a high level of vibrational excitation of the molecule is attained through MPA, the molecule may dissociate. This process is then called MPD. The molecule SF6 was chosen as representative of a whole class of molecules

and the laser employed in the experiments was a pulsed CO2 laser. Dissert. Abstr.

N80-10486# Illinois Univ. at Urbana-Champaign. Dept. of Chemistry.
CHEMILUMINESCENCE OF DIPHENYL PEROXIDE. PULSED LASER SPECTROPHOTOMETRIC DETECTION OF RADICAL ION INTERMEDIATES ON THE CIEEL PATH
Gary B. Schuster and Keith A. Horn 5 Jul. 1979 15 p refs
Sponsored in part by NSF Submitted for publication
(Contract N00014-76-C-0745; NR Proj. 051-616)
(AD-A071151) Avail: NTIS HC A02/MF A01 CSCL 07/4

The reactions of diphenyl peroxide with a series of electronically excited state hydrocarbon reactants were investigated by pulsed laser spectrophotometry. It was found that the primary reaction between the excited state and the peroxide is electron transfer to generate a radical ion pair. The ions were detected by their characteristic absorption spectra. The reaction kinetics were measured and used to verify the generation of radical ion intermediates in the chemically initiated electron-exchange luminescence (CIEEL) mechanism for the chemiluminescence of organic peroxides. GRA

N80-10487# Hughes Research Labs., Malibu, Calif.
OPTICAL-MICROWAVE INTERACTIONS IN SEMICONDUCTOR DEVICES Quarterly Report, 1 Apr. - 30 Jun. 1979
L. Figueroa, C. Slayman, and H. W. Yen Jul. 1979 29 p refs
(Contract N00173-78-C-0192)
(AD-A072539; QR-1) Avail: NTIS HC A03/MF A01 CSCL 20/5

The study of injection-laser mode locking was continued. The lasers were operated in the external cavity configuration using a piece of optical fiber. Pumping injection lasers with short electrical pulses at a frequency corresponding to the round-trip transit frequency of the cavity generated stable optical pulses. A modified GaAs FET structure was designed such that efficient optical coupling to the active region of the device causes a strong optical-microwave interaction in the device for high-speed optical detection, optical injection locking of oscillators and optical-microwave mixing in amplifiers. Liquid phase epitaxial growth was used to grow the necessary GaAs and Ga0.6Al0.4As layers on a semi-insulating substrate. Device fabrication is still in progress. Preliminary results showed that the devices exhibited a reasonable source-drain current versus source-drain voltage characteristic and are quite uniform over the entire wafer. A GaAs Gunn diode was designed and fabricated during the quarter. The diodes will be used to study the interaction between the injection laser's output and the high field Gunn domain in the diode. The ultimate goal is to achieve the efficient high-speed pulsed modulation of injection lasers. Diodes with various lengths were fabricated and tested using a curve tracer. Differential negative resistance was observed in all the diodes tested. GRA

N80-10488# Army Electronics Research and Development Command, Fort Monmouth, N. J. Night Vision and Electro-Optics Labs.
A PERFORMANCE EVALUATION OF MINI-LASER CARTRIDGE DEVICES Final Report
J. W. Strozyk and L. Wacenske May 1979 20 p
(AD-A072505; DELNV-TR-79-1) Avail: NTIS HC A02/MF A01 CSCL 20/5

The development of miniaturized laser rangefinders and laser sighting systems has evolved as a direct result of large scale integration of electronics and more recently, the integration of the laser transmitter assembly into a 'cartridge' device. This paper addresses the evaluation of the latest 'bonded cartridge' device design, presents performance data and provides a comparitive assessment with previous devices. Laser performance is discussed in terms of corrected beam divergence, beam quality and beam stability as well as energy efficiency. Although the number of devices available for examination was small (6), the improvement in beam characteristics over previous designs was readily observed. GRA

N80-10489# Naval Research Lab., Washington, D. C.
DARPA-NRL LASER PROGRAM Annual Report, 1 Oct. 1977 - 30 Sep. 1978
S. K. Searles 28 Jun. 1979 164 p refs
(DARPA Order 4019)
(AD-A072359; NRL-MR-4019) Avail: NTIS HC A08/MF A01 CSCL 20/5

The DARPA-NRL Program is concerned with the development of laser technology. New concepts in photolytic pumping and wavelength conversion have been investigated. Limitations of the mercury halide lasers have been studied. The basic physics of the XeF laser has been examined theoretically and experimentally. Author (GRA)

N80-10490# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT OF AN ACTIVELY MODELOCKED AND Q-SWITCHED OSCILLATOR FOR LASER FUSION PROGRAM AT LLL
D. J. Kuizenga 19 Jul. 1978 8 p refs Presented at Meeting on Picosecond Phenomena, Hilton Head, S.C., 24 May 1978
(Contract W-7405-eng-48)
(UCRL-81365; Conf-780579) Avail: NTIS HC A02/MF A01

A method was developed that allows the mode-locking process to go to its steady state condition before the laser is Q-switched. This is done by pumping the laser quasi-cw for about 5 ms. During this time, the loss in the Q-switch is such that the laser will just slightly go above threshold. The active modulator is on during this time, and the laser oscillates quasi-cw for a period long enough to obtain stable transform-limited short pulses. At the end of this prelase period, the laser is Q-switched, and a train of stable, short pulses is obtained. DOE

N80-10491# Los Alamos Scientific Lab., N. Mex.
MID-INFRARED OPTICALLY PUMPED LASERS
C. R. Jones Aug. 1979 20 p refs
(Contract W-7405-eng-36)
(LA-7331-MS; UC-22) Avail: NTIS HC A02/MF A01

Optically pumped lasers emitting in the middle-infrared spectral region are reviewed. General features of these lasers are discussed, and published data on them are summarized. Approximate lasing wavelengths are indicated, and a few of the more important mid-infrared optically pumped lasers are treated in more detail. DOE

N80-10492# Los Alamos Scientific Lab., N. Mex.
DIFFRACTION MEASUREMENTS FOR LASL'S ANTARES LASER SYSTEM
J. E. Sollid Aug. 1978 36 p refs
(Contract W-7405-eng-36)
(LA-7443-MS) Avail: NTIS HC A03/MF A01

Beam diffraction, both in the near field and the far field, was studied to assess the effect of the 12-segmented annular exit window proposed for the Antares laser system. The near-field studies indicate that diffraction spillover effects are less than 5% and that hot spots in the aperture are not apt to exceed the design flux level of 2J/sq cm. The far-field investigation shows that the segments in the annulus may be considered independently and, therefore, energy and intensity add up incoherently. Also, the total intensity distribution is well approximated by 12 times the intensity distribution in a circular aperture with the same area as a single sector. DOE

N80-10493# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY MACHINING STUDY ON FLUOROBERYLLATE LASER GLASS Final Report
Phillip C. Baker, R. T. Maney, and G. M. Sanger 11 Jun. 1979 25 p refs
(Contract W-7405-eng-48)
(UCID-18201) Avail: NTIS HC A02/MF A01

A series of scribe tests of fluoroberyllate glass using a radiused diamond tool indicated the possibility of this glass being a candidate for diamond machining. Based on the scribe tests, an effort was undertaken using existing conventional equipment to explore the machinability of fluoroberyllate (836 Corning glass) with a machine parameter study. A series of cuts of varying depths was completed using heptyl alcohol as a coolant. Nomarski microphotographs and Celvite profilometer scans were made of the surface after each run. Microphotographs of the tool were made to document tool wear. The results indicate that substantial

amounts of the fluoroberyllate glass could be removed without any visible damage to the diamond tool. DOE

N80-10260*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S-BAND ULTRALOW-NOISE TRAVELING-WAVE MASER
D. Trowbridge and J. Loreman *In its* The Deep Space Network 15 Oct. 1979 p 148-154 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-10494* National Aeronautics and Space Administration. Pasadena Office, Calif.
SODIUM STORAGE AND INJECTION SYSTEM Patent
Alvin R. Keeton, inventor (to NASA) (Westinghouse Electric Corp., Trafford, Pa.) Issued 25 Sep. 1979 7 p Filed 24 Feb. 1978 Supersedes N78-22187 (16 - 13, p 1679) Sponsored by NASA
(NASA-Case-NPO-14384-1; US-Patent-4,169,129; US-Patent-Appl-SN-880728; US-Patent-Class-422-242; US-Patent-Class-210-186; US-Patent-Class-210-340; US-Patent-Class-239-102; US-Patent-Class-239-302; US-Patent-Class-422-187; US-Patent-Class-422-199; US-Patent-Class-422-208; US-Patent-Class-422-235; US-Patent-Class-423-350) Avail: US Patent and Trademark Office CSCL 13I

A sodium storage and injection system for delivering atomized liquid sodium to a chemical reactor employed in the production of solar grade silicon is disclosed. The system is adapted to accommodate start-up, shut-down, normal and emergency operations, and is characterized by (1) a jacketed injection nozzle adapted to atomize liquefied sodium and (2) a supply circuit connected to the nozzle for delivering the liquefied sodium. The supply circuit is comprised of a plurality of replaceable sodium containment vessels, a pump interposed between the vessels and the nozzle, and a pressurizing circuit including a source of inert gas connected with the vessels for maintaining the sodium under pressure.
Official Gazette of the U.S. Patent and Trademark Office

N80-10495 Engineering Sciences Data Unit, London (England).
EQUILIBRIUM TEMPERATURES IN SELF-CONTAINED BEARING ASSEMBLIES. PART 2: FIRST APPROXIMATION TO TEMPERATURE RISE
1979 11 p Also published as ISSN-0141-2590
(ESDU-78027; ISBN-0-85679-231-4; ISSN-0141-2590) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $290.50

Upper and lower estimates of the temperature rise in a simple bearing assembly in order to assess the need for redesign or more refined analysis were made. ESDU

N80-10496 North Carolina State Univ. at Raleigh.
DEVELOPMENT OF MATHEMATICAL MODELS TO DESCRIBE THE WEAR PROCESS IN VISCOELASTIC MATERIALS Ph.D. Thesis
Hamdi Ahmed Elsayed Saleh 1979 150 p
Avail: Univ. Microfilms Order No. 7923067

Mathematical models are presented for steady state solutions for stress and temperature for longitudinal wave propagation in a composite model of an elastic tire cord supported in a viscoelastic rubber matrix with a thermal coupling subjected to a sinusoidal shear stress at the interface. The models provide the capability of predicting the pressure and temperature at the interface between the cord and rubber matrix when subjected to dynamic loading simulating the tire operating conditions. The interfacial temperature of four tires varying in size and construction were calculated. The calculated results indicate the cords and rubber matrices in bias ply tires are more extensible in the longitudinal direction than the radial ply tires. In the radial ply tire with wire belts the cords were less extensible than a similar tire with a nylon cord belt. In all cases the extensibility of the cord increases with the angular speed of the tire. Dissert. Abstr.

N80-10497*# National Aeronautics and Space Administration, Washington, D. C.
ALGORITHM FOR CONSTRUCTING THE PROGRAMMED MOTION OF A BOUNDING VEHICLE FOR THE FLIGHT PHASE
V. V. Lapshin Aug. 1979 47 p refs Transl. into ENGLISH of "Algoritm Postroeniva Programmnogo Dvizheniva Prygayushchego Apparata dlya Fazy Poleta', Prep. No. 26 Acad. of Sci. USSR, Inst. of Appl. Math., Moscow, 1979 p 1-53 Transl. by Leo Kanner Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75668; Preprint-26) Avail: NTIS HC A03/MF A01 CSCL 13I

The construction of the programmed motion of a multileg bounding vehicle in the flight was studied. An algorithm is given for solving the boundary value problem for constructing this programmed motion. If the motion is shown to be symmetrical, a simplified use of the algorithm can be applied. A method is proposed for nonimpact of the legs during lift-off of the vehicle, and for softness at touchdown. Tables are utilized to construct this programmed motion over a broad set of standard motion conditions. F.O.S.

N80-10498# Ebasco Services, Inc., New York.
APPLICATIONS SURVEY: EVALUATION OF GAS TURBINE NEEDS Final Report
R. R. Bennett, H. J. Riedel, and J. E. Kruck Nov. 1978 151 p
(EPRI Proj. 990-1)
(EPRI-AF-911) Avail: NTIS HC A08/MF A01

The results of an extensive survey of 38 representative utilities to determine their needs for future gas turbine unit additions and to determine potentially beneficial research projects for resolving current problems with gas turbine units are presented with supporting statistics. DOE

N80-10499# Oak Ridge National Lab., Tenn.
IMPROVEMENTS IN REMOTE EQUIPMENT TORQUING AND FASTENING
John Garin 1978 32 p ref Presented at the ANS 26th Conf. on Remote Systems Technology, Washington, D. C., 12-17 Nov. 1978
(Contract W-7405-eng-26)
(CONF-781105-64) Avail: NTIS HC A03/MF A01

Specialized subassemblies to torque and fasten equipment in a remotely controlled environment were developed. The subassemblies were adapted into a system that would provide remote torquing and fastening in the range of 200 to 750 nm(150 to 550 ft/lb). DOE

N80-10500# Idaho National Engineering Lab., Idaho Falls.
IMPROVED RELAP4 JET PUMP MODEL Code Assessment and Applications Data Report
E. E. Ross Apr. 1979 60 p refs Sponsored in part by the Nuclear Regulatory Commission
(Contract EY-76-C-07-1570)
(CAAP-TR-046) Avail: NTIS HC A04/MF A01

A RELAP4 Jet Pump Model was developed based on subscale jet pump tests. This work was part of the INEL technical support to the NRC for Industry Cooperative Programs. Model evaluation results show the model to be an improvement of the previous model. DOE

N80-10501# Sandia Labs., Albuquerque, N. Mex.
DEPENDENCE OF FRACTURE TOUGHNESS OF MOLYBDENUM LASER WELDS ON DENTRITIC SPACING AND IN SITU TITANIUM ADDITIONS
J. L. Jellison 1979 12 p refs Presented at the US/UK Symp. on Neutron Generators, Albuquerque, New Mex., 21 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-0193C; CONF-790518-6) Avail: NTIS HC A02/MF A01

The fracture toughness of molybdenum welds was improved

by in situ gettering of oxygen by means of physically deposited titanium. The addition of titanium suppressed brittle intergranular fracture. Pulsed laser welds (both Nd:YAG and CO2) exhibited superior toughness to that of continuous wave CO2 laser welds. Also, welds of vacuum arc remelted grades were tougher than those of sintered molybdenum. DOE

N80-10502# Oak Ridge National Lab., Tenn.
STEAM TURBINES
John T. Meador. Oct. 1978. 110 p. refs
(Contract W-31-109-eng-38)
(ANL/CES/TE-78-7) Avail: NTIS. HC A06/MF A01

The selection, classification, and average shaft efficiencies are discussed of some small-to-medium size steam turbines that can be used for base-load, turbine-generator units to meet both the electrical and thermal energy demands of several communities, as specified in evaluations for Integrated Community Energy Systems (ICES). Shaft efficiencies are evaluated by combining the average internal turbine efficiencies and the Rankine steam-cycle efficiencies for several combinations of steam inlet conditions under conditions of both fully condensing and non condensing exhaust steam. Efficiencies of very small turbines for mechanical drive of compressors or power plant auxiliaries also are estimated. Two examples are given of the input data necessary to establish preliminary costs for an industrial-extraction type turbine that may be adapted to ICES. Some data on operational considerations and cost factors are included. DOE

N80-10023 Allerton Press, Inc., New York, N. Y.
MATHEMATICAL MODELS OF THE PROCESS OF VIBRO-ABRASIVE GRINDING OF PARTS WITH AUTONOMOUS VIBRATIONS IN THE VIBROMACHINE CONTAINER
F. S. Yunusov, V. G. Gazizov, N. P. Zinovev, A. A. Nazipov, and V. V. Yakunin. *In its* Soviet Aeron., Vol. 21, No. 3, 1978, p. 97-103. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 3, 1978, p. 133-141. (For primary document see N80-10001 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-10066 Allerton Press, Inc., New York, N. Y.
MEASUREMENT OF LIQUID PUMP TORQUE IN THE STARTING REGIME
N. S. Ershov, V. V. Ramodina, and V. V. Chervakov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 20-25. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 12, no. 1, 1979, p. 30-35. (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

N80-10070 Allerton Press, Inc., New York, N. Y.
METHOD FOR CALCULATING OPTIMAL PARAMETERS OF HIGH-PRESSURE PNEUMATIC DRIVES
M. Ya. Panov, A. M. Kurganov, and V. P. Kozelkov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 39-43. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 51-56. (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

N80-10081 Allerton Press, Inc., New York, N. Y.
UNLOADING THE DRIVE OF GAS DISTRIBUTER VALVES OPERATING AT HIGH PRESSURES
I. A. Krivosheev, A. M. Rusak, I. M. Urakev, and Z. G. Shaikhutdinov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 84-86. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 100-102. (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

N80-10088 Allerton Press, Inc., New York, N. Y.
STUDY OF SIZE DISTRIBUTION OF OIL DROPS FORMED IN GTE OIL
P. G. Petrov and O. A. Povarov. *In its* Soviet Aeron., v. 22, no. 1, 1979, p. 105-107. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekhn. (USSR), v. 22, no. 1, 1979, p. 117-119. (For primary document see N80-10061 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., New York, N. Y. 10011; $50.00

N80-10257*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANTENNA AZIMUTH BEARING MODEL EXPERIMENT
H. McGinness. *In its* The Deep Space Network, 15 Oct. 1979, p. 123-131. refs. (For primary document see N80-10240 01-12)
Avail: NTIS. HC A09/MF A01. CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-10503# Lockheed-Georgia Co., Marietta.
RELIABILITY OF NONDESTRUCTIVE INSPECTIONS. Final Report, Jul. 1974 - Dec. 1978
William H. Lewis, William H. Sproat, Bruce D. Dodd, and James M. Hamilton. Dec. 1978. 429 p. refs
(Contracts F41608-76-D-A005; F41608-77-D-A021)
(AD-A072097; LG79ER0011; SA-ALC/MME-76-6-38-1) Avail: NTIS. HC A19/MF A01. CSCL 01/3

The results of a four-year Air Force Logistics Command program to determine the reliability of Air Force nondestructive inspection capability are presented. The report completely describes the program-its objectives, scope, planning and logistics, participants, data collection, analysis, conclusions and recommendations. Actual aircraft structural samples containing fatigue damage were transported to 21 different Air Force bases and depots, where approximately 300 Air Force technicians performed ultrasonic, eddy current, penetrant and radiographic nondestructive inspections (NDI) on the samples. The same detailed NDI procedures were followed by all participating technicians. The individual results were recorded and accumulated in terms of 'finds', 'misses' and 'false calls', compared to a preliminary knowledge of actual flaw locations. A detailed teardown inspection of the samples at the end of the program verified and refined actual flaw tabulations. Results were computerized for data storage and retrieval and analyzed for each NDI method and structure sample type to provide detection probability versus flaw size (POD) curves. Other analyses provide POD curves for years training, experience, age, etc. The program results indicate that Air Force NDI needs improvement in several specific areas in order to meet existing requirements for inspection of Air Force hardware. Some conclusions were derived concerning factors that apparently affect Air Force inspection reliability. Recommendations for making both short-term and long-term improvements in NDI proficiency are presented. GRA

N80-10504# Atomics International, Golden, Colo. Rockwell Hanford Operations.
QUALITY ASSURANCE IN ALTERNATIVE ENERGY SOURCES
R. D. Hammond. 2 Feb. 1979. 14 p. Presented at the First Annual Western Energy Quality Assurance Seminar, San Francisco, 7 Apr. 1979
(Contract EY-77-C-06-1036; Contract EY-77-C-1030)
(RHO-SA-107) Avail: NTIS. HC A02/MF A01

The Hanford history, description of the radwaste efforts taking place, future plans, and highlights of the increasing role of quality assurance are outlined. DOE

N80-10505# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE ULTRASONIC TESTING AND INSPECTION. VOLUME 3: CITATIONS FROM THE ENGINEERING INDEX DATA BASE. Progress Report, May 1977 - Mar. 1979
Guy E. Habercom, Jr. Jul. 1979. 180 p.
(NTIS/PS-79/0636/5) Avail: NTIS. HC $28.00/MF $28.00. CSCL 14B

Ultrasonic equipment and techniques for nondestruction

inspection/testing of materials and fabrication processes are investigated in these reports obtained from worldwide literature. This updated bibliography contains 172 abstracts, none of which are new entries to the previous edition. GRA

N80-10506# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE ULTRASONIC TESTING AND INSPECTION. VOLUME 4: CITATIONS FROM THE ENGINEERING INDEX DATA BASE, APRIL 1978 MAY 1979 Progress Report, Apr. 1978 - May 1979
Guy E. Habercom, Jr. Jul. 1979 267 p Supersedes NTIS/PS-78/0568; NTIS/PS-77/0404; NTIS/PS-76/0424
(NTIS/PS-79/0637/3; NTIS/PS-78/0568; NTIS/PS-77/0404; NTIS/PS-76/0424) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

Ultrasonic equipment and techniques for nondestruction inspection/testing of materials and fabrication processes are investigated in these reports obtained from worldwide literature. This updated bibliography contains 260 abstracts, all of which are new entries to the previous edition. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-10507* National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR DETECTING SUBSTRUCTURE MICROFRACTURES AND METHOD THEREFORE Patent
Shakkottai P. Parthasarathy (JPL) and Keshavanyengar Y. Narasimhan, inventors (to NASA) (JPL) Issued 18 Sep. 1979 6 p Filed 6 Sep. 1977 Supersedes N79-20556 (17 - 11, p 1455) Sponsored by NASA
(NASA-Case-NPO-14192-1; US-Patent-4,168,483; US-Patent-Appl-SN-830562; US-Patent-Class-367-26; US-Patent-Class-181-102; US-Patent-Class-181-105; US-Patent-Class-467-2-8) Avail: US Patent and Trademark Office CSCL 20N

Bursts of signals at different frequencies are induced into substructure, adjacent to a borehole. The return signals from each burst of signals are normalized to compensate for the attenuation, experienced by more distant return signals. The peak amplitudes of return signals, above a selected level, are cut off, and an average signal is produced from the normalized amplitude-limited return signals of each burst. The averaged signals of the return signals of all the signal bursts at the different frequencies are processed to provide a combined signal, whose amplitude is related to the microfracture density of the substructure adjacent to the borehole.

Official Gazette of the U.S. Patent and Trademark Office

N80-10508 Colorado Univ. at Boulder.
NONLINEAR INELASTIC STABILITY OF FLEXIBLY-CONNECTED PLANE STEEL FRAMES Ph.D. Thesis
Michael Harold Ackroyd 1979 330 p

The effects of flexible beam-to-column connections on the ultimate capacity of regular, steel building frames were investigated. A classical elastic stability analysis procedure is formulated which accounts for connections having linear moment-rotation characteristics. This procedure is applied to a simple portal frame to determine the effects of connection stiffness on the elastic buckling capacity of the frame. It is seen that increased connection stiffness results in increased elastic buckling capacity. A procedure is developed which accounts for nonlinear flexible connections and inelastic behavior of the beams and columns comprising the frame. The resulting procedure, which is based on a secant stiffness approach, is programmed for digital computer to analyze frames under proportionately increasing loads until the ultimate capacity is reached. Dissert. Abstr.

N80-10509 Rensselaer Polytechnic Inst., Troy, N. Y.
THEORY OF REALIZABILITY FOR LINEARLY ELASTIC TRUSS-STRUCTURES AND RELATED APPLICATIONS IN OPTIMUM STRUCTURAL DESIGN Ph.D. Thesis
Eleftherios Lefcochilos 1979 142 p
Avail: Univ. Microfilms Order No. 7922233

The optimum design of linearly elastic truss-structures under multiple loading conditions in canonical schemes without making use of approximations are formulated. Consequently, by implementing appropriate mathematical programming methods, a solution representing the global optimum case can be obtained. The examination of the physical and deformational effects that the different loading conditions produce on the structure are reported. The scope of such a course is termed, henceforth, the subject matter of the theory of realizability. The particular objectives evolve along two distinct, though parallel, approaches representing the state of the structural effect considered; the displacement and the force approach. Dissert. Abstr.

N80-10510 Pennsylvania State Univ., University Park.
COINCIDENCE OF HIGHER-ORDER MODES: A MECHANISM OF THE EXCITATION OF CYLINDRICAL SHELL VIBRATIONS VIA INTERNAL SOUND Ph.D. Thesis
Jeremy Lee Walter 1979 180 p
Avail: Univ. Microfilms Order No. 7922360

A match in the characteristic axial phase velocity (defines a coincidence condition) between a particular spinning acoustic mode and the corresponding shell flexural mode is demonstrated. This occurs at a frequency slightly above the acoustic mode cutoff frequency. A spectral analysis of an experimentally measured pipe wall acceleration signal revealed that the maximum wall response occurs at the coincidence frequency, and not at the cutoff frequency of the mode in question. It was concluded that any and all prediction schemes for sound transmission through a pipe wall must address the contribution of spinning-mode coincidence coupling, and essentially none of the present ones do. Dissert. Abstr.

N80-10511# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
CONSTANT AND VARIABLE LOADING FATIGUE STRENGTH OF BLACK-HEART MALLEABLE CAST IRON REGARDING METALLURGICAL CHARACTERISTICS
H. Ostermann, H. Rueckert, and A. Engels 31 Jan. 1979 14 p refs Repr. from Giessereiforschung (Dusseldorf), vol. 1, 31 Jan. 1979 p 25-36 In GERMAN; ENGLISH summary
(ICAF-1089) Avail: NTIS HC A02/MF A01

Fatigue tests were carried out on axial loaded notched specimens made from black-heart malleable cast iron covering the range from 350 to 700 N/sq mm ultimate tensile strength. Within this range three alloys were produced according to the German specification GTS 35, GTS 55 and GTS 70; three foundries with two different melting heats which were included. The machined test bars with a final cross section of 40 x 5 mm were notched corresponding to the stress concentration factors K = 2.0 and 3.6 and in the fatigue tests subjected to axial loading with stress ratios of R = 0. For each combination of type of material and testing parameters K and R statistical data from S-N tests and 8 stepped program tests were obtained. A relation between the observed differences in fatigue properties dependent on casting and annealing techniques and some typical metallurgical characteristics so as number, shape and extension of temper-carbon nodules is presented. R.E.S.

N80-10512*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LIGHT AIRPLANE CRASH TESTS AT THREE ROLL ANGLES
Claude B. Castle and Emilio Alfaro-Bou Washington Oct. 1979 77 p refs
(NASA-TP-1477; L-12778) Avail: NTIS HC A05/MF A01 CSCL 01C

Three similar twin engine general aviation airplanes were crash tested at the Langley impact dynamics research facility at 27 m/sec and at nominal roll angles of 0 deg, -15 deg, and -30 deg. Other flight parameters were held constant. The test facility, instrumentation, test specimens, and test method are briefly described. Structural damage and accelerometer data for

each of the three impact conditions are presented and discussed. Author

N80-10513# Technion - Israel Inst. of Tech., Haifa. Material Mechanics Lab.
DYNAMIC RESPONSE OF A SLAB OF ELASTIC-VISCOPLASTIC MATERIAL THAT EXHIBITS INDUCED PLASTIC ANISOTROPY Interim Report
J. Aboudi and S. R. Bodner Aug. 1979 38 p refs Sponsored in part by European Office of Aerospace Research and Development
(Contract F49620-79-C-0196)
(ISSN-0072-9310; MML-67; SR-1) Avail: NTIS HC A03/MF A01

Various two dimensional problems of the dynamic loading of a slab are solved for a material characterization that is elastic-viscoplastic and exhibits anisotropic work-hardening. The governing constitutive equations are based on a unified formulation which requires neither a yield criterion nor loading or unloading conditions. They include multidimensional anisotropic effects induced by the plastic deformation history. The theory also considers plastic compressibility which depends on the extent of anisotropy. A numerical procedure for solving equations is developed which incorporates the history dependent anisotropic hardening effects. Cases considered are the dynamic penetration of a slab by a rigid cylindrical indenter, and a distributed force rapidly applied over part of the slab surface. Both conditions of fixed and free rear surfaces of the slab are examined. A uniaxial problem is also considered in which different bases for the anisotropic hardening law are examined. Author

N80-10514*# Engineering Information Systems, Inc., San Jose, Calif.
USER'S GUIDE: SPAR PROCESSOR MN ANALYSIS OF INELASTIC THREE-DIMENSIONAL SOLIDS, PART 2
W. D. Whetstone and C. E. Jones Sep. 1979 16 p refs
(Contract NAS8-32365)
(NASA-CR-161321; EISI/A3088) Avail: NTIS HC A02/MF A01 CSCL 20K

A user's guide to the processor MN is presented. The processor MN is used to analyze systems in which some or all of the three dimensional elements have nonlinear stress-strain relations. Representations of nonlinear material behavior implemented into the system are provided including Von Mises yield criterion, the Prandtl-Reuss flow rule, and the mechanical sublayer method. The primary data sets used to represent the state of the system are presented. A.W.H.

N80-10515*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
EFFECT OF TIME DEPENDENT FLIGHT LOADS ON JT9D-7 PERFORMANCE DETERIORATION
A. Jay and B. L. Lewis 21 Aug. 1979 73 p refs
(Contract NAS3-20632)
(NASA-CR-159681; PWA-5512-45) Avail: NTIS HC A04/MF A01 CSCL 01C

The results of a modal transient analysis of the engine/aircraft system are presented. The response of the JT9D to analytically simulated vertical gusts and landings was predicted using a NASTRAN finite element mathematical model of the JT9D/747 propulsion system. The NASTRAN finite element model of the propulsion system included engine structural models of the fan, low/high pressure compressors, diffuser/turbine cases, and high/low pressure rotors, as well as nacelle models of the inlet cowl, tailcone, and wing pylon. The analysis conducted predicts that an insignificant level of JT9D-7 performance deterioration would occur due to a typical vertical gust encounter or a typical revenue service landing. Analysis of a high sink rate landing with a heavy fuel load indicates the possibility of local wear, however, the lack of an accurate dynamic rotor/seal interference model precludes an accurate quantitative evaluation of performance change for this once-per-airframe-life event. J.M.S.

N80-10516*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COUPLED ROTOR AND FUSELAGE EQUATIONS OF MOTION
William Warmbrodt Oct. 1979 82 p refs
(NASA-TM-81153) Avail: NTIS HC A05/MF A01 CSCL 20K

The governing equations of motion of a helicopter rotor coupled to a rigid body fuselage are derived. A consistent formulation is used to derive nonlinear periodic coefficient equations of motion which are used to study coupled rotor/fuselage dynamics in forward flight. Rotor/fuselage coupling is documented and the importance of an ordering scheme in deriving nonlinear equations of motion is reviewed. The nature of the final equations and the use of multiblade coordinates are discussed. A.W.H.

N80-10517# Royal Aircraft Establishment, Farnborough (England).
A NEW METHOD OF ELECTRIC MEASUREMENT OF CRACK LENGTH
G. Baudin and H. Policella May 1979 24 p refs Transl. into ENGLISH from Rech. Aerosp. (France), v. 4, 1978 p 195-203
(RAE-Trans-2016; BR70094) Avail: NTIS HC A02/MF A01

Improvements on devices used for determining the existence or propagation of a crack in an electrically conducting material are presented: The procedure consists in ensuring a pulsed electric supply, which reduces the response time of the measurement, and, more important still, makes it free of noise and of the constant current amplifier zero drift. In case of cyclic loadings, the pulse may be synchronized with these loadings. The great flexibility of use, the performance obtained, and applications of the instrument are emphasized. M.M.M.

N80-10518# Dayton Univ., Ohio.
COLLAPSE LOAD ANALYSIS FOR PLATES AND SHELLS Final Report, Oct. 1977 - Oct. 1978
Nelson R. Bauld, Jr. and Kailasam Satyamurthy May 1979 217 p refs
(Contract F33615-76-C-3145; AF Proj. 2307)
(AD-A071649; AFFDL-TR-79-3038) Avail: NTIS HC A10/MF A01 CSCL 20/11

This report presents a theoretical foundation, computational procedures, and a computer program for the analyses of bifurcation or collapse of circular, cylindrical panels and rectangular plates. Discretization is accomplished via a variable-spacing, orthogonal, finite-difference grid using the principle of total poten' energy. The modified Newton-Raphson iterative procedure ed to generate nonlinear load-deflection curves and a separa... branch of the program provides a bifurcation analysis based on linear, prebuckling behavior. The program is capable of handling rectangular cut-out and initial geometric imperfections; a variety of zero force and zero displacement boundary conditions; and point loads, line loads, and distributed loads in transverse, longitudinal and circumferential directions, as well as axial end-compression. GRA

N80-10519# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
FRACTURE MECHANICS AND SURFACE CHEMISTRY STUDIES OF FATIGUE CRACK GROWTH IN AN ALUMINUM ALLOY
R. P. Wei, P. S. Pao, R. G. Hart, T. W. Weir, and G. W. Simmons Apr. 1979 36 p refs
(Contract N00014-75-C-0543)
(AD-A071438; IFSM-79-98; TR-9) Avail: NTIS HC A03/MF A01 CSCL 11/6

Fracture mechanics and surface chemistry studies were carried out to develop further understanding of the influence of water vapor on fatigue crack growth in aluminum alloys. The room temperature fatigue crack growth response was determined for 2219-T851 aluminum alloy exposed to water vapor at presures from 1 Pa to 30 Pa over a range of stress intensity factors (K). Data were also obtained in vacuum and dehumidified argon. The test results showed that, at a frequency of 5 Hz, the rate of crack growth is essentially unaffected by water vapor until a threshold pressure is reached. Above this threshold, the rates increased, reaching a maximum within one order of magnitude increase in vapor pressure. GRA

N80-10520# Naval Research Lab., Washington, D. C.
MATERIAL RESPONSE TO 500 keV PROTON BEAMS AT INTENSITIES BELOW 1 GW/cm2 Final Report
T. R. Tucker, D. Mosher, and D. Hinshelwood 25 Jul. 1979 28 p

(AD-A072416; NRL-MR-4043) Avail: NTIS HC A03/MF A01 CSCL 20/11

Stress-wave response of several materials to 500 keV, 1 kA/sq cm. proton pulses was monitored by shadowgraphy and interferometric methods. Results indicated the presence of both direct absorption and interaction plasma effects. Incident beam power densities of about 1 GW/sq cm are necessary for plasma effects to dominate the interaction. GRA

N80-10521# Army Materials and Mechanics Research Center, Watertown, Mass.

ILLUSTRATIONS OF TWO SIMPLE METHODS OF DETERMINING STRESS INTENSITY FACTORS FROM STRESS CONCENTRATIONS AND STRESS DISTRIBUTIONS Final Report

Francis I. Baratta Apr. 1979 23 p refs

(AD-A072199; AMMRC-MS-79-3) Avail: NTIS HC A02/MF A01 CSCL 20/11

Illustrative examples of two methods of determining approximate stress intensity factors from (a) stress concentration factors and (b) from stress distributions are presented. In the first case several example problems are presented whereby stress intensity factors are obtained from known stress concentration factor data. These illustrative problems include data obtained from both closed form and experimental solutions. The results of this method are compared to a well-known, accurate analysis, and guidelines regarding such usage are presented. In the second case, several approximate methods of determining stress intensity factors, utilizing stress distributions available in the literature, are presented to the reader. Example problems are illustrated and compared to more accurate results when available. Estimates of the accuracy and limited guidance on the usage of such methods are given. GRA

N80-10522# AiResearch Mfg. Co., Phoenix, Ariz.

CONTACT STRESS ANALYSIS OF CERAMIC-TO-METAL INTERFACES Final Report

D. G. Finger 24 May 1979 30 p refs

(Contract N00014-78-C-0547)

(AD-A072073; AiResearch-21-3239) Avail: NTIS HC A03/MF A01 CSCL 20/11

The program was specifically directed to study contact stresses at the interface between inserted ceramic turbine blades (hot-pressed silicon nitride) and a metal rotor, but the method of analysis, results, and conclusions also provided a better understanding of contact stresses at ceramic-to-metal and ceramic-to-ceramic interfaces for static components. A finite-element stress analysis procedure and structural evaluation technique consistent with the statistical nature of ceramic materials was generated. Specimen testing was conducted to obtain validation of these techniques and provide insight as to possible modifications of stress simulation or fracture prediction criteria. The objective was to develop a design methodology, which will improve on current design methods, thus permitting the design of interface configurations in which strengths more indicative of the inherent strength of ceramic materials can be realized. GRA

N80-10523# Texas A&M Univ., College Station.

AN INCREMENTAL FORM OF THE SINGLE-INTEGRAL NONLINEAR VISCOELASTIC THEORY FOR ELASTIC-PLASTIC-CREEP FINITE ELEMENT ANALYSIS

Duane R. Sanders and Walter E. Haisler Mar. 1979 13 p refs

(Contract N00014-76-C-0150)

(AD-A072151; TR-3275-79-1) Avail: NTIS HC A02/MF A01 CSCL 20/11

A single-integral nonlinear viscoelastic theory is cast into a generalized incremental form for use in predicting creep response of materials. The incremental creep constitutive model is tailored for use in an incremental finite element program wherein the equations of motion are integrated numerically step-by-step. Recursive relations for material memory parameters are developed which allow the retention of all past history, prior to the current time step, and require integration over the current time step only. The creep model parameters required in the theory are obtainable from a standard creep and recovery test. The incorporation of the model within an incremental elastic-plastic finite element formulation is outlined. GRA

N80-10524# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.

AN INVESTIGATION INTO THE COMBINED ISOTROPIC-KINEMATIC WORKHARDENING RULE Interim Report

David H. Allen 30 May 1979 14 p refs

(Contract N00014-76-C-0150)

(AD-A072152; TR-3275-79-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

The Ziegler modification of the Prager kinematic workhardening rule has been shown to be a correct statement of consistency during plastic loading. Although the same modification has been used in conjunction with a combined isotropic-kinematic workhardening rule, it has not been established that this latter model renders an acceptable statement of consistency. This paper shows that the Ziegler modification used with the combined isotropic-kinematic workhardening rule not only satisfies the consistency condition, but is also computationally more different than a direct employment of the consistency condition. GRA

N80-10525# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.

THE APPLICATION OF THERMAL AND CREEP EFFECTS TO THE COMBINED ISOTROPIC-KINEMATIC HARDENING MODEL FOR INELASTIC STRUCTURAL ANALYSIS BY THE FINITE ELEMENT METHOD Interim Report

David H. Allen and Walter E. Haisler 31 May 1979 28 p refs

(Contract N00014-76-C-0150)

(AD-A072153; TR-3275-79-3) Avail: NTIS HC A03/MF A01 CSCL 20/11

In this paper, a formulation is presented for a combined isotropic-kinematic hardening rule which includes both creep and thermal effects. The resulting model accounts for temperature dependent material properties as well as the Bauschinger effect for average loading. The virtual work equation and resulting matrix equations are derived for implementation of the model into a general purpose finite element code. GRA

N80-10526# California Univ., Livermore. Lawrence Livermore Lab.

COMPUTER MODEL FOR DUCTILE FRACTURE

B. Moran and J. E. Reavch 8 May 1979 24 p refs

(Contract W-7405-eng-48)

(UCID-18070) Avail: NTIS HC A02/MF A01

A computer model is described for predicting ductile fracture initiation and propagation. The computer fracture model is calibrated by simple and notched round-bar tension tests and a precracked compact tension test. The model is used to predict fracture initiation and propagation in a Charpy specimen and compare the results with experiments. The calibrated model provides a correlation between Charpy V-notch (CVN) fracture energy and any measure of fracture toughness, such as J/sub Ic/. A second simpler empirical correlation was obtained using the energy to initiate fracture in the Charpy specimen rather than total energy CVN, and compared the results with the empirical correlation of Rolfe and Novak. DOE

N80-10527# Oak Ridge National Lab., Tenn.

STRESS ANALYSIS OF CYLINDRICAL PRESSURE VESSELS WITH CLOSELY SPACED NOZZLES BY THE FINITE-ELEMENT METHOD. VOLUME 3: VESSELS WITH THREE NOZZLES UNDER INTERNAL PRESSURE AND EXTERNAL LOADINGS

F. K. W. Tso (System Development Corp.) and R. A. Weed (System Development Corp.) 3 Apr. 1979 59 p refs

(Contract W-7405-eng-26; DOE-IA-40-551-75; DOE-IA-40-552-75)

(NUREG-CR-0507-Vol-3; ORNL/NUREG-18/V3) Avail: NTIS HC A04/MF A01

A finite-element computer program, MULT-NOZZLE, was developed for the stress analysis of cylindrical pressure vessels with one, two, or three closely spaced reinforced nozzles. The nozzles may be unreinforced or fully reinforced according to the rules of the ASME Boiler and Pressure Vessel Code. The program consists of two modules that may be operated independently.

The first module, FEMG, automatically prepares a finite-element mesh, including the nodal point coordinates, finite-element connectivities, mesh options, and boundary value specifications for input to the finite-element solution module SAP3M. SAP3M, which is a modified and improved version of the SAP3 computer program, computes the nodal point displacements and stress tenor components and prints and/or stores the results for later postprocessing. DOE

N80-10528# Sandia Labs., Albuquerque, N. Mex.
VISCOPLASTIC FINITE ELEMENT ANALYSIS OF STEADY-STATE FORMING PROCESSES INCLUDING STRAIN HISTORY AND STRESS FLUX DEPENDENCE
P. R. Dawson 1978 26 p refs Presented at the ASME Meeting, San Francisco, 10 Dec. 1978
(Contract EY-76-C-04-0789)
(SAND-77-1663C; Conf-781202) Avail: NTIS HC A03/MF A01

A method to determine the strain history throughout a body by integration of the deformation rates or deformation gradients in an Eulerian reference frame is presented. With knowledge of the strain history, a viscoplastic formulation is extended to include strain history dependence. The extended viscoplastic formulation and strain history integration are applied to the thermomechanical analyses of slab rolling and axisymmetric extrusion. DOE

N80-10529# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
VIBRATION FREQUENCIES OF AN ARCH MODEL UNDER VARIOUS LOADING CONDITIONS Technical Report, Dec. 1978 - May 1979
Raymond H. Plaut May 1979 39 p refs
(Grant NSF ENG-77-17847)
(PB-297987/0; VPI-E-79-19) Avail: NTIS HC A03/MF A01 CSCL 20K

The loading-frequency relationship for a rigid bar model of a shallow elastic arch is studied. Three independent, concentrated, vertical loads are applied and the resulting load versus frequency curves are determined. Convexity properties and bounds are discussed. GRA

N80-10530# National Technical Information Service, Springfield, Va.
MATHEMATICAL ANALYSIS OF STRESS CRACKS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Report, 1974 - 1976
Guy E. Habercom, Jr. Aug. 1979 228 p
(NTIS/PS-79/0803/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 20K

Stress cracks were analyzed by mathematical methods, including extensive use of finite element analysis. Various materials including metals, wood, composites, and rock were investigated. (This updated bibliography contains 219 abstracts, none of which are new entries to the previous edition.) GRA

N80-10531# National Technical Information Service, Springfield, Va.
MATHEMATICAL ANALYSIS OF STRESS CRACKS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Report, 1977 - Jul. 1979
Guy E. Habercom, Jr. Aug. 1979 127 p Supersedes NTIS/PS-78/0768; NTIS/PS-77/0645; NTIS/PS-76/0554; NTIS/PS-75/467; COM-74-10242
(NTIS/PS-79/0804/9; NTIS/PS-78/0768; NTIS/PS-77/0645; NTIS/PS-76/0554; NTIS/PS-75/467; COM-74-10242) Avail: NTIS HC $28.00/MF $28.00 CSCL 20K

Stress cracks are analyzed by mathematical methods, including extensive use of finite element analysis. Various materials, including metals, wood, composites, and rock are investigated. This updated bibliography contains 118 abstracts, 21 of which are new entries to the previous edition. GRA

N80-10532# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
USE OF COMPUTER STRUCTURAL PROGRAMS FOR THE DYNAMIC ANALYSIS OF SATELLITES STRUCTURES
R. Barboni (Rome Univ.) and G. Morelli (Compagnia Nazionale Aerospaziale, Rome) Aug. 1979 17 p refs Presented at the 4th Struct. and Mater. Panel Meeting, Florence, Sep. 1978
(AGARD-R-680; ISBN-92-835-1335-5) Avail: NTIS HC A02/MF A01

The essential aspects of computer programs for structural analysis are analyzed along with the dynamic problems of satellites. Possible future trends are outlined, and the meaningful features in dynamic structural computer programs are presented. F.O.S.

N80-10039 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF INITIAL DEFLECTIONS ON BUCKLING OF CYLINDRICAL SHELLS UNDER CREEP CONDITIONS WITH COMBINED ACTION OF AXIAL COMPRESSION AND INTERNAL PRESSURE
Yu. P. Vorotilin and L. M. Kurshin *In its* Soviet Aeron., v. 21, no. 4, 1978 p 38-42 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 49-54 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10043 Allerton Press, Inc., New York, N. Y.
ANALYSIS OF THIN-WALL BEAMS BY THE METHOD OF SEGMENTS
A. S. Kretov and V. G. Shataev *In its* Soviet Aeron., v. 21, no. 4, 1978 p 58-61 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 75-80 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10052 Allerton Press, Inc., New York, N. Y.
CREEP ANALYSIS OF THIN-WALL STRUCTURES SUBJECT TO TRANSIENT HEATING AND LOADING
V. G. Shataev, Yu. A. Kashfraziev, and A. G. Samartsev *In its* Soviet Aeron., v. 21, no. 4, 1978 p 103-105 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 130-132 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10054 Allerton Press, Inc., New York, N. Y.
DETERMINATION OF STRAIN FIELDS NEAR CONCENTRATORS FROM STRAIN GAGE INDICATORS
A. L. Brushkovskii *In its* Soviet Aeron., v. 21, no. 4, 1978 p 142-144 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aeron. Tekh., (USSR), v. 21, no. 4, 1978 p 114-116 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fith Avenue, New York, N. Y. 10011; $45.00

N80-10055 Allerton Press, Inc., New York, N. Y.
STRESS-STRAIN DIAGRAM APPROXIMATION
I. U. Vyshedkevich *In its* Soviet Aeron., v. 21, no. 4, 1978 p 117-119 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 144-147 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10057 Allerton Press, Inc., New York, N. Y.
ON THIN-WALL BEAM EFFECTIVE STIFFNESS
V. A. Pavlov *In its* Soviet Aeron., v. 21, no. 4, 1978 p 124-128 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 151-155 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-10533 Colorado State Univ., Fort Collins.
CLUSTER ANALYSIS BASED ON DENSITY ESTIMATES AND ITS APPLICATION TO LANDSAT IMAGERY Ph.D. Thesis
John Kyoungyoon Park 1979 151 p
Avail: Univ. Microfilms Order No. 7923368

A hill sliding clustering algorithm with practical applicability to remotely sensed natural scene data was developed using the maximum likelihood decision rule. Difficulties commonly encountered in computing and storing discrete multivariate probability densities were circumvented by utilizing the idea of lexicographic probability cells. The program was successfully applied to Chippewa River Basin areas in estimating the aerial extent of various land use/land cover classes. The hill sliding program employed less heuristic input parameters and yielded more reasonable partitioning of the sample data of the Chippewa River Basin than did the ISOCLAS program. The hill sliding clustering technique has applicability for use in decomposing any multivariate normal mixture distribution into a number of unimodal distributions. Dissert. Abstr.

N80-10534 George Washington Univ., Washington, D. C.
REGIONAL GEOCHEMICAL EXPLORATION FOR MINERAL DEPOSITS IN THE APPALACHIANS OF CENTRAL AND NORTHWESTERN VIRGINIA Ph.D. Thesis
Dasharatham Sayala 1979 374 p
Avail: Univ. Microfilms Order No. 7923422

Element concentrations for Ag, Au, Mo, Cu, Pb, Zn, Mn, Fe, Ni, Cr and Co, were determined in 107 soils, 159 stream sediments and 159 corresponding stream waters, using atomic absorption spectrometry. The analytical data were evaluated using regional deviation analysis (RDA), Pearson correlation coefficient estimates, and 5th order trend surfaces. Geochemical maps were produced using the SYMAP program. RDA and SYMAP graphics were effective in presenting the geochemical data. Of the eleven elements studied, Mo, Cu, Pb, Ni and Co have the greater number of stream sediment anomalies and are considered pathfinders to mineralized areas. In soils, Zn, Mo, and Co anomalies are useful in regional exploration. In the study area, soil-anomalies of Pb, Au, Ni, and Cr were found to be the most important in prospecting since these elements are relatively less mobile than others studied and are generally located closer to related mineralization. Dissert. Abstr.

N80-10535 Colorado State Univ., Fort Collins.
A THERMAL VEGETATION CANOPY MODEL OF SENSOR RESPONSE Ph.D. Thesis
Daniel Scott Kimes 1979 220 p
Avail: Univ. Microfilms Order No. 7923358

A thermal canopy signature model was developed in which the thermal behavior of a vegetation canopy is approximated by a mathematical abstraction of three infinite horizontal layers of vegetation. Simulated results suggest that canopy element geometry can significantly influence the effective radiant temperature of a sensor at various view angles above the canopy, and this phenomenon has important implications on the optimum view angle for making inferences about the target of interest. Dissert. Abstr.

N80-10536# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
HUMAN FACTORS IN THE DESIGN AND EVALUATION OF AVIATION MAPS
V. David Hopkin (Royal Air Force Inst. of Aviation Medicine, Farnborough, England) and Robert M. Taylor (Royal Air Force Inst. of Aviation Medicine, Farnborough, England) Jun. 1979 259 p refs
(AGARD-AG-225; ISBN-92-835-1318-5) Avail: NTIS HC A12/MF A01

Information processing is appraised for map design. Methods and measures for the evaluation of maps are discussed. The skills and abilities of the successful map designer and the effective map user are considered. The communication of cartographic information in aviation is discussed in the area of separating human factors data from other sources and how to apply this to man design and map reading. A.W.H.

N80-10537*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EDUCATOR'S GUIDE FOR MISSION TO EARTH: LANDSAT VIEWS THE WORLD
Margaret A. Tindal 1978 56 p refs Original contains color illustrations
(NASA-SP-360) Avail: NTIS MF A01, SOD HC CSCL 08B

This teacher's guide is specifically designed to provide information and suggestions for using LANDSAT imagery to teach basic concepts in several content areas. Content areas include: (1) Earth science and geology; (2) environmental studies; (3) geography; and (4) social and urban studies. R.E.S.

N80-10538*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO-SOYUZ TEST PROJECT. VOLUME 2: EARTH OBSERVATIONS AND PHOTOGRAPHY
Farouk El-Baz, ed. (Smithsonian Institution) and D. M. Warner, ed. (Smithsonian Institution) Washington 1979 700 p refs Original contains color illustrations 2 Vol.
(Contract NAS9-13831)
(NASA-SP-412-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 05B

Visual observations of the earth are presented along with the corresponding photographs and maps for specific regions. For individual titles, see N80-10539 through N80-10581.

N80-10539*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUMMARY OF SIGNIFICANT RESULTS
Farouk El-Baz (Smithsonian Institution), Delia M. Warner, and R. Thomas Giuli *In its* Apollo-Soyuz Test Project, Vol. 2 1979 p 1-8 ref (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

A summary of the visual and photographic study of specific earth features is presented. The areas selected were in the fields of geology, desert studies, oceanography, hydrology, and meteorology. F.O.S.

N80-10540*# California Inst. of Tech., Pasadena.
GEOLOGIC ANALYSIS OF ASTP PHOTOGRAPHS OF PARTS OF SOUTHERN CALIFORNIA
R. E. Powell and L. T. Silver *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 9-27 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08G

Tectonic interpretations of the geologic features of the San Andreas, San Gabriel, and San Jacinto faults are discussed. F.O.S.

N80-10541*# Brown Univ., Providence, R. I.
MARDA FAULT ZONE AND THE OPENING OF THE RED SEA
Charles A. Wood *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 29-36 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08G

According to plate tectonic theory, Africa and Arabia were a single continental block before the Red Sea spreading center separated them. The Afar region of Ethiopia is an area of overlap

in palinspastic closings of the Red Sea, and thus Afar must be recently created crust. It is proposed that the Aisha hills have moved north-northwestward into their present position by strike-slip movement along the Marda Fault zone, a major fault belt extending more than 900 km across the Horn of Africa. Geological, geophysical, and photographic evidence are presented to support this hypothesis. F.O.S.

N80-10542*# Amherst Coll., Mass.
EVALUATION OF SATELLITE IMAGES OF THE LEVANTINE RIFT ZONE
Richard M. Foose *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 37-43 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Structural and lithologic features along the Levantine Rift zone were mapped using satellite images from three sources: LANDSAT, Skylab, and Apollo-Soyuz. The accuracy and completness of these maps were checked during January 1977 on a field trip from the southern end of the Gulf of Elat to the Israeli-Syrian border. Specific structural features and regional tectonic relationships along the zone were clearly displayed on all images. In certain instances, the oblique photographs from Apollo-Soyuz were superior; but, in most cases, the vertical images from LANDSAT provided more complete and accurate relationships. The analysis of tectonic features mapped on space images concurrent with geologic mapping in the field provides an improved basis for understanding the tectonic evolution of large regions. Author

N80-10543*# Texas Univ. at Austin.
ANALYSIS OF SKYLAB AND ASTP PHOTOGRAPHS OF THE LEVANTINE (DEAD SEA) FAULT ZONE
W. R. Muehlberger, L. K. Goetz, and R. C. Belcher *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 45-62 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Manned-spacecraft photographs of the Dead Sea Rift Zone (DSRZ) were studied to evaluate the fault zone. The interpretation shows a splintering of the DSRZ toward the East Anatolian Fault Zone. This splintering deranged modern drainage systems, which indicates that this region is tectonically active, and these faults constitute a major earthquake hazard. F.O.S.

N80-10544*# Missouri Univ. at Rolla.
ANALYSIS AND SYNTHESIS OF SPACE IMAGERY OF THE SOUTHEASTERN-TURKEY/NORTHWESTERN-IRAN MOBILE BELT
Paul Dean Proctor, Douglas C. Melton, Jr., Ali Beken (Middle Eastern Technical Univ., Ankara, Turkey), and L. K. Abrams *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 63-85 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz photographs and LANDSAT images of eastern Turkey and northwestern Iran were analyzed for major geological features to develop a regional tectonic map. The analysis revealed three major geological terrains: an autochthonous block of folded layered rocks; and allochthonous block of older, more uniform rocks with folds and faults; and a volcanic terrain. F.O.S.

N80-10545*# Ain Shams Univ., Cairo (Egypt).
STRUCTURAL PATTERN OF THE NORTHERN PART OF THE EASTERN DESERT OF EGYPT
Mohamed A. Abdel-Rahman and Hassan A. El-Etr *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 87-96 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz color photographs of the northern part of the eastern desert of Egypt were excellent for regional structural mapping because of their color fidelity and large areal coverage. The oblique Apollo-Soyuz photographs were used for the identification of faults, whereas enlarged LANDSAT images were used for planimetric mapping. Aerial photographs were also examined to verify the mapped fault lines, and it was revealed that several of the lines detected on Apollo-Soyuz photographs were, in fact, zones of narrowly spaced, parallel faults. The results suport the contention that vertical tectonics were responsible for the development of the fault pattern of the area. J.M.S.

N80-10546*# Ain Shams Univ., Cairo (Egypt).
PHOTOLINEAMENTS IN THE ASTP STEREOSTRIP OF THE WESTERN DESERT OF EGYPT
Hassan A. El-Etr, Adel R. Moustafa, and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 97-105 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Photolineaments displayed on the Apollo-Soyuz stereostrip covering part of the western desert of Egypt were studied. Virtually all of the photolineaments detected on LANDSAT images (black-and-white as well as false-color composites) were also detected on Apollo-Soyuz photographs of the same scale and approximately the same resolution. The drawbacks of Apollo-Soyuz photographs include (1) the low base/height ratio, which limited the effective stereovision; (2) the high sun-elevation angle, which limited the shadows required to easily identify linear features; and (3) the overexposure of the central parts of the frames, particularly over the Great Sand Sea. Recommendations are made to remedy this on future earth-orbital photographic missions. J.M.S.

N80-10547*# Ain Shams Univ., Cairo (Egypt).
UTILIZATION OF ASTP PHOTOGRAPHS IN THE STUDY OF SMALL STRUCTURES IN ABU RAWASH AND WADI EL NATRUN, EGYPT
Hassan A. El-Etr and Farouk El-Baz (Smithsonian Institution) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 107-118 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Geologic structures of the northern part of the western desert of Egypt were studied utilizing enlargement of Apollo-Soyuz Test Project color photographs. The Apollo Soyuz photographs of Abu Rawash clearly show structural uplifts that brought white chalk deposits to the surface, depict the distribution of dark volcanic rocks in the region, and clearly delineate complex structures including several domes and plunging anticlines. The Apollo Soyuz photographs of Wadi el Natrun display its structures as well as the string of salt lakes within it and the barren nature of the northern and southern extremities of the depression. The photographs reveal that there is a potential for increasing the area of cultivated land on the eastern slope of the depression. J.M.S.

N80-10548*# Missouri Univ. at Rolla.
PHOTOTECTONIC ANALYSIS OF SOUTHEASTERN SPAIN FROM ASTP PHOTOGRAPHS AND LANDSAT IMAGES
Paul Dean Proctor, Kenneth B. Horrall, Douglas C. Melton, Jr., and David F. Thompson *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 119-148 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

The tectonic characteristics of southeastern Spain were analyzed using the Apollo Soyuz Test Project oblique color photographs and LANDSAT vertical images. Four distinct tectonic provinces were identified along with three orders of fold dimensions and two orders of lineaments. Both thrust faults and normal were shown to occur in the region. A discussion of the geologic setting of southeastern Spain is given along with the results of the phototectonic analysis. J.M.S.

N80-10549*# Ain Shams Univ., Cairo (Egypt).
EAST-WEST PERVASIVE LINEAMENTS IN CENTRAL AND SOUTHEASTERN SPAIN
Mohamed A. Abdel-Rahman *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 149-156 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

The lineament pattern of central and southeastern Spain was detected on photographs taken during the Apollo-Soyuz mission. The obliquity of these photographs made possible the recognition of previously unnoticed structures. The true color of the photographs also aided in identifying the lineaments. Statistical analysis indicated that the lineament pattern was not random and must be caused by geological factors. Three lineament trends

were identified. In decreasing order of significance, these were east-west, northeast, and northwest. Faults in this region were traced from a geological map, and their strikes were analyzed and found to include two preferred orientations, a northeasterly trend and a west-northwesterly trend; the first trend was more prominent. Author

N80-10550*# Missouri Univ. at Rolla.
PHOTOGEOLOGIC ANALYSIS OF ASTP PHOTOGRAPHS OF THE LAKE TORRENS-FLINDERS RANGES-LAKE BLANCHE AREA, SOUTH AUSTRALIA
Paul Dean Proctor and Robert Sickler *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 157-181 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Excellent ASTP color prints and transparencies of the North Flinders Ranges and the adjacent Lake Torrens-Lake Blanche basin areas of South Australia were analyzed to determine the characteristics of the regional fold structures. Major folds, faults, and other lineaments were identified. Tectonic patterns and their relationships to mobile belt-plate tectonics were examined. In addition, basin forms and features were analyzed and related to the desert environment of the area. Possible rock types and the character of the widespread alluvial materials surrounding the bedrock areas were predicted. An interpretive photogeologic map covering the area of the ASTP photographs was produced. J.M.S.

N80-10551*# Arizona State Univ., Tempe.
VOLCANIC LANDFORMS AND ASTROBLEMES
R. S. Dietz and J. F. McHone (Illinois Univ. at Urbana-Champaign) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 183-202 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08G

Apollo crewmembers, while searching for circular ground features, observed and photographed astroblemes (ancient impact scars) in Brazil and Libya, and volcanoes in Italy, the Galapagos Islands, and Mexico. The Brazilian site was previously unknown to impact scientists, and photographic measurements of the Libyan structure proved larger than measurements made by earth-based investigators. Plumes of active volcanoes in Italy were traced great distances, and the inaccessible Galapago Islands were viewed synoptically. In Mexico, a feature that had been previously identified as a possible meteorite impact site was found to be formed by a volcanic steam explosion. Author

N80-10552*# Illinois Univ. at Urbana-Champaign.
RIACHAO RING, BRAZIL: A POSSIBLE METEORITE CRATER DISCOVERED BY THE APOLLO ASTRONAUTS
J. F. McHone *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 193-202 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

In north-central Brazil, the Apollo crewmembers photographed a 4 km wide circular ground pattern. Although the feature was not visible on airborne radar and in near-infrared satellite images, it was clearly seen from space in the visible part of the spectrum. A ground reconnaissance of this location and of a second circular structure nearby strongly supports a meteoritic origin for both sites. Author

N80-10553*# Smithsonian Institution, Washington, D. C.
COLOR ZONING IN THE WESTERN DESERT OF EGYPT
Farouk El-Baz and Hassan A. El-Etr (Ain Shams Univ., Cairo, Egypt) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 203-217 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

The Western Desert of Egypt was selected for detailed study as a type locality of the north African desert environment. In addition to astronaut observations, 55 color photographs of Egypt were obtained during the Apollo-Soyuz mission using 70 and 35 mm cameras. These photographs showed regional and local color zones that were mapped and checked in the field. The Apollo Soyuz color data were used in the selection of areas for field investigations and in the extrapolation of knowledge to unphotographed areas of the Western Desert. One of the results, the mapping of an arable zone west of the Nile Delta, attests to the potential value of color photographs in desert study. Author

N80-10554*# Smithsonian Institution, Washington, D. C.
ORBITAL OBSERVATIONS OF SAND DISTRIBUTION IN THE WESTERN DESERT OF EGYPT
Ann W. Gifford, Delia M. Warner, and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 219-236 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz Test Project photographs of the Western Desert of Egypt were studied to discover the usefulness of orbital imagery in delineating sand deposits. A strip of Apollo-Soyuz mapping-camera photographs was used to map sand distribution patterns. Information from this strip was extrapolated to the rest of Egypt using a falsecolor mosaic of LANDSAT images. Author

N80-10555*# Smithsonian Institution, Washington, D. C.
PRELIMINARY ANALYSIS OF COLOR VARIATIONS OF SAND DEPOSITS IN THE WESTERN DESERT OF EGYPT
Farouk El-Baz, Marie H. Slezak, and Ted A. Maxwell *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 237-262 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08G

Astronaut observations and photographs of color variations in the Western Desert of Egypt are related to both iron oxide coating on individual grains and the presence of locally derived material in the sand deposits. The northern region of the Western Desert has the highest percentage of calcareous grains originating from local limestone outcrops. Samples from the central part of the Western Desert contain numerous iron-rich grains originating from the iron deposits of Bahariya and are locally enriched in shale fragments from the Dakhla Shale. Sands of the Great Sand Sea are relatively homogeneous, quartz-rich deposits that vary little in percentage of minor components. R.E.S.

N80-10556*# Smithsonian Institution, Washington, D. C.
TEMPORAL CHANGES AS DEPICTED ON ORBITAL PHOTOGRAPHS OF ARID REGIONS IN NORTH AFRICA
Marie H. Slezak and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 263-272 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Processes typical of arid environments can be monitored from space by comparing orbital photographs taken over a period of years. Oblique photographs can be used, but best results are obtained with vertical or near-vertical photographs. Changes observed by comparing the 1975 Apollo-Soyuz photographs with data from previous missions include (1) an increase in vegetation west of the Nile Delta of approximately 1108 sq km in 10 years; (2) an average shift of 2.5 km over a 6 year period in the sand patterns of the Oweinat Mountain region at the borders between Egypt, Libya, and Sudan; and (3) a reduction in the water level of Lake Chad and dune encroachment upon the lake over a period of 9 years. R.E.S.

N80-10557*# Smithsonian Institution, Washington, D. C.
ASTP PHOTOGRAPHS OF SOUTHEASTERN ANGOLA
Delia M. Warner *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 273-283 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz photographs of southeastern Angola were studied to provide a preliminary description of landforms in this remote and sparsely populated region. These photographs were useful in distinguishing drainage patterns, lineament trends, rock types, and the distribution of unusual playlike features. Author

N80-10558*# Smithsonian Institution, Washington, D. C.
COLOR OF DESERT SURFACES IN THE ARABIAN PENINSULA
Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 285-299 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08G

A detailed analysis of the Apollo-Soyuz photographs is

presented. The following facts were established: (1) available charts and maps can be updated using the orbital photographs, particularly of coastal zones; (2) geologic maps can be improved by use of the natural color photographs, which clearly delineate major geologic features and their characteristics; (3) the photographs can be used in characterizing sand fields and classifying dune forms; and (4) enlargements of the photographs can be useful in detailed studies of small areas, such as the city of Ad Dawhah (Doha), Qatar, and its environs.
M.M.M.

N80-10559*# Smithsonian Institution, Washington, D. C.
MONTE DESERT OF SAN JUAN, ARGENTINA, AS PHOTOGRAPHED BY ASTP
Delia M. Warner and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 301-318 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B
The photographs by the ASTP reveal that the physiographic setting of the study area is characterized by mountain-and-bolson topography controlled mainly by faulting. Most of the lineaments detected on the photographs appear to correspond to faults, and some of them may provide evidence of recent fault movement in the area. Typical topographic features include barren, deeply dissected block mountains bordered by slopes of alluvial materials that descent to a flat-floored desert basin. M.M.M.

N80-10560*# Geological Survey, Flagstaff, Ariz.
DUNES AND OTHER WINDFORMS OF CENTRAL AUSTRALIA, AND A COMPARISON WITH LINEAR DUNES ON THE MOENKOPI PLATEAU, ARIZONA
C. S. Breed and W. J. Breed (Museum of Northern Arizona, Flagstaff) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 319-358 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08G
Internal structures of linear dunes that were examined in central Australia and in northern Arizona are mainly medium-scale, thin cross-beds or cross-laminae with dips commonly less than 20 deg. Astronauts aboard the Apollo spacecraft identified the same hue, chroma, and value of red sand in dunes of central Australia that ground survey teams found in the main body of the Simpson Desert. Ground examination confirms that within each field of dunes, relative degrees of redness can help discern sequences of depositional events in that area (given a uniform sand supply and climatic zone). It was concluded that reconnaissance from space is ideal for identifying key sites for field studies of specific geomorphic problems in remote desert regions.
M.M.M.

N80-10561*# Smithsonian Institution, Washington, D. C.
DETERMINING PHOTOGRAPH LOCATIONS OVER OCEANS
S. McLafferty, M. Pryslak, and G. A. Maul (NOAA) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 359-370 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08J
The methods used to quanitatively define the photo-locations of ocean photographs taken from the Apollo Soyuz spacecraft are described. They are based on photogrammetry, on a knowledge of the groundtracks of the spacecraft and the times during which the photographs were taken, and on a comparison with satellite imagery. Latitudes and longitudes with an estimated error of + or - 1 to + or - 3 seconds are calculated for the center points of photographs taken during mapping passes that lack photo-support data. A method is developed for determining the center points for photographs containing two or more recognizable features on landmasses. A map is provided which shows the Apollo groundtracks that correspond to the times when the photographs were taken. M.M.M.

N80-10562*# National Oceanic and Atmospheric Administration, Washington, D. C.
INTERPRETING ASTP PHOTOGRAPHS OF THE OCEAN AND LOCATING THE AREA PHOTOGRAPHED, CASE STUDY OF THE GULF OF MEXICO
G. A. Maul *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 371-383 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08J
Some of the Skylab recommendations relative to the problem of locating the ocean area obtained in the handheld-camera photographs and the problem of interpreting data in the space photographs by comparison with shipboard observations that were acquired at approximately the same time are discussed. Based on Skylab experience, the frequently observed circular cloud features were thought of as indicators of mesoscale turbulence in ocean currents. It was found that the features could be consistently explained as being attributable entirely to atmospheric changes and that the features were not associated with cold-core ocean eddies. M.M.M.

N80-10563*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
VISUAL OBSERVATIONS OVER OCEANS
R. D. Terry (Richard Terry and Assoc.) *In its* Apollo-Soyuz Test Project, Vol. 2 1979 p 385-407 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08C
Important factors in locating, identifying, describing, and photographing ocean features from space are presented. On the basis of crew comments and other findings, the following recommendations can be made for Earth observations on Space Shuttle missions: (1) flyover exercises must include observations and photography of both temperate and tropical/subtropical waters; (2) sunglint must be included during some observations of ocean features; (3) imaging remote sensors should be used together with conventional photographic systems to document visual observations; (4) greater consideration must be given to scheduling earth observation targets likely to be obscured by clouds; and (5) an annotated photographic compilation of ocean features can be used as a training aid before the mission and as a reference book during space flight. M.M.M.

N80-10564*# Scripps Institution of Oceanography, La Jolla, Calif.
ANTIPODAL SEAS
Robert E. Stevenson *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 409-429 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08J
An oceanographic experiment was conducted to learn: (1) whether or not astronauts could be trained to observe specific ocean features from space; (2) the variability of certain sea surface conditions in time and space; and (3) the role that these ocean features play in our understanding of synoptic oceanography. Sea surface and subsurface data to be compared to astronaut observations were collected by ships and aircraft from waters east of Australia, north of New Zealand, east of Ireland, and east of Spain. The analysis show that observations by man from orbiting space platforms have an important role in the development of synoptic oceanography. K.L.

N80-10565*# Smithsonian Institution, Washington, D. C.
MALTESE FRONT AND STRAIT OF SICILY OCEAN PATTERN ANALYSIS
Daniel Jean Stanley *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 431-440 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08B
Ocean surface phenomena related to turbulence, including possible internal waves, are observed in Apollo Soyuz Test Project color photographs of the eastern part of the Strait of Sicily between Djerba and the southeastern corner of Sicily. The convergence of the eastward flowing, less saline upper water of Atlantic origin and the dense intermediate water flowing underneath it in the opposite direction gives rise to the Maltese Front clearly visible off Cape Passero, Sicily. The investigation shows that the geographic position of these ocean surface features is in part related to sea floor topogaphy. The vertical coverage made from an altitude of 226 km allows good definition of turbulence phenomena and serves to supplement earlier physical oceanographic observations made of the central region of the Mediterranean Sea. K.L.

N80-10566*# Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, Maine.
OCEAN COLOR OBSERVATIONS
C. S. Yentsch, W. Skea, J. C. Laird, and T. S. Hopkins *In* NASA Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 441-454 refs (For primary document see N80-10538 01-43)
(Contracts NAS5-22948; E(11-1)-2538)
Avail: NTIS HC A99/MF A01 CSCL 08J

Apollo astronauts were briefed on four features that could alter ocean color: (1) phytoplankton chlorophyll; (2) dissolved yellow substance; (3) suspended sediments; and (4) bottom reflection. Before and during the Apollo-Soyuz mission, the crew was alerted to the possibility of a red tide occurrence along the coast of new England. They were unable to obtain useful photographs because of heavy fog and cloud cover. The astronauts were successful in observing ocean discolorations, and their verbal comments indicate that they were aware of the causes and sources of these color changes. Experience on this mission suggests that ground crews can work with astronauts in attempts to locate discolorations and to determine their extent and their sources. K.L.

N80-10567*# Smithsonian Institution, Washington, D. C.
ANALYSIS OF WATER COLOR AS SEEN IN ORBITAL AND AERIAL PHOTOGRAPHS OF CAPE COD, NANTUCKET, AND MARTHA'S VINEYARD, MASSACHUSETTS
Tracey Tisdall and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 455-480 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08J

Coastal water color was analyzed in two Apollo-Soyuz photographs. The natural color of the photographs enabled recognition of shoals and suspended sediments, sediment transport by longshore drift, wind streaks, and crests and troughs of internal ocean waves. Comparison with high altitude aircraft photographs revealed that the aerial photographs are necessary for detailed analyses and the spaceborne photographs are useful for studying large areas. A comparison of the aerial photographs with bathymetric charts showed that numerous changes occurred in the coastlines after the charts were made. Absolute reflectance values of shoals, chlorophyll concentrations, sediments, etc. were roughly estimated, but could not be accurately determined. K.L.

N80-10568*# McGill Univ., Montreal (Quebec).
ASTP AT BARBADOS: MESOSCALE POOLS OF AMAZON RIVER WATER IN THE WESTERN TROPICAL ATLANTIC
G. Borstad *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 481-497 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08H

Sea surface data was obtained at Barbados for temperature, salinity, chlorophyll concentration, clarity, color, and plankton concentration. The data suggest a succesive passage of pools of brackish Amazon River water until late August. Hence, it is unlikely that the discolored water observed by the Apollo crew during the Apollo Soyuz Test Project was due to the Orinco River. The expansive freshening of the Western Tropical Atlantic by brown colored Amazon water in July would mask any effect by the smaller Orinco. K.L.

N80-10569*# Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, Maine.
ESTIMATE OF TOTAL REFLECTANCE FROM THE ORINOCO RIVER OUTFLOW
C. S. Yentsch and Farouk El-Baz (Smithsonian Institution) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 499-503 refs (For primary document see N80-10538 01-43)
(Contracts NAS5-22948; E(11-1)-2538)
Avail: NTIS HC A99/MF A01 CSCL 08H

The Orinoco River Delta was photographed by Apollo astronauts. The photographs show discrete water color zones that reflect the mixing of the sediment laden Orinoco outflow with the water of the tropical Atlantic. A datacolor/edge enhancer analysis, assuming a 5-percent reflectance value for the open ocean water, showed the reflectance of the area varied between 4 percent for the jungle and approximately 13 percent for sediment laden river outflow. These values approximate those obtained by direct measurements of the Mississippi River Delta water. The results confirm that the reflectance from coastal waters is not high enought to saturate instruments onboard unmanned satellites such as the Coastal Zone Scanner. K.L.

N80-10570*# National Oceanic and Atmospheric Administration, Seattle, Wash.
OBSERVATIONS OF INTERNAL-WAVE SURFACE SIGNATURES IN ASTP PHOTOGRAPHS
John R. Apel *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 505-509 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08C

Three Apollo Soyuz Test Project photographs are presented which show indications of oceanic internal gravity waves. The features are indicated by periodic changes in the optical reflectivity of the ocean surface overlying the waves. Position and conditions of the internal wave photographs are presented and theories of the structure and existence of the surface signatures are reviewed. A.W.H.

N80-10571*# Ain Shams Univ., Cairo (Egypt).
DETECTION OF A PROBABLE ANCESTRAL DELTA OF THE NILE RIVER
Mohamed A. Abdel-Rahman and Farouk El-Baz (Smithsonian Institution) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 511-520 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01

Interpretation of a near vertical Apollo Soyuz photograph of the present Nile Delta in northern Egypt is presented. The interpretation determines an ancestral delta of the Nile R[illegible]. The limits, shape, position, and age of the ancestral Nile Delta are identified. The mineralogy of the delta is reported and the geochemistry data is analyzed. A.W.H.

N80-10572*# Smithsonian Institution, Washington, D. C.
SUSPENDED-SEDIMENT DISPERSAL PATTERNS OF RIVER DELTAS PHOTOGRAPHED BY ASTP
Ted A. Maxwell *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 521-530 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08H

Orbital photographs of five river deltas are presented. Suspended sediment plume patterns are identified and are related to models of sedimentation in a deltaic environment. The relative effects of river inertia, buoyancy of suspended matter, and turbulent bed friction are evaluated using delta geometry and plume pattern. A.W.H.

N80-10573*# Environmental Defense Fund, Inc., Denver, Colo.
USE OF APOLLO-SOYUZ PHOTOGRAPHS IN COASTAL STUDIES
M. T. El-Ashry *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 531-543 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08J

The use of spaceborne photography in coastal studies is examined. Apollo Soyuz photographs of coastal zones are provided to demonstrate various areas of application in coastal studies. These include shoreline features such as barrier islands, beach ridges, salt marshes, tidal inlets, and tidal deltas; shoreline changes including identification of major areas of erosion or accretion and prediction of future changes along rapidly/changing shorelines; and information regarding littoral drift. A.W.H.

N80-10574*# Texas Univ. at Austin.
SOUTH AMERICAN RIVER MORPHOLOGY AND HYDROLOGY c63
R. K. Holz, V. R. Baker, S. M. Sutton, Jr., and M. M. Penteado-Orellana (Fundacao Univ. de Brasilia) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 545-594 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01

A guide to the hydrologic properties of streams in the Amazon and Paraguay Basins is presented. Photographs are presented from the Apollo Soyuz Test Project of the Amazon

Basin. Stream regimes, including analyses of meander wavelengths, flood plain development, and basin morphology are discussed. Basin size, drainage network density, flood plain width, vegetation types and density, climatic factors, and terrain variability are assessed. Adjustments of changes in river morphology caused by altered water and sediment discharges and by quaternary climatic changes are discussed. A.W.H.

N80-10575*# Environmental Research and Technology, Inc., Concord, Mass.
SNOW HYDROLOGY STUDIES
M. D. Smallwood, C. J. Bowley, and J. C. Barnes. *In* NASA, Johnson Space Center, Apollo-Soyuz Test Project, Vol. 2, 1979, p 595-615, refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 08L

Photographs from the Apollo Soyuz Test Project of snow covered areas in the northwestern United States and Canada, the Chilean Andes, and the southern Alps of New Zealand are discussed. The photographs are analyzed and a tendency for the snowline elevations to be lower in the areas surrounding the permanent snowfields and glaciers rather than in areas of seasonal snowpack is examined. A.W.H.

N80-10576*# National Oceanic and Atmospheric Administration, Washington, D. C.
MESOSCALE CLOUD PATTERNS REVEALED BY ASTP PHOTOGRAPHS
P. G. Black. *In* NASA, Johnson Space Center, Apollo-Soyuz Test Project, Vol. 2, 1979, p 617-634, refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 04B

Complicated internal-wave patterns are revealed in Apollo-Soyuz Test Project photographs of marine fog patches. Evidence for the reflection of atmospheric wave packets at water-land boundaries is present in these patterns. Photographs of arc or ring clouds show that these clouds are associated with decaying maritime thunderstorms. The cloud-free inner ring delineates cold air tht has been transported from aloft by thunderstorm downdrafts, thus inhibiting cumulus cloud development. There is no evidence to indicate that this clear inner ring is a result of cold-core eddies in the ocean. Other interesting cloud patterns revealed by ASTP photographs include linear trails created in low stratocumulus cloud decks by passing ships and dome-shaped anvil clouds created by vigorous thunderstorms. Author

N80-10577*# Smithsonian Institution, Washington, D. C.
COMPARISON OF ASTRONAUT VISUAL COLOR OBSERVATIONS WITH ASTP PHOTOGRAPHS
Farouk El-Baz, Delia M. Warner, and Fred J. Anders. *In* NASA, Johnson Space Center, Apollo-Soyuz Test Project, Vol. 2, 1979, p 635-644, refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 14E

Visual observations of the color of both desert and ocean scenes, made by the U.S. astronauts on the Apollo-Soyuz mission, were analyzed and compared to photographs of the same regions. During the mission, use of Munsell color chips on a specially developed 'color wheel' made the comparison possible. Colors on photographs never exactly match those observed from space; available films are less color sensitive than the human eye and do not capture the true earth colors. Determination of a color correction factor for use with the photographs was not possible because of the inconsistent variations in measured colors and because of the meager statistical basis. It is recommended that additional observations be made from earth orbit utilizing uniformly illuminated color chips. This would allow meaningful correlations between natural colors as seen from space and those depicted on orbital photographs. Author

N80-10578*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
FILM SELECTION FOR THE EARTH OBSERVATIONS AND PHOTOGRAPHY EXPERIMENT
N. T. Lamar, H. E. Lockwood (Technicolor Graphic Services, Houston, Tex.), and R. E. DAlli (Smithsonian Institution). *In* its Apollo-Soyuz Test Project, Vol. 2, 1979, p 645-653, refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 14E

Four color-reversal positive-transparency films were evaluated: SO-368 (normal color), SO-242 (normal color), Aerochrome Infrared 2443 (false color), and high definition Aerochrome Infrared SO-127 (false color). Film SO-127 was eliminated because of its low speed. Aerochrome Infrared 2443, selected for use in discriminating vegetation, required exposure through a Wratten 12 filter. An equivalent lens filter (520 nm cutoff) was in the approved flight-hardware inventory. Aerial Color SO-242 was found to be suitably fast for use as a high resolution, normal color film; it required no special filter. However, SO-368, a medium resolution, normal color film, required exposure through the equivalent of a Wratten 2A filter. Because this item was not in the flight-hardware inventory and could neither be acquired nor approved in time for launch, a special version of SO-368 was manufactured with a yellow dye overcoat whose absorption characteristics matched those of a 2A filter. The new film (designated QX-807) performed in every respect the same as SO-368 used with a 2A filter. Film QX-807 processing was compatible with other flight film and was done in the model 1811 Versamat Processor with EA-5 chemistry. A.R.H.

N80-10579*# Technicolor Graphic Services, Inc., Houston, Tex.
FILM EXPOSURE CALCULATIONS
H. E. Lockwood, Lincoln Perry, and R. W. Wolfe (Smithsonian Institution). *In* NASA, Johnson Space Center, Apollo-Soyuz Test Project, Vol. 2, 1979, p 655-662, refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 14E

The determination of camera shutter and aperture settings to produce consistently high-quality aerial and orbital photographs is a task complicated by numerous variables. These variables and specific data that may be used to systematically control them are examined. The variables discussed include sunlight, atmospheric effects, subject and season, film speed, and optical system. Data that may be used as a base reference encompass sensitometric specification for two film-chemistry processes together with parameters that have been established and used to produce good exposures for Apollo-Soyuz Test Project photography. The information presented may be used to design and implement an exposure determination system for other orbital photography missions. A.R.H.

N80-10580*# Technicolor Graphic Services, Inc., Houston, Tex.
ASTP PHOTOGRAPHIC FILM PROCESSING AND SENSITOMETRIC SUMMARY
H. E. Lockwood. *In* NASA, Johnson Space Center, Apollo-Soyuz Test Project, Vol. 2, 1979, p 663-666, refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 14E

The procedures used for processing the camera film exposed during the Apollo-Soyuz Test Project resulted from extensive testing of each film type, and the procedures were verified in numerous simulations before the mission. Exposure control curves for both visual density and tricolor densities were established for each film type before the mission. Sensitometrically exposed control strips of film were retained during the mission for comparisons with the flight film. Processing of all film conformed to preestablished standards, and no difficulties were experienced during the film processing. Author

N80-10581*# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
PHOTOGRAMMETRIC ANALYSIS OF ASTP EARTH OBSERVATIONS EXPERIMENT DATA
C. W. Baker. *In* NASA, Johnson Space Center, Apollo-Soyuz Test Project, Vol. 2, 1979, p 667-673, refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01 CSCL 14E

Apollo-Soyuz Test Project photographs of the earth were used in photogrammetric triangulations to evaluate the spacecraft position data, the calibration of two camera lenses, and the orientation of the principal axis for each lens system. Photogrammetric triangulations were performed using 100 mm focal length photographs of California and 60 mm focal length photographs of Egypt, Syria, and Turkey. Spacecraft positions determined in the triangulation over California were within 100 m of their predicted values. However, those over Egypt, Syria, and Turkey were biased by approximately 2 km in latitude, 1.4 km in longitude, and 0.7 km in altitude. Only one element of camera calibration,

radial lens distortion, could be determined. In this case, both lenses were essentially free of distortion. Errors in camera orientation angles were approximately 1.19 deg as predicted, however, it was possible to compute and apply a misalignment matrix to all orientation data and to reduce the error to approximately 0.33 deg. A correction for each sequence of photographs could be applied to reduce the error to less than 0.01 deg. Author

N80-10582# Rochester Univ., N. Y. Dept. of Computer Science.
STRIP TREES: A HIERARCHICAL REPRESENTATION FOR MAP FEATURES
Dana H. Ballard. Dec. 1978. 40 p. refs.
(Contract N00014-78-C-0164)
(AD-A071124; TR-32) Avail: NTIS. HC A03/MF A01. CSCL 08/2

There is increasing interest in map features such as points, lines and regions both as a pictoral data base for resource management and as an aid to identifying objects in aerial images. Owing to the very large amount of data involved, and the need to perform operations on this data efficiently, the representation of such features is a crucial issue. We describe a hierarchical representation of map features that consists of binary trees with a special datum at each node. This datum is called a strip and the tree that contains such data is called a strip tree. Lower levels in the tree corresponds to finer resolution representations of the map feature. The strip tree structure is a direct consequence of using the method for digitizing lines (given by Duda Hart, 1973; Turner, 1974; Douglas Peucker, 1973) and retaining all intermediate steps. This representation has several desirable properties. For features which are well-behaved, calculations such as point-membership and intersection can be resolved in O(log n) where n is the number of feature points. The map features can be efficiently encoded and displayed at various resolutions. GRA

N80-10583# Coast Guard Research and Development Center, Groton, Conn.
LONG-TERM TRACKING OF ARCTIC ICEBERGS Final Report
R. Q. Robe and D. C. Maier. Apr. 1979. 41 p. refs.
(AD-A072473; CGR/DC-8/79; USCG-D-36-79) Avail: NTIS. HC A03/MF A01. CSCL 08/12

Seven Greenland icebergs were tracked, two in 1977 and five in 1978, using ADRAMS (Air-Deployable Random Access Measurement System) ice buoys. The ice buoys transmit a signal to the NIMBUS-6 satellite which is used in computing the buoy's position. Observation periods ranged from 138 days to 202 days. The tracking of two icebergs began near Disko Island, Greenland, and the tracking of the other five began on the Baffin Island side of Baffin Bay near Davis Straits. The icebergs initially located near Disko Island did not appear to be influenced by any well-defined current system, the drift track of each was erratic and the drift speeds generally less than 0.20 m/s. The icebergs initially located along the coast of Baffin Island followed the prevailing currents southward. These icebergs drifted at speeds as high as 0.8 m/s with model speeds generally falling between 0.10 m/s and 0.20 m/s. Groundings occurred frequently occupying 40 percent of the observed time. Data processing methods, accuracy of the ice buoy system, and a detailed analysis of each iceberg's drift is presented. It was estimated using the drift data obtained, that approximately 190 days are needed for an average size iceberg to travel the 1100 nautical miles from Cape Dyer, Baffin Island, to the outer limits of the Grand Banks of Newfoundland. GRA

N80-10584# Oak Ridge National Lab., Tenn.
COMPUTER SOFTWARE TO CALCULATE AND MAP GEOLOGIC PARAMETERS REQUIRED IN ESTIMATING COAL PRODUCTION COSTS Final Report
R. B. Honea, C. H. Petrich, D. L. Wilson, C. A. Dillard, R. C. Durfee, and J. A. Faber (Denison Univ.). Apr. 1979. 124 p. refs. Sponsored in part by Electric Power Research Inst.
(Contract W-7405-eng-26; EPRI Proj. 804)
(EPRI-EA-674) Avail: NTIS. HC A06/MF A01

A general overview of the software and methodology developed to calculate parameters such as surface slope and coal seam thickness and depth is provided along with sample map output which indicates the geographical distribution of these geologic characteristics. A user guide for implementing the software is included. Coal production, coal recovery, and coal resource calculation studies are reviewed. This system will be useful to utilities and coal mine operators alike in estimating costs through comprehensive assessment before mining takes place. DOE

N80-10585# Argonne National Lab., Ill.
MINERAL RESOURCES AND LAND-USE PLANNING, THE WATKINS, COLORADO CASE: A WORKSHOP SYNOPSIS
James R. LaFevers, Allen B. Agnew (USGS, Reston, Va.), Gail Hill (Denver Regional Council of Governments, Colo.), and J. Lee Guernsey. Sep. 1978. 46 p.
(Contract W-31-109-ENG-38)
(ANL/LRP/TM-7) Avail: NTIS. HC A03/MF A01

The reclamation and land use planning, program, which provides guidance materials and technical services to mining industry and public sector planners concerned with planning for effective land use in surface mine areas, is described. The program integrates reclamation planning with land use planning to assure maximum benefits to the public from both the reuse of mined areas and the efficient utilization of surface resources. Issues of critical importance relating to the potential development of lignite deposits in the vicinity of Denver, Colorado are discussed in detail. DOE

N80-10586# Oak Ridge National Lab., Tenn.
COMPUTER MAPPING SOFTWARE AND GEOGRAPHIC DATA BASE DEVELOPMENT: OAK RIDGE NATIONAL LABORATORY USER EXPERIENCE
Bob Honea and P. Johnson. 28 Jul. 1978. 35 p. refs. Presented at Conf. on Computer Mapping Software and Data Bases, Cambridge, Mass., 26 Jul. 1978.
(Contract W-7405-ENG-26)
(Conf-780727-1) Avail: NTIS. HC A03/MF A01

Computer graphic techniques developed for the sake of the computer graphics community tend to be esoteric and rarely suitable for user problems. Two types of users exist for computer graphic tools: the researcher who is generally satisfied with abstract but accurate displays for analysis purposes and the decision maker who requires synoptic and easily comprehended displays relevant to the issues he or she must address. Computer mapping software and data bases should be developed for the user in a generalized and standardized format for ease in transferring and to facilitate the linking or merging with larger analysis systems. Maximum utility of computer mapping tools is accomplished when linked to geographic information and analysis systems. Computer graphic techniques have varying degrees of utility depending upon whether they are used for data validation, analysis procedures or presenting research results. DOE

N80-10587# Hawaii Ad Hoc Committee on Remote Sensing, Honolulu.
LANDSAT PROJECT, STATE OF HAWAII: A PRELIMINARY REPORT
Dec. 1978. 41 p.
(PB-296712/3; NOAA-79050811) Avail: NTIS. HC A03/MF A01. CSCL 13B

The past, present and potential future application of satellite remote sensing technology is examined as a possible means for meeting growing land use and environment-related information needs of the State of Hawaii. GRA

N80-10588# New Mexico Univ., Albuquerque. Technology Application Center.
REMOTE SENSING APPLIED TO AGRICULTURAL RESOURCES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jun. 1979
Gerald F. Zollars. Jul. 1979. 48 p.
(NTIS/PS-79/0733/0) Avail: NTIS. HC $28.00/MF $28.00. CSCL 02D

This bibliography cites 193 articles from the international literature concerning remote sensing applications in the agricultural sector. The use of remote sensors for soil and vegetation mapping,

soil moisture mapping, and the interpretation of agricultural land use is stressed. GRA

N80-10589# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
SOME STEADY STATE EXACT SOLUTIONS OF THE WIND-DRIVEN CIRCULATION EQUATIONS FOR A RIGID-LID SHALLOW LAKE
Aldo Giorgini Jun 1979 63 p refs Sponsored by the Dept. of Interior
(PB-297206/5; TR-116; W79-07425; OWRT-A-048-IND(1))
Avail: NTIS HC A04/MF A01 CSCL 08H

A method is presented for solving the lake circulation equations under the rigid-lid approximation and for small shallow lakes. The driving force, simulating the wind, is constituted by a one-directional shear whose intensity may be variable across the lake. The method relaxes the bathymetry as a datum and finds it instead, together with the flow field, by suitable constraints on the flow field itself. The most interesting case of uniform surface shear (uniform wind intensity) is studied for the following subcases: a lake; and underwater hill in an otherwise constant-depth water body of infinite horizontal extend, and an underwater pool in an otherwise constant-depth water body of infinite horizontal extent. GRA

N80-10590# University of Eastern Michigan, Ypsilanti. Dept. of Geography and Geology.
IMPACT OF GREAT LAKES WATER LEVEL FLUCTUATIONS ON COASTAL WETLANDS Final Report, 1 Oct. 1976 - 30 Nov. 1978
Eugene Jaworski, C. Nicholas Raphael, P. J. Mansfield, and Brooks B. Williamson Apr 1979 364 p refs
(Contract DI-14-0001-7163)
(PB-296403/9; W79-07001; OWRT-B-045-MICH(1)) Avail: NTIS HC A16/MF A01 CSCL 08H

Field measurements were collected at seven study areas along Lakes Michigan, Huron, St. Clair, and Erie. Surface landforms were mapped and models of the four coastal wetland types were developed. With the aid of aerial photography and field bisects, the zonal plant communities were identified and three historical distribution maps were constructed which represented various lake level conditions. Field data indicate that water level, wave energy, and substrate type are important factors in determining the shifting of plant communities in response to lake level fluctuations. GRA

N80-10591# Washington Univ., Seattle. Hydraulics Lab.
HYDROLOGIC MODELING AND DATA REQUIREMENTS FOR ANALYSIS OF URBAN STREAMFLOW MANAGEMENT ALTERNATIVES
Gary J. Kemp and Stephen J. Burges Nov. 1978 134 p refs
(Contract DI-14-34-0001-8051)
(PB-296499/7; TR-57; W79-07004; OWRT-A-092-WASH(1))
Avail: NTIS HC A07/MF A01 CSCL 08H

The development of evaluative criteria for use of continuous simulation hydrologic models is presented for King and Snohomish Counties, Washington. From the examination of the general characteristics of several continuous simulation models it was found that variations of the Stanford University Model (SWM) were the only models possessing the desired characteristics. These are evaluated in detail as a group. It is concluded that the SWM provides better information than more commonly used methods. The Hydrocomp Simulation Processor II is recommended for implementation as the model best suited for this specific location. Its primary limitation is its demand for data, particularly rainfall records, and the associated cost of data development and handling. GRA

N80-10592# West Virginia Univ., Morgantown. Thermal-Hydraulics Lab.
INFLUENCE OF PUMPED STORAGE FLOWS ON THERMAL STRATIFICATION IN RESERVOIRS Final Report
V. Singh, R. A. Bajura, and S. H. Schwartz Jan. 1979 170 p refs
(Contract DI-14-34-0001-6214)
(PB-297131/5; VS/RAB/SHS-79-1; RR-10; W79-07365)
Avail: NTIS HC A08/MF A01 CSCL 13B

The characteristics of buoyant submerged horizontal jets which simulate the discharge from power plants were found to be dependent upon the Froude number and the jet and ambient water temperatures. The concentration of salt solutions used to simulate the buoyancy mechanism in some of the tests was observed to alter the mixing characteristics of the jets. A series of tests was conducted to determine the mixing which would occur in two tanks simulating a pumped storage reservoir system after a number of cycles of operation. The mixing in the reservoirs was also simulated using a numerical computational scheme in two dimensions. The numerical predictions were in qualitative agreement with the experimental results. GRA

N80-10994# Joint Publications Research Service, Arlington, Va.
LODGING OF GRAIN CROPS AND ITS DETECTION BY AERIAL PHOTOGRAPHY
V. Ye. Budanov (All-Union Scientific Res. Inst. of Cybernetics) *In its* USSR Report: Biomedical and Behavioral Sci., No. 112 23 Jul. 1979 p 1-6 Transl. into ENGLISH from Zashchita Rasteniy (Moscow), no. 4, 1979 p 32-33 (For primary document see N80-10993 01-99)
Copyright. Avail: NTIS HC A06/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-10593 Drexel Univ., Philadelphia, Pa.
OPTIMAL CONTROL OF DISTRIBUTED PARAMETER SYSTEMS FOR SOLAR THERMAL APPLICATIONS Ph.D. Thesis
Abraham Orbach 1979 252 p
Avail: Univ. Microfilms Order No. 7923085

The necessary conditions for optimality, which generate a set of equations whose solution yields the optimal control, were derived. It was shown that if the system and the performance index were bilinear and if the control vector was constrained, the optimal solution yielded a bang-bang policy for which the switching functions were obtained. These results were applied to the optimal control of the solar collector loop systems where the objective was to control the fluid velocity so as to maximize the net energy collected. A sensitivity study of a nonlinear first order in time and space system is presented. Three types of distributed parameter models, which represent the dynamics of the flat plate solar collector were derived. Dissert. Abstr.

N80-10594*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME TECHNIQUES FOR REDUCING THE TOWER SHADOW OF THE DOE/NASA MOD-0 WIND TURBINE TOWER Final Report
Richard R. Burley, Joseph M. Savino, Lee H. Wagner, and James H. Diedrich Sep. 1979 129 p refs
(Contract DE-AB29-76-ET20370)
(NASA-TM-79202; DOE/NASA/20370-79/17; E-087) Avail: NTIS HC A07/MF A01 CSCL 10B

Wind speed profile measurements to measure the effect of a wind turbine tower on the wind velocity are presented. Measurements were made in the wake of scale models of the tower and in the wake of certain full scale components to determine the magnitude of the speed reduction (tower shadow). Shadow abatement techniques tested on the towers included the removal of diagonals, replacement of diagonals and horizontals with round cross section members, installation of elliptical shapes on horizontal members, installation of airfoils on vertical members, and application of surface roughness to vertical members. A.W.H.

N80-10595*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA-LEWIS CLOSED-CYCLE MAGNETOHYDRODYNAMICS PLANT ANALYSIS
Paul F. Penko 1979 13 p refs Presented at Closed-Cycle Magnetohydrodynamics Specialists Meeting, Bozeman, Montana, 21 Jun. 1979
(Contract EF-77-A-01-2674)
(NASA-TM-79249; DOE/NASA-2674-79/7; E-159) Avail: NTIS HC A02/MF A01 CSCL 10A

A brief review of preliminary analyses of coal fired closed cycle MHD power plants is presented. The performance of three power plants with differing combustion systems were compared. The combustion systems considered were (1) a direct coal-fired combustor, (2) a coal gasifier with in-bed desulfurization and (3) a coal gasifier requiring external fuel gas cleanup. Power plant efficiencies (auxiliary power excluded) were 44.5, 43, and 41 percent for the three plants, respectively. R.E.S.

N80-10596# General Electric Co., Schenectady, N. Y. Energy Systems Programs Dept.
THE FIRST SMALL POWER SYSTEM EXPERIMENT, PHASE 1: ENGINEERING EXPERIMENT NO. 1 Final Report, 5 Jul 1978 - 4 May 1979
H. E. Jones et al 1978 570 p Prepared for JPL
(Contract JPL-955116)
(NASA-CR-162417) Avail: NTIS HC A25/MF A01 CSCL 10A

Conceptual designs were generated for several small solar thermal electric power plant configurations with a nominal size of one MWe and 0.4 annual capacity factor. Three startup times for a near term engineering experiment were considered for an application involving a small community and utility system. System characteristics, performance, and costs were determined for the nominal size plants. Size variations of from 0.5 to 10 MWe and from zero storage capacity to 0.7 annual capacity factor were evaluated with respect to cost and performance impact. Basic design goals for all the near term systems were: (1) high operational reliability; (2) minimum risk of failure; (3) commercial potential; and (4) low total experiment cost. K.L.

N80-10597*# SRI International Corp., Menlo Park, Calif.
NOVEL DUPLEX VAPOR: ELECTROCHEMICAL METHOD FOR SILICON SOLAR CELLS Quarterly Progress Report, 1 May - 31 Jul. 1979
L. Nanis, A. Sanjurjo, and K. Sancier 31 Aug. 1979 21 p Prepared for JPL
(Contracts NAS7-100; JPL-954471; SRI Proj. PYU-4980)
(NASA-CR-162387; DOE/JPL-954471-79/11; QPR-14) Avail: NTIS HC A02/MF A01 CSCL 10A

The scaled up chemical reactor for a SiF4-Na reaction system is examined for increased reaction rate and production rate. The reaction system which now produces 5 kg batches of mixed Si and NaF is evaluated. The reactor design is described along with an analysis of the increased capacity of the Na chip feeder. The reactor procedure is discussed and Si coalescence in the reaction products is diagnosed. A.W.H.

N80-10598*# Crystal Systems, Inc., Salem, Mass.
SILICON INGOT CASTING HEAT EXCHANGER METHOD, MULTI-WIRE SLICING, FIXED ABRASIVE SLICING TECHNIQUE, PHASE 3 Quarterly Progress Report, 1 Apr. - 30 Jun. 1979
Frederick Schmid and Chandra P. Khattak Jul. 1979 34 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-954373)
(NASA-CR-162398; DOE/JPL-954373-79/11; QPR-3) Avail: NTIS HC A03/MF A01 CSCL 10A

Ingot casting was scaled up to 16 cm x 16 cm square cross section size weighting up to 8.1 kg. The high degree of crystallinity was maintained in the large ingot. For large sizes, the non-uniformity of heat treatment caused 'chipping' of the surface of the ingot. Significant effort and progress was made in the development of a uniform graded structure in the silica crucibles. The high speed slicer was modified so that the bladehead weight was reduced to 37 pounds. This allowed for higher surface speeds of up to 500 feet per minute. Slicing of 10 cm diameter workpieces at these speeds increased the throughput of the machine to 5.7 mils/min., 0.145 mm/min., 50 per cent more than the projected cutting rates used in the economic analysis. R.E.S.

N80-10599# Committee on Science and Technology (U. S. House).
PASSIVE SOLAR ENERGY PROGRAMS AND PLANS
Washington GPO 1978 432 p Hearing before the Subcomm. on Advanced Energy Technologies and Energy Conservation Res., Development and Demonstration of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., 19 Sep. 1978
(GPO-36-211) Avail: Subcomm. on Advanced Energy Technologies and Energy Conservation Res., Development and Demonstration

Testimony delivered and statements received regarding passive solar energy systems development under the Solar Heating and Cooling Demonstration Act (PL 93-409) are presented. Basic approaches are described as well as the use of specific heat absorbing materials in building construction and the use of windows and baffles to control the amount of sunlight received. Additional research needs are examined. Market demand, technology transfer, and technology utilization are also considered. A.R.H.

N80-10600*# RCA Labs., Princeton, N. J. David Sarnoff Research Center.
ANALYSIS OF S-BAND SOLID-STATE TRANSMITTERS FOR THE SOLAR POWER SATELLITE Final Report, 1 Nov. 1978 - 1 Jun. 1979
E. F. Belohoubek, M. Ettenberg, H. C. Huang, M. Nowogrodzki, and F. N. Sechi 1 Jun. 1979 79 p refs
(Contract NAS9-15755)
(NASA-CR-160320) Avail: NTIS HC A05/MF A01 CSCL 10A

The possibility of replacing the Reference System antenna in which thermionic devices are used for the dc-to-microwave conversion, with solid-state elements was explored. System, device, and antenna module tradeoff investigations strongly point toward the desirability of changing the transmitter concept to a distributed array of relatively low power elements, deriving their dc power directly from the solar cell array and whose microwave power outputs are combined in space. The approach eliminates the thermal, weight, and dc-voltage distribution problems of a system in which high power tubes are simply replaced with clusters of solid state amplifiers. The proposed approach retains the important advantages of a solid state system: greatly enhanced reliability and graceful degradation of the system. A.R.H.

N80-10601*# Honeywell, Inc., Minneapolis, Minn.
OCMULGEE NATIONAL MONUMENT VISITOR CENTER SOLAR HEATING AND COOLING SYSTEM DESIGN REVIEW DATA
May 1978 72 p refs Prepared for NASA and DOE
(Contract NAS8-32093)
(NASA-CR-150706) Avail: NTIS HC A04/MF A01 CSCL 10A

The design of a solar heating and cooling system is documented. Solar collectors, design approaches, system trade studies, and preliminary specifications are discussed. K.L.

N80-10602*# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
SOLAR HEATING AND COOLING SYSTEMS DESIGN AND DEVELOPMENT Quarterly Report, 9 Jul. - 9 Oct. 1976
Oct. 1976 81 p Prepared for DOE
(Contract NAS8-32093)
(NASA-CR-150618; HONEYWELL-F3437-QR-101) Avail: NTIS HC A05/MF A01 CSCL 10A

Solar heating and heating/cooling systems were designed for single family, multifamily, and commercial applications. Subsystems considered included solar collectors, heat storage systems, auxiliary energy sources, working fluids, and supplementary controls, piping, and pumps. K.L.

N80-10603*# Energy Research Corp., Danbury, Conn.
TECHNOLOGY DEVELOPMENT FOR PHOSPHORIC ACID FUEL CELL POWERPLANT, PHASE 2 Quarterly Report
Larry Christner Jun. 1979 72 p Prepared for DOE

(Contract DEN3-67)
(NASA-CR-159705; DOE/NASA/0067-79-2; QR-3) Avail: NTIS HC A04/MF A01 CSCL 10A

A technique for producing an acid inventory control member by spraying FEP onto a partially screened carbon paper backing is discussed. Theoretical analysis of the acid management indicates that the vapor composition of 103% H3PO4 is approximately 1.0 ppm P4O10. An SEM evaluation of corrosion resistance of phenolic resins and graphite/phenolic resin composites in H3PO4 at 185 C shows specific surface etching. Carbonization of graphite/phenolic bipolar plates is achieved without blistering. K.L.

N80-10604*# University of Western Kentucky, Bowling Green.
MSFC SOLAR HEATING AND COOLING HIGH SPEED PERFORMANCE (HISPER) CODE VALIDATION Final Report
Henry M. Healey 12 Oct. 1979 15 p
(Contract NAS8-33387)
(NASA-CR-161323) Avail: NTIS HC A02/MF A01 CSCL 10A

The status of the Solar Heating and Cooling Project is reported. Modifications to the HISPER program are outlined, and recommendations concerning the validation study of HISPER are included. F.O.S.

N80-10605# Westinghouse Electric Corp., Eddystone, Pa.
SCREENING EVALUATION OF NOVEL POWER CYCLES INTEGRATED WITH GASIFICATION PLANTS Final Report
R. W. Foster-Pegg and R. V. Garland Feb. 1979 136 p
(Contract EPRI Proj. 990-3)
(EPRI-AF-1002) Avail: NTIS HC A07/MF A01

Three basic plant configurations were studied: (1) the condensing combined cycle, which includes combustion turbines, gas expanders and condensing steam turbines; (2) the single cycle, which is comprised of combustion turbines and gas expanders, but no steam turbines; and (3) the noncondensing combined cycle, which utilizes combustion turbines, gas expanders and a non-condensing steam turbine. The most efficient plant configuration studied included a non-condensing steam turbine. The best plant heat rate calculated for this configuration is 7956 Btu/Kwh. DOE

N80-10606# Argonne National Lab., Ill. Materials Science Div.
MATERIALS TESTING FOR CENTRAL RECEIVER SOLAR-THERMAL POWER SYSTEMS
S. Majumdar 1979 14 p
(Contract W-31-109-eng-38)
(DOE/TIC-10103) Avail: NTIS HC A02/MF A01

The determination of specific elevated temperature mechanical properties of materials used for critical components in solar control receiver power systems is described. The biaxial creep fatigue testing of type 316H stainless steel superheater tubing is discussed. A survey of sodium effects on candidate materials for solar-thermal electric piping and steam generators is presented. The mechanical properties data generation is evaluated. DOE

N80-10607# Department of Energy, Washington, D. C. Energy Information Administration.
ECONOMIC STRUCTURE, AGGREGATE PRODUCTION FUNCTIONS AND THE DEMAND FOR ENERGY AS AN INTERMEDIATE PRODUCT: A PRELIMINARY ANALYSIS
G. M. Lady Dec. 1978 57 p refs
(DOE/EIA-0103/8) Avail: NTIS HC A04/MF A01

The relationship between the price elasticity of demand for energy as a factor of production and differences in economic structure was investigated. A model of general economic equilibrium is constructed utilizing a constant-elasticity-of-substitution production function. Using this model the price elasticity of demand for an intermediate product (energy) is determined under alternative structural assumptions (i.e., the degree to which the production process for the intermediate product directly utilizes primary factors of production). For an open economy and the case of energy, these assumptions could concern the degree to which the economy utilizes its own versus imported energy resources. DOE

N80-10608# Sandia Labs., Albuquerque, N. Mex.
DISPERSED POWER SYSTEMS AND TOTAL ENERGY
V. L. Dugan Nov. 1978 3 p Presented at AIAA Conf. on Solar Energy, Phoenix, Ariz., 27 Nov. 1978
(Contract EY-76-C-04-0789)
(SAND-78-2006C; Conf-781133-3) Avail: NTIS HC A02/MF A01

The variations of solar systems considered for dispersed applications are defined, and their relative benefits and costs are examined. Also, the role and benefits of total energy systems in dispersed applications are discussed. Although dispersed solar power systems offer large stored energy multiplication factors, they exhibit a large materials and land dependency. The importance of using most plentiful and available materials and planning a recycling materials use strategy are emphasized. DOE

N80-10609# Sandia Labs., Albuquerque, N. Mex.
SAFETY AND ENVIRONMENTAL IMPLICATIONS DOE/SANDIA MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY
J. A. Leonard Nov. 1978 7 p Presented at Environ. Control Symp., Washington, D.C., 28 Nov. 1978
(Contract EY-76-C-04-0789)
(SAND-78-2292C; Conf-781109-8) Avail: NTIS HC A02/MF A01

The Midtemperature Solar Systems Test Facility (MSSTF) in Albuquerque, New Mexico, is presented. The MSSTF is, at 32 kWe, the largest solar electric power plant in the U.S. and also represents the world's first application of the solar total energy concept to an actual load, an 1100 sq m office building. DOE

N80-10610# Booz-Allen and Hamilton, Inc., Bethesda, Md.
EPRI NEW ENERGY RESOURCES DEPARTMENT STRATEGY PAPER Final Report, Jan. 1979
Michael Lotker 1979 114 p
(EPRI-ER-979) Avail: NTIS HC A06/MF A01

The rationale for national and utility industry involvement in new energy resources (NER) technology is presented. The procedures currently being used to formulate programs in each of the NER technologies are described. DOE

N80-10611# California Univ., Berkeley. Lawrence Berkeley Lab.
ANOTHER LOOK AT ENERGY CONSERVATION
L. Schipper 1978 24 p refs Presented at Amer. Econ. Assoc., Chicago, 30 Aug. 1978
(Contract W-7405-eng-48)
(LBL-7893; Conf-7808104-1) Avail: NTIS HC A02/MF A01

The need for energy conservation in U.S. buildings, industry and the transportation sector, the effects of the amount and cost of energy supplies on energy conservation, and goals of a national energy policy are discussed. DOE

N80-10612# System Development Corp., Santa Monica, Calif.
THE 10MW(e) SOLAR THERMAL CENTRAL RECEIVER PILOT PLANT: HELIOSTAT FOUNDATION AND INTERFACE STRUCTURE INVESTIGATION
R. K. Shogren and J. T. Phillips 28 Aug. 1978 87 p refs Sponsored by Sandia Labs.
(Contract EY-76-C-04-0789)
(SAND-78-8180) Avail: NTIS HC A05/MF A01

Foundation design requirements for heliostats for the 10 MWe Solar Thermal Power Plant (STPP) were investigated. Soils data were reviewed and a soils investigation specification and recommendations were prepared as required. Foundation to collector interface requirements were studied. Candidate foundation designs were prepared with associated cost studies. Grading requirements recommendations consistent with technical and budgetary restrictions, and recommendations for construction and test of prototype foundations were developed. DOE

N80-10613# Battelle Pacific Northwest Labs., Richland, Wash.
SUMMARY REPORT OF THE SOLAR REFLECTIVE MATERIALS TECHNOLOGY WORKSHOP
M. A. Lind and L. E. Ault Oct. 1978 93 p Workshop held at Denver, 28-30 Mar. 1978
(Contract EY-76-C-06-1830)

(PNL-2763; Conf-780380) Avail: NTIS HC A05/MF A01

Solar reflector materials technology was assessed. Metals, metallic films and alloys, and dielectric or ceramic stacks were considered as reflecting surface materials. Protective coatings discussed included polymer paints and films, inorganic coatings, and thin glass. The mirror support structures considered were polymer foams, cellular glass, aluminum honeycomb, wood, and fiberglass and epoxy composites. The requirements and properties for reflector materials were discussed along with environmental tests and actual field experiences with solar collector structures. High concentration ratio and central receiver concepts were emphasized. K.L.

N80-10614# Hanford Engineering Development Lab., Richland, Wash.

ACID DIGESTION OF COMBUSTIBLE WASTE Status Report

C. Allen, R. Cowan, and J. Divine Oct. 1978 124 p refs

(Contract EY-76-C-14-1270)

(HEDL-TME-78-77; SR-2) Avail: NTIS HC A06/MF A01

The radioactive acid digestion test unit (RADTU), which was constructed to process combustible transuranic waste, is presented. Laboratory testing, pilot plant testing, engineering studies, and safety studies were completed and incorporated in the system design. DOE

N80-10615# AiResearch Mfg. Co., Phoenix, Ariz.

BRAYTON ISOTOPE POWER SYSTEM, PHASE 1 Final Report

28 Jul. 1978 124 p

(Contract EY-76-C-03-1123)

(TID-28927) Avail: NTIS HC A06/MF A01

A closed gas turbine dynamic power conversion system to be used for space applications is presented. A conceptual design of the flight system is presented and the design, development, and test of a prototype demonstration system are described. When tested, the system showed 25 percent conversion efficiency and 1000 hours of endurance testing. R.E.S.

N80-10616# Combustion Engineering, Inc., Windsor, Conn. Power Systems Group.

MDAC/ROCKETDYNE SOLAR RECEIVER: DESIGN REVIEW

H. M. Payne Aug. 1978 130 p refs

(Contracts EY-76-C-04-0789; AT(29-1)-789)

(SAND-78-8188; ASA-78-06) Avail: NTIS HC A07/MF A01

The adequacy of the design in meeting the requirements of the solar central receiver (boiler) over a commercial lifetime of 30 years was assessed for an external solar heated receiver, composed of a multiple of modular panels arranged in parallel and operating on the once-through steam generation principle. Each panel is composed of welded tangent tubes, connected between inlet and outlet headers. Subcooled water enters the bottom headers, flows upward, absorbs heat, produces saturated steam throughout the two phase region, and exits at the top as superheated steam. Tube size and material are the same for both commercial and pilot plants. Panel sizes are different between the two plants. Commercial plant heat flux is approximately 2.8 times that of the pilot plant. Structural supports and attachments of both designs are similar. Control of final superheat temperature is maintained by varying the water flow to each of the panels, according to the thermal absorption of each panel. DOE

N80-10617# Department of Energy, Oak Ridge, Tenn. Technical Information Center.

ENERGY INFORMATION DATA BASE. CORPORATE AUTHOR ENTRIES Progress Report, Jun. 1978 - Mar. 1979

Mar. 1979 40 p

(DOE/TIC-4585-R1-Suppl-1) Avail: NTIS HC A03/MF A01

This supplement contains additions to TID-4585-R1 and is intended to be used with that publication. Future supplements will be cumulative from June 1978 until another revision is issued. DOE

N80-10618# Department of Energy, Washington, D. C.

NATIONAL ENERGY PLAN 2

1979 355 p

(DOE/TIC-10109) Avail: NTIS HC A16/MF A01

The Administration's second National Energy Plan is presented. The past, present, and future of energy supply and demand for the U.S. is discussed. DOE

N80-10619# California Univ., Livermore. Lawrence Livermore Lab.

ENERGY TRANSITION IN CALIFORNIA

M. N. Christensen 1979 25 p refs

(Contract W-7405-eng-48)

(UCRL-15003) Avail: NTIS HC A02/MF A01

Major elements of consensus within current energy debates are discussed. Implications of that consensus for development of large scale supply facilities, decisions by end-users of energy, and prospects for future demands for energy are also discussed. Events and circumstances in California are focused but relevant information from other places is also used. DOE

N80-10620# Department of Energy, Washington, D. C.

ENERGY SUPPLY AND DEMAND IN THE MIDTERM: 1985, 1990, AND 1995 Analysis Report

Apr. 1979 223 p

(DOE/EIA-0102/52) Avail: NTIS HC A10/MF A01

To account for the uncertainty inherent in projecting future energy production, consumption, prices, and associated variables, five basic projection series (A-E) are presented. These series constitute variations in assumptions influencing energy supply and demand curves. High demand is assumed for Series A and B, and low demand is assumed for D and E. High supply is assumed for Series A and D, and low supply is assumed for Series B and E. Series C assumes medium supply and demand. Two additional scenarios, C High and C Low, evaluate the sensitivity of the Series C forecasts to variations in the projected world of oil price. A computer model, called the 'midterm energy forecasting system', simulates the interactions of energy suppliers and consumers in the marketplace. DOE

N80-10621# California Univ., Berkeley. Lawrence Berkeley Lab.

ENERGY CONSERVATION AND THE ENVIRONMENT: CONFLICT OR COMPLEMENT

L. Schipper Sep. 1978 84 p refs Presented at Conf. on Impacts and Risks of Energy Strategies, Stockholm, Sweden, Sep. 1978 and the Environmental Secretariate, Organization for Economic Cooperation and Development, Paris, Oct. 1978

(Contract W-7406-eng-48)

(LBL-7882; Conf-7809141-1; Conf-7810167-1) Avail: NTIS HC A05/MF A01

The relationship among energy, the environment, and economic well-being is discussed. The confusing aspects were sorted out in order to show how goals relating to the efficient use of energy are aligned both with traditional economic goals and with modern environmental goals. The role of energy in the economy was analyzed and the origins of many of the misconceptions about that role were traced. DOE

N80-10622*# General Electric Co., Schenectady, N. Y.

CONCEPTUAL DESIGN OF THERMAL ENERGY STORAGE SYSTEMS FOR NEAR-TERM ELECTRIC UTILITY APPLICATIONS. VOLUME 2: APPENDIXES, SCREENING OF CONCEPTS

W. Hausz, B. J. Berkowitz, and R. C. Hare Apr. 1979 151 p refs

(Contract EC-77-A-31-1034; EPRI Proj. 1082-1)

(NASA-CR-159411; EPRI-EM-1037-Vol-2) Avail: NTIS HC A08/MF A01

Volume two contains three appendices entitled: (1) Bibliography and Cross References; (2) Taxonomy: Proponents and Sources; and (3) Concept Definitions. DOE

N80-10623# California Univ., Livermore. Lawrence Livermore Lab.

METHODS OF ESTIMATING THE RELIABILITY OF WIND ENERGY SYSTEMS WITH STORAGE

C. R. Glassey and G. F. Moyer 1978 61 p refs

(Contract W-7405-eng-48)

(UCRL-15005) Avail: NTIS HC A05/MF A01

Some preliminary results obtained in analyzing the reliability of wind generator storage systems are presented. The investigation took two separate approaches, simulation and probabilistic modeling, to reveal the trade-offs which can be made between generating capacity and storage capacity to attain a desired level of reliability. The performance criterion used throughout this work was the frequency of occurrence of empty storage. This criterion was essentially the same as the frequency of loss of load. DOE

N80-10624# Brookhaven National Lab., Upton, N. Y.
SOLAR ASSISTED HEAT PUMP OVERVIEW AND SUMMARY OF IN-HOUSE RESEARCH
John W. Andrews Sep. 1978 5 p refs Presented at the 3rd Ann. Solar Heating and Cooling R and D Contractors' Meeting, Washington, D.C., 24 Sep. 1978
(Contract EY-76-C-02-0016)
(BNL-24911; Conf-780983-2) Avail: NTIS HC A02/MF A01

The following areas of solar assisted heat pump research and development are overviewed: (1) development of special heat pump tuned to take advantage of the 40 to 100 F source temperature range appropriate for solar assist; (2) identification of low cost, solar energy collection and storage subsystems appropriate for the solar assist function; and (3) analysis of solar assisted heat pump systems to determine what component parameters are required to produce economically competitive systems. DOE

N80-10625# Battelle Pacific Northwest Labs., Richland, Wash.
METHODOLOGY FOR IDENTIFYING MATERIALS CONSTRAINTS TO IMPLEMENTATION OF SOLAR ENERGY TECHNOLOGIES
J. W. Litchfield, R. L. Watts, W. E. Gurwell, J. N. Hartley, and C. H. Bloomster Jul. 1978 91 p refs
(Contract EY-76-C-06-1830)
(PNL-2711) Avail: NTIS HC A05/MF A01

A materials assessment methodology for identifying specific critical material requirements that could hinder the implementation of solar energy was developed and demonstrated. The methodology involves an initial screening process, followed by a more detailed materials assessment. The detailed assessment considers such materials concerns and constraints as process and production constraints, reserve and resource limitations, lack of alternative supply sources, geopolitical problems, environmental and energy concerns, time constraints, and economic constraints. Data for 55 bulk and 53 raw materials required in the example photovoltaic systems are available on the data base. Engineering and bulk material requirements were defined for one photovoltaic system, thirteen photovoltaic cells, ten solar heating and cooling systems, and two agricultural and industrial process heat systems. DOE

N80-10626# Sandia Labs., Albuquerque, N. Mex.
SENSITIVITY STUDY OF BRAYTON CYCLE POWER PLANT PERFORMANCE
Carl C. Hiller Aug. 1978 36 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8020) Avail: NTIS HC A03/MF A01

The efficiency of Brayton cycle power plants is investigated. The parameters and configurations examined include open and closed air cycles, optimum pressure ratio, helium versus air working fluids, turbine and compressor isentropic efficiencies, recuperator effectiveness, turbine inlet temperature, heat rejection temperature, pressure drop losses, with/without intercooling, and with/without reheat. Equation derivations, a computer listing, and a hand calculator program listing are included. DOE

N80-10627# Oak Ridge National Lab., Tenn.
SURVEY OF SOLAR THERMAL ENERGY STORAGE SUBSYSTEMS FOR THERMAL/ELECTRIC APPLICATIONS
C. L. Segaser Aug. 1978 101 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5758) Avail: NTIS HC A06/MF A01

The technology and estimated costs of subsystems for storing the thermal energy produced by solar collectors are discussed. The systems considered are capable of producing both electricity and space conditioning for a single family detached residence, an apartment complex of 100 units, and a city of 30,000 residents containing both single family residences and apartments. Up to 36 x 10 to the 5th power kWhr of thermal storage capacity is required. In addition to sensible heat and latent heat storage materials, several other media were investigated as potential thermal energy storage materials, including the clathrate and semiclathrate hydrates, various metal hydrides, and heat storage based on inorganic chemical reactions. DOE

N80-10628# Public Service Electric and Gas Co., Newark, N. J.
BATTERY ENERGY STORAGE TEST (BEST) FACILITY Progress Report
Emile A. Hyman Feb. 1979 94 p refs
(Contract EY-76-C-02-2857)
(EPRI-EM-1005; PR-1) Avail: NTIS HC A05/MF A01

The activities of the first three phases during the time period March 1, 1976 to July 1, 1978 are presented. Included are a background review, key milestone dates, a description of activities for the three phases (including those associated with the future implementation of the second test bay), and a description of major interactions between the BEST Facility program and the advanced battery development programs. DOE

N80-10629# Mitre Corp., McLean, Va. Metrek Div.
ENVIRONMENTAL DATA FOR ENERGY TECHNOLOGY POLICY ANALYSIS. VOLUME 1: SUMMARY
Joke Verhoeff, Robert Kline, William L. Parker, Thomas F. Wolfinger, David Adler (CONSAD Research Corp.), Gabriel Sucher (CONSAD Research Corp.), Marc Narkus-Kramer (International Research and Technology, Inc.), Nicklaus E. Leggett (International Research and Technology, Inc.), and Tyrone Williams (International Research and Technology, Inc.) Jan. 1979 106 p refs
(Contract EE-77-C-01-6119)
(HCP/EV6119-1) Avail: NTIS HC A06/MF A01

Qualitative and quantitative information on the environmental aspects of different energy technologies is provided. Data are given on nuclear energy, coal, synthetic fuels, oil shale, solar energy, geothermal energy, and hydroelectricity. Each category of technology is broken down into individual technology phases or base units for which environmental effects could reasonably be specified. Each base unit is described in terms of a typical unit or plant size and configuration. DOE

N80-10630# Department of Energy, Washington, D. C. Office of Program Coordinator.
COMPREHENSIVE ENVIRONMENT, HEALTH, AND SAFETY PROGRAM REPORT, FY 1978
Feb. 1979 67 p refs
(DOE/EV-0035) Avail: NTIS HC A04/MF A01

A description is given of the environment, health, and safety research, development, and demonstration activities carried out and in progress. Discussion is presented under the following section headings: a comprehensive environment, health, and safety program; concept and implementation approach; the DOE Office of Environmental - program and selected activities; environmental, health, and safety activities of other DOE offices; and, environmental, health, and safety activities of other Federal agencies. Titles of the four appendixes are: definition of research categories; summary of energy-related environment, health, and safety concerns; environment, health, and safety laws and regulations governing activities of the Department of Energy; and environmental, health, and safety activities of Federal agencies participating in the Federal Inventory. DOE

N80-10631# Department of Energy, Washington, D. C. Div. of Technology Assessments.
ENVIRONMENTAL READINESS OF EMERGING ENERGY TECHNOLOGIES Summary Report
Jan. 1979 77 p
(DOE/ERD-0022) Avail: NTIS HC A05/MF A01

The principal conclusions of the 21 Environmental Readiness Documents, which assessed 24 technologies are presented. Seven technologies were judged to have minimal environmental constraints. Four are solar technologies. The minimally constrained technologies nevertheless have some potential environmental, health, and safety problems, which will require careful management. Eleven technologies, many of which are high-technology systems with great promise for meeting the Nation's energy needs, were judged to have moderate environmental constraints.

The moderately constrained technologies are, with few exceptions, in the predemonstration stage, with demonstration and environmental readiness likely to be achieved by 1980-1990. Six technologies, enhanced oil recovery (micellar polymer), hydrothermal, coal gasification, coal liquefaction, diesel cogeneration, and in situ oil shale, were judged to have significant environmental constraints that will require extensive environmental research and development before they can be widely used or before they can be deployed in some environmentally sensitive areas. DOE

N80-10632# Argonne National Lab., Ill.
MODELING APPROACH SUITABLE FOR ENERGY SYSTEM
Dudley V. Goetschel 1979 8 p Presented at Pittsburg Modeling and Simulation Conf., Pittsburgh, 25-27 Apr. 1979
(Contract W-31-109-eng-38)
(Conf-790459-4) Avail: NTIS HC A02/MF A01

A nonlinear model that can be used in the formulation of certain energy conversion systems modeling problems is presented. The model lends itself nicely to solution approaches based on nonlinear programming algorithms and, in particular, to those methods falling into the class of variable metric algorithms for nonlinearly constrained optimization. DOE

N80-10633# Brookhaven National Lab., Upton, N. Y.
DYNAMICS AND CONTROL: ENERGY CONVERSION, DELIVERY, AND DEMAND ANALYSIS
Kenneth C. Hoffman Apr. 1979 22 p refs Presented at the Workshop on Process and Systems Dyn. Control, Denver, 20 Jun. 1979
(Contract EY-76-C-02-0016)
(BNL-26045; Conf-790636-1) Avail: NTIS HC A02/MF A01

Techniques of mathematical modeling and modern control theory, using microprocessors and advanced measurement and control devices, are extensively applied to components and systems for the conversion and delivery of energy. The projection of energy demands, as a function of economic growth and energy price, is also the subject of active research and analysis. This position paper reviews the current state-of-the-art of analysis in these areas dealing with the planning and operation of energy systems that deliver fuels and electric power. Future research directions are also discussed. DOE

N80-10634# RAND Corp., Santa Monica, Calif.
SOVIET ENERGY BALANCES
Robert Campbell Dec. 1978 115 p refs
(Contract EX-76-C-01-2337)
(RAND/R-2257-DOE) Avail: NTIS HC A06/MF A01

The pattern of energy flows in the Soviet economy contrasts sharply with that in the U.S. and in Western Europe. Today, the flow of energy exports in the USSR amounts to about 12% of Soviet primary energy production in 1975, whereas the U.S. and Western Europe must relay heavily on imports to augment domestic production. The composition of primary energy production in the USSR has changed considerably since 1950, when 80% was accounted for by solid fuel and only 18.5% by hydrocarbons. By 1975, hydrocarbons accounted for 64%, and the share for solid fuels had fallen to 33%. Since most Soviet energy exports have consisted of oil, the emphasis on solid fuels in consumption in the USSR is still higher than in production: solid fuels now represent 37% of consumption compared with 21% in Western Europe and 19% in the U.S. Within solid fuels, there is heavy reliance on relatively low-grade fuels: lignite, peat, oil shale, and firewood constituted nearly a third of Soviet solid fuel production in 1975. DOE

N80-10635# Washington Scientific Marketing, Inc., Washington, D. C.
DEPARTMENT OF ENERGY WORKSHOPS ON INDUSTRIAL ENERGY CONSERVATION REPORTING Final Report
[1979] 190 p Workshops held at Washington, D. C., Atlanta, Houston, Tex., Chicago, New York, San Francisco, Nov. 1978 - Feb. 1979
(DOE/CS-1830-T3) Avail: NTIS HC A09/MF A01

A voluntary industrial energy-conservation program was initiated and now includes 50 trade organizations representing over 3,000 companies. Their current reporting system is an effort to respond to the Energy Policy and Conservation Act requirements, as now modified by the National Energy Conservation Policy Act. DOE's Office of Industrial Programs held six workshops in various key locations between November 1978 and February 1979 to enable energy managers to develop ideas and make suggestions that would improve the current and future energy-reporting programs. This report is a summary of the wide range of recommendations that the workshop participants offered as a means of meeting the NECPA requirements and the criticism of the current reporting program. It also reflects industry's views on potential approaches to future reporting. DOE

N80-10636# RAND Corp., Santa Monica, Calif.
RESOLVING ENVIRONMENTAL ISSUES IN ENERGY DEVELOPMENT: ROLES FOR THE DEPARTMENT OF ENERGY AND ITS FIELD OFFICES
Phyllis L. Ellickson and Edward W. Merrow Jan. 1979 62 p refs
(Contract EX-76-C-01-2337)
(RAND/R-2335-DOE) Avail: NTIS HC A04/MF A01

The role of the Department of Energy to resolve environmental conflicts that arise during the implementation of energy projects or programs was studied. The environmental concerns surrounding implementation and feasibility of national energy policies were also studied. The investigation reached the conclusion that the government's most effective role in resolving environmental conflicts and uncertainties is to improve communications among the concerned parties. This role requires flexibility and evenhandedness from the government as well as an understanding of the local conditions and a commitment to appropriate local solutions. Involving local sources at every stage of the environmental impact analysis can reduce the probability of conflicts and make those that do arise more easily resolvable. DOE

N80-10637# Los Alamos Scientific Lab., N. Mex.
SELECTED RESULTS FROM THE TECHNOLOGY ASSESSMENT OF SOLAR ENERGY PROGRAM
Milton C. Krupka and John H. Altseimer 1979 8 p refs Presented at AIAA Terrestrial Energy Systems Conf., Orlando, Fla., 4-6 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-950; Conf-790611-3) Avail: NTIS HC A02/MF A01

Emerging solar technologies and selected applications were studied from environmental, institutional and social viewpoints. The impacts resulting from the large scale deployment of decentralized solar technologies were assessed. Emphasis was placed upon technical characterization of the technology and the development of a representative model system for a given application upon which an environmental analysis could be made. DOE

N80-10638# Sandia Labs., Albuquerque, N. Mex.
ANALYTICAL EVALUATION OF A SOLAR THERMOPHOTOVOLTAIC (TPV) CONVERTER
Michael W. Edenburn 1979 5 p refs Presented at the International Solar Energy Society Meeting, Atlanta, 28 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-0504C; Conf-790541-2) Avail: NTIS HC A02/MF A01

A thermophotovoltaic converter was parametrically analyzed for emitter temperature, cell reflectance to radiation with energy below the cell's bandgap energy and concentration ratio requirements. Important conclusions are: (1) an emitter temperature of 2000 K is optimal; (2) a cell reflectance value of 0.98 is required for below bandgap irradiation; (3) a secondary concentrator must be used with a parabolic dish primary; and (4) a mirror quality resulting in a 4 mrad reflection-beam dispersion is required for a 24% conversion efficiency. DOE

N80-10639# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FLYWHEEL ENERGY STORAGE AND CONVERSION SYSTEM FOR SOLAR PHOTOVOLTAIC APPLICATIONS
Alan R. Millner 1979 9 p Presented at the ASME Gas Turbine Conf., San Diego, Calif., 12-15 Mar. 1979
(Contract EY-76-C-02-4094)
(COO-4094-31; Conf-790305-6) Avail: NTIS HC A02/MF A01

A low-drag, low-power magnetic bearing and a permanent magnet brushless DC motor-generator developed were developed for a satellite flywheel. These will be combined with a terrestrial flywheel and control electronics to make up a flywheel energy storage and conversion system for use in a stand-alone solar photovoltaic residence. Technical and economic performance analyses indicate that, contrary to general thought, a flywheel system will be competitive if not superior to more conventional systems utilizing either present day or advanced batteries. This derives from the ability of the flywheel to perform the functions of dc-to-ac inversion and optimal impedance matching between the PV arrays and the load in addition to providing energy storage. The structural topology, performance data, design parameters, and test measurements of the magnetic bearing and motor-generator are to be used as well as the flywheel and control electronics. A preliminary discussion of the economic aspects is also included. DOE

N80-10640# Sandia Labs., Albuquerque, N. Mex.
GRAPHICAL REPRESENTATION OF TMY SOLAR RADIATION AVAILABILITY FOR ONE- AND TWO-AXIS SOLAR COLLECTORS
L. L. Lukens and R. R. Peters May 1979 113 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0418) Avail: NTIS HC A06/MF A01

Information about the availability of direct normal radiation to three tracking modes of concentrating collectors (two-axis, east-west, and north-south horizontal axis tracking collectors) for the 26 typical meteorological year stations is presented. The data presented include energy availability, efficiency based on the direct normal radiation availability, and energy distribution. DOE

N80-10641# Sandia Labs., Albuquerque, N. Mex.
STUDIES OF THE ABNORMALLY HIGH PEAK VOLTAGE OBSERVED WITH FeS2 DEPOLARIZED THERMAL BATTERIES
Samuel C. Levy and C. C. Crafts Apr. 1979 22 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0090) Avail: NTIS HC A02/MF A01

Studies reported show that initial voltage spike occurring in FeS2 depolarized thermal batteries at low current densities is due to a surface impurity on the FeS2 particles. This impurity is the result of a reaction with atmospheric oxygen. Several techniques were developed for lowering the initial peak voltage spike and thereby attaining longer active lives to 75 or 80% of peak voltage cutoff. The most successful technique is to put a thin electrolyte-binder layer on the side of the cathode pellet contacting the collector. DOE

N80-10642# Sandia Labs., Albuquerque, N. Mex. Fluid and Thermal Sciences Dept.
NUMERICAL SIMULATION OF DUAL-MEDIA THERMAL ENERGY STORAGE SYSTEMS
R. J. Gross, C. E. Hickox, and C. E. Hackett 1979 38 p refs Presented at the 18th ASME Natl. Heat Transfer Conf., San Diego, Calif., Aug. 1979
(Contract EY-76-C-04-0789)
(SAND-78-2282C; Conf-790808) Avail: NTIS HC A03/MF A01

An easily implemen.ed, finite difference predictor-corrector numerical technique is used to solve for fluid and solid temperature distributions in one dimensional flow through a finite packed bed. The method allows for temperature dependent properties, time varying inlet conditions, and nonuniform initial conditions. The numerical method agrees with the classical Schumann model to within one percent in simulations which exhibit fully developed thermal gradients of 310 C/m. Additional examples demonstrate that the technique is flexible and that the constant property assumption may lead to temperature distributions significantly different from a more realistic variable property assumption. The attractiveness of the method is its accuracy, flexibility, ease of implementation, and efficiency of computation. DOE

N80-10643# Rensselaer Polytechnic Inst., Troy, N. Y. Cogswell Lab.
PHYSICAL PROPERTIES DATA COMPILATIONS RELEVANT TO ENERGY STORAGE. 2. MOLTEN SALTS: DATA ON SINGLE AND MULTI-COMPONENT SALT SYSTEMS
G. J. Janz, C. B. Allen, N. P. Bansal, R. M. Murphy, and R. P. T. Tomkins Apr. 1979 440 p refs
(Contract W-7405-eng-48)
(NSRDS-NBS-61-Pt-2; LC-77-10824) Avail: NTIS HC A19/MF A01

The work provides selected data with value judgments for a set of 49 salt systems of interest as candidate materials for thermal energy storage sub-systems and for electrochemical energy storage systems. The physical properties assessed are melting points; phase diagrams; eutectic compositions; density; surface tension; viscosity; electrical conductivity; diffusion for ions; heat of fusion; heat capacity; volume change on fusion; vapor pressure; thermal conductivity (liquid and solid); and cryoscopic constant. The status of corrosion studies in the form of annotated bibliographic summaries, and salient observations on safety and hazards are also reported. A summarizing series of tables are provided as index to the data-gaps status for this set of candidate materials. DOE

N80-10644# Department of Energy, Washington, D. C. Div. of Legislative Research and Analysis.
SUMMARY OF MAJOR ENERGY LEGISLATION OF THE 95TH CONGRESS
Dec. 1979 158 p
(DOE/TIC-10118) Avail: NTIS HC A08/MF A01

The title, sponsor, synopsis, and legislative status of major energy lesiglation of the 95th Congress includes the following subjects: Alaska lands, Alaska gas transportation, antiboycott legislation, backhauling, Canadian fuel imports, cargo preference/tanker safety, Clean Air Act, coal conversion, coal leasing, coal slurry pipelines, cogeneration, dealer protection, Department of Energy (organization), DOE FY-79 appropriations and authorizations, divestiture, electric energy and utilities, energy conservation, energy impact assistance, Energy Policy Institute, ERDA FY-78 authorizations, ERDA/FEA FY-78 appropriations, enhanced oil recovery, environment and safety, FEA FY-78 authorization, fuels transportation safety, gasohol, geothermal energy, insulation standards, liquefied natural gas, mine safety, National Energy Act, natural gas, nuclear energy, nuclear siting and licensing, nuclear waste management, oil and gas leasing, oil import fees, oil pollution liability, oil shale commercialization, outer continental shelf, pipeline destruction, Safe Drinking Water Act, solar energy, state energy management program, strip mining, and uranium mill tailings. DOE

N80-10645# Los Alamos Scientific Lab., N. Mex.
ECONOMIC PERFORMANCE OF PASSIVE SOLAR HEATING: A PRELIMINARY ANALYSIS
Fred Roach, Scott Noll (New Mexico Univ., Albuquerque), and Shaul Ben-David 1978 11 p refs Presented at AIAA/ASERC Conf. on Solar Energy, Phoenix, Arizona, 27-29 Nov. 1978
(LA-UR-78-2861; Conf-781133) Avail: NTIS HC A02/MF A01

For the thermal storage wall two types of storage medium-masonry (Trombe) and water are examined. In addition, a night insulation option is included in the thermal storage wall concept, thus giving rise to four alternative passive designs. The economic performance of these alternative designs is evaluated on a state-by-state basis. The architectural design criteria, solar performance characteristics, and the incremental solar cost of each solar design are reviewed. Conventional energy costs are discussed as well as the optimal sizing/feasibility criterion employed in the economic performance analysis. Nationwide feasibility results are reviewed for each alternative design. In addition to contracting the solar systems themselves, the effects of two incentive proposals-the National Energy Act (NEA) income tax credits and low interest loads-upon each design are examined. Major conclusions are summarized for each design. DOE

N80-10646# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
OPTIMAL CONTROL STUDIES OF A SOLAR HEATING SYSTEM
M. Somasundaram, James L. Melsa, and Donald R. Farris 1978 6 p refs Presented to IEEE Midcom on Electron., Dallas, Tex., 13 Dec. 1978

(Contract W-7405-eng-36)
(LA-UR-78-2556; Conf-781208) Avail: NTIS HC A02/MF A01

Performance bounds were established for a heating, ventilating and air conditioning system in a solar heated and cooled building. Perfect knowledge of environmental conditions such as ambient temperature, wind velocity and insulation was assumed in order to determine whether prior knowledge of such information can be effectively employed to reduce the amount of auxiliary energy used. The optimal control study is based on a model of the 660000 sq. ft. National Security and Resources Study Center at the Los Alamos Scientific Laboratory. DOE

N80-10647# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
STATE-OF-THE-ART SURVEY OF JOINABILITY OF MATERIALS FOR OTEC HEAT EXCHANGERS
R. J. Beaver Dec. 1978 85 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6284) Avail: NTIS HC A05/MF A01

Literature and industrial sources were surveyed to assess, on the basis of apparent economics and reliability, the joinability of both shell-and-tube and compact ocean thermal energy conversion (OTEC) heat exchangers. A no-leak requirement is mandatory to prevent mixing seawater and the ammonia working fluid. The operating temperature range considered is 7 to 28 C (45 to 82 F). Materials evaluated were aluminum, titanium, copper-nickel, AL-6X austenitic stainless steel, singly and in combination with steel and concrete. Many types of welding and brazing processes, roller expansion, magnaforming, O-ring sealing, and adhesive bonding were considered. The automatic gas tungsten-arc welding process and explosion welding processes are the only two joining processes that now appear to offer the high reliability required of no-leak shell-and-tube heat exchangers. Of the two processes, the gas tungsten-arc welding process appears to be the more economically attractive. DOE

N80-10648# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
ENERGY TRANSFER IN ANISOTROPIC SYSTEMS. A: EXCITATION MIGRATION IN SUBSTITUTIONALLY DISORDERED ONE-DIMENSIONAL SOLIDS. B: THE SPECTROSCOPY OF MOLECULES ABSORBED ON METAL SURFACES
D. A. Zwemer Nov. 1978 231 p refs
(Contract W-7405-eng-48)
(LBL-8332) Avail: NTIS HC A11/MF A01

The energy and dynamics of excited states in a variety of anisotropic environments, including isotopically and chemically mixed crystals and molecular overlayers adsorbed on a nickel (III) surface were investigated. The relationship between local and long-range structure and spectroscopic properties was explored. A theory for energy transfer in substitutionally disordered solids is presented. Explicit expressions for the diffusion coefficients and the energy partitioning ratios in binary systems were derived. Energy transfer between localized states was found to be facilitated by concurrent tunnelling and thermal promotion. DOE

N80-10649# Los Alamos Scientific Lab., N. Mex.
SIMPLE PROCEDURE FOR ASSESSING THERMAL COMFORT IN PASSIVE SOLAR HEATED BUILDINGS
William O. Wray 1979 6 p refs Presented to Intern. Solar Energy Soc. Meeting, Atlanta, Ga., 28 May 1979
(Contract W-7405-eng-36)
(LA-UR-79-1337; Conf-790541-5) Avail: NTIS HC A02/MF A01

A thermal comfort equation, a procedure for assessing thermal comfort levels in passive solar heated buildings is presented. A thermal index called the equivalent uniform temperature is introduced to relate comfort levels in nonuniform environments to uniform conditions. DOE

N80-10650# Sandia Labs., Albuquerque, N. Mex.
DETERMINATION OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF LUMINESCENT SOLAR CONCENTRATORS Final Report
C. F. Rapp, N. L. Boling, I. M. Thomas, G. L. Opdycke, R. B. Fechter, J. Chrysochoos, and P. S. Friedman Mar. 1979 213 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7005) Avail: NTIS HC A10/MF A01

A somewhat different concentrator configuration was investigated. In the configuration, a thin luminescent film is deposited on all undoped substrate. The luminescence then originates in the film but is trapped within the entire thicker structure. In this study, a large number of fluorescent dopant-host combinations were identified. These were primarily organic but inorganic materials were also included. Absorption spectra, emission spectra and quantum efficiencies were measured on various samples in order to identify the best candidates for the luminescent concentrator device. Six inch by six inch and twelve inch by twelve inch concentrator plates were made which demonstrated approximately 15% effective concentrator efficiencies. The major loss mechanisms responsible for decreases in collector efficiencies were identified and quantitatively evaluated. Efficiency improvement factors of several times appear possible. DOE

N80-10651# Brookhaven National Lab., Upton, N. Y.
STATE OF THE ART OF SENSIBLE HEAT STORAGE FOR SOLAR HEAT PUMP SYSTEMS
Philip D. Metz 1979 9 p refs Presented to Solar Energy Storage Options Workshop, San Antonio, Tex., 18 Mar. 1979
(Contract EY-76-C-02-0016)
(BNL-25909; Conf-790328-4) Avail: NTIS HC A02/MF A01

Factors which influence the storage characteristics of solar source heat pump systems are discussed including: solar collection devices, the heat pump, and the utility interface. Some of the characteristics of solar source heat pumps storage are specified such as: temperature range and thermal inertia. The storage options which are discussed are: rock beds, water tanks, ground coupled storage, swimming pools, and ponds. DOE

N80-10652# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
ANALYSIS OF A LiCl OPEN-CYCLE ABSORPTION AIR CONDITIONER WHICH UTILIZES A PACKED BED FOR REGENERATION OF THE ABSORBENT SOLUTION DRIVEN BY SOLAR HEATED AIR Final Report, Dec. 1977 - Sep. 1978
Cecile M. Leboeuf and G. O. G. Loef Oct. 1978 32 p refs
(Contract EG-77-S-02-4546)
(COO-4546-1) Avail: NTIS HC A03/MF A01

The technical feasibility of lithium chloride open cycle absorption air conditioner which utilizes solar heated air for reconcentration of the absorbent solution is examined. The use of a packed bed concentrator was described. Operating conditions for a 3-ton residential unit are determined from equilibrium data, conservation of mass and energy, and transfer rate equations. Humidity, air temperature, and packing type are varied to determine their effect on packed bed performance and required packing volumes. The required operating temperatures, humidities, and flow rates are comparable to those which can be obtained from a conventional solar air-heating system during the summer, especially in dry climates. Construction and testing of a packed bed of appropriate design is recommended for validation of the analysis. DOE

N80-10653# Colorado State Univ., Fort Collins. Solar Energy Applications Labs.
PRELIMINARY ANALYSIS OF A TOTAL SOLAR HEATING SYSTEM Final Report, Dec. 1977 - Sep. 1978
James A. Leflar, P. Burns, and C. B. Winn Oct. 1978 28 p
(Contract EG-77-S-02-4546)
(COO-4546-4) Avail: NTIS HC A03/MF A01

A set of computer simulation programs was developed such that the programs provide a useful design tool for the design of total solar heating systems DOE

N80-10654# Carrier Corp., Syracuse, N. Y. Energy Systems Div.
DEVELOPMENT OF A HIGH TEMPERATURE SOLAR POWERED WATER CHILLER. VOLUME 3: PHASE 1 Technical Progress Report, 26 Sep. 1977 - 1 Jun. 1978
Richard A. English Jun. 1978 121 p refs

(Contract EG-77-C-03-1590)
(SAN-1590-1/3-Vol-3) Avail: NTIS HC A06/MF A01

The conceptual design rationale and resulting design configuration are described as well as estimates of cost and performance. Because the development of the turbocompressor design paralleled the development of the chiller system design, all of the cost and performance data are based on intermediate turbo-compressor performance data, as well as on unoptimized components. Optimized performance was computed. DOE

N80-10655# Alabama Univ., Huntsville.
EXPERIMENTAL AND NUMERICAL STUDIES OF LIQUID STORAGE TANK THERMAL STRATIFICATION FOR A SOLAR ENERGY SYSTEM Semiannual Progress Report, 1 Mar. - 31 Aug. 1978
S. T. Wu 29 Sep. 1978 24 p
(Contract EG-77-S-02-4479)
(COO-4479-2) Avail: NTIS HC A02/MF A01

The construction of the thermal stratification system was completed and checked out. The details of this check-out procedure are included. The physical dimensions of the facility are shown. This storage tank is a modified septic tank with a capacity of 1500 gallons. This tank is installed with approximately half of the tank below ground. Insulation is 3 in of spray-on foam externally and 1 in internally, protected by a butyl rubber covering. The liquid level in the tank is 44 in. DOE

N80-10656# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
SOLAR GENERATION OF INDUSTRIAL STEAM. INNOVATIVE RESEARCH PROGRAM SUBTASK Final Report, Dec. 1977 - Sep. 1978
Terry Lenz Oct. 1978 10 p refs
(Contract EG-77-S-02-4546)
(COO-4546-9) Avail: NTIS HC A02/MF A01

Comparison of hybrid solar-mechanical (vaporization at low pressure followed by compression), inorganic salt eutectic and polymer latent heat slurry, and solar-thermochemical schemes, pointed to the thermochemical approach as most promising. The condensed-phase reactions were studied. The following classes of reactions meet the set of criteria: reversibly-catalyzed thermal isomerizations, Diels-Alder additions, and esterifications. These particular reaction classes offer significant potential for lower temperature solar-thermochemical systems with condensed phase energy storage. DOE

N80-10657# PRC Energy Analysis Co., Los Angeles, Calif.
SATELLITE POWER SYSTEM (SPS) PRELIMINARY SOCIETAL ASSESSMENT
Charles Bloomquist, A. Daurio, and S. Shotland May 1979 69 p refs
(Contract EG-77-C-01-4024)
(HCP/R4024-01/14) Avail: NTIS HC A04/MF A01

The findings of fourteen papers dealing with SPS societal issues are presented. While numerous societal problems and potential concerns are delineated, no program stoppers were identified. Thus, in so far as the societal ramifications of an SPS are concerned, additional study of the concept is warranted. Societal topics which merit particular attention in the future are delineated. These include rectenna site availability, utility integration, and institutional/international considerations. Study findings that might be used in a comparative assessment of the SPS with alternative energy systems are presented. Methodological considerations for future SPS societal research are also discussed. DOE

N80-10658# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
COST-EFFECTIVE CONTROL SYSTEMS FOR SOLAR HEATING AND COOLING APPLICATIONS Final Report
Jane H. Pejsa, W. W. Bassett, S. A. Wenzler, K. H. Nguyen, and T. J. Olsen Sep. 1978 180 p refs
(SAN-1592-1) Avail: NTIS HC A09/MF A01

A methodology is defined and the results are presented to arrive at control recommendations for a variety of climate control system designs, applications and regions, strategies, functions, sensors, actuators, and the controllers themselves. The bulk of the study effort - an attempt to simulate and evaluate system performance for several representative residential and commercial heating and cooling designs and thus to derive improved performance techniques within cost-effective control systems - are discussed. DOE

N80-10659# International Business Machines Corp., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: A-FRAME INDUSTRIES, SINGLE FAMILY DWELLING, KANEOHE, HAWAII Progress Report, Feb. - Sep. 1978
D. L. Nemetz 1978 29 p refs
(Contract EG-77-C-01-4049)
(SOLAR/1010-78/14) Avail: NTIS HC A03/MF A01

The operation of the solar energy system is summarized. This system is designed to provide domestic hot water for a single family dwelling in Kaneohe, Hawaii. Measured system performance is evaluated and measured climatic data are compared with long term average conditions. Performance evaluations of each major subsystem are also presented. DOE

N80-10660# Pennsylvania Univ., Philadelphia. Dept. of Mechanical Engineering and Applied Mechanics.
OPTIMAL INSULATION OF PIPES AND TANKS FOR SOLAR HEATING SYSTEMS
Gerard F. Jones and N. Lior Feb. 1979 75 p refs
(Contract EM-78-C-04-5319)
(ALO-5319-2) Avail: NTIS HC A04/MF A01

A compact and time effective insulation design procedure for solar heating system piping and water-filled thermal storage tanks was developed. Recognizing the particular sensitivity of solar systems to cost, the economic aspect of the problem is treated by a comprehensive present-value life-cycle cost analysis. In the development of the method, a numerical sensitivity analysis was performed to determine the relative effects of all relevant independent variables (within their pertinent ranges) on piping and tank heat transfer coefficient values. DOE

N80-10661# Idaho National Engineering Lab., Idaho Falls.
OVERVIEW OF GEOTHERMAL ENERGY IN THE UNITED STATES
Robert J. Schultz and E. G. DiBello 1 May 1979 14 p refs
Presented at the Energy Conserv. Symp., San Francisco, 1 May 1979
(Contract EY-76-C-07-1570)
(Conf-790530-1) Avail: NTIS HC A02/MF A01

The development of hydrothermal resources, hot igneous rock resources, and conduction dominated resources is reviewed. Geothermal power generation and direct applications in the U.S. are discussed. DOE

N80-10662# Westinghouse Research and Development Center, Pittsburgh, Pa.
PERFORMANCE MONITORING OF AN OFF-PEAK HEATING AND COOLING SYSTEM UTILIZING THERMAL STORAGE AND SOLAR AUGMENTED HEAT PUMP
W. C. Moreland Apr. 1979 39 p
(EPRI-ER-845) Avail: NTIS HC A03/MF A01

The instrumentation system (including sensors and data logging equipment) used in the demonstration system are described. A general description is also given of the modes of operation of the main heat pump/storage/solar system, the proposed methodology and format for data reduction, and the present status of the program. DOE

N80-10663# Midwest Research Inst., Golden, Colo.
SOLAR POND CONCEPTS: OLD AND NEW
T. S. Javadev, Michael Edesess, and Jon Henderson 1979 7 p refs Presented at the 14th Intersoc. Energy Conversion Eng. Conf., Boston, 5-10 Aug. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-35-208; Conf-790803-3) Avail: NTIS HC A02/MF A01

Different types of solar ponds were considered from the early 1900s to the present. Salty ponds use salt to create a nonconvecting pond. Shallow solar ponds were investigated by Shuman and Willsie in 1906 and 1907 and are currently being studied by Lawrence Livermore Laboratories. Swedish investigators are studying a combination of solar collectors and water

storage in a pond-cover configuration. In addition, there are thermoclines created in large bodies of water, as in large reservoirs. The various types of solar ponds are surveyed and the best of the ideas are combined to synthesize new concepts. A new solar pond concept is presented which combines the good features of convecting and nonconvecting (salty) ponds. DOE

N80-10664# California Univ., Livermore. Lawrence Livermore Lab.
EFFECT OF MECHANICAL ENERGY STORAGE SYSTEMS ON THE CHARACTERISTICS OF ELECTRIC VEHICLES
Martin W. Schwartz 14 May 1979 7 p Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5-10 Aug. 1979; Sponsored by the Am. Chem. Soc.
(Contract W-7405-eng-48)
(UCRL-82710; Conf-790803-17) Avail: NTIS HC A02/MF A01

Batteries for electric vehicle propulsion were investigated to see if effective trade-offs between short term peak power capability and energy storage capacity are possible. It was found that batteries in combination with a mechanical energy storage device can optimize both power and range capability of an electric vehicle. Equations were derived for determining the vehicle mass fraction of the mechanical energy storage system that is required to achieve a vehicle mass saving or increase in range. The extent to which mechanical energy storage systems can improve electric vehicle performance was found to depend upon the battery type and the vehicle power/mass requirements. DOE

N80-10665# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
WASTE HEAT UTILIZATION: PROCEEDINGS OF 1978 ENGINEERING FOUNDATION CONFERENCE
Apr. 1979 327 p refs Conf. held at Henniker, N. H., 13-18 Aug. 1978
(CONF-7808102) Avail: NTIS HC A15/MF A01

Fifteen papers are presented containing engineering concepts, improved methods, and/or equipment descriptions pertaining to waste heat utilization. R.E.S.

N80-10666# National Technical Information Service, Springfield, Va.
LITHIUM BATTERIES: CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1979
Diane M. Cavagnaro Jul. 1979 230 p Supersedes NTIS/PS-78/0661; NTIS/PS-77/0639; NTIS/PS-76/0544
(NTIS/PS-79/0676/1; NTIS/PS-78/0661; NTIS/PS-77/0639; NTIS/PS-76/0544) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

Studies on design, development, components, corrosion, and hazards are included in this compilation of worldwide research. Lithium batteries with sulfides, chlorides, thionyl chloride, organic compounds, and water are cited. Applications cover use of lithium cells in pacemakers, spacecraft, electric vehicles, and off peak energy storage. (This updated bibliography contains 223 abstracts, 43 of which are new entries to the previous edition.) GRA

N80-10667# New Mexico Univ., Albuquerque.
WASTE UTILIZATION AS AN ENERGY SOURCE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979
Gerald F. Zollars Jul. 1979 55 p
(NTIS/PS-79/0765/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

Articles from the international literature concerning the processing of solid and organic wastes for use as an energy source are cited. Industrial agricultural, and residential wastes are considered as sources of both gaseous and liquid fuels such as methane, methanol, ethanol, and synthane. This bibliography contains 219 entries. GRA

N80-10668# New Mexico Univ., Albuquerque. Technology Application Center.
AIRCRAFT FUEL. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979
Gerald F. Zollars Jul. 1979 43 p Sponsored in part by NTIS, Springfield, Va.
(NTIS/PS-79/0764/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

These 160 citations concern means to conserve fuel in airline operations. Articles dealing with aircraft design, fuels, engine design, propulsion efficiency, and operating procedures which conserve fuel are included. GRA

N80-10669# National Technical Information Service, Springfield, Va.
NICKEL CADMIUM BATTERIES. VOLUME 1: CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - 1976
Diane M. Cavagnaro Jul. 1978 201 p
(NTIS/PS-79/0646/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

This bibliography cites reports concerning the design fabrication, components, testing, and assembly of nickel cadmium batteries. Most of the citations cover the development of power supplies for aircraft and spacecraft. (This updated bibliography contains 195 abstracts, none of which is new to the previous edition.) GRA

N80-10670# National Technical Information Service, Springfield, Va.
NICKEL CADMIUM BATTERIES. VOLUME 2: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Jun. 1979
Diane M. Cavagnaro Jul. 1978 122 p Supersedes NTIS/PS-78/0618; NTIS/PS-77/0555; NTIS/PS-76/0466; NTIS/PS-75/445
(NTIS/PS-79/0647/2; NTIS/PS-78/0618; NTIS/PS-77/0555; NTIS/PS-76/0466; NTIS/PS-75/445) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

The design, fabrication, components, testing, and assembly of nickel cadmium batteries are covered in the bibliography. The majority of these citations deal with the development of power supplies for aircraft and spacecraft. This updated bibliography contains 116 abstracts, 23 of which are new entries to the previous edition. GRA

N80-10671# National Technical Information Service, Springfield, Va.
LITHIUM BATTERIES. VOLUME 2: CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - 1977
Diane M. Cavagnaro Jul. 1979 214 p
(NTIS/PS-79/0674/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

This bibliography covers the design, development, components, testing, corrosion, electrolytes, sealing, and hazards of lithium cells. The citations include lithium organic cells, lithium sulfur cells, lithium-water air cells, and lithium nickel fluoride cells. The applications cover use in spacecraft, electric vehicles, off peak energy storage, and forklift trucks. This updated bibliography contains 205 abstracts, none of which is new to the previous edition. GRA

N80-10672# National Technical Information Service, Springfield, Va.
LITHIUM BATTERIES. VOLUME 3: CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Jun. 1979
Diane M. Cavagnaro Jul. 1979 103 p Supersedes NTIS/PS-78/0660; NTIS/PS-77/0638; NTIS/PS-76/0543; NTIS/PS-75/471
(NTIS/PS-79/0675/3; NTIS/PS-78/0660; NTIS/PS-77/0638; NTIS/PS-76/0543; NTIS/PS-75/471) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

Design, development, components, testing, corrosion, electrolytes, sealing, and hazards of lithium cells are presented. Batteries studied include lithium organic cells, lithium sulfur cells, lithium-water-air cells, and lithium nickel fluoride cells. Applications cover use in spacecraft, electric vehicles, off peak energy storage, and forklift trucks. This updated bibliography contains 94 abstracts, 58 of which are new entries to the previous edition. GRA

N80-10673# National Technical Information Service, Springfield, Va.
MICROWAVE HEATING: APPLICATIONS AND EQUIP-

MENT. CITATIONS FROM NTIS DATA BASE Progress Report, 1964 - May 1979
William E. Reed Jul. 1979 96 p Supersedes NTIS/PS-78/0571; NTIS/PS-77/0514; NTIS/PS-76/0446
(NTIS/PS-79/0631/6; NTIS/PS-78/0571; NTIS/PS-77/0514; NTIS/PS-76/0446) Avail: NTIS HC $28.00/MF $28.00 CSCL 13A

These Federally-funded reports cover applications of microwave heating. Excluded are reports on the use of microwave heating in medicine or in plasma studies. The bibliography does include citations of food heating, microwave oven design, drying techniques, and safety. This updated bibliography contains 90 abstracts, 19 of which are new entries to the previous edition. GRA

N80-10674# National Technical Information Service, Springfield, Va.
MICROWAVE HEATING: INDUSTRIAL APPLICATIONS. CITATIONS FROM THE ENGINEERING DATA BASE Progress Report, 1970 - May 1979
William E. Reed Jul. 1979 209 p Supersedes NTIS/PS-78/0572; NTIS/PS-77/0515; NTIS/PS-76/0447
(NTIS/PS-79/0632/4; NTIS/PS-78/0572; NTIS/PS-77/0515; NTIS/PS-76/0447) Avail: NTIS HC $28.00/MF $28.00 CSCL 13A

Industrialized uses of microwave heating are covered in these citations of worldwide research. The topics include industrial heating and drying for processes such as paper drying, vulcanization, and textile processing. Equipment design and safety are also cited. This updated bibliography contains 203 abstracts, 29 of which are new entries to the previous edition. GRA

N80-10675# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
POLYCRYSTALLINE THIN FILM GALLIUM ARSENIDE SOLAR CELLS Final Report
J. M. Borrego and S. K. Ghandhi 30 Sep. 1978 62 p refs (Grant NSF AER-76-06168)
(PB-298168/6; NSF/RA-780549) Avail: NTIS HC A04/MF A01 CSCL 10B

The objective of this program was to demonstrate the feasibility of solar cells made on a metallic substrate, using polycrystalline thin film GaAs and an upper layer of a highly conductive wide gap material such as doped tin oxide. The program has established the feasibility of making cells of this type, and has outlined problems encountered during the high temperature growth of the upper layer. In addition, room temperature growth of tin oxide has been achieved for the first time. Techniques have been developed for optical characterization of the transparent layer. Deep level transient spectroscopy methods have also been developed to aid in the improvement of the polycrystalline layer. Other accomplishments include the development of a technique for measuring diffusion length in direct gap materials, the fabrication of GaAs-Ge-Mo diodes with a BV of 35 volts, and a technique for the passivation of the grain boundary edge, which results in greatly increasing the open circuit voltage. GRA

N80-10676# National Bureau of Standards, Washington, D. C. National Engineering Lab.
A PERSPECTIVE OF A WORKSHOP ON STABILITY OF THIN FILM SOLAR CELLS AND MATERIALS Final Report
Harry A. Schafft and David E. Sawyer Jun. 1979 17 p refs Sponsored in part by DOE
(PB-297396/4; NBSIR-89-1778) Avail: NTIS HC A02/MF A01 CSCL 10B

The stability of solar cells of the following three material groupings were considered: (1) Cu2S/(CdZn)S, Cu-ternaries/CdS, InP/CdS, and amorphous Si; (2) polycrystalline, MIS, and conducting-oxide Si; and (3) polycrystalline and AMOS GaAs. Considering the relative state of immaturity of these developing cells and the goal for high reliability and stability, two general areas of work are recommended. One is to develop an improved understanding of cell operation and of component structures of these cells. The other is to develop an improved measurements base. Specific needs and recommendations are provided. GRA

N80-10677# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Nuclear and Alternative Energy Systems.
GEOTHERMAL RESOURCES AND TECHNOLOGY IN THE UNITED STATES
Feb. 1979 65 p refs
(PB-296623/2; ISBN-0-309-02874-4) Avail: NTIS MF A01;HC National Academy of Science, Washington, D. C., $5.50 CSCL 10B

The potentials and problems of geothermal energy are assessed with particular focus on current obstacles in the development of the geothermal industry. GRA

N80-10678# General Accounting Office, Washington, D. C. Energy and Minerals Div.
ENERGY SAVING STRATEGIES FOR FEDERAL PROCUREMENT
19 Jun. 1979 14 p
(PB-296969/9; EMD-79-68) Avail: NTIS HC A02/MF A01 CSCL 10A

Federal energy conservation measures are evaluated, and what Federal agencies have done to develop and implement procurement techniques which result in reduced energy consumption is reviewed. GRA

N80-10679# General Accounting Office, Washington, D. C. Energy and Minerals Div.
NATURAL GAS RESERVES ESTIMATES: A GOOD FEDERAL PROGRAM EMERGING, BUT PROBLEMS AND DUPLICATIONS PERSIST
15 Jun. 1979 85 p
(PB-296628/2; EMD-78-68) Avail: NTIS HC A05/MF A01 CSCL 10A

Improvements needed in the Government's efforts to estimate the Nation's natural gas reserves are discussed. GRA

N80-10680# National Technical Information Service, Springfield, Va.
LEAD BATTERIES, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1976
Diane M. Cavagnaro Aug. 1979 213 p refs
(NTIS/PS-79/0781/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

Reports from worldwide research are cited, covering lead battery components, charging, corrosion, and testing. The majority of studies cover batteries used in electric vehicles. Citations on lead recovery from battery scrap and air pollution at battery factories are also included. This updated bibliography contains 207 abstracts, none of which are new entries to the previous edition. GRA

N80-10681# National Technical Information Service, Springfield, Va.
LEAD BATTERIES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Jul. 1979
Diane M. Cavagnaro Aug. 1979 121 p refs Supersedes NTIS/PS-78/0690; NTIS/PS-77/0634; NTIS/PS-76-0550
(NTIS/PS-77/0634; NTIS/PS-76/0550; NTIS/PS-79/0782/7; NTIS/PS-78/0690) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

Worldwide research on lead battery components, charging, corrosion, and testing is cited. The majority of studies concern battery use in electric vehicles. Studies on lead recovery from battery scrap and air pollution at battery factories are also included. This updated bibliography contains 115 abstracts, 59 of which are new entries to the previous edition. GRA

N80-10682# National Technical Information Service, Springfield, Va.
LEAD BATTERIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1979
Diane M. Cavagnaro Aug. 1979 169 p refs Supersedes NTIS/PS-78/0689; NTIS/PS-76/0549; NTIS/PS-75/472; NTIS/PS-77/0633
(NTIS/PS-79/0780/1; NTIS/PS-77/0633; NTIS/PS-78/0689; NTIS/PS-76/0549; NTIS/PS-75/472) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

The design, development, components, fabrication, chemistry,

and testing of lead batteries are cited in this compilation of Federally-funded research. Specific applications for spacecraft, consumer products, and electric vehicles are covered. Studies on lead recovery from battery scrap are covered. Several abstracts on lead toxicity in industrial plants are also cited. This updated bibliography contains 163 abstracts, 39 of which are new entries to the previous edition. GRA

N80-10683# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
FLUID DYNAMIC ASPECTS OF WIND ENERGY CONVERSION
O. DeVries (Natl. Aerospace Lab., Amsterdam) Jul. 1979 145 p refs
(AGARD-AG-243; ISBN-92-835-1326-6) Avail: NTIS HC A07/MF A01

The theory of horizontal axis and vertical axis wind driven turbines is discussed. Inhomogeneous flow, turbulence effects, turbine control, wake interference effects, and wind concentrator concepts are surveyed. K.L.

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-10684 Washington State Univ., Pullman.
EXPERIMENTAL DETERMINATION AND MODELING OF DRY DEPOSITION FOR OZONE Ph.D. Thesis
Maniam Palaniswamy Chockalingam 1979 111 p
Avail: Univ. Microfilms Order No. 7923471

A relationship between deposition velocity and a general diffusion parameter that is extensively used in pollutant diffusion and long range transport modeling calculations is established. The general diffusion variable is a turbulence parameter exhibiting a diurnal cycle and has relevance to the micrometeorological situation of the atmosphere at any given location. It is shown that the dry deposition velocity also exhibits a diurnal cycle. The correlation between deposition velocity and the general diffusion parameter is evaluated on field experimental data. Dissert. Abstr.

N80-10685*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE 1977 EMISSIONS INVENTORY FOR SOUTHEASTERN VIRGINIA
Dana A. Brewer (George Washington Univ., Hampton, Va.), Ellis E. Remsberg, Gerard E. Woodbury, and Linell C. Quinn Sep. 1979 30 p refs
(NASA-TM-80119) Avail: NTIS HC A03/MF A01 CSCL 13B

Regional tropospheric air pollution modeling and data compilation to simulate the time variation of species concentrations in and around an urban area is discussed. The methods used to compile an emissions inventory are outlined. Emissions factors for vehicular travel in the urban area are presented along with an analysis of the emission gases. Emission sources other than vehicular including industrial wastes, residential solid waste disposal, aircraft emissions, and emissions from the railroads are investigated. A.W.H.

N80-10686*# National Aeronautics and Space Administration, Washington, D. C.
ANALYSIS OF METHOD OF POLARIZATION SURVEYING OF WATER SURFACE OIL POLLUTION
B. S. Zhukov Sep. 1979 26 p refs Transl. into ENGLISH of "Analiz Metoda Polyarizatsionnoy Siyemki Neftyanykh Zagryaznenii Vodnoz Poverkhosti", Rept. Pr-443 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1979 p 1-30 Transl. by Scientific Translation Services, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75708; PR-443) Avail: NTIS HC A03/MF A01 CSCL 13B

A method of polarization surveying of oil films on the water surface is analyzed. Model calculations of contrasted oil and water obtained with different orientations of the analyzer are discussed. The model depends on the spectral range, water transparency and oil film, and the selection of observational direction. A.W.H.

N80-10687*# Delaware Univ., Newark. Coll. of Marine Studies.
THE USE OF SATELLITES IN ENVIRONMENTAL MONITORING OF COASTAL WATERS Final Report
W. Philpot and V. Klemas 20 Sep. 1979 79 p refs
(Grant NsG-1433)
(NASA-CR-162409) Avail: NTIS HC A05/MF A01 CSCL 13B

The feasibility of using satellites in an operational system for monitoring the type, concentration, location, drift, and dispersion of pollutants in coastal waters is evaluated. Visible, microwave, and thermal infrared sensing are considered. Targets to be detected include photosynthetic pigments, iron acid waste, and sewage sludge. K.L.

N80-10688# California Univ., Livermore. Lawrence Livermore Lab.
THE IMPACT OF LNG SPILLS ON THE ENVIRONMENT: A COMPARISON OF DISPERSION MODELS AND EXPERIMENTAL DATA
B. R. Bowman, S. B. Sutton, and W. J. Comfort 9 Jan. 1979 6 p refs Presented at the 19th Ann. Meeting of the Inst. of Environ. Sci., Seattle, 29 Apr. - 2 May 1979
(Contract W-7405-eng-48)
(UCRL-81812; Conf-790445-1) Avail: NTIS HC A02/MF A01

Two dispersion model calculations are compared with experimental data collected for 5-cubic-meter spills of liquefied natural gas (LNG) on water. The models are a Gaussian dispersion model, which includes models for vapor generation and gravity spread, and a three dimensional solution of the compressible turbulent transient Navier-Stokes equations and associated equations for conservation of species and energy. The latter model was also run in a two dimensional mode to evaluate the utility of two dimensional calculations. These calculations are compared to data collected in LNG spill and dispersion experiments, which measured the concentration of hydrocarbons at several downwind locations. The adequacy of the models and differences between them are discussed. Areas for model improvement are indicated. DOE

N80-10689# Computer Genetics Corp., Wakefield, Mass.
REMOTE SENSING OF LNG SPILL VAPOR DISPERSION USING RAMAN LIDAR
D. A. Leonard and B. Caputo Mar. 1979 121 p
(Contract W-7405-eng-48)
(UCRL-13984) Avail: NTIS HC A06/MF A01

A field experiment which evaluated the remote sensing of hydrocarbon concentrations in the dispersing cloud of gas produced by a spill of LNG using a Raman LIDAR technique is described. The background and objectives of the effort; a description of the lidar equipment; a description of the test site and the test scenario; and sections on data analysis and recommendations are included. DOE

N80-10690# Pennsylvania State Univ., University Park.
LIKELIHOOD ESTIMATIONS OF VEGETATIVE ALTERATION NEAR KNOWN OR PROPOSED SOURCES OF AIR POLLUTION Annual Progress Report
Donald D. Davis and S. P. Pennypacker Aug. 1978 40 p refs
(Contract EE-77-S-02-4497)
(COO-4497-1; CAES-513-78; APR-1) Avail: NTIS HC A03/MF A01

A computer model to simulate and predict SO2 injury to vegetation is presented. The proposed simulator would provide valuable input information for tasks such as site selection and compilation of environmental impact statements. Such a model would also provide data to management operators for the regulation of emissions. The model would also aid in the basic understanding of the complex interactions which influence plant susceptibility to air pollution. Input to the model would consist of biological and physical data and the output would include

the probability of SO2 injuring vegetation near existing or proposed sites. DOE

N80-10691# Brookhaven National Lab., Upton, N. Y.
COMPILING A MULTISTATE EMISSIONS INVENTORY
Carmen M. Benkovitz 1978 17 p refs Presented at Conf. on Emissions Inventories and Factors, Anaheim, Calif., 13 Nov. 1978
(Contract EY-76-C-02-0016)
(BNL-25043; Conf-781126-1) Avail: NTIS HC A02/MF A01

The Multistate Atmospheric Power Production Pollution Study (MAP3C) is described. Topics covered include the acquisition of both emissions and ancillary data, techniques for quality assurance and data updating, and current and future plans for upgrading and using the inventory. The MAP3S program is charged with studying the entire spectrum of atmospheric pollutants that are ascribed to fossil fuel electric power production or that may interact in the atmosphere with power plant emissions. These pollutants include: (1) sulfur oxides, sulfites, and sulfates; (2) nitrogen oxides and their secondary reaction products, including oxidants; (3) hydrocarbons, including polycyclic organic matter; (4) trace inorganic elements; and (5) particulates, which may contain any or all of the above substances and elemental carbon or soot. DOE

N80-10692# Decision Focus, Inc., Palo Alto, Calif.
PROPOSED RESEARCH PLANNING FORMAT FOR THE ENVIRONMENTAL ASSESSMENT DEPARTMENT Final Report
D. Cohan and D. W. North Mar. 1979 127 p refs Sponsored by Electric Power Research Inst.
(EPRI-EA-1018; TPS-78-798) Avail: NTIS HC A07/MF A01

Issues of concern to Environmental Assessment Department (EAD) clients are reviewed, and alternative roles for EAD research are defined. The proposed planning format describes explicitly the steps in the planning and research process: identifying broad needs of industry and society; defining specific forcing issues; detailing research needs and objectives; developing research programs and projects; and producing the research results and integrated products that form the EPRI response to the original needs. An illustrative application of the planning format to the current EAD research program is included. DOE

N80-10693# Oak Ridge National Lab., Tenn. Energy Div.
SOCIOECONOMIC DATA REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT: COAL GASIFICATION AND LIQUEFACTION PROJECTS
R. Steven Konkel 1978 28 p refs Presented at the Conf. on Net Energy Anal. and Energy Modeling, Colorado Springs, 21 Aug. 1978
(Contract W-7405-eng-26)
(CONF-780843-5) Avail: NTIS HC A03/MF A01

The development of data bases and monitoring programs will allow (1) identification of baseline conditions and existing levels of stress in the environment; (2) prediction of the potential impacts of construction, operation, and decommissioning of a coal conversion complex at a specific site; (3) determination of whether these or unanticipated impacts actually occur during these periods; and (4) evaluation of the effectiveness of mitigation measures designed to lessen adverse impacts on the environment. Socioeconomic data requirements include characterization of land uses, land-use management alternatives, demography and employment, economic and fiscal indicators, and infrastructure capacities for site-specific study areas. The monitoring program should be designed to identify appropriate study areas, and incorporate input from citizen groups and local planning officials. Author

N80-10694# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
ENVIRONMENTAL IMPLICATIONS FOR GEOTHERMAL ENERGY DEVELOPMENT
Robert B. Craig and Glenn W. Suter, II 1979 8 p refs Presented to the Inst. of Environ. Sci., Seattle, Wash., 29 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790445-3) Avail: NTIS HC A02/MF A01

The nature of hydrothermal, hot dry resources and the constraints that site characteristics place on their development are discussed. Effects on cultural, aesthetic, and wildlife resources are considered. DOE

N80-10695# Johns Hopkins Univ., Baltimore, Md. Dept. of Environmental Health Sciences.
COAGULATION RATES OF SUB-MICRON PARTICULATES IN THE TROPOSPHERE Final Report
David L. Swift and William H. Wells Feb. 1979 56 p refs Sponsored by Md. Dept. of Natural Resources.
(PB-295756/1; PPSP/PPRP-24) Avail: NTIS HC A04/MF A01 CSCL 13B

The coagulation rates of aerosol particles in turbulent shear flow were studied experimentally. Rates for turbulent coagulation were compared with the coagulation rates resulting from Brownian motion. Under the conditions of Couette shear flow studied (in all instances turbulent) the flow induced coagulation was the dominant process. Calculation of the rate of coagulation of sub-micrometer particles in the atmosphere and in a typical power plant stack were performed with emphasis on the 'scrubbing' of sub-micrometer particles by larger particles. This was found to be an important mechanism in the stack, but not in the atmosphere, due to sedimentation and other processes. GRA

N80-10696# TRW, Inc., Redondo Beach, Calif.
EMISSION ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS. VOLUME 2: INTERNAL COMBUSTION SOURCES Final Report, Sep. 1978 - Jan. 1979
C. C. Shih, J. W. Hammersma, D. G. Ackerman, R. G. Beimer, M. L. Kraft, and M. M. Yamada Jan. 1979 239 p refs
(Contract EPA-68-02-2197)
(PB-296390/8; EPA-600/7-79-029c) Avail: NTIS HC A11/MF A01 CSCL 13B

Emissions from gas- and oil-fueled gas turbines and reciprocating engines for electricity generation and industrial applications are assessed. The results indicate that internal combustion sources contribute significantly to the national emissions burden. The source severity factor, defined as the ratio of the calculated maximum ground level concentration of the pollutant species to the level at which a potential environmental hazard exists, was used to identify pollutants of environmental concern. GRA

N80-10697# Illinois Univ. at Urbana-Champaign.
MODELING THE IMPACTS OF TRANSPORTATION SYSTEMS MANAGEMENT ON VEHICLE EMISSIONS, PHASE 1
David E. Boyce, George Provenzano, Frank Southworth, Kristi Cromwell-Cain, and Kyung S. Chon Apr. 1979 127 p refs Sponsored by the Illinois Inst. of Natural Resources
(PB-296908/7; IINR-79/09) Avail: NTIS HC A07/MF A01 CSCL 13B

Literature on the impact of transportation systems management on travel in cities in the United States and other countries was surveyed in order to qualitatively analyze their potential effectiveness in reducing motor vehicle emissions. GRA

N80-10698# Technology Service Corp., Santa Monica, Calif.
STATISTICAL ANALYSIS OF TSP AND METEOROLOGICAL DATA IN EPA REGION 6
John Trijonis, Yuji Hone, and Dennis Bicker Jan. 1979 237 p refs
(Contract EPA-68-02-2828)
(PB-296838/6; EPA-906/9-79-005) Avail: NTIS HC A11/MF A01 CSCL 13B

Statistical analyses were conducted on total suspended particulates (TSP) in order to determine if the relationship between TSP and meteorology can be used to classify sites as to the types of sources causing nonattainment. It was found that decision tree analysis was a very effective means of characterizing the relationship between TSP and meteorology, and the TSP-meteorology relationship provides useful insights concerning the sources of high TSP levels. The results indicate distinct geographical patterns in causes of nonattainment. Despite a fair level of success with the method, however, it was found that the TSP-meteorology relationship does not provide results that are definitive or quantitative enough for it to be used as the sole

support for regulatory policy concerning causes of nonattainment. GRA

N80-10699# Research Triangle Inst., Research Triangle Park, N. C.
ANALYSIS OF ORGANIC AIR POLLUTANTS BY GAS CHROMATOGRAPHY AND MASS SPECTROSCOPY Final Report, Oct. 1975 - Sep. 1978
Edo D. Pellizzari Mar. 1979 243 p refs
(Contract EPA-68-02-2262)
(PB-296835/2; EPA-600/2-79-057) Avail: NTIS HC A11/MF A01 CSCL 07D

Analytical methods and instrumentation for collecting and analyzing hazardous vapor phase organics occurring in ambient air were developed and evaluated. The areas of investigation included: (1) the evaluation of Tenax GC sorbent for variations in the breakthrough volumes for different lots; (2) studies on in situ reactions which might occur during the collection of organic vapors from ambient air; (3) evaluation of a permeation system for delivering precise quantities of organic vapors for calibrating instruments; (4) development of software programs for quantification of volatile organics using high resolution gas chromatography/mass spectrometry/computer; (5) determination of relative molar response factors for quantitative analysis; and (6) the identification and quantification of organic pollutants in ambient air from several geographical areas within the Continental U.S. GRA

N80-10700# Water Purification Associates, Cambridge, Mass.
WASTEWATER TREATMENT IN COAL CONVERSION Final Report, Oct. 1976 - Jan. 1979
R. E. Hicks, D. J. Goldstein, F. B. Seufert, and I. W. Wei Jun. 1979 287 p refs
(Contract EPA-68-03-2207)
(PB-297587/9; EPA-600/7-89-133) Avail: NTIS HC A13/MF A01 CSCL 07A

Water treatment control technology specific to fuel conversion plant sites in the western U.S. is described. Most plants converting coal to other fuels use a large quantity of clean water (as stream) and put out a large quantity of dirty water that is condensed when the products from the coal reactor are cooled. Procedures for removing phenolic compounds are discussed: they include distillation, extraction, and adsorption. Design equations, step-by-step design procedures, and calculations for a typical unit are included along with physical data that are required for design. GRA

N80-10701# Mitre Corp., McLean, Va. Metrek Div.
HEALTH AND ENVIROMENTAL EFFECTS OF COAL GASIFICATION AND LIQUEFACTION TECHNOLOGIES: A WORKSHOP SUMMARY AND PANEL REPORTS Final Report
Richard Brown, ed. and Alice Witter, ed. May 1979 374 p Workshop held at Leesburg, Va., Aug. 1978
(Contract DE-AC01-79EV-10018)
(PB-297618/1; MTR-79W00137; DOE/HEW/EPA-03) Avail: NTIS HC A16/MF A01 CSCL 06F

Responses to President Carter's directive to identify health and environmental problems associated with advanced energy technologies are presented. The highlights of the issues and the detailed information requirements identified by panels of a workshop held in Leesburg, Virginia in August 1978 to address the health and environmental effects of coal gasification and liquefaction technologies are presented. The purposes of the workshop were to: (1) assemble multidisciplines of biomedical and environmental scientists to address current developments in these technologies, (2) review and identify specific health and environmental issues and problems associated with their development and commercialization, and (3) consider research strategies required to address them and to identify requisite information needs for resolving uncertainties of assessing the relevant impacts of coal gasification and liquefaction technologies. The six panels of the workshop were: occupational and public health and safety; air quality; water quality; water quantity, and aquatic ecology; terrestrial effects; ambient measurement and monitoring; and source characterization. Panel reports containing specific information on environmental and health effects, information requirements, and detailed research statements are included in this report. GRA

N80-10702# Rockwell International Corp., Creve Couer, Mo. Air Monitoring Center.
REGIONAL AIR POLLUTION, QUALITY ASSURANCE AUDITS Final Report
O. Klein and F. Littman May 1979 135 p
(PB-297576/1; EPA-600/4-79-031) Avail: NTIS HC A07/MF A01

Audit results are reported for systems measuring NO, NOx, O3, SO2, total sulfur, total hydrocarbons, CH4 and CO. An investigation was conducted on the effect of Teflon particulate filters on NO, NO2, O3, and SO2 concentrations in sampled air. Sample losses are reported for synthetic pollutant - air mixtures sampled through new and used filters under both dry and humid conditions. The investigation also revealed effects of humidity on the response of analyzers to the various pollutants. The accuracy of SO2 calibration mixtures prepared with the commercial dynamic calibration system employed in the audits was investigated. The calibration system was modified to improve performance under field conditions. GRA

N80-10703# Kentucky Water Resources Research Inst., Lexington.
CHARGED MEMBRANE, LOW PRESSURE ULTRAFILTRATION TO TREAT ACID MINE DRAINAGE WATERS Research Report, 1 Oct. 1976 - 30 Sep. 1978
Dibakar Bhattacharyya, Robert B. Grieves, and Shiela Shelton May 1979 181 p refs
(Contract DI-14-34-0001-7160)
(PB-297209/9; W79-07424; OWRT-B-050-KY(1); RR-120) Avail: NTIS HC A09/MF A01 CSCL 08I

Low-pressure, ultrafiltration with negatively charged, noncellulosic membranes is shown to be a feasible process in terms of achieving the simultaneous separation of dissolved metals (and sulfate) and of suspended solids from acid mine drainage water. The process is evaluated in terms of the simultaneous achievement of good water flux without membrane fouling and of adequate ultrafiltrate quality at high water recovery for water reuse operation. The results of the ultrafiltration investigations are compared with the reported results from lime precipitation-settling and reverse osmosis treatment field studies in terms of treated water quality, reusability, concentrate (sludge) production rates, water recovery and membrane flux behavior. GRA

N80-10704# GCA Corp., Bedford, Mass. Technology Div.
FABRIC FILTER MODEL SENSITIVITY ANALYSIS Final Report, Jun. 1978-Feb. 1979
Richard Dennis, H. A. Klemm, and William Bahye Apr. 1979 214 p refs
(Contract EPA-68-02-2607)
(PB-297755/1; GCA-TR-78-26-G; EPA-600/7-79-043C) Avail: NTIS HC A10/MF A01 CSCL 13K

Preliminary tests show good agreement with field data. However, the apparent agreement between predicted and actual values was based on limited comparisions; validation was carried out without regard to optimization of the data inputs selected by the filter users or manufactures. Factors, such as air/cloth ratio, cleaning frequency, amount of cleaning, specific resistance coefficient K2, the number of compartments, and inlet concentrator were examined in various permutations. The variables that require the greatest accuracy in estimation based on their overall impact on model output were determined. GRA

N80-10705# Equitable Environmental Health, Inc., Park Ridge, Ill.
THE ECONOMIC IMPACT OF PROPOSED REGULATIONS TO REDUCE PARTICULATE EMISSIONS FROM STEEL MILLS AND INDUSTRIAL FUGITIVE SOURVES. R78-11
Apr. 1979 252 p refs
(PB-296527/5; IINR-79/06) Avail: NTIS HC A12/MF A01 CSCL 13B

The benefits and costs of proposed regulations intended to reduce emissions of particulate matter to the atmosphere are estimated. Emphasis is placed on steel mills and industrial fugitive sources. GRA

N80-10706# Association of Bay Area Governments, Berkeley, Calif.
EXAMPLE CONTROL STRATEGY FOR OZONE. VOLUME 2:

CASE STUDY OF THE SAN FRANCISCO BAY REGION, 1976-1978 Final Report
Apr. 1979 168 p refs
(Contract EPA-68-02-3001)
(PB-297800/5; EPA-450/2-79-001B; OAQPS-1.2-121) Avail: NTIS HC A04/MF A01 CSCL 13B

Information is presented to assist states and local agencies in preparing ozone control strategies for nonattainment areas. The guidance should be most useful in preparing 1982 State Implementation Plan revisions. The guideline covers the following topics: intergovernmental cooperation, development and assessment of air quality and emissions data, modeling to related air quality to emissions, control strategy analysis and assessment, plan adoption, and the continuing planning process. The case study for the San Francisco Bay Region: 1976-1978 is included. GRA

N80-10707# Monsanto Research Corp., Dayton, Ohio.
ANALYSIS OF PRIORITY POLLUTANTS AT A PRIMARY ALUMINUM PRODUCTION FACILITY Final Report, Mar. 1978 - Jan. 1979
Gary D. Rawlings and Thomas J. Hoogheem Apr. 1979 48 p refs
(Contract EPA-68-03-2550)
(PB-297491/3; MRC-DA-861; EPA-600/2-79-087) Avail: NTIS HC A03/MF A01 CSCL 13B

The source of priority pollutants, assessment of the wastewater treatment plant, and priority pollutant removal efficiency for a single Soderberg-type primary aluminum plant were investigated. Forty-eight hour composite samples were collected from the following streams: (1) plant intake water; (2) wastewater from the primary air pollution control system (gas stream cooling water and wet EPS's); (3) secondary air pollution control system (room ventilation wet scrubber liquor); (4) paste plant briquette cooling water; and (5) final effluent after the wastewater treatment plant. Wastewater from the primary air pollution control system entered a conventional chemical coagulation (using slacked lime)-clarification plant. Clarified water from the clarifier was combined with the other three wastewater streams and flowed into a settling lagoon with a 20-hr hydraulic retention time. Clarified lagoon water was finally discharged to the river. The principal source of organic compounds in the wastewater was from the primary and secondary air pollution control systems and results from the volatilization of petroleum coke and pitch in the Soderberg anode. Wastewater treatment plant removal efficiencies of greater than 85% were achieved for the majority of the organic priority pollutant species detected. GRA

N80-10708# Virginia Inst. of Marine Science, Gloucester Point.
OFFSHORE PIPELINE CORRIDORS AND LANDFALLS IN COASTAL VIRGINA, VOLUMES 1 AND 2 AND APPENDICES Final Report
Ann Hayward Rooney-Char and Ronald Page Ayres 1978 319 p
(Grant NOAA-04-7-158-44041)
(PB-297439/2) Avail: NTIS CSCL 13B

The Commonwealth's planning effort to anticipate and prepare for the possibility of oil and gas coming ashore in Virginia from the Atlantic outer continental shelves is described. A suitability methodology was developed to determine alternative locations in coastal Virginia for pipeline corridors and landfalls, given environmental and industrial concerns. Additional products of the study include: identification and description of industrial and environmental pipeline siting considerations, maps illustrating the presence of these considerations in Virgina's coastal area, and impact and mitigating measures tables for coastal resources likely to be affected by pipeline activities. GRA

N80-10751# Joint Publications Research Service, Arlington, Va.
FILTERS FOR COLLECTION OF CHEMICAL AEROSOL AND FUME SAMPLES FROM THE AIR
S. I. Murav'yeva (USSR Academy of Medical Sciences), T. I. Solov'yeva (USSR Academy of Medical Sciences), N. B. Borisov (USSR Academy of Medical Sciences), L. I. Borisova (USSR Academy of Medical Sciences), and I. V. Petryanov (USSR Academy of Medical Sciences) *In its* USSR Report: Biomedical and Behavioral Sci., No. 122 12 Oct. 1978 p 89-93 refs
Transl. into ENGLISH from Gig. Tr. Prof. Zabol. (USSR), no. 8, 1979 p 52-54 (For primary document see N80-10748 01-51)
Avail: NTIS HC A07/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N80-10709* National Aeronautics and Space Administration. Pasadena Office, Calif.
BOREHOLE GEOLOGICAL ASSESSMENT Patent
William H. Spuck, III, inventor (to NASA) (JPL) Issued 11 Sep. 1979 10 p Filed 4 May 1978 Supersedes N79-19521 (17 - 10, p 1306) Sponsored by NASA
(NASA-Case-NPO-14231-1; US-Patent-4,167,111; US-Patent-Appl-SN-903019; US-Patent-Class-73-155; US-Patent-Class-175-78) Avail: US Patent and Trademark Office CSCL 08G

A method and apparatus are discussed for performing geological assessments of a formation located along a borehole, and a boring tool that bores a pair of holes into the walls of the borehole and into the surrounding strata along with a pair of probes which are installed in the holes. One of the probes applies an input such as a current or pressured fluid, and the other probe senses a corresponding input which it receives from the strata. Official Gazette of the U.S. Patent and Trademark Office

N80-10710 California Inst. of Tech., Pasadena.
VARIATION OF SEISMIC SOURCE PARAMETERS AND STRESS DROP WITHIN A DESCENDING SLAB AS REVEALED FROM BODY-WAVE PULSE-WIDTH AND AMPLITUDE ANALYSIS, PART 1. A SEISMOLOGICAL INVESTIGATION OF THE SUBDUCTION MECHANISM OF ASEISMIC RIDGES, PART 2 Ph.D. Thesis
Wai-Ying Chung 1979 206 p
Avail: Univ. Microfilms Order No. 7915593

A least squares searching technique was developed to estimate the source dimensions of intermediate and deep focus earthquakes from the azimuthal variation of body wave pulse width. Intermediate and deep earthquakes in the Tonga-Kermadec arc system were investigated in order to determine changes in the state of stress and source properties within a subducting slab. Three different modes of rupture, unilateral, bilateral, and circular faults, are compared and tested against observations. Tectonic features associated with a subducting fracture zone aseismic ridge system in the New Hebrides island arc are investigated. Several features, including a discontinuity of the trench, peculiar locations of two major islands regional uplift, and the formation of a basin are interpreted as a result of the subduction of a buoyant ridge system. Seismicity near locations of aseismic ridge subduction was investigated for five seismic regions: New Hebrides, Bonin-Mariana, Tonga-Kermadec, Peru and Northern Chile. Dissert. Abstr.

N80-10711*# Old Dominion Univ. Research Foundation, Norfolk, Va.
EVALUATION OF ATMOSPHERIC TRACE CONSTITUENT SENSORS OPERATING FROM REMOTE SPACE AND AIRBORNE PLATFORMS Final Report, period ending 13 Jun. 1979
Estelle Condon and Earl C. Kindle Oct. 1979 29 p refs
(Grant NsG-1394)
(NASA-CR-162365; GSTR-79-8) Avail: NTIS HC A03/MF A01 CSCL 04A

A laboratory gas analysis system was developed specifically to make trace level measurements of carbon monoxide. To assure that the data collected with this system are correctly aligned with other established methods for making these measurements, an intercalibration study was conducted. The calibration gas was analyzed by the various participating laboratories and found to contain 1.28 ppm CO. Samples were collected at 25 deg, 35 deg, and 45 deg N for profile data to study the variation in concentrations of CO and CH4 as a function of altitude and

latitude in continental air over the eastern seaboard of the United States. The experiment was repeated several months later to determine if there were seasonally dependent variations in the CO and CH4 concentrations. A.R.H.

N80-10712# Rice Univ., Houston, Tex.
STUDY TO ANALYZE AND SYNTHESIZE SATELLITE DATA
Final Report, 1 Oct. 1977 - 30 Sep. 1978
M. Harel, P. H. Reiff, R. W. Spiro, and R. A. Wolf Hanscom AFB, Mass. AFGL 15 Jan. 1979 34 p refs
(Contract F19628-78-C-0078; AF Proj. 2311)
(AD-A070947; AFGL-TR-79-0024) Avail: NTIS
HC A03/MF A01 CSCL 04/1

We have completed four computer runs simulating the behavior of the earth's inner magnetosphere during the substorm-type event that had its onset at about 1000 UT on 19 September 1976. Our program simulated many aspects of the behavior of the closed-field-line portion of the auroral and subauroral ionosphere. For these regions, the program self-consistently computes electric fields, electric currents, hot-plasma densities, plasma flow velocities and other parameters. Our computed ionospheric electric fields compare reasonably well with corresponding data from satellite S3-2. The most striking observational feature of the electric fields in the modeled region during the 19 September 1976 event was an instance of rapid subauroral flow, which was observed on the outbound part of pass 4079B South and was also predicted by the computer runs. These computer results seem consistent with a simple analytic model for rapid subauroral flow developed by Southwood and Wolf. Birkeland-current densities predicted by the model are presented, for eventual comparison with S3-2 magnetometer data. A program has been developed to follow the evolution of the plasmasphere, or any other magnetospheric or upper-ionospheric cold-plasma boundary, through a modeled event. Some interesting preliminary results for computed plasmasphere shapes are presented. GRA

N80-10713*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
A CORRELATION BETWEEN AURORAL KILOMETRIC RADIATION AND INVERTED-V ELECTRON PRECIPITATION
Progress Report
James Lauber Green, Donald A. Gurnett, and Robert A. Hoffman Jan. 1979 40 p refs
(Contracts NAS1-13129; U-of-IOWA-79-2; Grant NGL-16-001-043)
(NASA-CR-162399; AD-A070795) Avail: NTIS
HC A03/MF A01 CSCL 04/1

Simultaneous observations of energetic electron precipitations and auroral kilometric radiation (AKR) were obtained from the polar orbiting satellites AE-D and Hawkeye. The Hawkeye observations were restricted to periods when the satellite was in the AKR emission cone in the northern hemisphere and at radial distances = or < 7 R(E) to avoid local propagation cutoff effects. In addition, the AE-D measurements were restricted to complete passes across the auroral oval in the evening to midnight local time sector (from 20 to 01 hours magnetic local time). This is the local time region where the most intense bursts of AKR are believed to originate. A qualitative survey of AKR and electron particle precipitation shows that AKR is more closely associated with inverted-V electron precipitation than with plasma sheet precipitation. Quantitatively, a good correlation is found between the AKR intensity and the peak energy of inverted-V events. In addition, in the tail of the most field-aligned portion (approx. 0 deg. pitch angle) of the distribution functions of the inverted-V events, systematic changes are indicated as the associated AKR intensity increases. GRA

N80-10714# Massachusetts Inst. of Tech., Cambridge.
SOURCE AND PROPAGATION EFFECTS OF RAYLEIGH WAVES FROM CENTRAL ASIAN EARTHQUAKES
Ph.D. Thesis. Semi-annual Technical Report, 1 Jul. - 31 Dec. 1978
Howard Patton Apr. 1979 193 p refs
(F44620-75-C-0064; ARPA Order 1827)
(AD-A070241; AFOSR-79-068TR; SATR-7) Avail: NTIS
HC A09/MF A01 CSCL 08/11

Partial Contents: Source and Propagation Effects of Rayleigh Waves from Central Asian Earthquakes--Abstract of Doctoral Thesis; Three-Dimensional Crust and Upper Mantle Structure of the Northeastern United States; The Attenuation of Seismic Waves in Dry and Saturated Rocks: Thermal Cracking and Amplitude Dependent Attenuation; and Ultrasonic P and S Wave Attenuation in Dry and Saturated Rocks under Pressure. GRA

N80-10715# Los Alamos Scientific Lab., N. Mex.
MAGNETOPAUSE LAYER AND PLASMA BOUNDARY LAYER OF THE MAGNETOSPHERE
T. E. Eastman and E. W. Hones, Jr. 1978 22 p refs Presented at Conf. on Quantitative Modeling of Magnetospheric Processes, LaJolla, Calif., 19 Sep. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2992; Conf-780938-3) Avail: NTIS
HC A02/MF A01

A summary is presented of recent published results on two distinct regions of the plasma boundary layer (PBL): that bordering open field line regions and that bordering closed field line regions. The magnetopause layer can usually be identified by a change in magnetic field direction and cannot be uniquely identified by any other field or plasma parameters. Immediately earthward of this magnetopause current layer, a PBL of magnetosheath-like plasma is usually observed that has dominantly magnetosheath-like energy spectra and flow characteristics. Observed plasma boundary layer thicknesses are highly variable and are generally much larger than the magnetopause layer thicknesses even near the subsolar region. Several suggested source mechanisms for the plasma boundary layer are discussed and compared. DOE

N80-10716# Los Alamos Scientific Lab., N. Mex.
THE 1978 SYMPOSIUM ON THE RIO GRANDE RIFT. PROGRAM AND ABSTRACTS
Sep. 1978 110 p Conf. held at Santa Fe, N. Mex., 8 Oct. 1978
(Contract W-7405-eng-36)
(LA-7487-C; Conf-781082) Avail: NTIS HC A06/MF A01

Abstracts of the scientific papers given at the International Symposium on the Tectonics and Magnatism of the Rio Grande Rift are presented. Topics covered include: continental rifts, rift systems, rift magmatism, tectonics and geophysics. R.E.S.

N80-10717# California Univ., Livermore. Lawrence Livermore Lab.
STRATOSPHERIC H2O
Hugh W. Ellsaesser 25 Mar. 1979 13 p refs Presented at NASA Stratospheric Workshop, Harper's Ferry, W. Va., 4 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82542; Conf-790607-1) Avail: NTIS
HC A02/MF A01

The extreme aridity of the lower stratosphere and the rapid decrease of mixing ratio with height just above the polar tropopause is documented. The Brewer stratospheric circulation hypothesis is coupled with a lower stratosphere winter pole freeze dry sink to explain the available data over Antarctica. According to the hypothesis, all air enters through the tropical tropopause where it is freeze dried to a mass mixing ratio of two to three ppM. This dry air then spreads poleward and descends through the polar tropopauses, overpowering upward transport of water vapor by diffusion, which would otherwise be permitted by the much warmer temperatures of the polar tropopauses. DOE

N80-10718# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
MAGNETIC POTENTIAL PLOTS OVER THE NORTHERN HEMISPHERE FOR 26-28 MARCH 1976
A. D. Richmond, H. W. Kroehl, M. A. Henning, and Y. Kamide Apr. 1979 123 p refs
(PB-297195/0; UAG-71; NOAA-79052401) Avail: NTIS
HC A06/MF A01 CSCL 04A

Contour maps of magnetic potential variations over the Northern Hemisphere at 10 min intervals between 0000 UT, 26 March and 0550 UT, 28 March 1976 are presented. These are excerpts from a larger data set, with plots every minute, which were used to make a data moving picture. GRA

N80-10719# National Center for Atmospheric Research, Boulder, Colo.
INVESTIGATION OF POSSIBLE SUN-WEATHER RELATIONSHIPS
Steven Businger 1978 83 p refs
(Grant NSF ATM-77-23757)
(PB-297385/7; NCAR-CT-49) Avail: NTIS HC A05/MF A01 CSCL 04A

Statistical correlations between anomalous solar activity (as denoted by large solar flares, active plages, and interplanetary magnetic sector boundaries) and the circulation of the troposphere are reviewed. Two indexes (measuring atmospheric vorticity and mean zonal geostrophic flow in the Northern Hemisphere) are analyzed in an effort to reveal possible sun-weather relationships. The result of this analysis provides no additional statistical evidence for a connection between solar activity and the weather. Finally, physical mechanisms that have been suggested to explain the claimed correlations are discussed. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-10720# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19304D GSRS MISSILE NUMBER 1026, ROUND NUMBER V-25
30 Apr. 1979 21 p
(DA Proj. 1T6-65702-D-126)
(AD-A071425; ERADCOM/ASL-DR-1012) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19304D GSRS, Missile Number 1026, Round Number V-25, are presented in tabular form. GRA

N80-10721# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NO. 301, ROUND B-10
Apr. 1979 17 p
(DA Proj. 1T6-65702-D-126)
(AD-A070707; ECOM-DR-1003) Avail: NTIS HC A06/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702A GSRS, Missile Number 301, Round Number B-10, are presented in tabular form. GRA

N80-10722# Army Electronics Command, White Sands Missile Range, N. Mex.
THE 19035D GSRS, MISSILE NUMBER 1020, ROUND NUMBER V-21 Meteorological Data Report
Apr. 1979 16 p
(DA Proj. 1T6-65702-D-126)
(AD-A070559; ECOM-DR-999) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19305D GSRS, Missile Number 1020, Round V-21, are presented in tabular form. GRA

N80-10723# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19304D GSRS, MISSILE NUMBER 1023, ROUND NUMBER V-23 Meteorological Data Report
Apr. 1979 17 p refs
(DA Proj. 1T6-65702-D-126)
(AD-A070558; ECOM-DR-1004) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19304D GSRS, Missile Number 1023, Round V-23, are presented in tabular form. GRA

N80-10724# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12823AT LANCE, MISSILE NUMBER 3382, ROUND NUMBER 327 ECL 8 MARCH 1979
Mar. 1979 40 p
(AD-A070557; ECOM-DR-992) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12823AT Lance, Missile Number 3382, Round Number 327 ECL, are presented in tabular form. GRA

N80-10725# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBER N/A, ROUND NUMBER B-6/B-7, 26 MARCH 1979
Mar. 1979 26 p
(AD-A070556; ECOM-DR-995) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702A GSRS, Missile Number N/A, Round Number B-6/B-7, are presented in tabular form. GRA

N80-10726# Army Electronics Command, White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBER 087, ROUND NUMBER B-11 Meteorological Data Report
Apr. 1979 15 p
(DA Proj. 1T6-65702-D-126)
(AD-A070549; ECOM-DR-1002) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702A GSRS, Missile Number 087, Round Number B-11, are presented in tabular form. GRA

N80-10727# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE (FA) 19304 GSRS, MISSILE NUMBER 1019, ROUND NUMBER V-20 Meteorological Data Report
Mar. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A070830; ECOM-DR-996) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of (FA) 19304 GSRS, Missile Number 1019, Round Number V-20, are presented in tabular form. GRA

N80-10728# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, ROUND NUMBERS B-2 AND B-3 21 FEBRUARY 1979
Mar. 1979 24 p
(AD-A070814; ECOM-DR-990) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702A GSRS, Round Numbers B-2 and B-3 are presented in tabular form. GRA

N80-10729# Environmental Research and Technology, Inc., Concord, Mass.
METEROLOGICAL DATA ANALYSIS IN SUPPORT OF THE ABRES PROGRAM Final Report, Jan. 1976 - Jan. 1979
Kenneth R. Hardy Jan. 1979 28 p refs
(Contract F19628-76-C-0069; AF PROJ. 627A)
(AD-A070946; ERT-P-1996F; AFGL-TR-79-0084) Avail: NTIS HC A03/MF A01 CSCL 04/2

The Air Force Geophysics Laboratory (AFGL) has been tasked by the Space and Missiles System Organization (SAMSO) to provide meteorological analysis in support of the Advanced Ballistic Reentry Systems (ABRES) Program. The primary objectives of the work carried out under this contract have been to assist AFGL in: (1) the analysis of surface, upper air, and satellite data leading to the computation of liquid water content profiles, (2) the analysis of special observational data obtained from aircraft flight experiments, (3) computer analysis of radar data, (4) development of display techniques for the AFGL Liquid Water Content Analyzer, (5) the evaluation of the uncertainties in the estimation of hydrometeor mass concentrations using radar and aircraft measurements, and (6) the assessment of thin cirrus cloud over the tropical Pacific. GRA

N80-10730# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

EVALUATION OF THE PASSIVE REMOTE CROSSWIND SENSOR Research and Development Technical Report, 31 Jan. - 8 Mar. 1978
Ruben Rodriguez May 1979 75 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A071176; ERADCOM/ASL-TR-0032) Avail: NTIS
HC A04/MF A01 CSCL 04/2

Field measurements of integrated path crosswinds were made at Biggs Optical Range, Biggs Army Airfield, Fort Bliss, Texas, during the period 31 January to 8 March 1978 with the passive remote crosswind sensor, a system that measures crosswinds by detecting and analyzing the movement of atmospheric scintillations. Data collected with this sensor were compared to integrated path wind averages measured by the calibrated anemometer array. Presented in this report are X-Y scatter plots, derived weighting functions, analog comparative plots, and sampled analog data. Conclusions and recommendations are made in the last sections. GRA

N80-10731# Eastman Kodak Co., Rochester, N. Y. Apparatus and Optical Div.
SPECTRAL RADIOMETRIC MEASUREMENT AND ANALYSIS PROGRAM. VOLUME 2: DESCRIPTION OF THE DATA COLLECTION PROGRAM Final Report
Lawrence G. Christensen, R. Simmons, G. Schauss, R. Norton, and R. Schoenfeld Apr. 1979 168 p
(AD-A072079; AWS-TN-79/001-Vol-2) Avail: NTIS
HC A08/MF A01 CSCL 14/2

This report covers a recently completed contract with the United States Air Force Air Weather Service to conduct research into the transfer of atmospheric energy in the visible and near-infrared portions of the electromagnetic spectrum. Its objective was to produce a spectral model of path transmittance, radiance, and ground-level irradiance that could be related to meteorological observations through the use of simultaneous, insitu data collections. The instrumentation package developed under subcontract to Eastman Kodak by the Albuquerque Division of EG and G was used in a 14-month data-collection program. The program had two objectives: (1) to collect spectral radiometric data on the atmosphere and on ground-level surface irradiance under the broadest possible range of climatic/meteorological conditions, and (2) to collect radiometric and meteorological data in such a way that would permit them to be related mathematically. In this field collection portion of the task, data was obtained for 18 different climatic conditions. This volume (2) of the final report describes the design of the data collection program conducted in the field, the ranges of importance experimental parameters, the measurements and supportive observations that were made, and the analytical software developed to perform the statistical analyses on the resulting data. GRA

N80-10732# Fleet Weather Central/Joint Typhoon Warning Center, FPO San Francisco, Calif. 96630.
TYPHOON REPORT, 1978 Annual Report, Jan. - Dec. 1978
Dean R. Morford and James K. Lavin 1978 176 p
(AD-A070904) Avail: NTIS HC A09/MF A01 CSCL 04/2

This annual publication summarizes the tropical cyclone season in the western North Pacific, Bay of Bengal, and the central North Pacific. A brief narrative is given on each typhoon in the western North Pacific including the best track. Pertinent reconnaissance data used to construct the best tracks are provided. Forecast verification data and statistics for the JTWC are summarized. Research efforts at the JTWC are discussed briefly. GRA

N80-10733# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
LANCE MISSILE NO. 4388, ROUND NO. 330 ACL
Apr. 1979 29 p
(DA Proj. 1T6-65702-D-126)
(AD-A071335; ERADCOM/ASL-DR-1007) Avail: NTIS
HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12821 Lance, Missile Number 4388, Round Number 330 ACL, are presented in tabular form. GRA

N80-10734# Geo-Atmospherics Corp., Lincoln, Mass.
SENSITIVITY STUDY OF CFAS AND CFAR OBJECTIVE ANALYSIS TECHNIQUES Final Report
W. D. Mount, B. R. Fow, B. D. Mount, and J. F. Rapp Feb. 1979 276 p refs
(Contract DAEA18-76-C-0060)
(AD-A071452; ASL-CR-79-0060-1) Avail: NTIS
HC A13/MF A01 CSCL 04/2

The Cloud/Fog Analysis System (CFAS) and the Cloud/Fog Application Routines (CFAR) were applied to weather data bases to determine their sensitivity to control parameters and to type, density, and distribution of observing stations. The data rich region of southeastern United States was selected and hourly aviation weather (Service A), six-hourly synoptic (Service C), and twelve-hourly radiosonde (RAOB) observations were collected for weather scenarios of interest to Army aviation. Computer methods were developed to process these data and convert them into a form suitable for CFAS. Objective analyses and output displays were generated using CFAS and CFAR, respectively, on such weather variables as sky cover, lowest cloud base, ceiling, visibility, significant present weather, and cloud obscuration to pilot's vision within discrete flight layers. Results, produced from large variations in the computer control parameters and density and distribution of stations, were used to modify the CFAS and CFAR to correct for detected errors and to fix the control parameters so that users are now relieved of that responsibility. This greatly simplifies the knowledge and experience required to execute CFAS. A large number of color-coded displays was generated to demonstrate feasibility, skill, and detail that is possible with an automated meteorological system in providing weather information tailored to Army user needs. GRA

N80-10735# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF STATISTICAL PARAMETERS FROM SATELLITE DIGITAL DATA, JULY 1978 GOES-WEST, FOR USE IN DIAGNOSING MARINE FOG M.S. Thesis
Otto Frank McNab Mar. 1979 69 p refs
(AD-A072145) Avail: NTIS HC A04/MF A01 CSCL 04/2

GOES West Infrared (IR) and Visual (VIS) satellite observations for the North Pacific Ocean area, 35-55N, 120W-180, at 2345 GMT for eight June/July 1978 dates are processed to yield 20 statistical parameters which are analyzed for their use in discerning the existence of marine fog. The exploratory sample of 522 satellite observations, at 3 nmi x 3 nmi resolution (at subsatellite point) are related to the associated 0000 GMT synoptic ship reports which serve the role of ground truth. The best discrimination between fog/no-fog observations, using the statistical parameters, occurs for stratification of the data by the meridional component of the wind (south vs north), IR temperature, and the standard deviation of IR temperature. GRA

N80-10736# Avco-Everett Research Lab., Mass.
TURBULENCE ENVIRONMENT CHARACTERIZATION Final Technical Report, 15 Oct. 1975 - 30 Sep. 1978
M. G. Miller and P. L. Zieske Jun. 1979 135 p refs
(Contract F30602-76-C-0054; AF Proj. 2646)
(AD-A072379; RADC-TR-79-131) Avail: NTIS
HC A07/MF A01 CSCL 04/2

This report presents discussions of a variety of activities and results related to the characterization of atmospheric turbulence and its effects on optical propagation at the AMOS Observatory on Maui, Hawaii. The report is divided into two major parts. The first part summarizes the measurements carried out during the entire program and presents an integrated view of the AMOS turbulence environment. Numerical values and the statistics of several optical parameters such as the Mutual Coherence Function correlation scale, r sub o, and the aperture averaged (36cm) log-amplitude variance are discussed. Furthermore, an averaged AMOS turbulent profile based on data from several different instrumental systems is defined. Values of optical parameters derived from this profile are in good agreement with their directly measured values. The most important conclusion drawn from this analysis is that sufficient information now exists to provide a consistent model of the average AMOS environment. However, due to a variety of short term behavior, the application of this model to the detailed operation of various systems should be approached with care. The second part discusses the activities carried out during the period 1 October

1977 - 30 September 1978. Included is a discussion of experimental operations, instrumentation status and data reduction and analysis. GRA

N80-10737# BDM Corp., Monterey, Calif.
AIRCRAFT MEASUREMENTS OF MICROMETEOROLOGICAL PARAMETERS AT PANAMA CITY, FLORIDA, IN 1978
Christopher W. Fairall 1 Apr. 1979 185 p refs
(Contract N00014-78-C-0204)
(AD-A070956; BDM/M-79-008) Avail: NTIS
HC A09/MF A01 CSCL 04/2

A preliminary analysis and listing is given of micrometeorological data obtained from aircraft measurements. Thirteen flights were made on ten different days from 26 November 1978 to 13 December 1978. The typical flight duration was approximately three hours. Three types of flight pattern were employed for specific environmental characterization: low-level, constant altitude runs for sea surface temperature maps, spiral ascents and descents for surface-to-altitude profiles, and 'ladder' profiles obtained from level runs of two minutes duration at successively increasing altitudes for marine boundary layer turbulence structure. A printout of the primary variables of interest for each flight is presented as a time series (32 second average). A similar printout for each ladder profile (a series of two minute averages at constant altitude) is also presented. GRA

N80-10738# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12823A LANCE MISSILE NUMBER 4724 ROUND NUMBER 332 NCL
May 1979 39 p
(DA Proj. 1T1-66572-D-126)
(AD-A072044; ERADCOM/ASL-DR-1018) Avail: NTIS
HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12823A Lance, Missile No. 4724, Round No. 332 NCL, are presented in tabular form. GRA

N80-10739# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
METEOROLOGICAL DATA BASES AVAILABLE FOR THE UNITED STATES DEPARTMENT OF ENERGY OAK RIDGE RESERVATION
R. H. Strand and Charles W. Miller Dec. 1978 23 p refs
(Contract W-7405-eng-48)
(ORNL/TM-6358; ESD-Publ-1184) Avail: NTIS
HC A02/MF A01

Solar radiation, precipitation, wind, and temperature phenomena are being monitored at two sites on the Oak Ridge Reservation-Oak Ridge and Walker Branch Watershed. For these two sites and two non active sites on the Reservation, height of the instruments, the available data for the parameters, and the temporal distribution of the data collected are described. Examples of data access and the contact for accessing the data are given. DOE

N80-10740# National Bureau of Standards, Washington, D. C. Center for Radiation Research.
SELF-STUDY MANUAL ON OPTICAL RADIATION MEASUREMENTS PART 1: CONCEPTS. CHAPTERS 7: THE RELATIVE SPECTRAL RESPONSIVITY AND SLIT-SCATTERING FUNCTION OF A SPECTRORADIOMETER. CHAPTER 8: DECONVOLUTION. CHAPTER 9: PHYSICALLY DEFINING MEASUREMENT-BEAM GEOMETRY BY USING OPAQUE BARRIERS.
Henry J. Kostkowski, John B. Shumaker, and Fred E. Nicodemus Jun. 1979 137 p refs
(PB-296047/4; NBS-TN-910-4) Avail: NTIS
HC A07/MF A01 CSCL 20F

This is the fourth in a series of Technical Notes (910-) entitled Self-Study Manual on Optical Radiation Measurements. The manual is a comprehensive tutorial treatment of the measurement of incoherent radiation that is complete enough for self instruction. Detailed chapter summaries make it also a convenient authoritative reference source. The manner in which the spectral responsivity of a spectroradiometer containing a monochromator varies with wavelength is treated. Deconvolution is the numerical process of recovering an improved spectral distribution from spectroradiometric measurements inevitably smeared spectrally by the spectral-responsivity function of the radiometer. The physical definition of measurement beams, including the integration limits in the measurement equation, is treated in terms of geometrical-optics quantities and concepts. GRA

N80-10741# Aero Systems, Inc., Boulder, Colo.
SIERRA COOPERATIVE PILOT PROJECT, FIELD Final Report, 1978 - 1979
William Carley, Fredrick Solheim, Edwin Berry, and Lyle Lilie 31 May 1979 93 p
(Contract DI-9-07-85-V0022)
(PB-297065/5) Avail: NTIS HC A05/MF A01 CSCL 04B

Basic cloud physics parameters related to determining a cloud's seedability are presented. The analysis of seedability, as indicated by a continued presence of available supercooled liquid water and small numbers of ice crystals, suggests that these situations are rare in northern Sierra Nevada storms. The tentative implication is that costs effective operational cloud seeding may not be possible in the northern Sierra Nevada. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-10742# Georgia Marine Science Center, Savannah.
HYDROGRAPHIC OBSERVATIONS IN THE GEORGIA BIGHT, JULY 1977
L. P. Atkinson, A. L. Edwards, J. J. Singer, W. S. Chandler, and G. A. Paffenhofer Feb. 1979 135 p refs
(Contracts EY-76-S-09-0889; EY-76-S-09-0936; Grant NOAA-04-7-158-44126)
(PB-297135/6; TR-79-03; NOAA-79060402; TR-79-3) Avail: NTIS HC A07/MF A01 CSCL 08J

From 4 to 8 July, 1977 five hydrographic sections and one temperature section were made in the Georgia Bight between Savannah, Georgia and Jacksonville, Florida. Salinity, temperature, dissolved oxygen, nutrient (NO3, PO4, SiO2), and chlorophyll data were collected. Nutrient rich intrusions of cold, deep Gulf Stream waters were observed off Savannah and Jacksonville. GRA

N80-10743# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
CIRCULATION AND HYDROGRAPHY NEAR KODIAK ISLAND, SEPTEMBER TO NOVEMBER 1977
J. D. Schumacher, R. K. Reed, M. Grigsby, and D. Dreves May 1979 54 p refs
(PB-297421/0; NOAA-TM-ERL-PMEL-13; NOAA-79061310)
Avail: NTIS HC A04/MF A01 CSCL 08C

Conductivity, temperature, and depth observations are presented and discussed. There was weak, southwestward flow along the outer continental shelf and gyrelike features in the troughs separating the shoal banks. On the inner shelf near the Kenai Peninsula, a well developed westward flow was present; transport of this flow increased from September to October. The horizontal and vertical distributions of properties are influenced by both the circulation and the sharply varying bank-trough topography. Tidal mixing over the banks appears to be an important factor, and local upwelling induced by wind events also exerts influence on water structure. The westward flowing band of low salinity water off the Kenai Peninsula appears to be strongly affected by freshwater drainage from land. GRA

N80-10744# Hawaii Inst. of Marine Biology, Honolulu
METABOLIC RESPONSES OF SHALLOW TROPICAL BENTHIC MICROCOSM COMMUNITIES TO PERTURBATION Final Report
S. V. Smith, P. L. Jokiel, G. S. Key, and E. B. Guinther Jun. 1979 67 p refs
(Grant EPA-R-800906)
(PB-298243/7; EPA-600/3-79-061) Avail: NTIS
HC A04/MF A01 CSCL 08A

Benthos communities simulating various aspects of coral reefs were established in 600-liter microcosm tanks. These communities were then subjected to various environmental perturbations, including altered light regime, altered substratum type, salinity depression, elevated nutrient level, and biological manipulation. The metabolic responses of the community to these perturbations were monitored primarily by analysis of dissolved oxygen flux. Light, substratum type, and nutrient levels are resources which limit community metabolism From 35 to 22 parts per 1000 by weight, metabolism is not sensitive to salinity. Metabolism is sensitive to biological manipulation. GRA

N80-10999# Joint Publications Research Service, Arlington, Va.
MINISUBS FOR DEEP-SEA EXPLORATION
Aleksandr Durnev *In its* USSR Report: Biomedical and Behavioral Sci., No. 112 23 Jul. 1979 p 64-71 refs Transl. into ENGLISH from Tekhnika Molodezh: (Moscow), no. 4, 1979 p 24-26 (For primary document see N80-10993 01-99)
Avail: NTIS HC A06/MF A01

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-10745*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF DYNAMIC FACTORS OF SPACE FLIGHT ON ANIMAL ORGANISMS
A. M. Genin, ed. Sep. 1979 243 p refs Transl. into ENGLISH from the book 'Vliyaniye Dinamicheskikh Faktorov Kosmicheskigo Poleta na Organizm zhivotnhy', Moscow, Nauka Press, 1979 p 1-73, 79-148, 165-183, 186-191, 192, 196-217, 219-223, 231, 248 Transl. by Kanner (Leo) Associates, Redwood City, Calif. (Contract NASw-3199)
(NASA-TM-75692) Avail: NTIS HC A11/MF A01 CSCL 06C

Physiological, biochemical and morphological studies made on the Cosmos-782 biosatellite are presented. Rats, which were exposed on the biosatellite for 19.5 days, were examined immediately after completion of the flight and also during the 25 day period of readaptation to earth's conditions. The effect of factors of space flight, primarily weightlessness, on the organism was investigated for all systems of the body. R.E.S.

N80-10746# Desmatics, Inc., State College, Pa.
AN EXAMINATION OF STATISTICAL IMPACT ACCELERATION INJURY PREDICTION MODELS BASED ON TORQUE AND FORCE VARIABLES
Dennis E. Smith and John J. Peterson Jul. 1979 23 p refs (Contract N00014-79-C-0128)
(AD-A071625; TR-112-1) Avail: NTIS HC A02/MF A01 CSCL 06/19

This technical report describes the construction of impact acceleration injury prediction models from a set of twenty-eight -G sub x accelerator runs involving Rhesus monkeys with securely restrained torso and unrestrained head. Peak torque and force variables measured during these runs were used to predict injury likelihood. The relative contribution of these variables was examined with respect to the original and a modified version of the data set. Two possible prediction models were used to construct two critical envelopes, i.e., those values of the variables for which the predicted probability of injury (or fatality) is less than or equal to some specified probability. The preferred model was identified and discussed. GRA

N80-10747# Oak Ridge National Lab., Tenn.
TYPES OF AQUATIC MICROCOSMS AND THEIR RESEARCH APPLICATIONS
J. M. Giddings 1978 34 p refs Presented at the Symp. on the Savannah River Ecology Laboratory, Augusta, Ga., 8 Nov. 1978
(Contract W-7405-eng-26)
(CONF-781101-1; ESD-Publ-1254) Avail: NTIS HC A03/MF A01

Aquatic microcosm research has developed along two basic lines, the model ecosystem and the model food chain. Originally used mainly to test ecological hypotheses, microcosms are now finding applications in assessing the environmental effects of human activities, particularly chemical pollution. A critical problem today is selection of appropriate microcosm types for different research needs. Model ecosystems are used for studying community or ecosystem-level phenomena, such as diversity, stability, nutrient cycling, and energy flow, under controlled conditions. Model food chains, which are simpler, easier to analyze, but less realistic than model ecosystems, are applicable to studies of population dynamics, interspecific competition, predator-prey interactions, and trophic dynamics. In contaminant research, microcosms are more useful as predictive tools than as screening tools. DOE

N80-10748# Joint Publications Research Service, Arlington, Va.
USSR REPORT: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 122
12 Oct. 1979 134 p
(JPRS-74365) Avail: NTIS HC A07/MF A01

Various topics in biomedical and behavioral sciences are considered. Pharmacology in aerospace medicine, psychometric test equipment for assessing the human functional state, and air filters for removal of aerosols and fumes from the air are among the topics covered. For individual titles, see N80-10749 through N80-10751.

N80-10749# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF PHARMACOLOGY IN SPACE MEDICINE c52
V. S. Shaskov and B. B. Yegorov *In its* USSR Report: Biomedical and Behavioral Sci., No. 122 12 Oct. 1979 p 1-20 refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), no. 4, 1979 p 325-339 (For primary document see N80-10748 01-51)
Avail: NTIS HC A07/MF A01

The effective use of drugs during the various stages of space flight is considered. The formulation and preparation of the composition of drugs for onboard medicine kits is discussed in terms of the specific factors of space flight, i.e. weightlessness. The use of drugs to enhance resistance to the factors of space flight is also discussed. J.M.S.

N80-10750# Joint Publications Research Service, Arlington, Va.
A PORTABLE STAND FOR ASSESSING THE DYNAMICS OF A WORKING INDIVIDUAL'S FUNCTIONAL STATE c54
A. B. Leonova and V. G. Romanyuta *In its* USSR Report: Biomedical and Behavioral Sci., No. 122 12 Oct. 1979 p 41-48 refs Transl. into ENGLISH from Tekhnicheskaya estetika (USSR), no. 7, 1979 p 24-26 (For primary document see N80-10748 01-51)
Avail: NTIS HC A07/MF A01

A portable, experimental test standard based on the use of a microprocessor as a working memory is described. Experiments aimed at studying the dynamics of human functional state during learning activity were conducted in order to test the portable stand. Results are presented and discussed. J.M.S.

N80-10751# Joint Publications Research Service, Arlington, Va.
FILTERS FOR COLLECTION OF CHEMICAL AEROSOL AND FUME SAMPLES FROM THE AIR c45
S. I Murav'yeva (USSR Academy of Medical Sciences), T. I. Solov'yeva (USSR Academy of Medical Sciences), N. B. Borisov (USSR Academy of Medical Sciences), L. I. Borisova (USSR Academy of Medical Sciences), and I. V. Petryanov (USSR Academy of Medical Sciences) *In its* USSR Report: Biomedical and Behavioral Sci., No. 122 12 Oct. 1979 p 89-93 refs Transl. into ENGLISH from Gig. Tr. Prof. Zabol. (USSR), no. 8, 1979 p 52-54 (For primary document see N80-10748 01-51)
Avail: NTIS HC A07/MF A01

Filters capable of effectively trapping toxic agents present in air in different aggregate forms at high rates of air pumping were developed. Thin fiber filtering material (Petryanov filter, FP) was used along with finely ground sorbents. The main parameters

characterizing the filters were sorbent content per unit filter surface and aerodynamic resistance of the filter to the flow of air passing through it at a rate of 1 cm/s. The sorption properties of various filter compositions were tested. Results are given and indicate that filters based on FP filtering material and finely ground OU-A carbon can be used for simultaneous trapping of aerosols and fumes of some organic compounds, for the purpose of assaying their levels in the air environment. J.M.S.

N80-10752# Joint Publications Research Service, Arlington, Va.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 13, NO. 5, 1979

O. G. Gazenko, ed. 29 Oct. 1979 145 p Transl. into ENGLISH of Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 1-87

(JPRS-74470) Avail: NTIS HC A07/MF A01

The physiological and biological effects of various space flight factors are considered. Motion sickness in weightlessness, effects of hypoxia and hypokinesia on metabolism, toxicity of the atmosphere of pressurized chambers, and aspects of the closed ecological system are among the topics covered. For individual titles, see N80-10753 through N80-10776.

N80-10753# Joint Publications Research Service, Arlington, Va.

CURRENT CONCEPTIONS ON THE GENESIS OF VESTIBULOVEGETATIVE DISORDERS IN WEIGHTLESSNESS c52

B. I. Polyakov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 1-12 refs Transl. into ENGLISH of Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 3-10 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

The hypotheses of the genesis of vestibulo-vegetative disorders in weightlessness are analyzed. Preference is given to the concept which attaches greatest importance to the changes in stereotyped interactions of analyzers responsible for space perception. It is however, emphasized that neither hypothesis can account for all the phenomena seen in crewmembers in orbital flight. It is, therefore, indicated that mechanisms of vestibulo-vegetative disorders need further study. It is believed that the most promising line of research is to study the role of endogenous factors determining individual variations of motion sickness susceptibility. J.M.S.

N80-10754# Joint Publications Research Service, Arlington, Va.

EFFECT OF HYPOXIA ON FLUID-ELECTROLYTE METABOLISM AND RENAL FUNCTION IN MAN AS RELATED TO DIFFERENT DEGREES OF MOTOR ACTIVITY c52

A. I. Grigoryev, V. I Korolkov, G. I. Kozyreyskaya, and M. A. Dotsenko *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 13-18 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 10-14 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

It was demonstrated that a prolonged (24 days) bed rest at altitudes of 2200 m and 3200 m as well as at sea level was accompanied by an increased renal excretion of fluids and osmotically active substances, including electrolytes. Exercises done during bed rest induced a smaller increase of the renal excretion of sodium and potassium. However, as bed rest continued the differences between the groups of test subjects disappeared. The levels of hypoxia and exercises used in the study proved inefficient to prevent changes in the fluid-electrolyte metabolism occurring during bed rest. Author

N80-10755# Joint Publications Research Service, Arlington, Va.

POSSIBILITY OF USING BONE CONDUCTION IN AVIATION RADIO COMMUNICATION c32

E. V. Lapayev, V. S. Kuznetsov, G. I. Tarasenko, and M. I. Katalov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 19-25 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 14-19 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

The dissemination of verbal sounds emitted by man over the cranial bones was investigated in order to improve the quality of speech perception and reproduction over communication channels equipped with noise-suppressing devices. The generation of a verbal signal by the articular system, extending through the cranial bones (microphone channel) and distinctions of auditory perception of a verbal signal through the bone (telephone channel) was studied. It is concluded that a combined use of advanced anti-noise devices and a bone transducer makes it possible to provide a better quality of speech perception under noisy conditions. The frequency characteristics of the bone transducer depend on its location and configuration. Author

N80-10756# Joint Publications Research Service, Arlington, Va.

SPEECH ILLUSIONS AND SIGNIFICANCE THEREOF TO AEROSPACE PRACTICE c32

I. Shults and M. Moravek *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 26-29 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 19-21 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

The pattern of erroneous perception of intelligible and incoherent words accompanied by loud noise was investigated. It was found that proper interpretation of incoherent words depends on their rhythmic, or syllabic structure. As a rule, the words are reconstructed in the back-to-forward direction. One and two syllable words with predominant median and low frequencies are those which are most frequently subjected to speech illusions. J.M.S.

N80-10757# Joint Publications Research Service, Arlington, Va.

AGE-RELATED DISTINCTIONS OF CHANGES IN PSYCHOPHYSIOLOGICAL FUNCTIONS OF PILOTS IN THE CIVIL AVIATION UNDER THE INFLUENCE OF VIBRATION AND NOISE c52

Yu. N. Kamenskiy and Ye. A. Sokolova *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 30-34 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 21-24 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

The effect of vibration and noise of helicopters on the psychophysiological functions of their crewmembers was studied in relation to their age. The changes were mostly pronounced in pilots younger than 20-25 and older than 45 years. The peculiar changes in the psychophysiological functions can be associated with the age-related features of adaptation to vibration and noise effects and with the different level of professional training. Author

N80-10758# Joint Publications Research Service, Arlington, Va.

DIETARY SUPPLEMENTS USED TO PREVENT SOME CHANGES IN THE HUMAN BODY IN THE PRESENCE OF NERVOUS AND EMOTIONAL STRESS c54

V. P. Bychkov and M. V. Markaryan *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 35-39 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 25-28 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

Stress situations similar to those encountered in space flight were simulated. These included: (1) ascent to an altitude of 8000 m in a pressure chamber; (2) anticipation of gravitational acceleration on a centrifuge; and (3) performance mental activity under the conditions of time defficiency in 'success' and 'failure' situations. Changes in protein, carbohydrate, and vitamin metabolism, heart rate, adrenal function, and peripheral blood were noted. Nutrient ingredients (vitamins, glucose, minerals, phosphatid concentrate) added to the diet before and during stressful exposures were shown to correct the parameters studied. J.M.S.

N80-10759# Joint Publications Research Service, Arlington, Va.

ROENTGENOLOGICAL EXAMINATION OF THE HUMAN HEART AFTER 100-DAY HYPOKINESIA c52

I. G. Krasnych *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 40-44 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 28-31 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

Two groups of male test subjects (each of 3 persons) took part in a 100-day bed rest experiment. During the study, group 2 did exercise. X-ray examinations showed that bed rest induced changes in the roentgenoanatomical structure of the heart, a decrease of its size and a disorder of its contractile function. In group 2 these changes were far less expressed. The recovery took 3 to 6 months. Author

N80-10760# Joint Publications Research Service, Arlington, Va.

EFFECT OF SPACE FLIGHT CONDITIONS ON DEOXYRIBONUCLEOPROTEIN AND NUCLEIC ACID CONTENT OF RAT TISSUES

E. Misurova, R. A. Tigranyan, K. Kropaceva, and M. Praslicka *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 29 Oct. 1979 (JPRS-74470) p 45-49 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm Med. (Moscow), vol. 13, no. 5, 1979 p 32-35 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

The spleen of rats flown for 19.5 days aboard the biosatellite Cosmos-782 showed a significant increase of polydeoxyribonucleotides and a decrease of DNP and DNA. The spleen of synchronous rats did not exhibit any differences. This suggests that the increase of polydeoxyribonucleotides in flight rats immediately post-recovery was a result of the so-called gravity stress. The liver and white blood cells did not display any significant changes in DNP or nucleic acids. The changes in the content of nucleic acids in the thymus and bone narrow were insignificant. Author

N80-10761# Joint Publications Research Service, Arlington, Va.

REACTIONS OF RATS TO OVERHEATING FOLLOWING PROLONGED HYPOKINESIA

P. V. Vasilyev, G. D. Glod, Ye. P. Melnikova, L. N. Nikolskiy, S. V. Petrukhin, S. I. Sytnik, and N. N. Uglova *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 50-57 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 35-41 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

The influence of hypokinesia on the nature of development of hyperthermia and dynamics of functional state of the animal thermoregulatory system is described. It was shown that following acute thermal exposures, the survival rate and life-time of hypodynamic rats increased. The changes were more expressed after 15-day than after 30-day hypokinesia. By the 7th recovery day thermal stability of rats approached the initial level. M.M.M.

N80-10762# Joint Publications Research Service, Arlington, Va.

EFFECT OF HYPOKINESIA ON HIGHER NERVOUS ACTIVITY OF ALBINO RATS

M. A. Kuznetsova and Ye. S. Meyzerov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 58-62 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 41-44 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

The effect of a 22-day hypokinesia study on the labyrinthine behavior of white rats was investigated. The test animals showed certain behavioral changes which developed throughout 22 days. However, significant changes occurred only during the first 6-7 days. Later, the changes diminished but retained their trend. The behavioral changes can be associated with inhibition of the nervous processes of higher cerebral compartments responsible for the higher nervous activity. M.M.M.

N80-10763# Joint Publications Research Service, Arlington, Va.

THE COMBINED EFFECT OF CARBON MONOXIDE AND HYPOKINESIA c52

B. I. Abidin, V. V. Kustov, V. I. Belkin, and A. N. Kondratyev *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 63-68 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 44-48 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

The 30-day experiment, in which white male rats were exposed to a combined effect of hypokinesia and carbon monoxide at a concentration of 0.05 + or - 0.002 mg/l, showed that carbon monoxide did not influence significantly hypokinesia-induced changes. It is concluded that maximally allowable concentrations of carbon monoxide need not be reduced for 30-day hypokinesia exposures. Author

N80-10764# Joint Publications Research Service, Arlington, Va.

LEVELS AND PROPORTION OF RNA AND PROTEINS IN THE SYSTEM OF THE NEURON: VESTIBULAR NUCLEAR NEUROGLIA AND CEREBELLUM DURING HYPOKINESIA c52

L. M. Mamalyga *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 69-75 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 49-53 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

The changes in the cell structures of the vestibular Bechterew's and Deiter's nuclei and in the cerebellal cortex were studied in rats in the presence of reduced muscular activity. The RNA and protein content were used to assess the direction and severity of changes in the functional activity of these brain elements. It was concluded that the restriction of motor activity has a substantial effect on RNA and protein content of the neuroglia system. The nature of changes in these substances was related both to the force of the extreme factor and morphofunctional organization of the brain, and the biochemical structure as well. M.M.M.

N80-10765# Joint Publications Research Service, Arlington, Va.

SOME HEMODYNAMIC PARAMETERS DURING RESPIRATION OF OXYGEN UNDER EXCESSIVE PRESSURE c52

K. I. Murakhovskiy and L. I. Letkova *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 76-81 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 53-57 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

The experimental findings on the pattern and value of circulation changes in ten test subjects exposed to oxygen breathing at positive pressure of 20 mm Hg are cited. The major parameters of central circulation were registered by the method of radioactive label (I131) dilution. During the exposure, the test subjects showed an average 27% decrease in the cardiac output as compared with the control level. The test subjects who were pretrained to the exposure displayed a smaller reduction of cardiac output. The circulation changes found under the experimental conditions were mainly induced by peripheral changes rather than by the cardiac function. It is concluded that the reduction of cardiac output is associated with a decrease of the venous return to the heart caused by the diminished circulating blood volume and by the increased total peripheral resistance. M.M.M.

N80-10766# Joint Publications Research Service, Arlington, Va.

BICHROMATE OXIDABILITY AS A CRITERION OF QUANTITATIVE LEVELS OF ORGANIC IMPURITIES IN RECLAIMED WATER c54

V. A. Kryuchkov and N. S. Mareyeva *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 82-87 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 57-61

(For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

Experiments were carried out to study permanganate and bichromate oxidation of chemicals that may contaminate reclaimed water, initial and intermediate products of reclamation. Permanganate oxidability can be used as a qualitative indicator of water contamination with readily oxidizable admixtures only. Bichromate oxidability can be employed as a quantitative indicator of the total content of organic admixtures, provided that oxidation is carried out in a certain way. For the water reclaimed from the atmospheric condensate the following correlation between bichromate oxidability and the concentration of admixtures has been established: 1 mg O2 consumed corresponds approximately to 0.66 mg of organic admixtures in water. M.M.M.

N80-10767# Joint Publications Research Service, Arlington, Va.

AMOUNT OF MICROORGANISMS DISCHARGED FROM THE UPPER RESPIRATORY TRACT AND INTEGUMENT OF PEOPLE CONFINED IN A SEALED CHAMBER c52

S. N. Zaloguyev, A. N. Viktorov, K. V. Zarubina, and V. P. Gorshkov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 88-92 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 61-65 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

In an enclosure the rate of microorganisms discharged into the ambient atmosphere increased significantly. There was a correlation between the rate, on the one hand, and the environmental parameters and hygienic measures used, on the other. The data characterizing the rate with which microorganisms are discharged into an enclosed environment can be applied for the design of air purification systems. Author

N80-10768# Joint Publications Research Service, Arlington, Va.

ULTRASTRUCTURAL CHANGES IN CANINE HEPATOCYTES DURING CONTINUOUS CHRONIC EXPOSURE TO LOW DOSES OF GAMMA RADIATION c52

L. A. Bespalova, V. V. Shikhodyrov, and V. S. Romanov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 93-99 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 65-69 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

Electron microscopy of the liver of dogs exposed to chronic 6-year gamma-irradiation from the Co60 source demonstrated early changes in the hepatocyte structure at a relatively low dosage of 63 rad for 3 years. A comparative study of the submicroscopic reaction of hepatocytes of 3 groups of test dogs showed equally pronounced changes in the endoplasmatic reticulum: vacuolar transformation balloon dystrophy. The heterogeneity of ultrastructural changes of different hepatocytes was probably associated with a simultaneous development of processes of injury, reparation and adaptation of intracellular structures during the long-term gamma-irradiation exposure. Parallel development of these processes assured reparative biosynthesis to maintain the normal hepatic function. Author

N80-10769# Joint Publications Research Service, Arlington, Va.

RUSH NUTS (CYPERUS ESCULENTUS) AS A SOURCE OF VEGETABLE OIL IN A CLOSED LIFE SUPPORT SYSTEM c54

M. P. Shilenko, G. S. Kalacheva, G. M. Lisovskiy, and I. N. Trubachev *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 100-105 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 70-74 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

The cultivation schemes, productivity, total biochemical, lipid in particular, composition of nodules of chufa (Cyperus esculentus) were studied, using a phytotron. Upon continuous illumination, chufa yielded a high total productivity and a satisfactory coefficient of economic effectiveness (not less than 50%). Chufa nodules have an optimal ratio of proteins, carbohydrates, and fats containing essential fatty acids. To meet man's requirements for vegetable oils and essential fatty acids, it is necessary to produce daily 150-200 g dry chufa nodules which are quite acceptable as a dietary ingredient. Author

N80-10770# Joint Publications Research Service, Arlington, Va.

A METHOD OF DEFINING THE OPTIMUM LEVEL OF IONIZING RADIATION FROM DETERMINATE SOURCES DURING SPACE FLIGHTS c52

A. V. Kolomenskiy and V. A. Sakovich *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 106-110 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 74-76 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

A method of determining the permissible dose, Dd (or dose rate) of such determinate radiations over the entire flight is described. The criterion of radiation safety in the form of maximum risk is obtained with a minimum weight of such protection. It is also possible to extend this method to a large number of sources, each with its own protection, unrelated to other sources. J.M.S.

N80-10771# Joint Publications Research Service, Arlington, Va.

PSYCHOPROPHYLAXIS OF FATIGUE AND FUNCTIONAL CARDIOVASCULAR DISEASES IN PILOTS BY MEANS OF SELF-CONDITIONING c52

A. N. Gurov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 111-113 ref Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 77-78 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

The great physical and emotional tension inherent in flight work, and the effects of various adverse flight factors (temperature changes, lowering of partial oxygen pressure, restriction of movements, gravitational influence, etc.) are considered in terms of development of early fatigue and functional cardiovascular diseases. Psychological, moral, and political pilot training to increase mental and physical resistance to various flight factors is shown to be effective in reducing flight fatigue and structural cardiovascular diseases. J.M.S.

N80-10772# Joint Publications Research Service, Arlington, Va.

USE OF SHORT-ARM CENTRIFUGE TO PREVENT DECONDITIONING WHEN IMMERSED IN WATER (ACCORDING TO H-REFLEX) c52

B. I. Zborovskaya *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 114-116 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 78-79 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

The possibility of using periodic rotation on a short-arm centrifuge (SAC) as a means of preventing the adverse effects of immersion was assessed. Healthy volunteer subjects were immersed in water for 3 days. The rate of build-up of accelerations constituted 0.2 units/s, time of exposure to accelerations of +3Gz constant in magnitude and direction constituted 5 min. Each subject was submitted to +3Gz after pure immersion and immersion combined with periodic rotation on a SAC, where accelerations of +0.8 Gz, +1.2 Gz or 1.6 Gz were generated for 60 min twice a day (first series) and for 40 min 3 times a day (second series). The subjects were positioned on the SAC in such a manner as to have the axis of rotation traverse the region of the bridge of the nose. Under these conditions, neuromuscular functions were tested by the methods of the H (Hoffmann) reflex and electromyography. Results are discussed. J.M.S.

N80-10773# Joint Publications Research Service, Arlington, Va.

COURSE OF ALTITUDE CAISSON DISEASE IN DOGS EXPOSED TO ACCELERATIONS

V. I. Prodin and I. N. Chernyakov *In its* USSR Report: Space

Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 117-120 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 79-81 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

The combined or successive effects of low pressure and G forces were investigated. The dynamics of development of symptoms of altitude decompression sickness were traced against the background of changing hydrostatic pressure due to acceleration. Altitude decompression sickness was induced in mongrel dogs. Animals with marked symptoms were divided into two groups. The natural outcome of the sickness was observed in one group, while the other group was rotated on a centrifuge. Results are discussed. J.M.S.

N80-10774# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF ALVEOLOARTERIAL DIFFERENCE FOR OXYGEN AND CARBON DIOXIDE WHEN BREATHING HIGH-DENSITY GAS MIXTURES c52
I. A. Bryantsev, A. G. Dianov, V. V. Isayenko, A. V. Suvorov, and R. I. Finogenova *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct 1979 p 121-123 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 81-83 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

Respiratory reactions to breathing high density gas mixtures were investigated using nonanesthetized animals. Respiration rate, minute volume, and oxygen and carbon dioxide concentration in alveolar air were determined using a capnograph and a gas analyzer. It is concluded that inclusion of inert gas of high density in respiratory mixtures, at normal atmospheric pressure, does not elicit any appreciable changes in transport of oxygen and carbon dioxide. J.M.S.

N80-10775# Joint Publications Research Service, Arlington, Va.
TOXIC EFFECTS OF CHEMICALS IN THE ALTERED GAS ENVIRONMENT OF PRESSURIZED CHAMBERS c54
G. I. Solomin *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 124-126 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 83-84 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

The toxic effect of chemicals that are the products of gas emission from polymers on experimental animals in an altered gas environment were investigated in relation to spacecraft cabins. Studies were conducted with the use of 1,4-dioxane, ethyl acetate and isopropyl benzene. These agents are often identified in the air of manned compartments of spacecraft. Results are discussed. J.M.S.

N80-10776# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPOXIA ON ATPASE ACTIVITY OF THE BRAIN c52
I. B. Buravkova, E. S. Mailyan, and Ye. A. Kovalenko *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 127-131 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 85-87 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

Experiments were conducted on rats and mice in order to study the effect of hypoxia on ATPase activity of the brain. It is shown that an increase in activity is the most typical reaction of Mg(2+)-ATPase to acute hypoxia. Factors affecting enzyme activity include dissociation of oxidation and phosphorylation and activation of phospolipase A. J.M.S.

N80-10996# Joint Publications Research Service, Arlington, Va.
THE THIRD SYSTEM OF REGULATION OF ANIMAL AND HUMAN FUNCTIONS, THE ACTIVE POINT SYSTEM
A. V. Zhirmunskiy (USSR Academy of Sciences, Vladivostok) and V. I. Kuzmin (USSR Academy of Sciences, Vladivostok) *In its* USSR Report: Biomedical and Behavioral Sci., No. 112 23 Jul. 1979 p 13-30 refs Transl. into ENGLISH from Zh. Obshchey Biologii (Moscow), no. 2, 1979 p 176-188 (For primary document see N80-10993 01-99)
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N80-10997# Joint Publications Research Service, Arlington, Va.
TWO IMPORTANT DIRECTIONS OF DEVELOPMENT OF SOVIET BIOMETRY
V. M. Shmidt (Leningrad State Univ.) *In its* USSR Report: Biomedical and Behavioral Sci., No. 112 23 Jul. 1979 p 31-46 refs Transl. into ENGLISH from Zh. Obshchey Biol. (Moscow), no. 2, 1979 p 219-228 (For primary document see N80-10993 01-99)
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N80-11001# Joint Publications Research Service, Arlington, Va.
ULTRASTRUCTURE OF CHLORELLA PYRENOIDOSA CELLS (STRAIN g-11-1) FOLLOWING GROWTH UNDER CONDITIONS OF A PROLONGED SPACE FLIGHT
K. M. Sytnky (Academy of Sciences Ukrainian SSR, Kiev), Ye. L. Kordyum (Academy of Sciences Ukrainian SSR, Kiev), O. L. Mashynskyy (Academy of Sciences Ukrainian SSR, Kiev), A. F. Popova (Academy of Sciences Ukrainian SSR, Kiev), and H. M. Hrechko (Academy of Sciences Ukrainian SSR, Kiev) *In its* USSR Report: Biomedical and Behavioral Sci., no. 112 23 Jul. 1979 p 98-104 refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukrayinskoyi RSR (Kiev), no. 4, 1979 p 311-315 (For primary document see N80-10993 01-99)
Avail: NTIS HC A06/MF A01

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-10777 Rochester Univ., N. Y.
USE OF THE PUPIL TO STUDY THE SCOTOPIC AND CHROMATIC MECHANISMS OF VISION IN HUMANS Ph.D. Thesis
Vasant Durgadas Saini 1979 361 p
Avail: Univ. Microfilms Order No. 7922962

Automated instrumentation was developed to conduct pupillometric experiments rapidly, accurately, and repeatably. Key features of the pupil light reflex were then studied, and its useful attributes were identified. A suitable procedure for measuring pupillary threshold was developed. It was verified that the pupil response to simple foveal flashes against a dark background was scotopic, but that other experiments indicated cone contribution to pupillary miosis. The unidirectional rate sensitivity of the pupil to retinal illumination was found to be a useful property of the pupil control system, and made it a convenient tool for studying the relationships between the scotopic and different chromatic channels of vision. This property was exploited, and a suitable model incorporating it was developed and used. Dissert. Abstr.

N80-10778* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
1979 63 p refs
(NASA-SP-7011(198)) HC A03 CSCL 06E

This bibliography lists 171 reports, articles, and other documents introduced into the NASA scientific and technical information system in September 1979. A.R.H.

N80-10779 California Univ., Los Angeles
THE EXTENDED KALMAN FILTER AS PULMONARY BLOOD FLOW ESTIMATOR Ph.D. Thesis
Oleg Brovko 1979 276 p
Avail: Univ. Microfilms Order No. 7921375

The anesthetic uptake model was examined and developed to include dead space and shunt in the lung. The number of

body compartments was examined and a representative model for anesthetic uptake was chosen which is computationally manageable for the on-line algorithm. Ljung's formulation of the extended Kalman filter was compared with the optimal nonlinear filter and modified to estimate time-varying lung perfusion. The results were then generalized to a large class of nonlinear filtering problems which are of theoretical and practical interest. The algorithm accuracy, ability to follow lung perfusion changes, stability and robustness were examined and the technique was shown to be as accurate as thermal dilution in the clinical environment. These experiments establish the potential value of the on-line algorithm as an estimator of pulmonary blood flow during both steady and nonsteady states. Dissert. Abstr.

N80-10780 Wayne State Univ., Detroit, Mich.
A MODEL FOR AUDITORY EVOKED POTENTIALS Ph.D. Thesis
Peter Michael Nefcy 1979 282 p
Avail: Univ. Microfilms Order No. 7921705

Volume-conducted potentials from brain stem auditory structures were recorded from the scalp. These auditory evoked potentials (AEP) are due to neuronal activity from subcortical structures located in the brain stem, as well as the primary cortical areas. A mathematical model utilizing moving and fixed dipoles in a homogeneous volume-conducting medium was developed to simulate the response of the auditory system to acoustic clicks of intensity 60 dBSL during the first fifteen msec after stimulus delivery. The model demonstrates that the waves of the AEP can be generated from multiple sites in the brain stem. Various neurological disorders can be modeled with changes in the pathways, dipole magnitudes, and tract delays which reflect mechanisms of the disease processes. Dissert. Abstr.

N80-10781 Pennsylvania State Univ., University Park.
PLASMA VOLUME CHANGES IN FIT MEN AND WOMEN DURING A HUMID HEAT STRESS BEFORE AND AFTER AN ACCLIMATION Ph.D. Thesis
Janet Torma-Krajewski 1979 158 p
Avail: Univ. Microfilms Order No. 7922358

Plasma volume responses of fit men and women demonstrating similar maximum aerobic capacities were measured during a humid heat stress while walking on a treadmill at 30% maximal oxygen consumption. Prior to the acclimation no statistical differences in the core temperature, heart rate and blood pressure responses of the three groups were found. However, as judged by these responses, the observed trends indicated less strain in the pre-ovulation females when compared to the post-ovulation females and males. The females were better acclimated than the males as indicated by the rectal temperature responses. No statistical differences were observed in heart rate or blood pressure responses among the three groups. Dissert. Abstr.

N80-10782*# Pennsylvania State Univ., University Park.
KIDNEY CELL ELECTROPHORESIS Progress Report
Paul Todd Jun. 1979 25 p refs
(Contract NAS9-15584)
(NASA-CR-160353) Avail: NTIS HC A02/MF A01 CSCL 06B

A kidney cell electrophoresis technique is described in four parts: (1) the development and testing of electrophoresis solutions; (2) optimization of freezing and thawing; (3) procedures for evaluation of separated kidney cells; and (4) electrophoretic mobility characteristics of kidney cells. R.E.S.

N80-10783# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
THERMAL CONDUCTION EFFECTS IN HUMAN SKIN. PHASE 2: EXPERIMENTAL VALIDATION AND APPLICATION OF DATA IN SELECTION OF MATERIALS
A. M. Stoll, M. A. Chianta, and J. R. Piergallini 15 Jan. 1979 17 p refs
(Contract CPSC-C-77-0091; WF51523000)
(AD-A068480) Avail: NTIS HC A02/MF A01 CSCL 06/14

Experimental production of threshold blisters at material temperatures, and contact times predicted from measurements of pain thresholds validated the concept underlying this study, that is, that the relationship between pain and blister thresholds established earlier for radiant and for convective heating could be extended into the region appropriate to conductive heating to provide a simple factor by which to convert pain threshold contact times to threshold blister times. From the successful demonstration of this thesis, it is concluded that extrapolation of converted pain threshold temperature-time values determined empirically constitutes a reliable means of predicting maximum permissible temperature of materials for safe contact with bare skin. The information so derived, pertinent to areas of minimal epidermal thickness, is presented to chart form suitable for use in preselection of thermally safe construction and manufacturing materials. GRA

N80-10784# Wisconsin Univ. - Madison.
PULMONARY ADAPTATION TO HIGH ALTITUDE Annual Report, 1 Feb. - 31 Dec. 1978
Jerome A. Dempsey 22 Dec. 1978 20 p refs
(Contract DAMD17-77-C-7006; DA Proj. 3E1-61102-BS-08)
(AD-A068317) Avail: NTIS HC A02/MF A01 CSCL 06/19

This project is aimed at two closely related questions concerning man's adaptation to high altitude hypoxia: (1) What mechanisms regulate the ionic composition of brain intra- and extra-cellular fluid in long-term hypoxia; and (2) What role do these regulatory factors play in mediating ventilatory acclimatization to hypoxia; In the second year of our contract, we have accomplished the following: (a) found that CSF (H-) changed as a function of ventilation during normoxia deacclimatization from chronic hypoxia; (b) established the rat as an animal model for human ventilatory acclimatization to chronic hypoxia, and observed the relative insensitivity of ventilation to alkaline brain perfusion in chronic hypoxia; (c) established the near-perfect regulation of brain pHi in short-term hypoxia and/or hypocapnia and determined the contribution of changes in brain metabolism of this regulation; (d) established the necessary biochemical and physiologic methods and then showed a close link between CNS serotonin metabolism and the control of air-breathing eupnea in the awake rat; and (e) showed the difference in and importance of ventilatory adaptation in other physiologic states--sleep and exercise. GRA

N80-10785# Oak Ridge National Lab., Tenn.
NATIONAL LIBRARY OF MEDICINE TOXICOLOGY DATA BASE MANAGEMENT SYSTEM
J. S. Stanton and J. L. McNeany Apr. 1979 44 p
(Contract W-7405-eng-26)
(ORNL/CSD/TM-80) Avail: NTIS HC A03/MF A01

A data management system developed for the National Library of Medicine toxicology data base (TDB) is described. The TDB data management system includes features to handle initial data entry, data editing, generation of proof listings, and conversion of data to and from the MARK IV file management system's input format. DOE

N80-10786# Medical Coll. of Wisconsin, Milwaukee. Div. of Environmental and Occupational Medicine.
EFFECT OF A RAPID 4 PERCENT CARBOXYHEMOGLOBIN SATURATION INCREASE ON MAXIMAL TREADMILL EXERCISE
R. D. Stewart, P. E. Newton, J. Kaufman, H. V. Forster, J. P. Klein, M. H. Keelen, Jr., D. J. Stewart, A. Wu, and C. L. Hake 1978 46 p refs
(PB-296627/3; MCOW/ENVM/CO-78/2;
CRC-APRAC-CAPM-22-75) Avail: NTIS HC A03/MF A01 CSCL 06T

The effect and adaptation to this hypoxic stress over four hours was measured in six physically fit fire fighters. The subjects were randomly exposed and exercised to exhaustion in a double blind experiment to either carbon monoxide (CO) or uncontaminated air twice a week for three weeks. On exposure days the subjects breathed 20,000 ppm CO for 45 seconds, followed by 30 ppm CO for four hours. The rapid increase in COHb resulted in a decrease (p less than .05) in the mean exhaustion times obtained immediately after the CO bolus (745.2 to 736.3 sec). However, this small exercise decrement was not consistently observed, and in 16 of the 44 measurements the trained subjects performed better following CO exposure. GRA

N80-10787# Ames Lab., Iowa.
ANALYSIS OF AIRBORNE PARTICULATES AND HUMAN

URINE BY INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROMETRY
Kenneth W. Olson, William J. Haas, Jr., and Velmer A. Fassel
Oct. 1978 123 p refs Sponsored by HEW
(PB-297775/9; NIOSH-79/110) Avail: NTIS
HC A06/MF A01 CSCL 06T

The results of sampling and multielement analysis of trace elements found in urine of workers and in workplace environments are presented. Inductively coupled plasma-atomic emission spectrometry (ICP-AES) was used to investigate both direct and indirect analysis schemes for air particulates. A unique facility was developed and used for the preparation of air particulate standard reference materials and is described. A complete sampling and ICP-AES analytical method for the simultaneous determination of trace elements typically present in urine samples was also developed and characterized. GRA

N80-10749# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF PHARMACOLOGY IN SPACE MEDICINE
V. S. Shaskov and B. B. Yegorov *In its* USSR Report: Biomedical and Behavioral Sci., No. 122 12 Oct. 1979 p 1-20 refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), no. 4, 1979 p 325-339 (For primary document see N80-10748 01-51)
Avail: NTIS HC A07/MF A01

N80-10753# Joint Publications Research Service, Arlington, Va.
CURRENT CONCEPTIONS ON THE GENESIS OF VESTIBULOVEGETATIVE DISORDERS IN WEIGHTLESSNESS
B. I. Polyakov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 1-12 refs Transl. into ENGLISH of Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 3-10 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10754# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPOXIA ON FLUID-ELECTROLYTE METABOLISM AND RENAL FUNCTION IN MAN AS RELATED TO DIFFERENT DEGREES OF MOTOR ACTIVITY
A. I. Grigoryev, V. I. Korolkov, G. I. Kozyreyskaya, and M. A. Dotsenko *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 13-18 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 10-14 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10757# Joint Publications Research Service, Arlington, Va.
AGE-RELATED DISTINCTIONS OF CHANGES IN PSYCHOPHYSIOLOGICAL FUNCTIONS OF PILOTS IN THE CIVIL AVIATION UNDER THE INFLUENCE OF VIBRATION AND NOISE
Yu. N. Kamenskiy and Ye. A. Sokolova *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 30-34 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 21-24 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10759# Joint Publications Research Service, Arlington, Va.
ROENTGENOLOGICAL EXAMINATION OF THE HUMAN HEART AFTER 100-DAY HYPOKINESIA
I. G. Krasnych *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 40-44 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 28-31 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10763# Joint Publications Research Service, Arlington, Va.
THE COMBINED EFFECT OF CARBON MONOXIDE AND HYPOKINESIA
B. I. Abidin, V. V. Kustov, V. I. Belkin, and A. N. Kondratyev *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 63-68 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 44-48 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10764# Joint Publications Research Service, Arlington, Va.
LEVELS AND PROPORTION OF RNA AND PROTEINS IN THE SYSTEM OF THE NEURON: VESTIBULAR NUCLEAR NEUROGLIA AND CEREBELLUM DURING HYPOKINESIA
L. M. Mamalyga *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 69-75 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 49-53 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10765# Joint Publications Research Service, Arlington, Va.
SOME HEMODYNAMIC PARAMETERS DURING RESPIRATION OF OXYGEN UNDER EXCESSIVE PRESSURE
K. I. Murakhovskiy and L. I. Letkova *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 76-81 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 53-57 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10767# Joint Publications Research Service, Arlington, Va.
AMOUNT OF MICROORGANISMS DISCHARGED FROM THE UPPER RESPIRATORY TRACT AND INTEGUMENT OF PEOPLE CONFINED IN A SEALED CHAMBER
S. N. Zaloguyev, A. N. Viktorov, K. V. Zarubina, and V. P. Gorshkov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 88-92 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 61-65 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10768# Joint Publications Research Service, Arlington, Va.
ULTRASTRUCTURAL CHANGES IN CANINE HEPATOCYTES DURING CONTINUOUS CHRONIC EXPOSURE TO LOW DOSES OF GAMMA RADIATION
L. A. Bespalova, V. V. Shikhodyrov, and V. S. Romanov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 93-99 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 65-69 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10770# Joint Publications Research Service, Arlington, Va.
A METHOD OF DEFINING THE OPTIMUM LEVEL OF IONIZING RADIATION FROM DETERMINATE SOURCES DURING SPACE FLIGHTS
A. V. Kolomenskiy and V. A. Sakovich *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 106-110 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 74-76 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10771# Joint Publications Research Service, Arlington, Va.
PSYCHOPROPHYLAXIS OF FATIGUE AND FUNCTIONAL CARDIOVASCULAR DISEASES IN PILOTS BY MEANS OF SELF-CONDITIONING
A. N. Gurov *In its* USSR Report: Space Biol. and Aerospace

Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 111-113 ref Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 77-78 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10772# Joint Publications Research Service, Arlington, Va.
USE OF SHORT-ARM CENTRIFUGE TO PREVENT DECONDITIONING WHEN IMMERSED IN WATER (ACCORDING TO H-REFLEX)
B. I. Zborovskaya *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 114-116 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 78-79 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10774# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF ALVEOLOARTERIAL DIFFERENCE FOR OXYGEN AND CARBON DIOXIDE WHEN BREATHING HIGH-DENSITY GAS MIXTURES
I. A. Bryantsev, A. G. Dianov, V. V. Isayenko, A. V. Suvorov, and R. I. Finogenova *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 121-123 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 81-83 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10776# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPOXIA ON ATPASE ACTIVITY OF THE BRAIN
I. B. Buravkova, E. S. Mailyan, and Ye. A. Kovalenko *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 127-131 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 85-87 (For primary document see N80-10752 01-51)
Avail: NTIS HC A07/MF A01

N80-10995# Joint Publications Research Service, Arlington, Va.
HEALTH PROGNOSIS IN FLIGHT DISCUSSED
R. Bayevskiy *In its* USSR Report: Biomedical and Behavioral Sci., No. 112 23 Jul. 1979 p 10-12 Transl. into ENGLISH from Meditsinskaya Gazeta (Moscow), 30 May 1979 p 3 (For primary document see N80-10993 01-99)
Avail: NTIS HC A06/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-10788# Civil Aeromedical Inst., Oklahoma City, Okla.
THE DEVELOPMENT OF THE ATC SELECTION BATTERY: A NEW PROCEDURE TO MAKE MAXIMUM USE OF AVAILABLE INFORMATION WHEN CORRECTING CORRELATIONS FOR RESTRICTION IN RANGE DUE TO SELECTION
James O. Boone and Mary A. Lewis Sep. 1978 46 p refs
(AD-A066132; FAA-AM-78-36) Avail: NTIS
HC A03/MF A01 CSCL 05/9

A five test selection battery is currently given to select the air traffic controllers. Data was collected on two new tests being considered for incorporation into the battery. To determine the utility of the old and new tests, it is necessary to correlate the tests with a criterion of job success. However, since criterion information is available only on persons already selected for air traffic control work, the correlation is restricted to this upper range of persons, and is, thereby, spuriously low for prediction purposes. To properly evaluate the utility of the tests, the correlation must be corrected for this restriction in range. A new procedure that was developed to more accurately correct correlations for restriction in range is described. The new procedure was compared with Gulliksen and Thorndike's procedures by the Monte Carlo method and was shown to be more accurate. R.E.S.

N80-10789# Washington Univ., Seattle. Dept. of Psychology.
LIFE STRESS, SELF-PREOCCUPATION, AND SOCIAL SUPPORTS
Irwin G. Sarason 15 Apr. 1979 49 p refs Presented at meeting of the Western Psychological Assoc., San Diego, Calif., 6 Apr. 1979
(Contract N00014-75-C-0905; NR Proj. 170-804)
(AD-A068624; SCS-LS-008) Avail: NTIS HC A03/MF A01 CSCL 05/10

A theoretical framework for stress research is presented which emphasizes the role of cognitions related to situational demands, constraints, and opportunities. The nature of these cognitions is influenced by personality characteristics, recent life experiences, and social supports. Relevant research dealing with these factors is reviewed. Two studies in which elements of social supports were experimentally manipulated are described. Their clinical and developmental implications are discussed. GRA

N80-10790# Human Factors Research, Inc., Goleta, Calif.
RESEARCH ON THE PSYCHOPHYSIOLOGICAL BASIS OF HUMAN VIGILANCE Final Report, 1968 - 1978
James F. O'Hanlon, Jr. Apr. 1979 17 p refs
(Contract N00014-68-C-0296; NR Proj. 201-052)
(AD-A068562; TR-787-F) Avail: NTIS HC A02/MF A01 CSCL 05/10

The research products of a program of studies directed at identifying the psychophysiological basis of human vigilance are briefly summarized. Much of the work focused on identifying the relationship between the biogenic catecholamines, adrenaline (A) and noradrenaline (NA), and human vigilance. A new fluorometric assay for subnanogram concentrations of (A) and (NA) was developed. Several studies were performed showing substantial correlations between vigilance performance and circulating concentrations of (A). It was shown that vigilance could be increased through pulsatile infusions of (A). Vigilance was shown to be adversely affected by typical urban concentrations of carbon monoxide (CO) and by hypoxia experienced at high altitudes. It was also shown that vigilance decrements occur not only with typical laboratory tasks (used early in the program) but also with realistic radar monitoring tasks. Target detection performance, using a typical radar PPI, was shown to deteriorate over time as excretion rates of (A) decreased. Concurrent monitoring of the EEG showed that the performance decrement was also accompanied by a decreased percentage of Beta and increased percentage of Alpha and Theta. GRA

N80-10791# Yale Univ., New Haven, Conn. Dept. of Psychology.
AN APTITUDE-STRATEGY INTERACTION IN LINEAR SYLLOGISTIC REASONING Research Report, 1 Jan. - 30 Mar. 1979
Robert J. Sternberg and Evelyn M. Weil 1 Apr. 1979 51 p refs
(Contract N00014-78-C-0025; NR Proj. 150-412)
(AD-A068498; RR-1-79; TR-15) Avail: NTIS
HC A04/MF A01 CSCL 05/10

The major goal of the present study was to demonstrate an aptitude-strategy interaction in linear syllogistic reasoning. Specifically, it was hypothesized that the efficiency of each of four alternative strategies for solving linear syllogisms--problems such as 'John is taller than Bill; Bill is taller than Pete' who is tallest?'--would depend upon subjects' patterns of verbal and spatial abilities. This hypothesis was confirmed. The research also had three subsidiary goals. The first was to determine whether it is possible to train subjects to use various classes of strategies for solving linear syllogisms. It was found that such training is possible. The second goal was to determine whether certain strategies for solving linear syllogisms might be more efficient on the average than others. It was found that one strategy, used spontaneously by only a small minority of subjects but rather easily trainable, is more efficient than alternative strategies that subjects seem to use. The third goal was to provide a series of converging operations for testing the validity of one

particular account of linear-syllogistic reasoning--a spatial-linguistic mixture model--for subjects receiving no explicit instruction in the solution of linear syllogisms. The validity of this model for the untrained subjects was upheld. It was concluded that componential analysis, a series of concepetual and methodological techniques for investigating intelligent performance, can provide a useful means for studying interactions between aptitudes and experimental treatments. GRA

N80-10792/ California Univ., San Diego, La Jolla. Center for Human Information Processing.
A STUDY OF COMPLEX LEARNING THEORY AND METHODOLOGIES
Ross A. Bott. Mar. 1979. 88 p.
(Contract N00014-76-C-0628; ARPA Order 2284; NR Proj. 154-387)
(AD-A068323; REPT-7901) Avail: NTIS HC A05/MF A01 CSCL 05/10

This paper presents an analysis and model of the cognitive processes underlying complex learning situations. A theory is proposed that attempts to specify particular internal knowledge structures generated and modified during instruction, and to use them to explain specific difficulties that the learner experiences and also the overall progress being made. The theory states that (1) the underlying process reflects largely the prior knowledge structures of the student interacting with the information implied by the instruction; (2) the learning mechanisms involved are mostly simple and automatic; (3) the key information within the knowledge structures which allows complex learning to occur is the similarity between higher-order structures. This theory was applied to novices learning to use a computer text editor by reading a basic instruction manual and completing some exercises. After each sentence of instruction, they were asked to describe their current understanding, any difficulties they were aware of, and their expectations about what would follow. Their protocols were analyzed for evidence of underlying cognitive processes. These learning processes and the associated knowledge structures on which they operate were then modeled in terms of the theory at several levels of detail. Several issues of knowledge representation related to the model are discussed and possible solutions proposed. GRA

N80-10793/ Naval Ocean Systems Center, San Diego, Calif.
REMOTE OPERATOR PERFORMANCE COMPARING MONO AND STEREO TV DISPLAYS: THE EFFECTS OF VISIBILITY, LEARNING AND TASK FACTORS. Final Report
D. C. Smith, R. E. Cole, J. O. Merritt, and R. L. Pepper. Feb. 1979. 46 p. refs.
(RR04207)
(AD-A068201; NOSC/TR-380) Avail: NTIS HC A03/MF A01 CSCL 05/10

An analysis of visual perception related to the underwater environment is presented, followed by a discussion of 3-dimensional space perception, and the absolute and relative cues employed by the operator during task performance. Using a category 1 task, experiment 1 employed highly practiced subjects to reduce the effects of learning. Mono and stereo TV performance was measured under three levels of visibility degradation (simulated by contrast reduction). As predicted, stereo was superior to mono under all conditions tested. Performance using both mono and stereo displays were both affected by degraded visibility. Experiment 2 was conducted with naive subjects using an experimental design which enabled an assessment of the degree of learning under operator testing conditions. We hypothesized that the category 1 task would show significantly less advantage for stereo, but that the effects of degraded visibility would continue to occur. The results are consistent with our interpretation. In experiment 3, the more visually complex category 2 task was employed. The design of the experiment was similar to experiment 2 so that evidence for learning could be assessed under these different conditions. Predictions concerning the degree of performance advantage for stereo vs mono displays were supported. This advantage was observed to increase with decreasing visibility, a finding which is consistent with our earlier predictions. GRA

N80-10794/ City Univ. of New York, N. Y. Dept. of Psychology.
EVOKED CORTICAL POTENTIALS AND INFORMATION PROCESSING. Annual Report, 1 Jan. 1978 - 30 Jun. 1979
John L. Andreassi, Joseph A. Gallichio, and Nancy E. Young. 30 Jun. 1979. 104 p. refs.
(Contract N00014-77-C-0114)
(AD-A070789; AR-16) Avail: NTIS HC A05/MF A01 CSCL 05/2

In summary, the present findings show that there are perceptual differences between continuous and apparent motion and that these differences may be reflected in the latency and amplitude of the VEP. Furthermore, theoretical and cell system models were presented to account for the observed differences. These models propose that continuous motion is processed by specialized motion detecting cells which may respond to velocity as an intensity factor in motion. In apparent motion, the models suggest that cells would respond to the spatial and temporal change in position over time aspects of this type of motion and the role of velocity as an intensity factor would be diminished. Thus, it is suggested that future studies be undertaken to compare continuous and apparent motion using a wider range of velocity conditions and recording locations. Also, the direction of motion should be systematically examined for both continuous and apparent motion. GRA

N80-10795/ Oklahoma Univ., Norman. Decision Processes Lab.
A MEMORY RETRIEVAL AID FOR HYPOTHESIS GENERATION. Progress Report, Aug. 1978 - Aug. 1979
Charles Gettys, Tom Mehle, Suzanne Baca, Stanley Fisher, and Carol Manning. 27 Jul. 1979. 37 p. refs.
(Contract N00014-77-C-0615; NR PROJ. 197-040)
(AD-A072657; TR-27-7-79) Avail: NTIS HC A03/MF A01 CSCL 05/10

This study investigates an aid for the hypothesis retrieval process which is based on a model for hypothesis retrieval developed by Gettys, Fisher, and Mehle (1978). A computer simulates the human hypothesis retrieval process by searching an enriched associative memory which contains the associations of a number of individuals in the form of a list of hypotheses for each datum. When the data of a decision problem become known, the appropriate lists are searched by the computer. Hypotheses that are common to most or all of the lists are suggested to the user, who assesses them for plausibility. An experiment was performed to determine the utility of the aid for both expert and non-expert users. The aid produced a substantial gain in performance for both groups of users, suggesting that further development of the aid would be worthwhile in decision situations which are repeated often enough to warrant the creation of an enhanced artificial memory. Also discussed are several techniques for implementing the aid, and determining the maximum gain in performance that the aid can produce. GRA

N80-10796/ Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MODALITY EFFECTS IN SCANNING NONVERBAL INFORMATION: EVIDENCE FOR MULTIPLE MEMORY CODES. Ph.D. Thesis
R. L. Hann. Jun. 1979. 74 p. refs.
(AF PROJ. 7184)
(AD-A072297; AMRL-TR-79-53) Avail: NTIS HC A04/MF A01 CSCL 05/2

The purpose of this experiment was to study memory coding processes as a function of input sensory modality. Some investigators have proposed a single auditory/articulatory code, regardless of stimulus modality, while others have suggested that multiple sensory-specific codes are generated. Subjects in this study learned to associate 10 twelve-sided random polygons with ten complex sounds. These paired associates were then used in several versions of a Sternberg binary choice reaction time task. Results indicated that subjects were able to maintain sensory-specific memory information when it was advantageous to do so. The observed effects were best interpreted in terms of a multiple-code model, in which both a primary (same-modality) code and a weaker associate (opposite-modality) code are simultaneously generated as the to-be-remembered information is input. GRA

N80-10797# Sandia Labs., Albuquerque, N. Mex.
SUMMARY OF PROJECT TO DEVELOP HANDBOOK OF HUMAN RELIABILITY ANALYSIS FOR NUCLEAR POWER PLANT OPERATIONS
A. D. Swain 12 Sep. 1978 25 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1812C; Conf-781146-1) Avail: NTIS HC A02/MF A01

A handbook to aid qualified persons to evaluate the effect of human error on the availability of engineered safety systems and features in nuclear power plants is described. The handbook includes a mathematical model, procedures, derived human failure data, and principles of human behavior and ergonomics. DOE

N80-10798# California Univ., Livermore. Lawrence Livermore Lab.
HUMAN VIGILANCE INVESTIGATION ANALYSIS OF THE PATTERN ARRAY TEST (FURTHER DATA ANALYSIS) Final Report
Andrew C. Have Apr. 1979 68 p refs Prepared in cooperation with Calif. Polytechnic State Univ., San Luis Obispo
(Contract W-7405-eng-48)
(UCRL-13891-3) Avail: NTIS HC A04/MF A01

A test which is designed to help solve problems of human vigilance encountered in a material safeguard system is presented. The efficiency of an operator is measured when large amounts of information are being processed from a video screen over extended periods of time. For the test, eight objects, either circles, squares, or triangles, are set in a 5 x 5 matrix which appeared on a video screen. The eight objects are shown for a specified length of time, blanked out for another specified period, and then eight objects are again shown in the same 5 x 5 matrix. The observer is tested on his ability to discern changes in patterns and/or symbols from frame to frame. It was found that changes in pattern were more easily identified than changes in symbols. DOE

N80-10674*# Texas Univ. at Austin.
SOUTH AMERICAN RIVER MORPHOLOGY AND HYDROLOGY
R. K. Holz, V. R. Baker, S. M. Sutton, Jr., and M. M. Penteado-Orellana (Fundacao Univ. de Brasilia) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 545-594 refs (For primary document see N80-10538 01-43)
Avail: NTIS HC A99/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-10799* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PORTABLE BREATHING SYSTEM Patent
John S. Lovell, inventor (to NASA) (United Technologies Corp., East Hartford, Conn.) Issued 25 Sep. 1979 8 p Filed 24 Mar. 1977 Supersedes N77-21847 (15 - 12, p 1643) Sponsored by NASA
(NASA-Case-MSC-16182-1; US-Patent-4,168,706; US-Patent-Appl-SN-780938; US-Patent-Class-128-142R; US-Patent-Class-128-191R; US-Patent-Class-128-212) Avail: US Patent and Trademark Office CSCL 06K

A semiclosed-loop rebreathing system is discussed for use in a hostile environment. A packed bed regenerative heat exchanger providing two distinct temperature humidity zones of breathing gas with one zone providing cool, relatively dry air and the second zone providing hot, moist air is described. A.W.H.

N80-10800*# Life Systems, Inc., Cleveland, Ohio.
EXTENDED DURATION ORBITER STUDY: CO2 REMOVAL AND WATER RECOVERY Final Report
R. D. Marshall, G. S. Ellis, F. H. Schubert, and R. A. Wynveen May 1979 91 p refs
(Contract NAS9-15218)
(NASA-CR-160317; LSI-ER-319-24) Avail: NTIS HC A05/MF A01 CSCL 06K

Two electrochemical depolarized carbon dioxide concentrator subsystems were evaluated against baseline lithium hydroxide for (1) the baseline orbiter when expanded to accommodate a crew of seven (mission option one), (2) an extended duration orbiter with a power extension package to reduce fuel cell expendables (mission option two), and (3) an extended duration orbiter with full capability power module to eliminate fuel cell expendables (mission option three). The electrochemical depolarized carbon dioxide concentrator was also compared to the solid amine regenerable carbon dioxide removal concept. Water recovery is not required for Mission Option One since sufficient water is generated by the fuel cells. The vapor compression distillation subsystem was evaluated for mission option two and three only. Weight savings attainable using the vapor compression distillation subsystem for water recovery versus on-board water storage were determined. Combined carbon dioxide removal and water recovery was evaluated to determine the effect on regenerable carbon dioxide removal subsystem selection. R.E.S.

N80-10801*# Life Systems, Inc., Cleveland, Ohio.
PREPROTOTYPE VAPOR COMPRESSION DISTILLATION SUBSYSTEM Final Report
George S. Ellis, R. A. Wynveen, and F. H. Schubert Aug. 1979 69 p
(Contract NAS9-15267)
(NASA-CR-160332; LSI-ER-312-4) Avail: NTIS HC A04/MF A01 CSCL 06K

A three-person capacity preprototype vapor compression distillation subsystem for recovering potable water from wastewater aboard spacecraft was designed, assembled, and tested. The major components of the subsystem are: (1) a distillation unit which includes a compressor, centrifuge, central shaft, and outer shell; (2) a purge pump; (3) a liquids pump; (4) a post-treat cartridge; (5) a recycle/filter tank; (6) an evaporator high liquid level sensor; and (7) the product water conductivity monitor. A computer based control monitor instrumentation carries out operating mode change sequences, monitors and displays subsystem parameters, maintains intramode controls, and stores and displays fault detection information. The mechanical hardware occupies 0.467 m3, requires 171 W of electrical power, and has a dry weight of 143 kg. The subsystem recovers potable water at a rate of 1.59 kg/hr, which is equivalent to a duty cycle of approximately 30% for a crew of three. The product water has no foul taste or odor. Continued development of the subsystem is recommended for reclaiming water for human consumption as well as for flash evaporator heat rejection, urinal flushing, washing, and other on-board water requirements. K.L.

N80-10802# Logicon, Inc., San Diego, Calif.
DESIGN CONSIDERATIONS FOR THE MAN-MACHINE RELATIONS USER INTERFACE TO TAS Interim Technical Report, 15 Mar. - 15 Jul. 1979
15 Jul. 1979 134 p
(Contract MDA903-79-C-0261; ARPA Order 3705)
(AD-A071207) Avail: NTIS HC A07/MF A01 CSCL 09/2

This effort consists of the analysis and design of a user interface which employs several man-machine relations factors; an existing system will be employed as a testbed for these beliefs - the COINS II Terminal Access System (TAS). This new interface must not interfere with the existing TAS user interface; it must coexist with the original and both must be accessible to TAS users. In addition to the software effort, intelligent terminals (i.e., microprocessor controlled) will emulate an electronic desk environment for the user. We feel that such modifications will result in greatly increased user acceptance of TAS, while providing a good indication of how such considerations can be applied to other systems and the possible effects of such efforts. GRA

N80-10803# Anthropology Research Project, Yellow Springs, Ohio.
REVISED HEIGHT/WEIGHT SIZING PROGRAMS FOR MEN'S PROTECTIVE FLIGHT GARMENTS
Milton Alexander, John T. McConville, and Ilse Tebbetts Wright-Patterson AFB, Ohio AMRL Apr. 1979 117 p refs
(Contract F33615-78-C-0508; AF Proj. 7184)

(AD-A070732; AMRL-TR-79-28) Avail: NTIS HC A06/MF A01 CSCL 06/14

Presented in this report is an updated series of height/weight sizing programs for use by designers of protective clothing for USAF men. The sizing values are based on an analysis of data obtained in the 1967 survey of flying personnel and cover some 71 dimensions (excluding head, hand and foot measurements.) GRA

N80-10804# Rockwell International Corp., Columbus, Ohio. Autonetics Missile Systems Div.

VISUAL SEARCH PERFORMANCE IN SIMULATED REMOTELY PILOTED VEHICLE UTILIZATION AS A FUNCTION OF AUXILIARY TASK LOADING ON THE OBSERVER Final Report, 25 Aug. 1975 - 3 May 1976

Richard B. Huntoon, Benjamin Schohan, and Uldi Shvern Apr. 1979 65 p refs

(Contract DAHC19-76-C-0011)

(AD-A072402; ARI-TR-357) Avail: NTIS HC A04/MF A01 CSCL 05/5

Baseline data were obtained on how well observers could extract information from a TV monitor while performing auxiliary tasks under task loading conditions that might be encountered in use of a remotely piloted vehicle (RPV) as the sensor platform. A simulation facility was used. It contained a terrain model, a TV camera transport, hybrid computing equipment, and a television display and control console. Six pilots and six nonpilots participated in the three-phase effort. Phase A required participants to detect and recognize tank-sized targets in open and cluttered backgrounds from a simulated altitude of 2,000 feet and a simulated RPV velocity of 100 knots. Phase B required participants to monitor and correct deviations in the RPV course and altitude and to respond to two visual warning indicators. Increasing the auxiliary load level decreased the probabilities and ranges of target detection and recognition. Target acquisition task demands similarly increased auxiliary task response times. Cluttered background significantly degraded target acquisition task performance, particularly when the auxiliary task was performed concurrently. GRA

N80-10750# Joint Publications Research Service, Arlington, Va.

A PORTABLE STAND FOR ASSESSING THE DYNAMICS OF A WORKING INDIVIDUAL'S FUNCTIONAL STATE

A. B. Leonova and V. G. Romanyuta *In its* USSR Report: Biomedical and Behavioral Sci., No. 122 12 Oct. 1979 p 41-48 refs Transl. into ENGLISH from Tekhnicheskaya estetika (USSR), no. 7, 1979 p 24-26 (For primary document see N80-10748 01-51)

Avail: NTIS HC A07/MF A01

N80-10758# Joint Publications Research Service, Arlington, Va.

DIETARY SUPPLEMENTS USED TO PREVENT SOME CHANGES IN THE HUMAN BODY IN THE PRESENCE OF NERVOUS AND EMOTIONAL STRESS

V. P. Bychkov and M. V. Markaryan *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 35-39 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 25-28 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

N80-10766# Joint Publications Research Service, Arlington, Va.

BICHROMATE OXIDABILITY AS A CRITERION OF QUANTITATIVE LEVELS OF ORGANIC IMPURITIES IN RECLAIMED WATER

V. A. Kryuchkov and N. S. Mareyeva *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 82-87 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 57-61 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

N80-10769# Joint Publications Research Service, Arlington, Va.

RUSH NUTS (CYPERUS ESCULENTUS) AS A SOURCE OF VEGETABLE OIL IN A CLOSED LIFE SUPPORT SYSTEM

M. P. Shilenko, G. S. Kalacheva, G. M. Lisovskiy, and I. N. Trubachev *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 100-105 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 70-74 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

N80-10775# Joint Publications Research Service, Arlington, Va.

TOXIC EFFECTS OF CHEMICALS IN THE ALTERED GAS ENVIRONMENT OF PRESSURIZED CHAMBERS

G. I. Solomin *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 13, No. 5 (JPRS-74470) 29 Oct. 1979 p 124-126 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), vol. 13, no. 5, 1979 p 83-84 (For primary document see N80-10752 01-51)

Avail: NTIS HC A07/MF A01

N80-11000# Joint Publications Research Service, Arlington, Va.

EVALUATION OF HEAT FLOW COMPONENTS FROM HEATER TO SKIN IN AN ELECTRIC THERMAL SUIT

I. M. Naumenko (Academy of Sciences Ukrainian SSR, Kiev) *In its* USSR Report: Biomedical and Behavioral Sci., No. 112 23 Jul. 1979 p 76-80 refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukrayinskoyi RSR (Kiev), no. 4, 1979 p 294-297 (For primary document see N80-10993 01-99)

Avail: NTIS HC A06/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-10805# Maryland Univ., College Park. Computer Science Center.

A SYSTEM FOR CONTROL STRUCTURE IMPLEMENTATION FOR IMAGE UNDERSTANDING

Martin Herman Mar. 1978 26 p refs

(Contract DAAG53-76-C-0138; ARPA Order 3206)

(AD-A071603; TR-646) Avail: NTIS HC A03/MF A01 CSCL 09/2

A data base system with inferencing capabilities is described. This system, developed by C. Rieger, is investigated as a tool in support of control structure implementation for image understanding. GRA

N80-10806# Naval Postgraduate School, Monterey, Calif.
NPS-PASCAL: A PASCAL IMPLEMENTATION FOR MICROPROCESSOR-BASED COMPUTER SYSTEMS M.S. Thesis
John L. Byrnes Jun. 1979 283 p refs
(AD-A071972) Avail: NTIS HC A13/MF A01 CSCL 09/2

NPS-PASCAL is a Naval Postgraduate School research project whose goal is the implementation of the PASCAL programming language on a microprocessor-based system. The NPS-PASCAL compiler consists of two software subsystems, the first analyzes the source program and produces a machine-independent intermediate form, while the second produces target machine code. The system is designed to satisfy the constraints of Standard Pascal, as defined by the British Standards Institute/International Standards Organization Working Draft of Standard Pascal. GRA

N80-10807# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
APPLICATION OF A MICROPROGRAMMED, BIT SLICE MICROPROCESSOR TO THE REAL TIME IMAGING TRACKER PROBLEM
Lewis G. Minor 30 Sep. 1978 252 p refs
(AD-A071638; DRDMI-T-78-53) Avail: NTIS HC A12/MF A01 CSCL 09/2

Following sections detail the design and construction of an imaging tracker built inhouse. The program was very successful and nearly all of the objectives in the original scope of work were achieved. The program's major accomplishments are listed as follows: (1) Designed, built, and tested the first Army imaging tracker capable of correlation and adaptive gate optical contrast tracking, (2) the feasibility of trackers using high speed microprocessors and CCD TV technology was demonstrated, (3) several correlation and template matching techniques were studied and implemented in real time microprocessors. Though the tracker was built primarily as a research tool, the hardware concept has the potential for achieving a very small packaging size. GRA

N80-10808# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.
ANALYSIS TECHNIQUES FOR USE WITH THE EXTENDED SDM MODEL
S. L. Huff and S. E. Madnick May 1979 126 p refs
(Contract N00039-78-G-0160)
(AD-A071647; CISR-P010-7905-09; CISR-TR-9) Avail: NTIS HC A07/MF A01 CSCL 09/2

Complex design problems are characterized by a multitude of competing requirements. System designers frequently find the scope of the problem beyond their conceptual abilities, and attempt to cope with this difficulty by decomposing the original design problem into smaller, more manageable sub-problems. Functional requirements form a key interface between the users of a system and its designers. In this research effort, a systematic approach has been proposed for the decomposition of the overall set of functional requirements into sub-problems to form a design structure that will exhibit the key characteristics of good design: strong coupling within sub-problems, and weak coupling between them. Recent work in the Systematic Design Methodology project has led to certain extensions to the basic representational model used therein. This report presents new analytical mechanisms that may be used to execute decomposition analyses in the context of the extended model. Included are new methods for calculating inter-requirement similarities, for measuring decomposition goodness, and for generating clustering hierarchies. As well, some new hierarchical clustering tools are presented, with examples. A complete analysis of a 22-node design problem is presented, and compared with results obtained for the same problem in earlier work using the original SDM. GRA

N80-10809# Naval Postgraduate School, Monterey, Calif.
CONVERGENCE ZONE PREDICTION MODELS WITH PROGRAMS FOR USE ON HP-67 AND HP-97 PROGRAMMABLE CALCULATORS M.S. Thesis
Richard L. Badger Mar. 1979 100 p refs
(AD-A072050) Avail: NTIS HC A05/MF A01 CSCL 09/2

Convergence zone (CZ) prediction models are developed based on acoustic ray tracing theory as applied to linearly segmented sound velocity profiles (SVP). The models were developed into three calculator programs, two for CZ range predictions under different source and receiver depth conditions and one for CZ gain and transmission loss (TL) predictions. The performance of the models as programmed on Hewlitt-Packard HP-67 or HP-97 programmable calculators was compared to the Fast Asymptotic Coherent Transmission (FACT) model which is based on similar but more elaborate theory and which is designed for use on large digital computers. Agreement of the calculator programs with the FACT model is fairly good when conditions are within the design limitations of the programs and environmental conditions are not unusual. GRA

N80-10810# Naval Postgraduate School, Monterey, Calif.
A TACTICAL SYSTEM EMULATOR FOR A DISTRIBUTED MICRO-COMPUTER ARCHITECTURE M.S. Thesis
Luis A. Guillen Jun. 1979 325 p refs
(AD-A072578) Avail: NTIS HC A14/MF A01 CSCL 09/2

An emulator is constructed in order to study the behaviour of a Tactical System in a distributed micro-computer architecture environment. This emulator represents Tactical Systems as a set of periodic and demand scheduled functional module processes that collaborate with each other. A special purpose operating system was implemented for the distributed micro-computer architecture that supports the emulator. It includes processor management and system wide input/output capabilities. GRA

N80-10811# Ames Lab., Iowa.
SPECIAL PURPOSE COMPUTER TO COMPUTER INTERFACE M.S. Thesis
B. F. Carter, III Jan. 1979 56 p refs
(Contract W-7405-eng-82)
(IS-T-830) Avail: NTIS HC A04/MF A01

The specific design criteria for interfacing two dissimilar computers are presented. The discussion also includes hardware and software protocol for communication between the systems. DOE

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-10812 Utah State Univ., Logan.
A METHOD OF COMPUTER-AIDED GENERATION OF SOFTWARE FOR DIGITAL SYSTEM CONTROLLERS USING FIXED-INSTRUCTION MACHINES Ph.D. Thesis
Mark Leonard Manwaring 1979 198 p
Avail: Univ. Microfilms Order No. 7917972

A method of applying a general purpose high-level language to the writing of software for digital system controllers which are implemented with fixed-instruction machines is presented. Several hardware configurations for synchronous digital system controllers are presented. Each of these fit the model of a Mealy or Moore sequential machine. An example of a programmable sequential machine applicable to the digital control process is presented. This microprogrammable machine may be converted to a fixed-instruction programmable machine. The concept of state of the machine is discussed. Software (program code) for a fixed-instruction machine is a sequence of states. Because of the limited set of instructions available on a machine, the state sequence is restricted. Designing software for a programmable machine requires a somewhat different philosophy than that of designing hardware-programmed machines. In the hardware programmed machine, the design is made to reflect the sequential nature of the control problem as the designer views it. In the software programmed machine, the sequential nature of the problem is forced to fit state sequence capabilities of the machine. Dissert. Abstr.

N80-10813*# National Aeronautics and Space Administration, Washington, D. C.
BEYSIK: LANGUAGE DESCRIPTION AND HANDBOOK FOR PROGRAMMERS (SYSTEM FOR THE COLLECTIVE USE OF THE INSTITUTE OF SPACE RESEARCH, ACADEMY OF SCIENCES USSR)
I. G. Orlov Oct. 1979 42 p Transl. into ENGLISH of BEYSIK

Opisaniye Nazika i Rukovodstvo dlya Programmista (Sistema kollektivnogo polizovaniya IKI AN SSSR) (Moscow), pr-476, 1979 42 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences (USSR), Moscow
(Contract NASw-3198)
(NASA-TM-75680; Pr-476) Avail: NTIS HC A03/MF A01 CSCL 09B

The BASIC algorithmic language is described, and a guide is presented for the programmer using the language interpreter. The high-level algorithm BASIC is a problem-oriented programming language intended for solution of computational and engineering problems. F.O.S.

N80-10814*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ISSUES IN THE DIGITAL IMPLEMENTATION OF CONTROL COMPENSATORS Ph.D. Thesis
Paul Moroney Oct. 1979 265 p refs
(Grant NGL-22-009-124)
(NASA-CR-162416; LIDS-TH-951) Avail: NTIS HC A12/MF A01 CSCL 09B

Techniques developed for the finite-precision implementation of digital filters were used, adapted, and extended for digital feedback compensators, with particular emphasis on steady state, linear-quadratic-Gaussian compensators. Topics covered include: (1) the linear-quadratic-Gaussian problem; (2) compensator structures; (3) architectural issues: serialism, parallelism, and pipelining; (4) finite wordlength effects: quantization noise, quantizing the coefficients, and limit cycles; and (5) the optimization of structures. A.R.H.

N80-10815# University of Southern California, Los Angeles.
DECISION MAKING, FUZZY SET THEORY AND COMPUTERS Final Report, 15 Aug. 1975 - 14 Aug. 1978
Richard Bellman and E. Stanley Lee Jul. 1979 29 p refs
(Grant DAAG29-76-G-0027)
(AD-A071842; ARO-12494.12-M) Avail: NTIS HC A03/MF A01 CSCL 09/2

A summary of the accomplishments of this project is given. A book has been published which contains chapters on can computers think, the digital computers, decision making, puzzles, uncertainty, simulation, learning, consciousness, humor, local logics, mathematical models of the mind, and communication and ambiguity. The summary also discusses fuzzy set theory in health delivery systems and in computers and linguistics. GRA

N80-10816# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
HEURISTICS FOR DETERMINING EQUIVALENCE OF PROGRAM MUTATIONS
Douglas Baldwin (Yale Univ.) and Fredrick Sayward (Yale Univ.) New Haven, Conn. Yale Univ. Apr. 1979 32 p refs
(AD-A071795; ARO-15950.3-A-EL) Avail: NTIS HC A03/MF A01 CSCL 09/2

A mutant M of a program P is a program derived from P by making some well defined simple change in P. Some initial investigations on automatically detecting equivalent mutants of a program are presented. The idea is based on the observation that compiler optimization can be considered a process of altering a program to an equivalent but more efficient mutant of the program. Thus the inverse of compiler optimization techniques can be seen as, in essence, equivalent mutant detection. GRA

N80-10817# Army Tank-Automotive Systems Development Center, Warren, Mich.
TARADCOM SIGNAL ANALYSIS PROGRAM Final Report, Apr. - Sep. 1978
G. A. Fix Sep. 1978 109 p
(AD-A072014; TARADCOM-TR-12412) Avail: NTIS HC A06/MF A01 CSCL 09/2

The objective of this report is to provide a user manual for the Signal Analysis Computer Program. The TARADCOM Signal Analysis Program (formerly called the Fast Fourier Transform Program) was developed originally as a BASIC Wang Program by Robert Daigle and associates. The TSA computer program has been converted from BASIC to FORTRAN and various graphics displays, such as linear plot of evaluation vs. distance, a point plot of amplitude vs. periods, and a log-log graph of power spectral density vs. frequency, have been added. Terrain data input to the program may be used in processing, rather than data equations that are contained in the program. Options available during processing include: first to last point detrending, digital high pass filters, exponentially weighted running average, no detrending, interpolation, amplitude smoothing, and a GEO window. The results of the TSAP include, besides graphics displays, amplitudes, periods, frequencies, power spectral densities, and RMS values. GRA

N80-10818# Army Satellite Communications Agency, Fort Monmouth, N. J.
PROJECT ARIES: USERS MANUAL FOR ARIAN 2 AND ASSOCIATED SUBSYSTEMS Interim Report, 16 May - 24 Jul. 1979
Richard L. Conn 24 Jul. 1979 239 p
(DA Proj. 1L1-61101-A-91A)
(AD-A072471) Avail: NTIS HC A11/MF A01 CSCL 09/2

The objective of the research conducted under Project ARIES is to investigate and analyze an interactive assembly language software development technique which is similar in several basic concepts to techniques employed in Project Gandalf at CORADCOM. Tests comparing the development capability and speed of conventional assembly language programming techniques (cross assembly, resident assembly via a 'conventional' operating system, and cross compilation) and an early implementation of the proposed technique have shown that this new technique promises to provide a factor of from 3 to 10 decrease in program development time for assembly language programs written for the 8080 and Z80 microprocessors. GRA

N80-10819# California Univ., Santa Cruz. Information Sciences.
THE DESIGN AND VERIFICATION OF AN OPERATING SYSTEM KERNEL M.S. Thesis
Philip Gary Levy 19 Jun. 1979 130 p refs
(Contract N00014-76-C-0682)
(AD-A072552; TR-79-6-001) Avail: NTIS HC A07/MF A01 CSCL 09/2

Practical aspects of the design, implementation, and verification of operating systems are explored in this thesis. Axiomatic techniques for proving parallel programs (developed by Hoare, Owicki, and Gries) are extended and applied in the proof of an operating system kernel. The techniques developed apply directly only to environments with a single physical processor. A technique for mutual exclusion that is simple to implement and has properties that contribute to verification is presented. It is based on the disabling of context switching to allow a single process to execute without pre-emption. In such an excluded region, sequential verification techniques can be applied. GRA

N80-10820# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
SET COVERING ALGORITHMS USING CUTTING PLANES, HEURISTICS, AND SUBGRADIENT OPTIMIZATION: A COMPUTATIONAL STUDY
Egon Balas and Andrew Ho Jul. 1979 43 p refs
(Contract N00014-75-C-0621; Grant NSF MCS-76-12026; NR Proj. 047-048)
(AD-A072458; MSRR-438; WP-6-79-80) Avail: NTIS HC A03/MF A01 CSCL 12/1

We report on the implementation and computational testing of several versions of a set covering algorithm, based on the family of cutting planes from conditional bounds. The algorithm uses a set of heuristics to find prime covers, another set of heuristics to find feasible solutions to the dual linear program which are needed to generate cuts, and subgradient optimization to find lower bounds. It also uses implicit enumeration with some new branching rules. Each of the ingredients was implemented and tested in several versions. The variant of the algorithm that emerged as best was run on 55 randomly generated test problems (20 of them from the literature), with up to 200 constraints and 2000 variables. The results show the algorithm to be more reliable and efficient than earlier procedures on large, sparse set covering programs. GRA

N80-10821# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
CUTTING PLANES FROM CONDITIONAL BOUNDS: A NEW APPROACH TO SET COVERING
Egon Balas Jul. 1979 31 p refs
(Contract N00014-75-C-0621; Grant NSF MCS-76-12026; NR Proj. 047-048)
(AD-A072459; MSRR-437; WP-5-79-80) Avail: NTIS HC A03/MF A01 CSCL 12/1

A conditional lower bound on the minimand of an integer program is a number which would be a valid lower bound if the constraint set were amended by certain inequalities, also called conditional. If such a conditional lower bound exceeds some known upper bound, then every solution better than the one corresponding to the upper bound violates at least one of the conditional inequalities. This yields a valid disjunction, which can be used to partition the feasible set, or to derive a family of valid cutting planes. In the case of a set covering problem, these cutting planes are themselves of the set covering type. The family of valid inequalities derived from conditional bounds subsumes as a special case the Bellmore-Ratliff inequalities generated via involutory bases, but is richer than the latter class and contains considerably stronger members, where strength is measured by the number of positive coefficients. GRA

N80-10822# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
AN IMPROVED FORTRAN REORGANIZER Interim Report, Aug. 1977 - Feb. 1979
Kervyn D. Mach May 1979 96 p refs
(AD-A071334; AFAPL-TR-79-2052) Avail: NTIS HC A05/MF A01 CSCL 09/2

Because this office frequently distributes Fortran computer programs to other organizations, it needed a means to furnish these programs in a clean, easy to read format. This report describes a computer program designed to provide such a format by reorganizing Fortran routines. This reorganization includes: a sequential renumbering of the executable statment label with deletion of unused labels; a sequential renumbering and relocation of format statements; an alphanumeric reordering of dimensional and typed variables; and a uniform pattern of text spacing. The program has been extensively tested and has proved to be extremely valuable for reorganizing Fortran routines developed in-house and under contract and for preparing routines for distribution and publication. Author (GRA)

N80-10823# Rochester Univ., N. Y. Dept. of Computer Science.
PROGRESSIVE REFINEMENT OF RASTER IMAGES Technical Report
Kenneth R. Sloan, Jr. and Steven L. Tanimoto (Univ. of Washington) Nov. 1978 34 p
(Contract N00014-78-C-0164)
(AD-A072517; TR-39) Avail: NTIS HC A03/MF A01 CSCL 20/6

The transmission of high resolution raster images over low-bandwidth communication lines requires a great amount of time. User interaction in such a transmission environment can be frustrating. The problem can be eased somewhat by transmitting a series of low resolution approximations, which converge to the final image. Several methods of computing such a series of images are presented. Each is related to a particular type of pyramid data structure. They rely on the ability of the local display device to overpaint an existing image, and generally require some transmission and computation overhead. However, one of the methods requires no transmission overhead and only a small amount of local computation. A notation is introduced that permits concise descriptions of the image refinement processes. GRA

N80-10824# Systran Corp., Dayton, Ohio.
MATE SUPPORT SOFTWARE ANALYSIS Final Technical Report, Feb. - Aug. 1978
W. Lynn Trainor Aug. 1978 89 p refs
(Contract F33615-77-D-1042)
(AD-A070931; AFAL-TR-78-166) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes a research study, the objective of which was to analyze and document those elements of support software used on the Digital Avionics Information System (DAIS) Program which could satisfy the support software requirements of the Modular Automatic Test Equipment (MATE) Project. Since many of the objectives of the MATE Program are closely aligned with those of DAIS, it was felt that some of the software items and standards developed for DAIS could be applicable to the MATE Program. The first sections of this report present an overview of the three areas of MATE software: MATE software of current-day systems, additional MATE software requirements beyond those satisfied with current-day MATE software, and MATE-unique software requirements. Using these as a basis for comparison the DAIS software was analyzed for applicability to the MATE system. The results of this analysis are presented in the final sections. GRA

N80-10825# General Electric Co., Arlington, Va.
IDENTIFICATION AND VALIDATION OF QUANTITATIVE MEASURES OF THE PSYCHOLOGICAL COMPLEXITY OF SOFTWARE Final Report, 1 Mar. 1977 - 28 Feb. 1979
Bill Curtis and Sylvia B. Sheppard 27 Apr. 1979 71 p refs
(Contract N00014-77-C-0158)
(AD-A072547; TR-79-388100-7) Avail: NTIS HC A04/MF A01 CSCL 09/2

This final report describes a program of research conducted to identify factors affecting the psychological complexity of software. The work conducted pursuant to this task consisted of three within subjects, multifactor experiments. The methodology employed in these experiments is described in detail. Separate sections discuss the results obtained for software complexity metrics and for modern coding practices. The major results of this research program are experimental verifications of increased programmer efficiency when working with structured code and the ability to predict programmer performance with Halstead's effort metric (a quantitative measure of software complexity). GRA

N80-10826# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
VAL: A VALUE-ORIENTED ALGORITHMIC LANGUAGE (PRELIMINARY REFERENCE MANUAL)
William B. Ackerman and Jack B. Dennis 13 Jun. 1979 84 p
(Contract N0014-75-C-0661; Grant NSF DCR-75-04060)
(AD-A072394) Avail: NTIS HC A05/MF A01 CSCL 09/2

The programming language VAL (Value-Oriented Algorithmic Language) is designed for expressing algorithms for execution on computers capable of highly concurrent operation. More specifically, the application area to be supported is numerical computation which strains the limits of high performance machines, and the primary targets for translation of VAL programs are data driven machines of the form under development by the Computation Structures Group of the MIT Laboratory for Computer Science for High performance numerical computers. GRA

N80-10827# California Univ., Livermore. Lawrence Livermore Lab.
ALGORITHM FOR ENHANCING LOW-CONTRAST DETAILS IN DIGITAL IMAGES
G. K. Myers and R. E. Twogood 10 Nov. 1978 6 p refs
(Contract W-7405-eng-48)
(UCID-18015) Avail: NTIS HC A02/MF A01

An algorithm for improving the contrast in digital images, called contrast stretching was implemented on the CDC 7600 computer. The applicability of this algorithm to radiographic image enhancement was investigated. Excellent contrast improvements were observed for several example images. DOE

N80-10828# Argonne National Lab., Ill. Applied Mathematics Div.
TEST PROBLEMS FOR CONSTRAINED NONLINEAR MATHEMATICAL PROGRAMMING ALGORITHMS
Larry W. Cornwell (Western Illinois Univ., Macomb), P. A. Hutchinson (Western Illinois Univ., Macomb), Michael Minkoff, and Hilbert K. Schultz (Wisconsin Univ., Oshkosh) Oct. 1978 77 p refs Revised
(Contract W-31-109-eng-38)

(ANL-AMD-TM-320-Rev-1) Avail: NTIS HC A05/MF A01

A collection of constrained nonlinear programming problems are presented for use in testing optimization algorithms. The problems vary in size from two variables to one hundred variables with various combinations of linear/nonlinear constraints and objective functions. IBM FORTRAN IV programs were written to provide function values and gradients for the objective function and constraints. Each coded problem was checked at several points against published results, and a validation process was used to check the values of the objective function, constraints, and gradients. The problems were collected from various sources, and many of them have been used by other authors in published results of their algorithm testing. This report should also be useful in an educational setting to provide students with experience in nontrivial problems. Listings of the IBM FORTRAN code are included in this report. DOE

N80-10829# Argonne National Lab., Ill.
USER'S GUIDE TO PLOTIN/MYPLOT. A GENERAL-PURPOSE PLOTTING ROUTINE FOR USE WITH AMD GRAPHICS
R. E. Toohey, J. Rundo, and T. J. Kotek Sep. 1978 102 p
(Contract W-31-109-eng-38)
(ANL/RER/78-3) Avail: NTIS HC A06/MF A01

Topics covered in the user's guide include use of PLOTIN; additional features afforded by subprograms; job control language; examples; and calling MYPLOT. DOE

N80-10830# Los Alamos Scientific Lab., N. Mex.
INTRODUCTION TO VECTRAN AND ITS USE IN SCIENTIFIC APPLICATIONS PROGRAMMING
B. L. Buzbee, comp. and J. F. Morrison, comp. 20 Sep. 1978 261 p refs Presented at the LASL Workshop on Vector and Parallel Processors, Los Alamos, New Mexico, 20-22 Sep. 1978
(Contract W-7405-eng-26)
(LA-7491-C; Conf-780945) Avail: NTIS HC A12/MF A01

Abstracts of the papers presented at the workshop are given. Topics discussed include: diagnostic system of the ICL 2900 series, vectorization of large scale codes, the CRAY-1 simulator, and Poisson solvers. F.O.S.

N80-10254*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A REED-SOLOMON DEEDING PROGRAM FOR CORRECTING BOTH ERRORS AND ERASURES
R. L. Miller, T. K. Truong, B. Benjauthrit, and I. S. Reed *In its* The Deep Space Network 15 Oct. 1979 p 102-107 refs
(For primary document see N80-10240 01-12)
(Grant AF-AFOSR-1798-75)
Avail: NTIS HC A09/MF A01 CSCL 09B

N80-10256*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN CONSCAN: A VECTOR NOMENCLATURE AND METHOD FOR DETERMINING PARAMETER VALUES
T. H. Taylor and J. LuValle *In its* The Deep Space Network 15 Oct. 1979 p 113-122 ref (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N80-10831# California Univ., Berkeley. Lawrence Berkeley Lab.
PROCEEDINGS OF THE THIRD BERKELEY WORKSHOP ON DISTRIBUTED DATA MANAGEMENT AND COMPUTER NETWORKS
Aug. 1978 377 p refs Conf. presented at San Francisco, 29 Aug. 1978
(Contract W-7405-eng-48)
(LBL-7953; Conf-780828) Avail: NTIS HC A17/MF A01

The following topics are discussed: (1) Provisional model of open system architecture; (2) Software architecture for a microprocessor-based packet network; (3) Protocol converters and user interface in the CYCLADES network; (4) Architecture for secure packet-switched networks; (5) Inter-network fragmentation and the TCP; (6) Dynamic management of packet radio slots; (7) Failsafe distributed algorithms for routing in communication networks; (8) Design of elementary distributed systems; (9) Synchronization in distributed system modules; (10) Performance limits of the TMM protocol: modeling and measurement; and (11) Distributed simulation using a network of microcomputers. M.M.M.

N80-10832# Department of Justice, Washington, D.C.
COMPUTER SYSTEMS CONVERSION: A MANAGEMENT PERSPECTIVE Final Report
Daniel B. Schneider Oct. 1978 86 p refs
(PB-297604/1) Avail: NTIS HC A05/MF A01 CSCL 09B

Computer systems conversion, and its interplay with the procurement of computer equipment is considered. Large-scale computer systems such as are found in the U.S. Department of Justice are emphasized. Data base management systems, and on-line transaction processing are included. The Federal procurement situation is also discussed. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-10833 State Univ. of New York at Stony Brook.
CONTINUOUS SIMULATION OF QUEUEING NETWORKS WITH TRANSIENT AND TIME VARYING CONDITIONS Ph.D. Thesis
Kuo-Kai George Wang 1979 109 p
Avail: Univ. Microfilms Order No. 7922975

This research deals with the simulation of transient solutions of average queue length L(t) and variance D(t) with time varying input process. Instead of using arrival process control, service process control which includes varying in number of servers, service rates and the dispatch routing will be used to control states of the queueing network. These states of the queueing network are represented by a set of variables L sub i (t) and D sub i (t) for each service station i in the network. Robust and simple differential equations of states with an approximate equation of utilization U sub i(t) were sought and simulated for a M/M/1 queueing network. Results checked very closely with those of direct simulation of probability distributions by Fan and were obtained with a substantial savings in storing memories and computing time. The system which was represented by these state equations and an approximation equation was proved to be stable during the numerical integration process. Dissert. Abstr.

N80-10834# Naval Underwater Systems Center, New London, Conn. New London Lab.
OPTIMIZATION OF COMPUTER OPERATING SYSTEMS Ph.D. Thesis
Charles Raymond Arnold 15 Apr. 1979 286 p refs
(AD-A071463; NUSC-TR-6045) Avail: NTIS HC A13/MF A01 CSCL 09/2

The first portion of this thesis is devoted to an adequate formulation within modern control-theoretic concepts of the resource management function of computer operating systems. Then a major portion of the remainder of the thesis is devoted to exploiting estimating and control techniques for the management of the single most important resource, namely, memory. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-10835*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LYAPUNOV STABILITY AND ITS APPLICATION TO SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS
Euel W. Kennedy Sep. 1979 32 p refs
(NASA-TM-80806; Rept-79-FM-31; JSC-16079) Avail: NTIS HC A03/MF A01 CSCL 12A

An outline and a brief introduction to some of the concepts and implications of Lyapunov stability theory are presented. Various aspects of the theory are illustrated by the inclusion of eight examples, including the Cartesian coordinate equations of the two-body problem, linear and nonlinear (Van der Pol's equation) oscillatory systems, and the linearized Kustaanheimo-Stiefel element equations for the unperturbed two-body problem. A.R.H.

N80-10836*# Houston Univ., Tex. Dept. of Mathematics.
ON THE CONSISTENCY OF THE MAXIMUM LIKELYHOOD ESTIMATE OF NORMAL MIXTURE PARAMETERS FOR A SAMPLE WITH FIELD STRUCTURE
Charles Peters Aug. 1979 18 p refs
(Contract NAS9-15543)
(NASA-CR-160352; Rept-74) Avail: NTIS HC A02/MF A01 CSCL 12A

General theorems concerning the strong consistency of the MLE of exponential mixture parameters are proved. These theorems imply the strong consistency of the MLE of normal mixture parameters when the data is organized into fields each of which is a random sample from one of the component normal distributions. Author

N80-10837# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Science Research Group.
A RESTRICTED LAGRANGEAN APPROACH TO THE TRAVELING SALESMAN PROBLEM
Egon Balas and Nicos Christofides (Imperial College of Science and Technology, London) Jul. 1979 50 p refs
(Contract N00014-75-C-0621; Grant NSF MSC-76-12026)
(AD-A072457; MSRR-439; WP-7-79-80) Avail: NTIS HC A03/MF A01 CSCL 12/1

We describe an algorithm for the asymmetric traveling salesman problem (TSP) using a new, restricted Lagrangean relaxation based on the assignment problem (AP). The Lagrange multipliers are constrainted so as to guarantee the continued optimality of the initial AP solution, thus eliminating the need for repeatedly solving AP in the process of computing multipliers. We give several polynomially bounded procedures for generating valid inequalities and taking them into the Lagrangean function with a positive multiplier without violating the constraints, so as to strengthen the current lower bound. Upper bounds are generated by a fast heuristic whenever possible. When the bound-strengthening techniques are exhausted without matching the upper with the lower bound, we branch by using two different rules, according to the situation: the usual subtour breaking disjunction, and a new disjunction based on conditional bounds. We discuss computational experience on 120 randomly generated asymmetric TSP's with up to 325 cities, the maximum time used for any single problem being 82 seconds. Though the algorithm discussed here is for the asymmetric TSP, the approach can be extended to the symmetric TSP by using the 2-matching problem instead of AP. GRA

N80-10838# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
GENERATING COVARIANCE SEQUENCES AND THE CALCULATION OF QUANTIZATION AND ROUNDING ERROR VARIANCES IN DIGITAL FILTERS
J. P. Dugre, A. A. Beex, and L. L. Sharf Jun. 1979 13 p refs
(Contract N00014-75-C-0518)
(AD-A072077; CSU-TR-28) Avail: NTIS HC A02/MF A01 CSCL 12/1

A linear algorithm is given for the generation of covariance sequences for rational digital filters using numerator and denominator coefficients directly. There is no need to solve a Lyapunov equation or to solve for the residues of a spectrum, as in other methods. By appealing to certain results from the theory of inners we show the algorithm provides a unique solution provided only that the filter is stable. Our results may be used to compute error variances due to product rounding and signal quantization, and to generate covariance strings (r sub k) from 0 to K used in other studies involving second-order properties of digital filters. GRA

N80-10839# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ON ESTIMATING VARIANCE OF ROBUST ESTIMATORS WHEN THE ERRORS ARE ASYMMETRIC Interim Report
Raymond J. Carroll Aug. 1978 22 p refs
(Grant AF-AFOSR-75-2796; AF Proj. 2304)
(AD-A072598; MIMEO-SER-1177; AFOSR-78-1438TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We investigate the effects of asymmetry on estimates of variance of robust estimator in location and regression problems, showing the heavy skewness of errors can seriously bias the common variance estimates for location and intercept, a problem that can be corrected by jackknifing for location but is more intractable for the intercept in regression. The scale parameters in regression seem not to be as seriously subject to this bias if the sample size is large compared to the number parameters. GRA

N80-10840# Maryland Univ., College Park. Inst. for Physical Science and Technology.
ON THE NUMERICAL SOLUTION OF HELMHOLTZ EQUATION BY THE FINITE ELEMENT METHOD
A. K. Aziz and A. Werschulz Jan. 1979 51 p refs
(Contract E(40-1)-3443)
(DOE/ER-03443-79; TN-BN-894) Avail: NTIS HC A03/MF A01

An optimal error bound in a general context is obtained which contains as a special case an optimal error estimate. The solution of the boundary value problem was reduced by a two-stage finite element procedure to the solution of a 2 x 2 first order elliptic system of the Petrovski type for which suitable shift theorems are known. A numerical example is given for a certain case. The computed error estimates agree with the theoretical estimates given. DOE

N80-10841# Los Alamos Scientific Lab., N. Mex.
METHOD OF LINES APPROACH TO THE NUMERICAL SOLUTION OF CONSERVATION LAWS
J. M. Hyman 1979 14 p refs Presented at the 3d IMACS Intern. Symp. on Computer Methods for Partial Differential Equations, Bethlehem, Pa., 20-22 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-837; Conf-790619) Avail: NTIS HC A02/MF A01

Explicit finite difference methods are developed for approximating the discontinuous time dependent solutions of nonlinear hyperbolic conservation laws. The analysis is based on the method of lines approach of decoupling the space and time discretizations and analyzing each independently before combining them into a composite method. Particular attention is given to analyzing high order spatial differences, artificial dissipation, and the accurate approximation of boundary conditions. Both a third order iterated leap frog predictor-corrector and a second order iterated Runge-Kutta method are shown to have excellent stability and accuracy properties for the time integration. These methods are A-stable when iterated to convergence and have the special property of allowing for local improvements in the stability and accuracy of the computed solution. DOE

N80-10842# Maryland Univ., College Park. Dept. of Physics and Astronomy.
TIME-DEPENDENT HARTREE-FOCK PHASE: UNIQUE IMPLICATION OF VARIATIONAL PRINCIPLE
P. C. Lichtner, J. J. Griffin, R. Schultheis, and A. B. Volkov Mar. 1979 11 p refs
(Contract EY-76-S-05-5126)
(ORO-5126-50; UMD-TR-79-018; UMD-PP-79-032) Avail: NTIS HC A02/MF A01

The time dependent Hartree-Fock (TDHF) variational principle is shown to yield a unique solution with no indeterminacy in its time-dependent phase. The long-standing contrary opinion arises from an impermissible restriction to norm-preserving variations. DOE

N80-10843# Union Carbide Corp., Oak Ridge, Tenn. Mathematics and Statistics Research Dept.
MODELING FOR MOVING BOUNDARY PROBLEMS
A. D. Solomon 1979 20 p refs Presented at Solar Energy Storage Workshop, Chandigarh, India, 9 Mar. 1979
(Contract W-7405-eng-26)
(CONF-790345) Avail: NTIS HC A02/MF A01

The current state of the art of moving boundary problems as it applies to the storage of heat as latent heat is described. DOE

N80-10844# Stanford Univ., Calif. Dept. of Statistics.
MIXING CONDITIONS AND LIMIT THEOREMS FOR MAXIMA OF SOME STATIONARY SEQUENCES
Michael R. Chernick Aug. 1978 97 p refs Sponsored in part by EPA and NSF
(Contract EY-76-S-02-2874)
(COO-2874-38; TR-18) Avail: NTIS HC A05/MF A01

The results presented, along with results for associative processes provide the basic tools used to prove the limit theorems studied. A class of first-order exponential autoregressive processes is also studied. The processes are shown to satisfy the condition of Loynes' theorem. The strong mixing condition which in general would be difficult to check is found to be much easier to verify in this special case due to the Markov structure of the process. A general condition is given which implies strong mixing for Markov and p/sup th/ order autoregressive processes. This condition is easy to check for Markov processes. It was concluded that even when stationary and mixing conditions are assumed, the limit can differ from the independent case. It was shown that for some first-order autoregressive processes the limit distribution can depend on the autocorrelation at lag 1 whereas for processes satisfying Leadbetter's or Loynes' conditions the limit does not depend on the lag 1 autocorrelation. DOE

N80-10845# Denver Univ., Colo. Dept. of Mathematics.
CONSTRUCTION OF WELL-CONDITIONED SYSTEMS FOR FREDHOLM I PROBLEMS BY MESH ADAPTING
F. Hagin 1979 31 p refs
(Contract EY-76-C-02-2482)
(COO-2482-10) Avail: NTIS HC A03/MF A01

The numerical solution of linear Fredholm I integral equations of the type arising from various one-dimensional inverse scattering problems is addressed. Typically, when these equations are discretized, they lead to very ill-conditioned algebraic systems. It is shown that for these types of kernels a relatively simple mesh adapting scheme leads to very well-conditioned systems. Moreover, when the kernel is not known explicitly but must be generated by numerically solving a boundary-value problem, an asymptotic analysis can extract the information to adapt this mesh successfully. DOE

N80-10846# California Univ., Livermore. Lawrence Livermore Lab.
PROCEEDINGS OF AESOP-SCIE SYMPOSIUM ON ADVANCED COMPUTING
1978 111 p refs Symp. held at Las Vegas, Nev., 19 Oct. 1979
(Contract W-7405-eng-48)
(CONF-781061-P2) Avail: NTIS HC A06/MF A01

Large and small machines of advanced designs that are currently in the conception, design or initial production stage are presented. Individual items were prepared separately for the data base. The BSP which uses a large-scale Burroughs B 7700/B 7800 general-purpose computer as a system manager is described. The BSP parallel processor has 16 parallel artihmetic elements driven in lock-step by a single instruction stream. Hence, the BSP is a single-instruction, multiple-data stream architecture. In this respect, it is comparable with other large pipeline or parallel scientific processors. DOE

N80-10051 Allerton Press, Inc., New York, N. Y.
ON MINIMIZING INTEGRAL QUADRATIC ESTIMATES
L. G. Romanenko *In its* Soviet Aeron., v. 21, no. 4, 1978 p 98-102 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh., (USSR), v. 21, no. 4, 1978 p 124-129 (For primary document see N80-10031 01-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

N80-10261*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN IMPROVEMENT IN FOURIER TRANSFORM ACCURACY
R. C. Bunce *In its* The Deep Space Network 15 Oct. 1979 p 155-160 (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-10847# Florida State Univ., Tallahassee. Dept. of Statistics.
LIMIT DISTRIBUTIONS OF KOLMOGOROV-SMIRNOV TYPE STATISTICS UNDER A FIXED ALTERNATIVE WITH ESTIMATED LOCATION AND SCALE PARAMETERS
Constance L. Wood (Kentucky Univ.) and R. J. Serfling Jul. 1979 18 p refs
(Contract N00014-76-C-0608)
(AD-A072159; FSU-STATISTICS-M509; ONR-TR-142) Avail: NTIS HC A02/MF A01 CSCL 12/1

Much attention has been devoted to Monte Carlo simulations of the power of Kolmogorov-Smirnov type goodness-of-fit statistics when nuisance parameters of the hypothesized distribution are estimated. Here we consider the asymptotic behavior of such statistics at fixed alternatives when location and scale parameters are estimated. It is shown that suitably normalized Kolmogorov-Smirnov statistics converge in distribution to Gaussian-related random variables depending on the alternative distribution and the maximum deviation between the null and alternative distribution functions. The work of Raghavachari is thus extended from simple hypotheses to the case of composite hypotheses with estimated nuisance parameters. GRA

N80-10848# Florida State Univ., Tallahassee. Dept. of Statistics
ON RATES OF CONVERGENCE IN THE L2 NORM OF NONPARAMETRIC PROBABILITY DENSITY ESTIMATES
K. F. Cheng and R. J. Serfling Jul. 1979 15 p refs
(Contract N00014-76-C-0608)
(AD-A072134; FSU-STATISTICS-M506; ONR-TR-139) Avail: NTIS HC A02/MF A01 CSCL 12/1

For estimation of a probability density function f by an empirical probability density function f sub n based on a sample of size n from f, a useful measure of distance is the L2-norm. Considerable study of the rate of mean square convergence of abs. val. (f sub n-f) to 0 has taken place. This paper investigates the rate of almost sure convergence of abs. val. (f sub n-f) to 0. Application to certain estimation problems in nonparametric inference is discussed. GRA

N80-10849# Florida State Univ., Tallahassee. Dept. of Statistics.
CONVERGENCE RATE FOR THE MEAN INTEGRATED SQUARED ERRORS OF SOME NONPARAMETRIC DENSITY ESTIMATORS OF RECURSIVE DELTA-FUNCTION TYPE
E. P. Cheng and R. J. Serfling Jul. 1979 15 p refs
(Contract N00014-76-C-0608)
(AD-A072133; FSU-STATISTICS-M505; TR-138-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

For estimation of a probability density function f by an empirical function f sub n based on a sample of size n from f, a widely used measure of goodness is the mean integrated squared error. For the well known delta-function type of f sub n, we show that the asymptotic behavior of this measure is essentially unchanged if f sub n is replaced by a recursive version. Also, we characterize this asymptotic behavior under somewhat milder smoothness restrictions on f than previously considered in the literature, at the expense however of adding tail restrictions GRA

N80-10850# Florida State Univ., Tallahassee. Dept. of Statistics.
A VARIATION ON SCHEFFE'S THEOREM WITH APPLICATION TO NONPARAMETRIC DENSITY ESTIMATION
R. J. Serfling May 1979 11 p refs
(Contract N00014-76-C-0608)
(AD-A072132; FSU-STATISTICS-M502; TR-137-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

For probability density functions (f sub n) and f defined on a d-dimensional Euclidean space, Scheffe proved the useful result that pointwise convergence of f sub n to f implies convergence in the mean as well. In some applications it is of interest to know the rate of the mean convergence, and, in particular, to connect it with the rate of the uniform pointwise convergence. A basic lemma of this type is derived and applied to some problems in nonparametric density estimation. GRA

N80-10851# Los Alamos Scientific Lab., N. Mex.
BIVARIATE DISTRIBUTIONS WITH GIVEN MARGINALS AND FIXED MEASURES OF DEPENDENCE
Mark E. Johnson and Aaron Tenenbein (New York Univ., N. Y.) Mar. 1979 25 p refs
(Contract W-7405-eng-36)
(LA-7700-MS) Avail: NTIS HC A02/MF A01

Two systematic approaches are given for constructing continuous bivariate distributions with specified marginals and fixed dependence measures. Both approaches are based on linear combinations of independent random variables and result in bivariate distributions, which can attain the Frechet bounds. The dependence measures considered are the grade correlation coefficient and Kendall's tau. The joint distributions obtained are compared to those of earlier authors. Applications to testing for sensitivity in simulation models are discussed. DOE

N80-10040# Allerton Press, Inc., New York, N. Y.
FIELD STATE ESTIMATION BY LEAST SQUARES
G. L. Degtyarev *In its* Soviet Aeron., v. 21, no. 4, 1978 p 43-47 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats Tekh., (USSR), v. 21, no. 4, 1978 p 43-47 (For primary document see N80-10031 01-01)
Avail: Allerton Press, Inc., 150 Fifth Avenue, New York, N. Y. 10011; $45.00

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-10852*# ECON, Inc., Princeton, N. J.
THE REQUIREMENTS AND FEASIBILITY OF BUSINESS PLANNING IN THE OFFICE OF SPACE AND TERRESTRIAL APPLICATIONS
Joel S. Greenberg and B. P. Miller 22 Mar. 1979 265 p refs
(Contract NASw-3047)
(NASA-CR-162388; Rept-79-278-2) Avail: NTIS HC A12/MF A01 CSCL 12B

The feasibility of applying strategic business planning techniques which are developed and used in the private sector to the planning of certain projects within the NASA Office of Space and Terrestrial Applications was assessed. The methods of strategic business planning that are currently in use in the private sector are examined. The typical contents of a private sector strategic business plan and the techniques commonly used to develop the contents of the plan are described, along with modifications needed to apply these concepts to public sector projects. The current long-range planning process in the Office of Space and Terrestrial Applications is reviewed and program initiatives that might be candidates for the use of strategic business planning techniques are identified. In order to more fully illustrate the information requirements of a strategic business plan for a NASA program, a sample business plan is prepared for a hypothetical Operational Earth Resources Satellite program. A.R.H.

N80-10853# Radio Corp. of America, Palo Alto, Calif.
METHOD OF TIME SERIES MODELLING, PARAMETER AND STATE ESTIMATION OF NONLINEAR SYSTEMS
Harold Schneider 23 Jul. 1979 71 p refs Backup document for AIAA Synoptic scheduled for publication in the Journal of Guidance and Control, Mar. - Apr. 1980
Avail: NTIS HC A04/MF A01

Analytical spline algorithms are presented for obtaining weighted least squares estimates for states of a nonlinear system of nth order differential equations whose functional state dependence is largely unknown and whose measured states are corrupted by zero mean uncorrelated noise. The algorithms are general and flexible. The spline series accurately represents complex state functional dependence in the time domain using relatively few terms. K.L.

N80-10854*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF QUEUEING MODELS TO MULTIPROGRAMMED COMPUTER SYSTEMS OPERATING IN A TIME-CRITICAL ENVIRONMENT
Dave E. Eckhardt, Jr. Washington Oct. 1979 22 p refs
(NASA-TM-80143; L-13209) Avail: NTIS HC A02/MF A01 CSCL 09B

A model of a central processor (CPU) which services background applications in the presence of time critical activity is presented. The CPU is viewed as an M/M/1 queueing system subject to periodic interrupts by deterministic, time critical process. The Laplace transform of the distribution of service times for the background applications is developed. The use of state of the art queueing models for studying the background processing capability of time critical computer systems is discussed and the results of a model validation study which support this application of queueing models are presented. Author

N80-10998# Joint Publications Research Service, Arlington, Va.
PRINCIPLES OF ERGONOMIC STANDARDS DISCUSSED
V. Munipov *In its* USSR Report: Biomedical and Behavioral Sci., No. 112 23 Jul. 1979 p 47-54 refs Transl. into ENGLISH from Obshchestvennye Nauki (Moscow), no. 3, 1979 p 175-181 (For primary document see N80-10993 01-99)
Copyright. Avail: NTIS HC A06/MF A01

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-10855# Stanford Univ., Calif. Dept. of Computer Science.
MATRIX INVERSE EIGENVALUE PROBLEM FOR PERIODIC JACOBI MATRICES
D. L. Boley and G. H. Golub Dec. 1978 17 p Presented at the 4th Conf. on Basic Probl. of Numerical Analysis, Pilsen, Czechoslovakia, Sep. 1978
(Contract EY-76-S-03-0326-030)
(STAN-CS-78-684) Avail: NTIS HC A02/MF A01

A stable numerical algorithm is presented for generating a periodic Jacobi matrix from two sets of eigenvalues and the product of the off-diagonal elements of the matrix. The algorithm requires a simple generalization of the Lanczos algorithm. It is shown that the matrix is not unique, but the algorithm will generate all possible solutions. DOE

N80-10856# Florida State Univ., Tallahassee. Dept. of Physics.
GENERAL RELATIVISTIC GRAVITATION AS THE THEORY OF BROKEN SYMMETRY OF INTRANSITIVE GROUPS OF TRANSFORMATIONS
L. Halpern Jul. 1979 9 p refs Presented at the Integrative Conf. on Group Theory and Math. Phys., Austin, Tex., 11-16 Sep. 1978
(Contract EY-76-C-03-0515)
(SLAC-Pub-2167; Conf-780970-4) Avail: NTIS HC A02/MF A01

General relativistic gravitational theories are constructed from

suitable intransitive continuous groups of transformations. A minimal invariant variety forms the unperturbed universe. The formalism of the group is generalized to have the symmetry of its action on this manifold broken by gauge potentials. The theory is expressed in these potentials, and it is shown how the present symmetry breaking is related to a general metric. The physical interpretation of the formalism is outlined. DOE

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-10857# California Univ., Livermore. Lawrence Livermore Lab.
HIGH TEMPERATURE SCIENCE: FUTURE NEEDS AND ANTICIPATED DEVELOPMENT IN HIGH-DENSITY SHOCK-WAVE RESEARCH
M. Ross, T. J. Ahrens, and W. J. Nellis 7 Mar. 1979 22 p
(Contract W-7405-eng-48)
(UCID-18072) Avail: NTIS HC A02/MF A01

Shock-wave experiments on condensed matter currently achieve pressures up to 5 Mbar, and temperatures over 20,000 K. Ultra high shock wave methods examined include the use of high powered lasers, electric guns, rail guns, and nuclear explosions. Space shuttle based compression studies and isentropic compression are discussed, as well as, the use of current driver technology in initiatives related to spectroscopy, optical properties, expanded metals research, and flash X-ray diffraction. A.R.H.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-10858 Rochester Univ., N. Y.
THEORY OF PHONON ECHOES IN INSULATORS Ph.D. Thesis
Charles Frank Gaumond 1979 95 p
Avail: Univ. Microfilms Order No. 7922932

The equation of motion for acoustic waves, including the nonlinear effects of a strain dependent dielectric constant in an insulator is examined. The time behavior of these acoustic waves when the material is immersed in a homogeneous time varying electric field is discussed. This behavior is shown to produce time reversed echoes when the electric field is pulsed. Dissert. Abstr.

N80-10859*# Utah Univ., Salt Lake City.
THE EFFECT OF THE DURATION OF JET AIRCRAFT FLYOVER SOUNDS ON JUDGED ANNOYANCE
Kevin P. Shepherd Sep. 1979 71 p refs
(Grant NsG-1272)
(NASA-CR-159132) Avail: NTIS HC A04/MF A01 CSCL 20A

The effect of the duration of jet aircraft flyover sounds on humans and the annoyance factor are examined. A nine point numerical category scaling technique is utilized for the study. Changes in the spectral characteristics of aircraft sounds caused by atomospheric attenuation are discussed. The effect of Doppler shifts using aircraft noises with minimal pure tone content is reported. The spectral content of sounds independent of duration and Doppler shift are examined by analysis of variance. A.W.H.

N80-10860# Texas Univ. at Austin. Applied Research Lab.
HIGH INTENSITY SOUND RESEARCH, 1961-1978 Final Report, 1 Nov. 1975 - 31 Oct. 1978
David T. Blackstock Jun. 1979 77 p refs
(Contract F44620-76-C-0040; AF Proj. 2307)
(AD-A072550; ARL-TR-79-36; AFOSR-79-0906TR) Avail: NTIS HC A05/MF A01 CSCL 20/1

Although the present contract covers only a three-year period, research on high-intensity sound was continuously supported by AFOSR for 17 years, that is since 1961. For completeness, therefore, work done under four predecessor contracts is also reviewed. Throughout the 17 year period, the primary goal was to investigate nonlinear effects in the behavior of very intense sound. Despite its fundamental nature, the research was carried out with a view toward applications in national defense and technology, for example, the sonic boom, intense aircraft noise, and sonar. A complete chronological bibliography of all papers and reports pertaining to all five contracts is included. The previous contract numbers were: AF49(638)-1118, AF49(638)-1320, F44620-69-C-0044, and F44620-71-C-0015. GRA

N80-10861# Ohio State Univ. Research Foundation, Columbus.
SCATTERING OF ACOUSTIC WAVES BY ELASTIC AND VISCOELASTIC OBSTACLES OF ARBITRARY SHAPE IMMERSED IN A FLUID Technical Report, 1 Oct. 1978 - 31 May 1979
Bo A. Peterson, Vasundara V. Varadan, and Vijay K. Varadan Jun. 1979 44 p refs
(Contract N00014-78-C-0559)
(AD-A072274; OSURF-761251/711374) Avail: NTIS HC A03/MF A01 CSCL 20/1

A scattering or T-matrix approach is presented for studying the scattering of acoustic waves by elastic and viscoelastic obstacles immersed in a fluid. A Kelvin-Voigt model is used to obtain the complex elastic moduli of the viscoelastic solid. The T-matrix formulation is somewhat complicated because the wave equations and fields are quite different in the solid and fluid regions and are coupled by continuity conditions at the interface. We have obtained fairly extensive numerical results for prolate and oblate spheroids for a variety of scattering geometries. The backscattering, bistatic, absorption and extinction cross-section are presented as a function of the frequency of the incident wave. GRA

N80-10862# Naval Research Lab., Washington, D. C.
ACOUSTIC FLUCTUATION WORKSHOP: TECHNICAL REVIEW, EDITORIAL SUMMARY, SYNOPSIS AND PAPERS, VOLUME 1 Final Report
S. Hanish, C. R. Rollins, and J. Cybulski 12 Jul. 1978 197 p refs Workshop held in Washington, D. C., 22-23 Feb. 1978
(XF11121200)
(AD-A072309; NRL-MR-3884-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 20/1

A Workshop on Acoustic Fluctuations in the Ocean, sponsored by NAVELEX320 was held at the Naval Research Laboratory, Washington, D.C., on February 22-23, 1978. The theme was to highlight the relation between requirements of system performance models (APSURV, PSEUDO, APAIR, etc.) and current research on acoustic fluctuations conducted by Industry and the Navy, to find ways to establish closer cooperation between Researchers working in the fields, and Users of research results, and to recommend programs. This memorandum summarizes the agenda and key technical issues of the Workshop, and contains all papers presented. It also gives a brief history or previous Workshops on this subject, and a technical review of acoustic fluctuations in general. Recommendations for programs are scheduled to be made available in a separate publication. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-10863 Rochester Univ., N. Y.
PROTON DEUTERON ELASTIC SCATTERING FROM 20 TO 220 GeV/c Ph.D. Thesis
Gary David Warren 1979 114 p
Avail: Univ. Microfilms Order No. 7922969

A deuteron gas jet was the target and the recoil deuterons were detected at large angles from the forward direction with a spectrometer employing a superconducting dipole and quadrupole doublet. A total of 5 x 10 to the 5th power recoil deuterons

were recorded for incident momenta from 20 to 220 GeV/c and with four-momentum transfer squared, in the range .6 < t < 3.0 sq (GeV/c). From these, approximately 150 differential cross sections were obtained. The results disagree with simple Glauber model predictions, and are typically significantly less than the predictions. The bulk of the data can be understood by adding corrections for the space-time development of the strong interaction to the Glauber model. Dissert. Abstr.

N80-10864 Vanderbilt Univ., Nashville, Tenn.
DIMUON PRODUCTION IN 15.5 GeV/c PION P INTERACTIONS Ph.D. Thesis
Ronald Edwin Cassell 1979 98 p
Avail: Univ. Microfilms Order No. 7922162

Prompt muon pair production in 15.5 GeV/c pi-rho interactions is described. The muon pairs are observed before they traverse an absorber yielding a mass resolution of the muon pair, and allowing a study of the charged hadrons accompanying muon pair production. A history of the field of prompt lepton production is presented, and the experimental apparatus is described. An account of the analysis procedure used to identify prompt muons is reported, along with the results of the analysis. Inclusive distributions of the muon pair, distributions of the charged hadrons accompanying the muon pair, and dimuon distributions from exclusive channels are discussed. Dissert. Abstr.

N80-10865 Colorado Univ. at Boulder.
SEMICLASSICAL QUANTIZATION OF NONSEPARABLE HAMILTONIAN SYSTEMS Ph.D. Thesis
Charles Jaffe 1979 152 p
Avail: Univ. Microfilms Order No. 7923251

The methods for the primitive and uniform semiclassical quantization of nonseparable Hamiltonian systems are developed. The transformation of integrable nonseparable Hamiltonians to angle action variables by a sequence of Van Vleck transformations is described. The calculation of the primitive semiclassical eigenvalues by evaluating the transformed Hamiltonian at the quantized values of the actions is discussed. The uniform semiclassical eigenvalues, found by numerical evaluation of the uniform semiclassical quantization condition are calculated. Dissert. Abstr.

N80-10866*# National Aeronautics and Space Administration, Washington, D. C.
ELEMENTS OF THE THEORY OF MOLECULAR SPECTRA
L. A. Gribov Oct. 1979 44 p refs Transl. into ENGLISH of "Elementy Teorit Molekulyarnykh Spectrov", Rept. PR-461 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1979 p 1-42 Original language document was announced as A78-15221 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75686; PR-461) Avail: NTIS HC A03/MF A01 CSCL 20H

The basic aspects of the theory concerning the spectra of multiatomic molecules are presented. The classification of the forms of motions in a molecule, the methods for determining the corresponding Schroudinger levels, the spectral types and the selection rules are discussed in order to identify their presence and state in outer space. M.M.M.

N80-10867# Washington Univ., Seattle. Dept. of Chemistry.
TRANSIENTS IN VIBRATIONAL RELAXATION OF POLYATOMIC MOLECULES AT HIGH TEMPERATURES BY THE VARIABLE ENCOUNTER METHOD
M. C. Flowers, D. F. Kelley, F. C. Wolters, and B. S. Rabinovitch Jun. 1979 7 p refs Sponsored in part by NSF
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A070774; NR092-549-TR07) Avail: NTIS HC A02/MF A01 CSCL 07/4

Temperature dependence of vibrational energy transfer efficiency in high temperature gas systems is described. The Variable Encounter Method is applied to the study of the transient region in vibrational accommodation of cyclobutane at high temperature surfaces. Collision efficiency declines with rise of temperature. Surface collisions are more efficient than binary gas phase encounters. GRA

N80-10868# Louisiana State Univ. and A&M Coll., Baton Rouge. Dept. of Physics and Astronomy.
ELECTRON EXCITATION CROSS SECTIONS FOR MULTIPLY CHARGED IONS Progress Report, 1 Mar. 1978 - 28 Feb. 1979
R. J. W. Henry and J. Callaway 1978 8 p refs
(Contract EY-76-S-05-4881)
(ORO-4881-23) Avail: NTIS HC A02/MF A01

Collision strengths for electron impact excitation of helium-like ions were calculated for energies up to five times threshold energy for transitions 1S1-2S3, 2S1, 2P3(0), and 2P1(0). Results were obtained in a five state close coupling approximation for helium-like Li, C, O, and Si. Isoelectronic fits to the collision strength data were given. Cross sections for the electron impact excitation of the 2p/sub 1/2/ and 2p/sub 3/2/ states of the lithium-like ions C, Fe, Mo, and W were calculated in a relativistic Coulomb-Born approximation for energies up to ten times the 2p/sub 3/2/ threshold. An interpolation formula was presented which permits the estimation of these cross sections for similar ions of intermediate charges. The effect of an external electric field on the photodetachment of H(-) was calculated. DOE

N80-10869# California Univ., Berkeley. Lawrence Berkeley Lab.
IMPACT OF STORAGE RINGS ON ELEMENTARY PARTICLE PHYSICS
G. H. Trilling Mar. 1979 8 p Presented at the IEEE Particle Accelerator Conf., San Francisco, 12 Mar. 1979
(Contract W-7405-eng-48)
(LBL-8908; Conf-790327) Avail: NTIS HC A02/MF A01

Discoveries in elementary particle physics and the development of the art and science of making high-energy accelerators are related. It is almost twenty-five years since the construction of the Bevatron made possible the discovery of the antiproton; and, since that time, knowledge and understanding of particle physics has made enormous strides in step with developments in both the acclerator and the detector arts. How intimately many the recent advances are associated with success in the development of storage rings and colliding beams is assessed. DOE

N80-10870# Arizona Univ., Tucson.
DIFFRACTION DISSOCIATION OF HIGH ENERGY PROTON ON HELIUM
E. Jenkins, A. Bujak, A. Devensky, A. Kuznetsov, B. Morozov, V. A. Nikitin, P. Nomokonov, Y. Philipenko, A. Sandaez, V. Smirnov et al 1978 5 p refs Presented at 19th Conf. on High Energy Phys., Tokyo, 23 Aug. 1978 Prepared in cooperation with Joint Inst. for Nucl. Res., Dubna, (USSR) and Fermi Natl. Accelerator Lab., Batavia, Ill.
(Contract EY-76-C-02-3000)
(CONF-780826-10) Avail: NTIS HC A02/MF A01

Preliminary results are presented from a measurement of the inclusive process p + He(4) yields X + He(4) in the region .04 < or = /t/ < or = .5 sq(GeV/c) and sq Mx < or = 12 Ge sq V for five incident proton momenta from 48 to 400 GeV/c. In this region the differential cross section sq d epsilon/dt sq Mx shows at dependence of the type e /sup b/ 1 /sup t/ + de /sup b/ 2 /sup t/ and a dominant 1/sq Mx behavior for sq Mx > 5 Ge sq V. The measurement was performed at Fermilab by detecting slow recoil alpha particles from helium gas jet target placed at the internal beam of the accelerator. DOE

N80-10871# Arizona Univ., Tucson.
PROTON-HELIUM ELASTIC SCATTERING FROM 40 TO 400 GeV
E. Jenkins, A. Bujak, A. Kuznetsov, B. Morozov, V. A. Nikitin, P. Nomokonov, Y. Pilipenko, V. Smirnov, E. Malamud, M. Miyajima et al 1978 31 p refs Presented at 19th Conf. on High Energy Phys., Tokyo, 23 Aug. 1978 Prepared in cooperation with Joint Inst. for Nucl. Res., Dubna, (USSR) and Fermi Natl. Accelerator Lab., Batavia, Ill.
(Contract EY-76-C-02-3000)
(CONF-780826-9) Avail: NTIS HC A03/MF A01

The elastic proton-helium differential cross sections were determined for 5 different incident laboratory energies from 40 to 400 GeV in the range 0.003 < t' absolute value

< 0.52 sq(GeV/c). The differential cross section drops 4 to 5 orders of magnitude to the first dip at t absolute value = 0.22. A Glauber analysis is performed on the data. The inelastic intermediate states are found to be important. The shrinkage of the slope of the differential cross section is measured. The rate of shrinkage is twice as large as in the p-p case. Results on the real part of the elastic scattering amplitude at forward angle and at the dip structure (t absolute value = to or approximately 0.22) are presented. DOE

N80-10872# Ohio Univ., Athens.
STUDY OF STRUCTURE OF LIGHT NUCLEI WITH NEUTRONS Progress Report, 1 Sep. 1977 - 30 Aug. 1978
Raymond O. Lane 1978 56 p refs
(Contract EY-76-S-02-2490)
(COO-2490-9) Avail: NTIS HC A03/MF A01

The series of measurements of neutron elastic differential cross sections for 4 MeV < or = E/sub n/ < or = 8 MeV is nearing completion. New elastic measurements for C-13 + n (1.57 MeV < or = E/sub n < 6.5 MeV) were completed, and these results are being studied with the R-matrix analysis program ORMAP. Elastic measurements for B-11 + n for 2 MeV < E/sub n/ < 4 MeV completed, and these results along with the earlier measurements from 4 MeV < or = E/sub n/ < 8 MeV are being used in a comprehensive analysis of B-11 + n from 0 to 8 MeV. This analysis should be completed by early fall. Inelastic measurements on these same light nuclei have begun, with differential cross sections for Li-7 + n (0.478 MeV level) completed at 2.3 and 2.8 MeV. DOE

N80-10873# Sandia Labs., Livermore, Calif.
PRODUCTION OF HYDROGEN, DEUTERIUM, AND HELIUM BY 15-MeV NEUTRONS
R. C. Haight, S. M. Grimes, K. R. Alvar, and H. H. Barschall 1978 7 p refs Prepared jointly with Wisconsin Univ., Madison
(Contract EY-76-S-02-2719)
(COO-2719-5; Conf-781105-49) Avail: NTIS HC A02/MF A01

Measurements were made of the hydrogen and helium production cross sections for both natural elements and separated isotopes which are constituents of metal under consideration for the first wall of fusion reactors. Results are applicable to the study of radiation damage to the first wall of a fusion reactor caused by hydrogen and helium produced in nuclear transmutations. The results of all measurements of reaction cross sections are summarized in tabular form. J.M.S.

N80-10874# Ames Lab., Iowa.
ANALYSIS AND COMPUTERIZED FITTING OF THE LINESHAPE OF THE NMR POWDER PATTERN
P. Dubois Murphy and Bernard C. Gerstein Oct. 1978 124 p refs
(Contract W-7405-eng-82)
(IS-4516) Avail: NTIS HC A04/MF A01

A derivation is presented of the theoretical lineshape of the NMR powder pattern. The effects of broadening and the finite value of the discontinuity are discussed. A graphical convolution technique is described. FORTRAN IV computer programs which will fit the lineshape (one or two tensors) to experimental data by the nonlinear least-squares method are presented. DOE

N80-10875# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
MECHANISMS OF PROTON STABILITY AND DECAY IN UNIFIED MODELS
R. Slansky 1978 16 p refs Presented at Sem. on Proton Stability, Madison, Wisc., 8 Dec. 1978
(Contract W-7405-eng-36)
(LA-UR-79-361; Conf-781243-1) Avail: NTIS HC A02/MF A01

Proton stability is reviewed in the context of the Yang-Mills theories that unify electromagnetic, weak, and strong interactions with a simple Lie group G. The possibility of making the proton exactly stable or giving it a finite, but long lifetime, is discussed. Mechanisms for both possibilities are described. DOE

N80-10876# Oak Ridge National Lab., Tenn.
THEORY OF ELECTRON TRANSFER AND IONIZATION
Richard L. Becker 1979 5 p refs Presented at DOE/BES Res. Meeting on High Energy Atomic Phys., Manhattan, Kan., 5 Apr. 1979
(Contract W-7405-eng-26)
(Conf-790438-1) Avail: NTIS HC A02/MF A01

Charge transfer and ionization in high energy atomic collisions is discussed. Classical trajectory calculations, quantum mechanical collision theory, and phenomenological treatments of quantal interference effects in heavy ion collisions are examined. DOE

N80-10877# California Univ., Livermore. Lawrence Radiation Lab.
HIGH PEAK POWER PULSED WIP ELECTRON GUN Final Report, 1 Apr. - 1 Oct. 1978
G. Wakalopulos 1978 35 p
(Contract W-7405-eng-48)
(UCRL-13950) Avail: NTIS HC A03/MF A01

Experience in high power high pressure CO2 lasers resulted in the development of an electron gun capable of either pulsed or CW operation at current densities that can be varied by six orders of magnitude by a modulator at ground potential. This device, called the wire iron plasma (WIP) electron gun, was orginally developed for a CW airborne electrodynamic laser to improve the overall reliability, lifetime and ruggedness of E-beam pumped lasers. The following results were demonstrated: (1) pulse widths of less than 200 nsec are readily attainable at 150 kV and 1A/sq cm, (2) grid modulation is feasible but not necessary to obtain short pulses; and (3) high repetition rate (10 KHZ) operation is feasible, i.e., the plasma decays between pulses. DOE

N80-10878# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy.
DEVELOPMENT AND TESTING OF A THREE-STAGE DOUBLE TANDEM ACCELERATOR-DECELERATOR SYSTEM FOR LOW ENERGY, HIGHLY STRIPPED IONS Progress Report, 1 Mar. 1978 - 28 Feb. 1979
James E. Bayfield Nov. 1978 36 p refs
(Contract EG-77-S-02-4257)
(COO-4257-3) Avail: NTIS HC A03/MF A01

Three-stage operation of the University of Pittsburgh accel decel double tandem source of highly stripped ion beams is described. The system produced O(+5), O(+6), O(+7), and O(+8) ions at specific energies as low as 15 keV per AMU. The design of the new decelerator tubes is discussed. The present performance and limitations of the overall system are outlined. Some new charge exchange cross sections were measured, for combined higher ion charge states and lower ion energies than heretofore was possible. Future four-stage operation with very heavy ions is considered. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-10879 Indiana Univ., Bloomington.
INTERMEDIATE ENERGY, INELASTIC, AND CHARGE EXCHANGE NUCLEON-NUCLEUS SCATTERING Ph.D. Thesis
Alan Picklesimer 1979 117 p
Avail: Univ. Microfilms Order No. 7921304

The cross section, asymmetry, and polarization data for elastic, inelastic, and charge exchange nucleon-nucleus scattering at intermediate energies is examined. The structure of nuclei and the reaction mechanisms of strongly interacting systems is studied. Arguments for the applicability of the distorted wave t-matrix approximation to the reaction mechanism are given. Three ingredients for theoretical calculations, the transition operator, the optical potential, and the requisite nuclear structure information, are discussed. The generation of an optical potential from

first order multiple scattering theory is described and results for the antisymmetrization terms are analyzed. Dissert. Abstr.

N80-10880 Illinois Univ. at Chicago Circle, Chicago.
MICROSCOPIC CLASSICAL EQUATIONS OF MOTION CALCULATIONS OF HIGH-ENERGY HEAVY-ION COLLISIONS Ph.D. Thesis
Constantine N. Panos 1979 253 p
Avail: Univ. Microfilms Order No. 7923025

Classical microscopic nonrelativistic calculations for collisions between equal mass nuclei projectile and target and between nuclei are discussed. The trajectories of all nucleons are calculated classically with two body forces between all pairs of nucleons. The implementation of the classical equations of motion calculations is presented and four aspects, the choice of the 2 body potentials, choice of initial configurations, the A body trajectory calculations, and the analysis of these are investigated. Dissert. Abstr.

N80-10881# Virginia Univ., Charlottesville. Dept. of Physics.
EXPERIMENTS ON THE NUCLEAR INTERACTIONS OF PIONS Progress Report, 1 Dec. 1977 - 30 Nov. 1978
R. C. Minehart and K. O. H. Ziock 1978 42 p refs
(Contract EY-76-S-05-4043)
(ORO-4043-38) Avail: NTIS HC A03/MF A01

Experimental research in pion reactions is summarized. A list of publications is included. DOE

N80-10882# Texas Univ., Austin. Center for Particle Theory.
PRODUCTION AND DETECTION OF NEW NEUTRINOS
D. A. Dicus, E. W. Kolb, H. J. Lubatti, and V. L. Teplitz Oct. 1978 42 p refs
(Contract EY-76-S-05-3992)
(ORO-3992-346) Avail: NTIS HC A03/MF A01

The implications of an electromagnetic transition moment for production and decay of massive neutral leptons are considered. Rates for disconnected gamma and disconnected e(+) e(-) pair events from electromagnetic production and decay of Nu sub H are calculated. Production is considered both in the neutrino beam shielding and production in the detector apparatus. The rates expected from three classes of plausible models are compared with the rates that are detected by present generation experiments. DOE

N80-10883# Stanford Linear Accelerator Center, Calif.
HEAVY LEPTON PHENOMENOLOGY
M. L. Perl Nov. 1978 59 p refs
(Contract EY-76-C-03-0515)
(SLAC-Pub-2219) Avail: NTIS HC A04/MF A01

An empirical definition of a charged lepton is presented using the properties of the electron and muon. For this purpose the evidence is surveyed that the electron and muon are elementary particles without constituents. Some of the evidence is discussed that these particles do not partake of the strong interactions. A similarly empirical discussion is given of neutrinos. Only enough theory is given to provide a basis for the discussion of the tau lepton, for which the properties and areas for future research are considered. Limits are reviewed from past searches on the existence of other types of heavy leptons, and the extensions of such searches are discussed. DOE

N80-10884# Sandia Labs., Albuquerque, N. Mex. Fuel Cycle Risk Analysis Div.
RISK METHODOLOGY FOR GEOLOGIC DISPOSAL OF RADIOACTIVE WASTE: THE SANDIA WASTE ISOLATION FLOW AND TRANSPORT (SWIFT) MODEL
R. T. Dillon, Ronald B. Lantz (INTERA Environ. Consultants, Inc.), and Suresh B. Pahwa (INTERA Envrion. Consultants, Inc.) Oct. 1978 108 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1267; NUREG-CR-0424) Avail: NTIS HC A06/MF A01

A three-dimensional finite difference model (SWIFT) developed to simulate the transport by ground water of trace concentration of radioisotopes is described. The model was developed for use in the analysis of deep geological nuclear waste disposal facilities. It is based upon an existing model which treats the injection of liquid chemical wastes into deep saline aquifers. Complete documentation of SWIFT is provided. Comparison of SWIFT results with the analytical solution for constant velocity and diffusivity condition and with the ORIGEN code results for static conditions is presented. A discussion of possible future developments is given. DOE

N80-10885# Georgia Univ., Athens. Dept. of Physics and Astronomy.
SUBGROUP REPORT ON ALTERNATIVE TECHNOLOGY STRATEGIES FOR THE ISOLATION OF NUCLEAR WASTE
Oct. 1978 241 p refs
(TID-28818) Avail: NTIS HC A11/MF A01

Programmatic approaches to the disposal of high level and transuranic contaminated wastes are discussed. The dimensions and types of nuclear wastes are examined and the problem of waste management is addressed. Candidate technologies for nuclear waste disposal are emplacement in mined repositories, emplacement in ocean sediments, emplacement in deep drill holes, and ejection into space. A.W.H.

N80-10886# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM
R. D. Baker, comp. Sep. 1978 38 p
(Contract W-7405-eng-36)
(LA-7560-PR) Avail: NTIS HC A03/MF A01

Studies related to the use of (Pu-238)O2 in radioisotopic power systems carried out for the Advanced Systems and Materials Division by the Los Alamos Scientific Laboratory are discussed. DOE

N80-10887# California Univ., Berkeley. Lawrence Berkeley Lab.
NEW PARTICLES, THEORETICAL
J. D. Jackson (Fermi Natl. Accelerator Lab., Batavia, Ill.), C. Quigg (Fermi Natl. Accelerator Lab., Batavia Lab., Ill.), and J. L. Rosner (Minnesota Univ., Minneapolis) Sep. 1978 56 p refs Presented at the 19th Conf. on High Energy Phys., Tokyo, 23 Aug. 1978 Submitted for publication
(Contract W-7405-eng-48)
(LBL-7977; Conf-780826) Avail: NTIS HC A04/MF A01

Various topics in high energy physics are covered. The Q anti Q interaction and charmonium, implications of the upsilon states, and weak decays of heavy quarks are included. DOE

N80-10888# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
EXPERIMENTAL JOULE-HEATED CERAMIC MELTER FOR CONVERTING RADIOACTIVE WASTE TO GLASS
Paul H. Chrismar 1978 18 p refs Presented at ANS Meeting, Washington, D. C., 12 Nov. 1978
(Contract EY-76-C-09-0001)
(DP-MS-78-59; Conf-781105-76) Avail: NTIS HC A02/MF A01

A small electric melter was developed to implement studies for converting radioactive waste to glass at the Savannah River Laboratory (SRL). During its 10 months of operation, the ceramic-lined, jouleheated melter processed simulated, high-level-waste, calcined materials and frit at rates of 2 to 15 g/min. The melt chamber is 7.6 cm wide, 22.9 cm long and 7.6 cm deep. The total power consumption is 3.5 KVA when the glass processing temperature is 1150 C. A similar unit will be in operation in FY-1979 in the SRL high-level cells. DOE

N80-10889# Idaho National Engineering Lab., Idaho Falls.
APPLICATION OF MICROWAVE ENERGY TO POST-CALCINATION TREATMENT OF HIGH-LEVEL NUCLEAR WASTES
S. J. Priebe, T. C. Piper, and J. R. Berreth Feb. 1979 34 p refs
(Contract EY-76-C-07-1570)
(ICP-1183) Avail: NTIS HC A03/MF A01

The drying of a pelleted waste and vitrifying of a calcined waste by microwave heating were investigated. Tests show pellet drying by microwave energy to be superior to drying by conventional methods. Vitrification by microwave energy gave a uniform glass in less time than radiant energy. DOE

N80-10890/# Oak Ridge National Lab., Tenn.
DEVELOPMENT OF CERMETS FOR HIGH LEVEL RADIOACTIVE WASTE FIXATION
W. S. Aaron, T. C. Quinby, and E. H. Kobisk 1979 15 p refs Presented at the Intern. Symp. on Ceram. in Nucl. Waste Management, Cincinnati, 30 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790420-10) Avail: NTIS HC A02/MF A01

A method for the solidification and fixation of commercial and defense high-level radioactive wastes, namely a cermet process, is described. Chemical and physical processing techniques, the subsequent properties of the resulting cermet bodies, unique and advantageous features of the cermet waste form, and the conversion process are discussed. DOE

N80-10891/# Nuclear Services Corp., Campbell, Calif.
RISK ANALYSIS METHODOLOGY AND DATA: STUDY OF ALTERNATIVES FOR LONG-TERM MANAGEMENT OF HANFORD DEFENSE HIGH-LEVEL RADIOACTIVE WASTE
Sep. 1978 176 p refs
(Contract EY-77-C-06-1001)
(NSC-PS-ARH-77001) Avail: NTIS HC A09/MF A01

The risk analysis was done on a modular basis. The modules include: waste retrieval, waste preparation, waste immobilization, transportation, and storage and disposal. Based on the values obtained, it is apparent that the overall risk either to an individual or to the population is extremely low. DOE

N80-10892/# Sandia Labs., Albuquerque, N. Mex.
SAFEGUARDS METHODOLOGY DEVELOPMENT HISTORY
L. D. Chapman, H. A. Bennett, D. Engi, L. M. Grady, B. L. Hulme, and D. W. Sasser 1979 11 p refs Presented at the 1st Ann. Symp. on Safeguards and Nucl. Mater. Management, Brussels, 25 Apr. 1979
(Contract DE-AC04-76DP-00789)
(SAND-79-0059C; Conf-790430-14) Avail: NTIS HC A02/MF A01

The development of models for the evaluation and design of fixed site nuclear facility, physical protection systems is discussed. The evolution of these models and the model descriptions are presented. DOE

N80-10893/# Sandia Labs., Albuquerque, N. Mex. Theoretical Div.
MODIFIED METHOD OF PERTURBED STATIONARY STATES 1
T. A. Green Oct. 1978 106 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0235) Avail: NTIS HC A06/MF A01

The reaction coordinate approach of Mittleman is used to generalize the method of perturbed stationary states. A reaction coordinate is defined for each state in the scattering expansion in terms of parameters which depend on the internuclear separation. These are to be determined from a variational principle described by Demkov. The variational result agrees with that of Bates and McCarroll in the limit of separated atoms, but is generally different elsewhere. The theory is formulated for many-electron systems, and the construction of the scattering expansion is discussed for simple one-, two-, and three-electron system. The scattering expansion and the Lagrangian for the radial scattering functions are given in detail for a heteronuclear one-electron system. DOE

N80-10894/# California Univ., Berkeley. Lawrence Berkeley Lab.
MULTIPION PRODUCTION IN NUCLEAR COLLISIONS
Miklos Gyulassy Mar. 1979 13 p refs Presented at Intern. Conf. on Meson-Nuclear Phys., Houston, Tex., 5 Mar. 1979
(Contract W-7405-eng-48)
(LBL-8758; Conf-790347-6) Avail: NTIS HC A02/MF A01

Multipion production in nuclear collisions is discussed. The negative pion multiplicity distribution and the pi(-)pi(-) correlation function is examined. How these observables are used to search for signals of collective phenomena in nuclear collisions is investigated. DOE

N80-10895/# California Univ., Berkeley. Lawrence Berkeley Lab. Nuclear Science Div.
ROLE OF DEEP INELASTIC PROCESSES IN NUCLEAR PHYSICS: EXPERIMENTAL AND THEORETICAL ASPECTS OF DEEP INELASTIC REACTIONS
L. G. Moretto Mar. 1979 62 p refs Presented at Intern. Conf. on Dynamical Properties of Heavy Ion Reactions, Johannesburg, Aug. 1978
(Contract W-7405-eng-48)
(LBL-8936) Avail: NTIS HC A04/MF A01

The collective modes excited in deep inelastic reactions and their natural hierarchy provided by their characteristic relaxation times is described. The relaxation of the mass asymmetry mode is discussed in terms of a diffusion process. Charge distributions and angular distributions as a function of Z are calculated. The transfer of energy and angular momentum is discussed in terms of particle transfer, and is compared with gamma ray multiplicities as a function of both Q value and mass asymmetry. The angular momentum transfer is considered in connection with the sequential fission of heavy, deep inelastic fragments and the excitation of collective modes in the exit channel is considered. The role of the giant E1 mode in the equilibration of the neutron to proton ratio is discussed. DOE

N80-10896/# Stanford Univ., Calif.
EXPERIMENTAL REVIEW OF BEAM POLARIZATION IN HIGH ENERGY POSITRON ELECTRON STORAGE RINGS
R. F. Schwitters Feb. 1979 19 p refs Presented at the Symp. on High Energy Phys., Argonne, Ill, 26 Oct. 1978
(Contract EY-76-C-03-0515)
(SLAC-Pub-2258; Conf-781095-6) Avail: NTIS HC A02/MF A01

Information that is provided by beam polarization in high energy e(-)e(+) interactions, how polarized beams are produced, the experimental evidence for radiative beam polarization, and the results which were obtained to date, using polarized beams are reviewed. Prospects for beam polarization experiments in future generations of storage rings are discussed. DOE

N80-10897/# Washington State Univ., Pullman.
IMMOBILIZATION OF HAZARDOUS RESIDUALS BY ENCAPSULATION Final Report
R. V. Subramanian and R. Mahalingam Feb. 1979 212 p refs
(Grant NSF ENV-76-06583)
(PB-296642/2; NSF/RA-790046) Avail: NTIS HC A10/MF A01 CSCL 13B

The feasibility of encapsulating hazardous aqueous wastes in a water-extensible polyester matrix for land burial was demonstrated. Laboratory experiments conducted to determine the leachability of encapsulated wastes indicate that the polyester matrix can be used safely to immobilize low-level radioactive wastes. In addition, acceptable low levels of leachabilities can be achieved for solid wastes incorporated in the matrix. A polyester matrix is much more efficient than cement or urea-formaldehyde polymers in containing wastes. A pilot plant was conducted to handle 15 gal/hr liquid waste. Polymerization was readily controllable, and process upsets were easily handled. An economic evaluation of the polyester process shows it to be two-and-one-half times more expensive than its nearest competitor, the cement silicate process, the major cost item being the polyester resin. GRA

74 OPTICS

Includes light phenomena.

N80-10898 Ohio State Univ., Columbus.
THE SPHERICAL WAVE PHASE DIFFERENCE TEMPORAL POWER SPECTRA FOR LIGHT BEAMS DEGRADED BY A TURBULENT ATMOSPHERE Ph.D. Thesis
George William Reinhardt 1979 173 p
Avail: Univ. Microfilms Order No. 7922545

A general theory is developed for an arbitrary angle between the phase point measurements and the wind direction. The theory allows for wind velocity, wind direction, turbulence strength and outer scale variations along the beam path. Calculations were performed for real world wind velocities and directions, along

with typical outer scale and turbulence strength variations that are encountered along slant and vertical paths. Approximate and computer solutions for horizontal path temporal spectra are obtained in terms of a set of dimensionless variables. Calculations are performed for vertical paths along which the path variables, wind direction, wind velocity, outer scale of turbulence and turbulence strength change significantly. A three layer wind profile was developed. Both plane wave and spherical wave temporal spectra are calculated for actual radiosonde wind data. Differential path contribution data are also calculated. Dissert. Abstr.

N80-10899 Lowell Univ., Mass.
MAGNETO-OPTICAL STUDIES OF PARAMAGNETIC SYSTEMS TO DETERMINE THEIR POTENTIAL FOR USE AS CONTINOUSLY TUNABLE COHERENT FAR-INFRARED SOURCES Ph.D. Thesis
Shobhana Subhash Madan 1979 94 p
Avail: Univ. Microfilms Order No. 7923002

High resolution spectroscopic studies on paramagnetic systems having zero field splittings in the far infrared region are reported. Dependence of the transition energies on high magnetic fields (up to 50 kG) are studied for different orientations of the crystal with respect to the magnetic field. The minima of certain transitions and the splitting of some transition energies for fields above 20 kG are discussed. Variation of the transition energies as a function of magnetic field and orientation using an 8 by 8 numerical Hamiltonian matrix is examined.
Dissert. Abstr.

N80-10900 Rochester Univ., N. Y.
DESIGN, ENGINEERING, AND MANUFACTURING ASPECTS OF GRADIENT INDEX OPTICAL COMPONENTS Ph.D. Thesis
Stephen Dennis Fantone 1979 330 p
Avail: Univ. Microfilms Order No. 7922929

The fifth order aberration coefficients for gradient index lenses derived using Lagrangian methods are discussed. The aberrations of lenses containing spherical gradients are considered. The radius of curvature of the gradient is demonstrated to be an extra degree of freedom. The fabrication process of gradient materials is studied and models are devised for describing the refractive index, spectral, and mechanical properties of gradient index materials. Dissert. Abstr.

N80-10901 Rochester Univ., N. Y.
FRUSTRATED TOTAL REFLECTION POLARIZER FOR THE INFRARED Ph.D. Thesis
David Eric Berman Lees 1979 151 p
Avail: Univ. Microfilms Order No. 7922944

Middle infrared polarizers are reviewed and a polarizer based on the differential phase shift upon reflection from a frustrated total reflection layer is described. A design technique developed for multiple cavity frustrated total reflection polarizers is discussed. A numerical example of polarizer design is given. The fabrication and testing of a three cavity frustrated total reflection polarizer working at carbon dioxide laser wavelengths is described.
Dissert. Abstr.

N80-10902 California Inst. of Tech., Pasadena.
SERRATED APERTURES: STATISTICAL DIFFRACTION THEORY AND EXPERIMENTS Ph.D. Thesis
George Michael Morris 1979 169 p
Avail: Univ. Microfilms Order No. 7922052

Diffraction of monochromatic light by rough apertures is analyzed. Correlation functions are derived for the electric field and for the intensity in the optical transform plane. Solutions are presented for serrated edges and gaps. Both space and wavelength dependences are included and solutions for cross correlations of electric field and intensity are obtained. The optical transforms of serrated and sharp edges are contrasted. The edge statistics, determined by processing the transform plane intensity measurements are discussed and edge roughness (or standard deviation), established from transform plane measurements along the central spike is examined. Dissert. Abstr.

N80-10903 Texas Univ. at Dallas, Richardson.
X-RAY TOMOGRAPHY BY OPTICAL RECONSTRUCTION FROM PROJECTIONS Ph.D. Thesis
Robert Calvin Murry 1979 205 p
Avail: Univ. Microfilms Order No. 7921339

The potential of optical reconstruction of tomograms from X-ray projection data was investigated. A linear scanning geometry, well suited to the recording of projection data onto film, was suggested. An encoding-decoding scheme for reconstruction was proposed, and some potential methods of filtering for image enhancement were introduced. The investigation of filters led to several methods of reconstruction by optical back-projection, both with and without filtering. Each of the different reconstruction techniques offered one or more of the following: (1) faster reconstruction than computerized axial tomography (CAT), (2) higher spatial resolution than CAT, (3) better contrast than conventional tomography, or (4) multiple-plane reconstruction for the same dose as a conventional tomography single-plane image. None of the optical techniques appeared to offer better contrast or a cheaper system than CAT, or to offer better resolution than conventional tomography. Dissert. Abstr.

N80-10904 Polytechnic Inst. of New York.
SECOND-ORDER PERTURBATION THEORY FOR FABRY-PEROT RESONATORS Ph.D. Thesis
John Lucien Remo 1979 111 p
Avail: Univ. Microfilms Order No. 7920799

The computation of additional power losses and phase shifts caused by perturbations of optical resonators is presented. The numerical results for flat strips, curved strips, flat discs, and curved discs are calculated and the values for the unperturbed eigenvalues and eigenfunctions for each of these configurations are determined. The diffraction power losses for tilted resonators with both circular and strip flat reflectors is computed for several tilt angles. A second order perturbation which is sinusoidally periodic for both the infinite strip reflector as well as for the circular disc reflector is determined. The computation for obtaining the scattered (radiation) power over several modes to estimate the laser resonator beam quality is discussed. Dissert. Abstr.

N80-10905 California Univ., San Diego.
AN EXPERIMENTAL STUDY OF OPTICAL PHASE FLUCTUATIONS IN A RANDOM REFRACTIVE FIELD Ph.D. Thesis
Richard Lynne Sandstrom 1979 174 p
Avail: Univ. Microfilms Order No. 7921493

The phase perturbations induced in a laser beam as it propagates 0.52 m through a thermally induced random refractive field is studied using a heated grid subsonic turbulence tunnel. A dual beam laser heterodyne interferometer is used for the phase measurements. The refractive field along two parallel ray paths is studied. Single and two path statistics over a mutual separation distance which is variable from 1 mm to about 8 cm are discussed. Theoretical integral equations relating the temperature spectrum to several statistical functions of the phase fluctuation are developed. The special case in which the temperature spectrum is represented by an inverse power-law of unspecified exponent is considered. Phase statistics measured include the root mean square, structure functions, absolute phase power spectrum, relative phase power spectrum for both longitudinal and transverse beam separations, longitudinal space time autocorrelation, phase, and coherence functions.
Dissert. Abstr.

N80-10906 Arizona State Univ., Tempe.
FEEDBACK SYSTEMS FOR IMAGE ACQUISITION AND PROCESSING Ph.D. Thesis
Nobuhiko Tamura 1979 149 p
Avail: Univ. Microfilms Order No. 7921820

The application of feedback methods to imaging systems was investigated. The methodologies that introduce a feedback loop to imaging systems were explored in two areas: (1) coherent optical feedback methods and (2) optoelectronic hybrid feedback methods. In the coherent optical feedback methods, a Fabry-Perot optical cavity, or a pair of partially reflective parallel mirrors, were used to form a feedback loop in which an optical beam with long temporal coherence traveled back and forth. In optoelectronic hybrid feedback methods, incoherent imaging optics used for convolution operations and electronics are used for subtraction operations. The dodging technique practiced by photographic technicians in the printing process is studied as an example of hybrid feedback methods. A mathematical model

is formulated and an optoelectronic model is built. The use of image transducers as active components of a hybrid feedback system are examined. Dissert. Abstr.

N80-10907*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REFRACTION CORRECTIONS FOR SURVEYING
William M. Lear (TRW) Aug. 1979 20 p refs
(NASA-TM-80803; Rept-79-FM-27; JSC-16064) Avail: NTIS HC A02/MF A01 CSCL 20F

Optical measurements of range and elevation angle are distorted by the earth's atmosphere. High precision refraction correction equations are presented which are ideally suited for surveying because their inputs are optically measured range and optically measured elevation angle. The outputs are true straight line range and true geometric elevation angle. The 'short distances' used in surveying allow the calculations of true range and true elevation angle to be quickly made using a programmable pocket calculator. Topics covered include the spherical form of Snell's Law; ray path equations; and integrating the equations. Short-, medium-, and long-range refraction corrections are presented in tables. A.R.H.

N80-10908*# National Aeronautics and Space Administration, Washington, D. C.
TEMPERATURE DEFORMATIONS OF THE MIRROR OF A RADIO TELESCOPE ANTENNA
V. I. Avdeyev, S. A. Grach, K. Kh. Kozhakhmetov, and F. I. Kostenko Jun. 1979 15 p refs Transl. into ENGLISH of "Temperaturnyye Deformatsii Sostavnogo Zerkala Antenny Radioteleskopa", Rept. PR-412 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-19 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(NASA-TM-75633; PR-412) Avail: NTIS HC A02/MF A01 CSCL 20F

The stress informed state of the mirror of an antenna, with a diameter of 3 m, for a radio interferometer used in space, and located in a temperature field is examined. The mirror represents a parabolic shell, consisting of 19 identical parts. The problem is based on representations of the thermoelasticity of thin shells. A.W.H.

N80-10909# Honeywell Systems and Research Center, Minneapolis, Minn. Systems and Research Center.
FIBER OPTICS TRANSMITTER INTEGRATED CIRCUIT DEVELOPMENT Final Report, Jun. 1976 - Dec. 1977
Ben R. Elmer Jul. 1978 130 p refs
(Contract F33615-76-C-1280; AF Proj. 6096)
(AD-A071437; F0470-FR; AFAL-TR-78-107) Avail: NTIS HC A07/MF A01 CSCL 20/6

This report describes the development of the Fiber Optic Transmitter Integrated Circuit (FOTIC) from synthesis through analysis, layout, processing, packaging, and testing the 1050 parts that were delivered. Detailed test, burn-in, and qualification plans are also included. One of the highlights of this report is an Application Information section, written to inform users of the characteristics of the device that are not apparent from reading the specification. GRA

N80-10910# North Dakota State Univ., Fargo. Dept. of Electrical and Electronics Engineering.
USE OF PREDISTORTION TO REDUCE INTERMODULATION DISTORTION IN OPTICAL FIBER COMMUNICATION SOURCES Final Report, Mar. 1978 - May 1979
Gary L. Larson and Donald A. Smith May 1979 84 p
(Grant AF-AFOSR-3554-78)
(AD-A072637; AFOSR-79-0904TR) Avail: NTIS HC A05/MF A01 CSCL 20/6

Optical fiber communication is a new technology which has the potential of surpassing conventional communication techniques in many applications. One problem area is the introduction of distortion produced by nonlinearities in the system. Light-emitting diodes, used as sources in optical communication systems, are the main contributors of the nonlinearities. A procedure for compensating for the nonlinearity of an LED is developed. An optical receiver and LED transmitter were constructed to measure the light intensity vs LED current characteristic of various LEDS. The static and dynamic characteristics of each of the LEDS were measured. A polynomial describing the dynamic characteristic is used to predict the intermodulation distortion vs percent modulation. Measurements of the intermodulation components of the received signal at different depths of modulation show a close correlation to the calculated values. A predistortion approach to compensating for the nonlinearity of the LED is pursued. Using the LED characteristic, a means of determining the parameters of the compensating network is sought. These parameters are used and measurement of the overall linearity of the system is again checked and compared to that of the uncompensated system. GRA

N80-10911# Los Alamos Scientific Lab., N. Mex.
PROPOSAL FOR THE THEORETICAL INVESTIGATION OF LIGHT-ION BEAM PROPAGATION THROUGH A RESIDUAL PLASMA ENVIRONMENT
L. E. Thode and E. L. Lindman Feb. 1979 20 p refs
(Contract W-7405-eng-36)
(LA-7590-P) Avail: NTIS HC A02/MF A01

An investigation of ion beam propagation in residual plasma is proposed in order to: (1) gain insight into the nonlinear physics of microinstabilities associated with a well collimated ion beam propagating through a plasma, (2) isolate parameter regimes where problem areas for propagation appear to exist; and (3) suggest techniques to overcome any problems. A strong interplay between theory and two dimensional, electromagnetic particle in cell simulation is emphasized. DOE

N80-10912# Los Alamos Scientific Lab., N. Mex.
FIBER OPTIC UTILIZATION AT THE NEVADA TEST SITE
P. B. Lyons, J. E. Golob, L. D. Looney, R. E. Robichaud (EG&G, Inc., Los Alamos, N. Mex.), M. A. Nelson (EG&G, Inc., Goleta, Calif.), and T. J. Davies (EG&G, Inc., Goleta, Calif.) Nov. 1978 12 p refs
(Contract W-7405-eng-36)
(LA-7029-MS) Avail: NTIS HC A02/MF A01

Optical fiber cables were successfully used for 100 MHz analog data transmission during an underground nuclear test at the Nevada Test Site. Two 700 m cables provided thirteen single fiber data channels from the vicinity of the underground detonation, 350 meters below ground level, to recording instrumentation, 350 meters from the downhole shaft. No fiber performance degradation was observed during the extensive procedures used to seal the shaft. These procedures included backfilling the shaft with layers of sand and gravel, as well as poured epoxy plugs. Techniques were developed for internal sealing of the cable to prevent any possible radioactive gas flow through voids within the cable. The effects on optical fibers of intense, pulsed neutron and gamma irradiation were studied. Specialized tools, including a system for location of faults or breaks in the optical fibers, were developed. DOE

N80-10245*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A VOLTAGE-CONTROLLED OPTICAL RADIO FREQUENCY-PHASE SHIFTER
K. Y. Lau *In its* The Deep Space Network 15 Oct. 1979 p 24-32 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20F

N80-10249*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE R SUB 0 PARAMETER FOR OPTICAL COMMUNICATION USING PHOTON COUNTING
R. J. McEliece *In its* The Deep Space Network 15 Oct. 1979 p 62-65 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-10913 Rochester Univ., N. Y.
A STUDY OF SOFT X-RAY LASER SCHEMES IN MULTI-COMPONENT LASER PLASMAS Ph.D. Thesis
Venkata Adiseshaiah Bhagavatula 1978 187 p

Avail: Univ. Microfilms Order No. 7922919

Soft X-ray population inversion studies by recombination and resonant photoexcitation processes were conducted. Highly ionized, multi component plasmas produced by high power glass laser were employed in the experiments. Population inversions, sufficient for observable gains were shown to exist at wavelengths below 140 A. Computational models were formulated to study the inversion schemes. Excited state models were used to analyze the soft X-ray inversion schemes. The hydrogenic and the helium like excited state populations for a variety of laser produced plasma parameters were determined. The excited state models, coupled with hydrodynamic and ionization codes, were used to predict temporal and spatial profiles of the electron temperature and densities, resultant population inversions and gains in helium like and hydrogen like ions of Mg and Al. Dissert. Abstr.

N80-10914*# National Aeronautics and Space Administration, Washington, D. C.

ESTABLISHMENT OF THE SPECTRA OF KINETIC TURBULENCE

L. A. Bolshov, A. M. Dykhne, V. P. Kiselev, and A. Kh. Pergament Aug. 1979 28 p Transl. into ENGLISH of "Ustanovleniye Spektrov Kineticheskoy Turbulentinosti" (Moscow), Preprint no. 31, 1979 30 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Academy of Sciences (USSR), Moscow

(Contract NASw-3199)

(NASA-TM-75666) Avail: NTIS HC A03/MF A01 CSCL 20I

An analysis of kinetic equations describing the establishment of Langmuir turbulence spectra is presented. Secondary turbulence occurs where stationary distribution consists of many peaks. The position of peaks is established and their amplitudes complete undamped oscillations. It is pointed out that establishing spectra can occur only during adiabatic inclusion of pumping. It is significant here that the adiabatic condition is more rigid than the ordinary by several hundred times. R.E.S.

N80-10915*# National Aeronautics and Space Administration, Washington, D. C.

NUMERICAL EXPERIMENTS ON THE THETA PINCH

P. P. Volosevich and G. G. Zukakishyili Oct. 1979 18 p refs Transl. into ENGLISH of "Chislennyye Eksperimenty po Teta-Pinchu", Prep. No. 47 Acad. of Sci. USSR, Inst. of Appl. Math., Moscow, 1979 p 1-30 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75694) Avail: NTIS HC A02/MF A01 CSCL 20I

Numerical calculation of theta pinch problems are presented. Physical processes in theta pinch systems are considered in a one dimensional, two temperature magnetohydrodynamic, approximation with allowance for end losses by longitudinal heat conductivity. The numerical calculations are compared with results of earlier experiments. A.W.H.

N80-10916# Sandia Labs., Livermore, Calif.

ALPHA TRANSPORT AND BLISTERING IN TOKAMAKS

W. Bauer, K. L. Wilson, C. L. Bisson, L. G. Haggmark (Princeton Univ.), and R. J. Goldston Dec. 1978 40 p refs

(Contract EY-76-C-04-0789)

(SAND-78-8684) Avail: NTIS HC A03/MF A01

The particle flux and angular distribution of 3.5 MeV alpha particles impinging on the first wall from uncontained banana orbits in an axisymmetric Tokamak reactor were calculated. The resulting helium concentration profiles in the first wall can give rise to surface exfoliation under specified conditions. The major mitigating factor is the simultaneous surface recession due to sputtering by the D-T charge exchange neutral flux. For the parameters used in these calculations, blistering in high sputtering rate materials such as Be is unlikely whereas in low sputtering rate materials such as Nb, He induced surface deformation is quite probable. DOE

N80-10917# Argonne National Lab., Ill.

TELESCOPING BEAMS FOR HEAVY ION FUSION

R. J. Burke 1979 5 p refs Presented at IEEE Particle Accelerator Conf., San Francisco, 12 Mar. 1979

(Contract W-31-109-eng-38)

(CONF-790327-100) Avail: NTIS HC A02/MF A01

Enhancement of the design for heavy ion fusion drivers by telescoping bunches of different ion species is considered. Telescoping is defined as the overtaking and interpretation of bunches consisting of ions of different species but whose velocity, mass, and charge state have been selected so that the typical ions in the various bunches have the same ratio of momentum to charge, or magnetic rigidity, and, therefore, the same single particle dynamics in transport and focussing lines. With velocities differing by 10% or more, the highest powers would only arise close to the end of the transport lines. Telescoping also increases the total available phase space of the different species. This can be translated to a smaller final momentum spread or a means to accommodate greater phase space dilution. DOE

N80-10918# Argonne National Lab., Ill.

POWER SUPPLY REQUIREMENTS FOR A TOKAMAK FUSION REACTOR

Jeffrey N. Brooks and Robert L. Kustom Feb. 1979 63 p refs

(Contract W-31-109-eng-38)

(ANL/FPP/TM-119) Avail: NTIS HC A04/MF A01

A system approach combining models of the reactor and poloidal coil set, plasma burn cycle and MHD calculations, and power supply characteristics and cost data was used to determine power supply requirements for a 7-M major radius commercial reactor. A conventional system using an MGF set and solid-state rectifier/inverter power supplies was studied in addition to systems using a homopolar generator, superconducting energy storage inductor, and dump resistors. The requirements and cost of the power supplies depend on several factors but most critically on the ohmic heating ramp time used for startup. Long ramp times (approximately > 85) seems to be feasible, from the standpoint of resistive voltsecond losses, and would appear to make conventional systems quite competitive with nonconventional ones, which require further research and development. DOE

N80-10919# Westinghouse Electric Corp., Pittsburgh, Pa.

STAINLESS STEEL BLANKET CONCEPT FOR TOKAMAKS

J. S. Karbowski, A. Y. Lee, T. V. Prevenslik, G. W. Ruck, and T. E. Shannon (ORNL) 25 Jan. 1979 6 p refs Presented at ANS Ann. Meeting, Atlanta, Ga., 3 Jun. 1979

(WFPS-TME-79-010; Conf-790602-32) Avail: NTIS HC A02/MF A01

A design concept for a Tokamak reactor blanket system which satisfies engineering requirements for a utility environment is discussed. Reliability, fabricability, and lifetime are emphasized. DOE

N80-10920# Northwestern Univ., Evanston, Ill.

COMPUTER SIMULATION OF KINETIC PROPERTIES OF PLASMA Progress Report, 1 Oct. 1977 - 30 Sep. 1978

J. Denavit 1978 8 p

(Contract EY-76-S-02-2200)

(COO-2200-10) Avail: NTIS HC A02/MF A01

The development and testing of new numerical methods for particle and hybrid simulation of plasmas and their application to physical problems of current significance to magnetic fusion energy is addressed. Research on the following specific problems is reported: (1) analysis and computer simulations of the dissipative trapped electron instability in Tokamaks; (2) long-time-scale algorithms for numerical solutions of the drift-kinetic equation; and (3) computer simulation of field-reversed ion ring stability. DOE

N80-10921# Oak Ridge National Lab., Tenn.

STUDY OF A TOKAMAK CLEANING METHOD UTILIZING GLOW DISCHARGE

N. N. Brevnov, R. Clausing, A. A. Kazachkov, and N. V. Kuznetsov 1979 10 p refs Transl. into ENGLISH of Report IAE-3100 (Moscow), from Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, 1979 10 p

(ORNL-TR-4664; IAE-3100) Avail: NTIS HC A02/MF A01

The effect of glow discharge cleaning on the Tokamak T-12 wall surfaces and residual gas composition in the apparatus working chamber was studied. Auger spectroscopy was the diagnostic technique employed. DOE

N80-10922# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.
ONE- AND TWO-DIMENSIONAL HEATING ANALYSES OF FUSION SYNFUEL BLANKETS
J. S. K. Tsang, O. W. Lazareth, and J. R. Powell 1979 5 p refs Presented to the Am. Nucl. Soc., Atlanta, Ga. 3-8 Jun. 1979
(Contract EY-76-C-02-0016)
(BNL-NUREG-25635; Conf-790602-14) Avail: NTIS HC A02/MF A01

Neutronics and heating analyses were performed on a fusion reactor blanket featuring synthetic fuel production. In this two temperature region blanket design, the structural shell is stainless steel. The interior of the module is a packed ball of high temperature ceramic material. The low temperature shell and the high temperature ceramic interior are separately cooled. Process steam (approximately 1500 C) is then produced in the ceramic core for the producion of H2 and H2-based synthetic fuels by a high temperature electrolysis (HTE) process. DOE

N80-10923# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
FAST MAGNETOSONIC WAVE HEATING OF THE NUWMAK TOKAMAK REACTOR
J. E. Scharer, D. T. Blackfield, J. B. Beyer, and T. K. Mau Jun. 1978 141 p refs
(Contract ET-78-C-02-4710)
(UWFDM-227) Avail: NTIS HC A07/MF A01

The radiofrequency (RF) coupling and heating-to-ignition of a conceptual Tokamak fusion reactor by means of the fast magnetosonic wave at the second ion cyclotron harmonic is discussed. The current status of fast magnetosonic wave propagation and heating, mode conversion, and eigenmode theory is briefly reviewed. A space-averaged, time-dependent startup model is used to describe the role of RF heating for ignition of a Tokamak reactor. DOE

N80-10924# Addis Translations International, Portola Valley, Calif.
ELECTRON TRANSFER IN A SUPERDENSE NONDEGENERATE PLASMA
V. V. Ermakov and N. N. Kalitkin Mar. 1979 34 p refs Transl. into ENGLISH of "Elektronnyi Perenos v Sverkhplotnoi Nevyrozhdennoi Plasme" Acad. of Sci. USSR, Inst. of Appl. Math., Moscow, 1977 44 p
(UCRL-Trans-11473) Avail: NTIS HC A03/MF A01

A physical model is suggested which describes the conductivity and electron heat conductivity of an equilibrium, nondegenerate plasma in the density range from gas densities to superhigh densities, and at all temperatures. In this model, the degree of ionization of the matter is found on the basis of the static Thomas-Fermi model of the atom with quantum and exchange corrections. The interaction of the charged particles, which may be quite strong, is described by the Debye potential. The transport coefficients are determined from the Boltzmann equation in the fourth approximation of Chapman and Enskog, and quantum effects are used to calculate the scattering cross sections. This method is used to calculate the transfer properties of a number of substances (Be, Al, Si, Ar, Cu, Xe, Cs, Pb, SiO2, NaCl) at densities of 10 to the 17th power/cubed centimeters to 10 to the 24th power/cubed centimeters. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N80-10925 Pennsylvania State Univ., University Park.
ATOM-SURFACE INTERACTIONS DERIVED FROM SCATTERING DATA Ph.D. Thesis
William Edward Carlos 1979 128 p
Avail: Univ. Microfilms Order No. 7922272

The band structure effects of He-LiF in bound state resonances were studied. Splittings of the ground state and first excited state by the (0,1) and (1,1) Fourier components of the potential were investigated and matrix elements of V sub 01 and V sub 11 were determined. The ability of various pairwise sums to fit the He-graphite experimental data was tested and an accurate model of the potential determined. It was found necessary to take into account the anisotropy of the He-C pair interaction. The band structure of He adsorbed on graphite was calculated, yielding a test of the nearly free particle of the resonant state used to derive the eigenvalues and matrix elements from the experimental data and the corrections to the energy near the ground state for comparison with results derived from measurements of thermodynamic properties of He films adsorbed on graphite. Dissert. Abstr.

N80-10926 Rensselaer Polytechnic Inst., Troy, N. Y.
AN EXPERIMENTAL INVESTIGATION OF ANGULAR EFFECTS ON THE MOSSBAUER LINEBREADTH AND TIME DOMAIN ANALYSIS OF MOSSBAUER LINE BROADENING Ph.D. Thesis
John Walter Pettit 1979 155 p
Avail: Univ. Microfilms Order No. 7922236

Alternate techniques for the study of Mossbauer linebreadths are presented. The basis of expanding the range of Mossbauer spectroscopy to nuclear isomers with lifetimes greater than approximately ten microseconds through the incorporation of proposed linenarrowing techniques is developed. A short survey of proposed linenarrowing techniques is given along with a review of potential alternate principles for linebreadth measurement and a review of linebroadening mechanisms. The basis for the selection of time domain Mossbauer spectroscopy as a viable means of linebreadth measurement and the appearance of a measured angular correlation in the Mossbauer Linebreadth was investigated. Dissert. Abstr.

N80-10927 California Univ., San Diego.
MAGNETIC AND SUPERCONDUCTING TRANSITIONS IN THE RARE EARTH RHODIUM BORIDE COMPOUNDS Ph.D. Thesis
Harry Bruce MacKay 1979 105 p
Avail: Univ. Microfilms Order No. 7921483

The superconducting and magnetic transition temperatures of the series of rare earth rhodium boride compounds are examined. Exchange scattering of conduction electrons by the RE magnetic moments in this system with an exchange coupling parameter is discussed. The nature of the superconducting to normal state transition at T sub c2 of the ferromagnetic superconductor ErRH4B4 was studied by heat capacity and ac magnetic susceptibility measurements with increasing and decreasing temperature. Thermal hysteresis, latent heat, and superheating effects that identify this transition as first order and distinguishable from the magnetic transition are examined. Dissert. Abstr.

N80-10928 Rochester Univ., N. Y.
STUDY OF INTERNAL FRICTION IN SINGLE CRYSTAL SILICON Ph.D. Thesis
Clive Chemo Lam 1979 126 p
Avail: Univ. Microfilms Order No. 7922943

A technique to study internal friction and the internal properties of silicon crystals is discussed. The Akhieser mechanism and two Arrhenius type Debye relaxation peaks associated with oxygen are examined. Dissert. Abstr.

N80-10929 Colorado State Univ., Fort Collins.
MEASUREMENTS OF THERMAL CONDUCTIVITY OF bcc He-3 AT VERY LOW TEMPERATURES Ph.D. Thesis
Gregory James Armstrong 1979 222 p
Avail: Univ. Microfilms Order No. 7923342

The thermal conductivity of bcc He-3, measured in samples grown at constant volume using the blocked capillary technique was studied. Molar volumes between 24.4 cc/mole and 22.4 cc/mole were investigated to temperatures in the vicinity of 30 mK using a dilution refrigerator. The thermal conductivity, with temperature near T to the 3 power in the low temperature limit, is discussed in relation to diffuse phonon scattering from crystal boundaries in a Debye solid. Dissert. Abstr.

N80-10930 Northeastern Univ., Boston, Mass.
MAGNETIC FIELD STUDIES OF ELECTRONIC RAMAN

SCATTERING IN RARE-EARTH ZIRCONS Ph.D. Thesis
Donato Cardarelli 1979 228 p
Avail: Univ. Microfilms Order No. 7923531

The influence of an external field on the electronic energy states, which are responsible for driving the transition in these systems, was investigated using Raman scattering. The energies of the electronic modes were used to infer the splitting of these states as a function of magnetic fields at T > T sub D and T < T sub D The results were then compared with available theoretical predictions. For a magnetic field at 45 deg to the easy axis, the splitting in the electronic levels is mainly due to a Zeeman interaction. Dissert. Abstr.

N80-10931 Wisconsin Univ. - Milwaukee.
INTERACTION OF SURFACE WAVES WITH THIN NICKEL FILMS Ph.D. Thesis
I-an Feng 1979 172 p
Avail: Univ. Microfilms Order No. 7923446

Measurements of the surface wave attenuation of surface wave delay lines coated with a nickel film in a magnetic field parallel to the film plane in the frequency range 500 to 665 MHz exhibited attenuation peaks which depended strongly on film thickness, temperature and magnetic field. The effect was very strong for 200 A thick nickel film coated 618 MHz quartz delay lines at room temperature. The maximum attenuation was about 40 db/cm. The only LiNbO3 substrate covered with a 200 A nickel film that was measured exhibited a maximum attenuation of about 10 db/cm and similar behavior in a magnetic field. A 1000 A film and a 500 A film exhibited similar but much smaller attenuation peaks at 2200 Oe and 625 Oe respectively. Attenuation measurements were carried out over the temperature range 4-350 K, for the 500 A film. In general, the maximum attenuation decreased at lower temperatures and peaks occurred at higher field values. Dissert. Abstr.

N80-10932 California Inst. of Tech., Pasadena.
AN ATTEMPT TO PRODUCE BOTH THICK AND THINNED FLOWING SUPERFLUID FILMS. 1: A STUDY OF THE FEASIBILITY OF VERIFYING LIFSHITZ'S THEORY OF VAN DER WAALS FORCE FOR A METALLIC SURFACE. 2: THE ELECTROHYDRODYNAMIC INSTABILITY OF THE SUPER-THICK HELIUM FILM Ph.D. Thesis
Daniel Sai Wah Kwoh 1979 105 p
Avail: Univ. Microfilms Order No. 7922050

The thickness of a flowing helium film is investigated. The feasibility of verifying Lifshitz's theory of Van der Waals, force by measuring the helium film thickness on a nickel surface from a height of about 1.5 mm to 0 mm is evaluated. The existence of instability of the helium film under a strong electric field is examined. Dissert. Abstr.

N80-10933 Washington State Univ., Pullman.
STUDIES OF CHEMICAL AND MECHANICAL SURFACE PHENOMENA BY PARTICLE EMISSION TECHNIQUES Ph.D. Thesis
Lawrence Albert Larson 1979 79 p
Avail: Univ. Microfilms Order No. 7923491

Three independent surface phenomena were studied by particle emission techniques. These techniques included thermal flash desorption, thermally stimulated exoemission, and tribostimulated exoemission. The dependence of neutral or charged particle emission on the thermal or mechanical stimulation is examined. The decomposition of formic acid on a clean Ru(10(-1)0) surface for adsorption temperatures between 100 K and 460 K by means of thermal flash desorption is described. The emission of neutral particles during tensile deformation of anodized aluminum alloys is discussed. The surface composition of NaCl after electron bombardment and color center decomposition was studied by the thermally stimulated emission of charged and neutral particles, and Auger electron spectroscopy. Dissert. Abstr.

N80-10934# Honeywell Electro-Optics Center, Lexington, Mass.
MINORITY CARRIER LIFETIME AND DIFFUSION LENGTH IN P-TYPE MERCURY CADMIUM TELLURIDE Final Report, Aug. 1977 - Jan. 1979
Joseph L. Schmit, Stephen P. Tobin, and Timothy J. Tredwell Feb. 1979 153 p refs
(Contract F33615-77-C-5142; AF Proj. 2423)
(AD-A071094; AFML-TR-79-4036) Avail: NTIS HC A08/MF A01 CSCL 20/12

This report covers a study of the relationship between minority carrier properties and majority carrier hole and acceptor concentrations. This report documents the following conclusions: The dominant recombination mechanism is Shockley-Read not radiative. The recombination center is at 140 meV above the valence band edge and has a concentration proportional to the acceptor concentration. GRA

N80-10935# Army Electronics Research and Development Command, Fort Belvoir, Va. Night Vision and Electro-Optics Labs.
PHYSICS OF MESOMORPHIC COMPOUNDS Final Report, May 1963 - Jun. 1971
Arlin J. Brown and Reinhard D. Ennulat Sep. 1978 125 p refs
(DA Proj. 1T1-61102-A-31B)
(AD-A070539; DELNV-TR-0003) Avail: NTIS HC A06/MF A01 CSCL 07/4

This final report summarizes the physical behavior of over 200 cholesteric liquid crystals including transition temperatures, heats of transition, temperature sensitivity of visible selective reflection spectra, the effect of impurities, combining liquid crystals, and behavior in a thermal-imaging system. Eleven homologous series of alkanoates omega phenylalkanoates, alkyl carbonates, and S-alkyl thiocarbonates of cholesterol, cholest-5-en-3 Beta-thiol, and 5 alpha-cholestan-3 Beta-o1 were investigated. Twenty liquid crystals were found to have a cholesteric color spectral range of 0.2 C or less. GRA

N80-10936# Saint Louis Univ., Mo. Dept. of Electrical Engineering.
AN ac LARGE SIGNAL MODEL FOR THE GaAs MESFET Final Report, 1 Jan. 1978 - 31 Jul. 1979
Asher Madjar and Fred J. Rosenbaum Aug. 1979 217 p refs
(Contract N00014-78-C-0256; RR02103046)
(AD-A071663) Avail: NTIS HC A10/MF A01 CSCL 20/12

An ac large signal model for the GaAs FET is presented. It incorporates the device geometry and semiconductor properties and relates the terminal currents to the instantaneous applied voltages and their time derivatives. The model is efficient and fast when implemented on a digital computer. Its form is suitable for large signal component design and optimization. A power amplifier and an oscillator are analyzed to demonstrate the use of the model. GRA

N80-10937# Cornell Univ., Ithaca, N. Y. School of Electrical Engineering.
RECTIFICATION AT N-N GaAs: (Ga, Al)As HETEROJUNCTIONS
Amitabh Chandra and Lester F. Eastman 22 Jun. 1979 12 p refs
(Contract N00014-75-C-0739)
(AD-A071732) Avail: NTIS HC A02/MF A01 CSCL 20/12

N-N Ga (.7)Al(.3)As: GaAs heterojunction structures have been grown by LPE, with 10 to the 15th power per cu cm net carriers in the ternary. N-W profiling across the heterojunction shows an accumulation region on the GaAs side and a depletion region on the (Ga, Al)As side. I-V characteristics at room temperature show significant rectification. GRA

N80-10938# Cornell Univ., Ithaca, N. Y. School of Electrical Engineering.
RECTIFICATION AT NGaAs - N Ga.7Al.3As HETEROJUNCTIONS GROWN BY LPE
Amitabh Chandra and Lester F. Eastman 22 Jun. 1979 21 p refs
(Contract N00014-75-C-0739)
(AD-A071733) Avail: NTIS HC A02/MF A01 CSCL 20/12

Heterojunctions between n-type GaAs, and high purity n-type Ga.7Al.3As have been grown by LPE at 700 C, and significant current rectification has been observed across them at room temperature. At low temperatures, the current drops and the degree of rectification increases considerably. The reverse current characteristic shows reasonable semi-quantitative agreement with theoretical I-V curves, calculated by using a thermionic emission

model. The N-W profile measured across the interface indicates qualitatively the presence of a dipolar space-charge region, as expected. GRA

N80-10939# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
ELECTRONIC CHARACTERISTICS OF 3 - 5 COMPOUNDS Final Report, 1 Jan. 1977 - 30 Sep. 1978
Harry C. Gatos May 1979 76 p refs
(Contract F19628-77-C-0060; AF Proj. 2306)
(AD-A071447; RADC-TR-79-95) Avail: NTIS HC A05/MF A01 CSCL 20/12

Our experimental and theoretical program has been aimed at the development of approaches and methods for the reliable electronic characterization of III-V compounds. We have investigated the determination of compositional, structural and electronic characteristics of GaAs and InP on a macro- and micro-scale. We have developed novel theoretical and experimental techniques for obtaining two-dimensional microprofiles of the carrier concentration in GaAs and InP (scanning IR absorption) and microprofiles of the minority carrier characteristics (SEM-EBIC mode). We have also developed convenient methods for the determination of the compensation ratio and total concentration of ionized impurities which is based on electron mobility and free carrier absorption. Finally, we have initiated a comprehensive characterization study of InP in conjunction with crystal growth. GRA

N80-10940# Illinois Univ., Urbana.
GROWTH OF BISMUTH TUNGSTATE SINGLE CRYSTALS
A. G. DeLeprevier 1979 7 p Presented at the Intern. Symp. on Ceramics in Nucl. Waste Management, Cincinnati, Ohio, 30 Apr. 1979
(Contract EY-76-C-02-1198)
(COO-1198-1261; Conf-790420-11) Avail: NTIS HC A02/MF A01

Hydrothermal and flux growth of Bi2W06 is described. Single crystals of Bi2W06 are examined and a complete characterization of the compound is presented. A.W.H.

N80-10941# Brookhaven National Lab., Upton, N. Y. Dept. of Chemistry.
DEPENDENCE OF CONDUCTION BAND ENERGY AND ELECTRON MOBILITY ON FLUID DENSITY
R. A. Holroyd and Ned E. Cipollini 1979 8 p refs Presented at the Intern. Congress Symp. on Radiation Res. and Stem Cells, Tokyo, 13 May 1979
(Contract EY-76-C-02-0016)
(BNL-26072; Conf-790524-2) Avail: NTIS HC A02/MF A01

Measurements of electron mobility and conduction band energy are reported as a function of density for neopentane and tetramethylsilane. Electron mobilities are for the gas phase at a temperature just above the critical temperature and for densities between 0.1 and 3.0 x 10 to the 21st power molecules/cc. The band energies (V sub 0) are for the gas phase over the same density range and temperature as well as for the liquid from 25 deg to the critical temperature. These data permit a comparison between V sub 0 and electron mobility over the entire density range. At low densities V sub 0 from work function shifts is given by (sq h/2 pi m)N alpha where the parameter alpha can be evaluated from mobility data. At an intermediate density there is a transition and V sub 0 changes abruptly to more negative values; in this transition region the mobility is minimum. Throughout the intermediate and high density range V sub 0 remains negative and changes only very slowly. DOE

N80-10942# California Univ., Livermore. Lawrence Livermore Lab.
MAGNETIC ORDER IN GOLD-IRON ALLOYS
R. J. Borg 22 Dec. 1978 33 p refs
(Contract W-7405-eng-48)
(UCRL-52636) Avail: NTIS HC A03/MF A01

The magnetic behavior of the Au-Fe alloy system was investigated. Moessbauer spectroscopy results demonstrate the existence of magnetic order and define three regions of alloy composition which exhibit the Kondo effect, spin glass behavior, and dependence on short-range order. Polarization and magnetization measurements also provide clues to magnetic behavior. DOE

N80-10943# Connecticut Univ., Storrs. Inst. of Materials Science.
ELECTRON-DISLOCATION INTERACTION AT LOW TEMPERATURES Progress Report
1978 57 p refs
(Contract EY-76-S-02-2305)
(COO-2305-6) Avail: NTIS HC A04/MF A01

Dislocations in aluminum are slowed down by magnetic fields, with the drag varying as H sup 2 and the drag is independent of temperature. The flux motion, in the mixed state of superconductors can be used to measure the mobile dislocation density over a wide range of strains and stresses. These results show, for the first time how to measure the mobile dislocation density in a tensile test. DOE

N80-10944# Universidade Estadual de Campinas (Brazil).
EFFECTS OF STOICHIOMETRY AND NEUTRON IRRADIATION IN SUPERCONDUCTING A-15 COMPOUNDS Ph.D. Thesis
S. Moehlecke 1978 232 p refs Prepared in cooperation with Brookhaven National Lab.
(Contract EY-76-C-02-0016)
(BNL-25940) Avail: NTIS HC A11/MF A01

The effects of varying stoichiometry, heat treatment, and irradiation with high energy neutrons on the superconducting transition temperature, Bragg-William order parameter, and the lattice parameter studied. The systems were Nb3Ge, Nb3Al, Nb3Pt, Nb3Ir, V3Ga, V3Si and Mo3Os. Results are analyzed. A simple hard sphere model is developed to calculate the dependence of on composition within the A-15 phase. Excellent agreement is obtained for the measured values in the Nb-Al, Nb-Pt and V-Ga systems. The results of both compositionally and irradiation induced disorder can be understood on the basis of site-exchange taking place between the A and B sites in the A-15 structure. DOE

N80-10945# Oak Ridge National Lab., Tenn.
STRUCTURE SOLUTION METHODS FOR SUPERSTRUCTURES
Carroll K. Johnson 1979 7 p refs Presented to the US-Japan Seminar on Long-Range in Ordering Crystals, Honolulu, Haw. 18 Mar. 1979
(Contract W-7405-eng-26)
(CONF-790342-1) Avail: NTIS HC A02/MF A01

Mechanistic perturbation techniques and conventional crystallographic techniques, suitably modified, are both applicable in crystal structure analysis of superstructures and modulated structures. It is strongly recommended that conventional crystallographic techniques be used whenever possible because of the greater opportunity to recognize unexpected physical results not built into the trial model. DOE

N80-10946# National Standard Reference Data System.
PHYSICAL PROPERTIES DATA COMPILATIONS RELEVANT TO ENERGY STORAGE. 3: ENGINEERING PROPERTIES OF SINGLE AND POLYCRYSTALLINE SODIUM BETA AND BETA-ALUMINA
G. R. Miller and D. G. Paquette Jun. 1979 22 p refs Prepared by Utah Univ., Salt Lake City
(PB-297847/6; NSRDS-NBS-61-Pt-3; LC-77-10824)
Copyright. Avail: Issuing Activity CSCL 20L

A review of the properties of the two dimensional supersonic conductors of the sodium beta alumina family is presented, with emphasis on the variability of properties with composition and processing. Processing methods, including methods of distributing additives, may strongly influence engineering properties of these substances through changes in microstructures. Described are common methods of measurement of properties with generally accepted ranges of property values. The need to compromise in the design of devices requiring several coincident optimal properties is, at this time, a necessary ingredient in the use of these materials as device components. GRA

N80-10947# National Technical Information Service, Springfield, Va.

LIQUID CRYSTALS, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Report, 1964 - 1975
Diane M. Cavagnaro Aug. 1979 219 p
(NTIS/PS-79/0795/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 20F

The bibliography cites studies on optical properties, phase transformations, chemical and physical properties, molecular synthesis, and testing of liquid crystals. The use of liquid crystals in display systems, fiber optics, memory devices, and test equipment is discussed. The bibliography contains 215 abstracts and no new entries to the previous edition are included. GRA

N80-10948# National Technical Information Service, Springfield, Va.
LIQUID CRYSTALS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Report, 1976 - Jul. 1979
Diane M. Cavagnaro Aug. 1979 97 p Supersedes NTIS/PS-78/0767; NTIS/PS-77/0744; NTIS/PS-76/0681; NTIS/PS-75/591; NTIS/PS-74/116
(NTIS/PS-79/0796/7; NTIS/PS-78/0767; NTIS/PS-77/0744; NTIS/PS-76/0681; NTIS/PS-75/591; NTIS/PS-74/116) Avail: NTIS HC $28.00/MF $28.00 CSCL 20F

Research studies on optical properties, phase transformations, chemical and physical properties, molecular structure, synthesis, and testing of liquid crystals are cited. The compilation includes the use of liquid crystals in display systems, fiber optics, memory devices, and test equipment. The updated bibliography contains 91 abstracts, 17 of which are new entries to the previous edition. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-10949# Texas Univ., Austin. Center for Particle Theory.
QUANTUM ELECTRODYNAMICS AND LIGHT RAYS
E. C. G. Sudarshan Nov. 1978 13 p refs
(Contract EY-76-S-05-3992)
(ORO-3992-354) Avail: NTIS HC A02/MF A01

Light is a quantum electrodynamic entry and hence bundles of rays must be describable in this framework. The duality in the description of elementary optical phenomena is demonstrated in terms of two-point correlation functions and in terms of collections of light rays. The generalizations necessary to deal with two-slit interference and diffraction by a rectangular slit are worked out and the usefulness of the notion of rays of darkness is illustrated. DOE

N80-10950# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
TIME SERIES ANALYSIS BY THE MAXIMUM ENTROPY METHOD
B. L. Kirk, B. W. Rust (Computer Sciences Div., Union Carbide), and W. VanWinkle Jan. 1979 222 p refs
(Contract W-7405-eng-26)
(ORNL-5332; ESD-Publ-1220) Avail: NTIS HC A10/MF A01

The classical Fourier method is discussed as a standard for comparison with the maximum entropy method. Examples are given which clearly demonstrate the superiority of the latter method over the former when the time series is short. Topics covered include the theory of the method, the effects of noise in the data, significance tests, the problem of choosing the prediction filter length, and, a package of FORTRAN subroutines for making the various calculations. Cross-referenced program listings are given in the appendices. The use of the programs is demonstrated. Real time series like the lynx data and sunspot numbers are also analyzed. DOE

N80-10951# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
ANALYTIC COHERENT STATES FOR GENERALIZED POTENTIALS
Michael Martin Nieto and L. M. Simmons, Jr. 1978 29 p refs Presented at Symp. on the Foundation of Radiation Theory Quantum Electrodynamics, Boulder, Colo., 28 Apr. 1978
(Contract W-7405-eng-36)
(LA-UR-79-218; Conf-7804122-1) Avail: NTIS HC A03/MF A01

A prescription is given for finding coherent states in generalized potentials. The prescription is based upon finding those natural classical variables which vary as the sine and the cosine of the classical omega/sub c/t. As an example, the symmetric Rosen-Morse potential is discussed in detail. DOE

N80-10952# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
ASYMPTOTIC FREEDOM WITHOUT GUILT
Ernest Ma Jan. 1979 9 p refs
(Contract EY-76-C-03-0511)
(UH-511-329-79) Avail: NTIS HC A02/MF A01

The notion of asymptotic freedom in quantum chromodynamics is explained on general physical grounds, without invoking the formal arguments of renormalizable quantum field theory. The related concept of quark confinement is also discussed along the same line. DOE

N80-10953# Argonne National Lab., Ill.
THERMAL CONDUCTIVITY OF THE HELIUM-ARGON SYSTEM
A. Purohit and J. R. Moszynski (Univ. of Delaware) Feb. 1979 19 p refs
(Contract W-31-109-eng-38)
(ANL-79-3) Avail: NTIS HC A02/MF A01

A semiempirical relation for the thermal conductivity of helium-argon gas mixtures is described. Thermal conductivity data for helium, argon, and helium-argon mixtures is presented and an approach to predict thermal conductivities of helium-argon mixtures to within 5% of their true values for temperatures up to 1200 K is discussed. DOE

N80-10954# Argonne National Lab., Ill.
ELECTRONIC SPECIFIC HEATS IN METAL-HYDROGEN SYSTEMS
Howard E. Flotow 1979 34 p refs Presented at the Intern. Meeting Hydrogen in Metals, Munster, West Germany, 6-9 Mar. 1979
(Contract W-31-109-eng-38)
(CONF-790301-11) Avail: NTIS HC A03/MF A01

The electronic specific heats of metals and metal-hydrogen systems are evaluated from the measured specific heats at constant pressure. A low temperature calorimetric cryostat employing a He-3/He-4 dilution refrigeration is described. Various considerations and complications encountered in the evaluation of gamma from specific heat data are discussed. The experimental values of gamma for the V-Cr-H system and for the Lu-H system are summarized and the variations of gamma as a function of alloy composition are examined. DOE

N80-10955# Oak Ridge National Lab., Tenn.
THERMODYNAMICS OF PRECIPITATION SYSTEMS
R. O. Williams Jun. 1979 23 p refs
(Contract W-7405-eng-48)
(ORNL-5537) Avail: NTIS HC A02/MF A01

The particular combination of features that are required for a binary system to show useful precipitation hardening is examined. The thermodynamics of useful systems and the supplementary conditions necessary for a useful precipitation system are investigated. The potential for the development of new alloys containing three or more compounds is discussed. A.W.H.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

No abstracts in this category.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-10956*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NSSDC DATA LISTING
Aug. 1979 51 p
(NASA-TM-80349; NSSDC/WDC-A-R&S-79-05) Avail: NTIS HC A04/MF A01 CSCL 05B

Data available from the National Space Science Data Center (NSSDC) are listed. The spacecraft, principal investigator, the experiment, and time span of the data are given. A listing is also included of ground-based data, models, computer routines and composite spacecraft data that are available from NSSDC. F.O.S.

N80-10957# System Development Corp., Santa Monica, Calif.
DEDUCTIVE PLANNING AND PATHFINDING FOR RELATIONAL DATA BASES
Charles Kelloge, Philip Klahr, and Larry Travis (Wisconsin Univ., Madison) 1978 22 p refs
(Contract N00014-76-C-0885)
(AD-A070801) Avail: NTIS HC A02/MF A01 CSCL 05/2

Inference planning techniques have been implemented and incorporated within a prototype deductive processor designed to support the extraction of information implied by, but not explicitly included in, the contents of a relationally structured data base. Deductive pathfinding and inference planning are used to select small sets of relevant premises and to construct skeletal derivations. When these skeletons are verified, the system uses them as plans to create data-base access strategies that guide the retrieval of data values, to assemble answers to user requests, and to produce proofs supporting those answers. Several examples are presented to illustrate the current capability of the prototype Deductively Augmented Data Management (DADM) system. GRA

N80-10958# Army Research Inst. for the Behavioral and Social Sciences, Arlington, Va.
EFFECTS OF RETRIEVAL TERM SPECIFICALLY ON INFORMATION RETRIEVAL FROM COMPUTER-BASED INTELLIGENCE SYSTEMS
Lawrence M. Potash Jul. 1979 52 p refs
(AD-A072312; ARI-TP-379) Avail: NTIS HC A04/MF A01 CSCL 05/2

This experiment assessed the impact of using two levels of retrieval terms on formulating and inputting query statements. One level used specific terms to retrieve one element of information; the other level used global terms to retrieve blocks of information that would otherwise require five to six specific terms. Participants were then given a set of 48 problems. For each problem, the participants had to write and type a query statement that would satisfy the information requirements. The opportunity to use global terms had no effect either on the time needed to write query statements or on the accuracy of typed query statements. Where the use of global terms was applicable, substantial savings in the time required to input query statements was shown. Except that the global-specific group reported that it made more use of the data name chart before using the data dictionary, the two groups indicated that they went about writing query statements in approximately the same way. Both groups gave high ratings to the value of using global terms. Use of global terms is not recommended unless the specific items of information subsumed under the global term are normally retrieved together frequently. GRA

N80-10959# Sandia Labs., Albuquerque, N. Mex. Chemistry of Organic Materials Div.
SUMMARY OF THE SANDIA MATERIALS INFORMATION DATA BANK
K. E. Mead 1978 14 p Presented at DOE Compatibility Meeting, Golden, Colo., 17 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1961C; Conf-781067-3) Avail: NTIS HC A02/MF A01

A data bank intended to provide quick retrieval of information regarding materials properties and reactions is described. The data bank consists of two major parts: a computerized index of materials and document descriptions and a microfiche file of all documents catalogued in the computer. Of particular interest is a record of materials aging and compatibility data. The computer program provided rapid interactive searching and is written so that the uninitiated can quickly learn to search. The data bank now references 420 documents and memoranda with information on 600 materials. DOE

N80-10960# Oak Ridge National Lab., Tenn. Computer Sciences Div.
ON THE DESIGN OF AN INTERACTIVE INFORMATION RETRIEVAL PROGRAM
G. K. Haeuslein 1978 16 p Presented at Conf. on Very Large Data Bases, Berlin, 13 Sep. 1978
(Contract W-7405-eng-26)
(CONF-780990-1) Avail: NTIS HC A02/MF A01

The Oak Ridge RECON program is described. This is an interactive program that searches bibliographical data bases. The data bases are collections of document descriptions along with the corresponding inverted files. Twenty data bases are now supported; some of these are very large, containing about 1/4 million abstracts, with each abstract on the average being 1300 characters long. The user operates in the system by means of a remote console. The logic and operation of the code are discussed. DOE

N80-10961# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
MANUAL OF DOCUMENTATION PRACTICES APPLICABLE TO DEFENCE-AEROSPACE SCIENTIFIC AND TECHNICAL INFORMATION, VOLUME 2
S. C. Schuler, ed. Jul. 1979 124 p refs
(AGARD-AG-235-Vol-2) Avail: NTIS HC A06/MF A01

An introduction to the hardware and software of computer systems is given, followed by a description of the problems of the input of data, including the representation of characters and the choice of a character set. The different types of input and storage equipment are described and examples are given. Management and systems analysis problems are outlined in the project environment. Finally, there is a brief introduction to chemical structure input and storage techniques. Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-10962*# ECON, Inc., Princeton, N. J.
A STUDY OF THE COST-EFFECTIVE MARKETS FOR NEW

TECHNOLOGY AGRICULTURAL AIRCRAFT
George A. Hazelrigg, Jr. and Fred Clyne Sep. 1979 161 p
(Contract NASw-2781)
(NASA-CR-159090) Avail: NTIS HC A08/MF A01 CSCL 05C

A previously developed data base was used to estimate the regional and total U.S. cost-effective markets for a new technology agricultural aircraft as incorporating features which could result from NASA-sponsored aerial applications research. The results show that the long-term market penetration of a new technology aircraft would be near 3,000 aircraft. This market penetration would be attained in approximately 20 years. Annual sales would be about 200 aircraft after 5 to 6 years of introduction. The net present value of cost savings benefit which this aircraft would yield (measured on an infinite horizon basis) would be about $35 million counted at a 10 percent discount rate and $120 million at a 5 percent discount rate. At both discount rates the present value of cost savings exceeds the present value of research and development (R&D) costs estimated for the development of the technology base needed for the proposed aircraft. These results are quite conservative as they have been derived neglecting future growth in the agricultural aviation industry, which has been averaging about 12 percent per year over the past several years. A.R.H.

N80-10963# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
SENSITIVITY ANALYSIS OF OPTIMAL LINEAR RANDOM PARAMETER SYSTEMS M.S. Thesis
Prashant Parikh May 1979 140 p refs
(Grant AF-AFOSR-3321-77; NSF SOC-76-05837)
(AD-A071091; LIDS-TH-911; AFOSR-79-0753TR) Avail: NTIS HC A07/MF A01 CSCL 05/3

This report involves the application of ideas in adaptive stochastic control to economics. We investigate the control problem for a linear, multivariable, dynamic system with purely random (i.e. white) parameters. The quadratic cost criterion is formulated to make the problem a tracking problem. Since the parameters are modelled as white stochastic processes, there is no posterior learning and no dual effect. The certainty-equivalence principle does not hold. We find that the extension of the Uncertainty Threshold Principle from scalar systems to multidimensional ones turns out to be analytically intractable. Next, we derive sensitivity equations for the above optimal system to study the effects of small variations in parameter uncertainties on the optimal performance of the system. These equations enable us to rank parameters in order of the sensitivity of the performance to variations in their variances. This makes it possible to locate the 'pressure' points in a model, if any exist. We then convert an economic policy problem into a stochastic optimal control tracking problem and analyze it with the equations we have derived. We study the different elements that enter into a tracking problem and then discuss the empirical results obtained from the sensitivity equations. The model we choose for the analysis turns out to be insensitive to variations in parameter variances which makes it reasonably reliable. We also analyze in detail the structure of the model and the interdependences of the state and control variables. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-10964# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1980. PART 4: INDEX
Washington GPO 1979 122 p Hearings on S. 357 before the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 1979
(GPO-51-336) Avail: Comm. on Commerce, Sci., and Transportation

Indexes to appropiations for space research and development, construction of facilities, and research and program management. A.W.H.

N80-10965# Unified Industries, Inc., Alexandria, Va.
MANAGERIAL PLAN: EXECUTIVE ORDER 12003 AND THE NATIONAL ENERGY ACT
Dec. 1978 96 p
(Contract EM-77-C-01-8962)
(DOE/TIC-10067) Avail: NTIS HC A05/MF A01

A management tool is provided to assist in planning and developing the Federal Energy-Conservation Program which requires that, by 1985, Executive Branch agencies that own or will own buildings reduce building energy-consumption substantially below 1975 levels. The order also requires that all agencies of the Branch conduct programs designed to reduce energy consumption in general operations of the agency. The program master plan defines goals, objectives strategies, and milestones within a structure that describes the framework, elements, phases, and roles of the agencies. Data requirements for the planning, implementing, evaluating, and reporting functional requirements of the executive order are included with an analysis of the DOE organizational management and resource requirements. DOE

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-10966 Pennsylvania State Univ., University Park.
THE APPLICATION OF AN ADDITIVE-ULTIMATE MODEL TO THE EVALUATION OF TRANSPORTATION SYSTEM MANAGEMENT STRATEGIES Ph.D. Thesis
Peter Morley Lima 1979 202 p
Avail: Univ. Microfilms Order No. 7922308

Transportation efficiency was investigated in terms of implementing transportation system management (TSM) strategies. Various TSM strategies were compared by testing the hypothesis that an additive-utilities model can be applied to evaluate alternative TSM strategies. The current transportation resource allocation process, cost effectiveness, and the feasibility of assessing an additive-utilities model by a random sampling of the metropolitan population were among the topics studied. It is concluded that the systems analytic method is an effective approach for constructing a TSM evaluation framework and that the expected utility theory is a valuable tool for specifying single attribute utility functions, and general equations based on this theory can be used to trace an individual's utility function. The additive-utilities model successfully distinguishes between different TSM packages and indicates like packages. Dissert. Abstr.

N80-10967*# National Aeronautics and Space Administration, Washington, D. C.
NASA TECH BRIEFS INDEX, 1978
1978 123 p
(NASA-SP-5021(20)) Avail: NTIS HC A06/MF A01 CSCL 05A

Approximately 601 announcements of new technology derived from the research and development activities of the National Aeronautics and Space Administration are presented. Emphasis is placed on information considered likely to be transferrable across industrial, regional, or disciplinary lines. Subject matter covered includes: electronic components and circuits; electron systems; physical sciences; materials; life sciences; mechanics; machinery; fabrication technology; and mathematics and information sciences. A.W.H.

N80-10968*# National Aeronautics and Space Administration, Washington, D. C.
NASA TECH BRIEFS INDEX, 1977, VOLUME 2,

NUMBERS 1-4
1977 99 p
(NASA-SP-5021(19)) Avail: NTIS HC A06/MF A01 CSCL 05A

Announcements of new technology derived from the research and development activities of NASA are presented. Abstracts, and indexes for subject, personal author, originating center, and Tech Brief number are presented for 1977. F.O.S.

N80-10969*# National Aeronautics and Space Administration, Washington, D. C.
CUMULATIVE INDEX TO NASA TECH BRIEFS, 1970-1975
1979 767 p refs
(NASA-SP-5021(18)) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 05A

Tech briefs of technology derived from the research and development activities of the National Aeronautics and Space Administration are presented. Abstracts and indexes of subject, personal author, originating center, and tech brief number for the 1970-1975 tech briefs are presented. A.W.H.

N80-10970# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY STORAGE SYSTEMS FOR AUTOMOBILE PROPULSION, 1978 STUDY. 1: OVERVIEW AND FINDINGS
C. J. Berhrim, C. J. Anderson, H. Bomelburg (Battelle Pacific Northwest Labs.), M. Farahat (Argonne National Lab.), H. C. Forsberg, C. L. Hudson (Interplan Corp.), B. C. Kullman (Cambridge Systematics, Inc., Mass.), L. G. OConnell, G. Strickland (Brookhaven National Lab.), and W. J. Walsh 15 Dec. 1978 57 p refs
(Contract W-7405-eng-48)
(UCRL-52553-Vol-1) Avail: NTIS HC A04/MF A01

Technical and cost analyses were made of electrochemical, mechanical, chemical, and thermal storage devices and power systems which are likely to provide credible alternatives to current and future internal combustion engine propulsion systems between now and the year 2000. These devices were used in conceptual designs of various energy storage propulsion systems. Their resultant performances and costs were calculated and compared against each other and against a baseline ICE vehicle system conceptually designed to provide the same performance. Aspects of concern were the effect on all-battery electric systems of optimizing batteries for the specific peak power and specific energy relationship, the effect on the relative results of using highly optimistic (10% confidence level) component characteristics; the national energy impact of the future introduction of energy storage automobiles; and the effect on prior results and conclusions of R and D achievements in the past year. DOE

N80-10971# Sandia Labs., Albuquerque, N. Mex.
SANDIA IRRADIATOR FOR DRIED SEWAGE SOLIDS
Feb. 1979 192 p refs Seminar held at Albuquerque, N. Mex., 18-19 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-79-0182; Conf-7810165) Avail: NTIS HC A09/MF A01

The state-of-knowledge and state-of-the-art of gamma irradiation of dried sewage solids are reviewed in 13 papers presented at a seminar organized in conjunction with the formal dedication of a facility for this purpose. Topics covered include: (1) the DOE interest and participation in the program; (2) the EPA responsibility for sludge management; (3) the encouragement given by the Congress in various public laws for the beneficial utilization of sludges by means of land application; (4) the pathogen hazards of such use; (5) pathogen reduction with gamma irradiation from isotope sources; (6) Nuclear Regulatory Commission licensing and regulation requirements for the safety of isotope usage; (7) other utilization constraints; public health, institutional, and legal considerations; (8) the beneficial utilization of the treated raw product in agronomics, animal refeeding and over-the-counter sales of composted products; (9) the facilities for irradiation of these sludge products to ensure adequate pathogen reduction; (10) formulation of the design criteria and the construction of an eight-ton/day, one-megarad dose pilot plant; (11) the pre-A&E design package, supporting software, and licensing checklist prepared for a larger (25 ton/day) demonstration plant; and (12) similar European activities which look at isotope source quantities and sludge utilization and their cost-benefit implications. A.R.H.

N80-10972# British Petroleum Oil, Inc., Marcus Hook, Pa.
TREATMENT OF REFINERY WASTEWATER USING A FILTRATION-ACTIVATED CARBON SYSTEM Final Report, Oct. 1973 - Jun. 1978
Bruce A. McCrodden Mar. 1979 91 p
(Grant EPA-12050-GXF)
(PB-295780/1; EPA-600/2-79-066) Avail: NTIS HC A05/MF A01 CSCL 13B

The applicability of a dual media filtration-activated carbon adsorption system for the treatment of petroleum refinery waste water is assessed. The capital cost of the waste water treatment plant was $1,812,000 with an annual operating cost of $223,980. GRA

N80-10973# Clean Water Fund, Washington, D. C.
CRITICAL RESEARCH NEEDS IN COMMUNITY WATER MANAGEMENT
25 Jul. 1978 57 p refs
(PB-295984/9; NSF/RA-780563) Avail: NTIS HC A04/MF A01 CSCL 13B

Research needs were identified as critical when they could, if filled, make for significant near-term improvements in efforts to solve some of the most important water problems. Needs which appeared as obstacles to solutions of more than one significant water problem were regarded as especially critical. The water problems examined include: (1) problems resulting from widespread use of conventional sewage treatment technologies and resistance to alternative methods; (2) water storages and the price of water; and (3) drinking water contamination. The sewage treatment program is considered the weakest link in the national effort to control concentrated pollution from point sources. GRA

N80-10974# Environmental Protection Agency, Kansas City, Mo.
MUNICIPAL WASTEWATER TREATMENT FACILITY, WINTER 1978
Steven P. Busch Feb. 1979 29 p
(PB-296813/9; EPA-907/9-79-002) Avail: NTIS HC A03/MF A01 CSCL 13B

Data collected at seventy waste water treatment facilities during the winter of 1978 are summarized and briefly evaluated. Types of treatment plants examined include the following: oxidation ditch, rotating biological surface, activated bio surface, uncovered trickling filter, covered trickling filter, activated sludge, and lagoon. GRA

N80-10975# National Bureau of Standards, Washington, D. C.
DIMENSIONS/NBS, VOLUME 63, NO. 6, JUNE 1979 Monthly Report
Jun. 1979 37 p
(PB-297836/9; NBS/DIM-63/6) Avail: NTIS HC A03/MF A01 CSCL 14B

Contents: Cities in Renaissance; Keeping Tabs on Toxicity; Wanted-Better Energy Ideas; NBS Publishes Updated Survey of State Solar Energy Legislation; Characterizing South Pole Aerosols with the Raman Microprobe; Conferences; Publications; News Briefs. GRA

N80-10976# Massachusetts Inst. of Tech., Cambridge.
HIGH ENERGY ELECTRON RADIATION OF WASTEWATER LIQUID RESIDUALS
28 Feb. 1979 74 p
(Grant NSF ENV-77-10199)
(PB-297593/6; NSF/RA-790074) Avail: NTIS HC A04/MF A01 CSCL 13B

The disinfection of municipal sludge by treatment with energized electrons is reported. Microbiological, operational, and economic information on the electron disinfection process is discussed. The degradation of trace toxic chemicals and gram negative bacteria including coliforms, salmonellae, and shigellae is examined. GRA

N80-10977# Utah Water Research Lab., Logan.
PERFORMANCE AND UPGRADING OF WASTEWATER STABILIZATION PONDS Final Report
E. Joe Middlebrooks, Donna H. Falkenborg, and Ronald Lewis May 1979 226 p refs Conf. held at Logan, Utah, 23-25 Aug. 1978
(Grant EPA-R-805842)
(PB-297504/3; EPA-600/9-79-011) Avail: NTIS HC A11/MF A01 CSCL 13B

The design, operation, performance, and upgrading of lagoon systems are discussed. Performance data for facultative and aerated lagoons are presented. Design criteria and the applicability of performance data to design equations are discussed. Rock filters, intermittent sand filters, microscreening and other physical chemical techniques, phase isolation, land application, and controlled environment aquaculture are evaluated. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-10978*# Steward Observatory, Tucson, Ariz.
NEAR INFRARED PHOTOGRAPHIC SKY SURVEY. 1: CATALOG OF RED STELLAR OBJECTS
E. R. Craine, R. E. Duerr, V. M. Horner, C. L. Imhoff, D. E. Routsis, D. L. Swihart, and D. A. Turnshek Aug. 1979 73 p refs Sponsored by NASA and NSF
(NASA-CR-162386; Contrib-Ser-A-3) Avail: NTIS HC A04/MF A01 CSCL 03A

Red stellar objects for which V-1 was greater than a value of about 2 (supm). 5 were extracted from photographs of 23 program fields. Tabular data for each field show the object name; the 1950 epoch right ascension, declination, galactic longitude, galactic latitude; radial distance from field venter in decimal degrees; color classes; and objects ordered by redness. A.R.H.

N80-10244*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO ASTRONOMY
R. J. Fahnestock and R. M. Taylor *In its* The Deep Space Network 15 Oct. 1979 p 21-23 refs (For primary document see N80-10240 01-12)
Avail: NTIS HC A09/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-10979*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
STELLAR CONVECTION 2: A MULTI-MODE NUMERICAL SOLUTION FOR CONVECTION IN SPHERES
Philip S. Marcus Nov. 1979 63 p refs
(Grants NGR-33-010-186; NSF ATM-76-10424; NSF AST-78-20708)
(NASA-CR-162252; CRSR-731) Avail: NTIS HC A04/MF A01 CSCL 03B

The convective flow of a self gravitating sphere of Boussinesq fluid for small Reynolds and Peclet numbers is numerically determined. The decomposition of the equations of motion into modes is reviewed and a relaxation method is developed and presented to compute the solutions to these equations. The stable equilibrium flow for a Rayleigh number of 10 to the 4th power and a Prandtl number of 10 is determined. The 2 and 3 dimensional spectra of the kinetic and thermal energies and the convective flux as a function of wavelengths are calculated in terms of modes. The anisotropy of the flow as a function of wavelength is defined. A.W.H.

N80-10980*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
STELLAR CONVECTION 3: CONVECTION AT LARGE RAYLEIGH NUMBERS
Philip S. Marcus Nov. 1979 54 p refs
(Grants NGR-33-010-186; NSF ATM-76-10424; NSF AST-78-20708)
(NASA-CR-162253; CRSR-732) Avail: NTIS HC A04/MF A01 CSCL 03B

A three dimensional study of convection in a self gravitating sphere of Boussinesq fluid with a Rayleigh number of 10 to the 10th power and a Prandtl of 1 is presented. The velocity and temperature of the fluid are computed at the largest wavelengths using spectral methods. A confirmation that the fluid is anisotropic and that the energy spectra are not smooth functions of wavelength but have a large amount of fine structure is discussed. The parameterization of the transport properties of the unresolvable inertial subrange with eddy viscosities and diffusivities is described. The time dependent fluctuations in the energy spectra and how they cascade from large to small wavelengths is examined. A.W.H.

N80-10981*# National Aeronautics and Space Administration, Washington, D. C.
NON-EQUILIBRIUM PROCESSES IN INTERSTELLAR MOLECULES
V. S. Strelnitskiy Oct. 1979 27 p refs Transl. into ENGLISH of Neravnovesniye Protessy v Mezhzvezdnykh Molekulah (Moscow), Pr-462, 1979 30 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original document prepared by Academy of Sciences (USSR), Moscow
(Contract NASw-3198)
(NASA-TM-75685; Pr-462) Avail: NTIS HC A03/MF A01 CSCL 09B

The types of nonequilibrium emission and absorption by interstellar molecules are summarized. The observed brightness emission temperatures of compact OH and H2O sources are discussed using the concept of maser amplification. A single thermodynamic approach was used in which masers and anti-masers are considered as heat engines for the theoretical interpretation of the cosmic maser and anti-maser phenomena. The requirements for different models of pumping are formulated and a classification is suggested for the mechanisms of pumping, according to the source and discharge of energy. A.W.H.

N80-10982*# National Aeronautics and Space Administration, Washington, D. C.
PROPAGATION OF WAVES IN A MEDIUM WITH HIGH RADIATION PRESSURE
G. S. Bisnovatyy-Kogan and S. I. Blinnikov Oct. 1979 40 p refs Transl. into ENGLISH of Rasprostraneniye Voln v Srede s Vysokim Luchistym Danleniem (Moscow), Pr-421, 1978 45 p Original language document announced as A79-39378 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original document prepared by Academy of Sciences (USSR), Moscow
(Contract NASw-3198)
(NASA-TM-75679; Pr-421) Avail: NTIS HC A03/MF A01 CSCL 03B

The propagation and mutual transformation of acoustic and thermal waves are investigated in media with a high radiative pressure. The equations of hydrodynamics for matter and the radiative transfer equations in a moving medium in the Eddington approximation are used in the investigation. Model problems of waves in a homogeneous medium with an abrupt jump in opacity and in a medium of variable opacity are presented. The characteristic and the times of variability are discussed. Amplitude for the brightness fluctuations for very massive stars are discussed. A.W.H.

N80-10983*# National Aeronautics and Space Administration, Washington, D. C.

HYDRODYNAMICS OF PRIMORDIAL BLACK HOLE FORMATION

D. K. Nadezhin, I. D. Novikov, and A. G. Polnarev Oct. 1979 31 p refs Transl. into ENGLISH of "Gidrodinamika Obrazovaniya Pervichnikh Chyernykh dyr", Rept. Pr-347 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1979 p 1-36 Original language document was announced as A79-16307 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75918; Pr-347) Avail: NTIS HC A03/MF A01 CSCL 03B

The hydrodynamic picture of the formation of primordial black holes (PBH) at the early stages of expansion of the Universe is considered. It is assumed that close to singularity, expansion occurs in a quasi-isotropic way. Using an EVM, a spherically symmetrical nonlinear problem of the evolution of primary strong deviation from the Fridman solution was solved. What these deviations must be, so that the formation of PBH occurred was clarified. Attention was devoted to the role of pressure gradients. It is pointed out that at the moment of formation of PBH, only a small part of matter enters into it, primarily the component of perturbation. It is also pointed out that at this moment, the mass of PBH essentially is smaller than the mass considered within the cosmic horizon. The possibility of changing the mass of the PBH as a result of accretion is analyzed. F.O.S.

N80-10984# Los Alamos Scientific Lab., N. Mex.

ION ACCELERATION AT THE EARTH'S BOW SHOCK: A REVIEW OF OBSERVATIONS IN THE UPSTREAM REGION

J. T. Gosling, J. R. Asbridge, S. J. Bame, and W. C. Feldman 1979 21 p refs Presented at Workshop on Particle Acceleration Mechanisms in Astrophysics, La Jolla, Calif., 3 Jan. 1979

(Contract W-7405-eng-36)

(LA-UR-79-309; Conf-790144-1) Avail: NTIS HC A02/MF A01

Positive ions and their acceleration at or near the earth's bow shock and their propagation into the upstream region are studied. Two distinctly different populations of these ions, distinguished by their greatly different spectral and angular widths, are identified. The type of ion population observed in the upstream region is correlated with the presence or absence of long period compressive waves in the solar wind. Whether the most energetic ions are accelerated at the shock or in broad disturbed region upstream from the shock is discussed. Stochastic acceleration by turbulent electrostatic field, the most viable candidate for the acceleration of the energetic particles is examined. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology, and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-10985 California Univ., Los Angeles.

LUNAR CRUSTAL MAGNETIC ANOMALIES DETECTED BY THE APOLLO SUBSATELLITE MAGNETOMETERS Ph.D. Thesis

Lonnie Lamar Hood 1979 183 p

Avail: Univ. Microfilms Order No. 7921416

Optimal magnetic anomaly mapping techniques using Apollo subsatellite magnetometer data were determined. These techniques were applied to extend the selenographic coverage of existing maps. Model fitting procedures for inferring bulk magnetization properties of major anomaly sources were developed. Numerical modeling of previously mapped large anomaly fields on the lunar far side were carried out using an iterative forward modeling procedure. The major anomaly source locations and limits on the bulk directions of magnetization of individual sources were determined. Dissert. Abstr.

N80-10986*# Planetary Science Inst., Pasadena, Calif.

LUNAR RADAR BACKSCATTER STUDIES Final Report, 15 Jul. - 14 Oct. 1978

Thomas W. Thompson 19 Oct. 1979 51 p refs

(Contract NASw-3205)

(NASA-CR-162415; Rept-5-420-71-780-09) Avail: NTIS HC A04/MF A01 CSCL 03B

The lunar surface material in the Plato area is characterized using Earth based visual, infrared, and radar signatures. Radar scattering in the lunar regolith with an existing optical scattering computer program is modeled. Mapping with 1 to 2 km resolution of the Moon using a 70 cm Arecibo radar is presented. A.W.H.

N80-10987# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

SATURN'S MAGNETOSPHERE, RINGS, AND INNER SATELLITES

J. A. Van Allen, M. F. Thomsen, B. A. Randall, R. L. Rairden, and C. L. Grosskreutz 2 Nov. 1979 30 p refs Submitted for publication

(Contract N00014-76-C-0016)

(U-of-Iowa-79-44) Avail: NTIS HC A03/MF A01

The discovery of the magnetosphere of Saturn and a survey of its characteristics is presented. Measurements of energetic charged particle distributions within the inner magnetosphere are discussed and new findings on the rings and inner satellites of the planet, provided by the measurements, are examined. A.W.H.

N80-10988*# National Aeronautics and Space Administration, Washington, D. C.

RESULTS AND INTERPRETATION OF MEASUREMENTS OF THE LIGHT FLUX IN THE NEAR-SURFACE LAYER OF THE VENUSIAN ATMOSPHERE

Yu. M. Golovin, B. Ye. Moshkin, and A. P. E. Ekonomov Oct. 1979 48 p refs Transl. into ENGLISH of Rezul'taty i interpretatsiya izmereniy svetovykh potokov v pripoverkhnostnom sloye atmosfery Venery (Moscow), Pr-338, 1977 40 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Academy of Sciences (USSR), Moscow

(Contract NASw-3199)

(NASA-TM-75716; Pr-338) Avail: NTIS HC A03/MF A01 CSCL 03B

The characteristics of the field of radiation in the near surface layer of the atmosphere and on the surface of Venus are reported. Optical measurements made during the landing of the descent vehicles are described. The relief of the surface and the amount of dust on it are examined. The spectral relationship of the albedo of the soil and the light flux incident on the surface is discussed. A.W.H.

N80-10989*# National Aeronautics and Space Administration, Washington, D. C.

ON THE STRUCTURE OF THE UPPER ATMOSPHERE OF MARS ACCORDING TO DATA FROM EXPERIMENTS ON THE VIKING SPACE VEHICLES

M. N. Izakov Oct. 1979 21 p refs Transl. into ENGLISH from O strukture verkhney atmosfery marsa po dannym eksperimentov na kosmicheskikh apparatakh Viking (Moscow), Pr-343, 1977 p 1-19 Original language document announced as A79-18856 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original document prepared by Academy of Sciences (USSR), Moscow

(Contract NASw-3198)

(NASA-TM-75717; Pr-343) Avail: NTIS HC A02/MF A01 CSCL 03B

Altitude profiles of the concentrations of the atmospheric components measured by the on board mass spectrometers during the descent of Viking lander are discussed by assuming that temperature has a smoother profile, and the eddy mixing coefficients are smaller at altitudes of 120 to 170 km than those formally determined. The influence of acoustic gravitational waves and errors in measurements and calculations are discussed in relation to the convolutions in the altitude profiles of the concentrations of the atmospheric components and the temperature of the atmosphere. A.W.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-10990*# National Aeronautics and Space Administration, Washington, D. C.
NUMERICAL MODELING OF STIMULATION OF INDUCED MAGNETOSPHERE DURING INTERACTION OF SOLAR WIND WITH THE IONOSPHERE OF VENUS
A. S. Lipatov. Oct. 1979. 25 p. refs. Transl. into ENGLISH of "Chislennoye modelirovaniye vozbuzhdenia indutsirovannoy magnitosfery pri pri vzaimodeystvii solnechnogo vetra s ionosferoy venery". Rept. Pr-351. USSR Academy of Sciences, Inst. of Cosmic Research, Moscow, 1977. p. 1-24. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75921; Pr-351) Avail: NTIS. HC A02/MF A01. CSCL 03B
Electrodynamic processes in the ionopause are examined as well as the structure of the induced magnetosphere. Author

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-10991*# National Aeronautics and Space Administration, Washington, D. C.
ALGORITHMS FOR LOCATING CELESTIAL SOURCES OF X-RAYS AND GAMMA FLARES WITH THE AID OF SEVERAL SPACECRAFT
G. A. Mersov. Oct. 1979. 15 p. refs. Transl. into ENGLISH of "Algoritmy lokalizatsii nebesnykh istochnikov rentgenovskikhi gamma-vspleskov s pomoshch' yu neskol' kikh ksomicheskikh apparatov". Rept. Pr-344. USSR Academy of Sciences, Inst. of Space Research, Moscow, 1977. p. 1-14. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75920; Pr-344) Avail: NTIS. HC A02/MF A01. CSCL 03B
An Algorithm is suggested for defining the coordinants of X-ray and Gamma Ray radiation sources by measuring the time lag of the transmission of radiation flares from various points of space in which spacecraft are located. Instances are cited where the 2-x, 3-x and 4x spacecraft are used. Author

99 GENERAL

N80-10992# Army Research Office, Research Triangle Park, N. C.
ELECTRONICS RESEARCH IN THE ARMY
Feb. 1979. 27 p.
(AD-A071805) Avail: NTIS. HC A03/MF A01. CSCL 09/5
Contents: Solid-State Electronics, Electromagnetics, Communications, Computers, Signal Processing, and Integrated Circuits. GRA

N80-10993# Joint Publications Research Service, Arlington, Va.
USSR REPORTS: BIOMEDICAL AND BEHAVIORAL SCIENCE, NO. 112
23 Jul. 1979. 109 p. refs. Transl. into ENGLISH from various Russian journals.
(JPRS-73882) Avail: NTIS. HC A06/MF A01
Articles are presented on agrotechnology, aerospace medicine, clinical medicine, ecology, ergonomics, deep sea exploration, physiology, and space medicine. For individual titles, see N80-10994 through N80-11001.

N80-10994# Joint Publications Research Service, Arlington, Va.
LODGING OF GRAIN CROPS AND ITS DETECTION BY AERIAL PHOTOGRAPHY c43
V. Ye. Budanov (All-Union Scientific Res. Inst. of Cybernetics). *In its* USSR Report: Biomedical and Behavioral Sci., No. 112, 23 Jul. 1979. p. 1-6. Transl. into ENGLISH from Zashchita Rasteniy (Moscow), no. 4, 1979. p. 32-33. (For primary document see N80-10993, 01-99)
Copyright. Avail: NTIS. HC A06/MF A01
It was found that in several basic areas of grain production (northern Caucasus, nonchernozem areas, Kazakhstan, Ukraine, Belorussia and others) fermentative mycotic exhaustion especially increases under the influence of rainy weather, incessant dews and fogs. Investigations begun in various areas of the country in 1973 have made it possible to determine the basic features of the complicated biological mechanism causing the appearance, development and occurrence of the described phenomenon. The pathologic process occurs and develops under a certain combination of external and internal factors coming through successively and consists of the two following stages. The first stage is noninfectious and occurs during the phase of milk, wax and, less frequently, full ripeness of grain when the ears are moistened by rain, fog or continuous dews (with irrigated crops, during late watering when the grain is being formed). The second stage is infectious and is caused by saprophyte and semi-parasitic fungi from the genera of Alternaria, Cladosporium, Helminthosporium, Fusarium, etc. F.O.S.

N80-10995# Joint Publications Research Service, Arlington, Va.
HEALTH PROGNOSIS IN FLIGHT DISCUSSED c52
R. Bayevskiy. *In its* USSR Report: Biomedical and Behavioral Sci., No. 112, 23 Jul. 1979. p. 10-12. Transl. into ENGLISH from Meditsinskaya Gazeta (Moscow), 30 May 1979. p. 3. (For primary document see N80-10993, 01-99)
Avail: NTIS. HC A06/MF A01
A system of preventive measures to insure the rapid readaptation of a cosmonaut to the earth is discussed along with a method for predicting the state of health on long space flights. F.O.S.

N80-10996# Joint Publications Research Service, Arlington, Va.
THE THIRD SYSTEM OF REGULATION OF ANIMAL AND HUMAN FUNCTIONS, THE ACTIVE POINT SYSTEM c51
A. V. Zhirmunskiy (USSR Academy of Sciences, Vladivostok) and V. I. Kuzmin (USSR Academy of Sciences, Vladivostok). *In its* USSR Report: Biomedical and Behavioral Sci., No. 112, 23 Jul. 1979. p. 13-30. refs. Transl. into ENGLISH from Zh. Obshchey Biologii (Moscow), no. 2, 1979. p. 176-188. (For primary document see N80-10993, 01-99)
Copyright. Avail: NTIS. HC A06/MF A01
The identification of the mechanisms and structures for control of vital functions of organisms is discussed in terms of active points. F.O.S.

N80-10997# Joint Publications Research Service, Arlington, Va.
TWO IMPORTANT DIRECTIONS OF DEVELOPMENT OF SOVIET BIOMETRY c51
V. M. Shmidt (Leningrad State Univ.). *In its* USSR Report: Biomedical and Behavioral Sci., No. 112, 23 Jul. 1979. p. 31-46. refs. Transl. into ENGLISH from Zh. Obshchey Biol. (Moscow), no. 2, 1979. p. 219-228. (For primary document see N80-10993, 01-99)
Copyright. Avail: NTIS. HC A06/MF A01
The history and application of Soviet biometry are discussed in terms of correlation pleiads, and taxonomic analysis. F.O.S.

N80-10998# Joint Publications Research Service, Arlington, Va.
PRINCIPLES OF ERGONOMIC STANDARDS DISCUSSED c88
V. Munipov. *In its* USSR Report: Biomedical and Behavioral

Sci., No. 112, 23 Jul. 1979, p 47-54 refs Transl. into ENGLISH from Obshchestvennye Nauki (Moscow), no. 3, 1979, p 175-181 (For primary document see N80-10993 01-99)
Copyright. Avail: NTIS HC A06/MF A01

The theory and methodology of ergonomics is discussed. The establishment of unified sociopsychological and sociological criteria is examined and the principles of ergonomic research towards aspects of human labor are outlined. A.W.H.

N80-10999# Joint Publications Research Service, Arlington, Va.
MINISUBS FOR DEEP-SEA EXPLORATION c48
Aleksandr Durnev *In its* USSR Report: Biomedical and Behavioral Sci., No. 112, 23 Jul. 1979, p 64-71 refs Transl. into ENGLISH from Tekhnika Molodezh' (Moscow), no. 4, 1979, p 24-26 (For primary document see N80-10993 01-99)
Avail: NTIS HC A06/MF A01

A history of the development of the U.S.S.R. research apparatus and programs for deep sea research is presented. Among the apparatuses discussed are minisubmarines and underwater laboratories, including the Bentos-300. A.W.H.

N80-11000# Joint Publications Research Service, Arlington, Va.
EVALUATION OF HEAT FLOW COMPONENTS FROM HEATER TO SKIN IN AN ELECTRIC THERMAL SUIT c54
I. M. Naumenko (Academy of Sciences Ukrainian SSR, Kiev) *In its* USSR Report: Biomedical and Behavioral Sci., No. 112, 23 Jul. 1979, p 76-80 refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukrayinskoyi RSR (Kiev), no. 4, 1979, p 294-297 (For primary document see N80-10993 01-99)
Avail: NTIS HC A06/MF A01

The nature of heat transfer from the heater in an electric thermal suit to the human body is studied. An evaluation of the heat flow components of biological significance are presented. Information that prolonged exposure to low intensity radiant heat promotes an increase in the adenine nucleotides is discussed. A.W.H.

N80-11001# Joint Publications Research Service, Arlington, Va.
ULTRASTRUCTURE OF CHLORELLA PYRENOIDOSA CELLS (STRAIN g-11-1) FOLLOWING GROWTH UNDER CONDITIONS OF A PROLONGED SPACE FLIGHT c51
K. M. Sytnky (Academy of Sciences Ukrainian SSR, Kiev), Ye. L. Kordyum (Academy of Sciences Ukrainian SSR, Kiev), O. L. Mashynskyy (Academy of Sciences Ukrainian SSR, Kiev), A. F. Popova (Academy of Sciences Ukrainian SSR, Kiev), and H. M. Hrechko (Academy of Sciences Ukrainian SSR, Kiev) *In its* USSR Report: Biomedical and Behavioral Sci., no. 112, 23 Jul. 1979, p 98-104 refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukrayinskoyi RSR (Kiev), no. 4, 1979, p 311-315 (For primary document see N80-10993 01-99)
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The effects of space flight on the growth and viability of the unicellular alga Chlorella pyrenoidosa, analysed by studying the ultrastructure of the cell, is examined. Difference between the control and experimental cells in the ultrastructure and volume relationships of cytoplasmic organelles and storage material are described. The accelerated accumulation of biomass and the accelerated ageing of the cells in space flight is discussed. A.W.H.

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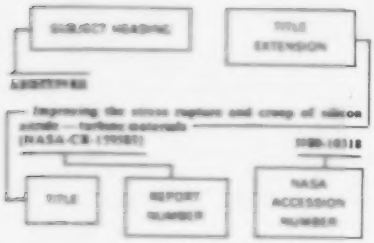

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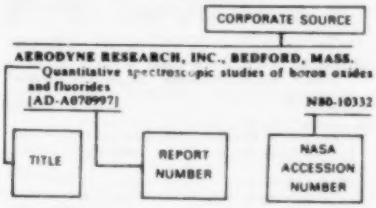

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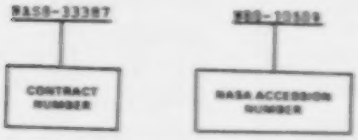

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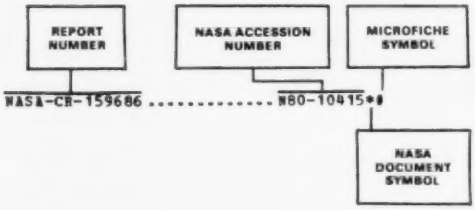

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26 METALLIC MATERIALS 166
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 171
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 173
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 175
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 177
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 185
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 191
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 195
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 196
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 202
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 205
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 207
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) 211

43 EARTH RESOURCES 211

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 214

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 225

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 230

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 235

Includes weather forecasting and modification.

48 OCEANOGRAPHY 240

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 241

Includes genetics.

52 AEROSPACE MEDICINE 241

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 243

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 244

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 246

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 248

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 250

Includes computer networks.

63 CYBERNETICS 251

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 252

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 254

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 255

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 255

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

70 PHYSICS (GENERAL) 256

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 256
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 257
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 259
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 259
Includes light phenomena.

75 PLASMA PHYSICS 261
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 263
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 265
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) 265
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 266
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 266
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 267
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 267
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 267
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 269
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 270
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 270
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 271
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 271
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 272

Note: N.A. means that no abstracts were assigned to this category for this issue.

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TYPICAL CITATION AND ABSTRACT

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NASA ACCESSION NUMBER → N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif ← CORPORATE SOURCE

TITLE → **STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE**

PUBLICATION DATE

AUTHOR → D. J. Mourey 3 Sep 1979 409 p refs

(Contract NAS1-15624) ← AVAILABILITY SOURCE

CONTRACT OR GRANT → (NASA-CR-159149) Avail: NTIS HC A18/MF A01

CSCL 01C ← COSATI CODE

REPORT NUMBER →

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, MINI-RPV (REMOTELY PILOTED VEHICLE) ENGINE DEMONSTRATOR PROGRAM
M. Johnston, Teledyne Continental Motors, Aircraft Products Division, *P.O. Box 90, Mobile, Alabama* 36601 (DA0D4106; DAAJ02-77-C-0015)

Develop a lightweight, twin cylinder, two-stroke demonstrator engine which provides a technology base for future Army mini-RPV's. Address and solve existing problems of high weight, vibration levels, fuel consumption and short life.

Design, fabricate, test and deliver for government test five mini-RPV engines designed around currently available high-production engine components, i.e., pistons, cylinders, rods, etc. Make component modifications necessary to achieve the program goals of 1.2 lb/hp, 0.8 lb/hp-hr SFC, 150 hour life, operation to 12,000 foot density altitude.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0002, AN IMPROVED COMPUTER MODEL FOR PREDICTION OF AXIAL GAS TURBINE PERFORMANCE LOSSES
R.M. Jenkins, Tuskegee Inst., Graduate School, *Tuskegee Institute, Alabama* 36088 (NSG 3295)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0003, VISCOELASTIC BEHAVIOR OF THE INTERVERTEBRAL DISC RELATED TO EJECTION SHOCK
W.G. Knauss, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (DF046780; AFOSR-77-3139)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including flail and impact. The body in general and the musculoskeletal system particularly is adversely affected by these forces. This is of special importance in cases of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. Deficiency - non-invasive techniques that may provide information about the mechanical performance of the human intervertebral disc do not exist. This information is important for the diagnosis as well as for the prevention of low back injuries, as may occur in aircraft ejections. This research seeks to set up the basis for the development of such a technique. Objective - the overall objective of this research is to improve the knowledge of the physiology and mechanical properties of the human intervertebral disc. How research contributes - this work should provide essential information to understand the short duration, transient loading problems of the spinal discs and contributes directly to subarea 1.6, 'aircrew safety and effectiveness in mechanical force environments' and will also be applicable to the fields of diagnostic, preventive and reparative medicine.

The researchers will delineate the inherent actions of the disc to mechanical load and define these physiologic and anatomical changes in terms of engineering parameters and constants. Experimentation will include for the coming year specimen preparation, relaxation of vertebral specimens subjected to a constant strain, and determination of the stiffness matrix for disc lamella.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0004, RESEARCH OF TUTORIAL CAPABILITY FOR THE USE OF LARGE STRUCTURAL ANALYSIS SYSTEMS
R.J. Melosh, Marc Analysis Research Corp., *260 Sheridan Ave., Suite 314, Palo Alto, California* 94306 (DF133220; F33615-78-C-3206)

The use of finite element analysis for the design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. The effective use of large structural analysis systems requires the user to devote a considerable effort and long calendar time to become familiar with its capabilities or consult some person who is an expert in its utilization. The objective of this effort is to explore the possibility of creating an expert consultant by utilizing the capabilities of a computer. The successful accomplishment of this objective will insure the ready capability to provide the analysis support for present and future aerospace systems, such as F-16, A-10, and YC-15 with a minimum analysis time.

A literature search has revealed that significant advances have been made in other scientific fields in using the methodology of production systems to create an expert consultant. The ideas of production systems will be utilized to investigate the possibility of creating an expert consultant for the use of large structural analysis systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, CONTROL OF V/STOL AIRCRAFT IN GROUND EFFECT
D.B. Debra, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NSG 2400)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0006, AERONAUTICAL TECHNOLOGY, TECH AREA I - AERODYNAMICS TECHNOLOGY
I.C. Statler, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, *Moffett Field, California* 94035 (DA0B5000)

This project provides for technological development in rotary-wing fluid dynamics, acoustics, dynamics, stability, controllability and handling qualities where deficiencies are known to exist in meeting the requirements of future Army airmobile systems. Objectives are to develop handling quality design goals and performance criteria in terms required in future systems and to allow knowledgeable tradeoffs to be made among pilot workload, task performance and costs. This effort will lead to new design criteria and a revised handling qualities mil. spec. for helicopters. It is intended to contribute not only to the improvement of capabilities

in industry, but also to the development of the Army's in-house ability to assess the potential of new systems against predicted requirements.

These objectives will be reached through joint participation with NASA in theoretical and experimental research programs utilizing wind tunnel, ground-based simulation, and flight research capabilities.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0007, FLIGHT SOFTWARE REQUIREMENTS AND DESIGN SUPPORT SYSTEM

W.E. Riddle, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NSG 1638)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0008, ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION

W.J. Twomey, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0E3774; DAAJ02-77-C-0037)

The coupled interaction between two or more helicopter dynamic subsystems has often been the source of vibration problems. This is particularly true when considering the helicopter as a dynamic system in which excitations can be generated by any or all of the propulsion system, the airframe or the drive system. The problems of vibration-related interface compatibility in engine/drive system installations are usually complicated by the inherent coupling of the three (3) major multi-degree-of-freedom systems, i.e., engine, airframe and drive train. All background data and documentation of past experience lies in the hands of the airframe/engine industry, primarily the former. The technical objective of this contractual effort is to document industry experience to the degree required to permit plans/programs to be formulated as part of an overall government effort to accumulate data which will eventually lead to a solution of generic problems of this type.

Award sole source contracts to the major manufacturers of gas turbine powered US military helicopters, to review existing files, compile reports, memoranda, analytical design efforts, etc., and coordinate with appropriate engine manufacturers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0009, ACCIDENT INFORMATION RETRIEVAL SYSTEM (AIRS) INVESTIGATION

H. Ask, United Technologies Corp., Hamilton Standard Division, *Bradley Field Rd., Windsor Locks, Connecticut* 06096 (DA0E3843; DAAK51 78 C 0025)

Reduce Army aircraft accidents, enhance accident investigation validity and derive precise crashworthiness design criteria through the development and implementation of an accident information retrieval system that records flight and crash impact data.

AIRS detailed design, fabrication, component test, and system brassboard flight test in a Black Hawk helicopter memory module will be subjected to impact and fire survivability tests.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0010, ADVANCED COMPOSITES DESIGN PROGRAM

R.B. Pipes, University of Delaware, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Newark, Delaware* 19711 (DF140900; F33615-77-C-3132)

Advanced composite structures offer the potential of saving weight and cost on future military airframe structures and will allow significant increases in aircraft performance (particularly ranges). The amount of payoff in weight and cost to be realized will depend on the efficiency of the design concepts used. One concept proposed by AFFDL/FB has outstanding promise for a tremendous payoff, but needs development before it can be introduced into production aircraft. This program will develop essential design information on this concept, which features spar caps embedded in composite wing skins.

This effort will investigate promising new concepts for attaching spars to skins in advanced composite wing structures. An existing fighter aircraft will be used as baseline, and the new concepts will be developed to meet the specific requirements of this baseline. Activities to be conducted include preliminary design, detailed design, component fabrication, and testing of the components. A final report will be published.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, RESEARCH ON HELICOPTER ROTOR NOISE 13517-EX

H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DA0E9139; DAAG29-78-G-0152)

To extend current knowledge of high speed helicopter rotor noise by determining the influence of non-compact source distribution on high speed rotor blade tips, the influence of aerodynamic pressure distribution on radiated near and far acoustic fields and influence of unsteady pressure fluctuations on radiated noise. Relevance - high speed rotor noise studies are very relevant to Army missions of the next few years. Blade slap must be reduced if the true advantages of nap-of-the-earth flight are to be realized. This study is also relevant to determining detectability, community annoyance and possible effects of FAR 36 on new helicopter designs.

The non-homogeneous wave equation describing the radiated acoustic pressure will be solved both analytically, where possible, and numerically in a form that removes the restrictions of compactness, hovering rotors, far-field approximation, geometry, and mathematical singularities characteristic of high tip speeds.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0012, AIRCRAFT EFFECTS ON CLIMATE

Unknown, U.S. National Science Foundation, *1800 G St. N.W., Washington, District of Columbia* 20550 (FA78WAI-911; FA161456 (TRAIS NO.))

The National Science Foundation (NSF) is to provide advisory, review and evaluation services of the climatic impact of high altitude aviation to the Federal Aviation Administration (FAA). Performing this study, the NSF shall include, but not be limited to, the following: 1) take into account the special nature of the aircraft as a perturbing source, 2) consider changes in atmospheric ozone, and 3) consider the aircraft source in the context of all other known perturbing influences.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0013, FINITE ELEMENT ANALYSIS OF TRANSONIC FLOW THROUGH A CASCADE OF AIRFOILS USING A SELF-ADAPTIVE MESH

A. Ecer, Purdue University, Graduate School, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 3294)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0014, MULTIPLE LEVEL TECHNIQUES FOR COMPUTATIONAL FLUID DYNAMICS

D.R. McCarthy, Purdue University, Graduate School, Dept. of Mathematics, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 1635)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0015, WING/BODY INTERFERENCE FLOW INVESTIGATION
J.M. Vogel, Iowa State University of Science & Technology, Graduate School, *Beardshear Hall, Ames, Iowa* 50010 (NCC 2 19)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0016, ANALYSIS OF PERFORMANCE AND HANDLING QUALITIES - CONSIDERATIONS FOR WAKE MODIFICATION DEVICES ON AGRICULTURAL AIRCRAFT
K.H. Lenzen, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Civil Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NSG 1633)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0017, A RESEARCH PROGRAM TO REDUCE INTERIOR NOISE IN GENERAL AVIATION AIRPLANES
J. Roskam, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NCC 1 6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0018, WEIGHT ESTIMATION TECHNIQUES FOR HYPERSONIC FLIGHT VEHICLES
E.L. Cook, Wichita State University, School of Engineering, Dept. of Aeronautical Engineering, *1845 Fairmont N., Wichita, Kansas* 67208 (NCC 1 21)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0019, DEVELOPMENT OF A NICAD BATTERY INTERFACE UNIT - ARMY AIRCRAFT
C. Thomas, Chrysler Corp., Space Division, *Old Gentilly St., New Orleans, Louisiana* 70129 (DA0D4061; DAAJ02-76-C-0054)

Develop an interface between the on-board PICAD battery and the electrical system for aircraft in the field and upcoming aircraft (UTTAS, AAH) which will result in the safe, cost effective use of nickel cadmium batteries. The interface will be designed to accommodate a given battery size (11AH, 34AH, etc.) and will be common to all aircraft using that battery size.

The technical objectives of this program can best be accomplished as follows: a. Define the required/desired features in an interface unit. B. Design and fabricate or procure off-the-shelf units. C. Test to verify compliance with requirements. D. Supply prototype units for field evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0020, IMPROVEMENT OF SHORT-RANGE FORECASTS OF THUNDERSTORMS
Unknown, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, *8060 13th St., Silver Spring, Maryland* 20910 (FA78WAI-886; FA161246 (TRAIS NO.))

At the present time the FAA Air Traffic Controllers utilize only real-time information about thunderstorms and associated hazards in directing air traffic. Accurate and reliable short-range (0-2 hour) forecasts of thunderstorms, especially in the 0-30 minute time period with 10 minute updates, can aid the controller in the safe and expeditious movement of air traffic. The 0-30 minute forecast can be used in the air traffic control system 1) to expedite the movement of aircraft to avoid the hazards of thunderstorms as they move through the controlled airspace, and 2) selecting holding patterns that will minimize the effect of thunderstorms.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0021, KEVLAR PROPERTIES DETERMINATIONS
N.J. Abbott, Fabric Research Labs. Inc., *1000 Providence Hwy., Dedham, Massachusetts* 02026 (DF138070; F33615-78-C-3406)

Aerodynamic decelerators are required in the performance of many military missions such as aircraft landing decelerations, aircraft spin recovery, crew escape and recovery, weapons delivery and recovery of remotely piloted vehicles (RPVS). It is most desirable that the decelerator subsystem be as small as possible and as lightweight as practical to accomplish the objective for which it is designed. Parachute systems previously fabricated from nylon materials can be reduced in both volume and weight by as much as 50 percent by utilizing Kevlar materials. This program will determine the effects of static and dynamic loading, abrasion and cyclic loading on the properties of selected coated and uncoated Kevlar ribbon parachute material configurations and typical junctions. Reducing weight and volume of the decelerator or recovery subsystem minimizes the impact on the payload or range capabilities of the primary vehicle.

Kevlar material configurations (for which specifications have previously been developed) and typical junctions or joints in the materials will be subjected to laboratory tests to determine effects of abrasion, cyclic loading and impact loading. Where low resistance to abrasion or poor efficiency in materials is evident, efforts to effect improvements through application of coatings will be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, COCKPIT DISPLAYS FOR NEW CONTROL CAPABILITIES
W.M. Hollister, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF142110; AFOSR-78-3620)

This work unit will support the development of cockpit displays for control configured aircraft. These advanced aircraft will provide for new dimensions in guidance and control. The addition of direct lift and side force control provides the pilot with separate control capability over all six degrees of freedom. A problem exists with using a conventional flight command system which directs attitude changes to make flight path corrections. The objective of this effort is to perform the research required to define a new display format to obtain maximum utility from the new control capabilities. Advanced combat strategies are possible with the added control dimensions, but displays must be developed to present command information required for the pilot to fly the prescribed maneuvers in current and future military aircraft.

Conduct graduate thesis research on the development of cockpit displays to provide guidance for new control capabilities. Cockpit simulation facilities will be utilized. Results will be documented in graduate thesis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, FINITE ELEMENT ANALYSIS OF CREEP AND THREE-DIMENSIONAL FRACTURE
T.H. Pian, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF048350; F49620-77-C-0084)

AF function - advanced flight vehicle structures and engine structures require improved design methods which accurately consider environmental conditions. Deficiency - accurate and efficient structural analysis methods do not exist which consider elevated temperature creep response. Objective - this research will investigate the propagation of structural defects under creep conditions. How work contributes -research will improve engine durability predictions.

This research will study the extension of hybrid finite element methods for crack analysis to include creep phenomena. Crack extension studies will investigate the stress distribution and stress time histories at the crack front. Special elements will be developed to model correct stress singularity under creep conditions. Predictions of crack growth will be compared with experimental data found in the literature. In addition six problems will be solved which involve the prediction of stress intensity factors governed by three-dimensional behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0024, VIBRATION OF COMPOSITE SHELLS WITH TRANSVERSE SHEAR

T.H. Pian, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF140450; AFOSR-77-3335)

This effort will support the design of military aircraft structures. It will improve the performance of the aircrafts and reduce the cost of the aerospace vehicles. Structural dynamics is an important facet in the design of flight vehicles. There is a need to correctly predict the vibration characteristics of advanced composite shells. This effort will develop a computer program to investigate the vibration characteristics of composite shells taking into consideration the transverse shear. The analytical results will be compared with experimental results. This will provide an improved reliable analytical tool for the design of structures leading to reliable military aircrafts.

The method of finite element analysis will be used to predict the vibration and mode shape analysis of composite shells and compare the results with the experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, FLIGHT TRAJECTORY CONTROL INVESTIGATION

M.W. Bird, Lear Siegler Inc., *4141 Eastern Ave., Grand Rapids, Michigan* 49508 (DF141380; F33615-78-C-3607)

The Air Force function for this effort is to study and develop advanced techniques for real-time flight trajectory generation and execution of complex flight paths for advanced military transport aircraft. Future mission requirements and air traffic control constraints will present significant pilot workload and performance problems to flight crews if additional capability is not provided by enhanced flight control system features. The objective of this effort is to develop a set of algorithms suitable for on-board computation of complex trajectories which also interface with pilot displays to minimize crew duties. This development will provide the Air Force capability to operate in future civil and military environments not possible with current aircraft equipments.

Development of trajectory generation software. Software validation and capability demonstration via computer-based engineering simulation. Definition of display requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, EXPERIMENTAL EVALUATION OF NON-AXISYMMETRIC EXHAUST NOZZLES

P.E. Hiley, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF136160; F33615-76-C-3019)

The relevant problem of this effort is the need to increase the range and/or decrease the fuel requirements of military aircraft plus a need for increased fighter aircraft maneuverability. The objective of this program is to experimentally investigate several non-axisymmetric exhaust nozzle concepts to determine what range improvement and/or maneuver enhancement may be obtained when the nozzles are designed into a particular airframe.

During the initial phase of the investigation selected non-axisymmetric exhaust nozzles will be designed, fabricated and statically tested to determine their relative static performance. These nozzles will then be installed in an isolated pod/wing arrangement and tested in a wind tunnel to determine their relative thrust minus drag performance and lift enhancement plus vectoring/reversal capability. The acquired data will then be used to estimate the performance (including maneuver capability) of aircraft that have the non-axisymmetric nozzles installed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, APPLICATION OF ADAPTIVE FINITE ELEMENT ANALYSIS OF INTEGRATED DESIGN AND ANALYSIS OF AIRCRAFT STRUCTURES

B.A. Szabo, Washington University, Graduate School, *Brookings 220, St. Louis, Missouri* 63130 (NSG 1640)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0028, UNSTEADY TRANSONIC AERODYNAMICS OF CASCADES

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0029, MULTIPLE AIRCRAFT APPROACH LANDING TECHNIQUES

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The primary objective of this task is to investigate V/STOL instrument approach requirements, controller techniques, terminal area flight procedures and landing/air traffic control (ATC) equipment requirements for realizing, especially under IMC conditions, high landing rates consistent with the intrinsic flight characteristics of the helicopter. This includes an examination of V/STOL related terminal area ATM problems (via computer simulation and subsequent flight experimentation) under conditions of both IMC and VFR. The ultimate goal is to establish cooperative pilot/controller techniques and landing/ATC equipment requirements, which will make possible efficient landing of IMC terminal area V/STOL traffic with minimum separation of aircraft.

Apply AVRADA's computer simulation (I/A SIM) facility to simulate an air traffic control (ATC) terminal area with closely spaced IMC helicopter traffic. The I/A SIM facility provides for interactive input from one simulated controller position and four simulated V/STOL pilot positions. Also, investigate cooperative pilot/ATC techniques, procedures and equipment requirements allowing pilot, in cooperation with controller, to set his own separations from other nearby aircraft. Apply the data and experience from these investigations to fabricate an experimental crossbanded military microwave landing system (MMLS)/ATC system to achieve a tactical landing and ATC capability in a minimum size equipment. This system would possess the resolution, accuracy and data rate of the MMLS and would utilize the airborne MMLS receiver to solicit replies from the on-board ATCRBS transponder. These replies would be received and processed by the ground-based ATC system and presented to the controller's display with a resolution sufficient for control of closely-spaced V/STOL terminal area traffic.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0030, FLIGHT EVALUATION OF THROTTLE EM FOR TRANSPORT

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The Air Force stands to gain substantial fuel-cost benefits through the use of fuel saving energy management flight profiles. The high costs of hydrocarbon fuels as compared with pre-1973 levels continue to impact military aircraft operations. Real-time

energy management techniques for fuel conservation have recently been analyzed for large military transport aircraft (C-141) and compared with typical flight handbook trajectoreis by means of digital simulation. Considerable fuel and cost savings were realized by following the optimal altitude/velocity profiles. Verification of these savings in flight through implementation and testing of fuel conserving control algorithms and system concepts is now required.

It is planned to verify potential fuel savings of transport aircraft by incorporating fuel conserving control laws in an on-board computer system with an appropriate pilot control-display interface. Fuel savings will be validated by comparing fuel optimal flights against standard flight handbook operating procedures. In addition fuel optimal flights with autothrottle and autopilot engaged will be investigated. The flight test aircraft will be the C-135C aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, AN INVESTIGATION TO IMPROVE THE PERFORMANCE OF A TECHNIQUE TO IDENTIFY LIFT, DRAG AND POWER SIMULTANEOUSLY FROM FLIGHT TEST DATA

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Dryden Flight Research Center

1.0032, INTERACTIVE FLOW-FIELD CALCULATIONS IN TURBOMACHINERY

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0033, BASIC EROSION INVESTIGATION IN SMALL TURBOMACHINERY 13653-E

W. Tabakoff, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering & Applied Mechanics, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (DA0E9138; DAAG29 76 G0229)

To investigate the erosion process of small turbomachinery in order to develop a quantitative model which will facilitate the prediction of erosion in future advanced turbomachinery in a particulate environment. Relevance - the research is relevant to the development of erosion resistant components for helicopter gas turbine engines and, to a lesser degree, to the design of efficient filtration devices for Army gas turbine-driven generator sets.

Factors affecting ductile erosion, such as angle of impingement, particle velocity, size, shape, and strength, will be investigated experimentally. Experimental and analytical work will be performed to examine the effects of target material size, velocity dependence due to the angle of impingement and the aerodynamic effect of temperature on erosion of alloys for future compressors and turbines.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0034, ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION

J.R. Alwang, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0E3773; DAAJ02-77-C-0040)

The coupled interaction between two or more helicopter dynamic subsystems has often been the source of vibration problems. This is particularly true when considering the helicopter as a dynamic system in which excitations can be generated by any or all of the propulsion system, the airframe or the drive system. The problems of vibration-related interface compatibility in engine/drive system installations are usually complicated by the inherent coupling of the three (3) major multi-degree-of-freedom systems, i.e., engine, airframe and drive train. All background data and documentation of past experience lies in the hands of the airframe/engine industry, primarily the former. The technical objective of this contractual effort is to document industry experience to the degree required to permit plans/programs to be formulated as part of an overall government effort to accumulate data which will eventually lead to a solution of generic problems of this type.

Award sole source contracts to the major manufacturers of gas turbine powered US military helicopters, to review existing files, compile reports, memoranda, analytical design efforts, etc., and coordinate with appropriate engine manufacturers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0035, STUDY OF THE EFFECT OF TERRAIN ON HELICOPTER NOISE PROPAGATION BY ACOUSTICAL MODELING, PART I 14795-E

H. Sternfeld, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0F9145; DAAG29-78-C-0002)

To study the effect of terrain geometry on the propagation and aural detection of helicopter rotor noise. Relevance - an understanding of aural detection of helicopters is of direct concern in evaluating the U.S. Army tactics required for successful helicopter operations, especially when conducting low-level 'nap of the earth' maneuvers.

The method of acoustical modeling will be developed to understand the effects of ground terrain contours on the aural detection of helicopters, to evaluate the sensitivity of analytical predictions and/or acoustical model results to definition of ground surface and to further develop the experimental techniques for application to aural detection.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0036, INVESTIGATION OF THE CRASH IMPACT CHARACTERISTICS OF ADVANCED AIRFRAME STRUCTURES

J. Cronkhite, Bell Helicopter Co., Division of Textron, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3789; DAAJ02-77-C-0062)

To determine (1) the ability of advanced airframe structural materials to withstand crash impact loading, (2) the effect of these materials on impact structural integrity and impact force attenuation, and (3) technological barriers to advanced airframe structures withstanding impact loads.

Design concepts for Mil-Std-1290 airframe structures constructed from composite materials will be designed, analyzed and tested. Analytical and test results will be evaluated to ascertain structural integrity and crash impact energy absorption.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0037, CRITERIA AND CONCEPT FOR IMPROVED UH-1H MAST BUMPING SAFETY MARGIN

L.W. Dooley, Bell Helicopter Co., Dvision of Textron, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3790; DAAJ02-77-C-0064)

The purpose of the effort is to (1) develop an analytical method of predicting rotor mast loads due to hub/mast contact, (2) validate the analysis through aeroelastic model tests, (3) develop criteria for the design of the mast and a hub restraint mechanism to make contact or structural deformation improbable under typical operational conditions, and (4) develop and demonstrate the characteristics of a hub spring for the UH-1H helicopter.

An existing rotor/pylon hybrid computer analysis will be modified to predict rotor mast loads due to flapping stop contact. Aeroelastic model tests will be conducted to obtain data on mast

impact loads for subsequent program validation. Conduct a parametric study of UH-1H rotor and pylon stiffness parameters and apply toward development of mast design load criteria. Analyze, design and fabricate a nonlinear hub spring system for the UH-1H. Flight test both the baseline and modified (with hub spring) UH-1H in high flapping maneuvers to investigate hub spring characteristics.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0038, DEVELOP AND IMPROVE ANALYTICAL TECHNIQUES OF MAJOR FINITE ELEMENT PROGRAM
H. Hanson, Bell Helicopter Co., Division of Textron, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3845; DAAK51 78 C 0011)

To expand on the investigation of Vincent Circle technique application on a complex helicopter finite element model to include damping and dynamic absorber location changes.

Apply the Vincent Circle technique to optimize the vibratory response, at a selected point and under a specified load, on an elastic line model of AH-1G aircraft and conduct a sensitivity study using the strain energy method. Repeat the above process utilizing a complex 3-D AH-1G NASTRAN model. Also, the Vincent Circle technique will be investigated further by damping and dynamic absorber location changes.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0039, ANALYSIS OF LOW-SPEED HELICOPTER FLIGHT TEST DATA
G.A. Shockey, Bell Helicopter Co., Division of Textron Inc, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0D4107; DAAJ02-77-C-0022)

To investigate the aerodynamic and dynamic behavior of a helicopter operating in the low-speed flight regime particularly in the NOE evasive mode.

Effort will consist of reducing and analyzing existing AH-1G flight test response data acquired for simulated NOE maneuvers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0040, APPLICATION OF STABILITY THEORY TO LAMINAR FLOW CONTROL
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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0041, DESIGN OF MULTI-VARIABLE FEEDBACK CONTROL SYSTEMS VIA SPECTRAL ASSIGNMENT
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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0042, FLYING QUALITIES OF AUGMENTED AIRCRAFT
J.M. Schuler, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF139220; F33615-78-C-3603)

This work unit supports the flying qualities specification Mil-F-8785B. The problem is to identify areas in Mil-F-8785B that can be revised to increase the safety assurance aspects of flying qualities requirements. The objectives are (1) to improve interfacing between Mil-F-8785B and the flight control system specification Mil-F-9490D, (2) development of criteria for highly augmented unstable or neutrally stable aircraft under normal and emergency conditions, (3) improve criteria concerning pilot-induced oscillations, (4) development of criteria for control saturation and pilot workload saturation conditions, and (5) development of criteria covering unusual or extreme atmospheric environmental conditions. The results will be used to make future military aircraft safer through improving the handling qualities specification Mil-F-8785B.

The approach to achieve this objective includes reviewing existing requirements and conducting analytical investigations to develop criteria for the problem ar as identified in the objective.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, ACQUISITION AND RETENTION OF COGNITIVE VERSUS PERCEPTUALLY-ORIENTED MATERIALS
D.J. Sullivan, Canyon Research Group Inc., *32107 Lindero Canyon Rd., Suite 123, Thousands Oaks, California* 91361 (DA644249; DAHC19-77-C-0040)

To investigate the effect of various instructional strategies on acquisition and retention of aircraft ranging and engagement skills across individuals varying in academic aptitude.

To conduct a parametric investigation of the effects of instructional strategy including various mixes of principle, rule and sign learning, as a function of sex and academic aptitude on acquisition and retention of basic ranging skills. To conduct a follow-up investigation of the various mixes of perceptual and cognitive-oriented materials and strategies on acquisition and retention of ranging and rage-ring profile tasks during redeye training.

SUPPORTED BY U.S. Dept. of Defense, Research Inst. for the Behavioral & Social Sciences, Individual Training & Performance Research Lab.

3.0002, ASSESSMENT OF THE STATE OF KNOWLEDGE PERTAINING TO SOLID PARTICLE EROSION 14980-MS
W.F. Adler, Effects Technology Inc., *Santa Barbara, California* 93105 (DA0F9079; DAAG29-77-C-0039)

To carry out a comprehensive review and assessment of the field of solid particle erosion of materials and thereby elucidate the gaps in knowledge required to provide realistic information on materials response as well as information on the mechanisms underlying particle erosion processes. The review would constitute a critique of significant contributions to the subject area with sufficient supporting data to develop concepts and a useful data base. Relevance - the review relates to Army problems with particle erosion in turbines and helicopter components and may contribute new knowledge in penetrator-target interactions and in gun tube erosion.

To conduct a review of pertinent literature in the field of particle erosion, and complement the information thus gained by discussion and written communications with other researchers active in the field.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0003, PLASMA ETCHING OF THIN FILMS FOR INTEGRATED CIRCUITS
D.W. Hess, University of California, Berkeley Campus, School of Engineering, Dept. of Chemical Engineering, *Berkeley, California* 94720 (ENG7812236)

This program is providing a systematic investigation of basic factors that influence etching of films of such materials as silicon nitride, silicon dioxide, poly-crystalline silicon, and aluminum, all of which are important to the fabrication of integrated circuits. Variables being considered include etching gas, radio-frequency power levels, gas pressure, gas dynamics, substrate temperature, and electrode spacing. Characterization of the various etching procedures includes the development of kinetic models that lead

to increased quantitative understanding of the plasma processes. These models are likely to result in improved processing methods and thus higher performance and lower cost integrated circuits.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

3.0004, LABORATORY MEASUREMENTS OF REACTION RATE OF HYDROXYL RADICALS (OH) WITH CHLORINE MONOXIDE (ClO)

Unknown, Xonics Inc., *6911 Hayvenhurst Ave., Van Nuys, California* 91406 (FA78WA-4262; FA161587 (TRAIS NO.))

The purpose of this effort is to measure by direct observation of reactants and/or products over the relevant range of stratospheric pressure and temperature, the absolute rate of coefficient and products for the reaction of the hydroxyl radical (OH) with chlorine monoxide (ClO). The rate coefficient for the reaction will be measured over a temperature range of 200K to 300K using a variable reaction length, flow system, or for slow reactors, a stopped flow, stirred reactor system. Absolute measurements of (O), (Cl), and (OH) will be made by resonance scattering methods, and (ClO) shall be measured by chemical conversion to Cl and measurement of (Cl).

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

3.0005, NEW CHEMICAL ANALYSIS TECHNIQUES

R.E. Sievers, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Chemistry, *1200 University Ave., Boulder, Colorado* 80302 (DF042170; F44620-76-C-0031)

AF function - advanced analytical and experimental techniques are needed to support the Air Force mission in the sensing and detection areas. Deficiency - this area of research has need of measurement techniques that are highly sensitive and selective. Objective - the program deals with several distinct and interrelated measurement techniques which include chromatographic separation and mass spectrometric analysis of isotopes, metal complexes that are highly soluble in organic solvents, nuclear magnetic resonance of metal chelates, thermal gravimetric analysis, environmental analytical chemistry, and trace analysis. How work contributes - volatile metal chelates will be exploited to develop more rapid separation and accurate analytical methods in order to determine very low but significant concentrations of metals and their compounds, that play a part in engine wear and pollution problems.

In materials technology there is a continuing need for fluids that will withstand high temperatures without thermal, hydrolytic or oxidative breakdown. A synthesis and materials characterization study will be carried out on new metal chelates that are potential candidates as high temperature fluids. A system is being developed, capable of analyzing small concentrations of nitrogen oxides, hydrocarbons, and various trace metals, using gas chromatography coupled with a microwave excited emission detector. This method of detection is inherently selective in its mode of action, highly sensitive, and applicable to quantitative and qualitative analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0006, ANALYSIS AND DESIGN OF COMPOSITE BONDED JOINTS UNDER A DYNAMIC TYPE LOAD

J.R. Vinson, University of Delaware, School of Engineering, Dept. of Mechanics & Aerospace Engineering, *Newark, Delaware* 19711 (DF027060; AFOSR-74-2739)

AF function - advanced aerospace vehicle designs require improved structural efficiency to meet mission objectives and improved durability to reduce Air Force ownership costs. Opportunity - advanced composite materials for primary structure and adhesive bonding represent significant new opportunities to enhance Air Force structures in functions indicated above. Objective - the objective of this research is to experimentally study the fatigue behavior of composite adhesively bonded joints and identify the failure mechanisms and governing parameters. How work contributes - this research contributes to the technology base associated with composite structural development for aerospace vehicles.

Approach being followed by this research is experimental primarily. Single lap joints of graphite epoxy will be statically and fatigue tested. Tests will include environmental exposure to both moisture and temperature in order to study degradation of both composite adherends and adhesive. In particular, changes in failure mechanisms which can occur as a result of environment will be sought. Load-frequency effects will also be studied through experimentation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, THE INFLUENCE OF THERMAL-MECHANICAL TREATMENTS ON THE FRACTURE OF POLYMERS 12710

L.J. Broutman, Illinois Inst. of Technology, School of Engineering & Physical Science, Dept. of Metallurgical & Materials Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (DA0N5570; DAAG29 77 G0160)

To conduct a quantitative study of the effects of residual stresses upon toughness and fracture behavior of glassy amorphous polymers such as polycarbonates and polymethylmethacrylate. The role of residual stresses in stress cracking will also be addressed. Relevance - the proposed research is relevant to Army problems in transparent armor (for aircraft and personnel protection) and in the processing of many hardware components molded of glassy polymers.

Residual stresses will be introduced into polymer sheets by thermal quenching and/or mechanical deformation. The three-dimensional stress states will be measured by ultrasonic wave techniques. The latter, together with optical birefringence studies and stress analysis methods, will be employed to distinguish between elastic locked-in stresses and the residual molecular orientation due to flow of the polymers. The effects of the various residual stress states on the physical properties of the polymers will be determined, with consideration to stress relaxation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0008, DEVELOPMENT OF THE THEORY OF REFLECTANCE AND EMITTANCE OF FIBROUS MATERIALS 14076

J.R. Aronson, Arthur D. Little Inc., *15 Acorn Park, Cambridge, Massachusetts* 02140 (DA0F8932; DAAG29 77 C 0

To develop the theory of reflectance or emittance of particulate materials so as to apply it to fibrous materials. Relevance - the research is relevant to the Army's interest in the areas of laser hardening, camouflage, and thermal insulation.

Specifically, research efforts will be concerned with obtaining the optical constants of model materials, constructing a theoretical model of the reflectance or emittance of fibers and making experimental measurements of the infrared emittance to verify and modify the developing theory.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0009, VISCOUS FLOW AND CRYSTALLIZATION BEHAVIOR OF HYDROCARBON MIXTURES

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0010, MICROSTRUCTURE OF AMORPHOUS AND SEMI-CRYSTALLINE POLYMERS

D.R. Uhlmann, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgical & Materials Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF046980; AFOSR-77-3226)

AF function - advanced aircraft systems will utilize lightweight polymeric and adhesively bonded structural components and composites and impact resistant transparent canopy materials. Deficiency - although the mechanical and optical properties are determined by processing, the fundamental understanding governing behavior is inadequate. Objective -selected microstructural features of amorphous and semi-crystalline polymers and their relation to processing and mechanical, physical and optical properties will be investigated. How work contributes - this research will help develop the understanding regarding the character of supramolecular structure and the importance of specific morphological features in determining properties which is needed for processing matrix and adhesive resins whose chemistry and microstructure can reproducibly be tailored to specific needs.

The study will explore (1) nodular structures in amorphous thermosetting and thermoplastic polymers (2) chemical and structural differences between bulk material and near-surface regions in semi-crystalline polymers (3) crystallization behavior under high thermal gradients and its effect on structure and (4) differentiation between adjacent re-entry folding and switchboard models for the basic structural units in semi-crystalline polymers. In each case a combination of experimental techniques will be used to elucidate the important structural features of the materials and their variations with changes in process conditions. The structural features will in turn be related to the mechanical and optical properties of the materials with specific attention directed to yield and fracture behavior and to transparency at optical frequencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, ORGANOSILICON COMPOUNDS AND ORGANOSILICON POLYMER INTERMEDIATES

D. Seyferth, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF041490; AFOSR-76-2917)

AF function - future Air Force flight operations require better environmental resistant materials. Deficiency - fluids and lubricants are needed as hydraulic fluids, coolants, engine oils and gyro fluids. Seals and sealants serve indispensable needs for fuel, liquid and air retention, and expulsion bladders in liquid rocket systems. Objective -a study of the synthesis and properties of new organosilicon compounds which may prove useful for these purposes. How work contributes - the work will provide new compounds and new methods of synthesizing organosilicon and related compounds.

The research will involve a study of the chemistry of silacyclopropanes, including ring opening reactions and dimethylsilylene extrusion, the chemistry of silacyclopropenes, and the Diels-Alder route to arylene-bridged disilanes suitable for organosilicon polymer preparation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0012, EFFECT OF STRUCTURE ON PHYSICAL POLYMER INTERACTIONS AND PROPERTIES

F.E. Karasz, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Polymer Sciences & Engineering, *Amherst, Massachusetts* 01002 (DF043340; AFOSR-76-2983)

AF function - advanced aircraft employ structural materials which require superior performance characteristics over a broad range of temperature and environmental conditions. Deficiency - new high-temperature polymer systems are difficult to process and the effects of processibility on properties and life expectancy for these systems are not understood. Objective - this research is to study how molecular structure and morphology on a supermolecular scale govern polymeric interactions and the resultant physical and mechanical properties. How work contributes - it is expected that this research will generate information for the processing of intractable, high temperature resin systems and self-reinforced or molecular polymeric composites and the design of mechanisms to overcome the polymeric degradation due to temperature-humidity effects.

Polymer physical chemistry will center on (1) development of the specific principles for predicting compatibility and alloying in multi-component polymer systems, (2) assessment of the interaction of water with epoxies to include determination of the kinetics and equilibrium properties of the interactions and analyses in terms of a bound-water model, and (3) characterization of the conformational states of rigid chain polymers using polybenzoximidazole as a model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, EUTECTOID DECOMPOSITION IN TITANIUM ALLOYS

H.I. Aaronson, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engineering, *Houghton, Michigan* 49931 (DF038240; AFOSR-74-2595)

AF function - a rational basis for materials development is required to assure the availability and effective utilization of structural materials in future Air Force systems. Opportunity - the fundamental methodology to provide comprehensive and systematic improvement of existing metallic materials and creation of new materials is dependent upon an understanding of the physical metallurgy of alloys. Objective - this investigation will deduce the principles underlying the eutectoid decomposition processes in titanium alloys. How work contributes - understanding of these phase transformations is necessary in order to furnish a more substantial base for the development of useful titanium alloys in which these processes play an important role in determining their microstructure and mechanical properties at room and moderately elevated temperatures.

Specifically, this research will determine why the massive transformation of beta to fully supersaturated alpha occurs in some Ti-X eutectoid systems but not in others, and the ability of the bainite reaction to compete with pearlite formation in hypo-eutectoid and eutectoid alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, BERLINITE CRYSTAL GROWTH

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Air Force function - navigation, communication, surveillance. Deficiency - presently available resonator materials cause long term frequency drifting. Objective - to develop superior material for both timing and acoustic surface wave devices. How research contributes -development of new possibly superior material may result in improved timing and acoustic surface wave devices.

The approach will be the study and growth of berlinite (aluminum phosphate) of sufficient size and quality for evaluation as timing and acoustic surface wave material. The hydrothermal crystal growth technique will be used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0015, RESEARCH ON UNSTEADY COMBUSTION PROCESSES

L. Caveny, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DF045780; AFOSR-76-3104)

AF function - most advanced Air Force strategic and tactical rocket weapons rely on solid propellants for propulsion. Deficiency - more energetic and reliable propellants are required for future weapons. Objective - this research is aimed at increasing the understanding of the unsteady combustion process which occurs in solid propellants, especially in the areas of velocity coupled instabilities and the burning of aluminum droplets. How work contributes - the understanding gained will permit the design of more reliable high performance missiles.

Three directions of study are being pursued simultaneously in this broad investigation of solid propellant combustion. The first is a combined analytical and experimental effort centered

around the modulated throat rocket motor (MTRM), which is a system for gathering meaningful data over a wide range of realistic operating conditions of actual small motors. The dynamic responses of the combustion process to external excitation of longitudinal pressure and velocity waves are measured as functions of frequency, mean pressure, propellant characteristics, internal Mach number and propellant geometry. The second research topic is elucidation, primarily through high-speed photography, of the agglomeration and combustion processes for aluminum particles in propellants. Size, purity and pretreatment of aluminum particles, as well as chamber pressure and cross-flow velocity are variables. In the third portion of the effort, break-up of aluminum and alumina agglomerates in the accelerating flow-field associated with entering or approaching the rocket nozzle will be examined both experimentally and analytically.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0016, FUELS COMBUSTION RESEARCH

I. Glassman, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DF001830; F49620-78-C-0004)

AF function - weapons delivery, air support, airlift. Deficiency -accurate modelling of combustion and exhaust plume processes in present and future aircraft engines requires much more reliable numerical values of molecular reaction rates than are presently available. Objective -as an AFOSR center for fuels combustion research, this group will perform research leading to understanding of kinetic mechanisms and to accurate values of reaction rate constants for pyrolysis and oxidation of hydrocarbon constituents of present and alternative fuels. How work contributes - the results of these experiments are directly useful to design engineers in jet combustion and plume technology and also to scientists working on the elusive problems of combustion dynamics.

High-temperature homogeneous gas-phase reaction kinetics of hydrocarbon fuel constituents are being studied in flow reactors. The extensive concentration and temperature data obtained as functions of reaction time are used to obtain the correct kinetic mechanisms and global rates and rate constants. Spectroscopic and mass spectroscope capabilities are being added to obtain rate constants of reaction steps involving free radicals and many large product species. The mechanisms of soot formation and of carbon oxidation are also to be studied in experiments yet to be devised. A theoretical effort will be devoted to development of an efficient and comprehensive kinetic sensitivity analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, VAPORIZATION AND COMBUSTION OF MULTICOMPONENT FUEL DROPLETS

W.A. Sirignano, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Sciences, *Box 430, Princeton, New Jersey* 08540 (ENG7812564)

The research deals with an experimental and theoretical investigation of the vaporization and burning of liquid fuel droplets which contain more than one chemical component. The objective is the prediction of the transient rate of vaporization of individual components from multicomponent liquid fuel droplets during vaporization and burning in convective flow. The predictions are compared with experimental measurements. Two-component fuel droplets of small size are collected from a high velocity, high temperature laminar gas flow. Fuel components of relatively low boiling temperature are used to preclude droplet pyrolysis. A new phase-discriminating droplet collection probe is used. The efficiency of the probe is being inve tigated. The chemical composition of collected droplets are determined with a gas chromatograph. The research provides a model of droplet burning. The model is related to combustion in diesel engines, gas turbines and furnaces.

The research is a continuation of work done under NSF Grant ENG7681253.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

3.0018, HYDROGEN AND FATIGUE PROPERTIES OF STEEL

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0019, STRESS INDUCED HYDROGEN CONCENTRATION CHANGES IN TITANIUM PHASE III

P.N. Adler, Grumman Corp., Grumman Aerospace Corp, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF043350; F44620-76-C-0071)

AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials including steels, titanium, aluminum and nickel-base alloys. Hydrogen related phenomena are suspect of playing key roles in the mechanisms of stress corrosion cracking, subcritical crack growth, hot salt corrosion, weld cracking, temper embrittlement, fatigue crack growth, and brittle fracture in general. Opportunity - stress induced hydrogen concentration changes appear to be basic to this problem. Objective - this research will determine the extent and kinetics of the hydrogen redistribution that takes place in titanium alloys under the influence of elastic and plastic deformation. How work contributes - the vazious forms of hydrogen-related mechanical property degradation severely restrict the serviceability of our important aircraft materials. Basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack.

Objective will be accomplished using Grumman's recently developed lithium nuclear microprobe (LNM) technique that enables in situ hydrogen concentration measurement in the surface of samples while under an applied stress. The results of these measurements will permit evaluation of the manner by which hydrogen participates in crack propagation and embrittlement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, ION BEAM TEXTURING OF POLYMERS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0021, SELF-DIFFUSION OF OXYGEN AND ALUMINUM IN DOPED ALUMINA

A.R. Cooper, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NSG 3291)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0022, INFLUENCE OF COMPOSITION AND MICROSTRUCTURE ON THE LOW-CYCLE FATIGUE RESISTANCE OF A-PHASE AND NEAR A-PHASE ALLOYS

J.C. Williams, Carnegie Mellon University, Inst. of Technology, Dept. of Metallurgy & Materials Science, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF042420; AFOSR-76-2925)

AF function - titanium and its alloys have been of considerable interest to the Air Force because of very favorable strength-to-weight characteristics at temperatures from cryogenic up to 800 degrees F, and resistance to attack by many chemicals. Potential applications for skins, structural and engine components of nigh performance aircraft, cryogenic fuel storage tanks for missiles, and tubing for transporting corrosive fuels all emphasize the available materials roles for titanium alloys. Opportunity - the occurrence of strain localization due to the development of localized regions which are plastically unstable results in severe reductions in fatigue and ductility of many high strength structural materials including certain titanium alloys.

Thus, the critical strain for fracture can be locally surpassed at very low average macroscopic strains, since such instabilities can lead to premature failure. Objective - this research will provide an improved understanding of the metallurgical factors which control strain localization, and the relationship of strain localization phenomena to low-cycle fatigue performance of alpha-Ti alloys. How work contributes -the use of alloys which exhibit the tendency for strain localization requires particular caution since the tolerance for local stress concentrations is reduced.

The program consists of two interrelated tasks: (1) the role of alloy composition in controlling deformation behavior and the relationship between deformation behavior and low-cycle fatigue performance, and (2) the role of microstructure on deformation behavior and low-cycle fatigue performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0023, DIRECTIONAL SOLIDIFICATION OF NONOXIDE EUTECTICS 14069-MS

V.S. Stubican, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Materials Science, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (DA0E9298; DAAG29 77 G0057)

Study the directional solidification of several refractory carbide and boride compositional systems which exhibit eutectics, and relate the resulting microstructures to selected mechanical properties of the materials. Relevance - the materials to be studied may find use as high temperature unlubricated bearings for helicopters, as ceramic tool bits, as high temperature ceramic turbines and adiabatic diesel engines for Army vehicles, and as high temperature missile components.

Determine the crystallography of the eutectic systems and elucidate the fundamental factors which determine the topotaxial relations, measure the three and four point bend strength of the specimens as a function of temperature up to 2000 C, and evaluate the microhardness and wear resistance of the specimens.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0024, PROPERTIES OF MA ERIALS FOR ADVANCED ENERGY SYSTEMS

M.M. Abraham, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (AK-01-02-02-2; W7405-ENG-26)

This program consists of three major tasks concerned with the determination of fundamental information on the properties of materials that will be needed to develop new technologies for the production, storage, and transport of energy. Research on the physical properties of ceramic materials is directed toward obtaining a better correlation between the desirable macroscopic behavior of ceramics and their microscopic properties. Investigations on the physical properties of superconductors are concerned with methods for obtaining higher critical current densities and higher transition temperatures. The program on the research and development of pure materials involves the determination of new techniques for the purification, crystal growth and characterization of research quality materials that are needed in the research and development programs sponsored by DOE. (ORNL/CF-78/111)

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SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, DYNAMIC RESPONSE OF SOLID ROCKET MOTORS TO TRANSVERSE BLAST LOADS

T.L. Cost, Athena Engineering Co., *P.O. Box 235, Northport, Alabama* 35476 (DA0N4518; DAAD05-76-C-0751)

The objective of this effort is to develop the theory and computer program required to predict the structural response of a solid rocket motor subjected to transverse air blast loads while simultaneously subjected to internal pressure and transverse acceleration loads.

The approach to the problem will be primarily theoretical and will involve the development of a structural analysis method which can be implemented on a digital computer.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0002, LASER MISSILE GUIDANCE CONCEPT (ROCKET DESIGN)

R.W. Forgey, U.S. Dept. of Defense, Army, Missile Research & Development Command, Engineering Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0E1287)

Define flight vehicle for Growlar Program.

Select a suitable test vehicle for the demonstration program, from all available candidates, and initiate design effort to produce drawings from which the test hardware may be manufactured.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

4.0003, THIN FILM OPTICAL DEVICES AND QUANTUM ELECTRONICS

A. Yariv, California Inst. of Technology, Graduate School, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (DF041480; AFOSR-78-3685)

AF function - the Air Force seeks decreased distortion in fiber optic transmission for avionic system miniaturization, cost reduction, and bandwidth extension and novel tunable lasers especially solid state for optical communication and electronic warfare including jamming. Opportunity - exploration of novel pioneering concepts for devices for optical communication and electronic warfare. Objective - to investigate 1) direct transmission of optical information through optical fibers of kilometer lengths, 2) interaction of electron beams with longitudinal EM waves in a periodic structure environment, 3) Raman scattering in optical fibers experimentally and theoretically. How work contributes -success in objectives will lead to devices useful for optical communication and electronic warfare systems.

1) Compensate for distortion in transmission of optical information in optical fibers through introduction of phase conjugation by means of four wave-mixing, 2) attenuate velocity spread of electrons as electrons propagate in periodic structure and interact with longitudinal EM wave by cascading periodic structures with compensatory entry phases, 3) compare experiment with theory of optical fiber Raman laser and construct this laser including tuning by Franz-Keldysh effect.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, ADVANCED MISSILE AERO CONTROL INVESTIGATION

M.D. Thomas, Lgarde Inc., *1555 Plancentia Ave., Newport Beach, California* 94304 (DA0G1033; DAAK40 78 C 0072)

The objective of this effort is to investigate the adaptation of a movable aerodynamic flare to present and advanced missile systems in order to compare increases in control effectiveness and maneuverability characteristics.

A conceptual design of the advanced aerodynamic control, adapted to existing Pershing II and Patriot missile systems, shall be accomplished to provide baseline configurations from which performance calculations can be made to determine increases in

maneuverability and a reduction in control system weight thus providing a lower systems cost. An open-loop 6 DOF simulation shall be performed to ascertain the performance when comparisons are made between the baseline configurations and the existing Pershing and Patriot missiles. A plan for a flight demonstration program to include recommendations as to possible flight test boosters as well as test ranges, costs and other related parameters shall be developed and submitted as part of the final report.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

4.0005, SINGLE CHIP CCD LENSES FOR ULTRASONIC IMAGING

J.D. Meindl, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DF050130; F49620-77-C-0133)

AF function - the maintenance and quality assurance of flight vehicles relies heavily on nondestructive evaluation (NDE) of critical metallic components. Deficiency - there is a deficiency in techniques to specify size, shape and orientation of flaws which initiate catastrophic failure. Objective - the objective of this research is to develop electronic focusing of acoustic field patterns detected by piezoelectric transducer arrays. How work contributes - the monolithic electronic lenses would serve to reduce present ultrasonic imaging system weight, volume, power consumption and cost as much as an order of magnitude. In addition, they would permit improvements in system resolution, field of view, range and frame rate heretofore unfeasible.

Cascade charge coupled device (C3D) integrated circuit analog delay lines will be explored for ultrasonic imaging systems. Various models will be developed to characterize the influence of device technology on lens performance. Theoretical analysis and fabrication methodology will be adjusted to optimize performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, SUPERCONDUCTING WEAK LINKS FOR MIXING AT MILLIMETER-WAVE FREQUENCIES 13678-EL

T.V. Duzer, University of California, Berkeley Campus, Graduate School, *2200 University Ave., Berkeley, California* 94720 (DA0E9086; DAAG29 76 G0191)

To study novel schemes for detection and mixing in the millimeter and submillimeter wave range. This work will have a long range impact on millimeter and submillimeter wave programs in the Army such as the beam rider guidance system, or general radar and terminal homing applications.

To investigate Josephson junctions for low noise mixing and detection in waveguide applications (below 150 gHz), test wave impedance matching arrays for submillimeter wavelengths, and continue comparison between Josephson junctions and super-Schottky metal-insulator metal characteristics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0007, BASIC RESEARCH IN ELECTRONICS (JSEP)

D.J. Angelakos, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering & Computer Science, *Berkeley, California* 94720 (DF008700; F44620-76-C-0100)

AF function - electronic research is essential to all Air Force missions and functions, especially aerospace reconnaissance, communications, surveillance, navigation, command and control of operating forces, and gathering, processing, and transmission of intelligence and information. Technology for all of these functions requires more compact, lower power consumption, higher sensitivity and more reliable electronic components, networks and systems. Opportunity - this technology is dependent on continued research on properties of electronic materials, circuits, and systems. Objective - the joint services electronics program (JSEP) provides the research baseline in the electronic sciences for all three military services. How work contributes - jointly and equally supported and managed by the Air Force, Army and Navy, this program provides the DOD with a hard core electronic research capability which includes a highly flexible, quick response to new research opportunities over a broad area of electronic science and engineering.

One part of the electronic research being conducted concerns solid-state electronics, and electro-magnetics. These areas entail fundamental theoretical and experimental studies of semiconductor devices, semiconductor properties and technologies, studies in select areas of electromagnetic wave guiding scattering and measurement techniques. This portion of the JSEP deals with research in large scale system theory, cizcuit analysis and synthesis, VLSI circuits, signal processing, and data base management systems. Specifically, new emphasis is being placed on problems arrising in data base systems distributed over many host computer systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, LASER-INDUCED FLUORESCENCE SPECTROSCOPY FOR MAKING IN-SITU SPECIES CONCENTRATION MEASUREMENTS IN TURBULENT COMBUSTION FLOWS

J.W. Daily, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (DF049060; AFOSR-77-3357)

AF function - advanced diagnostic techniques, advanced air-breathing engines, weapon delivery and defense. Deficiency - inability to obtain reliable measurement of important parameters in turbulent reacting flows in practical hostile combustion environment via present day measuring and diagnostic techniques, inability to reliably evaluate combustion models. Objective - to develop sensitive selective, precise, reliable and rapid diagnostic methods for measuring important parameters in jet engine reacting flow environment. To determine feasibility of using laser induced fluorescence spectroscopy (LIFS) for obtaining high spacial and time resolution in-situ species concentration measurements in practical combustion environments, to determine capabilities and limitations of LIFS as a laboratory diagnostic tool, to provide reliable experimental data to the combustion modeler. How work contributes - will provide additional understanding and reliable data to permit realistic evaluation of analytical models of complex reacting flows, will help reduce development time and cost of air-breathing propulsion systems, will permit evaluation of capabilities and limitations of various diagnostic methods, will aid in development of improved or novel new in-situ nondisturbing techniques for accurately measuring turbulent reacting flow parameters.

Using laser-induced fluorescence spectroscopy techniques, measurements will be made of hydroxyl radical concentrations in two laboratory burners, one laminar and one turbulent. Standard burners will be used wherever possible. Initial work will involve examination of the OH spectrum in both flames, mapping interferences, temperatures, and concentrations using conventional absorption and emission spectroscopy. The OH fluorescence spectrum will then be measured in the laminar flame and saturation and trapping effects examined. Results will be used to optimize the excitation and detection schemes. Data acquisition electronics and signal processing will be developed. The system will be applied to the turbulent flame and fluorescence results compared with those from more conventional measuring techniques. The experimental procedures will be guided by and the results compared with a theoretical model that will be developed to describe the excited state populations of OH. Additionally, theoretical predictions of turbulence results will be made using standard theory for comparison with experimental results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, TURBULENCE MEASUREMENTS BY RAYLEIGH SCATTERING

L. Talbot, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (DF038830; F44620-76-C-0083)

AF function - aerospace vehicles, air-breathing propulsion, weaponry. Deficiency/opportunity - experimental study of turbulent flows associated with aerospace vehicles and their propulsion systems has been hampered in the past by the lack of non-intrusive measurement methods suitable for measuring all the desired quantities. Hot wires have produced much imxortant information, but they do disturb the flow, and they cannot survive many of the harsher environments in which it is desired to make measurements. The laser Doppler velocimeter (LDV) techniques promise a new dimension in turbulence measurements, but these can measure flow velocity only. Knowledge of turbulent fluctuations of temperature, gas composition, and gas density, as well as pressure and velocity, would contribute to the body of known information about turbulence and diminish the amount of speculative assumption that goes into scientific and engineering work with turbulent flows. The proposed work explores the recent innovation in gas velocity and temperature measurement by Rayleigh scattering, combining it with LDV or hot wire methods, to obtain data on both the temperature and velocity turbulence in hostile gas flow environments. Objective - to provide a practical demonstration of the use of Rayleigh scattered laser light for investigating turbulent flows in a severe environment, and at the same time to gain knowledge of the interaction of turbulence with exothermic reactions or other heat releasing processes in gas flows. How work contributes - many modern applications of gas dynamics involve flows in which chemical reactions occur. It is well known that turbulence in a flow can be amplified by an exothermic chemical reaction. A quantitative correlation between these phenomena could serve to clear up some troublesome questions about entropy layers, flame zones, and radiating or absorbing flows.

Extensive demonstration of the Rayleigh scattering diagnostic method, in combination with LDV will be made in experiments. Interaction of a Karman vortex street with a plane laminar flame, interaction of flat plate boundary layer turbulence with a standing flame, and survey of the flow field near a curved standing flame will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, CONDUCTIVITY IN MODIFIED GRAPHITE

Unknown, University of California, Davis Campus, Graduate School, *Davis, California* 95616 (NAS 2-10258)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0011, WAVES AND INSTABILITIES IN STEADY-STATE HIGH-BETA PLASMAS

N.C. Luhmann, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Electrical Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DF035050; F49620-76-C-0012)

AF function - operation of high-altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of high-beta processes occurring in plasmas such as waves and instabilities caused by beams of particles and photons. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research. Objective - this project will investigate both theoretically and experimentally the behavior of high-beta plasmas specifically studying their waves and instabilities, their interaction with electron and laser beams as well as the abnormally high appearing resistivities. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This project will perform theoretical and experimental work to specifically study the following - A. Interaction of the electromagnetic radiation with an inhomogeneous near critical density plasma, namely, 1. Resonance absorption, 2. Density profile modification, 3. Parametric instabilities, 4. Nonthermal hot electron production, 5. Main body heating, 6. Magnetic field generation, 7. second harmonic generation. B. Instabilities in an underdense plasma, including both the absorptive instability occurring at the quarter critical layer (two plasmon decay) and the reflective instabilities, namely, 1. Stimulated Brillouin scattering and 2. Stimulated Raman scattering. C. Self focussing instabilities, which occur when intense microwave or laser beams are propagated through plasmas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, MAGNETIC FIELD INTERACTIONS WITH MATERIAL DISCONTINUITIES 13279-MS

W. Lord, Colorado State University, School of Engineering, Dept. of Electrical Engineering, *Fort Collins, Colorado* 80523 (DA0E9194; DAAG29 76 G0249)

To model the interaction of magnetic fields with material discontinuities using finite element analysis techniques. Relevance -the research is relevant to nondestructive evaluation of steels used in such components as gun tubes, munitions, pipe, aircraft etc. To detect inclusions voids and cracks. It is also relevant to the design of magnetic ordinance and communication devices where geometry and spatial distribution of magnetic fields are important. The computer codes to be generated as a result of the research will be made available to Army scientists, and this is relevant to processing of data in various R and D programs in Army laboratories.

The program will include development of magnetic leakage field profiles for a variety of surface and subsurface defects in an axially magnnetized ferromagnetic bar; measurement of magnetic leakage fields around actual defects using hall plates, and comparison of results with theory; and extension of models to include residual forms of magnetization and study of the feasibility of using finite element analysis to model eddy current interactions with material discontinuities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0013, DEVELOP A NAVIER-STOKES ANALYSIS FOR THE AFT-END FLOW FIELD OF AERODYNAMIC VEHICLES 15905-E

H. McDonald, Scientific Research Associates Inc., *Glastonbury, Connecticut* 06033 (DA0G8961; DAAG29-79-C-0003)

To develop a Navier-Stokes solution for the viscous elliptic portion of jet plume interaction flow fields in the vicinity of an axisymmetric base. Relevance - the research is directly relevant to the improved design of Army missiles, rockets and projectiles.

A local flow field Navier-Stokes analysis including flow both upstream of the base where a shock wave-boundary layer interaction may occur on a boat-tail and downstream of the base where recirculation may be present will be carried out. This detailed solution then would be joined either to inviscid solutions or viscous parabolic solutions in an interactive manner to determine the entire flow field.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0014, STRUCTURE OF AUTOMATIC CONTROL SYSTEMS

A.S. Morse, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DF046570; AFOSR-77-3176)

AF function - the design of aerospace and turbojet control systems. Deficiency - the control process is still poorly understood for nonlinear and time-varying systems. Objective - the objective of this research program is to develop concrete analysis and synthesis methods for dealing with the engineering problems encountered in the design of complex control and information systems. How work contributes - this work would provide new aspects from which to analyze the control design problem.

Research will be made in a number of important design problems associated with the identification and control of linear multivariable systems. Included will be the continuation of a fundamental study of self-tuning systems with the objective of developing effective techniques for designing such systems so that they function reliably over a reasonable range of process operating conditions - the study is motivated, in part, by the control requirements of proposed, high performance turbojet engines. A study will be made of the basic properties of nonlinear dynamical systems with input-output maps admitting finite Volterra series expansions. An effort will be made to develop systematic procedures for constructing realizations directly from multivariable transfer function data and for designing practical feedback controllers for such systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, PROBING OF TRANSONIC BOUNDARY LAYERS 15172-E

J.E. Danberg, University of Delaware, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Newark, Delaware* 19711 (DA0F9168; DAAG29-78-G-0057)

To probe the boundary layer on spinning and non-spinning projectiles with the aim of developing physical insight into the reasons for the observed strong variations in pitching moment and magnus force and moments at transonic speeds. Relevance - the proposed investigation is directed toward obtaining a physical understanding of large pitching moment variations observed at transonic speeds on several of the Army's projectiles being evaluated by BRL. Consequently, the research is directly relevant to performance prediction and development of stable long range gun-launched projectiles.

Pilot probing of the flow field will be one of the main techniques used to obtain new information on the state of the boundary layer on the projectile afterbody. The measurement technique will be verified for certain flow conditions and will then be applied to realistic boat-tails.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0016, EIGENVALUE/EIGENVECTOR ASSIGNMENT IN LINEAR SYSTEMS

A.K. Choudhury, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 7624)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

4.0017, NOISE SUPPRESSION IN JET INLETS

B.T. Zinn, Georgia Inst. of Technology, School of Engineering, Dept. of Aerospace Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF047490; F49620-77-C-0066)

AF function - improved aerospace vehicles. Opportunity - reduce noise levels produced by air-breathing engine-inlet configurations. Objective - develop and experimentally verify an analytical technique for predicting the far field radiated noise taking variable noise source characteristics, duct absorption properties and inlet geometries into consideration. How work contributes - a better understanding of the coupling mechanisms of the noise generated in the engine inlet ducting (fans and compressor noise) with the far field radiated noise is required. Also, methods for evaluating the effects of various duct wall acoustic treatments and engine-inlet configurations are needed. Full success of this effort will allow the accurate prediction of the far field noise levels of an engine-inlet and changes to this level due to inlet duct treatment or inlet geometry without the costly cut and dry full-scale testing required at present.

An integral formulation of the Hemholtz equation will be developed, discretized and solved numerically. This formulation will couple the sound source with the radiated far field and will account for changes in the far field due to inlet geometry and wall acoustic liner treatments. Experimental data will be obtained of the radiated sound field from several simple inlet configurations to evaluate the theoretical predictions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, INTERNAL AND EXTERNAL BALLISTICS OF MISSILES WITH SPECIAL CONSIDERATION OF JET PLUMES INTERFERENCE EFFECTS DURING LAUNCH AND FREE FLIGHT PH

H.H. Korst, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical & Industrial Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DA0E9089; DAAG29 76 G0209)

To conduct a comprehensive research program dealing with aerodynamic interference problems encountered during various phases of in-tube propulsive burning and ballistic flight trajectory of rockets. This research is directly relevant to the problem of estimating jet plume effects on performance, stability and control of high acceleration rockets and missiles. Such problems have been identified as high priority advanced technology areas in the MICOM missile plan. In addition, it is relevant to the research activities at BRL in launch and transitional ballistics.

This program shall include theoretical analysis, computer program development, mathematical modeling, and selected experimentation aimed at establishing the merits of analytical and modeling concepts for jet plume-launcher wall interference, blow-back at breach, muzzle blast, and jet plume-slipstream interference.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0019, A FUNDAMENTAL STUDY OF A NEW FABRICATION TECHNIQUE FOR FIBER REINFORCED ALUMINUM MATRIX COMPOSITES 13847-MS

R. Mehrabian, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DA0E9048; DAAG29-78-G-0067)

To sutdy the fundamental parameters of a new processing technique, consisting of incorporating discontinuous fibers into a partially solidified alloy before casting, for fabrication of metal matrix composites. The research is relevant to the fabrication of fiber reinforced, metal matrix composites for Army applications, such as lightweight portable bridges, transmission housings for helicopters, and structural bulkheads for ground vehicles (armored personnel carrier). There is a potential application for the hubs for the super flywheel project at MERDC.

The program will include (1) determination of the effect of processing parameters on microstructure, interphase interface characteristics, wetting of the fiber by the matrix and mechanical properties of the composite, (2) determination of the effect of composite composition (fiber type, matrix alloy, volume fraction of fibers) and internal structure (fiber length, distribution, alignment, and orientation) on the mechanical properties of the composite, and (3) development of models to describe the reactions at the fiber-matrix interface.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0020, PSEUDOMEASURES - CHARACTERIZATION OF THE BASIC SIGNAL PROCESSING CAPABILITIES OF DIGITAL AND SAMPLED DATA SYSTEMS

R.J. Leake, University of Notre Dame, School of Engineering, Dept. of Electrical Engineering, *Notre Dame, Indiana* 46556 (DF044050; AFOSR-76-3036)

AF function - to advance the theory and application of digital signal processing, filtering, estimation, and detection, which are so important in communications, sensors, and surveillance systems. Deficiency - although the many advantages of digital circuitry are well established, the implementation of the technology

is often much too expensive for the expected return. Objective - to extend the theory of sampled digital systems to better understand quantized data-processing, digital controllers, and other concepts that were so important in classical circuit theory. How work contributes - success in this research would result in improved and more economical military electronic systems.

The theory of generalized functions, which includes Fourier analysis of more general functions that the classical theory, will be used as a tool to extend the important sampling theorem of Shannon, and to study the stability properties of digital filters and control devices. A new concept on quantizers is also to be perfected that will include the various devices now in use and which will permit the evaluation and analysis of quantized digital filters in a more accurate manner than has been possible heretofore.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, A SYSTEM STUDY FOR THE APPLICATION OF DISTRIBUTED PROCESSORS TO FLIGHT TESTING TECHNIQUES

G.L. Kelley, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Electrical Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NSG 4026)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Dryden Flight Research Center

4.0022, DRAG REDUCTION/DELIVERY TRUCK

V.U. Muirhead, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NSG 4023)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0023, EVALUATION OF AIRCRAFT SEPARATION ASSURANCE CONCEPTS, DISPLAYS AND AVIONICS EQUIPMENT

Unknown, Arnic Research Corp., *Annapolis, Maryland* 21401 (FA78WA-4091; FA161204 (TRAIS NO.))

The contractor shall furnish all of the personnel, materials, services, equipment and facilities for evaluation of pilot performance and commercial aircraft operation when operating with Aircraft Separation Assurance (ASA) avionics, This program will be structured in two parts: (1) simulation; and (2) preparation for operational testing.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0024, EFFECTS OF SHOCK LOADING VARIABLES ON SHOCK-WAVE STRENGTHENING OF METALS 13183-MS

D.E. Mikkola, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engineering, *Houghton, Michigan* 49931 (DA0T5573; DAAG29-78-G-0005)

To determine the effects of shock loading variables upon the microstructure and properties of materials and to make a detailed comparison of laser-induced shock wave effects with those associated with mechanically introduced shock waves. Relevance - the proposed research has relevancy to hypervelocity impact research on projectiles and armor, and to the laser effects on materials as described in the Army's laser hardened materials and structures plan (1974).

Detailed studies will be made of the microstructural and substructural effects caused by changes in pulse duration during shock loading of metallic alloys, a quantitative examination of the relationship between structure and properties of shock-loaded materials, and will include studies of how various time-dependent flow mechanisms partake in the deformation process. Both laser shocking and mechanical shocking studies would be performed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0025, LASER DIAGNOSTICS OF METALLIC PLASMAS

D.R. Bach, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Nuclear Engineering, *Ann Arbor, Michigan* 48104 (DF039640; AFOSR-74-2713)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand advanced equipment unavailable to date. Deficiency - present day information is inadequate to design the aforementioned equipment. Such information may be obtained from experimental and theoretical work in metallic (collisional) plasmas. Objective - this project will investigate experimentally various laser diagnostic methods on high density metallic plasmas. Both exploding wires and Z pinch plasmas will be investigated, specifically aluminum and tungsten wires. Contribution - this work is a part of a comprehensive program on plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications and the development of countermeasures.

This project will use the information obtained from lithium exploded wire plasmas to extend it to higher Z wire plasmas of aluminum and tungsten in the investigation of low energy x-ray emission from the plasma. These x-ray emission measurements will be compared with the calculations of Drs. Ong and Duderstadt (AFOSR grant 76-2904). The explosion wire system will be rebuilt in such a way that the plasma can be heated in the radial direction by using the high intensity CO2 laser in the axial direction in order to simplify the geometry to perform better comparisons between the calculations and experiments. Attempts will also be made to determine the geometrical shape of the x-ray emitting regions using x-ray pinhole photography.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, AERODYNAMIC AND ELECTROMAGNETIC PROPERTIES OF PLASMAS

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AF function - design of advanced aerospace vehicles. Deficiency -more critical design criteria requires more exact evaluation involving additional physical effects. Objective - increased understanding of satellite environment and structure. How work contributes - by developing solution techniques for problems in shock waves in fluids and plasmas, chemical reaction and diffusion, optical resonance, nonlinear elastic deformation and buckling, etc.

At present nonlinear problems are to a large extent treated individually although subclasses of such problems, their properties and their solution techniques are being characterized. Theoretical and numerical AF relevant examples in bifurcation aspects of three-dimensional viscous fluid flow - plasma, optical, water, and atmospheric waves and shock waves - reaction diffusion systems, nonlinear elasticity and buckling, etc., chosen for their importance in the development of a general theory, will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, SIMPLIFIED INERTIAL GUIDANCE DEMONSTRATION (SIG-D)

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The technical objective is to design, manufacture, test and deliver three flight demonstration missile airframes with pneumatic controls to be utilized as flight demonstration vehicles to test low cost strapdown guidance techniques.

The airframe will use solid propellant motors manufactured during the Greener Pastures Program, empty Lance E-11 warheads for the nose section, and modified midsection for guidance system mounting. Aft-mounted pneumatic controls using four elevons for control will be developed. Midship wings and aft

tail/elevon surfaces are being designed based on wind tunnel tests. The government will integrate a ring laser gyro strapdown inertial guidance system into the airframe for feasibility demonstration flight testing.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Guidance & Control Directorate

4.0028, ELECTRON LITHOGRAPHY STAR DESIGN GUIDELINES

W.H. Causey, Mississippi State University, School of Engineering, Dept. of Electrical Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (NAS 8-33450)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

4.0029, DEVELOPMENT OF PARTIAL CHANNEL FLOW FOR ARBITRARY INPUT VELOCITY DISTRIBUTIONS USING BOUNDARY-FITTED COORDINATE SYSTEMS 13675-EX

L.R. Hester, Mississippi State University, School of Engineering, Dept. of Aerospace Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (DA0E9022; DAAG29 76 G0144)

To develop numerical solutions for time-dependent, two-dimensional incompressible laminar partial channel flow. This investigation is directly relevant to research on fluidic devices, utilized for example in such Army applications as helicopter and tank stabilization systems, being conducted at HDL and impacts on the techniques for modeling of flows in rivers, estuaries, and coastal seas being carried out at Waterways Experiment Station.

A numerically generated curvilinear coordinate system having a coordinate line coincident with the boundary contour will be utilized for solving the Navier-Stokes equations of viscous fluid mechanics describing flows through arbitrarily shaped channels.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0030, PROCESSING MECHANISMS, STRUCTURE, AND MORPHOLOGY OF HIGH-TEMPERATURE POLYMERIC ALLOYS

I.L. Hay, Celanese Corp., *Box 1000 Morris Ct., Summit, New Jersey* 07901 (DF047260; F49620-77-C-0046)

AF function - advanced Air Force lightweight aircraft, missile and satellite systems will utilize structural matrices and adhesives which will provide high performance at elevated temperatures in extreme service environments. Deficiency - the most stable polymer systems are relatively intractable and difficult to process by current fabrication techniques. Objective - the principles and mechanisms underlying the alloying of intractable, high-temperature polymers will be investigated. How work contributes - it is expected that this research will yield combinations of polymers that are more readily fabricable and have high temperature properties similar to the major intractable components.

Research will center on (1) the processibility of intractable polymers when alloyed with compatible polymers and monomers, (2) correlation of the particulate form and character of polymer mixtures before hot pressing with physical and mechanical properties after consolidation, and (3) the assessment and utilization of various experimental techniques to characterize the chemical and physical interactions occurring during processing and to establish the chemical nature of the polymer alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, STUDIES OF SLENDER, AXIALLY SYMMETRIC BODIES AT INCIDENCE AT HIGH REYNOLDS NUMBERS 14254-E

S.M. Bogdonoff, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (DA0F9113; DAAG29-77-G-0234)

To experimentally investigate the flow field about two axisymmetric configurations, a tangent Ogive-cylinder and a secant Ogive-cylinder, at low incidence using a high Reynolds number supersonic wind tunnel. Relevance - experimentally obtained data for three-dimensional turbulent boundary layers on axisymmetric bodies at incidence is urgently needed for verification of recent theoretical developments at BRL. Such data would be quite useful in validating theories for design of Army missiles and projectiles.

Both surface and flow field measurements will first be made on a tangent Ogive-cylinder model at Mach 3 and a Reynolds number of approximately 1.6 million per inch, at incidence angles of 2 degrees and 4 degrees. Measurements will be made at 30 degree increments of Azimuth angle at 4, 5, and 6 diameters from the model tip and similar measurements will then be made for a second nose geometry.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0032, NONLINEAR PROCESSES IN PLASMAS

R.M. Kulsrud, Princeton University, School of Engineering & Applied Sciences, Dept. of Astrophysical Sciences, *Box 430, Princeton, New Jersey* 08540 (DF040390; F44620-75-C-0037)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of the nonlinear evolution of energy transformations in plasmas. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research program. Objective - this program will investigate nonlinear collective phenomena, such as anomalous transport phenomena, linear wave absorption, and plasma wave turbulence, both in the laboratory and in space. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications and the development of countermeasures.

This project will perform theoretical calculations, analyze, evaluate and correlate the available experimental results of laser plasma interactions, solar wind plasmas, ionospheric plasmas, acceleration processes and runaway electron plasmas. Specifically it will investigate (a) the problem when 'islands' in plasmas appear in two forms, either as magnetic 'islands' in configuration space, or as 'islands' of near resonance in phase space. The islands may be sporadic but their presence causes rapid diffusion, (b) the nonlinear evoluation of the tearing instability made with specific reference to the development of magnetic island structures and to move violent processes such as disruptive instabilities and rapid magnetic reconnection, (c) various types of solitary wave structures which develop in the very large amplitude turbulence associated with rapid heating methods in laser interactions, (d) it will also develop numerical techniques for elucidating the properties of runaway electron discharges and the instabilities observed in laboratory situations and (e) it will continue the study of electron density striations in the ionosphere and their relation to communication problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, SPEED-DEPENDENT COLLISION EFFECTS ON RADAR BACK-SCATTERING FROM THE IONOSPHERE

O.H. Theimer, New Mexico State University, Las Cruces Campus, School of Arts & Sciences, Dept. of Physics, *University Park, Las Cruces, New Mexico* 88003 (NSG 7622)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

4.0034, PROPOSAL TO VERIFY ROCKET EXHAUST PLUME EFFECT SIMULATION TECHNIQUES 13797-E
C.F. Reid, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DA0F8934; DAAG29 77 C 0008)

To investigate the validity of a cold jet simulation of rocket exhaust plume effects by direct experimental comparison between hot and cold jet base and afterbody pressures and between calculated pressures based on cold jet modeling and measured hot jet pressures. Relevance -the research is directly relevant to the understanding of plume effects on missile aerodynamics which is important because of the possible adverse effects of plumes and because of the potential for improving the accuracy of free rockets. Such technology is one of the principal thrusts of the aeroballistics directorate at MICOM.

Base and afterbody pressure measurements and Schlieren photographs of the plume from a solid fuel rocket engine will be made and used for comparison with an analytical model based on cold jet simulation of the hot jet and with cold jet experimental measurements of similar quantities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0035, INVESTIGATION OF MOLECULAR BEAM EPITAXIAL GROWTH OF COMPOUND SEMICONDUCTORS AND CONTACTS 15479-EL
L.F. Eastman, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DA0G8960; DAAG29-79-G-0036)

To advance the state of the art in compound semiconductor layers, Schottky barriers and ohmic contacts for electron devices. Relevance -this research will directly support an active program at ERADCOM/ETDL to improve materials technology for very high speed integrated circuits. Close cooperation between this principal investigator and ETDL has already been established.

To use molecular beam epitaxy (MBE) to grow bulk and layered structures. Characterize and analyze grown materials for metallurgical and electrical properties in order to improve quality needed for device application.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0036, FABRICATION OF GAINASP MICROWAVE TRANSISTORS
J. Frey, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (NSG 1642)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0037, BASIC TECHNOLOGY OF SQUEEZE-FILM DAMPERS FOR ROTOR-DYNAMICS CONTROL 15657-E
C.H. Pan, Shaker Research Corp., *Northway 10 Executive Pk., Ballston Lake, New York* 12019 (DA0F9245; DAAG29-78-C-0027)

To study and analyze the squeeze-film damper as a means of stabilizing rotor shafts and reducing vibration and shock excitation. Relevance - dampers of the type studied are needed to control vibration of rotors.

To perform an analytic formulation and solution of the system, including cavitation; and verify the solution experimentally.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0038, LASER-INDUCED FLUORESCENCE 12211-P
R. George, Duke University, School of Engineering, Dept. of Electrical Engineering, *Durham, North Carolina* 27706 (DA0D9232; DAHC04-74-G-0067)

Investigation of fundamental parameters associated with the use of laser-induced fluorescense in remote sensing. This program is related to the use of laser-induced fluorescence techniques to spoof camouflaged material in reconnaisance applications.

The preliminary investigations will involve assembling a basic facility for evaluating the optimum wavelengths for excitation of various target materials. Parameters to be studied will include those associated with the laser transmitter, the target material, and the detector.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0039, INVESTIGATION OF D-REGION BACKSCATTERING PROCESSES 11054-GS
W.A. Flood, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Electrical Engineering, *Raleigh, North Carolina* 27607 (DA0D9299; DAAG29 76 G0138)

To conduct a comprehensive investigation of the accuracies of ground-base radio techniques for sounding the motions and electron densities in the ionospheric D-region between 6 km and 110 km. Upper air winds affect rocketry (BRL, MICOM, ASL) and ionospheric drifts affect communications (e.g., VLF communications program). This ground-based technique for wind measurement in the 60-110 km interval could replace the wind measurements of the cooperative meteorological rocket network with obvious advantages.

Specific studies include A) assessment of the validity of the randomly phased angular spectrum approximaton as it applies to HF radio wave ionospheric drift measurements, B) determination of the amplitude and distribution of D-region echoes as a function of altitude and pulse length, C) investigation of the presence and cause of orthogonally polarized D-region echoes, and D) determination of the cone angle of arrival of D-region echoes and correlation of the cone angle measurements with the orthogonally polarized D-region echoes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0040, PRE-COOP ENGINEERING EDUCATION PROGRAM
D.W. Chenelle, Case Western Reserve University, Graduate School, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NGT 36-027-790)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0041, PRE-COOP ENGINEERING EDUCATION PROGRAM
W.C. Cathie, Carnegie Mellon University, Graduate School, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (NGT 39-087-790)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0042, APPLICATIONS OF BOUND AND MODE APPROXIMATION TECHNIQUES FOR LARGE DEFLECTIONS OF PULSE LOADED STRUCTURES 15427-E
P.S. Symonds, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DA0F9201; DAAG29-78-G-0085)

To find methods for estimating large plastic deflections due to pulse or impact loading of engineering structures. Relevance - Army structures such as components of helicopters, vehicles, etc. are subject to large strains resulting from impulse loading. Improved methods of analysis would be useful to designers of such equipment.

Two methods of approximation will be used: (1) bound, and (2) mode. The former replaces the dynamic problem by a static one, and energy theorems are used to obtain bounds on the solu-

tions. The latter depends on the development of the solution in terms of instantaneous modes or shape functions obtained from the governing equations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0043, WIND TUNNEL TESTS OF DEMONSTRATION ROCKET

Unknown, U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center, *Arnold Air Force Station, Tullahoma, Tennessee* 37389 (DA0G1011)

To perform aerodynamic design of low cost rocket.

Wind tunnel tests will be performed on free rocket configurations.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Free Flight Rocket Technical Office

4.0044, MISSILE VORTEX WAKE MEASUREMENTS 14921-A-E

K.E. Harwell, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DA0F8968; DAAG29 77 G0107)

To measure the three velocity components, the turbulent intensities and the turbulent correlations in the separating boundary layer and vortex wake regions on missile bodies at high angles of attack. Relevance - the proposed investigation will provide fundamental information on the origin of forces experienced by violently maneuvering missiles and is directly relevant to the design and development of tactical missiles.

The measurements will be made in the NASA/Marshall 7-inch square subsonic/supersonic wind tunnel facility and will utilize the NASA three-dimensional laser Doppler velocimeter system. Data will be analyzed and compared with existing analytical models to provide validations and improvement.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0045, STUDY RELATIVE TO DEVELOPING A MICROWAVE ANTENNA POINTING ERROR SENSING SCHEME

J.C. Hung, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Electrical Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS 8-33604)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

4.0046, AN ANALYTICAL STUDY OF POWERED MISSILE AERODYNAMIC PERFORMANCE 14966-A-E

J.M. Wu, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DA0F8972; DAAG29 77 G0108)

To develop calculation techniques as well as a basic phenomenological understanding that allows the aerodynamic characteristics of realistic missile configurations to be estimated and optimized. Relevance - the understanding and prediction of the aerodynamics of canard-body-fin configurations at angle of attack is of greatest relevancy to the design and development of high performance tactical missiles and therefore has great impact on the Army's need for greater firepower.

Utilizing existing potential flow analyses, viscous flow past missiles at angles of attack will be determined including the effects of fins, fin tips and wake interactions. The resulting model will be utilized to examine aerodynamics of canard-fin-elevon combinations including effects of blunt noses and small geometric imperfections.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0047, ROBUST PARAMETER ESTIMATORS FOR COMMUNICATION DATA

P. Papantoni Kazakos, Rice University, School of Engineering, Dept. of Electrical Engineering, *6100 Main St., Houston, Texas* 77001 (DF046340; AFOSR-77-3156)

AF function - radio multi-access communications, remote sensing, image encoding schemes and radar signature recognition. Deficiency -improvements are needed in the techniques of signal estimation and image processing in the presence of unpredicted interferences and abrupt changes. Objective - develop estimators that are 'robust' in the presence of statistically 'contaminated' communication data. How work contributes - this research will allow for better design of communication systems and signal processing techniques.

A big percentage of the communication channels in the literature have been modeled as Gaussian and additive, in the term 'channel' one incorporates all disturbances and measurement errors that are undesirable and which one must get rid of. The main reason for the Gaussian and additive assumptions in modeling is analytical simplicity. However, communication channels are often subject to abrupt changes. Therefore, realistically speaking, even when the channel can be modeled successfully as additive, one almost never has a very accurate knowledge of the true underlying distribution. Taking this under consideration together with the fact that the performance of some of the classical parametric tests or estimates for some information retrieval is very unstable under small changes of the underlying distribution, the need for study and design of receivers (or estimators) insensitive to such changes becomes evident. This need has been recognized by statisticians and engineers, and that is how the nonparametric and robust concepts were created. However, although tests with small sensitivity to distribution changes have been proposed and analyzed, the area is far from being exhausted. Indeed, the nonparametric property has been treated separately from the concept of robustness, although they should be connected. The subject of this proposal is the design of estimators that are 'robust' in the presence of statistically 'contaminated' communication data. A radical approach to the concept of robustness is used. A precise detailed definition of statistical contamination is given. Such definition is very sensitive to the distance between probability measures that are used. Robustness is defined as a stability property inside certain contaminated families. Constructive analysis of robustness as defined above leads to methods for designing 'robust' estimators where the concept is not vague any more.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0048, SPREAD SPECTRUM MULTIPLE ACCESS TECHNIQUES AND MICROWAVE MOBILE RADIO COMMUNICATIONS

S.C. Gupta, Southern Methodist University, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *Hillcrest & University, Dallas, Texas* 75222 (DF048010; AFOSR-77-3277)

AF function - the interference rejection and inherent message privacy properties of spread spectrum communications is of great significance to military communications as it provides a large measure of protection from active countermeasures by an enemy. Opportunity -current spread spectrum systems are too costly to be incorporated into the tactical air forces. Objective - the proposed research will investigate new spread spectrum concepts for advanced communication systems and explore the applications of these concepts to practical systems, including microwave mobile communications and military satellite communications. How work contributes - this effort will advance spread spectrum techniques for military communications.

Further simulation work will be performed to establish the practical limits on the new acquisition technique that was developed which employs an autoregressive parametric model and a variable wave digital filter. A comprehensive mathematical analysis will be performed on a spread spectrum multiple access technique for satellite communications. Finally, the problem of data transmission, at microwave frequencies, over mobile radio channels will be studied. The use of spread spectrum systems will be investigated and compared to conventional systems. Various modulation and encoding schemes will be comparatively evalu-

ated to determine the data rates that can be supported over mobile radio channels in very hostile propagation environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, DESIGN STUDIES FOR A TECHNOLOGY ASSESSMENT RECEIVER FOR THE GLOBAL POSITIONING SYSTEM

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0050, DENSE PLASMA HEATING AND RADIATION GENERATION

M. Kristiansen, Texas Tech University, School of Engineering, Dept. of Electrical Engineering, *P.O. Box 4340, Lubbock, Texas* 79409 (DF038180; AFOSR-74-2639)

AF function - operation of high latitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of dense plasma heating and radiation generation processes. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research program. Objective - this project will perform theoretical and experimental investigations on (A) CO2 laser interaction with preformed plasmas, and (B) nonlinear optical mixing in plasmas. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications and the development of countermeasures.

This research will investigate dense plasma heating and radiation generation. This will follow two main routes: (A) CO2 laser interaction with preformed plasmas employing the laser obtained from AFWL coupled with an intracavity to enhance laser absorption. For diagnostics of the new plasma source they will use Twymann-Green and Mach-Zehnder interferometers, fast photography, spectroscopy, and diamagnetic loops. They may also use Thomson scattering. In addition to hydrogen they will use high Z materials to enhance the x-ray generation. (B) Non-linear optical mixing in plasmas will be performed by the two counterstreaming laser beams which are expected to heat the plasma by inverse bremsstrahlung. One of the most important goals of the experimental investigation is to determine the threshold for exciting various plasma instabilities that can either absorb the laser energy or scatter it out of the interaction volume. The required power densities for the onset of various possible nonlinear mechanisms is rather large. They will start a theoretical investigation of heating to determine if waves other than the Langmuir plasma wave might be more suitable to be driven by the laser beat frequency. They will use the operator formulation (Markuvitz) to calculate the excitation coefficients of various waves that might fall in the appropriate range. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0051, HIGH INTENSITY SOUND

D.T. Blackstock, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712 (DF042700; F44620-76-C-0040)

AF function - advanced aerospace vehicles. Deficiency - lack of basic understanding of nonlinear sound waves. Objective - achieve a fundamental understanding of the behavior of finite-amplitude (i.e. very intense) acoustic waves and apply this understanding to important problems of defense technology. How work contributes - major sources of nonlinear waves under investigation are jet and rocket engines. Understanding of this phenomenon and how the frequency spectrum changes with distance will enable the Air Force to remove or a least lower the noise level found around aircraft and air fields.

Research in high intensity sound will be carried out in three areas: 1) propagation of finite-amplitude noise; 2) propagation of periodic waves; and 3) diffraction, reflection, and focusing of N waves. This will be a combined theoretical and experimental program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0052, SUBSONIC AERODYNAMIC LOADS ON MISSILES 13164-E

A.H. Nayfeh, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Mechanics, *Blacksburg, Virginia* 24061 (DA0Q5576; DAAG29 76 G0034)

To utilize discrete-vortex techniques to treat the subsonic aerodynamic interactions between the components of missile-like configurations. The design programs at MICOM for most missiles and rockets would benefit from this research program. Two major thrust areas, free flight rocket program and terminal homing program, would be particularly benefitted. At BRL, the proposed work would be applicable to the flow about the tail fins of low velocity mortars.

The discrete-vortex technique will be extended to interactions of wings having arbitrary planforms, positions, and orientation as well as to wing-body interactions. Quantitative comparisons with experimental data will determine the accuracy of the predicted interactions effects.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0053, UNSTEADY AIRLOADS ON A SINUSOIDALLY OSCILLATING SUPERCRITICAL AIRFOIL

H. Tijdeman, National Aerospace Lab., *Amsterdam, Netherlands* (DF048340; AFOSR-77-3297)

AF function - aerospace vehicles. Deficiency - there is a lack of reliable experimental unsteady aerodynamic data at transonic speeds. These data are required for analysis and for validation of unsteady transonic aerodynamic theories. Objective - to obtain accurate unsteady aerodynamic measurements at transonic speeds on two-dimensional airfoils. Unsteady wall effects will also be investigated. How work contributes - unsteady transonic aerodynamic data are required for evaluation of flutter characteristics of aircraft, flutter characteristics of helicopter rotor blades, gust response of aircraft, performance of helicopter rotor blades, and design of active control systems. The acquisition of accurate unsteady aerodynamic data in which the effects of model scale and facility wall configurations will be evaluated should serve as a standard for the comparison and evaluation of the new generation of calculation methods for unsteady transonic flow.

This is a collaborative program between NASA Ames and the NLR (which has requested nominal Air Force support for their portion of the program). The NLR 7301 airfoil will be investigated in both the NLR transonic tunnel and the NASA Ames 11 by 11 foot transonic wind tunnel. Both the NLR and NASA Ames tests will investigate the amplitude and phase relationships of the pressure distribution and the resultant integrated forces over a range of Mach numbers, angles of attack, Reynolds numbers and reduced frequency. Sufficient data and details of the test facilities pertinent to evaluating wall and scale effects will also be provided as well as details of the test techniques including data acquisition and reduction procedures. It is expected that the close cooperation of the two research laboratories will result in greater progress to improve data accuracy and reliability in a shorter period of time than would be possible by each group working independently.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, THE EFFECTS OF TOPOGRAPHY, ALBEDO AND THERMAL INERTIA VARIATIONS ON THE GENERATION OF MESOSCALE MARTIAN WIND PATTERNS
R.L. Rankin, Arizona State University, School of Engineering & Applied Sciences, Dept. of Engineering Science, *Tempe, Arizona* 85281 (NSG 7630)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0002, IMAGE RECONSTRUCTION USING LARGE ASTRONOMICAL TELESCOPES
P.A. Strittmatter, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (DF248810; F19628-78-C-0058)

AF function - communications, surveillance, detection, tracking. Deficiency - severe limitation in observing fine spatial details on deep space objects. Objective - to utilize new and existing techniques used in observational stellar astronomy to assist in solving Air Force needs in the areas of satellite identification and monitoring. How research contributes - enables the Air Force to increase spatial resolution through the atmosphere by a factor of over fifty.

A data acquisition system to obtain short exposure astronomical photographs used in the technique known as 'speckle interferometry'. This system will be used to obtain test and evaluation data on both man-made space objects (satellites) and non-man-made objects (stars, asteroids and extended nebulae). These data will be used to develop and perfect data processing schemes to recover images with spatial detail approaching the best theoretically possible in the absence of atmospheric turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0003, FUNDAMENTAL STUDIES IN GEODYNAMICS
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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0004, ESTABLISHMENT OF A SAMPLE TREATMENT PROTOCOL FOR VIRUS DETECTION BY LASER FLUOROMETRY
G.A. Funk, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Science, *Washington Sq., San Jose, California* 95192 (NSG 2398)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0005, STRATOSPHERIC POLLUTANT TRANSPORTS BY PLANETARY WAVES AND TROPICAL CIRCULATIONS
C.A. Riegel, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2 17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0006, QUANTITATIVE MODELS OF THE TOTAL DENSITY OF THE DISTURBED UPPER ATMOSPHERE AND THE DISTURBED MAGNETOSPHERIC MAGNETIC FIELD
W.P. Olson, McDonnell Douglas Astronautics Co., *5301 Bolsa Ave., Huntington Beach, California* 92647 (DF040430; F44620-75-C-0033)

AF function - accurate models of the earth's magnetic field and the distribution of the earth's neutral atmosphere are needed to accurately predict nuclear weapons effects in the aerospace environment. Deficiency - current models are inadequate for the precise predictions needed. Objective - models will be derived utilizing coordinate systems that will easily interface with existing computer codes. Contributions -these models will improve the accuracy of prediction of nuclear weapons effects.

Existing models of the magnetospheric magnetic field and the density of the neutral upper atmosphere will be improved so that they are useful over the full range of magnetic conditions. Input parameters to the models will be chosen such that the models be used in a predictive mode. In line with this program the following will be accomplished: 1) quantitatively determine position and strength of the three magnetospheric current systems as a function of appropriate parameters describing the variability of each current. 2) by vector integration compute for each current system its associated vector magnetic field in the magnetosphere. 3) using vector B at a grid of points develop an analytic representation for both vector B and its associated vector potential, vector A, valid at least throughout the inner magnetosphere. 4) modify the existing quiet atmospheric density program to include disturbance effects with storm time dependencies included as appropriate. 5) extend the range of the quiet atmosphere density program to an altitude of 1000 km using available data to check and verify the extension.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0007, TRACKING AND MONITORING OF HURRICANES BY HF SKYWAVE RADAR OVER THE GULF OF MEXICO
J.W. Maresca, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF044800; F49620-76-C-0023)

AF function - the Air Weather Service has a technical need for remote measurement of tropical cyclone parameters. Deficiency - in the early developing stages of a tropical cyclone, the center of the cyclone, as determined by satellite data, can be displaced from the surface center by as much as 100 nautical miles. At nighttime, the coarser resolution of the satellite IR sensor presents problems in locating the tropical cyclone. Objective - HF radar technology will be used for remote sensing of the sea surface conditions and surface winds in tropical cyclones. Contribution - the availability of a remote wind sensing capability with OTH radar will permit a significant reduction of the weather reconnaissance flights with little or no degradation of the present existing forecast capability. This will be a cost effective measure.

The SRI radar (OTH) will be used as an active radar. The tropical storm area will be illuminated by a beam of radio waves originating at this radar transmitting site, and the radio waves reflected (backscatter) from the storm area are detected by a highly directional antenna located at the radar receiving site. The recorded backscatter data will be analyzed to track and monitor hurricanes to determine the sea state and surface winds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0008, VERY-LOW-FREQUENCY PROBING OF THE MAGNETOSPHERE FROM PALMER STATION, ANTARCTICA
R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DPP7682042A02)

This is a continuation of NSF Grant Number DPP76-82042.

The very-low-frequency (VLF) wave receiving system established at Palmer Station, Antarctica, during the austral summer of 1977-78 will continue to operate during 1979 and early 1980 to obtain data on natural VLF-wave activity and on the magnetospheric response to signals injected from Siple Sta-

tion, Antarctica. The data taken at Palmer Station during transmissions from Siple will support ground-to-satellite transmitting experiments during the International Magnetosphere Study now under way. VLF-direction finding experiments will also be conducted at Palmer along with observations for VLF-wave induced particle precipitation. Two scientists will visit Palmer during the austral summer of 1979-80. One of these will winter-over during 1980.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0009, MAGNETOSPHERE-IONOSPHERE-ATMOSPHERE INTERACTIONS
R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ATM7820967)

This grant supports the investigation of magnetosphere-ionosphere-atmosphere interactions for a two year period. The approach to be used involves both theoretical and experimental work. In the experimental area, the primary source of data will be a field program of active and passive probing of the magnetosphere-ionosphere system at Siple, Antarctica, and Roberval, Quebec, Canada. In addition, analysis of correlative data from a number of other ground-based and satellite programs will be performed. Major scientific problems to be investigated include (1) wave-induced particle precipitation and its effects on the ionosphere, (2) the origin of VLF waves in the magnetosphere, with particular emphasis on the role of man-made VLF noise in stimulating wave activity in the magnetosphere, (3) longitudinal wave-particle interactions in the magnetosphere, and (4) substorm electric fields in the plasmasphere and their effects on the ionospheric F region.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0010, OPTIMIZATION OF AN INTERACTIVE BATCH ANALYSIS SETUP SYSTEM FOR LANDSAT APPLICATIONS
A.M. Peterson, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (NCA 2-745910)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0011, INTERPLANETARY FIELD STUDY
I.A. Kinsey, University of California, Berkeley Campus, Space Sciences Lab., *3 Leuschner Observatory, Berkeley, California* 94704 (DF247230; F19628-76-C-0125)

AF function - communications and detection. Deficiency - understanding ionospheric effects caused by various auroral phenomena which cause communications degradation in the Arctic. Objective -investigate the effects of the interplanetary magnetic field on various auroral phenomena. How research contributes - provides inputs to in-house work efforts in substorm prediction and ionospheric mapping. This contractual effort is for investigation of the IMF and its relationship to various auroral phenomena and the predictive indications inherent in the IMF behavior. Interpretation of IMF parameters in terms of auroral phenomenology provides a background for the interpretation of data collected by the AFCRL Airborne Ionospheric Observatory.

Assemble and interpret IMF data to specify a given ionospheric state and structures associated with the chosen state. To correlate the specific states and structures with DMSP photos and aircraft data. To identify any precursor states or structures which warn of impending substorms or other magnetic disturbances.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, SHIP AND SATELLITE BIO-OPTICAL RESEARCH IN THE CALIFORNIA BIGHT
R.C. Smith, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (NSG 1641)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0013, ONE-TIME GRANT FOR MAJOR UPGRADING AT JICAMARCA
B.B. Balsley, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (ATM78-17663)

This grant provides major upgrading of the data processing capability for aeronomical and meteorological research done at the Jicamarca Radio Observatory. The Observatory has importantly unique research capabilities by virtue of its geophysical location at the magnetic equator and its instrumental capabilities. These unique research opportunities have led to the maintenance of a long standing substantial U.S. research effort at the Observatory by a large number of first rate U.S. scientists. By replacing old worn-out units with their modern counterparts, the capability of this Observatory and the efficiency of the dependent research programs are significantly enhanced.

The improved reliability and order of magnitude increase in data handling capability provided by this grant will correspondingly enhance research in the areas of: 1) Dynamics of the Neutral Atmosphere, including measurement and analysis of winds, waves, and turbulence in troposphere, stratosphere, and mesosphere; 2) Structure and Dynamics of the Equatorial F Regions; 3) Equatorial F-Region Irregularities (Spread F) with emphasis on the explanation of the experiments at Jicamarca and which are so severe as to interfere with radio communications in the very high GHz range; and 4) Equatorial Electrojet Irregularities (Equatorial Sporadic E).

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0014, METEOROLOGY STUDIES OF MARS
S.L. Hess, State University System of Florida, Florida State University, Geophysical Fluid Dynamics Inst., Dept. of Meteorology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (NSG 7629)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0015, COLOR INFRARED APPLICATIONS TO CITRICULTURE
C.H. Blazquez, State University System of Florida, University of Florida, School of Agriculture, Dept. of Plant Pathology, *Gainesville, Florida* 32601 (NAS10-9666)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Kennedy Space Center

5.0016, SHIPBOARD TECHNICIAN SUPPORT
J. Gibbons, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (OCE7726357A01)

This grant will provide partial support for the activities of the Marine Electronics Group at the University of Miami's Rosenstiel School of Marine and Atmospheric Research. Principal activities supported by the grant include the maintenance of complex shipboard electronic gear essential to research sponsored by the National Science Foundation as well as integration and utilization of computerized data collection and satellite communication systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0017, OZONE TRANSPORT IN THE LOWER STRATOSPHERE AND THE OZONE-NO2 RELATIONSHIP
D.M. Cunnold, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NSG 1643)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0018, NIMBUS 7 APPLICATIONS INVESTIGATION
Unknown, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAS 5-25817)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0019, SHORT COURSES IN REMOTE SENSING
R. Welch, University of Georgia, Graduate School, Dept. of Geography, *Athens, Georgia* 30601 (NAS13-123)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0020, RESEARCH OF PRECIPITATION GROWTH IN CONVECTIVE CLOUDS
R.C. Srivastava, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (NSG 5402)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0021, NORTHERN PLAINS OF MARS
J.R. Underwood, Kansas State University, School of Arts & Sciences, Dept. of Geology, *Anderson Hall, Manhattan, Kansas* 66502 (NSG 7613)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0022, GEOLOGY OF LIBYAN DESERT GLASS SITE, S.W. EGYPT
J.R. Underwood, Kansas State University, School of Arts & Sciences, Dept. of Geology, *Anderson Hall, Manhattan, Kansas* 66502 (NSG 7580)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0023, DETECTION OF BURIED SURFACES ON MARS
Unknown, Northeast Louisiana University, Graduate School, *700 University Ave., Monroe, Louisiana* 71201 (NSG 7628)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

5.0024, RESEARCH OF HIGH TEMPERATURE SOLAR CONVERTER
F.W. Oliver, Morgan State University, Graduate School, Dept. of Physics, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NSG 5401)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0025, CONFERENCE ON THE REGIONAL APPLICATIONS OF REMOTE SENSING TECHNOLOGY
Unknown, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NAS 5-25851)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0026, AIRBORNE WATER VAPOR LIDAR EXPERIMENT
T.D. Wilkerson, University of Maryland, College Park Campus, Inst. for Fluid Dynamics & Applied Mathematics, *College Park, Maryland* 20742 (NCC 1 25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0027, RESEARCH LEADING TO THE DEVELOPMENT OF INSTRUMENTATION FOR RESEARCH ROCKETS SUPPORT AND INSTALLATION AT ROCKET LAUNCH SITES
S.J. Rochefort, Northeastern University, School of Engineering, Dept. of Electrical Engineering, *360 Huntington Ave., Boston, Massachusetts* 02115 (DF247220; F19628-76-C-0111)

AF function - research leading to the development of state-of-the-art airborne instrumentation systems. Deficiency - the inability to accurately forecast the atmospheric interactions affecting the design and operation of military systems in the area of rockets and satellites. Objective - to perform studies leading to the design, construction and flight test of state-of-the-art airborne instrumentation systems. Such studies will attempt to improve present day systems by more efficient utilization of transmission bandwidths. Provide field support - carry on post-flight analysis of performance and provide continuing improvement. How research contributes - the development of more efficient airborne data processing techniques and instrumentation systems will allow more efficient use of RF bandwidth within the limited allowed band.

Theoretical development of more efficient telemetry systems for use in rocket, satellite and balloon instrumentation systems. Construct these telemetry systems for flight - provide field support and carry on post-flight analysis of performance. The closed loop will ensure rapid response to current needs. The design objectives concern space, weight and power. The vast experience accumulated through previous contracts should ensure efficient use of valuable Air Force funds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, ELECTRONICS FOR ULTRAVIOLET SPECTROMETER
C.G. Kuczun, Tri Con Associates Inc., *Cambridge, Massachusetts* (DF249990; F19628-77-C-0048)

AF function - vehicle tracking during flight and re-entry, trajectory prediction, communication systems. Deficiency - present atmospheric models predict only slight variability of the density of the upper atmosphere below 200 km; however, empirical data show this conclusion to be incorrect and observations indicate density changes as great as 50 percent in both space and time at altitudes between 120 and 200 km. This altitude, important for Air Force operations, will be studied on a world-wide basis by density experiments aboard the DMSP satellites. The present work will support these experiments. Objective -in-situ measurements with rockets of atmospheric parameters to provide correlative data for comparison with photometric data from DMSP satellites. How research contributes - provides direct, low-altitude measurements of pertinent atmospheric properties as an aid in understanding the remote optical measurements made from DMSP satellites.

Contractor shall design, fabricate and test an electronics subsystem for a double-deck solar EUV spectrometer and auxiliary experiments (a UV photometer, a dayglow photometer and an electron analyzer), modify ground support equipment consoles for the spectrometer and the photometers, and assist in the preparation of the rocket payload for flight. Measurements will subsequently be made from a rocket in the altitude range between 120 and 200 km. of the photoelectron flux, differential energy distribution for energies between 0 and 100 electron volts, of the radiance of nitrogen airglow at 3371 Angstroms and of the density and composition of the upper atmosphere as established by solar ultraviolet photon absorption rates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, ADVANCED WEATHER RADAR DIAGNOSTIC SOFTWARE
C.L. Bjerkaas, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581480)

AF function - protection of aerospace systems in severe storms. Deficiency - identification and warning of storm hazard by current methods are unreliable and require ineffective utilization of projected reduced manpower. Objective - to develop software suitable for the operational detection of meteorologically significant features of storms and the prediction of storm movement, development, and severity. How development contributes - provides improved identification and prediction of convective storm hazards using automated data processing techniques for storm diagnosis.

Algorithms for detecting radar indicators of severe weather phenomena will be developed based on radar data taken in Oklahoma during the joint agency Doppler tests in the spring of 1977. The algorithms will be operationally tested during the spring 1978 test and modified based on the test results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, LANDSAT STUDY OF URBAN AND LAND USE - JACKSON, MS

M. Lang, Jackson State University, School of Liberal Studies, Dept. of Social Science & Educational Geography, *1325 Lynch St., Jackson, Mississippi* 39217 (NSG 736)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

5.0031, CLIMATIC MISSION SUCCESS INDICATORS

D.E. Martin, St. Louis University, School of Engineering, Dept. of Earth & Atmospheric Sciences, *3507 Laclede Ave., St. Louis, Missouri* 63103 (DF248330; F19628-77-C-0032)

AF function - support weather sensitive Air Force and Army mission. Deficiency - current climatology needs to be adapted to expeditiously meet the input requirements for indicators of mission success. Research - apply statistical theory and computer methods to the climatic record. How research contributes - will contribute to a military capability to assess the climatic influence anywhere, at any time, worldwide, upon the probabilities of the successful completion of an Air Force mission.

Develop and test stochastic models for estimating joint or conditional probabilities of weather events including events with time lag between them, all of which will be favorable for the successful completion of a multiphased Air Force mission. The weather events are those relevant at take-off, enroute and at one or more destinations and their alternates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, STRATOSPHERIC DISCHARGES

R.E. Orville, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Atmospheric Science, *1400 Washington Ave., Albany, New York* 12222 (DF580040; F19628-78-C-0007)

AF function - environmental impact statements of high-altitude Air Force operations. Deficiency - current or anticipated AF operations in the stratosphere may deposit harmful materials and it is important to assess the potential impact of this in the context of the harmful substances deposited naturally by such things as thunderstorms. Objective - to perform an experimental study of glow discharges associated with lightning in thunderstorms but which occur above the storm in the stratosphere. How research contributes - this work would establish the existence and some of the characteristics of these discharges. Such discharges may be having a significant effect upon the chemistry of the stratosphere. They may in fact be generating large amounts of NOX there, but comparatively little is known about the phenomenon at present. The work would also be important for future aircraft operations when they have the ability to fly over thunderstorms. This is because it is possible that they may experience or even initiate clear air stratospheric discharges. A third area of relevance is that of navigation, surveillance, and communication since these can be affected by electrical activity.

The experimental program will center around an optical approach involving still and cine photographs as well as spectroscopic investigations using filters and multichannel recordings. A comparison of certain spectral lines will prove or disprove the existence of the clear air stratospheric discharges. Vehicles such as high altitude aircraft and balloons will allow detection of the phenomenon from above the thunderstorms. Both ground-based and airborne observations will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, STATISTICAL MODELLING OF SURFACE WATER MOVEMENTS USING RADAR ALTIMETER DATA

C.C. Tung, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Civil Engineering, *Raleigh, North Carolina* 27607 (NAS 6-3018)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0034, A SECOND YEAR OF EFFORT IN ESTABLISHING LANDSAT WORKSHOP

J.A. Harrington, University of Oklahoma, Norman Campus, Graduate School, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (NAS13-122)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0035, THE ROLE OF DIABATIC HEATING IN GENERATING LOWER TROPOSPHERIC MESOSCALE CIRCULATION 13817-GSX

R.A. Anthes, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (DA0E9047; DAAG29 76 G0157)

To investigate the role of differential heating at the earth's surface and N-producing mesoscale circulations. This research is relevant to the Army Automated Meteorological System (AMS) requirement for development of the technology base on small-scale atmospheric processes.

Prediction of atmospheric behavior in the planetary boundary layer will be determined using a complex three-dimensional, multi-level primitive equation model modified to realistically account for vertical fluxes of heat and momentum, and a simpler two-dimensional analog to the 3-D model. The role of differential heating at the earth's surface will be stressed in this comparison.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0036, MEASUREMENT OF REFLECTIVITIES OF ROCKS, MINERALS AND GLASSES IN THE VACUUM ULTRAVIOLET

B. Hapke, University of Pittsburgh, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (NSG 7631)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0037, ADVANCED MICROWAVE SOIL MOISTURE STUDIES

J.L. Heilman, South Dakota State University, Graduate School, *Brookings, South Dakota* 57006 (NSG 5396)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0038, ROCKETBORNE ELECTRON SOURCE

W.R. Pendelton, Utah Higher Education System, Utah State University, School of Science, Dept. of Physics, *Main Bldg., Office 104, Logan, Utah* 84321 (DF580550; F19628-78-C-0103)

AF function - detection. Deficiency - lack of knowledge of atmospheric processes controlling infrared and optical backgrounds. Objective - a rocketborne electron source will be designed, fabricated and tested for eventual integration in a rocket payload designed to determine specific atmospheric parameters by means of electron induced optical emissions. A rocketborne Echelle spectrometer will measure relative band intensities, band profiles and absolute band intensities of specific molecular emission excited by a rocketborne electron source. The emissions will be interpreted in terms of CO_2, O_2 and O and N_2 atmospheric densities as well as N_2 rotational and vibrational temperatures. How research contributes - the rocket payload measures a series of atmospheric parameters that control infrared

4.3 micron CO2 emission in both auroral and nuclear disturbed atmospheres. The results provide insight into the spectral, spatial and temporal nature of IR backgrounds under auroral and nuclear disturbed conditions.

A rocketborne electron source will be designed and fabricated to provide a beam of electron induced optical emissions to be observed by a rocketborne Echelle spectrometer. The spectrometer measures the molecular band profile and photon emission rate of selected molecular emissions induced by an energetic beam of electrons. The electron source energy and current and the spectrometer are designed as a compatible system with the measurement precision of the ambient atmospheric parameters the principal design criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0039, DYNAMICS OF THE HIGH LATITUDE IONOSPHERE

W.J. Raitt, Utah Higher Education System, Utah State University, School of Science, Dept. of Physics, *Main Bldg., Office 104, Logan, Utah* 84321 (DF248300; F19628-77-C-0011)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of plasma flows, charge distributions, electric fields for the design needs of AF systems. Objective - study high latitude ionospheric dynamics in three areas: 1. High latitude F region dynamics, 2. Convection electrodynamics, and 3. Polar wind. How research contributes - provides data essential to HF and UHF propagation predictions, provides data required for the design and utilization of communication guidance and surveillance systems and provides understanding of the dynamical processes in the ionosphere.

Develop theoretical procedures and computer codes to determine plasma flow, particle distributions and effects of electric fields on the high latitude F region. Satellite data will be utilized to test the theoretical methods and to develop a prediction capability for the high latitude ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0040, CLOUD AND PRECIPITATION PARTICLE SIZE SPECTRA 15420-GS

L.F. Radke, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Sciences, *Seattle, Washington* 98105 (DA0G8929; DAAG29-79-G-0005)

To obtain measurements and relate liquid and solid particle size spectra in clouds and precipitation to the mesoscale structure of storms, the mechanism by which precipitation is produced, the effects of moisture supply, air motion and changes in the particle spectra produced by topography. Relevance - many E-O weapon and communication systems are sensitive to attenuation by liquid and solid particles in clouds and precipitation. Liquid and solid particle size spectra also are important in rain and ice crystal erosion, icing of aircraft, and prediction of cloudiness and precipitation.

As a subtask of a larger cycles project, use airborne and ground-based instrumentation to measure size spectra of solid and liquid cloud and precipitation particles as they move from over the Pacific Ocean into Washington State. Combine these measurements with other simultaneous measurements and observations from satellites, two instrumented aircraft, four weather radar (two Doppler), serial radiosondes, and a dense network of precipitation rate measuring gages to analyze cloud and precipitation microphysics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0041, AEROSOL LIFE CYCLES AND RELATED ATMOSPHERIC PROCESSES

M.B. Baker, University of Washington, School of Engineering, Dept. of Civil Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (ATM78-08163)

The processes by which materials are cycled through the troposphere determine their spatial and temporal distributions, as well as their physical and chemical properties. This study will perform an analytical investigation of a selected set of aerosol cycles. The optical effects of each aerosol are derived from models of the dominant cycle mechanisms. Determination of the sensitivity of these optical effects to uncertainties in the data leads to quantitative characterization of the major data requirements. The cycles are examined both from a deterministic and a stochastic point of view. Measured variability in input parameters is incorporated into models which predict the statistical properties of the time-dependent and steady-state particle concentrations. The techniques thus developed are generalized and applied to a class of mathematically similar atmospheric phenomena.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0042, SATELLITE OBJECTIVE FORECASTING

D.R. Johnson, University of Wisconsin, Madison Campus, Graduate School, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF581920; F19628-78-C-0137)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of information to meet military weather support requirements. Objective - to develop automated techniques which utilize meteorological satellite data and where necessary, conventional data in the objective specification and forecasting of mesoscale weather features. How development contributes -successful development of these techniques will allow automated forecasts of weather conditions at many locations satisfying AWS requirements specified in AWS TN 3-76.

Objective techniques will be developed using both satellite and conventional data. Use will be made of interactive data display systems to assist in identifying features of the satellite imagery and conventional data analyses that have potential as predictors. Tests will be made to evaluate how well forecasts with satellite data alone compare with those using conventional data as well.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0043, A REMOTE JOB ENTRY TERMINAL PROCESSOR

D.D. Houghton, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (ATM7818095)

Research programs in the University of Wisconsin Meteorology Department and Space Science and Engineering Center (SSEC) have in recent years involved large computational tasks. These include parameterization and simulation studies with NCAR and Goddard (formerly GISS) general circulation models, analysis and forecast with operational prediction models, and analysis of large volumes of observational data from satellite aircraft, and climatological data archives. Research for at least the next ten years will continue to be focused in areas such as these that rely heavily on external computer support. This equipment grant will allow to continue more effectively the present and future research and teaching in meteorology at this university. The proposed RJE facility will be part of an intelligent processor capable of emulating a variety of terminal disciplines, will allow the flexibility of communicating with virtually any scientific computing facility, will link directly to the data base manager in SSEC, and with future additional peripherals. The terminal could serve as an applications processor to a McIdas type (Chatters and Suomi, 1975) system and as such would serve as a valuable tool in meteorology department teaching.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0044, MEASUREMENT OF FLUOROCARBONS, NITROUS OXIDE, AND AEROSOLS IN THE ANTARCTIC STRATOSPHERE

D.J. Hofmann, University of Wyoming, School of Arts & Sciences, Dept. of Physics & Astronomy, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (DPP7721202A01)

This is a continuation of NSF Grant DPP77-21202.

Balloon soundings to measure aerosols, condensation nuclei, nitrous oxide and fluorocarbons in the Antarctic stratosphere will be conducted at McMurdo and South Pole stations during the austral summers of 1978/79 and 1979/80. The data obtained will be used to (1) extend the existing data base and determine if seasonal and secular trends exist in their concentrations, (2) assess the effects of volcanic activity on the stratosphere and provide information on interhemispheric transport and exchange processes in the upper atmosphere, and (3) determine the importance of condensation nuclei on clear sky ice crystal precipitation in the Antarctic.

Logistics support is required for five persons at McMurdo and South Pole stations during the austral summers of 1979-80.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, POPULATION DYNAMICS IN SMALL-SCALE MICROBIAL ECOSYSTEMS

R.D. Haight, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Science, *Washington Sq., San Jose, California* 95192 (NCA 2-675907)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0002, NEUROPHARMACOLOGICAL EVALUATION OF TOXIC CHEMICALS

M.B. Sterman, University of California, Los Angeles Campus, School of Medicine, Dept. of Anatomy, *2025 Zonal Ave., Los Angeles, California* 90033 (DF319630; F33615-76-C-5014)

The 6570 AMRL has been investigating the pharmacological and toxicological effects of certain missile propellants in order to more safely use such compounds in a manner dictated by good industrial hygiene and industrial medical practice. In order to set standards for exposure criteria and to determine methods for combating the effects of those propellants and chemicals in exposed individuals, it is necessary to determine the exact mode of action of the agents on specific body function. The specific objective is to study the effects of hazardous chemicals of interest to the USAF on behavior responses in laboratory animals, obtain data on performance, correlate behavior changes with other neurological events, and test the efficacy of therapeutic measures to abort untoward effects of the agents.

A study will be conducted to advance the state-of-the-art with respect to the central nervous system effects of toxic chemical compounds of interest to the USAF. Previous studies in this regard have been performed using the cat as the primary model. Research with the cat has indicated a need to change the primary model to a primate for comparative purposes. It is now evident that certain forms of chemically induced epileptic manifestations are better studied in the primate. The specific agent to be studied using primate models will be the propellant, methylhydrazine. The data will be utilized to study mechanisms of action of the compound as well as various therapeutic regimens necessary to abort toxic manifestations. The data will also help develop toxicity criteria for the USAF as required by AFR 19-1.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0003, THE EVALUATION OF STRUCTURAL AND CHEMICAL ALTERATIONS OF BONE AND RED BLOOD CELLS IN THE RESTRAINED MONKEY MODEL

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, RESPONSE OF THE CARDIOVASCULAR SYSTEM TO VIBRATION AND COMBINED STRESSES

C.F. Knapp, University of Kentucky, School of Engineering, Dept. of Mechanical Engineering, *Limestone & Euclid, Lexington, Kentucky* 40506 (DF037240; F44620-74-C-0012)

AF function - environmental stresses such as acceleration may severely compromise aircrew performance. Circulation may be extended to critical limits since it is directly affected by acceleration and is indirectly involved in all adjustment of the body to environmental stress. Deficiency - with the recent development and deployment of high speed terrain-following tactical aircraft, operational crews are exposed to a dynamic acceleration environment with a significant frequency content below 1.5 Hz for extended periods of time. There is an acute lack of information available concerning responses at frequencies below 1.5 Hz. The design of effective countermeasures to acceleration stress depends upon the understanding of the mechanisms responsible for cardiovascular regulation. Because of the invasive nature of the instrumentation required for assessing cardiovascular responses, studies will be performed using chronically instrumented canines. Objective -the proposed studies are designed to 1) yield needed quantitative information about the cardiovascular system's ability to function in, and adjust to, ultra low frequency acceleration environments, and allow a qualitative evaluation of the possible hazards of exposure to such acceleration stress, and 2) to provide a means of analyzing the frequency response of the cardiac and vascular control mechanisms, acting to maintain circulatory integrity, during exposure to these dynamic, total-circulatory (i.e. whole body) acceleration loadings. How research contributes - this effort will provide the background required for the design and implementation of human investigations which would lead to improved protective equipment and operational procedures for military personnel exposed to the acceleration environment resulting from the optimal utilization of advanced aerospace systems.

Emphasis will be placed on the use of pharmacologic blocking agents to identify the frequency response of neural and adrenal mechanisms associated with cardiovascular regulation. The frequency response characteristics will be obtained from the magnitude of the physiological changes and their phase relationship to the acceleration loadings through the use of Fourier analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0005, HIGH Q WINDBLAST FORCES ON MAN

L. Specker, Payne Inc., *Annapolis, Maryland* (DF323000; F33615-77-C-0523)

The forces acting on the ejecting crewman entering the windstream during emergency escape are the second most frequent major cause of all injuries experienced during ejection. Injuries attributed to windblast flail are encountered in 5.6 to 6.9 percent of all survived ejections, while 54 percent of ejections in the 450 to 600 KEAS range result in major injuries or fatalities. As the performance envelope of advanced aircraft systems is expanded, windblast injuries will probably become more common. With the advent of the newer bubble canopies, windblast forces are encountered before the crewman is clear of the aircraft. The data that have been collected on crewman during emergency escape have been limited to that portion of the escape sequence in which the crewman was exposed to free-stream conditions. One-ninth scale model wind tunnel tests of the F-16 aircraft have indicated that the environment within the cockpit before entry into the high speed windstream is potentially hazardous. The aerodynamic forces are increasing in magnitude and the turbulence levels encountered may seriously compromise the crewman's chance of survival before rescue. The objectives of this program are to provide measurements of the aerodynamic forces that are encountered during the initial and transitory phases in the turbulence about the cockpit in order that effective protection countermeasures can be developed.

The program will combine an analytical effort with a wind tunnel scale study. The model will be used to collect pressure and force data needed to quantify inertial and aerodynamic forces acting on the ejecting crewman to cause injury and the development of requirements for the design of personnel protection systems. The analytical effort will allow for the analysis of the

wind tunnel data as well as exploring the use of various testing facilities and techniques for windblast research.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0006, DEVELOPMENT OF HUMAN PERFORMANCE MODELS FOR MAN-MACHINE SYSTEM SIMULATION
R.W. Pew, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF042440; F44620-76-C-0029)

AF function - whatever the precise form of the final RPV operational capability, timely and reliable performance of human components will be critical to mission success. The most responsive design of an RPV system requires valid data on the functioning of the human operation. Deficiency - previous efforts have not provided information specific enough for detailed design of the total complex of rules, procedures and decision-making which must support new, more stringent system functions. Consequently, the task of combining human performance data in the solution of the man-machine reliability equation and, thereby, of assaying alternative system configurations cannot be satisfactorily accomplished. Objective - BBN proposes to develop and test improved models of human performance. These models are to be integrated with structure models of the tasks associated with control of RPV systems being developed by AMRL. How research contributes -promising models in sufficient detail for AMRL implementation and evaluation of their usefulness will identify subsystem model parameters having greatest influence on system performance. By exercising these models, systems engineers can predict the effects of changes in system parameters before proceeding to full-scale simulation efforts and the operational evaluation of prototype systems.

Modelling studies will be conducted in collaboration with AMRL/Human Engineering Division personnel to explore quantitatively and in detail several key issues in model development. Recommendations and guidelines will be prepared concerning the most suitable approaches, and resolving ambiguities in the application of simulation models in future model development programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0007, NOISINESS AND ANNOYANCE OF NOISE-TONE COMPLEXES
R.D. Hellman, Boston University, Graduate School, *705 Commonwealth Ave., Boston, Massachusetts* 02215 (NSG 1644)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

6.0008, EFFECTS OF SLEEP DEPRIVATION ON THE CENTRAL NERVOUS SYSTEM
A.K. Sinha, College of Medicine & Dentistry of New Jersey, Rutgers Medical School, School of Medicine, Dept. of Physiology, *Box 101, Piscataway, New Jersey* 08854 (DF051050; AFOSR-78-3532)

AF function - Air Force operations expose personnel to a wide range of physiological stresses including prolonged missions with altered work/rest cycles. Varying levels of fatigue and performance degradation may occur as a result of such conditions and thus could impact on the efficiency of aircrew members and support personnel. Deficiency - sleep loss and fatigue due to extended missions occur in many Air Force operations. The ability to reduce crew rest requirements would be a significant application of this research effort. Objective - it is generally accepted that dramatic and incapacitating behavioral changes take place in human subjects due to prolonged sleep deprivation. It is assumed that the behavioral decrement due to sleep loss is a consequence and symptomological expression of cellular and subcellular level changes taking place in the brain cells during the deprivation period. The long term objectives are to detect and describe some of these changes, to explore the possibility of reversing them (thereby reversing or minimizing the functional decrement) by chemical intervention and to determine if qualitatively some biochemical changes take place during cyclic alterations between normal sleep and wakefulness. How research contributes - this research will provide essential information on the effects of sleep deprivation on central nervous system integrity. Findings will be applied to the establishment of rest recovery procedures for flight crews/support personnel and will feed in to related on-going in-house 6.2 efforts at USAFSAM.

A variety of stressful situations is known to stimulate neuroprotease (lysosomal) activity. This generalization suggests that neuroprotease activity in brain will increase following sleep deprivation. A number of conditions (exercise, starvation, infection, hypoxia) and chemicals (progesterone, vitamin A, hyperbaric oxygen) are known to cuase simultaneous increase in neuroprotease activity and sleeping time. Based on these observations this effort proposes the following working hypothesis: prolonged wakefulness or sleep loss increases neuroprotease activity, which causes subcellular disorientation in brain cells and is behaviorally manifested in sleepiness and associated behavioral decrement. This hypothesis will be tested by light and electronmicroscopic survey of morphological changes in brain cells due to prolonged sleep loss. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, VCASS HELMET-MOUNTED DISPLAY DESIGN
M. Shenker, Farrand Optical Co. Inc., *New York, New York* (DF323770; F33615-78-C-0512)

The objective of this program is to accomplish an optimized system design for an extremely wide field-of-view (FOV), virtual image, head-coupled display system for the Visually Coupled Airborne Systems Simulator (VCASS) Program. This device will be utilized in conjunction with head and eye position sensing mechanisms and computer generated imagery subsystems to develop a wide FOV virtual scene simulator for engineering and training simulation applications.

The approach will be to develop a weighted matrix using appropriate analytical techniques which give in an engineering sense a figure of merit when related to the specified design criteria. When the matrix has been completed and design criteria are set a comprehensive study of potential design approaches will be made. The design approach which appears most promising will be selected for detailed analysis. Finally a detailed technical specification complete enough to allow fabrication of the design by any knowledgeable manufacturer of optics and display systems will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0010, INDIVIDUALIZED OXYGEN DELIVERY SCHEME
E.A. Patrick, University of Cincinnati, Graduate School, *305 Physics Bldg., Cincinnati, Ohio* 45221 (DF319700; F33615-77-C-0603)

The contractor is to identify and select several physiologically sound schemes for enhancement of an ideal oxygen delivery process that will provide the individual crew member with physiologically adequate amounts of oxygen while simultaneously ensuring optimal oxygen supply conservation. An accurate, reliable methodology, convertible to lightweight hardware at a later date, must be continuously changing flow demands imposed by the airborne crew member during various exposures of acceleration, altitude, and workload.

The eventual remedy to current hardware limitations must be based on development of alternative methodologies for oxygen delivery that can later be implemented with hardware fabrication. The starting point for this effort, to be detailed in this statement, should consist of (1) nomination and theoretical evaluation of candidate concepts for matching instantaneous oxygen delivery with crew member demand, (2) mathematical simulation of the two most promising schemes, as chosen by a panel of physiological investigators currently active in aerospace medicine endeavors. This suggested approach is necessarily contingent on respiratory property and response data that is available from qualified sources. The end product of this effort is expected to be a functional, physiologic-based scheme for accurately controlling the inflight delivery of oxygen, with maintenance of optimal crew member performance serving as the guiding criterion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0011, MYOELECTRIC FEEDBACK CONTROL OF VISUAL DISPLAY DIMMING

D. Rogers, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF228480; F33615-77-C-0080)

To design and develop a bionic controlled feedback system for controlling the acceleration induced dimming of a simulator pilot's visual environment including the visual display and instruments. Such training devices as the simulator for air-to-air combat (SAAC) have visual display dimming capabilities to simulate the vision loss of a pilot under high positive acceleration. However, this sytem is not pilot interactive, the pilot has no physiological (M-1 maneuver) control over the display. State-of-the-air simulators provide no means for a tactical aircraft simulator pilot to control visual display dimming as a function of g. This effort will result in a technique by which pilot straining (M-1) can be sensed and the signal used to control the g effect dimming of simulator visual displays.

The approach is to develop the software and hardware (electrodes and package) to include the pilot in the visual display/simulation control loop. Two algorithms will be developed. One will predict the human visual systems's response to both antecedent and current g-levels. The other will predict the pilot's increased g-tolerance as a function of his ability (which will be determined by monitoring electromyographic potentials from selected muscle groups) to perform the M-1 maneuver. Development of this algorithm will require experimentation with trained subjects to determine which muscle groups are the most reliable indicators of the effectiveness of the M-1 maneuver. The two algorithms will be integrated to drive a brightness controller for the pilot's visual field. The integrated system will be implemented on the T-38 simulator at the AFHRL Stars facility. If successful, the system may be refined and integrated with the simulator for air-to-air combat (SAAC). Model development complete - 8 MAC; electrode development complete - 9 MAC; integrated controller operational - 10 MAC; system delivered, integrated on stars - 11 MAC; final report - 12 MAC.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0012, BONE GROWTH AND ALTERATION VIA ENDOSSEOUS IMPLANTS

I.L. Kamel, Drexel University, School of Engineering, Dept. of Materials Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NAS 9-15915)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Johnson Space Center

6.0013, PROCEDURAL TESTS FOR ANTI-G PROTECTIVE DEVICES

R.W. Thompson, Technology Inc., *8531 N. New Braunfalo Ave., San Antonio, Texas* 78217 (DF320570; F33615-77-C-0610)

The purpose of this effort is to provide more definitive data on standard and experimental anti-g valve operational characteristics. In addition a failure analysis life expectancy of g valves will be undertaken. The final products will be (a) the development of a standard experimental technique for evaluating anti-g valves, (b) a standard analytical approach for evaluating g valves, and (c) a failure analysis/life expectancy prediction of a g valve.

The contractor will impose various onset rates of g and absolute g levels to g valves using the SAM centrifuge while also modifying flow rates of air and inlet pressures of air to the valve. Using these experimental techniques he will develop and test an anti-g valve test protocol for reliability and producibility as a standard test procedure. Also using this technique, he will test standard and experimental valves in various modes of failure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0014, POWER AND CONTROL CONFIGURATIONS FOR A HIGH G-ONSET CENTRIFUGE DRIVE SYSTEM

T.J. Jones, Trinity University, Graduate School, Dept. of Engineering Science, *715 Stadium Dr., San Antonio, Texas* 78212 (DF052510; AFOSR-78-3622)

AF function - aircrew personnel operating high performance aircraft are exposed to increasing levels of rapid onset, sustained, repetitive maneuvering forces which can impose certain physiological responses that can affect operator performance in aerial combat. There is a need to conduct research utilizing test facilities such as the human centrifuge that will simulate these high g forces at levels of g and at rates of onset that match those of present or planned high performance aircraft. Deficiency - for a human centrifuge to provide an adequately realistic simulation of the environment of flight, the pilot to be trained must have control of the g force imposed, as he would through the control stick in an aircraft. In addition, for optimum simulation, the centrifuge should be capable of producing g onset rates from one g to several g per second. Objective - this research will investigate centrifuge power and control configurations which provide pilots (gondola subjects) controlled high g onset rates capable of simulating aerial combat maneuvers in new high performance aircraft. How research contributes - a research centrifuge's power and control system should, as much as possible, simulate the g forces, and g onset rates, produced by high performance fighter aircraft during aerial combat maneuvers. Any modifications, or new or additional gear necessary for achieving aerial combat maneuver simulation should be incorporated in a manner making them maximally compatible with existing equipment. This work supports subarea 1.6, 'habitable crew environments in AF operations.'

This study will be carried out by gathering data and specifications on available power equipment, and using this information in an analysis which will contain the mathematical model of the centrifuge arm and gondola. Methods of control will be included in the overall model. In this manner a number of possible solutions to the problem of pilot-controlled high g onset rates can be obtained. Both all-electric and hydraulic power systems with appropriate controls for each will be considered. Computer programs analyzing the system are to be run on Trinity University's IBM 370/155 computer. Standard programs employing CSMP as well as ones written using APL or FORTRAN would be used in the analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0015, APPLIED PREDICTIVE MODEL FOR HUMAN EXPOSURE TO THERMAL STRESS IN USAF OPERATIONS

E.H. Wissler, University of Texas, Austin Campus, School of Engineering, Dept. of Chemical Engineering, *200 W. 21st, Austin, Texas* 78712 (DF320430; F33615-77-C-0602)

This effort is designed to develop a computer model for predicting human response to the thermal stresses encountered in USAF operations. Use of such a model should permit prompt answers to questions from the field without the need for human experimentation, and should also serve to pinpoint critical areas where further investigation is indeed required. Although a number of programs on thermoregulation are already in existence, none is immediately suitable for USAF application. This effort will produce either a new model or a modification of an older one for this purpose.

The contractor will develop a digital computer program for predicting human response to thermal stress. The objectives of this contract are (1) to conduct a review of existing models to determine their suitability for this application, (2) to write a new program or modify an existing one to meet the technical requirements, (3) to provide computer programs written in FORTRAN, compatible with USAFSAM computer hardware, and (4) to compose a technical report summarizing the literature review and citing the experimental findings which form the basis for the model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0016, EFFECTS OF ANTI-G MEASURES ON GAS EXCHANGE

H.I. Modell, University of Washington, School of Medicine, Dept. of Physiology & Biophysics, *500 17th Ave., Seattle, Washington* 98122 (DF051920; F49620-78-C-0058)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including high sustained acceleration (HSG). It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance capabilities in aircrew members. Although information is available concerning physiological effects of moderate exposure to g (up to 5g), little information is available at higher levels of g exposure such as might be experienced during aerial combat maneuvers flown in the F-15 and F-16 high performance aircraft. Deficiency - several questions remain to be answered relevant to high sustained g (HSG) tolerance if more effective protective measures are to be developed. This study will elucidate on the extent to which commonly used protective measures (e.g., anti-g suits, straining manuevers) enhance or impair ventilation-perfusion ratios and the development of atelectasis at 1g and during exposure to HSG, the time course of gas exchange detriment resulting from use of these protective devices, the means by which these measures can be modified to optimize gas exchange during HSG. Objective - the overall objective of this research is to determine the extent to which commonly used anti-g measures enhance or impair gas exchange at 1 g and during exposure to HSG. How research contributes - this research will directly feed-in to ongoing exploratory development work conducted at USAFSAM and is covered under sub-area 1.6, 'habitable crew environments in Air Force operations.'

Animal experiments designed to examine changes in ventilation-perfusion distribution and atelectasis will be conducted at 1g in the University of Washington laboratory and at HSG at USAFSAM. Protective measures to be examined include the anti-g suit abdominal bladder, positive pressure breathing, and the combined measures of anti-g suit abdominal bladder and positive pressure breathing. In addition to the experimental studies, the computer model of gas exchange presently under development for USAFSAM by Collins' study will be extended to include nonsteady state pulmonary gas exchange and effects of anti-g protective measures on ventilation-perfusion distribution and gas exchange.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0017, TASK LOAD AND OPERATOR ATTENTION CAPACITY IN TIME SHARING PERFORMANCE

D. Gopher, Technion, Israel Inst. of Metals, *Haifa, Israel* (DF046760; AFOSR-77-3131)

AF function - this research supports aircrew training, aircrew performance in high task load environments (e.g., combat), and overall force readiness. Deficiency - as the role of the pilot is shifting from a direct controller of aircraft functions to a monitor and decision-maker in a complex, dynamic, and intelligent man-machine system, we need to measure those abilities which support this new role. The increasing complexity of flight missions combined with the growing sophistication of airborne systems and the concurrent increase in production and training costs emphasize the need for improved assessment techniques for pilot attention capacity and task loads. Objective - the research activity will follow three major lines - (1) development of a quantitative assessment of time sharing efficiency, (2) training for time sharing, and (3) development of software packages, including feedback devices and adaptive techniques. How research contributes -improved techniques and prediction equations for the evaluation of task load and operator efficiency in time sharing situations will be utilized in system design and development, the structuring of aircrew training programs, and the assessment of the workload quotient of various tactical maneuvers.

In FY-78 the research will be devoted to achieving the following goals - (1) cross-validation and improvement of procedures developed during the first year, (2) expansion and diversification of the investigation of performance limitations by adding new tasks to the existing battery. Visual monitoring, memory, reaction time and dichotic listening tasks have been constructed and incorporated in experimental designs, (3) experimentally investigate both dual-task and triple-task conditions, (4) increase emphasis on developing theoretical concepts that can tie applied human factors research with the general theory of attention.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, BLENDING ELEMENT-DIFFERENCE SCHEMES

G.H. Golub, Stanford University, School of Humanities & Sciences, Dept. of Computer Science, *Stanford, California* 94305 (NCA 2-745912)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0002, STUDY ON ONE- AND TWO-DIMENSIONAL FILTERING AND DECONVOLUTION ALGORITHMS FOR A STREAMING ARRAY COMPUTER

G.E. Ioup, Louisiana State University, University of New Orleans, School of Arts & Sciences, Dept. of Physics, *1542 Tulane Ave., Lake Front, New Orleans, Louisiana* 70122 (NSG 1648)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0003, NONLINEAR OSCILLATIONS BY TOPOLOGICAL AND FUNCTIONAL ANALYTIC METHODS 12981-M

J.C. Scanlon, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Mathematics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DA0K5572; DAHC04-75-G-0148)

To determine useful conditions for the existence and stability of periodic and almost periodic solutions of ordinary and functional differential equations, and to study bifurcation phenomena in nonlinear problems. Relevance - the questions of existence and stability of periodic solutions of nonlinear problems arise in a variety of areas, e.g., flap-lag stability analysis of helicopter rotor blades. These problems are aggravated when hysteresis or material memory introduces a time lag into the system. Bifurcation studies serve a dual role, supporting the theoretical existence studies mentioned above and unraveling such practical problems as buckling and sudden changes of structural response due to the variation of a physical parameter.

To formulate these problems in an abstract function space and apply the methods of topological degree theory to the resulting operator equations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0004, EFFECTIVE BEHAVIOR OF COMPOSITE MATERIALS

G.C. Papanicolaou, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (DF053040; AFOSR-78-3668)

AF function - aerospace vehicle design. Deficiency - design techniques for fastening composite materials. Objective - improved understanding of edge effects in composites. How work contributes -cracking and separation of laminates is influenced by stresses due to edge effects.

Asymptotic techniques including multispace and averaging have been used to obtain macroscopic equations for media with periodic fine structure like composites valid sufficiently far from edges. It is proposed to extend this work to areas including edge

effects, irregular structure with associated fluctuation equations, and humidity transport and associated swelling as for example in epoxy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, MATHEMATICAL MODEL (KRASH) OF CH-47A CRASHWORTHINESS

Y. BadriNath, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0D4040; DAAJ02-76-C-0015)

The objective of this program is to (1) simulate the dynamic response of a CH-47A helicopter to crash impact using computer program KRASH; (2) correlate the predictons of KRASH with data from a full-scale CH-47A crash test; and (3) recommend improvements to KRASH.

The structural response of a CH-47A to crash impact will be modeled using KRASH, and the initial impact conditions planned for a CH-47A full-scale crash test to be performed jointly by ATL and NASA at NASA's Langley Research Center. Following the test the model will be correlated with the test data and the CH-47A model improved. The contractor will recommend improvements to the KRASH computer program.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

7.0006, FINITE ELEMENT ANALYSIS OF TRANSONIC FLOWS 14371-M

G.J. Fix, Carnegie Mellon University, Mellon Inst. of Science, Dept. of Mathematics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DA0E9249; DAAG29 77 G0026)

To investigate the numerical solution of the partial differential equations describing transonic flow. Relevance - the subject matter has clear relevance to many Army flight problems including flows around rotors, missiles and artillery projectiles.

A new variational principle will be implemented which has certain desirable properties when used in conjunction with the finite element method. This variational principle will be investigated first in the two-dimensional case and then later in the three-dimensional case.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0007, CONTINUUM THEORY OF FRACTURE

M.E. Gurtin, Carnegie Mellon University, Mellon Inst. of Science, Dept. of Mathematics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DF043720; AFOSR-76-3013)

AF function - damage tolerance of advanced aerospace vehicles is essential to reductions in AF cost of ownership. Deficiency - new failure criteria are needed to accurately predict the fracture process under a wide range of materials (metals and composites) and environmental states. Objective - the objective of this research is to investigate new fracture theories for metallic structures and to apply continuum mechanics based upon basic energy balance considerations and diffusion to the durability of composites. How work contributes -research contributes to improved failure resistant designs for aircraft and solid propulsion vehicles.

Principal investigator is approaching the fracture problem as a rational treatment of energy balance. The energy of the fracture surface should be treated as a loss in binding energy caused by the creation of new fracture surfaces. Consideration will be given to the propagation of the fracture surfaces and the effects of temperature. Moisture absorption will continue to be investigated as a diffusion process in a deforming solid. Both moisture and temperature considerations will be included in the study. The influence of free and bound states of moisture in the solid will be studied, as well as interfacial diffusion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0008, RESEARCH IN DIFFERENTIAL GAME THEORY

M. Mintz, University of Pennsylvania, Moore School of Electrical Engineering, *203 Logan Hall, Philadelphia, Pennsylvania* 19104 (DF048690; AFOSR-77-3327)

AF function - research in differential game theory for conventional Air Force weapons systems. Deficiency - mathematical models for determining evasion strategies for an aircraft threatened by a multiple missile attack has not been fully investigated. Objective - the objective of this research is to develop an improved mathematical model which (1) accounts for the uncertainties and modeling errors associated with the dynamics of multiple pursuing missiles, and (2) leads to the determination of a suitably robust algorithm for specifying the optimal evasion stategies. How work contributes - success here would allow system operational planners to devise methods to avoid a hostile air-to-air or surface-to-air attack on planned air missions.

The proposed research will be divided into three related areas. First, the development of an improved mathematical model which accounts for uncertainties in the assumed missile dynamics which are used in the determination of the optimal evasion strategies will be investigated. Second, the computation of saddle-point solutions for the current mathematical/computer model developed under previous research which assumes simplified dynamics and perfect information will be pursued. Finally, there will be simulation studies to determine the sensitivity of the optimal evasion strategies to uncertainties in the underlying parameters dynamic structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, ALGORITHM AND SOFTWARE DEVELOPMENT FOR MULTI-LEVEL SCHEMES FOR PARTIAL DIFFERENTIAL EQUATIONS

A.H. Sherman, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Computer Science, *200 W. 21st St., Austin, Texas* 78712 (NSG 1632)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, TIME-OF-FLIGHT MOLECULAR SPECTROSCOPY

W.E. Lamb, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DF039720; AFOSR-75-2864)

AF function - this research contributes to RO 6.3, electromagnetic weaponry. Opportunity - the search for new lasing media will be facilitated if potential energy diagrams of candidate molecules are known. Objective - to make velocity-resolved studies of the production of metastable atoms from dissociating molecules and their de-excitation by collisions with other atoms and molecules. Contribution - this research has the capability of establishing the potential energy diagrams of a number of diatomic molecules of interest to new lasers.

A time-of-flight spectrometer is being used to obtain high-resolution electron-bombardment dissociation spectra and collisional quenching cross-section data for molecules of importance as reservoirs of potential energy which can be transferred to other lasing species.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0002, ENERGY TRANSFER REACTIONS OF EXCITED ATOMS AND MOLECULES 14708-C

G. Black, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DA0F9016; DAAG29 77 C 0018)

To determine the kinetics for reactions involving oxygen molecules and atoms with various species prevalent in the upper atmosphere. Relevance - the kinetic data to be determined will

have application in on-going Army programs in combustion, laser, and possibly in optical surveillance systems and in atmospheric modeling.

A range of spectroscopic techniques including photon counting, resonance fluorescence and absorption, time-resolved radiative decay measurements, pulsed flash lamps, and laser excitation will be utilized in the investigation to be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0003, FUNDAMENTAL EXPERIMENTS AT LIQUID HELIUM TEMPERATURES

W.M. Fairbank, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (DF027070; F44620-75-C-0022)

AF function - the proposed research primarily falls in the 7.1 research objectives which deal with reconnaissance and surveillance. In particular the experiments involving the production and trapping of very low energy ground state electrons in a weak magnetic field lead to a photon counting millimeter wave detector. AF operations require the search and mapping of regions of interest in real- or near-real-time in order to detect, identify, locate, count or investigate weapons, personnel, vehicles, installations by microwave, electronic and other sensing methods. Deficiency - the far infrared portion of the electromagnetic spectrum is an underdeveloped area that potentially could contribute significantly to remote sensing. This probable interaction of such radiation with materials along with high atmospheric transmission in many bands and especially at the longer wavelengths gives rise to interest regarding potential reconnaissance or surveillance application. Objective - they propose to continue their investigation of the temperature-dependent anomalous shielding effect which we observe on the surface of a copper tube at liquid helium temperatures. During the present contract year they expect to conclude experiments which will determine the behavior of the shielding effect at temperatures below 4.2K (probably down to 2.5K or so) and which will yield improved measurements in the 4.2K-9 region. Contribution - this research is a part of a comprehensive program in low temperature physics.

During the next year the development of the electron/positron thermalizer as a photon counting detector will be continued. Optimization of the device for use in the surface shielding work will be directed toward operating the thermalizer with a positron beam. The problems of interfacing the thermalizer to the time-of-flight apparatus include minimizations of physical size, magnetic field matching and shielding of the high energy particles emitted by the radioactive source at the ejector stage of the thermalizer. Use of the thermalized electron source will allow significant improvements in counting statistics and because of the reduced time needed for data acquisition, will make it possible to perform many more experiments on the surface shielding effect.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, LOW TEMPERATURE PROPERTIES OF MATERIALS

N.E. Phillips, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720

The general objective is to obtain low-temperature heat-capacity data that contribute to an understanding of the relations between atomic properties and the macroscopic properties of materials. The materials investigated include normal and superconducting metals, superfluids, dielectric solids, and magnetic materials. Heat capacity measurements are confined to temperatures below 25K because usually only in that region can various contributions be reliably separated. Establishment of a temperature scale for the region from 0.06 to 25 K on germanium resistance thermometers is anticipated. For temperatures from 0.06 K to below 1 mK nuclear susceptibility and gamma-ray anisotropy thermometers will be used as primary thermometers. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0005, INTEGRATED-OPTICS CADMIUM/TELLURIDE ELECTRO-OPTIC MODULATOR FOR THE 10 UM REGION

R.Y. Chiao, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (NSG 1637)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0006, THE NEW PLASMAS AND THEIR APPLICATIONS TO PLANETARY MAGNETOSPHERES AND THE HELIOSPHERE

H. Alfven, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (NSG 7623)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0007, STUDIES RELATED TO DROPLET BURNING AT ZERO G

F.A. Williams, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (NSG 3296)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0008, MAGNETIC TEXTURES AND SURFACE EFFECTS IN LIQUID 3 HE AT ULTRA LOW TEMPERATURES

H.M. Bozler, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR7900830)

This research is a continuation and extension of work supported by NSF Grant No. DMR7702160. Pulsed nuclear magnetic resonance techniques will be used to investigate magnetic textures in the A phase of superfluid helium-3. Several experiments will be undertaken to observe the effects of restricted geometries on these textures in order to test various aspects of the theory of solutions. Magnetic textures generated by heat flow will be studied to test predictions of current theories regarding the nature of textures in superfluid helium-3. Thermal conduction across boundaries between liquid helium-3 and metallic surfaces will be studied at temperatures as low as 0.4MK; such data will probe the effects of magnetic coupling on the thermal conductance across boundaries. Enhanced surface magnetism of helium-3 in contact with various substrates will also be investigated. This research is important for our fundamental understanding of quantum liquids and solids.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, QUANTUM ELECTRODYNAMICS OF SIMPLE ATOMIC SYSTEMS

P.J. Mohr, Yale University, Graduate School, *206 Elm, New Haven, Connecticut* 06520 (PHY7820776)

A research program in theoretical atomic physics will be initiated. Among the topics to be investigated are: 1. Radiative corrections and vacuum polarization effects for Coulomb field; 2. Structure of high Z two-electron atoms.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0010, THERMOPHYSICS OF SATELLITES AND ASTEROIDS

D. Morrison, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *2444 Dole St., Honolulu, Hawaii* 96822 (NSG 7633)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0011, MOLECULAR RADIATION PHYSICS--THEORETICAL STUDY OF SECONDARY-ELECTRON SPECTRA

Y. Kim, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (ANL 67100; ERDA RK-02-04-02)

The method is entirely theoretical, but the majority of the input data will be experimental. The results of this study will serve as a vital input to energy-degradation studies in progress in the Fundamental Molecular Physics and Chemistry section, as well as in radiation chemistry (in Chemistry Division of ANL). Also, this study will identify those areas in which more experimental data are needed. Such information will be relayed to experimental groups in and out of ANL.

SUPPORTED BY U.S. Dept. of Energy

8.0012, THEORETICAL RESEARCH

D.L. Price, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (59001; EE-02-02-03)

Theoretical research is an integral part of the solid state science division program, complementing the experimental research. Some of the theoretical activities involve direct collaboration with experimental activities at Argonne; some are based on experimental work at other laboratories; and some are devoted to developing methods and concepts for future experimental programs.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0013, NUCLEAR RESONANCE IN SOLIDS

R.G. Barnes, U.S. Dept. of Energy, Ames Lab., *Ames, Iowa* 50010

Applications of nuclear magnetic resonance, nuclear quadrupole resonance, and Moessbauer effect to the following are being studied: determination of hydrogen-isotope locations and diffusion parameters in hydride and deuteride phases of refractory metals (e.g., V, Nb, Ta), alloys (e.g., Nb--Ti, Nb--V), and compounds (e.g., Ta6W, V2C); electronic and structural phase transitions in refractory metal hydrides; interactions between hydrogen isotopes and interstitial impurities such as O, N, and C in refractory metals (V, Nb, Ta); characterization of lattice perfection and structural transformations in superconducting intermetallic compounds (e.g., NbSe2, HfV2); charge density wave effects in superconducting intermetallic compounds (e.g., NbSe2, TaSe2); and electronic structure of one- and two-dimensional metals (e.g., ZrCl, Sc7Cl10). (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0014, EVALUATION OF MEASUREMENT OF MICROWAVE BACKSCATTER COEFFICIENT WITH ACTIVE MICROWAVE SYSTEMS

Unknown, University of Kansas, Lawrence Campus, Graduate School, *214 Strong Hall, Lawrence, Kansas* 66044 (NAS 5-25807)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0015, SELF-CONSISTENT NUMERICAL SIMULATION OF PLASMA-INSULATOR INTERACTIONS IN SPACE

T.P. Armstrong, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Physics & Astronomy, *112 Bailey Hall, Lawrence, Kansas* 66045 (NSG 3290)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0016, CONSTRUCTION OF A PROTOTYPE SUPERCONDUCTING GRAVITY GRADIOMETER

H.J. Paik, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NAS 8-33557)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

8.0017, APPLICATION OF MODERN METHODS OF STATISTICAL MECHANICS TO THE PERCOLATION PHENOMENON 15750-P

H.E. Stanley, Boston University, School of Arts & Sciences, Dept. of Physics, *881 Commonwealth Ave., Boston, Massachusetts* 02215 (DA0G8931; DAAG29-79-G-0002)

To develop percolation theory to a level of sophistication that allows its use in a number of Army applications. Relevance - the research is potentially relevant to ongoing work on composites, particularly in areas of graded metal-ceramic armour, airfoil noise reduction, reduction of blast damage and related phenomena. It may prove important to other phenomena such as crack propagation, chemical reactivity, resistance to wear, printed circuit wiring, and phenomena in solid state physics such as semiconductor-metal transitions.

Modern methods of statistical mechanics, such as the renormalization group method and fractural dimensionality, will be used. Equations of state near the percolation threshold will be derived. Six generalizations of the classical percolation problem will be constructed and solved involving correlation, anisotropy, further-than-nearest-neighbors interaction, chains, and site-bond combinations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0018, ANALYSIS OF METAL/SEMICONDUCTOR STRUCTURES BY AUGER AND ELECTRICAL TECHNIQUES

G.Y. Robinson, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Electrical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DMR7614997A01)

This research will be a study of metal/semiconductor contacts using the surface analysis technique of Auger electron spectroscopy combined with conventional electrical characterization techniques. The aim is to develop an understanding about the metallurgical and chemical nature of the metal/semiconductor interface. Research in two areas will be completed during the grant period: (1) studies of the electrical behavior of aluminum-palladium silicide contacts during heat treatment and (2) development of techniques for achieving ohmic contact in the palladium-germanium-gallium arsenide system. Compositional profiling will be done by Auger electron spectroscopy to examine the kinetics of reactions in each of the two systems. A limited number of specimens will also be examined by electron spectroscopy for chemical analysis.

This is a renewal of NSF Grant DMR 76-14997.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, OPTICAL HYPERFINE STRUCTURE AND ISOTOPIC SHIFT STUDIES

G.W. Greenlees, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (PHY7721737A02)

This grant will support research on fine details of atomic spectra using very high precision laser techniques. These measurements yield information on the electric and magnetic properties of the nuclei of the atoms studied.

These techniques are also highly sensitive allowing measurement on a single atom crossing the laser beam.

The method will be used to study highly unstable nuclei which are produced only in small quantities and decay quickly.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0020, THEORETICAL STUDIES OF SPIN CORRELATION FUNCTIONS

P.A. Fedders, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR7706719A01)

A theoretical program of four partially overlapping categories will be carried out: 1. The study of time-dependent spin correlation functions for systems of strongly interacting spins in the high temperature limit. These studies are based on first principles microscopic equations of motion and should elucidate our understanding of dynamical interactions in spin systems. 2. The development and application of a recently discovered formalism for treating the hopping of vacancies, impurities, and interstitial hydrogen in crystal lattices. This formalism is applicable to correlation functions measured in neutron scattering and magnetic resonance experiments in systems where the hopping rates between members of a pair of sites are asymmetric. 3. The further study of the effects of impurities and other crystal defects on measurable spin correlation functions. The proposed work in this category attacks the important problem of how one can quantitatively study crystal defects. 4. The study of basic spin-phonon interactions and their effects on spin lineshapes and on acoustic velocity and attenuation.

This is a continuation of research supported under DMR7518100.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, IMPROPER FERROELECTRICITY - A THEORETICAL AND EXPERIMENTAL STUDY 14221-P

J.R. Hardy, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (DA0E9251; DAAG29 77 G0008)

To elucidate the physical mechanism responsible for the ferroelectric transition in improper ferroelectrics. Relevance - the results of this research explore the mechanism for a new class of materials that have high potential in electro-optic application. GMO acts as an optical switch; its present applicability is limited because of its slow response time. The work is applicable to a broad range of electrooptical materials and as such supports the technological base of nonlinear optics and electro-optical materials.

The program combines a theoretical and experimental program. (1) Theory - the author will consider anharmonic interactions using self-consistent phonon theory to gadolinium molybdate (GMO) in addition to calculation of the lattice dynamics of complex structures like those of other improper ferroelectrics. Some candidate systems are the boracites, dicadmium sulfate and ammonium sulfate. (2) Experimental studies will consist of the measurement of the Raman and far-infrared spectra of these materials as well as a study of the effects of pressure (up to 50 kilobars) and temperature to elucidate mode-Gruneisen parameters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0022, THE PHYSICS OF SPIN-POLARIZED ATOMIC VAPORS

W. Happer, Columbia University, School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (DF038840; AFOSR-74-2685)

AF function - the AF has a requirement for long term, low drift space reference systems. Opportunity - development of optically-pumped frequency standards, magnetometers, and gyroscopes will benefit from study of magnetic resonance in dense vapors where spin exchange equilibrium prevails. Objective - investigation of the properties of high-density, optically-pumped alkali vapors and development of ways to make use of these vapors in miniature, inexpensive devices like magnetometers and gyroscopes. Contribution - cheaper and more rugged navigation, guidance, and control devices.

This research is directed toward development of ways to optically pump a very dense alkali vapor with a laser. Advantages are: the high light flux from the laser will allow much more sensitive and rapid measurements of magnetic resonance frequencies than is feasible with conventional optically-pumped systems or with conventional nuclear magnetic resonance or electron spin resonance techniques, since gallium arsenide injection lasers are very small and potentially very inexpensive; a laser pumped magnetic resonance device can be very small and cheap compared to conventional devices; and the active volume of a device operating in the high density regime can be very much smaller than usual.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0023, NEW SEMICONDUCTOR MATERIALS FOR MICROWAVE DEVICES 14354-EL

J. Frey, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DA0F9118; DAAG29-78-G-0009)

To identify ternary and quaternary III-V compound semiconductors which may be more suitable than GaAs for high-performance microwave devices, such as field-effect transistor (FET's) and transferred-electron devices (TED's). Relevance - microwave devices fabricated from III-V ternary and quaternary materials offer the possibility of extending the frequency-of-operation, increasing the available power and gain, and decreasing the noise over existing GaAs devices. Such devices would impact Army communications/navigation systems in tactical, satellite, and missile guidance applications.

The Monte Carlo method will be used to study the steady-state and transient high-field transport properties of III-V ternary and quaternary semiconductors. Material parameters will be obtained from an interpolation procedure which uses known material parameters for the binary compounds of which the ternary and quaternary materials are composed. This technique will generate fundamental transport parameters which will then be used in device models to predict figures-of-merit for FET's and TED's. The fundamental gain, power, frequency response, and noise-determining mechanisms will be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0024, THEORY OF ORBITAL EFFECTS IN RARE-EARTH COMPOUNDS

P.M. Levy, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (DMR7825008)

Research previously supported in part by DMR7682363.

Theoretical and experimental research will be carried out on a number of properties of a particularly interesting class of metallic compounds, viz. the rare-earth pnictides. The unusual properties of these compounds are due to the large orbital contribution to the magnetic moments of the rare earths, which complicates the interaction between the rare earth and conduction electrons. The effects on the magneto-transport properties of the spin-orbit coupling of the 5D electrons will be calculated. To obtain more realistic estimates of the anisotrophy of the magnetoresistivity of cubic rare-earth compounds due to scattering of the conduction electrons, a variational form of the resistivity will be used. To complement the theoretical work, an experimental study of the anisotropic electrical resistivity of the rare-earth pnictides is planned. These measurements will provide data on the background anisotropy coming from the band structure. To determine the hyperfine field at rare-earth nuclei in metallic compounds, the field coming from the orbital polarization of the conduction electrons by the electrons will be calculated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, FREE-ELECTRON LASER FROM WAVE MECHANICAL BEATS OF TWO ELECTRON BEAMS

H.J. Schwarz, Rensselaer Polytechnic Inst., School of Science, Dept. of Physics, *110 8th, Troy, New York* 12181 (NSG 1628)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0026, COMBUSTION THEORY FOR CLOUDS OF POROUS SOLIDS AT REDUCED GRAVITATIONAL CONDITIONS

A. Berlad, State University of New York, Stony Brook Campus, School of Engineering & Applied Science, Dept. of Mechanics, *Stony Brook, New York* 11794 (NSG 3298)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0027, NEUTRON SCATTERING STUDIES

L. Corliss, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973

The following subjects are being investigated: neutron scattering measurements to obtain structural and dynamic properties of solids; magnetic systems; spatial distribution of magnetization, its response to applied fields, and behavior of spontaneous magnetic fluctuations; complete characterization of the magnetic ordered and disordered states as well as the interesting critical region in the neighborhood of the ordering transition; arrangement of atoms and dynamics of motion of nonmagnetic solids. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0028, EXPERIMENTAL RESEARCH - SURFACE STUDIES

M. Strongin, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973

The following subjects are being investigated: use of AC pulsing techniques under ultrahigh vacuum conditions to study chemical reactions such as the oxidation of CO on the surfaces of single-crystal and polycrystalline Group VIII metals (Pt, Pd, Rh, Ru, etc.) and transition metal oxides; understanding and development of secondary ion mass spectroscopy for chemisorption studies; correlation with chemisorption bonds and surface phases; and interaction of low-energy ions with surfaces. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0029, LIQUID HELIUM AT LOW TEMPERATURES

D.O. Edwards, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DMR7901073)

This research is a continuation and extension of work supported under NSF Grant No. DMR-7519546. Experiments to study the free surface of liquid helium will be carried out at temperatures down to 0.02K using a dilution refrigerator. The measurements will include the conduction of heat along the surface by quantized capillary waves, the scattering of free helium atoms, and the heat capacity of helium-3 atoms adsorbed on the surface of superfluid helium-4. The superfluid properties of helium-3 at ultra-low temperatures (down to 0.0004K) will be studied using a nuclear demagnetization cryostat. The experiments will include measurements of the heat capacity of the A and B superfluid phases and of the normal liquid in zero magnetic field, of the superfluid phase diagram and the nuclear magnetization in fields up to 6 kilogauss. The same apparatus will also be used to study nuclear spin ordering in solids helium-3.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, FLUX PINNING AND FLUX FLOW STUDIES IN SUPERCONDUCTORS USING FLUX FLOW NOISE TECHNIQUES

W.C. Joiner, University of Cincinnati, McMicken College of Arts & Sciences, Dept. of Physics, *Van Wormer Adm. Bldg., Room 204, Cincinnati, Ohio* 45221

The objective of this work is to study flux pinning and the dynamics of flux flow in type-II superconductors. Superconducting alloy samples will be prepared containing various metallurgical defects and exhibiting different critical current characteristics resulting from the defect structure, and the flux flow noise power spectrum will be studied. This gives information on flux bundle size, transit time, pinning forces, and other flux flow parameters. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0031, THEORETICAL STUDIES OF NUCLEAR STRUCTURE AND NUCLEAR REACTIONS

N. Austern, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY7681104A02)

Theoretical research on nuclear structure and reactions and related studies of medium-energy meson-nucleus processes and of multiple scattering theory initiated under NSF grant PHY75-01397 A01 will be continued.

The nuclear structure work emphasizes a large-scale study of properties of the shell-model effective interaction, derived by the systematic selection of a limited part of Hilbert space. Careful study is given to the singularities of this effective interaction. Techniques for overcoming these singularities and for other improvements to the effective interaction are being developed.

A vigorous program in 'medium-energy nuclear physics' will be continued. Computer codes developed for meson-nucleus collision studies have been improved and generalized so they can be used more conveniently at Pittsburgh and made available to others. Applications to kaon scattering are under way, as are studies of mesic atoms and of pion photoproduction and capture. Much of this work is in collaboration with experimental groups at Carnegie-Mellon University and at LAMPF. Other medium-energy work concerns fundamentals of multiple scattering theory, with particular attention to corrections to closure and to the impulse approximation.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0032, THEORETICAL ATOMIC PHYSICS

R.L. Becker, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (AK-01-03-01-3; W7405-eng-26)

Initiated as a separate project in FY-78 this activity aims to perform calculations and develop theories for important atomic processes, primarily those under experimental investigation at ORNL, with emphasis on cross-sections and spectroscopy useful to the magnetic fusion energy and heavy-ion accelerator programs. At present effort is concentrated on calculating charge exchange and ionization produced by energetic highly stripped ions colliding with atomic hydrogen, which are being measured at ORNL and are important as energy-loss mechanisms resulting from impurities in plasmas. Also the capability to compute spectra of multi-charged ions is being developed for use in the diagnostics and modeling of plasmas. Consulting and collaboration with experimentalists is an important activity expected to increase as theoretical tools are developed. Participation by university theorists will be encouraged strongly. (ORNL/CF-78/111)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0033, INVESTIGATIONS IN X-RADIATION STIMULATION

K. DasGupta, Texas Tech University, School of Arts & Sciences, Dept. of Physics, *P.O. Box 4340, Lubbock, Texas* 79409 (DF035070; AFOSR-76-3098)

AF function - non-destructive testing of structural members of aerospace vehicles could benefit greatly from the development of an X-ray laser for use in three-dimensional holography. Deficiency - attempts to develop an X-ray laser by standard population inversion techniques have been unsuccessful primarily because of short life-times of excited states. Objective - the objective of this research is to investigate the nature of nearly non-divergent beams of X-rays (hot spots) which apparently are generated by hitherto undiscovered processes and to use this

radiation to make three-dimensional holograms of opaque materials. How work contributes - an understanding of the nature of these hot spots could lead to or contribute to the development of X-ray lasers and three-dimensional holography could lead to important non-destructive testing techniques for structural materials.

The nearly non-divergent beams of X-rays will be studied to determine their penetration properties in various materials, role of stimulated emission, and the degree of coherence and polarization. Three-dimensional holograms will be made in collaboration with Prof. N. George of the University of Rochester.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0034, INVESTIGATION OF THE INITIATION OF SOLID STATE STRUCTURAL PHASE TRANSFORMATIONS AT CRYSTAL SURFACES BY LOW-ENERGY ELECTRON DIFFRACTION

A. Ignatiev, University of Houston, School of Arts & Sciences, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DA0K5574; DAAG29 77 G0162)

To investigate the initiation at surfaces of structural phase transformations of the non-diffusional Martensitic type in solids. Relevance - the proposed research is highly relevant to the technologically important Martensitic phase transformation and its control is responsible for strengthening the steels used by the Army, for control of fragmentation, fatigue, stress corrosion cracking, etc. The study is directly relevant to programs at AMMRC involving phase transformations in metals.

The program will include (1) determination of virbrational properties and crystallographic spacing of surface atoms during Martensitic phase transformations using low energy electron diffraction, and (2) interpretation of vibration of surface atoms in terms of the theory that high amplitude (soft mode) vibration lowers the barrier to nucleation of non-diffusional Martensitic transformations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0035, EXPERIMENTAL STUDY OF THE INITIAL PHASES OF A TOKAMAK DISCHARGE

R.D. Bengtson, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712

This experimental study will be conducted in a research Tokamak with design parameters R equals 53 cm, a equals 16 cm, B equals 10 to 20 KG, I/sub p/ equals 80 to 160 KA, T/sub e/ equals 400 eV, usable pulse length 50 msi. Emphasis will be placed on impurity transport and atomic physics studies of discharge initiation by a variety of techniques. Diagnostics to be installed on the device include 2 and 4 mm microwave Thompson scattering, and a wide variety of spectrometers.

SUPPORTED BY U.S. Dept. of Energy

8.0036, COMPTON SCATTERINGS OF METAL HYDRIDES WITH 412 KEFY - RADIATION

M.J. Cooper, University of Warwick, Dept. of Physics, *Coventry, England, United Kingdom* (DA0D9371; DAERO 78 G0019)

An Au 198 gamma ray source is constructed at Rutherford Laboratory. Dr. J. L. Dubard of the U.S.A. is experienced with similar sources and is to spend a sabbatical year in the U.K. assisting in this Au 198 source. The research itself will center around the sensitivity of the Compton profile to the behavior of hydrogen in metals. The electron momentum density of metals, and particularly metal hydrides, will be measured.

It is anticipated that by using the Au 198 source, two orders of magnitude improvement will be achieved.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, FOREIGN LABOR AND CAPITAL COSTS FOR THE MANUFACTURE OF BALANCE OF SYSTEM COMPONENTS

J.E. Jacobson, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NSG 3297)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, LABORATORY INVESTIGATION OF THE ORIGIN OF DIFFUSE INTERSTELLAR BANDS

T.J. Wdowiak, Miles College, Undergraduate School, *5500 Ave. G, Birmingham, Alabama* 35208 (RIM78-17825)

The research that will be done is to elucidate the origin of the diffuse interstellar bands by subjecting fused ring organic compounds to temperatures in the range of 10 degrees to 100 degrees K and to ultraviolet radiation. The samples will be examined by absorption spectroscopy. Molecular structures to be investigated will include graphite precursor molecules and conjugated linear molecules thought to be good candidates for the constituents of interstellar dust. A free radical, free electron model fits many of the characteristics of diffuse interstellar bands and will be used as the rationale for the experiments.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, STUDIES OF WHITE DWARF STARS

J.W. Liebert, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (AST7821071)

This project will be devoted to an investigation of the origin and properties of white dwarf stars and pre-white dwarf star evolution. White dwarf stars represent one of the end points of stellar evolution. They are stars of about one solar mass, with radii of about 5,000 kilometers and densities of one ton per cubic centimeter. The research to be carried out on these stars will include detailed analyses based on optical spectrophotometry of hot white dwarf stars. There will be a theoretical investigation of the manner in which stars become white dwarfs.

It is now generally believed that nova take place in binary systems which contain a white dwarf star. The nova occurs when mass is transferred from the companion star onto the white dwarf star. There will be theoretical and observational studies of white dwarf stars in binary stars, with particular attention directed towards the properties of the classical novae, the formation of dust in nova shells, and nova-like variables.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, THERMAL BEHAVIOR OF MARTIAN SATELLITES PHOBOS AND DEIMOS

C.H. Townes, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (NSG 7635)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0004, GAS IN GALAXIES - ASTROPHYSICAL GAS DYNAMICS

W.G. Mathews, University of California, Santa Cruz Campus, Lick Observatory, *Mount Hamilton, California* 95140 (AST7818220)

Locally, in our own galaxy stars represent the most apparent form of condensed matter. Many of these stars are as old as the galaxy itself. New stars are continuously being formed from rarefield clouds of interstellar matter. Old stars are observed to throw off a significant part of their outer envelopes back into the pool of interstellar gas, enriched with elements produced by nuclear processes within these stars. Studies of the gaseous component of our galaxy have been scientifically fruitful as the gas responds to additional and more subtle forces than of gravity alone, which is the major force acting on the stellar component. Observational and theoretical studies of tenuous gas near stars has revealed the presence of stellar winds similar to the wind from the sun.

In the central nucleus of quasi-stellar (QSOs) and certain remarkable galaxies, the Seyfert galaxies, an enormous energy powerhouse exists which strongly influences the motion of nearby gas.

At present we know very little about exactly how this energy is released, but giant black holes may be responsible for the energy released. Black holes are not directly observed, but violent motions in nearby gas are easily observed. A careful theoretical study of this gaseous component may reveal more about how energy is released at rates unparalleled elsewhere in the known universe.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, DEDUCTION OF IMPULSE SIGNAL FROM THE RESPONSE FUNCTION IN THE IONOSPHERE

W.A. Barker, University of Santa Clara, School of Science, Dept. of Physics, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685909)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0006, EFFECTS OF TURBULENCE ON IMAGE QUALITY IN AIRBORNE TELESCOPES

G.A. Fraser, University of Santa Clara, School of Science, Dept. of Mathematics, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685908)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0007, ACCURACY OF GRAVITATIONAL PHYSICS TESTS USING RANGES TO THE INNER PLANETS

N. Ashby, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (NSG 7637)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0008, RADIATION TRANSPORT IN SPACE

M.J. Berger, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (2401430)

PROJECT OBJECTIVE: To solve radiation metrology problems arising in space science and technology. To determine response functions of gamma ray and charged particle detectors, and to use them for converting observed pulse height distributions to energy spectra. Application of these techniques to the analysis of data obtained in space experiments.

PROJECT APPROACH: Research involves modeling of detection systems, calculation of energy deposition in detectors by random sampling, to obtain detector response functions. Important additional phase of work involves reconstruction of energy spectra from gamma and charged particle radiation, taking into account response function as well as removal of distortion and background.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

10.0009, OBSERVATIONS OF ULTRAVIOLET LINE SPECTRA STARS

R.A. Bell, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NSG 5399)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0010, STELLAR PHYSICS - SOLAR OBSERVATIONS

R.W. Noyes, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138

This project is an ongoing one, which includes both satellite and ground-based observations. Satellite observations were obtained in 1967 and 1969 from the Orbiting Solar Observatories OSO 4 and OSO 6, by means of extreme ultraviolet spectrometers built by the Harvard College Observatory Solar Satellite Project. The data have opened up a new spectral region to detailed physical analysis and will continue for several years to provide fundamental information on the physics of the solar corona.

In a related program of ground-based observations, the structure of the solar atmosphere near its temperature minimum is being explored, by use of high-resolution infrared (5 micron) spectra of the sun obtained at Kitt Peak National Observatory. These data are being analyzed using an SAO stellar atmospheres program and should provide definitive information on the solar temperature minimum. At the same time, the structure of sunspots is being studied with the same observing equipment.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0011, ASTRONOMY RESEARCH AT THE FIVE COLLEGE RADIO ASTRONOMY OBSERVATORY

G.R. Huguenin, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Amherst, Massachusetts* 01002 (AST7624610A03)

The Five College Radio Astronomy Observatory will pursue three major projects: 1. The very successful program of pulsar observation will be continued. The behavior of pulsars and their motion through space will be determined in an attempt to characterize the emission mechanism, the rate of formation and other attributes of these unusual, highly condensed objects. The meter wave array used for these observations will be enlarged in order to improve the sensitivity and increase the number of observable objects. 2. The 45-foot, radome enclosed, millimeter telescope will be used for studies of the interstellar medium, extragalactic radio sources, and solar system objects.

Development will continue on the application of very low noise maser amplifiers for radio astronomy at millimeter wavelengths. As such receivers become available, they will be put into use on the telescope where it is expected they will provide a ten to fifty-fold increase in sensitivity.

This is a continuation of work previously supported under NSF Grant AST 76-24610.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0012, OBSERVATIONS OF EMISSION LINES IN THE CRAB NEBULA

K. Davidson, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Astronomy, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (NSG 5397)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0013, RESEARCH STUDY - ANALYSIS OF SPACE TELESCOPE COLLECTION SYSTEMS

F.M. Ingels, Mississippi State University, School of Engineering, Dept. of Electrical Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (NAS 8-33570)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

10.0014, RESEARCH OF MASS LOSS IN THE ULTRAVIOLET SPECTRUM
S.A. Lamb, University of Missouri, St. Louis Campus, Graduate School, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (NSG 5400)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0015, GALACTIC AND EXTRAGALACTIC RESEARCH WITH THE IMPROVED BURRELL SCHMIDT-TYPE TELESCOPE
P. Pesch, Case Western Reserve University, Graduate School, Dept. of Astronomy, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (AST7723063A01)

A variety of astronomy research projects will be undertaken by the staff of the Warner and Swasey Observatory. The projects will include studies of faint nearby stars, luminous stars in the Milky Way Galaxy, and Quasars. The common theme of the projects is the unique capability of a Schmidt telescope equipped with objective-prisms to do faint spectroscopy and surveys of astronomical objects.

One of the new projects is a low-dispersion (1000 A/mm at 6500A) survey of the northern sky in the red region of the spectrum. This survey, to update one last done in the early 1940's at very low resolution, will identify nearby M-type dwarfs, sulfur and carbon-sulfur stars, and objects that emit the hydrogen-alpha lines of the spectrum.

Another new project is a color-independent survey in the northern sky for bright, high-redshift, radio-quiet, quasi-stellar objects (QSO's). Malcolm Smith at Cerro Tololo Inter-American Observatory has shown that a low-dispersion objective-prism can be used to discover high-redshift QSO's independent of color and/or radio characteristics. A survey of this nature is being done by others in the southern hemisphere; a similar survey in the northern sky will be initiated. This is the only known method of obtaining an accurate and unbiased sample of these cosmologically important objects. The continuing projects will include an effort aimed at identification of objects listed in the Air Force Infrared Sky Survey Catalogue. The photoelectric photometry of faint M stars in the direction of both the north and the south galactic poles will be obtained for purposes of determining correctly the space of dwarf M stars. Objective-prism spectral classification of parallax stars, studies of the Magellanic Clouds, and an investigation of radial velocities of stars obtained from Schmidt telescope objective-prism plates will be carried out. This is a continuation of research done under NSF grant AST 77-23063.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0016, SPECTRUM OF THE CONTINUOUS GRAVITATIONAL RADIATION BACKGROUND
R.L. Zimmerman, Oregon State Higher Education System, University of Oregon, Inst. of Theoretical Science, *Johnson Hall, Eugene, Oregon* 97403 (NSG 7639)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0017, SPECTRAL ANALYSIS OF GALACTIC AND EXTRAGALACTIC SUPERNOVA REMNANTS
R.J. Dufour, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (NAS 9-15940)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Johnson Space Center

10.0018, INTERPRETATION OF SURVEY WORK OF SUPERNOVA SHOCKS, BUBBLES AND STUDYING VARIABILITY OF ACTIVE GALAXIES
M. Kafatos, George Mason University, School of Arts & Sciences, Dept. of Astronomy, *400 University Dr., Fairfax, Virginia* 22030 (NSG 5403)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0019, ULTRAVIOLET OBSERVATIONS OF SELECTED CATACLYSMIC VARIABLES
P. Szkody, University of Washington, Graduate School, *Seattle, Washington* 98105 (NSG 5395)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0020, OBSERVATIONS OF CLASSICAL STELLAR CHROMOSPHERES
E. Bohm Vitense, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (NSG 5398)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

GENERAL

11.0001, TO CONDUCT RESEARCH ON THE EFFECTIVENESS OF GOVERNMENT SPONSORED CIVILIAN RESEARCH AND DEVELOPMENT
H.I. Fusfeld, New York University, Graduate School, *100 Washington Sq. E., New York, New York* 10003 (NSG 7636)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

11.0002, LECTURE SERIES - 'OUR FUTURE IN THE COSMOS'
C.H. Barnes, College of William & Mary, Williamsburg College, Graduate School, *Ewell Hall, Williamsburg, Virginia* 23185 (NAS 1-15899)

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01 AERONAUTICS (GENERAL)

N80-11002 Allerton Press, Inc., New York, N. Y.
SOVIET AERONAUTICS, VOLUME 21, NO. 2
A. V. Talantov, ed., A. I. Bogomolov, ed., B. S. Vinogradov, ed., and A. F. Gurov, ed. 1978 130 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 5-146
Copyright. Avail: Allerton Press Inc., 150 Fifth Ave., N. Y. 10011; $45.00

The aerodynamics of aircraft structures and engine design are considered. Emphasis is placed on the application of numerical analysis techniques and mathematics to such problems. For individual titles, see N80-11003 through N80-11027.

N80-11003 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF SHELL STABILITY UNDER HEATING AND LOADING c39
V. K. Belov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 1-3 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 5-8 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press Inc., 150 Fifth Ave., N.Y. 10011; $45.00

The stability of cylindrical shells partially filled with liquid when heated and subjected to combined loading by axial compression and internal pressure is studied. The experimental results are compared with the theoretical data. J.M.S.

N80-11004 Allerton Press, Inc., New York, N. Y.
ON SOLUTION OF THE PLANE PROBLEM OF REINFORCED PANELS OF VARIABLE STIFFNESS c39
M. B. Vakhitov, V. N. Paimushin, and N. M. Yakupov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 4-9 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21 no. 2, 1978 p 9-16 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press Inc., 150 Fifth Ave., N.Y. 10011; $45.00

An approximate approach is proposed for the solution of the problem of the plane stress state of structurally anisotropic panels of variable stiffness and complex planform. Assuming linear variation of the displacement vectors between the computational lines, specified in equation form, the governing system of ordinary difference-differential equations is obtained. The numerical solution of these equations for a panel with three free edges and one clamped edge is examined. Results are presented of calculations for particular cases and they are compared with the solutions available in the literature. J.M.S.

N80-11005 Allerton Press, Inc., New York, N. Y.
SURFACE-EFFECT COMPONENTS OF AERODYNAMIC CHARACTERISTICS OF AIR-CUSHION VEHICLE WITH RAM PRESSURIZATION c02
M. A. Guryanov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 10-19 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 17-29 (For primary document see N80-11002 02-01)
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Results are presented of theoretical studies of the purely surface-effect components of the aerodynamic characteristics of an air-cushion vehicle consisting of a semitunnel of pi-shaped cross section traveling above a ground plane with translational velocity. A solution establishing the connection between these characteristics and the basic parameters defining the geometric form of the semitunnel and its position relative to the ground plane is obtained. It is shown that the studied vehicle has high aerodynamic efficiency and natural stability with respect to running height and pitch angle, particularly in the region of low semitunnel aspect ratios. Use of the proposed analysis method together with the known methods for determining the aerodynamic characteristics of flight vehicles in out-of-ground-effect flight makes it possible to calculate and optimize in the first approximation the aerodynamic characteristics of surface-effect vehicles and air-cushion aerotrains with ram pressurization. J.M.S.

N80-11006 Allerton Press, Inc., New York, N. Y.
STATISTICAL DIAGNOSTICS AIRCRAFT ENGINES c07
Yu. V. Kozhevnikov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 20-25 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 30-35 (For primary document see N80-11002 02-01)
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The linear formulation of the statistical problem for engine parametric diagnostics is examined in a discrete system of steady-state aircraft engine operating regimes. F.O.S.

N80-11007 Allerton Press, Inc., New York, N. Y.
OPTIMAL THERMOGASDYNAMIC DESIGN OF GAS TURBINE ENGINES USING ELEMENT PROTOTYPES, 1 c07
Yu. V. Kozhevnikov, V. O. Borovik, V. S. Ivanov, V. A. Talyzin, I. N. Agliullin, and Yu. V. Meluzov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 26-32 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 36-43 (For primary document see N80-11002 02-01)
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The problem of optimal thermogasdynamic design of gas turbine engines (GTE) is examined on the basis of a systematic mathematical model of a two-spool bypass GTE, containing the characteristics of the engine element prototypes in similarity parameters. The multiregime nature of GTE application is considered in the statistical formulation. Some GTE design parameter optimization criteria are presented. J.M.S.

N80-11008 Allerton Press, Inc., New York, N. Y.
AERODYNAMIC HEATING OF BLUNT WEDGES c02
N. M. Krutova, T. I. Murashina, and G. B. Petrazhitskii *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 33-36 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR),

v. 21, no. 2, 1978 p 44-48 (For primary document see N80-11002 02-01)
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A numerical method was used to solve the two dimensional problem of unsteady heat conduction. The temperature distribution over the surface of a blunt wedge was determined for various physical properties of the body material. R.E.S.

N80-11009 Allerton Press, Inc., New York, N. Y.
SELECTION OF GEOMETRIC PARAMETERS AND LOCATION OF NOSE FLAP ON SWEPT WING ROOT PROFILE FROM TUNNEL TEST DATA, 1 **c02**
A. I. Matyazh, V. A. Sterlin, V. A. Popov, V. V. Isaev, and G. A. Cheremukhin *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 37-41 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 49-54 (For primary document see N80-11002 02-01)
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The influence of nose flap geometric parameters (curvature and location on profile nose) on the basic aerodynamic coefficients of a mechanized wing segment whose profile corresponds to the typical profile used on swept wings of civil aircraft were examined. Recommendations are made on selection of the curvature and location of a nose flap used in conjunction with a two element slotted trailing-edge flap. R.E.S.

N80-11010 Allerton Press, Inc., New York, N. Y.
ANALYTIC FORMULAS FOR WING PROFILE AERODYNAMIC CHARACTERISTICS IN INCOMPRESSIBLE FLOW **c02**
N. M. Monakhov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 42-47 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 55-61 (For primary document see N80-11002 02-01)
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The conformal mapping method was used to construct in the third approximation the equations for determining the abscissa of the conformal center of gravity of a profile, the mapping circle radius, and the points of the circle corresponding to the profile leading and trailing edges. Analytic formulas for the lift and moment coefficients, aerodynamic center and center of pressure coordinates, and profile surface velocity were obtained with accuracy to quantities of fourth order of smallness. An example (cambered lune) calculation shows that the proposed formulas have very high accuracy. R.E.S.

N80-11011 Allerton Press, Inc., New York, N. Y.
ON A SMOOTH APPROXIMATION METHOD AND ITS APPLICATION TO MATHEMATICAL DESCRIPTION OF WING AERODYNAMIC CHARACTERISTICS **c02**
V. A. Ovchinnikov, V. D. Osorgin, V. G. Pavlov, and E. Ya. Fedorov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 48-51 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 62-65 (For primary document see N80-11002 02-01)
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A method for smooth epsilon approximation of a function of many variables with discontinuities of the first order derivatives at the points of some hypersurface is presented. The method makes it possible to represent any function, specified in the region of smoothness by suitable relations, in the form of a differentiable envelope lying in the epsilon vicinity of the original function. An example is given of specification of the aerodynamic characteristics of a wing with two element trailing-edge flap by the envelope. It is shown that the definition of the function epsilon introduced herein makes it possible with existing limits on its magnitude to obtain an approximation accuracy which is adequate for practical calculations. R.E.S.

N80-11012 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF WING DEFORMATION ON TRAILING-EDGE FLAP DEFLECTIONS **c02**
V. A. Pavlov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 52-53 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 66-67 (For primary document see N80-11002 02-01)
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The interaction of a three hinge trailing-edge flap with a wing is described. The influence of wing bending deformations on displacements of the flap carriages along the rails is also described. An analogy between trailing-edge flap analysis and multihinge control surface analysis is presented. Analysis procedures for various flap extension and retraction mechanism locations are examined. R.E.S.

N80-11013 Allerton Press, Inc., New York, N. Y.
SOLUTION OF THE INVERSE AERODYNAMICS PROBLEM BY THE RANDOM SEARCH METHOD **c02**
G. D. Peshatov and Yu. N. Novoselov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 54-58 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 68-73 (For primary document see N80-11002 02-01)
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A technique for computer design of a wing profile contour for a given pressure distribution is examined. A mathematical method for constructing the singly connected closed contour with limitations specified on its form is presented. The method can be used for computer design of subsonic and supersonic profiles in the automatic regime. A brief description of the optimization algorithm used and its block diagram are given. Results are presented of a test computer design of the aerodynamic profile for a given experimental pressure distribution. R.E.S.

N80-11014 Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF COMPLEX SYSTEMS, 1 **c66**
T. K. Sirazetdinov and A. I. Bogomolov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 67-73 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 83-91 (For primary document see N80-11002 02-01)
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The fundamental questions of the control and design of multicriterial and multiregime systems (complex systems) are discussed. It was concluded that for such systems the approach to control and design from the viewpoint of the basic control problem is the best engineering practice. M.M.M.

N80-11015 Allerton Press, Inc., New York, N. Y.
ON THE LIMIT STATE OF A TOROIDAL SHELL OF REVOLUTION UNDER AXISYMMETRIC DEFORMATION **c39**
I. G. Teregulov and E. S. Sibgatullin *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 74-77 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 92-96 (For primary document see N80-11002 02-01)
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The lower failure load bound for a shell supported clamped along one of the parallels was determined. The shell is partially filled with liquid and subjected to the action of uniform internal pressure. The solution is constructed by the static method and the simplex linear programming method is used. M.M.M.

N80-11016 Allerton Press, Inc., New York, N. Y.
OPTIMAL OBJECT CONTROL WITH WORST RANDOM PARAMETER DISTRIBUTION **c63**
V. I. Timofeev and S. M. Chernyavskii *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 78-83 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 97-103 (For primary document see N80-11002 02-01)
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The optimal control is presented for the problem of minimizing the mathematical expectation of the norm of the final state of the linear controllable system under conditions of incomplete information on the statistical characteristics of the random quantities appearing in the system. It was concluded that the statistic characteristics are not specified exactly, only the set of

their allowable values is known. The optimal control is found for the worst distribution of the characteristics of the random quantities. The results obtained makes it possible to reduce the original problem to the classical maximum problem. M.M.M.

N80-11017 Allerton Press, Inc., New York, N. Y.
LOAD-CARRYING ABILITY OF CYLINDRICAL SHELL LOADED BY CONCENTRATED FORCE ACTING ALONG THE GENERATOR c39
A. M. Khomyakov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 84-87 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 104-107 (For primary document see N80-11002 02-01)
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The critical concentrated force was evaluated on the basis of analysis of a variant of the plane stress state of the shell material near the given loading area. Two variants of a certain combination of slip lines were examined around the area and the corresponding computational formulas were derived for the limit force. An approximate grapho-analytic technique is presented for determining the limit force, valid in a broad range of values of the stress state components in the shell. The proposed technique can be used to evaluate the load-carrying ability of correspondingly loaded shell-type structures. M.M.M.

N80-11018 Allerton Press, Inc., New York, N. Y.
NUMERICAL INTEGRATION OF EQUATIONS OF THEORY OF THIN-WALL BEAMS WITH DEFORMABLE CONTOUR c39
V. Shataev *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 88-92 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 108-114 (For primary document see N80-11002 02-01)
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The stress-strain state of cylindrical stiffened beams with deformable cross-section contour are presented. The skin works only in shear, the stiffening ribs work in tension-compression. The normal diaphragms are smeared over the length of the structure. The structure is broken down into bays in order to account for the heavy diaphragms. Matrix equations are obtained for numerical solution of the problem by the finite sum method. M.M.M.

N80-11019 Allerton Press, Inc., New York, N. Y.
HARMONIC OSCILLATIONS OF ANNULAR WING IN STEADY IDEAL FLUID FLOW c02
Z. N. Shesternina *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 93-98 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 115-121 (For primary document see N80-11002 02-01)
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A method is presented to solve the problem of the annular wing with thick profile, performing small harmonic oscillations in ideal incompressible fluid flow. Two cases are examined: axisymmetric flow with oscillations along the axis of symmetry; and flow with periodically varying small angle of attack. M.M.M.

N80-11020 Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF REGULATORS FOR VARIABLE-PARAMETER SYSTEMS c66
A. A. Baloev *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 99-102 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 122-126 (For primary document see N80-11002 02-01)
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Formulas are obtained which make it possible to calculate the coefficients of the sought control law for known particular solutions of the variational problem equations to reduce computer time. M.M.M.

N80-11021 Allerton Press, Inc., New York, N. Y.
ON THE DAMPING EFFECT IN SURFACE PLASTIC DEFORMATION c31
P. G. Balyura *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 103-106 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 126-129 (For primary document see N80-11002 02-01)
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Vibration theory is used to examine two techniques for metal working by surface plastic deformation which are schematized by two mechanical models. It is shown that in the second metal working technique the indentor vibrations can be minimized by reducing its period and amplitude. Oscillographic studies and the obtained quantitative data confirm the advisability of using the second technique for metal working under production conditions. K.L.

N80-11022 Allerton Press, Inc., New York, N. Y.
OVERALL AERODYNAMIC CHARACTERISTICS OF CARET AND DELTA WINGS AT SUPERSONIC SPEEDS c02
Yu P. Gunko and I. I. Mazhul *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 107-110 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 129-132 (For primary document see N80-11002 02-01)
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The influence of caret angle, design Mach number, and free stream Mach number on the aerodynamic characteristics of caret wings are studied experimentally and theoretically. Caret wings and their equivalent delta wings are compared in the class with constant volume coefficient and aspect ratio. The results obtained relate basically to the flow regimes around caret wings with free stream Mach number less than design Mach number. K.L.

N80-11023 Allerton Press, Inc., New York, N. Y.
DETERMINATION OF LOADS AND STRESS IN COMPOSITE MATERIAL LAYERS FOR A PLATE IN THE PLANE STRESS STATE c39
A. A. Dudchenko and A. N. Elpatevskii *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 111-113 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 132-135 (For primary document see N80-11002 02-01)
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A method is described for determining the loads and stresses in the layers of an anisotropic plate using the least work principle. The secondary energy is written in terms of forces whose direction coincides with the fiber placement direction. It is shown that addition to the packet of each new layer of a definite direction above the three existing layers increases the degree of static indeterminacy of the plane problem by one. K.L.

N80-11024 Allerton Press, Inc., New York, N. Y.
SELECTING THE PASSENGER AIRPLANE FUSELAGE c05
Yu. N. Egorov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 114-116 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 135-138 (For primary document see N80-11002 02-01)
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The problem of selecting fuselage parameters is examined. A simple approach allows early selection of fundamental regions of goodness for a particular fuselage as a function of its passenger capacity. K.L.

N80-11025 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF CONTOUR DEFORMATION IN PREBUCKLING STATE ON BENDING STABILITY OF OPEN CYLINDRICAL SHELLS c39
S. N. Kan, Yu. I. Kaplan, and N. V. Panova *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 117-119 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 138-141 (For primary document see N80-11002 02-01)
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The influence of contour deformation on bending moments was studied by successive approximation to determine the critical moment for bending. It was found that bending occurs before

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the limit point. This must be considered in analyzing the loading of cylindrical shells. K.L.

N80-11026 Allerton Press, Inc., New York, N. Y.
MIXED INVERSE PROBLEM FOR PROFILE WITH GIVEN VELOCITY DISTRIBUTION ON ONE SIDE AND KNOWN THICKNESS LAW c02
S. D. Kostornoi and A. A. Litvinenko *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 120-122 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 142-144 (For primary document see N80-11002 02-01)
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The formulation and solution of the mixed inverse problem is examined for a profile contour in a plan-parallel ideal incompressible fluid stream when the profile thickness distribution and the flow velocity distribution on one side of the profile are given. Application of the vortex layer method reduces the problem to a system of two integrodifferential equations for one side of the profile. A successive approximation method is proposed for solution of the resulting system of integrodifferential equations. Results of numerical calculations are presented. K.L.

N80-11027 Allerton Press, Inc., New York, N. Y.
ON FREE PERIODIC PARACHUTE SYSTEM OSCILLATIONS IN THE AXIAL PLANE c02
V. M. Churkin and N. A. Kosarchuk *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 144-146 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 144-146 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

The harmonic linearization method is used to analyze the free periodic oscillations of a parachute system as it travels in the axial plane with zero glide angle. It is shown that such oscillations are always stable and their amplitude and frequency are determined. Author

N80-11028*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF A WIND-TUNNEL GUST RESPONSE TECHNIQUE INCLUDING CORRELATIONS WITH ANALYTICAL AND FLIGHT TEST RESULTS
L. Tracy Redd, Perry W. Hanson, and Eleanor C. Wynne Nov. 1979 55 p refs
(NASA-TP-1501; L-1313) Avail: NTIS HC A04/MF A01 CSCL 01A

A wind tunnel technique for obtaining gust frequency response functions for use in predicting the response of flexible aircraft to atmospheric turbulence is evaluated. The tunnel test results for a dynamically scaled cable supported aeroelastic model are compared with analytical and flight data. The wind tunnel technique, which employs oscillating vanes in the tunnel throat section to generate a sinusoidally varying flow field around the model, was evaluated by use of a 1/30 scale model of the B-52E airplane. Correlation between the wind tunnel results, flight test results, and analytical predictions for response in the short period and wing first elastic modes of motion are presented. A.W.H.

N80-11029*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERSONIC CRUISE RESEARCH (SCR) PROGRAM PUBLICATIONS FOR FISCAL YEAR 1977 THROUGH FISCAL YEAR 1979: PRELIMINARY BIBLIOGRAPHY
S. Hoffman Nov. 1979 43 p
(NASA-TM-80184; P3110) Avail: NTIS HC A03/MF A01 CSCL 01B

Approximately 512 bibliographies are presented for the time period from FY 77 to FY 79. Several non-SCR publications and a few papers not included in the last publication are included. Topics include propulsion, stratospheric emissions impact, materials and structure, aerodynamic performance, and stability and control. A.W.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-11030*# United Technologies Research Center, East Hartford, Conn.
A COMPARISON OF THE PITCHING AND PLUNGING RESPONSE OF AN OSCILLATING AIRFOIL Final Report
Franklin O. Carta Washington NASA Oct. 1979 158 p refs (Contract NAS1-14012)
(NASA-CR-3172) Avail: NTIS HC A08/MF A01 CSCL 01A

An oscillating SC1095 airfoil model was tested for its aerodynamic stability in a rigid body with a single degree of freedom pitch about its quarter chord, and also in a rigid body with single degree of freedom plunge. The ability of pitching data to model plunging motions was evaluated. A one to one correspondence was established between pairs of pitching and plunging motions according to the potential flow transformation formula alpha = ikh. The imposed variables of the experiment were mean incidence angle, amplitude of motion, free stream velocity, and oscillatory frequency. Results indicate that significant differences exist between the aerodynamic responses to the motions, particularly at high load conditions. At high load conditions, the normal force for equivalent pitch is significantly greater than that for true pitch at the geometric incidence angle. R.C.T.

N80-11031*# Kentron International, Inc., Hampton, Va.
AIRCRAFT CONTROL BY PROPELLER CYCLIC BLADES
John DeYoung Washington NASA Nov. 1979 61 p refs (Contract NAS1-13500)
(NASA-CR-3212) Avail: NTIS HC A04/MF A01 CSCL 01A

A theory is developed for aircraft control obtained from the propeller forces and moments generated by blade angle variation during a blade revolution. The propeller blade is pitched harmonically one cycle per propeller revolution which results in vehicle control forces and moments, termed cyclic-control. Using a power series respresentation of an arbitrary function of cyclic-blade angle, cyclic-control theory is developed which leads to exact solutions in terms of derivatives of steady-state thrust and power with respect to blade angle. An alternative solution, when the cyclic-blade angle function is limited to a sinusoidal cycle, is in terms of Bessel functions. An estimate of non-steady azimuth angle change or lag is presented. Cyclic-control analysis applied to the counter-rotating propeller shows that control forces or moments can be uniquely isolated from each other. Thus the dual rotor, in hovering mode, has propulsion without rotor tilt or moments, or, when in propeller mode at the tail of an air ship or submarine, vehicle control with no vehicle movement. Control isolation is also attainable from three or more propellers in-line. Author

N80-11032# Aeronautical Research Labs., Melbourne (Australia).
PREDICTION OF HELICOPTER ROTOR DOWNWASH IN HOVER AND VERTICAL FLIGHT
K. R. Reddy Jan. 1979 31 p refs
(ARL-AERO-Rept-150; AR-001-335) Avail: NTIS HC A03/MF A01

A vortex-wake method to calculate the rotor downwash in hovering and vertical flight is presented. The blade is represented by a lifting line. The rotor wake is simulated by a vortex sheet and a series of rolled up root and tip vortices, similar in form to that of a classical fixed wing. The concept of rectangularization of the rotor wake is used in obtaining a formula for the normal component of induced velocity. Wake contraction based on experimental data is introduced into the calculations. Numerical calculations are performed for two rotor configurations. Computed induced velocities and blade loadings are compared with the available flight data. A.W.H.

N80-11033*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC INTERACTIONS FROM REACTION

CONTROLS FOR LATERAL CONTROL OF THE M2-F2 LIFTING-BODY ENTRY CONFIGURATION AT TRANSONIC AND SUPERSONIC AND SUPERSONIC MACH NUMBERS
Rodney O. Bailey and Jack J. Brownson Washington Nov. 1979 125 p refs
(NASA-TM-78534; A-7624) Avail: NTIS HC A06/MF A01 CSCL 01A

Tests were conducted in the Ames 6 by 6 foot wind tunnel to determine the interaction of reaction jets for roll control on the M2-F2 lifting-body entry vehicle. Moment interactions are presented for a Mach number range of 0.6 to 1.7, a Reynolds number range of 1.2 x 10 to the 6th power to 1.6 x 10 to the 6th power (based on model reference length), an angle-of-attack range of -9 deg to 20 deg, and an angle-of-sideslip range of -6 deg to 6 deg at an angle of attack of 6 deg. The reaction jets produce roll control with small adverse yawing moment, which can be offset by horizontal thrust component of canted jets. A.R.H.

N80-11034*# Pennsylvania State Univ., University Park.
CHARACTERISTICS OF LIGHTLY LOADED FAN ROTOR BLADE WAKES Final Report
B. Reynolds and B. Lakshminarayana Washington NASA Oct. 1979 192 p refs
(Grant NsG-3012)
(NASA-CR-3188; PSU-TURBO-R-78-4) Avail: NTIS HC A09/MF A01 CSCL 01A

Low subsonic and incompressible wake flow downstream of lightly loaded rotor was studied. Measurements of mean velocity, turbulence intensity, Reynolds stress, and static variations across the rotor wake at various axial and radial locations were investigated. Wakes were measured at various rotor blade incidences to discern the effect of blade loading on the rotor wake. Mean velocity and turbulence measurements were carried out with a triaxial hot wire probe both rotating with the rotor and stationary behind the rotor. Results indicate that increased loading slows the decay rates of axial and tangential mean velocity defects and radial velocities in the wake. The presence of large radial velocities in the rotor wake indicate the extent of the interactions between one radius and another. Appreciable static pressure variations across the rotor wake were found in the near wake region. Similarity in the profile shape was found for the axial and tangential components of the mean velocity and in the outer layer for axial, tangential, and radial turbulence intensities. R.C.T.

N80-11035*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT-MEASURED AFTERBODY PRESSURE COEFFICIENTS FROM AN AIRPLANE HAVING TWIN SIDE-BY-SIDE JET ENGINES FOR MACH NUMBERS FROM 0.6 TO 1.6
Louis L. Steers Washington Nov. 1979 88 p refs
(NASA-TP-1549; H-1066) Avail: NTIS HC A05/MF A01 CSCL 01A

Afterbody pressure distribution data were obtained in flight from an airplane having twin side-by-side jet exhausts. The data were obtained in level flight at Mach numbers from 0.60 to 1.60 and at elevated load factors for Mach numbers of 0.60, 0.90, and 1.20. The test altitude varied from 2300 meters (7500 feet) to 15,200 meters (50,000 feet) over a speed range that provided a matrix of constant Mach number and constant unit Reynolds number test conditions. The results of the full-scale flight afterbody pressure distribution program are presented in the form of plotted pressure distributions and tabulated pressure coefficients with Mach number, angle of attack, engine nozzle pressure ratio, and unit Reynolds number as controlled parameters. Author

N80-11036*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FUSELAGE AND NOZZLE PRESSURE DISTRIBUTIONS ON A 1/12-SCALE F-15 PROPULSION MODEL AT TRANSONIC SPEEDS
Odis C. Pendergraft, Jr. Nov. 1979 140 p refs
(NASA-TP-1521; L-12948) Avail: NTIS HC A07/MF A01 CSCL 01A

Static pressure coefficient distributions on the forebody, afterbody, and nozzles of a 1/12 scale F-15 propulsion model were determined. The effects of nozzle power setting and horizontal tail deflection angle on the pressure coefficient distributions were investigated. A.W.H.

N80-11037*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL STUDY OF LOW ASPECT RATIO COMPRESSOR BLADING
Lonnie Reid and Royce D. Moore 1979 19 p refs Proposed for presentation at the 25th Ann. Intern. Gas Turbine Conf., New Orleans, La., 9-13 Mar. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-79280; E-217) Avail: NTIS HC A02/MF A01 CSCL 01A

The effects of low aspect ratio blading on aerodynamic performance were examined. Four individual transonic compressor stages, representative of the inlet stage of an advanced high pressure ratio core compressor, are discussed. The flow phenomena for the four stages are investigated. Comparisons of blade element parameters are presented for the two different aspect ratio configurations. Blade loading levels are compared for the near stall conditions and comparisons are made of loss and diffusion factors over the operating range of incidence angles. A.W.H.

N80-11038*# Old Dominion Univ. Research Foundation, Norfolk, Va.
LEADING EDGE VORTEX-FLAP EXPERIMENTS ON A 74 DEG DELTA WING
Dhanvad M. Rao Nov. 1979 53 p refs
(Grant NsG-1315)
(NASA-CR-159161) Avail: NTIS HC A04/MF A01 CSCL 01A

Exploratory wind tunnel tests are reported on a 74 deg. delta wing model. The potential of a vortex flap concept in reducing the subsonic lift dependent drag of highly swept, slender wings is examined. The suction effect of coiled vortices generated through controlled separation over leading edge flap surfaces to produce a thrust component is discussed. A series of vortex-flap configurations were investigated to explore the effect of some primary geomtric variables. A.W.H.

N80-11039# Texas Univ. at Austin.
SUPERSONIC FLOW MEASUREMENTS IN THE BODY VORTEX WAKE OF AN OGIVE NOSE CYLINDER Final Report
W. L. Oberkampf and T. J. Bartel Eglin AFB, Fla. AFATL Nov. 1978 302 p refs
(Contract F08635-77-C-0049; AF Proj. 2307)
(AD-A071337; AFATL-TR-78-127) Avail: NTIS HC A14/MF A01 CSCL 16/2

This report covers an experimental investigation of the symmetric body vortex wake of a circular cylinder in supersonic flow. Flow field measurements were made in the cross-flow plane at various axial body stations for angles of attack from 10 to 25 degrees. Data were obtained for two Reynolds numbers at a freestream Mach number of 2 and for one Reynolds number at a freestream Mach number of 3. A conical pressure probe was used to measure total pressure, Mach number, and three orthogonal velocity components at a large number of grid points in each of the survey planes. The pitch and yaw angles of the probe were manipulated in the wind tunnel in order to minimize any probe interference effects on the body vortex. A new experimental technique was used which involved the interaction of a theoretical predictive technique, a computer driven probe, and real time data quality optimization. Results are presented for the distribution of total pressure, Mach number, cross-flow velocity field, and axial velocity component in the cross-flow plane. These quantities are further processed to infer the position of the primary body vortex in the cross-flow plane, local circulation distribution in the cross-flow plane, vortex core size, wake height, and total circulation in the cross-flow plane. GRA

N80-11040# Tennessee Univ. Space Inst., Tullahoma.
THE ANALYSIS OF WING-BODY COMBINATIONS AT MODERATE ANGLES OF ATTACK

N. Uchiyama (Japan Defense Agency, Tokyo), R. P. Mikkilineni, and J. M. Wu. 1978. 7 p. refs. Presented at the AIAA 16th Aerospace Sci. Meeting, Huntsville, Ala., 16-18 Jan. 1978.
(Contract DAAG29-77-G-0108)
(AD-A074284; ARO-14966.1-A-E) Avail: NTIS HC A02/MF A01 CSCL 20/4

A computational scheme is developed to predict the flow over wing-body combinations at moderate angles of attack and the results of computation are presented for two different wing-body combinations. The wing is represented by a system of discrete non-intersecting vortex lines. Each vortex line in the wake is composed of a series of straight finite segments and a semi-infinite segment. The body is represented by a system of source/sink elements distributed on the surface of the body. The effect of lifting nose is taken into account by a horseshoe vortex system, the strength and the location of which are based on the empirical relations. The basic unknowns in the problem are the strengths of the vortex elements and the source/sink elements, and the direction of the vortex elements in the wake. The problem is solved using an iterative approach. The shape of the trailing vortex sheet is shown at different stations along the body. A.R.H.

N80-11041# Maryland Univ., College Park. Dept. of Aerospace Engineering.
NEW COMPUTATIONAL MODELS IN CONTINUUM MECHANICS. Final Report.
Oleg Beltserkovski. Mar. 1979. 94 p. refs.
(Contract N00014-79-M-0022)
(AD-A071418; AE-79-1) Avail: NTIS HC A05/MF A01 CSCL 20/4

Direct numerical simulation of complex gas dynamics problems (computational experiment) is performed with the help of Euler, Navier-Stokes and Boltzmann equations. The basic principles of the computational experiment are formulated and the results for various gas dynamics problems of a complex internal structure are presented. The problems examined include the transonic regime (super-critical flows including transition through sound velocity), flows with a jet injected into the main stream and diffraction problems. Body wake flows are studied at various Reynolds numbers. The structure of a shock wave provides an example of rarefied gas flows at various Mach numbers. A set of control tests is worked out for the estimation of calculation accuracy. GRA

N80-11042# Illinois Univ. at Urbana-Champaign. Dept. of Mechanical and Industrial Engineering.
SEPARATED FLOW PROBLEMS WITHIN THE TRANSONIC AND SUPERSONIC FLOW REGIMES. Final Report, 5 Apr. 1976 - 31 May 1979.
W. L. Chow. Jun. 1979. 27 p. refs.
(Grant DAAG29-76-G-0199)
(AD-A071899; ME-TR-395-8; ARO-13510.8-E) Avail: NTIS HC A03/MF A01 CSCL 20/4

The base pressure associated with supersonic axisymmetric flow past a backward facing step, employing previously developed analysis of recompression, reattachment, and redevelopment processes, has been calculated for small supersonic approaching flow Mach numbers with thin initial boundary layers. The model of dealing with transonic flow past a backward facing step in two-dimensional or axisymmetric configuration has been successfully developed. Large scaled calculations of the turbulent Navier-Stokes equation based on the 'two-equation model', has been carried out for the low speed flow past a two-dimensional backstep, where a considerable amount of hot-wire data is available for compression and good description of the overall flow pattern has been obtained. Numerical calculations of the potential flow after hodograph transformation have been proved to be fruitful by solving many previously unsolved problems where the effect of gravitation predominates. GRA

N80-11043# California Univ., Livermore. Lawrence Livermore Lab.
MACH 130 AIR SHOCK ATTENUATION STUDIES
H. D. Glenn, H. R. Kratz, D. D. Keough, and R. P. Swift. 30 Nov. 1978. 19 p. refs. Presented at the Nucl. Blast and Shock Simulation Symp., San Diego, Calif., 28 Nov. 1978.
(Contract W-7405-eng-48)
(UCRL-82012; Conf-781197-1) Avail: NTIS HC A02/MF A01

Voitenko compressors were used to generate approximately 4.5 cm/micron sec air shocks in a steel and a grout outlet pipe. Diaphragm burst times and time-of-arrival data of shock-front luminosity along the 2 cm i.d. exit pipes are provided by fiber-optics ports. Pressure profiles were obtained for this high enthalpy shock propagation at many locations in both experiments. The effect of wall material on high-energy shock propagation was investigated. In the interval between 10 and 250 cm from the diaphragm the velocity and peak pressure of the shock front attenuated from approximately 4.5 to 0.5 cm/micron sec and approximately 21 to approximately 0.2 kb, respectively. Over this distance, the shock propagation gave nearly identical results for both experiments within the range of experimental accuracy. This rapid attenuation of the shock front velocity and pressure is attributed to ablation and entrainment of wall material. Results indicate that the shock propagation is independent of wall composition to the extent of materials considered over the 250 cm distance of the outlet pipes. DOE

N80-11044# Aeronautical Research Inst. of Sweden, Stockholm.
MEASUREMENTS ON A THREE-DIMENSIONAL SWEPT WING AT LOW SPEEDS. PART 1: THE FLOW AROUND THE LEADING EDGE
Arild Bertelrud. Sep. 1977. 112 p. refs. Sponsored by Swed. Defence Mat. Admin. 2 Vol.
(FFA-130-Pt-1; PB-294203/5) Avail: NTIS HC A06/MF A01

As a part of a project on extrapolation from wind tunnel to flight, measurements in the boundary layer of a three dimensional swept wing were made in a low speed wind tunnel. The flow in the region close to the leading edge was studied. Two different flow patterns were investigated; natural transition and bubble transition. The wing tested is outer part of the actual wing of a SAAB 32 Lansen with a NACA 64A010 profile normal to the 25 percent line and a leading edge sweep of 39 deg. It is found that for the present wing the pressure distribution in the leading edge region back to 30 percent of the chord is well described by two-dimensional calculations of attack close to start of separation the attachment line flow probably becomes transitional/turbulent in the tested speed range, followed by relaminarization and bubble. According to calculations there should not be relaminarization in the flight case, despite strong indications from earlier flight tests of bubble separation. Author (ESA)

N80-11045# Aeronautical Research Inst. of Sweden, Stockholm.
MEASUREMENTS ON A THREE-DIMENSIONAL SWEPT WING AT LOW SPEEDS. PART 2: THE FLOW IN THE BOUNDARY LAYER ON THE MAIN WING
Arild Bertelrud. Sep. 1977. 85 p. refs. Sponsored by Swed. Defence Mat. Admin. 2 Vol.
(FFA-131-Pt-2; PB-294204/3) Avail: NTIS HC A05/MF A01

As a part of a project on extrapolation from wind tunnel to flight, measurements in the boundary layer of three-dimensional swept wing were made in a low speed tunnel. The flow on the main part of the wing is discussed and essentially time-averaged information is given. The experimental investigation consists of measurements of the static distribution and also of measurements with total head/static probes. These also provide skin friction data. As the flow visualizations and the preliminary measurements indicated that the flow was close to two dimensional, boundary layer rakes were used to get streamwise information on the boundary layer profiles. Calculations of the static pressure distribution and the turbulent boundary layer characteristics were performed and show good agreement with the experimental results. Author (ESA)

N80-11046# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
COMPARISON OF BOUNDARY LAYER CALCULATION FOR A WING: THE MAY 1978 STOCHOLM WORKSHOP TEST CASE
D. A. Humphreys. Jan. 1979. 121 p. refs.
(FFA-AE-1522) Avail: NTIS HC A06/MF A01

Eight calculation methods for determining three-dimensional turbulent boundary layers were compared. All methods were applied to the same test case which was designed to simulate flow over a wind tunnel model wing. Geometry and free stream

conditions were chosen to be representative, yet to yield a relatively simple compressible (subsonic) boundary layer with only moderate three-dimensionality and spanwise variation. Wing root, tip, and leading edge regions were excluded. Two wing incidences were considered. The main comparison of the calculation methods involved comparing four parameters appearing in the integral equations of motion in streamline coordinates. Despite the simplicity of the test case, disproportionately large differences were evident among the outputs of the eight programs (as much as 10 percent or 20 percent typically). Possible explanations for these discrepencies are suggested. Author (ESA)

N80-11047# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
AN EXPERIMENTAL SURVEY OF A SEPARATED REGION ON A CONICAL AFTERBODY IN A SUPERSONIC FREE STREAM Final Report
Johan Agrell. Oct. 1978. 24 p. refs
(Contract FMV-F-VT-81713-74-013-07-001)
(FFA-TN-AU-1187) Avail: NTIS HC A02/MF A01

The separated flow region on a boat-tailed afterbody was investigated experimentally at a Mach number of 2.00 during wind tunnel tests. The size of the reversed flow region was determined and, where possible, the velocity of the recirculating flow was estimated. Experimental methods comprised different types of pressure probes and flow visualization techniques. Despite the shortcomings of the method qualitative profiles of the local Mach number in the reverse flow were obtained. Author (ESA)

N80-11048# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
PITOT PRESSURE AND TOTAL TEMPERATURE PROFILE MEASUREMENTS IN A HYPERSONIC, TURBULENT BOUNDARY LAYER AT M = 9
R. P. Bartlett, A. J. Edwards, J. K. Harvey, and R. Hilier. Feb. 1979. 36 p. refs
(Contract AT/2037/084)
(IC-Aero-79-01) Avail: NTIS HC A03/MF A01

Pitot pressure and total temperature profiles were measured in a zero pressure gradient, turbulent, hypersonic boundary layer under conditions of severe cooling. Velocity profiles were calculated and compared with several available velocity - total temperature relationships. The van Driest transformation was used to compare the data with well-known incompressible results. Results and estimates of the wake component suggested the boundary layer was not fully developed. Author (ESA)

N80-11049# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
A SURVEY OF THE LITERATURE ON SURFACE ROUGHNESS EFFECTS ON THE DRAG OF SUBSONIC AIRCRAFT Final Report
A. Bertelrud. Sep. 1978. 131 p. refs
(Contracts SWEDBTD-75-4494; SWEDBTD-76-4505)
(FFA-AU-1224) Avail: NTIS HC A07/MF A01

A survey of selected investigations concerning drag associated with isolated or distributed roughness elements in laminar and turbulent flow is given. Basic roughness types tested in laboratory experiments are covered and the results are related to conditions on wings of subsonic aircraft. Whereas considerable information is available on zero-pressure-gradient two-dimensional turbulent flows with roughness effects can be incorporated in current routines for assessing overall drag of aircraft based on wind tunnel and flight tests is demonstrated. It is suggested to develop a computer code which will allow the determination of allowable roughness size, or the effect of given roughness size on drag for new aircraft. This program would also make possible predictions of the degradation in performance associated with maintenance procedures, structural modifications, etc. Such a program involves a detailed analysis of the flow field around wing and body instead of the over-simplified methods based on flat plate relations now in use. Author (ESA)

N80-11005 Allerton Press, Inc., New York, N. Y.
SURFACE-EFFECT COMPONENTS OF AERODYNAMIC CHARACTERISTICS OF AIR-CUSHION VEHICLE WITH RAM PRESSURIZATION
M. A. Guryanov. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 10-19. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 17-29 (For primary document see N80-11002 02-01)
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N80-11008 Allerton Press, Inc., New York, N. Y.
AERODYNAMIC HEATING OF BLUNT WEDGES
N. M. Kruova, T. I. Murashina, and G. B. Petrazhitskii. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 33-36. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 44-48 (For primary document see N80-11002 02-01)
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N80-11009 Allerton Press, Inc., New York, N. Y.
SELECTION OF GEOMETRIC PARAMETERS AND LOCATION OF NOSE FLAP ON SWEPT WING ROOT PROFILE FROM TUNNEL TEST DATA, 1
A. I. Matyazh, V. A. Sterlin, V. A. Popov, V. V. Isaev, and G. A. Cheremukhin. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 37-41. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 49-54 (For primary document see N80-11002 02-01)
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N80-11010 Allerton Press, Inc., New York, N. Y.
ANALYTIC FORMULAS FOR WING PROFILE AERODYNAMIC CHARACTERISTICS IN INCOMPRESSIBLE FLOW
N. M. Monakhov. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 42-47. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 55-61 (For primary document see N80-11002 02-01)
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N80-11011 Allerton Press, Inc., New York, N. Y.
ON A SMOOTH APPROXIMATION METHOD AND ITS APPLICATION TO MATHEMATICAL DESCRIPTION OF WING AERODYNAMIC CHARACTERISTICS
V. A. Ovchinnikov, V. D. Osorgin, V. G. Pavlov, and E. Ya. Fedorov. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 48-51. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 62-65 (For primary document see N80-11002 02-01)
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N80-11012 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF WING DEFORMATION ON TRAILING-EDGE FLAP DEFLECTIONS
V. A. Pavlov. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 52-53. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 66-67 (For primary document see N80-11002 02-01)
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N80-11013 Allerton Press, Inc., New York, N. Y.
SOLUTION OF THE INVERSE AERODYNAMICS PROBLEM BY THE RANDOM SEARCH METHOD
G. D. Peshatov and Yu. N. Novoselov. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 54-58. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 68-73 (For primary document see N80-11002 02-01)
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N80-11019 Allerton Press, Inc., New York, N. Y.
HARMONIC OSCILLATIONS OF ANNULAR WING IN STEADY IDEAL FLUID FLOW
Z. N. Shesternina. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 93-98. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 115-121 (For primary document see N80-11002 02-01)

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N80-11022 Allerton Press, Inc., New York, N. Y.
OVERALL AERODYNAMIC CHARACTERISTICS OF CARET AND DELTA WINGS AT SUPERSONIC SPEEDS
Yu. P. Gunko and I. I. Mazhul. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 107-110, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 129-132. (For primary document see N80-11002, 02-01)
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N80-11026 Allerton Press, Inc., New York, N. Y.
MIXED INVERSE PROBLEM FOR PROFILE WITH GIVEN VELOCITY DISTRIBUTION ON ONE SIDE AND KNOWN THICKNESS LAW
S. D. Kostomoi and A. A. Litvinenko. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 120-122, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 142-144. (For primary document see N80-11002, 02-01)
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N80-11027 Allerton Press, Inc., New York, N. Y.
ON FREE PERIODIC PARACHUTE SYSTEM OSCILLATIONS IN THE AXIAL PLANE
V. M. Churkin and N. A. Kosarchuk. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 144-146, refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 144-146. (For primary document see N80-11002, 02-01)
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03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations, and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-11050# National Aviation Facilities Experimental Center, Atlantic City, N. J.
CABIN HAZARDS FROM A LARGE EXTERNAL FUEL FIRE ADJACENT TO AN AIRCRAFT FUSELAGE **Final Report**
Louis J. Brown, Jr. Aug. 1979. 59 p. refs.
(FAA Proj. 181-521-100)
(AD-A073494; FAA-NA-79-27) Avail: NTIS HC A03/MF A01 CSCL 13/12

Fourteen fire tests were conducted with a surplus, fire hardened DC 7 fuselage. The flame penetration and resulting accumulation of heat and smoke inside an aircraft cabin, produced by a large external fuel fire adjacent to a fuselage door opening, was measured and studied. Temperatures, light transmittances, and heat fluxes were measured. The effect of wind direction and velocity on the flame propagation and penetration were investigated. A.W.H.

N80-11051# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT - UNITED AIRLINES, INC., MCDONNELL-DOUGLAS DC-8-61, N8082U, PORTLAND, OREGON, DECEMBER 28, 1978
7 Jun. 1979. 63 p.
(NTSB-AAR-79-7) Avail: NTIS HC A04/MF A01

The crash of flight 173, a DC 8 aircraft, is investigated. The cause of the accident is listed as flight crew error in responding to the low fuel state of the aircraft due to a malfunction in the landing gear. Damage to the aircraft and injuries to persons are reported. Wreckage information, an aircraft systems examination, a fuel control test, and a report of the main landing gear retract cylinder assembly are discussed. A.W.H.

N80-11052*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
AIRCREW DISPLAYS AND AVIONICS FOR APPLICATION IN A FUTURE NATIONAL AIRSPACE SYSTEM
Seymour Salmirs. Nov. 1979. 28 p. refs.
(NASA-TM-80095) Avail: NTIS HC A03/MF A01 CSCL 01D

A concept for increased pilot involvement in a future National Airspace System was evolved during the FAA New Initiatives in Engineering and Development Users responsibilities and ways in which they might interact. The technical feasibility of the system is indicated by the sophisticated level of presently manufactured digital computers and display avionics, and the application of that technology under design by the major airframe manufacturers. Data collected during simulations and flights with the Terminal Configured Vehicle Program B-737 airplane are shown to have direct application to the new system concept. The adoption of the operational changes envisioned, offers some potentially significant advantages to the user. Author

N80-11053*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
MULTICIRCLE CARGO AIRCRAFT OPTIONS AND CONFIGURATIONS
D. William Conner and John C. Vaughan, III (USAF). Oct. 1979. 15 p. refs. Presented at 1979 SAE Aerospace Meeting, 3-9 Dec. 1979.
(NASA-TM-80177) Avail: NTIS HC A02/MF A01 CSCL 01C

A future requirements and advanced market evaluation study indicates derivatives of current wide-body aircraft, using 1980 advanced technology, would be economically attractive through 2008, but new dedicated airfreighters incorporating 1990 technology, would offer little or no economic incentive. They would be economically attractive for all payload sizes, however, if RD and T costs could be shared in a joint civil/military arrangement. For the 1994-2008 cargo market, option studies indicate Mach 0.7 propfans would be economically attractive in trip cost, aircraft price and airline ROI. Spanloaders would have an even lower price and higher ROI but would have a relatively high trip cost because of aerodynamic inefficiencies. Dedicated airfreighters using propfans at Mach 0.8 cruise, laminar flow control, or cryofuels, would not provide any great economic benefits. Air cushion landing gear configurations are identified as an option for avoiding runway constraints on airport requirements and/or operational constraints are noted. Author

N80-11054# Douglas Aircraft Co., Inc., Long Beach, Calif.
EJECTION SEAT FOR HIGH G ESCAPE **Final Technical Report, 1 Jun. 1978 - Apr. 1979**
Orville E. Howland. Apr. 1979. 184 p. refs.
(Contract F33615-78-C-3416; AF Proj. 2402)
(AD-A072444; MDC-J8434; AFFDL-TR-79-3044) Avail: NTIS HC A09/MF A01 CSCL 06/7

Advanced flight vehicles operating at acceleration loads beyond human functional capabilities require a new reclining seat design. An ejection seat compatible with this requirement must provide safe ejection and aircraft clearances under high-G conditions as well as the requirements associated with high dynamic pressures and low altitudes. Design criteria and interface requirements have been established. Ejection seat subsystems have been developed and seat design concepts generated to meet criteria and interface requirements. Candidate seat concepts have been analyzed to determine cockpit integration effects, accelerations, ejection clearances, escape performance, structural requirements and weights. A final design concept has been selected to meet all requirements of an ejection seat for high-G escape. The final report includes a parametric study of tail clearances and discusses technical design details and conclusions of the work performed. GRA

N80-11055# Rockwell International Corp., El Segundo, Calif. Los Angeles Div.
EXPLORATORY DEVELOPMENT OF AIRCREW WINDBLAST PROTECTION CONCEPTS **Final Report, May 1978 - Jan. 1979**
Robert J. Cummings and Frank E. Drsata. Jun. 1979. 100 p. refs.

(Contract F33615-78-C-0514; AF Proj. 7231)
(AD-A072013; RI/LAD-NA-79-77; AMRL-TR-79-16) Avail: NTIS HC A05/MF A01 CSCL 06/7

Design requirements for windblast limb protection systems to be used in current ejection seats were defined. The ACES II system was used as a baseline system. Using the baseline seat and the requirements, three arm and three leg restraint concepts were defined. A proposed program was then defined to evaluate and develop the proposed systems. Design requirements were derived from a list of criteria or constraints for the system as defined in the reference to the escape, aircraft, crew flight conditions and using commands' needs. Resulting requirements were then rank ordered and significant interactions between them identified. Identification of negative interactions highlights the significant trades necessary to design a successful windblast protection system. Ejection events and the resulting environment the crew is exposed to were then analyzed to define the physical actions the man and system must contend with. Review of previous ejection injuries and limb restraint systems was included to further refine the understanding of injury mechanisms. Specific injury mechanisms of the knees, shoulder, elbow, and spinal column are presented. Using the requirements and injury mechanisms the six candidate protection systems were defined. A proposed program for concept refinement and final selection is presented. GRA

N80-11064# Coast Guard, Washington, D.C. Oceanographic Unit.
LIFE RAFT STUDY, FEBRUARY 1978
R. W. Scobie and D. L. Thompson. Apr. 1979. 33 p. refs
(AD-A073055; CGOU-TR-79-1) Avail: NTIS HC A03/MF A01 CSCL 06/7

A life raft study was conducted from the CGC EVERGREEN in February 1978. Of the six life rafts tested, only one was seen capsizing. The Givens life raft suffered the most damage with both the canopy and ballast bag being destroyed. Leeway for life rafts with improved ballast systems was found to follow the equation Uliferaft = 0.042 Uwind + 0.060. This type of life raft was noted to drift at a much slower rate when the canopy was not deployed. In over 80% of the cases the life rafts drifted within 45 degrees of the downwind direction. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft, air navigation systems (satellite and ground based), and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N80-11057# Sterling Systems, Inc., Washington, D.C.
AN ASSESSMENT OF TERMINAL AIR TRAFFIC CONTROL SYSTEM PERFORMANCE WITH AND WITHOUT BASIC METERING AND SPACING AUTOMATION Final Report
H. C. Wintermoyer, William Pailen, and Donald Meyer. Mar. 1979. 134 p. refs
(Contract DOT-FA79WAI-012)
(AD-A073548; FAA-RD-79-81) Avail: NTIS HC A07/MF A01 CSCL 17/7

Basic arrival metering and spacing (M&S), developed as an ARTS (automated radar terminal system) 3 enhancement, is discussed. The functions of metering arrival aircraft prior to their acceptance in terminal airspace, sequencing them according to their estimated time at the runway, scheduling each aircraft at fix points along the arrival path to the runway arrival gate, and providing control commands to assure precise and proper spacing for aircraft on final approach to the runway are examined. Simulation tests to determine the landing time interval error, the potential safe landing rate, and the potential excessive delay are described. A.W.H.

N80-11058*# Sperry Flight Systems, Phoenix, Ariz.
STUDY FOR INCORPORATING TIME-SYNCHRONIZED APPROACH CONTROL INTO THE CH-47/VALT DIGITAL NAVIGATION SYSTEM
Walter J. McConnell, Jr. Oct. 1979. 226 p. refs
(Contract NAS1-14238)
(NASA-CR-159151) Avail: NTIS HC A11/MF A01 CSCL 17G

Techniques for obtaining time synchronized (4D) approach control in the VALT research helicopter is described. Various 4D concepts and their compatibility with the existing VALT digital computer navigation and guidance system hardware and software are examined. Modifications to various techniques were investigated in order to take advantage of the unique operating characteristics of the helicopter in the terminal area. A 4D system is proposed, combining the direct to maneuver with the existing VALT curved path generation capability. A.W.H.

N80-11059# Air Force Academy, Colo.
FALCONFIX: A MULTI-MODAL APPROACH TO FIX COMPUTATION Final Report
William T. Hodson, III and Joseph C. H. Smith. Jun. 1979. 77 p.
(AD-A072527; USAFA-TR-79-5) Avail: NTIS HC A05/MF A01 CSCL 17/3

FALCONFIX is a new algorithm for computing the location of an emitter given the bearings from a number of direction-finding stations located worldwide. This approach assumes that each reported bearing may be considered as a sample from a composite normal/uniform distribution, thereby explicitly acknowledging that the bearing may be either true or wild. These distributions are used to create a likelihood function defined over the unit sphere. Non-linear programming techniques are then employed to identify all relative maxima (modes) of this function. The modes (which coincide with concentrations of bearings) are then ordered by value and reported as estimates of the emitter location. GRA

N80-11060# Honeywell, Inc., St. Petersburg, Fla.
LIMS: LASER INERTIAL MEASUREMENT SYSTEM Final Report
Jul. 1978. 18 p.
(Contract DAAK40-76-C-0665)
(AD-A072389) Avail: NTIS HC A02/MF A01 CSCL 17/7

Acceptance and delivery of the items described was accomplished. A summary acceptance test report was provided for each LIMU delivered. The anomalies and/or failures during these acceptance test were primarily due to remaining hardware development problems and procedure development problems, not unusual for new items. After these developmental problems were solved, the LIMU's capability of meeting the requirements established for it, was adequately demonstrated as evidenced by the fact that the last four acceptance tests were accomplished in a 2 month interval and were routine in nature. GRA

N80-11061# Boeing Aerospace Co., Seattle, Wash. Military Airplane Development Organization.
EVALUATION OF DAIS TECHNOLOGY APPLIED TO THE INTEGRATED NAVIGATION SYSTEM OF A TACTICAL TRANSPORT Final Report, Sep. 1977 - May 1979
Donald Dewey, Richard Bousley, Stephen Behnen, and James Mason. May 1979. 181 p. refs
(Contract F33615-77-C-1233; AF Proj. 2003)
(AD-A073068; AFAL-TR-79-1061) Avail: NTIS HC A09/MF A01 CSCL 17/7

This effort has provided an independent contractor assessment of the DAIS executive software, industry exposure to the J-73 level one compiler and DAIS software development tools, and a definition of the interface between DAIS and integrated navigation systems. A combination of INS, GPS and air data was used to demonstrate the usefulness of the DAIS/integrated navigation system for tactical air drop and terminal area operations w/transport aircraft. A Boeing Aerospace Lab Simulation jointly managed by AFAL and Boeing, was conducted for the purposes of evaluating the DAIS/integrated navigation system software performance capabilities in a simulated tactical air drop and terminal area navigation flight profile. A 'Hot Bench' simulation was conducted using contractor developed sensor software modules and navigation filter, and the DAIS executive software and processing hardware. Outputs of the program include: Verification of the overall DAIS concept, measurements of

executive software overhead and suggestions for improving the DAIS executive software. GRA

N80-11062# National Technical Information Service, Springfield, Va.
AIR TRAFFIC CONTROL SIMULATION MODELS VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Jul. 1979
Guy E. Habercom, Jr. Aug. 1979 179 p refs Supersedes NTIS/PS-77/0702; NTIS/PS-76/0610; NTIS/PS-75/521; NTIS/PS-78/0788
(NTIS/PS-79/0799/1; NTIS/PS-78/0788; NTIS/PS-77/0702; NTIS/PS-76/0610; NTIS/PS-75/521) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

En-route and terminal air traffic control facilities are investigated by use of mathematical models and computerized simulations. Ground based and satellite navigational aids are modeled for present and predicted air traffic requirements. Worldwide networks for traffic scheduling are simulated. This updated bibliography contains 169 abstracts, 44 of which are new entries to the previous edition. GRA

N80-11063# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
TRI-FAST HARDWARE-IN-THE-LOOP SIMULATION. VOLUME 1: TRI-FAST HARDWARE-IN-THE-LOOP SIMULATION AT ADVANCED SIMULATION CENTER
David B. Merriman, Robert C. Ward, James T. Taylor (Boeing Aerospace Co., Huntsville, Ala.), and C. R. Green (Computer Sciences Corp., Huntsville, Ala.) 28 Mar. 1979 86 p
(AD-A072919; DRDMI-T-79-43-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 17/7

The purpose of this report is to document the Tri-FAST missile simulation development and the seeker hardware-in-the-loop (HWIL) testing in the Radio Frequency Simulation Cell of the Advanced Simulation Center (ASC). Tri-FAST is a tri-service active seeker technology program. GRA

N80-11064# New Mexico Univ., Albuquerque. Technology Application Center.
INERTIAL NAVIGATION AND GUIDANCE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jul. 1979
Samuel C. Mauk Aug. 1979 50 p Sponsored in part by NTIS
(NTIS/PS-79/0825/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

This bibliography cites 208 articles from the international literature concerning air naviagation, navigation instruments and aids, aircraft guidance, missile control, strapdown inertial guidance, gyroscopes, stabilized platforms, position and instrument error, error analysis, and accelerometers. Civil, commercial, and military applcations are covered. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-11065*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A HYDRAULIC ACTUATOR MECHANISM TO CONTROL AIRCRAFT SPOILER MOVEMENTS THROUGH DUAL INPUT COMMANDS Patent Application
Stephen C. Irick, inventor (to NASA) Filed 17 Aug. 1979 11 p
(NASA-Case-LAR-12412-1; US-Patent-Appl-SN-067595) Avail: NTIS HC A02/MF A01 CSCL 10C

A conventional, primary spoiler control system retains its operational characteristics while accommodating a secondary input controlled by a conventional computer system to supplement the settings made by the primary input. This is achieved by interposing springs between the primary input and the spoiler control unit. The springs are selected to have a stiffness intermediate to the greater force applied by the primary control linkage and the lesser resistance offered by the spoiler control unit. Thus, operation of the primary input causes the control unit to yield before the springs, yet, operation of the secondary input, acting directly on the control unit, causes the springs to yield and absorb adjustments before they are transmitted into the primary control system. NASA

N80-11066# National Aerospace Lab., Tokyo (Japan). V/STOL Div.
FUEL MINIMAL TAKE-OFF PATH OF JET LIFT VTOL AIRCRAFT, LOG NO. C3558
Hiroshi Nishimura 7 Aug. 1979 40 p refs Backup document for AIAA synoptic scheduled for publication in Journal of Aircraft on Feb. 1980
Avail: NTIS HC A03/MF A01

The fuel minimal take-off path analysis for jet lift type VTOL aircraft is presented. The study is made of two basic configurations, namely, separate type and swivel type. The fuel minimal take-off path problems of the two configurations are analyzed as nonlinear systems with the controls constrained by their magnitude. The solutions for both types are generally composed of two or three discontinuous segments connected by switching points. For the separate type, the singular part is analytically deterministic and unique, and plays a decisive role; but for the swivel type, the singular part is not unique. Two methods of solution involving different handling of singular parts are considered. Author

N80-11067*# United Technologies Research Center, East Hartford, Conn.
NOISE OF A MODEL HELICOPTER ROTOR DUE TO INGESTION OF TURBULENCE Final Report
Robert W. Paterson and Roy K. Amiet Nov. 1979 131 p refs
(Contract NAS1-15094)
(NASA-CR-3213) Avail: NTIS HC A07/MF A01 CSCL 01C

A theoretical and experimental investigation of the noise of a model helicoper rotor due to ingestion of turbulence was conducted. Experiments were performed with a 0.76 m dia. articulated model rotor for a range of inflow turbulence and rotor operating conditions. Inflow turbulence levels varied from approximately 2 to 19 percent and tip Mach number was varied from 0.3 to 0.52. Test conditions included ingestion of a atmospheric turbulence in outdoor hover as well as ingestion of grid generated isotropic turbulence in the wind tunnel airstream. In wind tunnel testing, both forward flight and vertical ascent (climb) were simulated. Far field noise spectra and directivity were measured in addition to incident turbulence intensities, length scales, and spectra. Results indicate that ingestion of atmospheric turbulence is the dominant helicopter rotor hover noise mechanism at the moderate to high frequencies which determine perceived noise level. R.C.T.

N80-11068*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIND-TUNNEL/FLIGHT CORRELATION STUDY OF AERODYNAMIC CHARACTERISTICS OF A LARGE FLEXIBLE SUPERSONIC CRUISE AIRPLANE CXB-70-1). 1: WIND-TUNNEL TESTS OF A 0.03-SCALE MODEL AT MACH NUMBERS FROM 0.6 TO 2.53
James Daugherty, C. Nov. 1979 222 p refs
(NASA-TP-1514; A-7712) Avail: NTIS HC A10/MF A01 CSCL 01C

The longitudinal and lateral forces and moments for a 0.03 scale deformed rigid, static force model of the XB-70-1 airplane were determined. Control effectiveness was determined for the elevon in pitch and roll, for the canard, and for the rudders. Component effects of the canard, deflected with tips, variable position canopy, bypass doors, and bleed dump fairing were measured. The effects of small variations in inlet mass flow ratio and small amounts of asymmetric deflection of the wing tips were assessed. A.W.H.

N80-11069*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF MODIFIED PROFILE ANALYSIS TO FUNCTION TESTING OF SIMULATED CTOL TRANSPORT

TOUCHDOWN-PERFORMANCE DATA
Russell V. Parrish and Burnell T. McKissick Nov. 1979 19 p refs
(NASA-TP-1541; L-13091) Avail: NTIS HC A02/MF A01 CSCL 01C

The modification to the methodology of profile analysis to accommodate the testing of differences between two functions with a single test, rather than multiple tests at various values of the abscissa, is described and demonstrated for two sets of simulation-performance data. The first application was to a flight-simulation comparison of pilot-vehicle performance with a three-element refractive display to performance with a more widely used beam-splitter-reflective-mirror display system. The results demonstrate that the refractive system for out-the-window scene display provides equivalent performance to the reflective system. The second application demonstrates the detection of significant differences by modified profile-analysis procedures. This application compares the effects of two sets of pitch-axis force-feel characteristics on the sink rate at touchdown performance utilizing the refractive system. This experiment demonstrates the dependence of simulator sink-rate performance on force-feel characteristics. Author

N80-11070# Rockwell International Corp., El Segundo, Calif. Los Angeles Div.
IMPROVED METHODS FOR PREDICTING SPECTRUM LOADING EFFECTS, PHASE 1 REPORT. VOLUME 2: TEST DATA Interim Report, 15 Feb. 1978 - 15 Jan. 1979
James B. Chang and John H. Stolpestad 31 Jan. 1979 330 p
(Contract F33615-77-C-3121)
(AD-A072387; NA-78-491-3-Vol-2; AFFDL-TR-79-3036-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 01/3

This report presents the interim status of a program which is aiming to upgrade the crack growth prediction technology required for the implementation of the damage-tolerance and durability control procedures throughout the life cycle of any weapon system. The controlling damage parameters in flight-by-flight loading for all classes of aircraft have been identified. Methodologies which characterize the flight spectra have been developed. Guidelines for development of three levels of crack growth analysis used for detail design, individual aircraft tracking, and preliminary design have been established. Crack growth data generated from the test program has been summarized. GRA

N80-11071# Rockwell International Corp., El Segundo, Calif. Los Angeles Div.
IMPROVED METHODS FOR PREDICTING SPECTRUM LOADING EFFECTS, PHASE 1 REPORT, VOLUME 1: RESULTS AND DISCUSSION Interim Report, 15 Feb. 1978 - 15 Jan. 1979
James B. Chang, John H. Stolpestad, Masanobic Shinozuka, and Rimas Vaicaitis 31 Jan. 1979 333 p refs Prepared in cooperation with Modern Analysis, Inc.
(Contract F33615-77-C-3121)
(AD-A072386; NA-78-491-3-Vol-1; AFFDL-TR-79-3036-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 01/3

This report presents the interim status of a program which aims to upgrade the crack growth prediction technology required for the implementation of the damage-tolerance and durability control procedures throughout the life cycle of any weapon system. The controlling damage parameters in flight-by-flight loading for all classes of aircraft have been identified. Methodologies which characterize the flight spectra have been developed. Guidelines for development of three levels of crack growth analysis used for detail design, individual aircraft tracking, and preliminary design have been established. GRA

N80-11072# Delaware Univ., Newark. Center for Composite Materials.
DESIGN OF THE SPAR-WINGSKIN JOINT Final Report, 1 Sep. 1977 - 15 Dec. 1978
Ralph D. Cope and R. Byran Pipes Wright-Patterson AFB, Ohio Air Force Flight Dynamics Lab. Mar. 1979 188 p refs
(Contract F33615-77-C-3132; AF Proj. 2401)
(AD-A072426; AFFDL-TR-79-3015) Avail: NTIS HC A09/MF A01 CSCL 13/5

A variety of spar-wingskin joint concepts were investigated to optimize out-of-plane strength while still providing low weight and ease of fabrication. The spar-wingskin configuration consists of a thin spar which overlaps and is co-cured perpendicular to a thick wingskin. Investigation parameters were the joint geometry in the immediate vicinity of the base of the spar, and the spar-to-spar spacing. It was found that by varying the overlap geometry and decreasing the interspar spacing, a significant increase in out-of-plane strength could be realized. A theoretical analysis was made by the extended use of the finite element technique. Joint strength was predicted through the application of Tsai-Wu and maximum stress failure criteria. These results were verified by comparison to experimental results in which all significant concepts were fabricated and tested. GRA

N80-11073# Neilsen Engineering and Research, Inc., Mountain View, Calif.
PREDICTION OF LATERAL AERODYNAMIC LOADS ON FIGHTER AIRCRAFT AT HIGH ANGLES OF ATTACK Summary Technical report, 1 May 1977 - 31 Jul. 1978
S. B. Spangler and S. C. Perkins, Jr. 31 Jul. 1978 86 p refs
(Contract N00014-74-C-0344)
(AD-A071893; NEAR-TR-173; ONR-CR212-225-4F) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report presents a brief summary of methods and experimental data developed over a four year period, to predict the static lateral forces acting on a modern fighter-type aircraft at high angles of attack, and small angles of sideslip characteristic of a departure flight attitude. The major part of the report is devoted to application of the methods to two aircraft configurations on which detailed data exist, comparison of the predicted and measured results, and evaluation of the comparisons. The configurations are a research V/STOL fighter configuration and the F-5 aircraft. Comparisons are made on nose vortex positions, circulation distributions in the separated region above the nose, flow velocities in the same region, and loads on the nose alone and complete configuration. Generally, the methods predict all of the correct behavior of these highly nonlinear and complicated flows. However, the agreement in many cases is not sufficiently good to consider the methods as satisfactory design or analysis techniques. Additional work is suggested to provide further verification and improvements. GRA

N80-11074# Polar Research Lab., Inc., Santa Barbara, Calif.
FEASIBILITY TESTS OF USE OF THE TRI TURBO-3 AIRCRAFT FOR ARCTIC AXBT DROPS Interim Report
B. M. Buck 25 Jul. 1979 17 p
(Contract N00014-79-C-0002; RR0320501)
(AD-A073159; PRL-TR-19) Avail: NTIS HC A02/MF A01 CSCL 08/10

Field feasibility trials of the new Arctic Tri Turbo-3 Aircraft were conducted as part of ONR's Arctic East Program in the Eurasian Basin. One of these trials was a test of its usefulness to collecct temperature profiling data in the Greenland-Svalbard Strait in support of underwater acoustics studies. This report describes the aircraft facilities, dropping techniques and results of trial drops. GRA

N80-11075# Kuhn (Richard E.), Newport News, Va.
HEIGHT OF SPRAY PRODUCED BY VERTICAL TAKEOFF AND LANDING (VTOL) AIRCRAFT
Richard E. Kuhn Apr. 1979 30 p refs
(Contract N00167-78-M-2599)
(AD-A073099; DTNSRDC/ASED-79/04) Avail: NTIS HC A03/MF A01 CSCL 01/2

The flow phenomenon involved in the production of spray by a vertical takeoff and landing aircraft hovering over smooth water is examined, and a method for predicting spray height is developed from a correlation of the limited amount of large-scale data available. The method is limited to conditions where the spray height does not exceed the nozzle or rotor height and includes VTOL concepts ranging from the helicopter to jet VTOL'S. Application of the method shows that the spray height is primarily dependent on the operating weight of the aircraft and is only slightly dependent on the disk loading. GRA

N80-11076# Pisa Univ. (Italy). Ist. di Aeronautica.
A METHOD FOR EVALUATING AIRCRAFT TAKE-OFF PERFORMANCE [UN METODO PER LA VALUTAZIONE DELLE PRESTAZIONI DEI VELIVOLI]
C. Casarosa, A. Mancino, and N. Motroni. Jun. 1978. 74 p. refs. In ITALIAN; ENGLISH summary.
(Contracts CNR-76-00442.07; CNR-76-01620.07)
(Rept-1663; AIA-78-1) Avail: NTIS HC A04/MF A01

A theoretical method and a computation program for aircraft takeoff performance evaluation are presented. The method is based on the integration of the center of gravity motion equation and allows for the evaluation of takeoff performance in function of the main aerodynamic and propulsive characteristics of the aircraft as well as of the takeoff procedure used. Performance evaluation in the case of critical engine failure after a critical point is also possible. The method was tried for the takeoff performance evaluation of a typical executive aircraft having two turbojet engines. Theoretical results were compared with experimental ones and good agreement is shown. Results show that the use of this computerized simulation method for determining aircraft to airfield compatibility is reliable.
Author (ESA)

N80-11077# National Swedish Road and Traffic Research Inst., Linkoeping.
AIRCRAFT ROLLING RESISTANCE IN LOOSE, DRY SNOW: A THEORETICAL ANALYSIS
Mats Lidstroem. 1979. 40 p. refs. Sponsored by Natl. Swed. Civil Aviation Admin.
(VTI-173-A) Avail: NTIS HC A03/MF A01

In order to provide data on the rolling resistance of aircraft in dry, loose snow, measurements using an aircraft tire and an ASTM-tire were carried out. In order to be able to predict the rolling resistance as a function of aircraft speed, static wheel load, snow density, and snow depth, with the presented measurements as base, a complementary theoretical predictive model was derived. Finally, after comparing theory and practical measurements, a formula for the determination of the rolling resistance as a function of aircraft and snow parameters is suggested.
Author (ESA)

N80-11078# National Transportation Policy Study Commission, Washington, D. C.
NEW AIRCRAFT TECHNOLOGY: REPORT ON THE FARNBOROUGH INTERNATIONAL AIR SHOW
Samuel Colwell. Aug. 1979. 12 p.
(PB-298345/0; NTPSC-WP-79/06) Avail: NTIS HC A02/MF A01 CSCL 01C

Aircraft displayed at the air show are described with emphasis on those that are likely to have significant impact on nonmilitary aviation market for the rest of the century. Categories of aircraft considered include commercial, light transport, general aviation, and helicopters. The Mountbatten (SR.N4) MK.3 hovercraft is also discussed. Of particular interest is the number of STOL aircraft and the reduced noise characteristics.
A.R.H.

N80-11024 Allerton Press, Inc., New York, N. Y.
SELECTING THE PASSENGER AIRPLANE FUSELAGE
Yu. N. Egorov. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 114-116. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 135-138.
(For primary document see N80-11002, 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-11079*# Old Dominion Univ., Norfolk, Va.
AVIONICS: PROJECTIONS FOR CIVIL AVIATION, 1995-2000
Griffith J. McRee (Old Dominion Univ.), Russell E. Lueg (Ala. Univ., Tuscaloosa, Ala.), Patricia A. Carlson, ed. (Rose-Hulman Inst. of Tech.), Yearn H. Choi (Jackson State Univ.), John Barrett Crittenden (Va. Polytech. Inst. and State Univ.), Jeffrey C. Dozier (Coll. of William and Mary), Robert M. Eastman (Missouri-Columbia Univ.), Jerry W. Gravander, ed. (Clarkson Coll. of Tech.), Andrew Hargrove (Hampton Inst.), Alvin E. Keston, ed. (New Mexico State Univ.) et al. Sep. 1979. 205 p. refs. Sponsored by NASA.
(NASA-CR-159035) Avail: NTIS HC A10/MF A01 CSCL 10D

A view of the 1995-2000 civil aviation avionics system is summarized. Descriptions of the scenarios considered, the avionics technologies, the 1995-2000 avionics system, and an evaluation of the impacts are presented. Recommendations are also presented.
R.E.S.

N80-11080# Semcor, Inc., Moorestown, N. J.
AVIONIC SYSTEM ARCHITECTURE INVESTIGATION (AVSAR II)
D. Davino, R. Mereday, M. Minnich, R. Noble, and L. Sorenson. 20 Mar. 1979. 246 p.
(Contract DAAB07-78-C-2445; DA Proj. 1L1-62202-AH-85)
(AD-A071743) Avail: NTIS HC A11/MF A01 CSCL 09/2

The objective of the Avionic System Architecture Investigation (AVSAR II) was to investigate the extent to which multiplex technology and integrated control/display techniques could be applied to the AH-1S Night Cobra (Step 4). The primary purpose of the study was to determine if the integration of a multiplex data bus system would have a significant impact on aircraft system weight. Secondary objectives were to determine whether a reduction of crew workload and a reduction of cockpit real estate requirements could be effected through implementation of the new architecture. This technical report describes the system analysis, system definition, and system integration considerations that resulted in a Step 4 Night Cobra avionic system with integrated controls/displays and a multiplex data bus.
GRA

N80-11081# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
CONTROL STRATEGIES FOR COMPLEX SYSTEMS FOR USE IN AEROSPACE AVIONICS. Interim Report, 1 Jul. 1978 - 30 Jun. 1979
Jose B. Cruz, Jr. 10 Jul. 1979. 17 p. refs.
(Grant AF-AFOSR-3633-78; AF Proj. 2304)
(AD-A072540; AFOSR-79-0907TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

This interim scientific report highlights the results on a research project devoted to the development of concepts and methodology for the analysis and synthesis of control strategies for complex systems. The results are documented in journal articles, meeting papers, and technical reports cited in the list of publications. The results are summarized under the following headings: Sensitivity adaptive feedback with estimation redistribution, sensitivity reducing compensators using observers, design of optimal systems with low sensitivity to small time delays, output feedback compensator design, zeros of multivariable systems, optimal control of a class of singularly perturbed nonlinear systems, Newton-Lyapunov design for a class of nonlinear regulator problems, variable structure model following control systems, and robust control system design.
GRA

N80-11082# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
A FAULT TOLERANCE ASSESSMENT OF DAIS. Final Report, Sep. 1978 - Mar. 1979
Walter L. Heimerdinger and Karl M. Fant. Mar. 1979. 128 p. refs.
(Contract F33615-77-C-1232; AF Proj. 2003)
(AD-A072450; HONEYWELL-79SRC13; AFAL-TR-79-1007)
Avail: NTIS HC A07/MF A01 CSCL 09/2

A functional/graphical approach is used to assess the fault tolerance of the Digital Avionics Information System (DAIS), a real-time federated multicomputer digital avionics system. Two separate assessments are made; first, the functional/graphical approach is used to assess the fault tolerance of the DAIS architecture, then the utility of the functional/graphical approach itself is considered. The functional/graphical approach used has two complementary aspects: a functional characterization

of fault phenomena, and a graphical approach to the representation of system behavior, both for normal operations and in response to faults. The graphical representation used is based on the LOGOS system description schema, which uses two associated graphs, a control graph and a data graph, to represent a process or activity. The study extends earlier functional/graphical studies of individual, isolated fault tolerance mechanisms, to the assessment of a complex large scale digital system. The assessment begins by modeling top level DAIS control functions and includes DAIS master executive functions and top level functions from a potential DAIS application. GRA

N80-11083# Arinc Research Corp., Annapolis, Md.
AVIONICS MASTER PLAN DATA BASE MECHANIZATION ARCHITECTURE
J. Maquire and M. Berger Jun. 1979 56 p
(Contract F33657-79-C-0475)
(AD-A071545; PUBL-1743-01-1-1963) Avail: NTIS HC A04/MF A01 CSCL 05/1

This report addressed the development of the architecture for mechanizing the program tracking system used by the Deputy for Avionics Control ASD/AX in the Avionics Master Plan AMP preparation and in the avionics control function. The effort described is to be utilized by the ASD Data Processing facility ADP in its coding and implementation of the AMP data base storage and retrieval program on the DEC PDP 11T60 computer. GRA

N80-11084# Army Aeromedical Research Lab., Fort Rucker, Ala.
IN-FLIGHT PERFORMANCE EVALUATION OF EXPERIMENTAL INFORMATION Final Report
Michael Lees, Michael G. Sanders, Raymond T. Burden, Jr., and Kent A. Kimball May 1979 27 p refs
(DA Proj. 3E7-62773-A-819)
(AD-A071701; USAARL-79-8) Avail: NTIS HC A03/MF A01 CSCL 01/4

The objective of this investigation was to evaluate a method of displaying information which permits rapid transmission of flight data to the operator under three viewing conditions: (1) day flights with the unaided eye, (2) night flights with the unaided eye, and (3) night flights using the AN/PVS-5 night vision goggles (40 deg field of view focused at infinity). Information obtained from the analyses of aviator performance data demonstrated the potential of presenting flight information to the aircrew via prototype displays for all viewing modes. GRA

N80-11085# Tactical Air Command, Langley AFB, Va.
F-4 RADAR ALTIMETER AURAL WARNING
29 Jun. 1979 4 p
(AD-A072870) Avail: NTIS HC A02/MF A01 CSCL 01/4

The F-4 radar altimeter has a red warning light that lights up when the aircraft goes below a selected altitude. This light is small and will not attract the pilot's attention if it is not in his field of view. Numerous accidents have occurred in which aircraft have struck the ground in level terrain when the mission required primarily straight and level flight. It has been postulated that an aural warning supplied by the radar altimeter would have alerted the aircrew in sufficient time to avoid contact with the ground. GRA

N80-11086# Battelle Inst., Frankfurt am Main (West Germany). Dept. of Economics and Social Science.
DEVELOPMENT OF STARTING POINTS FOR A SELECTIVE SUPPORT PROGRAM FOR CIVIL AVIONICS TECHNOLOGIES Final Report
Eberhard Hellermann and Herbert Weinreich Bonn Bundesmin. fuer Forsch. u. Technol. Jun. 1978 251 p refs In GERMAN; ENGLISH summary
(Contract BMFT-LFF-7605)
(BMFT-FB-W-78-21) Avail: NTIS HC A12/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 52,50

The technological and economic structure of the German civil avionics industry was analyzed. The study was mainly designed to answer the question of whether and in which area the technological development of the German civil avionics industry can be meaningfully furthered by systematic government support. The relevant information was obtained in interviews with experts in Germany and other countries. A Delphi survey and a workshop served to assess and check the plausibility of the results obtained. A catalog of 11 technologies recommended for public assistance under a support program of the Federal German Ministry of Research and Technology is given.
Author (ESA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-11087*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLUENCE OF COOLANT TUBE CURVATURE ON FILM COOLING EFFECTIVENESS AS DETECTED BY INFRARED IMAGERY
S. Stephen Papell, Robert W. Graham, and Richard P. Cageao Washington Nov. 1979 18 p refs
(NASA-TP-1546; E-066) Avail: NTIS HC A02/MF A01 CSCL 21E

Thermal film cooling footprints observed by infrared imagery from straight, curved, and looped coolant tube geometries are compared. It was hypothesized that the differences in secondary flow and in the turbulence structure of flow through these three tubes should influence the mixing properties between the coolant and the main stream. A flow visualization tunnel, an infrared camera and detector, and a Hilsch tube were employed to test the hypothesis. A.W.H.

N80-11088# Air Force Logistics Command, Wright-Patterson AFB, Ohio. Directorate of Management scienties.
OPPORTUNISTIC MAINTENANCE ENGINE SIMULATION MODEL: OMENS 2 Final Report
John L. Madden, Philip A. Persensky, Virginia L. Williamson, and Robert A. Novak Jun. 1979 133 p
(AD-A072516; AFLC/XRS-79-137-1) Avail: NTIS HC A08/MF A01 CSCL 21/5

This model simulates the operation of a single engine through a very long period of future time. In operating over this extended period, the engine must be removed for repair from time to time. Repairs become necessary on the engine when one of the modules fails prematurely or whenever it requires replacement of an internal life-limited part. The model tracks all the engine removals and all replacements of each module and offending life-limited part through future simulated time. Records are kept through simulated time of the number of removals and the reasons for removal for each module and for the engine. Reasons for removal include (1) premature failure of one or more parts, (2) reaching the scheduled operating time limit, or (3) being screened out due to the opportunistic maintenance policy. The model also computes maintenance, pipeline, parts costs, and transportation costs associated with the forecasted removals and aggregates the costs for any desired life cycle period (in years) to aid in selecting that optimal maintenance policy which produces the least total cost. GRA

N80-11089# Naval Air Test Center, Patuxent River, Md. Air Vehicle Technology Dept.
SIMULATED MISSION ENDURANCE TEST (SMET) FOR AN AIRCRAFT ENGINE TO BE USED IN A FIGHTER/ATTACK ROLE Final Report
S. M. Cote and J. L. Birkler 23 Apr. 1979 130 p refs
(AD-A071907; NADC-77051-30) Avail: NTIS HC A07/MF A01 CSCL 21/5

A 750 hour simulated mission endurance test (SMET) cycle which will closely represent the expected in-service engine duty cycle for the F18 power plant has been developed. The test cycle evolved from an extensive investigation of Navy and Marine

fleet engine operating conditions experienced in fighter and attack aircraft during shorebased and carrier operations. The test cycles reflect power lever movements that are an order of magnitude greater than originally thought, and incorporate a representative distribution of time at intermediate and augmented power. It is concluded that this SMET will aid the overall development process to substantiate the suitability of a new engine for service introduction. GRA

N80-11090# Ford Motor Co., Dearborn, Mich.
BRITTLE MATERIALS DESIGN, HIGH TEMPERATURE GAS TURBINE Interim Report, 30 Sep. 1977 - 31 Mar. 1978
Arthur F. Mclean and John R. Secord. Army Materials and Research Center, Watertown, Mass. Army Materials and Research Center, Watertown, Mass. May 1979. 77 p. refs.
(Contracts DAAG46-71-C-0162; ARPA Order 1849)
(AD-A071750; AMMRC TR-79-12) Avail: NTIS HC A05/MF A01 CSCL 21/5

Modifications in the procedure for hot spin testing ceramic rotors resulted in several changes. Of twenty-five rotors being proposed for hot testing, ten were inspected by dye-penetrant methods, dimensionally inspected, and curvic coupling contact patterns checked. Five have now completed hot testing, six are ready for test, and the remainder are in processing. Four ceramic turbine rotors and one rotor hub were qualified for hot testing in the cold spin pit at 55,000 rpm, and three rotors and two rotor hubs were qualified to 70,000 rpm. Blades were lost on all rotors qualified to 70,000 rpm because of gross flaws in the blade cross section. From four to eleven blades per rotor were lost in qualification testing. Six rotors was subjected to a twenty-five hour durability test in the hot spin test rig at 50,000 rpm and 1800 F rim temperature. Four rotors completed the test and two failed during acceleration to test speed. In several instances, post test rotor inspection revealed presence of curvic tooth cracking after disassembly from the test shaft. One of the successful rotors was operated an additional 175 hours to complete the objective of 200 hours at 1800 F rim temperature over a simulated duty cycle speed schedule. GRA

N80-11091# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
BLADED DISK DYNAMIC RESPONSE Final Report, 1 Sep. 1977 - 1 Sep. 1978
J. L. Bearden. Wright-Patterson AFB, Ohio. AFAPL. Feb. 1979. 41 p. refs.
(Contract F33615-77-C-2093; AF Proj. 2307)
(AD-A071975; PWA-FR-10576; AFAPL-TR-79-2002) Avail: NTIS HC A03/MF A01 CSCL 21/5

The feasibility of applying an optical derotator system to conduct dynamic structural analysis of a rotating/vibrating fully bladed gas turbine rotor assembly in a controlled spin pit facility was investigated. Interferometric holograms using pulsed laser holography were constructed for various assembly modes of vibration at assembly rotational velocities up to 835.6 rad/sec (8000 rpm). Results of this investigation are encouraging, although a large bias fringe density, resulting from a plexiglass panel in the optical train, made definitive analysis of the resultant mode shapes difficult. GRA

N80-11092# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
THE EFFECT OF INTERBLADE PHASE ANGLE AND SOLIDITY ON THE TIME VARIANT AERODYNAMIC RESPONSE OF A COMPRESSOR STATOR Interim Report, 1 May 1978 - 1 May 1979
R. R. Allran. Jun. 1979. 55 p.
(Contract F49620-78-C-0070; AF Proj. 2307)
(AD-A071878; DDA-EDR-9930; AFOSR-79-0853TR) Avail: NTIS HC A04/MF A01 CSCL 21/5

The overall objective of this experimental program was to quantify the effects of the reduced frequency as well as the interblade phase angle and associated solidity variations on the fundamental time variant aerodynamics relevant to forced response in turbomachinery. This was accomplished in a large, low speed, single-stage research compressor which permitted variation of the interblade phase angle and solidity by varying the number of rotor to stator blades. A single value of interblade phase angle, 36 degrees and a corresponding value of solidity of .758, the aerodynamically induced fluctuating surface pressure distributions on the downstream vane row, with the primary source of excitation being the upstream rotor wakes, were measured over a wide range of compressor operating conditions. The individual vane surface data were investigated to determine the effect of interblade phase angle and solidity on the overall unsteady pressure magnitude as well as to determine the dynamic pressure coefficient and aerodynamic phase lag for the unsteady pressure differential across the vanes. The unsteady pressure differential data were correlated with predictions from a state-of-the-art flat plate cascade transverse gust analysis. GRA

N80-11093# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
DESIGN AND PERFORMANCE EVALUATION OF SUPERCRITICAL AIRFOILS FOR AXIAL FLOW COMPRESSORS Final Report
H. E. Stephens and D. E. Hobbs. Jun. 1979. 45 p. refs.
(Contract N00019-77-C-0546)
(AD-A071206; PWA-FR-11455) Avail: NTIS HC A03/MF A01 CSCL 20/4

Pratt Whitney Aircraft has developed an analytical design procedure for producing supercritical cascade airfoils satisfying practical aerodynamic and structural requirements. The purpose of this research is to demonstrate the potential for substantial efficiency improvements in compressor stages incorporating these airfoil designs. The midspan section of a fan exit stator was selected for the design application. An airfoil was designed, fabricated, and tested in a transonic cascade tunnel. Test conditions were varied over a wide range of inlet flow angles and inlet Mach numbers to determine design and off-design performance. Test point information included inlet and exit conditions and airfoil surface pressure distribution. GRA

N80-11094# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF AN EJECTOR POWERED ENGINE SIMULATOR AT TRANSONIC MACH NUMBERS Final Report
C. E. Robinson. AEDC. Jul. 1979. 248 p. refs. Sponsored by the Air Force
(AD-A071607; AEDC-TR-78-69) Avail: NTIS HC A11/MF A01 CSCL 20/4

An experimental program was conducted to evaluate an air-driven ejector for use as a turbo-engine simulator in wind tunnel testing. The use of an engine simulator will provide the capability to simultaneously simulate inlet and afterbody flow fields of a turbo-powered vehicle. The ejector-powered engine simulator (EPES) was fitted to the right-wing nacelle of a 0.06 scale B-1 aircraft model. The B-1 model was chosen for the investigation because of the availability for comparisons of inlet and nozzle afterbody data previously obtained in the Arnold Engineering Development Center (AEDC) Propulsion Wind Tunnel Facility Propulsion Wind Tunnel (16T) using conventional test techniques. A limited amount of flight data from the B-1 flight to wind tunnel correlation program was also available to aid in determining the effectiveness of the EPES as a wind tunnel test tool. GRA

N80-11095# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE USE OF THE MAURER FACTOR FOR ESTIMATING THE COST OF A TURBINE ENGINE IN THE EARLY STAGES OF DEVELOPMENT Final Report, Jun. 1978 - Jun. 1979
Charles W. Barrett, Jr. and Michael J. Koenig. Jun. 1979. 165 p. refs.
(AD-A073018; AFIT-LSSR-19-79A) Avail: NTIS HC A08/MF A01 CSCL 14/1

Military managers are faced with increasing systems costs. One area where this increasing cost is especially true is in the acquisition of aircraft weapon systems. A driving factor in the aircraft cost is the turbine engine, and therefore, acquisition managers have been tasked with developing cost estimating methods that will more accurately predict turbine engine cost. At present, several parametric costing models available are briefly discussed in this report. However, the primary objective of this report, is to evaluate a costing technique used extensively by the Navy--the Maurer Factor (MF) technique. The MF technique is a parametric costing technique based on the materials in a turbine engine. The report includes the following: (a) a detailed

description of the MF technique; (b) a validation of the MF technique; (c) the development of an estimated MF (EMF) model using engine performance parameters; and (d) statistical analysis and validation of the EMF models. GRA

N80-11096# Defence Research Information Centre, Orpington (England).
ON THE DEVELOPMENT OF THE RB 199
Mariano Gubitosi. London, Dec. 1978. 22 p. Transl. into ENGLISH from Rivista Aeron. (Rome), v. 54, no. 3, May-Jun. 1978 p. 32-39.
(DRIC-Trans-5429; BR67500) Avail: NTIS HC A02/MF A01.
The development of the RB 199 engine as a tailor-made solution for the MRCA 'Tornado' project is discussed. Operational requirements, such as very high thrust under combat flight conditions and low fuel consumption under other flight conditions, are considered. Design technological alternatives, principally thrust/weight ratio, and as built characteristics are examined. The triple-shaft configuration is treated in light of the performance principles of a jet engine. Among functional choices, afterburn, the double flow solution, and the setting of the by-pass ratio are particularly detailed. Finally, the RB 199 turbofan is described and a short synopsis of the design evolution of this engine is given. Author (ESA)

N80-11006 Allerton Press, Inc., New York, N. Y.
STATISTICAL DIAGNOSTICS AIRCRAFT ENGINES
Yu. V. Kozhevnikov. *In its* Soviet Aeron., Vol. 21, No. 2, 1978 p. 20-25. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p. 30-35 (For primary document see N80-11002, 02-01).
Copyright. Avail: Allerton Press Inc., 150 Fifth Ave., N.Y. 10011; $45.00.

N80-11007 Allerton Press, Inc., New York, N. Y.
OPTIMAL THERMOGASDYNAMIC DESIGN OF GAS TURBINE ENGINES USING ELEMENT PROTOTYPES, 1
Yu. V. Kozhevnikov, V. O. Borovik, V. S. Ivanov, V. A. Talyzin, I. N. Agliullin, and Yu. V. Meluzov. *In its* Soviet Aeron., Vol. 21, No. 2, 1978 p. 26-32. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p. 36-43 (For primary document see N80-11002, 02-01).
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-11097*# Systems Technology, Inc., Mountain View, Calif.
A COMPILATION AND ANALYSIS OF HELICOPTER HANDLING QUALITIES DATA. VOLUME 1: DATA COMPILATION Report, Sep. 1976 - Feb. 1978
Robert K. Heffley, Wayne F. Jewell, John M. Lehman, and Richard A. VanWinkle. Aug. 1979. 387 p. refs.
(Contract NAS2-9344)
(NASA-CR-3144; TR-1087-1) Avail: NTIS HC A17/MF A01 CSCL 01C.
A collection of basic descriptive data, stability derivatives and transfer functions for six degrees of freedom, quasi-static model is introduced. The data are arranged in a common, compact format for each of the five helicopters represented. The vehicles studied include the BO-105, AH-1h, and the CH53D. R.C.T.

N80-11098*# Boeing Commercial Airplane Co., Seattle, Wash.
LINEAR SYSTEMS ANALYSIS PROGRAM, L224(QR). VOLUME 2: SUPPLEMENTAL SYSTEM DESIGN AND MAINTENANCE DOCUMENT Final Report, May 1975 - May 1977
K. W. Heidergott. Nov. 1979. 142 p. refs.
(Contract NAS1-13918)
(NASA-CR-2862; D6-44471) Avail: NTIS HC A07/MF A01 CSCL 01C.
The computer program known as QR is described. Classical control systems analysis and synthesis (root locus, time response, and frequency response) can be performed using this program. Programming details of the QR program are presented. R.C.T.

N80-11099# Naval Surface Weapons Center, White Oak, Md.
INEQUALITIES AND APPROXIMATION WITH APPLICATIONS TO VSTOL AIRCRAFT
William W. Hager and John W. Wingate. 3 Dec. 1978. 24 p. refs.
(AD-A071807; NSWC/WOL/TR-78-210) Avail: NTIS HC A02/MF A01 CSCL 01/3.
A class of inequalities are discussed that are related to the following topics: (1) error estimates for variational inequality and optimal control approximation; (2) stability for mathematical programs; and (3) solution regularity for optimal control problems. These results are used to study the error in the semidual method for approximating the solution to optimal control problems. The application of the semidual to optimize VSTOL flight trajectories is discussed. GRA

N80-11100# California Univ., Los Angeles. School of Engineering and Applied Science.
ENTROPHY ANALYSIS OF FEEDBACK FLIGHT DYNAMIC CONTROL SYSTEMS Final Report, May 1977-May 1978
Henry Lawrence Weidemann and C. T. Leondes. Jan. 1979. 165 p. refs.
(Contract F33615-77-C-3013; AF Proj. 2307)
(AD-A072259; AFFDL-TR-78-123) Avail: NTIS HC A98/MF A01 CSCL 01/2.
This report is a study of the application of the entropy function of Information Theory to the analysis of sampled data systems so characteristic of the evolving and important field of digital flight control, including multimode systems. The systems studied are both feed-forward and feedback with the emphasis placed on the regulator problem. The feature common to all the configurations is the presence of a sensor which measures the input signal and which has an output that is usually some random function of the input. For the purposes of the analysis it is convenient to describe the behavior of the sensor by its Sensor Channel Transmittance, which is defined as the mutual information between the input and output of the measuring device. This quantity is not independent of the properties of the input signal, however, in any given problem it need only be calculated once. This research is important because it imbeds the control problem in the communication problem and clearly demonstrates the manner in which the information handling capability of the system elements limits performance, and is, therefore, of considerable potential significance to advanced flight dynamic systems. GRA

N80-11101# Rodden (William P.), La Canada, Calif.
AERO-SERVO-ELASTIC STABILITY ANALYSIS Final Report, 6 Apr. 1976 - 21 Jul. 1977
William P. Rodden, Mildred R. Zeifman, and John M. Powers, Jr. Apr. 1979. 205 p. refs.
(Contract N00019-76-C-0346)
(AD-A072797) Avail: NTIS HC A19/MF A01 CSCL 14/2.
A general matrix formulation of the aero-servo-elastic stability problem is presented based on the British method of flutter analysis. The analysis applies to the closed-loop system, and the digital computer program (MPASES) developed to perform the analysis is described. An application is made to a typical air-to-air missile with three feedback loops. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-11102*# Virginia Univ., Charlottesville.
EXPERIMENTAL FEASIBILITY STUDY OF THE APPLICA-

TION OF MAGNETIC SUSPENSION TECHNIQUES TO LARGE-SCALE AERODYNAMIC TEST FACILITIES
R. N. Zapata, Robert R. Humphris, and Karl C. Henderson 1975 10 p refs Submitted for publication
(Grants NGR-47-005-029; NGR-47-005-110; NGR-47-005-112; NsG-1010)
(NASA-CR-146761) Avail: NTIS HC A02/MF A01 CSCL 14B

Based on the premises that magnetic suspension techniques can play a useful role in large scale aerodynamic testing, and that superconductor technology offers the only practical hope for building large scale magnetic suspensions, an all-superconductor 3-component magnetic suspension and balance facility was built as a prototype and tested sucessfully. Quantitative extrapolations of design and performance characteristics of this prototype system to larger systems compatible with existing and planned high Reynolds number facilities at Langley Research Center were made and show that this experimental technique should be particularly attractive when used in conjunction with large cryogenic wind tunnels. A.R.H.

N80-11103*# San Jose State Univ., Calif. Dept. of Psychology.
PERCEPTION AND PERFORMANCE IN FLIGHT SIMULATORS: THE CONTRIBUTION OF VESTIBULAR, VISUAL, AND AUDITORY INFORMATION Final Report
Oct. 1979 20 p refs
(Grant NsG-2269)
(NASA-CR-162129) Avail: NTIS HC A02/MF A01 CSCL 14B

The pilot's perception and performance in flight simulators is examined. The areas investigated include: vestibular stimulation, flight management and man cockpit information interfacing, and visual perception in flight simulation. The effects of higher levels of rotary acceleration on response time to constant acceleration, tracking performance, and thresholds for angular acceleration are examined. Areas of flight management examined are cockpit display of traffic information, work load, synthetic speech call outs during the landing phase of flight, perceptual factors in the use of a microwave landing system, automatic speech recognition, automation of aircraft operation, and total simulation of flight training. A.W.H.

N80-11104*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
PRELIMINARY INVESTIGATIONS OF DESIGN PHILOSOPHIES AND FEATURES APPLICABLE TO LARGE MAGNETIC SUSPENSION AND BALANCE SYSTEMS
C. P. Britcher Nov. 1979 35 p refs
(Grant NsG-7523)
(NASA-CR-162433) Avail: NTIS HC A03/MF A01 CSCL 14B

The technology which is required to allow the principles of magnetic suspension and balance systems (MSBS) to be applied to the high Reynolds number transonic testing of aircraft models is examined. A test facility is presented as comprising a pressurized transonic cryogenic wind tunnel, with the MSBS providing full six degree of freedom control. The electro-magnets which are superconducting and fed from quiet, bipolar power supplies are examined. A model control system having some self adaptive characteristics is discussed. A.W.H.

N80-11105# Systems Technology, Inc., Hawthorne, Calif.
MANNED ENGINEERING FLIGHT SIMULATION VALIDATION, PART 2: SOFTWARE USER'S GUIDE Final Report, Aug. 1977 - Nov. 1978
Susan A. Riedel Feb. 1979 57 p
(Contract F33615-77-C-206518)
(AD-A071395; STI-TR-1110-2; AFFDL-TR-78-192-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 14/2

The goal of this research is to establish an orderly, relatively simple method for optimizing the presentation of motion cues in moving base simulations. This is accomplished via choice of the drive logic parameters for a given simulator and flying task. The method developed here is based upon use of motion fidelity criteria. It has been applied to optimize the LAMARS motion base drive logic parameters for an air-to-ground scenario. The methods and procedures can be applied for any given motion base and any desired scenario. This report describes the FORTRAN computer program used for evaluating and optimizing motion base drive logic. GRA

N80-11106# Little (Arthur D.), Inc., Cambridge, Mass.
SYSTEMS ANALYSIS OF ARCTIC FUELS DISPENSING EQUIPMENT Final Report, 1 Jan. - 30 Jun. 1979
Donald B. Rosenfield, Edgar A. Gilbert, III, and John S. Howland 30 Jun. 1979 174 p
(Contract DAAK70-77-D-0024)
(AD-A071815; ADL-80260-18) Avail: NTIS HC A08/MF A01 CSCL 21/4

A systems analysis was performed to evaluate military fuel dispensing systems for arctic applications. The present systems, the Forward Area Refueling Equipment (FARE) and Fuels System Supply Point (FSSP), encounter problems in the areas because engines fail to start and elastomerics become brittle at temperatures of -60 F. The systems analysis consisted of two phases of evaluating and scoring system attributes for numerous combinations of systems concepts and components. The systems with the highest evaluations were the basic designs with gas turbine drives, state-of-the-art elastometrics, and either state-of-the-art batteries or a compressed gas start. It was also concluded that additonal development should be undertaken in the area of cold weather elastomerics. GRA

N80-11107# Naval Aerospace Medical Research Lab., Pensacola, Fla.
DOCUMENTATION AND USER'S MANUAL FOR THE VISUAL DETECTION SIMULATOR (VDS) Interim Report
Julie A. Hopson Apr. 1979 348 p
(ZF51524004)
(AD-A070487; NAMRL-SR-79-2) Avail: NTIS HC A15/MF A01 CSCL 05/9

The Visual Detection Simulator (VDS) is comprised of three individual subsystems: A Link GAT-1 trainer, a projection system, and a PDP 8/e controller. These systems have been custom interfaced to permit the study of target acquisition in a simulated in-flight environment. The purpose of this report is to provide an operational and maintenance manual for the VDS system. Subsystems and their interrelationships are described, and operational procedures for the total system are provided. Computer programs for the simulator operation, data transfer, and the maintenance, and testing procedures are included. GRA

N80-11108# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE MEASUREMENT OF FILM COOLING EFFECTIVENESS IN SHORT DURATION WIND TUNNELS
J-P. Ville, D. Cunat, and B. E. Richards Dec. 1978 59 p refs
(VKI-TN-127) Avail: NTIS HC A04/MF A01

A method to measure adiabatic wall effectiveness and the associated heat transfer coefficient of a film cooling system under simulated gas turbine conditions in a short duration wind tunnel is described. This method is based on the measurement of heat transfer rates under different wall and coolant temperature conditions and the definition of a linear relationship between a heat transfer coefficient, h, based on the main stream recovery temperature, and a non dimensional temperature theta. The measurements on a film cooled flat plate at Mach 0.6, main stream temperature of 385 K, and unit Reynolds number of 2.4 million for a range of wall to main stream temperature ratios of from 0.70 to 0.93 and a range of coolant to mainstream temperature ratios between 0.73 and 0.93 with a coolant relative mass flow from 0.6 to 1.4 confirm the linearity of the h (theta) relation. This demonstrates that a short duration facility can provide good film cooling data with this method. Author (ESA)

N80-11109# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
DATA ACQUISITION SYSTEMS FOR THE HYPERSONIC GUN AND NITROGEN WIND TUNNELS
R. P. Bartlett, J. Davis, and J. K. Harvey Feb. 1979 32 p refs
(Contract AT/2037/084)
(IC-Aero-79-03) Avail: NTIS HC A03/MF A01

A digital system that links the Nitrogen Tunnel and the No. 2 Gun Tunnel to a time shared minicomputer system was

developed. The prime requirement for both facilities was data acquisition and processing, but in the case of the Nitrogen Tunnel it has also been possible to make on-line calculations and to present the processed data to the operator while the facility is running. A high speed digital data acquisition system was also commissioned to make detailed time resolved measurements in the Gun Tunnel which has a steady running time of a few milliseconds. Author (ESA)

N80-11110# Fondazione Ugo Bordoni, Rome (Italy).
SURVEILLANCE AND COMMUNICATION SYSTEMS USING MOBILE MEDIA ON THE AIRPORT SURFACE [SISTEMI DI SORVEGLIANZA E DI COMUNICAZIONE CON MEZZI MOBILI SULLA SUPERFICIE AEROPORTUALE]
Tullio Corzani (Trieste Univ., Italy) and Gabriele Falciasecca (Bologna Univ.) Sep. 1978 10 p refs In ITALIAN Presented at 79th A.E.I. Ann. Reunion, Catanzaro, Italy, Sep. 1978 Sponsored by CNR
(FUB-13-1978) Avail: NTIS HC A02/MF A01

The problems of an airport surface traffic control system developed in Italy are examined. A selection among possible systems is discussed, starting with solutions which use primary radar (now being adopted in many airports) and arriving at a completely automated system for surveillance and control of the airport surface, based on the use of secondary surveillance radar equipment on the ground. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-11111*# General Dynamics/Convair, San Diego, Calif.
SPACE CONSTRUCTION AUTOMATED FABRICATION EXPERIMENT DEFINITION STUDY. (SCAFEDS), PART 3. VOLUME 1: EXECUTIVE SUMMARY Final Report
29 Jun. 1979 33 p
(Contract NAS9-15310)
(NASA-CR-160345; CASD-ASP-78-016-Pt-3-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

A range of tasks focused on a baseline system concept is discussed. A beam builder concept developed to produce a triangular beam is discussed. Beam elements used laminated graphite and glass composite strip material with external surface coatings are described. A.W.H.

N80-11112*# Battelle Columbus Labs., Ohio.
EVALUATION CRITERIA FOR COMMERCIALLY ORIENTED MATERIALS PROCESSING IN SPACE PROPOSALS Final Report
W. F. Moore and J. R. McDowell Jan. 1979 58 p
(Contract NASw-2800)
(NASA-CR-162437; BCL-OA-TFR-78-5) Avail: NTIS HC A04/MF A01 CSCL 22A

An approach and criteria for evaluating NASA funded experiments and demonstrations which have commercial potential were developed. Methods for insuring quick initial screening of commercial proposals are presented. Recommendations are given for modifying the current evaluation approach. New criteria for evaluating commercially orientated materials processing in space (MPS) proposals are introduced. The process for selection of qualified individuals to evaluate the phases of this approach and criteria is considered and guidelines are set for its implementation. R.C.T.

N80-11113# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Hauptabteilung Raumfahrtprogramme.
FEASIBILITY STUDY FOR SELECTED SPACELAB EXPERIMENTS CONDUCTED IN THE DISCIPLINES OF EARTH OBSERVATION AND METEOROLOGY Final Report
Hansgeorg Francois, Hans Werner Killian, Gerhard Bommas, Gerd Steffen, vonArved Breitenstein, Bernd Kunkel, and Peter Mueller Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 103 p refs In GERMAN; ENGLISH summary Prepared in cooperation with MBB, Munich
(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QS-395)
(BMFT-FB-W-77-46) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 21.40

For five remote earth sensing and meteorological experiments proposed for the first SPACELAB mission the conceptual designs and feasibility of these payloads were studied. The results are used to support planning of hardware development. The five experiments selected require equipment such as a multi-channel scanning radiometer, a spectral albedometer, a trace gas analyzer, a multi-channel polarimeter, and a two-frequency microwave scatterometer. The feasibility analyses cover mission planning, system design, SPACELAB interfaces, and development planning. The results clearly show that even for the first SPACELAB mission it is feasible to develop and qualify these selected experiments. Author (ESA)

N80-11114# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Freiburg (West Germany). Inst. fuer Physikalische Weltraumforschung.
USE OF SPACELAB FOR THE SOLUTION OF TERRESTRIAL PLASMA RESEARCH PROBLEMS Final Report
Rainer Kist and Karl Rawer Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1978 65 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1076; DFVLR-BPT-01-QV-296)
(BMFT-FB-W-78-08) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 13.45

A representative review of the problems in plasma physics is given. The main aims and problems of laboratory plasma physics are discussed in more detail. A few examples are chosen to demonstrate the potential of Spacelab plasma physics experiments to achieve these goals and help solve these problems. Candidates for plasma physical experiments on Spacelab include studies of excitation and propagation of electromagnetic and electrostatic waves in plasmas; processes and effects due to the interaction of a beam of charged particles with plasmas; processes and effects due to the interaction of strong electromagnetic wave fields with plasmas; production, properties, and consequences of instable plasma states; structure and dynamics of wakes behind bodies moving with respect to the plasma; and plasma diagnostic measuring methods. It is recommended that the use of the specific opportunities afforded by Spacelab for plasma research should be optimized by implementing activities of precursing and accompanying research with suitable laboratory plasma facilities. Author (ESA)

N80-11115# Siemens A.G., Munich (West Germany).
FEASIBILITY STUDY FOR THE SPACELAB USER PROGRAM. MEASUREMENT OF TERRESTRIAL NOISE, RADIO CONTROL Final Report
Reinhard Bredow, Anton Brunner, Dieter Lovis, Theodor Schwierz, Peter Kreutzer, and Rolf Stiefel Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 221 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Std. Elec. Lorenz AG
(Contracts BMFT-WRT-1076; DFVLR-BPT-01-QV-616)
(BMFT-FB-W-78-14) Avail: NTIS HC A10/MF A10; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 46.20

The feasibility of a 90 minute orbiter for scanning terrestrial natural noise (primary noise) and man made noise (secondary noise) was studied. The data are intended for use in compiling a noise map. Both are to be scanned by the 90 minute orbiter especially for the purpose of registrating a noise map. The frequency range to be scanned in the proposed experiment extends from 225 to 1000 MHz. The local scanning is handled by a wide angle antenna along with a narrow beam antenna with reflector size of 10 by 7 m and an area of resolution of about 18 to 70 km. The frequency scanning procedure is carried out by quickly switching extremely spectral pure synthesizers which control the quick amplitude amplification stages of the receiver belonging to the antenna concerned. The data processing system built around a microprocessor controls the sequence of the experiment as well as acquisition, processing, and storage of the picked up data. The incoming data rate will be 150 to 350 kbits depending on the chosen frequency resolution. Author (ESA)

N80-11116# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
PLANNING SYNTHESIS FOR SPACELAB PROJECTS IN COMMUNICATION AND NAVIGATION Final Report
Hans J. Albrecht Oct. 1978 89 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1076; DFVLR-BPT-01-QV-097)
(BMFT-FB-W-78-30) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 18.50

Considering the present state of the art as well as current research work and developmental trends in communication and navigation, an analysis of Spacelab projects in this discipline is presented. An evaluation of experiment proposals submitted within the Federal Republic of Germany is given. As a synthesis of scientific planning activities, criteria of research relevancy, including trend analysis, application-oriented project results, and cost effectiveness are considered. Projects reviewed deal with electromagnetic wave propagation, modulation and bandwith, integrated communication systems, navigation systems, monitoring terrestrial parameters, and equipment technology in space. International coordination is reported and system oriented recommendations as well as a comprehensive bibliography are given. Author (ESA)

N80-11117# Swedish Board for Space Activities, Solna.
SWEDISH SPACE ACTIVITIES DURING 1978 Annual Report
11 May 1979 10 p refs
Avail: NTIS HC A02/MF A01

A build-up of the level of remote sensing activities in Sweden is reported. Meteorological, communication, and navigation applications are cited. National scientific space programs include magnetospheric and ionospheric physics, study of the upper atmosphere, astrophysics, and material sciences. Swedish involvement in various satellite projects, such as the International Sun-Earth Explorer (ISEE) satellite, GEOS 1 and GEOS 2 as well as the International Ultraviolet Explorer (IUE) satellite, is also reported. Sweden conducts an extensive sounding rocket program and activities at the Esrange sounding rocket and balloon range are described. Ground based experiments which involve, among other activities, satellites tracking are also discussed. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-11118# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPTIMUM SHAPE FOR TRANSPIRATION-COOLED NOSE-TIP OF A REENTRY VEHICLE Final Report, Oct. 1974 - Jun. 1978
Kevin E. Yelmgren Nov. 1978 93 p refs
(AF Proj. 2404)
(AD-A072296; AFFDL-TR-78-147) Avail: NTIS HC A05/MF A01 CSCL 16/3

The variations of parameters method was used to determine the optimum nose shape for a reentry vehicle having a transpiration-cooled nosetip (TCNT). Three families of nose shapes were considered - The oblate ellipsoid, the flat face - round shoulder, and the spherical arc - round shoulder. These families are bounded by the flat face - sharp corner at one extreme and the hemisphere at the other extreme. The amount of coolant required by each nose shape during reentry was determined by using a high speed computer to couple the aerodynamic equations with the trajectory equations. The optimum shape is the shape which requires the least amount of coolant for reentry. The flat face - sharp corner shape was found to require the least amount of coolant, about 60 percent less water than the hemisphere. Although the time to impact is longer for the flat face, the smaller surface area and lower heating intensity more than offsets the increased reentry time. The possibility of an optimum flat face height was also investigated; no face height was found that minimized the total heating to the vehicle during reentry. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-11119# Royal Signals and Radar Establishment, Christchurch (England).
THE RSRE SATELLITE COMMUNICATIONS TEST FACILITY
E. H. Thomas Mar. 1978 15 p ref
(RSRE-78008; BR63099) Avail: NTIS HC A02/MF A01

An explanation of the functions of the facility and a list of in-orbit measurement accuracies are presented. The satellite communications test facility essentially consists of a number of satellite communications earth stations connected on-line into a central spacecraft test laboratory and from there into several research and development laboratories. The prime purpose of the facility is to support the development of satellite communications systems. The establishment is engaged in studies of satcoms for various defense purposes. Support to satellite communications projects includes the testing of new types of earth station equipments and sub-systems, and in-orbit testing of spacecraft. Such work includes studies of interference between various signals passing through spacecraft repeaters, diagnosis of fault conditions in the communications sub-systems of orbiting spacecraft, support of inter-operability trials, detailed measurement of transmissions from operational stations, measurement of spacecraft range, and other tasks requiring special expertise. Author (ESA)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-11120*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
APPLICATION OF IPAD TO MISSILE DESIGN
J. E. Santa and T. R. Whiting Apr. 1974 393 p refs Sponsored in part by Army Missile Command, Redstone Arsenal, Ala.
(Contract NAS1-12436)
(NASA-CR-132671) Avail: NTIS HC A17/MF A01 CSCL 16D

The application of an integrated program for aerospace-vehicle design (IPAD) to the design of a tactical missile is examined. The feasibility of modifying a proposed IPAD system for aircraft design work for use in missile design is evaluated. The tasks, cost, and schedule for the modification are presented. The basic engineering design process is described, explaining how missile design is achieved through iteration of six logical problem solving functions throughout the system studies, preliminary design, and detailed design phases of a new product. Existing computer codes used in various engineering disciplines are evaluated for their applicability to IPAD in missile design. A.W.H.

N80-11121*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, PHASE 2. Interim Report
9 Jul. 1979 265 p
(Contract NAS9-15636)
(NASA-CR-160377; D180-25381-1) Avail: NTIS HC A12/MF A01 CSCL 22B

A program plan for the Solar Power Satellite Program is presented. The plan includes research, development, and evaluation phase, engineering and development and cost verification phase, prototype construction, and commercialization. Cost estimates and task requirements are given for the following technology areas: (1) solar arrays; (2) thermal engines

and thermal systems; (3) power transmission (to earth); (4) large space structures; (5) materials technology; (6) system control; (7) space construction; (8) space transportation; (9) power distribution, and space environment effects. J.M.S.

N80-11122*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, PHASE 2. PART 1: MIDTERM BRIEFING
27 Jun. 1979 543 p
(Contract NAS9-15636)
(NASA-CR-160378; D180-25402-1) Avail: NTIS HC A22/MF A01 CSCL 22B

An overview of the program plan for the Solar Power Satellite Program is given. Progress in the microwave power transmission system is reported. A description is given of the following: (1) launch and recovery site facilities, systems and operations; (2) cargo packaging; (3) earth-to-LEO cargo transportation operations; (4) LEO-to-GEO cargo transportation operations; (5) personnel transportation operations; (6) space vehicles in-space maintenance operations; and (7) SPS maintenance systems and operations. Other topics discussed include GEO base operations, satellite construction operations, intra-base logistics, and GEO base definition. A research and program plan is presented along with cost estimates. J.M.S.

N80-11123*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY
26 Jul. 1978 161 p Prepared jointly with GE, Schenectady, N.Y. and Grumman, Bethpage, N.Y. and Little (Arthur D.), Boston, Mass. and TRW, Redondo Beach, Calif.
(Contract NAS9-15636)
(NASA-CR-160368; D180-24735-1) Avail: NTIS HC A08/MF A01 CSCL 22B

A synopsis of the study plan for the solar power satellite system is presented. Descriptions of early task progress is reported for the following areas: (1) laser annealing, (2) solid state power amplifiers, (3) rectenna option, (4) construction of an independent electric orbit transfer vehicle, and (5) construction of a 2.5 GW solar power satellite. R.E.S.

N80-11124# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTICAL ARTIFICIAL SATELLITE SEARCHES
Laurence G. Taff May 1979 48 p refs
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A071248; ETS-44; ESD-TR-79-76) Avail: NTIS HC A03/MF A01 CSCL 17/1

This report presents a summary of the current state of optical artificial satellite searches using two telescopes. A rudimentary presentation of search strategy is given for near-stationary satellites and high inclination satellites. A complete discussion of the astrometric and photometric observing procedures necessary for identification and subsequent reacquisition is also provided. We also include a complete list of the necessary software and the minimum necessary tools that the orbital analyst requires. GRA

N80-11125# Raytheon Co., Bedford, Mass. Missile Systems Div.
MODULAR DIGITAL MISSILE GUIDANCE Technical Report, 1 Jan. - 31 Oct. 1978
Frank J. Langley and John Demetrick 30 Nov. 1978 57 p refs
(Contract N00014-75-C-0549)
(AD-A072544; BR11013; ONR-CR233-052-5) Avail: NTIS HC A04/MF A01 CSCL 09/2

The rapidly developing microprocessor technology poses serious standardization problems for the user, particularly the military, where logistics support costs are significant over the life cycle of tactical systems. Whereas standard interface busses are now in existence e.g., (S-100, Intel Multibus, National Microbus, Motorola Microbus, European 'MUBUS'), no two busses are the same. To provide freedom of choice in microcomputer components throughout a system life cycle, a programmable microbus interface module (MIM) using common programmable control elements (PCEs), such as that described in this report, absorbs the interface irregularities of commercial microprocessors, memory and input-output (I/O) modules, thereby allowing the selection of components based on performance, support software, cost and other driving factors. GRA

N80-11126# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
DISTRIBUTED SOURCE GENERATION FOR RF ENVIRONMENTAL MODELING FOR HARDWARE-IN-THE-LOOP MISSILE GUIDANCE SIMULATION
F. M. Belrose and D. A. McPherson 12 Mar. 1979 19 p
(AD-A072927; DRDMI-T-79-37) Avail: NTIS HC A02/MF A01 CSCL 17/7

The basic simulation philosophy of the Advanced Simulation Center (ASC) is to incorporate as much missile hardware as possible into simulation. Errors associated with modeling nonlinear devices are thus avoided while increasing credibility of the simulation. However, this places a special burden on the simulators to display a realistic and comprehensive environment during the simulations because the seekers are stimulated at their operating wavelengths. The seeker is the more difficult subsystem to model properly, and if it is to form valid responses to environmental stimuli, then the stimuli must portray the correct time, space and frequency characteristics of the target, clutter, ECM and multipath. GRA

N80-11127# California Univ., Livermore. Lawrence Livermore Lab.
ANALYSIS OF BERYLLIUM PARTS FOR COSMOS 954
J. E. Hanafee 25 Oct. 1978 47 p refs
(Contract W-7405-eng-48)
(UCRL-52597) Avail: NTIS HC A03/MF A01

Operation Morning Light, conducted to search for the reactor core of Cosmos 954, the nuclear powered Soviet satellite that crashed in the northwest territories of Canada in late January 1978 is discussed. The geometry, condition, microstructure, and possible fabrication history of these beryllium parts are discussed. DOE

N80-11128# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Aerospace Dept.
KINETIC HEATING OF HIGH SPEED MISSILES
B. E. Richards Jan. 1979 23 p refs Presented at AGARD Lecture Series on 'Missile Aerodyn.', Ankara, Rome, and Rhode Saint Genese, Belgium, Mar. 1979
(Preprint-1975-5) Avail: NTIS HC A02/MF A01

Kinetic heating as related to high speed tactical missiles is reviewed. The aspects considered are the design problem, the prediction of heating in attached and separated flows, measurements on configurations in flight and in wind tunnels, ground simulation obtained of flows over models, and the measurement of kinetic heating. Experience is generally obtained from studies in related areas such as high speed aircraft, reentry vehicles, etc., rather than on tactical missiles since little information appears to be available on this application. Because of the wide coverage of the field, a list of references is provided as a guide to papers giving more refined details. Author (ESA)

N80-11129# Technische Universitaet, Brunswick (West Germany). Inst. fuer Nachrichtentechnik.
DESIGN AND OPERATION OF THE SEARCH-COIL MAGNETOMETER EXPERIMENT ON THE SOLAR PROBE HELIOS Final Report
Guenther Dehmel and Fritz Manfred Neubauer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 76 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-0107; GfW-01-H-3004)
(BMFT-FB-W-77-25) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 15.75

Scientific objectives, functioning, electronic and mechanical design, as well as operation of the HELIOS search-coil magnetometer experiment which investigates the magnetic component of electromagnetic waves in the solar wind from 0.3 to 1.0 AU are described. By means of its wave form channel (WFC) the rapid variations in the magnetic field are measured in 3 orthogonal directions from 4 to 128 Hz. The Spectrum Analyzer (SPA) observes power spectral density and peak values on the field components in the eliptic plane and perpendicular to it in the range from 4.7 to 2200 Hz. After amplification they are band-limited by low pass filters in the WFC and analog integrators

give output signals for digitization and transmission. The integrators in the second flight unit were replaced by amplifiers. The SPA data is automatically adapted to the telemetry capacity enabling a continuous transmission. Author (ESA)

N80-11130# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
SIMULATION TESTS OF AN ATTITUDE CONTROL SYSTEM WITH STAGGERED PULSES ON A SATELLITE MOTION STIMULATOR Final Report
Reinhold Stapf and Klaus Becker. Bonn: Bundesmin. fuer Forsch. u. Technol., Nov. 1978. 82 p. refs. In GERMAN; ENGLISH summary. Prepared in cooperation with ERNO Raumfahrttech. GmbH.
(Contracts BMFT-WRT-2073; DFVLR-BPT-01-AO-074)
(BMFT-FB-W-78-29) Avail: NTIS. HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 17.25

An attitude control system with staggered pulses was tested in a physical simulation on a three-axis air bearing table using specially designed sensors and cold gas thrusters. The system behavior under real conditions was determined, critical modes were searched and analyzed, and the limits of the system were found. The system and the experimental setup are described. Results show that the system is suitable for acquisition and coarse attitude control as well as for attitude control in the range of arc seconds. Author (ESA)

N80-11131# Royal Aircraft Establishment, Farnborough (England).
REVISED TABLE OF EARTH SATELLITES, VOLUME 2: 1969 TO 1973
J. A. Pilkington, D. G. King-Hele, H. Hiller, and Doreen M. C. Walker. London: Jan. 1979. 180 p. refs. Sponsored by Procurement Executive, Min. of Defence.
(RAE-TR-79001; BR66975) Avail: NTIS. HC A09/MF A01

A list of 559 satellite launches, arranged chronologically, is presented. For each launch, the name and international designation of each instrumented satellite and its associated rocket(s) are given, along with the data of launch, lifetime (actual or estimated), mass, shape, dimensions, and at least one set of orbital parameters. Other fragments associated with a launch are listed without these details. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-11132# British Aerospace Dynamics (Space), Stevenage (England). Space Div.
PALLET-ONLY CONFIGURATION IMPROVEMENT STUDY: TECHNICAL SUMMARY REPORT Final Report
B. Collins, comp. London: 1979. 95 p. refs.
(Contract ESA-3608/78)
(RAE-TP-7717; ESA-CR(P)-1210) Avail: NTIS. HC A05/MF A01

A data base from which potential modifications of the Spacelab baseline pallet-only configuration can be selected for the development of an improved version is presented. Summaries of working papers on 21 improvement candidates are included, classifed by categories refering to short pallets, hardpoints, miscellaneous structural, mounting surfaces, and systems. Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-11133# Sandia Labs., Livermore, Calif. Post Development Testing Div.
DESIGN OF A MULTICHANNEL FM/FM TELEMETRY SYSTEM FOR HIGH G ENVIRONMENT APPLICATIONS
L. D. Humpreys. Jan. 1979. 79 p. refs.
(Contract EY-76-C-04-0789)
(SAND-78-8042) Avail: NTIS. HC A05/MF A01

Design criteria are presented for a multichannel telemetry system to provide data for the reliability assessment of a major electromechanical system to be used in a high g flight environment. Procedures are included for designing an FM/FM telemetry system capable of optimum performance when operating close to the signal-to-noise threshold of the receiver. The theory supporting this design is also presented, along with the theory of the associated pre-emphasis of multichannel FM signals. The application of the design procedure imposed by this philisophy is illustrated by inclusion of a telemetry design to meet the electrical, environmental, and mechanical requirements of an actual telemetry system under development. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-11134*# Grumman Aerospace Corp., Bethpage, N.Y.
DESIGN AND FABRICATION OF ELEVON COVE THERMAL PROTECTION SYSTEMS FOR AEROSPACE VEHICLES Progress Report, Apr. 1976 - Jul. 1977
Angelo Varisco, Albin Borysewiez, and Willie Wolter. May 1979. 77 p.
(Contract NAS1-14112)
(NASA-CR-159055; Rept-1764-79) Avail: NTIS. HC A05/MF A01. CSCL 22B

The design study of a flighweight, effective, reuseable seal for use along the elevon cove of shuttle-type reentry and hypersonic cruise vehicles is presented. The study deals primarily with membrane seals, both metallic and non-metallic. This type of seal spans the cove gap between the wing and elevon, and does not depend on spring tension to maintain contact along a flexing wing span. Technical requirements and criteria were generally derived from the space shuttle and utilized for seal design. R.E.S.

N80-11135# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Space Development Dept.
INSTRUMENTATION DEVELOPED BY THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY FOR NON-APL SPACECRAFT
Nov. 1978. 230 p. refs.
(Contracts N00024-78-C-5384; N00017-72-C-4401)
(AD-A072438; APL/JHU-SDO-4100) Avail: NTIS. HC A11/MF A01. CSCL 22/2

Scientific and engineering instrumentation and support equipment developed by the Applied Physics Laboratory of the Johns Hopkins University for non-APL spacecraft since 1960 are described. The descriptions are arranged in chronological order according to experiment and include illustrations and system block diagrams. References and a listing of APL contributions

to space research and technology are included. Instrumentation described includes: Transit-on-Discoverer; Injun Satellite Proton Instrumentation; Magnetic Attitude Control System; Solar Proton Monitors; Doppler Beacon, Orbiting Frog Otolith Experiment; Energetic Particles Experiment; Charged Particle Measurement Experiment; Ultraviolet Spectrometer Experiment; Skylab Experiment M131; Photoelection Spectrometer; Apollo-Soyuz Ultraviolet Absorption Experiment MA-059; NAVPAC (Navigational Package); Low Energy Charged Particle Experiment (Voyager); Particle Flux Monitor (International Ultraviolet Explorer); and SEASAT-A Instrumentation Radar altimeter, SAR data link; Doppler Beacon, and Laser retroreflector array, geiger telescope, a low energy magnetospheric particular analyzer, a low energy particle telescope, and oculogyral illustration, a polar cap absorption, and a rotating litter chair. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-11136*# Rockwell International Corp., Anaheim, Calif. Strategic Systems Div.
THE 10 TO THE 8TH POWER BIT SOLID STATE SPACECRAFT DATA RECORDER
G. W. Murray, O. D. Bohning, R. Y. Kinoshita, and F. J. Becker. Washington NASA Oct. 1979 179 p refs
(Contract NAS1-14174)
(NASA-CR-3182; C78-1151.1/201) Avail: NTIS HC A05/MF A01 CSCL 14E

The results are summarized of a program to demonstrate the feasibility of Bubble Domain Memory Technology as a mass memory medium for spacecraft applications. The design, fabrication and test of a partially populated 10 to the 8th power Bit Data Recorder using 100 Kbit serial bubble memory chips is described. Design tradeoffs, design approach and performance are discussed. This effort resulted in a 10 to the 8th power bit recorder with a volume of 858.6 cu in and a weight of 47.2 pounds. The recorder is plug reconfigurable, having the capability of operating as one, two or four independent serial channel recorders or as a single sixteen bit byte parallel input recorder. Data rates up to 1.2 Mb/s in a serial mode and 2.4 Mb/s in a parallel mode may be supported. Fabrication and test of the recorder demonstrated the basic feasibility of Bubble Domain Memory technology for such applications. Test results indicate the need for improvement in memory element operating temperature range and detector performance. R.C.L.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-11137*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
SPECIFIC SPACECRAFT EVALUATION: SPECIAL REPORT
Special Report, 1 Nov. 1977 - 1 Jun. 1978
J. M. Sellen, Jr. 1 Nov. 1978 211 p
(Contract NAS3-21047)
(NASA-CR-159420) Avail: NTIS HC A10/MF A01 CSCL 21H

Charged and neutral particle transport from an 8 cm mercury ion thruster to the surfaces of the P 80-1 spacecraft and to the Teal Ruby sensor and the ECOM-501 sensor of that spacecraft were investigated. Laboratory measurements and analyses were used to examine line-of-sight and nonline-of sight particle transport modes. The recirculation of Hg(+) ions in the magnetic field of the earth was analyzed for spacecraft velocity and Earth magnetic field vector configurations which are expected to occur in near Earth, circular, high inclination orbits. For these magnetic field and orbit conditions and for expected ion release distribution functions, in both angles and energies, the recirculation/reinterception of ions on spacecraft surfaces was evaluated. The refraction of weakly energetic ions in the electric fields of the thruster plasma plume and in the electric fields between this plasma plume and the material boundaries of the thruster, the thruster sputter shield, and the various spacecraft surfaces were examined. The neutral particle transport modes of interest were identified as sputtered metal atoms from the thruster beam shield. Results, conclusions, and future considerations are presented. R.C.T.

N80-11138# Science Applications, Inc., La Jolla, Calif.
AN EXPERIMENTAL APPARATUS FOR INVESTIGATING THE KINETIC REACTIONS IN SOLID ROCKET NOZZLES
Final Report, 2 Jun. 1977 - 30 Mar. 1979
J. P. Pope and R. B. Dirling. Jun. 1979 62 p
(Contract F04611-77-C-0047)
(AD-A071318; AFRPL-TR-79-17) Avail: NTIS HC A04/MF A01 CSCL 21/8

The present interest in carbon composite and bulk polycrystalline graphite materials for solid propellant rocket nozzles has occurred, primarily due to the poor thermostructural performance of conventional pyrolytic graphite throat inserts as propellant flame temperature is increased. Circumvention of this problem has necessitated complex, multi-component nozzle configurations which are not only costly to fabricate, but inherently less reliable than an integral design. Composite materials, in particular carbon-carbon composites, offer the potential of considerable improvement in manufacturing, reliability and performance attributes compared to pyrolytic graphite. However, their ablation response in the primarily rate-controlled ablation regime of rocket nozzles is poorly understood. At the present time their ablation response is being assessed using the same techniques previously applied to non-porous pyrolytic graphite; e.g., evaluation of the kinetic coefficients from measurements of recession rate in arc plasma generator (APG) facilities. GRA

N80-11139# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab Section.
LGM-30B, STAGE 2 DISSECTED MOTORS Semiannual Test Report
Mar. 1979 144 p
(AD-A071402; MANCP-414(79)) Avail: NTIS HC A07/MF A01 CSCL 21/8

This report contains test data from propellant and case bond materials from Minuteman Stage 2 dissected motors. Testing was performed in accordance with Service Engineering General Test Directive GTD-1 Dissect dated 28 June 1974 and Project M83248C. Statistical analysis includes data from both inner (ANP 2864) and outer (ANP 2862) propellant. Test samples were obtained from two dissected motors this test period. Data obtained from these two motors have been combined with earlier test data from these same two motors and from a third motor. Linear regression plots using unique symbols to identify the three motors were used to indicate trends. Most of the propellant specimens were prepared and tested in the axial orientation, that is, parallel to the longitudinal axis of the motor. GRA

N80-11140# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
MEASUREMENTS OF TURBULENCE PARAMETERS IN A ROCKET ENGINE EXHAUST USING A LASER CROSSED BEAM CORRELATION TECHNIQUE
Gautam T. Kalghatgi. Jan. 1979 26 p refs
(AASU-340) Avail: NTIS HC A03/MF A01

The laser crossed beam correlation method in its Schlieren mode was used to measure the root mean square value of the fluctuation in density gradient along the flow direction, the integral scale in the transverse direction, convection velocity, and a form of time and length scales in the flow direction in the axisymmetric exhaust plume of a stationary liquid fuel rocket engine. Under certain restrictive assumptions, the root mean square value of the density fluctuation is also inferred. These measurements were made at different radial positions at four different axial stations

and are consistent with each other as well as with expectations based on previously published knowledge of axisymmetric turbulent jets. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N80-11141*# Technochemie G.m.b.H., Heidelberg (West Germany).
DEVELOPMENT AND FABRICATION OF BISMALEIMIDE-GRAPHITE COMPOSITES: Final Report
H. D. Stenzenberger, M. Herzog, W. Roemer, and R. Scheiblich. 23 Aug. 1979. 49 p.
(Contract NASw-3027)
(NASA-CR-152324; Rept.-7908) Avail: NTIS HC A03/MF A01 CSCL 11D

The successful fabrication of high temperature resistant composites depends mainly on the processability of the resin binder matrix. For two new bismaleimide type resins the processing of graphite fabric prepregs to composites is described. One resin coded M 751 has to be processed from N-Methylpyrrolidone, the other resin evaluated is a so-called hot melt solvent-less system. Commercial T300/3000 Graphite fabrics were used as reinforcement. The M 751 - Resin is a press grade material and laminates are therefore moulded in high pressure conditions (400 N/sq cm). The solvent-less resin system H 795 is an autoclave grade material and can be cured at 40 N/sq cm. The cure cycles for both the press grade and the autoclave grade material (Fiberite W 143 fabric prepregs) are provided and the mechanical properties of laminates at low (23 C) and high (232 C) temperatures were measured. For comparison, the neat resin flexural properties are also presented. The water absorption for the neat resins and the graphite fabric laminates after a 1000 hour period was evaluated. Author

N80-11142*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CORROSION RESISTANT THERMAL BARRIER COATING: Patent Application
S. R. Levine, R. A. Miller, and P. E. Hodge, inventors (to NASA). Filed 31 Oct. 1979. 8 p.
(NASA-Case-LEW-13088-1; US-Patent-Appl-SN-089779) Avail: NTIS HC A02/MF A01 CSCL 11D

A thermal barrier coating system was developed to protect the surfaces of metal components, gas turbines, and other heat engine parts that are exposed to fuels contaminated with metallic impurities which are normally corrosive to previously known metallic coatings. The coating system includes a metal alloy bond coating, the alloy containing nickel, cobalt, iron, or a combination of these metals. The system also includes a corrosion resistant thermal barrier oxide coating containing at least one alkaline earth silicate. The preferred oxides are calcium silicate, barium silicate, magnesium silicate, or a combination of these silicates. NASA

N80-11143*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
MICROMECHANICS OF INTRAPLY HYBRID COMPOSITES: ELASTIC AND THERMAL PROPERTIES
C. C. Chamis and J. H. Sinclair. Washington, 1979. 19 p. refs. Presented at the Winter Ann. Meeting of the Am. Soc. of Mech. Engr., New York, 2-7 Dec. 1979.
(NASA-TM-79253; E-164) Avail: NTIS HC A02/MF A01 CSCL 11D

Composite micromechanics are used to derive equations for predicting the elastic and thermal properties of unidirectional intraply hybrid composites. The results predicted using these equations are compared with those predicted using approximate equations based on the rule of mixtures, linear laminate theory, finite element analysis and limited experimental data. The comparisons for three different intraply hybrids indicate that all four methods predict approximately the same elastic properties and are in good agreement with measured data. The micromechanics equations and linear laminate theory predict about the same values for thermal expansion coefficients. The micromechanics equations predict through-the-thickness properties which are in good agreement with the finite element results. Author

N80-11144*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
TENSILE AND FLEXURAL STRENGTH OF NON-GRAPHITIC SUPERHYBRID COMPOSITES: PREDICTIONS AND COMPARISONS
C. C. Chamis, J. H. Sinclair, and R. F. Lark. 1979. 27 p. refs. Presented at 11th Natl. Tech. Conf., Boston, Mass., 13-15 Nov. 1979; sponsored by Soc. for the Advancement of Material and Process Engr.
(NASA-TM-79276; E-203) Avail: NTIS HC A03/MF A01 CSCL 11D

Equations are presented and described which can be used to predict bounds on the tensile and flexural strengths of nongraphitic superhybrid (NGSH) composites. These equations are derived by taking into account the measured stress-strain behavior, the lamination residual stresses and the sequence of events leading to fracture. The required input for using these equations includes constituents, properties (elastic and strength), NGSH elastic properties, cure temperature, and ply stress influence coefficients. Results predicted by these equations are in reasonably good agreement with measured data for strength and for the apparent knees in the nonlinear stress-strain curve. The lower bound values are conservative compared to measured data. These equations are relatively simple and are suitable for use in the preliminary design and initial sizing of structural components made from NGSH composites. Author

N80-11145*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
DYNAMIC RESPONSE OF DAMAGED ANGLEPLIED FIBER COMPOSITES
C. C. Chamis, J. H. Sinclair, and R. F. Lark. 1979. 17 p. refs. Presented at the Winter Ann. Meeting of the Am. Soc. of Mech. Engr., New York, 2-7 Dec. 1979.
(NASA-TM-79281; E-182) Avail: NTIS HC A02/MF A01 CSCL 11D

The effects of low level damage induced by monotonic load, cyclic load and/or residual stresses on the vibration frequencies and damping factors of fiber composite anglepliied laminates were investigated. Two different composite systems were studied - low modulus fiber and ultra high modulus fiber composites. The results obtained show that the frequencies and damping factors of anglepliied laminates made from low modulus fiber composites are sensitive to low level damage while those made from ultra high modulus composites are not. Vibration tests may not be sufficiently sensitive to assess concentrated local damage in anglepliied laminates. Dynamic response determined from low-velocity impact coupled with the Fast Fourier Transform and packaged in a minicomputer can be a convenient procedure for assessing low-level damage. A.R.H.

N80-11146*# Materials Sciences Corp., Blue Bell, Pa.
DEVELOPMENT OF A REALISTIC STRESS ANALYSIS FOR FATIGUE ANALYSIS OF NOTCHED COMPOSITE LAMINATES
E. A. Humphreys and B. Walter Rosen. May 1979. 90 p. refs.
(Contract NAS1-15411)
(NASA-CR-159119; MSC-TFR-1005/0206) Avail: NTIS HC A05/MF A01 CSCL 11D

A finite element stress analysis which consists of a membrane and interlaminar shear spring analysis was developed. This approach was utilized in order to model physically realistic failure mechanisms while maintaining a high degree of computational economy. The accuracy of the stress analysis predictions is

verified through comparisons with other solutions to the composite laminate edge effect problem. The stress analysis model was incorporated into an existing fatigue analysis methodology and the entire procedure computerized. A fatigue analysis is performed upon a square laminated composite plate with a circular central hole. A complete description and users guide for the computer code FLAC (Fatigue of Laminated Composites) is included as an appendix. A.R.H.

N80-11147# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
CLASSICAL ANALYSES OF LAMINATED BIMODULUS COMPOSITE MATERIAL PLATES
Charles W. Bert. Jul. 1979. 42 p. refs.
(Contract N00014-78-C-0647)
(AD-A072276; OU-AMNE-79-10) Avail: NTIS
HC A03/MF A01 CSCL 20/11

A differential-equation formulation is presented for the equations governing the small-deflection elastic behavior of thin plates laminated of anisotropic bimodulus materials (which have different elastic stiffnesses depending upon the sign of the fiber-direction strains). As a basis for comparative evaluation of a finite-element formulation presented in Technical Report No. 3 of the contract, exact closed-form solutions are presented for two cross-ply-laminated plate problems: (1) a freely supported rectangular plate subjected to a sinusoidally distributed normal pressure, and (2) a fully clamped elliptic plate subjected to uniform normal pressure. For the special case of isotropic bimodulus material, simplified approximate solutions are deduced from the exact ones. Good agreement is obtained among the two solutions presented here, as well as with numerical results existing in the literature for special cases and with the finite-element results. Also, for the first time, a closed-form solution is presented for a rectangular plate arbitrarily laminated of anisotropic ordinary (not bimodulus) material. GRA

N80-11148# Army Materiel Development And Readiness Command, Alexandria, Va.
ENGINEERING DESIGN HANDBOOK. JOINING OF ADVANCED COMPOSITES
Andrew Devine. Mar. 1979. 147 p. refs.
(AD-A072362; DARCOM-P-706-316) Avail: NTIS
HC A07/MF A01 CSCL 13/8

This handbook should serve as a guide to designers concerned with the technology associated with the joining of advanced composites. It deals with basic joint design practice as well as with those practices specific to composite joining. Tabulated and graphical representations of joint property data obtained on both bonded and mechanically fastened composites are presented. These data can be used by designers to test the degree of conservatism in calculated joint properties for their composite joint designs and hopefully will impart the necessary degree of confidence or warriness in the early design stages where alterations can be made most economically. It is hoped that the diversity of joint possibilities and the magnitude of the joint strength properties reported will prompt cautious designers of Army materiel to make use of the strength-to-weight advantages offered by advanced composites and also to recognize that the technology is available for practical implementation of these valuable engineering materials. GRA

N80-11149# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
TRANSIENT HYDROTHERMAL STRESSES IN COMPOSITES: COUPLING OF MOISTURE AND HEAT WITH TEMPERATURE VARYING DIFFUSIVITY Final Report
G. C. Sih and M. T. Shih. Mar. 1979. 67 p. refs.
(Contract DAAG46-78-C-0014; DA Proj. 8X3-63304-D-215)
(AD-A072613; AMMRC-TR-79-14) Avail: NTIS
HC A04/MF A01 CSCL 11/4

The influence of coupled diffusion of heat and moisture on the transient stresses in a composite is investigated analytically, where the moisture diffusion coefficient is taken to be temperature dependent, while the thermal diffusion coefficient is kept constant. A study of the coupled diffusion equations were made by a finite-difference scheme allowing for time-dependent changes in the humidity and temperature of the environment. The appropriate transient boundary conditions are specified on the surfaces of an infinite plate. Numerical calculations were carried out for the T300/5208 graphite fiber-reinforced epoxy matrix composite, in which the nonuniformity of moisture and temperature is evaluated for sudden changes in the surface moisture and/or temperature. The coupling effect between temperature and moisture is found to be most significant when the plate undergoes a sudden change in surface temperature while the surface moisture concentration is held constant. The present findings indicate that the stresses due to coupling can deviate from the uncoupled results anywhere from 20 to 80 percent depending on the surface temperature gradient. GRA

N80-11150# Army Materials and Mechanics Research Center, Watertown, Mass.
HPLC MONITORING OF GRAPHITE-EPOXY PREPREG AGING Final Report
Gary L. Hagnauer, Julia M. Murray, and Beverley M. Bowse. May 1979. 23 p. ref.
(DA Proj. 1L1-61102-AH-42)
(AD-A072294; AMMRC-TR-79-33) Avail: NTIS
HC A02/MF A01 CSCL 11/4

A method using high performance liquid chromatography has been developed for the quality control of graphite-epoxy prepregs. The method may be applied both as a standard test method in Military Specifications and as a method for process control. The method is used to monitor compositional changes as the prepreg ages at -13 C, 22 C, and 49 C. Chemical changes in the prepreg are correlated with aging time and process acceptability. GRA

N80-11151# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
ANALYTICAL AND EXPERIMENTAL EVALUATION OF TWO DESIGNS FOR A GRAPHITE/EPOXY ANTENNA FEED TRUSS FOR A COMMUNICATIONS SATELLITE Final Report, Jun. 1977 - Mar. 1978
Oscar Ornnger, John F. McCarthy, Jr., Michael Weinreich, and Alexander Harris. Jun. 1978. 332 p.
(Contract F33615-77-C-3083; AF Proj. 69CW)
(AD-A072484; CSR-TR-78-1; AFFDL-TR-78-78) Avail: NTIS
HC A15/MF A01 CSCL 11/4

Two final candidate configurations for a communications satellite antenna feed truss are studied to determine which concept is better suited to the application. Both candidates are designed with graphite/epoxy tubing, and were screened from several other concepts in a preliminary study. The comparative assessment in the present study is based in part on cyclic thermal fatigue design development tests, and in part on dynamic response analyses and finite-element stress analysis. GRA

N80-11152# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
POTENTIAL CHEMICAL SYSTEMS FOR INTRAMOLECULAR CYCLOADDITION CURES Final Report, Sep. 1977 - Sep. 1978
Kreisler S. Y. Lau and Fred E. Arnold. May 1979. 80 p. refs.
(AF Proj. 2419)
(AD-A072526; AFML-TR-79-4065) Avail: NTIS
HC A05/MF A01 CSCL 11/4

This report is concerned with an in-depth review of the chemical literature from 1957 to 1978 on intramolecular cycloaddition reactions. Selective hydrocarbon and heterohydrocarbon systems were synthesized and evaluated to demonstrate potential for inclusion into IMC curing matrix resins. GRA

N80-11153# Bendix Corp., Kansas City, Mo.
COATING LAMINATED SUBSTRATES Final Report
G. J. Hale. Jan. 1979. 18 p. refs. Revised.
(Contract EY-76-C-04-0613)
(BDX-613-2062-Rev) Avail: NTIS HC A02/MF A01

The feasibility and development results for coating uniform 6.3 to 12.7 micron m metal films on flat and non-planar Mylar or Kapton laminated substrates are summarized. Four coating techniques (ion plating of aluminum, chemical vapor deposition of aluminum, electroless plating of copper and nickel, and physical vapor deposition of aluminum and aluminum-0.12 weight percent copper) were evaluated. Based on the capability of each process and the resulting properties and structure of these coatings with respect to the requirements, physical vapor deposition was

selected for further development. Processes were developed for depositing aluminum-0.12 weight percent copper alloy from an rf induction vapor source and for depositing pure aluminum from an electron beam gun vapor source. In addition, precision pattern deposition of aluminum from an electron beam gun vapor source was demonstrated for flat Kapton substrates. DOE

N80-11154# Sandia Labs., Albuquerque, N. Mex.
HYGROTHERMAL EFFECTS ON THE MECHANICAL RESPONSE OF KELVAR 49/EPOXY LAMINATES
R. E. Allred 1978 16 p refs Presented at DOE Compatibility Meeting, Golden, Colo., 17 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1362C; Conf-781067) Avail: NTIS HC A02/MF A01

Prior to use in weapon systems, it is necessary to understand the durability of materials in a long term storage environment. The effects of moisture and temperature on the flexural response of Kevlar reinforced epoxy laminates are examined. Temperature or moisture alone do not severely affect the mechanical properties of Kevlar/epoxy; however, strength losses up to 60 percent and modulus losses of 45 percent are seen with saturation moisture contents (5 weight percent) tested at 150 C. Results indicate that filament hygrothermal degradation is the dominant mechanism until moisture solvation depresses the matrix Tg below the test temperature. This is in direct contrast to the majority of high performance resin-matrix composites which exhibit little filament degradation. It is recommended that Kevlar/epoxy components be coated with moisture barriers and that research be conducted on prospective coatings. DOE

N80-11155# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
INFLUENCE OF ENVIRONMENTAL CYCLING ON THE MECHANICAL PROPERTIES OF COMPOSITE MATERIALS, PART 2
Christer L. Lundemo 1978 56 p refs
(Contract FMV-F-FL-82223-75083-07-001)
(FFA-TN-HU-1853:1-Pt-2) Avail: NTIS HC A04/MF A01

Static and fatigue tests (R = 0.1 and R = -1) on carbon fiber reinforced test specimens exposed to temperature and moisture cycling were carried out with the purpose of simulating the real environmental conditions an aircraft may meet during actual use. The investigation comprised regular test specimens and beams built up from carbon fiber prepreg THORNELL 300/NARMCO 5208. The results show that the mechanical properties of the laminate were not influenced by the relatively moderate environmental cycling used. Better fatigue properties were measured for specimens exposed to humid conditions, compared with untreated specimens. This effect is valid only for short times of exposure. Author (ESA)

N80-11156# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
A METHOD FOR CLEANING GUDE-SPACE D96 TAPE
Paris ESA Apr. 1979 12 p
(ESA-PSS-52/QRM-32P-ISSUE-1) Avail: NTIS HC A02/MF A01

A cleaning method which reduces the unacceptably high outgassing rate of Gude-Space D96 in its as received form to a level acceptable for general spacecraft use is described. Gude-Space D96 is a lacing tape consisting of flat braid Dacron fiber impregnated with a special non-corrosive, synthetic-rubber finish. Author (ESA)

N80-11157# New Mexico Univ., Albuquerque. Technology Application Center.
ABLATION AND ABLATIVE MATERIALS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979
Samuel C. Mauk Aug 1979 49 p Sponsored in part by NTIS
(NTIS/PS-79/0833/8) Avail: NTIS HC $28.00/MF $28.00 CSCL 11G

Citations of various aspects of ablation and ablative materials are presented. Included are articles covering aerodynamic heating, heat shielding, radiative heat transfer, atmospheric entry, reentry effects, reentry shielding, and reentry vehicles. Ablation of meteorites is covered. Articles concerning various ablative materials are included. Contains 200 citations. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-11158# Materials Research Labs., Melbourne (Australia).
PERFORMANCE OF A GEL PERMEATION CHROMATOGRAPH AND ITS USEFULNESS IN EXAMINING MIXTURES OF ORGANIC MATERIALS
Ivan Grabovac and Carolyn E. M. Morris Jan. 1979 32 p refs
(MRL-R-725; AR-001-369) Avail: NTIS HC A03/MF A01

The molecular properties of organic materials of defense interest were assessed using a locally designed gel permeation chromatograph fitted with a refractive index (R.I.) detector and an evaporative analyser (E.A.) detector. It was found that with the R.I. detector, the performance is similar to that of other instruments. The response of the E.A. detector was found to depend on a number of operating conditions in an unforeseen manner which limits the usefulness of this detector, however, molecular weight distributions determined with the E.A. detector showed good agreement with the R.I. results. The two detectors were used simultaneously to study a complex mixture of epoxy resins (an aircraft adhesive). A.R.H.

N80-11159# Science Applications, Inc., Woodland Hills, Calif. Combustion Dynamics and Propulsion Technology Div.
MIXING AND COMBUSTION IN HIGH SPEED AIR FLOWS Interim Report, Apr. 1978 - Apr. 1979
P. T. Harsha and R. B. Edelman May 1979 43 p refs
(Contract F49620-77-C-0044; AF Proj. 2308)
(AD-A072642; SAI-79-013-WH; AFOSR-79-0912TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report describes the development of a modular model for the prediction of the performance of sudden expansion burners as a function of the controllable parameters relevant to combustor design. The model is based upon a concept in which the recirculation zone, treated as a stirred reactor, is coupled to a parabolic boundary layer formulation for the flow outside the recirculation zone. Hydrocarbon oxidation kinetics and turbulent kinetic energy models are employed in the model development. In addition to the parabolic-flow and stirred reactor elements, a module representing the fuel injection process has been developed. Results of the application of the modular model to the analysis of cold-flow and reacting-flow dump combustor experimental data are described. GRA

N80-11160# TRW Defense and Space Systems Group, Redondo Beach, Calif.
NONISENTHALPIC INTERACTION OF A PLANAR PREMIXED LAMINAR FLAME WITH A PARALLEL END WALL
G. F. Carrier, F. W. Fendell, W. B. Bush, and P. S. Feldman 1979 28 p refs Presented at Congress and Exposition, Detroit, 26 Feb. - 2 Mar. 1979 Also available as SAE Tech. Ser. no. 790245
(Contracts DAAG29-77-C-0032; E(04-3)-1261)
(AD-A071858; ARO-15048.3-E) Avail: NTIS HC A03/MF A01 CSCL 21/2

The unsteady one-dimensional interaction of a planar flame, propagating through a fuel-lean premixture, with a parallel impervious noncatalytic wall is modeled as a Stefan-type problem incorporating one-step chemistry. Quantitative details concerning retardation of flame speed near an isothermal wall (pertinent to current cooled engines), and concerning acceleration of flame speed near an adiabatic wall (pertinent to proposed engines), are obtained. The time history of unburned hydrocarbon content varies with dimensionless Arrhenius activation energy, the order of the reaction chemistry, and the Lewis-Semenov number. Both

temporally varying pressure, and also nonuniform fuel stratification, are discussed. GRA

N80-11161# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
TITANIUM COMBUSTION RESEARCH PROGRAM AND USER'S MANUAL FOR DECK CCD 1152-0.0 Final Technical Report, 1 Dec. 1975 - 30 Nov. 1978
M. R. Glickstein Wright-Patterson AFB, Ohio AFML Mar. 1979 108 p refs
(Contract F33615-76-C-5041; AF Proj. 7312)
(AD-A072529; PWA-FR-10748; PWA-FR-10755; AFML-TR-79-4001) Avail: NTIS HC A06/MF A01 CSCL 11/6

Titanium and its alloys are known to undergo self-sustained combustion in aerodynamic environments. Energy in several forms, i.e. radiation, frictional heating, or aerodynamic heating can be sufficient to bring the matter to a condition where self-sustained combustion can occur. The phenomenon has been of interest in the laser effects-vulnerability area, and also in aircraft propulsion systems, where titanium alloys are extensively used. GRA

N80-11162# California Inst. of Tech., Pasadena. Chemical Physics Lab.
SIMILARITIES AND DIFFERENCES BETWEEN ELECTRON AND PROTON TRANSFERS AT ELECTRODES AND IN SOLUTION
R. A. Marcus Aug. 1979 13 p refs
(Contract N00014-79-C-0009)
(AD-A073001; Contrib-6006; TR-9) Avail: NTIS HC A02/MF A01 CSCL 07/4

Depending on the initial energies, a proton transfer may proceed either via a saddle-point in a potential energy surface or by crossing from the reactants' to the products' valley before the saddle-point is reached. In the second path the analogy to weak-overlap electron transfers is pointed out. The present study is intended to unify previously divergent viewpoints, by showing how they are special cases of a more general picture. Expressions are obtained for the reaction rate in terms of the properties of the potential energy surface and of other properties of the system, using a hydrogen overvoltage reaction as an example. GRA

N80-11163# Princeton Univ., N. J. Dept. of Chemical Engineering.
A GENERALIZED TIME-TEMPERATURE-TRANSFORMATION PHASE DIAGRAM FOR THERMOSETTING SYSTEMS Technical Report, Sep. 1978 - Sep. 1979
J. K. Gillham Sep. 1979 17 p refs
(Contract N00014-76-C-0200)
(AD-A073007; TR-18) Avail: NTIS HC A02/MF A01 CSCL 07/4

A generalized time-temperature-transformation diagram for the thermosetting process is presented in which the four physical states encountered (i.e., liquid, rubber, ungelled glass and gelled glass) are related to the time and temperature of cure. Gelation and vitrification, as a consequence of quenching morphological development and chemical conversion respectively, are discussed with respect to control of material properties. GRA

N80-11164# New York Univ., N. Y. Dept. of Chemistry.
NUMERICAL DECONVOLUTION OF PHOTOELECTRON SPECTRA OF LIQUIDS
James B. Flanagan Jul. 1979 25 p refs
(Contract N00014-75-C-0397)
(AD-A073087) Avail: NTIS HC A02/MF A01 CSCL 07/4

Described is a method for the deconvolution or removal of spectral broadening due to electron interactions with solvent in liquid-phase ultraviolet photoelectron spectroscopy. Certain differences between this usage of deconvolution and its usual applications in pes are noted. Application of the technique is illustrated using synthetic and experimental data. Possible uses include recovering the 'original' photoemission spectrum before broadening by liquid as well as studying the mechanism of energy loss in solvent. Effects of unscattered electrons on the interpretation of this procedure are discussed. GRA

N80-11165# Ames Lab., Iowa.
X-RAY EXCITED OPTICAL LUMINESCENCE OF POLYNUCLEAR AROMATIC HYDROCARBONS Ph.D. Thesis
Gregory Joseph Oestreich May 1979 164 p refs
(Contract W-7405-eng-82)
(IS-T-856) Avail: NTIS HC A08/MF A01

X-ray excited optical luminescence (XEOL) coupled with time resolved spectroscopy was employed to analyze polynuclear aromatic hydrocarbons (PAH) in n-alkane solvents at 10 K. A pulsed XEOL system which was designed around minicomputer control of a medical X-ray unit was developed. Computer software which generated variable width X-ray pulses, monitored timing reference pulses, controlled data acquisition, and analyzed data was written. Phosphorescence decay constants of several PAHs were determined. Synthetic mixtures of zone refined PAHs were prepared and time resolved with the pulsed XEOL technique. Analytical results obtained from the five component mixtures of PAHs at the part per million level were tabulated. Systematic improvements and further development of the pulsed XEOL method were considered. DOE

N80-11166# Ames Lab., Iowa.
ANALYSIS OF BACKMIXING AND MASS TRANSFER IN SOLVENT EXTRACTION COLUMNS M.S. Thesis
Mahmoud Nazem Jan. 1979 155 p refs
(Contract W-7405-eng-82)
(IS-T-851) Avail: NTIS HC A08/MF A01

The true mass transfer coefficients in backmixed solvent extraction columns are presented. These parameters are of great significance and are very useful in the design and performance evaluation of solvent extraction columns. Several approximate correlations of these parameters as a function of column geometry, operating conditions, and physical properties of the liquid systems involved were developed, and it is possible to use mathematical models in the interpretation and analysis of experimenttal data to determine which correlations appear to be most accurate and easiest to use. The results of the data analysis, together with the best possible estimate of the extraction efficiency were applied to a differential backmixing model to obtain concentration profiles in an extraction column. DOE

N80-11167# Ames Lab., Iowa.
CHROMATOGRAPHY OF METAL IONS WITH A TRIAZINE CHELATING RESIN M.S. Thesis
Wang-Nang Wang May 1979 65 p refs
(Contract W-7405-eng-82)
(IS-T-855) Avail: NTIS HC A04/MF A01

The synthesis, characterization, and some analytical applications of a new triazine resin are described. Separation of group 1B, 2B, 6B, and 7B metal ions from group 8 metal ions is achieved by this PDT-4 resin. Calcium(II) and magnesium(II) are taken up at pH = 6,0.1 M acetate and are eluted at pH = 6,0.1 M sodium nitrate. Copper(II) is retained at pH = 6,0.1 M acetate and pH = 1 hydrochloric acid and is eluted subsequently by 5 M perchloric acid. Molybdenum(VI) is sorbed selectively from 0.1 N sulfuric acid or hydrochloric acid and is eluted in a tight band by 0.1 N sodium hydroxide. Numerous rapid column chromatographic separations are reported using this new resin, including analysis of NBS standard samples. DOE

N80-11168# Oak Ridge National Lab., Tenn.
CHEMICAL STRUCTURES AND REACTIVITIES OF COAL AS AN ORGANIC NATURAL PRODUCT
Clair J. Collins, H. P. Hombach, B. M. Benjamin, W. H. Roark, B. Maxwell, and V. F. Raaen 1979 6 p refs Presented at 177th ACS Natl. Meeting, Honolulu, Hawaii, 1 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790415-25) Avail: NTIS HC A02/MF A01

Some chemical reactions involved in coal liquefaction were studied using carbon 14 labelled compounds and nuclear magnetic resonance. It is concluded that the role of tetralin during coal conversion is (1) to act as a dispersion vehicle; (2) to supply hydrogen radicals, when needed, to trap coal radicals; and (3) in a very minor way to undergo intermolecular reaction with the coal through making and breaking of C-C (and possibly other) bonds. As a result of other experiments it is concluded that to the methods previously employed for breaking bonds in coal molecules and thereby lowering their molecular weights, must now be added the use of solvated-electrons for break-

ing -CH2-CH2-linkages. A possible mechanism for the cleavage of bibenzyl (used as a model compound for coal) is given. DOE

N80-11169# California Univ., Livermore. Lawrence Livermore Lab.
CALCULATION OF CHEMICAL EQUILIBRIUM BETWEEN AQUEOUS SOLUTION AND MINERALS: THE EQ3/6 SOFTWARE PACKAGE
T. J. Wolery. 1 Feb. 1979. 46 p. refs.
(Contract W-7405-eng-48)
(UCRL-52658) Avail: NTIS. HC A03/MF A01

The newly developed EQ3/6 software package computes equilibrium models of aqueous geochemical systems. The package contains two principal programs: EQ3 performs distribution-of-species calculations for natural water compositions; EQ6 uses the results of EQ3 to predict the consequences of heating and cooling aqueous solutions and of irreversible reaction in rock-water systems. The programs are valuable for studying such phenomena as the formation of ore bodies, scaling and plugging in geothermal development, and the long-term disposal of nuclear waste. EQ3 and EQ6 are compared with such well-known geochemical codes as SOLMNEQ, WATEQ, REDEQL, MINEQL, and PATHI. The data base allows calculations in the temperature interval 0 to 350 C, at either 1 atm-steam saturation pressures or a constant 500 bars. The activity coefficient approximations for aqueous solutes limit modeling to solutions of ionic strength less than about one molal. The mathematical derivations and numerical techniques used in EQ6 are presented in detail. DOE

N80-11170# New York Univ., N. Y. Courant Mathematics and Computing Lab.
LECTURES ON COMBUSTION THEORY
Samuel Z. Burstein, ed., Peter D. Lax, ed., and Gary A. Sod, ed. Sep. 1979. 323 p. refs.
(Contract EY-76-C-02-3077)
(COO-3077-153) Avail: NTIS. HC A14/MF A01

Eleven lectures are presented on mathematical aspects of combustion: fluid dynamics, deflagrations and detonations, chemical kinetics, gas flows, combustion instability, flame spread above solids, spark ignition engines, burning rate of coal particles and hydrocarbon oxidation. DOE

N80-11171# Sandia Labs., Livermore, Calif.
LOCAL TURBULENCE PROPERTIES IN FLAMES FROM TIME-AVERAGED RAMAN SPECTROSCOPY MEASUREMENTS
R. E. Setchell. 1979. 10 p. refs. Presented at the AIAA Aerospace Sciences Meeting, New Orleans, 15 Jan. 1979.
(Contract EY-76-C-04-0789)
(SAND-78-1263C; Conf-790102-1) Avail: NTIS. HC A02/MF A01

Local fluctuations in temperature and composition in a turbulent flame are examined through their influence on Raman-scattering measurements of time-averaged flame properties. Using mean temperatures and number densities measured in a hydrogen diffusion flame, two approaches to investigating turbulence properties are examined. In the first, which is restricted to flame condition where fluctuations are fairly small, the variation of measured number density with spectral resolution is used to determine values for particular correlations between fluctuations in number density and temperature. In the second approach the Raman measurements are used to evaluate a particular model for concentration fluctuations. DOE

N80-11172# Ames Lab., Iowa.
PARTIAL MOLAR VOLUMES OF HYDROGEN AND DEUTERIUM IN NIOBIUM AND VANADIUM. M.S. Thesis
H. M. Herro. Jan. 1979. 42 p. refs.
(Contract W-7405-eng-82)
(IS-T-839) Avail: NTIS. HC A03/MF A01

Lattice dilation studies and direct pressure experiments gave comparable values for the partial molar volumes of hydrogen and deuterium in niobium and vanadium. Small isotope effects in the partial molar volume of hydrogen were measured in both metals by the differential isotope method. Hydrogen had a larger partial molar volume than deuterium in niobium, but the reverse was true in vanadium. The isotope effect measured in niobium can be represented as being due to the larger amplitude of vibration of the hydrogen atom than the deuterium atom in the metal lattice. Since hydrogen has a larger mean displacement from the equilibrium position than does deuterium, the average force hydrogen exerts on the metal atoms is greater than the force deuterium exerts. The isotope effect in vanadium is likely a result of anharmonic effects in the lattice and local vibrational modes. DOE

N80-11173# Sandia Labs., Albuquerque, N. Mex.
CHEMICAL VAPOR DEPOSITION OF TiB2 ON GRAPHITE
H. O. Pierson and E. Randich. 1978. 15 p. refs. Presented at 6th Conf. on Borons and Borides, Drubzna, Bulgaria, 9 Oct. 1978.
(Contract EY-76-C-04-0789)
(SAND-78-1794C; Conf-781064-1) Avail: NTIS. HC A02/MF A01

An experimental investigation of the coating of graphite with TiB2 by chemical vapor deposition (CVD) using the hydrogen reduction of BCl3 and TiCl4 at 925 C and 1 atm. Reasonable matching of the thermal expansion of TiB2 and graphite was necessary to eliminate cracking. A suitable graphite was POCO DFP-1. Adhesion was improved by having a slightly rough graphite surface. Heat treatment at 2000 C and above resulted in a certain degree of diffusion. No melting or solid phases other than TiB2 and graphite were detected up to 2400 C. The coatings showed no failure when repeatedly submitted to an electron beam pulse of 2 KW/sq cm for 0.9 sec. DOE

N80-11174# Argonne National Lab., Ill.
PHOTO ION MASS SPECTROMETRY AND PHOTOELECTRON SPECTROSCOPY OF HIGH TEMPERATURE VAPORS
J. Berkowitz. 1978. 25 p. refs. Presented at 10th Mater. Res. Symp., Gaithersburg, Md., 18 Sep. 1978.
(Contract W-31-109-eng-38)
(CONF-780941-4) Avail: NTIS. HC A02/MF A01

PIMS and PES were used to study the bond energies and molecular structure in the molecules S2, AlCl, AlCl(+), InCl, TlCl, TlCl(+), TlF, Tl2F2, KF, KF(+), LiCl, and LiCl(+). DOE

N80-11175# Argonne National Lab., Ill.
RESONANCE RAMAN SPECTRA OF METAL HALIDE VAPOR COMPLEXES
G. N. Papatheodorou. 1978. 63 p. refs. Presented at 10th Mater. Res. Symp., Gaithersburg, Md., 18 Sep. 1978.
(Contract W-31-109-eng-38)
(CONF-780941-8) Avail: NTIS. HC A04/MF A01

Resonance Raman spectra of complex vapor phase compounds formed by reacting acidic gases (A2X6 = Al2Cl6, Al2Br6, In2Cl6) with metal halides have been measured. Spectra obtained from equilibrium vapor mixtures of A2X6 over solid MX2 (= PdCl2, PdBr2, CuCl2, CoBr2, TlCl2, FeCl2, NiCl2, PtCl2) were a superposition of the A2X6-AX3 bands and in few cases of new resonanceenhanced polarized bands due to MA2X8 and/or MAX5 complexes. At temperatures above 800 deg K, characteristic bands due to MX2(g) (M = Fe, Co, Ni, Cu, Zn) and M2X4(g) (M = Cu) were observed. The predominant features of the PdAl2Cl8, CuAl2Cl8, and PdAl2Br6 spectra were three high-intensity, polarized bands which were attributed to the vibrational modes of the complex coupled to the electronic state of the central atom. The spectra of CuAlCl5(g), CuInCl5(g) and Cu2Cl4(g) species showed resonance enhancement of selective fundamentals which were attributed to vibrational modes of trigonally coordinated Cu(II). DOE

N80-11176# California Univ., Berkeley. Lawrence Berkeley Lab.
DEEP LEVEL TRANSIENT SPECTROSCOPY OF HIGH PURITY GERMANIUM DIODES/DETECTORS
Eugene E. Haller, Pearl P. Li, G. Scott Hubbard, and William L. Hansen. Oct. 1978. 8 p. refs. Presented at the 1978 IEEE Nucl. Sci. Symp., Washington, D. C., 18-20 Oct. 1978.
(Contract W-7405-eng-48)
(LBL-8140; Conf-781033-26) Avail: NTIS. HC A02/MF A01

Deep Level Transient Spectroscopy (DLTS) was applied for the first time to high purity germanium p-i-n diodes. Using the correlator technique, a large number of peaks due to acceptor levels in the forbidden band were observed. The levels due to

substitutional copper, to copper-hydrogen complexes and to divacancy-hydrogen defects are examined. Several unknown levels discovered are reported. The results obtained with DLTS are discussed and compared with Hall-effect measurements. DOE

N80-11177# Ames Lab., Iowa.
INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROSCOPY: AN EVALUATION OF THE USE OF NITROGEN-ARGON ADMIXTURES AS PLASMA DISCHARGE ATMOSPHERES M.S. Thesis - Iowa State Univ.
J. C. Zalewski. Jan. 1979. 67 p. refs.
(Contract W-7405-eng-82)
(IS-T-834)
Avail: NTIS. HC A04/MF A01

The effects of the use of nitrogen in either the plasma coolant or aerosol carrier gas flows on the physical and spectrochemical properties of the inductively coupled plasma (ICP) are examined. The plasma operated with nitrogen in the coolant flow and the use of nitrogen in the aerosol carrier gas flow are discussed. The use of nitrogen-argon admixtures in the plasma coolant gas flow is examined. A demountable plasma torch which yielded detection limits for 15 elements and 19 spectral lines that were approximately within a factor of two of those obtained with the torch of fused quartz design is described. DOE

N80-11178# Unilever Research, Vlaardingen (Netherlands).
RHEOLOGY OF CONCENTRATED SUSPENSIONS
M. vandenTempel. 1978. 10 p. refs. Revised. Submitted for publication.
Avail: NTIS. HC A02/MF A01

The viscoelastic properties of a flocculated dispersion, at small or slow deformations, are explained in terms of a network model. If the network consists of single particle chains the modulus and strength are proportional to the first power of the volume fraction and weakly dependent on the particle size. More realistic results are now obtained by constructing a network in which the chains consist of preformed aggregates. In several systems, the state of aggregation is found to depend on volume fraction and particle size only through the total particle concentration. Author (ESA)

N80-11179# IEA Coal Research, London (England).
COMBUSTION OF LOW GRADE COAL
G. F. Morrison. Jun. 1978. 90 p. refs.
(ICTIS/TR-02; ISBN-92-9029-016-1) Avail: NTIS
HC A05/MF A01

A technical review of the literature is presented in order to assess the increasing extent to which lignite, brown coal, peat, and bituminous shale are combusted for power generation. Although the most common form of combustion in use today, the firing of pulverized low grade coal has presented major operational problems of erosion, corrosion, and fouling of heat exchange equipment. Recent developments in the design of pulverized-coal fired stations are discussed. Fluidized bed combustion has the potential to overcome many of these problems and a brief history of the development of this form of combustion and an assessment of current research is included. One important parameter in the future development of low grade coal combustion is the ability of power stations to comply with national emission standards. The influence of combustion mode on the emission of SO2, NO, and particulates is reviewed. Author (ESA)

N80-11180# IEA Coal Research, London (England).
TRACE ELEMENTS FROM COAL COMBUSTION: ATMOSPHERIC EMISSIONS
M. Y. Lim. May 1979. 58 p. refs.
(ICTIS/TR-05; ISBN-92-9029-024-2) Avail: NTIS
HC A04/MF A01

The literature relating to trace elements in coal combustion is reviewed from the point of view of atmospheric pollution. Some data on trace element concentration in coal are given and comparisons are made with atmospheric emissions from other sources. Environmental effects and potential health hazards are discussed. Radioactive emissions and trace element accumulation around power plants are also reviewed and types of equipment used for particulate control in power plants are summarized. It is concluded that the importance of coal combustion as a pollutant source depends on what type of regulations are established for emission control and on how well power plants comply with these regulations. Author (ESA)

N80-11181# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
OXIDATION OF GALLIUM ARSENIDE IN A PLASMA MULTIPLE DEVICE. STUDY OF THE MOS STRUCTURES OBTAINED Final Report [OXYDATION DE L'ARSENIURE DE GALLIUM PAR PLASMA EN UTILISANT UN DISPOSITIF MULTIPOLAIRE. ETUDE DES STRUCTURES MOS OBTENUES]
Serge Gourrier, Andrei Mircea, and Francois Simondet. Dec. 1978. 61 p. refs. Partly in FRENCH and ENGLISH.
(Contract DGRST-77-7-1638)
(LEP-79/62.SME-687-A) Avail: NTIS. HC A04/MF A01

The oxygen plasma oxidation of GaAs was studied in order to obtain extremely high frequency responses with MOS devices. In the multipole system (magnetic confinement associated with a hot cathode), a homogeneous oxygen plasma of high density 5 x 10 to the 10 power/cu cm) can easily be obtained in a large volume. This system is thus highly convenient for the study of plasma oxidation of GaAs. The electrical properties of the MOS diodes obtained in this way are controlled by interface states, located mostly in the upper half of the band gap where densities in the 10 to the 13 power/sq cm x eV range can be estimated. Despite these interface states the possibility of fabricating MOSFET transistors working mostly in the depletion mode for a higher frequency cut-off still exists. Author (ESA)

N80-11182# Environmental Monitoring and Support Lab., Cincinnati, Ohio.
AN EPA MANUAL FOR ORGANICS ANALYSIS USING GAS CHROMATOGRAPHY-MASS SPECTROMETRY
William L. Budde and James W. Eichelberger. Mar. 1979. 166 p. refs.
(PB-297164/6; EPA-600/8-79-006) Avail: NTIS
HC A08/MF A01. CSCL 13B

The applicability of gas chromatography-mass spectrometry in environmental analysis is discussed. Included are sample preparation methods specifically adapted to this measurement technique, data processing and interpretation methods, quality control procedures, quantitative analytical techniques, utility software requirements, preventive maintenance recommendations, systematic trouble shooting methods, and a selected bibliography. GRA

N80-11183# Texas A&M Univ., College Station. Dept. of Chemistry.
SURFACE REACTIONS OF OXIDES OF SULFUR
J. H. Lunsford. Apr. 1979. 42 p. refs.
(Grant EPA-R-801136)
(PB-297410/3; EPA-600/7-79-088) Avail: NTIS
HC A03/MF A01. CSCL 07D

Surface reactions of several sulfur-containing molecules were studied in order to understand the mechanism by which sulfate ions are formed on atmospheric aerosols. At 25 C the heterogeneous oxidation of SO2 by NO2 to sulfuric acid and sulfate ions occurred on hydrated silica and silica-alumina surfaces. The oxidation of SO2 by O2 was undetectably slow on these surfaces, however, the reaction was catalyzed by Mn(+2) ions in a Y-type zeolite in this case the only reaction product was a SO4(-2) species which was strongly bound in the zeolite micropores. Molecule oxygen also reacted with H2S on zeolites and magnesium oxide. The mechanism by which S2O(-) and H2S2(-) are formed on MgO was determined. GRA

N80-11184# Celanese Research Co., Summit, N.J.
HIGH FLUX PBI REVERSE OSMOSIS MEMBRANES FOR DESALINATION AND WATER REUSE Final Report
Marshall Tan and Howard J. Davis. 30 Nov. 1978. 61 p. refs.
(Contract DI-14-34-0001-7527)
(PB-297285/9; W79-07571; OWRT-7527(1)) Avail: NTIS
HC A04/MF A01. CSCL 07D

High flux, high rejection flat polybenzimidazole (PBI) reverse osmosis membranes were prepared. Membrane film casting and processing parameters were first identified and optimized in small-scale laboratory film casting trials. On the basis of these results, membranes measuring 12 in. by 36 in. and 2.5 mils in thickness were prepared and evaluated in long-term testing at

600 psi and 400 psi with nonchlorinated and chlorinated salt colutions. Two prototype spiral wound modules were fabricated for demonstration purposes. Membrane samples were tested in high pressure test cells against 5000 ppm salt solutions. In long-term testing, a decline in flux was observed, presumably the result of pressure induced compaction. GRA

N80-11185# Research Triangle Inst., Research Triangle Park, N. C.
AMBIENT AIR CARCINOGENIC VAPORS, IMPROVED SAMPLING AND ANALYTICAL TECHNIQUES AND FIELD STUDIES Final Report
Edo D. Pellizzari and John E. Bunch. May 1979. 341 p. refs. (Contract EPA-68-02-2764)
(PB-297932/6; EPA-600/2-79-081) Avail: NTIS HC A15/MF A01 CSCL 07D

Improved techniques for sampling and analyzing volatile organic compounds in the ambient air were developed and evaluated. Emphasis was placed on techniques for halocarbons and other compounds known or suspected of being carcinogenic. Areas of investigation included (1) the evaluation of XAD-2, charcoal and Tenax GC sorbents for in situ formation on halogenated organics during the sampling air containing chlorine and olefins; (2) the development and testing of a cryoheater module for a thermal desorptions inlet-manifold; and (3) the characterization and quantification of hazardous organic vapors in ambient air collected at several different geographical areas within the continental United States. GRA

N80-11186# Bureau of Mines, Reno, Nev. Reno Metallurgy Research Center.
PLATINUM-SUBSTITUTE MATERIALS AS ELECTROCATALYSTS FOR OXYGEN REDUCTION
W. N. Cathey, L. J. Nicks, and D. J. Bauer. 1979. 23 p. refs. (PB-297261/0; BM-RI-8341) Avail: NTIS HC A02/MF A01 CSCL 07D

Materials including carbides, silicides, phosphides, borides, nitrides, oxides, and metals were studied as potential fuel cell catalysts for electroreduction of oxygen in a 1N H2SO4 electrolyte. An assessment of the potential of abundant, low-cost materials as substitutes for platinum and a means to increase the catalytic efficiency of platinum are discussed. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion, and metallurgy.

N80-11187# Materials Research Labs., Melbourne (Australia).
A THERMOGRAVIMETRIC SYSTEM FOR INVESTIGATING GAS-METAL REACTIONS AT ELEVATED TEMPERATURES
Lawrence D. Palmer. Oct. 1978. 36 p. refs.
(MRL-R-726; AR-001-357) Avail: NTIS HC A03/MF A01

The thermogravimetric system recently established at MRL to study the kinetics of reactions between solids and their gaseous environments at elevated temperatures is described. Changes in the weight of heated samples, due to reactions such as high-temperature oxidation of metals, are measured by a sensitive, large-capacity electrobalance. The source of uncertainties in the measurment of both weight and temperature were considered, and experimental techniques which were introduced to minimize these uncertainties are discussed. F.O.S.

N80-11188*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
MECHANICAL PROPERTIES AND OXIDATION AND CORROSION RESISTANCE OF REDUCED-CHROMIUM 304 STAINLESS STEEL ALLOYS
Joseph R. Stephens, Charles A. Barrett, and Charles A. Gyorgak. Washington, Nov. 1979. 22 p. refs.
(NASA-TP-1557; E-065) Avail: NTIS HC A02/MF A01 CSCL 11F

An experimental program was undertaken to identify effective substitutes for part of the Cr in 304 stainless steel as a method of conserving the strategic element Cr. Although special emphasis was placed on tensile properties, oxidation and corrosion resistance were also examined. Results indicate that over the temperature range of -196 C to 540 C the yield stress of experimental austenitic alloys with only 12 percent Cr compare favorably with the 18 percent Cr in 304 stainless steel. Oxidation resistance and in most cases corrosion resistance for the experimental alloys were comparable to the commercial alloy. Effective substitutes for Cr included Al, Mo, Si, Ti, and V, while Ni and Mn contents were increased to maintain an austenitic structure. R.C.T.

N80-11189*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EFFECT OF THERMALLY INDUCED POROSITY ON AN AS-HIP POWDER METALLURGY SUPERALLOY
R. L. Dreshfield and R. V. Miner, Jr. Washington, 1979. 20 p. refs. To be presented at Ann. Meeting of the Am. Inst. of Mining, Met. and Petol. Engr., Las Vegas, Nev., 24-28 Feb. 1980.
(NASA-TM-79263; E-178) Avail: NTIS HC A02/MF A01 CSCL 11F

The impact of thermally induced porosity on the mechanical properties of an as-hot-isostatically-pressed and heat treated pressing made from low carbon Astroloy was determined. Porosity in the disk-shape pressing studied ranged from 2.6 percent at the bore to 1.4 percent at the rim. Tensile, yield strength, ductility, and rupture life of the rim of the porous pressing was only slightly inferior to the rim of sound pressings. The strength, ductility, and rupture life of the bore of the porous pressing was severely degraded compared to sound pressings. At strain ranges typical of commercial jet engine designs, the rim of the porous pressing had slightly inferior fatigue life to sound pressings. A.R.H.

N80-11190# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
INFLUENCE OF MULTIAXIAL STRESS STATES, STRESS GRADIENTS AND ELASTIC ANISOTROPY ON THE EVALUATION OF RESIDUAL STRESSES BY X-RAYS
H. Doelle. Apr. 1979. 52 p. refs.
(Contract N00014-75-C-0580)
(AD-A067909; TR-22) Avail: NTIS HC A04/MF A01 CSCL 11/6

This paper reviews treatments for these nonlinear distributions, including stress gradients, shear-stresses and anisotropic X-ray elastic constants. Methods for the evaluation of stresses are reported, and recommendations are given for the practical application of X-ray stress measurement. GRA

N80-11191# Dayton Univ. Research Inst., Ohio.
IMPACT INDUCED TENSILE FAILURES IN STEEL
Stephan J. Bless and John P. Barber. Feb. 1979. 55 p. refs. (Contract F33615-76-C-5124; AF Proj. 2307)
(AD-A072477; UDR-TR-78-56; AFML-TR-79-4020) Avail: NTIS HC A04/MF A01 CSCL 11/6

Steel spheres 11 mm in diameter struck hemispherical and cylindrical targets at 3 km/s. Materials were AISI 1020 and 4340. Tensile strength of these materials at strain rates of .0001/s to 1000/s was determined and important rate effects were observed. Peak particle velocity as a function of range and angle was measured by a fly-off plate technique. Peak stress was calculated from these data. Failure modes were determined from post-impact analysis of targets. Targets less than 6 cm diameter were totally fragmented. The 8 cm diameter hemispheres failed in bi-axial tension. The 4 cm thick hemispheres failed by planar spall. Large targets did not undergo gross tensile failure. GRA

N80-11192# Dayton Univ. Research Inst., Ohio.
STRAIN RATE EFFECTS ON ULTIMATE STRAIN OF COPPER Technical Report, Oct. 1976 - Oct. 1977
David P. Bauer and S. J. Bless. May 1979. 85 p. refs. (Contract F33615-76-C-5124; AF Proj. 2307)
(AD-A072175; UDR-TR-78-45; AFML-TR-79-4021) Avail: NTIS HC A05/MF A01 CSCL 11/6

The strain-rate effect on strain to failure of copper was experimentally investigated. Both Oxygen Free High Conductivity (OFHC) copper and Electrolytic Tough Pitch (ETP) copper were studied. Ultimate strains were measured for a range of strain rates from 0.0001 strain/second to over 10000.0 strain/second.

Normal quasi-static tensile machines were used at low strain rates, a split Hopkinson bar apparatus was used at strain rates of 1000.0 strain/second, and an exploding tube technique was developed for strain rates to over 10000.0 strain/second. High speed photographic techniques and post shot fragment analysis were used to determine the strain rate effects. Copper shows little strain rate dependence below 1000.0 strain/second with average ultimate strains around 0.4. Above approximately 5000.0 strain/second, several geometrical and material related factors cause the average ultimate strain to increase to values above 1.3, due to suppression of necking in the material until very late in the straining process. OFHC copper and ETP copper behave much the same to strain rates of 10000.0 strain/second. GRA

N80-11193# Naval Research Lab., Washington, D. C.
LOSS OF FRACTURE RESISTANCE IN HIGH CARBON STEEL DUE TO NON-MARTENSITIC PHASES. Interim Report
R. J. Weimer, W. L. Phillips, and C. Kim. 5 Jul. 1979. 13 p. refs.
(RR0220441)
(AD-A072051; NRL-MR-4031) Avail: NTIS
HC A02/MF A01 CSCL 11/6

Attempts to control the dynamic compression failure modes of tungsten fiber reinforced steel matrices included changing the matrix material from mild steel to a hypereutectoid steel. However, the thermo-mechanical processes used to fabricate such metal matrix composite materials produce mixed microstructures, and it was not known to what extent the nonmartensitic transformation products influence mechanical behavior. This work examines the effects of isothermally transformed pearlite, bainite, and cementite on the strength, ductility, and plane-strain fracture toughness of a hypereutectoid silico-manganese steel that typifies the compositions being evaluated for a class of metal matrix composite systems. The small-grained, quenched-and-tempered martensite was the toughest material (60 MPa sq. root of m). Increasing the pearlite content gradually decreased the fracture toughness. However, increasing the banite content by even slight amounts produced a catastrophic decrease in fracture toughness to half that value, which was found to be nearly the minimum KIC determined from low temperature (-54C) tests, i.e., 28 MPA sq. root of m. This result dramatizes the importance of careful heat treatment when using such materials in engineering structures. GRA

N80-11194# Pratt and Whitney Aircraft, Middletown, Conn. Materials Engineering and Research Lab.
HOT CORROSION DEGRADATION OF METALS AND ALLOY: A UNIFIED THEORY. Final Scientific Report, 1 Jun. 1976 - 30 Sep. 1978
C. S. Giggins and F. S. Pettit. Jun. 1979. 145 p. refs.
(Contract F44620-76-C-0123; AF Proj. 2306)
(AD-A072645; PWA-FR-11545; AFOSR-79-0905TR) Avail: NTIS HC A07/MF A01 CSCL 11/6

The hot corrosion attack of metals and alloys has been examined over an extensive range of experimental conditions in order to develop a hot corrosion theory. Experiments have been performed at temperatures from 700 to 1000 C in air and in gases containing oxygen and SO3. Sodium sulfate was the principal deposit used to induce attack and the effects of NaCl and carbon in the Na2SO4 was also studied. Nickel- and cobalt-base alloys containing various amounts of chromium, aluminum, molybdenum and tungsten constituted the principal materials studied. The hot corrosion attack of alloys has been found to consist of an initiation stage and a propagation stage. The factors which determine the length of the initiation stage and the type of propagation mode are shown to be: alloy composition, fabrication condition, gas composition and velocity, salt composition, salt deposition rate, condition of salt, temperature, temperature cycles, erosion and specimen geometry. The hot corrosion propagation modes are described and shown to consist of fluxing processes and processes involving the oxidation of phases formed in alloys as a result of reaction with components in the deposit (e.g. sulfides, chlorides). The effects produced by a number of different elements (e.g. Cr, Al, Mo, W) on the hot corrosion of alloys is examined. It is shown that by using the unified theory for hot corrosion, previous inconsistencies are resolved. GRA

N80-11195# Naval Postgraduate School, Monterey, Calif.
CORROSION FATIGUE OF A MARINE ALUMINUM ALLOY (5456-H343) IN THE PRESENCE OF SHALLOW CRACKS. M.S. Thesis
Terrence L. Tinkel. Jun. 1978. 147 p. refs.
(AD-A072562) Avail: NTIS HC A07/MF A01 CSCL 11/6

Marine aluminum alloy 5456-H343 is a candidate primary structural material for naval high performance ships. This material in the form of 1/8 inch sheet was used to obtain initial alternating surface stress v. cycles to failure data in air and salt water. Room temperature tests were performed using deflection controlled fully reversed bending at 30 Hz. Data were obtained for smooth and shallow, sharply notched specimens for fatigue lives up to 10 million cycles. Notches were semi-elliptical surface cracks with depths equal to .002 in., .0115 in., and .025 in. The 5456-H343 showed excellent corrosion fatigue resistance in salt water, with increasing environmental sensitivity in the range of 1-10 million cycles. The material exhibits some notch sensitivity at a fatigue life of 10 million cycles. The following fatigue design/failure criterion were developed: (1) for shallow cracks less than .001 in. deep, the maximum fatigue stress is determined by endurance limit or fatigue strength of smooth specimens, and (2) for shallow cracks greater than .020 in. deep, the maximum fatigue stress is determined by the threshold or allowable stress intensity factor of notched specimens. GRA

N80-11196# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF YTTRIATED TITANIUM 6 Al-4 V PLATES AND FORGINGS. Final Report, Jun. 1975 - Aug. 1978
A. E. Gunderson and R. F. Geisendorfer. Jan. 1979. 124 p. refs.
(AF Proj. 2418)
(AD-A072439; AFML-TR-78-158) Avail: NTIS
HC A06/MF A01 CSCL 11/6

This program evaluated the effects of yttrium additions to titanium 6Al-4V alloy by means of mechanical property testing and metallurgical studies. Product forms evaluated which contained yttria (yttrium oxide) included hand forgings, die forgings, and plate material which were compared to baseline plate material which had no yttria additions. The summary of results of the mechanical property evaluations are presented below. Certain heats and specimens did appear as outliers from the norm and these have been noted. Metallographic evaluations of the yttriated material demonstrated the yttria particles are readily observable by optical and scanning electron microscopy. Fracture surface analysis on the failed fatigue and tensile specimens did not establish a direct correlation between specimen performance and yttria particles or clusters. These results indicate the effects of yttria additions are indirect and more subtle, and that the variations in data are more likely to be a consequence of the differences in mill processing procedures due to the greater hot workability of the yttriated titanium. GRA

N80-11197# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
A PHENOMENOLOGICAL MECHANISM FOR THE OCCURRENCE OF THE EXTRUSION CENTRAL BURST DEFECT. Interim Technical Report, 15 Feb. 1978 - 10 Jan. 1979
F. J. Gurney. Wright-Patterson AFB, Ohio: AFML, Apr. 1979. 31 p. refs.
(Contract F33615-78-C-5003; AF Proj. 2418)
(AD-A072476; FM-TR-79-4031) Avail: NTIS
HC A03/MF A01 CSCL 11/6

Six billets of 7075 Al were partially extruded in a horizontal extrusion press using a three-inch diameter container. Extrusion conditions were selected such that the central burst defect would occur. A rigid ram stop mechanism was employed to halt the extrusion process abruptly after selected increments of deformation were achieved in each billet. Both metallographic and scanning electron microscopy analyses were used to identify the mechanism for occurrence of the defect. The occurrence of the defect was found to be preceded by the development of tangential velocity discontinuity surface in the deformation zone. Enhanced metal flow in the radial direction on the die exit side of this discon-

tinuity surface caused tensile stresses to develop along the axis of the billet initiating the defect by a tensile overload mechanism. The defect was found to propagate along the discontinuity surface but was halted when continued ram motion caused continued plastic flow along this discontinuity surface to become diffused. GRA

N80-11198# California Univ., Berkeley.
ADSORPTION OF OXYGEN ON Pt (111) AND ITS REACTIVITY TO HYDROGEN AND CARBON MONOXIDE Interim Report
David R. Monroe and Robert P. Merrill Oct. 1978 23 p
(Grant AF-AFOSR-2926-76; AF Proj. 2303)
(AD-A072710; AFOSR-78-1432TR) Avail: NTIS HC A02/MF A01 CSCL 07/2

Oxygen was found to adsorb on Pt(111) with an initial sticking coefficient of 0.048 - or - .006 and linear adsorption kinetics. The surface saturated at an oxygen to platinum ratio of 1:4. The reactivity of adsorbed oxygen to hydrogen and CO was determined from steady state oxygen coverages for H2-O2 and CO-O2 mixtures. From the reactivity data which show reaction probabilities of 1.0 for CO and 1/2 for H2 over a wide range of oxygen coverages, it is concluded that both H2 and CO are reactive in mobile states which are probably the precursors to adsorption. GRA

N80-11199# Effects Technology, Inc., Santa Barbara, Calif.
ASSESSMENT OF THE STATE OF KNOWLEDGE PERTAINING TO SOLID PARTICLE EROSION Final Report
William F. Adler 30 Jun. 1979 153 p refs
(Contract DAAG29-77-C-0039)
(AD-A073034; ETI-CR79-680; ARO-14980.1-MS) Avail: NTIS HC A08/MF A01 CSCL 11/6

This investigation examines the analyses of solid particle erosion which have been formulated for both ductile and brittle materials. The solid particle erosion process can be described qualitatively for several materials from microscopic examinations of the eroded surfaces; however, most of the available erosion analyses are based on material removal models which do not represent the physical processes of material removal as they are presently known. A number of published results have been generally accepted by the erosion community without proper scrutiny of the basis for the conclusions reached. Some of these inconsistencies are pointed out, and the various analytical approaches used in describing solid particle erosion phenomena are summarized. The need for an adequately characterized solid particle erosion testing capability is indicated due to the range of test parameters, which have been found recently to significantly influence the measured erosion rates. Meaningful advancement in the field is strongly dependent on the development of a reliable experimental data base and experimentation which isolates and clarifies a particular feature of the material removal process. GRA

N80-11200# State Univ. of New York at Stony Brook.
THE RESPONSE OF COATED STEELS TO CAVITATION IN CORROSIVE ENVIRONMENTS
H. Herman, C. R. Clayton, M. Dorfman, S. Safai, and J. Vargas Mar. 1979 64 p refs
(Contract N00014-75-C-1018)
(AD-A072841; TR-4) Avail: NTIS HC A04/MF A01 CSCL 11/6

This ONR-supported program has concentrated on the cavitation-erosion behavior of thermal-sprayed coatings on steel in distilled and in salt water. The coatings have been Zn, Al and Zn-150 w/o Al. Porosity is a major cause of failure in a cavitation field, and further work is proposed whereby the porosity can be controlled and the coatings examined both from the points of view of corrosion (visually and electrochemically) and cavitation-erosion (visually and with weight-change measurements). The microstructures of both oxide and metal coatings have been examined through X-ray diffraction and using scanning and transmission electron microscopy techniques. Aside from active coatings, it is also desired to examine thermally-sprayed stainless steels, exothermic coatings and sprayed metallic glass forming materials. Acoustic emission (AE) is being developed as an important tool for coating evaluation. It is one goal to relate AE measurements to cavitation-corrosion survivability. GRA

N80-11201# Failure Analysis Associates, Palo Alto, Calif.
FRACTURE AND FATIGUE PROPERTIES OF 1Cr-Mo-V BAINITIC TURBINE ROTOR STEELS
I. Roman, C. A. Rau, Jr., A. S. Tetelman, and K. Ono Mar. 1979 268 p refs
(EPRI Proj. 700-1)
(EPRI-NP-1023) Avail: NTIS HC A12/MF A01

The deformation, fracture and fatigue properties of 1Cr-Mo-V turbine rotor steel have been evaluated for a wide range of loading conditions and metallurgical structures controlled by melting and heat treatment practice. The mechanical property differences and corresponding metallurgical differences between older, air-melted steels and newer heats that are vacuum degassed were determined. The effects of prior fatigue cycling on fracture toughness were measured, and a model was developed to predict the effect for various materials and loading conditions. Irrespective of the fracture mode, materials which soften under strain cycling, like this rotor steel, show a toughness which increases with number and magnitude of prior fatigue cycling. DOE

N80-11202# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
INVESTIGATIONS OF INTERMETALLIC ALLOY HYDRIDING MECHANISM Annual Progress Report, 1 May 1978 - 30 Apr. 1979
B. R. Livesay and J. W. Larsen Apr. 1979 169 p refs
(Contract EY-76-S-05-5246)
(ORO-5246-3) Avail: NTIS HC A08/MF A01

Investigations are reported on mechanisms involved with hydrogen metal interactions which control the absorption and desorption processes in intermetallic compounds. A microbalance to determine the thermodynamic parameters is presented. DOE

N80-11203# Iowa State Univ. of Science and Technology, Ames. Dept. of Materials Science and Engineering.
LOW TEMPERATURE HEAT CAPACITY STUDIES ON HYDROGEN ABSORBING INTERMETALLIC COMPOUNDS
T. Takeshita, G. Dublon, O. D. McMasters, and K. A. Gschneidner, Jr. 1979 5 p refs Presented at Rare Earth Res. Conf., Fargo, N.D., 25 Jun. 1979
(Contract W-7405-eng-82)
(IS-M-210; Conf-790641-4) Avail: NTIS HC A02/MF A01

Low temperature heat capacities of some ternary Hauke compounds were studied. The electronic specific heat constants of these compounds decrease as Ni is substituted with Al or Cu. The Debye temperatures show some variations but not in a systematic manner for the aluminum substitution. In the aluminum substituted ternaries, there is no correlation between the hydrogen absorption capacity with the electronic specific constant and the Debye temperature except for ThNi2Al3. In the pseudo-binary system, LaNi5 - /sub x/Cu/sub x/, the stability of the metal hydride may be rigidity of the metal lattice, i.e., softer the metal lattice the more related to the stable the metal hydride. This is in agreement with our previous observations. DOE

N80-11204# Sandia Labs., Albuquerque, N. Mex.
IMPLANTED AND ANNEALED ALLOYS IN PHYSICAL METALLURGY
S. M. Myers 1978 27 p refs Presented at the Conf. on Ion Beam Modification of Materials, Budapest, 4 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1638C; Conf-780932-5) Avail: NTIS HC A03/MF A01

The annealing behavior of implanted metals is presented. All metal systems are considered. In such systems, defect related phenomena are generally less dominant than in semiconductors or insulators. DOE

N80-11205# Los Alamos Scientific Lab., N. Mex.
CONTOUR FORMING OF VARIOUS METALS: DEFORMATION AND RECRYSTALLIZATION CHARACTERISTICS
James F. Muller 1978 12 p Presented at SAMPE Conf., Kiamesha Lake, N.Y. 17 Oct. 1978
(Contract W-7405-eng-36)
(LA-UR-78-1412; Conf-781068-2) Avail: NTIS HC A02/MF A01

The effects of different forming and annealing sequences on resultant grain size were investigated for several materials. Deep

drawing as well as forging techniques were employed. One evaluation was additionally performed to determine the contribution of size effects. DOE

N80-11206# Los Alamos Scientific Lab., N. Mex.
EFFECT OF PERIODIC CHEMICAL VARIATION ON THE MECHANICAL PROPERTIES OF Ta FOILS
R. W. Springer, N. L. Ott (St. Joseph's College, Philadelphia), and D. S. Catlett 1978 11 p refs Presented at 25th Natl. Am. Vacuum Soc. Symp., San Francisco, 27 Nov. - 1 Dec. 1978
(Contract W-7405-eng-36)
(LA-UR-78-3065; Conf-781130-5) Avail: NTIS HC A02/MF A01

Acetylene gas was admitted to the chamber over approximately two orders of magnitude of pressure during Ta deposition. Residual gas analysis was used to verify that a reaction between the Ta film and the gas occurred. Subsequent Auger analysis showed that the carbon in the films could be predicted using simple pressure vs rate equation. The pulse gas process (PGP) has been applied to the electron beam gun deposition of Ta. Tensile test specimens a few micro-meters thick have been produced to show fracture strengths varying from approximately 170 MPa to approximately 860 MPa for pure to highly pulsed runs. The fracture strength loosely follows a Hall-Petch relation fracture strength to the time between pulses. Although diffusion of the carbon smoothes out the chemical period, it is thought that the remaining structure accounts for the strength enhancement. DOE

N80-11207# Bendix Corp., Kansas City, Mo.
PULSE PLATING OF HARD GOLD ELECTRODEPOSITS
C. J. Stimetz and J. J. Hren Feb. 1979 16 p refs Presented at Intern. Symp. on Pulse Plating, Boston, Mass., 19 Apr. 1979
(Contract EX-76-C-04-0613)
(BDX-613-2165; Conf-790450-1) Avail: NTIS HC A02/MF A01

The conventional and pulse plated, cobalt hardened gold deposits were evaluated and differences in cobalt chemical composition, morphology, and microstructure were determined. Cobalt hardened gold samples were plated on polished brass substrates for morphology study. For microstructure and chemical composition the substrate was stainless steel-304. DOE

N80-11208# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
ACOUSTIC EMISSION FROM HYDROGEN SATURATED TYPE 304L STAINLESS STEEL
G. R. Caskey, Jr. 1978 16 p refs Presented at TMS/AIME Fall Meeting, St. Louis, Mo., 15 Oct. 1978
(Contract EY-76-C-09-0001)
(DP-MS-78-50; Conf-781093-1) Avail: NTIS HC A02/MF A01

Acoustic emission was monitored during tensile tests of Type 304L austenitic stainless steel to explore the applicability of the technique to hydrogen-assisted fracture. DOE

N80-11209# Oak Ridge National Lab., Tenn.
DUCTILITY MINIMUM AND ITS REVERSAL WITH PROLONGED AGING IN COBALT-AND NICKEL-BASE SUPERALLOYS
1978 15 p refs Presented at ASME Meeting, San Francisco, Calif., 10 Dec. 1978
(Contract W-7405-eng-26)
(CONF-781202-35) Avail: NTIS HC A02/MF A01

The cobalt-base superalloys Haynes alloy No. 25 and Haynes alloy No. 188 and the nickel-base superalloy Inconel 625 show a pronounced ductility minimum at temperatures of 760 and 704 C, respectively, in the solution-annealed condition. However, after prolonged (11,000 h) aging at 816 C (1500 F), copious precipitates form to completely reverse the behavior. These precipitates reduce tensile ductility drastically up to temperatures where the ductility dip is observed for the solution-annealed condition; then the brittle behavior from aging gives way to greatly enhanced ductility. This behavior in Haynes alloy No. 25 is examined in detail. Its tensile properties in the solution-annealed and 816 C-aged conditions are correlated with mode of fracture and the amounts, identity, and morphology of the precipitates. The latter were assessed by optical and scanning electron metallography, microhardness, electron microprobe, and X-ray diffraction. The minimum and its reversal are explained by thermally activated processes, which began with the onset of recovery. DOE

N80-11210# Illinois Univ. at Urbana-Champaign, Urbana. Graduate Coll.
STUDY OF METAL-OXYGEN SOLID SOLUTIONS UTILIZING SOLID ELECTROLYTIC CELLS Ph.D. Thesis
Robert John Lauf Oct. 1978 104 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1216) Avail: NTIS HC A06/MF A01

A study was made of the thermodynamic and kinetic behavior of oxygen in a number of Group V metals and alloys. Investigations were made with a ThO_2/Y_2O_3 electrolyte over the temperature range of 600 to 1150 C (873 to 1423 K). The activity of oxygen in three Nb-Ta alloys (nominally 25, 50, and 75 at. % Ta) was found to obey Henry's Law up to the solubility limit in each alloy. The standard entropy and enthalpy of solution of oxygen in the three Nb-Ta alloys were intermediate between those for pure niobium and pure tantalum, and varied almost linearly with Nb : Ta content. The diffusion coefficient of oxygen was measured in niobium and vanadium, and the values were found to be in excellent agreement with literature values obtained by a variety of techniques. The diffusion coefficient of oxygen in each of several dilute substitutional niobium alloys was measured and compared to the diffusion coefficient in pure niobium. The addition of 1 to 5% substitutional solutes resulted in as much as an order-of-magnitude decrease in the oxygen diffusivity. DOE

N80-11211# Argonne National Lab., Ill.
HIGH PRECISION METAL STABLE ISOTOPE RATIO MEASUREMENTS USING VOLATILE METAL CHELATES
D. L. Hachey, J. Johnston, and P. D. Klein 1978 15 p refs Presented at 3d Intern. Conf. on Stable Isotopes, Oak Brook, Ill., 23 May 1978
(Contract W-31-109-eng-38)
(CONF-780501-7) Avail: NTIS HC A02/MF A01

A series of volable metal chelates were prepared for magnesium, calcium, iron, and cadmium. Extraction efficiency studies were done for magnesium and calcium in order to define the optimum conditions of pH and chelating agent required for recovery of these elements from aqueous media. Mass spectra of these chelates were obtained to evaluate their suitability for the measurement of metal stable isotope ratios. Chemical ionization mass spectrometry is most useful for the measurement of transition metal isotope ratios but electron ionization mass spectrometry is required for measurement of calcium and magnesium isotope ratios, since these elements are extensively polymerized in the gas phase. Isotope ratios can be measured to an absolute accuracy of +-0.03 to 0.72 percent, depending on the element, the ionization technique and the magnitude of the isotope ratio. The natural abundance can be determined in a single run for as many as eight isotopes or one element with better than +-0.48 percent accuracy when corrected for the natural abundance of C(13), H(2), and O(18) present in the chelating agent. DOE

N80-11212# Oak Ridge National Lab., Tenn.
TENSILE AND CREEP PROPERTIES OF TYPE 316 STAINLESS STEEL
V. K. Sikka 1978 31 p Presented at the UK/UKAEA Specialists Meeting on Mechanical Properties, Oak Ridge, Tenn., 4 Dec. 1978
(Contract W-7405-eng-26)
(CONF-781219-3) Avail: NTIS HC A03/MF A01

A mechanical property characterization test program on type 316 stainless steel is presented. Information for the formulation and verification of constitutive equations, setting failure criteria, and verification of design stresses and rules is discussed. DOE

N80-11213# Oak Ridge National Lab., Tenn.
MECHANICAL PROPERTIES OF MODIFIED 9 Cr-1 Mo STEEL
V. K. Sikka 1978 15 p Presented at the UK/UKAEA Specialists Meeting on Mechanical Properties, Oak Ridge, Tenn., 4 Dec. 1978

(Contract W-7405-eng-26)
(CONF-781219-2) Avail: NTIS HC A02/MF A01

A mechanical property evaluation of 24 experimental and 1 large commercial heat Mo steel developed by Combustion Engineering is presented. The mechanical properties evaluation involves the following tests: Charpy impact test to determine the ductile brittle transition temperature, tensile tests at room temperature and 649 C, and screening creep and creep rupture tests at 593 and 649 C. DOE

N80-11214*# Sandia Labs., Albuquerque, N. Mex.
EFFECTS OF IMPURITIES ON THE WELDABILITY OF ELECTROFORMED NICKEL
J. A. Brooks, J. W. Dini, and H. R. Johnson Dec. 1978 36 p refs
(NASA Order-L-50230A; Contract EY-76-C-04-0789)
(NASA-CR-162455; SAND-78-8774) Avail: NTIS HC A03/MF A01 CSCL 11F

The effect of impurities on weld cracking of electroformed nickel was studied using gas tungsten arc welding, varestraint testing and hot ductility testing. High purity electroformed nickel was found to be very resistant to weld cracking; furthermore, intentional additions of copper and iron to levels above those commonly observed in electrodeposits had no detrimental effects on welding. However, nickel electrodeposits with sulfur and lead impurities were found to exhibit increased susceptibility to weld cracking with increasing impurity content. High levels of carbon, oxygen, and nitrogen result in intergranular porosity of the weld heat affected zone and this leads to weld cracking resulting from locally reduced strength and ductility. Other cracking mechanisms resulting from impurities are proposed. DOE

N80-11215# Ames Lab., Iowa.
ANNEALING OF NEUTRON-IRRADIATED VANADIUM CONTAINING OXYGEN M.S. Thesis
R. E. Foster Jan. 1979 54 p refs
(Contract W-7405-eng-82)
(IS-T-816) Avail: NTIS HC A04/MF A01

The role of interstitial oxygen in irradiated vanadium was studied by measuring the activation energy of the 0.2 T/sub m/ recovery stage in well-characterized samples, where T/sub m/ is the melting temperature in degrees Kelvin. DOE

N80-11216# Ames Lab., Iowa.
STRUCTURAL STUDY OF HIGH TEMPERATURE METAL-RICH TITANIUM SULFIDE PHASES Ph.D. Thesis
J. P. Owens Jan. 1979 206 p refs
(Contract W-7405-eng-82)
(IS-T-832) Avail: NTIS HC A10/MF A01

Ti2S and Ti8S3 were prepared by high temperature annealing techniques. The crystal structures of these two phases were determined from single crystal X-ray diffraction data. Both structures were refined using a full-matrix least-squares treatment of positional parameters and isotropic temperature factor coefficients. Ti2S crystallizes with orthorhombic symmetry, space group Pnnm, having unit cell dimensions a = 11.367A, b = 14.060A, and c = 3.326A. Ti2S is isostructural with Ta2P. Ti8S3 crystallizes with monoclinic symmetry, space group C2/m,a = 32.69A, b = 3.327A, c = 19.35A, Beta = 139.9 deg (b - unique). Ti2S and Ti8S3 have structural features similar to the features of a large number of metal-rich transition-metal chalcogenides and pnictides. These various structure types have been characterized in terms of nonmetal trigonal prismatic coordination polyhedra, eight different metal partial coordination polyhedra, a short (approximately equal to 3.4A) crystallographic axis, two unique layers of atoms containing both metal and nonmetal atom positions, and mirror planes coincident with the two layers of atom positions. DOE

N80-11217# Illinois Univ., Urbana. Dept. of Physics.
CATALYSIS BY TRANSITION METAL COMPOUNDS Ph.D. Thesis
David Lee Klein 1978 153 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1234) Avail: NTIS HC A08/MF A01

The catalytic properties of cobalt oxide were investigated theoretically. The interactions of atomic hydrogen with small clusters of atoms, respresenting cobalt oxide surfaces, were calculated using the ab initio Unrestricted Hartree-Fock method. The electronic structure of the bulk solid was studied through band and cluster models. The bulk electronic structure computed predicts insulating behavior for cobalt oxide and agrees with experimental optical results. The perfect (100) cobalt oxide surface was determined not to chemisorb atomic hydrogen. Singly-ionized oxygen ions located near cation vacancies were found to chemisorb hydrogen, forming two-center covalent bonds. The effect of lattice defects on the creation of singly ionized oxygen ions was examined. A systematic procedure for the study of surface and bulk electronic properties is discussed. DOE

N80-11218# Defence Research Information Centre, Orpington (England).
THE DEPOSITION OF GOLD - COPPER - CADMIUM ALLOYS
M. Dettke London Dec. 1978 6 p Transl. into ENGLISH from Oberflaeche-Surface, v. 18, no. 4, 1977 p 101-102
(DRIC-Trans-5465; BR67498) Avail: NTIS HC A02/MF A01

Methods of electrolytic deposition of low carat gold alloys using gold - copper - cadmium systems are described. The production and properties of hard gold coatings, current densities for regulating the color in decorative electroplating, corrosion resistance of the coatings, and the possibility of sandwich plating are considered. An isotope irradiator whose electrons penetrate about five microns is suggested as suitable for producing coatings eight microns thick while for thinner coatings a carbon 14 irradiator is recommended. Author (ESA)

N80-11219# Royal Aircraft Establishment, Farnborough (England).
A CREEP DATA LIBRARY FOR DTD 5070A ALUMINUM ALLOYS
J. N. Webb London Dec. 1976 17 p refs Document includes a microfiche supplement. This supplement is available in microfiche on request from the NASA Scientific and Technical Information Facility
(RAE-TR-76067) Avail: NTIS HC A02/MF A01

Tensile creep and strain recovery data, accumulated during an investigation into creep behavior under varying load conditions of an aluminum alloy suited to airframe applications at elevated temperature, are presented. The data is of high quality as special attention was paid to the control of temperature, load, and load axiality. Data are included from continuous creep tests over a range of stresses (80 to 250 MM/sqm) and temperatures (150 to 195 C) as well as from tests, mainly at 180 C, involving prior heating and step changes in load level. Particular attention was paid to transient response and the effect of strain recovery periods. Each test phase was accurately fitted with a polynomial; computer printouts were obtained listing time, measured and fitted strain, strain rate, and the second derivative together with the polynomial coefficients. These collected printouts comprise the library of creep data which are presented in microfiche form. Author (ESA)

N80-11220# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
THE INFLUENCE ON THE FATIGUE PROPERTIES OF ALUMINUM AZ 74 FROM PROCESS VARIANTS IN SULPHURIC ACID ANODIZING
Nils Larsson 1979 37 p ref
(Contract FMV-F-FL-82223-76-001-21-001)
(FFA-TN-HU-1943) Avail: NTIS HC A03/MF A01

A fatigue investigation of surface treated aluminum AZ 74 (3633-4) is reviewed. The test specimens were turned and notched (K = 1.5). The loading was axial tension with R = 0. The separate processes used in treatment and some ten process variants are detailed. Owing to a limited number of test specimens, the investigation only admits rough estimations. However, process variants supposed to be detrimental, but not appearing so, as well as variants associated with considerable improvements point to the necessity of attention to details in anodizing processes. Author (ESA)

N80-11221# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
FATIGUE TESTING OF PRECIPITATING STEEL 1745

(CUSTOM 455) WITH MACHINING AS THE FINAL PROCESS
Nils Larsson 1979 35 p
(Contract FMV-F-K-82223-76-001-21-001)
(FFA-TN-HU-1965) Avail: NTIS HC A03/MF A01

Results from fatigue testing of turned specimens of a precipitation hardened steel are presented. The specimens were either plain or notched (K = 2.5 and K = 4.0) with machining as the final process. The fatigue testing was carried out with R = -1, R = 0, and sigma min = 300 N/sq mm. Supplementary static tests were performed. The ultimate tensile strength for plain specimens was 1612 N/sq mm. The fatigue results are presented as S-N curves and are also revised to Haig diagrams. Notch fatigue factors (Kf) were calculated and are shown.
Author (ESA)

N80-11222# Metallkundelabor an der Fachhochschule, Kiel (West Germany).
ANALYSIS OF THE INFLUENCE OF SPACE CONDITIONS UPON REACTIONS BETWEEN LIQUID AS WELL AS GASEOUS CORROSIVE AGENTS AND METALS Final Report
Guenther Mix Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 150 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-SLN-7751; DFVLR-BPT-01-QV-205-B22)
(BMFT-FB-W-77-10) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 31.30

In order to eliminate the deleterious influence of convection on research into chemical reactions between aquatic electrotypes and metallic surfaces, a low gravity environment is necessary. A comprehensive evaluation of the literature describing liquid mechanics under low gravity conditions is given in support of the use of SPACELAB for this type of study. Advantages cited include a gravitational field of 1/10,000 g, a low temperature gradient, and a low concentration gradient. It is shown that material transport depends on diffusion only under these conditions. Six experiments are proposed; i.e. the measuring of the double-layer capacity and the adsorption on metallic surfaces, corrosion of homogeneous metals, pitting corrosion, and cathodic protection against corrosion. Author (ESA)

N80-11223# Uppsala Univ. (Sweden). Inst. of Technology.
ON THE INFLUENCE OF NICKLE ON TOUGHNESS AND DUCTILE-BRITTLE TRANSITION IN LOW-CARBON LATH MARTENSITE STEELS
Lars-Aake Norstroem (Uddeholms AB) Jun. 1978 36 p refs
(UPTEC-78-53-R) Avail: NTIS HC A03/MF A01

The ductile-cleavage transition was studied with respect to grain size, yield strength, and nickel content by impact testing of low-carbon (< 0.1 percent C) lath martensite steels with 5% Mn, 5% Ni, and 9% Ni. The impact transition temperature (ITT) is found to be controlled by the martensite packet size and the yield strength. Regardless of packet size and yield strength, nickel additions imply powerful intrinsic toughness improvments while decreasing the ITT by as much as 20 C per percent nickel. At the same time, nickel moderated the effect of packet size and yield strength on ITT. These important effects of nickel additions are mainly attributed to a corresponding increase in cleavage fracture resistance and form the basis for the use of Ni-steels in cryogenic applications. Author (ESA)

N80-11224# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
FATIGUE TESTING OF FORGED TITANIUM
Nils Larsson Feb. 1979 31 p
(Contract FMV-F-FL-82223-77-001-21-001)
(FFA-HU-1997) Avail: NTIS HC A03/MF A01

Results from fatigue testing with specimens of forged titanium AMS 4971 satisfying the Saab-Scania specifications 6466-2 and 6466-3 are presented. The specimens were taken longitudinally as well as transversely from six similar forgings. They were turned and either plain (k sub t = 1.0) or notched (k sub t = 2.5 and 4.0). The fatigue testing was carried out with r = -1, R = 0, and sigma min = 250 N/sq mm. Supplementary static tests were performed. The ultimate tensile strength for plain specimens was 1020 and 1230 N/sq mm for 6466-2 and 6966-3, respectively. Most of the fatigue testing was devoted to 6466-2 returning seven S-N curves. Comparisons between the two conditions (6466-2, 6466-3) and the two forging directions (longitudinal, transverse) were made in the case k sub t = 2.5/R = 0. No marked differences were noticed. Large scatter was noticed for 6466-2 in the case k sub t = 1.0/R = 0.
Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-11225*# Rensselaer Polytechnic Inst., Troy, N. Y.
DETERMINATION OF PHYSICAL AND CHEMICAL STATES OF LUBRICANTS IN CONCENTRATED CONTACTS, PART 1 Final Report
James L. Lauer Washington NASA Nov. 1979 58 p refs
(Grant NsG-3170)
(NASA-CR-3204) Avail: NTIS HC A04/MF A01 CSCL 11H

A Fourier emission infrared microspectrometer, set up on a vibration-proof optical table and interfaced to a dedicated minicomputer, was used to record infrared emission spectra from elastohydrodynamic bearing contacts. Its range was extended to cover the entire mid-infrared from 2 to 15 micron. A series of experiments with 5P4E polyphenyl ether showed the existence of a temperature gradient through the lubricant in an ehd contact, which is perpendicular to the flow direction. The experiments also show marked polarization of some of the spectral bands, indicating a molecular alignment. Alignment is less evident at high pressure than at low pressure. To account for this behavior, a model is suggested along the lines developed for the conformational changes observed in long-chain polymers when subjected to increased pressure--to accommodate closer packing, molecules become kinked and curl up. Experiments with a traction fluid showed periodic changes of flow pattern associated with certain spectral changes. These observations will be studied further. A study by infrared attenuated total reflection spectrophotometry was undertaken to determine whether gamma irradiation would change polyethylene wear specimens. The results were negative. A.R.H.

N80-11226*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ELECTRON AND PROTON ABSORPTION CALCULATIONS FOR A GRAPHITE/EPOXY COMPOSITE MODEL
Edward R. Long, Jr. Nov. 1979 33 p refs
(NASA-TP-1568; L-13073) Avail: NTIS HC A02/MF A01 CSCL 11G

The Bethe-Bloch stopping power relations for inelastic collisions were used to determine the absorption of electron and proton energy in cured neat epoxy resin and the absorption of electron energy in a graphite/epoxy composite. Absorption of electron energy due to bremsstrahlung was determined. Electron energies from 0.2 to 4.0 MeV and proton energies from 0.3 to 1.75 MeV were used. Monoenergetic electron energy absorption profiles for models of pure graphite, cured neat epoxy resin, and graphite/epoxy composites are reported. A relation is determined for depth of uniform energy absorption in a composite as a function of fiber volume fraction and initial electron energy. Monoenergetic proton energy absorption profiles are reported for the neat resin model. A relation for total proton penetration in the epoxy resin as a function of initial proton energy is determined. Electron energy absorption in the composite due to bremsstrahlung is reported. Electron and proton energy absorption profiles in cured neat epoxy resin are reported for environments approximating geosynchronous earth orbit. R.C.T.

N80-11227# New York Univ., N. Y. Dept. of Applied Science.
EXPLORATORY RESEARCH ON NOVEL AMBIENT TEMPERATURE CURING TECHNIQUES FOR ADHESIVES, SEALANTS AND LAMINATES Final Report, 28 Feb. 1978 - 27 Feb. 1979
Walter Brenner Apr. 1979 82 p
(Contract N00019-78-C-0169)
(AD-A072591; NYU/DAS-79/07) Avail: NTIS

HC A05/MF A01 CSCL 11/1

The performance properties of thermosetting polymer systems which are cured with the application of heat and pressure generally surpass those obtained with ambient temperature cures for the same systems. This report describes a program of research and development comprising the exploration and study of selected novel ambient temperature curing techniques with the goal of obtaining performance characteristics equaling or surpassing those achieved with conventional heat/pressure type cures. The specific room temperature curing methods experimentally investigated included electron beam radiation; flash polymerization; interfacial polymerization and anaerobic cures. Some experiments were also carried out on room temperature curing epoxy polymer systems with high temperature service capabilities. GRA

N80-11228# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.

TOXICITY AND THERMAL PROPERTIES OF POLYPHOSPHAZENES Interim Report

P. J. Lieu, J. H. Magill, and Y. C. Alarie 19 Jul. 1979 37 p refs

(Contract N00014-77-C-0310)

(AD-A072120; SETEC-MME-79-40; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/3

Flammability and toxicity of various polyphosphazenes with and without fillers have been measured. The performance characteristics of these polymers are compared with other more conventional plastics of commercial interest. Other small scale tests such as limiting oxygen index, at different heat fluxes, have been used as indicators of flammability. Under ambient conditions, polyphosphazenes require a higher oxygen concentration to burn than air alone can supply. LOI values always decrease as heat flux or ambient temperature is raised. Fillers also influence LOI measurements. Foam samples burn more readily than films of the same chemical constitution. RD(50) and LC(50) values were obtained by exposing animals (mice) to a gaseous stream of polyphosphazene decomposition products. The respiratory response of mice is directly correlatable with the rate of polymer decomposition. The toxicity of a particular polyphosphazene depends strongly upon the type of the side groups on the phosphorus. There is no direct correlation between toxicity hazard and CO concentration in these polymers. Halogen side groups give rise to the most toxic products. Based upon an overall hazard rating involving thermal stability, flammability and toxicity parameters, halogen free polyphosphazenes are favored over halogen containing polymers for high temperature applications. GRA

N80-11229# Sandia Labs., Albuquerque, N. Mex.

EFFECT OF CHEMICAL ENVIRONMENTS ON THE FRACTURE OF CERAMIC SURFACES

Robert E. Cuthrell 1978 18 p refs Presented at Symp. on Ceram. Machining and Surface Finishing, Washington, D.C., 13 Nov. 1978

(Contract EY-76-C-04-0789)

(SAND-78-1664C; Conf-781143-1) Avail: NTIS HC A02/MF A01

Environmental effects on the deformation and fracture of a variety of materials during drilling/grinding and four point bending to failure were traced to embrittlement by hydrogen. The extent of embrittlement is determined by the availability of hydrogen in the drilling fluid or in the gaseous environment in an ultrahigh vacuum chamber. The hydrogen availability is in turn dependent on its binding in liquids (ionic, covalent, ion paired in media of low dielectric constant) or by the blocking effect of adsorbed carbon monoxide in the vacuum chamber. These hydrogen effects are shown in drilling rates, maximum strain to fracture, acoustic emission amplitude (energy) distributions accompanying fracture, and scanning electron microscope photomicrographs of the fracture surfaces. DOE

N80-11230# Sandia Labs., Albuquerque, N. Mex.

COMPARISON OF POLYMER FLAMMABILITIES AND A DETERMINATION OF THE LOSS OF FIRE RETARDANT ADDITIVES WITH AGING

R. L. Clough and E. A. Salazar 1979 9 p refs Presented at JOWOG-28, Albuquerque, N. Mex., 11 Jun. 1979

(Contract DE-AC04-76DP-00789)

(SAND-79-0978C; Conf-790632-2) Avail: NTIS HC A02/MF A01

An investigation on the flammability of two major types of commercial cable insulation formulations that are widely used in nuclear applications is described. The effects of thermal and radiation aging on the combustion properties of these polymeric materials are studied including an evaluation of the potential loss of fire retardant additives. The two polymer types being studied are chlorosulfonated polyethylene (Hypalon) and ethylenepropylene rubber (EPR). The fire retardant system used commercially with both of these polymers consists of two components antimony trioxide and a chlorinated hydrocarbon. DOE

N80-11231# Carnegie-Mellon Univ., Pittsburgh, Pa.

FURTHER MEASUREMENTS OF THE SPECIFIC HEATS AT LOW TEMPERATURES IN METALLIC GLASSES Final Report

T. B. Massalski 27 Sep. 1978 8 p refs

(UCRL-13908) Avail: NTIS HC A02/MF A01

The effect of the crystallization on the electronic structure and on certain lattice properties of amorphous alloys, Pd-Si and Pd-Si-Cu is presented. The temperature dependence of the low temperature specific heats for nonmagnetic amorphous alloys was established. The customary fitting equation C = gamma T + alpha T cubed + delta T to the 5th power was found to describe adequately the data for all amorphous samples studied. The linearly temperature dependent term gamma T, which measures the density of states at the Fermi level after the correction for the electron-phonon interaction and the noncrystalline effect, was found to be strongly dependent on composition. A large, broad maximum was observed at about 19 at. percent Si in the binary system. The interaction of the conduction electrons with the first peak of the structure factor S(q) was studied. DOE

N80-11232# Bendix Corp., Kansas City, Mo.

CHARACTERIZATION OF LOW DENSITY RIGID URETHANE FOAM

F. N. Larsen Oct. 1978 20 p refs

(Contract EY-76-C-04-0613)

(BDX-613-1890-Rev) Avail: NTIS HC A02/MF A01

The chemical and mechanical properties of a low density, rigid polyurethane foam material taken from a Joint Test Assembly after 13 years of storage were measured. The chemical composition was Bendix Rigifoam 6003-1.5, a pentaerythritol/epsilon-caprolactone/tolyene diisocyanate polyurethane foam. Comparison of data from testing the thermal and mechanical characteristics with data from a currently manufactured foam of identical composition indicates no degradation of properties had occurred. This information gives added confidence to the stockpile lifetime integrity of the Rigifoam 6003-2 foam system designated for use in other programs. DOE

N80-11233# Bendix Corp., Kansas City, Mo.

SHELF LIFE DETERMINATION OF EPOXY PREPREGS AND FILM ADHESIVES Final Report

B. G. Parker Jan. 1979 24 p refs

(Contract EY-76-C-04-0613)

(BDX-613-2033-Rev) Avail: NTIS HC A02/MF A01

Kinetic data describing the cure of a Kevlar/epoxy prepreg and an epoxy film adhesive were determined by the use of Differential Scanning Calorimetry. For the Kevlar/epoxy prepreg, a correlation was found between the heat of reaction and percent resin flow; a similar correlation was found between the heat of reaction and lapshear strength for the film adhesive. An equation was derived for the determination of the B stage time required to yield an epoxy prepreg possessing the desired flow properties. The effects of storage temperature on the shelf-life of both the prepreg and film adhesive were determined. DOE

N80-11234# Ames Lab., Iowa.

THERMAL EXPANSION OF GLASSES AT LOW TEMPERATURES Ph.D. Thesis - Iowa State Univ.

K. G. Lyon Jan. 1979 89 p refs

(Contract W-7405-eng-82)

(IS-T-829) Avail: NTIS HC A05/MF A01

The linear thermal expansion coefficient was measured at temperatures to 1.2 K for two amorphous solids, fused silica

and plexiglas, using a parallel plate capacitor differential dilatometer. The low temparature expansion coefficients for these solids have the same temperature dependences as the specific heats, and show a contribution which is linear in the temperature and which can be associated with the postulate of a broad distribution of two level states. The Grueneisen parameters which are associated with this contribution are comparable for the two solids, and suggest a further indication of common behavior for amorphous solids at low temparature. Large magnitudes for Grueneisen parameters generally are associated with tunneling models. A symmetric double harmonic oscillator funneling model can be used to understand the sign and magnitude of gamma for these solids. This model is inconsistent with other thermal and thermodynamic data for fused silica. DOE

N80-11235# Sandia Labs., Albuquerque, N. Mex.
ETCHING STUDY FOR THE MC2980 GLASS CERAMIC PREFORM
S. T. Reed and C. R. Abrams. Nov. 1978. 23 p. refs.
(Contract EX-76-C-04-0789)
(SAND-78-1295). Avail: NTIS. HC A02/MF A01.

Variables of the etching process for the MC2980 glass ceramic preform were studied to determine their effect upon the etching rate. These variables include: type of agitation on the preform, temperature of the etchant, duration of etch, surface finish of preform, depletion of etchant, evaporation of etchant, and interruption of etching cycle. The etching rate varied from 0.18 g/min at room temperature to 1.31 g/minute at 80 C. A constant etching rate, at elevated temperatures using the same batch of etchant, could not be maintained because of evaporation losses and the depletion of the etchant. The vapor-honed surface layer of the preform was removed after 10 min of etching at room temperature and only 2 min of etching at 80 C. DOE

N80-11236# Nevada Univ., Reno. Dept. of Chemistry.
MEASUREMENT OF DIFFUSION COEFFICIENTS OF SHORT-LIVED SPECIES IN SOLUTION AND IN AMORPHOUS GLASSES. Final Report, 1 May 1967 - 31 Aug. 1978
R. D. Burkhart. Aug. 1978. 36 p. refs.
(Contract EY-76-S-08-0535)
(NVO-0535-7). Avail: NTIS. HC A03/MF A01.

The diffusion coefficients of 1-propyl, 1-pentyl, 1-dodecyl, 1-octadecyl cyclohexyl and benzyl radicals were measured in hydrocarbon solvents at room temperature using the method of photochemical space intermittency. The results indicate that strong radical-solvent interactions exist for all but the benzyl radical. Solvent effects observed are those to be expected from changes in viscosity. Measurements of triplet energy transfer between molecules in polystyrene matrices show that the energy transfer probability is a decreasing exponential function of the average separation distance of solute molecules. Triplet energy migration was studied in solid films of poly(N-vinyl carbazole) (PVCA). Effects of temperature on intensities and lifetimes of PVCA phosphorescence and delayed fluorescence were determined and a PVCA delayed luminescence spectrum at room temperature was obtained. DOE

N80-11237# Central Electricity Generating Board, Bristol (England). Scientific Services Dept.
GLASS FIBRE REINFORCED, SPRAYED COATING FOR SEALING THERMAL INSULATION CONTAINING ASBESTOS
P. H. Crum, inventor, B. Godfrey, inventor, R. D. Hunt, inventor, and T. K. Marston, inventor. May 1979. 4 p.
(TDB-325). Avail: NTIS. HC A02/MF A01.

A method of sealing asbestos insulation was developed. It consists of simultaneously spraying short glass fiber rovings and certain water based paints of the type commonly used for sealing asbestos such that the two components mix and form, when dry, a tough membrane reinforced with randomly orientated fiber. Spraying tests were run at two electric power stations. Results show that the sprayed coatings are superior to other coatings as they extend more before perforation and are much more resistant to tearing and impact damage. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N80-11238*# Union Carbide Corp., Tonawanda, N.Y. Linde Div.
ECONOMICS OF HYDROGEN PRODUCTION AND LIQUEFACTION UPDATED TO 1980
C. R. Baker. Nov. 1979. 41 p. refs.
(Contract NAS1-14698)
(NASA-CR-159163). Avail: NTIS. HC A03/MF A01. CSCL 21D.

Revised costs for generating and liquefying hydrogen in mid-1980 are presented. Plant investments were treated as straight-forward escalations resulting from inflation. Operating costs, however, were derived in terms of the unit cost of coal, fuel gas and electrical energy to permit the determination of the influence of these parameters on the cost of liquid hydrogen. Inflationary influence was recognized by requiring a 15% discounted rate of return on investment for Discounted Cash Flow financing analysis, up from 12% previously. Utility financing was revised to require an 11% interest rate on debt. The scope of operation of the hydrogen plant was revised from previous studies to include only the hydrogen generation and liquefaction facilities. On-site fuel gas and power generation, originally a part of the plant complex, was eliminated. Fuel gas and power are now treated as purchased utilities. Costs for on-site generation of fuel gas however, are included. A.R.H.

N80-11239# Ballistic Research Labs., Aberdeen Proving Ground, Md.
WORKSHOP REPORT: FUNDAMENTAL REACTIONS IN SOLID PROPELLANT COMBUSTION
Robert A. Fifer. May 1979. 30 p. refs.
(DA Proj. 1L1-61102-AH-60)
(AD-A072162; AD-E430263; ARBRL-TR-02166). Avail: NTIS. HC A03/MF A01. CSCL 21/2.

This report summaries the results of a JANNAF workshop held 26-27 July 1977 at the Ballistic Research Laboratory. The purpose of the workshop was to assess our current understanding of the fundamental chemical and physical processes involved in the ignition and combustion of nitrate ester and nitramine propellants. A brief review is presented of the nitramine slope break and nitrate ester catalysis phenomena. The workshop discussions are summarized. Specific discussion questions are listed, together with some of the ideas and recommendations that resulted from the workshop. GRA

N80-11240# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
THE 84-INCH PROPELLANT GRAINS. Final Report, Jan. 1978 - Feb. 1979
Terry V. OHara and Albert J. Martel. Edwards AFB, Calif. Air Force Rocket Propulsion Lab. 28 Apr. 1979. 91 p.
(Contract F04611-78-C-0010; AF Proj. 3059)
(AD-A071961; CSD-2660-FR-D; AFRPL-TR-79-25). Avail: NTIS. HC A05/MF A01. CSCL 21/9.

This report documents the results obtained during casting a total of 7 84 in. SLSH cartridges with UTP-18,803A propellant (90% solids, 21% aluminum, HTPB) for AFRPL. This program is an extension of the work discussed in AFRPL-TR-77-92 and brings the total amount of UTP-18 903A produced under full-scale production conditions to over 880,000 lb. In addition one ELSH grain was cast with 22,000 lb of UTI-610B, an inert propellant. GRA

N80-11241# Hercules, Inc., Cumberland, Md. Allegany Ballistics Lab.
NAVAL SEA SYSTEM COMMAND RESEARCH AND EXPLORATORY DEVELOPMENT, 1978. Quarterly Summary Report, 10 Nov. 1978 - 30 Jan. 1979
Mar. 1979. 49 p.
(Contract N00024-79-C-5314)

(AD-A071875; QSR-10) Avail: NTIS HC A03/MF A01 CSCL 21/8

This report describes the progress in the first quarter on the following tasks: Signature Evaluation, Low Cost Strip Laminate Case, Vertical Launch Controllable Motor, Prediction of XLDB Propellant Mechanical Failure, HMX (RDX) Bonding Agents, Polymer Morphology Studies of XLDB Binder. GRA

N80-11242# ARO, Inc., Arnold Air Force Station, Tenn.
INFRARED OPTICAL PROPERTIES OF BIPROPELLANT CRYOCONTAMINANTS Interim Report, 1 Oct. 1977 - 15 Mar. 1979
J. A. Roux, B. E. Wood, and A. M. Smith Arnold AFB AEDC Aug. 1979 123 p refs
(AD-A073186; AEDC-TR-79-50) Avail: NTIS HC A06/MF A01 CSCL 17/5

The infrared spectral transmittance of cryofilms formed by MMH, N2O4, and N2H4 propellants was measured. These films were cryopumped on 20 and 77K germanium substrates and ranged in thickness from 0.25 to 9 microns; the deposition pressure for the films was approximately 1 x 10-7 torr. Transmission spectra were obtained for the 500 to 3700 wavenumber range using a Fourier transform spectrometer. Values of the complex index of refraction for the cryodeposits were derived from the experimental data using an analytical model and a nonlinear least-squares method. The analytical model treats the germanium as a thick, noninterfering film and the deposit as a thin film. Results from the least-squares method are also compared with a Kramers-Kronig determination of the real part of the index of refraction. The optical properties of such cryofilms are essential for predicting the degradation of cryocooled optical surfaces contaminated by liquid propellant exhaust plumes. GRA

N80-11243# Princeton Univ., N. J. Dept. of Electrical Engineering.
THE INFLUENCE OF CONTACT AND INTERFACE EFFECTS OF THE ELECTRONIC PROPERTIES AND STABILITY OF CHEMICALLY UNSTABLE MATERIALS Final Report, 1 Jul. 1974 - 30 Sep. 1978
Peter Mark 23 Jul. 1979 53 p ref
(Grants DAAG29-76-G-0017; DANC04-74-G-0193; Grant DAHC04-75-G-0085)
(AD-A073073; ARO-12606.2-P; ARO-13370.2-P) Avail: NTIS HC A04/MF A01 CSCL 19/1

This report summarizes an effort to assess the usefulness of electron beam probe analysis, such as Auger electron spectroscopy (AES), in the analysis of initiation event in primary explosives, principally, azides. Attempts were made to extract a variety of chemical and physical information from AES analyses of KN and NaN3 crystal specimens to determine whether one could ascribe the chemical instability of these materials to surface as distinct from volume properties. GRA

N80-11244# Exxon Research and Engineering Co., Linden, N.J.
FUNDAMENTAL CHARACTERIZATION OF ALTERNATE FUEL EFFECTS IN CONTINUOUS COMBUSTION SYSTEMS
W. S. Blazowski, R. B. Edelman (Science Applications, Inc., Woodland Hills, Calif.), and P. T. Harsha (Science Applications, Inc., Woodland Hills, Calif.) 11 Sep. 1978 86 p refs
(Contract EC-77-C-03-1543)
(SAN-1543-12) Avail: NTIS HC A05/MF A01

The development of fuel-flexible combustion systems for gas turbines as well as Rankine and Stirling cycle engines is presented. An improved understanding was developed of relationships between alternate fuel properties and continuous combustion system effects, and to provide analytical modeling/correlation capabilities to be used as design aids for development of fuel-tolerant combustion systems. Experimental procedures were evaluated for studying alternate fuel combustion effects and to determine current analytical capabilities for prediction of these effects. Jet Stirred Combustor studies during this period produced new insights into soot formation in strongly back-mixed systems and have provided much information for comparison with analytical predictions. Applications of quasi-global modeling techniques were included as well as comparison of prediction with the experimental results generated. DOE

N80-11245# California Univ., Livermore. Lawrence Livermore Lab.
LABORATORY COAL GASIFIER FACILITY
W. R. Aiman, C. B. Thorsness, and R. J. Cena 16 Apr. 1979 35 p refs Presented at Spring Meeting on Western States Section, and the Combustion Inst., Provo, Utah, 23 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-82602; Conf-790434-3) Avail: NTIS HC A03/MF A01

A laboratory coal gasifier test facility consists of systems for metering gases into an experimental gasifier, condensing the tar and water out of the product gases and flaring them, sampling and analyzing the product gases, and monitoring the gasifier during an experiment. The major items of equipment include: a mass spectrometer, a process gas chromatograph, a mini-computer, and the experimental coal gasifiers--currently a 1.5 m fixed-bed gasifier and a 0.9 m bore-hole gasifier. This facility is described and the use of the facility in validating software and hardware for use in field experiments are discussed. The results of an experiment with the 1.5 m fixed-bed gasifier are described. Temperature profiles down the centerline of the reactor at various times during the experiment are discussed. Product gas compositions are discussed. DOE

N80-11246# Oak Ridge National Lab., Tenn.
ECONOMICS OF GASOLINE PRODUCTION FROM UNDERGROUND COAL GASIFICATION VIA MOBIL M PROCESS
M. S. Edwards, W. C. Ulrich, and R. Salmon 1979 36 p refs Presented at AICE Meeting, Houston, Tex., 1 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790405-12) Avail: NTIS HC A03/MF A01

A conceptual process design and cost estimate is presented for a facility producing approximately 15,000 barrels per day of M-gasoline via methanol from synthesis gas generated by gasification of coal in situ. The design was based on experimental data obtained at the Laramie Energy Technology Center on the linked vertical well in situ coal gasification process. In-place coal consumption is 756 Mg/h (20,000 tons/day), based on a subbituminous Wyoming coal. The capital investment was estimated to be $535 million in first quarter 1978 dollars. The product price of M-gasoline (including mixed butane LPG) is about $240/cubed m ($0.90/gal) at the plant gate. Calculated overall thermal efficiency for the facility was 22%, based on in-place coal. DOE

N80-11247# California Univ., Livermore. Lawrence Livermore Lab.
BEHAVIOR OF LIGHTLY CONFINED HIGH EXPLOSIVES IN A JET-FUEL FIRE
K. J. Scribner and G. J. Tanaka 2 Feb. 1979 23 p
(Contract W-7405-eng-48)
(UCRL-52659) Avail: NTIS HC A02/MF A01

The effects of a jet-fuel fire on the behavior of several plastic-bonded explosives of military interest were investigated. Eight small spherical explosive assemblies cased in stainless steel and containing thermocouples to record the ambient flame temperature at several points inside the assembly were fabricated. The explosive formulations contained HMX, TATB, NQ, or combinations of HMX with either TATB or NQ. When these units were tested, similar behavior for all formulations was observed. There were no detonations. Decomposition began at the outer surface of the high-explosive charge and proceeded slowly toward the center, and all casings vented under the pressure of the decomposition products. Thermograms showed that, under the test conditions, TATB is the most thermally stable and NQ is the least stable of the three explosives tested. DOE

N80-11248# Metal Properties Council, Inc., New York.
PROGRAM TO DISCOVER MATERIALS SUITABLE FOR SERVICE UNDER HOSTILE CONDITIONS OBTAINING IN EQUIPMENT FOR THE GASIFICATION OF COAL AND OTHER SOLID FUELS Quarterly Progress Report, 1 Apr. 1978 - 30 Jun. 1978
A. O. Schaefer, ed. DOE 16 Oct. 1978 238 p refs
(Contract EX-76-C-01-1784)

(FE-1784-42) Avail: NTIS HC A11/MF A01

Progress is reported in screening materials for use in such plants with corrosive environments and in providing useful corrosion data as well as reliable information on other properties needed for the design, construction, and operation of such plants. The program involves high temperature corrosion studies involving low concentration of H2S, exposure of metal coupons and refractories in coal gasification pilot plants, aqueous corrosion erosion and corrosion testing, and measurements of the mechanical and physical properties of materials. DOE

N80-11249# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS (RISER CRACKING OF COAL) Quarterly Report, 1 Apr. - 30 Jun. 1978
D. A. Duncan, J. L. Beeson, and R. D. Oberle Sep. 1978 25 p refs
(Contract EX-76-C-01-2307)
(FE-2307-38; QR-1) Avail: NTIS HC A02/MF A01

Runs were made in the bench-scale unit to investigate hydrocarbon yields from North Dakota lignite at operating pressures of 500 and 1000 psig. The base carbon conversions were reduced to approximately 26 and 33%, and hydrocarbon liquids yields were reduced to 6.4 and 9.2 grams per 100 grams of feed carbon, respectively. These values are considerably lower than those obtained from North Dakota lignite in bench-scale unit operations at 2000 psig. At that pressure, base carbon conversions were approximately 50%, and hydrocarbon liquids yields were 18 grams per 100 grams of feed carbon. Runs were also made with Illinois No. 6 bituminous coal [free-swelling-index (FSI) - 4-1/2]. To avoid plugging the reactor, the coal was mixed with fine silica sand at levels of 10%, 20%, and 30% (by weight) coal with sand. The bench-scale unit was operated using an upsweeping temperature profile at coil outlet temperatures of 1450 and 1500 F and a system outlet pressure of 2000 psig. Runs with the 10% and 20% (by weight) coal were successful. DOE

N80-11250# Electric Power Research Inst., Palo Alto, Calif.
BIOFUELS: A SURVEY
John R. Benemann Jun. 1978 96 p refs Sponsored by EPRI
(EPRI-ER-746-SR) Avail: NTIS HC A05/MF A01

Photosynthesis, plant productivity, waste and residue resources, 'energy farming,' processes for using biomass directly or converting it to fuels, and overall economics are discussed. Applications by U.S. industries and utilities are emphasized and current U.S. research and development programs presented. With foreseeable technologies and economics, approximately 5% of the fossil fuels now consumed in the United States could presently be replaced by available forestry, agricultural, and municipal wastes and residues. DOE

N80-11251# Department of Energy, Washington, D. C. Energy Policy Office
NATIONAL GAS SURVEY REPORT TO THE FEDERAL ENERGY REGULATORY COMMISSION BY THE SUPPLY-TECHNICAL ADVISORY TASK FORCE ON NONCONVENTIONAL NATURAL GAS RESOURCES
Jun. 1978 116 p refs
(DOE/FERC-0010) Avail: NTIS HC A06/MF A01

An analysis of the future energy situation in the U.S. with emphasis on the natural gas industry is presented. The analysis includes chapters on historical research efforts, industry criteria for commercialization of coal bed gas, technology for recovering methane from coal beds, identification of problems, legal concerns, and environmental considerations. DOE

N80-11252# Toulouse Univ. (France).
DETONATION OF EXPLOSIVES USING SEMICONDUCTING LAYERS [INITIATION D'EXPLOSIVES A COUCHES SEMICONDUCTRICES]
J. F. Vincent Jul. 1978 20 p ref In FRENCH
(Publ-368) Avail: NTIS HC A02/MF A01

Nonlinear layers to be combined with appropriate detonators for the electrical firing of explosives were developed in order to provide an elevation of the low voltage safety limit and a reduction of the operating point dispersion. Indirect operation in series with a conductive initiator and direct operation producing detonation by primary current heating of the nonlinear layer were investigated. The materials under study were OZN ceramics with the addition of 0.5 percent of Bi203 (binary system) and the same with the addition of 0.5 percent Mn02 (tertiary system). Results show that using a 100 nF condenser, an operation point of 150 volts with a + or - dispersion of 10 volts with the tertiary system is possible for indirect firing, while 400 volts and 1000 nF are necessary for direct firing. Author (ESA)

N80-11253# Prins Maurits Lab. TNO, Rijswijk (Netherlands). Inst. voor Chemische en Technologische Research.
SURVEY OF THE ACTIVITIES CONCERNING SENSITIVITY TEST METHODS FOR EXPLOSIVES
I. J. J. Janswoude 22 Aug. 1978 32 p refs
(Contract A76/KL/071)
(PML-1979-20; TDCK-71984) Avail: NTIS HC A03/MF A01

A survey of sensitivity test methods for explosives as used by an explosion safety laboratory is presented. The survey includes sensitivity methods regarding impact, friction, sparks, hot surfaces, and the importance and applications of critical hot spot size theory. Author (ESA)

N80-11254# New York City Resource Recovery Task Force, N. Y.
METHANE RECOVERY FROM SANITARY LANDFILLS; GAS RECOVERY SYSTEM INSTALLATION AND TESTING Interim Report
Dec. 1978 45 p refs Prepared in cooperation with Brooklyn Union Gas Co., N. Y. and Wegman Co., Inc., Buffalo, N. Y.
(PB-296622/4; NYSERDA-78/18) Avail: NTIS HC A03/MF A01 CSCL 21D

A methane gas recovery program to mine this clean energy form from the municipal solid wastes deposited at the New York Fresh Kills Landfill in Staten Island, New York is described. Optics covered include the results of a six-week test program subsequent modifications made to the gas system, and the objectives and plans for the phase 3 landfill gas utilization program. GRA

N80-11255# Mitre Corp., McLean, Va. Metrek Div.
ASSESSMENT OF LONG TERM RESEARCH NEEDS FOR COAL-GASIFICATION TECHNOLOGIES Final Report
Apr. 1979 201 p
(Contract ER-78-C-01063)
(PB-297853/4; MTR-79W00160) Avail: NTIS HC A10/MF A01 CSCL 07A

An assessment of research areas that affect long term development of coal gasification technologies is presented. Research recommendations and findings are discussed. Included are: an analysis of the major application areas for coal gasification technologies; discussion of the status and needs of the principal systems according to reactor type (fixed bed, fluidized bed, etc.); reports from site visits and communications with technology developers; and in-depth assessment of basic research needs in the critical areas of scaling and modeling, materials, effluent characterization, diagnosis and instrumentation, coal chemistry, catalytic chemistry, gas particle systems, and unit operations. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-11256# Forecasting International Ltd., Arlington, Va.
U. S. ARMY METRICATION ANALYSIS AND RECOMMENDATIONS FOR DA IMPLEMENTATION PLAN, VOLUME 1
M. J. Oetron, L. A. Roepcke, C. F. McFadden, S. E. Sugarek, and E. B. Peters 9 Jun. 1978 345 p refs
(Contract DAAG39-77-C-0108)
(AD-A069746) Avail: NTIS HC A15/MF A01 CSCL 05/1

Much has been learned about the metrication experiences and practices of foreign nations and U.S. companies. The most

crucial lessons learned from the experience of others which have relevance to the U.S. Army are briefly summarized below. (1) Metrication is inevitable. (2) Key to the Army's approach to metrication should be an evolutionary, least cost philosophy - including the concepts of keeping pace with industry, letting costs lie where they fall and employing flexible timetables and plans. (3) A strong, high level commitment to metrication is essential. (4) Planning and coordination are the keys to successful, least cost metrication, and the 'doers' (line management) should be the planners. (5) Only a small, dedicated metrication organization is needed. It can be supported by ad hoc working groups with membership drawn from the line organization. GRA

N80-11257# Army Aviation Research and Development Command, St. Louis, Mo.
SCHEDULE. MANAGERIAL TOOL FOR PROJECT/PRODUCT MANAGERS Final Report
Vernon Allen, Lonnie Antwiler, and Michael Garsik May 1979 195 p refs
(AD-A072140; USAAVRADCOM-TR-79-17) Avail: NTIS HC A09/MF A01 CSCL 09/2

Schedule is an interactive computer program designed to organize and present schedule information. It enables the user to maintain a master file of schedule type information for each of many projects, from which current status, change impact analysis or 'what if' studies can be obtained. The program, which was developed on an IBM 360/65, provides graphic output on a Tektronix 4014 or tabular output on most printers/typewriters. It was written in PL/1 language except for the graphics routines, which are combinations of Fortran IV and Tektronix Advanced Graphics, Release 3. GRA

N80-11258# Army Construction Engineering Research Lab., Champaign, Ill.
THE BUILDING LOADS ANALYSIS AND SYSTEM THERMODYNAMICS (BLAST) PROGRAM, VERSION 2.0. USERS MANUAL, VOLUME 1 Final Report
Douglas C. Hittle Jun. 1979 287 p
(AD-A072272; CERL-TR-E-153-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 09/2

The Building Loads Analysis and System Thermodynamics (BLAST) program is a comprehensive set of subprograms for predicting energy consumption in buildings. There are three major subprograms: (1) the space load predicting subprogram, which computes hourly space loads in a building or zone based on user input and hourly weather data; (2) the air distribution system simulation subprogram, which uses the computed space load and user inputs describing the building air-handling system to calculate hot water or steam, chilled water, and electric energy demands; and (3) the central plant simulation program, which simulates boilers, chillers, onsite power generating equipment and solar energy systems and computes monthly and annual fuel and electrical power consumption and plant life cycle cost. GRA

N80-11259# Army Construction Engineering Research Lab., Champaign, Ill.
THE BUILDING LOADS ANALYSIS SYSTEM THERMODYNAMICS (BLAST) PROGRAM, VERSION 2.0. INPUT BOOKLET Final Report
E. Sowell Jun. 1979 118 p
(AD-A072435; CERL-TR-E-153) Avail: NTIS HC A06/MF A01 CSCL 09/2

The Building Loads Analysis and System Thermodynamics (BLAST) program is a comprehensive set of subprograms for predicting energy consumption in buildings. There are three major subprograms: (1) the space load predicting subprogram, which computes hourly space loads in a building or zone based on user input and hourly weather data; (2) the air distribution system simulation subprogram, which uses the computed space load and user inputs describing the building air-handling system to calculate hot water or steam, chilled water, and electric energy demands; and (3) the central plant simulation program, which simulates boilers, chillers, onsite power generating equipment and solar energy systems and computes monthly and annual fuel and electrical power consumption and plant life cycle costs. GRA

N80-11260# Pennsylvania State Univ., University Park. Applied Research Lab.
DEVELOPMENT EFFORTS ON A DIFFUSER AND PUMP INLET FOR A WATER JET PROPULSION SYSTEM
A. M. Yocum 4 Apr. 1979 88 p refs
(Contract N00024-79-C-6043)
(AD-A072567; ARL/PSU/TM-79-51) Avail: NTIS HC A05/MF A01 CSCL 13/10

Results from three studies relating to the development of a water jet propulsion system for a high speed planing craft are presented. More specifically, these studies apply to the development of the diffuser and pump inlet of the system and represent a continuation of previous work done at ARL/PSU in this area. The first study investigates the possible interaction of the flow between the diffuser and a vaned-volute type pump inlet. No interaction was revealed. The second study determined the feasibility of an improved vaned-volute type inlet using conventional pump design techniques to lay out the vanes. With the restrictions placed on the design by the propulsion system, flow separation from the vanes is likely and, thus, this type of inlet was found to be infeasible. The third study consisted of the design and model testing of a new diffuser and a conventional double suction pump inlet. The design and test results are documented in this report. Test results showed that the diffuser efficiency was improved slightly and the losses through the pump inlet were reduced by more than a factor of two from the losses in the vaned-volute inlet. GRA

N80-11261# Sandia Labs., Albuquerque, N. Mex.
EXPLOSIVE TECHNIQUE FOR AXISYMMETRIC EXPANSION OF CYLINDERS AT HIGH STRAIN RATES
R. I. Butler, B. W. Duggin, and M. J. Forrestal Jan. 1979 17 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2393) Avail: NTIS HC A02/MF A01

Dry PETN high explosive which was vibrated into an annular cavity and surface initiated with a mesh pattern of etched copper bridgewires was used to expand type 304 stainless steel cylinders through fracture at initial strain rates of approximately 2700/s. This technique produced a uniform detonation that was simultaneous to within 100 ns over the loaded surface. DOE

N80-11262# Bendix Corp., Kansas City, Mo.
ELECTROCHEMICAL DEBURRING: ANOTHER SHARP SWORD IN THE BATTLE WITH BURRS
LaRoux K. Gillespie 1979 35 p
(Contract EY-76-C-04-0613)
(BDX-613-2132) Avail: NTIS HC A03/MF A01

A technology assessment of the process of electrochemical deburring (ECD) is presented. ECD is a process which uses both electricity and chemistry to remove burrs. It is a very fast process suitable to a wide range of metals. It is one of the few processes which does not require a tool which cuts, scrapes, abrades, or otherwise touches the burr. Some of its best applications are with materials or configurations which are not easily deburred by any other process. DOE

N80-11263# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
A MODEL FOR NONLINEAR CREEP OF CONCRETE
J. H. Argyris, K. S. Pister, and K. J. William Apr. 1978 14 p refs Presented at 2d Session of RILEM Colloq. on Creep Concrete, Leeds, Engl., 20-21 Apr. 1978
(ISD-Rept-246) Avail: NTIS HC A02/MF A01

A constitutive model for uniaxial creep of concrete, based on thermodynamics of materials with internal state variables is described. Using experimental data, model parameters are estimated using least squares procedures. It is found that considerable nonlinearity with respect to stress exists in instantaneous creep response, that recoverable creep strain is relatively insensitive to aging, and that irreversible creep strain is relatively strongly affected by aging and stress level. A brief discussion of important open questions concerning choice of models for creep is included. Author (ESA)

N80-11264# Uppsala Univ. (Sweden). Inst. of Technology.
DESORPTION HEAT CAPACITY OF 3He ADSORBED ON SOLID ARGON

Per Wennerstroem, Anders Toerne, and Torsten Lindqvist Mar. 1978 14 p refs
(UPTEC-78-16-R) Avail: NTIS HC A02/MF A01

The desorption heat capacity of successive monolayers of 3He absorbed on solid argon was measured and a rigid band model for the adsorption states was used in the analysis. Results show that the desorption energy for the first layer varies from -90 K to -38 K as a function of coverage. For the second layer the model shows that the first adatoms in this layer have thermodynamic properties very similar to the last atoms in the first layer. Author (ESA)

N80-11265# Uppsala Univ. (Sweden). Inst. of Technology.
DESORPTION HEAT CAPACITY OF 4He ADSORBED ON SOLID NEON
Anders Toerne, Per Wennerstroem, and Torsten Lindqvist Mar. 1978 10 p refs
(UPTEC-78-17-R) Avail: NTIS HC A02/MF A01

The desorption heat capacity of successive monolayers of 4He adsorbed on solid neon was measured and a rigid band model for the adsorption was used in the analysis. The desorption energy for the first layer varies from -66 K to -29 K as a function of coverage. The desorption process is described using Fermi-Dirac statistics although the adatoms are bosons. Author (ESA)

N80-11266# Uppsala Univ. (Sweden). Inst. of Technology.
DESCRIPTION OF EXPERIMENTAL TECHNIQUES USED IN HEAT CAPACITY MEASUREMENTS OF ADSORBED HELIUM
Anders Toerne, Per Wennerstroem, and Torsten Lindqvist Mar. 1979 14 p refs
(UPTEC-78-18-R) Avail: NTIS HC A02/MF A01

Calorimeters and methods for heat capacity mesurements of helium adsorbed on inert gas crystals are described. Nitrogen and helium isotherms are presented. Data collection and handling are described. Author (ESA)

N80-11267# Uppsala Univ. (Sweden). Inst. of Technology.
HEAT CAPACITY OF SUBMONOLAYERS OF 3He ADSORBED ON SOLID NEON
Per Wennerstroem, Anders Toerne, and Torsten Lindqvist Mar. 1978 17 p refs
(UPTEC-78-31-R) Avail: NTIS HC A02/MF A01

The heat capacity of 3He adsorbed on solid neon was measured for coverages from 1% of monolayer capacity to a complete monolayer with high resolution. Results show that the desorption heat capacity has a maximum at 7 K. At predesorption temperatures the heat capacity is linear and coverage dependent. The heat capacity of the lowest coverages has an anomalous behavior below 0.7 K. Author (ESA)

N80-11268# Transportation Research Board, Washington, D.C.
ANALYSIS OF PAVEMENT SYSTEMS
Michael I. Darter, Thomas W. Kennedy, Amir M. Tabatabaie, Ernest J. Barenberg, and Y. H. Huang 1978 104 p
(PB-298098/5; TRB/TRR-671; ISBN-0-309-02811-6) Avail: NTIS HC A06/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D. C. 20418, HC $5.40 CSCL 13B

Fourteen papers are presented which discuss the following areas: (1) structural design for concrete pavement; (2) pavement design characteristics; (3) fatigue behavior of concrete; (4) prediction of pavement distress (abridgement); and (5) design and behavior or soil-fabric-aggregate systems. GRA

N80-11269# Transportation Research Board, Washington, D.C.
GEOMETRICS, HYDRAULICS, AND HYDROLOGY
V. F. Hurdle (Toronto Univ., Ontario), Joseph Craus (Transportation Res. Inst.), Moshe Livneh (Technion-Israel Inst. of Tech., Haifa), Edward R. Post (Nebraska Univ., Lincoln), Patrick T. McCoy (Nebraska Univ., Lincoln), Richard J. Ruby (Nebraska Dept. of Roads), David O. Coolidge (Nebraska Dept. of Roads), Patrick Shannon (Boise State Univ.), Alohn Stanley (Idaho Transportation Dept.), Kumares C. Sinha (Purdue Univ.) et al 1978 49 p refs
(PB-298102/5; TRB/TRR-685; ISBN-0-309-0230-2) Avail: NTIS HC A03/MF A01; also available from Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D. C. 20418 HC $3.00 CSCL 13B

Contents: edge-of-pavement profiles; superrelevation and curvature of horizontal curves; cost-effectiveness of driveway slope improvements; pavement width standards for rural two-lane highways (abridgement); earth berms and their actual and perceived effects on noise and privacy in adjacent neighborhoods; hydraulic and safety characteristics of selected grate inlets (abridgement); determining design flows for culverts and bridges on ungauged streams: a watershed rationale (abridgement); and rainfall intensity-duration-frequency curves developed from (not by) computer output. GRA

N80-11021 Allerton Press, Inc., New York, N. Y.
ON THE DAMPING EFFECT IN SURFACE PLASTIC DEFORMATION
P. G. Balyura *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 103-106 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 126-129
(For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N80-11270 British Broadcasting Corp., Kingswood (England). Research Dept.
SATELLITE BROADCASTING: RESULTS OF A PRELIMINARY COVERAGE SURVEY IN THE UK
R. V. Harvey Sep. 1979 13 p refs
(BBC-RD-1979/18) Avail: British Broadcasting Corp., Kingswood Warren, Tadworth, Surrey, England

In order to discover the types and extent of local obstructions to domestic reception of future satellite broadcast transmissions to the UK, a questionnaire was distributed to a limited number of the staff of organizations concerned with broadcasting. The report describes the basis for the survey, and gives an analysis of the results; it is estimated that the loss of possible coverage by individual reception, through shadowing of all parts of the premises occupied, would be less than 0.5% of the population. Author

N80-11271 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL SOUND: SAMPLING-RATE SYNCHRONISATION BY VARIABLE DELAY
N. H. C. Gilchrist Sep. 1979 9 p refs
(BBC-RD-1979/17) Avail: British Broadcasting Corp., Kingswood Warren, Tadworth, Surrey, England

In a situation where a number of digital sound signals, all from sources operating at nominally the same sampling frequency, need to be processed, a variable delay technique may be used to synchronize the signals at the input to the processor. Experimental equipment is described which changes the sampling rate of a digital sound signal by using a variable delay which is automatically reset during program pauses. Listening tests indicate that the adjustment of sampling rates by a small amount using this technique can be achieved with little or no impairment to the sound signal. Author

N80-11272*# National Aeronautics and Space Administration, Washington, D. C.
PROSPECTS AND LIMITATIONS FOR USE OF FREQUENCY SPECTRUM FROM 40 TO 300 GHz
Clarence E. Catoe [1979] 11 p refs
(NASA-TM-80812) Avail: NTIS HC A02/MF A01 CSCL 17B

The existing and future use of the electromagnetic spectrum

from 40 to 300 gigahertz is discussed. The activities envisioned for this segment of the electromagnetic spectrum fall generically into two basic categories: communications and remote sensing. The communications services considered for this region are focused on the existing and future frequency allocations that are required for terrestrial radio services, space to ground radio services, space to space radio services, and space to deep space radio services. The remote sensing services considered for this region are divided into two groups of activities: earth viewing and space viewing. A.W.H.

N80-11273# National Aviation Facilities Experimental Center, Atlantic City, N. J.
VOICE DATA ENTRY IN AIR TRAFFIC CONTROL Report, May 1975 - Dec. 1978
Donald W. Connolly Aug. 1979 76 p refs
(FAA Proj. 219-151-100)
(AD-A073670; FAA-NA-79-20) Avail: NTIS
HC A05/MF A01 CSCL 17/2

The potential operational utility of state-of-the-art word recognition technology in air traffic control applications were studied. Experiment 1, employing 12 operators or talkers, secured baseline data representing the inherent best case recognition accuracy of the system. Three of the subvocabularies of an operational data entry language were tested exhaustively to a total of over 46,000 spoken words. On the average, across all speakers and all three subvocabularies, only 1 percent of the words spoken were erroneously recognized. Subsequent tuning of the recognition algorithm reduced the error rate to less than 0.4 percent. Experiment 2 compared the quality and efficiency of the voice system versus the existing keyboard method of entering complete operational messages. The voice system produced 64 percent fewer errors of all kinds than the keyboard in the messages entered, but showed no advantage (or disadvantage) in rate of entry. Voice entry, however, did demonstrate an advantage in the overall time consumed by the data entry process - less time was required to translate entry requirements into the spoken language than into the keyboard code. Other influential factors were also examined, including the effects of microphone type, individual differences between operators, the stability of operators' word-prints over time, and operator adaptation to the voice entry system. F.O.S.

N80-11274# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
PROVISIONAL MESSAGE FORMATS FOR THE DABS/NAS INTERFACE Final Report
Apr. 1979 42 p refs
(AD-A073461; FAA-RD-74-63B-Rev-2) Avail: NTIS
HC A03/MF A01 CSCL 17/2

Formats for messages which are to be transmitted between DABS and NAS facilities (en route or terminal) are defined. These messages include one-way Surveillance Reports to NAS and two-way Communications Messages. The latter support data link functions between NAS and DABS-equipped aircraft, as well as aiding in the monitoring and control of DABS sensors. These message formats are to be used in the design and construction of interface equipment and ground data links for engineering model system test and evaluation at NAFEC during Phase 2 of the DABS Development Program; and with modifications resulting from this test and evaluation effort, the basis for the operational implementation of DABS is formed. M.M.M.

N80-11275# IIT Research Inst., Annapolis, Md.
EVALUATION OF TRANSPONDER ANTENNA COVERAGE/ATCRBS DURING SIMULATED FLIGHTS OF AIRCRAFT Final Report
Thomas Gibson Apr. 1979 73 p refs
(Contracts DOT-FA70WAI-175; F19628-78-C-0006)
(AD-A073547; ECAC-PR-76-019; FAA-RD-77-122) Avail: NTIS HC A04/MF A01 CSCL 17/9

A computer model was used to analyze the effect of aircraft orientation on the performance of the Air Traffic Control Radar Beacon System (ATCRBS). Flights by Cessna 150, Boeing 727, Boeing 747, and F-4H aircraft over a common flight route out of La Guardia Airport were simulated. Transponder/antenna performance for various aircraft attitudes and locations along the flight path was analyzed with respect to interrogators located at JFK airport. This performance was compared to a transponder having ideal, omni-directional antenna coverage to illustrate the degree to which the combination of aircraft orientation and transponder antenna pattern may affect ATCRBS performance. Author

N80-11276# National Mechanical Engineering Research Inst., Pretoria (South Africa). Strength Mechanics Div.
PROGRAM PSD: DIGITAL DETERMINATION OF POWER SPECTRAL DENSITIES OF RANDOM SIGNALS
J. T. D. Fritz Oct. 1978 52 p refs
(CSIR-ME-1594; ISBN-0-7988-1460-8) Avail: NTIS
HC A04/MF A01

The algorithm and procedure for the digital determination of power spectral densities from random signals are described. The program yields power spectra with a frequency range resolution of (1/256)f(MAX). Floating point arithmetic utilizing Varian supplied software is used with a consequent relatively long execution time of 210 seconds per analysis. This, however, is not a very serious drawback as the program was constructed to enable batch analyses to be carried out and can thus be run overnight. A significant improvement on execution time can be obtained by changing the program to fixed point double precision arithmetic. Should an even shorter execution time be desirable, the program must be rewritten to utilize the so-called Fast Fourier Transform algorithm. Author

N80-11277*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
CONCEPTS FOR 18/30 GHz SATELLITE COMMUNICATION SYSTEM, VOLUME 1 Final Report
R. Jorasch, M. Baker, R. Davies, L. Cuccia, and C. Mitchell
1 Nov. 1979 169 p 3 Vol.
(Contract NAS3-21362)
(NASA-CR-159625-Vol-1; WDL-TR8457-Vol-1) Avail: NTIS
HC A08/MF A01 CSCL 17B

Concepts for 18/30 GHz satellite communication systems are presented. Major terminal trunking as well as direct-to-user configurations were evaluated. Critical technologies in support of millimeter wave satellite communications were determined. M.M.M.

N80-11278*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
CONCEPTS FOR 18/30 GHz SATELLITE COMMUNICATION SYSTEM, VOLUME 1A: APPENDIX Final Report
R. Jorasch, M. Baker, R. Davies, L. Cuccia, and C. Mitchell
1 Nov. 1979 181 p refs 3 Vol.
(Contract NAS3-21362)
(NASA-CR-159625-Vol-1A; WDL-TR8457-Vol-1A) Avail: NTIS
HC A09/MF A01 CSCL 17B

The following are appended: (1) Propagation phenomena and attenuation models; (2) Models and measurements of rainfall patterns in the U.S.; (3) Millimeter wave propagation experiments; (4) Comparison of theory and experiment; (5) A practical rain attenuation model for CONUS; (6) Space diversity; (7) Values of attenuation for selected U.S. cities; and (8) Additional considerations. M.M.M.

N80-11279*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
CONCEPTS FOR 18/30 GHz SATELLITE COMMUNICATION SYSTEM STUDY. EXECUTIVE SUMMARY
M. Baker, R. Davies, L. Cuccia, and C. Mitchell 1 Nov. 1979
36 p 3 Vol.
(Contract NAS3-21362)
(NASA-CR-159680; WDL-TR8457) Avail: NTIS
HC A03/MF A01 CSCL 17B

An examination of a multiplicity of interconnected parameters ranging from specific technology details to total system economic costs for satellite communication systems at the 18/30 GHz transmission bands are presented. It was determined that K sub A band systems can incur a small communications outage during very heavy rainfall periods and that reducing the outage to zero would lead to prohibitive system costs. On the other hand, the economics of scale, ie, one spacecraft accommodating 2.5 GHz of bandwidth coupled with multiple beam frequency reuse, leads

to very low costs for those users who can tolerate the 5 to 50 hours per year of downtime. A multiple frequency band satellite network can provide the ultimate optimized match to the consumer performance/economics demands. M.M.M.

N80-11280*# National Aeronautics and Space Administration, Washington, D. C.
ANTENNA OF THE SPACE RADIOTELESCOPE KRT-3
V. I. Kostenko and L. I. Matveyenko Nov. 1979 22 p refs Transl. into ENGLISH of Antenna Kosmicheskogo Radioteleskopa KRT-3 (Moscow), PR-340, 1977 20 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-75714) Avail: NTIS HC A02/MF A01 CSCL 09C

The questions of antenna design with a diameter of 3 m for space radio-interferometry are examined. The basic characteristics of the antenna are determined, on the basis of which a model of the antenna of a space radiotelescope of 3.1 m KRT-3 is developed and prepared. The technological peculiarities of the antenna preparation are examined. The results of measurement of the reflecting surfaces of the telescope are cited, which point to the fact that the antenna may operate to wave lengths in the order of 2 mm. Author

N80-11281# General Electric Co., Syracuse, N.Y. Heavy Military Equipment Dept.
RADAR DETECTION CALCULATIONS WITH THE HP-65 AND HP-67
M. A. Johnson May 1979 71 p refs
(AD-A071609; R79EMH5) Avail: NTIS HC A04/MF A01 CSCL 17/7

Card programmable calculators together with suitable programs can easily provide numerical answers which formerly took large computers and volumes of tabular or plotted outputs for everyday reference. Presented here are derivations and program listings for the HP-65 and HP-67 calculators to provide the user with commonly used radar detection performance data. Both fixed threshold and adaptive threshold CFAR detection with noncoherent integration are covered. Recursive programs for the general chi-squared target fluctuation distribution are treated as well as faster running recursive programs for the Swerling target Cases I - IV. Also included are fast programs for the required detection signal-to-noise ratio based on the simplified algorithms of Barton. GRA

N80-11282# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
MESSAGE SERVICES IN COMPUTER NETWORKS
Franklin F. Kuo 1978 9 p refs
(Contract N00014-78-C-0498)
(AD-A071730) Avail: NTIS HC A02/MF A01 CSCL 17/2

In this paper we discuss the key issues in the generation and distribution of messages in a computer network. The principal issues are: user support, privacy and security, addressing, and standards and regulations. Examples of current message systems on the ARPANET are discussed. GRA

N80-11283# Hughes Research Labs., Malibu, Calif.
INTELLIGENT BANDWIDTH COMPRESSION Quarterly Report, 1 Nov. 1978 - 31 Jan. 1979
D. Y. Tseng, B. L. Bullock, J. D. Olsen, and K. E. Olin Jun. 1979 58 p refs
(Contract DAAK70-78-C-0148)
(AD-A071692; QPR-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

This is the first quarterly technical progress report for the Intelligent Bandwidth Compression (IBC) program (DAAK70-78-C-0148). The report describes the results of the first three months of a seven-month technical effort to develop techniques and algorithms for achieving a 1,000:1 bandwidth compression in image data transmission rate for RPV applications. The period covered by this report is 1 November 1978 to 31 January 1979. GRA

N80-11284# State Univ. of New York at Buffalo.
AN EXPERIMENTAL INVESTIGATION OF THE REDUCTION OF NONLINEAR EFFECTS USING PASSIVE COMPENSATING NETWORKS Progress Report, Oct. 1977 - Sep. 1978
Carmen A. Paludi, Jr. and James J. Whalen Jun. 1979 63 p refs
(Contract F30602-75-C-0122; AF Proj. 2338)
(AD-A072422; RADC-TR-79-148) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report describes an experimental investigation to determine if a procedure reported upon for reducing third order Intermodulation Products (IMP's) in an RF amplifier stage could be implemented in the laboratory. The third order IMP reduction procedure is based upon altering the RF amplifier linear out-of-band response by adding passive compensating networks. For this experiment, an RF amplifier tuned at 10 MHz was selected. The RF amplifier was excited by two CW signals at frequencies f1 = 9.0 MHz and f2 = 9.5 MHz in order to obtain a third order IMP at the frequency 2f2 - f1 = 10 MHz. The objective of the experiment was to determine if a significant reduction in this third order IMP could be obtained by connecting properly designed compensating networks to the basic RF amplifier stage. A linear model for the basic RF amplifier stage was developed. This model yielded calculated results that were in relatively good agreement with measured results for the magnitude and phase of the linear transfer function VOUT/VIN. Using the linear model for the basic amplifier stage, compensating networks were synthesized. GRA

N80-11285# Naval Surface Weapons Center, White Oak, Md.
HIGH EXPLOSIVE DETONATION AND ELECTROMAGNETIC INTERACTION Technical Report, Sep. 1977 - Jul. 1978
Edward T. Toton 30 Mar. 1979 35 p refs
(ZR0000101)
(AD-A072577; NSWC/WOL/TR-79-205) Avail: NTIS HC A03/MF A01 CSCL 19/4

The effect of stationary, uniform, electric, and magnetic fields on steady-state detonation of condensed explosives is studied. The electrical conductivity profile in the region of the reaction zone provides a current path and Joule heating. Expected increases of detonation velocity and pressure by Joule heating are computed using an Abel equation of state. It is shown that the detonation pressure of TNT can be increased by as much as 12% and detonation velocity by as much as 6% before electrical breakdown can occur. GRA

N80-11286# Range Commanders Council, White Sands Missile Range, N. Mex. Safety Group.
TEST PROCEDURE FOR C-BAND NONCOHERENT RADAR TRANSPONDER
1979 46 p
(AD-A072069; RSG-310-79) Avail: NTIS HC A03/MF A01 CSCL 17/9

The purpose of this document is to delineate types of tests and test procedures for radar transponder qualification, flight certification, and preflight readiness as required for support of test programs at the national ranges. The test procedures are general in type but are intended for standardization within the national ranges. Qualification or flight certification of a transponder by a national range does not necessarily mean that it is acceptable for all other ranges because each range has its own tracking and range safety responsibilities which, by their very nature, cannot be delegated. This document, however, outlines the test requirements and procedures for standardization at all national ranges. GRA

N80-11287# Booz-Allen and Hamilton, Inc., Bethesda, Md. Communications and Information Technology Div.
CATEGORIZATION AND SPECIFICATION REQUIREMENTS FOR A COMMON FAMILY OF AUTODIN TERMINALS Final Report
W. Landis, S. Garber, and R. Letner 1 May 1979 78 p refs
(Contract DCA100-77-C-0057)
(AD-A072164; AD-E100247) Avail: NTIS HC A05/MF A01 CSCL 17/2

This report presents results of an analysis conducted to determine specification requirements for a common family of AUTODIN terminals. It defines a set of standard terminal functions, describes a set of terminal categories and identifies which functions in each category must be defined further, and specified to ensure

consistency with the Integrated AUTODIN System Architecture. GRA

N80-11288# Booz-Allen and Hamilton, Inc., Bethesda, Md. Communications and Information Technology Div.
INTEGRATED AUTODIN SYSTEM (IAS): GENERATION OF VIABLE FAR-TERM ARCHITECTURES FOR IAS Final Report
Stefan Shrier and P. Torelli. 1 Jun. 1979. 37 p. refs.
(Contract DCA100-77-C-0057)
(AD-A072165; AD-E100248) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report presents an implementation of a methodology for the synthesis and ranking of logical architectures. The purpose of the methodology is to generate in a plausible manner, those logical architectures that lead to the identification and selection of candidate network architectures. GRA

N80-11289# Royal Australian Navy Research Lab., Edgecliff.
ON SURFACE-BASED ADVECTIVE RADAR DUCTS
Phillip J. Mulhearn. Dec. 1978. 29 p. refs.
(AD-A071454; RANRL-TN-5/78) Avail: NTIS HC A03/MF A01 CSCL 17/9

As a warm, well mixed air mass flows off a land surface and over a cooler sea, the air is modified in a layer near the surface. Within this layer humidity decreases while temperature increases with height and a radar duct is formed. The non-dimensional parameters governing the growth of the modified layer are derived and simple forms are found for the increase of layer height with fetch and for the shapes of humidity and temperature profiles. From these relations the depth and strength of the radar duct are derived as functions of the modified layer depth and the differences in potential temperature and water vapor pressure between the overland air mass and air in thermodynamic equilibrium with the sea surface. GRA

N80-11290# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TECHNOLOGY ASSESSMENT FOR FUTURE MILSATCOM SYSTEMS: THE EHF BANDS
David J. Frediani. 12 Apr. 1979. 294 p. refs.
(Contract F19628-78-C-0002)
(AD-A071886; DCA-5; ESD-TR-79-43) Avail: NTIS HC A13/MF A01 CSCL 17/2

Severe crowding of the radio frequency spectrum and of the geostationary orbital arc, coupled with DoD requirements for increased bandwidth, motivate a transition of future MILSATCOM systems to operating frequencies between 20 and 50 GHz (EHF). The identification of potential users, the frequency selection process and the transitional architecture are the focus of DCA/MSO studies. This report, prepared in support of the DCA/MSO Frequency Selection Working Group, assesses the technology necessary to support MILSATCOM evolution to EHF. The technology assessment delineates the present, near term (3-5 years) and far term (6-10 years) availabilities of the major MILSATCOM subsystems. The major subsystems and systemic requirements are derived from strawman systems defined by the DCA/MSO Frequency Selection Working Group. The specific subsystems assessed include low-noise receivers, RF power amplifiers and antennas for the space and ground segments. The antenna gain limitations at EHF imposed by antenna surface accuracy and tracking accuracy are also addressed. As rain attenuation at EHF impacts system design and technology requirements, a global rain attenuation model is presented and the related issues of system availability, duration and impact of rain outages, and site diversity are assessed. Finally, recommendations are presented for technology development efforts and further studies necessary to support future EHF MILSATCOM deployment. GRA

N80-11291# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
ACCURACY VALIDATION OF THE MODIFIED NIKE HERCULES RADAR
Edward M. Darcy. May 1979. 77 p. refs.
(DA Proj. 1L1-62111-AH-71)
(AD-A071720; ERADCOM/ASL-TR-0031) Avail: NTIS HC A05/MF A01 CSCL 17/9

During the week of 7-11 February 1977, 12 balloon flights were made during which the balloon was tracked simultaneously by a modified Nike Hercules radar and a range radar. The range radars used were MPS-36s. The results of these tests and the statistical results of the machine differences are presented. Results show that the Nike Hercules is quite adequate for most mesoscale applications and is also adequate as a standard of comparison for such instruments that might be developed as a replacement for the Army's GMD. GRA

N80-11292# TDR, Inc., Los Angeles, Calif.
AN INVESTIGATION OF PORTABLE ELECTROMAGNETIC PULSE SIMULATORS/ALTERNATE SIMULATORS Final Report
M. I. Sancer, S. Siegel, and A. D. Varvatsis. Jun. 1979. 48 p.
(Contract F29601-77-C-0090)
(AD-A071342; AFWL-TR-78-200) Avail: NTIS HC A03/MF A01 CSCL 14/2

A theory is developed which defines the technical objectives for portable EMP simulator experiments and calculations. It is shown that under certain conditions, a configuration of portable sources need only excite a prescribed external interaction response on a class of systems. Under these conditions, the source configuration will excite the same electrical quantities within the system as would an EMP. Considerable attention is devoted to the demonstration that these conditions must include on accounting for the external environment to the system under test as well as the degree of electromagnetic rigidity of the portable sources. Finally, calculations that were chosen to address the plausibility of achieving the described external interaction objectives are presented and interpreted according to the required conditions. GRA

N80-11293# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
AN IMPROVED THEORY FOR MICROSTRIP ANTENNAS AND APPLICATION, PART 1 Interim Report
Y. T. Lo, W. F. Richards, and D. D. Harrison. May 1979. 33 p. refs.
(Contract F19628-78-C-0025; AF Proj. 2305)
(AD-A070791; UIEM-78-18-Pt-1; IR-1;
UILU-ENG-78-2563-Pt-1; RADC-TR-79-111-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

An improvement to a recently reported theory for the analysis of the pattern and impedance loci of microstrip antennas is developed. It yields a theory which is simple and inexpensive to apply. The fields in the interior of the antennnas are characterized in terms of a discrete set of modes. The poles corresponding to these modes are complex and depend on the losses in the antenna. The representation of the fields in terms of these modes is rigorous only for a bona fide cavity with no copper loss. The proper shift in the complex poles due to the addition of copper and radiative losses is approximated by lumping the latter two together with the dielectric loss to form an effective loss tangent. By so doing, it is found that the resulting expressions for impedance of the microstrip antenna is in good agreement with measured results for all modes and feed locations. The theory is applied to the evaluation of impedance variation with feed location, multiport analysis, and to design of circularly polarized microstrip antennas. GRA

N80-11294# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
AN ANALYSIS OF THE DISK MICROSTRIP ANTENNA, PART 2 Interim Report
Y. T. Lo, D. D. Harrison, and W. F. Richards. Griffiss AFB, New York. RADC. May 1979. 98 p. refs.
(Contract F19682-78-C-0025)
(AD-A070794; UIEM-78-19-Pt-2; IR-2;
UILU-ENG-78-2564-Pt-2; RADC-TR-79-132-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 09/5

Disk microstrip antennas are treated as cavities, from which both internal and external (radiation) field can be determined, based on an efficient improved theory. This theory can predict the impedance characteristics very accurately even for cases where the dominant mode is not strongly excited. The theory is extended to two-port disk microstrip antennas. In particular, if one port is shorted the input resonant impedance at another port on the circumference can be varied over orders of magnitude

by simply changing the relative angular positions between the two ports. In case of a single port a similar variation of input impedance can be achieved by moving the feed in the radial direction. All of these provide a means for impedance matching with practically no effect on the pattern. So far as the input impedance matching is concerned the antenna can be represented accurately by a parallel resonant circuit in series with an inductance. The former derives from the resonant mode term and the latter from all non-resonant terms of the field solution in expansion. Experiments have been conducted to verify the theoretical results. Excellent agreement is observed in all cases. GRA

N80-11295# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DEVELOPMENT OF A VOICE FUNNEL SYSTEM Quarterly Technical Report, 1 Feb. - 30 Apr. 1979
M. Hoffman and R. D. Rettberg. 29 Jun. 1979. 42 p.
(Contract MDA903-78-C-0356; ARPA Order-3653)
(AD-A072424; BBN-4149; QTR-3) Avail: NTIS
HC A03/MF A01 CSCL 17/2

This Quarterly Technical Report covers work performed during the period noted on two projects: (1) the development of a high-speed interface, called a Voice Funnel, between digitized speech streams and a packet-switching communications network, and (2) the analysis of Pluribus performance and end-to-end flow control in the wideband satellite network. GRA

N80-11296# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DEVELOPMENT OF A VOICE FUNNEL SYSTEM Quarterly Technical Report, 1 Nov. 1978 - 31 Jan. 1979
M. Hoffman and R. T. Rettberg. 14 Jun. 1979. 38 p. refs.
(Contract MDA903-78-C-0356; ARPA Order 3653)
(AD-A072423; BBN-4143; QTR-2) Avail: NTIS
HC A03/MF A01 CSCL 17/2

This quarterly technical report covers work performed during the period noted on the development of a high-speed interface, called a Voice Funnel, between digitized speech streams and a packet-switching communications network. GRA

N80-11297# TDR, Inc., Los Angeles, Calif.
PSEUDOSYMMETRIC EIGENMODE EXPANSION FOR THE MAGNETIC FIELD INTEGRAL EQUATION AND SEM CONSEQUENCES Final Report
Maurice I. Sancer, A. D. Varvatsis, and Scott Siegel. Jun. 1979. 57 p. refs.
(Contract F29601-78-C-0098)
(AD-A071429; AFWL-TR-78-172) Avail: NTIS
HC A04/MF A01 CSCL 20/3

An eigenmode expansion for the magnetic field integral equation (MFIE) is derived which eliminates the requirement that an adjoint solution be explicitly sought. Instead, an orthogonality relation is derived which only involves the eigenmodes of the original MFIE operator. To promote confidence in the validity of the resulting expansion, two analyses based on this expansion are presented which lead to known results. First, the expansion is applied to the problem of determining the surface current density induced on a perfectly conducting sphere by a plane wave and the known solution for this problem is duplicated by the expansion. The second analysis shows that for a general perfectly conducting body, the eigenmode expansion coefficient numerator evaluated at the purely imaginary frequency corresponding to an interior resonance is zero. This result is necessary in order to relate the eigenmode expansion to SEM. GRA

N80-11298# TDR, Inc., Los Angeles, Calif.
FORMULATION OF ELECTROMAGNETIC PULSE EXTERNAL INTERACTION ABOVE A LOSSY EARTH Final Report
M. I. Sancer, S. Siegel, and A. D. Varvatsis. Jun. 1979. 58 p. refs.
(Contract F29601-77-C-0090)
(AD-A071327; AFWL-TR-78-173) Avail: NTIS
HC A04/MF A01 CSCL 20/3

Two separate but related efforts are described in this report. The first and more significant effort is a demonstration of the capability of the patch zoning method for numerically solving the magnetic field integral equation (MFIE). This is accomplished by comparing experimental data with numerical computations of the current density induced on metallic structures. The secondary effort is a derivation of the electric field integrodifferential equation (EFIDE) and the MFIE for electromagnetic pulse external interaction with perfectly conducting bodies above a finitely conducting half-space. The relationship between the two efforts is that the equations are represented in such a manner that the computational results, which are compared with experimental data, are readily seen to correspond to the numerical treatment of special cases of the MFIE finitely conducting ground equations. GRA

N80-11299# Mission Research Corp., Santa Barbara, Calif.
RADIO COMMUNICATION UTILIZING THE BASE OF A STRIATED BARIUM PLASMA
G. J. Fulks, L. D. Scott, D. H. Sowle, and W. R. Nortman. Jul. 1978. 43 p. refs.
(Contract DNA001-78-C-0237)
(AD-A072167; AD-E300465; MRC-R-401-R; DNA-4670T) Avail: NTIS HC A03/MF A01 CSCL 17/2

In conjunction with the DNA barium releases, Avefna I and II, an experiment was undertaken to determine if radio communication was possible off the base of a striated plasma created by these barium releases. A transmitting station was set up to broadcast a steady signal at two HF frequencies toward the base of the barium striations and two receiving stations listened for signal returns on the two frequencies. (The chosen geometry prevented reflections off the sides of the barium cloud from affecting the experiment). One station heard substantial returns while the other heard nothing. Data from the first station provide an estimate of the reflection cross sections for the base of the striated barium cloud. The negative result from the second station arises partly from limited sensitivity of equipment but the upper limit on cross section was less than that seen from the first station. This suggests a directional character for the signal reflected from the base of the cloud. GRA

N80-11300# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REDUCTION OF QUANTIZATION NOISE IN PCM SPEECH CODING
Jae S. Lim and Alan V. Oppenheim. 31 May 1979. 21 p. refs.
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A072203; TN-1979-47; ESD-TR-79-85) Avail: NTIS
HC A02/MF A01 CSCL 17/2

A new technique to reduce the effect of quantization noise in PCM speech coding is proposed. The procedure consists of using dither noise to ensure that the quantization errors can be modelled as additive signal independent noise and then reducing this noise through the use of a noise reduction system. The procedure is illustrated with examples. GRA

N80-11301# Naval Ocean Systems Center, San Diego, Calif.
TIME ENCODED SPATIAL DISPLAY. TIME-COMPRESSED DISPLAY SYSTEM USES SOLID-STATE COMPONENTS AND DATA COMPRESSION TECHNIQUES FOR IMAGE PROCESSING, STORAGE, AND RETRIEVAL Technical Document, Feb. 1978 - Feb. 1979
B. D. Directo and R. J. Morin. 25 Apr. 1979. 28 p.
(AD-A072128; NOSC/TD-258) Avail: NTIS
HC A03/MF A01 CSCL 17/9

This report describes in detail the operation and capabilities of the TIESPAD unit. This unit was tested with AN/SPS-10 surface search radar and an AN/SPS-30 air search radar, and with an AN/FPS-93 air search radar via a microwave relay. These brief tests show that the TIESPAD unit does effectively help the operator to detect and track moving targets that would otherwise not be detected on a standard AN/SPS-type indicator. GRA

N80-11302# National Academy of Sciences - National Research Council, Washington, D. C. Panel on the Extent of Radiation from the PAVE PAWS Radar System.
ANALYSIS OF THE EXPOSURE LEVELS AND POTENTIAL BIOLOGICAL EFFECTS OF THE PAVE PAWS RADAR SYSTEM Final Report
Stephen F. Cleary (Va. Commonwealth Univ.), W. Ross Adey (Veterans Admin. Med. Center, Loma Linda, Calif.), Om P. Gandhi (Utah Univ.), Don R. Justesen (Veterans Admin. Med. Center, Kansas City, Mo.), Brockway McMillan (Bell Telephone Labs., Whippany, N. J.), Shields Warren (New Engl. Deaconess Hosp.,

Boston, Mass.), Clayton S. White (Okla. Med. Res. Found., Okla. City, Okla.), George M. Wilkening (Bell Telephone Lab, Murray Hill, N. J.), Arthur W. Guy (Wash. Univ, Seattle, Wash.), and David E. Janes (EPA, Silver Spring, Md.) 1979 106 p refs
(Contract F49620-78-C-0118)
(AD-A072332; AFSC-TR-79-07) Avail: NTIS
HC A06/MF A01 CSCL 17/9

The Panel on the Extent of Radiation from the PAVE PAWS Radar System was charged to examine the extent of radiation and the exposure of the public to radiation from the PAVE PAWS system. In carrying out this task, the Panel has considered the characteristics of the PAVE PAWS radiation as related to public exposure and compared the possible exposure to existing ambient radiofrequency radiation on Cape Cod and in other locations in the United States. To provide perspective for the assessment of possible exposure effects the Panel has also, to the extent possible, reviewed and summarized the state of knowledge concerning the biologic effects of exposure to such radiation. The Panel did not address the question of the desirability or adequacy of the anticipated exposure control procedures, nor did it make a judgment concerning the relative safety or hazard of exposure to PAVE PAWS emissions. GRA

N80-11303# National Academy of Sciences - National Research Council, Washington, D. C. Engineering Panel on the PAVE PAWS Radar System.
RADIATION INTENSITY OF THE PAVE PAWS RADAR SYSTEM Final Report
Brockway McMillan (Bell Telephone Labs.), Henry G. Booker (Calif. Univ., San Diego), C. Chaplin Cutler (Stanford Univ.), Om P. Gandhi (Utah Univ.), Charles Lerch (System Planning Corp.), Russell C. Newhouse, and Victor A. Vyssotsky (Bell Telephone Labs.) 1979 51 p refs
(Contract F49620-78-C-0118)
(AD-A072333; AFSC-TR-79-08) Avail: NTIS
HC A04/MF A01 CSCL 17/9

This volume contains the results of a panel study of the assessment of certain aspects of the PAVE PAWS radar facility in regard to radiation emissions. GRA

N80-11304# Naval Postgraduate School, Monterey, Calif.
A MODEL FOR ESTIMATING RADIOWAVE ACQUISITION RECEIVING SYSTEM INTERCEPT PROBABILITY Final Report
Jeffrey B. Knorr Jun. 1979 39 p
(AD-A072503; NPS-62-79-005) Avail: NTIS
HC A03/MF A01 CSCL 15/4

This report describes a method for estimating radiowave acquisition receiving system intercept probability. Performance data for two or more receiving systems is required to implement the method. GRA

N80-11305# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ENHANCEMENT AND BANDWIDTH COMPRESSION OF NOISY SPEECH
Jae S. Lim and Alan V. Oppenheim 26 Jun. 1979 99 p refs
(Contracts F19628-78-C-0002; N00014-75-C-0951; AF Proj. 7820)
(AD-A073139; TN-1979-51; ESD-TR-79-159) Avail: NTIS
HC A05/MF A01 CSCL 09/4

Over the past several years there has been considerable attention focussed on the problem of enhancement and bandwidth compression of speech degraded by additive background noise. This interest is motivated by several factors including a broad set of important applications, the apparent lack of robustness in current speech compression systems and the development of several potentially promising and practical solutions. One objective of this paper is to provide an overview of the variety of techniques that have been proposed for enhancement and bandwidth compression of speech degraded by additive background noise. A second objective is to suggest a unifying framework in terms of which the relationships between these systems is more visible and which hopefully will provide a structure which will suggest fruitful directions for further research. GRA

N80-11306# Naval Research Lab., Washington, D. C.
SPECTRAL ESTIMATES OF BAND-LIMITED SIGNALS Interim Report
William B. Gordon 2 Aug. 1979 22 p refs
(RR0210541)
(AD-A072776; NRL-8322) Avail: NTIS HC A02/MF A01 CSCL 09/4

We consider the problem of estimating the spectrum of a band-limited signal perturbed by additive white noise. Sharp bounds on the mean square errors of linear spectral estimates are computed and expressed as functions of time-bandwidth product sand signal-to-noise power ratios. When the data are sampled at the Nyquist rate, no linear spectral estimator can produce significantly more accurate results than the conventional discrete Fourier transform. In the more general case, consistent spectral estimators can be obtained only if both the data rate and the length of the observation window are increased without bound. GRA

N80-11307# Naval Research Lab., Washington, D. C.
A MULTIPLE-BEAM MICROWAVE ANTENNA BASED ON THE PRINCIPLE OF THE MILLS CROSS Progress Report
J. F. Siebert, L. R. Murphy, T. R. Larson, and J. P. Hollinger 3 Apr. 1979 57 p refs
(AD-A072876; AD-E000309; NRL-MR-3959) Avail: NTIS
HC A04/MF A01 CSCL 09/5

A study has been carried out to determine the feasibility of various antenna configurations for a proposed satellite mission to profile the surface temperature of the ocean using a passive microwave radiometer. Specifically, a static, multiple-beam microwave antenna utilizing a phase-switched Mills cross as its basic element is proposed and analyzed in detail. Although the Mills cross configuration does not completely meet the specified requirements of this particular application, its analysis does provide a necessary frame of reference for assessing its usefulness in general, and for establishing its features and drawbacks relative to alternative antenna configurations. It also serves as an illustrative example of some of the design tradeoffs and problems that are encountered in trying to map the earth's surface from a space platform. GRA

N80-11308# Virginia Polytechnic Inst. and State Univ., Blacksburg. Human Factors Lab.
RASTER-SCAN DISPLAY PHOTOMETRIC NOISE MEASUREMENT Final Technical Report, Aug. 1975 - Dec. 1977
Harry L. Snyder, Maier Almagor, and David I. Shedivy Wright-Patterson AFB AMRL Jun. 1979 70 p refs
(Contract F33615-76-C-5022; AF Proj. 7184)
(AD-A073024; VPI-HFL-79-1; AMRL-TR-79-13) Avail: NTIS
HC A04/MF A01 CSCL 17/2

This report describes the results of two studies designed to measure dynamic noise, photometrically, on a raster-scan display. One study evaluated spot microphotometry of a single raster line; the other evaluated microdensitometric power spectral analysis of close-up photographs of raster lines. The spot microphotometry technique proved superior and very reliable, yielding results that are highly correlated with input noise spectra. GRA

N80-11309# Rome Air Development Center, Griffiss AFB, N.Y.
HEMISPHERICAL COVERAGE OF FOUR-FACED AIRCRAFT ARRAYS
Robert J. Mailloux and William G. Mavroides May 1979 19 p refs
(AF Proj. 4600)
(AD-A073079; RADC-TR-79-176) Avail: NTIS
HC A02/MF A01 CSCL 17/1

This report describes the radiating characteristics of a four-faced array with faces arranged in a streamlined configuration for hemispherical coverage. The report presents new experimental and theoretical results giving coverage for a side array in the plane perpendicular to the cylinder and shows that the structure radiates both polarizations efficiently for angles from the zenith to the horizon. In the absence of mutual coupling effects, the circularly polarized radiation remains within approximately 1 dB of the array projection factor. Finally, the report presents coverage contours for a four-faced array with the front and back faces half the size of the side faces. In this case, the proper choice of front array tilt angle can result in a hemispherical gain projection

factor within 3.5 dB of peak gain over nearly the whole hemisphere. GRA

N80-11310# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
SPACE-TIME SIGNAL PROCESSING OF RADAR RETURNS Technical Report, Dec. 1977 - Oct. 1978 on Phase 2
G. R. Cooper and C. D. McGillem Griffiss AFB, N.Y. RADC Jun. 1979 58 p refs
(Contract F30602-75-C-0082; AF Proj. 9567)
(AD-A072751; RADC-TR-79-156) Avail: NTIS HC A04/MF A01 CSCL 17/9

This work shows the presence of spatial symmetries which may allow a radar system to predict a frequency which will give a near maximum response as the target approaches the radar. If the target is complex then the target may be resolved into simpler components, which have desirable characteristics, and symmetries that may be exploited when tracking the target. An efficient method for the approximate evaluation of the time ambiguity functions for complex pulse envelope shapes has also been presented. GRA

N80-11311# Sandia Labs., Albuquerque, N. Mex.
LONG-TERM INSTABILITY PROBLEMS IN ADAPTIVE NOISE-CANCELERS
N. Ahmed (Kansas State Univ.), G. R. Elliot, and S. D. Stearns Aug. 1978 25 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1032) Avail: NTIS HC A02/MF A01

The performance of the nonrecursive adaptive noise canceler (or predictor) is considered in terms of long term stability. The concept 'error-surface' is introduced and how a predictor can have a distributed error surface is described. Also, how its transfer function can wander from narrowband to broadband due to small perturbations at the input is discussed. Solutions to this instability problem are proposed. These include the MLMS algorithm and a perturbation scheme. Both solutions are shown to work successfully in a simple example and are implemented in a field usable microprocessor band filter. J.M.S.

N80-11312# California Univ., Livermore. Lawrence Livermore Lab.
PROPAGATION OF Lg WAVES ACROSS EASTERN EUROPE AND ASIA
A. J. Piwinskii and D. L. Springer 19 Jul. 1978 103 p refs
(Contract W-7405-eng-48)
(UCRL-52494) Avail: NTIS HC A06/MF A01

Data regrarding Lg propagation across Asia and eastern Europe is reported. The data from earthquakes located within the boundaries of the U.S.S.R. indicate that both short and long period Lg waves propagate efficiently across most of the Soviet Union land mass. The data from certain border regions, however, display erratic characteristics that may be due to propagation, source depth, or radiation pattern. These regions include paths across southern portions of the Black and Caspian Seas, the Caucasus Mountains, the Uzbek and Tadzhik Republics, the Sea of Okhotsk, and the northern seas (e.g., the Kara Sea). The only areas that appear to block Lg propagation completely are the central portions of the Sea of Japan and regions of the People's Republic of China. DOE

N80-11313# Standard Elektrik Lorenz A.G., Stuttgart (West Germany). Unternehmensgruppe Nachrichtentechnik.
CONCEPT FOR A WORLDWIDE CIVIL MARITIME SATELLITE COMMUNICATION NETWORK (MARSAT). OPERATION SYSTEM STUDY Final Report
Oskar Bettinger, Heinz Cohrs, Johannes Conradt, Kurt Lindig, Rudolf Mosch, Eberhard Mueller, Gotteried Porst, Dieter Roth, and Kurt Taenzer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 216 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1073; GfW-01-E-0724)
(BMFT-FB-W-77-13) Avail: NTIS HC A10/MF A01; ZLDI, Munich DM 45.15

A concept for a worlwide maritime satellite communication network that can fulfill the requirement of long-term demand and still allow further was worked out. At least three, maximally six geostationary satellites having linear transponders will each make full use of the exclusive MARSAT frequency. Best suited modulation methods and optimization procedures are discussed for normal and reduced requirements. Each satellite, its shore terminals, and the ships within its coverage area combine their functions to a single explored automatic local exchange. It is interfaced to existing telephone and telex networks. Procedures for optimum use of satellite channels are described. Central signaling channels are proposed for all call data, coordination, and remote control of channel selection on ships. The need for special distress call channels is justified. Author (ESA)

N80-11314# Standard Elektrik Lorenz A.G., Stuttgart (West Germany). Unternehmensgruppe Nachrichtentechnik.
PARABOLIC ANTENNA FOR HOME RECEIVERS OF THE BROADCASTING SATELLITE SYSTEM Final Report
Ruediger Zeitz Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1978 32 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-5007; DFVLR-BPT-01-YX-046)
(BMFT-FB-W-78-13) Avail: NTIS HC A03/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggeinstein-Leopoldshafen, West Ger. DM 6.60

The planned broadcasting satellite system, operating within the 12 GHz band, requires small, inexpensive parabolic antennas. An antenna having high gain and small sidelobes was developed in order to show the feasibility of the mentioned system. In experiments, a parametric amplifier as well as a mixer were directly connected to the antenna. The antenna design enables the operator to direct the antenna towards the satellite (azimuth, elevation) and to parallel the polarization. It is shown that this simple design can be regarded as a prototype for an antenna to be mass produced. Author (ESA)

N80-11315# Uppsala Univ. (Sweden). Inst. of Technology.
SOME METHODS FOR IDENTIFICATION OF LINEAR SYSTEMS WITH NOISY INPUT OUTPUT DATA
Torsten Soederstroem Sep. 1978 39 p refs
(UPTEC-78-73-R) Avail: NTIS HC A03/MF A01

Most identification methods rely on the assumption that the input is known exactly. However, when collecting data under an identification experiment it may not be possible to avoid noise in measuring the input signal. Some different ways to identify systems from noisy data are discussed. Sufficient conditions for identifiability are given. An approach which treats the measured input and output signals as outputs of a multivariable stochastic system is presented. If a prediction error method is applied using this approach the system will be identifiable under mild conditions. Such conditions are given. Author (ESA)

N80-11316# Fondazione Ugo Bordoni, Rome (Italy).
CONSIDERATIONS ON PROJECTS FOR HIGH CAPACITY AND LONG DISTANCE NUMERICAL DATA TRANSMISSION SYSTEMS [CONSIDERAZIONI INERENTI AL PROGETTO DI SISTEMI NUMERICI DI TRASMISSIONE A ELEVATA CAPACITA' E A GRANDE DISTANZA]
Odoardo Brugia, Benedetto Daino, Giancarlo DeMarchis, Domenico Deseta, Gabriele Falciasecca, Wolfango Maggi, Claudio Rossi, and William Wolfowicz Oct. 1977 14 p refs In ITALIAN Presented at 25th Intern. Congr. on Commun., Genoa, Oct. 1977
(FUB-50-1977) Avail: NTIS HC A02/MF A01

Some problems concerned with digital multiplexing of 140 Mbit/sec plesiochronous tributaries and transmission of the multiplexed signals over coaxial cables, optical fibers, or circular waveguides are investigated. Frame formats and frame alignment strategy characteristics are designed for three different systems having four, five, or six tributaries and operating at 560.488, 700.672, or 840.768 Mbit/sec, respectively. Orientative results are given for designing the repeater section of these systems for both the cases of coaxial cable and optical fiber transmission. Finally, the main characteristics of two waveguide systems operating at about 560 and 840 Mbit/sec are outlined on the basic of technical and economical considerations. Author (ESA)

N80-11317# Fondazione Ugo Bordoni, Rome (Italy).
THE RELATIONSHIP BETWEEN DISTORTION AND IMAGE QUALITY: SAMPLING PROCEDURES AND ACCURACY
Salvatore Miceli and Antonino Orlando Sep. 1977 7 p refs Presented at Intern. Symp. on Meas. in Telecommun., Lannion, France, Oct. 1977

(FUB-51-1977) Avail: NTIS HC A02/MF A01

The time variability in subjective assessments of image quality is considered as well as its effect on the evaluation of the mean opinion in double stratified samples of observers viewing still images. Attention is focused on a sampling procedure which avoids the factors that might introduce a bias in the function used in the least squares fit of experimental data. A method to evaluate the accuracy of the fitted function and to verify the validity of the additional law of impairments is also presented.

Author (ESA)

N80-11318# Fondazione Ugo Bordoni, Rome (Italy).

SELF-PHASE MODULATION AND TRANSMISSION IN OPTICAL FIBERS

Bruno Crosignani and Paolo DiPorto Dec. 1978 9 p refs

(FUB-23-1978) Avail: NTIS HC A02/MF A01

The self-modulation effects in fibers and the role of linear dispersion are described, pointing out that while self-phase modulation can significantly broaden the spectrum of a pulse propagating over a long fiber length, the same mechanism allows, under certain circumstances, the transmission of short pulses without distortion. The investigation of nonlinear propagation in a single-mode fiber, taking advantage of the formalism of couple-mode equations, is proposed in order to contribute to the study of the transmission of stable solitary pulses.

Author (ESA)

N80-11319# Fondazione Ugo Bordoni, Rome (Italy).

CHARACTERIZATION OF WAVE SCATTERING FROM RAINFALL, WITH PARTICULAR REFERENCE TO THE POSSIBLE INTERFERENCE IN EARTH-SATELLITE-EARTH LINKS AT FREQUENCIES ABOVE 10 GHz [CARATTERIZZAZIONE DELLA DIFFUSIONE DA IDROMETEORE CON PARTICOLARE RIGAURDO ALLE POSSIBILI INTERFERENZE TRA COLLEGAMENTI TERRESTRI E VIA SATELLITE A FREQUENCE SUPERIORI A 10 GHz]

Aldo Paraboni (Milan Polytec.) Nov. 1978 67 p refs In ITALIAN

(FUB-26-1978) Avail: NTIS HC A04/MF A01

Wave scattering due to rainfall is discussed in consideration of electromagnetic scattering from raindrops with rotational symmetry. It is shown that the Mie or Oguehi algorithms must be adapted to obtain a description that makes possible the integration of the effects of all the raindrops that constitute a dispersion. Then, the integration of dispersion scattering along with the characteristics of the resultant radiation. Scatter coupling and the evaluation of the received power and wave polarization are covered. Finally, details of application to the SIRIO-FUB station link are given, determining the insertion loss matrix and the polarization loss (1.45 dB for only one antenna oriented along the major axis of the polarization ellipse). Author (ESA)

N80-11320# Fondazione Ugo Bordoni, Rome (Italy).

RADIO COMMUNICATIONS AT EXTREMELY HIGH FREQUENCIES: THE USE OF METEOROLOGICAL DATA [RADIOCOMUNICAZIONI A FREQUENZE ELEVATISSME. UNA NOVA UTENZA DEI DATI IDROMETEOROLOGICI]

Francesco Barbaliscia, Francesco Fedi, and Bruno Peroni (Rome Univ.) Sep. 1978 17 p refs In ITALIAN Presented at CNR Convegno sull'Aggior delle Metodologie di Raccolta ed Elaborazione dei Dati Idrometeorol., Rome, Nov. 29-30, 1978

(FUB-27-1978) Avail: NTIS HC A02/MF A01

Extensive hydrometeorological measurements were conducted in relation to microwave propagation. The time distribution function of rain intensity in the microwave path was conducted. The relationship between attenuation and rain intensity was studied at 10, 11, and 30 GHz using 50 rain gages during several years and data were measured with high time-resolution. The systematic rain intensity data was recorded in selected spots. It is concluded that results obtained from available methods are in general acceptable, and that the integration time is an important measurement parameter. Counting the number of discharges of normal rain gages on a five minutes time-base and then extrapolating from distribution curves for smaller periods is recommended. Author (ESA)

N80-11321# Fondazione Ugo Bordoni, Rome (Italy).

PRECIPITATION AND MULTIPATH EFFECTS ON PROPAGATION PHENOMENA. SYSTEM CHARACTERISTICS AND TRANSMISSION QUALITY OF NUMERICAL RADIO LINKS WITH AND WITHOUT FREQUENCY REUSE [INFLUENZA DEI FENOMENI PROPAGATIVI DOVUTI A PRECIPITAZIONE E CAMMINI MULTIPLI, E DELLE CARATTERISTICHE DEL SISTEMA SULLA QUALITA' DI TRASMIZZIONE DI PONTI RADIO NUMERICI CON E SENZA RIUSO DI FREQUENZE]

Paolo Mandarini (Rome Univ.) Dec. 1978 65 p refs In ITALIAN

(FUB-29-1978) Avail: NTIS HC A04/MF A01

A general system description and a simulation program are presented. The system description includes channel models and design check-up for both the case where it is possible not to consider the effect of band selectivity due to echoes and where it is. The simulation program blocks description includes source simulation, codifiers, mathematical pulse sequence generators, modulators, channels, filters, and demodulators. Numerical results are given for a pure quaternary phase shift keying system, with rectangular base band pulses, six pole Butterworth emitting filters, and four pole Butterworth receiving filters. The margin reduction in the presence of an echo is calculated for the cases with and without reuse of frequency. It is concluded that the reuse of intersticial type channel frequencies is in general more convenient than use of channels at the same frequency (1.4 dB against 2.3 dB for non-selective propagation conditions). Author (ESA)

N80-11322# Fondazione Ugo Bordoni, Rome (Italy).

ELECTROMAGNETIC WAVE PROPAGATION THROUGH RANDOMLY ORIENTATED NONSPHERICAL PARTICLES. A GENERAL THEORY [PROPAGAZIONE DI ONDE E.M. ATTRAVERSO DISPERSONI DI PARTICELLE NONSFERICHE CON ORIENTAMENTO CASUALE. UNA TEORIA GENERALE]

Carlo Capsoni (Politec. di Milan), Francesco Fedi, Dario Maggiori (Politec. di Milan), and Aldo Paraboni Oct. 1978 30 p refs In ITALIAN

(FUB-31-1978) Avail: NTIS HC A03/MF A01

The depolarization effects found when electromagnetic waves propagate through randomly dispersed nonspherical particles are analyzed. Numerical results are presented for the case of centimeter waves propagation through a medium of ellipsoidal raindrops. Particular orientations of the raindrops are considered. It is concluded that a simplified model that assumes that all drops have the same orientation is sufficient to describe the propagation of 30 GHz waves. Curves of differential phase-differential attenuation-polarization for 11 and 30 GHz are given. Author (ESA)

N80-11323# Fondazione Ugo Bordoni, Rome (Italy).

A PROPOSAL FOR A NONLINEAR METHOD OF REPRESENTATION OF VOICE SIGNALS [PROPOSTA PER UN NUOVO METODO NON LINEARE DI RAPPRESENTAZIONE DEI SEGNALI VOCALI]

Lucio Prina Dec. 1978 28 p refs In ITALIAN

(FUB-33-1978) Avail: NTIS HC A03/MF A01

Mathematical models of the audio signal transformation in the human ear are discussed pointing out the limitations of linear models, and a nonlinear bispectral anelysis is proposed. The Kernel method of fixing the shape of the integral equations that determine the transformation is reviewed, concluding that the bispectral analyzer model of the human ear is the simpler hypothesis when considering nonlinear systems. A program for calculating bispectral acoustic signals was written in order to examine the validity of this model. Author (ESA)

N80-11324# Fondazione Ugo Bordoni, Rome (Italy).

THE RHYMED WORDS METHOD OF MEASURING THE INTELLIGIBILITY INDEX IN AUDIOMETRIC WORK. THE INFLUENCE OF OPEN AND CLOSED VOWELS [METODO DELLE PAROLE RIMATE PER LA MISURA DELL'INDICE DI INTELLIGIBILATA' PER SCOPI AUDIOMETRICI. INFLUENZA DELLE VOCALI APERTE E CHIUSE]

Foster Bianchi Feb. 1979 11 p In ITALIAN

(FUB-1-1979) Avail: NTIS HC A02/MF A01

The influence of open and closed vowels (o and e) in the Italian language intelligibility rhyme tests was examined. The test material consisted of 15 lists of 25 four letter words grouped

in five sets with a difference in the initial consonant within each set. The magnetic recording of this phonetic material was carried out together with a second recording of a disturbance signal whose intensity could be independently controlled. The experimental design and the results are discussed, showing that no significant difference between intelligibility indexes are found between open and closed vowel words and that some of the lists present average indexes which are significantly different from the mean due to statistical coincidences of signal and masking noise, thus requiring a time-displacement of the masking noise recording for its use in future experiments. Author (ESA)

N80-11325# Research Inst. of National Defence, Linkoeping (Sweden).
RADIO-WAVE PROPAGATION INVESTIGATIONS ON A DIGITAL RADIO LINK AT 2.2 GHz
Aake Blomquist, Folke Eklund, and Sture Wickerts Mar. 1979 64 p refs In SWEDISH; ENGLISH summary
(FOA-A-30020-E2) Avail: NTIS HC A04/MF A01

Propagation measurements comprising recordings of field strength, bit error rates, and spectral characteristics of fading were carried out on two paths 73 km and 49 km long respectively, in the same geographical area. The paths were running over rugged forested terrain in the middle of Sweden. A 34 Mbit/sec signal was transmitted using four phase shift keying. Conventional fading statistics were evaluated. Results show that the quality of the received digital data flow deteriorates at much smaller fading depths than expected at simple flat fading. The dominant reason for fading is radio wave reflection or refraction in horizontal layers in the lowest few hundred meters of the atmosphere where there are significant changes in the radio refractive index. A possible physical description of these fading events is presented. Author (ESA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-11326*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF GLOW DISCHARGE IN FLUIDIZED BEDS Patent Application
Theodore Wydeven, Peter C. Wood (San Jose State Univ. Foundation, Calif.), E. Vernon Ballou (San Jose State Univ. Foundation, Calif.), and Leroy A. Spitze, inventors (to NASA) (San Jose State Univ., Calif.) Filed 26 Oct. 1979 15 p
(NASA-Case-ARC-11245-1; US-Patent-Appl-SN-088663) Avail: NTIS HC A02/MF A01 CSCL 09C

Static charges and agglomeration of particles in a fluidized bed system are minimized by maintaining in at least part of the bed a radio frequency glow discharge. This approach is eminently suitable for processes in which the conventional charge removing agents, i.e., moisture or conductive particle coatings, cannot be used. The technique is applied here to the disproportionation of calcium peroxide diperoxyhydrate to yield calcium superoxide, an exceptionally water and heat sensitive reaction. NASA

N80-11327*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT PIPE COOLING OF POWER PROCESSING MAGNETICS
Irving G. Hansen and Morris Chester (TRW Corp., Redondo Beach, Calif.) 1979 10 p refs Presented at the 14th Intern. Conf. on Elec. Propulsion, Princeton, N. J., 30 Oct. - 2 Nov. 1979; Sponsored by AIAA and Deut. Ges. fur Luft- und Raumfahrt
(NASA-TM-79270; E-223) Avail: NTIS HC A02/MF A01 CSCL 09C

A heat pipe cooled transformer and input filter were developed for the 2.4 kW beam supply of a 30 cm ion thruster system. This development yielded a mass reduction of 40% (1.76 kg) and lower mean winding temperature (20 C lower). While these improvements are significant, preliminary designs predict even greater benefits to be realized at higher power. The design details are presented along with the results of thermal vacuum operation and the component performance in a 3 kW breadboard power processor. R.E.S.

N80-11328*# Hughes Research Labs., Malibu, Calif.
SOLID-STATE X-BAND COMBINER STUDY Final Report
O. Pitzalis, Jr. and K. J. Russell Aug. 1979 79 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955223)
(NASA-CR-162432) Avail: NTIS HC A05/MF A01 CSCL 09C

The feasibility of developing solid-state amplifiers at 4 and 10 GHz for application in spacecraft altimeters was studied. Bipolar-transistor, field-effect-transistor, and Impatt-diode amplifier designs based on 1980 solid-state technology are investigated. Several output power levels of the pulsed, low-duty-factor amplifiers are considered at each frequency. Proposed transistor and diode amplifier designs are illustrated in block diagrams. Projections of size, weight, and primary power requirements are given for each design. R.C.T.

N80-11329# Syracuse Univ., N. Y. Dept. of Mechanical and Aerospace Engineering.
RECTANGULAR FLAT-PACK LIDS UNDER EXTERNAL PRESSURE IMPROVED FORMULAS FOR SCREENING AND DESIGN, REVISED Final Report
Charles Libove Jun. 1979 87 p refs
(Contract F30602-78-C-0083; AF Proj. 2306)
(AD-A072421; MAE-1233-T1; RADC-TR-79-138) Avail: NTIS HC A05/MF A01 CSCL 09/5

Earlier work is improved and extended to provide formulas for the maximum tensile stress in the lid-to-wall seal, the maximum lid deflection, and the lid collapsing pressure for a rectangular flat-pack under external pressure. It is shown how these formulas can facilitate (a) the proper design of the package so that it will retain its hermeticity and serviceability under a given screening pressure and (b) the selection of a proper pressure to use in the hermeticity screening of an already designed package. Information is also given on the approximate equivalence of external pressure and centrifuge acceleration in regard to the seal stresses and lid behavior. Finally, experimental data on package hermeticity are presented which tend to confirm the validity of the main hypotheses of the present work. Author (GRA)

N80-11330# Northrop Corp., Des Plaines, Ill. Defense Systems Div.
I/J BAND LOW-COST CROSSED-FIELD AMPLIFIER Final Technical Report, 28 Mar. 1977 - 31 Mar. 1979
Robert R. Moats Jun. 1979 54 p refs
(Contract DAAB07-77-C-2642)
(AD-A072311; Rept-094-008972; DELET-TR-77-2642-F) Avail: NTIS HC A04/MF A01 CSCL 09/1

This program is directed toward development of an I/J band, linear format, injected-beam crossed-field amplifier (IBCFA) for electronic warfare. The IBCFA should be capable of power output of 1000 W peak, 200 W average, between 8.5 and 17 GHz with 20 dB gain. A laser-cut shaped-substrate meander line is used. Performance in an E/F band IBCFA was evaluated, for which the objective performance in the 2-4GHz band is 3.0 kW peak power output, 1.0 kW average power output, also with 20 dB gain. In addition, a gun for I/J band was designed. The technology for constructing meander circuits on laser-cut shaped substrates bonded to co-expansive ground planes has been established. Operating CFA's have been built and tested in E/F-band, and cold test meander circuits have been built in I/J-band. The first E/F-band operating CFA using the shaped-substrate meander line, and other parts common with a standard E/F-band CFA design, was built and tested. Performance was comparable with a typical CFA of standard design, slightly lower in efficiency at mid band and approximately the same over the remaining part of the 2-4 GHz band. The second E/F band operating model was limited in peak power, apparently from RF arcs for reasons not yet determined. GRA

N80-11331# Watkins-Johnson Co., Palo Alto, Calif.
HIGH AVERAGE POWER BROADBAND ELECTRON-BOMBARDED SEMICONDUCTOR EBS AMPLIFIER Monthly Progress Report, 1 Dec. 1978 - 30 Apr. 1979
Bruce Bell 30 Apr. 1979 11 p
(Contract N66001-78-C-0295)
(AD-A072533) Avail: NTIS HC A02/MF A01 CSCL 09/5

During the current reporting period the analysis phase of the program was completed, which included the diode design study, thermal analysis and output matching circuit analysis. Based on the analysis, modifications are currently being made to two existing diode mask sets. Diode fabrication will not continue until the mask sets are completed. Similarly, device fabrication will not continue until additional testing has been completed on contract no. F30602-78-C-0247, whose goal is to develop a 500 W peak, 20% duty amplifier for JTIDS in conjunction with this program. It is planned that device fabrication will resume by May, which will allow sufficient time for completion of the program on schedule. GRA

N80-11332# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering.
ELECTRIC AND MAGNETIC FIELDS OF AN INTENSE PULSE OF RELATIVISTIC ELECTRONS PROPAGATING THROUGH AIR Final Report
Kenneth A. Dreyer 1979 206 p refs
(AD-A071621; AFIT/DS/PH/79-1) Avail: NTIS HC A10/MF A01 CSCL 20/3

Since propagation characteristics of an electron beam traversing a neutral gas are determined by the response of the beam electrons to their self-fields, an accurate evaluation of the electric and magnetic (EM) fields is essential to any propagation analysis. We report here on theoretical models that were developed for the electromagnetic fields associated with an electron beam propagating in air. One- and two-dimensional models of the fields, and a model for the electron avalanche of the air, were solved on a computer. The major conclusions from calculational results are: the ionization model adequately describes the ionization process over a pressure range of from five Torr to 760 Torr; ionization l&g from the high energy secondary electrons is unimportant; in many cases, the one-dimensional model was found to be as good as the two-dimensional model; and the net current saturates near 15 kilo-Amperes at sea-level pressure, and saturates at lower values at lower air pressure. GRA

N80-11333# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
NANOSECOND PULSERS FOR MM WAVE TUBES Interim Report, Sep. 1978 - Jan. 1979
J. Stover and N. Komatsu Jul. 1979 23 p
(Contract DAAB07-78-C-2991; DA Proj. 1L1-62705-AH-94)
(AD-A071414; HAC-FR79-14-353; IR-1; Delet-TR-78-2991-1)
Avail: NTIS HC A02/MF A01 CSCL 09/5

No decision has been reached as to the semiconductor device that will be used as the switching element for the nanosecond pulsers. The evaluation of avalanche transistors, VMOS FET, and LASS devices is continuing. A contributing factor to the lack of progress during the early months of the contract was program staffing problems and late arrival of critical test equipment. GRA

N80-11334# Pennsylvania State Univ., University Park. Materials Research Lab.
CERAMIC PIEZOELECTRIC TRANSDUCERS Final Report, 1 Jan. - 31 Dec. 1978
L. E. Cross, J. V. Biggers, and R. E. Newnham 1 Jun. 1979 247 p refs
(Contract N00014-76-C-0515; DARPA Order 3203)
(AD-A071652) Avail: NTIS HC A11/MF A01 CSCL 20/2

The work described in this report was carried out in the Materials Research Laboratory of The Pennsylvania State University over the period January 1, 1978 to December 31, 1978. The period is the final year of a joint DARPA/ONR sponsored three-year contract effort directed towards the development of new and improved piezoceramic materials for electromechanical transducers. A major success of the program has been the development of new composite transducers with unusually high piezoelectric g(h) coefficients. A second important advance has been the development of a new family of electrostrictive materials based on the ferroelectric relaxor Pb3MgNb2O9 (PMN). Sophisticated computer aided graphics techniques have been used to develop a phenomenological Gibbs function for the PZT solid solution family. In support of these major efforts, a considerable amount of detailed work has been done to develop the processing capabilities required to assemble the many different ceramics and composites which have been the topics of study. A small additional effort was committed to the growth of single crystals and of oriented polycrystals of the ferroelectric antimony sulphur iodide. GRA

N80-11335# Boeing Aerospace Co., Seattle, Wash. Navy Systems and Advanced Projects Div.
OPTICAL POWER SPECTRUM ANALYSIS OF PROCESSED IMAGERY Final Report, 10 Jan. 1978 - 30 Jun. 1979
Richard A. Schindler Jul. 1979 80 p refs
(Contract F33615-78-C-0503; AF Proj. 2313)
(AD-A073083; AMRL-TR-79-29) Avail: NTIS HC A05/MF A01 CSCL 09/4

This report describes the approach, procedures and results of a study to examine the use of information density values based on image power spectra as tools in the selection and application of digital image processing techniques. Information density measures are determined for unprocessed and processed imagery and compared with observer target recognition performance. The report describes modifications to the information density measure to improve the relationship with performance and to select the most effective processing technique. GRA

N80-11336# Naval Research Lab., Washington, D. C.
THE EQUIVALENT CIRCUIT IN THE MOBILITY ANALOGY OF A MAGNETOSTRICTIVE TRANSDUCER IN THE PRESENCE OF EDDY CURRENTS Interim Report
Steven W. Meeks 26 Mar. 1979 42 p refs
(RR0110842)
(AD-A072879; AD-E000305; NRL-8294) Avail: NTIS HC A03/MF A01 CSCL 09/1

Recent research into the highly magnetostrictive rare earth iron compounds has renewed an interest in magnetostrictive transducers. A typical magnetostrictive transducer is designed with the aid of an equivalent circuit which electrically represents the differential equations that govern the motion of the transducer. The equivalent circuit is used to predict the transmitting responses, receiving response, electrical impedance, and efficiency of the transducer. Ohmic losses generated by eddy currents in metallic magnetostrictive transducers reduce the efficiency and alter the electrical impedance. Thus an equivalent circuit is required which can predict the effect of eddy currents on the efficiency, the electrical impedance, the transmitting responses, and the receiving response of a magnetostrictive transducer. The report presents the derivation of an equivalent circuit of a magnetostrictive transducer in the presence of eddy currents using an exact eddy-current theory. However, use of the exact theory can be time consuming. Lumped equivalent circuits are also presented which use approximations to the exact theory to simply and accurately predict the efficiency and electrical impedance of a transducer with eddy currents within a frequency range of practical interest near the clamped characteristic frequency. GRA

N80-11337# Stanford Univ., Calif.
JOINT SERVICES ELECTRONICS PROGRAM OF THE EDWARD L. GINZTON LABORATORY OF STANFORD UNIVERSITY Annual Progress Report, 1 Apr. 1978 - 31 Mar. 1979
Marvin Chodorow, B. A. Auld, M. R. Beasley, S. E. Harris, and G. S. Kino Apr. 1979 90 p refs
(Contract N00014-75-C-0632)
(AD-A072766; SU-GL-2950) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report summarizes the research progress and activity on Joint Services Electronics Program Contract N00014-75-C-0632 for the period 1 April 1978 through 31 March 1979. Specific Projects are: (1) High-T(c) Superconducting Weak-Link Josephson Junctions and Circuits (M.R. Beasley); (2) Acoustic Surface Wave Scanning of Optical Images (G.S. Kino); (3) Fiber Optic Signal Processing (H.J. Shaw); (4) Nonlinear Interactions of Acoustic Waves with Domains in Ferroic Materials (B.A. Auld);

(5) Measurements of Ultrafast Physical Phenomena (A.E. Siegman);and (6) A VUV and Soft X-ray Light Source (S.E. Harris and J.F. Young). GRA

N80-11338# Surface Technology, Inc., Princeton, N. J.
NON-NOBLE COLLOIDAL CATALYSTS Final Report, 15 May 1977 - 15 Sep. 1978
Nathan Feldstein May 1979 39 p refs
(Contract F33615-77-C-5106)
(AD-A072757; AFML-TR-78-203) Avail: NTIS HC A03/MF A01 CSCL 09/5

This investigation is concerned with the development of non-noble metal autocatalytic colloids suitable for initiating electroless copper plating of printed wiring boards (PWB's). Additionally, the processing materials and parameters are selected and adjusted so that costs are reduced and the reliability of the PWB's are increased. This is achieved by the elimination of 'precious metals' as catalysts and the maintenance of near-normal pH levels (approx. 5-10) throughout the process thereby minimizing acidic residues on the PWB's. GRA

N80-11339# Radio Corp. of America, Princeton, N. J.
LOW-LOSS CHARGE-COUPLED DEVICE Final Technical Report, 15 May 1977 - 15 Nov. 1978
W. J. Kosonocky, D. J. Sauer, C. Y. Tayag, and F. V. Shallcross Griffiss AFB, N. Y. RADC Jun. 1979 101 p refs
(Contract F19628-77-C-0176; AF Proj. 2305)
(AD-A072989; PRRL-78-CR-57; RADC-TR-79-144) Avail: NTIS HC A06/MF A01 CSCL 09/5

Two closed-loop CCD structures, a 256-stage and a 1024-stage devices were designed, fabricated, and operated to demonstrate a low-loss mode of operation for a very long CCD delay line or a closed-loop CCD structure. The low-loss CCD concept consists of operating a CCD with each signal charge well followed by one or more trailing-bias-charge wells. Two orders of magnitude improvement in the effective transfer losses were demonstrated experimentally by periodically recombining at a signal-regeneration stage the (first-order) signal-charge transfer losses collected by the trailing bias charger with the corresponding signal-charge packets. An effective transfer loss of 2.4 x 10 to the -7th power per transfer was demonstrated. The maximum time delay has also been improved by two orders of magnitude over that of conventional CCDs by means of a new dark-current subtraction technique. The 1024 stage closed-loop low-loss CCD was also operated as a synchronous signal correlator producting an improvement in the signal-to-noise ratio of 17.5 dB as a result of 100 signal recirculations in the loop. GRA

N80-11340# Ohio State Univ., Columbus. Electroscience Lab.
A LOOP FOR TRACKING THE FREQUENCY OF A PULSED SINUSOID Interim Report
R. J. Huff and D. W. Herr Griffiss AFB, N. Y. RADC Jul. 1979 61 p refs
(Contract F30602-75-C-0061; AF Proj. 6523)
(AD-A072750; ESL-710300-4; RADC-TR-79-171) Avail: NTIS HC A04/MF A01 CSCL 09/3

The configuration and performance of a hybrid frequency tracking loop which tracks the frequency of a pulsed sinusoid are addressed in this report. A linear model of the loop is developed and an approximate expression is derived for the standard deviation of the frequency tracking error due to the presence of additive white Gaussian noise at the loop's input. Results obtained by simulating the loop on a digital computer are presented which show the extent to which loop non-linearities affect the standard deviation of the frequency tracking error, the distribution of the frequency tracking error, and the loop lock range. These results show that the loop operates with a high degree of effectiveness. GRA

N80-11341# Naval Avionics Center, Indianapolis, Ind.
DELETERIOUS EFFECT OF FUSING FLUIDS ON PRINTED WIRING BOARDS Report, 1 Dec. 1978 - 30 Apr. 1979
David O. Pond 9 May 1979 59 p
(AD-AC72716; NAC-TR-2259) Avail: NTIS HC A04/MF A01 CSCL 09/5

This study identified the corrosive effects of fusing fluids and fusing fluid residues on printed wiring boards subjected to electrical stress in a humid environment at elevated temperature. The effect of varying delay times between solder fusing and cleaning of fusing fluid residues for three fusing fluids was studied. The effect of a single delay time between solder fusing and cleaning of fusing fluid residues for eight other fusing fluids was studied. Also, the protective value of a solder resist and a conformal coating was evaluated. GRA

N80-11342# Litton Systems, Inc., San Carlos, Calif. Electron Tube Div.
FEASIBILITY DEMONSTRATION OF A HIGH POWER WIDEBAND TWT WITH LOW AM/PM DISTORTION Final Report
E. G. Chaffee 26 Feb. 1979 54 p refs
(Contract N00173-77-C-0214)
(AD-A072932) Avail: NTIS HC A04/MF A01 CSCL 09/1

Loss-line stabilized tubes have been under development at Litton Industries under the supervision of the Naval Research Laboratories since 1973. Early developmental tubes demonstrated high power, wide bandwidth and efficient operation. In-band distributed loss techniques were developed to form attenuator sections to provide lower bandedge stability and to allow efficient operation at the high frequency bandedge. Stabilization problems, however, at the upper bandedge prevented operation at full design perveance. In the last tube preceding this contract, upper bandedge stability techniques were improved significantly; but, the tube exhibited in-band regenerative oscillations which prevented direct demonstration of this stability improvement. The two tubes built under this contract both demonstrated oscillation stability at design perveance and fully demonstrated the potential of loss line stabilized tubes. The design changes and the demonstration of these two tubes are discussed in this report. GRA

N80-11343# Honeywell, Inc., Golden Valley, Minn. Ceramics Center.
PRODUCTION ENGINEERING MEASURE (PEM) MANUFACTURING METHODS AND TECHNOLOGY FOR PIEZOELECTRIC TRANSFORMERS Final Report, 14 Jul. 1975 - 14 Dec. 1978
William B. Harrison 15 May 1979 192 p refs
(Contract DAAB07-76-C-0008)
(AD-A072674; HONEYWELL-47514) Avail: NTIS HC A09/MF A01 CSCL 09/1

This is the final report on Contract DAAB07-76-C-0008, which established a cost-effective production capability for manufacturing piezoelectric ceramic transformers to be used in operating 18mm night vision image intensifier tubes. The 18 mm PET production approach established by this program produced acceptable units which met all of the specifications established for this high voltage step-up transformer. A one-element packaged PET was established in place of the original two-element developmental units. This was accomplished by establishing more realistic resistive and capacitive load requirements for each of the V12 and V3 voltage outputs. All of the equipment and tooling designed and built produced satisfactory pilot production run units. The cost objectives were achieved on the individual piezoelectric elements. Higher costs were associated with attaching leads to the PET ceramic elements and packaging was more time-consuming than desired. GRA

N80-11344# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A 3 MV PULSE TRANSFORMER
G. J. Rohwein May 1979 22 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0813) Avail: NTIS HC A02/MF A01

A 3 MV transformer designed for charging high voltage pulse forming transmission lines is described. The transformer is an air core spiral strip design which incorporates ring cage shielding to control edge breakdown in the secondary winding. The physical features of the transformer are described along with its electrical characteristics and the operational results. Air core transformers are an attractive alternative to Marx generators for charging high voltage pulse forming transmission lines (PFL) such as those used with high power electron or ion beam accelerators. Some of the advantages of transformer systems include simplicity, compactness, high reliability, reasonable cost and high energy transfer efficiency. The transformer was designed to

demonstrate these features. The primary objective, however, was to establish the feasibility of multimegavolt operation. DOE

N80-11345# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
NOISE AND OPTIMIZATION OF THE dc SQUID Ph.D. Thesis
Claudia Denke Tesche. Nov. 1978. 110 p. refs.
(Contract W-7405-eng-48)
(LBL-8510) Avail: NTIS HC A06/MF A01

A lumped circuit model for the isolated dc SQUID is developed. A set of coupled nonlinear differential equations is derived for the output voltage and circulating current as functions of time. A computer algorithm is developed to compute the time averaged SQUID I-V characteristics and noise spectral densities. DOE

N80-11346# Los Alamos Scientific Lab., N. Mex.
DESIGN OF SAFE ELECTRICAL EQUIPMENT FOR RESEARCH
J. L. Rand, R. W. Leep, and W. A. Bradley. Apr. 1979. 59 p. refs.
(Contract W-7405-eng-36)
(LA-7597-MS) Avail: NTIS HC A04/MF A01

Design information needed by research personnel engaged in the construction and operation of experimental apparatus is presented with emphasis on electrical safety. Figures, charts, and tables are used to present reference data. General information on the construction and use of Marx generators and high-voltage capacitor energy storage banks is presented with emphasis on electrical safety. DOE

N80-11347# Los Alamos Scientific Lab., N. Mex.
MAGNETIC ANOMALY IN SUPERCONDUCTING TmRh4B4
J. L. Smith, C. Y. Huang, J. J. Tsou (Wichita State Univ.), and J. C. Ho (Wichita State Univ.). 1978. 10 p. refs. Presented at the 24th Annual Conf. on Magnetism and Magnetic Materials, Cleveland, 14-17 Nov. 1978.
(Contract W-7405-eng-36)
(LA-UR-78-2701; Conf-781114-4) Avail: NTIS HC A02/MF A01

The magnetic and superconducting properties of TmRh4B4 (which becomes superconducting at 9.6 K) were investigated by means of ac and dc magnetic susceptibility and specific heat measurements. At 10.7 K, an ac susceptibility peak similar to those found in spin glasses was observed. In addition, a pronounced specific heat peak was observed at 11.4 K. The susceptibility peak is essentially unaffected by substitution of 1% Lu or Er for the Tm, but it diminishes when much larger amounts of Er are substituted. The physical origin of this anomalous peak is discussed. DOE

N80-11348# Los Alamos Scientific Lab., N. Mex.
SOME dc SUPERCONDUCTING CABLES
William E. Keller. 1979. 27 p. refs. Presented at the 1979 Workshop on Public Policy Aspects of High Capacity Electric Power Transmissions, Aspen, Colo., 14-16 May 1979.
(Contract W-7405-eng-26)
(LA-UR-79-1057; Conf-790527-1) Avail: NTIS HC A03/MF A01

The general characteristics of dc superconducting cables as well as details of two specific designs, one coaxial and the other double monopolar, are discussed. The special advantages of these cables lie in the relative simplicity of construction, their extremely high operating efficiency, and their compactness when compared with other ac or dc high-capacity cables cooled by flowing fluids, either at ambient or cryogenic temperatures. These features are discussed in the context of economic, environmental, and power system considerations, including some of the possible trade-offs among conventional and superconducting ac and dc systems. DOE

N80-11349# Bendix Corp., Kansas City, Mo.
RELIABILITY OF PACKAGED BEAM-LEAD TRANSISTORS BUILT WITH DIFFERENT PRE-SEAL ASSEMBLY TECHNIQUES
J. P. Gracey. Oct. 1978. 36 p. refs. Revised.
(Contract EY-76-C-04-0613)
(BDX-613-1952-Rev) Avail: NTIS HC A03/MF A01

The reliability of two TO-18 packaged beam-lead transistors was studied using high temperature reverse bias and high temperature storage as accelerated aging methods. Three pre-seal assembly techniques were evaluated and compared based on reliability test results. Results were affected by the use of damaging breakdown voltage tests during part of the experiments. DOE

N80-11350# Bendix Corp., Kansas City, Mo.
HERMETIC SEALING OF HYBRID MICROCIRCUITS: INITIAL CAPABILITY DEVELOPMENT
J. H. Williams and W. A. Piper. Dec. 1978. 24 p. refs. Revised.
(Contract EY-76-C-04-0613)
(BDX-613-1930-Rev) Avail: NTIS HC A02/MF A01

The capability to hermetically seal hybrid microcircuits was established. Tests indicate that helium fine leak rates in the low 10 to the 8th power cu cm/s region and moisture content of less than 500 ppm are obtained with the 80 percent gold-20 percent tin solder sealing process being used. Initial production results indicate a yield of better than 90 percent for the process. DOE

N80-11351# Underground Systems, Inc., Armonk, N. Y.
PRELIMINARY DIELECTRIC STUDIES. SPIR-O-LINE CABLE FOR APPLICATION AT POWER FREQUENCIES. Final Report
John S. Engelhardt. 4 Dec. 1978. 55 p. refs.
(Contract EG-77-C-01-5054)
(HCP/T5054-01) Avail: NTIS HC A04/MF A01

A unique dielectric system for both flexible and rigid power cable applications was studied. The Spir-O-line is a high powered radio frequency transmission system. The cable consists of a central conductor continuously supported by six high density polyethylene tubes inside a metal sheath, which operates as a gas insulated transmission line with either nitrogen or SF6 as the filling medium. A rough analysis of the dielectric geometry concluded that its breakdown strength might be improved over that of the open coaxial conductor configurations. A series of breakdown tests was performed on the smaller range of commercially available sizes. The results confirmed the expected behavior patterns, but did not fully explore the upper units of performance due to occasional tube separations in the samples tested. The potential voltage ratings of the larger available sizes were estimated. There is considerable flexibility in the design of the conductor due to the continuous support of the dielectric tubes. DOE

N80-11352# Sandia Labs., Albuquerque, N. Mex. Div. 2113.
CONTROLLABILITY/OBSERVABILITY ANALYSIS OF DIGITAL CIRCUITS
Lawrence H. Goldstein. Nov. 1978. 28 p. refs.
(Contract EY-76-C-04-0789)
(SAND-78-1895) Avail: NTIS HC A03/MF A01

The testability of a digital circuit is directly related to the difficulty of controlling and observing the logical values of internal nodes from circuit inputs and outputs, respectively. A method for analyzing digital circuits in terms of six functions which characterize combinational and sequential controllability and observability is presented. DOE

N80-11353# California Univ., Berkeley. Lawrence Berkeley Lab.
ONE SHOTS AND ALTERNATIVES IN SYNCHRONOUS DIGITAL SYSTEM DESIGN
S. Hui and J. B. Meng. Jan. 1979. 16 p. refs.
(Contract W-7405-eng-48)
(LBL-8722) Avail: NTIS HC A02/MF A01

Undesirable features of monostable multivibrators (one shots) in digital integrated circuits are described and some alternatives to their use are discussed. These include flip-flops and gates, delay lines, and other methods. DOE

N80-11354# Bendix Corp., Kansas City, Mo.
ELECTRICAL COMPENSATION SYSTEM FOR PLATED-THROUGH-HOLE TESTER: MILESTONE REPORT
W. B. Abel. Oct. 1978. 71 p. refs. Revised.
(Contract EY-76-C-04-0613)

(BDX-613-1943-Rev) Avail: NTIS HC A04/MF A01

A microprocessor system was developed to control the acquisition and interpretation of resistance-measurement data from plated-through holes in printed wiring boards. The system provides a direct digital display of the thickness of the copper plating on the hole walls. The complex calibration for holes having different geometries is stored in the memory of the system, and the geometry factors are input through thumbwheel switches. A special probe system makes possible the determination of an average resistance value for each test hole without moving the probe contacts in relation to the hole. DOE

N80-11355# Bendix Corp., Kansas City, Mo.
STATIC ELIMINATION WORK STATIONS Final Report
R. S. Hedges and J. L. Bellah Dec. 1978 14 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-1953-Rev) Avail: NTIS HC A02/MF A01

Electrostatic charges, if not properly controlled, destroy or degrade certain semiconductor devices. Several techniques for controlling static charges were evaluated, using an electronic signal selector as the primary model for investigation. Air-ionizing equipment, encapsulant additives and materials, antistatic spray, and the use of X-rays were included. DOE

N80-11356# Bendix Corp., Kansas City, Mo.
LASER WELDING OF ELECTRICAL INTERCONNECTIONS
F. R. Bauer Dec. 1978 26 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2022-Rev) Avail: NTIS HC A03/MF A01

Processes and equipment were developed for welding thin aluminum and copper foils using a Nd : YAG laser. It is shown that laser welding provides an alternate technique with improved quality for welding these types of electrical terminations. DOE

N80-11357# Bendix Corp., Kansas City, Mo.
EFFECTS OF GAS PLASMA ON PRINTED CIRCUIT BOARD MATERIALS
L. C. Jackson Nov. 1978 37 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-2030-Rev) Avail: NTIS HC A03/MF A01

The project was established to define gas plasma process parameters for printed circuit board cleaning without damage to the substrate. Process parameters of gas flow, wattage, and time are defined for both oxygen and argon treatments. The surface activity changes of plastics and printed circuit board materials are described. A preliminary evaluation of the life (surface activity) of these materials after plasma treatment is presented. Swell index, contact angle, and Moseran analysis tests were used to measure process parameters, plasma life, and surface changes. DOE

N80-11358# Argonne National Lab., Ill.
DESIGN OF A TUNABLE HIGH-Q SUPERCONDUCTING NOTCH FILTER
Charles M. Falco, R. T. Kampwirth, C. S. Pang, and I. Schuller Oct. 1978 40 p refs
(Contract W-31-109-eng-38)
(ANL-78-91) Avail: NTIS HC A03/MF A01

The design of a tunable high-Q superconducting notch filter is presented. The filter is designed to be manufactured from high T/sub c/ superconductors (Nb3Sn, Ng3Ge) made by high-rate magnetron sputtering on sapphire substrates. The geometry of the various elements, holder materials for the cryostat, studies relating to the preparation of suitable high T/sub c/ materials, and the photoetching procedures for the filter elements are discussed. DOE

N80-11359# Bendix Corp., Kansas City, Mo.
AUTOMATED MONITORING OF THIN FILM CAPACITORS FOR ELECTRICAL BREAKDOWN
R. T. Horn Jan. 1979 20 p
(Contract EY-76-C-04-0613)
(BDX-613-2076-Rev) Avail: NTIS HC A02/MF A01

The automated test system sensitivity was investigated to relate electrical background noise to electrical breakdowns. DOE

N80-11360# Danish Research Center for Applied Electronics, Hoersholm.
WILL AN INCREASING NUMBER OF COMPANIES START MAKING THEIR OWN LSI-COMPONENTS? AN EVALUATION OF DEVELOPMENT TRENDS IN THE ELECTRONICS INDUSTRY [EGEN PRODUKTION AF LSI-KOMPONENTER? EN VURDERING AF, OM UDVIKLINGEN I ELEKTRONIKINDUSTRIEN VIL MEDFOERE AT STADIGT FLERE VIRKSOMHEDER ETABLERER EGEN PRODUKTION AF LSI-KOMPONENTER]
Soeren Larsen Jun. 1978 34 p refs Partly in DANISH and ENGLISH
(ECR-82) Avail: NTIS HC A03/MF A01

Low sales volume custommade LSI market trends are examined in order to assess the market development potential for Danish companies specialized in this field. Activities of the large electric materials and electronics producers in the U.S.A. and Europe, their production programs, the financial relationship between electronic activities and LSI production, the actual extent of home-used LSI, and development trends are reviewed. It is concluded that there are few indications pointing to an increase in low sales volume custom LSI components use. On the contrary microprocessors and other commercially available LSI components can be adapted to still more applications than before so that the need for custom made LSI will diminish. Author (ESA)

N80-11361# Defence Research Information Centre, Orpington (England).
DIGITAL CALCULATION OF THE COMMUTATION CHARACTERISTICS OF ARMATURE WINDINGS
Franz Maier London Dec. 1978 58 p refs Transl. into ENGLISH from Sci. Elec., v. 19, 1973 p 97-133
(DRIC-Trans-5359; BR67219) Avail: NTIS HC A04/MF A01

The process of commutation and the role of the mechanical commutator in both electric motors and generators are discussed. The principles of modern commutation theory are reviewed and equations are derived for the commutation characteristics of armature windings. Theoretical considerations include current commutation curves and fields, independent and dependent commutation, rectilinear and medially rectilinear commutation as well as general descriptions of electromagnetic fields and their interactions. Characteristic values for the commutation properties of a winding are particularly emphasized. Commutation inductances and their calculation are covered. Various winding configurations and their associated circuit elements are modeled mathematically. Finally, calculation results are applied to specific examples of commutation behavior. Author (ESA)

N80-11362# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatiale.
ANALYSIS AND DESIGN OF A PHASE LINEARIZATION SYSTEM FOR TRAVELING WAVE TUBE AMPLIFIERS [ETUDE ET REALISATION D'UN LINEARISEUR DE PHASE POUR L'AMPLIFICATEUR A TUBE A ONDE PROGRESSIVE]
Jean-Pierre Pochon Nov. 1977 216 p refs In FRENCH; ENGLISH summary
(CNES-NT-86) Avail: NTIS HC A10/MF A01

A concise theory of the operation of traveling wave tube amplifiers TWTA is presented. The tradeoff between efficiency and nonlinearity is emphasized. Distortion in transmission of a television signal caused by nonlinearities, such as AM/PM conversion, in the TWTA of a communication channel is discussed. The performance measurement of an X-band TWTA for satellite communication and the measurement of related nonlinearity is outlined. The analysis and design of a phase linearization system which considerably reduces the AM/PM conversion coeffficient and so allows the TWTA to be operated at saturated power are shown. The study was conducted in the 11 GHz frequency band and applications to satellite television transmission are cited. Author (ESA)

N80-11363# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatiale.
ON THE USE OF A SEMI-AUTOMATED TEST SYSTEM FOR MEASURING THE CHARACTERISTICS AND/OR THE 'S' PARAMETERS OF A QUADRUPOLAR NETWORK [UTILISATION D'UN SYSTEME DE TEST SEMI-AUTOMATIQUE POUR LA MESURE DES CARACTERISTIQUES ET/OU DES PARAMETRES 'S' D'UN QUADRIPOLE]

Jean-Luc Sedard Nov. 1978 78 p In FRENCH; ENGLISH summary
(CNES-NT-87) Avail: NTIS HC A05/MF A01

The implementation and use of a semi-automated test system based on a Hewlett-Packard computer, type HP 9825 A, and its associated peripherals is described. The system includes a series of programs which allow the measurement of the chief characteristics of a four terminal network (quadripolar) versus input power (linearity, phase, etc.) at a constant frequency, or versus frequency (gain, bandwidth, phase, transit time, etc.) for a given input power. This allows microwave equipment performance to be checked and determined rapidly. A second series of programs was studied to obtain the S parameters characteristic of a four terminal network. It automatically calibrates the equipment and calculates, from the measurements, the real parameters, allowing for errors introduced either by the equipment of by the measurement principle. Author (ESA)

N80-11364# Toulouse Univ. (France). Lab. de Genie Electrique.
ELECTRICAL PROPERTIES OF SOLID INSULATORS AS A FUNCTION OF TEMPERATURE AND PRESSURE Final Report [PROPRIETES ELECTRIQUES DES ISOLANTS SOLIDES EN FONCTION DE LA TEMPERATURE ET DE LA PRESSION]
Jun. 1978 12 p In FRENCH
(Contract CNET-75-9B-BCF/LET)
(Publ-364) Avail: NTIS HC A02/MF A01

A high pressure (1500 bar) experimental device working in the -50C to 150C temperature range was built in order to measure the low and high frequency dielectric loss coefficient of insulating materials which are currently used in underwater telephone cables. Results related to polyethylene losses in the 0.1 to 15 MHz range show that these losses increase with pressure and frequency at a given temperature, while the permittivity diminishes at higher pressures. The experimental values present a rather large dispersion in spite of several corrections that were being considered. Author (ESA)

N80-11365# Pisa Univ. (Italy). Ist. di Elettrotecnica.
ON THE MAGNETIZING ENERGY BALANCE IN ELECTRIC NETWORKS, PARTICULARLY REGARDING NETWORKS INVOLVING MACHINES WITH COMMUTATORS [SUL BILANCIO DELL'ENERGIA MAGNETIZZANTE NELLE RETI ELETTRICHE, CON PARTICOLARE RIGUARDO ALLE RETI COMPRENDENTI MACCHINE A COMMUTAZIONE]
R. Bini and L. Taponecco 1978 11 p refs
(Rept-1630) Avail: NTIS HC A02/MF A01

The magnetizing energy balance for various types of electric networks involving machines with commutators of electronic switching devices is considered. It is assumed that the networks are nonsinusoidal in operation. Three different networks are analyzed. These are a network with a permanent magnet which is immobile, a network containing a permanent magnet which is in relative motion, and a network whose circuit is subjected to the periodic interruption and reinsertion of a magnetic field. The characteristics of the energy balance are discussed for each case. In order to establish the validity of theoretical assumptions a test circuit was built and its characteristics measured. Results show acceptable agreement. Author (ESA)

N80-11366# Uppsala Univ. (Sweden). Dept. of Electronics.
A METHOD FOR TEMPERATURE STABILIZATION OF CURRENT GENERATORS AND ZENERDIODES
Tommy Oeberg Oct. 1978 18 p ref
(UPTEC-78-76-R) Avail: NTIS HC A02/MF A01

An inexpensive method for temperature stabilization of zener diodes and current generators is presented. The method makes it possible to compute the temperature dependence of the current in a simple one transistor current generator. The temperature drift can be utilized to balance the temperature variation of the voltage over a zener diode. The method is based on differentiation of the expression for the output current generator. A formula for the calculations is presented which makes the method easy to use. Good results were obtained. Minor changes in the calculations make it possible to compute the dependence on variation in other parameters, such as in the supply voltage. Author (ESA)

N80-11367# Fondazione Ugo Bordoni, Rome (Italy).
MULTIHOLE COUPLERS BETWEEN DIFFERENT WAVEGUIDES. THEORY AND EXPERIMENTS
Franco Bertolani and Gabriele Falciasecca (Bologna Univ.) Aug. 1978 6 p refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. 1978
(FUB-30-1978) Avail: NTIS HC A02/MF A01

A procedure to obtain, with the required approximation, the phase shift in multihole couplers between equal or different waveguides is presented in order to avoid the problem of experimental adjustment when a strong coupling is wanted. The experimental results show good agreement with theory. This design method was extensively used to produce couplers between the TE1C of rectangular waveguides and the more important modes of circular waveguides (TE01, TE02, TE11, TE12, TM11). In the described example for a coupler with the TE01 mode a 0.5 dB coupling was obtained at the design frequency (30 to 38 GHz band). Author (ESA)

N80-11368# AEG-Telefunken, Berlin (West Germany). Forschunginst.
UNCONVENTIONAL CIRCUITS FOR STATIC VOLTAGE TRANSFORMERS Final Report
Johannes Nestler, Guenther Junge, Ingeborg Tzivelekas, and Hans Wrede Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 269 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-78-26) Avail: NTIS HC A12/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 56,90

The design and development of circuits for static converters are reported on. These include primarily thyristor/transistor circuits as well as a circuit for load-controlled converters. In thyristor/transistor circuits transistors are used for quenching and commutation purposes as well as to protect thyristors. With these circuits the rated current can be commuted down to very low imput voltages. The load-controlled converter by virtue of this method of commutation is characterized by simple design and by the fact that it displays high efficiency at high clock frequencies. Two load-controlled converters were constructed, one of which provided a power of 20 kW at a clock frequency of 7 kHz, the efficiency achieved being 90%. Modular systems were developed for voltage converters. In this connection the possible application of heat pipes was examined for such converters with respect to the dependence on mounting position and the start-up and peak load behavior. Author (ESA)

N80-11369# Royal Aircraft Establishment, Farnborough (England). Defensive Weapons Dept.
A SIMPLE PULSE PEAK DETECTOR
G. A. Wilkinson London Sep. 1977 16 p refs
(RAE-TM-DW-10; BR60614) Avail: NTIS HC A02/MF A01

A simple peak detector was built to act as an analog monitor of the height of a video pulse train such as might be received from a pulsed microwave transmitter. The performance of the circuit as a function of pulse width and pulse repetition frequency (PRF) was investigated. The detector is shown to be usable for pulse widths greater than 1 micro sec and PRF's greater than about 50 Hz. Author (ESA)

N80-11370# Danish Research Center for Applied Electronics, Hoersholm.
A COMPARATIVE 5000 HOURS LIFE TEST OF LIGHT EMITTING DIODE DISPLAYS, INCLUDING 22 VARIANTS FROM 10 MANUFACTURERS
H. J. Nordby Mar. 1979 48 p Sponsored by Dan. Council of Technol. and Soc. for Reliability and Environ. Testing (SPM) Original contains color illustrations
(ECR-86) Avail: NTIS HC A03/MF A01

Each type of display was represented in 4 groups. The 4 groups were exposed in different environments with different load conditions. None of the displays were overloaded with respect to the manufacturers specifications. During the 5000 hours life test the total 7 segment luminous intensity from each display was measured and recorded. In this way is is possible to produce degradation curves for each variant. The intensity of all segments in one group was recorded to determine the nonuniformity for each display. The results show that only a few variants display

remarkable degradation. Temperature cycling and intermittent operation are the only exposures that produce catastrophic failures. The nonuniformity is found to be a serious drawback for a number of the investigated devices. Author (ESA)

N80-11371# National Bureau of Standards, Washington, D. C. Electron Devices Div.
SEMICONDUCTOR TECHNOLOGY PROGRAM, PROGRESS BRIEFS Interim Report, Jan. - Mar. 1979
W. Murray Bullis, ed. Jun. 1979 12 p refs Sponsored in part by Div. of Elec. Energy Systems, Defense Nucl. Agency, Wash., D. C., Charles Stark Draper Lab., Inc., Cambridge, Mass., AFAL, Wright-Patterson AFB, Ohio, Army Electronics R/D Command, Ft. Monmouth, N. J.
(Contracts N00030-78-C-0100; EX-77-A-01-6010; ARPA Order 2897)
(PB-298064/7; NBSIR-79-1591-3) Avail: NTIS HC A02/MF A01 CSCL 09A

The current status of work on measurement technology for semiconductor materials, process control, and devices is presented. Highlighted activities include studies of reverse-bias second breakdown, an integrated gated-diode electrometer, random fault measurements, pattern generator positional accuracy, intrachip linewidth variation, transient upset in TTL circuits, photoresist sensitometry, optical linewidth measurements, spreading resistance profiting, model spreading resistance data, silicon resistivity SRMs, and sheet resistance measurements. GRA

N80-11372# National Bureau of Standards, Washington, D. C. Electron Devices Div.
SEMICONDUCTOR TECHNOLOGY PROGRAM, PROGRESS BRIEFS Interim Report, Oct. - Dec. 1978
W. Murray Bullis Mar. 1979 12 p refs Sponsored in part by Div. of Elec. Energy Systems, Defense Nucl. Agency, Wash., D. C., Charles Stark Draper Lab., Inc., Cambridge, Mass., AFAL, Wright-Patterson AFB, Ohio and Army Electronics R/D Command, Ft. Monmouth, N. J.
(Contract N00030-78-C0100; EX-77-A-01-6010; ARPA Order 2397)
(PB-298063/9; NBSIR-79-1591-2) Avail: NTIS HC A02/MF A01 CSCL 09A

The current status of work on measurement technology for semiconductor materials, process control, and devices is presented. Highlighted activities include studies of process-induced radiation damage, resistivity-dopant density relationships in silicon, spreading resistance measurements, spreading resistance profiling, cross-bridge sheet resistor test structure, PIND test, moisture infusion into hermetic packages, and conduct of a workshop on power semiconductor devices. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-11373# Missouri Univ. -Rolla. Dept. of Chemistry.
TRANSPORT PROPERTIES FOR ABLATION PRODUCTS: AN ILLUSTRATION USING THE He-C2H INTERACTION
Louis Biolsi 2 Oct. 1979 33 p refs Backup document for AIAA synoptic 'Proposed computational method for transport properties of ablation products' scheduled for publication in AIAA journal in Apr. 1980
Avail: NTIS HC A03/MF A01

The peripheral force method for obtaining atom-molecule interaction potentials was applied to the He-C2H interaction (C2H is an important ablation product and He is one of the primary species in the Jovian atmosphere). Results indicate that the peripheral force method can be applied to the calculation of transport properties for interactions involving other ablation products. R.C.T.

N80-11374# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
FLOW BEHIND CURVED SHOCK WAVES
S. Molder Sep. 1979 43 p refs
(Grant AF-AFOSR-3303-77)
(UTIAS-217; ISSN-0082-5255) Avail: NTIS HC A03/MF A01

Equations are presented for the gradients of pressure, density and velocity behind curved shock waves in a uniform upstream flow. Formulas are given for the inclination of constant property lines behind two dimensional, conical and doubly curved shocks. Graphical results are presented for lambda = 1.4 and a free stream Mach number of 3.0. An equation is derived which relates the inclination of the isobars, isopycnics and isotachs. A general relationship is derived for doubly curved shocks which connects the two shock curvatures and the streamline curvature just behind the shock wave. Curved shock theory is applied to the calculation of flow curvature and pressure gradients in the vicinity of a normal shock as well as to finding the orientation of the sonic line behind a curved oblique shock in uniform flow. Author

N80-11375*# Old Dominion Univ. Research Foundation, Norfolk, Va.
EFFECTS OF PRECURSOR HEATING ON RADIATIVE AND CHEMICALLY REACTING VISCOUS FLOW AROUND A JOVIAN ENTRY BODY Final Report, 1 Feb. 1978 - 31 Mar. 1979
S. N. Tiwari and K. Y. Szema Washington NASA Oct. 1979 183 p refs
(Grant NsG-1492)
(NASA-CR-3186) Avail: NTIS HC A09/MF A01 CSCL 20D

The influence of change in the precursor region flow properties on the entire shock layer flow phenomena around a Jovian entry body was investigated. The flow in the shock layer was assumed to be steady, axisymmetric, and viscous. Both the chemical equilibrium and the nonequilibrium composition of the shock layer gas were considered. The effects of transitional range behavior were included in the analysis of high altitude entry conditions. Realistic thermophysical and radiation models were used, and results were obtained by employing the implicit finite difference technique in the shock layer and an iterative procedure for the entire shock layer precursor zone. Results obtained for a 45 degree angle hyperboloid blunt body entering Jupiter's atmosphere at zero angle of attack indicates that preheating the gas significantly increases the static pressure and temperature ahead of the shock for entry velocities exceeding 36 km/sec. The nonequilibrium radiative heating rate to the body is found to be significantly higher than the corresponding equilibrium heating. The precursor heating generally increases the radiative and convective heating of a body. That increase is slightly higher for the nonequilibrium conditions. R.C.T.

N80-11376*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
STREAKLINE FLOW VISUALIZATION STUDY OF A HORSESHOE VORTEX IN A LARGE-SCALE, TWO-DIMENSIONAL TURBINE STATOR CASCADE
Raymond E. Gaugler and Louis M. Russell 1979 20 p refs Proposed for presentation at 25th Intern. Gas Turbine Conf. and Products Show, New Orleans, La., 9-13 Mar. 1980; sponsored by ASME
(NASA-TM-79274; E-201) Avail: NTIS HC A02/MF A01 CSCL 20D

Neutrally bouyant helium-filled bubbles were observed as they followed the streamlines in a horseshoe vortex system around the vane leading edge in a large scale, two dimensional, turbine stator cascade. Inlet Reynolds number, based on true chord, ranged between 100,000 to 300,000. Bubbles were introduced into the endwall boundary layer through a slot upstream of the vane leading edge. The paths of the bubbles were recorded photographically as streaklines on 16 mm movie film. Individual frames from the film were selected, and overlayed to show the details of the horseshoe vortex around the leading edge. The transport of the vortex across the passage near the leading edge is clearly seen when compared to the streaks formed by bubbles carried in the main stream. Limiting streamlines on the endwall surface were traced by the flow of oil drops. Author

N80-11377*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RADIATIVE AND FREE CONVECTIVE HEAT TRANSFER FROM A CONTAINERLESS SPHERE
Karen Johnson. Sep. 1979. 29 p. refs.
(NASA-TM-78249). Avail: NTIS. HC A03/MF A01. CSCL 20D.

A mathematical model is derived for heat loss due to radiation and free convection for a small copper sphere (approximately 0.3 to 0.4 cm diameter) cooled by a helium-argon gas mixture. A FORTRAN program written to simplify calculations and extend the range of applicability to experimentation is presented. Pressures used were less than 400 torr, and resulting temperatures ranged from 500 to 4600 K. Comparison of results for initial cooling by the gas mixture with experimental data showed a 5 percent error for temperature values and ± 2.7 percent error for the temperature difference caused by the cooling. Results indicate that the accuracy could be increased significantly by using better estimates for thermal conductivities. R.C.T.

N80-11378# Tel-Aviv Univ. (Israel). School of Engineering.
FURTHER OBSERVATIONS ON TRANSITION IN A PIPE Interim Report, Mar. 1978 - Mar. 1979
Y. Rubin, I. Wygnanski, and J. H. Haritonidis. Jun. 1979. 43 p. refs.
(Contract AF AFOSR-3275-77; AF Proj. 2307).
(AD-A071909; AFOSR-79-0869TR). Avail: NTIS. HC A03/MF A01. CSCL 20/4.

Fully developed Poiseuille flow in a pipe was artificially disturbed at x/D = 400 and 17-RE-4000. Puffs and slugs generated by the disturbance were identical to the structures observed when the flow in the inlet region had undergone transition (Wygnanski and Champagne 1973). Since the disturbance was sufficiently strong to cause transition even at low Reynolds numbers the appearance of either puffs or slugs depended on the Reynolds number only. Velocity measurements in the pipe were taken with rakes of hot wires using digital acquisition methods and in this way each realization could be observed in its entirety. The coherence of the large structures was studied in radial and azimuthal directions. Puffs and slugs generated by the disturbance were mapped and found to be identical to the structures observed at the inlet region of the pipe. It was established that a slug which has all the attributes of a fully developed turbulent pipe flow is generated by a coalescence of puffs. The puff, which seems to contain a small number of toroidal eddies appears to be a fundamental coherent structure in a fully developed turbulent pipe flow. Previous observations, which were based on a single-point measurement and ensemble-averaged data did not reveal the full structure of the puff in the same detail as the present techniques. Single realizations were analyzed showing instantaneous velocity profiles, vorticity perturbation contours, as well as streamlines moving with the structure. Artificially generated successions of puffs which were allowed to interact, closely resembled a slug. The evolution of a slug from puffs was thus established. GRA

N80-11379# TriTec, Inc., Columbia, Md.
DEVELOPMENT OF CRITICAL FLUIDIC COMPONENTS
Kevin C. Chen and Vincent F. Neradka. 14 Jul. 1978. 79 p. refs.
(Contract DAAG39-77-C-0173).
(AD-A071650; HDL-CR-78-173-1). Avail: NTIS. HC A05/MF A01. CSCL 13/7.

This report is an independent assessment of the performance of three fluidic rate sensors which were provided for test. All tests were run using MIL-H-5606 hydraulic fluid. The results of the testing showed that the Fluidisc had the lowest threshold and null sensitivity, and that its output is sufficient to directly drive some hydraulic components. On the other hand the Laminar Angular Rate Sensor is the most economical sensor and its low noise and power consumption makes it the sensor having the most potential for future applications. GRA

N80-11380# Dynamics Technology, Inc., Torrance, Calif.
GENERATION RATE OF TURBULENT PATCHES IN THE LAMINAR BOUNDARY LAYER OF A SUBMERSIBLE
C. P. Chen, Y. Goland, and E. Reshotko. Jun. 1979. 56 p. refs.
(Contract N00014-77-C-0005).
(AD-A071796; DT-7802-9). Avail: NTIS. HC A04/MF A01. CSCL 20/4.

Suspended particulate in the environment of underwater vehicles has been suspected to be responsible for the generation of turbulent patches in the laminar boundary layer of the vehicle. This speculation, which is supported by much indirect evidence, is examined in this report through an attempt at calculating the turbulent patch generation rate. The method presented herein is based on the premise that patches are generated by those particles entering the boundary layer that are sufficiently large to 'trigger' a turbulent event. Since the triggering mechanism is not known, the choice of a critical particle size will involve some empiricism. An important element of the method is the calculation of the number of particles of a given size and specific gravity that enter the laminar boundary layer, through computation of the particle trajectories in the inviscid flow field about the vehicle. GRA

N80-11381# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
NUMERICAL SOLUTION OF RECIRCULATING FLOW BY A SIMPLE FINITE ELEMENT RECURSION RELATION
D. W. Pepper and R. E. Cooper. 1979. 27 p. refs. Presented at the 2d Intern. Conf. on Computational Methods in Nonlinear Mech., Austin, Tex., 26-30 Mar. 1979.
(Contracts EY-76-C-09-0001).
(DP-MS-78-83; Conf-790311-4). Avail: NTIS. HC A03/MF A01.

A time-split finite element recursion relation, based on linear basis functions, is used to solve the two-dimensional equations of motion. Recirculating flow in a rectangular cavity and free convective flow in an enclosed container are analyzed. The relation has the advantages of finite element accuracy and finite difference speed and simplicity. Incorporating dissipation parameters in the functionals decreases numerical dispersion and improves phase lag. DOE

N80-11382# Knolls Atomic Power Lab., Schenectady, N. Y.
NUMERICAL SOLUTION OF TURBULENT FLOW PROBLEMS IN GENERAL GEOMETRY
E. L. Wachspress. Mar. 1979. 24 p. refs. Presented at Conf. on Appl. of Numerical Analysis, Dundee, UK, 26 Jun. 1979.
(Contract EY-76-C-12-0052).
(KAPL-4116; Conf-790620-1). Avail: NTIS. HC A02/MF A01.

Turbulent flow of fluid was computed satisfactorily with the TEACH program for a wide spectrum of problems. The TEACH geometry is restricted to rectangular grids in Cartesian or cylindrical coordinates. The TURF program uses the TEACH methodology with foursided isoparametric elements. This broadens modeling capabilities and enhances practical utilization of the TEACH method. It was discovered that a thorough understanding of TEACH numerics was essential for the desired geometry generalization. Crucial aspects of the analysis arise in study of the Navier-Stokes momentum and continuity equations without the complications associated with turbulence modeling common to TEACH and TURF. Among the devices in TEACH are direct computation of primitive variables, interlocking velocity and pressure grids, and derivation of pressure equations from integration over boxes of the continuity equation in which pressures do not appear explicitly. DOE

N80-11383# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF IMPLICIT NUMERICAL METHODS TO PROBLEMS IN TWO-PHASE FLOW
John H. Mahaffy and D. R. Liles. Apr. 1979. 15 p. refs.
(Contract W-7405-eng-36).
(NUREG-CR-0763; LA-7770-MS). Avail: NTIS. HC A03/MF A01.

A numerical method for treating two-phase flow in pipes is presented which incorporates the use of a partially implicit scheme in regions of relatively low flow velocity and a fully implicit treatment in regions of high velocity. This method takes advantage of the lower cost per iteration of the partially implicit scheme, without being limited by its conditional stability. Applications of this approach to water reactor blowdown calculations produce reductions in computer time by factors of 2-4 without a significant loss of accuracy. DOE

N80-11384# Bendix Corp., Kansas City, Mo.
COOLING ALUMINUM MOLDS USING HEAT PIPES Final Report
D. R. Hahn Dec. 1978 49 p ref Revised
(Contract EY-76-C-04-0613)
(BDX-613-2039-Rev) Avail: NTIS HC A03/MF A01

A system was developed to provide zone cooling and more efficient heat removal from an aluminum mold used to make a polyurethane foam part. Heat removal with heat pipes and forced convection was four to six times faster than cooling without heat pipes in still air. Tests are planned to determine if zone cooling will reduce shrinkage depressions in parts fabricated in this mold. DOE

N80-11385# Sandia Labs., Albuquerque, N. Mex. Computational Physics and Mechanics Div.
COUPLEFLO: A COMPUTER PROGRAM FOR COUPLED CREEPING VISCOUS FLOW AND CONDUCTIVE-CONVECTIVE HEAT TRANSFER. PART 2: USER'S MANUAL
P. F. Chavez and P. R. Dawson Nov. 1978 72 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1407) Avail: NTIS HC A04/MF A01

A user manual for a two dimensional finite element code (COUPLEFLO) for plane strain or axisymmetric analyses of thermomechanically coupled systems is presented. It is capable of analyzing the creeping flow of non-Newtonian fluids or the secondary creep of solids. The program solves equations for conductive-convective heat transfer to determine the thermal response of a system. Thermomechanical coupling between the flow field and temperature distribution can exist in terms of temperature dependent material properties, temperature dependent body forces, viscous dissipation, material convection, and changing system geometry. Either transient or steady-state problems can be analyzed in Eulerian or quasi-Lagrangian reference frames. The governing equation, finite element formation, and verification of code capabilities are presented with the instructions for use. DOE

N80-11386# California Univ., Livermore. Lawrence Livermore Lab.
TWO-DIMENSIONAL TRANSIENT DISPERSION AND ADSORPTION IN POROUS MEDIA
R. V. Homsy 23 Apr. 1979 11 p refs Presented at 5th Underground Coal Conversion Symp., Alexandria, Va., 18 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-81970; Conf-790630) Avail: NTIS HC A02/MF A01

Contaminant transport model was made of an underground aquifer following in situ coal gasification to determine the environmental impact on ground water. The aquifer was treated as a semi-infinite porous medium, bounded on top and bottom by impermeable parallel walls. Line, plane and finite-volume sources were studied. The two-dimensional convective-dispersion equation, which governs the rate of contaminant transport, was reduced to an ordinary differential equation and solved for an instantaneous source. Asymptotic series solutions valid for short and long times are given for a continuous-line source. DOE

N80-11387# Idaho National Engineering Lab., Idaho Falls.
HEAT TRANSFER CORRELATION DEVELOPMENT AND ASSESSMENT: A SUMMARY AND ASSESSMENT OF RETURN TO NUCLEATE BOILING PHENOMENA DURING BLOWDOWN TESTS CONDUCTED AT THE IDAHO NATIONAL ENGINEERING LABORATORY (INEL)
A. M. Eaton and E. L. Tolman Apr. 1979 80 p refs
(Contract EY-76-C-07-1570)
(CDAP-TR-054) Avail: NTIS HC A05/MF A01

The data are presented which were obtained in Loss-of-Coolant Experiments (LOCE) which demonstrate the presence of cladding rewetting after the critical heat flux has been exceeded as a viable cooling mechanism during the blowdown phase of a LOCE. A brief review of the mechanisms associated with the boiling crisis and rewetting is also provided. The relevance of LOCE rewetting data to nuclear reactor licensing Evaluation Model Requirements is considered, and the conclusion is made that the elimination of rewetting and return to nucleate boiling in evaluation models represents a definite conservatism. DOE

N80-11388# California Univ., Berkeley.
GAS FLOW THROUGH POROUS BARRIERS M.S. Thesis
N. S. Jacobson Oct. 1978 29 p refs
(Contract W-7405-eng-48)
(LBL-8283) Avail: NTIS HC A03/MF A01

The possibility of CO2 surface diffusion through the porous BaO that results from BaCO3 decomposition is examined. CO2 and He flow rates through a BaO barrier are compared and both are found to exhibit similar behavior. Because He is known not to undergo surface diffusion, it is concluded that CO2 goes through BaO by ordinary Knudsen flow. The decomposition of SO3 to SO2 and O2 in a porous alumina barrier is studied. The goal is to determine if this reaction will equilibrate in the barrier. A stream of SO3 is run through the barrier and the exit gas compositions are determined as a function of temperature with a mass spectrometer. These compositions are found to differ considerably from the calculated equilibrium values, indicating the reaction does not equilibrate in the barrier. DOE

N80-11389# Sandia Labs., Albuquerque, N. Mex.
TEST PLAN FOR INTERMEDIATE RANGE AIRBLAST PROPAGATION MEASUREMENTS
J. W. Reed Dec. 1978 37 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1703) Avail: NTIS HC A03/MF A01

An explosion test program is planned for firings at Cape Canaveral, Florida and Vandenberg Air Force Base, California to determine how atmospheric refraction influences explosion wave propagation. Meteorological data for correlation with airblast propagation results will be obtained from rawinsonde balloon ascensions and meteorological tower instruments. Blast pressure gages will be operated at distances of 200 m to 5 km in a cruciform array centered on the explosion area. This will allow evaluation of wind component effects in four directions from each explosion. The primary experimental goal is to correlate the airblast over-pressure distance decay rate and the sound velocity-altitude gradient in the atmospheric boundary layer. In addition, there will be exploration of (1) wind effects on height-of-burst Mach stem formation; (2) [illegible]fluences of low level winds and ground surface temperature on propagation; and (3) the attenuation caused by atmospheric turbulence. DOE

N80-11390# Sandia Labs., Albuquerque, N. Mex.
COUPLEFLO: A COMPUTER CODE FOR COUPLED CREEPING VISCOUS FLOW AND CONDUCTIVE-CONVECTIVE HEAT TRANSFER. PART 1: THEORETICAL BACKGROUND
P. R. Dawson Nov. 1978 67 p refs
(Contract EX-76-C-04-0789)
(SAND-78-1046-Pt-1) Avail: NTIS HC A04/MF A01

COUPLEFLO, a two-dimensional finite-element code for plane strain or axisymmetric analyses of thermomechanically coupled systems, is presented. It is capable of analyzing the creep flow on non-Newtonian fluids or the secondary creep of solids. COUPLEFLO solves equations for conductive-convective heat transfer to determine the thermal response of a system. Thermomechanical coupling between the flow field and temperature distribution can exist in terms of temperature-dependent materials properties, temperature-dependent body forces, viscous dissipation, material convection, and changing system geometry. Either transient or steady-state problems can be analyzed in Eulerian or quasi-Lagrangian reference frames. Governing equations, finite-element formulation, and verification of the code capabilities are presented as well as a user's manual which contains instructions for code use. DOE

N80-11391# Illinois Univ., Urbana. Dept. of Computer Science.
RUNGE-KATTA STARTERS FOR MULTISTEP METHODS
C. W. Gear Sep. 1978 36 p refs
(Contract EY-76-S-02-2383)
(COO-2383-0053; UILU-ENG-78-1733; UIUCDCS-R-78-938) Avail: NTIS HC A03/MF A01

Runge-Kutta type formulas are presented which enable a multistep method to start or restart at a high order after just one RK step. These problems with frequent discontinuities or sudden large increases in derivatives, either of which causes an automatic program to reduce order and step size suddenly. DOE

N80-11392# Energy, Inc., Idaho Falls, Idaho.
COMPARISONS OF RETRAN AND TWO-VELOCITY TWO-PHASE FLOW MODELS WITH EXPERIMENTAL DATA
Interim Report
E. D. Hughes and R. K. Fujita. Nov. 1978. 341 p. refs. Prepared for EPRI.
(EPRI Proj. 958-1)
(EPRI-NP-928) Avail: NTIS. HC A15/MF A01.

Several aspects of two-phase flow models and computer programs associated with steady-state and transient analyses of nuclear steam supply systems were investigated. The areas investigated include: comparisons of homogeneous equilibrium mixture and two-fluid model predictions with experimental data and with each other; numerical solution techniques; comparison of RETRAN predictions with experimental data; application of RETRAN to simple multi-dimensional flows; and derivation of macroscopic balance equations for two-fluid models of two-phase flows. The results of the investigations show the accuracy and ease of application of RETRAN, some of the limitations associated with homogeneous equilibrium mixture models of two-phase flow, and some of the areas in which RETRAN can be improved. DOE.

N80-11393# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
THE EFFECT OF SHORT REGIONS OF HIGH SURFACE CURVATURE ON TURBULENT BOUNDARY LAYERS
A. J. Smits, S. T. B. Young, and P. Bradshaw. Dec. 1978. 130 p. refs. Supersedes IC-Aero-TN-78-104. Submitted for publication.
(Contracts AT/2037/0101; AT/2037/0141)
(IC-Aero-78-02) Avail: NTIS. HC A07/MF A01.

Measurements 'downstream' of 20 deg and 30 deg convex and concave bends with radii of curvature 5 to 10 times the boundary layer thickness are described. Analysis shows that relaxation downstream of the concave bends is non-monotonic; this can be explained without invoking structural changes but in fact large changes in second and third order structure parameters do occur. Author (ESA)

N80-11394# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
THE RESPONSE OF A TURBULENT BOUNDARY LAYER TO LATERAL DIVERGENCE
A. J. Smits, J. A. Eaton, and P. Bradshaw. Dec. 1978. 77 p. refs. Supersedes IC-Aero-TN-78-106. Submitted for publication.
(IC-Aero-78-03) Avail: NTIS. HC A05/MF A01.

Measurements in the axial flow over a cylinder-flare body of flare semi-angle 20 deg, the radius of longitudinal curvature of the transition piece between the cylinder and the conical flare being about 10 times the boundary layer thickness, are described. Analysis shows that the effects of this curvature die out so that the changes in second and third-order structural parameters found in the boundary layer on the flare can be attributed to lateral divergence. The destablizing effect of a given lateral strain rate is nearly the same as the effect of longitudinal curvature. Author (ESA)

N80-11395# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
TURBULENT BOUNDARY LAYERS ON SURFACES OF MILD LONGITUDINAL CURVATURE
P. H. Hoffmann and P. Bradshaw. Dec. 1978. 57 p. refs. Sponsored in part by Brown Boveri and Co., Baden, West Ger. Submitted for publication.
(Contract AT/2037/0171)
(IC-Aero-78-04) Avail: NTIS. HC A04/MF A01.

Detailed measurements were made on a rig in which boundary layers that have developed on flat surfaces enter a curved section with concave and convex wall radii about 100 times the initial boundary layer thickness. The data include second, third, and fourth-order mean products of velocity fluctuations and provide a consistent picture of the effects of curvature on structure parameters. Analysis shows that in general these structure parameters increase on the concave (destablized) side and decrease on the convex side, but some interesting nonmonitonic trends occur. This nonlinearity is analogous to that found in buoyant flows. Author (ESA)

N80-11396# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE EFFECT OF PRESSURE GRADIENT AND EXTERNAL TURBULENCE ON HEAT TRANSFER TO A COLD FLAT PLATE
H. Consigny, C. K. Chan, and B. E. Richards. Feb. 1979. 58 p. refs.
(VKI-TN-128) Avail: NTIS. HC A04/MF A01.

Measurements of heat transfer to a cold surface at conditions simulating advanced aircraft gas turbine flow conditions are presented. They obtained under isothermal wall conditions in a short duration isentropic light piston tunnel using surface temperature transient techniques. The effects of external turbulence and strong favorable pressure gradient were especially studied. Results indicate that turbulence has little or no influence on the heat transfer in a turbulent boundary layer. However, turbulence level effects the heat transfer in a laminar boundary layer both with and without pressure gradient. Measurements were also compared with various viable predictive methods including simple correlations and finite difference approaches. Poor agreement was obtained between turbulent data and predictions selected for study (approximate integral, mixing length and one equation models). Author (ESA)

N80-11397# Montpellier Univ. (France). Lab. de Physique Mathematique.
ALMOST PERIODIC N-SOLITON SOLUTIONS OF THE NONLINEAR HYDRODYNAMIC KAUP EQUATION [SOLUTIONS PRESQUE PERIODIQUES ET A N-SOLITONS DE L'EQUATION HYDRODYNAMIQUE NONLINEAIRE DE KAUP]
V. B. Matveev and M. I. Yavor (Nord-West. Politech. Inst., Leningrad). 1979. 22 p. refs. In FRENCH; ENGLISH summary.
(PM/79/10) Avail: NTIS. HC A02/MF A01.

The algebraic geometrical integration of some hydrodynamic equations is discussed. The vast class of almost periodical solutions containing N-soliton solutions as a degenerate case is found exactly. The asymptotic behavior of N-soliton solutions is calculated at the explicit isomorphism between the Kaup equation and the complexified nonlinear Schroedinger equation is obtained. Author (ESA)

N80-11398# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). General and Environmental Fluid Dynamics Dept.
A METHOD FOR THE MEASUREMENT OF MIXING PROPERTIES IN A TURBULENT JET FLOW
C. Borrego and D. Olivari. Jun. 1979. 32 p. refs. Sponsored in part by Avieiro Univ., Portugal.
(VKI-TN-130) Avail: NTIS. HC A03/MF A01.

An experimental investigation of the flow development of a turbulent air jet of circular cross section exhausting into still air was carried out in order to test a method for measuring certain parameters relevant to the mixing process. The measurement method involves laser equipment in combination with the introduction of a tracer in the jet in the form of oil smoke. The flow field was examined at locations varying from two to twenty diameters downstream of the nozzle. A laser doppler velocimeter and a laser scatter system were used to measure flow velocity and tracer concentration. Main parameters recorded at each downstream station were mean axial velocity, mean concentration, fluctuating velocity and concentration, and velocity-concentration correlation. Results show that the method permits an accurate description of the nozzle fluid concentration and velocity fields for a round turbulent free jet. Measurements are in general agreement with data from other sources. Author (ESA)

N80-11399# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
A STUDY OF COHERENT STRUCTURES IN AXISYMMETRIC JETS USING AN OPTICAL TECHNIQUE
Gautam T. Kalghatgi. Jun. 1979. 38 p. refs.
(Contract MIN-DEF/AT/2040/084)
(AASU-341) Avail: NTIS. HC A03/MF A01.

Coherent structures in the first six diameters of five axisymmetric jets of different velocities and densities were studied by an optical method using the deflection of laser beams caused by density gradients in the flow. Results show that the average

interval between succesive events increases with axial distance independently of the density, velocity, or Reynolds number of the jets and that near the nozzle exit plane the interval is very similar to that found for two dimensional mixing layers. The proposition that there are random interactions between the coherent structures as they are convected downstream is used to explain many of the observations. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-11400*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
SMALL CONDUCTIVE PARTICLE SENSOR Patent Application
Israel Taback, inventor (to NASA) (Bionetics Corp., Hampton, Va.) Filed 28 Aug. 1979 14 p. Sponsored by NASA
(NASA-Case-LAR-12552-1; US-Patent-Appl-SN-070366) Avail: NTIS HC A02/MF A01 CSCL 14B

This invention is an electrostatic conductive fiber detector for use in detecting, counting and measuring the length of fibers down to 0.1 mm and below with increased accuracy and reliability over prior art devices. It can be used for detection of fibers suspending in a flowing gas, in a nonflowing gas, or in a vacuum and its accumulated counts over a period of time is essentially unaffected by velocity of the fibers being detected. NASA

N80-11401# Navy Experimental Diving Unit, Panama City, Fla.
EVALUATION OF COMMERCIALLY AVAILABLE SUBMERSIBLE PRESSURE GAUGES
James R. Middleton Mar. 1979 25 p.
(AD-A071481; NEDU-3-79) Avail: NTIS HC A03/MF A01 CSCL 14/2

Fourteen commercially available submersible pressure gauges were evaluated by the Navy Experimental Diving Unit to determine accuracy and watertight integrity. The gauges tested represent a realistic survey of the market. While not every gauge currently sold in the U.S.A. was tested, the results of this test are felt to represent the general state-of-the-art in gauge design and manufacturing technique. As a result of unmanned testing, and due to the overall quality of design and construction, it is recommended that submersible pressure gauges be designated as open purchase items on the list of equipment Approved for Navy Use (ANU). It should be emphasized to all divers that submersible pressure gauges should be given the same care as that given other life supporting equipment. GRA

N80-11402# Idaho National Engineering Lab., Idaho Falls.
CURRENT CAPABILITIES OF TRANSIENT TWO-PHASE FLOW INSTRUMENTS
C. W. Solbrig and N. N. Kondic (NRC) 1979 10 p. refs
Presented at 25th ISA Intern. Instrumentation Symp., Anaheim, Calif., 7 May 1979
(Contract EY-76-C-07-1570)
(CONF-790505-9) Avail: NTIS HC A02/MF A01

The measurement of two phase flow phenomena in transient conditions representative of a loss of Coolant Accident is presented. The geometries in which these measurements must be made, the instruments which are currently used, new instruments being developed, the facilities used to calibrate these instruments, and the improvements which must be made to measurement capabilities are described. DOE

N80-11403# Sandia Labs., Albuquerque, N. Mex.
QUARTZ RESONATOR PRESSURE GAUGE: DESIGN AND FABRICATION TECHNOLOGY
Errol P. EerNisse Jan. 1979 41 p. refs
(Contract EY-76-C-04-0789)
(SAND-78-2264) Avail: NTIS HC A03/MF A01

The base technology used in designing and fabricating the Sandia Quartz Resonator Pressure Gauges for geothermal well logging is presented. The following topics are treated: resonator design (crystallographic orientation), transducer design (static stress analysis and transfer function), electrode technology, and assembly details. In addition, preliminary results of pressure measurements at 275 C are presented. DOE

N80-11404# Los Alamos Scientific Lab., N. Mex.
PREPROCESSING OF PHERMEX FLASH RADIOGRAPHIC IMAGES WITH HAAR AND ADAPTIVE FILTERING
J. E. Brolley Nov. 1978 9 p. refs
(Contract W-7405-eng-36)
(LA-7561-MS) Avail: NTIS HC A02/MF A01

Haar filtering was found to be useful in developing line or edge structures along with Widrow LMS adaptive filtering. Shadow effects were obtained with the adaptive filtering technique. Application of Haar and adaptive filtering to a PHERMEX image is demonstrated. J.M.S.

N80-11405# Tennessee Univ., Knoxville.
SOLUTION MICROCALORIMETER FOR MEASURING HEATS OF SOLUTION OF RADIOACTIVE ELEMENTS AND COMPOUNDS Ph.D. Thesis
D. L. Raschella Dec. 1978 95 p. refs
(Contract W-7405-eng-26)
(ORO-4447-081) Avail: NTIS HC A05/MF A01

An isoperibol solution microcalorimeter capable of measuring the heats of solution of submilligram quantities of radioactive elements and compounds was constructed. The calorimeter was tested by measuring heats of solution of TRIS and magnesium metals. The heat of solution of curium-248 metal was then measured in 1 N HCl at 298 K. The experiments yielded a heat of solution of -606.4 + or - 1.8 kJ/mol. A single measurement in 6 N HCl gave a heat of solution of -602.3 kJ/mol. From these results the heat of formation of Cm/sub (aq) is calculated to be -607.2 + or - 2.5 kJ/mol. K.L.

N80-11406# Oak Ridge National Lab., Tenn.
USE OF INDEXED SENSITIVITY FACTORS IN THE ANALYSIS OF NICKEL AND IRON BASED ALLOYS: STUDY OF THE DECALIBRATION OF SHEATHED CHROMEL/ALUMEL THERMOCOUPLES
W. H. Christie 1978 7 p. refs Presented at the US-Japan Seminar on SIMS, Osaka, 23 Oct. 1978
(Contract W-7405-eng-26)
(CONF-781076-1) Avail: NTIS HC A02/MF A01

Sheathed Chromel versus Alumel thermocouples decalibrate when exposed to temperatures in excess of 1100 C. Thermocouples sheathed in Inconel-600 and type 304 stainless steel were studied. Quantified SIMS data showed that the observed decalibrations were due to significant alterations that took place in the Chromel and Alumel thermoelements. The amount of alteration was different for each thermocouple and was influenced by the particular sheath material used in the thermocouple construction. Relative sensitivity factors, indexed by a matrix ion species ratio, were used to quantify SIMS data for three nickel-based alloys, Chromel, Alumel, and Inconel-600, and an ion-based alloy, type 304 stainless steel. Oxygen pressure ~ 2 x 10 to the 6th power torr in the sputtering region gave enhanced sensitivity and superior quantitative results as compared to data obtained at instrumental residual pressure. DOE

N80-11407# Sandia Labs., Albuquerque, N. Mex.
DESIGN OF A HIGH PRECISION DILATOMETER USING LASER INTERFEROMETRY
W. D. Drotning Dec. 1978 29 p. refs
(Contract EX-76-C-04-0789)
(SAND-78-1796) Avail: NTIS HC A03/MF A01

The dilatometer described is being designed for operation from ambient to 800 C using samples which require minimal preparation. Several interferometric techniques useful to dilatometry were reviewed from the literature. As a result of this review and establishment of performance criteria, a technical design is proposed. The optical design incorporates a two-frequency He-Ne laser with ac detection in a modified Michelson interferometer. A vertical sample/furnace configuration appears

to offer a number of design advantages. Operational considerations and dilatometer development costs are also presented. DOE

N80-11408# California Univ., Livermore. Lawrence Livermore Lab.
SPECIAL SESSION ON STREAK CAMERA DYNAMIC RANGE MEASUREMENT DEFINITION
S. W. Thomas Aug. 1978 5 p Presented at 13th Congr. on High-Speed Photography and Photonics, Tokyo, 20 Aug. 1978
(Contract W-7405-eng-48)
(UCRL-81704; Conf-780804-12) Avail: NTIS HC A02/MF A01

An agreed-upon dynamic range measurement definition for use by commercial manufacturers of electro-optic streak cameras is presented and is as follows: the ratio of the peak amplitudes of an upper and lower usable signal. The limits of usable signals are to be the points at which the pulse width at half maximum is broadened or changed by 20% as referenced to the width of a pulse near the middle of the dynamic range. DOE

N80-11409# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
CONCEPT AND FEASIBILITY STUDY ON A VERY WIDE ANGLE PHOTOGRAPHIC CAMERA FOR SPACELAB Final Report
Rainer Krieger, Stephan Koschade, Ursula Kriete, Peter Vits, and Peter Henneberg Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 173 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QV-595-V22)
(BMFT-FB-W-77-17) Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 36,10

With a ground version of a wide angle camera, proper images of large scale galactic structures were obtained within the range 2000 to 20,000 A. For SPACELAB applications, a similar instrument can be developed with increased spectral range to 900 A. For this purpose basic analysis was necessary regarding the optics and the detector system. Furthermore, investigations on filters, reflecting surfaces, and spectral shifters as well as on mechanical problems and compatibility with SPACELAB were necessary to establish and select feasible concepts. The increased spectral range turned out to be feasible only by mirror optics. A promising alternative to photographic film is the microchannel plate-detector still under development. Problems remain regarding sensitivity between 900 and 1100 A, but results do not rule out a possible solution. Author (ESA)

N80-11410# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
A SPECTROMETER FOR DETECTING CHARGED PARTICLES OF MEDIUM ENERGIES: EXPERIMENT KED-ISEE Final Report
Erhard Keppler, Berend Wilken, Gerhard Umlauft, Harald Fischer, Donald Williams, Klaus Richter, Erich Bubla, and Klaus Fischer Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 233 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRK-0274; DFVLR-BPT-01-DO-274)
(BMFT-FB-W-78-19) Avail: NTIS HC A11/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 48,75

A charged particle spectrometer is presented for measuring electron energies in the energy range 20 keV to 1000 keV and proton and ion energies in the energy range 25 keV to 3000 keV with high time and directional resolution. The spectrometer is on the ISEE-B satellite. The sensor system is described along with data formation and operational modes. Author (ESA)

N80-11411# Central Electricity Generating Board, Berkeley (England). Nuclear Lab.
AN ABRADING SYSTEM FOR THE MEASUREMENT OF OXIDE THICKNESS
R. Wilson, inventor Jan. 1979 4 p
(TDB-319) Avail: NTIS HC A02/MF A01

A device for the measurement of oxide or other coating thicknesses is described. The device was designed primarily for the remote measurement of oxide thickness inside a shutdown nuclear reactor. The oxide is removed over a region 1 mm in diameter by an air jet containing a controlled amount of abrasive powder. A high precision linear displacement transducer is used to measure the oxide thickness at this position. The technique is suitable for thickness in the range 10 to 2500 micron. An accuracy of + or - 5 micron is attainable. Author (ESA)

N80-11412# Central Electricity Generating Board, Heysham (England). Power Station.
IMPROVEMENTS IN APPARATUS FOR pH MEASUREMENT OF WATER
I. R. Claxton, inventor Feb. 1979 6 p
(TDB-320) Avail: NTIS HC A02/MF A01

An electronic device which automatically corrects the measurement of the pH of ammonia dosed power station boiler feedwater for changes in alkalinity brought about by the temperature dependence of the association of ammonia is described. It is noted that the pH depends on the temperature of the sample and that in a typical boiler plant where pH may be measured at the extraction pump, deaerator, and economizer inlet, widely varying values of pH may be indicated. The pH at the temperature of the sample is corrected to a standard temperature of 25 C. Author (ESA)

N80-11413# Fulmer Research Inst. Ltd., Stoke Poges (England).
SPACE DOSIMETRY. VOLUME 2: TECHNICAL APPENDICES Final Report
A. Holmes-Siedle 1978 67 p refs
(Contract ESA-2440/74-HP)
(FRI-R646/3-Vol-2; ESA-CR(P)-1176-Vol-2) Avail: NTIS HC A04/MF A01

Technical data supplementing volume one, including calibration data, TLD relativities, and a conference paper, are presented. The problem includes the dosimetry of radiation sources as well as the design and procurement of special dosimetric MOS devices (the TOT series). The devices were first used for laboratory dosimetry and, later, incorporated in two ESTEC flight units which are now monitoring internal radiation doses in geostationary orbit. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-11414*# National Aeronautics and Space Administration, Washington, D. C.
SHUTTLE ATMOSPHERIC LIDAR RESEARCH PROGRAM Final Report
1979 231 p
(NASA-SP-433) Avail: NTIS HC A11/MF A01 CSCL 20E

The Shuttle atmospheric lidar program is discussed in relation to an understanding of the processes governing the Earth's atmosphere and in the capacity to evaluate the atmospheric susceptibility to manmade and natural perturbations. Applications of the lidar which are discussed are the determination of the global flow of water vapor and pollutants in the troposphere, improvement of chemical and transport models of the stratosphere and mesosphere, evaluation of radiative models of the atmosphere, investigation of chemistry and transport of thermospheric atomic species, and investigation of magnetospheric aspects of sun/weather relationships. The features of the lidar measurements discussed are the high spatial resolution, control of the source wavelength and intensity, and high measurement specificity. For individual titles, see N80-11415 through N80-11428.

N80-11415*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVES Final Report
In its Shuttle Atmospheric Lidar Res. Program 1979 p 7-9 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The features of the shuttle lidar experiments considered are the very good veritcal resolution when used in the pulsed mode, fine horizontal resolution with the capability to probe the troposphere between the clouds, and very high sensitivity in aerosol and thin cloud detection. The ability to select atmospheric constituents by narrow spectral features, such as in resonant scatter or in absorption, the ability to measure temperatures of these constituents by the spectral shape of the features, given

adequate spectral purity of the laser, the ability to obtain global scale data rapidly, and the ability to point the lidar system in any direction, subject to the restriction of slew rate and scattered sunlight, are discussed. A.W.H.

N80-11416*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 1: GLOBAL FLOW OF WATER VAPOR AND POLLUTANTS
In its Shuttle Atmospheric Lidar Res. Program 1979 p 10-23 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The global flow of water vapor and pollutants in the troposphere and lower stratosphere is traced. Atmospheric transport processes are discussed. The use of trace constituents in the atmosphere for establishing the effects of the general circulation on the transport of pollutants is described. The use of Shuttle lidar for studies of aerosol transport is discussed and research topics are considered. A.W.H.

N80-11417*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 2: STRATOSPHERIC AND MESOSPHERIC CHEMISTRY AND TRANSPORT
In its Shuttle Atmospheric Lidar Res. Program 1979 p 24-33 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The tests and improvements for models of stratospheric and mesospheric chemistry and transport are discussed. The structure of the stratosphere and mesosphere, in terms of chemistry and dynamics, is reviewed. Current satellite experiments for long duration observation, focused on the measurement of aerosols and gases involved in the ozone-nitrogen chemistry of the stratosphere, are discussed. Future satellite experiments and Shuttle lidar contributions are proposed. A.W.H.

N80-11418*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 3: RADIATIVE MODELS
In its Shuttle Atmospheric Lidar Res. Program 1979 p 34-45 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The testing and improvements for atmospheric models of radiation, radiatively active substances, and radiative effects are discussed. The tests and improvements encompass two research areas. The first is that of providing input data for models which describe radiative energy exchange in the earth's atmosphere and the effects on this exchange of altered atmospheric composition. The second is that of providing input data for studies which test the basic assumptions used to analyze data from passive remote sensors. The alterations in the radiative energy exchange which alter the climate are examined. A.W.H.

N80-11419*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 4: METEOROLOGICAL DATA
In its Shuttle Atmospheric Lidar Res. Program 1979 p 46-57 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The augmentation of the meteorological data base using lidar and other sensors is discussed. The development of satellite temperature sounders and their application in understanding and forecasting weather is reviewed. The lidar technique combined with the method of differential to permit the direct measurement of either the surface pressure or cloud pressure heights is examined. The resolution and accuracies required of various parameters for improvements in weather forecasting and the performance that is expected from various lidar experiments are summarized. A.W.H.

N80-11420*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 5: UPPER ATMOSPHERIC WAVES
In its Shuttle Atmospheric Lidar Res. Program 1979 p 58-66 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The excitation, propagation, and dissipation of wave motions in the upper atmosphere is studied. The global morphology of mesospheric and thermospheric waves, the wave motions of all scales from 80 to 100 km altitude, the global morphology of lower mesospheric waves using the OH radical, and the wave motions of all scales in the stratosphere and their sources are discussed. A.W.H.

N80-11421*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 6: THERMOSPHERIC CHEMISTRY AND TRANSPORT
In its Shuttle Atmospheric Lidar Res. Program 1979 p 67-73 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The chemistry and transport of thermospheric atomic species is studied. The use of lidar, based on the simultaneous use of active and passive techniques for simultaneous global coverage of several atomic species together with the measurement of the dynamical parameters responsible for their transport, is discussed towards understanding the equilibrium of atomic species in the lower thermosphere. The role of eddy diffusion in the energy transport through the mesopause level is examined. The morophology of Na abundances and the origin of Na and K in the upper atmosphere is discussed. A.W.H.

N80-11422*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC OBJECTIVE 7: MAGNETOSPHERIC SUN AND WEATHER RELATIONSHIPS
In its Shuttle Atmospheric Lidar Res. Program 1979 p 74-79 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

Possible mechanisms by which short term solar variability may effect the atmosphere are reviewed. If accompanied by an extensive supporting program of ground, rocket, and balloon measurements, lidar experiments may play a significant role in determining the (1) magnetospheric convection patterns of Mg(+); (2) chemical coupling from thermosphere to mesosphere; and (3) ozone heating effects on circulation. Requirements for sortie missions to study mesospheric aspects related to sun-weather interactions are tabulated. A.R.H.

N80-11423*# National Aeronautics and Space Administration, Washington, D. C.
CANDIDATE SHUTTLE LIDAR EXPERIMENTS
In its Shuttle Atmospheric Lidar Res. Program 1979 p 80-88 (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The degree of feasibility, probable measurements accuracy, and particular contributions to the relevant scientific objective were evaluated for twenty-six representative experiments designed to study the possible relationships between solar activity and meteorological variables. A hardware envelope was established for the shuttle lidar that will permit high confidence operation for those measurements whose operation is well defined and will also permit potential growth for generations of lidar measurements whose techniques are still under development. A.R.H.

N80-11424*# National Aeronautics and Space Administration, Washington, D. C.
SHUTTLE ATMOSPHERIC LIDAR PROGRAM EVOLUTION
In its Shuttle Atmospheric Lidar Res. Program 1979 p 89-94 (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

Because many of the specific lidar measurements of interest in the late 1980's cannot yet be foreseen, the hardware approach for a shuttle lidar system should be both modular and evolutionary. With a modular approach, the distinct components (laser transmitter, telescopic return-signal collector, detector, and data processing electronics) are readily interchangeable and can be replaced as appropriate to changing measurement needs and technology developments. With an evolutionary approach, the initial hardware complement for the simplest early experiments will be augmented by subsequent hardware additions to expand the lidar capability for more complex and more technologically demanding experiments. A.R.H.

N80-11425*# National Aeronautics and Space Administration, Washington, D. C.
APPENDIX A: DESCRIPTIONS OF SHUTTLE BORNE LIDAR EXPERIMENTS
In its Shuttle Atmospheric Lidar Res. Program 1979 p 95-162 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The purpose of twenty-six shuttle lidar experiments is summarized and the techniques used in each are described. Limiting factors and unique features are included with numerical values of the hardware parameters needed and the measurement accuracy obtainable with these parameters, as well as supporting evidence for the viability of the experiment. The feasibility rating and its rationale is given for each experiment. Critical areas which must be addressed before the experiment is considered ready for shuttle use, the relation of the experiment to science objectives, the uniqueness of the shuttle lidar measurement, and the particular correlative or supportive measurements needed are discussed. A.R.H.

N80-11426*# National Aeronautics and Space Administration, Washington, D. C.
APPENDIX B: LASERS OF POTENTIAL USE FOR SHUTTLE LIDAR
In its Shuttle Atmospheric Lidar Res. Program 1979 p 163-174 ref (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

The remote identification of particulates as well as atomic and molecular species from the Space Shuttle platform requires pulsed lasers for active (lidar) detection or CW lasers for passive (heterodyne) detection. The detection of atomic species usually limits the laser source to the visible or ultraviolet spectral regions, while molecular species have many of their spectral signatures (vibrational-rotational transitions) in the mid-infrared (2 to 20 micron m). The detection of particulates (clouds and aerosols) is best done using lasers which operate in the visible to the near infrared regions where elastic scattering cross sections are large. Topics discussed include Nd:Yag lasers, carbon dioxide lasers, dye lasers, rare gas-halide lasers, semiconductor lasers, and nonlinear conversion of laser frequency. A.R.H.

N80-11427*# National Aeronautics and Space Administration, Washington, D. C.
APPENDIX C: TRANSMITTING AND RECEIVING OPTICS CONSIDERATIONS
In its Shuttle Atmospheric Lidar Res. Program 1979 p 175-192 ref (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

To define detailed requirements for a Shuttle lidar receiving optics system, the application or set of applications for which it is to be used must be considered. Fortunately, however, most atmospheric applications require a similar class of receiving optics which is well within the state of the art and, therefore, general requirements can be bounded. Limits for the various hardware parameters can be used to produce an initial design concept. Convolved with these hardware considerations, such as instantaneous field of view, area, baffling, wavelength range, size, weight, thermal and mechanical stability, surface quality, etc., are economic trade-offs, such as cost and Shuttle power versus weight, and considerations for eye safety. In addition, considerations for pointing and the accommodation of different detection systems must be examined. A.R.H.

N80-11428*# National Aeronautics and Space Administration, Washington, D. C.
APPENDIX D: SPECTRAL DISCRIMINATORS AND DETECTORS FOR SHUTTLE LIDAR
In its Shuttle Atmospheric Lidar Res. Program 1979 p 193-218 refs (For primary document see N80-11414 02-36)
Avail: NTIS HC A11/MF A01 CSCL 20E

Possible methods and hardware available for spectrally isolating (or analyzing) and for detecting the received lidar signal are surveyed. The most promising candidates are summarized, and other candidates and more detailed characteristics of all candidates are described. A.R.H.

N80-11429# Raytheon Co., Wayland, Mass. Advanced Development Lab.
TEN POINT SIX MICRON LASER TARGET DESIGNATOR Final Report, 15 Nov. 1975 - 31 Mar. 1978
R. I. Rudko Nov. 1978 41 p refs
(Contract DAAB07-76-C-08; DA Proj. 1L1-62703-DH-93)
(AD-A071912; BR79-4167; DELNV-TR-76-0830-F) Avail: NTIS HC A03/MF A01 CSCL 20/5

A research version of a 10.6 micron laser designator was constructed. The device weighs 26 lbs without power supply. Output energy of 100 mJ in 30 nsec pulses at 2 - 20 pulses per second with a 1.5 percent overall efficiency were achieved. GRA

N80-11430# Naval Air Development Center, Warminster, Pa. Sensors and Avionics Technology Directorate.
LASER IRRADIANCE IN THE SEA: THEORY AND EXPERIMENT
Lloyd C. Bobb, Gerald Ferguson, and Michael Rankin Sep. 1978 45 p refs
(ZR00001)
(AD-A072601; NADC-78253-30) Avail: NTIS HC A03/MF A01 CSCL 20/5

Laser beam spreading due to the air/sea interface, volume scattering, and initial beam divergence is modeled. Beam steering is considered for the case in which the laser beam diameter is small compared to the length of the refracting wave. An expression is developed for the irradiance as a function of depth into the ocean. A comparison of the terms in this expression shows that the surface spreading effect is small compared with bulk scattering. Wavetank experiments were performed. The height, slope, and frequency content of wind-driven capillary waves are reported for wind speeds in the range 2.2 m/sec to 7.6 m/sec. GRA

N80-11431# Laser Diode Labs., Inc., Metuchen, N. J.
INJECTION LASER DIODES FOR FIBER OPTIC COMMUNICATIONS Quarterly Report, 1 Jul. - 30 Sep. 1977
Rob Adair 15 Jun. 1978 41 p
(Contract DAAB07-76-C-0040)
(AD-A072504; QR-5) Avail: NTIS HC A03/MF A01 CSCL 09/1

The design and fabrication of injection laser diodes for use in fiber optic communications is discussed with regard to material synthesis, chip configuration, and device assembly in manufacturing environment. The opto-electronic source is based on the GaAs-GaAlAs double heterojunction structure and consists of a parallel array of lasers formed by the application of triple stripe geometry to the surface of the epitaxial wafer. The monolithic triad of discrete lasing elements is mounted in a high frequency package which incorporates a high quality optical window. GRA

N80-11432# Sperry Univac, St. Paul, Minn. Applied Physics Lab.
LASER DEFLECTION ANALYSIS Final Report, Jul. 1977 - Aug. 1978
F. G. Hewitt, G. L. Nelson, and J. A. Krawezak May 1979 74 p
(Contract F33615-77-C-1163; AF Proj. 2001)
(AD-A072560; AFAL-TR-78-193) Avail: NTIS HC A04/MF A01 CSCL 17/5

The objective of this program was to provide mathematical analysis for the use of laser beam deflection in various potential applications. The analysis considered the effects of beam divergence, pointing accuracy, and signal-to-background noise. The analysis was supported by experimental measurements of relevant factors involved in the laser deflection process. GRA

N80-11433# Bala, Cupertino, Calif.
DESIGN OF AN EXPERIMENTAL PROGRAM FOR EVALUATION OF LBR SYSTEMS
N. Balasubramanian 6 Apr. 1979 48 p
(Contract DAAK70-78-C-0125)
(AD-A071526; ETL-0182) Avail: NTIS HC A03/MF A01 CSCL 14/3

Design and characteristics of an experimental laser beam recording system (LBR) is presented. The experimental LBR has a scanning subsystem serving both as an image sampler and an image recorder. Specific recommendations for an experimental program are outlined to evaluate EBR parameters and trade offs for selected applications. GRA

N80-11434# Illinois Univ. at Urbana-Champaign. Electro-Physics Lab.
OPTICALLY PUMPED FAR INFRARED LASERS Final Report, 1 Aug. 1978 - 31 Jan. 1979
T. A. DeTemple and Paul D. Coleman Mar. 1979 45 p refs
(Grant DAAG29-78-G-0128)
(AD-A071836; UILU-ENG-79-2547; ARO-15641.2-P) Avail: NTIS HC A03/MF A01 CSCL 20/5

Experiments and theory regarding the emission processes in optically pumped far infrared laser sources are reported. Super-radiance from CH3F at 496 micrometers in the homogeneously broadened regime has been identified for the first time. Stimulated Raman emission on pure rotational transitions in D2O at 50 and 66 micrometers has also been identified for the first time. Generally good agreement between experiments and a Maxwell-Bloch approach was obtained for the super-radiance study, and good qualitative agreement between experiments and a Maxwell-density matrix approach using three waves interacting in a four-level system was noted for the Raman study; both implying that the processes are now reasonably well characterized and understood. GRA

N80-11435# Stanford Univ., Calif. Edward L. Ginzton Lab.
LASER PHYSICS AND LASER TECHNIQUES Annual Report, 1 Jan. - 31 Dec. 1978
A. E. Siegman and R. L. Byer Apr. 1979 177 p refs
(Contract F49620-77-C-0092; AF Proj. 2301)
(AD-A072009; GL-2953; AFOSR-79-0891TR) Avail: NTIS HC A09/MF A01 CSCL 20/5

A program of basic research in laser physics and laser techniques has been carried out in order to help meet Air Force mid-term and long-term requirements as outlined in the AFSC Research Planning Guide. A Fast Hankel transform algorithm has been developed and applied to nonlinear interactions and to diffraction biased resonators studies. Picosecond spectroscopy via the induced grating approach has been successfully used to study fast relaxation processes. Optical parametric amplifiers and oscillators have been shown to be useful sources of coherent radiation over the 0.4 to 4 micrometers spectral range. Finally, stimulated Raman scattering and four-wave mixing has been used for efficient frequency conversion in the infrared. Detailed studies have shown excellent theoretical and experimental agreement in the Raman interactions. GRA

N80-11436# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ADVANCED LASER CONCEPTS. ADDENDUM: PRODUCTION OF EXCITED STATES Final Report, 6 Apr. 1976 - 6 Dec. 1977
D. J. Miller Kirtland AFB, N. Mex. AFWL May 1979 101 p refs
(Contract F29601-76-C-0065; ARPA Order 2861; AF Proj. 1256)
(AD-A071393; AFWL-TR-77-234) Avail: NTIS HC A06/MF A01 CSCL 20/5

Experiments are described which use an exclusively chemical system to generate the necessary reagents and energy transfer partners required for production of the a 1 Delta and b 1 Sigma - electronic excited states of the NF molecule. The purpose is to assess the potential for the development of an electronic transition chemical laser operating on the NF transitions at wavelengths of 874 nm or 529 nm. In the first of these experiments, staged combustion in a laser cavity is employed by adding a second mixer downstream from the cavity mixer in a conventional, supersonic, diffusion mixing HF chemical laser. This allows for the mixing of F-atoms, H2, and N2F4 the starting reagents required in the NF system. The second set of experiments utilized a tristream HF chemical laser nozzle which allows the three reagents F-atoms, H2, and N2F4 to be mixed in the throat of a supersonic slit nozzle. In both sets of experiments, thermal dissociation of N2F4 was the limitation for the final concentration of NF excited states. In both experiments the quenching of NF excited states is slow. GRA

N80-11437# Army Missile Research and Development Command, Redstone Arsenal, Ala. High Energy Laser and Research Lab.
COMPILATION OF DATA RELEVANT TO NUCLEAR PUMPED LASERS, VOLUME 1
E. W. McDaniel, M. R. Flannery, E. W. Thomas, H. W. Ellis, and K. J. McCann Dec. 1978 567 p refs
(AD-A071360; DRDMI-H-78-1-Vol-4) Avail: NTIS HC A24/MF A01 CSCL 20/5

This volume and volumes III and V contain a compilation of data relevant to nuclear pumped lasers and are part of a series on atomic and molecular data for gas laser research and development. Volume IV contains data on many different species on atoms, molecules and ions, a large fraction of them are already of direct interest in laser media, many more may become important in the future. GRA

N80-11438# Naval Research Lab., Washington, D. C.
RIGOROUS DERIVATION OF GENERAL DISPERSION RELATIONSHIP FOR GYROTRON
Saeyoung Ahn and Joon Y. Choe Jul. 1979 42 p refs
(AD-A072005) Avail: NTIS HC A03/MF A01 CSCL 20/5

General dispersion equation for the electron cyclotron maser instability in co-axial cylindrical geometry is derived in the framework of linearized Vlasov-Maxwell system. While previous works have been carried out for the azimuthally symmetric mode and for the specified equilibrium electron distribution function in simple waveguide structure, we have extended our analysis to include the azimuthally mode with general equilibrium distribution function. After selfconsistent analysis of the equilibrium distribution function, we have solved the orbit integral for the perturbed distribution function closely following the previous analysis by Chu, and have derived a new rigorous formal dispersion equation for arbitrary equilibrium distribution function. The resulting equation is useful to find the dispersion relation of electron beam with spread in energy and momenta. A closed form of dispersion relation for the cold beam electrons is given as an example. GRA

N80-11439# Colorado Univ. at Boulder.
OPTICAL AND DISCHARGE STUDIES OF NOVEL ELECTRONIC TRANSITION LASER SPECIES Interim Report
Stephen R. Leone Jun. 1979 6 p
(Contract N00014-77-C-0115)
(AD-A071853) Avail: NTIS HC A02/MF A01 CSCL 20/5

Summary of Conclusions from the Discharge S2 Laser Work. Electric discharges in pure S2 vapor do produce brilliant blue glow discharges characteristic of the S2(B-X) emission. Sulfur vapor is extremely corrosive and is effectively incompatible with all metal materials at 600 C. GRA

N80-11440# Air Force Weapons Lab., Kirtland AFB, N. Mex.
MODELING STUDIES OF THE MIXING AND CHEMISTRY OF THE NF RADICALS ON THE TRISTREAM NOZZLE Final Report
R. A. Armstrong and N. L. Rapagnani Jun. 1979 27 p refs
(AF Proj. 3326)
(AD-A071315; AFWL-TR-78-263163) Avail: NTIS HC A03/MF A01 CSCL 20/5

Among the many systems being investigated in the effort to develop a thermochemically pumped electronic transition laser, the NF radical has shown high promise. This report describes the modeling completed to evaluate an NF mixing concept. Calculations were made with varying expansion ratios, both in the nozzle and cavity, to determine the optimum throat pressures, throat temperatures and element lengths. The mixing concept as described is very promising and could last if the optical path length is long enough. GRA

N80-11441# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
LASER INDUCED LUMINESCENCE OF MILITARY TARGETS
L. M. Narducci and H. C. Meyer 13 Mar. 1979 22 p refs
(AD-A073200; DRDMI-T-79-31) Avail: NTIS HC A02/MF A01 CSCL 17/8

The objective of this report is to identify specific problems where laser induced luminescence may prove useful to current Army remote sensing system and terminal homing devices. Luminescence, as any other molecular emission process (e.g., Raman emission), is typical of a particular molecular system

and should provide the basis for discrimination of a given target if sufficient spectral resolution is employed. GRA

N80-11442# California Univ., Livermore. Lawrence Livermore Lab.
ADVANCED LASERS FOR FUSION APPLICATIONS
W. F. Krupke. Nov. 1978. 25 p. refs. Presented at Intern. Conf. on Laser, San Diego, Calif., 20 Aug. 1978
(Contract W-7405-eng-48)
(UCRL-81940; Conf-7808106-1) Avail: NTIS HC A02/MF A01

Producing commercial fusion power using inertial confinement techniques is discussed. Repetitively pulsed laser systems for fusion reactor drive are examined. The projected efficiencies of a number of driver laser systems based on selected new laser media and excitation techniques are reported and physical and technological scaling issues are identified. The systems are compared with driver systems based on more developed laser media. A.W.H.

N80-11443 This accession not used.

N80-11444# Oak Ridge Y-12 Plant, Tenn.
LASERS IN MACHINE TOOL CONTROLS
Robert R. Burleson. Apr. 1979. 9 p. Presented at Westinghouse Machine Tool Forum, Pittsburgh, 4 Jun. 1979
(Contract W-7405-eng-26)
(Y/DA-8211; Conf-790639-1) Avail: NTIS HC A02/MF A01

A system for measuring the parameters which determine the dynamic the dynamic characteristics of a numerically controlled machine is presented. A system to correct for those errors is discussed. Both systems utilize a laser interferometer as the measurement transducer. The machining of optical quality surfaces required for the laser fusion program is considered. DOE

N80-11445# Brookhaven National Lab., Upton, N. Y.
FREE ELECTRON LASER AND ITS POSSIBLE DEVELOPMENTS
C. Pellegrini. 1979. 7 p. refs. Presented at the 1979 Particle Accelerator Conf., San Francisco, 12-14 Mar. 1979
(Contract EY-76-C-02-0016)
(BNL-25857; Conf-790307-70) Avail: NTIS HC A02/MF A01

The basic characteristics of a free electron laser in a storage ring are reviewed. Some of the more recent works and ideas and how performance of the laser might be improved are described. DOE

N80-11446# Los Alamos Scientific Lab., N. Mex.
LASL PROGRAM IN NUCLEAR PUMPED LIQUID LASERS
Charles R. Mansfield, Paul F. Bird, and John F. Davis. 1978. 9 p. refs. Presented at First Intern. Symp. on Fission Induced Plasmas and Nucl.-Pumped Lasers, Orsay, France, 23 May 1978
(Contract W-7405-eng-36)
(LA-UR-78-3016; Conf-780537-4) Avail: NTIS HC A02/MF A01

The suitability of the lanthanide rare earths for nuclear pumped lasers is considered. Four of the rare earth ions with high pumped laser output are Eu(+3), Tb(+3), Nd(+3), and Pm(+3). A sixty fold increase in pumping efficiency was observed with the addition of a mixture of uranyl and neodymium ions at 1.06 microns. DOE

N80-11447# Los Alamos Scientific Lab., N. Mex.
NUCLEAR PUMPED ELECTRONIC TRANSITION LASER STUDIES
W. M. Hughes and H. H. Helmick. 1978. 15 p. refs. Presented at First Intern. Symp. on Fission Induced Plasmas and Nucl.-pumped Lasers, Orsay, France, 23 May 1978
(Contract W-7405-eng-36)
(LA-UR-78-3015; Conf-780537-3) Avail: NTIS HC A02/MF A01

The subjects discussed are: (1) an outline of experiments and theoretical considerations for determining the production efficiency of excited states using high energy fission fragments; (2) calculation of the excited state production rate required for efficient laser operation; and (3) indication of the desirability to match the fission power pulse shape to the laser system considered. KrF is used as an example. DOE

N80-11448# Bendix Corp., Kansas City, Mo.
LASER-BEAM PROFILER AND DETECTOR-SURFACE SCANNER
L. R. Foulk. Nov. 1978. 32 p. refs. Revised
(Contract EY-76-C-04-0613)
(BDX-613-1841-Rev) Avail: NTIS HC A03/MF A01

A portable, relatively inexpensive laser-beam profiler and detector-surface scanner was developed to map the intensity profile of laser beams and the cross-sectional response of optical detectors within a wavelength range of 633 nm to 10.6 micrometers. Equipment diagrams, circuit schematics, and examples of detector-response maps and laser-beam profiles are provided. Intensity distribution is an important parameter in obtaining good laser welds, and a knowledge of detector response is essential in determining the accuracy of laser power measurements. DOE

N80-11449# California Univ., Livermore. Lawrence Livermore Lab.
FLUORESCENCE DIAGNOSTICS IN TWO-STEP LASER EXCITATION OF HIGH J ATOMS
Richard C. Stern, Bruce W. Shore, and Neil C. Lang. 5 Apr. 1979. 15 p. Presented at ACS Conf., Honolulu, Haw., 1 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81746; Conf-790415-14) Avail: NTIS HC A02/MF A01

Using a pair of lasers near 6000 A, the J = 6 ground state is excited to a J = 6 intermediate level and then to a J = 5 upper state. Nonresonant fluorescences from both excited states are separately detected. Results of a set of model calculations are tabulated. Level 3 average populations are always very small, since the system decays rapidly into inaccessible metastable states. This means that chmistry experiments are difficult. The differences between parallel and perpendicular polarization are modest. The fluorescence dips converge to a value near 50%. The level 3 populations do not approach a common value. This means that the most reliable experimental measurement does not determine the level populations. The most striking changes appear in the last two, most exact, models. The difference between the models is that one includes, for the first time, the linear frequency chirp produced by the fanlike spread of the focussed laser beams. This seemingly innocuous change halves the population left in the ground state. DOE

N80-11450# Sandia Labs., Albuquerque, N. Mex.
RADIAL ELECTRON BEAM LASER EXCITATION: THE REBLE REPORT
J. J. Ramirez and Kenneth R. Prestwich. Oct. 1978. 101 p. refs
(Contract EY-76-C-04-0789)
(SAND-78-2005) Avail: NTIS HC A06/MF A01

The results of an investigation of techniques to generate high power radially converging electron beams and the application of these beams to gas lasers was discussed. The design and and performance of the REBLE accelerator that was developed is presented. The measured total and spatially resolved energy deposition of this radial electron beam in various gases is compared with Monte Carlo calculations. In most cases, these codes give an accurate description of the beam transport and energy deposition. With the electron beam pumping xenon gas, the amplitude of xenon excimer radiation (1720 A) a radially uniform to within the experimental uncertainty. The efficiency of converting

deposited electron beam energy to xenon excimer radiation is 20%. DOE

N80-11451# California Univ., Livermore. Lawrence Livermore Lab.
MEASUREMENT OF FLUORESCENCE DECAY TIMES OF LASER DYES. 1. BEHAVIOR OF RIGID AND MOBILE MEDIA WITH RESPECT TO SIGNAL EXTRACTION AND SIGNAL PROPAGATION, 2
P. P. Hammond 3 Jul. 1978 16 p Presented at the Office of Naval Res. Review Meeting, Cambridge, Mass., 8 Sep. 1978
(Contract W-7405-eng-48)
(UCRL-81568; Conf-780965-1) Avail: NTIS HC A02/MF A01

Experimental techniques are described that distinguish or avoid these errors and that permit the measurement of accurate decay times and quantum yields. As a signal propagates and amplifies in a dye laser medium, the average excited state lifetime expectancy, or turnover time of the dye molecules becomes shorter and shorter. As it becomes comparable to the orientational relaxation time, propagation occurs through a mobile, viscous and rigid medium in turn. Extraction of stored energy and signal propagation are examined for the two extreme situations-mobil and rigid media. DOE

N80-11452# California Univ., Livermore. Lawrence Livermore Lab.
EFFECTS OF LONGITUDINAL ELECTRIC SELF-FIELD ON THE ACCEPTABLE ENERGY SPREAD IN A FREE ELECTRON LASER
V. K. Neil 27 Nov. 1978 9 p
(Contracts W-7405-eng-48; ONR-79-F-0004)
(UCID-17985) Avail: NTIS HC A02/MF A01

The final stable phase area in a free electron laser is calculated taking into account the longitudinal electric self-field of the electrons. The calculation is static; longitudinal plasma oscillations are not treated. K.L.

N80-11453# California Univ., Livermore. Lawrence Livermore Lab.
JANUS NEODYMIUM GLASS LASER OPERATIONS MANUAL
J. M. Auerbach, N. C. Holmes, and R. J. Trainor 29 Sep. 1978 60 p
(Contract W-7405-eng-48)
(UCID-17952) Avail: NTIS HC A04/MF A01

A manual, prepared to guide personnel in operating and maintaining the Janus glass laser system, is presented. System components are described in detail. Step by step procedures are presented for firing the laser and for performing routine maintenance and calibration procedures. DOE

N80-11454# California Univ., Livermore. Lawrence Livermore Lab.
LASER INDUCED FLUORESCENCE EXTENSION TO NON-FLUORESCENT MATERIALS
G. R. Haugen, J. H. Richardson, J. E. Clarkson, and G. M. Hieftje Oct. 1978 5 p refs Presented at the Workshop on Detection and Identification of Explosives, Reston, Va., 30-31 Oct. 1978
(Contract W-7405-eng-48)
(UCRL-81837; Conf-7810115-4) Avail: NTIS HC A02/MF A01

It was demonstrated that laser induced fluorescence (LIF) was a highly sensitive (sub-parts-per-trillion) technique for general application to trace chemical analysis. To gain enhanced selectivity, LIF was combined with separation capability of chromatographic techniques. A new approach being studied is to use fluorescent quenching as the means of quantitative detection of nonfluorescent materials. This technique along with chromatographic separation greatly increases the number of compounds which can be analyzed by LIF. GRA

N80-11455# California Univ., Livermore. Lawrence Livermore Lab.
LASER INDUCED DAMAGE IN FLUORIDE GLASSES: A STATUS REPORT
S. E. Stokowski, D. Milam, and M. J. Weber 27 Sep. 1978 15 p refs Presented at the Symp. on Opt. Mater. for High Power Lasers (Damage Symp.), Boulder, Colo., 12-14 Sep. 1978
(Contract W-7405-eng-48)
(UCRL-81358; Conf-780977-3) Avail: NTIS HC A02/MF A01

Bulk and surface damage thresholds of fluorophosphate and fluoroberyllate glasses have been measured for 1-ns 1064-nm laser pulses. For crystal-free samples, threshold values for fluoride glasses are comparable to those measured in optical quality fused silica and borosilicate glasses. However, for many samples investigated, the presence of solid inclusions results in low damage thresholds. Some examples of solid inclusions are shown and discussed. Surface damage thresholds in FK-51 fluorophosphate glass are uniformly high and exhibit an approximated square root dependence on pulse duration in the range of 0.1 to 1.0 ns. DOE

N80-11456# Bendix Corp., Kansas City, Mo. Kansas City Div.
CHARACTERISTICS OF LASER CUTTING KEVLAR LAMINATES
R. A. VanCleave Jan. 1979 28 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2075-Rev) Avail: NTIS HC A03/MF A01

Comparison of laser-cut and machined samples of Kevlar/epoxy laminates has shown that material properties are not degraded by use of the laser. With present techniques and a 1000-W CO2 laser, the maximum laminate thickness that can be cut satisfactorily is 9.5 mm. Power requirements, edge taper, and kerf width for various thicknesses were established. Partial depth cuts, controlled and repeatable to within 0.5 mm, were produced in Kevlar/epoxy laminates by scanning the material under a pulsed beam. Fumes produced during cutting operations require proper exhaust methods to avoid long exposures to benzene, a potential carcinogen. DOE

N80-11457# Central Electricity Generating Board, Heysham (England). Scientific Services Dept.
LASER SCANNING CAMERA
M. Jagger, inventor May 1979 4 p
(TDB-324) Avail: NTIS HC A02/MF A01

A camera suitable for inreactor surveys is described. The camera embodies a scanning principle similar to that in the scanning electron microscope. It consists of a laser beam scanning head and a photosensitive detector. The scanning head consists of two plane mirrors which vibrate about orthogonal axes arranged in such a way that a laser beam, when directed into the arrangement, will be doubly reflected and emerge to scan in a raster over the surface of the object to be examined. The amount of light reflected at any time is controlled by the properties of the surface at each point in the scan and thus the signal from the detector can be used to modulate the brightness of a TV raster scanned in synchronism with the laser beam to produce a TV picture of the object. Author (ESA)

N80-11458# New Mexico Univ., Albuquerque. Technology Application Center.
GALLIUM ARSENIDE LASERS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jul. 1979
Samuel C. Mauk Aug. 1979 47 p Sponsored in part by NTIS
(NTIS/PS-79/0821/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

This bibliography cites 226 articles from the international literature concerning the research, testing, and applications of gallium arsenide and aluminum gallium arsenide double heterojunction lasers. GRA

N80-11459# National Technical Information Service, Springfield, Va.
LASER CUTTING AND MACHINING: METALS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1979
Guy E. Habercom, Jr. Sep. 1979 282 p Supersedes NTIS/PS-78/0852; NTIS/PS-77/0722
(NTIS/PS-79/0890/8; NTIS/PS-78/0852; NTIS/PS-77/0722)
Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Techniques for metalworking, machining, and cutting by use of controlled laser beams are investigated in these reports gathered in worldwide literature surveys. Precision finishing of metal surfaces is described. The thermal response of various metals is evaluated. This bibliography contains 275 abstracts, 23 of which are new entries to the previous edition. DOE

N80-11460# New Mexico Univ., Albuquerque. Technology Application Center.
DYE LASERS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jul. 1979
Samuel C. Mauk. Aug. 1979. 55 p. Sponsored in part by NTIS.
(NTIS/PS-79/0823/9) Avail: NTIS. HC $28.00/MF $28.00. CSCL 20E.

This bibliography cites 279 articles concerning continuous wave, pulsed, ultrashort pulsed, ultraviolet, and infrared dye lasers. Articles covering laser outputs, materials, and applications are stressed. GRA

N80-11461# New Mexico Univ., Albuquerque. Technology Application Center.
NEODYMIUM YAG LASERS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jul. 1979
Sep. 1979. 43 p. Sponsored in part by NTIS.
(NTIS/PS-79/0862/7) Avail: NTIS. HC $28.00/MF $28.00. CSCL 20E.

This bibliography cites 190 reports on neodymium YAG lasers. Included are articles covering laser materials and outputs; laser mode locking; crystal, fiber, and nonlinear optics; optical pumping communications; energy conversion efficiency; and laser applications. Articles covering pulsed, continuous wave, solid state, Q switched, and infrared lasers, are included. GRA

N80-11462# New Mexico Univ., Albuquerque. Technology Application Center.
ULTRAVIOLET LASERS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1975 - Jul. 1979
Samuel C. Mauk. Sep. 1979. 46 p. Sponsored in part by NTIS.
(NTIS/PS-79/0861/9) Avail: NTIS. HC $28.00/MF $28.00. CSCL 20E.

This bibliography cites 217 reports from the international literature on ultraviolet lasers. Included are articles covering laser outputs, far ultraviolet radiation, electron pumping, otpical pumping, and laser materials. Articles concerning gas lasers, pulsed lasers, dye lasers, CO2 lasers, xenon fluoride lasers, and transversely excited atmospheric (TEA) lasers are included. GRA

N80-11463# New Mexico Univ., Albuquerque. Technology Application Center.
HYDROGEN FLOURIDE AND DEUTERIUM FLUORIDE LASERS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979
Samual C. Mauk. Sep. 1979. 51 p. Sponsored in part by NTIS.
(NTIS/PS-79/0860/1) Avail: NTIS. HC $28.00/MF $28.00. CSCL 20E.

This bibliography cites 230 reports from the international literature on hydrogen fluoride and deuterium fluoride lasers. Included are articles covering flows, laser outputs, molecular relaxation, molecular rotation, energy conversion efficiency, reaction kinetics and laser materials. Articles are included on both continuous wave and pulsed lasers. GRA

N80-11464# National Technical Information Service, Springfield, Va.
LASER CUTTING AND MACHINING: NONMETALS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1979
Guy E. Habercom, Jr. Sep. 1979. 136 p. Supersedes NTIS/PS-78/0853, NTIS/PS-77/0723.
(NTIS/PS-79/0891/6; NTIS/PS-78/0853; NTIS/PS-77/0723) Avail: NTIS. HC $28.00/MF $28.00. CSCL 13H.

Techniques for electrothermal cutting and machining of glass, fabrics, wood, plastics, and other nonmetal products by use of controlled laser beams are described in these reports gathered in world-wide literature surveys. Thermal analyses of materials exposed to laser beams are investigated. This updated bibliography contains 130 abstracts, 15 of which are new entries to the previous edition. GRA

N80-11485# National Technical Information Service, Springfield, Va.
DYE LASERS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Aug. 1979
Diane M. Cavagnaro. Sep. 1979. 275 p. Supersedes NTIS/PS-78/0872, NTIS/PS-77/0724, NTIS/PS-76/0614, NTIS/PS-75/539 and NTIS/PS-74/120.
(NTIS/PS-79/0894/0; NTIS/PS-78/0872; NTIS/PS-77/0724; NTIS/PS-76/0614; NTIS/PS-75/539; NTIS/PS-74/120) Avail: NTIS. HC $28.00/MF $28.00. CSCL 20E.

The citations present studies on dye laser theory, design, components, optical systems, and frequency range. Abstracts on lasing dyes, pumping, tuning, excitation, molecular structure, and modulation are included. Studies on dye laser use in spectroscopy are covered. This updated bibliography contains 268 abstracts, 67 which are new entries to the previous edition. GRA

N80-11486# National Technical Information Service, Springfield, Va.
NEODYMIUM YAG LASERS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Brian Carrigan. Sep. 1979. 172 p. Supersedes NTIS/PS-78/0808.
(NTIS/PS-79/0883/3; NTIS/PS-78/0808) Avail: NTIS. HC $28.00/MF $28.00. CSCL 20E.

Federally-funded research reports on lasing of neodymium doped yttrium aluminum garnet are cited. Studies on design, fabrication, quantum efficiency, light pulses, stabilization, and testing are covered. Optical pumping, mode locking, frequency conversion, and modulation of these lasers are discussed. Laser applications such as optical communications range finding, and tracking are included. Safety hazards and radiation damage related to neodymium YAG lasers are also covered. This updated bibliography contains 166 abstracts, 17 of which are new entries to the previous edition. GRA

N80-11487# National Technical Information Service, Springfield, Va.
GAS DYNAMIC LASERS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Brian Carrigan. Aug. 1979. 256 p. Supersedes NTIS/PS-78/0829, NTIS/PS-77/0726, NTIS/PS-75/573 and NTIS/PS-75/018.
(NTIS/PS-79/0839/5; NTIS/PS-78/0829; NTIS/PS-77/0726; NTIS/PS-75/573; NTIS/PS-75/018) Avail: NTIS. HC $28.00/MF $28.00. CSCL 20E.

The citations cover research on kinetic and energy transfer processes, design, optics, nozzles, and performance of gas and chemical lasers relying on gas dynamic effects for lasing enhancement. Diffusion and flow studies specifically applicable to such lasers are also included. (This updated bibliography contains 247 abstracts, 11 of which are new entries to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and proce- s; and mechanical equipment.

N80-11488*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INDUCTION HEATING GUN Patent Application
John D. Buckley, Robert J. Swaim, and Robert L. Fox, inventors (to NASA). Filed 24 Aug. 1979. 14 p.
(NASA-Case-LAR-12540-1; US-Patent-Appl-SN-069429) Avail: NTIS. HC A02/MF A01. CSCL 13I.

A device was developed for inductively heating and fusing thermoplastics. The device includes an alternating current passing

through a tank circuit and an inductor member of the tank circuit being wrapped around a curved pole piece of a ferromagnetic material. The magnetic flux arising within the inductor coil member flows to the ends of the pole piece and into a screen placed between the materials to be joined. The flux induces a current in the screen, and heat is generated to melt the thermoplastics together. Because only 30-150 watts of power are passed through the tank circuit, a wire which will remain cool under operational wattage may be selected, making air or fluid cooling unnecessary. NASA

N80-11469*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ONE STEP DUAL PURPOSE JOINING TECHNIQUE
John D. Buckley, Robert J. Swaim, and Robert L. Fox, inventors (to NASA) 30 Aug. 1979 9 p
(NASA-Case-LAR-12595-1; US-Patent-Appl-SN-070774) Avail: NTIS HC A02/MF A01 CSCL 13I

A fastener to be used between two organic matrix composite objects for induction heating and joining purposes was developed. The fastener is comprised of a wire screen made of a high resistance, low reluctance material such as carbon steel. Selected wires of copper or similar conductive material, are integrated within the screen; these wires are insulated in a sheath 20 of enamel or similar oxidation-resistant, high temperature sustaining material. When placed between two sheets of thermoplastic, the screen may be used for induction heating and fusing of the thermoplastic. Upon application of inductive heating technique, the wires become hot and cause the thermoplastic to melt and fuse together around the screen. After cooling, the wires are capable of carrying electric current along the now-joined thermoplastics. The novel feature of the invention is the inclusion of conductive elements in an inductive heating fastener. NASA

N80-11470*# Beech Aircraft Corp., Boulder, Colo.
PRSA HYDROGEN TANK THERMAL ACOUSTIC OSCILLATION STUDY Final Report
D. H. Riemer Sep. 1979 76 p refs
(Contract NAS2-10229)
(NASA-CR-152319; BAC-ER-14887) Avail: NTIS HC A05/MF A01 CSCL 13G

The power reactant storage assembly (PRSA) hydrogen tank test data were reviewed. Two hundred and nineteen data points illustrating the effect of flow rate, temperature ratio and configuration were identified. The test data were reduced to produce the thermal acoustic oscillation parameters. Frequency and amplitude were determined for model correlation. A comparison of PRSA hydrogen tank test data with the analytical models indicated satisfactory agreement for the supply and poor agreement for the full line. R.C.T.

N80-11471# Florida Univ., Gainesville. Rotordynamics Lab.
INVESTIGATION OF LOAD-INDUCED NON-SYCHRONOUS WHIRL INSTABILITIES IN ROTATING MACHINERY Final Report, 15 Sep. 1977 - 31 Mar. 1979
John M. Vance, George N. Sandor, Kenneth E. Ard, and Frank J. Laudadio Mar. 1979 126 p refs
(Grant DAAG29-77-G-0217)
(AD-A071716; ARO-1915041.2-E) Avail: NTIS HC A07/MF A01 CSCL 20/11

Seven tasks are described which were designed to reach the objectives. At the time of termination of the grant, these tasks were in various stages of completion, as described in this report. Tasks 1 and 2: Experimental Verification of 'Torquewhirl'; Task 3: Measurement of the Alford Force; Task 4: Comparison of Test Data with Theory; Task 5: Inclusion of a More General Shaft Flexibility in the 'Torquewhirl' Theory; Task 6: Derivation of the Linearized Stiffness Damping, and Cross-Coupling for Use in a Computer Stability Analysis; and Task 7: Load-Dependent Stability Predictions for a Machine of Realistic Complexity. GRA

N80-11472# IIT Research Inst., Chicago, Ill. Laser Center.
DEVELOPMENT OF LASER WELDING TECHNIQUES FOR JOINING ARMOR
F. D. Seaman 31 Mar. 1979 24 p
(Contract DAAK30-78-C-0118)
(AD-A072537; IITRI-B6157-Q2) Avail: NTIS HC A02/MF A01 CSCL 13/8

The multikilowatt laser as an industrial tool in the production line has now been accepted for three years. Recently, the laboratory feasibility of heavy-penetration laser welding was demonstrated in low strength steel. This program describes the establishment of laser welding process parameters that will produce a sound, cost-effective joint with ballistic potential of 1 1/2 in. armor plate. Sufficient production, test, and operational data will be prepared to permit a detailed analysis of the achievement of this objective and repeatability of the process. GRA

N80-11473# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF LASER WELDING TECHNIQUES FOR JOINING ARMOR Quarterly Report, 1 Oct. - 31 Dec. 1978
F. D. Seaman 31 Dec. 1978 26 p
(Contract DAAK30-78-C-0118)
(AD-A072536; IITRI-B6157-Q1) Avail: NTIS HC A03/MF A01 CSCL 13/8

The laboratory feasibility of heavy penetration laser welding was recently demonstrated in low strength steel. The objective of this program is the establishment of laser welding process parameters that will produce a sound, cost-effective joint with ballistic potential in 1-1/2 in. armor plate. Sufficient production, test, and operational data will be prepared to permit a detailed analysis of the achievement of this objective and repeatability of the process. Ballistic testing is not within the scope of this initial work. The program material is MIL-A-12560C(MR) (Mn-Mo) 1-1/2 in. armor plate. The program welding electrode is MIL-E-19822. A 20 deg V-joint will serve as the initial configuration for laser filler wire welding. Work will be accomplished with a 10.6 micron beam from a 15 kW CO2 laser. GRA

N80-11474# Brunswick Corp., Deland, Fla. Technetics Div.
DEVELOPMENT OF IMPROVED ABRADABLE COMPRESSOR GAS PATH SEAL Final Report, 20 Sep. 1976 - 19 May 1978
W. P. Jarvi and A. R. Erickson Jul. 1978 140 p
(Contract F33615-76-C-5302; AF Proj. 7312)
(AD-A072171; ER-382; AFML-TR-78-101) Avail: NTIS HC A07/MF A01 CSCL 21/5

A number of fiber metal systems were evaluated by rig testing in comparison with the base line material, FM-521 - a 19% dense, Haynes 188, 8 micron fiber metal - which is the standard production material used for the highest temperature compressor blade tip seals in the P and WA F-100 engine. A range of densities and strengths of alternative materials were evaluated including Haynes 188, FeCrAlY, NiCrAlY, and FeNiCrAlY employing fiber diameters in the range of 8 - 23 microns with fiber aspect ratios in the range of 45 - 80. Rig tests employed were high speed rub testing, cyclic static oxidation, cyclic dynamic oxidation, and hot particulate erosion. These data were supplemented with measurements of mechanical, thermal, and chemical properties. The best material tested was a 20.5% dense FeNiCrAlY fiber metal employing 17 micron fibers. This had at least equivalent abradability and improved oxidation and erosion resistance in comparison with the base line material. GRA

N80-11475# Naval Ordnance Station, Louisville, Ky. Manufacturing Technology Dept.
EXPLOSIVE FORMING OF BUTT WELDED PIPE REDUCERS Final Report
Michael W. Johnson Apr. 1979 60 p
(AD-A072430; NOSL-MT-052) Avail: NTIS HC A04/MF A01 CSCL 13/11

This program was conducted to develop a method of explosively forming butt-welded pipe reducers. Forming trials were conducted in both carbon steel and 70-30 copper-nickel material. A chart showing the various sizes of reducers that can be formed via this process, and listing the explosive charge size required, is included. Results of burst tests performed on explosively-formed reducers are reported. GRA

N80-11476# Bendix Corp., Kansas City, Mo.
HOBBING RATCHET WHEELS FOR MINIATURE MECHANISMS
R. B. Wetherill and L. K. Gillespie Dec. 1978 24 p refs

Revised
(Contract EY-76-C-04-0613)
(BDX-613-1927-Rev) Avail: NTIS HC A02/MF A01

A study of hobbing as a production technique is presented. This indicated that for many configurations it is a more economical approach than traditional methods. A technique for determining ratchet shapes applicable to hobbing is defined. DOE

N80-11477# Oak Ridge Y-12 Plant, Tenn.
ELECTRON-BEAM BRAZE WELDING OF BERYLLIUM
M. A. Perkins 19 Sep. 1978 28 p refs
(Contract W-7405-eng-26)
(Y-2138) Avail: NTIS HC A03/MF A01

Electron beam braze welds were made in beryllium by using less than the recommended amount of aluminum filler metal. The welds exhibited a tendency to form microcracks prior to the termination of solidification; however, these microcracks were healed by the backfilling action of the aluminum/beryllium eutectic present in the fusion zone. Adverse effects attributable to the prior microcracking condition were not found. DOE

N80-11478# Sandia Labs., Albuquerque, N. Mex. Process Metallurgy Div.
EFFECT OF SURFACE CONTAMINATION OF SOLID PHASE WELDING: AN OVERVIEW
J. L. Jellison 1978 26 p refs Presented at Symp. on Surface Contamination, Hamilton, Ontario, 2 Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0223C; Conf-7806124-1) Avail: NTIS HC A03/MF A01

Surface contaminants which hinder solid phase welding by not allowing metallic surfaces to be brought sufficiently close together so that short range interatomic attractive forces operate are investigated. The effect of surface contamination on solid phase welding due to surface metallic atoms forming bonds with contaminant atoms and thus reducing attractive forces is discussed. The detrimental effect of organic contaminants on deformation welding is examined along with the effect of inorganic films on diffusion welding. DOE

N80-11479# Bari Univ. (Italy). Ist. di Macchine.
OFF-DESIGN PERFORMANCE PREDICTION OF RADIAL INFLOW TURBINES, VOLUME 2
Francesco Casalini and Andrea Dadone 1978 25 p refs In ITALIAN; ENGLISH summary Presented at 33d Natl. Assoc. Termotec. Ital. (ATI) Congr., Ancona, Italy, 5-8 Sep. 1978
(Contract CNR-77-01088.07)
Avail: NTIS HC A02/MF A01

Two theoretical methods apt to estimate the off-design performances of small-size radial inflow turbines are outlined. A modification of one of the two methods is suggested which allows for evaluating nozzle and rotor velocity coefficients as well as disk friction losses. Theoretical results are compared with experimental ones reported in the literature; the modified method gives theoretical predictions which are more reliable and in good agreement with experimental ones. Author (ESA)

N80-11480# Uppsala Univ. (Sweden). Inst. of Technology.
METALLIC WEAR PARTICLES: A SHORT REVIEW
Jose Rendon Feb. 1978 19 p refs
(UPTEC-78-11-R) Avail: NTIS HC A02/MF A01

A classification of various metal surface wear particles according to shape as well as type of wear formation is presented. The different wear mechanisms involved, such as rubbing wear, cutting wear, surface fatigue wear, and corrosion wear, are discussed and related to the physical characteristics of the wear particles they produce. The discussion is supported by micrographs taken with a scanning electron microscope. Finally, methods for recovering wear particles for quantitative analysis of machine parts wear are briefly described and the analysis of wear particles as a way of understanding wear is considered. Author (ESA)

N80-11481# Uppsala Univ. (Sweden). Inst. of Technology.
STUDIES OF ABRASIVE WEAR IN A MODIFIED IMPACT TESTING MACHINE
Ulf Bryggman, Sture Hogmark, and Olof Vingsbo Sep. 1976 32 p refs
(UPTEC-78-79-R) Avail: NTIS HC A03/MF A01

Single tip abrasive wear was simulated in a conventional impact test machine modified by attaching a cemented carbide tip radially to the hammer. The swinging hammer produced a groove in the horizontal surface of low carbon steel of specimens, supported by a specially designed holder. Microstructure studies, using optical microscopy, scanning electron microscopy, and transmission electron microscopy, reveal the formation of successive layers of different structures, which are related to measured variations in microhardness under the groove bottom surface. Also, repeated grooving in the same track was performed in order to simulate normal abrasion. The energy consumed during grooving is given by the loss of potential energy of the pendulum and was read with the aid of the standard equipment of the impact tester. It proved possible to obtain a significant differentiation between the steels to consumed grooving energy. Author (ESA)

N80-11482# Bari Univ. (Italy). Ist. di Macchine.
A COMPARISON OF FIVE METHODS FOR CALCULATING THE EXHAUST FLOW FROM INTERNAL COMBUSTION ENGINES [CONFRONTO TRA CINQUE METODI DI CALCOLO DEI CONDOTTI DI SCARICO DEI MOTORI ALTERNATIVI]
Andrea Dadone and Francesco Varrese Apr. 1978 35 p refs In ITALIAN; ENGLISH summary
(Contract CNR-76-00771.07)
Avail: NTIS HC A03/MF A01

A Euler equations method, a conservation equations method, Ferrai-Toti's method, the Goyal-Scharpf-Borman Method, and the Issa-Spalding method were compared in terms of their application to the integration of the differential equations pertaining to the one dimensional unsteady flow in internal combustion engine exhaust systems. Theoretical results were compared with experimental ones, reported in the literature, obtained with a one cylinder engine exhaust system. The comparison involved varying the mesh number. The Euler equations method gives the best results, but Ferrari-Toti's method and the conservation equations method are also satisfactory. On the contrary, the Goyal-Scharpf-Borman method requires too much computation time and the Issa-Spalding method results are unsatisfactory. Author (ESA)

N80-11483# Bari Univ. (Italy). Ist. di Macchine.
EXHAUST FLOW SIMULATION FO A ONE CYLINDER ENGINE WITH A DIVERGENT EXHAUST PIPE
Andrea Dadone Mar. 1978 20 p refs In ITALIAN; ENGLISH summary
(Contract CNR-77-01088.07)
Avail: NTIS HC A02/MF A01

A single cylinder engine model is considered together with its exhaust system consisting of a straight pipe followed by a divergent one. A particular set of equations describing the flow at the interior of the exhaust system is outlined and a form of artificial viscosity is suggested which allows the integration of flow equations overcoming the occurrence of numerical oscillations. Theoretical results obtained by means of an electronic computer program fairly agree with experimental ones reported in the literature. Author (ESA)

N80-11484# Bari Univ. (Italy). Ist. di Costruzioni di Macchine.
STRUCTURAL ANALYSIS OF A 15,000 TONS 'O' PRESS
Bruno Atzori, Franco Fresa, and Oronzo Giordano (Italsider) 1978 21 p refs
Avail: NTIS HC A02/MF A01

The stresses related to a 15,000 ton 'O' press under working conditions were analyzed using a modified version of the computer program STRUDL 2. Results were compared with experimental values obtained by strain gage measurements. Several mathematical models were considered in order to determine the effects of load distribution and the idealization of external constraints. The accuracy of the results given by the different models was examined in terms of the structural analysis performed, taking into account its associated difficulties. The good agreement between numerical and experimental results confirms the effectiveness of STRUDL 2 in studying complex mechanical structures. Author (ESA)

N80-11485# Bari Univ. (Italy). Ist. di Macchine.
ON THE OFF-DESIGN PERFORMANCE OF SMALL RADIAL TURBINES
Francesco Casalini and Andrea Dadone May 1978 39 p refs
In ITALIAN; ENGLISH summary
(Contract CNR-77-01088.07)
Avail: NTIS HC A03/MF A01

Two theoretical methods apt to estimate the off-design performances of small size radial flow turbines are outlined. A modification of one of the two methods is suggested which makes it possible to evaluate nozzle and rotor velocity coefficients as well as disk friction losses. Theoretical results were obtained for the two methods. A comparison was also carried out with experimental results reported in the literature, pertaining to four different radial turbines. The second modified method gives theoretical predictions which are more reliable and in good agreement with experimental results. Author (ESA)

N80-11486# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.
ONE DIMENSIONAL DESIGN OF CENTRIFUGAL COMPRESSORS TAKING INTO ACCOUNT FLOW SEPARATION IN THE IMPELLER
P. Frigne (Navorsingsstagiair Van Het I. W. O. N. L.) and R. vandenBraembussche Jun. 1979 107 p refs
(VKI-TN-129) Avail: NTIS HC A06/MF A01

A one dimensional computation method for the design of a centrifugal compressor which takes into account various real flow effects, such as flow separation in the impeller, jet-wake mixing in the vaneless space, transonic vaned diffuser performance, and diffuser outlet dump diffusion, is discussed. Several numerical examples are worked out in detail to show the influence of different important geometrical and aerodynamical parameters on the compressor performances. This approach is the one used for the VKI computer program COMRAD. The equations used in the program are elucidated. Author (ESA)

N80-11487# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
RANKING TIRES USING A TRANSIENT SPEED-TIME CYCLE
Richard N. Burgeson Mar. 1979 19 p refs
(PB-297756/9; SDSB-79/14) Avail: NTIS HC A02/MF A01 CSCL 13F

The ability to rank passenger car tires according to their respective rolling resistance facilitates emission and fuel economy testing and can serve as a consumer buying aid. However, at the present time a single, universally accepted tire rolling resistance measurement method is not available. Current practices measure rolling resistance while the tire operated at steady state conditions which are a typical of actual tire use. Emission Control Technology Division is concerned that tires ranked according to typical steady state practices perform differently when operated according to current emissions and fuel economy (transient) tests or in real life. This study was conducted to determine the difference in tire rolling resistance rankings from steady state and transient testing. GRA

N80-11488# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
COMPUTER SIMULATION OF TIRE SLIP ON A CLAYTON TWIN ROLL DYNAMOMETER
John Yurko Feb. 1979 15 p refs
(PB-297764/3; SDSB-79-10) Avail: NTIS HC A02/MF A01 CSCL 13F

The occurrence of tire slip on a twin roll dynamometer, due to the difference in the velocities of the front and rear rolls of the dynamometer is examined. The slip is modeled by a method previously described and the results are presented. A computation of the total energy effect due to the tire slip is discussed. A.W.H.

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques, and quality control.

N80-11489# Army Tropic Test Center APO, Miami 34004.
MATERIEL TESTING IN THE TROPICS
Apr. 1979 274 p refs
(AD-A072434; USATTC-790401) Avail: NTIS HC A12/MF A01 CSCL 14/2

Practically every materiel development effort and subsequent procurement of materiel for Army use must undergo developmental testing to ensure that specified performance criteria are met in a variety of climatic categories. It is thus, highly desirable to have ready access to a document that is an update of available information in terms of appropriate environmental descriptions, and their known and perceived effects on man and materiel as an aid in planning and executing effective environmental tests. The objective of Materiel Testing in the Tropics is to meet such needs by periodically updating information pertinent to testing materiel in the humid tropics. The report is a compendium of the US Army's experiences and available literature in testing materiel in the humid tropics, and special investigations conducted by USATTC to better understand the effects of the environment on the performance of man and materiel. Topics include the need for tropic testing, an environmental description of the Panama Canal Zone, degrading environmental factors, tropic degradation of selected materials and materiel, materiel reliability and maintainability, and effects of the jungle on man and materiel. This document should provide valuable information for those who design, evaluate or use equipment in the humid tropics. GRA

N80-11490# California Univ., Davis. Dept. of Mathematics.
BATHTUB AND RELATED FAILURE RATE CHARACTERIZATIONS Interim Report
Ronald E. Glaser Sep. 1978 31 p refs
(Grant AF-AFOSR-3180-77; AF Proj. 2304)
(AD-A072626; TR-8; AFOSR-78-1440TR) Avail: NTIS HC A03/MF A01

Sufficient conditions are obtained which provide that a lifetime density has a bathtub shaped failure rate. Analogous conditions handle increasing, decreasing, and upside-down bathtub shaped failure rates. Application of these results to exponential families of densities is particularly straight forward and effective. Examples are furnished which introduce new bathtub models and illustrate the use of the general results for existing models. Examples involving mixtures are considered. Maximum likelihood estimation for one of the bathtub models is described. GRA

N80-11491# Missouri Univ. - Columbia. Dept. of Statistics.
A BAYESIAN NONPARAMETRIC APPROACH TO RELIABILITY
Richard L. Dykstra and Purushottam Laud 10 Jul. 1979 43 p refs
(Contract N00014-78-C-0655)
(AD-A072431; TR-84) Avail: NTIS HC A03/MF A01 CSCL 12/1

It is suggested that problems in a reliability context may be handled by a Bayesian non-parametric approach. A stochastic process is defined whose sample paths may be assumed to be either increasing hazard rates or decreasing hazard rates by properly choosing the parameter functions of the process. The posterior distribution of the hazard rates are derived for both exact and censored data. Bayes estimates of hazard rates, c.d.f.'s, densities, and means, are found under squared error type loss functions. Some simulation is done and estimates graphed to better understand the estimators. Finally, estimates of the c.d.f. from some data in a paper by Kaplan and Meier are constructed. GRA

N80-11492# Polytechnic Inst. of New York, Brooklyn. Dept. of Mathematics.
RENEWAL MODEL OF RELIABILITY FOR SERIES SYSTEMS - REVISITED
Leon H. Herbach, J. Arthur Greenwood (Oceanweather, Inc., White Plains, N. Y.), and Saul B. Blumenthal (Kentucky Univ., Lexington)

29 Jun. 1979 88 p refs
(Contract N00014-77-C-0601; NR Proj. 042-377)
(AD-A072401; POLY/MA-79-3) Avail: NTIS
HC A05/MF A01 CSCL 12/1

The fact that failures follow the exponential distribution is almost universally accepted in reliability analysis. Two reasons are given for this assumption: (1) It is commonly assumed that electronic components do not wear out but are subject to random shocks which may cause failure. If these shocks form a Poisson process the underlying failure distribution is exponential. (2) Sufficiently complex equipment run for a long time (failed components being replaced by good ones) will follow the exponential distribution. These reasons are investigated. GRA

N80-11493# Stanford Univ., Calif.
RELIABILITY PREDICTION FOR MECHANICAL SYSTEMS Final Report, 20 Apr. 1976 - 19 Apr. 1979
M. Vernon Johns, Jr. 11 Jul. 1979 10 p refs
(Grant DAAG29-76-G-0213)
(AD-A071835; ARO-13859.3-MX) Avail: NTIS
HC A02/MF A01 CSCL 14/4

Two areas were investigated. A method for producing exact confidence bounds for the reliability of highly reliable series systems is considered. The methods are based on finding suitable orderings of the sample outcome space, and are valid when the probabilities of component failure are small enough for the failure data to be distributed as Poisson random variables. Optimality criteria are invoked to insure that the orderings used produce confidence bounds which are as tight as possible. Tables to facilitate applications were produced. A new class of robust estimators of location were studied. These estimators (called P-estimators) are analogous to Pitman estimators in the same way that M-estimators are analogous to maximum likelihood estimators. Members of this class were evaluated by computer simulation and were found to perform with even higher efficiency than the bisquare M-estimator for both long and short tailed distributions. GRA

N80-11494# Florida State Univ., Tallahassee. Dept. of Statistics.
ACCELERATED LIFE TESTING: A PRAGMATIC BAYESIAN APPROACH Interim Report
Frank Proschan and Nozer D. Singpurwalla Jul. 1978 24 p refs
(Contract N00014-77-C-0263; AF-AFOSR-2581-74; AF Proj. 2304)
(AD-A072622; FSU-Statistics-M474) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In this paper we propose a model for accelerated life testing which differs from those considered in the past. Our model does not require the usual assumptions about the failure distributions and the acceleration functions. Our approach is Bayesian, and depends on the estimation of ordered failure rate functions at different stress levels. Since our model is nonprametric, and our approach is quite pragmatic, our results should be of use to engineers working on accelerated life tests, and biometricians involved in carcinogenic experiments. GRA

N80-11495# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
A COMPUTATIONAL MODEL FOR THREE-DIMENSIONAL INCOMPRESSIBLE WALL JETS WITH LARGE CROSS FLOW Final Report, 19 Sep. 1977 - 18 Sep. 1978
W. D. Murray, V. Shankar, and N. Malmuth Sep. 1978 117 p refs
(Contract N62269-77-C-0412; RR0230221)
(AD-A071689; SC5129.5FR; NADC-77163-30) Avail: NTIS
HC A06/MF A01 CSCL 20/4

The flow field of three dimensional incompressible wall jets prototypic of thrust augmenting ejectors with large cross flow is solved using a very efficient centered-Euler scheme in an orthogonal curvilinear coordinate system. The computational model treats initial conditions with arbitrary velocity profiles at or downstream of the jet exit. An averaging approach is employed for the first few marching steps to overcome spurious numerical oscillations associated with arbitrary initial profiles. Laminar as well as turbulent wall jets are simulated. Turbulence is introduced using a two layer mixing length model appropriate to curved three-dimensional wall jets. Typical results quantifying jet spreading, jet growth, nominal separation and jet shrink effects due to cross flow are presented. GRA

N80-11496# Adaptronics, Inc., McLean, Va.
EXPLORATORY DEVELOPMENT OF ADHESIVE BAND FLAW DETECTION Final Report, 1 Apr. 1976 - 30 Nov. 1978
Murray H. Loew, James M. Fitzgerald, Anthony N. Mucciardi, Richard E. Elsley, and George A. Alers Dec. 1978 136 p refs Sponsored in part by Rockwell International Science Center
(Contract F33615-76-C-5079; AF Proj. 7351)
(AD-A072724; AFML-TR-78-206) Avail: NTIS
HC A07/MF A01 CSCL 14/2

This project sought to establish the feasibility of automatic detection and classification of bond line defects in multiple-layer adhesively bonded structures. Bond strength was not the issue in this work; rather, the detection and classification of a bond line flaw per layer into one of three classes- unbond, void, porosity-independent of part geometry was the main objective. Each part was scanned from one flat surface using a 0.5 inch transducer in the pulse-echo mode. A decision was rendered automatically regarding the existence and classification of defects in each layer for each pulse-echo return in an overall scan pattern. Results show that flaws in multiple-layer structures can be found with accuracies of 91% as to defect versus non-defect discrimination, and 92% as to the correct type of defect. In this work, a false-alarm rate of 19% (non-defects called defects) and a false dismissal rate of 2% (defects called non-defects) was obtained. It is believed that the false alarm rate could be greatly reduced by use of multiple-point(contextual) information from contiguous scans. It has been shown that it is feasible and practical to use ultrasound to detect and classify defects and flaws in multiple-layer adhesively bonded structures, regardless of the layers in which they lie. The method is, by design, insensitive to moderate variations in transducer orientation and to construction geometry. The accuracies on a blind evaluation test compare very well with the data used to train the ALN classifier system. GRA

N80-11497# Hanford Engineering Development Lab., Richland, Wash.
EXPERIMENTAL ELECTRO-THERMAL METHOD FOR NONDESTRUCTIVELY TESTING WELDS IN STAINLESS STEEL PIPES
D. R. Green 19 Jan. 1979 29 p refs Presented at Natl. Am. Soc. for Nondestructive Testing Conf., San Diego, Calif., 2 Mar. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1705; Conf-790366-1) Avail: NTIS
HC A03/MF A01

Electrothermal nondestructive testing of welds in austenitic stainless steel pipes is examined. The development of contacts for injecting the electrothermal exciting current into asreceived stainless steel pipe weld specimens without contaminating or damaging the surface is discussed. The electrothermal method's potential applicability to stainless steel welds of the type used in fast flux test facility pipes is investigated. A.W.H.

N80-11498# Danish Research Center for Applied Electronics, Hoersholm.
SYSTEM RELIABILITY AND COMPONENT COSTS. A CORRELATION OF COMPONENT QUALITY, FAILURE RATE, AND REDUNDACY PARAMETERS [SYSTEMPAALIDELIGHED OF KOMPONENTOMKOSTNINGER. BETRAGTNINGER OVER SAMSPILLET MELLEM PAALIDELIGHED OF KOMPONENTOMKOSTNINGER FOR ET ELEKTRONISK SYSTEM. HOVEDPARAMETRENE ER KOMPONENTKVALITET, -BELASTNINGSGRAD OG REDUNDANS]
Joergen Biegel Feb. 1978 34 p refs In DANISH; ENGLISH summary
(ECR-79) Avail: NTIS HC A03/MF A01

System reliability was correlated to component costs using as main parameters the component quality, the component failure rate, and redundancy in order to optimize the relationship. The reliability, costs, and the relationship quality/cost was studied for each of the three parameters. It is concluded that if a short

term period is considered, redundancy shows a better ratio reliability/cost, while at medium and long term, high quality components are preferred. Author (ESA)

N80-11499# Uppsala Univ. (Sweden). Dept. of Automatic Control and Systems Analysis.
COMPARISON OF SOME INSTRUMENTAL VARIABLE METHODS: CONSISTENCY AND ACCURACY ASPECTS
T. Soederstroem and P. Stoica (Inst. Politec. Bucharest). Oct. 1978. 58 p. refs.
(UPTEC-78-88-R) Avail: NTIS HC A04/MF A01

A general analysis of various instrumental variable methods is given. The investigation includes methods for open loop operation as well as methods designed for closed loop operation. The instrumental variables are formed as different combinations of inputs, delayed outputs, filtered inputs, and external set point variations. Comparison is also made with prediction error methods. Necessary conditions as well as sufficient conditions for consistency are explicitly derived and discussed. Some simple counter-examples to general consistency for some common instrumental variable methods are also included: asymptotic accuracy properties are then reviewed. Finally, examples show how the use of filters will influence the covariance matrix of the parameter estimates. Author (ESA)

N80-11500# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
DEVELOPMENT OF THE STATISTICAL PATTERN RECOGNITION METHODOLOGY AND ITS APPLICATION TO QUALITY CONTROL
Josef Kittler. Sep. 1978. 145 p. refs. Sponsored by Roy. Soc.
(ENST-D-78023) Avail: NTIS HC A07/MF A01

Various aspects of statistical pattern recognition are reviewed. In the area of feature selection, feature set search algorithms for selecting a subset of pattern descriptors from a set of measurements are comparatively studied. Decision making systems are then considered, particularly as regards measurement errors and the subsequent increase in the error probability of the system. In the realm of pattern classification, the problem of designing a pattern recognition system for processing incomplete pattern vectors is discussed. Next, it is shown that the probability distribution of empirical error count estimate is not binomial and a recursive formula for determining this distribution is given. Finally, pattern recognition techniques are applied to the problem of automatic inspection of products by lots. Alternative approaches to acceptance sampling plan design are proposed. Author (ESA)

N80-11501# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
SOFTWARE AND PROCEDURES FOR STATISTICAL QUALITY CONTROL [LOGICIELS ET PROCEDURES DE CONTROLE STATISTIQUE DE RECEPTION]
L. F. Pau, M. Deglaire, J. Kittler, M. Thongsa, and C. Toghraie. Apr. 1979. 171 p. refs. Partly in FRENCH and ENGLISH.
(Contracts ENST-292261; LCIE-292958)
(ENST-D-79006) Avail: NTIS HC A08/MF A01

A number of acceptance sampling procedures for statistical quality control, most of which involve measurements, together with the software packages developed for the corresponding sampling plan computations are introduced. The procedures include finite lot acceptance sampling by attributes, without or with individual classification errors; acceptance sampling by measurements with two-sided control of the mean; nonparametric sequential control by measurements; Bayesian acceptance sampling of the mean; and statistical control of the percentage defective determined from multivariate measurements on each item in the sample. A complete theoretical description and an example of computer implementation are given for each procedure presented. Author (ESA)

N80-11502*# National Bureau of Standards, Washington, D.C. Center for Materials Sciences.
PROCEEDINGS OF THE 28TH MEETING OF THE MECHANICAL PREVENTION GROUP, REPORT ON MFPG DETECTION, DIAGNOSIS, AND PROGNOSIS
T. Robert Shives and William A. Willard. Jul. 1979. 371 p. Meeting held at San Antonio, Tex., 28-30 1978. Sponsored in part by Office of Naval Res., Arlington, Va., and DOE, Wash., D.C.
(NASA-TM-80881; PB-297399/8; NBS-SP-547;
LC-79-600078) Avail: NTIS HC A16/MF A01 CSCL 14B

These proceedings consist of a group of twenty five papers dealing with detection, diagnosis, and prognosis as related to mechanical failure prevention. Special emphasis is on aerospace applications, land based applications, marine applications, and industrial application. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-11503# Verlag Stahleisen m.b.H., Duesseldorf (West Germany).
BEHAVIOUR OF STEEL UNDER CYCLIC LOADING
Winfried Dahl. 1978. 337 p. refs. In GERMAN. Presented at Werkstoffkunde, Eisen und Stahl 3, 1977.
(ICAF-1090) Avail: NTIS HC A15/MF A01

The report contains 20 papers covering the following subjects, preferably demonstrated for steels: testing technology, plastic yielding and fracture behaviour, crack initiation, crack propagation, influence of texture, manufacture, loading conditions, internal stresses and notches on the cyclic behaviour, application of fracture mechanics, description of measured load-time histories, simulations on load-time-histories in fatigue tests, influence of the material on fatigue, fatigue life prediction methods, corrosion and endurance limit, cyclic loading at high temperature, low cycle fatigue at room temperature and fatigue of welded joints. A.R.H.

N80-11504# Royal Aircraft Establishment, Farnborough (England).
ANALYSIS AND SYNTHESIS OF OPERATIONAL LOADS
J. H. Argyris, W. Aicher, and H. J. Ertelt. May 1979. 85 p. refs. Transl. into ENGLISH of "Analyse und Synthese von Betriebsbelastungen", ISD Rept. 193, Univ. of Stuttgart, 1976
(RAE-Lib-Trans-2008; BR70163; ISD-Rept-193) Avail: NTIS HC A05/MF A01

A method for the analysis of the operational loads on light structures is investigated. The representation of the specified theoretical value, in servohydraulic loading devices, in the form of a Markov matrix of the transition probabilities, is the method examined. The suitability of the method for the analysis and synthesis of operational loads is discussed. The advantages of data reduction and plotting over previous methods for the control of fatigue tests are described and the accuracy of the method in dynamic loading in tests is reported. An analysis and synthesis of an operational load is presented. A.W.H.

N80-11505*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
LIGHT AIRPLANE CRASH TESTS AT THREE PITCH ANGLES
Victor L. Vaughan, Jr. and Emilio Alfaro-Bou. Nov. 1979. 62 p. refs.
(NASA-TP-1481) Avail: NTIS HC A04/MF A01 CSCL 01C

Three similar twin-engine general aviation airplane specimens were crash tested at an impact dynamics research facility at 27 m/sec, a flight path angle of -15 deg, and pitch angles of -15 deg, 0 deg, and 15 deg. Other crash parameters were held constant. The test facility, instrumentation, test specimens, and test method are briefly described. Structural damage and accelerometer data for each of the three impact conditions are presented and discussed. Author

N80-11506*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
STATISTICAL ENERGY ANALYSIS RESPONSE PREDICTION METHODS FOR STRUCTURAL SYSTEMS Final Report, 25 Sep. 1978 - 25 Sep. 1979

R. F. Davis. Oct. 1979. 107 p. refs.
(Contract NAS8-33191)
(NASA-CR-161334; MDC-G8150) Avail: NTIS
HC A06/MF A01 CSCL 20K

The results of an effort to document methods for accomplishing response predictions for commonly encountered aerospace structural configurations is presented. Application of these methods to specified aerospace structure to provide sample analyses is included. An applications manual, with the structural analyses appended as example problems is given. Comparisons of the response predictions with measured data are provided for three of the example problems. R.C.T.

N80-11507# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
DISCONTINUOUS DEFORMATION GRADIENTS IN THE FINITE TWISTING OF AN INCOMPRESSIBLE ELASTIC TUBE
Rohan C. Abeyaratne. Jun. 1979. 77 p. refs.
(Contract N00014-75-C-0196)
(AD-A071728; TR-42) Avail: NTIS HC A05/MF A01 CSCL 20/11

It is known that the type of the system of partial differential equations governing finite elastostatics can change from elliptic to non-elliptic at sufficiently large deformations for certain materials. This introduces the possibility that the elastostatic field may exhibit certain discontinuities. In this paper we illustrate the occurrence of elastostatic fields with discontinuous deformation gradients in a physical problem. The body is assumed to be composed of a material which belongs to a particular class of isotropic, incompressible, elastic materials which allow for a loss of ellipticity. It is shown that no solution which is smooth in the classical sense exists to this problem for certain ranges of the applied loading. Next, we admit solutions involving elastostatic shocks into the discussion and find that the problem may then be solved completely. When this is done, however, there results a lack of uniqueness of solutions to the boundary-value problem. In order to resolve this non-uniqueness, the dissipativity and stability of the solutions are investigated. GRA

N80-11508# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
A MULTILAYER TRACTION-FREE EDGE, QUADRILATERAL, WARPING ELEMENT FOR THE STRESS ANALYSIS OF COMPOSITE PLATES AND SHELLS. Final Report, 1 Mar. 1978 - 30 Apr. 1979
Alexander Harris, Oscar Orringer, and Emmett A. Witmer. Apr. 1979. 241 p. refs.
(Contract DAAG46-78-C-0015)
(AD-A071910; ASRL-TR-193-1) Copyright. Avail: NTIS
HC A11/MF A01 CSCL 20/11

A hybrid stress multilayer warping quadrilateral element with a traction-free edge (TFQE), based on the Principle of Modified Complementary Energy, has been developed for efficient finite element modeling and analysis at and near free edges. The assumed stress distributions in the element were selected so as to satisfy the basic equations of equilibrium; sufficient detail was implemented throughout each layer of each element to model the steep boundary layer stress gradients, including the important interlaminar stresses. The interlayer stress continuity and traction-free conditions at the free edge are satisfied exactly; the resulting stress distribution was examined for consistency as required by 3-dimensional stress functions. The stress assumption includes no singularity. The traction-free edge is allowed to warp freely. GRA

N80-11509# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
LARGE DEFORMATION ELASTIC-PLASTIC BUCKLING ANALYSIS OF SPHERICAL CAPS WITH INITIAL IMPERFECTIONS
Robert Kao. May 1979. 53 p. refs.
(Contract N00014-75-C-09446)
(AD-A071480) Avail: NTIS HC A04/MF A01 CSCL 20/11

Large deformation elastic-plastic buckling loads are obtained for axisymmetric spherical caps with initial imperfections. The problem formulation is based on equilibrium equations in which the plastic deformation is taken as effective plastic loads. Plasticity theory is derived from von Mises initial yield condition and Prager-Ziegler kinematic hardening rule. Results show that both initial imperfection and plastic deformation have the same effect of reducing buckling loads, and that the influence of plastic yielding diminishes as the magnitude of imperfections increases. GRA

N80-11510# PMB Systems Engineering, Inc., San Francisco, Calif.
FAILURE CRITERIA FOR REINFORCED CONCRETE STRUCTURES. VOLUME 1: LITERATURE SURVEY AND PROPOSED ANALYTICAL MODELS. Final Report
Richard W. Litton and Jawahar M. Gidwani. May 1979. 123 p. refs.
(Contract F29601-76-C-0135)
(AD-A070643; AFWL-TR-77-239-Vol-1) Avail: NTIS
HC A06/MF A01 CSCL 11/2

This literature summary reviews experimental and analytical studies relevant to the Theoretical Investigation of Failure Criteria for Reinforced Concrete Structures. An extensive list of relevant references used in this survey is also presented. GRA

N80-11511# PMB Systems Engineering, Inc., San Francisco, Calif.
FAILURE CRITERIA FOR REINFORCED CONCRETE STRUCTURES. VOLUME 2: ANALYTICAL MODEL AND RESPONSE DATA. Final Report
Richard W. Litton and Jawahar M. Gidwani. May 1979. 266 p.
(Contract F29601-76-C-0135)
(AD-A070644; AFWL-TR-77-239-Vol-2) Avail: NTIS
HC A12/MF A01 CSCL 11/2

Failure criteria defining complete loss of section strength for reinforced concrete sections are defined in this Volume II of the report. Failure envelopes obtained from a three-dimensional finite element analysis with a three dimensional nonlinear constitutive material model are presented in terms of deformations for various rectangular and cylindrical sections. Applications and examples of the use of these failure envelopes are also presented. GRA

N80-11512# Northrop Corp., Hawthorne, Calif. Aircraft Group.
EFFECT OF MULTIAXIAL LOADING ON CRACK GROWTH. VOLUME 3: COMPILATION OF INTERFEROMETRY PHOTOGRAPHS. Final Report, 15 Sep. 1976 - 15 Sep. 1978
A. F. Liu and D. F. Dittmer. Dec. 1978. 185 p.
(Contract F33615-76-C-3121; AF Proj. 486U)
(AD-A072074; NOR-78-161-Vol-3; AFFDL-TR-78-175) Avail: NTIS HC A09/MF A01 CSCL 20/11

An exploratory research program has been conducted to systematically evaluate the effects of biaxial stress ratio on constant amplitude and variable amplitude fatigue crack growth rates. A series of experiments and analyses have been carried out on the cyclic crack growth behavior of center-cracked cruciform specimens under various biaxial loading conditions. GRA

N80-11513# Northrop Corp., Hawthorne, Calif. Aircraft Group.
EFFECT OF MULTIAXIAL LOADING ON CRACK GROWTH. VOLUME 1: TECHNICAL SUMMARY. Final Report, 15 Sep. 1976 - 15 Sep. 1978
A. F. Liu and D. F. Dittmer. Dec. 1978. 238 p. refs.
(Contract F33615-76-C-3121; AF Proj. 486U)
(AD-A072122; NOR-78-161-Vol-1; AFFDL-TR-78-175-Vol-1)
Avail: NTIS HC A11/MF A01 CSCL 20/11

An exploratory research program has been conducted to systematically evaluate the effects of biaxial stress ratio on constant amplitude and variable amplitude fatigue crack growth rates. A series of experiments and analyses have been carried out on the cyclic crack growth behavior of center-cracked cruciform specimens under various biaxial loading conditions. The results may be summarized as follows. Cracks will grow straight in a biaxial stress field when the stress component parallel to the crack is equal to or smaller than the stress component normal to the crack. Elastic K factors are obtainable for both straight and curved cracks and are adequate for correlating the biaxial growth rate data. At a given stress intensity level, the constant

amplitude crack growth rates are the same in all the biaxial loading conditions. In out-of-phase loading conditions, the crack growth rate and crack growth directions are the same as those in the in-phase loading conditions. Crack tip plastic zone size variations with biaxial ratio appeared to have no effect on constant-amplitude crack growth rate. As for the variable amplitude tests, it is very evident that cracks grow faster at positive biaxial stress states, but slower at negative biaxial loading conditions. GRA

N80-11514# George Washington Univ., Washington, D. C. School of Engineering and Applied Science
NONLINEAR DYNAMIC BUCKLING OF SPHERICAL CAPS WITH INITIAL IMPERFECTIONS
Robert Kao, Jun. 1979, 53 p. refs
(Contract N00014-75-C-0946)
(AD-A071450) Avail: NTIS HC A04/MF A01 CSCL 20/11

A finite difference method is developed for large deformation elastic-plastic dynamic buckling analysis of imperfect spherical caps. The problem formulation is based on governing equations of motion, treating plastic deformation as effective plastic loads. Plasticity theory is derived from von Mises yield condition and Prager-Ziegler kinematic hardening rule which predicts an ideal Bauschinger effect. Results indicate that dynamic effect has the influence of reducing load carrying capacity of perfect spherical caps, however, its influence on imperfect caps depends on the magnitude of initial imperfections. GRA

N80-11515# California Univ., Livermore. Lawrence Livermore Lab.
STRESS-RUPTURE LIFE OF KEVLAR EPOXY SPHERICAL PRESSURE VESSELS
R. E. Barlow, R. H. Toland, and T. Freeman, 23 Feb. 1979, 62 p. refs
(Contract W-7405-eng-48)
(UCID-17755-Pt.3) Avail: NTIS HC A04/MF A01

This study of stress rupture has two objectives: to generate baseline data on vessel life under pressure and to apply statistical reliability theory to vessel and strand data in order to predict reliability at given stress levels. The improved life prediction methods useful in the analysis of life data are described. These methods are applied to two sets of data, i.e., the extensive Kevlar/epoxy strand data and the current Kevlar/epoxy spherical pressure vessel data. Of principal importance is the observation that the hazard rates for both data sets are time-dependent at low stress levels; as a result, the exponential lifetime distribution is not valid. Plans are discussed for accelerated life tests of pre-production units, methods for choosing sample sizes, and in-service replacement policies. DOE

N80-11516# California Univ., Livermore. Lawrence Livermore Lab.
ON-LINE STRUCTURAL RESPONSE ANALYSIS USING THE EXTENDED KALMAN ESTIMATOR/IDENTIFIER
J. V. Candy, 5 May 1979, 68 p. refs
(Contract W-7405-eng-48)
(UCID-18175) Avail: NTIS HC A04/MF A01

The development of on-line state and parameter estimators used to analyze the structural response of buildings is discussed. The estimator/identifier, an extended Kalman filter (EKF), is described. The EKF performance on simulated noisy structural response data is determined. DOE

N80-11517# Foster Wheeler Corp., Livingston, N.J.
ELASTIC-PLASTIC-CREEP ANALYSIS OF SHELLS
D. H. Dai, 1979, 23 p. refs. Presented at Computational Methods in Nuclear Engineering, Williamsburg, Va., 23 Apr. 1979
(Contract EW-76-C-2395)
(CONF-790402-16) Avail: NTIS HC A02/MF A01

The ASME elevated temperature design criteria discussed followed by examples of actual computations performed to support the design/analysis and fabrication of a breeder reactor component in which a substantial amount of elastic-plastic-creep analysis was performed. Mathematical challenges encountered by the design analyst in these problems are highlighted. Developmental needs and future trends are given. DOE

N80-11518# General Atomic Co., San Diego, Calif.
SIMPLIFIED INELASTIC ANALYSIS IN HELICAL COIL HEAT EXCHANGER DESIGN
C. E. Richard, Nov. 1978, 7 p. refs. Presented at 3d US Natl. Congr. on Pressure Vessels and Piping, San Francisco, Calif., 25 Jun. 1979
(Contract EY-76-C-03-0167-065)
(GA-A-15188; Conf-790615-5) Avail: NTIS HC A02/MF A01

A simplified inelastic analysis of helical coil tubing for high-temperature applications is described. Elastically calculated operating stresses are compared with inelastic estimates of allowable cyclic creep/fatigue stresses. The technique of simplifying and analyzing the operating cycles to determine acceptable creep damage levels has general application. The allowable stresses represent the greatest uncertainty in the method, and tests are required to improve their accuracy. A method of utilizing short-time test data to determine allowable stresses for reactor lifetimes of 30 to 40 years is proposed. DOE

N80-11519# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
RESPONSE OF A DOUBLE TUBE SHEET STRUCTURE TO HYDRAULIC PRESSURE TRANSIENTS
W. F. Yau, 1979, 15 p. refs. Presented at 3d US Natl. Congr. on Pressure Vessels and Piping, San Francisco, Calif., 25 Jun. 1979
(Contract EY-76-C-09-0001)
(DP-MS-78-73) Avail: NTIS HC A02/MF A01

A general procedure was developed to analyze complex tubesheet structures under dynamic loading conditions. The top shield of a Savannah River Plant production reactor is a stainless steel box structure perforated by tubular conduits. It supports the hanging fuel assemblies and the weight of the reactor superstructure. During normal reactor operation the top shield and the fuel assemblies are submerged in water coolant. For a postulated transient induced by a loss-of-coolant, a loading profile was constructed that considered (1) reduction of buoyancy, (2) rapid pressure changes due to generation and condensation of steam, and (3) vacuum force on one side following condensation. Dynamic responses to such a loading are analytically represented by linear combinations of natural models that satisfy a fourth-order equation of motion. Localized stress magnification in the tube sheets of the structure is determined according to the theory of perforated plates. DOE

N80-11520# Sandia Labs., Albuquerque, N. Mex.
ASSESSMENT OF STRESS-STRAIN DATA SUITABLE FOR FINITE-ELEMENT ELASTIC-PLASTIC ANALYSIS OF SHIPPING CONTAINERS
H. J. Rack and Gerald A. Knorovsky, Sep. 1978, 69 p. refs
(Contract EX-76-C-04-0789)
(NUREG-CR-0481; SAND-77-1872; R-7) Avail: NTIS

Stress-strain data which describes the influence of strain rate and temperature on the mechanical response of materials presently being used for light water reactor fuel shipping containers have been assembled. Selection of data has been limited to that which is suitable for use in finite-element elastic-plastic analysis of shipping containers (e.g., they must include complete material history profiles). Based on this information, recommendations were made for further work which is required to complete the necessary data base. DOE

N80-11521# Hanford Engineering Development Lab., Richland, Wash.
SPECIMEN SIZE CONSIDERATIONS IN FATIGUE CRACK GROWTH RATE TESTING
L. A. James, Dec. 1978, 34 p. refs
(Contract EY-76-C-14-2170)
(HEDL-TME-78-99) Avail: NTIS HC A03/MF A01

The effect of specimen size upon the fatigue-crack growth behavior of annealed AISI Type 304 stainless steel was studied at two stress ratios at an elevated temperature. The resulting data were examined in the light of the present ASTM size criterion (based upon monotonic yield strength) as well as a proposed criterion based upon the material flow strength. The flow stress criterion is considerably less restrictive than the present ASTM

Criterion, and is entirely appropriate for strain-hardening materials such as the austenitic stainless steels. DOE

N80-11522# Bari Univ. (Italy). Ist. di Costruzioni di Macchine.
EFFECT OF WELD PENETRATION ON THE STRESS CONCENTRATION FACTOR FOR CRUCIFORM WELDED JOINTS [EFFETTO DELLA MANCANZA DI PENETRAZI ONE SULFATTORE DI EFFETTO DI INTAGLIO PER GIUNTI SALDATI A CROCE]
Bruno Atzori and Carmine Pappalettere Jun. 1978 16 p refs In ITALIAN; ENGLISH summary Presented at Sez. di Brescia, Brescia, Italy, 22-24 Jun. 1978
Avail: NTIS HC A02/MF A01

The influence of the lack of penetration on the elastic stress concentration factor of a cruciform welded joint loaded by axial of bending forces was investigated k sub t. The analysis was performed using finite element techniques with an isoparametric quadrangular element. The computations were carried out on an IBM 370-158. The results are compared with those available in the literature and are applied to justify the different fatigue strength shown by cruciform joints with or without lack of penetration. Author (ESA)

N80-11523# Bari Univ. (Italy). Ist. di Costruzioni di Macchine.
STRESS CONCENTRATION FACTORS FOR FILLET WELDED JOINTS DURING BENDING [FATTORI DI EFFETTO DI INTAGLO PER GIUNTI D'ANGOLO SOLLECITATI A FLESSIONE]
Bruno Atzori and Franco Fresa 1978 17 p refs In ITALIAN; ENGLISH summary Presented at Sez. di Brescia, Brescia, Italy, 22-24 Jun. 1978
Avail: NTIS HC A02/MF A01

The influence of the geometry on the elastic stress concentration factor k sub t for a fillet welded joint during bending was investigated. Complete penetration is assumed for the analysis which was performed by finite element techniques using a plane-stress isoparametric element. Computations were carried out on a IBM 370-158 computer. The results explain the variation in fatigue strength due to variation in sizes of geometrically similar joints which was reported in the literature and is not considered in the existent norms. Author (ESA)

N80-11524# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
FLIGHT SIMULATION FATIGUE CRACK PROPAGATION EVALUATION OF CANDIDATE LOWER WING SKIN MATERIALS WITH PARTICULAR CONSIDERATION OF SPECTRUM TRUNCATION
R. J. H. Wanhill 15 Jan. 1979 34 p refs
(Contract NIVR-1806)
(NLR-TR-77092-U) Avail: NTIS HC A03/MF A01

Flight simulation fatigue crack propagation tests were carried out on 2024-T3, 7475-T761, and mill annealed Ti-6Al-4V sheet in thicknesses up to 3 mm. These materials are representative of transport aircraft lower wing skin stiffened panels of end load capacities 1.5 and 3 MN/m. Results show that the performance of 2024-T3 is much superior, owing mainly to greater retardation of crack growth after severe flights. The effect of load truncation is also greater for 2024-T3. The significance of the results in the choice of advanced structural concepts and materials as well as in the choice of truncation level is discussed. A recommendation for further investigation is given. Author (ESA)

N80-11525# Southampton Univ. (England). Inst. of Sound and Vibration Research.
HIGHER ORDER TAPERED BEAM FINITE ELEMENTS FOR VIBRATION ANALYSIS
C. W. S. To May 1978 51 p refs Sponsored by UK Min. of Defence
(ISVR-TR-99) Avail: NTIS HC A04/MF A01

Explicit expressions for mass and stiffness matrices of two higher tapered beam elements for vibration analysis are presented. One has three degrees of freedom per node and the other has four degrees of freedom per node. The four degrees of freedom of the latter element are the displacement, slope, curvature, and gradient of curvature. The explicit element mass and stiffness matrices eliminate the loss of computer time and round-off errors associated with the extensive matrix operations used in the numerical evaluation of these expressions. Comparisons with results in the literature concerning tapered cantilever beam structures with or without an end mass and its rotary inertia are made. Results show that the higher order tapered beam elements are superior to the lower order one in that they offer more realistic representation of the curvature and loading history of the beam element. Author (ESA)

N80-11526# Ingemanssons Ingenjoersbyraa AB, Goteborg (Sweden).
FORCE AND MOMENT IMPEDANCE OF INFINITE PLATES
Sten Ljunggren Stockholm Swed. Council for Bldg. Res. 1978 176 p refs
(Grant SWEDCBR-730645-7)
(D3-1978; ISBN-91-540-2824-8) Avail: NTIS HC A09/MF A01; Swed. Council for Bldg. Res., Stockholm Skr 45

The mechanical excitation of an infinite plate is described in terms of impedances. Excitations by a force perpendicular to the plate and by a moment with its axis in the plane of the plate applied over an indenter with finite dimensions are treated. Analysis through two-dimensional and three-dimensional bending wave theory was used to describe plate reaction. Exact solutions in closed form for a stiff indenter with a circular area of contact were obtained. Approximate expressions were derived for the case of a rectangular area of contact. Analysis of plate reaction with three-dimensional theory shows that an applied force or moment causes a bending wave and also a longitudinal wave as well as near fields. With three-dimensional theory the case of a small indenter on a thick plate is studied in particular. Author (ESA)

N80-11003 Allerton Press, Inc., New York, N. Y.
EXPERIMENTAL STUDY OF SHELL STABILITY UNDER HEATING AND LOADING
V. K. Belov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 1-3 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 5-8 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11004 Allerton Press, Inc., New York, N. Y.
ON SOLUTION OF THE PLANE PROBLEM OF REINFORCED PANELS OF VARIABLE STIFFNESS
M. B. Vakhitov, V. N. Paimushin, and N. M. Yakupov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 4-9 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 9-16 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11015 Allerton Press, Inc., New York, N. Y.
ON THE LIMIT STATE OF A TOROIDAL SHELL OF REVOLUTION UNDER AXISYMMETRIC DEFORMATION
I. G. Teregulov and E. S. Sibgatullin *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 74-77 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 92-96 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11017 Allerton Press, Inc., New York, N. Y.
LOAD-CARRYING ABILITY OF CYLINDRICAL SHELL LOADED BY CONCENTRATED FORCE ACTING ALONG THE GENERATOR
A. M. Khomyakov *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 84-87 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 104-107 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11018 Allerton Press, Inc., New York, N. Y.
NUMERICAL INTEGRATION OF EQUATIONS OF THEORY OF THIN-WALL BEAMS WITH DEFORMABLE CONTOUR
V. Shataev *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 88-92 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 108-114 (For primary document see N80-11002 02-01)
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N80-11023 Allerton Press, Inc., New York, N. Y.
DETERMINATION OF LOADS AND STRESS IN COMPOSITE MATERIAL LAYERS FOR A PLATE IN THE PLANE STRESS STATE
A. A. Dudchenko and A. N. Elpatevskii *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 111-113 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 132-135 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11025 Allerton Press, Inc., New York, N. Y.
INFLUENCE OF CONTOUR DEFORMATION IN PREBUCKLING STATE ON BENDING STABILITY OF OPEN CYLINDRICAL SHELLS
S. N. Kan, Yu. I. Kaplan, and N. V. Panova *In its* Soviet Aeron., Vol. 21, No. 2 1978 p 117-119 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978 p 138-141 (For primary document see N80-11002 02-01)
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42 GEOSCIENCES (GENERAL)

N80-11527# Joint Publications Research Service, Arlington, Va.
GEOPHYSICS, ASTRONOMY AND SPACE, NO. 450
2 Aug. 1979 47 p refs Transl. into ENGLISH from selected Russian articles
(JPRS-73946) Copyright. Avail: NTIS HC A03/MF A01
Articles concerning the earth's crust under the ocean, and the upper atmosphere are reported. For individual titles, see N80-11528 through N80-11529.

N80-11528# Joint Publications Research Service, Arlington, Va.
EARTH'S CRUST UNDER THE OCEANS c46
G. B. Rundnik and G. J. Kashintsev *In its* Geophys., Astron. and Space, No. 450 (JPRS-73947) 2 Aug. 1979 p 7-15 refs Transl. into ENGLISH from Priroda (Moscow), no. 4, 1979 p 42-47 (For primary document see N80-11527 02-42)
Avail: NTIS HC A03/MF A01
Differences in the earth's crust on the continents, and under the ocean are discussed in terms of the geological structures.
F.O.S.

N80-11529# Joint Publications Research Service, Arlington, Va.
OBSERVATIONS OF ATMOSPHERIC DUST FROM SPACE c46
Al. Grigoryev and K. Kondratyev *In its* Geophys., Astron. and Space, No. 450 (JPRS-73946) 2 Aug. 1979 p 29-37 refs Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 6, 1979 p 88-92 (For primary document see N80-11527 02-42)
Avail: NTIS HC A03/MF A01
The observation from space of atmospheric dust storms over the Aral Sea, Mesopotamia, and the Caspian Sea are analyzed. Climatological changes due to atmospheric dust are discussed.
F.O.S.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N80-11530# Committee on Science and Technology (U. S. House).
EARTH RESOURCES DATA AND INFORMATION SERVICE
Washington GPO 1979 222 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., No. 24, 2-3 May 1979
(GPO-49-530) Avail: Subcomm. on Space Sci. and Applications
The implementation of and an earth resources data and information service is discussed. Policy issues surrounding the remote sensing of earth resources are presented. The role of the government versus the role of the private sector, the needs of private industry, state and local governments, and the international community are examined in relation to the formation of the earth resources and data information service. A.W.H.

N80-11531# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AN IMPLICIT COMPACT FOURTH-ORDER ALGORITHM FOR SOLVING THE SHALLOW-WATER EQUATIONS IN CONSERVATION-LAW FORM
I. M. Navon and H. A. Riphagen Jan. 1979 64 p refs
(CSIR-TWISK-57) Avail: NTIS HC A04/MF A01
An alternating direction implicit finite difference scheme is developed for solving the nonlinear shallow water equations in conservation law form. The algorithm is second order time accurate, while fourth order compact differencing is implemented in a spatially factored form. Extraneous boundary conditions required by the fourth order method are determined and a fourth order dissipative term is added to the equations to overcome the increased aliasing due to the fourth order method. The numerical integration is performed in a channel corresponding to a middle latitude band. The integral invariants of the equations are well conserved during the integration, ensuring that a realistic nonlinear structure is obtained. K.L.

N80-11532*# Battelle Columbus Labs., Ohio.
SEASAT DEMONSTRATION EXPERIMENTS WITH THE OFFSHORE OIL, GAS AND MINING INDUSTRIES Final Report
A. G. Mourad, A. C. Robinson, and J. E. Balon Nov. 1979 145 p refs
(Contract NASw-2800)
(NASA-CR-162423; BCL-OA-TFR-79-6) Avail: NTIS HC A07/MF A01 CSCL 05B
Despite its failure, SEASAT-1 acquired a reasonable volume of data that can be used by industrial participants on a non-real-time basis to prove the concept of microwave sensing of the world's oceans from a satellite platform. The amended version of 8 experimental plans are presented, along with a description of the satellite, its instruments, and the data available. Case studies are summarized for the following experiments: (1) Beaufort Sea oil, gas, and Arctic operations; (2) Labrador Sea oil, gas, and sea ice; (3) Gulf of Mexico pipelines; (4) U.S. East Coast offshore oil and gas; (5) worldwide offshore drilling and production operations; (6) Equatorial East Pacific Ocean mining; (7) Bering Sea ice project; and (8) North Sea oil and gas.A.R.H.

N80-11533*# Battelle Columbus Labs., Ohio.
AN ECONOMIC ANALYSIS OF FIVE SELECTED LANDSAT ASSISTED INFORMATION SYSTEMS IN OREGON Final Report
S. Solomon and K. M. Maher Oct. 1979 30 p refs
(Contract NASw-2800)
(NASA-CR-162434; BCL-OA-TFR-79-5) Avail: NTIS HC A03/MF A01 CSCL 05B
A comparative cost analysis was performed on five LANDSAT-based information systems. In all cases, the LANDSAT system

was found to have cost advantages over its alternative. The information sets generated by LANDSAT and the alternative method are not identical but are comparable in terms of satisfying the needs of the sponsor. The information obtained from the LANDSAT system in some cases is said to lack precision and detail. On the other hand, it was found to be superior in terms of providing information on areas that are inaccessible and unobtainable through conventional means. There is therefore a trade-off between precision and detail, and considerations of costs. The projects examined were concerned with locating irrigation circles in Morrow County; monitoring tansy ragwort infestation; inventoring old growth Douglas fir near Spotted Owl habitats; inventoring vegetation and resources in all state-owned lands; and determining and use for Columbia River water policies.
A.R.H.

N80-11534# Naval Ocean Systems Center, San Diego, Calif.
PROCESSING AND DISPLAY TECHNIQUES FOR MULTISPECTRAL SATELLITE IMAGERY Final Report, 1 Feb. - 30 Sep. 1978
J. A. Roese Apr. 1979 39 p refs
(AD-A072509; NOSC/TR-439) Avail: NTIS HC A03/MF A01 CSCL 09/2

In recent years, the technology area of remote sensing by multispectral satellite sensors has evolved greatly. Imagery obtained by satellite means has been the basis for much work in the areas of environmental studies, resource planning, terrain mapping, weather prediction and military reconnaissance. This program effort has investigated the application of various image processing and display techniques for use with multispectral satellite imagery. Emphasis has been placed on the development and implementation of two-dimensional processing techniques applied in the domain of the original image. Two-dimensional transform domain image processing and display techniques were also adapted for use with satellite imagery. GRA

N80-11535# Army Engineer Topographic Labs., Fort Belvoir, Va.
LAND COVER CLASSIFICATION FROM LANDSAT DATA: PHASE 3 OF A JOINT DOE/NASA DEMONSTRATION Final Report
Richard N. Foreman Mar. 1979 84 p
(AD-A071723; ETL-0175) Avail: NTIS HC A05/MF A01 CSCL 14/5

The Corps of Engineers and NASA's Earth Resources Laboratory conducted a joint demonstration of the production of land cover classification data from LANDSAT data. This report describes Phase III of the demonstration, in which classification maps and data were produced for two Corps of Engineers Districts Wilmington District, an area in the upper Roanoke River basin of Virginia; and Jacksonville District, an area along the route of the Cross Florida Barge Canal. The report includes the Districts: evaluations of the accuracy and applicability of the classifications and cost information for Phase III of the demonstration. The report also includes cost information for the application of interdisciplinary analysis of aerial photography as a means of obtaining land cover and environmental data. LANDSAT data may be cost-effective for identifying and showing the distribution of general types of land cover for large areas, although some land cover types may not be identifiable on a particular LANDSAT scene. Interdisciplinary analysis of aerial photography identifies and explains in a technical report the distribution of land cover. The extra detail of the report and the ability to ensure that specific land cover types are studied may make interdisciplinary analysis of aerial photography cost-effective for limited study areas. GRA

N80-11536# Telecommunications Associates, Fairfax, Va.
INVESTIGATION OF LINEAR TRANSFORMATIONS FOR AUTOMATIC CARTOGRAPHIC ANALYSIS Final Report, Apr. 1978 - Apr. 1979
R. L. Pickholtz, M. Movahed, and S. S. Murty 1 Apr. 1979 189 p refs
(Contract DAAK70-78-C-0045; DA Proj. 4A1-61102-B-52C)
(AD-A071752; TA-79-1-1; ETL-0181) Avail: NTIS HC A09/MF A01 CSCL 08/2

This report contains a summary of the investigation in applying linear transforms such as Fourier, Bessel, Walsh-Hadamard, Slant and Discrete Cosine to cartographic analysis. Recommendations are made and hardware and software implementations are proposed. GRA

N80-11537# Washington Univ., Seattle. Remote Sensing Applications Lab.
STUDY IN REMOTE SENSING FOR LAND USE Final Report, Apr. 1977 - Jun. 1978
Richard D. Shinn and Frank V. Westerlund Air Force Engineering and Services Lab., Tyndall AFB, Fla. Jun. 1979 74 p refs
(Contract F08635-77-C-0278; AF Proj. 2103)
(AD-A071802; AFESC/ESL-TR-79-15) Avail: NTIS HC A04/MF A01 CSCL 14/2

This research tested three methods of obtaining land use information by remote sensing for United States Air Force (USAF) land use planning. The three methods tested were: (1) photo interpretation of aircraft photography; (2) equidensitometric processing of aircraft or LANDSAT imagery; and (3) statistical analysis of LANDSAT digital data. The two sites tested were McChord AFB and Fairchild AFB in Washington State. Using test scenarios of mission realignments it was found that photo interpretation was an accurate and ready means to obtain land use information. GRA

N80-11538# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
DETECTION OF ARCTIC WATER SUPPLIES WITH GEOPHYSICAL TECHNIQUES
S. A. Arcone, A. J. Delaney, and P. V. Sellmann Jun. 1979 37 p refs
(DA Proj. 4A7-62730-AT-42)
(AD-A072157; CRREL-79-15) Avail: NTIS HC A03/MF A01 CSCL 13/2

This report discusses the application of several modern geophysical techniques to groundwater exploration in areas in permafrost. These methods utilize the principles of magnetic induction and radiowave surface impedance in the 10- to 400-kHz band, the techniques of impulse and side-looking radar in the 50- to 10,000-MHz band, and also some optical techniques using imagery obtained from a satellite. Low frequency case studies demonstrate the use of the techniques for detecting free water under an ice cover in shallow, almost completely frozen lake basins, and thaw zones within lake beds, stream channels, and in permafrost in general. The radar studies demonstrate the use of these techniques for determining depth of free water and ice cover thickness on lakes and rivers. GRA

N80-11539# Image Graphics, Inc., Fairfield, Conn.
INVESTIGATIONS OF THE USE OF CONVENTIONAL FILMS IN THE ETL CARTOGRAPHIC EBR
Andrew A. Tarnowski 15 Mar. 1979 42 p refs
(Contract DAAK70-77-C-0163)
(AD-A072628; ETL-0177; Rept-4006) Avail: NTIS HC A03/MF A01 CSCL 14/5

Conventional photographic films sensitive to electrons may be used in the ETL Cartographic EBR provided that image distortions caused by deflection of the electron beam due to electric charge accumulation on the film is within acceptable limits. Various techniques for minimizing film charging problems were investigated and practical solutions are discussed. GRA

N80-11540# RAND Corp., Santa Monica, Calif.
HEURISTICS FOR KNOWLEDGE ACQUISITION FROM MAPS
Perry W. Thorndyke Jul. 1979 40 p refs
(Contract N00014-78-C-0042)
(AD-A073126; RAND/N-1193-ONR) Avail: NTIS HC A03/MF A01 CSCL 08/2

Acquiring knowledge from a map depends upon procedures for focusing attention, encoding information, and integrating diverse knowledge. This paper describes the heuristics people use to study and learn maps. Verbal protocols obtained from eight subjects suggested four categories of procedures that were invoked during learning: attention, encoding, evaluation, and control. The use of certain heuristics in each category was highly predictive of learning success. Good learners differed from poor learners in their ability to encode spatial information, to evaluate their learning progress, and to focus their attention in accordance

with a learning plan. Many of the successful heuristics appear to be readily trainable. GRA

N80-11541# Ohio State Univ., Columbus. Dept. of Geodetic Science.
A COVARIANCE APPROXIMATION PROCEDURE
Hans Suenkel. Hanscom AFB, Mass. AFGL. Mar. 1979. 66 p. refs.
(Contract F19628-79-C-0075; AF Proj. 7600)
(AD-A072853; DGS-286; AFGL-TR-79-0075; SR-1) Avail: NTIS. HC A04/MF A01. CSCL 08/5

The steadily increasing stream of geodetic data primarily provided by automatized measurement techniques calls for a data processing method which is both simple and fast. The simplicity of least-squares collocation can hardly be surpassed, however, the processing speed, which depends on covariance calculation procedure and matrix inversion algorithms used, can be improved considerably by the feaster covariance computation procedure presented in this report. The method is basically a differentiation interpolation procedure applied to a smooth function interpolating on a regular rectangular grid of exact covariances. Once this covariance network has been generated, the covariance approximation procedure, called COVAPP, is able to provide covariance expressions of second and lower order derivatives of the disturbing potential about ten times faster than existing methods. The approximation error can be kept as small as we please by choosing an appropriately small grid spacing. A FORTRAN IV program listing together with sample inputs and outputs are included in the report. GRA

N80-11542# Honeywell Electro-Optics Center, Lexington, Mass.
STUDY OF TEMPERATURE/MOISTURE RETRIEVAL CAPABILITIES OF DMSP/SSH SENSOR CHANNELS Final Report, 22 Aug. 1977 - 22 Aug. 1978
Alexander S. Zachor. 25 Sep. 1978. 149 p. refs.
(Contract F19628-77-C-0184; AF Proj. 7670)
(AD-A073144; HONEYWELL-7809-4; AFGL-TR-78-0279) Avail: NTIS. HC A07/MF A01. CSCL 17/5

A number of retrieval algorithms were examined for efficacy in inferring atmospheric temperature and humidity structure from upwelling earth-atmospheric radiances measured in the sensing bands of DMSP/SSH. Inversions of synthetic radiances for cloud-free conditions were performed to determine the limits on retrieval information. It is shown that the CO2 channels yield fairly accurate temperature retrievals, especially when statistical data are used in constructing a guess profile and in regularizing the solutions. Maximum errors below the 70 mb pressure level are typically 3 to 4 C at middle-to-high latitudes, and 4 to 5 C in the tropics. The analysis used noise-free synthetic radiances, but regularization parameter values were assigned on the basis of measured DMSP noise-equivalent spectral radiances. The humidity retrieval capabilities of the six SSH H2O channels are marginal because three of the channels are redundant, and because the channels are too strongly absorbing to infer low-level moisture except under moderately dry conditions. It was found that substitute window channels near 795 and 900/cm are too opaque to provide an independent determination of total precipitable water, although they are probably good candidates as sounding channels to replace the redundant DMSP. GRA

N80-11543# Los Alamos Scientific Lab., N. Mex.
GEOTHERMAL EXPLORATION METHODS AND RESULTS: INLAND STATES
J. C. Maxwell. 1979. 3 p. refs. Presented at Symp. on Geothermal Energy and its Direct Uses in the Eastern United States, Hot Springs, Va., 5 Apr. 1979.
(Contract W-7405-eng-36)
(LA-UR-79-665; Conf-790433-2) Avail: NTIS. HC A02/MF A01

The Los Alamos Scientific Laboratory geothermal exploration sequence includes: (1) review of AAPG/USGS gradient maps; (2) literature search; (3) consideration of potential markets; (4) groundwater silica geothermometry; (5) analysis of bottom-hole temperatures; (6) heat flow measurement of available wells; and (7) drilling of new tests holes. Anomalies were located near Syracuse, NY (36 C/km, 56 C silica max.), near Buffalo, NY (36 C/km, 65 C silica max.), southeast Ohio, western and southwestern Nebraska, and three new warm springs in Arkansas. Other investigations found high heat generation (14 to 25 HGU) in the White Mountain batholith NH (170 C calculated at 6 km depth), uparching of the Adirondac Dome, NY, and potentially economic electricity from hot brines in southwest Arkansas. DOE

N80-11544# Texas Univ., Austin.
TERTIARY OIL RECOVERY PROCESSES RESEARCH AT THE UNIVERSITY OF TEXAS Annual Report, Oct. 1977 - Sep. 1978
R. S. Schechter and W. H. Wade. Washington. DOE. Dec. 1978. 61 p. refs.
(Contract EW-78-S-19-0001)
(BETC-0001-1) Avail: NTIS. HC A04/MF A01

Many species of monoisomeric alkyl-substituted benzene sulfonates were synthesized and examined at low concentrations. Interfacial tension in particular was studied. Optimum salinity for high surfactant concentrations was defined as the middle of the 3-phase region. Work on surfactant adsorption was focused on a model that can explain maxima and minima in adsorption curves. A model for diffusion and stranding at the aqueous surfactant-oil interface was applied to spontaneous emulsification and extended to systems that form middle-phase microemulsions. DOE

N80-11545# Pennzoil Co., Vienna, W. Va.
OIL RECOVERY BY CARBON DIOXIDE INJECTION Annual Report, Jul. 1977 - Jul. 1978
L. G. Guckert and G. P. SanFilippo. DOE. Sep. 1978. 57 p.
(Contract EF-76-C-05-5301)
(ORO-5301-34) Avail: NTIS. HC A04/MF A01

A project to determine the feasibility of miscible carbon dioxide oil recovery in the Rock Creek Big Injun field in Roane County, West Virginia is now showing a response to waterflood. Water injection into the backup injection wells was initiated on October 16, 1976 and water injection into the six pattern injection wells commenced on April 22, 1977. As of July 1, 1978, the cumulative injection into the nineteen injection wells totaled 1,306,966 barrels. DOE

N80-11546# Gary Operating Co., Englewood, Colo.
BELL CREEK RESIDUAL OIL SATURATION TECHNOLOGY TEST Quarterly Report, Oct. 1978 - Dec. 1978
D. Myal. 18 Jan. 1979. 7 p.
(Contract ET-78-C-03-2180)
(BETC-2180-4) Avail: NTIS. HC A02/MF A01

The capabilities of different techniques to measure residual oil saturation, in situ, in a consolidated sandstone reservoir were assessed to provide a basis for d selecting appropriate methods for determining oil saturation at tertiary recovery pilot test sites. DOE

N80-11547# Technical Research Centre of Finland, Espoo. Lab. of Land Use.
AUTOMATED EARTH RESOURCES SURVEYS USING SATELLITE AND AIRCRAFT SCANNER DATA: A FINNISH APPROACH
Einari Kilpelae, Sipi Jaakkola, Risto Kuittinen, and Jouko Talvitie. 1978. 174 p. refs. Co-Sponsored by Finn. Natl. Fund for Res. and Develop., Acad. of Finland, Found. for Res. of Nat. Res., Min. of Trade and Ind., Sci. Comm. of Natl. Defence. Original contains color illustrations.
(VTT-LU-15; ISBN-951-38-0723-1) Avail: NTIS. HC A08/MF A01

A tree-year multidisciplinary earth resources oriented remote sensing project was carried out to develop automated environment monitoring and natural resources inventory methods for Finnish conditions and to study the technical feasibility of such methods in the fields of water resources, geology, agriculture, and forestry. Both satellite (LANDSAT) and aircraft scanner data from several test sites in southern Finland were used in the study. Data acquisition and analsysis procedures as well as the results obtained are discussed. The results justify more detailed remote sensing research on various problems in all fields cited. Author (ESA)

N80-11548# Connecticut Univ., Storrs. Inst. of Water Resources.
DETERMINATIONS OF HYDROLOGIC PARAMETERS FOR

GLACIAL TILLS IN CONNECTICUT Final Report
David Huntley and Robert F. Black 30 Jun. 1979 20 p refs
(Contract DI-14-34-0001-7014)
(PB-297578/7; W79-07715; OWRT-A-077-CONN(2)) Avail: NTIS HC A02/MF A01 CSCL 13B

Glacial tills located in the upland areas of the Shetucket and Quinebaug River basins, Connecticut, were evaluated for transmissivity and hydraulic conductivity by performing slug-injection tests on nine, small diameter drilled wells and slug-withdrawal tests on nineteen existing, dug wells. Test data yielded values of horizontal hydraulic conductivity that ranged from 1.0 to 355 gpd/sq ft (0.13 to 14.46 m/day). Laboratory-determined values of horizontal hydraulic conductivity were obtained using specially-constructed permeameters on relatively undisturbed samples of till. Computer-model simulations of waste movement through a till aquifer, have widespread application relative to the design of sanitary landfills and other forms of waste disposal in till and stratified sediments. GRA

N80-11549# New York Univ., N. Y. Graduate School of Public Administration.
INSTITUTIONAL CONSTRAINTS ON LAND MANAGEMENT FOR WATER RESOURCE PROTECTION IN URBAN AND SUBURBAN WATERSHEDS
Rae Zimmerman Jul. 1979 98 p refs
(Contract DI-14-34-0001-8013; OWRT Proj. B-075-NY(1))
(PB-298271/8; W79-08341) Avail: NTIS HC A05/MF A01 CSCL 13B

Land management activities which contribute to adverse changes in both water quality and natural hydrology are operations and maintenance functions basic to infrastructure, such as street sanitation and repair, snow removal, maintenance of parks, catchbasins and sewers, and pesticide use. Insights into institutional constraints for avoiding adverse water resource effects related to: (1) adaptability of land management functions to new goals; (2) relationship of an inability to establish liasions with environmental concerns and role perceptions, organizational attributes, and manpower; and (3) viability of networking existing agencies for new goals for water resource goal implementation via land management. An interview questionnaire was sent to 36 officials in 17 localities in the lower Hudson. GRA

N80-11550# Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
INTERACTIVE WATER RESOURCES PLANNING USING COMPUTER GRAPHICS
Peter N. French, Lynn E. Johnson, Daniel P. Loucks, and Donald P. Greenberg Jan. 1979 91 p refs
(Contract DI-14-34-0001-6226; OWRT Proj. C-7183(6226)(4))
(PB-297994/6; W79-08196) Avail: NTIS HC A05/MF A01 CSCL 13B

Computer-aided design methods for water resources planning using interactive computer graphics routines are presented. Five specific types of probelms, including water quality prediction, parameter identification, flood management, reservoir simulation, and multiobjective reservoir-water supply planning are illustrated. In all cases, tablet digitizing routines were used for the input of spatial and other data, and vector display methods were used for the graphical output. Visual feedback is provided at all stages of the procedures. The interactive computer graphics methods provide many advantages, including convenience, flexibility, the reduction of input errors, and improved communication and response time. GRA

N80-11551# West Virginia Univ., Morgantown. Thermal-Hydraulics Lab.
EFFECT OF VERTICAL SCALE DISTORTION ON THE TEMPERATURE FIELD OF A THERMAL-HYDRAULIC MODEL
D. P. Michelotti, R. A. Bajura, and S. H. Swartz Nov. 1978 131 p refs
(Contract DI-14-34-0001-6214; OWRT Proj. C-7171(6214)(4))
(PB-297274/3; DPM-RAB/SHS-78-1; RR-9) Avail: NTIS HC A07/MF A01 CSCL 13B

The generation of electricity by pumped storage hydroelectric plants to supplement existing thermal power plant facilities for peak energy supply is discussed and the effects of a vertical scale distortion on the flow and temperature fields of a hydraulic model of a pumped storage reservoir system are assessed. Vertical to horizontal scale ratios of 1:1, 3:1, and 5:1 were considered. The model consisted of a submerged hot water jet discharging into an initially cold isothermal reservoir. The jet discharge geometry was patterned after what was considered to be a typical pumped storage outlet. Results are presented for various jet Froude numbers. GRA

N80-11552# National Oceanic and Atmospheric Administration, Highlands, N. J. Northeast Fisheries Center.
RECONNAISSANCE SURVEY OF THE DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE NEW YORK BIGHT APEX 5-14 JUNE 1973 Data Report
John Pearce, John Pearce, Clyde MacKenzie, Janice Caracciolo, and Leslie Rogers Oct. 1978 15 p refs
(PB-297333/7; NOAA-DR-ERL-MESA-41; NOAA-79051402)
Avail: NTIS HC A02/MF A01 CSCL 13B

A reconnaissance cruise to stations within the New York Bight apex provided a baseline to be used in assessing the impacts of contaminants from all sources, particularly ocean dumping, on the sediments in this area. Machine listed data and certain statistical calculations, diversity and equitability concerned with the distribution and abundance of benthic invertebrate organisms found in the New York Bight apex is provided. Data from these samples, when compared with data collected at later dates, will provide a baseline against which seasonal and temporal changes in the Bight may be assessed. GRA

N80-11553# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO HYDROLOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Audrey S. Hunderman Aug. 1979 219 p Supersedes NTIS/PS-78/0792 and NTIS/PS-77/0677
(NTIS/PS-79/0845/2; NTIS/PS-78/0792; NTIS/PS-77/0677)
Avail: NTIS HC $28.00/MF $28.00 CSCL 08H

The use of aerial and satellite imagery in hydrologic studies, including water resources planning and management, is discussed. The abstracts cover remote sensing studies of water quality, soil moisture, floodplain delineration, ice cover, and determination of snow depth and water equivalent. This updated bibliography contains 210 abstracts, 22 of which are new entries to the previous edition. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-11554 International Institute for Applied Systems Analysis, Laxenburg (Austria).
MEDEE 2: A MODEL FOR LONG TERM ENERGY DEMAND EVALUATION
Bruno Lapillonne Nov. 1978 53 p refs
(IIASA-RR-78-17) Avail: Issuing Activity

A simulation model, MEDEE 2, designed to evaluate the long-term energy demand of a country in combination with a scenario description of the main aspects of the country's social, economic, and technological evolution is described. Parameters taken into consideration are end-use total demand by category (e.g., residential space heating, service sector cooling, gasoline for intercity cars)and the potential market (maximum demand that can be technically met) for each final energy form (electricity, coal, gas, solar, oil products, and district heat). The model also calculates useful energy demand in each end-use category for

which several energy forms can be used, thus determining the substitution possibilities is energy use. The scenario description is complemented with technological parameters (e.g., insulation standards, efficiencies, fuel mix), the evolution of which is specified in a way consistent with the macroeconomic assumptions.
Author (ESA)

N80-11555*# North Georgia Area Planning and Development Commission, Dalton.
SOLAR ENERGY SYSTEM INSTALLED AT THE NORTH GEORGIA APDC OFFICE BUILDING
Aug. 1979 131 p refs Sponsored by NASA
(Contract EG-77-A-01-4075)
(NASA-CR-161273) Avail: NTIS HC A07/MF A01 CSCL 10A

A hydronic, automatic drain-down solar heating and cooling system is described. The system provides solar heat exchange from a 2,001 square foot effective collector area and supplies 65-70 percent of the building's cooling demand, 90-95 percent of the heating demand, and domestic hot water. The acceptance test plan and results, system operation and maintenance, and predicted system performance are presented. J.M.S.

N80-11556# Committee on Interstate and Foreign Commerce (U. S. House).
SOLAR COMMERCIALIZATION
Washington GPO 1979 548 p refs Hearings before the Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Commerce, 96th Congr., 1st Sess., 10-11 Jan. 1979
(GPO-43-586) Avail: Subcomm. on Energy and Power

Government policies to commercialize solar energy and a program to encourage solar energy commercialization are examined. Solar energy technology and the applications of this technology are discussed. The role of government in solar energy commercialization is debated. A.W.H.

N80-11557# Committee on Energy and Natural Resources (U.S. Senate).
ENERGY INITIATIVES OF THE 95TH CONGRESS
Washington GPO 1979 342 p refs Rept. for Comm. on Energy and Natural Resources, 96th Congr., 1st Sess., May 1979
(GPO-42-797; Publ-96-10) Avail: SOD HC

Congressional response to the energy problem is defined and assessed. Actions toward the utilization of solar energy, nuclear energy, geothermal energy, and the production of alcohol fuels, natural gas, and crude oils is reported. A.W.H.

N80-11558*# General Electric Co., Philadelphia, Pa. Space Div.
EXECUTIVE SUMMARY: MOD-1 WIND TURBINE GENERATOR ANALYSIS AND DESIGN REPORT Final Report
Mar. 1979 61 p
(Contracts NAS3-20058; EC-77-A-29-1010)
(NASA-CR-159497; DOE/NASA/0058-79/3) Avail: NTIS HC A04/MF A01 CSCL 10A

Activities leading to the detail design of a wind turbine generator having a nominal rating of 1.8 megawatts are reported. Topics covered include (1) system description; (2) structural dynamics; (3) stability analysis; (4) mechanical subassemblies design; (5) power generation subsystem; and (6) control and instrumentation subsystem. A.R.H.

N80-11559*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
AN EVALUATION OF THE NASA TECH HOUSE, INCLUDING LIVE-IN TEST RESULTS, VOLUME 1
Ira H. A. Abbott, Kenneth A. Hopping, and Warren D. Hypes Nov. 1979 72 p refs
(NASA-TP-1564; L-13440) Avail: NTIS HC A04/MF A01 CSCL 10A

The NASA Tech House was designed and constructed at the NASA Langley Research Center, Hampton, Virginia, to demonstrate and evaluate new technology potentially applicable for conservation of energy and resources and for improvements in safety and security in a single-family residence. All technology items, including solar-energy systems and a waste-water-reuse system, were evaluated under actual living conditions for a 1 year period with a family of four living in the house in their normal lifestyle. Results are presented which show overall savings in energy and resources compared with requirements for a defined similar conventional house under the same conditions. General operational experience and performance data are also included for all the various items and systems of technology incorporated into the house design. Author

N80-11560*# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
SOLAR HEATING AND COOLING SYSTEMS DESIGN AND DEVELOPMENT Quarterly Report, 9 Oct. 1976 - 9 Jan. 1977
Jan. 1977 198 p
(Contract NAS8-32093)
(NASA-CR-150873; F3737-QR-102) Avail: NTIS HC A09/MF A01 CSCL 10A

Progress in the development of prototype solar heating/cooling systems is reported. Results obtained from refinement/improvement of the single family, multifamily, and commercial systems configurations and generalized studies on several of the subsystems are presented. J.M.S.

N80-11561*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.
SILICON SOLAR CELL PROCESS DEVELOPMENT, FABRICATION AND ANALYSIS, PHASE 1 Annual Report, 15 Jun. 1978 - 15 Jun. 1979
H. I. Yoo, P. A. Iles, and D. P. Tanner 15 Jun. 1979 174 p refs
(Contract JPL-955089)
(NASA-CR-162427; DOE/JPL-955089-79/4;
DRL-74/DRD-SE) Avail: NTIS HC A08/MF A01 CSCL 10A

Solar cells from RTR ribbons, EFG (RF and RH) ribbons, dendritic webs, Silso wafers, cast silicon by HEM, silicon on ceramic, and continuous Czochralski ingots were fabricated using a standard process typical of those used currently in the silicon solar cell industry. Back surface field (BSF) processing and other process modifications were included to give preliminary indications of possible improved performance. The parameters measured included open circuit voltage, short circuit current, curve fill factor, and conversion efficiency (all taken under AM0 illumination). Also measured for typical cells were spectral response, dark I-V characteristics, minority carrier diffusion length, and photoresponse by fine light spot scanning. the results were compared to the properties of cells made from conventional single crystalline Czochralski silicon with an emphasis on statistical evaluation. Limited efforts were made to identify growth defects which will influence solar cell performance. A.R.H.

N80-11562*# Motorola, Inc., Scottsdale, Ariz.
THE AUTOMATED ARRAY ASSEMBLY TASK OF THE LOW-COST SILICON SOLAR ARRAY PROJECT, PHASE 2 Annual Report
M. G. Coleman, L. P. Grenon, E. M. Pastirik, R. A. Pryor, and T. G. Sparks Nov. 1978 213 p
(Contract JPL-954847; Proj. 2345)
(NASA-CR-162429; DOE/JPL-954847-78/4) Avail: NTIS HC A10/MF A01 CSCL 10A

An advanced process sequence for manufacturing high efficiency solar cells and modules in a cost-effective manner is discussed. Emphasis is on process simplicity and minimizing consumed materials. The process sequence incorporates texture etching, plasma processes for damage removal and patterning, ion implantation, low pressure silicon nitride deposition, and plated metal. A reliable module design is presented. Specific process step developments are given. A detailed cost analysis was performed to indicate future areas of fruitful cost reduction effort. Recommendations for advanced investigations are included.
A.R.H.

N80-11563*# Boeing Engineering and Construction, Seattle, Wash.
WIND LOADS ON FLAT PLATE PHOTOVOLTAIC ARRAY FIELDS Final Report
Ronald Miller and Donald Zimmerman Sep. 1979 112 p refs
Prepared for JPL and DOE

(Contract JPL-954833)
(NASA-CR-162424; DOE/JPL-954833-79/2) Avail: NTIS HC A06/MF A01 CSCL 10A

The aerodynamic forces resulting from winds acting on flat plate photovoltaic arrays were investigated. Local pressure distributions and total aerodynamic forces on the arrays are shown. Design loads are presented to cover the conditions of array angles relative to the ground from 20 deg to 60 deg, variable array spacings, a ground clearance gap up to 1.2 m (4 ft) and array slant heights of 2.4 m (8 ft) and 4.8 m (16 ft). Several means of alleviating the wind loads on the arrays are detailed. The expected reduction of the steady state wind velocity with the use of fences as a load alleviation device are indicated to be in excess of a factor of three for some conditions. This yields steady state wind load reductions as much as a factor of ten compared to the load incurred if no fence is used to protect the arrays. This steady state wind load reduction is offset by the increase in turbulence due to the fence but still an overall load reduction of 2.5 can be realized. Other load alleviation devices suggested are the installation of air gaps in the arrays, blocking the flow under the arrays and rounding the edges of the array. A wind tunnel test plan to supplement the theoretical study and to evaluate the load alleviation devices is outlined.
A.R.H.

N80-11564*# Hughes Research Labs., Malibu, Calif.
ELECTRON RADIATION DAMAGE OF (AlGa) As-GaAs SOLAR CELLS. Final Report, 25 Apr. 1978 - 24 Apr. 1979
R. Loo, G. S. Kamath, and R. Knechtli. Oct. 1979. 71 p. refs. Prepared for JPL.
(Contract NAS7-100)
(NASA-CR-162425) Avail: NTIS HC A04/MF A01 CSCL 10A

Solar cells (2 cm by 2 cm (AlGa) As-GaAs cells) were fabricated and then subjected to irradiation at normal incidence by electrons. The influence of junction depth and n-type buffer layer doping level on the cell's resistance to radiation damage was investigated. The study shows that (1) a 0.3 micrometer deep junction results in lower damage to the cells than does a 0.5 micrometer junction, and (2) lowering the n buffer layer doping density does not improve the radiation resistance of the cell. Rather, lowering the doping density decreases the solar cell's open circuit voltage. Some preliminary thermal annealing experiments in vacuum were performed on the (AlGa)As-GaAs solar cells damaged by 1-MeV electron irradiation. The results show that cell performance can be expected to partially recover at 200 C with more rapid and complete recovery occurring at higher temperature. For a 0.5hr anneal at 400 C, 90% of the initial power is recovered. The characteristics of the (AlGa)As-GaAs cells both before and after irradiation are described.
R.E.S.

N80-11565*# Solarex Corp., Rockville, Md.
PHASE 2 OF THE ARRAY AUTOMATED ASSEMBLY TASK FOR THE LOW COST SILICON SOLAR ARRAY PROJECT
Manfred Wihl, John Torro, Alan Scheinine, and Jack Anderson. Nov. 1978. 86 p. Sponsored by JPL and DOE.
(Contract JPL-954854)
(NASA-CR-162426; DOE/JPL-954854-77/4) Avail: NTIS HC A05/MF A01 CSCL 10A

An automated process sequence, to manufacture photovoltaic modules at a capacity of approximately 500 MW per year at a cost of approximately $0.50 per peak watt is described. Verification tests were performed and are reported along with cost predictions.
R.E.S.

N80-11566*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 10: ELECTRICAL CHARACTERISTICS OF SPECTROLAB BSF, TEXTURED, 10 OHM-CM, 300 MICRON CELLS AS A FUNCTION OF INTENSITY, TEMPERATURE AND IRRADIATION
B. E. Anspaugh, R. G. Downing, T. F. Miyahira, and R. S. Weiss. 1 Oct. 1979. 38 p.
(Contract NAS7-100)
(NASA-CR-162422; JPL-Pub-78-15-Vol-10) Avail: NTIS HC A03/MF A01 CSCL 10A

Electrical characteristics of textured, back surface field, 10 ohm cm, 300 micron N/P silicon solar cells are presented in graphical and tabular format as a function of solar illumination intensity, and temperature.
Author

N80-11567# California Univ., Berkeley. Lawrence Berkeley Lab.
ON-LINE TESTS OF ORGANIC ADDITIVES FOR THE INHIBITION OF THE PRECIPITATION OF SILICA FROM HYPERSALINE GEOTHERMAL BRINE. 2: TESTS OF NITROGEN-CONTAINING COMPOUNDS, SILANES, AND ADDITIONAL ETHOXYLATED COMPOUNDS
J. E. Harrar, F. E. Locke, C. H. Otto, Jr., L. E. Lorensen, and W. P. Frey. 1 Jun. 1979. 24 p. refs.
(Contract W-7405-eng-48)
(UCID-18195) Avail: NTIS HC A02/MF A01

Several new classes of organic compounds were screened as potential geothermal scale control agents by examining their effect on the precipitation of silica from Magmamax No. 1 brine. The substances were tested using the Brine Treatment Test System at the Niland, California, Test Site. Solutions of the test substances were injected into flowing brine at 210 C, the brine was flashed to 125 C, and then the kinetics of solids and silica precipitation from effluent brine held at 90 C were measured. Three new types of compounds were shown to have activity as precipitation inhibitors: polyethylene imines, polyethyloxazalines, and quaternary ammonium compounds containing polyoxyethylene. Among the latter, Ethoquad 18/24, which is methylpolyoxyethylene(15) octadecylammonium chloride, is the leading candidate antiscalant. It is a more powerful inhibitor of silica precipitation than the pure polyoxyethylene polymers, and it apparently has no high temperature solubility limitations. Measurements were made of the concentrations of monomeric silica and the effect of addition of inhibitor at various points in the Brine Treatment Test System.
DOE

N80-11568# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
LITHIUM-THIONYL CHLORIDE BATTERY. Quarterly Report, 1 Jan. - 31 Mar. 1979
A. N. Dey, W. Bowden, J. Miller, and P. Witalis. Jul. 1979. 69 p.
(Contract DAAB07-78-C-0563; DA Proj. 1L1-62705-AH-94)
(AD-A072358; DELET-TR-78-0563-2) Avail: NTIS HC A04/MF A01 CSCL 10/3

This report describes the Li/SOCl2 inorganic electrolyte system, which is the highest energy density system known to date. It consists of a Li anode, a carbon cathode and SOCl2 which acts both as a solvent and as a cathode active material. The electrolyte salt that has been used most extensively is LiAlCl4, but salts such as Li2B10Cl10 and Li2(AlCl3)2 have also been used successfully in this system for improving the shelf life characteristics. The main objective of this program is to develop high rate Li/SOCl2 cells and batteries for portable applications of the U. S. Army. The cells and batteries must deliver higher energy densities than are presently available and must be safe to handle under U. S. Army field conditions.
GRA

N80-11569# Princeton Univ., N. J. Plasma Physics Lab.
ENERGY STORAGE FOR TOKAMAK REACTOR CYCLES
C. H. Buchanan. Jan. 1979. 31 p. refs.
(Contract EY-76-C-02-3073)
(PPPL-1511) Avail: NTIS HC A03/MF A01

The problem of energy storage to permit continuous electrical output to the power grid of a Tokamak reactor cycle is discussed. The cycle under consideration is a 1000 second burn followed by a 100 second reignition phase.
DOE

N80-11570*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SAMICS: INPUT DATA PREPARATION
R. G. Chamberlain and R. W. Aster. 1 Mar. 1979. 35 p. ref. Revised.
(NASA-CR-162421; DOE/JPL-1012-22-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 10A

The Solar Array Manufacturing Industry Costing Standards (SAMICS) provide standard formats, data, assumptions, and procedures for estimating the price that a manufacturer would have to charge for the product of a specified manufacturing process sequence. A line-by-line explanation is given of those standard formats which describe the economically important

characteristics of the manufacturing processes and the technological structure of the companies and the industry. This revision provides an updated presentation of Format A Process Description, consistent with the October 1978 version of that form. A checklist of items which should be entered on Format A as direct expenses is included. DOE

N80-11571# Rocket Research Corp., Redmond, Wash.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEM DEVELOPMENT Interim Report
Feb. 1979 105 p refs
(Contract W-31-109-eng-38)
(ANL/ICES-TM-27) Avail: NTIS HC A06/MF A01

Heat pump centered intergrated community energy systems (HP-ICES) are energy systems for communities which provide heating, cooling, and/or other energy services through the use of heat pumps. Since heat pumps primarily transfer energy from existing and otherwise probably unused sources, rather than convert it from electrical or chemical to thermal form, HP-ICES are viewed as having significant potential for energy conservation. The System Development phase of the HP-ICES project is described and the results are reported. DOE

N80-11572# Dubin-Bloome Associates, New York.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEMS DEVELOPMENT, DUBIN-BLOOME ASSOCIATES
Fred S. Dubin, A. Halfon, and P. Herzog Feb. 1979 242 p refs
(Contract W-31-109-eng-38)
(ANL/ICES-TM-29) Avail: NTIS HC A11/MF A01

A heat pump centered integrated community energy system (HP-ICES) which provides all the heating, cooling, and other energy requirements to an entire community is investigated. The ice generating HP-ICES which uses the heat of fusion of water as a heat source for the heat pump, thus converting the water into ice, is described. The ice is stored in a bin and used the following summer for cooling. The systems performance and engineering are evaluated and a comparison is made with conventional heating systems. A.W.H.

N80-11573# Mechanical Technology, Inc., Latham, N. Y.
HIGH COP HEAT PUMP SYSTEM, PHASE 1, RESULTS
Apr. 1979 151 p
(Contract EC-77-C-01-5056)
(HCP/M5056-01, TR-1) Avail: NTIS HC A08/MF A01

The High COP Heat Pump System described is a device for recovering heat or energy usually lost in process streams by rejection to once-through cooling systems. The acetone recovers process makes use of river water to cool process streams, with the river water taking on heat in the heat exchange process. Heat or energy is thereby rejected from the process stream and is not recovered for reuse. The MTI Heat Pump System allows reuse of this energy. The estimated cost of a production Heat Pump System is $625,000 plus installation. The system can deliver 20 million BTU's per hour of latent steam energy. Based on a steam cost of $1.89 million BTU's for natural gas, the system being in service for 7884 hours per year (90% in-service rate), a 20% investment tax credit and installation costs at 50% of hardware costs; the discounted cash flow rate of return is 29.5%. Breakeven points are 2.6, 3.6, and 4 years for oil, gas and coal respectively. Details are provided about the Heat Pump System operation in the section entitled Process Description. Cycle Optimization is discussed, providing insight on the technique of determining the optimum system configuration. System Sensitivity shows how relatively little the output varies with changes in turbine and compressor efficiencies. Details of System Design are given, in which design objectives, applicable codes, working fluid, general arrangement, and component design features are discussed. Installation at the host site is analyzed, as is System Cost. Under Environmental Effects, it is shown that the Heat Pump System will increase the quality of the environment. DOE

N80-11574# Georgia Inst. of Tech., Atlanta.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEM DEVELOPMENT Interim Report
D. W. Wade, B. C. Trammel, B. S. Dixit, D. C. McCurry (McCurry and Assoc., Atlanta), and B. A. Rindt (McCurry and Assoc., Atlanta) Feb. 1979 201 p refs Prepared for Argonne National Lab.
(Contract W-31-109-eng-38)
(ANL-ICES-TM-28) Avail: NTIS HC A10/MF A01

The heat pump - wastewater heat recovery (HP-WHR) scheme is one approach to heat pump centered integrated community energy systems that proposes to reclaim low grade thermal energy from a community's wastewater effluent. The concept of an HP-WHR system is developed, the potential performance and economics of such a system is evaluated and the potential for application is examined. A thermodynamic performance analysis of a hypothetical system projects an overall system coefficient of performance of from 2.181 to 2.264 for wastewater temperatures varying from 50 F to 80 F. Primary energy source savings from the implementation of this system is projected to be 5.014 QUADS, or the energy equivalent of 687 millions tons of coal, from 1980 to the year 2000. Economic analysis shows the HP-WHR scheme to be cost competitive, on the basis of a net present value life cycle cost comparison, with conventional residential and light commercial systems. DOE

N80-11575# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEM; SYSTEM DEVELOPMENT Interim Report
Mar. 1979 153 p refs Prepared for Argonne National Lab.
(Contract W-31-109-eng-38)
(ANL/ICES-TM-31) Avail: NTIS HC A08/MF A01

Heat Pump Centered-Integrated Community Energy System (HP-ICES), based on the use of privately owned heat pumps in each building within a community, is described. The heat pumps will provide all of the space heating, space cooling and domestic hot water needs. All of the energy required is provided by electrical power, thereby eliminating a community's dependence on gas or oil supplies. The electrical power can be generated using any available fuel. The heat pumps will operate in both air and water source modes, deriving the best performance advantages of both. The water source, provided to the users by a community-owned distribution system dedicated to HP-ICES use, is closed-loop. During most of the winter heating season, the heat pumps will operate from the community water source, extracting the latent heat of the water and thereby producing ice. This ice will be pumped back into the same community main from which the water was originally withdrawn. Thus, the community water main becomes, in addition to a simple water supply, an energy slush fund from which individual users can draw as required. The resdences draw off water and return ice; the commercial buildings draw off chilled water and/or ice and return warmed water. DOE

N80-11576# Argonne National Lab., Ill. Energy and Environmental Systems Div.
TRANSFER OF ENERGY CONSERVATION TECHNOLOGY TO INDUSTRY. A PRELIMINARY SURVEY OF EXISTING MECHANISMS
Carolyn S. Colsher and Allan R. Evans Sep. 1978 55 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-28) Avail: NTIS HC A04/MF A01

To ascertain the current level of interest, capabilities, and involvement in the dissemination of information on industrial energy conservation, a survey was conducted. Based upon 150 responses from major groups, it was found that although form and level of activity varied widely, the most frequently used communications channels were workshops, seminars, conferences, energy audits, energy committees, and distribution of literature. Among the areas cited as needing improvement was (1) awareness and acquisition of literature and (2) availability of industry or process specific technical manuals for plant managers or engineers. The most successful government/industry interfaces were felt to be workshops held cooperatively with trade associations, programs to encourage sharing of generic conservation techniques between firms, and published literature. DOE

N80-11577# Argonne National Lab., Ill. Energy and Environmental Systems Div.

IMPLEMENTING ENERGY CONSERVATION STRATEGIES IN ENERGY MATERIALS TRANSPORT: U. S. DEPARTMENT OF ENERGY AND OTHER GOVERNMENT AGENCY POLICY-MAKING DECISIONS
K. M. Bertram Nov. 1978 62 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-32) Avail: NTIS HC A04/MF A01

The policy-making channels within Federal agencies for the strategy implementation efforts of U. S. Department of Energy conservation projects are defined. Government agency policy-making mechanisms are reviewed and analyzed. Emphasis was placed upon relevant Federal agencies and summary treatment given other federal, state, and local agencies. Brief case studies were made of states and localities which have significant effects upon energy materials transport systems. The main findings of the report are that two primary channels exist for effecting this project's policy-oriented strategies: inputs to legislation and inducement of regulatory involvements. DOE

N80-11578# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.
WIND ENERGY SYSTEMS: PROGRAM SUMMARY
Dec. 1978 134 p refs
(DOE/ET-0093) Avail: NTIS HC A07/MF A01

Projects to develop reliable and economically viable wind energy systems and enable the earliest possible commercialization of wind power are described. The program's general organization is also described. DOE

N80-11579# California Univ., Berkeley. Lawrence Berkeley Lab.
GEOTHERMAL ENERGY FOR INDUSTRIAL APPLICATION
R. L. Fulton Mar. 1979 19 p refs Presented at Assoc. of Energy Engineers Conf., San Francisco, Calif., 21 Mar. 1979
(Contract W-7405-eng-48)
(LBL-8919; Conf-790358-1) Avail: NTIS HC A02/MF A01

The types of geothermal resources are reviewed briefly. The uses of geothermal energy for electrical generation and non-electric direct use are described. DOE

N80-11580# Sandia Labs., Albuquerque, N. Mex.
CONCENTRATING SOLAR COLLECTOR TEST RESULTS COLLECTOR MODULE TEST FACILITY (CMTF) Summary Report, Jan. - Dec. 1978
V. E. Dudley and R. M. Workhoven Mar. 1979 54 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0977) Avail: NTIS HC A04/MF A01

The results are summarized of tests on four concentrating solar collectors at output fluid temperatures from 100 C to 300 C. DOE

N80-11581# Sandia Labs., Albuquerque, N. Mex.
HEAT LOSS REDUCTION TECHNIQUES FOR ANNULAR SOLAR RECEIVER DESIGNS
A. C. Ratzel and C. E. Simpson Feb. 1979 56 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1769) Avail: NTIS HC A04/MF A01

Analytical and experimental work was undertaken to quantify thermal conduction and natural convection heat losses in annular solar receiver geometries. Techniques studied for reducing conduction heat loss include evacuation of the annulus gas, oversizing of the annular space while maintaining slight vacuum levels, and use of gases other than air in the annular space. DOE

N80-11582# Sandia Labs., Albuquerque, N. Mex.
DESIGN CONSIDERATIONS FOR A PROPOSED PASSIVE VACUUM SOLAR ANNULAR RECEIVER
T. D. Harrison, G. N. Bond, and A. C. Ratzel Apr. 1979 43 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0982) Avail: NTIS HC A03/MF A01

Testing of an east-west 90 deg parabolic trough collector revealed problems associated with achieving and maintaining annulus pressures below 1 Pa along with other receiver problems and maintaining annulus pressures below 1 Pa along with other receiver problems (black chrome degradation) that reduced the performance of the collector. Analyses of the test results show that a vacuum in the annulus of the receiver assembly can significantly increase the amount of energy collected daily by at least 13% depending upon the reflector trough and tracking capabilities of the collector design. The problem associated with the current receiver are described and a modified passive vacuum design intended to correct the problems is presented. Test results will determine whether the value of the additional energy collected is greater than the cost of achieving the vacuum. DOE

N80-11583# Department of Energy, Washington, D. C.
UNITED STATES/CANADA ELECTRICITY EXCHANGES
Feb. 1979 233 p refs Prepared in cooperation with Department of Energy, Mines and Resources, Ottawa, Ontario
(DOE/ERA-0053) Avail: NTIS HC A11/MF A01

The United States and Canada have been cooperating in all areas of energy exchange for many years. Electrical energy was chosen to be the focus because substantial means for exchanges offer benefits that have not yet been fully exploited. There may be some bilateral benefits from additional interconnections because of the buffers which they represent against domestic imbalances. After the history of the electricity exchanges between the two countries is reviewed, opportunities and incentives and obstacles and constraints are discussed. The procedures to resolve obstacles and minimize constraints are discussed. DOE

N80-11584# Brookhaven National Lab., Upton, N. Y.
CASE STUDY OF THE BROWNELL LOW ENERGY REQUIREMENT HOUSE, THERMAL STORAGE ANALYSIS
R. Jones, R. Krajewski, and G. Dennehy 1979 15 p refs Presented at Solar Energy Storage Options Workshop, San Antonia, Tex., 18 Mar. 1979
(Contract EY-C-02-0016)
(BNL-25832; Conf-790328-6) Avail: NTIS HC A02/MF A01

An analysis is made of the thermal storage performance of an innovative residence built in the Adirondacks area of New York State by Adirondack Alternate Energy. A detailed case study report of this residence will be issued shortly by Brookhaven National Laboratory. Effective integral thermal storage provided by the exposed interior building structure, serves to keep interior temperature swings within acceptable limits. Additional remote thermal storage, is provided in the form of a large sand bed, with air ducts located below the basement floor slab. The building was instrumented and tested by BNL staff during January, February, and March of 1978, with technical assistance provided by the builder's staff. The thermal storage effects of the remote sand bed and the building materials available for thermal storage within the structure are quantified. The thermal storage performance of the exposed building materials was found to be quite effective. The existing sand bed, however, has a diurnal storage utilization factor of only 8%. Two hypothetical designs are shown which improve the storage bed utilization to 38% for a sand bed with an enhanced duct system 61% for a ducted concrete slab. Other comparisons of these storage beds are also made, including a comparison with a rock bed storage system. DOE

N80-11585# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.
REGIONAL REFERENCE ENERGY SYSTEMS: ELECTRIC UTILITY APPLICATIONS
A. Hermelee Jan. 1979 106 p refs
(Contract EY-76-C-02-0016)
(BNL-50962) Avail: NTIS HC A06/MF A01

The Reference Energy Systems (RES) projection methodology is reformulated in order to apply the format to an electric utility region. The system's approach, incorporating all resources, technologies and uses of energy, allows a utility to assess the impact of alternate technologies and policies across the entire energy system. Demand patterns for 25 end-use demand categories within the residential, commercial, industrial, and transportation sectors are developed for a base case scenario representing reasonable energy use patterns derived in a consistent manner by applying engineering techniques to the best available information. The impact of a new technology in terms of resource consumption is evaluated by modifying the energy flow paths to incorporate the new technology. Alternate paths through the network reflect the substitutability of resources and technologies for one another. DOE

N80-11586# Argonne National Lab., Ill.
DOE HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS PROJECT
J. M. Calm 1979 17 p refs Presented at Heat Pump Technol., Inform. Exchange Meeting, Gaithersburg, Md., 7 Mar. 1979
(Contract W-31-109-eng-38)
(CONF-790362-1) Avail: NTIS HC A02/MF A01

The development of centralized, distributed, and cascaded heat pump centered integrated community energy systems using both waste and natural heat is discussed. These systems show promise for cost reduction, increased reliability, and avoidance of adverse environmental effects in providing process and space heating and cooling. K.L.

N80-11587# Argonne National Lab., Ill.
WORLD ENERGY DATA SYSTEM (WENDS)
W. E. Lareau 1979 45 p refs Presented at the Spring Meeting of the Assoc. of System 2000 Users for Tech. Exchange (ASTUTE), Austin, Tex., 3 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790461-2) Avail: NTIS HC A03/MF A01

The storage of preformatted textual information in a completely user oriented data base, the World Energy Data System, is discussed. The system allows qualified users online access to nonclassfied management level data on worldwide energy technology and research and development activities. WENDS transmits up-to-date information on foreign energy technology and research and development programs to DOE program divisions, the Congress, and other U.S. Government officials going abroad. The WENDS concept is described and the method storing and retrieving the textual information is discussed. DOE

N80-11588# Bituminous Coal Research, Inc., Monroeville, Pa.
GAS GENERATOR RESEARCH AND DEVELOPMENT: BI-GAS PROCESS Interim Report, Jul. 1977 - 30 Jun. 1978
Sep. 1978 254 p refs Prepared in cooperation with Phillips Petroleum Co. Sponsored in part by the American Gas Assoc.
(Contracts EX-76-C-01-1207; EF-77-C-01-1207)
(FE-1207-49; BCR-L-919) Avail: NTIS HC A12/MF A01

Work continued on the evaluation of fluidized-bed methanation catalysts at both the bench-scale and PEDU-scale levels. In addition, assistance has been given in planning, acquisition, and assessment of the BI-GAS pilot plant operation data. Bench-scale studies included six standard life tests to evaluate 22 new fluidized-bed methanation catalysts, and one life test of samples of catalyst from PEDU Test No. 27 to determine, if possible, a reason for the decreased activity of the catalyst during the PEDU test. Of the 22 new catalysts, only one showed sufficiently high activity at normal operating temperatures to justify consideration as a PEDU test candidate; a PEDU-size sample of this catalyst was ordered. A new clear-plastic model of the PEDU methanator was constructed for the purpose of studying heat-transfer characteristics within the methanator. Initial tests agreed substantially with PEDU data and indicated that the axial tube location gave better heat transfer than the nonaxial location. DOE

N80-11589# Department of Energy, Seattle, Wash.
INCREASED ENERGY FROM BIOMASS: 1985 POSSIBILITIES AND PROBLEM. WORKING PAPERS FOR PLANNERS
1978 202 p From Pacific Northwest Bioconversion Workshop, Portland, Oreg., 24-26 Oct. 1978; Sponsored in cooperation with the Energy Offices of Alaska, Idaho, Montana, Oregon and Washington, U. S. Forest Service and Oregon State Univ.
(RLO-788-5; Conf-7810132) Avail: NTIS HC A10/MF A01

Summaries, together with charts and data in some cases, of the talks given by panelists to the Conference are compiled. The first four sessions examined current agricultural and peat applications with emphasis on wood use. The resource base for agricultural wastes, peat, and wood was evaluated. In the fifth session the barriers and constraints on the use of biomass as an energy source were identified and some possible solutions suggested. The sixth session consisted of work groups on the production of gaseous and liquid fuels, utility applications of biomass and impacts, residential and small scale applications, and biomass supply systems. Extensive summaries were provided of the discussions of each work group; these included recommendations on private and public actions necessary to foster the use of biomass for energy. DOE

N80-11590# Department of Energy, Washington, D. C.
DEPARTMENT OF ENERGY FOSSIL ENERGY EQUIPMENT DEVELOPMENT PROGRAMS
J. L. Powell, W. R. Williams (ORNL), T. K. Lau, and H. T. Jones Apr. 1979 13 p refs Presented at AICE Meeting, Houston, Tex., 1 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790405-14) Avail: NTIS HC A02/MF A01

Design, construction, and operation of synthetic fuel processing plants in the near future must consider equipment requirements to make such operations economically feasible and sound. The Department of Energy's approach is to use as much available equipment as practical, to modify and qualify equipment which is not expected to perform acceptably in its standard configuration, and to develop new equipment only if no current capability or acceptable alternative exists. Approaches, philosophy, goals, and implementation of fossil energy equipment development programs are discussed. Some results of a recent survey of industrial coal conversion equipment capabilities are presented as an example of current equipment, state-of-the-art and equipment development needs. DOE

N80-11591# Sandia Labs., Albuquerque, N. Mex.
COMPOSITION STABILITY AND DEGRADATION PRODUCTS OF SELECTED MATERIALS FOR SOLAR HEATING AND COOLING
C. Arnold, Jr. and R. E. Trujillo Mar. 1979 36 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0681) Avail: NTIS HC A03/MF A01

The composition, stability and thermal degradation products of a variety of structural plastics, heat transfer fluids, thermal storage media and sealants, which have been proposed for use in solar heating and cooling applications, were either defined generically by analysis or obtained by surveying the literature. This information will be used to aid in the assessment of the environmental impact of these materials. By gas chromatography-mass spectrometry (GCMS), Beta-phenylnaphthylamine, a suspected carcinogen, was tentatively identified as a component in the heat transfer fluid, UCON. In addition, aromatic components which might be toxic were detected in all of the heat transfer fluids that were derived from petroleum sources. By TGA (thermogravimetric analysis), it was found that polysulfide, Neoprene, poly(vinyl chloride) and poly(vinyl fluoride) were the least stable solar heating and cooling materials. In the event of a solar system failure, these materials would be expected to thermally degrade and evolve such toxic substances as H2S, HC1 and HF. Other solar heating and cooling materials were found to be more thermally stable and hence should not outgas if the solar system fails. DOE

N80-11592# Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF INTEGRATED THERMIONIC CIRCUITS FOR GEOTHERMAL HIGH-TEMPERATURE APPLICATIONS
J. Byron McCormick and D. Wilde 1979 6 p refs Presented at 20th Ann. Logging Symp., Tulsa, Okla., 3 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-723; Conf-790605-1) Avail: NTIS HC A02/MF A01

A new integrated thermionic device capable of withstanding ambient temperatures in excess of 500 C is reported. The evolution of the integrated thermionic circuit (ITC) is discussed and a set of practical device design and performance equations are demonstrated. DOE

N80-11593# Department of Energy, Washington, D. C. Economic Regulatory Administration.
STANDBY CONSERVATION PLAN NO. 2: EMERGENCY BUILDING TEMPERATURE RESTRICTIONS. ECONOMIC ANALYSIS
Feb. 1979 39 p refs
(DOE/ERA-0047) Avail: NTIS HC A03/MF A01

The emergency building temperature restrictions plan is

intended to be implemented in the event of a petroleum supply interruption or to satisfy the obligations of the United States under the International Energy Program. The economic impact of the measure was analyzed by assuming that the measure was implemented during 1980-1981 in a hypothetical petroleum shortfall of 15%. The plan is designed to reduce energy consumption by placing restrictions on thermostat settings for heating, cooling, and hot water in commercial, industrial, and public buildings. Specifically, the plan would mandate a maximum thermostat setting of 65 F for space heating, a minimum setting of 80 F for space cooling, and maximum setting of 105 F for hot water. Hotels and motels, hospitals, and areas of buildings where specific temperatures are required to maintain special equipment or supplies are exempt. Also exempt is hot water used for dishwashing and other uses where health codes require higher temperatures for sanitation. Effects of the measure on worker comfort and productivity are discussed in the appendices. DOE

N80-11594# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
REGENERATIVE FLYWHEEL ENERGY STORAGE SYSTEM
E. L. Lustenader, I. H. Edelfelt, D. W. Jones, A. B. Plunkett, E. Richter, and F. G. Turnbull 1979 30 p refs
(Contract W-7405-eng-48)
(UCRL-13982) Avail: NTIS HC A03/MF A01

The current status of a program to develop and evaluate a regenerative flywheel energy storage system is described. The system was designed for a battery/flywheel electric vehicle in the 3000 pound class. DOE

N80-11595# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
INEL GEOTHERMAL ENVIRONMENTAL PROGRAM Annual Report, 1978
Susan G. Spencer, J. F. Sullivan, and N. E. Stanley Apr. 1979 65 p refs
(Contract EY-76-C-07-1570)
(TREE-1340) Avail: NTIS HC A04/MF A01

The monitoring and research efforts were conducted to characterize the beneficial and detrimental impacts resulting from the development of moderate temperature geothermal resources in the Raft River Valley. DOE

N80-11596# Los Alamos Scientific Lab., N. Mex.
NIGHT STORAGE AND BACKUP GENERATION WITH ELECTROCHEMICAL ENGINES
G. R. B. Elliott and N. E. Vanderborgh 1978 15 p Presented at Solar Thermal Test Facilities Users Assoc. Meeting, Golden, Colo., 11 Apr. 1978
(Contract W-7405-eng-36)
(LA-UR-78-1149; Conf-780447-1) Avail: NTIS HC A02/MF A01

The design of Li-I2 electrochemical engines which both store and generate electric power is described. The conversion of heat energy to electrical energy in the electrochemical engines is examined. The laboratory performance of electrochemical engines based on the Li-I2 chemical system is discussed. The calculations for the expected performance of particular Li-I2 electrochemical engines used for storage and for each solar to electric conversion path are presented. A.W.H.

N80-11597# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
BIOLOGICAL EVALUATION OF DEVICES USED FOR ENTRAINMENT AND IMPINGEMENT LOSSES AT THERMAL POWER PLANTS
G. F. Cada and A. T. Szluha 1978 53 p refs Presented at the Intern. Symp. on the Environ. Effects of Hydraulic Eng. Works, Knoxville, Tenn., 12 Sep. 1978 Sponsored in part by NUREG and EPA
(Contract W-7405-eng-26)
(CONF-7809109-1) Avail: NTIS HC A04/MF A01

A preliminary survey of fish protection devices either in use or proposed for water intake structures was conducted for the purpose of assessing their potential for reducing impingement and entrainment. All the designs examined fit into two basic categories: behavioral screening devices systems and physical screening systems. The behavioral screening devices rely upon the ability of fish to sense artificial stimuli and respond by swimming away from hazardous areas. These systems are of little or no value in protecting planktonic fish eggs, larvae, and disoriented, heat-shocked, or lethargic adult fishes. Many of the physical screening devices, on the other hand, require the impingement of organisms against a screen before they can be removed from the intake system, thus subjecting survival. Some of the designs incorporate both behavioral and physical screening concepts. The design features and status of biological testing is discussed for each device, and an evaluation of their fish protection potential is presented. DOE

N80-11598# Midwest Research Inst., Golden, Colo.
PROCEEDINGS: SOLAR THERMAL POWER USER REVIEW PANEL MEETING
Mar. 1979 33 p Conf. held 1-2 Mar. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-69-221) Avail: NTIS HC A03/MF A01

Solar Energy Research Institute presentations on (1) the R&D mission in Solar Thermal technology; (2) TID management and organization; and (3) target audience characteristics are reviewed. Synopses of discussions on target audience needs are included. DOE

N80-11599# Ocean Data Systems, Inc., Monterey, Calif.
OTEC THERMAL RESOURCE REPORT FOR CARIBBEAN SEA PLANT SHIP 13-15 DEGREES N 75-80 DEGREES N
W. A. Wolff May 1979 41 p refs
(Contract ET-78-C-01-2898)
(HCP/T2898) Avail: NTIS HC A03/MF A01

A large and consistent thermal resource which exists in the area between 13-15 deg North latitude and 75-80 deg West longitude, was studied for possible use by a plant ship. The area is primarily in the Colombian Basin of the Caribbean Sea. The average annual delta T (surface temperature minus temperature at depth) for the area at 1000 meters is 22.4 C. At 650 meters, an adequate delta T exists, with no month of the year having a mean delta T less than 19 C. The total variability of temperature at all depths in this Caribbean area is small. Below 1000 meters, the total variation is extremely small. The area has a good mixed layer at all times of the year. It is occasionally exposed to strong winds from hurricanes. Currents generally show the same general pattern throughout the year with a predominant flow toward the west or northwest at average speeds of 40-50 cm/sec. DOE

N80-11600# Ocean Data Systems, Inc., Monterey, Calif.
OTEC THERMAL RESOURCE REPORT FOR WESTERN COAST MEXICO
W. A. Wolff May 1979 44 p refs
(Contract ET-78-C-01-2898)
(HCP/T2898) Avail: NTIS HC A03/MF A01

The site chosen for study off the western coast of Mexico between 20 deg 23 deg North latitude, 105 deg 110 deg West longitude has a temperature difference resource which is more than adequate for potential OTEC use. The annual mean delta to 1000 meters is 20.9 C. An annual mean delta T of 20.0 C is available at 800 meters. The monthly mean delta T for the coldest month of the year is 17.2 C; at 800 meters while there is some variation in the monthly mean temperature difference, even the coldest month is adequate. The mixed layer depth is very shallow throughout the entire year. Storms are a problem for this area between May and November. Low sea and swell predominate throughout the year. The surface currents are generally weak to moderate with some variation in direction during the year. The continental shelf is fairly wide for most of the region making the distance to shore from depths of 1000 meters somewhat large. There is one bay from which deep water can be reached within 5 kilometers. DOE

N80-11601# Department of Energy, Washington, D. C. Energy Information Administration.
RESIDENTIAL SECTOR ENERGY FORECASTS, NATIONAL LEVEL FOR 1978-ELECTRICITY, NATURAL GAS, NUMBER TWO FUEL OIL AND PROPANE
P. DonVito and H. Walton Mar. 1979 23 p refs
(DOE/EIA-0102/50) Avail: NTIS HC A02/MF A01

Methods and results of estimating the average 1978 price of fuels used in the residential sector are given. Average (as opposed to marginal) prices were requested and are given for electricity, natural gas, No. 2 fuel oil, and propane. The projected 1978 average fuel prices resulting from the analysis are: electricity, 4 cents/kWh; natural gas, 27.5 cents/therm; No. 2 fuel oil, 49.2 cents/gallon; and propane, 44.9 cents/gallon. Regional and seasonal variations are not discussed here. DOE

N80-11602# Midwest Research Inst., Kansas City, Mo.
STATUS OF INFORMATION FOR CONSUMERS OF SMALL WIND ENERGY SYSTEMS
P. Weis Feb. 1979 19 p refs Presented at the Symp. on Commercialization of Solar and Conserv. Technol., Miami Beach, Fla., 11 Dec. 1978
(Contract EG-77-C-01-4042)
(SERI/TP-51-158; Conf-781235-3) Avail: NTIS HC A02/MF A01

Research efforts, existing information sources, and ongoing work to improve data necessary for potential consumers of small wind energy conversion systems are presented. DOE

N80-11603# Monsanto Research Corp., Dayton, Ohio.
ENERGY STORAGE FOR SOLAR AIR CONDITIONING APPLICATIONS UTILIZING A FORM-STABLE, HIGH DENSITY POLYETHYLENE PELLET BED
R. B. Whitaker, G. H. Jenkins, G. L. Ball, and I. O. Salyer (Dayton Univ. Res. Inst.) 1979 10 p refs Presented at the Solar Energy Storage Options Workshop, San Antonio, Tex., 18 Mar. 1979
(Contract EY-76-C-04-0053)
(MLM-2598(OP); Conf-790328-1) Avail: NTIS HC A02/MF A01

The results obtained from a cost effectiveness comparison of three different methods of crosslinking high density polyethylene (HDPE) to make it a form-stable, useful thermal energy storage (TES) material are presented in some detail. In addition, the projected costs of a proposed HDPE-liquid thermal transfer system are compared to those of other liquid and air thermal transfer TES systems operative in the same 100 to 150 C range. DOE

N80-11604# Stanford Linear Accelerator Center, Calif.
HYDROGEN-ELECTRIC POWER DRIVES
F. F. Hall Oct. 1978 10 p
(Contract EY-76-C-03-0515)
(SLAC-PUB-2203; Conf-781214-2) Avail: NTIS HC A02/MF A01

Hydrogen-electric power drives consist of most or all of the following: chilled hydrogen gas tank, liquid oxygen tank, a bank of fuel cells, dc/ac inverter, ac drive motors, solid state ac speed control, dc sputter-ion vacuum pumps, steam turbine generator set and steam condenser. Each component is described. Optional uses of low pressure extraction steam and warm condensate are listed. Power drive applications are listed. Impact on public utilities, fuel supplies, and users is discussed. DOE

N80-11605# Battelle Pacific Northwest Labs., Richland, Wash.
USER MANUAL FOR GEOCITY: A COMPUTER MODEL FOR GEOTHERMAL DISTRICT HEATING COST ANALYSIS
H. D. Huber, C. L. McDonald, and S. C. Schulte Oct. 1978 200 p refs
(Contract EY-76-C-06-1830)
(PNL-2742) Avail: NTIS HC A09/MF A01

A computer model called GEOCITY was developed to systematically calculate the potential cost of district heating using hydrothermal geothermal resources. GEOCITY combines climate, demographic factors, and heat demand of the city, resource conditions, well drilling costs, design of the distribution system, tax rates, and financial factors into one systematic model. The GEOCITY program provides the flexibility to individually or collectively evaluate the impact of different economic and technical parameters, assumptions, and uncertainties on the cost of providing district heat from a geothermal resource. Both the geothermal reservoir and distribution system are simulated to model the complete district heating system. GEOCITY calculates the unit cost of energy and the unit cost of heat for the district heating system based on the principle that the present worth of the revenues will be equal to the present worth of the expenses including investment return over the economic life of the distribution system. DOE

N80-11606# Fletcher (A. L.) and Associates, Gainesville, Fla.
ANALYSIS OF FINANCIAL PROGRAMS FOR ENERGY CONSERVATION: MARKET SIMULATION (PENETRATION) MODEL
G. S. Maddala, J. W. Milliman, and R. B. Roberts Aug. 1978 273 p refs
(Contract EC-76-C-01-8662)
(HCP/M8662-1) Avail: NTIS HC A12/MF A01

A simulation model was developed to evaluate the effects of Federal financial-incentive programs. Specifically the model was developed for two industries: primary metals and stone, clay, and glass. The model is designed to be a link between existing macro models of the economy and micro engineering models. The model is also designed as a prototype that could be easily adapted to a variety of industries. The model, as currently developed, performs the following major functions: (1) evaluates the impact of different financial incentive programs on the rate of market penetration of energy-saving technologies; (2) estimates the energy saved over-time because of these programs; (3) estimates the change in energy efficiency of the capital stock because of these programs; (4) estimates the value of the energy saved and the cost to the government of the program; and (5) calculates the social benefits and costs of the program. DOE

N80-11607# Fluor Engineers and Constructors, Inc., Irvine, Calif.
HEBER GEOTHERMAL DEMONSTRATION POWER PLANT Interim Report, Aug. 1977 - Jan. 1978
Aug. 1978 67 p refs Sponsored in part by San Diego Gas and Electric Company
(EPRI Proj. 580-2)
(EPRI-ER-863; IR-1) Avail: NTIS HC A04/MF A01

The work performed from August 1977 through January 1978 pertinent to the design of the demonstration plant is reported. The Heber project objective is to design, construct and operate a power plant to produce a net power output of 45 MW/sub e/, deriving energy from a low-salinity, moderate temperature (360 F, 182 C) brine heat source available from the Heber geothermal reservoir. A binary cycle conversion system employs a light alphatic hydrocarbon mixture to derive heat from the brine supply, through heat exchangers, and drive the turbine-generator to produce power. Power output will be distributed to California's Imperial Valley. DOE

N80-11608# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE DEVELOPMENT. PHASE 1: DESIGN REQUIREMENTS
E. C. Snow and R. W. Zocher Sep. 1979 24 p refs
(Contract W-7405-eng-36)
(LA-7385-SR) Avail: NTIS HC A02/MF A01

Studies were performed to determine the necessary design requirements for a PuO2 General Purpose Heat Source (GPHS). Systems and missions applications, as well as accident conditions, were considered. The results of these studies, along with the recommended GPHS design requirements, are presented and discussed. DOE

N80-11609# Addis Translations International, Portola Valley, Calif.
CONVERSION OF RADIANT ENERGY INTO CHEMICAL ENERGY
G. Calzaferri Nov. 1978 44 p refs Transl. into ENGLISH from Chimia, Switzerland, v. 32, no. 7, Nov. 1978 p 241-253
(UCRL-Trans-11427) Avail: NTIS HC A03/MF A01

The conversion of light into chemical energy as well as the conversion of chemical energy into light leads to exciting speculations and experiments. Reversible photoredox reactions appear to be the most promising chemical system for converting solar energy into chemical or electrochemical energy. Finding selective electrode material in photogalvanic cells is one of the problems to be solved. Selective electrode material for Fe(+3)/sub sq/Fe(+2)/sub sq was found in the thionine/iron system as well as in the iodine/iron system. Attention should now be focused on reversible two or more photon processes at low light intensities

because clevage of water in the visible region cannot be done with one photon. DOE

N80-11610# Argonne National Lab., Ill.
CHEMICAL ENGINEERING DIVISION BASIC ENERGY SCIENCES RESEARCH. Report, Jul. 1976 - Sep. 1977
1978. 112 p. refs.
(Contract W-31-109-eng-38)
(ANL-78-42) Avail: NTIS. HC A06/MF A01.

Studies in basic energy science covered many different activities, nearly all of which were designed to gain information required for a better understanding of systems important to national needs in energy and environment. Studies of associating gases included measurements of thermal conductivities and basic molecular orbital calculations. Raman spectroscopy and spectrophotometry were used to determine thermodynamic and spectroscopic data on salt vapor complexes. Polarized Raman spectra of As2S3 thin films and vapors were recorded. Halogenation of lanthanide oxides with aluminum chloride allowed the separation of the resultant chloride complexes by vapor transport. Electrochemical titrations were used to obtain the solubility product of iron sulfide in molten LiCl-KCl eutectic. Solubility products of eleven sulfides in the same eutectic mixture were calculated. Galvanostatic techniques were used to study metal deposition/dissolution reactions in molten salts. Activity-coefficients of lithium in lithium-lead alloys were determined electrochemically; phase diagrams of ternary alloys of Li-Al-Mg and Li-Ca-Mg were computed. Thermodynamic studies are being made of the sorption of hydrogen by Li-Al and Li-Pb alloys. DOE

N80-11611# Eidgenoessisches Institut fuer Reaktorforschung, Wuerenlingen (Switzerland).
ON THE BEHAVIOUR OF HELIOSTATS IN THE EXTREME WINTER CLIMATE OF THE SWISS MOUNTAINS
M. Real and P. Kesselring. 1978. 20 p. refs. Presented at the Symp. on Solar Thermal Power Stations, Koeln, Germany, 11 Apr. 1978.
(AED-Conf-78-212-001; Conf-780418-2) Avail: NTIS. HC A02/MF A01.

A baby heliostat of 0.25 sq m mirror surface was investigated for reflection losses due to icing phenomena on the mirror surface. The test facility and the mechanically guided heliostat are described. A comparison of the heliostat reflected and direct solar radiation is discussed. A.W.H.

N80-11612# Transportation and Economic Research Associates, Inc., Arlington, Va.
DISAGGREGATING PIES FUEL FORECASTS, VALIDATING PIES TRANSPORTATION MODEL DATA BASE, AND OTHER TECHNICAL SERVICES
15 Sep. 1978. 84 p.
(Contract EC-77-C-01-8578)
(TID-29000) Avail: NTIS. HC A05/MF A01.

Three research tasks concerned with modifications and/or alterations to the PIES (Project Independence Evaluation System) and one auxiliary research task are reported. The first task, a modification to the transportation data base for petroleum refining regions, was necessitated by a proposed change of the present seven refining districts to ten refining districts. Five of the Standard Tables on transportation costs required changes. Tariffs and route descriptions are given in interregional pipeline rates for crude oil and petroleum products. Pipeline tariffs and tanker costs for distribution of Alaskan oil to PIES refining regions are tabulated. In the second task the structure of the coal transportation submodel in PIES was changed by building a simplified transshipment network which makes it possible to easily track coal from the mine to the point of use. The third task is a brief description of natural gas rates and rate making practices in the U.S. The fourth task analyzes differences in actual wholesale prices in various other locations in a region (as opposed to the PIES centroid) with respect to the differences in transportation costs. DOE

N80-11613# Sandia Labs., Albuquerque, N. Mex. Midtemperature Solar Systems Test Div.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY (MSSTF) PROJECT TEST RESULTS: PHASE 4A MSSTF SYSTEM OPERATION
Thomas D. Harrison and William H. McCulloch. Nov. 1978. 53 p. refs.
(Contract EY-76-C-04-0789)
(SAND-78-1088) Avail: NTIS. HC A04/MF A01.

The results of testing the Department of Energy's Midtemperature Solar Systems Test Facility (MSSTF) at Sandia Laboratories, Albuquerque, New Mexico are summarized. The system is a dispersed power system that collects solar energy and supplies both the electrical and thermal energy demands of a representative load. Testing was done between July 1976 and March 1978. The Phase IVA MSSTF studied consists of: (1) a 200-m sq m (2160-sq ft) east-west parabolic trough collector field subsystem, which collects a measured 431-kWh thermal on a typical winter day and as estimated 483 kWh on a typical summer day; (2) a high-temperature thermocline storage subsystem, capable of storing 278-kWh thermal energy in Therminol 66 between 240 C and 310 C; (3) fluid-transfer equipment, including piping, pumps, and valves; (4) a prime-mover subsystem (toluene heat exchanger and turbine/generator) to convert thermal energy to electrical energy; and (5) a control and data-acquisition system. A brief description of each of these elements is given, and test results are reported. DOE

N80-11614# California Univ., Berkeley. Lawrence Berkeley Lab.
ENERGY CONSERVATION: POLICY ISSUES AND END-USE SCENARIOS OF SAVINGS POTENTIAL. PART 3: POLICY BARRIERS AND INVESTMENT DECISIONS IN INDUSTRY
Sep. 1978. 54 p.
(Contract W-7405-eng-48)
(LBL-7896-Pt-3) Avail: NTIS. HC A04/MF A01.

Industrial decision making was investigated with respect to energy conservation. It was concluded that government policy could be formulated to encourage conservation investments, but government intervention should be limited to those situations where it is both necessary and likely to be effective. To assist policy makers in understanding the industrial decision making process and recognizing the factors which prevent a measure from being adopted, a methodology is developed that can be applied to most conservation measures in all industrial subsectors. The methodology is summarized in two flow charts and a matrix. DOE

N80-11615# Institute of Gas Technology, Chicago, Ill.
INFLUENCE OF ELECTROLYTE COMPOSITION ON ELECTRODE KINETICS IN THE MOLTEN CARBONATE FUEL CELL
P. Ang and A. F. Sammells. 1978. 30 p. refs. Presented at the 2d Intern. Symp. on Molten Salts, Pittsburgh, Pa., 15-20 Oct. 1978; sponsored by the Electrochem. Soc., Inc.
(Contract EM-78-C-03-1735)
(CONF-781063-2) Avail: NTIS. HC A03/MF A01.

Electrode Kinetics for fuel oxidation on nickel and cobalt electrodes is discussed for three selected molten carbonate mixtures. Activation kinetics under the probable mixed-control conditions present in the electrochemical half-cell were determined using a potential step technique. With all melts, the highest exchange current values were found on nickel anodes, and the highest of these values were found for the melt comprised of 43.5 mole percent Li2CO3 31.5 mole percent Na2CO3 25 mole percent K2CO3. For this ternary melt the exchange current density on nickel varied from 78 mA/sq cm for intermediate-Btu fuel to 22 mA/sq cm for low-Btu fuel at 650 C. The exchange current density was found to have a reaction order of around 0.25 for hydrogen, carbon dioxide, and water. Electrochemical performance on the two anode materials in the three melts is discussed, and a tentative reaction mechanism for the oxidation reaction is suggested. DOE

N80-11616# Los Alamos Scientific Lab., N. Mex.
ENERGY SAVINGS FOR A SOLAR HEATED AND COOLED BUILDING THROUGH ADAPTIVE OPTIMAL CONTROL
D. R. Farris and James L. Melsa. Nov. 1978. 9 p. refs. Presented at IEEE Conf. on Decision and Control, San Diego, Calif., 10 Jan. 1979. Prepared in cooperation with Notre Dame Univ.
(Contract W-7405-eng-36)
(LA-UR-78-2986; Conf-790105-1) Avail: NTIS. HC A02/MF A01.

The applicability of adaptive and optimal control techniques to the control of heating, ventilating, and air conditioning systems of solar heated and cooled buildings is described. The suitability of optimal and adaptive concepts is discussed and the selected approach is explained. An integral quadratic cost functional to define optimal performance and an identification process to produce a linearized building model are discussed. The building model is described and heating system simulations of three versions of the adaptive optimal controller are reported along with a simulation of a conventional controller for comparison. DOE

N80-11617# Midwest Research Inst., Golden, Colo.
RESEARCH OVERVIEW OF BIOLOGICAL AND CHEMICAL CONVERSION METHODS AND IDENTIFICATION OF KEY RESEARCH AREAS FOR SERI. Final Report
T. A. Milne, John S. Connolly, Robert E. Inman, Thomas B. Reed, and Michael Seibert. Sep. 1978. 75 p. refs.
(Contract EG-77-C-01-4042)
(SERI/TR-33-067) Avail: NTIS. HC A04/MF A01.
The current and future research areas of the biological and chemical conversion branch is presented. Energy and petrochemical substitutes from biomass, thermochemical conversion, and photoconversion are research areas examined. DOE

N80-11618# California Univ., Livermore. Lawrence Livermore Lab.
MATERIALS PROGRAM FOR FIBER COMPOSITE FLYWHEELS
J. A. Rinde. 10 Oct. 1978. 13 p. refs. Presented at 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978.
(Contract W-7405-eng-48)
(UCRL-81724; Conf-781046-9) Avail: NTIS. HC A02/MF A01.
A rubberized epoxy resin that offers improved fracture toughness and suitable performance at moderately elevated temperatures (up to 70 C) and six epoxy resins for service at 150 C were evaluated. In addition, the rubberized epoxy resin was used as a matrix in Kevlar 49 composites and engineering design data were generated. Stress rupture tests were initiated on E-glass composites at load levels of 60% to 85% of short term strength. Dynamic fatigue tests on Kevlar 49 composites in the tension-tension mode and fatigue tests on a Kevlar 49 composite ring specimen at 50% to 75% ultimate strength were begun. DOE

N80-11619# Argonne National Lab., Ill.
PRELIMINARY MATERIALS ASSESSMENT IN SOLAR DEMONSTRATION SYSTEMS
C. F. Cheng. Nov. 1978. 29 p. refs. Presented at the ASME Energy Technol. Conf., Houston, Tex., 5 Nov. 1978.
(Contract W-31-109-eng-38)
(ANL/EES-CP-30; Conf-781112-8) Avail: NTIS. HC A03/MF A01.
Materials performance in solar demonstration systems is assessed from published literature and service experience. The solar demonstration systems and the materials used in the collector and transport systems are summarized. DOE

N80-11620# Chalmers Univ. of Technology, Goteborg (Sweden). Institutionen foer Fysik.
SPECTRALLY SELECTIVE SURFACES WITH COATINGS COMPRISED OF ULTRAFINE METAL PARTICLES
C. G. Granqvist. 1978. 15 p. refs. Presented at the Symp. on Solar-Thermal Power Stations, Cologne, 12 Apr. 1978.
(AED-Conf-78-212-004; Conf-780425-7) Avail: NTIS. HC A02/MF A01.
Efficient photothermal conversion of solar energy requires high absorption at wavelengths lambda > lambda/sub c/ and low absorption at lambda > lambda/sub c/, where lambda/sub c/ is approximately 2 micro m. Such spectrally selective surfaces can be prepared by coating metal plates with films consisting of ultrafine metal particles dispersed in an insulating matrix. Gas evaporated Cr particles with diameters approximately 10 nm were used. Spectrophotometry in the range 0.3 < lambda < 25 micron m displayed good spectral selectivity. The parameters governing the position of lambda/sub c/ were determined. The crucial importance of the shape of the particles was documented, and, in general, increased eccentricity shifted lambda/sub c/ toward larger wavelengths. A similar shift was obtained for nonhomogeneous spheres whose dielectric core size was enlarged. DOE

N80-11621# Department of Energy, Washington, D. C.
INTERNATIONAL COAL TECHNOLOGY SUMMARY DOCUMENT
Dec. 1978. 113 p. refs. Prepared in cooperation with TRW, Inc., McLean, Va.
(Contract EX-76-C-10-3885)
(DOE/PE-0010; HCP/P3885) Avail: NTIS. HC A06/MF A01.
The status of coal technologies expected to be available for commercial application by 1990 is reviewed. Technologies discussed include direct combustion using flue gas desulfurization, fluidized bed combustion, gasification, liquefaction, and advanced power cycles. Coal mining and transportation are also reviewed. Social, environmental, safety, and health constraints on coal use are considered. K.L.

N80-11622# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
LATERAL AND TILT WHIRL MODES OF FLEXIBLY MOUNTED FLYWHEEL SYSTEMS
C. W. Bert and T. L. C. Chen. Dec. 1978. 36 p. refs. Presented at the 49th Shock and Vibration Symp., Washington, D. C., 17-19 Oct. 1978. Prepared for Sandia Labs.
(Contract EY-76-C-04-0789)
(SAND-78-7070; OU-AMNE-78-5; Conf-7810154-1) Avail: NTIS. HC A03/MF A01.
High performance, composite material flywheel systems were driven by an air turbine at the Sandia Livermore spin test facility. An analysis of the systems considering six degrees of freedom was applied to two versions of a specific design. DOE

N80-11623# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
WHIRLING RESPONSE AND STABILITY OF FLEXIBLY MOUNTED, RING-TYPE FLYWHEEL SYSTEMS
T. L. C. Chen and C. W. Bert. Nov. 1978. 122 p. refs.
(Contract EY-76-C-04-0789)
(SAND-78-7073; OU-AMNE-78-6) Avail: NTIS. HC A06/MF A01.
Rim type composite material flywheels are examined. Free whirling, stability, and forced whirling are examined for these fly-wheel systems. In the free whirling analysis, predicted critical speeds are encountered in the design operating speed range. Practical ways to increase such critical speeds are suggested. Effects of material internal damping on the stability of the system are discussed. DOE

N80-11624# Argonne National Lab., Ill.
UNDERGROUND PUMPED HYDRO STORAGE: AN OVERVIEW
S. W. Tam, C. A. Blomquist, and G. T. Kartsounes. 1978. 13 p. refs. Presented at the 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978.
(Contract W-31-109-eng-38)
(CONF-781046-1) Avail: NTIS. HC A02/MF A01.
The status of underground pumped hydro storage (UPHS) for electric utility peaking and energy storage applications is reviewed. The salient features of major recent studies are reviewed. Turbomachinery options and advances in high head pump/turbines are discussed. The effect of head, capacity, turbomachinery unit size and type, and other performance variables on the cost of a UPHS plant are presented. Market potential, siting criteria, lower reservoir construction, and geological related issues are addressed. The environmental impact of a UPHS plant is reduced from comparable facilities, and these issues and other safety concerns are presented. DOE

N80-11625# Argonne National Lab., Ill. Energy and Environmental Systems Div.
EVALUATION OF TURBOMACHINERY FOR COMPRESSED AIR ENERGY STORAGE PLANTS
George T. Kartsounes and Choong S. Kim. 1978. 11 p. refs. Presented at Mech. and Magnetic Energy Storage Contractors Inform. Exchange Conf., Luray, Va., 24-26 Oct. 1978.

(Contract W-31-109-eng-38)
(CONF-781046-6) Avail: NTIS HC A02/MF A01

Turbomachinery options for compressed air energy storage plants are presented. The plant is divided into four subsystems: a turbine system, compressor system, motor/generator, and an underground air storage reservoir. Plant performance is presented in terms of five parameters: specific air flow rate, specific heat rate, specific storage volume, specific compression rate, and overall plant efficiency. The capital and operating costs of the plant as a function of the turbomachinery options are presented. DOE

N80-11626# Williams (O. G.) and Skaggs (R. L.), Las Vegas, Nev.
SOLAR PARABOLIC TROUGH FORMING PROCESS Final Report
O. G. Williams and R. L. Skaggs 31 May 1978 58 p refs
(Grant EG-77-G-04-4158)
(ALO-4158-1) Avail: NTIS HC A04/MF A01

A new forming process is presented which exceeds an 8/1 concentration. Expanding on work previously done, many variables were investigated. Using one foot long trough samples, a high degree of slope accuracy was obtained. The forming process eliminated the need for ribs, boxes or other devices now used to maintain the parabolic shape of a solar parabolic shell. The process, in brief, involves (1) alloy aluminum; (2) moments; (3) temperature; (4) time; (5) thickness; (6) bearings; (7) flange angle bend; (8) hardness; (9) lengthwise sag; (10) material flatness; and (11) aperture control. DOE

N80-11627# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MAXIMUM POWER TRACKERS FOR PHOTOVOLTAIC ARRAYS
E. E. Landsman 1977 6 p refs Presented at the 13th IEEE Photovoltaic Specialists' Conf., Washington, D. C., 5-8 Jun. 1978
(Contract EY-76-C-02-4094)
(COO-4094-17) Avail: NTIS HC A02/MF A01

Progress is reported on the following tasks: agriculture applications; Natural Bridges National Monument, rooftop test bed; Chicago Museum of Science and Industry; data management; materials, processes, and testing, and power conditioning and handling. DOE

N80-11628# Argonne National Lab., Ill. Energy and Environmental Systems Div.
DESIGN OPTIMIZATION OF AQUIFER RESERVOIR-BASED COMPRESSED AIR STORAGE SYSTEMS
Frederick W. Aherns 1978 12 p refs Presented at the Mech. and Magnetic Energy Storage Contractors' Inform. Exchange Conf., Luray, Va., 24-16 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-781046-5) Avail: NTIS HC A02/MF A01

The application of a general compressed air energy storage (CAES) power system design optimization methodology to the class of CAES plants having aquifer air storage reservoirs is discussed. Performance and economic models for the aquifer reservoir, wells, piping, and air compression system are described. Identification of designs which minimize the subsystem power generation cost, while satisfying constraints related to the geology, equipment, and utility load curve are presented. The design specification resulting from the optimization procedure includes: land area to be purchased, well depth, number of wells, well spacing, wellbore diameter, main pipeline diameter, required compressor system power and discharge pressure, and required compression time durations for each day of the week. DOE

N80-11629# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatiale.
THE DYNAMIC RESPONSE OF SOLAR CELLS [COMPORTEMENT ELECTRIQUE DYNAMIQUE DE CELLULES SOLAIRES]
Jean-Pierre Catani Oct. 1978 92 p refs In FRENCH; ENGLISH summary
(CNES-NT-85) Avail: NTIS HC A05/MF A01

The dynamic response of solar generators was studied in relation to the design of power conditioning equipment and for applications in electromagnetic compatibility analyses. A mathematical model of solar cells was developed from impedance measurements performed under various conditions of temperature, charge, and illumination, before and after electron irradiation. This model was compared with that derived from the PN junction theory associated with static measurements. Using this data, an integration method was developed to simulate the dynamic response of a nominally illuminated solar generator under ambient ground conditions. Results show that it is possible to calculate the impedance of a solar cell in function of the frequency up to 1MHz, or for its equivalent circuit given static measurements. Author (ESA)

N80-11630# Gesellschaft fuer Wirtschaftliche Bautechnik m.b.H., Munich (West Germany). Inst. fuer Angewandte Bauforschung.
INVESTIGATION OF THE APPLICABILITY OF TECHNICAL SYSTEMS UTILIZING SOLAR ENERGY FOR THE HEAT SUPPLY OF BUILDINGS Final Report
Josef Franz Holbl and Hannes Krack Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 240 p refs In GERMAN; ENGLISH summary
(Contract BMFT-ET-4056-A)
(BMFT-FB-T-78-48) Avail: NTIS HC A11/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 50,40

The use of solar energy to heat German army barracks was studied. Possibilities for the installation of solar energy systems for heating water and for general heating purposes were considered. Information on available building types, their construction, and intended use, as well as climatic parameters, was compiled. Four categories were analyzed. Results indicate that energy costs can be reduced by between 40 percent to 55 percent in the case of barracks. It is recommended to install four solar heating systems, two in buildings with flat roofs and two in buildings with pitched roofs. It is intended to study the influence of roof type on heating efficiency. Author (ESA)

N80-11631# Stockholm Univ. (Sweden). Dept. of Meteorology.
INTERACTION IN LIMITED ARRAYS OF WINDMILLS: REVIEW OF EARLIER RESULTS FROM A SIMPLE MODEL AND A PRESENTATION OF THE CAPABILITIES OF A DYNAMIC PBL MODEL
Carl Crafoord 27 Mar. 1979 57 p refs Prepared in cooperation with Intern. Meteorol. Inst.
(DM-26) Avail: NTIS HC A04/MF A01

The problem of how closely packed an array of windmills can be erected without unduly interfering with each other is considered. A general technical background for the behavior of a single windmill in a homogeneous flow, together with a list of important parameters for the general performance of a group, is given. Earlier results for neutral stratification are reviewed and presented in a slightly different manner more fully illustrating the trade-off between windmill density and mean efficiency as function of group size. The analogy between plumes and wakes as a basis for a model formulation is reviewed. Preliminary results indicate a variation in mean efficiency of 13% for a group with 80 units, which may correspond to a factor of 2.5 in area coverage. A dynamic one dimensional planetary boundary layer model is presented and redesigned for simulation experiments. Using it, the regeneration of the wind profiles behind a windmill unit is studied for different ambient conditions. Preliminary results indicate a variation of up to a factor of 9 in the rate of regeneration of the profiles. How this data might be considered in a statistical analysis is discussed. Author (ESA)

N80-11632# Austrian Solar and Space Agency, Vienna.
SOLAR ENERGY WITH LATENT HEAT STORAGE: FUNDAMENTALS AND APPLICATIONS [SONNENENERGIE. LATENTSPEICHER. GRUNDLAGEN AND ANWENDUNGEN]
Oct. 1978 78 p refs In GERMAN; ENGLISH summary
(ASSA-10/1978) Avail: NTIS HC A05/MF A01

Solar heating systems are examined in terms of their year-round efficiency. The desirability of storing the surplus of solar energy in summer for the heating period autumn and winter is mentioned. Possible storage schemes, such as water storage, ground storage, and latent heat storage, are examined. It is

shown that water and ground as storage mediums have only small thermal storage capacity and, therefore, need large volumes. As far as latent-heat-storage is concerned, a phase-conversion (solid to liquid) is caused by the supply of heat and this process is reversed again by the withdrawal of heat. Thus, the heat is being stored in the form of conversion energy and the storage volumes become considerably lower since the energy density is much higher. Possible media for latent storage are compiled and their features described. The present state of technology is explained by illustrating applications. Economic aspects and conclusions are presented. Author (ESA)

N80-11633# Environmental Law Inst., Washington, D. C.
SOLAR ACCESS LAW. PROTECTING ACCESS TO SUNLIGHT FOR SOLAR ENERGY SYSTEMS
Gail Boyer Hayes May 1979 173 p refs Sponsored in part by DOE
(Grant HUD-H-8213G)
(PB-296532/5) Avail: NTIS HC A08/MF A01 CSCL 10A

Legal strategies to assure that owners of solar energy systems receive sunlight on their collectors are evaluated. The protection of solar access in developed urban and suburban areas is emphasized. Recommendations are made and conclusions are reached about laws and zoning and land use regulations that offer the best protection of solar rights. K.L.

N80-11634# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKSHOP ASSESSMENT, PHASE 3. ENERGY PROGRAMS Final Report
Aug. 1979 106 p
(Grant EPA-T-900591-03)
(PB-298587/7; EPA-600/8-79-023H) Avail: NTIS HC A06/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

In addition to well-established programs in nuclear engineering, mining, petroleum and natural gas technology and engineering, there are programs in energy conversion, energy engineering and policy, energy conversion and resources, energy resources management, and several others which represent recent innovative approaches to the broad spectrum of energy problems. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-11635 International Institute for Applied Systems Analysis, Laxenburg (Austria).
THE SMEARED CONCENTRATION APPROXIMATION METHOD: A SIMPLIFIED AIR POLLUTION DISPERSION METHODOLOGY FOR REGIONAL ANALYSIS
R. L. Dennis Jul. 1978 78 p refs
(IIASA-RR-78-9) Avail: Issuing Activity

A methodology, the smeared concentration approximation (SCA) method, which allows the inclusion of air pollution dispersion in the long-term analysis of air pollution impact without the direct use of complex, large air pollution models is developed. The SCA method is intended for use in models and analysis concerned with long-term policy analysis and where simulation is one of the important techniques employed. The SCA method centers around short-range transport of dispersion on the urban scale for each of three emission classes: low-level area sources, medium-level point sources, and high-level point sources. A central assumption of the SCA method is that a single spatially averaged exposure for an urban area is a sufficient indicator of air pollution exposure for long-term policy option analysis. Initial validation of the SCA method indicates that the spatially averaged exposure calculated by the means of the SCA dispersion parameters is within 20% of the spatially averaged monitoring data. Author (ESA)

N80-11636# Missouri Univ. - Columbia. Dept. of Civil Engineering.
METAL HYDROXIDES FROM ELECTROPLATING SLUDGE CHARACTERIZATION AND METAL RECOVERY Final Report, 29 Jul. 1977 - 18 Feb. 1978
John T. Novak, Mriganka M. Ghosh, William Knoche, Thomas Clevenger, and Charles Yeh May 1979 281 p refs
(Contract F08635-77-C-0281; AF Proj. 2054)
(AD-A070233; AFESC/ESL-TR-79-09) Avail: NTIS HC A13/MF A01 CSCL 13/2

The purpose of this project was to investigate the precipitation of metals from plating facilities, to determine the dewatering characteristics of the resultant metal hydroxide slurries and to evaluate the solvent extraction process for metal recovery and reuse. Individual metals were found to precipitate according to the theoretical solubility calculations, however, mixed metals solutions containing Cr (III) often would form 'co-precipitants.' The co-precipitation would result in certain metals precipitating at pH levels below the range of predicted insolubility. Colloidal metal hydroxides remaining after settling could be removed by filtration using either a gravity filter or diatomaceous precoat pressure filter. Metal removal was effective (≈95%) but the filtrate metal concentrations were not sufficiently low to meet effluent requirements. Sludges produced by hydroxide precipitation varied depending upon the pH of precipitation and the specific metals in the sludge. Sludge dewatering characteristics were found to be determined by the mean particle size of the flocs. Polymers improved dewatering rates by increasing the mean floc size. Freshly precipitated chronium hydroxide sludges were found to pass through filtering media because of floc break-up. Polymer conditioning was necessary to prevent sludge penetration through the filter media. Solvent extraction could be used to selectively extract individual metals from a mixed metal sludge but the process was not economical. GRA

N80-11637# Oak Ridge National Lab., Tenn.
KINETIC STUDIES OF GAS MIXTURES AND THEIR APPLICATION TO GAS LASERS AND POLLUTANT DETECTION
C. H. Chen, J. D. Judish, and M. G. Payne 1978 6 p Presented at Conf. on Appl. of Small Accelerators, Denton, Tex., 6 Nov. 1978
(Contract W-7405-eng-26)
(CONF-781113-6) Avail: NTIS HC A02/MF A01

A 2 MeV proton beam with a 10 ns pulse width was used to excite various gas mixtures. The emitted vacuum ultraviolet and ultraviolet visible photons passing through separate monochromators were detected by using single photon counting techniques. Time resolved and time integrated fluorescent spectroscopy was used to study the detailed mechanism of excitation energy transfer, Penning ionization, charge transfer, and ion-ion recombination processes. The energy precursors of various excited species in a number of gas mixtures were identified, and the quenching rates of excited atoms and ions by numerous small molecules were measured. Relative fluorescence efficiencies and energy pathways of proton excited gas mixtures were used to study the kinetics of high power gas lasers. An ultrasensitive method for the detection of certain pollutants utilizing energy or charge transfer processes in proton excited gas mixtures was developed. DOE

N80-11638# Oak Ridge National Lab., Tenn. Health and Safety Research Div.
ANALYSIS OF ORGANIC POLLUTANTS BY SYNCHRONOUS LUMINESCENCE SPECTROMETRY
T. Vo-Dinh, R. B. Gammage, and A. R. Hawthrone 1978 14 p refs Presented at the Third Intern. Symp. On Polynucl. Aromatic Hydrocarbons, Columbus, Ohio, Oct. 1978
(Contract W-7405-eng-26)
(CONF-781039-8) Avail: NTIS HC A02/MF A01

A synchronous luminescence technique was developed for the identification and quantification of polynuclear aromatic hydrocarbons in mixtures. The synchronous method was applied to fluorescence as well as phosphorescence analysis of samples of environmental interest. DOE

N80-11639# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.
ENVIRONMENTAL CONTROL TECHNOLOGY FOR CARBON DIOXIDE
Meyer Steinberg, A. S. Albanese, and Vi-Duong Dang Sep. 1978 36 p refs Presented at the 71st Ann. Meeting of the

Am. Inst. of Chem. Engr., Miami, Fla., 12-16 Nov. 1978
(Contract EY-76-C-02-0016)
(BNL-24999; Conf-781110-10) Avail: NTIS HC A03/MF A01

Routes for removal, recovery, disposal, and reuse of CO2 from various control points in the global system are reviewed. The energy and mass balances for various routes are used as a criteria for evaluation. Alternative energy sources are assessed as a means of control. DOE

N80-11640# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. SOLID WASTE PROGRAMS Final Report
Aug. 1979 24 p
(Grant EPA-T-900591-03)
(PB-298586/9; EPA-600/8-79-023G) Avail: NTIS HC A02/MF A01, also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory of solid management programs and education courses is presented. The institution, program title, department, and degrees offered are identified. Approximately 74 programs are described. A.W.H.

N80-11641# Los Alamos Scientific Lab., N. Mex.
ENERGY DEVELOPMENT vs WATER QUALITY IN THE UPPER COLORADO AND UPPER MISSOURI RIVER BASINS
A. B. Bishop, S. L. Klemetson, M. F. Torpy, and M. McKee Oct. 1978 84 p refs
(Contract W-7405-eng-36)
(LA-7497-MS) Avail: NTIS HC A05/MF A01

Impacts from energy developments are discussed in terms of the various pollutants generated by energy extraction and processing activities, and the pollution transport mechanisms and pathways by which they can enter surface and groundwater. The implications for energy development of the water quality aspects of legislative requirements and regulations are discussed. Many of the potential water pollution problems associated with energy development will occur through the transport of pollutants from air pollution and solid waste disposal. The consumptive use of all water withdrawn for energy processing as a pollution control measure raises three important issues-each of which represents a potential conflict between energy developers compliance with the legislation and western water law: (1) junior rights and water transfer, (2) the beneficial use question, and (3) the reasonable use measure of certain water quality practices. DOE

N80-11642# Illinois Inst. of Tech., Chicago.
ENVIRONMENTAL EFFECTS OF HEAT AND MOISTURE RELEASE FROM ATMOSPHERIC SPRAY COOLING SYSTEMS
S. Chaturvedi and R. W. Porter 1978 11 p refs Presented at the 2d Thermophys. and Heat Transfer Conf., Palo Alto, Calif., 24 May 1978
(Contract EC-77-S-02-4531)
(CONF-780520-7) Avail: NTIS HC A02/MF A01

A thermal model for atmospheric sprays including heating and humidification of downwind elements was developed. Ambient wind and turbulent diffusivity profiles which depend on aerodynamic surface roughness and atmospheric stability were presumed to prevail throughout the domain of interest. The convective diffusion equation governing the enthalpy of the air-moisture mixture was integrated numerically continuing through and beyond the source, and the local temperature and vapor concentration were computed. Fogging is described by an equilibrium model which requires condensation of vapor in excess of saturation. Ground level dispersent concentration and height are compared with those of ground level line sources and of field and wind tunnel experiments with a finite source. DOE

N80-11643# World Meteorological Organization, Geneva (Switzerland).
METEOROLOGY AND THE HUMAN ENVIRONMENT
J. A. Izrael (USSR Hydrometeorol. Serv.), F. Kenneth Hare (Toronto Univ., Canada), and Fereidoon Hashemi 1979 54 p refs Presented at 29th Session of the WMO Executive Comm., 1977
(WMO-577; SER-13; ISBN-92-63-10517-0; Rept-13) Avail: NTIS HC A04/MF A01; WMO, Geneva SWFR 6

The texts of three lectures on man and his relationship to the environment are given. First, the problem of air pollution and other aspects of environmental pollution is dealt with, including the concept of monitoring and regulating the quality of the environment. Next, climatic variability, environmental change and human response is treated. Finally, climatology and the fight against desertification is surveyed. Author (ESA)

N80-11644# World Meteorological Organization, Geneva (Switzerland).
IMPLEMENTATION PLAN FOR THE DETERMINATION OF THE ATMOSPHERIC CONTRIBUTION OF PETROLEUM HYDROCARBONS TO THE OCEANS.
Robert A. Duce 1979 59 p refs Sponsored by UN Environ. Programme (UNEP)
(WMO-504; SER-12; ISBN-92-63-10504-9) Avail: NTIS HC A04/MF A01; WMO, Geneva SWFR 15

An implementation plan for the collection and analysis methodology to determine the atmospheric concentration and fluxes of petroleum hydrocarbons entering the open ocean from the atmosphere is developed. Included are detailed discussions of sampling site selection, atmospheric and sea-surface sample collection, analytical procedures, and a proposed timetable. It is recommended that this program be initiated on a pilot study basis in Bermuda and American Samoa. Since the measurement of petroleum hydrocarbons in the atmosphere is not routine of standardized at this time, it is recommended that this program be undertaken in a research mode, with one laboratory selected to develop and test in detail the collection and analytical procedures. Author (ESA)

N80-11645# Royal Netherlands Meteorological Inst., De Bilt.
THE USE OF A TRAJECTORY MODEL FOR STUDYING INTERREGIONAL TRANSPORT OF AIR POLLUTION
J. Reiff and C. A. Velds 1979 37 p refs
(KNMI-WR-79-6) Avail: NTIS HC A03/MF A01

The possibility of using a trajectory model, including vertical wind components, to calculate the path of air pollution traveling across the German-Netherlands border is considered. The operational trajectory model, which principally was set up for weather forecasting and which uses windfields from three layer vorticity model is described. The properties of a near-future trajectory model based on a four layer vorticity model are also discussed. The accuracy of the trajectory model is specified. Two periods of interregional transport were studied. Trajectories, calculated with the operational model, arriving at the 850 mbar level are compared with hand-analyzed trajectories at the 10 m level and with trajectories in the 80 to 200 m layer. Results show that a trajectory model including vertical wind, together with the four layer model, promises success for air pollution studies as air paths can be calculated fairly easily on a routine basis. Author (ESA)

N80-11646# Swedish Space Corp., Solna.
AIRBORNE OIL SPILL SURVEILLANCE SYSTEMS IN SWEDEN
L. Backlund 12 Mar. 1979 20 p
(FP1-9) Avail: NTIS HC A02/MF A01

Two different oil spill surveillance systems are described. These systems are presently installed in two Cessna 337 aircraft. One of the systems is based on a side looking airborne radar (SLAR) and the other on a Daedalus IR/UV-line scanner. In both systems imagery generated from the sensors is presented in real-time on a TV-monitor to the operator/co-pilot in the aircraft. The SLAR system generates black-and-white imagery whereas the IR/UV-scanner system uses false color coding for image enhancement. The IR/UV-scanner system also has capabilities of recording unprocessed data on tape, polaroid photographing of displayed images, and near real-time image transmission down to ships via a TV video to Xerox telecopier interface and a voice channel link. The technical evaluation and field testing of the two systems is summarized. Most of the tests were carried out in the Baltic Sea and included oil spill detection, cleanup surveillance, ice reconnaissance, monitoring

of fishing activities, and search and rescue operations.
Author (ESA)

N80-11647# IEA Coal Research, London (England).
HOT GAS CLEANUP
G. F. Morrison Mar. 1979 53 p refs
(ICTIS/TR-03; ISBN-92-9029-017-X) Avail: NTIS
HC A04/MF A01

The current technological status of hot gas cleanup systems for cleaning gases from coal gasifiers or fluidized bed combustors prior to their use in combined cycle power generating systems is reviewed. Self contained cleanup systems which can be applied to various gasifiers or combustors are emphasized. Contaminants in the gas stream are identified as sulphur compounds, particulates, nitrogen compounds, and trace elements. Hot gas desulphurization processes are classified according to the sorbent on which they are based (iron oxide or calcium). Particulate removal is subdivided according to the separation technique. Cyclones, surface and depth filters, and electrostatic precipitators are covered.
Author (ESA)

N80-11648# TRW Environmental Services, Vienna, Va.
SUMMARY REPORT ON MOTOR VEHICLE EMISSIONS INSPECTION AND MAINTENANCE PROGRAMS FOR NON-ATTAINMENT AREAS IN LOUISIANA Final Report
John Dadiani and Thomas J. Raubacher Feb. 1979 42 p refs
(Contract EPA-68-02-2541)
(PB-294979/0; EPA-906/9-79-001) Avail: NTIS
HC A03/MF A01 CSCL 13B

General information is documented on motor vehicle inspection and maintenance (I/M) with respect to the metropolitan areas of New Orleans, Baton Rouge, and Shreveport. A background discussion of events leading to the need for an I/M program is provided. A general description of I/M is provided with respect to types of programs, the benefits of I/M, and information on implementation activities. Expected hydrocarbon emission reductions are included.
GRA

N80-11649# Research Triangle Inst., Research Triangle Park, N. C.
STUDY OF THE NATURE OF OZONE, OXIDES OF NITROGEN, AND NONMETHANE HYDROCARBONS IN TULSA, OKLAHOMA. VOLUME 2: DATA TABULATION
W. C. Eaton and F. E. Dimmock Apr. 1979 479 p
(Contract EPA-68-02-2808)
(PB-297801/3; EPA-540/4-79-008B) Avail: NTIS
HC A21/MF A01 CSCL 13B

Tabulated ambient air quality and meteorological data resulting from surface and airborne measurements made in Tulsa, Oklahoma during July, August and September 1977 are presented. Also included are figures which illustrate the monitoring network and aircraft flight tracks followed during the airborne measurements program.
GRA

N80-11650# Textile Research Inst., Princeton, N. J.
STUDIES OF DUST CAKE FORMATION AND STRUCTURE IN FABRIC FILTRATION: SECOND YEAR
Bernard Miller, George Lamb, Peter Costanza, George Harriott, and Janet Dunbar Apr. 1979 48 p refs
(Grant EPA-R-804926)
(PB-297581/1; EPA-600/7-79-108) Avail: NTIS
HC A03/MF A01 CSCL 13K

The experiments to improve fabric filter efficiency and pressure drop by use of electric fields near the filter surface are described. Modified fiber geometries and fabric construction are investigated. The features of the dust cake and the fabric dust system which explain the observed changes in performance are identified. This design of improved filter fabrics and systems are discussed.
A.W.H.

N80-11651# North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
A FIELD STUDY OF THE RELATIONSHIP BETWEEN HEAVY METAL CONCENTRATIONS IN STREAM WATER AND SELECTED BENTHIC MACROINVERTEBRATE SPECIES M.S. Thesis
Richard P. Maas 1978 79 p refs
(Contract DI-14-34-0001-9035)
(PB-297284/2; W79-07570; OWRT-A-095-NC(1)) Avail: NTIS HC A05/MF A01 CSCL 13B

The correlation between heavy metal concentration in stream water and selected benthic macroinvertebrate species from stations on the Neuse River, N.C. watershed was studied to determine the utility of benthic macroinvertebrates as monitors of short and long term stream metal conditions. Cadmium, and zinc were determined in both water and test organisms by graphite furnace atomic adsorption spectrophotometry (GFAAS). The GFAAS method proved satisfactory for metal quantifcation in all water and test organism samples. Relatively good linear correlations between water and test organism metal concentrations were observed for most cases.
GRA

N80-11652# Acurex Corp., Mountain View, Calif.
EXTENDED TESTS OF SAFFIL ALUMINUM FILTER MEDIA Final Report, Feb. 1978 - Feb. 1979
M. A. Shackleton May 1979 30 p refs
(Contract EPA-68-02-2611)
(PB-297567/0; EPA-600/7-79-112) Avail: NTIS
HC A03/MF A01 CSCL 13K

Dust feeding of Saffil alumina ceramic filters was tested at 800 C and 10 atm pressure, using reentrained fly ash. Pressure drop and collection efficiency were determined as functions of time and filter face velocity. Off line cleaning by reverse pulse was effective in maintaining low pressure drop after a cleaning cycle. Collection efficiency was high and was also substantially independent of face velocity over the range tested. Outlet concentration was less than the most stringent requirements proposed for turbine applications and showed a trend toward lower values at higher filtration velocity. Mechanical durability was indicated in that none of the test filters appeared to have been damaged by the 200-hour tests with cleaning at 10 minute intervals.
GRA

N80-11653# Massachusetts Inst. of Tech., Cambridge. Sea Grant Coll. Program.
ALL THE WATER ON EARTH IS ALL THE WATER THERE IS
Dean A. Horn Apr. 1979 13 p refs
(PB-298340/1; MITSG-79/5; NOAA-79061808) Avail: NTIS
HC A02/MF A01 CSCL 13B

The ocean's capacities, and how these limits change with time are described. The education of young people, in order to create a conscious awareness of man's dependence on water, is proposed.
GRA

N80-11654# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
TRACE METALS AND MARINE PRODUCTION PROCESSES
Richard A. Feely and Herbert Curl, Jr. Jan. 1979 29 p refs
Proc. of a Workshop held at The Pacific Marine Environmental Lab., Seattle, 28 Feb. - 2 Mar. 1978
(PB-298333/6; CONTRIB-385; NOAA-79062601) Avail: NTIS
HC A03/MF A01 CSCL 13B

As part of a program studying the long-range effects of pollution the Pacific Marine Environmental Laboratory, one of the Environmental Research Laboratories of NOAA, conducted a workshop to prepare recommendations for research on the effects of trace metals on estuarine and coastal ecosystems.
GRA

N80-11655# GCA Corp., Bedford, Mass. GCA Technology Div.
AIR QUALITY MAINTENANCE ANALYSIS FOR NEW JERSEY-NEW YORK AND MID-HUDSON AQMA Final Report
Kenneth W. Wiltsee, Jr., William L. Frech, and David B. Ramsay Jun. 1979 408 p refs
(Contract EPA-68-02-2866)
(PB-297988/8; GCA-TR-79-19-G; EPA-902/4-78-006) Avail: NTIS HC A18/MF A01 CSCL 13B

The year 1975 was used as the base for the air quality maintenance analysis and projections were made to 1980, 1985, and 2000. An emissions inventory created under a previous contract was reviewed and updated using best available data. Improvements were made in the point source inventory, county level area source inventories, and subcounty allocation procedures.

A version of the AQDM model was validated and then used to predict annual regional air quality levels for each year. The results indicate that annual primary SO2 and TSP standards could be exceeded in the South Bronx by 2000. TSP levels throughout much of northeastern New Jersey and New York City exceed the secondary TSP annual guidelines. GRA

N80-11656# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
TECHNICAL ASSESSMENT OF THERMAL DeNOx PROCESS Final Report, Nov. 1977 - Dec. 1978
C. Castaldini, K. G. Salvesen, and H. B. Mason May 1979 138 p
(Contract EPA-68-02-2611)
(PB-297947/4; EPA-600/7-79-117) Avail: NTIS
HC A07/MF A01 CSCL 13B

The thermal deNOx process applied to coal fired utility boilers is assessed. It is concluded that the process is a promising technique for controlling NOx emissions. However, flue gas temperature fluctuations may limit NOx reductions to approximately 50%. In addition, operational and environmental impacts of NH3 emissions and ammonium bisulfate formation could further limit the performance of the process and effect is applicability. Costs depend primarily on boiler size, initial NOx concentration, and level of control required. The impact of widespread process implementation on the ammonia market, feedstock supplies, and their costs are considered and found to be small. GRA

N80-11657# Air Pollution Technology, Inc., San Diego, Calif.
MOBILE BED FLUX FORCE/CONDENSATION SCRUBBERS Final Report, Nov. 1975 - Dec. 1978
S. C. Yung, R. Chmielewski, and S. Calvert Feb. 1979 262 p refs
(Contract EPA-68-02-2124)
(PB-297198/4; EPA-600/7-79-071) Avail: NTIS
HC A12/MF A01 CSCL 13B

Fine particle collection in mobile bed scrubbers was determined experimentally. Particle collection efficiency increased greatly as the gas phase pressure drop increased. Compared to packed bed and sieve plate scrubbers, the mobile bed scrubber had better efficiency when the pressure drop was above 20 cm W.C. Limestone in the scrubber liquid had no effect on particle collection. When the mobile bed scrubber was used as a flux force/condensation (FF/C) scrubber, it had better performance characteristics than sieve plate and spray scrubbers with condensation. However, its capability was inferior to a FF/C system consisting of a condenser and venturi scrubber. Correlations to predict particle collection and pressure drop were developed. GRA

N80-11658# California Univ., Davis. Dept. of Vegetable Crops
INTERACTION OF LOW LEVELS OF OZONE AND RELATIVE HUMIDITY ON LEAFY VEGETABLES Final Report, Jun. 1977 - Oct. 1978
J. P. Bennett Mar. 1979 30 p refs
(Contract ARB-AG-194-30)
(PB-297062/2; ARB-R-AG-194-30-79-98) Avail: NTIS
HC A03/MF A01 CSCL 13B

The effects of varying levels of ozone and humidity on the yields of leaf lettuce and spinach were studied. Generalizations about yield losses in humid vs. dry environments were not possible because spinach yield losses due to ozone were greater at 50% than at 80% relative humidity while lettuce yield losses followed the opposite pattern. Lettuce plants were also significantly smaller and more tender, rendering them unmarketable regardless of the weight loss. This occurred at a concentration below the California one hour ozone standard of 0.10 ppm and suggests that the standard does not adequately protect this crop. GRA

N80-11659# Stop-Los Co., West Orange, N. J.
REDUCTION OF AIR EMISSIONS FROM GASOLINE STORAGE TANKS Final Report, Jan. 1978 - Jan. 1979
Arnold Gunther May 1979 39 p
(Contract EPA-68-02-2679)
(PB-297976/3; EPA-600/2-79-108) Avail: NTIS
HC A03/MF A01 CSCL 13B

The technical and economic feasibility of using flexible plastic membranes to control emissions from gasoline storage tanks was investigated. A demonstration pilot unit was built and operated. The emission rates were determined as well as the life expectancy of the membranes. The results indicate that emission control of 99-plus percent, compared to uncontrolled tanks, can be achieved readily, and that the life expectancy of the membranes is in the order of 20 years of continuous service. The estimated installed cost of these devices for commercial application is very competitive with conventionally used floating roofs. GRA

N80-11660# Institute of Industry of Cement Building Materials (Poland).
TEST OF FABRIC FILTRATION MATERIALS Final Report, Jun. 1973 - Dec. 1978
Jan R. Koscianowski, Lidia Koscianowska, and Maria Szablewicz Mar. 1979 268 p refs
(PB-297500/1; EPA-600/7-79-087) Avail: NTIS
HC A12/MF A01 CSCL 13K

The report describes pilot scale and laboratory tests of U.S. and Polish woven baghouse fabrics. Cotton, polyester, aramid, and glass fabrics were tested using cement, flyash, coal, and talc dusts at loadings of about 10 g/cu m, filtration velocities of 60 and 80 cu m/sq m, and ambient temperature and humidity. General conclusions reached were: (1) air permeability is a poor predictor of fabric performance, (2) fabric construction parameters do not correlate well with the resistance coefficient for fabrics KI, (3) a critical value of pressure drop exists above which fissures are formed in the dust cake, (4) there is a maximum in the efficiency versus air-to-cloth-ratio curve which is related to fissure formation, and (5) cleaning properties of the fabric depend primarily on its chemical composition, the dust being filtered, and the superficial structure of the dust cake and fabric (they do not depend on air-to-cloth ratio). GRA

N80-11661# Fish and Wildlife Service, Fort Collins, Colo. Western Energy and Land Use Team.
PHYSICAL REGIONALIZATION OF COASTAL ECOSYSTEMS OF THE UNITED STATES AND ITS TERRITORIES
Terry T. Terrell Mar. 1979 39 p refs Sponsored in part by EPA
(PB-297143/0; FWS/OBS-78-80) Avail: NTIS
HC A03/MF A01 CSCL 13B

A hierarchical regional classification scheme for partitioning coastal ecosystems of the United States and its territories based on the physical (mainly hydrological and geological) characteristics of those areas was formulated. Physical rather than biotic criteria were utilized so as to define whole ecosystems, rather than to define the distribution of a few species. The classification provides a data collection structure and delineates geographic zones about which predictions on the structure and functioning of ecosystems within these zones may be made at various levels of resolution. Boundaries as defined by the National Wetlands Inventory were used extensively for landward and seaward limits. GRA

N80-11662# North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
SMOG CHAMBER VALIDATION USING LAGRANGIAN ATMOSPHERIC DATA Interim Report
Charles Eugene Feigley, Harvey E. Jefferies, and Myra A. Carpenter May 1979 272 p refs
(Grant EPA-800916)
(PB-297480/6; EPA-600/3-79-050) Avail: NTIS
HC A12/MF A01 CSCL 04A

A method was developed for validating outdoor smog chamber experiments. When chamber experiments were performed in a manner that simulated relevant meteorological processes and precursor concentrations, the validation method showed that photochemical smog reactions observed in the smog chamber generally agreed with data from the Los Angeles Reactive Pollutant Programs. GRA

N80-11663# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.
USPHS/NIOSH MEMBRANE FILTER METHOD FOR EVALUATING AIRBORNE ASBESTOS FIBERS

Stephen G. Bayer, Ralph D. Sumwalde, and Kenneth A. Busch
Feb. 1979 93 p refs
(PB-297731/2; DHEW/PUB/NIOSH-79/127) Avail: NTIS
HC A05/MF A01 CSCL 07D

The equipment and procedures for collecting, mounting, sizing, and counting asbestos fibers on cellulose ester membrane filters are described. Procedures for treating random and systematic errors are presented, including statistical procedures for determining compliance with asbestos exposure standards. Five phase contrast microscopes for asbestos counting are evaluated. GRA

N80-11664# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. PESTICIDES AND TOXICOLOGY PROGRAMS Final Report
Aug. 1979 94 p
(Grant EPA-T-900591-03)
(PB-298582/8; EPA-600/8-79-023C) Avail: NTIS
HC A05/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory of post secondary pesticides and toxicology programs in the U.S. is presented. One hundred and thirty-five academic program titles are listed along with names and addresses of institutions, degrees offered, and contact persons. K.L.

N80-11665# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT. PHASE 3: POTABLE WATER PROGRAMS Final Report
Aug. 1979 41 p
(Grant EPA-T-900591-03)
(PB-298583/6; EPA-600/8-79-023D) Avail: NTIS
HC A03/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory of potable water education/training programs is presented. Categories identified are hydrology, aquatic biology, hydrogeology, water works technology, marine environmental sciences, and coastal oceanography. Forty one programs are identified. A.W.H.

N80-11666# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. WATER/WASTEWATER PROGRAMS Final Report
Aug. 1979 119 p
(Grant EPA-T-900591-03)
(PB-298588/5; EPA-600/8-79-023I) Avail: NTIS
HC A06/MF A01, also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

The volume of post-secondary education/training entries presents those programs which are classified as intersecting both environmental areas of potable water and wastewater. Programs categorized as applicable to either potable water or to waste-water, solely, will be found in those individual volumes of this report. This volume includes 183 water/wastewater programs which represent 46 states and one territory. In order for the program to be included in this directory, the catalog description must list at least three water and/or waste-water courses necessary for program completion. GRA

N80-11667# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. COMPOSITE: ENVIRONMENTAL ENGINEERING/TECHNOLOGY Final Report
Aug. 1979 116 p
(Grant EPA-T-900591-03)
(PB-298589/3; EPA-600/8-79-023J) Avail: NTIS
HC A06/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

Information on post-secondary environmental education programs in the United States is presented in this twelve volume directory. Programs are representative of all levels, from academic certification through doctoral degrees. The environmental pollution control areas of air, noise, pesticides, potable water, radiation, solid waste, wastewater and energy were surveyed. In addition, some programs which were not readily categorized into media-specific areas (i.e., radiation, air, etc.) or which represented multiple media areas in curricula content, were presented under the title of composite. R.E.S.

N80-11668# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. COMPOSITE: ENVIRONMENTAL SCIENCE/HEALTH Final Report
Aug. 1979 131 p
(Grant EPA-T-900591-03)
(PB-298590/1; EPA-600/8-79-023K) Avail: NTIS
HC A07/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory of post-secondary environmental education programs in the U. S. is presented. Names and addresses of institutions, academic program titles, contact persons, and degrees offered are listed. Areas of program concentration include marine and environmental sciences, solar energy, potable water supply, wastewater, land use, ecology, environmental biology, industrial hygiene, toxicology, radiation health, environmental management, environmental earth science, environmental and regional planning, environmental monitoring, and pollution prevention and control. K.L.

N80-11669# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. COMPOSITE: ENVIRONMENTAL STUDIES Final Report
Aug. 1979 202 p
(Grant EPA-T-900591-03)
(PB-289591/9; EPA-600/8-79-023L) Avail: NTIS
HC A10/MF A01; also available in set of 18 reports PC-E99, PB-298579-SET CSCL 05I

A directory of general environmental education programs is presented. Areas identified are environmental studies, environmental education, marine sciences, environmental management, and general environmental programs. The directory includes 336 programs. A.W.H.

N80-11670# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. AIR PROGRAMS Final Report
Aug. 1979 39 p
(Grant EPA-T-900591-03)
(PB-298580/2; EPA-600/8-79-023A) Avail: NTIS
HC A03/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

Information on post-secondary environmental education programs in the United States is provided. Structured around information requests mailed to post-secondary education institutions, the directory provides the name and address of each institution listed, a contact person at each institution, the academic program title, and the degree offered at the institution (2-year, 4-year, etc.) Twelve such directories of post-secondary programs include: one each for air, noise, pesticides and toxicology, potable water, wastewater, radiation, solid waste, and energy; one for combined water/wastewater programs; and a composite volume on each of the three areas of environmental engineering/technology, environmental science/health, and environmental studies. GRA

N80-11671# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. NOISE PROGRAMS Final Report
Aug. 1979 29 p
(Grant EPA-T-900591-03)
(PB-298581/0; EPA-600/8-79-023B) Avail: NTIS
HC A03/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory of identified post secondary education and/or training programs pertinent to the control of noise pollution is

presented. Categories identified are acoustics, noise and its control, measurement of sound/instrumentation, and hearing conservation. Sixteen noise programs are identified. A.W.H.

N80-11672# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. WASTEWATER PROGRAMS Final Report
Aug. 1979 34 p
(Grant EPA-T-900591-03)
(PB-298584/4; EPA-600/8-79-023E) Avail: NTIS HC A03/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory which identifies and describes waste water pollution control education/training programs is presented. Education areas include water resources, waste water pollution, plant operations, environmental health, waste water treatment and disposal, plant design, and water chemistry. Twenty eight education/training programs are identified. A.W.H.

N80-11673# National Field Research Center, Inc., Iowa City, Iowa.
NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT, PHASE 3. RADIATION PROGRAMS Final Report
Aug. 1979 40 p
(Grant EPA-T-900591-03)
(PB-298585/1; EPA-600/8-79-023F) Avail: NTIS HC A03/MF A01; also available in set of 18 reports PC E99, PB-298579-SET CSCL 05I

A directory which identifies and describes radiation education/training programs is presented. Categories identified are health physics, radiation health and safety, radiological health, nuclear or radiological waste management, and radiological technician training. Thirty nine program entries are identified. A.W.H.

N80-11674# National Technical Information Service, Springfield, Va.
AIRPORT NOISE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Guy E. Habercom, Jr. Sep. 1979 271 p Supersedes NTIS/PS-78/0807, NTIS/PS-77/0704, NTIS/PS-76/0625 and NTIS/PS-75/530
(NTIS/PS-79/0878/3; NTIS/PS-78/0807; NTIS/PS-77/0704; NTIS/PS-76/0625; NTIS/PS-75/530) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Aircraft created noise, noise intensity, noise exposure, and physiological effects, all in airport environments, are investigated in these research reports. This updated bibliography contains 265 abstracts, 19 of which are new entries to the previous edition. GRA

N80-11675# National Technical Information Service, Springfield, Va.
CHEMICAL ANALYSIS OF AEROSOLS AND AIRBORNE PARTICULATES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Jul. 1979
Diane M. Cavagnaro Aug. 1979 147 p Supersedes NTIS/PS-78/0756, NTIS/PS-77/0717, NTIS/PS-76/0617, NTIS/PS-75/527 and COM-74-11018
(NTIS/PS-79/0791/8; NTIS/PS-78/0756; NTIS/PS-77/0717; NTIS/PS-76/0617; NTIS/PS-75/527; COM-74-11018) Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

Reports are cited covering the chemical analysis and composition of aerosols and airborne particulate matter. Articles on particle sampling techniques and size analysis are excluded. Some of the techniques that are described include chromatography, activation analysis, and spectroscopic analysis. This bibliography contains 141 abstracts, 40 of which are new entries to the previous edition. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-11676*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
EFFICIENCY OF AEROSOL COLLECTION ON WIRES EXPOSED IN THE STRATOSPHERE
Homer Y. Lem (LFE Environmental Analysis Labs. Div.) and Neil H. Farlow Oct. 1979 29 p refs
(NASA-TM-81147; A-7958) Avail: NTIS HC A03/MF A01 CSCL 04A

The theory of inertial impaction is briefly presented. Stratospheric aerosol research experiments were performed duplicating Wong et al. experiments. The use of the curve of inertial parameters vs particle collection efficiency, derived from Wong et al., was found to be justified. The results show that stratospheric aerosol particles of all sizes are collectible by wire impaction technique. Curves and tables are presented and used to correct particle counts for collection efficiencies less than 100%. R.E.S.

N80-11677*# Ohio State Univ. Research Foundation, Columbus.
AN INVESTIGATION OF A MATHEMATICAL MODEL FOR ATMOSPHERIC ABSORPTION SPECTRA Interim Report
Edward R. Niple Jul. 1979 88 p refs
(Grant NsG-7479; RF Proj. 761420/711626)
(NASA-CR-162430) Avail: NTIS HC A05/MF A01 CSCL 04A

A computer program that calculates absorption spectra for slant paths through the atmosphere is described. The program uses an efficient convolution technique (Romberg integration) to simulate instrument resolution effects. A brief information analysis is performed on a set of calculated spectra to illustrate how such techniques may be used to explore the quality of the information in a spectrum. Author

N80-11678# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
GLOBAL LIGHTNING DISTRIBUTION AT DAWN AND DUSK FOR AUGUST-DECEMBER 1977 AS OBSERVED BY THE DMSD LIGHTING DETECTOR Interim Report
Bruce C. Edgar 15 Jun. 1979 35 p refs
(Contract F04701-78-C-0079)
(AD-A071896; TR-0079-4639-1; SAMSO-TR-79-43) Avail: NTIS HC A03/MF A01 CSCL 04/1

The lightning detector aboard a DMSP satellite in a dawn-dusk polar orbit sampled lightning activity worldwide during August-December 1977. At dawn the distribution of events is somewhat evenly spread over both hemispheres with a slight bias towards land areas in the summer hemisphere. There is significant activity over the oceans in both hemispheres at dawn, presumably due to radiative cooling of the atmosphere. However, at dusk lightning occurs primarily over the warmer land areas in the summer hemisphere with very few events in the winter hemisphere. Also there is a marked increase of lightning events about the tropical convergence zone. These distribution plots give for the first time a global snapshot of lightning activity which could lead to a better understanding of the global atmospheric noise distribution. GRA

N80-11679# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
MEASUREMENTS OF IMPORTANT MINOR CONSTITUENTS IN THE MIDDLE ATMOSPHERE Final Report, Apr. 1976 - Apr. 1979
John J. Olivero 19 Jun. 1979 10 p refs
(Grants DAAG29-76-G-0219; DAAG29-78-G-0083)
(AD-A071845; PSU-IRL-FR-79/2; ARO-13877.3-GSX) Avail: NTIS HC A02/MF A01 CSCL 04/1

This final report summarizes two major projects. The first is the design and development of a ground based microwave radiometer for the measurement of water vapor in the middle atmosphere. The second is the detailed study of the possible existence of small ice particles in the mesosphere under normal

conditions as has been hypothesized by D-region electrical structure measurements. GRA

N80-11680# Utah State Univ., Logan.
ELIMINATION OF THE EFFECT OF SURFACE MICROTOPOGRAPHY IN AN IMPROVED SOIL SKIN MOISTURE DETERMINATOR
Inge Dirmhirn. White Sands Missile Range, N. Mex. Atmospheric Sciences Lab. Jun. 1979 20 p refs
(Contract DAEA18-78-C-0051; DA Proj. 1L1-62111-AH-71)
(AD-A072814; ERADCOM/ASL-CR-79-0051-1) Avail: NTIS HC A02/MF A01 CSCL 08/13

This report discusses the development of an instrument, the soil surface moisture determinator (SSMD), that provides soil surface moisture independent of the microstructure of the surface. Such an instrument was needed because the reflection characteristics of soils and sands depend on the moisture and microstructure of the surface layer; and under natural conditions; the many surfaces of different slope and exposure that account for the soil surface layer interfere with a simple relation between soil moisture and reflection. Tests performed with the SSMD show that the instrument can provide knowledge of the moisture content of the soils with one simple measurement. The results of the measurements do not provide information on the moisture condition within the soil, but the knowledge of the moisture of the surface layer can readily be correlated with all remotely detected data. GRA

N80-11681# Nova Univ., Dania, Fla. Ocean Science Center.
IMPROVED DETERMINATIONS OF THE EARTH'S GRAVITY FIELD
Georges Blaha 31 Jan. 1979 163 p refs
(Contract F19628-78-C-0013; AF Proj. 2309)
(AD-A071198; AFGL-TR-79-0058) Avail: NTIS HC A08/MF A01 CSCL 08/5

Partial contents: An Accurate Non-iterative Algorithm for Computing the Length of a position Vector to a Subsatellite Point; Feasibility of the Short Arc Adjustment Model in SEASAT-a Altimetry Reductions Mathematical Outline of the Short Arc Orbital Investigation, and Realistic GEOS-3 and SEASAT-A analysis; Accuracy Improvement in Adjusting Gravity Anomalies; Geopotential Model Containing Spherical Harmonics and Point Masses; Refinement of the Gravity Anomaly Model -- Gravity Anomaly Mathematical Model, Gravity Mathematical Model, Comparison of the Gravity and the Gravity Anomaly Models, Equivalence of the Coefficients, and Equivalence of the Constant Terms. GRA

N80-11682# Systems Science and Software, La Jolla, Calif.
SYNTHESIS OF REGIONAL GROUND MOTION FROM WESTERN US EARTHQUAKES Final Report, Nov. 1977 - Dec. 1978
W. L. Rodi, T. C. Bache, H. J. Swanger, T. G. Barker, and J. T. Cherry Hanscom AFB, Mass. Air Force Geophysics Lab. 29 Mar. 1979 206 p
(Contract F19628-77-C-0004; AF Proj. 2309)
(AD-A069727; SSS-R-79-3988; AFGL-TR-79-0080) Avail: NTIS HC A10/MF A01 CSCL 08/11

Synthetic displacement, velocity and acceleration seismograms and the resulting response spectra are computed and analyzed for earthquake ground motions in the western United States. A source model for the 1975 Pocatello Valley earthquake is used with plane layered earth models to estimate the ground motions at Minuteman Wing V which is at a range of about 700 km. The 1975 Yellowstone earthquake was a similar event at the same range from Wing V. However, the ground motions are estimated to be an order to magnitude smaller due to three effects: the two earthquakes were the same size at long periods but the Yellowstone event appears to be a factor of 2 to 4 smaller at short periods; the sources are oriented such that radiation pattern differences between the two events are nearly maximum; the Yellowstone caldera and, perhaps, other highly attenuating structures to the south cause the Wing V ground motions from the Yellowstone event to be much smaller than otherwise expected. GRA

N80-11683# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeronutronic Div.
METHOD OF CALCULATING H2O TRANSMISSION BETWEEN 333 AND 633 cm-1 Final Report, 4 Oct. 1976 - 30 Sep. 1978
Darrell E. Burch and David A. Gryvnak Apr. 1979 52 p refs
(Contract F19628-76-C-0302; AF Proj. 7670)
(AD-A072850; AFGL-TR-79-0054; U6503) Avail: NTIS HC A04/MF A01 CSCL 04/1

Spectral absorption data are presented for H2O between 1/333 cm and 1/633 cm. An empirical continuum has been determined to account for all of the absorption not attributed to absorption lines centered within approximately 1/30 cm of any wavenumber of observation. The empirical continuum, which consists of one part for self broadening of the H2O lines and one part for N2 broadening, has been determined experimentally for three temperatures: 296K, 338K and 430K. Other values based on extrapolation have been determined for lower temperatures representative of the atmosphere. A line-by-line calculation scheme involving the empirical continuum and the AFGL line parameters has been used to calculate spectra for several samples investigated in the laboratory. The calculated spectra agree quite well with the laboratory spectra. GRA

N80-11684# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
LOW LATITUDE ATMOSPHERIC X-RAYS OBSERVED BY HEAO-1 Interim Report
Janet G. Luhmann, Hugo R. Rugge, J. Bernard Blake, and Lee A. Christopher 16 Jul. 1979 22 p refs
(Contract F04701-78-C-0079)
(AD-A072722; TR-0079(4960-05)-4; SAMSO-TR-79-69) Avail: NTIS HC A02/MF A01 CSCL 04/1

The low energy (0.15-3keV) proportional counter detectors of the A-2 experiment on the X-ray astronomy satellite HEAO-1 have detected night-time atmospheric emissions at the limb of the earth. Three observations of this phenomenon occurred during the first two months of operation. On two occasions, fluxes greater than the diffuse galactic background were detected when the detectors scanned the limb in the vicinity of the magnetic conjugate point of the South Atlantic Anomaly. Enhanced emissions were also observed on a single scan of the atmosphere over northern Africa. The X-rays are presumed to result from bremsstrahlung generated by precipitating electrons. In the case of the emissions related to the Anomaly conjugate point, it is suggested that the electrons were secondaries backscattered from the atmosphere above the Anomaly during the intensified precipitation of radiation belt particles that occurs throughout a magnetic storm recovery period. These initial observations demonstrate that the earth's atmosphere can be a significant X-ray source at low latitudes as well as in the auroral zones, and hence that it may be practical to remotely monitor the global morphology of particle precipitation by satellite observations of terrestrial X-rays. GRA

N80-11685# Air Force Geophysics Lab., Hanscom AFB, Mass.
REPORT ON PERU SCINTILLATION TESTS, MARCH 1978 Air Force Surveys in Geophysics
H. E. Whitney 22 Jan. 1979 102 p
(AF Proj. 4643)
(AD-A072994; AFGL-TR-79-0030; AFGL-AFSG-407) Avail: NTIS HC A06/MF A01 CSCL 08/14

This report summarizes the occurrence of ionospheric scintillation observed during March 1978 scintillation tests conducted in Peru. The data are reduced and presented as was done in AFGL-TR-77-0282, 'Report on Peru Scintillation Tests - October 1976 and March 1977.' GRA

N80-11686# Air Force Geophysics Lab., Hanscom AFB, Mass.
CORRELATION STUDIES OF PROTONOSPHERIC ELECTRON CONTENT OVER THE US CONTINENT Environmental Research Papers
A. Shuval, J. A. Klobuchar, and H. Soicher 6 Mar. 1979 27 p refs
(AF Proj. 4643)
(AD-A073080; AFGL-TR-79-0064; AFGL-ERP-658) Avail: NTIS HC A03/MF A01 CSCL 08/14

Measurements of the electron content of the earth's protonosphere N sub p, defined here as the region above the height where Faraday rotation measurements of VHF signals

are significant, have been compared from pairs of stations in North America. Results of studies of N sub p and of the variabilities from the monthly mean values at station pairs show a lower correlation than expected. Correlation coefficients of total electron content data taken at the same station pairs by the group-delay technique and by the Faraday rotation technique are significantly higher than those from N sub p data. The random component necessary to explain the lower than expected correlation of N sub p values is larger than the estimated data accuracy from the stations. From the available data we are unable to conclude whether or not the lower than expected correlation coefficients represent a real random component in the protonosphere having horizontal scale sizes less than 400 km. GRA

N80-11687# Alaska Univ., Fairbanks. Geophysical Inst.
NON-NEUTRAL FIELD-ALIGNED CURRENT SHEET AND AURORAL ELECTRIC FIELD Final Report, 15 May - 31 Dec. 1978
R. K. Albano, L. C. Lee, and J. R. Kan Feb. 1979 21 p refs
(Contract F19628-78-C-0128; AF Proj. 2311)
(AD-A072852; AFGL-TR-79-0066) Avail: NTIS
HC A02/MF A01 CSCL 04/1

Equilibrium configurations of the non-neutral field-aligned electron current sheet in a Maxwellian plasma are obtained from solutions of the time-independent Vlasov-Maxwell equations. This is the first field-aligned non-neutral current sheet model in a hot plasma in which the electrons are allowed to be nonadiabatic. The current in this model has a perpendicular as well as a parallel component to the external magnetic field. The electric field of the current sheet is pointing normally toward the midplane of the sheet. This zeroth-order perpendicular electric field is identified as the primary electric field which gives rise to a few keV potential drop along auroral field lines. GRA

N80-11688# Stanford Univ., Calif. Guidance and Control Techniques.
STUDY TO DEVELOPMENT GRADIOMETER TECHNIQUES
D. B. DeBra, J. V. Breakwell, and M. Kurosaki Jan. 1979 46 p refs
(Contract F19628-78-C-0038; AF Proj. 3201)
(AD-A072821; AFGL-TR-79-0063; SCIENTIFIC-1) Avail: NTIS
HC A03/MF A01 CSCL 08/5

This report is concerned with the problem of real-time filtering of gravity-gradiometer readings onboard a uniformly horizontally moving vehicle to produce estimates of the gravity deflection and gravity anomaly at the vehicle's position. GRA

N80-11689# Utah State Univ., Logan. Electro-Dynamics Lab.
STUDIES OF ATMOSPHERIC INFRARED EMISSIONS Final Report, 1 Jan. 1973 - 31 Dec. 1977
Doran J. Baker 1 Jan. 1978 87 p refs
(Contract F19628-73-C-0048)
(AD-A072831; AFGL-TR-78-0251) Avail: NTIS
HC A05/MF A01 CSCL 04/1

This contract between the Air Force Geophysics Laboratory and Utah State University provided for the investigation into the nature of the disturbed and undisturbed atmosphere with particular emphasis placed upon the spectral, spatial, and temporal behavior of atmospheric emission and the controlling stimuli that initiate such emission. A major thrust was concentrated on the development of new instrumentation and measuring techniques and their use in the measurement program, particularly in atmospheric disturbances. GRA

N80-11690# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
COORDINATED DATA ANALYSIS OF ONR-118 DATA Final Report
R. G. Johnson, R. D. Sharp, and E. G. Shelley Aug. 1978 33 p refs
(Contract N00014-77-C-0600)
(AD-A073113; LMSC/D626959) Avail: NTIS
HC A03/MF A01 CSCL 04/1

This is the final report of a program to study the physical causes of ionospheric scintillation and disturbance phenomena by performing coordinated observations of the energetic particle inputs to the disturbance region and the resulting disturbance phenomena as observed in the ionosphere. GRA

N80-11691# Environmental Research and Technology, Inc., Concord, Mass.
ANALYSIS OF TROPOSPHERIC EFFECTS AT LOW ELEVATION ANGLES Final Report, 1 Jan. 1977 - 31 May 1978
Robert K. Crane Nov. 1978 69 p refs
(Contract F19628-77-C-0074; AF Proj. 4600)
(AD-A073089; RADC-TR-78-252) Avail: NTIS
HC A04/MF A01 CSCL 04/1

Precision low elevation angle radar observations of orbiting spheres were used to evaluate the utility of surface based refraction techniques. Elevation angle error measurements were obtained from differences between the precision radar measurements and the true or absolute position of the orbiting sphere obtained from a multiple pass orbit determination using data from the same radar system. The results of the refraction effects study show that the average observed elevation angle error caused by refraction is identical with the average calculated elevation angle error obtained from ray tracings using radiosonde data to within the measurement accuracy of the radar system. The results also reveal a relatively large uncorrectable component of the elevation angle error caused by small scale refractive index gradients. This uncorrectable component is of the order of 30 millidegrees (mdeg) at a true elevation angle of 1 degree and 4 mdeg at 10 degrees. GRA

N80-11692# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
A CASE STUDY OF S3-2 OBSERVATIONS IN THE LATE EVENING AURORAL OVAL
W. J. Burke, D. A. Hardy, F. J. Rich, M. C. Kelley (Cornell Univ., Ithaca, N.Y.), M. Smiddy, B. Shuman, R. C. Sagalyn, R. P. Vancour, P. J. L. Wildman, and S. T. Lai (Logicon, Inc., Lexington, Mass.) 8 Jan. 1979 42 p refs
(AF Proj. 2311)
(AD-A072996; AFGL-TR-79-0011; AFGL-ERP-651) Avail: NTIS HC A03/MF A01 CSCL 04/1

Instrumentation aboard the polar-orbiting Air Force satellite S3-2, as well as the methods by which the measurements are reduced to geophysically significant quantities, are described in great detail. The quality of the high-time resolution data is illustrated using measurements of an auroral zone overpass in the late evening sector when simultaneous DMSP imagery was also available. The validity of the data reduction processes is corroborated by a detailed comparison of simultaneous measurements of the entire complement of scientific experiments on the satellite. GRA

N80-11693# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
STUDY OF THE EQUATORWARD EDGE OF THE AURORAL OVAL FROM SATELLITE OBSERVATIONS Scientific Interim Report Environmental Research Papers
B. S. Dandekar 9 Jan. 1979 44 p refs
(AF Proj. 4643)
(AD-A072997; AFGL-TR-79-0010; AFGL-ERP-650) Avail: NTIS HC A03/MF A01 CSCL 04/1

The auroral ovals in the Northern and Southern Hemispheres observed by the optical instruments aboard the DMSP satellites are studied on a statistical basis in terms of the temporal, spatial, and magnetic activity dependence of the equatorward edge of the diffuse (continuous) aurora. In the nightside (18-08 CGT), the equatorward edges of the auroral ovals are located predominantly in the latitude range 61 deg - 69 deg CGL. They show strong dependence on the levels of magnetic activity. Of the indices Kp, AE, Dst, and Q, the Q index is correlated best with the position of the equatorward edge of the diffuse aurora. Assuming that the auroral oval is approximately circular in a CG coordinate system, the dependence of the radius of the auroral oval on magnetic activity is determined. The radius and the center of the auroral circle changes with variation in magnetic activity. The ovals of the Northern and Southern Hemispheres consistently show an asymmetry. On the nightside, the oval in the Southern Hemisphere is located about 1 deg closer to the equator than the oval in the Northern Hemisphere. GRA

N80-11694# Air Force Geophysics Lab., Hanscom AFB, Mass.
PHASE SPACE COORDINATES OF LONG LIFETIME TRAPPED RADIATION FROM STOERMER MAPPING
Charles W. Dubs 18 Jan. 1979 28 p refs
(AF Proj. 2311)
(AD-A072995; AFGL-TR-79-0029; AFGL-ERP-655) Avail: NTIS HC A03/MF A01 CSCL 04/1

The concept of an 'essentially closed' manifold and several theorems on a plane mapping are introduced and applied to a 'Stoermer mapping' for a particle trapped in a dipole magnetic field. The trapped region is found to be divisible into many subregions in any one of which a particle forever remains confined. Alternatives are given to Dragt and Finn's interpretation that homoclinic points exist. A method is given of determining if they do exist. Numerical examples are given of regions of phase space where protons should have a long lifetime. GRA

N80-11695# Air Force Geophysics Lab., Hanscom AFB, Mass.
A DYNAMICAL MODEL FOR THE ONSET OF MAGNETOSPHERIC SUBSTORMS
P. L. Rothwell and G. K. Yates 13 Dec. 1978 44 p refs
(AF Proj. 7601)
(AD-A072987; AFGL-TR-78-0306; AFGL-ERP-647) Avail: NTIS HC A03/MF A01 CSCL 04/1

A model for the onset of magnetospheric substorms is developed based on the observations of Pytte et al (1976). North-south single-particle motion across the plasma sheet becomes instrumental in generating magnetic instabilities when the plasma sheet is sufficiently compressed. The number density times the square of the plasma sheet thickness is found to be the critical parameter (nl squared less than or equal to 8.1 x 10 to the 15th power protons/cm). A merging theory is developed based on these magnetic instabilities. The nightside merging rate is controlled by the value of the magnetic field in the tail lobes which, in turn, is dependent on the dayside merging rate. Merging and collisional damping of the J x B force contribute to the heating of the plasma sheet. The 10-15 min interval between onsets is interpreted in terms of a weak coupling between the tail lobes and the plasma sheet. A straightforward application of small-amplitude oscillation theory shows that the period between onsets is a direct measure of the mean collision frequency in the plasma sheet. The obtained value is in good agreement with that calculated from the resistivity relation. GRA

N80-11696# California Univ., Livermore. Lawrence Livermore Lab.
SEISMIC SAFETY MARGINS RESEARCH PROGRAM OVERVIEW
Frank J. Tokarz and Paul D. Smith 30 Nov. 1978 31 p refs Presented at third ASCE Specialty Conf. on the Structural Design of Nuclear Plant Facilities, Boston, 2 Apr. 1979 Sponsored in part by NUREG
(Contract W-7405-eng-48; DOE-40-550-75)
(UCRL-81884; Conf-790408-4) Avail: NTIS HC A03/MF A01

An overview of the seismic safety margins research program is presented. The program objective, the approach to meet the program goal and objectives, end products, the probabilistic systems methodology, and planned activities for phase 1 are discussed. DOE

N80-11697# Sandia Labs., Albuquerque, N. Mex.
APPROXIMATE METHODS FOR THE ANALYSIS OF EARTH PENETRATION
P. Yarrington and F. R. Norwood 1978 12 p refs Presented at Soc. of Eng. Sci., Gainesville Fla. 4 Dec. 1978
(Contracts EY-76-C-04-0789)
(SAND-78-1748C; Conf-781206-4) Avail: NTIS HC A02/MF A01

Theoretical models of earth penetration are described. These models are incorporated into computer codes which are used to predict penetrator stresses and depth of penetration. The cases of normal and oblique impact are treated and comparisons with full scale experiments are made. DOE

N80-11698# California Univ., Livermore. Lawrence Livermore Lab.
PREDICTING SOLAR ENERGY FLUXES IN POLLUTED URBAN AREAS
T. R. Galloway Apr. 1979 9 p refs Presented at the 14th Intersoc. Energy Conversion Conf., Boston, Mass., 5 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-82080; Conf-790803) Avail: NTIS HC A02/MF A01

A method which utilizes known molecular absorption coefficients for gaseous air pollutants and various manmade and natural aerosols in an urban atmospheric model is presented. The atmospheric optical thickness and thus the ratio of ground level direct incident flux to insolation flux above the atmosphere are predicted. A prediction method for the representative values of the unpolluted air background that was commonly used in the past by the solar energy designer to derive an urban solar energy correction factor is discussed. DOE

N80-11699# Wiggins (J. H.) Co., Redondo Beach, Calif.
SEISMIC SAFETY MARGINS RESEARCH PROGRAM. PHASE 1, PROJECT 7: SYSTEMS ANALYSIS SPECIFICATIONS OF COMPUTATIONAL APPROACH
J. D. Collins Feb. 1979 166 p refs
(Contract W-7405-eng-48)
(UCRL-13986-1) Avail: NTIS HC A09/MF A01

A computational methodology is presented for the prediction of core melt probabilities in a nuclear power plant due to earthquake events. The proposed model has four modules: seismic hazard, structural dynamic (including soil-structure interaction), component failure and core melt sequence. The proposed modules would operate in series and would not have to be operated at the same time. The basic statistical approach uses a Monte Carlo simulation to treat random and systematic error but alternate statistical approaches are permitted by the program design. DOE

N80-11700# General Atomic Co., San Diego, Calif.
SOILST: A COMPUTER PROGRAM FOR SOIL-STRUCTURE INTERACTIONS ANALYSIS
J. J. Johnson Apr. 1979 150 p refs
(Contract EY-76-C-03-0167-065)
(GA-A-15067) Avail: NTIS HC A07/MF A01

SOILST is a computer program to perform soil-structure interaction analysis. Two types of analysis can be performed: time history analysis by direct integration, and the determination of equivalent modal damping ratios for the coupled soil-structure system. The super-structure dynamic characteristics are defined by the structure's fixed-base eigensystem. The behavior of the supporting soil is defined by frequency independent impedance functions. The theory, user's manual, and listing of the program are presented. DOE

N80-11701# Oak Ridge National Lab., Tenn.
SIMULATION OF LAND-USE PATTERNS AFFECTING THE GLOBAL CARBON CYCLE Ph.D. Thesis
Y. H. Chan, J. S. Olson, and W. R. Emmanuel Jan. 1979 183 p refs
(Contract W-7405-eng-26; ESD-Publ-1273)
(ORNL/TM-6651) Avail: NTIS HC A09/MF A01

Past increase of atmospheric CO_2 involves significant contributions from both fossil and nonfossil (biospheric) sources. A simulation model was used to reconstruct changes since 1860 and project four hypothetical future scenarios of CO_2 injection to 2460. Nineteen compartments and their exchanges of carbon were considered. Areal extent of tropical forests, other wooded ecosystems, and nonforests were incorporated into the model. Rapidly and slowly exchanging pools of carbon per unit area, and net primary production for each pool and exosystem group, were projected by integrating income loss differential equations numerically using SSMP programming language. Limits of exploitable forest area and biomass were evaluated and found to contribute much less future CO_2 than the usable coal, oil, gas, and oil shale. DOE

N80-11702# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
DEVELOPMENT AND TESTING OF EQUIPMENT FOR AEROLOGICAL MEASUREMENTS ON BOARD SMALL ROCKETS AND AIR-DROPPED OBJECTS Final Report
Georg Pfotzer Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1978 65 p refs In GERMAN; ENGLISH summary

(Contract BMFT-WRT-69)
(BMFT-FB-W-78-11) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Eggenstein-Leopoldshafen, West Ger. DM 13.50

Results of studies and experimental investigations on methods of aerological measurement on board small rockets are reported. The development and construction of a system for position finding of a fast moving object by the combination of a radiointerferometer for the direction finding and a device for the measurement of the distance via the time delay between signals transmitted from ground and retransmitted by a converter aboard the flying object is described. A study on a special kind of accelerometer, to be inserted in falling spheres or satellites for the measurement of air density, whereby a spherical body inside of the freely moving object is restrained by magnetic or electric forces, is presented. The construction of a functional model of the magnetic accelerometer is also discussed. A study on the possibility of the determination of the air density by measuring the Rayleigh scattering of artificial light is reported on. The development and construction of a barometer box with lids of metallic coated membranes of quartz glass forming a pressure sensitive condensor is summarized and the investigation of a pressure gage consisting of a gas discharge tube is outlined. Author (ESA)

N80-11703# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
AERONOMICAL SOUNDING ROCKET PROGRAM. RESULTS OF THE FOIL CLOUD EXPERIMENT FLOWN ON THE PAYLOAD B1 OF THE NATIONAL AERONOMY PROGRAM WINTER ANOMALY AND TRACE CONSTITUENTS AT EL AERNOSILLO, SPAIN, DECEMBER 1975 TO FEBRUARY 1976 Final Report
Hans-Ulrich Widdel Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 64 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRK-0274; DFVLR-BPT-01-D1-173)
(BMFT-FB-W-78-16) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 13.45

The results of a foil cloud experiment executed during the National Aeronomy Program Winter Anomaly and Trace Constituents from December 1975 until February 1976 over El Arenosillo are reported. The experiment was flown on small rockets (SKUA 2 and SKUA 3). The experiment was designed for the measurement of the wind profile in the height region 80 to 95 km, providing a high resolution of height and yielding air density measurements. When the campaign results were compared with results of earlier measurements it was found that the sensitive levels, in which a change of wind speed correlates significantly with a change of short wave absorption are about 3 to 6 km higher under conditions of low sunspot activity than is the case when the sun's activity is high. However, the air pressure, derived from the fall rates of the foil cloud, does not change appreciably with the activity of the sun. Author (ESA)

N80-11704# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
AERONAUTICAL SOUNDING ROCKET PROGRAM. RESULTS OF GROUND-BASED SHORT WAVE ABSORPTION MEASUREMENTS PERFORMED AT 38 DEG NORTHERN LATITUDE BETWEEN 1967 AND 1976 Final Report
Hans-Ulrich Widdel Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 73 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRK-0274; DFVLR-BPT-01-OW-015)
(BMFT-FB-W-78-22) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 15.15

Radio wave absorption measurements were taken in different places in Spain. The results are discussed in relation to meteorological processes taking place at D-region heights of the ionosphere. The experimental setup, including sending and receiving antennas, power supplies, ionosondes, and data handling is described. Results, particularly those related to the winter anomaly, are discussed point by point. Emphasis is on the winter anomaly structure, its two year cycle, its intensity, and the apparent correlation with solar activity as well as on magnetic field disturbances and their parallel atmospheric parametric changes. Author (ESA)

N80-11705# Stockholm Univ. (Sweden). Dept. of Meteorology.
PHYSICAL AND CHEMICAL PROPERTIES OF AEROSOLS UNDER VARYING EUROPEAN INFLUENCE
Jost Heintzenberg, Claes Traegaardh, G. Alm, R. Bostroem, L. Granat, H-C. Hansson (Lund. Inst. of Technol., Sweden), B. Holm, S. Moritz, A. Richter, and R. Soderlund 6 Feb. 1979 111 p refs Prepared in cooperation with Intern. Meteorol. Inst.
(AC-48) Avail: NTIS HC A06/MF A01

In a joint field experiment in Valen, southern Sweden, physical and chemical aerosol properties in air masses with varying degrees of contamination were measured. By means of trajectory calculations the aerosol properties were related to air mass in order to study the influence of different source regions. During the total time period a wide range of air masses passed over the station. Consequently aerosol properties varying by factors between 5 and 1000 were encountered. Maximum light scattering and light absorption occurred at the same time as maximum particle concentrations as well as NH4 and SO4 ionic concentrations. The corresponding trajectories clearly indicated the inflow of air as coming from southeastern or western Europe. For other elements the trajectory analysis pointed to maritime or local Scandinavian sources. Author (ESA)

N80-11706# Stockholm Univ. (Sweden). Dept. of Meteorology.
PARAMETERIZATION OF VERTICAL DIFFUSION IN A DIURNALLY VARYING BOUNDARY LAYER
Gunnar Omstedt 12 Mar. 1979 21 p refs Prepared in cooperation with Intern. Meteorol. Inst.
(DM-27) Avail: NTIS HC A02/MF A01

A one-dimensional time-dependant diffusion model is used to represented a diurnally varying boundary layer. How such a variation affects the daily average vertical flux of a pollutant is studied. The model show that, independent of where the source is located (above or inside the boundary layer) a diurnal variation in the turbulent diffusivity profile makes the 24 hour average vertical flux less than the 24 hour average vertical flux computed with a constant turbulent diffusivity profile with the turbulent diffusivity given by its daily average. To assess this difference the concept of effective turbulent diffusivity is introduced. Author (ESA)

N80-11707# World Meteorological Organization, Geneva (Switzerland)
THE ATMOSPHERE BOUNDARY LAYER
R. W. Stewart 1979 58 p refs Presented at 3d Intern. Meteorol. Organ. (IMO) Lecture of the 7th WMO Congr., 1975
(WMO-523; ISBN-92-63-10523-5) Avail: NTIS HC A04/MF A01; WMO, Geneva SWFR 20

The definition of the atmospheric boundary layer is discussed. Its importance to the dynamics of the atmosphere is pointed out. The exchange of heat and water vapor between the earth's surface and the boundary layer is considered. Stable conditions and their consequences for the concentration of anthropogenic air pollution are examined. The theoretical treatment of the boundary layer, especially as regards mixing properties, is taken up. Various mathematical models, including eddy coefficient theory, similarity theories covering both the surface layer and theory above the surface layer, and closure models, are analyzed for their accuracy and efficiency. The properties of the lower boundary (land and water surfaces) are treated in greater detail and suggestions for further study are made. Author (ESA)

N80-11708# IEA Coal Research, London (England).
CARBON DIOXIDE AND THE GREENHOUSE EFFECT: AN UNRESOLVED PROBLEM
Irene Smith Apr. 1978 40 p refs
(ICTIS/ER-01; ISBN-92-9029-002-1) Avail: NTIS HC A03/MF A01

Current scientific literature concerned with the accumulation of carbon dioxide in the atmosphere is reviewed and evaluated. The extent and possible causes of natural variations in global climate are outlined as a background to potential variations due to human activity. Estimates are given on relative contributions of carbon dioxide to the atmosphere due to fossil fuel combustion, deforestation, and other land modifications. The possibility of a rise in global temperature as a result of increasing the amount

of carbon dioxide in the atmosphere is discussed including model predictions, natural factors which could compensate for or emphasize a warming effect, and the implications if extensive warming actually occurred. It is concluded that there is no evidence of a rise in global temperature due to carbon dioxide at present. An increase in the global temperature in the next century is considered in terms of an increase in precipitation rate and melting of all the ice sheets. Author (ESA)

N80-11709# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
THE EFFECT OF THE MAGNETOSPHERE PROCESSES ON THE IONOSPHERE DURING THE MAGNETIC STORM OF DECEMBER 1, 1977 BASED ON THE COSMOS-900 DATA
E. N. Sosnovets, V. V. Afonin, G. L. Gdalevich, A. V. Dronov, V. D. Ozerov, M. I. Panasyuk, L. V. Tverskaya, V. I. Tulupov, O. V. Korosheva, and J. Smilauer 1979 12 p refs
(D-277) Avail: NTIS HC A02/MF A01

The effect of the magnetospheric disturbances on the high latitude ionospheric plasma during the magnetic storm of December 1, 1977 was investigated using data from measurements onboard Cosmos 900 satellite. (The circular orbit is at the height of about 500 km, its inclination is 83 deg, the orbit period is 94.4.) The regions of energetic electron precipitation are correlated with auroras and with the intensity of protons forming the storm ring current, and the dynamics of the main ionospheric trough and the polar peaks of the density and the temperature of the ionospheric plasma are studied. Author (ESA)

N80-11710# Geological Survey, Indianapolis, Ind. Water Resources Div.
EFFECTS OF PUMPING ON GROUND-WATER LEVELS NEAR, TAYLORSVILLE, BARTHOLOMEW COUNTY, INDIANA Final Water Resources Investigations.
Michael Planert and Patrick Tucci Feb. 1979 28 p refs
(PB-298244/5; USGS/WRD/WRI-79/018; USGS/WRI-79-20) Avail: NTIS HC A03/MF A01 CSCL 13B

A two-dimensional digital flow model was used to estimate the effects of continuous pumping of a public-supply well field on the ground-water levels near Taylorsville, Indiana. Results of the modeling showed that the water levels would decline from less than 1 to about 4.5 feet within the study area and a maximum of 1 to 2 feet in Taylorsville in response to a pumping rate of 700 gallons per minute. Model results also show that the groundwater system would reach steady state in approximately 5 years after pumping begins. Corrections applied to water-level declines indicated by the model, to account for the effects of partial penetration of the aquifer by wells, showed that these effects, although substantial in the pumping wells, are negligible 200 feet from the wells. GRA

N80-11711# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
SEISMIC REFRACTION INVESTIGATION OF THE SALTON SEA GEOTHERMAL AREA, IMPERIAL VALLEY, CALIFORNIA M.S. Thesis
Robert Frith Bruce Dec. 1978 106 p refs
(Grant NSF AER-72-03551)
(PB-296547/3; UCR/IGPP-78/19; NSF/RA-780511) Avail: NTIS HC A06/MF A01 CSCL 08G

Seven seismic refraction profiles and four long refraction shots were used to investigate the Salton Sea geothermal in preparation for energy resource development. From the data, two models of the geothermal and adjacent area were proposed. GRA

N80-11712# Colorado State Univ., Fort Collins. Dept. of Atmospheric Sciences.
CONVECTION INDUCED TEMPERATURE CHANGE IN GATE
Pamela G. Grube Feb. 1979 138 p refs
(Grants NSF ENV-77-10229; NSF ATM-78-01640)
(PB-298130/6; AS-Paper-305) Avail: NTIS HC A07/MF A01 CSCL 04A

An analysis is made of GATE B-array short time resolution (3-6 hours) upper tropospheric temperature and moisture changes. Convective patterns are examined to determine how deep-cumulus clouds are related to such upper level changes. Thermodynamic characteristics of a raining area are compared to those of a nonraining area. Information is obtained from the B-array rawinsonde, rain gauge, and weather radar products. The magnitude and time-scales of cumulus warming events are discussed as well as how cumulus warming may be related to tropical cyclone genesis. GRA

N80-11713# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
COMPARISON OF SPECTROSCOPIC AND RADIOMETRIC MEASUREMENTS OF UPPER ATMOSPHERE WATER VAPOR
Ira G. Nolt, James V. Radostitz, Russell J. Donnelly, and Lois P. Stearns May 1979 24 p refs Prepared in cooperation with Oregon Univ., Eugene
(PB-299072/9; NOAA-TR-ERL-406; APCL-44; NOAA-79071308) Avail: NTIS HC A02/MF A01 CSCL 04A

Simultaneous spectroscopic and radiometric measurements of atmospheric water vapor overburden are compared. The measurements taken during 15 flights indicated that both techniques give the same water vapor overburden to within 1 micrometer of precipitable water vapor. The median water vapor overburden is 6.5 micrometers precipitable water vapor at 41,000 ft (approx 180 mbar pressure) in the midlatitude western United States during the summer-fall season, with a range from 4 to 11 micrometers. GRA

N80-11714# Meteorology Research, Inc., Altadena, Calif.
RADAR ECHO ORGANIZATION AND DEVELOPMENT IN THE MESOSCALE ENVIRONMENT: A CASE STUDY APPROACH
P. C. Chen, M. E. Humbert, and T. B. Smith Sep. 1978 98 p refs
(Contract DI-14-06-D-7587)
(PB-298444/1; MRI-78-FR-1580; TDWR/LP-97) Avail: NTIS HC A05/MF A01 CSCL 04A

The relationship between the mesoscale organization and development of clouds (echoes) and the environmental atmospheric conditions is examined. The synoptic conditions, the convective stability, wind shear and wind structure as well as the organization, movement, and evolution of echoes as shown by the M-33 radar are analyzed. GRA

N80-11528# Joint Publications Research Service, Arlington, Va.
EARTH'S CRUST UNDER THE OCEANS
G. B. Rundnik and G. J. Kashintsev *In its* Geophys., Astron. and Space, No. 450 (JPRS-73947) 2 Aug. 1979 p 7-15 refs Transl. into ENGLISH from Priroda (Moscow), no. 4, 1979 p 42-47 (For primary document see N80-11527 02-42)
Avail: NTIS HC A03/MF A01

N80-11529# Joint Publications Research Service, Arlington, Va.
OBSERVATIONS OF ATMOSPHERIC DUST FROM SPACE
Al. Grigoryev and K. Kondratyev *In its* Geophys., Astron. and Space, No. 450 (JPRS-73946) 2 Aug. 1979 p 29-37 refs Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 6, 1979 p 88-92 (For primary document see N80-11527 02-42)
Avail: NTIS HC A03/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-11715# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service
WIND SHEAR HAZARD DEFINITION FOR A WIDE BODY JET Final Report
Herbert W. Schlickenmaier Jun. 1979 80 p ref
(FAA-RD-79-90) Avail: NTIS HC A05/MF A01

A computer program is developed to simulate the flight dynamics and automatic flight control system (AFCS) of a three engine jumbo jet following a 3 deg glideslope during final approach

Wind shear profiles representative of actual encounters are used. The simulation uses both autopilot and autothrottle. An initial effort is made to define specific wind shear conditions that pose hazards to aircraft. Parameter values are analyzed for each of four categorized wind shear environments and performance scores achieved on computer simulations are assigned for each of the four wind shear types. The most severe situations that can be accommodated by a jumbo tri-jet with current configuration are described for each of the four wind shear types. Conservative controllability criteria is applied and a hazardous condition is presumed to exist when the control action demanded and provided by the simulator exceeds the control limits of the actual aircraft, or when the airspeed and/or touchdown dispersion exceed limit values. Definition of these criteria provide a basis for the formulation of procedures allowing aircraft to anticipate and avoid hazardous wind shear conditions. A.R.H.

N80-11716*# Naval Weapons Center, China Lake, Calif.
AIRBORNE MEASUREMENTS OF CLOUD FORMING NUCLEI AND AEROSOL PARTICLES AT KENNEDY SPACE CENTER, FLORIDA
Lawrence F. Radke, Gerhard Langer, and Edward E. Hindman, II. Dec. 1978. 33 p. refs. Sponsored in part by NSF. Prepared in cooperation with Washington Univ., Seattle and National Center for Atmospheric Research, Boulder, Colo.
(Contract NASA Order T-6782-F; Contract N60530-78-C-0114)
(NASA-CR-160359; NWC-TM-3667) Avail: NTIS
HC A03/MF A01 CSCL 04B

Results of airborne measurements of the sizes and concentrations of aerosol particles, ice nuclei, and cloud condensation nuclei that were taken at Kennedy Space Center, Florida, are presented along with a detailed description of the instrumentation and measuring capabilities of the University of Washington airborne measuring facility (Douglas B-23). Airborne measurements made at Ft. Collins, Colorado, and Little Rock, Arkansas, during the ferry of the B-23 are presented. The particle concentrations differed significantly between the clean air over Ft. Collins and the hazy air over Little Rock and Kennedy Space Center. The concentrations of cloud condensation nuclei over Kennedy Space Center were typical of polluted eastern seaboard air. Three different instruments were used to measure ice nuclei: one used filters to collect the particles, and the others used optical and acoustical methods to detect ice crystals grown in portable cloud chambers. A comparison of the ice nucleus counts, which are in good agreement, is presented. Author

N80-11717# RAMCOR, Inc., Vienna, Va.
A REPORT ON ATMOSPHERIC OBSTRUCTIONS TO VISIBILITY. VOLUME 1: STUDY RESULTS Final Report
Victor J. Lujetic. 10 Mar. 1979. 115 p.
(Contract DAAK70-78-C-0109)
(AD-A071741; RC168-001-Vol-1; ETL-0169) Avail: NTIS
HC A06/MF A01 CSCL 04/2

The aims and objectives of this report were to collect and assimilate information and synthesize data on the effects of atmospheric obstructions to visibility for the non-specialist. The following areas were addressed: A general discussion of the visible wavelengths, overall electromagnetic spectrum, radiometric and photometric quantities and concepts, and other visibility parameters. The human eye, nature of visibility, and the atmospheric effects on detection ranges. A description of those obstructions to visibility as listed in the Federal Meteorological Handbook on surface observations. A description of the primary visual instruments. The practicality of developing techniques that could be used to determine the effects of atmospheric obstructions on visibility and some typical charts and graphs, and. A summary of the extensive literature search performed. GRA

N80-11718# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19305A GSRS MISSILE NUMBER 1025, ROUND NUMBER V-33
May 1979. 19 p.
(DA Proj. 1T6-65702-D-126)
(AD-A071894; ERADCOM/ASL-DR-1021) Avail: NTIS
HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19305A GSRS, Missile No. 1025, Round No. V-33, are presented in tabular form. GRA

N80-11719# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19305A GSRS MISSILE NUMBER 1055 ROUND NUMBER V-31
May 1979. 19 p.
(DA Proj. 1T1-66572-D-126)
(AD-A071880; ERADCOM/ASL-DR-1019) Avail: NTIS
HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19305A GSRS, Missile No. 1055, Round No. V-31, are presented in tabular form. GRA

N80-11720# Eastman Kodak Co., Rochester, N. Y. Apparatus and Optical Div.
SPECTRAL RADIOMETRIC MEASUREMENT AND ANALYSIS PROGRAM. VOLUME 4: SCAT3 OPERATOR'S MANUAL Final Report
L. G. Christensen, R. Simmons, G. Schauss, R. Norton, and R. Schoenfeld. Apr. 1979. 57 p.
(AD-A072081; AWS-TN-79-001-Vol-4) Avail: NTIS
HC A04/MF A01 CSCL 04/2

This report covers a recently completed contract with the United States Air Force Air Weather Service to conduct research into the transfer of atmospheric energy in the visible and near-infrared portions of the electromagnetic spectrum. Its objective was to produce a spectral model of path transmittance, radiance, and groud-level irradiance that could be related to meteorological observations through the use of simultaneous, insitu data collections. For this purpose, a mathematical model was developed. It was based on physical equations for a homogeneous atmosphere that were modified by empirical observations made under a broad range of meteorological conditions. With the model, it is possible to estimate the visible and near-infrared spectral absorption and scattering phenomena that result from atmospheric constituents, from surface synoptic weather observations. The atmospheric model was coded into a computer program called SCAT3. This document is the fourth volume documenting the radiometric data collection program that culminated in the radiometric atmospheric model, SCAT3. The objective of this volume is to acquaint the user with the proper input sequences and options when SCAT3 is run on an IBM 370 computer. Volumes 1, 2, and 3 contain the details of data collection, analysis, and derivation of equations that were coded into the program to reconstruct atmospheric radiance, transmittance, and ground irradiation. GRA

N80-11721# Eastman Kodak Co., Rochester, N. Y. Apparatus and Optical Div.
SPECTRAL RADIOMETRIC MEASUREMENT AND ANALYSIS PROGRAM. VOLUME 3: DATA ANALYSIS AND FORMULATION OF THE MODEL Final Report
L. G. Christensen and R. Simmons. Apr. 1979. 225 p. refs.
(AD-A072080; AWS-TN-79-001-Vol-3) Avail: NTIS
HC A10/MF A01 CSCL 04/2

This report covers a recently completed contract with the United States Air Force Air Weather Service to conduct research into the transfer of atmospheric energy in the visible and near-infrared portions of the electromagnetic spectrum. Its objective was to produce a spectral model of path transmittance, radiance, and ground-level irradiance that could be related to meteorological observations through the use of simultaneous, insitu data collections. For this purpose, a mathematical model was developed. It was based on physical equations for a homogeneous atmosphere that were modified by empirical observations made under a broad range of meteorological conditions. With the model, it is possible to estimate the visible and near-infrared spectral absorption and scattering phenomena that result from atmospheric constituents, from surface synoptic weather observations. This document presents the details of analysis used to reduce the collected radiometric and meteorological data to a series of equations which became the SCAT3. Examples are also shown illustrating the final model's ability to match observed spectral structure based upon coefficients derived from surface meteorology. GRA

N80-11722# Eastman Kodak Co., Rochester, N. Y. Apparatus and Optical Div.

SPECTRAL RADIOMETRIC MEASUREMENT AND ANALYSIS PROGRAM. VOLUME 1: DESCRIPTION OF MOBILE RADIOMETRIC LABORATORY SYSTEM Final Report

Lawrence G. Christensen, R. Simmons, G. Schauss, R. Norton, and R. Schoenfeld. Apr. 1979. 98 p.

(AD-A072078; AWS-TN-79-001-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report covers a recently completed contract with the United States Air Force Air Weather Service to conduct research into the transfer of atmospheric energy in the visible and near-infrared portions of the electromagnetic spectrum. Its objective was to produce a spectral model of path transmittance, radiance, and ground-level irradiance that could be related to meteorological observations through the use of simultaneous, in-situ data collections. For data collection, a self-sustaining, mobile field radiometric laboratory was used that contained custom-designed spectroradiometers, mechanical/electrical servo controls, and computer interfaces; the laboratory utilized computer software for laboratory operation and data analysis. By means of minicomputers and peripherals, the laboratory produced calibrated and corrected data that could later be processed on larger, in-house IBM systems for development of the final radiometric model. This volume (No. 1) provides an engineering description of the mobile laboratory, the calibration of radiometers, and the computer software developed to operate the laboratory. More detailed documentation of devices and software is available upon request that will permit better understanding of the details of electronic, mechanical, and optical operation and maintenance of the laboratory system. This related system documentation is listed in Appendix A of this volume. Author (GRA)

N80-11723# Weather Wing (3rd), Offutt AFB, Nebr. Aerospace Sciences Div.

MAJOR MIDWEST SNOWSTORMS

Eugene M. Weber. 8 Aug. 1979. 104 p. Supersedes Rept-3WW-TN-76-2-Rev.

(AD-A072746; Rept-3WW-TN-79-2; Rept-3WW-TN-76-2) Avail: NTIS HC A06/MF A01 CSCL 04/2

This Technical Note discusses the various atmospheric conditions essential to the development of major wintertime storm systems over the Midwest (Central United States). Primary emphasis is placed upon determination of areas favorable for cyclogenesis. Intensification and movement of the 500 mb low as a function of 500 mb height falls tendency is presented. Identification, intensification, and movement of the main surface system is then introduced. Finally, the related developments of all levels of the atmosphere, as they occurred, are shown in various summary forms. Author (GRA)

N80-11724# Naval Research Lab., Washington, D. C.

FIELD TEST OF THE STABILIZATION OF SUPERSIZED WATER DROPLETS CONDENSED ON PYROTECHNICALLY GENERATED HYGROSCOPIC NUCLEI

S. G. Gathman, B. G. Julian, R. K. Markson (Airborne Research Associates, Weston, Mass.), and J. Sedlacek (Airborne Research Associates, Weston, Mass.). 10 Aug. 1979. 29 p. refs.

(AD-A073035; NRL-MR-4059) Avail: NTIS HC A03/MF A01 CSCL 04/2

A field experiment is described which was undertaken to determine if water droplets grown on pyrotechnically generated hygroscopic nuclei at high relative humidities can be stabilized in size when exposed to lower ambient relative humidities. Droplets coated with surface active materials were observed to persist longer than untreated droplets in identical experiments performed off of Nantucket, Massachusetts. GRA

N80-11725# Meteorology International, Inc., Monterey, Calif.

THE APPLICATION OF MEASURES OF SYNOPTIC SIMILARITY TO THE EVALUATION AND DEVELOPMENT OF ATMOSPHERIC PREDICTION MODELS: TASK 1 Final Report

Manfred M. Holl and Michael J. Cuming. Monterey, Calif.: Dept. of the Navy, Mar. 1979. 93 p. refs.

(Contract N00228-78-C-3258)

(AD-A073098; MII-M-238; NEPRF-CR-79-01) Avail: NTIS HC A05/MF A01 CSCL 04/2

A method is described for bit-coding meteorological analyses and forecasts in terms of specifying parameters which measure pattern characteristics. By matching the associated bit strings, an absolute measure of the similarity between forecast and analyzed synoptic fields can be obtained. Applications to numerical model verification, evaluation and development are discussed. GRA

N80-11726# Air Force Geophysics Lab., Hanscom AFB, Mass.

SHORTRANGE FORECASTING THROUGH EXTRAPOLATION OF SATELLITE IMAGERY PATTERNS. PART 1: MOTION VECTOR TECHNIQUES

H. Stuart Muench and Rupert S. Hawkins. 26 Apr. 1979. 22 p. refs.

(AF Proj. 6670)

(AD-A073081; AFGL-TR-79-0096; AFGL-ERP-660) Avail: NTIS HC A02/MF A01 CSCL 04/2

The advent of the geosynchronous satellite with 1 km resolution has presented meteorologists with the opportunity to routinely track and forecast smaller scale weather phenomena than hitherto was possible. The enormous data rate, however, precludes a completely manual system of data interpretation and forecasting, so to fully utilize this opportunity we must use computers. Following examples set by forecasters using digitized radar data, we are developing techniques to make guidance forecasts through automatic extrapolation of satellite imagery. Candidate techniques for extracting motion vectors from satellite imagery have been selected and programmed. This report describes the techniques and presents results of a preliminary test using simulated motions of selected satellite video images. GRA

N80-11727# Air Force Geophysics Lab., Hanscom AFB, Mass.

DESIGN STUDY FOR THE DEVELOPMENT AND USE OF MODEL OUTPUT STATISTICS IN AUTOMATED AVIATION WEATHER FORECASTING Final Report, 1 Apr. 1976 - 30 Sep. 1978

Harry R. Glahn and Karl F. Hebenstreit. 1 Dec. 1978. 38 p. refs.

(AF Proj. 6670)

(AD-A072849; AFGL-TR-79-0002) Avail: NTIS HC A03/MF A01 CSCL 04/2

The Air Weather Service is preparing for the WWMCCS era by developing a support concept whereby weather information inputs will be in terms of Weather Impact Indicators (WIIs) which specify the probability that all stages of a mission will have 'favorable' weather. This report presents the design of a system based on the proven Model Output Statistics (MOS) approach to provide, in real-time, acceptably skillful objective estimates of WII probabilities. The system is mission oriented allowing the user to specify the limiting values for the weather elements which impact his mission. If forecast equations for such a mission profile are not already available in the system, forecast equations will be developed, applied, and archived for future use. Acceptable accuracy of these forecasts is essential. A user will not be satisfied with probabilities which, through poor reliability, lead to unexpected losses or which, through poor resolution, furnish little discrimination over and above a simple application of climatology. The design analysis for a real-time MOS system for global application shows such a system to be feasible within the resources of a large-scale computing center such as that operated by the National Oceanic and Atmospheric Administration or the Air Force Global Weather Central. GRA

N80-11728# California Univ., Livermore. Lawrence Livermore Lab.

COMPARISON OF THE FINITE ELEMENT AND FINITE DIFFERENCE METHODS IN A DIAGNOSTIC REGIONAL WIND FIELD MODEL M.S. Thesis

Daniel Joseph Rodriguez. May 1979. 97 p. refs.

(Contract W-7405-eng-48)

(UCRL-52789) Avail: NTIS HC A05/MF A01

A comparative study was undertaken to investigate the similarities and differences between the finite element and finite difference methods of numerically approximating an objective analysis equation. Both models are three-dimensional, time-independent, and incorporate terrain in adjusting a field of observed three-component velocities to achieve mass-consistency. Principles from the calculus of variations are utilized in developing model equations. The variational approach assumes that velocities

input to the models are a fair representation of actual mean winds. Starting with meteorological data available randomly on a regional scale, wind component values are interpolated and extrapolated to each grid point in the calculational domain in a manner consistent with prevailing meteorology. Model adjustments are made in response to the original mass-inconsistency in this field of discrete velocities and to the topographical boundary surface representing the application area. DOE

N80-11729# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
SATELLITE SUPPORT TO HIPLEX: SUMMARY OF RESULTS, 1976 - 1978 Final Report, 2 Dec. 1975 - 30 Sep. 1978
David W. Reynolds and Thomas H. VondeHaar. Feb. 1979. 207 p. refs.
(Contract DI-6-07-DR-20020)
(PB-297839/3) Avail: NTIS HC A10/MF A01 CSCL 04B

Research in the use of satellite digital imagery in support of the High Plain Cooperative Program (HIPLEX) during the period 1976-1978 is presented. In general, the report is divided into two main sections. Satellite determined cloud climatologies gathered during the past several HIPLEX seasons and intensive case study analyses are reported. A description of the CSU All Digital Video Imaging System for Atmospheric Research (ADVISAR) and the Direct Readout Satellite Groundstation (DRSGS) facilities is included. GRA

N80-11730*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
INTERANNUAL VARIABILITY OF THE OCEAN ATMOSPHERE SYSTEM
1978. 15 p. refs. Presented at the Symp. on Solar-Terrestrial Phys., Innsbruck, 29 May 1978.
(Grants NGR-06-002-098; EY-76-S-02-1340; NSF ATM-76-21017; Contract N00228-76-C-3205)
(NASA-CR-162456; COO-1340-64; Conf-780598) Avail: NTIS HC A02/MF A01 CSCL 04B

Feedback mechanisms between the ocean and atmosphere are discussed. The influence of these mechanisms on the interannual variability of the atmosphere and on climatic fluctuations are examined. Large sea surface temperature anomalies which influence weather patterns by influencing planetary long waves are discussed. A.W.H.

N80-11731# World Meteorological Organization, Geneva (Switzerland).
FIRST SESSION OF THE WAMEX SCIENTIFIC AND MANAGEMENT REGIONAL COMMITTEE Global Atmospheric Research Program
1978. 82 p. refs. In FRENCH and ENGLISH. Conf. held at Ibadan, Nigeria, 6-10 Nov. 1978. Prepard jointly with ICSU, Rome.
(GARP-Spec-Rept-31) Avail: NTIS HC A05/MF A01

The status of the West African Monsoon Experiment (WAMEX), which is part of the GARP Monsoon Sub-Program, is reported on. The WAMEX implementation and operations plan is discussed in detail. The WAMEX observing system, data management, and the commitments and activities of the WAMEX participating countries are described. Scientific planning, research aspects of WAMEX, and public information activities related to WAMEX are also covered. Author (ESA)

N80-11732# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: CONSOLIDATED REPORT ON THE VOLUNTARY ASSISTANCE PROGRAMME INCLUDING PROJECTS APPROVED FOR CIRCULATION IN 1978 Annual Report
Jan. 1979. 415 p.
(WMO-525; ISBN-92-63-10525-1) Avail: NTIS HC A18/MF A01; WMO, Geneva SWFR 15

The voluntary assistance Program (VAP) as part of the World Weather Watch (WWW) plan is reported. The purpose of VAP is to provide assistance of participating countries in the implementation of the WWW plan, the financing and training of staff, and in the application of WWW in the field of hydrology. Suggestions on the form of notification of contribution of equipment and services to the VAP to be used are given. The status of the program to date is recapitulated and broken down by country. Author (ESA)

N80-11733# World Meteorological Organization, Geneva (Switzerland).
[REPORT OF ACTIVITIES ON WORLD METEOROLOGICAL RESEARCH, APPLICATIONS AND WATER RESOURCES DEVELOPMENT] Annual Report, 1978
1979. 236 p.
(WMO-529; ISBN-92-63-10529-4) Avail: NTIS HC A11/MF A01

Activities in such areas as water resources, agrometeorology and world food production, natural disasters and environmental problems of various kinds relating to weather modification, ozone depletion, atmospheric and marine pollution; and wind and solar energy are reported. The launching of the Global Weather Experiment is extensively covered. Meteorological applications in improving man's environment are emphasized. Progress made in hydrology and water resources development on regional and global levels along with the development programs of other organizations is discussed. A technical cooperation program through which assistance is rendered to developing countries is also summarized. Author (ESA)

N80-11734# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE FIFTEENTH SESSION OF THE JOINT ORGANIZING COMMITTEE Global Atmospheric Research Program Annual Report
1979. 184 p. refs. Conf. held at Dubrovnik, Yugoslavia, 28 Feb. - 6 Mar. 1979. Prepared jointly with ICSU, Rome.
Avail: NTIS HC A09/MF A01; WMO, Geneva SWFR 25

The status of the Global Experiment, the GARP climate dynamics subprogram, the World Climate Research Program, and other GARP subprograms is reported. Progress made by the Working Group on Numerical Experimentation is also cited. These activities cover such research areas as oceanography and climate, the carbon dioxide problem, climate modeling, the parameterization of extended cloudiness and radiation, as well as oceanic processes and observation of the world ocean. Author (ESA)

N80-11735# Fondazione Ugo Bordoni, Rome (Italy).
PLUVIOMETRIC DATA PRINTER [STAMPANTE DATI PLUVIOMETRIC]
Paolo Giorgi. Dec. 1978. 26 p. refs. In ITALIAN; In ITALIAN; ENGLISH summary.
(FUB-25-1978) Avail: NTIS HC A03/MF A01

A data printer of pluviometric data was developed in order to satisfy the requirements of a research project on the effects of rainfall on electromagnetic wave propagation above 10 GHz. The apparatus makes possible telemetric real time measurements, avoiding long processing delays. The characteristics of the logic circuits, power supply, and printer, are described. Author (ESA)

N80-11736# Royal Netherlands Meteorological Inst., De Bilt.
THE CALCULATION OF EVAPOTRANSPIRATION USING THE PENMAN FORMULA [TOEPASSINGEN VAN DE PENMAN FORMULE]
H. A. R. deBruin and W. Kohsiek. 1979. 57 p. refs. In DUTCH; ENGLISH summary.
(KNMI-WR-79-3) Avail: NTIS HC A04/MF A01

The application of the Penman equation for determining evapotranspiration, both for wet vegetation and for open surface water, is considered. Attention is payed to heat storage in the body of water, estimation of net radiation, and to the function describing the turbulent exchange in the atmosphere of water vapor and sensible heat. A brief error analysis is also given. The example of a crop surface is then treated. Results show that uncertainties in the wind function have a severe influence on the calculated evaporation. It is shown that uncertainties in the wind velocity at 2 m above a crop surface, derived from observations at neighboring meteorological stations, may lead to errors of up to 10% of the magnitude of the wind function. Finally, the effect of different averaging procedures on the water vapor pressure deficit is discussed. Author (ESA)

N80-11737# Royal Netherlands Meteorological Inst., De Bilt.
A CLIMATOLOGICAL STUDY ON THE OCCURRENCE OF EASTERLY GALES ON THE NORTH ATLANTIC OCEAN
C. G. Korevaar 1979 72 p refs
(KNMI-WR-79-5) Avail: NTIS HC A04/MF A01

The number of easterly gales that occurred in the North Atlantic Ocean north of 25 deg N were estimated using a selection criterion involving minimum values for the meridional pressure gradient for each day of the period 1881 to 1970. Looking at the number of days per year on which an easterly gale did occur it is seen that there are considerable differences between the successive periods 1881 to 1900, 1901 to 1920, 1921 to 1940, and 1941 to 1960. The fluctuations in the number of days per year with an easterly gale can be explained by a climatic fluctuation, connected by Willett with the cycle of solar activity, with a period of 80 to 90 years. This is in agreement with the fact that Schuurmans and Willett found the greatest increase in air pressure, after a solar flare, in the areas under consideration. It can be concluded that the occurrence of various numbers of easterly gales during the 80 to 90 year cycle of solar activity is a confirmation of the theories of Willett and Schuurmans. Results also show that next to influencing the frequency, the solar activity influences the persistence and extensiveness of easterly gales. Author (ESA)

N80-11738# Royal Netherlands Meteorological Inst., De Bilt.
VERIFICATION OF TWELVE AND 24 HOUR GEOSTROPHIC WIND FORECASTS AT 850 mbar USING BK3 AT IJMUIDEN OVER THE PERIOD OF 1 OCTOBER 1972 TO 30 NOVEMBER 1976 [VERIFICATIE VAN 12- EN 24 UURS GEOSTROFISCHE WINDVERWACHTINGEN OP 850 mbar VAN BK3 VOOR IJMUIDEN OVER DE PERIODE 1 OKTOBER 1972 T/M 30 NOVEMBER 1976]
L. C. Heijbor and G. W. Brouwer 1979 43 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-7) Avail: NTIS HC A03/MF A01

Verifications were carried out using geostrophic wind forecasts from an operational three-level quasi-geostrophic numerical model, BK3, and from the forecasts of the persistence. Contingency tables were composed for the forecasts of the wind speeds. With the aid of these tables the indices of the performance (relative performance of the model compared to the climatology) and skill scores (relative performance compared to the forecasted persistence) were computed. The forecasts of the wind directions were verified by taking the differences between the forecasted and observed directions and computing the mean differences and standard deviations for all chosen classes of forecasted wind speeds. Results show that the predictions of BK3 were better than those of the forecasted persistence. Author (ESA)

N80-11739# National Technical Information Service, Springfield, Va.
FOG PREDICTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978
Guy E. Habercom, Jr. Aug. 1979 178 p Supersedes NTIS/PS-77/0799; NTIS/PS-76/0635; NTIS/PS-78/0775 (NTIS/PS-79/0820/5; NTIS/PS-78/0775; NTIS/PS-77/0799; NTIS/PS-76/0635) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Methods for predicting the possibility of fog formation and forecasting the eventual natural dissipation of fog are investigated. Worldwide climatic conditions conducive to the probability of fog in specific geographic areas are observed. This updated bibliography contains 169 abstracts, 4 of which are new entries to the previous edition. GRA

N80-11740# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
THE DYNAMICS OF EQUATORIAL MASS-FLOW ADJUSTMENT
Pedro Leite Silva Dias Jun. 1979 218 p refs
(Grants NSF ATM-76-09370; NSF ATM-78-08125)
(PB-297992/0; ATS/Paper-312) Avail: NTIS HC A10/MF A01 CSCL 04B

The problem of the adjustment of the mass and wind fields in a divergent barotropic model is solved on the equatorial beta-plane. It is also shown that the concept of an adjusted state on the beta-plane is dependent on the dispersive properties and energetics of Rossby and gravity waves. Two basic experiments are shown: the first is a perturbation in the geopotential field, and the second is a perturbation in the rotational part of the wind field. GRA

N80-11741# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
MARINERS WEATHER LOG, VOLUME 23, NUMBER 3
Elwyn E. Wilson May 1979 86 p
(PB-298738/6; NOAA-79061903) Avail: NTIS HC A05/MF A01 CSCL 04B

Mariners Weather Log, volume 23, number 3, discusses marine meteorology in the North Pacific Ocean. Articles include: ship response and environmental ship routing; Eastern North Pacific tropical cyclones, 1978; and Central North Pacific tropical cyclones, 1978. A.W.H.

N80-11742# National Weather Service, Salt Lake City, Utah. Western Region.
THE DEPTH OF THE MARINE LAYER AT SAN DIEGO AS RELATED TO SUBSEQUENT COOL SEASON PRECIPITATION EPISODES IN ARIZONA
Ira S. Brenner May 1979 25 p refs
(PB-298817/8; NOAA-TM-NWS-WR-143; NOAA-79070602)
Avail: NTIS HC A02/MF A01 CSCL 04B

The relationship between the depth of the marine layer at San Diego, California, and potential precipitation episodes in Arizona during the cool season is studied. A marine layer from the surface to at least the 700 mb level is necessary for consideration of a subsequent widespread precipitation episode in Arizona. The relationship of the height of this marine inversion to the current vertical motion field is discussed. GRA

N80-11743# National Weather Service, Salt Lake City, Utah. Western Region.
THE USEFULNESS OF DATA FROM MOUNTAINTOP FIRE LOOKOUT STATIONS IN DETERMINING ATMOSPHERIC STABILITY
Jonathan W. Corey May 1979 14 p refs
(PB-298899/6; NOAA-TM-NWS-WR-142; NOAA-79070601)
Avail: NTIS HC A02/MF A01 CSCL 04B

A lifted index derived from data taken at several mountaintop fire lookout stations is discussed as a technique for thunderstorm forecasting during the fire season. The procedure for deriving an index of atmospheric temperature and moisture data is described and a discussion of the reliability of the procedure is presented. A.W.H.

N80-11744# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.
OBJECTIVE USE OF SATELLITE DATA DUE TO FORECAST CHANGES IN INTENSITY OF TROPICAL DISTURBANCES
Carl O. Erickson Apr. 1979 48 p refs
(PB-298915/0; NOAA-TM-NESS-103; NOAA-79070902) Avail: NTIS HC A03/MF A01 CSCL 04B

Eighty-nine classified and unclassified tropical disturbances of all intensities (several hundred synoptic 'cases') were investigated to determine how high-cloud vectors and other satellite data might be used for objective forecasts of changes in intensity. For unclassified (weak) disturbances, a 6-variable discriminator can identify many that are nondeveloping. For the remainder of unclassified disturbances, additional information is needed. For classified disturbances, two modified regression equations were developed to predict the 24 hr change in windspeed. The equations are derived from operationally available data, and the variables are calculated by a relatively simple numerical program. It appears that introduction of low-level vorticity and the nonlinear advection of vorticity should offer further improvements. GRA

N80-11745# National Weather Service, Silver Spring, Md.
THE NESTED GRID MODEL
Norman A. Phillips Apr. 1979 89 p refs
(PB-299046/3; NOAA-TR-NWS-22; NOAA-79071307) Avail: NTIS HC A05/MF A01 CSCL 04B

The nested grid model, which consists of a stereographic hemispheric grid with the option of one or two interior rectangular grids, each of successively smaller area and finer horizontal

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resolution is described. Second order accurate finite difference formulas used in a two step Lax-Wendroff procedure are discussed. Special initial treatments used to reduce spurious gravity waves from the Himalayas, and to insure symmetry about the equator are examined. Details of the September 1978 state of the model and its numerical procedures are presented, including the representation of latent heat release, small scale vertical exchange, spatial filtering, grid meshing at boundaries, and data input from the global analysis system. GRA

N80-11746# New Mexico Univ., Albuquerque. Technology Application Center.
CLEAR AIR TURBULENCE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979
Samuel C. Mauk Sep. 1979 37 p Sponsored in part by NTIS
(NTIS/PS-79/0858/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

Articles covering research and analysis, theories and experiments, detection and measurement equipment, simulation modeling, and CAT accidents involving aircraft are presented. (Contains 121 citations) GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-11747*# Battelle Columbus Labs., Ohio.
PRELIMINARY ASSESSMENT OF INDUSTRIAL NEEDS FOR AN ADVANCED OCEAN TECHNOLOGY
A. G. Mourad, K. M. Maher, J. E. Balon, A. G. Coyle, and J. A. Henkener 15 Oct. 1979 59 p refs
(Contract NASw-2800)
(NASA-CR-162435; BCL-OA-TFR-79-4) Avail: NTIS HC A04/MF A01 CSCL 08C

A quick-look review of selected ocean industries is presented for the purpose of providing NASA OSTA with an assessment of technology needs and market potential. The size and growth potential, needs and problem areas, technology presently used and its suppliers, are given for industries involved in deep ocean mining, petrochemicals ocean energy conversion. Supporting services such as ocean bottom surveying; underwater transportation, data collection, and work systems; and inspection and diving services are included. Examples of key problem areas that are amenable to advanced technology solutions are included. Major companies are listed. A.R.H.

N80-11748# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
NUMERICAL CASE STUDIES FOR OCEANIC THERMAL ANOMALIES WITH A DYNAMIC MODEL
Joseph Chi Kan Huang 1979 41 p refs Prepared in cooperation with Michigan Univ., Ann Arbor
(AD-A072587) Avail: NTIS HC A03/MF A01 CSCL 08/10

Numerical investigations to identify the physical processes responsible for the generation, evolution, and dissipation of oceanic thermal anomalies (OTA) were carried out using the numerical dynamic model of the North Pacific Experiment (NORPAX). The NORPAX model is based on time-integrations of the finite-difference forms of the primitive equations. It possesses an actual coastal configuration and 10 vertical layers, with a constant maximum depth of 4 km. The horizontal grid spacing, both longitudinal and latitudinal, is 2.5 deg. The seasonally varying model climatology is generated by integrating the model over 80 years of simulations under the climatological atmospheric forcing with the last 20 years varying with the seasonal cycle. Large-scale features of the model ocean climatology compare favorably with observed large-scale motions and structure in the North Pacific Ocean. The model is used for oceanic thermal anomaly studies. Two simulated cases are presented: one demonstrates the generation and evolution of OTA's under anomalous atmospheric wind forcing of winter 1949-50, and the other portrays the evolution and dissipation of the OTA's under climatological atmospheric conditions in winter 1971-72. GRA

N80-11749# Texas A&M Univ., College Station. Dept. of Oceanography.
LONG WAVE COUPLING OF THE MID AND SOUTH ATLANTIC BIGHTS FORCED BY THE ATMOSPHERE
David A. Brooks May 1979 131 p refs
(Contract N00014-77-C-0354; Grant NSF OCE-77-20971)
(AD-A072282; TAMU-Ref-79-3-T) Avail: NTIS HC A07/MF A01 CSCL 08/3

The eastern United States continental margin profile is relatively uniform throughout the Middle Atlantic Bight (Hatteras to Gulf of Maine), but in the South Atlantic Bight (Florida Keys to Hatteras) it bifurcates into an inner and outer slope region. Coastal tide gage records indicate that sea level oscillations with periods longer than one week can propagate southward as continental shelf waves in both Bights, thereby providing a coupling mechanism between the Bights. However, several-day period motions appear to be confined to the South Atlantic Bight and may result from backscattering of long wave energy by the variable topography and the Gulf Stream. The coastal sea level phase data for the several-day period motions is not easily attributable to a monochromatic propagating wave; rather, it appears that wave group properties may lead to a more consistent explanation of the phases. Cross-shelf and longshelf wind stress components were both strongly coupled to sea level fluctuations for long periods; short period motions were more closely associated with dynamic responses to atmospheric pressure fluctuations. GRA

N80-11750# Office of Naval Research, Bay St. Louis, Miss.
PHYSICAL OCEANOGRAPHY PROGRAM Report, FY 1979
Robert G. Kirk 1 May 1979 68 p refs
(RR0310301)
(AD-A073115) Avail: NTIS HC A04/MF A01 CSCL 08/10

This report presents a summary of work sponsored by the Physical Oceanography Program (Code 481) Office of Naval Research, Ocean Science and Technology Detachment, covering the FY 79 period. It includes a brief description of (1) the status of research for each of eleven different areas of physical oceanography, (2) each of the four multi-investigator, multi-institutional, and multidisciplinary projects which ONR 481 jointly sponsors, (3) each of the 79 individual projects which ONR 481 sponsors, and (4) all referred journal articles appearing during FY 1979. GRA

N80-11751# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.
OCEAN SYSTEMS, PROGRAM SUMMARY
Feb. 1979 260 p refs
(DOE/ET-0083) Avail: NTIS HC A12/MF A01

This program summary describes each of the DOE's Ocean Systems Program projects funded during FY 1978 (October 1, 1977 through September 30, 1978) and reflects their status as of September 30, 1978. The Ocean Systems Program includes ocean thermal energy conversion, wind-wave energy, ocean current energy, and salinity gradient energy. The project summary sheets list the project title, contractor, principal investigator, work location, contract number, DOE funding, and project summary. DOE

N80-11752# Environmental Protection Agency, Annapolis, Md.
BIOCHEMICAL STUDIES OF THE POTOMAC ESTUARY, SUMMER 1978
Joseph Lee Slayton and E. Ramona Trovato May 1979 42 p refs
(PB-297394/9; EPA-903/9-79-005) Avail: NTIS HC A03/MF A01 CSCL 08A

The carbonaceous and nitrogenous oxygen demand of Potomac River and STP effluent samples was determined during the summer of 1978. The oxygen depletion kinetics were studied during long term incubation using an inhibitor to nitrification. The average deoxygenation constants k sub e for the river sample CBOD and NOD were 0.12/day and 0.10/day, respectively. The CBOD of the Potomac STP effluent samples followed first order kinetics with an average k sub = e .16/day. The NOD for the STP effluent samples had a significant lag time resulting in poor correlation coefficients for first order fit. The average algal

contribution to the BOD5 was 0.027 mg/micrograms chlorophyll a with 70 percent due to decay and 30 percent due to respiration. GRA

N80-11753# National Marine Fisheries Service, Galveston, Tex. Galveston Lab.
ENVIRONMENTAL STUDIES OF THE SOUTH TEXAS OUTER CONTINENTAL SHELF, 1977. ICHTHYOPLANKTON/MACKEREL EGGS AND LARVAE Final Report, 1977
John H. Finucane, L. Alan Collins, Lyman E. Barger, and John D. McEachran. Apr. 1979. 527 p. refs. Prepared in cooperation with Texas A and M Univ., College Station.
(PB-296647/1; BLM/YM/ES-79/07) Avail: NTIS HC A23/MF A01 CSCL 08A

An ichthyoplankton study of the south Texas continental shelf is discussed. The species composition, relative abundance, and seasonal and areal distribution of ichthyoplankton are examined. Spawning times and spawning locations of major fish species are reported and data on the ecology of the area is provided. A.W.H.

N80-11754# National Marine Fisheries Service, Galveston, Tex.
ENVIRONMENTAL STUDIES OF THE SOUTH TEXAS CONTINENTAL SHELF, 1976 - 1977. HISTORICAL ZOOPLANKTON Final Report, 1977
E. Taisoo Park. Apr. 1979. 568 p. refs.
(PB-296646/3; BLM/YM/ES-79/06) Avail: NTIS HC A24/MF A01 CSCL 08A

Monthly samples taken off the South Texas coast between 1963 and 1965 were used to examine temporal and spatial variability in zooplankton populations. These data were compared to data from four stations on a previously examined transect in the same area. Seasonal peaks of density in the zooplankton and copepods generally occurred in the spring and fall, but seasonal and year to year variability was high. The dominant groups of zooplanktonic organisms included Copepoda, Larvacea, Mollusca, Euconchoecia, and Chaelognatha. Copepods generally comprised 50% to 65% of the zooplankton. Species diversity increased and density decreased with the distance from shore. GRA

N80-11755# National Marine Fisheries Service, Panama City, Fla. Panama City Lab.
ENVIRONMENTAL STUDIES OF THE SOUTH TEXAS CONTINENTAL SHELF. SNAPPER/GROUPER Final Report, 1977
William A. Fable, Jr. May 1979. 32 p. refs.
(PB-296645/5; BLM/YM/ES-79/05) Avail: NTIS HC A03/MF A01 CSCL 08A

The tagging of 299 red snapper and 793 vermilion snappers is described. The nonmigratory behavior of the snappers is discussed and the effects of altering the snappers habitat is examined. A.W.H.

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-11756*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INDIRECT MICROBIAL DETECTION Patent Application
Judd R. Wilkins, inventor (to NASA). Filed 17 Aug. 1979. 18 p.
(NASA-Case-LAR-12520-1; US-Patent-Appl-SN-067596) Avail: NTIS HC A02/MF A01 CSCL 06C

The 'invention' disclosed is an indirect microbial detection method. The growth of microorganisms in a sample is detected and monitored by culturing microorganisms in a growth medium and detecting a change in potential between two electrodes separated from the microbial growth by a barrier which is permeable to charged particles but microorganism impermeable. NASA

N80-11757# Army Research Inst. of Environmental Medicine, Natick, Mass.
THE 5-THIO-D-GLUCOSE THERMOREGULATORY EFFECTS IN MICE AT VARIOUS TEMPERATURES
Ralph P. Francesconi and Milton Mager. 14 May 1979. 24 p. refs.
(AD-A069511; USARIEM-M-12/79) Avail: NTIS HC A02/MF A01 CSCL 06/5

Adult, male mice were administered various doses of 5-thio-D-glucose (5-TG) at three environmental temperatures: 4 C, 22 C, and 35 C. Both intracerebroventricular (ICV) and intraperitoneal (IP) administration of 5-TG resulted in significant (p less than .05 to p less than .001) decreases in rectal temperature (Tre) which were usually dose-dependent. After 30 min the hypothermic effects were significantly (p less than .001, ICV, 100 microgram) exacerbated by cold exposure (4 C vs 22 C) and were likewise intensified significantly (p less than .005, 45 min, fed vs 18 hr fasted) by food deprivation. These decrements in rectal temperature (Tre) were accompanied by significant (p less than .001) increases in circulating levels of glucose. The present results indicate that 5-TG may be eliciting both central and peripheral cellular glucopenia concomitant with circulatory hyperglycemia; thus, the resultant hypothermia may be arising from competitive inhibition of glycolysis by 5-TG intermediates as well as reduced availability of tissue glucose. GRA

N80-11758# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
EARLY DIAGNOSIS OF DECOMPRESSION SICKNESS. CHANGES IN THE BLOOD FOUND SHORTLY AFTER DECOMPRESSION. EXPERIMENTS ON RATS
M. Wijnans, P. M. Draeck, and P. vanEck. Jul. 1978. 29 p. refs. In DUTCH; ENGLISH summary.
(MBL-1978-7) Avail: NTIS HC A03/MF A01

In rats subjected to compression followed by decompression hemoconcentration was observed. The effects were then related to the severity of the applied compression-decompression procedure. In nearly all cases this hemoconcentration became apparent before signs of decompression-sickness were observed. Hemoconcentration occurred even in rats without symptoms. In a relatively large number of rats a drop in platelet count was noticed soon after decompression; but usually only after the platelet count was corrected for the hemoconcentration. It was found that in rats a rise in hematocrit had the highest prognostic value for the occurrence of symptoms of decompression sickness. Recommendations are given for an investigation of the possible prognostic value of hemoconcentration in divers. Author (ESA)

N80-11759# Deutsche Forschungs- and Versuchsanstalt fuer Luft- und Raumfahrt, Frankfurt am Main (West Germany). Inst. fuer Flugmedizin.
DISCRETE MULTIVARIATE ANALYSIS ON RADIOBIOLOGICAL RESULTS FROM THE BIOSTACK 3 BACILLUS SUBTILIS EXPERIMENT
R. Facius, H. Buecker, and M. Schaefer. 1979. 6 p. refs. Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979.
Avail: NTIS HC A02/MF A01

The dependency of spore survival on HZE particle linear energy transfer (LET) and on their distance from the particles trajectory during Biostack 3 experiments is discussed. Multivariate methods are applied as far as the stochastic point of view is concerned. It is shown that the major features of the bivariate results cannot be reduced to the heterogeneous frequency distributions of the respectively remaining physical parameters of the HZE particles. These findings bear on considerations about mechanisms, by which biological damage might be induced by high LET heavy ions. Author (ESA)

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N80-11760 Medical Univ. of South Carolina, Charleston.
CARBON DIOXIDE CONTRIBUTIONS IN RESPIRATORY CONTROL Ph.D. Thesis
Edwin Merrill Adams. 1979. 148 p.
Avail: Univ. Microfilms Order No. 79620656

The contribution of carbon dioxide to respiratory control made by the carotid bodies and vagus nerves is investigated. The relationship between the central respiratory neutron in the ventral respiratory group and airflow, the latency response to CO2, the contribution of the carotid body to the hypercapnic response are discussed. Dissert. Abstr.

N80-11761# National Research Inst. for Mathematical Sciences, Pretoria (South Africa)
IDENTIFICATION OF CONTROLS IN NEURO-MUSCULOSKELETAL CONTROL SYSTEM MODELS
H. Hatze. Oct. 1978. 25 p. refs.
(CSIR-TWISK-52) Avail: NTIS HC A02/MF A01

The commonly adopted practice of identifying the myo-actuator torques in neuro-musculoskeletal control systems as the system controls is discussed. It is demonstrated that it leads to biologically unrealistic results. A systems model describing the excitation and contraction dynamics of skeletal muscle is then presented. In this model the control parameters are the actual neural controls, motor unit recruitment and stimulation frequency, and the model correctly predicts experimentally observed muscular force outputs for a wide variety of neural control inputs. A general myocybernetic performance criterion, and certain special cases pertaining to specific contractive modes are also discussed. R.E.S.

N80-11762# Civil Aeromedical Inst., Oklahoma City, Okla.
INTERSTIMULUS INTERVAL AS IT AFFECTS TEMPORARY THRESHOLD SHIFT IN SERIAL PRESENTATIONS OF LOUD TONES
Jerry V. Tobias. Jun. 1979. 10 p. refs.
(AD-A072006; FAA-AM-79-16) Avail: NTIS HC A02/MF A01 CSCL 06/16

Temporary threshold shifts were measured repeatedly during a session in order to determine effects of interstimulus interval (ISI) on the shift. The fatiguing sound was a 3 minute, 110 dB SPL, 4,000 Hz tone. Immediately following the 3 minute stimulation, Bekesy-audiometric tracings were made for 3 minutes at 5,656 Hz. Then the subject sat quietly for the ISI that was used during that session. The effect of the subject's rest time or time off was compared at two points on the recovery curve: at 30 seconds and at 2 minutes following the cessation of the fatiguing sound. For susceptible subjects tested with short-duration ISIs, each successive threshold showed a greater shift than the earlier ones for at least four tests. As ISI was increased, improvement seemed not to follow the expected linear form. At some critical value that varies from subject to subject, successive tests no longer differ from each other; each one is similar to a first trial in which no previous exposure to the high-level tone has occurred. For most subjects run under these conditions, the critical ISI value is at least 30 minutes. Author

N80-11763*# Boeing Aerospace Co., Houston, Tex.
STARPAHC SPACE-ORIENTED MEDICAL EVALUATION Final Report
12 Oct. 1979. 6 p. refs.
(Contract NAS9-14513)
(NASA-CR-160360) Avail: NTIS HC A02/MF A01 CSCL 06E

Development of the STARPAHC telemedicine system is documented. Using STARPAHC assessment results and monitoring experience, on board and ground based flight medical system monitoring requirements and operational procedures were developed for use with the Space Transportation System during OFT and mature operation phases of the shuttle. K.L.

N80-11764# Army Research Inst. of Environmental Medicine, Natick, Mass.
HYPOTHERMIA INDUCED BY CHLORPROMAZINE OR L-TRYPTOPHAN EFFECTS ON TREADMILL PERFORMANCE IN THE HEAT
Ralph P. Francesconi and Milton Mager. 28 Mar. 1979. 21 p. refs.
(DA Proj. 3E1-61102-BS-08)
(AD-A069849; USARIEM-M-8/79) Avail: NTIS HC A02/MF A01 CSCL 06/19

To study the effects of preinduced hypothermia on the physiological and thermoregulatory responses to exercise in the heat, rats were intravenously administered 100 micrograms of chlorpromazine (Cpz) or 200 mg/kg of L-tryptophan (L-tryp) under restraint in a cold (4 C) environment. When rectal temperatures (Tre) reached 32-33 C, the rats were removed to a hot environment (35 C) where they ran on a level treadmill (9.14 m/min) to hyperthermic exhaustion (Tr - 42.5-43 C). Both Cpz and L-tryp hypothermia was effective in increasing significantly (p less than .001) the time to hyperthermic exhaustion. However, the maximal tre and skin temperatures (Tsk) attained were unaffected by either treatment. While exercising on the treadmill increments (C/min) in Tre and Tsk were significantly (p less than .02, minimal) greater for the initially hypothermic animals when compared to normothermic controls. Cooling rates were unaffected by either treatment. We concluded from these studies that while preinduced hypothermia is extremely effective in prolonging the time to hyperthermic exhaustion, no additional beneficial thermoregulatory responses accrued as a result of this treatment. Author (GRA)

N80-11765# Army Research Inst. of Environmental Medicine, Natick, Mass.
COLD AIR INHALATION, ESOPHAGEAL TEMPERATURE LUNG FUNCTION IN EXERCISING HUMANS Final Report
J. J. Jaeger, E. Chandler Deal, Jr., D. E. Roberts, and E. R. McFadden, Jr. 14 Mar. 1979. 24 p. refs. Prepared in cooperation with Peter Bent Brigham Hospital, Boston, Mass. and Harvard Medical School, Boston, Mass.
(AD-A069510; USARIEM-M-7/79) Avail: NTIS HC A02/MF A01 CSCL 06/16

Eight normal individuals performed 10 min of bicycle exercise at 80% of their predicted maximum workload while breathing air at 22 C, saturated with water vapor and air at -40 C, dry. Rectal temperature and temperature at various locations along the length of the esophagus were measured during the exercise period. Pulmonary mechanics were measured before and 5 to 10 min after exercise. Temperature in the lower third of the esophagus was in close agreement with rectal temperature and was unaffected by level of respiratory heat exchange. Upper esophageal temperature decreased substantially during exercise, the magnitude of the decrease being dependent upon proximity to intrathoracic airways and the level of respiratory heat exchange. Subjects bronchodilated in response to exercise breathing warm air but this response was abolished by exercise breathing -40 C air. We conclude that at sufficiently high levels of respiratory heat exchange, normal individuals exhibit mild bronchoconstriction qualitatively similar to the severe bronchospasm induced in asthmatics by modest increases in respiratory heat exchange. GRA

N80-11766# Army Aeromedical Research Lab., Fort Rucker, Ala.
A PORCINE BIOASSAY METHOD FOR ANALYSIS OF THERMALLY PROTECTIVE FABRICS: A CLINICAL GRADING SYSTEM Final Report
Thomas L. Wachtel, Francis S. Knox, III, and G. R. McCahan, Jr. Jun. 1978. 35 p. refs.
(DA Proj. 3E7-62173-A-819)
(AD-A069202; USAARL-78-8) Avail: NTIS HC A03/MF A01 CSCL 06/3

A clinical grading system of severity of cutaneous burn was developed in a porcine cutaneous burn bioassay model using a flame thermal source. From surface appearance, color, sensation, tactile response, tenacity of hair anchoring, and appearance on cut section, a progression of the severity of burn injury was developed and documented with serial still photographs, high-speed cinephotomacrography and clinical descriptions. Variations in this grading scheme were required for skin protected or partially protected with fabrics, blackened with stove polish, or deprived of its circulation. GRA

N80-11767# Gesamthochschule, Siegen (West Germany). Dept. of Physics.
CALCULATED LINEAR ENERGY TRANSFER SPECTRA OF HZE PARTICLES FOR THE FREE FLYER BIOSTACK EXPERIMENT ON THE LDEF-MISSION
W. Heinrich. 1979. 14 p. refs.
Avail: NTIS HC A02/MF A01

The LDEF-mission, scheduled for launch on the Space Shuttle in 1981, will fly for about nine months in a near earth orbit

with an inclination angle of 28. During this flight the Free Flyer Biostack experiment will measure biological effects of individual heavy ions from cosmic radiation. The corresponding results of a calculation of linear energy transfer (LET) spectra in free space and inside the experiment are presented. The calculation considers the geomagnetic shielding of the spacecraft against charged particles with low energies and the disintegration of the heavy ions inside the experiment by fragmentation. For this mission the LET spectra will differ significantly from those of previous experiments. Primary particles with high LET are scarce. Inside the experiment the LET spectra change with depth of matter due to the energy loss and fragmentation of the nuclei.
Author (ESA)

N80-11768# Deutsche Forschungs- and Versuchsanstalt fuer Luft- und Raumfahrt, Frankfurt am Main (West Germany). Inst. fuer Flugmedizin.
SUMMARY OF RADIOBIOLOGICAL FINDINGS: FROM SPACEFLIGHT TO GROUND-BASED STUDIES Annual Report
H. Buecker and R. Facius. 1979. 8 p. refs. Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979.
Avail: NTIS. HC A02/MF A01.

Radiobiological studies relative to manned space flight are reviewed. The prediction of relevant physical parameters, radiation effects and space flight factors, late effects, and heavy effects are discussed. It is concluded that a reliable a priori assessment of the radiobiological risk from longer duration space missions remains as yet a difficult task. The fact that some symptoms of biological injury become manifest only long after exposure is pointed out.
Author (ESA)

N80-11769# National Technical Information Service, Springfield, Va.
TELECOMMUNICATIONS IN MEDICINE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Elizabeth A. Harrison. Aug. 1979. 150 p. Supersedes NTIS/PS-77/0725; NTIS/PS-76/0641; NTIS/PS-75/580; NTIS/PS-78/0751.
(NTIS/PS-79/0786/8; NTIS/PS-78/0751; NTIS/PS-77/0725; NTIS/PS-76/0641; NTIS/PS-75/580). Avail: NTIS. HC $28.00/MF $28.00. CSCL 06E.

Research reports cover teleconsultation, communications for emergency medical services, medical communication networks and television systems, and telecommunications for medical information systems and rural health services. This updated bibliography contains 143 abstracts, 15 of which are new entries to the previous edition.
GRA

N80-11770# New Mexico Univ., Albuquerque. Technology Application Center.
ALTITUDE ACCLIMATIZATION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979
Samuel C. Mauk. Aug. 1979. 31 p. Sponsored in part by NTIS.
(NTIS/PS-79/0857/7). Avail: NTIS. HC $28.00/MF $28.00. CSCL 06P.

This bibliography the international literature and covers all aspects of altitude acclimatization. Topics include high altitude environments, hypoxia, heart function and hemodynamic responses, physical exercise, human tolerances and reactions, physiological responses, and oxygen consumption.
GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-11771°# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
PERFORMANCE, PHYSIOLOGICAL, AND OCULOMETER EVALUATION OF VTOL LANDING DISPLAYS Final Report
R. A. North, S. P. Stackhouse, and K. Graffunder. NASA. Sep. 1979. 160 p. refs.
(Contract NAS1-15081).
(NASA-CR-3171; HONEYWELL-F0584-FR1-1). Avail: NTIS. HC A08/MF A01. CSCL 05H.

A methodological approach to measuring workload was investigated for evaluation of new concepts in VTOL aircraft displays. Physiological, visual response, and conventional flight performance measures were recorded for landing approaches performed in the NASA Visual Motion Simulator (VMS). Three displays (two computer graphic and a conventional flight director), three crosswind amplitudes, and two motion base conditions (fixed vs. moving base) were tested in a factorial design. Multivariate discriminant functions were formed from flight performance and/or visual response variables. The flight performance variable discriminant showed maximum differentation between crosswind conditions. The visual response measure discriminant maximized differences between fixed vs. motion base conditions and experimental displays. Physiological variables were used to attempt to predict the discriminant function values for each subject/condition trial. The weights of the physiological variables in these equations showed agreement with previous studies. High muscle tension, light but irregular breathing patterns, and higher heart rate with low amplitude all produced higher scores on this scale and thus represent higher workload levels.
Author

N80-11772# Oklahoma Univ., Norman. Coll. of Education.
COGNITIVE STYLES: A REVIEW OF THE LITERATURE Interim Report, Jan. 1977 - Jan. 1978
Tillman J. Ragan, Kathryn T. Back, Vance Stansell, Lynna J. Ausburn, Floyd B. Ausburn, Patricia A. Butler, and Keith Huckabay. Brooks Air Force Base, Tx. Air Force Human Resources Lab., Brooks Air Force Base, Tx. May 1979. 62 p. refs.
(Contract F33615-77-C-0047; AF Proj. 2313).
(AD-A069435; AFHRL-TR-78-90(I)). Avail: NTIS. HC A04/MF A01. CSCL 05/9.

A review of the literature to identify the various cognitive style constructs and the instruments used to measure them was completed. Each was evaluated with specific attention to possible relationships to Air Force technical training. Ten cognitive styles were selected for an in-depth summary of the state of the art, with special attention given to those that gave most promise for use.
GRA

N80-11773# California Univ., Berkeley. Operations Research Center.
THE SCOPE, LIMITS, AND TRAINING IMPLICATIONS OF THREE MODELS OF AIRCRAFT PILOT EMERGENCY RESPONSE BEHAVIOR Research Report
Stuart E. Dreyfus and Hubert L. Dreyfus. Feb. 1979. 39 p. refs.
(Grant AF-AFOSR-3594-78; AF Proj. 2313).
(AD-A071320; ORC-79-2). Avail: NTIS. HC A03/MF A01. CSCL 05/9.

Three models of skill acquisition are proposed: (1) Nonsituational, (2) Intermediate, and (3) Situational. It is argued that only the third can account for highly skilled performance. The type of emergency training program each suggests and the level of pilot performance that each can be expected to produce is then investigated. We conclude that only training based on the situational model could possibly produce highly skilled emergency response behavior.
GRA

N80-11774# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
ROTARY WING PROFICIENCY-BASED AVIATOR SELECTION SYSTEM (PASS) Final Report, 15 Feb. 1977 - 1 Mar. 1978
Ruth Ann Marco, Richard F. Bull, Ronald L. Vidmar, and Brian D. Shipley, Jr. Jan. 1979. 244 p. refs.
(Contract DAHC19-77-C-0015; DA Proj. 2Q2-63743-A-722).
(AD-A069838; MDC-1839; ARI-TR-79-A2). Avail: NTIS. HC A11/MF A01. CSCL 05/9.

The Proficiency-Based Aviator Selection System (PASS) is the result of an operational feasibility program developed to determine whether a learning sample approach could be used to select candidates for rotary wing aviator training. PASS was based on the Automatic Pilot Aptitude Measurement System (APAMS), a five-hour learning sample of fixed wing piloting

tasks, developed for the Air Force Pilot Selection Program. PASS utilizes a UH-1 Flight Simulator (UH-1 FS) with a five-degree-of-freedom motion base to present the syllabus and test materials. the APAMS syllabus was extensively modified to conform to rotary wing flight operations, and the UH-1 FS software was reconfigured and formatted to meet the PASS requirements for training and performance measurement. Four voice synthesizers (VOTRAX) were interfaced to the UH-1 FS to provide vocal feedback. The operational capability of the PASS was demonstrated in a test with 11 experienced rotary wing pilots and 11 candidates for rotary wing training. The primary audience for this report will be operational personnel in training selection and simulation, particularly for rotary wing aircraft. GRA

N80-11775# Washington Univ., Seattle. Dept. of Psychology.
INTELLIGENCE AS AN INFORMATION PROCESSING CONCEPT. Interim Report, 1 Apr. 1978 - 31 Mar. 1979.
Earl Hunt. May 1979. 91 p. refs. Presented at the Brit. Psychological Soc. Conf. Nottingham, Engl., Apr. 1979.
(Contract N00014-77-C-0225; NR Proj. 154-398; RR0420601)
(AD-A069953) Avail: NTIS. HC A05/MF A01. CSCL 05/10

This paper examines the relationship between general cognitive competence and several aspects of information processing. Three sources of individual differences in information processing are proposed: structure, strategy, and general attentional resources. Structural factors set limits on the effectiveness of specific information processing steps. These factors appear to be important when we contrast the cognitive capacities of extreme groups, such as normal and mentally retarded persons but they account for only a small amount of the variability in homogeneous groups such as college students. The reason may be that within such groups, strategy of attacking problems is a more important source of variation, and moderates the relationship between simple information processing steps and complex reasoning. Finally, the fact that scores on almost all measures of cognitive competence are positively correlated may be related to the fact that all mental processes seem to compete for general attentional resources, and that individuals differ in the attentional resources they can bring to bear on any cognitive task. Author (GRA)

N80-11776# Canyon Research Group, Inc., Westlake Village, Calif.
DEVELOPMENT OF UNIT TRAINING AND EVALUATION TECHNIQUES FOR COMBAT-READY HELICOPTER PILOTS. TASK 2: ASSESSMENT OF ARTEP AND ATM TRAINING OBJECTIVES AND REQUIREMENTS FOR MAINTAINING OPERATIONAL READINESS. Research Note, 21 Sep. 1977 - 20 Sep. 1978.
Colin D. Ciley, Jr. and George E. Long. May 1979. 25 p. refs.
(Contract DAHC19-77-C-0059)
(AD-A069224; FTR-01-78; ARI-RN-79-11) Avail: NTIS. HC A02/MF A01. CSCL 05/9

The recently published Army Training and Evaluation Programs (ARTEP) and Aircrew Training Manuals (ATM) represent a new concept of Army aviation unit training. Commanders are now responsible for determining the training requirements of their individual units and for developing and implementing programs to meet those requirements. The ARTEP and ATMs were designed to assist the unit commanders in carrying out that responsibility. This report presents the results of a brief review of the utility of these documents in the field and the extent to which their content adequately represents the training objectives and requirements for maintaining combat readiness. The research concludes that the documents have been well received and are being utilized effectively by field commanders, that they contain a valid, though not entirely complete, reflection of combat-readiness training objectives and requirements, but, that the required recordkeeping is burdensome and there is a need for a more effective feedback system between its users and its developers. Author (GRA)

N80-11777# Canyon Research Group, Inc., Westlake Village, Calif.
DEVELOPMENT OF UNIT TRAINING AND EVALUATION TECHNIQUES FOR COMBAT-READY HELICOPTER PILOTS. TASK 1: DEVELOPMENT OF AN INSTRUCTION PROGRAM FOR INDIVIDUAL AND UNIT TRAINING WITH COMBAT-READY PILOTS. Research Note, 21 Sep. 1977 - 20 Sep. 1978.
George E. Long, Colin D. Ciley, Jr., Rolk L. Jockenberger, and Ethlyn A. Garlich. May 1979. 86 p. refs.
(Contract DAHC19-77-C-0059; DA Proj. 2Q2-63743-A-772)
(AD-A069242; FTR-05-78-1; ARI-RN-79-10-1) Avail: NTIS. HC A05/MF A01. CSCL 05/9

The attainment and maintenance of combat readiness must be a, if not the, primary responsibility of every field unit commander. To carry out that responsibility, commanders of units with combat missions need training and evaluation techniques that will train pilots who already know how to fly to accomplish the requirements of a specific mission in a battlefield environment as part of the combined arms team. In order to provide the required techniques and procedures noted above, it is first necessary to derive an effective and efficient approach to their development. That approach should result in the availability of techniques and procedures that will facilitate the attainment of the highest level of combat readiness in the largest number of operational units in the shortest amount of time. This report describes the research effort directed at the derivation of an approach to the development of training and evaluation techniques and procedures for combat-readiness training that will meet the above noted requirements. It also describes the effort directed at the partial development of two training modules consistent with that approach. Author (GRA)

N80-11778# Illinois Univ. at Urbana-Champaign. Engineering-Psychology Lab.
HUMAN FAILURE DETECTION AND RESOURCE ALLOCATION IN DYNAMIC ENVIRONMENT. Final Report, 1 Jul. 1977 - 31 Dec. 1978.
Christopher D. Wickens. Feb. 1979. 31 p. ref.
(Contract AF-AFOSR-3380-77; AF Proj. 2313)
(AD-A069821; EPL-79-2; AFOSR-79-0682TR) Avail: NTIS. HC A03/MF A01. CSCL 05/10

Three major areas of research are summarized: (1) Processing Resource allocation between tasks in dynamic environments. Results indicate that these abilities are distinctly limited. Rather than effectively allocating in response to task demand increases, the operator appears to temporarily 'expand' the capability of available processing resources. (2) Failure detection in dynamic systems. Human operators are found to be better at detecting failures (step transitions in the order of a dynamic system) when they are active participants in controlling those systems, than when they are passive monitors of the system under autopilot control. Some reasons for this difference are discussed, while research explores the role of training, and information processing channels in the detection process. (3) The attentional demands of failure detection. A model of human processing resources is described which partitions these resources into structure-specific reservoirs related to stages of processing. Task interference patterns between failure detection in the controlling vs. the autopilot monitoring mode, and between two qualitatively different loading tasks are shown to be consistent with this structure-specific resource view. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering, biotechnology, and space suits and protective clothing.

N80-11779# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
LINEAR STATE FEEDBACK CONTROL OF RIGID-LINK MANIPULATORS.
David F. Golla. May 1979. 66 p. refs.
(UTIAS-TN-214; ISSN-0082-5263) Avail: NTIS. HC A04/MF A01.

Linear state variable feedback controllers were designed for rigid-link manipulator arms. Two types of feedback schemes were considered: general rigid control (GRC) which allows for both interjoint and intrajoint feedback, and independent joint control

(UC) which allows for only intrajoint feedback. The design scheme consisted of arbitrary closed loop pole placement. Pole assignment algorithms were developed for both GRC and UC feedback control schemes. Two controllers, UC and GRC, were designed for a preliminary two-link rigid model of the space shuttle manipulator arm carrying a full payload in planar motion. The two models are simulated and the controllers compared. R.E.S.

N80-11780# Virginia Polytechnic Inst. and State Univ., Blacksburg.
SPATIO-TEMPORAL INTERGRATION IN THE VISUAL SYSTEM. Final Technical Report, Aug. 1975 - Dec. 1977
Maier Algamor, Willard W. Farley, and Harry L. Snyder. Feb. 1979. 104 p. refs.
(Contract F33615-76-C-5022; AF Proj. 7184)
(AD-A069558; VPI-HFL-78-6; AMRL-TR-78-126) Avail: NTIS HC A06/MF A01 CSCL 05/10

A new model for temporal and spatial encoding in the visual system is developed and presented. Three series of experiments were conducted to validate the model. The experiments used (1) a TV display of random, dynamic noise, and (2) a specially designed stimulus generator which produces very large homogeneous visual fields which can be easily modulated to reproduce a large variety of temporal waveforms having a rise time longer than 1 ms. The obtained results support the proposed model. The principal findings are: (1) Time integration of the eye is locally controlled at the retina and has very fast dynamics. (2) The obtained CFF curves suggest a correlation between the frequency at which maximum sensitivity is obtained and the sensitivity itself. (3) As predicted by the model, temporal bands are developed in the visual system for stimuli showing temporal discontinuity points. The width of the temporal bands was measured and a strong correlation was found between the temporal band width and the integration time. The width of the temporal bands is a function of the luminance level of the bands; the width is not dependent on the stimulus slope. The apparent brightness of the temporal band is, however, dependent on the slope of the stimulus. GRA

N80-11781# Anthropology Research Project, Yellow Springs, Ohio.
HEIGHT/WEIGHT SIZING PROGRAMS FOR WOMEN'S PROTECTIVE GARMENTS
Ilse Tebbetts, John T. McConville, and Milton Alexander. Jun. 1979. 126 p. refs.
(Contract F33615-79-C-0511; AF Proj. 7184)
(AD-A072376; AMRL-TR-79-35) Avail: NTIS HC A07/MF A01 CSCL 06/17

Presented in this report is a series of height/weight sizing programs for use by designers of protective clothing for USAF women. The sizing values are based on an analysis of data obtained in the 1968 survey of Air Force women and cover some 60 dimensions (excluding head, hand and foot measurements). Author (GRA)

N80-11782# Honeywell Systems and Research Center, Minneapolis, Minn. Government and Aeronautical Products Div.
INTEGRATED HELMET-MOUNTED SIGHT/DISPLAY PROGRAM: COATING TECHNOLOGY. Technical Report, 15 May 1973 - 15 Jun. 1973
J. M. Seeman and L. E. Homstad. Jul. 1979. 169 p. refs.
(Contract F33615-72-C-0420; AF Proj. 5973)
(AD-A072060; HONEYWELL-2079-SR3; AMRL-TR-79-61) Avail: NTIS HC A08/MF A01 CSCL 05/8

Contents: Introduction; Summary of task results--Optics on plastics, Variable density, Durability and Abrasions, High absorption; Conclusions; Recommendations; Discussion; and References. GRA

N80-11783# Honeywell Systems and Research Center, Minneapolis, Minn.
HELMET-MOUNTED DISPLAYS: AN EXPERIMENTAL INVESTIGATION OF DISPLAY LUMINANCE AND CONTRAST
B. J. Cohen, J. R. Bloomfield, and K. J. McAlleese. Jul. 1979. 73 p. refs.
(Contract F33615-72-C-0420)
(AD-A072059; AMRL-TR-79-60) Avail: NTIS HC A04/MF A01 CSCL 14/2

This study was carried out in order to validate experimentally the predictions of previous analytic work (Cohen, 1973). The objective was to determine the best combination of filter coatings and display luminances required for viewing the Helmet Mounted Display (HMD) against a wide, but operationally realistic variety of background luminances. The predictions relating beamsplitter transmittance, visor transmittance and display luminance to performance were largely supported by the data. GRA

N80-11784# Honeywell Systems and Research Center, Minneapolis, Minn.
HELMET-MOUNTED DISPLAYS: A COMPUTER-ASSISTED ANALYSIS OF DAY-NIGHT VISUAL REQUIREMENTS
B. J. Cohen. Jul. 1979. 296 p. refs.
(Contract F33615-72-C-0420; AF Proj. 5973)
(AD-A072061; HONEYWELL-2079-SR5; AMRL-TR-79-62) Avail: NTIS HC A13/MF A01 CSCL 14/2

Honeywell has conducted a computer-assisted analysis in order to predict the range of ambient luminance conditions under which Helmet Mounted Display (HMD) imagery can be usefully resolved by an observer. This report examines those variables relating to ambient luminance, display luminance, and the attenuation of each in terms of optimizing display contrast minimizing differences in luminance to the two eyes. Visual performance predictions were made based upon comparing the analytically derived data with criteria values obtained from a limited number of technical reports. These criteria values were used even though it was recognized that the monocular see-through HMD is a unique system, thus limiting the applicability of data obtained from studies of related but still dissimilar systems such as head-up displays (HUDs) and occluded monocular HMDs. Among the factors affecting the quality of the displayed imagery, those variables most crucial to display luminance and contrast were systematically varied on a computer. GRA

N80-11785# Honeywell Systems and Research Center, Minneapolis, Minn. Systems and Research Center.
THE ROLE OF THE UPPER FIELD OF VIEW IN SELECTED HMS/D VISUAL TASKS
B. J. Cohen and R. A. Levit. 12 Jul. 1979. 38 p. refs.
(Contract F33615-72-C-0420; AF Proj. 5973)
(AD-A072064; F4001-HSR1; AMRL-TR-79-65) Avail: NTIS HC A03/MF A01 CSCL 05/8

A study was conducted to determine whether opaque obstructions located in an observer's upper field of view would affect the visual detection of briefly illuminated targets located above his horizontal line of sight. Five versions of an acrylic visor considered for use with a helmet-mounted sight and display (HMS/D) contained one or more opaque areas located above their horizontal axes. Target detection performance for 12 subjects using the experimental visors was compared with the subjects' performance using an unobstructed control visor. Target appearance was signalled by a central cue light for six subjects (directed search), while the other six subjects were forced to rely only on peripheral detection of the briefly illuminated targets (undirected search). It was found that target detection performance was unaffected by either visor obstructions or by method of search, or any combination of the two. It was concluded that any of the visors would be usable from a visual performance standpoint. GRA

N80-11786# Honeywell Systems and Research Center, Minneapolis, Minn.
HELMET-MOUNTED SIGHT/DISPLAY PROGRAM: CESSNA 310 FLIGHT TEST
L. J. Mueller and B. A. Olson. 12 Jul. 1979. 84 p. refs.
(Contract F33615-72-C-0420)
(AD-A072058; F5517-HSR2; AMRL-TR-79-59) Avail: NTIS HC A05/MF A01 CSCL 05/8

The first phase of an engineering flight evaluation of operator performance with a Helmet-Mounted Sight/Display system has been completed. A total of 22 flights were conducted during which subjects utilized a helmet-mounted sight to control the pointing direction of a gimballed television camera and a helmet-mounted display to view the picture from the TV camera. Particular attention was paid to any indication of disorientation

or discomfort attributable to the helmet-mounted equipment. No significant effect was noted. Secondary investigations considered the effect of servo dynamics in the TV camera system, angular motion limits in the pointing system, display field for view, display brightness, and environmental factors including target complexity and contrast, ambient brightness, and atmospheric haze. Interaction between the ambient scene viewed directly and through the combining glass of the helmet display caused no difficulty during the experiment. A second phase of this study considered the potential for inducing vertigo through the use of helmet-mounted equipment. The test plan and preliminary results for this experiment are presented in an appendix to this report. A detailed report on Phase II will be issued later. GRA

N80-11787# Honeywell Systems and Research Center, Minneapolis, Minn.
OPERATIONAL PILOT FACTORS ANALYSIS REPORT
B. A. Olson. 12 Jul. 1979. 123 p. refs
(Contract F33615-72-C-0420; AF Proj. 5973)
(AD-A072063; HONEYWELL-2079-SR7; AMRL-TR-79-64)
Avail: NTIS HC A06/MF A01 CSCL 14/2

This report describes the studies and analysis work done to identify performance requirements with respect to the operator who will wear the helmet and use the helmet sight/display system in the operational situation. Its purpose is to identify and document performance requirements for the IHMS/D equipment with respect to: Pilot population anthropometric and visual characteristics. Environmental effects of ambient light, field of view, acceleration, vibration, noise and space available. Display information requirements of accuracy, format, brightness, contrast, and the control response of the system. Author (GRA)

N80-11788# Army Aeromedical Research Lab., Fort Rucker, Ala.
HEAD AIMING/TRACKING ACCURACY IN A HELICOPTER ENVIRONMENT Final Report
Robert W. Verona, John C. Johnson, and Heber D. Jones. May 1979. 86 p.
(AD-A071359; USAARL-79-9) Avail: NTIS HC A05/MF A01 CSCL 05/8

This experiment was conducted to measure man's head aiming/tracking capability using a helmet mounted sighting device. The influences of target speed, helmet suspension types, and helmet weighting parameters on head aiming/tracking were investigated. If the aiming/tracking accuracy was sensitive to manipulation of these man-machine interface parameters, then it would seem to indicate that improved aiming/tracking accuracy could be obtained by improving the interface. The factors analyzed were eye dominance, helmet weighting, target speed, and helmet suspension. The eye dominance, helmet weighting, and target speed factors were statistically significant; however, the only factor of practical significance was target speed. A subject aiming at a static target with his head had an RMS error of about 3 milliradians. When the target began to move 4 degrees/second, the error increased to about 10.5 milliradians. When the subject began to vibrate, too, the error increased to 13 milliradians. When the target speed doubled, the vibrating error increased to 16.8 milliradians. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-11789# Naval Air Development Center, Warminster, Pa. Communication Navigation Technology Directorate.
BASIC LABORATORY ARCHITECTURE PLAN Final Report
Stanley Greenberg, Carl Joeckel, and Richard Mejzak. 17 May 1979. 302 p.
(AD-A072427; NADC-79161-40) Avail: NTIS HC A14/MF A01 CSCL 05/2

Provided herein is a definition of an avionic information processing system architecture and recommendations for implementing a subset of this architecture in the BASIC (Basic Avionic Subsystem Integration Concept) Laboratory. This recommended architecture is classified as a distributed, multiple processing system. It was derived based on the S-3A operational requirements employing a structured system design methodology. The AYK-14 airborne computer and 1553 bus were utilized to the greatest possible extent. A structured system design methodology was employed as a tool in arriving at the architecture in this report. GRA

N80-11790# SRI International Corp., Menlo Park, Calif.
STUDY OF AUTOMATED COMMAND SUPPORT SYSTEMS Final Report, 1 Apr. 1978 - 30 Mar. 1979
Marshall C. Pease and Daniel Sagalowicz. 9 Jul. 1979. 56 p. refs
(Contract N00014-77-C-0308)
(AD-A072298) Avail: NTIS HC A04/MF A01 CSCL 09/2

This study addresses techniques for the design of automated support systems for naval management. It seeks to apply advanced computer techniques developed by the artificial intelligence community to real-world command environments. The managerial environment exhibits two major differences from most other application environments. First, the problems encountered by the manager are not routine or predictable. It is important that it be possible to tune the system to the actual needs as the problem develops. Second, the manager is the expert; he must be able to understand the system's behavior and the reasons for the actions it takes. In combination, these requirements indicate that the commander, or his delegate, should be able to modify or extend the system even though they may have little knowledge of programming or system design. The crucial design issue is to provide means by which the human user can exercise deep control without requiring a correspondingly deep knowledge of the system's implementation. The primary device we have exploited to provide the user with effective control is to base the design on the explicit encoding of the system's knowledge as a set of models each of which contains the constraints and goals that describe necessary relations in the information that describes the situation in a specified component of the application environment. These models remain available to the user for his study and modification. The implementation principles used to develop this design have been demonstrated in an experimental system called ACS.1 for automated command support. GRA

N80-11791# Naval Research Lab., Washington, D. C.
A USERS GUIDE FOR THE ADVANCED SCIENTIFIC COMPUTER (ASC) Interim Report

Walter W. Jones 26 Jun. 1979 44 p
(RR040941)
(AD-A072405; NRL-MR-3979) Avail: NTIS HC A03/MF A01 CSCL 09/2

A great deal of effort goes into starting on a new computer system. This is especially true on sophisticated system designed to accomplish intricate tasks. In order to minimize this effort and thus to maximize people usefulness this guide has been prepared for the NRL ASC computer. GRA

N80-11792# University of Southern California, Marina del Rey. Information Sciences Inst.
AN EXPERIMENT IN DISTRIBUTED INTERPRETATION
Victor R. Lesser (Mass. Univ.) and Lee D. Erman May 1979 52 p refs Prepared jointly with Mass. Univ., Amherst, and Carnegie-Mellon Univ., Pittsburgh
(Contracts DAHC15-72-C-0308; F44620-73-C-0074; Grant NSF MCS-78-04212; ARPA Order 2223)
(AD-A072558; ISI/RR-79-76; CMU-CS-79-120) Avail: NTIS HC A04/MF A01 CSCL 09/2

The range of application areas to which distributed processing has been applied is limited. In order to extend this range, new models for organizing distributed systems must be developed. We present a new model, in which the distributed system is able to function effectively even though processing nodes have inconsistent and incomplete views of the data bases necessary for their computations. This model differs from conventional approaches in its emphasis on dealing with distribution-caused uncertainty and errors in control, data, and algorithm as an integral part of the network problem-solving process. We show how this new model can be applied to the problem of distributed interpretation. Experimental results with an actual interpretation system support these ideas. GPA

N80-11793# Texas A&M Univ., College Station. Dept. of Electrical Engineering.
A COMPARISON OF LOW-COST MICROPROCESSORS FOR THE GPS RECEIVER PROCESSOR Final Report
Phillip S. Noe Sep. 1978 10 p
(Grant AF-AFOSR-3377-77; AF Proj. 2304)
(AD-A072632; TAMU-DSL-RM-78-03; AFOSR-78-1447TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report compares the floating point capabilities of the LSI-11 Motorola 6800, and projects the capabilities of three recently announced 16 bit processors, the Intel 8086, the Zilog Z8000, and the Motorola 68000. GRA

N80-11794# Sandia Labs., Albuquerque, N. Mex.
TOWARD AUTOMATING THE DATABASE DESIGN PROCESS
P. L. Asprey 25 Apr. 1979 20 p refs Presented at 20th AESOP Conf., Gatlinburg, Tenn, 24 Apr. 1979
(Contract DE-AC04-76DP-00789)
(SAND-79-0858C; Conf-790431-3) Avail: NTIS HC A02/MF A01

An approach to designing complex, interrelated databases is described. The problems encountered and the techniques developed are discussed. A set of software tools to aid the designer and to produce an initial data base directly is presented. DOE

N80-11795# Ohio State Univ., Columbus.
WHAT WILL YOUR TIME SERIES ANALYSIS COMPUTER PACKAGE DO? COMPUTER PACKAGES
D. J. Pack 1978 35 p refs Presented at the IMS Special Topics Meeting on Time Series Analysis, Ames, Iowa, 1 May 1978
(Contract W-7405-eng-26)
(CONF-7805149-2) Avail: NTIS HC A03/MF A01

Packages relating to the ARIMA model building process and packages that are nonspectral are presented. The survey is segmented into general purpose standard statistical packages (BMDP, IMSL, SAS, SPSS), many method packages, and integrated ARIMA model building packages. Likely new directions are discussed. A number of concerns arise as a result of the survey, relating to the absence of time series capabilities in the standard statistical packages, the definition of an optimal method, the supply of computer packages from the academic to the business environment, and the degree of computerization appropriate for time series analysis. DOE

N80-11796# Idaho National Engineering Lab., Idaho Falls. Electrical Design Branch.
INFLUENCE OF MICROPROCESSOR TECHNOLOGY ON INSTRUMENT AND SYSTEM DESIGN
M. Ray Johnson 1979 18 p Presented at 8th IMEKO Congr., Moscow, 21 May 1979
(Contract EY-76-C-07-1570)
(CONF-790525-1) Avail: NTIS HC A02/MF A01

Current microprocessor technology as it relates to the design of instruments and instrumentation and control systems is surveyed. Representative applications of microprocessors are examined, including some implemented at the Idaho National Engineering Laboratory. Trends in LSI product capability, programming languages, standardization, and applications such as intelligent transducers and distributed processing systems are considered. DOE

N80-11797# Oak Ridge Y-12 Plant, Tenn.
MICROCOMPUTER-BASED VIDEO MOTION DETECTION SYSTEM
L. C. Howington 1979 8 p Presented at the Carnahan Conf. on Crime Countermeasures, Lexington, Ky., 16-18 May 1979
(Contract W-7405-eng-26)
(Y/DA-7999; Conf-790502-4) Avail: NTIS HC A02/MF A01

This system was developed to enhance the volumetric intrusion detection capability of the Oak Ridge Y-12 Plant's security program. Not only does the system exhibit an extended range of detection over present infrared, microwave, and ultrasonic devices, it also provides an instantaneous assessment capability by providing the operator with a closed-circuit television (CCTV) image of the alarm scene as soon as motion is detected. The system consists of a custom-built, microcomputer-based, video processor which analyzes the signals received from a network of video cameras. The operator can view the camera images as they are displayed on a CCTV monitor while alarm scenes are displayed on a second monitor. Motion is detected by digitizing and comparing successive video frames and making an alarm decision based on the degree of mismatch. DOE

N80-11798# Brookhaven National Lab., Upton, N. Y.
BLACKOUTS AND BROWNOUTS AND THEIR EFFECT ON COMPUTER OPERATIONS
A. Peskin and C. Pittenger Sep. 1978 11 p refs Presented at the AESOP-SCIE Symp. on Advan. Computing, Las Vegas, Nev., 19 Oct. 1978
(Contract EY-76-C-02-0016)
(BNL-24960; Conf-781061-3) Avail: NTIS HC A02/MF A01

Reasons for blackout and brownouts and the sensitivity of computers to them are described. The sequence of events in one typical blackout is recalled. The effects of blackouts on computers are discussed. It is estimated that the total cost of blackouts at a busy installation could exceed several hundred thousand dollars a year. An uninterruptible power system (UPS) can provide temporary power when utility power is unavailable. A solid-state UPS typically has four sections: battery, inverter, rectifier/charger, and UPS bypass. The computer must experience a minimum disturbance of voltage wave forms and phase relationships during switching. Considerations in the design and installation of a UPS and associated equipment are discussed, safety aspects are included. DOE

N80-11799# National Technical Information Service, Springfield, Va.
THE USE OF COMPUTERS IN SOLVING MATHEMATICAL PROBLEMS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - Jul. 1979
George W. Reimherr Aug. 1979 115 p Supersedes NTIS/PS-77/0780; NTIS/PS-76/0667; NTIS/PS-75/485; COM-74-11454; NTIS/PS-78/0782
(NTIS/PS-79/0798/3; NTIS/PS-78/0782; NTIS/PS-77/0780; NTIS/PS-76/0667; NTIS/PS-75/485; COM-74-11454) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Reports are cited on the computer solution of algebraic and differential equations. The necessary software and hardware for implementation, as well as solutions to large sparse matrices,

stiff differential equations, and statistical problems, are included. Some of the research is directly applicable to various physical sciences. This updated bibliography contains 107 abstracts, 13 of which are new entries to the previous edition. GRA

N80-11800# National Technical Information Service, Springfield, Va.
COMPUTER STORAGE MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Brian Corrigan Sep. 1979 215 p Supersedes NTIS/PS-78/0803, NTIS/PS-77/0775, NTIS/PS-76/0669, NTIS/PS-75/528 and NTIS/PS-74/095
(NTIS/PS-79/0884/1; NTIS/PS-78/0803; NTIS/PS-77/0775; NTIS/PS-76/0669; NTIS/PS-75/528; NTIS/PS-74/095) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Dynamic storage allocation, paging, interleaved memory, and virtual memory are covered in the citations. Also included are the necessary programs, compilers, and algorithms for implementation in various computer systems. This updated bibliography contains 209 abstracts, four of which are new entries to the previous edition. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-11801# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
SENS: A PACKAGE OF FORTRAN SUBROUTINES FOR FUNCTIONAL SENSITIVITY ANALYSIS OF SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS
Irith Ben-Arroyo and Duncan H. Martin Jan. 1979 41 p refs
(CSIR-SWISK-8) Avail: NTIS HC A03/MF A01

Three subroutines designed to facilitate assessment of the sensitivity of a system of ordinary differential equations to finite functional perturbations are presented. The division into three subroutines leaves the user considerable freedom of choice regarding both the frequency in time and comprehensiveness in space of the analysis. M.M.M.

N80-11802# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AUGMENTED RESTRICTED LAGRANGIANS IN CONVEX PROGRAMMING
S. Zlobec (McGill Univ.) and B. D. Craven (Melbourne Univ.) Jan. 1979 20 p refs
(CSIR-TWISK-62) Avail: NTIS HC A02/MF A01

Augmented Lagrangians, from which certain terms have been omitted, are proposed. The stationary points of these augmented restricted Lagrangians identify the optimal solutions of convex programs. The results extend to abstract spaces and convex cones. An application is given to an optimal control problem. R.C.T.

N80-11803# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A NEW CLASS OF FEASIBLE DIRECTION METHODS
A. Ben-Tal (Technion - Israel Inst. of Tech.) and S. Zlobec (McGill Univ.) Jan. 1979 27 p refs
(CSIR-TWISK-61) Avail: NTIS HC A03/MF A01

A class of feasible direction methods based on two characterizations of optimality in convex programming is introduced. These methods are capable of generating all feasible directions, including those along the boundary of the feasible set. K.L.

N80-11804*# ESPEE, Inc., Huntsville, Ala.
DATA ANALYSIS SOFTWARE FOR THE AUTORADIOGRAPHIC ENHANCEMENT PROCESS. VOLUMES 1, 2, AND 3, AND APPENDIX Final Report
S. P. Singh Nov. 1979 150 p
(Contract NAS8-33405; NASA Order H-30573-B)
(NASA-CR-161327) Avail: NTIS HC A07/MF A01 CSCL 09B

The computer software developed to set up a method for Wiener spectrum analysis of photographic films is presented. This method is used for the quantitative analysis of the autoradiographic enhancement process. The software requirements and design for the autoradiographic enhancement process are given along with the program listings and the users manual. A software description and program listings modification of the data analysis software are included. R.C.T.

N80-11805*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PREPARATION GUIDE FOR CLASS B SOFTWARE SPECIFICATION DOCUMENTS
Robert C. Tausworthe 1 Oct. 1979 85 p refs
(Contract NAS7-100)
(NASA-CR-162431; JPL-Pub-79-56) Avail: NTIS HC A05/MF A01 CSCL 09B

General conceptual requirements and specific application rules and procedures are provided for the production of software specification documents in conformance with deep space network software standards and class B standards. Class B documentation is identified as the appropriate level applicable to implementation, sustaining engineering, and operational uses by qualified personnel. Special characteristics of class B documents are defined. K.L.

N80-11806*# Science Applications, Inc., Huntsville, Ala.
NASA SOFTWARE SPECIFICATION AND EVALUATION SYSTEM DESIGN Final Report
31 Oct. 1979 20 p
(Contract NAS8-32526)
(NASA-CR-161335; SAI-80-743-HU) Avail: NTIS HC A02/MF A01 CSCL 09B

The Software Specification and Evaluation System (SSES) manager's guide is presented along with the NSSC-2 computer brochure. Development, evaluation, and modification of the SSES are summarized. K.L.

N80-11807# Northwestern Univ., Evanston, Ill.
ON SOFTWARE RELIABILITY MODELING Interim Report, 1 Aug. 1978 - 30 Sep. 1978
Stephen S. Yau and Terry E. MacGregor Jun. 1979 55 p refs
(Contract F30602-76-C-0397; AF Proj. 5581)
(AD-A072420; RADC-TR-79-127) Avail: NTIS HC A04/MF A01 CSCL 09/2

In this report, the concept of software reliability is discussed. Various software reliability models along with the basic philosophy of their development, their characteristics, and derived figures of merit are examined. These model's strengths and weaknesses are evaluated. Attempts for validating these models are discussed. GRA

N80-11808# Maryland Univ., College Park. Computer Science Center
RELAXATION APPLIED TO MATCHING QUANTITATIVE RELATIONAL STRUCTURES
Les Kitchen Oct. 1978 26 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A071604; TR-707) Avail: NTIS HC A03/MF A01 CSCL 09/2

A relaxation process is applied to the problem of matching relational structures involving numeric quantities. The method is empirically shown to be very sensitive to the exact form of the updating rule used. However, with the proper updating rule, the method works well, and is remarkably tolerant of measurement errors. GRA

N80-11809# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research
A NORMATIVE COST-BENEFIT ANALYSIS OF THE SYSTEMATIC DESIGN METHODOLOGY
S. L. Huff May 1979 73 p refs
(Grant N00039-78-G-0160)
(AD-A072355; CISR-P010-7905-10; CISR-TR-10) Avail: NTIS HC A04/MF A01 CSCL 09/2

Complex design problems are characterized by a multitude of competing requirements. System designers, finding the scope of the problem beyond their conceptual abilities, frequently cope with this difficulty by decomposing the original design problem

into smaller, more manageable sub-problems. Functional requirements form a key interface between the system's users and its designers. This report proposes a systematic approach for the decomposition of the overall set of functional requirements into sub-problems to form a design structure that will exhibit the key characteristics of good design: strong coupling within sub-problems, and weak coupling between them. Recent work in the Systematic Design Methodology (SDM) project has led to certain extensions to the basic representational model. This report presents a normative cost-benefit analysis of the SDM. It is a decision support methodology for aiding a software designer in determining an optimal structuring of a system's functional requirements. A model-oriented, normative cost/benefit analysis of the SDM is presented. A set of three sub-models, pertaining to specification impact, procedural design impact, and maintenance/modification impact, are derived. These models attempt to capture, in functional form, the important quantifiable effects - both positive and negative - that ought to occur as a result of developing a system based on an optimal partitioning of requirements. A numerical example is included. GRA

N80-11810# Hughes Aircraft Co., Fullerton, Calif.
VALIDATION OF SOFTWARE RELIABILITY MODELS Final Technical Report, Oct. 1977 - Nov. 1978
R. E. Schafer, J. E. Angus, J. F. Alter, and S. E. Emoto Jun. 1979 201 p refs
(Contract F30602-77-C-0219; AF Proj. 5581)
(AD-A072113; FR-78-16-1263) Avail: NTIS HC A11/MF A01 CSCL 09/2

This report presents the results of a study and investigation of software reliability models. In particular, the purpose was to investigate the statistical properties of selected software reliability models, including the statistical properties of the parameter estimates, and to investigate the goodness of fit of the models to actual software error data. The results indicate that the models fit poorly, generally due to in most part the vagaries of the data rather than shortcomings of the models. GRA

N80-11811# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
A FORTRAN ALGORITHM FOR PLOTTING CONTOURS OVER A TRIANGULAR MESH Final Report, Jul. - Dec. 1978
Kervyn D. Mach Jun. 1979 31 p refs
(AD-A072525; AFAPL-TR-79-2057) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes a contour plotting algorithm for data distributed on a triangular mesh such as might occur from numerical solutions of partial differential equations over an irregular domain. The method of application is described and illustrated with examples. The algorithm requires considerable memory but very little execution time. Suggestions for reducing the memory requirements and a complete program listing are included. GRA

N80-11812# Rensselaer Polytechnic Inst., Troy, N. Y. Computer Research Lab.
AUTOMATIC DATA PROCESSING TECHNIQUES FOR GRAPHIC-DATA DISPLAY, GENERATION AND ANALYSIS Final Report, 1 Sep. 1975 - 31 Aug. 1978
Herbert Freeman Oct. 1978 24 p refs
(Grant AF-AFOSR-2937-76; AF Proj. 2304)
(AD-A072636; CRL-60; AFOSR-78-1445TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This is the Final Report for a research grant whose objective was the development of efficient computer techniques for the processing of line-drawing images. A variety of specific problems were investigated. These included improved coding techniques for cartographic data, the reconstruction of solid-object descriptions from multiple-image projections of the objects, the removal of hidden lines from projections of both planar-faced and curved-surface objects, the design of a line-drawing analysis language called CHAP and the development of a scheme for line-pattern classification. GRA

N80-11813# Naval Research Lab., Washington, D. C.
GRAFIT: A GENERALIZED GRAPHICS PACKAGE Interim Report
J. P. Boris, E. Dent, M. J. Fritts, I. Haber, and W. W. Jones 20 Jul. 1979 62 p
(RR0230101; RR0140302)
(AD-A072339; NRL-MR-4027) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report is a concise user Manual for the GRAFIT package of subroutines. GRAFIT is a simple system for generating computer-graphics magnetic tapes for the Stromberg-Carlson 4020 microfilm recorder, on-line Calcomp incremental plotter, page-plot graphs, or Tektronix plots. The system is designed to be very efficient so using it to generate movies on 16mm film is relatively inexpensive. Appendices A, B, C, and D discuss the use of GRAFIT with consideration of the necessary control language and with an example of rather general utility. GRA

N80-11814# Yale Univ., New Haven, Conn. Dept. of Computer Science.
SCHEDULING PARALLEL PROCESSES WITHOUT A COMMON SCHEDULER Final Report
George Holober and Lawrence Synder Jul. 1979 16 p refs
(Contract N00014-75-C-0752)
(AD-A072158; TR-154) Avail: NTIS HC A02/MF A01 CSCL 09/2

An algorithm which solves the critical section problem for distributed processes is presented. We extend the solution of Lamport LL76 by continuing to allow processes to access their respective critical sections in any arbitrary user-specified order, but with greatly reduced storage requirements for each process. In addition, we supply a facility for testing the presence of deadlock among processes waiting to enter their critical code. We show our scheme to be tolerant of several malfunctioning processors and derive an equation relating the probability of total system failure to the probability of many individual failures occurring simultaneously among the processors. GRA

N80-11815# Princeton Univ., N. J. Dept. of Statistics.
FORTRAN SUBROUTINES FOR M ESTIMATORS IN THE LINEAR MODEL
Alfio Marrazi Apr. 1979 14 p refs
(Grant DAAG29-76-G-0298)
(AD-A071744; TR-147; SER-2; ARO-14244-7-M) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes the computational methods used in programming a set of subroutines to solve linear least squares problems and their robust versions by use of M estimators. GRA

N80-11816# Bettis Atomic Power Lab., West Mifflin, Pa.
MDSFP: A COMPUTER PROGRAM FOR ELASTIC SOLUTION OF THREE DIMENSIONAL STRUCTURES BY THE FINITE ELEMENT METHOD (LWBR DEVELOPMENT PROGRAM)
R. M. Clark Feb. 1979 209 p refs
(Contract EY-76-C-11-0014)
(WAPD-TM-1187) Avail: NTIS HC A10/MF A01

A computer program that solves linear elastic, small deflection, three dimensional structures by the finite element method is presented. The idealized model may consist of a mixture of beam, plate, and shell elements connected at node points. Structure loadings are represented by point or distributed loads, temperature distribution, and support displacements. Stresses are calculated from elastic strains which are calculated from nodal displacements. DOE

N80-11817# California Univ., Livermore. Lawrence Livermore Lab.
FUTURE TRENDS IN DATA BASE SOFTWARE
S. E. Jones 1979 16 p refs Presented at 20th AESOP Conf., Gatlinberg, Tenn., 24 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-82619; Conf-790431-2) Avail: NTIS HC A02/MF A01

In the 1970's, the Data Base Management System (DBMS) became a major software component in most commercial computing facilities, and is now becoming more widely used in scientific computing. This paper assesses the trends in DBMS research to infer the type of software that will be available in coming years. The very exciting area of data management functions implemented in hardware is only mentioned briefly. The relational

model is discussed because much of the current research is based on this model and its terminology. While the relational approach is not necessarily the wave of the future, its impact is being and will be felt. DOE

N80-11818# California Univ., Berkeley. Lawrence Berkeley Lab.
COMPUTER MAPPING SOFTWARE AT THE LAWRENCE BERKELEY LABORATORY
P. M. Wood and W. H. Benson Jun. 1978 48 p Presented at Harvard Computer Graphic Week Conf., Cambridge, Mass., 23 Jul. 1978
(Contract W-7405-eng-48)
(LBL-7938; Conf-780749-2) Avail: NTIS HC A03/MF A01

A number of FORTRAN mapping program useful for preparing base files and displays of statistical data are reviewed. Digitizing and editing of geographic base files is maintained by the programs MAPEDIT and ZING. Display of statistical attributes of discrete points, lines, or areas in two dimensions is done by the program CARTE. Display in three dimensions or of surfaces is accomplished using subroutines from the integrated data display system. All the programs use a device independent graphics system, GRAFPAC. DOE

N80-11819# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatiale.
SPHEROIDAL FUNCTIONS. THEORETICAL STUDIES AND COMPUTATIONAL TECHNIQUES [PRESENTATION DES FONCTIONS SPHEROIDES: ETUDES THEORIQUES ET OUTILS DE CALCUL]
Paulette Dorio and Colette Soubry Mar. 1979 186 p refs In FRENCH, ENGLISH summary
(CNES-NT-88) Avail: NTIS HC A09/MF A01

The general properties of spheroidal wave functions and related work are reviewed. The formulas and algorithms necessary for the numerical evaluation of these functions on a CDC 7600 computer are also presented. Subjects discussed include the equations from which spheroidal wave functions are derived, approximations by other special functions, double orthogonality as regards the intervals (-1, +1) and (- infinity, + infinity), and the normalization coefficients with respect to the intervals. The eigenvalues of spheroidal wave functions are then given and it is shown that these functions form complete function bases on the intervals defined. The software developed using FORTRAN on a CDC 7600 computer is described and numerical results obtained are reported and compared with other published results. Results coincide to 12 and 14 significant figures. Author (ESA)

N80-11820# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Mathematik.
RAVAGE. A SUBROUTINE LIBRARY FOR COMPUTER GENERATION OF RANDOM NUMBERS, RANDOM VARIABLES, RANDOM VECTORS AND STOCHASTIC PROCESSES
Ion Vaduva (Bucharest Univ.) 1977 67 p refs
(SMD-Mitt-39) Avail: NTIS HC A04/MF A01

A subroutine library for computer generation of random variables, random vectors, stochastic processes, and other stochastic elements is presented. The subroutines selected and included in the library cover only the most important types of random variables, random vectors, and stochastic processes. Additions of other types of random elements to the library are discussed. The algorithms were collected from different books and papers which are given in the bibliography. FORTRAN was used for the coding. The statistical distributions used along with a short description of each subroutine and its auxiliary or preparatory subroutines are introduced. All subroutines are listed in the contents. Author (ESA)

N80-11821# Uppsala Univ. (Sweden). Inst. of Technology.
AN INTERACTIVE FRAMEWORK FOR DESIGN AUTOMATION
Bjoern Pehrson May 1978 24 p refs
(UPTEC-78-47-R) Avail: NTIS HC A02/MF A01

The architecture of an integrated interactive system for use in computer aided design of control computer systems and other design engineering applications is presented. The design process is structured into the modeling synthesis, and the implementation phases. A human oriented dialogue system comprised of different design descriptions is emphasized as essential to computerized design. Suitable information structures and programming languages for the implementation of such a system are discussed. Author (ESA)

N80-11822# Research Inst. of National Defence, Stockholm (Sweden).
USER'S MANUAL FOR THE COMPUTER PROGRAM TODEP [ANVAENDARHANDLEDNING FOER PROGRAMMET TODEP]
Bo Einarsson and Sven-Olaf Staahl Jun. 1979 76 p refs In SWEDISH
(FOA-C-20308-D4) Avail: NTIS HC A05/MF A01

An up to date users manual for the TODEP, TOREZ, and TOPLOT computer programs was prepared in order to overcome some errors and difficulties observed in the program applications and to adapt the manual to succesive modifications and improvements of the programs. The TODEP program is for studying two dimensional wave propagation and distortion, while TOREZ is used for rezoning the corresponding Lagrange nets. The TOPLOT program is used for plotting the results. Changes in the user's manual result in simplification of data inlet, equalizing running intervals, and improving overall computer performance. These programs are written in Fortran 4 language for an IBM 370 computer. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N80-11823# Fiat Research Center, Turin, Italy. Centro Informazione Tecnica.
THE DATA BANKS. WHAT THEY ARE AND HOW THEY ARE USED [LE BANCHE DATI. COSA SONO E COME SI UTILIZZANO]
Bruno Zambon Mar. 1979 243 p refs In ITALIAN
Avail: NTIS HC A11/MF A01

A detailed panoramic description of data banks and their utilization is presented. Information retrieval, data banks and host computers, communication with host computers (LIS, SDC, and IRS), conversational systems (Dialog, Orbit, Recon), installation and management of online information retrieval systems, systems limitations, practical examples of bibliographic research, and nonbibliographic databases online, are discussed. Author (ESA)

N80-11824# Fondazione Ugo Bordoni, Rome (Italy).
THE USE OF COMPLEX NUMBERS IN A NETWORK FLOW ALGORITHM [IMPIEGO DEI NUMERI COMPLESSI IN UN ALGORITMO DI FLUSSO]
Piero Filipponi and Francesco Mazzarella Dec. 1977 26 p refs In ITALIAN
(FUB-49-1977) Avail: NTIS HC A03/MF A01

In order to solve an optimization problem of reserve networks by means of a computer, the capacity and data flow were expressed by complex numbers, modifying a standard algorithm. The initial problem, the algorithm used, and the corresponding computer program are described. The program is parametric and can work with an arbitrary number of nodes. FORTRAN 5 language and UNIVAC computers were used. The results obtained with several test networks are presented. Author (ESA)

N80-11825# Fondazione Ugo Bordoni, Rome (Italy).
CONTROL PROCEDURES IN PACKET SWITCHED COMPUTER NETWORKS: PART 2 [PROCEDURE DI CONTROLLO NELLE RETI A COMMUTAZIONE DI PACHETTO (PARTE SECONDA)]
Nicola Accarino, Maurizio Decina (Rome Univ.), and Claudio Rossi Aug. 1978 74 p In ITALIAN
(FUB-15-1978-Pt-2) Avail: NTIS HC A04/MF A01

The main control procedures used on packet switched networks are described. International regulations governing public networks are referred to in particular. Flow control at several hierarchic levels, window data flow control at levels n = 3 and n = 2, invariant and adoptive routing procedures, arithmetic

data flow control, and the efficiency of the various data flow control procedures are discussed. Author (ESA)

N80-11826# Fondazione Ugo Bordoni, Rome (Italy).
ANALYSIS AND SYNTHESIS PROBLEMS IN DIMENSIONING PACKET SWITCHED NETWORKS [PROBLEMI DI ANALISI E DI SINTESI NEL DIMENSIONAMENTO DELLE RETI A COMMUTAZIONE DI PACCHETTO]
Nicola Accarino, Maurizio Decina (Rome Univ.), and Claudio Rossi
Sep. 1978 96 p refs In ITALIAN
(FUB-32-1978) Avail: NTIS HC A05/MF A01

The problems inherent to packet switched network design are reviewed. Definitions, lag time, cost, throughput, and reliability are discussed. Boundary problems; network classification; capacity optimization; linear, concave, and discrete cost-capacity functions; flow optimization; a flow deviation method; and the properties of the local minimum and general algorithm for its determination are then discussed. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-11827# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMAL FEEDBACK CONTROL LAWS USING RANDOM SAMPLING OF THE OBSERVATION
Yaakov Yavin Feb. 1979 29 p refs
(CSIR-TWISK-63) Avail: NTIS HC A03/MF A01

It is assumed that a control object is described by the system of nonlinear stochastic equations dx = >f(x) + v(z)<dt + sigma(x)dW, t > O, x, z epsilon R sub n, where W is a vector of independent standard Wiener processes and v is the control vector. It is further assumed that the process Z is observed, described by dz(i) = x(i)dN(i) + gamma (i) (x)dB(i), 1,...,n, x,z epsilon R sup n, where B = col. [B (1), ...B(n)] is a vector of independent standard Wiener processes and N = col. [N(1), ...,N(n)] is a vector of doubly stochastic Poisson processes with intensity [(lambda (1) Z (t), ..., lambda (n) Z (sub t), t > or equals O]. It is shown how the process N can be constructed, and for a given sampling process N, sufficient conditions are derived on optimal controls. In addition, the problem is dealt with in selecting an optimal sampling process N for a given admissible control law. Author

N80-11828# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
MINIMUM L-p-NORM CONTROLS FOR TIME-VARYING LINEAR DYNAMIC SYSTEMS
D. H. Jacobson Sep. 1978 12 p refs Sponsored in part by Control Data
(CSIR-TWISK-49) Avail: NTIS HC A02/MF A01

The problem is considered of determining a control function which derives a linear dynamic system from an initial state to a desired state in specified time and which minimizes the integral of a strictly convex, co-finite function of the control. Existence and uniqueness of the optimal control are proved under mild assumptions, considerably weaker than those in a related paper by Brockett. A constructive, globally convergent algorith is provided for computing the optimal control. Minimum L(p) norm controls are obtained for special choices of the performance functional integrand. Author

N80-11829# Brown Univ., Providence, R. I. Div. of Engineering.
CONTROL OF NONLINEAR SYSTEMS Progress Report, 1 May 1977 - 30 Sep. 1978
Allan E. Pearson 13 Oct. 1978 14 p refs
(Grant AF-AFOSR-2793-75)
(AD-A072635; AFOSR-78-1443TR; PR-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

Results are summarized for the feedback stabilization of linear time varying differential and discrete-time linear systems, as well as a class of differential-delay systems. Extensions are described for a control law which tolerates a large class of nonlinearities in the loop without destroying stability. Research results are also described for the control of a class of intercept systems, including its interpretation as a commutative bilinear system, and a feedback control law, which incorporates least squares estimation of the target speed and turning rate. Results are described for parameter identification of a class of nonlinear systems, with particular attention given to the identification of parameters for a helicopter system in longitudinal motion, using input-output data on a finite time interval. Extensions to a signal estimation problem are indicated. GRA

N80-11830# Brown Univ., Providence, R. I. R. I. Lefschetz Center for Dynamical Systems.
MEASURE-VALUED PROCESSES IN THE CONTROL OF PARTIALLY-OBSERVABLE STOCHASTIC SYSTEMS Interim Report
Wendell H. Fleming Jun. 1979 30 p refs
(Grants AF-AFOSR-3063-77; NSF MCS-76-07261; AF Proj. 2304)
(AD-A072070; AFOSR-79-0849TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper is concerned with the optimal control of continuous-time Markov processes. The admissible control laws are based on white-noise corrupted observations of a function on the state processes. A 'separated' control problem is introduced, whose states are probability measures on the original state space. The original and separated control problems are related via the nonlinear filter equation. The existence of a minimum for the separated problem is established. Under more restrictive assumptions it is shown that the minimum expected cost for the separated problem equals the infimum of expected costs for the original problem with partially observed states. GRA

N80-11831# Naval Research Lab., Washington, D. C.
INFORMATION THEORETIC APPROXIMATIONS FOR M/G/1 AND G/G/1 QUEUING SYSTEMS Final Report
John E. Shore 18 Jul. 1979 40 p refs
(RR0140941)
(AD-A072338; NRL-MR-4047) Avail: NTIS HC A03/MF A01 CSCL 12/1

The behavior of single server queuing systems is characterized by various performance distributions, including distributions of queue length, waiting time, residence time, busy period, number served in a busy period, etc. In principle, if the arrival and service time distributions are known exactly, then these performance distributions can be computed using standard techniques. We consider the problem of estimating the distributions when only the first few moments of the service time distribution are known. Our approach uses standard relations to compute moments of the performance distributions from the known moments of the service time distribution and the principles of maximum entropy and minimum cross-entropy to estimate the performance distributions themselves. For M/G/1 systems with known average arrival rates, we derive analytic results for cases when one or two moments of the service time distribution are known, and we show how one can compute results using as many moments of the service time distribution as are available. For G/G/1 systems, our results are limited to the case in which only the average arrival and service rates are known. Among the results obtained with this information, theoretic approach is a new light-load approximation for the M/M/1 busy period probability density. Throughout the paper, we illustrate our approach using M/M/1, M/H2/1, and M/D/1 examples. GRA

N80-11832# Maryland Univ., College Park. Computer Science Center.
ARCHITECTURE FOR HIGHER LEVEL DIGITAL IMAGE PROCESSING Quarterly Status Report
Thomas J. Willett 30 Jul. 1978 66 p refs Prepared in cooperation with Westinghouse, Baltimore, Md.
(Contract DAAG53-76-C-0138)
(AD-A071599; QSR-1) Avail: NTIS HC A04/MF A01 CSCL 05/8

The report begins with a review of desired system design goals. This is followed by a description of available microprocessor hardware, a review of LISP approach to the manipulation of list structures, and a preliminary discussion of the processing required

to implement relaxation methods of object classification. The report concludes with a description of specific bit-slice processors. GRA

N80-11833# Colorado Univ. at Boulder. Dept. of Electrical Engineering.
QUANTITATIVE SYNTHESIS OF MULTIPLE LOOP FEEDBACK SYSTEMS WITH LARGE PLANT UNCERTAINTY Interim Report
Te-Shing Wang and Isaac Horowitz. Jun. 1979. 194 p. refs. (Contract AF-AFOSR-2946-76; AF Proj. 2304)
(AD-A072644; AFOSR-79-0880TR) Avail: NTIS HC A09/MF A01 CSCL 13/8

This work extends single input-output linear time invariant minimum-phase quantitative feedback synthesis to two new complex plant structures with internal sensing points. One is the triangular structure. The second consists of parallel branches, each with cascaded sections. Due to uncertainty, the plant parameters are elements of given sets. The system response must satisfy specified time or frequency domain tolerances. The basic problem is how to divide the feedback burden among the available loops so as to minimize the net rms effect at the plant input, of the various sensor noise sources. GRA

N80-11834# Uppsala Univ. (Sweden). Inst. of Technology.
ON THE ACHIEVABLE ACCURACY IN STOCHASTIC CONTROL
P. E. Moden and T. Scederstroem. Apr. 1978. 37 p. refs. (Contract SWEDBTD-73-4381)
(UPTEC-78-23-R) Avail: NTIS HC A03/MF A01

Two ways of designing controllers for linear stochastic discrete time are compared. One method, ordinary linear quadratic control, means minimization of the expected value of quadratic forms. For the other method the expectation is taken conditionally on all old measured data. The weights on the quadratic forms are used as free design variables. It is shown that the use of ordinary linear quadratic control in general gives superior behavior for a closed loop system. The use of conditional expectation often gives reasonable results for systems with a positive real transfer function. For first order systems the same set of regulators can be obtained with both methods. The analysis is supported with numerical examples illustrating the results. Author (ESA)

N80-11016 Allerton Press, Inc., New York, N. Y.
OPTIMAL OBJECT CONTROL WITH WORST RANDOM PARAMETER DISTRIBUTION
V. I. Timofeev and S. M. Chernyavskii. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p. 78-83. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p. 97-103. (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011, $45.00

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-11835# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ASPECTS OF A MULTI-CRITERION SECRETARY PROBLEM
T. J. Stewart. Sep. 1978. 29 p. refs.
(CSIR-TWISK-42) Avail: NTIS HC A03/MF A01

The selection of the most satisfactory from a random sequence of objects when these are evaluated according to a number of different criteria is presented. Various proposed methods of multi-criterion decision making are applied, and when evaluation is based on ranking only, procedures are very robust, and fairly simple. For the multi-criterion problem, however, ranking has the disadvantage that no allowance is made for differences in the range of options available for different attributes. On the other hand, rules based on measured values are difficult to implement. Such values can be used to determine criterion weights which can be incorporated into the rank-based procedures. M.M.M.

N80-11836# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
NOETHER'S THEORY IN CLASSICAL NONCONSERVATIVE MECHANICS
R. Roesel. Feb. 1979. 21 p. refs.
(CSIR-TWISK-66) Avail: NTIS HC A02/MF A01

Using the Hamiltonian formalism, it was found that a group of transformations which leaves the action integral of a nonconservative mechanical system invariant, generally does not leave the equations of motion invariant. R.C.T.

N80-11837# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
FUNCTIONAL SENSITIVITY FOR ORDINARY DIFFERENTIAL EQUATIONS
D. H. Martin. Jan. 1979. 46 p. refs.
(CSIR-TWISK-65) Avail: NTIS HC A03/MF A01

Systems of nonlinear ordinary differential equations in normal form, with prescribed initial 'state' x sub 0 and given time interval (t sub 0, t sub f) are considered. The sensitivity of the corresponding final state x sub f to arbitrary functional perturbations in the right-hand sides of the differential equations is addressed. It is assumed that a suitable Riemannian measure of distance between points in state space has been chosen, and in terms of this measure, a scalar function r(.), called the insensitivity function, is defined in a deleted neighborhood of x sub f. The behavior of this function characterizes the insensitivity of x sub f to finite functional perturbations to the right-hand sides of the differential equations. As the state x approaches x sub f in the direction of a vector Si, r squared (x) approaches a value which is the ratio of a positive definite quadratic form in Xi to the square of the Riemannian norm of Xi. The coefficients of this quadratic form, which are easily computed, define the insensitivity tensor at x sub f, and this provides a convenient description of the sensitivity of the final state in each direction. J.M.S.

N80-11838# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OBSERVABILITY WITH CONIC OBSERVATION SET
M. Pachter and D. H. Jacobson. Jan. 1979. 10 p. refs. Sponsored in part by Control Data.
(CSIR-TWISK-59) Avail: NTIS HC A02/MF A01

A geometric proof of Brammer's theorem on observability with a conic observation set is given. It is shown that Brammer's result is generalized because it is not required that the observation cone be polyhedral. J.M.S.

N80-11839# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
M-ESTIMATION IN THE PRESENCE OF UNEQUAL SCALE
Noel Cressie (Flinders Univ.). Jan. 1979. 19 p. refs.
(CSIR-TWISK-60) Avail: NTIS HC A02/MF A01

The class of weighted M-estimators is defined. The ratio of the asymptotic variance of the weighted estimator to the asymptotic variance of the optimally weighted estimator is defined as the inefficiency. A Kantorovich inequality is proved, and its implications are investigated for the misweighted mean and misweighted median. Author

N80-11840# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
COLLECTIVE STATES AND CROSSING SYMMETRY
W. D. Heiss. Jan. 1979. 29 p. refs.
(CSIR-TWISK-58) Avail: NTIS HC A03/MF A01

Results are presented which were obtained with a model for the vertex function, such that crossing symmetry is implemented to lowest order. While in the model the vertex function obeys neither an s-channel nor a t-channel integral equation, it satisfies an equation in which the two channels are treated simultaneously and in a symmetric way. The s-channel and t-channel two particle propagators are calculated from the same vertex function. In comparison with the respective RPA-propagators the numerical results obtained within a schematic model show a remarkable effect at the higher levels of the respective energy spectra, while at the lower levels only the

residues of the propagators are strongly affected. The sum rules are satisfied to within + or -1%. The pole structure of the single-particle self-energy differs considerably from that which follows from the weak coupling approach. Author

N80-11841# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
VERTEX FUNCTION AND CROSSING SYMMETRY
W. D. Heiss Oct. 1978 23 p refs
(CSIR-TWISK-53) Avail: NTIS HC A02/MF A01

An integral equation for the vertex function occurring in the quantum mechanical many-body problem is proposed. The s-channel and the t-channel are treated simultaneously and on the same level. An intricate blending of the two channels is provided by the equation. Its solution is given in closed form, and although this is complicated, it allows the physically interesting features to be investigated numerically. R.C.T.

N80-11842# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ON THE REGULARITY AND APPROXIMATION OF THE SOLUTIONS OF SOME OPTIMAL CONTROL PROBLEMS GOVERNED BY ELLIPTIC EQUATIONS
Tunc Geveci Sep. 1978 37 p refs
(CSIR-TWISK-47) Avail: NTIS HC A03/MF A01

Regularity results are obtained for the solutions of some optimal control problems governed by elliptic equations. Error estimates for approximate solutions, using Fenchel-Rockafellar duality theory are also obtained. F.O.S.

N80-11843# Hughes Research Labs., Malibu, Calif.
STUDY OF BOUNDARY STRUCTURES Final Report, 1 May 1976 - 30 Apr. 1979
Ryocichi Kikuchi Jun. 1979 155 p refs
(Contract DAAG29-76-C-0026)
(AD-A071710; ARO-13252.6-P) Avail: NTIS HC A08/MF A01 CSCL 12/1

The scalar product (SP) formulation evaluates the boundary free energy sigma using the properties of only the two homogeneous phases (without explicitly calculating the boundry profile) that meet at the boundary. The SP method is explored in detail and is now considered ready for further use. The boundary profile can be calculated using the sum method. How to formulate this method using the cluster variation method (CVM) and the natural iteration method (NIM) is presented. GRA

N80-11844# Southern Methodist Univ., Dallas, Tex. Dept. of Operations Research.
COMPUTER GENERATION OF BIVARIATE GAMMA RANDOM VECTORS
Bruce W. Schmeiser and Ram Lal Jul. 1979 38 p refs
(Contract N00014-77-C-0425)
(AD-A072407; OR-79009) Avail: NTIS HC A03/MF A01 CSCL 12/1

The use of bivariate gamma distributions in simulation modeling is considered. A family of algorithms is given, any member of which can be used to generate random bivariate vectors having any gamma marginal distributions and any theoretically possible correlation, both positive and negative. Computational considerations are discussed, including the selection of parameters to provide regression curves consistent with the modeler's needs. A modification which is easier to implement and provides most, but not all, correlations is also given. Finally the use of these algorithms to generate first order autoregressive time series is discussed. GRA

N80-11845# Tennessee Univ., Knoxville. Dept. of Psychology.
METHOD OF MOMENTS AS THE LEAST SQUARES SOLUTION FOR FITTING A POLYNOMIAL
Fumiko Samejima and Philip Livingston 16 Jun. 1979 137 p refs
(Contract N00014-77-C-0360; RR0420401)
(AD-A072357; RR-79-2) Avail: NTIS HC A07/MF A01 CSCL 12/1

Methods of moments have been used frequently and effectively in our previous research for developing theories and methods of estimating the operating characteristics of the item response categories and ability distributions. It has been discovered that the method is quite useful, for fitting some curves to the set of observations, like maximum likelihood estimates, to the unobserved, conditional density function of which only the first few moments are estimated, and to the resultant, estimated density function of ability. It has also been discovered that polynomials are useful as functions to fit in applying the method of moments, with their unrestricted nature, regardless of the fact that there always is a possibility that they produce negative values for the estimated density. In the present paper, it is pointed out that a polynomial fitted by the method of moments is the same polynomial produced by the least squares principle. Using some examples, the two processes, i.e., the method of moments and the least squares solution, are compared. It is pointed out that, in general, the method of moments provides us with a simpler process and a more accurate result, than the least squares method, when the computer work is involved. The importance of using the appropriate interval in applying the method of moments, and the least squares method, is emphasized. GRA

N80-11846# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
TESTING TRANSFORMATIONS TO ACHIEVE APPROXIMATE NORMALITY Interim Report
Raymond J. Carroll Aug. 1978 13 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A072596; Mimeo-Ser-1190; AFOSR-78-1436TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We propose a competitor to likelihood and significance methods for power transformations to achieve approximate normality in a linear model. The new method is shown in theory and a Monte-Carlo experiment to produce more robust inferences than the likelihood method and considerably more powerful (although possibly slightly less robust) inferences than the significance method. GRA

N80-11847# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
AN EFFICIENT CONTENTION RESOLUTION ALGORITHM FOR MULTIPLE ACCESS CHANNELS M.S. Thesis
Jeannine Mosely Jun. 1979 85 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A072440; LIDS-TH-918) Avail: NTIS HC A05/MF A01 CSCL 12/1

In this thesis, the general form of a first-come first-served contention resolution algorithm is given. A sub-class of FCFS algorithms, called single interval algorithms, are analyzed using Markovian decision theory. It is seen that, if the horizon is infinite, Humblet's algorithm has the maximum throughput for this sub-class. However, if the system is shut down after a finite number of transmissions, then an extended version of his algorithm is optimal. GRA

N80-11848# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
AN INVESTIGATION INTO THE EFFECTS OF ASYMMETRY ON ROBUST ESTIMATES OF REGRESSION Interim Report
Raymond J. Carroll Aug. 1978 26 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A072597; MIMEO-SER-1172; AFOSR-78-1431TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

We investigate the effects of asymmetry errors on robust regression estimates. Theoretical and Monte-Carlo results show that slopes are essentially unaffected, but that the intercept has a bias and its variance is difficult to access. GRA

N80-11849# Purdue Univ., Lafayette, Ind. Dept. of Mathematics.
AN APPROXIMATION TECHNIQUE FOR SMALL NOISE OPEN LOOP CONTROL PROBLEMS Interim Report
Charles J. Holland 1978 16 p refs
(Grant AF-AFOSR-3286-77; AF Proj. 2304)
(AD-A072638; AFOSR-78-1444TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper is concerned with the development of an approximation technique for the solution of a class of fixed stopping time small noise open loop control problems. These

problems arise by adding an additive white noise term with a small coefficient sq rt (2 epsilon) I to the system equations in the deterministic control problem. An approximation scheme is developed that has the advantage that one finds approximately optimal controls simultaneously for all sufficiently small epsilon. The scheme requires the solution of a generalized linear regulator problem which is solvable easily numerically. The numerical method is also presented. GRA

N80-11850# Science Applications, Inc., Monterey, Calif.
THE ROLE OF THE ASYMMETRIC TERMS OF THE DIVERGENCE AND VORTICITY EQUATIONS IN THE ZERO LAPLACIAN VORTEX
Francis H. Nicholson Nov. 1978 42 p refs
(Contract N00014-78-C-0393)
(AD-A072452) Avail: NTIS HC A03/MF A01 CSCL 12/1

The generation of divergence, and to a lesser extent, vorticity, are highly dependent upon the development of asymmetries in this model. Because of the laborious mathematical analysis, a numerical model should be parameterized using the asymmetries of this model to assess their contributions to the heat, momentum and water vapor budgets of the hurricane. GRA

N80-11851# Polytechnic Inst. of New York, Brooklyn. Dept. of Mathematics.
APPROXIMATIONS OF NORMAL RANGE REVISITED WITH NEW TABLES FOR d SUB 2 AND d SUB 3 - FACTORS
John H. K. Kao 19 Jan. 1979 28 p refs
(Contract N00014-77-C-0601)
(AD-A073004; POLY/MA-79-2) Avail: NTIS HC A03/MF A01 CSCL 09/1

Patnaik's X-approximation and Cox's X-squared-approximation to the normal mean range are revisited and many inaccurate entries discovered. Investigations revealed, among other reasons, that the original Tippett's calculations on d2 and d3 -factors were of inadequate accuracy. New tables for d2 and d3-factors as well as constants associated with Patnaik's and Cox's approximations are recomputed and tabulated. These new tables will be useful for revising the MIL-STD-414 range plans for inspection by variable and for the analysis of variance tests when ranges or mean ranges are used in place of sample variances or standard deviations, as well as for constructing limits for the cumulative sum charts for range variability. GRA

N80-11852# Brown Univ., Providence, R. I. Dept. of Physics.
UNITARITY RESTRICTIONS ON SEMI-CLASSICAL APPROXIMATIONS TO CERTAIN FUNCTIONAL INTEGRALS
H. M. Fried 1978 5 p refs Presented at Conf. on Math. Probl. in Feynman Path Integrals, Marseille, May 1978
(Contract EY-76-C-02-3130)
(COO-3137A-343; Conf-7805151-1) Avail: NTIS HC A02/MF A01

Estimates of physically relevant quantities (cross sections, multiplicities, correlations) in eikonal models of high-energy field theories lead to a class of semiclassical solutions to nonlinear Euler equations. The requirement of unitarity restricts these possible solutions to a unique function of energy and impact parameter. DOE

N80-11853# Bari Univ. (Italy). Ist. di Macchine.
ON THE NUMERICAL SOLUTION OF CAUCHY INTEGRALS
Michele Napolitano Apr. 1978 17 p refs
(Contract CNR-77-0095)
Avail: NTIS HC A02/MF A01

The development of a reliable second order accurate Cauchy integral solver is discussed. The singular logarithmic behavior of the integral is extracted analytically and the residual regular function is numerically integrated by standard techniques. It is shown that simple trapezoidal rule integration leads to first order accurate behavior instead of to second order behavior as expected; such an anomaly is explained as due to the singular nature of the integrand. A general approach for obtaining consistent second order accuracy is presented and tested on linear airfoil integrals for which the exact solution is available. Also a vectorization of the logarithms, suitable for very efficient use within a complex iterative algorithm, is presented. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-11854# Florida State Univ., Tallahassee. Dept. of Statistics.
ON BERRY-ESSEN RATES FOR STATISTICAL FUNCTIONS, WITH APPLICATION TO L-ESTIMATES
Dennis D. Boos and R. J. Serfling Apr. 1979 15 p refs
(Contract N00014-76-C-0608)
(AD-A072131; FSU-Statistics-M499; TR-136-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A parameter expressed as a functional T(F) of a distribution function (d.f.) F may be estimated by the statistical function T(F sub n) based on the sample d.f. F sub n. Typically, T(F sub n) is asymptotically normal. We investigate the rate of this convergence by utilizing the von Mises representation to express T(F sub n) - T (F) as an approximate U-statistic plus R sub n, and applying the Berry-Esseen rate O(sq rt n) established for U-statistics by Callaert and Janssen. This essentially reduces the problem to a handling of R sub n. We carry out this method for linear functions of order statistics (L-estimates) and obtain results competitive with Bjerve and Helmers. Also, we briefly indicate the application of the method to M-estimates. GRA

N80-11855# Pittsburgh Univ., Pa. Dept. of Mathematics and Statistics.
MULTISTATE RELIABILITY MODELS
William S. Griffith and Henry W. Block Jul. 1978 19 p refs
(Contract N00014-76-C-0839)
(AD-A072303; RR-78-02) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper an axiomatic development of multistate systems is presented. Three types of coherence based on the strength of the relevancy axiom are studied. The strongest of these has been investigated previously by El-Neweihi, Proschan, and Sethuraman. One of the weaker types of coherence permits wider applicability to real life situations without sacrificing any of the mathematical results obtained by El-Neweihi, Proschan, and Sethuraman. The concept of system performance is formalized through expected utility and the effect of component improvement on system performance is studied using a generalization of Birnbaum's reliability importance. GRA

N80-11856# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ON SEQUENTIAL CONFIDENCE INTERVALS FOR THE LARGEST NORMAL MEAN
Raymond J. Carroll Aug. 1978 20 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A072599; MIMEO-SER-1191; AFOSR-78-1437TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We construct a competitor to Tong's method for defining a fixed-width confidence interval for the largest normal mean. This competitor eliminates inferior populations early in the experiment; a Monte-Carlo experiment shows that it can use significantly fewer observations than Tong's method without any real loss in observed coverage probability. GRA

N80-11857# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
A STUDY OF SEQUENTIAL PROCEDURES FOR ESTIMATING THE LARGER MEAN
Raymond J. Carroll Aug. 1978 18 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A072595; MIMEO-SER-1189; AFOSR-78-1435TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Blumenthal considered the problem of sequential estimation of the largest of k normal means when a bound is set on the acceptable mean square error. He showed that his procedure results in only a small savings in sample size when compared to a conservative fixed sample procedure for the case of known variance. Carroll criticized this procedure because it does not give the user the flexibility of sampling selectively from the k populations. Carroll defined a procedure which early in the experiment eliminates from further consideration those populations

which are obviously not associated with the largest mean and hence provide little relevant information; his theoretical large-sample calculations indicate possible large savings in sample size with no corresponding increase in mean square error. In this paper we contrast the small sample behavior of the two approaches by means of a Monte-Carlo simulation study; both known and unknown variance are considered. GRA

N80-11858# North Carolina Univ. at Chapel Hill. Dept. of Statistics.
INFERENCE UNDER ORDER AND SMOOTHNESS RESTRICTIONS WITH APPLICATIONS IN TIME SERIES ANALYSIS Final Report
Edward J. Wegman. Oct. 1978. 5 p. refs
(Grant AF-AFOSR-2840-75; AF Proj. 2304)
(AD-A072594; AFOSR-78-1419TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Work began on this contract in the summer of 1975. Through the succeeding years, work has evolved in several directions. It is convenient to group the work into four related categories: (1) Nonparametric density estimation, (2) Probabilistic automata theory, (3) Isotonic inference and splines, and (4) Miscellaneous. GRA

N80-11859# Southern Methodist Univ., Dallas, Tex. Dept. of Operations Research and Engineering Management.
ANOTHER VERSATILE FAMILY OF PROBABILITY DISTRIBUTIONS
Bruce W. Schmeiser and Ram Lal. Dec. 1978. 17 p. refs
(Contract N00014-77-C-0425)
(AD-A072406; OREM-78015) Avail: NTIS HC A02/MF A01 CSCL 12/1

A new four parameter family of probability distributions is described. Special cases include Bernoulli trials, uniform, power series, exponential, triangular and Laplace (double exponential) distributions. Statistical properties, parameter determination, and random variate generation are developed. GRA

N80-11860# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON THE LENGTHS OF THE PIECES OF A STICK BROKEN AT RANDOM
Lars Holst (Uppsala Univ., Sweden). 21 May 1979. 22 p. refs
Prepared in cooperation with Goteborg Univ.
(CTH-Math-1979-13) Avail: NTIS HC A02/MF A01

The pieces of a randomly broken stick are considered. The length of the j the longest piece is determined and the exact distribution of the lengths is derived. It is noted that the analysis is particularly valid when the number of pieces is large. Also, moments of the lengths are obtained and some useful representations using independent exponential random variables are given. A necessary and sufficient condition for asymptotic normality is given and convergence of moments is obtained for linear combinations of length. The question of how many breaks are necessary to get all the pieces less than a certain length is also discussed. A limit distribution for the number of breaks is derived and convergence of moments is proved when the number tends to zero. The problem is also treated for the minimum number of arcs, having random length and placed at random on a circle of length one, needed in order to get complete coverage. Author (ESA)

N80-11861# Goteborg Univ. (Sweden). Dept. of Mathematics.
REMAINDER TERM ESTIMATES IN ONE AND MANY-DIMENSIONAL RENEWAL THEORY
Hasse Carlsson. 1979. 61 p. refs
Avail: NTIS HC A04/MF A01

Let X1, X2, ... be d-dimensional independent radom vectors with a common distribution mu. Let nu = the summation of n = 0 to infinity mu exponent N* and, for d = 1, H(X) = NU (-infinity, X). The asymptotic behavior of NU (A + X) and H(X) as the absolute value of X tends to infinity are investigated. It is known that H(X) - X/mu sub 1 - mu sub 2/2 mu 1 to 2 tends to zero as X tends to + infinity if mu sub 1 > zero and mu is a non-lattice measure (mu sub k is the kth moment of mu). The rate of this convergence under further condition on mu is considered. The estimates are obtained by a Fourier transform technique making use of Bohr's inequality. The problem is also treated for d > or = Z. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis, and operations research.

N80-11862*# Old Dominion Univ. Research Foundation, Norfolk, Va.
A SUMMARY OF SPECTRAL SYNTHESIS PROCEDURES FOR MULTIVARIABLE SYSTEMS Final Report, 1 May 1978 - 15 Sep. 1979
S. R. Liberty, R. R. Mielke, and R. A. Maynard. Nov. 1979. 31 p. refs
(Grant NsG-1519)
(NASA-CR-162436) Avail: NTIS HC A03/MF A01 CSCL 12B

A new approach to the eigensystem assignment problem is presented. The approach utilizes a null-space formulation of the eigenvalue/eigenvector assignment problem to simultaneously realize arbitrary eigenvalue specifications, approximate desired modal behavior, and achieve low eigensystem sensitivity with respect to plant parameter variations. The methods are applied to the design of regulator and integral plus proportional servo control systems. Author

N80-11014 Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF COMPLEX SYSTEMS, 1
T. K. Sirazetdinov and A. I. Bogomolov. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p 67-73. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p 83-91 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

N80-11020 Allerton Press, Inc., New York, N. Y.
ANALYTIC DESIGN OF REGULATORS FOR VARIABLE-PARAMETER SYSTEMS
A. A. Baloev. *In its* Soviet Aeron., Vol. 21, No. 2, 1978, p 99-102. refs. Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (USSR), v. 21, no. 2, 1978, p 122-126 (For primary document see N80-11002 02-01)
Copyright. Avail: Allerton Press, Inc., 150 Fifth Ave., N.Y. 10011; $45.00

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-11863# Florida State Univ., Tallahassee. Dept. of Statistics.
TREND-FREE BLOCK DESIGNS: EXISTENCE AND CONSTRUCTION RESULTS
Ching-Ming Yeh and Ralph A. Bradley. Jul. 1979. 30 p. refs
(Contracts N00014-76-C-0608; N00014-76-C-0394)
(AD-A072138; FSU-Statistics-M508; TR-141-ONR) Avail: NTIS HC A03/MF A01 CSCL 12/2

Designs for which treatment and block contrasts are orthogonal to specified common trend components within blocks have been called trend-free block designs. Necessary and sufficient conditions for the existence of such designs were given in a reference. A matrix sum was required to have certain properties. It is shown now that the existence of a matrix with the required properties assures the existence of the necessary component matrices. The existence of trend-free block designs for specified trends in one or more dimensions is examined in a number of theorems and corollaries. Initial results are general and then trends in one dimension are considered. An alternative formulation of the necessary and sufficient conditions for a trend-free block design is given when each treatment has the same number of replications. Some special results are obtained for complete and

balanced incomplete block designs. Youden Square designs are trend-free balanced incomplete block designs for up to p orthonormal, one-dimensional trend components, p - k, the block size. Some design construction methods are developed to establish the existence of certain trend-free block design. But, apart from the matter of treatment labelling, trend-free block designs may not be unique. The construction methods used may lead to designs particularly vulnerable to incorrect modelling of trend components. GRA

N80-11864# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
THEORY AND APPLICATIONS OF GENERALIZED WALSH FUNCTIONS IN DIGITAL SYSTEMS Final Report, 1 Mar. 1975 - 30 Apr. 1979
David K. Cheng. Jun. 1979. 30 p. refs.
(Grant AF-AFOSR-2809-75; AF Proj. 2304)
(AD-A072511; AFOSR-79-0916TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This is a final technical report on the theory and applications of generalized Walsh functions in digital systems. Research accomplishments in the areas of Walsh-Transform solution of difference equations; development of an algorithm for sequency ordering of Hadamard functions; development of a general two-parameter orthogonal transformation matrix; and analysis of the stochastic behavior of digital combinational circuits are summarized. Reprints are attached. GRA

N80-11865# Los Alamos Scientific Lab., N. Mex.
LIE-GROUP THEORY FOR SYMBOLIC INTEGRATION OF FIRST-ORDER DIFFERENTIAL EQUATIONS: A MODERN TREATMENT
W. A. Beyer. 1979. 35 p. refs. Presented at 2d MACSYMA Users Conf., Washington, D. C., 20 Jun. 1979.
(Contract W-7405-eng-36)
(LA-UR-79-251; Conf-790629-2) Avail: NTIS HC A03/MF A01

The application of Lie group theory to the solution of first order ordinary differential equations (ODEs) is reviewed. A code written in the MACSYMA language is presented which finds and solves first order DOEs invariant under group with infinitesimal generation of the form U = A(x)B(y)delta/sub x/ + C(x)D(y)delta/sub y/. An algorithm is given by which one can begin with an ODE y prime = f(x,y) with known solution phi(x,y) = c and obtain a possibly larger class of ODEs with solutions given in closed form. A final algorithm for forming a sequence of solvable differential equations is suggested. The work can be generalized to higher order differential equations, partial differential equations, and difference equations. DOE

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-11866# California Univ., Livermore. Lawrence Livermore Lab.
MAGNETIC PROPULSION RAILGUNS: THEIR DESIGN AND CAPABILITIES
R. S. Hawke and J. K. Scudder. 8 May 1979. 32 p. refs. Presented at 2d Intern. Conf. on Megagauss Magnetic Field Generation and Related Topics, Washington, D. C., 29 May 1979.
(Contract W-7405-eng-48)
(UCRL-82677; Conf-790540-7) Avail: NTIS HC A03/MF A01

An electromagnetic railgun which accelerates an electrically conducting armature which in turn accelerates a projectile is examined. The technical issues which control the dc railgun efficiency and performance are discussed. The areas studied include resistive heating and magnetic loading of the parallel rails; stress considerations within the rail support structure; interior ballistics of the projectile; and estimates of launcher performance as a function of input energy. A.W.H.

N80-11867# National Bureau of Standards, Boulder, Colo. Center for Electronics and Electrical Engineering.
ELECTROMAGNETIC BOUNDARY-VALUE PROBLEMS BASED UPON A MODIFICATION OF RESIDUE CALCULUS AND FUNCTION THEORETIC TECHNIQUES
James Patrick Montgomery and David D. Chang. Jun. 1979. 126 p. refs.
(PB-297305/5; NBS-MN-164; LC-79-600072) Avail: NTIS HC A07/MF A01 CSCL 20C

The solution to a number of electromagnetic problems, in both closed and open systems, is presented. Specific problems considered are: (1) the trifurcated waveguide; (2) the dielectrically loaded trifurcated waveguide; (3) the N-furcated waveguide; (4) the dielectrically loaded N-furcated waveguide; (5) determination of the eigenvalues of a ridged waveguide; (6) scattering by a dielectric stop; (7) a parallel plate radiating into a homogeneous halfspace; (8) a finite phased array; (9) remote sensing of the earth using parallel plate waveguides; (10) a flanged waveguide radiating into a half-space; (11) scattering by a thick, semi-infinite plane; and (12) radiation from a slot in a waveguide wall. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-11868*# Kentron International, Inc., Hampton, Va. Technical Center.
A METHOD FOR PREDICTING THE NOISE LEVELS OF COANNULAR JETS WITH INVERTED VELOCITY PROFILES
James W. Russell. Washington NASA Oct. 1979. 156 p. refs.
(Contract NAS1-13500)
(NASA-CR-3176) Avail: NTIS HC A08/MF A01 CSCL 20A

A coannular jet was equated with a single stream equivalent jet with the same mass flow, energy, and thrust. The acoustic characteristics of the coannular jet were then related to the acoustic characteristics of the single jet. Forward flight effects were included by incorporating a forward exponent, a Doppler amplification factor, and a Strouhal frequency shift. Model test data, including 48 static cases and 22 wind tunnel cases, were used to evaluate the prediction method. For the static cases and the low forward velocity wind tunnel cases, the spectral mean square pressure correlation coefficients were generally greater than 90 percent, and the spectral sound pressure level standard deviation were generally less than 3 decibels. The correlation coefficient and the standard deviation were not affected by changes in equivalent jet velocity. Limitations of the prediction method are also presented. R.C.T.

N80-11869*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A CLOSED-FORM SOLUTION FOR NOISE CONTOURS
Elwood C. Stewart and Thomas M. Carson. Nov. 1979. 40 p. refs.
(NASA-TP-1432; A-7660) Avail: NTIS HC A03/MF A01 CSCL 20A

An analytical approach for generating noise contours that overcome the difficulties of existing programs is described. This approach is valid for arbitrarily complex paths and reveals the importance of various factors that influence contour shape and size. The calculations are simple enough to be implemented on a small, hand-held programmable calculator, and a program for the HP-67 calculator is illustrated. The method is fast, simple, and gives the area, the contour, and its extremities for arbitrary flight paths for both takeoffs and landings. R.C.T.

N80-11870*# Lockheed-Georgia Co., Marietta.
STUDIES OF THE ACOUSTIC TRANSMISSION CHARACTERISTICS OF COAXIAL NOZZLES WITH INVERTED VELOCITY PROFILES, VOLUME 1 Final Report
P. D. Dean, M. Salikuddin, K. K. Ahuja, H. E. Plumblee, and P. Mungur. Cleveland, Ohio NASA May 1979. 186 p. refs.
(Contract NAS3-20797)

(NASA-CR-159698; LG79ER0178-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 20A

The efficiency of internal noise radiation through coannular exhaust nozzle with an inverted velocity profile was studied. A preliminary investigation was first undertaken to: (1) define the test parameters which influence the internal noise radiation; (2) develop a test methodology which could realistically be used to examine the effects of the test parameters; (3) and to validate this methodology. The result was the choice of an acoustic impulse as the internal noise source in the in the jet nozzles. Noise transmission characteristics of a nozzle system were then investigated. In particular, the effects of fan nozzle convergence angle, core extention length to annulus height ratio, and flow Mach number and temperatures were studied. The results are presented as normalized directivity plots. R.C.T.

N80-11871# Army Construction Engineering Research Lab., Champaign, Ill.

TRUE-INTEGRATING ENVIRONMENTAL NOISE MONITOR AND SOUND EXPOSURE LEVEL METER. VOLUME 2: WIRING AND PARTS LISTS, PARTS LAYOUTS, AND SCHEMATICS Final Report

Aaron J. Averbuch, Paul D. Schomer, and M. W. Weisberg Jun. 1979 176 p refs

(AD-A072002; CERL-TR-N-41-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 13/2

This report provides the complete hardware construction of the CERL environmental noise monitor. Included are: a task block diagram of the unit, a parts list and diagram of the front panel, a parts list and diagram of the power supply circuit, a list of the back plane wiring, parts list, layout, and schematics of the PC boards, and wiring list for cables and connectors. GRA

N80-11872# Defence Research Establishment Pacific, Victoria (British Columbia).

ACOUSTIC PHASE FLUCTUATIONS CAUSED BY GARRETT-MUNK INTERNAL WAVES

B. Hughes Mar. 1979 35 p refs

(AD-A071354; DREP-TM-79-1) Avail: NTIS HC A03/MF A01 CSCL 20/1

Perturbed acoustic propagation is considered between a point source and an array receiver in which the perturbations are due to a Garrett-Munk internal wave field. The resultant acoustic phase fluctuations along the array are determined. Straight ray propagation is assumed, and three array orientations are considered: broadside horizontal, end fire horizontal and broadside vertical. It is shown that for an acoustic frequency of 150 Hz, a range of 50 km and a horizontal broadside receiver separation distance (in the array) of 1 km, the rms phase difference between the two receivers at 1000 m depth in the N. Pacific is typically 5 deg, and in the Arctic it is typically 2 deg, whereas in the N. Atlantic at the same depth it is typically 50 deg. These geographical variations are due mainly to variations in the potential sound velocity gradient. Similar phase differences occur for a vertical receiver separation of 50 m. The horizontal receiver separation necessary to reduce the acoustic coherence to 0.5 for the same operating conditions is shown to be very large in the N. Pacific (about ~ 400 km) and Arctic (~ 1000 km), but only 2.3 km in the N. Atlantic. GRA

N80-11873# Texas Univ. at Austin. Applied Research Labs.

DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL PARAMETRIC ACOUSTIC RECEIVING ARRAY (PARRAY) Final Technical Report, 5 May 1976 - 31 Jan. 1978

Tommy G. Goldsberry, C. Richard Reeves, David F. Rohde, M. Ward Widener, Robert A. Lamb, Voldi E. Maki, Jr., and Wiley S. Olsen 16 Feb. 1979 154 p refs

(Contract N00039-76-C-0231; DARPA Order 2910)

(AD-A072307; ARL-TR-79-5) Avail: NTIS HC A08/MF A01 CSCL 17/1

The development, test, and evaluation of an experimental parametric acoustic receiving array (PARRAY) with a pump-hydrophone separation of 340 m are described in this report. Tests in Lake Travis, Texas, demonstrated a greater than 40 dB reduction in the self-noise floor of the experimental PARRAY compared to any previous parametric acoustic receiver. This reduction in the self-noise floor was achieved through state-of-the-art advances in four major hardware subsystems employed in the experimental PARRAY: high spectral purity pump signal generation; commensurate power amplification; high efficiency, high power transducer element and array design; and detection of sideband signals with very small modulation indices. Design and test results are presented for a crystal controlled oscillator with spectrum level single sideband phase noise less than -170 dB referenced to the carrier level. The design of a band elimination receiver preprocessor capable of detecting sideband signals approaching 180 dB below the carrier is presented and discussed. Test results are presented for simple, high efficiency transducer elements and arrays. Tests and experiments that were performed to evaluate the experimental 340 m PARRAY are described. GRA

N80-11874# Texas Univ. at El Paso. Dept. of Physics.

ON THE DETERMINATION OF ARRIVAL TIMES FOR SOUND RANGING. 1: EFFECTS OF FINITE AMPLITUDE PROPAGATION, VERTICAL METEOROLOGICAL GRADIENTS, AND SYSTEM TRANSIENT RESPONSE

E. A. Dean May 1979 64 p refs

(Contract DAAG29-76-D-0100; DA Proj. 1L1-62111-AH-71)

(AD-A072600; ERADCOM/ASL-CR-79-0100-2) Avail: NTIS HC A04/MF A01 CSCL 17/1

Several factors bearing on the determination of arrival times in sound ranging are investigated. These factors include the propagation of a finite amplitude triangular shock wave, the diffraction due to the surface and the refraction due to the phase velocity increasing with height, and the effect of the microphone response. Corrections are derived for finite amplitude effects and refraction under a constant gradient for sound speed and wind speed. Recommendations for experimental studies to confirm this theoretical work are included. GRA

N80-11875# Lund Inst. of Tech. (Sweden). Dept. of Building Acoustics.

ON THE USE OF FINITE ELEMENT METHOD ON SOME ACOUSTICAL PROBLEMS

Leif Cederfelt 1979 95 p refs Original contains color illustrations

(Grant SWEDCBR-740095-5)

(D4-1979; ISBN-91-540-3009-9) Avail: NTIS HC A05/MF A01

The finite element method application on some acoustical problems is discussed in order to show the possibilities of the method. A brief description of the element formulation for air and beam elements is given and the technique of how to take boundary conditions into consideration and how internal losses are regarded is considered. The coupled beam-air system solution is made by iteration between two equation systems, one for the air and one for the beam elements. Applications such as sound attenuation of a right angle bend, a lined duct and an expansion chamber are described. The finite element method is also discussed in terms of costs and limitations. The method has its power for small geometries or low frequencies, that is, when analytical methods are usually weak. The more complex the geometry of a studied problem is, the more powerful the finite element method seems to be. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-11876# Nagoya Univ. (Japan). Inst. of Plasma Physics.

SINGLE-ELECTRON CAPTURE INTO Ar + EXCITED STATES IN Ar + Na COLLISION BELOW 12 keV. 2: RELATIVE POPULATION DISTRIBUTED IN Ar + EXCITED STATES

Atsushi Matsumoto, Seiji Tsurubuchi, Kazuhiko Okuno, Shunsuke Ohtani, Tsuruji Iwai, and Yozaburo Kaneko Aug. 1979 29 p refs Sponsored by the Min. of Educ.

(IPPJ-411) Avail: NTIS HC A03/MF A01

Excitation cross-sections are obtained for each term of the ArII nl-states (nl = 4p, 4p' and 4d) at 4 and 8 keV. The relative population distribution among the terms of a given nl-state can be interpreted in terms of statistics based on the building-up

principle of molecule under radial coupling scheme. The relative population distribution among the multiplets in a given term is proportional to their statistical weight; spin-orbit recoupling at large internuclear separations is responsible for the population mechanism. The energy dependence of excitation cross-sections is discussed in connection with the Landau-Zener theory. Author

N80-11877# Naval Research Lab., Washington, D. C.
SPACE CHARGE LIMITED TRANSPORT AND BUNCHING OF NON K-V BEAMS
I. Haber. 25 Jul. 1979. 12 p. refs.
(AD-A072417; NRL-MR-4050) Avail: NTIS HC A02/MF A01 CSCL 20/8

Particle simulations are used to examine the behavior of an intense beam propagating down an alternate gradient focusing channel. In order to examine the dependence of emittance growth on the particle distribution function, an initially low current, non K-V, matched distribution is established. The current is then slowly increased as the beam propagates down the channel. Differences are observed in both the current at which emittance growth begins, and the rate at which the emittance grows, when the form of the initial distribution is changed. But this emittance growth still limits the intensity of the beam being transported. GRA

N80-11878# IBM Research Lab., San Jose, Calif.
ATOMIC AND MOLECULAR INTERACTION THEORY Final Report, Jun. 1978 - May 1979
R. K. Nesbet. Jul. 1979. 26 p. refs.
(Contract N00014-78-C-0447)
(AD-A072124) Avail: NTIS HC A03/MF A01 CSCL 20/10

New methods were used in theoretical studies on the dynamical development of final state populations in atom-molecule reactive collisions. Quantitative calculations of the H-H2 exchange reaction showed that information theory predicts rotational distributions far from equilibrium. A new theory of vibration excitation in electron-molecule scattering was devised. Accurate (1%) cross sections for e(-) He scattering below 19 eV were computed variationally. GRA

N80-11879# SRI International Corp., Menlo Park, Calif. Molecular Physics Lab.
ION PHOTOFRAGMENT SPECTROSCOPY: POTENTIAL SURFACES OF MOLECULAR IONS Final Report, 16 May 1976 - 15 May 1979
J. T. Moseley, P. C. Cosby, and J. R. Peterson. 2 Jul. 1979. 97 p. refs.
(Contract F44620-76-C-0095; AF Proj. 2303; SRI Proj. 5495)
(AD-A073000; SRI-MP-79-49; AFOSR-79-0943TR) Avail: NTIS HC A05/MF A01 CSCL 07/4

Techniques of ion photofragment spectroscopy have been used to investigate the structure and dissociation of molecular ions. For this research, a unique laser-ion coaxial beams spectrometer was constructed, allowing substantially improved sensitivity and resolution. The rare gas dimer ions were studied in detail, resulting in the determination of potential curves, absorption and photodissociation cross-sections, and photofragment angular distributions for these ions. Effects from spin-orbit coupling were found to be very important. The predissociation of the positive and negative ozone ions were investigated to obtain structural information about these ions. Very high resolution spectroscopy of the quartet states of the positive oxygen ion allowed a substantial improvement in these potential curves, as well as an improved determination of the bond dissociation energy of neutral oxygen. Photofragment spectroscopy of the positive ion of CH led to the observation of two predissociations, one in the singlet and one in the triplet system. Similar measurements on the positive ion of methyl iodide led to the resolution of rotational and fine structure levels in the previously observed predissociation of this ion. GRA

N80-11880# California Univ., Berkeley. Lawrence Berkeley Lab.
STUDY BY ELASTIC THEORY OF THE CLUSTERING OF SOLUTE ATOMS DURING THE EARLY STAGE OF SOLID SOLUTION DECOMPOSITION Ph.D. Thesis
Minghwei Hong. Sep. 1978. 75 p. refs.
(Contract W-7405-eng-48)
(LBL-7680) Avail: NTIS HC A04/MF A01

An expression for the elastic strain energy of a coherent inclusion of arbitrary shape in an anisotropic medium is derived from both macroscopic theoretical approaches. This expression is simplified for the case of a very thin disk shape inclusion. A method which takes the thickness effects into account developed in order to calculate minimum strain energy orientation of the disk shaped nitride precipitate in iron-nitrogen martensite. DOE

N80-11881# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. Development Div.
THE C-13 STUDY OF THE POTENTIAL INFLUENCE OF THERMAL AGING ON THE MOLECULAR INTEGRITY OF FEFO
G. L. Clink. Aug. 1978. 9 p.
(Contract EY-76-C-04-0487)
(MHSMP-78-32) Avail: NTIS HC A02/MF A01

A C-13 nuclear magnetic resonance study of isothermally aged FEFO is examined for molecular instability in the materials. A C-13 analysis of acetone extracts of thermally aged LX-09 is discussed. A.W.H.

N80-11882# McElroy (Ralph) Co., Austin, Tex.
ISOTOPE SEPARATION BY LASER-INDUCED PHOTOMIGRATION
K. Wada. 1978. 19 p. refs. Transl. into ENGLISH from Reza Kenkyu (Japan), v. 4, no. 3, 1976 p. 225-233. Prepared for LASL.
(Contract W-7405-eng-36)
(LA-TR-78-36) Avail: NTIS HC A02/MF A01

A gas mixture of 1:100 BCl3 and Xe is blown against a cold plate to form a solid film. This sample is irradiated by a cw CO2 laser. After several hours of irradiation, it is found from infrared spectra that (B-11)Cl3 molecules are excited selectively and are educed on the cold plate as fine crystals. This phenomenon is considered to be due to laser-induced migration of (B-11)Cl3 molecules through Xe matrix. As Xe sublimates, (B-10)Cl3 molecules are released from the cold plate so that (B-11)Cl3 is enriched on the plate. The value of the separation factor obtained with 3.3 watt laser radiation is estimated to be 8.4. DOE

N80-11883# Minnesota Univ., Minneapolis. Dept. of Chemistry.
MOLECULAR BEAM STUDIES OF ION-MOLECULE REACTIONS
W. R. Gentry. 1978. 23 p. refs. Presented at NATO Inst. on Ion-mol. Reactions, La Boule, France, 4 Sep. 1978.
(Contract EY-76-S-02-2640)
(COO-2640-8; Conf-780931-4) Avail: NTIS HC A02/MF A01

The areas in which molecular beam techniques contribute to the understanding of ion-molecule reaction dynamics are reviewed. Included are reactant kinetic energy range and resolution, internal state selection and analysis, and chemical systems and phenomena. DOE

N80-11884# Washington Univ., Seattle. Dept. of Chemistry.
HIGH TEMPERATURE GAS ENERGY TRANSFER Annual Summary Report, 1 Aug. 1978 - 31 Jul. 1979
B. S. Rabinovitch. 7 Aug. 1979. 9 p. refs.
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A072727) Avail: NTIS HC A02/MF A01 CSCL 07/4

Work under this contract is summarized. Results on collisional transfer of vibrational energy of gases and temperature dependence of transfer efficiency by the Diffusion Cloud method are described. New results by a novel and simple Variable Encounter Method for the study of vibrational energy transfer between gas molecules and a wall, at high temperatures and levels of activation, in the transient region are reported; cyclopropane and cyclobutane have been studied. GRA

N80-11885# Montpellier Univ. (France). Dept. de Physique Mathematique.
ON THE COMPUTATION OF BOUNDS FOR LOW ENERGY COMPTON SCATTERING PARAMETERS: PROOF OF A CONJECTURE
G. Auberson and G. Mennessier. 1979. 16 p. refs.

(PM/79/7) Avail: NTIS HC A02/MF A01

A proof showing that the outer approximation results of a method proposed by Rasulier gives the optimal bounds for low energy scattering parameters as functions of the fixed transfer cross sections above the photoproduction threshold is shown. The Rasulier method was proposed to solve an extremum problem which arises in the derivation of dispersion inequalities for Compton scattering. A reduced mathematical form of the problem is stated after suitable changes of function (amplitudes) and conformal mapping of the energy plane. The proof is reached by making use of duality formulas in order to avoid the difficulties of dealing with spaces of analytical functions. Author (ESA)

N80-11886# Montpellier Univ. (France). Dept. de Physique Mathematique.

TESTS OF STRONG, ELECTROMAGNETIC INTERACTIONS AND WEAK INTERACTIONS WITH POSITRON ELECTRON COLLISIONS

F. M. Renard. Mar. 1979. 62 p. refs. Presented at 10th Spring Symp. on High Energy Phys., Bermogruen, East Ger.

(PM/79/8) Avail: NTIS HC A04/MF A01

The use of electron-positron collisions for testing quantum electrodynamic hypothesis and for studying electromagnetic hadron structure is reviewed. The applications discussed include studies about the total cross section of hadron-forming electron-positron collisions, vector mesons, light u and d quarks, strange quarks, charm quarks, bottom quarks, the search for heavier quarks, multiparticle production of quark and gluon jets, the phenomenological parton jet model, and electromagnetic as well as weak interactions at high energy. Author (ESA)

N80-11887# Montpellier Univ. (France). Dept. de Physique Mathematique.

DIRECT PHOTON EMISSION IN POSITRON ELECTRON ANNIHILATION PROCESSES

F. M. Renard. Apr. 1979. 12 p. refs. Presented at ECFA-LEP Working Group Meeting, Hamburg, 4-6 Apr. 1979

(PM/79/9) Avail: NTIS HC A02/MF A01

The reactions electron positron yields gamma + anything at very high energy are reviewed. The QED processes and their possible modifications by weak interactions are considered. The production of weak bosons is studied and their interest for testing the Yang-Mills couplings and checking the absence of any anomalous other couplings is shown. The case of electron positron yields gamma + hadrons is treated, the two processes: (1) radiation from initial spectral lines depending on the cross-section for electron positron yields hadrons at lower energies, and (2) central photon emission gamma or zeta yields gamma + hadrons expressed in terms of photon structure functions are examined. Their 'Born terms' are calculated, their interest for testing quark quantum numbers (charge, color) is noted. The possible use of photon spectra to search for exotic particles is also discussed. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-11888# California Univ., Livermore. Lawrence Livermore Lab.

LIMITATIONS TO THE USE OF TWO-DIMENSIONAL THERMAL MODELING OF A NUCLEAR WASTE REPOSITORY

B. W. Davis. 4 Jan. 1979. 41 p. refs.

(Contract W-7405-eng-48)

(UCID-18101) Avail: NTIS HC A03/MF A01

Recent modeling studies show that the time-dependent temperature distribution of the waste emplacement media can be accurately modeled in the far-field using a 2-dimensional (2-D) planar numerical model; however, the near-field cannot be modeled accurately enough by either 2-D axisymmetric or 2-D planar numerical models for repositories in salt. The accuracy limits of 2-D modeling were defined by comparing results from 3-dimensional (3-D) TRUMP modeling with results from both 2-D Axisymmetric and 2-D planar. Both TRUMP and ADINAT were employed as modeling tools. Two-dimensional results from the finite element code, ADINAT were compared with 2-D results from the finite difference code, TRUMP; they showed almost perfect correspondence in the far-field. This result adds substantially to confidence in future use of ADINAT and its companion stress code ADINA for thermal stress analysis ADINAT was found to be somewhat sensitive to time step and mesh aspect ratio. DOE

N80-11889# Los Alamos Scientific Lab., N. Mex.

GENERAL-PURPOSE HEAT SOURCE PROJECT SPACE NUCLEAR SAFETY PROGRAM AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report

R. D. Baker, comp. Sep. 1978. 55 p.

(Contract W-7405-eng-36)

(LA-7519-PR) Avail: NTIS HC A04/MF A01

Studies related to the use of (Pu-238)O2 in radioisotopic power systems are reported. DOE

N80-11890# Brookhaven National Lab., Upton, N. Y.

INFORMAL CONFERENCE ON STATUS AND FUTURE OF SOLAR NEUTRINO RESEARCH; PROCEEDINGS

Gerhart Friedlander, ed. 1978. 272 p. refs. Conf. held in Upton, N.Y., 5-7 Jan. 1978

(Contract EY-76-C-02-0016)

(BNL-50879-Vol-2; Conf-780117-P2-Vol-2) Avail: NTIS HC A12/MF A01

Possible electronic methods and new theoretical approaches to the study of solar neutrinos are discussed in twelve papers. Topics covered include solar distortion; the possibility of a changing gravitational constant and of mixing in stars; the rotational history of the sun; nonradial oscillations of the nonstandard solar model; neutrino oscillations; and a critique of the chlorine-37 experiment. The round table discussion addressed the astronomical and cosmological implications of the various nonstandard models, future programs in laboratory experiments and theoretical calculations on reaction cross sections, opacities, convections, and observations of elemental abundances on the sun and the meteorites, and lastly the program in solar neutrino research. DOE

N80-11891# Technical Research Centre of Finland, Espoo.

EVALUATION OF NUCLEAR POWER PLANT SITING BY PROBABILISTIC ASSESSMENT OF ENVIRONMENTAL IMPACT Ph.D. Thesis - Helsinki Univ., Otaniemi, Finland

Seppo Vuori. 1978. 20 p. refs.

(VTT-EN-24; ISBN-951-38-0704-5) Avail: NTIS HC A02/MF A01

A probabilistic consequence assessment model ARANO and the individual calculation schemes therein included are described. This assessment model was applied to the risk/benefit and cost/benefit analyses of the siting of nuclear power plants. In addition, some comparisons with alternative fossil-fuelled energy production scenarios are made. Results indicate the model gives useful data in these applications. Author (ESA)

74 OPTICS

Includes light phenomena.

N80-11892*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

WIDE ANGLE OPTICAL SYSTEMS Patent Application

Fred Vicik, inventor (to NASA) (Barnes Engineering Co., Stamford, Conn.) Filed 19 Oct. 1979. 12 p. Sponsored by NASA

(NASA-Case-MSC-18373-1; US-Patent-Appl-SN-86508) Avail: NTIS HC A02/MF A01 CSCL 20F

A wide angle optical field flattening system for a multispectral scanner is described which provides a large field angles and high resolution at low f-numbers. The system utilizes a basic optical element in the form of a first flat surface of a reflecting element which directs a ray bundle to a second sperical reflection surface. The second spherical reflection surface reflects the bundle

to a field flattener coating on a third spherical surface located intermediate of the first flat surface and the second spherical surface. The third spherical surface forms an exit ray bundle on a flattened image plane with a lower f-number than that reflected from the field flattener coating. The exit ray bundle is passed through a coating to the image plane and to a sensing or scanning surface. NASA

N80-11893# New Mexico State Univ., Las Cruces. Dept. of Electrical and Computer Engineering.
REAL-TIME VIDEO TRACKING CONCEPTS Final Report
G. M. Flachs, P. I. Perez, R. B. Rogers, S. J. Szymanski, and J. M. Taylor. Jun. 1979. 46 p. refs.
(Grant DAAG29-76-G-0231)
(AD-A071792; NMSU-TR-79-1; ARO-13857.4-EL) Avail: NTIS HC A03/MF A01 CSCL 17/8

Real-time video (RTV) tracking concepts are developed for tracking high performance targets in noisy background scenes. Image processing techniques are combined with parallel processing methods to perform a statistical analysis of a TV image, partition the picture into target and background components, perform a structural analysis of the target image, and control the tracking optics to form an automatic tracking system. GRA

N80-11894# Maryland Univ., College Park. Computer Science Center.
STRIP DETECTION USING RELAXATION
Alan Danker and Azriel Rosenfeld. Jan. 1979. 14 p. refs.
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A071606; TR-725) Avail: NTIS HC A02/MF A01 CSCL 17/8

This note describes some experiments in the detection of parallel sided strips using a relaxation-like process which iteratively reinforces collinear or anti-parallel edges. The process was tested on two types of data, tree trunks and runways. GRA

N80-11895# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.
INFRARED ABSORPTION BY WATER CLUSTERS Final Report, Aug. 1976 - Sep. 1978
Hugh R. Carlon. Mar. 1979. 47 p. refs.
(AD-A071455; AD-E410129; ARCSL-TR-79013) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report summarizes the results of a two-year study of atmospheric infrared 'continuum' absorption attributed to intermolecularly bonded clusters in water vapor. Spectral data are reviewed for water vapor, steam and liquid water. The infrared continuum absorption is discussed in detail and is shown to be explicable on the basis of homogeneous or ion-induced cluster distributions in water vapor, where the cluster population is approximately proportional to the square of the partial water vapor pressure. Thermodynamic consistency between the vapor and liquid phases is discussed for temperatures including the critical (374 C) where the phases become one. Simple oscillator models are shown to give agreement with observed spectral lines, suggesting certain cluster configurations. The ion concentration of moist air versus temperature is discussed, and measurements of ion cluster distributions are considered. Cluster absorption at longer wavelengths including the microwave region is discussed. Conclusions are presented. GRA

N80-11896# Florida Technological Univ., Orlando. Dept. of Electrical and Computer Engineering.
INVESTIGATION OF A MULTIMODE FIBER OPTIC COUPLER Final Report, 1 Apr. - 31 Dec. 1978
Marvin D. Drake. 1979. 50 p. refs.
(Grant AF-AFOSR-3566-78; AF Proj. 2305)
(AD-A071874; AFOSR-79-0859TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

The operation of a three-fiber multimode fiber optic coupler was experimentally investigated for the dependence of the forward coupling ratio upon surface conditions of the aligning rods, stress on the fibers, length of the aligning rods, mode distribution in the main fiber, make of fiber, and length of input fiber. An explanation of the discrepancies between theory and experiment was also sought. The forward coupling was found to increase for gross perturbations of the surface of the alignment rods, increase for increased stress on the fibers, increase with length of the aligning rods, increase with increasing number of higher order modes, depend strongly on type of fiber, and decrease with input fiber length. Further, the directivity of the coupler was increased greatly by reducing reflections from the ends of the fibers. GRA

N80-11897# University of Southern California, Los Angeles.
WAVEGUIDE STUDIES FOR FIBER OPTIC SOURCES Interim Report
Elsa Garmire. Griffiss AFB, N. Y. RADC. Jun. 1979. 69 p. refs.
(Contract F19628-77-C-0221; AF Proj. 2306)
(AD-A071446; RADC-TR-79-112) Avail: NTIS HC A04/MF A01 CSCL 20/6

Methods for multimode optical beam expansion, deflection, and switching are discussed in connection with fiber optic and optical signal processing applications. The feasibility of using negative waveguide lenses as beam expanders for stripe-geometry lasers is demonstrated. A monolithically integrated laser source and beam expander is designed utilizing planar epitaxy and selective chemical etches. Epilayer designs for optical coupling of light from the laser region to the waveguide are discussed. Grating distributed Bragg deflectors are fabricated, and the beam expansion from them is characterized. The use of electrical feedback is produce bistability in an optical switch in both bulk $LiNbO_3$ and $LiNbO_3$ waveguides is demonstrated, and the transient response of these hybrid bistable optical devices is investigated. Theoretical predictions of the dependence of switching time on applied light increment are confirmed. GRA

N80-11898# TRW Defense and Space Systems Group, Redondo Beach, Calif.
FIBER OPTIC DETECTION OF LOW FREQUENCY UNDERWATER SOUND Final Report, 4 Jan. 1976 - 30 Apr. 1979
D. W. Baggett and R. L. Johnson. 28 Jun. 1979. 32 p. refs.
(Contract N00014-76-C-0490; NR Proj. 089-117)
(AD-A072829; TRW-AT-ATD-TR-79-2) Avail: NTIS HC A03/MF A01 CSCL 17/1

Theoretical and experimental studies of acousto-optic interferometry were continued. An experimental test of the differential loop interferometer demonstrated that the theoretical sensitivity limit can be achieved with acoustic frequencies from 1 kHz to 50 kHz. The Michelson interferometer was studied under an environmentally stabilized configuration, but the theoretically sensitivity limit was not achieved. A Fabry-Perot configuration was analyzed, giving a theoretical prediction of very high sensitivity per unit fiber length. GRA

N80-11899# Sandia Labs., Albuquerque, N. Mex.
RADIATION EFFECTS IN OPTICAL EMITTERS AND RECEIVERS
C. E. Barnes and K. W. Mitchell. 1978. 7 p. refs. Presented at Fiber Optics and Communications Exposition, Chicago, 6 Sep. 1978.
(Contract EY-76-C-04-0789)
(SAND-78-1798; Conf-780923-2) Avail: NTIS HC A02/MF A01

Radiation damage to the emitter and detector components of optoelectronic systems was studied. Results are summarized for light-emitting diodes, laser diodes, semiconductor detectors, and optical isolators. DOE

N80-11900# California Univ., Livermore. Lawrence Livermore Lab.
FRESNEL ZONE CORRECTION PLATES FOR THE ELECTRON MICROSCOPE
W. Hoppe. Dec. 1978. 12 p. refs. Transl. into ENGLISH from Optik, vol. 20, no. 12, 1963, p. 599-606. Transl. by Addis Translation Intern., Portola Valley, Calif.
(UCRL-Trans-11440) Avail: NTIS HC A02/MF A01

A correction element for correction of the spherical aberration of rotationally symmetric electron lenses is described. It consists of circular annular diaphragms which block off those zones of the image-side wave from which elementary waves arrive at the image point in phase opposition. DOE

N80-11901# Ecole Nationale Superieure des Telecommunications, Paris (France). Lab. Image.
[ACTIVITIES REPORT OF THE IMAGE LABORATORY] Annual Report, 1976 [COMPTE-RENDU D'ACTIVITE]
Jan. 1979 39 p refs In FRENCH; ENGLISH summary
(ENST-D-79005) Avail: NTIS HC A03/MF A01

Hybrid numerical, optical, and video image processing is reported. Research projects include image modelization aimed at describing stationary zones (textures) and nonstationary characteristics (contours). This theoretical study was applied to television and visiophone pictures as well as to numerical image processing (contour detection algorithms). Image pattern recognition work comprised the optimization of optical filtering methods. This technique was implemented numerically and a machine was tested for the blind. As examples of numerical synthesis of optical filters and numerical analysis of optical processing, biomedical applications and scene analysis through complex filtering are cited. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-11902# Nagoya Univ. (Japan). Inst. of Plasma Physics.
BALLOONING BETA LIMIT OF A NON-CIRCULAR SMALL-ASPECT-RATIO TOKAMAK
K. Yamazaki Aug. 1979 27 p refs
(IPPJ-413) Avail: NTIS HC A03/MF A01

The influence of the cross sectional shape of the plasma with rather small aspect ratio on the infinite mode number ballooning stability is discussed and the related critical beta value is determined. The Soloviev equilibrium model with quasi uniform current is adopted in the discussion. The equilibrium model and the reduced ordinary differential equation for linear ballooning modes on each magnetic surface is described. The dependences of the aspect ratio, ellipticity, and triangularity on the beta limitation due to the ideal linear ballooning instability are examined. A.W.H.

N80-11903# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RELAXATION OF Z DISCHARGE BETWEEN ELECTRODES
K. Ikuta Aug. 1979 11 p refs
IPPJ-414) Avail: NTIS HC A02/MF A01

The application to of Taylor's theory to zeta discharged plasma with finite length, which is determined by electrodes made of good conductor, is described. The problem of the impurity ejection from the electrode surfaces until the burn condition of fuel plasma is attained is addressed. The application of the zeta discharge to thermonuclear purposes is examined. The existence of a helical state in the zeta discharge is discussed and the formation of a toroidal configuration by an intense zeta discharge in a casing is considered. A.W.H.

N80-11904# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A STUDY OF REVERSED FIELD PINCH EXPERIMENTS USING A NEW PROGRAMMING MODE
Y. Kita Aug. 1979 44 p refs
(IPPJ-415) Avail: NTIS HC A03/MF A01

A mode of external field programming for setting up a reversed field pinch (RFP) is tested. An initial plasma with a screw pinch followed by external field reversal is created. The program is described and the equilibrium relation with respect to the minor radius throughout the setting up phase is examined. A one dimensional stability analysis based on an ideal MHD model is applied to the experimental results. The instability which is m = 1 resistive tearing mode under the influence of viscosity, is discussed. High current operation at 110 kA using the new programming is evaluated. A.W.H.

N80-11905# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DIRECT COMPARISON BETWEEN CIRCULARLY AND LINEARLY POLARIZED RF FIELD IN ICRF HEATING OF A TOROIDAL PLASMA
Yasuyoshi Yasaka and Ryohei Itatani Aug. 1979 34 p refs
(IPPJ-416) Avail: NTIS HC A03/MF A01

ICRF heating of a toroidal plasma is performed using slow waves generated by the m = +1 circularly polarized rf field and the m = + or - 1 linearly polarized rf field which is, in general, conventionally employed. From direct comparison between the two field-modes on wave generation, ion heating efficiency, and enhanced plasma loss, it is revealed that the circularly polarized field is far more effective than the linearly polarized field in both achieving higher heating efficiency and reducing enhanced plasma loss. The ion heating by the linearly polarized field is accompanied with the enhanced cross-field plasma loss, which may be qualitatively explained by the ion convection resulting from the ponderomotive force of the applied RF field. Author

N80-11906*# United Technologies Research Center, East Hartford, Conn.
ARGON/UF6 PLASMA EXHAUST GAS RECONSTITUTION EXPERIMENTS USING PREHEATED FLUORINE AND ON-LINE DIAGNOSTICS
Ward C. Roman Oct. 1979 79 p refs
(Contract NAS1-14329)
(NASA-CR-159158) Avail: NTIS HC A05/MF A01 CSCL 20I

The feasibility of employing a flowing, high-temperature, pure fluorine/UF6 regeneration system to efficiently convert a large fraction of the effluent plasma exhaust back to pure UF6 was demonstrated. The custom built T.O.F. mass spectrometer sampling system permitted on-line measurements of the UF6 concentration at different locations in the exhaust system. Negligible amounts (< 100 ppm) of UF6 were detected in the axial bypass exhaust duct and the exhaust ducts downstream of the cryogenic trap system used to collect the UF6, thus verifying the overall system efficiency over a range of operating conditions. Use of a porous Monel duct as part of the exhaust duct system, including provision for injection of pure fluorine, provided a viable technique to eliminate uranium compound residue on the inside surface of the exhaust ducts. Typical uranium compound mass deposition per unit area of duct was 2 micron g/sq cm. This porous duct technique is directly applicable to future uranium compound transfer exhaust systems. Throughout these experiments, additional basic data on the corrosion aspects of hot, pressurized UF6/fluorine were also accumulated. A.R.H.

N80-11907# Naval Research Lab., Washington, D. C.
THE OSCILLATING TWO STREAM AND PARAMETRIC DECAY INSTABILITIES IN A WEAKLY MAGNETIZED PLASMA
H. P. Freund and K. Papadoupoulos 23 Jul. 1979 33 p refs
(AD-A072396; NRL-MR-4042) Avail: NTIS HC A03/MF A01 CSCL 20/9

We consider the effects of a weak ambient magnetic field on the oscillating two stream and parametric decay instabilities, with particular emphasis on the dependence on the angular variation of the instability thresholds and growth rates on the magnetic field. A dispersion relation is derived in the limit in which omega sub e > Omega sub e (where omega sub e and Omega sub e are the electron plasma and cyclotron frequencies respectively), and is solved for dipole and monochromatic pump spectra. The analysis shows that the presence of a magnetic field can substantially enhance thresholds and reduce growth rates for waves propagating at an oblique angle with respect to the magnetic field and (k lambda sub e)-squared approximately = (Omega sub e/omega sub e)-squared (where k is the wavevector of the perturbation and lambda sub e the Debye length). Thus, the magnetic field has a stabilizing influence on the off-parallel propagating modes. GRA

N80-11908# California Univ., Livermore. Lawrence Livermore Lab.
MAGNETIC MIRROR FUSION RESEARCH AT THE LAWRENCE LIVERMORE LABORATORY
R. F. Post 9 Feb. 1979 25 p Presented at the All-Union Conf. on Controlled Fusion, Moscow, 21-27 Feb. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-82318; Conf-790232-1) Avail: NTIS HC A02/MF A01

Success in achieving workable solutions to the scientific

problems of plasma equilibrium and plasma instability and to technical problems of creating and sustaining fusion plasma in mirror systems is reviewed. The economic problem of improving the power amplification factor, Q, of a fusion system using magnetic mirrors is addressed. Possible solutions examined include the use of tandem mirrors and field reversal using high level current neutral beam injection. A.R.H.

N80-11909# Los Alamos Scientific Lab., N. Mex.
STABILITY THEORY FOR INTERNAL RING CONFIGURATIONS
Guthrie Miller. Jan. 1979. 13 p. refs.
(Contract W-7405-eng-36)
(LA-7618-MS) Avail: NTIS. HC A02/MF A01
The magnetohydrodynamics stability theory of internal ring configurations is developed using nearly cylindrical, sharp-boundary plasma model. DOE

N80-11910# Illinois Univ., Urbana. Fusion Studies Lab.
STABILITY OF FIELD REVERSED MIRRORS
E. C. Morse, W. C. Condit (Lawrence Livermore Lab.), and G. H. Miley. 1978. 3 p. refs. Presented at ANS Meeting, Washington, D. C., 12 Nov. 1978.
(Contract EY-76-S-02-2218)
(COO-2218-119; Conf-781105-79) HC A02/MF A01
An energy principle is used to demonstrate stability of low frequency modes and derive limiting conditions of importance to design stability studies such as SAFFIRE. DOE

N80-11911# Oak Ridge National Lab., Tenn.
LONG PULSE TECHNOLOGY TOKAMAK
T. C. Jernigan. 1978. 10 p. refs. Presented at the Meeting on the Eng. of Large Tokamak Experiments, Paris, 1 Sep. 1978.
(Contract W-7405-eng-26)
(CONF-780966) Avail: NTIS. HC A02/MF A01
The long pulse technology Tokamak, a noncircular Tokamak, is described for extended pulse operation at high beta and reactor level wall power loading. The toroidal field coils are superconducting and a superconducting bundle divertor is discussed for active impurity control. Experimental access and flexibility in operation are discussed. DOE

N80-11912# Minnesota Univ., Minneapolis. Dept. of Physics and Astronomy.
THEORETICAL AND HIGH ENERGY PHYSICS. Progress Report, 1977 - 1978
1978. 39 p. refs.
(Contract EY-76-C-02-1764)
(COO-1764-342) Avail: NTIS. HC A03/MF A01
Generalization of the spherical harmonic gradient formula, nuclear many body problems, and effective operators in the shell model are among the topics covered in this review of research into elementary particle theory and high energy interactions. Experiments being conducted relate to elastic scattering; depolarization, p-He (4) scattering; direct electron production; pn polarization at 2.3 and 6 GeV/c; low energy polarization; and coherent production. A.R.H.

N80-11913# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Freiburg (West Germany). Inst. fuer Physikalische Weltraumforschung.
DENSITY FLUCTUATIONS IN A PLASMA CHAMBER. Final Report
Rainer Kist, Surya P. Gupta, Heinz Thiemann, and Wolfgang Kampa. Bonn: Bundesmin. fuer Forsch. u. Technol. Dec. 1977. 99 p. refs. In GERMAN; ENGLISH summary.
(Contracts BMFT-WRT-1076; DFVLR-BPT-01-QV-296)
(BMFT-FB-W-77-48) Avail: NTIS. HC A05/MF A01; ZLDI, Munich DM 20.60
Density fluctuations in a large plasma chamber were investigated and first results obtained are described. The investigations covered density fluctuations in the undisturbed plasma beam with and without external magnetic field and for different beam energies, density fluctuations produced by extracting as well as injecting electron currents (beam-plasma-interaction) in connection with the production of electric fields parallel to B (electric double layers), and density fluctuations in the wake of a sphere in view of the role of the wake dynamics for plasma investigations on Spacelab. The resonance cone in the real magnetoplasma was also studied and results are used in the development of an improved kinetic resonance cone theory. Author (ESA)

N80-11914# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
CONTINUOUS DOUBLE ADIABATIC SPECTRUM IN A PLASMA CONFINED IN A POLOIDAL MAGNETIC FIELD. Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
T. Hellsten. Feb. 1979. 18 p. refs. Sponsored by EURATOM.
(TRITA-PFU-79-02) Avail: NTIS. HC A02/MF A01
The continuous spectrum of an anisotropic toroidal plasma confined in a poloidal magnetic field is investigated with the double adiabatic theory. The continuous spectrum is given by an eigenvalue problem of two uncoupled second order ordinary differential equations. Results show that in contrast to the magnetohydrodynamic continuum the double adiabatic continuum may become unstable. The stability depends upon the perpendicular and parallel pressure distributions along the field lines. Author (ESA)

N80-11915# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
MEASUREMENTS OF ELECTRON DENSITY AND TEMPERATURE PROFILES IN A GAS BLANKET EXPERIMENT. Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
A. Kuthy. Feb. 1979. 28 p. refs. Sponsored by EURATOM.
(TRITA-PFU-79-03) Avail: NTIS. HC A03/MF A01
Radial profiles of electron density, temperature, and H beta intensity are presented for the rotating plasma device F-1. The hydrogen filling pressure, the average magnetic field strength at the midplane, and the power input to the discharge were varied in the ranges 10 to 100 mTorr, 0.25 to 0.5 Tesla, and 0.1 to 1.5 MW, respectively. These experiments were performed in order to study the gas blanket (cold-mantle) state of the plasma. It is shown that a simple spectroscopic method can be used to derive the radial distribution of the electron temperature in such plasmas. The observed peak temperatures and densities are in agreement with earlier theoretical estimates. Author (ESA)

N80-11916# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
RESONANCE AND CUT-OFF SURFACES IN THE ION CYCLOTRON FREQUENCY RANGE IN TOROIDAL GEOMETRY. Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
T. Hellsten and E. Tennfors. Mar. 1979. 19 p. refs. Sponsored by EURATOM.
(TRITA-PFU-79-04) Avail: NTIS. HC A02/MF A01
Resonances and cut-offs of the fast Alfven and ion-cyclotron waves were studied for a multicomponent plasma in a toroidal axisymmetric geometry. The resonance and cut-off frequencies are given by eigenvalues of ordinary differential equations on the resonance and cut-off surfaces, respectively. These surfaces coincide with magnetic surfaces. Author (ESA)

N80-11917# Pisa Univ. (Italy). Fac. di Ingegneria.
ON THE BALANCE EQUATION FOR ANGULAR MOMENTUM IN A PLASMA. [L'EQUAZIONE DI BILANCIO DEL MOMENTO DELLE QUANTITA' DI MOTO IN MECCANICA DEI PLASMI]
Giulio Mattei. 1978. 5 p. refs. In ITALIAN; ENGLISH summary. Presented at 4th Cong. Nazl. di Meccan. Teorica ed Appl., Florence, 25-28 Oct. 1978.
(Rept-1670) Avail: NTIS. HC A02/MF A01
The balance equation for angular momentum in a plasma described by the magnetohydrodynamic model is obtained. The equation is derived as a consequence of four factors. These are: (1) the related equation of continuity, (2) the equation of motion, (3) the symmetry of the mechanical stress tensor in the plasma, and (4) the fact that the electromagnetic force per unit volume in the plasma can be expressed as the divergence of a symmetric tensor, i.e. the Maxwell magnetic stress tensor in the plasma. Author (ESA)

N80-11918# Uppsala Univ. (Sweden). Dept. of Theoretical Electronics.
ON THE EXISTENCE AND STABILITY OF TRAPPED LANGMUIR MODES IN A DOUBLE LAYER
Christer Wahlberg Nov. 1978 46 p refs Sponsored by Swed. Nat. Sci. Res. Council Submitted for publication
(UPTEC-78-89-R) Avail: NTIS HC A03/MF A01

The stability problem of the double layer (electrostatic shock) is investigated using a simple model of the plasma. It is shown that local Penrose stability in general is insufficient for global stability due to the existence of linearly unstable trapped Langmuir modes in the density cavity. An additional requirement for stability is that the thickness of the layer must be smaller than a critical value, which in the case of a strong layer, and for the particular model being used, is shown. Various qualitative features of the instability mechanism are discussed in terms of normal mode coupling and quantitative results such as mode frequencies, growth rates, etc., are obtained by means of a conventional perturbation approach which in addition to the results expected from coupled mode theory also shows the existence of two purely decaying modes appearing for a sufficiently thin, stable layer. The double layer formation process is briefly commented on and some distinguishing features of the instability in this regard are pointed out. Author (ESA)

N80-11919# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
PARAMETER CALCULATION OF A SCREW-PINCH REACTOR WITH ELONGATED CROSS-SECTION
J. A. Hoekzema and W. Schuurman Apr. 1979 37 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (SWO) and EURATOM
(Rept-79-117) Avail: NTIS HC A03/MF A01

In continuation of systems on screw-pinch reactors with a circular cross section, a parameter calculation was performed for a similar reactor with a chamber of rectangular shape. The duty cycle of the reactor comprises an implosion heating phase, an adiatatic compression of the plasma up to the ignition temperature, a phase of thermonuclear burn maintained by generated alpha particles, and a down-time for plasma cooling, pumping, and refuelling. Starting with a set of parameters that are mainly determined by expected technical limitatons, a zero dimensional, time dependent computer code is used to describe the various stages of the duty cycle. The physical model and the numerical method for this parameter calculation are described. It is found that severe ohmic losses limit the net efficiency to 20%. Therefore, it must be concluded that a screw-pinch reactor based on the assumptions of plasma heating by fast implosion and subsequent adiabatic compression, the use of resistive coils, an actively controlled value of beta and omittance of fuel injection, is not economically feasible. Author (ESA)

N80-11920# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
PROGRESS IN RINGBOOK 2, TORTUR 2 AND SPICA 2 FOR 1978 Annual Status Report, December 31, 1978
Apr. 1978 82 p refs Sponsored in part by EURATOM and Neth. Organ. for Pure Sci. Res. (ZWO)
Avail: NTIS HC A05/MF A01

Three plasma confinement experiments, RINGBOOG 2, TORTUR 2, and SPICA 2, are reported. The SPICA 2 design is evaluated in order to minimize stray magnetic fields and mechanical forces resulting from the gaps in the copper shell. An experiment is described which shows that the confinement of the heated plasma is affected by an influx of neutrals from the wall. The RINGBOOG 2 experiment is discussed. RINGBOOG 2 operates in the well established, high density, low temperature RINGBOOG 1 regime, under normal Tokamak operating conditions and in an intermediate, high density Tokamak mode without using gas puffing. Magnetohydrodynamic studies on the sharp boundary model of a high beta Tokamak are described. Author (ESA)

N80-11921# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
ON THE BOUNDARY LAYER BETWEEN A FLOWING PLASMA AND A MAGNETIC FIELD. PART 1. THE CONDITIONS FOR EQUILIBRIUM
L. R. O. Storey and L. Cairo Oct. 1978 65 p refs
(CRPE-NT-63-Pt-1) Avail: NTIS HC A04/MF A01

A qualitative study is made of a plane charge-neutral magnetopause separating a field-free plasma from a plasma-free magnetic fields, in the case where the plasma is flowing parallel to the applied field. It is shown that the existence of small-scale equilibrium depends on boundary conditions which are governed by the large-scale structure of the system. On certain conditions, which are defined, equilibrium is possible at all flow speeds. For a class of structures characterized by approximately axial flow, these conditions cannot be satisfied if the plasma encloses the magnetic field, but can if the magnetic field encloses the plasma. They are satisfied most naturally if, in addition, the magnetopause has the form of a torus. While intended originally as a contribution to magnetospheric physics, results may be more relevant to the high confinement of fusion plasmas. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.
For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-11922# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
MNOS BORAM MANUFACTURING METHODS AND TECHNOLOGY PROJECT Progress Report, 1 Apr. 1978 - 31 May 1979
J. E. Brewer and R. C. Lyman Jun. 1979 40 p
(Contract DAAB07-76-C-0048)
(AD-A071413; DELET-TR-76-0048-7; Rept-79-0467; TR-1)
Avail: NTIS HC A03/MF A01 CSCL 20/12

A manufacturing methods project has been initiated to establish a pilot production line for metal nitride oxide semiconductor (MNOS) block oriented random access memory (BORAM) multichip hybrid circuits. This report presents an analysis of test results from an 8900 hour endurance-retention experiment. GRA

N80-11923# Cornell Univ., Ithaca, N. Y. School of Electrical Engineering.
ELECTRIC CURRENT CONTROLLED LIQUID PHASE EPITAXY OF COMPOUND SEMICONDUCTORS FOR MICROWAVE DEVICES Final Report, 1 Oct. 1978 - 31 May 1979
Lester F. Eastman, Colin E. C. Wood, and Bart VanRees 1979 26 p refs
(Contracts AF-AFOSR-2929-76; AF Proj. 2306)
(AD-A072643; AFOSR-79-0913TR) Avail: NTIS HC A03/MF A01 CSCL 20/12

A study has been made to determine the growth rate and the mechanism responsible for the growth of InP epitaxial layers while applying an electric current across the melt-substrate interface, maintaining a constant overall temperature. The object of the study was to produce layers of thicknesses up to 100 micrometers with a constant residual impurity profile for impurity levels of approximately 2 x 10 to the 15th cu cm for use in Gunn diodes and other microwave devices. GRA

N80-11924# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.
RESONATORS FOR ACCELERATION ENVIRONMENTS
Theodore Lukaszek and Arthur Ballato Jun. 1979 39 p refs
(DA Proj. 1L1-61101-A-01A)
(AD-A072741; DELET-TR-79-10) Avail: NTIS HC A03/MF A01 CSCL 09/1

Singly rotated AT cut plates are most often used for frequency control in applications where moderate and high precision is required, but recent developments point to a greatly expanded role for doubly rotated cuts. Virtually all of these thickness mode cuts are of the form of thin circular discs mounted on their edges. Any forces communicated between the mounting supports and the quartz plate produce high stresses and stress-gradients resulting in significant frequency perturbations. This report describes crystal plate designs having a prescribed

lateral contour for singly and doubly rotated plates. These designs provide a relatively large portion of the periphery for mounting, such that mounting stresses are greatly reduced with no detriment to the force immunity of the older-type mounts. GRA

N80-11925# Stanford Univ., Calif.
STUDY OF THE ELECTRONIC SURFACE STATES OF 3-V COMPOUNDS Semiannual Progress Report, 1 Oct. 1978 - 31 Mar. 1979
W. E. Spicer and I. Lindau 31 Mar. 1979 58 p refs
(Contract N00014-79-C-0072; DARPA Order 3564; NR Proj. 322-078)
(AD-A073014) Avail: NTIS HC A04/MF A01 CSCL 11/6

Although several theories of Schottky-barrier formation have been proposed, none has emerged as the correct general theory which elucidates the mechanism responsible for the barrier formation. Indeed, there may be no such general theory and, at the present time, it seems more appropriate to study limited classes of semiconductor materials. We have chosen the 3-5 compounds for both theoretical and practical reasons. The cleavage faces of GaAS, GaSb, and InP have the advantage that there are no intrinsic states in the band gap. This is in contrast to the more familiar column 4 semiconductors which do have intrinsic surface states in band gap upon cleaving. It was this concept of intrinsic semiconductor surface states in the gap which was used by Bardeen to explain Schottky-barrier formation on Si. However, the presence of these intrinsic surface states in the gap on the clean cleaved Si (111) surface does not rule out the possibility that other mechanisms may be responsible for surface Fermi energy stabilization after deposition of an overlayer. GRA

N80-11926# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Res. Div.
ELIPSOMETRY OF SURFACE LAYERS ON LEAD AND LITHIUM M.S. Thesis
Richard Dudley Peters Oct. 1978 175 p refs
(Contract W-7405-eng-48)
(LBL-8375) Avail: NTIS HC A08/MF A01

Anodic and corrosion films on lead exposed to sulfuric acid and lithium exposed to water were studied using an automatic self compensating ellipsometer. The processes in the growth of surface layers and the factors that determine electrode behavior are discussed. Simultaneous measurement of current and potential is made and scanning electron micrographs of surface layers are examined. A.W.H.

N80-11927# California Univ., Berkeley. Lawrence Berkeley Lab.
ELLIPSOMETRY OF ANODIC FILM GROWTH Ph.D. Thesis
Craig Gordon Smith Aug. 1978 360 p refs
(Contract W-7405-eng-48)
(LBL-8082) Avail: NTIS HC A16/MF A01

An automated computer interpretation of ellipsometer measurements of anodic film growth was developed. A multiple-film model was used to characterize the growth of films which proceeds via a dissolution-precipitation mechanism; the model also applies to film growth by adsorption and nulceation mechanisms. The characteristic parameters for film growth describe homogeneous and heterogeneous crystallization rates, film porosities and degree of hydration, and the supersaturation of ionic species in the electrolyte. Additional descriptions which may be chosen are patchwise film formation, nonstoichiometry of the anodic film, and statistical variations in the size and orientation of secondary crystals. Theories were developed to describe the optical effects of these processes. The growth in alkaline solution of anodic films on silver, cadmium, and zinc is discussed. DOE

N80-11928# California Univ., Berkeley. Lawrence Berkeley Lab.
THE EFFECT OF CRYSTAL GROWTH DIRECTION ON THE ENERGY RESOLUTION OF HIGH-PURITY GERMANIUM DETECTORS
G. Scott Hubbard, E. E. Haller, and W. L. Hansen Oct. 1978 7 p refs Presented at the IEEE Nucl. Sci. Symp., Washington, D.C., 18 Oct. 1978
(Contract W-7405-eng-48)
(LBL-8133; Conf-781033-32) Avail: NTIS HC A02/MF A01

Both [100] and [113] direction high-purity germanium crystals with dislocation densities > 10 to the 4th power/sq cm have been examined by Hall effect, Deep Level Transient Spectroscopy and gamma-ray spectrometer performance. High dislocation density [100] crystals appears to give rise to acceptor levels which cause broadened and/or asymmetric photopeaks. [113] crystals with EPD >10 to the 4th power/sq cm do not show these effects. DOE

N80-11929# Freiburg Univ. (West Germany). Kristallographisches Inst.
ZONE CRYSTALLIZATION UNDER ZERO GRAVITY Final Report
Achim Eyer and Harald Zimmermann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 191 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1072; GfW-01-E-0064)
(BMFT-FB-W-77-12) Avail: NTIS HC A09/MF A01; ZLDI, Munich DM 39.50

Based on theoretical considerations and after experimenting with several preliminary set-ups (using various radiation sources and focusing geometries), a zone crystallization apparatus was built. It is intended to serve as an experimental model to define the requirements for a SPACELAB version. The central part is a mirror furnace consisting of two adjoining rotary ellipsoids (half-axes a = 100 mm, b = C = 100 mm, volume 6 1), having one common focus. The sample rod to be crystallized is located in this focus while two halogen lamps as radiation sources are located in the other two foci. Approximately 95% of the radiation is focused. The (completely sealed) furnace can be operated under vacuum or a protective gas atmosphere. Temperatures up to 2000 C can be attained depending on the size and properties of the sample. Power consumption is extremely low as compared with conventional heating methods, especially if the very high heating and cooling rates are taken into account. Author (ESA)

N80-11930# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazoni.
AN EXPERIMENTAL APPARATUS FOR MEASURING THE THERMAL ABSORPTION OF GaSe SUB 1-x SUB x COMPONENTS
V. Angelini, M. Casalboni, and P. Vecchia 21 Dec. 1978 18 p refs In ITALIAN; ENGLISH summary
(ISS-T-78/17) Avail: NTIS HC A02/MF A01

The measurement of the optical behavior of mixed GaSe sub 1-x S sub x semiconductors as a function of the parameter x is discussed. A computer assisted analysis of thermal absorption measurements is proposed. A experimental setup for making these measurements is described. A comparison of samples grown by the Bridgman method with those grown using the transport method is suggested and some preliminary results are shown. Author (ESA)

N80-11931# Uppsala Univ. (Sweden). Dept. of Solid State Physics.
[ACTIVITIES OF THE DEPARTMENT OF SOLID STATE PHYSICS] Annual Report
Feb. 1978 26 p refs
(UPTEC-78-08-R) Avail: NTIS HC A03/MF A01

A survey of the present research projects is given. The projects fall within the fields of magnetism, mainly ordered spin structures, itinerant electron magnetism, specific heat, and disordered materials. Inorganic chemistry, quantum chemistry, and physics (Moessbauer spectroscopy) are included. Author (ESA)

N80-11932# Montpellier Univ. (France). Lab. de Physique Mathematique et Theorique.
DIFFERENTIAL DIFFERENCE EVOLUTION EQUATIONS. PART 2: DARBOUSE TRANSFORMATION FOR THE TODA LATTICE
V. B. Mateev and M. A. Salles (Inst. of Exact Mechan. and Optics, Leningrad) 1979 7 p refs
(PM/79/11) Avail: NTIS HC A02/MF A01

The Toda lattice equation is represented in the form of the condition of compatibility of the system of linear equations corresponding to a nonhermitian Lax representation. The

Darboux invariance of this linear system is defined and proved. Results are used to construct formulas for the solutions of the Toda lattice equation. These formulas involving determinants are applicable to an arbitrary initial solution of the Toda equation, for example, to a solution growing at infinity. Author (ESA)

N80-11933# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
CRYSTAL GROWTH FROM THE VAPOR PHASE WITH AN INERT COMPONENT PRESENT
S. I. Aladiev and A. S. Okhotin 1978 7 p refs
(D-268) Avail: NTIS HC A02/MF A01

The rates of crystal growth from the vapor-gas medium were studied. The conditions that are adequate to the growth process of the diffusion zone are discussed. Whether the crystal growth rate is determined by transporting the substance to the boundary with phase transition or by chemical reaction rate is examined. It is assumed that both the phase transition and the chemical reaction rate develop rather quickly and are not the limiting stages. Author (ESA)

N80-11934# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
INVESTIGATION OF THE STRUCTURE OF Te-Se SOLID SOLUTIONS OBTAINED IN DIFFERENT GRAVITY CONDITIONS ONBOARD THE SALYUT-6 STATION AND IN THE CENTRIFUGE
Y. S. Avraamov (Moscow Inst. of Steel and Alloys), E. N. Kachanov (Moscow Inst. of Steel and Alloys), S. B. Felgina (Moscow Inst. of Steel and Alloys), G. E. Ignatjev, and A. S. Okhotin 1978 4 p
(D-269) Avail: NTIS HC A02/MF A01

The structures of Te-Se solid solutions obtained onboard the Salyut-6 station (zero-gravity conditions), on earth, and in a centrifuge with the force field at 10 g are compared. The structures of transverse and longitudinal specimens and of freely crystallized surfaces are given. Ingots obtained under microgravity differ even externally from those obtained on earth and in the centrifuge. The considerably macroporous surface of ingots grown in space is most noticeable. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics, and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-11935# Braun (C. F.) and Co., Alhambra, Calif.
EXPERIMENTAL ENTHALPIES FOR A MIXTURE OF 80 MOLE PERCENT ISOBUTANE IN ISOPENTANE Final Report
C. R. Koppany and J. M. Lenoir Mar. 1979 52 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 928-4)
(EPRI-ER-1034) Avail: NTIS HC A04/MF A01

Seven enthalpy isobars were measured for a nominal mixture of 80% isobutane/20% isopentane. A phase envelope was constructed for use in the design of a turbine expander and the heat exchangers for a geothermal power plant. The dew point values for the phase envelope are discussed for the region near the critical. DOE

N80-11936# California Univ., Berkeley. Lawrence Berkeley Lab.
THERMODYNAMICS OF HIGH TEMPERATURE BRINES
Kenneth S. Pitzer, D. J. Bradley, P. S. Z. Rogers, and J. C. Peiper Apr. 1979 40 p refs Presented at the 177th ACS Natl. Meeting, Honolulu, Hawaii, 1 Apr. 1979
(Contract W-7405-eng-48)
(LBL-8973; Conf-790415-32) Avail: NTIS HC A03/MF A01

Osmotic and activity coefficient data and enthalpy and heat capacity data for NaCl solutions at saturation pressure water from 0 to 300 C and to saturation composition simultaneously fit to a 30 parameter equation, are presented. Calculated values of the osmotic coefficient, the activity of water, the activity of NaCl, and the heat capacity, enthalpy and entropy of the solution are discussed. DOE

N80-11937# Addis Translations International, Portola Valley, Calif.
CONSTRUCTION OF THE EQUATION OF STATE FOR CHEMICAL COMPOUNDS
N. N. Kalitkin Mar. 1979 68 p refs
(UCRL-Trans-11474) Avail: NTIS HC A04/MF A01

A method is presented for construction of interpolation equations, decribing the thermodynamic function of matter over a very broad range of temperature (from room temperature to some millions of degrees) and densities (from gas to a supercompressed state). The equations are constructed using calculations, based on various models of the atom produced in this work, and a large body of models of the atom produced in this work, and a large body of experimental data. As an example, the equation of state of H2O and NaCl is found; the mean-square error of the equation is approximately 5%. DOE

N80-11938# Oak Ridge National Lab., Tenn.
THERMODYNAMIC ASSESSMENT OF OTEC OPEN-CYCLE POWER SYSTEMS
F. C. Chen 1979 6 p refs Presented at the ISA Modeling and Simulation Conf., Pittsburgh, 27 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790459-2) Avail: NTIS HC A02/MF A01

The thermodynamic process of the open cycle is presented and the recent power system studies on the subject are summarized. Based on the range of operating parameters that have been established in the recent system design studies, an optimal thermal performance model is developed. The modeling results for the case studied indicate that low flashdown temperature and higher water velocity in smooth condenser tubes maximize the net power per unit condenser heat transfer surface area. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N80-11939 International Institute for Applied Systems Analysis, Laxenburg (Austria).
SPATIAL POPULATION ANALYSIS: METHODS AND COMPUTER PROGRAMS Final Report
Frans Willekens and Andrei Rogers Nov. 1978 311 p refs
(IIASA-RR-78-18) Avail: Issuing Activity

An integrated methodology for spatial (or multiregional) demographic analysis is reviewed. The FORTRAN 4 codes for the computer programs and a user's manual for implementing this methodology are given. Programs included are the multiregional life table, multiregional demographic projections, fertility and mobility analyses of both life table and stable populations, stable population analyses, the spatial reproductive value, and the analysis of alternative paths to spatial zero population growth. The focus is on the interpretation of the output. The user's manual describes steps to be taken in the preparation of the data deck. Author (ESA)

N80-11940*# Hampton Inst., Va.
SUMMER RESEARCH FELLOWSHIP PROGRAM
Geraldine C. Darden, comp. Oct. 1979 41 p
(Contract NAS1-14832)
(NASA-CR-159153) Avail: NTIS HC A03/MF A01 CSCL 05A

Significant accomplishments reported include uniaxial compression tests of high strength graphite-epoxy laminates. The results show that Young's modulus and fracture stress depend upon the specimen's dimensions. Also presented are: an investigation of robot vision; estimation of spectral signatures of algae from the airborne lidar oceanographic probing equipment; impact tests on polymeric compounds; calibration of quartz crystal

microbalance; and a profile of naturally occurring hydrocarbons.
M.M.M.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-11941# Ohio Public Utilities Commission, Columbus.
DEMAND MANAGEMENT DEMONSTRATION PROJECT. STAGE 1: DEVELOPMENT OF RESIDENTIAL LOAD CHARACTERISTICS. STAGE 4: DEMONSTRATION OF RESIDENTIAL INCREMENTAL COST PRICING IMPLEMENTED BY TIME-OF-DAY METERING Final Report, Jan. 1979
Apr. 1979 144 p
(Contract EC-75-F-01-8072)
(HCP/B8072-01) Avail: NTIS HC A07/MF A01

Several load-management technologies were used in order to gather data necessary for further implementation, gain insight into customer reactions to the various techniques studied, and develop the computer codes necessary to process such data. The results are consistent with economic theory and will contribute to the further development of effective pricing structures for electricity. The customers on the time-of-day rate responded by reducing their peak-period consumption significantly below that of comparable control-group customers. Total energy use by customers in the pricing group declined about 3.5%. Customers in the time-of-use and radio-controlled groups reacted favorably to the techniques.
DOE

N80-11942# Mathematics and Computation Lab., Washington, D. C. Information Science Div.
ZERO BASE BUDGET SOFTWARE Final Report
Nathan J. Ray Jun. 1979 118 p
(PB-298732/9; GSA/FPA/MCL-TM-283) Avail: NTIS HC A06/MF A01 CSCL 05A

This manual contains descriptions of software modules which may be used to facilitate the physical preparation of budgets using the Zero Base Budget concept. The software includes facilities for entering and manipulating decision packages, rank tables, staffing tables, and object class tables. The manipulation facilities include the capability to obtain resource summaries by organizational elements or by program area. The Zero Base Budget Software executes on the PDP 11/45 computer under control of the STAMOS operating system.
GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-11943# Committee on Governmental Affairs (U. S. Senate).
LACK OF ACCOUNTABILITY IN GOVERNMENT PUBLIC INFORMATION AND PUBLISHING PROGRAMS
Washington GPO 1979 95 p refs Rept. for Comm. on Governmental Affairs, 96th Congr., 1st Sess., May 1979
(GPO-45-775) Avail: Comm. on Governmental Affairs

Federal agencies do not know how much they spend to write, print, and distribute government publications. The Monthly Catalog of U.S. Government Publications is far from complete because many agencies neglect their reporting responsibilities required under Federal law (title 44). Difficulties in evaluating public affairs government-wide and at the Department of Health, Education, and Welfare are discussed. A survey of selected publications practices of Executive Branch Agencies is included.
A.R.H.

N80-11944# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PERTURBATION METHOD ON THE STUDY OF THE INTERACTION OF THE SOLAR WIND WITH COMETS [METODO DE PERTURBACOES NO ESTUDO DA INTERACAO DO VENTO SOLAR COM COMETAS]
Rene A. Medrano-B. Jul. 1979 15 p refs In PORTUGUESE Presented at the 31st Reuniao Anual da Soc. Brasil. Para o Progr. da Cienc. (SBPC), 11-18 Jul. 1979 Revised
(INPE-1529-RPE/061) Avail: NTIS HC A02/MF A01

A hydrodynamic model as well as one in an interplanetary field B were used to study the solar wind-comet interactions. The problem was solved considering that energies in the B fields were smaller than energies of the solar wind at distances of IUA from the sun. An analysis on the balance of pressure at both sides of the shock waves indicate that the size of the fields where the noise is contained is considerably reduced. First order perturbation equations with a solution based on zero order restored the particles to 3 degrees of freedom.
Transl. by M.M.M.

N80-11945# Denver Research Inst., Colo.
MICROFICHE APPLICATIONS IN AN INDIVIDUALIZED, SELF-PACED LEARNING SYSTEM Final Report, Sep. 1977 - Dec. 1978
James P. Kottenstette Brooks AFB, Tx. Air Force Human Resources Lab. May 1979 50 p refs
(Contract F33615-77-C-0057; AF Proj. 1121)
(AD-A069445; AFHRL-TR-79-6) Avail: NTIS HC A03/MF A01 CSCL 05/9

The microfiche medium offers proven advantages in the management, storage, and retrieval of information, as well as significant cost advantages. The study was directed towards developing microfiche formatting concepts and microfiche production methods to capture the power of the medium for delivery of both text and illustrations within context of the Advanced Instructional System (AIS)--a computer based, multi-media, self-paced instructional program of the Air Training Command at Lowry AFB, Colorado. Specific applications were (a) the conversion of color intensive audiovisual modules to microfiche; (b) the formatting of the microfiche to deliver both primary and alternative track modules in an integrated (multi-track) module, and (c) the use of microfiche in testing and test control.
GRA

N80-11946# California Univ., Berkeley. Lawrence Berkeley Lab.
A MANUAL FOR CATALOGING AND INDEXING DOCUMENTS
S. R. Schwartz, S. L. Phillips, and J. J. Perra Jul. 1978 85 p refs Revised
(Contract W-7405-eng-48)
(LBL-4432-Rev-1) Avail: NTIS HC A05/MF A01

The descriptive cataloging and subject indexing rules and methodology needed to process bibliographic information for the National Geothermal Information (GRID) database storage are documented. Data elements which may appear in a bibliographic record are tabulated. Examples of coded data entry forms are included in an appendix. Examples are given of unit records in the database corresponding to one bibliographic reference. DOE

N80-11947# Hanford Engineering Development Lab., Richland, Wash.
AUTOMATED DOCUMENT RETRIEVAL WORKSHOP
Linda Sue Boehmer, Gerald A. Marzyck, Weeona G. Harves, Theresa Humason, June E. Isaacs, Jan R. Jackson, and Gerald W. Main Sep. 1978 128 p
(Contract EY-76-C-14-2170)
(HEDL-SA-1628) Avail: NTIS HC A07/MF A01

Records management establishing microfilm system, aperture card production, keywording, and computerizing the document retrieval system were considered.
DOE

N80-11948# Charles River Associates, Inc., Boston, Mass.
DEVELOPMENT OF A MODEL OF THE DEMAND FOR SCIENTIFIC AND TECHNICAL INFORMATION SERVICES Final Report
Apr. 1979 119 p

(Grant NSF IST-77-18020)
(PB-297826/0; CRA-385) Avail: NTIS HC A06/MF A01 CSCL 05B

The development and estimation of an econometric model of the demand by scientists for scientific and technical journals and the various ways of obtaining these journals and their articles is considered. The demand for subscription as opposed to library use and for hardcopy as opposed to photocopy are explicitly incorporated into the model. A large sample of physicists was surveyed to collect the data necessary to estimate the model. GRA

N80-11949# Capital Systems Group, Rockville, Md.
DEVELOPMENT OF A PLANNING GUIDE TO INNOVATION IN THE DISSEMINATION OF SCIENTIFIC INFORMATION
John M. Strawhorn Feb. 1979 44 p
(Contract NSF C-950)
(PB-296537/4; NSF/IST-24410/15) Avail: NTIS HC A03/MF A01 CSCL 05B

A concise summary of a project designed to simulate the adoption of useful innovations by scientific and technical (S&T) publishers is given. Publication of a book, development of a specialized document collection and bibliographic data base, creation of a computerized human-resources file, conduct of several working meetings on communications technologies, and a major survey of the policies and practices of U. S. S&T journal publishers are among the topics discussed. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-11950*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COST-EFFECTIVE TECHNOLOGY ADVANCEMENT DIRECTIONS FOR ELECTRIC PROPULSION TRANSPORTATION SYSTEMS IN EARTH-ORBITAL MISSIONS
John D. Regetz, Jr. and C. H. Terwilliger (Boeing Aerospace Co., Seattle, Wash.) 1979 21 p ref Presented at the Fourteenth Intern. Conf. on Electric Propulsion, Princeton, N. J., 30 Oct. - 1 Nov. 1979, sponsored by AIAA and Deut. Ges. fur Luft und Raumfahrt
(NASA-TM-79289) Avail: NTIS HC A02/MF A01 CSCL 05C

The directions that electric propulsion technology should take to meet the primary propulsion requirements for earth-orbital missions in the most cost effective manner are determined. The mission set requirements, state of the art electric propulsion technology and the baseline system characterized by it, adequacy of the baseline system to meet the mission set requirements, cost optimum electric propulsion system characteristics for the mission set, and sensitivities of mission costs and design points to system level electric propulsion parameters are discussed. The impact on overall costs than specific masses or costs of propulsion and power systems is evaluated. A.W.H.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-11951# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1980
Washington GPO 1979 54 p Rept. on H.R. 1786 for the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 11 Jun. 1979
(S-Rept-96-207; GPO-39-010) Avail: US Capitol, Senate Document Room

Budget requests for the fiscal year 1980 by National Aeronautics and Space Adminstration are presented. Appropriations for research and development, construction of facilities, and research and program management are discussed. A.W.H.

N80-11952# General Accounting Office, Washington, D. C. General Government Div.
PERSPECTIVES ON INTERGOVERNMENTAL POLICY AND FISCAL RELATIONS
28 Jun. 1979 52 p
(PB-297280/0; GGD-79-62) Avail: NTIS HC A04/MF A01 CSCL 05A

Intergovernmental policy and fiscal relations are examined. Relationships among Federal, state, and local governments are studied. Perspectives on intergovernmental issues and a forecast of future developments concerning ways to improve the intergovernmental management system are discussed. A.W.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-11953*# National Aeronautics and Space Administration, Washington, D. C.
SMALL TRANSPORT AIRCRAFT TECHNOLOGY. A REPORT FOR THE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION, UNITED STATES SENATE Interim Report
Oct 1979 77 p refs
(NASA-TM-80813) Avail: NTIS HC A05/MF A01 CSCL 05A

A preliminary assessment of the research and technology that NASA could undertake to improve small transport aircraft is presented. The advanced technologies currently under study for potential application to the small transport aircraft of the future are outlined. Background information on the commuter and shorthaul local service air carriers, the regulations pertaining to their aircraft and operations, and the overall airline system interface is included. A.R.H.

N80-11954*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SURVEY OF ELECTRIC AND HYBRID VEHICLE SIMULATION PROGRAMS Final Report
J. Bevan, D. A. Heimburger, and M. A. Metcalfe Nov. 1978 110 p refs
(Contract EC-77-A-31-1011)
(NASA-CR-162457; HCP/M1011-04) Avail: NTIS HC A06/MF A01 CSCL 13F

Results of a survey conducted within the United States to determine the extent of development and capabilities of automotive performance simulation programs suitable for electric and hybrid vehicle studies are summarized. Altogether, 111 programs were identified as being in a usable state. The complexity of the existing programs spans a range from a page of simple desktop calculator instructions to 300,000 lines of a high-level programming language. The capability to simulate electric vehicles was most common, heat-engines second, and hybrid vehicles least common. Batch-operated programs are slightly more common than interactive ones, and one-third can be operated in either mode. The most commonly used language was FORTRAN, the language typically used by engineers. The higher-level simulation languages (e.g. SIMSCRIPT, GPSS, SIMULA) used by 'model builders' were conspicuously lacking. DOE

N80-11955# Oak Ridge National Lab., Tenn.
ADVANCED METHODS FOR THE TREATMENT OF DOMESTIC SEWAGE
A. L. Compere and W. L. Griffith 1978 29 p refs Presented at the 37th meeting of the Southeastern Assoc. for State Highway and Transp. Serv. Offic., Nashville, 21 Oct. 1978
(Contract W-7405-eng-26)
(CONF-7810108-1) Avail: NTIS HC A03/MF A01

Several methods for the treatment of domestic sewage which

are currently at the bench and large pilot stages of development, may be particularly applicable to state highway rest station problems, which often represent a practicable scale-up. Cross-flow filtration produces a high-quality effluent which might be suitable for lawn watering after disinfection. Anaerobic filter processes, either alone or in conjunction with a tertiary process such as ion exchange, may also provide adequate waste treatment for rest stop applications. DOE

N80-11956# General Electric Co., Schenectady, N. Y.
NEAR-TERM ELECTRIC VEHICLE PROGRAM: PHASE 2: MID-TERM SUMMARY REPORT
Aug. 1978 427 p
(Contracts EY-76-C-03-1213; EY-76-C-03-1294)
(SAN-1213-02; SAN-1294-02) Avail: NTIS
HC A19/MF A01

Developments in the areas of system analysis and design, subsystem analysis and design, and test and evaluation are reported. Significant technical accomplishments which are described include aerodynamic design and testing to achieve an extremely low-drag body design and development of a lightweight vehicle structure which will satisfy the current Federal Motor Vehicle Safety Standards. DOE

N80-11957# Kansas Univ., Lawrence. Dept. of Civil Engineering.
REMOVAL OF LAGOON EFFLUENT SUSPENDED SOLIDS BY A SLOW-ROCK FILTER Final Report, 1973 - 1975
Walter J. OBrien and Ross E. McKinney Jun. 1979 120 p refs
(Contract EPA-68-03-0280)
(PB-297454/1; EPA-600/2-79-011) Avail: NTIS
HC A06/MF A01 CSCL 13B

The removal of algae cells and other suspended solids contained in the effluents from facultative lagoons treating domestic wastewaters by means of rock filters is examined. The operating characteristics of the rock filter systems are presented and evaluated. Biological activity within the rock filter noted by the changes in dissolved oxygen concentrations is discussed. GRA

N80-11958# Culp/Wesner/Culp, Santa Ana, Calif.
WATER REUSE AND RECYCLING. VOLUME 1: EVALUATING
Apr. 1979 197 p
(OWRT Proj. R-0088(7804)(1))
(PB-297283/4; W79-07501; OWRT/RU-79-1) Avail: NTIS
HC A09/MF A01 CSCL 13B

Estimates of the potential for waste water reuse and recycling are presented. Information on water supply, water needs and availability, and waste water discharges is discussed. Existing and proposed waste water reuse facilities are reported. Water quality requirements are described for the following potential reusers of reclaimed waste water: agricultural irrigation, landscape irrigation, steam electric cooling, industrial cooling, and other industrial uses. GRA

N80-11959# Urban Inst., Washington, D.C.
DIRECTIONS TO IMPROVE URBAN TRAVEL DEMAND FORECASTING: CONFERENCE SUMMARY AND WHITE PAPERS Final Report
Louise E. Skinner, ed. 1978 411 p refs Conf. held in Washington, D. C., May 1978 Prepared in cooperation with DTM, Inc., Transport and Road Research Lab., Cambridge Systematics, Inc., Oklahoma Univ., S. G. Associates, Inc., sponsored by UMTA and FHWA
(Contracts DOT-FH-11-9386; DOT-FH-11-9387; DOT-FH-11-9389; DOT-8-3-0032)
(PB-297409/5; FHWA/PL-79/007) Avail: NTIS
HC A18/MF A01 CSCL 13B

Approaches and procedures for improving urban travel demand forecasting are studied. Areas of research examined are the application of time and money budgets to planning, increased understanding of location theory (land use, spatial perception, accessibility measures), development of multinomial supply models, and determination of the temporal and geographic stability of demand and supply models used in transportation planning. Data collection procedures in diary data and household interactions are discussed. A.W.H.

N80-11960# Massachusetts Inst. of Tech., Cambridge.
HYBRID OPTIMIZATION IN URBAN TRAFFIC NETWORKS Final Report, 13 Mar. 1978 - 14 Mar. 1979
Han-Ngee Tan, Stanley B. Gershwin, and Michael Athans Apr. 1979 123 p refs
(Contract DOT-TSC-1456)
(PB-297146/3; DOT-TSC-RSPA-79-7) Avail: NTIS
HC A06/MF A01 CSCL 13B

The hybrid optimization problem, a general theoretical framework for the analysis of a class of traffic control problems, is discussed. The role of individual drivers as independent decision makers is examined in relation to the problem. Different behavioral models for flow distribution are investigated. Necessary conditions for this problem are derived, and a physical interpretation of these conditions is provided. Possible directions for the development of algorithms applicable for solving large scale hybrid optimization problems are proposed. A procedure for computing the upper and lower bounds of the optimal cost of the hybrid optimization problem is outlined. A.W.H.

N80-11961# National Fertilizer Development Center, Muscle Shoals, Ala.
ECONOMICS OF DISPOSAL OF LIME/LIMESTONE SCRUBBING WASTES: SLUDGE/FLYASH BLENDING AND GYPSUM SYSTEMS Final Report, Jun. 1977 - May 1978
J. W. Barrier, H. L. Faucett, and L. J. Henson Feb. 1979 209 p refs
(PB-297946/6; BULL-Y-140; EPA-600/7-79-069) Avail: NTIS
HC A10/MF A01 CSCL 13B

Soil-like landfill material is produced without using purchased additives by blending separately collected flyash with dewatered flue gas desulfurization sludge from a limestone scrubbing system; and by air-oxidation modifications sulfate sludge (gypsum) which is dewatered and discarded without further treatment. Both processes are being developed; neither has been fully demonstrated. The sludge/flyash blending process had a higher capital investment ($36.40/kW) than the other (as well as untreated ponding and three of four chemical processes evaluated in an earlier study) primarily because of high electrostatic precipitator and process equipment costs; however, the process had lower annual revenue requirements (1.64 mills/kWh) than three of the four chemical processes. GRA

N80-11962# Envirex, Inc., Milwaukee, Wis. Environmental Sciences Div.
DEVELOPMENT OF AN EMERGENCY RESPONSE PROGRAM FOR TRANSPORTATION OF HAZARDOUS WASTE Final Report
1979 343 p
(Contract EPA-68-01-3973)
(PB-297438/4; EPA-530/SW-171C) Avail: NTIS
HC A15/MF A01 CSCL 13B

The problems associated with hazardous materials spills due to the anticipated increase in transportation of hazardous wastes are discussed. The capabilities of existing systems and an evaluation of their applicability to hazardous waste spills are presented. Federal and State regulations regarding spill notification, reporting requirements, and clean up procedures are reviewed. GRA

N80-11963# SCS Engineers, Reston, Va.
SAMPLING AND ANALYSIS OF THE AQUATIC ENVIRONMENT IN POTW'S AND THEIR VICINITY Final Report, 1977 - 1978
R. Carr, J. Erlandson, R. Greenspun (EPA, Wash., D. C.), M. Halper (EPA, Wash., D. C.), O. Mitz (EPA, Wash., D. C.), M. Neely (EPA, Wash., D. C.), P. Taylor, and G. Vogel 27 Jun. 1979 92 p refs Prepared in cooperation with Versar, Inc., Springfield, Va.
(Contracts EPA-68-01-4679; EPA-68-01-3852)
(PB-297606/6; EPA-440/4-79-026) Avail: NTIS
HC A05/MF A01 CSCL 13B

The sampling and analysis results of influent, effluent, and sludge in the waters of publicly owned treatment works (POTW) are presented. The water and sediment of the POTWs receiving

waters were tested for 13 heavy metals and 115 synthetic organic compounds. A.W.H.

N80-11964# Environmental Protection Agency, Washington, D.C. Municipal Construction Div.
A HISTORY OF LAND APPLICATION AS A TREATMENT ALTERNATIVE
William J. Jewell and Belford L. Seabrook Apr. 1979 97 p (PB-298227/0; EPA-430/9-79-012; EPA/MCD-40) Avail: NTIS HC A05/MF A01 CSCL 13B

A review was conducted to attempt to determine whether the history of land treatment could assist in explaining the reasons behind the apparent reluctance to use this wastewater treatment option, and to provide a basis of judging its future prospects. The approach to explain the major shifts that have occurred throughout the history of land treatment was to interweave the influences of social-public health concerns, legal issues, and technological developments. Surveys of land treatment system failures showed that most convert from land treatment to discharge technology because of population expansion around the site, and not because of a failure of the renovation capability of the soil. GRA

N80-11965# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
SOUTHEASTERN FORUM ON APPROPRIATE TECHNOLOGY Final Report
Jeffrey S. Tiller, David S. Clifton, Jr., and Robert A. Cassanova Apr. 1979 98 p Conf. held at Atlanta, Ga., 17-18 Sep. 1978 (Grant NSF ISP-78-22994)
(PB-298796/4; GIT-B-519-F; NSF/RA-790007) Avail: NTIS HC A05/MF A01 CSCL 05A

The background and purpose of the forum are described as well as its structure and agenda. Results of the forum are presented and a strategy is proposed for NSF to follow in an appropriate technology program. The specific appropriate technologies that participants believed had the greatest potential for widespread implementation were passive solar energy, cooperative community projects, waterless toilets, an AT extension service, active solar equipment, utilization of local material and human resources in energy, resource recovery plants, conversion of biomass to fuel, recycling centers, techniques for passive and active space cooling, photovoltaics and marketing cooperatives for small farms. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-11966* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN EMISSION-LINE SURVEY OF THE MILKY WAY
Robert A. R. Parker, Theodore R. Gull (NASA Goddard Space Flight Center), and Robert P. Kirschner (Mich. Univ.) Washington 1979 224 p
(NASA-SP-434) Avail: SOD HC $15.00 CSCL 03A

The instrumentation used in an examination of the ionization structure of emission nebulae and of the galactic plane in general, is described, as well as the characteristics of the prints obtained. Reasonable exposure times were obtained with the use of an image intensifier and five interference filters isolated the band passes chosen for the survey. A rough map of each field is presented with a print from the Becvar Skalnate Pleso covering the same area. No systematic effort was made to identify and mark each nebulosity. A new supernova remnant was discovered in the field 1 = 65.5 deg, b = + 5 deg using this technique. A.R.H.

N80-11967# Royal Observatory, Edinburgh (Scotland).
SPECTROPHOTOMETRY OF COOL STARS IN THE NEAR INFRARED. RESULTS FOR A REGION IN CASSIOPEIA
K. Nandy, F. Smriglio (Rome Univ.), and R. Buonanno (Rome Astron. Obs.) 1978 19 p refs Reprint from Publ. Roy. Obs. (Edinburg), v. 9, no. 5 1978 p 125-134 Sponsored by Sci. Res. Council
(ISBN-0-9025-5320-8) Avail: NTIS HC A02/MF A01

The space density of M and C stars was investigated for a region of about 15 square degrees in the direction of Cassiopeia. The spectral classification is based on the relative strength of the TiO bands visible in low dispersion objective prism spectra in the photographic infrared. The infrared/magnitudes were derived from direct plates which are calibrated by photoelectric standards obtained with the twin telescope of the Royal Observatory, Edinburgh. It is found that the stars earlier than M4 and carbon stars tend to concentrate in spiral arm regions whereas the late M stars (M7-M10) are evenly distributed in arm and interarm regions. Author (ESA)

N80-11968# Cambridge Univ. (England). Inst. of Astronomy.
CELESTIAL OBSERVATION AND RELATED WORK Annual Report, 1977-78
1978 38 p refs
Avail: NTIS HC A03/MF A01

Observations centered on quasars and galactic nuclei, galaxies, star clusters, and measurements of stellar radial velocities are reported. Topics covered include clustering and N-body dynamics as well as galactic structure, stellar structure, cosmology, galaxy formation, compact objects, and relativity. As a contribution to astronomical instrumentation, the development of a cooled integrating television system for precision two dimensional photometry continued. The Institute of Astronomy pedagogical activities are also discussed. Author (ESA)

N80-11969# Geneva Observatory (Switzerland).
PHOTOMETRIC PROPERTIES OF G, K AND M STARS IN RELATION TO GALACTIC STRUCTURE AND EVOLUTION
Michel Grenon 1978 33 p refs
(Publ-Ser-B-Fasc-5) Avail: NTIS HC A03/MF A01

During the last ten years, an increasing number of investigations based on photoelectric measurements of G, K and M stars were made in the Geneva photometeic system. The ability of the Geneva system to provide a multi-dimensional classification of the late type stars was tentatively checked on the basis of a small sample of typical objects differing in temperature, luminosity, chemical composition, or showing abundance anomalies. Positive results led to the definition of various programs, tending at first to define precisely the properties of the system, to calibrate it in the various obtainable physical parameters, and to apply these calibrations to investigations mainly in the fields of stellar classification, local galactic structure, and chemical evolution. The main properties of the Geneva system are summarized based on these results and some examples of applications are given. Author (ESA)

N80-11970# Geneva Observatory (Switzerland).
THE MEASUREMENT OF STELLAR RADIAL VELOCITY BY OPTICAL CORRELATION [MESURES DE VITESSE RADIALES STELLAIRES PAR CORRELATION OPTIQUE]
J. L. Poncet 1978 162 p refs In FRENCH; ENGLISH summary
(Publ-Ser-B-Fasc-6) Avail: NTIS HC A08/MF A01

A stellar radial velocity instrument is described. This fully computer controled instrument uses an optical correlation technique, between the stellar spectrum and a spatial filter. An optical method of partitioning the spectrum allows the use of a large spectral range (lambda lambda 360-5200 A) and at the same time takes into account the problem of the variation of the Doppler shift with lambda. The spatial filter is studied and possible sources of systematic and random errors are discussed. Using a one meter Cassegrain telescope, one can determine velocities for stars at least as faint as m sub v = 12 with a precision of about 1 km/sec in less than 10 minutes. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-11971# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
POLARIZATION AND ANISOTROPY OF THE RELICT RADIATION IN AN ANISOTROPIC UNIVERSE
M. M. Basko and A. G. Polnarev. 1979. 20 p. refs.
(PR-486) Avail: NTIS. HC A02/MF A01.

A rigorous solution in the first order with respect to anisotropy is obtained for the equation of polarized radiation transfer in a homogeneous anisotropic universe with a flat co-moving space. The degree of polarization of the background radiation is shown to be very sensitive to the recombination dynamics and to the secondary reheating epoch. Provided that a quadrupole anisotropy of the background radiation is established, the measurements of the degree of its polarization will enable us to set severe limitations on the conditions of secondary ionization. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-11972*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE MISSIONS TO COMETS
M. Neugebauer, ed. (JPL), D. K. Yeomans, ed. (JPL), J. C. Brandt, ed., and R. W. Hobbs, ed. Washington. 1979. 229 p. refs. Conf. held at Greenbelt, Md., Oct. 1977.
(NASA-CP-2089) Avail: NTIS. HC A11/MF A01. CSCL 03B.

The broad impact of a cometary mission is assessed with particular emphasis on scientific interest in a fly-by mission to Halley's comet and a rendezvous with Tempel 2. Scientific results, speculations, and future plans are discussed. For individual titles, see N80-11973 through N80-11979.

N80-11973*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SCIENTIFIC NEED FOR A COMETARY MISSION
Fred L. Whipple. *In* NASA. Goddard Space Flight Center. Space Missions to Comets. 1979. p. 1-31. (For primary document see N80-11972 02-91)
Avail: NTIS. HC A11/MF A01. CSCL 03B.

Known facts about comets are reviewed including their organic and inorganic content. Photographs are used to show the differences in the physical appearances of the three types of comets. Space missions will provide the opportunity to determine the sequence of events that led to their formation and that of the solar system; how volatiles arrived on earth; and the basis for the existence of life on earth; and the source of the outer planetary system. A.R.H.

N80-11974*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
CONNECTIONS BETWEEN COMETS AND PLASMAS IN SPACE
Frederick L. Scarf. *In* NASA. Goddard Space Flight Center. Space Missions to Comets. 1979. p. 33-58. refs. (For primary document see N80-11972 02-91)
Avail: NTIS. HC A11/MF A01. CSCL 03B.

The dynamical processes in the cometary system represent unusual examples of very important, widespread natural phenomena. Topics covered include: (1) the comet as an obstacle in the solar wind; (2) the nature of the plasma flow; (3) collisionless shocks; and (4) plasma processes in the comet tail. A.R.H.

N80-11975*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMETS: COSMIC CONNECTIONS WITH CARBONACEOUS METEORITES, INTERSTELLAR MOLECULES AND THE ORIGIN OF LIFE
Sherwood Chang. *In* NASA. Goddard Space Flight Center. Space Missions to Comets. 1979. p. 59-111. refs. (For primary document see N80-11972 02-91)
Avail: NTIS. HC A11/MF A01. CSCL 03B.

The ions, radicals, and molecules observed in comets may be derived intact or by partial decomposition from parent compounds of the sort found either in the interstellar medium or in carbonaceous meteorites. The early loss of highly reducing primitive atmosphere and its replacement by a secondary atmosphere dominated by H_2O, CO_2, and N_2, as depicted in current models of the earth's evolution, pose a dilemma for the origin of life: the synthesis of organic compounds necessary for life from components of the secondary atmosphere appears to be difficult, and plausible mechanisms have not been evaluated. Both comets and carbonaceous meteorites are implicated as sources for the earth's atmophilic and organogenic elements. A mass balance argument involving the estimated ratios of hydrogen to carbon in carbonaceous meteorites, comets, and the crust and upper mantle suggests that comets supplied the earth with a large fraction of its volatiles. The probability that comets contributed significantly to the earth's volatile inventory suggests a chemical evolutionary link between comets, prebiotic organic synthesis, and the origin of life. A.R.H.

N80-11976*# Center for Astrophysics, Cambridge, Mass.
COMETS, CARBONACEOUS CHONDRITES, AND INTERSTELLAR CLOUDS: CONDENSATION OF CARBON
G. B. Field. *In* NASA. Goddard Space Flight Center. Space Missions to Comets. 1979. p. 113-137. refs. (For primary document see N80-11972 02-91)
Avail: NTIS. HC A11/MF A01. CSCL 03B.

Comets, carbonaceous chondrites, and interstellar clouds are discussed in relation to information on interstellar dust. The formation and presence of carbon in stars, comets, and meteorites is investigated. The existence of graphite in the interstellar medium, though it is predicted from thermodynamic calculations, is questioned and the form of carbon contained in comets is considered. A.W.H.

N80-11977*# Toledo Univ., Ohio. Dept. of Physics and Astronomy.
SCIENTIFIC RETURNS FROM A PROGRAM OF SPACE MISSIONS TO COMETS
A. H. Delsemme. *In* NASA. Goddard Space Flight Center. Space Missions to Comets. 1979. p. 139-178. refs. (For primary document see N80-11972 02-91)
Avail: NTIS. HC A11/MF A01. CSCL 03B.

A program of cometary missions is proposed. The nature and size of interstellar dust, its origin and evolution; identification of new interstellar molecules; clarification of interstellar chemistry; accretion of grains into protosolar cometesimals; role of a T Tauri wind in the dissipation of the protosolar nebula; record of isotopic anomalies, better preserved in comets than in meteorites; cosmogenic and radiogenic dating of comets; cosmochronology and mineralogy of meteorites, as compared with that of cometary samples; origin of the earth's biosphere, and the origin of life are topics discussed in relation to comet exploration. A.W.H.

N80-11978*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
COMET HALLEY AND HISTORY
Brian G. Marsden. *In* NASA. Goddard Space Flight Center. Space Missions to Comets. 1979. p. 179-196. (For primary document see N80-11972 02-91)
Avail: NTIS. HC A11/MF A01. CSCL 03B.

A history of Halley's Comet is presented. Comets Kohoutek and Ikeya-Seki are discussed. A.W.H.

N80-11979*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ION PROPULSION AND COMET HALLEY RENDEZVOUS
Kenneth L. Atkins. *In* NASA. Goddard Space Flight Center. Space Missions to Comets. 1979. p. 197-214. (For primary document see N80-11972 02-91)

Avail: NTIS HC A11/MF A01 CSCL 03B

Cometary rendezvous missions using ion propulsion are considered. The characteristics of the ion engine are discussed including the fuel efficiency and acceleration, and the design of the ion engine is described. The operation of the ion drive engine and an overview of its applications are presented. A.W.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-11980# National Physical Research Lab., Pretoria (South Africa).

COMPARISON OF EXTRATERRESTRIAL AND EARTH-BASED SOLAR SPECTRAL IRRADIANCE RESULTS

C. J. Kok 1979 12 p refs

(CSIR-RR-342; ISBN-0-7988-1447-0) Avail: NTIS HC A02/MF A01

The uncertainties involved in measuring the solar spectral irradiances and the solar constant are discussed. A comparison of extraterrestial and ground based solar spectral energy distributions is presented and evaluated to resolve some of the uncertainties qualitatively. Normalized standard daylight spectral power distribution as related to correlated color temperature is analyzed. A.W.H.

N80-11981# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

IS THE SUN CONSTANT?

J. B. Blake and D. S. P. Dearborn (Ariz. Univ., Tucson) 30 Oct. 1979 20 p refs

(ATR-79(9552)-4) Avail: NTIS HC A02/MF A01

Models of the solar convection zone were studied. The effect of fluctuations in the mode of energy transport were investigated at different depths in the sun to determine which regions are most effective in causing change. Short term radius fluctuations observed in the model were examined. Possible causes of convective efficiency fluctuations are discussed and the application of this theory to other stars is considered. A.W.H.

N80-11982# Ruhr Univ., Bochum (West Germany). Lehrstuhl fuer Physikalische Chemie 1.

DETERMINATION OF THE SOLAR PHOTON FLUX IN THE RANGE OF FROM 160 TO 220 nM USING THE PHOTOLYSIS OF AMMONIA COMBINED WITH NITRIC OXIDE DETECTION Final Report

Christian Hubrich and Friedrich Stuhl Bonn Bundesmin. fuer Forsch. u. Technol. Aug 1978 30 p refs In GERMAN; ENGLISH summary

(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QV-655)

(BMFT-FB-W-78-12) Avail: NTIS HC A03/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 6.10

As a possible experimental payload on board SPACELAB, the measurement of the solar photon flux in the wavelength range of from 160 to 220 nm is proposed. Emphasis is placed on the role of this flux rate in the formation of ozone in the stratosphere. It is noted that the concentration of stratospheric ozone is controlled by a complex chemical which can be influenced by human activity. The monitoring of ammonia photolysis combined with nitric oxide detection is suggested as an accurate means of determining photon flux at about 200 nm. It is also pointed out that previous determinations of the photon flux do not agree and hence there is a need to use SPACELAB for this purpose. Author (ESA)

N80-11983# Fraunhofer Institut, Freiburg (West Germany).

PROJECT SPECTROSTRATOSCOPE: BALLOON-BORNE SOLAR RESEARCH Final Report

J. Peter Mehltretter, Wolfgang Mattig, and Alvo vonAlvensleben Bonn Bundesmin. fuer Forsch. u. Technol. Aug 1978 166 p refs In GERMAN; ENGLISH summary

(Contracts BMFT-WRK-0274; DFVLR-BPT-01-DO-184)

(BMFT-FB-W-78-15) Avail: NTIS HC A08/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 34.70

A historical review of the project development (1961 to 1975) is followed by an outline description of the instrument. More details on the technical problems related to photometry and the quantitative analysis of the observations are then given. Focusing, instrument profile, instrumental polarization, pointing, and guiding stability are discussed. After a brief description of the balloon flight of 17 May 1975. The functioning of critical components and the thermal behavior of the instrument are analyzed. The scientific program for the investigation of photospheric granulation by means of time series integrated light pictures and spectra with high angular and spectral resolutin is described; first results concerning life times temperature fluctuations, and velocities of granules are reported. Author (ESA)

N80-11984# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

SOLAR-GEOPHYSICAL DATA NUMBER 417. PART 2: DATA FOR NOVEMBER 1978 - OCTOBER 1978 AND MISCELLANEA

Helen E. Coffey May 1979 72 p

(PB-297448/3; SGD-417-Pt-2; NOAA-79061403) Avail: NTIS HC A04/MF A01 CSCL 03B

This comprehensive report provides data for November 1978 on: active regions synoptic solar maps, solar flares, solar radio emission, energetic solar particles and plasma, and solar X-ray radiation. It also provides synoptic charts, abbreviated calendar record and regional flare index for October 1978. The miscellaneous data includes solar radio emission for January and February 1979 and cosmic rays for February 1979. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-11985*# University of West Florida, Pensacola. Faculty of Physics.

A COMBINED TLD/EMULSION METHOD OF SAMPLING DOSIMETRY APPLIED TO APOLLO MISSIONS

Hermann J. Schaefer 1 Sep. 1979 15 p refs

(Contract NAS9-15417)

(NASA-CR-160367) Avail: NTIS HC A02/MF A01 CSCL 03B

A system which simplifies the complex monitoring methods used to measure the astronaut's radiation exposure in space is proposed. The excess dose equivalents of trapped protons and secondary neutrons, protons, and alpha particles from local nuclear interactions are determined and a combined thermoluminescent dosimeter (TLD)/nuclear emulsion method which measures the absorbed dose with thermoluminescent dosimeter chips is presented. A.W.H.

N80-11986# Lund Univ. (Sweden). Dept. of Cosmic and Subatomic Physics.

ISOTOPIC COMPOSITION OF PRIMARY COSMIC RAY NITROGEN AND OXYGEN WITH CONSEQUENCES FOR SOURCE MODELS

L. Jacobsson, G. Joensson, and K. Kristiansson 7 Dec. 1978 46 p refs Sponsored by Swed. Nat. Sci. Res. Council

(LUIP-7811) Avail: NTIS HC A03/MF A01

An experimental investigation of the isotopic composition of cosmic ray nitrogen and oxygen is reported. The detector was a stack of nuclear emulsions exposed at about 3 g/sq cm atmospheric depth. The mass determinations were based on photometric track width measurements on stopping nuclei. The energy of the measured nuclei falls in the interval 220 to 450 MeV/nuclean at the top of the atmosphere. The cosmic ray source shows that the nitrogen-oxygen abundances ratio is approximately the same in the source as in the solar system. The results were compared with different hypotheses about the source composition and is found to be in best agreement with

a hypothesis which states that the source matter has approximately the composition of the solar system. Author (ESA)

99 GENERAL

N80-11987# Texas Univ. at Austin. Electronics Research Center.
ELECTRONICS RESEARCH AT THE UNIVERSITY OF TEXAS AT AUSTIN. Progress Report, 1 Apr. 1978 - 31 Mar. 1979
Edward J. Powers and Steven I. Marcus, ed. 15 Jul. 1979 102 p refs
(Contract F49620-77-C-0101)
(AD-A072436; Rept-26) Avail: NTIS HC A06/MF A01 CSCL 09/5

This report summarizes progress on projects carried out at the Electronics Research Center at The University of Texas at Austin and which were supported by the Joint Services Electronics Program. In the area of Information Electronics progress is reported for projects involving (1) nonlinear filtering and estimation, (2) electronic multi-dimensional signal processing, (3) electronic control systems, (4) electronic computer system design and analysis and (5) electronic computer software systems. In the Solid State Electronics area recent findings in (1) basic solid state materials research and (2) research on instabilities and transport near surfaces and interfaces of solids are described. In the area of Quantum Electronics progress is presented for the following projects: (1) nonlinear wave phenomena, (2) atomic and molecular electronic processes and (3) high power laser systems. GRA

N80-11988# Brown Univ., Providence, R. I. Materials Research Lab.
STRUCTURAL RELATED RESEARCH. Final Report, 1 Jun. 1975 - 31 Mar. 1977
1978 103 p
(Contract N00014-75-C-1019)
(AD-A071416) Avail: NTIS HC A06/MF A01 CSCL 05/1

Contents: Microscopic and Macroscopic Dynamic Plasticity; Fracture of Solids; Inorganic Glasses; Chemisorption on Metallic Surfaces; Chalcogenide Materials; Alloy Design and Synthesis of Microstructure for Specific Properties; Plasmas in Solids; Low Temperature Properties of Materials; Pseudo One-Dimensional Conductors; Other research. GRA

N80-11989# National Academy of Sciences - National Research Council, Washington, D. C. Solid State Sciences Committee.
SUPPORT OF SMALL RESEARCH PROJECTS IN MATERIALS SCIENCE AT UNIVERSITIES. Final Report, 1 Aug. 1977 - 20 Jun. 1979
B. N. Gregory 1979 58 p
(Contract F49620-77-C-0135; AF Proj. 2306)
(AD-A071940; AFOSR-79-0838TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

A major question facing the nation's scientific community and makers of science policy, is how to maintain the quality of our scientific programs in the face of shrinking resources, either from budgetary cuts or increasingly sophisticated and costly research needs. To explore this situation the NRC's Solid State Sciences Committee initiated a series of meetings to inquire into the manner in which research is supported in the solid state and materials sciences. The general objectives of the study are to review and enlarge understanding of the role of small research projects in the U.S. solid-state sciences effort, to determine factors that lead to meaningful research projects, and to establish guidelines to aid those who must make decisions concerning the allocation of resources. The intended audience includes both universities and funding agencies. In pursuing this study, the panel was asked to undertake the following general tasks: (1) To assess the role of small research projects in relation to regional and national needs; (2) to determine the factors affecting the production of high-quality research in small projects; and (3) To recommend constructive modes of research organization and required support. GRA

N80-11990# Netherlands Committee for Geophysics and Space Research, Amsterdam.
SPACE RESEARCH IN THE NETHERLANDS, 1977
1978 34 p refs Presented at COSPAR Meeting, Innsbruck, Switz., Jun. 1978
Avail: NTIS HC A03/MF A01

Solar and stellar space research focused on studying electromagnetic and particle radiation from the sun and stars. Work included cosmic X-ray satellite observations, infrared astronomy, magnetospheric measurements, ultraviolet stellar spectroscopy, and solar X-radiation observation. Research in X-ray astronomy was supported by rocket sounding, satellite experiments, balloon experiments, and the development of a prototype detector with high spatial resolution. Ultraviolet photometry was also undertaken. In the field of satellite geodesy, participation in observation programs and methods of geodetic analysis are reported. Author (ESA)

N80-11991# Technical Research Centre of Finland, Espoo.
[REPORT ON FINNISH TECHNOLOGICAL ACTIVITIES] Annual Report, 1978
1979 35 p Original contains color illustrations
Avail: NTIS HC A03/MF A01

Results of research and test programs in building, community, materials, processing, energy, and information processing technologies are reported. Specific topics covered include heat economy of buildings, road friction, plastics, lubricants, ceramics, metallic materials and metal production, biotechnology, food science, mineralogy, and measurement of impurities in flue gases. Other areas discussed include graphical processes, mechanical wood handling, ship building, nuclear engineering, measurement of electrical quantities, and data processing and transmission. K.L.

N80-11992# Deutsche Forschungsgemeinschaft, Bad Godesberg (West Germany).
SPACE RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY, 1978
1978 56 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979 Sponsored by Bundesminister Forsch. u. Technol.
Avail: NTIS HC A04/MF A01

German space research in 1978 is summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites, often participation in international cooperation programs was involved. Main subjects include aeronomy, ionospheric physics, magnetospheric studies, solar radiation and solar wind, solar system, stellar astronomy, cosmic rays, life sciences, and material sciences. Author (ESA)

N80-11993# Swedish Board for Space Activities, Stockholm.
SPACE RESEARCH IN SWEDEN, 1978
1979 41 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979
Avail: NTIS HC A03/MF A01

Swedish space research is summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites, often participating in international cooperation programs. Main subjects include particle experiments, aurora observation, meteor observation, solar wind, ultraviolet astronomy, infrared astronomy, meteorology, and remote sensing. Author (ESA)

N80-11994# Danish Academy of Technical Sciences, Copenhagen.
SPACE RESEARCH IN DENMARK
1979 13 p Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979 Sponsored by Dan. Min. of Educ.
Avail: NTIS HC A02/MF A01

The 1978 activities of five Danish institutions in the field of space research are summarized. The subjects include cosmic rays, plasma and space physics (GEOS satellite data and sounding rockets were employed), rocket measurement of meteorological parameters, real time reception of meteorological data from satellites, Doppler observations combined with gravitational field determination, and aircraft and satellite remote sensing in the Greenland area. Author (ESA)

N80-11995# Committee on Space Research (COSPAR), Berne (Switzerland).
SPACE RESEARCH IN SWITZERLAND, 1978
1979 22 p Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979 Sponsored by Swiss Natl. Sci. Found.
Avail: NTIS HC A02/MF A01

Swiss space research is summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites, often participating in international cooperation programs. Main subjects include satellite geodesy, middle atmosphere studies, magnetosphere studies, solar wind composition, investigations on fine materials and rocks returned from the moon, solar physics, astronomic photometry, and earth resources studies.
Author (ESA)

N80-11996# Netherlands Committee for Geophysics and Space Research, Amsterdam.
SPACE RESEARCH IN THE NETHERLANDS, 1978
1979 33 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979
Avail: NTIS HC A03/MF A01

The 1978 activities of four Dutch working groups in the field of space research are summarized. The main subjects include solar and stellar space research, photometry, satellite astronomy, gamma ray astronomy, X-ray astronomy, infrared astronomy, balloon and rocket sounding, and physics of the interplanetary medium.
Author (ESA)

N80-11997# Centre National de Recherches de l'Espace, Brussels (Belgium).
SPACE RESEARCH IN BELGIUM, 1978 [LA RECHERCHE SPATIALE EN BELGIQUE]
1979 25 p refs In FRENCH Presented at 22d COSPAR Plenary Meeting, Bangalore, India, 29 May/Jun. 1979
Avail: NTIS HC A02/MF A01

Belgian research during 1978 and 1979 is summarized. The main subjects include stratospheric and mesospheric models, solar ultraviolet flux, sun-earth relationships, solar wind interaction with planetary atmospheres, aurora ionospheric composition, morphology of metallic ions in the E and F subtropical layers, auroral spectra, ultraviolet stellar flux recording, star classification, star atmospheres, satellite observation analysis, telemetry, solar constant, earth radiation balance, and space geodesy.
Author (ESA)

N80-11998# Royal Society, London (England).
SPACE RESEARCH IN THE UNITED KINGDOM
1979 134 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, 29 May - 9 Jun. 1979 Sponsored by UK Sci. Res. Council
Avail: NTIS HC A07/MF A01

British space research activities are summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites. The main subjects include orbital analysis, plasmaspheric studies, atmospheric physics, ultraviolet astronomy, X-ray astronomy, lunar and meteoritic studies, cosmic ray experiments, solar physics, magnetic field measurements, planetary atmospheres, and remote sensing research.
Author (ESA)

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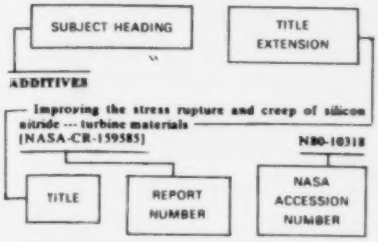

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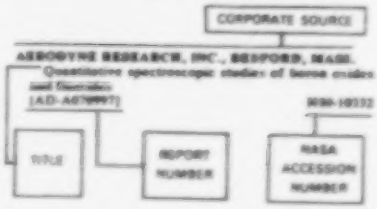

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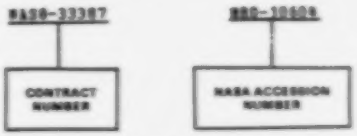

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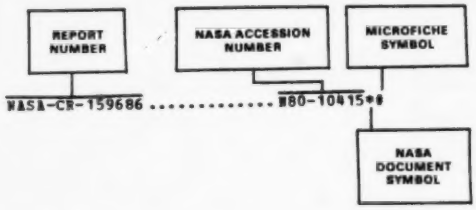

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 275

02 AERODYNAMICS 282

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 287

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 288

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 288

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION N.A.

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 290

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 291

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 292

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) N.A.

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 292

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 293

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION N.A.

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE N.A.

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION **N.A.**

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER **294**

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) **294**

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **295**

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **296**

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS **300**

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **302**

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **304**

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) **307**

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **313**

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING **318**

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For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER **321**

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For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY **330**

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36 LASERS AND MASERS **332**

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING **334**

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **335**

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **336**

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For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

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43 EARTH RESOURCES 340
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 352
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 361
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 364
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 367
Includes weather forecasting and modification.

48 OCEANOGRAPHY 374
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) N.A.
Includes genetics.

52 AEROSPACE MEDICINE 375
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 376
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 376
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) 377

60 COMPUTER OPERATIONS AND HARDWARE 377
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For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 379
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS N.A.
Includes computer networks.

63 CYBERNETICS 381
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 382
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 384
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 386
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 386
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PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
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70 PHYSICS (GENERAL) 386
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71 ACOUSTICS 387
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72 ATOMIC AND MOLECULAR PHYSICS 388
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73 NUCLEAR AND HIGH-ENERGY PHYSICS 391
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 393
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75 PLASMA PHYSICS 394
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For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 398
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77 THERMODYNAMICS AND STATISTICAL PHYSICS 403
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 403
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 404
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 405
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 405
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 407
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 407
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 408
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 408
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 408
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 409

Note: N.A. means that no abstracts were assigned to this category for this issue.

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TYPICAL CITATION AND ABSTRACT

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NASA ACCESSION NUMBER → N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif ← CORPORATE SOURCE

TITLE → STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

PUBLICATION DATE

AUTHOR → D. J. Mourey 3 Sep 1979 409 p refs

CONTRACT OR GRANT → (Contract NAS1-15624)

AVAILABILITY SOURCE

REPORT NUMBER → (NASA-CR-159149) Avail NTIS HC A18/MF A01

CSCL 01C ← COSATI CODE

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, MINI-RPV (REMOTELY PILOTED VEHICLE) ENGINE DEMONSTRATOR PROGRAM

A.G. Bennett, Aerotech Co., *543 Auburn Dr., Auburn, Alabama* 36830 (DA0D4101; DAAJ02-77-C-0014)

Develop a lightweight multicylinder, two-stroke demonstrator engine to provide the technology base and source for future Army RPV engines for mini-RPV's. Address and solve the current engine problems of high vibration, high weight, high fuel consumption, short life and high cost.

Design, fabricate and test a 20 hp engine and deliver five engines o the government for evaluation. Design utilizes, to the maximum extent possible, high production rate components (cylinders, pistons, etc). Modify components as necessary to achieve program goals of 1.2 lb/hp, 0.8 lb/hp-hr sfc, 12,000 ft. altitude and 150 hour life.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0002, SUPPLIES TO BE FURNISHED

G. Leffler, Signal Co. Inc., Airesearch Manufacturing, *402 S. 36th St., Phoenix, Arizona* 85034 (FA78NA-5050; FA161450 (TRAIS NO.))

The contractor is charged with furnishing and delivering the government a Gas Turbine Engine P/N372980-100, Model 085-91C, S/N P9563. This unit is to be overhauled and put in certified condition according to the specification of the manufacturer. It should also be certified as serviceable by the Federal Aviation Administration (FAA).

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0003, FLUIDIC FLEX VALVE FOR RAMJET FUEL CONTROL

D.J. Schaffer, Signal Co. Inc., Airesearch Mfg Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DN881345; N62269-77-C-0352)

The basic objectives of this effort are to develop the analytical design criteria for flex duct valves for high fluid flow applications in general, and to conduct a practical demonstration on a flex duct valve for a 10,000 pound per hour range ramjet fuel control. This contract supports work unit ZA601, Agency Accession No. DN681080.

Analysis associated with a 500 pound per hour fuel metering valve indicated that the receiver rather than the nozzle should be the flexible member in the valve. This analysis will be reviewed again to determine the suitability of this approach for general application. In addition, the following parameters affecting valve design will be studied: duct aspect ratio, recovery nozzle design, flow forces, and leakage.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0004, INTERACTIVE COMPOSITE JOINT DESIGN

M.K. Smith, McDonnell Douglas Astronautics Co., *Long Beach, California* (DF136140; F33615-76-C-3058)

Working in an interactive mode with digital computers has been shown to drastically reduce elapsed time for iterative type solutions and reduce human errors. The design of composite joints is normally an interactive problem, where it is necessary to review geometrics, materials, and internal load and stresses of candidate designs to optimize design details. The objective of this program is to improve the design capability for joints and stress concentrations in composite aircraft structures by exploiting the interactive communication with digital computers. The most critical design problem in composite aircraft structures is that of the stress concentrations at joints and cutouts.

An in-depth investigation will be made of the use of interactive computer operation and computer graphics to facilitate the design of composite structures at stress concentrations. Double-lap, single-lap, scarf and stepped-lap bonded and bolted joints will be considered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, IN-HOUSE LABORATORY INDEPENDENT RESEARCH PROGRAM (ILIR) - ROTOR ACOUSTIC RESEARCH

I.C. Statler, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, *Moffett Field, California* 94035 (DA0C5003)

The objective is to make maximum utilization of the information inherent in the radiated aerodynamically generated noise signature of rotors obtained by the newly developed in-flight noise measurement technique. These measurements provide noise pressure signals undistorted by reverberation, Doppler shift and other normally prevalent signal distortion mechanisms. These research efforts should provide the understanding of the noise generation mechanisms necessary to develop relatively simple mathematical analysis which can be used for rotor noise source and radiation pattern prediction.

A combined experimental theoretical effort will be followed utilizing tools developed to separate the noise generation mechanisms and allow concentrated effort to solve the complex problems in a step-by-step fashion. The first effort will be to define the impulsive noise generation mechanism and provide theoretical prediction capability. The second phase will concentrate on the blade vortex interaction noise and determine influence of rotor blade geometric parameters on rotor noise. Model rotor experimental efforts will utilize the laser velocimeter and other techniques such as schlieren and shadowgraph to verify flow field disturbance patterns.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Ames Research Center

1.0006, STUDY FOR SYSTEM ANALYSIS TO DEVELOP FUTURE CIVIL AIRCRAFT NOISE REDUCTION ALTERNATIVES

Unknown, Wyle Lab., *123 Maryland St., El Segundo, California* 90245 (FA77WA-3990; FA160340 (TRAIS NO.))

The contractor shall develop civil aircraft classification specifications which consider the details of aircraft design, noise

characteristics and performance to provide separately identifiable classes for noise regulations. For administrative and regulatory practicability reasons, the key result of this shall be the identification of the minimum practical number of classes which meets all requirements.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0007, THUNDERSTORM TURBULENCE HAZARD DETECTION AND DEPICTION FOR CONTROLLERS
Unknown, U.S. Dept. of the Interior, Bureau of Reclamation, *Bldg. 67, Denver Federal Center, Denver, Colorado* 80225 (FA77WAI-806; FA161235 (TRAIS NO.))

The acquisition of information on the location and severity of turbulence in severe convection storm situations is of vital importance to safety of flight and efficient management of the nation's airspace. Thunderstorm turbulence and gust front and low-level clear air wind shear detection and tracking have become feasible with the development of pulsed Doppler radar systems. The program requirements are for the development and testing of the detection, tracking and extrapolation of movement, and presentation of severe weather areas for use in the NAS.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0008, ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION
W.G. Flannelly, Kaman Aerospace Corp., *Old Windsor Rd., Bloomfield, Connecticut* 06002 (DA0E3772; DAAJ02-77-C-0039)

The coupled interaction between two or more helicopter dynamic subsystems has often been the source of vibration problems. This is particularly true when considering the helicopter as a dynamic system in which excitations can be generated by any or all of the propulsion system, the airframe or the drive system. The problems of vibration related interface compatibility in engine/drive system installations are usually complicated by the inherent coupling of the three (3) major multi-degree-of-freedom systems, i.e., engine, airframe and drive train. All background data and documentation of past experience lies in the hands of the airframe/engine industry, primarily the former. The technical objective of this contractual effort is to document industry experience to the degree required to permit plans/programs to be formulated as part of an overall government effort to accumulate data which will eventually lead to a solution of generic problems of this type.

Award sole source contracts to the major manufacturers of gas turbine powered US military helicopters, to review existing files, compile reports, memoranda, analytical design efforts, etc., and coordinate with appropriate engine manufacturers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0009, ADVANCED STRUCTURES CONCEPTS R&M/COST ASSESSMENTS
T.N. Cook, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0E3788; DAAJ02-77-C-0061)

Establish R&M and life-cycle cost characteristics of advanced structures concepts as applied to Army helicopters.

(a) Perform a failure mode and effects analysis of existing advanced structures design concepts to evaluate the effectiveness of these concepts for minimizing Army aircraft structures field problems and repair costs. (b) Fabricate representative samples of the most promising structural design concepts and conduct laboratory testing to evaluate R&M characteristics. (c) Perform a maintenance evaluation of the most promising structural design concepts. (d) Prepare a R&M design considerations document. (e) Perform a cost analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0010, THREE-DIMENSIONAL TRANSONIC DATA ACQUISITION AND EVALUATION
B.L. Hinson, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DF052310; F49620-78-C-0068)

AF function - advanced aerospace vehicles. Deficiency - a lack of reliable experimental data for isolated wings in transonic flow that is suitable for use in developing and evaluating computational methodologies. Objective - to obtain a set of high quality experimental data for isolated wings suitable for evaluating new and future theoretical subsonic and transonic aerodynamic methods, to determine the influence of simple fuselage simulations on the wing aerodynamics, and to evaluate the level of accuracy and computational efficiency of representative versions of the new three-dimensional transonic computer codes. How work contributes - the acquisition of a reliable set of transonic wing data will provide a means for comparison of the various new and developing three-dimensional transonic codes which can differ in problem formulation, grid arrangement, finite difference schemes, and solution algorithms. With the availability of a good data base, methods can be assessed. Ultimately, the active use of these computer codes in aircraft design will depend to a large degree on the confidence developed through comparisons with good quality data.

Two supercritical wings, one of high and one of low aspect ratio, designed to produce well-behaved flows, will be tested in a high Reynolds number wind tunnel incorporating tunnel wall, boundary layer removal allowing simulation of true isolated wing conditions. The half span wings will be tested with and without a fuselage representation for a range of Mach numbers and angles of attack at which no extensive shock or pressure gradient induced boundary layer separation occurs. Both surface pressure (approximately 160 pressure orifices in each wing) and force balance readings will be taken. Also, a set of computational results will be generated and comparisons made for these test wings using the Bailey-Ballhaus small disturbance code, the Jameson full potential equation code, and the Jameson finite volume code.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0011, OVERPRESSURE/GUST STRUCTURE RESPONSE
G.M. Campbell, Boeing Co., *Wichita, Kansas* (DF191400; F29601-75-A-1017)

The objective is to determine experimentally the effect of internal pressurization on the response of the KC-135A fuselage upper lobe frames and to correlate the resulting data with data obtained analytically using the AFWL NOVA-2 computer code.

A 10-foot long section of fuselage will be modified, instrumented and installed in the 19-foot diameter thunderpipe shock tube at Sandia Laboratories, Albuquerque, New Mexico. A typical upper lobe frame in the fuselage section will be analyzed using the AFWL NOVA-2 computer code to predict the response of the frame to various levels of blast overpressure for several levels of internal pressurization. Using these predicted levels of response as a guide, a series of tests will be conducted on the fuselage section in the shock tube, varying the levels of pressurization and blast overpressure parametrically. Results from these tests will provide an experimental data base for use in developing methods for generalized predictions for this type of structure. Specifically, pressure-time history test data will be used with the NOVA-2 code to correlate predicted and measured strains and displacements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

1.0012, OBSERVER RESPONSE TO HELICOPTER TYPE NOISE BELOW 100 HZ
S. Fidell, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DA0E3840; DAAK51 78 C 0013)

Examine the low frequency helicopter noise region to determine the applicability of the critical bandwidth concept on detectability; investigate infrasonic cueing effects; and incorporate the results in an existing helicopter detection computer program.

Conduct subjective tests in the laboratory using noise masking and noise signal inputs. Primary emphasis will be on frequen-

cies below 100 Hz to determine detectability effects of rotor fundamental frequency and several harmonics. Mathematical modeling will be developed describing the results.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0013, WAKE STUDIES RELATED TO WAVERIDER AERODYNAMIC SHAPES

M. Finston, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF042900; F44620-76-C-0049)

AF function - advanced aerospace vehicles. Opportunity - obtain preliminary aerodynamic information about a possible new class of aerodynamically configured vehicles and reentry bodies. Objective - map the near wake pressure and temperature characteristics and obtain lift to drag data of aerodynamically configured shapes to enable designers and developers to predict possible uses for these new shapes. How work contributes - will provide basic aerodynamic data to enable flight vehicle designers to evaluate possible uses for these new shapes.

An experimental effort at Mach 4.3 and 6.3 is planned using the magnetic suspension of an aerodynamically configured pyramid shape to investigate the lift to drag and near wake characteristics and their dependence on Reynolds number. Prior year experiments indicated that magnetic suspension is the only viable suspension method; string or wire suspension methods produce an acceptable blockage and disturbance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0014, DIGITAL FLIGHT CONTROL SYSTEM ADVANCED TECHNIQUES EVALUATION

D.G. Bailey, Honeywell Inc., *2600 Ridgeway Parkway N.E., Minneapolis, Minnesota* 55413 (DF140040; F33615-77-C-2070)

Advanced high performance aircraft will be dependent on sophisticated flight controls integrated with other avionics for mission success. Improved survivability of the flight controls against combat damage, equipment failure, and electrical hazards will be required. Advanced digital techniques have the potential for satisfying these requirements but lack the necessary flight test verification that flight control system quality and integrity will not be impacted. The objective of this effort is to flight test demonstrate the feasibility of refinements to multimode control laws, analytic redundancy, area multiplexing, and fiber optic data links. This effort will reduce the technical risk and increase the confidence that these advanced digital techniques do not compromise flight control system performance and safety. It will also demonstrate the improved target tracking achieved through software refinements.

Existing multimode control laws in YA-7D (67-14583) will be refined through software reprogramming to optimize flight path performance during turning maneuvers. Software coding will be developed for fault tolerance through analytical redundancy and tested on the aircraft. A dais type area multiplexing data bus per MIL-STD-1553 will be developed to be compatible with the existing dual HDC-301 computers and flight tested for suitability of performing the flight stabilization and control functions. An optically coupled data bus will be investigated by exchanging the twisted shielded pair transmission lines with a fiber optic cable including optical line drivers and receivers and flight tested. A test program will be conducted to evaluate the potential susceptibility of the multiplexed data bus flight control system to lightning induced voltages. Using the multiplexed data bus, an improved dynamic gun sight will be added to further investigate target tracking capabilities of the multimode control laws.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, AIRCRAFT TRAFFIC LOADING ANALYSIS AND MODEL

W.J. Horn, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0S8187)

To obtain aircraft traffic distribution and aircraft loading data essential to the development of the improved method of pavement design for both rigid and flexible pavements and to develop computer aids for considering traffic in pavement design.

The results of current studies associated with aircraft dynamic wheel loads, aircraft traffic distribution at civil airports, as well as earlier studies of aircraft traffic distribution at military airfields will be extended and supplemented if necessary to obtain the desired traffic distribution and loading information. Data in the form of aircraft type, load distribution, operational speeds, lateral traffic distribution, longitudinal traffic distribution and pavement temperatures will be obtained from these studies and supplied in a usable form to those elements having the responsibility of developing pavement design procedures.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

1.0016, IMPROVED AIRCRAFT/EXTERNAL STORE FLUTTER PREDICTION

M.A. Ferman, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF140420; F33615-77-C-3087)

This work unit supports the area of aircraft/external store flutter prediction. Establishing flight flutter safety for military aircraft carrying large numbers and different combinations of external stores is presently costly and time consuming. The objective of this effort is to reduce the time and cost for aircraft/external store flutter prediction. This reduction is expected to reduce the time and cost required for establishing flight flutter safety of military aircraft carrying external stores.

Add the capability to include empennage flexibilities in vibration and flutter analyses using the FACES (flutter of aircraft carrying external stores) computer program of AFFDL-TR-75-101. Also, provide program maintenance as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, FEASIBILITY DEMONSTRATION OF A RAFT SYSTEM

D. Meisner, Air Cruisers Co., *P.O. Box 180, Belmar, New Jersey* 07719 (DN781462; N62269-76-C-0273)

Demonstrate the feasibility of a helicopter installed system designed to provide deceleration during free fall, and subsequent flotation, of a high value cargo that has been intentionally jettisoned or inadvertently dropped during vertical replenishment operations over water. Automatic deployment of the system is planned to prevent specified levels of damage to the cargo upon impact with the water, to avert sinking and to facilitate recovery by surface ship or helicopter. This contract supports work unit PH104, Agency Accession No. DN681034.

It is planned to conceive, analyze, and design a raft system including its method of attachment, which is capable of meeting the objectives specified in statement of work SOW 3041-21; to fabricate feasibility test hardware, and to support NavAirDevCen personnel in subsequent flight tests.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0018, DESIGN AND FABRICATION OF RAFT/H46 INTERFACE FITTINGS

D. Meisner, Air Cruisers Co., *P.O. Box 180, Belmar, New Jersey* 07719 (DN881487; N62269-78-M-2229)

The objective of this task is to design and fabricate the H46 helicopter attachment fittings required to interface with the raft system. The fittings are internal to the airframe and are required to structurally transmit the mass and aerodynamic forces to the aircraft frame. This contract supports work unit PH104, Agency Accession No. DN 681034.

The approach is to determine the location of the major aircraft frame stations immediately aft of the cargo hatch. Structural bulkheads will be added as required to insure adequate load capability. Fabrication of structural bridges between major frames may be necessary. Emergency release shear pins will be included in the design.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0019, TACTICAL LANDING SYSTEM GUIDANCE TECHNIQUES (TLSGT)
A. Ploski, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Avionics Research & Development Activity, *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0B3400)

To develop a tactical landing system (TLS) that has (a) high potential for providing satisfactory performance in the Army's severe tactical enviroment, and (b) sufficient versatility to permit determination of guidance system parameters necessary for safe helicopter instrument approaches under tactical operational conditions.

A flexible scanning beam landing system (A-SCAN) subsequently called TLS was developed which provides selectable glide slope angles, multiple localizers, variable horizontal and vertical course widths, optional DME, course softening, split or colocated siting, and altitude above touchdown. An in-house flight research program was conducted to evaluate scanning beam guidance techniques. This led to the initiation of the development of a lightweight (under 50 pounds) KU-band equipment to show contrasts among the microwave landing system, the marine remote area approach and landing system and the Army tactical landing system philosophies.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0020, WEIGHT AND COST IMPACT OF DAMAGE TOLERANCE CRITERIA ON NAVY AIRCRAFT
P. Bell, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN881382; N62269-77-C-0174)

To make an analytical assessment of the weight and cost impact of damage tolerance criteria, specifically those of A.F. specification MIL A 83444, on a Navy fighter aircraft. This contract will support work unit ZA 601, 'Aircraft Technology', Agency Accession DN 681080.

The specification MIL A 83444, 'Airplane Damage Tolerance Requirements' will be analytically applied to the Navy F 14 aircraft. This aircraft was not designed to this specification so hypothetical redesign required to meet the specification can be quantitatively translated into weight and cost. The impact of this specification on the structural reliability, weight and cost of Navy aircraft can then be assessed.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0021, DISPERSED AND RECONFIGURABLE DIGITAL FLIGHT CONTROL SYSTEM STUDY
J. Boudreau, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF139720; F33615-77-C-3041)

This work unit supports advanced aerospace vehicles. The advantage gained by the work unit is the increased survivability of flight control systems due to hostile fire. The objective of the work is to develop strategies to increase aircraft survivability by dispersing and/or reconfiguring the flight control system. The development of these strategies should reduce the total number of components required to perform the flight control function, reduce the logistics cost in maintaining flight control systems, and significantly increase the survivability of military aircraft.

Analyze the dispersion of sensors about the airframe with appropriate structural filtering. Compare the use of multiple control surfaces to perform the flight control functions with the use of multiple actuators on single surfaces. Analyze the advantages of dispersing micro-processors about the airframe. Compare the use of a central processing computer with dispersed and non-dispersed micro-processors for synchronization, monitoring of failures, and size required. Develop reconfiguration strategies for detectable sensor failures, surface failures, and computer failures. Determine how to isolate where the failure occurred and what mode of reconfiguration to use, i.e., switch the bad unit out, switch to a redundant unit, approximate the function using other non-redundant units, or switch to a back-up mode.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, PARALLEL COMPUTATION FOR DEVELOPING NONLINEAR CONTROL PROCEDURES
H. Kaufman, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Systems Engineering, *110 8th St., Troy, New York* 12181 (DF140850; AFOSR-77-3418)

This work unit supports the enhancement of advanced aerospace vehicles. This work unit is developing techniques to allow the use of parallel processing elements for flight control laws. The objective of this work unit is to determine a parallel microprocessor computer system which will allow the on-line processing of non-linear equations. On-line non-linear computation would permit USAF aircraft to hand-tailor flight control laws which would improve their performance.

Using a Van der Pol system the control vector will be found using the variation of extremals method. The above algorithms will be modified so as to update the initial costate matrix by a parallel optimization procedure, and then by the parallel shooting algorithm. Using a representative high order flight control system, design and evaluate optimal controllers. Evaluate improvement in performance using nonlinear rather than linear equations of motion. Consider an adaptive system which is adjusted on-line.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, ADVANCED FUEL DELIVERY SYSTEM
R. Anderson, General Electric Co., Aircraft Engine Group, *1 Jimson Rd., Cincinnati, Ohio* 45215 (DN889779; N00140-78-C-0059)

The overall objective is to design, develop and demonstrate a lightweight, compact, contaminant resistant, fuel delivery system for use on advanced augmented gas turbine engines. This contract will supplement developments reported under DN596806 and DN796803.

The contractor will obtain a fuel contaminant hardened vane pump/motor element to replace the gear-type element currently integrated into the unitized pump being developed and tested under contract N00140-75-C-0040. The element will be integrated into the unitized pump and will be bench tested to confirm satisfactory performance. Tests will then be run to confirm the capability of the pump to operate with unfiltered contaminated fuel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0024, H. E. PROJECTILE PROTECTION DESIGN CRITERIA VALIDATION
G.W. Ducker, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141800)

Most of the source material used in the development of the general specification and design guide of contract F33615-76-C-3006 is unverified or derivative information. This work unit will provide direct verification of the contents of these documents, or the basis for their revision. This will insure that the documents are both effective and sufficient for their intended use. The objective of this work unit is to evaluate the design guidance developed under this contract, validate the requirements and design procedures delineated in the documents and define any necessary modifications. The result of this work effort will be assurance that the standardization documents are adequate for procurement and design, and that the protection requirements are sufficient.

A test plan will be prepared which will reflect the requirements established in the system specification. Test specimens will be prepared in accordance with the design guide. Ballistic tests will be performed in the aircraft survivability research facility, with threats up to and including 57mm HE-T rounds. The results will be analyzed and appropriate modifications made, as necessary, to the specification and design guide developed under the referenced contract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, MULTI-MICROPROCESSOR CONTROL ELEMENTS

J.E. Houtz, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142560)

This program seeks to apply multiple microprocessors to aircraft digital flight control systems. State-of-the-art digital flight control systems are tailored to a general purpose digital computer architecture. This program will apply multiple microprocessors to mechanize a flight control system specifically tailored to flight control requirements. It is anticipated that this program will improve reliability of flight critical control systems and reduce control system hardware and software costs.

Evaluation modules will be breadboarded and candidate microprocessors and supporting hardware will be evaluated in the AFFDL/FGL development laboratory. A candidate microprocessor type will be selected as the basic unit for a flight control system design. Based upon the selected microprocessor type, a prototype modularized distributed microprocessor flight control system will be designed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, AIR-TO-AIR EFFECTIVENESS MODELING

R.A. Mercier, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141260)

Before substantial resources are invested in new technologies, there is the need to determine if the technology contributes to future Air Force capabilities. The Air Force has developed PACAM as air-to-air combat simulation model, to assess the utility of advanced fighter aircraft concepts. To date, this model has not been verified and has seen only limited use. The objectives of this effort are to verify PACAM and to use this model to evaluate the effectiveness of advanced fighter aircraft concepts.

This effort will be conducted in-house. AIMVAL-ACEVAL data gathered during Project Red Flag will be screened and reduced to provide baseline time histories for various air-to-air engagements. FXB will then run PACAM using the same starting conditions as the baseline cases. The results will be compared to identify required improvements in the model. All changes to the model will be coordinated with AFAL, ADTC/XR, and JTCG. After the model has been verified, it will be used to evaluate the effectiveness of advanced fighter aircraft concepts. Anticipated results from this portion of the effort include assessing design utility, identifying areas for improving the design, and identifying tactics development needs to effectively use these advanced concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, LAMINATED WING STRUCTURES

J.B. Monfort, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140090)

There is a continuing need to reduce costs and improve the structural efficiency of advanced military aircraft. Conventional design and construction techniques have been virtually pushed to their limits, with further improvements dependent almost entirely upon development of new alloys and material systems. The objective of this effort is to evaluate innovative design and fabrication techniques wherein additional system advantage can be achieved through laminating aluminum sheet by adhesive bonding to reduce acquisition and life cycle costs concurrently with weight savings and increased damage tolerance of primary airframe structure. The combination of economic and performance benefits realizable from improved airframes will provide the Air Force with a valuable tool for accomplishing the assigned mission with critical resources.

The Air Force Flight Dynamics Laboratory and the Air Force Materials Laboratory are jointly sponsoring contract F33615-75-C-5178 with General Dynamics/Fort Worth, MASIS Accession Number 678180, to design, fabricate and evaluate an adhesively bonded, laminated aluminum stub wing box based on the F-16 design criteria. As an integral part of this program three such wing boxes will be tested by the AFFDL, with non-destructive evaluation support from AFML, at Wright-Patterson AFB for static strength, fatigue and damage tolerance. All data and the wing boxes shall be returned to the contractor for analysis and inclusion of results in their final technical report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, CONTROL SYSTEM INDUCED AEROELASTIC INSTABILITIES

T.E. Noll, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF134660)

Aircraft with active control systems can encounter instabilities which result from the interaction of the control system with the aeroelastic response if adequate control compensation is not provided. The objective of this effort is to substantiate analyses which account for the control system interaction. This effort will establish the confidence and reliability of AFFDL in-house analysis procedures. The ultimate payoff will be a reliable method for use in the design stage for predicting and preventing control induced aeroelastic instabilities thus reducing cost and increasing flight safety for a new aircraft.

Frequency and time domain computer programs developed under AFFDL contract F33615-73-C-3063 will be applied to an advanced fighter aircraft with an active control system to predict control induced aeroelastic instabilities. These analyses will involve the interaction of the structural response, the airloads, and the control system response. A final technical report will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0029, COMBINED ENVIRONMENTS RELIABILITY TEST

H.E. Reynolds, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136650)

Repair costs of Air Force aircraft electronics equipment attributable to environmentally induced failures have been found to be approximately 460 million dollars per year. Equipments typically fail in service six to eight times more often than expected from laboratory demonstrations. The objective of this effort is to develop a realistic but cost-effective combined environments test that could be used for both qualification and reliability test and evaluation. The use of this test in the development and acquisition of electronics equipment should significantly improve its field reliability and correlation between field and laboratory reliability.

Realistic assessment of and prediction of actual environmental conditions that equipment is subjected to in field service will be determined through acquisition and analysis of aircraft environmental data. Realistic combined environment profiles will be developed for evaluation and test of aircraft equipment for various classes of aircraft. Capability to 'fly the equipment in the laboratory' will be developed by combined environment testing under realistic temperature, airflow, humidity, altitude, and random vibration conditions representative of aircraft equipment installations. New testing standards will be generated to provide the tests required to increase the effectiveness of testing needed to assure that only reliable hardware is introduced into service.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, DEFINE THE LOADING ENVIRONMENT OF AEROSPACE VEHICLES FOR THE DEVELOPMENT OF DESIGN CRITERIA

E.W. Turner, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF131870)

One broad problem which the USAF must address is the design and fabrication of aerospace vehicles which have both high reliability and low life-cycle cost. Achieving these mutually conflicting goals requires a detailed knowledge of the loading environment to be used in developing valid design criteria, and advanced methods for computing the response of aerospace vehicles to this environment. The objective of this effort is to extend the present knowledge of the loading environment by acquiring and analyzing flight data, and developing techniques for computing the response of aerospace vehicles to the environment. This will lead to higher reliability and lower life cycle costs of aerospace vehicles.

A large collection of gust data is available from the previous critical atmospheric turbulence (CAT) recording programs. The aircraft structural integrity program (ASIP) is the primary source of operational flight loads data. Complementary data will be obtained from other recording programs conducted both by government agencies (including the AFFDL), and nongovernment agencies. The AFFDL recording programs will be conducted by installing special sensing and recording devices on both manned and unmanned flight vehicles, and flight simulators. Flight recorders will be developed when necessary to fulfill the future requirements of AFFDL recorder programs. Current data processing techniques will be used to reduce the data, and new techniques will be developed when existing techniques are inadequate. New methods will be investigated, and computer programs implemented to compute the response of aerospace vehicles to the gust and maneuver loading environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, STRESS MEASUREMENT IN PARACHUTE CANOPIES UNDER BIAXIAL LOADING

H.G. Heinrich, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF142080; F33615-76-C-3145)

Current design practices for textile type canopies used in parachute recovery systems incorporate significant safety factors to account for the stresses resulting from dynamic loadings during the parachute opening process. As a result, parachute canopies are excessively heavy and bulky due to the required materials strength. The objective of this program is the development of a direct stress measurement technique for acquiring biaxial stress data on parachute canopies. The data acquired and engineering tool developed will contribute to the design of lighter and more reliable parachute recovery subsystems for AF weapons systems.

Model parachute canopies shall be instrumented with Omega stress transducers and the circumferential and radial stresses shall be measured during wind tunnel tests. Measured values shall be compared with the values calculated by existing parachute stress analyses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0032, A STUDY OF THE AERODYNAMIC INTERACTIONS OF THE TAIL ROTOR AND FIN 15710-E

P.F. Sheridan, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0F9244; DAAG29-78-C-0021)

To conduct a study of wind tunnel model test data to gain an understanding of fin-tail rotor aerodynamic interactions, to identify the gaps in understanding the physical mechanisms at work, and to establish a basis for further analytical and test programs. Relevance -the investigation seeks to study and understand aerodynamic interactions between tail rotors and fins which have caused problems in vibration, performance and flying qualities and is therefore directly relevant to improving helicopter directional control techniques.

A study of all the relevant data acquired by Boeing-Vertol will be carried out and will include both fin and tail rotor forces and moments in both dimensional and non-dimensional forms. Flow visualization records will be examined in relation to the trends of the plotted data and correlative studies will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0033, DEVELOPMENT OF FLIGHT CONTROL SYSTEMS/FLYING QUALITIES CRITERIA FOR LIFT/CRUISE FAN V/STOL AIRCRAFT

C. Abrams, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881124; N62269-77-C-0163)

To develop the criteria and specifications for an advanced flight propulsion control system and suitable pilot displays for a Navy multimission lift cruise fan aircraft. This effort is supported by work unit DH820B.

Investigations will be conducted to define flight control requirements for a lift cruise fan vehicle. Flying qualities criteria will be established for the design of a flight control display system suitable for all modes of flight including hover maneuvering, transition maneuvering, cruise maneuvering, take off and landing. The flight control development will address intergrated propulsive and aerodynamic control concepts, failure mode effects, pilot station controls and display actuation concepts and system reliability. The ability of the flight control display system to provide satisfactory flying qualities will be demonstrated through piloted simulation at the NASA Ames Research Center.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0034, HEAVY-LIFT AIRSHIPS TECHNOLOGY SUPPORT

J.A. Eney, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN581478)

To explore and develop candidate heavy lift air vehicles pursuant to operational requirement OR 1019 SL.

Two vehicle concepts are under consideration, the 'rotor-balloon' with a rigid rotor affixed to an aerostat centerbody, and the 'quad-rotor' with four articulated rotors flanking an ellipsoidal hull. Both concepts are being carried through model testing and simulation phases. A preferred configuration, when determined, will be prototyped and flight tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0035, NAVY STRUCTURAL FRACTURE CONTROL AND SERVICE LIFE MANAGEMENT PROGRAM

S.L. Huang, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN781434)

The objectives of this program are to augment the specifications for designing and accepting naval aircraft structures which will have a high degree of reliability and damage tolerance, and to formulate a new service life management system based on the existence of initial flaws and the technology for determining their rate of growth and the residual strength of structures in which they occur. Fracture mechanics concepts and NDI techniques will be used to quantify inherent and service induced damage and to evaluate their effect on structural behavior.

In order to achieve the stated objective of developing highly reliable fracture resistant air vehicle structures, new design and test specifications will be developed and implemented to insure structural integrity for current and future naval aircraft. A basic philosophical difference exists between this approach and the current procedure in that it is based upon the existence of initial flaws in the structure. The knowledge of the location, size and distribution of these flaws, inherent or induced during manufacture, is the starting point.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0036, ROTOR BLADE DYNAMIC RESPONSE AND BALLISTIC DAMAGE SURVIVABILITY
H. Zinberg, Bell Helicopter Co., *P.O. Box 482, Fort Worth, Texas* 76101 (DA0D4018; DAAJ02-75-C-0049)

To develop analytical techniques and modeling methods that will evaluate rotor blade survivability when subjected to ballistic damage in flight. The method shall be capable of evaluating composite and metal constructed main rotor blades for ballistic impacts up to and including 23mm HEI. The boundary conditions for structural stability and the flight regime necessary for 30 minutes safe flight after impact shall be established.

New computer programs will be generated or existing programs modified to account for reduced blade stiffness resulting from ballistic damage. Input data for programs will be blade section properties, location, impact energy and amount of material removed as a result of damage. Program will calculate blade residual strength, blade dynamic properties, and coupled rotor airframe dynamic properties. Static and dynamic tests will be performed on damaged blades and/or blade sections to verify analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0037, EXPERIMENTAL D-OPTIMAL DESIGN METHOD IN OPTIMAL AIRCRAFT DESIGN
J.A. Craig, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF141310; F33615-78-C-3011)

Computer aided aircraft designs are being increasingly applied for optimized aircraft designs. A significant problem area in computer aided aircraft designs is the selection of an optimal set of design vectors which are necessary for determining a quadratic regression for the aircraft performance parameters. A computer code for generating D-optimal designs, if accomplished, will exactly do the optimal screening of the design vectors, and the effectiveness, from the cost-savings point of view, of the D-optimal designs will be significant. Accuracy and reliability of the proposed work effort (i.e. computerizing the D-optimal design method) will enhance optimal aircraft designs for the Air Force missions.

The approach will be based on minimizing the variance of the response functions as well as by requiring that the variance of the coefficients of the quadratic regression be minimum too.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0038, HT RM 78-17 - DEVELOPMENT OF ADVANCED STRUCTURES MAINTENANCE CONCEPTS
T.E. Condon, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3814)

Development of maintenance concepts based on advanced structures concepts proposed or under development for application to Army helicopters of the 1980s.

Investigate and evaluate maintenance concepts applicable to advanced structures concepts. Additionally develop test and evaluation techniques applicable to the advanced structures concepts. An integral part of this program will be the development of field repair techniques and kits.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0039, HT RM 78-20 - ENVIRONMENTAL DESIGN AND TEST GUIDE FOR ARMY HELICOPTERS
Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3828)

The objective of this effort will be to develop an environmental design and test guide for Army helicopters based on the previous work performed by Rockwell International. The guide will be used to assist Army planners in the establishment of design and test criteria for future Army aircraft programs. This document will also be used by industry personnel to assist them in the design and test of their vehicles to meet environmental requirements.

Using the services of the Earth Sciences Laboratory, Fort Belvoir, VA, the combined and accelerated environmental design and test criteria and procedures will be developed where practical or a method developed to establish those criteria and procedures when it is not practical to establish generalized criteria and/or procedures. The previous work by Rockwell and this work will then be combined and a design and test guide prepared.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0040, DYNAMIC RESPONSE OF COMPOSITE STRUCTURES TO NONNUCLEAR THREATS
J.G. Avery, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF137670; F33615-78-C-3403)

With increased usage of advanced composites as structural materials in aircraft components, the effect of threat induced damage in a combat environment becomes increasingly important. Aircraft structural designs using composite materials tend to present some unique problems which need to be further explored. The objective of this program is to investigate the effects of nonnuclear threat mechanisms on aircraft structures fabricated from composite materials. As the result of this effort, the effects of threat damage mechanisms on composite structures will be understood and will provide a data base for the development of survivable composite structure design criteria and guides.

To be investigated is the damage that results from the interaction of nonnuclear threat mechanisms with composite structures and the effects that such damage has on the strength of the composite structures. Factors associated with the investigation will be threat types and the damage mechanism associated with each type of threat, various types of composite materials and structural concepts, the application of the various composite structural concepts, the damage produced by the various threat mechanisms and the effects on the strength of the structural composites produced by the damage. Data voids will be identified and test plans developed to fill these voids.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0041, EXTENSION OF FLEXSTAB FOR ANALYSIS ACCURACY AND EFFICIENCY
J. Dornfeld, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF138870; F33615-76-C-3170)

This work unit supports TPO 3, flight control, and major thrust FG02B, flight control system design techniques. Specifically this work unit will identify errors/or inefficiencies in, and add capabilities to, level 3.01.00 FLEXSTAB computer program systems. The objectives of this work unit are to (a) modify FLEXSTAB to allow the aeroelastic analysis of cantilevered, flexible wind tunnel models, (b) modify FLEXSTAB to include Kussner-Wagner indicial lift growth functions for increased accuracy when analyzing higher frequency modes and gust aerodynamics, modify FLEXSTAB to optionally allow a linear time response capability in addition to the current nonlinear time history analysis capability, (c) improve the accuracy of the hinge moment calculation, (d) modify FLEXSTAB to more efficiently handle, store, and operate upon matrices in order to effect a 50 percent - 80 percent cost savings for matrix operations, (e) correct all known and newly discovered errors in the FLEXSTAB coding and documentation. When this work unit is completed all errors and inefficiencies in level 3.01 FLEXSTAB CPS and documentation will either be corrected (money permitting) or identified in detail for later correction.

This work will consist of analytical and experimental studies to determine the best methods to modify FLEXSTAB to produce a more accurate and cost-effective prediction method. The approach is to (1) formulate dynamic load equations based on level 2.01.00 perturbation output, (2) incorporate these equations into the control-free analysis programs, (3) determine limits of applicability, (4) recommend other in-house and contracted efforts, (5) provide additional support. Reports will be prepared during the course of this effort to document significant accomplishments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0042, MICROSTRUCTURAL CHANGES FOLLOWING SUPERPLASTIC DEFORMATION OF TI-6AL-6V

A. Rosen, Technion, *Haifa, Israel* (DF289520; AFOSR-77-3441)

AF function - research in improved and lower cost air frame components. Deficiency - present methods for the fabrication of titanium components result in high cost. Furthermore, little is known of the post forming response of superplastically shaped titanium, a low cost approach. How research contributes - it is expected to find answers to the following questions - (1) What is the effect of temperature on the mechanism of superplastic deformation? It is well known that the volume fraction of beta is strongly temperature dependent, and therefore, the change of the alpha/beta ratio may influence the deformation mechanism. (2) If superplastic deformation is controlled by grain boundary sliding, what is the role of the alpha-alpha, beta-beta and alpha-beta grain boundaries? (3) What is the mechanism which eliminates void formation during grain boundary sliding? (4) Is there any change of structure due to superplastic deformation? (5) What is the role of plastic deformation on grain growth?

The aim of the proposed research is to understand the mechanism of superplastic deformation of Ti-6Al-4V by means of direct observation of the structure in the transmission electron microscope. Direct observation of the microstructure and the structural changes which take place during superplastic deformation is not feasible due to lack of appropriate equipment. Instead, this approach is to freeze - in the high temperature structure which develops during superplastic forming - and to compare it with the structure which develops under similar conditions, but without application of stress. Tensile testing will be carried out in vacuum at various temperatures and strain rates in a specially designed apparatus.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, SULFUR IN THE CORROSION OF SUPERALLOYS 14925-MS

J.B. Wagner, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (DA0F9141; DAAG29-78-G-0032)

Investigate high temperature degradation of metals in sulfur-containing gases, to contribute to an understanding of the transport of sulfur through oxides and to determine the role of surface finish and subsequent protectiveness to oxide films formed in SO sub 2-O sub 2 gas mixtures. Relevance - the research is relevant to the hot corrosion of turbine components and to the Army program to develop improved hot corrosion resistant coatings for high temperature alloys.

Oxidation of pure nickel and cobalt in SO sub 2-O sub 2 gas mixtures, with particular attention directed at the role of oxide morphology and metal surface preparation on the subsequent structure of the corrosion product. Radiotracer diffusion of sulfur-35 in cobaltous oxide single crystals to determine whether anomolous penetration profiles as seen on nickel surfaces is a general phenomena.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0002, A STUDY OF MATERIALS PHENOMENA AND LOW-TEMPERATURE PROCESSES

R.A. Armistead, Advanced Research & Applications Corp., *1223 E. Arques Ave., Sunnyvale, California* 94086 (DF051030; F49620-78-C-0010)

AF function - the proposed research primarily falls in the 2.3 research objectives which deal with developing superconducting materials with higher transition temperatures, higher upper critical magnetic fields, lower AC losses and higher current carrying capabilities. Deficiency - new approaches to Air Force power generation and distribution and remote sensing and detection of electromagnetic radiation depend upon new and improved superconducting materials. Josephson junction devices are needed for ultrasensitive detectors of electromagnetic radiation especially in the ranges of 1-100 microns and 10-6 to 10-5 Gauss. Objective - the subject concerns nonequilibrium processes and Josephson tunneling in superconducting films. Contribution - this research is a part of a program in low temperature physics.

The studies in the Josephson tunneling I-V characteristics of superconductors in nonequilibrium state will be conducted in crossed film, superconductor/oxide/superconductor junctions. The crossed film junctions will be fabricated by thermal evaporation of Sn. A slow oxidation, and a second thermal evaporation of the second Sn electrode will form a complete Sn-SnO-Sn junction. These films make reliable junctions with easily attainable transition temperatures (37 degrees K). they are also useful for forming the first electrode and insulating layer of junctions using another material, for example, Pb or In, for the second superconducting electrode. Such systems allow the study of superconducting energy gaps from quite-different, more strongly coupled, superconducting materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, ENVIRONMENTAL DURABILITY OF FIBER-REINFORCED COMPOSITES 14414-MS

D.H. Kaelble, Rockwell International Corp., *1049 Camios Dos Rios, Thousand Oaks, California* 91360 (DA0E9297; DAAG29 77 C 0005)

To determine the physicochemical mechanisms of environmental durability and degradation of graphite-epoxy and fiberglass-epoxy composites under hydrothermal (high moisture and temperature) exposure. Relevance - the research is directly relevant to the degradation of the structure and properties of epoxy matrix composites, which are being used (or considered for use) in many Army components, e.g., aircraft, portable bridges, missile launch tubes and motor cases, tank wheels.

Determine the effects of moisture and temperature on the composition and bonding of the fiber-matrix interface; evaluate loss of bonding at the fiber-matrix interface by measurement of interlaminar shear strength; and determine the effects of moisture and temperature upon the bulk properties of the matrix epoxy, e.g., composition, adhesive aspects, and rheology.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0004, CHEMICAL PHYSICS OF CHARGE MECHANISMS IN NONMETALLIC SPACECRAFT MATERIALS

J.E. Nanevicz, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF048670; F49620-77-C-0113)

AF function - operational and future Air Force space systems are required to perform their missions in extreme service environments. Deficiency - the interaction of a synchronous-orbit satellite with its environment activates electrification and electrical discharge processes producing electromagnetic noise pulses and effluents which deteriorate satellite materials, surfaces and components. Objective - the objective is to perform research to understand the mechanisms underlying spacecraft charging in polymeric and other nonmetallic dielectrics. How work contributes - it is expected that this research will contribute to the establishment of guidelines for the design and modification of satellite materials which are not degraded by the effects of electrical charging and which will minimize disruptions in Air Force space systems mission performance.

(a) Study nature, causes and effects of charging and discharging processes in typical spacecraft polymers and other non-metallic dielectrics under orbital conditions, (b) deter physics of critical electrostatic charging phenomena and properties of materials that affect electrostatic charging properties, and (c) study methods for modification of materials properties to improve their in-space performance characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, LABORATORY MEASUREMENTS OF PHOTOLYTIC PARAMETERS OZONE (O3)
Unknown, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (FA78WA-4263; FA161583 (TRAIS NO.))

The contractor will measure the absorption cross-section and quantum yields of all product branches on the photolysis and ozone (O3) as a function of temperature (between 200 and 300 K) and wavelength range. The experimental approach will be based on 1) a neodymium-YAG pumped doubled dye laser which shall be used as a photolysis source; 2) a multichannel analyzer system which will be used to monitor the O(1D) emission at 630NM and the O(3P) resonance fluorescence at 130.5 NM; 3) the temporal behavior; and 4) the absorption coefficients for ozone from 270 to 350 NM over a temperature range of 200-300 K which will be determined in a long path absorption cell.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

3.0006, FILM SYNTHESIS AND NEW SUPERCONDUCTORS
T.H. Geballe, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (DF050440; F49620-78-C-0009)

AF function - high temperature superconducting materials are needed for application in airborne multi-megawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high transition temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - the research studies fundamental mechanisms which give rise to superconductivity, explores the occurrence of superconductivity in compounds and composites, synthesizes films with optimal superconducting transition temperatures, and seeks a model for predicting high temperature (above 23 degrees K) superconducting state in metastable metallic phases. How work contributies - the performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators, transformers and induction energy storage systems could be significantly improved if the upper critical field, the current-carrying capacity and the critical transition temperature of the superconducting material could be enhanced.

Metastable phase equilibria at lower temperatures are being studied by utilizing the unique capability of the electron-beam codeposition apparatus to lay down intimate mixtures of two or more components on a substrate whose temperature is subject to independent control. The high superconducting transition temperature A-15 phases are being investigated. Particular attention is given to Nb3Ge, Nb3Si, and ternary compounds derived from them. The superconducting properties are being correlated with the new phases using sensitive thermal and electrical techniques as well as crystallographic and metallurgical methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, FUNDAMENTAL APPROACH TO PROBLEMS IN CERAMIC ENGINEERING
D.M. Esterling, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DF046050; AFOSR-77-3114)

This proposed research primarily falls in the 2.1 research objectives which deal with failure processes. Basic research to identify new families of ceramic materials capable of economical consolidation to densities approaching 100 percent and possessing improved creep and thermal fatigue resistance is needed for extending limits of future generation expendable and recoverable high temperature turbine engine components. A rational basis for the development of alloys, nonmetallic materials, ceramics, and composites which are stronger is needed for all Air Force systems. Deficiency - failure processes such as fatigue, fracture, and creep are in most cases intimately related to the microstructures of alloys, polymers, ceramics, and composites. Understanding of these processes and properties mechanisms must be integrated with appropriate constitutive equations and appropriate failure criteria. Considerable progress can be achieved in structural reliability and integrity as a result of some basic studies. Objective - the objective of this research is to study the microstructure responsible for the mechanical properties of materials on an atomic scale. The areas to be investigated include the structure and energy of large angle grain boundaries, impurity-dislocation interactions and crack-grain boundary interactions. Contributions - this research is a part of a comprehensive program to use statistical mechanics on real systems.

An alternative approach to problems in ceramic engineering is proposed, exploiting the constructs and methodology of solid state physics. The analysis will be taken one level beyond the microstructure investigating atomic processes and their role in determining the microstructure. It is proposed to computer simulate crack tips, dislocation cores, and grain boundaries within a lattice (as compared to continuum) model employing realistic potentials. The present lattice model which is based on a variation of the lattice statics method will be improved. The potentials will be derived using recently developed techniques in quantum chemistry as well as the more established pseudopotential method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, ORIGIN OF N-ALKANES IN JET FUELS DERIVED FROM SHALE OIL, COAL AND TAR SANDS
R.N. Hazlett, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880122)

The purpose of this research is to determine how N-alkanes in the jet fuel range are formed in the thermal processes used to produce liquid fuels from shale oil, coal and tar sands. A further objective is to suggest variations of thermal processes or refining procedures which will result in a lower concentration of N-alkanes, thus relieving the jet fuel freezing point problem.

The original resource material will be analyzed to define the potential for N-alkane formation. Then thermal processes such as retorting, pyrolysis and delayed coking will be examined by varying system parameters such as temperature, pressure and time.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0009, RELATIONSHIP BETWEEN MICROSTRUCTURE AND MECHANICAL PROPERTIES OF INTERMETALLICS
J.J. Hren, State University System of Florida, University of Florida, School of Engineering, Dept. of Materials Science & Engineering, *220 Black Hall, Gainesville, Florida* 32611 (DF047770; AFOSR-77-3254)

AF function - requirements for gas turbine engines include strong, lightweight, oxidation resistant materials for high temperature operation. A need exists for materials to operate at higher engine temperatures (to improve operating efficiency), and for lighter weight materials (to decrease engine weight, engine operating stresses due to heavy components, and fuel consumption). The needed materials must have the same density as titanium combined with the mechanical properties and oxidation resistance of nickel base superalloy. Opportunity -intermetallic compounds in general, and the titanium aluminides in particular, have exhibited great potential for such applications. Unfortunately, nearly all intermetallic compounds are brittle at low temperatures, making their fabrication difficult and presenting potential hazards in service. However, recent reports indicate that some alloying additions can substantially improve low temperature ductility. Objective - this research will determine the intrinsic mechanisms of deformation and the available means for their control in a wide class of intermetallic compounds. How work contributes - initially; the investigation will be directed towards clarifying the source of improved ductility in the titanium aluminides.

The research will involve fabrication, testing, and detailed microstructural analysis of a range of alloys. Prime goals will be to

deduce the microstructural sources of these beneficial effects and to discover guidelines for more general application. The strength of these studies is founded on the use of advanced electron metallographic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, NAVY ENVIRONMENT - STUDIES OF DELAYED FRACTURE MECHANISMS IN ALUMINUM ALLOYS USED IN NAVAL AIRCRAFT AND BOAT STRUCTURES

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The investigators seek to determine the causes and mechanisms responsible for delayed failure in many strength aluminum alloys used in naval structures when stressed in the marine environment.

The effect of microstructural and compositional variations on a macro- and micro-scale on the delayed fracture behavior of Al-Zn-Mg alloys is being studied. Structure and compositional variations are achieved by heat treatment and characterized by standard metallurgical techniques. Tensile fracture tests are conducted in various environments and fracture characteristics are correlated with structure and composition. A description of the mechanisms of delayed fracture in terms of variations in material, stress and environmental conditions is sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0011, MATERIALS SUPPORT TECHNOLOGY - PHOTO AND IMPURITY EFFECTS IN AMORPHOUS COVALENT SYSTEMS AND FORMATION OF AMORPHOUS METALLIC ALLOYS

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Some amorphous metals have been shown to possess unusual physical or mechanical properties suggesting possible Navy use in soft magnet applications, photosensitive materials, high strength reinforcements, magnetic bubble materials, etc. This effort will investigate several factors which may affect the structure and properties of these interesting materials.

This program will explore the photosensitive nature of A-As2Se3 and A-As2S3 and compare the results to A-Se, which was previously shown to crystallize as a result of photoillumination. Factors affecting retention of the amorphous state in metals will be determined. Of special interest are compositional and thermal effects on formation and crystallization of these glassy metals. Accordingly diffusivity and viscosity behavior below TG will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0012, MATERIAL SUPPORT TECHNOLOGY - GRAPHITE INTERCALATION COMPOUNDS

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Intercalated graphite compounds have exhibited high conductivities. Research has been directed towards achieving conductivity equal to or greater than that for copper. Many naval systems could benefit from a light, strong metallic fiber. The objective of this program is to determine the electronic structure of these compounds in order to correlate the electrical behavior with their atomic structure and composition, with the view to being able to design better conductors.

Metallic graphite intercalation compounds are studied by Raman and infrared spectroscopic techniques to determine those lattice modes which can be identified with vibrations of the carbon atoms in the graphitic layers and other modes specific to each intercalate species. These results are combined with theoretical studies to determine the electronic structure of the compound when graphitic and intercalate layers are brought together to their equilibrium separation in the intercalation compound. Both acceptor and donor intercalation compounds are studied and special attention is given to the symmetry properties of the Raman and infrared spectra to provide information on the inplane ordering of the intercalate layer planes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0013, PREPARATION AND CHARACTERIZATION OF INFRARED MATERIALS

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AF function - aerospace communications surveillance and detection systems require electro-optical devices which exploit the special properties and interactions of infrared radiation with solid state materials. Opportunity - infrared materials research has high potential for airborne and satellite applications. Sophisticated electro-optical techniques and characteristics of narrow band-gap compound semiconductors offer promise for electro-optical microcircuitry in the spectral range 10 to 100 micrometers. Objective - the aim of this research is to optimize compositional homogeneity and to control compositional variations in III-V and II-VI semiconductor compounds. The goal is to establish quantitative relationships between growth parameters and materials characteristics and to utilize the special properties of these materials for electro-optical device concepts and components. How work contributes - infrared detectors and tunable infrared sources of coherent radiation require solid state materials with narrow band gaps, controlled carrier concentrations and doping to provide optimal performance characteristics for sensing and for communicating in an aerospace environment.

To obtain infrared materials with the specified compositional control requires basic modifications of conventional crystal growth systems. For the growth of intrinsic InSb the hot-zone of a Czochralski system is to be modified through the installation of a coaxial sodium heat-pipe. InSb with modulated carrier concentration is to be obtained by appropriate N-type current pulsing during rotational and/or non-rotational pulling. Heavily doped (Bi, Tl) InSb is to be grown in a modified Bridgman-Stockbarger system in which the onset of constitutional supercooling is delayed by means of differentially operated heat-pipes which permit the establishment of maximized thermal gradients across the growth interface. All materials grown are to be quantitatively characterized for compositional distribution, crystalline perfection and for potential application as infrared detectors or sources.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, ELECTROPLATING ON TITANIUM

C. Levy, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G4813)

The objective is to develop a method for applying adherent electrodeposits on titanium alloys.

Alloy composition electrodeposits will be plated followed by low temperature diffusion treatments of less than 1100 degrees F. Adhesion will be evaluated by metallographic examination and ASTM methods.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0015, DEVELOPMENT OF NEW FIRE RESISTANT POLYMERS

R.E. Singler, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0D4697)

To develop high-strength, chemically resistant, thermally stable polymers with a phosphorus-nitrogen backbone which will be evaluated for use in nonflammable coatings, foams and insulation, hydraulic fluids, and other applications. Major thrust - survivability, night operations, aircraft and combat vehicles.

Exploratory synthesis will be continued in the area of poly (aryloxy and aminophosphazene) copolymers. Chemical modifications will be studied in attempts to prepare phosphazene terpolymers, suitable for cross-linking, and cyclolinear polyphosphazenes. These polymers will be investigated for both closed-cell and open-cell foam applications. Polymerization conditions will be manipulated in order to prepare phosphazene oligomers as fire resistant hydraulic fluids. The thermal mechanical behavior and morphology of these polymers will be investigated to determine structure-porperty relationships for the polyphosphazenes. The large scale laboratory synthetic effort will be continued to provide sufficient quantities of polymers for laboratory processing studies and long term environmental deterioration studies.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0016, RECYCLING EXISTING PAVEMENT MATERIALS FOR PAVEMENT REHABILITATION

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Current construction state of the art includes recycling processes for asphalt pavements. Recycling asphalt pavement can provide economic, logistic, environmental, and technical benefits. However, there is a lack of definitive criteria that would take advantage of functional properties of the recycled material. It is proposed that a study be initiated to develop design and construction criteria for recycling asphalt concrete. This objective would best be accomplished by a laboratory study of pertinent material and mechanical properties. Test data from this study would form a data base from which to generate criteria and means of evaluating the capability and performance of recycled asphalt paving materials.

The intent of this study is to develop criteria for re-use of existing asphalt concrete airfield pavements. The study will encompass a review of procedures for breaking up and re-using embrittled asphalt, laboratory tests on recycled mixtures, establishment of quality provisions for recycled mixtures, and preparation of a technical report containing criteria recommendations.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

3.0017, WEAPONRY - PROCESSES AFFECTING COMBUSTION OF SOLID PROPELLANTS

L. Caveny, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DN623049; N00014-75-C-0705)

The Navy missile arsenal contains a wide variety of solid propellant rockets, and it is the objective of this task to advance the understanding of performance behaviors of solid propellants, and thereby lay the scientific groundwork for solid propellant rocket developments of the future. The main emphasis here is on solid propellant combustion embracing the description and incorporation into theoretical scheme all processes, physical and chemical, which occur during the burning of a solid propellant. The fundamental studies of this task form the bases for selection of propellant ingredients and physical design of the solid propellant grain which may be used in Navy ordnance rockets, as well as in solid propellant rockets for any application.

The pressure dependence of the burning rate of RDX and RDX composite propellants will be studied emphasizing the kinetics of RDX decomposition and the rates of reaction of the decomposition products. These rate data will be used in models of the burning process that include reaction, momentum, energy, and mass transfer rates.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0018, SOLID ELECTRODE STUDIES RELATED TO CORROSION PREVENTION, FUEL CELLS AND BATTERIES

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AF function - Air Force operational environment's power generation is relied on through electrochemical power sources, such as batteries and fuel cells. Deficiency - the detrimental effects of corrosion on AF equipment is also involved with electrochemical reactions. Objective -research involves the study of solid electrode surfaces processes, and the phenomena that influence these processes. How work contributes -results will give a better understanding of the adsorption and formation of products on the surface of the electrodes, as well as the potential corrosion sites.

Emphasis of this research will involve 'underpotential' metal deposition. It deals with an adsorption of a metal ion with some charge transfer at a potential more anodic than the equilibrium potential of the ion in contact with its reduced form in the metallic state. The exact description of these adsorbed species on the electrode surface is to be determined. Sinusoidal hydrodynamic modulation (SHM) and small signal A.C. techniques will be employed in the underpotential adsorption studies. The principal experimental technique will involve the rotating ring-disk to separate out the partial currents for alloy dissolution from the cathodic process leading to the mixed potential.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0019, EFFECT OF BONDING CHARACTERISTICS ON METAL MATRIX COMPOSITE PROPERTIES

R.G. Carlson, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF047990; F49620-77-C-0067)

AF function - Air Force propulsion systems of the future are expected to contain metal matrix composites because of their attractive mechanical properties at substantially reduced weight. Opportunity -however, a better technical understanding is required for design and application of this class of materials. In addition, this understanding is anticipated to provide for improved impact resistant materials for fan and compressor blades, and to allow for lower cost processing and fabrication of metal matrix composites. Objective - this research will develop an understanding of the metal matrix composites to effect a balanced increase in mechanical properties, placing specific emphasis on increased impact resistance. How work contributes - this technology can then be translated into composite systems in general, including resin matrix composites, and lead to more extensive application of composite materials to aircraft propulsion systems.

This program is directed toward understanding the basic bonding mechanisms of metal matrix composites, specifically between boron filaments and an aluminum matrix. The effort consists of three tasks -(1) surface preparation and characterization of single sandwich panels incorporating both aluminum and boron surface treatments, (2) upon extraction of correlative data, larger 8-ply panels will be selected and fabricated, and scrutinized by nondestructive evaluation, (3) the larger panels will be sectioned, and selected mechanical and physical properties will be evaluated in order to ascertain generic coupling/property behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, MATERIALS SUPPORT TECHNOLOGY - ADVANCED OPTICAL CERAMICS

S. Musikant, General Electric Co., Reentry & Environmental Systems Division, *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DN775728; N00014-77-C-0649)

A limiting area for many weapons systems (present and planned) is performance of solid transmitting window materials needed for their operation. Such systems include missiles, RPV's, spacecraft and lasers. These materials must exhibit acceptable transmission characteristics during operation and must also have acceptable resistance to aerodynamic heating, other thermal

stressing, rain and dust erosion, shock, etc. This task is aimed at quantification of severity of performance requirements for electromagnetic solid window materials to give additional direction to materials development activities.

Required performance characteristics, improvement in them, and hence, properties of window materials will be defined. Advanced systems performance goals will be related to window capabilities. State-of-the-art evaluations for materials properties, processing and finishing will be made. Relations between systems parameters and window performance will be assessed. A basis for establishing materials performance requirements and materials development work is to be established.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0021, IMPROVED MONOPROPELLANTS

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Development of high energy liquid monopropellants which are non-toxic relative to the nitrate ester type in current use, and which meet stringent safety requirements.

Since wakelessness is not an imposed requirement as was the case when solex monopropellants were conceived and developed, 'complete combustion' stoichiometry is not a restriction. Hence, a great deal more latitude would appear to be available for formulation. In the candidate selection of suitable choices, both the intramolecular type where the energy of decomposition resides in one molecule (a nitrate ester, for example - Ottofuel II) and the intermolecular type where useful propulsive energy is derived from the reaction between two chemical species (SOLEX-1 or SOLEX-2, for example) are approach options. SOLEX-1 monopropellant undergoes a thermal explosion at elevated temperatures (500 degrees F) due to the fact that the fuel component does not boil off prior to thermal decomposition of the perchloric acid. In order to eliminate this potential hazard (in the event of an accidental fire) fuel candidate selection will be largely concerned with behavior and characteristics at elevated temperatures; safety is an overriding objective.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0022, TURBULENT MIXING RESEARCH

P.T. Harsha, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF420818; F40600-75-C-0001)

The objective of this experimental and analytical project is to develop reliable prediction techniques for high speed turbulent mixing processes, including those flows with exothermic chemical reactions.

Special emphasis is placed on mixing systems which are used in propulsion devices and ground testing facilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

3.0023, VIBROTHERMOGRAPHY - INVESTIGATION OF A NEW NONDESTRUCTIVE EVALUATION TECHNIQUE 16202-MS

K.L. Reifsnider, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (DA0G8959; DAAG29-79-G-0037)

To determine the mechanisms responsible for evolution of heat in mechanically loaded materials, especially in the neighborhood of materials defects, and to study limitations in techniques to detect the evolution of heat. Relevance - this research is relevant to the nondestructive evaluation of composite materials used in structures, penetrators, armor, helicopter and missile components, and to understanding of the mechanisms of fatigue failure in composite materials.

Isolation and characterization of the various processes known to generate heat in materials (plastic deformation, rubbing of mating surfaces, elastic hysteresis, release of strain energy, dispersion and attenuation of stress waves). Measurement of evolution of heat from a series of well-characterized flaws which are cyclically loaded. Modelling of the heat transfer from defects in solids. Comparison of theory with results on state-of-the-art manufactured materials.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0024, QUANTUM CHEMISTRY OF SMALL MOLECULES

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Davidson will continue his work on potential surfaces and excited states, and begin research in theoretical X-ray photoelectron spectroscopy. Triatomic potential surfaces (especially for excited states) are of great practical interest because of work in plasmas, lasers, and atmospheric pollution. Theoretical calculations of the potential surfaces for several of the more interesting triatomics will aid in building experience in the types of topographic features which can be presented. The HCO radical is of great importance in flames, and calculations of its quite complex excited-state potential surfaces will be undertaken. Similar studies are planned for other triatomic radicals such as HNO, CH2, etc., of importance in hydrocarbon fuel combustion in air. X-ray photoelectron spectroscopy is an important experimental tool in studies of the electronic structure of molecules, but interpretations of the spectra still leave many unanswered questions. Studies are underway on the X-ray extended fine structure of Br2, C12, and F2, and on the satellite structure of ethylene. Projects to be initiated under this grant include application of discrete basis function methods to calculations of intensities of primary spectral peaks associated with core-hole and valence hole states of neon, carbon monoxide, ethylene, and acetylene.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0025, SYNTHESIS AND SPECTROSCOPIC INVESTIGATION OF INORGANIC MATERIALS POSSESSING UNUSUAL ELECTRONIC PROPERTIES

G.A. Crosby, Washington State University, School of Arts & Sciences, Dept. of Chemistry, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DF042400; AFOSR-76-2932)

AF function - advanced aircraft employ avionic and weapons systems with increased performance requirements. Deficiency - functional components for electromagnetic and electro-optical systems require materials with tailorable and predictable properties. Objective - the objective of this research is to utilize transition metal complexes and their charge-transfer excited states in solids to guide the design of new electronic materials. How work contributes - highly specialized materials could result in significant performance improvement in Air Force electronic displays, non-linear optics, electro-optical devices, and laser systems.

The research encompasses chemical synthesis, optical absorption, emission and reflectance measurements, and the determination of the effects of external magnetic fields on excited solid state properties of complementary inorganic complexes whose electronic structures suggest the incidence of strong solid-state interactions where the units are incorporated with solids. These include complexes of d-6, d-8 and d-10 ions from all the transition series with emphasis on those whose low-lying excited states are charge transfer in nature and those with high electronic affinities. Special emphasis is placed on mixed-ligand materials and sulfur coordination. There will be increased emphasis on measurements at low temperatures as the role of isolated systems in solid state interactions become defined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0026, SURVEILLANCE - PRIMARY PHOTOPROCESSES

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Tunable lasers and, in particular, dye lasers are of considerable interest to the Navy for application in communication systems, in systems for underwater photography and in systems for rescuing downed naval aviators. Limited accessibility for servicing and restrictions on available space place a high premium on reliability and the overall electrical efficiency of such systems. It is the purpose of this research to find and to study short-lived, light absorbing species in dye lasers. The data obtained will be used to recommend changes in the molecular structure of the dyes that will lead to improved laser reliability and efficiency.

The short-time photophysics of triphenylmethane dyes will be studied. Work will also be carried out to determine products of dye degradation in a blue-green dye laser.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0027, MEASUREMENT OF THERMAL DIFFUSIVITY OF CARBON/CARBON FIBER COMPOSITES FROM 20 - 3000 DEGREES C

R. Taylor, University of Manchester, *Oxford Rd., Manchester, England, United Kingdom* (DF050060; AFOSR-77-3449)

AF function - weapon delivery. Deficiency - in order to design, develop and evaluate carbon/carbon composites for use in reentry vehicles and rockets, the transport properties must be determined to accurately refine the temperature field, and calculate the thermal response, within nosetips, heat shields, and rocket nozzles. Objective - in this research, detailed experimental data will be obtained and used to derive an analytical model which relates thermal diffusivity at temperatures up to 3300K to matrix properties, fiber volume and orientation, and pore structure of carbon/carbon composites. How work contributes - if a successful model is obtained, it will go a long way toward satisfying the noted deficiency. But in any case, the reliable thermal diffusivity data will in themselves be useful to AF technology.

Using the laser heating pulse method already developed at the University of Manchester, thermal diffusivity from ambient to 3300K will be measured for carbon/carbon composites of various geometries, fiber type and matrix properties. Samples, and all available information relative thereto, will be furnished by AFML. Additional characterization will be obtained by the contractor through metallography, electron microscopy and X-ray diffraction. Correlation of measured thermal diffusivities with structures and other properties, leading to semi-empirical heat transport models, will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0028, NEW MATERIALS FOR ELECTROCHEMICAL CELLS

J.B. Goodenough, University of Oxford, *S. Parks Rd., Oxford, England, United Kingdom* (DF049570; AFOSR-77-3402)

AF function - propulsion and power generation systems for operational vehicles and devices rely on electrochemical power sources, such as batteries and fuel cells. Deficiency - need for solid electrolyte materials and for information on the preparation and characterization of ionic conducting materials. Objective - work will be directed to the improvement of solid electrolytes, and of mixed electronic/ionic conductors for use in electrochemical cells. How work contributes - results will yield a better understanding of the preparation and characterization of new ionic conductors, both electronic insulators for electrolytes and electronic conductors for battery cathodes, and display purposes.

Emphasis will be given to the determination of thermochemical, structural, electrochemical, and transport data on selected solids relevant to their potential use as battery cathodes, display cathodes, or solid electrolytes. Work will concentrate on full characterization of the insertion compounds to lithium which form cathodically from the oxides of molybdenum, vanadium and manganese. Electrochemical and standard thermodynamic functions will be measured for the reactions. Quantitative information on the mobility of the alkali-metal species in the parent oxide matrix will be obtained from pulsed NMR measurements. Design of new cathodic insertion systems with known skeleton and layer compounds that are good solid electrolytes will be initiated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, LOW COST LAUNCHER TECHNOLOGY EVALUATION AND INTEGRATION

J. Prater, U.S. Dept. of Defense, Army, Missile Command, Ground Equipment & Materials Directorate, *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1013)

The objectives of this task are A. Integration of low cost launcher technology into the free flight rocket technology program. B. determination of the effect low cost launcher technology has on mal-launch. C. Investigation of methods for eliminating blow-by in tip-off type launchers. D. Determination of mal-launch induced by blow-by elimination mechanisms.

Launchers using low cost technology will be designed and fabricated. Flight test will be performed using rocket motors developed under a low cost motor technology program. Optical lever and telemetry data will be used to determine rocket motions during launch. These data will be compared to data from earlier tasks to determine effect on launch accuracy.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Free Flight Rocket Technical Office

4.0002, FLUIDIC TECHNOLOGY INVESTIGATIONS - FLUIDIC ACTUATION SYSTEM

D.A. Millett, Signal Co. Inc., AiResearch Manufacturing Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DA0G1007; DAAK40 77 C 0163)

The objective of this task is to develop an air vane actuator using low cost and reliable fluidic valving techniques.

An actuator will be designed, developed and tested to use a two stage fluidic valve. The first stage of the valve will be a pin amplifier which will drive a diaphragm to actuate a flexible jet pipe. Warm gas from a solid propellant generator will supply power for the actuator.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Guidance & Control Directorate

4.0003, ELECTROMAGNETIC PULSE (EMP) PROPAGATION IN AN ELECTRON CONDUCTION PLASMA

R.N. Carlile, University of Arizona, School of Engineering, Dept. of Electrical Engineering, *Tucson, Arizona* 85721 (DF042680; AFOSR-76-2949)

AF function - the EMP created during a nuclear detonation may adversely affect AF systems depending upon its direction and magnitude The extent to which the plasma of the source region will interact and modify the EMP must be understood in order to harden aircraft effectively. Opportunity - the proposed research will aid in the understanding of the propagation of EMP through ionized media. Objective - this study will measure the energy absorption and heating of gaseous media by EMP when the media is immersed in a magnetic field. Contribution - a high gas pressure absorption that is much larger than that predicted by the swarm model has been measured experimentally and will be investigated further. Also, long time experimental energy emergence will be investigated further to find causes of the long time effects.

The absorption of energy from the EMP by the electron conduction plasma following a nuclear detonation will be studied in the presence of a superimposed magnetic field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

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4.0004, ELECTRONIC COMPONENTS FOR A/C PROPULSION CONTROLS

R.F. Potter, (No Performing Organization Reported), *California* (DN890085; N00019-78-M-0285)

A research study to examine and evaluate the impact future propulsion system controls will have on electronic components and constituent solid state materials.

Major aircraft engine companies will be contacted by the investigator to assist him in assessing electronic control needs for future high temperature jet engines.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0005, RAPID APPROACH FOR MISSILE SYNTHESIS (RAMS)

R. Bithell, General Dynamics Corp., *P.O. Box 1950, San Diego, California* 92112 (DF133140; F33615-78-C-3007)

It is often necessary to synthesize a large number of missile designs that meet different performance requirements so that mission effectiveness and design trade-off studies can be performed. To conduct these effectiveness and trade-off studies a rapid method or procedure is needed to synthesize various missile designs. This conceptual design procedure will allow one to select the most promising missile design for further exploratory development.

Develop a method to estimate the size, weight, range, maneuverability, accuracy, and cost for a conceptual air launched supersonic missile design. Using theoretical and empirical methods a procedure will be developed so that a missile design can be synthesized. By iterating the design through the established procedure a converged conceptual design will be obtained that meets desired performance specifications. From the converged conceptual missile design the various desired quantities can then be estimated. The procedure developed will be modularized and shall be such that a digital computer can be used to perform the calculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0006, ELF POLAR FADING STUDY

W.L. Imhof, Lockheed Missiles & Space Co. Inc., *3251 Hanover St., Palo Alto, California* 94304 (DN575307; N00014-75-C-0954)

In Navy ELF radio propagation measurements, unexplained amplitude degradation has occurred frequently. It is postulated that energetic electron precipitation into the lower D-region ionosphere is the source of the amplitude degradation. The verification of this postulate is important in the design and sizing of the Seafarer ELF FBM Communication System.

Electron precipitation data taken by the ONR/ARPA Gamma Ray Research Satellite will be analyzed to determine the correlation of the ELF fading with electron precipitation along the propagation path. These results will then be used to predict the magnitude of fading due to PCA events and other high energy electron precipitation events, thus allowing a design margin to be built into the Seafarer system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0007, RESEARCH ON NEW APPROACHES TO OPTICAL SYSTEMS FOR INERTIAL ROTATION SENSING

M. Chodorow, Stanford University, School of Humanities & Sciences, Dept. of Microbiology & Immunology, *Stanford, California* 94305 (DF044420; AFOSR-76-3070)

AF function - navigation, guidance and control of aircraft, spacecraft and missiles requiring sensors of angular rotation rate in inertial space. However conventional gyroscopic sensors pose cost and adaptation problems. Opportunity - although the coming use of ring lasers in strapdown systems will offer considerable advantages, proper use of new integrated optics and integrated circuit advances will minimize the cost and maximize the adaptability and availability of these new sensors which allow the direct measurement of absolute inertial rotation rate without requiring comparison with other standards for calibration. Objective - the intrinsic limitations of ring lasers are to be avoided by new approaches which have the potential for integrated optics implementation and high performance cost ratio. How work contributes - this research should lead to devices which are free from lock-in and bias effects encountered in conventional laser gyros, have high sensitivity and accuracy and allow ready adaptation to specific requirements such as size reduction, cost decrease or sensitivity increase and adaptation to a specific environment and geometry.

The new approaches are based on the Sagnac effect like the ring laser. However in contrast to the latter, the laser source is outside the ring, pulse transmission and amplification in a multiturn loop is used, which leads to a frequency readout signal equivalent to that of a conventional ring laser. Optical fiber waveguides appear promising for constructing the sensing loops, offering unique advantages in fabrication and application. Calculations have indicated sensitivities in measurement down to very low rotation rates suitable for future navigation systems. This phase of the investigation continues experiments with components of what is referred to as the Active Re-entrant Sagnac System (ARS) using a CW He-Ne laser and a passive multiple fiber loop, then recirculation and sampling and later active recirculating of pulses from a solid state laser.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, NAVY VEHICLES DESIGN AND CONSTRUCTION - AUTOMATIC WIND-POWERED PROPULSION SYSTEM

R.M. Baker, Transportation Sciences Corp., *Playa Del Rey, California* 90291 (DN875439; N00014-78-C-0358)

The objective of this task is to test a system of rigid airfoils with self-trimming vane controls. The tests will produce definitive data on the performance of a wind-powered propulsion system for a remotely piloted marine vehicle. This energy-saving propulsion system may become competitive with other propulsion systems for such vehicles when principles of aerodynamic balance can be utilized for the efficient trim of snail-type wings in normal wind and sea conditions.

The development of the water support system for this remotely piloted marine vehicle was privately funded. The design of rigid sail-type wings with self-trimming vane controls, or aerodynamic balance, was funded by the ONR technology program. Tests were not performed, and the performance of this automatic wind-energy propulsion system remains to be demonstrated. A computer simulation of the craft exists in which these test data can be used to determine performance characteristics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, PARACHUTE ENERGY ABSORBING DEVICES

L.C. Wickman, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN937025)

To provide fleet emergency egress systems with energy absorbing devices which will limit the deceleration applied by the parachute to aircrew men during deployment. Objective of this development will be to reduce peak decelerations from 40 g's to 15-20 g's. Such load reductions on personnel and equipment will extend the useful range of the survival equipment while reducing injury potential to personnel. Goal: limit maximum g loading attributed to parachute opening on aircrew men to 15-20 g's.

Metal deformation devices, high elongation polymers, and tearing devices were constrcuted and tested. All of these systems resulted in technical difficulties and/or undesirable features. In order to retrofit existing parachute/ejection seats, low bulk/weight/cost and adequate force limitation are all prime requisites. Present effort is centered upon ply-tear webbing, metal or plastic extrusion, and rotary metal deformation as the most promising energy absorbing mechanisms. These types of devices are being designed, fabricated, and competively tested and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0010, IDENTIFICATION OF FLAWS IN HIGH PERFORMANCE CERAMICS

G.H. Sines, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DF049820; AFOSR-77-3425)

AF function - ceramic electromagnetic windows for radar and target acquisition allow combat aircraft to operate in all weather conditions. Deficiency - ceramic windows are, however, subject to brittle fracture originating from preexisting defects. Objective - the objective of this research is to identify the source and character of the defects which lead to mechanical failure in ceramic components. How work contributes - identification of the sources of failure is necessary in order to design nondestructive evaluation (NDE) techniques to find and reject components having unacceptable preexisting defects.

An eccentrically loaded column bend test will be developed to enable a number of small cracks (equivalent to 20) to grow without catastrophic failure occurring from just one worst flaw. The selective nature of slow crack growth from certain categories of flaws will be determined. New techniques which permit the identification of many flaws (greater than 10 to the 4th power) from the study of microspallation of a single compressively loaded specimen will be correlated with tensile fracture initiation sites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, FINE SCALE STRUCTURE OF TURBULENT VELOCITY FIELDS

F.H. Champagne, University of California, San Diego Campus, School of Engineering, Dept. of Applied Mechanics & Engineering Science, *P.O. Box 109, La Jolla, California* 92037 (DF046560; AFOSR-77-3172)

AF function - advanced aerospace vehicles. Deficiency - lack of understanding about turbulence and turbulent flows. Objective -investigate the phenomenon of relaminarization of turbulent pipe flow. How work contributes - many applications of interest to the Air Force are subject to relaminarization, i.e. diffusers and augmentors. Better knowledge of the basic mechanism of the relaminarization process will provide a better understanding of turbulence and transition to turbulence. This will be directly applicable to the design of future aerospace vehicles.

The experimental program for the relaminarization of turbulent pipe flow will be continued. Emphasis will be placed on determining the nature of the flow field for Reynolds numbers from 1900 to 3000 at 50 to 150 diameters downstream of the diffuser. The origin and evaluation of turbulent puffs will be studied for various Reynolds numbers in the relaminarizing flow. Data on the development of the puffs will be obtained using upstream flush mounted hot wire probes and an array of ten hot wires spanning the radius of the pipe.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, MATERIAL SUPPORT TECHNOLOGY - HIGH FIELD IN ELECTRON TRANSPORT IN SEMICONDUCTORS

D.K. Ferry, Colorado State University, School of Engineering, Dept. of Electrical Engineering, *Fort Collins, Colorado* 80523 (DN875150; N00014-78-C-0124)

Improvement in or development of new electron devices for Navy electronics systems will require better understanding of the basic interactions of electric-field-driven electrons with the device material. Electron transport in advanced wide-bandgap semiconductors and insulators and in the interfacial region formed at the joining of two solid materials needs to be investigated.

High field transport of carriers in semiconductors will be studied theoretically and experimentally. There are four separate problem areas: (1) a theoretical study of the transport in the quasi-two-dimensional system such as the quantized inversion layer in MOS silicon devices, which will explore the scattering mechanisms in a two-dimensional electron gas and the effects of a nearly amorphous dielectric; (2) a combined theoretical and experimental study in wide bandgap semiconductors such as silicon dioxide and silicon carbide. Silicon carbide has great potential for applications to high temperature electronics, but many properties must be evaluated; (3) pico second optical pulses will excite fast electrons which lose energy to the lattice phonons. These interactions will be clarified in concept, and electron-phonon interaction strengths determined; (4) scattering mechanisms will be studied theoretically and experimentally in mixed cyrstal ternary and quaternary semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0013, INTENSE RAINFALL RATES AND THEIR EFFECTS ON MICROWAVE ATTENUATION

H.W. Hiser, University of Miami, School of Engineering & Environmental Design, Dept. of Mechanical Engineering, *Miami, Florida* 33124 (DA0F9111; DAAG29-77-G-0227)

To investigate intense rainfall rates such as occur in subtropical storms and their effect on microwave attenuation. Relevance - rainfall attenuation of electromagnetic propagation at microwave frequencies poses a serious problem for communication, navigation, homing and other related systems to be deployed for use in the 1980 time frame.

Three-dimensional models of rainfall rates in intense rain storms such as occur in subtropical storms will be developed using simultaneous measurements from rain-gages, radars and satellites. The resulting models will be used to predict microwave attenuation along horizontal and slant paths through the atmosphere, and to explain the attenuation observed during a 'COMSTAR Satellite K-band Propagation Experiment' conducted by the University of South Florida.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0014, COMPRESSOR RESEARCH FACILITY

J. Untz, Cadre Corp., *2845 Clearview Pl., Atlanta, Georgia* 30362 (DF455760; F33615-73-C-2030)

The objective of this program is to contribute to the advance of the state-of-the-art of turbine engine compressor technology by (1) supporting exploratory and advanced development of compressor design, (2) improving compressor component characteristics, (3) determining steady-state and dynamic air flow characteristics, and (4) determining effects of steady-state and transient air flow on compressor performance.

The approach is a three contract, turn key effort having five (5) phases. Phase I - detail design; phase II - equipment procurement; phase III - installation; phase IV - inspection and maintenance of existing equipment; phase V - test and inspection. AFAPL utilizes a 10-man team to monitor the program (see Accession 455770 AFAPL in-house 30660412).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0015, MODULAR AVIONICS PACKAGING/STANDARD AVIONICS MODULE

R.H. Huss, U.S. Dept. of Defense, Navy, Naval Avionics Center, *Indianapolis, Indiana* 46218 (DN897005)

To develop a total avionics packaging concept for future Navy aircraft. Key technical performance objectives are to significantly increase system reliability, maintainability, and supportability while at the same time achieving avionics weight and volume reductions. The driving performance parameters are based on the projected requirements of the V/STOL 'A' aircraft.

The approach is to utilize integrated rack and standard module configurations for packaging of future avionics. The integrated rack concept has been shown to increase thermal efficiency (hence increase reliability), reduce weight and volume, and increase system maintainability. The standard module concept has been shown to increase reliability and reduce supportability costs. Prototype configurations will be developed, fabricated, and evaluated in laboratory and flight tests to demonstrate feasibility of the total concept.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0016, QUASI-OPTICAL TECHNIQUES FOR MILLIMETER AND SUBMILLIMETER-WAVE CIRCUITS
T. Itoh, University of Kentucky, Graduate School, *Limestone & Euclid, Lexington, Kentucky* 40506 (DA0F9077; DAAG29-77-G-0220)

To investigate both theoretically and experimentally a class of dielectric transmission lines suitable for millimeter and submillimeter wave components and integrated circuits. Relevance - results of the study are directly relevant to Army systems requiring low cost, reproducible millimeter wave components. Reviewers from miradcom and ECOM mention applications to missile sensors and terminal guidance, radar for mini-remotely piloted vehicles and communications.

To utilize surface wave propagation guided on the interface between a dielectric slab and a dielectric strip as a building block for millimeter wave integrated circuits. Particular emphasis will be placed on the utilization of grating structures within the guiding region to obtain (1) leaky-wave antennas and (2) high-Q band-pass and band-reject filters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0017, FLIGHT DYNAMICS--RESEARCH IN AERODYNAMICS--RESEARCH IN BALLISTICS
R.H. Krieger, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0N4437)

This project covers exterior ballistics research in aerodynamics related to projectiles and missiles and the factors affecting their flight behavior and environments. Significant studies undertaken involve methods to obtain static surface pressure measurements on non-spinning secant-ogive-cylinders; to develop a method and obtain surface pressure measurements on spinning bodies of revolution using a wind tunnel telemetry technique and to develop a finite difference computer program for computing the three-dimensional boundary layer development on spinning bodies.

These objectives are to be met through theoretical analysis and experimental testing in the BRL closed circuit variable density, continuous flow supersonic wind tunnels.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0018, STRUCTURAL RESPONSE ANALYSIS
J.M. Santiago, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0M4547)

The objectives are to enhance and augment existing structural response computer code capabilities in order to more realistically assess blast and fragment induced damage to complex engineering structures used by the Army (such as helicopter airframes, armored vehicle bodies, equipment shelters, reentry vehicles).

Effort will be made to acquire and implement on the BRL computer the most suitable finite element structural dynamics program capable of treating the nonlinear anelastic transient response of bulkheaded, stringered shell structures typical of airframe and armored vehicle construction. The initial phase of the effort would involve a literature search and evaluation of existing programs. After implementation of the program, suitable modifications to enhance treatment of new problems as encountered will be made. A subsidiary effort will be performed to enhance the strain predictions and boundary modeling capability of our inhouse finite difference structural response program, REPSIL, and to modify the REPSIL/PETROS family of programs to treat cutouts and access openings by coding internal free edge boundaries.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0019, TRANSIENT RADIATION EFFECTS IN DIELECTRICS
H.E. Boesch, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Harry Diamond Lab., *2800 Powder Mill Rd., Adelphi, Maryland* 20783 (DA0B5646)

Perform research, analysis, and testing to develop a better understanding of transient nuclear radiation effects on dielectric materials. The goal is to gain sufficient knowledge to accurately predict the response of materials and devices (integrated circuits, capacitors, cables) to nuclear radiation or to design these entities to assure proper operation in a radiation environment.

Determine the physical mechanisms of the permanent and transient radiation damage in organic and inorganic dielectric materials used in semiconductor devices, cables and capacitors. The charge generation, recombination, transport and trapping properties of the insulator will be determined following a short radiation pulse. The time dependence of the charge transport and the buildup of trapped charges in the bulk and at the insulator/metal or insulator/semiconductor interfaces will be examined. In the semiconductor devices mechanisms responsible for radiation induced interface states will also be investigated. Models describing the radiation response will be developed.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Harry Diamond Lab.

4.0020, LARGE APERTURE SYSTEM APPLICATIONS
Unknown, Charles Stark Draper Lab. Inc., *68 Albany St., Cambridge, Massachusetts* 02139 (DF911430; F30602-78-C-0128)

The objective of this effort is to assess active control concepts for disturbance suppression and performance enhancement of large aperture, ultra-lightweight space radar antennas. Also to develop design criteria for improved performance of such antennas with and without active control.

Active control approaches shall be analytically investigated for distortion suppression of modeled disturbance characteristic of large aperture, ultra-lightweight radar antennas for space applications. Mechanical/electrical implementations shall be assessed for both reflective and phased array antennas. Performance benefits shall be contrasted against passive distortion suppression approaches.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0021, FRACTURE MECHANICS AND BUCKLING
B.B. Budiansky, Harvard University, Cambridge Campus, School of Engineering, Dept. of Engineering & Applied Science, *Cambridge Station, Cambridge, Massachusetts* 02138 (DF049000; AFOSR-77-3330)

AF function - aerospace vehicles require improved understanding of fatigue and fracture processes so that designs of enhanced durability can be achieved. Deficiency - current design methodologies for structural failure are empirical in nature and result in premature failures and excessive inspection and space parts costs. Objective -the principal objective of this research effort is to understand the behavior of cracks and flaws in metallic structures. In particular, this research will investigate the influence of nonlinear material behavior in the vicinity of cracks on crack growth and fracture characteristics. How work contributes - based upon a deeper knowledge of crack behavior, improvements in airframe and engine designs can result which reduce Air Force cost of ownership.

This research is theoretical in nature. Theories will be studied which improve the predictive capability of establishing stress concentration factors when material plasticity is involved. These studies will include plasticity effects on stationary and growing cracks. In addition, plasticity effects on fatigue crack growth will be investigated and retardation factors investigated. Finally, within this framework the influence of creep on crack growth will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022. BASIC INSTABILITY MECHANISMS IN CHEMICALLY REACTING SUBSONIC AND SUPERSONIC FLOWS

T. Toong, Massachusetts Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF005060; AFOSR-78-3662)

AF function - advanced air-breathing combustion engines and chemical explosive weapons, weapon delivery and defense, close-air support. Deficiency - insufficient understanding of instability mechanisms, basic to many problems involving chemically reacting subsonic and supersonic flows associated with advanced air-breathing propulsion engines, chemical explosive weapons and lasers. Objective -to understand and develop accurate theoretical and mathematical models realistically describing the instability mechanisms involved in the mutual influence among sound, entropy, and vorticity modes in chemically reacting flows. How work contributes - will provide additional fundamental understanding and realistic analytical modeling of the various interactions involved in triggering and sustaining instabilities in reacting flow field, will contribute to resolving some of the controversies associated with ignition and propagation of unconfined fuel-air explosions, will aid in design and development of advanced stable power and propulsion systems and fuel-air explosive devices and chemical lasers, will aid in alleviation of noise pollution and in effective control and prevention of explosions.

Study will be made of instability mechanisms, basic to many problems involving chemically reacting subsonic and supersonic flows, e.g., problems related to combustion instability, chemical noise, detonation wave structure and stability and ignition, turbulence spectra in reacting flows, etc. Included will be studies of (1) chemical effects on generation and amplification (or attenuation of acoustic and non-acoustic (chemical) waves and their propagation), (2) chemical effects on generation of vorticity, (3) chemical effects on interactions among the three basic fluctuation modes in turbulence, viz, sound, entropy, and vorticity, (4) energy transport mechanisms among the fluctuation modes with and without chemical reaction, (5) non-linear wave kinetic interactions, (6) initiation and suppression conditions of explosions. In the experimental investigation, both Schlieren visualization and microphone monitoring will be utilized. Realistic mathematical models will be formulated and theoretical analyses will interpret the experimental results, with emphasis on elucidating the basic energy transport mechanisms involved in the interactions between chemical reaction and turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023. FINITE ELEMENT SOLUTIONS TO TRANSONIC FLOWS IN AXIAL FLOW TURBOMACHINES

S.S. Wang, University of Mississippi, University Campus, School of Engineering, Dept. of Mechanical Engineering, *101 Carrier Hall, University, Mississippi* 38677 (DF043320; AFOSR-76-2982)

AF function - advanced gas turbine engine technology. Deficiency -lack of fundamental knowledge on flows through axial flow compressors. Objective - develop a numerical solution technique which can handle transonic flows through turbomachinery. How work contributes - better knowledge of flow fields through turbomachinery will allow designers to improve present empirical techniques used today in designing advanced turbomachinery compressors.

A numerical solution technique based on the finite element method for solving the fluid flow through an axial flow compressor will be developed for blade to blade flow. Once blade to blade flow has been shown to be solved, the results will be applied to the solution of meridional plane flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024. EFFECT OF STRUCTURAL PARAMETERS ON ROTOR BLADE VIBRATIONAL CHARACTERISTICS

D.A. Peters, Washington University, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (DA0F8964; DAAG29 77 G0103)

(1) To find the relationships between structural parameters and rotating beam vibrational characteristics; (2) develop an adequate model of the phenomenon; and (3) develop efficient computational methods for solving the problems of flap-lag-torsion vibrations of rotor blades. Relevance - highly relevant to current rotorcraft dynamics problems.

The approach will be theoretical using both modal and finite element techniques.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0025. ADHESION AND PHYSICS OF ICE

D. Itagaki, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (DA0D8151)

To provide fundamental knowledge of the mechanisms and properties of ice adhering to surfaces of fixed and rotary-wing surfaces as well as other surfaces where the accretion and adhesion of ice interferes with the operation of materiel. To establish basic principles involved in the development of methods and techniques to remove ice from surfaces. To explore and develop means to prevent and/or alleviate icing. To evaluate and predict incidence and intensity of icing on the basis of readily available meteorological parameters.

The required information will be generated by a coordinated sequence of investigations including microscale evaluation of the physics and properties of ice adhering to interfaces, examination of the mechanisms of crack propagation in ice near an interface, and investigation of the interrelationships and influences of electrical properties on the mechanical properties of ice. Studies will also be pursued to determine in more detail the actual mechanism of accretion with attention centered on the freezing process of small droplets from the time they first impact to the time when they are frozen (accreted) or removed by the ambient air stream. Information developed will be disseminated to users and other project participants to provide a basis for improved design and performance of materiel. Foreign state-of-the-art is being considered.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

4.0026. SEPARATED FLOW AND TURBULENT BOUNDARY LAYER RESEARCH

S.M. Bogdonoff, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DF041440; F44620-75-C-0080)

AF function - aerospace vehicles. Deficiency/opportunity - turbulent boundary layers and separated shear layers in supersonic flow are commonplace on airplanes, engine inlets and internal flow passages. Hypersonic turbulent boundary layers occur on reentry vehicles. In both cases the aerodynamic and heat protection design is often dominated by the necessity of coping with the turbulent boundary layers or the possibility of their occurrence. More complete understanding of these boundary layers could improve the design procedures and make it possible to build less costly and more effective aerodynamic and heat protection components. Objective - to conduct experimental studies in the following areas: 1) turbulence structure of an equilibrium, supersonic, high Reynolds number wall boundary layer, 2) detailed flow field structure of a two-dimensional supersonic turbulent shear layer reattachment region, 3) structure and properties of hypersonic turbulent boundary layers, and 4) structure of hypersonic turbulent free shear layers. How work contributes - increased understanding of the phenomena in these problem areas will permit significant improvement in designs of aerodynamic and thermal protective components of aerospace vehicles. Improvements may be in the form of increased vehicle capabilities or better cost-effectiveness.

Experiments will be performed in supersonic and hypersonic flows of air, helium, and nitrogen in the extensive gas dynamics laboratory facilities at Princeton University.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, CHANGE IN REFLECTIVITY OF METALS UNDER INTENSE LASER RADIATION

W.T. Walter, Polytechnic Inst. of New York, Brooklyn Campus, Graduate School, Dept. of Electrical Engineering & Electrophysics, *333 Jay St., Brooklyn, New York* 11201 (DF051660; AFOSR-78-3557)

AF function - aircraft operating in future hostile engagements must be protected from intense laser radiation. High power lasers are also used for cutting, machining, drilling, heat treating and welding metals. Deficiency - the absorption of energy by the metal is critical in all cases and experimentally the reflectivity of a metal has been observed to decrease rapidly, by as much as a factor of 10, during a laser pulse of sufficient intensity. Objective - this research seeks to understand the mechanisms which couple energy from the electromagnetic beam into the material surface and results in the rapid loss of reflectivity. How work contributes - once the mechanisms are known, progress toward optimizing reflectance or absorption can be made by altering the chemistry and or microstructure of the materials.

An experimental program which is closely tied with an ongoing theoretical effort will be initiated. Reflectivity measurements of metal surfaces under intense laser radiation will be conducted in real-time using reflected laser light and a probe light source. Time histories of metal surface reflectivity during laser irradiation will be compared with theoretical predictions of nonlinear effects, surface deformation and vaporization or plasma blowoff to attempt to explain the steep initial decrease in metallic reflectivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, ANTENNA FEED TECHNIQUES

P.R. Franchi, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903710)

To provide a simple design that will have very low sidelobe yet will be capable of electronic scan in elevation with a wide bandwidth. The requirements of possible future tactical air surveillance radars are the goals set for this effort.

The design, fabrication and testing of a (pill-box type) reflector-feed system. This type antenna will provide information on the azimuth pattern of a large parabolic cylinder with a phased array feed system. The feed spillover, illumination taper, and impedance and reflector tolerance are the critical concerns.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0029, PRECISE REFRACTION CORRECTION SYSTEM FOR SLBM RADARS

L.E. Telford, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF901240)

AF function - improve techniques for providing tropospheric refractive bending and range error corrections for precision radar and navigation systems. Deficiency or opportunity - present methods of correcting for tropospheric refractive bending and range error assume a horizontally stratified atmosphere and rely on data collected at one surface site. For low elevation angles these methods usually fail since the ray traverses long horizontal distances and the assumption of horizontal stratification is not met. This results in unacceptable refraction correction for low elevation angle tracking. Objective -design, fabricate and test a three frequency millimeter wavelength radiometer system to provide atmospheric emission data which has been shown to improve low elevation angle refraction correction prediction. How research contributes - atmospheric emission data at millimeter wavelengths have been found to be of value in improving the prediction of refractive bending and range error at low elevation angles.

A prototype of a three frequency radiometer system will be procured under contract and tested under pseudo-operational condition at one of the USAF precise radar sites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0030, STABILITY AND DYNAMICS OF ELASTIC STRUCTURES AND FLUID FLOWS

E.L. Reiss, Miami University, Graduate School, *Oxford, Ohio* 45056 (DF053290; AFOSR-78-3663)

AF function - to design stable aerospace structures. Opportunity -a new mathematical approach to buckling in the presence of imperfections and to secondary buckling. Objective - aircraft structural design techniques are almost entirely based on linear elastic models. Present aircraft, however, operate in the nonlinear elastic regime with portions of the structure buckled or wrinkled. Improved nonlinear design techniques are being sought. How work contributes - original techniques for predicting catastrophic and secondary buckling and flutter.

Asymptotic techniques of stretching and matching yield of non-singular equations which extend bifurcation theory. This extended theory will be explored in the contexts of buckling with imperfections, secondary buckling, and nonlinear dynamic stability. Possible directions of research include extension of the theory to the more imperfection-sensitive bifurcation points of high multiplicity, periodic and quasi-periodic fluid structure interaction such as aircraft panel flutter, a statistical theory of bifurcation permitting direct determination of statistics, forced oscillation of nonlinear systems, and laminar flow transition to turbulence or chaos. Work on wave propagation in thin elastic structures, and nonlinear wave motion in air will be explored also by asymptotic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATION

T. Compton, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DN890051; N00019-78-C-0131)

The objective of this program is to investigate techniques for using adaptive antenna concepts appropriate for use in conventional airborne military communications systems to reduce or eliminate signal interference.

The research study on adaptive antennas will include (1) concepts for identifying single side band (SSB) and frequency shift keying (FSK) signals without increasing the bandwidth of the system, (2) techniques of frequency acquisition in adaptive arrays, and (3) investigation of methods for phase tagging desired signals that do not produce significant envelope distortion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0032, ROTOR FLOW FIELD RESEARCH IN LOW-SPEED HELICOPTER FLIGHT

H.R. Velkoff, Ohio State University, Columbus Campus, School of Engineering, Dept. of Mechanical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DA0E9182; DAAG29 76 G0260)

To experimentally examine and define representative flows past rotors and rotors-fuselage-empennage configurations which model a helicopter in a transitional flight regime. This research investigation is highly relevant to ongoing research at AMRDL in rotor aerodynamic environments characteristic of NOE operations and hence will impact the technological requirements of improved airfoil design, performance, dynamics and handling qualities.

Model rotors, fuselages, and empennages will be designed, fabricated and put in a small wind tunnel, and tests will be performed which consist of measurement of velocity distributions in the wake as well as flow visualization to define the characteristics of the flow peculiar to rotors in low advance-ratio flight regimes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0033, AVIONICS EVALUATION PROGRAM

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Perform in-house analyses of air-to-ground weapon system concepts utilizing a computerized model. The analyses quantitatively assess the impact of avionic reliability, subsystem performance and system survivability on mission effectiveness. Sensitivity and trade-off analyses performed under this effort will provide performance data to engineers involved in concept synthesis and analysis.

Utilize the Avionics Evaluation Program (AEP) to perform trade-off and sensitivity analyses. The AEP is an air-to-ground mission effectiveness model which has been implemented in a conversational interactive graphics mode. Data generated using the AEP include number of targets killed, targets acquired, A/C lost and mission aborts, avionic utilization data, avionic black box failures, subsystem performance data and weapon delivery error sensitivities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0034, GROOVED RADOME AERODYNAMIC TESTING

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The objective is to determine aerodynamic performance of broadband orthogonally grooved radome configurations when designed for millimeter wavelength (30-100 GHz) frequencies. The radome mockups will have shallow (.050 inch) longitudinal grooves on the exterior surface with similar orthorgonal grooves on the inner surface. The general radome mockup shape will be that of a 6/10 inch diameter air-to-air missile. There is similar interest in aerodynamic performance for A/C leading edge wing installations for threat warning receiver applications. The purpose of the aerodynamic testing is to determine feasibility of exposed grooves designed for millimeter wavelength frequencies, such that detailed electrical design, development, and testing can be initiated in FY78.

This program will be accomplished through the AF Flight Dynamics Lab drawings of the radome mockup exterior shape and groove dimensions will be given to AFFDL. Construction of the mockup will be accomplished by one of their local support contractors. Testing and data reduction will be performed in-house by AFFDL. The principal measurement to be made is aerodynamic drag induced by the presence of the grooves. Testing will be initially made with grooves in place, subsequently, the grooves will be filled with clay to collect comparative ungrooved data. Contingent upon successful aerodynamic drag test results, a program will be initiated in FY78 to develop and test both ceramic and plastic millimeter radomes for missile and A/C applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0035, INVESTIGATION OF COHERENT STRUCTURE IN THE TURBULENT BOUNDARY LAYER

D.E. Abbott, Lehigh University, Graduate School, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DF052500; F49620-78-C-0071)

AF function - advanced aerospace vehicles. Opportunity - provide better understanding of the structure of turbulent boundary layer flows. Objective - to disclose the three-dimensional details of the convected coherent structures of turbulent boundary layers and to develop new flow models for improved predictive methods. How work contributes - new and improved prediction methods for turbulent boundary layer flows are needed by designers of advanced aerospace vehicles. This effort is directly related to providing this information.

Flow visualization of wall boundary layer flows in a water channel using transverse and vertical hydrogen bubble wires will be observed in a convected frame of reference. Video presentations of the flows will be made using orthogonal views of the structure of the turbulence or detailed views of a portion of the boundary layer while simultaneously viewing the entire layer. Quantitative data of the turbulence will be obtained through digitization of the video data and by hot-film measurement. The effects of surface roughness, transpiration and suction will be investigated. Interactive theoretical studies will be conducted to provide analytical expression and theoretical basis for the observed phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, INVERSE SCATTERING - IONOSPHERIC STRUCTURE DETERMINATION

J. Cohen, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DF052790; AFOSR-78-3608)

AF function - radio communication and control. Opportunity - a newly developed method for data processing seems applicable to ionospheric probing. Objective - real-time measurement of F layer irregularities. How work contributes - scintillation characteristics of radio wave propagation will aid development of optimized modulation and diversity schemes.

Present ray based algorithms for ionospheric probing induce only the near side of peaks in index of refraction. Newly developed wave based inverse scattering techniques seem capable of determining the far side of the peak as well. Amplitude and phase data versus frequency for vertical propagation will be obtained on a quiet day near the magnetic equator. A definite variational principle for the Gelfand Levitan equation will be used to construct and obtain error bounds for the variation of index of refraction in the F layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0037, SAW RESONATORS

W.R. Shreve, Texas Instruments Inc., *13500 N. Central Expy., P.O. Box 5621, Dallas, Texas* 75222 (DN680329; N0004-75-C-0824)

There is a need for improved secure and covert communications systems for applications ranging from voice communications to remotely piloted vehicles. The objective of this program is to develop advanced state-of-the-art VHF and UHF signal processing components for communications systems under development.

High Q filters will be developed for the VHF and UHF bands using SAW resonators. Basic limitations of these devices will be identified and overcome so far as is practical or is required for systems applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0038, ATMOSPHERIC TURBULENCE EFFECTS ON THE TEMPORAL-SPECTRAL DENSITIES OF OPTICAL SIGNALS

J. Smith, University of Texas, El Paso Campus, School of Engineering, Dept. of Electrical Engineering, *El Paso, Texas* 79999 (DA0H5579; DAAG29-78-G-0027)

To develop models for optical crosswind systems to describe the temporal spectral densities of remote scenes viewed through a turbulent atmosphere. Relevance - atmospheric turbulence effects over different ranges are important in several laser propagation systems being developed or currently used in the Army. ASL is particularly interested in turbulence effects in the laser remote sensing crosswind measurement system under development for use in the main battle tank. 'The program could be relevant and important for laser weapon systems or systems employing laser guidance.' (MICOM). 'The resolution of the effects of saturation is fundamental to the application of this scheme (optical measurement of wind) under many turbulence-path-length conditions.' (BRL).

Simulataneous measurements yielding the spectral densities obtained from intensity and angle of arrival fluctuations of remote scenes and of beams from coherent sources will be made over 0.5 km and 2.0 km horizontal paths during periods of strong and weak turbulence and a variety of wind conditions. The spectral characteristics will be compared with in-situ measurements of related meteorological parameters to check the validity of the model predictions. Upon establishment of the expected spectral characteristics, spatial and temporal filters will be used to obtain wind profiles along the path.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0039, POSITRON ANNIHILATION STUDIES OF DEFECTS IN SOLIDS

J.G. Byrne, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Mechanical Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF040820; AFOSR-75-2810)

AF function - nondestructive evaluation (NDE) of materials before and during service saves the Air Force many lives and millions of dollars annually. Structural (airframe) and high performance (turbine engine) materials must be inspected periodically and evaluated to determine their continued use or need for replacement. Deficiency - many critical defects such as metal fatigue and small cracks are impossible to evaluate with current nde techniques. Objective - this research seeks to develop a new technique, positron annihilation, to inspect small internal defects in metals. How work contributes - early detection of fatigue and other types of damage in operational structures is essential to their continued reliable, safe operation.

Positron annihilation techniques will be used to study pure aluminum and alloys of Al-Cu, Al-Zn, Al-Li, 7075 and 2024. Aging and deformation conditions will be studied to assess the utility of this method for nondestructively evaluating the structural properties of aluminum alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0040, RESTORING IMAGES DEGRADED BY ATMOSPHERIC TURBULENCE

C.K. Rushforth, Utah Higher Education System, Utah State University, School of Engineering, Dept. of Electrical Engineering, *Office in Engineering, Room L50, Logan, Utah* 84321 (DF047250; AFOSR-77-3212)

AF function - surveillance and detection of missiles and satellites. Deficiency - degradation of images produced by atmospheric turbulence. Objective - to produce a practical procedure for achieving increased resolution in the presence of atmospheric turbulence. Contribution - increase of resolution in images degraded by atmospheric turbulence.

Initial efforts conducted on one- and two-dimensional simulations of two recently (1976) proposed techniques of image restoration will be refined and improved using existing statistical models of the atmosphere and of sensor noise. The Knox-Thompson procedure obtains amplitude and phase information separately from two different averages taken over a number of short-time images. The amplitude and phase are then combined to obtain estimate of the object intensity distribution from the inverse Fourier transform. The Sherman procedure treats the object as a whole and solves an integral equation in terms of measured data and known statistical parameters. Modified or alternative procedures will be sought which have better performance and reduced computational requirements. Underlying approximations will be investigated and such features as sparse matrices will be exploited to facilitate computation. The best procedure will be applied to a large quantity of astronomical data to improve the procedure and increase our understanding of its operation and to obtain significant astronomical results. Suitable data will be obtained through continued collaboration with Kitt Peak Observatory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0041, MIXING OF SWIRLING FLOWS AND BEHAVIOR OF WET FLOWS

G.C. Oates, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF052130; F49620-78-C-0063)

AF function - advanced turbomachinery. Opportunity - improve our understanding of the flow through an axial flow turbomachine. Objective - to conduct an investigation into 1) the mixing behavior of swirling flows and 2) the effects of water droplets and water vapor on the flow processes within transonic fans. How work contributes - will provide fundamental knowledge needed in order to provide solutions to two constantly reappearing problems of high performance turbomachinery.

An investigation will be conducted in two areas. In the first area, which will study the effect upon mixing by swirling the inner stream of two co-annular streams, the first step will be to construct the required test facility. Once completed, detailed investigations concerned with obtaining data on the mean flow will be carried out. Parameters to be varied will include degree of swirl, pressure gradient and variation in geometric shape of inner annulus. In addition, a theoretical investigation will be carried out with the goal of developing a method capable of predicting the mixing behavior of swirling flows. In the second area, which will study the effect of water droplets and water vapor on the flow processes, the experimental study will study the behavior of water droplets passing through a shock. An extension of Marble's theory would also be undertaken. Results of analysis and experiment would be compared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, LATITUDINAL STRUCTURE OF SOLAR WIND STREAMS FROM RADIO SCINTILLATION OBSERVATIONS

B.J. Rickett, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (DF248790; F19628-77-C-0161)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate means to determine conditions within solar-wind streams. Objective - to recognize from coronal radio and optical observations which high latitude coronal structures can give rise to solar wind streams in the ecliptic. How research contributes - provides the observational tools necessary to predict conditions in the solar wind as it effects the terrestrial space environment.

Observe the solar wind speed in and out of the ecliptic by the method of interplanetary radio scintillations and compare these with geomagetic and coronal optical observations. These data will then be compared with spacecraft observed solar wind data to infer correlations among the various types of data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0002, ATMOSPHERIC PHYSICS (ATMOSPHERIC ELECTRICITY AND CLOUD PHYSICS)

W.A. Hoppel, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN480215)

Provide new and improved capabilities to the Navy in overcoming operational difficulties caused by hazardous environmental conditions and in using the environment to an advantage. Achieve a better understanding of cloud and fog dynamics, nucleation, glaciation, condensation, atmospheric electrification, pollution, and atmospheric radioactivity.

Perform interrelated laboratory, field, and modeling experiments and develop the theoretical tools necessary to explain and predict the observed results. Field experiments include the use of aircraft, ships, and ground field sites as platforms for data acquisition. The data acquired from laboratory and field investigations are analyzed and compared to the predictions of current theoretical models with the aim of improving these models and our understanding of atmospheric physics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0003, ENVIRONMENTAL SUPPORT TECHNOLOGY - MARINE GEOCHEMISTRY AND ITS EFFECT ON NAVAL OPERATIONS

F.K. Lepple, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN020191)

To investigate the chemistry and distribution of aerosols in the marine environment; to relate aerosol composition to different sources (the oceans, the continents, volcanism and atmospheric processes) and to meteorological events and geogrpahical location; to investigate the chemical composition of the boundary layers at the air-sea interface. The Navy needs this information for ASW remote sensing technology and for long-range weather prediction.

Marine aerosol samples are collected aboard ships and aircraft over different ocean areas mainly employing NRL-developed sampling devices. Chemical composition of these marine aerosols including sea fog and rain is determined by instrumental neutron activation analysis, X-ray methods and various wet chemical and spectroscopic techniques. Equipment and methods for real-time monitoring of related parameters are simultaneously evaluated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0004, CONTINUOUS OPERATION OF THE GEORGIA TECH METEOR WIND RADAR 1978-81

R.G. Roper, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (ATM7811741)

This grant funds a program of research which continuously measures the winds at mesopause altitudes (80-100 km) above Atlanta (34 degrees N, 84 degrees W) using the established Georgia Tech Radio Meteor Wind Facility. Those measurements which have been made since August, 1974, have shown the necessity for continuous operation in order to observe the planetary wave portion of the dynamic spectrum, and to attempt to detail the synoptic meteorology of the mesopause level. Such data, in conjunction with that gathered by other members of the Global Radio Meteor Wind Studies Project, is essential to the production of global models of the circulation in the neighborhood of the mesopause, and in providing 'ground truth' for proposed measurement of mesopause dynamics from satellites. The determination of the dynamics of the mesopause is a key objective of the Middle Atmosphere Program of the Special Committee on Solar Terrestrial Physics, scheduled for the next decade.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0005, SPECTROMETER

R.P. Crabbs, Research Support Instruments, *Timonium, Maryland* 21093 (DF249970; F19628-75-C-0154)

AF function - environmental impact of high-altitude vehicles. Deficiency - effect of aircraft effluents on solar UV absorption and on ozone. Objective - to determine solar, ultraviolet energy deposition rates and ozone concentrations. How research contributes - energy deposition rates and ozone concentrations will improve models used in computation of environmental impact of Air Force vehicles.

Contractor shall design, fabricate and test a balloon-borne ultraviolet spectrometer for the measurement of solar radiation in the range between 2000 and 3100 angstroms. After each balloon flight, the instrumentation will be refurbished and prepared for a subsequent flight. Four balloon flights of the solar spectrometer are planned to provide data on the solar spectrum as a function of height in the stratosphere. From these data, energy deposition rates and ozone concentrations will be computed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0006, NAVY ENVIRONMENT - SOLAR TERRESTRIAL RELATIONSHIPS

R. Markson, Airborne Research Associates, *46 Kendal Common Rd., Weston, Massachusetts* 02193 (DN475450; N00014-74-C-0336)

The major objective of this research is to subject to experimental verification a plausible mechanism through which variable solar activity might influence tropospheric weather. If the hypothesis were to be verified, the result would contribute to important corrections of and improvementS in the naval weather forecast.

Two separate data sets will be used in the experimental verification. One is the thirty year collection of thunderstorm data developed up to 1965 by Mae Lethbridge of the University of Pennsylvania. She has just received a grant from NSF to bring this up to date. This data will be examined for variability of thunderstorm activity with magnetic sector crossings. The other set of data is the GOES Satellite infrared pictures. Under this contract, we have developed software by which we can obtain distributions of cloudiness within latitude/longitude squares of variable size. We can also examine this data against the magnetic sector crossings.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0007, A GLOBAL STUDY OF THE VARIATIONS IN UPPER-ATMOSPHERIC COMPOSITION THAT ACCOMPANY TRANSIENT CHANGES IN THE EARTH'S MAGNETIC FIELD

L. Jacchia, Smithsonian Institution, Astrophysical Observatory, Analytical Satellite Geophysic, *60 Garden St., Cambridge, Massachusetts* 02138 (SRF - 460117)

Through analysis of mass-spectrometer data from the ESRO-4 satellite, Dr. Jacchia plans to model the large changes in composition which accompany geomagnetically induced density variations. A preliminary model of these atmospheric variations is already designed.

SUPPORTED BY Smithsonian Institution, Office of Fellowships & Grants

5.0008, SELF CALIBRATING FREQUENCY DIVERSITY DOPPLER WEATHER RADAR

A.W. Bishop, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581350)

AF function - navigation and detection functions of the strategic, tactical, air defense, and airlift forces. Deficiency - weather radar systems in current use are unable to separate hazardous from non-hazardous zones in storm systems. Objective - to develop a frequency diversity Doppler weather radar with a self calibrating capability. How development contributes - provides an improved weather radar system which enables the reliable identification of storm hazards on the basis of their Doppler spectral characteristics.

This in-house effort will be accomplished by modifying an AN/FPS-18 transmitter-receiver to give a frequency diversity Doppler system with performance characteristics comparable to specifications contained in multicommand ROC 4-6-76 for an advanced weather radar. This work is a continuation of work heretofore conducted in in-house work unit 66720602.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0009, DEVELOPMENT OF NEW TECHNIQUES FOR SOON MEASUREMENTS

H.L. Demastus, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580790)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to improve present techniques and develop new ones for the collection and interpretation of magnetic data from the Solar Observing Optical

Network (SOON) in order to generate better predictions of solar-induced geomagnetic disturbances. How research contributes - when completed, SOON will provide the only continuous coverage of solar acitivity in the optical wavelength region. To maximize the potential of SOON for reliable flare prediction, techniques must be perfected for extracting the required data from these telescopes in a highly efficient manner. The Air Weather Service, which is responsible for accurate disturbance forecasts, depends on PHS for technical expertise and guidance in the operation of SOON.

Technique development will include improved computer algorithms, theoretical analyses, both by contractors and by in-house work unit 2311G309 under this task, and new hardware for the study of active region magnetic and intensity fields. Some of the hardware will be built by contractors. It will be of an experimental nature and feasibility studies will be conducted on existing SAC Peak Telescope, prior to attempting modifications of SOON to incorporate these features. Data from SOON, SAC Peak and other instruments will be used in these studies. Close cooperation with AWS is anticipated in data gathering, archival, and distribution. PHS will coordinate scientific efforts between AWS and the outside solar physics community. A CWU 'sunspot dynamics' will report on conditions in sunspot regions which may lead to flares.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0010, PCM TELEMETRY AND CC FOR BALLOONS

A.A. Giannetti, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF248870)

AF function - advance balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency - existing instrumentation systems do not meet control and telemetry requirements for proper evaluation of AF payloads. Objectives - design, develop, and test hardware and software for balloon PCM flight systems to provide real-time data documentation and manipulation through the use of a minicomputer. How research contributes - the new instrumentation will provide the necessary accuracy and format for the proper logging and display of vital scientific data essential for proper evaluation of AF scientific balloon-borne payloads.

An existing PDP11/40 computer will be interfaced with a PCM ground station and a software program will be developed for data handling, logging and manipulation. An airborne PCM system will be developed in-house to meet most scientific technical requirements and used to verify and evaluate the overall system capability. A contract will be utilized to support this work, both for component fabrication and for interface, installation and software development.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011, THE OZONE ABSORPTION SPECTRUM IN THE UV REGION

D.H. Katayama, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581170)

AF function - environmental impact of high altitude vehicles. Deficiency - effect of aircraft effluents on solar UV absorption and on ozone. Objective - measure and analyze the absorption spectrum of ozone. How research contributes - the ozone absorption spectrum will be analyzed to improve ozone concentration computations used for determination of the environmental impact of Air Force vehicles.

The absorption spectrum of ozone in the UV region will be analyzed by studying its isotope shifts. An ozonizer with its associated vacuum system and various absorption cells will be used with a 3M spectrograph. The ozone absorption data will be recorded in the UV region at various pressures, temperatures, and cell lengths.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, ELECTRIC FIELDS IN THE IONOSPHERE AND MAGNETOSPHERE

M. Smiddy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249360)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modeling. Deficiency - environmental electric fields produce plasma motions which degrade orbital prediction and tracking accuracy as well as limiting the use of velocity vector sensors (VVAS) for satellite and missile guidance systems. They also cause irregularities which seriously degrade electromagnetic propagation prediction progress. Nuclear burst debris is diffused by electric fields, modifying the radio blackout observation of the burst. Objective - FY77 - new instrumentation will be developed for environmental electric field and vehicle potential measurements at synchronous altitude and at rocket altitudes in the auroral zones. Analysis of results from past rocket flights will be completed, integrated with simultaneous particle and optical emission measurements, and prepared for publication. How research contributes - models of electric fields and currents in the ionosphere and magnetosphere will significantly improve AF prediction capability of electromagnetic propagation and nuclear burst debris radio blackout conditions. It will minimize errors in satellite and missile ephemeris and tracking prediction and will define operational and design parameters for velocity vector guidance sensors.

Electric field measurements carried out by means of rockets and satellites and analytical studies are carried out based on the results of these experiments. The global F region electric fields will be mapped and the influence of electric fields on spacecraft charging determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, HYDROXYL AIRGLOW MEASUREMENTS

G.T. Best, University of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DF580490; F19628-78-C-0098)

AF function - surveillance, reconnaissance, early warning. Deficiency - insufficient data to predict background radiance levels and spectral distributions in a disturbed atmosphere, particularly temporal-spatial variations. Objective - obtain additional laboratory and field measurements of the hydroxyl airglow phenomena, particularly nocturnal variations of emission intensity, rotational temperatures and an empirical photon emission rate constant. How research contributes -expected to enable the prediction of hydroxyl airglow intensity from known reactant concentrations. OH measurements from ground observations will provide data on the spatial and temporal airglow variations due to gravity waves or travelling ionospheric disturbances.

Conduct an in-depth investigation of the hydroxyl airglow phenomenon using A) laboratory measurements of the photon emission rate constant for the reaction hydrogen plus ozone yields hydroxyl plus oxygen, including dependence on reactants concentration, their ratio, and temperature dependence. Also, the quenching coefficient will be determined. The spectral distribution of the chemiluminescence will be obtained, and the photon emission rate constant will be measured for the individual bands as well as the total radiation. B) Ground-based observations of the hydroxyl emission in the various vibrational bands, and verification of spatial emission irregularities by scanning the celestial hemisphere with a narrow-field-of-view photometer. C) Computerized modeling of the hydroxyl airglow based on best available density profiles of hydrogen and ozone, and the laboratory determined rate constants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, THREE-DIMENSIONAL SLOPE AND VALLEY WIND SYSTEMS 12461-GS

W. Tang, University of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DA0T5572; DAAG29-78-G-0012)

To model variations in wind circulations in a three-dimensional slope and valley-plain terrain situation, coupling the interactions between the upper air flow and the thermally induced lower level winds which vary diurnally. Relevance - three-dimensional modeling of air motion over complex terrain has relevance

to transport and diffusion of obnoxious materials; for identifying optimal conditions for laying smoke screens; for wind effects on artillery accuracy, low level helicopter operations, and other Army activities in mountainous terrain. The study should contribute to the development of operational terrain effect models for the Army's automatic meteorological system.

The research involves the development of the governing differential equations for air motion and temperature above mountain-valley terrain. The equations will be solved numerically and the results checked with analytical solutions and with real data.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0015, REMOTE SENSING WOODED WETLANDS USING LANDSAT MULTISPECTRAL SCANNER DATA

W.P. MacConnell, University of Massachusetts, Amherst Campus, Agricultural Experiment Station, McIntire Stennis Program, *Amherst, Massachusetts* 01002 (0076742; MAS00029-MS)

OBJECTIVE: Evaluate the utility of various LANDSAT Multispectral Scanner products for detecting and correctly identifying wooded wetlands in Massachusetts. These image products will be enhanced to accentuate specific features associated with wetlands. The enhanced images will be used by skilled personnel to interpret the wetlands and these results will be compared with results obtained using conventional aerial photographs and corollary wetland information produced from aerial photographs in work done here in MS-13 research. Evaluate the feasibility of automatic data processing of digital LANDSAT data to identify and classify wooded wetlands in western Massachusetts. Evaluate the potential for development of a system of integrated remote sensing techniques to provide regional or state-wide vegetation and land-use data or computer maps on an annual basis.

APPROACH: See item No. 24.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Massachusetts

5.0016, OPTICAL DENSITY MEASUREMENTS

O. Shepherd, Visidyne Inc., *Burlington, Massachusetts* (DF247140; F19628-76-C-0253)

AF function - low altitude operational satellites, airborne surveillance, ballistic nuclear weapon delivery. Deficiency -inaccuracies of AF predictive capabilities of missile trajectories and satellite ephemerides due to lack of density data at critical altitudes. Objective - development and test of remote sounding technique using laser propagation and scattering technology for measurement of atmospheric density in the lower thermosphere. How research contributes - laser experiment will provide measurements of atmospheric density over the critical altitude region from 80-160 km.

Develop, fabricate and test laser rocket sounding experiment to be flown to determine the accuracy, range and reliability of the technique for use in remote sounding applications for the measurement of atmospheric density.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, SNOW COVER ANALYSIS IN NEW ENGLAND USING LANDSAT DIGITAL DATA

C.J. Merry, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (31584)

OBJECTIVE: To synoptically map snow cover and to determine if a relationship exists between the water equivalent of the snowpack and the associated radiance values obtained from LANDSAT computer compatible tapes (CCT's).

APPROACH: Digital processing of selected CCT's will be accomplished to map the areal extent of snow. The next step will be to test if a relationship exists between the water equivalent of the snowpack and the associated radiance values on the LANDSAT CCT's. Snow course data in two New England watersheds will provide the ground truth to enable this comparison to be made. In addition, a newly developed microwave sensor to quantitatively assess the water equivalent of the snowpack will be tested. LANDSAT spectral band ratios of the radiance for selected snow course sites that provide the most reliable information for correlation to the water equivalent of snow data will be evaluated. The number of ground truth data stations required when using the CCT's for reliable prediction of water runoff associated with the snowpack will also be determined. Significant savings in costs can result if snow surveys can be accomplished using LANDSAT digital data rather than ground survey procedures. The results of this investigation will be presented in ETL's and technical reports for use in flood forecasting in cold regions.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

5.0018, BALLOON-BORNE RADIOSONDE

W.P. Winn, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (DN223113; N00014-75-C-0168)

This research, as part of a coordinated program of thunderstorm research with other investigators, aims at ascertaining the relationships between the thunderstorm electric field and the cloud circulation and precipitation regime. Application will be to improve the naval weather forecast and in-cloud flight paths.

In situ measurements of the electric field with a balloon borne electric field meter are made simultaneously with radar observations of the cloud precipitation. These measurements are combined with other coordinated ground and aircraft measurements of other investigators to gain a better total perspective of cloud meteorological and electrical characteristics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0019, GRAVITY AND ACOUSTIC WAVES APPLIED TO THE DYNAMICS AND KINEMATICS OF THE ATMOSPHERE

W.L. Donn, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (DA0F9005; DAAG29 77 G0131)

To develop the application of infrasound as a possible probe for the remote sensing of wind-temperature parameters of the stratosphere and lower thermosphere and the relation of gravity waves in the atmosphere to meteorological conditions. Relevance - the research attacks several Army meteorological problems, including the role of internal gravity waves in determining the structure of the upper atmosphere and the response of the upper atmosphere to nuclear disturbances, the relation between gravity waves and precipitation and severe storm development, remote sensing of wind-temperature parameters of the upper atmosphere, and detection of ballistic missiles in flight for early warning.

Use observations from the present ground array of capacitor type microphone sensors at Lamont Observatory and a companion array to be established at the meteor radar laboratory of the University of New Hampshire to compare estimates of wind conditions at reflecting levels aloft to those determined by radar echoes from meteor trails and study the effect of gravity waves on precipitation and severe storms.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0020, OBSERVATION OF VHF BEACONS OR SATELLITES

K. Pai, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Army Research Office, *P.O. Box 12211, Research Triangle Park, North Carolina* 27709 (DF580020; AFOSR-74-0215)

AF function - navigation. Deficiency - signal fading, pulse delays, refraction errors. Objective - measures ionospheric parameters related to geomagnetic activity. How research contributes - results used to develop global predictive models of scintillation and total electron content. Models support AFSATCOM

and GPS development. Work is done in conjunction with the Joint Satellite Studies Group.

Signals from transmitting satellites will be monitored to determine morphology and statistics of ionospheric total electron content and scintillation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, ESTIMATION OF SHORT-WAVE AND LONG-WAVE RADIATION FOR CLIMATIC MODELS

J.J. Cahir, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (8-414; 04-6-158-44013 MOD. NO. 6)

TECHNICAL OBJECTIVE: The objective of this research project is to generalize the previously developed overland statistical equations to account for diurnal and seasonal effects, to re-derive comparable equations over the oceans, and to conduct limited diagnostic studies concerning the radiative characteristcs of varying cloud height over oceans.

APPROACH: A limited sample of geostationary satellite data and conventional hydrodynamic data will be applied to the over-land regression model to account for diurnal variation, at least in the summer. Seasonal variation of the models will be tested, using summer equations all year at low latitude, winter equations all year near the Pole, and letting the winter/summer boundary migrate with time of year. Data for this test are available in the NESS archive, TDL, and on hand from previous work. Regression equations over the oceans will be re-derived, using data from the 6-layer Primitive Equation Model archive for such points, where there are approximate time-correspondence to the polar orbiters. The plan also calls for some limited diagnostic studies concerning the mean depth of cloudiness over oceans by combining the longwave and shortwave regression equations.

PROGRESS: Regression equations which satisfactorily predict the shortwave and longwave radiation components for both winter and summer regionally over continents have been developed, tested and published. Preliminary results from work on the corresponding over-ocean problems, however, are less satisfactory due partially to the unrealistic temperatures used from the operational LFM model.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0022, NAVY ENVIRONMENT - BALLOON CLOUD PROBES

A.A. Few, Rice University, Graduate School, Dept. of Space Science, *6100 Main St., Houston, Texas* 77001 (DN123363; N00014-75-C-0139)

To apply modern balloon technology to the probing of maritime clouds in order to support naval operations through a better comprehension of atmospheric phenomena.

Balloons of special construction will be prepared with sensing equipment and telemetry contained within the balloon. The balloon surface will also be used for sensing. The balloons will be released as free balloons into clouds and be supplemented and compared with standard radio sounding techniques. Standard radiosondes will be modified to produce low cost thunderstorm sounding devices.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0023, COMPUTER MODEL OF PLASMA FLOW NEAR THE EARTH'S PLASMAPAUSE

R.A. Wolf, Rice University, Graduate School, Dept. of Space Physics & Astronomy, *6100 Main St., Houston, Texas* 77001 (DF248280; F19628-78-C-0078)

AF function - communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of how convective processes in magnetosphere perturb ionospheric structure characteristics which in turn affect AF communication systems design. Objective - develop computer models for time-dependent convective flow, analyze and synthesize AF satellite data. How research contributes -provides data essential to radar propagation, provides data essential for design and utilization of communication, guidance and surveillance systems, provides understanding of dynamical ionospheric/magnetospheric processes.

Construct computer models for time-dependent convection in the ionosphere and magnetosphere at auroral and middle latitudes using electric fields and plasmas observed by AF satellites as realistic boundary conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, NIMBUS 6 CLOUD EVALUATION

K.N. Liou, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF581910; F19628-78-C-0130)

AF function - weather observation, analysis and forecasting. Deficiency or opportunity - limited ability to specify and forecast cloud conditions in real-time. Objective - develop techniques to parameterize weather satellite microwave and infrared imagery data for the inference of cloud properties. How development contributes - a successful development will lead to improved cloud detection from satellites and improved input to cloud forecasting models.

For a variety of cloud conditions, radiances measured by the Nimbus 6 Satellite will be compared to conventional sources of weather data. The observed radiances will also be compared to radiances calculated from a model of radiative transfer in cloudy atmospheres for ice and water clouds over a range of visibilities and thicknesses. Combinations of microwave and infrared channels which best identify cloud properties will be sought.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, NAVY ENVIRONMENT - UPPER OCEAN MESOSCALE RESPONSES TO ATMOSPHERIC FORCING NEAR STATION PAPA

R.W. Burling, University of British Columbia, Inst. of Oceanography, *2075 Wesbrook Pl., Vancouver, British Columbia, Canada* V6T 1W5 (DN624127; N00014-77-G-0047)

The Navy has a need to gain an understanding and improved predictive capability of the characteristics of the mixed layer and its response to air-sea interactions, particularly to strong wind events. These include (1) the lower atmospheric boundary layer needed for forecasting radar propagation and mixed layer depth changes, (2) upper ocean wind induced drift currents, and mixed layer structure for surface duct acoustic propagation, and (3) the predictive capabiltiy of simple anemometry devices to forecast ocean wind waves. The objective of this task is to conduct a field investigation at Ocean Station Papa to assess recent models of air-sea interactions and mixed-layer responses to strong winds.

Instrumentation has been developed to measure the fluxes of heat, moisture and momentum from the air-sea atmospheric boundary layer into, and out of, the upper ocean. Both direct and indirect methods of measuring Reynolds flux from the wind to wind waves are compared to assess drag law predictive capabilities of storm generated wind waves. Analysis of 10 years of Ocean Station Papa data has been done and a study of Ocean Station Papa data this year is underway to publish the data. Navy aircraft have been utilized to monitor the temperature structure before and after storm passage.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, UPT DATA BASE

M. Nataupsky, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223250)

To identify long-term effects of diverse viarables on flying performance, to determine the relationship between daily grades and check grades, and to evaluate practice requirements and student progress rates (i.e., readiness to learn) during various phases of UPT by studying UPT grades and other appropriate measures. The primary objective is the establishment of a single UPT data base. The secondary objective is the conduct of statistical investigations on the data base.

The daily flying grades will be obtained from Air Training Command. This data will be formatted for analysis by AFHRL/MT. As a minimum, the data will also include syllabus flight number, maneuver identification, and IP grades. A series of statistical analyses will be performed on the data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, VISUAL DISPLAY INTEGRATION FOR ADVANCED FIGHTER AIRCRAFT

E. Streeter, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DF322910; F33615-77-C-0521)

To provide a systematic definition and assessment of optical visual display design approaches for future tactical fighter aircraft employing advanced technology. During FY 77 this contract will provide (1) a planning and technical framework for a phased, multi-year development and evaluation of cockpit design alternatives, and (2) a series of engineering trade-off comparisons among alternative approaches for visual display integration. The need for this effort arises because the quest for reduced cost dictates smaller size vehicles (hence, reduced panel space for cockpit control/display, as typified by the F-16) at the same time that technology can provide an overwhelming amount of flight data and new flight modes previously unavailable, while cockpit designers lack expertise with the interaction of new technologies and resulting impact on the crew. By closing this gap in display integration technology in a near-term applied context emphasizing advanced avionic and flight vehicle state-of-the-art, direct support is provided to ASD TN 72-46 (high acceleration cockpit, control/display definition), the draft requirements TAF-301-73 (advanced tactical fighter) and the AFSC development goals TC-2, 4, 5, and MS-4.

This is one of three parallel contracts aimed at developing better methods and criteria for interfacing tactical aircrews with advanced technology fighter aircraft (i.e., target first operational capability post - 1985). Visual display design alternatives will be derived based upon mission requirements analyses, crew size/function options, and potential (aircraft, avionic, and display system) technology combinations. Engineering trade-off comparisons among the postulated alternatives will determine the incremental impact of specific applications of advanced display technology upon aircrew needs, capabilities and cockpit configurations. Figures of merit used in the trade-off analysis will include performance, safety, survivability and cost. Promising alternative designs will be selected for detailed development and evaluation under a follow-on contract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0003, A BIOLOGICAL WASTE WATER MONITOR STUDY USING DIFFERENTIAL LASER LIGHT SCATTERING FROM BACTERIA

P.J. Wyatt, Science Spectrum Inc., *1216 State St., Santa Barbara, California* 93105 (DF053030; F49620-78-C-0096)

AF function - the Air Force uses a variety of chemicals in its daily operations. These chemicals may provide detrimental impact to surrounding environments and/or be toxic to humans and other life forms. Recent legislation mandates that the Air Force assess the toxicity of the unique chemicals it uses and be responsible for assessing and controlling pollution in its operations. Deficiency - rapid and accurate methods for pollution monitoring and toxicological assessment are required to replace the time-consuming and costly techniques presently employed. Objective - the objective of this research is to provide basic data necessary for the development of a rapid bioassay method for monitoring toxicants. How research contributes - this work should provide needed data on the applicability of bacteria as monitors of toxicants from any liquid effluent and contributes directly to subarea 1.9, 'environmental protection and toxicological hazards.'

The investigators will measure dose-response curves for several bacterial strains as a function of toxicant concentration. The toxicants studied will include missile propellants (hydrazines), jet fuels, nitrosodimethylamine and various phenolics of Air Force interest. Basic studies to quantitate the effect of the various toxicants on growth rates, morphologies, sizes and size distribution of bacterial cells will also be undertaken. Research to identify bacteria best suited for the detection of specific toxicants will be initiated. Effects on two component mixed cultures will be studied for at least two different toxicants. Application of results for the development of a rapid screening method for toxicants will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0004, DUMMY AND HUMAN PARACHUTIST RESPONSE COMPARISONS

D. Goodrich, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN895414)

(1) To permit dummy test data to be used more knowledgeably in evaluating parachutes with regard to human injury. (2) To better define and verify physiological tolerance limits during parachute opening. (3) To identify shortcomings in existing instrumented dummies, and to specify critical requirements to be addressed in developing improved dummies to evaluate human injury potential during parachute opening.

Parachute opening tests will be conducted using anthropomorphic dummies instrumented to obtain tri-axial linear acceleration and rotational rate data to compare with data accrued from live jumpers and with data from previous tests using similar dummies. Test conditions will be identical to the conditions used for separately funded concurrent live human subject tests. Analyses will be performed to identify the response differences between existing dummies and live subjects, and to develop a method with which to determine the probability of exceeding given acceleration limits for given airspeed ranges and parachute configurations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

6.0005, TOXIC HAZARDS RESEARCH - ENVIRONMENTAL TOXICOLOGY

T.T. Crocker, University of California, Irvine Campus, California College of Medicine, Dept. of Community & Environmental Medicine, *Irvine, California* 92664 (DF319590; F33615-76-C-5005)

This program will provide specific data and knowledge on the toxic properties of new materials, propellants, and other atmospheric contaminants used or encountered by Air Force personnel in the development, test, and operational phases of new aeronautical, aerospace, missile, and orbital systems. The results of this program, in conjunction with the over-all toxicology program, will provide the Air Force and other governmental agencies with tolerance criteria to provide for the optimum protection of Air Force and other Department of Defense personnel. Pertinent toxicological information will provide guidance to design engineers in order to develop aeronautical, aerospace vehicles, and launch systems with maximum functional capability. Results will also be used for the development of design criteria for pollution abatement procedures and equipment.

The contractor shall maintain and operate the toxic hazards research unit and conduct toxicological research on a wide variety of current and advanced USAF research and development materials. Emphasis is upon the applied inhalation research area. The spectrum of occupational inhalation exposures that will be investigated begins with accidental, short-term, high-level exposures, include occupational, daily, 8-hour, industrial exposure, and culminates in truly uninterrupted, long-term continuous exposure as experienced during confinement in sealed habitable atmospheres. In addition, the effort shall provide definitive data concerning the environmental impact of selected Air Force materials through the use of representative aquatic and plant species. This R & D effort to develop environmental pollution toxici-

ty criteria for Air Force chemicals is a firm AFSC requirement as outlined in AFR 19-1 and AFR 19-2.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0006, PREDICTING MOTIVATIONAL CHANGE AND AERONAUTICAL ADAPTABILITY AMONG NAVY AND MARINE CORPS AVIATION TRAINEES

R.E. Doll, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept., *Pensacola, Florida* 32512 (DN141807)

Past research and development has supplied the means of reducing attrition from undergraduate pilot training and identifying poor training risks at relatively early points in training. There still exists, however, a significant attrition rate in which about half can be associated with motivation and aeronautical adaptability. Part of this attrition can be attributed to individual idiosyncratic characteristics yet to be measured and part to the impact of external change or lack thereof in the applicant/trainee population. The objective of this work unit is to develop improved methods for measuring and predicting motivational change and aeronautical adaptability as related to attrition from and performance in training and operations.

Together with present measures of cognitive aptitude and interest in flying, new measures of aptitude, attitude, and personality will be assessed, separately and in combination, for prediction validity against attrition from and performance in different stages and pipelines of naval air training, and ultimately against fleet criteria. The effects of identifiable cultural and organizational factors upon attrition will be examined.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0007, VISUAL ACQUISITION FUNCTIONS IN OPERATIONAL ENVIRONMENTS

J.E. Goodson, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept., *Pensacola, Florida* 32512 (DN477112)

The current state of knowledge concerning the relationship between specific visual functions and the performance of operational tasks is critically deficient. New information is required in order to identify visual requirements for screening and/or training of aviation personnel, and to develop more effective criteria for human factors design requirements in operational systems. Further, the visual system is known to be sensitive to stressful conditions encountered in the operational environment. Data are not available for predicting or assessing the effects of environmental variables upon mission limiting visual functions. The objectives of this work unit are to define critical visual requirements in naval aviation, and to assess visual capabilities in the aviation community for meeting these requirements.

This exploratory development work will extend and apply the data of coordinated work unit sponsored by OPNAV and AIRSYSCOM. The relationships of existing visual tests to aviation performance requirements will be investigated. Psychophysical and physiological techniques will be utilized to develop new methods of assessing visual capabilities. Emphasis will be placed upon dynamic visual functions which currently are not being tested, and upon stimulus conditions which reflect conditions of the aviation environment. As methods are developed for assessing visual characteristics which are important to operational performance, these will be applied to determine distribution among naval aviation personnel, and to derive new visual screening requirements.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0008, DIVIDED ATTENTION AND TASK WORKLOAD IN CONTROL FAILURE DETECTION AND DECISION-MAKING IN AVIATION SYSTEMS

C.D. Wickens, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Psychology, *Urbana, Illinois* 61801 (DF049320; AFOSR-77-3380)

AF function - the role of attentional processes in flight control has assumed an increasingly important position in aviation and man-machine systems research because of increased complexity of weapon systems and aircraft missions. Deficiency - accordingly, it is critical to better define the pilot's attention capacities and limitations for purposes of enhancing the probability of mission effectiveness. Objective -attention allocation processes as they affect pilot operator performance under varying task loads and in relation to monitoring vs control functions will be modeled to elucidate understanding of the interrelationships. How research contributes - a major contribution of the proposed research to real-world aviation problems is anticipated to be the provision of a theoretical basis for predicting the consequences of adding different operator requirements in the design of new systems.

Employing a latency based theory of signal detection, the research will model the operator's performance in detecting and responding to changes (failures) in the dynamics of simulated aircraft systems. performance as a function of operator monitoring vs operator controlling functions will be examined, and conclusions will be drawn concerning the appropriateness of one mode vs the other. Also, the effects of divided attention on tracking performance using control theory analysis will be investigated and an attempt will be made to model the dynamic characteristics of attention allocation as the operator is required to respond to increasing or decreasing task demands in the dual task environment. Application of the results will be explored concerning (1) on-line monitoring of attention, and (2) attention allocation ability as a predictor of flight training success.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, OPERATOR WORKLOAD MEASUREMENT

Unknown, Massachusetts Inst. of Technology, Graduate School, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (OS-70055; OS161037 (TRAIS NO.))

The proposed research has the following objectives: 1) The selection of candidate workload measures for pilots through analysis, modeling, and experimentation. 2) The validation of the effectiveness of these measures in a simulated full workload environment for IFR piloting.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary of Transportation

6.0010, INVESTIGATION OF SIGNAL ANALYSIS TECHNIQUES FOR ECG/VCG CLASSIFICATION

D.E. Gustafson, Scientific Systems Inc., *1640 Massachusetts Ave., Cambridge, Massachusetts* 02138 (DF320400; F33615-77-C-0606)

Over the past four years, computer algorithms have been developed for digitizing and preprocessing vectorcardiograms (VCG), compressing the data so that it can be efficiently transmitted via commercial grade telephone lines, and classifying VCGs into normal and a selected set of abnormal categories. In addition, computer algorithms have been developed for detecting and identifying various categories of arrhythmias. These algorithms have been assembled into a prototype version of an overall VCG interpretation system which is operational on the USAF San Antonio Data Services Center (USAFSADSC) IBM 360-65 computer. The objective of this effort is to extend the currently utilized algorithms and to develop new algorithms for interpretation of VCGs based on experience gained with the operational prototype VCG interpretation system. This is an extension of the work done under 77550112.

Algorithms developed for detecting and classifying arrhythmias via R-R intervals will be extended to include P-R intervals. Kl expansions will be performed separately on the P and QRST segments of VCGs. Investigations of the tendency of VCG pattern vectors to cluster in feature space will continue. Com-

puter algorithms will be developed for calculating the eigenvalues and eigenvectors of large matrices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0011, HIGHER ORDER LANGUAGES FOR FLIGHT SIMULATOR PROGRAMS

J. Goodenough, Softech Inc., *460 Totten Pond Rd., Waltham, Massachusetts* 02154 (DF228150; F33615-77-C-0029)

To investigate the problems in and approaches to developing a higher order language (HOL) for standard use in future Air Force simulators. The work will result in a thorough programming analysis of flight simulation problems and use of this analysis to develop and evaluate alternative programming approaches. This will give the Air Force the technology necessary to increase the efficiency of its programming in future simulations.

A technique will be developed that can be used to analyze large scale programming problems to determine what programming and information processing features are required. This technique will then be applied to perform a detailed analysis of the programming of modern flight training simulators. Specifications for an ideal simulation higher order language will be developed, and existing higher order languages will be evaluated. Modifications required to make the most suitable existing languages of maximum use in simulation will be determined. Alternative approaches to implementing a standard HOL will be identified and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0012, NUTRITIONAL EDUCATION - A BASIC NUTRITION COURSE FOR AIR FORCE PERSONNEL

O. Maller, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0H4364)

To develop and evaluate a prototypic basic nutrition education course designed for AF personnel to be used in basic training, flight training programs and base level nutrition. This course should be designed so as to be of use for the Reserve, National Guard and the dependents of military personnel. The course will be directed at preventing malnutrition as a consequence of following fad diets or overnutrition by developing poor eating and activity habits.

Assess current level of nutritional knowledge and practices in a target population of AF personnel. Design and implement a program of nutrtional intervention. Retest target population and appropriate control groups to evaluate efficacy of the intervention.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

6.0013, IDENTIFICATION AND QUANTIFICATION OF WATER SOLUBLE COMPONENTS OF JP4

J.D. Brammer, North Dakota State University, School of Science & Mathematics, Dept. of Zoology, *Fargo, North Dakota* 58102 (DF053550; AFOSR-78-3709)

AF function - the Air Force consumes 225,000 barrels of JP-4 each day. Transport of this fuel, as well as routine operations have resulted in the contamination of aquatic environments with JP-4. Water-soluble components of this jet fuel may affect man through drinking water supplies, accumulate in food chains and be detrimental to aquatic ecosystems. Deficiency - little information is available on the biological and environmental fate of water-soluble components of JP-4. Objective - the objective of this research is to identify and quantify the water-soluble components of JP-4 and to determine the biological effects of those constituents on aquatic biota. How research contributes - results of this study will provide information necessary to establish realistic guidelines regarding release of JP-4 into aquatic ecosystems. This research directly supports Subarea 1.9, 'Environmental Protection and Toxicological Hazards' and RO's 1.9.1, 'Health Effects' and 1.9.5, 'Predictions of Environmental Impact'.

Water-soluble components of JP-4 will be identified. Quantitative measurements of individual components will be made over time under different water salinities, temperatures and states of physical agitation. Acute toxicity tests using individual components will be conducted using selected freshwater organisms. Biological effects of sublethal exposures will be measured. Uptake, accumulation and depuration of JP-4 components will be examined in selected aquatic species.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0014, BODY SIZE AND MASS OF AF PERSONNEL

C.E. Clauser, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320940)

To describe body-size distributions of AF personnel for (1) guiding the design, sizing, and procurement of personal-protective equipment and clothing and the layout of workstations, (2) establishing relationships between body-size and injuries incurred upon ejection, and (3) developing human mass distribution and body-size criteria for the design of human analogues required to simulate the body's response to impact, ejection and windblast forces.

The anthropometric data base of USAF men and women required for guiding the design, sizing, and procurement of personal-protective equipment and clothing will be updated in FY 77 for establishing relationships between body-size and injuries incurred during the ejection sequence. In FY 77 and 78, advantages will be taken of recently developed biostereometric techniques to determine for the first time mass distribution characteristics of a sufficient number of living human beings to be able to describe variability of these parameters in the USAF male population. Emphasis is placed upon developing procedures for improving the efficacy with which anthropometric data can be applied to the design of AF systems and equipment. This effort was formerly documented under work units 71840803 and 71840807.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0015, DIRECT VISUAL MECHANISMS OF NON-DESTRUCTIVE COUNTERMEASURES

R.D. Odonnell, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321090)

To develop and assess countermeasures against the human operator in representative threat systems which involve interference, deception, or neutralization of the visual system. To identify a large number of potential countermeasures, and to carry out a systematic, minimal-cost series of evaluations designed to eliminate low probability concepts and isolate those with a high probability of success. To refine these concepts, maximizing their effectiveness, until sufficient testing has been done to deliver the concept to operational development. This work unit supports AFSC development goals SO-5, TC-5, and TC-8.

Candidate countermeasures will be identified through study of the fundamentals of visual mechanisms, and will be subjected to a series of increasingly more high-fidelity evaluations. In the first stage, a conceptual evaluation will be done to estimate the probability of visual confusion. Secondly, laboratory evaluations will be carried out on the basic mechanism concept. Third, combined laboratory/field evaluations will be performed. Finally, where justified, high fidelity simulator and/or field tests will be carried out. Initial concept ideas, and the confusability matrices necessary for conceptual evaluation will be derived from complementary programs in AMRL. Laboratory facilities for carrying out the second level of evaluation presently includes an image metric capability, a laboratory for assessment of visual perception, a five-channel Maxwellian view optical system, and a sophisticated eye tracking system. Capability for novel psychophysical and psychophysiological evaluations are being developed. A mobile laboratory system capable of tracking real aircraft, and of simulating a broad range of countermeasures, will be placed in operational use in order to carry out the third level of evaluation. Other programs in AMRL are developing high fidelity simulators and a metric for quantification of the threat environment. Sug-

gested countermeasures concepts may enter the evaluation sequence at any level, depending on their previous level of investigation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, IMPLEMENTATION OF ANSI SPECIFICATION S3.19-1974, PERSONAL HEARING PROTECTIVE DEVICES FOR USE IN NOISE ENVIRONMENTS

M.R. Stephenson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321310)

AMRL/BBA is responsible for evaluating personal hearing protectors for use in AF hazardous noise environments. Military specification Mil-P-38268A specifies the procedures employed to evaluate hearing protectors, and requires the use of the ANSI real-ear attenuation at threshold (REAT) method for the evaluations. The American National Standards Institute (ANSI) has recently revised the standard relevant to the REAT method. To maintain compliance with Mil-P-38268A, it is the objective of this work unit to procure and assemble the items necessary to implement the new measurement instrumentation and test methodology for use under 72310338.

Requirements necessary to implement the new standard will be identified, including specification of the instrumentation needed to generate the test signals and record the subjects' responses. A survey will be made of existing facilities to determine whether modifications of these facilities will be required, as well as to determine possible requirements to procure additional instrumentation. When the necessary equipment is available it will be assembled into an instrument console adjacent to the test room. Completion of this assembly will permit this laboratory to initiate hearing protector evaluations using the ANSI S3.19-1974 standard. Software will be developed to present the data in forms consistent with current methods and standards.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, TIMING OF G-PROTECTIVE TECHNIQUES

M.M. Cohen, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881475)

To determine the single and combined effects of the timing of three g-protective techniques, namely seat supination, the M1 maneuver and inflation of the anti-g suit on subsequent human g tolerance.

Five relaxed and restrained subjects shall be exposed to increasing g loading on the dynamic flight simulator while seated in a mechanized supinating seat. Each of three g-protective techinques shall be separately evaluated with respect to the timing of its initiation on subsequent g tolerance as judged by peripheral light loss (PLL) and/or reversal of blood flow in the superficial temporal artery. Once time relationships for each of the three techniques with respect to time of g onset have been established the time relationships for combinations of two techniques and for the combination of all three techniques shall be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

6.0018, TECHNIQUES FOR ASSESSING G-RELATED PATHOLOGY IN PILOTS OF HIGH-PERFORMANCE AIRCRAFT

E.B. Smith, Technology Inc., *Houston, Texas* (DF323760; F33615-78-C-0614)

The myocardial infarctions that go unrecognized each year in the general population and the cardiomyopathy and subendocardial hemorrhage detected recently in swine exposed to acceleration stress make it imperative to develop a diagnostic tool to detect this damage if it exists in aircrew members of high-performance aircraft. An analytical biochemical technique that correlates with myocardial injury will be developed.

The experimental protocol of this task is divided into four parts: (1) select the most appropriate analytical method for serum creatine phosphokinase isoenzymes and other chemical indicators to validate myocardial injury, (2) correlate laboratory induced myocardial injury with these selected chemical indicators, (3) correlate myocardial damage resulting from plus GZ acceleration stress as in part 2, and (4) compare changes in isoenzymes concentrations in human subjects exposed to plus GZ acceleration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0019, RADIATION PRODUCED BRAIN INJURY - AIRCREW PERFORMANCE DECREMENT

D.E. Cordts, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF312190)

Performance decrement has been consistently observed in trained primates exposed to weapons radiation. Since performance is dependent on the central nervous system (CNS), a temporary loss of consciousness and/or alteration of brain function can result in mission failure. This effort will investigate radiation injury to the brain and to systems supporting the brain.

Strong presumptive evidence exists that diminished cardiovascular capacity leading to diminished blood flow to the brain is a major factor in radiation induced decrement. Since flight maneuvers involve g stress, and g stress also affects the cardiovascular system, there is a need to study these combined factors. Rats will be evaluated for the effects of radiation plus g versus g alone. The parameters will be EEG, ECG, and heart rate.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0020, USAF HEARING CONSERVATION PROGRAM

D.C. Gasaway, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322030)

Many USAF weapon systems and support operations represent potential risk to the hearing of both military and civilian personnel. Loss of highly trained personnel and compensation for hearing loss continue to be major AF problems. The primary objective of this effort is to monitor the USAF hearing conservation program, specifically as defined in AFR 161-35. The prevention of noise induced hearing loss among AF members requires that these personnel be included in a comprehensive hearing conservation program and the purpose of this research is to guarantee that the mulifarious elements of the program are effective. Also, research will be performed to validate auditory risk limits, determine the effectiveness of personal ear protection devices and noise control measures, and insure adequacy of criteria and procedures for disposition of noise-exposed personnel who demonstrate shifts in hearing. Many aspects of the R & D efforts have potential for direct operational support of hearing conservation programs in the field. The tasks described in the Management Review, 1-2 May 78, along with the milestone elements can be defined and transferred to OEHL. This work will then continue as a pure R & D effort.

AF forms 1490/1491 and associated documents received at the USAF hearing conservation data registry will receive quality control and then be processed by automated techniques. Computer readouts on a routine basis will be used to continually appraise and evaluate the effectiveness of the overall hearing conservation program. The effectiveness of different elements (military or civilian) at a single base will be continually appraised. Instrumentation utilized in monitoring audiometry, personal ear protection, and disposition procedures for personnel who demonstrate shifts will be assessed on a continuing basis. Methods and techniques used to monitor individuals exposed to potentially hazardous noise will also be continually evaluated and deficiencies, once identified, will be carefully studied so that corrective action(s) can be recommended. Auditory acuity of various groups and subgroups of personnel who work in noise will be studied. Recommendations for correction of problem areas will be made to command surgeons and HQ USAF/SGP, as appropriate. Current plan is for OEHL to acquire all aspects of operational support (MFP8) by March, 1980. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0021, CLINICAL STUDY GROUPS/CARDIOVASCULAR CRITERIA FOR AIRCREW SELECTION AND RETENTION
D. Hickman, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321590)

Minimize the number of flyers who must be grounded because of the presence of circulatory and respiratory disease. It will be necessary that the significance of the abnormal response to testing procedures in regard to flying performance and safety be better quantified. This effort will accomplish this by establishing the functional and prognostic nature of abnormalities through long-term followup employing newly developed measurement techniques.

Approaches will be developed to allow more precise evaluation of cardiovascular functional integrity and capability in the presence of abnormalities to allow retention of more crewmen in flying duties than previously possible. Techniques will be developed to improve the ability to detect potential problematic disease earlier and permit a more productive preventive approach. Longitudinal studies to assess the significance of disease in aerospace operations coupled with the intensive study of patient groups with specific problems (e.g., acquired bundle branch block) will yield definitive information to help formulate or modify medical standards for aircrew selection and retention. Work was formerly documented under work unit 7755-01-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0022, EVALUATION OF HIGH-ALTITUDE PROTECTION TECHNOLOGY
R.W. Krutz, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322630)

The advent of advanced concept fighter and multi-role combat aircraft has both broadened the spectrum of hazards to which aircrew are potentially exposed and led to a convergence of crew-protective philosophies among NATO allies. The US, Britain, and Canada all share requirements to protect aircrew during high-altitude intercept, reconnaissance, or weapons delivery roles. However, only outdated, cumbersome and often dangerously compromising gear, using a variety of protective concepts and equipment combinations, is available for such needs. To assure the observance of critical minimum protective standards, Working Party 61 (of the Air Standardization Coordinating Committee) has ratified Air Std. 61-011, a document which defines pressure-garment design and use criteria. To assure compliance with such guidance, together with developing a data base useful in updating/revising present recommendations, this effort will provide for continuing tri-nation cooperation in evaluation of available altitude protection technology. Previous work in this area has been documented under work unit 7164-11-01, the present work unit has been established by direction of HQ AMD to implement a new technology planning objective.

This organization has established appropriate liaison with the RAF Institute of Aviation Medicine (IAM) and Canada's Defense and Civil Institute of Environmental Medicine (DCIEM). Cooperative evaluation of selected in-service prototype garments will be conducted with test responsibilities divided among participants in a manner taking best advantage of the facilities/expertise available within each organization. Data obtained from tests of flying gear will be used to assess its compliance with existing guidance, determine suitability for use in specific flying roles and from a data base useful in future equipment design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, TREATMENT OF AIRSICKNESS IN AIRCREW UTILIZING BIOFEEDBACK TRAINING, AUTOGENIC TRAINING, AND PSYCHOTHERAPY
R.A. Levy, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324340)

Develop a cost-effective treatment program for rehabilitating airsick aircrew, without using medication, utilizing self-monitoring physiological instrumentation, autogenic training and psychotherapy.

USAF aircrew with operationally significant airsickness may be referred to USAFSAM Aeromedical Consultation Service for evaluation and consideration for the rehabilitation study. If found medically and psychiatrically fit, they will undergo a regimen of biofeedback conditioning, autogenic training and psychotherapy (as required). Upon completion of the program they will be returned for an immediate operational trial.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0024, DEVELOPMENT OF A VARIABLE G-SENSITIVE POSITIVE PRESSURE REGULATOR
R.M. Shaffstall, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323540)

To design, fabricate and test experimental g-sensitive positive pressure breathing (PPB) regulators which may be used to improve aircrews plus-GZ tolerance.

Several types of positive pressure breathing (PPB) regulators will be designed, fabricated, and tested in order to determine the optimum PPB relationship to onset of g and the g of the aerial combat maneuver. The first regulator will be designed, fabricated, and tested in-house and will be capable of infinite variability relative to PPB and the g environment. This variable experimental regulator will be used in work unit 7930-12-11 in order to define the best PPB relationship to g. Further PPB regulator development will include design of regulators with other controls (i.e., fluidics and mechanical) and refinement of the electronic PPB regulator to a flight worthy model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, STRESS/WORKLOAD CRITERIA FOR EVALUATION OF IMPROVED AIRCRAFT INSTRUMENTATION
W.F. Storm, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF319930)

The objectives of this work unit are to (a) quantify the relationships between psychobiological/biochemical indices of fatigue and stress with pilot performance during missions/sorties systematically varying in workload, (b) document pilot acceptance of new aircraft instrumentation, and (c) quantify the relationship between inflight electrocardiograms and behavioral/biochemical measures for identical maneuvers flown in different modes.

Establishing the correlation between psychobiological indices of fatigue and stress with pilot performance parameters developed by the instrument flight center (IFC) will form a data base for future predictions of pilot fatigue during short duration missions. The analysis of changes in psychobiological measures during identical missions with different instruments/conditions provides an additional parameter for evaluation of instrument effectiveness. Portions of this effort were documented previously under 7930-09-11 and 7930-10-07.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, CONTACT LENSES AND KERATOCONUS
T.J. Tredici, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323030)

The objective of this work unit is to evaluate and follow selected USAF aircrew personnel with visual disorders, principally corneal, requiring contact lenses to maintain their visual function. Particular emphasis will be placed on those individuals with irregular astigmatism and keratoconus. This work unit will also include a group of individuals who prior to entering flying training had refractive errors altered by a technique known as orthokeratology. A small number of patients who underwent this

form of 'treatment' and who appear to be developing a corneal dystrophy (keratoconus) have now been identified. The possibility has to be explored that this may have been hastened or caused by the orthokeratology procedure. The permanence of this procedure (alteration of the refractive error) has been questioned and therefore follow-up examinations might better help in answering these questions.

Patients to be included in this study will be identified primarily from referrals to the Aeromedical Consultation Service from base-level flight surgeons' offices Air Force-wide and to a lesser extent from MAJCOM and HQ USAF referral. Referral will usually be based on the fact that the patient cannot be corrected to 20/20 visual acuity with spectacle lenses. The scope of each evaluation will be dictated by those elements indicated from the patient's condition. Extensive baseline data from the initial evaluation will be used in assessing changes in ocular status over time. Each follow-up examination will result in a new recommendation regarding fitness for continued flying duty. Work on this unit was formerly conducted under 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0027, CORTISOL RISK FUNCTION

R.G. Troxler, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321810)

Since aircrew with positive coronary angiograms were found to have increased plasma cortisol, the objective is to determine if plasma cortisol is a true risk factor for coronary artery disease.

Measure cortisol routinely on all patients. Compare cortisol as a predictor to predictors used in Framingham formula. Administer cortisol to monkeys in an attempt to see if cortisol induces atherosclerosis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0028, LIMITS FOR BREATHING GAS MIXTURES FOR AIRCRAFT COMBAT MANEUVERING ENVIRONMENTS

J.E. Whinnery, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322270)

Human volunteer subjects will be exposed to various levels of acceleration stress while inspiring gas mixtures containing various concentrations of oxygen and nitrogen. The responses of the respiratory system will be examined and analyzed to determine the degree of physiologic change imposed by these combined stresses. Data will include, but not be limited to, effects of pulmonary compliance, pulmonary resistance, tidal volume, frequency of breathing, and pulmonary ventilation. New methods utilizing nuclear medicine techniques for determination of ventilation and perfusion will be developed first using a miniature swine model and when refined will be used on human volunteer subjects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0029, EFFECTS OF COMBINED STRESSES OF AF OPERATIONS AND MEDICATION ON CARDIOVASCULAR AND NERVOUS FUNCTIONS

A.H. Briggs, University of Texas, Health Science Center at San Antonio, South Texas Medical School, Dept. of Pharmacology, *7703 Floyd Curl Dr., San Antonio, Texas* 78284 (DF026870; AFOSR-76-3029)

AF function - AF operations involve a wide range of aircraft and related weapons systems which may impose abnormal levels of stress on human operators due to extremes in temperature, pressure, acceleration, vibration and breathable atmospheres. The circulatory and nervous systems are early to be affected by such challenges and their responses are in many cases unknown as to time of onset and degree of application. Deficiency - there is a need for updated technology to protect the human operator from such environmental extremes and/or to extend operator tolerance and performance. Objective - this research seeks to develop an understanding of discrete basic mechanisms of circulatory and nervous system adaptation to stresses encountered in an AF operational environment. How research contributes - this research directly supports task 2312A3 and, indirectly, other tasks in the life sciences technical area.

Five research efforts will be pursued which closely complement and support research and exploratory development efforts on-going at USAFSAM and AMRL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, COMPUTER AIDED GEOMETRIC DESIGN

G.M. Nielson, Arizona State University, School of Liberal Arts, Dept. of Mathematics, *Tempe, Arizona* 85281 (DN223592; N00014-75-C-0244)

The purpose of this research is to devise new ways of approximating shapes (mathematical functions) used to define curves and surfaces in the process of computer aided geometric design (CAGD). CAGD is already used to design a wide variety of Navy vehicles (e.g., it is used to design aircraft and shop exteriors). CAGD can be extended to design almost every mechanical component of naval vehicles and weapons. This extension depends upon the development of new fundamental tools for representing shapes; tools must be developed which allow the designer to carry out his intention without worrying about mathematical details of the representation.

This research will pursue techniques for approximating (primarily multivariate) functions. The search for new techniques will concentrate on two qualities. First, new ways of determining the approximates must be developed in order to given the designer-user flexibility and control. The traditional ways of determining approximates, e.g., interpolation, do not work in a design context. Secondly, the approximates should be definable over fairly complex domains, not just rectangular polygons. Also, emphasis will be placed on approximates which can be calculated easily. Ease of calculation is often critical for computer graphics applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0002, A PDP 11/55 COMPUTER FOR THE LOWELL OBSERVATORY

O.G. Franz, Lowell Observatory, *P.O. Box 1269, Flagstaff, Arizona* 86001 (AST7821671)

This grant partially supports the purchase of a new computer for scientific computation and analysis of data from modern, efficient detector systems in use at Lowell Observatory.

The new computer will be used in support of Lowell Observatory's entire research program, which includes not only the work of its own scientific staff of ten full-time astronomers, but also the activities of the 60 to 70 quest investigators from the United States and from abroad who annually use the Observatory's research facilities.

Observational programs now in progress or in preparation encompass virtually the entire field of optical astronomy; investigations of the physical properties of asteroids, comets, planets, and satellites; studies of the colors, brightnesses, surface temperatures, diameters, masses, motions, and distances of stars; research on the distribution and chemical composition of interstellar material; investigations concerning the properties and the nature of quasi-stellar objects; and studies of faint, distant galaxies. This research bears directly on questions concerning the nature, age, origin, and evolution of the observable universe.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

7.0003, MATHEMATICAL THEORY OF NONLINEAR WAVE PROPAGATION

G.B. Whitham, California Inst. of Technology, Graduate School, Dept. of Applied Mathematics, *1201 E. California Blvd., Pasadena, California* 91109 (DN525213; N00014-75-C-0702)

The mathematical research being done under this task responds to naval requirements for prediction and control of physical phenomena in the fields of oceanography, meteorology, gas dynamics and plasma physics. The mathematical theory of nonlinear wave propagation is particularly relevant to naval research in oceanography. This work provides fundamental insight into the propagation of both internal and surface waves and water waves on a beach.

Research is being done in the mathematical theory of nonlinear wave propagation and related problems in the general theory of partial differential equations. This work includes the investigation of variational principles for nonlinear wave problems and the study of the general mathematical structure of partial differential equations derivable from variational principles.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0004, NUMERICAL TECHNIQUES FOR OPTIMIZATION AND SYSTEMS OF NONLINEAR EQUATIONS

P.S. Jensen, Lockheed Missiles & Space Co. Inc., *3251 Hanover St., Palo Alto, California* 94304 (DF044770; F49620-76-C-0003)

AF function - design of aerospace vehicles. Deficiency - no effective analytical and computational methods are available for optimizing the complex structures used in the bodies and parts of aerospace vehicles. Objective - to develop, implement and test efficient algorithms for global optimization and the solution of nonlinear systems of equations. How work contributes - computer codes for use in the design of structures will be developed under this effort.

Algorithms for optimization and the solution of systems of nonlinear equations will be developed, implemented as computer programs, tested and documented. The emphasis of the effort on optimization will be on algorithms for achieving global rather than local optima. The emphasis of the effort on the solution of nonlinear systems will be on algorithms appropriate for use in the integration of stiff oscillatory problems. Methods suitable for broad application will be sought rather than methods that exploit specific problem characteristics, subject to the above emphases.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, NUMERICAL VORTEX TRACING

O. Buneman, Stanford University, Inst. for Plasma Research, *Stanford, California* 94305 (DN875232; N00014-78-C-0272)

The development of accurate numerical procedures for predicting high Reynolds number flows will lead to improved methods for optimizing the performance of aircraft, ships, and missiles. The purpose of the proposed research on three-dimensional turbulence will be to develop a viable and accurate vortex tracing method which will be able to simulate, for special cases, the evolution of turbulence.

The basic approach of the proposed method is to represent the continuous distribution of vorticity in a flow field by discrete, closed, vortex filaments. In this model, viscous effects will occur only in the internal structure of the vortex filaments. Since viscous effects are neglected elsewhere, the vortex filaments move with the local fluid velocity. The velocity field is not calculated directly from Biot-Savart's Law but by integrating a Poisson equation on an appropriate mesh. Once the velocity field is established, the fluid elements along each vortex filament are advanced in time to establish a new vorticity distribution.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0006, MATHEMATICAL FOUNDATIONS OF STABILITY THEORY, CONTROL THEORY AND NUMERICAL LINEAR ALGEBRA

M. Marcus, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Mathematics, *Santa Barbara, California* 93106 (DF046720; F49620-78-C-0030)

AF function - the design of efficient and stable control systems for future aircraft engines, missile motors, aircraft control surfaces. Deficiencies - the stability on nonlinear as well as some linear control systems are not well understood. Objective - this research will study the stability theory for systems of ordinary differential equations that describe any dynamical system. How work contributes - results may be obtained which may aid the designer of control systems for future aerospace vehicles.

Under this block contract the following topics will be investigated: (1) eigenvalue location and the numerical range, (2) the relationship between eigenvalues and entries of a finite matrix, inequalities for eigenvalues of sum and products, (3) eigenvalue theory for matrices with non-negative entries, (4) control theory applications of matrix theory and eigenvalue localization theory, eigenvector and eigenvalue computing methods, and (5) exact matrix and combinatorial computations on the ILLIAC 4. In addition, the computerized linear algebra bibliography will be updated and searches requested by AF laboratories will be honored on a time-available basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, RIGOROUS DIFFRACTION THEORY SCATTERING FOR APPLICATION

R.E. Kleinman, University of Delaware, School of Arts & Sciences, Dept. of Mathematics, *Newark, Delaware* 19711 (DF038150; AFOSR-74-2634)

AF function - radar target recognition. Opportunity - target vibration effects radar return. Objective - analytical relations between target eigenmodes and the radar return. How work contributes - engine vibration aerodynamic flutter, etc., characteristics, if determinable from the radar return, would improve target recognition capabilities.

A simplified model for scattering from vibrating bodies will be derived mathematically using asymptotic techniques and tested against experimental data. Other research areas being continued include application of optimal control methods to impedance loading problems in order to find that loading or induced current distribution on a surface which optimizes a desired scattering or radiation characteristic, and extension of integral equation scattering techniques to higher frequencies and non-smooth boundaries in ways suitable for efficient numerical solution.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0008, FIRST PASSAGE TIMES IN STOCHASTIC DIFFERENTIAL EQUATIONS OF MATHEMATICAL PHYSICS AND ENGINEERING

B.J. Matkowsky, Northwestern University, Evanston Campus, Technological Inst., Dept. of Engineering Science & Applied Mathematics, *633 Clark St., Evanston, Illinois* 60201 (DF051910; AFOSR-78-3602)

AF function - improve the reliability of aerospace vehicle structures. Opportunity - an analysis technique newly developed by the author promises results in AF relevant reliability problems. Objective - new insight into control of reliability in physical structures. How work contributes - by suggestive examples exhibiting and quantifying relevant non-intuitive effects.

Matched asymptotics are used to study small stochastic perturbation of deterministic problems involving multiple turning points and equilibria. Probability of passage from one equilibrium to another, position of inner 'boundary' layers occurring in 'resonance', expected exit times or points, etc., are to be determined as appropriate for problems including dynamic stability of structures, electrical network stability under thermal noise, determining rate coefficient in chemical reactions, and atomic migration in crystals.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, FRACTURE PROBLEMS IN POWER LAW VISCOELASTIC MATERIALS

A. Nachman, Texas A & M University, College Station Campus, School of Science, Dept. of Mathematics, *College Station, Texas* 77843 (DF048270; AFOSR-77-3290)

AF function - engineering intuition relating to tire impact on a runway, composite bonding, etc. Deficiency - mathematical techniques and solutions for power law viscoelastic materials. Objective - solution of two-dimensional time-dependent contact and fracture problems. How work contributes - by suggestive examples, exhibiting and quantifying relevant non-intuitive effects.

The motion of a crack tip in a power law viscoelastic layer important to bonding, Shallamach waves of detachment for a sliding tire over pavement, etc., will be investigated by reduction to a coupled system of dual relation problems or integral equations. Mathematical techniques used include Fourier and Mellin transforms, Abel integral equation solutions, and other techniques used on Cauchy integral equations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, ION PHOTOFRAGMENT SPECTROSCOPY POTENTIAL SURFACES OF MOLECULAR IONS

J.T. Moseley, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF043690; F44620-76-C-0095)

AF function - Air Force operations in reconnaissance, communications, detection and discrimination require understanding of complex atomic, molecular and ionic phenomena that occur in the natural and disturbed atmosphere. Deficiency - there is a lack of sufficient quality information on fundamental processes that occur in the atmosphere that affect electron densities, which hinder propagation of electromagnetic signals in the presence of perturbed atmosphere backgrounds. Objective - investigate the energy and angular distributions of photofragment ions from parent molecular ions important in the atmosphere and interpret experimental results in terms of the parent ion molecular potentials and structural properties. Examine and interpret photodetachment cross-sections if important in these ions. How work contributes - provides a measure of ion and electron densities in the normal and disturbed atmosphere which affect communication signals. Also important in the development of high energy lasers.

Use of laser and a fast ion beam apparatus termed the coaxial-beam photofragment spectrometer to produce photofragmentation of polyatomic atmospheric ions and other ions of interest. Determine photofragment energy and angular distributions to establish the structural properties of the ions. If important, interpret results of photodetachment cross-section investigations in terms of vertical detachment energies and electron affinities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0002, THEORETICAL ASPECTS OF SUPERCONDUCTOR BEHAVIOR

E. Simanek, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Physics, *Riverside, California* 92502

Theoretical study of the properties of inhomogeneous superconducting films and aggregates of ultrafine metallic particles is planned. Temperature dependence of the order parameter will be calculated from the model of random superconductivity to interpret tunneling studies of Al films. The effects of Josephson coupling between particles in aggregates will be studied. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0003, MANY-BODY SOLID STATE

D.J. Scalapino, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DMR7617373A02)

Research begun under NSF grant DMR73-07660 will be continued and extended, including studies of the physical properties of pseudo one-dimensional materials and phase transitions and related problems in quantum field theory. Specifically, techniques developed in the previous grant period will be applied to calculations of correlation functions for one-dimensional systems. Microscopic calculation of the parameters that enter the model Hamiltonians will be undertaken. Work on the mapping of a two-dimensional classical field problem into a one-dimensional quantum field theory problem will be pursued. Non-perturbative solutions to these quantum field theories will be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, MAGNETIC CRYSTALS WITH WEAK INTERACTIONS

W.P. Wolf, Yale University, Graduate School, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (DMR7623102A02)

Research previously funded under grant DMR73-02405 will be continued. The work covers several related areas: 1. Experimental studies of multicritical points, including work on tricritical, bicritical and wing critical points. 2. Domain studies near phase transitions. 3. High-frequency relaxation measurements of magnetic specific heats. 4. High-sensitivity magnetometry, development of a SQUID magnetometer. 5. Phonon contributions to bulk magneto-thermodynamic properties, a heat capacity study of non-additive effects. 6. Phase transitions in mixed crystals including mixed antiferromagnetic-ferromagnetic and antiferromagnetic-diamagnetic crystals. 7. Preparation of new magnetic materials, including high-pressure hydrothermal synthesis of rare-earth hydroxides and hydroxy carbonates. The principal objective of all these studies is to seek direct confrontation between theory and experiment, with a view to improving our understanding of the microscopic processes important in magnetic materials.

This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, MAGNETICALLY ORDERED MATERIALS AND QUANTAM ELECTRONICS

V.J. Folen, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620115)

To investigate magnetic materials and magnetic quantum electronic phenomena which are essential in the operation and design of practical devices. Such investigations result in the discovery of new magnetic effects and/or in improved magnetic properties which enhance the sophistication, reliability and economic competitiveness of devices for communications, control, sensing, memory, radar, sonar and many other applications needed in the Navy.

Experimental techniques (including magnetization, magnetic susceptibility, magnetoelectric susceptibility, magnetic anisotropy, magnetostriction, optical absorption and resonance) and analysis are utilized on selected magnetic materials and magnetic quantum electronic components in order to study and exploit those phenomena which have the greatest potential for military applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0006, SUPERCONDUCTING MATERIALS AND TECHNOLOGY

D.U. Gubser, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620040)

Determination of basic interactions in solids which control electrical and magnetic properties at cryogenic temperatures, particularly those interactions responsible for the occurrence of superconductivity. Identification of physical and chemical parameters which optimize superconducting properties of a given system.

This program emphasizes the study of alloys and compounds formed by new and unusual fabrication techniques. The magnetic moment, magnetic susceptibility and electrical resistivity of carefully prepared and well characterized sample alloys are studied as functions of temperature, pressure and magnetic field. Data are interpreted in terms of modern theories of their modifications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0007, MATERIALS PROCESSING OF HIGH TC SUPERCONDUCTORS FOR SYSTEMS APPLICATIONS

R.A. Hein, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680280)

This jointly funded program (ref. WUAS M01-43.701) is to develop to the point of production readiness multifilament V3Ga composite wire for service at higher tempertures, higher magnet fields, and with higher current densities than presently available with commercial Nb-Ti wires. It is to develop processes and fabrication procedures which are amenable to commerical production and to fully characterize the superconducting properties of the wires so produced.

The technology developed at NRL for producing multifilament V3Ga wire will be extended to long lengths of high filament density wire. Measurements of the critical current of V3Ga as functions of temperature, magnetic field, and other important engineering parameters will be compared with similar measurements for Nb3Sn. These data will aid in material optimization and provide options for superconducting systems development.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Sea Systems Command

8.0008, ELECTRONIC STATES OF DEEP LEVEL DEFECTS IN SEMICONDUCTORS

L.A. Hemstreet, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680408)

Deep level defects in semiconductor materials, however produced, have a great effect on the electronic properties of devices. An understanding of the properties of such defects is therefore essential to insure proper design and performance of a broad spectrum of electronic and optoelectronic systems employed by the Navy. The objective of this program is to conduct a systematic theoretical study of various classes of deep level defects in such semiconductor materials as silicon, gallium arsenide, and indium phosphide, and to correlate the behavior of such defects with the local bonding properties of the defect-solid system.

The host solid will be represented by a large cluster of atoms, and realistic self-consistent calclulations of the electronic properties associated with various impurities/lattice defects in the host cluster will be calculated using multiple scattering theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0009, SOLAR-TERRESTRIAL PHYSICS

D.J. Michels, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880036)

To improve basic understanding of the relationships between geophysical disturbances and the variability of solar plasma and electromagnetic radiations. Improved understanding of the mechanisms that cause disturbances in the earth's magnetic field and the ability to characterize and predict the occurence and severity of such disturbances (geomagnetic storms) is of great importance to the Navy. Essential Navy/DOD systems are affected by geomagnetic anomalies; in some cases geomagnetic activity ranks high among causes of system outage or degradation or as a significant cause of false signatures.

Research emphasis will be on improved understanding of how the solar material is propagated towards earth and on understanding what parameters govern the severity of the geomagnetic response. Solar monitoring experiments will be flown in satellites; collaborative arrangements will be worked out to achieve the multidisciplinary approach required by this problem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0010, TWO- AND THREE-BODY CORRELATIONS IN SIMPLE GASES

J.W. Dufty, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (CHE7822211)

This grant, spported by the Structral Chemistry and Thermodynamics Program, is for theoretical and experimental research on the detailed nature of the forces between pairs and triplets of molecules. These forces contribute significantly to the structure and motion that occurs in the important area of high density gases and liquids. Simple gases, for example, Xe, HCl, and DCl, are chosen because detailed experimental and theoretical studies are tractable.

The research program will use neutron scattering and diffraction experiments, computer simulation experiments, and theoretical analysis to extract detailed two-body and three-body potential energy functions. The central experimental quantity is called the partial structure factor and it can be related to the structural and dynamic properties of the fluid through the use of a theoretical model. The theory of the structure factor itself will also be developd and compared with the experimental results.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0011, SEMICONDUCTOR OXIDE INTERFACE STATES

C.T. Sah, University of Illinois, Urbana Champaign Campus, Inst. of Aviation, *Willard Airport, Savoy, Illinois* 61874 (DF042160; AFOSR-76-2911)

AF function - Air Force communications, data processing, and remote sensing systems are among the many systems requiring reliable and stable solid state electronic components and devices. Deficiency - silicon is the dominant semiconducting material used in these devices, and the surface states, interface states, and oxide traps exert a controlling influence on the reliability as well as the electrical characteristics of bipolar and MOS field effect transistors. In addition, the two- and three-dimensional electrical properties of semiconductors are becoming increasingly important as the characteristic size in devices is reduced to submicron dimensions. Objective - the objective of this research is to obtain an understanding of the atomic origins and microscopic-macroscopic properties of the interface surfaces and oxide charges on semiconductor surfaces, as well as an understanding of two- and three-dimensional effects which become important at submicron device sizes. How work contributes - the objective will be accomplished by providing a combined experimental/theoretical approach.

Studies will continue on the atomic origin of interface states and oxide charges in silicon MOS structures by means of a) fabrication variations correlated with detailed evaluation of electrical properties. b) studies of the generation, diffusion, and annealing kinetics with ultraviolet light and keV electron beam excitation. A shared multiprogrammer interface between the electron-beam station and the ultraviolet light source setup with the minicomputer will be added. This will automate data acquisition as well as control of experimental conditions. Small geometry effects and defects will be simulated as small device patterns by photo-engraving and measured using the electron-beam presently on hand. Mathematical analysis techniques will be developed to handle the two- and three-dimensional models more accurately than the partially lumped quasi-three-dimensional model developed previously.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0012, NUCLEAR STRUCTURE AND NUCLEAR PROCESSES AT INTERMEDIATE ENERGIES

R.E. Pollock, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (PHY7822774)

The Indiana University Cyclotron Facility provides beams of protons, deutrons, helium ions and other light ions up to an energy of 200 million electron volts, with ancillary equipment and support services to permit a broad range of studies of nuclear structure and nuclear reactions. Research using the facility is carried out by a large community of users from outside the University as well as by large Indiana University groups.

The research performed is in the area of studies of the properties of nuclear ground states and excited states by means of a wide variety of techniques using precisely defined particle beams from the cyclotron and detection devices such as a magnetic spectrometer, solid state detectors and neutron time-of-flight equipment. An active program of studies of pion production near threshold is in progress.

This grant will support the operation of the facility, the continued development of its capabilities, and technical assistance to the full spectrum of users of the facility. It will also provide direct support to the Indiana University users, other users being expected to obtain their support via separate grants from NSF, DOE or other agencies.

This work is a continuation of that supported under Foundation grant PHY76-84033AO1.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0013, CRITICALLY EVALUATED DATA ON OPTICAL AND TRANSPORT PROPERTIES OF SOLIDS

H.H. Li, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DF044030; F44620-76-C-0105)

AF function - weapons, defense. Deficiency - lack of readily available standard reference data on basic solid materials (metals, alloys, refractory compounds) hampers materials development and evaluation for EM radiation resistance. Objective - the goal of this work will be tables of evaluated optical property and electrical resistivity data at high temperatures on selected solid materials of potential importance in laser window and laser-hardened materials technologies. How work contributes - the products of this work will be widely used by design engineers and as input data for a variety of computer programs.

Properties to be first evaluated will be index of infraction and absorption index as functions of wavelength, and the temperature and pressure dependence of both. These will be done for selected families of elements and compounds which may be important in Air Force laser-hardened materials technology. Electrical resistivity and its variation with temperature will be simultaneously reviewed. These results will be accomplished by collecting and organizing all available pertinent experimental data, critically evaluating it, and recommending most probable values. The work of evaluation, and of interpolation and extrapolation, will be aided by the development of improved theoretical or semi-empirical inter-property relationships.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0014, SURVEILLANCE - X-RAY EMITTED FROM HIGHLY IONIZED ATOMS

B. Curnutte, Kansas State University, School of Arts & Sciences, Dept. of Physics, *Anderson Hall, Manhattan, Kansas* 66502 (DN323076; N00014-75-C-0490)

This research provides data for developing models for understanding the properties of highly ionized atoms and interactions of these systems with other atomic species. Since these atomic species occur in high temperature plasmas and violent collisions, understanding their properties and interactions is important to the Navy from the standpoint of modeling nuclear weapons detonations with high temperature plasmas, studying solar activity which affects the ionosphere and studying the effects of a nuclear detonation on the environment.

The Lamb shift in O(7-plus) will be determined by measuring the polarization components of the radiation from the Stark-mixed S(1/2) and P(1/2) states. The polarimeters for similar measurements in hydrogen-like silicon and sulfur will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0015, POSITRONIUM EXPERIMENTS

S. Berko, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (PHY7824702)

Positronium (Ps), the electron-positron bound state, has long been recognized as the ideal 'atom' to be investigated as a test of the quantum electrodynamical theory of atomic systems. However, it has only been recently that the elusive first excited state (n equals 2) of Ps could be observed, and thus lay the ground work for precise testing the 'Lamb shift', i.e., radiative correction measurements.

A program of obtaining high precision measurements of the n equals 2 Ps fine-structure through improved microwave techniques and an investigation of the Ps production phenomena will be continued. The investigation of the Ps emission is aimed at improving the yield of n equals 2 Ps, producing sub-eV Ps emission velocities, as well as carrying out a proposed first direct measurement of the Ps-helium scattering cross-section.

This is the first year of a three-year continuing grant, currently supported under NSF grant PHY76-23883A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0016, LOW-TEMPERATURE AND NEUTRON PHYSICS STUDIES

C.G. Shull, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139

The neutron spectrometers currently being modernized at the reconstructed MIT Research Reactor will be reinstalled and used for studies in materials characterization and fundamental neutron physics. These studies will be included: further work on the diamagnetization structure of bismuth, de Haas--van Alphen scattering effects, and neutron interferometry development and uses. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0017, RADIATION PHYSICAL CONSEQUENCES OF CHARGED PARTICLES INTERACTING WITH ATOMIC AND MOLECULAR SYSTEMS (DOD 1338.10M)

C.P. Wang, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0G4323)

To study the primary interactions during the passage of charged particles (protons, electrons, etc.) through matter. Such studies are important to the radiation preservation of food since these fundamental processes determine essentially all the physics and chemistry during food irradiation.

The interactions between incoming charged particles and atoms and molecules of target material manifest themselves most clearly in slowing down of incoming particles with accompanying excitation and ionization of target atoms and molecules, the ejection of secondary electrons and emission of Cerenkov light. An accurate description of stopping power necessarily contains knowledge of interactions and structure of atomic and molecular systems. Investigations will study the stopping power of those materials relevant to food irradiation.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

8.0018, RESEARCH WITH HEAVY IONS USING A 500 MEV SUPERCONDUCTING CYCLOTRON

H.G. Blosser, Michigan State University, School of Natural Sciences, Dept. of Physics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (PHY7822696)

This grant will provide support for a research program in nuclear science at Michigan State University. In addition to continuation of light-ion work using the 50 MeV cyclotron constructed under NSF grant GP-19978 and presently supported under NSF grant PHY78-01684, heavy ion studies will begin using the new superconducting 500 MeV cyclotron presently being constructed under NSF grant PHY76-83256. As the 500 MeV cyclotron comes into operation, the program will change from predominantly in-house research to research involving many outside users and operation of the 50 MeV cyclotron will be phased out. The ongoing accelerator development program will shift from final design of the 500 MeV to studies towards a similar 800 MeV cyclotron proposed as the second stage of a powerful two-cyclotron heavy ion accelerator.

Among the areas of research to be pursued with the 50 MeV accelerator are: precision direct reaction measurements, exotic nuclei and mass measurments, nuclear excitation, beta and gamma spectroscopy, fundamental processes, nuclear astrophysics and heavy-ion studies. Some of the work using the 500 MeV machine will be extensions of work presently underway, including studies of exotic nuclei, high spin spectroscopy, giant multipole resonances and nuclear astrophysics. It is anticipated that entirely new studies will be carried out as new properties of nuclei are discovered. Possibilities exist as well in fusion reactions where a new range of heavy nuclei can be produced. Processes intermediate between complete fusion and peripheral quasi-elastic processes will also be studied. This area is replete with unexplained phenomena.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, KINETIC REACTION COEFFICIENTS IN ROCKET EXHAUST PLUMES

W.R. Snow, University of Missouri, Rolla Campus, School of Arts & Sciences, Dept. of Physics, *103 Parker Hall, Rolla, Missouri* 65401 (DF038680; AFOSR-74-2672)

AF function - weapons delivery, defense. Deficiency - advancement of predictive, detection, preventive and other techniques in rocket plume technology has been hampered by lack of fundamental reactive and radiative data. Specifically, determination of plume radar cross-sections requires input data on charged particle reactions. Objective -this four-year program is to provide measured data on ionization, recombination, attachment and detachment processes that occur with HCl and KCl and their elements. How work contributes - this work will provide data called for in research objective 5.1.2, and placed in the highest priority category by AFRPL.

Drift tube, flowing afterglow, modulated crossed beams and laser excitation techniques will be used for the various reactions to be studied. Quantitative effects of various collision partners and third bodies will be emphasized. Temperatures ranging from 300-10,000K and pressures from 0.1 to 10 sup 5 PA will be covered. Some of the important reactions being studied are ion-pair production from potassium and chlorine atoms, recombination of potassium ions as affected by third bodies, and the effect of clustering on the associative detachment of chloride ions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0020, HIGH-PRECISION NUCLEAR MAGNETIC SUSCEPTIBILITY MEASUREMENTS IN SOLID 3 HELIUM

P.B. Pipes, Dartmouth College, School of Arts & Sciences, Dept. of Physics, *P.O. Box 833, Hanover, New Hampshire* 03755 (DMR7704665A01)

This is a continuation of research initiated under DMR7704665.

High-precision nuclear magnetic resonance techniques combined with improved thermometry will be used to measure the RF magnetic susceptibility of solid helium-3 over the temperature range 0.4K to 0.02K. Experimental work will be performed at the National Bureau of Standards, Washington, DC, as part of a collaborative study. These data should resolve an existing thermodynamical conflict in existing data and will provide a clearer understanding of the fundamental aspects of nuclear exchange in quantum solids.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, LIFETIMES AND QUENCHING RATES FOR THE TRIPLET PI STATES OF INTERHALOGEN MOLECULES

J. Wright, University System of New Hampshire, University of New Hampshire, School of Technology, Dept. of Physics, *James Hall, Durham, New Hampshire* 03824 (DF047470; AFOSR-77-3232)

AF function - reconnaissance, communication, weaponry. Deficiency - there is a lack of a high-power, efficient, chemically pumped electronic transition laser which is a projected requirement for future Air Force applications. Objective - use laser-induced time-resolved spectroscopy to measure the decay rate and quenching rates for the triplet-pi states of several interhalogen molecules which are attractive candidates for chemical lasers. How work contributes - a requirement for a chemically-pumped electronic transition laser is that the decay rate of the excited state and quenching rates be less than the chemical reaction rate. This research intends to measure these rates for interhalogen molecules which have been identified as candidate electronic transition laser molecules.

A tunable dye laser will be used to excite the triplet pi electronic states of certain interhalogen molecules. Time resolved fluorescence spectroscopy will be used to infer the excited state lifetimes and quenching rates in the presence of other molecules.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0022, DIATOMIC MOLECULE PROPERTIES IN THE INTERMEDIATE ENERGY TO DISSOCIATION LIMIT RANGE

C.L. Beckel, University of New Mexico, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Hill N.E., Albuquerque, New Mexico* 87106 (DF046320; AFOSR-77-3132)

AF function - this research contributes to research objective 6.1, nuclear weapons effects. Deficiency - weapons effects computer codes need information on the energy levels of diatomic molecules. Objective - this program is directed toward achieving better understanding of and more useful procedures for treating diatomic molecule bound states in the intermediate to high energy range. Contribution - this research will permit more reliable description of diatomic molecule properties in high energy, high temperature environments.

Expressions are being developed that relate vibration-rotation eigenenergy E-Sub-V, J to vibrational quantum number V. Eigenvalues are being found for a set of model potentials and a corresponding set of actual potentials that correlate with a variety of separated atom states. Reduced mass is being varied to vary eigenvalue density as an aid in determining E-Sub-V, J versus V functional forms. Possible causes for failure of the RKR method near dissociation are being evaluated and improvements are being devised to make RKR useful at high-V.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0023, MATH INVESTIGATIONS

N. Tzoar, City University of New York, City College, School of Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DF902380; F19628-77-C-0114)

AF function - development of high data rate optical fiber communications. Deficiency - lack of knowledge regarding the detrimental effects of nonlinear pulse propagation in solid dielectric waveguides. Objective - determine possibility and conditions for propagation of intense short pulses for high data rate optical fiber communications. How research contributes - will determine

the characteristics and thus the feasibility of ultra-short pulse propagation in optical fibers.

Investigate the broadening and narrowing of short pulses in nonlinear circular optical waveguides by solving electromagnetic wave equations analytically and numerically.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

8.0024, MEASUREMENT OF THE MICROWAVE SURFACE IMPEDANCE IN NON-EQUILIBRIUM SUPERCONDUCTING THIN FILMS

J.C. Amato, Colgate University, Graduate School, Dept. of Physics & Astronomy, *Hamilton, New York* 13346 (DMR78-10279)

Superconducting systems can easily be driven far from equilibrium by externally-applied perturbations. In a non-equilibrium state, a superconductor or superconducting device may behave rather differently than it does in equilibrium. Recent theoretical advances make it possible to study the non-equilibrium state by measurement of transport properties. Such a study is proposed: measurement of the microwave surface impedance of superconducting thin films excited by moderately strong microwave radiation. A novel microwave cavity design greatly simplifies the measurement procedure.

There is an immediate technological and scientific need for experiments of this kind. An understanding of non-equilibrium superconductivity is essential for further development of millimeter and infrared superconductivity detectors. The distinctive features of this experiment offer a fresh, complementary study of the non-equilibrium state. In particular, use of single thin films, rather than tunnel-junction structures, will provide a clearer distinction between the role of the superconductor proper, and that of thermal coupling to the surrounding environment.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0025, GROWTH OF HOMOGENEITY CHARACTERIZATION OF MERCURY CADMIUM TELLURIDE CRYSTALS

F.H. Pollak, Yeshiva University, New York Campus, Graduate School, Dept. of Physics, *55 5th Ave., New York, New York* 10003 (DF039430; AFOSR-74-2714)

AF function - infrared detectors are essential solid-state components of air reconnaissance and surveillance systems. Opportunity - presently, infrared materials are insufficiently understood to produce detectors with predictable responses. The development of improved infrared detectors requires a full understanding of the roles defects, impurities and nonstoichiometry play in the detection process and their optimum performance in detector arrays. Objective - to characterize and understand the lattice response and detection properties of synthesized and specially-doped narrow band-gap compound semiconductors such as (Hg, Cd) Te systems having optimum detectivities in the spectral range of 8 to 14 micrometers. How work contributes - high density infrared detector arrays could result from this new approach to crystal growth, characterization and understanding of the electronic structure and optical properties of narrow band-gap semiconducting compounds.

Characterization of electronic structure and optical properties is accomplished non-destructively by a unique wave-length modulated photoresponse and by electrolyte electroreflectance (EER) spectroscopy to analyze impurity centers and to recognize actual changes in composition across the surface of a wafer with a spatial resolution commensurate with the dimensions of the detector array. A new approach to the growth of highly-uniform large (Hg, Cd)Te crystals involves the application of current-controlled liquid phase epitaxy (LPE) and evaluating topographical variations in stoichiometry of the grown crystals. The highly sensitive optical technique of the rotating light pipe reflectometer (RLPR) will be utilized to gain information about the formation and dissolution of anodic oxide films (potential Schottky barriers) which form on the surface of the crystal. Raman spectroscopy which is sensitive to surface conditions will be used to elucidate the structural nature of the chemical bonding at the surface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0026, EXPERIMENTAL HIGH ENERGY PHYSICS

D.K. Robinson, Case Western Reserve University, Graduate School, Dept. of Physics, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (PHY7821338)

This research effort in experimental particle physics is searching for strong interaction resonances in K ion n interactions. They are measuring the angular distribution and the polarization of the recoil neutron in the reaction K ion n-K ion n. Analysis of the data should reveal whether there are particle resonances which do not fit in simple representations of SU(3).

This is a continuation of research initiated under NSF grant PHY77-21738 and is the first year of a two year grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

8.0027, STRUCTURAL AND KINETIC PROPERTIES OF GRAPHITE INTERCALATED COMPOUNDS

D.L. Chung, Carnegie Mellon University, Graduate School, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF051500; AFOSR-78-3536)

AF function - airborne systems utilized for command, control, communications, reconnaissance and surveillance depend heavily upon interconnected electronic components. Opportunity - improved performance of these systems can be expected from the use of less expensive lighter materials such as intercalated graphite compounds for electrical conductors. Intercalated graphite compounds, weighing about one fourth as those of copper, could have conductivities greater than those of copper. Objective - the objective of this research is to contribute to the understanding of the basic physical properties of intercalated graphite compounds. How work contributes - this work should contribute to the development of intercalated graphite compounds that could replace copper as the dominant electrical conductor of airborne systems.

The structural and kinetic properties of graphite intercalation compounds will be studied. Attention will be given to the microstructure which varies with the parent graphite material, the intercalate species and concentration, the sample preparation technique, the interaction of the intercalate with structural defects, the epitaxial growth of the intercalate on the intercalate with structural defects, the epitaxial growth of the intercalate on the intercalated compound, the kinetics of intercalations, and the kinetics of exfoliation. Thermal gravimetric analysis, Auger spectroscopy, scanning and transmission electron microscopy, low and high energy electron diffraction and dilatometry will be used to investigate compounds based on various types of pristine graphite materials, such as pyrolytic graphite, graphite fibers, graphite whiskers, and grafoil.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0028, ION IMPLANTATION IN III-V COMPOUND SEMICONDUCTORS

G.W. Eldridge, Westinghouse Electric Corp., *3 Gateway Ctr., Pittsburgh, Pennsylvania* 15222 (DF040310; F44620-75-C-0034)

AF function - microwave solid state electronic devices are essential components of Air Force reconnaissance, electronic countermeasures and communications systems. Opportunity - continuing systems requirements demand improvements in power, frequency, efficiency and noise properties in solid-state electronic devices. Currently, GaAs is being heavily investigated for its properties, but other III-V materials such as InP and GaIn AsP present the opportunity for higher performance devices due to some of their superior electrical characteristics. Objective - the objective of this research is to investigate the utility of ion implantation into InP and GaIn AsP for the selective control of doping profile control and junction formation. How work contributes - the control and understanding of ion implantation into these III-V materials will permit the fabrication of high performance microwave devices.

During the first portion of this research year, additional work will be carried out in order to optimize InP implant and encapsulation procedures. In order to determine the effect of substrate

quality on the implant results, low dose implants will be made into a variety of iron and chromium doped InP substrates as well as into some undoped VPE layers. Mobility data will then be correlated with these various implanted substrates. Any improvements in mobility or activation efficiency due to radiation damage gettering will also be investigated. Work will also continue on trying to improve the low activation associated with P-type implants. Finally, a systematic study of encapsulants will be made. Both carrier concentration and mobility will be profiled in unimplanted and annealed epitaxial layers. In addition, inert gas implants will be profiled to study radiation damage gettering and mobility recovery. In the second half of this research work will begin on GaIn AsP. First, epitaxial layers of this compound will be grown and characterized. Then work will begin on implants into this epitaxial material followed by encapsulation with silicon dioxide and silicon nitride layers. Inert gas and isoelectronic ions (as well as N-and P-type implants) will be used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0029, TOPICS IN THE PHYSICS OF FLUIDS - PHASE TRANSITIONS TO A STATE OF LOWER SYMMETRY

J.B. Swift, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR7611426A01)

Research previously supported by DMR 76-11426. The research will be primarily concerned with the problem of dynamical phenomena near phase transitions to states displaying spatial structure. Several problems having to do with this topic will be investigated, including dynamics near the nematic-smectic-C transition of a liquid crystal and dynamics near the Lifshitz point of a liquid crystal. Also the dynamics near the paramagnetic helicoidal transition in isotropic models of magnetic systems, and acoustic attenuation near a critical point, will be studied.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0030, THEORY OF PLASMA WAVES IN THE EARTH'S BOW SHOCK

S.P. Gary, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185

Theoretical investigation of possible plasma instabilities in the earth's bow shock; solution of the complete electromagnetic, Vlasov, linear dispersion relation for conditions appropriate to perpendicular shocks, dominant instabilities, construction of appropriate nonlinear theories to determine saturation mechanisms and turbulent scattering frequencies. Structure of the earth's bow shock and how it heats the solar wind plasma. Dispersion relation for the case of unmagnetized ions and magnetized electrons undergoing an E-vector x B-vector drift. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0031, INFRARED SCHLIEREN SYSTEM

T.D. Wilkerson, Versar Inc., *6621 Electronic Dr., Springfield, Virginia* 22151 (DF035040; F44620-72-C-0076)

AF function - aerospace vehicles. Opportunity - Schlieren optical systems have long been used to make visible the density inhomogeneities in experimental gas glows, especially in supersonic wind tunnels. This technique is limited in sensitivity by the small refractive effect of air on visible light wavelengths, making it useless for observation of a number of phenomena at low overall gas density. Anomalous dispersion near resonance absorption wavelengths results in refractive index enhancement by up to two orders of magnitude. This makes it attractive to develop Schlieren and interferometric methods for infrared wavelengths in the 5 to 10 micron region, where such resonance phenomena abound for many molecules of gas dynamic interest. Objective - to demonstrate the feasibility of infrared observations of gas dynamic phenomena that could not be observed by visible spectrum methods. How work contributes - this research is directed toward the problem of infrared image recording, special sensitivity problems associated with laser focal spot size combinations of observed gases and spectral wavelength for optimum sensitivity of optical methods of flow observation depending upon index of refraction variations in the gas.

Measurements will continue on infrared refractive index and absorption surveys near available laser lines on a selection of molecular species, and flow visualization experiments, using suitable combinations of gas and infrared wavelength, will demonstrate these methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0032, ELECTRICAL CONDUCTIVITY OF SHOCK-COMPRESSED INSULATORS

G.E. Duvall, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DF051190; AFOSR-78-3478)

AF function - Air Force studies of the effects of nuclear blasts are consistently plagued by problems of unwanted electrical conductivity in monitoring probes. Opportunity - mechanisms of conduction are not understood, and no rational basis for selecting better insulation is available. Objective - this research will define the role of ionic conduction in shock induced conductivity in crystalline solids, investigate the role of electron excitation in shock induced conductivity in organic materials, and design a set of experiments for measuring shock induced conductivity up to pressures of about 1 megabar. How work contributes - the results and understanding obtained through this research will lead to a set of recommendations for selection and development of insulating materials for use under shock loading conditions.

A survey will be made of information on the electrical conductivity of insulators under shock conditions. An experimental arrangement will be designed for measuring electrical conductivity in both the Washington State University and AFWL contractor's (Sandia Labs) gas gun facilities. A series of shots will be made to determine the characteristic features of ionic conduction in a shock wave, and the relationship of basic mechanisms to the development of insulators for use at very high shock pressures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0033, SURFACE WAVE INVESTIGATION OF SUPERCONDUCTING ALLOYS

M. Levy, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF041820; AFOSR-76-2893)

AF function - superconducting materials are needed for application in airborne multi-megawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high transition temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - this research involves a unique technique, ultrasonic surface waves, to investigate flux pinning, flux flow and AC losses in films of superconducting alloys including A-15 compounds and solution hardened titanium alloys. The effect of nickel films on surface acoustic wave devices will be studied. How work contributes - the performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators and inductive energy storage systems could be significantly improved if AC power distribution losses, transients and mechanical breakdown of the superconductor were reduced.

Surface waves will be used to make measurements on thin superconducting films and on nickel films. These measurements will be performed in the 0.6 to 3.5 gigahertz frequency range. The Nb3Ge films will have to be deposited on sapphire substrates overlayed with a piezoelectrically active aluminum nitride film in order to produce the surface waves. A technique for exciting surface waves with sputtered ZnO films will be developed. Time of flight and ultrasonic attenuation measurements of both the ternary compound ErRh4B4, superconducting alloys and solution hardened titanium alloys. These measurements will be done as a function of temperature, and for the superconductors, they will be also done as a function of magnetic field. Thermal expansion

measurements will be performed in order to determine the elastic constants of these samples. A magnetometer will be used to determine the Ginzburg-Landau parameters K1 and K2 for the type II superconductors. Electron phonon interaction will be measured in the mixed state of bulk superconducting alloys in order to study flux motion in these superconducting alloys. The ultrasonic attenuation coefficient will be measured as a function of applied external magnetic field. The temperature of the isolated samples will be measured simultaneously in order to also determine thermal heating in these alloys as flux penetrates or escapes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, ASTRONOMY RESEARCH AT THE OWENS VALLEY RADIO OBSERVATORY

A.T. Moffet, California Inst. of Technology, Graduate School, Dept. of Physics, *1201 E. California Blvd., Pasadena, California* 91109 (AST7700247A02)

Extragalactic research will center on the fine scale radio properties of quasars and the nuclei of active galaxies, the continued study of the polarization and intensity changes in variables sources, and the kinematics and gas content of nearby galaxies. Galactic research will include studies of isotope abundances in various parts of our galaxy, the fine structure of the non-thermal source of radiation at the galactic center and the physical properties of dense clouds of dust and gas which are regions of star formation and large scale natural masers.

The solar system work will continue on the scattering properties of the rings of Saturn, the shape of the Jovian radiation belts and the thermal properties of the major satellites.

A second precise 10-meter diameter antenna will be brought into service as part of a three element millimeter wave interferometer. Low noise receivers and an advanced autocorrelation spectrometer will be brought into use on these telescopes. Interferometric observations will be started.

This research is a continuation of work previously supported under NSF Grant AST 77-00247.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, ANALYSIS OF MOLECULAR SPECTRA

J.G. Phillips, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST7605905 A02)

The successful study of molecular structure, excitations and abundances in astrophysical sources requires extensive and reliable laboratory information on molecules. This information includes transition identifications, relative and absolute transition probabilities and dissociation energies. This research program will provide astrophysicists with such information. During the coming year, the analysis of ZrO will be completed. The infrared spectrum of TiO and the spectra of FeH and FeD will be studied. A program to measure the lifetimes of excited molecular states will be carried out. Computer generated synthetic spectra of ZrO will be compared with electronic furnace spectrograms and photoelectric scans. The laboratory measure, analyses and transition probabilities will be applied to studies of molecular spectra found in cool stars.

This action provides additional funding for work previously supported by NSF grant AST76-05905A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, COMPARATIVE STUDY OF IGNIMBRITES, IMPACTITES AND CHONDRITES

K. Fredriksson, Smithsonian Institution, Div of Meteorites. *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560 (3350-49)

Detailed petrographic, mineralogical and geochemical studies will be made on series of ash flow rocks, impactites (Gosse's Bluff, Australia and Chassenon, France) and certain chondrites. These rocks are frequently similar in gross fabric although chemically very different. The study aims towards an understanding of the 'welding' process in ash flow tuffs and impactites (both of which may be present on the lunar surface) as well as an explanation of the wide textural variations within chemically well-defined groups of chondrites.

SUPPORTED BY Smithsonian Institution, National Museum of Natural History

10.0004, A STUDY OF THERMONUCLEAR PROCESSES ON ACCRETING NEUTRON STARS

P.C. Joss, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST78-21993)

The X-ray burst sources are a recently discovered class of objects which are characterized by repetitive short, intense outbursts of X-ray radiation. Over thirty such sources are now known and they appear to be concentrated in the direction of the galactic center. It has been suggested that the X-ray bursts are caused by matter falling onto a massive black hole. Another suggestion for these sources involves runaway thermonuclear reactions taking place on the surface of neutron stars.

Detailed numerical models of thermonuclear burning in the surface layers of accreting neutron stars will be computed. These computations will test the hypothesis that it is thermonuclear flashes on neutron stars that are the source of the X-rays. These studies will also be relevant to the question of the stability of nuclear burning in the surface layers of X-ray pulsars.

Another type of X-ray source that has been detected are the transient X-ray sources, or 'X-ray novae.' They have luminosity variation timescales ranging from days to months. The X-ray emission of some of these sources may result from thermonuclear flashes in the envelopes of neutron stars having a mass of about one-tenth of a solar mass. Models of such sources will be constructed.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, STELLAR PHYSICS - ANALYSIS OF SOLAR ROCKET AND SATELLITE DATA

E.H. Avrett, Smithsonian Institution, Astrophysical Observatory, Solar & Stellar Physics Division, *60 Garden St., Cambridge, Massachusetts* 02138

Development of numerical methods for the solution of the equations of statistical equilibrium and the equation of radiative transfer in spectral lines and in continua. Application of the numerical methods to solar and stellar lines of multilevel atoms, especially in study of the chromospheric structure of the sun. Investigation of the properties of radiation emerging from stochastic media, and media exhibiting horizontal structure. Study of deviations from local thermodynamic equilibrium in stellar photospheres. Determination of the source function from observations of solar lines by means of an inversion of the Laplace transform. Development of methods for correcting observed spectral profiles for instrumental broadening and noise.

Also, studies of observational data, namely ultraviolet spectra of the sun, to be used to test and improve SAO models of the variation with optical depth of structure, density, and pressure in quiet regions of the sun. The improved models will then be used to extend this analysis to active regions.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0006, 24-INCH TELESCOPE

D.W. Latham, Smithsonian Institution, Astrophysical Observatory, Optical and Infrared Division, *60 Garden St., Cambridge, Massachusetts* 02138 (310-4050-14)

This is a joint project with the State University of New York at Stony Brook to install and operate an Ealing-Beck 24-inch optical telescope at Mt. Hopkins. This telescope will complement the existing 60-inch telescope, since it will be installed nearby and will accommodate the same set of auxiliary instruments.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0007, AN ASTRONOMICAL OBSERVING PROGRAM IN ISRAEL

M. Lecar, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (SFG 0 3005)

An observatory has been constructed and instrumented and is now operating in the Negev desert in Israel. The observatory is jointly financed by Tel Aviv Univerity and the Smithsonian Institution; 50% of the observing time is reserved for US observers. The observations were made at the Israeli site (in connection with the moon, and with X-ray observations of SCO-XR-1). The major instruments at this new observatory are: a 40 inch wide-field telescope manufactured by Boller & Chivens, a photometer made at Cal Tech, and an image tube spectrograph made by Boller & Chivens. Currently under design is a Videcon System to be made by Bell Labs, Princeton University Observatory and the Beta Company in Israel. The observatory was dedicated in October 1971, and a number of cooperative observing programs are underway.

Plans have been drawn for the last major instrument - a digital (TV) camera and the process of negotiating its fabrication at the University of Texas has begun. The estimated completion data is June 1975. During the past year, there were some interruptions in the observing schedule, but the astronomers did produce an additional dozen research contributions including an unambigious determination of water in Comet Kohoutek.

SUPPORTED BY Smithsonian Institution, Museum of History & Technology

10.0008, COSMIC RAY ACCELERATION AT THE SUN

D.J. Mullan, Franklin Inst. of the State of Pennsylvania, *20th & Benjamin Franklin Pkwy., Philadelphia, Pennsylvania* 19103 (ATM7820936)

The emission of energetic particles from the sun disturbs the space environment around the Earth. To understand and predict these disturbances, it is important to investigate the conditions in the sun which allow particle acceleration to high energies. In association with some solar flares, cosmic rays are accelerated over a wide energy range. The relativistic component of cosmic rays persists for only a short time. At lower energies, a long-lasting component persists for many hours or even days. Detailed knowledge as to how and where these two components are accelerated is currently unavailable. The aim of the research supported here is to investigate theoretically processes whereby particles may be accelerated, with a view to determining how and where the particles gain energy. To do this, the effectiveness of two general classes of acceleration mechanisms in the sun's atmosphere will be evaluated quantitatively at a time when a region of the atmosphere has been modified by a flare explosion. The plan is to calculate how the solar atmosphere is modified by a blast wave from a flare, and then examine acceleration mechanisms associated with the blast wave itself as well as with the hot gas left behind the blast.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0009, THE SPECTROSCOPY AND THEORY OF HERBIG-HARO OBJECTS AND OF ATMOSPHERES OF WHITE DWARF STARS

K. Bohm, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST7820542)

The research to be carried out under this grant will involve studies of objects that are believed to represent early stages in stellar evolution (Herbig-Haro objects) and studies of objects that represent very late evolutionary stages -- white dwarf stars.

Herbig-Haro objects are found to occur only in regions where star formation and early stellar evolution are taking place. These objects are found in dark nebulae, and have a stellar or semistellar nucleus surrounded by a small emission nebulae. Observations of these objects has shown that they are changing over a time period of a few years, and there has been considerable speculation that these objects may be newly forming stars. Thus, it is necessary to determine the physical conditions in such objects and their energy sources. The research to be carried out will involve a detailed comparison of spectra photometric data for the very brightest of these objects with detailed theoretical predictions in order to determine some of the physical parameters of these objects. There will be studies of the heavy element abundances in the objects.

The atmospheres of cool white dwarf stars will be studied. These studies are important for an understanding of the final cooling stages of a star. The photospheres and coronae of hot white dwarf stars will be examined in order to improve our understanding of the observed extreme ultraviolet and soft X-ray radiation from these objects.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0010, HIGH ENERGY ASTROPHYSICS

P.B. Boynton, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST7722326A01)

In recent years a number of binary stellar systems which emit X-rays have been detected. One of the most unusual of these systems is the system known as HZ Hercules (Hercules X-1). This system shows a number of clearly defined periodic phenomena at optical and X-ray wavelengths. The system consists of a relatively low luminosity star and a compact companion star. This companion is surrounded by a disk of material which is produced from matter ejected by the low luminosity star.

The research to be carried out under this grant will involve analysis of data in order to obtain information on the mass transfer mechanisms taking place in the system. There will be studies of the manner in which material lost from the luminous star interacts with the disk of material surrounding the compact object. The properties of this disk material will be analyzed. Some of the periodic behavior observed in the X-ray emission from this star will be examined.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

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VOLUME 18 NUMBER 3/FEBRUARY 8, 1980

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N80-11999* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING. A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 114
Oct. 1979 116 p
(NASA-SP-7037(114)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 394 reports, articles, and other documents introduced into the NASA scientific and technical information system in September 1979. Author

N80-12000# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium)
AEROELASTIC PROBLEMS IN AIRCRAFT DESIGN
1979 534 p Lecture held at Rhode-Saint-Genese, Belgium, 7-11 May 1979
(VKI-Lec-Ser-1979-8) Avail: NTIS HC A23/MF A01

A review of present knowledge in aeroelasticity and the methods used to solve aeroelastic problems are discussed. A modal analysis of aircraft structures and a determination of structural inputs for aeroelastic analyses are presented. Aircraft flutter and dynamic response, wind tunnel flutter techniques, and flight flutter techniques are examined. For individual titles, see N80-12001 through N80-12012.

N80-12001# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany)
A SURVEY OF AEROELASTIC PROBLEMS c05
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 p 1-15 refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

A survey and a classification of aeroelastic problems are presented. The interaction of the aeroelastic system forces is demonstrated by means of functional diagrams, and the application of operators for the general formulation of aeroelastic problems is shown. Author

N80-12002# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany)
AEROELASTICITY FROM THE VIEWPOINT OF THE DESIGNER c05
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 32 p (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The effects of aeroelastic phenomena on aircraft design and development are discussed and illuminated through representative practical examples. A survey of structural dynamic loading problems arising with the development of launch vehicles is presented. A.W.H.

N80-12003# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany)
MODAL ANALYSIS OF AIRCRAFT STRUCTURES c05
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 26 p (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The physical and analytical relations of the modal approach, in terms of natural modes and generalized coordinates, for the analytical treatment of dynamic aeroelastic problems of aircraft are demonstrated. Two modal techniques are derived based on the generalized equations of motion of the elastic structure. These are a modal substructure coupling technique, and a modal perturbation method. A.W.H.

N80-12004# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany)
LIFTING SURFACE DIVERGENCE AND CONTROL EFFECTIVENESS c05
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 35 p (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The various methods of analyzing static aeroelastic phenomena on high aspect ratio swept and unswept wings are presented. The problems of static aeroelastic divergence, aileron effectiveness, and symmetric and antisymmetric lift distribution are discussed. Examples of the various computation procedures are presented. A.W.H.

N80-12005# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France)
MODAL REPRESENTATION AND TRANSFER FUNCTION OF LINEAR DISSIPATIVE STRUCTURES c05
Roland Dat *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 20 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The methods used for modeling structures with their normal modes or their natural damped modes are presented. The principle of the classical modal representation is reviewed and the analytic formulation of the transfer functions is obtained as a superposition of natural damped modes. Vibration testing methods based on this formulation is presented. The determination of the structural dynamic characteristics with only one excitation point or only one point of measurement using the vibration testing methods is discussed. A.W.H.

N80-12006# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France)
NEW METHODS FOR GROUND TESTS OF AERONAUTICAL STRUCTURES c05
G. Piazzoli *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 22 p refs In FRENCH; ENGLISH summary (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The dynamical identification of structures by classical method, based on the distribution of synchronous multiexcitations appropriate for each modal resonance, is discussed. The

inaccuracies of the method when it is applied to complex systems, such as aeronautical structures, are described. Two methods are described. The first method consists in resolving the eigenvalues equations of a complex power matrix. The second method is based on the research of a set of forces which isolate one mode and cancel all others. The data acquisition and processing techniques of the ground tests are described. A.W.H.

N80-12007# Avions Marcel Dassault, Saint-Cloud (France).
PRACTICAL ASPECTS OF THE CALCULATION OF STRUCTURAL VIBRATIONS c08
J. P. Brevan *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 60 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The computation of the vibration modes of structures with finite element models, which leads to large sparse generalized eigen problems, is presented. The basic tools such as sparse matrix factorization are described. A review of the methods for eigensolutions is given. Two methods currently in use, the Lanczos method and the subspace iteration method, are examined. A dynamic substructuring method is presented. Practical results for the model of a complete aircraft are given. A.W.H.

N80-12008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
UNSTEADY AERODYNAMIC INPUTS FOR AEROELASTIC ANALYSES: A GENERAL INTRODUCTION c02
W. Geissler *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 102 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The arbitrary time dependent equations of motion in fluid dynamics which serve as the starting points for aeroelastic investigations are examined. Solution procedures based on integral or singularity methods are described for pure sub- and supersonic flows and the corresponding boundary conditions are determined. The prediction methods used in unsteady aerodynamics are discussed. A.W.H.

N80-12009# National Aerospace Lab., Amsterdam (Netherlands).
REMARKS ON THE TRANSONIC FLOW PAST OSCILLATING AIRFOILS c02
H. Tijdeman *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 33 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The characteristics of unsteady and steady transonic flow are reported. The transonic flow past an oscillating airfoil is discussed. Three types of shock waves which are identified in the flow field of an airfoil are examined. The linear relation between the frequency of oscillation and the motion of the shock wave is discussed. A qualitative analysis of the contribution of an oscillating shock wave to the overall loading is presented. A.W.H.

N80-12010# Liege Univ. (Belgium).
AIRCRAFT FLUTTER AND DYNAMIC RESPONSE c08
M. Geradin *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 58 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The equations of motion and the dynamics of the elastic airplane are presented. The fundamentals of unsteady aerodynamics and an analysis of flutter and dynamic response are discussed. A.W.H.

N80-12011# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
WIND TUNNEL FLUTTER INVESTIGATIONS c08
D. Sensburg *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 59 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

Wind tunnel investigations with rigid and dynamically scaled models are examined. An assessment of the influence of parameter variations on flutter speed such as geometry changes, stiffness changes, and external store mass properties is presented. The measurement of unsteady aerodynamic forces with direct pressure transducers or tubes is discussed. Buffet investigations on rigid models are reported. A.W.H.

N80-12012# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
FLIGHT FLUTTER TESTING c08
G. Haidl and M. Steininger *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 41 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The excitation methods applied to flight flutter testing are described. Examples of excitation by frequency sweep, pseudo random, harmonic oscillation and control feedback techniques are given and their effectiveness and adaption to digital processing is discussed. Experience with generating aerodynamic forces by control surfaces or additional vanes is presented. The digital analysis of flight flutter test data is evaluated. Recommendations for selection of analysis parameters and how to avoid errors due to digital processing are given. Errors and effects of digital blockwise computation and analysis procedures like block overlapping, windowing, averaging or curve fitting are demonstrated. A.W.H.

N80-12013# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1978-4
Paris ESA Jun. 1979 167 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-4, Jul.-Aug. 1978 p 143-212
(ESA-TT-561) Avail: NTIS HC A08/MF A01

The collection of papers includes the calculation of flows around wings, the three dimensional supersonic flow in an axial compressor by a method of characteristics, the calculation-experiment comparisons of the transonic two-dimensional flow in a high deflection cascade, the application of sputtering to the improvement of coatings of superalloys, a new method of electric measurement of crack length, preliminary tests in a cryogenic wind tunnel driven by induction, and a theoretical analysis of radiation pressure on a uniform sphere as a function of skin optical properties. For individual titles, see N80-12014 through N80-12020.

N80-12014# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION OF TRANSONIC FLOWS AROUND WINGS c02
Jean-Jacques Chattot, Colette Coulombeix, and Carlos daSilvaTome *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 1-41 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 143-159 Original language report was announced as A79-11132 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

The full potential equation is chosen as a mathematical model for simulating transonic flows of an ideal fluid past symmetrical wings set without side-slip in a uniform subsonic free stream. Two relaxation methods are presented. In the first method the equation is written in quasi-linear form and is discretized using a mixed scheme of the Murman-Cole type. The algebraic set of difference equations is solved by column relaxation. In the second method the equation, together with an artificial viscosity term, is written in conservation form and is discretized using a centered scheme. An approximate factorization method is used to solve the difference equations. Results obtained with the two methods are presented for a rectangular wing, the M6 wing and the AFV-D wing, and include comparisons with experimental data. Author (ESA)

N80-12015# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION OF THE THREE-DIMENSIONAL SUPERSONIC FLOW IN AN AXIAL COMPRESSOR BY A METHOD OF CHARACTERISTICS c02
Jean Martinon *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 42-78 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-4,

Jul.-Aug. 1978 p 161-174 Original language report was announced as A79-11133 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

A three-dimensional method of characteristics was developed to describe the axial, radial, and tangential variation of the velocity field in the supersonic domain of axial compressors. The calculation was adapted to calculate the flow in a straight cascade with converging walls, and the flow in a supersonic, annular cascade. The ideal-fluid calculation provides a very useful first approximation of the flow in the inviscid region and gives basic information for the determination of viscous effects. The case of fixed or rotating cascades is treated by means of a bi-characteristic mesh, using a method for eliminating terms involving derivatives which do not act in the grid directions. This method leads to higher precision. The results show that the computer program developed for the two cases examined, requires a shorter computer time than any other known method. Author (ESA)

N80-12018# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION - EXPERIMENT COMPARISONS OF THE TRANSONIC TWO-DIMENSIONAL FLOW IN A HIGH-DEFLECTION CASCADE c02
Georges Meauze *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1978-4 Jun. 1979 p 79-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 175-180 Presented at Euromech. Colloq. 87 on Transonic Flows in Turbomachines, Prague, 12-15 Apr. 1977 Original language report was announced as A79-11134 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

The validation of transonic flow calculations in compressor cascades is discussed. The method under study is the pseudo-unsteady method (using the assumption of a flow with constant stagnation enthalpy and entropy) and is first compared to a classical calculation performed by a relaxation method (Katsanis method), with good agreement. Experimental results, as comprehensive as possible, are then compared with the calculations. The comparison is very satisfactory if the viscous layers developing along the blade surfaces are taken into account, provided that their effects do not become predominant. Author (ESA)

N80-12017# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF SPUTTERING TO THE IMPROVEMENT OF COATINGS OF SUPERALLOYS c26
Robert Pichoir *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 94-124 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 181-194 Original language report was announced as A79-11135 Sponsored by DGRST (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

The utilization of protective alloy precoatings on superalloys used for aeronautical turbines by sputtering techniques in order to further improve their corrosion resistance is discussed. The equipment used for cathodic sputtering and the conditions of deposition are specified. Deposits of pure Ni and Ni based alloys of simple composition were produced, then transformed into aluminides. Deposits of Co Based alloys, which are directly protective, were also obtained. It is concluded that industrial production of predeposits, before aluminization of alloy coatings, does not show particular technical difficulties for simple shaped bodies such as blades. Its limitations for producing deposits on the internal surface of cooled blades are pointed out. Author (ESA)

N80-12018# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NEW METHOD OF ELECTRIC MEASUREMENT OF CRACK LENGTH c33
Georges Baudin and Humbert Policella *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 125-144 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 195-203 Original language report was announced as A79-11136 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

Improvements to devices which are used to determine the existence of progression of a crack in an electrically conducting material are discussed. A pulsed electrical supply is used which reduces the response time of the measurement and, in particular, makes it free from noise and from zero drift in the d.c. amplifier. In the case of cyclic loadings, the pulses can be synchronized with the loadings. After describing in detail an instrument of this type, the flexibility of use and the performances obtained are shown for specific applications, such as the measurement in direct current of the length of a crack in two dimensions. Author (ESA)

N80-12019# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PRELIMINARY TESTS IN A CRYOGENIC WIND TUNNEL DRIVEN BY INDUCTION c09
Roger Michel and Dietrich Faulmann *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 145-152 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 205-207 Presented at Supersonic Tunnel Assoc. Meeting, El Segundo, Calif., 17-18 Apr. 1978 Original language report was announced as A79-15300 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

A 1/4 scale cryogenic operation pilot wind tunnel test for higher Reynolds number was performed to verify a liquid nitrogen injection fast cooling process. The cryogenic operation was combined with an induction driven operation in the hope that the short flow duration will give rise to a decrease in the wall and model surface temperature only, avoiding some technological problems. Operation temperatures down to 100 K were obtained. Thin layers of wall insulation are shown to be efficient in containing nitrogen consumption. It is concluded that the simplicity of implementation makes the process promising for adapting existing wind tunnels to cryogenic operation. Author (ESA)

N80-12020# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RADIATION PRESSURE ON A UNIFORM SPHERE AS A FUNCTION OF SKIN OPTICAL PROPERTIES c44
Andre Girard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 153-163 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978, p 209-212 Original language report was announced as A79-11137 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

The radiation pressure produced by a sun type spectral distribution or by a 220 K black body is theoretically studied for the case of a uniform sphere. A general expression is initially reached, considering that for perfectly absorbant, perfectly reflecting, perfectly scattering, and mixed cases the coefficients are independent of the angle of incidence. It is deduced that for a perfectly scattering sphere the reflection factor does not have any effect on the system response, and that the chromatic error is zero for any nonscattering sphere. Considering then the case of a real skin, in which the scattering factor diminishes with frequency, and the reflection factor increases with the angle of incidence, it is concluded that an optically polished surface would eliminate the effects of chromatic error. Author (ESA)

N80-12021# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE, BI-MONTHLY BULLETIN NO. 1978-5
Paris ESA Jul. 1979 102 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 213-286
(ESA-TT-555) Avail: NTIS HC A06/MF A01

Topics included are: flow separation along a line of a regular surface, missile trajectories by Kalman filtering-smoothing, the flow within a turbomachine combustor, aeroacoustic characterization of free jets, calculation methods associated with cyclic and damage constitutive laws, large scale structures in turbulent jet mixing layers, and thermoelastic properties of media with

periodic structures. For individual titles, see N80-12022 through N80-12028.

N80-12022# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SEPARATION OF A FLOW ALONG A LINE OF A SMOOTH SURFACE **c02**
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 1-12 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 213-219 Original language report was announced as A79-18531 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

A method, much more elementary than those used up to now, is proposed for the study of the separation of a flow along a line of a regular surface The definitions of the main part of the boundary layer and of the laminar sublayer are gradually generalized for complex flows. The behavior of the separation angle, the external flow, and the two parts of the boundary layer are then described with a minimum of calculation. However, the study of the strong coupling between a supersonic external flow and a boundary layer is only sketched. Author (ESA)

N80-12023# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESTITUTION OF MISSILE TRAJECTORIES BY KALMAN FILTERING-SMOOTHING **c15**
Dominique Biausse *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 13-31 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 221-232 Original language report was announced as A79-18532 Sponsored by DRET (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

A method for determining the whole trajectory of a missile is described. Only measurements provided by the launching range tracking means (radars, etc.) are used. It is based on an algorithm of filtering and smoothing which is based upon the Kalman filtering technique: the model of the process dynamics takes into account the unknown characteristics of the missile and the model of the measurement measurements, then is applied to the estimation of a missile trajectory, using real data.
Author (ESA)

N80-12024# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYSIS AND MODELLING OF THE FLOW WITHIN A TURBOMACHINE COMBUSTOR **c07**
Patrick Hebrard, Philippe Magre, and Gerard Collin *In its* La Rech. Aerospaitiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 33-54 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 233-249 Original language report was announced as A79-18533 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

The control of the correct operation of a turbomachine combustor requires the knowledge of the organization of the flow within the primary zone, where most combustion reactions take place. A study has been carried out with hydrodynamic and aerodynamic models, without and with combustion. The direction and intensity of local flow velocities have been determined, and were used as a basis for a simplified combustor model allowing a reasonably good prediction of the combustor overall performance. These results will also be used as a support for the development of methods for calculating threedimensional, turbulent flows with chemical reactions; these methods should provide a more refined description of combustor characteristics.
Author (ESA)

N80-12025# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AEROACOUSTIC CHARACTERIZATION OF FREE JETS **c71**
Georges Elias, Annie Lelarge, Jean Maulard, and Mariano Perulli *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 55-69 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 251-261 Original language report was announced as A79-18534 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

The methods used to characterize sources of aircraft engine noise are described. These include (1) IR radiometry, which is sensitive to temperature fluctuations, (2) laser Schlieren method, giving data proportional to components of the density gradient, (3) Doppler laser anemometry, and (4) fluorescence diffusion measurements to deduce mean and fluctuating concentration. Complex measurements by more than one technique and employing crossed paths were experimented with, in order to reveal the complementary possibilities of the methods. By means of a principle of scale separation and suitable data evaluation methods, reliable statements about noise sources could be obtained. Author (ESA)

N80-12026# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION METHODS ASSOCIATED WITH THE LAWS OF CYCLIC AND DAMAGE BEHAVIOR **c39**
Serge Savalle and Jean-Pierre Culie *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 71-92 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 263-278 Original language report was announced as A79-18535 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

Models of cyclic viscoplastic flow and damage laws are reviewed and incremental methods of linearization are summarized. These include Euler's method, the Euler-Cauchy method, the Runge-Kutta method, and a second-order method. Berger's method of automatic step-size determination is recalled. The methods were applied to a simple example of a one dimensional problem of isothermal relaxation strain hardening at constant strain and are compared with respect to the tradeoff between precision and number of calculations. The methods were also applied to integration of damage laws with and without creep/fatigue interaction. The effect of damage on the cyclic viscoplastic flow was investigated numerically. Author (ESA)

N80-12027# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL INVESTIGATION OF LARGE SCALE STRUCTURES IN TURBULENT JET MIXING LAYERS **c02**
Otto Leuchter and Khoa Dang *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1978-5 Jul. 1979 p 93-96 ref Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 279-282 Presented at Working Group on Coherent Struct. and Turbulent Boundary Layers, Bethlehem, Penn. 1-3 May 1978 Original language report was announced as A79-18536 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

A simple method of conditional sampling for identifying coherent structures in jet mixing layers is used to characterize the effects of initial conditions, such as turbulence, and initial boundary layers. Ensemble averaging is initiated from the peaks occurring either in the hot-wire signal or in separated signals from a trigger probe. Author (ESA)

N80-12028# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOMOGENIZATION OF STATIC THERMOELASTIC PROPERTIES OF MEDIA WITH PERIODIC STRUCTURES **c39**
Daniel Engrand *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1978-5 Jul. 1979 p 97-102 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 283-286 Original language report was announced as A79-18537 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

A law describing in a global manner, the thermoelastic behavior of heterogeneous materials whose mechanical properties are periodic functions of the space variables, is discussed. A novel application of homogenization theory furnishes a solution to this problem. Two examples are presented, one for a compound bar and another for a composite material. Author (ESA)

N80-12029# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1978-6
Paris ESA Sep. 1979 109 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 1-107
(ESA-TT-560) Avail: NTIS HC A06/MF A01

Research is presented on aerodynamic research on helicopters, shock wave-boundary layer separation interaction, the Pogo effect, flight results of the cactus accelerometer, spectrometer for the first Spacelab mission, and potential of velocities generated by a localized vortex distribution. For individual titles, see N80-12030 through N80-12034.

N80-12030# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ONERA AERODYNAMIC RESEARCH WORK ON HELICOPTERS **c02**
Jean-Jacques Philippe and Claude Armand *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 1-23 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 287-304 Presented at AGARD Symp. on "Rotocraft Design", Moffett Field, Calif., 16-19 May 1977 Original language report was announced as N78-19148 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

Aerodynamic research on helicopters included basic research in two or three dimensional flows and studies on rotors. The study of steady and unsteady characteristics of airfoils and of problems pertaining to blade tips and to vortex interactions is discussed. For the rotors, a computing program for the forces on the blades, based on the acceleration potential method was developed. The problems of unsteady transonic aerodynamics related to high speed flight are also discussed. In order to perform wind tunnel tests for helicopter companies and for research purposes two rotor test rigs were developed. Results of the total forces on helicopter, for absolute pressure on the blades, for identification of the boundary layers, for smoke visualization, and for rotating blade deformations are presented. Author (ESA)

N80-12031# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYSIS OF THE SEPARATION DUE TO SHOCK WAVE-TURBULENT BOUNDARY LAYER INTERACTION IN TRANSONIC FLOW **c02**
Jean Delery *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 23-45 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 305-320 Original language report was announced as A79-25074 Sponsored by DRET (Res. Directorate, Min. of Defence) (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

Holographic interferometry and laser velocimetry were used in conjunction to analyze the flow resulting from the interaction between a shock and the boundary layer in a two-dimensional transonic duct. The Mach number at the beginning of the interaction is 1.37 and the local Reynolds number based on initial boundary layer thickness is 85,000. Initially, the external flow was investigated in order to obtain an accurate map of the nondissipative field and a description of the structure of the system of lambda shocks associated with the interaction. The laser velocimetry data allowed a characterization of the organization of the dissipative layer, which included a large separated zone. The following parameters were measured on the basis of a sample of 5000 values of the instantaneous velocity U: mean velocity, fluctuation factor, and the coefficients of skewness and flatness. Author (ESA)

N80-12032# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A SYNTHESIS OF THE EXPERIENCE ACQUIRED BY ONERA ON THE POGO PHENOMENON **c15**
Daniel Lourme, Jean-Jacques Dordain, and Denis Schmitt *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 45-67 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 321-334 Original language report was announced as A77-51427 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

The structure-propulsion instability (termed the pogo effect) encountered in rocket launching is discussed, and a simplified mathematical model for studying such instability is given. A feedback loop defining the interactions of the combustor, the fueling apparatus and the structure of the launch vehicle is considered; linearized equations describing the dynamic behavior of the system are presented. Stability criteria, such as that related to the concept of critical damping, are reviewed, and the difficulties of obtaining fully coupled solutions to the analysis are cited. In particular, the problem of defining a margin of safety when the natural frequency of the structural system approaches the natural frequency of the propulsive system is addressed. An approximate solution, capable of assessing the need for a stabilizer in a launch vehicle under development, is given. This method is applied to the analysis of the L140 stage of the launch vehicle Ariane. Author (ESA)

N80-12033# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SYNTHESIS OF FLIGHT RESULTS OF THE CACTUS ACCELEROMETER FOR ACCELERATIONS BELOW ONE BILLIONTH G **c19**
Yves Boudon (Centre of Geodyn. and Astron. Res., Grasse, France), Francois Barlier, Alain Bernard, Remy Juillerat, Anne-Marie Mainguy, and Jean-Jacques Walch (Centre of Geodyn. and Astrodyn. Res., Grasse, France) *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 67-76 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 355-364 Presented at 29th Intern. Astronautical Congr., Dubrovnik, Yugoslavia, 1-8 Oct. 1978 Original language report was announced as A79-11247 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

The Cactus accelerometer aboard the Castor satellite has been functioning continously and nominally for forty months. The paper reports on measurements of very weak accelerations, due mostly to infrared radiation pressure from the earth when the satellite is in the earth's shadow, or due to the thrust the satellite experiences under the influence of the anisotropy of its own radiation. Some of the measured accelerations are of the order of one billionth G. Author (ESA)

N80-12034# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SPECTROMETER FOR THE FIRST SPACELAB PAYLOAD **c19**
Jean Besson, Andre Girard, Marcel Ackerman, and Dirk Frimout (Inst. of Space Aeronomy, Brussels) *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 77-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 343-353 Presented at 29th Intern. Congr. of Astronautics, Dubrovnik, Yugoslavia, 1-8 Oct. 1978 Original language report was announced as A79-11279 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

The grille spectrometer for measuring stratospheric and mesospheric composition, which will be mounted on board permits infrared measurements of active atmospheric constituents in the altitude range where their local concentration is higher than 100 million mol/cu cm. The instrument operates in two modes: in absorption with the sun as a source and in emission in the spectral ranges corresponding to the thermal emission of atmospheric gases. The instrument consists of a sighting system (tiltable front mirror), a radiation collector, a monochromator with output optics and detectors, and electronic subassemblies for the instrument command and its connection with the Spacelab electronic system. Author (ESA)

N80-12035# European Space Agency, Paris (France).
CONTRIBUTIONS TO GAS DYNAMICS AND AERODYNAMICS
F. Maurer Jun. 1979 328 p refs Transl. into ENGLISH from "Beitrage zur Gasdynamik und Aerodynamik", DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 Original German report available from DFVLR, Cologne DM 84,30
(ESA-TT-518; DLR-FB-77-36) Avail: NTIS HC A15/MF A01

A collection of 15 original contributions from different fields of experimental and theoretical gasdynamics and aerodynamics is presented. Experimental contributions investigate problems of missile aerodynamics in transonic and supersonic flow and two experimental contributions deal with hypersonic boundary layer development in longitudinal corner flows and shock-shock and shock-boundary interaction in rarefied hypersonic flow. The problems of laser-Raman spectroscopy are also investigated. Results of atmospheric density, temperature, and pressure distribution measurements within the meso and thermosphere are derived from sounding rocket pitot pressure experiments. The remaining contributions are theoretical studies of three-dimensional, compressible flow fields and boundary layers using numerical methods. For individual titles, see N80-12036 through N80-12050.

N80-12036# European Space Agency, Paris (France).
ON THE SIMULATION OF AN UNDEREXPANDED PROPULSIVE JET FOR THE WIND TUNNEL INVESTIGATION OF THE STATIC LONGITUDINAL STABILITY OF FLIGHT VEHICLES IN SUPERSONIC FLOW **c02**
Hans Emunds and Hansgeorg Riedel *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 15-44 refs Transl. into ENGLISH from 'Zur Simulation eines unterexpandierten Treibstrahls beider Untersuchung der statischen Laengsstabilitaet von Flugkoerpern im Windkanal bei Ueberschallanstroemung,'' DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Three different kinds of simulation of an underexpanded propulsive jet comprising cold air were investigated in a 30 x 30 sq cm supersonic wind tunnel to determine the effect of the jet of the static longitudinal stability of some typical flight vehicle configurations. A jet simulation by solid body, by an annular gas jet with cylindrical solid core, and by a combination of solid body and annular gas jet were treated. The investigation was limited to small angles of incidence. Qualitative results are obtained for the representation of a gas propulsive jet. Accurate simulation is obtained in the case of stage separation without simultaneous ignition of an upper stage engine. Author (ESA)

N80-12037# European Space Agency, Paris (France).
THE NORMAL FORCE ON A CRUCIFORM MISSILE AT BANK ANGLES OF A DEG AND 45 DEG **c02**
Helmut Esch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 45-60 refs Transl. into ENGLISH from 'Die Normalkraft eines Flugkoerpers mit Kreuzleitwerk bei Rollagen von o deg und 45 deg,' DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Force and pressure distribution measurements were made on a body-tail combination to investigate the influence of bank angle on the normal force. A subsonic Mach number and supersonic Mach numbers between 2 and 4 were investigated for incidence angles up to 19 deg. The experimental data is compared with results from simple theoretical methods. It is shown that the normal force on a cruciform tail is more strongly decreased for x attitude than for + attitude. This is due to the separated body cortices that occur. Author (ESA)

N80-12038# European Space Agency, Paris (France).
INFLUENCE OF THE FLOW FIELD AROUND AN INCLINED OGIVE-CYLINDER BODY UPON SUPERSONIC AFT-INTAKES **c02**
Klaus Triesch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 61-78 refs Transl. into ENGLISH from 'Einfluss des Rumpfes auf am Flugkoerperheck angeordnete Ueberschalleinlaeufe bei Anstellung,' DFVLR, Cologne Report DLR-FB-77-36 Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

The measured pitot-pressure distributions are reproduced as a function of incidence at a plane 10 diameters behind the body apex of an inclined body at a Mach number of 2.0. The boundary layer distribution and position of the separated body vortices can be inferred from the measurements. By integration of the pitot-pressure the determination of the intake behavior of a ram jet at the rear of the body is investigated. A comparison between calculation and intake measurements shows good overall agreement. Potential improvements in the procedure are discussed. Author (ESA)

N80-12039# European Space Agency, Paris (France).
NORMAL FORCE DERIVATIVE AND CENTER OF PRESSURE MOVEMENT DUE TO MACH NUMBER ON WING-BODY COMBINATIONS WITH TRIANGULAR WINGS OF THE SAME SPAN AND DIFFERENT ASPECT RATIOS AT SUPERSONIC SPEEDS **c02**
Wolfgang Wyborny *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 79-96 refs Transl. into ENGLISH from 'Normalkraftanstieg und Verschiebung des Luftkrafttangriffspunktes ueber der Machzal von Rumpf-Leitwerk-Kombinationen mit Rochenleitwerken gleicher Spannweite bei verschiedenen Flaechenverhaeltnissen im Ueberschall,' DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Experimental results from wind tunnel measurements on wing-body combinations at Mach numbers of 1.57, 2.25, 2.89 and 4.15 at small angles of attack are compared with calculated results obtained using a semi-empirical method, based on linearized supersonic theory, slender body theory and empirical data. The parameters, other than Mach number, are the aspect ratio of the triangular wing (b square/F between 0.75 and 1.75) and the wing sweepback angle. The models consist of a cylindrical body of diameter D = 30 mm with an ogival forebody, whose radius in the first case is 2.5 D and in the second is 7.5 D. The total length of the model is therefore, in the first case, L = 12 D while in the second, it is L = 7.9 D. The span of the exposed triangular wings is B = 1.5 D. Author (ESA)

N80-12040# European Space Agency, Paris (France).
FLOW FIELD INVESTIGATIONS IN CORNER REGIONS IN HYPERSONIC FLOW Final Report **c02**
Hermann-Josef Schepers and Heinz Pfeiffer *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 97-109 refs Transl. into ENGLISH from 'Stroemungsfelduntersuchung in Eckengebieten bei Hyperschallanstroemung', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
(Proj. 88)
Avail: NTIS HC A15/MF A01

Results are presented for the investigations of the flow over three different configurations of streamwise-oriented corners. The experiments were performed in a hypersonic wind tunnel at a free stream Mach number of M = 8.8. The measurements of pitot pressure, static pressure and stagnation temperature in the flow field are presented which enable the flow quantities in complex flow regions to be determined. A semi-empirical calculation method based on known shock relations showed good agreement with the experiment for the flow quantities behind curved secondary shocks. Author (ESA)

N80-12041# European Space Agency, Paris (France).
LASER-RAMAN SPECTROSCOPY **c02**
Werner Krahn *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 110-127 refs Transl. into ENGLISH from 'Laser-Raman Spektroskopie', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Pulsed laser-Raman spectroscopy is studied as a method for making nonintrusive local flow field measurements. An argon ion laser was used to record the rotational Raman spectrum of air, nitrogen, and oxygen. The use of a pulsed laser for measurements of gas concentrations and combustion temperatures is discussed as well as data interpretation problems. Author (ESA)

N80-12042# European Space Agency, Paris (France).
DETERMINATION OF ATMOSPHERIC DENSITY, TEMPERATURE AND PRESSURE PROFILES FOR WINTER ANOMALOUS CONDITIONS AT HEIGHTS BETWEEN 52 AND 117 KM **c46**
Demetrius G. Papanikas, Jochen Baete, Manfred Becker, and Uwe Niederloehner *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 128-167 refs Transl. into ENGLISH from 'Ermittlung der atmosphaerischen Dichter-, Temperatur- und Druckverteilun-

gen bei winteranomalen zustaenden in Hoehen zwischen 52 and 117 km', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Pitot pressures were measured continuously during the flight of a Skylark high altitude rocket by means of two pressure measuring instruments which were mounted with six other experimental units in the rocket payload. Two rocket flights took place during winter anomalous conditions on 4th and 21st January 1976 in Huelva, Spain. In preparation for the flights, calibration tests and simulation measurements for the experiment described were carried out in a low density wind tunnel. Author (ESA)

N80-12043# European Space Agency, Paris (France).
SIMILARITY IN NOZZLE FLOWS WITH VIBRATIONAL NONEQUILIBRIUM **c34**
Nimai K. Mira and Martin Fiebig *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 168-184 refs (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Requirements for similarity for vibrationally relaxing flows of pure gases or gas mixtures of CO2-N2-He as found in a gasdynamic laser in geometrically similar nozzles were investigated. Nondimensionalization of the basic flow equations shows that exact similarity for two cases requires identical composition of the flow media, identical stagnation chamber temperatures, and identical values of the product of the stagnation chamber pressure and the throat height. Inclusion of viscosity does not generally require any additional constraint. The stringent requirements of exact similarity were relaxed to obtain approximate similarity when the requirement of identical stagnation chamber temperature for two cases is not necessary. The characteristic Damkoehler number is shown to be the parameter for approximate similarity for the frozen vibrational temperature at the nozzle exit. Author (ESA)

N80-12044# European Space Agency, Paris (France).
MIXING LENGTH MODEL FOR COMPRESSIBLE TURBULENT FLOWS IN ROUGH CHANNELS **c34**
Wilhelm A. Neuberger *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 185-217 refs Transl. into ENGLISH from 'Ein Mischungswegmodell fuer kompressible turbulente Stroemungen in rauhen Kanaelen', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Compressible turbulent flow in a rough channel, which possesses the character of a developing flow when heat is continuously introduced over the length of the channel, is studied. The velocity and the temperature field, as well as the axial variation of the pressure, the friction factor, and the Stanton number in such a thermally developing flow are calculated. The turbulent contributions to the momentum and the energy transport are determined using a mixing length model. The free parameters occuring in the mixing length model are determined so that the calculations correctly describe the limiting case of a fully developed incompressible flow in a smooth or rough pipe. A correlation between the mixing length of the hypothetical rough wall and the relative sand grain roughness is developed. The effect of compressibility on the friction factor and the Stanton number is examined. Author (ESA)

N80-12045# European Space Agency, Paris (France).
CURVATURE EFFECTS ON THE BEHAVIOR OF LAMINAR BOUNDARY LAYERS **c02**
Roger Grundmann and Klaus Robert *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 217-229 refs Transl. into ENGLISH from 'Kruemmungseinfluesse auf das Abloeseverhalten von laminaren Grenzschichten', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Numerical investigations of laminar boundary layers around strongly curved wall surfaces are described. The flow is around an elliptic cylinder with different angles of incidence. The development of thin or already thickened boundary layers in the maximum curvature nose region is analyzed. Calculations are performed by means of a multi-point difference scheme using second order boundary layer equations. The equations are switched to first or zeroth order (Prandtls equations). The three theories yield identical results for high Reynolds numbers. For Reynolds numbers in the intermediate range a higher order theory must be used, whereas for low Reynolds numbers the conventional second order boundary layer equations are not sufficient to describe the flow field adequately. Author (ESA)

N80-12046# European Space Agency, Paris (France).
VERIFICATION OF THE EXPERIMENTALLY DETERMINED LAMINAR-TURBULENT TRANSITION ON A SWEPT WING **c02**
Ernst Heinrich Hirschel and Vera Jawtusch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 229-250 refs Transl. into ENGLISH from Nachrechung des experimentell ermittelten Uebergangs laminar-turbulent an einem gepfeilten Fluegel, DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 Sponsored in part by German Res. Council (DFG) (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

An investigation of the location of the transition line on a finite tapered swept wing is presented in order to make assertions about known stability and transition criteria. For the suction and the pressure side of the wing for different angles of attack. The boundary layer is calculated with panel method results as an external flow field. The boundary layer in calculated using the approximation locally infinite swept wing. The stability and transition criteria are applied to this boundary layer. A comparison of the experimental with the theoretical results shows the need for further experiments, as well as extended correlation investigations, in order to improve the prediction possibilities for the laminar-turbulent transition in three dimensional boundary layers. Author (ESA)

N80-12047# European Space Agency, Paris (France).
A COMPUTATIONAL METHOD FOR CALCULATING LAMINAR-TURBULENT TRANSITION IN A BOUNDARY LAYER **c02**
Ulrich Nehring *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 251-273 refs Transl. into ENGLISH from "Ein Verfahren zur Berechnung des laminar-trubulenten Uebergangs in der Grenzschicht," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

An implicit finite difference method for the calculation of the compressible, two dimensional, steady boundary layer in the transition region between laminar and turbulent flow is presented and discussed. The turbulence model is a single variable model which is defined by the turbulent kinetic energy equation and empirical assumptions. The introduction of a streamwise changing parameter, which determines the development of the characteristic lengths, such as the mixing length is discussed. The effect of molecular viscosity in regions of low turbulent Reynolds numbers and the damping of the turbulence near the wal is determined. The practical calculation determines the transition process as a function of the freestream turbulence and the external pressure field. Preliminary numerical tests were carried out for the incompressible flow on a flat plate. Author (ESA)

N80-12048# European Space Agency, Paris (France).
HIGHER-ORDER BOUNDARY LAYER EQUATIONS FOR THREE-DIMENSIONAL COMPRESSIBLE FLOW **c02**
Klaus Robert *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 273-288 refs (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

The shell geometrical concept is discussed within the framework of general tensor analysis. A method based upon this concept is presented to derive higher order boundary layer equations for compressible flow. Different approximations are obtained. Author (ESA)

N80-12049# European Space Agency, Paris (France).
THREE-DIMENSIONAL, INVISCID, ROTATIONAL DUCT FLOWS WITH EMBEDDED SHOCKS: CONSIDERATIONS WITH REGARD TO A COMPUTATIONAL METHOD AND PRELIMINARY RESULTS **c02**
Kurt Gruemmer *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 289-300 refs Transl. into ENGLISH from "Dreidimensionale, reibungsfreie, drehungsbehaftete innenstroemungen mit

eingebetteten Stoessen - Ueberlegungen zu einem Berechnungsverfahren, erste Rechenergebnisse," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

A short discussion of the problem of the computation of supersonic inlet diffusers is followed by some preliminary calculation results. The flow in a plane symmetric inlet diffuser is calculated up to the first intersection of shock surfaces. The oncoming flow is considered to be both rotational as well as nonrotational. The results show that for rotational oncoming flow theprofiles of the total pressure at the final cross section considered are quite similar to each other for linear, convex and concave wall contours. Author (ESA)

N80-12050# European Space Agency, Paris (France).
SHOCK-SHOCK AND SHOCK-BOUNDARY LAYER INTERACTION AT FLAT AND INCLINED PLATES IN RAREFIELD HYPERSONIC FLOW **c02**
Gustav Schweiger, Knut Erhardt, Manfred Becker, and Demetrius G. Papanikas *In its* Contrib. to Gas Dyn. and Aerodyn. 1979 p 301-328 refs Transl. into ENGLISH from "Stoss-Stoss-und Stoss-Grenzschicht-Wechselwirkung an ebenenund angestellten Platten in verduennter Hyperschallstroemung," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

The interaction phenomena between shock and boundary layer at flat and inclined plates and between cylinder shock and plate shock are experimentally described by the recording of plate surface pressures and profiles of pitot pressure, rotational temperature, and density. A strong upstream influence from the interaction regions and total mixing downstream was found. The rarefaction of the flow (mean free paths greater than 1 mm) was used as a geometric means for magnifying the interaction events. Author (ESA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-12051 New York Univ., N. Y.
AN ARTIFICIAL VISCOSITY METHOD FOR THE DESIGN OF SUPERCRITICAL AIRFOILS Ph.D. Thesis
Geoffrey B. McFadden 1979 167 p
Avail: Univ. Microfilms Order No. 7925492

An inverse method for the numerical design of supercritical airfoils is presented. The speed distribution along the surface of the desired profile is prescribed and the shape required to generate such a profile is computed. In contrast to other approaches to the design problem that employ the hodograph transformation, this technique does not produce shockless solutions. Instead, an artificial viscosity is used to inhibit the formation of shocks in the flow during the design procedure with the result that weak shocks may appear in the actual flow past the profile. By choosing the prescribed velocity distribution correctly, the wave drag associated with these shocks is small and airfoils can be obtained that compare favorably with shockless airfoils in their overall performance. Dissert. Abstr.

N80-12052 Dayton Univ., Ohio.
DEVELOPMENT OF STABILITY METHODS FOR APPLICATION TO NONLINEAR AEROELASTIC OPTIMIZATION Ph.D. Thesis
Ronald Franklin Taylor 1979 192 p
Avail: Univ. Microfilms Order No. 7925694

An approximate procedure is developed which determines the amplitude dependent stability of nonlinear systems. This procedure, the method of imposed disturbances, is shown to be applicable to studies of the sensitivity of nonlinear aeroelastic systems to changes in design variables. Emphasis is placed on airfoil and panel flutter instabilities in aerodynamically nonlinear flow. The method is applied to nonlinear transonic flutter and divergence of a two dimensional airfoil. Airloads are predicted using an existing small disturbance computer code, which determines structural loads due to airflow containing moving shock waves. A nonlinear two degree of freedom follower load problem is studied to demonstrate the applicability of the method of imposed disturbances to a multiple degree of freedom system. Another multiple degree of freedom system examined is a sandwich panel in nonlinear hypersonic flow, for which the rate of change of limit amplitude with respect to structural design variables is studied. Dissert. Abstr.

N80-12053*# Wichita State Univ., Kans.
WIND TUNNEL FORCE AND PRESSURE TESTS OF A 21% THICK GENERAL AVIATION AIRFOIL WITH 20% AILERON, 25% SLOTTED FLAP AND 10% SLOT-LIP SPOILER
W. H. Wentz, Jr. and K. A. Fiscko Washington NASA Jun. 1979 114 p ref
(Grant NsG-1165)
(NASA-CR-3081; WSU-AR-77-6) Avail: NTIS HC A06/MF A01 CSCL 01A

Force and surface pressure distributions were measured for the 21% LS(1)-0421 modified airfoil fitted with 20% aileron, 25% slotted flap and 10% slot lip spoiler. All tests were conducted at a Reynolds number of 2.2 x 10 to the 6th power and a Mach number of 0.13. The lift, drag, pitching moments, control surface normal force and hinge moments, and surface pressure distributions are included in the results. Incremental performance of flap and aileron are discussed and compared to the GA(W)-2 airfoil. Spoiler control which shows a slight reversal tendency at high alpha, is examined. A.W.H.

N80-12054*# Boeing Co., Seattle, Wash. Commercial Airplane Group.
TWO-DIMENSIONAL WIND-TUNNEL TESTS OF A NASA SUPERCRITICAL AIRFOIL WITH VARIOUS HIGH-LIFT SYSTEMS. VOLUME 1: DATA ANALYSIS
E. Omar, T. Zierten, and A. Mahal Washington NASA Apr. 1977 87 p refs
(Contract NAS1-10824)
(NASA-CR-2214; D6-41063-1-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 01A

High-lift systems for a NASA, 9.3%, method for calculating the viscous flow about two-dimensional multicomponent airfoils was evaluated by comparing its predictions with test data. High-lift systems derived from supercritical airfoils were compared in terms of performance to high-lift systems derived from conventional airfoils. The high-lift systems for the supercritical airfoil were designed to achieve maximum lift and consisted of: a single-slotted flap; a double-slotted flap and a leading-edge slat; and a triple-slotted flap and a leading-edge slat. Agreement between theoretical predictions and experimental results are also discussed. R.C.T.

N80-12055*# Boeing Co., Seattle, Wash.
TWO-DIMENSIONAL WIND-TUNNEL TESTS OF A NASA SUPERCRITICAL AIRFOIL WITH VARIOUS HIGH-LIFT SYSTEMS. VOLUME 2: TEST DATA Final Report
E. Omar, T. Zierten, M. Hahn, E. Szpiro, and A. Mahal Washington NASA Apr. 1977 234 p
(Contract NAS1-10824)
(NASA-CR-2215; D6-41063-2-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 01A

Three high lift systems for a 9.3 percent blunt based, supercritical airfoil were designed, fabricated, and wind tunnel tested. A method for calculating the viscous flow about two dimensional multicomponent airfoils was evaluated by comparing its predictions with test data. A comparison of high lift systems derived from supercritical airfoils with high lift systems derived from conventional airfoils is presented. The high lift systems for the supercritical airfoil were designed to achieve maximum lift and consisted of: (1) a single slotted flap, (2) a double slotted flap and a leading edge slat, and (3) a triple slotted flap and a leading edge slat. Aerodynamic force and moment data and surface pressure data are presented for all configurations and boundary layer and wake profiles for the single slotted flap configuration. The wind-tunnel models, test facilities and instrumentation, and data reduction are described. Author

N80-12056*# Boeing Commercial Airplane Co., Seattle, Wash.
A PROGRAM FOR CALCULATING LOAD COEFFICIENT MATRICES UTILIZING THE FORCE SUMMATION METHOD, L218 (LOADS). VOLUME 1: ENGINEERING AND USAGE
R. D. Miller and L. R. Anderson Oct. 1979 143 p refs
(Contract NAS1-13918)
(NASA-CR-2853; D6-44462-Vol-1) Avail: NTIS
HC A07/MF A01 CSCL 01A

The LOADS program L218, a digital computer program that calculates dynamic load coefficient matrices utilizing the force summation method, is described. The load equations are derived for a flight vehicle in straight and level flight and excited by gusts and/or control motions. In addition, sensor equations are calculated for use with an active control system. The load coefficient matrices are calculated for the following types of loads: translational and rotational accelerations, velocities, and displacements; panel aerodynamic forces; net panel forces; shears and moments. Program usage and a brief description of the analysis used are presented. A description of the design and structure of the program to aid those who will maintain and/or modify the program in the future is included. F.O.S.

N80-12057*# Boeing Commercial Airplane Co., Seattle, Wash.
EQUATION MODIFYING PROGRAM, L219 (EQMOD). VOLUME 1: ENGINEERING AND USAGE Contractor Report, May 1975 - May 1977
R. D. Miller, R. J. Fraser, M. Y. Hirayama, and R. E. Clemmons Oct. 1979 139 p refs
(Contract NAS1-13918)
(NASA-CR-2855; D6-44464-Vol-1) Avail: NTIS
HC A07/MF A01 CSCL 01A

The analysis and use of the Equation Modifying Program (EQMOD) L219, digital computer program which modifies matrices according to specific instructions was described. The program modifies the theoretical equation of motion and load equations generated by the DYLOFLEX programs Equation of Motion L217 (EOM), and Load Equations, L218 (LOADS), respectively. R.C.T.

N80-12058*# Boeing Commercial Airplane Co., Seattle, Wash.
RANDOM HARMONIC ANALYSIS PROGRAM, L221 (TEV156). VOLUME 1: ENGINEERING AND USAGE Contractor Report, May 1975 - May 1977
R. D. Miller and M. L. Graham Oct. 1979 158 p refs
(Contract NAS1-13918)
(NASA-CR-2857; D6-44466) Avail: NTIS HC A08/MF A01 CSCL 01A

A digital computer program capable of calculating steady state solutions for linear second order differential equations due to sinusoidal forcing functions is described. The field of application of the program, the analysis of airplane response and loads due to continuous random air turbulence, is discussed. Optional capabilities including frequency dependent input matrices, feedback damping, gradual gust penetration, multiple excitation forcing functions, and a static elastic solution are described. Program usage and a description of the analysis used are presented. A.W.H.

N80-12059*# General Dynamics/Convair, San Diego, Calif. Convair Div.
WIND TUNNEL INVESTIGATION OF AN OBLIQUE WING TRANSPORT MODEL AT MACH NUMBERS BETWEEN 0.6 AND 1.4
R. L. Black, J. K. Beamish, and W. K. Alexander Jul. 1975 334 p refs
(Contract NAS2-8127)
(NASA-CR-137697; HST-TR-344-0) Avail: NTIS
HC A15/MF A01 CSCL 01A

Models of three practical oblique-wing transport configurations were tested in the NASA Ames 11 foot wind tunnel. The three configurations used a common forward fuselage, wing, and support system but employed different aft fuselage sections simulating alternate propulsion system installations. These included an integrated propulsion system, pylon-mounted nacelles, and clean (no propulsion system) configuration. The tests were conducted over a Mach number range from 0.6 to 1.4 and at sweep angles from 0 to 60 degrees. The nominal unit Reynolds number was 1.83 million per meter and the angle of attack range was -3 to +6 degrees. The models were mounted in the tunnel by means of a lower blade support system. The interference effects of this lower blade and the flow inclination were determined by using an image blade system and testing the configuration in both the upright and inverted positions. M.M.M.

N80-12060*# Bihrle Applied Research, Inc., Jericho, N. Y.
ROTARY BALANCE DATA FOR A TYPICAL SINGLE-ENGINE GENERAL AVIATION DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEGREES TO 35 DEGREES, 3. EFFECT OF WING LEADING-EDGE MODIFICATIONS, MODEL A
William Bihrle, Jr. and William Mulcay Nov. 1979 176 p refs
(Contract NAS1-14849)
(NASA-CR-3102) Avail: NTIS HC A05/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a rotational flow environment utilizing a rotary balance located in the Langley spin tunnel are presented in plotted form for a 1/5 scale, single-engine, low-wing, general aviation airplane model. The configurations tested included the basic airplane, sixteen wing leading-edge modifications and lateral-directional control settings. Data are presented for all configurations without analysis for an angle of attack range of 8 deg to 35 deg and clockwise and counter-clockwise rotations covering an Omega b/2v range from 0 to 0.85. Also, data are presented above 35 deg of attack for some configurations. Author

N80-12061*# Kansas Univ. Center for Research, Inc., Lawrence.
AN IMPROVED WOODWARD'S PANEL METHOD FOR CALCULATING LEADING-EDGE AND SIDE-EDGE SUCTION FORCES AT SUBSONIC AND SUPERSONIC SPEEDS
C. Edward Lan and Sudhir C. Mehrotra Nov. 1979 37 p refs
(Grant NsG-1046)
(NASA-CR-3205; CRINC-FRL-266-3) Avail: NTIS
HC A03/MF A01 CSCL 01A

Woodward's panel method for subsonic and supersonic flow was improved by employing control points determined by exactly matching two-dimensional pressure at a finite number of points. The results show great improvement in the predicted pressure distribution of a flapped airfoil. With the paneling scheme of cosine law in both chordwise and spanwise directions, the method is shown to accurately predict leading edge and side edge suction forces of various configurations in subsonic and supersonic flow. R.C.T.

N80-12062# Aeronautical Research Labs., Melbourne (Australia).
EVALUATION OF WALL INTERFERENCE EFFECTS IN A TWO-DIMENSIONAL TRANSONIC WIND TUNNEL BY SUBSONIC LINEAR THEORY
B. D. Fairlie and N. Pollock Feb. 1979 74 p refs
(ARL/Aero-Rept-151; AR-001-596) Avail: NTIS
HC A04/MF A01

Results of transonic wind tunnel tests on two-dimensional aerofoils are analyzed with respect to the effects of wind tunnel wall interference. The tests were conducted on two geometrically similar models of each of two aerofoil sections--the NACA 0012 and the BGK-1 sections--and covered a range of Mach numbers from 0.5 to 0.82 with model chord to tunnel height ratios of 0.125 and 0.25. Measurements on all models in both solid and slotted wall test sections are corrected for wind tunnel wall interference effects by the application of classical linearized theory. For the solid wall results, these corrections appear to produce data which are very close to being free of the effects of interference. In the case of slotted walls however, linear theory is found to significantly underestimate the magnitude of blockage interference. The introduction of an empirical blockage correction, when combined with the linear theory representation of lift-interference, enables the cross-flow characteristics of the slotted walls to be determined, and leads to a successful correction scheme for the slotted wall results. Extensive comparisons with data from other sources, both experimental and theoretical, provide further verification that the corrected results are closely interference free. Author

N80-12063# Aeronautical Research Labs., Melbourne (Australia).
TRANSONIC WIND TUNNEL TESTS ON A SERIES OF TWO-DIMENSIONAL AEROFOILS IN A SOLID WALL TEST SECTION
B. D. Fairlie and N. Pollock Jan. 1979 39 p refs

(ARL/Aero-Note-384; AR-001-330) Avail: NTIS HC A03/MF A01

Transonic wind tunnel tests are reported on a series of two dimensional models in a test section equipped with four solid walls. The tests conducted on two geometrically similar models of each of two aerofoil sections, are described. The validity of linear interference theory without the complication of the unknown boundary conditions associated with nonsolid wind tunnel walls is examined. A.W.H.

N80-12064*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

AERODYNAMIC CHARACTERISTICS OF A HYPERSONIC RESEARCH AIRPLANE CONCEPT HAVING A 70 DEG SWEPT DOUBLE-DELTA WING AT MACH NUMBERS FROM 0.80 TO 1.20, WITH SUMMARY OF DATA FROM 0.20 TO 6.0

Jim A. Penland, James B. Hallissy, and James L. Dillon Washington Dec. 1979 147 p refs

(NASA-TP-1552; L-13158) Avail: NTIS HC A07/MF A01 CSCL 01A

The static longitudinal, lateral, and directional stability characteristics of a hypersonic research airplane concept having a 70 deg swept double-delta wing were investigated. Force tests were conducted in the Langley 8 foot transonic pressure tunnel for a Reynolds number (based on fuselage length) range of 6.30 x 10 to the 6th power to 7.03 x 10 to the 6th power, at angles of attack from about -4 deg to 23 deg, and at angles of sideslip of 0 deg and 5 deg. The configuration variables included the wing planform, tip fins, the center vertical tail, and scramjet engine modules. Variations of the more important aerodynamic parameters with Mach number for Mach numbers from 0.20 to 6.0 are summarized. A state-of-the-art example of theoretically predicting performance parameters and static longitudinal and directional stability over the Mach number range is included. A.R.H.

N80-12065*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

APPLICATION OF SUPERSONIC LINEAR THEORY AND HYPERSONIC IMPACT METHODS TO THREE NONSLENDER HYPERSONIC AIRPLANE CONCEPTS AT MACH NUMBERS FROM 1.10 TO 2.86

Jimmy L. Pittman Washington Dec. 1979 59 p refs

(NASA-TP-1539; L-13142) Avail: NTIS HC A04/MF A01 CSCL 10A

Aerodynamic predictions from supersonic linear theory and hypersonic impact theory were compared with experimental data for three hypersonic research airplane concepts over a Mach number range from 1.10 to 2.86. The linear theory gave good lift prediction and fair to good pitching-moment prediction over the Mach number (M) range. The tangent-cone theory predictions were good for lift and fair to good for pitching moment for M more than or equal to 2.0. The combined tangent-cone theory predictions were good for lift and fair to good for pitching moment for M more than or equal to 2.0. The combined tangent-cone/tangent-wedge method gave the least accurate prediction of lift and pitching moment. The zero-lift drag was overestimated, especially for M less than 2.0. The linear theory drag prediction was generally poor, with areas of good agreement only for M less than or equal to 1.2. For M more than or equal to 2.), the tangent-cone method predicted the zero-lift drag most accurately. R.C.T.

N80-12066*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

PITOT PRESSURE MEASUREMENTS IN FLOW FIELDS BEHIND CIRCULAR-ARC NOZZLES WITH EXHAUST JETS AT SUBSONIC FREE-STREAM MACH NUMBERS

Mary L. Mason and Lawrence E. Putnam Washington Dec. 1979 60 p refs

(NASA-TM-80169; L-13060) Avail: NTIS HC A04/MF A01 CSCL 01A

The flow field behind a circular arc nozzle with exhaust jet was studied at subsonic free stream Mach numbers. A conical probe was used to measure the pitot pressure in the jet and free stream regions. Pressure data were recorded for two nozzle configurations at nozzle pressure ratios of 2.0, 2.9, and 5.0. At each set of test conditions, the probe was traversed from the jet center line into the free stream region at seven data acquisition stations. The survey began at the nozzle exit and extended downstream at intervals. The pitot pressure data may be applied to the evaluation of computational flow field models, as illustrated by a comparison of the flow field data with results of inviscid jet plume theory. R.C.T.

N80-12067# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.

EFFECT OF HORIZONTAL AND VERTICAL SIDE FORCES AND MOMENTS ON STABILITY OF A SYMMETRIC MISSILE IN ASCENDING OR DESCENDING FLIGHT Final Report

Charles H. Murphy Apr. 1979 30 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A072808; ARBRL-MR-02915; AD-E430280) Avail: NTIS HC A03/MF A01 CSCL 19/4

Lloyd and Brown have shown that constant horizontal and vertical side forces and moments applied to a spinning projectile can result in dynamic instability. This instability arises from the nonlinear terms in the fixed-plane coordinate system spin that appear in the equations of motion. By quasilinearization, these nonlinear terms are shown to affect the frequencies slightly but the damping rates not at all. By the use of the fixed-plane system (rather than Lloyd and Brown's nonrolling system) simpler relations can be developed, the full effects of gravity, drag and roll damping obtained and the limitation to large gyroscopic stability factors removed. Very simple stability bounds are given for a slowly spinning or nonspinning finned missile such as Copperhead. GRA

N80-12068# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.

DESIGN AND ANALYSIS OF SINGLE CELL BALLOONS

James L. Rand Aug. 1978 81 p refs

(Contract F19628-76-C-0082; AF Proj. 6665)

(AD-A072828; AFGL-TR-78-0258; Scientific-1) Avail: NTIS HC A05/MF A01 CSCL 14/2

The procedures used in the design and analysis of single cell balloons are reviewed and reformulated to include lobing between load tapes and a realistic model of the load transfer mechanism between load carrying members. Results are presented for a typical 'heavy' load balloon which reveals the existence of significant circumferential stresses near the edge of the cap under certain conditions. Results also suggest a more severe state of stress below the design altitude than above. GRA

N80-12069# Calspan Advanced Technology Center, Buffalo, N.Y.

TRESTLE WIND TUNNEL STUDY Final Report, Sep. 1977 - Aug. 1978

Gary R. Ludwid and Joseph P. Nenni Mar. 1979 255 p refs

(Contract F29601-77-C-0093)

(AD-A072791; AFWL-TR-78-184; AD-E200340; Calspan-6171-A-2) Avail: NTIS HC A12/MF A01 CSCL 20/4

This report presents the results of an experimental and analytical study to determine the effects of atmospheric winds on aircraft situated on the ramp and test stand of the TRESTLE facility which is being built at Kirtland Air Force Base, New Mexico. The program included model tests to determine the wind flow patterns around the TRESTLE facility and the use of the wind flow data in an analysis to predict the effects of these winds on various large aircraft. The model tests, which were conducted in the Calspan Atmospheric Simulation Facility, included flow visualization studies and quantitative hot-film anemometer measurements of three components of mean velocity. A simplified method of analysis was developed to estimate the forces and moments on aircraft situated in the experimentally determined flow field. The analysis incorporated provisions to account for unconventional wind-aircraft orientations and nonuniform flow fields. Results of the program are presented for twelve wind directions, three different aircraft, and nine positions of each aircraft on the TRESTLE facility ramp and test stand. GRA

N80-12070# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.

TURBULENT BOUNDARY LAYERS ON AN AIRFOIL IN SEVERAL ADVERSE PRESSURE GRADIENTS M.S. Thesis Final Report, 1 Jan. 1977 - 30 Jun. 1978
Richard T. Cervisi Aug. 1978 135 p refs
(Contract F49620-77-C-0031; AF Proj. 2307)
(AD-A072839; AFOSR-78-1450TR; MIT-TR-203) Avail: NTIS
HC A07/MF A01 CSCL 20/4

Turbulent boundary layer profiles in a wide range of adverse pressure gradients were measured using a boundary layer velocity-flow angle measuring probe designed for this experiment. The different pressure gradients were created on a NACA 0012 airfoil by changing the angular orientation of an elliptic cylinder placed near the airfoils trailing edge. Rotating the elliptic cylinder to various angular positions changed the effective angle of attack and camber of the airfoil-ellipse combination thereby creating different pressure distributions about the airfoil. In anticipation of spinning the ellipse to create an unsteady flow in future experiments; this experiment defined the steady state environment. The boundary layer profiles are presented in three different graphical formats; conventional nondimensional plots, profiles in modified Law of the Wall coordinates and Velocity Defect Law graphs. The Law of the Wall was modified to account for longitudinal streamline curvature. Local skin friction coefficients were found using the modified Law of the Wall in the form of a Clauser chart. The boundary layer data was checked for repeatability, consistency and agreement with theory and previous experiments. The final results were deemed excellent. GRA

N80-12071# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
IMPROVEMENTS TO THE SOLUTION OF THE VISCOUS SHOCK LAYER EQUATIONS Final Report, Jan. 1977 - Oct. 1978
W. M. Hosny, R. T. Davis, and M. J. Werle Aug. 1979 115 p refs
(Contract F40600-77-C-0001)
(AD-A072673; AFL-78-11-45; AEDC-TR-79-25) Avail: NTIS
HC A06/MF A01 CSCL 20/4

An analysis and numerical solution of the fully viscous shock layer equations for hypersonic flow past blunt nosed bodies is presented. Solutions were obtained using a numerical scheme developed to solve the governing equations simultaneously as a coupled set of equations. Through application of the method to hypersonic flow past hyperboloids, it was found that the method is stable and produces results in good comparison with other methods. The main success of the method lies in its ability of extending the flow field calculations far aft of the nose region. GRA

N80-12072# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A METHOD FOR ASSESSING THE IMPACT OF WAKE VORTICES OF USAF OPERATIONS Final Report, 15 Dec. 1978 - 5 Apr. 1979
George Kurylowich Jul. 1979 111 p refs
(AD-A072967; AFFDL-TR-79-3060) Avail: NTIS
HC A06/MF A01 CSCL 01/2

Experience as a consultant to the Safety Office at Norton AFB led to compiling the engineering tools presented, so that this report can be used by engineering personnel to investigate future incidents/accidents and existing USAF operations that are impacted by the vortical wake hazard. The approach presented is amenable to easy hand computations. Mixed airplane/helicopter operations can be assessed, since the engineering tools to determine the location and strength of the rotor downwash field behind a helicopter are presented. Finally, a simplified mathematical model is given to represent this hazard for use in USAF simulators, to make pilots aware of the problems associated with operating in wake-contaminated airspace. GRA

N80-12073# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
AEROELASTIC RESPONSE ANALYSIS OF TWO DIMENSIONAL, SINGLE AND TWO DEGREE OF FREEDOM AIRFOILS IN LOW-FREQUENCY, SMALL-DISTURBANCE UNSTEADY TRANSONIC FLOW Final Report, Nov. 1978 - May 1979
T. Y. Yang, P. Guruswamy, and A. G. Striz Wright-Patterson AFB, Ohio AFFDL Jun. 1979 55 p refs
(Grant AF-AFOSR-3523-78; AF Proj. 2307)
(AD-A073379; AFFDL-TR-79-3077) Avail: NTIS
HC A04/MF A01 CSCL 20/4

A procedure is developed to obtain the aeroelastic responses of single and two degree of freedom aeroelastic systems in transonic flow. The fluid is described by the two dimensional unsteady low-frequency transonic potential equation based on small disturbance theory. The aerodynamic computer code LTRAN2 which is based on a fully implicit time integration scheme is employed to obtain the aerodynamic forces. The structural equations are simultaneously integrated with the potential flow equations by a numerical method and the aeroelastic responses are obtained. Results for neutrally stable responses are compared with those obtained by the U-g method. Aeroelastic responses are obtained for flat plates (single and two degree of freedom) at M = 0.7 by the linear part of LTRAN2. Examples of an NACA 64A006 airfoil at Mach numbers of 0.88 and 0.85 are also analyzed. Response results obtained for a single pitching degree of freedom system at M = 0.88 are compared with an existing solution. The response results obtained for a two degree of freedom system at M = 0.85 for neutrally stable condition are correlated with those obtained by the flutter analysis. Results also include stable and unstable response curves and their variations with altitude. GRA

N80-12074*# ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF SEPARATED FLOW ABOUT A HEMISPHERE-CYLINDER AT 0- TO 19- DEGREE IN THE MACH NUMBER RANGE FROM 0.6 TO 1.5 Final Report, Oct. 1974 - Jun. 1976
T. Hsieh AEDC Nov. 1976 121 p refs
(AF Proj. 8219)
(AD-A073451; AEDC-TR-76-112) Avail: NTIS
HC A06/MF A01 CSCL 20/4

A wind tunnel investigation was conducted of the separated flow about a hemisphere-cylinder at incidence from 0 to 19 deg in the Mach number range from 0.6 to 1.5. At zero incidence, a nose separation bubble is revealed from analysis of shadowgraphs and surface pressure distributions between Mach numbers 0.7 and 0.9. The basic differences between the present nose separation bubble and the leading-edge separation bubble of airfoils are discussed. A multiple shock system, consisting of a lambda shape shock and two normal shocks, prevails in the flow field as a result of the viscous/inviscid interaction which is strongest at M sub infinity equals 0.85. Velocity field measurements utilizing a laser velocimeters were obtained for M at infinity equals 0.85. The concept of an effective body and the particle dynamics are used to analyze the velocity. For incidences from 5 to 19 deg, shadowgraphs, surface pressures, and oil flow pictures showing the separation patterns and limiting streamlines, were obtained through the Mach number range. Two separation regions, the nose separation bubble and the crossflow separation zone, were found to exist simultaneously. Concentrated vortices standing at the leeside forebody were found, and the mechanism and conditions for their appearance are discussed. GRA

N80-12075# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
REAL TIME DIGITAL MODEL OF A ROLLING AIRFRAME
Victor S. Grimes, Jr. 31 Jul. 1978 50 p refs
(DA Proj. 1X4-64306-D-646)
(AD-A073456; DRDMI-T-78-75) Avail: NTIS
HC A03/MF A01 CSCL 20/4

An all-digital airframe model of a rolling missile is developed by using tunable convolution and integration techniques. The model is capable of handling high frequency airframe dynamics in real time with large time steps and hardware in the loop (HWIL). This model is currently in use in three applications at the MIRADCOM Advanced Simulation Center in Aeroballistics Directorate, Technology Laboratory. GRA

N80-12008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
UNSTEADY AERODYNAMIC INPUTS FOR AEROELASTIC ANALYSES: A GENERAL INTRODUCTION
W. Geissler *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design, 1979 102 p refs (For primary

document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12009# National Aerospace Lab., Amsterdam (Netherlands).
REMARKS ON THE TRANSONIC FLOW PAST OSCILLATING AIRFOILS
H. Tijdeman *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 33 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12014# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION OF TRANSONIC FLOWS AROUND WINGS
Jean-Jacques Chattot, Colette Coulombeix, and Carlos daSilvaTome *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 1-41 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 143-159 Original language report was announced as A79-11132 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

N80-12015# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION OF THE THREE-DIMENSIONAL SUPERSONIC FLOW IN AN AXIAL COMPRESSOR BY A METHOD OF CHARACTERISTICS
Jean Martinon *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 42-78 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-4, Jul.-Aug. 1978 p 161-174 Original language report was announced as A79-11133 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

N80-12016# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION - EXPERIMENT COMPARISONS OF THE TRANSONIC TWO-DIMENSIONAL FLOW IN A HIGH-DEFLECTION CASCADE
Georges Meauze *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1978-4 Jun. 1979 p 79-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 175-180 Presented at Euromech Colloq. 87 on Transonic Flows in Turbomachines, Prague, 12-15 Apr. 1977 Original language report was announced as A79-11134 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

N80-12022# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SEPARATION OF A FLOW ALONG A LINE OF A SMOOTH SURFACE
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 1-12 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 213-219 Original language report was announced as A79-18531 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

N80-12027# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL INVESTIGATION OF LARGE SCALE STRUCTURES IN TURBULENT JET MIXING LAYERS
Otto Leuchter and Khoa Dang *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1978-5 Jul. 1979 p 93-96 ref Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 279-282 Presented at Working Group on Coherent Struct. and Turbulent Boundary Layers, Bethlehem, Penn. 1-3 May 1978 Original language report was announced as A79-18536 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

N80-12030# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ONERA AERODYNAMIC RESEARCH WORK ON HELICOPTERS
Jean-Jacques Philippe and Claude Armand *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 1-23 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 287-304 Presented at AGARD Symp. on "Rotocraft Design", Moffett Field, Calif., 16-19 May 1977 Original language report was announced as N78-19148 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

N80-12031# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYSIS OF THE SEPARATION DUE TO SHOCK WAVE-TURBULENT BOUNDARY LAYER INTERACTION IN TRANSONIC FLOW
Jean Delery *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 23-45 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 305-320 Original language report was announced as A79-25074 Sponsored by DRET (Res. Directorate, Min. of Defence) (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

N80-12036# European Space Agency, Paris (France).
ON THE SIMULATION OF AN UNDEREXPANDED PROPULSIVE JET FOR THE WIND TUNNEL INVESTIGATION OF THE STATIC LONGITUDINAL STABILITY OF FLIGHT VEHICLES IN SUPERSONIC FLOW
Hans Emunds and Hansgeorg Riedel *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 15-44 refs Transl. into ENGLISH from 'Zur Simulation eines unterexpandierten Treibstrahls beider Untersuchung der statischen Laengsstabilitaet von Flugkoerpern im Windkanal bei Ueberschallanstroemung," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12037# European Space Agency, Paris (France).
THE NORMAL FORCE ON A CRUCIFORM MISSILE AT BANK ANGLES OF A DEG AND 45 DEG
Helmut Esch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 45-60 refs Transl. into ENGLISH from 'Die Normalkraft eines Flugkoerpers mit Kreuzleitwerk bei Rollagen von o deg und 45 deg.' DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12038# European Space Agency, Paris (France).
INFLUENCE OF THE FLOW FIELD AROUND AN INCLINED OGIVE-CYLINDER BODY UPON SUPERSONIC AFT-INTAKES
Klaus Triesch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 61-78 refs Transl. into ENGLISH from 'Einfluss des Rumpfes auf am Flugkoerperheck angeordnete Ueberschalleinlaeufe bei Anstellung,' DFVLR, Cologne Report DLR-FB-77-36 Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12039# European Space Agency, Paris (France).
NORMAL FORCE DERIVATIVE AND CENTER OF PRESSURE MOVEMENT DUE TO MACH NUMBER ON WING-BODY COMBINATIONS WITH TRIANGULAR WINGS OF THE SAME SPAN AND DIFFERENT ASPECT RATIOS AT SUPERSONIC SPEEDS
Wolfgang Wyborny *in its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 79-96 refs Transl. into ENGLISH from 'Normalkraftanstieg und Verschiebung des Luftkrafttangriffspunktes ueber der Machzal von Rumpf-Leitwerk-Kombinationen mit Rochenleitwerken gleicher Spannweite bei verschiedenen Flaechenverhaeltnissen im Ueberschall,' DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12040# European Space Agency, Paris (France).
FLOW FIELD INVESTIGATIONS IN CORNER REGIONS IN HYPERSONIC FLOW Final Report
Hermann-Josef Schepers and Heinz Pfeiffer *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 97-109 refs Transl.

into ENGLISH from 'Stroemungsfeldunterschung in Eckengebieten bei Hyperschallanstroemung', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
(Proj. B8)
Avail: NTIS HC A15/MF A01

N80-12041# European Space Agency, Paris (France).
LASER-RAMAN SPECTROSCOPY
Werner Krahn *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 110-127 refs Transl. into ENGLISH from 'Laser-Raman Spektroskopie', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12045# European Space Agency, Paris (France).
CURVATURE EFFECTS ON THE BEHAVIOR OF LAMINAR BOUNDARY LAYERS
Roger Grundmann and Klaus Robert *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 217-229 refs Transl. into ENGLISH from 'Kruemmungseinfluesse auf das Ablosevorhalten von laminaren Grenzschichten', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12046# European Space Agency, Paris (France).
VERIFICATION OF THE EXPERIMENTALLY DETERMINED LAMINAR-TURBULENT TRANSITION ON A SWEPT WING
Ernst Heinrich Hirschel and Vera Jawtusch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 229-250 refs Transl. into ENGLISH from Nachrechung des experimentell ermittelten Uebergangs laminar-turbulent an einem gepfeilten Fluegel, DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 Sponsored in part by German Res. Council (DFG) (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12047# European Space Agency, Paris (France).
A COMPUTATIONAL METHOD FOR CALCULATING LAMINAR-TURBULENT TRANSITION IN A BOUNDARY LAYER
Ulrich Nehring *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 251-273 refs Transl. into ENGLISH from "Ein Verfahren zur Berechnung des laminar-trubulenten Uebergangs in der Grenzschicht," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12048# European Space Agency, Paris (France).
HIGHER-ORDER BOUNDARY LAYER EQUATIONS FOR THREE-DIMENSIONAL COMPRESSIBLE FLOW
Klaus Robert *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 273-288 refs (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12049# European Space Agency, Paris (France).
THREE-DIMENSIONAL, INVISCID, ROTATIONAL DUCT FLOWS WITH EMBEDDED SHOCKS: CONSIDERATIONS WITH REGARD TO A COMPUTATIONAL METHOD AND PRELIMINARY RESULTS
Kurt Gruemmer *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 289-300 refs Transl. into ENGLISH from "Dreidimensionale, reibungsfreie, drehungsbehaftete innenstroemungen mit eingebetteten Stoessen - Ueberlegungen zu einem Berechnungsverfahren, erste Rechenergebnisse," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12050# European Space Agency, Paris (France).
SHOCK-SHOCK AND SHOCK-BOUNDARY LAYER INTERACTION AT FLAT AND INCLINED PLATES IN RAREFIELD HYPERSONIC FLOW
Gustav Schweiger, Knut Erhardt, Manfred Becker, and Demetrius G. Papanikas *In its* Contrib. to Gas Dyn. and Aerodyn. 1979 p 301-328 refs Transl. into ENGLISH from "Stoss-Stoss-und Stoss-Grenzschicht-Wechselwirkung an ebenenund angestellten Platten in verduennter Hyperschallstroemung," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12211 Institut Franco-Allemand de Recherches, St. Louis (France).
SHOCK TUBE RESEARCH LOOKING AT THE ORIGIN OF THE MACHWAVES INSIDE AND OUTSIDE SUPERSONIC JETS
H. Oertel *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 167-208 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations, and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-12076*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
TECHNOLOGY OPTIONS FOR AN ENHANCED AIR CARGO SYSTEM
Matthew M. Winston Oct. 1979 34 p refs Presented at the ASCE Natl. Convention, Atlanta, 22-26 Oct. 1979
(NASA-TM-80173) Avail: NTIS HC A03/MF A01 CSCL 01C

A view of potential enhancements to the air cargo system through technology application is provided. NASA's role in addressing deficiencies of the current civil and military air cargo systems is outlined. The evolution of conventional airfreighter design is traced and projected through the 1990's. Also, several advanced airfreighter concepts incorporating unconventional design features are described to show their potentials benefits. A number of ongoing NASA technology programs are discussed to indicate the wide range of advanced technologies offering potential benefits to the air cargo system. The promise of advanced airfreighters is then viewed in light of the future air cargo infrastructure predicted by extensive systems studies. The derived outlook concludes that the aircraft technology benefits may be offset somewhat by adverse economic, environmental, and institutional constraints. Author

N80-12077# Air Force Engineering and Services Center, Tyndall AFB, Fla.
AN EVALUATION OF THE BIRD/AIRCRAFT STRIKE HAZARD AT SELECTED UNITED KINGDOM BASES: RAF MILDENHALL, RAF ALCONBURY, RAF UPPER HEYFORD, RAF BENTWATERS, RAF FAIRFORD, RAF LAKENHEATH, AND RAF WOODBRIDGE Final Report, Nov. - Dec. 1978
James S. Kent, Joan Scott, and William H. Niemeier Jun. 1979 100 p refs
(AD-A073062; AFESC-TM-3-79) Avail: NTIS HC A05/MF A01 CSCL 01/2

Selected United Kingdom air bases were surveyed from 3 November to 4 December 1978 by the Air Force Engineering and Services Center's Bird/Aircraft Strike Hazard Team. During this period, operational and environmental factors which combine to create bird strike hazards at each location were observed. Specific recommendations based on observations are provided to reduce the bird strike hazard. GRA

N80-12078# Coast Guard Research and Development Center, Groton, Conn.
ANALYST LEVEL DOCUMENTATION FOR THE SEARCH AND RESCUE SIMULATION (SARSIM) Final Report
G. L. Underwood, J. A. Smith, and G. B. Walters Mar. 1979 85 p refs
(AD-A073155; CGR/DC-14/79; GC-D-49-79) Avail: NTIS HC A05/MF A01 CSCL 09/2

The Search and Rescue Simulation (SARSIM) is a management tool that has been developed to aid Coast Guard decision-makers in developing long-range strategic plans to carry out the SAR mission. SARSIM is a discrete event digital computer simulation program programmed in SIMSCRIPT II.5. It is a highly flexible user-oriented model that simulates Coast Guard response to futuristic caseloads. SARSIM is comprised of three major modules. The first major module is the PREPROCESSOR. The PREPROCESSOR is used to generate expected caseloads based on the historical SAR Data Base. In other words, it supplies a scenario, or futuristic caseload which may, if desired, be used for many different simulation runs. The heart of SARSIM, the SIMULATOR, is essentially a bookkeeping system which logs in cases, registers their needs, investigates the availability of service facilities, assigns resources for servicing, and generally keeps track of simulated time spent in the several possible activities represented within the model and maintains statistics for output. The POSTPROCESSOR is a data retrieval package, which operates on data files from the SIMULATOR to permit a more detailed analysis of simulation runs as a supplement to the printed report from the SIMULATOR. GRA

N80-12079# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
PROPULSION AND ENERGETICS PANEL WORKING GROUP 2 ON AIRCRAFT FIRE SAFETY. VOLUME 1: EXECUTIVE SUMMARY
B. P. Botteri (AFSC) Sep. 1979 17 p
(AGARD-AR-132-Vol-1; ISBN-92-835-0246-9) Avail: NTIS HC A02/MF A01

The fire experience, areas in which fire protection enhancement is needed, technological advances in the areas of safety and personnel survivability for a civilian turbine engine transport aircraft are presented. M.M.M.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-12080# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DABS SINGLE SENSOR PERFORMANCE TEST PLAN
Jul. 1979 157 p
(AD-A072695; FAA-NA-79-151) Avail: NTIS HC A04/MF A01 CSCL 17/7

The single-sensor performance tests are described which are to be conducted upon three engineering laboratory models of the Discrete Address Beacon System (DABS) sensor. These sensors are to be installed at NAFEC and two adjacent sites: Elwood and Clementon, New Jersey. These performance tests address the following characteristics: surveillance processing, accuracy and resolution, data link, performance monitoring and failure recovery, network management (stand-alone mode) and communications. The results of these performance tests will be used to prepare a technical data package for DABS procurement. F.O.S.

N80-12081# Electronics Research Lab., Adelaide (Australia).
THE FREQUENCY RESPONSE OF A PARTICULAR GIMBAL SYSTEM TO COHERENT ROTATION AND ACCELERATION EXCITATION
R. F. Dancer Dec. 1978 65 p refs
(AD-A073153; ERL-0037-TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

The general theoretical expression for the frequency response of a gimbal system to a joint rotation/acceleration driving force is derived. Theoretical estimates of physical system parameters are made for particular gimbal system. Experimental verification of these theories is obtained by measurements of the rotationally excited response of the gimbal system. GRA

N80-12082# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE IMPACT OF GLOBAL POSITIONING SYSTEM ON GUIDANCE AND CONTROLS SYSTEMS DESIGN OF MILITARY AIRCRAFT, VOLUME 1
G. C. Howell, ed. (Royal Aircraft Establishment) Sep. 1979 43 p refs 2 Vol.
(AGARD-AR-147-Vol-1; ISBN-92-835-1339-8) Avail: NTIS HC A03/MF A01

Contents: (1) to study the application of GPS to interdiction, ground attack, interception and close combat aircraft; (2) to determine the extent which improved performance or new capabilities are made possible; (3) to study the integration of GPS into guidance and control systems, determine the impact on system design, and indicate where simplification and cost savings may be brought about; and (4) to make recommendations for further and more detailed study of the most promising applications. M.M.M.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-12083 Kansas Univ., Lawrence.
THE DEVELOPMENT OF THE DAST 1 REMOTELY PILOTED RESEARCH VEHICLE FOR FLIGHT TESTING AN ACTIVE FLUTTER SUPPRESSION CONTROL SYSTEM
Ph.D. Thesis
David Lee Grose 1979 368 p
Avail: Univ. Microfilms Order No. 7925873

The development of the DAST 1 remotely piloted research vehicle is described. The DAST 1 is a highly modified BQM-34E/F Firebee 2 supersonic aerial target incorporating a swept supercritical wing designed to flutter within the vehicle's flight envelope. The predicted flutter and rigid body characteristics are presented. A description of the analysis and design of an active flutter suppression control system designed to increase the flutter boundary of the DAST wing by a factor of 20% is given. The design and development of the digital remotely augmented primary flight control system and onboard analog backup control system is presented. An evaluation of the near real time flight flutter testing methods is made by comparing results of five flutter testing techniques on simulated DAST 1 flutter data. Dissert. Abstr.

N80-12084*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
BEHAVIOR OF AIRCRAFT ANTISKID BRAKING SYSTEMS ON DRY AND WET RUNWAY SURFACES. A SLIP-VELOCITY-CONTROLLED, PRESSURE-BIAS-MODULATED SYSTEM
Sandy M. Stubbs, John A. Tanner, and Eunice G. Smith Washington Dec. 1979 194 p refs
(NASA-TP-1051; L-11760) Avail: NTIS HC A09/MF A01 CSCL 01C

The braking and cornering response of a slip velocity controlled, pressure bias modulated aircraft antiskid braking system is investigated. The investigation, conducted on dry and wet runway surfaces, utilized one main gear wheel, brake, and tire assembly of a McDonnell Douglas DC 9 series 10 airplane. The landing gear strut was replaced by a dynamometer. The parameters, which were varied, included the carriage speed, tire loading, yaw angle, tire tread condition, brake system operating pressure, and runway wetness conditions. The effects of each of these parameters on the behavior of the skid control system is presented. Comparisons between data obtained with the skid control system and data obtained from single cycle braking tests without antiskid protection are examined. A.W.H.

N80-12085# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
PREDICTION OF DRAG COEFFICIENTS OF A SUPERSONIC

V/STOL CONFIGURATION WITH VARIOUS STORE ARRANGEMENTS
Tsze-C. Tai, Thomas H. Boyd, and Richard E. Kuhn. Aug. 1979. 43 p. refs. Presented at the Navy Symp. on Aerobalistics, NADC, Trevose, Penn., 22-24 Aug. 1978.
(WR0230201)
(AD-A072999; DTNSRDC-79/074; DTNSRDC/AERO-1260) Avail: NTIS. HC A03/MF A01. CSCL 20/4

Numerical computations, using supersonic area rule, linear theory and turbulent boundary layer solutions, were performed to evaluate the drag coefficients of a supersonic V/STOL configuration with various store arrangements. External stores included short- and medium-range missiles, electronic pod, and 600 gallon (2280 liters) fuel tanks. Predictions were based on cruise conditions at Mach numbers 1.2, 1.6, and 1.8 with Reynolds numbers between 2 and 66.2 million per foot. As expected, it was found that the drag coefficient decreases as the free-stream Mach number increases. The wave drag varies nonlinearly with added store capacity. Data indicate that for the same store capacity, the wave drag may be minimized by judicious selection of store location. GRA

N80-12086# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
THE PERFORMANCE OF A CONCEPTUAL VERTICAL ATTITUDE TAKEOFF AND LANDING FIGHTER AIRCRAFT Final Report, Sep. - Dec. 1978
Basil S. Papadales, Jr. Jan. 1979. 30 p. refs.
(AD-A073100; DTNSRDC/ASED-76/06) Avail: NTIS. HC A03/MF A01. CSCL 01/3

The performance of a conceptual 18,000 lb (8200 kg) vertical attitude takeoff and landing fighter aircraft is presented. The single-seat aircraft is designed around a single F100 turbofan. Contemporary avionics and materials technologies are assumed. The design payload includes an M61 cannon with ammunition and four Dogfight missiles. No compromises for mission capabilities, other than air combat, exist in the design. The fighter has a combat radius of 308 nm (570 km) with a maximum level speed in excess of Mach 2 at altitude. Range, turning, and specific excess energy performance are presented. Weight and range performance penalties for the inclusion of conventional landing gear, a rotating cockpit, and a multi-engine design are summarized. GRA

N80-12087# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
INERTIA CALCULATION PROCEDURE FOR PRELIMINARY DESIGN Final Report
Charles Lanham. Apr. 1979. 70 p. refs.
(AD-A072679; ASD-TR-79-5004) Avail: NTIS. HC A04/MF A01. CSCL 01/3

This report explains the methods involved in estimating aircraft moments of inertia for preliminary design purposes. Assumptions that were made for this procedure and the derviation of equations that evolved from these assumptions are included. An example using the method on the C-5A aircraft is shown. This procedure requires a knowledge of the major aircraft group weights, the location of major components (landing gear, avionics bay, etc.), geometry information, and inertias of some major subsystem items. Using this data, the moments of inertia about the roll, pitch, and yaw axes are calculated as well as the roll-yaw cross-product of inertia. GRA

N80-12088# Army Aviation Test Activity, Edwards AFB, Calif.
AH-1G LATERAL FLIGHT PERFORMANCE TEST
Leslie J. Hepler, James S. Kishi, and Albert L. Winn. 30 Jun. 1979. 21 p. refs.
(AD-A072868; USAASTA-71-43) Avail: NTIS. HC A02/MF A01. CSCL 01/1

The lateral flight performance of the tractor-tail-rotor-configured AH-1G helicopter was evaluated at gross weights of 8500 and 9500 pounds. The AH-1G is capable of 0.53 g and 0.38 g accelerations in right and left lateral flight, respectively, at 8500 pounds. At a 9500 pound gross weight, acceleration was 0.23 g to the right and 0.20 g to the left. Aircraft handling qualities and time required to attain maximum lateral velocity are dependent upon rate and type of control application. A step-type lateral control input permitted rapid attainment of accelerating attitude but produced yaw oscillations which resulted in loss of directional control and caused high pilot workload in stabilizing power and aircraft attitude. Ramp inputs delayed establishment of the accelerating attitude. A modified pulse input induced negligible roll and yaw oscillation and produced rapid establishment of the desired roll attitude. Direction-of-flight reversals induced large power transients that frequently exceeded the transmission torque limits. Precise heading and pitch attitude could not be maintained during the reversals. Airspeed in lateral flight could not be determined without special airspeed measuring devices. The sideward airspeed limit was exceeded frequently in left lateral flight with no warning or cue to the pilot that the limit had been reached. GRA

N80-12089# Battelle Columbus Labs., Ohio.
F-111 A/E DIGITAL BOMB-NAV SYSTEM SOFTWARE ANALYSIS Final Technical Report, Apr. - Nov. 1978
Ellis Hitt, Tom Clark, Mike Bridgman, Bill Young, and Norman Thompson. Wright-Patterson AFB, Ohio. AFAL. Apr. 1979. 331 p. refs.
(Contract F33615-76-C-1299; AF Proj. 2003)
(AD-A072826; AFAL-TR-79-1043) Avail: NTIS. HC A15/MF A01. CSCL 09/2

The objective of this project was to perform an independent evaluation of the technical and economic factors affecting a set of software development alternatives for the F-111A and F-111E digital bomb-navigation system operational flight program. Specifically, the use of Jovial (J73/I), higher order language or the assembly language of the selected computer was compared. The comparison was to consider the implications of various software development options as well as the impact of the options on the existing software support organizations and facility at Sacramento, Cal. GRA

N80-12001# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
A SURVEY OF AEROELASTIC PROBLEMS
H. Foersching. *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design. 1979. p. 1-15. refs. (For primary document see N80-12000 03-01)
Avail: NTIS. HC A23/MF A01

N80-12002# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
AEROELASTICITY FROM THE VIEWPOINT OF THE DESIGNER
H. Foersching. *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design. 1979. 32 p. (For primary document see N80-12000 03-01)
Avail: NTIS. HC A23/MF A01

N80-12003# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
MODAL ANALYSIS OF AIRCRAFT STRUCTURES
H. Foersching. *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design. 1979. 26 p. (For primary document see N80-12000 03-01)
Avail: NTIS. HC A23/MF A01

N80-12004# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
LIFTING SURFACE DIVERGENCE AND CONTROL EFFECTIVENESS
H. Foersching. *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design. 1979. 35 p. (For primary document see N80-12000 03-01)
Avail: NTIS. HC A23/MF A01

N80-12005# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France).
MODAL REPRESENTATION AND TRANSFER FUNCTION OF LINEAR DISSIPATIVE STRUCTURES
Roland Dat. *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design. 1979. 20 p. refs. (For primary document see N80-12000 03-01)
Avail: NTIS. HC A23/MF A01

N80-12008# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France).
NEW METHODS FOR GROUND TESTS OF AERONAUTICAL STRUCTURES
G. Piazzoli *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 22 p refs In FRENCH; ENGLISH summary (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-12090*# Massachusetts Inst. of Tech., Cambridge.
PREMIXING QUALITY AND FLAME STABILITY: A THEORETICAL AND EXPERIMENTAL STUDY Final Report
Krishnan Radhakrishnan, John B. Heywood, and Rodney J. Tabaczynski Washington Dec. 1979 65 p refs
(Grant NGR-22-009-378)
(NASA-CR-3216) Avail: NTIS HC A04/MF A01 CSCL 21E

Models for predicting flame ignition and blowout in a combustor primary zone are presented. A correlation for the blowoff velocity of premixed turbulent flames is developed using the basic quantities of turbulent flow, and the laminar flame speed. A statistical model employing a Monte Carlo calculation procedure is developed to account for nonuniformities in a combustor primary zone. An overall kinetic rate equation is used to describe the fuel oxidation process. The model is used to predict the lean ignition and blow out limits of premixed turbulent flames; the effects of mixture nonuniformity on the lean ignition limit are explored using an assumed distribution of fuel-air ratios. Data on the effects of variations in inlet temperature, reference velocity and mixture uniformity on the lean ignition and blowout limits of gaseous propane-air flames are presented. A.W.H.

N80-12091*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
DESIGN, DURABILITY AND LOW COST PROCESSING TECHNOLOGY FOR COMPOSITE FAN EXIT GUIDE VANES
S. S. Blecherman Aug. 1979 139 p refs
(Contract NAS3-21037)
(NASA-CR-159677; PWA-5570-37) Avail: NTIS HC A07/MF A01 CSCL 21E

A lightweight composite fan exit guide vane for high bypass ratio gas turbine engine application was investigated. Eight candidate material/design combinations were evaluated by NASTRAN finite element analyses. A total of four combinations were selected for further analytical evaluation, part fabrication by two vendors, and fatigue test in dry and wet condition. A core and shell vane design was chosen in which the unidirectional graphite core fiber was the same for all candidates. The shell material, fiber orientation, and ply configuration were varied. Material tests were performed on raw material and composite specimens to establish specification requirements. Pre-test and post-test microstructural examination and nondestructive analyses were conducted to determine the effect of material variations on fatigue durability and failure mode. Relevant data were acquired with respect to design analysis, materials properties, inspection standards, improved durability, weight benefits, and part price of the composite fan exit guide vane. R.C.T.

N80-12092*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ENGINE COMPONENT IMPROVEMENT PROGRAM: PERFORMANCE IMPROVEMENT
John E. McAulay 1979 17 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-79304; E-256) Avail: NTIS HC A02/MF A01 CSCL 21E

Fuel consumption of commercial aircraft is considered. Fuel saving and retention components for new production and retrofit of JT9D, JT8D, and CF6 engines are reviewed. The manner in which the performance improvement concepts were selected for development and a summary of the current status of each of the 16 selected concepts are discussed. R.C.T.

N80-12093# General Dynamics Corp. Fort Worth, Tex. Fort Worth Div.
THE CRITICALITY OF ENGINE EXHAUST SIMULATIONS ON VSTOL MODEL MEASURED GROUND EFFECTS Final Report, Jul. 1978 - Aug. 1979
J. R. Lummus Jul. 1979 213 p refs
(Contract N00014-78-C-0384)
(AD-A073114; ONR-CR-212-285-1F) Avail: NTIS HC A10/MF A01 CSCL 20/4

This experimental investigation demonstrated the criticality of performing accurate full-scale engine exhaust simulations during model-measured VSTOL ground effects testing. The effects of varying the nozzle exit turbulence, total pressure distributions, and nozzle pressure ratio on the net and component ground-induced forces for two-, three-, and four-nozzle configurations with large blocking surfaces (as well as a smaller, cruciform two-nozzle blocking surface more characteristic of a real aircraft planform) were studied. GRA

N80-12094# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
VALIDATION OF THE DETROIT DIESEL ALLISON LOGISTIC SUPPORT COST MODEL (PROGRAM OS 590) M.S. Thesis
Howard E. Creek and Christopher Harlambakis Jun. 1979 83 p refs
(AD-A072670; AFIT-LSSR-20-79A) Avail: NTIS HC A05/MF A01 CSCL 21/5

The Department of Defense (DoD) is genuinely concerned about Operation and Support Costs (O/S) during the early stages of the aquisition process. An area of particular interest to the Air Force Aero Propulsion laboratory (AFAPL) was the validation of Detroit Diesel Allison's O/S cost model, OS590. This study was designed to assist the AFAPL in determining O/S costs for future advanced high technology turbine engines. The results of this research include the following findings: (a) input data for OS590 within the scope of this effort was available from Air Force sources; (b) OS590 produced valid O/S costs; (c) OS590 was sensitive to selected input parameters; and (d) the Directorate of Propulsion YZLR reviewed and agreed that OS590 was complete. GRA

N80-12095# Dayton Univ. Research Inst., Ohio.
IMPACT DAMAGE ON TITANIUM LEADING EDGES FROM SMALL SOFT BODY OBJECTS Interim Report, Apr. 1976 - Aug. 1977
Robert S. Bertke and John P. Barber Mar. 1979 66 p refs
(Contract F33615-76-C-5124; AF Proj. 2307)
(AD-A072705; UDR-TR-78-54; AFML-TR-79-4019) Avail: NTIS HC A04/MF A01 CSCL 21/5

Impact damage on titanium leading edge configurations was investigated by performing leading edge soft-body impacts on flat-edge and tapered-edge specimens. The objectives were to determine the laboratory specimen size, boundary condition, and test methods necessary to adequately simulate the leading edge

local damage of actual blades from soft-body impacts (such as birds). The effects of leading edge geometry, specimen mounting, impact velocity, impactor type, impactor size, and impact angle were investigated. The damage modes excited in titanium were identified. Damage measurement techniques were devised and the damage quantified. Comparisons of the damage were drawn regarding the effects of specimen size and mounting. GRA

N80-12096# Scientific Research Associates, Inc., Glastonbury, Conn.
COMPUTATION OF DISCRETE HOLE FILM COOLING FLOW USING THE NAVIER-STOKES EQUATIONS
J. P. Kreskovsky, W. R. Briley, and H. McDonald Jul. 1979 17 p refs
(Contract F49620-78-C-0036)
(AD-A073057; R79-910002-1; AFOSR-79-0935TR) Avail: NTIS HC A02/MF A01 CSCL 21/5

An investigation is being performed to develop an analysis and computational procedure for predicting the flow field which results from discrete hole film cooling. This study represents the first step in the development of a computer code capable of predicting aerodynamic loss levels and heat transfer levels associated with discrete hole film cooling on gas turbine blades. The specific problem being considered here is that of predicting the flow and temperature fields resulting from injecting a row of hot or cold jets into a cross flow through a flat plate. The approach is based on numerical solution of the three-dimensional compressible Navier-Stokes equations, and utilizes a zone embedding procedure to limit the computational domain to the immediate vicinity of the coolant injection. The zone embedding is accomplished through the use of interactive boundary conditions at inflow and outflow boundaries, which are compatible with flow behavior outside the computational region. GRA

N80-12097# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
SUPERSONIC COMBUSTION, AIR DISSOCIATION THROUGH SHOCK WAVES AND AERODYNAMICS OF CHEMICALLY REACTING GASES IN A PLANAR CONVERGING - DIVERGING NOZZLES Final Report, Mar. - Oct. 1978. M.S. Thesis - Ohio State Univ., Columbus
Dennis W. Schroll May 1979 72 p refs
(AD-A073135; ASD-TR-79-5002) Avail: NTIS HC A04/MF A01 CSCL 21/5

Much research has been accomplished to develop a supersonic ramjet engine. Very little headway has been made in theoretical design techniques as many of the standard computational methods used for ramjet subsonic combustion do not apply. For instance, it is possible to use a constant area nozzle for subsonic combustion in a ramjet as heat addition and frictional effects in the combustion chamber will decrease the pressure and accelerate the flow. For supersonic combustion the velocity decreases tending to choke the flow. To overcome this area increase in the combustion zone is used. A strong normal shock on the diffuser inlet for free stream mach numbers of 5 and 10 and the shock free flow of these mach numbers are assumed. Accompanied with the strong normal shock are large stagnation pressure losses in the diffuser inlet, meaning the diffuser inlet will act as a flat plate to oncoming airflow. For this reason, it would be best to provide air spillage and not use too large an inlet. The final Thrust Specific Fuel Consumption values are sufficiently high to warrant further investigation into supersonic combustion as a method of propulsion. GRA

N80-12024# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYSIS AND MODELLING OF THE FLOW WITHIN A TURBOMACHINE COMBUSTOR
Patrick Hebrard, Philippe Magre, and Gerard Collin *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-5 Jul. 1979 p 33-54 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 233-249 Original language report was announced as A79-18533 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-12098 Michigan Univ., Ann Arbor.
COMPUTER AIDED DESIGN OF SUBOPTIMAL CONSTANT GAIN FILTERS SUBJECT TO STABILITY CONSTRAINTS Ph.D. Thesis
Spyridon P. Karatsinides 1979 140 p
Avail: Univ. Microfilms Order No. 7925172

An algorithm for the design of an alternate filter that has the Kalman structure and at the same time satisfies predefined stability bounds is developed. In addition to satisfying the stability requirements the filter also produces the best possible estimate of the state. The algorithm proceeds in two stages. In the first stage, the eigenvalues of the filter stability matrix are moved inside the appropriate restricted region. In the second stage, the trace of the error covariance matrix is minimized inside the specified region. The error covariance matrix is determined by the solution of an algebraic matrix Lyapunov equation. The quality principle between the control and state estimation problems proves to exist for the suboptimal cases. This allows the use of the algorithm for the design of suboptimal regulators under stability constraints. The algorithm is applied to numerous example problems, including the combined control state estimation problem for the attitude control of a solar probe. Dissert. Abstr.

N80-12099# Aeronautical Research Labs., Melbourne (Australia).
SEA KING Mk. 50 HELICOPTER FLIGHT CONTROL SYSTEM. A MATHEMATICAL MODEL OF THE AFCS (AUTOSTABILIZER/AUTOPILOT MODE)
C. R. Guy Feb. 1979 24 p refs
(ARL/Aero-Note-387; AR-001-605) Avail: NTIS HC A02/MF A01

A mathematical model for the autostabilizer/autopilot mode of the automatic flight control system (AFCS) for the Sea King Mk.50 helicopter is presented. An outline of the autostabilizer/autopilot used in the aircraft is given followed by a description of the mathematical model, which includes a representation of each major element of the aircraft system. R.C.T.

N80-12100*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
V/STOL FLIGHT SIMULATION
Nov. 1979 52 p refs
(NASA-TM-81156; A-8012) Avail: NTIS HC A04/MF A01 CSCL 01C

The requirements for a new research aircraft to provide in-flight V/STOL simulation were reviewed. The required capabilities were based on known limitations of ground based simulation and past/current experience with V/STOL inflight simulation. Results indicate that V/STOL inflight simulation capability is needed to aid in the design and development of high performance V/STOL aircraft. Although a new research V/STOL aircraft is preferred, an interim solution can be provided by use of the X-22A, the CH-47B, or the 4AV-8B aircraft modified for control/display flight research. R.C.T.

N80-12007# Avions Marcel Dassault, Saint-Cloud (France).
PRACTICAL ASPECTS OF THE CALCULATION OF STRUCTURAL VIBRATIONS
J. P. Brevan *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 60 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12010# Liege Univ. (Belgium).
AIRCRAFT FLUTTER AND DYNAMIC RESPONSE
M. Geradin *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 58 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12011# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

WIND TUNNEL FLUTTER INVESTIGATIONS
O. Sensburg *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 59 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12012# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
FLIGHT FLUTTER TESTING
G. Haidl and M. Steininger *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 41 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-12101# European Space Agency, Paris (France).
CONSTRUCTION PROBLEMS FOR HIGH REYNOLDS NUMBER WIND TUNNEL MODELS
Maurice Bazin Jun. 1979 50 p refs Transl. into ENGLISH of 'Problems de Construction de Maquettes pour les Souffleries a Grand Nombre de Reynolds', ONERA, Paris Report ONERA-NT-1978-6, 1978 Presented at 14th Colloq. d'Aerodyn. Appl. de l'Assoc. Aeron. et Astron. de France, Toulouse, 7-9 Nov. 1977 Original report in FRENCH previously announced as N79-32224
(ESA-TT-564; ONERA-NT-1978-6) Avail: NTIS HC A03/MF A01

Design structures, problems of definition, and materials for high Reynolds number wind tunnel models are discussed. Models for force and pressure distributions, air intakes, jet simulation, and dynamic flutter are considered. It is shown that deformations in operation under the effect of aerodynamic and thermal loads require new measuring techniques and the adaptation of the capacity, thermal protection, and calibration methods of the balance. The mechanical strength of the supports, in particular the risk of divergence, and the dynamic behavior of the mountings are the most severe limitations in the use of pressurized wind tunnels. Thermal problems are added in a cryogenic environment. The development of pressure measurement methods and instruments is considered. Author (ESA)

N80-12102# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
DETERMINATION IN GROUND FACILITIES OF AERODYNAMIC STABILITY PARAMETERS OF AIRCRAFT
M. Scherer Sep. 1979 69 p refs In FRENCH; ENGLISH summary
(AGARD-AG-242; ISBN-92-835-2106-4) Avail: NTIS HC A04/MF A01

The present state of experimental ground facilities for determining the aerodynamic stability parameters of aircraft was deduced from the proceedings of the AGARD/FDP and FMP meetings of the last four years. A critical study of the experimental methods for analyzing unsteady aerodynamic phenomena brings to light the insufficiencies of present-day methods and means, especially as regards information necessary for the correct implementation of flight simulators in case of non-linear behavior (separation, shock wave). Suggestions are presented on the possible orientations of research for filling these gaps. Author

N80-12019# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PRELIMINARY TESTS IN A CRYOGENIC WIND TUNNEL DRIVEN BY INDUCTION
Roger Michel and Dietrich Faulmann *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 145-152 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 205-207 Presented at Supersonic Tunnel Assoc. Meeting, El Segundo, Calif., 17-18 Apr. 1978 Original language report was announced as A79-15300 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

No abstracts in this category.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-12103*# Analytical and Computational Mathematics, Inc., Houston, Tex.
ORBIT DECAY ANALYSIS OF STS UPPER STAGE BOOSTERS Final Report
O. F. Graf, Jr. and Alan C. Mueller [1979] 64 p refs
(Contract NAS9-15444)
(NASA-CR-160385; ACM-TR-119) Avail: NTIS HC A04/MF A01 CSCL 22A

An orbit decay analysis of the space transportation system upper stage boosters is presented. An overview of the computer trajectory programs, DSTROB, algorithm is presented. Atmospheric drag and perturbation models are described. The development of launch windows, such that the transfer orbit will decay within two years, is discussed. A study of the lifetimes of geosynchronous transfer orbits is presented. A.W.H.

N80-12104# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN INTERMEDIATE-AVERAGED THEORY FOR HIGH ALTITUDE ORBITS
Ramaswamy Sridharan and William P. Seniw 27 Jun. 1979 20 p refs
(Contract F19628-78-C-0002)
(AD-A073094; TN-1979-25; ESD-TR-79-164) Avail: NTIS HC A02/MF A01 CSCL 22/3

An analytic theory for the evolution of high altitude satellite orbits is developed in this note. The distinctive feature of the theory lies in the double averaging of the differential equations - once over the period of the orbit, and secondly over the period of the moon. This technique is called intermediate averaging to distinguish it from the conventional doubly averaged theories, and to denote the time scales inherent in the averaging technique. GRA

N80-12105# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
WAKE STUDIES RELATED TO REENTRANT PYRAMIDS Final Report, 1 Jan. 1976 - 30 Nov. 1978
Marshall Solomon, Morton Finston, and Charles W. Haldeman Aug. 1979 82 p refs
(Contract F44620-76-C-0049)
(AD-A073825; MIT-TR-205; AFOSR-79-0984TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

The original objectives of this project were to completely map the reentrant pyramid near wake with pitot pressure and recovery temperature probes in order to study the axial development of the wake's azimuthal asymmetry. Although only a modest amount of data has been collected, compared to our original goal, sufficient information is available to identify most features of the pyramid's wake and to make a comparison to the axisymmetric cone wake. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-12106*# Rockwell International Corp., Downey, Calif. Space Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 4: SPS POINT DESIGN DEFINITION Final Report
G. Hanley Apr. 1978 220 p 5 Vol.
(Contract NAS8-32475)
(NASA-CR-150683; SD-78-AP-0023-4-Vol-4) Avail: NTIS HC A10/MF A01 CSCL 22B

The satellite power systems point design concept is described. The concept definition includes satellite, ground and space systems, and their relationships. Emphasis is placed on the definition of the GaAlAs photovoltaic satellite system. The major subsystems of the satellite system including power conversion, power distribution and control, microwave, attitude control and stationkeeping, thermal control, structures, and information management and control are discussed. A.W.H.

N80-12107*# Battelle Columbus Labs., Ohio.
IGOS IMPROVEMENTS FOR SEASAT Final Report
Janice M. Warmke Apr. 1979 110 p
(Contract NASw-2800)
(NASA-CR-162604; BCL-OA-TPR-79-2) Avail: NTIS HC A06/MF A01 CSCL 22B

Modifications to Battelle's Interactive Graphics Orbit Selection (IGOS) computer program to assist in the planning and evaluation of the Seasat-A Scatterometer System (SASS) flight program were studied. To meet the planning needs of the LaRC Seasat-A Scatterometer team, the following features/modifications were implemented in IGOS: (1) display and specification of time increments in orbital passes represented by the cross-hatching of ground swaths; (2) addition of pass number annotations on the horizontal axis of the STPLNG and STPTOD plots; (3) modification of the sensor model to include more than two swaths associated with a single sensor to approximate the SASS cell pattern; (4) inclusion of down range and cross-track swath geometry to display the characteristic skewed SASS pattern; (5) addition of a swath schedule to allow the display of the SASS mode changes and to calibrate gaps; and (6) development of a set of commands to generate the detailed swath data from sensor characteristics and orbit/earth motion. F.O.S.

N80-12108*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. PART 1: MIDTERM BRIEFING Interim Report
19 Oct. 1978 456 p
(Contract NAS9-15636)
(NASA-CR-160369; D180-24872-1; DRL-T-1487; DRD-MA-732T) Avail: NTIS HC A20/MF A01 CSCL 22B

The solar power satellite systems are defined and analyzed. Included are areas of space construction, rectennal construction, rectenna siting, and the aluminum satellite structure. A.W.H.

N80-12109*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, VOLUME 5. PHASE 2: FINAL BRIEFING Final Report
5 Nov. 1979 640 p
(Contract NAS9-15636)
(NASA-CR-160380; D180-25461-5-Vol-5; DRL-T-1487; DRD-MA-732T) Avail: NTIS HC A99/MF A01 CSCL 22B

A briefing outline of the definition study is presented. Topics discussed include: Solar Power Satellite (SPS) research and development, definition study, operations control, transportation, solid state SPS, pilot link analysis, and offshore space center. F.O.S.

N80-12110# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
A SHOCK TUBE INVESTIGATION OF SILO-LAUNCHED VEHICLE AERODYNAMIC FLOW ASYMMETRIES Interim Report
Robert L. Varwig, David H. Ross, and J. M. Lyons 5 Jul. 1979 59 p
(Contract F04701-78-C-0079)
(AD-A071811; TR-0079(4550-83)-1; SAMSO-TR-79-48) Avail: NTIS HC A04/MF A01 CSCL 16/1

A shock tube was used to simulate the initial transient flow from a rocket launching silo when the rocket motor was ignited. The object was to investigate the relationship between lateral loads observed on the missile being launched during the early transient flow and the silo exit geometry. A centerbody simulating the missile to be launched was installed in the shock tube and instrumented with pressure gages to detect the lateral loads. Three silo exit geometries were also modeled. The early transient flow in the silo is described along with the modeling of this flow by the shock tube. Finally, the pressures measured on the missile model are presented together with a correlation technique that was developed to display the effect of the silo exit geometries on the model pressure difference force. Also included are results from the application of this correlation technique to full-scale flight data, which appear to demonstrate a close relationship between on-board accelerometer measurements and the pressure difference force history. GRA

N80-12111# Systems Research Labs., Inc., Dayton, Ohio. Aerosystems Research Div.
PRELIMINARY DESIGN AERODYNAMIC PREDICTION METHODOLOGY FOR MISSILES WITH NOSE BLUNTNESS Final Report, Apr. 1977 - Jun. 1978
Charles W. Ingram, Karlheinz O. W. Ball, Carter Dinkeloo, and David Shida Wright-Patterson AFB, Ohio AFFDL Sep. 1978 199 p refs
(Contract F33615-75-D-0089; AF Proj. 2403)
(AD-A073664; AFFDL-TR-78-117) Avail: NTIS HC A09/MF A01 CSCL 20/4

A semi-empirical methodology is presented for predicting the axial and normal force coefficients and the center of pressure to include nose bluntness effects for missiles. This methodology includes the transonic and supersonic Mach number regime with angles of attack from 0 to 180 degrees. This methodology correlates well with wind tunnel test data. GRA

N80-12112# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
THE ATS6 RADIO BEACON POINTING DATA: OCTOBER 1975 - JANUARY 1976 Technical Memorandum
R. F. Donnelly, R. Hetzel, and J. Falcon Mar. 1979 98 p
(PB-297511/8; NOAA-TM-ERL-SEL-53; NOAA-79061312)
Avail: NTIS HC A05/MF A01 CSCL 22C

Pointing data for the ATS6 satellite are presented for use by radio-beacon experimenters to determine and correct the errors introduced in their measurements by small changes in the direction of the satellite. These errors are important for midlatitude measurements of plasmaspheric content and for equatorial measurements of the shape-factor F. GRA

N80-12023# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESTITUTION OF MISSILE TRAJECTORIES BY KALMAN FILTERING-SMOOTHING

Dominique Biausse *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 13-31 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 221-232 Original language report was announced as A79-18532 Sponsored by DRET (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

N80-12032# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A SYNTHESIS OF THE EXPERIENCE ACQUIRED BY ONERA ON THE POGO PHENOMENON
Daniel Lourme, Jean-Jacques Dordain and Denis Schmitt *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 45-67 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 321-334 Original language report was announced as A77-51427 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

No abstracts in this category.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-12033# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SYNTHESIS OF FLIGHT RESULTS OF THE CACTUS ACCELEROMETER FOR ACCELERATIONS BELOW ONE BILLIONTH G
Yves Boudon (Centre of Geodyn. and Astron. Res., Grasse, France), Francois Barlier, Alain Bernard, Remy Juillerat, Anne-Marie Mainguy, and Jean-Jacques Walch (Centre of Geodyn. and Astrodyn. Res., Grasse, France) *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 67-78 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 355-364 Presented at 29th Intern. Astronautical Congr., Dubrovnik, Yugoslavia, 1-8 Oct. 1978 Original language report was announced as A79-11247 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

N80-12034# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SPECTROMETER FOR THE FIRST SPACELAB PAYLOAD
Jean Besson, Andre Girard, Marcel Ackerman, and Dirk Frimout (Inst. of Space Aeronomy, Brussels) *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 77-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 343-350 Presented at 29th Intern. Congr. of Astronautics, Dubrovnik, Yugoslavia, 1-8 Oct. 1978 Original language report was announced as A79-11279 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-12113# Tennessee Univ. Space Inst., Tullahoma.
REFINEMENT OF PLUME MODELING IN THE INFRARED SPECTRAL REGION Final Report, 19 Nov. 1976 - 30 Jun. 1978
Kenneth E. Harwell 30 Jun. 1979 103 p refs
(Contract DAAK40-77-C-0032)
(AD-A072725) Avail: NTIS HC A06/MF A01 CSCL 21/8

The MIRADCOM Radiation Model was improved and used successfully to predict CO2 and H2O radiation emitted from a turbojet exhaust plume and a rocket exhaust plume. The model was validated using experimental data. Two existing gas dynamic models (LAPP and REPS) were employed to calculate the flow field properties required as input to the radiation computer codes. A new finite difference code was developed, but was only partially successful in predicting imbedded shock waves. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-12114 Kansas Univ., Lawrence.
ION ELECTRODES SELECTIVE FOR ORGANIC FUNCTIONAL GROUPS Ph.D. Thesis
Steven Hamilton Hoke 1979 86 p
Avail: Univ. Microfilms Order No. 7925821

Research conducted on ion selective electrodes for both the carbonyl and sulfonate functional groups is discussed. The carbonyl electrode consisted of a polyvinyl chloride membrane containing 3 amino bis phthalate. This electrode was expected to exhibit a potential across the membrane via the charged intermediate formed in the Schiff's Base reaction between the primary amine and a carbonyl. Infrared indicated the free primary amine in the membrane. An electrical potential across the membrane was produced by protonating the amine. Several solid electrodes are also investigated. Dissert. Abstr.

N80-12115 Lehigh Univ., Bethlehem, Pa.
PREPARATION AND CHARACTERIZATION OF LATEXES Ph.D. Thesis
Syed Mahmood Ahmed 1979 164 p
Avail: Univ. Microfilms Order No. 7919966

A serum replacement technique was developed for cleaning latexes for characterization. Distilled, deionized water is pumped through the latex while the particles are confined in a stirred flow-through cell by a Nucleopore filtration membrane. This washing with water removes the solute electrolyte and adsorbed emulsifier and water-soluble polymers, but does not completely replace the Na(+) and K(+) counterions with H(+) ions. Further washing with dilute hydrochloric acid followed by a water wash to remove excess acid replaces these counterions completely. This method of cleaning gives results in much better agreement with results using the ion exchange method than the results using the dialysis method, yet avoids arduous purification of the resins. Dissert. Abstr.

24 COMPOSITE MATERIALS

Includes laminates.

N80-12116 Michigan Univ., Ann Arbor.
RESOLUTION OF HEAT-CAPACITY CONTRIBUTIONS IN LANTHANIDE COMPOUNDS (THERMOPHYSICS OF THE LANTHANIDE TRIHYDROXIDES) Ph.D. Thesis
Robert Dennis Chirico 1979 252 p
Avail: Univ. Microfilms Order No. 7925122

Lattice heat capacities and Schottky contributions are resolved and analyzed for a series of lanthanide trihydroxides through heat-capacity measurements between 5 and 350 K. These compounds all crystallize with the UCl3-type structure and, therefore, are a particularly suitable series for which to attempt this separation. These two methods are described and discussed in detail and the derived energy levels are compared with spectroscopic data that do exist for the concentrated trichlorides. Dissert. Abstr.

N80-12117*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MULTIWALL THERMAL PROTECTION SYSTEM Patent Application
L. Robert Jackson, inventor (to NASA) Filed 5 Sep. 1979 19 p
(NASA-Case-LAR-12620-1; US-Patent-Appl-SN-072857) Avail: NTIS HC A02/MF A01 CSCL 11D

Multiwall insulating sandwich panels are provided for thermal protection of hypervelocity vehicles and other enclosures. In one version of the invention, the multiwall panels are formed of alternate layers of dimpled and flat metal (titanium alloy) foil sheets and beaded scarfed edge seals to provide enclosure thermal protection up to 1000 F. Another version employs an intermediate fibrous insulation for the sandwich panel to provide thermal protection up to 2000 F, and a third version employs a silicide coated columbium waffle as the outer panel skin and fibrous layered intermediate protection for thermal environment protection up to 2500 F. The use of multiple panels on an enclosure facilitates repair of the thermal protection system. NASA

N80-12118*# TRW Equipment Labs., Cleveland, Ohio.
SECOND GENERATION PMR POLYIMIDE/FIBER COMPOSITES
P. J. Cavano 26 Oct. 1979 144 p refs
(Contract NAS3-21349)
(NASA-CR-159666; ER-7989F) Avail: NTIS HC A07/MF A01 CSCL 11D

A second generation polymerization monomeric reactants (PMR) polyimdes matrix system (PMR 2) was characterized in both neat resin and composite form with two different graphite fiber reinforcements. Three different formulated molecular weight levels of laboratory prepared PMR 2 were examined, in addition to a purchased experimental fully formulated PMR 2 precurser solution. Isothermal aging of graphite fibers, neat resin samples and composite specimens in air at 316 C were investigated. Humidity exposures at 65 C and 97 percent relative humidity were conducted for both neat resin and composites for eight day periods. Anaerobic char of neat resin and fire testing of composites were conducted with PMR 15, PMR 2, and an epoxy system. Composites were fire tested on a burner rig developed for this program. Results indicate that neat PMR 2 resins exhibit excellent isothermal resistance and that PMR 2 composite properties appear to be influenced by the thermo-oxidative stability of the reinforcing fiber. R.C.T.

N80-12119*# Michigan Univ., Ann Arbor.
INCREASED FRACTURE TOUGHNESS OF GRAPHITE-EPOXY COMPOSITES THROUGH INTERMITTENT INTERLAMINAR BONDING Final Technical Report, Nov. 1978 - Oct. 1979
David K. Felbeck and Li-Chung Jea Oct. 1979 37 p refs
(Grant NGR-23-005-528)
Avail: NTIS HC A03/MF A01 CSCL 11D

Increased fracture toughness of multilayer continuous-filament graphite-epoxy composites was studied. The method used was intermittent interlaminar bonding, which leads to a large increase in the fracture surface area. Intermittent bonding was achieved through the introduction of thin perforated Mylar between the layers of the composite. Fracture toughness was increased from about 100 kJ square meters for untreated specimens to an average of about 500 kJ square meters. Tensile strength dropped from 500 MPa to 400 MPa, and elastic modulus remained the same at about 75 GPa. An approximate analysis is presented to explain the observed improvement in toughness. R.C.T.

N80-12120*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL PROPERTY CHARACTERIZATION OF INTRAPLY HYBRID COMPOSITES
C. C. Chamis, R. F. Lark, and J. H. Sinclair 1979 26 p refs
Presented at the Am. Soc. for Testing and Materials Symp., Dearborn, Mich., 2-3 Oct. 1979
(NASA-TM-79306; E-261) Avail: NTIS HC A03/MF A01 CSCL 11D

An investigation was conducted to characterize the mechanical properties of intraply hybrids made from graphite fiber/epoxy matrix (primary composites) hybridized with varying amounts of secondary composites made from S-glass or Kevlar 49 fibers. The tests were conducted using thin laminates having the same thickness. The specimens for these tests were instrumented with strain gages to determine stress-strain behavior. Significant results are included. R.C.T.

N80-12121# Pennsylvania Univ., Philadelphia. Coll. of Engineering and Applied Science.
PROCESSING FUNDAMENTALS FOR INTERCALATION OF GRAPHITE FIBERS Technical Report, 15 Sep. 1977 - 15 Sep. 1979
F. Lincoln Vogel and William C. Forsman May 1979 54 p refs
(Contract F33615-77-C-5182; AF Proj. 2422)
(AD-A072943; AFML-TR-79-4034) Avail: NTIS HC A04/MF A01 CSCL 11/4

Chemical kinetics of intercalation of carbon/graphite fibers with HNO sub 3/AsF sub 5 was determined. Fiber electrical conductivity increased by about an order of magnitude. Humidity testing of the bare fiber caused deintercalation as expected but the intercalated fibers were successfully incorporated into epoxy matrix composites which maintained their properties with time at room temperature. The expected increase of IR reflectivity at 10.6 microns for the intercalated fiber composite was not obtained. The remarkable observation was made that the electrical conductivity of composites was increased by a factor of about one hundred when filled to 55% with intercalated fibers having a seven fold increase in conductivity. GRA

N80-12122# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
EFFECTS OF THERMAL SPIKING ON GRAPHITE-EPOXY COMPOSITES Interim Report, Mar. 1978 - Mar. 1979
George S. Springer and Alfred C. Loos Jun. 1979 69 p refs
(Contract F33615-75-C-5165; AF Proj. 7340)
(AD-A072825; AFML-TR-79-4059) Avail: NTIS HC A04/MF A01 CSCL 11/4

Tests were performed evaluating the effects of thermal spikes on the moisture absorption characteristics, the ultimate tensile strength, and the buckling modulus of Thornel 300/Fiberite 1034 composites. Measurements were made on unidirectional and angleply laminates, using different types of thermal spikes. A survey was also made of the existing data. This survey, together with the present data, indicate how thermal spikes affect the moisture absorption and the mechanical properties of different graphite-epoxy composites. GRA

N80-12123# Martin Marietta Aerospace, Orlando, Fla.
TEST AND EVALUATION OF GRAPHITE/EPOXY COMPOSITE STRUCTURE Final Report, 16 Nov. 1978 - 16 Mar. 1979
Robert P. Hewitt, Jr., Frank H. Koo, and Robert D. Keys (Denver Div.) Jul. 1979 128 p refs
(Contract DAAG46-79-C-0006; DA Proj. IW1-62113-A-661) (AD-A072770; OR-15448; AMMRC-TR-79-39) Avail: NTIS HC A07/MF A01 CSCL 11/4

The test and evaluation of a graphite/epoxy structure is part of a technology program to develop and validate composite structures for BMD interceptor applications. This contract is essentially an extension of work recently completed by Martin Marietta Corporation on Phase I of the Advanced Structures Prototype (ASP) program conducted for the Ballistic Missile Defense Advanced Technology Center (BMDATC) under Contract DASG60-77-C-0111. This report presents the results of the test and evaluation of six subscale conical frusta during the period from November 1979 through March 1979. The objective of this evaluation was to provide an increased structural data base for the assessment of the strength and stiffness properties of ultra-high modulus GY70/934 graphite/epoxy structure fabricated by the hand-laid gore, autoclave cure processes. The contractual effort was divided into three tasks: Task 1 - Fabrication of Conical Frusta; Task 2 - Static Testing of Frusta; Task 3 - Plan for Further Development. GRA

N80-12124# California Univ., Livermore. Lawrence Livermore Lab.
EFFECT OF CONSTITUENT PROPERTIES ON COMPOSITE STRENGTH
H. Thomas Hahn 22 Dec. 1978 11 p refs Presented at the 24th Annual SAMPE Symp., San Francisco, 8-10 May 1979
(Contract W-7405-eng-48)
(UCRL-82051; Conf-790517-2) Avail: NTIS HC A02/MF A01

Several sets of data were examined concerning the effect of matrix properties on the strength of continuous and discontinuous fiber composites. The data are analyzed in terms of the average constituent stresses and the matrix ductility. The analysis correctly predicts the experimental observation that the composite-to-matrix strength ratio in transverse tension and shear can be greater than unity and can increase with the constituent modulus ratio and the fiber content. This observation is contrary to the elastic prediction which is applicable only if the composite failure is triggered by the premature interfacial failure. The use of a strong and ductile matrix may improve the fiber efficiency. DOE

N80-12125# European Space Agency, Paris (France). Research Div. for Materials and Construction Techniques.
ON THE PROBABILITY OF CRACK PROPAGATION IN A UNIDIRECTIONAL COMPOSITE WITH A SINGLE FIBER BREAKAGE Ph.D. Thesis - Stuttgart Univ.
Kuno Stellbrink Mar. 1979 104 p refs Transl. into ENGLISH of 'Ueber relative Bruchwahrsheinlichkeiten benachbarter Fasern in belasteten Composites', DFVLR, Stuttgart Report DLR-FB-77-56, Dec. 1977 Original German report available from DFVLR, Cologne DM 42,70
(ESA-TT-524; DLR-FB-77-56) Avail: NTIS HC A06/MF A01

Taking the case of a large, tension loaded, glass fiber reinforced plastic strand with unidirectional fiber orientation, calculations are made of the probability that an isolated single fiber breakage generating further fiber fractures in its neighborhood. Two mathematical models are used; one describes a random fiber array with an ideal elastic matrix and perfect fiber matrix bonding, while the other describes a regular fiber array with an elastic-plastic matrix or imperfect fiber matrix bonding. It is demonstrated that individual fiber stength is the dominant parameter governing fiber fracture probabilities in the neighborhood of a single fiber breakage. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N80-12126 Syracuse Univ., N. Y.
THE MAGNETIC SUSCEPTIBILITY OF THE LIQUID BISMUTH-INDIUM ALLOY SYSTEM Ph.D. Thesis
Howard Robert Leo 1979 156 p
Avail: Univ. Microfilms Order No. 7925577

Magnetic susceptibility was chosen as the method of investigation since it is sensitive to the electronic structure of both the conduction electrons and the ion cores of metals. It can thus be used not only as a means of detecting molecularity in a liquid alloy, but it can also yield information as to the nature of the interatomic forces if they exist. In order to carry out the investigation a very sensitive high temperature Faraday susceptibility apparatus was constructed. The design and operation of the apparatus are described in detail. The magnetic susceptibilities of pure bismuth and indium were measured from their melting points to 450 C and 500 C respectively. The gram-susceptibility of pure bismuth at its melting point was determined to be -0.0412 x 10 to the -6th power cgs-emu/g, and that of pure indium was determined to be -0.0799 x 10 to the -6th power cgs-emu/g. The susceptibility of both metals increased linearly with temperature. The temperature coefficient of the susceptibility of bismuth was found to be 3.44 x 10 to the -11th power cgs-emu/g C, and that of indium was found to be 2.18 x 10 to the -11th power cgs-emu/g C. Dissert. Abstr.

N80-12127 Michigan Univ., Ann Arbor.
SPECTROSCOPIC AND OPTICALLY DETECTED MAGNETIC RESONANCE STUDIES OF PO2(-) IN POTASSIUM CHLORIDE Ph.D. Thesis
Susan Joy Hunter 1979 233 p
Avail: Univ. Microfilms Order No. 7925164

The phosphorescence, optically detected magnetic resonance (ODMR), and photo-reorientation of phosphorus activated single crystals of potassium chloride were examined at 4.2 K. The impurity center responsible for the emission from these crystals was identified by isotopic substitution as PO2(-). The vibrational frequencies were used to compute the valence bond angle and the normal coordinates of the totally symmetric ground state modes. The geometrical changes associated with excitation to the lowest triplet state were also computed for comparison with the results of similar calculations and measurements for other 18 electron AB2 type molecules. The ODMR spectra, obtained in zero field for PO2(-) in both KCl and KBr lattices, yielded the fine structure parameters D and E of the lowest triplet state. The temperature dependence of the rate of photo-reorientation was determined and a potential energy calculation was performed for rotation about several simple and compound molecular axes. Dissert. Abstr.

N80-12128 Iowa State Univ. of Science and Technology, Ames.
THE METHANATION REACTION ON RUTHENIUM THIN FILMS: A MECHANISTIC INVESTIGATION Ph.D. Thesis
Michael Dwayne Slaughter 1979 183 p
Avail: Univ. Microfilms Order No. 7924272

The kinetics of the methanation reaction were measured on ruthenium thin films in the temperature range 548 to 623 K. The CO kinetic order varied from +1 at low pressures to -2 at high pressures. As the H2 pressure was increased its kinetic order varied from +2 to -1. The reaction is zero order in both CH4 and H2O. The apparent activation energy was dependent upon temperature. Both the H2/D2 and the (C-13)(O-18)/(C-12)(O-16) isotopic exchange reactions proceeded rapidly on the thin

film at 573 K. The surface was always covered with carbon, but no oxygen was ever detected on the surface after methanation. A mechanism was developed which quantitatively fits the kinetic data and qualitatively predicts all of the other observations. This mechanism involves adsorbed hydrogen interacting with nondissociated carbon monoxide. The rate limiting step involves the interaction of Ru-H and Ru-CH3 to form methane. A methylene carbonyl hydride is believed to act as a reversible poison at high H2:CO ratios. Dissert. Abstr.

N80-12129 City Univ. of New York, N. Y.
TARGET FACTOR ANALYSIS OF GAS-CHROMATOGRAPHIC RETENTION INDICES Ph.D. Thesis
Joseph Moshe Soroka 1979 297 p
Avail: Univ. Microfilms Order No. 7923770

Target factor analysis, a multivariate statistical technique, is applied to the analysis of gas chromatographic (GC) retention index data. Eight matrices of GC data are analyzed to provide basic insights into the solute-solvent interactions. Particular attention is applied to the analyses of the solvent contribution. Possible recommendations for selections of standard stationary phases are made including equivalences of various solvents. Dissert. Abstr.

N80-12130 Boston Univ., Mass.
PHASE TRANSITIONS AND STATISTICAL MECHANICS OF LIPID BILAYERS SYSTEMS Ph.D. Thesis
John Day 1979 203 p
Avail: Univ. Microfilms Order No. 7923924

Laser Raman spectroscopy is used to study the microscopic state of specifically deuterated groups of the hydrocarbon chains in lipid-water dispersions. The gel to liquid crystal phase transitions that occur in lipid systems are monitored by measuring the broadening of the Raman line widths that occur at the phase transition as a function of the rotational freedom of the CD2 groups in the liquid crystal phase. Raman spectra were taken of a series of labeled carbon positions of dimyristoyl-, dipalmitoyl-, and distearoyl phosphatidyl choline. The samples were prepared in the forms of lipid-water dispersions. The spectra were taken at temperatures below and above the phase transition temperatures for these systems. The full widths of the deuterated peaks show a discrete change at the phase transition temperature for all the labeled positions except the symmetric peak of the 3 position of dimyristoyl phosphatidyl choline. Dissert. Abstr.

N80-12131 Columbia Univ., New York.
SUPERFLUID HELIUM THREE: SOME HYDRODYNAMIC MEASUREMENTS Ph.D. Thesis
Joseph K. Lyden 1979 176 p
Avail: Univ. Microfilms Order No. 7924933

The design of an oscillating viscometer to measure the superfluid fraction and normal fraction viscosity of Helium Three in the A and B phases above two millikelvin is presented. A basically parallel plate geometry, low flow velocities, and magnetic shielding are used to obtain the conditions necessary for measuring only one selected component of the superfluid fraction and normal fraction viscosity tensors in the A phase. A discussion of the period and damping data in the superfluid phases which displayed prominent resonance phenomena is presented. Properties of the superfluid phases are discussed. Dissert. Abstr.

N80-12132 Michigan Univ., Ann Arbor.
THE DETERMINATION OF TRACE METALS IN POWDER MICRO SAMPLES USING EXPLODING THIN FILM ATOMIZATION AND EXCITATION Ph.D. Thesis
Elke Monika Antje Clark 1979 141 p
Avail: Univ. Microfilms Order No. 7925133

The direct determination of trace metals in powder micro samples is explored using thin metal films electrically exploded by capacitive discharge as atomization cells and excitation sources for atomic emission spectroscopy. Emphasis is placed on the analysis of refractory materials prepared as alcoholic suspensions of their powder. A parametric study is presented, which explores the variations in atomic emission line intensities from the thin film and the analyte species, for different voltage/capacitance combinations in the discharge power source as well as different plasma support gas pressures. The feasibility of using the exploding thin film method for the determination of metals in airborne particulate matter collected on metallized filters was explored. Dissert. Abstr.

N80-12133 Rhode Island Univ., Kingston.
CHARACTERIZATION OF OXIDATION PRODUCT FILMS ON LEAD IN AQUEOUS MEDIA BY IN SITU RAMAN SPECTROSCOPY Ph.D. Thesis
Richard James Thibeau 1979 164 p
Avail: Univ. Microfilms Order No. 7925397

Raman spectroscopy was used to determine the composition of surface films formed on lead by exposure to aqueous solutions of several different compositions. Controlled potential exposures of lead in phosphate, carbonate, chloride, and sulfate solutions were conducted under various conditions of potential and pH. The results of spectroscopic identification of the compounds present in insoluble surface films were compared to theoretical Pourbaix diagrams for lead in simple solutions of the appropriate ions and to potentiodynamic polarization curves for the solutions used. Raman spectra of thin oxide films formed on iron by high temperature oxidation were obtained. Dissert. Abstr.

N80-12134 Wisconsin Univ. - Madison.
PHOTOCHEMISTRY AND PHOTOPHYSICS OF FORMYL FLUORIDE Ph.D. Thesis
Sherwin Toshio Amimoto 1979 250 p
Avail: Univ. Microfilms Order No. 7919785

Formyl fluoride photochemistry was investigated using: (1) small signal gain probing of HF vibrational states; (2) the observation and characterization of high overtone CH stretch transitions using intracavity photoacoustic spectroscopy;(3) relative gain measurements in the HF chemical laser to obtain the HF vibrational distribution; and (4) the fluorescence quantum yield measurements of the excited singlet state of HFCO. The weak 6-0 and 5-0 CH stretches of HFCO observed by intracavity photoacoustic spectroscopy were assigned to the pure CH stretching and to combination bands of HFCO. The single vibronic level fluorescence quantum yields had an exponential dependence on vibrational energy and a large isotope effect of approximately 50. By analogy with H2CO, it was concluded that internal conversion by nuclear momentum coupling is not significant and that direct coupling to a continuum is probably important. Dissert. Abstr.

N80-12135 Wisconsin Univ. - Madison.
MICROWAVE SPECTROSCOPY OF THE FORMYL ION, HYDROGEN ISOCYANIDE, AND THE HYDROXYL RADICAL Ph.D. Thesis
Thomas Gordon Anderson 1978 265 p
Avail: Univ. Microfilms Order No. 7918134

The technique of using a d.c. discharge as the absorption cell of a microwave spectrometer was used to obtain microwave spectra of the formyl ion hydrogen isocyanide, and the hydroxyl radical. The formyl ion J=0-1 transition frequency and Doppler Shift were observed for six isotopically substituted species. Rest frequencies were used to determine a complete substitution structure for all the isotopic forms. The pressure broadening of the formyl ion J=0-1 absorption line by hydrogen was also measured and the pressure dependence of the linewidth was determined for the formyl ion transition broadened by H2 at 100 K. All three vibration-rotation interaction constants were determined for the hydrogen isocyanide main isotopic species by combining high resolution infrared studies with the measurements of the J=0-1 transition in the ground state and the v sub 1, v sub 3, and v sub 2 excited states. The lambda doublet transitions of the hydroxyl radical were measured in the region of 8-40 Ghz and an effort was made to develop a theoretical model for calculating the transition frequencies. Dissert. Abstr.

N80-12136 North Carolina Univ. at Chapel Hill.
NUMERICAL SOLUTIONS TO PROBLEMS IN LIQUID MEMBRANE ELECTROCHEMISTRY Ph.D. Thesis
Frederick Scott Stover 1979 213 p
Avail: Univ. Microfilms Order No. 7925971

The method and results of a digital simulation of electrochemical properties for associated and nonassociated liquid ion-exchange membranes are presented. Concentration profiles, potentiometric responses, transient potential responses to activity steps, and current-voltage curves are given and the effects of ion-pairing

and species mobilities are studied. It is found that ion-pairing increases the potentiometric selectivity toward the complexing ion, as does high site mobility. Transient responses to an ion activity step are shown to depend in a complex way on the ion-pair formation constant and the various mobilities. Current-voltage curves are simulated for varying degrees of ion-pairing and quantitative agreement is found in those cases where closed-form expressions are known. Dissert. Abstr.

N80-12137 North Carolina Univ. at Chapel Hill.
SEARCH ALGORITHMS AND RELATED TECHNIQUES FOR THE ANALYSIS OF SPECTROMETRIC DATA Ph.D. Thesis
Gregory Terrance Rasmussen 1979 172 p
Avail: Univ. Microfilms Order No. 7925959

The use of search algorithms with mass spectral data is examined. A data compression method based on fractional ion currents of specific ion series within mass spectra is reported, and the potential for implementing an efficient search system employing this compression method is assessed. Infrared spectral searches which rely on detailed intensity information and those based on peak position information are compared using trial searches with a library of five hundred spectra. Three different distance metrics are evaluated for searches using intensity information, and the effects of selecting data from limited regions of the infrared spectrum are examined. Mathematical techniques for the identification of components in mixtures from the mass spectra of a series of related mixtures are described. The approach is analogous to library search methods in that spectra from a reference collection are compared with an unknown. Dissert. Abstr.

N80-12138 North Carolina Univ. at Chapel Hill.
APPLICATION OF MINI-AND MICROCOMPUTER TECHNIQUES TO PROBLEMS IN ANALYTICAL CHEMISTRY Ph.D. Thesis
Jerry Paul Koontz 1979 458 p
Avail: Univ. Microfilms Order No. 7925939

Two high performance multifunction real time data acquisition and instrument control interfaces implemented for Raytheon 704 and Mod Comp 2 minicomputers are described. Software for machine to machine communications and microcomputer down loading from the host was developed. Several peripheral controllers were constructed for the UNC microcomputer system: a general purpose keyboard interface, an asynchronous serial communications module, a 333 KHz analog to digital converter, and a four channel digital to analog converter. This technology was applied to Fourier transform nuclear magnetic resonance experiments and spectral searches over a large (91875 spectra) infrared data base. Dissert. Abstr.

N80-12139 North Carolina Univ. at Chapel Hill.
STUDIES IN ANALYTICAL SPECTROSCOPY. 1. COMPUTER TREATMENT OF SPECTROSCOPY DATA. 2. RESONANCE RAMAN SPECTROELECTROCHEMISTRY Ph.D. Thesis
Harvey Saul Gold 1979 317 p
Avail: Univ. Microfilms Order No. 7925919

A number of interrelated topics in the field of analytical spectroscopy are examined. A computer spectral decomposition program developed to address a wide range of experimentally significant problems while maintaining ease of use is described. The establishment of a laser Raman facility for research in the field of resonance Raman spectroelectrochemistry is described. Results of studies of a number of model and test systems are presented. Studies of several polycyclic aromatic hydrocarbons in solution and their sodium- and electro-generated anions are discussed along with an evaluation of the instrumental capabilities. Dissert. Abstr.

N80-12140 Pennsylvania State Univ., University Park.
VACANCY SOLUTION AND TWO-DIMENSIONAL GAS MODELS FOR GAS MIXTURE ADSORPTION Ph.D. Thesis
Solot Suwansyuen 1979 193 p
Avail: Univ. Microfilms Order No. 7922354

Four correlational methods for predicting binary gas mixture adsorption equilibria from single component isotherm data were developed and tested. In these methods three approaches were used to describe the adsorption system: (1) the vacancy solution model, (2) the two dimensional gas equation of state, and (3) the adsorbed solution theory. In the vacancy solution model, the adsorption equilibrium is treated as an osmotic equilibrium between two vacancy solutions having different compositions. In the two dimensional gas model, the virial equation of state as well as the equation of state taken from the vacancy solution theory were used to derive the binary correlations. From the third approach, a new ideal adsorbed solution correlation was derived by taking the total adsorption pressure of the mixture as the standard state. Dissert. Abstr.

N80-12141 Carnegie-Mellon Univ., Pittsburgh, Pa.
ELECTROLESS (CHEMIPHORETIC) DEPOSITION OF POLYMER LATEX ON A RAPIDLY-DISSOLVING STEEL SUBSTRATE Ph.D. Thesis
Ronald Evan Smith 1979 215 p
Avail: Univ. Microfilms Order No. 7925027

A process for applying organic polymer coatings to steel surfaces is studied. The process, termed chemiphoretic deposition, or chemiphoresis, is used commercially. The process resembles the well-known process of electrodeposition used for polymer coating, except that no external electric field is applied. The combination of acid and hydrogen peroxide is extremely corrosive, resulting in rapid dissolution of a steel substrate when immersed in the bath. The rate of deposition of latex onto the steel substrate is proportional to the rate of metal dissolution. It is concluded that the coating deposition rate is controlled by a local electric field formed at the steel/aqueous interface. This field results from the diffusion of ionic species toward and away from the steel during dissolution. Dissert. Abstr.

N80-12142*# Pennsylvania State Univ., University Park.
INVESTIGATION OF CRITICAL BURNING OF FUEL DROPLETS Final Report, 1 Sep. 1966 - 30 Jun. 1979
G. M. Faeth Jul. 1979 87 p refs
(Grant NGR-39-009-077)
(NASA-CR-159697) Avail: NTIS HC A04/MF A01 CSCL 21B

The general problem of spray combustion was investigated. The combustion of bipropellent droplets; combustion of hydrozine fuels; and combustion of sprays were studied. A model was developed to predict mean velocities and temperatures in a combusting gas jet. R.C.T.

N80-12143# Army Construction Engineering Research Lab., Champaign, Ill.
DURABILITY AND FIRE-SPREAD ASPECTS OF PLASTIC PIPE SYSTEMS Final Report
Alvin Smith and R. Brady Williamson Jul. 1979 68 p refs
(DA Proj. A47-62731-AT-41)
(AD-A073031; CERL-TR-M-264) Avail: NTIS HC A04/MF A01 CSCL 13/11

This report presents the findings of the two studies of commercially available thermoplastic pipe now in widespread use for water distribution, drain-waste-vent (DWV), sewage, and plumbing systems. One study dealt with the long-term performance of plastic pipe and drew information from users' experience. The other study concerned accumulation of test data on fire spread in structures having plastic pipe in interior plumbing and DWV systems. Results of the two studies indicate that plastic pipe is very durable in long-term service as predicted by short-term tests and that while most plastic pipe will burn in established building fires, the fire spread potential is not great. Designs that further limit fire spread are given. GRA

N80-12144# Harvard Univ., Cambridge, Mass. Gordon Mckay Lab.
QUASICONTINUUM PHYSICS Annual Summary Report, 1 Jul. 1978 - 30 Jun. 1979
Eli Yablonovitch Aug. 1979 18 p refs
(Contract N00014-78-C-0531)
(AD-A073117) Avail: NTIS HC A02/MF A01 CSCL 20/10

We summarize the progress made in the first year of our research project. We are progressing in two research directions: (a) infrared-infrared double resonance and (b) infrared-visible double resonance. The first of these probes intramolecular dynamics in the phase space of polyatomic molecules while the second probes molecular distributions along the energy axis. In this connection we have, for the first time, infrared multiphoton

pumped the electronically excited state of a molecule, with a corresponding effect on its visible fluorescence. GRA

N80-12145# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
FLAME - A SLOW-FLOW COMBUSTION MODEL
Walter W. Jones and Jap P. Boris 16 Jul. 1979 37 p
(RR0110941; RR0240241)
(AD-A072988; NRL-MR-3970) Avail: NTIS
HC A03/MF A01 CSCL 21/2

We have developed a two-dimensional, time-dependent reactive flow model for studying the various aspects of combustion, including ignition, flame spread and plume formation. The basic model is a self-consistent slow-flow hydrodynamic algorithm with chemical reactions. Also included are the basic transport processes of molecular diffusion and thermal conductivity. The model is implemented so that other physical mechanisms, such as different chemical reaction schemes, turbulence models, heterogeneous phenomena, etc., can be included on a modular basis. GRA

N80-12146# Illinois Univ. at Urbana-Champaign. Dept. of Aeronautical and Astronautical Engineering.
INITIATION, COMBUSTION AND TRANSITION TO DETONATION IN HOMOGENEOUS AND HETEROGENEOUS REACTIVE MIXTURES Interim Report, 1 Jun. 1978 - 31 May 1979
Roger A. Strehlow, Harold O. Barthel, and Herman Krier Jul. 1979 71 p refs
(AF-AFOSR-3336-77; AF Proj. 2308)
(AD-A073058; AFOSR-79-0934TR) Avail: NTIS
HC A04/MF A01 CSCL 21/2

The research deals with the broad topics of initiation, combustion and transition to detonation in homogeneous and heterogenous reactive mixtures. One specific area deals with analytical and experimental work directed to direct initation of detonation by a nonideal blast wave in chemically sensitized reactive fuel-air clouds. The other specific topic involves the hydrodynamic modeling of ignition and flamespreading in granular energetic solids to predict the potential for deflagration (DDT). GRA

N80-12147# Hanford Engineering Development Lab., Richland, Wash.
MATERIALS COMPATIBILITY IN LIQUID SODIUM
W. F. Brehm Aug. 1978 38 p refs Presented at NACE Conf., Denver, Colo., 3 Oct. 1978
(Contract EY-76-C-14-2170)
(HEDL-SA-1559; Conf-781071-2) Avail: NTIS
HC A03/MF A01

The types and rates of reaction of sodium with reactor materials are presented. Confident predictions on the corrosion behavior for steel in sodium were obtained. Deposition phenomena are not well defined, at least with respect to establishing quantitative correlation. The potential uses of liquid metal heat transfer systems in energy conversion systems other than nuclear reactors were considered. DOE

N80-12148# Sandia Labs., Albuquerque, N. Mex.
RAYLEIGH TEMPERATURE PROFILES IN A HYDROGEN DIFFUSION FLAME
J. R. Smith Sep. 1978 11 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8726) Avail: NTIS HC A02/MF A01

Rayleigh scattering from a hydrogen-air laminar jet diffusion flame in combination with a numerical model of the flame was used to determine temperature profiles. The model predictions of species concentration are used to calculate a mean Rayleigh cross-section which is used to relate the Rayleigh scattered intensity to temperature. Using an argon ion laser producing 7.5 watts at 488 nm and an optical multichannel analyzer the scattered light was imaged into a spectrometer. Spatial resolution of 0.18 mm on each of the 500 detector elements with good signal-to-noise ratios was achieved even with integration times of only 0.03 second. Since the entire profile is made simulataneously, particulate perturbed profiles are easily recognized and discarded. Transverse profiles are presented to show structure. Axial profiles are compared to radiation corrected thermocouple measurements. DOE

N80-12149# California Univ., Berkeley. Lawrence Berkeley Lab.
OPERATION OF A HIGH-CURRENT XENON SOURCE
W. Chupp, D. Clark, R. Richter, J. Staples, and E. Zajec Mar. 1979 4 p ref Presented at IEEE Particle Accelerator Conf., San Francisco, 12 Mar. 1979
(Contract W-7405-eng-48)
(LBL-8859; CONF-790327-108) Avail: NTIS
HC A02/MF A01

A multi-aperture Ehlers-type source was constructed and operated to produce a 60 mA Xe(+1) beam. The multi-aperture source utilizes a 13 hole aperture in a circular pattern producing a beam 25 mm in diameter. An accel-decel extraction system was used, producing a 22.5 keV beam whose normalized emittance at 29 mA was 0.027 pi cm-mrad. The neutralized beam was transported one meter through two magnetic quadrupole triplets to the entrance of a 20 cm accelerating gap consisting of five intermediate electrodes with a total voltage drop of 500 kV. The vacuum in the extraction region was held to 0.00001 Torr by using a puff valve and two 1500 l/sec turbo pumps. Multi-wire profile monitors just ahead of the column entrance measured the beam size, which was in good agreement with single-particle transport calculations. DOE

N80-12150# Sandia Labs., Albuquerque, N. Mex.
HIGH RESOLUTION FOURIER TRANSFORM INFRARED SPECTROSCOPY FOR THE INVESTIGATION OF DECOMPOSITION GASES GENERATED BY AGING ORGANIC MATERIALS
D. M. Haaland and G. E. Rivord 1979 6 p refs Presented at JOWOG-28, Albuquerque, N.M., 11 Jun. 1979
(Contract DE-AC04-76DP-00789)
(SAND-79-0935C; CONF-790632-6) Avail: NTIS
HC A02/MF A01

A 10 year program to determine the long-term ambient temperature aging characteristics of pentaerythritol tetranitrate (PETN) and hexanitrostilbene (HNS) in explosive components is described. Because of the limited supply of components and the desire to study the aging process at temperatures as close to ambient as possible, a sensitive, nondestructive technique such as Fourier transform infrared spectroscopy (FTIR) is required. Of the major decomposition gases to be monitored (CO, CO2, H2O, NO, NO2, N2O, and N2) only N2 is not infrared active. Preliminary investigations of the FTIR method prior to its application to actual explosives are reported. DOE

N80-12151# European Space Agency, Paris (France).
INFLUENCE OF TURBULENCE ON HYDROCARBON COMBUSTION IN A STIRRED COMBUSTOR Ph.D. Thesis - Paris Univ.
Claude Bonniot Jul. 1979 76 p refs Transl. into ENGLISH of 'Influence de la Turbulence sur la Combustion d'Hydrocarbures dans un Foyer 'homogene'', ONERA, Paris Report ONERA-NT-1978-7, 1978 Original report in FRENCH previously announced as N79-32315
(ESA-TT-580; ONERA-NT-1978-7) Avail: NTIS
HC A05/MF A01

The reciprocal influence of turbulence and combustion was determined for the case of homogeneous turbulence, which corresponds to the primary zone of turbomachine combustors. A method was developed to calculate the statistic characteristics of the flame and experiments were carried out on a stirred at large scale combustor. The results of optical temperature measurements show that the combustor presents good homogeneity. The maximum characteristic mixing time is much lower than the mean residence time in the combustor. The influence of equivalence ratio fluctuations at injections was also studied. A simple calculation predicts these ratios in the case of fluctuations with a low frequency relative to residence time. In the case of high frequency fluctuations, the calculations and experiments agree well qualitatively, but not quantitatively. Author (ESA)

N80-12152# Little (Arthur D.), Inc., Cambridge, Mass.
GAS SAMPLE STORAGE Final Report, Jan. 1978 - Feb. 1979

K. E. Thrun, J. C. Harris, and K. Beltis Apr. 1979 49 p refs
(Contract EPA-68-02-2150)
(PB-298350/0; EPA-600/7-79-095) Avail: NTIS
HC A03/MF A01 CSCL 14B

Results are presented of a laboratory evaluation to compare the storage stability of selected gases covering a range of compound categories, in three types of containers: glass bulbs and two different polymeric sample bags. It was concluded that glass bulbs are the best overall choice, with no significant gas losses. Reactive and highly polar gases were preferentially lost from samples stored in the polymeric bags. Some contaminants were detected in the samples taken from the polymeric sample bags, presumably the result of outgassing from the materials used to construct the bags. GRA

N80-12153# TRW Defense and Space Systems Group, Redondo Beach, Calif.
APPROACHES TO LEVEL 2 ANALYSIS BASED ON LEVEL 1 RESULTS, MEG CATEGORIES AND COMPOUNDS, AND DECISION CRITERIA Final Report, Dec. 1976 - Dec. 1978
L. E. Ryan, R. G. Beimer, and R. F. Maddalone Feb. 1979 164 p refs
(Contract EPA-68-02-2613)
(EPA-600/7-79-063A) Avail: NTIS HC A08/MF A01 CSCL 07D

An approach to the decision criteria needed to proceed from the initial emission screening analysis (Level 1) to the detailed emission characterization (Level 2) is described. The types of Level 1 environmental assessment samples, and the chemical data available which can be prioritized for a MEG-based Level 2 plan are discussed and a logic network for determining the need for a Level 2 sampling effort is presented. An integrated approach to Level 2 inorganic compound analysis, an identification scheme consisting of characterization of the initial sample, of bulk composition, and of individual particles is included along with detailed logic networks to provide direction to the analyst during the identification process. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-12154 Clemson Univ., S.C.
STORED ENERGY IN THE I SUB b SUBSTAGE OF ALUMINUM Ph.D. Thesis
Bruce Warren Koehn 1979 95 p
Avail: Univ. Microfilms Order No. 7925095

An attempt was made to measure the stored energy due to point defects in the crystal lattice of aluminum. The experimental technique makes use of differential thermal analysis. A technique in indirect thermometry was attempted where the temperature change due to release of stored energy was to be inferred by the enhanced recovery caused by the release of stored energy during a comparatively rapid thermal annealing pulse. A sample mounting technique was tested. Two data analysis methods were used to show that stored energy was not detected in any of the experiments. Even though no stored energy was detected, the basic principles of this work are still applicable, as shown by theory, and deserve further study. The analysis presented points to some of the major problems, provides quantitative estimates of some experimental values, and gives a basis for extending these types of measurements. Author

N80-12155 Clarkson Coll. of Technology, Potsdam, N.Y.
MAGNETIC SUSCEPTIBILITY OF CHROMIUM AND ITS ALLOYS Ph.D. Thesis
Jack Robert Kelly 1979 174 p
Avail: Univ. Microfilms Order No. 7925430

The static spin susceptibility of antiferromagnetic chromium containing nonmagnetic impurities is calculated using a two-band model. Variation in the size of the electron jack and hole octahedron upon alloying is taken into account within the rigid band approximation. The effect of phonon scattering on the susceptibility is included. The theory is compared with experimental results on binary chromium alloys containing dilute amounts of ruthenium and rhenium. A simplified version of the spin Hamiltonian which takes account of nearest neighbor exchange coupling of the local moments as well as their coupling to the spin density wave is presented. For dilute moment concentrations, semiquantitative agreement with experiments on Cr-Fe and Cr-Co systems can be obtained with a strong interaction between the moments and the spin density wave. Dissert. Abstr.

N80-12156 Michigan Univ., Ann Arbor.
STUDIES OF ULTRAFINE METAL PARTICLES Ph.D. Thesis
Stephen Ross Forrest 1979 219 p
Avail: Univ. Microfilms Order No. 7925149

Experiments which measure charged particle velocity and mobility are described. From the distribution in mobility, the particle size distribution is inferred. The size distribution is approximately log-normal with a median radius 1.5 times larger than obtained by electron microscopy measurements. Possible causes for the discrepancy are discussed. The distribution width parameter for the two measurement techniques is the same. An advantage of the mobility method is the immediate availability of the size distribution. A type of magnetic resonance expected in free, small, ferromagnetic particles is presented and a resonance spectrometer is built to detect it. The spectrometer includes a preamplifier which operates at liquid helium temperatures, and a superconducting rf coil. It produces either oscillation or rotating rf fields. The predicted resonance was not detected. Dissert. Abstr.

N80-12157 Western Reserve Univ., Cleveland, Ohio.
PASSIVATION STUDIES OF IRON, NICKEL, AND THEIR ALLOYS BY IN SITU ELLIPSOMETRIC AND EX SITU ESCA TECHNIQUES Ph.D. Thesis
Chia-Tien Chen 1979 223 p
Avail: Univ. Microfilms Order No. 7924812

The optical spectra of passive films on iron in borate buffer (pH = 8.4) were determined for wavelengths from 350 to 760 nm. The spectral properties of poly- and single crystal alpha-Fe2O3 were also examined and show distinct differences for the spectra of the passive film. A detailed mechanistic model for the reduction stages is proposed. The calculated transition times for the reduction stages can be fitted reasonably well with those determined ellipsometrically. The ex situ ESCA spectra on passive iron electrodes indicate changes in the oxygen peaks with oxide formation potential which are explained in terms of protons in the film. The ESCA studies were extended to high chromium steel. In the transpassive region, chromium was completely depleted within the film, at least within the escape depth for the electron. Dissert. Abstr.

N80-12158 Iowa State Univ. of Science and Technology, Ames.
THERMODYNAMIC STUDY OF LIQUID CERIUM AND COPPER ALLOYS BY LEVITATION CALORIMETRY Ph.D. Thesis
Won Dokko 1979 161 p
Avail: Univ. Microfilms Order No. 7924239

The electromagnetic levitation method of heating a sample along with conventional isothermal drop calorimetry was applied to determine the heat content and the heat capacity of liquid cerium-copper alloys over the complete range of composition. The temperatures of the levitated samples were determined by means of an automatic optical pyrometer. The normal spectral emissivities (lambda = 645 nm) of the binary liquid alloys were measured over the complete range of composition by an integral blackbody comparison method. It was found that the normal spectral emissivities are constant over the experimental temperature range, from approximately 1120 K to 1700 K.
Dissert. Abstr.

N80-12159# Naval Postgraduate School, Monterey, Calif.
FRACTURE TOUGHNESS CHARACTERIZATION OF SELECTED ULTRA HIGH CARBON STEELS M.S. Thesis
James Louis Taylor Jun. 1979 75 p refs
(AD-A073395) Avail: NTIS HC A05/MF A01 CSCL 11/6

This effort, part of an ongoing program examining the microstructural and mechanical properties of extensively warm-worked ultra high carbon (UHC) steels, was directed at measurement of the fracture toughness of these steels. A facility was constructed to test bend-type fracture toughness specimens

in accordance with the American Society for Testing and Materials (ASTM) Standard E399-78; several UHC steel alloys were evaluated and the results correlated with microstructural and other mechanical test results. With one exception, processing failed to eliminate coarse carbides from the microstructures of these materials and fracture toughness, K(IC), values were accordingly low. A commercial alloy, AISI 52100, processed similarly to the other experimental alloys, did not have the coarse carbides present to as great an extent, and was significantly tougher, as manifested by a strength ratio twice that of the other alloys. GRA

N80-12160# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF THE USE OF CORROSION INHIBITORS AT THE ANODIC OXIDE-METAL INTERFACE Final Report, May 1978 - Apr. 1979
Neil T. McDevitt and James S. Solomon Jul. 1979 24 p refs
(AF Proj. 2416)
(AD-A073124; AFML-TR-79-4090) Avail: NTIS HC A02/MF A01 CSCL 11/6

Aluminum alloy, 2024, was treated with a number of solutions having corrosion inhibitor properties. These surfaces were then anodized in a H3PO4 acid electrolyte. After anodization, the specimens were dipped into a 10% salt solution. A chromate solution-anodized composite film showed some corrosion improvement when compared to a standard phosphoric anodized specimen. GRA

N80-12161# Martin Marietta Labs., Baltimore, Md.
AUGER ELECTRON SPECTROSCOPY STUDIES OF OXIDE FILMS ON Al-Zn-Mg ALLOYS
R. K. Viswanadham, T. S. Sun, and J. A. S. Green Jul. 1979 17 p refs
(Contract N00014-74-C-0277)
(AD-A073096; MML-TR-79-33) Avail: NTIS HC A02/MF A01 CSCL 11/6

Auger electron spectroscopy and depth profiling have been used to obtain information on the composition of oxide films formed on high purity Al-5.5Zn-2.5Mg alloys as a function of heat treatment, grain size, storage environment and temperature. These studies show that in the as-heat-treated condition the oxide film is predominantly MgO. The Mg/O peak-to-peak height ratio of this oxide is sensitive to the heat treatment temperature and exhibits a maximum at 475 C. During subsequent storage, especially in a moist environment, this film undergoes substantial changes in composition. The Mg/Al ratio of the oxide decreases due to formation of an Al-rich oxide on top of the as-heat-treated oxide. A model is proposed to account for the changes in the oxide film composition during growth of the Al-rich oxide, and possible implications to pre-exposure embrittlement and stress corrosion cracking are discussed. GRA

N80-12162# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
STRUCTURE OF SOME REFRACTORY TRANSITION METAL METALLOID GLASSES
Arthur R. Williams and William L. Johnson Dec. 1978 15 p refs
(Contract EY-76-C-03-0822)
(CALT-822-105) Avail: NTIS HC A02/MF A01

The radial distribution function of four refractory alloys of composition (W sub 5 Ru sub 5) sub 8 M sub 2 where M = some metalloid are presented, along with densities, atomic volumes of metalloids and coordination numbers. The results are discussed and some comparisons made with some model calculations of dense random packings of hard spheres. DOE

N80-12163# International Nickel Co., Inc., Suffern, N. Y. Inco Research and Development Center.
EVALUATION OF HIGH CHROMIUM OVERPLAYS TO PROTECT LESS ALLOYED SUBSTRATES FROM CORROSION IN A COAL GASIFICATION ATMOSPHERE Quarterly Report, 1 Mar. - 31 May 1978
E. P. Sadowski 1978 32 p
(Contract EF-77-C-01-2621)
(FE-2621-3) Avail: NTIS HC A03/MF A01

Three-quarters of the welding is complete and pre-exposure testing started on one-half of the completed weldments in this program to produce overlays resistant to corrosion in coal gasification atmospheres at 982 C. The welding processes were: submerged-arc, gas metal-arc and gas tungsten-arc with a hot wire addition. Pre-exposure testing was continued. The tests consisted of hardness surveys, bend, tensile, stress-rupture, bulk chemical analysis of the overlay and microprobe analysis for the distribution of major alloying elements from the outside edge of the overlay to the center of the base plate. The results are described. DOE

N80-12164# Idaho National Engineering Lab., Idaho Falls.
OXIDATION AND EMBRITTLEMENT OF ZIRCALOY-4 CLADDING FROM HIGH TEMPERATURE FILM BOILING OPERATION
Stephen L. Seiffert and Richard Hobbins Dec. 1978 354 p refs
(Contract EY-76-C-07-1570)
(TFBP-TR-292) Avail: NTIS HC A16/MF A01

The results of an evaluation of the power cooling mismatch and irradiation effects test data on fuel rod cladding behavior are presented. Cladding embrittlement resulting from the high temperature oxidizing reactions with the coolant and the fuel was evaluated and comparisons with failure criteria are presented. The in-pile data are correlated with room temperature embrittlement criteria based on the fraction of remaining beta-phase, the total extent of oxidation, and the mean oxygen concentration near saturation in the beta-phase. The applicability of other failure criteria are discussed. The results show that the in-pile data are most consistent with criteria based on the mean oxygen content in the beta-phase, which suggests the critical effect of time and temperature upon the ultimate cladding oxygen distribution and on the extent of cladding embrittlement. DOE

N80-12165# Sandia Labs., Albuquerque, N. Mex.
NMR OF Cu SATELLITES IN THE KONDO ALLOY CuCr
L. J. Azevedo, D. Fallstaedt, and A. Narath 1978 10 p refs
Presented at the 24th Conf. on Magnetism and Magnetic Mater., Cleveland, Ohio, 14 Nov. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1514; CONF-781114-6) Avail: NTIS HC A02/MF A01

Using pulsed NMR techniques, resonances of Cu nuclei which are near neighbors to Cr impurities (c = 100 and 200 ppM) in CuCr were studied in the temperature range 1 to 4K and applied fields H sub 0 = 20 to 125 kOe. At the highest fields and lowest temperatures the satellite shifts approach saturation. Above near 40 kOe the spin-lattice relaxation rate 1/T sub 1 is proportional to T/H sub 0 squared, indicating that the dominant relaxation mechanism arises from transverse fluctuations of a polarized local moment. The measured rates yield a local-moment/conduction-electron exchange interaction vertical bar J sub 0 vertical bar/g = 0.30, where g is the Cr g-value. Below approximately 40 kOe/T sub 1 appears to be slightly enhanced in comparison with the high-field behavior, but becomes field independent below near 30 kOe. Both effects are attributed to Kondo anomalies. DOE

N80-12166# Foreign Resources Associates, Fort Collins, Colo.
EXPERIENCE WITH PERMANENT MODIFICATION OF ALUMINUM-SILICON CAST ALLOYS
K. Alker and U. Hielscher Aug. 1978 48 p Transl. into ENGLISH from Aluminum, W. Germany (Dusseldorf), v. 48, no. 5, 1972 p 362-367
(RFP-Trans-250) Avail: NTIS HC A03/MF A01

The inspection and testing of long term modified alloys in casting practice is reported. The alloys which can be used, as well as the batching, smelting, and melt treatment of such alloys are presented. Examples of the application of long term modified aluminum-silicon alloys are illustrated by several castings. DOE

N80-12167# Foreign Resources Associates, Fort Collins, Colo.
INCOMPATIBILITY OF SODIUM AND ANTIMONY IN THE TREATMENT OF ALUMINUM, SILICON ALLOYS
Sep. 1978 5 p ref Transl. into ENGLISH from Fondeur d'Aujourd'hui, France, no. 272, 1976 p 12-13
(RFP-Trans-256) Avail: NTIS HC A02/MF A01

Besides the classical modification treatment using sodium, the structure of aluminum-silicon alloys can be influenced by adding antimony. These two treatments are not compatible and the presence of antimony is detrimental to modification by sodium. Starting from an AS13 alloy with granular structure, sodium and antimony were added to obtain various structures. These structures vary as a function of sodium and antimony content for sand casting and chill casting. In the range examined, up to 0.6% determined antimony, it is possible to obtain modified structures by increasing the sodium dose when the content of antimony is increased. The treatment by sodium (or sodium-containing fluxes) eliminates part of the antimony from the alloy. By comparing the two diagrams, the limit of the lamellar structure is not very sensitive to the cooling rate. The range of good modification is very reduced for sand casting. Curious microstructures are observed where the traditional signs of under-modification and over-modification are practically superposed.
DOE

N80-12168# Ames Lab., Iowa.
ULTRAPURIFICATION OF REACTIVE METALS
D. T. Peterson 1979 13 p refs Presented at the Intern. Conf. on Advances in Chem. Met., Bombay, 3 Jan. 1979
(Contract W-7405-eng-82)
(IS-M-167) Avail: NTIS HC A02/MF A01

The development of advanced and more sensitive analytical methods and more sophisticated processing equipment to create the opportunity for further advances in the field of metal purification is presented. More detailed and quantitative examination of presently used purification methods reveal ways in which significant improvements in the results can be made. The need of highly purified metals in the continued advance of metallurgical research is stressed and examples of this need are cited. The cost of metal purification are considered. DOE

N80-12169# Sandia Labs., Albuquerque, N. Mex.
SOLDERABILITY
1978 9 p refs Presented at SME Seminar, Anaheim, Calif., 19 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1749C; CONF-780964-1) Avail: NTIS HC A02/MF A01

The problems in attaining good solderability, primarily printed circuit boards, testing for solderability and maintaining solderability over extended periods for electronic components, particularly those of copper, are addressed. DOE

N80-12170# Oak Ridge National Lab., Tenn.
DUCTILITY MINIMUM AND ITS REVERSAL WITH AGING IN COBALT-BASE SUPERALLOYS
J. P. Hammond Jan. 1979 31 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6624) Avail: NTIS HC A03/MF A01

Good mechanical properties in the face of long-term aging at high temperatures are required of superalloys for nuclear and solar power-conversion applications. Of special concern are losses in ductility and toughness resulting from microstructural instability. The tensile ductility responses in two cobalt-base superalloys were compared for the solution annealed and aged conditions and results were rationalized with contemporary concepts. The cobalt-base superalloys Haynes alloy No. 25 and Haynes alloy No. 188 show a pronounced ductility minimum at 760 C for the solution annealed condition. However, after prolonged (11,000 h) aging at 816 C, copious precipitates form and completely reverse this behavior. These precipitates drastically reduce tensile ductility up to the temperature at which the ductility begins to dip for the solution annealed condition; then the brittle behavior from aging gives way to greatly enhanced ductility. This behavior in Haynes alloy No. 25 was examined in detail. Tensile properties in the solution annealed and 816 C-aged conditions are correlated with mode of fracture and the amounts, identity, and morphology of the precipitates. The latter were assessed by optical and scanning electron metallography, microhardness, electron microprobe, and X-ray diffraction. The minimum and its reversal are explained by thermally activated processes that began with the onset of recovery. DOE

N80-12171# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
STRUCTURE AND PROPERTIES OF TRANSITION METAL-METALLOID GLASSES BASED ON REFRACTORY METALS
W. L. Johnson and A. R. Williams Jan. 1979 51 p refs
(Contract EY-76-C-03-0822)
(CALT-822-107) Avail: NTIS HC A04/MF A01

The structure of the alloys was investigated by X-ray diffraction methods and measurements of superconducting properties, electrical resistivity, density, hardness, and mechanical behavior were made. These data are used in developing a description of the structure of TM/sub 1-x/M/sub x/glasses. The experimental evidence suggests that an ideal amorphous phase forms at a specific composition x/sub c/ and that this phase has a well defined atomic short range order. For metallic glasses having x < x/sub c/ (metalloid poor glasses) vacancy-like defects form, which are characterized by the excess volume which they contribute to the glass. Another, as yet unspecified defect appears to form in glasses with x > x/sub c/. DOE

N80-12172# Oak Ridge Y-12 Plant, Tenn. Metallurgy Dept.
WELDABILITY OF ELECTROFORMED NICKEL
L. D. Frye 30 Mar. 1979 20 p refs
(Contract W-7405-eng-26)
(Y-2171) Avail: NTIS HC A02/MF A01

The cause of variations in the weldability of electroformed nickel was investigated. Evaluation of gas tungsten-arc welds in 0.254 mm thick electroformed nickel sheet by chemical analyses of the nickel base material identified phosphorus and sulfur contamination as the cause for welding variability. A screening test was developed that predicted the weldability of electroformed nickel. DOE

N80-12173# Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.
PROCEEDINGS OF THE WORKSHOP ON ALTERNATIVES FOR CADMIUM ELECTROPLATING IN METAL FINISHING
Elbert Dage, Edward Dyckman, William Isler, and Fielding Ogburn Mar. 1977 634 p refs Workshop held at Gaithersburg, Md., 4-6 Oct. 1977 Sponsored in part by Consumer Product Safety Commission, Commerce Dept., DOD, HEW, Interior Dept., DOL, and GSA
(PB-298841/8; EPA-500/2-79-003) Avail: NTIS HC A99/MF A01 CSCL 13H

Techniques were examined and alternatives pointed out to minimize the environmental losses of cadmium from electroplating by applying cadmium by mechanisms that reduce the loss of cadmium during plating, and developing suitable and cost-effective alternative materials, methods, and coatings. Presentations on the Federal and industrial concerns for the commercial significance, environmental effects, and health effects of cadmium were given. The topics 'Are specifications and standards barriers to change' and 'How essential is electrodeposited cadmium' were reviewed and discussed. GRA

N80-12017# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF SPUTTERING TO THE IMPROVEMENT OF COATINGS OF SUPERALLOYS
Robert Pichoir *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 94-124 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 181-194 Original language report was announced as A79-11135 Sponsored by DGRST (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-12174 Wisconsin Univ. - Madison.
OSCILLATORY FLOW BIREFRINGENCE MEASUREMENTS OF BLOCK COPOLYMERS IN SOLUTION Ph.D. Thesis

Alan Lewis Soli 1978 214 p
Avail: Univ. Microfilms Order No. 7919814

Oscillatory flow birefringence (OFB) was used to study the conformational dynamics of block copolymers in dilute solution. Experimental results for the OFB of block copolymers of styrene with either butadiene or isoprene (both linear and star topology) in a chlorinated biphenyl solvent are presented; these particular types of copolymers are of commercial interest because of their heterogeneous nature in the bulk or melt states. Results for copolymers of styrene and alpha-methylstyrene-which were previously determined as homogeneous in the bulk state-are also presented. The data for the linear copolymers qualitatively fits the bead-spring theory of F.W. Wang for block copolymers in solution. Included are OFB results for homopolymers to provide a basis for comparison with the copolymer studies.
Dissert. Abstr.

N80-12175 Michigan State Univ., East Lansing.
SYNTHESIS AND PHOTOPHYSICAL PROPERTIES OF A FLUORESCENT POLYAMIDE SERIES AND THEIR MONOMER ANALOGS: NOVEL INTRAMOLECULAR EXCIMER AND EXCIPLEX INTERACTIONS Ph.D. Thesis
John Akolisa Ibemesi 1978 265 p
Avail: Univ. Microfilms Order No. 7917717

The photophysical properties of a fluorescent aromatic polyamide-series and their monomer analogs were utilized to investigate: (1) the configurational and conformational requirements for intramolecular excimer formation in hetero-chain polymeric systems; (2) the effect of chain-binding on the reactivity of a chemical moiety; (3) the mechanism of solvent-induced intramolecular exciplex fluorescence in aromatic hydrocarbon-aliphatic amine systems; and (4) the nature of exciplex interaction with polar molecules. The room temperature absorption and emission spectra of dilute solutions of P-2, P-4, P-6 and P-8 were measured. Their emission spectra showed the formation of intramolecular excimers between naphthyl groups separated from one another by as many as 20, 2N and 10C atoms. The fluorescence lifetimes and quantum yields were dependent on the distance of separation between the chromophores.
Dissert. Abstr.

N80-12176 Nevada Univ., Reno.
TEMPERATURE DEPENDENT TRIPLET ENERGY PROCESSES IN AROMATIC POLYMERS Ph.D. Thesis
Rafael Gonzalez Aviles 1979 135 p
Avail: Univ. Microfilms Order No. 7925405

The delayed fluorescence and phosphorescence intensities and lifetimes of poly(N-vinyl carbazole) (PVCA) solid films were measured at temperatures ranging from 77 K to 300 K. The presence of two trapped triplet species was confirmed. The delayed fluorescence intensity of radically polymerized PVCA films was found to possess a temperature dependence which includes a minimum at about 145 K and a maximum at about 200 K. The delayed fluorescence decay is multi-exponential over the temperature range studied but a fast component was isolated and was attributed to triplet-triplet annihilation involving mobile triplets formed directly by intersystem crossing of an excited singlet chromophore. The mobile triplet lifetime was found to have little temperature dependence and an average value of about 7 msec. Longer lived delayed fluorescence lifetimes in the low temperature region arise from interactions between trapped triplets and mobile triplets indirectly produced by detrapping.
Dissert. Abstr.

N80-12177# National Bureau of Standards, Washington, D.C. Polymer Science and Standards Div.
THE KINETICS OF HYDROLYTIC AGING OF POLYESTER URETHANE ELASTOMERS Technical Report, Sep. 1978 - Aug. 1979
Daniel W. Brown, Robert E. Lowry, and Leslie E. Smith Jul. 1979 25 p refs
(NR Proj. 356-647)
(AD-A072855; TR-3) Avail: NTIS HC A03/MF A01 CSCL 11/9

The hydrolytic degradation of polyester urethane elastomers is due to the acid catalyzed hydrolysis of the ester group. Acid content (A) and the reciprocal of the number average molecular weight increase by equivalent amounts indicating that each molecular chain scission produces one acid group. The fractional rate of increase in acidity, k, is a pseudo first order rate constant because the ester and water contents change only slightly with degradation. Values of k at 85 C and 100% relative humidity are in the 15-20% per day for polyurethanes, based on polycaprolactone and polytetramethylene adipate diols. At 100% relative humidity k obeys the Arrhenius equation between 35 and 85 C with activation energies in the range 68-83 kJ/mol (16-20 kcal/mol). Values of k decrease with relative humidity, becoming zero in dry air.
GRA

N80-12178# Queen Mary Coll., London (England). Dept. of Materials.
FRACTURE MECHANICS OF INELASTIC POLYMERS Final Report, 11 Apr. 1975 - 1 Oct. 1978
E. H. Andrews Apr. 1979 20 p refs
(Grant DA-ERO-75-G-049; DA Proj. 1T1-61102-BH-57)
(AD-A072792) Avail: NTIS HC A02/MF A01 CSCL 11/9

The author's Generalized Theory of Fracture Mechanics has been applied to several quite different polymeric materials which have in common a nonlinear and inelastic deformation behaviour. Thus the normal Linear Elastic Fracture Mechanics cannot be applied. When applied to experimental data the theory provides a unique characterization of fracture resistance and also sheds light on the molecular or microscopic fracture mechanisms of the material concerned.
GRA

N80-12179# Army Natick Research and Development Command, Mass. Clothing Equipment and Materials Engineering Lab.
EVALUATION OF AN ACOUSTIC TECHNIQUE AS A NONDESTRUCTIVE METHOD OF MEASURING UV DEGRADATION OF NYLON RIP-STOP FABRIC
Vasant K. Devarakonda Mar. 1979 21 p refs
(AD-A072817; CEMEL-201; NATICK/TR-79/031) Avail: NTIS HC A02/MF A01 CSCL 14/2

To determine whether the frequency of the resulting vibration could be used as a nondestructive method of evaluating degradation, samples of nylon rip-stop fabric with varying degrees of UV degradation were suspended under tension and impacted. It was found that the generated frequency is dependent on several variables including the vibrating length of sample and the applied tension. The suitability of the technique as a nondestructive method could not be established in this study because of lack of a definable relationship between frequency and degree of degradation.
GRA

N80-12180# Oklahoma Univ., Norman. Dept. of Chemistry.
THE CRYSTAL AND MOLECULAR STRUCTURE OF TRIMETHYLTIN CHLORIDE AT 135 K, A HIGHLY VOLATILE ORGANOTIN POLYMER
M. Bilayet Hossain, J. L. Lefferts, K. C. Molloy, D. VanDerHelm, and J. J. Zuckerman 27 Aug. 1979 11 p refs
(Contract N00014-77-C-0432)
(AD-A073641; TR-8) Avail: NTIS HC A02/MF A01 CSCL 20/2

Trimethyltin chloride is the key starting material in the laboratory synthesis of the trimethyltin derivatives most subjected to study. It is an article of commerce, and has itself been extensively studied by a great variety of spectroscopic and physical methods. There is in the literature starting in 1970, a trial of oft referenced private communications (see our ref. 17) which describe a yet unpublished X-ray structure which is incorrect. In addition, the structure of the analogous triphenyltin chloride, which is monomeric at ambient temperature, is said to undergo a change on cooling to a chlorine-bridged polymer, but this suggestion is based upon NQR data at 77 K which cannot be reproduced (see our ref. 5). The structure of the homologous trimethyltin fluoride cannot be solved because of disorder, and thus the widely-quoted bridging halide structures for R3SnX compounds are being confirmed here in the case of the title compound for the first time.
GRA

N80-12181# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
FT-NMR DETERMINATION OF SILANE HYDROGEN
G. L. Clink Oct. 1978 6 p
(Contract EY-76-C-04-0487)
(MHSMP-78-45) Avail: NTIS HC A06/MF A01

A rapid and precise method for the analysis of silane hydrogen in prepolymers is presented. The catalysts used as well as comparisons of this proton nuclear magnetic resonance method with the wet chemical analysis are outlined. DOE

N80-12182# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
REPLICATION TECHNIQUE FOR EXAMINING DEFECTS IN THE INTERFACE OF A METAL-TO-GLASS CERAMIC BOND
R. K. Spears 22 Sep. 1978 20 p
(Contract EY-76-C-04-0656)
(GEPP-TIS-391) Avail: NTIS HC A02/MF A01

Epoxy replicas were made of the interface of a molybdenum and glass-ceramic assembly and examined by scanning electron microscopy. Replications of this interface were produced by first removing the molybdenum from four assemblies using a nitric acid-based etchant. The glass-ceramic insulators that remained were pressure encapsulated in epoxy. After curing, the glass-ceramics were etched from the epoxy in an hydrogen fluoride-based acid etchant. The resulting replicas resembled the texture of the molybdenum surface with the interface defects shown in detail as projections. This process revealed some unusual interface problems which appeared to be associated with the evolution of gas from the molybdenum piece parts. DOE

N80-12183# National Bureau of Standards, Washington, D.C.
PERFORMANCE OF PLASTIC PACKAGING FOR HAZARDOUS MATERIALS TRANSPORTATION. PART 4: STANDARDIZING PERMEATION MEASUREMENTS Final Report, Jun. 1976 - Jun. 1977
J. D. Barnes, G. M. Martin, and F. L. McCrackin Jun. 1979 48 p refs
(PB-298047/2; NBSIR-79-1768; DOT/MTB/OHMO-77/5) Avail: NTIS HC A03/MF A01 CSCL 11I

Experiments were performed which confirm the essential features of the permechor method for estimating the permeability of polyethylene to various liquids. A concept called the effective carbon atom number is introduced as a means of correlating data. Once the effective carbon atom number of a liquid is known from measurements on one kind of polyethylene, it should be possible to predict its permeability performance in containers made from different polyethylenes. Procedures are presented for implementing a standard-based system for measuring effective carbon atom numbers of various liquids and using information to make permeability performance predictions. This system minimizes the number of tests which must be made using full-scale containers. GRA

N80-12184# Howard, Needles, Tammen, and Bergendoff, Fairfield, N. J.
BRIDGE DECK JOINT-SEALING SYSTEM: EVALUATION AND PERFORMANCE SPECIFICATION Final Report
Jun. 1979 56 p refs Sponsored by Federal Highway Admin., Washington, D.C. and Am. Assoc. of State Highway and Transportation Officials, Washington, D.C.
(PB-298942/4; TRB/NCHRP/REP-204; LC-79-65828; ISBN-0-309-02910-4; ISSN-0077-5614) Avail: NTIS MF A01; HC available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C., 20428, $5.60 CSCL 13B

An investigation is reported on current and past use of prefabricated proprietary bridge deck joint-sealing systems by highway agencies throughout the U.S. and a number of other countries. The good features in a wide variety of products are examined; reported shortcomings in their serviceability under traffic (notably their failure to be entirely watertight) are searched out. The major contributory input to collection of field experiences with such systems was responses to a comprehensive questionnaire sent to all State highway departments and numerous toll authorities. Evaluations of all findings resulted in preparation of a practical and detailed performance specification for rubber membrane- and cushion-seal systems up to 4 in. (102 mm) total movement. (Cellular compression seals are not included.) This specification includes extensive requirements for pre-installation and post-installation testing and places on the contractor for installing systems having such attributes as water-tightness, low noise, puncture resistance, endurance to temperature extremes, long service under traffic, etc. In-service guarantee clauses holding the contractor liable for joint failure for a few years were judged to be unenforceable as a practical contractural obligation; nevertheless, suggested requirements and field tests are given for those highway agencies electing to include them. GRA

N80-12185# Transportation Research Board, Washington, D.C.
ADHESIVE MATERIALS, PAINTS AND CORROSION
Steven D. Hofener (Texas A. & M. Univ., College Station), David A. Law (Dept. of Transportation, N. Y. State), Gerald L. Anania (Dept. of Transportation, N. Y. State), W. R. Tooke, Jr. (Tooke Eng. Assoc., Atlanta), H. J. Fromm (Ontario Ministry of Transp. and Commun., Downsview), and A. M. Rosenberg (Grace, W. R., and Co., Columbia, Md.) 1978 47 p refs
(PB-298941/6; TRB/TRR-692; ISBN-0-309-02838-8; LC-79-17217) Avail: NTIS HC A03/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D. C. 20418, HC $3.00 CSCL 13B

Papers in this report deal with the following areas: improving thermoplastic stripe adhesion on concrete pavements, acceptance sampling of structural paints; accelerated performance testing of bridge paints for seacoast environments; measurement of polarized potentials in concrete bridge decks; methods of determining corrosion susceptibility of steel in concrete; and measurement of cement content by using nuclear backscatter and absorption gauge. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-12186 Michigan Univ., Ann Arbor.
THEORETICAL DETERMINATION OF MINIMUM ENERGY REQUIRED FOR THE DIRECT INITIATION OF DETONATIONS Ph.D. Thesis
Rajshekhar Devendrarai Oza 1979 126 p
Avail: Univ. Microfilms Order No. 7925208

The determination of minimum energy for the direct initiation of a detonation in a planar, cylindrical or spherical cloud of a homogeneous gaseous combustible mixture is presented. It is assumed that the initial blast energy release E sub 0 is instantaneous in an infinitesimally small volume. The governing equations for the flow are one dimensional nonsteady equations without the transport effects. The oxyacetylene mixtures and the CH4 + 2O2 + xN2 mixtures were used to test the validity of the theory. The agreement between the theoretical prediction and the experimentally observed value for high values of the initiation energy is discussed. The value of the critical explosion radius for a given combustible mixture calculated using the present theory, is discussed in relation to both the cylindrical and the spherical geometries. Dissert. Abstr.

N80-12187 Pittsburgh Univ., Pa.
BURNING VELOCITIES OF A SOLID PROPELLANT, VIA A MICROWAVE TECHNIQUE, AT ELEVATED PRESSURES AND PRESSURIZATION RATES Ph.D. Thesis
Lisle Hoeglund Russell 1979 261 p
Avail: Univ. Microfilms Order No. 7924750

A research effort to directly measure, via a microwave Doppler/phase shift technique, the burning rate of solid propellant in both steady and dynamic elevated pressure environments is discussed. The recession velocity of the propellant when burned planarly within a small rectangular waveguide is examined in relation to the time rate of change of a measured relative phase angle. The relative phase angle was based upon the phase relationship between guided microwave reflections from two surfaces, one a reference plane and the other an effective plan created by the dielectric discontinuity at the burning propellant surface. In the attempt to extend the microwave technique to rapid pressurizations, a twin propellant strand differential system was constructed to isolate the propellant combustion response

from its mechanical response. The ability of the technique to cancel propellant mechanical responses was evaluated in a series of vibration or nonburning dynamic tests conducted at two distinctly different pressurization rates, slow and fast.
Dissert. Abstr.

N80-12188 Utah Univ., Salt Lake City.
ELUCIDATION OF COAL STRUCTURAL COMPONENTS BY SHORT RESIDENCE-TIME EXTRACTIVE LIQUEFACTION Ph.D. Thesis
Doonee Kang 1979 202 p
Avail: Univ. Microfilms Order No. 7925040

Short contact time thermal reactions of bituminous coals with tetralin in hydrogen atmosphere were studied to ascertain the nature of the reaction such as the mechanism of the coal liquefaction process, the labile functional structures in the coal and the products, the hydrogen transfer reactions between coal and tetralin, and the kinetics of coal conversion. Yield and kinetic data indicated reaction paths of the coal conversion. A hybrid kinetic model containg first and second order rate equations was developed and tested for the data. Dissert. Abstr.

N80-12189# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE FUTURE ROLE OF HYDROGEN FUEL IN AN ELECTRICAL SOCIETY
Gordon N. Patterson Oct. 1979 30 p refs
(UTIAS-241; CN-ISSN-0082-5255) Avail: NTIS HC A02/MF A01

The manufacture, storage, and use of hydrogen for peak-shaving purposes, vehicular power plants, and as a chemical raw material are discussed and programs for future development are indicated. It is concluded that plans for the future use of hydrogen on a large scale should be initiated now. M.M.M.

N80-12190# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
DYNAMIC MODEL OF WATER DELUGE SYSTEM FOR PROPELLANT FIRES
Joseph P. Caltagirone May 1979 21 p refs
(AD-A071457; AD-E400315; ARLCD-MR-78008) Avail: NTIS HC A02/MF A01 CSCL 19/1

Since the conventional water deluge system is ineffective in extinguishing propellant/explosive fires, a program was undertaken to develop a deluge system able to withstand the pressures involved in a propellant or explosive fire and to extinguish it before a detonation or extreme hazard occurs. Testing a full-scale water deluge system is costly; therefore, a model law was developed in order to test scaled-down systems. GRA

N80-12191# Texaco, Inc., El Monte, Calif. Montebello Research Lab.
GASIFICATION OF RESIDUAL MATERIALS FROM COAL LIQUEFACTION. EVALUATION OF SRC 2 VACUUM FLASH DRUM BOTTOMS FROM POWHATAN COAL AS A FEEDSTOCK FOR THE TEXACO GASIFICATION PROCESSES
A. M. Robin Mar. 1979 10 p
(Contract EX-76-C-01-2247)
(FE-2247-2) Avail: NTIS HC A02/MF A01

A 20 pound sample of vacuum flash drum bottoms, obtained from the liquefaction of Powhatan coal, was judged to be a suitable feedstock for a synthesis gas generation process. It can be charged directly to the gasifier at a temperature of about 615 F. The material is too viscous to be pumped with the pilot plant equipment, however, which is capable of maintaining a temperature of only 515 F. The addition of 3 to 5 percent cutter is required for the pilot plant tests. No cutter is required for a commercial plant. Based on these results, operating conditions and yields were estimated for gasifying 1000 pounds per hour of molten undiluted residue at 350 psig. A Type 2 preliminary pilot plant evaluation is planned. DOE

N80-12192# Babcock and Wilcox Co., Alliance, Ohio. Research Development Div.
CHARACTERIZATION AND COMBUSTION OF SRC 2 FUEL OIL Final Report
W. Downs and A. J. Kubasco Jun. 1979 131 p refs
(EPRI-FP-1028) Avail: NTIS HC A07/MF A01

An industrial boiler rated at a steam flow of 45,000 lbs/hr was used for combustion tests of solvent refined coal (SRC) fuel oil, No. 2 fuel oil, and No. 5 fuel oil. Operating variables included load, excess air, and burner register settings. The laboratory fuel analyses indicates that in most respects this SRC fuel oil sample behaved similarly to No. 2 fuel oil. The combustion test confirms that SRC fuel oil burns similarly to No. 2 fuel oil with one notable exception. NO/sub x/ emissions were substantially higher than for either the No. 2 or No. 5 fuel oils. The SRC fuel oil will require the application of NO/sub x/ combustion control techniques to meet the proposed New Source Performance Standards of 0.5 pound NO2/million Btu when burned in power boilers equipped with wall-mounted burners. DOE

N80-12193# Oklahoma State Univ., Stillwater. Dept. of Chemistry.
CHARACTERIZATION OF COAL-DERIVED LIQUIDS AND OTHER FOSSIL FUEL RELATED MATERIALS EMPLOYING MASS SPECTROMETRY Quarterly Report, 29 Sep. - 29 Dec. 1978
S. E. Scheppele 29 Jan. 1979 19 p refs
(Contract EX-76-S-01-2537)
(FE-2537-9) Avail: NTIS HC A02/MF A01

Field-ionization mass spectra, FI/MS, were obtained for the following saturate fractions: Arco Shale Concentrates, 200-325 C, 325-425 C, and 425 C +; South Swan Hills Concentrate 370-535 C; and Utah Crude Oil No. 72054. The molecular ion intensities in the FI/MS of each sample were converted into carbon number distributions as a function of Z(H). The weight percents across each Z(H) series were summed to obtain total weight percents as a function of saturate type. Steps in completing the interfacing of the Nova 3/12 data acquisition system to the comparator-microdensitometer are outlined and preliminary designs are given for the interface circuitry and the interface software. High- and low-resolution field-ionization mass spectral data were acquired for 19 monoaromatic, diaromatic, and polyaromatic polar concentrations. High-resolution field-ionization mass spectral data for the remaining asphaltene fractions from the COED coal liquid were acquired. DOE

N80-12194# California Univ., Livermore. Lawrence Livermore Lab.
SHOCK INITIATION AND DETONATION MODELS IN ONE AND TWO DIMENSIONS
S. G. Cochran and J. Chan 20 Jan. 1979 47 p refs
(Contract W-7405-eng-48)
(UCID-18024) Avail: NTIS HC A03/MF A01

A model for shock initiation and detonation of high explosives is presented. It has been implemented in one and two dimensional computer programs, KOVEC and Vector HEMP, respectively. The theory and implementation of the model are dicussed along with a description of its use. Applications of the model to two explosives, PBX-9404 and RX-03-BB, are presented. DOE

N80-12195# Alaska Dept. of Community and Regional Affairs, Kenai. Div. of Community Planning.
CHARACTERIZATION OF INITIATION AND DETONATION BY LAGRANGE GAGE TECHNOLOGY Final Report
N. Cowperthwaite and J. T. Rosenberg Dec. 1978 52 p refs
(Contract W-7405-eng-48; EY-76-C-03-115; SRI Proj. PYU-5611)
(UCRL-13976) Avail: NTIS HC A04/MF A01

Experimental and theoretical studies on the Lagrange gage and analysis techniques for determining constitutive relationships and energy release rates in shocked explosives were performed. Propositions were formulated for deducing hydrodynamic flow properties for a series of Lagrange pressure and particle velocity histories exhibiting maxima. These propositions were used to establish the phenomenology of the shock initiation process in PBX-9404 from the experimental pressure histories recorded at LLL. A Lagrange analysis was performed with the model solution to formulate and test methods for handling Lagrange gage records with pressure and particle velocity peaks similar to those exhibited by PBX-9404. DOE

N80-12196# Los Alamos Scientific Lab., N. Mex.
THERMOCHEMICAL PRODUCTION OF HYDROGEN FROM WATER, A CRITICAL REVIEW
K. E. Cox 1978 56 p refs Presented at USA/USSR Workshop on Alternative Uses of Fusion Energy, Moscow, 20 Nov. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2996; CONF-781178-1) Avail: NTIS HC A04/MF A01

The current status of thermochemical hydrogen technology as regards process chemistry, preliminary chemical engineering design, and techno-economics for a number of cycles undergoing active research and development efforts throughout the world at this time is assessed. Three cycles are receiving the bulk of the total effort and most of the funding: the hybrid sulfuric acid cycle; the sulfuric acid-hydrogen iodide cycle; and the hybrid sulfuric acid-hydrogen bromide cycle (Mark 13). All three cycles are at the stage where a laboratory scale continuous plant can be or is in operation. Improvements are being made in estimating the cost and efficiency of hydrogen produced from water and a thermal energy source either by thermochemical cycle technology or by water electrolysis. These include the heat penalty analysis and the OPTIMO computer code. Costs of thermochemical hydrogen have been found to fall in the $7 to $10/10 to the 16th power Btu range with efficiencies in the 35% to 45% bracket. DOE

N80-12197# Los Alamos Scientific Lab., N. Mex.
LASL THERMOCHEMICAL HYDROGEN PROGRAM STATUS ON OCTOBER 31, 1978
K. E. Cox and M. G. Bowman 31 Oct. 1978 9 p refs Presented at Chem. Hydrogen Energy Systems Contracts Rev., Washington, D.C., 28 Nov. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2895; CONF-781142-4) Avail: NTIS HC A02/MF A01

Progress is reported in developing an efficient and economical thermochemical cycle for the production of hydrogen from water utilizing thermal energy sources that become available. Topics covered include: (1) continuing experiments in sulfate decomposition, sulfate formation, and hydrogen iodide electrolysis; (2) fusion-synfuel study (hydrogen); and (3) evaluation of thermochemical cycles. DOE

N80-12198# Oklahoma State Univ., Stillwater. Dept. of Chemistry.
CHARACTERIZATION OF COAL-DERIVED LIQUIDS AND OTHER FOSSIL FUEL RELATED MATERIALS EMPLOYING MASS SPECTROMETRY. MASS SPECTROMETRY AND FOSSIL-ENERGY CONVERSION TECHNOLOGY: A REVIEW
Quarterly Report, 30 Mar. - 29 Jun. 1978
S. E. Scheppele 1978 141 p
(FE-2537-7) Avail: NTIS HC A07/MF A01

The following activities in regard to the development of micromolecular probe distillation in combination with field-ionization mass spectrometry (FI/MS) for quantitative analysis are reported. The temperature-control module for the direct-introduction probe was received and successfully interfaced to both the probe and the NOVA 3/12. Both temperatures and FI/MS data were minicomputer acquired for probe distillation of a 19 component synthetic blend, an asphaltene-acid fraction, and the base fraction from an anthracene-oil sample. The acquired temperatures and FI/MS data for the 19 component blend were processed on the IBM 370/158 to obtain a quantitative distribution which is in excellent agreement with both the known composition and the one obtained from the FI/MS data acquired using the batch-inlet system for sample introduction. Development of algorithms for correlating the acquired temperatures with the acquired FI/MS data using the NOVA 3/12 and for preparing the correlated data for remote job entry to the IBM 370/158 were initiated. DOE

N80-12199# Institute of Gas Technology, Chicago, Ill.
STATUS OF THE PEATGAS PROCESS
D. V. Punwani 1978 30 p refs Presented at Syn. Pipeline Gas Symp., Chicago, 30 Oct. 1978
(Contract EX-76-C-01-2469)
(CONF-781045-3) Avail: NTIS HC A03/MF A01

PDU-scale tests were conducted to determine the effects of initial scale-up from the laboratory-scale equipment. The hydrogasification PDU represents a scale-up of about 250 times the laboratory-scale hydrogasifier. The tests in the laboratory-scale equipment were conducted with hydrogen and/or helium, whereas the tests in the PDU were conducted with hydrogen, steam-hydrogen, and synthesis gas. The PDU test results are in very good agreement with the results obtained in the laboratory-scale equipment. A mathematical model describing the kinetics was developed for the PEATGAS Process. A complete process design has been prepared for a preliminary base case for producing 250 x 10 to the ninth power Btu/day of SNG from the Minnesota peat (containing 50 percent moisture content). The plant thermal efficiency of this process is estimated to be 67 percent. Process economics for the completed base-case process design as well as several modified designs are evaluated. DOE

N80-12200# Institute of Gas Technology, Chicago, Ill.
HYGAS PROCESS UPDATE
W. G. Bair 1978 20 p refs Presented at Syn. Pipeline Gas Symp., Chicago, 30 Oct. 1978
(Contract EX-76-C-01-2434)
(CONF-781045-4) Avail: NTIS HC A02/MF A01

Nine tests with Illinois No. 6 Seam coal from the Peabody No. 10 mine were completed at 900 and 500 psig with char conversions reaching 90%, and sinter-free gasifier conditions were achieved at both pressure levels. Fines elutriation was studied and a method of identifying fines sources is being developed so that higher percentages of the char fed to the reactor can be gasified. In addition, the steam--oxygen distributor in the steam--oxygen gasifier zone of the reactor was successfully modified to improve the gasifier's ability to achieve high char conversions under sinter-free conditions. All of these activities and the data obtained through them contributed to improving the data base from which a successful commercial/demonstration plant can be designed. DOE

N80-12201# California Univ., Livermore. Lawrence Livermore Lab.
ENVIRONMENTAL ASPECTS OF ALTERNATIVE FUELS UTILIZATION FOR HIGHWAY VEHICLES
C. J. Anderson 25 Oct. 1978 16 p refs Presented at Environ. Control Symp., Washington, D.C., 28 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-81841; CONF-781109-22) Avail: NTIS HC A02/MF A01

Non-petroleum-derived transportation fuels being considered are derived from coal, oil shale, and biomass. The resultant synthetic liquid hydrocarbon fuels may or may not be identical to those derived from petroleum; the alcohols and hydrogen are certainly quite different. A number of environmental issues related to the alternative fuels utilization program are described as well as some of the various projects undertaken to resolve these issues. The accomplishments of these programs are emphasized (in some ways some of these fuels may be superior to existing fuels) and needs for further work are identified. DOE

N80-12202# Dynatech Corp., Cambridge, Mass.
COST ANALYSIS OF AQUATIC BIOMASS SYSTEMS
25 Jul. 1978 268 p refs
(Contract EG-77-C-01-4000)
(HCP/ET/4000-78/1) Avail: NTIS HC A12/MF A01

A cost analysis was conducted to provide the U.S. Department of Energy with engineering cost information on which to base decisions in the area of planning and executing research and development programs dealing with aquatic biomass as an alternative energy resource. Calculations show that several hundred 100 square mile aquatic biomass farms, the size selected for this analysis, would be needed to provide meaningful supplies of energy. It was found that the projections of costs for harvested open-ocean biomass, utilizing optimistic assumptions of scientific and engineering design parameters, appear to be above any practical costs to be considered for energy. One of the major limitations is due to the need to provide upwelled sub-surface water containing needed nutrients, for which pumping energy is required. It is concluded that large scale land-based aquatic biomass farms may merit development, but perhaps within a much narrower range than investigated. Aquatic plants which appear to have potential for development as an energy resource

are the so-called emersed plants, or angiosperms, including many types of freshwater weeds such as duckweed, Hydrilla, and water hyacinths. DOE

N80-12203# Department of Energy, Bartlesville, Okla.
COMPONENT RELATIONSHIPS WITHIN TWO-PHASE GASOLINE/METHANOL/WATER SYSTEMS
F. W. Cox Feb. 1979 52 p refs
(BETC/RI-78/6) Avail: NTIS HC A04/MF A01

Experimental data were derived from selected two-phase gasoline/methanol/water systems specifically to gain a better understanding of the phase relationships of these mixtures, to establish more firmly the severity of the phase-separation problem, and to devise a methodology applicable to future studies of gasoline/methanol blends for use as automotive fuels. Partition and mutual solubility relationships were then established from these data. The lower water-rich phase of a separated gasoline/methanol/water mixture is not usable as a fuel in current-production automobiles without engine adjustments. Generally speaking, increasing mixture temperature or adding the cosolvent, 1-hexanol, produces favorable equilibrium shifts for methanol and water by increasing their solubility in the upper gasoline-rich phase. Partition coefficient interrelationships offer a comparatively simple and reliable route to two-phase gasoline/methanol/water systems description. DOE

N80-12204# TRW, Inc., Redondo Beach, Calif.
ENVIRONMENTAL ASSESSMENT REPORT: LURGI COAL GASIFICATION SYSTEMS FOR SNG Final Report, May 1978 - Apr. 1979
M. Ghassemi, K. Crawford, and S. Quinlivan May 1979 344 p refs
(Contract EPA-68-02-2635)
(PB-298109/0; EPA-600/7-79-120) Avail: NTIS HC A15/MF A01 CSCL 21D

A compilation and analysis of data on the equipment and processes consituting the Lurgi Substitute Natural Gas (SNG) systems, the control/disposal alternatives for a media, the performance and cost of control alternatives, and present and proposed environmental requirements are presented. Data are provided on the characteristics of input materials, products, and waste streams associated with each process. Pollution control alternatives for air emissions, water effluents, solid wastes, and toxic substances in an integrated facility were examined for performance, costs, energy requirements, and ability to comply with current and anticipated environmental standards. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-12205 Institut Franco-Allemand de Recherches, St. Louis (France).
CONTRIBUTIONS TO BALLISTICS, DETONATIONS, AND PULSE PHYSICS [BEITRAEGE ZUR BALLISTIK, DETONATIONS- UND KURZZEITPHYSIK]
1979 280 p refs Partly in GERMAN, ENGLISH and FRENCH
(BMVG-FBWT-79-01) Copyright. Avail: Issuing Activity

The following papers are presented: detonation of Nitromethane-Al-NO2 mixtures, use of Hamiltonian quaternions for determining the translational and rotational motion of a projectile, miscellaneous topics in end ballistics, use of holography for kinetic energy measurements of target splinters, development of passive Doppler techniques in LRSL/ISL and their applications to ballistic and aerodynamic measurements, shock tube research to investigate the origin of Machwaves inside and outside supersonic jets, X-ray crystallographic analysis of the deformation of the crystalline structure of sodium chloride submitted to a shock wave compression, transient interactions of laser pulses with matter, experimental studies of laser induced detonation waves, and fanning spark discharges. For individual titles, see N80-12206 through N80-12215.

N80-12206 Institut Franco-Allemand de Recherches, St. Louis (France).
DETONATION OF NITROMETHANE-AL-NO2 MIXTURES c34
H. Moulard, C. Fauquignon, A. Lichtenberger, and J. M. Lombard *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 3-21 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

The internal and external detonation characteristics of nitromethane and aluminum powder mixtures were investigated. Nitrogen dioxide was added in order to vary the oxygen balance in the combustion reactions. The experimental results indicate the existence of a maximum detonation velocity in the vicinity of stochiometric compositions. A pressure drop associated with energy absorption due to the melting of the metal is also observed together with a subsequent progressive increase in pressure corresponding to the combustion of the metal. The kinetic energy released during the delayed aluminum combustion was determined from the expansion work of the reaction products. Author (ESA)

N80-12207 Institut Franco-Allemand de Recherches, St. Louis (France).
THE USE OF HAMILTONIAN QUATERNIONS FOR DETERMINING THE TRANSLATIONAL AND ROTATIONAL MOTION OF A PROJECTILE c64
V. Fleck *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 22-35 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
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Although Eulerian angles allow a good description of gyroscopic motion to be obtained, they are not the best fitted parameters for all problems. A system of differential equations is developed for determining the translational and rotational motion of a projectile with the aid of Hamiltonian quaternions. No singularities occur in the resulting system. An example is presented in which it is shown that the method proposed does not consume more computer time than the Eulerian method. Author (ESA)

N80-12208 Institut Franco-Allemand de Recherches, St. Louis (France).
MISCELLANEA CONCERNING TERMINAL BALLISTICS c37
G. Weihrauch, H. F. Lahr, and E. Wollmann *In its* Contrib. to Ballistics, Detonations, and Pulse Phys., 1979 p 36-110 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

Some terminal ballistic problems with kinetic energy penetrators are studied. Scaling rules, which permit the phenomena observed on a model to be transferred are examined. The dynamic compression of slender rods during impact on a rigid target is simulated numerically. A model is used in which the bar is treated as a linear chain of mass points. The dynamic plastic buckling of cylindrical projectiles is studied theoretically. Author (ESA)

N80-12209 Institut Franco-Allemand de Recherches, St. Louis (France).
THE USE OF HOLOGRAPHY FOR KINETIC ENERGY MEASUREMENTS OF TARGET SPLINTERS c35
H. Royer and M. Giraud *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 110-121 refs (For primary document see N80-12205 03-31)
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The residual energy of high kinetic energy projectiles perforating armored targets is discussed. Two holograms are recorded at suitable times after the projectile impact. The image reconstruction of individual fragments from both holograms enables their velocities and three dimensional trajectories to be determined. The fragments collected are identified from their holographic images, and their kinetic energies are determined after weighing. Author (ESA)

N80-12210 Institut Franco-Allemand de Recherches, St. Louis (France).
THE DEVELOPMENT OF PASSIVE DOPPLER TECHNIQUES IN LRSL/ISL AND THEIR APPLICATIONS TO BALLISTIC

AND AERODYNAMIC MEASUREMENTS c35
B. Koch *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 122-166 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

A concise review of the historical and logical stages in the development of passive CW Doppler interferometer instrumentation for velocity and continuous space time measurements together with applications to ballistic and aerodynamic problems is presented. The extensive use of CW gas lasers, and their application in instruments such as the laser-Doppler-anemometer for aerodynamic flow research are discussed. Examples are given. Author (ESA)

N80-12211 Institut Franco-Allemand de Recherches, St. Louis (France).
SHOCK TUBE RESEARCH LOOKING AT THE ORIGIN OF THE MACHWAVES INSIDE AND OUTSIDE SUPERSONIC JETS c02
H. Oertel *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 167-208 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

The kinematics and dynamics of Machwaves within the near field noise of supersonic jets were investigated. New optical techniques (system incorporating a differential interferometer), which revealed the existence of two families of regular Machwaves outside the jet together with two such families inside the jet, are described. The families accompany coherent structures of the jet boundary layer propagation downstream at three preferential speeds. These speeds are calculated with simple formulas. Shock compressions and shock distances measured using an optical microphone outside the jet are approximated by simple formulas. A suitable gas envelope which will suppress the Machwaves was confirmed experimentally. Author (ESA)

N80-12212 Institut Franco-Allemand de Recherches, St. Louis (France).
ANALYSIS OF THE STRUCTURE DEFORMATION OF SODIUM CHLORIDE SUBMITTED BY A SHOCK WAVE c76
F. Jamet and F. Bauer *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 209-226 refs In FRENCH; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

The experimental procedure used to obtain quantitative data on crystal deformation is described. Experiments in which molybdenum K alpha radiation was reflected from (200) lattice planes demonstrated that the deformation resulting from an incident plane wave is one dimensional for pressures exceeding the Hugoniot elastic limit (0.028 GPa in the (100) direction). It is thus concluded that the isotropic compression model is not suitable to explain behaviors observed with shock pressures in the 0.3 to 1 GPa range, where crystal behavior is plastic. Author (ESA)

N80-12213 Institut Franco-Allemand de Recherches, St. Louis (France).
TRANSIENT INTERACTIONS OF LASER PULSES WITH MATTER c36
K. Daree *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 227-241 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

Possible fusion energy application has incited work on laser generated plasmas. Discontinuous and arbitrary transient gasdynamic processes are discussed together with their applications to laser induced detonations. The mechanisms involved in this phenomenon are explained. The corresponding numerical calculation methods are presented. The pressure exerted on a target is shown to be highly dependent on the temporal shape of the laser pulse. The effects of different pressures, intensities, and pulse durations are investigated. The specific case of an aluminum target is studied. Author (ESA)

N80-12214 Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL STUDIES OF LASER INDUCED DETONATION WAVES c36
M. Hugenschmidt and K. Vollrath *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 242-259 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
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The interaction of CO2 laser pulses with metals (copper) is studied together with the resulting optically induced detonation waves (expansion properties, reflectivity and absorption). Measurements were performed at power densities up to 10 sup(9) W/sq cm in air under normal conditions and at reduced pressures as low as 0.1 torr. Cinematographically measured expansion versus time curves of waves and thermodynamic calculations were used to evaluate state parameters in the shock front. Initial pressures up to several kbars and internal specific energies of 10 sup(8) j/g were determined in this way. Author (ESA)

N80-12215 Institut Franco-Allemand de Recherches, St Louis (France).
FANNING OF SPARK DISCHARGES c33
M. Schwertl and A. Stenzel *In its* Contrib. to Ballistics, Detonations, and Pulse Phys 1979 p 260-268 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
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High intensity, short pulse duration light sources have important applications in high-speed photography. A favorable ratio between these two parameters can be achieved by splitting a high current discharge into a large number of individual channels. Tests were carried out on radially symmetric and cylindrical discharges with various discharge condenser voltages and discharge conductivities. It was shown that fanned discharges enable photographs to be taken of high velocity objects (even in reflected light) with negligible blurring. Author (ESA)

N80-12216 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
SPACE COMMUNICATIONS
Mar. 1979 321 p refs Proc. of Symp. on Advanced Satellite Commun. Sys., Genoa, 14-16 Dec. 1977 Original contains color illustrations
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The state of the art in space communications is presented. On-board message switching and signal processing, space antennas (such as Intelstat 5 spot beam antennas), and the more general subject of redundancy reduction in voice and video signals are among the top covered. For individual titles, see N80-12217 through N80-12235.

N80-12217 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
RELIABILITY PERFORMANCES OF SYSTEMS WITH A SWITCHING MATRIX c33
C. DallOlio *In its* Space Commun. Mar. 1979 p 21-58 refs Submitted for publication (For primary document see N80-12216 03-31)
(Contract ESTEC-2872/76/NL-AK(SC))
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A satellite model with an onboard switching matrix is examined in order to improve system reliability. An analytic method is used to predict the reliability of a satellite model with and without a switching matrix between receiving and transmitting equipment. It is concluded that the use of a switching matrix allows an increase in the complexity of transreceiving blocks and a reduction in the number of redundant units, which implies a mass and complexity reduction also for switching matrices on antenna ports. Author (ESA)

N80-12218 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
PERFORMANCE AND IMPAIRMENTS IN A QPSK SATELLITE TO GROUND LINK c32
P. Amadesi, L. Moreno, and M. SantAgostino *In its* Space Commun. Mar. 1979 p 59-107 refs Sponsored by ESA Submitted for publication (For primary document see N80-12216 03-31)
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The problems of satellite to ground transmission are discussed

with particular reference to factors that degrade the transmission quality. The use of four-phase coherent phase shift keying modulation with a very close spacing of the RF channels is assumed. The choice of the transmitter and receiver filters is examined in order to minimize the combined effects of intersymbol and adjacent channel interference. The effects of additional degradation factors are presented, including switching time of the RF modulator diodes, nonlinear behavior of the high power transmitter amplifier. A sample budget of the overall carrier-to-noise degradation is presented for typical satellite configurations. Author (ESA)

N80-12219 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

SYNCHRONIZATION PROCEDURES FOR A REGENERATIVE SS-TDMA SYSTEM **c32**

D. DiPino and R. Preti *In its* Space Commun. Mar. 1979 p 109-124 refs Submitted for publication (For primary document see N80-12216 03-31)

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A model of a regenerative, multi-spot, satellite-switched TDMA was developed in order to examine synchronization problems mainly caused by the nonapplicability of current low-level techniques (inhibited by a regenerative device) and the lack of transparency of the spatial segment in the network. The basic choices from which a self-consistent synchronization procedure can be derived are discussed, the functional structure of an onboard switching matrix is presented, and the functions to be performed both by the satellite and the ground station devices are indicated. It is shown that the synchronization problems related to an SS-TDMA can be solved more easily when employing a regenerative device for the repeaters. A synchronization method is described which eliminates the need of heavy data buffering. Author (ESA)

N80-12220 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

THE TELECOMMUNICATION SATELLITE AS AN INTEGRATED TIME DIVISION TRANSMISSION-SWITCHING SYSTEM **c32**

A. deFlammineis and A. Loffreda *In its* Space Commun. Mar. 1979 p 125-134 refs Repr. from IEE Conf. Digital Satellite Commun., Publ. 59 Sponsored by Intern. Telecommun. Satellite Consortium (INTELSAT) (For primary document see N80-12216 03-31)

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The best exploitation of facilities offered by satellite communications and several operational modes are discussed. Facets of the system operation considered include reliability, feasibility, survivability, traffic characteristics, and adequacy to existing installations. Combinations of operational modes, such as preassigned modes with slowly patched or conditionally selected, or variable, or fully variable, destination circuits, can also result in convenient application, depending on local characteristics. It is also shown that the satellite system, being assimilated by an integrated time division transmitting-switching system adopted by different stations insisting on the same transponder, must have operational modes which are compatible with each other; signalling and burst reallocation procedures, in particular, must be the same. Author (ESA)

N80-12221 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

TRAFFIC SIMULATION IN A TELEPHONE NETWORK VIA SATELLITE WITH PREASSIGNED AND DEMAND ASSIGNED CIRCUITS **c32**

F. Manucci and A. Tonietta *In its* Space Commun. Mar. 1979 p 135-144 refs Repr. from IEE Conf. Digital Satellite Commun., Publ. 59 Sponsored by Intern. Telecommun. Satellite Consortium (INTELSAT) (For primary document see N80-12216 03-31)

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An evaluation of statistical network performance was done by means of computerized simulation, analyzing the relative Markov chains in discrete time and comparing them with results of an analytical method based on a two-parameter traffic model. The application of both methods to a model with real dimension (network having two subsequent choices with preassigned first routing and fully variable alternate routing circuits) shows similar results, except for the call and time congestion encountered on access terrestrial links. These discrepancies are interpreted as lack of accuracy displayed by the analytic method. Author (ESA)

N80-12222 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

AN APPROACH TO BLOCKED APERTURE SYNTHESIS **c32**

P. Bielli and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 183-186 refs Presented at European 77, Venice, May 1977 (For primary document see N80-12216 03-31)

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Various aspects of blockage effects on the performance of Cassegrain antennas are discussed. Very simple expressions found for calculating the influence of the blocked parts on the antenna efficiency with respect to the aperture illumination functions are given. The behavior of the side lobe levels versus the struts and subreflector dimensions appears from several plots. The reported results make it possible to synthesize, using only a desk-top computer, a ground station Cassegrain antenna which has the characteristics of having the blocked aperture efficiency as high as possible and the first lobe levels bounded within fixed values. Author (ESA)

N80-12223 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

ANALYSIS AND SYNTHESIS OF CORRUGATED CONICAL HORNS **c32**

P. Bielli, Salvatore DePadova, and E. Pagana *In its* Space Commun. Mar. 1979 p 195-200 refs Presented at 6th European Microwave Conf., Rome, Sep. 1976 (For primary document see N80-12216 03-31)

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The characteristics of corrugated conical horns, radiating the balanced hybrid mode HE11 are summarized in a number of linear curves giving the beam width at different levels versus the horn flare angle and versus the radius of the horn aperture, normalized to the wavelength. Moreover, the feed horn performance for single or double reflector antennas is analyzed and curves are presented for the antenna illumination efficiency (aperture efficiency by spillover efficiency) versus other parameters. All the curves reported are useful basis for antenna design and give a fast and accurate solution to the problem of synthesis of a corrugated conical horn with a specified amplitude radiation pattern and synthesis of a corrugated conical horn as a function of the antenna illumination efficiency. Author (ESA)

N80-12224 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

A METHOD FOR COMPUTING CORRUGATED HORNS PHASE CENTER **c32**

P. Bielli, E. Pagana, and G. Rosenga *In its* Space Commun. Mar. 1979 p 201-206 refs (For primary document see N80-12216 03-31)

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Corrugated feed horns are often required to offer a phase radiation pattern as flat as possible within the feeding angle subtended by the reflector edge. A method for phase-center computation was developed which complies with this requirement. The phase center and the phase radiation patterns obtained were compared with experimental measurements. Variations of phase-center positions with horn geometrical parameters, observation distance, and wavelength are plotted for several corrugated horns which can be considered as typical feeds for Cassegrain antennas. Author (ESA)

N80-12225 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

ANALYSIS AND SYNTHESIS OF AN ELLIPTICAL PARABOLOID OFFSET REFLECTOR ANTENNA. AN ELLIPTICALLY SHAPED BEAM ANTENNA **c32**

Salvatore DePadova, Enrico Pagana, and Giorgio Rosenga *In its* Space Commun. Mar. 1979 p 207-210 refs Repr. from Antennas and Propagation, 15-19 May 1978 p 381 (For primary document see N80-12216 03-31)

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A method to design an elliptically shaped beam antenna

characterized by a particular type of reflector is presented. The main advantages of such a configuration are an easier mechanical realization; the possibility of varying the main beam cross section for a given feed system by simply operating on the range of variation of the reflector foci; a simplification in the reflector design due to the feasibility offered by a graphical and analytical representation of the relationship between the main beam ellipticity and the paraboloid ellipticity; and the possibility of designing multibeam antennas characterized by different given ellipticities for each beam. Author (ESA)

N80-12226 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

ANALYTICAL AND GRAPHICAL METHODS FOR THE DESIGN OF AN ELLIPTICALLY SHAPED BEAM ANTENNA WITH ELLIPTICAL PARABOLOID REFLECTOR c32

Salvatore DePadova, E. Pagana, and G. Rosenga *In its* Space Commun. Mar. 1979 p 211-215 refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. - Sep. 1978 (For primary document see N80-12216 03-31)

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A study of an antenna having an elliptically shaped main beam is presented. The geometry of the reflector has led to the antenna being called an elliptical paraboloid reflector antenna. The reported results refer to the offset configuration. General graphical or analytical laws to simplify a first approximation synthesis of this antenna are discussed. Curves of the efficiency, ellipticity, and cross levels versus a normalized variable are plotted. This variable is strictly related to the maximum phase error on the aperture edge. Author (ESA)

N80-12227 Centro Studi e Laboratori Telecdmunicazioni, Turin (Italy).

AN ELLIPTICALLY SHAPED BEAM ANTENNA c32

Salvatore DePadova, Enrico Pagana, and Giorgio Rosenga *In its* Space Commun. Mar. 1979 p 229-234 refs Presented at European Microwave Conf., Paris, Sep. 1978 (For primary document see N80-12216 03-31)

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A reflector antenna having a shaped main beam with elliptical cross section was developed in order to save power and avoid interference in satellite communications. In many cases an elliptical contour is required. Often the methods used to design a shaped main beam antenna are based on the geometrical optics theory which, as known, is not completely valid at microwave frequencies. An extensive analysis of an elliptically shaped beam antenna is reported. The peculiarity of this antenna is the shape of the reflector which is an elliptical paraboloid. The geometry of the reflector has led to the antenna being called an 'elliptical paraboloid reflector antenna'. For this antenna general curves are presented which allow a very fast and accurate design. Author (ESA)

N80-12228 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

REFLECTOR ANTENNAS WITH HIGH EFFICIENCY AND LOW DEPOLARIZATION c32

P. Bielli and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 235-238 refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. - Sep. 1978 (For primary document see N80-12216 03-31)

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Compensation of the feed cross polar fields by means of the whole reflecting surface was carried out by making the integral of the elements which give the cross polar pattern zero. Then the set of feed and reflector parameters were optimized. The cross polarization due to the feed cancelled the cross polarization due to the reflector curvature. Several feed horns were considered and a comparison is made on the basis of antenna efficiency, depolarization, and bandwidth. Author (ESA)

N80-12229 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

SOME CONSIDERATIONS ABOUT SKY NOISE TEMPERATURE AT FREQUENCIES ABOVE 10GHz c32

E. D. Damasso and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 239-247 refs Repr. from Alta Frequenza, v. 65, no. 2, 1976 p 98-10E-106-18E (For primary document see N80-12216 03-31)

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Estimation criteria of sky noise temperature as related to elevation angle are presented for frequencies between 11 and 18 GHz. In particular, in the case of clear sky conditions, some relationships for estimating noise temperature as related to elevation angle are given in which only the knowledge of ground absolute humidity is required. The noise contribution due to atmospheric precipitation is computed from rain attenuation and corresponding kinetic temperature knowledge (between 260 and 280 K). Procedures to evaluate the angular dependence of the attenuation exceeded for time percentage of 0.17 or 0.01% (on a yearly basis) are given. Attenuation values can be obtained for a given elevation angle if the attenuation at other angles is known. Author (ESA)

N80-12230 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

BIT RATE REDUCTION BY AUTOMATIC ADAPTATION OF QUANTIZER STEP-SIZE IN DPCM SYSTEMS c32

Paolo Castellino, Giulio Modena, Luciano Nebbia, and Carlo Scagliola *In its* Space Commun. Mar. 1979 p 257-263 refs Repr. from CSELT Rappt. Tec., no. 2, Sep. 1974 (For primary document see N80-12216 03-31)

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A Differential Pulse Code Modulation (DPCM) system with adaptative quantization is described. Theoretical considerations on the optimum parameters that determine the quantizer adaptation in order to minimize the quantizing noise are developed. The performances of a 32 kbit/sec computer simulation of such a system are shown and the particular type of output quantizing noise examined. Attention is devoted to subjective evaluation of the output quality, even in the presence of channel errors. It is concluded that the DPCM system, at a 32 kbit/sec rate is subjectively comparable with a 64 kbit/sec log-PCM system for the whole range of real telephone speech signals. Author (ESA)

N80-12231 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

AN ADAPTIVE QUANTIZER WITH CHANNEL ERROR RECOVERY c32

Carlo Scagliola *In its* Space Commun. Mar. 1979 p 265-272 refs Repr. from CSELT Rappt. Tec., no. 4, Dec. 1976 (For primary document see N80-12216 03-31)

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Adaptation schemes of the quantizer characteristic in digital transmission of signals were proposed in which the range scale of the quantizer is controlled by the output codeword sequence so that the relevant information does not need to be transmitted. These schemes are, however, sensitive to channel errors; in fact, a transmission error may cause a multiplicative offset between the level at the receiver and at the transmitter, which in theory, will never be recovered. In order to eliminate this effect an adaptation algorithm of the quantizer step-size was developed which is robust to channel errors in that their effect diminishes with time. After a description of the algorithm, with a proof of the convergence to zero of the deviation between the levels at the receiver and at the transmitter, system performance in terms of signal-to-noise ratio are evaluated as a function of the input level in an error-free situation. In the last section a numerical evaluation of the time needed by the system to forget the effect of the errors is carried out. Author (ESA)

N80-12232 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

DESIGN OF INSTANTANEOUSLY COMPANDED DELTA MODULATORS WITH M-BIT MEMORY c33

Paolo Castellino and Carlo Scagliola *In its* Space Commun. Mar. 1979 p 273-276 refs Presented at IEEE Intern. Conf. on Acoustics, Speech and Signal Process, 1977 (For primary document see N80-12216 03-31)

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Starting from simple observations on ideal waveform tracking, a learning algorithm is given, which permits the calculation of values of the multipliers for any bit sequence length which are tailored to the statistical properties of the signal used in the learning stage. This algorithm automatically takes into account

even the particular predictor used in the delta feedback loop. The multiplier design is exploited for speech signals in various circuit conditions such as clock rate, predictor complexity and length of the bit sequence. The modulator performances are evaluated also as a function of the input signal level.

Author (ESA)

N80-12233 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

EVALUATION OF ADAPTIVE SPEECH CODERS UNDER NOISY CHANNEL CONDITIONS **c32**

Carlo Scagliola *In its* Space Commun. Mar. 1979 p 277-281 refs Repr. from ICC Conf. Record, v. 1, 4-7 Jun. 1978 p 8.1.1-8.1.5 (For primary document see N80-12216 03-31)
(Contract CH1350-8/78/0000-0037)
Copyright. Avail: Issuing Activity

The results of an experiment in which the digital transmission of speech coded by adaptive differential pulse code modulation was simulated under noisy channel conditions are presented. Subjective quality judgements and a number of objective performance measures were collected. The influence of various design parameters on speech quality under noisy channel conditions is discussed. Overall subjective quality is well predicted by the combination of an objective performance measure that disregards any effect of level mismatching due to the sensitivity of the adaptation algorithm to channel errors and a measure of the level mismatching itself. The best prediction scores are achieved by three objective performance measures: two level-compensated signal to noise ratios and a spectral signal to distortion ratio.

Author (ESA)

N80-12234 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

AN ADAPTIVE DELTA MODULATOR ROBUST TO TRANSMISSION ERRORS **c32**

Paolo Castellino *In its* Space Commun. Mar. 1979 p 283-287 refs Presented at 4th Intern. Conf. on Digital Satellite Commun., Montreal, Oct. 1978 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

A technique is described suitable to make a fully digital adaptive delta modulator robust to channel error rates even higher than those of a satellite link. It is shown that the addition of a bias term into the adaptation algorithm makes the two step-sizes at the transmitter and at the receiver converge after a channel error. The step-size adapter parameters are obtained by a compromise between the convergence time and the idle-channel; in fact both are increasing funtions of the bias term. Results of simulations at 32 kbit/sec are given in terms of signal to noise ratio. The halving time of the relative deviation between the transmitter and receiver step-sizes is given as an index of the validity of the algorithm. Finally the error recovery time is defined and experimentally measured.

Author (ESA)

N80-12235 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

TRANSFORM CODING OF PAL COMPOSITE SIGNALS **c32**

L. Chiariglione, M. Guglielmo, and Sciarappa *In its* Space Commun. Mar. 1979 p 289-312 refs Submitted for publication (For primary document see N80-12216 03-31)
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Investigations were carried out on the coding of PAL composite signals. The analog signal is sampled at a frequency just above Nyquist's, which can be derived in an easy way from the fundamental frequencies of the PAL system and is such as to ensure the formation of an orderly grating of sampler. The statistical properties of the sampled signal were derived and suitable transformations well matched to the signal statistics were employed. The differential pulse code modulation coding on the DFT coefficients of line blocks was investigated and a prediction algorithm was developed which can be applied on temporally successive lines. Two and three dimensional block transformations were also considered with artifices to lessen block visibility at low numbers of bits/pel.

Author (ESA)

N80-12236# California Inst. of Tech., Pasadena.

LEADING EDGE FLUTTER OF SUPERCAVITATING HYDROFOILS Final Report

C. Brennen, K. Oey, and C. D. Babcock May 1979 85 p refs (Contract N00014-75-C-0379; SR0230101)
(AD-A073382; ENG-216-1) Avail: NTIS HC A05/MF A01 CSCL 13/10

This document represents the results of experiments and analysis of the phenomenon of leading edge flutter which has been observed to occur for supercavitating hydrofoils. The experiments confirmed the existence of such a single degree of freedom flutter involving chordwise bending and indicated that for long, natural (or vapor-filled) cavities the reduced flutter speed U sub F/omega sub FC was in the range 0.15 to 0.23. Secondary effects observed were the variation with the angle of attached (a minimum flutter speed occurred at 10 deg) and with a foil mass ratio. Shorter cavities typically yielded lower flutter speeds due to a complex interaction between the bubble collapse process occurring in the cavity closure region and the unsteady hydrodynamic load on the foil. Finally, a relatively simple theoretical analysis for supercavitating hydrofoils with elastic axes aft of mid-chord is presented. This linear analysis yields reduced flutter velocities somewhat lower than those observed.

GRA

N80-12237# Sydney Univ. (Australia). Civil Engineering Labs.

REINFORCEMENT TO CONTROL THERMAL AND SHRINKAGE CRACKING

D. Campbell-Allen and G. W. Hughes Nov. 1978 37 p refs (PB-298412/8; R-334) Avail: NTIS HC A03/MF A01 CSCL 13C

A theory was developed based on the 'bond-slip' mechanism to calculate the quantity of reinforcement required to satisfactorily distribute thermal and shrinkage cracking. A study of published experimental results and field measurements and the results of a laboratory test program confirm that this theory is a reasonable description of observed cracking behavior. A survey of the provisions of current design codes shows that the quantity of shrinkage and temperature reinforcement, currently specified, is totally inadequate for the range of thermal and shrinkage strains normally experienced in Australia. A method of calculating the required quantity of reinforcement is expressed in a format suitable for inclusion in a design code.

GRA

N80-12238# Sydney Univ. (Australia).

RECENT CONCEPTS: THEIR INFLUENCE ON CODE PREDICTIONS OF SHRINKAGE AND CREEP

H. Roper and G. Bott Apr. 1979 29 p refs
(PB-298413/6; R-343) Avail: NTIS HC A03/MF A01 CSCL 13C

The mechanisms of creep and shrinkage of concrete, in particular activation energy and the rate of flow concepts as applied to creep, are studied. Creep predictions using various codes (AS1481, NAASRA, CEB-FIP 1970 and 1978) are compared with Australian data. The derivation of the code values is discussed and it is recommended that improvements to the AS1481 predictions for creep be considered.

GRA

N80-12239# Sydney Univ. (Australia). Civil Engineering Labs.

THE EFFECTS OF FREESTREAM TURBULENCE ON THE GALLOPING BEHAVIOUR OF A SQUARE TOWER

K. C. S. Kwok and W. H. Melbourne Dec. 1978 43 p refs (PB-298744/4; R-338) Avail: NTIS HC A03/MF A01 CSCL 13M

It is also shown that the fine scale turbulence produced by a thin rod upstream of the stagnation streamline of the tower is sufficient to increase turbulence mixing in the separated shear layers, increase the rate of entrainment from the wake, and decrease the radius of curvature of the shear layers. These effects significantly alter the transverse force characteristic and hence the galloping behavior of the tower.

GRA

N80-12240# Rensselaer Polytechnic Inst., Troy, N. Y.

SEISMIC VULNERABILITY, BEHAVIOR AND DESIGN OF BURIED PIPELINES, PHASE 1 Final Report

Leon Ru-Liang Wang, Michael J. ORourke, and Richard R. Pikul Mar. 1979 148 p refs
(Grants NSF PFR-76-14884; NSF ENV-76-14884)
(PB-298269/2; NSF/RA-790093; TR-9) Avail: NTIS

HC A07/MF A01 CSCL 13K

The seismic damage and response behavior of general buried pipelines is presented and vulnerability evaluation and design criterion of buried simple piping systems are described. The investigation focuses on the simplified analysis' and quasi static analysis' approaches for determining the axial strains and relative joint displacements and rotations due to seismic shaking. To verify the assumptions and limitations in the analyses, the ground motion characteristics of the San Fernando earthquake and related soil parameters are studied in detail. To evaluate the seismic vulnerability design of simple buried piping systems, a seismic risk analysis using data for Albany, New York is performed, and a failure criterion for buried water pipes is proposed. GRA

N80-12241# California Univ., Richmond. Earthquake Engineering Research Center.

A MATHEMATICAL MODEL OF MASONRY FOR PREDICTING ITS LINEAR SEISMIC RESPONSE CHARACTERISTICS

Yalcin Mengi and Hugh D. McNiven Feb. 1979 115 p refs (Grants NSF ENV-76-04265; NATO-1446)
(PB-298266/8; UCB/EERC-79/04; NSF/RA-790069) Avail: NTIS HC A06/MF A01 CSCL 13M

A mathematical model for masonry was developed which can be used to derive the elastic stress field, in a wall or pier, when either is subjected to seismic loads. Because masonry is made of two materials, and because its geometry is so complicated, it was necessary, in studying stress fields that could arise, to replace the composite material by a homogeneous one. The model was appraised by comparing the responses predicted by the model for a transient input with those observed experimentally. GRA

N80-12242# National Bureau of Standards, Washington, D.C.

DIMENSIONS/NBS, VOLUME 63, NO. 7/8 Monthly Report, Jul. - Aug. 1979

Aug. 1979 33 p
(PB-298372/4; NBS-DIM-63-7-8) Avail: NTIS HC A03/MF A01 CSCL 14B

Summaries of major technical developments and highlights of work in progress are presented along with a listing of current publications. GRA

N80-12243# California Univ., Richmond. Earthquake Engineering Research Center.

ANALYTICAL PROCEDURES IN SOIL DYNAMICS

John Lysmer Dec. 1978 101 p refs Presented at the ASCE Geotechnical Eng. Div. Specialty Conf. on Earthquake Eng. and Soil Dyn., Pasadena, Calif. 19-21 Jun. 1978
(PB-298445/8; UCB/EERC-78/29) Avail: NTIS HC A06/MF A01 CSCL 08M

The state-of-the-art of soil dynamics analysis is reviewed. A classification system is suggested for soil dynamics response problems and a discussion is given of current abilities and future possibilities for solving different types of problems. Special attention is given to the possibilities for nonlinear and effective stress analysis of seismic problems. Major topics discussed are: foundation vibrations, pile vibrations, seismic site response problems, and soil-structure interaction. GRA

N80-12244# Transportation Research Board, Washington, D.C.

STABILIZATION AND COMPACTION

L. Raad (Illinois University -Urbana), C. L. Monismith (Calif. Univ., Berkeley), J. K. Mitchell (Calif. Univ., Berkeley), R. M. Quigley (University of Western Ontario, London), L. R. DiNardo (University of Western Ontario, London), Alfreds R. Jumikis (Rutgers Univ., New Brunswick, N. J.), Dirk J. A. vanZyl (Purdue Univ.), L. E. Wood (Purdue Univ.), C. W. Lovell (Purdue Univ.), and W. J. Sisiliano (Indiana State Highway Comm.) 1978 44 p refs
(PB-298935/8; TRB/TRR-690; ISBN-0-309-02836-1; LC-79-17962) Avail: NTIS HC A03/MF A01 CSCL 13B

Seven papers are presented which deal with the following areas: crack propagation in soil-cement bases subjected to repeated wheel loads; clay mineral weathering controls on lime and cement stabilization of southwestern Ontario clay borrow (abridgment); pressure-grouted soil anchors; storge, retrieval, and analysis of compacted shale data; the use of indicative properties to predict the density-moisture relationship of soils; specifying soil compaction; and base-course gravel compaction control by the comprimeter. GRA

N80-12245# Transportation Research Board, Washington, D.C.

RELATIONSHIP OF ASPHALT CEMENT PROPERTIES TO PAVEMENT DURABILITY Final Report

Jun. 1979 51 p refs Sponsored in part by Federal Highway Administration and American Association of State Highway and Transportation Officials
(PB-298833/5; TRB/NCHRP/SYN-59; ISBN-0-309-02911-2; LC-79-65727; ISSN-0547-5570) Avail: NTIS MF A01; HC $5.60, Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

Detailed information is presented on how various properties of asphalt cement influence pavement performance. In recent years, apparent changes have evolved in the physical properties of asphalt cements used in pavement construction. Some of these properties are not controlled or are controlled only partially by AASHTO specifications. All available information is reviewed relating durability and performance of asphaltic concrete mixtures to the properties of asphalt cement. Recommendations for improved test procedures and criteria are included. It is concluded that hardness of the asphalt is the property most important to pavement performance. GRA

N80-12246# Transportation Research Board, Washington, D.C.

FAILURE AND REPAIR OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENT Final Report

Jul. 1979 50 p refs Sponsored in part by Federal Highway Administration and American Association of State Highway and Transportation Officials
(PB-298832/7; TRB/NCHRP/SYN-60; ISBN-0-309-02913-9; LC-79-66364; ISSN-0547-5570) Avail: NTIS MF A01; HC $5.60, Transportation Research Board, 2101 Constitution Ave., NW, Washington, D. C. 20418 CSCL 13B

Detailed information is presented on maintenance and repair techniques currently used for continuously reinforced concrete pavement (CRCP). The performance of CRCP has revealed a number of failure modes that are traceable to design, construction, materials, and maintenance deficiencies and such other factors as environmental conditions and traffic loadings. A review of the cumulative experiences of states that have constructed and maintained CRCP is included. Guidelines for repair techniques are included, and areas of needed research are identified. GRA

N80-12247# Transportation Research Board, Washington, D.C.

DURABILITY OF CONCRETE BRIDGE DECKS Final Report

May 1979 69 p refs Sponsored in part by Federal Highway Administration and American Association of State Highway and Transportation Officials
(PB-298829/3; TRB/NCHRP/SYN-57; LC-79-64881; ISSN-0547-5570) Avail: NTIS MF A01; HC $6.00, Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

Detailed information is presented on the causes, prevention, evaluation, and rehabilitation of deck deterioration related to corrosion of steel reinforcement. It was reported in 1978 that nearly one-third of all highway bridge decks in the United States are seriously deteriorated due to corrosion of reinforcing steel. The cost of restoring these decks has been estimated at $6.3 billion. Virtually all protective systems currently in use to prevent corrosion of bridge deck reinforcing steel were developed following publication of Synthesis 4. In addition, methods of evaluation and rehabilitation have changed significantly since then. The current synthesis is, therefore, intended to supplement the earlier effort. The design and construction techniques currently in use to prevent deterioration of new bridge decks and also the evaluation and rehabilitation techniques in use to extend the service life of existing decks are reviewed. Recommendations are included for research needs related to bridge deck durability. GRA

N80-12248# Sydney Univ. (Australia).

LARGE DEFLECTION ANALYSIS OF PORTAL FRAMES

R. Q. Bridge Oct. 1978 25 p refs
(PB-298741/0; R-331) Avail: NTIS HC A02/MF A01 CSCL 13B

A numerical method is described for the second order, in-plane analysis of portal-type, steel, industrial frames accounting for both non-linear geometrical and material responses. Although primarily designed for determining the ultimate strength of frames, the same method can be used to predict the critical elastic frame buckling loads for any axial load configuration. Comparisons with results from tests on frames have confirmed the accuracy of the method. The method is well suited to minicomputer application as it is simple and makes no great demands on storage, the most complex operation being the inversion of 3x3 array. GRA

N80-12249# Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
PERFORMANCE OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENT IN ILLINOIS Interim Report, 1976 - 1977
Scott A. LaCourisere, Michael I. Darter, and Scott A. Smiley Dec. 1978 149 p Sponsored in part by Ill. State Dept. of Transportation, Springfield
(PB-298495/3; UIUC/ENG-77-2018; TE-Ser-20; FHWA/IL/UI-172) Avail: NTIS HC A07/MF A01 CSCL 13B

A study of the performance of continuously reinforced concrete pavement (CRCP) constructed on the interstate highway system in Illinois was conducted. The types, severities, amounts, and causes of distress were determined. Distress found included edge punchouts, steel ruptures, 'D' cracking, blowups, construction joint failures, lug rotation, longitudinal cracking, distress related to construction problems, pumping, and shoulder deterioration. Heavy truck loads, excess free moisture, deicing salts, construction practice and poor aggregate quality in the CRCP slab were the major factors causing distress. GRA

N80-12250# Purdue Univ., Lafayette, Ind. Joint Highway Research Project.
PERFORMANCE OF BURIED FLEXIBLE CONDUITS Interim Report
G. A. Leonards and R. A. Stetkar 12 Dec. 1978 111 p refs Sponsored in part by Ind. State Highway Commission, Indianapolis
(PB-298224/7; JHRP-78-24; FHWA/RD-79-S0873) Avail: NTIS HC A06/MF A01 CSCL 13B

An extensive review was made of the performance of buried flexible culverts, with special emphasis on buckling failure modes. All known theories on elastic buckling of rings and cylinders with radial support subjected to external radial pressures were analyzed and compared with each other, and with the results of controlled experiments on small and full-scale culverts. Some relevant field measurements were also investigated. The significant results are presented. GRA

N80-12251# Kansas Dept. of Transportation, Topeka. Planning and Development Dept.
AN EVAPO-TRANSMISSION METHOD FOR DETERMINING RELATIVE PERMEABILITY OF CONCRETE Interim Report, Jan. 1976 - Mar. 1979
Garrett L. Morrison, William J. Gilliland, John E. Bukovatz, G. P. Jayaprakash, and Richard D. Seitz Apr. 1979 43 p refs
(PB-298323/7; FHWA/KS-79/1) Avail: NTIS HC A03/MF A01 CSCL 13C

A simple and inexpensive procedure was developed to determine the 'relative permeability' of concrete. A capillary tube was attached to a wet cell to measure drawdown. Both the capillary and the wet cell were filled with distilled water. A desiccant, anhydrous magnesium perchlorate, is put in the dry cell to provide 0% relative humidity. Differences in relative humidity between sides of the test sample provided the driving force for water or water vapor movement. Under the influence of this force, water was transmitted through the test slab from the wet side toward the dry side where it evaporates. 'Evapo-transmission' was measured instead of true permeability. GRA

N80-12252# National Bureau of Standards, Washington, D.C. Office of Nondestructive Evaluation.
A COMPARISON OF AMERICAN AND EUROPEAN ULTRASONIC TESTING STANDARDS
Sam Golan Aug. 1979 74 p refs
(PB-298809/5; NBSIR-79-1790) Avail: NTIS HC A04/MF A01 CSCL 14B

The twenty-seven general ultrasonic standards from eleven countries and international organizations were reviewed. Thirty-seven ultrasonic product standards from five countries were studied to evaluate the utilization of the general ultrasonic standards, i.e., to what the procedures outlined in the general standards are applied by the product standards. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N80-12253 Carnegie-Mellon Univ., Pittsburgh, Pa.
GUIDED WAVE ACOUSTOOPTIC DEVICES FOR WIDEBAND REAL-TIME SIGNAL PROCESSING Ph.D. Thesis
Iwen Yao 1979 207 p
Avail: Univ. Microfilms Order No. 7919160

Two guided wave acoustooptic devices for wideband real-time signal processing along with a wideband anisotropic acoustooptic Bragg deflector in Y-cut Ti-diffused LiNbO3 waveguides are presented. In addition to the inherent wide bandwidth capability, these acoustooptic devices possess following novel features: (1) low cost, (2) light weight, (3) rugged structure, (4) low power consumption, and (5) optics aligned during the fabrication process. An overview on the fabrication techniques for optical waveguides and the guided wave modes in these waveguides is first presented, followed by an analysis of surface acoustic wave propagation and guided wave acoustooptic Bragg interaction. A description of the design and fabrication of interdigital transducers and the study of optimized guided wave anisotropic acoustooptic Bragg diffraction are presented. Dissert. Abstr.

N80-12254 State Univ. of New York at Albany.
ELECTROMAGNETIC INTERACTIONS IN RELATIVISTIC INFINITE COMPONENT WAVE EQUATIONS Ph.D. Thesis
Christopher Clayton Gerry 1979 155 p
Avail: Univ. Microfilms Order No. 7925078

A way of making a minimal relativistic generalization of the minimal interactions in the nonrelativistic equation for the hydrogen atom is proposed. In order to calculate the effects of the relativistic minimal interactions so introduced, a covariant perturbation theory suitable for infinite component wave equations, which is an algebraic and relativistic version of the Rayleigh-Schroedinger perturbation theory was developed. By utilizing the developed perturbation technique, the electric and magnetic polarizabilities for the ground state of the hydrogen atom were calculated. It was shown that the results do have the correct nonrelativistic limits. The problem of interactions with a radiation field were considered. Directly applying the S-matrix formalism in field theory to the infinite component theoretic treatment of the interactions, the relativistic cross section of photon absorption by the atom was evaluated. Dissert. Abstr.

N80-12255*# Arinc Research Corp., Annapolis, Md.
CONTROL OF ELT FALSE ALARMS Final Report
S. Toth and I. Gershkoff Oct. 1979 110 p refs
(Contract NASw-3229)
(NASA-CR-162502; Publ-1362-01-1-2032) Avail: NTIS HC A06/MF A01 CSCL 17B

The statistics of emergency locator transmitter (ELT) alarms are presented. The primary sources of data include ELT Incident Logs, Service Difficulty Reports, and Frequency Interference Reports. The number of reported and unreported alarms is discussed, as are seasonal variations, duration of ELT transmissions, and cost of silencing. Origin, causes, and possible strategies for reducing the impact of alarms on the aviation community are considered. A.R.H.

N80-12256*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD FOR SHAPING AND AIMING NARROW BEAMS Patent Application

Richard C. Heyser, inventor (to NASA) (JPL) Filed 7 Nov. 1979 19 p
(Contract NAS7-100)
(NASA-Case-NPO-14632-1; US-Patent-Appl-SN-092143) Avail: NTIS HC A02/MF A01 CSCL 20N

A method and apparatus is disclosed for use of a linear frequency chirp in a transmitter/receiver having a correlator to synthesize a narrow beamwidth pattern from otherwise broad beam transducers when there is relative velocity between the transmitter/receiver and the target. The chirp is so produced in a generator in bandwidth, B, and time, T, as to produce a time-bandwidth product, TB, that is increased for a narrower angle. A replica of the chirp produced in a generator is time delayed and Doppler shifted for use as a reference in receiver for correlation of received chirps from targets. This reference is Doppler shifted to select targets preferentially, thereby to not only synthesize a narrow beam but also aim the beam in azimuth and elevation. NASA

N80-12257*# Mitre Corp., Houston, Tex.
CENTRAL COMPUTATIONAL FACILITY CCF COMMUNICATIONS SUBSYSTEM OPTIONS
K. B. Hennigan Jun. 1979 129 p
(NASA Order T-5295-F; Contract F19628-79-C-0001)
(NASA-CR-160383; MTR-4728; JSC-16006) Avail: NTIS HC A07/MF A01 CSCL 17B

A MITRE study which investigated the communication options available to support both the remaining Central Computational Facility (CCF) computer systems and the proposed U1108 replacements is presented. The facilities utilized to link the remote user terminals with the CCF were analyzed and guidelines to provide more efficient communications were established. M.M.M.

N80-12258*# Mitre Corp., Houston, Tex.
THE NASA BUS COMMUNICATIONS LISTENING DEVICE SOFTWARE
M. A. Allen Jul. 1979 73 p refs
(NASA Order T-5295-F; Contract F19628-79-C-0001)
(NASA-CR-160384; MTR-4729; JSC-16054) Avail: NTIS HC A04/MF A01 CSCL 17B

The development of the bus listener is presented. Special software was developed to control the 'bus interface units' (BIU) connecting each of these devices to a communications cable to form the bus communication network. The code used in the BTU is described. Author

N80-12259*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Electrical Engineering and Applied Physics.
LOW SIDELOBE LEVEL LOW-COST EARTH STATION ANTENNAS FOR THE 12 GHz BROADCASTING SATELLITE SERVICE
R. E. Collin and L. R. Gabel Sep. 1979 117 p refs
(Contract NAS3-21365)
(NASA-CR-159703) Avail: NTIS HC A06/MF A01 CSCL 17B

An experimental investigation of the performance of 1.22 m and 1.83 m diameter paraboloid antennas with an f/D ratio of 0.38 and using a feed developed by Kumar is reported. It is found that sidelobes below 30 dB can be obtained only if the paraboloids are relatively free of surface errors. A theoretical analysis of clam shell distortion shows that this is a limiting factor in achieving low sidelobe levels with many commercially available low cost paraboloids. The use of absorbing pads and small reflecting plates for sidelobe reduction is also considered. Author

N80-12260*# Mitre Corp., Bedford, Mass.
APPLICATION OF ADVANCED ON-BOARD PROCESSING CONCEPTS TO FUTURE SATELLITE COMMUNICATIONS SYSTEMS
J. L. Katz, M. Hoffman, S. L. Kota, J. M. Ruddy, and B. F. White Jun. 1979 406 p refs 2 Vol.
(Contract F19628-79-C-0001; AF Proj. 8680)
(NASA-CR-159682; MTR-3787-Vol-1) Avail: NTIS HC A18/MF A01 CSCL 17B

An initial definition of on-board processing requirements for an advanced satellite communications system to service domestic markets in the 1990's is presented. An exemplar system architecture with both RF on-board switching and demodulation/remodulation baseband processing was used to identify important issues related to system implementation, cost, and technology development. R.C.T.

N80-12261*# Mitre Corp., Bedford, Mass.
APPLICATION OF ADVANCED ON-BOARD PROCESSING CONCEPTS TO FUTURE SATELLITE COMMUNICATIONS SYSTEMS: BIBLIOGRAPHY
R. L. Edelman and J. L. Katz Jun. 1979 109 p 2 Vol.
(Contract F19628-79-C-0001; AF Proj. 8680)
(NASA-CR-159684; MTR-3787-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 17B

Abstracts are presented of a literature survey of reports concerning the application of signal processing concepts. Approximately 300 references are included. R.C.T.

N80-12262# Polytechnic Inst. of New York. Microwave Research Inst.
DIELECTRIC GRATING ANTENNAS Final Report, 1 May 1978 - 31 Jan. 1979
S. T. Peng 18 Jul. 1979 17 p refs
(Grant DAAG29-78-G-0099)
(AD-A073261; POLY-MRI-1401-79; ARO-15713.1-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

Three basic problems associated with dielectric grating antennas are investigated. First, the radiation characteristics in the stopband region are carefully analyzed, showing the range of blindness of the antenna in the broadside direction. Second, a new perturbation procedure for grating antennas is shown numerically to yield accurate propagation characteristics including the changes in phase as well as decay constant. Finally, the scattering of a plane wave by a dielectric grating at an arbitrary incidence angle is analyzed showing the coupling between TE and TM modes. GRA

N80-12263# Naval Ocean Systems Center, San Diego, Calif.
TACTICAL INTELLIGENCE LINK CONTROL FACILITY (TLCF) SUBSYSTEM RF LINK REMOTING DESIGN AND INSTALLATION PLANS
D. P. Hurst Mar. 1979 40 p refs
(AD-A071789; NOSC/TD-216) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report documents Tactical Intelligence Link Control Facility (TLCF) rf link remoting design and installation plans. It presents TLCF subsystem configurations, lists and describes equipments associated with remoting, gives remoting considerations, and states rf link remoting system requirements/specifications. GRA

N80-12264# Southern Research Inst., Birmingham, Ala.
CONTRAST ENHANCEMENT METHODS FOR VIDEO SYSTEMS Final Report, 30 May 1978 - 30 May 1979
Albert L. Thomas, Jr. 1 Jun. 1979 56 p refs
(Contract DAAK40-78-C-0155)
(AD-A073076; SORI-EAS-79-330; SOR-4106-9) Avail: NTIS HC A04/MF A01 CSCL 14/5

Methods have been studied of improving the display contrast of targets observed by TV search and tracking systems. Typical camera components can be improved upon several fold by spectral selection, lens selection, and optimum exposure of high resolution vidicons. Stationary noise can be reduced by pixel sensitivity equalization (PSE) and dynamic noise can be reduced by multiframe averaging. Local area gain and brightness control (LAGBC) can be applied to raise the differential contrast of small, target-sized areas after reducing the total scene contrast. Schemes for rendering PSE and LAGBC are diagrammed. About 70 items of technical and commercial literature are cited. GRA

N80-12265# Harry Diamond Labs., Adelphi, Md.
HEMP STUDY OF PLANNED DAS3 CONFIGURATION
Thomas A. Rose Jun. 1979 71 p refs
(AD-A072948; HDL-TR-1891) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report presents the results of a preliminary study to determine high-altitude electromagnetic pulse (HEMP) protection measures required for the Decentralized Automated Service Support System (DAS3). The DAS3 planned configuration

examined consists of automatic data processing equipment (ADPE) housed in an XM971 semitrailer van and powered by commercial power or two MEP-005A, 30 kW, 50/60 Hz, 120/208 V generators. The ADPE is commercial, off-the-shelf computer equipment which is, as yet, not fully defined as to manufacturer and specific components. The DAS3 system was examined in order to identify possible or definite weaknesses from an HEMP susceptibility standpoint and to provide recommendations for enhancing the overall HEMP survivability. GRA

N80-12266# Harris Corp., Melbourne, Fla. Government Communication Systems Div.
CROSS POLARIZATION INTERFERENCE REDUCTION TECHNIQUES Final Report, Sep. 1977 - Dec. 1978
Bruce E. Gillingham, Charles A. Baird, and M. Guy Pelchat Jun. 1979 178 p refs
(Contract F30602-77-C-0100; AF Proj. 4519)
(AD-A072748; RADC-TR-79-154) Avail: NTIS
HC A09/MF A01 CSCL 20/14

The objective of this program was to design, fabricate and test the optimum algorithm developed on the previous contract (Contract F30602-76-C-0041) to improve the performance of cross-polarization on line-of-sight (LOS) digital microwave channels. Specifically, an adaptive equalizer which would function with cross-polarization discrimination ratios from 5 dB to 40 dB and provide up to 20 nanoseconds of linear and parabolic group delay compensation was desired. An experimental equalizer was constructed and successfully tested both in the laboratory and at RADC. All primary design objectives were met with the exception of automatic operation in the copolar mode. Theoretical limitations of the performance measurement techniques used in the equalizer restrict copolar operation to a manual mode. In the automatic cross-polar mode, the equalizer can reduce an input cross-polarization discrimination ratio (CPDR) of 5 dB to a CPDR near 25 dB with the modem signal meeting FCC 19311 requirements over an LC8D radio. Non-dispersive cross-pole interference can be reduced by 25 dB. In back-to-back modem tests, the equalizer's residual interference level is near the design objective of -40 dB. GRA

N80-12267# Rome Air Development Center, Griffiss AFB, N.Y.
MUTUAL COUPLING EFFECTS ON A CIRCULAR ARRAY OF DIPOLES
Gregory Cruz Apr. 1979 25 p
(AF Proj. 2305)
(AD-A073077; RADC-TR-79-82) Avail: NTIS
HC A03/MF A01 CSCL 20/14

An analysis of coupled dipoles based on integral equations for currents that must be satisfied in order to meet the boundary conditions along the surface of the elements. The computer is used to numerically solve the M nonhomogeneous integral equations, using numerical approximations for the integrals and complex algebra techniques to solve the simultaneous equations. Such an analysis displays the mutual and self-admittance characteristics of a circular array and determines the effects of mutual coupling on the active element pattern. GRA

N80-12268# Mississippi Univ., University.
NUMERICAL COMPUTATION OF ELECTROMAGNETIC SCATTERING BY INHOMOGENOUS PENETRABLE BODIES
S. Govind and D. R. Wilton Jul. 1979 211 p refs
(Contract F30602-78-C-0148; AF Proj. 2338)
(AD-A073143; RADC-TR-79-172) Avail: NTIS
HC A10/MF A01 CSCL 20/14

Different approaches for studying scattering by inhomogeneous dielectric bodies are considered. The unimoment method, a differential equation approach, and the integral equation approach are discussed in detail. The integral equation approach with unknown equivalent surface currents is selected for further study. For this formulation, layered inhomogeneities result in an overall system matrix which is block-tridiagonal, the solution of which can be obtained through an iterative procedure. Such an iterative procedure reduces the computer core storage requirement as compared to a simultaneous solution of the unknown surface currents on the interfaces. The procedure is tested by applying it first to solve for the surface currents on layered spheres and comparing the results to an exact eigen-function solution. The procedure is then extended to permit the determination of the current on a missile in the presence of a trailing inhomogeneous exhaust plume. The resultant system matrix in this case, though not strictly block-tridiagonal, is again transformed by suitable matrix partitioning into a block-tridiagonal form. The currents on the missile are obtained for selected plume inhomogeneities at various frequencies and angles of incidence. In the appendix, various possible surface current formulations and the uniqueness of corresponding solutions are discussed. GRA

N80-12269# Army Communications Research and Development Command, Fort Monmouth, N. J.
SCATTERING FROM PERIODIC SURFACES WITH SINUSOIDAL HEIGHT PROFILE. A THEORETICAL APPROACH. PART 2: NUMERICAL EVALUATION Final Report, 1 Jul. 1973 - 30 Jun. 1976
G. M. Whitman and F. Schwering Jun. 1979 70 p
(AD-A072998; CORADCOM-79-5-Pt-2) Avail: NTIS
HC A04/MF A01 CSCL 20/3

A computer program was written. Numerical evaluations were performed. Program outputs include the current distribution in the metal surface, the complex amplitudes of the plane wave spectrum (space harmonics representation) of the scatter field and an accuracy check based on conservation of power. This data was computed for both TE-and TM-polarization, where TE and TM is understood with respect to the direction of the surface grooves. The study was performed in support of work on a practical problem, the polarization question of microwave landing systems. One of the aspects of this problem concerns scattering by large periodic metal surfaces, such as hangar doors, and the question whether the specular reflection coefficient of such surfaces can be significantly reduced by appropriate choice of polarization. The numerical results confirm experimental evidence that horizontal polarization generally leads to substantially less specular reflection than vertical polarization, in particular in the interesting range of large angles of incidence (near grazing). R.E.S.

N80-12270# Army Communications Research and Development Command, Fort Monmouth, N. J.
SCATTERING FROM PERIODIC SURFACES WITH SINUSOIDAL HEIGHT PROFILE. A THEORETICAL APPROACH. PART 1: THEORY Final Report, 1 Jul. 1973 - 30 Jun. 1976
G. M. Whitman and F. Schwering Jun. 1979 29 p refs
(AD-A072984; CORADCOM-79-4) Avail: NTIS
HC A03/MF A01 CSCL 20/3

A theory scattering by periodic metal surfaces is presented which utilizes the physical optics approximation to determine the current distribution in the metal surface in first order, but modifies this approximate distribution by multiplication with a Fourier series whose fundamental period is that of the surface profile (Floquet's theorem). The coefficients of the Fourier series are determined from the extended boundary condition that the field radiated by the current distribution into the lower (shielded) half-space must cancel the primary plane wave in this space range. The theory reduces the scatter problem to the familiar task of solving a linear system. For certain basic topics of surface profiles, including the sinusoidal profile considered here, the coefficients of the linear system are obtained as closed form expressions in well-known (Bessel) functions for sinusodial profiles and exponential functions for piece-wise linear profiles). The theory is thus amenable to efficient computer evaluation. GRA

N80-12271# Army Communications Research and Development Command, Fort Monmouth, N. J.
A RIGOROUS THEORY FOR PLANE WAVE SCATTERING FROM PERIODIC TRAPEZOIDAL METAL SURFACES Final Report, 1 Jul. 1973 - 30 Jun. 1976
G. M. Whitman, D. M. Leskin, and F. Schwering Jun. 1979 91 p refs
(AD-A072983; CORADCOM-79-3) Avail: NTIS
HC A05/MF A01 CSCL 20/3

A rigorous method for analyzing plane wave scattering from perfectly conducting periodic surfaces is examined and applied to trapezoidal profiles. Both TE - and TM - polarizations of the incident plane wave are considered. An integral equations for the unknown current distribution in the metal surface is

formulated by invoking the extended boundary condition. Upon expressing the current density in terms of its physical optics approximation multiplied by a Fourier series, the integral equation reduces to a linear system of equations. For the case of a piecewise linear surface profile, the coefficient matrix of this system involves closed form expressions only. As a consequence, the linear system is amenable to efficient computer evaluation, which furnishes the Fourier coefficients of the current distribution. The method is applied to trapezoidal scatterers for which little data is available in the literature, and, by using appropriate limiting procedures, to triangular and rectangular profiles. Scatter fields and surface current densities are calculated. The accuracy of the method, its range and limitations, are investigated and comparisons are made with the results of others. The method has given accurate results for surface groove depths of less than half a wavelength and for surface periods of greater than a wavelength at minimal computational cost. GRA

N80-12272# Ohio State Univ., Columbus. Electroscience Lab.
SUBSURFACE ELECTROMAGNETIC TARGET CHARACTERIZATION AND IDENTIFICATION Ph.D. Thesis
Luen Charm Chan Jun. 1979 277 p refs
(Contract DAAK70-77-C-0114)
(AD-A072491; ESL-784722-3) Avail: NTIS
HC A13/MF A01 CSCL 17/9

A method for subsurface radar target characterization and identification is described. This method characterizes subsurface radar targets by their complex natural resonances which are extracted directly from their backscattered timedomain waveforms. The difference equation coefficients associated with the complex resonances are then used in the predictor-correlator for target identification. Both the characterization and identification processes are extensively tested with real radar measurements and found to yield practical target identification performance. The target identification process is simple and involves only simple algebraic operations. Based on the identification process, a first-generation microcomputer identification radar system is implemented for target identification in real time. This radar system is found to yield practical identification performance. GRA

N80-12273# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
SCATTERING OF ELECTROMAGNETIC WAVES BY OBSTACLES IN PRESENCE OF THE EARTH'S SURFACE CURRENT DISTRIBUTION ON PERFECTLY CONDUCTING CYLINDRICAL LOOPS IN AN INCIDENT Final Report, 21 Apr. 1977 - 30 Sep. 1978
T. T. Wu and H. M. Lee Griffiss AFB, New York RADC Jun. 1979 24 p refs
(Contract F19628-77-C-0146; AF Proj. 2305)
(AD-A072880; RADC-TR-79-134) Avail: NTIS
HC A02/MF A01 CSCL 20/3

The current distribution excited by an external field on a perfectly conducting cylindrical loop with zero thickness placed above the earth's surface with its axis normal to the earth is obtained. The case two coupled coaxial loops at different separations has also been solved. A variational principle is employed in the derivation. GRA

N80-12274# Data/Ware Development, Inc., San Diego, Calif.
ADVANCED DIGITAL TV SYSTEM Final Report, Jun. - Sep. 1977
Philip J. Erdelsky, Richard V. Keele, G. Graham Murray, and Ronald B. Weiss Wright-Patterson AFB, Ohio AFAL Feb. 1979 346 p
(Contract F33615-77-C-1198; AF Proj. 6096)
(AD-A072917; AFAL-TR-79-1006) Avail: NTIS
HC A15/MF A01 CSCL 09/2

A laboratory version of a programmable digital processor system for TV bandwidth reduction was designed and placed in operation. The system consists of a TV camera A/D converter unit, two pipelined microprocessor units, and a frame store D/A-TV display unit interfaced to a PDP 11/04 minicomputer controller in such a manner that data transfers can be effected between any two units over the PDP 11/04 Unibus under software control of the CPU. The pipelined microprocessor units are software programmable via local program stores which are loaded over the PDP 11/04 Unibus. Each pipelined processor is twelve bits wide and uses three AMD 2901 bit-slice microprocessor chips in conjunction with a 12x12 bit hardware multiplier for high speed computation. GRA

N80-12275# M/A-COM, Inc., Burlington, Mass.
COMMUNICATIONS TECHNOLOGY IN THE 10 TO 40 GIGAHERTZ FREQUENCY BAND
Apr. 1979 140 p
(PB-297221/4; FCC/OST/SA-79/03) Avail: NTIS
HC A07/MF A01 CSCL 17B

The state-of-art in communications technology in the 10-40 GHz band with emphasis on the trade-offs between cost and performance are presented. System considerations, propagation characteristics, FM transmission and interference, digital modulation, rf power sources, frequency stability, and rf low-noise amplifiers and mixers are included. GRA

N80-12276# National Bureau of Standards, Washington, D.C. Electromagnetic Technology Div.
ELECTROMAGNETIC INTERFERENCE (EMI) RADIATIVE MEASUREMENTS FOR AUTOMOTIVE APPLICATIONS
J. W. Adams, H. E. Taggart, M. Kanda, and J. Shafer Jun. 1979 49 p refs Sponsored in part by Natl. Highway Traffic Safety Admin., Washington D.C.
(PB-298605/7; NBS-TN-1014) Avail: NTIS
HC A03/MF A01 CSCL 13F

The measured results of the electromagnetic (EM) environment encountered by three different-sized vehicles exposed to a selection of CB and mobile radio transmitters and broadcast stations are described. The electric and magnetic fields were measured independently. The EM environmental conditions under different circumstances were identified in order to estimate electromagnetic compatibility testing criteria for vehicles and their electronic systems. GRA

N80-12277# Institute for Telecommunication Sciences, Boulder, Colo.
STATISTICAL METHODS FOR ESTIMATING TIME AND RATE PARAMETERS OF DIGITAL COMMUNICATION
Edwin L. Crow Jun. 1979 39 p refs
(PB-297977/1; NTIA/Rept-79/21) Avail: NTIS
HC A03/MF A01 CSCL 17B

Statistical methods are given for estimating time and rate parameters of digital communication systems according to the specifications of proposed federal standards. The methods may be applied to delay, disengagement, transfer and service times, and to transfer rates. Some ARPANET and Bell System data are examined for the form of distribution of times. The properties of various types of estimators are discussed, and the sample mean is recommended. Approximate confidence limits are given for time and rate parameters. A step by step procedure is provided for designing an experiment to estimate time and rate parameters with prescribed accuracy. GRA

N80-12278# Institute for Telecommunication Sciences, Boulder, Colo.
GROUND WAVE PROPAGATION OVER IRREGULAR, INHOMOGENOUS TERRAIN: COMPARISONS OF CALCULATIONS AND MEASUREMENTS
R. H. Ott, L. E. Vogler, and G. A. Hufford May 1979 140 p refs Sponsored in part by SAMSO and Electromagnetic Compatibility Anal. Center
(PB-298668/5; NTIA/REPT-79/20) Avail: NTIS
HC A07/MF A01 CSCL 20N

An algorithm (PROGRAM WAGNER) that evaluates HF ground-wave attenuation over irregular, inhomogeneous terrain is used to compare calculated field strengths with observed measurements for 9 actual paths and frequencies ranging from 120 kHz to 50 MHz. All comparisons show encouraging agreement between calculations and measurement. The 20 MHz comparisons over the Colorado Mountains provided a challenge for PROGRAM WAGNER. GRA

N80-12279# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
PROCEEDINGS OF THE 1978 ELECTROMAGNETIC INTERFERENCE WORKSHOP Final Special Publication

M. G. Arthur, ed. Jul. 1979 62 p Workshop held in Gaithersburg, Md., 2-3 Nov. 1978
(PB-298675/0; NBS-SP-551; LC-79-600091) Avail: NTIS HC A04/MF A01 CSCL 20N

A summary of the overview talks and session discussions at the 1978 Electromagnetic Interference Workshop is presented. These discussions addressed the following questions: What are the significant electromagnetic interference (EMI) problems. How serious are they. Which should be tackled first. What solutions are practical. Who is responsible for solutions. What new standards or changes in present voluntary standards are needed. What is needed for process. Impacted areas featured at the workshop included communications, transportation, consumer products, industrial, and medical. Workshop speakers and attendees represented a broad segment of decisionmakers in both industry and government. GRA

N80-12218 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
PERFORMANCE AND IMPAIRMENTS IN A QPSK SATELLITE TO GROUND LINK
P. Amadesi, L. Moreno, and M. SantAgostino *In its* Space Commun. Mar. 1979 p 59-107 refs Sponsored by ESA Submitted for publication (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12219 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
SYNCHRONIZATION PROCEDURES FOR A REGENERATIVE SS-TDMA SYSTEM
D. DiPino and R. Preti *In its* Space Commun. Mar. 1979 p 109-124 refs Submitted for publication (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12220 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
THE TELECOMMUNICATION SATELLITE AS AN INTEGRATED TIME DIVISION TRANSMISSION-SWITCHING SYSTEM
A. deFlammineis and A. Loffreda *In its* Space Commun. Mar. 1979 p 125-134 refs Repr. from IEE Conf. Digital Satellite Commun., Publ. 59 Sponsored by Intern. Telecommun. Satellite Consortium (INTELSAT) (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12221 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
TRAFFIC SIMULATION IN A TELEPHONE NETWORK VIA SATELLITE WITH PREASSIGNED AND DEMAND ASSIGNED CIRCUITS
F. Manucci and A. Tonietta *In its* Space Commun. Mar. 1979 p 135-144 refs Repr. from IEE Conf. Digital Satellite Commun., Publ. 59 Sponsored by Intern. Telecommun. Satellite Consortium (INTELSAT) (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12222 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
AN APPROACH TO BLOCKED APERTURE SYNTHESIS
P. Bielli and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 183-186 refs Presented at European 77, Venice, May 1977 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12223 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
ANALYSIS AND SYNTHESIS OF CORRUGATED CONICAL HORNS
P. Bielli, Salvatore DePadova, and E. Pagana *In its* Space Commun. Mar. 1979 p 195-200 refs Presented at 6th European Microwave Conf., Rome, Sep. 1976 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12224 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
A METHOD FOR COMPUTING CORRUGATED HORNS PHASE CENTER
P. Bielli, E. Pagana, and G. Rosenga *In its* Space Commun. Mar. 1979 p 201-206 refs (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12225 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
ANALYSIS AND SYNTHESIS OF AN ELLIPTICAL PARABOLOID OFFSET REFLECTOR ANTENNA. AN ELLIPTICALLY SHAPED BEAM ANTENNA
Salvatore DePadova, Enrico Pagana, and Giorgio Rosenga *In its* Space Commun. Mar. 1979 p 207-210 refs Repr. from Antennas and Propagation, 15-19 May 1978 p 381 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12226 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
ANALYTICAL AND GRAPHICAL METHODS FOR THE DESIGN OF AN ELLIPTICALLY SHAPED BEAM ANTENNA WITH ELLIPTICAL PARABOLOID REFLECTOR
Salvatore DePadova, E. Pagana, and G. Rosenga *In its* Space Commun. Mar. 1979 p 211-215 refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. - Sep. 1978 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12227 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
AN ELLIPTICALLY SHAPED BEAM ANTENNA
Salvatore DePadova, Enrico Pagana, and Giorgio Rosenga *In its* Space Commun. Mar. 1979 p 229-234 refs Presented at European Microwave Conf., Paris, Sep. 1978 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12228 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
REFLECTOR ANTENNAS WITH HIGH EFFICIENCY AND LOW DEPOLARIZATION
P. Bielli and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 235-238 refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. - Sep. 1978 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12229 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
SOME CONSIDERATIONS ABOUT SKY NOISE TEMPERATURE AT FREQUENCIES ABOVE 10GHz
E. D. Damasso and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 239-247 refs Repr. from Alta Frequenza, v. 65, no. 2, 1976 p 98-10E-106-18E (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12230 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
BIT RATE REDUCTION BY AUTOMATIC ADAPTATION OF QUANTIZER STEP-SIZE IN DPCM SYSTEMS
Paolo Castellino, Giulio Modena, Luciano Nebbia, and Carlo Scagliola *In its* Space Commun. Mar. 1979 p 257-263 refs Repr. from CSELT Rappt. Tec., no. 2, Sep. 1974 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12231 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
AN ADAPTIVE QUANTIZER WITH CHANNEL ERROR RECOVERY
Carlo Scagliola *In its* Space Commun. Mar. 1979 p 265-272 refs Repr. from CSELT Rappt. Tec., no. 4, Dec. 1976 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12233 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
EVALUATION OF ADAPTIVE SPEECH CODERS UNDER NOISY CHANNEL CONDITIONS
Carlo Scagliola *In its* Space Commun. Mar. 1979 p 277-281 refs Repr. from ICC Conf. Record, v. 1, 4-7 Jun. 1978 p 8.1.1-8.1.5 (For primary document see N80-12216 03-31)
(Contract CH1350-8/78/0000-0037)
Copyright. Avail: Issuing Activity

N80-12234 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
AN ADAPTIVE DELTA MODULATOR ROBUST TO TRANSMISSION ERRORS
Paolo Castellino *In its* Space Commun. Mar. 1979 p 283-287 refs Presented at 4th Intern. Conf. on Digital Satellite Commun., Montreal, Oct. 1978 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12235 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
TRANSFORM CODING OF PAL COMPOSITE SIGNALS
L. Chiariglione, M. Guglielmo, and Sciarappa *In its* Space Commun. Mar. 1979 p 289-312 refs Submitted for publication (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-12280 Columbia Univ., New York.
TRANSPORT THEORY OF CARRIERS ACROSS SEMICONDUCTOR HETEROJUNCTION INTERFACES Ph.D. Thesis
Chii-ming Morris Wu 1979 142 p
Avail: Univ. Microfilms Order No. 7925001

A sliding-boat liquid-phase-epitaxial system is built to fabricate AlxGa1-x As heterojunction diodes to examine the model described. A method is proposed to find the conduction band discontinuity by analyzing the temperature-dependent I-V data of the N-p heterojunction diode. Theoretical I-V curves are in agreement with experimental data obtained from AlxGa1-x As-GaAs DH laser diodes which consist of an N-p anisotype heterojunction and ohmic N-n and P-p isotype heterojunctions. The transport theory is applied to investigate the mechanism of carrier leakage over the confining barrier and to determine an appropriate molar composition of tenary compound in DH laser diodes. Dissert. Abstr.

N80-12281*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF MAKING V-MOS FIELD EFFECT TRANSISTORS Patent Application
Murzban D. Jhabvala, inventor (to NASA) Filed 5 Sep. 1979 12 p
(NASA-Case-GSC-12515-1; US-Patent-Appl-SN-072727) Avail: NTIS HC A02/MF A01 CSCL 09A

A method of making V-MOS field effect transistors is disclosed. A masking layer is first formed over a surface of a crystalline substrate. An aperture is formed in the masking layer to expose the surface of the substrate. An anisotropic etchant is applied to the exposed surface so that a groove having a decreasing width with increasing depth is formed. The etch is not allowed to go to completion, with the result that a partially formed V-shaped groove is formed. Ions are accelerated through the aperture for implantation in the crystalline substrate in the lower portion of the partially formed V-shaped groove. An anisotropic etchant is reapplied to the partially formed V-shaped groove, and the etch is allowed to go to completion. NASA

N80-12282*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN INTRODUCTION TO THE BANNING DESIGN AUTOMATION SYSTEM FOR SHUTTLE MICROELECTRONIC HARDWARE DEVELOPMENT
William J. McGrady 3 Apr. 1979 36 p
(NASA-TM-80831; MSC-06779) Avail: NTIS HC A03/MF A01 CSCL 09C

The BANNING MOS design system is presented. It complements rather than supplant the normal design activities associated with the design and fabrication of low-power digital electronic equipment. BANNING is user-oriented and requires no programming experience to use effectively. It provides the user a simulation capability to aid in his circuit design and it eliminates most of the manual operations involved in the layout and artwork generation of integrated circuits. An example of its operation is given and some additional background reading is provided. M.M.M.

N80-12283# Research Triangle Inst., Research Triangle Park, N. C. Electronic Technology Div.
AFAL SIMULATION FACILITY/CAPABILITY MANUAL. VOLUME 2: EXECUTIVE SUMMARY. COMPUTER AIDED DESIGN FOR MICROELECTRONICS Final Report, 30 Jun. 1977 - 31 Mar. 1978
Ronald L. Earp Wright-Patterson AFB, Ohio AFAL Feb. 1979 206 p
(Contract F33615-76-C-1308; AF Proj. 6096)
(AD-A073383; AFAL-TR-77-118-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 09/5

The Air Force Avionics Laboratory (AFAL) at Wright-Patterson AFB is the focal point for development of new avionics technology for the Air Force. In order to carry out this responsibility, a significant capability to simulate physical avionics systems and components has been created by the AFAL divisions. This manual presents introductory and summary coverage of the AFAL Computer Aided Design (CAD) Facility in Section I and by presenting more detailed descriptive material in subsequent sections. The contents of Section I address the CAD Facility capabilities from a planning/management viewpoint by relating the laboratory mission to present facility capability through the development of a conceptual simulation class structure. The contents of subsequent sections of this manual address specific facility/capability from a potential-user viewpoint. GRA

N80-12284# Michigan Univ., Ann Arbor. Electron Physics Lab.
MILLIMETER-WAVE MIXERS AND DETECTORS Final Report, 1 May 1976 - 30 Apr. 1979
G. I. Haddad, P. J. McCleer, and J. R. East Aug. 1979 10 p ref
(Grant DAAG29-76-G-0232)
(AD-A073591; Rept-014525-F; ARO-13853.3-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

The properties of BARITT devices and their application as mixers and detectors particularly at millimeter wavelengths have been considered and their characteristics have been determined. It is shown that the BARITT device will have several advantages over existing devices such as Schottky-barrier diodes in these applications and thus warrant further development. Several modes of operation have been identified and include: self-oscillating mixers where the device due to its negative resistance generates power and is utilized as a mixer simultaneously; a video detector and mixer element which exhibits a negative resistance over a band of frequencies determined by the width of the depletion layer; and a conventional video detector and mixer element which does not exhibit a negative resistance but has a negligible series resistance due to the basic nature of the device. This leads to a detector and mixer element with an extremely high cut-off frequency and can lead to better performance than existing Schottky-barrier diodes. GRA

N80-12285# Westinghouse Research and Development Center, Pittsburgh, Pa.
GALLIUM ARSENIDE VERTICAL CHANNEL INSULATED GATE FIELD EFFECT TRANSISTOR Final Annual Technical Report, Jan. - Dec. 1977
M. C. Driver, D. L. Barrett, G. W. Eldridge, H. C. Nathanson,

and V. L. Wrick 25 Sep. 1978 79 p refs
(Contract N00014-75-C-0418; RF54481001)
(AD-A073706; Rept-79-9F7-VMIST-R1) Avail: NTIS
HC A05/MF A01 CSCL 09/1

The techniques for producing n(-)-p-n(-) structures in gallium arsenides are described. Evaluation of the surface state densities of anodic oxide on gallium arsenide show minima at about mid gap of 2 times 10 to the 11th power eV sq cm. These densities are affected by annealing conditions and their measurement by sweep time. Recommendations for future work include the use of indium phosphide as the semiconductor. GRA

N80-12286# Oregon Graduate Center, Beaverton.
FIELD ELECTRON AND ION SOURCE RESEARCH FOR HIGH DENSITY INFORMATION STORAGE SYSTEM Interim Technical Report, 15 Nov. 1976 - 15 Feb. 1977
L. W. Swanson Wright-Patterson AFB, Ohio AFAL Aug. 1977 72 p refs
(Contract F33615-76-C-1327; AF Proj. 3184)
(AD-A073701; AFAL-TR-77-160; ITR-3) Avail: NTIS
HC A04/MF A01 CSCL 20/3

The purpose of this research program is the development of high brightness field emission and field ion sources. A new method of preparing W/Zr TF cathodes is discussed and life test results of LaB6 field emitters are described. Built up emitters of tantalum and indium have been examined. Results of experiment and calculation are presented for the energy distribution of field emitted electrons from substrates of varying temperature and work function. Field ionization data for several gases has been obtained. Also, noise measurements have been performed for a field ion source. GRA

N80-12287# Air Force Weapons Lab., Kirtland AFB, N. Mex.
METAL-NITRIDE-OXIDE-SEMICONDUCTOR (MNOS) RADIATION CHARACTERIZATION STUDIES Final Report
Roger W. Tallon Jul. 1979 170 p refs
(AD-A073637; AFWL-TR-79-39) Avail: NTIS
HC A08/MF A01 CSCL 09/1

This report describes the radiation characterization studies performed at the Air Force Weapons Laboratory (AFWL) on Metal-Nitride-Oxide-Semiconductor (MNOS) transistors, arrays, and related PMOS devices during the period of March 1972 to September 1978. The work presented shows the radiation test data, testing, techniques, and radiation hardening ideas which assisted AFWL in the development of a radiation hard, monolithic, PMOS/MNOS RAM array (the Sperry Rand SR2256). GRA

N80-12288# Argonne National Lab., Ill.
DESIGN AND DEVELOPMENT OF AN ULTRA-THIN SOLENOID FOR A HIGH ENERGY PHYSICS PARTICLE DETECTOR
R. P. Smith, R. C. Niemann, and F. Catania 1978 5 p refs Presented at Applied Superconductivity Conf., Pittsburgh, 25 Sep. 1978
(Contract W-31-109-eng-38)
(CONF-780952-28) Avail: NTIS HC A02/MF A01

An enhanced-stability thin solenoid magnet design is presented. The details of the high purity aluminum stabilized conductor are discussed. The design details of a special cryostat constructed for conductor evaluation is presented, and the aluminum alloy NbTi superconductor under procurement is described. DOE

N80-12289# Sandia Labs., Albuquerque, N. Mex. Model Shops and Inspection Div.
MICROPROCESSOR-CONTROLLED, PROGRAMMABLE RAMP VOLTAGE GENERATOR
J. Hopwood Nov. 1978 55 p
(Contract EY-76-C-04-0789)
(SAND-78-8040) Avail: NTIS HC A04/MF A01

A special-purpose voltage generator was developed for driving the quadrupole mass filter of a residual gas analyzer. The generator is microprocessor-controlled with desired ramping parameters programmed by setting front-panel digital thumb switches. The start votage, stop voltage, and time of each excursion are selectable. A maximum of five start-stop levels may be pre-selected for each program. The ramp voltage is 0 to 10 volts with sweep times from 0.1 to 999.99 seconds. DOE

N80-12290# Bendix Corp., Kansas City, Mo.
FEASIBILITY OF ELECTROPLATED GOLD FOR HYBRID MICROCIRCUITS
P. L. Blessner 1978 27 p refs
(Contract DE-AC04-76DB-00613)
(BDX-613-2114) Avail: NTIS HC A03/MF A01

Electroplating was investigated as a method of providing thick gold films. The characteristics of electroplated gold and its compatibility with present hybrid microcircuits fabrication processes were determined. Ceramic substrates 95 by 114 mm micrometers were electroplated with 6, 10, and 25 micrometers of gold after 0.02 micrometers of chrominum and 0.5 micrometers of gold were either sputtered or vacuum evaporated onto the substrate surfaces. Substrates vacuum evaporated with 6 micrometers of gold were used as a control group. The substrates were evaluated for via resistance, RF electrical characteristics, conductor definition and resolution, solder wettability, thermocompression bondability, and environmental stability. DOE

N80-12291# Gutehoffnungshuette Sterkrade A.G. Oberhausen (West Germany).
ELECTRIC POWER GENERATION AND LNG EVAPORATION WITH THE AID OF GAS TURBINES WITHIN A CLOSED-CYCLE PROCESS
D. Weber 1978 19 p refs In GERMAN Presented at Systems Exhibition Energy - Hanover Fair, Hanover, 19 Apr. 1978
(AED-Conf-78-155-010; CONF-7804102-6) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

In the proposed process the working fluid of a gas turbine plant with a closed circuit is cooled to -140 C with LNG before entering the compressor and heated to +720 C before entering the turbine by means of external heat gained by burning natural gas. With a 1 million cubic m/h throughput of LNG in its normal state, 237 MW of electric power can be generated with 53 percent efficiency with this simple circuit, which can be further developed. In a combination of closed gas turbine and diesel generator, almost 289 MW of electric power can be produced per 1 million cubic m/h LNG with an efficiency of 60 percent. DOE

N80-12292# Sandia Labs., Albuquerque, N. Mex.
ANALYSIS OF LATCH-UP PREVENTION IN CMOS IC'S USING AN EPITAXIAL-BURIED LAYER PROCESS
D. B. Estreich, A. Ochoa, Jr., and R. W. Dutton (Stanford Univ., Palo Alto, Calif.) 1978 5 p refs Presented at IEEE Electron Device Meeting, Washington, D.C., 4 Dec. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1648; CONF-781210-2) Avail: NTIS
HC A02/MF A01

The use of a P(+) buried layer beneath the p-well in CMOS is evaluated for controlling latch-up (parasitic SCR action). It is shown that this structure typically reduces the parasitic n-p-n transistor's current gain by two orders of magnitude. The n-p-n gain reduction is the principal mechanism for latch-up control. The n-p-n is studied using STRAP to numerically solve the transport equations. These simulations show the n-p-n current gain to be primarily governed by the base-retarding field arising from the impurity gradient of the outdiffusing buried layer. A wide-base lateral p-n-p model is developed to accurately model the field enhancement of the parasitic lateral p-n-p's current gain. Experimental confirmation of the lateral p-n-p model is given. DOE

N80-12293# Bendix Corp., Kansas City, Mo.
CHARACTERIZATION OF THIN FILM MICROSTRIP ATTENUATORS AT MICROWAVE FREQUENCIES
F. R. Smith Nov. 1978 20 p ref
(Contract EY-76-C-04-0613)
(BDX-613-1857-Rev) Avail: NTIS HC A02/MF A01

An investigation of thin film microstrip attenuators resulted in the development of characteristics for attenuator fabrication and defined the criteria for microwave performance. The understanding of microstrip resistive attenuator characteristics at microwave frequencies was improved. The process of modeling and fabricating the thin film networks is defined. An attenuator

configuration which approaches ideal microwave operation were developed. DOE

N80-12294# California Univ., Berkeley. Lawrence Berkeley Lab.
GERMANIUM FIELD-EFFECT TRANSISTOR MADE FROM A HIGH-PURITY SUBSTRATE
W. L. Hansen, Frederick S. Goulding, and Eugene E. Haller Nov. 1978 19 p refs Presented at IEEE Nucl. Sci. Symp., Washington, D.C., 18 Oct. 1978
(Contract W-7405-eng-48)
(LBL-8134; CONF-781033-44) Avail: NTIS HC A02/MF A01

Field effect transistors were fabricated on high-purity germanium substrates using low-temperature technology. The low density of trapping centers in high-quality starting material was preserved by low-temperature processing. The use of germanium promises to eliminate some of the traps which cause generation-recombination noise in silicon field-effect transistors (FET's) at low temperatures. Present devices exhibit a large 1/f noise component and most of this noise must be eliminated if they are to be competitive with silicon FET's commonly used in high-resolution nuclear spectrometers. DOE

N80-12295# Argonne National Lab., Ill.
ARGONNE PROGRAM TO ASSESS SUPERCONDUCTING STABILITY
S. T Wang, L. R. Turner, Y. C. Huang, J. W. Dawson, J. Harrang, M. A. Hilal, M. Lieberg, J. D. Gonczy, and S. H. Kim 1978 46 p refs Presented at the Superconducting MHD Magnet Design Conf., Cambridge, Mass., 18-19 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-781055-3) Avail: NTIS HC A03/MF A01

To assess superconductor stability, a complete program is developed to obtain basic information on the effects of local mechanical perturbations on the cryostatic stability. An analytical model for computing the transient recovery following the mechanical perturbation is developed. A test program is undertaken to develop data needed to verify the conclusions reached through the analytical studies. DOE

N80-12296# Princeton Univ., N. J. Plasma Physics Lab.
NUMERICAL STUDIES OF CURRENT GENERATION BY RADIO-FREQUENCY TRAVELING WAVES
C. F. F. Karney and N. J. Fish Jan. 1979 42 p refs
(Contract EY-76-C-02-3073)
(PPPL-1506) Avail: NTIS HC A03/MF A01

By injecting radio-frequency traveling waves into a Tokamak, continuous toroidal electron currents may be generated. This process is studied by numerically solving the two-dimensional Fokker-Planck equation with an added quasilinear term. The results are compared with the one-dimensional analytic treatment of Fisch, which predicted a reduced plasma resistivity when high-phase-velocity waves are employed. It is shown that two-dimensional velocity space effects, while retaining the predicted scaling, further reduce the ratio of power dissipated to current generated by about 40%. These effects enhance the attractiveness of steady-state Tokamak reactors utilizing this method of current generation. DOE

N80-12297# Electro Engineering Works, San Leandro, Calif.
STUDY PROGRAM FOR CONSTANT CURRENT CAPACITOR CHARGING METHOD
C. Pugh 4 Oct. 1978 98 p
(Contract W-7405-eng-48)
(UCRL-13914) Avail: NTIS HC A05/MF A01

The best method of charging 20,000 to 132,000 microfarads of capacitance to 22 kVdc in 14 to 15 sec was determined. Component costs, sizes, weights, line current graphs, copes of calculations and manufacturer's data are included. DOE

N80-12298# Oak Ridge National Lab., Tenn.
TRANSIENT 3-D EDDY CURRENT IN MULTIPLE CONDUCTORS
H. T. Yeh 1979 12 p refs Presented at the Joint INTERMAG-MMM Conf., New York, N. Y., 17 Jul. 1979
(Contract W-7405-eng-26)
(CONF-790738-2) Avail: NTIS HC A02/MF A01

A computer program was implemented to model the transient eddy current in multiple thin conductors. This program allows for holes and multiple materials and has symmetry options built in. For cases with known solutions, the program was checked for the eddy current induced in a cross, a plate with holes, a bent plate, an aluminum plate coil case, a plate with two materials and multiple plates. DOE

N80-12299# Martin Marietta Aerospace, Orlando, Fla.
INVESTIGATION OF MOISTURE MEASUREMENTS, FAILURE RATE AND LEAK RATE AND A STUDY OF MOISTURE INFUSION Final Report
R. L. Sulouff Aug. 1979 57 p refs
(Contract NBS-5-35880; ARPA Order 2397)
(PB-299172/7; NBS-GCR-79-170) Avail: NTIS HC A04/MF A01 CSCL 09A

A preliminary study of the relationships between moisture infusion, leak size, and device reliability is presented. The results exhibited a great amount of scatter, both because of the primitive nature of the measurement methods available for use in this type of experiment and because of the large variability in both water vapor infusion and the reactions of water vapor on device surfaces. It was concluded that present leak rate limits for large packages are not low enough to insure that the maximum permissible moisture level are not exceeded during a reasonable service lift. GRA

N80-12300# National Bureau of Standards, Washington, D.C. Electron Devices Div.
MEASUREMENT TECHNIQUES FOR HIGH-POWER SEMICONDUCTOR MATERIALS AND DEVICES: Annual Report, 1 Oct. 1977 - 30 Sep. 1978
Frank F. Oettinger Jun. 1979 146 p refs
(Contract EA-77-A-01-6010)
(PB-298574/5; NBSIR-79-1756) Avail: NTIS HC A07/MF A01 CSCL 09A

The development of measurement methods for semiconductor materials and devices which will lead to more effective use of high power semiconductor devices in applications for energy technologies is described. The major tasks are: (1) to evaluate the use of thermally stimulated current and capacitance measurements and other deep level measurement techniques as a means for characterizing lifetime controlling or leakage source defects in power grade silicon material and devices; and (2) to develop procedures to enable spreading resistance measurements of thyristor starting material and layer profiles to be made on a reliable basis. GRA

N80-12301# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: THERMAL RESISTANCE MEASUREMENTS ON POWER TRANSISTORS Final Report
Sherwin Rubin and Frank F. Gettinger Apr. 1979 73 p refs
(PB-298318/7; NBS-SP-400-14) Avail: NTIS HC A04/MF A01 CSCL 09A

The idealized concept of thermal resistance is given along with the problems and pitfalls encountered in applying the concept to power transistors. The advantages and disadvantages of various electrical techniques for measuring junction temperature (thermal resistance) are described. A preferred technique, in which the forward-biased emitter-base junction is used as the temperature-sensitive parameter, is usable on all types of bipolar transistors. The measurement procedure is relatively simple and lends itself to industrial measurements as well as for referee purposes. The power interruption circuitry is also relatively fast and simple since only one device terminal is switched. GRA

N80-12018# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NEW METHOD OF ELECTRIC MEASUREMENT OF CRACK LENGTH
Georges Baudin and Humbert Policella *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 125-144 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 195-203 Original language report was announced as A79-11136 (For primary

document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

N80-12215 Institut Franco-Allemand de Recherches, St. Louis (France).
FANNING OF SPARK DISCHARGES
M. Schwertl and A. Stenzel *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 260-268 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

N80-12217 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
RELIABILITY PERFORMANCES OF SYSTEMS WITH A SWITCHING MATRIX
C. DallOlio *In its* Space Commun. Mar. 1979 p 21-58 refs Submitted for publication (For primary document see N80-12216 03-31)
(Contract ESTEC-2872/76/NL-AK(SC))
Copyright. Avail: Issuing Activity

N80-12232 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
DESIGN OF INSTANTANEOUSLY COMPANDED DELTA MODULATORS WITH M-BIT MEMORY
Paolo Castellino and Carlo Scagliola *In its* Space Commun. Mar. 1979 p 273-276 refs Presented at IEEE Intern. Conf. on Acoustics, Speech and Signal Process, 1977 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-12302 City Univ. of New York, N. Y.
SOLUTIONS OF PRANDTL'S BOUNDARY LAYER EQUATIONS USING LINEAR PROGRAMMING AND MAPPINGS Ph.D. Thesis
Gerald Michael Flynn 1979 48 p
Avail: Univ. Microfilms Order No. 7923726

A method of solution to Prandtl's boundary layer equations is proposed and tested for three representative cases. The test flows are: (1) past a flat plate parallel to the stream, (2) past a circular cylinder and (3) linearly retarded flow. Calculations of the boundary layer thicknesses, velocity profiles, and shearing stresses are made and compared to known classical calculations. In the latter two cases, the point of separation is calculated.
Dissert. Abstr.

N80-12303 New York Univ., N. Y.
TWO-DIMENSIONAL VORTICAL MOTION Ph.D. Thesis
Sergio H. Lopez-Fernandez 1979 46 p
Avail: Univ. Microfilms Order No. 7925490

The motion of two rectilinear isolated vortices in a plane layer of incompressible, inviscid fluid contained in a simply connected domain, when one of the vortices is fixed in position and the other is free to move is presented. The only restriction in the domain is a reasonably shaped boundary which is impermeable, so that any flow must be tangent to it. It is proven that for any such domain, it is always possible to find configurations of positions and relative vortex strength lambda for which the free vortex is in a stationary position. Criteria are established for the stationary configuration. The split plane is taken as a special case and a method is developed to determine all stationary configurations. The stability is studied and trajectories of the free vortex are sketched for several ranges of values of lambda.
Dissert. Abstr.

N80-12304 New York Univ., N. Y.
SOME MINIMAX PRINCIPLES WITH APPLICATIONS IN NONLINEAR ELLIPTIC BOUNDARY VALUE PROBLEMS AND GLOBAL VORTEX FLOW Ph.D. Thesis
Wei-Ming Ni 1979 119 p
Avail: Univ. Microfilms Order No. 7925503

Minimax principles are presented and applied to nonlinear elliptic boundary value problems and fluid dynamic problems. The principles are designed to obtain critical points (in general, saddle points) of some functionals on R to the nth power, Banach spaces, Riemannian manifolds or Banach manifolds. The existence of axial-symmetric stationary global flow in R to the 3rd power with nontrivial vortex rings was determined.
Dissert. Abstr.

N80-12305 New York Univ., N. Y.
PERTURBED BIFURCATION THEORY FOR PLANE POISEUILLE FLOW Ph.D. Thesis
Gary Steven Strumolo 1979 111 p
Avail: Univ. Microfilms Order No. 7925534

The problem of a two dimensional viscous fluid flow between two parallel, infinite plates is addressed. By means of a linear stability analysis, it is shown that Poiseuille flow is stable for values of the Reynolds number, R, less than some critical value R sub c approximates 5772.22, and unstable for R > R sub c. The effects of perturbing the location of the upper wall is considered. The perturbation is considered as either an imperfection in the system or as a condition imposed on the system artificially. In the former case, if the imperfection has a component with a prescribed spatial and temporal frequency, then the solution of this perturbed problem will experience a transition near the Reynolds numbers found by experiment. In this way, a mechanism to reconcile theory and experiments is proposed. Dissert. Abstr.

N80-12306 Virginia Polytechnic Inst. and State Univ., Blacksburg.
VELOCITY AND TEMPERATURE FIELDS IN OSCILLATING BOUNDARY LAYERS Ph.D. Thesis
Maria Sybilla Romaniuk 1978 151 p
Avail: Univ. Microfilms Order No. 7925380

The response of boundary layer velocity and temperature distributions to small amplitude oscillations imposed by the free-stream is investigated. A straightforward combination of perturbation and numerical methods is applied. The analysis of the effect of the frequency of oscillations shows that in many respects the response of the boundary layer to the oscillations in time is periodic in xi (xi = frequency parameter), with the period delta xi approximately 4.0 and the first harmonic manifesting itself strongly at xi approximately 1.15. It is concluded that the interaction between the random turbulent motion and oscillations is probably too strong to be neglected and therefore more complex models, capable of incorporating the interaction process, are required to successfully predict the behavior of oscillatory turbulent boundary layers. Dissert. Abstr.

N80-12307 Carnegie-Mellon Univ., Pittsburgh, Pa.
SPREADING KINETICS OF A LIQUID DROP ON A SOLID SURFACE Ph.D. Thesis
Parthasakha Neogi 1979 101 p
Avail: Univ. Microfilms Order No. 7919150

The effect of surface roughness on spreading rates of liquid drops was analyzed using a model in which a liquid drop spreads over the surface of a porous medium filled with the same liquid. The equations of motion in the drop are simplified with the lubrication theory approximation and then solved for both zero and small but finite contact angles by the method of matched asymptotic expansions. Although the largest pressure gradients and velocity gradients occur near the contact line at the drop periphery, behaviour in this region is not singular as found in previous analyses of spreading on perfectly smooth surfaces. Qualitative features observed for spreading drops, e.g., the increase in spreading rate with increasing roughness and the frequent appearance of apparent contact angles significantly different from equilibrium contact angles are discussed. Dissert. Abstr.

N80-12308 Utah Univ., Salt Lake City.
PRESSURE DROP AND HEAT TRANSFER IN COCURRENT DOWNFLOW OF GAS-SOLIDS SUSPENSIONS Ph.D. Thesis

Jai Myung Kim 1979 234 p
Avail: Univ. Microfilms Order No. 7924316

Pressure drop and heat transfer of a gas-solids suspension flowing cocurrently downward in a 0.51 inch inside diameter tube were investigated using 329 micron spherical glass beads in air. For studying the fluid mechanics, experimental data were obtained on total pressure drop and particle holdup in the fully developed region. Pressure drop profiles along the entire distance of the tube were also measured at various solids loadings for three different gas Reynolds numbers. Experimental data for the heat transfer study consisted of local wall temperatures, measured at 16 locations along the axial distance of the heated tube, with uniform heat flux boundary conditions obtained by electrical power. Friction factors and Nusselt numbers were also obtained. Dissert. Abstr.

N80-12309 Wisconsin Univ. - Madison.
VISCOELASTIC RADIAL FLOW BETWEEN PARALLEL DISKS Ph.D. Thesis
Alberto Co 1979 365 p
Avail: Univ. Microfilms Order No. 7918147

The rheological model presented is a modified Zaremba-Fromm-DeWitt (MZFD) model, which has six adjustable parameters. The model parameters are obtained from experimental data for the viscosity and the primary normal stress coefficient. In sudden inception of steady shear flow, the model predicts stress overshoot but exhibits damped oscillations about the steady-state value. For elongational viscosity, the model gives the Newtonian prediction at low elongational rate; at higher elongational rate, the predicted elongatical viscosity decreases and then increases with increasing elongational rate. It is concluded that more experimental data on material functions would have to be available before proper assessment can be made of the appropriateness of the MZFD model; and more extensive experimental studies on the radial flow system need to be taken. Dissert. Abstr.

N80-12310 Institut Franco-Allemand de Recherches, St. Louis (France).
CONTRIBUTIONS TO FLUID MECHANICS AND BALLISTICS [BEITRAEGE ZUR STROEMUNGSFORSCHUNG UND ZUR BALLISTIK]
1979 109 p refs In GERMAN; ENGLISH summary
(BMVG-FBWT-79-3) Avail: Issuing Activity

Measurement and data acquisition systems for gas flows and ballistics are discussed. Specific topics covered include velocity measurements on supersonic jets in hot envelopes and propellant gases, measuring the length of coherent structures in subsonic free jets, digital data acquisition systems for laser Doppler anemometers, miniaturized ballistic missile data acquisition systems, and measurements and data transmission in interior ballistics. For individual titles, see N80-12311 through N80-12316.

N80-12311 Institut Franco-Allemand de Recherches, St. Louis (France).
VELOCITY MEASUREMENTS ON PROPELLANT GASES IN GUN TUBES
H. Mach *In its* Contrib. to Fluid Mech. and Ballistics 1979 p 2-14 refs In GERMAN; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Activity

Streak photography and a laser velocimeter technique were tested in order to see whether they were suitable methods for velocity measurements on highly absorbing powder gas flows in gun barrel tubes. Preliminary results are presented and compared. It is concluded that while streak photography provides mean velocity values of layers at specific depths, the laser velocimeter technique allows velocity profiles to be obtained over the whole barrel cross section. Author (ESA)

N80-12312 Institut Franco-Allemand de Recherches, St. Louis (France).
LASER ANEMOMETER MEASUREMENTS IN A SUPERSONIC FREE JET WITH A HOT GASEOUS ENVELOPE
H. J. Schaefer *In its* Contrib. to Fluid Mech. and Ballistics 1979 p 15-33 refs In GERMAN; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Acitivity

The flow processes taking place in a flame torch were investigated. An LDA technique was employed to measure the mean flow velocity (V) and turbulence intensity (tau) of a commerically available instrument. This technique is described and specific problems encountered with hot flows are discussed. The accuracies achieved for the mean V and Tau measurements were approximately 2% and 10% respectively. The considerable influence of the hot envelope on the central flow is seen in the profile measurements given. Author (ESA)

N80-12313 Institut Franco-Allemand de Recherches, St. Louis (France).
DIMENSIONS OF A COHERENT STRUCTURE IN THE POTENTIAL CONE OF A SUBSONIC FREE JET
H. J. Pfeifer *In its* Contrib. to Fluid Mech. and Ballistics 1979 p 34-49 refs In GERMAN; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Activity

The axially parallel length of a coherent structure in the potential cone was measured as a function of the distance from the 80 mm nozzle of a subsonic free jet escaping into the atmosphere at 100 meters/sec. Measurements were made with a laser anemometer in such a way as to avoid flow perturbation. In the flow region investigated, the greatest length of the structure was found to exceed one nozzle diameter, while the smallest length observed was two thirds of this diameter. Author (ESA)

N80-12314 Institut Franco-Allemand de Recherches, St. Louis (France).
DIGITAL DATA ACQUISITION SYSTEMS FOR LASER-DOPPLER-ANEMOMETRY: PROBLEMS AND DEVELOPMENTS DEMONSTRATED WITH THE AID OF INSTRUMENTS BUILT-UP AT THE ISL
M. Koenig *In its* Contrib. in Fluid Mech. and Ballistics 1979 p 50-68 refs In GERMAN; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Activity

The nature of the photomultiplier signal fed into the system is discussed together with the methods and criteria employed to select and measure high frequency signals over a few cycles. The functions of the corresponding signal validification circuit are described. Emphasis is placed on the interpretation and accuracy of the results obtained and their subsequent treatment (minicomputer, printed readout). Some particle velocity and turbulence measurements are presented. Author (ESA)

N80-12315 Institut Franco-Allemand de Recherches, St. Louis (France).
DATA ACQUISITION AND TRANSMISSION FROM HIGHLY ACCELERATED BALLISTIC MISSILES OF SMALL AND MEDIUM CALIBRE
G. Schultze *In its* Contrib. to Fluid Mech. and Ballistics 1979 p 69-87 refs In GERMAN; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Activity

The use of miniaturized sensors and transmission systems in the development of weapon systems is discussed. The sensors withstand extremely high accelerations and are manufactured by thick film techniques on ceramic substrates. The properties, characteristics, and manufacturing problems encountered with single and multichannel measuring systems are described. A few examples are presented showing how practical ballistic telemetric measuring systems are used. Author (ESA)

N80-12316 Institut Franco-Allemand de Recherches, St. Louis (France).
MEASUREMENTS IN INTERIOR BALLISTICS, TRANSMISSION, SENSORS
P. Rateau *In its* Contrib. to Fluid Mech. and Ballistics 1979 p 88-101 refs In FRENCH; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Activity

The study of moving projectiles in interior ballistics led to the development of systems in which signals could be transmitted from probes under severe conditions of acceleration, pressure, and temperature. Various transmission techniques (e.g. microwaves, optoelectronic devices, conducting wires, storage devices) are briefly described, as are inductive transducers for

measuring pressure, axial accelerations, and transverse vibrations to which the projectile is subjected. The technique best adopted to specific projectile systems is indicated. Author (ESA)

N80-12317# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
PREDICTION METHODS FOR TURBULENT FLOWS
1979 509 p refs Lecture held at Rhode-Saint-Genese, Belgium, 15-19 Jan. 1979
(VKI-Lec-Ser-1979-2) Avail: NTIS HC A22/MF A01

Recent advances in the development of prediction models for turbulent flows are reported and their application to various problems of industrial and geophysical interest is discussed. Particular emphasis is given to second order closure models and turbulent combustion. For individual titles, see N80-12318 through N80-12324.

N80-12318# Cornell Univ., Ithaca, N. Y.
SECOND ORDER MODELING OF TURBULENT FLOWS
J. L. Lumley *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 26 p refs Sponsored in part by Office of Naval Research (For primary document see N80-12317 03-34)
(Grant NSF ATM-77-22903)
Avail: NTIS HC A22/MF A01

Equations for the first and second order quantities (the variances and fluxes) are formed and the third order terms that appear in these equations are modeled in terms of the first and second order quantities. The equations for the second order quantities are usually supplemented by one or more equations for something equivalent to a length scale. The resulting set of equations is then solved on a computer by time-stepping. Second order modeling should be contrasted with the mixing length approach, which could be called first order modeling. Flaws in the mixing length approach are reviewed as well as the cost of using second order models. A.R.H.

N80-12319# Karlsruhe Univ. (West Germany).
TURBULENCE MODELS FOR ENVIRONMENTAL PROBLEMS
W. Rodi *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 89 p refs (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

Various models for describing the turbulent transport of momentum, heat and mass in environmental flows are presented. The merits and demerits of the individual models are discussed with respect to their predictive ability, their computational economy and the ease with which they can be used in practical calculations. Examples are presented of model applications to various flow situations relevant to environmental problems, most of them being examples from the water environment. The two-equation models employing differential transport equations for the velocity and length scales of the fluctuating motion are sufficiently complex for most practical calculations. In particular, the k - epsilon model is shown to predict reasonably well a fairly large range of problems with the same empirical input. In shear-layer situations where the length scale can be specified empirically, energy one-equation models are judged to work equally well; when history and transport effects on the turbulence are unimportant, the mixing length hypothesis can also be used. The most complex models included, which employ transport equations for the individual turbulent stresses and heat or mass fluxes, are conceptually superior, but there is no evidence that the increased computational effort they require is justified for most problems. A.R.H.

N80-12320# Kernforschungszentrum, Karlsruhe (West Germany).
DIRECT NUMERICAL SIMULATION OF TURBULENCE
U. Schumann, G. Groetzbach, and L. Kleiser *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 140 p refs (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

Methods for direct numerical simulation of turbulent incompressible flows - sometimes called large-eddy simulations are reviewed and various results of applications are presented which show the usefulness and limitations of these methods. Both finite difference methods and spectral methods are described. For high Reynolds numbers the idea of sub-grid scale models is explained. The turbulence problem is tackled as far as possible from first principles. The Navier-Stokes equations are viewed as the simplest turbulence theory. A.R.H.

N80-12321# Ecole Centrale de Lyon (France).
PATHOLOGICAL CASES IN TURBULENT FIELD AND SPECTRAL APPROACH
J. Mathieu and D. Jaendel *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 59 p refs (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

Pathological cases, which are defined by reference to standard patterns of flows, the mechanisms of which can supposedly be elucidated, display some failures in previous predictive methods. The role played by several preponderant factors which appear in the equations governing either the evolution of the turbulent kinetic energy or that of the velocity correlation is more or less explained. Mean velocity gradient orders the turbulent structure whereas the rate of strain pressure correlation refrains this trends. Such views can be supported by experimental data; however, if the behavior of some turbulent fields is examined, slight failures appear. In several cases, the reasons of such failures can be found by analyzing the spectral behavior of these turbulent fields. In most cases, the energy flux is constant within the inertial range, all the parts of the spectrum are linked to each other through this scalar quantity. Such a situation can be invalidated if a large amount of energy is introduced in a small spectral area. This peak in spectral space displays the important role of quasi ordered structures; hence, turbulence modellings carried out in physical space should be invalidated unless several characteristic scales are introduced. A.R.H.

N80-12322# Liege Univ. (Belgium).
THE APPLICATION OF TURBULENCE MODELS TO GEOPHYSICAL FLOWS: TURBULENCE IN THE OCEAN
Jacques C. J. Nihoul *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 26 p refs Prepared in cooperation with Louvain Univ., Belgium (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

Topics covered include (1) basic equations of ocean hydrodynamics; (2) time scales, length scales, and linear wave theory; (3) dispersions bands in the ocean - macroscale and mesoscale waves; (4) interaction band in the ocean; (5) turbulent windows in the w-k plane; (6) spectrum of turbulence and the energy cascade; (7) averaging and parameterization of unresolved motions; and (8) boundary turbulence. A.R.H.

N80-12323# Imperial Coll. of Science and Technology, London (England).
MODELS FOR TURBULENT FLOWS WITH VARIABLE DENSITY AND COMBUSTION
W. P. Jones *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 37 p refs (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

The accurate calculation of the fields of velocity, concentration of the major species and pollutants and temperature in such systems as industrial furnaces, gas turbine combustors and i.c. engine combustion chambers introduces a myriad of additional problems over and above those already present in inert turbulent flows. The central (unresolved) difficulty in devising prediction methods for reacting flows revolves around the problem of evaluating mean reaction rates. For this reason, rather than attempt to model features in their full complexity, attention is restricted to relatively simple flames. The flows considered are high Reynolds number, single phase, turbulent, high temperature flames in which radiative heat transfer can be considered negligible. Consideration of soot and particulate formation and consumption is omitted as are liquid and solid fuelled flames, fuel pyrolysis and ignition and extinction phenomena. A.R.H.

N80-12324# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MODELS OF TURBULENT COMBUSTION FOR NUMERICAL PREDICTIONS
Roland Borghi *In* Von Karman Inst. for Fluid Dyn. Prediction

Methods for Turbulent Flows 1979 36 p refs (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

Progress in the theoretical prediction of turbulent combustion was advanced by the development of calculation models and methods for turbulent non reactive flows, as well as by the use of probability density functions (p.d.f.) of the fluctuations. Studies reviewed concern the usefulness of the p.d.f. for reactive turbulent mixtures, the general properties of this p.d.f., and their exact calculation by a new balance equation, and an approximate hybrid method that seems to be of practical use. Comparisons with measurements inside a turbulent premixed flame are presented and discussed. A.R.H.

N80-12325# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
UNSTEADY FLOW IN TURBOMACHINES, VOLUME 1
2 Feb. 1979 454 p refs Lecture held at Rhode-Saint-Genese, Belgium, 29 Jan. - 2 Feb. 1979
(VKI-Lec-Ser-1979-3-Vol-1) Avail: NTIS HC A20/MF A01

The fluid mechanical aspects of unsteady flow in axial compressors were studied. For individual titles, see N80-12326 through N80-12330.

N80-12326# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
INTRODUCTION TO UNSTEADY FLOWS IN TURBOMACHINES
Edward M. Greitzer *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 1 2 Feb. 1979 43 p refs (For primary document see N80-12325 03-34)
Avail: NTIS HC A20/MF A01

The basic fluid mechanic aspects of unsteady flow in turbomachines are discussed. The unsteadiness is seen to arise from several different sources, and to have an impact on the overall behavior of the machine. The topics covered are: (1) basic consideration of unsteady flow and inherent unsteadiness of turbomachinery, (2) sources of unsteady flows and relevant parameters, (3) illustrative examples of unsteady flow, (4) unsteady effects with uniform inlet flow, and unsteady effects with nonuniform flow (inlet distortion). F.O.S.

N80-12327# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
INLET DISTORTION EFFECTS IN AXIAL COMPRESSORS
Edward M. Greitzer *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 1 2 Feb. 1979 60 p refs (For primary document see N80-12325 03-34)
Avail: NTIS HC A20/MF A01

Methods for predicting compressor response to inlet distortion are discussed. The emphasis is on those approaches which have proved most useful in analyzing circumferentially nonuniform flows in multistage compressors (as opposed to isolated rotors or single stages). Attention is focussed on the basic fluid mechanic concepts which underlie these methods in order to develop a clear physical understanding of the flow fields under consideration. Material on the parallel compressor model, unsteady and two-dimensional effects of inlet distortion, compressor/component coupling in asymmetric flows, and some discussion of the prediction of compressor stall with distorted inlet flows are included. F.O.S.

N80-12328# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
ROTATING STALL AND SURGE IN AXIAL COMPRESSORS
Edward M. Greitzer *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 1 2 Feb. 1979 27 p refs (For primary document see N80-12325 03-34)
Avail: NTIS HC A20/MF A01

The basic features of the instabilities that are associated with axial flow compression systems are described. The two different modes of instability, rotating stall and surge, are defined and criteria are presented for determining their onset. The phenomena that occur subsequent to this onset are discussed, and methods are presented for predicting the large amplitude transients that characterize post-stall behavior in multistage compressors. The impact of the two different modes on system recovery from stall is then discussed, and a technique is presented for predicting the performance of multistage compressors in rotating stall, with particular reference to the stall/unstall hysteresis behavior. F.O.S.

N80-12329# Iowa State Univ. of Science and Technology, Ames.
TURBOMACHINE WAKE TRANSPORT AND INTERACTION
T. H. Okiishi *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 1 2 Feb. 1979 183 p refs (For primary document see N80-12325 03-34)
Avail: NTIS HC A20/MF A01

Several simplified turbomachine configurations are sketched in to illustrate the kinds of wake interactions that are considered. Only low-speed effects are discussed. The modeling of a first row rotor or stator wake is reviewed and the chopping and subsequent transport of chopped wake segments by a downstream row are discussed. The effects of chopped wake segment influence on second and third row rotor or stator flows are considered. Finally, several kinds of interaction effect examples are discussed. F.O.S.

N80-12330# Liege Univ. (Belgium).
STEADY PRESSURE DISTORTIONS
J. Colpin and P. VanWambeke *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 1 2 Feb. 1979 47 p refs (For primary document see N80-12325 03-34)
Avail: NTIS HC A20/MF A01

A unified approach based on the analysis of the compressor rotor dynamic transfer with distorted inflow is presented. A simple flow model was formulated and analyzed to illustrate the factors affecting the dynamic response of the rotor. It is shown that a high peripheral velocity and a large chord is beneficial for the distortion attenuation. F.O.S.

N80-12331# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
UNSTEADY FLOW IN TURBOMACHINES, VOLUME 2
2 Feb. 1979 349 p refs Lecture held at Rhode-Saint-Genese, Belgium, 29 Jan. - 2 Feb. 1979
(VKI-Lec-Ser-1979-3-Vol-2) Avail: NTIS HC A15/MF A01

Problems associated with unsteady flow in turbocompressors are discussed. Specific topics covered include temperature distortion and unsteady pressure distortion in compressor inflows, flow measurements in a rotating stall cell, temperature effects in blade-wake interference, high speed blade-wake interactions, and rotor stall in axial flow compressors. For individual titles, see N80-12332 through N80-12337.

N80-12332# Cranfield Inst. of Tech., Bedfordshire (England).
TEMPERATURE DISTORTION
R. E. Peacock *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 31 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

Mathematical models for compressors subject to temperature distorted inflow are presented along with supporting experimental evidence. A time lag term is added to the parallel compressor hypothesis to predict the stability line for a compressor and the characteristics in distorted flow. In addition, the detailed flow around the airfoils is examined to create a model which accounts for the effects of distortion on the airfoils as well as the effects of the airfoils on distortion. K.L.

N80-12333# Cranfield Inst. of Tech., Bedfordshire (England).
UNSTEADY PRESSURE DISTORTION
R. E. Peacock *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 26 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

A model is proposed for the solution of unsteady flows in a compressor embedded in ductwork and subjected to repetitive or nonrepetitive pulses. Various methods for generating the unsteady pulses are discussed. A three-stage aircraft type compressor was subjected to pulsating flows in order to determine experimentally the effects of pulsating flow on compressor performance. K.L.

N80-12334# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FLOW MEASUREMENTS IN A ROTATING STALL CELL
F. A. E. Breugelmans *In its* Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 23 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

The cell structure in a low speed single stage compressor model is investigated for various stagger angles. The observations are compared to predictions based on two theories and to results of experiments with a three stage model. K.L.

N80-12335# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
BLADE WAKE INTERFERENCE: TEMPERATURE EFFECT
F. A. E. Breugelmans *In its* Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 14 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

Wake motion through the mean section of a NACA 65 series rotor and cascade blading was investigated. Cascade flow was studied using a stationary wake generator and compared to a moving generator where temperature effects existed. The rotor configuration was investigated using the hot wire sampling technique at different overheat ratios and hot wire orientations. K.L.

N80-12336# Technische Hochschule, Aachen (West Germany).
HIGH SPEED BLADE-WAKE INTERACTIONS
H. E. Gallus *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 46 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

Measurements were conducted on single stage turbomachines in order to explore the dependency of wake production, transport, and interaction on the main geometric and aerodynamic parameters of subsonic and supersonic axial flow turbomachines. Some of the results are compared with numerical results from simplified theoretical approaches. K.L.

N80-12337# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ROTATING STALL IN AXIAL FLOW COMPRESSORS
N. Orner *In its* Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 34 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

Some of the methods used to predict rotating stall or its characteristics are described. Predictions obtained using these methods are compared to experimental data obtained from four different single stage axial compressors, and their reliability is discussed. A nonlinear method is proposed to calculate rotating stall inception and characteristics in a quasi-three-dimensional compressible flow of a one stage or multistage axial flow compressor. The suitability of such a method for the solution of industrial problems is discussed and the missing experimental data for its improvement are identified. K.L.

N80-12338# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FLUID DYNAMICS OF POROUS MEDIA IN ENERGY APPLICATIONS, VOLUME 1
1979 433 p Lecture held at Rhode-Saint-Genese, Belgium, 12-16 Feb. 1979
(VKI-Lec-Ser-1979-4-Vol-1) Avail: NTIS HC A19/MF A01

The use of porous media in connection with energy storage or exchange is considered. Heat storage and transfer in packed beds, regenerators, moving bed heat exchangers, and natural convection in porous media are among the topics covered. Application to geothermics and solar energy is emphasized. For individual titles, see N80-12339 through N80-12345.

N80-12339# Karlsruhe Univ. (West Germany).
TRANSPORT PHENOMENA IN PACKED BED REACTORS
E. U. Schluender *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-27 refs (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

Transport phenomena in the voids between the particles of packed bed reactors are treated. Topics covered include: (1) hydraulic properties; (2) heat and mass transfer between the fluid and the particles; and (3) radial transport of heat and mass through the voids and the particles. J.M.S.

N80-12340# Michigan Univ., Ann Arbor. Heat Transfer Lab.
SURVEY AND DESCRIPTION OF TRANSPORT PHENOMENA IN PACKED-BEDS
John A. Clark *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-21 refs (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

A brief review of the literature pertaining to transport properties in packed beds, particulary as they apply to storage of thermal energy derived from solar energy conversion systems, is presented. Geometric and design parameters that influence the thermal and flow performance of a packed bed are discussed along with analytical models established to simulate the dynamic behavior of the bed. Single and two phase models are included. J.M.S.

N80-12341# Michigan Univ., Ann Arbor. Heat Transfer Lab.
DYNAMIC RESPONSE OF A PACKED-BED ENERGY STORAGE SYSTEM TO A TIME VARYING INLET TEMPERATURE
In Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-7 refs (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

An analytical method for determining the response of a rock-bed energy storage system to temperature variations is outlined. Emphasis is on the case in which the inlet air temperature feeding the bed varies arbitrarily with time, a condition commonly expected in a solar energy supply system. J.M.S.

N80-12342# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
HEAT STORAGE AND THERMAL TRANSFER ASPECTS OF THE DYNAMIC BEHAVIOUR OF A PACKED BED
John A. Clark and Ronald L. Nabozny *In* von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-12 refs (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

The formulation of the dynamic response and thermal storage capacity of a packed bed storage unit for solar energy application is outlined for both the charging and recovery modes. Owing to the limitations of analytical procedures, the solutions to this problem are given in terms of an implicit, finite difference numerical formulation. The computer program for this solution is called ROCKBED. Comparison between the numerical results and those from experiment indicate the importance of improved knowledge of certain empirical data for pack beds, including heat transfer coefficients, effective particle size, void fraction, and wetted area per unit volume. J.M.S.

N80-12343# Michigan Univ., Ann Arbor. Heat Transfer Lab.
HEAT TRANSFER IN A COLUMN PACKED WITH SPHERES
Chris D. VandenBroek and John A. Clark *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-17 refs (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

Average and local surface-heat transfer coefficients in a cylinder packed with spheres are investigated. The term 'local' applies to a single sphere within the bed. Averages are derived from the sixteen different spheres that are instrumented and distributed throughout the bed. The experimental technique consists of introducing a step change in temperature to the air flowing through the bed and recording the resulting air and ball temperature transients within the bed over a range of Reynolds numbers. An overall correlation of heat transfer with Reynolds number is derived and compared to others available in the literature. Patterns observed in the local coefficients are discussed. The experimental results are compared with analytical and numerical models. J.M.S.

N80-12344# Bureau de Recherches Geologiques et Minieres, Orleans (France).
TRANSPORT PHENOMENA IN GEOLOGICAL LAYERS MEASUREMENT OF PARAMETERS
J. P. Sauty *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-4 (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

The physics of mass transfer in aquifers is considered in terms of ground water pollution. Mathematical models for the numerical integration of the mass transfer equations are reviewed. Techniques discussed include finite difference, variational methods, and methods of characteristics. In situ tracer tests to determine dispersion and convection velocity are discussed including some conclusions resulting from such tests. J.M.S.

N80-12345# Bureau de Recherches Geologiques et Minieres, Orleans (France).
APPLICATION OF POROUS MEDIA TO HEAT STORAGE UNDERGROUND
J. P. Sauty *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-5 (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

Two types of underground heat storage are described: a dry bed and an aquifer. It is shown that the aquifer provides the more efficient heat transfer by forced convection. Heat storage in a single well and in two twin wells is discussed. J.M.S.

N80-12346# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FLUID DYNAMICS OF POROUS MEDIA IN ENERGY APPLICATIONS, VOLUME 2
1979 402 p refs Lecture held at Rhode-Saint-Genese, Belgium, 12-16 Feb. 1979
(VKI-Lec-Ser-1979-4-Vol-2) Avail: NTIS HC A18/MF A01

Topics are presented on heat exchangers, heat exchange processes, the post accident heat removal from a liquid metal fast breeder reactor, the influence of an obstruction on a fluid particle heat transfer, a fluorescence method for the local voidage in random packed beds, and the application of packed beds to energy storage use of latent heat of fusion. For individual titles, see N80-12347 through N80-12353.

N80-12347# Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk (Netherlands).
FUNDAMENTALS OF REGENERATORS
J. Brasz *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 25 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

The principal mechanisms of the regenerative heat exchangers are presented. Some of the analytical solutions of the start of the regenerators operation (the so called single blow problem) are dealt with, and some approximative numerical and graphical methods are described. The continuous operation of the regenerators is explained by means of some calculated temperature responses. M.M.M.

N80-12348# Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk (Netherlands).
MODELLING AND SIMULATION OF A MOVING-BED HEAT-EXCHANGE PROCESS
J. Brasz *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 36 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

More practicable simulation methods for the dynamic behavior of moving packed bed heat exchange processes are described. A pellet indurating plant which is a moving grated unit is analyzed to demonstrate the dynamic response of the cross flow heat exchangers. M.M.M.

N80-12349# Commissariat a l'Enargie Atomique, Cadarache (France).
GENERAL AND PARTICULAR ASPECTS OF THE PARTICULATE BED BEHAVIOUR IN THE POST ACCIDENT HEAT REMOVAL SITUATION FOR LIQUID METAL FAST BREEDER REACTORS
C. Joly (Laboratories du Centre d'Etude del Energie Nucleaire, Mol, Belgium) and C. LeRigoleur *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 77 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

The particular P.A.H.R. (post accident heat removal) situation for liquid metal fast breeder reactor) whose coolant is sodium is presented. This situation mainly results from the formation of a fine particulate bed internally heated by decay of fission products. The essential safety problem is to know the heat removal capability of such a bed when surrounded by stagnant sodium. Topics discussed are: (1) the formation of the particulate bed and its characteristics; (2) the possibilities of out-of-pile and in-pile simulation of the P.A.H.R. problem; and (3) the basic theoretical approaches of the P.A.H.R. problem. M.M.M.

N80-12350# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
INFLUENCE OF AN OBSTRUCTION ON FLUID-PARTICLE HEAT-TRANSFER IN A PACKED BED
C. Joly *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 20 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

The influence of a local obstruction on heat transfer between one particle in a packed bed and the coolant gas which is forced through it is presented. A method is developed, giving average as well as local heat transfer coefficients in the case of a packed bed containing spherical particles of constant diameter. Typical obstructions which can form inside a packed bed are then defined and heat transfer perturbations in the vicinity of such obstructions are measured. The results show (1) an important decrease of the average cooling of a sphere near the obstruction. The measurements are correlated by an expression such as Nu = A.Re superscript B where Nu is the Nusselt number, Re the Reynolds number and A, B constants depending upon the type and the amount of obstruction; (2) important local variations of the heat transfer coefficient over the surface of a sphere; and (3) rapid attenuation of the perturbation in the upward and downward directions. M.M.M.

N80-12351# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
HOT SPOT PHENOMENA IN ACTIVE PACKED BEDS
J-M Buchlin *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 61 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

A study of the hot spot formation in random packed beds of active spherical particles is presented. Two causes of temperature peak development are envisaged: the local variation of the porosity in the random packing; and the presence of obstructions. The first cause is analyzed experimentally and theoretically. Thermal nonuniformities are located in the peripheral region of the fixed bed. The disturbing effects of obstructions in the active bed are theoretically simulated. The complex nature of the resulting velocity and temperature fields are emphasized. M.M.M.

N80-12352# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A FLUORESCENCE METHOD FOR THE MEASUREMENT OF THE LOCAL VOIDAGE IN RANDOM PACKED BEDS
J-M Buchlin, M. Riethmuller, and J. J. Ginoux *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 9 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

A technique enabling the visualization of the internal structure of a randomly packed bed and likewise the void fraction distribution measurement by photoelectric process is presented. The method is based on the light reemission of a fluorescent liquid, filling the interstices of the packing and excited by a laser source. It requires the matching of the refractive indexes of the packed bed components. Preliminary tests are presented to illustrate the principle of the method. M.M.M.

N80-12353# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
APPLICATION OF PACKED BEDS TO ENERGY STORAGE USE OF LATENT HEAT OF FUSION
J.-M. Buchlin and P. H. Theunissen *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 15 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

A design of thermal storage unit based on the use of latent heat in packed beds is presented. A theoretical model is described of the unsteady heat transfer in such pile where the particles are formed by heat of fusion material incapsulated in spherical containers. The temperature distributions of the circulating fluid and of the phase change material as well as the rate of melting are obtained by numerical procedure. The theoretical predictions are validated in comparison with experimental results. M.M.M.

N80-12354# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
DATA ACQUISITION SYSTEMS AND DATA ANALYSIS IN FLUID DYNAMICS
1979 230 p refs Lecture held at Rhode Saint Genese, Belgium, 26 Feb. - 2 Mar. 1979
(VKI-Lec-Ser-1979-5) Avail: NTIS HC A11/MF A01

Theoretical fundamentals of data acquisition and analysis are discussed along with the design and applications of interactive data acquisition systems. For individual titles, see N80-12355 through N80-12357.

N80-12355# Radio Corp. of America, Moorestown, N. J.
DIGITAL SIGNAL ANALYSIS: THEORY AND APPLICATIONS
Louis Shapiro *In* Von Karman Inst. for Fluid Dyn. Data Acquisition Systems and Data Analysis in Fluid Dyn. 1979 92 p ref (For primary document see N80-12354 03-34)
Avail: NTIS HC A11/MF A01

The benefits of using digital methods for handling information are considered. The sampling theory, spectral analysis and correlation, digital filters, and data transmission are discussed. F.O.S.

N80-12356*# Southampton Univ. (England).
APPLICATION OF DATA ACQUISITION SYSTEMS FOR ON-LINE DEFINITION AND CONTROL OF WIND TUNNEL SHAPE
S. W. D. Wolf *In* Von Karman Inst. for Fluid Dyn. Data Acquisition Systems and Data Analysis in Fluid Dyn. 1979 46 p refs (For primary document see N80-12354 03-34)
(Grant NsG-7172)
Avail: NTIS HC A11/MF A01

Improvements in wind tunnel design to reduce test and flight discrepancies are analyzed. Flexible wall streamlining, criteria for tunnel streamlining, and error assessment are discussed. It is concluded that the concept of self-streamlining wind tunnels is suited for on-line computer control. F.O.S.

N80-12357# Electricite de France, Chatou.
APPLICATION OF DATA ACQUISITION SYSTEM FOR ON SITE MEASUREMENTS OF WIND EFFECTS ON STRUCTURES
J. F. Sageau and M. Hamonou *In* Von Karman Inst. for Fluid Dyn. Data Acquisition Systems and Data Analysis in Fluid Dyn. 1979 26 p refs (For primary document see N80-12354 03-34)
Avail: NTIS HC A11/MF A01

Problems specific to in situ acquisition of measurements are discussed along with the typical data acquisition chain used at present for in situ measurement of pressure fields at the surface of large structures. F.O.S.

N80-12358# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPUTATIONAL FLUID DYNAMICS
1979 263 p refs Lecture held at Rhode-Saint-Genese, Belgium, 19-23 Mar. 1979
(VKI-Lec-Ser-1979-6) Avail: NTIS HC A12/MF A01

Recent advances in the theory and application of numerical methods to solve complex problems of fluid mechanics are described. Particular emphasis is given to the treatment of moving boundaries and surface problems and recent progress in solving hyperbolic equations. For individual titles, see N80-12359 through N80-12364.

N80-12359# California Inst. of Tech., Pasadena. Dept. of Applied Mathematics.
NUMERICAL METHODS FOR HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS
H. O. Kreiss *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn. 1979 42 p refs (For primary document see N80-12358 03-34)
Avail: NTIS HC A12/MF A01

The theory and numerical solution of hyperbolic partial differential equations is presented. Only linear problems are considered. R.E.S.

N80-12360# College de France, Paris.
SOME ASPECTS OF THE APPROXIMATION OF FREE SURFACE PROBLEMS
J. L. Lions *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn. 1979 35 p refs Prepared in cooperation with Institut de Recherche d'Informatique et d'Automatisme (France) (For primary document see N80-12358 03-34)
Avail: NTIS HC A12/MF A01

The following aspects concerning free surface problems are discussed: (1) the obstacle problem, (2) homographic penalty, (3) variational inequalities, (4) standard penalty methods, (5) Bingham flows, and (6) free surfaces in composite materials. R.E.S.

N80-12361# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
ORDER OF ACCURACY AND BOUNDARY CONDITIONS FOR LARGE SCALE TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS
Eli Turkel *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn. 1979 46 p refs (For primary document see N80-12358 03-34)
(Grant EY-76-C-02-3077)
Avail: NTIS HC A12/MF A01

The factors that influence the choice of a scheme in the construction of numerical solutions are discussed. Special attention is paid to the treatment of boundaries--standard, moving, and artificial. In all cases, the interplay between the physics and the numerics is stressed. R.E.S.

N80-12362# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE COMPUTATION OF THREE DIMENSIONAL VISCOUS FLOWS
Egon Krause (Aerodynamisches Institut, RWTH Aachen, Germany) *In its* Computational Fluid Dyn. 1979 26 p refs (For primary document see N80-12358 03-34)
Avail: NTIS HC A12/MF A01

A method is presented for calculating the unsteady three dimensional incompressible flows in vessels with time and space dependent cross sections. The equations for the motion of the flow are writen for a generalized, non-orthogonal coordinate system. The finite difference equations are obtained by applying Gauss' divergence theorem to a volume element bounded by coordinate surfaces. The governing equations are solved in a simultaneous iteration process for velocity and pressure. A new matching technique for connecting hybrid mesh systems is described and the treatment of elastic walls is discussed. The formation of Taylor-Gortler cells in spherical gaps is discussed. Only axially symmetric flows are considered so that the stream-function-vorticity-formulation can be used. It is shown how the boundary conditions chosen influence the finite-difference solution. If the space and time resolution is not sufficiently fine, the finite difference approximation converges to a solution belonging to different boundary conditions. R.E.S.

N80-12363# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ON SOME PROBLEMS IN TWO AND SINGLE PHASE FLOWS
H. J. Wirz *In its* Computational Fluid Dyn. 1979 26 p refs

(For primary document see N80-12358 03-34)
Avail: NTIS HC A12/MF A01

The mathematical problem for extracting the relevant parameters that describe the bulk properties of heterogeneous flows is discussed for two limiting cases: (1) equipresent phases are nearly independent of each other; and (2) multi-phase material behaves statistically as a homogeneous material. Systems of partial differential equations are used as mathematical models. R.E.S.

N80-12364# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
THE NUMERICAL TREATMENT OF COMPRESSIBLE HIGH REYNOLDS NUMBER FLOWS
H. Hollanders and H. Viviand *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn. 1979 66 p refs (For primary document see N80-12358 03-34)
Avail: NTIS HC A12/MF A01

The case of compressible flows at high Reynolds numbers, such as flows of current interest in transonic or supersonic aerodynamics is considered. Problems relating to the numerical calculation of such flows, in the case when the influence of viscous effects is more or less strongly felt in the whole flow field, and not just in a small part of the flow field are described. The 'global approach', a method for solving interaction problems based on the coupled calculation of the solutions in the inviscid flow region and in the viscous layer, is presented. R.E.S.

N80-12365# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
APPLICATION OF NUMERICAL METHODS TO FLOW CALCULATIONS IN TURBOMACHINES
1979 480 p Lecture held at Rhode-Saint-Genese, Belgium, 23-27 Apr. 1979
(VKI-Lec-Ser-1979-7) Avail: NTIS HC A21/MF A01

A review of the application of numerical methods to flows in turbomachines is presented. Calculation techniques in which the partial differential equations are solved using finite difference, finite volume, and finite element methods are described. The fundamental equations of fluid mechanics and their properties are discussed. The calculation of two dimensional and three dimensional subsonic and transonic flows is examined. The computational aspects of viscous internal flows are reported. The merits of the various calculation methods are assessed by comparison with experimental data. For individual titles, see N80-12366 through N80-12371.

N80-12366# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTION TO NUMERICAL METHODS: MATHEMATICAL CONCEPTS AND FUNDAMENTAL EQUATIONS
W. Kollmann *In its* Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 22 p refs (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The development and the application of numerical methods to the basic mathematical concepts in fluid mechanics is discussed. The formulation of the problems arising in fluid mechanics into terms of partial differential equations, or partial differential systems, and a set of auxiliary conditions constituting a differential problem is examined. The solutions to the partial differential problems, solved by the numerical methods outlined, are described. A.W.H.

N80-12367# Vrije Universiteit, Brussels (Belgium).
FINITE ELEMENT CALCULATIONS OF TURBOMACHINERY FLOWS
C. Hirsch *In its* Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 78 p refs (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The finite element calculations of turbomachinery flows is presented. The different aspects in the application of the finite element method (FEM) and the finite difference method (FDM) are examined. An engineering presentation of the FEM is discussed in relation to turbomachinery flows and the different aspects of the FEM and the FDM are determined. Applications of the FEM to through flow calculations and to blade to blade subsonic flows are described. Quasi three dimensional and three dimensional methods are discussed and blade transonic flows are determined. A.W.H.

N80-12368# Stuttgart Univ. (West Germany).
DESIGN OF SUPERCRITICAL COMPRESSOR AND TURBINE CASCADES WITH A NUMERICAL METHOD CONSIDERING AXIAL VELOCITY DENSITY RATIO
E. Schmidt *In* Von Karman Inst. for Fluid Dyn. Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 49 p refs (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The development and application of a numerical design method for the design of two supercritical compressors and turbine cascades is presented. The use of the method to determine the blade contours from a given velocity distribution is discussed. The application of the numerical method for the computation of plane transonic flow field is described. An extension of the method which considers the variation of the axial velocity density ratio is discussed. A.W.H.

N80-12369# Cambridge Univ. (England).
TIME MARCHING METHODS FOR TURBOMACHINERY FLOW CALCULATION
J. D. Denton and U. K. Singh (GEC Power Engineering Ltd.) *In* Von Karman Inst. for Fluid Dyn. Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 47 p (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The time dependent methods used to solve flow calculation problems are discussed. The advantages and disadvantages of these methods are described. The applications of time dependent methods to turbomachinery flow problems are reported. The time dependent methods applied to two dimensional cascade flows, quasi three dimensional blade to blade flow, and three dimensional blade to blade flow are described. The development of time dependent methods for inviscid turbomachinery flow calculations is presented. A.W.H.

N80-12370# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TIME MARCHING METHODS FOR TURBOMACHINERY FLOW CALCULATIONS: METHODS OF IMPROVING CONVERGENCE
W. VanHove *In its* Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 38 p refs (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The time marching methods for the calculation of inviscid, transonic flows are examined. Several finite difference schemes for time marching methods, applied to the calculation of one dimensional, inviscid, transonic flow with shock through a convergent-divergent channel are described. The means to improve the convergence speed of a particular finite difference scheme are discussed. A one dimensional investigation, applied to the calculation of the inviscid, blade to blade flow in a transonic turbine cascade using a finite volume discretization method to discretize the flow domain is discussed. A.W.H.

N80-12371# Scientific Research Associates, Inc., Rockville, Md.
COMPUTATIONAL ASPECTS OF VISCOUS FLOWS
Henry McDonald *In* Von Karman Inst. for Fluid Dyn. Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 192 p refs (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The computational aspects of viscous flows are presented. The relationship of the boundary layer equations to the Navier-Stokes Equations is discussed. A summary of the two and three dimensional conventions in boundary layer equations is presented. Four categories of three dimensional viscous flow prediction schemes are identified. A.W.H.

N80-12372*# Old Dominion Univ. Research Foundation, Norfolk, Va.
A SIMPLIFIED MODEL FOR THE VISCOUS CROSSFLOW IN A SLOTTED TEST SECTION
Charlie H. Cooke Nov. 1979 27 p refs

(Grant NsG-1517)
(NASA-CR-3206) Avail: NTIS HC A03/MF A01 CSCL 20D

A simplified physical model was constructed which simulates the viscous crossflow in a fluid layer near the slots at a fixed streamwise location in a slotted wind tunnel. For low to moderate Reynolds numbers, numerical solutions of the two dimensional, incompressible Navier-Stokes equations in stream function and vorticity, which govern the model flow, were obtained. Fairly general slot geometry was incorporated by means of the Thompson-Thames-Mastin transformation. An approximate factorization scheme with cyclic acceleration parameters was employed to solve a finite difference analog of the stream function equation. The vorticity equation was numerically solved with a modified version of the classical alternating direction implicit scheme. Although no quantitative assessment of solution accuracy can be made, numerical results for variations in incremental wall pressure around the slat are at least qualitatively similar to some experimental results. R.E.S.

N80-12373# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
APPLICATIONS OF RANDOM-CHOICE METHOD TO PROBLEMS IN SHOCK AND DETONATION-WAVE DYNAMICS
T. Saito and I. I. Glass Oct. 1979 73 p refs
(UTIAS-240; CN-ISSN-0082-5255) Avail: NTIS HC A04/MF A01

Applications of the Random-Choice Method (RCM) are presented for the solution of problems in shock and detonation wave dynamics. It is shown that unlike other numerical methods, the RCM yields sharp fronted shocks and contact surfaces without resorting to artificial and perhaps erroneous means of predicting their locations. R.C.T.

N80-12374# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
IMPROVED FLOW VISUALIZATION BY WISE USE OF RESONANT REFRACTIVITY Final Report, 1 Mar. 1974 - 28 Feb. 1979
Daniel Bershader Jul. 1979 293 p refs
(Contract AF-AFOSR-2670-74; AF Proj. 2307)
(AD-A073074; AFOSR-79-0937TR) Avail: NTIS HC A13/MF A01 CSCL 20/4

This report discusses the experimental and theoretical work carried out associated with the use of resonance refractivity to improve flow visualization. The principal accomplishment of the present study was to verify quantitatively the feasibility of using the near-resonance spectral region around the sodium D-lines for obtaining one-to-two order-of-magnitude increase in the sensitivity of refractive methods of flow visualization such as schlieren, interferometric and shadow techniques. It is in this near region of the line wings, typically a few angstrom from line center, that the trade-off between refraction and absorption is highly favorable to permit implementation of the method with an available tunable dye laser light source. Here, the refractivity is high enough to see sound waves, weak vortices, etc. The accomplishments included a combined theoretical and experimental analysis of the near-region refractive and absorptive profile taking into account both doppler and collision broadening. The latter feature included studies to optimize the choice of collision parameters for self-broadening (pure sodium vapor) and for heterogeneous broadening (sodium highly diluted by a carrier gas in a flow facility). Experiments with an interferometer-heat pipe arrangement using a tunable pulsed dye laser gave results which agreed with the analysis. The technique is now at the facility-design stage. GRA

N80-12375# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.
COMPUTATION OF WATER WAVES
J. C. W. Rogers and S. Favin Jul. 1979 131 p refs
(Contract N00024-78-C-5384)
(AD-A072944; APL/JHU/TG-1325) Avail: NTIS HC A07/MF A01 CSCL 20/4

The report contains the numerical implementation of a theoretical algorithm that generalizes the Euler equations for irregular flows. The main features of the algorithm are described, and the relevant equations are summarized. The spatial region occupied by the fluid is then discretized, and the numerical quadrature of the theoretical algorithm's governing equations is effected. Computational results are given for the following hydrodynamic free-boundary problems: (a) the fall from rest of a liquid with a profoundly nonlinear initial free surface; (b) the motion from rest of a liquid whose initial free surface is only slightly removed from its equilibrium position, and (c) the collisions of streams of fluid with formation of a jet. A program listing is given in the appendix. GRA

N80-12376# United Technologies Research Center, East Hartford, Conn.
AN EXPERIMENTAL AND ANALYTICAL STUDY OF BOUNDARY LAYERS IN HIGHLY TURBULENT FREE-STREAMS Annual Report, 1 Jun. 1978 - 1 Jun. 1979
M. F. Blair Jul. 1979 72 p refs
(Contract F49620-78-C-0064; AF Proj. 2307)
(AD-A073006; UTRC/R78-914388-5; AFOSR-79-0936TR; AR-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

Experimental research has been conducted to determine the influence of free-stream turbulence on zero pressure gradient, incompressible, fully turbulent boundary layer flow. During this period convective heat transfer coefficients, boundary layer mean velocity and temperature profile and wall static pressure distribution data were obtained for two flow conditions of constant free-stream velocity and low free-stream turbulence intensity and for one flow condition of constant free-stream velocity and higher free-stream turbulence. Documentation of the free-stream turbulence for these flows is currently in progress. The conclusion reached from the low free-stream turbulence test results is that these data are in excellent agreement with classic two-dimensional, low free-stream turbulence, turbulent boundary layer correlations, thus establishing the absolute accuracy of the experiment. The data obtained for the higher free-stream turbulence test case indicates that free-stream turbulence does have a significant effect on fully turbulent boundary layer skin friction and heat transfer. A quantitative assessment of this influence will emerge as data obtained for additional free-stream turbulence levels and as the turbulence distributions are documented. GRA

N80-12377# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
A GENERALIZED BASE-FLOW ANALYSIS WITH INITIAL BOUNDARY-LAYER AND CHEMISTRY EFFECTS Final Report, 1 Oct. - 18 May 1979
John H. Fox Jul. 1979 117 p refs Prepared in cooperation with ARO, Inc., Tullahoma, Tenn.
(AD-A072683; AEDC-TR-79-46) Avail: NTIS HC A06/MF A01 CSCL 20/4

A general theory has been developed for the supersonic, turbulent, near-wake region behind bluff-based, two-dimensional and axially symmetric bodies in the presence of a coaxial, supersonic jet. This work is a generalization of the theory of H. H. Korst and his co-workers. The present theory includes the effects of the initial boundary layer, base bleed, total enthalpy and species differences, and equilibrium chemistry. The generalization was accomplished through the development of an analytical recompression model that obviates the requirement for a recompression factor; the development of a species distribution model for the mixing layers; and the use of a new spreading parameter for the axially symmetric problem. The theory shows good agreement with experiment for the classical, planar-backstep problem with both thin and very thick boundary layers. Good agreement is also shown with base flows behind axially symmetric bodies with a coaxial jet. GRA

N80-12378# Naval Research Lab., Washington, D. C.
NUMERICAL SIMULATION OF COLLAPSING TURBULENT WAKES: COMPARISON OF TURBULENCE CLOSURES AND NUMERICAL SCHEMES Interim Report
A. Warn-Varnas, S. A. Piacsek, G. Hain, and J. Block 22 Mar. 1979 36 p refs
(ARPA Order 2152)
(AD-A072143; AD-E000304; NRL-MR-3930) Avail: NTIS HC A03/MF A01 CSCL 20/4

The collapse of a partially mixed region generated by a prescribed amount of turbulence deposited on a linearly stratified

ambient ocean is studied numerically. Different turbulent closures such as first and second order are used to model the turbulent stresses. The resulting equations are solved numerically in a finite-difference formalism of the primitive form of the equations in a box region several times the size of the mixed region. The resulting maximum observed mean field velocities, densities, and turbulent energies in the fluid are obtained and cross-compared for different closures and numerical methods. GRA

N80-12379# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
CHEMICAL REACTIONS IN TURBULENT MIXING Final Technical Report, 1 Dec. 1975 - 14 Apr. 1979
H. W. Liepmann, G. L. Brown, P. E. Dimotakis, F. E. Marble, A. Roshko, and P. G. Saffman 19 Jul. 1979 297 p refs
(Contract F44620-76-C-0046; AF Proj. 2307)
(AD-A073746; GALCIT-151; AFOSR-79-0952TR) Avail: NTIS HC A13/MF A01 CSCL 20/4

The more important results and developments achieved as a direct result of this contract are as follows: A model for the calculation of turbulent flows was constructed which incorporates effects of Reynolds stress relaxation with the generation or destruction of turbulent energy by rotation. The model was verified by comparison with experiment. It was then used to predict the properties of isolated turbulent vortices and applied to the turbulent mixing layer, in particular to the formation and interaction of the organized structure in the mixing layer. An alternative approach to the mixing layer in which it is modelled by a rolling-up vortex sheet between fluids of different density has also been formulated. Calculations of strained flame elements for use in the coherent flame mode of H2, F combustion showed that only at very high strain rates was sufficient vibrational nonequilibrium produced to be of interest for a chemical laser. This result is reflected in the fact that only in the early portion of the jet, where strain rates are a maximum, does this vibrational nonequilibrium occur. Experimental results were obtained in a new facility and by a new technique for the amount of reaction product obtained betwen two chemically reacting aqueous streams. Results at high and low Reynolds number showed the dependence of the mixing on Reynolds number and Schmidt number. A transition Reynolds number region was found and the nature of the generation of small scale motions which dominate the formation of reaction product was explored. GRA

N80-12380# California Univ., Berkeley. Lawrence Berkeley Lab.
AIR-TO-AIR HEAT EXCHANGERS: SAVING ENERGY AND IMPROVING INDOOR AIR QUALITY
G. D. Roseme, C. D. Hollowell, A. Meier, A. Rosenfeld, and I. Turiel Jun. 1979 8 p refs Presented at the Intern. Conf. on Energy Use Management, Los Angeles, 22-26 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9381; CONF-791009-2) Avail: NTIS HC A02/MF A01

Some houses currently built have substantially reduced air infiltration rates to conserve heating and cooling energy use. Indoor air quality problems associated with this large reduction in ventilation air have become apparent. The use is described of mechanical ventilation, coupled with heat recovery devices in residential buildings, to maintain acceptable indoor air quality and conserve energy. Estimates of energy and peak power savings are given. DOE

N80-12381# Los Alamos Scientific Lab., N. Mex.
SIMPLIFIED SOLUTION ALGORITHMS FOR FLUID FLOW PROBLEMS
C. W. Hirt 1978 21 p refs Presented at the Numerical Methods for Partial Differential Equations Seminar, Madison, Wis., 23 Oct. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2813; CONF-7810149-1) Avail: NTIS HC A02/MF A01

A simplified algorithm is described for the numerical solution of the Navier-Stokes equations. Because of its simple construction, the algorithm serves as a good introduction to numerical fluid dynamics as well as a basis for developing many kinds of new solution methods. To illustrate the flexibility of this algorithm, simple modifications are described for introducing internal obstacles, an accelerated steady-state solution method, a potential flow option, and a method of increasing numerical accuracy. DOE

N80-12043# European Space Agency, Paris (France).
SIMILARITY IN NOZZLE FLOWS WITH VIBRATIONAL NONEQUILIBRIUM
Nimai K. Mira and Martin Fiebig *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 168-184 refs (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12044# European Space Agency, Paris (France).
MIXING LENGTH MODEL FOR COMPRESSIBLE TURBULENT FLOWS IN ROUGH CHANNELS
Wilhelm A. Neuberger *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 185-217 refs Transl. into ENGLISH from 'Ein Mischungswegmodell fuer kompressible turbulente Stroemungen in rauhen Kanaelen', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12206 Institut Franco-Allemand de Recherches, St. Louis (France).
DETONATION OF NITROMETHANE-AL-NO2 MIXTURES
H. Moulard, C. Fauquignon, A. Lichtenberger, and J. M. Lombard *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 3-21 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-12382 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL RECORDING USING HOLOGRAM ARRAYS: DEVELOPMENTS OF THE TRANSDUCERS FOR AN EXPERIMENTAL 100MBIT/S RECORDER
K. Hacking and J. L. Riley Sep. 1979 28 p refs
(BBC-RD-1979/16; PH-206) Copyright. Avail: BBC, Kingswood Warren, Tadsworth, Surrey, England

Special transducers for use with an experimental holographic recorder have been partly developed. They are hologram page-composer with 50 ports, a solid-state digital light-deflector and a photodetector array for intercepting 100 light-beams. The page-composer is based on an electro-optic ceramic material in the form of a large slice placed between two matched arrays of lenses. This device produces 50 collimated digit-beams each of which can be modulated independently by external electronic switches. The digital light-deflector comprises several stages of electro-optic crystals coupled with passive Wollaston prisms. A suitable photodetector array for operation at low light-levels was developed. The design consists of a bundle of 100 monofilament light-guides attached to silicon photodiodes and followed by low-noise amplifiers. F.O.S.

N80-12383*# National Aeronautics and Space Administration. Pasadena Office, Calif.
OPTICAL GYROSCOPE SYSTEM Patent Application
Willis C. Goss (JPL) and Raymond Goldstein, inventors (to NASA) (JPL) Filed 22 Dec. 1978 35 p Sponsored by NASA
(NASA-Case-NPO-14258-1; US-Patent-Appl-SN-972252) Avail: NTIS HC A03/MF A01, CSCL 20F

An optical gyroscope is disclosed which has high accuracy at both slow and fast rotation rates. The gyroscope operates alternately in two modes, one mode utilizing an added 90 deg phase shift and the other employing no added phase shift, to provide high sensitivity for a wide range of rotation rates. A

novel beam splitter is used which first lets the beam pass through, and is later energized to cause the returned beam to be reflected. Linear polarization of the light beam is maintained by keeping all fiber portions in curvature. NASA

N80-12384*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY APPLICATIONS AND EVALUATION RESULTS. LIXISCOPE: PROCEEDINGS OF THE LIXISCOPE CONFERENCE
Jul. 1978 89 p refs Conf. held at Greenbelt, Md., 27-28 Jul. 1978
(NASA-CP-2112) Avail: NTIS HC A05/MF A01 CSCL 14E
The principle of the Lixiscope along with its potential uses in industry, clinical medicine, and astrophysics are presented. For individual titles, see N80-12385 through N80-12397.

N80-12385*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LIXISCOPE CONCEPT
Lo I. Yin *In its* Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 3-4 refs (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
A portable X-ray imagery instrument which utilizes a converter phosphor or scintillator to convert the X-ray image into visible light image is described. The potential medical as well as industrial applications of the Lixiscope are presented. M.M.M.

N80-12386*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FUTURE PROGRESS IN THE DEVELOPMENT OF THE LIXISCOPE
Jacob I. Trombka *In its* Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 5-6 ref (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
Some of the potential of the lixiscope in astrophysics as well as in space medicine are reported. The positioning of the lixiscope as a sensitive detector placed at the focal plane of a focusing or collimating X-ray telescope, and studies of the inter-coastal spacing during weightlessness are described. M.M.M.

N80-12387*# Howard Univ., Washington, D. C.
THEORETICAL CALCULATIONS AND INSTRUMENT DEVELOPMENT AND TEST CHARACTERIZATION OF LOW INTENSITY X-RAY IMAGING DEVICES
George Ferguson, Marshall Lewis, Rajinderbir Harval, Javan Anderson, and Sandra Brown *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 7-10 refs (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The characteristics of the Lixiscope when excited by X-rays produced by conventional electrically powered X-ray generators are explored to determine the optimum X-ray spectrum and mode of operation of the generator, which yields satisfactory Lixiscope images of medical and industrial specimens. M.M.M.

N80-12388*# National Bureau of Standards, Washington, D.C. Center for Radiation Research.
X-RAY SOURCE CHARACTERISTICS AND DETECTION EFFICIENCIES OF PROTOTYPE LIXISCOPES
Stephen M. Seltzer *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 11-14 refs (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The radioactive X-ray sources and scintillator screens used in prototype Lixiscope units are described. Some of those considerations necessary for the optimization of future Lixiscope designs are stressed as well as some semi-quantitative information on the present prototype devices. M.M.M.

N80-12389*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME CONTEMPLATED IMPROVEMENTS TO THE PROTOTYPE LIXISCOPE
Lo I. Yin *In its* Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 15-18 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
Some contemplated improvements on the Lixiscope are described. These can be divided roughly into two categories: those which are well within existing technology, and thus can be implemented immediately; and those which are more at the state-of-the-art level, and which are directly related to applications in X-ray and gamma ray imaging in astronomy. M.M.M.

N80-12390*# Duke Univ., Durham, N. C. Dept. of Radiology.
A COMPARISON OF THE LIXISCOPE WITH OTHER X-RAY IMAGING SYSTEMS
Fearghus OFoghludha *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 19-27 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The imaging techniques relevant in the determination of the clinical potential of the Lixiscope are reviewed. M.M.M.

N80-12391*# Howard Univ., Washington, D. C. Dept. of Orthopedics and Radiology.
ORTHOPEDIC EVALUATION
Thomas Walden *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 31-35 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The clinical performance of the Lixiscope in orthopedics was compared with routine radiography. Portability and size were the major advantages of the Lixiscope. The main disadvantage at this point in time was the Lixiscope's inability to study large areas. R.E.S.

N80-12392*# National Inst. of Dental Research, Bethesda, Md.
DENTAL RESEARCH: PRELIMINARY OBSERVATIONS AND PROJECTIONS
Richard L. Webber *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 37-41 refs (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The potential applicability of the Lixiscope in dentistry was investigated. Conceptual limitations on basic design requirements common to the Lixiscope are discussed. R.E.S.

N80-12393*# National Institutes of Health, Bethesda, Md.
DOSIMETRIC CONSIDERATIONS IN DENTAL APPLICATIONS
John C. Goble *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 43-44 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The integration of the Lixiscope into dental procedures was studied and compared with conventional dental radiographic techniques. It was found that through the use of intraoral sealed sources in conjunction with microchannel plate technology, the Lixiscope gives increased diagnostic information with decreased radiation dosage. R.E.S.

N80-12394*# Connecticut Univ., Farmington. Health Center.
MAXILLO: FACIAL DIAGNOSIS
Allan B. Reiskin *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 45-49 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The application of the Lixiscope in dentistry was studied. Due to a problem in resolution, it is concluded that, at this present time, the Lixiscope can only be as a previewing device for conventional radiography. R.E.S.

N80-12395*# Connecticut Univ., Farmington. Health Center.
PEDIATRICS
Thomas J. Spackman *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 51-59 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E

The utilization of the Lixiscope in pediatrics was investigated. The types of images that can presently be obtained are discussed along with the problems encountered. Speculative applications for the Lixiscope are also presented. R.E.S.

N80-12396*# Pennsylvania Coll. of Podiatric Medicine, Philadelphia. Dept. of Radiology.
PODIATRY
Stephen Weissman *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 61-64 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E

The use of the Lixiscope in podiatry was preliminarily evaluated. It is concluded that the possibilities for the Lixiscope's clinical use in podiatry seems endless. R.E.S.

N80-12397*# National Aeronautics and Space Administration, Washington, D. C.
AN OVERVIEW OF THE NASA TECHNOLOGY UTILIZATION PROGRAM
Louis Mogavero *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 67-77 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E

The NASA technology utilization program is described. The transfer of that technology is described along with the publications which distribute the technological information. R.E.S.

N80-12398*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
EXPERIMENTAL STUDY OF LOW-ENERGY CHARGE TRANSFER IN NITROGEN
Alphonse Smith Nov. 1979 33 p refs
(NASA-TM-80156; L-13246) Avail: NTIS HC A03/MF A01 CSCL 20L

Total charge transfer cross sections were obtained for the N2(+)-N2 system with relative translational ion energies between 9 and 441 eV. Data were obtained to examine the dependence of total cross section on ion energy. The effect of ion excitation on the cross sections was studied by varying the electron ionization energy in the mass spectrometer ion source over an electron energy range between 14.5 and 32.1 eV. The dependence of total cross section on the neutralization chamber gas pressure was examined by obtaining data at pressure values from 9.9 to 0.000199 torr. Cross section values obtained were compared with experimental and theoretical results of other investigations. R.C.L.

N80-12399*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
DETERMINATION OF NOISE EQUIVALENT REFLECTANCE FOR A MULTISPECTRAL SCANNER: A SCANNER SENSITIVITY STUDY
Daniel E. Gibbons (Fort Lewis Coll., Durango, Colo.) and Richard R. Richard Dec. 1979 31 p refs
(NASA-TP-1575; S-497) Avail: NTIS HC A03/MF A01 CSCL 14E

The methods used to calculate the sensitivity parameter noise equivalent reflectance of a remote-sensing scanner are explored, and the results are compared with values measured over calibrated test sites. Data were acquired on four occasions covering a span of 4 years and providing various atmospheric conditions. One of the calculated values was based on assumed atmospheric conditions, whereas two others were based on atmospheric models. Results indicate that the assumed atmospheric conditions provide useful answers adequate for many purposes. A nomograph was developed to indicate sensitivity variations due to geographic location, time of day, and season. R.C.T.

N80-12400# Sandia Labs., Albuquerque, N. Mex.
LASER VELOCIMETER MEASUREMENTS IN A CONSTANT VOLUME INTERNAL COMBUSTION ENGINE SIMULATOR
T. M. Dyer and P. O. Witze Aug. 1978 9 p refs Presented at 3d Workshop on Laser Velocimetry, West Lafayette, Ind., 11 Jul. 1978
(Contract EY-76-C-04-0789)
(SAND-78-8721; Conf-780733-3) Avail: NTIS HC A02/MF A01

The transient gas motion in a constant volume combustor was studied with a dual beam backscatter laser anemometer system, using a counter-type signal processor. A highly-swirling methane-air mixture was introduced into an initially evacuated chamber through a tangentially-directed valve in the side of the cylinder. Time-resolved tangential component mean velocity measurements were made in both the pre- and post-combustion gases. High speed shadowgraph movies were also made to illustrate both the fluid motion and the combustion process. R.E.S.

N80-12401# SRI International Corp., Menlo Park, Calif.
AUTORADIOGRAPHIC ENHANCEMENT OF POLAROID FILM Final Report, 18 Apr. - 17 Oct. 1978
R. G. Manning and R. R. Pettijohn Nov. 1978 19 p Prepared for California Univ., Lawrence Livermore Lab.
(Contract W-7405-eng-48; SRI Proj. PYD-7420)
(UCRL-13952) Avail: NTIS HC A02/MF A01

The application of radiotracer photographic image enhancement techniques to increase the photographic speed of three Polaroid Films is presented. A state-of-the-art capability in the field of nondestructive photographic image enhancement of original negatives was acquired. These procedures have successfully increased optical density, contrast, and resolution of photographic imagery, and thereby increased the information derivable from original negatives. DOE

N80-12402# Wien Univ. (Austria). Inst. for Experimental Physics.
AEROSOL MEASUREMENTS IN THE SUBMICRON SIZE RANGE, STUDIES WITH AN AEROSOL CENTRIFUGE, A NEW DIFFUSION BATTERY, A LOW PRESSURE IMPACTOR AND AN ADVANCED CONDENSATION NUCLEI COUNTER Final Report, 1973 - 1978
Othmar Preining and Axel Berner May 1979 109 p refs
(Grant EPA-R-801983)
(PB-298073/8; EPA-600/2-79-105) Avail: NTIS HC A06/MF A01 CSCL 14B

The investigations of four aerosol classifiers which cover finite, but overlapping ranges of the aerosol particle size spectrum are summarized. A cylindrical aerosol centrifuge, which measures aerodynamic equivalent diameters precisely was used as a reference instrument in diffusion battery experiments. The diffusion battery was investigated for fairly large particle sizes to determine the influence of sedimentation, interception, and impaction on the transmission of the diffusion battery. A five stage low pressure impactor which covers the size range from 0.1 micrometer to 25 micrometers diameter was developed specifically for the determination of the deposited particulate mass. A special condensation nuclei counter which measures number-size distributions in the size range from 0.002 micrometers to 0.1 micrometers KELVIN equivalent diameter was also developed. GRA

N80-12209 Institut Franco-Allemand de Recherches, St. Louis (France).
THE USE OF HOLOGRAPHY FOR KINETIC ENERGY MEASUREMENTS OF TARGET SPLINTERS
H. Royer and M. Giraud *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 110-121 refs (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

N80-12210 Institut Franco-Allemand de Recherches, St. Louis (France).
THE DEVELOPMENT OF PASSIVE DOPPLER TECHNIQUES IN LRSL/ISL AND THEIR APPLICATIONS TO BALLISTIC AND AERODYNAMIC MEASUREMENTS
B. Koch *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 122-166 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-12403 State Univ. of New York at Binghamton.
INTRACAVITY QUENCHING AND DYE KINETICS OF A

NITROGEN LASER PUMPED DYE LASER Ph.D. Thesis
William Gerard Divens 1979 125 p
Avail: Univ. Microfilms Order No. 7924328

The design and construction of a compact N2 laser pumped dye laser operating in the intracavity quenched mode is described. The N2 laser spectrum as a function of pressure is presented along with a double pulsing effect observed when the laser dye solution is probed with a HeNe laser. By removing the cavity mirrors a double pulsing of the output beam was observed. The double pulse phenomenon was studied with a number of different laser dyes. The results indicate that the effect is a result of instantaneous changes in index of refraction caused by transverse optical pumping of the dye molecules which are, subsequently, depopulated along one axis by the dye laser pulse.
Dissert. Abstr.

N80-12404 Columbia Univ., New York.
COLLISION AND PHOTOFRAGMENTATION DYNAMICS OF IR LASER PUMPED METHYL FLUORIDE AND CARBONYL FLUORIDE Ph.D. Thesis
Rekha Sapre Sheorey 1979 188 p
Avail: Univ. Microfilms Order No. 7924982

By placing excess vibrational population in the v sub 3 C-F stretching mode of methyl fluoride by a Q-switched CO2 laser, the time dependence of fluorescence signals from the overtone level 2v sub 3 and from all fundamental vibrational levels was monitored. Laser induced fluorescence was studied in the infrared region of the electromagnetic spectrum in order to yield information about the qualitative and quantitative aspects of vibrational energy transfer in polyatomic molecules. Energy transfer mechanisms and timescales on which the equilibration processes occur were determined. Specific mode to mode energy transfer rate constants were determined by analyzing the temporal behavior of the various excited vibrational state fluorescences.
Dissert. Abstr.

N80-12405*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
CHARACTERIZATION OF THE Q-SWITCHED MOBLAS LASER TRANSMITTER AND ITS RANGING PERFORMANCE RELATIVE TO A PTM Q-SWITCHED SYSTEM
John J. Degnan and Thomas W. Zagwodski Oct. 1979 76 p refs
(NASA-TM-80339) Avail: NTIS HC A05/MF A01 CSCL 20E

A prototype Q-switched Nd:YAG laser transmitter intended for use in the NASA mobile laser ranging system was subjected to various tests of temporal pulse shape and stability, output energy and stability, beam divergence, and range bias errors. Peak to peak variations in the mean range were as large as 30 cm and drift rates of system bias with time as large as 6 mm per minute of operation were observed. The incorporation of a fast electro-optic cavity dump into the oscillator gave significantly improved results. Reevaluation of the ranging performance after modification showed a reduction in the peak to peak variation in the mean range to the 2 or 3 cm level and a drift rate of system time biases of less than 1 mm per minute of operation. A qualitative physical explanation for the superior performance of cavity dumped lasers is given. K.L.

N80-12406# Naval Ocean Systems Center, San Diego, Calif.
NAVAL BLUE-GREEN SINGLE-PULSE DOWNLINK PROPAGATION MODEL Final Report, Jan. - Dec. 1978
P. J. Titterton (GTE-Sylvania), H. E. Sweeney (GTE-Sylvania), R. D. Anderson, R. F. Howarth, and M. E. Hyde 1 Jan. 1979 91 p refs
(AD-A071780; NOSC/TR-387) Avail: NTIS HC A05/MF A01 CSCL 17/2

This technical report describes the official Navy model for signal and noise characteristics of a single blue-green optical pulse propagated from a satellite laser source to a submerged receiver in all weather conditions. A mathematical model is developed in two groups: the signal group relates the instantaneous received optical signal power, while, the noise group relates the total noise equivalent optical power to the noise source. Both groups of the model account for propagation path and receiver characteristics; and, they allow calculation of the signal-to-noise ratio for any blue-green single-pulse downlink from a satellite laser source to a submerged receiver. The relative technical uncertainty in accuracy of both equation groups has also been included. GRA

N80-12407# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
MINICOMPUTER APPLICATIONS IN AUTOMATED TESTING OF ELECTRO-OPTICAL GUIDANCE SYSTEMS
Ray E. Schneider 19 Mar. 1979 23 p
(AD-A073092; DRDMI-T-79-38) Avail: NTIS HC A02/MF A01 CSCL 17/8

An Automated Laser Seeker Performance Evaluation System (ALSPES) has been developed which utilizes a minicomputer to implement the control functions required to test electro-optical (E/O) guidance systems. These tests are used by the Government to identify problem areas in the guidance system design and to validate subsequent design changes. Software programs have been written for a series of tests which fully evaluate E/O seeker performance. Test conditions are fed into a CRT terminal and the minicomputer conducts a fully automated, hands-off test by varying such parameters as laser energy, target position and velocity, seeker position and angular rate, and time separation between targets. This report discusses the types of automated tests performed, the electro-optical test equipment utilized and the layout of the test facility, the minicomputer to test equipment interface, and the cost savings resulting from the development of this automated test facility. GRA

N80-12408# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESEARCH STUDIES ON NEODYMIUM PENTAPHOSPHATE MINIATURE LASERS Final Report, 1 Oct. 1977 - 30 Sep. 1978
Stephen R. Chinn 30 Sep. 1978 59 p refs
(Contract F19628-78-C-0002)
(AD-A073140; ESD-TR-78-392) Avail: NTIS HC A04/MF A01 CSCL 20/5

The thermal conductivity and specific heat of NdP5O14 have been measured using a dynamic electrical heating technique. The values of the thermal conductivity tensor elements (in W/cm K) are Lambda sub a = .021, Lambda sub b = .00966, and Lambda sub c = .014. The specific heat is 0.141 cal/g-K, in excellent agreement with the value of 0.139 cal/g-K that was measured by differential scanning calorimetry. We have calculated the time-dependent heating effects of typical flash-lamp-excited round and rectangular laser rods. With repetition rates limited to approx. 10 ppm, simple conductive cooling by an ambient-temperature heat-sink should be adequate. Computer simulation of the flash-lamp-excited NPP laser has been carried out by numerical solution of the laser rate equations. With 1 J electrical input, typical calculated output energies are 24 mJ for normal-mode operation and 10 mJ for passively Q-switched operation. Optimum Q-switch absorption and output mirror transmission have also been calculated. Experimental studies of such lasers have been made with varying laser rod size and laser resonator parameters. GRA

N80-12409# ILC Technology, Inc., Sunnyvale, Calif.
LASER PUMP LAMPS Final Report, Feb. 1976 - Sep. 1978
Norman C. Anderson Wright-Patterson AFB, Ohio AFAL Feb. 1979 149 p refs
(Contract F33615-76-C-1029; AF Proj. 2028)
(AD-A072704; R-ILC-77-4/F; AFAL-TR-79-1002) Avail: NTIS HC A07/MF A01 CSCL 20/6

The subject program was undertaken to develop technology for producing a potassium vapor arc lamp with a 3000 hour lifetime. The lamp is to be used as optical pump source in a Nd:YAG laser transmitter as part of a space communications system. The lamp lifetime goal was successfully achieved, a characteristic lifetime of approximately 6000 hours being demonstrated for lamps built late in the program. In addition, the final lamp satisfied virtually all other design and performance requirements. Most of the effort on the program was directed at developing supporting technology for the lamp. This work included solving problems of basal plane cracking and potassium vapor attack of the sapphire envelope, developing a long-lived

cathode, determining the most efficient lamp fill, developing an oxidation protection coating for the Kovar endcaps, optimizing the Kovar-to-sapphire brazed seal design, conducting thermal design proof tests (including simulation of zero-g effects), improving the potassium filling procedure, developing an optimized lamp operating procedure, and conducting vibration tests. GRA

N80-12410# Naval Research Lab., Washington, D. C.
HEATED ELECTRON BEAM CELL STUDY Final Report, Jun. 1977 - May 1978
J. G. Eden and S. K. Seales 12 Mar. 1979 12 p
(AD-A072875; AD-E000310; NRL-MR-3957) Avail: NTIS HC A02/MF A01 CSCL 20/5

In general, high power gas lasers operate with simple laser species at room temperature. High power electronic state gas lasers, however, operate only with diatomic rare gas or rare gas halide laser molecules. To increase the number of laser molecules for high power laser operation, it is necessary to raise cell temperature above room temperature. The alkali metals, Group I, become volatile, at 400-500 C. At even higher temperatures the metals in Groups IIB, IIIA, IVA, and VA have significant vapor pressures. The purpose of this work is to advance the state of the art of high temperature cell design to allow laser discovery experiments to proceed with fewer technical difficulties. The design and operation of a new valve and a new cell for high temperature, high pressure operation is reported. GRA

N80-12411# AeroChem Research Labs., Inc., Princeton, N. J.
KINETIC SPECTROSCOPY OF METAL ATOM/OXIDIZER CHEMILUMINESCENT REACTIONS FOR LASER APPLICATIONS Final Report, 1 May 1976 - 30 Apr. 1979
Arthur Fontijn Jul. 1979 13 p refs
(Contract F44620-76-C-0108; AF Proj. 2303)
(AD-A073082; AEROCHEM-TP-388; AFOSR-79-0941TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

This work addressed the need to discover, characterize, and understand highly efficient metal atom/oxidizer chemiluminescent reactions for their potential as chemical electronic transition laser (CETL) pumps. Efforts concentrated on the reactions of the Group IVA elements Sn and Ge with N2O. Overall rate coefficients, photon yields, and quenching coefficients were measured and mechanistic insights were obtained. Techniques for such studies were further developed and critically compared to those in use elsewhere. The experiments were performed in high-temperature fast-flow reactors (HTFFR) which allow for independent control of temperature, total pressure, and reactant and quencher concentrations and are thus uniquely suited to kinetic measurements. The detailed results are contained in a number of publications, the abstracts of which are included. It is concluded that Sn/N2O is the most attractive CETL candidate of the Group IVA element/N2O reactions but that, as a practical device, it may face development difficulties due to product quenching. GRA

N80-12213 Institut Franco-Allemand de Recherches, St. Louis (France).
TRANSIENT INTERACTIONS OF LASER PULSES WITH MATTER
K. Daree *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 227-241 refs In GERMAN; ENGLISH summary
(For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

N80-12214 Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL STUDIES OF LASER INDUCED DETONATION WAVES
M. Hugenschmidt and K. Vollrath *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 242-259 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-12412 Syracuse Univ., N. Y.
OIL WHIRL AND CRITICAL INSTABILITIES IN ROTOR-BEARING SYSTEMS Ph.D. Thesis
Ehtisham Uddin Ahmad Siddiqui 1979 272 p
Avail: Univ. Microfilms Order No. 7925653

The phenomenon of oil whirl is analyzed and the critical instabilities of a rotor system with flexible supports are determined. It is found that; (1) instability is not eliminated even for the case of infinitely rigid shafts; (2) a proper choice of foundation parameters raises the whirl threshold significantly above that obtained with rigid supports; and (3) external damping has a stabilizing effect on the rotor system, but the effect of external dampers on the critical speeds depends on the position of attachment to the rotor. A general formulation to determine critical speeds of an N mass system in journal bearings is given. To illustrate the feasibility of the program developed, damped natural frequencies are determined using a nine station model of a turbocompressor. Dissert. Abstr.

N80-12413 Kansas Univ., Kansas City.
ASSIST OF AN AIR-TO-AIR HEAT PUMP USING SOLAR HEATED HOT WATER Ph.D. Thesis
Margaret Sanders Drake 1979 110 p
Avail: Univ. Microfilms Order No. 7925871

An air-to-air heat pump of the type usually installed in residences was investigated. A split unitary heat pump was used with duct and outlets installed to approximate an actual installation. A 55 gallon drum fitted with an electric immersion heater simulated a solar heated water storage tank. Circuit piping led from the storage tank to a hot water coil located ahead of the outdoor refrigerant coil. The results indicate that a hot water solar system could be incorporated with an air-to-air heat pump and improve the utility of both systems. Solar-heated hot water was used down to a temperature of 60 F which was well below the necessary temperature for direct space heating. The Coefficient of Performance of the heat pump improved an average of about 50 percent and ranged from about 2.0 at 15 F ambient to 3.0 at 45 F ambient with solar assist. The heat output of the heat pump at a given outdoor temperature increased with solar assist from about 40 percent at an outdoor temperature of 15 F to about 25 percent at an outdoor temperature of 45 F. Dissert. Abstr.

N80-12414*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODIFIED FACE SEAL FOR POSITIVE FILM STIFFNESS Patent Application
Izhak Etsion (Technion-Israel Inst. of Technol., Haifa) and Abraham Lipshitz, inventors (to NASA) (Technion-Israel Inst. of Technol., Haifa) Filed 7 Nov. 1979 7 p Sponsored by NASA
(NASA-Case-LEW-12989-1; US-Patent-Appl-SN-092145) Avail: NTIS HC A02/MF A01 CSCL 11A

An invention to improve the film stiffness of a face seal without increasing the sealing and dam area is described. The improved sealing apparatus has a primary seal ring in the form of a nose piece. A spring forces a sealing surface on the seal ring into sealing contact with a seat to form a face seal. A circumferential clearance seal is formed in series with this face by a lip on the nose piece. The width of the surface of the lip is substantially the same as the width of the sealing surface on the face seal. Also, the clearance between the surface on the lip and the shaft is substantially the same as the spacing between the face sealing surfaces on the face seal when the shaft is rotating. The circumferential clearance seal restricts the flow of fluid from a main cavity to an intermediate cavity with a resulting pressure drop. The hydrostatic opening is strongly dependent on the face seal clearance, and the desired axial stiffness is achieved. NASA

N80-12415# Army Armament Research and Development Command, Watervliet, N. Y. Benet Weapons Lab.
ABRASIVE MACHINING OF MAJOR COMPONENTS

John Rodd May 1979 70 p refs
(AD-A071916; ARLCB-MR-79010) Avail: NTIS
HC A04/MF A01 CSCL 13/8

The term 'abrasive machining' has been expressed in many ways. It is generally used to denote stock removal operations that are more economically performed by abrasive grinding methods than the more conventional means of turning or milling. The two largest fields for abrasive machining are the production of flat surfaces and form grinding from the solid. This report is concerned with the latter; grinding various complex external shapes from the solid forging, bar stock or hollow cylindrical items. GRA

N80-12416# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
IMPROVED CAPABILITIES TO DETECT INCIPIENT BEARING FAILURES Interim Report, 1 May 1978 - 28 Feb. 1979
J. A. Alcorta and L. L. Packer Jun. 1979 67 p refs
(Contract F33615-78-C-2008; AF Proj. 3048)
(AD-A073123; FR-11509; AFAPL-TR-79-2050) Avail: NTIS
HC A04/MF A01 CSCL 21/5

A methodology using a low level radiation technique for the detection of wear in gas turbine engine mainshaft bearings has been developed. In conjunction with SOAP analyses, the radioactive tag will detect low levels of wear and will simultaneously indicate whether the tagged bearing is the source of the wear. Iron-55 is employed as the active tag owing to its low radiation levels, long half-life, and homogeneity of the isotope in the bearing rollers. The low levels of radiation existent in the tagged wear particles requires the separation of wear debris from the oil. Membrane filtration of the oil for debris removal is undertaken due to its high recovery efficiency, simplicity of use, and adaptability for direct incorporation into the nuclear counting system. A gas flow proportional counter with cosmic guard detector and background shielding constitutes the most suitable low-level radio-activity measuring device for the iron-55 X-ray counting. The radioactive bearing tagging technique complements engine modularization by defining a diagnostic system that will identify specific engine bearings experiencing wear. By assessing the location of the distressed bearing, the tagging technique permits the confinement of engine teardown to the module in which the bearing is located. Author (GRA)

N80-12417# Oak Ridge National Lab., Tenn.
AUSTENITIC STAINLESS STEEL-TO-FERRITIC STEEL TRANSITION JOINT WELDING FOR ELEVATED TEMPERATURE SERVICE
J. F. King, G. M. Goodwin, and G. M. Slaughter 1978 9 p refs Presented to SAMPE Conf., Kiamesha Lake, N. Y., 17 Oct. 1978
(Contract W-7405-eng-26)
(CONF-781068-1) Avail: NTIS HC A02/MF A01

Failure mechanisms of ferritic to austenitic steel transition joints were investigated in an effort to improve service life. Failures of these joints are attributed to metallurgical changes in the HAZ of the welds and creep fatigue damage resulting from the mis-match of thermal expansion properties of the materials and the cyclic temperature service. It is shown by finite element analysis techniques that a 38% decrease in stress is possible at the critical ferritic steel-weld metal interface by using a material with an intermediate coefficient of thermal expansion between the ferritic steel and austenitic stainless steel and the use of small angle weld joint geometries. J.M.S.

N80-12418# Los Alamos Nuclear Corp., N. Mex.
TOWARD A COMPREHENSIVE MODEL FOR COMBUSTION IN A DIRECT INJECTION STRATIFIED CHARGE ENGINE
T. D. Butler, L. D. Cloutman, J. K. Dukowicz, J. D. Ramshaw, and R. B. Krieger (GM Res. Labs., Warren, Mich.) 1978 53 p refs Presented at Intern. Symp. on Combustion Modeling in Reciprocating Engines, Warren, Mich., 6 Nov. 1978
(Contract W-7405-eng-36)
(LA-UR-78-3223; Conf-7811102-1) Avail: NTIS
HC A04/MF A01

Computational models that simulate the single-cylinder dynamics of an engine cycle are presented. One engine concept discussed in detail is the direct injection stratified charge engine. The reactive fluid dynamics method is described and extended to include species transport and chemistry. Limitations of the models as they stand today are discussed as well as the prospects for their improvement. Illustrative calculations of a comparison between homogeneous and stratified operation in an axisymmetric cylinder with a cupped piston are described. R.E.S.

N80-12419# Sandia Labs., Albuquerque, N. Mex.
FRACTURE TOUGHNESS OF STEEL-ALUMINUM DEFORMATION WELDS
C. E. Albright Nov. 1978 162 p refs
(Contract EX-76-C-04-0789)
(SAND-78-1736) Avail: NTIS HC A08/MF A01

A study of the fracture toughness (in this case, G/sub Ic/) of steel-aluminum deformation welds using a specially developed double cantilever beam fracture toughness specimen is presented. Welds made at 350 C were heat treated at 360, 380, 400, 420, and 440 C. An intermetallic reaction product layer of Fe2Al5 was formed at the steel-aluminum interface with increasing heat treating temperature and time by a process of nucleation and growth of discrete particles. A transition in toughness from a higher average G/sub Ic/ value (6097 N/m) to a very low average G/sub Ic/ value (525 N/m) was observed. The decrease in toughness was accompanied by an increase in Fe2Al5 particle diameter from 4 to 8 micrometers. Failure at the higher toughness values is characterized by ductile rupture through the aluminum. At the lower toughness values, failure occurs between the aluminum and the Fe2Al5 reaction product layer. DOE

N80-12420# Idaho National Engineering Lab., Idaho Falls.
LONG-TERM BEARING WEAR TESTS OF CONVENTIONAL JOURNAL BEARINGS AND DEVELOPMENT OF HYDROSTATIC BEARINGS FOR THE LOFT DRAG-DISC TURBINE TRANSDUCER
J. R. Fincke 22 Mar. 1979 62 p refs
(Contract EY-76-C-07-1570)
(LTR-141-101) Avail: NTIS HC A04/MF A01

The details of a program concerning materials for use as turbine bearings in a pressurized water reactor environment are reported. Two types of bearings were examined, both conventional journal bearings and hydrostatic bearings. The results of long-term bearing wear tests conducted at 590 K and 15.1 MPa in water are presented. The feasibility of using hydrostatic bearings for the same transducer is demonstrated. DOE

N80-12421# National Highway Traffic Safety Administration, Washington, D. C. Technical Services Div.
AUTOMOBILE FUEL TANKS
Lois Flynn May 1979 102 p
(PB-298933/3; DOT-HS-804728; SB-33) Avail: NTIS
HC A06/MF A01 CSCL 13F

Literature acquired since the establishment of the National Highway Traffic Safety Administration (NHTSA) is presented. It concerns automobile fuel tanks and fuel tank systems. NHTSA contract reports, reports of other organizations concerned with highway safety, and articles from periodicals in related fields are reported. GRA

N80-12208 Institut Franco-Allemand de Recherches, St. Louis (France).
MISCELLANEA CONCERNING TERMINAL BALLISTICS
G. Weihrauch, H. F. Lehr, and E. Wollmann *In its* Contrib. to Ballistics, Detonations, and Pulse Phys., 1979 p 36-110 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-12422# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Systems

Dev. Mfg. Tech. Directorate.
ELECTRICAL OVERSTRESS PROGRAM
D. Mathews, P. P. Budenstein (Auburn Univ.), W. H. Causey, Jr. (BDM Corp.), L. G. Green, C. R. Jenkins, G. W. Neudeck (Purdue Univ.), D. H. Phillips (Rockwell Intern.), and W. D. Raburn (Alabama Univ.) 1 Sep. 1979 166 p refs
(AD-A073148; DRDMI-EA-78-22) Avail: NTIS
HC A08/MF A01 CSCL 14/2

This report is a description of initial work on a program to provide information needed in the development of a nondestructive screen to eliminate junction bipolar devices especially suspectible to damage after second breakdown. Based on the results of the first 8 months of work, the decision has been made that the major thrust of the program should be towards identifying the reasons why specific samples of a given device type are unusually susceptible, rather than determining nominal susceptibility of generic types. GRA

N80-12423# General Dynamics Corp. Fort Worth, Tex.
OPTIMIZATION OF COMPUTER AUTOMATED ULTRASONIC INSPECTION SYSTEM Final Report, Jun. 1976 - Oct. 1978
Bill G. W. Yee, J. C. Couchman, and F. H. Chang Feb. 1979 199 p refs Prepared in cooperation with Pattern Analysis and Recognition Corp.
(Contract F33615-76-C-5104; AF Proj. 7351)
(AD-A072677; AFML-TR-79-4016) Avail: NTIS
HC A09/MF A01 CSCL 09/2

This report describes the work conducted on a program to optimize the hardware and software of a computer automated ultrasonic inspection system which was developed under a previous Air Force Contract F33615-72-C-1828. The hardware modifications included improvements of the scan drive mechanism to increase inspection speed and development of improved ultrasonic circuitry to perform zone scanning inspections. Software developments included: (1) implementation of the zone scanning inspection method, (2) programs for signal processing to enhance random flaw detection, and (3) development of a Computer Aided Design Data Control (CADDC) method to interface the inspection system with data generated by Computer Aided Design (CAD) approach to component design. GRA

N80-12424# Sandia Labs., Albuquerque, N. Mex.
EXPERIMENTAL VERIFICATION OF A COMBINED ENVIRONMENT ACCELERATED AGING METHOD APPLIED TO ELECTRICAL CABLE MATERIAL
K. T. Gillen 1978 16 p refs Presented at USNRC Water Reactor Safety Research Meeting, Germantown, Md., 6 Nov. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1907A; Conf-781146-16) Avail: NTIS
HC A02/MF A01

The results of a continuing program whose main goal is the development of reliable accelerated aging techniques are described. One result of these studies was the development of an approach or method potentially applicable to combined environment aging when synergism is important. A brief review of this suggested approach is given, followed by an extensive discussion of aging data on a neoprene cable jacketing material. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-12425 Rensselaer Polytechnic Inst., Troy, N. Y.
A THEORY OF THERMOVISCOPLASTICITY Ph.D. Thesis
Edward Paul Cernocky 1979 226 p
Avail: Univ. Microfilms Order No. 7922225

A theory of three-dimensional infinitesimal isotropic viscoplasticity and thermoviscoplasticity is proposed and investigated in several homogeneous deformations. The theory is developed in separate stages of isothermal three-dimensional, isothermal uniaxial, and nonisothermal three-dimensional behavior. In an additional separate stage of development, a general method is given to construct classes of functions with an arbitrary almost constant (linear) initial interval of behavior, followed by a nonprescribed interval of monotonic nonlinear behavior. This region of nonlinear behavior is succeeded by an unbounded region of almost constant (linear) behavior. These functions are indispensible tools for the numerical simulation of predictions of this theory. Total strain is used and the strain tensor is not decomposed into a sum of elastic and inelastic contributions. The transition from initially linear thermomechanical behavior to nonlinear inelastic behavior is smooth. The theory is represented by both a mechanical constitutive equation and a constitutive assumption for the heat equation; these equations are separately postulated but are coupled through their common linear dependence upon the stress rate and strain rate tensors and the time rate of change of absolute temperature, and through their common nonlinear dependence upon the stress and strain tensors and the absolute temperature. Dissert. Abstr.

N80-12426 Wisconsin Univ. - Madison.
THE DYNAMIC RESPONSE OF ELASTIC ISOTROPIC THIN CIRCULAR CYLINDRICAL SHELLS TO INTENSE HEAT Ph.D. Thesis
Hemendra Kumar Mitra-Roy 1979 128 p
Avail: Univ. Microfilms Order No. 7918158

The dynamic response to periodic thermal inputs and to suddenly applied thermal loadings was investigated. The shell has simply supported ends which are free to move in the axial direction. The general solutions for displacements and stresses were obtained for axisymmetric temperature distributions, and numerical results are presented. The strains are linear functions of displacements and displacement gradients. The mathematical formulation of the problem consists of three, fourth order, coupled, linear ordinary inhomogeneous differential equations with inhomogeneous time-dependent boundary conditions. The method of solution is based on the fact that a boundary-value problem consisting of a homogeneous or inhomogeneous differential equations with inhomogeneous boundary conditions can be transferred into a problem consisting of an inhomogeneous differential equation with homogeneous boundary conditions. The transformed problem is then solved by modal analysis. Dissert. Abstr.

N80-12427 Wisconsin Univ. - Madison.
STRESSES IN THE NEIGHBORHOOD OF LOADED HOLES IN WOOD WITH APPLICATION TO BOLTED JOINTS Ph.D. Thesis
Thomas Lee Wilkinson 1978 162 p
Avail: Univ. Microfilms Order No. 7918175

Stresses and strains around a pin-loaded hole in a finite wood plate and the effects of material properties, plate geometry, and ratio of pin-to-hole diameter upon the stresses are described. Numerical (finite element) and experimental (strain gages and moire) techniques were used to obtain solutions. An iterative process of handling the contact problem between the pin and plate was developed using finite elements. Both conventional and fringe multiplication techniques of moire analysis were used. Correlation of results obtained by the various techniques was excellent. Relatively small variations in pin-to-hole size were found to produce very significant changes in the stresses. Significant changes were found in the shape, as well as the magnitude, of the stress field below the pin for short end distances. Results suggest that optimum end distance should be eight times the hole radius. Plate width should be at least four times the hole radius for Sitka spruce plates. The presence of friction between the pin and plate was found to greatly influence the stresses. The nature of the problem considered resulted in moderate changes in material stiffnesses producing only minor modifications in stresses. Dissert. Abstr.

N80-12428 Rhode Island Univ., Kingston.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF PIPE RISER CLAMPS Ph.D. Thesis
Umesh Chandra 1979 219 p
Avail: Univ. Microfilms Order No. 7925814

Two different types of pipe riser clamps (called type A and

type B) used to support the vertical runs of pipes in nuclear and fossil power plants were stress analyzed. Experimental investigations revealed the presence of large amounts of normal and shear stresses in the vicinity of the bend in type A clamp. By the use of longitudinal stiffeners in type B clamp, normal stress along the bend was very much reduced and most of the region bounded by the two stiffeners carried rather uniform shear. Two kinds of errors were found with nodal stress output using numerically integrated finite elements (isoparametric elements) in the analysis of a clamp. Heuristic explanations for these errors are given. Mathematical formulation for the elasto-plastic, creep and dynamic analysis of the clamps is presented. Dissert. Abstr.

N80-12429 Columbia Univ., New York.
A CONTRIBUTION TO THE DESIGN AND ANALYSIS OF PRECAST PRESTRESSED SHELLS OF REVOLUTION UNDER SYMMETRIC AND UNSYMMETRIC LOADS Ph.D. Thesis
Giuseppe DeCampoli 1979 202 p
Avail: Univ. Microfilms Order No. 7924871

The stresses produced by prestressing and by symmetric and unsymmetric load conditions in suspended shells of revolution with various boundary constraints are investigated with a precise, systematic analysis which also considers the initial suspension cable structure. Design and construction criteria are formulated using the indications of the results of the investigation. Dissert. Abstr.

N80-12430 Columbia Univ., New York.
BUCKLING AND POST-BUCKLING BEHAVIOR OF ELASTO-PLASTIC STRUCTURES Ph.D. Thesis
Ka-Kin Chan 1979 105 p
Avail: Univ. Microfilms Order No. 7924862

An investigation of the problem of buckling and post-buckling behavior of elasto-plastic structures consisting of beam elements is presented. A general finite element formulation of the basic equations of large deflections of elasto-plastic structures was developed. The criteria of uniqueness and stability was formulated in terms of the tangent stiffness matrices of the system. A system of constitutive equations of beams in terms of the axial strain and curvatures and the axial force and bending moments was proposed as a device for improving the efficiency of the calculations. The analysis of the post-buckling behavior includes a static determination of the configurations of equilibrium as well as a dynamic simulation of the motion of the system in the range of unstable post-buckling modes. Dissert. Abstr.

N80-12431 California Univ., Los Angeles.
INELASTIC BEHAVIOR OF STEEL STRUCTURES SUBJECTED TO EARTHQUAKE-INDUCED GROUND MOTION Ph.D. Thesis
Alvar Mehis Kabe 1979 207 p
Avail: Univ. Microfilms Order No. 7921423

The large amplitude inelastic response of steel structures to earthquake type motions, was investigated experimentally. The response data from one of the structures was used to check the accuracy of the structural analysis computer program DRAIN-2D. It was concluded that in order for the analytical model to reproduce accurately the nonlinear response of the structure at both small and large amplitudes of vibration, the yield moment and strain hardening stiffness must be changed during the analysis. This indicates, that the force deformation relationship incorporated in the model needs to recognize that after the initial few large amplitude cycles, the yield stress of the steel increases. Dissert. Abstr.

N80-12432 Dayton Univ., Ohio.
A PENALTY FUNCTION APPROACH FOR THE NONLINEAR FINITE ELEMENT ANALYSIS OF THIN SHELLS Ph.D. Thesis
Robert Allen Brockman 1979 230 p
Avail: Univ. Microfilms Order No. 7925692

A penalty method for the nonlinear structural analysis of thin shells was developed, based upon an incremental form of the potential energy. Penalty terms were introduced into the incremental variational principle, which yielded behavioral constraints of discrete Kirchhoff type as part of the stationary conditions. Discretization of the incremental principle then lead to thin shell finite elements. Applications of the method are described, including static and transient nonlinear solutions. Capabilities of the penalty function approach for predicting very large displacements and rotations are demonstrated in the sample analyses. Application of the developed technique to structures of practical size is shown in the nonlinear analysis of an aircraft windshield canopy. Dissert. Abstr.

N80-12433 Wichita State Univ., Kans.
DEVELOPMENT OF THE SUBSTRUCTURAL ELEMENT METHOD FOR STRESS ANALYSIS Ph.D. Thesis
Viswanathan Padmanabhan 1979 127 p
Avail: Univ. Microfilms Order No. 7925426

Two-dimensional problems with stress singularities are solved by discretizing the problem into substructural elements. The general formulation of the displacement function of the substructural elements is presented for solving two-dimensional problems with stress singularities. This is achieved by writing an Airy stress function for the element and by satisfying certain boundary conditions of the element exactly. Two problems - the End Problem and the Partially Clamped Plate Problem - are solved using both the methods. The results are evaluated and compared. For the End Problem, the results are also compared with results from a photoelastic experiment. Dissert. Abstr.

N80-12434 Virginia Polytechnic Inst. and State Univ., Blacksburg.
POSTBUCKLING STUDIES OF CURVED LAMINATED COMPOSITE PANELS Ph.D. Thesis
Nandalke Jayanth Kudva 1979 97 p
Avail: Univ. Microfilms Order No. 7925374

A finite element postbuckling analysis of various curved, midplane symmetric, laminated composite panels was performed. The loading considered was axial compression along the curved edges. Donnell's strain-displacement relations, which take quadratic nonlinearities into account, were used. The material behavior considered was linear elastic. For the curved composite panels considered, a 45 degree fiber orientation for some of the plies was found to yield the highest buckling load as well as the largest drop in the equilibrium load level along the postbuckling path. Dissert. Abstr.

N80-12435# National Aerospace Lab., Tokyo (Japan).
THE METHOD OF WEIGHTED RESIDUALS IN THE TIME DOMAIN APPLIED TO NONLINEAR VIBRATIONS
Tetsuhiko Ueda and Yuji Matsuzaki Mar. 1979 8 p refs
(NAL-TR-564T) Avail: NTIS HC A02/MF A01

A method to solve nonlinear differential equations governing periodic motion is presented. The approximation is based on the method of weighted residuals. As an example problem, nonlinear vibrations of an infinitely long cylinder are examined, and their frequencies are calculated, using various types of assumed solutions and weighting functions. The numerical results show that the Galerkin type of finite element procedure gives a good approximation. Author

N80-12436# Aeronautical Research Labs., Melbourne (Australia).
A SPECIAL CRACK TIP ELEMENT FOR THREE-DIMENSIONAL CRACK PROBLEMS
R. Jones and R. J. Callinan Nov. 1978 21 p refs
(ARL-Struc-Note-374; AR-001-319) Avail: NTIS HC A02/MF A01

A finite element method for determining the stress intensity factors along the edge of a crack in an arbitrary three-dimensional body is presented. A spectral element is placed around the crack front and in each special element the stresses and displacements are derived using the asymptotic nature of the stress and displacement fields near a crack tip. The method is based on a technique for evaluating the stress intensity factors in cracked sheets, and coincides with this method in the case of a through crack in a thin sheet. As illustrative examples, the problems of a semicircular surface flaw and an internal penny shaped crack are considered. In each case the computed values of the stress intensity factors are in excellent agreement with known analytical results. M.M.M.

N80-12437# Indian Inst. of Tech., Bombay. Dept. of Civil Engineering.
THERMAL STRESSES IN NON-HOMOGENEOUS SHELLS OF REVOLUTION: THEORY AND ANALYSIS

Tarun Kant Aug. 1979 85 p refs
(IIT-B/CE-79-2) Avail: NTIS HC A05/MF A01

A general theory for small deformations of a thick shell made up of a layered system of different orthotropic materials having planes of symmetry coincident with the orthogonal reference frame and subjected to mechanical and arbitrary temperature distribution is presented. Quadratic variations in thickness coordinate for all the three displacement components were assumed. Generalized Hooke's law which includes the effects of transverse shear deformation, transverse normal stress and transverse normal strain were used. The general equations were particularized for axisymmetric shells, and cast into a set of coupled first order ordinary differential equations suitable for numerical integration on a digital computer. R.E.S.

N80-12438*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY DESIGN PROCEDURE FOR INSULATED STRUCTURES SUBJECTED TO TRANSIENT HEATING
Howard M. Adelman Washington Dec. 1979 53 p refs
(NASA-TP-1534; L-13144) Avail: NTIS HC A04/MF A01 CSCL 20L

Minimum-mass designs were obtained for insulated structural panels loaded by a general set of inplane forces and a time dependent temperature. Temperature and stress histories in the structure are given by closed-form solutions, and optimization of the insulation and structural thicknesses is performed by nonlinear mathematical programming techniques. Design calculations are described to evaluate the structural efficiency of eight materials under combined heating and mechanical loads: graphite/polyimide, graphite/epoxy, boron/aluminum, titanium, aluminum, Rene 41, carbon/carbon, and Lockalloy. The effect on design mass of intensity and duration of heating were assessed. Results indicate that an optimum structure may have a temperature response well below the recommended allowable temperature for the material. R.C.T.

N80-12439# Sydney Univ. (Australia). Civil Engineering Labs.
THE EFFECT OF PRE-CRACKING ON COLUMN BEHAVIOUR
R. Q. Bridge Apr. 1979 26 p refs
(PB-298743/6; R-344) Avail: NTIS HC A03/MF A01 CSCL 13B

An experimental investigation into the behavior under load of steel reinforced concrete columns containing cracks prior to the application of the load is presented. The pre-cracking was produced both by restrained shrinkage and by the release of loads sustained for periods up to six years. Bending in both single and double curvature was examined using a range of end eccentricities. The results demonstrate that apart from reducing the stiffness of the columns, pre-cracking can reduce the ultimate load capacity below that for similar columns which are uncracked prior to loading. It is shown that the influence of pre-cracking is accounted for in terms of an additional eccentricity of loading. GRA

N80-12440*# Mitre Corp., Houston, Tex.
NASTRAN PROCESSING AT JOHNSON SPACE CENTER
F. M. Richards, Jr. Mar. 1979 57 p refs
(NASA Order T-5295F; Contract F19628-79-C-0001)
(NASA-CR-160382; MTR-4722) Avail: NTIS HC A04/MF A01 CSCL 20K

The processing behavior of NASTRAN, a general purpose system of computer software used for solving engineering analysis problems by means of the finite element displacement method, is discussed. The host system for the NASTRAN is the Univac 1110, and the primary function is performing static and dynamic structural analyses of the Space Shuttle. The processing implications of the NASTRAN structural analysis are addressed and the current NASTRAN situation on the Univac 1110 is examined. The current NASTRAN workload is described and the effect of workload growth due to increased structure size is estimated. A cost and performance analysis is presented. A.W.H.

N80-12441# Oakland Univ., Rochester, Mich. School of Engineering.
DEVELOPMENT AND APPLICATION OF METHODS OF EXPERIMENTAL MECHANICS Annual Report
A. J. Durelli, J. D. Hovanesian, and Y. Y. Hung Aug. 1979 4 p
(Contract N00014-76-C-0487)
(AD-A072836) Avail: NTIS HC A02/MF A01 CSCL 14/2

The general objective of the research program is to develop method in experimental mechanics, with particular emphasis on stress analysis. The following phases have been dealt with: (1) new methods in three-dimensional photoelasticity, (2) viscoelasticity, (3) strains in actual solid propellant for rockets, (4) shrinkage stresses, (5) transient thermal stresses, (6) gravitational stress, (7) composite materials, (8) dynamic holography and photoelasticity, (9) interference phenomena, (10) two- and three-dimensional finite strains and stresses, (11) cables, (12) evaluation of relative merits and limitations of different experimental stress analysis methods, (13) elastostatics of boxes subjected to pressure and concentrated loads, (14) optimization of shapes, (15) speckle methods, (16) photoelastic coatings. GRA

N80-12442# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
SMALL-SCALE YIELDING AT THE TIP OF A THROUGH-CRACK IN A SHELL Interim Report
J. D. Achenbach and T. Bubenik Jan. 1979 10 p refs
(Contract N00014-76-C-0063)
(AD-A072832; NU-SML-TR-79-1) Avail: NTIS HC A02/MF A01 CSCL 20/11

Deformation theory is used to model plastic deformation at the tip of a through-crack in a thin shell. In the vicinity of the crack the shell is subjected to both stretching and bending, but stretching is assumed to dominate. Thus, the stresses are tensile, but with a non-uniform distribution through the thickness, which depends on the material properties as well as on the geometry. The non-linear near-tip fields (which are singular) have been analyzed asymptotically. Cracks in shallow shells and spherical shells have been investigated in some detail. It is shown that the angular variations are the same as for generalized plane-stress plate problems. Assuming small-scale yielding a path-independent integral, which is valid in a region close to the crack edge, is used to connect the nonlinear near-tip fields with the corresponding singular parts of the linear fields. It is shown that the nonlinear behavior significantly affects the through-the-thickness variations of the near-tip fields. The singular parts of the membrane stresses tend to become more uniform through the thickness of the shell with stronger strain hardening. GRA

N80-12443# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
NEAR-TIP PLASTIC DEFORMATIONS IN DYNAMIC FRACTURE MECHANICS Interim Report
J. D. Achenbach, P. Burgers, and V. Dunayevsky Jul. 1979 23 p refs
(Contract N00014-76-C-0063)
(AD-A072833; BU-SML-TR-79-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

Under rapid loading conditions and/or for a rapidly propagating crack, the mass density of a material affects the fields of stress and deformation. For such dynamic fracture problems plastic deformation in the immediate vicinity of a crack tip is investigated in this paper. Both stationary and propagating crack tips are considered. For a stationary crack tip, deformation theory is employed for the first phase of the loading when the fields are increasing monotonically with time. The general character of the near-tip fields is analyzed both with respect to its variation with time and with polar angle. The non-linear near-tip fields are related to the linearly elastic far-field by means of a path-independent integral. In the second part of the paper we consider rapidly propagating cracks. We discuss the near-tip fields for various models of material behavior. In particular we briefly review some earlier work by Achenbach and Kanninen for a rapidly propagating Mode-III crack, in a material which displays strain hardening. In the last part of the paper we consider the fields near a rapidly propagating crack-tip in an elastic-perfectly plastic material for the case that inertial terms are of importance. The system of governing equations in the plastic region is presented and shown to be hyperbolic in nature. As a first approximation the steady-state case with respect to the moving

crack-tip is considered and an asymptotic analysis of the near-tip field is carried out. GRA

N80-12444# Georgia Inst. of Tech., Atlanta. School of Engineering Science and Mechanics.
ON SOME NEW GENERAL AND COMPLEMENTARY ENERGY THEOREMS FOR THE RATE PROBLEMS IN FINITE STRAIN, CLASSICAL ELASTO-PLASTICITY Interim Report
Satya N. Atluri Dec. 1978 50 p refs
(Contract N00014-78-C-0636)
(AD-A072969; GIT-ESM-SNA-10; TR-1) Avail: NTIS HC A03/MF A01 CSCL 20/11

General Variational theorems, for the rate problem of classical elastoplasticity at finite strains, in both Updated Lagrangean and Total Lagrangean rate forms, and in terms of alternate measures of stress-rate and conjugate strain-rates, are critically studied from the point of view of their application. Attention is primarily focused on the derivation of consistent complementary energy rate principles, which could form the basis of consistent and rational assumed stress type finite element methods; and two such principles, in both UL and TL forms, are newly stated. Systematic procedures to exploit these new principles in the context of a finite element method are also discussed. Also, certain general modified variational theorems, to enable an accurate numerical treatment of near incompressible behavior at large plastic strains, are discussed. GRA

N80-12445# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
STRUCTURAL INELASTICITY 23: A PIECEWISE LINEAR THEORY OF PLASTICITY FOR AN INITIALLY ISOTROPIC MATERIAL IN PLANE STRESS
Philip G. Hodge, Jr. Nov. 1978 22 p
(Contract N00014-75-C-0177; NR Proj. 064-429)
(AD-A073008; AEM-H1-23) Avail: NTIS HC A02/MF A01 CSCL 20/11

A 20-faced polyhedron is chosen as a reasonable piecewise linear approximation to either the Mises or Tresca yield criterion. Strain hardening and motion of the faces during hardening are assumed to be linear functions. Subject to the above assumptions, to initial isotropy, and to some reasonable symmetry requirements it is shown that the most general possible theory contains 11 material constants. Some simple experiments with a thin-walled tube are suggested for determining these constants. GRA

N80-12446# Georgia Inst. of Tech., Atlanta. School of Engineering Science and Mechanics.
RATE COMPLEMENTARY ENERGY PRINCIPLES FINITE STRAIN PLASTICITY PROBLEMS AND FINITE ELEMENTS Interim Report
Satya N. Atluri Jun. 1979 13 p refs Submitted for publication
(Contract N00014-78-C-0636)
(AD-A072970; GIT-ESM-SNA-14; TR-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

Complementary energy theorems, for the rate problem of finite strain classical elasto-plasticity, in both Updated and Total Lagrangean forms with alternate stress-rates and conjugate measures of strain rate, are studied from the point of view of their application in finite elements schemes. Two new complementary theorems, in Updated and Total Lagrangean forms respectively, are proposed. The relative merits of these in application to finite-strain elasto-plastic stress analysis, in the treatment of near-incompressibility at large plastic flow, and treatment of buckling problems, are briefly discussed. GRA

N80-12447# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
RECOMMENDED PLAN FOR PROJECT FRACT: A CRITICAL EVALUATION OF FRACTURE RELATED ANALYTICAL AND COMPUTATIONAL TECHNIQUES Progress Report, Jun. 1978 - Jun. 1979
J. L. Swedlow, S. E. Benzley (Sandia Labs. N.M.), W. E. Haisler (Texas A.&M. Univ.), A. S. Kobayashi (Washington Univ.), H. J. Konish (Westinghouse R&D), J. C. Newman (NASA, Langley), C. H. Parr (Lord Kinematics), J. S. Solecki, and W. K. Wilson (Westinghouse R&D) Jul. 1979 49 p refs
(Contract N00014-78-C-0528)
(AD-A072773) Avail: NTIS HC A03/MF A01 CSCL 20/12

This report outlines a plan for critical evaluation of fracture related analytical and computational techniques. The plan involves ten to twelve investigators who, by various techniques, 'solve' a succession of problems involving elastic and elasto-plastic behavior, followed by residual fields after load removal. Solutions would proceed by analytical, computational and experimental techniques, applied to closely defined problems. The problems represent a sequence of stress concentrations, from none to mild to sharp - as used in fracture testing. The sequence of problems is intended to identify the essential needs for modeling of such problems to produce accurate results. The plan is described in terms of procedure and phasing over a two-year period, and the problems are described in terms of their experimental set-up. Thin-plate, round, and thick-section configurations are included. The report was prepared by a Planning Committee of experts in the field, and a preliminary draft was reviewed by a larger Advisory Group. Comments received during this review process are incorporated into this report. GRA

N80-12448# California Univ., Los Angeles. Dept. of Materials.
ACOUSTIC EMISSION METHOD FOR STRESS AND STRAIN DETERMINATION
M. Shibata and K. Ono Apr. 1979 11 p refs Presented at Inst. of Acoustics Conf., London, 3-5 Apr. 1979
(Contract N00014-75-C-0419)
(AD-A072774; TR-79-02) Avail: NTIS HC A02/MF A01 CSCL 20/1

Acoustic Emission (AE) was detected during magnetization of a nickel and was also found to depend on applied stress. Varying AE outputs were observed on several ferromagnetic materials under alternating magnetic field. This magnetomechanical AE phenomenon has a potential of performing nondestructive measurements of residual stresses in structures, components and weldments, and we examined systematically effects of applied stress and magnetic field strength in ferritic steels. Several carbon steels, A533B steel and Armco iron were tested in annealed or normalized condition. By employing two AE transducers (AC 175L and MAC 500), rms voltages were measured at two frequency ranges. Maximum stress level was 350 MPa. It was found that 1020 steel shows the highest AE response among the material tested. Residual stress levels can be determined by monitoring the outputs of two AE transducers for a given material condition. The amount of prior cold work can also be obtained by monitoring this AE phenomenon. Details of experimental findings will be discussed towards the goal of developing a new method of nondestructive evaluation of residual stress and material conditions. GRA

N80-12449# California Univ., Livermore. Lawrence Livermore Lab.
OASIS: A GENERAL PURPOSE MESH GENERATOR FOR FINITE ELEMENT CODES
M. A. Gerhard 26 Apr. 1979 89 p refs
(Contract W-7405-eng-48)
(M-101) Avail: NTIS HC A05/MF A01

A general purpose mesh generator for two and three dimensional finite element codes is described. The basic parts of OASIS are the surface generator and the three dimensional region generator, both of which use a linear blending interpolation formula. Integer space and geometric space coordinate systems are used. In 2D, OASIS generates triangular transitional elements, 4 node isoparametric elements, 5 to 9 node continuum elements, bars, and beams. In 3D, OASIS generates 8 node isoparametric elements as well as 9 to 27 node continuum elements and trusses. In 2D, a standard quad element may degenerate into a triangle. In 3D, a standard brick may degenerate into a triangular pyramid. Displacement, rotation, and traction boundary conditions may be applied in both 2D and 3D. DOE

N80-12450# California Univ., Richmond. Earthquake Engineering Research Center.
LINEAR AND NONLINEAR EARTHQUAKE RESPONSES OF SIMPLE TORSIONALLY COUPLED SYSTEMS
Christopher L. Kan and Anil K. Chopra Feb. 1979 120 p refs

(Grant NSF ENV-76-04264)
(PB-298262/7; UCB/EERC-79/03; NSF/RA-790122) Avail: NTIS HC A06/MF A01 CSCL 13M

The effects of torsional coupling on the earthquake response of simple one-story structures in both elastic and inelastic ranges of behavior are analyzed. The structures considered are symmetrical about one principal axis of resistance, resulting in coupling only between lateral displacement along the perpendicular principal axis and the torsional displacement. Torsional coupling arising only from eccentricity between centers of mass and elastic resistance is considered. Systems with several resisting elements, columns and walls are idealized by a single-element model. Response of such a model to a selected earthquake ground motion are presented for a wide range of the basic structural parameters. The results presented include maximum lateral and torsional deformations of the system as well as maximum deformation of individual columns. It is shown that the inelastic response is affected by torsional coupling to generally a lesser degree than elastic response. Procedures for estimating, to a useful degree of approximation, the maximum responses of elastic and inelastic systems from the corresponding response spectra and the maximum deformations of individual columns from the displacements at the center of mass are presented. GRA

N80-12451# California Univ., Richmond. Earthquake Engineering Research Center.
HYSTERETIC BEHAVIOR OF LIGHTWEIGHT REINFORCED CONCRETE BEAM-COLUMN SUBASSEMBLAGES
Brian Forzani, Egor P. Popov, and Vitelmo V. Bertero Apr. 1979 110 p refs
(Grant NSF ENV-76-04263)
(PB-298267/6; UCB/EERC-79/01; NSF/RA-790121) Avail: NTIS HC A06/MF A01 CSCL 13M

The behavior of interior beam-column joints of a ductile moment-resisting frame constructed of lightweight aggregate concrete is investigated. The effects of bond deterioration in the joint region are emphasized. Results of experiments carried out on two lightweight R/C specimens are compared with similar experiments on specimens constructed of normal weight concrete. The specimens perform similarly when subjected to monotonically increasing lateral loads, but lightweight specimens perform when subjected to cyclic loading similar to that which can be expected from severe seismic excitations. Recommendations are given for improving observed behavior and for further research. GRA

N80-12452# Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
BOND STRESS-SLIP RELATIONSHIP AND CRACKING RESPONSE OF REINFORCED CONCRETE COMPOSITE Progress Report
S. Somayaji and S. P. Shah Jun. 1979 71 p refs
(Grant NSF ENG-77-23534)
(PB-297744/5) Avail: NTIS HC A04/MF A01 CSCL 13C

An analytical model was developed based on an assumed bond stress distribution function rather than an assumed bond stress-slip function. The constants of the bond stress distribution function were obtained by integration of the function in steps and by satisfying the boundary conditions. Using this approach, equations were derived to predict the complete composite response, including crack width, stress-strain curve and the tension stiffening effect. The theoretical predictions of composite response were in good agreement with the experimental data on mortor specimens reinforced with the varying volume and diameter of longitudinal bars. GRA

N80-12453# Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
FRACTURE BEHAVIOR AND ANALYSIS OF FIBER REINFORCED CONCRETE BEAMS Progress Report
G. Velazco, K. Visalvanich, S. P. Shah, and A. E. Naaman Mar. 1979 129 p refs
(Grant NSF ENG-77-23534)
(PB-297743/7) Avail: NTIS HC A07/MF A01 CSCL 13C

Linear and elastic-plastic fracture mechanics approaches are summarized with a particular emphasis on their applications to fiber reinforced cementitious materials. Fiber reinforced concrete beams with varying notch depths and different volume fractions of fibers were tested. The results were analyzed to examine the applicability to fiber reinforced concrete of various experimental and analytical fracture mechanics approaches including: (1) critical stress intensity factor, (2) J integral, (3) critical crack opening displacement, (4) compliance techniques for determining slow crack growth, and (5) R curve analysis. Attempts were made to identify a fracture parameter which is independent of test specimen geometry and which can correctly predict the effects of fiber additions. GRA

N80-12026# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION METHODS ASSOCIATED WITH THE LAWS OF CYCLIC AND DAMAGE BEHAVIOR
Serge Savalle and Jean-Pierre Culie *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 71-92 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 263-278 Original language report was announced as A79-18535 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

N80-12028# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOMOGENIZATION OF STATIC THERMOELASTIC PROPERTIES OF MEDIA WITH PERIODIC STRUCTURES
Daniel Engrand *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1978-5 Jul. 1979 p 97-102 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestrial (Paris), no. 1978-5, Sep. - Oct. 1978 p 283-286 Original language report was announced as A79-18537 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N80-12454 Oklahoma Univ., Norman.
THE EFFECTIVENESS OF TWO AND THREE DIMENSIONAL ISARITHMIC SURFACES IN COMMUNICATING MAGNITUDE, GRADIENT, AND PATTERN INFORMATION Ph.D. Thesis
Joseph William Frasca 1979 286 p
Avail: Univ. Microfilms Order No. 7923784

The influence of cartographic variables on communication efficiency from two dimensional maps and perspective diagrams was assessed by using a factorial analysis of variance. Communication efficiency was operationalized by an index score based on each map reader's accuracy and response time for perceptual tasks pertaining to height assessment, steepest slope identification, and assessment of surface trend. Results indicated that two dimensional isarithmic maps were more efficient in transferring height information to map readers. Perspective maps were more efficient in transfering steepest slope and trend information than two dimensional isarithmic maps. These results for all three information types were, however, conditioned by two and three-way combinations of the independent variables on efficiency. Dissert. Abstr.

N80-12455 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany). Abt. des Deutschen Geodaetischen Forschungsinstituts.
INFORMATION RELATIVE TO CARTOGRAPHY AND

GEODESY. SERIES 2: TRANSLATIONS
1978 178 p refs
(Rept-36) Copyright. Avail: Issuing Activity

Topics are presented on photogrammetry research. The subjects include auto and cross-correlation of image coordinates, geometrical analysis of LANDSAT imagery, depth information from underwater acoustical scanners, effect of aircraft attitude on image geometry of linear array sensors, on-line aerial triangulation, bundle adjustment with field and self calibration texture analysis by means of synthetic impulse functions. For individual titles, see N80-12456 through N80-12466.

N80-12456 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AUTO- AND CROSS-CORRELATION OF IMAGE COORDINATES
F. Ackermann and M. Schlilcher *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 5-24 (For primary document see N80-12455 03-43)
Avail: Issuing Activity

Two series of wide-angle and of super wide-angle photographs of the testfield Rheidt are used to determine empirically the correlation of image coordinates within a photograph and between different photographs. The results show strong correlations which remain constant even between different photographs. The correlations depend on the systematic image errors which are reduced considerably to small magnitudes by their compensation. Author (ESA)

N80-12457 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
GEOMETRICAL ANALYSIS AND RECTIFICATION OF LANDSAT MSS IMAGERY: COMPARISON OF DIFFERENT METHODS
H.-P. Baehr *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 25-46 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

The quality of four different mathematical models (Helmert-transformations, second-order polynomials, collinearity equations, prediction) is discussed with respect to geometrical analysis of LANDSAT imagery. This leads to operational digital rectification procedures, providing two levels of accuracy: a bulk approach, applying scale factors and earth rotation and needs no or little ground control and yields an accuracy of about 2 pixel units; and a precision approach taking second order polynomials and 9 ground control points yields at least 1 pixel. Author (ESA)

N80-12458 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A STUDY IN THE DETERMINATION OF DEPTH INFORMATION FROM UNDERWATER ACOUSTICAL SCANNERS
E. Clerici and G. Konecny *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 47-65 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

A general mathematical model for the determination of depths using stereoscopic side scan sonar images is described. It is based on the assumption that the attitude and position parameters of the sensor can be continuously recorded or reconstructed by calculation. Three computer application programs were developed, operating in sequence to determine the Z coordinate of the intersection point of two range vectors from active sensors. Author (ESA)

N80-12459 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
EFFECT OF AIRCRAFT ATTITUDE CHANGES ON IMAGE GEOMETRY OF LINEAR ARRAY SENSORS
Egon Dorrer *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 67-77 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

The kind of geometry to be expected in airborne line scanned imagery as a consequence of attitude changes of the sensor carrier is analyzed. The theoretical discussion of this problem is based upon a digital computer simulation of the sensor's kinematic behavior during flying conditions. Some speculative conclusions are drawn as to what intrinsic properties of the image geometry could be used to reconstruct the orientation of the sensor. The results show that considerable numerical efforts must be made to solve the given equations. The problem was programmed in APL language. Author (ESA)

N80-12460 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
HEIGHT INTERPOLATION BY THE METHOD OF FINITE ELEMENTS
Heinrich Ebner and Peter Reiss *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 79-94 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

A method for the interpolation of the heights in a regular square grid is suggested, which is based on the Finite Element Method. The chosen formulation allows filtering of any desired amount as well as a direct and rigorous consideration of terrain inhomogeneity and discontinuities. Practical application examples are shown as perspective images of the interpolated digital height models, including the effect of various amounts of filtering. Author (ESA)

N80-12461 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
BUNDLE ADJUSTMENT WITH FIELD AND SELF CALIBRATION: RECENT RESULTS
Heiko Ellenbeck and Guenther Kupfer *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 95-111 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

Application of field and self calibration of photogrammetric systems along with bundle adjustment procedure is demonstrated with two experiments. Both approaches lead to optimized results only if the calibration is made without alteration of any component of the photogrammetric system. Triangulation results for judging pros and cons of both approaches is given, showing comparable accuracy. Author (ESA)

N80-12462 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PROGRESS IN PHOTOGRAMMETRIC POINT DETERMINATION BY COMPENSATION OF SYSTEMATIC ERRORS AND DETECTION OF GROSS ERRORS
Armin Gruen *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 113-140 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

Some basic problems of gross error detection and systematic error compensation procedures are discussed. The compensation of systematic errors in bundle adjustment is analyzed with the conclusion that further investigations are necessary if a better insight into the correlation problems of additional parameters and ground point coordinates are to be obtained. The accuracy potential of self-calibrating bundle adjustment is discussed. Finally, the problem of gross error detection is considered, showing that in order to obtain a minimum of bundle interactions a first stage of gross error detection should be combined with the computation of the approximate values of bundle adjustment. Author (ESA)

N80-12463 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON-LINE AERIAL TRIANGULATION WITH THE PLANICOMP C-100 ANALYTICAL STEREOPLOTTING SYSTEM
Dierk Hobbie *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 140-150 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

The applications of the C-100 PLANICOMP analytical stereoplotting system are described. The system includes a basic opto-mechanical unit, a photogrammetric control panel, control unit, computer, computer terminal preferably in the form of a video screen, and optional peripheral equipment and plotting table. The measurement-technique of on-line aerial triangulation is explained and the improvement in speed and gross error detection by automatic prepositioning of points and immediate display of residuals after completion of measurement is discussed. Author (ESA)

N80-12464# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
BLOCK-ADJUSTMENT PROGRAMS FOR MINICOMPUTERS
H. Klein *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 151-161 (For primary document see N80-12455 03-43)
Avail: Issuing Activity

The PAT-M and PAT-B computer programs for block adjustment with independent models and bundles, including additional parameters are reviewed. The viewpoints, problems and results of adapting these programs to minicomputers are explained and admissible block sizes given. A listing of comparable computing times and a special strip-adjustment program are presented. Author (ESA)

N80-12465 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AUTOMATIC DATA ACQUISITION FOR DIGITAL HEIGHT MODEL
Gerald Lindig *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 163-168 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

Experiments on automated height measurement using the ITEK-Correlator EC-5 planimat D-2 system are discussed. Software solutions were developed in order to solve the problems observed in the first attempts to use the EC-5 correlator for data acquisition for the Digital Height Model. The solutions have in common the necessity to measure additional planimetric lines such as edges of woods, built-up areas or break-lines. Some hardware and software improvements in the EC-5 itself were also adopted. A satisfactory accuracy of height measurements by using the modified system is expected. Author (ESA)

N80-12466 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TEXTURE ANALYSIS BY MEANS OF SYNTHETIC IMPULSE FUNCTIONS
Bernd-Siegfried Schulz *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 169-178 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

A method for object recognition utilizing multispectral data, which is different from statistical procedures and harmonic analysis, is presented. An area structure is described by an impulse pattern and then impulse functions are generated and systematically varied with regard to the duration, gap and phase of the impulse until the optimum adaptation to the given data is achieved. A test run made on areas with uniform texture is described, and the resulting autocovariance function is presented. The extension of this procedure to the classification according to their texture is discussed. Author (ESA)

N80-12467 Technische Hochschule, Darmstadt (West Germany). Fachgebeit Fernerkundung und Photointerpretation.
ON MEASUREMENTS FROM AIRCRAFT Final Report
Joerg Albertz and Manfred Schroeder Jun. 1978 505 p refs In GERMAN; ENGLISH summary Presented at Symp. Airborne Sensing Programme, Hanover, 29-31 Aug. 1977 Prepared in cooperation with DFVLR, Oberpfaffenhofen, West Germany (Contract BMFT-WE-0175)
(BMFT-FB-W-78-04) Avail: Issuing Activity

Some fifty papers are presented on the techniques developed and applied in the framework of the German remote sensing program pursued during the 1975 to 1977 period. Airborne multispectral imaging techniques were applied to the following disciplines: oceanography and coastal processes, urban and regional management, agriculture and forestry, geology and hydrology. Intensive research work in the fields of digital image processing and the spectral signatures of natural surfaces were associated with this program. For individual titles, see N80-12468 through N80-12517.

N80-12468 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
AIMS AND TASKS OF THE AIRCRAFT TEST PROGRAM [ZIELE UND AUFGABEN DES FLUGZEUGMESSPROGRAMS]
Manfred Schroeder *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 11-22 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Studies were carried out for developing German remote sensing equipment for future participation in international satellite projects for global and regional environmental monitoring systems. Emphasis is given to work in the following fields: multispectral imaging techniques, development of systems for the digital treatment of images, applications to geoscience problems, evaluations for future technological developments, balanced organizational and interdisciplinary teams. Author (ESA)

N80-12469 Technische Universitaet, Hanover (West Germany).
ON THE CURRENT STATE OF REMOTE SENSING TECHNIQUES [ZUM GEGENWAERTIGEN STAND DER FERNERKUNDUNG]
G. Konecny *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 23-36 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Several different aspects of current work are discussed: radiation characteristics of various objects, choice of sensors, choice of platform, data processing (analog and digital), and the handling and interpretation of complex information. A specific problem which benefits from the exploitation of such techniques is then exposed: the Jade coast region. The economic importance of the region is underlined. It is concluded that a high resolution thermal sensor and an even higher resolution optical sensor are invaluable for coastal water and engineering studies. Author (ESA)

N80-12470 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
FUTURE REMOTE SENSING PROGRAM OF THE DFVLR [DAS ZUKUENFTIGE FERNERKUNDUNGSPROGRAMM DER DFVLR]
H. Sax *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 37-50 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Work for evaluating German technology, and for defining the DFVLR European and international role is described. The most important elements of the DFVLR programs are: studies of various systems, basic research and the development of new methods, technological research and development and aiding equipment users. Attention is given to combined optical and microwave systems and their applications as satellite measurement devices. Data processing techniques are also discussed. Author (ESA)

N80-12471 Freiburg Univ. (West Germany).
INTERNATIONAL COOPERATION IN REMOTE SENSING [INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DER FERNERKUNDUNG]
G. Hildebrandt *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 51-57 ref In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The difficulties encountered in international coordination in this field are discussed. The corresponding programs require infrastructures to be set up enabling ideas to be exchanged on new methods and improvements in existing processes, contacts to be made between specialists, and a framework to be established for defining and carrying out projects. ISP is the organization that best fulfills this task at present, being composed of commissions and subcommissions which cover the subjects of interest. Other organizations such as OEEPE and EARSL have similar coverages. A higher degree of cooperation between these various bodies would be beneficial for all concerned. Concrete examples of world scale projects that could be treated in this way are given. Author (ESA)

N80-12472 Technische Universitaet, Hanover (West Germany).
FROM SATELLITE IMAGES TO AERIAL SURVEY PHOTOGRAPHS: COMPARISON BETWEEN OBSERVATIONS OF THE JADE REGION MADE WITH DIFFERENT SENSORS

[VOM SATELLITENBILD ZUR REIHENMESSKAMER - AUFNAME: DAS JADEGEBEIT IM VERGLEICH UNTERSCHIEDLICHER SENSOREN]
H. P. Baehr *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 59-69 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The suitability of images obtained with an aerial survey camera, a Hasselblad camera (with a frog's eye lens), an M sup(2)S multispectral scanning camera and a LANDSAT camera for obtaining specific types of information was investigated. The characteristics (spectral sensitivity, resolution, surface area covered, image information content, geometrical quality, average errors and data processing costs) are presented in a table. Both visible and infrared techniques are employed. Author (ESA)

N80-12473 Deutsches Hydrographisches Institut, Hamburg (West Germany).
SCANNER COORDINATION PROBLEMS: IMAGES FROM OVER THE SEA [ZUORDNUNGSPROBLEME BEI SCANNER - AUFNAHMEN UEBER SEE]
H. Krause and E. Krauth (DFVLR, Oberpfaffenhofen, West Germany) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 71-79 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

In evaluating open sea scanning images, geographical coordination problems are encountered. Discrepancies between ship and theoretically defined air navigation routes are deemed to be the cause. Furthermore, over-scanning introduces image distortion. Navigation difficulties arise from the lack of fixed reference points at sea. Specific problems in the German Bight are analyzed. One solution proposed is to employ greater heights, thus rendering the results less sensitive to flight path deviations. A scan-rate better adapted to the aircraft velocity and height would improve the results. Author (ESA)

N80-12474 Deutsches Hydrographisches Institut, Hamburg (West Germany).
NUMERICAL TREATMENT OF IR THERMAL DATA FOR THE GERMAN BIGHT TEST REGION [NUMERISCHE BEHANDLUNG DER IR-THERMALDATEN AUS DEM TESTGEBEIT DEUTSCHE BUCHT]
G. Becker and K. Huber *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 81-90 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Research to determine up to what extent scanning IR sensors are suitable for accurately determining surface water temperatures is reported. An extensive numerical treatment for such data is presented. Preliminary results indicate that an improvement in the atmospheric correction factor is required. Furthermore, comparisons between IR and conventional temperature distribution measurements enable differences betwen surface and near surface temperatures to be taken into consideration. Author (ESA)

N80-12475 Technische Universitaet, Hanover (West Germany).
EVALUATION OF THERMAL IMAGES OF THE JADE REGION [AUSWERTUNG VON THERMALAUFNAHMEN DES JADEGEBIETS]
P. Lohmann *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 91-101 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Differences are observed between ship measurements of the water stratum temperature and the temperatures derived from scanning data. A correction factor is introduced whereby agreement between these two types of measurement can be achieved. The computerized treatment of the corresponding data is described, and an example is given in which a clear enhancement in the quality of the measured parameter can be seen. Author (ESA)

N80-12476 Technische Universitaet, Hanover (West Germany).
DETERMINATION OF CURRENTS IN COASTAL REGIONS USING MULTISPECTRAL SCANNING IMAGES [STROEMUNGSUNTERSUCHUNGEN MIT HILFE VON MULTISPEKTRALEN SCANNERAUFNAHMEN IM KUESTENGEBEIT]
D. Kolouch *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 103-112 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The determination of current directions and speeds in the Jade region is very important in understanding sediment transport. The various clouds of troubled water have to be distinguished from one another (in this region, 95% of such clouds is due to clay minerals). A laboratory developed method shows that maximum contrast is obtained with three wavelength channels: 600, 850 and 1085 nm. Plotting the results, and their evaluation with a DIBIAS system are also discussed. Examples are given. Author (ESA)

N80-12477 Wasserwirtschaftsamt Wilhelmshaven (West Germany).
WATER QUALITY IN COASTAL REGIONS: EVALUATION OF THERMAL IMAGES OF FACTORY WATER COOLANT INLETS [WASSERGUETE IM KUESTENBEREICH: AUSWERTUNG VON THERMALAUFNAHMEN DES KUEHLWASSEREINLAUFS EINES KRAFTWERKS]
H. Regehly *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 113-121 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The rapid industrialization of the Jade coast at Wilhelmshaven is resulting in a detrimental biotope distribution in the Jade. Water quality must therefore be controlled. The use of aerial photography for this purpose was studied. Particular attention was paid to determining what happens to waste water (flowpaths, time spent in particular regions). Maps and tables showing different sources of contamination are given. Author (ESA)

N80-12478 Hamburg Univ. (West Germany).
ON THE PROBLEM OF THE REMOTE SENSING OF SUBSTANCES IN WATER BY MULTISPECTRAL SCANNING [ZUM PROBLEM DER FERNERKUNDUNG VON SUBSTANZEN IM WASSER MIT DEM MULTISPEKTRALSCANNER]
R. Doerffer *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 123-130 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Measurements devised to determine the characteristics and concentrations of three groups of substances (those producing a yellow/brown coloration, suspended matter and phytoplankton) are described. If qualitative and quantitative information is to be deduced, account must be taken of contributions to the measured signal arising from ground surfaces, interfaces and the atmosphere. Backscattered radiation fields are related to concentration levels. Author (ESA)

N80-12479 Deutsches Hydrographisches Institut, Hamburg (West Germany).
RESEARCH INTO DETERMINING CHEMICAL PARAMETERS AT THE SURFACE OF THE SEA BY REMOTE SENSING [UNTERSUCHUNG ZUR BESTIMMUNG CHEMISCHER PARAMETER VON DER MEERESOBERFLAECHE DURCH FERNERKUNDUNG]
D. Schmidt and K. Struebing *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 131-138 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

In the example selected, regularly introduced quantities of waste solution released by a titanium dioxide fabricant situated in northwest Helgoland since 1969 are studied. Remarkable coloration phenomena are observed; these phenomena have been investigated over a period of several years. Measurements made in the sea and results from aerial and satellite photography are discussed together with image analysis techniques. Images of ships' wakes and their digital treatment are presented. Author (ESA)

N80-12480# Technische Universitaet, Hanover (West Germany).
COLORED SUBSTANCE MIXING EXPERIMENTS IN THE KIELER BAY TEST REGION. COMPARATIVE EVALUATION

OF MULTISPECTRAL SCANNING AND COLOR SLIDE DATA [FARBSTOFFVERMISCHUNGSEXPERIMENTE IM TEST-GEBEIT KIELER BUCHT, VERGLEICHENDE AUSWERTUNG VON MULTISPEKTRALSCANNER- UND FARBDIATEN]
M. Ehlers and P. Haberaecker (DFVLR, Oberpfaffenhofen, West Germany) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 139-142 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

In the framework of the 1976 FMP campaign, six survey flights, employing both scanning and color aerial photography techniques, were carried out. Various mixing models were used to study these data. No significant differences were observed between the different results obtained. Practical information on the treatment of the information contained in these images is given together with details about image quality. Author (ESA)

N80-12481 Technische Universitaet, Hanover (West Germany).
MULTISPECTRAL CLASSIFICATION OF SAND BANK REGIONS [MULTISPEKTRALE KLASSIFIZIERUNG VON WATTGEBIETEN]
E. Dennert-Moeller and J. Doerjes (Inst. fuer Meeresgeol.) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 143-151 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The geological dispositions, extent, and nature of individual sand banks are required for ecological research purposes. The maximum likelihood method is applied to RMK and LANDSAT images, and in particular, to M sup(2)S scanning data. An extension of the method for scanning data is indicated. Various photographs of the Jade region are given. It is shown how the different types of sand are identified and classified. Author (ESA)

N80-12482 Technische Universitaet, Munich (West Germany).
QUANTITATIVE DETERMINATION OF MORPHOLOGICAL STRUCTURES IN SAND BANK REGIONS FROM IMAGE STRUCTURE ANALYSIS [QUANTITATIVE ERFASSUNG MORPHOLOGISCHER STRUKTUREN IN WATTGEBIETEN DURCH ANWENDUNG VON VERFAHREN DER BILD-STRUKTURANALYSE]
U. Wieczorek *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 153-164 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Several factors must be taken into consideration: variations in the altitude of the sun, the position of the object in the image field, the release of residual water from the sand bank's surface, drying out of the sand bank, and relief characteristics (micro, intermediate and macro features). Surface and texture variations are discussed. The way in which the problems encountered are overcome is described together with the computerized treatment of the data obtained. Examples are given. Author (ESA)

N80-12483 Technische Universitaet, Munich (West Germany).
MAKING MORPHOLOGICAL MAPS OF SAND BANKS FROM AERIAL PHOTOGRAPHS [MORPHOLOGISCHE WATTKARTIERUNG NACH LUFTBILDERN]
C. Franke *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 165-182 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Different current distribution and direction regions can be distinguished in aerial photographs of water sand banks. These regions correspond to different sedimentary dispositions of the sand bank surfaces. The materials and methods used are described together with the interpretation of color and texture characteristics. Studies of the Crildumensiel sand banks are treated in detail; the corresponding are given and interpreted. Author (ESA)

N80-12484 Regionale Planungsgemeinschaft Utermain, Frankfurt (West Germany).
FUTURE REMOTE SENSING TASKS IN REGIONAL PLANNING [ZUKUENFTIGE AUFGABEN DER FERNERKUN-DUNG IN DER REGIONALPLANUNG]
A. vonHesler *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 183-186 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Remote sensing techniques when used at the beginning of a whole variety of projects can provide notable advantages. Country, regional and town planning activities have, up until now, because of increasing population characteristics, employed quantitative planning procedures. The need for qualitative planning is becoming increasingly apparent. Financial and administrative problems are ever present. The maximum efficiency in the use of the information so acquired is essential. Suggestions put forward include promoting the availability of DIBIAS systems among experimental workers, making aircraft flights more easily available and encouraging exchanges of information. Author (ESA)

N80-12485 Ruhr Planning Authority, Essen (West Germany).
INTERPRETATION OF IR AND MSS DATA FOR TOWN AREAS [INTERPRETATION VON IR- UND MSS-DATEN IM STADGEBEIT]
F. H. Hirt and P. Stock *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 187-190 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

While the classification of open spaces and areas of vegetation is relatively easy, it is difficult to identify building and other built-up area elements (such as houses, roads and automobile parks) as they are not associated with any precise spectral characteristics. A maximum likelihood method is used to separate vegetation, asphalt, rooftop and shade. Preliminary experiments using digital data processing suggest important new applications for town and regional planning in builtup areas. Author (ESA)

N80-12486 Deutscher Wetterdienst, Offenbach am Main (West Germany).
A METHOD FOR EVALUATING INFRARED IMAGES TAKING PHOTOGRAPHY, VEGETATION COVERAGE AND BUILDINGS INTO CONSIDERATION [EIN AUSWERTEVER-FAHREN FUER INFRAROT-AUFNAHMEN DAS TOPOGRAP-HIE, BEWUCHS UND BEBAUUNG BERUECKSICHTIGT]
H. Bartels and P. Keuler *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 191-196 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Measurements were carried out and methods developed in the framework of a program for determining what meteorological data are necessary to interpret thermal images, whether the origin of cold air concentration can be established, whether a relation exists between measured radiation temperatures and air temperatures, whether large nets for determining meteorological parameters can be reduced, and in what way the temporal characteristics of vertically rising warm air are dependent on the nature of the subsoil. Infrared scanning measurements were performed in the lower main region. The coordination between radiation and surface temperatures is not very meaningful in this highly structured region. It is shown that useful information for local climate studies and regional planning can be obtained with the aid of a difference method. Author (ESA)

N80-12487 Freiburg Univ. (West Germany).
INTERACTION BETWEEN AIR AND SURFACE TEMPERA-TURES DURING THE COURSE OF A DAY AS A FUNCTION SURFACE TYPES AND RELIEF [WECHSELWIRKUNGEN ZWISCHEN LUFT- UND OBERFLAECHENTEMPERATUREN IM TAGESGANG IN ABHAENGIGKEIT VON DER OBERF-LAECHENART UND DER LAGE IM RELIEF]
H. Gossmann and D. Ahrens (Landesanstalt fuer Umweltschutz) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 197-206 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The aeration effects of topographical winds in town areas, and the determination of temperature and moisture profiles to investigate the consequences of large sources of combustion gas and water vapor, are of current interest. The differences between the surrounding air and surface temperatures of various objects with varying characteristics located in different topographical regions between the Upper Rhine and the Black Forest were investigated (infrared aerial images). Relations were found between surface temperature scattering, air and surface temperatures, times of day and weather conditions. Author (ESA)

N80-12488 Freiburg Univ. (West Germany).
POSSIBILITY OF OBTAINING INFORMATION ON COLD AIR CONCENTRATIONS AND MOVEMENTS FROM THERMAL IMAGES [MOEGLICHKEITEN DES NACHWEISES VON KALTLUFTSAMMELGEBIETEN UND KALTLUFTBEWEGUNGEN AUS THERMALBILDERN]
W. Nuebler *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 207-216 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

A surface temperature distribution model was developed from which the origin and characteristics of cold air concentrations can be determined. The use of the DIBIAS system to obtain the required information is described. Details about the terrain investigated are necessary. Additional ground level information such as wind speeds is desirable. Various images of the Freiburg region are treated as examples and the corresponding equidensity maps established. Author (ESA)

N80-12489 Freiburg Univ. (West Germany).
THERMAL IMAGES AND CLIMATIC CHANGES IN REGROUPED VINEYARDS ON MOUNTAIN SLOPES [THERMALBILDER UND DIE VERAENDERUNG DES GELAENDEKLIMAS IN FLURBEREINIGTEN WEINBERGEN]
W. Endlicher *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 217-226 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

As a result of the regrouping policy followed in Kaisenstuhl, conventional small exploited zones have been converted into larger zones. Thermal images and air temperature profiles were obtained and equidensity maps established using the DIBIAS system. Climatic changes are seen to have occurred. It is concluded that greater care should be exercised when developing such zones and that emphasis should be given to ecologically acceptable solutions. Author (ESA)

N80-12490 Freiburg Univ. (West Germany).
LARGE SCALE THERMAL IMAGES AS A MEANS OF DISTINGUISHING BETWEEN BUILDING STRUCTURES IN A TOWN [GROSSMASSTAEBIGE THERMALBILDER ALS HILFMITEL ZUR DIFFERENZIERUNG VERSCHIEDEN STRUKTURIERTER BAUKOERPER EINER STADT]
A. Gehrke *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 227-236 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Small scale thermal pictures give false impressions about thermal conditions in town regions because of their oversensitivity to roof tops and large exposed areas and their inability to penetrate narrow streets and suchlike. Large scale photographs obtained at low altitudes yield much more detail. Concrete examples in the Freiburg region are studied. The DIBIAS system is used to interpret data. Microdensitometry profiles are presented. An accurate overall view of the thermal conditions prevailing in a town can be established by combining these measurements with data obtained at ground level. Author (ESA)

N80-12491 Karlsruhe Univ. (West Germany).
DETERMINATION OF THE CHARACTERISTICS OF DIFFUSION PROCESSES AT COOLING WATER INLETS IN THE RHINE AND MAIN [UNTERSUCHUNGEN VON AUSBREITUNGSVORGAENGEN AN KUEHLWASSEREINLEITUNGEN AM RHEIN UND MAIN]
J. Grimm-Strele and H. Kellersmann *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 237-247 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Water mixing behavior is of interest in regional planning and in studying the overall thermal charging to which industry subjects rivers. Various IR scanning data were used to determine diffusion coefficients in a given section of river from which generalized properties applicable to other waterways were established. The theoretical basis of the problem is exposed and discussed. The DIBIAS system is used to exploit some of the data acquired. Author (ESA)

N80-12492 Forschungsinstitut Senckenburg, Frankfurt (West Germany).
STUDIES OF THERMAL DIFFUSION PROCESSES NEAR COOLING WATER INLETS IN A BANKED RIVER (LOWER MAIN) [UNTERSUCHUNGEN UEBER THERMISCHE AUSBREITUNGSVORGAENGE BEI KUEHLWASSEREINLEITUNGEN IN EINEN GESTAUTEN FLUSS (UNTER-MAIN)]
W. Tobias and P. Burwitz *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 249-256 refs In GERMAN Sponsored jointly by DFVLR, Oberpfaffenhofen, West Ger., and Umlandverband (RPU) (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Accurate information was sought on the behavior of cooling water. The DIBIAS system was used to exploit IR scanning data in the region of a large power plant. The results obtained were complemented with ground truth data. The various factors affecting the distribution and mixing are presented: water flow characteristics, hydrostatic factors (locks, weirs) boat traffic, profile flow and river bed interactions, the effects of removing and reintroducing cooling water, density, viscosity, etc. of cooling water, meteorological biological and ecological parameters. Author (ESA)

N80-12493 Freiburg Univ. (West Germany).
INTERPRETATION OF WATER QUALITY USING REMOTE SENSING TECHNIQUES [ZUR INTERPRETATION DER QUALITAET VON WASSERKOERPEN AUS FERNERKUNDUNGSAUFZEICHNUNGEN]
H. Dietze, G. Hildebrandt, and D. Mahr *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 257-270 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Characteristics of large water surfaces and waterways were investigated using an eleven channel multiscanner and from aerial photographs taken at different heights and times of the year. The results obtained show how information in the near infrared is influenced by high absorption. A more realistic interpretation of the results obtained can be achieved by employing a VP 8 analog evaluation system. A table of measured characteristics for eutrophic and non-eutrophic water masses is presented. Author (ESA)

N80-12494 Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
DETERMINATION OF SOIL WATER CONTENTS FROM RADIOMETRIC MEASUREMENTS AND IR SCANNING DATA [ERMITTLUNG DES WASSERGEHALTES VON BOEDEN MIT HILFE RADIOMETRISCHER MESSUNGEN UND IR-SCANNERDATEN]
J. Nithack *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 271-280 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Research conducted in the FMP4 test region demonstrated that data obtained from thermal images are insufficient to perform quantitative moisture calculations from vegetation covered regions. Temperature gradients (temperature variations/unit time) in uniformly vegetation covered regions only provide quantitatively different information for water contents up to 25% (by weight). Soils can be classified and correction data established from statistically processed temperature gradient information. Temperature gradient maps can, however, only be used as a basis for determination, warm air concentrations relative to surface moisture characteristics. They are most useful for classifying soils. High aerial soil moisture content measurements which take energy flux into consideration can provide information about soil depths up to 15 cm. However, a great number of measurements are required and it is dubious whether such a procedure is worthwhile. Author (ESA)

N80-12495 Landeskulturamt Hessen, Wiesbaden (West Germany).
CLASSIFICATION OF AGRICULTURAL LAND WITH THE AID OF REMOTE SENSING METHODS [KLASSIFIZIERUNG AGRARISCHER LANDNUTZUNG MIT HILFE VON FERNERKUNDUNGSMETHODEN]
P. Richtscheid *In* Tech. Hochschule On Meas. from Aircraft

best copy available

Jun. 1978 p 281-286 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Visual images of exploited land in the Rhein-Main region and around Wetterau were recorded and compared with scanning data and various photographs. Data obtained from flights in 1976 and May 1977 are interpreted. In spite of the unfavorable vegetation development periods during which data were recorded, it was possible to distinguish between different types of culture with the aid of the DIBIAS system. It is suggested that flights should either be more accurately synchronized with agricultural development phases, or that a program of regular flights should be set up. Author (ESA)

N80-12496 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
AERIAL PHOTOGRAPHY OF AGRICULTURAL FARMING LAND [UNTERSUCHUNG VON LUFTBILDERN LANDWIRTSCHAFTLICHER KULTUREN]
H. Helbig *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 287-294 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Work conducted in the framework of a program for the recognition and determination of plant protection procedures and manure effects is described. Land divided into 2 x 5 sq m plots was studied. Various photographic conditions and vignetting effects made interpretation difficult. A procedure was developed to correct such effects, which relies on information contained in the image itself, and does not require any further measurement data. Author (ESA)

N80-12497 Badische Anilin- und Soda-Fabrik A.G., Landwirtschaftliche, Giessen (West Germany).
FEASIBILITY OF USING REMOTE SENSING FOR DETERMINING NUTRITIONAL REQUIREMENTS, DISEASES AND PST INFESTATIONS IN AGRICULTURAL CROPS [MOEGLICHKEITEN DER FERNERKUNDUNG ZUR BESTIMMUNG VON NAEHRSTOFFVERSORGUNG, KRANK-HEITS- UND SCHAEDLINGSBEFALL AN LANDWIRTSCHAFTLICHEN KULTUREN]
K. H. Schneider *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 295-305 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The radiobiological behavior of crops in the IR and visible spectrum was studied. It is shown that measurements made during the 1976 summer FMP program are satisfactory for classifying different types of culture. Concrete examples with various crops are presented and examined. The biological processes taking place are considered. In one case, it was possible to distinguish between different varieties of oats. It was, however, not possible to determine nutrition requirements for the dry 1976 summer. It was possible, though, in one instance, to detect pest infestation in winter corn. The results obtained indicate that optimum information is acquired from low altitude vertical flights. The data obtained must be processed quickly. Author (ESA)

N80-12498 Freiburg Univ. (West Germany).
TEXTURE ANALYSIS AS A RECOGNITION PARAMETER FOR DIFFERENT TYPES OF FORESTS [ANALYSE DER TEXTUR ALS ERKENNUNGSPARAMETER ZUR IDENTIFIZIERUNG VON WALDTYPEN]
S. A. Masumy and G. Hilderbrandt *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 307-317 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

It is shown that quantitative and qualitative determinations of forest characteristics from textures are highly dependent on the sensors used and the aircraft altitudes, and at low altitudes, on the position within the image. Examples are given of results obtained using photographic and scanning techniques at varied heights with different forests. Similarities are observed between the values of defined texture parameters determined at given heights with these two techniques. Author (ESA)

N80-12499 Freiburg Univ. (West Germany).
PHENOLOGY AS A FACTOR IN THE DETERMINATION OF DIFFERENT FORMS IN VEGETATION BY REMOTE SENSING [PHAENOLOGIE ALS EINFLUSSGROESSE FUER DIE FERNERKUNDUNG VERSCHIEDENER VEGETATIONSFORMEN]
H.-J. Doefel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 319-330 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Temporal and spatial variations in vegetation forms were studied. Microdensitometer profile measurements were performed on images obtained by photographic methods, and different emulsions were tested. Specific phenological characteristics were revealed in forest and agricultural zones. Methods are suggested for recording and processing the corresponding information so as to optimize the differentiation between different forms of vegetation. Author (ESA)

N80-12500 Freiburg Univ. (West Germany).
APPLICABILITY OF MULTISCANNING TECHNIQUES IN ESTABLISHING INVENTORIES FOR AGRICULTURAL FARMING AND FORESTRY [EINSATZMOEGLICHKEITEN DES MULTISPEKTRALSCANNERS FUER LAND- UND FORSTWIRTSCHAFTLICHE INVENTUREN]
P. G. Reichert *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 331-344 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Multiscanning results obtained with a preselected test region are presented. Computerized maximum likelihood and minimum distance methods (DIBIAS system) permit the identification and classification of different crops and types of forest together with the regions over which they extend. The problems encountered and the factors to be taken into consideration are discussed. Author (ESA)

N80-12501 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
WHAT ARE THE ADVANTAGES OF MULTISPECTRAL CLASSIFICATION? [WAS BRINGT DIE MULTISPEKTRALE KLASSIFIZIERUNG?]
E. Triendl *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 345-350 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Multispectral methods for classifying different crops are compared with classical procedures. The introduction of an ellipsoidal probability distribution enables a critical parametric function to be obtained from mean values and the covariance matrix (maximum likelihood classification). A practical example (bend in the Main, near Frankfort) with two scanning channels is studied. It is concluded that reliability and applicability could be enhanced by combining multispectral methods with local parameters. Author (ESA)

N80-12502 Karlsruhe Univ. (West Germany).
APPLICATION OF A HIERARCHICAL CLASSIFICATION METHOD FOR SPECIAL PROBLEMS [ANWENDUNG EINES HIERARCHISCHEN KLASSIFIZIERUNGSVERFAHRENS BEI SPEZIELLEN PROBLEMEN]
F. Quiel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 351-357 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

A hierarchical classification system is described which corrects large direction-dependent variations observed in signals recorded during observation flights. The variations are caused by spectral reflection orientation, atmospheric effects, and other factors. Possibilities such as using texture parameters and the DIDAK data evaluation system are discussed. Practical examples are studied and results are given. Author (ESA)

N80-12503 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
INTERACTIVE CORRECTION OF CLASSIFIED PHOTOGRAPHS [INTERAKTIVE KORREKTUR KLASSIFIZIERUNG BILDER]
G. Kritikos *In* Tech. Hochschule On Meas. from Aircraft Jun.

1978 p 359-386 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

It is shown that badly classified photographs can be corrected with an image modification program. This program is based on the differences between qualitative human appreciation of given situations and quantitative computer evaluations. Examples are given. Author (ESA)

N80-12504 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DEVELOPMENT OF PROCESSING METHODS FOR IMAGES OF THE JADE COAST REGION AND EXPERIENCE ACQUIRED [METHODENENTWICKLUNG UND ERFAHRUNGEN MIT DER BILDVERARBEITUNG IM KUESTENBEREICH DER JADE]
P. Nowak *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 367-370 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The programs and methods developed in conjunction with investigations of the Ostfriesisches sand bank zone are presented. The work relates to magnetic tape interfaces for image processing, thermal mapping of coastal regions, determination of moisture and vegetation in sand bank regions, classification of sand bank by multispectral techniques, research into water currents, and radiometric and geometric corrections. The applications of the DIBIAS system for determining the required parameters is discussed. Author (ESA)

N80-12505 Forschungsgruppe fuer Informationsverarbeitung und Mustererkennung, Karlsruhe (West Germany).
DIGITAL PROCESSING PROCEDURE FOR TEXTURE ANALYSIS WITH REMOTE SENSING DATA [VERFAHREN DER DIGITALEN BILDVERARBEITUNG ZUR TEXTURANALYSE VON FERNERKUNDUNGSDATEN]
B. Bargel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 371-378 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Specific texture parameters were determined and an appropriate combination of parameters was selected in order to classify objects with the use of multispectral analysis. Forest and built-up regions were investigated. The methods employed involve gray scale evaluations, differenciating image data, line information and Fourier spectrum techniques. Preprocessing and image transformation procedures are applied. Some concrete examples and their treatments are presented. Author (ESA)

N80-12506 Technische Universitaet, Hanover (West Germany).
GEOMETRICAL RESTITUTION OF MULTISPECTRAL SCANNING IMAGES [GEOMETRISCHE ENTZERRUNG MULTISPEKTRALER ABTASTERAUFNAHMEN]
W. Schuhr *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 379-387 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Programs are developed for the digital restitution of multispectral aerial photographs using direct and indirect methods. Data recorded during flights, DGM, and sequential tapes are used for the restitution. Parameters are obtained for collinear equations in the development of a system of rigorous equations. An example in the Freiburg test region is treated. Application to future developments with other sensors in aerial, radar, and sonar fields are mentioned. Author (ESA)

N80-12507 Karlsruhe Univ. (West Germany).
EVALUATIONS IN THE FRAMEWORK OF THE FMP PROGRAM USING THE DIGITAL IMAGE PROCESSING SYSTEM DIDAK [AUSWERTUNGEN FUER DAS FLUGZEUGMESSPROGRAMM MIT DEM DIGITALEN BILDVERARBEITUNGSSYSTEM DIDAK]
J. Wiesel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 389-394 ref In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The operation and setting up of the DIDAK system is described. The largest part of the program is written in UNIVAC FORTRAN 5 and a smaller part is written in assembly language. Input, processing, and output functions are assured. The central storage contains information about input data, status, observation windows, specification and number of channels, types of image (FMP, LANDSAT, etc), descriptive texts, grayness histograms, classification and results, and geometral information. Examples of boundary extraction and image restitution are presented. Author (ESA)

N80-12508 Freiburg Univ. (West Germany).
CORRESPONDENCE PROBLEMS IN POLYGONAL SEGMENTED MULTISPECTRAL DIGITAL IMAGES [ZUORDNUNGSPROBLEM IN POLYGONAL UNTERTEILTEN MULTISPEKTRALEN DIGITALEN BILDERN]
G. Lange *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 395-404 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

General considerations on the shape of polygonal segments of a digital image are presented from which it is possible to deduce what information can be introduced into the corresponding system by the user, or be extracted from it. Classification problems related to images and their division into polygonal segments are discussed. A model developed for handling data that is meaningful without being in a generic order in a data bank is presented. Some specific problems are tested. Author (ESA)

N80-12509 Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
PRELIMINARY RESULTS ON THE USE OF DIGITAL METHODS WITH CENTER OF GRAVITY DATA REDUCTION IN A PRE-ALP TEST REGION [VORLAEUFIGE ERGEBNISSE IN DER ANWENDUNG DIGITALER VERFAHREN MIT SCHWERPUNKT DATENREDUZIERUNG IN EINEM VORALPEN-TESTGEBIET]
R. Haydn, S. Fernandez, M. Seiderer, and K. A. Ulbricht (DFVLR, Oberpfaffenhofen, West Ger.) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 405-411 ref In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The application of a typical element recognition method involving the optimum choice of channels to a particular multispectral scanning data reduction problem is described. Two fundamental requirements for this method to be valid are that the gray values used for classification obey a Gaussian distribution and that after the choice of channels, only the maximum likelihood method is used. Comparisons were made with the principal component method. It is concluded that both methods are valid, the method involving the smallest calculation time being the most appropriate. The above described method is the most suitable for treating the problem considered. Author (ESA)

N80-12510 Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
APPLICATION OF DIBIAS PROGRAMS FOR IMPROVEMENTS AND GEOSCIENTIFIC EVALUATIONS OF LANDSAT PHOTOGRAPHS OF CENTRAL MOROCCO AND SUDAN [DIE ANWENDUNG VON DIBIAS-PROGRAMMEN ZUR VERBESSERUNG UND ZUR GEOWISSENSCHAFTLICHEN AUSWERTUNG VON LANDSAT-BILDERN ZENTRAL-MAROKKOS UND DES SUDAN]
P. Hoppe and K. A. Ulbricht (DFVLR, Oberpfaffenhofen, West Ger.) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 413-416 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Standard photographs obtained with LANDSAT 1 and 2 were incorporated in the EROS Data Center at Sioux Falls. Joint studies were carried out by DFVLR and BGR on the application of the DIBIAS system to improve image quality and evaluation. Problems ranging from the intensification of image contrast to the development of automatic classification systems are treated. Two test regions were investigated: the vegetation covered region of Central Morocco and the Bayuder desert of Sudan. Author (ESA)

N80-12511 Institut fuer Physikalische Weltraumforshung, Freiburg (West Germany).
DETERMINATIONAL OF SPECTRAL SIGNATURES BY RADIOMETRIC GROUND MEASUREMENTS (REALIZATION

AND PROBLEMS) [BESTIMMUNG SPEKTRALER SIGNATUREN VON BEWACHSENEN OBERFLAECHEN DURCH RADIOMETRISCHE BODENMESSUNGEN (REALISIERUNG UND PROBLEME)]
H. J. Boehnel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 417-426 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Radiation in the 0.4 to 2.5 nm range reflected from objects and reference standards is studied. The materials used, including the vehicle and mechanical system adopted, are described together with the methods employed to assure the required distances and angles. The measured magnitudes are dependent on many parameters which must be determined for interpretation and classification purposes. The underlying theory is given and characteristic curves for the spectral reflection of fodder beet and corn are presented. Author (ESA)

N80-12512 Institut fuer Physikalische Weltraumforshung, Freiburg (West Germany).
ON THE SIGNIFICANCE OF SPECTRAL SIGNATURES OF VEGETATION COVERED SURFACES IN THE 400-1100 NANOMETER REGION [ZUR SIGNIFIKANZ VON SPEKTRALEN SIGNATUREN BEWACHSENER OBERFLAECHEN IM BEREICHT 400-110 NANOMETER]
W. Fischer *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 427-437 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The effect of the sun zenith and sun azimuth angles on the spectral reflection factors of fodder beet, corn and other crops is investigated using measurements from a spectroradiometer. Overall radiation effects and variations with time of day and seasonal advances were studied. Results obtained, primarily in the Gottenheim region, are presented as a series of curves. The optical directional, and morphological reasons behind the observed variations are discussed. Author (ESA)

N80-12513 Freiburg Univ. (West Germany).
SPECTRAL REFLECTION FROM AGRICULTURAL AND FOREST REGIONS DURING THE VEGETATION PERIOD [SPEKTRALE REFLEXION LAND- UND FORSTWIRTSCHAFTLICHER KULTUREN WAEHREND DER VEGETATIONSPERIODE]
A. Kadro *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 439-448 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Reflection measurements made in the 400 to 1100 nm region with a radiometer are discussed. The highly maneuverable apparatus developed to maintain the radiometer at a height of 17 meters while allowing measurements to be carried out at various angles is described. Investigations, performed on different dates, established typical qualitative and quantitive differences between reflection factor curves corresponding to the different regions studied. Author (ESA)

N80-12514 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
EFFECT OF RADIOMETRIC PARAMETERS ON REMOTE SENSING IMAGES [EINFLUSS RADIOMETRISCHER PARAMETER AUF FERNERKUNDUNGS-AUFNAHMEN]
R. Staetter *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 449-457 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Radiometric parameters, such as atmosphere transmission and scattering, are discussed due to the deterioration of image quality between the object studied and the recording sensor. The signal at the sensor is due to both atmospheric scattering and reflected radiation. When these parameters are known it is shown that remote sensing images can be corrected and signatures improved. Measurements made from LANDSAT (MSS) and NIMBUS in the visible and near infrared, theoretical considerations developed, and the results obtained are discussed. Author (ESA)

N80-12515 Freiburg Univ. (West Germany).
THE MULTISPECTRAL SCANNER AS AN INSTRUMENT FOR SIGNATURE DETERMINATIONS
P. G. Reichert *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 459-470 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The identification of objects by multispectral scanning supposes a knowledge of the spectral reflection characteristics of the surface investigated. The determination in situ of these characteristics has the disadvantage of requiring considerable apparatus and employing systems that enable only a few objects to be measured in a working day. A method of overcoming this difficulty is described, which enables various different objects in different regions to be studied under different image conditions. Examples are given. Author (ESA)

N80-12516 Deutsches Hydrographisches Institut, Hamburg (West Germany).
DETERMINATION OF THE OPTICAL PROPERTIES OF THE SEA IN THE GERMAN BIGHT [MEERESOPTISCHE UNTERSUCHUNGEN IN DER DEUTSCHEN BUCHT]
H. Gienapp *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 471-492 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The spectral distribution, transmission scattering, and CIE coordinate characteristics of the sea were investigated in the framework of the 1976 FMP program. The region between Helgoland and Sylt, and the Elb estuary were studied. The sea on the southern boundary of the Verklappung's region was shown to be very dirty. Relations between color metric magnitudes Gelbstoff, Chlorophyll, and suspended matter contents were shown to exist. Comparisons were made with ERTS satellite photographs. A high degree of correlation in some of these relations was seen for the Elb estuary. The DIBIAS system is used in the calculations performed. Author (ESA)

N80-12517 Institut fuer Angewandte Geodaesie, Singlingen (West Germany).
THE DETERMINATION OF LAND USAGES FOR PLANNING AND CARTOGRAPHY [DIE GEWINNUNG VON NUTZUNGSKATEGORIEN AUS MULTISPEKTRALEN ABTASTERAUFZEICHNUNGEN FUER PLANUNG UND KARTOGRAPHIE]
K. Niemz *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 493-500 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Analog and digital processing of data for regional planning and small scale map production purposes is described. The analog procedure is used for applications with diazo layers in which color compositions are generated. The digital processing employs the DIBIAS system and the maximum likelihood method for classification. Ground maps are produced by both methods. Multispectral scanning and the classification of LANDSAT 2 data are treated. Examples are given covering the classification of a variety of crops. Author (ESA)

N80-12518*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Jul. - Sep. 1979
Donald G. Moore, Principal Investigator and J. L. Heilman Sep. 1979 3 p ERTS
(Contract NAS5-24206)
(E80-10002; NASA-CR-162379; SDSU-RSI-79-15) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N80-12519*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PRELIMINARY ANALYSIS ON THE POTENTIAL VALUE OF LANDSAT IMAGES FOR A DESERTIFICATION STUDY [ANALISE PRELIMINAR DAS POTENCIALIDADES DAS IMAGENS LAND SAT PARA ESTUDO DE DESERTIFICACAO]

Nelson deJesusParada, Principal Investigator, Magda Adelaide Lombardo, and Vitor Celso deCarvalho Aug. 1979 40 p refs In PORTUGUESE; ENGLISH summary Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10003; NASA-CR-162380; INPE-1540-RPE/065) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-12520*# National Oceanic and Atmospheric Administration, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 2 Oct. 1979 9 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10004; NASA-CR-162381) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Additional analyses of Luverne, Minnesota ground data revealed that soil moisture variations are independent of elevation effects. Tidal fluctuations in the Potomac River and Delaware Bay were examined as a function of surface temperature. Preliminary findings suggest that temperature boundaries are sufficient to detect various stages of the tidal cycle in Delaware Bay, but are as yet uncertain for prediction in the Potomac River. At least three additional cases are needed to completely evaluate the tidal cycle. An alphanumeric printout at a scale of 1:1,000,000 compares closely with a 1:1,000,000 scale DMD image of the Chesapeake Bay region.

N80-12521*# Geological Survey, Denver, Colo. Petrophysics and Remote Sensing Branch.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Jun. - 31 Aug. 1979
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Aug. 1979 14 p Sponsored by NASA ERTS
(E80-10005; NASA-CR-162382) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-12522*# Commission of the European Communities, Ispra (Italy).
MAPPING THERMAL INERTIA, SOIL MOISTURE AND EVAPORATION FROM AIRCRAFT DAY AND NIGHT THERMAL DATA
J. Dejace, Principal Investigator, J. Meger, M. Kohl, G. Maracci, P Reiniger, G. Tassone, and J. Huygen 1978 10 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Proj. TELLUS)
(E80-10006; NASA-CR-162383) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N80-12523*# Commission of the European Communities, Ispra (Italy).
SOIL MOISTURE AND HEAT BUDGET EVALUATION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST Progress Report, 1 Apr. - 31 Aug. 1979
31 Aug. 1979 50 p refs Sponsored by NASA ERTS
(E80-10007; NASA-CR-162384; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-12524*# Texas A&M Univ., College Station. Remote Sensing Center.
APPLIED REGIONAL MONITORING OF THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION IN THE GREAT PLAINS CORRIDOR Final Report
J. C. Harlan and D. W. Deering, Principal Investigators Sep. 1979 30 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20796)
(E80-10008; NASA-CR-162385; RSC-3018-7) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. Rangelands in southwest Texas were used to establish threshold values and limitations on measuring herbaceous biomass under typical arid and semi-arid range conditions. Previous regression relationships established between ND6 and green biomass for two different ecosystems were similar. The west Texas data set for brush-free sites was too small to be statistically conclusive. It appears that a line with a third (and steeper) slope would be best for the west Texas data, and that line would intersect the other two. Results show that similar relationships exist between ND6 and green biomass under low brush canopy cover conditions, but local variations require a calibration to determine the best fit for an ecosystem. The brush canopy has a detrimental effect on the ND6 vs. herbaceous green biomass relationship.

N80-12525*# Commission of the European Communities, Ispra (Italy).
JOINT FLIGHT EXPERIMENT UK/1977. REPORT NO. 1: PLANNING AND EXECUTION
P. Reiniger, Principal Investigator Feb. 1977 22 p Sponsored by NASA ERTS
(Proj. TELLUS)
(E80-10022; NASA-CR-162394) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-12526*# Commission of the European Communities, Ispra (Italy).
TELLUS: A COMBINED SURFACE TEMPERATURE, SOIL MOISTURE AND EVAPORATION MAPPING APPROACH
A. Rosema (EARS, Delft, Netherlands), J. H. Bijleveld (EARS, Delft, Netherlands), P. Reiniger, G. Tassone, K. Blyth (Inst. of Hydrology, Wallingford, England), and R. J. Gurney, Principal Investigators (Inst. of Hydrology, Wallingford, England) 1978 11 p refs Presented at 12th Intern. Symp. on Remote Sensing of Environment, 20-26 Apr. 1978; sponsored by ERIM, Natural Resources Management Center, Philippines, Michigan Univ., AID, Geological Survey, Dept. of Agriculture, NASA, DOE, FHA, Dept. of Interior, DOT, NOAA, TVA, GE Co., Daedalus Enterprises, Inc., Bendix Corp., Taiwan Forestry Bureau and NAC, Inc., Tokyo Sponsored by NASA ERTS
(Proj. TELLUS)
(E80-10023; NASA-CR-162395) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-12527*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
REMOTE ESTIMATION OF SURFACE MOISTURE OVER A WATERSHED M.S. Thesis
Paul Jeffrey Kocin, Principal Investigator Nov. 1979 70 p refs Sponsored by NASA ERTS
(E80-10025; NASA-CR-162368) Avail: NTIS HC A04/MF A01 CSCL 08H

The author has identified the following significant results. Contoured analyses of moisture availability, moisture flux, sensible heat flux, thermal inertia, and day and nighttime temperatures over a Missouri watershed for a date in June and in September show that forests and creeks exhibit the highest values of moisture availability, whereas farmlands and villages are relatively dry. The distribution of moisture availability over agricultural districts differs significantly between the two cases. This difference is attributed to a change in the surface's vegetative canopy between June and September, with higher moisture availabilities found in the latter case. Horizontal variations of moisture, however, do

indicate some relationship between moisture availability and both local rainfall accumulations and the nature of the terrain.

N80-12528*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM, PHASE 3 Quarterly Report, 1 Apr. - 30 Jun. 1979
R. P. Mroczynski, Principal Investigator 30 Jun. 1979 29 p EREP
(Contract NAS9-15325)
(E80-10026; NASA-CR-160346; LARS-063079) Avail: NTIS HC A03/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-12529*# Environmental Research Inst. of Michigan, Ann Arbor.
A STUDY OF THE TOLERANCE BLOCK APPROACH TO SPECIAL STRATIFICATION Technical Report, 15 Dec. 1978 - 15 Jun. 1979
W. Richardson, Principal Investigator Aug. 1979 60 p refs EREP
(Contract NAS9-15476)
(E80-10027; NASA-CR-160351; ERIM-132400-25-R) Avail: NTIS HC A04/MF A01 CSCL 13B

The author has identified the following significant results. Twelve winter wheat LACIE segments in Kansas were used to compare the performance of three clustering methods: (1) BCLUST, which uses a spectral distance function to accumulate clusters; (2) blocks-alone, which divides spectral space into equally populated blocks; and (3) block-seeds, which uses spectral means of blocks-alone as seeds for accumulating distance-type clusters. Both BCLUST and block-seeds performed equally well and outperformed blocks-alone significantly. Their average variance ratio of about 0.5 showed imperfect separation of wheat from non-wheat. This result points to the need to explore the achievable crop separability in the spectral/temporal domain, and suggest evaluating derived features rather than data channels as a means to achieve purer spectral strata.

N80-12530*# Texas A&M Univ., College Station. Remote Sensing Center.
THE SYSTEM AND HARDWARE DESIGN OF REAL-TIME FAN BEAM SCATTEROMETER DATA PROCESSORS Final Report
John P. Claassen, Robert O. Stroud, Billy V. Clark, B. Randall Jean, and Richard W. Newton, Principal Investigator Mar. 1979 286 p refs EREP
(Contract NAS9-15311)
(E80-10028; NASA-CR-160350; RSC-3556) Avail: NTIS HC A13/MF A01 CSCL 14B

There are no author-identified significant results in this report.

N80-12531*# Commission of the European Communities, Ispra (Italy).
TELLUS NEWSLETTER 1
P. Reiniger, Principal Investigator Oct. 1978 8 p In ENGLISH and FRENCH Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Proj. TELLUS)
(E80-10029; NASA-CR-162397) Avail: NTIS HC A02/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-12532*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RELATIONSHIP OF RED AND PHOTOGRAPHIC INFRARED SPECTRAL DATA TO GRAIN YIELD VARIATION WITHIN A WINTER WHEAT FIELD
C. J. Tucker, Brent N. Holben, James H. Elgin, Jr. (Beltsville Agricultural Res. Center, Md.), and James E. McMurtrey, III (Beltsville Agricultural Res. Center, Md.) Jul. 1979 26 p refs Submitted for publication
(NASA-TM-80328) Avail: NTIS HC A03/MF A01 CSCL 02C

Two band hand-held radiometer data from a winter wheat field, collected on 21 dates during the spring growing season, were correlated within field final grain yield. Significant linear relationships were found between various combinations of the red and photographic infrared radiance data collected and the grain yield. The spectral data explained approximately 64 percent of the within field grain yield variation. This variation in grain yield could not be explained using meteorological data as these were similar for all areas of the wheat field. Most importantly, data collected early in the spring were highly correlated with grain yield, a five week time window existed from stem elongation through antheses in which the spectral data were most highly correlated with grain yield, and manifestations of wheat canopy water stress were readily apparent in the spectral data. Author

N80-12533*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXAMINATION OF LAMBERTIAN AND NON-LAMBERTIAN MODELS FOR SIMULATING THE TOPOGRAPHIC EFFECT ON REMOTELY SENSED DATA
Chris Justice and Brent N. Holben Sep. 1979 25 p refs Submitted for publication
(NASA-TM-80557) Avail: NTIS HC A02/MF A01 CSCL 05B

As a preliminary step to developing a technique to eliminate the topographic effect from remotely sensed data, two radiance simulation models were examined and compared. A Lambertian and a non-Lambertian model were tested using hand-held radiometer measurements from a uniform surface at different slope angle aspect orientations. Linear correlation coefficients for the non-Lambertian model and the field spectra were calculated to be greater than 0.92 for all cases; whereas correlation coefficients for the Lambertian model ranged from 0.06 to 0.98. An assumption regarding an empirical constant within the non-Lambertian equation was found to be invalid and the model was improved by using subsets of the data to derive the empirical value. Author

N80-12534*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERIM CALIBRATION REPORT FOR THE SMMR SIMULATOR
P. Gloersen and D. Cavalieri (Systems and Applied Sciences Corp., Riverdale, Md.) Sep. 1979 22 p refs
(NASA-TM-80564) Avail: NTIS HC A02/MF A01 CSCL 14B

The calibration data obtained during the fall 1978 Nimbus-G underflight mission with the scanning multichannel microwave radiometer (SMMR) simulator on board the NASA CV-990 aircraft were analyzed and an interim calibration algorithm was developed. Data selected for the analysis consisted of in flight sky, first-year sea ice, and open water observations, as well as ground based observations of fixed targets with varied temperatures of selected instrument components. For most of the SMMR channels, a good fit to the selected data set was obtained with the algorithm. K.L.

N80-12535*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEAN CHLOROPHYLL STUDIES FROM A U-2 AIRCRAFT PLATFORM
Hongsuk H. Kim, Charles R. McClain, Lamdin R. Blaine, William D. Hart (Sci. Systems and Applications, Inc., Lanham, Md.), Larry P. Atkinson (Skidaway Inst. of Oceanography, Savannah, Ga.), and James A. Yoder (Skidaway Inst. of Oceanography, Savannah, Ga.) Aug. 1979 37 p refs
(NASA-TM-80574) Avail: NTIS HC A03/MF A01 CSCL 08J

Chlorophyll gradient maps of large ocean areas were generated from U-2 ocean color scanner data obtained over test sites in the Pacific and Atlantic Oceans. The delineation of oceanic features using the upward radiant intensity relies on an analysis method which presupposes that radiation backscattered from the atmosphere and ocean surface can be properly modeled using a measurement made at 778 nm. An estimation of the chlorophyll concentration was performed by properly ratioing radiances measured at 472 nm and 548 nm after removing the atmospheric effects. The correlation between the remotely sensed data and in-situ surface chlorophyll measurements was validated in two

sets of data. The results show that the correlation between the in-situ measured chlorophyll and the derived quantity is a negative exponential function and the correlation coefficient was calculated to be -0.965. R.E.S.

N80-12536*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE ANGULAR VARIATION OF SOLAR REFLECTANCE OF SNOW
A. T. C. Chang and B. J. Choudhury (Computer Sciences Corp., Silver Spring, Md.) Oct. 1979 26 p refs
(NASA-TM-80576) Avail: NTIS HC A03/MF A01 CSCL 08L

Spectral and integrated solar reflectance of nonhomogeneous snowpacks were derived assuming surface reflection of direct radiation and subsurface multiple scattering. For surface reflection, a bidirectional reflectance distribution function derived for an isotropic Gaussian faceted surface was considered and for subsurface multiple scattering, an approximate solution of the radiative transfer equation was studied. Solar radiation incident on the snowpack was decomposed into direct and atmospherically scattered radiation. Spectral attenuation coefficients of ozone, carbon dioxide, water vapor, aerosol and molecular scattering were included in the calculation of incident solar radiation. Illustrative numerical results were given for a case of North American winter atmospheric conditions. The calculated dependence of spectrally integrated directional reflectance (or albedo) on solar elevation was in qualitative agreement with available observations. R.C.T.

N80-12537*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PASSIVE MICROWAVE REMOTE SENSING OF SOIL MOISTURE: THE EFFECT OF TILLED ROW STRUCTURE
J. R. Wang, R. W. Newton (Texas A and M Univ., College Station), and J. W. Rouse (Missouri Univ., Columbia) Jun. 1979 33 p refs
(NASA-TM-80589) Avail: NTIS HC A03/MF A01 CSCL 08M

The tilled rowstructure is known to be one of the important factors affecting the observations of the microwave emission from a natural surface. Measurements of this effect were carried out with both I and X band radiometers mounted on a mobile truck on a bare 40 m x 45 m row tilled field. The soil moisture content during the measurements ranged from approximately 10 percent to approximately 30 percent by dry weight. The results of these measurements showed that the variations of the antenna temperatures with incident angle theta changed with the azimuthal angle a measured from the row direction. A numerical calculation based on a composite surface roughness was made and found to predict the observed features within the model's limit of accuracy. It was concluded that the difference between the horizontally and vertically polarized temperatures was due to the change in the local angle of field emission within the antenna field of view caused by the large scale row structure. R.E.S.

N80-12538*# Bendix Corp., Englewood, Colo. Energy, Environment and Technology Office.
AUTOMATED LONGWALL GUIDANCE AND CONTROL SYSTEMS, PHASE 1
S. C. Rybak 6 Sep. 1978 410 p Sponsored in part by DOE
(Contract NAS8-32921)
(NASA-CR-161329) Avail: NTIS HC A18/MF A01 CSCL 08I

Candidate vertical control systems (VCS) and face advancement systems (FAS) required to satisfactorily automate the longwall system were analyzed and simulated in order to develop an overall longwall system configuration for preliminary design. R.E.S.

N80-12539*# Bendix Corp., Englewood, Colo. Energy, Environment and Technology Office.
AUTOMATED LONGWALL GUIDANCE AND CONTROL SYSTEMS, PHASE 2, PART 2: VERTICAL CONTROL SYSTEM (VCS) Final Report
5 Apr. 1979 196 p Sponsored in part by DOE
(Contract NAS8-32921)
(NASA-CR-161330) Avail: NTIS HC A09/MF A01 CSCL 08I

The prototype preliminary design of the vertical control system (VCS) of the 'automated longwall guidance and control system' is presented. R.E.S.

N80-12540*# Bendix Corp., Englewood, Colo.
AUTOMATED LONGWALL GUIDANCE AND CONTROL SYSTEMS, PHASE 2, PART 2: RCS, FAS, AND MCS Final Report
15 Jun. 1979 315 p Sponsored in part by DOE
(Contract NAS8-32921)
(NASA-CR-161331) Avail: NTIS HC A14/MF A01 CSCL 08I

The prototype preliminary design of the face advancement system (FAS) consisting of the yaw alignment system (YAS) and the roll control system (RCS), and the master control station (MCS) is outlined. R.E.S.

N80-12541# Ohio Dept. of Natural Resources, Columbus. Div. of Geological Survey.
METHOD OF ANALYSIS AND PRECISION OF X-RAY DIFFRACTION DATA FROM OHIO SHALE
R. W. Carlton Oct. 1978 28 p refs
(Contract EY-76-S-05-5200)
(METC/CR-78/16) Avail: NTIS HC A03/MF A01

Sample preparation and methods of calculation used by the Division of Ohio Geological Survey in its mineralogic and physical characterization of the Upper Devonian black shales are described. Methods of sample mounting, used in conjunction with a Philips automatic sample changer (ASC), allow analysis of a large number of samples by X-ray diffractometry. Because of the time saved with an ASC, each sample can be scanned twice to increase the precision of the results. The reproducibility of the X-ray data, expressed as relative deviation, ranges from about + or - 2 to + or - 10 percent in samples for which the percent total integrated intensity (percent TII) is above 6 percent. DOE

N80-12542# Department of Energy, Washington, D. C. Energy Information Administration.
IDENTIFICATION OF A METHODOLOGY FOR PROJECTING SHORT-TERM CRUDE PETROLEUM PRODUCTION IN THE UNITED STATES
N. D. Uri Dec. 1978 35 p
(DOE/EIA-0103/14) Avail: NTIS HC A03/MF A01

Box-Jenkins time series analysis is applied to state level monthly crude petroleum production data to forecast monthly production for 1978. Beyond supplying the requisite forecasts, the model is used to investigate the overall efficacy of the approach. The results indicate that the technique emulates past behavior. Further, for the aggregate United States, production is expected to be 0.65 percent above the level observed in the base period of July 1976 - June 1977 primarily due to a large anticipated growth in California production. DOE

N80-12543# Sandia Labs., Albuquerque, N. Mex. GEO Energy Technology Dept.
OVERVIEW OF IN SITU OIL SHALE TECHNOLOGY AND RECENT ADVANCES IN TRUE IN SITU RETORT MODELING
C. E. Tyner 1979 11 p refs Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract EY-76-C-04-0789)
(SAND-78-2367C; CONF-790803-08) Avail: NTIS HC A02/MF A01

In view of current liquid fuel shortages, development of the oil shale resources of Colorado, Utah, and Wyoming, estimated to contain more than one trillion barrels of oil equivalent, is considered. The in situ processing of this resource offers a potentially attractive alternative, both economically and environmentally, to surface processing. True and modified in situ retorting technologies are described and current research in these areas briefly outlined. True in situ and related low-void in situ processes would minimize the mining and materials handling problems associated with other technologies. A comprehensive mathematical model developed to describe the retorting process in these beds is presented. Use of the model to investigate the effect of various retort geometries and bed conditions on the oil yield from true in situ and low-void in situ retorts is discussed. DOE

N80-12544# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
SHALE OIL: US AND WORLD RESOURCES AND PROSPECTS FOR NEAR-TERM COMMERCIALIZATION IN THE UNITED STATES
G. Marland Mar. 1979 59 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-79-8(R)) Avail: NTIS HC A04/MF A01

Although the United States has large resources of shale oil, several decades of development effort have yet to result in a viable industry. Because both the cost of the oil and the environmental impact of its production are not well known and seem to remain perennially at the margin of acceptability, the matter of commercialization has become a political issue. A variety of economic incentives and government programs to encourage commercial development have been proposed - some implemented - and several industrial corporations are proceeding cautiously. Conflicting political, economic, and environmental views, however, continue to preclude a decisive commitment, and it does not appear at this time that significant quantities of shale oil will be avaiable in the next decade, or probably even longer. DOE

N80-12545# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF A METHOD FOR COMPARING ONE-DIMENSIONAL AND TWO-DIMENSIONAL MODELS OF A GROUND-WATER FLOW SYSTEM
T. G. Naymik 30 Aug. 1978 37 p refs
(Contract W-7405-eng-48)
(UCRL-52541) Avail: NTIS HC A03/MF A01

The inability of a one-dimensional ground-water model to interact continuously with surrounding hydraulic head gradients was evaluated by one- and two-dimensional ground water flow simulations. Two types of models were used: flow-conserving models and models designed to yield two dimensional solutions. The hydraulic conductivities of controlling features were varied and model comparison was based on the travel times of market particles. The solutions within each of the two model types compare reasonably well, but a three dimensional solution is required to quantify the comparison. DOE

N80-12546# National Oceanic and Atmospheric Administration, Washington, D. C.
SEASAT: GULF OF ALASKA EXPERIMENT. SURFACE TRUTH DATA INVENTORY
John C. Wilkerson and S. Lynn McNutt 15 Feb. 1979 100 p
(PB-294616; NOAA-79031609) Avail: NTIS HC A05/MF A01 CSCL 05B

An experiment designed to collect in situ physical oceanographic and meteorological data for verification and evaluation of SEASAT sensor performance is described. The experiment was carried out from ships, aircraft, and buoys. An inventory of all physical oceanographic and meteorological surface truth data collected during the experiment from each of the participating platforms is presented. J.M.S.

N80-12547# Geological Survey, Reston, Va.
U. S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: BEAVER CREEK WATERSHED
Janet Bonner, comp. 1979 89 p refs
(PB-297442/6) Avail: NTIS HC A05/MF A01 CSCL 08B

Remotely sensed data gathered from spacecraft and aircraft is presented. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-12548 Carnegie-Mellon Univ., Pittsburgh, Pa.
FOAM SOLAR SEA POWER: A PHYSICAL INVESTIGATION Ph.D. Thesis
Martin Greenstein 1979 151 p
Avail: Univ. Microfilms Order No. 7925016

A 30 foot high, 4 in. diameter column of glass pipe was constructed. Apparatus to generate a stable fresh water foam was developed and installed at the bottom of the column. An alcohol drip was found to effectively break foam. This, along with a spray condenser, was installed at the column top. Noncondensible gases were removed from the system by a vacuum pump. Water at 25 C, injected into the bottom of the column, was converted to a foam which flowed towards the 5 C condenser. This flow was found to have a dissipative loss similar to that of laminar flow of liquids in pipes. It was concluded that flow losses should not prevent the successful construction of a scaled-up foam solar sea power plant. Dissert. Abstr.

N80-12549*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SCHOTTKY BARRIER SOLAR CELL AND METHOD OF FABRICATION Patent Application
Richard J. Stirn (JPL) and Yea-chuan M. Yeh, inventors (to NASA) (JPL) Filed 13 Nov. 1979 33 p
(Contract NAS7-100)
(NASA-Case-NPO-13689-2; US-Patent-Appl-SN-093714) Avail: NTIS HC A03/MF A01 CSCL 10A

A Schottky barrier solar cell is described which consists of a thin substrate of low cost material with at least the top surface of the substrate being electrically conductive. A thin layer of heavily doped n-type polycrystalline germanium, with crystalline sizes in the submicron range, is deposited on the substrate after a passivation layer is deposited on the substrate to prevent migration of impurities into the polycrystalline germanium on a substrate of low-cost conductive material. Then, the polycrystalline germanium is recrystallized to increase the crystal sizes in the germanium layer to not less than 5 microns, and preferably considerably more. It serves as a base layer on which a thin layer of gallium arsenide is vapor-epitaxially grown to a selected thickness. Then, a thermally-grown oxide layer of a thickness of several tens of angstroms is formed on the gallium arsenide layer. NASA

N80-12550# Committee on Science and Technology (U. S. House).
INVENTORY OF ADVANCED ENERGY TECHNOLOGIES AND ENERGY CONSERVATION RESEARCH AND DEVELOPMENT, 1976-1978, VOLUME 1
Washington GPO 1979 859 p refs Prepared by ORNL and DOE for the Comm. on Sci. and Technol., 96th Congr., 1st Sess., Jan. 1979
(GPO-41-481) Avail: SOD HC

Each of 7,339 research projects is described and listed in one of the following nine sections into which the inventory is divided: solar energy, geothermal energy, hydro energy, basic physical research, biomass production/conversion and alternative fuels, electric power engineering, energy storage, energy conversion, and energy management, policy, and conservation. Each section is organized in a two- and three-level hierarchical arrangement. A.R.H.

N80-12551*# Ionics, Inc., Watertown, Mass. Research Div.
ANTON PERMSELECTIVE MEMBRANE
Samuel S. Alexander, Russell B. Hodgdon, and Warren A. Waite Mar. 1979 52 p Sponsored by NASA

(Contract DEN3-1)
(NASA-CR-159599; DOE/NASA/0001-79/1) Avail: NTIS HC A04/MF A01 CSCL 10A

Experimental composite membranes were synthesized on a lab scale consisting of a thin layer of anion permselective resin supported by and bonded to a porous physically strong and conductive substrate film. These showed good selectivity and also substantially lower electrical resistivities than the homogenous candidate membranes optimized in the previous contract. A wide range of resin porosities were examined for three candidate membrane systems, CDIL, CP4L, and A3L to identify the formulation giving the best overall redox cell performance. Candidate anion membranes showed large increases in resistivity after a short time of immersion in concentrated FeCl/HCl solution. Largely on the basis of resistance stability the CDIL formulation was selected as prime candidate and about thirty-five membranes (one foot square) were produced for experimental static and dynamic evaluation. R.E.S.

N80-12552*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PHOTOVOLTAIC POWER SYSTEM IN THE REMOTE AFRICAN VILLAGE OF TANGAYE, UPPER VOLTA
William J. Bifano, Anthony F. Ratajczak, and James E. Martz 1979 17 p refs Presented at UNITAR Conf. on Long-Term Energy Resources, Montreal, 26 Nov. - 7 Dec. 1979 Sponsored in part by AID
(NASA-TM-79318; E-274) Avail: NTIS HC A02/MF A01 CSCL 10B

A photovoltaic (PV) system powering a grain mill and a water pump was installed in the remote West African village of Tangaye, Upper Volta. Village characteristics as well as system design, hardware, installation and operation to date are described. The PV system cost is discussed. A baseline socio-economic study performed and a follow-up study is planned to determine the impact of the system on the villagers. R.E.S.

N80-12553# Air Force Academy, Colo. Research Lab.
THE USAF ACADEMY FLYWHEEL-ELECTRIC CAR PRELIMINARY DESIGN REPORT Progress Report, 1 Oct. 1977 - 31 May 1979
David D. Ratcliff May 1979 47 p refs
(AF Proj. 2303)
(AD-A071242; FJSRL-TR-79-0006) Avail: NTIS HC A03/MF A01 CSCL 13/6

Although problems caused by pollution and declining petroleum reserves have caused renewed interest in electric vehicles, currently-available lead-acid batteries impose performance limitations which are unacceptable to most drivers. These limitations, specifically low range and acceleration, are greatly improved by the addition of a flywheel and continuously-variable transmission to the power train of the of the electric vehicle. This paper describes a low-technology flywheel-electric car built by U.S. Air Force Academy cadets and faculty members in the Department of Physics under funding provided by Frank J. Seiler Research Laboratory. The car design discussed appears to offer the possibility for a four-passenger urban vehicle with a range of 70-100 miles and acceleration performance comparable to that of current sub-compact cars. This performance is achieved with a simple driving system which is comparable to that in current automatic transmission cars. The paper also details the benefits and problems resulting from the low-technology design chosen and provides trade-off analyses on some of the specific problems inherent in the use of a flywheel in the power train of a vehicle. Finally, the paper suggests future improvements which could lower the weight of the vehicle, make the transmission shifting more precise, and improve the performance of the car on grades. GRA

N80-12554# American Univ., Washington, D. C.
ON THE PROPERTIES OF A FUEL CELL ELECTROLYTE Final Report, 10 Jul. 1978 - 15 Jan. 1979
Robert T. Foley Feb. 1979 124 p refs
(Contract DAAK70-78-C-0128)
(AD-A072864) Avail: NTIS HC A06/MF A01 CSCL 10/2

The field of fuel cell electrolytes is surveyed with the objective of learning the deficiencies and good properties of the available systems. The survey included a study of inorganic acids as phosphoric, sulfuric, hydrochloric, perchloric, hydrofluoric and other strong acids; organic acids including sulfonic and carboxylic; alkaline systems; ion exchange membrane systems, solid electrolytes; and molten carbonate systems. Some general and specific conclusions are listed indicating the technical questions to be answered to develop a low temperature organic sulfonic acid system. GRA

N80-12555# EIC, Inc., Newton, Mass.
INVESTIGATIONS OF THE SAFETY OF Li/SOCl SUB 2 BATTERIES Quarterly Report, Dec. 1978 - 30 Mar. 1979
Kuzhikalail M. Abraham, Richard M. Mank, and Gerhard L. Holleck Jul. 1979 64 p refs
(Contract DAAB07-78-C-0564; DA Proj. 1L1-62705-AH-94) (AD-A072862; DELET-TR-78-0564-2; QR-2) Avail: NTIS HC A04/MF A01 CSCL 10/3

Cyclic voltammetry and infrared spectrometry were employed as analytical tools to characterize the reaction products in Li/SOCl2 cells during various modes of operation. Sulfur dioxide is produced during the discharge. The nature of products formed during forced overdischarge depends on whether the cells are cathode or anode limited. Infrared spectral data indicated that Li2S is formed in cathode limited cells during forced overdischarge. On the other hand, there was very little or no Li2S present in cells at the end of discharge or in anode limited cells after forced overdischarge. From anode limited cells, Cl2 and a compound exhibiting IR absorption at 1070 cm(-1) were detected after forced overdischarge. These materials are formed by oxidation reactions at the anode. Analysis of solutions from cells discharged without Li on the anode showed that SO2Cl2, SOCl(-)AlCl14(-), Cl2, a material absorbing at 1070 cm(-1) and probably SCl2 are formed as oxidation products. Some SO2 was also found in these solutions. The products detectable after 'charging' a Li/SOCl2 cell were SO2Cl2, SCl2, and the material exhibiting absorption in the infrared spectrum at 1070 cm(-1). On the basis of materials characterized from IR spectral and cyclic voltammetry data, a mechanism is proposed for the oxidation reactions in SOCl2/LiAlCl4 solutions. GRA

N80-12556# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
PHOTOELECTROCHEMICAL CONVERSION OF OPTICAL ENERGY TO ELECTRICITY AND FUELS Interim Report
Mark S. Wrighton 8 Aug. 1979 37 p refs Submitted for publication
(Contract N00014-78-C-0630; NR Proj. 051-696)
(AD-A072861; TR-2-ONR) Avail: NTIS HC A03/MF A01 CSCL 10/2

Though the first documented photovoltaic effect is associated with a semiconductor/liquid junction, it has not been until very recently that significant solar energy conversion efficiency could be realized with a photoelectrochemical device. A semiconductor/liquid junction solar cell is one where one or both electrodes in an electrochemical cell is semiconductor such that irradiation of the semiconductor(s) results in the non-spontaneous flow of electric current in the external circuit. Photogeneration of storable chemical fuels in the form of electrolytic products is possible, in addition to the prospect of converting light only to electricity when the redox reaction occuring at one electrode is the reverse of that at the other. The aim of this report is to outline our recent research accomplishments in the field of photoelectrochemistry. Our work in this area began in late 1974 - more than a century after the first studies of photoeffects upon irradiation of an electrode in a cell, and a number of years after modern pioneering studies of semiconductor/liquid interfaces which led to the formulation of our present working hypotheses of such interfaces exposed to optical illumination. GRA

N80-12557# Institute of Gas Technology, Chicago, Ill.
COMMERCIAL APPLICATION OF MOLTEN CARBONATE FUEL CELL SYSTEM
K. F. Blurton and J. R. Peterson 1979 16 p Presented at Energy Technol. Conf. and Exposition, Washington, D.C., 26 Feb. 1979 Prepared in cooperation with Gen. Elec., Schenectady, N. Y.
(Contract EM-78-C-03-1735)
(CONF-790213-4) Avail: NTIS HC A02/MF A01

The potential applications of molten carbonate fuel cells are

discussed with particular emphasis on the configuration of a dispersed, oil-fueled and a central, coal-fueled base-load power plant. The penetration of these power plants into the utility generation system is described. The status of this technology is reviewed, and the major technology areas currently under investigation are discussed. DOE

N80-12558# Washington State Univ., Pullman. Environmental Research Center.
COMPARISON OF GEOTHERMAL ENERGY WITH COAL, OIL, AND NATURAL GAS FOR SELECTED USES
G. W. Hinman and J. Robertson 1979 102 p refs
(Contract EY-76-S-06-2221)
(DOE/ET-27139-1; RLO/2221-T14/1) Avail: NTIS HC A06/MF A01

Environmental effects and energy efficiencies for geothermal energy, western strip-mined coal, and eastern underground mined coal applied to space heating, process heat, and electric drive were compared. The measure of an environmental effect is the amount of residual material released to the environment, and the measure of energy efficiency is the second law efficiency of the process involved. The results indicate that geothermal energy efficiencies (second law) are higher than those for coal for all three end uses. The environmental effects for geothermal supply systems are smaller than those for coal in the cases of space heat and process heat and are comparable in the case of electric drive. The optimum allocation of a finite geothermal resource and a finite coal resource between space heat and drive has been evaluated from the viewpoint of maximum end use service. The results indicate that, to the extent that location factors permit, geothermal energy should be used for space heat and coal for electric drive. DOE

N80-12559# Sandia Labs., Albuquerque, N. Mex.
BATTERIES FOR SPECIFIC SOLAR APPLICATIONS
R. P. Clark 17 Jul. 1979 24 p Presented at DOE/STOR Flow Battery Proj. Rev., Rockville, Md., 17 Jul. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1428C) Avail: NTIS HC A02/MF A01

Reproductions of slides used in an oral presentation are published. Thermal batteries are mentioned, and the program strategy for developing batteries for photovoltaic systems is outlined. DOE

N80-12560# Mobil Tyco Solar Energy Corp., Waltham, Mass.
PREPARATION AND CHARACTERIZATION OF HYDROGENATED AMORPHOUS SILICON THIN FILMS AND THIN FILM SOLAR CELLS PRODUCED BY ION PLATING TECHNIQUES Quarterly Progress Report, 1 Jan. - 31 Mar. 1979
30 Apr. 1979 8 p refs
(Contract ET-78-C-03-1846)
(SAN-1846-T1; QPR-1) Avail: NTIS HC A02/MF A01

A review of the ion plating deposition process, in which evaporation of a metal or semiconductor into a glow discharge is used to affect the character and surface bonding of the resulting thin film, is presented. It is noted that ion plating increases the adhesion in the substrate of implanted films compared to evaporated or sputtered films. This greater adhesion allows a greater choice of substrate materials, deposition rates approaching those produced by simple vacuum evaporation methods, and the option of doping. DOE

N80-12561# California Univ., Livermore.
USING SURFACE WATERS FOR SUPPLEMENTING INJECTION AT THE SALTON SEA GEOTHERMAL FIELD (SSGF), SOUTHERN CALIFORNIA
E. Raber, Lawrence B. Owen, and Jackson E. Harrar 10 Jul. 1979 5 p refs Presented at Geothermal Resources Council Ann. Meeting, Reno, Nev., 24 Sep. 1979
(Contract W-7405-eng-48)
(UCRL-83011; CONF-790906-15) Avail: NTIS HC A02/MF A01

It was found that direct injection of untreated makeup water is not feasible for cooling because of high suspended solids loading and potential incompatability problems. However, mixtures of ambient temperature makeup water and higher temperature (80 to 90 C) brine effluent, in a 1:4 mass ratio, are potentially injectable following processing by reaction clarification and granular media filtration. DOE

N80-12562# Argonne National Lab., Ill.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 11: NUCLEAR FISSION PROGRAM SUMMARIES
Jun. 1979 345 p
(Contract W-31-109-eng-38)
(ANL-PMS-79-2-Vol-11) Avail: NTIS HC A15/MF A01

Brief management and technical summaries of nuclear fission power programs are presented for nineteen countries. The programs include the following: fuel supply, resource recovery, enrichment, fuel fabrication, light water reactors, heavy water reactors, gas cooled reactors, breeder reactors, research and test reactors, spent fuel processing, waste management, and safety and environment. DOE

N80-12563# Sandia Labs., Albuquerque, N. Mex. Systems Analysis Div.
EFFECT OF OPERATING TEMPERATURES ON THE COST OF ENERGY FROM SOLAR THERMAL ELECTRIC POWER PLANTS
L. I. Lukens Jul. 1979 88 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0801) Avail: NTIS HC A05/MF A01

The operating temperature of a solar thermal electric power plant controls the efficiency of the collector field, the efficiency of the power generation system and the cost of the thermal energy storage system. The effect of these three items, as temperature is varied, on the annualized cost of energy produced by the system was evaluated for both stand-alone solar and solar diesel hybrid power plants. The type of solar power plant considered was one using a linear focus distributed collector field and a Rankine cycle power generation system. Systems using different collector performance models, Rankine cycle working fluids and thermal energy storage concepts were included in the evaluation. DOE

N80-12564# Midwest Research Inst., Golden, Colo.
THERMOELECTRIC OCEAN THERMAL ENERGY CONVERSION
T. S. Jayadev, D. K. Benson, and M. S. Bohn Jun. 1979 33 p refs Presented at the Sixth Intern. OTEC Conf., Washington, D.C., 19-22 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-35-254; CONF-790631-6) Avail: NTIS HC A03/MF A01

A novel thermoelectric ocean thermal energy conversion (OTEC) concept was proposed and compared with the ammonia closed-cycle designs. The thermoelectric OTEC was found to offer several potential advantages including; simpler and more easily mass produced components; higher reliability system performance through the use of a high level of redundancy and long-lived, solid state thermoelectric generators; greater safety for crew and environment by elimination of the pressurized safety for crew and environment by elimination of the pressurized working fluid; and the possibility of lower system costs. DOE

N80-12565# Midwest Research Inst., Golden, Colo.
SYSTEMS ANALYSIS AND TESTING (SAT) PROGRAM Progress Report, 1 Oct. 1978 - 31 Mar. 1979
C. J. Bishop Jul. 1979 19 p refs
(Contract EG-77-C-01-4042)
(SERI/PR-35-313) Avail: NTIS HC A02/MF A01

Activities of the systems analysis and testing (SAT) program are described. These include: (1) a reevaluation of thermosiphon hot water systems; (2) a review of existing wind machine performance models; a study of the effects of wind transients, and control system and load management on energy capture; (3) a study of new concepts for solar ponds involving stratified ponds; (4) establishment of the computational methods center; (5) dissemination of F-chart; (6) a review of photovoltaic systems analysis methods; (7) development of a draft SAT program plan, SAT management plan, and an integrated system test and validation plan, and (8) transfer of technical management of contracts in the SAT program. DOE

N80-12566# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMIZATION OF PHOTOVOLTAIC/THERMAL COLLECTOR HEAT PUMP SYSTEMS
M. C. Russell and E. C. Kern, Jr. 1979 5 p refs Presented at the 1979 Intern. Solar Energy Soc., Atlanta, 28 May - 1 Jun. 1979
(Contract EG-77-S-02-4577)
(COO-4577-7; CONF-790541-20) Avail: NTIS HC A02/MF A01

Photovoltaic/thermal (PV/T) collector-heat pump systems were simulated for residences in New York and Fort Worth climates. Analysis of the technical and economic results are discussed. The parallel heat pump configuration with 40 square meters of PV/T collectors was found to be the least-cost system option for the New York residence. DOE

N80-12567# Franklin Inst. Research Labs., Philadelphia, Pa.
THE GREAT ADVENTURE: A REPORT ON THE 10 REGIONAL PUBLIC HEARINGS ON SOLAR ENERGY FOR THE DOMESTIC POLICY REVIEW
Oct. 1978 52 p refs Prepared by the Inst. for Local Self Reliance
(Contract EU-78-C-01-6354)
(HCP/U6354-01) Avail: NTIS HC A04/MF A01

A report on the public hearings is presented along with policy recommendations. The recommendations are as follows: (1) the Federal government should move aggressively from research to commercialization, marketing, and public education; (2)decentralization both in program process and in context should be pursued vigorously; (3) the government should emphasize small scale systems, small businesses, individual inventors, community organizations, and small research groups in its funding programs; (4) solar energy systems that are decentralist are preferred over the more central-oriented; (5) passive solar design was the major technology recommended throughout; (6) DOE must streamline its grants process and reduce paperwork that proposals require; (7) the major item required for a successful solar industry is rapid passage of the solar income tax credit, either within, or separate from, the National Energy Act; (8) low interest loans and investiment capital are required by small businesses; (9) public information on solar energy should be more available; (10) the budget for solar should be increased substantially; and (11) solar programs should be related to job-creation programs. DOE

N80-12568# Oak Ridge National Lab., Tenn. Engineering Technology Div.
LOW-TEMPERATURE THERMAL ENERGY STORAGE PROGRAM ANNUAL OPERATING PLAN
H. W. Hoffman and D. M. Eissenberg Jan. 1979 130 p
(Contract W-7405-eng-26)
(ORNL/TM-6605) Avail: NTIS HC A07/MF A01

The LTTES program operating plans for FY 1978 are described in terms of general program objectives and the technical activities being implemented to achieve these objectives. The program structure provides emphasis on seasonal thermal storage, daily/short-term thermal storage, and waste heat recovery and reuse. A work breakdown structure organizes the efforts being carried out in-house or through subcontract within each thrust area. Fiscal data are summarized with respect to thrust area, individual efforts, and funding source. DOE

N80-12569# California Univ., Livermore. Lawrence Livermore Lab.
HYBRID STAGING OF GEOTHERMAL ENERGY CONVERSION PROCESSES
Robert F. Steidel Sep. 1978 27 p refs
(Contract W-7405-eng-48)
(UCID-17949) Avail: NTIS HC A03/MF A01

A hybrid system consists of two or more energy conversion processes. The use is examined of three energy conversion machines in hybrid systems: the conventional single-phase turbine, and the two-phase expanders known as the Lysholm engine and the radial outflow reaction turbine. Two hybrid systems are presented. The first is a two-stage, single-flash system with the Lysholm engine as the first stage, and a separator and conventional turbine as the second stage. The second system adds a radial outflow reaction turbine to recover a part of the energy rejected in the second stage. A theoretical specific power of 41.3 kW.s/lb is predicted for the two-stage, single-flash hybrid system. The addition of the radial outflow rotary turbine increases performance to 44.8 kW.s/lb. Both are superior to the double-flash system, with a specific power of 37.8 kW.s/lb. In addition, the hybrid system offers operating flexibility. DOE

N80-12570# California Univ., Livermore. Lawrence Livermore Lab.
NEW CONCEPTS FOR CONVERTING THE ENERGY IN LOW-TO MEDIUM-TEMPERATURE LIQUIDS, WITH EMPHASIS ON GEOTHERMAL APPLICATIONS
Arthur L. Austin and Palmer A. House 20 Sep. 1978 18 p refs
(Contract W-7405-eng-48)
(UCRL-52583) Avail: NTIS HC A02/MF A01

The Geothermal Development Program at Lawrence Livermore Laboratory has produced several novel expanders for liquids of low to medium temperatures (approximately 180 C). A unique radial outflow reaction turbine (RORT) was developed and laboratory-tested; results indicate that 50% engine efficiency is achievable. This work has led to a new concept called the velocity pump reaction turbine (VPRT), which could significantly increase the gross engine efficiency of the RORT. VPRT and its modifications are a unique family of turbines created specifically for expanding liquids to produce shaft work at potential engine efficiencies of up to 70%. Such devices, if used between the two separation stages of a double-flash system, could increase the overall power output by 15 to 20%, reducing power costs by at least 10% for about a 3% increase in capital costs. Geothermal applications are discussed with emphasis on geopressured resources. Also, these machines are suitable for utilizing solar heated fluids and waste heat sources from industrial processes. DOE

N80-12571# Sandia Labs., Albuquerque, N. Mex.
EVALUATION OF SOLAR RANKINE-CYCLE ENGINE SYSTEMS
Gilad Ramback (Ormat Turbines Ltd., Yavne, Israel) Jan. 1979 39 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0986) Avail: NTIS HC A03/MF A01

Electrical parasitic losses are evaluated for two solar Rankine-cycle engine systems: (1) a total-energy solar system for the Midtemperature Solar Systems Test Facility (MSSTF), and (2) the Willard solar irrigation pump. Estimates are given of the minimal electrical parasitic losses that a commercialized total-energy solar system of the size of the MSSTF could have as well as minimal losses for the Willard solar irrigation pump. DOE

N80-12572# Sandia Labs., Albuquerque, N. Mex. Chemical Technology Div.
CLOSED-CYCLE HYDRIDE ENGINES
Thomas E. Hinkebein, Clyde J. Northrup, and Albert A. Heckes Dec. 1978 25 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2228) Avail: NTIS HC A02/MF A01

Closed cycle hydride engines of 1/2 horsepower or less, which are capable of using a low quality heat source available from flat plate solar collectors or from process waste streams, are described. The engines are simple in concept and operation, potentially inexpensive, reliable, and capable of remote unattended operation. They perform work as hydrogen evolved from a heated metal hydride expands against a flexible member. The cycle is completed by the reabsorption of hydrogen in the metal upon cooling. Theoretical cycles are described and efficiencies are presented. A comparison is made to both Carnot and Rankine cycles. DOE

N80-12573# Battelle Pacific Northwest Labs., Richland, Wash.
SPECULARITY MEASUREMENTS FOR SOLAR MATERIALS
M. A. Lind, J. S. Hartman, and H. L. Hampton Aug. 1978 10 p refs Presented at Symp. and Instr. Display, San Diego, Calif., 28 Aug. 1978
(Contract EY-76-C-06-1830)
(PNL-SA-6831-Pt-2; CONF-780829-10) Avail: NTIS HC A02/MF A01

A technqiue using Fourier transform analysis which is suitable for measuring the specularity of solar glass components in the mrad and sub-mrad is discussed and demonstrated. A brief mathematical background as well as illustrative examples are included. A number of methods for image analysis are discussed with particular emphasis given to electronic integrating detectors. Typical Fourier plane image distributions are given for a few common solar utilization materials and details of the instrument used to produce the images are considered. The limitations and capabilities of various instruments are outlined along with methods for further enhancing the utility and sensitivity of the technique. DOE

N80-12574# Sandia Labs., Livermore, Calif. Exploratory Chemistry Div.
MATERIALS PROBLEMS IN REVERSIBLE CHEMICAL REACTION STORAGE SYSTEMS FOR SOLAR ENERGY
R. W. Mar Nov. 1978 17 p Presented at Mater. Sci. Conf., Argonne, Ill., 1 Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-78-8693; CONF-7806127-1) Avail: NTIS HC A02/MF A01

Materials problems encountered in the development of thermochemical energy storage systems for solar energy are discussed. Concerns with catalyzed reaction systems include effects of thermal cycling on reactor materials, catalyst availability and lifetime, and undesirable side reactions. Problems have arisen in thermal decomposition systems due to poor or variable kinetics, volume expansion effects, and poor intrinsic heat transfer properties. Reactions which make use of the heat of solution suffer least from materials problems; the major concerns are with the corrosive nature of the chemicals involved (e.g., sulfuric acid, sodium hydroxide). DOE

N80-12575# Oak Ridge National Lab., Tenn. Energy Div.
WASTE HEAT REJECTION FROM GEOTHERMAL POWER STATIONS
R. C. Robertson Dec. 1978 159 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6533) Avail: NTIS HC A08/MF A01

Waste heat rejection from geothermal power stations is concerned only with the heat rejected from the power cycle. The heat contained in reinjected or otherwise discharged geothermal fluids is not included with the waste heat considered here. The heat contained in the underflow from the flashtanks in such systems is not considered as part of the heat rejected from the power cycle. By following this definition of the waste heat to be rejected, various methods of waste heat dissipation are discussed without regard for the particular arrangement to obtain heat from the geothermal source. Recent conceptual design studies made for 50 MW(e) geothermal power stations at Heber and Niland, California, are of particular interest. The former uses a flashed-steam system and the latter a binary cycle that uses isopentane. In last-quarter 1976 dollars, the total estimated capital costs were about $750/kW and production costs about 50 mills/kWhr. If wet/dry towers were used to conserve 50% of the water evaporation at Heber, production costs would be about 65 mills/kWhr. DOE

N80-12576# Ames Lab., Iowa. Solar Div.
OPERATIONAL EXPERIENCE WITH DRAIN-DOWN SOLAR SYSTEMS
P. H. Sidles, R. G. Struss, and E. C. Brohl 1978 11 p ref Presented at Solar Heating and Cooling Systems Operational Results Conf., Colorado Springs, Colo., 29 Nov. 1978
(Contract W-7405-eng-82)
(IS-M-166; CONF-781102-3) Avail: NTIS HC A02/MF A01

Drain-down solar collector systems offer substantial economic advantage over antifreeze/heat-exchange systems. Drain-down systems are simpler, have lower piping and plumbing costs, and operate at higher collector and system efficiencies. Properly designed and installed drain-down systems intrinsically should require less maintenance. These advantages have not yet been demonstrated in actual operating experience. A substantial number of the Solar Heating and Cooling Demonstration projects under Ames Laboratory cognizance are of drain-down design. Most projects are located in freezing climates; some suffered damage from freezing last winter. Operating experiences for these projects are presented, together with some design criteria for drain-down systems that these operating experiences reveal. DOE

N80-12577# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE OF LOS ALAMOS SOLAR MOBILE/MODULAR HOME UNIT NO. 1
J. C. Hedstrom, S. W. Moore, and J. D. Balcomb 1978 7 p Presented at Solar Heating and Cooling Systems Operational Results Conf., Colorado Springs, Colo., 29 Nov. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2587; CONF-781102-1) Avail: NTIS HC A02/MF A01

Mobile/Modular Home Unit No. 1 at the Los Alamos Scientific Laboratory is an active air system which incorporates 340 sq ft of flat black single-glazed flat-plate air collectors mounted at a 60 tilt on the south wall. The thermal storage is in 1536 pint jars of water spaced apart by 5/8 in. to allow air flow around the jars. Data have been obtained on the unit from October 1976, up to the present. Data acquisition is by a Hewlett-Packard 3050 system controlled with a HP9825 desk top calculator. Complete energy summaries for the heating seasons have been obtained. The solar energy system has provided about 70% of the heating requirements of the house each season. Although the solar energy system provides a major fraction of the space and domestic hot water requirements, the yearly total energy supplied is low. This is primarily because the house load was lower than expected due to passive gains and internal heat generation. Low performance is also due to a low storage mass (5.3 Btu/sq ft F) and several possible uncontrolled air leaks. DOE

N80-12578# Midwest Research Inst., Golden, Colo.
DIRECT LABOR REQUIREMENTS FOR SELECT SOLAR ENERGY TECHNOLOGIES: A REVIEW AND SYNTHESIS
B. Mason and K. Armington Aug. 1978 32 p refs
(Contract EG-77-C-01-4042)
(SERI/RR-53-045) Avail: NTIS HC A03/MF A01

Various estimates of the labor requirements for the design, manufacture, installation, and maintenance of space heating and domestic hot water systems are presented. Total projected job requirements by year, calculated by multiplying person-hours per system times market penetration estimated, are provided. Limitations of previous studies and conclusions about needed research are discussed. DOE

N80-12579# Sandia Labs., Albuquerque, N. Mex. Div. 4715.
EFFORTS ON THE ECONOMIC ANALYSIS OF DARRIEUS VERTICAL AXIS WIND TURBINES
W. N. Sullivan 1978 8 p ref Presented at Am. Wind Energy Assoc. Conf., Hyannis, Mass., 25 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1851C; CONF-780972-1) Avail: NTIS HC A02/MF A01

There is an ongoing program designed to establish reasonable estimates for the cost of utility grid energy produced by Darrieus VAWT systems. The economic analysis is based on the detailed examination of actual point designs, which cover a range of system sizes. The approach is unique in that in addition to determining the direct costs of system components, an effort is made to include the indirect costs and profits of the manufacturing, marketing, distributions, and sales tasks of the enterprise producing the systems. The point design specifications and drawings were developed and provide the baseline for this study. The specifications represent optimum designs, as determined by an economic optimization model. This model, with mathematical formulas for the costs of major system elements, was used to select from many possibilities an optimum set of design specifications. DOE

N80-12580# Oak Ridge National Lab., Tenn. Energy Div.
FUEL CHOICE AND AGGREGATE ENERGY DEMAND IN THE COMMERCIAL SECTOR
Steve Cohn Dec. 1978 51 p refs
(Contract W-7405-eng-26)
(ORNL/CON-27) Avail: NTIS HC A04/MF A01

A fuel choice and aggregate demand model of energy use in the commercial sector of the United States is presented. The model structure is dynamic with short run fuel price responses

estimated to be close to those of the residential sector. Of the three fuels analyzed, electricity consumption exhibits a greater response to its own price than either natural gas or fuel oil. In addition, electricity price increases have the largest effect on end use energy conservation in the commercial sector. An improved commercial energy use data base is developed which removes the residential portion of electricity and natural gas use that traditional energy consumption data sources assign to the commercial sector. In addition, household and commercial petroleum use is differentiated on a state by state basis. DOE

N80-12581# Ernst and Ernst, Washington, D. C.
DEVELOPMENT OF A JOINT-COST-ALLOCATION MANUAL FOR INTEGRATED COMMUNITY ENERGY SYSTEMS (ICES)
Sep. 1978 117 p refs
(Contract W-31-109-eng-38)
(ANL/ICES-TM-20) Avail: NTIS HC A06/MF A01

The problem of an appropriate-cost-allocation system for an integrated community energy system was studied. Technical factors were examined and the relevant economic theory was synthesized. Three generic approaches to cost allocation (public projects, cost accounting, mathematical programming) were assessed and current utility and regulatory allocation procedures were surveyed. Based on these steps, conclusions to date are: (1) economic theory suggests that cost allocation is unnecessary for optimal feasibility, pricing, and output decisions; (2) reasonable and practicable allocations are required for regulatory purposes and cost-sharing arrangements; (3) no single approach to cost allocation in practice is wholly satisfactory; (4) the mathematical programming approach seems most promising at this juncture; and (5) implementation of any method is dependent on data availability. DOE

N80-12582# Department of Energy, Washington, D. C. Economic Regulatory Administration.
STANDBY CONSERVATION PLAN NO. 2: EMERGENCY BUILDING TEMPERATURE RESTRICTIONS. AUTHORITIES: NEED, RATIONALE, OPERATION
Feb. 1979 29 p
(DOE/ERA-0048) Avail: NTIS HC A03/MF A01

The text of the Emergency Building Temperature Restrictions is given. The text includes definitions, heating and cooling, hot water, reports and recordkeeping, operators, customer lists, relation to state law, administrative provisions, public information, and penalties. The statement of the need for rationale and operation of the plan is also given. The plan applies in each state or political subdivision thereof and preempt inconsistent state or local law. DOE

N80-12583# Department of Energy, Washington, D. C. Office of Fusion Energy.
UNITED STATES MAGNETIC FUSION ENERGY PROGRAM
S. O. Dean Aug. 1978 176 p
(DOE/ET-0072) Avail: NTIS HC A09/MF A01

The following topics are discussed: (1) policy; (2) magnetic fusion energy program; (3) physics proof-of-principle programs; (4) major scaling experiments; (5) energy producing experimental reactors: design studies and long lead time technology development; (6) commercialization: reactor designs and systems studies; and (7) enhancement studies. DOE

N80-12584# California Univ., Livermore. Lawrence Livermore Lab.
NOTES FROM THE SECOND DEPARTMENT OF ENERGY LIBRARY WORKSHOP
K. W. Fong and R. E. Jones Oct. 1978 15 p Presented at ACM-SIGNUM Conf. on the Programming Environment for Develop. of Numerical Software, Pasadena, Calif., 18 Oct. 1978
(Contract W-7405-eng-48)
(UCRL-81736; CONF-781052-4) Avail: NTIS HC A02/MF A01

Problems posed by the proliferation of minicomputers of different models and supercomputers of unconventional architecture are discussed. The role of commercial libraries in the operation of DOE computer center libraries is examined. A number of suggestions with respect to the format of software submitted to libraries are explained. DOE

N80-12585# IBM Federal Systems Div., Huntsville, Ala.
OCTOBER 1978 ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Oct. 1978 176 p refs
(Contract EG-77-C-01-4049)
(SOLAR/0010-78-10) Avail: NTIS HC A09/MF A01

The thermal performance of selected solar energy systems was determined. The energy contribution of each solar energy system was also determined. DOE

N80-12586# California Univ., Berkeley. Lawrence Berkeley Lab.
EXPERIMENTAL TEST FACILITY FOR EVALUATION OF SOLAR CONTROL STRATEGIES
M. Majteles, H. Lee, M. Wahlig, and M. Warren 15 Aug. 1978 11 p Presented at Workshop on the Control of Solar Energy, Hyannis, Mass., 23 May 1978
(Contract W-7405-eng-48)
(LBL-8308; CONF-7805126-5) Avail: NTIS HC A02/MF A01

An experimental solar heating and cooling system was constructed. It was designed to serve as a test system to check out the operation of a solar controller that looked promising in terms of its commercialization potential. Improvements were made in the experimental heating and cooling system to enable quantitative determination of the auxiliary energy savings made possible by using this type of controller. These improvements consisted of installation and calibration of accurate instrumentation, data acquisition capabilities, and development of simulated input and output devices that would allow repeated experiments using the same running conditions. In addition, the possibilities of further development of the heating and cooling system into an experimental test facility for a wide range of solar control strategies were investigated. DOE

N80-12587# InterTechnology Corp., Warrenton, Va.
PHOTOSYNTHESIS ENERGY FACTORY: ANALYSIS, SYNTHESIS, AND DEMONSTRATION Final Report
Nov. 1978 513 p refs
(Contract EX-76-C-01-2548)
(HCP/T3548-01) Avail: NTIS HC A22/MF A01

The potential of a combined dry-land Energy Plantation, wood-fired power plant, and algae wastewater treatment system is assessed. The cost effectiveness of recycling certain by-products and effluents from one subsystem to another is demonstrated. The algae pond provides a positive cash credit, resulting mainly from the wastewater treatment credit, which may be used to reduce the cost of the Photosynthesis Energy Factory (PEF)-generated electricity. The algae pond also produces fertilizer, which reduces the cost of the biomass produced on the Energy Plantation, and some gas. The cost of electricity is as low as 35 mills per kilowatt-hour for a typical municipally-owned PEF consisting of a 65-MWe power plant, a 144-acre algae pond, and a 33,000-acre Energy Plantation. Using only conventional or near-term technology, the most cost-effective algae pond for a PEF is the carbon-limited secondary treatment system. Analysis of the Energy Plantation subsystem at 15 sites revealed that plantations of 24,000 to 36,000 acres produce biomass at the lowest cost per ton. DOE

N80-12588# California Univ., Berkeley. Lawrence Berkeley Lab.
RESIDENTIAL ON SITE SOLAR HEATING SYSTEMS. A PROJECT EVALUATION USING THE CAPITAL ASSET PRICING MODEL M.S. Thesis
S. R. Schutz Dec. 1978 60 p refs
(Contract W-7405-eng-48)
(LBL-8298) Avail: NTIS HC A04/MF A01

The feasibility of 'on site solar heating' (OSSH) as a private utility investment was analyzed. The return on OSSH was calculated on the basis of the cost to the consumer of the equivalent amount of electrical energy that is displaced by the OSSH system. The hurdle rate for investment in OSSH was calculated using the Sharpe-Lintner Capital Asset Pricing Model. The results of this study indicate that OSSH is a low risk

investment having an appropriate hurdle rate of 7.9%. At this rate, OSSH investment appears marginally acceptable in northern California and unambiguously acceptable in southern California. The results also suggest that utility investment in OSSH should lead to a higher degree of financial leverage for utility companies without a concurrent deterioration in the risk class of utility equity. DOE

N80-12589# California Univ., Berkeley. Lawrence Berkeley Lab.
ANALYSIS OF THE CALIFORNIA SOLAR RESOURCE, VOLUME 2 Final Report
P. Berdahl, D. F. Grether, M. Martin, and M. Wanig Nov. 1978 90 p refs
(Contract W-7405-eng-48)
(LBL-7860-Vol-2) Avail: NTIS HC A05/MF A01

In order to assess the requirements for solar design data, several different paths were followed. The existing literature was consulted, analytical work was carried out within the project to determine the sensitivity of system design to errors in the solar data, and extensive contacts were made with potential users of solar data. Existing solar design techniques were evaluated in order to determine the types and quality of data needed. The determination of future solar data requirements for California was made on the basis of a regionalization of the state into solar zones, a familiarity with existing and proposed high-quality solar data networks, and knowledge of past data collection efforts. Recommendations for action by the state are presented. These recommendations are made to assure that adequate measures are taken now to meet solar data needs of the future. DOE

N80-12590# Sandia Labs., Albuquerque, N. Mex.
SOLAR MECHANICAL ENERGY STORAGE PROJECT
B. C. Caskey and H. M. Dodd 1978 6 p refs Presented at the First Inform. Exchange Conf., Lurey, Va., 24 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1982C; CONF-781046-10) Avail: NTIS HC A02/MF A01

Systems analyses identified flywheel energy storage systems as the most promising technology for small to intermediate load applications. Detailed design studies to investigate this storage mode are described. DOE

N80-12591# PRC Energy Analysis Co., McLean, Va.
SOLAR ENERGY COMMERCIALIZATION FOR AFRICAN COUNTRIES
Dec. 1978 101 p refs
(Contract EG-77-C-01-2522)
(HCP/CS-2522) Avail: NTIS HC A06/MF A01

Kenya, Cameroon, Nigeria, Niger, Ivory Coast, and Senegal were surveyed as part of the information acquisition task for the DOE International Solar Commercialization Working Group. All these countries are rich in solar energy and are friendly to the U.S. They represent a wide range of geographic features, climatic conditions, and energy resources. The main results are outlined. DOE

N80-12592# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MEAD, NEBRASKA, 25-kW PHOTOVOLTAIC POWER SYSTEM
W. R. Romaine 5 Jan. 1979 43 p refs
(Contract EY-76-C-02-4094)
(COO-4094-10) Avail: NTIS HC A03/MF A01

In 1977 MIT/Lincoln Laboratory designed, constructed, and put into operation a 25 kW peak solar photovoltaic power system in Mead, Nebraska. This system was to be used to provide power to an agricultural test facility operated by the University of Nebraska. The initial application of the PV system was to provide power to irrigate an 80 acre cornfield. The photovoltaic power system is described as it existed at the time of its inauguration, and as it will exist following the completion of presently planned modifications, which include more fully automated control and addition of an uninterruptible power supply. DOE

N80-12593# Drexel Univ., Philadelphia, Pa.
DOUBLE-EXPOSURE COLLECTOR SYSTEM Progress Report, 1 Jul. - 30 Sep. 1978
D. C. Larson and C. W. Savery 31 Oct. 1978 11 p
(Grant EG-77-G-04-4089)
(TID-28964) Avail: NTIS HC A02/MF A01

A retrofit solar water-heating system was installed in a three-story apartment building. The system employs two conventional collector banks (10 PPG collectors) mounted at the latitude angle for Philadelphia of 40 deg from the horizontal and two double-exposure collectors (DEC's) mounted vertically in mirrored enclosures. Although the DEC units are being used for year-round domestic water heating for the building, they are designed to provide maximum output in the winter and are therefore well-suited to solar space heating applications. Instrumentation for testing the collectors was available in the apartment building. New temperature sensors and a heat exchanger were installed and regular data collection was started. Every effort is being made to assure that reliable data are being obtained. A theoretical study of alternative mirror configurations was also completed. These calculations indicate that an optimal adjustable-mirror configuration exists which is optimal at latitudes 35, 40 and 45 deg. One mirror configuration, therefore, can be employed at diverse locations and is adaptable to a variety of solar energy applications. DOE

N80-12594# Institute for Energy Analysis, Oak Ridge, Tenn.
CONSTRAINTS ON ENERGY CONSERVATION
Willem vanGool Sep. 1978 21 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-78-17(M)) Avail: NTIS HC A02/MF A01

Energy conservation achieved through technology is discussed and distinguished against energy conservation achieved through changes of lifestyle. In the technological approach, the objectives of energy consuming activities are not questioned; thus, it is accepted that society needs a certain amount of aluminum, polymers, transport, etc., per year. What is analyzed in this approach is how these materials and services can be provided more efficiently. Alternatively, in the change of lifestyle approach to conservation the demand as such is analyzed: do we need aluminum, can we decrease the temperature in homes, do we need to travel? The distinction between the two approaches is demonstrated by considering the rate of energy-consuming activities. R.E.S.

N80-12595# Institute for Energy Analysis, Oak Ridge, Tenn.
FUNDAMENTAL ASPECTS OF ENERGY CONSERVATION POLICY
W. VanGool Nov. 1978 39 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-78-20(M)) Avail: NTIS HC A03/MF A01

The 'technological fix' approach to energy conservation is discussed. Higher capital investment can lead to a decrease in direct use of energy. Both the cost and the energy involved in these investments were analyzed along a conservation path, and a limited number of constants were used to direct the changes along this path. It was found that an increase in the price of energy will lead to higher capital investments in accordance with the economic lifecycles in the different sectors. For applications with a short lifetime, such as in the transport sector, energy conservation will mainly take place through the construction of new equipment. In sectors with long-lifetime investments (e.g., buildings), retrofitting will be important. DOE

N80-12596# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL ENERGY STORAGE TECHNOLOGY DEVELOPMENT FOR ELECTRIC AND HYBRID VEHICLE APPLICATIONS
T. M. Barlow 17 Oct. 1978 10 p refs Presented at 1st Inform. Exchange Conf., Lurey, Va., 24 Oct. 1978
(Contract W-7405-eng-48)
(UCRL-81786; CONF-781046-11) Avail: NTIS HC A02/MF A01

Flywheel concepts and one elastomeric energy storage concept all applicable to regenerative braking are developed. The performance and fuel economy of electric vehicles are improved. An experimental study of the effect of load leveling on battery life and analytical evaluations of mechanical energy storage technology are included. These activities are integrated in an

overall plan and management structure designed to enhance the commercialization of electric vehicles. DOE

N80-12597# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
RESEARCH ON THE DYNAMICS OF BAND-SUPPORTED FLYWHEEL SYSTEMS Final Report
C. W. Bert, C. A. Kocay, T. L. Chen, and J. P. Busby Nov. 1978 61 p refs
(Contract EY-76-C-04-0789)
(SAND-78-7074) Avail: NTIS HC A04/MF A01

Analytical research is reported relating to various aspects of the dynamics of band-supported, composite-material-rim flywheel energy-storage systems for application in hybrid automotive vehicles. A parametric study is carried out for free whirling of a flywheel system with a flywheel shaft supported by ball bearings, typical of a class of configurations contemplated in vehicular application as distinguished from R and D spin tests. It is shown that for a wide range of combinations of hub location and bearing and shaft stiffnesses, it is possible to avoid having any potentially dangerous forward-precession critical speeds throughout the desired operating range of 8,000 to 32,000 rpm. Nonlinear analyses are presented to describe the behavior of the bands in both the translational and tilting modes. The primarily softening behavior is geometrically induced and can lead to buckling at relatively small amplitudes. The band behaviors are approximated by polynomial expansions and applied to analyses of the steady-state forced whirling response. An analysis is presented for the behavior of a ring-type containment system after failure of the bands. This analysis combines Hertzian impact theory with an analysis of ring response to a concentrated load of half-sine waveform. It is shown that a 1-inch thick aramid-epoxy ring should provide satisfactory containment. Small model studies were initiated to study some of the nonlinear and containment phenomena. DOE

N80-12598# Oak Ridge National Lab., Tenn.
CRYSTALLOGRAPHIC CONTRIBUTIONS TO THE ENERGY PROBLEM
M. K. Wilkinson 1978 51 p Presented at 11th Congr. of Crystallography, Warsaw, 2 Aug. 1978
(Contract W-7405-eng-26)
(CONF-780867-1) Avail: NTIS HC A04/MF A01

Areas in which studies of crystallography can contribute to development of new materials for energy technology are reviewed. DOE

N80-12599# Oak Ridge National Lab., Tenn.
REGIONAL ECONOMIC/DEMOGRAPHIC PROJECTIONS FOR ENERGY POLICY ANALYSIS
D. J. Bjornstad Jan. 1979 37 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6668) Avail: NTIS HC A03/MF A01

The importance of adequate population and employment projections for regional policy analysis related to energy, and whether energy policy may significantly modify existing trends is studied. It is concluded that energy is less likely to create new subnational socio-economic tendencies than to enhance or retard existing trends, but that to analyze these circumstances a growth-policy format is desirable. It is emphasized that a lack of past experience with many new energy technologies will make impact analysis difficult. For this reason, attempts should be made to anticipate possible impacts well in advance of technology deployment. DOE

N80-12600# Gibbs and Cox, Inc., Washington, D. C.
OCEAN THERMAL ENERGY CONVERSION (OTEC) PLATFORM CONFIGURATION AND INTEGRATION, EXECUTIVE SUMMARY Final Report
R. J. Scott Jul. 1978 205 p refs
(Contract EG-77-C-01-4064)
(DOE/ET-4064-1) Avail: NTIS HC A09/MF A01

Studies leading to the development of conceptual designs for two 400 MW Offshore Thermal Energy Conversion (OTEC) commercial plants are summarized. A detailed overview of the study is presented. The successful deployment of a commercial OTEC plant in the near term is dependent upon the optimization of the platform configuration and power plant output level. The optimization procedure is based on both technical and economic factors and is used to evaluate a relatively large number of alternatives, i.e., six hullforms, five plant outputs ranging from 50 to 500 megawatts (MW), and three deployment sites. The hullforms under consideration include the ship (barge), cylinder (disc), spar, submersible, semi-submersible, and sphere; while the deployment sites are Hawaii, New Orleans, and Key West. The second part of the summary describes the development of the two platforms selected by DOE to be carried through the conceptual design level: a 400 MW ship and semi-submersible. DOE

N80-12601# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
ENERGY INFORMATION DATA BASE. SERIAL TITLES, FEBRUARY 1976 - MARCH 1979
Mar. 1979 87 p
(DOE/TIC-4579-R10-Suppl-4) Avail: NTIS HC A05/MF A01

This supplement contains changes and additions to TID-4579-R10 (Serial titles used by the DOE Technical Information Center) and is intended for use with that publication. DOE

N80-12602# Oak Ridge National Lab., Tenn. Computer Sciences Div.
ECONOMICS OF FUSION DRIVEN SYMBIOTIC ENERGY SYSTEMS
J. P. Renier, T. J. Hoffman, and J. G. Martin 1979 7 p refs Presented at ANS Ann. Meeting, Atlanta, Ga., 3 Jun. 1979 Prepared jointly with Lowell Univ., Mass.
(Contract W-7405-eng-26)
(CONF-790602-50) Avail: NTIS HC A02/MF A01

The economic analysis of symbiotic energy systems in which U233 (to fuel advanced converters burning U233 fuel) is generated in blankets surrounding fusioning D-T plasma's depends on factors such as the plasma performance parameters, ore costs, and the relative costs of Fusion Breeders (CTR) to Advanced Fusion Converters. The analysis also depends on detailed information such as initial, final makeup fuel requirements, fuel isotopics, reprocessing and fabrication costs, reprocessing losses (1%) and delays (2 years), the cost of money, and the effect of the underutilization of the factory thermal installation at the beginning of cycle. The results are presented of calculations of overall fuel cycle and power costs, ore requirements, proliferation resistance and possibilities for grid expansion, based on detailed mass and energy flow diagrams and standard US INFCE cost data and introduction constraints, for realistic symbiotic scenarios involving CTR's (used as drivers) and denatured CANDU's (used as U233 burners). The results are compared with those obtained for other strategies involving heterogeneous LMFBR's which burn Pu to produce U233 for U233-burners such as the advanced CANDU converters (MEU233-CANDU). DOE

N80-12603# Little (Arthur D.), Inc., Cambridge, Mass.
SOLAR HEATING AND COOLING OF BUILDINGS (SHACOB) COMMERCIALIZATION REPORT. PART B: ANALYSIS OF MARKET DEVELOPMENT, VOLUME 2 Final Report
Sep. 1977 88 p
(DOE/TIC-10071) Avail: NTIS HC A05/MF A01

The SHACOB Commercialization Model is designed to gauge the impacts of selected Federal incentive programs to encourage the development of solar energy equipment for hot water heating, space heating and space cooling in residential and commercial buildings. The model was implemented as a FORTRAN program and is presently running on the FEA computer system. It is used via the super WYLBUR data management system at FEA. Some modeling results are presented. DOE

N80-12604# Stockholm Univ. (Sweden). Forskningsgruppen foer Energisystestudier.
EFFECTS OF ENERGY POLICY ON INDUSTRY
Alf Carling and Joyce Dargay Jun. 1978 211 p refs In SWEDISH; ENGLISH summary
(USFFE-1978-8) Avail: NTIS (US Sales Only) HC A10/MF A01; DOE Depository Libraries

The results from a number of studies of energy consumption in Swedish manufacturing industries and of the sensitivity of different industrial sectors to energy taxation and other kinds of energy policy measures are presented. These studies were

concentrated on three energy-intensive sectors, namely the pulp and paper industry; mining and metal production (especially iron mines and the steel industry); and the brick, cement, and lime industry. DOE

N80-12605# Los Alamos Scientific Lab., N. Mex.
PROCESS DESIGN OF THE LASL BISMUTH SULFATE THERMOCHEMICAL HYDROGEN CYCLE
K. E. Cox, J. H. Pendergrass, and W. M. Jones 1979 8 p refs Presented at Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1256; CONF-790803-25) Avail: NTIS HC A02/MF A01

A process engineering flowsheet for a design of the LASL bismuth sulfate thermochemical cycle is presented. The design is based on laboratory data that indicate a lowered endothermic heat load for a partial decomposition of the solid bismuth sulfate. The results of the flowsheeting analysis yield a thermal efficiency of 50% for the cycle when coupled to a conceptual fusion energy heat source at 1500 K. A parametric analysis shows a slight drop in efficiency as the temperature of the heat source is decreased. The LASL bismuth sulfate thermochemical cycle appears to have potential as a means of producing hydrogen from high temperature heat sources such as fusion, fission, and solar energy; it also appears to be competitive with alternative thermochemical cycles as well as with water electrolysis for hydrogen production. DOE

N80-12606# League of Women Voters, Washington, D. C.
ENERGY CONSERVATION TECHNOLOGY EDUCATION PROGRAM Final Report
Jan. 1979 106 p refs
(Contract EC-77-C-01-2165)
(HCP/M2165) Avail: NTIS HC A06/MF A01

A project on teaching the public how to use energy more efficiently in the home is described. The methodology of the project is discussed and the findings and achievements are highlighted. A.W.H.

N80-12607# Ehrenkrantz Group, New York, N. Y.
ARCHITECTURAL CONCERNS IN SOLAR SYSTEM DESIGN AND INSTALLATION
S. Weinstein Mar. 1979 34 p
(Contract EG-77-C-01-2522)
(SOLAR/0801-79-01) Avail: NTIS HC A03/MF A01

The physical (rather than the mechanical or electrical) aspects involved in the design and installation of solar systems are discussed. The typical physical factors and problems encountered in design are considered. The cost effectiveness of various approaches are analyzed. DOE's specific experience relative to what solar designers nationwide are designing in the installation of solar collectors, array structures, piping and storage equipment, with particular emphasis on cost-effective alternatives is discussed. DOE

N80-12608# Bechtel National, Inc., San Francisco, Calif.
TECHNICAL AND ECONOMIC ASSESSMENT OF SOLAR POWERED WATER PUMPING FOR REMOTE AREAS Final Report
Jul. 1979 110 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8187) Avail: NTIS HC A06/MF A01

The technology of solar powered water pumping is reviewed. An overview of the technology and its economics is provided, based on a review and assessment of the open literature. It is shown that pumped water is used most extensively for irrigation, and that new irrigation methods, such as the center pivot system, have significantly increased the water pumping power demand in recent years. The coincidence of the peak irrigation season and peak seasonal insulation makes solar energy a good candidate to supplement or displace depletable energy sources currently used for water pumping. Solar powered water pumping demonstration systems utilizing solar thermal, photovoltaic and wind powered energy conversion are evaluated. The prime movers of these systems either drive the pumps directly or indirectly through electric power generation. A comparative evaluation of these and other proposed solar concepts was conducted and resulted in the selection of a reference system comprised of a number of individual parabolic dish collectors with integral Brayton cycle engines. DOE

N80-12609# Giner, Inc., Waltham, Mass.
STUDY OF CORROSION AND ITS CONTROL IN ALUMINUM SOLAR COLLECTORS Annual Report, 1 Jun. 1977 - 31 Jul. 1978
D. Wong, F. H. Cocks, J. Giner, and P. S. Majahad Aug. 1978 68 p refs
(Contract EY-76-C-02-2934)
(COO-2934-7) Avail: NTIS HC A04/MF A01

The development of corrosion control methods for aluminum solar collectors using ethylene glycol heat transfer fluids was studied. Corrosion inhibitors and impurity scavengers were tested and evaluated at temperatures up to 160 C under various laboratory conditions. A new corrosion rate measurement technique based on the use of thin foil samples was developed and adopted in this program to provide accelerated results. In addition to the development of corrosion control methods, the acquisition of baseline corrosion data was also extended to the aluminum/propylene glycol combination. Propylene glycol was chosen primarily because of its low toxicity. Aluminum corrosion characteristics were determined in 50, 85 and 100% propylene glycol solutions at temperatures between 25 to 160 C. Corrosion behavior of aluminum in more concentrated ethylene glycol solutions (up to 100%) at higher temperatures (up to 160 C) was also obtained in order to broaden the baseline. DOE

N80-12610# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
SOLAR-POWERED STEAM GENERATOR HELIOSTAT Final Report
J. G. Cottingham Dec. 1978 143 p refs
(Contract EY-76-C-02-0016)
(BNL-50974) Avail: NTIS HC A07/MF A01

A small-size central-receiver-type solar energy collecting system delivering commerical grade steam is analyzed and a wind avoidance type heliostat designed, built, and successfully tested. The heliostat design effort is described, including reflecting surface materials and measurements, optic considerations and mirror field arrangements, mechanical analysis and fabrication techniques, and economics and cost effectiveness. measurements of normal incident solar energy at Upton, N. Y., are reported and a method is proposed for estimating this input parameter for other locations proposed. DOE

N80-12611# Ames Lab., Iowa.
PHOTOTHERMAL CONVERSION SURFACE MEASUREMENTS USING PHOTOACOUSTIC AND PHOTOTHERMAL SPECTROSCOPIES
J. F. McClelland and R. N. Kniseley 1978 31 p refs Presented at Seminar on Testing Solar Energy Mater. and Systems, Washington, D.C. 22 May 1978
(Contract W-7405-eng-82)
(IS-M-202; CONF-780550-10) Avail: NTIS HC A03/MF A01

Photoacoustic and photothermal spectroscopic techniques have recently been under development in a number of laboratories. When applied to solar materials studies these techniques have the potential of providing a more direct measurement of photothermal conversion efficiency than conventional reflection or transmission measurements. Measurements are made by modulating the intensity of an incident light beam, which causes a temperature oscillation in the irradiated material under study, with the oscillation amplitude proportional to the absorbed and subsequently thermalized light energy. In the photoacoustic method the oscillation amplitude is measured by a transducer which detects an acoustical signal driven by the temperature oscillation. A thermal transducer is used as the detector in the photothermal technique. Spectral or integrated measurements are made using a monochromatic or broadband source with no correction needed for the spectral dependence of a detector since the signal is generated by the interaction of light with the sample rather than with a detector. DOE

N80-12612# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
PHOTOTHERMAL CONVERSION OF SOLAR ENERGY INTO ELECTRICITY

Jaime A. Moragues 1978 37 p refs Transl. into ENGLISH from unidentified Argentine report
(DOE-TR-159) Avail: NTIS HC A03/MF A01

Brief description of various collectors that can be used for electricity production by solar photothermal conversion are given including solar stills, shallow solar ponds, flat plate collectors, fixed collectors with moderate concentration, cylindrical-parabolic concentrators, fixed concentrators, fixed concentrators with faceted mirror, concentrations with concave rotating multiple mirrors, Fresnel lenses, paraboloidal rotating concentrators, semispherical fixed concentrators, central receiver system with linear focus, and central receiver system with point focus. Thermodynamic cycles, energy transport, energy storage, and economics are also discussed. A review of some of the programs throughout the world in development of solar thermal power conversion is included. DOE

N80-12813# Energy Utilization Systems, Inc., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF A HEAT AND PUMP WATER HEATER, VOLUME 1 Final Report
R. L. Dunning, F. R. Amthor, and E. J. Doyle Aug. 1978 69 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-7321-1) Avail: NTIS HC A04/MF A01

An electric heat pump water heater with an operating efficiency of 2.5 in average conditions of 70 to 75 F ambient air and 55 to 60 F supply water was designed. Separate heat pump designs are available for new water heaters and for retrofitting of existing units. The condenser is a dual tube direct immersion type which enters the tank through a special 4-in. hole in the top of new tanks. For retrofit units, the condenser is in the form of a helix and is screwed into the tank through the hole normally used by the lower resistance element. The payback period is dependent on the amount of hot water consumption and the price of electricity. In warm climates, the benefit/cost ratio will be improved by higher efficiency from warmer ambient air and by the value of free air conditioning and dehumidification provided while the unit is operating. In colder climates, the improved efficiency from colder supply water and the higher operating savings from higher kilowatt-hour use because of the cold water tend to offset the effect of the less favorable climate. DOE

N80-12814# Centro de Estudios de la Energia, Madrid (Spain).
PROJECT CESA-1, A 1 MW SOLAR POWER PLANT IN ALMERIA
Juan Temboury 1978 13 p Presented at Symp. on Solar Thermal Power Stations, Koeln, West Germany, 11 Apr. 1978
(AED-CONF-78-212-011; CONF-7804108-3) Avail: NTIS HC A02/MF A01

A solar energy utilization project to be carried out in Spain is described. The plant, CESA-1, is designed for a power of 1 MW. The technical data are given. The plant will start operation in 1980. DOE

N80-12815# Northeastern Legislative Leaders Energy Research Project, Albany, N. Y.
NATIONAL ENERGY ACT OF 1978: A REGIONAL ASSESSMENT
Peter R. Smith Dec. 1978 23 p
(Grant NSF ISP-75-15817)
(PB-296479/9; NSF/RA-780608) Avail: NTIS HC A02/MF A01 CSCL 10A

The detailed requirements of the National Energy Act of 1978 is presented and the specific impacts for each of the requirements on the Northeastern states is discussed. GRA

N80-12020# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RADIATION PRESSURE ON A UNIFORM SPHERE AS A FUNCTION OF SKIN OPTICAL PROPERTIES
Andre Girard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 153-163 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978, p 209-212 Original language report was announced as A79-11137 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-12616 State Univ. of New York at Albany.
AN INVESTIGATION OF THE ACIDITY OF STRATUS CLOUD WATER AND ITS RELATIONSHIP TO DROPLET DISTRIBUTION, PH OF RAIN, AND WEATHER PARAMETERS Ph.D. Thesis
Raymond Adolph Castillo 1979 129 p
Avail: Univ. Microfilms Order No. 7925077

Over fifty water samples from five case studies were analyzed for pH, conductivity and ions of sodium, potassium, magnesium, calcium, ammonium, sulfate, chloride and nitrate. Trajectory analyses and CCN concentrations at 0.5 percent S confirmed that the air masses in all five cases represented relatively clean, rural, continental air. Enrichment calculations were made based on the calcium ion concentrations for sedimentary rock. Droplet spectra were determined and various mean sizes were computed from the spectra. Statistical analysis techniques were applied to relationships between cloud water and precipitation pH measurements. Simple linear regression analysis was used for ion enrichment calculations and pH versus ion concentration comparisons. Dissert. Abstr.

N80-12617 Iowa State Univ. of Science and Technology, Ames.
FIELD METHODS FOR DETERMINING NITROUS OXIDE FLUXES OVER SOIL Ph.D. Thesis
Allan Dean Matthias 1979 134 p
Avail: Univ. Microfilms Order No. 7924255

A chamber method was developed to make precise determination of rates of N2O emission from diverse soils. A cylindrical chamber is installed over the soil surface and air samples removed from the chamber are analyzed for N2O by gas chromatography. The rate of N2O emission is determined from the rate of change in the N2O concentration in the air within the chamber during the short time the chamber is over the soil surface. The chamber is relatively inexpensive, easy to fabricate, transport, and use, and can be installed without significant disturbance of the soil area under study. Studies performed to evaluate the method indicate that it is reliable and is well suited for an extensive program of research on N2O emissions from soils.
Dissert. Abstr.

N80-12618 California Univ., Riverside.
STUDIES ON THE COLLECTION AND ANALYSIS OF NITRITE AND AMMONIUM IONS IN ATMOSPHERIC PARTICULATE MATTER Ph.D. Thesis
Thomas Martin Mischke 1979 128 p
Avail: Univ. Microfilms Order No. 7924298

Field experiments showed that artifact nitrate accounts for no more than 11 percent of the total nitrate in 24 hour high volume atmospheric particulate samples collected using glass fiber filters. A comparison collected of the ion specific electrode, ion chromatography, and automated colorimetric methods for analyzing ammonium ions in aqueous extracts of atmospheric particulates showed that all three methods give comparable results for ammonium. Ion chromatography and automated colorimetry give comparable results for nitrate analysis, but the nitrate specific ion electrode gives comparable results only when the method of standard addition is used. A pyrolytic nitrate and ammonium ion analyzer was constructed and shown to be comparable to colorimetric methods and capable of analyzing either aqueous extracts or filter segments. Dissert. Abstr.

N80-12619 Iowa State Univ. of Science and Technology, Ames.
A REGIONAL APPROACH TO FORECASTING ELECTRIC ENERGY REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENTS Ph.D. Thesis
Gerald Ray Hill 1979 253 p
Avail: Univ. Microfilms Order No. 7924484

A series of investigations was performed and a multistate

procedure developed for use by states in environmental reviews, in assessing the need for adding generating capacity. The multistate procedure enables states to collectively develop a regional forecast of energy requirements, while maintaining individual decision-making authority. A regional demonstration project was utilized as a means for determining what procedural problems exist in developing multistate capabilities. The demonstration project consisted of three sequential applications of the procedure to utility service areas which operate in the southeast in more than one state. Forecasts of electricity consumption were developed and information compiled on future growth of residential, commercial and industrial sectors, by state and by service area. The procedure was applied to a hypothetical midwest/southeast two-state assessment to evaluate its transferability. Performance standards were identified and acceptance criteria established for the procedure. Dissert. Abstr.

N80-12620*# Chemsoil Corp., Bakersfield, Calif.
SIMULTANEOUS STACK GAS SCRUBBING WASTEWATER PURIFICATION Final Report
[1978] 100 p
(Contract NAS9-14639)
(NASA-CR-160280) Avail: NTIS HC A05/MF A01 CSCL 13B

Variations of a process for removing sulfur dioxide from stack gases and using it to treat municipal waste water are described. The once-through system lowers the pH of the scrubbing water from minor depressions to a pH of about 2.5 under certain conditions. A recycle system uses iron for catalytic oxidation of sulfurous acid to sulfuric acid allowing very large amounts of sulfur dioxide to be absorbed in a small portion of water. The partial recycle system uses municipal wastewater and iron as a scrubbing medium, followed by neutralization of the wastewater with lime to produce an iron hydroxide precipitation which, when removed, produces tertiary quality treated wastewater. The SO2 scrubber is described, test results are analyzed, and a preliminary capital cost estimate for the three processes is included. A.R.H.

N80-12621# Committee on Commerce, Science, and Transportation (U. S. Senate).
AVIATION SAFETY AND NOISE ABATEMENT ACT OF 1979
Washington GPO 1979 32 p Rept. to accompany S. 413 for the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 29 Mar. 1979
(S-Rept-96-52) Avail: US Capitol, Senate Document Room

The hearings are reported concerning the bill to provide assistance to airport operators for preparing noise compatibility programs, and to assure aviation safety. Topics discussed include: source noise control, air traffic management, flight procedures, retrofit, and financial problems. F.O.S.

N80-12622*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MULTISPECTRAL LOOK AT OIL POLLUTION DETECTION MONITORING AND LAW ENFORCEMENT
Clarence E. Catoe and James T. McLean Oct. 1979 25 p refs
(NASA-TM-80573) Avail: NTIS HC A02/MF A01 CSCL 13B

The problems of detecting oil films on water, mapping the areal extent of slicks, measuring the slick thickness, and identifying oil types are discussed. The signature properties of oil in the ultraviolet, visible, infrared, microwave, and radar regions are analyzed. K.L.

N80-12623*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Geophysical Sciences.
THE DETERMINATION OF ATMOSPHERIC TRACE GASES USING THE CORRELATION INTERFEROMETER TECHNIQUE Final Report, period ending 31 Jan. 1979
Earl C. Kindle and Jerald T. Twitty Nov. 1979 37 p refs
(Grant NsG-1131)
(NASA-CR-162480; GSTR-79-9) Avail: NTIS HC A03/MF A01 CSCL 13B

The theoretical feasibility inherent in the correlation interferometry technique is demonstrated. High signal to noise and increased information content in a given partial interferogram are attractive features of the technique. The separation of interfering gas species is overcome by a precise measurement program for spectral line parameters of methane and other species. There are optical, mechanical, and electronic difficulties with the interferometry hardware design. Flight data from Cessna 402 over southeastern Virginia during April 1978 yielded amplitude fluctuations that are explainable only as internal nonlinearities. Misalignment of the AGC/interferometer optical axis also contributed to a large error source in the flight data. It is concluded that no useful data on gas burdens was obtained from these flights. K.L.

N80-12624# Gulf Universities Research Consortium, Bellaire, Tex.
NATURALLY OCCURING CARBON DIOXIDE SOURCES IN THE UNITED STATES. A GEOLOGIC APPRAISAL AND ECONOMIC SENSITIVITY STUDY OF DRILLING AND PRODUCING CARBON DIOXIDE FOR USE IN ENHANCED OIL RECOVERY
F. W. Zimmerman and C. W. Perry May 1979 137 p refs
(Contract EX-76-C-01-2025)
(FE-2025-38; GURC-Rept-165) Avail: NTIS HC A07/MF A01

Preliminary characterizations of reservoir rock quality and gas composition were performed for central Mississippi, West Virginia, the Delaware-Val Verde Basins of west Texas, and several locations in the Rocky Mountains. Four significant accumulations of carbon dioxide were chosen for in-depth geologic, reservoir, and economic analyses. Anticipated flowing pressure, sustained flow rates, recovery efficiencies, original gas in place, and reserves were determined. Sensitivity studies designed to bracket a possible range of prices were generated, utilizing estimated development and production costs, for each of the four areas. Projections of the potential supply, profitability of drilling and producing, and preliminary analysis of potential demand for naturally occurring carbon dioxide are presented. DOE

N80-12625# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL MODELING OF LNG SPILL PHENOMENA
W. J. Hogan, B. R. Bowman, and L. C. Haselman 13 Dec. 1978 18 p refs Presented at the Seminar on LNG Peak Shaving, Washington, D. C., 5 Mar. 1978
(Contract W-7405-eng-48)
(UCRL-82031; CONF-780387-1) Avail: NTIS HC A02/MF A01

The phenomena that must be simulated in modeling postulated liquefied natural gas (LNG) spills are complex, and some are not thoroughly understood. These phenomena include differential boil-off, flameless vapor explosions, vapor dispersion, and various modes of combustion. Our modeling results indicate that differential boil-off will create an ethane-enriched portion of the vapor cloud and that this portion will persist for significant times. Dispersion-model predictions begin to disagree at spill sizes between 50 and 100 cu m. Thus, spill tests are needed for larger spills. Both simple and complex combustion models exist. However, uncertainties in the combustion efficiency, optical thickness of the fireball, and cooling effects make the results of these models difficult to interpret properly. They do show that the addition of as little as 5% ethane to a methane cloud would increase the detonability of the cloud eightfold. The state of numerical modeling for evaluating postulated LNG accidents indicates that the theoretical and experimental efforts must be carried out interactively. DOE

N80-12626# Oregon State Univ., Corvallis. Dept. of Air Resources.
ESTIMATES FOR WET AND DRY REMOVALS CONTRIBUTION TO THE RESIDENCE TIME FOR ATMOSPHERIC POLLUTANTS IN THE EASTERN UNITED STATES
D. Vickers and W. G. N. Slinn Apr. 1979 85 p refs
(Contract EY-77-S-09-0980)
(SR-0980-6) Avail: NTIS HC A05/MF A01

The length of time that atmospheric pollutants released from low level sources in the midwestern United States remain in the atmosphere is discussed. Layer-average trajectories originating from Kansas City, Missouri are used to determine Lagrangian probability of dry and wet conditions. In summer,

the probability that precipitation is experienced by the pollutant is twice as great as the probability of precipitation at the origin of pollution; this ratio of probabilities is three in winter. Therefore, when precipitation scavenging is the more important removal mechanism, statistics for length of wet and dry periods at the source region overestimate residence time by a factor of about two to three. By taking into consideration Lagrangian probability of wet and dry periods, the relative importance of dry deposition and precipitation scavenging is discussed as a function of the wet and dry removal rates. Estimates for the expected atmospheric lifetimes of aerosol particles and trace gases are reported as functions of dry deposition velocities and collection efficiencies. DOE

N80-12627# California Univ., Livermore. Lawrence Livermore Lab.
ATMAS: A THREE-DIMENSIONAL ATMOSPHERIC TRANSPORT MODEL TO TREAT MULTIPLE AREA SOURCES
D. L. Ermak, R. A. Nyholm, and R. Lange 27 Nov. 1978 23 p refs
(Contract W-7405-eng-48)
(UCRL-52603) Avail: NTIS HC A02/MF A01

An atmospheric transport computer model which estimates the concentration of gaseous species emitted from multiple area sources is presented. It can handle space- and time-varying wind fields, first-order chemical transformations, ground deposition, and inversion effects. The model is based on the three-dimensional advection-diffusion equation to describe atmospheric transport. The model calculates short term (hourly) average concentrations over periods ranging from a month to a year; it can also calculate longer averages by varying the averaging time. A demonstration of the model is presented along with the output of the computer code. Output from the code typically includes isopleth maps showing the calculated concentration levels and the probability with which given thresholds or standards are exceeded during the simulation period. DOE

N80-12628# California Univ., Livermore. Lawrence Livermore Lab. Energy and Resources Group.
ENVIRONMENTAL ASPECTS OF ALTERNATIVE ENERGY TECHNOLOGIES FOR CALIFORNIA
J. P. Holdren, G. Morris, and G. Tanenbaum Nov. 1978 167 p refs
(Contract W-7405-eng-48)
(UCRL-15002) Avail: NTIS HC A08/MF A01

The following topics are discussed: (1) cost benefit analysis of energy impacts on biological, geophysical, and social environments; (2) impacts of soft and transition technologies such as solar heat, onsite/central wind systems, waste/farm biomass systems, geothermal heat/electricity, hydroelectric dams, and fluidized bed coal burners; (3) observations on increased efficiency; and (4) needs for further work. DOE

N80-12629# AD-EX, Portola Valley, Calif.
MEASUREMENTS OF INDOOR AIR CONDITIONED ENVIRONMENTS AND PRACTICAL EVALUATIONS OF INTAKE OF ATMOSPHERIC AIR. PART 4: COMPARISON OF MEASUREMENT RESULTS AND SIMULATION RESULTS. PART 5: STUDIES OF SIMULATION METHODS FOR OPTIMAL DESIGN OF AIR-CONDITIONED ENVIRONMENTS.
Nobuo Nakahara, Tatsu Goto, Yusuke Nakajima, and Keiji Kubo Apr. 1979 26 p refs Transl. into ENGLISH of Conf. paper from Ohbayashi-Gumi, Equipment Design Dept., Japan 26 p Presented at Sci. Lecture Meeting of Soc. of Heating, Air-Conditioning and Sanitary Engr. of Japan, Fukuoka, 20-21 Oct. 1978 Sponsored by DOE Prepared for Calif. Univ., Lawrence Berkeley Lab.
(UCRL-Trans-1570-Pt-4/5; Conf-7810174-1-Pt-4/5) Avail: NTIS HC A03/MF A01

The results of macroscopic simulation are compared to the results of actual measurements of the CO2 concentration in a system in which the CO2 concentration inside the main returning air duct is made to stand for the indoor CO2 concentration in the entire building. The results showed rather good agreement between the measurement results and the simulation results. Evaluations in terms of the dynamic contamination concentrations were made using a computer for a general model building. The CO2 and dust were considered with reference to the air conditioning systems and the amounts of intake of atmospheric air. Cases where there were rather high rates of occupancy of offices were evaluated, and the results were used for judging the dynamic effects. DOE

N80-12630# Brookhaven National Lab., Upton, N. Y.
SOME POTENTIAL EFFECTS OF ACID RAIN ON FOREST ECOSYSTEMS: IMPLICATIONS OF A COMPUTER SIMULATION
D. B. Botkin (Marine Biol. Lab., Woods Hole, Mass.) and J. D. Aber (Marine Biol. Lab., Woods Hole, Mass.) Apr. 1979 16 p refs
(Contract EY-76-C-02-0016)
(BNL-50889) Avail: NTIS HC A02/MF A01

Potential effects of acid precipitation on forest productivity and species composition were considered through the use of the JABOWA forest growth simulator. Physiological studies suggest that current levels of acid rain would result in a mortality of 5.5% or less of tree leaf tissue, depending on the species. Such reductions produce nonsignificant changes in the total productivity of the simulated forest. Significant changes in total productivity and relative species composition do occur at much higher levels of effects and are discussed. The simulations reported consider only effects due to species interactions and direct impact on leaves; no changes on soil chemistry are assumed. DOE

N80-12631# Argonne National Lab., Ill.
COMBINED EFFECTS OF POLYCYCLIC AROMATIC HYDROCARBONS AND SUNLIGHT
H. Utsumi, G. R. Lakas, and M. M. Elkind 1979 15 p refs Presented at Park City Environ. Health Conf., Utah, 4-7 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790447-4) Avail: NTIS HC A02/MF A01

Chinese hamster V79 cells were made photosensitive by dimethylbenzanthracene (DMBA) if the cells were treated with this PAH before, and not after, light exposure at wavelengths from approximately 290 to 400 nm. Samples of PAH's generated from a bench-scale pressurized fluidized bed coal combustion unit sensitized mammalian cells to sunlight-simulating light, although to a lesser extent than the DMBA. In addition, the photosensitization was shown to be a true photodynamic effect. Since all three factors (PAH's sunlight, and oxygen) necessary for the production of the phototoxic agent(s) would be expected to interact in the environment, the results are of particular concern to human health. Both PAH's and sunlight are known carcinogens and their interaction may result in a potentiation of their carcinogenic activities. In addition, the cytotoxicity produced could conceivably have a tumor promoting effect due to the resultant cellular repopulation. DOE

N80-12632# Oak Ridge National Lab., Tenn.
WHAT ROLE CAN SIMULATION MODEL PREDICTIONS PLAY IN ENVIRONMENTAL DECISIONS: CARBON DIOXIDE AS AN EXAMPLE
W. R. Emanuel 1979 10 p refs Presented at Inst. of Ecology Workshop, Indianapolis, 8 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790468-1) Avail: NTIS HC A02/MF A01

Various models of the global carbon cycle constructed to predict levels of CO2 in the atmosphere as a result of man's activities are described. The progression of models developed to analyze the global carbon cycle in resolving the CO2/climate issue indicates the changing character of models depending on the immediate role they play in environmental decision making. The dominant and successful role served by models in the carbon cycle problem points to the desirability of this flexible approach. DOE

N80-12633# Environmental Sciences Research Lab., Research Triangle Park, N.C. Atmospheric Chemistry and Physics Div.
OPTIMIZED CHEMILUMINESCENCE SYSTEM FOR MEASURING ATMOSPHERIC AMMONIA
Ralph Baumgardner, W. A. McClenny, and R. K. Stevens Feb. 1979 48 p refs
(PB-298248/6; EPA-600/2-79-028) Avail: NTIS

HC A03/MF A01 CSCL 14B

The optimization and testing of a continuous measurement system for analyzing atmospheric ammonia concentrations is described. The measurement system combines an ultra sensitive chemiluminescence detector, with a thermal converter for NH3 to NO conversion, and an acidic scrubber for alternate removal of NH3 from the sample stream. The chemiluminescence monitor with a high temperature converter gives a combined measurement of NO, NO2, and NH3. By taking the signal difference when the scrubber is in or out of the sample line, the concentration of NH3 is determined. Performance tests were conducted on the total measurement systems to verify its capability to measure NO, NO2, and NH3 under laboratory conditions and ambient monitoring conditions. GRA

N80-12634# North Carolina State Univ. at Raleigh. Water Resources Research Inst.

ASSESSING MAN'S IMPACT ON WETLANDS

G. E. Galloway (Military Academy) Dec. 1978 116 p refs Sponsored by NOAA

(PB-298736/0; UNC-SG-78-17; NOAA-79070910) Avail: NTIS HC A06/MF A01 CSCL 13B

The characteristics of a usable system for assessing man's impact on wetlands are defined and evaluation techniques are surveyed. A wetland evaluation system is proposed and applied to case studies of wetland evalution in the Yazoo Basin of Mississippi and the Neuse River Estuary of North Carolina. GRA

N80-12635# Pennsylvania State Univ., University Park. Center for the Study of Science Policy.

AIRCRAFT NOISE AND THE MARKET FOR RESIDENTIAL HOUSING: EMPIRICAL RESULTS FOR SEVEN SELECTED AIRPORTS Final Report, Jul. 1977 - Sep. 1978

Jon P. Nelson Sep. 1978 153 p

(Contract DOT-OS-70066)

(PB-297681/9; DOT/RSPA/DPB-50/78/24) Avail: NTIS HC A08/MF A01 CSCL 05C

The effect on property values of a decibel change in noise exposure forecast levels is studied. Census block and census tract data are employed for small geographic areas (about two miles radius) near seven selected major U.S. airports. In each of seven cases, the results indicate that aircraft noise has a negative and statistically significant effect on residential property values. GRA

N80-12636# Central Research and Design Inst. for Open-pit Mining, Wroclaw (Poland).

PURIFICATION OF WATERS DISCHARGED FROM POLISH LIGNITE MINES

Henryk Janiak Apr. 1979 178 p refs

(Contract EPA-05-534-3)

(PB-297466/5; EPA-600/7-79-099) Avail: NTIS HC A09/MF A01 CSCL 08I

Studies were conducted using flocculants to improve sedimentation basin efficiency. The dependence of purification on the length of fast mixing, flocculant dose rates, and concentration of solutions employed were evaluated. The laboratory results were verified in a pilot scale sedimentation basin. Studies of the hydraulics of the sedimentation basin and investigations of flocculant application are discussed. The relationships between the dose of flocculant and time of retention and the reduction of suspended solids, turbidity, oxygen demand and other chemical parameters were made. Results of pilot tests confirmed the usability of cationic polyelectrolites in purification of mine waters. GRA

N80-12637# TRW, Inc., Redondo Beach, Calif.

EMISSIONS ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS. VOLUME 1: GAS- AND OIL-FIRED RESIDENTIAL HEATING SOURCES Final Report, Sep. 1976 - Mar. 1979

N. F. Surprenant, R. R. Hall, K. T. McGregor, and A. S. Werner May 1979 177 p refs

(Contract EPA-68-02-2197)

(PB-298494/6; EPA-600/7-79-029B) Avail: NTIS HC A09/MF A01 CSCL 13B

Emissions from gas- and oil-fired residential heating sources were assessed through a critical examination of existing emissions data, followed by the conduct of a phased measurement program to fill gaps in the emissions data base. Mass emission rates of criteria pollutants, trace elements, and organics, including polycyclic organic matter (POM), were determined. Particulate sulfate, SO2, and SO3 emission data were also obtained at the oil-fired sites. The results of the emissions assessment indicate that residential sources are of potential significance based on multiple source severity factors calculated for an array of houses burning gas or oil. Pollutants for which multiple source severity factors exceed 0.05 are NOx from gas-fired sources and SO3, and NOx, and Ni from oil-fired sources. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-12638 California Univ., Santa Cruz.

DEFORMATION MECHANISMS IN THE OLIVINE AND SPINEL PHASES OF MAGNESIUM GERMANATE AND APPLICATIONS TO THE EARTH'S MANTLE Ph.D. Thesis

Peter James Vaughan 1979 345 p

Avail: Univ. Microfilms Order No. 7924598

An experimental study of the high temperature creep properties of the olivine and spinel phases of Mg2GeO4 is described. The fractional increase in the elastic velocities due to the olivine-spinel transition in the germanate was found to be approximately the same as that for a similar transition in the silicate. Dissert. Abstr.

N80-12639 Saint Louis Univ., Mo.

A THEORETICAL TREATMENT OF HYDROMAGNETIC DISTURBANCES GENERATED IN THE OUTER MAGNETOSPHERE BY DISCRETE SOLAR EMISSIONS Ph.D. Thesis

James Lee Hickerson 1979 143 p

Avail: Univ. Microfilms Order No. 7923648

A semi-quantitative demonstration to prove that simple models of the solar wind interaction with the earth's outer magnetic field and plasma can produce the observed perturbations is presented. The basic linearized magnetofluidynamic equations are modified to relate the influence of disturbance sources. Employing a tensorial representation of Fourier transformations of the basic differential equations, a pair of coupled equations called the master set, are determined. A demonstration of the capability of the formulation to produce acceptable results is presented. The use of less idealistic formulations of the source characteristics with the expectation of producing convergent inversions and formulating the analysis from the beginning so that a fast Fourier transform computer algorithm may be utilized is suggested. Dissert. Abstr.

N80-12640 Iowa Univ., Iowa City.

INTENSE ELECTROSTATIC WAVES NEAR THE UPPER HYBRID RESONANCE FREQUENCY Ph.D. Thesis

William Steven Kurth 1979 155 p

Avail: Univ. Microfilms Order No. 7924494

Plasma wave measurements, using instruments on the IMP 6 and Hawkeye 1 satellites, are utilized in a study of very intense electrostatic waves near the upper hybrid resonance frequency in the region just outside the plasmapause. These intense plasma wave events have electric field strengths of approximately 1 to 20 mV/m and are among the most intense waves seen in the earth's magnetosphere. Detailed studies of more than 140 of these intense electrostatic disturbances reveal that the events occur at all local times and at magnetic latitudes varying from the equator to as high as 50 deg. The polarization of these waves is such that the wave electric field vector is oriented perpendicular to the geomagnetic field. In most cases the center frequency of he intense waves appears to correspond to an (n + 1/2)f(-) sub g harmonic near the upper hybrid resonance frequency. The implications of the presence of the intense upper hybrid resonance waves on plasmas in the magnetosphere are discussed. In addition, the presence of large electrostatic waves

may be related to the terrestrial radio spectrum. Evidence is presented which suggests the intense electrostatic waves may be a source of non-thermal continuum radiation. Dissert. Abstr.

N80-12641 Montana Univ., Missoula.
GRAVITATIONAL AND ELECTROMAGNETIC POTENTIALS OF THE STATIONARY EINSTEIN-MAXWELL FIELD EQUATIONS Ph.D. Thesis
Thaddeus Charles Jones 1979 188 p
Avail: Univ. Microfilms Order No. 7925068

Associated with the stationary Einstein-Maxwell field equations is an infinite hierarchy of potentials. The basic characteristics of these potentials are examined in general and then in greater detail for the particular case of the Reissner-Nordstrom metric. Their essential utility in the process of solution generation is elucidated and the necessary equations for solution generation are developed. Appropriate generating functions, which contain the complete infinite hierarchy of potentials, are developed and analyzed. Particular attention is paid to the inherent gauge freedom of these generating functions. Two methods of solution generation, which yield asymptotically flat solutions in vacuum, are generalized to include electromagnetism. One method, using potentials consistent with the Harrison transformation and the Reissner-Nordstrom metric, is discussed in detail and its resultant difficulties explored. Dissert. Abstr.

N80-12642*# National Aeronautics and Space Administration. Pasadena Office, Calif.
GEOLOGICAL ASSESSMENT PROBE Patent Application
Earl R. Collins, inventor (to NASA) (JPL) Filed 25 Sep. 1978 16 p Sponsored by NASA
(NASA-Case-NPO-14558-1; US-Patent-Appl-SN-945436) Avail: NTIS HC A02/MF A01 CSCL 08G

A probe is described which can be installed in a side hole that extends from a bore hole in the earth, to assess the permeability of the strata surrounding the borehole. The probe is elongated and has seals spaced the walls of the side hole to form chambers sealed from one another. A tracer fluid injector on the probe can inject a tracer fluid into one of the chambers, while a tracer fluid detector located in another chamber can detect the tracer fluid, to thereby sense the permeability of the strata surrounding the side hole. The probe can include a train of modules, with each module having an inflatable packer which is inflated by the difference between the borehole pressure and the strata pressure. NASA

N80-12643*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFORMATION THEORY AND THE EARTH'S DENSITY DISTRIBUTION
David Parry Rubincam Aug. 1979 43 p refs Revised Submitted for publication
(NASA-TM-80586) Avail: NTIS HC A03/MF A01 CSCL 08G

An argument for using the information theory approach as an inference technique in solid earth geophysics. A spherically symmetric density distribution is derived as an example of the method. A simple model of the earth plus knowledge of its mass and moment of inertia lead to a density distribution which was surprisingly close to the optimum distribution. Future directions for the information theory approach in solid earth geophysics as well as its strengths and weaknesses are discussed. R.E.S.

N80-12644*# California Inst. of Tech., Pasadena. Seismological Lab.
A GLOBAL GEOCHEMICAL MODEL FOR THE EVOLUTION OF THE MANTLE
Don L. Anderson [1979] 44 p refs
(Grant NsG-7610)
(NASA-CR-162602; CONTRIB-3296) Avail: NTIS HC A03/MF A01 CSCL 08G

It is proposed that the upper mantle transition region, 220 to 670 km, is composed of eclogite which has been derived from primitive mantle by about 20 percent partial melting and that this is the source and sink of oceanic crust. The remainder of the upper mantle is garnet peridotite which is the source of continental basalts and hotspot magmas. This region is enriched in incompatible elements by hydrous and CO2 rich metasomatic fluids which have depleted the underlying layers in the L.I.L. elements and L.R.E.E. The volatiles make this a low-velocity, high attenuation, low viscosity region. The eclogite layer is internally heated and its controls the convection pattern in the upper mantle. Plate tectonics is intermittent. The continental thermal anomaly at a depth of 150-220 km triggers kimberlite and carbonatite activity, alkali and flood basalt volcanism, vertical tectonics and continental breakup. Hot spots remain active after the continents leave and build the oceanic islands. Mantle plumes rise from a depth of about 220 km. Midocean ridge basalts rise from the depleted layer below this depth. Material from this layer can also be displaced upwards by subducted oceanic lithosphere to form back-arc basins. F.O.S.

N80-12645# Scripps Institution of Oceanography, La Jolla, Calif. Visibility Lab.
AIRBORN MEASUREMENTS OF OPTICAL ATMOSPHERIC PROPERTIES, SUMMARY AND REVIEW 3 Final Report, 1 Aug. 1975 - 30 Sep. 1978
Seibert Q. Duntley, Richard W. Johnson, and Jacqueline I. Gordon Dec. 1978 119 p refs
(Contract F19628-76-C-0004; AF Proj. 7621)
(AD-A073121; SIO-Ref-79-5; AFGL-TR-78-0286) Avail: NTIS HC A06/MF A01 CSCL 04/1

This report summarizes a three year period devoted primarily to collection and evaluation of optical atmospheric data describing the western European environment. Five field expeditions were made between April 1976 and September 1978. They were conducted as a cooperative, but independent effort associated with the NATO Research Study Group 8 of Panel IV, AC243 and their Program OPAQUE. Measurements were made in six representative geographical areas during each of the four seasons, Summer, Fall, Winter and Spring. Optical measurements were made in four regions within the visual spectrum as follows: two moderately narrow bands having mean wavelengths of 478 and 664 nanometers, one slightly wider band at 765 nanometers and one relatively broad band representing the photopic response having a mean wavelength of 557 nanometers. The daytime optical measurements included total volume scattering coefficient, sky and terrain radiances, and both upwelling and downwelling irradiances. Simultaneous meteorological measurements included temperature, dewpoint temperature and atmospheric pressure. The optical atmospheric properties derived from these data and presented in reports typified by AFGL-TR-76-0188 and AFGL-TR-78-0168 are reviewed as are their methods of derivation and validation. The methods of data collection and processing are summarized and reviewed as is the overall resulting data bank. Examples related to the use of the data are included as well as recommendations for further data study and interpretation. GRA

N80-12646# SRI International Corp., Menlo Park, Calif. Molecular Physics Lab.
TWO-BODY POSITIVE ION-NEGATIVE NEUTRALIZATION Final Report, 19 Oct. 1974 - 31 Dec. 1978
T. M. Miller, A. P. Hickman, F. T. Smith, and J. R. Peterson 30 Jan. 1979 76 p refs
(Contract F19628-75-C-0050)
(AD-A073145; SRI-MP-79-010; AFGL-TR-79-0039) Avail: NTIS HC A06/MF A01 CSCL 04/1

The results are presented of a combined experimental and theoretical investigation of ion-ion mutual neutralization processes relevant to the earth's ionosphere. Experimetal results from our merged beams apparatus (thermal rate coefficients reduced from cross sections for nineteen sets of reactants) and also those from the more recent Birmingham experiments using a flowing afterglow are reviewed. The advantages and disadvantages of both techniques are discussed. A discrepancy in the NO(-) - NO(-)3 results is attributed to an effect of excitation in the NO-3 beams of the merged beams, and it is concluded that because of these effects the flowing afterglow is presently better for obtaining rate coefficients for complex molecular ions. Our theoretical work has focused on two neutralization mechanisms: electron transfer and tidal distortion. A new formulation of the collision dynamics, Semiclassical Perturbation Scattering Theory, was developed and used to estimate the importance of the tidal distortion mechanism. It is concluded that the electron transfer mechanism dominates in reactions of simple ions and small

clusters, but that the tidal distortion becomes more important for multiply hydrated reactants. An approximate scaling formula for the rate constants is obtained that fits a wide range of experimental data involving simple ions and small clusters with an accuracy of about + or - 30%. GRA

N80-12647# California Univ., Berkeley. Lawrence Berkeley Lab.
CIRCUMSOLAR RADIATION DATA FOR CENTRAL RECEIVER SIMULATION
A. Hunt, D. Grether, and M. Wahig Aug. 1978 14 p ref Presented at ERDA Workshop on Methods for Optical Analysis of Central Receiver Systems, Houston, Tex., 10 Aug. 1978
(Contract W-7405-eng-48)
(LBL-8371; CONF-780885-1) Avail: NTIS HC A02/MF A01

The circumsolar measurement project carried out to provide data to assess the effects of circumsolar radiation on the operation of solar thermal conversion systems using concentrating collectors, especially central receiver systems is described. Four circumsolar telescopes were constructed and are providing detailed intensity vs. angle profiles of the solar and circumsolar region, as well as other solar and climatological data. Emphasis is on reducing the data and making it available to groups analyzing the performance of central receiver systems. In most highly concentrating solar systems, the size of the receiver is determined by the ray bundle originating from the most distant heliostat. If the bundle size is calculated by using the solar disc, it is clear that some fraction of the circumsolar radiation will fall outside the receiver aperture. The results provide the detailed type of input data for central receiver simulation codes that are necessary for determining these losses, optimizing the receiver or field size, and determining the distribution of stray flux due to circumsolar radiation. DOE

N80-12648# California Univ., Berkeley. Lawrence Berkeley Lab.
ANALYSIS OF MEASURED VALUES FOR THE STATE OF STRESS IN THE EARTH'S CRUST
D. B. Jamison and N. G. W. Cook Aug. 1978 17 p refs
(Contract W-7405-eng-48)
(LBL-7071) Avail: NTIS HC A02/MF A01

Fifty stress measurements of the earth's crust which have yielded the complete state of stress and in which one of the principal stresses is vertical, were selected for a statistical analysis in an endeavor to define the nature of the state of stress in the crust. The data were analyzed as a whole, and divided into three groups depending upon whether the vertical stress was the maximum, minimum or intermediate principal stress. Linear regression analyses of the values of half the maximum stress difference as a function of half the sum of the maximum and minimum principal stresses were made. The correlation coefficients for these fits were 0.786 for the data as a whole and 0.848, 0.790 and 0.383 for each of the groups. Values of the coefficient of sliding friction between blocks of rock comprising the crust, interpreted from the slopes of these lines, ranged from 0.625 (for maximum principal stress) through 0.427 (for minimum principal stress), to 0.220 (for intermediate principal stress). DOE

N80-12649# Sandia Labs., Albuquerque, N. Mex.
SEISMIC ACTIVITY GENERATED BY HYDRAULIC FRACTURING
C. L. Schuster and R. W. Seavey 1978 12 p refs Presented at the ASME Energy Technol. Conf., Houston, Tex., 5 Nov. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0072; CONF-781112-4) Avail: NTIS HC A02/MF A01

A hydraulic fracture experiment was conducted at the Nevada Test Site. The formation to be fractured was located adjacent to a tunnel complex that allowed for the installation of a seismic array. Seismic recordings were made during the entire pumping of 214 barrels of water and cement slurry. More than a hundred separate seismic signals were received interspersed throughout the entire pumping period. Analysis of the arrival times and time delays between the P and S waves allowed the fracture location to be mapped. This location was verified during the mineback phase of the experiment. Analysis of the seismic data revealed that, to a large extent, the signals received were caused by shear type displacements. The source of these signals was apparently caused by natural fractures that were cut by the driven hydraulic fracture and then later had a fault slip type of motion. DOE

N80-12650# California Univ., Berkeley. Lawrence Berkeley Lab.
STRUCTURE OF THE EARTH'S CRUST AND UPPER MANTLE PLOTTED FROM DATA OF SEISMIC STUDIES
V. B. Sollogub, ed. and A. V. Chekunov, ed. 1977 601 p refs Transl. into ENGLISH of the book "Stroenie Zemnoi Kory i Verkhnei Mantii po Dannym Seismicheskikh Issledovanii", Kiev, Naukova Dumka, 1977 308 p Sponsored by DOE
(UCRL-Trans-11392) Avail: NTIS HC A99/MF A01

The reports of the International conference on the deep crustal investigations by seismic methods (Kiev, October 1974) are presented. The results of geophysical investigations made in Europe and Asia are given. Some aspects of wave fields theory in layered and inhomogeneous media as well as the questions of technique and interpretation of the seismological and DSS data are considered. DOE

N80-12651# California Univ., Livermore. Lawrence Livermore Lab.
PREDICTIONS OF THE EFFECTS ON THE STRATOSPHERE OF CHANGES IN THE OXIDES OF NITROGEN
W. H. Duewer and D. J. Wuebbles Mar. 1979 20 p refs Presented at NASA Stratospheric Workshop, Harper's Ferry, W.Va., 4 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82553; CONF-790607-2) Avail: NTIS HC A02/MF A01

Predictions of the influence of changes in the oxides of nitrogen on stratospheric ozone are presented. Some of the most important aspects of the chemistry of the oxides of nitrogen in the stratosphere are examined and some of the natural and anthropogenic sources of oxides of nitrogen that were proposed will be evaluated. The more recent estimates of the effects of these sources on stratospheric composition are summarized. DOE

N80-12652# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
ROUTINE SPECTRAL MEASUREMENTS OF INFRARED RADIATION FROM THE ATMOSPHERE
Paul Berdahl Mar. 1979 8 p ref Presented at Intern. Conf. on Infrared Phys., Zurich, 5 Mar. 1979
(Contract W-7405-eng-48)
(LBL-8777; CONF-790355-1) Avail: NTIS HC A02/MF A01

A quantitative knowledge of the infrared radiative transfer between the atmosphere and a building's surface requires detailed information regarding the angular and spectral distribution of the radiation from the atmosphere. The filter spectrometer system described is intended to provided data records at 30 minute intervals for weeks and months of continuous operation. The spectrometer design incorporates a Barnes Corporation model 12-880 radiometer equipped with an eight-position filter wheel, germanium lens, and pyroelectric detector. DOE

N80-12653# National Oceanic and Atmospheric Administration, Boulder, Colo. National Geophysical and Solar-Terrestrial Data Center.
ANNUAL MEAN VALUES OF GEOMAGNETIC COMPONENTS FOR SELECTED OBSERVATORIES, 1940 - 1973
Takesi Yukutake (Tokyo Univ.), William I. Paddock, and Joe H. Allen Jun. 1979 87 p
(PB-298716/2; NOAA-79062001; SE-17) Avail: NTIS HC A05/MF A01 CSCL 08N

Annual mean values of the geomagnetic components obtained at observatories were made based on data collected at the World Data Center A (WDCA) for 1940-73. This collection is based primarily on all-day means obtained by direct communication with the observatories or taken from year books. A table includes the names and abbreviations of the observatories, their geographic coordinates, and periods of operation. For those observatories that changed their sites during the interval 1940-73, locations and operation periods are also given. Individual data lists show uncorrected (original) and corrected annual means for each

station. The corrected component annual mean values are plotted on the diagrams following the individual data lists. DOE

N80-12654# Chicago Univ., Ill. Cloud Physics Lab.
THE ROLE OF COALESCENCE NUCLEI IN WARM RAIN INITIATION
David B. Johnson Mar. 1979 138 p refs
(Grants NSF-GI-33373; NSF-ENV72-03399; NSF ATM-77-08970; NSF ATM-77-12454; NSF ATM-18-18459) (PB-298556/2; UCHI-CPL-79-55) Avail: NTIS HC A07/MF A01 CSCL 04A

The role of giant and ultragiant aerosol particles in the initiation of rain by the coalescence of cloud droplets is investigated. The aerosol particles involved in this process are so large that they can start to grow effectively by coalescence with smaller cloud droplets without prior growth by condensation. GRA

N80-12655# Geological Survey, Lawrence, Kans. Water Resources Div.
GUIDELINES FOR THE USE OF STRUCTURAL VERSUS REGRESSION ANALYSIS IN GEOMORPHIC STUDIES Final Report
W. R. Osterkamp, J. M. McNellis, and P. R. Jordan Nov. 1978 27 p refs
(PB-298360/9; USGS/WRD/WRI-79/024; USGS/WRI-78-135) Avail: NTIS HC A03/MF A01 CSCL 08G

The practical application of simple structural analysis of water resources is discussed. Guidelines are presented to aid in the selection of a proper curve-fitting technique for relating two or more variables. An easily applied method to convert a regression relation to a structural relation is also presented. R.E.S.

N80-12042# European Space Agency, Paris (France).
DETERMINATION OF ATMOSPHERIC DENSITY, TEMPERATURE AND PRESSURE PROFILES FOR WINTER ANOMALOUS CONDITIONS AT HEIGHTS BETWEEN 52 AND 117 KM
Demetrius G. Papanikas, Jochen Baete, Manfred Becker, and Uwe Niederloehner *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 128-167 refs Transl. into ENGLISH from 'Ermittlung der atmosphaerischen Dichter-, Temperatur- und Druckverteilungen bei winteranomalen zustaenden in Hoehen zwischen 52 and 117 km', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-12656 New York Univ., N. Y.
A NEW SYSTEM OF EQUATIONS FOR NUMERICAL WEATHER FORECASTING Ph.D. Thesis
Gerald Lee Browning 1979 83 p
Avail: Univ. Microfilms Order No. 7925446

Kreiss has recently developed a general theory for the initialization of symmetric hyperbolic systems with multiple time scales. Using the theory, initialization schemes are obtained for two systems of equations. The first system is the standard shallow water system with orographic effects taken into account. For this system it is shown that previous initialization schemes are just special cases of the new theory. The second system is a new system which is derived from the Eulerian equations by a proper mathematical limiting procedure. As a proper limit of a symmetric hyperbolic system, the new system retains the well-posedness features of the Eulerian equations and, therefore, is necessarily not the primitive equation system. The new system admits nonhydrostatic solutions while precluding both horizontal and vertical sound waves. It may be used for both large-scale and mesoscale modeling. The effectiveness of the initialization schemes is demonstrated by using the data obtained from them in numerical models. Dissert. Abstr.

N80-12657 Oklahoma Univ., Norman.
DYNAMIC BEHAVIOR OF SINGLE AND MULTIPLE VORTEX TORNADOES INFERRED FROM LABORATORY SIMULATION Ph.D. Thesis
Fred Weldon Leslie 1979 154 p
Avail: Univ. Microfilms Order No. 7926012

A vortex generator was used to simulate tornado flows in the laboratory. Geometric and dynamic similitude was maintained to insure that the laboratory flow models the environment of natural tornadoes. The very small pressure drops were measured with a sensitive pressure transducer while the mean flow and the turbulent fluctuations were measured with a hot film anemometer. The influence of a rough surface on the vortex core and the multiple vortex transition phenomenon were also investigated. The results indicate that the core radius over a given surface is determined predominantly by the swirl radio parameter. When a lower rough surface is placed in the apparatus, the core radius decreases. The increased drag also delays multiple vortex transition, requiring progressively higher swirl to initiate the process. Dissert. Abstr.

N80-12658# Florida State Univ., Tallahassee. Dept. of Meteorology and Oceanography.
SURFACE METEOROLOGY OVER THE GATE A-SCALE
T. N. Krishnamurti and Ruby Krishnamurti Nov. 1978 50 p refs
(Contract N00014-75-C-0877)
(Rept-78-6; TR-16) Avail: NTIS HC A03/MF A01

A method of analysis for the surface motion field based on a mix of observations from research ships, merchant ships and low cloud motion vectors from geostationary satellites is proposed. The proposed scheme permits a turning of wind with height between the cloud wind level and the surface. Time averaged fields of the zonal and the meridional stresses as well as of the curl of the wind stress are illustrated. Spectral analysis of the motion field and the stresses over the trade wind belts of the summer and winter hemisphere were examined. Two modes of oscillation are emphasized, one around 3 to 6 days and the other around 10 to 15 days. While the former is identified with African waves, the scale and speed of propagation of the latter is determined from x-t diagrams and is identified as a westward propagating wave, whose scale is of the order of 40 deg longitude and speed of propagation is around 3 deg longitude/day. R.E.S.

N80-12659# Florida State Univ., Tallahassee. Dept. of Oceanography and Geophysical Fluid Dynamics Inst.
LABORATORY MODELLING OF OCEANIC RESPONSE TO MONSOONAL WINDS
Ruby Krishnamurti 1978 39 p refs Presented at IUTAM-IUGG Symp. on Monsoon Dynamics, Delhi, Dec. 1977
(Contract N00014-75-C-0877)
(TR-15) Avail: NTIS HC A03/MF A01

Fluid in a rotating tank of varying depth was subjected to various stress patterns simulating both steady and seasonally varying winds, including monsoonal winds. For a certain range of the governing parameters (Rossby number, Ekman number and Froude number), a homogeneous fluid displayed steady westward intensified flow. For the same range of parameters a two layer fluid had baroclinic instabilities. The parameter range for these instabilities was mapped in a regime diagram. The northward transport of the western boundary current was measured as it varied with imposed wind stress curl and compared with the corresponding values in a homogeneous fluid. The conditions for surfacing of the lower layer were measured as they varied with Rossby number and Froude number. K.L.

N80-12660# Committee on Commerce, Science, and Transportation (U. S. Senate).
WEATHER MODIFICATION: PROGRAMS, PROBLEMS, POLICY, AND POTENTIAL
Washington GPO 1978 776 p refs Rept. for Comm. on Commerce, Sci. and Transportation, 95th Congr., 2d Sess., May 1978 Prepared by the Library of Congr., Congressional Res. Service
(GPO-34-857) Avail: Comm. on Commerce, Sci., and Transportation

Technical, governmental, legal, economic, social, international, and ecological issues related to weather modification are reviewed.

Statements of the position of the White House, the Defense Department, and the United Nations on environmental modifications are included with state statutes concerning weather modification. A.R.H.

N80-12661*# National Aeronautics and Space Administration, Wallops Station, Wallops Island, Va.

WIND STUDY FOR HIGH ALTITUDE PLATFORM DESIGN

Thomas W. Strganac Washington Dec. 1979 288 p refs
(NASA-RP-1044) Avail: NTIS HC A13/MF A01 CSCL 04B

An analysis of upper air winds was performed to define the wind environment at potential operating altitudes for high altitude powered platform concepts. Wind conditions of the continental United States, Pacific area (Alaska to Sea of Japan), and European area (Norwegian and Mediterranean Sea) were obtained using a representative network of sites selected based upon adequate high altitude sampling, geographic dispersion, and observed upper wind patterns. A data base of twenty plus years of rawinsonde gathered wind information was used in the analysis. Annual variations from surface to 10 mb pressure altitude were investigated to encompass the practical operating range for the platform concepts. Parametric analysis for the United States and foreign areas was performed to provide a basis for vehicle system design tradeoffs. This analysis of wind magnitudes indicates the feasibility of annual operation at a majority of sites and more selective seasonal operation for the extreme conditions between the pressure altitudes of 100 to 25 mb based upon the assumed design speeds. R.C.T.

N80-12662*# Institute of Man and Science, Rensselaerville, N. Y.

POSITION PAPER ON THE POTENTIAL OF INADVERTENT WEATHER MODIFICATION OF THE FLORIDA PENINSULA RESULTING FROM NEUTRALIZATION OF SPACE SHUTTLE SOLID ROCKET BOOSTER EXHAUST CLOUDS Final Report, Apr. 1977 - Feb. 1978

Eugene Bollay, Lance Bosart, Earl Droessler, James Jiusto, G. Garland Lala, Volker Mohnen, Vincent Schaefer, and Patrick Squires Nov. 1979 204 p refs
(Contract NAS1-14965)
(NASA-CR-3091) Avail: NTIS HC A10/MF A01 CSCL 04B

A concept of injecting compounds into the exhaust cloud was proposed to neutralize the acidic nature of the low-level stabilized ground cloud (SGC) was studied. The potential Inadvertent Weather Modification caused by exhaust cloud characteristics from three hours to seven days after launch was studied. Possible effects of the neutralized SGC in warm and cloud precipitation processes were discussed. Based on a detailed climatology of the Florida Peninsula, the risk for weather modification under a variety of weather situations was assessed. R.C.T.

N80-12663*# Naval Weapons Center, China Lake, Calif.

AIRBORNE MEASUREMENTS OF CLOUD-FORMING NUCLEI AND AEROSOL PARTICLES IN STABILIZED GROUND CLOUDS PRODUCED BY SOLID ROCKET BOOSTER FIRINGS

Edward E. Hindman, II, G. Garland Ala (State Univ. of New York at Albany), Farn P. Parungo (NOAA, Boulder, Colo.), Paul T. Willis (NOAA, Coral Gables, Fla.), Richard J. Bendura (NASA, Langley Research Center), and David C. Woods (NASA, Langley Research Center) Oct. 1978 76 p refs
(NASA Order T-6782F)
(NASA-CR-160357; NWC-TM-3589) Avail: NTIS HC A05/MF A01 CSCL 04B

Airborne measurements of cloud volumes, ice nuclei and cloud condensation nuclei, liquid particles, and aerosol particles were obtained from stabilized ground clouds (SGCs) produced by Titan 3 launches at Kennedy Space Center, 20 August and 5 September 1977. The SGCs were bright, white, cumulus clouds early in their life and contained up to 3.5 g/m3 of liquid in micron to millimeter size droplets. The measured cloud volumes were 40 to 60 cu km five hours after launch. The SGCs contained high concentrations of cloud condensation nuclei active at 0.2%, 0.5%, and 1.0% supersaturation for periods of three to five hours. The SGCs also contained high concentrations of submicron particles. Three modes existed in the particle population: a 0.05 to 0.1 micron mode composed of aluminum-containing particles, a 0.2 to 0.8 micron mode, and a 2.0 to 10 micron mode composed of particles that contained primarily aluminum. K.L.

N80-12664# Naval Weapons Center, China Lake, Calif. Research Dept.

LABORATORY INVESTIGATIONS OF CLOUD FORMING NUCLEI AND AEROSOL PARTICLES FROM UNPRESSURIZED BURNS OF SPACE SHUTTLE PROPELLANT Final Report

Edward E. Hindman, II, Dennis M. Garvey (Colo. State Coll.), Gerhard Langer (Natl. Center for Atmospheric Res.), F. Kirk Odencrantz, Farn P. Parungo (NOAA, Boulder, Colo.), and Gerald L. Gregory (NASA, Langley Res. Center) Dec. 1978 90 p refs
(NASA Order T-6782F)
(NASA-CR-160358; NWC-TM-3666) Avail: NTIS HC A05/MF A01 CSCL 04B

Laboratory measurements of the concentrations and compositions of ice nuclei, concentrations of cloud condensation nuclei and the size, concentrations, and compositions of aerosol particles were obtained from the effluent of unpressurized burns of solid rocket booster propellant from the space shuttle. All of the devices to measure ice nuclei detected high concentrations from the effluent. The portable counters indicated 200 to 1,000 times fewer ice nuclei than did the large, permanet cloud chamber. The filter devices indicated 10 to 100 times fewer ice nuclei than did the portable counters. The ice nuclei were composed primarily of Al2O3 with traces of other elements (mainly S and Ca). The effluent is a prolific source of cloud condensation nuclei; no activity spectra were determined because the counter was saturated. The sizes, concentrations, and compositions of the particles generated in the laboratory did not duplicate completely those characteristics of particles measured in the stabilized ground clouds from Titan 3 launches. M.M.M.

N80-12665# World Meteorological Organization, Geneva (Switzerland).

ON CLIMATE AND MANKIND

1979 803 p refs Proc. of lectures of the World Climate Conf., Geneva, 12-23 Feb. 1979
(WMO-537; ISBN-92-63-10537-5) Avail: NTIS HC A99/MF A01

Present knowledge of climatic change and variability due to both natural and anthropogenic causes is reviewed. Possible future changes and their implications for human activities are assessed. For individual titles, see N80-12666 through N80-12698.

N80-12666# National Academy of Sciences - National Research Council, Washington, D. C.

CLIMATE AT THE MILLENNIUM

Robert M. White *In* WMO On Climate and Mankind 1979 p 1-11 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The world conditions by the year 2000 are discussed with emphasis on the impact of man-induced climate modifications. The food and energy problems are analyzed. It is concluded that a serious effort to understand climate modification should be made by the international scientific community, and that an advisory role toward governments may help to formulate long range programs to prevent the consequences of undesirable climate change. Author (ESA)

N80-12667# World Meteorological Organization, Geneva (Switzerland).

CLIMATIC CHANGE AND HUMAN STRATEGY

E. K. Fedorov (USSR State Comm. for Hydrometeorol. and Control of Natl. Environ., Moscow) *In its* On Climate and Mankind 1979 p 15-26 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Because of the climatic changes that will inevitably occur in the future, man must have a desirable strategy. The first and basic element of that strategy is the forecasting of natural and man-made climate changes. A second element is an assessment of the consequences of the different types of climatic change, and the effectiveness of social organization in reducing undesirable consequences. The third element of the strategy is to make recommendations on how to avoid the adverse consequen-

ces of climate change, or to avoid such change altogether.
Author (ESA)

N80-12668# Stockholm Univ. (Sweden). Dept. of Meteorology.
GLOBAL ECOLOGY AND MAN
Bert Bolin *In* WMO On Climate and Mankind 1979 p 27-50 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The influence of man on regional and global processes within the biosphere is examined. Present knowledge on the carbon, nitrogen, sulphur and oxygen cycles is reviewed. An assessment of a possible future increase of atmospheric CO2 shows a large variation in predicted maximum concentration, depending on which assumption is adopted for CO2 adsorption by land biota. The response of the terrestrial and marine biota to a changing climate is discussed. Author (ESA)

N80-12669# Toronto Univ. (Ontario). Inst. for Environmental Studies.
CLIMATIC VARIATION AND VARIABILITY: EMPIRICAL EVIDENCE FROM METEOROLOGICAL AND OTHER SOURCES
Kenneth F. Hare *In* WMO On Climate and Mankind 1979 p 51-87 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Existing evidence indicating climate change and the nature of climatic variation and variability, is examined, studying present weather and climate as well as previous climates. The recent trend of atmospheric and sea-surface temperatures is downward, at the rate of 0.1 to 0.2 deg per decade. It is not clear whether this will continue, and it may be offset by heating due to atmospheric contaminants like CO2. It is also concluded that high variability of temperature and precipitation during the 1970's may not, in fact, have been abnormal, and the best defenses against climatic anomalies is always to adopt economic practices that recognize their probable return. Author (ESA)

N80-12670# Academy of Sciences (USSR), Moscow. Inst. of Geography.
CLIMATES OF PAST GEOLOGICAL EPOCHS
I. P. Gerasimov *In* WMO On Climate and Mankind 1979 p 88-111 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Present knowledge of paleoclimatology is reviewed. The technical means of analysis are discussed. In particular the evolution and variability of earth average temperature are studied as well as the tropospheric circulation and the distribution of glaciated areas. The possibility of anthropogenic warming of climate is also examined, but a clear conclusion is not reached regarding climate trends in the future. Author (ESA)

N80-12671# Oregon State Univ., Corvallis.
THE PHYSICAL BASIS OF CLIMATE
Lawrence W. Gates *In* WMO On Climate and Mankind 1979 p 112-131 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The physical processes of climate and climatic change are reviewed. The discussion includes the climate system, the atmospheric-ocean interaction, the external influences and climatic history, the definition of climate and climatic change, the characteristics of climatic change, climate models and climate prediction, climate model hierarchy, climate predictability and the CO2 climate problem. Author (ESA)

N80-12672# Akademiya Nauk SSSR, Novosibirsk. Central Computing Center.
MODELING OF CLIMATIC CHANGES AND THE PROBLEM OF LONG-RANGE WEATHER FORECASTING
G. I. Marchuk *In* WMO On Climate and Mankind 1979 p 132-153 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The main features of the mechanisms governing atmospheric dynamic processes are reviewed and atmospheric models are described. Subsequently the problem of estimation of climate change is analyzed. The sensitivity of climatic models is discussed, and a number of sensitivity studies of the climate system with respect to parameter variations are mentioned. Long range weather forecasting is examined, pointing out the verified conclusion, that detailed weather forecasts for more than two weeks in advance are, in general, hardly possible. As an example, a three dimensional comparatively simple model of thermal interaction of the atmosphere with the active layer of the world's ocean and land is presented. Author (ESA)

N80-12673# World Meteorological Organization, Geneva (Switzerland).
CLIMATIC MONITORING AND CLIMATIC DATA COLLECTION SERVICES FOR DETERMINING CLIMATIC CHANGES AND VARIATIONS. MONITORING DATA RELEVANT TO CLIMATE
Ju. A. Izrael (USSR State Comm. for Hydrometeorol. and Control of Natl. Environ., Moscow) *In its* On Climate and Mankind 1978 p 154-169 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Climatic monitoring and climatic data collection utility, practice, and developments are examined. Objectives considered include measurement of climatic parameters, analysis and assessment of natural and antropogenic changes and variations of climate, and the prediction of potential climatic variations. The priorities and accuracy of measurement in the development of climate monitoring and climatic data collection services are discussed. The role of satellites in climate monitoring is also described. Author (ESA)

N80-12674# Toronto Univ. (Ontario). Inst. of Environmental Studies.
HUMAN ACTIVITIES THAT EFFECT CLIMATE
R. E. Munn and L. Machta (Natl. Oceanic and Atmos. Admin., Washington, D.C.) *In* WMO On Climate and Mankind 1979 p 170-209 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Climatic changes due to changing composition of the atmosphere, released heat, or changes of the physical and biological properties of the underlying surface are discussed. A 10% increase in atmospheric CFCL3 concentration observed in the period 1976-1978 is given as an example. Concentrations of CO2, SO2, dust particles, and Krypon-85 in the atmosphere are also discussed. Special considerations relating to the stratosphere are examined, in particular the effects of chlorofluormethanes, CO2, and CO on ozone content. The heat release and deforestation problems are also reviewed. It is concluded that few predictions call for significant climatic effects before the year 2000, and that further work is necessary to solve existing uncertainties. Author (ESA)

N80-12675# Meteorological Office, Bracknell (England).
SOME RESULTS OF CLIMATE EXPERIMENTS WITH NUMERICAL RESULTS
B. J. Mason *In* WMO On Climate and Mankind 1979 p 210-242 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The characteristics of two three-dimensional general atmospheric circulation models are described and the results obtained with the models are discussed. The 11-level models are successful in simulating pressure, wind, temperature and rainfall patterns, and other climate parameters. An experiment with a 5-level model shows that the melting of the Arctic ice will have the unexpected result of producing a significant cooling in middle latitudes especially over the United States. A simulation of an ice age with the 11-level model shows a 10% reduction in total global rainfall. Calculations on the effects of doubling the atmospheric concentration of CO2 show a rise of global land surface temperature of only 0.4 deg K and a corresponding 1% increase in precipitation with strong latitudinal and regional differences.
Author (ESA)

N80-12676# Bonn Univ. (West Germany). Inst. of Meteorology.
A SCENARIO OF POSSIBLE FUTURE CLIMATES: NATURAL AND MAN-MADE
H. Flohn *In* WMO On Climate and Mankind 1979 p 243-266 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Warm and cold episodes of earth climate are analyzed,

including the medieval warming, the Holocene warm episode, the last interglacial epoch, the glaciated Antartic versus ice-free Arctic scenario, the volcanic events and the Little Ice Age (1550-1850), and the possible initiation of a new ice age. It is concluded that a normal climate only exists in a very broad sense, and that many previous climate periods differed considerably from the present situation. However, the risks associated with a CO2 content that may reach 750-900 ppm should be seriously considered. Author (ESA)

N80-12677# International Institute for Applied Systems Analysis, Laxenburg (Austria).
ENERGY AND CLIMATE: A REVIEW WITH EMPHASIS ON GLOBAL INTERACTIONS
J. Williams, W. Haefele, and W. Sassin *In* WMO On Climate and Mankind 1979 p 267-289 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The potential impact of energy systems on climate and the implications of the present state of knowledge on energy policy decision making are discussed. The impact of climate on energy supply and demand is examined. The requirements for climate information necessary to improve the assessment of energy climate interaction are outlined. Author (ESA)

N80-12678# National Oceanic and Atmospheric Administration, Silver Spring, Md. Hydrologic Services Div.
CLIMATE VARIABILITY AND THE DESIGN AND OPERATION OF WATER RESOURCE SYSTEMS
John C. Schaake, Jr. and Zdzislaw Kaczmarek (Inst. of Meteorol. and Water Management, Warsaw) *In* WMO On Climate and Mankind 1979 p 290-312 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The use of climatic information in water resources management is reviewed. The nature of streamflow variability and methods of accounting for its effects are examined. The use of stochastic hydrologic models and the role they are likely to play in the future are described. The relationship between storage, demand for water, and the risk of failing to meet water demands from a given reservoir is considered. Author (ESA)

N80-12679# University Hospital, Basel (Switzerland). Biological Central Lab.
CLIMATE, HEALTH AND DISEASE
Wolf H. Weihe *In* WMO On Climate and Mankind 1979 p 313-368 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Various fields of human biometeorology are reviewed as a basis for a discussion of the possible effects on man of a major climatic variation in the near future. Climate in relation to the health of man, climate as a direct cause of disease, noncommunicable diseases, and communicable diseases are reviewed. Author (ESA)

N80-12680# World Meteorological Organization, Geneva (Switzerland).
GLOBAL ASPECTS OF FOOD PRODUCTION
M. S. Swaminathan (Indian Council of Agr. Res., New Delhi) *In its* On Climate and Mankind 1979 p 369-504 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The world food situation, potential capacity, and programs for the near future are discussed. It is concluded that no time should be lost in building dependable and effective national and international food security systems based on known technology. A highly cooperative interaction between scientists and decision makers is called for. It is shown that actual food production is only 1/30 of the estimated maximum. Author (ESA)

N80-12681# World Meteorological Organization, Geneva (Switzerland).
CLIMATIC VARIABILITY AND AGRICULTURE IN THE TEMPERATE REGIONS
James D. McQuigg *In its* On Climate and Mankind 1979 p 406-425 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The interaction of the temperate zone agricultural system with year climatic variability is discussed, examining first the impact on yields of climatic and agricultural development, and then analyzing the variability of crop season weather and the climate information system. It is shown that the yield increase observed since the 1950's seems to have reached a plateau, but future trends in grain yields and production must be related to future climate and technological developments. The climate information that will be most useful to crop prediction and agricultural practices is detailed, pointing out that long term weather records are a potential source of valuable management information. Author (ESA)

N80-12682# Kyoto Univ. (Japan). Center for Southeast Asian Studies.
CLIMATIC VARIABILITY AND AGRICULTURE IN TROPICAL MOIST REGIONS
Hayao Fukui *In* WMO On Climate and Mankind 1979 p 426-474 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Vulnerability of agriculture in the humid tropics to variable climate is analyzed, studying the influence of several parameters in various moist tropical regions, with particular reference to food production. It is concluded that cultivation of annual grain crops is highly risky in the humid tropics because of the probability of eventual land deterioration and susceptibility to rainfall variability. Root crops and tropical tree crops are less vulnerable. Lowland rice cultivation is the agricultural system best adapter to humid tropical conditions, and its vulnerability to rainfall variations could be decreased by better water control. Author (ESA)

N80-12683# Consiglio Nazionale delle Ricerche, Rome (Italy).
CLIMATIC VARIABILITY AND AGRICULTURE IN THE SEMI-ARID TROPICS
Francesco Mattei *In* WMO On Climate and Mankind 1979 p 475-509 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Agroclimatic factors and the influence of climatic variability in various regions of the world are presented. It is concluded that traditional rain-fed agriculture of the semi-arid tropics shows in general a relatively high fragility with increasing variability of the rain pattern and lower yields than in extra-tropical or subtropical environments with similar climatic characteristics. One important reason for that effect is the poor suitability of crops and agricultural systems to variability of climate. Author (ESA)

N80-12684# Central Meteorological Service, Peking (China).
CLIMATIC CHANGE AND THE EXPLOITATION OF CLIMATIC RESOURCES IN CHINA
Chang Chia-cheng, Wang Shao-wu (Peking Univ.), and Cheng Szu-c-chung (Acad. Sinica, Peking, China) *In its* On Climate and Mankind 1979 p 510-524 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Space-time characteristics of climatic change in China are described and the exploitation of climatic resources is discussed. General trends in temperature of various time scales in China up to 100 million years ago, the main features of the dryness-wetness distribution in the past 500 years and the distribution of correlation between circulation indexes and the high and low frequency dryness/wetness fluctuations are presented. China's policies for agriculture development are described, stressing the importance of climatic forecasting. Author (ESA)

N80-12685# Buenos Aires Univ. (Argentina).
RENEWABLE RESOURCES AND AGRICULTURE IN LATIN AMERICA IN RELATION TO THE STABILITY OF CLIMATE
Juan J. Burgos *In* WMO On Climate and Mankind 1979 p 525-551 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The productivity of the soil in Latin America is studied in relation to climate characteristics. Annual rates of soil erosion are discussed for various climatic regions. The effects of adapting the monsoon savannas, the semi-arid regions, and the arid regions to more intensive agricultural use are analyzed, showing the interaction of these changes with climate, and in some cases

the harm derived from these changes. The climate on the micro, meso and macroscales appears to be affected by these actions. Author (ESA)

N80-12686# Ibadan Univ. (Nigeria). Dept. of Geography.
CLIMATIC VARIABILITY AND LAND USE: AN AFRICAN PERSPECTIVE
Julius S. Oguntoyinbo and Richard S. Odingo *In* WMO On Climate and Mankind 1979 p 552-580 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

A highlight of climatic events in Africa is presented referring mainly to the south of the Sahara within the last few hundred years. The effects of climatic variability on land use characteristics under varying conditions are discussed, and the effect of man's impact on the environment are shown. Greater emphasis is laid on the areas marginal to the desert, which give a false sense of security to human occupation during periods of successively wet years, but are highly vulnerable in periods of drought. Author (ESA)

N80-12687# Technische Universitaet, Munich (West Germany). Dept. of Bioclimatology and Applied Meteorology.
CLIMATIC VARIABILITY AND FORESTRY
A. Baumgartner *In* WMO On Climate and Mankind 1979 p 581-607 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The characteristics of forest distribution on the globe, and the interaction between forests and regional climate are examined. Destructive forest operation and the vulnerability of tropical forest to the effects of exploitation are discussed. It is concluded that mankind should maintain the existing forest cover of the earth. The economical, ecological and social aspects of the problem are pointed out. Author (ESA)

N80-12688# Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
CLIMATIC VARIATION AND MARINE FISHERIES
D. H. Cushing *In* WMO On Climate and Mankind 1979 p 608-632 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The events in fisheries in recent decades are used to indicate the ways in which the biological production of the world oceans may be modified by climatic factors. The annual changes in recruitment to a single population of fishes vary by about an order of magnitude. It is suggested that such differences would be generated by changes in wind strength and direction, in solar radiation at the sea surface and in sea surface temperature in restricted areas where the larval fishes grow. Author (ESA)

N80-12689# World Meteorological Organization, Geneva (Switzerland).
CLIMATIC VARIABILITY, MARINE RESOURCES AND OFFSHORE DEVELOPMENT
T. F. Gaskell (Oil Ind. Intern. Explor. and Produc. Forum, London) *In its* On Climate and Mankind 1979 p 633-651 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The activities being carried out in marine resource development are surveyed, indluding the construction of ports, harbors and other coastal facilities, and ship routing in difficult climate situations. The impact of climatic variation is usually more important when considering short-term weather forecasts, but extremes of climate and long-term trends are important if catastrophies of gross overdesign are to be avoided. Oil is likely to remain the most important marine resource for the next few decades. Manganese nodules and similar seabed mineral concentrations may be valuable in the future. Author (ESA)

N80-12690# Wyoming Univ., Laramie.
CLIMATE AND ECONOMIC ACTIVITY
Ralph C. dArge *In* WMO On Climate and Mankind 1979 p 652-681 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The evidence on the impact of climatic changes on various economic sectors of several nations is reviewed. It is shown, as an example, that the economic cost to the United States of 1 deg C reduction in average temperature may cost as much as seven billion U.S. dollars per year. Some of the more obvious international repercussions of climatic variation are examined, including estimations of sensitivity of economic cost to precipitation and temperature change, benefit cost analysis of stratospheric aircraft fuel desulphurization, fluorocarbon pollution impact, and a discussion of the effects of nitrogen fertilizers on stratospheric pollution and of CO2 increase effect estimations. Author (ESA)

N80-12691# Clark Univ., Worcester, Mass. Graduate School of Geography.
CLIMATE AND SOCIETY: LESSONS FROM RECENT EVENTS
Robert W. Kates *In* WMO On Climate and Mankind 1979 p 622-691 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The effects of extreme weather events (blizzards, droughts, floods, tropical cyclones, tornados and storms) and the long term human response to their recurrence are discussed. Studies were conducted in some 20 countries and at 40 sites. Contrasting issues regarding vulnerability reduction are examined showing, for example, that there are common situations in which attempting to improve situations in the long run, makes things worse; a classical case being the use of levees for flood control. It is concluded that if we acted upon what we already know, the world death toll from flood, drought and tropical cyclones could be reduced by 85% and property damage by 50%. Author (ESA)

N80-12692# World Meteorological Organization, Geneva (Switzerland).
REPORT ON DISCUSSIONS HELD DURING THE FIRST WEEK OF THE CONFERENCE
In its On Climate and Mankind 1979 p 695-708 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

A summary of the discussions held at the world climate conference is presented. The importance of climate system modeling is emphasized, pointing out that the analysis of previously unknown influences such as atmospheric CO2 increase can be made only by using models to predict the future course of climate. The subjects discussed include: climate modeling, climatic variability, climatic scenarios, climate monitoring, climate and the biosphere, climate and the composition of the atmosphere, energy and climate, water resources, climate and health, agriculture, soil science, forests and climate, fisheries and climate, offshore development, and economical and social aspects. Author (ESA)

N80-12693# World Meteorological Organization, Geneva (Switzerland).
THE DECLARATION OF THE WORLD METEOROLOGICAL CONFERENCE: AN APPEAL TO NATIONS
In its On Climate and Mankind 1979 p 709-716 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

An appeal to nations is presented stating that it is important that the nations of the world: (1) take full advantage of man's present knowledge of climate; (2) take steps to improve significantly that knowledge, and (3) foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity. Detailed conclusions and recommendations are included. Author (ESA)

N80-12694# World Meteorological Organization, Geneva (Switzerland).
CLIMATE DATA
In its On Climate and Mankind 1979 p 719-726 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The objectives of climate monitoring and data collection, and the data required for research, applications, and impact studies are discussed in order to provide supporting analysis to the declaration of the World Climate Conference. It is concluded that participating nations and international bodies should include in their priority programs a task list which is defined. Highest priority is given to the extension and improvement of existing climatological networks and to the development of an international compatible data system. Author (ESA)

N80-12695# World Meteorological Organization, Geneva (Switzerland).
APPLICATIONS OF THE KNOWLEDGE OF CLIMATE
In its On Climate and Mankind 1979 p 727-738 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Climatological information applications to a wide variety of planning and operational activities are reviewed in a supporting document to the declaration of the world conference. A list of priorities is presented referring to socio-economic sectors such as food production, water resources, energy, and human health, and to areas of international action such as data information systems, education and training programs, technology transfer, promotion of the use of applications, and development of new technologies. The organizational problem and the goals of the climate applications program are also discussed. Author (ESA)

N80-12696# World Meteorological Organization, Geneva (Switzerland).
THE INFLUENCE OF SOCIETY ON CLIMATE CHANGE AND VARIABILITY
In its On Climate and Mankind 1979 p 739-743 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Human influence on climate is discussed. The issues examined include the effects of: CO2 release in the atmosphere, infrared absorbing gases, changes in the land surface, stratospheric changes, aerosols, heat emissions, weather modifications, and military activities. It is concluded that the most urgent attention should be given to the impact of the accumulation of CO2 in the atmosphere. Concern also arises with regard to the potential increases in other trace gases which have a greenhouse effect and a long residence time in the atmosphere. Author (ESA)

N80-12697# World Meteorological Organization, Geneva (Switzerland).
IMPACTS OF CLIMATE CHANGE AND VARIABILITY ON SOCIETY
In its On Climate and Mankind 1979 p 744-750 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

In order to assess the impact of climate change on society a study is proposed with the following objectives: (1) improvement of our knowledge of the specific primary responses and interactive relations, (2) improvement of the methodology employed, and (3) identification of the characteristics of human societies especially vulnerable or resilient to climate variability. A list of priority criteria and a discussion of the methods to be employed are given. Author (ESA)

N80-12698# World Meteorological Organization, Geneva (Switzerland).
RESEARCH ON CLIMATIC CHANGE AND VARIABILITY
In its On Climate and Mankind 1979 p 751-758 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

A world climate research program is proposed which will attempt, through international cooperation, to determine why, how, and where climate changes and variations occur, and thereby attempt prediction of their future occurence. The major objectives are to establish to what extent climate can be predicted, and the extent of man's influence on climate. The definitions, an analysis of research elements and a discussion on data requirements for climate research are presented. A list of scientific priorities is also presented. Author (ESA)

N80-12699# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
THE 19304DT GSRS, MISSILE NO. 1031, ROUND NO. V-46 Data Report
Jun. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073388; ERADCOM/ASL-DR-1037) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19304DT GSRS, Missile Number 1031, Round Number V-46, are presented in tabular form. GRA

N80-12700# Atmospheric Science Associates, Bedford, Mass.
COLLECTION AND MEASUREMENT EFFICIENCIES OF THE EWER CLOUD WATER METER FOR HYDROMETEORS Final Report, 1 Apr. - 31 May 1979
Hillyer G. Norment 11 May 1979 40 p refs
(Contract F19628-79-M-0005; AF Proj. 2310)
(AD-A072827; AFGL-TR-79-0122) Avail: NTIS HC A03/MF A01 CSCL 04/1

Calculated collection and measurement efficiencies for an airborne EWER cloud water content meter are presented for water drops and five types of ice crystals for three flight altitudes and for wide ranges of particle sizes. Particle type and size effects are found for very small particles, but the results are essentially constant for particles heavier than about 0.5 micrograms. GRA

N80-12701# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Science Lab.
THE 14818C LANCE, MISSILE NUMBER 3396, ROUND NUMBER 333 APL Meteorological Data Report
Jun. 1979 26 p
(DA Proj. 1T6-65072-D-126)
(AD-A073109; ERADCOM/ASL-DR-1029) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 14818C Lance, Missile No. 3396, Round No. 333 APL, are presented in tabular form. GRA

N80-12702# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19702A GSRS, MISSILE NUMBER 336, ROUND NUMBER B-19
Jun. 1979 18 p
(DA Proj. 1T6-65702-D-126)
(AD-A073110; ERADCOM/ASL-DR-1032) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702A GSRS, Missile Number 336, Round Number B-19, are presented in tabular form. GRA

N80-12703# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19702A GSRS, MISSILE NUMBER 302, ROUND NUMBER B-20
Jun. 1979 18 p
(DA Proj. 1T6-65702-D-126)
(AD-A073111; ERADCOM/ASL-DR-1033) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702A GSRS, Missile Number 302, Round Number B-20, are presented in tabular form. GRA

N80-12704# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19305AT GSRS, MISSILES NUMBER 1042, 1039, ROUNDS NUMBER V-44, V-45
Jun. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073112; ERADCOM/ASL-DR-1035) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19305AT GSRS, Missiles Number 1042 and 1039, Rounds Number V-44 and V-45, are presented in tabular form. GRA

N80-12705# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19305AT GSRS, MISSILE NUMBER 1040, ROUND NUMBER V-43
Jun. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073188; ERADCOM/ASL-DR-1034) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19305AT

GSRS, Missile Number 1040, Round Number V-43, are presented in tabular form. GRA

N80-12706# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 1930AT GSRS, MISSILES NUMBER 1026, 1036, 1034, ROUNDS NUMBER V-40, V-41, V-42
21 Jun. 1979 20 p
(DA Proj. 1T6-65702-D-167)
(AD-A073187; ERADCOM/ASL-DR-1031) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 1930AT GSRS, Missiles No. 1026, 1036, 1034, Rounds No. V-40, V041, V-42, are presented in tabular form. GRA

N80-12707# Northrop Services, Inc., Huntsville, Ala.
SOLAR-CLIMATIC STATISTICAL STUDY. SUMMARY REPORT, VOLUME 1
Roger E. Bray Feb. 1979 60 p refs 2 Vol.
(Contract EG-77-C-01-4016)
(HCP/T4016-1) Avail: NTIS HC A04/MF A01

Data at 26 (SOLMET) National Weather Service stations were processed to provide preliminary planning data, in the form of statistical information, for selected daily average solar and wind conditions occurring and persisting for time periods of interest. Empirical probabilities were constructed from the historic solar and wind data to provide a reasonable inference of the chance of similar climatological conditions occurring at any given time. (Diurnal wind power variations were also considered). Data used to obtain the daily average solar and wind power probabilities were combined into monthly averages and are presented. Average monthly, seasonal and annual solar and wind power trends were prepared to provide an overview for identifying areas for further investigation. DOE

N80-12708# Hawaii Univ., Honolulu. Dept. of Meteorology.
SUMMER WEATHER ON HALEAKALA, MAUI
S. W. Lyons Apr. 1979 65 p refs
(Grant EG-77-G-03-1617)
(UHMET-79-09) Avail: NTIS HC A04/MF A01

Meteorological observations from the summit of Haleakala, Maui, high-resolution satellite imagery, and rainfall climatology were examined to determine diurnal and day to day variations in weather both at the summit and along the slopes. Results show largest weather variations occur in response to the diurnal mountain heating cycle, while day to day weather changes result from continuous and systematic interaction between the local diurnal cycle and synoptic weather patterns. The diurnal cycle produces afternoon maxima and early morning minima in summit temperature, humidity, cloudiness, and rainfall. Summit maximum temperature and cloud amount depend directly on synoptic wind profiles and hydrostatic stability, while minimum temperature is positively correlated (R = .78) with the antecedent maximum temperature. Multiple regression equations were derived for summit humidity, cloud amount, maximum and minimum air temperatures, and wake cloud plume development. DOE

N80-12709# Sandia Labs., Albuquerque, N. Mex. Environmental Research Div.
WIND TIME SERIES ANALYSES FOR WECS APPLICATIONS
Jack W. Reed Dec. 1978 42 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1701) Avail: NTIS HC A03/MF A01

A methodology for wind power analyses of wind speed time series is described, including computation flow diagrams and a FORTRAN program listing. Examples of results are presented but complete outputs will follow in specialized reports. Primary calculation states are: (1) data homogenization for moved anemometers; (2) extrapolations to selected standardized heights; (3) distribution smoothing for observation bias; (4) power distribution function calculation; (5) turbine speed limit effects analysis; (6) time variability assessment; and (7) analysis of light wind durations. DOE

N80-12710# Midwest Research Inst., Golden, Colo.
WIND RESOURCE ANALYSIS
Donald M. Hardy Dec. 1978 20 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-36-088) Avail: NTIS HC A02/MF A01

Modern atmosphere models of near-surface wind flow and primary data sets were developed from previous studies of national and regional wind resources. Because numerous assumptions are necessary to interpret available data in terms of wind energy potential, conclusions of previous studies differ considerably. The primary data sets and principal features of the models are discussed. DOE

N80-12711# Institute for Energy Analysis, Oak Ridge, Tenn.
CLIMATE MODELS AND THE PREDICTION OF CO2-INDUCED CLIMATIC CHANGES
R. G. Watts Dec. 1978 41 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-78-24-(M)) Avail: NTIS HC A03/MF A01

The carbon dioxide (CO2) content of the atmosphere has shown a systematic increase each year since regular measurements began in 1958. A major source of CO2 is the combustion of fossil fuels. An assimilation of the results of studies of the sensitivity of climate to increases in the CO2 content of the atmosphere are presented. Various atmospheric feedbacks and ice albedo feedback are discussed. Recent estimates of the various feedbacks were used to estimate upper and lower bounds of the globally averaged temperature increase that would accompany a doubling of atmospheric CO2 content. The results of a CO2 doubling experiment using a general circulation model are presented, and the possible response of the cryosphere is discussed. DOE

N80-12712# California Univ., Livermore. Lawrence Livermore Lab.
REGIONAL WIND-FIELD STUDY IN COMPLEX TERRAIN DURING SUMMER SEA-BREEZE CONDITIONS
W. M. Porch, P. A. Volker, K. R. Peterson, R. L. Weichel, and C. Sherman 5 Mar. 1979 26 p refs
(Contract W-7405-eng-48)
(UCRL-52680) Avail: NTIS HC A03/MF A01

A regional scale data base, consisting of wind and temperature data for June and July of 1977, was developed for the greater San Francisco Bay area and eastward to the Central Valley. Continuous meteorological measurements were made in the area of Patterson Pass about 3 km east of Lawrence Livermore Laboratory. This area was chosen because of its complex terrain and importance as a downwind topographic feature affecting the dispersal of possible accidental atmospheric releases from the laboratory and as an area of high wind energy potential. Summer sea breeze oscillations of about 6 and 12 days were characterized and an optical space-averaging wind sensor was successfully applied over a 1 kilometer path across the pass to provide long-path averaged data for regional, numerical wind field models with kilometer-sized grid elements. DOE

N80-12713# National Weather Service, Salt Lake City, Utah.
AIDS FOR FORECASTING MINIMUM TEMPERATURE IN THE WENATCHEE FROST DISTRICT
Robert S. Robinson Apr. 1979 15 p
(PB-298339/3; NOAA-TM-NWS-WR-139; NOAA-79062907)
Avail: NTIS HC A02/MF A01 CSCL 04B

Regression equations and their graphical solutions were developed as aids for forecasting the lowest minimum temperature among frost key stations in the Wenatchee frost district on a given night during the spring. Two aids were developed, one based on morning data for the preliminary frost forecast and one based on evening data for the primary forecast. Both require that nights have no more than scattered clouds or thin cirrus. Verification on independent data showed both equations to be quite useful. To further improve their usefulness, more study is needed to objectively determine whether or not sufficient cloudiness will be present to affect minimum temperatures. GRA

N80-12714# Electronic Techniques, Inc., Fort Collins, Colo.
SIERRA COOPERATIVE PROJECT (SCPP) FORECASTING SUPPORT, VOLUME 1 Interim Progress Report, 1 Dec. 1978 - 30 Jun. 1979
J. Owen Rhea and John L. Lecompte Jun. 1979 121 p refs
(Contract DI-9-07-85-V0021)

(PB-298497/9) Avail: NTIS HC A06/MF A01 CSCL 04B

The feasibility of using weather modification for improving water resources in the Sierra Nevada is discussed. Field services performed and analyses completed in support of the SCPP are summarized along with collection, reduction, and archiving of the data. GRA

N80-12715# National Weather Service, Salt Lake City, Utah.
COMPARISON OF LFM AND MFM PRECIPITATION GUIDANCE FOR NEVADA DURING DOREEN
Christopher D. Hill. Apr. 1979. 20 p. refs.
(PB-298613/1; NOAA-TM-NWS-WR-141; NOAA-79062909) Avail: NTIS HC A02/MF A01 CSCL 04B

A brief qualitative case study comparison of limited-area fine mesh (LFM) and movable fine mesh (MFM) precipitation forecasts is presented. During the surge of precipitation into the Southwestern United States from the remnants of Hurricane Doreen, the LFM appeared to provide better quantitative precipitation forecast (QPF) guidance than the finer mesh, more physically realistic MFM. However, at least in this one case, the apparent superior skill was possibly superficial. The LFM, unable to resolve the split in the moisture surge, forecast a single center of activity. The MFM successfully delineated the split. GRA

N80-12716# National Weather Service, Salt Lake City, Utah.
THE INFLUENCE OF CLOUDINESS ON SUMMERTIME TEMPERATURES IN THE EASTERN WASHINGTON FIRE WEATHER DISTRICT
James Holcomb. Apr. 1979. 16 p.
(PB-298674/3; NOAA-TM-NWS-WR-140; NOAA-79062908) Avail: NTIS HC A02/MF A01 CSCL 04B

A relationship between surface temperature change and cloud-cover change was determined objectively for several weather zones in eastern Washington. This was combined with a measure of the general air-mass temperature change to produce equations which explained about 70 to 80% of the daily variation in surface temperature. The average error of the prediction equations when tested on two seasons of independent data was about 2 to 3 F. The equations may also apply to other areas in the Pacific Northwest at similar latitudes or others could similarly be derived. GRA

N80-12717# National Oceanic and Atmospheric Administration, Washington, D. C. National Climate Program Office.
PROCEEDINGS OF THE ANNUAL CLIMATE DIAGNOSTICS WORKSHOP
Nov. 1978. 258 p. refs. Workshop held at Miami Univ., Fla., 31 Oct. - 2 Nov. 1978.
(PB-298355/9; NOAA-79062901) Avail: NTIS HC A16/MF A01 CSCL 04B

Connections between terrestrial hydrology and ocean thermodynamics and the potential for affecting regional climate were considered. Development of credible climate prediction techniques was discussed. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography, and marine resources.

N80-12718*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
REMOTE SENSING AND PROBLEMS OF THE HYDROSPHERE
Edward D. Goldberg, ed. (Scripps Institution of Oceanography, La Jolla, Calif.) Washington. Dec. 1979. 67 p. refs. Workshop held at Warner Springs, Calif., 29-31 Jan. 1979; sponsored by NASA, Langley Res. Center and NASA, Washington.
(NASA-CP-2109; L-13404) Avail: NTIS HC A04/MF A01 CSCL 08J

A discussion of freshwater and marine systems is presented including areas of the classification of lakes, identification and quantification of major functional groups of phytoplankton, sources and sinks of biochemical factors, and temporal and regional variability of surface features. Atmospheric processes linked to hydrospheric process through the transfer of matter via aerosols and gases are discussed. Particle fluxes to the aquatic environment and global geochemical problems are examined. A.W.H.

N80-12719*# System Planning Corp., Arlington, Va.
DATA REQUIREMENTS FOR OCEANIC PROCESSES IN THE OPEN OCEAN, COASTAL ZONE, AND CRYOSPHERE
R. G. Nagler and S. W. McCandless, Jr. Sep. 1978. 70 p. refs. Prepared for JPL.
(Contract JPL-955068)
(NASA-CR-162451) Avail: NTIS HC A04/MF A01 CSCL 08C

The type of information system that is needed to meet the requirements of ocean, coastal, and polar region users was examined. The requisite qualities of the system are: (1) availability, (2) accessibility, (3) responsiveness, (4) utility, (5) continuity, and (6) NASA participation. The system would not displace existing capabilities, but would have to integrate and expand the capabilities of existing systems and resolve the deficiencies that currently exist in producer-to-user information delivery options. R.E.S.

N80-12720*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
ANALYSIS OF COASTAL UPWELLING AND THE PRODUCTION OF A BIOMASS
John T. Howe. Nov. 1979. 28 p. refs.
(NASA-TM-78614; A-7931) Avail: NTIS HC A03/MF A01 CSCL 08A

The coastal upwelling index derived from weather data is input to a set of coupled differential equations that describe the production of a biomass. The curl of the wind stress vector is discussed in the context of the physical extent of the upwelling structure. An analogy between temperature and biomass concentration in the upwelled coastal water is derived and the relationship is quantified. The use of remote satellite or airborne sensing to obtain biomass rate production coefficients is considered. K.L.

N80-12721# California Univ., Berkeley. Dept. of Physics.
DESCRIPTION OF NONLINEAR INTERNAL WAVE INTERACTIONS USING LANGEVIN METHODS
Neil Pomphrey, James D. Meiss, and Kenneth M. Watson. May 1979. 58 p. refs.
(Contract N00014-78-C-0050)
(AD-A069010; UCB/PTH-79/4) Avail: NTIS HC A04/MF A01 CSCL 08/3

A comparison is made between several different methods for calculating energy transport within a wave field. Two Langevin techniques are developed. The first is based on the fluctuation dissipation theorem and provides relaxation rates nu(F) and a transport equation. The second method is an application of the Krylov-Bogoliubov-Mitropolsky perturbation theory and provides a Langevin rate constant nu(P) at lowest order. The two formulations are shown to be closely related to the radiative transfer (Boltzmann) equation whose rate is the difference between nu(F) and nu(P). Specific application of the Langevin methods is to internal waves in the ocean. Computations show that the GM-76 spectrum is approximately an equilibrium spectrum except for frequencies near the inertial frequency and at the lowest vertical mode numbers. The sensitivity of nu(F) and nu(P) to spectral form is also discussed. Simple analytic expressions for the rates are derived for the induced diffusion, elastic scattering, and parametric subharmonic instability mechanisms. Only the first of these mechanisms is ever of much numerical significance. Finally, net energy flow in the non-equilibrium portion of the GM-76 spectrum is discussed. GRA

N80-12722# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.
REPORT TO THE CONGRESS ON COASTAL ZONE MANAGEMENT. TRANSITION QUARTER AND FISCAL YEAR 1977
Jan. 1979. 113 p.
(PB-298537/2; NOAA-79061803) Avail: NTIS HC A06/MF A01 CSCL 13B

This report contains separate sections on: identification of the state programs approved during the preceding Federal fiscal year and a description of those programs; listing of the states

participating and a description of the status of each state's program and its accomplishments during the preceding Federal fiscal year; itemization of the allocation of funds to the various coastal states and a breakdown of the major projects and areas; an identification of any state programs which have been reviewed and disapproved and which grants have been terminated and a statement for the reasons for such action; activities and projects which are not consistent with an approved state management program; and a summary of regulations issued by the Secretary or in effect during the preceding Federal fiscal year. GRA

N80-12723# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.
THE FIRST FIVE YEARS OF COASTAL ZONE MANAGEMENT
Mar. 1979 66 p
(PB-298780/7; NOAA-79061802) Avail: NTIS
HC A04/MF A01 CSCL 13B

Efforts to protect coastal wetlands, dunes, beaches, and other significant natural resources are described and assessed. It appears that coastal development is managed rationally. State coastal zone management (CZM) programs protect cultural, historic, and aesthetic resources in coastal areas, and in a number of states the permitting process for coastal development consistent with state CZM policies is simplified and streamlined. K.L.

N80-12724# Massachusetts Inst. of Tech., Cambridge. Lab. of Water Resources and Hydrodynamics.
AN ANALYSIS OF LONGSHORE CURRENTS AND ASSOCIATED SEDIMENT TRANSPORT IN THE SURF ZONE
D. W. Ostendorf and O. S. Madsen Apr. 1979 195 p refs
(Grant NOAA-04-6-158-44081)
(PB-298291/6; MITSG-79/13; NOAA-79061811) Avail: NTIS
HC A09/MF A01 CSCL 13B

Two momentum based longshore current models and a preliminary longshore sediment transport model are derived, calibrated, and tested. Calibration yields physically plausible behavior for the three model parameters while fixed bed, laboratory movable bed, and field testing show a general longshore current model accuracy of about 20%, where the latter two data bases only test the linear longshore current model. The linear longshore sediment transport model matches the laboratory data to an accuracy of about 20% but overpredicts the field data by a factor of 5; in view of the latter finding, the model should only be considered as an order of magnitude estimator of longshore sediment transport. Examples of the three models are presented. GRA

N80-12725# National Ocean Survey, Rockville, Md.
TIDE TABLES 1980. HIGH AND LOW WATER PREDICTIONS. EAST COAST OF NORTH AND SOUTH AMERICA INCLUDING GREENLAND
1979 302 p
(PB-298726/1; NOAA-79070301) Avail: NTIS
HC A14/MF A01 CSCL 08C

Full daily predictions for 38 reference ports and differences and other constants for about 2,000 stations in North America, South America, and Greenland are presented. Other data given include local mean time of sunrise and sunset at different latitudes for every fifth day of the year, moonrise and sunrise for eight places, the time of solar equinoxes and solstices, and a table of the Greenwich mean time of the moon's phases, apogee, perigee, greatest north and south, and zero declination. Tables are also provided for reducing local mean time to standard time and obtaining the approximate height of the tide at any time. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

No abstracts in this category.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-12726 New York Univ., N. Y.
NUMERICAL SOLUTION OF A HYPERBOLIC SYSTEM OF CONSERVATION LAWS FOR BLOOD FLOW IN THE ARTERIAL TREE Ph.D. Thesis
David Moise Bellehsen 1979 130 p
Avail: Univ. Microfilms Order No. 7925440

A code for an arbitrary arterial tree was developed that can accommodate any prescribed physiological data. The partial differential equations which describe the flow of blood in the cardiovascular system are nonlinear. The flow is treated as one-dimensional. The equations form a hyperbolic system of conservation laws which are solved by the Lax-Wendroff method. Special cases of one branch and three branches were worked out numerically and analytically with computed results in the form of tables. As an application, a structured arterial tree was studied and some graphs are presented. The effect of varying the reflection coefficient is also discussed. Dissert. Abstr.

N80-12727 Ohio Univ., Athens.
HUMAN MUSCLE FIBER TYPES IN POWER LIFTERS, DISTANCE RUNNERS AND UNTRAINED SUBJECTS: A HISTOCHEMICAL AND ULTRASTRUCTURAL STUDY Ph.D. Thesis
Frederick Paul Prince 1979 39 p
Avail: Univ. Microfilms Order No. 7924429

Cellular aspects (fiber size and qualitative measures of contraction time and aerobic capacity via histochemistry) and sub-cellular (morphometric analysis of mitochondrial volume percent, lipid volume percent and Z-line width via electron microscopy) aspects of the vastus lateralis muscle, a major extensor of the knee joint, in male and female athletes and non-athletes were investigated. The cross-sectional area and metabolic profile was obtained for each fiber. The fibers were thus classified as slow-twitch-oxidative, fast-twitch-oxidative-glycolytic, and fast-twitch-glycolytic. Much individual variation is present in the percentages of histochemical fiber types and fiber cross-sectional area. Male and female fibers are similar in most respects. The major difference being that all 3 fiber types appear larger in males. Dissert. Abstr.

N80-12728 Utah Univ., Salt Lake City.
STATISTICAL REPRESENTATION OF ELECTROCARDIOGRAPHIC BODY SURFACE MAPS FOR FEATURE IDENTIFICATION DATA COMPRESSION AND CLASSIFICATION Ph.D. Thesis
Arnold Kerry Evans 1979 96 p
Avail: Univ. Microfilms Order No. 7924352

The development and evaluation of methods for providing accurate representation of ECG body surface potential map data are discussed. Identifying diagnostically important map features, providing data compression, and forming a basis for applying statistical pattern recognition techniques to map classification are studied. Dissert. Abstr.

N80-12729 Michigan Univ., Ann Arbor.
A POSTURAL MEASUREMENT SYSTEM FOR INDUCED BODY SWAY ASSESSMENT Ph.D. Thesis
Robert Owens Andres 1979 162 p
Avail: Univ. Microfilms Order No. 7925105

A microcomputer based stimulus delivery and response measurement system for the analysis of human sagittal plane body sway response to induced instabilities was developed. The system is called a postural measurement system (PMS). The PMS provides flexibility in stimulus delivery while assessing postural sway responses with known resolution. The PMS was implemented in a predesigned factorial experiment investigating both static and induced sinusoidal body sway responses of one healthy young male subject; PMS performance was monitored concurrently with the human sway responses. The spectrum of antero-posterior body sway during quiet stance was non-adaptive over the 45 minute test session. The waist swayed less than the shoulders; most sway displacement had frequency components

less than 4 Hz. The lumbosacrum did not remain rigid during static sway as inverted pendulum body models assume.
Dissert. Abstr.

N80-12730*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SIMULTANEOUS MUSCLE FORCE AND DISPLACEMENT TRANSDUCER Patent Application
Cyril Feldstein (JPL), Gilbert W. Lewis (JPL), and Virgil H. Culler, inventors (to NASA) (JPL) Filed 30 Sep. 1977 12 p Sponsored by NASA
(NASA-Case-NPO-14212-1; US-Patent-Appl-SN-838308) Avail: NTIS HC A02/MF A01 CSCL 06B

A myocardial transducer for simultaneously measuring force and displacement within a very small area of myocardium is presented. Each branch of the forked transducer constitutes a low compliance tine for penetrating the heart. When the heart is penetrated, the surface membrane closes around indentations in the tines. A small piezoresistive element that converts a force into an electrical signal is bonded to one of the low compliance tines. A third high compliance tine is of a length that just pierces the surface membrane. Displacement of the myocardium in a direction in line with the two low compliance tines causes a deformation in curvature of the high compliance tine that is converted into an electrical signal by a second piezoresistive element. An electrode placed on the epicardium and referenced to the transducer provides an ECG with force and displacement measurements. NASA

N80-12731# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
DESIGN OF A MICROPROCESSOR BASED CARDIOTACHOMETER
D. Ratino, G. Potor, A. Marko, and C. Sharper Apr. 1979 39 p refs
(AF Proj. 6893)
(AD-A073105; AMRL-TR-79-21) Avail: NTIS HC A03/MF A01 CSCL 09/2

A microprocessor based cardiotachometer has been designed and fabricated in-house using 8080 Intel microcomputer hardware and assembly language software. The cardiotachometer accurately calculates and digitally displays beat-by-beat heart rate in beats per minute. The design incorporates standard semiconductor memory and I/O integrated circuits. Operational understanding does not require extensive microprocessor design background. In fact, the cardiotach's design provides excellent basic information in the use of microprocessors in the instrumentation field. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-12732*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SINGLE PILOT SCANNING BEHAVIOR IN SIMULATED INSTRUMENT FLIGHT
Jack E. Pennington Oct. 1979 55 p refs
(NASA-TM-80178) Avail: NTIS HC A04/MF A01 CSCL 05I

A simulation of tasks associated with single pilot general aviation flight under instrument flight rules was conducted as a baseline for future research studies on advanced flight controls and avionics. The tasks, ranging from simple climbs and turns to an instrument landing systems approach, were flown on a fixed base simulator. During the simulation the control inputs, state variables, and the pilots visual scan pattern including point of regard were measured and recorded. Author

N80-12733# Hughes Aircraft Co., Culver City, Calif. Display Systems Lab.
DETECTION OF DIFFERENT TARGET TYPES IN REALISTIC TERRAIN Interim Report, Sep. 1978 - Jan. 1979
G. E. Corrick Mar. 1979 42 p refs
(Contract N60530-78-C-0240)
(AD-A072973; HAC-FR-79-27-676; HAC-Ref-E3900; NWC-TP-6107) Avail: NTIS HC A03/MF A01 CSCL 17/8

The effects of target and terrain characteristics on visual air-to-ground target acquisition were studied. Five target types--a portable bridge; a portable bridge with adjacent anti-aircraft artillery (AAA); a surface-to-air missile (SAM) site; a petroleum, oil, and lubricants (POL) supply dump; and a group of three tanks--were embedded into oblique aerial photos of real terrain at a simulated slant range of 1.6 km. Background scenes were selected to represent desert, desert/mountain, and rural terrain. Results of a search experiment showed that target type was the most important factor in determining acquisition performance, accounting for up to 40% of the experimental variance. The relative detectabilities of the target were found to group so that the bridge alone, the bridge with AAA site, and the SAM site were significantly easier to detect than the three tank group or POL site. Results are discussed in terms of the detectability of a target as related to the constraints on its possible scene location. Background was shown to be a significant effect, but accounted for about one-fourth as much of the variance as did target type. These results are compared to a previous similar study using multiple configurations of a single target type where background characteristics were shown to account for more variance. Implications for target acquisition modeling are discussed. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-12734 Michigan Univ., Ann Arbor.
RATIONAL WAYS TO INCREASE PICTOGRAPHIC SYMBOL DISCRIMINABILITY Ph.D. Thesis
Paul Allan Green 1979 237 p
Avail: Univ. Microfilms Order No. 7925156

Several ways of increasing the discriminability of similar symbols were compared. Six alterations were considered; five modifications of symbol elements (changes in height to width ratio, strokewidth, rotation in the frontal plane, repetition, and filling in an enclosed area) and substitution of a new symbol (new prototype) for one member of a confusable pair. The last four changes were compared. To determine the effect of including confusable pairs of symbols in larger sets, symbols for several controls and displays (heater, air conditioner, vent, radio volume and tuning, exterior-lamp failure, and tire pressure) were developed. Suggestions for those symbols were drawn by 43 drivers in experiment two. Based on those drawings were several candidate symbols for each function. In the third experiment 62 drivers made magnitude estimates of how well each candidate's intended meaning was understood. From these data and existing standards a set of eight symbols was assembled. Dissert. Abstr.

N80-12735*# Georgia Inst. of Tech., Atlanta.
GUIDING THE DEVELOPMENT OF A CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM
Robert M. Mason, ed. (Metrics, Inc., Atlanta) and John L. Carden, ed. Nov. 1979 98 p refs Report on workshop held at NASA/Ames, 8-12 Jan. 1979
(Grant NsG-2323)
(NASA-CR-162452) Avail: NTIS HC A05/MF A01 CSCL 06K

The workshop is reported which was held to establish guidelines for future development of ecological support systems, and to develop a group of researchers who understand the interdisciplinary requirements of the overall program. For individual titles, see N80-12736 through N80-12738.

N80-12736*# Georgia Inst. of Tech., Atlanta.
EVALUATION OF A GROUND BASED MANNED DEMONSTRATION AS A MILESTONE IN CELSS DEVELOPMENT
In its Guiding the Development of a Controlled Ecological Life Support System Nov. 1979 p 8-75 (For primary document see N80-12735 03-54)
Avail: NTIS HC A05/MF A01 CSCL 06K

The requirements for a ground based manned controlled ecological life support system demonstration are summarized for the following: nutrition and food processing, food production, waste processing, systems engineering and modeling, and ecology-systems safety. F.O.S.

N80-12737*# Georgia Inst. of Tech., Atlanta.
DEVELOPMENT REQUIREMENTS FOR A SUCCESSFUL GROUND BASED CELSS DEMONSTRATION
In its Guiding the Development of a Controlled Ecological Life Support System Nov. 1979 p 16-49 refs (For primary document see N80-12735 03-54)
Avail: NTIS HC A05/MF A01 CSCL 06K

Considerations critical to a ground based control demonstration were identified. The controlled ecological life support system technologies were assessed for nutrition and food processing, food production, waste processing, and systems engineering/modeling. F.O.S.

N80-12738*# Georgia Inst. of Tech., Atlanta.
RESEARCH RECOMMENDATIONS
In its Guiding the Development of a Controlled Ecological Life Support System Nov. 1979 p 51-69 (For primary document see N80-12735 03-54)
Avail: NTIS HC A05/MF A01 CSCL 06K

The research and development sequences and priorities for CELSS development were established for each of the following areas: nutrition and food processing, food production, waste processing, systems engineering/modeling, and ecology-systems safety. F.O.S.

N80-12739*# Society of Automotive Engineers, Inc., New York. Bioenvironmental Systems Study Group.
EVALUATION AND COMPARISON OF ALTERNATIVE DESIGNS FOR WATER/SOLID-WASTE PROCESSING SYSTEMS FOR SPACECRAFT Final Report
J. M. Spurlock Jul. 1975 135 p refs
(Contract NASw-2439)
(NASA-CR-162492) Avail: NTIS HC A07/MF A01 CSCL 06K

Promising candidate designs currently being considered for the management of spacecraft solid waste and waste-water materials were assessed. The candidate processes were: (1) the radioisotope thermal energy evaporation/incinerator process; (2) the dry incineration process; and (3) the wet oxidation process. The types of spacecraft waste materials that were included in the base-line computational input to the candidate systems were feces, urine residues, trash and waste-water concentrates. The performance characteristics and system requirements for each candidate process to handle this input and produce the specified acceptable output (i.e., potable water, a storable dry ash, and vapor phase products that can be handled by a spacecraft atmosphere control system) were estimated and compared. Recommendations are presented. R.E.S.

N80-12740# Wisconsin Univ. - Milwaukee. Dept. of Systems Design.
SOME MODELS OF HUMAN ERROR FOR MAN-MACHINE SYSTEM EVALUATION Final Technical Report, 1 Jul. 1977 - 30 Dec. 1978
Marlin U. Thomas 15 May 1979 32 p refs Prepared in cooperation with Chrysler Corp., Detroit and Michigan Univ., Ann Arbor
(Contract N00014-77-C-0587)
(AD-A072838; TR-79-5) Avail: NTIS HC A03/MF A01 CSCL 05/8

A framework is presented for quantifying and modeling the occurance of human error events in a system. Decision tasks are classified according to the stochastic behavior of the relevant variables associated with the man-machine linkages. A general semi-Markov formulation is presented for describing transitions among error states. Closed form results for the time-between-errors are given through transform relationships for the case where interdecision times form a renewal process. An approximate time-between-error distribution is given that provides computational ease and compared well with some experimental data obtained from a laboratory human decision-making task. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N80-12741*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VALIDATION METHODS FOR FAULT-TOLERANT AVIONICS AND CONTROL SYSTEMS, WORKING GROUP MEETING 1
Washington Dec. 1979 112 p refs Workshop held at Hampton, Va., 12-14 Mar. 1979
(NASA-CP-2114; L-13436) Avail: NTIS HC A06/MF A01 CSCL 12A

The proceedings of the first working group meeting on validation methods for fault tolerant computer design are presented. The state of the art in fault tolerant computer validation was examined in order to provide a framework for future discussions concerning research issues for the validation of fault tolerant avionics and flight control systems. The development of positions concerning critical aspects of the validation process are given. R.C.T.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-12742 Virginia Polytechnic Inst. and State Univ., Blacksburg.
MULTIPROCESSOR ARCHITECTURES FOR SUPPORTING SECURE DATABASE MANAGEMENT Ph.D. Thesis
Robert Parker Trueblood 1979 194 p
Avail: Univ. Microfilms Order No. 7924148

A multiprocessor system supporting secure authorization with full enforcement (MULTISAFE) for database management is presented. The architecture of MULTISAFE combines the concepts of multiprocessing, pipelining, and parallelism to form a system organization partitioned into three modules: The user and application module (UAM), the data storage and retrieval module (SRM), and the protection and security module (PSM). Security is improved because it is physically impossible for a user to access the PSM or the SRM memories. The flow of messages in MULTISAFE is discussed and it is shown that this flow is secure. Abstract data operations on the data object message are used to describe the monitoring procedure for each module. Dissert. Abstr.

N80-12743 Carnegie-Mellon Univ., Pittsburgh, Pa.
BUILDING AND EXPLOITING USER MODELS Ph.D. Thesis
Elaine Alice Rich 1979 217 p
Avail: Univ. Microfilms Order No. 7925024

Stereotypes are proposed as a useful mechanism for building models of individual users on the basis of a small amount of information about them. A system, GRUNDY, that builds user

models with the aid of stereotypes, and then exploits those models to suggest novels that people may find interesting, is described. The system's performance is analyzed to provide some insight into the effectiveness of the user models. The techniques developed for GRUNDY are shown to be appropriate for at least two other domains. The tradeoffs involved in designing such a user modeler for an arbitrary system and the issues involved in the modification of the data base of stereotypes to better describe the system's actual users are discussed. Some questions raised by the ability to model individual users are raised. Dissert. Abstr.

N80-12744 Carnegie-Mellon Univ., Pittsburgh, Pa.
COMPILING CUSTOMIZED EXECUTABLE REPRESENTATIONS AND INTERPRETERS Ph.D. Thesis
Steven Ernest Saunders 1979 91 p
Avail: Univ. Microfilms Order No. 7925025

Issues in the design of executable representation (DELs) for programs are discussed and a compiler implementation which embodies responses to these issues is presented. Methods of tailoring a DEL to fit a chosen combination of host machine and source language, and customizing a tailored DEL to the needs and properties of particular source programs are emphasized. The experimental compiler implementation incorporates several customizing methods, including a tree pattern search for specialized instruction synthesis. The measured performance of the implementation gives promise that the methods presented will be of value. Dissert. Abstr.

N80-12745*# Harris Corp., Melbourne, Fla. Electro-Optics Dept.
OPTICAL MASS MEMORY INVESTIGATIONS. VOLUME 3: CONSIDERATIONS FOR THE DEVELOPMENT OF A DIGIMEM ARCHIVAL OPTICAL MASS STORAGE SYSTEM Final Technical Report, 14 May 1976 - 29 Jun. 1977
R. G. Zech, ed. Jun. 1977 89 p
(Contract NAS8-30564)
(NASA-CR-162460) Avail: NTIS HC A05/MF A01 CSCL 09B

Basic considerations relevant to the implementation of an archival mass storage system based on DIGIMEM technology are discussed in terms of evolving a new generation of mass storage systems which are archival, and cost effective. F.O.S.

N80-12746*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
AUTOMATIC DATA PROCESSING EQUIPMENT (ADPE) ACQUISITION PLAN FOR THE MEDICAL SCIENCES
Aug. 1979 35 p
(JSC-16075) Avail: NTIS HC A03/MF A01 CSCL 09B

An effective mechanism for meeting the SLSD/MSD data handling/processing requirements for Shuttle is discussed. The ability to meet these requirements depends upon the availability of a general purpose high speed digital computer system. This system is expected to implement those data base management and processing functions required across all SLSD/MSD programs during training, laboratory operations/analysis, simulations, mission operations, and post mission analysis/reporting. M.M.M.

N80-12747# Mitre Corp., Bedford, Mass.
ERROR CORRECTION CODING WITH NMOS MICROPROCESSORS. VOLUME 1: CONCEPTS
Eric N. Skoog May 1979 105 p refs
(Contract F19628-78-C-0001)
(AD-A072982; MTR-3618-Vol-1; ESD-TR-79-125-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

Error correction coding can be employed in the design of C3 systems to increase transmission reliability and enhance system effectiveness. The maturation of LSI technology and particularly the ubiquitous microprocessor now allow low-cost simple implementations of error coding hardware. Theoretical fundamentals of linear block codes are reviewed with respect to their suitability to decoder design utilizing 8-bit NMOS microprocessors. Key architectural features of NMOS microprocessors are analyzed to determine those characteristics that are best suited to performing decoding functions. A methodology for evaluating MIL-qualified candidate microprocessors is presented that leads to the selection of a microprocessor for the design of the decoder hardware. GRA

N80-12748# Mitre Corp., Bedford, Mass.
ERROR CORRECTION CODING WITH NMOS MICROPROCESSORS, VOLUME 2: A 6800-BASED 7, 3 REED-SOLOMON DECODER
J. R. Hamalainen and Eric N. Skoog May 1979 61 p refs
(Contract F19628-78-C-0001)
(AD-A073088; MTR-3618-Vol-2; ESD-TR-79-125-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 09/2

Design, operation and testing of a table-look-up microprocessor-based (Motorola MC6800) (7,3) Reed-Solomon decoder is presented. Decoder operation is fully illustrated by the use of error and erasure pattern examples. Exhaustive (complete) and random (Monte Carlo) testing is employed to exercise the decoder. Test results are analyzed and conclusions drawn relative to decoder performance. GRA

N80-12749# RDP, Inc., Waltham, Mass.
ATMOSPHERE EXPLORER MESA ACCELEROMETER DENSITY DATA BASE Final Report, 16 Mar. 1976 - 14 Jun. 1978
Robert W. Fioretti and Lawrence D. Cox 15 Jun. 1978 35 p refs
(Contract F19628-76-C-0169; AF Proj. 6690)
(AD-A072951; AFGL-TR-79-0062) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes the development of an extensive neutral atmospheric density data base generated from MESA accelerometer experiments. This data base represents the most extensive set of neutral density measurements in existence. Studies by AFGL scientists utilizing this data base are in preparation. GRA

N80-12750# Electronics Engineering Group (1842nd), Scott AFB, Ill.
LINE ACCESS TEST SYSTEM (LATS) Final Report
Mike Verstegen and John McCormack 15 Jul. 1979 26 p
(AD-A072768; Rept-1842-EEG/EETE/TR-79-12) Avail: NTIS HC A03/MF A01 CSCL 09/2

This technical report discusses the Line Access Test System (LATS) which can perform matrix switching operations on four wire circuits. Each circuit accessed may be tested for d.c. voltage, resistance, a.c. voltage and capacitance. A microprocessor control implementation is also included with the necessary programs for operation. GRA

N80-12751# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
RECENT AUTOMATION CHANGES IN MODEL VELOCITY ANALYSES AND DATA ACQUISITION BY MINIATURE PRICE METERS Final Report, Jul. 1974 - Jul. 1975
Donald L. Durham, Homer C. Greer, III, and Kent A. Turner May 1979 69 p refs
(AD-A072692; WES-HL-MP-79-6) Avail: NTIS HC A04/MF A01 CSCL 09/2

Recent automation of acquisition and analysis of velocity data collected by Price meters is presented in this report. Recent improvements to the fiber optic elements for the Price meter and development of electronic/binary counting circuits are discussed. A general description of a portable digital recording system and detailed documentation of its operating procedures are presented. In addition, documentation is provided for (a) the format of the output magnetic tape generated by the portable digital recording system, and (b) computer (H635) programs for reading and demultiplexing data on magnetic tape, editing and scaling velocity data, and reducing velocity data to a standard format for use in analysis programs and technical reports. GRA

N80-12752# California Univ., Berkeley. Lawrence Berkeley Lab.
DIRECTIONS FOR MEMORY HIERARCHIES AND THEIR COMPONENTS: RESEARCH AND DEVELOPMENT
A. J. Smith Oct. 1978 8 p refs
(Contract W-7405-eng-48)
(LBL-8276) Avail: NTIS HC A02/MF A01

The levels of a computer system memory hierarchy are considered and the state of the art and likely directions for research and development are described. Algorithmic and logical features of the hierarchy not directly associated with specific components are also discussed. The most significant problems

are the following: (1) evaluating the effectiveness of gap filler technology as a level of storage between main memory and disk and determining how/where it should be used; (2) developing algorithms for the use of mass storage in a large computer system; and (3) determining how cache memories should be implemented in very large, fast multiprocessor systems. DOE

N80-12753# Brookhaven National Lab., Upton, N. Y.
LARGE MASS STORAGE FACILITY
A. M. Peskin Aug. 1978 23 p refs
(Contract EY-76-C-02-0016)
(BNL-50900) Avail: NTIS HC A02/MF A01

The programmatic justification for the system presented is reviewed. Several candidate commercial products are identified and discussed. A draft of a procurement specification is developed. Some thoughts on possible new directions for computing at Brookhaven are also offered. DOE

N80-12754# Los Alamos Scientific Lab., N. Mex.
HIGH-SPEED GRAPHICS TERMINAL INTERFACE FOR A PDP-11 MINICOMPUTER
A. E. Spencer May 1979 10 p
(Contract W-7405-eng-36)
(LA-7840-MS) Avail: NTIS HC A02/MF A01

The Asynchronous Line Interface which provides a means of high-speed, asynchronous communications (up to 150 kilobits per second) with 4010 series Tektronix graphics display terminals is described. DOE

N80-12755# European Space Agency, Paris (France).
BACKGROUND STORAGE MANAGEMENT IN OPERATING SYSTEMS FOR COMMUNICATIONS COMPUTERS M.S. Thesis - Tech. Univ., Munich
Michail Melnikow May 1979 85 p refs Transl. into ENGLISH of 'Hintergrundspeicherverwaltung in Betriebssystemen fuer Kommunikationsrechner', DFVLR, Oberpfaffhofen Report DLR-FB-77-37, Aug. 22, 1977 Original report in German announced as N78-31821 Original German report available from DFVLR, Cologne DM 30,20
(ESA-TT-500; DLR-FB-77-37) Avail: NTIS HC A05/MF A01

A background storage management system adapted to the special purposes of communication computers is developed. The architecture of the background storage management system is described by a model consisting of three parts: storage management, data management, and data access methods. The file concept was investigated and formulated with respect to the organization of data on background storage. Using these basic ideas the structures and strategies of the various components of the model are demonstrated. The storage management system (PLADAT implemented on the communication computer TR869) is described in detail. Author (ESA)

N80-12756# Mathematics and Computation Lab., Washington, D. C. Information Science Div.
IMS 11: AN INFORMATION ON MANAGEMENT SYSTEM FOR THE PDP 11 COMPUTER Final Report
Nathan J. Ray Jun. 1979 111 p
(PB-298731/1; GSA/FPA/MCL-TM-274) Avail: NTIS HC A06/MF A01 CSCL 09B

The IMS 11 system, which facilitates the manipulation of data files on the PDP 11 series computing equipment, is described. The system features a query language based on a keyword concept and a random access technique that allows for rapid on-line updating as well as retrieving of data. The system is conversional in nature and is designed to service many users simultaneously while operating under control of the STAMOS time sharing system. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-12757 Johns Hopkins Univ., Baltimore, Md.
MATCHING ALGORITHMS Ph.D. Thesis
Alfred Burton Marsh 1979 220 p
Avail: Univ. Microfilms Order No. 7924624

An algorithm for finding an optimum weight perfect matching in a graph is described. A perfect matching is at hand throughout the algorithm, and a feasible solution to the dual problem is obtained only at termination. In many other respects, including its efficiency, it is similar to the blossom algorithm. Some advantages of this 'primal' algorithm for certain post-optimality problems are presented. An efficient algorithm for finding a set of 'K-best' matchings is developed based upon an assignment ranking scheme of Murty. An algorithm for optimum b-matching is given, whose computation bound depends logarithmically rather than linearly on the b's. The method uses the scaling approach introduced by Edmonds and Karp and a post-optimality method due to Pulley-blank. Some computational experience based upon a computer implementation of the blossom and primal algorithms (for weighted 1-matching) is reported. Dissert. Abstr.

N80-12758 Wisconsin Univ. - Madison.
SET EVALUATION Ph.D. Thesis
David Alan Gustafson 1979 156 p
Avail: Univ. Microfilms Order No. 7918895

An algorithm is presented that performs set evaluation on functions specified in a low level functional specification language. The algorithm is shown to always produce correct set evaluation results. The complexity of the algorithm is analyzed and shown to be polynomial bounded. The algorithm is compared with symbolic execution and program testing in terms of verifying range assertions and shown to be a computationally efficient, alternative method of validating software.

Dissert. Abstr.

N80-12759 Iowa Univ., Iowa City.
LANGUAGE RECOGNITION AND THE SYNCHRONIZATION OF CELLULAR AUTOMATA Ph.D. Thesis
Steven Roland Seidel 1979 336 p
Avail: Univ. Microfilms Order No. 7924527

The language-theoretic properties of three types of one dimensional cellular automata are compared and a link is established between a particular language recognition problem and the firing squad synchronization problem (FSSP). It is shown that the real time unilateral cellular acceptor (UCA) languages are incomparable to the real time serial input cellular acceptor (SCA) languages and properly contained within the real time bilateral cellular acceptor (BCA) languages. As an indication of the complexity of these automata it is shown that the empty intersection, emptiness, containment, and equality problems are undecidable for all the associated families of languages, all contain a non-Parikh-linear language, and while all are closed under inverse homomorphism, none are closed under homomorphism. It is also shown that there is an algorithm that transforms an arbitrary bilateral cellular space to a UCA that recognizes a language in real time if and only if the cellular space is an optimal solution to the FSSP. This should lead to a better understanding of the nature of parallel computation.

Dissert. Abstr.

N80-12760 Columbia Univ., New York.
QUALITY CONSIDERATIONS IN A PROGRAMMING LANGUAGE Ph.D. Thesis
Theodore Eric Mankovich 1979 372 p
Avail: Univ. Microfilms Order No. 7924938

Aspects of computer languages are examined using quality as a guiding point in order to identify problem areas in language design and usage. A new language, Q, is defined which contains a robust data declaration structure for allowing full control of data communication between modules. The selection mechanism is expanded and unified to provide a thorough treatment of this important group of mechanisms. In addition, several meta programming techniques such as coroutines and state tables are explored. These techniques of usage expand the concept of quality programming beyond the definition and use of language constructs. The proper approach to these methodologies is as important to quality as having the proper syntactic tools.

Dissert. Abstr.

N80-12761 Columbia Univ., New York.
THE DESIGN AND ANALYSIS OF A PARALLEL PROCESSING LANGUAGE Ph.D. Thesis

Nadim Robert Habra 1979 323 p
Avail: Univ. Microfilms Order No. 7924898

A high level language for parallel processing, HOPTRAN, is described as a parallel extension to FORTRAN 4. Implementation and code generation are discussed in detail. HOPTRAN is used and analyzed in four application problems and the simulated HOPTRAN program executions are compared against the scalar counterparts. Speedup, efficiency, and occupancy are used as indices of parallel processing efficiency. Dissert. Abstr.

N80-12762 California Univ., Los Angeles.
DESIGN AND MEASUREMENT OF IMPLEMENTATION SCHEMES FOR RETENTION STORAGE MANAGEMENT AS UTILIZED IN BLOCK STRUCTURED LANGUAGES Ph.D. Thesis
Michael Anthony Erlinger 1979 435 p
Avail: Univ. Microfilms Order No. 7926033

Problems in implementing block structured languages containing pointer, procedure, and label variables are discussed and a generalized model, the GMML, capable of retention or deletion storage management is presented. A lifetime stack machine (LSM) GMML utilizing deletion storage management and a partial reference count contour model (PRCCM) GMML utilizing retention storage management are designed and compared for the execution of a lifetime well-stacking (LWS) benchmark. For a large subset of the lifetime well-stacking programs, the PRCCM is shown to have large overhead dedicated to storage management. Another machine model, the partial reference count stack contour model, is then designed and demonstrated to be a much more efficient machine for the execution of LWS programs than the PRCCM and to more closely approach the LSM performance for such programs. Dissert. Abstr.

N80-12763 Yale Univ., New Haven, Conn.
SKIMMING STORIES IN REAL TIME: AN EXPERIMENT IN INTEGRATED UNDERSTANDING Ph.D. Thesis
Gerald Francis Dejong, II 1979 348 p
Avail: Univ. Microfilms Order No. 7925621

The process of interpreting input text words is shown to be greatly simplified if it is viewed as one component of a highly integrated understanding process. A computer program called FRUMP (Fast Reading Understanding and Memory Program) demonstrates how this integration can be accomplished. The program works on a broad domain of inputs which are not required to follow a constraining grammar. In FRUMP the text analyzer is embedded in a predictive understander. All of the world knowledge and top down predictions of the understander are available to the text analyzer. A data construct called a sketchy script is used to store world knowledge. FRUMP continually jumps to conclusions about what the text means and generates predictions about what might occur next. The text analysis process is reduced to finding a reading of the text that satisfies these predictions. The problem of script selection is addressed and a general solution for FRUMP's purposes is given. Dissert. Abstr.

N80-12764 Yale Univ., New Haven, Conn.
SUBJECTIVE UNDERSTANDING: COMPUTER MODELS OF BELIEF SYSTEMS Ph.D. Thesis
Jaime Guillermo Carbonell 1979 467 p
Avail: Univ. Microfilms Order No. 7925636

A process model embodying a theory of subjective understanding was implemented in a computer system, POLITICS. POLITICS models human ideological reasoning in understanding the natural language text of international political events and demonstates its understanding by answering questions in natural language question-answer dialogs. Political ideologies are represented by POLITICS as goal trees that structure the motivations of political actors and the relative importance of the various motivations. Counterplanning strategies determine when, how, and why political actors attempt various plans to thwart each other's goals, nullify each other's thwarting attempts, or end mutual hostilities. The subjective goal trees determine the focus of attention for the reasoning process. The theory of subjective understanding was embodied in other process models in addition to POLITICS and implemented as computer programs. These programs are TRIAD, a system that models human understanding of social conflict situations, and MICS, a system that models a participant in a natural language conversation. Dissert. Abstr.

N80-12765*# M&S Computing, Inc., Huntsville, Ala.
RESEARCH STUDY: DEVICE TECHNOLOGY STAR ROUTER USER'S GUIDE
R. A. Wright 27 Feb. 1979 49 p
(Contract NAS8-32632)
(NASA-CR-161213) Avail: NTIS HC A03/MF A01 CSCL 09B

The STAR Router program developed to perform automated layout of LSI discretionary interconnection masks is described. The input and output for the router are standard PR2D data files. A state-of-the-art cellular path-finding procedure, based on Lee's algorithm, which produces fast, shortest distance routing of microcircuit net data is included. J.M.S.

N80-12766*# Intermetrics, Inc., Long Beach, Calif.
PROGRAMMING IN HAL/S
Michael J. Ryer Sep. 1979 341 p For first edition see N79-14808
(Contract NAS9-13864)
(NASA-CR-162501) Avail: NTIS HC A15/MF A01 CSCL 09B

Intended as an introduction to programming in HAL/S, this manual is organized as a tutorial aid which may be used as part of a self-study program or in conjunction with a course of twenty to forty classroom hours over a period of one to two weeks. A number of corrections to the first edition are incorporated into the text along with a chapter on FIXED data and an additional appendix on FORMAT I/O. A.R.H.

N80-12767# George Washington Univ., Washington, D. C. Program in Logistics.
A SEPARABLE PROGRAMMING APPROACH TO THE LINEAR COMPLEMENTARITY PROBLEM
Jonathan F. Bard and James E. Falk 22 Jun. 1979 19 p refs
(Contract N00014-75-C-0729)
(AD-A072928; Serial-T-403) Avail: NTIS HC A02/MF A01 CSCL 12/1

The linear complementarity problem (LCP) is reformulated as a nonconvex, separable program and solved with a general branch and bound algorithm. Unlike the principal alternatives, the approach offered here works for all linear complementarity problems regardless of their underlying matrix structure. In the reformulated version, the optimal value is known at the outset so a convergence check can be made at each iteration of the algorithm. This greatly increases its performance; in fact, a number of cases are given where immediate convergence can be expected. GRA

N80-12768# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A PARAMETRIC MANAGEMENT TOOL FOR ESTIMATING SIMULATOR SOFTWARE SIZE M.S. Thesis
Gregory N. Frey and Kenneth L. Wildung Jun. 1979 201 p refs
(AD-A073015; AFIT-LSSR-4-79A) Avail: NTIS HC A10/MF A01 CSCL 09/2

This research investigated the causes of escalating software costs relative to Aircrew Training Devices (simulators) and resulted in a software sizing tool useful in reversing the cost growth trend. The hypothesis was that a collective software sizing estimate, aggregated and standardized at the functional level, would provide a more reliable estimate of simulator software size. Investigation disclosed that the heuristic sizing techniques being used were inadequate. There was no organized empirical data-base to support a formalized software sizing process. A software management model called SIMSIZ, including a supporting data-base, was designed and developed. The model's primary function is to assist software engineers in making realistic evaluations of the size of contractor's proposed software packages. It was concluded that a major cause of software program delays has been a growth trend in software size during program development. SIMSIZ has demonstrated that several software projects under development are undersized. The researchers

recommend establishing a requirement to standardize simulator software development and reporting at the functional level. GRA

N80-12769# Michigan Univ., Ann Arbor. Systems Engineering Lab.
A COLLECTION OF EQUATION-SOLVING CODES FOR THE CRAY-1
D. A. Calahan, W. G. Ames, and E. J. Sesek 1 Aug. 1979 23 p refs
(Grant AF-AFOSR-2812-75; AF Proj. 2304)
(AD-A073033; SEL-133; AFOSR-79-0932TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report contains user documentation and timing results for a collection of assembly language equation-solving codes for the CRAY-1. GRA

N80-12770# Harry Diamond Labs., Adelphi, Md.
THE INFINITE PARALLEL-WIRE ARRAY OVER A GROUND PLANE: A CODE FOR AN EMP VULNERABILITY ASSESSMENT AND HARDENING PROGRAM
Michael J. Vrabel Jul. 1979 17 p refs
(AD-A073103; HDL-TM-79-19) Avail: NTIS HC A02/MF A01 CSCL 09/2

Elements of the multiwire parallel array over a ground plane are addressed with a systems related EMP vulnerability assessment and hardening orientation. An abbreviated computer program supported by experimental data permits a calculation of the degree of interaction of the wires of a parallel array, the individual wire and array impedance to ground, and the relative current distribution among the wires exclusive of wire end loading. This represents the foundation for an inclusive EMP code. GRA

N80-12771# California Univ., Santa Cruz. Information Sciences.
GENERATING CORRECT PROGRAMS FROM LOGIC SPECIFICATIONS Ph.D. Thesis
Ruth Ellen Davis 24 May 1979 201 p
(Contract N00014-76-C-0682)
(AD-A073023; TR-79-5001) Avail: NTIS HC A10/MF A01 CSCL 09/2

We have designed and implemented a system that accepts logic specifications, generates algorithms in an intermediate language, and then translates these algorithms into programs in specific target languages. The specification and intermediate languages are described in detail via their context free grammars and axiomatic semantics. It has been proved that the mappings preserve the axiomatic semantics of the programs. We discuss the system as implemented, the requirements for extending it to new target languages, and further work suggested by the project. GRA

N80-12772# Sandia Labs., Albuquerque, N. Mex.
INPUT AND TABLE-HANDLING FACILITY FOR FORTRAN PROGRAMS
R. E. Jones Mar. 1979 101 p
(Contract EY-76-C-04-0789)
(SAND-78-1165) Avail: NTIS HC A06/MF A01

An input and table handling facility for FORTRAN programs is described. This facility, when incorporated into a FORTRAN program, allows input to FORTRAN programs to be prepared in an easy, natural form. It also allows users to input n-dimensional tables in a flexible manner, and allows the FORTRAN program to use these tables easily. Complete details are given on how to incorporate this facility into a program and how to prepare input to be read by this facility. DOE

N80-12773# Engineering Science and Systems Corp., San Diego, Calif.
ASSESSMENT OF PROCEDURES AND PRELIMINARY SOFTWARE DESIGN FOR FAULT TREE SYNTHESIS
H. J. Payne Oct. 1978 72 p refs
(Contract W-7405-eng-48)
(UCRL-13919; ES-R-A007-01) Avail: NTIS HC A04/MF A01

The safeguards effectiveness assessment methodology was applied to the assessment of the material control and accounting (MC and A) systems. A representation of the MC and A system and potential adversary actions is created as a directed network (digraph), and a fault tree is synthesized from the digraph. It is shown that the Lapp-Powers approach to constructing the digraph is not capable of handling the MC and A assessment problem. Software functional specifications are given. DOE

N80-12774# Los Alamos Scientific Lab., N. Mex.
INTERACTIVE USE OF COMPUTER DRAWN FACES TO STUDY MULTIDIMENSIONAL DATA
L. A. Bruckner and C. F. Mills Mar. 1979 39 p
(Contract W-7405-eng-36)
(LA-7752-MS) Avail: NTIS HC A03/MF A01

The code presented, DRFACE, allows the user to view facial representations of data at a graphics terminal and then, by easily made changes, to display new representations of the same data. The user can change the facial feature/data variable assignments, the facial feature ranges, and default values. This ability permits the user to determine if observations made about the data from viewing the first set of faces are due to chance assignments or actually reflect patterns in the data. DOE

N80-12775# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.
UNIVERSAL P-CODE DEFINITION, VERSION (0.3)
Richard L. Sites and Daniel R. Perkins Jul. 1979 45 p Sponsored in part by LASL and LLL
(PB-298577/8; UCSD/CS-79/037) Avail: NTIS HC A03/MF A01 CSCL 09B

Universal P-code (U-code), version (0.3) is officially defined as a language independent of U-code processors. The U-code is a compiler intermediate language into which many existing Pascal P-codes can be mapped. Processors exist to map Pascal and FORTRAN into U-code, and to map Cray-1 P-code into U-code. In turn, processors exist to map Pascal and Model into Cray-1 P-code. Translators also exist to map U-code into Cray-1 P-code and into S-1 machine language. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-12776*# American Mathematical Society, Providence, R.I.
SYSTEM THEORY AS APPLIED DIFFERENTIAL GEOMETRY
Robert Hermann Nov. 1979 67 p refs
(Grant NSG-2252)
(NASA-CR-3209) Avail: NTIS HC A04/MF A01 CSCL 09B

The invariants of input-output systems under the action of the feedback group was examined. The approach used the theory of Lie groups and concepts of modern differential geometry, and illustrated how the latter provides a basis for the discussion of the analytic structure of systems. Finite dimensional linear systems in a single independent variable are considered. Lessons of more general situations (e.g., distributed parameter and multidimensional systems) which are increasingly encountered as technology advances are presented. R.C.T.

N80-12777# Washington Univ., St. Louis, Mo. Dept. of Systems Science and Mathematics.
DESIGN AND PERFORMANCE EVALUATION FOR SYSTEMS IN AN UNCERTAIN ENVIRONMENT Final Report, 1 Mar. 1976 - 30 Jun. 1979
Ian B. Rhodes 23 Aug. 1979 174 p refs
(Contract N00014-76-C-0667)
(AD-A073207) Avail: NTIS HC A08/MF A01 CSCL 12/2

Included in this report are results of investigations into the

following topics: design and performance evaluation of optimal and suboptimal estimation and tracking systems for space-time point-process observations; optimal signal design for coded, direct-detection optimal communication systems; informationally-decentralized shortest path algorithms for networks; singular estimation and control problems; compensator design for polynomial matrix descriptions of linear multivariable systems; a direct proof of the informational equivalence of the innovations and observations processes for linear estimation or Gaussian processes; and quantitative measures of controllability and observability and their implications in system analysis and performance evaluation. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-12778 Princeton Univ., N. J.
FINITE GROUP ACTIONS ON SIMPLY-CONNECTED MANIFOLDS AND CW COMPLEXES Ph.D. Thesis
Amir Hossein Assadi 1979 85 p
Avail: Univ. Microfilms Order No. 7918548

The existence and construction of embeddings of a given G-CW complex (G-manifold) in another G-CW complex (G-manifold) having a prescribed homotopy type and a prescribed family of isotropy sub-groups are discussed. It is shown that for the case of compact complexes, obstructions can be specified as lying in the quotient of Grothendick groups of certain categories of equivariant complexes. In the non-compact case, the embedding is possible under favorable hypotheses. Topological and PL actions of finite groups on spheres leaving any finite simplicial complex stationary are demonstrated. Classification of concordance classes of actions and construction of equivariant embeddings are discussed. Dissert. Abstr.

N80-12779 Michigan Univ., Ann Arbor.
LINEAR EXTREMAL PROBLEMS IN THE CLASS OF UNIVALENT FUNCTIONS Ph.D. Thesis
Johnny Earl Brown 1979 84 p
Avail: Univ. Microfilms Order No. 7925118

Using variational techniques in the class S, the support points were investigated for the point-evaluation functionals phi (g) = g (z sub zero) and the functionals phi (g) = (a sub 3 + lambda a sub 2). The problem max Re g(z) sub zero, g epsilon S was solved completely. The support points corresponding to the point-evaluation functionals are determined explicitly and are shown to be extreme points of S. Applying some of the same techniques, similar geometric properties were obtained of the omitted arcs of the support points for phi (g) = (a sub 3 + lambda a sub 2). These omitted arcs lie in sectors and have monotonic arguments. Dissert. Abstr.

N80-12780 North Carolina Univ. at Chapel Hill.
SOME ASPECTS OF THE LOCAL AND GLOBAL THEORY OF PFAFFIAN SYSTEMS Ph.D. Thesis
Robert Leamon Bryant 1979 54 p
Avail: Univ. Microfilms Order No. 7925892

Smooth sub-bundles of the cotangent bundle of a smooth manifold which do not necessarily satisfy the conditions of complete integrability are considered. The structure tensor associated to the sub-bundle which measures the amount of deviation from complete integrability is exploited in order to prove local structure theorems about these sub-bundles. In particular, it is shown that a sub-bundle is locally equivalent to the bundle of contact forms on J(1)(R(m),R(n)) if its structure tensor satisfies certain mild restrictions. Vanishing theorems analogous to that of Bott for the integrable case are considered and it is proved that there are relations among the exotic classes for these bundles and their derived bundles. Dissert. Abstr.

N80-12781 New York Univ., N. Y.
HIGH-ORDER ACCURATE SOLUTION OF LAPLACE'S EQUATION ON GENERAL REGIONS USING INTEGRAL EQUATION METHODS AND FAST POISSON SOLVERS Ph.D. Thesis
Anita Alberta Mayo 1979 55 p
Avail: Univ. Microfilms Order No. 7925494

Fast methods are developed for the numerical solution of a variety of elliptic partial differential equations on arbitrary irregular regions. The methods use an integral equation formulation in a small carefully chosen region near the boundary, and use fast solvers to extend the solution to the rest of the region. Error estimates are obtained and numerical results are shown to agree with those estimates. The techniques work well for both Neumann and Dirichlet data, and for problems on interior, multiconnected, and exterior regions, as well as for regions with interior corners. Moreover, the computation of fourth order solutions is only slightly more expensive than those of second order. Since integral equations are used, the conjugate of a harmonic function can be computed at small additional cost. This proves useful in the application of our methods to problems in conformal mapping. The techniques are also applied to a problem in elasticity. Dissert. Abstr.

N80-12782*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
MODULAR THEORY OF INVERSE SYSTEMS Final Report, 1 Jun. - 31 Dec. 1979
Dec. 1979 57 p refs Submitted for publication
(Grant NsG-2388)
(NASA-CR-162491) Avail: NTIS HC A04/MF A01 CSCL 12A

The relationship between multivariable zeros and inverse systems was explored. A definition of zero module is given in such a way that it is basis independent. The existence of essential right and left inverses were established. The way in which the abstract zero module captured previous definitions of multivariable zeros is explained and examples are presented. R.C.T.

N80-12783# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
COVARIANCE SEQUENCE APPROXIMATION WITH APPLICATIONS TO SPECTRUM ANALYSIS AND DIGITAL FILTER DESIGN
A. A. Beex and L. L. Scharf Jul. 1979 150 p refs
(Contract N00014-75-C-0518)
(AD-A072884; CSU-TR-26(ONR)) Avail: NTIS HC A07/MF A01 CSCL 12/1

Modeling and estimation procedures for covariance sequence and spectrum approximation are developed in this thesis. The covariance sequence is modeled as a complex linear combination of damped complex exponentials. This model arises naturally as the representation for the covariance sequence associated with a strictly proper ARMA(M,N) system driven by white noise. Related to this seemingly natural covariance model is a synthesis procedure for a subclass of wide sense stationary ARMA(M,N) processes. The resulting spectral representation for the covariance sequence is a positive real linear combination of damped complex exponentials, a generalization of the standard representation in terms of stochastic almost periodic functions. The importance of the generalized structure lies in the more efficient representation of a large class of wide sense stationary processes. For this parametric approach estimation techniques are developed that lie in philosophy somewhere between the nonlinear least squares approach and the tractable modified least squares procedure. The resulting parameter estimation equations are linear, except for a single polynominal rootfinding problem that must be solved. GRA

N80-12784# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
ON THE EXISTENCE OF SIMPLE LIAPUNOV FUNCTIONS FOR LINEAR RETARDED DIFFERENCE DIFFERENTIAL EQUATIONS Interim Report
L. A. V. Carvalho, E. F. Infante, and J. A. Walker Jul. 1979 35 p refs Prepared in cooperation with Universidade Federal de Goias, Goiania, Brazil and Northwestern University, Evanston, Ill.
(Contract N00014-76-C-0278; AF-AFOSR-3092-76; Grants NSF eng-76-81570; NSF MCS-78-18858; ARO-D-31-124-73-G130; AF Proj. 2304)
(AD-A072762; AFOSR-79-0920TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Liapunov functions of simple form have been used for the study of stability properties of difference-differential equations. In this paper, we provide necessary and sufficient conditions for the existence of such functions. GRA

N80-12785# Brown Univ., Providence, R. I. Center for Dynamical Systems.
SPLINE APPROXIMATIONS FOR FUNCTIONAL DIFFERENTIAL EQUATIONS Interim Report
H. T. Banks and F. Kappel (Graz Univ.) Aug. 1978 53 p refs
(Grants AF-AFOSR-3092-76; NSF GP-28931; AF Proj. 2304)
(AD-A072763; AFOSR-78-1442TR) Avail: NTIS
HC A04/MF A01 CSCL 12/1

An approximation framework is developed for linear hereditary systems which includes as special cases approximation schemes employing splines of arbitrary order. Numerical results for first and third order spline based methods are presented and compared with results obtained using a previously developed scheme based on averaging ideas. GRA

N80-12786# Colorado State Univ., Fort Collins. Dept. of Mathematics.
UNIFORM APPROXIMATION BY RATIONAL FUNCTIONS HAVING RESTRICTED DENOMINATORS Interim Report
G. D. Taylor and E. H. Raufman, Jr. (Central Michigan Univ.) 1979 24 p refs
(Grants AF-AFOSR-2878-76; NSF MCS-78-05847; AF Proj. 2304)
(AD-A072835; AFOSR-79-0897TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This paper considers approximation of continuous functions on a compact metric space by generalized rational functions for which the denominators have bounded coefficients and are bounded below by a fixed positive function. This lower bound alleviates numerical difficulties, and in some applications (e.g., digital filter design) has a useful physical interpretation. A zero in the convex hull characterization of best approximations is developed and used to prove uniqueness and de la Vallee Poussin results. Examples are given to illustrate this theory and its differences with the standard theory, where the denominators are merely required to be positive. A modified differential correction algorithm is presented and is proved to always converge at least linearly, and often quadratically. GRA

N80-12787# SRI International Corp., Menlo Park, Calif.
TWO-DIMENSIONAL MESH ADJUSTMENT ALGORITHM Annual Report, 1 Jun. 1978 - 31 May 1979
C. M. Ablow and S. Schecter 31 Jul. 1979 8 p refs
(Contract F49620-77-C-0114; AF Proj. 2304)
(AD-A073060; AFOSR-79-0938TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This second year of research effort has produced a mesh adjustment algorithm for the solution of one-dimensional boundary-value problems based on an arbitrarily given monitor function. A second, more complex algorithm simultaneously finds the solution and the optimal monitor to minimize the truncation error. The results provide an immediately applicable technique for the solution of stiff differential systems such as arise in reactive duct flow problems, as well as a firm basis for the extension to the higher dimensional problems of viscous duct flow or external lifting flows. GRA

N80-12788# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SPECTRAL ANALYSIS OF TIME SERIES M.S. Thesis
Anthony L. Bertapelle Mar. 1979 60 p refs
(AD-A072921; AFIT/GST/MA/79M-1) Avail: NTIS
HC A04/MF A01 CSCL 12/1

One use of spectral analysis of time series is to determine if two different time series are realizations from the same process. This thesis develops the theory behind Krishnaiah and Schuurmann's theoretical work reported in their report Approximations to the Distributions of the Traces of Complex Multivariate Beta and F Matrices. We take the trace of a test statistic calculated from the spectral density matrices of the time series and test it. The thesis applies the theory to two small sample simulations. GRA

N80-12789# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
ON THE RELATIONSHIP BETWEEN THE R AND S ARRAYS AND THE BOX-JENKINS METHOD OF ARMA MODEL IDENTIFICATION
Wayne A. Woodward and H. L. Gray 25 Jul. 1979 39 p refs
(Contract N00014-75-C-0439; NR Proj. 042-280)
(AD-A072934; TR-134) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper an extension of the partial autocorrelation function which we call the generalized partial autocorrelation function is investigated. This generalized partial autocorrelation function is useful in examining the relationship between the R- and S-array method of Gray, Kelley, and McIntire and the Box-Jenkins approach to ARMA model identification. Also the generalized partial autocorrelation is shown to be a useful model identification tool to be used along with the R- and S-arrays. Also discussed is a reformatting of the S-array into the shifted S-array which the authors believe to be easier to use in practice than the S-array. The methods of this paper are illustrated by means of examples including an analysis of the Makridakis metals series data. GRA

N80-12790# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
A CONDITIONAL PROPERTY OF ADAPTIVE ESTIMATORS
William C. Parr 25 Jul. 1979 15 p refs
(Contract N00014-75-C-0439)
(AD-A072991; TR-133) Avail: NTIS HC A02/MF A01 CSCL 12/1

In adaptive estimation, it is often considered that an estimator has made a mistake if the component estimator chosen for use is not the most efficient for the distribution sampled. Theoretical and simulation results point to a fallacy in this line of thought. The Monte Carlo study involves extension of the Princeton Swindle to distributions conditional on a location-and scale free statistic, and to the uniform. The results give a partial explanation for the sometimes surprising robustness of adaptive L-estimators. GRA

N80-12791# Pittsburgh Univ., Pa. Inst. for Computational Mathematics and Applications.
INVERSION OF ISOPARAMETRIC MAPPINGS AND APPLICATIONS OF COMPUTER GRAPHICS TO THREE DIMENSIONAL FINITE ELEMENT ANALYSES Final Report
Charles A. Hall and Thomas A. Porsching Jul. 1979 33 p refs
(Contract F44620-76-C-0104)
(AD-A073013; ICMA-79-08; AF-79-1) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Finite element analyses of two and three dimensional structures often require the use of curved isoparametric elements. The overall effectiveness of such analyses by large scale finite element computer programs is often handicapped by the costly and tedious job of verifying input data and the lack of a comprehensive graphical presentation of the output. This contract work involved mathematical research concerning various approaches to improving this pre and post processing of finite element data utilizing interactive computer graphics. A key aspect of this work was the characterization of the existence of the inverses of isoparametric mappings, as well as the development of efficient algorithms for the numerical inversion of such mappings. GRA

N80-12792# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
ON THE SOLUTION OF A CERTAIN LINEAR LEAST SQUARES FIT PROBLEM Interim Report, Jul. 1978 - Apr. 1979
Donald A. Gignac Jun. 1979 27 p refs
(SR0140301; ZF53532001)
(AD-A072689; DTNSRDC/CMLD-79/07) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This report investigates the difficulties encountered with respect to a certain linear least squares fit problem which arises in the field of holographic interferometry. It was found that the addition of another variable to the equations of this linear least

squares fit problem explained these difficulties and provided consistent results. This report also demonstrates the usefulness of Stewart's recently published perturbation bounds for the purpose of error bounding. GRA

N80-12793# Maryland Univ., College Park. Inst. for Physical Science and Technology.
DIRECT AND INVERSE ERROR ESTIMATES FOR FINITE ELEMENTS WITH MESH REFINEMENTS
I. Babuska, R. B. Kellogg, and J. Pitkaeranta Apr. 1979 45 p refs
(Contract EY-76-S-05-3443)
(ORO-3443-81; BN-907) Avail: NTIS HC A03/MF A01

The finite element method is used to solve a second order elliptic boundary value problem on a polygonal domain. Mesh refinements and weighted Besov spaces are used to obtain optimal error estimates and inverse theorems. DOE

N80-12794# Los Alamos Scientific Lab., N. Mex.
BLOCK RELAXATION TECHNIQUES FOR FINITE-ELEMENT ELLIPTIC EQUATIONS: AN EXAMPLE
D. L. Boley and S. V. Parter Jun. 1979 19 p refs
(Contract W-7405-eng-36)
(LA-7870-MS) Avail: NTIS HC A02/MF A01

The Ritz-Galerkin equations for the numerical solution of the two-point boundary value problem, u double prime = f, o < or = x < or = 1, u(o) = u(1) = 0, are considered. Ritz-Galerkin subspaces of hermite cubic splines with equally spaced knots are examined. These equations are then solved via iterative methods. The rate of convergence of these methods is estimated. DOE

N80-12207 Institut Franco-Allemand de Recherches, St. Louis (France).
THE USE OF HAMILTONIAN QUATERNIONS FOR DETERMINING THE TRANSLATIONAL AND ROTATIONAL MOTION OF A PROJECTILE
V. Fleck *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 22-35 refs In GERMAN; ENGLISH summary
(For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-12795 American Univ., Washington, D. C.
ADAPTIVE PROCEDURES IN ANALYSIS OF VARIANCE Ph.D. Thesis
William Clark Rinaman 1979 187 p
Avail: Univ. Microfilms Order No. 7924361

Adaptive procedures are developed for testing main effects in one and two way analysis of variance situations. The adaptive testing procedure consists of selecting tests for use when the population distributions have light, medium, or heavy tail weight, respectively, and using a tail weight detection scheme to select the appropriate test. The asymptotic properties of Kruskal-Wallis like statistics based on trimmed samples are developed for the one way case. FOr the two way situation, Sen's generalization of the Friedman test is further generalized to the case of more than one observation per cell. In addition, for the case where the number of observations per cell is large compared to the number of blocks, the trimmed sample tests already developed are adapted for use in the two way case. Computer simulations are used to compare the resulting adaptive procedures with the single test statistics for small sample sizes. Dissert. Abstr.

N80-12796 Boston Univ., Mass.
EFFECTS OF CATEGORIZATION ON RELATIONSHIPS IN BIVARIATE DISTRIBUTIONS AND APPLICATIONS TO RATING SCALES Ph.D. Thesis
Lily Neumann 1979 127 p
Avail: Univ. Microfilms Order No. 7923947

The problems of scale length and effects of grouping on relationships among variables were approached both theoretically and practically. Effects of grouping on the correlation coefficient and on proportional reduction in variance were examined for several bivariate distributions: uniform, normal, exponential, and logistic. In general, the change in these measures of association decreased as the number of classification groups increased. The pattern and degree of change were very similar for five, seven, and ten point scales. This fact was also supported by the results of a questionnaire on students' satisfaction with courses, which was designed to compare six rating scales. The longer scales resulted in similar outcomes. A clear preference (by the respondents) was given to scales with a neutral point. Dissert. Abstr.

N80-12797 Johns Hopkins Univ., Baltimore, Md.
MEASURING INTER-RATER RELIABILITY OF DICHOTOMOUS RESPONSES: A COMPONENTS OF VARIANCE APPROACH Ph.D. Thesis
Ellen Jane Mackenzie 1979 132 p
Avail: Univ. Microfilms Order No. 7924622

A multistage modeling of the random variables Y sub ij (of which the ratings of the ith subject by the jth rater are observed values) is presented. The unconditional variation in the Y sub ij is determined and shown to partition into components corresponding to subject and shown to partition into components corresponding to subject and rater effects. Agreement is measured by the intraclass correlation coefficient, defined as the proportion of total variation in ratings which can be explained by differences in subjects. The components of variance model developed for dichotomous data is completely specified within the general two stage framework. Four models are considered: (1) random subject, no rater effects; (2) random subject, random rater effects; (3) random subject, fixed rater effects; and (4) fixed subject, random rater effects. The resulting estimators are interpreted within the context of reliability experiments and are compared with other proposed measures of agreement. Dissert. Abstr.

N80-12798 North Carolina Univ. at Chapel Hill.
TOWARDS RECONSTRUCTION OF AN UN-PAIRED RANDOM SAMPLE Ph.D. Thesis
Donna Jeanne Lucas 1979 115 p
Avail: Univ. Microfilms Order No. 7925942

The probability of occurrence of a sufficient condition for equivalency of the maximum likelihood and optimal solutions when the broken random sample is from a bivariate normal distribution is examined. For the problem of matching one particular observation of the unpaired random sample, a procedure based on the most probable rank of the concomitant of that observation is proposed. The maximum likelihood solution to the matching problem for multivariate normal data when each observation vector is separated into three components is given. Additionally, reconstruction of partially broken random samples is presented in the framework of regression and experimental designs. For the case in which the partially unpaired random sample arises from a bivariate normal distribution, the maximum likelihood estimator of the correlation coefficient is derived. Where X and Y have an absolutely continuous bivariate distribution, the joint distribution is discussed as a tool in examining the consequences of estimation and testing procedures applied to re-paired samples. Dissert. Abstr.

N80-12799 North Carolina Univ. at Chapel Hill.
RANK TESTS FOR RESTRICTED ALTERNATIVE PROBLEMS IN MULTIVARIATE ANALYSIS Ph.D. Thesis
Vernon Michael Chinchilli 1979 182 p
Avail: Univ. Microfilms Order No. 7925899

Restricted alternative hypothesis problems in multivariate analysis are discussed. The tests considered include: (1) the likelihood ratio (LR) statistic for testing the hypothesis that the multivariate normal distribution with known covariance matrix is zero against the hypothesis that it lies in the nonnegative orthant; (2) the LR statistic for restricted alternatives involving the mean of a multivariate distribution whose covariance matrix is not completely specified; and (3) a bivariate linear rank statistic used in conjunction with the union-intersection principle for a bivariate, two sample, restricted location problem and an order restriction problem with randomized blocks. Dissert. Abstr.

N80-12800 North Carolina Univ. at Chapel Hill.
LIMITING BEHAVIORS OF CERTAIN CONTINUOUS TIME-PARAMETER STOCHASTIC PROCESSES AND THEIR APPLICATIONS Ph.D. Thesis
Yi Tsong 1979 138 p
Avail: Univ. Microfilms Order No. 7925975

The asymptotic Wiener process properties of a class of continuous time parameter stochastic processes are obtained. These results are also studied in supnorm topology. Applications of these results arising in life testing under progressive truncation schemes are given. The asymptotic Wiener process properties of the progressively truncated likelihood ratio statistic in Skorokhod topology as well as in supnorm topology are obtained. Limiting distributions of the statistic under a sequence of contiguous alternatives are studied. An extension to the multiparameter case is also studied. These results are applied to the hypothesis testing and parameter estimation in life testing under progressive truncation schemes. Comparisons are made by using Bahadur asymptotic relative efficiencies on the test statistics under progressive truncation schemes and under fixed point truncation schemes. Dissert. Abstr.

N80-12801 California Univ., Riverside.
STATISTICAL INFERENCE IN MARKOV CHAINS USING THE PRINCIPAL OF MINIMUM DISCRIMINATION INFORMATION Ph.D. Thesis
Said Mohamed Rujbani 1979 107 p
Avail: Univ. Microfilms Order No. 7924303

The principal of minimum discrimination information is applied to some Markov models in a manner similar to that applied to contingency tables and in a form suitable for use by applied statisticians. Basic concepts of information theory are introduced, minimum discrimination information estimation is discussed, and analysis of information tables are constructed. Methods are outlined for assessing the order of a chain and transforming higher order chains to lower order ones. Tests of homogeneity, symmetry, and stationarity are presented along with a test of the hypothesis of order t against that of order t prime (t prime < t). An embedded Markov chain is also presented. Examples demonstrating the conceptual simplicity of the information approach are given. Dissert. Abstr.

N80-12802 Iowa Univ., Iowa City.
IMPROVED ESTIMATIONS UNDER RESTRICTED PARAMETERS SPACES Ph.D. Thesis
David Harry Robinson 1979 104 p
Avail: Univ. Microfilms Order No. 7924524

Restrictions placed on the usual parameter space are assumed which reduce the size of the parameter space. Under such an assumption, it seems reasonable that improved estimation should be possible even when $p > 3$. Estimation is considered using two criteria: mean square error and confidence interval coefficients. Shrinkage estimators are examined in both the one dimensional and multidimensional cases. Several choices for the coefficient c are examined, both as a fixed constant and as a random variable. Results derived are presented. Dissert. Abstr.

N80-12803 Oregon State Univ., Corvallis.
ESTIMATION OF THE ORDER OF AN AUTOREGRESSIVE TIME SERIES - A BAYESIAN APPROACH Ph.D. Thesis
Loretta Jean Robb 1979 68 p
Avail: Univ. Microfilms Order No. 7925684

The problem of autoregressive order estimation is placed in a Bayesian framework. This is done with the intent of illustrating how the Bayesian approach brings the numerous aspects of the problem together into a coherent structure which is both complementary to presently used methods and intuitively satisfying. A joint prior probability density is proposed for the order, the partial autocorrelation coefficients and the variance, and the marginal posterior probability distribution for the order, given the data, is obtained. It is noted that the value with maximum posterior probability is the Bayes estimate of the order with respect to a particular loss function. The asymptotic posterior distribution of the order is also given. Sunspot data as well as simulated data corresponding to several autoregressive models are analyzed. Dissert. Abstr.

N80-12804 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A COMPARATIVE STUDY OF NONPARAMETRIC METHODS IN THE RANDOMIZED BLOCK DESIGN UNDER ORDERED ALTERNATIVES Ph.D. Thesis
Barbara Mann Stauffer 1979 224 p
Avail: Univ. Microfilms Order No. 7925384

Several classes of nonparametric tests for ordered treatment alternatives in the randomized block model with one observation per cell are compared. The tests included are within-blocks ranks tests, extensions of paired sample tests, and aligned ranks tests. A normal theory likelihood ratio test is also included for comparative purposes. The Monte Carlo study compares several tests, including at least one from each class, under several combinations of design size, symmetric error distributions, and spacing of alternatives. Both the significance level and the power of the tests are examined. Finally, on the basis of the asymptotic results and the small-sample simulation, some suggestions are made to the potential user of these methods. Dissert. Abstr.

N80-12805*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
MAXIMUM LIKELIHOOD ESTIMATION OF LABEL IMPERFECTIONS AND ITS USE IN THE IDENTIFICATION OF MISLABELED PATTERNS
C. B. Chittineni Aug. 1979 44 p
(Contract NAS9-15800)
(NASA-CR-160364; LEC-16067; JSC-16067) Avail: NTIS HC A03/MF A01 CSCL 12A

The problem of estimating label imperfections and the use of the estimation in identifying mislabeled patterns is presented. Expressions for the maximum likelihood estimates of classification errors and a priori probabilities are derived from the classification of a set of labeled patterns. Expressions also are given for the asymptotic variances of probability of correct classification and proportions. Simple models are developed for imperfections in the labels and for classification errors and are used in the formulation of a maximum likelihood estimation scheme. Schemes are presented for the identification of mislabeled patterns in terms of threshold on the discriminant functions for both two-class and multiclass cases. Expressions are derived for the probability that the imperfect label identification scheme will result in a wrong decision and are used in computing thresholds. The results of practical applications of these techniques in the processing of remotely sensed multispectral data are presented. R.C.T.

N80-12806# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
ONE-SIDED TOLERANCE LIMITS FOR A BROAD CLASS OF LIFETIME DISTRIBUTIONS WITH APPLICATIONS TO DATA OF LIMITED ACCURACY
Wayne A. Woodward and William H. Frawley 25 Jul. 1979 28 p refs Prepared in cooperation with E-Systems, Inc., Greenville, Tex.
(Contract N00014-75-C-0439)
(AD-A072936; TR-135) Avail: NTIS HC A03/MF A01 CSCL 12/1

Addressed is the problem of determining a one-sided tolerance limit for a population possessing a distribution belonging to a broad class of life-time distributions. A new implementation of existing general theory is given and contrasted with an earlier utilization of that theory. General guidelines are given for deciding which implementation to use. A method for adjusting for the accuracy of the measuring device is discussed and illustrated with an actual example. GRA

N80-12807# Illinois Univ. at Urbana-Champaign. Dept. of Computer Science.
BURST PROCESSING Final Report
W. J. Poppelbaum Feb. 1979 32 p refs
(Contract N00014-75-C-0982)
(AD-A072872; UIUCDCS-R-79-957; UILU-ENG-79-1702) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report describes both a quasi-analog and a purely digital fashion of performing arithmetic using bursts; on the way the use of non-compacted bursts and the corresponding encoders is brought up. Then, the general area of digital filters, realized in burst technology, is discussed and practical examples from the area of convolution, adaptive filtering and RF tuning and

demodulation are given. Finally, applications to picture processing and 'spatial' versions of burst processing are mentioned and suggestions made for future areas of study. GRA

N80-12808# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
A SPECIAL DISTRIBUTION RESULT FOR BILINEAR FORMS
James Beckett, III, William R. Schucany, and James D. Broffitt 22 Jun. 1979 13 p refs
(Contract N00014-75-C-0439)
(AD-A072933; TR-131) Avail: NTIS HC A02/MF A01 CSCL 12/1

Necessary and sufficient conditions are given such that a quadratic form has a moment generating function. An important corollary gives conditions under which the bilinear form involving two different multivariate normal random vectors (of not necessarily the same dimensions) has the same distribution as the sum of independent random variables, each having the LaPlace (double exponential) distribution. Examples are given and discussed. J.M.S.

N80-12809# Battelle Pacific Northwest Labs., Richland, Wash.
STATISTICAL METHODS FOR EVALUATING SEQUENTIAL MATERIAL BALANCE DATA
M. A. Wincek and K. B. Stewart Apr. 1979 184 p refs
(Contract EY-76-C-06-1830)
(NUREG-CR-0683; PNL-2920) Avail: NTIS HC A09/MF A01

The material balance model is considered where the only modeled variability is that due to the measurements of the net throughput. Models which assume no loss, constant loss, and all-at-once loss situations are examined. Emphasis is placed on explaining state variable model and Kalman filtering in relation to the general linear statistical model to which least squares is applied yielding a minimum variance unbiased estimator. All errors affecting material balances are assumed to be random. DOE

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-12810# Yale Univ., New Haven, Conn. Cowles Foundation for Research in Economics.
STOCHASTIC GAMES, OLIGOPOLY THEORY AND COMPETITIVE RESOURCE ALLOCATION
Martin Shubik and Matthew J. Sobel 30 May 1979 19 p refs
(Contract N00014-77-C-0518; NR Proj. 047-006; Grant NSF SOC-78-05770)
(AD-A073030; Discussion Paper-525) Avail: NTIS HC A02/MF A01 CSCL 12/1

We define discrete time sequential games which are multiperson Markov decision processes. The extant theory is sketched and compared with our assessment of research needs in dynamic models of oligopoly and other competitive resource allocation problems. A special class of economic survival games is noted. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-12811 Iowa Univ., Iowa City.
ON RINGS WITH SELF-DUALITY Ph.D. Thesis
Joel Knight Haack 1979 73 p
Avail: Univ. Microfilms Order No. 7924480

It is shown that there is a large class of Nakayama's serial rings that have self duality. Using related methods it is proven that, over division rings, Mitchell's tic tac toe rings (a much larger class of subrings of matrix rings over division rings) have self duality. Associated with each Artinian ring R are two digraphs called the left and right quivers of R. A well known theorem on hereditary serial rings is generalized by proving that if these quivers have no closed paths, then R is a factor ring of a tic tac toe ring and has self duality. Applying this theorem and theorems of Gabriel and Dlab and Ringel, it is shown how one can write explicit matrix representations of all hereditary algebras of finite module type. Dissert. Abstr.

N80-12812 Kansas State Univ., Manhattan.
EXTENSIONS OF FUNCTIONS IN SOBOLEV AND BESOV SPACES Ph.D. Thesis
David William Hutchison 1979 116 p
Avail: Univ. Microfilms Order No. 7925823

Necessary and sufficient conditions were found for the existence of an extension of a function defined on a polyhedral set contained in R sup n to a function defined on all of R sup n and which is in either the Sobolev space (possibly of fractional order) or the Besov space (with two parameters) defined on R sup n with a given order of smoothness. The problem has applications in the area of boundary value problems in partial differential equations. The results were applied to a nonlinear problem. Dissert. Abstr.

N80-12813 Columbia Univ., New York.
GOOD FUNCTIONS, ELEMENTARY SETS AND AUTOMATA Ph.D. Thesis
Alan Littleford 1979 67 p
Avail: Univ. Microfilms Order No. 7924932

Characterization theorems are given for elementary series and good functions. In addition, elementary series are related to the structure of certain types of formal machines (automata) which generate them, and the concept of a good function is extended to the case f:N to the kth power approaches N(k > or = 2). A theorem is given which characterizes good f in the case CardSigma > or = 2 and combinatorial problems relating to the case CardSigma = 1 are discussed. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-12814# Sandia Labs., Albuquerque, N. Mex.
MOTION OF A MATERIAL WHOSE PARTICLE VELOCITY IS A LINEAR FUNCTION OF THE SPATIAL POSITION
J. M. McGlaun 10 Oct. 1978 41 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1423) Avail: NTIS HC A03/MF A01

The equations of motion are derived for plane one-dimensional motion of a material whose particle velocity is a linear function of the spatial position. It is proved the mass density is uniform at all times if it is initially uniform. A closed form solution to the equations of motion is obtained for a special case. Sensitivity of the solution to various parameters is investigated. An equation for the efficiency of a power history is derived and discussed. DOE

N80-12815# Oak Ridge National Lab., Tenn.
TURBULENT DESTABILIZATION AND SATURATION OF THE UNIVERSAL DRIFT MODE IN A SHEARED MAGNETIC FIELD
S. P. Hirshman and K. Molvig Nov. 1978 18 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6620) Avail: NTIS HC A02/MF A01

The turbulent diffusion of electrons across the rational surface, due to a combination of shear and random E Vector cross product B Vector fluctuations and/or stochastic magnetic perturbations is examined. A finite amplitude induced version of the absolute universal instability is shown to be the result of this process. The turbulent scattering of electrons across the rational layer which leads to an effective finite value is discussed. The electron growth at larger amplitudes is examined. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-12816 Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN EXPERIMENTAL STUDY OF ACOUSTIC PROPAGATION AND ATTENUATION IN A CIRCULAR ANNULAR DUCT WITH A VARIABLE CROSS-SECTIONAL AREA Ph.D. Thesis
Roy Leslie Marshall 1979 142 p
Avail: Univ. Microfilms Order No. 7924125

A program to evaluate the performance of sound suppression techniques in ducts that produce refraction effects due to axial velocity gradients is described. The program employs a computer code based on the method of multiple scales to calculate the influence of axial variations due to slow changes in the cross sectional area as well as transverse gradients due to the wall boundary layers. The verification of the analytical model through direct comparison of experimental and computational results is presented. Comparison between the analytical predictions and the experimental measurements is made. The circumferential variations of pressure amplitudes and phases at several axial positions were examined in straight and variable area ducts, hard wall and lined sections with and without a mean flow.
Dissert. Abstr.

N80-12817 Ohio Univ., Athens.
ULTRASONIC VELOCITY AND ABSORPTION MEASUREMENTS IN SEVERAL BINARY MIXTURES WITH PYRIDINE Ph.D. Thesis
Prem Kumar Gupta 1979 203 p
Avail: Univ. Microfilms Order No. 7924418

The structure and molecular processes in liquid mixtures were studied by measuring ultrasonic velocity and absorption in binary liquid mixtures of pyridine with heavy water, tertbutyl alcohol and phenol. These measurements were conducted with pulsed ultrasound at a frequency of 19.5 MHz at several temperatures between 5 C and 40 C. The velocity of sound in the pure liquids as a function of the temperature was measured.
Dissert. Abstr.

N80-12818*# Lockheed-Georgia Co., Marietta.
A STUDY OF THE PREDICTION OF CRUISE NOISE AND LAMINAR FLOW CONTROL NOISE CRITERIA FOR SUBSONIC AIR TRANSPORTS Final Report, May 1977 - Jun. 1978
G. Swift and P. Mungur Aug. 1979 262 p refs
(Contract NAS1-14946)
(NASA-CR-159104; LG78ER0218) Avail: NTIS HC A12/MF A01 CSCL 20A

General procedures for the prediction of component noise levels incident upon airframe surfaces during cruise are developed. Contributing noise sources are those associated with the propulsion system, the airframe and the laminar flow control (LFC) system. Transformation procedures from the best prediction base of each noise source to the transonic cruise condition are established. Two approaches to LFC/acoustic criteria are developed. The first is a semi-empirical extension of the X-21 LFC/acoustic criteria to include sensitivity to the spectrum and directionality of the sound field. In the second, the more fundamental problem of how sound excites boundary layer disturbances is analyzed by deriving and solving an inhomogeneous Orr-Sommerfeld equation in which the source terms are proportional to the production and dissipation of sound induced fluctuating vorticity. Numerical solutions are obtained and compared with corresponding measurements. Recommendations are made to improve and validate both the cruise noise prediction methods and the LFC/acoustic criteria.
A.R.H.

N80-12819*# Lockheed-Georgia Co., Marietta.
NEAR-FIELD NOISE PREDICTION FOR AIRCRAFT IN CRUISING FLIGHT: METHODS MANUAL Final Report, May 1977 - Jun. 1978
J. G. Tibbetts Aug. 1979 97 p
(Contract NAS1-14946)
(NASA-CR-159105; LG78ER0219) Avail: NTIS HC A05/MF A01 CSCL 20A

Methods for predicting noise at any point on an aircraft while the aircraft is in a cruise flight regime are presented. Developed for use in laminar flow control (LFC) noise effects analyses, they can be used in any case where aircraft generated noise needs to be evaluated at a location on an aircraft while under high altitude, high speed conditions. For each noise source applicable to the LFC problem, a noise computational procedure is given in algorithm format, suitable for computerization. Three categories of noise sources are covered: (1) propulsion system, (2) airframe, and (3) LFC suction system. In addition, procedures are given for noise modifications due to source soundproofing and the shielding effects of the aircraft structure wherever needed. Sample cases, for each of the individual noise source procedures, are provided to familiarize the user with typical input and computed data.
A.R.H.

N80-12820*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GROUND EFFECTS ON AIRCRAFT NOISE
William L. Willshire, Jr. and David A. Hilton Nov. 1979 71 p refs
(NASA-TM-80185) Avail: NTIS HC A04/MF A01 CSCL 20A

A flight experiment was conducted to investigate air-to-ground propagation of sound near grazing incidence. A turbojet-powered aircraft was flown at low altitudes over the ends of two microphone arrays. An eight-microphone array was positioned along a 1850 m concrete runway. The second array consisted of 12 microphones positioned parallel to the runway over grass. Twenty-eight flights were flown at altitudes ranging from 10 m to 160 m. The acoustic data recorded in the field reduced to one-third-octave band spectra and time correlated with the flight and weather information. A small portion of the data was further reduced to values of ground attenuation as a function of frequency and incidence angle by two different methods. In both methods, the acoustic signals compared originated from identical sources. Attenuation results obtained by using the two methods were in general agreement. The measured ground attenuation was largest in the frequency range of 200 to 400 Hz. A strong dependence was found between ground attenuation and incidence angle with little attenuation measured for angles of incidence greater than 10 to 15 degrees.
A.R.H.

N80-12821*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTAL AND NUMERICAL RESULTS ON A SHEAR LAYER EXCITED BY A SOUND PULSE
Lucio Maestrello, Alvin Bayliss, and Eli Turkel Nov. 1979 47 p refs Presented at 32d Am. Phys. Soc. Meeting in Notre Dame, Indiana, 18-19 Nov. 1979
(NASA-TM-80183) Avail: NTIS HC A03/MF A01 CSCL 20A

The behavior of a sound in a jet was investigated. It is verified that the far-field acoustic power increased with flow velocity for the lower and medium frequency range. Experimentally, an attenuation at higher frequencies is also observed. This increase is found numerically to be due primarily to the interactions between the mean vorticity and the fluctuation velocities. Spectral decomposition of the real time data indicates that the power increase occurs in the low and middle frequency range, where the local instability waves have the largest spatial growth rate. The connection between this amplification and the local instability waves is discussed.
Author

N80-12822*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TIME-DEPENDENT DIFFERENCE THEORY FOR NOISE PROPAGATION IN A TWO-DIMENSIONAL DUCT
Kenneth J. Baumeister 1979 13 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-79298; E-249; AIAA-Paper-80-0098) Avail: NTIS HC A02/MF A01 CSCL 20A

A time dependent numerical formulation was derived for sound propagation in a two dimensional straight soft-walled duct in the absence of mean flow. The time dependent governing

acoustic-difference equations and boundary conditions were developed along with the maximum stable time increment. Example calculations were presented for sound attenuation in hard and soft wall ducts. The time dependent analysis were found to be superior to the conventional steady numerical analysis because of much shorter solution times and the elimination of matrix storage requirements. R.C.T.

N80-12823*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A TIME DEPENDENT DIFFERENCE THEORY FOR SOUND PROPAGATION IN DUCTS WITH FLOW
K. J. Baumeister 1979 38 p refs Presented at 98th Meeting of the Acoustical Soc. of Am., Salt Lake City, Utah, 26-30 Nov. 1979
(NASA-TM-79302; E-254) Avail: NTIS HC A03/MF A01 CSCL 20A

A time dependent numerical solution of the linearized continuity and momentum equation was developed for sound propagation in a two dimensional straight hard or soft wall duct with a sheared mean flow. The time dependent governing acoustic difference equations and boundary conditions were developed along with a numerical determination of the maximum stable time increments. A harmonic noise source radiating into a quiescent duct was analyzed. This explicit iteration method then calculated stepwise in real time to obtain the transient as well as the steady state solution of the acoustic field. Example calculations were presented for sound propagation in hard and soft wall ducts, with no flow and plug flow. Although the problem with sheared flow was formulated and programmed, sample calculations were not examined. The time dependent finite difference analysis was found to be superior to the steady state finite difference and finite element techniques because of shorter solution times and the elimination of large matrix storage requirements. R.C.T.

N80-12824*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RECIPROCITY PRINCIPLE IN DUCT ACOUSTICS
Young-chung Cho 1979 23 p refs Presented at 97th Meeting of the Acoustical Soc. of Am., Cambridge, Mass., 11-15 Jun. 1979
(NASA-TM-79300; E-250) Avail: NTIS HC A02/MF A01 CSCL 20A

Various reciprocity relations in duct acoustics have been derived on the basis of the spatial reciprocity principle implied in Green's functions for linear waves. The derivation includes the reciprocity relations between mode conversion coefficients for reflection and transmission in nonuniform ducts, and the relation between the radiation of a mode from an arbitrarily terminated duct and the absorption of an externally incident plane wave by the duct. Such relations are well defined as long as the systems remain linear, regardless of acoustic properties of duct nonuniformities which cause the mode conversions. Author

N80-12825# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
SHALLOW BULK ACOUSTIC WAVES
Arthur Ballato and Theodore Lukaszek Jun. 1979 49 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A072742; DELET-TR-79-13) Avail: NTIS HC A03/MF A01 CSCL 20/1

Shallow bulk acoustic wave propagation in piezoelectric crystals is considered from the standpoint of work reported to date. It is compared to bulk and surface acoustic waves as to properties and device potential. Singly and doubly rotated cuts are considered, as are piezoelectric transduction, energy trapping equivalent networks, as well as areas of future work such as new materials, other than quartz, and nonlinear effects. GRA

N80-12826# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
GENERAL EFFECTS OF CURRENT AND SOUND-SPEED VARIATIONS ON SHORTRANGE ACOUSTIC TRANSMISSION IN CYCLONIC EDDIES
M. J. Jacobson, W. L. Siegmann, and R. F. Henrick 1 Jul. 1979 59 p refs
(Contract N00014-76-C-0288)
(AD-A072765; RPI-MATH-125) Avail: NTIS HC A04/MF A01 CSCL 20/1

The effects of sound-speed and current variations induced by a mesoscale cyclonic eddy on short-range propagation are considered. A parametric eddy model is used to determine acoustically-relevant eddy environmental effects, so that eddy-acoustical effects can be determined for eddies of arbitrary size, strength, and position. Approximations to sound-speed and current structures are used to investigate eddy effects on the three-dimensionality of rays and on ray types. The influence of current and sound-speed variations on travel time is examined, and accurate expressions for per-ray phase variation are obtained. Examples are presented illustrating effects of source-receiver position and orientation on per-ray phase shifts and relative phase spreading of arrivals. Also, general results are presented which illustrate the variations of eddy-acoustical effects as functions of source-receiver range and of eddy size and strength. GRA

N80-12827# Texas Univ. at Austin. Applied Research Labs.
SHEAR WAVE PROPAGATION IN UNCONSOLIDATED FLUID SATURATED POROUS MEDIA
David Warren Bell 15 May 1979 180 p refs
(Contract N00014-76-C-0117)
(AD-A072867; ARL-TR-79-31) Avail: NTIS HC A09/MF A01 CSCL 20/1

Experimental shear wave speed and attenuation measurments are reported for seven laboratory sediments. The samples consisted of four sizes of well sorted glass beads and three natural sands. Measurements were obtained for both air and water saturation without application of external pressure. The speed and attenuation for each sample was determined from the change with transducer separation of the transit time and amplitude of an acoustic pulse. Broadband bender elements provided an overall frequency range of 600 Hz to 200 kHz, with individual sediment ranges of approximately a decade. The attenuation was found to vary approximately as the first power of the frequency. Various physical characteristics of the samples, for example, density and permeability, are reported to allow comparison of the experimental results with theoretical predictions. Supplementary compressional wave speed and attenuation measurements at the single frequency of 120 kHz are also provided. A simple viscoelastic model based on perfect coupling between the sediment grains and the pore fluid predicts the main features of the observed data. There is evidence, however, of an effect due to relative motion between the grains and the fluid. GRA

N80-12025# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AEROACOUSTIC CHARACTERIZATION OF FREE JETS
Georges Elias, Annie Lelarge, Jean Maulard, and Mariano Perulli *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 55-69 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 251-261 Original language report was announced as A79-18534 (For primary document see N80-12021 03-01) Avail: NTIS HC A06/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-12828 Wisconsin Univ. - Madison.
MICROWAVE SPECTRA AND THEORETICAL CALCULATION OF TRANSIENT MOLECULES Ph.D. Thesis
Peter George Szanto 1979 207 p
Avail: Univ. Microfilms Order No. 7919822

Ab-initio calculations, an alternate method for the determination of the structure of ions, are discussed. An SCF + CI calculation was carried out on CN(+) with the following objectives in mind: determination of the ground state of the species and its dipole moment - which at present is inaccessible by any other method - and to gauge the feasibility of predicting microwave transitions by a relatively simple and inexpensive method. The

electronic energy was calculated for the lowest states. The equation of motion of the nuclei was solved numerically to yield the rotational and vibrational levels of both electronic states. The first terrestrial observation of protonated nitrogen, N2h(+), was made in our liquid nitrogen cooled glow discharge apparatus. The theory of an asymmetric rotor with up to two unpaired electrons and up to two magnetically nonequivalent nuclei is developed and encoded in a FORTRAN program. Dissert. Abstr.

N80-12829 North Carolina Univ. at Chapel Hill.
ANALYSIS OF COHERENT ANTI-STOKES RAMAN SPECTRA: DETERMINATION OF MOLECULAR PARAMETERS Ph.D. Thesis
James Warnscott Fleming 1979 106 p
Avail: Univ. Microfilms Order No. 7925908

Expressions for the intensity arising from coherent anti-Stokes Raman scattering (CARS) were analyzed for both CARS and for resonance CARS. Measurable experimental quantities including the relative intensity and exact frequency position of the maximum and minimum for a single line spectrum are shown to be related to the third order nonresonant susceptibility, Raman scattering cross section, Raman vibrational frequency, and Raman linewidth. Single line approximations are discussed and experimental data presented to validate the relationships between measured and molecular parameters. The consequences of more than one line are examined and an analysis appropriate for several lines is given and experimental data presented. Using the relationships available in this study, polarization properties of CARS spectra are discussed and a quantitative treatment of the Kleinman symmetry conjecture, local field correction factor, and the Raman depolarization ratio is given. Dissert. Abstr.

N80-12830 Michigan Univ., Ann Arbor.
ELECTRON CORRELATION AND HUND'S RULE Ph.D. Thesis
John William Warner 1979 76 p
Avail: Univ. Microfilms Order No. 7925241

The traditional interpretation of Hund (Nule, now known to be incorrect, is discussed and an alternative approach is presented. It is suggested that for two electron configurations built up out of orbitals with different orbital angular momenta, the angular correlation introduced by symmetrizing the wavefunction with respect to particle exchange gives rise to the following shielding effect: the electrons will be at wider angles in either the singlet or the triplet state. In the state in which the electrons are at wider angles, the outer electron feels more of the effective nuclear charge, causing a contraction of the outer orbital and a lowering of the energy. This approach gives rise to the following alternating rule: for the state of greatest total orbital angular momentum in an atomic configuration, the singlet lies above the triplet. The ordering of energy levels reverses for the state of next higher orbital angular momentum, and continues to alternate with each change of one unit in the total orbital angular momentum until the state of lowest orbital angular momentum is reached. Dissert. Abstr.

N80-12831 Harvard Univ., Cambridge, Mass.
VIBRATION-TORSION INTERACTION IN THE MICROWAVE SPECTRUM OF METHYL MALONALDEHYDE Ph. D. Thesis
Nigel Denis Sanders 1979 149 p
Avail: Univ. Microfilms Order No. 7925307

The microwave spectrum of methylmalonaldehyde was measured and the molecule shown to be in an intramolecularly hydrogen bonded chelate form in the gas phase. The spectrum shows the effects of two large amplitude internal motions: the torsion of the methyl group about its symmetry axis and the inversion of the hydrogen bonded ring through a potential barrier to a C sub 2 sub v conformation. A two vibration plus rotation model is developed and applied to explain the sizeable perturbations of the pure rotational transitions in four ground state sublevels from a rigid rotor pattern. The experimentally derived parameters are discussed in terms of an effective inversion-torsion potential surface. Some aspects of the gas phase decomposition kinetics of tetramethyldioxetane are discussed in relation to attempts to obtain its microwave spectrum. Dissert. Abstr.

N80-12832 Wisconsin Univ. - Madison.
GROUND STATE ENERGY OF MOLECULAR TRIMERS Ph.D. Thesis
Fernando Cabral 1979 138 p
Avail: Univ. Microfilms Order No. 7918142

The ground state energy of dimer and trimer systems in two and three dimensions is calculated. Both the boson case and the case of three spin 1/2 particles are treated. A Jastrow variational calculation with one variational parameter, a Monte Carlo simulation, and a lower bound calculation are performed for the trimer boson in three dimensions. For the fermion case only a variational work is done. A variational calculation is done for the fermion case and boson case in two dimensions. An exploratory variational calculation using nonorthogonal basis set is performed for the boson trimer in three dimensions. Dissert. Abstr.

N80-12833 Wisconsin Univ. - Madison.
THE STUDY OF BONDING IN SILICON COMPOUNDS BY FENSKE-HALL MOLECULAR ORBITAL CALCULATIONS AND PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis
Francis Charles Burns 1979 556 p
Avail: Univ. Microfilms Order No. 7919788

Calculations with and without silicon 3d orbitals were performed for three series of small silanes, SiH(4-x)Yx, SiHCl(3-x)(CH3)x, and for pentacarbonyl manganese silanes, Y3Si(Mn(CO)5 and Cl(3-x)(CH3)xSiMn(CO). The PE spectra was measured for the SiHCl(3-x)(CH3)x and the manganese compounds. For the small silanes, the silicon 3d orbital contributed only to the higher occupied orbitals. Electron density was acquired by the silicon 3d orbitals by rearrangement of electron density from the silicon 3s and 3p orbitals and by transfer of electron density from the atoms bonded to the silicon. Most of the electron density acquired by the Si 3d orbitals, through transfer, resulted from dpi-ppi interactions; however, the amount of dpi-ppi bonding is small, and did not correlate with the electronegativity of the atoms. The silicon 3d orbitals had an indirect effect on the character of the molecular orbitals by changing the energy of the other basis orbitals. Dissert. Abstr.

N80-12834# California Univ., Livermore. Lawrence Livermore Lab.
ELECTROSTATICS, SMALL PARTICLES, AND LASER FUSION TARGETS
C. D. Hendricks 26 Sep. 1978 20 p refs Presented at the Inst. of Electrostatics Meeting, Tokyo, 26 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-81537; CONF-7811125-1) Avail: NTIS
HC A02/MF A01

A discussion of an inertial confinement fusion system for the production of useful power and its dependence on the production of suitable targets is presented. The target characteristics such as material composition, structure, and surface finish which are tailored to the laser pulse length, energy, peak and average power, and pulse shape are examined. The physics of the interaction of laser pulse and target, and the number of different types of targets necessary to study laser fusion are discussed. DOE

N80-12835# Los Alamos Scientific Lab., N. Mex.
PARITY VIOLATION IN THE SCATTERING OF 15 MeV PROTONS BY HYDROGEN
D. E. Nagle, J. D. Bowman, C. Hoffman, J. McKibben, R. Mischke, J. M. Potter, H. Frauenfelder (Illinois Univ.), and L. Sorenson (Illinois Univ.) 1978 8 p refs Presented at Symp. on High Energy Physics, Argonne, Ill., 26-28 Oct. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2875; CONF-781095-2) Avail: NTIS
HC A02/MF A01

A transmission experiment to measure the longitudinal asymmetry for polarized protons on hydrogen is described. The present result is (-1.7 + or - 0.8) X 10 to the -7th power. DOE

N80-12836# California Univ., Berkeley. Lawrence Berkeley Lab.
THE EXPERIMENTAL SUPERCONDUCTING SYNCHROTRON (ESCAR) Final Report
G. R. Lambertson, W. S. Gilbert, and J. B. Rechen 1 Mar. 1979 119 p refs
(Contract W-7405-eng-48)

(LBL-8211) Avail: NTIS HC A06/MF A01

Topics covered include the Lattice and beam parameters, superconducting magnets and cryostats; refrigeration and cryogenic distribution; vacuum systems; electrical systems; and conventional facilities. DOE

N80-12837# Oak Ridge National Lab., Tenn.
POLARIZED NEUTRON DIFFRACTION IN HIGH MAGNETIC FIELDS
R. M. Moon Jul. 1978 21 p refs Presented at Conf. on Solids and Plasmas in High Magnetic Fields, Cambridge, Mass., 18 Sep. 1978
(Contract W-7405-eng-26)
(CONF-780927-1) Avail: NTIS HC A02/MF A01

The use of magnetic fields in the general area of neutron scattering is briefly surveyed, and some specific areas of research are identified which would benefit by the availability of higher fields. Since most of the past work combining neutron scattering and high magnetic fields has involved the polarized neutron technique, a description of this technique is presented along with a discussion of experimental errors produced by the magnetic field. The current status of polarized-beam research in four areas is reviewed: induced form factors in transition metals, mixed-valence systems, Kondo systems, and complicated paramagnets. DOE

N80-12838# Ames Lab., Iowa.
APPLICATIONS OF SOLID STATE NUCLEAR MAGNETIC RESONANCE TECHNIQUES TO THE STUDY OF COALS AND POLYMERS Ph.D. Thesis
R. G. Pembleton Jan. 1979 184 p refs
(Contract W-7405-eng-82)
(IS-T-822) Avail: NTIS HC A09/MF A01

The use of nuclear magnetic resonance (NMR) to study molecules in the solid state has grown rapidly over the past several years. This is due to the advent of techniques which allow for the removal of certain interactions in the solid state which previously have thwarted most attempts at obtaining chemical shift or their anisotropies. With these parameters and others now available, NMR has become an important tool to be used in the understanding of the chemistry of solids. The work reported applies the techniques of solid state NMR to a number of chemical systems. Specific applications are made to crystallinity in polymers, to combined sample spinning and multiple pulse techniques, and to aromatic and aliphatic content of vitrain portions of coals of varying carbon content. DOE

N80-12839# California Univ., Livermore. Lawrence Livermore Lab.
HIGH-PRESSURE AND HIGH-TEMPERATURE BEHAVIOR OF SIMPLE AND COMPLEX MOLECULAR LIQUIDS
F. H. Ree and Marvin Ross 19 Jul. 1979 8 p refs Presented at 7th Intern. AIRAPT Conf., La Creusot, France, 30 Jul. 1979
(Contract W-7405-eng-48)
(UCRL-82129; CONF-790709-11) Avail: NTIS HC A02/MF A01

Recent theories in statistical mechanics and intermolecular forces are used to explain the shock-wave data of inert gases (Ar, Xe), diatomic molecules (H2, N2), and hydrocarbons. DOE

N80-12840# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
HIGH TEMPERATURE FACILITY FOR ATOMIC PHYSICS STUDIES Final Report
15 Dec. 1978 22 p refs
(Contract W-7405-eng-48)
(UCRL-13969) Avail: NTIS HC A02/MF A01

A program designed to develop a laser heated plasma sample for atomic physics studies in the 30 to 100 eV range of electron temperature and the range in electron density is presented. The approach used is discussed in detail. An extensive rework of the plasma sample facility, specifically, a new solenoid magnet constructed to allow higher field operation, and the plasma chamber, modified to allow the use of puff filling orifices and small bore tube liners is described. Changes in the vacuum system, focussing optics, and the 10 liter CO2 laser optics are evaluated. DOE

N80-12841# Argonne National Lab., Ill. Applied Physics Div.
SCATTERING OF MeV NEUTRONS FROM ELEMENTAL IRON
A. Smith and P. Guenther Mar. 1979 43 p refs
(Contract W-31-109-eng-38)
(ANL/NDM-47) Avail: NTIS HC A03/MF A01

Neutron elastic- and inelastic-scattering cross sections of elemental iron were measured from 1.5 to 4.0 MeV with incident-neutron resolutions of less than or approx. = 50 keV and at incident-neutron energy intervals of less than or approx. = 50 keV. Cross sections for the excitation of observed levels at 0.853, 1.389, 2.097, 2.579, 2.677, 2.974 and 3.152 MeV were determined. The observed elastic- and inelastic-scattering angular distributions fluctuate strongly with incident energy. The experimental results are averaged over broad energy intervals and interpreted in terms of spherical optical-statistical and coupled-channels models including consideration of direct-vibrational excitations. The importance of a comprehensive data base in such energy-averaged interpretations and of the direct-vibrational excitations is stressed. The present measured and calculated results, combined with those reported in the literature, are used to formulate an evaluated scattered-neutron data file in the ENDF format extending from 1.0 to 4.0 MeV. DOE

N80-12842# Texas Univ., Austin. Center for Particle Theory.
RESEARCH PROGRAM IN ELEMENTARY PARTICLE THEORY Progress Report, 1978 - 1979
E. C. G. Sudarshan and Y. Ne'eman 1979 79 p
(Contract EY-76-S-05-3992)
(ORO-3992-362) Avail: NTIS HC A05/MF A01

A theoretical high energy physics research program is summarized. Topics include the foundation of quantum theory, particle physics in relativistic astrophysics, the phenomenology of weak and electromagnetic interactions, strong interaction physics, and supersymmetry and supergravity. A.W.H.

N80-12843# Texas A&M Univ., College Station. Cyclotron Inst.
X-RAY EMISSION IN HEAVY-ION COLLISION Progress Report, 1 Jul. 1978 - 30 Jun. 1979
R. L. Watson Apr. 1979 75 p refs
(Contract ER-78-S-05-6036)
(ORO-6036-1) Avail: NTIS HC A04/MF A01

Studies of spectra of X-rays produced in heavy-ion collisions are reported. The aims of these studies are: (1) to attain a better understanding of the mechanisms for multiple inner-shell ionization of target atoms; (2) to characterize the fast rearrangement processes that occur following multiple inner-shell ionization; (3) to utilize K-alpha X-ray satellite and hypersatellite structure to study the equilibration of inner-shell vacancy states in fast ions penetrating solid targets; and (4) to investigate the effects of surface interactions on the polarization of X-rays emitted by highly stripped ions emerging from thin foils. A summary of studies in each of these areas is presented. DOE

N80-12844# California Inst. of Tech., Pasadena.
CASCADE OF NEGATIVE MUONS IN ATOMS Ph.D. Thesis
V. R. Akylas 1978 80 p refs
(Contracts EY-76-C-03-0063; AT(04-3)-63)
(CALT-63-300) Avail: NTIS HC A05/MF A01

The evolution is studied of a negative muon captured in an atom and the formalism of energy loss associated with the muonic atom. The principal goals are to calculate reliability the muon X-ray intensities, given the initial population of the muonic orbits, to invert the problem and deduce the initial distribution from the X-ray intensities, to provide a reasonably simple and convenient tool to correlate observations, and finally, to systematize some questions of theoretical interest. The early part of the history of the muon in matter, including the atomic capture and classical phase of the atomic cascade are reviewed. In the quantal treatment of the transition rates, both radiative and electron Auger transitions are considered. In general, multipolarities up to E3 and K, L, and M electronic shells are fully investigated. Multipole radiation is treated in the conventional way and presents no special problems. Magnetic type transitions between states with different principal quantum numbers are shown to be small. The basic

results have been computed in terms of elementary functions.
DOE

N80-12845# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
STUDIES OF ELECTRON CORRELATION IN THE PHOTOIONIZATION PROCESS Ph.D. Thesis
R. A. Rosenberg Mar. 1979 200 p refs
(Contract W-7405-eng-47)
(LBL-8948) Avail: NTIS HC A09/MF A01

Electron correlation is a result of the interaction of two or more electrons confined in a region of space, and may conveniently be treated under the formalism of configuration interaction (CI). Photoionization provides a rather direct experimental method for studying CI. The types of CI involved in the photoionization process can be divided into three categories: initial-state configuration interaction (SCI), final-ionic-state configuration interaction (FISCI), and continuum-state configuration interaction (CSCI). The photoelectron spectroscopy of Ba, Sm, Eu, and Yb was studied using both HeI (22.22 eV) and NeI (16.85 eV) radiation. Satellite structure observed in these spectra using NeI (and for Yb, HeI also) radiation could be satisfactorily explained by ISCI alone. The HeI spectra of Sm, Eu, and, in particular, Ba showed dramatic changes in the satellite population which could only be explained by autoionization, a special form of CSCI. The detailed nature of the mechanism was explored in Ba with synchrotron radiation. It was found that the autoionizing level decays preferentially via an Auger-type mechanism.
DOE

N80-12846# Louisiana State Univ., Baton Rouge.
ELECTRON-IMPACT EXCITATION OF n = 2 LEVELS OF HELIUM AT INTERMEDIATE ENERGIES
K. Bhadra, J. Callaway, and R. J. W. Henry 1979 43 p refs
(Contract EY-76-S-05-4681)
(ORO-4881-24) Avail: NTIS HC A03/MF A01

Five state close coupling equations for electron-helium scattering are solved in the energy region from 30 to 100 eV. Integral and differential cross sections for excitation of the ground state to the n = 2 states are presented. Calculated shapes of differential cross sections versus angle for various energies are compared with measurements.
DOE

N80-12847# Ames Lab., Iowa.
HYDRODYNAMIC MODEL WAVEFUNCTIONS IN INTRINSIC COORDINATES AND THEIR APPLICATION TO THE STRUCTURE OF EVEN-EVEN NUCLEI
F. J. Margetan Jan. 1979 494 p refs
(Contract W-7405-eng-82)
(IS-T-825) Avail: NTIS HC A21/MF A01

A closed expression is presented for intrinsic-coordinate eigenfunctions of the hydrodynamic, quadrupole-vibration Hamiltonian of A. Bohr. These functions are used as an expansion basis for the treatment of more general collective Hamiltonians. Two classes of such Hamiltonians are considered. In each, the potential energy term of the Bohr Hamiltonian was replaced with a more general function of the shape coordinates. The potential of Gneuss and Greiner (1) is used to demonstrate the soundness of the calculational techniques, and to illustrate convergence properties of calculated energies. Potentials possessing a single minimum on 0 less than or equal to gamma less than or equal to 60 deg are considered through the study of a quadratic-potential [QP] Hamiltonian. The smooth development from spherical to asymmetrically deformed nuclear shapes is investigated. Model energies and E2 transition rates are traced during this process.
DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-12848 State Univ. of New York at Stony Brook.
PARTICLE PRODUCTION IN HIGH-ENERGY REACTIONS AND STUDIES IN A GAUGE MODEL Ph.D. Thesis
Rohini Madhusudan Godbole 1979 104 p
Avail: Univ. Microfilms Order No. 7925416

In a gauge field model of weak and electromagnetic interactions the weak correction to the anomalous magnetic moment of the muon is calculated. The experimental bounds on this quantity fail to constrain the mass of the neutral boson or the heavy neutral lepton. The calculation is done in a general gauge and use of Slavnov-Taylor identities enable the removal of all the gauge dependence before the loop integration is performed. The production of a Higgs boson and neutral vector mesons in neutrino and antineutrino scattering is calculated. The possibility of observing the Higgs boson production in neutrino scattering is discussed. Also, the production of rho meson(o) in e(+)e(-) colliding beams, up to the energies corresponding to PEP and PETRA, is calculated.
Dissert. Abstr.

N80-12849 Columbia Univ., New York.
DIRECTIONAL DISTRIBUTIONS OF BETA-RAYS EMITTED FROM ORIENTED NUCLEI Ph.D. Thesis
Leo Maria Freishyn Chirovsky 1979 156 p
Avail: Univ. Microfilms Order No. 7924864

A new ultralow temperature nuclear orientation facility was developed with which the directional distributions of Beta rays emitted from statically polarized nuclei are observed, for the first time, at many angles with respect to the polarization axis. Nuclei are polarized in bulk by imbedding them in an appropriate ferromagnetic host, which is cooled to near absolute zero temperature and is magnetized to saturation with an externally applied field. The polarization axis is defined by the direction of this applied field. The angular dependence of the parity violating term in the directional distribution function for beta rays emitted from polarized Co(60) nuclei was directly measured for the first time. The results were found to be consistent with the accepted theories of nuclear beta decay. Additional fundamental experiments possible with this new facility involving parity violation, isospin nonconservation and time-reversal invariance are discussed.
Dissert. Abstr.

N80-12850 Pittsburgh Univ., Pa.
PION-NUCLEUS SCATTERING USING FINITE BINDING POTENTIALS Ph.D. Thesis
Michael David Silver 1979 133 p
Avail: Univ. Microfilms Order No. 7924683

A nonperturbative treatment of finite binding potentials in pion bound nucleon scattering is developed. Coupled differential equations in configuration space are derived from a model wavefunction broken into two parts. Coordinates from the source of binding to the pion and to the nucleon are used in the elastic channel, while pion nucleon center of mass coordinates are used for the excited channels. The excited channel equations are solved in closed form using a separable nonlocal pion nucleon interaction. When inserted into the elastic channel equation, a relativistically modified single particle equation for the elastically scattered meson is derived, which features an optical potential with both local and nonlocal parts. This model is used in conjunction with first order multiple scattering theory to construct pion nucleus scattering. The assumed pion nucleon interaction is taken to be s waves with threshold p wave behavior. The region around the 33 resonance is numerically studied for both the three body model and for pions on O-16.
Dissert. Abstr.

N80-12851*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MINIATURE CYCLOTRON RESONANCE ION SOURCE USING SMALL PERMANENT MAGNET Patent Application
Vincent G. Anicich and Wesley T. Huntress, inventors (to NASA)
Filed 11 Sep. 1978 13 p
(NASA-Case-NPO-14324-1; US-Patent-Appl-SN-940970) Avail: NTIS HC A02/MF A01 CSCL 20H

An ion source using the cyclotron resonance principle is presented. A miniaturized ion source device in an air gap of a small permanent magnet with a substantially uniform field in the air gap of about 0.5 inches is described. The device and permanent magnet are placed in an enclosure which is maintained at a high vacuum into which a sample gas is introduced. A discussion of how the invention avoids the problem of getting

the ion beam coupled into the utilization system is presented.
NASA

N80-12852# California Univ., Livermore. Lawrence Livermore Lab.
RESEARCH ON THE ANNULAR LITHIUM JET CONCEPT FOR FUTURE LASER-FUSION REACTORS Final Report, Sep. 1977 - Dec. 1978
M. A. Hoffman Dec. 1978 34 p refs
(Contract W-7405-eng-48)
(UCRL-13938; FR-3) Avail: NTIS HC A03/MF A01

Experiments were performed to determine the length for convergence or closure of a vertical, hollow annular water jet due to the action of surface tension forces. The data agree well with theoretical predictions up to a velocity of about 3 m/s. At higher velocities, the convergence lengths are less than predicted and this is attributed to the jet acting as an ejector pump and thereby reducing the air pressure inside the annulus to slightly sub-atmospheric values. The stability of such a jet is also discussed in the light of the fact that no hydrodynamic instabilities were yet observed. The results of a series of experiments on the flow spreading or splitting due to the presence of wedge-shaped obstacles in the path of the annular jet flow are described. DOE

N80-12853# Sandia Labs., Albuquerque, N. Mex.
EVALUATION OF SALT BEDS IN NEW MEXICO AS A GEOLOGIC REPOSITORY FOR NUCLEAR WASTE
W. D. Weart Oct. 1978 36 p Presented at the Environmental Control Symp., Washington, D. C., 28 Nov. 1978
(Contract EY-76-C-04-0789)
(SAND-78-2086C; CONF-781109-5) Avail: NTIS HC A03/MF A01

The Department of Energy is proposing to demonstrate the acceptability of geologic disposal of radioactive waste by locating a waste isolation pilot plant (WIPP) in the salt beds 26 miles east of Carlsbad, New Mexico. The WIPP will serve as a permanent repository for defense generated transuranic contaminated waste and will also be used as a facility in which experiments and demonstrations with all radioactive waste types can be conducted. Rock salt has been the leading candidate for geologic disposal of nuclear waste since the National Academy of Science recommended in 1957 that salt for repositories receive further evaluation. Subsequent studies have failed to reveal any phenomena which would disqualify salt beds as a repository medium. The present area being proposed for the WIPP is the second such location in the Delaware Basin for which new site data have been developed; the first site proved geologically unacceptable. DOE

N80-12854# Los Alamos Scientific Lab., N. Mex.
GENERAL PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report
R. D. Baker, (comp.) Dec. 1978 39 p
(Contract W-7405-eng-36)
(LA-7601-PR) Avail: NTIS HC A03/MF A01

The studies reported are related to the use of Pu 238 O2 in radioisotopic power systems. The three programs involved are: (1) general-purpose heat source development; (2) space nuclear safety; and (3) radioisotopic terrestrial safety. DOE

N80-12855# California Univ., Livermore. Lawrence Livermore Lab.
SUGGESTED NUCLEAR WASTE MANAGEMENT RADIOLOGICAL PERFORMANCE OBJECTIVES
J. Cohen Dec. 1978 43 p refs
(Contract W-7405-eng-48)
(NUREG-CR-0579; UCRL-52626) Avail: NTIS HC A03/MF A01

Development of criteria for the safe disposal of nuclear wastes in geologic media requires the establishment of definitive objectives against which the adequacy of various waste management methods may be judged. Certain guidelines are suggested that might serve as first approximations pending promulgation of official criteria. These include: the allowable radiation dose to individuals should be related to the predicted probability of receiving the dose such that as the dose increases, the events leading to that dose should become less probable. A quantitative relationship is developed and discussed. Selection of a waste management method should be made in accordance with the principles of ALARA. Doses to future generations should be considered to be equally as serious as doses to present populations. When the hazard potential of an underground nuclear waste repository becomes less than that of typical hazardous ore formations (i.e., 0.2% uranium ore), further concern is unwarranted. DOE

N80-12856# Analytic Sciences Corp., Reading, Mass.
ANALYSIS OF SOME NUCLEAR WASTE MANAGEMENT OPTIONS. VOLUME 1: ANALYSIS AND INTERPRETATION
L. E. Berman, D. A. Ensminger, M. S. Giuffre, C. M. Koplik, S. G. Oston, G. D. Poltak, and B. I. Ross 10 Oct. 1978 141 p refs
(Contract W-7405-eng-48)
(UCRL-13917-Vol-1) Avail: NTIS HC A07/MF A01

Risk analyses were performed on that portion of a nuclear fuel cycle which begins following solidification of high-level waste. Risks associated with handling, interim storage and transportation of the waste are assessed, as well as the long term implications of disposal in deep mined cavities. The risk is expressed in terms of expected dose to the general population and peak dose to individuals in the population. DOE

N80-12857# Maryland Univ., College Park. Dept. of Physics and Astronomy.
HIGH ENERGY ACCELERATOR AND COLLIDING BEAM USER GROUP Progress Report, 1 Feb. 1977 - 31 Jan. 1978
G. A. Snow 1978 82 p refs
(Contract EY-76-C-05-2504)
(ORO-2504-273) Avail: NTIS HC A05/MF A01

A summary of high energy physics studies is presented. Topics covered include (e(+),e(-)) experiments; weak interactions; and electromagnetic and strong interaction experiments. DOE

N80-12858# Atomics International Div., Richland, Wash. Energy Systems Group.
ENGINEERING STUDY OF DRY NEAR-SURFACE INTERIM STORAGE OF FAST FLUX TEST FACILITY SPENT FUEL
Nov. 1978 66 p refs
(Contract EY-77-C-06-1030)
(RHO-LD-66) Avail: NTIS HC A04/MF A01

The methods for dry, near-surface storage of fast flux test facility (FFTF) spent driver fuel assemblies in the 200 Area at Hanford was accessed. The disposable cask, drywell and vault concepts are the most promising approaches for FFTF spent fuel storage in the Hanford 200 Area Starting in 1986. The cost and risk for the vault concept are higher than for either the disposable cask or drywell concepts. The disposal cask and drywell concepts are both satisfactory for this application. The risk for any of these concepts is minimal. Design and construction of a disposable cask or drywell facility can be completed within the constraint of a 1986 startup date if the project is initiated in fiscal year-1980. DOE

N80-12859# California Univ., Livermore. Lawrence Livermore Lab.
ACTINIDE CROSS SECTION DATA AND INERTIAL CONFINEMENT FUSION FOR LONG TERM WASTE DISPOSAL
H. Meldner 15 Jan. 1979 11 p refs Presented at the Conf. on Nucl. Data of Higher Plutonium and Americium Istopes for Reactor Appl., Upton, N. Y., 20-22 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-82177; CONF-781174-6) Avail: NTIS HC A02/MF A01

Actinide cross section data at thermonuclear neutron energies needed for the calculation of ICF pellet center burnup of fission reactor waste, viz. 14 MeV neutron fission of the very long lived actinides that pose storage problems are examined. The actinide data tables required for Monte Carlo calculations of the burnup of Am-241 and Am-243 are discussed in connection with typical burnup reactor fusion and fission spectra. DOE

N80-12860# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY AREA SELECTION CONSIDERATIONS FOR RADIOACTIVE WASTE REPOSITORIES IN BEDDED SALT
J. L. Wagoner and T. L. Steinborn 12 Jun. 1979 52 p refs
(Contract W-7405-eng-48)
(UCID-18122) Avail: NTIS HC A04/MF A01

An approach to selection of areas of bedded salt which contain potentially suitable sites for the storage of radioactive waste is described. To evaluate a site selected by a license applicant, it is necessary to understand the technical site characteristics which should be considered in the preliminary phase of site selection. These site characteristics are presented in checklist form, and each item is accompanied by a discussion which explains its significance. These qualitative considerations are used first to select an area of interest within a broad geologic or geomorphic region. Once an area has been selected, more quantitative information must be acquired to determine whether the proposed site meets the resultations for storage of nuclear waste. DOE

N80-12861# California Univ., Berkeley. Lawrence Berkeley Lab.
INDEPENDENT PARTICLE ASPECTS OF NUCLEAR DYNAMICS Ph.D. Thesis
M. C. Robel May 1979 290 p refs
(Contract W-7405-eng-48)
(LBL-8181) Avail: NTIS HC A13/MF A01

A generalization of the independent particle model from nuclear statics to nuclear dynamics is sought. Attention is centered on the average behavior of nuclear dynamics, as opposed to detailed behavior, such as that characteristic of shell effects in nuclear statics. In many situations, all that is needed is a model of dissipation in nuclear dynamics. DOE

N80-12862# Notre Dame Univ., Ind. Dept. of Physics.
MULTIQUARK MESONS
S. K. Bose and E. C. G. Sudarshan (Texas Univ., Austin) Nov. 1978 6 p refs
(Contract EY-76-S-05-3992)
(ORO-3992-355) Avail: NTIS HC A02/MF A01

Coupling schemes are considered for multiquark mesons, specifically those connecting the diquark-antidiquark mesons to conventional mesons and baryons. The resulting unique scheme is given, where the wave function is the three-quark composite baryon tensor having given properties. DOE

N80-12863# Los Alamos Scientific Lab., N. Mex.
COMPLEMENTARITY BETWEEN NEUTRON CAPTURE AND HEAVY-ION REACTIONS IN NUCLEAR STRUCTURE STUDIES
O. W. B. Schult 1978 19 p refs Presented at the 3d Intern. Symp. on Neutron Capture of Gamma-ray Spectry., Upton, N. Y., 18-22 Sep. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2432; CONF-780926-21) Avail: NTIS HC A02/MF A01

Neutron capture and heavy ion reactions are examined in terms of their relevancy to the study of nuclear structure. Spectroscopic methods employed for the study of nuclear structure are reviewed. Nuclear rotation and coupling of nucleons to the core and the de-excitation and structure of high lying states are among the topics covered. DOE

74 OPTICS

Includes light phenomena.

N80-12864 Pittsburgh Univ., Pa.
EFFECT OF DIMER DISSOCIATION ON DEPOLARIZED SCATTERED LIGHT IN DILUTE GASES Ph.D. Thesis
Frank John Paul Perzak 1979 90 p
Avail: Univ. Microfilms Order No. 7924677

A simple model for calculating the depolarized scattered light from dilute gases of isotropic species is derived using classical mechanics, and the results are compared with experimental data. Triple collisions are neglected. Binary collisions are considered to be transient dimers which translate and rotate in accordance with Maxwellian distribution laws, and they are assumed to dissociate at an apparent first order rate. The effect of the more stable dimers (i.e., dimers with negligible rate of dissociation) is also considered. The equilibrium concentration of these stable dimers is calculated for argon, xenon, and methane at 300 K, and the resulting scattered light is found to be a small fraction of the total scattering in agreement with earlier calculations. Dissert. Abstr.

N80-12865 Clarkson Coll. of Technology, Potsdam, N.Y.
THE 360 DEG LIGHT SCATTERING PHOTOMETER FOR SINGLE PARTICLE ANALYSIS Ph.D. Thesis
Marty Frank Bartholdi 1979 174 p
Avail: Univ. Microfilms Order No. 7925428

Light scattering by single spherical homogeneous particles in the diameter range 1 to 20 micrometers and relative refractive index 1.20 is measured. Particle size of narrowly dispersed populations is determined and a multimodal dispersion of five components is completely analyzed. The design and development of a 360 deg. light scattering photometer for analysis of single particles is presented. A fluid stream containing single particles intersects a focused laser beam at the primary focal point of an ellipsoidal reflector ring. The intensity and angular distribution of light scattered by spherical particles are indicative of size and relative refractive index. Calculations, using Lorenz-Mie theory, of differential scattering patterns integrated over angle corresponding to the detector geometry determined the instrument response to particle size. From this, the expected resolution and experimental procedures are determined. Dissert. Abstr.

N80-12866*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SCANNING AFOCAL LASER VELOCIMETER PROJECTION LENS SYSTEM Patent Application
David B. Rhodes, inventor (to NASA) Filed 7 Sep. 1979 10 p
(NASA-Case-LAR-12328-1; US-Patent-Appl-SN-073477) Avail: NTIS HC A02/MF A01 CSCL 20F

A method and apparatus for projecting and focusing parallel laser light beams from a laser Doppler velocimeter on a target area is presented. The system which includes three lenses is described. Two lenses work together as a fixed afocal lens combination. The third lens is a movable scanning lens. Parallel laser beams travel from the velocimeter through the scanning lens and through the afocal lens combination and converge. The constant focal volume and crossbeam angle which are maintained during the scan are discussed. NASA

N80-12867# Boeing Vertol Co., Philadelphia, Pa.
HELICOPTER CANOPY INTERNAL REFLECTION INVESTIGATION Final Report, Jul. 1978 - Jan. 1979
Dino Piccione Jul. 1979 40 p
(Contract DAAK51-78-C-0009; DA Proj. 1L1-62209-AH-76)
(AD-A073084; D210-11494-1; USARTL-TR-79-14) Avail: NTIS HC A03/MF A01 CSCL 01/3

The reflections on helicopter canopies from instrument panel light sources adversely affect night flight operations. A program objective was to investigate the application of Light Control Film, such as 3M or equivalent material, as a technique for eliminating helicopter canopy reflections in the AH-1S from instrument panel lighting which cause the pilot and copilot night flight operational problems. A mock-up of the AH-1S was used to test and evaluate the reflection conditions. Light control technology was reviewed to uncover corrective techniques or materials. The most promising approach was to apply 3M Light Control Film on the face of instruments and control panels. Most reflections were eliminated using this technique. A few problem areas still remain which appear to be treatable by applying a soft glare shield extension that enshrouds the cockpit. GRA

N80-12868# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
OPTICAL FRINGE ANALYSIS TECHNIQUES, VOLUME 1 Final Report, 1 Jul. 1975 - 30 Sep. 1978
T. L. Williamson and Charles Richard Lane Jun. 1979 24 p
(AF Proj. 2001)

(AD-A072714; AFAL-TR-79-1115-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 17/8

The use of specklegrams for performing certain types of NDI and NDT has been known for some time yet a method for extracting the data quickly and cheaply has eluded specklegram users. This report discusses a new technique for performing the data reduction of the large amounts of data obtained through speckle interferograms. This new technique correlates an optical mask on a fringe pattern to generate a single line scale proportional to the frequency of the cosine fringe pattern when integrated orthogonally to the fringe line. GRA

N80-12869# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
HOLOGRAPHIC SPECTRAL ANALYSIS Final Report, 1 Jul. 1975 - 30 Sep. 1978
T. L. Williamson and Charles Richard Lane Jun. 1979 41 p refs
(AF Proj. 2001)
(AD-A072715; AFAL-TR-79-1115-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 17/8

This report discusses the basic concepts and techniques required to design and use holographic optics for a number of spectral analysis problems. Since an in depth knowledge of the holographic processes is not required to use holographic optics for the various applications, the text is written for simplistic implementation into optical spectral analysis systems. Included in the report is a 9820A calculator ray trace program for aiding in the optical system design. GRA

N80-12870# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ACCURACY OF PARAMETER ESTIMATES FOR CLOSELY SPACED OPTICAL TARGETS Technical Note
Keh-Ping Dunn 13 Jun. 1979 35 p refs
(Contract F19628-78-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A073093; TN-1979-43; ESD-TR-79-152) Avail: NTIS HC A03/MF A01 CSCL 17/8

Cramer-Rao lower bounds on the degradation of measurement precision for closely space optical targets are found. Degradation is more severe than previously thought, especially, for small target separations. The bound obtained by a previous analysis, is, in fact, theoretically identical to the Cramer-Rao bound presented here. The disagreement in results is caused by numerical problems in a computer program used in the previous analysis. GRA

N80-12871# Alabama Univ., University.
THEORETICAL ANALYSIS OF SCATTERING OF A LASER BEAM FROM ROUGH SURFACES Final Report, 15 Dec. 1976 - 31 May 1979
C. C. Sung Jul. 1979 45 p refs
(Contract DAAG29-77-G-0051)
(AD-A073129; ARO-13913.6-P) Avail: NTIS HC A03/MF A01 CSCL 20/6

The accomplishments of the work performed under the support of the grant are summarized. The abstracts of all twelve publications are given in Appendix A. An important part of the effort in the speckle statistics deals with the computation of the probability density function of light received by a finite size detector. This work is included as Appendix B. GRA

N80-12872# Massachusetts Univ., Amherst. Dept. of Mechanical Engineering.
LIFETIME PREDICTION FOR OPTICAL GLASS FIBERS Technical Note, 1 Sep. 1978 - 31 Aug. 1979
John E. Ritter, Jr. and Karl Jakus Aug. 1979 30 p refs
(Contract N00014-78-C-0836)
(AD-A072771) Avail: NTIS HC A03/MF A01 CSCL 20/6

The number of test samples used to characterize the crack propagation parameter N of glass and ceramic materials determines the confidence in failure predictions for these materials. A Monte Carlo simulation technique was used to study the effect of sample size on the statistical reproducibility of the fatigue constant N from dynamic fatigue data. It is shown that the statistical variability in N can be large especially for sample sizes of less than 100. It is recommended that before meaningful conclusion can be drawn regarding the effect of a test variable on N as measured from the dynamic fatigue experiment, the statistical reproducibility of N should be evaluated. GRA

N80-12873# California Univ., Livermore. Lawrence Livermore Lab.
TOFS - A TIMING OPTICAL FIBER SYSTEM
D. L. Davis May 1979 14 p refs Presented at 2d Intern. Conf. on Megagauss Magnetic Field Generation and Related Topics, Washington, D. C., 29 May 1979
(Contract W-7405-eng-48)
(UCRL-81973; CONF-790540-5) Avail: NTIS HC A02/MF A01

A technique was established to accurately determine the position of a high velocity liner as it slides past or impinges on another surface. A small diameter optical fiber is accurately positioned relative to a target or liner. A bright light source (such as a small He-Ne laser) illuminates one end. The output from the other end is passed through a bandpass filter to a gated photomultiplier tube. Loss of the light signal thus accurately determines the time and position at which the fiber is broken by a passing liner. This technique is especially useful in environments where the presence of large magnetic fields or large circulating currents make the use of other techniques difficult (e.g., electrical shorting pins). This optical system is completely decoupled from environments having large electromagnetic noise levels. Shock waves in solid materials have been found to turn the fiber opaque during passage so that shock wave time of arrival studies are also feasible using the TOPS system. DOE

N80-12874# California Univ., Livermore. Lawrence Livermore Lab.
BRILLOUIN SCATTER IN A HYDRODYNAMIC SIMULATION
J. Harte, K. Estabrook, and D. Bailey 8 Jun. 1979 15 p refs Presented at 3d Ann. Conf. on Transport Processes in Plasmas, Traverse City, Mich., 18 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82793; CONF-790675-2) Avail: NTIS HC A02/MF A01

A numerical method for modeling stimulated Brillouin scatter (SBS) in a hydrodynamic simulation code is discussed. Preliminary results using the model show that scattering is reduced as shorter wave lengths are used, and for spherical symmetry, that ion heating by SBS is not significant since the ions cool by expansion. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-12875 Illinois Univ. at Chicago Circle, Chicago.
EIGENVALUE BOUNDS AND STABILITY OF CONSERVATIVE FLUID AND PLASMA FLOWS Ph.D. Thesis
Richard John Lucas 1979 192 p
Avail: Univ. Microfilms Order No. 7925992

The linear stability of several steady plasma and magnetohydrodynamic flows is studied. Circle theorems, which furnish bounds for the complex eigenfrequencies of any normal mode, are obtained for the swirling flow of a compressible, inviscid, perfectly conducting MHD fluid with axial and azimuthal equilibrium magnetic fields. Results for an inviscid compressible fluid are contained as a special case. Circle theorems are obtained for a macroscopic model of a swirling, inviscid, compressible N component plasma immersed in a static magnetic field having both axial and azimuthal components. The stability of plane parallel flow of an inviscid, compressible MHD fluid with a transverse equilibrium magnetic field, and the stability of an N component plasma with a transverse equilibrium magnetic field are discussed. Dissert. Abstr.

N80-12876 Iowa Univ., Iowa City.
NON-MARKOVIAN THEORY OF STRONG TURBULENCE Ph.D. Thesis
Michael Mond 1979 104 p
Avail: Univ. Microfilms Order No. 7924509

Steady state and time dependent statistical properties of quadratical nonlinear model turbulence equations are studied.

The nondissipative equilibrium, derived from the knowledge of the constants of motion which survive the truncation of the Fourier transformed equations, are discussed. Kolmogorov-like dimensional analysis is used in order to obtain the spectral laws for the dissipative forced case. The force acting on each degree of freedom in the turbulent system is split into two parts in the time dependent problem. A dynamical friction force which is nonmarkovian and a random force which has zero ensemble average. The demand that the random force has zero mean provides a procedure for renormalized expansion. The expansion procedure is applied to two cases: (1) two dimensional MHD turbulence. The DIA for this case is derived, and (2) a simple model due to Orszag. Dissert. Abstr.

N80-12877 Wisconsin Univ. - Madison.
CONVECTIVE CELLS AND THEIR RELATIONSHIP TO VORTEX DIFFUSION IN THE WISCONSIN LEVITATED OCTUPOLE Ph.D. Thesis
Alicia Butcher Ehrhardt 1978 210 p
Avail: Univ. Microfilms Order No. 7918886

Nonazimuthally symmetric floating potential structure (also called vortices or convective cells) were examined to determine whether the structure is responsible for enhanced diffusion in the Octupole. Two gun plasma were used: a collisionless H plasma and a collisional He plasma. The floating potential was measured as a function of the coordinates perpendicular to the magnetic field by a Langmuir probe mounted on a cart which could be moved azimuthally along the bottom of the Octupole; the results are presented as two dimensional contour plots. For a purely poloidal field, the floating potential was found to be constant along a magnetic field line, and the two dimensional contours are rotated about one of the internal rings to show the three dimensional potential structure. Dissert. Abstr.

N80-12878 Virginia Polytechnic Inst. and State Univ., Blacksburg.
OSCILLATIONS AND WAVES IN ANISOTROPIC PLASMAS Ph.D. Thesis
Michael D. Arthur 1979 114 p
Avail: Univ. Microfilms Order No. 7924087

The linearized Vlasov-Maxwell equations describing anisotropic plasma oscillations and waves are studied using an operator theoretic approach. The model considered is one dimensional. Existence and uniqueness of the solution to the longitudinal plasma wave boundary value problem is proved by writing the longitudinal equations in operator form and using the theory of semigroups. The solution of the plasma wave boundary value problem is arrived at by a Fourier time transformation of the Vlasov equation coupled to Ampere's Law rather than Gauss' Law, and analyzing a scalar operator. The Wiener-Hopf factorization of the fixed frequency longitudinal plasma dispersion function is presented. The longitudinal plasma wave problem and the coupled nonlinear integral equations for the Wiener-Hopf factors are studied. Dissert. Abstr.

N80-12879 Wisconsin Univ. - Madison.
TURBULENCE MEASUREMENTS BY DIGITAL SPECTRAL ESTIMATION IN THE OHMICALLY HEATED PROTOCLEO TORSATRON Ph.D. Thesis
Thomas Anthony Casper 1979 185 p
Avail: Univ. Microfilms Order No. 7919791

Low frequency fluctuations observed in the ohmically heated plasma of the Proto-Cleo Torsatron are examined. Density fluctuations inferred by ion saturation current of double Langmuir probes were Fourier analyzed using digital signal processing techniques. Results indicate the fluctuations to be of a turbulent nature with no narrow band coherent phenomena observed for frequencies less than 500 kHz. The fluctuations examined are believed to be driven by the ohmic heating current and result in diffusion coefficient estimates consistent with fluctuation induced diffusion. Dissert. Abstr.

N80-12880*# State Univ. of New York at Buffalo. Lab. for Power and Environmental Studies.
EXPERIMENTAL AND THEORETICAL INVESTIGATION FOR THE SUPPRESSION OF THE PLANAR ARC DROP IN THE THERMIONIC CONVERTER Final Report, 1 Jul. 1974 - 15 Apr. 1978
David T. Shaw Apr. 1979 41 p refs
(Grant NsG-7071)
(NASA-CR-159611; LAPES-79-003) Avail: NTIS HC A03/MF A01 CSCL 20I

The possibility of using N2 as a gas additive for the development of thermionic topping generators was investigated. The experiment is described and observations are discussed. The potential of applying microwave power in the interelectrode spacing of the converter as an ion generation source was also assessed. A.R.H.

N80-12881*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS OF DUCT AREA RATIO CHANGES IN THE NASA LEWIS H2-O2 COMBUSTION MHD EXPERIMENT
J. Marlin Smith 1979 12 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-79308; E-264) Avail: NTIS HC A02/MF A01 CSCL 20I

MHD power generation experiments utilizing a cesium-seeded H2-O2 working fluid were carried out using a diverging area Hall duct having an entrance Mach number of 2. The experiments were conducted in a high field strength cryomagnet facility at field strengths up to 5 tesla. The effects of power takeoff location, generator loading B field strength, and electrode breakdown voltage were investigated. The effect of area ratio, multiple loading of the duct, and duct location within the magnetic field are considered. R.C.T.

N80-12882# Argonne National Lab., Ill. Engineering Div.
EXPERIMENTAL TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC GENERATOR PROGRAM Final Report, Oct. 1977 - Sep. 1978
M. Petrick, G. Fabris, E. S. Pierson, A. K. Fischer, and C. E. Johnson Apr. 1979 214 p refs
(Contract N00014-78-F-0004)
(AD-A073128; ANL/MHD-79-1) Avail: NTIS HC A10/MF A01 CSCL 20/9

The experimental results presented herein satisfy one major goal in demonstrating the technical feasibility of two-phase LMMHD (liquid-metal MHD), i.e., operating an MHD generator at power densities equal to or above that anticipated for practical power systems. Power densities of up to 32 MWe/m(3) and efficiencies higher than 0.6 at high void fractions were attained for a small 20 kWe generator. Slip ratio data, and more extensive pressure distribution and voltage profile data are also given. Barium has been identified as an attractive additive for the generation of foams with NaK, and bismuth is a back-up for barium. A guiding hypothesis for understanding the phenomena contributing to foamability in liquid metal systems has been developed, and basic data on surface tension obtained. GRA

N80-12883# California Univ., San Diego, La Jolla.
SPECIFICATION OF THE NATURAL PLASMA ENVIRONMENT AT GEOSYNCHRONOUS ORBIT Final Report, 1 Oct. 1977 - 30 Sep. 1978
Sherman E. Deforest and E. C. Whipple Hanscom AFB, Mass. AFGL 10 Dec. 1978 32 p
(Contract F19628-77-C-0014; AF Proj. 7661)
(AD-A073160; AFGL-TR-79-0060) Avail: NTIS HC A03/MF A01 CSCL 20/9

This work has made extensive use of data taken by instruments funded by NASA contracts NAS 5-10364 (ATS-5) and NAS 5-21055 (ATS-6). Much use has been made of software also developed under the same contracts. The present contract was negotiated as a result of the realization that the UCSD plasma instruments onboard the ATS spacecraft could be used to specify an environmental model which would be of use to the Air Force in developing design specifications for spacecraft to prevent faulty operation due to environmentally induced electrostatic charging. In addition, reorganization and study of the existing data would also be of use in developing models which could be of use in predicting times when hazards to spacecraft from charging might be great. Within the next year, SCATHA will make the first observations from a vehicle specifically designed to study charging at geosynchronous orbit. We expect that refinements to the data presented here will result from that program, and that new models will result. GRA

N80-12884# Princeton Univ., N. J.
TEARING MODES IN A PLASMA WITH MAGNETIC BRAIDING
P. K. Kaw, E. J. Valeo, and P. H. Rutherford Jul. 1979 18 p refs
(Contract EY-76-C-02-3073)
(PPPL-1561) Avail: NTIS HC A02/MF A01

Certain linear and nonlinear properties of macroscopic tearing modes driven by anomalous electron viscosity effects associated with magnetic braiding are examined. Strong linear growth of m = 1, 2 tearing modes (respectively proportional to micron/sup 1/5/ and micron/sup 1/3/) which can occur for rather modest values of micron are discussed. In the nonlinear phase, the island width grows in time as t/sup 1/3/. Speculations regarding the disruptive instability in Tokamaks are investigated. DOE

N80-12885# Los Alamos Scientific Lab., N. Mex.
EXPERIMENTS ON THE ZT-S REVERSED-FIELD PINCH, AUGUST - DECEMBER 1978
A. R. Jacobson Jun. 1979 42 p refs
(Contract W-7405-eng-36)
(LA-7862-MS) Avail: NTIS HC A03/MF A01

The ZT-S reversed field pinch was used to explore the utility of pitch programming techniques in setting up stable diffuse pinch profiles. Experimental observations relating to this goal are presented. DOE

N80-12886# California Univ., Livermore. Lawrence Livermore Lab.
TANDEM MIRROR FUSION REACTOR STUDIES Status Report
G. A. Carlson, R. S. Devoto, J. L. Erickson, J. H. Fink, B. G. Logan, and W. S. Neef, Jr. 15 Nov. 1978 37 p refs
(Contract W-7405-eng-48)
(UCID-17990) Avail: NTIS HC A03/MF A01

A preliminary design study of a 1000 MWe tandem mirror fusion reactor is discussed. Work on the reactor concept including development of a more detailed computer model for tandem mirror physics, the investigation of possible routes to higher Q tandem mirror reactors, design of less expensive central cells for tandem mirror reactors, and component design for the 1 MeV neutral beam injectors required for the end cells is described. DOE

N80-12887# Science Applications, Inc., La Jolla, Calif. Lab. for Applied Plasma Studies.
TRANSPORT AND RADIATION STUDIES OF BELT PINCHES AND HIGH-BETA TOKAMAKS
R. N. Byrne and C. K. Chyu Nov. 1978 24 p refs
(Contract EY-76-C-03-1028)
(SAI-78-964-LJ; LAPS-47) Avail: NTIS HC A02/MF A01

Transport and radiation studies are performed for 2 to 1 radio elliptical cross section plasmas, using the toroidal geometry diffusion code G2M. The Torus 1 and 2 machines are used as models. Two types of profiles are studied: parobolic density and temperature distributions, and force free current profiles, with density peaked near the center and temperature almost flat. DOE

N80-12888# Princeton Univ., N. J. Plasma Physics Lab.
VOLT-SECOND CONSUMPTION DURING THE STARTUP PHASE OF A LARGE TOKAMAK
R. J. Hawryluk and K. Bol Jan. 1979 14 p refs
(Contract EY-76-C-02-3073)
(PPPL-1508) Avail: NTIS HC A02/MF A01

The volt-second consumption in the PLT Tokamak was measured. The volt-second consumption was determined primarily by the external and internal flux required to establish the current profile during the startup phase. The resistive volt-second loss on axis is discussed. DOE

N80-12889# Los Alamos Scientific Lab., N. Mex.
PROPOSAL FOR THE THEORETICAL INVESTIGATION OF THE RELATIVISTIC BEAM-PLASMA INTERACTION WITH APPLICATION TO THE PROOF-OF-PRINCIPLE ELECTRON BEAM-HEATED LINEAR SOLENOIDAL REACTOR
L. E. Thode Sep. 1978 21 p refs
(Contract W-7405-eng-36)
(LA-7359-P) Avail: NTIS HC A02/MF A01

A 36-month program to study the linear relativistic electron beam-plasma interaction is proposed which includes direct support for 1- and 3-m beam-plasma interaction experiments and development of theory relevant for design of a 10-m proof-of-principle electron beam-driven linear solenoidal reactor. DOE

N80-12890# Los Alamos Scientific Lab., N. Mex.
MULTIPLE-MIRROR AXIAL CONFINEMENT USING THE FLUID MODEL
Gurthrie Miller Dec. 1978 14 p refs
(Contract W-7405-eng-36)
(LA-7580-MS) Avail: NTIS HC A02/MF A01

Axial plasma flow through a multiple mirror is calculated using the fluid equations with classical transport. The validity limits are discussed and an attempt is made to extend them. The results are compared with results in the literature. DOE

N80-12891# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
CHARACTERIZATION OF MICROCHANNEL PLATE PHOTOMULTIPLIERS FOR PLASMA DIAGNOSTICS
L. P. Hocker, P. A. Zagarino, J. Madrid (EG&G, Inc., Las Vegas, Nev.), D. Simmons (EG&G, Inc., Las Vegas, Nev.), B. Davis (EG&G, Inc., Las Vegas, Nev.), and P. B. Lyons 1978 8 p refs Presented at IEEE Nuclear Sci. Symp., Washington, D.C., 18 Oct. 1978
(S-129-TP; CONF-781033-4) Avail: NTIS HC A02/MF A01

Properties of four types of microchannel plate photomultipliers were studied, with emphasis on applications to plasma diagnostic experiments. Detector pulse shapes, peak linear currents, pulse rate effects, and ionic feedback effects are documented. Minimum FWHM of 210 ps was observed. Peak linear currents up to 11 A are included. DOE

N80-12892# California Univ., Livermore. Lawrence Livermore Lab.
SUPERCONDUCTING MAGNETS FOR MIRROR MACHINES
G. A. Carlson 12 Sep. 1978 16 p refs Presented at Driven Magnetic Fusion Reactors, Erice, Italy, 18 Sep. 1978
(Contract W-7405-eng-48)
(UCRL-81578; CONF-780946-4) Avail: NTIS HC A02/MF A01

The simple mirror configuration, consisting of a long solenoid with increased field strength at the ends (magnetic mirrors), proved to be an unstable plasma container and was replaced by the minimum absolute value of B mirror configuration. The Yin-Yang minimum absolute value of B coil was chosen for the mirror fusion test facility experiment and recent conceptual designs of standard mirror reactors. For the multicell field-reversed mirror reactor concept, to the long solenoid configuration, augmented by normal copper mirror coils and Ioffe bars were placed at the first wall radius to provide a shallow magnetic well for each field-reversed plasma layer. The central cell of the tandem mirror is also a long solenoid while the end plug cells require a minimum absolute value of B configuration. DOE

N80-12893# Battelle Pacific Northwest Labs., Richland, Wash.
SAFETY ASPECTS OF ACTIVATION PRODUCTS IN A COMPACT TOKAMAK FUSION POWER PLANT
H. J. Willenberg and W. E. Bickford Oct. 1978 119 p refs
(Contract EY-76-C-06-1830)
(PNL-2823) Avail: NTIS HC A06/MF A01

Neutron activation of materials in a compact Tokamak fusion reactor was investigated. Results of activation product inventory, dose rate, and decay heat calculations in the blanket and injectors are presented for a reactor design with stainless steel structures. Routine transport of activated materials into the plasma and vacuum systems is discussed. Accidental release of radioactive materials as a result of liquid lithium spills is also considered. DOE

N80-12894# Sandia Labs., Albuquerque, N. Mex.
USER'S MANUAL FOR THE MAGNETOHYDRODYNAMIC GENERATOR CHANNEL CODE, MHDCHN
A. J. Russo Jan. 1979 52 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1260) Avail: NTIS HC A04/MF A01

A two-dimensional steady state MHD generator channel code was developed to solve for the electric current density and potential field in a channel section. It was designed to operate with a companion fluid code, SCF, which supplies thermodynamic and velocity data as input; however, it may also be used independently or made to interact with other fluid codes. The program is currently operational on the CDC 6600-7600 computer system. The equations that are solved and the input and output data that are required for operation of the code are described. DOE

N80-12895# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DEVELOPING MAINTAINABILITY FOR TOKAMAK FUSION POWER SYSTEMS, PHASE 2 REPORT. VOLUME 2: STUDY RESULTS
G. M. Fuller, H. S. Zahn, H. C. Mantz, G. R. Kaletta, L. M. Waganer, L. A. Carosella, and J. L. Conlee Nov. 1978 386 p refs
(Contract EG-77-C-02-4184)
(COO-4184-6-Vol-2) Avail: NTIS HC A17/MF A01

The impact of unscheduled maintenance, several vacuum wall arrangements, and maintenance of other reactor interfacing subsystems and maintenance equipment are added to the evaluation of the maintainability of the fusion power reactor concepts. Four concepts are normalized to common performance parameters and evaluated for their capability to achieve availability and cost of electricity goals considering both scheduled and unscheduled maintenance. The results of this evaluation are used to generate a series of maintainability design guidelines and to select the more desirable features and design options which are used to configure a preliminary reactor concept having improved maintainability. DOE

N80-12896# General Atomic Co., San Diego, Calif.
THERMAL-HYDRAULIC CONSIDERATIONS IN MAGNETICALLY CONFINED FUSION REACTORS
D. W. Kearney Jan. 1979 15 p refs Presented at Intern. Conf. on Structural Mech. in Reactor Tech., Berlin, 13 Aug. 1979
(Contract EY-76-C-03-0167)
(GA-A-15365; CONF-790802-13) Avail: NTIS HC A02/MF A01

The structural-related thermal problems that have developed from work on the Tokamak and mirror concepts were studied, though many of the important considerations are generic to all magnetic fusion systems. The thermal loads due to alpha particle energy deposition on the first wall, and the energy deposited by neutron interaction as volumetric heating, place substantial cooling requirements on many components of a fusion reactor, e.g., coils, blankets, shields and first walls. The high temperature region in close proximity to the plasma are discussed. Heat fluxes, temperatures and temperature fluctuation are highest in these components, possibly leading to creep rupture and thermal fatigue. Some of the design solutions and thermal-hydraulic results presented in recent fusion reactor conceptual design studies are discussed. DOE

N80-12897# Argonne National Lab., Ill. Chemical Engineering Div.
CURRENT STATUS OF FUSION REACTOR BLANKET THERMODYNAMICS
E. Veleckis, R. M. Yonco, and V. A. Maroni Apr. 1979 34 p refs
(Contract W-31-109-eng-38)
(ANL-78-109) Avail: NTIS HC A03/MF A01

Recent studies of liquid lithium have concentrated on its sorption characteristics for hydrogen isotopes and its interaction with common impurity elements. Hydrogen isotope sorption data (P-C-T relations, activity coefficients, Sieverts' constants, plateau pressures, isotope effects, free energies of formation, phase boundaries etc.) are presented in a tabular form that can be conveniently used to extract thermodynamic information for the alpha phase of the Li-LiH, Li-LiD, and Li-LiT systems and to construct complete phase diagrams. Recent solubility data for Li3N, Li2O, and Li2C2 in liquid lithium are discussed with emphasis on the prospects for removing these species by cold-trapping methods. Current studies on the sorption of hydrogen in solid lithium alloys (e.g., Li-Al and Li-Pb), made using a new technique (the hydrogen titration method), have shown that these alloys should lead to smaller blanket-tritium inventories than are attainable with liquid lithium and that the P-C-T relationships for hydrogen in Li-M alloys can be estimated from lithium activity data for these alloys. DOE

N80-12898# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.
CONCEPTUAL DESIGN OF A DEMONSTRATION TOKAMAK HYBRID REACTOR (DTHR)
J. L. Kelley Dec. 1978 195 p refs
(Contract EG-77-C-02-4544)
(WFPS-TME-107) Avail: NTIS HC A09/MF A01

The flexibility of the fusion hybrid reactor to function as a fuel production facility, power plant, waste disposal burner or combinations of all of these, as well as the reactor's ability to use proliferation resistant fuel cycles, has provided the incentive to assess the feasibility of a near-term demonstration plant. The goals for a Demonstration Tokamak Hybrid Reactor (DTHR) were established and an initial conceptual design was selected. Reactor performance and economics were evaluated and key developmental issues were assessed. The study has shown that a DTHR is feasible in the late 1980's, a significant quantity of fissile fuel could be produced from fertile thorium using present day fission reactor blanket technology, and a large number of commercially prototypical components and systems could be developed and operationally verified. The DTHR concept would not only serve as proof-of-principle for hybrid technology, but could be operated in the ignited mode and provide major advancements for pure fusion technology. DOE

N80-12899# Department of Energy, Washington, D. C.
MAGNETIC FUSION THEORY EFFORT
May 1979 104 p refs
(DOE/ET-0099) Avail: NTIS HC A06/MF A01

A comprehensive listing of the magnetic fusion theory effort is presented. Data on the FY 1977 and FY 1978 budgets are given. Approximately 34 entries are reported along with a section devoted to the National Magnetic Fusion Computer Center. DOE

N80-12900# California Univ., Livermore. Lawrence Livermore Lab.
SEARCH FOR FUSION POWER
R. F. Post 12 Oct. 1978 16 p
(Contract W-7405-eng-48)
(UCRL-81890) Avail: NTIS HC A02/MF A01

The basics of fusion power are reviewed. Both inertial confinement and magnetic confinement fusion are discussed. DOE

N80-12901# Oak Ridge National Lab., Tenn.
RESPONSE OF A TOKAMAK PLASMA TO PARTICLE AND MOMENTUM SOURCES
W. M. Stacey, Jr. and D. J. Sigmar Dec. 1978 47 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6575) Avail: NTIS HC A03/MF A01

The response of an axisymmetric toroidal Tokamak plasma to first-order particle and momentum sources is investigated. The momentum sources which drive coupled poloidal and toroidal mass flows and electrostatic field evolution are examined. Transport fluxes which are driven across flux surfaces both by interspecies collisional momentum exchange, and by momentum exchange between the plasma and external sources and/or drags are discussed. A generalized Ohm's law is obtained and used to determine the manner in which particle and momentum sources can drive parallel currents and can alter the evolution of the q-profile. The theory is formulated for arbitrary plasma cross sections, beta, and collision regimes. DOE

N80-12902# California Univ., Livermore. Lawrence Livermore Lab.
RADIAL DIFFUSION OF RESONANT PARTICLES IN TANDEM MIRRORS
Y. C. Lee 4 Dec. 1978 29 p refs
(Contract W-7405-eng-48)
(UCID-17992) Avail: NTIS HC A03/MF A01

The radial diffusion of resonant particles in the banana regime and the plateau regime is derived in detail from kinetic theory.

The plateau diffusion, calculated in the tau approximation, is discussed in relation to the result given by Ryutov-Stupakov. The banana diffusion which agrees with the R-S result provided the latter is corrected for some dependence of the collision frequency on epsilon and phi is examined. DOE

N80-12903# California Univ., Livermore. Lawrence Livermore Lab.
STATISTICAL MECHANICS OF REACTING DENSE PLASMAS
F. J. Rogers 22 Nov. 1978 23 p refs Presented at the Conf. on Dense Plasmas, Pasadena, Calif., 14-16 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-81936; CONF-781189-1) Avail: NTIS HC A02/MF A01

The quantum statistical theory of strongly coupled many component plasmas is reviewed. The theoretical development is shown to consist of six separate parts. Compensation between bound and scattering state contributions to the partition function and use of the shifted Debye energy levels are discussed. DOE

N80-12904# Princeton Univ., N. J. Plasma Physics Lab.
SYSTEMS STUDY OF TOKAMAK FUSION-FISSION REACTORS
F. H. Tenney, C. G. Bathke, W. G. Price, Jr., W. H. Bohlke, R. G. Mills, E. F. Johnson, A. M. M. Todd, C. H. Buchanan, and S. L. Gralnick Nov. 1978 549 p refs
(Contract EY-76-C-02-3073)
(PPPL-1450) Avail: NTIS HC A23/MF A01

A systematic analysis of wide variety of Tokamak driven fissioning blanket reactors is presented. The quantitative problems of determining the economically most desirable mix of the two products: electric power and fissionable fuel are addressed. An optimizing algorithm that operates in a six dimensional parameter spece is described. Comparisons made on sets of as many as 100,000 distinct machine models, and the principal results of the study derived from the examination of several hundred thousand possible reactor configurations are presented. DOE

N80-12905# Columbia Univ., New York. School of Engineering and Applied Science.
THERMONUCLEAR BURN IN WALL-CONFINED PLASMAS
L. N. Kmetyk 1979 151 p refs
(Contract EY-76-S-02-2456)
(COO-2456-60) Avail: NTIS HC A08/MF A01

The one dimensional initial value problem describing a hot, dense, thermonuclear reacting plasma which is magnetically insulated and contained between cold metal walls was studied by means of computational simulation. The resulting time evolution of the plasma temperature, number density and magnetic field profiles includes the effects of thermal conduction and radiation energy losses from the plasma, convection, and a detailed treatment of alpha particle heating, as well as ohmic heating and magnetic field diffusion. The results are used to evaluate the net energy gains possible in shock heated, magnetically insulated, well confined fusion cycle. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-12906 Wisconsin Univ. - Madison.
THE TRANSPORT PROPERTIES OF DILUTE GASES IN APPLIED FIELDS Ph.D. Thesis
James Arthur Thomas 1978 196 p
Avail: Univ. Microfilms Order No. 7918166

The difficulties inherent in treating diatom-diatom interactions lead to consideration of binary gaseous mixtures in which the dominant species is atomic, the diatomic species being restricted to low concentrations. Such systems require consideration of atom-atom and atom-diatom interactions only. Employing methods introduced by Hunter, scalar equations are obtained for the transport properties of binary mixtures in applied magnetic fields. The shear viscosity of an atom-diatom mixture in an applied magnetic field is then treated in detail. The basis set is truncated and the diatomic species is restricted to low concentrations. The expressions obtained for the shear viscosity tensor are reported. Steps leading to calculation of the shear viscosity tensor in this particular case are discussed. Dissert. Abstr.

N80-12907 Iowa State Univ. of Science and Technology, Ames.
THE CRYSTAL AND MOLECULAR STRUCTURE OF SOME HIGH COORDINATION RARE EARTH COMPOUNDS, THE MAGNETIC AND STRUCTURAL PROPERTIES OF SOME RARE-EARTH-TRANSITION-METAL COMPOUNDS, AND USE OF RADIAL DISTRIBUTION FUNCTIONS IN STRUCTURAL ANALYSIS Ph.D. Thesis
Charles Curtis Fuller 1979 190 p
Avail: Univ. Microfilms Order No. 7924241

The crystal and molecular structures of two decacoordinate rare earth compounds, lanthanum HEDTA and praseodymium nitrate, are investigated. A discussion of decacoordination is given. The crystal and magnetic properties of three classes of ternary rare earth alloys, RMn4Al8, RFe4Al8, and RCu4Al8, are discussed. X-ray and neutron diffraction experiments are described, as well as magnetic susceptibility measurements. The use of radial distribution functions as a tool in structural analysis is investigated, using niobium hydride and lutetium hydride structures as an example. When coupled with neutron diffraction, this technique is shown to be useful in determination of the hydrogen positions. Dissert. Abstr.

N80-12908 Clarkson Coll. of Technology, Potsdam, N.Y.
STUDIES IN SURFACE STRUCTURE BY MEANS OF SURFACE VISCOSITY Ph.D. Thesis
Dennis Wayne Goupil 1979 178 p
Avail: Univ. Microfilms Order No. 7923695

The research involves two applications of the Goodrich viscometer. The interfacial conformations of a polypeptide were investigated with the hope that surface shear viscosity can provide a diagnostic tool for differentiating in situ between various conformers. The behavior of a fatty acid at the oil/water interface as the pH of the aqueous phase is altered is illustrated. Dissert. Abstr.

N80-12909 City Univ. of New York, N. Y.
EFFECTS OF UNIAXIAL STRESS ON EXCITONS IN CUPROUS OXIDE Ph.D. Thesis
Robert George Waters 1979 177 p
Avail: Univ. Microfilms Order No. 7923777

The effects of uniaxial stress on several exciton states in cuprous oxide were studied. The experiments, which were performed using oriented single crystal samples, utilized the resonant Raman scattering spectroscopic technique. This method identifies quadrupole allowed exciton states by the enhancement in the Raman cross section for normally forbidden scattering from odd parity phonons. Three S (L=0) exciton states and one D (L=2) state were studied using stresses of two different symmetries. The results of the experiments are analyzed and compared with theoretical predictions. Dissert. Abstr.

N80-12910 Utah Univ., Salt Lake City.
HYDROSTATIC PRESSURE EFFECTS ON THE MOTIONAL BEHAVIOR OF MOLECULES AND IONS IN ALKALI HALIDES, ALKALI CYANIDES AND BETA-ALUMINA Ph.D. Thesis
Klaus Thoermer 1979 167 p
Avail: Univ. Microfilms Order No. 7925044

Lattice compression by hydrostatic pressure was applied to study the motional behavior of ions and molecules in solids, using dielectric and optical techniques. Two simple model systems with dilute noninteracting dipole defects were investigated here: Li(+) in RbCl - a test-case for the theory - was shown to be an off center defect, displaying a strong decrease of potential barriers and relaxation time under lattice compression. An extensive study in the effects of pressure on the rotation of dilute OH(-) molecules in eight alkali-halide hosts was conducted. Two complex systems, in which interaction effects cannot be neglected or are predominant, were studied using similar concepts and techniques: The motional behavior of Li(+), Na(+), K(+),Ag(+), and H3O(+) ions in the superionic conductor beta alumina was investigated under fields applied perpendicular to

the conduction planes. The collective ordering of CN(-) molecules in KCN mixed with KCl and KBr was studied under pressure by monitoring with laser light the onset of light scattering from domains at the ferroelastic phase transition. Dissert. Abstr.

N80-12911 Columbia Univ., New York.
A STUDY OF THE OPTICAL AND TRANSPORT PROPERTIES OF THE TERNARY SEMICONDUCTING COMPOUNDS AlxGa1-xAs HIGH PRESSURE Ph.D. Thesis
Nadezhda Lifshitz 1979 166 p
Avail: Univ. Microfilms Order No. 7924931

An investigation on the effect of hydrostatic pressure as well as composition on the electronic band structure and transport properties of the compound semiconductor Al sub x Ga sub 1-xAs is discussed. The results are discussed using models appropriate for the situation. The actual experiments were (1) optical absorption measurements on Al sub x Ga sub 1-xAs samples as a function of pressure, (2) Hall effect and resistivity measurements to 40 kbar pressure at temperature in the range 150 K to 300 K. These measurements provided experimental data from which the direct energy gap pressure coefficient and also the Hall coefficient and Hall mobility variation with pressure, temperature and composition were determined. Dissert. Abstr.

N80-12912 New York Univ., N. Y.
LATTICE AND ELECTRONIC PROPERTIES OF THE HIGH TEMPERATURE SUPERCONDUCTOR VANADIUM SILICIDE Ph.D. Thesis
Marvin Milewits 1979 218 p
Avail: Univ. Microfilms Order No. 7925495

The anomalous temperature dependencies of the transport and thermodynamic properties of the A-15's are explored via measurements of electrical resistivity, thermal expansion, and neutron scattering. High precision measurements of electrical resistivity coupled with highly sensitive thermal expansion and moderately precise thermal neutron scattering measurements on various single crystals of V3Si which reveal unknown characteristics are discussed. The electrical resistivity rho (T) of V3Si as well as the other A-15 compounds Nb3Sn and Nb3Sb are characterized by the sum of a linear and a dominant exponential term over a wide range in temperature. Dissert. Abstr.

N80-12913 Brandeis Univ., Waltham, Mass.
MOMENTUM DENSITY MEASUREMENTS IN Cu AND ALPHA-PHASE Cu-Zn ALLOYS WITH A MULTI-COUNTER TWO-DIMENSIONAL ANGULAR CORRELATION OF ANNIHILATION RADIATION APPARATUS Ph.D. Thesis
Mohammed Haghgooie 1979 161 p
Avail: Univ. Microfilms Order No. 7925708

A multicounter point slit apparatus with 0.5 mrad by 1.5 mrad slit openings was used to measure two dimensional angular correlation of annihilation radiation (2D-ACAR) surfaces from oriented crystals of pure Cu, Cu-11.6 at.% Zn and Cu-30 at.% Zn alloys. The experimental results from three orientations of the Cu crystal reveal the known topology of the Cu Fermi surface. The alloy surfaces are quite similar in shape to the corresponding results in Cu; however, they show a clear increase in the size of the Fermi surface. The 2D-ACAR surfaces at large momenta reveal marked anisotropies which are believed to be due to the high momentum components of the positron and conduction electrons wave functions. The comparison of the first derivative curves from pure Cu and disordered Cu-Zn alloys indicates that the FS smearing in the alloys due to randomness is less than 3% even for the Cu-30 at.% Zn alloy. Dissert. Abstr.

N80-12914 California Univ., Riverside.
STUDIES OF HOPPING AND CORRELATED HOPPING IN P-TYPE GERMANIUM BY PIEZO-MAGNETO-RESISTANCE MEASUREMENTS Ph.D. Thesis
Ching-Long Jiang 1979 90 p
Avail: Univ. Microfilms Order No. 7924286

Hopping conductivity in p-type germanium was measured as a function of magnetic field H, temperature T, tensile and compressive stress X, and acceptor concentration. A model was proposed to explain the features of the results. In this model, the acceptor consists of two wave functions with different anisotropies and similar radii which are degenerate at X = 0 and gradually split at a finite stress. In the low and intermediate stress regimes, the main effect of stress is to split the wave functions, while that of the magnetic field is to modify the size of the wave functions. In the high stress regime, the effect of stress on the size of the wave functions is important. Correlated hopping was proposed to be the mechanism which dominates transport at high stress and/or at high impurity concentrations. Dissert. Abstr.

N80-12915 Columbia Univ., New York.
VERY SHALLOW P-N JUNCTIONS WITH BORON-RICH LAYERS AND APPLICATIONS AS HIGH EFFICIENCY P+/N PHOTOVOLTAIC JUNCTIONS Ph.D. Thesis
Myung Seung Bae 1979 83 p
Avail: Univ. Microfilms Order No. 7924848

A boron diffusion process is described for the fabrication of a very shallow p+ diffused layer in silicon with a very high surface concentration. The diffused layers and the thin boron rich layers which form during this diffusion process were studied by auger electron spectroscopy, secondary ion mass spectrometry, low energy electron diffraction, reflection high energy electron diffraction, and reflection X-ray topography. It was demonstrated for the first time that very efficient photovoltaic devices of p+/n structure can be made by this process with AMI efficiency of greater than 17%. By retaining a thin boron rich layer, it was possible to lower the lateral series resistance of the very shallow diffused layer and also to passivate the bare surface of silicon. Dissert. Abstr.

N80-12916 Illinois Univ. at Chicago Circle, Chicago.
LOW TEMPERATURE SPECIFIC HEAT OF NICKEL-COPPER ALLOYS IN VARIOUS MAGNETIC FIELDS Ph.D. Thesis
Robert George Aitken 1979 172 p
Avail: Univ. Microfilms Order No. 7925988

The specific heat of three Ni-Cu alloys (40, 43, & 45 at.% Ni) in applied magnetic fields of 10, 20, 30, and 42 kOe, as well as in zero field, was measured over the temperature range from 1.2 to 12 K. The anomalous magnetic term in the specific heat of these alloys, is found to be due to dilute concentrations of paramagnetic clusters with giant magnetic moments. The values obtained for the coefficient of the electronic term in the specific heat are considerably higher than the known value for pure copper, indicating that the itinerant-electron rigid band model is not correct. The magnetic term in the specific heat was found to vary linearly with temperature at the lowest temperatures, which is considered to be characteristic of a spin-glass-like distribution of internal fields within the material. It appears that the internal field distribution in Ni-Cu is basically the same on both sides of the critical composition for ferromagnetism. Dissert. Abstr.

N80-12917 Pittsburgh Univ., Pa.
SINGLE CRYSTAL DEFECT STUDIES BY MEANS OF ION CHANNELING Ph.D. Thesis
Jeng Hsien Chang 1979 100 p
Avail: Univ. Microfilms Order No. 7924650

The efficacy of Rutherford Backscattering and Channeling in elucidating the nature of radiation induced defects and strain incuded structural defects in single crystals of metals and semiconductors was explored. A reveiw is given of the basic theories of channeling followed by a description of the apparatus. Experimental procedures are outlined in detail. Case studies are presented for radiation damaged Mo and epitaxial layers of Si grown on sapphire substrates. Within the very serious limitations of presently available theory the experimental results were analyzed. Dissert. Abstr.

N80-12918 Stevens Inst. of Tech., Hoboken, N. J.
AN X-RAY DIFFRACTION STUDY OF THE THERMAL VIBRATION OF ATOMS IN BETA-TIN Ph.D. Thesis
Berton Laurence Greenberg 1979 169 p
Avail: Univ. Microfilms Order No. 7925050

An expression for the temperature factor, exp(-W) of Beta-tin was calculated using the independent anharmonic oscillator model of thermal motion. The result confirms previous analyses and extends them to include fourth order terms in the atomic potential energy. Anharmonic effects were experimentally observed. These include tentative observations of centric anharmonic components of thermal motion in certain crystallographic

directions. Controversial space group forbidden reflections were observed. Their presence could be explained on the basis of simultaneous reflection effects. Anomalously low values of less than u squared greater than were observed in a room temperature experiment and in an intensity versus temperature experiment. In the former case the effect was explained on the basis of secondary extinction and in the latter on the basis of an unusual configuration of seven simultaneous reflections.

Dissert. Abstr.

N80-12919 Michigan Univ., Ann Arbor.
EXCITONS, PHONONS, AND ENERGY TRANSPORT IN MIXED NAPHTHALENE CRYSTALS: PERCOLATION OR ANDERSON LOCALIZATION Ph.D. Thesis
David Cutler Ahlgren 1979 211 p
Avail: Univ. Microfilms Order No. 7925100

The phonons and vibrational exciton bands in the far infrared spectrum of isotopic mixed naphthalene crystals are studied. The validity of the amalgamation limit for lattice modes (phonons) and the separated band limit for vibrational excitons are investigated. Heavily doped isotopic mixed naphthalene crystals were used to verify exciton splitting for the lowest energy in naphthalene. Results are compared with coherent potential approximation calculations. Phonon sidebands are identified and a comparison is made with the one phonon density of states of naphthalene. Exciton-phonon interactions are discussed and the exciton-phonon coupling in the naphthalene 0-0 phosphorescence and its phonon sideband is reported and compared to the exciton-phonon coupling in fluorescence. Dissert. Abstr.

N80-12920 Michigan Univ., Ann Arbor.
COHERENCE STUDIES IN THE FIRST ELECTRONIC EXCITED SINGLET STATE OF SOLID NAPHTHALENE Ph.D. Thesis
Panayiotis Argyrakis 1979 234 p
Avail: Univ. Microfilms Order No. 7924839

An energy transfer model is proposed that describes the exciton migration in the naphthalene system at 1.8 K. The problem is treated in a twofold manner: A Monte Carlo simulation process is employed in which a binary crystal lattice is generated and kept in the computer memory with all the physical parameters of our experimental system. Several types of random motion are treated on this lattice. Exciton-phonon scattering is included via a phenomenological parameter and impurity or defect trapping was accounted for in the choice of our system. The important parameter tested is the coherence length, 1, the length in lattice units over which the excitation memory is perfectly retained. Dissert. Abstr.

N80-12921 New York Univ., N. Y.
EXCITON DYNAMICS IN ALPHA-PARTICLE TRACKS IN ORGANIC CRYSTALS: MAGNETIC FIELD STUDY OF THE SCINTILLATION IN ANTHRACENE AND TETRACENE CRYSTALS Ph.D. Thesis
Michael Binder 1979 129 p
Avail: Univ. Microfilms Order No. 7925441

The scintillation mechanism in organic crystals bombarded by alpha particles are discussed in terms of current knowledge of exciton dynamics derived from a study of the photofluorescence of anthracene and tetracene. The scintillation of tetracene excited by 4.4 MeV alpha particles incident perpendicular to the ab plane was studied in the presence of external magnetic fields and compared to the scintillation of crystalline anthracene. Using appropriate equations, expressions are derived for the prompt and delayed components of the total scintillation yield. Nanosecond time resolved magnetic field effects on the alpha-particle induced scintillation in anthracene, tetracene doped anthracene and anthracene crystals containing high densities of induced para-magnetic quenching centers is presented. A simple kinetic picture for triplet exciton motion consistent with current knowledge of triplet exciton dynamics is discussed. Dissert. Abstr.

N80-12922 Vermont Univ. and State Agricultural Coll., Burlington.
ELECTRON CONDUCTIVITY MOBILITY IN SEMICONDUCTORS BASED ON A DIELECTRIC FUNCTION MODIFICATION OF THE DINGLE IMPURITY ION POTENTIAL Ph.D. Thesis
Llanda Mae Richardson 1979 210 p
Avail: Univ. Microfilms Order No. 7925313

The Brooks-Herring theory of ionized impurity scattering in semiconductors incorporating a more accurate description of dispersive valance screening in the scattering potential. Because of the form of the spatial dielectric function, defined as the ratio of the unscreened to screened impurity ion potential, it is postulated that the improved potential should equal the usual single screened Coulomb potential multiplied by a correction factor which would equal unity at large distances from the ion. Several methods of achieving such a potential are discussed. It is concluded that an entirely numerical approach, such as the method of finite differences, provides the most accurate and most efficient means of solution of the requisite differential equation. To gauge the effect of this potential upon transport properties, a calculation of the electron conductivity mobility, in the first Born approximation, is made. Dissert. Abstr.

N80-12923 Stevens Inst. of Tech., Hoboken, N. J.
ORDER PARAMETER RELAXATION AND ANOMALOUS CONDUCTIVITY IN SUPERCONDUCTING TIN Ph.D. Thesis
A. John Ritger 1979 189 p
Avail: Univ. Microfilms Order No. 7925057

The order parameter relaxation time tau sub R, the time required for the density of Cooper pairs to achieve equilibrium with a change in current density, was measured using one dimensional samples of tin. An anomalous excess conductivity was discovered and characterized. The calculations and results are presented and discussed. Dissert. Abstr.

N80-12924 State Univ. of New York at Albany.
Na BETA-ALUMINA: STRUCTURE ANALYSIS OF A SUPERIONIC CONDUCTOR Ph.D. Thesis
Franz Reidinger 1979 165 p
Avail: Univ. Microfilms Order No. 7925082

The conduction mechanism in Na beta alumina and the establishment of a relation between the structure and the composition of this compound is discussed. Neutron diffraction data were collected from a single crystal in a high flux beam reactor. They were analyzed together with already existing data on Na, Ag and (H3O(+),H(+)) beta alumina, K and Ba ferrite, calcia hexaluminate and magnesia stabilized Na beta sub 1 alumina. These structures, which have in common a four layered spinel block, are discussed. They are divided into two groups, the magneto plumbites and the beta aluminas, by a difference in the density of the interconnecting layer, while two forms of stacking differentiate beta alumina from beta sub 1 alumina proper. The three structure types which share local responses to the interruption of the spinel sequence and the replacement of Me(2+) by Me(3+), but differ characteristically in their stabilization mechanisms, are considered as derivatives of spinel and discussed. Dissert. Abstr.

N80-12925 Ohio Univ., Athens.
LOW-TEMPERATURE SPECIFIC HEAT MEASUREMENTS OF SUPERCONDUCTING INDIUM-THALLIUM ALLOYS Ph.D. Thesis
Lakshmi Venkata Munukutla 1979 141 p
Avail: Univ. Microfilms Order No. 7924427

The superconducting transition temperature and the low temperature specific heats of In-Tl alloys are discussed. The specific heat measurements are performed in the temperature range from 4.8 - 1.0 K. The methods used to prepare and anneal these alloys are described. An ac susceptibility method was used to measure the transition temperature of these samples. A heat pulse technique was used to measure the specific heats both in zero field and in the presence of 408 Oe magnetic field. Both the ac susceptibility method and the heat pulse technique are described in detail. A section is devoted to thermometry. The designs of the ac susceptibility probe and the specific heat probe are described. The superconducting transition temperatures obtained for these In-Tl alloys are compared with previous measurements. Dissert. Abstr.

N80-12926 Iowa Univ., Iowa City.
X-RAY DIFFRACTION STUDY OF THE ALLOY SYSTEM SmP(x)S(1-x) Ph.D. Thesis

Kevin James Sisson 1979 190 p
Avail: Univ. Microfilms Order No. 7924531

The alloy system Sm P sub x S sub 1-x was examined through lattice parameter measurements as a function of temperature. Alloys were prepared by heating compressed powders of SmS and SmP. The temperature dependence of the lattice parameter in the range from 400 K to 70 K was determined from Debye-Scherrer X-ray powder diffraction films, for samples prepared in the concentration range of 3 to 20 mole percent phosphorus. The temperature dependence of the lattice parameters of SmS and SmP was also determined in this temperature range. Guinier-de Wolff camera films at 300 K of these samples were made, and the diffraction patterns analyzed with an integrating densitometer. The temperature dependence of the magnetic susceptibility of these samples was measured and the values are discussed. Dissert. Abstr.

N80-12927 Iowa State Univ. of Science and Technology, Ames.
MAGNETIC AND ELECTRONIC PROPERTIES OF Nd-La AND Ce-La ALLOYS Ph.D. Thesis
Thomas Sonke Petersen 1979 101 p
Avail: Univ. Microfilms Order No. 7924264

The magnetic ordering temperatures of polycrystalline double-hexagonal close packed (dhcp) Ce-La and Nd-La alloys and Nd single crystals were determined by measuring the electrical resistivity, thermoelectric power and magnetic susceptibility. The heat capacity of Nd was shown to have several peaks between 5K and 8K. The resistivity and thermopower show some of these same anomalies. Some of these anomalies are dependent on the thermal history of the sample. The Ce-La alloys were pure dhcp only for large Ce or large La concentrations. Intermediate concentration alloys contained the fcc phase. These alloys show two magnetic ordering temperatures for the dhcp phase and an additional one for the fcc phase. Kondo effects are seen in both the thermoelectric power and resistivity of alloys containing Ce. The effects are explained by crystal field or mean field Kondo theories. Dissert. Abstr.

N80-12928 California Univ., Los Angeles.
INTERVALLEY TRANSFER IN N-TYPE GERMANIUM AT 77 DEG K Ph.D. Thesis
Walter Harry Pate 1979 426 p
Avail: Univ. Microfilms Order No. 7921445

The current density versus electric field characteristics of n-type germanium for resistivities ranging from 0.3 ohms-cm to 30 ohms-cm were measured at a lattice temperature temperature of 77 K for the electric field applied in the <100>, <110>, and <111> crystallographic directions. Data are also shown for 2 ohm-cm and 0.4 ohm-cm samples which are conpensated with indium. From this data the conductivity anisotropy was observed and analyzed in terms of the repopulation of carriers between the different valleys. The experimental repopulation is given as a function of electric field and sample resistivity. Dissert. Abstr.

N80-12929 Brandeis Univ., Waltham, Mass.
AN NMR STUDY OF THE CRITICAL PHENOMENA OF MnF2 IN A 75 KG FIELD Ph.D. Thesis
Herbert Samuel Patz 1979 214 p
Avail: Univ. Microfilms Order No. 7925721

The technique of nuclear magnetic resonance (NMR) was used to study the critical behavior of manganous fluoride, MnF2, in an externally applied field of H sub 0 = 74.976 plus or minus 0.003 kG along the preferred axis. The NMR lineshapes of the two fluorine sites (alpha and beta) were measured as a function of temperature T for T approaching the critical temperature T sub c (H) from below. The static results with a preliminary analysis of the linewidth data are discussed. Dissert. Abstr.

N80-12930 Iowa State Univ. of Science and Technology, Ames.
LATTICE DYNAMICS OF hcp AND bcc ZIRCONIUM Ph.D. Thesis
Jerel L. Zarestky 1979 208 p
Avail: Univ. Microfilms Order No. 7924276

The lattice dynamics of hcp and bcc zirconium are examined using inelastic neutron scattering techniques. The temperature dependence of the normal vibrational modes of hcp Zr was studied by measuring the phonon dispersion curves in the /001/, /100/, and /110/ symmetry directions at 295 K, 793 K and 1007 K and in the /001/ direction and selected other points at 5.5 K. The phonon dispersion curves for bcc Zr were measured at 1423 K. The data for hcp and bcc Zr were used to calculate the lattice specific heat as a function of temperature. The total specific heat obtained by taking the electronic contribution into account, was found to be consistent to within experimental uncertainties, with the results of specific heat measurements for both hcp and bcc Zr. Dissert. Abstr.

N80-12931# Electronics Research Lab., Adelaide (Australia).
THE MEASUREMENT OF TEMPERATURE INSTABILITIES AND THEIR EFFECT ON THE LIQUID PHASE EPITAXIAL GROWTH OF GALLIUM ARSENIDE
M. Folkard Aug. 1979 31 p refs
(ERL-0077-TR; AR-001-667) Avail: NTIS HC A03/MF A01

Epitaxial layers grown on gallium arsenide substrates using the steady state temperature gradient form of liquid phase epitaxy are discussed and compared to the growth rate calculated for diffusion limited conditions. The large variation in epilayer thickness over the surface of a single sample, and the nonreproducibility from sample to sample are investigated. Various measurements of the temperature and its local variation within the gallium melt solution are described. An attempt to relate the observed variations and instabilities to the epitaxial layers actually grown is presented. A.W.H.

N80-12932# Oregon Graduate Center, Beaverton.
FIELD ELECTRON AND ION SOURCE RESEARCH FOR HIGH DENSITY INFORMATION STORAGE SYSTEM Interim Report, 15 May 1976 - 15 Aug. 1977
L. W. Swanson Nov. 1978 161 p refs
(Contract F33615-76-C-1327; AF Proj. 3164)
(AD-A072541; AFAL-TR-78-174; IR-4) Avail: NTIS HC A08/MF A01 CSCL 14/2

The purpose of this program is the development and characterization of high brightness field emission and field ion sources. Several emitter materials and modes of operation for both field electron and ion sources have been investigated. The most promising sources have been examined with respect to fabrication techniques, source stability and life, spatial energy and distribution of the emitted beam. Optical characteristics of the source, e.g. virtual source size, etc., have also been examined. From this study two electron and one gas phase field ion emitters have met most of the source requirements to be of interest for high current density submicron focussed beam applications. In addition, the liquid gallium source has been investigated with respect to both electron and ion emission. The electron emission mode exhibits an unusual high peak current pulse mode while the ion emission mode results in an extremely intense d.c. mode. The ion emission mode is 100 to 1000 times more intense than the gas phase field ion sources. GRA

N80-12933# International Business Machines Corp., Hopewell Junction, N. Y. East Fishkill Labs.
LIFETIME CONTROL IN SILICON THROUGH FOCUSED LASER BEAM DAMAGE Final Report, 1 May 1978 - 30 Apr. 1979
G. H. Schwuttke and K. H. Yang 30 Jun. 1979 93 p refs
(Contract N00173-76-C-0303; DARPA Order 3231)
(AD-A073052; TR-22.2290) Avail: NTIS HC A05/MF A01 CSCL 20/12

Minority carrier lifetime and resistivity engineering in silicon through use of high power laser beams is described. Unique doping profiles are produced through 80 Kev As(+) implantations followed by laser annealing. Minority carrier lifetime distributions on silicon surfaces are substantially improved through laser damage gettering. Laser operating conditions to obtain optimum lifetime and resistivity engineering effects are given. GRA

N80-12934# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Technical Summary, 1 Nov. 1978 - 31 Jan. 1979
Alan L. McWhorter 15 Feb. 1979 82 p refs
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A073152; ESD-TR-79-8) Avail: NTIS HC A05/MF A01 CSCL 20/12

This report covers in detail the solid state research work of

the Solid State Division at Lincoln Laboratory for the period 1 November 1978 through 31 January 1979. The topics covered are Solid State Device Research Quantum Electronics, Materials Research, Microelectronics, and Surface-Wave Technology. Funding is primarily provided by the Air Force, with additional support provided by the Army, ARPA, NSF, and DOE. GRA

N80-12935# Brown Univ., Providence, R. I. Dept. of Chemistry.
PREPARATION AND COMPARISON OF THE PHOTOELECTRIC PROPERTIES OF Sr2Nb2O7 AND Ba0.5Sr0.5Nb2O6
Aaron Wold, J. Hormedaly, S. N. Subbarao, R. Kershaw, and K. Dwight. 20 Aug. 1979. 24 p. refs.
(Contract N00014-77-C-0387)
(AD-A073192; TR-6) Avail: NTIS HC A02/MF A01 CSCL 20/12

The two alkaline earth niobates Sr2 Nb2 O7 and Ba0.5 Sr0.5 Nb O6 have been prepared, their electronic properties measured, and their photoresponses compared. The indirect band gap in Sr2 Nb2 O7 is 3.86 EV compared with 3.38 EV for Ba0.5 Sr0.5 Nb2 O6. Hence, photoanodes composed of Sr2 Nb2 O7 respond to much less of the white light spectrum than those made from Ba05 Sr0.5 Nb2 O6. Nevertheless, their electrical outputs at an anode potential of 0.8 EV with respect to SCE in 0.2 M sodium acetate under white xenon arc irradiation of 1.25 W/sq cm are comparable. GRA

N80-12936# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.
ACOUSTIC WAVES IN CUBIC CRYSTALS NETWORKS FOR SEMICONDUCTING VIBRATORS, AND APPLICATIONS TO GALLIUM ARSENIDE
Arthur Ballato and Charles D. Bosco. Apr. 1979. 50 p. refs.
(DA Proj. 1L1-62705-AH-94)
(AD-A072764; DELET-TR-79-9) Avail: NTIS HC A04/MF A01 CSCL 20/2

Some consequences of acoustic bulk wave propagation in piezoelectric semiconductors of class 4-bar 3m are investigated. Doubly rotated plate vibrators are considered, as are coupled modes and transmission line equivalent networks. It is shown how sensitive measurements of oxide films may be simply made in a nondestructive manner by use of such crystals as piezoelectric vibrators. Calculations are carried out using gallium arsenide as a typical compound. GRA

N80-12937# Kanner (Leo) Associates, Redwood City, Calif.
THEORY OF INTERSTITIAL ORDERING IN ALLOYS WITH HEXAGONAL CLOSE-PACKED CRYSTAL LATTICE
V. N. Bugaev (Inst. of Metal Phys., Acad. of Sciences, USSR (Kiev)). Nov. 1978. 14 p. refs. Transl. into ENGLISH from Ukr. Fiz. Zh., USSR, v. 23, no. 7, 1978 p 1073-1080
(IS-Trans-106; VAAP-00-2) Avail: NTIS HC A02/MF A01

A theory on the ordering of interstitial atoms in alloys with HCP crystal lattice is constructed. The theory which accounts for interatomic interaction in an arbitrary number of coordination spheres is evaluated. The discussion is conducted within the framework of the method of statistical concentration waves. The distribution of interstitial atoms about the interstices of pure metals (at the lattice sites) is discussed. DOE

N80-12938# Argonne National Lab., Ill.
ENERGY LEVEL STRUCTURE AND TRANSITION PROBABILITIES IN THE SPECTRA OF THE TRIVALENT LANTHANIDES IN LaF3
W. T. Carnall, H. Crosswhite, and H. M. Crosswhite. 1978. 199 p. refs.
(Contract W-31-109-eng-38)
(ANL-78-XX-95) Avail: NTIS HC A09/MF A01

Two types of correlations with experimental results are reported. For even-f-electron systems, a center of gravity was computed based on the energies of the observed states, and calculated optimized sets of atomic energy level parameters. For odd-electron systems complete crystal field calculations were performed in which parameters of both the atomic and crystal-field parts of the interaction were adjusted to experimental data. The result is a set of eigenvectors for all the ionic states in each configuration. Spectroscopic results for all lanthanides doped into LaF3(In(+3)(LaF3) except Pm3+ and Eu3+ are reported. DOE

N80-12939# Sandia Labs., Albuquerque, N. Mex.
EFFECTS OF ADDITIVES AND MOISTURE ON THE IONIC CONDUCTIVITY OF Li5MO4 (M = Al, Ga, Fe)
R. T. Johnson, Jr. and R. M. Biefeld. 1979. 11 p. refs. Presented at Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wisc., 21 May 1979.
(Contract DE-AC04-76DP-00789)
(SAND-79-0541C; CONF-790538-3) Avail: NTIS HC A02/MF A01

When polycrystalline Li5MO4 (M = Al, Ga, Fe) is exposed to moisture, LiOH is formed within the material and produces a dramatic increase in the conductivity above approximately 400 C. The addition of Li2SO4 shifts this temperature to approximately 350 C due to a LiOH-Li2SO4 eutectic reaction. In the dry state, Li2SO4 additions increase the conductivity (10 to 100 times) to approximately 0.1 ohm/cm at 600 C. Annealing to 650 C in dry environments increases the conductivity activation energy from approximately 0.6 to approximately 1.0 eV, apparently due to the removal of LiOH from surface and grain boundary effects significantly influence the conductivity characteristics of these materials. DOE

N80-12940# Brookhaven National Lab., Upton, N. Y.
COLLECTIVE EFFECTS, RELAXATION AND LOCALIZATION OF HOLE LEVELS IN ATOMS, MOLECULES, SOLIDS, AND ADSORBATES
G. Wendin. 1979. 26 p. refs. Presented at Sanibel Symp. on Quantum Chem. and Solid State Phys., Palm Coast, Fla., 12 Mar. 1979.
(Contract EY-76-C-02-0016)
(BNL-26068; CONF-790368-2) Avail: NTIS HC A03/MF A01

Recent progress in descriptions of photoelectron spectra is reviewed with emphasis on cases where the one-electron and quasiparticle approximations break down and the hole level becomes spread over a number of discrete lines or a continuum or both. Unifying aspects and similarities between interaction processes in atoms, molecules and solids are stressed. DOE

N80-12941# Argonne National Lab., Ill.
SUPERCELL CALCULATIONS OF POSITRON TRAPPING AND ANNIHILATION AT VACANCIES IN SIMPLE AND TRANSITION METALS
R. P. Gupta and R. W. Siegel. 1979. 6 p. refs. Presented at 5th Intern. Conf. on Positron Annihilation, Lake Yamanaka, Japan, 8 Apr. 1979.
(Contract W-31-109-eng-38)
(CONF-790437-7) Avail: NTIS HC A02/MF A01

A new approach, based upon augmented-plane-wave calculations in a supercell lattice, was developed to theoretically predict the annihilation characteristics of the positron in vacancies, taking into account for the first time the atomic nature of the solid. This method, which is general and suited equally well to be simple and transition metals, was used to calculate positron trapping and annihilation characteristics in Al, Nb, Ta, and W. The results indicate that the positron is sufficiently strongly trapped in a vacancy in all of these metals that significant thermal detrapping in any of them is highly unlikely. DOE

N80-12942# California Univ., Livermore. Lawrence Livermore Lab.
PHOTOFISSION AND ELECTROFISSION
B. L. Berman. 17 Aug. 1978. 12 p. refs. Presented at the Intern. Conf. on Nucl. Interactions, Canberra, Australia, 28 Aug. - 1 Sep. 1978.
(Contract W-7405-eng-48)
(UCRL-81596; CONF-780854-5) Avail: NTIS HC A02/MF A01

Recent experimental progress in the fields of photofission and electrofission of actinide nuclei is summarized. In particular, experimental results which throw light on the delineation of the characteristics of the giant resonances are highlighted. Measurements of especial interest in this regard include photofission cross section studies with monoenergetic photons and electrofission yield and angular distribution studies. DOE

N80-12943# Sandia Labs., Albuquerque, N. Mex.
HIGH PRESSURE STUDIES OF IONIC CONDUCTIVITY IN SOLIDS
G. A. Samara 1979 13 p refs Presented at the 7th Intern. AIRAPT Conf., La Creusot, France, 30 Jul. 1979
(Contract EY-76-C-04-078)
(SAND-79-1511C; CONF-790709-6) Avail: NTIS HC A02/MF A01

The pressure dependence of the ionic conductivity in crystal lattices is studied. Information about the volume relaxation associated with the formation of lattice defects as well as with the diffusive motion of these defects is discussed. Pressure results on a variety of crystals are discussed with emphasis on recent results on crystals with large lattice polarizabilities and soft phonon modes. DOE

N80-12212 Institut Franco-Allemand de Recherches, St. Louis (France).
ANALYSIS OF THE STRUCTURE DEFORMATION OF SODIUM CHLORIDE SUBMITTED BY A SHOCK WAVE
F. Jamet and F. Bauer *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 209-226 refs In FRENCH; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright Avail: Issuing Activity

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-12944 Saint Louis Univ., Mo.
VARIATIONAL PADE APPROXIMANTS APPLIED TO THE THREE-AND FOUR-BODY PROBLEM Ph.D. Thesis
Ernest Raymond Bernardi 1979 40 p
Avail: Univ. Microfilms Order No. 7923809

The three and four body problems in quantum mechanics are considered. The particles are assumed to interact with each other through square well potentials. A determination of the lowest energy eigenvalue of each system is desired. Taking for each particle the well depth to be -7.9529 Mev. and range of 1.5 Fermi, we obtain a ground state energy of -17.5 Mev. for the four body system. The mathematical method used to solve the above problems is based on the Schwinger variational principle which in the end expresses the unknown energy eigenvalue as the ratio of polynomials of arbitrary degree (fixed beforehand) in the coupling constant, i.e., the Pade approximation. The equality of the eigenvalue to the ratio is true only when the Schwinger functional, which depends on a variational parameter, achieves a minimum. The Schwinger functional itself becomes the ground state energy when this minimum occurs. Dissert. Abstr.

N80-12945 Michigan Univ., Ann Arbor.
PERTURBATIVE APPLICATIONS OF QUANTUM CHROMODYNAMICS Ph.D. Thesis
Bruce Gregory Weeks 1979 88 p
Avail: Univ. Microfilms Order No. 7925244

Theoretical tools for obtaining experimental predictions from quantum chromodynamics perturbation theory are reviewed. These include the renormalization group, the Sterman-Weinberg approach, the parton model, the operator product expansion, leading logarithm summations, and the factorization schemes of Georgi, Politzer, et al., of Mueller, and of Sterman and Libby. Several applications are described, including total and two jet cross sections in e(+)e(-) annihilation, jet production from a gluon source, and deep inelastic lepton hadron scattering. The extent to which past and future experiments test quantum chromodynamics is considered. Dissert. Abstr.

N80-12946 Saint Louis Univ., Mo.
A THERMODYNAMIC THEORY OF STEADY-STATE SYSTEMS Ph.D. Thesis
Susan Joan Haney 1979 131 p
Avail: Univ. Microfilms Order No. 7923825

A rigorous, thermodynamic theory of steady state systems is developed by generalizing the methods used by Clausius and Kelvin in the development of classical thermodynamics (thermostatics). The principles of thermodynamics, which are extremely general, and the laws of thermostatics which are valid only for equilibrium systems are discussed. A new class of process, retraceable processes, and a new class of conversions of heat to work, recoverable conversions are defined. These are generalizations of reversible processes and reversible conversions, respectively. A set of necessary conditions for net conversion in steady state systems are determined. The principles of thermodynamics are applied to processes connecting steady states, and to conversions occurring in steady state systems. The existence of functions of state for steady state systems is thus shown. These functons of state are of two types, scalar functions and vector functions. Dissert. Abstr.

N80-12947# California Univ., Berkeley. Lawrence Berkeley Lab.
SEMICLASSICAL STATISTICAL MECHANICS Ph.D. Thesis
R. M. Stratt Apr. 1979 174 p refs
(Contract W-7405-eng-48)
(LBL-9095) Avail: NTIS HC A08/MF A01

A formalism is developed which allows the nonperturbative incorporation of of quantum effects into equilibrium classical statistical mechanics. The resulting expressions bear a close similarity to classical phase space integrals. Problems considered include the simple harmonic oscillator, the vibrational state distribution of HCl, the density-independent radial distribution function of He-4, and the statistical mechanics of nonanalytic potentials and of fluids. Some ramifications of having a phase space version of quantum mechanics are discussed. To test the breadth of the formulation, the task of constructing quantal ensemble averages of phase space functions is undertaken, and in the process several limitations of the formalism are revealed. The concept of quantum mechanical ergodicity is examined through the use of numerically evaluated eigenstates of the Barbanis potenial, and the existence of this quantal ergodicity normally associated with classical phase space - is verified. DOE

N80-12948# California Univ., Berkeley. Lawrence Berkeley Lab.
COMMENTS ON THE DERIVATION OF THE CARNOT EFFICIENCY ACCORDING TO MAX PLANCK: THERMODYNAMICS (ELEVENTH EDITION) DE GRUYTER 1964 AND R. CLAUDIUS: MECHANICAL HEAT THEORY (THIRD EDITION) VIEWEG 1887
Joachim Kirchhoff May 1979 24 p Transl. into ENGLISH from West German paper, 1979 23 p Sponsored by DOE
(UCRL-Trans-1572) Avail: NTIS HC A02/MF A01

A discussion on the derivation of the Carnot efficiency according to Max Planck is presented. The laws of thermodynamics are derived and examined in relation to the mechanical heat theory and Carnot's cycle. Planck's error in calculating the temperatures of the heat containers and not the temperatures of the working medium is examined. A.W.H.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-12949# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

RELIABILITY AND MAINTAINABILITY ANALYSIS: A CONCEPTUAL DESIGN MODEL
Anthony F. Czajkowski Mar. 1972 237 p refs
(AD-A073120; AFIT-SLTR-3-72) Avail: NTIS HC A11/MF A01 CSCL 05/1

This study combines aspects of utility theory, probability theory, and mathematical programming to develop an efficient method for performing reliability/maintainability analysis during the early conceptual stages of system development. The general concepts of operational capability and system life cycle cost are used to construct an operational model for determining subsystem reliability and maintainability 'design point' characteristics. Consideration of both technological and cost uncertainty is incorporated within the model. Specifically, the method developed provides a systematic and operationally efficient technique for selecting subsystem reliability/maintainability alternatives when (1) attainable subsystem reliability/maintainability levels are not known with certainty, (2) all life cycle element cost flows are not known with certainty, (3) chance-constraint restrictions exist on some or all of the following factors: system availability, weight, reliability, maintainability, and/or R and D cost, (4) some subsystem reliability/maintainability design alternatives are interdependent (contingent and/or mutually-exclusive), (5) the suitability of selecting any particular system (combination of subsystem reliability/maintainability alternatives) depends upon both cost and risk considerations. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-12950# General Research Corp., McLean, Va.
ANALYSIS TO DETERMINE FUNCTIONAL AND SYSTEMS REQUIREMENTS FOR AN ON-LINE STRUCTURE AND COMPOSITION SYSTEM (SACS) Final Report
Francis O. Deppner, John J. Anderson, and Whitney C. Scully Aug. 1979 61 p refs
(Contract MDA903-78-C-0445)
(AD-A072947; GRC-1070-05-79-CR) Avail: NTIS HC A04/MF A01 CSCL 05/2

Previous reports have identified all current and developing procedures that are either directly or indirectly involved in the SACS process. Those reports also pointed out how these systems/procedures did or did not support the on-line SACS. This report now delineates what modifications must be made to the current and developing systems/procedures, and identifies new requirements that must be fulfilled to make the on-line SACS effective, efficient, and responsive to the Army's needs. GRA

N80-12951# Behavioral Technology Consultants, Silver Spring, Md.
IMPLICATIONS OF AN ALL-DIGITAL NAVY TECHNICAL INFORMATION PRESENTATION SYSTEM Final Report, May 1978 - May 1979
Thomas W. Frazier, J. Thomas Roth, Willard Y. Howell, and Shun Y. Huang 3 Jul. 1979 102 p
(Contract N00019-78-C-0175; ZF55522003)
(AD-A073095) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report describes an assessment of the application, implications, and developments involved in the introduction of a single-medium computer-administered Technical Information presentation system into the U. S. Navy. It defines the nature and operation of a hypothetical system of this type through development of a system scenario. It identifies and considers implications of introducing such a system into the Navy from various viewpoints, including economic, strategic, naval missions, energy and personnel considerations. It also defines developments and procedural modifications necessary for introduction of such a system by the mid- to late 1980's. Such a system of optimized Technical Information preparation, distribution, delivery, change and updating is viewed as fundamental to the process of reversing current trends toward decreased combat readiness. An all-digital data approach can permit improved solutions to problems of lowered personnel productivity and of inherent human limitations in understanding and maintaining ever more complex systems, as well as an improved technology for Technical Information centralization and control. GRA

N80-12952# SRI International Corp., Menlo Park, Calif. Artificial Intelligence Center.
MECHANICAL INTELLIGENCE: RESEARCH AND APPLICATIONS Final Report, 1 Oct. 1977 - 30 Sep. 1978
Robert C. Moore Aug. 1979 104 p refs
(Contract N00039-78-C-0060; ARPA Order 3175)
(AD-A073127) Avail: NTIS HC A06/MF A01 CSCL 09/2

Section I of this report gives some background information on the LADDER system, outlines the changes made to the architecture of the system, and briefly explains the enhanced capabilities produced by those changes. Section II discusses user experiences with the first-generation LADDER system and the response of SRI to the reports of those experiences. Section III describes new user features that have been added to LADDER. Section IV discusses SODA, an improved data access system for LADDER, explaining its new capabilities and the problems of supporting those capabilities in accessing distributed data. Section V describes how the system has been extended to access a heterogeneous data base consisting of both Datacomputer and DBMS-20 data base management systems. Section VI reports on progress to date in bringing the results of our longer-term research into the LADDER system, in the form of a new natural-language processor that will permit a greater range of natural-language questions and lay the groundwork for transporting the system to new data bases and new domains. Section VII lists the publications and presentations by the project staff during the period covered by this report. Finally, Appendix A gives more detail on the new formal query language for data access, and Appendix B describes an experimental French-language version of LADDER. GRA

N80-12953# General Accounting Office, Washington, D. C.
BETTER INFORMATION MANAGEMENT POLICIES NEEDED: A STUDY OF SCIENTIFIC AND TECHNICAL BIBLIOGRAPHIC SERVICES
6 Aug. 1979 75 p refs
(PB-298776/6; PSAD-79-62) Avail: NTIS HC A04/MF A01 CSCL 05B

GAO's study of government information centers providing bibliographic services to the scientific and technical community is presented. It confirmed the need for better management. Evidence of duplication, proliferation of facilities, and inconsistent cost recovery practices were found. The vagueness of authorizing laws and function statements contributes to the duplication of services. Each department and agency should designate a top official to coordinate and manage its information, and the Office of Management and Budget should establish a committee to coordinate government scientific and technical information activities. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-12954# Civil Aeronautics Board, Washington, D.C.
FEDERAL AVIATION ACT OF 1958
[1979] 197 p Revised
Avail: SOD HC

The general provisions of the Act are defined as well as the powers of the Civil Aeronautics board and procedures for their exercise. Public Law 95-504 (October 24, 1978) is included in this 1979 revision. A.R.H.

N80-12955# California Univ., Livermore. Lawrence Livermore Lab.
NATIONAL ENERGY ACT OF 1978: FAR WESTERN PERSPECTIVE. A STUDY FOR THE US DEPARTMENT OF ENERGY, FEDERAL REGION 9
D. Dorn and P. Moulthroup 15 Dec. 1978 77 p
(Contract W-7405-eng-48)
(UCID-17944-Rev-1) Avail: NTIS HC A05/MF A01

Information on the impact of the National Energy Act of 1978 (NEA) on Federal Region 9 was studied. The U.S. energy problem; the National Energy Act of 1978; the expected effects of the NEA on Federal Region 9 as a whole; and the expected impact of the NEA in Arizona, California, Hawaii, and Nevada are discussed. DOE

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-12956# Committee on Rules and Administration (U. S. Senate).
POLICY COORDINATION GROUP FOR TECHNOLOGY DEVELOPMENT Annual Report
Washington GPO 1978 34 p refs Rept. for Comm. on Rules and Administration and the Comm. on House Administration, 95th Congr., 2d Sess., 1 Aug. 1978
(GPO-31-469; AR-1) Avail: US Capitol, Senate Document Room

The Congressional report of the policy coordination group for technology development is presented. Topics include the legislative information and status system, audio and video technology, microform technology, and computer hardware and software requirements. A.W.H.

N80-12957*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
BALTIMORE APPLICATIONS PROJECT Annual Progress Report, Jun. 1978 - May 1979
Thomas S. Golden and Philip Yaffee Jun. 1979 16 p refs
(NASA-TM-80577; APR-5) Avail: NTIS HC A02/MF A01 CSCL 05A

An update is presented for the following projects: (1) asphalt pavement recycling; (2) data collection platform/water quality monitoring; (3) digital emergency traffic routing; (4) fire department communications and dispatch system; (5) health department management information system; (6) hazardous materials; (7) coal gasification; and (8) emergency vehicle proximity sensing. A.R.H.

N80-12958*# Battelle Columbus Labs., Ohio.
TRAFFIC MODEL FOR COMMERCIAL PAYLOADS IN THE MATERIALS EXPERIMENT ASSEMBLY (MEA) Final Report
F. A. Tietzel [1979] 51 p
(Contract NASw-2800)
(NASA-CR-162454; BCL-OA-TFR-79-1) Avail: NTIS HC A04/MF A01 CSCL 05A

One hundred individuals representing universities, technical institutes, government agencies, and industrial facilities were surveyed to determine potential commercial use of a self-contained, automated assembly for the space processing of materials during frequent shuttle flights for the 1981 to 1987 period. The approach used and the results of the study are summarized. A time time-phased projection (traffic model) of commercial usage of the materials experiment assembly is provided. A.R.H.

N80-12959# Life Systems, Inc., Cleveland, Ohio.
EVALUATION OF A DEVELOPMENTAL HEAVY METALS WASTE TREATMENT SYSTEM Technical Report, May 1978 - May 1979
J. B. Lantz May 1979 83 p refs
(Contract DAMD17-76-C-6063)
(AD-A073131; LSI-ER-314-40-6) Avail: NTIS HC A05/MF A01 CSCL 13/2

The Heavy Metals Waste Treatment System, consisting of a precipitation reactor, a precision control and monitor system and an experimental parallel plate clarifier, has been used to evaluate hydroxide and sulfide precipitation processes for removal of heavy metals from industrial wastes containing 0 and 50% seawater. Removal of metals from simulated mixed-metal wastes by hydroxide precipitation was shown to be superior to theoretical projections apparently due to co-precipitation of minor components. However, the studies showed that discharge criteria cannot be met by this process alone for all metals of interest in industrial wastes, particularly if seawater is present. Also, optimum pH's vary for the different metals, and co-precipitation will not be quantitatively reliable. Hydroxide precipitation tests also showed that process demand for hydroxide reagent is roughly comparable to projections in the case of 0% seawater. However, treatment of 50% seawater can require as much as an order of magnitude higher reagent demand at high pH. The hydroxide process will therefore be uneconomical for testing or pretreating wastewaters containing high proportions of seawater, except at low pH's (e.g., 8 to 9). GRA

N80-12960# Cambridge Systematics, Inc., Mass.
DEMAND FOR SPECIAL PERFORMANCE VEHICLES, 1975 - 2025
Sep. 1978 107 p refs
(Contract W-7405-eng-48)
(UCRL-13911) Avail: NTIS HC A06/MF A01

Concepts were developed for alternative energy storage and propulsion systems for passenger cars and light trucks. These conceptual designs include battery electric systems, hydrogen powered systems, and the quasi-electric-drive hybrid with a small internal combustion engine (ICE) for range extension. The difference between the cost and performance of the special performance vehicles (SPVs) and ICEs was determined. The vehicle miles travelled by each SPV type were forecasted for 1975, 1985, 2000, and 2025. Market forecasts of SPVs in light truck applications and regional ton mile forecasts for heavy truck use were made for use in energy consumption and flow models. National aggregate forecasts of population, auto ownership, per capita income, vehicle miles travelled, ton miles, and other variables were also made. DOE

N80-12961# Westinghouse Research and Development Center, Pittsburgh, Pa.
PROGRAMMABLE ASSEMBLY RESEARCH TECHNOLOGY TRANSFER TO INDUSTRY, PHASE 2 Quaterly Report
R. G. Abraham, R. J. S. Stewart, T. Csakvary, L. Y. Shum, C. Ho, W. L. Rogers, and A. Meyerhoff 31 Mar. 1979 101 p refs
(Grant NSF ISP-78-18773)
(PB-299024/0; NSF/RA-790070; QR-1) Avail: NTIS HC A06/MF A01 CSCL 13H

The adaptable-programmable assembly system (APAS) pilot line conceptual design was modified because of longer cycle times of commercially available robots and the identification of more assembly operations and motor part variations. An in-line, power-and-free, buffered transfer system concept is used now for both end bell and final assembly. Computer and control system

requirements were determined for the supervisory, vision, path control, and sequence control subsystems. High risk portions of the APAS pilot system are identified and experiments planned. Vision system experimentation demonstrates what image processing execution time is well within the 1.5 second time goal needed to achieve the overall 15 second motor assembly cycle time. GRA

N80-12962# Mitre Corp., McLean, Va.
THE STATUS OF ADVANCED PROPULSION SYSTEMS FOR URBAN RAIL VEHICLES Final Report, Oct. 1978 - May 1979
Vilas D. Nene May 1979 227 p refs
(Contract DOT-UT-9002)
(PB-297980/5; MTR-79W0022; UMTA-VA-06-0053-79-1) Avail: NTIS HC A11/MF A01 CSCL 13F

With the advent of power electronics, more efficient alternate propulsion systems have been developed. These include chopper controls, ac drive with induction motors, systems using onboard energy storage, and ac drive with tabular axle motors. A technology review of advanced traction systems is presented, based on information and data gathered from propulsion equipment suppliers in Europe, Japan, and the United States. The status performance characteristics, significant advantages and disadvantages and the deployment of the hardware in revenue service for all these systems are discussed. GRA

N80-12963# Wisconsin Univ. - Madison. Dept. of Civil and Environmental Engineering.
BACKGROUND STUDY ON THE DEVELOPMENT OF A STANDARD LEACHING TEST Final Report
Robert Ham, Marc A. Anderson, Rainer Stegmann, and Robert Stanforth May 1979 275 p refs
(Grant EPA-R-804773)
(PB-298280/9; EPA-600/2-79-109) Avail: NTIS HC A12/MF A01 CSCL 13B

The recommended procedure is a batch or flask test, using distilled water plus other leaching media according to the characteristics of the landfill(s) of concern. One leaching medium simulates the leaching characteristics of leachate derived from actively decomposing municipal refuse landfills, for example. Test procedures were designed to provide information regarding the materials likely to be leached from a waste, an estimate of the maximum concentrations of these materials, an estimate of the amount of material likely to be released per unit weight of waste, and an indication of the effect of codisposal of the waste in question with mixed municipal refuse or other specific wastes. GRA

N80-12964# Department of Transportation, Washington, D. C.
TRANSPORTATION AND THE FUTURE Final Report
Norman G. Paulhus, Jr. Jan. 1979 71 p refs
(PB-298907/7; DOT-1-71-1) Avail: NTIS HC A04/MF A01 CSCL 13B

Technological developments in connection with urban, rural, intercity, cargo and space transportation over the next twenty to thirty years are covered. GRA

N80-12965# Texas Historical Commission, Austin.
HOUSTON CONFERENCE ON THE REVITALIZATION OF THE INNER CITY
Aug. 1979 25 p Conf. at Houston 5-6 May 1978
(Grant EDA-08-6-27556)
(PB-298906/9; EDA-79-0135) Avail: NTIS HC A02/MF A01 CSCL 13B

A conference on the Revitalization of the Inner City fulfilled an important task, and satisfied the major goals of its sponsors. It provided a forum for discussing redevelopment of Houston's inner city. The Foundation and the Commission involvement with revitalization proposed the conference to help educate those involved with revitalization by providing concrete examples of successful projects in Houston and other cities, and consequently, serve as a catalyst for solving the city's problems. The revitalization process required a cooperative effort between government, private enterprise and Houston citizens. GRA

N80-12966# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
LEVEL-OF-SERVICE CONCEPTS IN URBAN PUBLIC TRANSPORTATION
William Taylor and John Brogan Sep 1978 22 p refs Sponsored by the Michigan State Highway Commission.
(PB-298849/1; UMICH-HSRI-78-50) Avail: NTIS HC A02/MF A01 CSCL 13B

The level of service concept as it might be applied to public transportation services is examined. Proposed definitions of public transportation level of service based on both system and rider attributes are described. The variation in public transportation quality as viewed by various user market segments is examined, and the sensitivity or demand elasticity to the various factors constituting level of service is then made. A proposed study methodology to evaluate the increased level of service provided to user groups in line with their perceived measures of service quality is outlined. GRA

N80-12967# Sperry Rand Corp., Great Neck, N. Y. Sperry Systems Management Div.
A COMMUNICATIONS TRADE-OFF STUDY FOR COMPUTERIZED TRAFFIC CONTROL VOLUME 2: APPENDIXES Final Report
J. Scott, R. Gordon, B. Soicher, J. Dudek, and R. Kroeger 22 Nov. 1978 195 p refs
(Contract DOT-FH-11-9275)
(PB-298844/2; GF-3704-1060-Vol-2; FHWA/RD-78/86) Avail: NTIS HC A09/MF A01 CSCL 13B

Detailed information on various topics relevant to reducing costs of computerized traffic control. Topics discussed include the following: vehicle detector data communications; multiplexing and modulation; error detection and correction; reliability and availability; characteristics of existing computerized traffic control systems; user owned wire pair communication; leased line communications; coax cable communications; Air path optical communications; fiber optics communications; radio communication; power line communication techniques. GRA

N80-12968# National Field Research Center, Inc., Washington, D. C.
A WORKFORCE AND TRAINING PROFILE FOR SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY Final Report
Jack F. Seum, Darold E. Albright, Robert D. Oxberger, Gary S. Lance, and Linda Bardelmeier 1979 164 p refs
(Grant EPA-T900-591-03)
(PB-298612/3; EPA-600/8-79-024) Avail: NTIS HC A08/MF A01 CSCL 13B

The Resource Conservation and Recovery Act of 1976, is divided into the following topics: (1) A workforce profile and analysis section studying the workforce needs of public and private agencies involved in solid waste management and recovery; (2) a section analyzing what are considered by sources in the field to be the principal blockages to initial employment and career advancement in solid waste management; and (3) an analysis of the U.S. Environmental Protection Agency's responsibilities for workforce development and training activities. Information in the report was obtained primarily from personnel, onsite interviews with officials directly involved in solid waste management, including officials at Federal, State, and local levels; representatives from the private sector and from professional associations; and academic officials connected with postsecondary education programs in solid waste mangement. GRA

N80-12969# Remak-Rosenbloom, Santa Barbara, Calif.
IMPLEMENTING PACKAGES OF CONGESTION-REDUCING TECHNIQUES: STRATEGIES FOR DEALING WITH INSTITUTIONAL PROBLEMS OF COOPERATIVE PROGRAMS
Roberta Remak and Sandra Rosenbloom Jun. 1979 140 p refs Sponsored in part by Am. Assoc. of State Highway and Transportation Officials and Federal Highway Admin.
(PB-298831/9; TRB/NCHRP/REP-205; ISBN-0-309-02912-0; LC-79-66248) Avail: NTIS MF A01; HC available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D. C. 20418 $7.60 CSCL 13B

The institutional barriers to cooperative programs for implementing complex packages of congestion-reducing (C-R) techniques are identified. Experiences of 18 U.S. cities in carrying

out simpler joint agency transportation projects were studied. Sources of institutional problems and possible solutions are noted. This information is extrapolated to suggest problems that local agencies might meet in attempting to implement the C-R packages and suggest strategies for overcoming them. Problems and strategies are discussed as they relate to: (1) individual techniques selected for the package; (2) needs to coordinate activities of independent agencies; and (3) organizations and the characteristics of the implementation site. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-12970*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TIME-OF-FLIGHT SYSTEM ON THE GODDARD MEDIUM ENERGY GAMMA-RAY TELESCOPE
R. W. Ross and J. R. Chesney Oct. 1979 7 p refs Presented at IEEE Nucl. Sci. Symp., San Francisco, Calif., 17-19 Oct. Submitted for publication
(NASA-TM-80579) Avail: NTIS HC A02/MF A01 CSCL 03A

A scintillation counter time of flight system, incorporated into the Goddard 50 cm by 50 cm spark chamber gamma ray telescope is described. The system, which utilizes constant fractions timing and particle position compensation and digitizes up to 10 ns time differences to six bit accuracy in less than 500 ns is analyzed. The performance of this system during balloon flight is discussed. A.W.H.

N80-12971# Los Alamos Scientific Lab., N. Mex.
THEORETICAL LIGHT AND VELOCITY CURVES FOR CEPHEID VARIABLES
T. F. Adams, C. G. Davis, and C. F. Keller Dec. 1978 14 p refs
(Contract W-7405-eng-36)
(LA-7598-MS) Avail: NTIS HC A02/MF A01

A series of nonlinear Cepheid models were calculated with the DYN code. The models were used to extend to light curves the conclusion, based on velocity curves, that the observations of Cepheids cannot be matched unless the mass is significantly reduced (assuming a homogeneous composition). It is concluded that observed light curves are considerably more complex than previously thought. The light and velocity curves that were calculated should be useful guides for interpreting the observations. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-12972 Michigan Univ., Ann Arbor.
THE HE I TRIPLET LINE EMISSION IN CLASS 1 SEYFERT GALAXIES Ph.D. Thesis
Fred Ross Feldman 1979 97 p
Avail: Univ. Microfilms Order No. 7925147

The equations of statistical equilibrium are solved for an 11 level helium atom, including radiative and collisional transitions and allowing for self absorption from any level. Calculated triplet line intensities as a function of tau(lambda 10830) are presented in graphical form. The possible importance of photoionization from the n = 2 levels by continuum and resonance line radiation is investigated. New spectrophotometric observations of 3C 120, Mrk 618, NGC 7469, and Mrk 335 are compared to the theoretical results. Dissert. Abstr.

N80-12973 Pittsburgh Univ., Pa.
ON THE RELATIONSHIP BETWEEN LYMAN-ALPHA AND 21-CM RADIATION AS IT APPLIES TO CLOUDS OF GAS ASSOCIATED WITH QUASI-STELLAR OBJECTS Ph.D. Thesis
John J. Urbaniak 1979 131 p
Avail: Univ. Microfilms Order No. 7924771

A model is proposed in which Lyman-continuum radiation emitted by the QSO is converted to Lyman-alpha radiation in an ionized portion of the cloud. This Lyman-alpha radiation propagates through the neutral portion of the cloud, where it will lower the spin temperature provided that the intensity is high and it has the proper spectral characteristics. Parameters pertaining to the model are obtained from observations of the object 1331 + 170 and the equation of radiative transfer is solved numerically in both the ionized and neutral sections of the cloud. The results of these calculations verify that the Lyman-alpha mechanism lowers the spin temperature enough to permit 21-cm absorption in clouds located near (approximately 1 kpc) or intrinsic to quasi-stellar objects. The model predicts the appearance of a characteristic double-hump, that is, two emission peaks which should be located in the broad, deep Lyman-alpha absorption trough 1331 + 170. Dissert. Abstr.

N80-12974 Pittsburgh Univ., Pa.
VERTICAL STRUCTURE OF GALACTIC GASEOUS DISKS Ph.D. Thesis
Allan Douglas Tubbs 1979 124 p
Avail: Univ. Microfilms Order No. 7924686

A theoretical examination of the vertical structure of galactic gaseous disks is discussed in light of recent observational studies of external galaxies and of our own galaxy. Both the large scale and fine scale structure of these disks are considered. The unperturbed large scale distribution of the gas of our galaxy and its implications to the galactic mass distribution are examined. The warp observed in NGC 5907 is examined in detail and is found to be consistent with either a tidal or primordial origin. On a fine scale (approximately 100 pc) the two dimensional response of the gas to a spiral density wave is examined. The self gravity of the gas is considered and is shown to be important for average midplane gas densities of over 5 particles per/cucm. Dissert. Abstr.

N80-12975 Iowa Univ., Iowa City.
ON THE ACCELERATION OF ENERGETIC PROTONS BY INTERPLANETARY SHOCK WAVES Ph.D. Thesis
Mark Elliott Pesses 1979 230 p
Avail: Univ. Microfilms Order No. 7924515

The acceleration of energetic protons in interplanetary magnetosonic fast mode shock waves is studied via analytical modeling, numerical simulations and in situ observations. It is shown that it is physically impossible for charged particles to be Fermi accelerated by MHD shock waves or discontinuities. An analytical model is presented in which the particle shock interaction is viewed in an intermediate frame in which the upstream and downstream electric fields are simultaneously zero. The analytical predictions of post shock energies and pitch angles and shock relfection and transmission coefficients are discussed. Dissert. Abstr.

N80-12976 City Univ. of New York, N. Y.
COSMOLOGICAL TESTS OF A SCALE COVARIANT THEORY OF GRAVITATION Ph.D. Thesis
Jane Rix Owen 1979 300 p
Avail: Univ. Microfilms Order No. 7923757

The Friedmann models with Lamda = 0, subjected to several optical and radio tests within the standard and scale covariant theories of gravitation are examined. Both interferometric and scintillation data are interpreted in terms of selection effects and evolution. The full solution to Einstein's gravitational equations in atomic units for a matter dominated universe, the study of the magnitude vs. redshift relation for elliptical galaxies,

the isophotal angular diameter vs. redshift relation, the metric angular diameter vs. redshift relation, and the integrated and differential expressions for the number count vs. radio flux test are discussed. Dissert. Abstr.

N80-12977 Maryland Univ., College Park.
BLACK HOLES AND COSMIC CENSORSHIP Ph.D. Thesis
William Allen Hiscock 1979 243 p
Avail: Univ. Microfilms Order No. 7925744

The validity of the cosmic censorship hypothesis which states that singularities which are even locally naked are never produced in a black hole is investigated. The possibility of converting an extreme Kerr-Newman black hole into a naked singularity by the accretion of test particles is studied. The motion of test particles with a large angular momentum to energy ratio, and test particles with a large charge to energy ratio are examined. The possible black hole interior solutions are studied. The effects of the Hawking black hole evaporation process on black hole interiors are considered. Dissert. Abstr.

N80-12978 Michigan Univ., Ann Arbor.
ANALYTIC THEORY OF ORBIT CONTRACTION AND BALLISTIC ENTRY INTO PLANETARY ATMOSPHERES Ph.D. Thesis
James Michael Longuski 1979 140 p
Avail: Univ. Microfilms Order No. 7925185

Equations of motion are derived to provide a set of universal entry equations applicable to all regimes of atmospheric flight from orbital motion under the dissipative force of drag through the dynamic phase of reentry and finally to the point of contact with the planetary surface. A complete uniformly valid theory is developed for orbit contraction due to atmospheric drag for all elliptic orbits in the case of orbital motion. A simple model is chosen in which the atmospheric density is assumed to vary exponentially with altitude. The universal entry equations applied to the problem of ballistic entry are described. The analytic theory of ballistic entry is developed by analyzing the three typical cases: (1) entry from a decaying orbit, (2) entry with circular speed at small initial flight path angles and (3) entry at moderate and large initial flight path angles with arbitrary speed. The second order theory is developed by applying Poincare's method of small parameters to a system of nonlinear equations. Dissert. Abstr.

N80-12979*# Planetary Science Inst., Tucson, Ariz.
COLLISIONAL AND DYNAMICAL PROCESSES IN MOON AND PLANET FORMATION Semiannual Report, 23 May - 22 Nov. 1979
22 Nov. 1979 106 p refs
(Contract NASw-2909)
(NASA-CR-162500; SAI-1-141-00-633-03) Avail: NTIS HC A06/MF A01 CSCL 03B

The collisional and dynamical processes in moon and planet formation are discussed. A hydrodynamic code of collision calculations, the orbital element changes due to gravitational scattering, a validation of the mass shifting algorithm, a theory of rotations, and the origin of asteroids are studied. A numerical model of planet growth is discussed and a methodology to evaluate the rate at which megaregolith increases its depth as a function of total accumulate number of impacts on an initially smooth, coherent surface is described. A.W.H.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-12980* Texas Univ. at Austin.
ANALYSIS OF LUNAR SEISMIC SIGNALS: DETERMINATION OF INSTRUMENTAL PARAMETERS AND SEISMIC VELOCITY DISTRIBUTION Ph.D. Thesis
Peter Horvath 1979 354 p refs
(Grant NsG-7418)
(NASA-CR-162603) Avail: NTIS HC A16/MF A01 CSCL 03B

Inverse filters were designed to correct the effect of instrumental response, coupling of the seismometer to the ground, and near surface structures. The least squares technique was used to determine the instrumental constants and the transfer functions of the long period lunar seismographs. The influence of noise and the results of these calculations are discussed. R.C.T.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-12981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EMPIRICAL POLYTROPE LAW FOR SOLAR WIND THERMAL ELECTRONS BETWEEN 0.45 AND 4.76 AU: VOYAGER 2 AND MARINER 10
Edward C. Sittler, Jr. and J. D. Scudder Nov. 1979 26 p refs Submitted for publication
(NASA-TM-80594) Avail: NTIS HC A03/MF A01 CSCL 03B

Empirical evidence is presented that solar wind thermal electrons obey a polytrope law with polytrope index gamma = 1.175 plus or minus 0.03. The Voyager 2 and Mariner 10 data used as evidence are compared and discussed. The theoretical predictions that solar wind thermal electrons in the asymptotic solar wind should obey a polytrope law with polytrope index gamma = 1.16 plus or minus. The widespread impressions in the literature that solar wind electrons behave more like an isothermal than adiabatic gas, and the arguments that Coulomb collisions are the dominant stochastic process shaping observed electron distribution functions in the solar wind are reexamined, reviewed and evaluated. The assignment of the interplanetary potential as equal to approximately seven times the temperature of the thermal electrons is discussed. A.W.H.

N80-12982# California Univ., Berkeley. Lawrence Berkeley Lab.
MEASUREMENT OF CIRCUMSOLAR RADIATION: STATUS REPORT
D. F. Grether, A. Hunt, D. Evans, and M. Wahig Sep. 1978 4 p refs Presented at the 3d Solar Heating and Cooling R and D Branch Contractors Meeting, Washington, D. C., 24 Sep. 1978
(Contract W-7405-eng-48)
(LBL-8391; CONF-780983-7) Avail: NTIS HC A02/MF A01

Four instruments systems, each of which contains a scanning telescope to make the circumsolar measurements, and includes standard solar and meteorological instruments, were deployed at sites of interest to various DOE programs utilizing concentrating collectors systems. The telescope remain more or less in the same place for a period on the order of a year, so that seasonal variations can be quantified. The data obtained are stored and processed, and the results made available to the various solar concentrating collector projects in a form appropriate to each project. These forms include: (1) sample scans of the telescope for a particular time or for a variety of conditions; (2) variation in solar and circumsolar radiation over the course of a day, month or year; and (3) detailed data suitable for input to computer-based simulations or solar energy conversion systems. DOE

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-12983*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DETECTION OF A FAST, INTENSE AND UNUSUAL GAMMA RAY TRANSIENT
T. L. Cline, U. D. Desai, G. Pizzichini, B. J. Teegarden, W. D. Evans (LASL, N. Mex.), R. W. Klebesadel (LASL, N. Mex.), J. G. Laros (LASL, N. Mex.), K. Hurley (Centre d'Etude Spatiale des Rayonnements), M. Niel (Centre d'Etude Spatiale des Rayonnements), G. Vedrenne (Centre d'Etude Spatiale des Rayonnements) et al Sep. 1979 17 p Submitted for publication
(NASA-TM-80570) Avail: NTIS HC A02/MF A01 CSCL 03B

An unusual transient pulse of approximately > 50 keV was detected by the gamma-ray burst sensor network using nine space probes and satellites. Its characteristics are unlike those of the known variety of gamma-ray bursts and therefore suggest that it was formed either by a completely different origin species or in a very different manner. It is identified with the LMC supernova remnant N49. Author

N80-12984*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELEMENTAL COMPOSITION, ISOTOPES, ELECTRONS AND POSITRONS IN COSMIC RAYS
V. K. Balasubrahmanyan Sep. 1979 16 p refs Submitted for publication
(NASA-TM-80571) Avail: NTIS HC A02/MF A01 CSCL 03B

Papers presented at the 16th International Cosmic Ray Conference, Kyoto, Japan, dealing with the composition of cosmic rays are reviewed. Particular interest is given to data having bearing on nucleosynthesis sites, supernovae, gamma-process, comparison with solar system composition, multiplicity of sources, and the energy dependence of composition. A.R.H.

N80-12985*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF DIFFUSE GALACTIC GAMMA RAYS
George A. Simpson Oct. 1979 14 p refs Presented at 22d Plenary Meeting, COSPAR, Bangalore, India Submitted for publication
(NASA-TM-80578) Avail: NTIS HC A02/MF A01 CSCL 03B

The observations of galactic diffuse gamma radiation are reviewed. The connections of the gamma ray observations with galactic structure and cosmic rays are discussed. The high latitude galactic component and the low latitude emission from the galactic plane are examined. The observations in other regions of the gamma ray spectrum are discussed. A.W.H.

N80-12986*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROPULSATIONS IN THE ELECTRIC FIELD NEAR THE PLASMAPAUSE, OBSERVED BY ISEE-1
T. E. Moe, N. C. Maynard, and J. P. Heppner Oct. 1979 33 p refs Submitted for publication
(NASA-TM-80580) Avail: NTIS HC A03/MF A01 CSCL 03B

The occurrence of micropulsations near and inside the plasmapause was surveyed. The observed pulsations, classified as Pc3 and Pi2, are discussed. In addition one single event of Pc1 was observed. The frequencies in the Pc3 and Pi2 bands, the amplitude ranges, and the direction of rotation for the electric field vector are reported. A.W.H.

N80-12987*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY LINE EMISSION FROM THE TYCHO SUPERNOVA REMNANT
Steven H. Pravdo, B. W. Smith, P. A. Charles (California Univ., Berkeley), and I. R. Tuohy (California Inst. of Technology) Oct. 1979 16 p refs Submitted for publication
(NASA-TM-80581) Avail: NTIS HC A02/MF A01 CSCL 03B

The observation of the X-ray spectrum of the Tycho supernova remnant in the energy range 0.5 to 20 keV is discussed. Four significant line features in the spectrum: The K alpha lines of silicon, sulphur, and iron; and the L lines of iron are examined. Comparisons between the silicon and sulphur equivalent widths and K alpha iron line energies of Tycho and Cas A are discussed. Suggest that the X-ray emitting plasma in Tycho is further from collisional ionization equilibrium than that of Cas A. A.W.H.

N80-12988*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETECTION OF HIGH ENERGY X-RAYS FROM THE GALACTIC CENTER REGION
B. R. Dennis, J. H. Beall, E. P. Cutler, C. J. Crannell, J. G. Dolan, K. J. Frost, and L. E. Orwig Oct. 1979 25 p refs Submitted for publication
(NASA-TM-80584) Avail: NTIS HC A02/MF A01 CSCL 03B

Observations of the galactic center region made with the high energy X-ray detector on OSO-8 are discussed. A strong hard X-ray which was detected during these observations from the vicinity of the galactic center are examined. The counting rate spectrum and the photon number spectrum of the flux are determined. Comparisons with the high energy X-ray fluxes observed from sources in the region by others are discussed. A.W.H.

N80-12989*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPLICATIONS OF CYCLOTRON FEATURES IN THE X-RAY SPECTRUM OF HER X-1
R. Bussard May 1979 48 p refs Submitted for publication
(NASA-TM-80588) Avail: NTIS HC A03/MF A01 CSCL 03B

The X-ray spectra from binary pulsars is investigated through the modification of physical processes due to an intense magnetic field. An effective scattering cross section for line photons and the Coulomb cross section for electron-ion collisions, treating the electrons relativistically, are calculated. The quantization of electron orbits in strong fields are discussed. The absorption cross sections and emission rates for cyclotron photons are calculated. An application of the results to the data from Hercules X-1 is examined. A.W.H.

99 GENERAL

N80-12990# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AGARD BULLETIN TECHNICAL PROGRAMME, 1980
Aug. 1979 33 p
(AGARD-Bull-79/2) Avail: NTIS HC A03/MF A01

A list of scheduled meetings for 1980 is presented along with descriptions of programs. Budget and publications summaries are included. F.O.S.

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SUBJECT INDEX

Typical Subject Index Listing

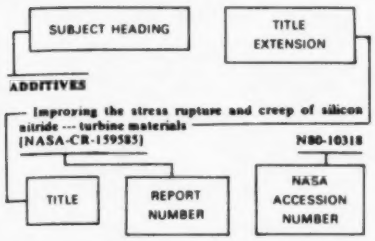

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

A

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[AD-A071916] N80-12415
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ABUNDANCE
Elemental composition, isotopes, electrons and positrons in cosmic rays
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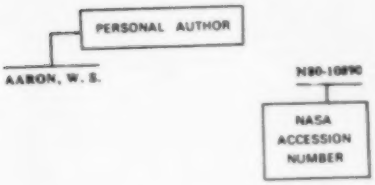

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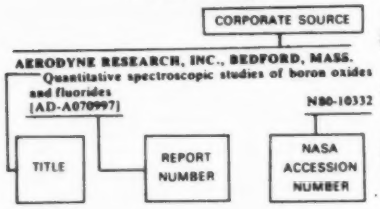

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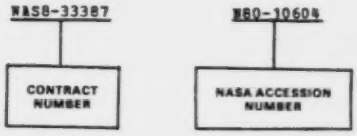

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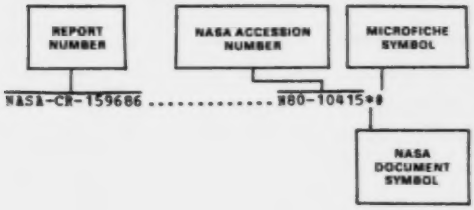

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

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07 AIRCRAFT PROPULSION AND POWER 418

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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Includes powered and free-flight trajectories; and orbit and launching dynamics.

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For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 433

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 433

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20 SPACECRAFT PROPULSION AND POWER 434

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CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 435

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24 COMPOSITE MATERIALS 435

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 437

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 441

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ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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33 ELECTRONICS AND ELECTRICAL ENGINEERING 459

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

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GEOSCIENCES

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For related information see also *Space Sciences*.

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For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

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LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

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54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 518

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

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65 STATISTICS AND PROBABILITY 528

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

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Includes mathematical modeling; network analysis; and operations research.

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Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

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SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

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SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
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N80-10196*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey. 3 Sep. 1979. 409 p. refs.
(Contract NAS1-15624)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01
CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AUTOMATIC LAUNCHING/LOADING TECHNIQUES - HELICOPTER SYSTEMS

G.T. Lamar, U.S. Dept. of Defense, Army, Missile Research & Development Command, Technology Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1009)

Investigate the depot-to-fire sequence of future systems and develop transport-load-launch-reload concepts minimizing manpower requirements and total sequence time for helicopter launch systems.

A full study of the techniques for rapid load and reload of helicopters will be conducted. Automatic boresighting features, self-loading hardback design, rough terrain loaders and techniques to satisfy the complete wooden round philosophy will be investigated. A tri-service/NATO survey will be conducted. Prototype hardware of promising concepts will be designed, developed, and tested.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Ground Equipment & Missile Structures Directorate

1.0002, EXPEDIENT SNOW ROADS AND LANDING FIELDS

P.R. Johnson, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *Bldg. 4070, Fort Wainwright, Alaska* 99703 (DA0D8149)

To evaluate the effectiveness of roads and landing fields built of snow while minimizing damage to the underlying vegetation and investigate constructing snow roads and landing fields in low snowfall areas using snow collection and entrapment methods.

In the subarctic, work will be concentrated on methods of compacting the light cold snow so as to develop a snow pad with adequate strength and surface characteristics to carry medium to heavy truck traffic. Existing snow roads will be studied. In the arctic, special attention will be given to snow supply and induced drifting along with the terrain, snow and traffic characteristics. Methods of collecting and transferring snow on the tundra to the desired roadway will be examined and tested. Ice roads, constructed primarily of water applied to the tundra will be examined. The protection offered the vegetative mat and ground below the various snow and ice roads and pads will be evaluated during the following summers.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

1.0003, COMBUSTOR DESIGN CRITERIA, ARMY AIRCRAFT

K.M. Johansen, Signal Co. Inc., Airesearch Manufacturing Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DA0D4007; DAAJ02-75-C-0044)

Combustors have typically required more rig test development time and cost than other gas turbine engine components. Though combustors have been the component least amenable to analytical design, recent techniques have shown the potential of significant reductions in development time and cost. Analytical math models will be refined and validated by full-scale rig tests of a small (2-5 pps) annular combustor. This technology will provide a shorter, lower cost development cycle for future Army gas turbine helicopter engines.

Existing combustor math models will be refined and validated by elemental testing, i.e., fuel injection, liner cooling. Full-scale high pressure rig tests will validate the entire design procedure. The following phases (and percentage of total effort) will be conducted: (1) analytical model refinement (33 percent), (2) full-scale combustor design, fabrication, and preliminary test (38 percent), (3) combustor performance mapping (20 percent), (4) limited modification and retest (9 percent).

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0004, MIRA INERTIAL SENSOR FAILURE, REDUNDANCY ANALYSIS

J. Craig, Incosym Inc., *21243 Ventura Blvd., No. 138, Woodland Hills, California* 91364 (DF140400; F33615-77-C-3015)

Present inertial reference units are costly to procure and maintain. Complement the on-going multifunction inertial reference assembly (MIRA) program in the determination of the final MIRA candidate designs. Assist the Air Force in the selection, evaluation, and approval of the final MIRA designs. Successful implementation of the MIRA concept to military aircraft would result in replacement of numerous conventional reference sensors, and a life cycle cost savings of fifty percent.

This investigation will determine and specify MIRA candidate configurations. To accomplish this, analyses of the failure modes of the MIRA system components and their effects on the various possible mechanizations will be performed. Possible redundant mechanizations will be analyzed to establish the most cost effective MIRA configurations with consideration of life-cycle-cost, performance, reliability, maintainability, and survivability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, EJECTION SEAT FOR HIGH G ESCAPE

O.E. Howland, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DF142060; F33615-78-C-3416)

Advance flight vehicles incroporating new technologies such as low profile cockpits or control configurations which permit direct lift, direct side force and drag modulation, and reduced margins of stability, require a new and different type of escape system. With these types of aircraft, a typical aircraft emergency will characteristically include a high g field while the ejection takes place and the additive effect of aircraft g and ejection accelerations will exceed the limits of human tolerance. The objective of this program is to provide an emergency ejection seat type escape system design that will provide safe ejection and clearance while the combat aircraft is under high g as well as safe escape under the usual severe requirements associated with high dynamic pressure and low altitude flight regimes.

This program consists of 1) an investigation phase to gather together and evaluate pertinent technologies, requirements and information related to the problem, 2) synthesis phase to establish reasonable concepts and a preferred conceptual design, and 3) a reporting phase to document activities, results and rationale.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, EVALUATION OF THE IMPACT OF TOWING TRANSPORT AIRPLANES AT BOSTON LOGAN AIRPORT

Unknown, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (FA78WA-4198; FA161582 (TRAIS NO.))

The towing loads at the Boston-Logan Airport, or other airports as designated will be measured as well as the resultant loads and/or stresses in an airplane structure. These measurements will be conducted to obtain parametric data so that the results can be applied to any towing operations at any airport. Also three-loads models for each airplane specified will be developed citing the history of the loads on the nose landing gear and support structure. Critical structural members of the nose landing gear and support structure will be identified and analyzed.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0007, ADVANCED REPAIR TECHNIQUES FOR LOWER COST

D.E. Parker, Rockwell International Corp., *International Airport, Los Angeles, California* (DF141300; F33615-78-C-3208)

An important element of the overall maintenance and repair of a weapon system is the refurbishment and/or repair of structural components. Frequently, excessive costs arise due to either basic structural design deficiencies or inadequate/outmoded repair methods. The objective of this effort is to devise innovative structural concepts and repair/maintenance techniques for selected high cost maintenance items to decrease both frequency of repair and cost.

Specific critical airframe and ground support equipment, maintenance items from fighter, cargo/tanker, or bomber aircraft will be selected for development of improved design and/or repair techniques. The lower cost potential of these techniques will be demonstrated through prototype applications and the approach will be documented for possible AFLC implementation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, IMPROVED FLOW VISUALIZATION BY USE OF RESONANT REFRACTIVITY

D. Bershader, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DF038630; AFOSR-74-2670)

AF function - aerospace vehicles. Opportunity - Air Force flight operations depend on the science of aerodynamics for the quantitative prediction of performance and loads on vehicle surfaces, both for operational use and especially for rational design. Optical methods such as shadowgraph, schlieren and interferometry are important and long established tools of experimental aerodynamics. There is a need for obtaining highly increased sensitivity in these refractive optical methods. With the use of laser sources, resonant refractivity should provide this needed highly increased sensitivity in refractive optical systems. Objective - to develop a resonant refractive system for air and to demonstrate its use with a simple flow field. How work contributes -this work will investigate the feasibility of using the resonant refractivity of sodium or other vapor to enhance the sensitivity of optical flow measurements by a factor of 100.

Theoretical and experimental graduate study and post-doctoral research are being done to provide a feasibility assessment and design recommendations for using resonant refractivity of sodium or other vapor to provide flow visualization for very weakly refractive flows.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0009, ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATIONS

B. Widow, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DN890084; N00019-78-C-0276)

Novel adaptive techniques for processing antenna array signals will be investigated. The overall objective is to develop and determine the usefulness of several schemes for separating incoming signals by power level, spectral characteristics, angle of incidence, etc., to demodulate and identify such signals and to do this with a sparse and irregular receiving array.

Emphasis will be directed toward the investigation of a 'leaky' least mean square (lms) algorithm. The leaky lms algorithm appears to offer unique advantages for achieving antenna adaption under conditions where the antenna elements change their spacing due to antenna movement such as occurs for elements mounted on aircraft wings. The leaky lms algorithm will be studied to determine stability, rate of learning, maladjustment, and demodulation distortion in the presence of broadband noise and narrowband signal inputs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0010, ENVIRONMENTAL EFFECTS AND DURABILITY EVALUATION OF ADVANCED COMPOSITE STRUCTURE

H.T. Lund, Summa Corp., Hughes Helicopters Division, *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0E3836; DAAK51 78 C 0004)

The objective of this work is to develop and fabricate full-scale flight worthy OH-58 tail sections (tailboom, horizontal stablizer, vertical fin) and fly them on service helicopters in place of existing metallic components. The composite tail sections will be flown and maintained under actual service conditions to evaluate the long-term effects of exposure to the natural elements (i.e. heat, cold, moisture, ultraviolet, etc), coupled with daily service usage.

The initial work will be the development of preliminary design concepts to improve structural performance and reduce fabrication cost. In addition to improved structural designs, the composite tail section will include reasonable design modifications and innovations to enhance ballistic survivability when impacted with 23mm HEI and reduced radar detection. Selection - selected tail section design will be fabricated and tested (both laboratory and flight demonstration) prior to quantity fabrication of tail sections and subsequent service installation and environmental/durability evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0011, DEVELOPMENT OF FLIGHT CONTROL SYSTEMS/FLYING QUALITIES CRITERIA FOR LIFT/CRUISE FAN V/STOL AIRCRAFT

D. McRuer, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DN881486; N62269-78-C-0129)

To establish baseline flying qualities requirements, flight control laws, flight path critical displays and control/propulsion integration concepts for a Navy lift/cruise FAN aircraft. Supports work unit DH820, DN881124.

Investigations will be conducted to define flight control requirements for a lift/cruise FAN vehicle. Flying qualities criteria will be established for the design of a flight control/display system suitable for all modes of flight including hover maneuvering, transition maneuvering, cruise maneuvering, takeoff and landing. The flight control development will address integrated propulsive and aerodynamic control concepts, failure mode effects, pilot station controls and displays, actuation concepts and system reliability. The ability of the flight control/display

system to provide satisfactory flying qualities will be demonstrated through piloted simulation at the NASA Ames Research Center.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0012, AERONAUTICAL TECHNOLOGY, TECH AREA 1 - AERODYNAMICS TECHNOLOGY
I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0B5001)

This project provides for technological development in rotary-wing fluid dynamics, acoustics, dynamics, stability, controllability and handling qualities where deficiencies are known to exist in meeting the requirements of future Army airmobile systems. Objectives are to develop handling quality design goals and performance criteria in terms required in future systems and to allow knowledgeable tradeoffs to be made among pilot workload, task performance and cost. This effort will lead to new design criteria and a revised handling qualities mil spec for helicopters. It is intended to contribute not only to the improvement of capabilities in industry, but also to the development of the Army's in-house ability to assess the potential of new systems against predicted requirements.

These objectives will be reached through joint participation with NASA in theoretical and experimental research programs utilizing wind tunnel, ground-based simulation, and flight research capabilities.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0013, IN-HOUSE LABORATORY INDEPENDENT RESEARCH PROGRAM (ILIR)- ROTOR ACOUSTIC RESEARCH
I.C. Statler, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, *Moffett Field, California* 94035 (DA0D5002)

The objective is to make maximum utilization of the information inherent in the radiated aerodynamically generated noise signature of rotors obtained by the newly developed in-flight noise measurement technique. These measurements provide noise pressure signals undistorted by reverberation, Doppler shift and other normally prevalent signal distortion mechanisms. These research efforts should provide the understanding of the noise generation mechanisms necessary to develop relatively simple mathematical analysis which can be used for rotor noise source and radiation pattern prediction.

A combined experimental theoretical effort will be followed utilizing tools developed to separate the noise generation mechanisms and allow concentrated effort to solve the complex problems in a step by step fashion. The first effort will be to define the impulsive noise generation mechanism and provide theoretical prediction capability. The second phase will concentrate on the blade vortex interaction noise and determine influence of rotor blade geometric parameters on rotor noise. Model rotor experimental efforts will utilize the laser velocimeter and other techniques such as schlieren and shadowgraph to verify flow field disturbance patterns.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0014, RESEARCH IN AERODYNAMICS
I.C. Statler, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, *Moffett Field, California* 94035 (DA0C5002)

To expand the technologies in those areas which are most likely to impact improved operational and cost effectiveness, survivability and safety of future Army airmobile systems. Analytical and experimental studies are selected on the basis of a continual review of the Army's aviation objectives and assessment of those fundamental technological deficiencies which would prevent achievement of the desired objectives.

Rotary-wing research will be conducted through joint participation with NASA to develop or improve analytical tools, prediction techniques, and fundamental understanding related to basic fluid mechanics, rotary-wing airfoils, acoustics, rotary wing dynamics and control, and flight simulation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Ames Research Center

1.0015, ADVANCED DRIVE SHAFT ALIGNMENT INDICATOR PROGRAM - ARMY HELICOPTER
R.B. Bossler, Kaman Aerospace Corp., *Old Windsor Rd., Bloomfield, Connecticut* 06002 (DA0D4090; DAAJ02-77-C-0006)

To design, fabricate, field test and evaluate an advanced drive shaft alignment indicator (DSAI), for both static and dynamic modes as a candidate replacement for the present UH-1 and AH-1 drive shaft alignment indicator.

An advanced DSAI, based on a prototype indicator designed under a previous contract, will be fabricated. An optimum procedure using the current UH-1 alighment tools will be developed. The new DSAI along with this optimum procedure will be field tested and evaluated. At the conclusion of the field tests (approx. 55 helicopters), the previously developed AVUM procedures will be updated and a final cost and operational effectiveness assessment will be made.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0016, ADVANCED COMPOSITE UTTAS ROTOR HUB PRELIMINARY DESIGN
E. Olster, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0E3784; DAAJ02-77-C-0056)

Conduct a preliminary design and determine the merit of an advanced composite main rotor hub for the UH-60A (UTTAS) helicopter.

Contractor will first establish design criteria and specifications for a flight-worthy composite main rotor hub for the UTTAS. Three design concepts which make maximum use of existing rotor system components will be developed and then a tradeoff study will be performed. One concept will be selected and a preliminary design prepared. The following analyses/estimates will be performed - damage tolerance, preliminary structural vulnerability, reliability, RCS, cost-weight, producibility, and lightning protection. Upon completion of the preliminary design evaluation a program review will be held at this laboratory.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0017, FLAMMABILITY STANDARDS - CABIN CREW UNIFORMS
Unknown, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (FA78WAI-865; FA161224 (TRAIS NO.))

Provide the technical expertise and services in fabrics, textiles, and uniforms needed by the FAA to support the promulgation of flammability standards for air transport crew uniforms.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0018, TOWER CAB DIGITAL DISPLAY (TCDD) REVISED CIRCUIT BOARDS
Unknown, Magnavox Government & Industries Electronics Co., *1313 Production Rd., Fort Wayne, Indiana* 46808 (FA78WA-4202; FA161443 (TRAIS NO.))

Tower Cab Digital Display (TCDD) Revised Circuit Boards involve revising fine printed circuit board types and producing fourteen sets of the new boards. These changes will be reflected in the TCDD Instruction Books and provide the updated layout drawings for those boards, displaying the new parts. Once the circuit boards are ready for demonstration, it has to be performed at a site in Tampa, Florida. The circuit

boards have to be designed, constructed and tested according to specifications outlined in TCDD Subsystem Design, while addressing the indicated exceptions.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0019, QUALITY OF SERVICE AND REGULATION IN AIR PASSENGER TRANSPORT
Unknown, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (OS-70041; OS161028 (TRAIS NO.))

The objective of the research is to identify and implement a rigorous theoretical model of air passenger transportation. The implementation is to be achieved by developing and estimating an econometric model. The focus of this effort will be to determine quality of service and quantity of service as a function of fare structure, entry conditions, cost parameters, and demand parameters. The model will of necessity implicitly include profit and cost-benefit type determinations which may be made explicit. The findings of this research will be of great interest to regulatory and policy makers. It should provide a superior framework for examining the impact of regulatory changes.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary of Transportation

1.0020, MINIMUM-WEIGHT, FAST-REACTION, INTEGRATED INERTIAL SENSOR ASSEMBLIES FOR SHIPBOARD V/STOL AIRCRAFT
R.C. Burns, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DN890045; N00019-78-C-0120)

To define and specify a minimum-weight, fast-reaction, integrated inertial sensor assembly for shipboard V/STOL aircraft. High-performance, strapdown laser gyros will be used in redundant configurations, along with air data sensors, to provide inertial and air data for navigation, weapon delivery, flight control, and pilot display functions.

Shipboard air operations, mission scenarios, and performance requirements of Navy/Marine Corps V/STOL aircraft will be studied and analyzed as an essential part of this effort. The information obtained will be used, along with related technical data from other sources, to define performance goals, conduct configuration tradeoffs, and specify an integrated inertial sensor assembly configuration capable of meeting the required operational objectives.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0021, WIRE OBSTACLE WARNING SYSTEM (WOWS)
A. Kleider, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Avionics Research & Development Activity, *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0D2824)

This program has been initiated to provide, at a cost which the Army can afford, a solution to the wire strike problem for helicopters flying nap-of-the-earth (NOE). The objectives include means of detection and recognition compatible with the aircraft lift capabilities, forward speed, and the expected incremental change in altitude required to clear the wire obstacle. The development of a flyable exploratory development model operable under restricted lighting conditions in clear weather is the prime program objective.

Recent developments in monolithic semi-conductor devices called charge coupled devices (CCD) will be exploited in a mode of operation referred to as single site activation (SSA) to detect and recognize wire obstacles. Operating in a combined electronic and mechanical scanning mode, the characteristics of wire are utilized to extract pattern recognition information. The processed video signal is converted to a visual/audible alarm with an appropriate symbolic display. Range data and low light level operation are based upon the synchronous use of a pulsed gallium-arsenide (GaAs) illuminator.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0022, COANDA/REFRACTION EXHAUST NOISE SUPPRESSOR FOR AIRCRAFT HUSH-HOUSES
D. Croce, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN896013)

To develop the coanda/refraction noise suppression concept with specific application to aircraft hush-house exhaust systems. To define a functional configuration for use with all Navy/Marine Corps aircraft.

Conduct an investigative program consisting of breadboard scale-model tests with simulated engine sources, analytic studies and configuration analysis studies. Conduct aero/thermodynamics and acoustic analyses of tests performed with model flat-plate ejectors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0023, NAVY VEHICLE DESIGN AND CONSTRUCTION - INVESTIGATION OF OPTIMAL CONTROL CRITERIA TO SATISFY FLYING QUALITIES
E.G. Rynaski, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DN875209; N00014-78-C-0155)

The objective of this research effort is to develop linear optimal control system design methods for advanced multivariable feedback flight control systems which will satisfy existing and future CTOL and V/STOL flying qualities requirements. These requirements define acceptable regions of aircraft behavior with respect to pilot command inputs. Future Navy tactical CTOL and V/STOL aircraft will utilize multiple and perhaps unorthodox means of producing forces and moments on the aircraft. The technology of defining control system configurations that will properly use these multiple force and moment producing devices to satisfy specified flying qualities requirements is far from fully developed.

An investigation will be made to determine and exploit the relationship that exists among the performance index parameters and the dynamic characteristics of the resulting closed loop optimal system. The investigation will be directed towards obtaining specific closed form relationships that relate the zeros of the closed loop, multicontroller system to the system's outputs and weighting matrices of the performance index.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0024, NON LINEAR ANALYSIS AND DESIGN OF SUPERSONIC AIRCRAFT
F.J. Marconi, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF140820; F33615-77-C-3126)

A more accurate method for analyzing advanced supersonic aircraft configurations over a wide range of flight parameters is required beyond the present linear methods. The non-linear analysis/design methods will enable handling realistic future military type aircraft geometries. There will be significant acquisition cost savings due to the accuracy and the reliability of the method. The objective of the effort is to generate a user-oriented computer code that gives the aerodynamic parameters of interest and detailed flow field characteristics around the aircraft. Military aircraft not only will have complex geometries but also operate over a wide range of flight parameters. These problems are non-linear in nature and therefore non-linear methods are required to generate reliable data useful for designers.

Cross-sectional geometries of aircraft will be transformed conformally into simpler shapes such as circles and rectangles, and the appropriate non-linear Eulerian equations will be solved by finite difference techniques. Reliability of the schemes will be established.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, VTOL AERODYNAMICS
R. Rubel, Grumman Corp., Dept. of Research, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN775687; N00014-77-C-0524)

The overall mission capability of a high-performance VTOL aircraft depends critically upon optimization of the aircraft characteristics at lift-off. The objective of the proposed theoretical study is to provide a quantitative understanding of

the fluid dynamics of a VTOL aircraft in proximity of the ground.

The overall flow field associated with a VTOL aircraft in the vicinity of the ground will be segmented into a sub-system of coupled, but more simply described regions based on a formal asymptotic analysis. The regions will be characterized as inviscid, boundary layer-like, and strong interaction. The equations appropriate for each individual region will be derived and studied in detail. The subdivision of the flow will follow from the asymptotic analysis as a consequence of the assumptions that the reciprocal of the Reynolds number, the spreading rate of the VTOL jet, and the ratio of the jet diameter to the distance of the VTOL above the ground all approach zero.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0026, COMPOSITE TURBINE BLADES FOR TURBINE ENGINES

I. Ahmad, U.S. Dept. of Defense, Army, Armament Research & Development Command, Research Branch, *Watervliet Arsenal, Watervliet, New York* 12189 (DA0A1708)

Development of high strength filament reinforced superalloy composites suitable for fabricating turbine blade/vanes for Army helicopter engines, capable of performing in the temperature range of 1900-2000 degrees F. This project is in direct support of the Army Aviation Materials Plan.

Composites of silicon carbide (carbon core) filament coated with tungsten and hafnium carbide (or nitride) in FeCrAlY, will be fabricated by diffusion bonding process, and their tensile strength and stress rupture behavior will be studied in the 1500-2000 degrees F range. Application of hot corrosion resistant coatings or composites of tungsten filaments in cobalt alloy matrix will be evaluated, and thermal fatigue of the coated specimens will be determined.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Benet Weapons Lab.

1.0027, V19U FUZE LETHALITY COMPARISON

M.J. Bittakis, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141770)

This program will support ongoing laboratory survivability/vulnerability investigations. The vulnerability of a weapons system, when impacted by a cannon round, is a function of not only the incident threat but also the type of fuzing incorporated into that threat. The new threat to be studied deviates significantly from the norm. The objective of the program is to quantify and analyze lethality aspects of the new threat. It will provide sufficient data to establish weapons systems defense concepts for the new threat.

The program will be approached in the following fashion: Phase I will investigate the effects of impact obliquity and incident material thickness on the activation of fuze and high explosive warhead. Phase II will establish the activation delay time characteristics of this type of fuzing. Phase III will compare the lethality of the V19U type threat with certain previously encountered threat types. Phase IV will investigate the results of the different lethality characteristics of this threat. This phase will incorporate a full scale A-7 replica as a test specimen. Inlet duct damage will be the major parameter to be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, HIGH-ANGLE-OF-ATTACK SEPARATED FLOWS

R.B. Crombie, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140870)

The mission to be supported is FG02, development and improvement of flight control design techniques. Current Air Force fighter aircraft exhibit dangerous stall/post-stall characteristics which limit combat effectiveness and may cause loss of both aircraft and crew. Criteria based on the aerodynamic characteristics of the aircraft is being developed for use in the early design phase of future systems. The objective of this effort is to develop a fundamental understanding of the separated aerodynamic flow associated with high-angle-of-attack dynamic problems thus allowing solutions to be found which will increase combat effectiveness and safety of flight for future fighter/attack aircraft.

Wind tunnel tests will be conducted at AEDC to investigate the high-angle-of-attack dynamic stability characteristics of an advanced aerodynamic configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0029, PRELIMINARY DESIGN OF ADVANCED WING STRUCTURE

A. Gonsiska, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF131620)

The rising acquisition and maintenance costs of advanced aircraft structures present a formidable obstacle to the procurement and operation of future Air Force weapon systems. Development of lightweight, high integrity, low cost airframe structures is urgently required to reverse the current trend of materials and labor cost increases. This effort is to innovatively exploit the latest developments in the field of structures technology to reduce, by at least 10 percent, the costs of advanced USAF strategic bomber wing structures while maintaining or increasing current levels of efficiency and integrity.

A swing wing aircraft (B-1) will be used as the baseline for a preliminary design study to develop innovative structural concepts for advanced system form, fit and function requirements. New structural arrangements, materials and fabrication techniques will be exploited and integrated to establish potential cost and weight reductions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, EMERGENCY CREW ESCAPE SYSTEM DESIGN AND PERFORMANCE ASSESSMENT

L.A. Jines, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136580)

The fatality rate among USAF ejectees from military aircraft is increasing. This is true in spite of many apparent improvements to operational ejection seats. Because of cost and other practical physical limits an ejection seat system is never fully tested. Modifications are then incorporated with similar lack of demonstration of capability. Comprehensive technical evaluation capability needs to be developed to insure that the limited testing is most effective. The objective of this effort is to develop a reliable and valid analytical capability for military crew escape systems to use in design of escape systems, accident investigations, performance evaluations, etc. Extensive effort will also be expended toward the development of a crew escape concept for safe escape while under high acceleration loads.

Emergency crew escape statistics will be analyzed to determine conditions at ejection that possibly indicate a pattern to resulting injuries, fatalities or successes. A companion analysis of current emergency crew escape systems to include effects of individual components on total system performance will be conducted. These analyses will be correlated to define current system limitations and problems. Refined data on the mechanical properties of escape systems will continue to be measured, including aerodynamic properties, weight and balance, force, dimensional and functional data. A computer math model depicting the detailed operation of the system is generated, validated and applied during analyses of various crew escape systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, FLIGHT CONTROL SYSTEM DEVELOPMENT CRITERIA

T.D. Lewis, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF138620)

Analysis tools to predict aircraft flight control/weapon system performance and cost estimates are inadequate to be applied early in the design cycle. Also, newly emerging flight control technologies require a firm data base and experience factors

to be included in military specifications. The objectives of this effort are to: (1) refine and consolidate the flight control system (FCS) development analysis, evaluation, and life cycle cost (LCC) prediction techniques and (2) develop, refine, and revise military specifications for flight control system design, development, test, and evaluation. FCS specification revisions will incorporate newly emerging technology and aid in reducing FCS design and test time. Consolidation and refinement of analysis techniques will provide criteria for realistic system performance and cost estimates early in the design cycle.

Digital flight control system experience will be broadened through support of the A-7 Digital Multimode FCS test aircraft while in use at the test pilots school, through experience gained on the digital flight control system ADP, and through interaction with work on related programs performed by other agencies for application and incorporation into Mil-F-9490D. Development of a new specification for servo-actuators will continue. Review and update of Mil-V-27162, servovalve specification, will be initiated. Review, refinement, and consolidation of FCS analysis programs such as TAWDS, DIGIKON, MAPS, and FCS LCC prediction will be conducted as applicable. Coordination with AFLC ALC's and the USAF Safety Center will be conducted along with review of FCS safety, survivability, reliability, and maintainability data to establish criteria for future FCS programs and specification update.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0032, APPLICATION OF PHOTOMECHANICS TO EXPERIMENTAL STRUCTURAL ANALYSIS

G.E. Maddux, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF134460)

Accurate stress analysis methods are required to accomplish low cost design, development and maintenance of aerospace vehicles. These are used to secure structural integrity for safety and longevity of a system. The objectives of this effort are twofold. The first is to apply laser/optical experimental stress analysis technology such as holographic interferometry and speckle photography to current design problems. The second is to improve and/or develop new laser/optical techniques with particular emphasis on reducing the cost of design analysis. The expected payoff is an improvement of in-house capability to advance the state of the art and to provide accurate and reliable analysis with a near term impact on systems such as RPV, AFTI, AMST, ASALM, and B-1.

Under a completed exploratory development program (JON 14670212), specialized holographic and speckle photographic methods have been developed and exploited to experimentally validate finite element stress analysis of structural components. This included strain field measurements around interference fit fasteners installed in fatigue resistant structural joints. The current effort will involve application of this technology to composite, bonded, and weld-bonded structures. Experimental studies concerning structural joints and the stress distribution in the vicinity of fasteners will continue. Techniques for using speckle photography on high temperature structures will be investigated. New techniques which might improve accuracy or reduce analysis cost will be evaluated. A quick response in-house capability will be maintained to solve urgent problems that often arise but are easily disposed of using the unique techniques of photomechanics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0033, DEVELOPMENT OF THERMAL AND FLOW MEASUREMENT TECHNIQUES

D.M. Parobek, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142430)

Advanced re-entry, interceptor, and maneuverable military flight vehicles operate at speeds which lead to problems with aerodynamic heating. This has generated the requirement to measure the surface heating rate to test models of these vehicles and certain thermodynamic parameters of the flow fields surrounding these vehicles. The objective of this work unit is to develop the instrumentation required to make these measurements.

Specialized measurement instrumentation will be developed in-house with contract assistance as required. Extensive tests on new sensors, probes, struts, and various other measurement instruments such as infrared detectors and scanners will be conducted in the thermal lab and test facilities. Work units 14260116, 14260120, 14260134, 14260135 and 14260213 are in process of termination and the remaining work of these will be consolidated under this new work unit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0034, SIMULATION OF BIRD IMPACT ON AIRCRAFT TRANSPARENCIES

J.P. Barber, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF137660; F33615-78-C-3402)

Air Force flight missions involve high speed, low altitude operations. Under these conditions, bird impacts on aircraft transparent crew enclosures pose a significant hazard and have resulted in unacceptable losses of aircraft and aircrew. The objective of this work unit is to develop math models for bird impact loads on aircraft transparencies. Utilization of existing computer methods for transparency design is contingent upon the availability of such bird loading models. These computer design methods will allow design of transparencies having improved bird resistance and will provide significant savings by reducing the costly empirical development historically required for transparency design. The availability of transparencies having improved bird resistance will reduce, to an acceptable level, the birdstrike hazard to USAF aircraft.

Efforts under this program will include upgrading the test and data acquisition capability of an air gun test facility, validation of an available math model for large bird impact, study of bird attitude effects on impact loads and investigation and validation of a substitute bird material to be used in impact testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0035, SERVICE TRACKING AND EVALUATION OF S-3A GRAPHITE/EPOXY SPOILER

C. Foreman, Vought Corp., Vought Aeronautics Co, *P.O. Box 5907, Dallas, Texas* 75222 (DN781395; N62269-76-C-0439)

To closely monitor the usage and performance of composite structure on fleet aircraft in order to evaluate long term durability, reliability, and maintenance requirements of composite structure in the Navy operational environment. This work is in support of work unit ZA601, 'Aircraft Technology', Agency Accession No. DN 681080.

Fourteen ship sets of spoilers, fabricated under previous contracted efforts, will be installed on fleet aircraft. A handbook will be prepared for squadron and field service personnel containing inspection requirements, damage criteria, and repair and maintenance procedures. Program progress will be reported quarterly for the first year and semi-annually thereafter. Spoiler ship sets will be periodically removed and shipped to NavAirDevCen for non-destructive and destructive evaluation. Program duration is five years.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0036, HT PP 78-10 - INVESTIGATION OF CANDIDATE THRUST PRODUCING SYSTEMS FOR FUTURE ARMY AIRCRAFT

J. Gomez, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3813)

To define advanced thrust producing systems which may provide significant helicopter and fixed wing aircraft improvements in order to identify future research.

1. Review and summarize past thrustor concepts including advantages and disadvantages of each. 2. Review future Army aircraft requirements and their related mission requirements. 3. Identify thrustor systems with potential to accomplish required

missions. 4. Define scope of work required for each thrust device.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0037, HT RM 78-18 - COMBAT MAINTENANCE CONCEPTS AND REPAIR TECHNIQUES (FLUID LINES)
Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3827)

To design and fabricate interim- and quick-fix repair kits for leaking fuel/oil/hydraulic lines on the AH-1 helicopter.

An in-house effort will identify all fluid lines and fittings on the AH-1 and establish a fluid line size or sizes to be used to bypass any leaking fluid line. In addition, the identification of several quick-fix concepts to repair the damaged fluid line on aircraft will be accomplished. Contractual effort following will design and fabricate quick-fix kits identified by this laboratory and demonstrate the kit or kits fabricated on an operational AH-1.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0038, RESEARCH IN AERODYNAMICS
J.L. Shipley, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Langley Research Center, *Hampton, Virginia* 23665 (DA0E3553)

To conduct basic and applied research to develop or improve analytical techniques, prediction techniques, measurement techniques, and design data related to rotary wing airfoil development, unsteady aerodynamic phenomena, rotor wake characteristics, and tip vortex generation and propagation. Investigations are selected based on continual review of the Army's aviation objectives and assessment of those fundamental technology short-comings which would prevent or restrict achievement of these objectives.

In joint participation with NASA, analytical and experimental programs will be conducted to develop rotor airfoils which are based on mission profiles and empirically derived environments. Unsteady experimental and analytical research will be conducted to develop an understanding of and the capability to analyze and predict rotor unsteady aerodynamic characteristics. Experimental programs will be conducted to quantify rotor wakes, to develop methods for drag reduction and to determine rotor performance and helicopter interference effects.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0039, PARAMETER IDENTIFICATION OF HEREDITARY SYSTEMS
E.M. Cliff, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace Engineering, *Blacksburg, Virginia* 24061 (DF139650; AFOSR-77-3221)

This work unit supports in part the AFFDL/FGC basic research plan that is intended to provide experimental methods to validate theoretical unsteady aerodynamics. The identification of these experimental aerodynamics will provide for safer control of aircraft flight. The specific objective of this work unit is to develop a parameter estimation method for a flexible aircraft described by state equations containing a convolution of the approximate Kussner/Wagner functions with the lifting surface steady aerodynamic methods. When these experimental data are better estimated and incorporated into design, the response of aircraft conventional and advanced control systems will be more rapid.

The hereditary models for a system with memory shall be generalized to include time delays on each state. The estimation procedure to identify the aerodynamic parameters of A and B, in the state such that DX/DT equals AX(T minus C) plus BU, will then be developed for C constant, C dependent upon state.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0040, AN INVESTIGATION OF SEPARATION MODELS FOR THE PREDICTIONS OF MAXIMUM LIFT COEFFICIENT 13225-EX
F.A. Dvorak, Analytical Methods Inc., *110 116th Ave. S.E., Bellevue, Washington* 98004 (DA0E9013; DAAG29 76 C 0019)

To develop a gas flow separation model which, when combined with an existing viscous/potential flow interaction analysis, results in a method capable of predicting airfoil or rotor performance at or beyond maximum lift coefficient. The proposed research will provide fundamental information for the prediction of helicopter performance and is thus highly relevant to the ARMDL mission.

Three separation models, two utilizing source distributions for representing the separated flow and the third utilizing a vorticity distribution for representing the free shear layers leaving the airfoil surface, will be evaluated for use in predicting maximum lift coefficient.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0041, ADVANCED FIBER REINFORCED THERMOPLASTICS (AFRTP) FOR AIRCRAFT STRUCTURES
J.T. Hoggatt, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF136020; F33615-76-C-3048)

Although significant advancements have been made in reducing the weight of aircraft structures through the use of advanced composites, further reductions in ownership and especially acquisition costs are potentially available through the substitution of thermoplastic matrix materials for the present thermosetting matrix materials (such as epoxies). Flat thermoplastic laminates can potentially be laid up and consolidated with highly automated processes, they can be stored without refrigeration as long as necessary (as can the thermoplastic adhesives) and they can then be postformed into complex shapes by applying heat and pressure. In addition, the thermoplastics can be welded in seconds either ultrasonically or with an electromagnetic vibration welding technique. The objectives of the program are (1) to demonstrate the potential of advanced fiber reinforced thermoplastics (AFRTP) to reduce the fabrication and assembly costs of aircraft structures, (2) to demonstrate the structural integrity and durability of an AFRTP component and (3) to simplify the repair procedures and reduce the cost of maintaining advanced composite structures.

The approach to attaining the objective is to select a structural component from either an operational system or a future production system, redesign the component, develop the manufacturing and repair techniques, manufacture the component and thoroughly test it. The selection of the demonstration article is restricted to a component that has a definite potential for acquisition cost savings and/or reduction in maintenance costs on an operational or future production aircraft. This program is sponsored jointly by the Manufacturing Technology Division of the AFML and the Structures Division of the AFFDL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0042, DEVELOPMENT OF AN IMPROVED GROUND VIBRATION TESTING AND ANALYSIS METHOD FOR COMPLEX AEROSPACE SYSTEMS
R.F. Michalak, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF140030; F33615-77-C-3059)

Ground vibration tests on current and new weapons systems require an excessive amount of time and cost. The general objective of this program is to develop and demonstrate an optimal, practical, and economical ground vibration test and analysis procedure for use in complex aerospace systems to determine by measurement their dynamic characteristics. The procedure developed shall be one which can be used for testing a wide variety of Air Force flight vehicles in both laboratory and field environments. The dynamic characteristics shall be of sufficient quality and in acceptable form for use in checking analytically predicted data in final flutter and other aeroelastic analyses. The specific objectives of this program are to markedly decrease the time and cost for ground vibration test (GVT), and to obtain additional dynamic characteristic data from test information.

The program will be conducted by a contractor using a team with expertise in the flutter and structural dynamics fields. To accomplish the above objective, the program will be divided into phases consisting of method selection, development, demonstration, application and reporting.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0043, TRANSONIC UNSTEADY AERODYNAMICS FOR AEROELASTIC APPLICATIONS
H.K. Yoshihara, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF133090; F33615-78-C-3201)

This work unit supports the prediction of time-dependent loads, flutter, stability and control for flexible aircraft in transonic flight. At present, there are no analytical methods available which can be used in aircraft design, and reliance must be placed on proof-tests of extremely expensive aeroelastic wind tunnel models which yield very limited data. The objective of this effort is to improve the accuracy and realism of the design of flexible aircraft which fly in or through the transonic region. These improvements will also improve the cost and efficiency of the aircraft design process and improve flight safety.

A contractor will evaluate the aerodynamic equations for time-dependent flow over aircraft at transonic speeds. He will write computer programs to solve those equations by relaxation techniques and by time-integration techniques. The final phase will be the application of the programs to a large-scale aircraft aeroelastic design problem.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0044, MULTIVARIABLE DIGITAL CONTROL SYSTEMS
B. Porter, University of Salford, *The Crescent, Salford, England, United Kingdom* (DF138790; AFOSR-76-3005)

This work unit supports the functions of advanced aerospace vehicles. The Air Force is currently developing the use of the digital computer for flight control management. For the digital computer to solve real-time flight control equations, the computer must solve the equations in the time domain (rather than the frequency domain). The objective of the study is to analyze the real-time implementation of disturbance-rejection and tracking control policies using digital computers. The proposed effort is to develop high-performance multivariable digital control systems whose functions are simultaneously to reject external disturbances and to track multiple command inputs.

This study will analyze the practical problems involved in the real-time implementation of disturbance-rejection and tracking control policies using a digital computer. A computer simulation of the digital real-time controllers will be applied to various airborne systems in a simulation. The simulation will cover the control of airborne systems and aircraft in a number of representative flight modes. The results of the simulation studies may result in the emergence of new control performance criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CARBORANE BURNING RATE MODIFIERS FOR SOLID PROPELLANTS
W.E. Hill, Auburn University, School of Chemistry, Dept. of Chemistry, *Auburn, Alabama* 36830 (DN590583; N00024-75-C-5318)

To perform research on carborane compounds for use as propellant burning rate catalysts. Three main problems will be investigated: (1) possibility of migration from the propellant, (2) undesirably high melting points, and (3) low-yield synthesis.

To prevent migration, existing binders will be modified by using carboranyl plasticizers which react with double bonds of the polymers on curing. Hydroxy terminated polybutadiene (HTPB) and carboxy terminated polybutadiene (CTPB) polymers will be reacted with functional carboranes to make polymers containing boron which should not migrate easily. Silyl carboranes which contain Si-Si bonds or Si-C bonds will be synthesized. These compounds should yield high burning rates with less carborane which should be less volatile. Difunctional carboranyl isocyonates and epoxides for use as curing agents will be synthesized. Meta-isomers of carborane derivatives will be prepared and compared with their ortho analogs in an effort to lower the melting point. Carboranes will be synthesized from acetylenes for improved yield.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Sea Systems Command

3.0002, MECHANICAL BEHAVIOR OF AIRFRAME MATERIALS
N.E. Paton, Rockwell International Corp., *1049 Camios Dos Rios, Thousand Oaks, California* 91360 (DF042380; F44620-76-C-0025)

AF function - titanium and its alloys have been of considerable interest to the AF because of very favorable strength-to-weight characteristics at temperatures from cryogenic up to 800 degrees F, and resistance to attack by many chemicals. Potential applications for skins, structural and engine components of high performance aircraft, cryogenic fuel storage tanks for missiles, and tubing for transporting corrosive fuels all emphasize the available materials roles for titanium alloys. Opportunity - despite improvements in processing techniques, all commercial titanium products contain residual hydrogen which can, under certain conditions, influence their mechanical behavior. The effects of such residual hydrogen on the properties of titanium are of primary importance from a practical point of view, but these effects are incompletely understood in the more complex commercial alloys. Consequently, hydrogen is often overlooked as the cause of variability in the mechanical behavior of these alloys. Objective - this research will determine the influence of hydrogen on mechanical properties such as loss of ductility, decrease in fracture toughness, increase in creep rate, and increase in both sustained load and fatigue crack growth rates. How work contributes - the mechanisms by which internal hydrogen influences these and other mechanical properties are not well understood.

A systematic study of the effect of hydrogen content and aluminum content on the stress field around hydrides, and an investigation of tensile, creep, fatigue and sustained load cracking properties of Ti-Al and Ti-Sn specimens, with and without notches, and over a range of temperatures, will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, ELECTROCHEMISTRY OF SOLUTES IN CHLOROALUMINATE SYSTEMS
R.A. Osteryoung, Colorado State University, School of Natural Sciences, Dept. of Chemistry, *Fort Collins, Colorado* 80523 (DF043300; AFOSR-76-2978)

AF function - communications and flight operations depend on auxiliary battery sources for power. Deficiency - lighter weight, higher temperature, longer life, and higher energy batteries are needed to meet the requirements. Objective - this research involves an understanding of the solution processes by which solute materials interact with certain acid solvents. These solvents are promising as battery fluids, and as systems for metallurgical separations. How work contributes - research results have the potential of improvement in high energy density batteries, corrosion prevention, new approaches for thermal batteries, and innovations for auxiliary power sources.

Electrochemical studies are to be carried out on a variety of solute species in aluminum halide based melts, mainly low temperature systems. The behavior and kinetics of oxygen, sulfur, selenium, and tellurium electrode processes will be studied. Aluminum oxychloride detection in the melt warrants a systematic investigation. Tungsten oxide, molybdenum oxide, and other oxides which appear stable and soluble in the melt, and of potential interest as cathode materials, will be examined. In attempting to identify certain chemical species in conjunction

with the electrochemical studies, there will be an increase in spectroscopic work.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0004, PHOTODETACHMENT STUDIES OF MOLECULAR NEGATIVE IONS 16023-P

W.C. Lineberger, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Chemistry, *1200 University Ave., Boulder, Colorado* 80302 (DA0F9198; DAAG29-78-G-0096)

To provide information required to predict the effect of light on a decaying atmospheric plasma. Negative ions play an important role in controlling the electrical conductivity in the atmosphere, and consequently the transmission of electromagnetic energy. Relevance -this research is relevant to various DOD efforts to model the atmospheric conductivity, for example, in connection with radar cross-section codes.

To utilize beam techniques to measure absolute photodetachment and photodissociation cross-sections for NO sub 2, NO sub 3, CO sub 3, and CO sub 4 anions in the spectra region 3,400-2,800 Angstroms. Fixed laser photoelectron spectrometry in the visible and near ultraviolet will also be utilized to determine binding energies and structures of atmospheric ions and cluster ions.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0005, DEFECTS IN SOLID-STATE POLYMERIZED MATERIALS

J.M. Schultz, University of Delaware, School of Engineering, Dept. of Chemical Engineering, *Newark, Delaware* 19711 (DMR7821751)

This research deals with the structure of polymers synthesized in the solid state. Specifically, it deals with the defects in the crystalline structures of the solid-state polymerized materials known as poly(sulfur nitride), the halogenated derivatives therefrom, and the polymers from bis(p-toluenesulfonte) diacetylene. The methods to be used include electron and x-ray microscopy, extended x-ray absorption fine structure (EXAFS) and small-angle x-ray scattering. The principal emphasis will be on relating local imperfections with various bulk properties, such as mechanical properties.

This is a renewal of NSF grant DMR76-04789.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0006, INVESTIGATIONS OF RARE-EARTH TRANSITION-METAL ALLOY HYDRIDES BY NMR AND MOSSBAUER EFFECT 13371-MS

L.H. Bennett, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (DA0E9044)

To evaluate the structural factors, especially the electronic structure, which determine the mechanisms, rates, and quantities of hydrogen absorption of certain rare-earth transition-metal alloys. The research is relevant to the absorption, storage, and controlled release of hydrogen by metallic alloys. Army applications for these alloys include storage of hydrogen for fuel for power supplies (ECOM, MERDC), catalysts for hydrogen-air fuel cells (ECOM, MERDC), storage of hydrogen for low power gas guns (RIA), absorption of the hydrogen evolved from radio batteries - hydrogen which has caused explosions of field radios -(ECOM), and perhaps catalysts or absorbers of other gaseous chemical agents (EA). In addition, the research is relevant to hydrogen-enhanced stress-corrosion cracking of metals.

The program will include (1) preparation and characterization of alloys having the CaCu sub 5 hexagonal structure (where the Ca site is occupied by a rare-earth metal, and the Cu site is occupied by a transition metal), (2) determination of the crystallographic and electronic structure of the alloys before and after absorption of hydrogen, and (3) determination of the effects of electronic and crystallographic structure on the diffusion of hydrogen formation of hydrides.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0007, STRUCTURE-PROPERTY-ENVIRONMENTAL RELATIONS IN GLASS AND GLASS-CERAMICS

L.L. Hench, State University System of Florida, University of Florida, School of Engineering, Dept. of Metallurgical & Materials Engineering, *220 Black Hall, Gainesville, Florida* 32611 (DF047230; AFOSR-77-3210)

AF function - advanced aircraft and tactical missile systems employ glass as a structural and optical component which requires superior mechanical, optical and thermal performance under extreme environmental conditions. Deficiency - the methodology for predicting long-term stability and performance of glass and glass-ceramics has not been established. Objective - the objective of this research is to establish predictive structure-property-environmental relations in glass and glass-ceramics. How work contributes - this research is expected to establish the relationships between environmental exposure and use and the non-destructive testing procedures for predicting long-term stability and performance in glass and glass-ceramics.

Glass chemistry will center on (1) alkali silicate, commercial, and other glasses and glass-ceramics, (2) the development of techniques to obtain quantitative analysis of the residual glassy phase, (3) the effects of the glassy phase on various physical properties and (4) environmental deterioration of the glassy phase and the effect of the deterioration on the physical properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, HOT CORROSION AND THE EFFECTS OF NACL AND CARBON

F.S. Pettit, United Technologies Corp., Pratt & Whitney Aircraft Div, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF044380; F44620-76-C-0123)

AF function - the useful lives of nickel-and-cobalt-base alloys and coatings in gas turbine engines are significantly reduced under conditions where salts are ingested into the engine or are present as fuel contaminants. Deficiency - although significant progress has been made of inhibitors in fuel and maintenance washing procedures, no general theory of the initiation stages of hot corrosion exists. Objective - this research seeks to reduce the hot corrosion problem through a thorough understanding of the initiation stage, two propogation modes, and the effects produced by NaCl and carbon deposition. How work contributes - having a knowledge of the factors which initiate the reactions will enable the rational design of turbine alloys to be made.

The scientific approach of this program involves performing oxidation tests at temperatures between 700 and 1000 degrees C on alloy specimens coated with deposits of different salts. During exposure the specimens are examined visually using hot stage microscopy. After exposure, the specimens are examined in detail using optical metallography, scanning electron and electron microscopy, x-ray diffraction and electron beam microprobe. The data obtained from experiments and analyses are then used to construct models to account for the reaction as a function of time between groups of alloys and specific salt deposit-gas environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0009, INITIATION MECHANISMS OF SOLID ROCKET PROPELLANT DETONATION

H. Napadensky, I I T Research Inst., *10 W. 35th St., Chicago, Illinois* 60616 (DF040790; F44620-75-C-0059)

AF function - this effort directly responds to requirements specified in research objective 5.1. Future missile systems will employ nitramine propellants. Deficiency - current attempts to develop Navy systems using these propellants have experienced unscheduled detonations. Objective - this contract seeks to iden-

tify the causes and mechanisms of deflagration to detonation transition. How work contributes - permits the use of high energy propellants for optimized propulsion performance without creating unreliable systems.

Theoretical and experimental studies of impact phenomena are being conducted. The propellants experimentally studied are chiefly nitramine formulations. The impact studies are made with carefully controlled flyer plate velocities. High speed motion pictures and scanning electron microscopy are the chief diagnostic tools. The studies focus cheifly on crack propagation, crack enlargement or collapse, and other effects of high-pressure, high-temperature gas flow. Theoretical work aims at refining the present IITRI DDT model to include the simultaneous variation of pressure and area within cracks, the effects of stress waves on multiple cracks, and the interaction of foam and melt layers with stress waves.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, CORROSION FATIGUE BEHAVIOR OF ALUMINUM ALLOYS

J.H. Mulhern, Materials Research Lab. Inc., *1 Service Rd., Glenwood, Illinois* 60425 (DA0B0677)

This proposed contract effort will be the result of an unsolicited proposal which has been received from Materials Research Laboratory, Inc. The objective of the work is to investigate the corrosion fatigue behavior of both 7000 series powder metallurgy and ingot metallurgy aluminum alloys in both inert and aggressive environments. The fatigue behavior will be determined by measurements of the fatigue crack growth rate at high delta K values. Such work is of extreme importance to helicopter structural parts, bridging and tank automotive structures.

The fatigue crack growth rate will be measured at various high delta K values from 7075-T6 and a new aluminum powder metallurgy alloy MA87. The variables to be examined are the environment, frequency, wave form, and stress intensity ratios. The influence of these variables will be described in terms of fracture mechanics paramaters.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab.

3.0011, RELATION OF STRUCTURE TO FATIGUE PROPERTIES IN ALUMINUM-BASE ALLOYS

M.E. Fine, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science, *633 Clark St., Evanston, Illinois* 60201 (DF041810; AFOSR-76-2892)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. In fact, the fatigue properties of structural materials often limit their application. Opportunity - it is important to understand the mechanism of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Objective - this research will relate fatigue crack initiation, fatigue crack propagation, and the character of the plastic deformation from cyclic loading to the structure of aluminum base alloys, particularly those which contain copper as the major precipitation hardening alloying element. How work contributes - such information will point the way to development of improved fatigue resistant aluminum base alloys. Since aluminum alloys form a major portion of the material currently used for skin and other structural airframe applications, it is appropriate that they are the basis of this investigation.

The effects of several different kinds of precipitates and other dispersed phases will be investigated. In addition, this research will determine a method of simultaneously increasing both the cyclic yield stress and the effective surface energy for fatigue crack propagation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0012, CORROSION OF FIBER COMPOSITES WITH ALUMINUM ALLOY MATRIXES 14350-MS

M. Metzger, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mining & Metallurgical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DA0E9290; DAAG29 77 G0025)

To investigate the principles governing the corrosion behavior of fiber composite materials with aluminum alloy matrixes when exposed to aqueous and atmospheric environments. Relevance - the Army evaluators cite relevance of this investigation to potential utilization of fiber reinforced aluminum matrix composites in aircraft, missiles, equipment such as bridges, and in design concepts for general application of composite materials.

Research will include: (1) the galvanic effects of coupling graphite and alumina fibers to aluminum matrix will be studied to determine the electrochemical reactions and their kinetics as a function of sample geometry and environmental chemistry; (2) effects of interface layers and identification of relation between selective attack at the interface and the interface phases present, and effects of interfacial layer thickness on corrosion behavior; and (3) study of crevicing and other localized attack which may be caused by incomplete fiber-matrix interfacial bonding.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0013, CALCULATION OF CERAMIC PHASE DIAGRAMS

L. Kaufman, Manlabs Inc., *21 Erie St., Cambridge, Massachusetts* 02138 (DF042880; F44620-76-C-0060)

AF function - ceramic materials are being developed for a variety of components (e.g. blades, vanes, rotors, combustors, bearings and seals) in future gas turbine engines and for a variety of electronic and optical components in aircraft. Opportunity - the process of selecting the chemical composition and heat treatment of any material to obtain optimum properties has been a slow one based upon past experience and time consuming experimentation. Over the past ten years computer techniques have been developed for calculating the phase diagrams of simple binary and selected ternary metal alloy systems. This offers the possibility of rapidly and economically searching out phase equilibria on any combination of metals desired. Objective - the calculational techniques developed for metal alloys will be extended into ceramic systems based on combinations of Cr, Al, Fe, Mg, Ca, Si, nitrogen, and oxygen. How work contributes - this work contributes to the selection of thermodynamically stable materials for future AF turbine engines.

The lattice stability, compound and solution phase interaction parameters will be evaluated to characterize the stable and metastable phases. Thermochemical data will be estimated from existing experimental phase diagrams where necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, DEVITRIFICATION PROCESSES IN AMORPHOUS METALS

D.R. Chipman, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0F4739)

Work now in progress will compare the properties of metal-metalloid and metal-metal systems in amorphous form. From those materials studied, one or more having promise for Army applications will be chosen for additional investigation of the amorphous structure. The objective of the work will be to define and determine parameters of this structure most useful in relating to applications; for example, parameters connected with crystallization. An allied mechanical testing program will allow correlation of observed structural changes with property changes.

Amorphous alloy specimens will be prepared and given a preliminary test evaluation by Professor B. C. Giessen and Dr. D. E. Polk, Northeastern University, under contract with this program. Alloy structures will be characterized through x-ray diffraction measurements. These will be correlated with the crystallization temperature, resistivity, hardness and/or susceptibility, and mechanical behavior in tension, creep and fatigue.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0015, MORPHOLOGY AND KINETICS OF STRAIN-INDUCED CRYSTALLIZATION OF POLYMERS DURING FLOW 15299-MS

G.S. Yeh, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Metallurgical & Materials Engineering, *Ann Arbor, Michigan* 48104 (DA0G8956; DAAG29-79-G-0029)

To extend work on stress-induced crystallization (SIC) of elongational non-flow polymer systems to shear flow systems in order to formulate a SIC theory comparable to one currently available for quiescent crystallization. Such a study would provide guidelines for polymer processing or fabrication which involves SIC (e.g., fiber spinning, film extrusion). Relevance - the research may find Army applications in a variety of end items, from personnel armor to helicopter components to encapsulation of chemical components and smoke ingredients.

Based upon earlier findings relating SIC crystal thicknesses and crystallization kinetics to crystallization temperature, strain, and/or strain rate, morphological and kinetic studies would be carried out. Polyethylene would be crystallized by shear in a dilatometer, including variables such as molecular weight variations. In addition, other polymers, such as polypropylene and polybutene, with increasing branch chain lengths, would be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0016, MACRO/MICRO STUDIES OF HYDROGEN EMBRITTLEMENT MECHANISMS IN TITANIUM AND ALUMINUM ALLOYS

W.W. Gerberich, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Chemical Engineering & Materials Science, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DF046300; AFOSR-77-3133)

AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials including steels, titanium, aluminum and nickel-base alloys. The various forms of hydrogen-related mechanical property degradation severely restrict the serviceability of important aircraft materials. Opportunity - basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack. Objective - this research will investigate the hydrogen embrittlement susceptibility of titanium and aluminum alloys from both macroscopic and microscopic points of view. Macroscopic studies will focus on a fracture mechanics evaluation of the effects of gaseous and internal hydrogen on threshold stress intensities and crack growth conditions; microscopic studies will focus on the mechanistic details of nucleation and growth processes in concentration gradients. How work contributes - this not only has ramifications to alloy design, but carries specific ramifications to component design where sustained load, spectrum fatigue loading or corrosion fatigue might be encountered.

Factors to be investigated include specimen thickness, internal versus external hydrogen, temperature effects, phase stability, hydride formation, decohesion at particle-matrix interfaces, and in situ concentration profiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, PREPARATION AND STUDY OF HIGHLY REACTIVE METAL POWDERS 15255-C

R.D. Rieke, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Chemistry, *Lincoln, Nebraska* 68508 (DA0F9102; DAAG29-78-G-0007)

To determine the scope and limitations of a new technique for generating metal powders in a finely divided and highly reactive state; to establish the modes of reactivity. Relevance - reactive metals are used in rocket propellants, in explosive and pyrotechnic formulations. Certain basic synthetic procedures have been accomplished in a direct fashion only since the discovery of the subject process.

Main group and transition metal salts will be reduced with molten potassium metal in inert solvents; the effect of crown ethers will be explored.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0018, DISLOCATION DENSITY IN FATIGUED SPECIMENS

S. Weissmann, Rutgers the State University of New Jersey, New Brunswick Campus, School of Engineering, Dept. of Materials Engineering, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DN678757; N00167-75-M-8315)

To measure the dislocation density in fatigued specimens by x-ray techniques.

A double crystal diffractometer will be used to determine the widths of the diffraction lines. This line width is related to the excess dislocation density and particle size. The line widths will be determined as a function of distance from the surface and the fraction of fatigue life. X-ray topographs will be used to measure the dislocation density.

SUPPORTED BY U.S. Dept. of Defense, Naval Ship Research & Development Center, Ship Materials Engineering Dept.

3.0019, COORDINATION OF FUELS AND LUBRICANTS RESEARCH

R.K. Nelson, Coordinating Research Council Inc., *30 Rockefeller Plaza, New York, New York* 10020 (DA0N3747; DAAK70 78 C 0102)

Coordinate test programs and research and development among the petroleum industry, automotive industry and the US Government. The areas of interest include fuels and lubricants, lubricants and related material and equipment testing, and service evaluation testing of fuels, lubricants and power transmission fluids for both surface and air applications.

Establish advisory groups and panels in those areas where a broad range of knowledge and experience will be helpful and impossible to maintain as an in-house capability. These are formed by drawing engineers and scientists from the automotive and petroleum industries who cooperate with the CRC. The latter administers and coordinates the programs. Work is divided into four major categories: (1) special, (2) aviation, (3) diesel vehicle, (4) motor (gasoline) vehicle.

SUPPORTED BY U.S. Dept. of Defense, Mobility Equipment Research & Development Command, Fuels & Lubricants Div.

3.0020, MATERIALS SUPPORT TECHNOLOGY CHEMICALLY PRODUCED EXCITED STATES

J. Wiesenfeld, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Chemistry, *Ithaca, New York* 14850 (DN323075; N00014-75-C-0828)

The technical objective of this contract is to understand the chemical and physical processes which control the behavior of electronically excited atoms and molecules in the gas phase. The Navy needs more detailed knowledge of chemical reaction kinetics. Particular items here are new techniques for chemical synthesis, rocket propellants with modified plume radiation characteristics, and new materials for chemical lasers.

Additional quenching processes in the quenching of excited I by Br(2) relative to those already studied are being investigated. Then the quenching of excited I by HBr will be studied to compre the two processes. The lifetime of the doublet P (J equals 1/2) state of I is being measured using time-resolved atomic absorption spectroscopy.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0021, NAVY VEHICLE DESIGN AND CONSTRUCTION - DISPERSION STRENGTHENED METAL ALLOYS

G.S. Ansell, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Metallurgical Engineering, *110 8th St., Troy, New York* 12181 (DN525008; N00014-76-C-0458)

The Navy has a need for high strength, high toughness metal alloys for use in a wide variety of components ranging from pumps and compressors to aircraft frame structure and jet engine parts. Improved alloys would result in greater reliability, better performance and/or decreased weight. In this research the investigator will explore mechanisms of strengthening in metal alloys, with emphasis on martensitic steels and nickel alloys for use at high temperatures.

Strengthening of martensitic steels will be examined with regard to factors controlling martensite morphology. Variables include imposed stress, crystal orientation and composition. The degree of relaxation of the austenite shear modulus will be determined and the observations related to martensite formation. Nickel superalloys that are strengthened by gamma prime precipitates will be carefully examined to see how precipitate coherency strains affect the mechanical behavior, particularly the creep, stress rupture, and tensile properties at high temperatures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0022, INFLUENCE OF ANNEALING ON THE STRENGTHS OF SECONDARY RELAXATIONS IN GLASSES

M. Goldstein, Yeshiva University, New York Campus, School of Science, Dept. of Chemistry, *601 W. 183rd St., New York, New York* 10033 (DF037090; AFOSR-73-2540)

AF function - advanced aircraft systems will require new lightweight structural components with improved environmental stability and reliability. Deficiency - the process control of new thermally stable polymeric systems for matrix resins and adhesives is not well understood. Objective - the quantitative relationships between glass structure, relaxation processes, and annealing treatments in the transition range of noncrystalline solids will be determined. How work contributes - it is expected that this research will lead to a better understanding of the glass transition phenomena and generate information for the control of the glass transition temperature and, thereby, polymer processing and the resultant engineering properties.

The dependence of relaxation strength on structural state or fictile temperature in glasses including molecular and hydrogen bonded liquids, fused salts and organic high polymers will be investigated. The beta-relaxation and low temperature relaxations will be studied by dielectric and calorimetric measurements. The thermodynamic implications of various structural hypotheses will be explored to determine which glass structural theory is supported by the experimental data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0023, MECHANISMS OF PHOTOCHEMICAL DEGRADATION IN XANTHENE LASER DYES

R.E. Schwerzel, Battelle Memorial Inst., Columbus Laboratories, *505 King Ave., Columbus, Ohio* 43201 (DF047980; AFOSR-77-3313)

AF function - future Air Force flight operations in reconnaissance, communications, and other areas require new systems including lasers of varied wavelengths. Deficiency - research is needed to define methods to minimize dye photochemical instabilities while maintaining the overall high efficiency derived from flashlamp pumped laser systems. Objective -to study and identify photodegradation products of xanthene dyes and recommend approaches for future development of improved laser dye systems having enhanced photochemical stability. How work contributes -the work should provide more efficient organic laser dye systems.

The research will emphasize the separation and identification of the primary photochemical degradation products from solutions of kiton red S in methanol and water, both in the presence and absence of oxygen. This effort will rely heavily on the use of high pressure liquid chromatograph, gas chromatography/mass spectrometry, infrared, visible, and ultraviolet spectroscopy, and nuclear magnetic resonance spectrometry. In parallel with these studies, the lasing characteristics of kiton red S will be evaluated in a tunable, flashlamp pumped, pulsed dye laser, in the presence and absence of oxygen, argon, and previously isolated degradation products. In this way, the effects of dye degradation on the efficiency and wavelengths of lasing can be compared with the spectroscopic changes which have been observed in course of the non-laser irradiations performed to date. Finally, the quantum yields of photodegradation and of product formation will be evaluated at several different irradiation wavelengths, both in the presence and absence of oxygen.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0024, WEAPONRY - THE ROLE OF CHEMICAL BONDING IN THE STRENGTH OF ADHESION IN POLYMERS

A.N. Gent, University of Akron, Inst. of Polymer Science, *302 E. Buchtel Ave., Akron, Ohio* 44304 (DN675225; N00014-76-C-0408)

The objective is to determine how the adhesive strength of polymeric materials is related to the type and density of interfacial bonds, the rate of detachment and temperature. This fundamental knowledge is necessary to guide missile propellant developers to select the optimum bonding agents. The data will also be useful as inputs into fracture mechanics analyses of propellant grain response to stress. Propellant fracture must be avoided to insure stable burning and to preclude the deflagration to detonation transition.

Functionalized and characterized synthetic polymer substrates will be interfacially reacted to produce an adhesive interface. Surface bond density will be altered and the strength of adhesion will be determined as a function of temperature and the rate of detachment. Adhesives similar to those in propellant manufacture will also be characterized.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0025, FATIGUE IN POWDER METALLURGY ALUMINUM ALLOYS

A. Lawley, Drexel University, School of Engineering, Dept. of Metallurgical Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (DF047690; AFOSR-77-3247)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. Opportunity - since the fatigue properties of structural materials often limit their application, it is important to understand the mechanism of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Objective - this research will establish and quantify processing-microstructure-mechanical behavior relationships in fully-dense powder metallurgy materials. Particular interest centers on fatigue response in aluminum-base alloys and includes the roles of stress state and environment. How work contributes - since aluminum alloys form a major portion of the material currently used for skin and other structural airframe applications, it is appropriate that they are the basis of this investigation.

The fundamental understanding of the fatigue behavior of powder-metallurgy-processed aluminum alloys to be developed during the course of this research will provide the basis for carrying out future alloy and process development to achieve improved materials. In addition, the principles developed during the course of this investigation should also be applicable to other age-hardening systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0026, FATIGUE CRACK PROPAGATION IN POLYMERIC MATERIALS 14409-MS

R.W. Hertzberg, Lehigh University, School of Engineering & Physical Science, Dept. of Metallurgical & Materials Science, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DA0E9233; DAAG29 76 G0336)

To study (a) the relative fatigue crack propagation (FCP) frequency sensitivity of polymers over a range of temperature; (b) the effect of molecular weight and molecular weight distribution on FCP behavior in polymers; (c) the kinetics and micromechanisms of cyclically-induced craze and crack growth in polymeric solids. Relevance - the research is relevant to a

number of Army problems in flight vehicles (e.g., in windshields, airframe structures, etc.) and to a wide range of structural and nonstructural Army applications where plastics and polymer-based composites are coming into usage as substitutes for metals and alloys because of lighter weight, cost savings, and other factors.

FCP frequency sensitivity will be studied with the aid of transition measurements (related to segmental molecular motions). Frequency sensitivity and propensity for discontinuous crack extension will be examined as a function of molecular weight and molecular weight distribution. Electron fractography would be employed in studies of crack morphology and to assist in identification of the micromechanisms underlying crack growth.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0027, DEUTERATION OF FLUIDS FOR NAVAL AIRCRAFT

N. Rebuck, U.S. Dept. of Defense, Navy, Naval Air Development Center, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN933001)

The goal of this program is to provide scientific guidelines for the next generation of aircraft fluids based on deuterium modified molecules. A more complete definition of deuteration processing will define directional information for new approaches to wide temperature range fluids combined with extreme pressure lubricant effects.

Our approach in this investigation involves the exchange of hydrogen atoms in a synthetic fluid with deuterium atoms via a liquid/gas phase transfer mechanism in the presence of a suitable catalyst. The properties of the resultant deuterium modified fluid are investigated in the fluid state as well as compounded into a grease formulation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

3.0028, RESEARCH ON CATASTROPHIC DAMAGE PHENOMENA AND DAMAGE CONTROLLING NAVAL AIRCRAFT ALLOYS

J.J. Deluccia, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN781418)

To develop advanced materials science concepts for fracture and corrosion control. To study environmental embrittlement phenomena of high strength steel, titanium and aluminum alloys using an integrated mechanistic approach. Determine the effect of hydrogen on the embrittlement of, and the means for mitigation of, high strength alloys vital to the use of such material in high performance aircraft.

Damage control will be approached from two standpoints: prevention of embrittlement through process control and arrestment of corrosion and crack propagation through the development of new compounds that could be applied in situ. The idea of minimizing electrochemical hydrogen entry into metals by imposing physical constraints such as electromagnetic fields will be investigated. Based on the chemistry of the laboratory successful corrosion preventive compounds, crack arrestment compounds capable of displacing moisture from the crack tip and providing inhibition will be developed. The diffusion of embrittling hydrogen in high strength aircraft alloys will be studied using the electrochemical permeation and metallurgical techniques in various chemical and mechanical environments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

3.0029, ELECTRONIC STRUCTURE AND STABILITY OF METALLIC GLASSES 13723-P

J. Tauc, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DA0E9132; DAAG29 76 G0221)

Develop theoretical and experimental understanding of the influence of the electron gas on the stability of metallic glasses. Relevance -metallic glasses prepared by fast quenching of some alloys have many valuable properties of technological importance. Among these outstanding characteristics are high strength, ductility, corrosion resistance and simplicity of production. Increased understanding of the mechanisms which control the stability of these and other systems is crucial to the ultimate exploitation of their potential.

A test of the basic assumptions of an electron theory of metallic glasses will be made by a variety of experiments including ultraviolet photoemission, optical properties, magnetic susceptibility, transport properties and inelastic neutron scattering. An attempt will be made to extend the present theory to other classes of alloy systems.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0030, SPACE ENVIRONMENTAL EFFECTS ON ADVANCED COMPOSITES

R.C. Tennyson, University of Toronto, *92 College St., Toronto, Ontario, Canada* M5S 1B2 (DF053280; AFOSR-78-3694)

AF function - large space structures will be of major significance to the Air Force with the operational capability of the space transportation system (STS). Opportunity - the influence of the space environment on the mechanical and thermal properties of advanced composite structural materials is largely unknown. This research will provide a unique opportunity to investigate these conditions. Objective - to identify the influence of simulated and in-situ space environmental conditions on the mechanical characteristics of advanced composite materials in real-time and to evaluate accelerated environmental exposure techniques. How work contributes - results will contribute to the development of large space structures for the Air Force.

Tubular test specimens fabricated from graphite-epoxy prepreg tapes will be used in the experimental research. Both layup angles for symmetric laminates and ply thickness will be varied during the experiments to be conducted. Experiments will be conducted at both ambient and simulated space conditions. Space simulated conditions will be at 10 exp 7 torr and from minus 200F to plus 250F. Thermal coefficients of expansion (CTE), internal stresses and outgassing products will be measured under steady state exposure and thermal cycling. In addition, stress-strain behavior, strength and fracture toughness will be determined as a function of exposure conditions. Accelerated environmental exposure techniques will also be investigated. Finally, comparisions will be made between the experimental results obtained as a result of ground space simulation and results from specimens used on NASA Long Duration Exposure Facility (LDEF).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, COMPUTER-BASED LANDING SIGNAL OFFICER CARRIER AIRCRAFT RECOVERY MODEL

G. Borden, Human Performance Research Inc., *616 Carlo Dr., Goleta, California* 93017 (DN894013; N61339-77-C-0110)

In support of development of a trainer for landing signal officers (LSO), a study is required to expand a laboratory-developed preliminary model of ideal LSO 'waving' behavior to include precautionary and advisory calls. The model will be used to judge performance of student LSOs during training.

Initial model bases power and waveoff calls (EMCON model) on three approach parameters. Expanding number of monitored parameters and degree of approach segmentation will allow all NATOPS calls to be generated.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

4.0002, LED (LIGHT EMITTING DIODE) WATER ACTIVATED SWITCH
W.D. Raftery, Koch & Sons, *Anaheim, California* 92807 (DN881342; N62269-77-C-0367)

To develop a failsafe water activated parachute canopy release device for use in Navy aircraft. This contract supports work unit ZB104, Agency Accession No. DN681085.

Twelve prototype LED (light emitting diode) water activating switches will be designed and manufactured. These switches automatically release the parachute/harness fittings by use of an electrically explosive piston actuator. After delivery of the prototypes, an in-house test and evaluation program will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0003, COMMUNICATIONS - CHARGED PARTICLE ACCELERATION IN THE INNER MAGNETOSPHERE
W.P. Olson, McDonnell Douglas Astronautics Co., *5301 Bolsa Ave., Huntington Beach, California* 92647 (DN875382; N00014-78-C-0215)

The precipitation of energetic magnetosphereic particles during geomagnetic disturbances degrades or disrupts the performance of naval communications, navigation, and surveillance systems with operating frequencies ranging from the ELF to the SHF bands. Those precipitating particles, originally of solar wind origin, are accelerated by more than an order of magnitude within the magnetosphere. The purpose of this study is to investigate the processes responsible for this acceleration, and which are not currently understood. An understanding of these processes is required to successfully develop a dynamical physical model to predict the occurrence and effects of geomagnetic disturbances.

The sophisticated model of the geomagnetic field developed previously by this group will be used to quantitatively determine the acceleration and energization of charged particles caused by the time varying magnetic field (caused by the diurnal rotation of the dipole axis) and its associated electric field. The electric field induced by the time varying magnetic field will also be used to study the mapping of electric fields from the ionosphere into the magnetosphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, ADVANCED SURFACE SINGULARITY TECHNIQUES FOR CALCULATING 3-D POTENTIAL FLOW
J. Hess, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DN881120; N62269-76-O-0377)

To develop advanced singularity techniques for calculating three-dimensional potential flow about arbitrary bodies, and to prepare and deliver a computer program for the calculation. The contract supports work unit NN701, Agency Accession No. DN481077.

Under a previous contract, a computer program was developed at Douglas using panel method. This program requires a large computing cost for complex body configurations. In the proposed work, curved surface panels and a variable surface singularity strength will be used in place of flat panels and constant singularity strength used in the previous program.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0005, WORLDWIDE PERFORMANCE OF TACTICAL MILLIMETER WAVE RADIO LINKS
N. Feldman, Rand Corp., *1700 Main St., Santa Monica, California* 90406 (DA0F2854; DAAB07-77-C-0142)

The objective of this study program is to investigate the environmental performance of tactical millimeter wave transceivers operating in frequency bands from 35 GHz through 75 GHz, with voice, TV and data communications.

Using available worldwide rainfall data, calculations will be performed on radio fading, link performance, maximum range, outage/availability. Automated techniques for increasing link availability will be investigated by analyzing various operating parameters - power transmission, space, time/frequency diversity techniques, or a combination thereof. An investigation will be made of whether an enemy can use satellite meteorological data, airborne/ground weather radar data/sensor information, to determine if Army millimeter wave radio outages exist in order to gain tactical advantage.

SUPPORTED BY U.S. Dept. of Defense, Communications Research & Development Command, Center for Communications Systems

4.0006, MECHANICAL RESPONSE OF STRUCTURAL ELEMENTS TO DYNAMIC LOADS
G. Herrmann, Stanford University, School of Engineering, Dept. of Applied Mechanics, *Stanford, California* 94305 (DF050670; AFOSR-77-3403)

AF function - Air Force aerospace vehicles encounter time dependent external loads during flight. Opportunity - new structural designs emerging as applications of advance composite materials and bonding techniques provide a new dimension to the study of structural dynamics. Objective - the objective of this research is to study the behavior of new structural concepts and develop theories which can be applied to accurately predict their dynamic response. How work contributes - this research contributes to the science base of structural technology.

This research will consider a number of physical models to study dynamic behavior in differing time regimes. Wave propagation behavior will investigate the propagation of different wave types in laminated composites and bonded structures. Amplitude, phase and dispersion characteristics will be the major quantities of interest in this study. Response of composite structures to moving loads representative of pressure waves will be investigated. Finally, steady-state and transient response studies will be conducted. In summary, the principal effort will be in extending approximate theories of the effective dispersion theory previously developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, INVESTIGATION AND DEVELOPMENT OF AEROSPACE RECOVERY SYSTEM MATERIALS
D. Reinhold, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN895412)

To obtain necessary information and develop safe and economical techniques for establishing: (a) service life of materials, components, and systems; (b) maintenance procedures for systems and components; (c) storage and packing techniques and environments for materials and components. Goals are to increase service and storage life, minimize maintenance, reduce bulk of packed parachute, and maintain or increase present reliability and performance standards.

Conduct test and evaluation to form a basis in theory, equations, and empirical data relating to material creep; cyclic fatigue; environmental effects of pressure packing, inert atmosphere storage, and packing methods, and destructive and nondestructive testing. These data will be used to establish service life, maintenance procedures, and storage/packing procedures, age life, and service life.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0008, FUNDAMENTAL COMBUSTION STUDIES RELATED TO AIR BREATHING PROPULSION
F.A. Williams, University of California, San Diego Campus, School of Engineering, Dept. of Aerospace & Mechanical Engineering Science, *P.O. Box 109, La Jolla, California* 92037 (DF034870; AFOSR-77-3362)

AF function - advanced air breathing engines, airborne weapons delivery and defense. Deficiency - insufficient understanding of the basic mechanisms and processes involved in advanced air breathing combustors and lack of realistic guidelines for predicting propulsion engine and external burning characteristics and combustor design with acceptable pollutant emissions. Objective - to understand and develop accurate theoretical and mathematical models describing the hydrocarbon droplet com-

bustion and extinction, carbonaceous particle ignition and combustion phenomena in premixed and unpremixed turbulent subsonic and supersonic reactive flows. How work contributes - will provide additional understanding and realistic analytical modeling of turbulent reactive flow fields not now available and will contribute to establishing realistic design criteria for efficient, stable air breathing combustors with increased combustion efficiency and acceptable exhaust gas pollutants and reduced vehicle detectability. Also will aid design of external burning and other types of propulsion and control systems utilizing turbulent diffusion flames.

Ignition and combustion mechanisms of hydrocarbon droplets and carbon particles, and turbulent diffusion-flame combustion will be studied. High speed photography will be used to observe individual droplet and carbonaceous particle ignition and combustion in controlled oxygen-containing atmospheres. Pressures will range from 1/10 to 5 atm. and droplet and particle diameters from 20 to 2000 microns. Ignition will be produced by a pulsed laser and by a spark discharge. Attention will be focussed on hydrocarbon materials including alternate fuels (e.g. alkanes, branched paraffins, alcohols and shale oil derived fuels and carbonaceous materials). The theoretical methods will be primarily analytical, but involving small-scale computer calculations. Experimental observations will guide development of burning process theoretical models. For the hydrocarbon droplets and carbon particles, emphasis will be on combustion dynamic aspects of steady-state combustion processes, of overall finite-rate gas-phase chemistry and of extinction processes, as they affect smoke production and loss of combustion efficiency. For turbulent diffusion flames, the emphasis will be on perturbation methods and on novel ways to calculate burning rates, nitric oxide production rates and flame speeds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, TRANSONIC WING THEORY

H.K. Cheng, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DN123361; N00014-75-C-0520)

The development of accurate procedures for the calculation of three-dimensional flows is essential for the design and optimization of naval aircraft. This research will develop a systematic expansion method for studying the effects of lift and thickness on the inviscid transonic flow over wings and wing body combinations for wing geometries (aspect ratios) of current interest.

The transonic flow regime is one of the most difficult fields of aeronautical research because of the intrinsic non-linearity of the problem; yet it remains one of the most important from a military viewpoint. Though most of the present theoretical transonic research is directed to two-dimensional flows, real flows are three-dimensional. In the proposed research, the small disturbance inviscid equation of motion will be studied. Specifically, two different flow regimes will be examined: thickness dominated (lift may be present) and lift dominated. A lifting line theory for transonic flows will be developed. Attention will be devoted to far field shock waves to extend the validity of the analysis to the low supersonic portion of the transonic regime.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, ANTENNA MEASUREMENTS & CONSULTATION

A.C. Newell, U.S. Dept. of Commerce, National Bureau of Standards, *325 S. Broadway, Boulder, Colorado* 80302 (2765408)

PROJECT OBJECTIVES: Provide essential and appropriate antenna measurement support to other government agencies and industry in order to relate critical antenna parameters such as gain, polarization, pattern, and noise to primary physical standards.

PROJECT APPROACH: Develop special measurement techniques for new and unique systems or situations; perform specialized measurements requiring accuracies and/or capabilities available only at NBS; consult with other organizations on specific measurement problems and on the improvement of their overall measurement capabilities; and transfer newly developed technology outside NBS through cooperative measurement programs, courses, MAP's guest workers, etc.

PRIOR YEAR ACCOMPLISHMENTS: Developed computer programs which greatly increased usefulness of portable near-field measurement systems. Demonstrated feasibility of using near-field techniques for evaluating shaped-beam satellite antennas.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

4.0011, NON-LINEAR FAILURE CRITERIA AND DYNAMIC SPHERICAL SHELL RESPONSE

H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DN475447; N00014-75-C-0946)

For various operating naval structural systems such as aircraft, submarines, surface ships, etc. the problem of premature fracture under normal service loads or excessive damage due to shock type loads should obviously be prevented. Fracture of materials of naval interest as well as shock response of selected submarine components are addressed under this task.

Research is continuing along the following lines: experimentally evaluating non-linear energy fracture toughness as a function of specimen thickness for several aluminum and titanium alloys; extending a finite element analysis approach to incorporate non-linear material response into the numerical calculation of the toughness parameter; determining the dynamic response of shallow spherical shells under various pressure pulse loadings.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0012, BOUNDARY LAYER CONTROL

P.S. Klebanoff, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (2130484)

PROJECT OBJECTIVE: To improve the performance of compressible flow wind tunnels as laboratory instruments for obtaining reliable test and design data.

PROJECT APPROACH: Two aspects of the problem are being investigated. One is to determine the feasibility of laminarizing boundary layers in the test sections of compressible flow tunnels by using suction. This aspect utilizes the NBS Mach 2,3-inch by 4-inch tunnel. The other is the effectiveness of boundary layer trips at transonic speeds. Involved herein is a study of modifications of the Mach 2 tunnel in order to operate in the transonic regime, and a fundamental study, at incompressible flow speeds, of the behavior of three-dimensional roughness elements in inducing transition which will be conducted in the NBS unsteady wind tunnel.

PRIOR YEAR ACCOMPLISHMENTS: Designed rodded-nozzle block for laminarization investigation. Designed flat plate for boundary layer (trip) investigation. Designed traversers for boundary layer (trip) investigation.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

4.0013, MICROWAVE INTERACTIONS WITH SEMICONDUCTOR DEVICES

T.G. Giallorenzi, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880030)

To investigate the interaction of light with solid state microwave devices so that optical control may be implemented; to study the dynamics of carrier transport in III-V semiconductors and to study carrier relaxation, trapping, mobility in amorphous semiconductors. Through light control of solid state devices, it is expected that new solid state device capabilities will result and improved performance from existing devices realized. The Navy has a continuing need for semiconductor devices with improved performance and a hybrid optical/microwave technology may satisfy these continuing needs.

Using semiconductor lasers and fiber optics, light will be directed onto semiconductor devices to investigate gating, frequency shifting, domain initiation and phase locking. Basic phys-

ical interactions will be investigated using picosecond laser sources, optically synchronized electrical switches and semiconductor test samples. Carrier mobility, relaxation, trapping and high field band bending effects will be investigated. Subpicosecond transient effects will be investigated in subsequent studies using mode-locked dye lasers.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0014, RADIO SOURCES
C.H. Mayer, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880100)

Conduct research leading to application of natural radio sources and related technology for improvement in areas of navigation and guidance, signal detection, remote sensing and surveillance.

Detect and map extragalactic, galactic, and solar system radio sources with current emphasis on identification of radio sources with optical and infrared counterparts, such as stars. Determine size, structure and positional relationships by interferometer techniques for relating radio and optical/IR components and position reference systems. Investigate emission mechanisms particularly in relation to radio/optical IR positional coincidence, and the physical relationships of radio sources in prestellar and stellar evolution.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0015, RESEARCH ON SIMULATOR TRAINING EFFECTIVENESS
P.W. Caro, Seville Research Corp., *Pensacola, Florida* 32505 (DF049310; F49620-77-C-0112)

AF function - this research supports aircrew training, mission readiness, the development of critical combat skills, and the USAF Flight Simulator Procurement Program. Deficiency - modern flight simulators are complex physical systems that simulate other complex physical systems such as aircraft. Because of this emphasis on physical systems, the personnel who design flight simulators are almost exclusively engineers. As a result, flight training simulators usually reflect physical rather than behavioral models. Once the simulator is built and installed in the field, an operational test and evaluation (OT and E) is conducted to determine if the simulator is an effective training device. However, the relationship between training effectiveness and combat readiness is not always clear. This seems to be caused by the lack of an adequate definition of combat readiness which is meaningful in the OT and E/aircrew training context. Objective - this research will determine the relationship between physical models and training effectiveness and recommend ways to translate behavioral models into a form which is understandable by design engineers. A new conceptual methodology for OT and E's will be developed which defines combat readiness in terms which are related to training effectiveness in measurable ways. How research contributes - more effective simulator design and operational testing of that design will occur as a result of the conceptual developments of this research.

The simulator design process will be studied and techniques of using training information to impact the design will be assessed. Ways of communicating instructional considerations to the designer will be studied. Current concepts of operational combat readiness will be articulated through literature search and interviews with appropriate officials. The existing OT and E process will be examined and a new way of stating combat readiness in testable training parameters will be developed. A case study of an ongoing simulator OT and E will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, A STUDY OF TURBULENT FLOWS ABOUT OSCILLATING AIRFOILS 13100-E
J.C. Wu, Georgia Inst. of Technology, School of Aerospace Engineering, Dept. of Aerospace Engineering, *Atlanta, Georgia* 30332 (DA0H5578; DAAG29 75 G0147)

To establish a general computational capability for the prediction of turbulent flow fields, which may involve appreciable flow separation and strong viscous-in viscid interaction, associated with finite bodies undergoing arbitrary motion at high Reynolds numbers. Relevance - this research is directly relevant to the AMRDL program of fundamental research on unsteady viscous flows and helicopter blade stall. It is also relevant to the problems of missiles penetrating the wake of another missile or the downwash of helicopter rotors both of which are of interest to MICOM.

The work will utilize the two-equation models of turbulence in conjunction with the integro-differential method of solution of the Navier-Stokes equations for treating the flow past oscillating airfoils at high Reynolds numbers.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0017, COMMUNICATIONS - ION MOLECULE INTERACTION
E.W. McDaniel, Georgia Inst. of Technology, School of Physics, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DN223583; N00014-76-C-0015)

The objective of this work is to accurately measure mobilities, longitudinal diffusion coefficients and invert the experimental data to obtain accurate interaction potentials. These studies are important to the Navy for an improved understanding of gaseous electronic devices and the ionosphere.

The drift velocities and longitudinal diffusion coefficients for positively charged Tl ions in Ne, Ar, N(2), O(2), CO, and CO(2) will be determined over a large range of E/N. The transport properties of negatively charged F, Cl, Br, and I ions in Kr and Xe will be determined. The experimental data will be inverted to determine the interaction potentials. The necessary computer programs will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0018, DEVELOPMENT OF AN ADVANCED STRUCTURAL INTEGRITY MONITORING SYSTEM (SIMS)
R. Onley, General Time Corp., *1200 Hicks Rd., Rolling Meadows, Illinois* 60008 (DN881380; N62269-77-TS-71218)

To develop a compact airborne system for monitoring 12 strain and other data necessary to evaluate the fatigue life expended in critical structural elements.

Using microprocessors and non-volatile memory chips, a small airborne recorder will be developed weighing not more than 12 lbs. The airborne unit will have a solid state memory. A ground-based interrogator will be capable of putting 10 airplane months of data on one cassette which will be forwarded to NADC for processing. The contract covers five recorders, one ground-based interrogator and a read-out system.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0019, GRAPH THEORY AND COMBINATORICS WITH APPLICATIONS TO DIGITAL SYSTEMS AND NETWORKS
S.L. Hakimi, Northwestern University, Evanston Campus, Technological Inst., Dept. of Electrical Engineering, *633 Clark St., Evanston, Illinois* 60201 (DF043670; AFOSR-76-3017)

AF function - the design of complex networks, such as in electrical transportation, and communications systems. Deficiency - the knottiest problems in this field are combinatorial, and existing methods are relatively few and they do not form a unified theory. Objective - the objective of this research is to develop analysis and design methods that will be useful in solving the various types of network problems. How work contributes - success in this research could lead to significantly better logistics and communications systems in the Air Force.

The main tool will be the theory of graphs, a fairly new field with few experts, but which has surprisingly many applications to sundry and disparate concrete problems. Emphasis will be placed in the areas of invulnerable communications networks,

the construction of codes exhibiting high degrees of automatic error detection or error correcting capability, and digital systems and their fault diagnosis and correction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, COMBUSTOR FLAME STABILIZATION, FUEL SPRAY IGNITION BY HOT SURFACES AND AIRCRAFT FIRE STABILIZATION

A. Lefebvre, Purdue University, School of Engineering, Dept. of Mechanical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (DF050030; AFOSR-77-3446)

AF function - advanced air-breathing engines, weapon delivery and defense, transport, aircraft fire safety, vulnerability and survivability. Deficiency - insufficient fundamental understanding of basic processes of ignition and flame stabilization in advanced high temperature, high pressure air-breathing combustors, inability to predict propulsion system performance, insufficient understanding of ignition and stability phenomena related to internal and external aircraft fires caused by engine and fuel system damage. Objective - to formulate realistic analytical representations of the mechanisms and processes of fuel spray pre-ignition, ignition by hot surfaces, flashback, blowoff, and flame stabilization by flameholders, other separated flow regions, and jets. Applications include external fire situations and void space fires, as well as advanced burner concepts, e.g., catalytic, vortex, rapid expansion and premixing/prevaporizing combustors. How work contributes - will provide additional understanding, experimental data and realistic analytical (modeling not now available) of pre-ignition, flashback and blowoff in gas turbine combustors, for ignition of fuel sprays by hot surfaces, for flameholding by objects such as may occur in structural damage to the airframe, and for flow and flame stability in void space fires. Will aid in performance and flame stabilization improvements, will improve hazard assessment for aircraft fires resulting from accidental or combat damage, and contribute to improved aircraft vulnerability and survivability.

Phase I - ignition of fuel sprays will be investigated by injection of a fuel spray into an airflow of known properties passing through a heated pipe section. The influence of spray, air flow, and surface properties will be investigated for each fuel considered. Stabilization of fires by large-scale flameholders is to be investigated in a combustion tunnel initially with V-type and L-type gutters using the water injection method developed by LeFebvre. Exploratory investigations of the flow in partially ventilated enclosures of the type encountered in void-space fire situations will be conducted. Phase II - flashback and blowoff associated with premixing/prevaporizing combustor systems will be studied. A sudden expansion combustor which models aspects of airbreathing combustors will be employed. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, INTEGRATED SINGLE FAMILY OR LIGHT COMMERCIAL SOLAR ASSISTED HEATING SYSTEM USING AIR COLLECTORS MADE FROM PREFABRICATED STEEL (ABBREV)

J. Jordy, Solar Engineering & Equipment Co., *Metairie, Louisiana* 70001 (NAS8-32247)

Development of an integrated single family or light commercial solar assisted heating system using air collectors made from prefabricated steel building materials.

Solar Engineering and Equipment Co. will manufacture and deliver two solar assisted heating systems, one residential and one commercial. Both systems use air heating flat-plate collectors. Methods of applying Tedlar glazings will be developed for these collectors. The single family residential system is located in El Reno, OK, and the commercial system is in Lincoln, NE. System performance is monitored by Marshall Space Flight center. (DOE/CS-0010)

SUPPORTED BY U.S. Dept. of Energy, Office of Conservation & Solar Applications, Div. of Solar Applications

4.0022, LOW ENERGY LASERS - MATERIAL ANALYSIS

C.A. Morrison, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Harry Diamond Lab., *2800 Powder Mill Rd., Adelphi, Maryland* 20783 (DA0E5696)

The object of this task is to advance a systematic approach for selecting solid-state laser materials that offer promise as new lasers with predetermined characteristics and for improving existing solid-state lasers and components. Also, those areas of quantum optical technology that may contribute toward the development of new and improved military laser systems are to be investigated.

A parametrized theory of crystal fields has been developed that gives agreement between derived and phenomenological, even-fold crystal-field parameters which determine energy levels and wave functions. The parametrized theory also predicts the odd-fold fields which are needed for intensity calculations and are very difficult to obtain by any other method. The necessary computer programs shall be incorporated with this new theory so that laser related properties of selected materials can be calculated and, thus, the most promising can be selected for further study.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Harry Diamond Lab.

4.0023, INVESTIGATION OF THE REDUCTION OF HIGH DENSITY UNIFORM PLASMAS

D.H. Douglas Hamilton, Avco Corp., *2385 Revere Beach Pkwy., Everett, Massachusetts* 02149 (DF462510; F33615-78-C-2013)

Development of appropriate theories for predicting electron impact excitations of excited atoms and molecules. Calculation of electron impact cross-sections from metastable states for selected atomic and molecular gases. This research directly contributes to the Air Force requirement for high power coherent and incoherent light sources. Cross-sections are not well known for indirect excitations from excited or metastable states. In order to correctly model and control the light source, electron impact cross-sections must be known. Evidence exists that indirect excitations play a very important role in determining the energy balance in gas discharge lasers. This research is of immediate interest in furthering the development of coherent light sources.

The multichannel eikonal treatment will be applied to the excitation processes while the born approximation will be applied initially to the ionization processes. The binary encounter method will be modified so as to treat ionization of molecules. Also, the eikonal approximation will be generalized and applied to ionization. Moreover, certain developments in the theory of ionization will be required so as to provide a description of ionization more accurate than the various theories that are at present available and to derive therefrom relative excitation and ionization probabilities from metastable excited states. The functions to be calculated shall be in the order of priorities listed or as coordinated with the technical monitor. The theoretical methods from atoms and from molecules shall be studied in parallel rather than sequentially.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0024, HYPERSONIC HEAT TRANSFER TEST SUPPORT PROGRAM

V. Dicristina, Avco Corp., *201 Lowell St., Wilmington, Massachusetts* 01887 (DF051170; F49620-78-C-0029)

AF function - aerospace vehicles. Deficiency - unpredicted or poorly predicted transition from laminar to turbulent flow on the nose tips of ABRES shapes has caused numerous severe problems of heating and aerodynamic instability. Ground-based flow facilities do not simulate all of the flow parameters of free flight that influence these phenomena. One facility, which is rather economical to operate, located at the VKIFD, Brussels, is capable of simultaneous simulation of Mach number and Reynolds number of these flights, while not achieving the sustained, realistic running time. Nevertheless, heat transfer and pressure distribution measurements on a number of nose tip shapes of interest to ABRES appears to be desirable. Objective -

to extend and confirm data previously obtained by VKIFD with AVCO support and coordination. How work contributes - the results will help with design of nose tips which ameliorate the problems alluded to under deficiency.

AVCO will supply the model(s) and instrumentation and will coordinate the test schedule with AFOSR and SAMSO to assure that the most appropriate possible measurements are made. VKIFD will run the experiments in the longshot facility. Resulting data will be given to AVCO for analysis, as well as undergoing analysis at VKIFD.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0025, TOTAL ELECTRON CONTENT AND SCINTILLATION STUDIES

S. Basu, Emmanuel College, Graduate School, Dept. of Physics, *400 the Fenway, Boston, Massachusetts* 02115 (DF245980; F19628-76-C-0003)

AF function - communications and navigation. Deficiency - radio fading and timing errors. Objective - improve performance of communication and navigation systems. How research contributes -provides data for statistical models of propagation effects.

Paper chart and magnetic tape record will be analyzed to determine parameters which relate the variations in total electron content and amplitude scintillations to the degradation in performance of navigation and communication systems. The data base will include sites ranging from the auroral zone to the equatorial region and allow for the development of global models depicting the variations in TEC and scintillations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0026, MERCURY-CADMIUM TELLURIDE ARRAY TECHNOLOGY

R. Broudy, Honeywell Inc., *2 Forbes Rd., Lexington, Massachusetts* 02173 (DN780200; N00173-77-C-0335)

The objective of the program is the development of an infrared detector array and signal processing technology using mercury-cadmium telluride as the detection medium.

Two approaches will be pursued in parallel. The first involves the development of an MIS technology for mercury-cadmium telluride followed by the fabrication of monolithic detector - CCD TDI registers. The second approach incorporates mercury-cadmium telluride detectors with silicon signal processing in a hybrid configuration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0027, REMOTE SENSING WITH ELECTROMAGNETIC WAVES

J.A. Kong, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ENG7823145)

This research involves the generation of theoretical models that account for absorption, layering, scattering effects and rough interfaces to facilitate interpretation of passive remote sensing data collected with radiometers and active remote sensing data collected with radars. Efforts are being made to (1) Complete the radiative transfer theory from wave theory that accounts for complete coherence, and (2) Develop the modified radiative transfer theory that incorporates partial coherent effects. The volume scattering effects of the medium are accounted for with a random medium model as well as a homogeneous medium containing Mie scatterers. Available remote sensing data will be interpreted with these theoretical models.

This is a continuation of research previously supported under NSF grant ENG-7601654.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0028, THREE-DIMENSIONAL FLOW IN HIGHLY LOADED TURBOMACHINERY

J.E. McCune, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF040230; F49620-78-C-0084)

AF function - advanced gas turbine engine technology. Deficiency -lack of fundamental knowledge of flows through rotating turbomachinery. Objective - develop a technique to predict the flow conditions for highly loaded (high angle of attack) annular cascades in transonic flow. How work contributes - better knowledge of flow fields through turbomachinery will allow the designer to improve present empirical techniques used in designing advanced turbomachinery compressors and turbines.

A step by step procedure is being followed. It is as follows: 1) development of method for three-dimensional incompressible flow through annular cascade, 2) development of method for three-dimensional compressible flow through annular cascade, 3) comparison of results with experiments, 4) generalization of method to include nonuniform inlet conditions and viscous effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, ROUGH WALL REENTRY HEATING ANALYSIS

M.L. Finson, Physical Sciences Inc., *18 Lakeside Office Park, Wakefield, Massachusetts* 01880 (DF038030; F49620-78-C-0028)

AF function - aerospace vehicles. Deficiency - reentry nose tips are exposed to a number of fluid mechanical phenomena that have been surprising, in the sense that they were not predicted or expected by the designers a priori. One of these is a variety of bistable oscillating flow. This flow switches back and forth between two quasi-steady flow configurations that are radically different in pressure distribution. This effort is intended to provide an a posteriori explanation for the observed results, in the hope that future cases may be predicted, and therefore designed around or otherwise avoided. Objective - to explain the fundamental flow phenomena resulting in a bistable flow oscillation on a reentry nose shape. How work contributes - if a suitable physical model of the bistable phenomenon can be constructed it would show how the difficulty can be avoided by new designs.

Available heat transfer and ablation results, shapes of recovered nose tips, and wind tunnel measurements will be considered in an attempt to construct a composite flow field picture whose behavior agrees with the observed cases. Ablative shape change from cycle to cycle will be considered, along with other possibilities, as a triggering mechanism for the flow switching.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, DIELECTRIC LAYER FILTER

R. Pozgay, Raytheon Co., *Hartwell Rd., Bedford, Massachusetts* 02173 (DF901100; F19628-77-C-0111)

Technical objective - the goal of this contract is to evaluate experimentally the performance of a dielectric slab spatial filter. This filter (when placed in front of an antenna aperture) should allow radiation at near broadside angles to pass virtually unattenuated, while severely attenuating radiation at all other angles; it acts as a band pass filter with angle instead of frequency.

A large 35 wavelength antenna will provide the aperture for the dielectric filter. This aperture will consist of 64 elements in two rows and will have the capability of providing both horizontal and vertical polarization. Antenna patterns will be taken with and without the filter present. The separation of the aperture and filter will also be varied and the effects measured. All the measurements will be for both polarizations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0031, HIGH-DURABILITY MISSILE DOMES - CHEMICALLY VAPOR-DEPOSITED SPINEL AND MAGNESIUM OXIDE

J. Pappis, Raytheon Co., Research Division, *28 Seyon St., Waltham, Massachusetts* 02154 (DN675315; N00014-76-C-0635)

Future tactical missiles of the Navy will need IR domes, radomes and dual mode capabilities. Materials now used are not suited for such applications because the operating environment will impose severe conditions such as mechanical and thermal loading, impact-caused erosion, and effects such as optical and electrical property changes. The possibility of dual mode operation emphasizes the need for greatly improved or novel materials. In addition to possessing useful mechanical, thermal, optical, electrical and chemical properties, such materials must have the potential for being economically fabricable. Chemically vapor-deposited (CVD) spinel, and coated CVD magnesium oxide (MgO) appear to satisfy these requirements. This research task will investigate areas of processing research materials characterization and property determinations which will (1) minimize or eliminate surface deterioration of MgO, (2) establish the suitability of CVD spinel as a potential dome material and (3) develop CVD processes suitable for use in dome fabrication.

The surface protection of MgO and the CVD process for spinel will be investigated in parallel efforts. The best approach will be continued in depth. Spinel will be deposited on MgO by CVD and reactive methods. The purposes are to eliminate or minimize effects of hydrate and carbonate formation and erosion damage. Exploratory CVD spinel runs will be made to obtain small rectangular pieces. Optical, mechanical, and thermal properties of materials produced will be determined (transmittance, image spoiling, strength, elastic modulus, hardness, thermal conductivity, thermal expansion, specific heat, microstructure, environmental stability).

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0032, RELATIONSHIP OF ABLATIVE MECHANISMS TO FIBER PERFORMANCE AGAINST LASERS

E.M. Healy, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0G4271)

The objective of this effort is to determine the mechanisms of ablation and other breakdown pathways, when fibrous polymers and other materials of potential value in individual protection are exposed to infrared CW laser radiation.

Selected polymeric materials will be exposed to controlled laser irradiation to 10.6 microns and other wavelengths of interest. Delineation of breakdown processes will be sought by examination of volatiles, condensible materials and residues, with and without positive removal of ablated material.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

4.0033, PROPAGATION OF DETONATION THROUGH A NON-UNIFORM HETEROGENEOUS MIXTURE 14417-E

J.A. Nicholls, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (DA0F8962; DAAG29 77 G0104)

To study experimentally and analytically the propagation of a detonation wave through a heterogeneous mixture which the fuel-to-oxidizer ratio may vary along the path. Relevance - this research will improve the understanding of the influence of fuel/oxidizer ratio and side relief on reactive wave propagation that is required for the development of fuel/air mixtures for munitions. It will further contribute to the studies on pressure instabilities in liquid and solid gun propellant burning.

Liquid fuel drops, all of the same size, will be used and the experimental configuration will correspond to cylindrical geometry. Two different drop sizes will be studied. Distributions of fuel-to-oxidizer ratio with radius which will be examined will include the continuously changing case, the case of uniform ratio except for a void in fuel between radii R sub 1 and R sub 2, and the case of a discontinuity dividing the region into two uniform mixture ratio sections.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0034, STUDIES IN THE VISCOMETRY OF SLOW MOTIONS OF RHEOLOGICALLY COMPLEX LIQUIDS 12754-E

D.D. Joseph, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Mechanics & Aerospace Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DA0R5579; DAAG29 76 G0047)

To perform experimental and mathematical studies on the mechanics of flow of rheologically complex liquids, to develop sets of standard experiments which will lead to reliable viscometric data characterizing rheologically complex fluids. Relevance - the flow properties of hydraulic fluids and lubricants to weapon systems and vehicles are of great importance to the Army. In particular, application to the design of recoil mechanisms, hydraulic power transmission, and the lubrication of aircraft and tank components are obvious examples.

Starting from Noll's formulation for the so-called 'simple' fluid and specifying classes of motion or histories in which the stress response function is manageable, various types of viscometric flow will be solved and checked experimentally.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0035, DEVELOPMENT OF A COMPREHENSIVE RDT/E PROGRAM FOR GROUND SUPPORT EQUIPMENT

J.E. OleJack, C M R Inc., *Toms River, New Jersey* 08753 (DN133406)

To develop a systematized RDT/E program which will define and integrate future ground support requirements with a comprehensive RDT/E effort insuring an optimal operational support capability for future generation aircraft and weapons systems.

Develop a detailed identification of the testing, servicing, maintenance, and handling functions necessary to support aircraft and associated directives, along with organizational structure for the planning and managing of GSE RDT/E. Develop and implement systematic measures to insure prompt consideration of ground support equipment requirements which may be introduced by advancements in airborne systems, changes in support technology, or changes in the operational environment. Develop a long range plan for GSE RDT/E to parallel aircraft systems and technology forecasts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0036, NOVEL DIGITAL SIGNAL PROCESSING AND DETECTION TECHNIQUES

B. Liu, Princeton University, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *Box 430, Princeton, New Jersey* 08540 (DF044760; AFOSR-76-3083)

AF function - to advance the theory and design of digital signal processing hardware and techniques for use in Air Force electronic communications and surveillance systems. Deficiency - ever more stringent requirements in the areas of communications, reconnaissance, radar navigation, and flight control create corresponding demands in the area of signal processing. The high prices now paid in weight, size, power consumption can and must be reduced - higher speeds and accuracy are needed as well. Objective - to discover new structures for signal processors, to devise better ways of processing two-dimensional signals, and to find improved statistical methods that can be implemented for signal detection. How work contributes - the results of this research could be directly usable in the design of future Air Force electronics equipment.

New filter structures will be studied in connection with adpative signal quantization. The roundoff error will be investigated in a new class of fast algorithms for the convolution and

DFT. Work will continue in the study of sequential sampling in hypothesis testing applied to detection.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0037, CONVECTIVE IGNITION OF NITROCELLULOSE-BASED PROPELLANTS IN NONSTEADY FLOW FIELDS 15994-E

W.A. Sirignano, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Engineering, *Box 430, Princeton, New Jersey* 08540 (DA0F9242; DAAG29-78-G-0153)

To continue research on convective ignition of nitrocellulose-based propellants to determine the site and mode of convective ignition of cylinders in cross flow and to determine the influence of igniter gas composition on the ignition events. Relevance - the results of this research can be incorporated in packed bed propellant studies that are of mission interest to both the ignition and the gun propulsion technology programs of the large caliber weapons systems lab.

A model is being developed which includes heat-up to gasification, flow of reacting gases around a specified cylinder geometry, and accumulation and reaction of combustion intermediates in the flow wake.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0038, ELECTRIC GENERATOR DEVELOPMENT FOR 1980

W. Uellner, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696009)

To determine the approximate handling, servicing, maintenance and test systems and configurations as well as the associated cost requirements for existing and future aircraft electrical ground support equipment which will conform to the proposed revision of Mil-Std-704.

(A) determine the specific operational support requirement. (B) investigate the possibility of updating present inventory equipment and the associated data. (C) investigate the technology, feasibility, and costs associated with new systems development to meet the new requirements. (D) develop breadboard mock-ups of modified and/or new support system designs. (E) evaluate these mock-ups and formulate recommendations for system development actions.

SUPPORTED BY U.S. Dept. of Defense, Navy, . 'aval Air Systems Command

4.0039, PLASMA DYNAMICS FOR POPULATION INVERSION

R.L. Liboff, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DF051870; AFOSR-78-3574)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand fundamental understanding of energy transformation processes occurring in plasmas such as x-ray lasing media. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by well-planned theoretical and experimental research. Objective - this project will investigate theoretically the fundamental characteristics of energy transformation processes. It will specifically study the plasma dynamics aspects of population inversion for x-ray lasing media. Contribution - this work is part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam) the development of space and ionospheric communications and the development of countermeasures.

This project will perform theoretical work to understand the energy transformation processes occurring in x-ray lasing media, taking into account the fluid dynamic aspects of the system. It will perform a consistent description of a time varying reacting plasma. The macroscopic description which will be incorporated in the theory is that of a freely expanding cooling aggregate. Here one is mainly concerned with the effects that such fluid dynamics have upon the population densities of the excited states. For the realization of a high-power x-ray lasing medium it is important to study the aforementioned dynamics in the limit of high densities. Where possible, realistic (experimentally found) cross-sections will be incorporated into the theory. In addition to the foregoing they will study the effects that the lasing radiation has upon the level populations. This effort will be closely coordinated with the main experimental x-ray laser program performed at the University of Rochester as well as the other satellite efforts (Boston College, Toronto, St. Louis and Maryland).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0040, NAVY VEHICLE DESIGN AND CONSTRUCTION - TRANSONIC ANALYSIS OF TWO-ELEMENT AIRFOILS

G. Volpe, Grumman Corp., Grumman Aerospace Corporation, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN575295; N00014-75-C-0722)

This research is directed towards developing a completely theoretical solution to the analysis and design of transonic two-element airfoil configurations. The use of such two-element airfoil configurations such as slats has improved performance of combat aircraft at transonic speeds where air-to-air combat usually occurs. However, the reasons for the effectiveness of slats or flaps at transonic speeds are not presently well understood and good slat or flap designs are experimentally arrived at through expensive wind tunnel test programs.

A three phase program is being conducted to develop a systematic and efficient numerical procedure for the design of multi-element airfoil systems for high lift at transonic flight conditions. Under the two completed phases a viscous transonic flow analysis has been developed. The procedure predicts pressure distributions and force and moment coefficients for multi-element configurations with boundary-layer effects included. The current phase is concerned with the development of an effective inverse method to determine multi-element airfoil systems by specifications of a desired pressure distribution and free stream Mach number.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0041, THEORETICAL STUDIES OF WAVE PROPAGATION IN LAMINAR BOUNDARY LAYERS

G. Miller, New York University, Washington Square & University College of Arts & Sciences, Dept. of Aerospace Science, *421 1st Ave., New York, New York* 10012 (DN675088; N00014-76-C-0183)

The instability of laminar boundary layers and the associated transition to turbulence are extremely complex phenomena that have major effects on the performance of aircraft and missiles throughout the speed range. An increased understanding of these occurrences, coupled with an improved predictive capability, could lead to a significant improvement in vehicle performance, particularly as regards range and fuel economy. The proposed research will study, theoretically, the propagation of waves through laminar boundary layers at high subsonic speeds emphasizing the nonlinear interaction of the wave with the boundary layer.

The stability of the laminar boundary layer will be studied by finite difference techniques, for the flow past a flat plate at high subsonic speeds. Disturbances will be introduced at the upstream, downstream and outer boundaries. The propagation and distortion of the disturbances, and the associated modifications of the flow, will be calculated using second order compressible boundary layer theory. The influence of disturbance amplitude and wavelength will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0042, MICROWAVE, ELECTROMAGNETIC THEORY AND INFORMATION PROCESSES (JSEP)

A.A. Oliner, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Electrophysics, *333 Jay St., Brooklyn, New York* 11201 (DF001680; F49620-78-C-0074)

AF function - electronic research is essential to all Air Force missions and functions, especially aerospace reconnaissance, communications, surveillance, navigation, command and control of operating forces, and gathering, processing, and transmission of intelligence and information. Technology for all of these functions requires more compact, lower power consumption, higher sensitivity and more reliable electronic components. Opportunity - this technology is dependent on continued research on properties of electronic materials, circuits, and systems. Objective - the Joint Services Electronics Program (JSEP) provides the research baseline in the electronic sciences for all three military services. How work contributes - jointly and equally supported and managed by the Air Force, Army and Navy, this program provides the DOD with a hard core electronic research capability which includes a highly flexible, quick response to new research opportunities over a braod area of electronic science and engineering.

The JSEP effort addresses itself to research in electromagnetics and waveguide techniques, quantum electronics and optics, solid state electronics and materials, communications and computers, and systems, control and network theory. The part under task 2305/A9 entails problems of propagation, guiding and scattering of electromagnetic and acoustical waves, of interaction of high energy density waves and materials, as well as problems in solid state electronics concerning electric, magnetic, acoustic and optic interactions in solids and related devices. The JSEP effort addresses itself to research in systems theory, network analysis, communications theory, and image processing. Work in modeling FM receiving channel interference continues. New work commences in developing models for image processing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0043, UNSTEADY BOUNDARY LAYER FLOWS

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AF function - aerospace vehicles. Opportunity - of prime interest for the future will be the ability of the scientist and engineer to model flows with unprecedented accuracy, thereby minimizing the costly consequences of small errors in estimating the static and dynamic loads over a wide variety of shapes and configurations. The major communicating link between a body and the moving fluid in which it is immersed is the boundary layer. An important unresolved feature of this boundary layer is its stability and transition to turbulence in response to time varying (unsteady) inputs such as might result from a maneuver. While the mean characteristics of the unsteady laminar boundary layer have been studied to some extent and are believed to be reasonably well understood, the transition of this laminar boundary layer to turbulence and the turbulent boundary layer which develops from this unsteady initially laminar flow have not been looked at in any detail. A unique way of studying, experimentally, the stability of unsteady viscous flows, particularly of transient as distinct from periodic flows, is by use of a Ludwieg tube as anticipated in this research effort. Objective - to study analytically and primarily experimentally the stability and transition characteristics of unsteady laminar wall boundary layers as well as the features of the turbulent flow at long times following passage of a finite wave over an observed measuring station in a Ludwieg tube. How work contributes - a major objective of this research effort will be to exploit the great flexibility of the expansion (Ludwieg) tube as regards independent variations of pertinent flow conditions which determine the basic similitude parameters.

The experimental program has concentrated on obtaining transition-time data by thin-film detection for a range of the parameters involved. It appears desirable to employ other diagnostic techniques as well. For that purpose a special hot wire probe is under construction and will be used to sense velocity fluctuations within the boundary layer itself. The theoretical investigation of the expansion wave boundary layer stability is based on a linearized small disturbance analysis using the method of multiple scales.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0044, COOPERATIVE INVESTIGATION OF THE NOISE PRODUCING REGION OF AN AXISYMMETRIC JET

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AF function - advanced aerospace vehicles. Opportunity - fundamental understanding of the sources of noise and vibration caused by mixing gaseous flows is not available. Recent investigations provide evidence that coherent structure of the turbulent flow field either is the source or the carrier of the source for the radiated acoustic energy. This effort provides the opportunity to investigate the correlation between the coherent structure of a jet and its radiated noise and also to investigate the existence of coherent structure in the midfield of a jet flow field and techniques for its detection. Objective - comprehensive study, both experimental and analytical, of the turbulence structure of low Reynolds number jets and its relation to jet noise. How work contributes - noise radiated from jet mixing flows are not only unpleasant from an environmental standpoint but induce vibrations within the solid structure of the vehicle and adjacent structures reducing system reliability and fatigue life. Better understanding of the physics involved in the jet flow field and resulting acoustic energy will allow more efficient and reliable components such as jet exhaust nozzles, jet pumps and augmented jets.

The investigation will study RE lower than that at which visually observable structures disappear and will be carried out as a three university effort at SUNY, Buffalo, the University of Minnesota and the Illinois Institute of Technology. All three investigations will be experimental and will be carried out on similar axisymmetrical jets at identical Reynolds numbers. To insure similarity, traditional turbulence measurements (turbulence intensities, etc.) will be obtained on each apparatus for comparision. The SUNY will apply Lumley's orthogonal decomposition to the velocity and temperature fields, the University of Minnesota will apply orthogonal decomposition to the radiated noise field and the Illinois Institute of Technology will resolve the observable velocity structures by visualization techniques. Detailed analysis of these data will attempt to resolve the existence (or nonexistence) of the relationships between the coherent structures and the acoustic radiation field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0045, SENSOR DEVELOPMENT

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To reduce cost of electro-optic sensors.

New improved cameras based upon internal photoemission from Schottky barrier arrays offer the possibility of a more than ten-fold reduction in the cost of infrared thermal imaging systems. Applications of these cameras include night attack, navigation, weapons delivery, and passive non-cooperative identification and classification of aircraft. Prototype cameras are evaluated to determine their performance characteristics including resolution, temperature sensitivity, operating parameters and noise.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0046, TACTICAL TARGET IDENTIFICATION SIMULATION

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The purpose of this effort is to develop a TTI (tactical target identification) simulation capability to evaluate specific radar identification techniques (RCS, Doppler, imaging). This in-house effort will provide a means for evaluation and focus of the TTI contractual program as well as serve as a vehicle to demonstrate this technology to users.

The technical approach to the TTI simulation program will be to instrument the TTI laboratory with the appropriate computing power. This shall be realized with existing government-owned equipment and integrating the necessary peripherals. The necessary data processing algorithms will be developed on this system in conjunction with contractor-furnished software and applied to the demonstration of interactive aircraft identification and classification functions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0047, MOLECULAR INTERACTIONS WITH MANY-BODY PERTURBATION THEORY

R.J. Bartlett, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF053020; AFOSR-78-3661)

AF function - this research contributes to RO 6.3, electromagnetic weaponry. Deficiency - more accurate and efficient methods for calculating potential energy hypersurfaces are needed. Objective -many-body perturbation theory will be adapted to the study of molecular interactions. Contribution - further understanding of intermolecular interaction phenomena will assist in the development of high-power lasers.

Research is directed toward developing new, efficient, and more accurate methods for first-principle quantum mechanical determinations of molecular interactions in order to determine parts of energy hypersurfaces for ground and excited states. Since a predictive theory of potential energy surfaces is required, the approach must exceed the Hartree-Fock self-consistent-field method in accuracy and must include correlation. The method being pursued is a natural extension of Hartree-Fock theory based upon the linked-cluster expansion and many-body perturbation theory. MBPT possesses advantages that make it attractive for the calculation of energy surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0048, CHEMICAL DYNAMICS AT THE GAS-SOLID INTERFACE - COLLISION-INDUCED ELECTRONIC TRANSITIONS

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AF function - this proposed research primarily falls in the 6.3 research objectives which deal with the development of high energy lasers. The specific problem under consideration will be the dynamics of reactions occurring at the gas-solid interface. A novel pumping mechanism for infrared lasers could result from this study, and the subsequent developments and refinements will have important technological consequences. Deficiency - in the development of any laser the main step is to achieve the correct population inversion of the system. With the large variety of possible gas-solid interactions (including various crystal faces and alloys), a preliminary computer screening to identify necessary characteristics for population inversion is needed to provide valuable guidelines for experimentation. Objective - the present proposal addresses two extensions of the model, (1) the role of surface atom motion in determining desorption dynamics, (2) the specialized energy requirements for adsorption and how the adsorption process affects the momentum distribution of the adsorbed particles. Contribution - this research is a part of a comprehensive program in statistical mechanics.

Using computer simulations, it is proposed to study the energy requirements (vibrational, rotational and translational) for adsorption of a gas-phase molecule on a solid surface. The role of the gas-solid potential for different types of surfaces and various lattice dynamics for the surface atoms will be investigated. The importance of these effects in promoting adsorption will be assessed. Battelle researchers have developed a model to describe the interaction of diatomic and triatomic gas molecules with solid surfaces. Work currently in progress at Battelle under AFOSR sponsorship is using this model to investigate the dynamics of recombination and desorption of adsorbed atoms to elucidate conditions under which useful amounts of vibrational energy will appear in desorbing molecules. This, in turn, affects the desorption dynamics and, hence, the feasibility of obtaining useful amounts of vibrational energy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, EFFECT OF BODY FORCES ON MOTION AND HEAT TRANSFER OF CONFINED FLUIDS

S. Ostrach, Case Western Reserve University, School of Engineering, Dept. of Engineering, *University Cir., Cleveland, Ohio* 44106 (DF046540; AFOSR-77-3171)

AF function - advanced aerospace vehicles. Opportunity - improve efficiency of electronic equipment cooling systems, waste heat disposal and fuel cooling systems. Objective - to increase the understanding of confined flows and heat transfer relevant to fuel and hydraulic systems, tankage, and aircraft equipment environmental control. How work contributes - this work is building a step by step understanding of flow features and configurations that are common, albeit poorly understood, features of vehicle equipment operation. Any increased understanding of these flows will yield hydraulic fuel and temperature control systems of better performance and decreased weight.

Experiments will be performed on heat transfer augmentation by thermal instability, on natural convection with multiple heat flow directions, on the interaction of a buoyant plume in a stratified environment, and on convection due to combined temperature and concentration gradients. Papers will be prepared describing completed work.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0050, RECEIVER CONCEPT AND EVALUATION

J.B. Tsui, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF097990)

The in-house capability to be established under this effort will provide a much needed service to the operational commands deploying EW receivers and to the exploratory and advanced development programs attempting to advance the state of the art. Specific objectives include the capability to evaluate and calibrate passive receiver systems operating from 50 MHz to 40 GHz and to define standards which will support systems under development. In addition, new concepts developed by laboratory engineers and contractors will be evaluated and demonstrated under the program.

In-house laboratory equipment will be acquired (through purchase and use of existing equipment identified in other divisions) and integrated into a semi-automated capability. Initial work will emphasize the frequency ranges that existing equipment provides, resulting in minimal new purchase of equipment. As experience is gained in measurements, the program will expand to new concept evaluation and demonstration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0051, ERDA-DOE/NASA PROPULSION SYSTEM R AND D FOR ELECTRIC AND HYBRID VEHICLES

H.J. Schwartz, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Lewis Research Center, *21000 Brookpark Rd., Cleveland, Ohio* 44135 (RTOP 778-36-06)

The objective of this work is to provide the propulsion system research and technology required to support DOE's Electric and Hybrid Vehicle Systems program. This will be accomplished through contracts with industry and university grants supported where appropriate with in-house research projects. The projects will be planned to provide new electric and hybrid propulsion technologies required to permit the DOE Vehicle Systems program to meet its objectives. Responsibility for propulsion research and technology is assigned to NASA by DOE under Interagency Agreement No. EC-77-A-31-1044, dated May 20, 1977. All basic and applied research plus engineering development necessary to improve, advance, and/or

evolve new components and systems are included in this effort. Initial work addresses improving existing components such as motors, controllers, etc., to be followed by research and development eventually resulting in significantly advanced concepts.

SUPPORTED BY U.S. Dept. of Energy, Div. of Electric Energy Systems

4.0052, STRONG OPTICAL SCATTERING IN ATMOSPHERIC TURBULENCE

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AF function - electro-optical communications systems have defense applications which include indication and warning and weaponry. Opportunity - aberrations in optical propagation paths due to atmospheric turbulence may be corrected if the effect of the turbulent scattering is more clearly understood. Objective - the purpose of this research is to collect and analyze detailed statistical data on strong optical scattering in a well characterized laboratory medium. Results will be used to verify or modify recently developed theoretical descriptions of the scattered field as a function of all pertinent variables. How work contributes - high levels of atmospheric temperature turbulence distort electro-optical signal propagation. The phenomenon, which is not yet well understood prevents optical systems from achieving their diffraction limited capabilities. This project should provide a better understanding of the situation and allow improvements or compensations to be made for such optical systems.

The approach to be taken will be to construct liquid-filled scattering chamber. Atmospheric turbulence in the mdeium will be simulated by inserting transparent glass beads whose index of refraction is nearly that of the liquid. A low power, highly coherent laser is intended for use as a virtual point light source with scattering measurements being made by high resolution optical instrumentation. Data collected will include evaluation of the variance of irradiance, the detailed covariance shape, and high moments and their probability distributions as a function of strength of turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0053, OPTICAL DATA PROCESSING

D. Casasent, Carnegie Mellon University, Inst. of Technology, Dept. of Electrical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF041370; AFOSR-75-2851)

AF function - advanced terminal guidance processors will permit maneuverable reentry vehicles to take evasive action while ensuring accuracy of delivery. Opportunity - the fundamental difficulty in achieving a practical terminal guidance system lies in real-time correlation of the stored reference image with an input image that differs in scale, aspect, contrast, and even content when sensed in a different spectral band or at a different time than the reference image. The most promising technology is optical processing with its increasing repertoire of space-variant data processing operations. Objective - the proposed research will investigate the problems associated with differences between input and reference imagery in missile guidance, and will devise appropriate optical pattern recognition techniques and systems to overcome these problems.

The following projects will be pursued: evaluation of candidate real-time light modulators, modelling the effects of correlation degradations due to the various differences that occur between the input and reference imagery, improvement of image registration by employing light modulators to produce phase modulated input data, performance of optical correlation of data from one sensor with that of another to assess SNR and correlation degradation, investigation of the optical analog to the invariant moment method used in digital pattern recognition, and performance and analysis of correlations involving IR tank imagery, millimeter wave imagery, and imagery in which transmittance is proportional to altitude and terrain slope.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0054, ASW POD FOR CV TACTICAL AIRCRAFT

C. Phillips, U.S. Dept. of Defense, Navy, Naval Air Development Center, *Warminster, Pennsylvania* 18974 (DN581412)

Minimize problems in fleet antisubmarine warfare relay systems by supporting NavAir, NAFI, and contractors with facilities and technical staff essential for evaluation of total system and/or components for development through production and use.

Operational requirement (OR ASW 30) established the parameters and guidelines for the development of an ASW POD which will provide tactical aircraft with a sonobuoy dispense and signal relay capability. Work also being performed on contracts as reported in work units SX301 B, SX301 B3, and VR101B.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Avionics Facility

4.0055, LIVE CREWSTATION MOCK-UP AND DYNAMIC FLIGHT SIMULATOR

R.J. Crosbie, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881417)

To develop a generic dynamic crewstation capable of being efficiently inserted in the gondola of the NavAirDevCen centrifuge and used as a pilot controlled dynamic flight simulator for current and advanced aircraft. This development effort includes the design and fabrication of the necessary hardware required to accommodate advanced cockpit/systems, e.g. displays, controls, seats, restraints, etc. It will also include the identification, refinement and verification of various software tasks required to control and operate the simulator. All directorates that use or may use dynamic simulation at NADC will be contributing to the development of this station.

This development effort will include the inputs of the Center S directorates as outlined in the background statement and includes the following tasks: (1) Design and building of physical cockpit will be a multiple directorate effort. (2) The development of the methods for the optimum simulator drive will use personnel and information from the Facilities (TSD) and the Life Sciences Division (ACSTD). (3) The aerodynamics will involve the Flying Qualities Branch of Aero Design and Propulsion Division (ACSTD). (4) The controls and force feels will include inputs from the Aircraft Systems Division (SCSTD). Displays and systems integration will be coordinated through the Systems Project Director for AIDS and Systems Simulation Division (SD).

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0056, SIMULATION DEVELOPMENT SCENE GENERATOR SYSTEM

R.L. Jones, U.S. Dept. of Defense, Navy, Naval Air Development Center, Systems Directorate, *Warminster, Pennsylvania* 18974 (DN233164)

Research and develop the simulation capability to generate visual cues an air crew requires to accomplish earth oriented operations such as landing on surface ships, air-to-ground weapon delivery and air-to-air combat.

The scene generator capability is being developed in several phases. The initial phase included the design of the gantry system and the development of the optical probe. The second phase is the development of the space and the lighting system. The third phase is the integration of the gantry, lighting and a terrain model and ship model with sea scape.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0057, TRENDS IN DIGITAL COMPONENT TECHNOLOGY AND THEIR EFFECTS ON SEQUENTIAL COMPUTER PROCESSING RATES

G.M. Dick, University of Pittsburgh, Johnstown Campus, Undergraduate School, Dept. of Engineering Technology, *Johnstown, Pennsylvania* 15902 (DF051450; AFOSR-78-3540)

AF function - aerospace vehicle design and operation. Deficiency -three-dimensional aerodynamic design is at present not

computationally feasible. Opportunity - new computer architectures and associated computational algorithms might be able to do the problem. How work contributes - by establishing limits of advantage attainable by specialized computer architecture.

Computational algorithms contain both sequential and vector operations. Pipeline and parallel computer speed can be limited by necessary sequential operations. The proposal attempts to estimate the needed and attainable speed of sequential computation in order to do three-dimensional aerodynamic design. This study will directly address processing rates of sequential machines only. Extrapolation of these results to vector machines is not a main item within the investigation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0058, AIRBREATHING ENGINE SIMULATOR EVALUATION

L.L. Galligher, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF420772; F40600-77-C-0003)

Investigate various problems and test techniques associated with integrated nozzle-afterbody testing in transonic wind tunnels.

Provide a data base from which an evaluation can be made of the test techniques currently used to determine the performance of integrated airframe-propulsion systems. Based on this evaluation, new procedures can be initiated where needed to improve the wind tunnel test capability. In addition, the results of this project will provide a means of identifying influences of wind tunnel generated disturbances on test data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0059, UNSTEADY AERODYNAMIC

T. Hsieh, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF421058; F40600-77-C-0003)

Study the approach to determining whether high-angle-of-attack unsteady aerodynamic forces can be isolated and recovered from wind tunnel test data.

Sources and effects of unsteady flow on wind tunnel test data will be investigated. Evaluate hardware requirements for unsteady aerodynamic data extraction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0060, LASER VELOCIMETER MEASUREMENTS OF THE FLOW OVER MISSILES AT HIGH ANGLES OF ATTACK 14761-E

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To utilize a three-dimensional laser Doppler velocimeter (LDV) to measure the velocity distribution and vortex structure in flows over missiles at high angles of attack. Relevance - a quantitative understanding of the flow field structure about missiles at high angles of attack is directly relevant to the development of highly reliable, accurate, and maneuverable missiles.

Simultaneous three-dimensional velocity measurements at a point in a flow established about bodies of revolution at high angles of attack in both subsonic and supersonic wind tunnels will be made using both a dual-scatter LDV and a reference beam LDV system. Measurements will be made both in the boundary layer and vortex wake regions.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0061, INVESTIGATION OF ADAPTIVE OBSERVERS FOR THE HUMAN OPERATOR IDENTIFICATION PROBLEM

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AF function - in the design of high performance control systems, accurate models of the pilot dynamics are necessary to properly account for the pilot as a control element. Deficiency - pilot models can be used to perform stress tests which might be harmful or undesirable to subject humans to such as nuclear irradiation, hypoxia, severe acceleration due to extremes of aerial combat maneuvers, and responses due to temperature and vibration. Objective - the real-time identification problem as regards aircraft pilot modeling and parameter identification as currently under study by the USAF School of Aerospace Medicine will be examined. How research contributes - the research will enhance the development of on-line identification algorithms for identifying time-varying models, both linear and nonlinear. The resulting computer algorithms will be useful in obtaining accurate, reproducible pilot transfer function models which are of great importance in predicting accurate responses for human stress studies.

New identification approaches will be developed, and an investigation of the identification algorithms via computer simulation will be verified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0062, MEASUREMENTS IN THE LASER IRRADIATED EYE

A.J. Welch, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engineering, *200 W. 21st, Austin, Texas* 78712 (DF048650; AFOSR-77-3314)

AF function - Air Force personnel may be exposed to a wide spectrum of radiation hazards in the operation of aircraft and weapon systems. This spectrum includes laser energy. The results of the measurements proposed should substantially contribute to work being conducted by USAFSAM in TPO II, radiation hazards. Deficiency - techniques are needed to develop microsensors which are capable of acquiring data in the pulse duration phase associated with most Air Force lasers. It seems probable that the development of these microsensors will add substantially to the attainment of means of direct measurement of temperatures during short duration exposure of the eye and for small retinal images. In addition, the investigators will measure the transmission properties of the monkey eye by the use of a dye laser. Objective - this research will lead to intensity and electrical activity within the laser irradiated eye. In addition, measurements of the transmission properties of the eye will be accomplished with the use of a dye laser. How research contributes - the need for determination of safe retinal exposure levels to high intensity visible light increases each year. The health hazards of these sources cannot be properly evaluated until we increase our knowledge of the nature of the damage mechanism and are better able to measure these effects. This research will afford the means to more accurately assess and quantify the effects of laser irradiation on the eye.

Measurements in the laser irradiated eye will be made by the insertion of newly developed fiber optic probes as well as from combination fiber optic-thermocouple probes and combination electrode-thermocouple probes. The probes will be inserted in monkey eyes. By scanning the animal through the laser beam, it should be possible to produce high quality two-dimensional intensity profiles of the retina. Also simultaneous light-temperature recording or ERG-temperature recordings will be made using the rabbit and/or monkey.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0063, THREE-DIMENSIONAL FRACTURE

E.S. Folias, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Civil Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF047440; F49620-77-C-0053)

AF function - advanced aerospace flight vehicles and propulsion systems require improved damage tolerance. Deficiency - the inability to accurately and efficiently assess fracture and crack growth which involve three-dimensional behavior seriously limits the Air Force capability to develop a realistic structural damage criteria. Objective - objective of this theoretical research is to investigate the three-dimension behavior of surface and corner cracks with particular attention being given to the

region where the crack intersects the structural free surface. How work contributes - the research directly contributes to the Air Force research effort seeking to develop a realistic three-dimension fracture criteria and crack growth law which has experimental validity.

This research effort, using the three-dimensional theory of elasticity, will study the behavior of surface and corner cracks. The stress singularity behavior at the intersection of a corner crack and free surface will be studied. In addition, for surface cracks the stress distribution in the vicinity of the crack surface will be determined and the influence of the rear surface proximity studied. Using perturbation analysis the advancement of a crack front will be investigated in an effort to explain 'tunneling' behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0064, THEORETICAL BASIS OF THE FLOW TURNING EFFECT IN COMBUSTION STABILITY

W.K. VanMoorhem, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Mechanical & Industrial Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF052770; AFOSR-78-3645)

AF function - weapons delivery. Deficiency - all developments in rocket technology (tactical or strategic) are subject to at least the possibility of unstable combustion. Objective - this theoretical analysis will improve the basic understanding of the 'flow turning' effect which has been incorporated empirically into the most-used solid propellant combustion instability models. How work contributes - the result of this work should be clarification of assumptions and improved understanding of 'flow turning', as it is presently used in combustion modelling.

The existing theory will be reviewed and reformulated to clearly define assumptions and approximations already made. In a second phase the relationship between one- and three-dimensional problems will be studied. In a third phase, time permitting in this one year program, some simple 'flow turning' models will be investigated and numerical results produced.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0065, MULTIPLE WAVELENGTH SIGNATURE STUDY

J. Wilson, General Research Corp., *7655 Old Springhouse Rd., McLean, Virginia* 22101 (DF911380; F30602-78-C-0082)

To determine the nature of target observables and their interaction with high frequency active sensors in the micron to millimeter region of the electromagnetic spectrum. Air Force strategic surveillance systems require the capability to retain full operational performance for all system scenarios and environments to be encountered. These systems must obtain repaid and confident detection, classification and identification of military targets by utilizing vital target signature information. The utility of extant computer programs for modeling real-world strategic targets, such as spacecraft and aircraft has not been adequately demonstrated throughout the micron to microwave portion of the electromagnetic spectrum. Comprehensive field measurements do not represent a cost effective approach without a preliminary selection of the most promising combination of wavelength and system parameters.

This proposed effort will demonstrate a simulation capability for target observables with an accuracy adequate to predict and evaluate the system performance of advanced surveillance concepts. This study will (a) demonstrate the utility of extant computer simulations for strategic surveillance sensor evaluation, (b) improve the methods of treating the complex geometries of strategic threats, and (c) establish the basis for extrapolating a basis for the microwave codes using either the optical or millimeter codes or by establishing the microwave codes independently.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0066, THREE-DIMENSIONAL DISTURBANCES IN HIGH SPEED BOUNDARY LAYER FLOWS

G.R. Inger, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace Engineering, *Blacksburg, Virginia* 24061 (DF045690; F49620-76-C-0013)

AF function - advanced aerospace vehicles. Opportunity - provide better understanding of the structure and mechanisms of flow separation/reattachment with their attendant three-dimensional effects on pressure distribution, skin friction and heat transfer phenomena. Objective - investigate the twin problems of flow separation/reattachment and three-dimensional effects in high speed boundary layer flows along two-dimensional and axisymmetric bodies. How work contributes - better understanding of these phenomena will be directly applicable to the design of future aerospace vehicles.

A theoretical study will be established with the objective of developing a fundamentally sound yet engineering-oriented analytical approach from which skin friction, heat transfer, and wave drag can be predicted as function of Mach and Reynolds number, wall temperature ratio and vortex parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0067, DICE THROW DATA ANALYSIS (HARD FLUSH AIRCRAFT SHELTER)

J.C. Pyle, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF190550; F29601-77-C-0086)

The objective of this project is to analyze the dice throw data for the Boeing Aerospace Company's hard flush aircraft shelter concept model. The test phenomenology and its implication on the Boeing shelter design will be based on the data analysis. This project will result in a report summarizing data results, analysis results and analysis/test correlation.

This project will require data review, damage review and assessment, prediction analysis review and assessment, new analysis based on measured load data in overpressures and soil pressures, and analysis/test correlation. The dice throw test simulated the air overpressure and ground shock weapons effect on the one-third scale hard flush aircraft shelter. The test prediction analysis approach was the same approach as the design analysis for these weapons effects. The same approach or an expansion of it will be used for analysis/test correlation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0068, REFRACTING GAS PRISM AND AERODYNAMICS OF ELECTRON BEAM DISCHARGES

W.H. Christiansen, University of Washington, School of Engineering, Dept. of Aerospace & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF026720; AFOSR-74-2650)

AF function - weaponry. Opportunity - some fluid mechanical flows have promise for performing as optical elements for handling the light output of high power lasers at power densities higher than those possible with solid state mirrors, lenses, prisms, and windows. Objective - to both theoretically and experimentally study aspects of fluid mechanical optics that might lead to new optical systems useful for laser technology. An additional objective is to study fundamental principles involved in the interaction of electron beam discharges with gas dynamic flows. How work contributes - this work will determine at what energy densities and for what time periods light can be stored in a fluid mechanical storage ring. It will also elucidate the fundamental processes occurring in the interaction of electric discharges with supersonic gas flow in a closed channel.

Experiments will be carried out on the 360-degree Venus machine. Other experiments will investigate the flow-electric discharge interaction using a Ludwieg tube and a plasma diode.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0069, FINITE ELEMENT METHODS IN FLUID DYNAMICS

N. Geffen, Tel Aviv University, *155 Herzl St., Tel Aviv, Israel* (DF048990; AFOSR-77-3345)

AF function - aerospace vehicles. Opportunity - both present and future Air Force aerospace vehicles will be required to fly at high speeds and have an ability to maneuver at all speeds. This will require that new and improved engineering design and analysis methods be developed throughout the total speed regime for the precise engineering determination of the performance and system capabilities of these vehicles. Objective - this research will attempt to develop new methods for fluid dynamical analysis using high speed computers, methods which circumvent the disadvantages of currently employed machine algorithms. How work contributes - the ability to perform aerodynamic calculations about complex (real) shapes using finite element methods which are becoming standard in structural analysis could lead to great improvements in efficient use of computers as engineering design and analysis tools. Resolutions of the variational problems underlying the use of such finite elements will do much to bolster engineering confidence in the (numerical) finite element methods, thereby giving the engineer an added and vital tool for use in predicting the 'grand ensemble' vehicle flow field.

This research will investigate the possibility and feasibility of using variational formulations to obtain finite element analysis and procedures for the solution of quasilinear hyperbolic and mixed initial value problems, with application to unsteady flow about bodies, time dependent simulation of aerodynamic phenomena in all speed ranges, steady transonic flows (including the case of the super-critical wing) and to internal gasdynamic flows (e.g. cascades and inlets).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, NAVY ENVIRONMENT - AEROSOL COMPOSITION

G.A. Dawson, University of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (DN123034; N00014-77-C-0099)

In the interest of improving the forecast model for marine fog, the objective of this research is to furnish data on the chemical character of the marine aerosol around marine fog forms.

The technique for sampling the aerosol makes use of a cooled hemisphere on which a condensate from the atmosphere forms. From a measurement of the relative humidity and the volume of condensate, the volume of atmosphere sampled can be computed. By using a bank of collectors operating at different temperatures down to -6 C, it is possible to say something about the proportion of nuclei active at various temperatures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0002, INVESTIGATION OF SOLAR-TERRESTRIAL EFFECTS ON ATMOSPHERIC ELECTRIC FIELDS IN ANTARCTICA

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DPP7821712)

The earth's fair weather electric field will be measured at South Pole and Vostok Stations in Antarctica for a period of two years beginning in the austral summer of 1979-80. The electric field data will be used in conjunction with solar and geomagnetic data to investigate solar terrestrial effects associated with solar flares, solar magnetic sector boundaries, and transpolar magnetospheric convection electric fields, during the third year of this grant.

Logistics support is required for one person to visit Vostok and South Pole Stations during the austral summers of 1979-80 and 1980-81.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0003, ANALYSIS OF STRATOSPHERIC TRANSPORT PROPERTIES

G.D. Nastron, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, *Moffett Field, California* 94035 (DF580480)

AF function - environmental impact statements (EIS) of high altitude Air Force operations. Deficiency - current or anticipated AF operations in the stratosphere and upper troposphere may deposit harmful materials and it is important to assess the potential impact of this. Objective - analyze archived meteorological data of winds, ozone and temperature, 30 to 60 km, and derive eddy diffusion coefficients and ozone flux values. How work contributes - this work will provide improved eddy diffusion coefficients and ozone flux values required for environmental model verification and evaluate lifetime of pollution in the stratosphere.

The statistics of observed winds obtained from rocket soundings are used to estimate eddy diffusion coefficients. Horizontal diffusivity can be estimated from variance of the meridional wind and its integral time scale. Vertical diffusivity is estimated from the wavelengths of the small scale disturbances observed in the mean wind profile. The ozone transient eddy flux values required for model verification will be obtained from ozonesonda data correlated with the wind data. The mean flux can be computed directly from the ozone data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0004, NAVY ENVIRONMENT - REMOTE SYNOPTIC MEASUREMENT OF SURFACE CIRCULATION

J.D. Isaacs, University of California, San Diego Campus, Inst. of Marine Resources, *P.O. Box 109, La Jolla, California* 92037 (DN775038; N00014-76-C-1103)

The objective of this research is to develop a method for the remote synoptic measurement of ocean surface circulation. The remote, near real-time measurement of surface currents would be a highly valuable contribution in the planning and execution of Navy/Marine Corps operations in coastal waters.

This method relies on wavelength measurements of two distinct trains of gravity waves as they propagate through regions where surface circulation is to be determined. The method proposed here is basically simple, as it utilizes only wavelength measurements of two wave trains. The wavelength data will be determined from vertical aerial photographs. The photographs will be analyzed by optical data processing techniques to obtain the wavelength information from the two separate wave-trains propagating simultaneously. The waves will be generated by two wave generators of controlled frequency. The experimental work will include model simulation in a small basin located outdoors to simulate real illumination conditions for photography, and surface circulation measurement in a lagoon of a known and simple circulation. The results of these experiments will be evaluated for their application to surface circulation detection and measurement in harbors and larger bodies of water, both those accessible to ground measurements and otherwise; and the utility of local wind or ships' waves for such analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0005, REMOTE SENSING OF OCEAN PROPERTIES BY MEANS OF VISIBLE LIGHT

R.W. Austin, University of California, San Diego Campus, Scripps Institution of Oceanography, Visibility Laboratory, *P.O. Box 1529, La Jolla, California* 92038 (7-721; 04-6-158-44033 MOD. NO. 7)

OBJECTIVE: The reduction, analysis and interprepation of the oceanographic atomospheric and satellite data obtained during the November 1978 post-launch Coastal Zone Color Scanner (CZCS) Nimbus-G Experiment Team (NET) cruise and related work. This effort is a continuation and extension of the research conducted by the Visibility Laboratory over the last several decades, which in the last two years has been focused on the application of the Nimbus-G to ocean color.

APPROACH: Following the November 1978 post-launch CZCS/NET cruise, the Laboratory will be involved in planning and execution of two 'validation' cruises during February-

March 1979 in the Gulf of California and during May-June 1979 in the Gulf of Maine. These are critical cruises with respect to validation and utilization of the CZCS data to usefully determine ocean optical properties and related biological properties. As a consequence, the primary effort will be devoted to optimum execution of these cruises and the timely preliminary analysis of appropriate data.

CURRENT PLANS AND/OR PROGRESS: Progress under NOAA/NESS Grant No. 04-6-158-44033 to date includes: 1) The development and construction of ocenographic instrumentation for measuring the relevant optical properties of ocean waters; 2) the development and construction of shipboard instruments for determination of specific atmospheric properties (transmission and scattering); 3) the development and utilization (in conjunction with NESS and NET) of experimental techniques for performing surface validation experiments; 4) automatic computer techniques (including mathematical model development) for reduction and analysis of oceanic and atmospheric data; 5) the performance of oceanographic surface validations and development of relationships between biological parameters and oceanic optical properties; and 6) the development of techniques for atmospheric correction of ocean color measurements.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0006, MW REMOTE SENSING HARD ROCK

D. Belsher, U.S. Dept. of Commerce, National Bureau of Standards, *325 S. Broadway, Boulder, Colorado* 80302 (2762421)

PROJECT OBJECTIVE: Development of microwave measurement equipment and measurement techniques to probe hard rock or coal to depths up to 100 feet.

PROJECT APPROACH: Develop focused polarized antennas for the frequency range 30 MHz to 2 GHz. Extend probing range to 100 feet through development of advanced measurement techniques, define and construct a portable, permissible non-ignition source and practical microwave instrument.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

5.0007, DESERT EROSION AND SAND MOVEMENT IN EGYPT

F. Elbaz, Smithsonian Institution, Earth & Planetary Studies Center, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

It is here proposed to study the Western Desert of Egypt as a type locality of the North African desert environment. Emphasis is placed on desert color as a probable age indicator and on sand movement and landform development. Correlations will be made with data on other desert regions.

Objectives of the proposed research include: 1. Investigation of desert color to better understand color zoning and its relationship to dune reddening with time, and to formulate a relative age scheme for zones within the Western Desert. Use will be made of color photographs taken for this particular purpose by the Apollo-Soyuz mission. 2. Detailed analysis of regional desert erosion, sand distribution, grain movement, and dune shapes. Attention will be paid to desert landforms in the Oweinat Mountain region for analogue correlations with similar features on Mars.

The proposed study will entail both field work and photogeologic investigations. Geological field work will encompass collection of sand samples and documentation of observations in preselected localities. Laboratory investigations and photogeologic interpretations of available aerial photographs and Earth orbital images will support and supplement field observations.

The Principal Investigator at the Smithsonian Institution will direct and coordinate the photogeologic investigations. Other U. S. experts and specialists in the field of desert study will assist the Principal Investigator in interpreting Earth orbital imagery and inspecting field localities. The Co-Principal Investigator at Cairo's Ain Shams University will manage the funds and day-to-day progress of the scientific research project. He will also be responsible for the coordination of field work and laboratory investigations. He will be assisted by local experts in structural geology, geomorphology, and mineralogy petrology.

SUPPORTED BY Smithsonian Institution, Office of Fellowships & Grants

5.0008, OIL SPILL AGING TESTS

W.A. Hovis, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service, Satellite Experiment Lab., *14th St. at Const. Ave. N.W., Washington, District of Columbia* 20233 (042 (NOAA/EAO NO.))

The goal of this investigation is to determine the optical spectra of a number of various crude oil samples as a function of aging under simulated ocean conditions. The results will be utilized in analysis of remotely sensed data from spacecraft for oil spill location and monitoring.

Samples of crude oil will be floated on the surface of the EPA OHMSETT tank in Leonardo, New Jersey, in specially constructed floats that contain the oil, but allow for evaporation and dissolution. The oil will also be agitated by waves produced in the tank. Optical signatures will be collected with a scanning monochromator from 0.4 to 2.4 micrometers and with a radiometer from 10.5 to 12.5 micrometers. Data will be collected for one week as the oil samples age.

The measured reflectances from the samples will then be used to determine how best to process data for oil spill observation from spacecraft or aircraft.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0009, PREDICTABILITY OF SHORT-TERM CLIMATE FLUCTUATIONS

K.E. Trenberth, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (ATM78-19318)

Globally distributed sea level pressure data are being analyzed in order to isolate two known potentially predictable modes of the atmospheric circulation with time scales of one to ten years. Both modes have been shown to be significant in spectra of sea level pressure data.

The first is the Quasi-Biennial Oscillation (QBO). It is a widespread phenomenon, found in records of meteorological and geophysical parameters world-wide, but no attempt has been made to compile the details of the globally coherent patterns of the QBO or fully assess its significance.

The second is the Southern Oscillation (SO), which has a well defined time-scale of about 3-6 years and is most prominent in tropical regions. It has been shown to be the primary global mode of the normalized monthly sea level pressure field (in the sense that it explains more variance than any other). However, the importance of the SO for high latitude regions remains to be determined.

Since the time scales of these two modes are well defined (viz. about 2 years and 3-6 years) filtering of time series combined with empirical orthogonal function analyses should enable the modes to be isolated in the sea level pressure field. Spectral and cross-spectral analysis techniques are being used to investigate interrelationships between different modes in the atmosphere. The time series describing each mode will then be used to determine their importance and contribution to other geophysical parameters and economically important factors such as crop yields.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0010, REMOTE SENSING OF CURRENTS (RSC)

W. Scherer, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey, Engineering Development Lab., *6001 Executive Blvd., Rockville, Maryland* 20852 (86221300)

OBJECTIVE: Verify the practicality of remote sensing of currents by demonstrating a single channel acoustic device. Develop and verify a body of theory describing the acoustic volume reverberation and Doppler shift mechanisms involved.

Generate functional engineering specifications with system limitations.

APPROACH: Design and develop a single-channel feasibility model that can be used to collect data for analysis and evaluation. Survey existing theoretical scattering models and develop new models where necessary to describe the volume scattering process as a function of environmental parameters. Verify a framework of models through experiment.

PROGRESS: Preliminary lab and field testing for single channel feasibility have been conducted. Data analyses and technical feasibility demonstrations are summarized in a working document entitled 'Remote Current Sensor Feasibility Demonstration, Summary Report.' Additional data sets were collected during 1978 and data analyses are in progress, as are theoretical model developments for identification of the scattering mechanism(s).

SUPPORTED BY U.S. Dept. of Commerce, National Ocean Survey, Engineering Development Lab.

5.0011, MAGNETIC INDICATORS OF SUBSTORM ACTIVITY

R.L. Carovillano, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Physics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF248270; F19628-77-C-0085)

AF function - operation of communication, detection, and navigation systems and satellite orbit prediction. Deficiency - severe geomagnetic disturbances produce extreme departures from the normal conditions in the ionosphere that degrade system performance and increase atmospheric drag on satellites. Objective - develop a method for identifying the onset and specifying the development of magnetospheric substorms utilizing measurements made by the Air Force Geophysics Laboratory ground-based magnetometer network. How research contriubtes - a method for real-time specification of the development of magnetospheric substorms is essential for geomagnetic activity forecasts. The forecasts will enable system operators to take appropriate measures to lessen the impact of magnetic disturbances on operational capability.

Specifying substorm activity with data from the Air Force Geophysics Laboratory magnetometer network involves efforts in three areas - development and evaluation of a suitable index, investigation of micropulsation activity as related to substorms, and extension of ionospheric current models to characterize the intensity and location of current systems producing mid-latitude magnetic variations. An index specifying substorm activity will be developed utilizing measurements made by the magnetometer network as the main data input. The quality of the index will be evaluated by comparing it with additional magnetic and auroral particle data from a number of observed substorms occuring at various universal times. Geomagnetic micropulsation activity in the period range 10-150 seconds will be investigated for possible correlations with interplanetary magnetic field conditions that generally result in substorm activity. Analytical models of global ionospheric currents will be improved by including experimentally determined ionospheric conductivities and extended to calculate the magnetic perturbations produced at the surface of the earth.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, DEVELOPMENT OF NONLINEAR INVERSION ALGORITHMS

A.S. Zachor, Honeywell Inc., Radiation Center, *2 Forbes Rd., Lexington, Massachusetts* 02173 (DF249800; F19628-77-C-0184)

AF function - remote sensing of atmospheric moisture environment. Deficiency - moisture information contained in DMSP satellite data is not currently utilized. Objective - to develop retrieval algorithm which will extract from the radiance data all possible information regarding atmospheric humidity structure. How research contributes - determines the capability of remote satellite sensing for mapping the atmospheric moisture environment.

Existing algorithms will be analyzed for inference efficacy. Computer code will be chosen and developed for application to Block 5D DMSP H-Package radiance data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, STUDY OF ENERGY BALANCE AND PLASMA MOTIONS IN THE IONOSPHERE

A. Dalgarno, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (DF581840; F19628-78-C-0047)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of energy balance and plasma motions in the ionosphere for the design of AF communication and navigation systems. Objective - development of theoretical and computational techniques for the calculation of quantities pertaining to the energy balance and plasma motions in the ionosphere including the effects of particle precipitation and electric fields. Satellite measurements shall serve as inputs to calculations and as a test of the validity of the theory. How research contributes -provides data and analysis essential for the design and maximum utilization of communications, guidance and surveillance systems such as the defense satellite communication system, AF SATCOM II, 4141. The work provides an understanding of the dynamical processes in the ionosphere.

Study theoretical and computational procedures for calculation of energy balance, plasma motions and electrical conductivities on a global basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, MEASUREMENT OF TIME DEPENDENT PARAMETERS OF STRATOSPHERIC TURBULENT LAYERS OVER LEVEL TERRAIN

R.E. Good, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581150)

AF function - provide data to predict if there is a significant change in the environmental quality of the stratosphere as a result of flight of USAF aircraft and missiles. Deficiency - existing data on stratospheric transport is insufficient to accurately predict changes in stratospheric composition from small perturbations caused by aircraft and missile exhaust products. Objective - conduct and analyze balloon-borne observations of the characteristics of turbulence layers. How research contributes - measurements of the turbulence characteristics over level terrain, away from mountains will be compared to previous measurements over mountains. This data will then be used to derive representative mixing coefficients and stratospheric pollution residence times over the United States. This will result in more precise environmental impact assessment of AF flight operations.

A balloon platform is used to carry a corona turbulence sensor that measures the intensity and spectral characteristics of turbulence layers. The balloon will initially be allowed to rise to 90,000 ft. producing a vertical record of the location of turbulence layers. The balloon will then be forced to descend so to float in a turbulent layer for several hours to observe the time history of the turbulent layer. This will be repeated several times during the estimated ten hour mission. A total of four balloon flights are planned with launches from Watertown, S. Dakota. Two flights will be made in early March and two flights during the summer to cover the westerly and easterly flow conditions. Additional turbulence data will be obtained with piggyback experiments flown on the BAMM program. A gas tracer payload developed and tested under LDF funds will be refurbished for four flights to obtain turbulence transport data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, POST BURNOUT THRUST AND OUTGASSING MEASUREMENTS FOR SOUNDING ROCKETS
E.F. McKenna, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580680)

AF function - sounding rocket operations. Deficiency - degradation of scientific data due to interference from expended solid propellant sounding rocket motor. Objective - to determine the magnitude of low level post burnout thrust, outgassing and particulate contamination by spent solid propellant rocket motors. How research contributes - knowing the magnitude of the hot gas discharge, motor throttling devices or vehicle/payload separation systems could be developed that would allow clean payloads to fly on the normally less expensive solid propellant rocket motors.

A separable payload will be designed and flown on a solid propellant sounding rocket motor that will measure the post burnout combustion mass flow rate and resulting thrust, monitor the diffusion of motor outgassing, and observe and measure the relative motions of the two bodies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, EQUATORIAL IONOSPHERIC IRREGULARITIES MEASUREMENTS
R.S. Narcisi, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249350)

AF function - maintain command control capabilities for Air Force operations in naturally or nuclearly disturbed conditions. Opportunity - the wide band satellite permits propagation measurements during periods of equatorial scintillations. Objective - measure the distribution of ion species during periods of equatorial scintillations to determine the structure and development of small scale ionospheric irregularities. How research contributes - this effort will provide the first detailed measurements of ionospheric irregularities in conjunction with wideband satellite amplitude and phase measurements. From this, the physical causes of scintillations can be understood to then permit the determination of trans-ionospheric electromagnetic channels for defense communication and navigation systems.

Three rocket payloads were prepared for launch in conjunction with passes of the wideband satellite experiment. One was flown on a DNA-provided launch; although data were obtained, the vehicle failed to achieve the required altitude. The series was postponed, as a result, and the experiments are now planned for a May or August 1978 launch window. After the remaining two flights are completed, analysis and interpretation of the data will begin but completion of the final report is not expected until approximately one year following the experimental series.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, VARIATION OF THE SOLAR ULTRAVIOLET LUMINOSITY
S.P. Worden, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582550)

AF function - communication, surveillance, detection, tracking. Opportunity - to determine factors which influence long range weather patterns and atmospheric conditions. Objective - to determine whether the sun varies its ultraviolet luminosity by more than .1 percent over the course of a year. How research contributes - changes in solar ultraviolet luminosity may be the major factor influencing long range weather patterns as well as upper atmospheric ionization conditions. If such changes can be observed and predicted Air Force long range prediction capabilities in these areas may be greatly increased.

Because there is no suitable comparison source against which to directly observe changes in the solar ultraviolet luminosity we will use sunlight reflected off objects in the outer solar system such as the moons of Saturn. These will be compared against stellar standards to determine variability. We will use the Cloudcroft, New Mexico 48-inch photometric telescope for this purpose. The National Science Foundation will operate this telescope for one year to do this study. We have chosen outer solar system objects both with atmospheres, such as Saturn's moon Titan, and without atmospheres, such as Saturn's moon Rhea. We feel we can obtain .1 percent accuracy in our measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, FAST SOLUTION METHOD APPLIED TO AN NWP MODEL ON A SPHERE
S.Y. Yee, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581330)

AF function - military operations involving Air Force vehicles used by strategic tactical and general purpose forces. Deficiency - such operations are adversely affected by deficiencies in specifying and predicting winds and weather because of inaccurate or inefficient methods used in solving numerical weather prediction (NWP) models. Objective - to develop accurate and efficient methods for solving the NWP model equations. How research contributes - research will improve the accuracy and timeliness of weather forecasts.

The technical problem is one of casting an NWP model in a global setting, removing the coordinate singularities of a Poisson-type equation at the poles and overcoming the computational instability problem of a hyperbolic equation near the polar caps. The approach is to formulate the model equations in spherical coordinates, take special care in dealing with the polar caps, and insure computational stability by the use of digital filtering.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, OBSERVATIONS OF SUBSURFACE EQUATORIAL JETS IN THE INDIAN OCEAN
J.R. Luyten, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (ATM7821491)

The central scientific objective of this research is the observation of the east-west scales of the near-surface equatorial jets in the Indian Ocean, including their fate in the presence of the African coast. To accomplish this objective, a field program will be undertaken to measure velocity, temperature and salinity profiles at approximately 18 sites, extending from 47 degrees E near the African coast, to 70 degrees E in the central part of the western Indian Ocean. This observational program is an integral part of the oceanographic component of the GARP regional subprogram, the Monsoon Experiment (MONEX), contributing to the overall scientific objective of observing and understanding the sources and the onset process of the Somali Current. The equatorial region plays an important role in theoretical models of the onset phenomenon, and the influx of mass and momentum from this region is an important element in any estimates of the budgets in the Somali Current.

The Indian Ocean is subject to strong meteorological forcing at the annual periods and longer. The winds are monsoonal, blowing in the western Indian Ocean from the southwest from May until September and from the northeast during the remainder of the year. There is a corresponding set of oceanographic phenomena which are presumably related dynamically to the monsoon winds. Hence, the Somali Current is intimately connected with the Indian monsoon and the scientific problem addressed here is a first step in understanding the detailed dynamics of that connection.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0020, REMOTE SENSING TECHNIQUES TO OPTIMIZE THE RECLAMATION OF PRIME FARMLAND
C.J. Johannsen, University of Missouri, Columbia Campus, Agricultural Experiment Station, Dept. of Agronomy, *130 Jesse Hall, Columbia, Missouri* 65201 (0076636; MO00356-3)

OBJECTIVE: Characterize soil and vegetation parameters on prime farmland and newly strip-mined prime farmland utilizing direct measuring and remote sensing techniques. Develop a

data base format for storage and retrieval of collected information. Provide information in format usable by reclamation authorities.

APPROACH: Study sites of prime farmland and newly mined prime farmland will be located at active mining areas in two different geographic locations of the state. Detailed soil descriptions and data will be obtained using soil borings to a depth of 6 feet on a 50 foot grid. Vegetation will be established on the mined study areas. Measurements and observations of vegetation will be made on the same grid locations. Aerial photography will be flown at selected time intervals during the growing season. The film will be scanned by film recorder and response measurements obtained on a grid system. Through a data base retrieval system (to be developed) correlations of remote sensing responses with soil and vegetation parameters will be demonstrated. Results will be provided to extension service personnel to be utilized in educational programs as well as work by Missouri Land Reclamation Commission.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Missouri

5.0021, NAVY ENVIRONMENT - GRAVITY MEASUREMENTS AT SEA AND LOCAL MARINE GRAVITY AND GEODETIC ANOMALIES

M. Talwani, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (DN475182; N00014-75-C-0210)

The accuracy of inertial navigation systems, which are used extensively by the Navy in ships, submarines, airplanes, and missiles, is limited by the extent of knowledge about the earth's gravity field and consequent deflections-of-the-vertical. In support of the Navy's extensive effort to expand this knowledge, this program is (1) providing gravity data over the world's oceans, (2) helping to provide basic understanding of gravity variations which is necessary for predicting deflections-of-the-vertical, and (3) determining the relationship between local gravity and geodetic anomalies.

Surface and satellite-derived gravity data will be analyzed to determine the geologic structure of the crust and upper mantle in the region of plate boundaries and marginal basins. Regional maps of 1 deg x 1 deg average gravity anomalies will be published. Detailed geoids constructed from surface gravity data and satellite data will be used to determine deflection-of-the-vertical at sea in regions of large deflections. Mathematical techniques will be developed to determine density inhomogeneities from geoid undulations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0022, STUDIES OF THE EQUATORIAL IONOSPHERE AND ATMOSPHERE

D.T. Farley, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (ATM7812323)

This award funds a program of research leading to a better understanding of the basic physical processes controlling Earth's equatorial ionosphere and atmosphere. The program includes: studies of plasma turbulence in the equatorial electrojet and equatorial F region; measurement of winds and temperature variations in the E region; studies of electric field variations at the equator and how these are related to high latitude phenomena; and studies of radar scattering from the troposphere, stratosphere, and mesosphere.

The experimental work will be carried out at the Jicamarca Radio Observatory located near Lima, Peru. This radar is uniquely situated for equatorial studies; it is also currently the most powerful system in the world for scatter measurements of the upper stratosphere and lower mesosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0023, ASSESSMENT OF THE HYDROLOGIC EFFECTS OF STRIP MINING IN THE NEW RIVER BASIN OF TENNESSEE

W.P. Carey, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *A 413 Federal Bldg., U.S. Courthouse, Nashville, Tennessee* 37203 (D8-E685-BW; V625C-081)

OBJECTIVE: The general objective is to determine the effect of coal mining on water quality, sediment production, and streamflow in the New River basin of Tennessee. Specific objectives are to derive land cover and physical parameters of the basin, assess temporal changes, characterize sub-basins and monitor select sub-basins to assess integrated effects on hydrology, and characterize spatial differences in water quality, suspended sediment, and bed-load transport for both short and long-term events.

APPROACH: The approach is to derive land cover data to characterize the basin and segment it into relatively homogeneous regions. Monitoring stations have been established at the outlet of each region and at the mouth of the total basin. Six small basins with different mining activity will be monitored for surface water, water quality and suspended sediment; three of these will have continuous sediment samplers and measurements of bed-load. These will be used to establish the range of quality and runoff parameters and to calibrate digital models of the runoff, water quality, and sediment load characteristics.

PROGRESS: LANDSAT imagery was used to characterize land cover in the basin into nine land cover categories covering the entire 382 sq. mi. basin. All water monitoring stations have been installed and are operational. Five of the stations have automatic pumping samplers and one has an automatic six parameter water quality sampler. Data has been acquired over a considerable range of hydrologic extremes including floods with a 35-year return frequency. Data acquisition will be maintained but emphasis in 1979 will be on reports.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

5.0024, INVESTIGATION OF THE CIRCULATION AND PRECIPITATION STRUCTURES OF SOUTH CHINA SEA DISTURBANCES DURING THE WINTER MONEX

J. Simpson, University of Virginia, School of Arts & Sciences, Dept. of Environmental Science, *Garrett Hall, Charlottesville, Virginia* 22903 (ATM78-00233)

The objective of this proposal is to study weather disturbances in the South China Sea as a part of the U.S. program under the Monsoon Experiment (MONEX), a regional subprogram of the Global Atmospheric Research Program (GARP). The principal platform for these studies will be the National Center for Atmospheric Research (NCAR) Electra Aircraft. MONEX is a study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmosphere and ocean in monsoon regions of the world. The monsoon is an intense regional weather phenomenon, but is second only to the global general circulation of the atmosphere (the Hadley Circulation) in energy content and, therefore, affects weather and climate on a global scale.

Specific research goals are to investigate: 1) The relationship between growth, development and decay of South China Sea disturbances to the cold surges of the winter monsoon; 2) The small-scale structure of these disturbances, the organization of their clouds and precipitation; and 3) How the monsoon and the disturbances, down to the small-scale cloud structures, interact to control or modulate precipitation over the maritime continent of Malaysia.

These investigations contribute to two main MONEX objectives: 1) Improved precipitation forecasting for the Malay Peninsula, a vital problem owing to the heavy flooding often occurring in early winter; and 2) Documentation of the latent heat supply for the winter planetary (Hadley cell) circulations in the Asian Monsoon area.

A secondary objective of this research is to compare the dynamics, thermodynamics and structure of cloud and disturbance scale weather phenomena over the monsoon region with those over the GARP Atlantic Tropical Experiment (GATE)

area. The PI and her group were active participants in GATE which was carried out in 1974.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0025, NAVY ENVIRONMENT - STRATOSPHERIC CONSTITUENTS
D.J. Hofmann, University of Wyoming, School of Arts & Sciences, Dept. of Physics, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (DN223089; N00014-76-C-0170)

The objective of this work is to provide funds to support an atmospheric electrical measurements workshop to be held at the University of Wyoming, Laramie, Wyoming during the summer of 1978. In addition to an exchange of technical information the workshop will conduct balloon-borne experiments offered by the participants in the area of the influence of aerosols on the electrical properties of the atmosphere.

The University of Wyoming desires an exchange of information relating to the influence of aerosols of the electrical properties of the atmosphere. A workshop is an excellent means to achieve this goal. Actual balloon-borne experiments will be conducted during the workshop to provide comparisons of similar instruments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, PLATFORM MOTION REQUIREMENTS FOR INITIAL TRAINING OF AIR-TO-AIR COMBAT SKILLS
L.D. Pohlman, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223230)

To determine the effectiveness of platform motion for the initial training of F4 air-to-air combat skills and to determine whether the onset cues provided by the synergistic six-post system on the simulator for air-to-air combat (SAAC) transfer of skills to performance in the aircraft.

The incremental training value of simulator platform motion will be determined through the application of a transfer of training paradigm. In the event that onset motion cuing has an incremental transfer effect, students training using platform motion should perform significantly better in the airplane than students trained without platform motion. To make this assessment, three groups are required: (1) students trained in the simulator who receive onset cuing provided by platform motion, (2) students trained in the simulator who do not receive onset platform motion cuing, and (3) students who do not receive any simulator training. The third group is necessary to establish that transfer from the simulator to the aircraft has occurred. The research effort will include the following tasks: (a) selection of air combat maneuvers where motion cues could play a vital role and the development of performance measures for those chosen, (b) development of a syllabus for training these fighter maneuvers, (c) evaluation of the effects of platform motion in terms of transfer of training to the aircraft using student pilots, and (d) evaluation of the effectiveness of the training provided.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, USMC AIR NAVIGATION TRAINING
O.A. Larson, U.S. Dept. of Defense, Navy, Personnel Research & Development Center, *San Diego, California* 92152 (DN797567)

To develop a program for training Marine Corps helicopter pilots in techniques that will allow them to fly over unfamiliar terrains under a wide variety of environmental conditions.

Map interpretation and terrain analysis techniques will be developed and evaluated. Flight navigation problems specific to USMC operational requirements will be analyzed and recommendations made. Materials and methods will be field-tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Personnel Research & Development Center

6.0003, AN EVALUATION OF MALE AND FEMALE ANXIETY DURING SERE TRAINING
D.C. Gillman, U.S. Dept. of Defense, Air Force, Air Force Academy, Behavioral Science & Leadership Dept., *Colorado Springs, Colorado* 80840 (DF282270)

AF function - technology base. Deficiency - adequate information on the response of AF cadets to stress-inducing situations at the USAF Academy is not available. Objective - the purpose of this study is to examine several aspects of anxiety and stress in second-year cadets participating in survival, evasion, resistance, and escape (SERE) training. How work contributes - the results of this study will make it possible to determine the levels of anxiety present in male and female cadets and to compare these anxiety levels with national collegiate norms. Further, it will determine how stable trait anxiety is, how much anxiety, stress, depression, and fatigue SERE training creates in men and women, and how stressful the SERE experience is compared to a normal college environment.

This effort is a continuation of work begun during the summer of 1977. Approximately 450 cadets from the class of 1980 were administered a questionnaire comprised of the following instruments: the eight-state questionnaire, Institute of Personality and Ability Testing (IPAT), Champaign, Illinois, the Anxiety Scale Questionnaire, IPAT, the Stressful Situations Questionnaire, Hodges and Felling, 1976, and specially constructed items dealing specifically with SERE training. These same instruments, with slight modifications, will be administered to the class of 1981 before and after SERE training during the summer of 1978. This pre-test/post-test design will detect any change in anxiety levels caused by SERE, and will yield valuable information about male versus female response to physically and mentally stressful experiences.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

6.0004, LONG TERM PULMONARY EFFECTS OF MILITARY AVIATION
N.R. MacIntyre, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Medical Sciences Dept., *Pensacola, Florida* 32508 (DN477051)

This study is directed toward determining if repeated exposure to the high performance jet environment, including 100% oxygen usage over the course of a naval aviation career, produces any significant change in pulmonary functions.

The study was originally designed to test spirometric function of jet versus non-jet naval aviators. Significant differences are emerging. It is now appropriate to further evaluate these pilots using more sensitive and sophisticated techniques. Additionally, the long term characteristics of the 35 year old 1000 aviator population offers a unique opportunity to study the natural history of pulmonary function in various aviator subgroups.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0005, DEVELOP NOISE-CHECK TECHNOLOGY FOR MONITORING AIRCRAFT NOISE
P. Rentz, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF322710; F33615-77-C-0514)

A vital part of Air Force environmental noise planning efforts is the need to perform spot-check noise measurements which provide data supporting predicted noise exposure values and the corresponding decisions made regarding land use compatibility and environmental noise impact. The objective of this contract is to develop the aircraft noise monitoring technology needed by Air Force personnel to collect field measureed noise exposure data acceptable as evidence in cases involving extreme controversy or litigation.

The contractor will review the present state-of-the-art in aircraft noise monitoring technology. He will develop specific

procedures and instrumentation requirements for use by Air Force personnel in collecting noise exposure data able to withstand the closest technical scrutiny. The contractor will demonstrate the adequacy of the proposed AF noise-check methodology by performing an actual field application study at an AF airbase. Refinements in noise-check will be made after analysis of the data from the field application study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0006, CONCEPTUAL DESIGN AND MODIFICATION OF HUMAN IMPACT RESEARCH FACILITIES

J.A. Brown, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321460)

The success of research to define human exposure limits to emergency escape and aircraft crash environments and the development of design and evaluation criteria for personnel protective equipment in these environments is dependent upon the availability of adequate impact test facilities and equipment. The facilities must be capable of producing and measuring the complex acceleration-time histories that are experienced in USAF operations. Furthermore, they must be designed to meet the unique safety requirements associated with the use of volunteer subjects. The objective of this effort is to plan, design and/or modify impact test facilities and test fixtures required by experimental designs to meet USAF technology needs and operational safety requirements.

The capabilities of existing facilities and test equipment are assessed by test and analysis. Requirements for future research programs are studied to determine if these requirements can be met by existing equipment or by modification of this equipment. If new designs are required to meet the requirements, the design is developed through the conceptual phase and procurement specifications and plans are prepared and implemented. Operational performance capabilities and reliability of new and existing facilities are documented for review by laboratory engineering safety and human use committees. New instrumentation and data processing techniques are continuously investigated to improve measures of biodynamic responses and overall measurement accuracy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0007, COMPUTER AIDED HUMAN ENGINEERING DESIGN

J.W. McDaniel, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320930)

The objective of this work unit is to develop a computerized technique which will accomplish major elements of the design of man-machine crew stations. The products will be detailed, integrated design requirements to be utilized by those activities that procure crew stations and the capability to provide either crew station design alternative or evaluation of existing designs. The work unit will also provide realistic modeling techniques for evaluating man's performance capabilities in hazardous environments in order to reduce the risks associated with experimenting with human subjects. This effort is coordinated with cognizant U.S. Navy and NASA personnel in regard to both overall objectives and technical approaches.

Computer-aided design and evaluation techniques will be developed which translate the human engineering data statistical bases into functional standards for crew station design and evaluation. Computerized interactive graphics techniques will be employed to minimize the time required to (1) design crew stations and (2) analyze that or other designs. The computerized biomechanical man-model (COMBIMAN) program will display to the user a man-model of variable proportion capable of simulating the physical characteristics of crew members in a true 3-D crew station. During FY 77, the COMBIMAN link and enfleshment equations will be validated against actual subject data including clothing and protective equipment variables. By the end of 1978, the model will be able to simulate the characteristics of AF women in the workplace. The human engineering computer-aided design (HECAD) program will allow the user to perform complex task analyses on candidate control/display configurations. The times required to reach, operate, and attend to various types of controls/displays can be rapidly determined on an interactive graphic type display. During 1977, human performance data on operation of standard cockpit components will be incorporated in HECAD.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0008, SCREENING TECHNIQUES

R.D. Odonnell, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321080)

To develop a graded screening procedure for potential visual countermeasures which will allow increasingly more refined decisions concerning the effectiveness of the countermeasure against anticipated threats. The enormous costs of high fidelity and field simulation requires that only proposed countermeasures with a high probability of success be tested in these modes. The ultimate purpose is to add a low-cost series of screening procedures to a systematic evaluation sequence in order to allow larger numbers of countermeasure ideas to be tested, and to cost-effectively evaluate those with the highest probability of success. Supports AFSC development goals SO-5, TC-5, and TC-8.

Traditional and novel measurement techniques will be explored for potential utility in evaluation of countermeasures concepts. Such techniques include classical psychophysical measures, standard laboratory performance metrics, as well as standard and novel psychophysiological evaluations (e.g., visually-evoked responses, eye movement analysis, etc.). In addition, a generalized tracking task containing the highest level of fidelity consistent with a broad range of operator input requirements will be developed under a separate work unit. This tracking task, and other promising measurement techniques developed in the laboratory will be validated against high fidelity simulation and field tests, and will be sufficiently standardized to become part of assessment battery for potential countermeasures concepts. Integration of these screening procedures with higher fidelity evaluations will provide a systematized process which will allow maximally cost-effective decisions concerning the development of each countermeasure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0009, EFFECTS OF LONG DURATION NOISE EXPOSURE ON HUMAN AUDITORY PROCESSES

M.R. Stephenson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321290)

Noise exposure standards for durations of 16 hours and greater as experienced during long missions and duty assignments are tentative and require additional knowledge to finalize criteria. Research carried out under this work unit will attempt to identify and measure changes in human auditory processes effected by noise exposure durations of greater than 16 hours. These efforts will provide part of data base necessary to validate and/or revise existing tentative hearing damage risk criteria and establish firm criteria and standards. This work is being coordinated with the Environmental Protection Agency and is being partially funded by EPA under Interagency Agreement Number EPA-IAG-D6-0356.

The approach will be to measure safe temporary hearing losses induced in human subjects by long duration low level acoustic exposures and to analyze the hearing recovery curves as additional indicators of risk. Human subjects will be exposed to broadband noise with exposure durations of between 24 and 48 hours. Groups of subjects will experience systematic variations of such acoustic parameters as the intensity, duration, and duty cycle of the test stimulus. Effects of the stimuli will be identified by monitoring the subjects' audiometric thresholds at specific time intervals.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0010, SUBJECTS FOR HUMAN FACTORS APPLIED RESEARCH

W.J. Hovey, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF318360; F33615-76-C-0524)

The primary purpose of this contract is to procure the services of student volunteers to serve as experimental subjects in experiments conducted by and for the Human Engineering Division of the 6570 Aerospace Medical Research Laboratory for human factors applied research. The secondary purpose is to procure professional-technical effort associated with requirements herein specified.

This effort will be involved in experiments to determine human performance capabilities and limitations as they relate to the design of Air Force equipment and systems and to establish design principles and criteria for optimum utilization of human performance capabilities. For example, university students will serve as subjects to determine operator capabilities for controlling remotely piloted vehicles, head switching comparison, voice recognition, joystick evaluation, validation of COMBIMAN, anthropometry of design eye position, test and evaluation of special purpose photo-grammetric system, HUD symbology criteria, windscreen visibility, etc. These experiments will be conducted at the Human Engineering Divison facilities at Wright-Patterson Air Force Base. Screening and pretesting of subjects will be done by the contractor at the contractor's facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0011, DATA REDUCTION AND BIODYNAMIC MODELING

D. Leet, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF323720; F33615-78-C-0504)

The constant trend toward the design and development of faster and more mobile aerospace systems requires an increasingly greater understanding of man's interaction with and tolerance to the physical environmental demands of such systems. The present program is for the purpose of quantitatively defining given biodynamic environments, determining the physical and physiological properties and responses of the human body with respect to vibration, blast and impact force environments encountered in high-performance aerodynamic operation and during emergency procedures, providing necessary data in proper format for formulating injury criteria and tolerance limits and developing mathematical and computer models to describe complex biological functions.

This program will include the development of experimental biodynamic data reduction techniques, formulation of new and modification of existing computer programs for the simulation of human body dynamics, the generation of quantitative definitions for injury criteria based on such body models, analytic investigations of body tissue properties and development of mathematical methods applicable to the study of biological systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0012, CARDIAC CHANGES DURING EXERCISE CONDITIONING AND ACCELERATION

H.L. Stone, University of Oklahoma, Norman Campus, Graduate School, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (DF050410; AFOSR-78-3506)

AF function - aircrew personnel operating high performance aircraft are exposed to increasing levels of rapid onset, sustained, repetitive maneuvering forces. It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance and severely limit or restrict the capabilities of the aircrew. Deficiency - with the development and deployment of high performance aircraft, flight personnel may be exposed to sustained periods of acceleration stress. Sustained plus Gz acceleration has been shown to produce marked changes in human cardiac performance characterized by various arrhythmias and ECG abnormalities. These responses have been interpreted as suggesting possible hypoxic or ischemic insult to the myocardium. The miniature swine has been proposed as an animal model having similar cardiac anatomy to that of humans and, for this reason, has been used in experimental studies designed to determine the effects of acceleration stress on the heart. Objective -the overall goal of the proposed work is to define the cardiac responses of miniature swine to the high sustained plus Gz acceleration levels which will be encountered by man in high performance aircraft during combat maneuvers. The major thrust of the current research is to identify the factor or factors leading to the cardiac responses previously observed in acceleration-stressed miniature swine. More specifically, the relative contributions of physiological factors (sympathetic nervous system) and/or mechanical stresses associated with plus Gz acceleration will be determined. How research contributes - the research is in direct support of RO 1.6, 'habital crew environments in AF operations' and supplements ongoing projects at AMD.

After exercise conditioning and left stellate ganglionectomy, acceleration will be imposed to determine whether those responses previously observed in acceleration-stressed swine can be prevented or reduced in magnitude. Cardiac responses will be evaluated on the basis of physiological, biochemical, and histological changes. The measurement of cardiac function, indices of myocardial metabolism, coronary blood flow, and serum enzyme levels will provide information regarding the physiological status of the myocardium during acceleration stress. Long-term effects of repeated exposure to high sustained TS made in cardiac tissue will be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0013, MASS DISTRIBUTION CHARACTERISTICS OF LIVING HUMAN BEINGS

R.E. Herron, Baylor College of Medicine, School of Medicine, *1200 Moursund Ave., Houston, Texas* 77025 (DF320390; F33615-76-C-0529)

The goal of this effort is to describe the variability of mass distribution characteristics of Air Force men for providing design criteria for analogues of the human body. These analogues are used to assess man's reactions to hazardous environments, e.g., impact, ejection, and to evaluate systems to protect man against such environments.

Stereophotographs will be made of a sample of 30 males selected to represent the body-size distribution of the Air Force population. From the stereophotographs, the weight, volume, location of the center of mass, and moments of inertia about the principal axes of inertia of the body and its major segments will be assessed. The relationships between these parameters and the anthropometry of the subjects will be established from which population statements will be formulated to serve as design criteria for human analogues.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0014, DEVELOPMENT OF IMPROVED METHODS FOR PREDICTING INVOLUNTARY SEPARATION

C.D. Gott, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233340)

To develop improved mathematical/statistical methods for predicting involuntary separation within the Air Force enlisted force and other success/failure criteria such as graduation/elimination from undergraduate pilot training (UPT), technical training, and basic military training (BMT). Generalize the resulting mathematical prediction system to improve predictability in other areas of the personnel system. Compare and evaluate the predictability of the motivational attrition prediction (MAP) model with other existing and/or newly developed prediction systems.

The MAP prediction model will be implemented and tested on AFHRL's UNIVAC 1108 computer system. The original data base used by AFMPC/DPMYAA in developing MAP will be used by AFHRL to assure error-free implementation by duplicating the original study for which MAP was developed. Other already operational prediction systems and/or modified and improved new systems will be implemented and tested. For comparison purposes, the data base of approximately 15,000 recruits entering the Air Force in 1972 will be used. For this data base, the necessary predictor variables, such as history opinion

inventory (HOI), aptitude scores, high school courses, demographic information, and attrition criterion data are already available. The final optimum prediction model will be used to generalize to prediction of other success/failure-type binary and/or categorical criteria. Milestones--Dec. 77, implementation of MAP on U1100 computer system. Mar. 78, reanalysis of 1972 AF accession data using MAP and other existing and/or modified prediction systems to arrive at the system with the optimum predictability. June 78, technical report comparison of multiple linear regression and MAP for prediction of involuntary separation. April 79, completion of systematic study to generalize to prediction of other success/failure criteria. Dec. 79, technical report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0015, MULTIPLE RISK FUNCTIONS FOR AIR FORCE PERSONNEL

R.A. Albanese, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321780)

Coronary artery disease (CAD) is a major cause of ineffective time and disability retirement in the Air Force, and has been implicated in aircraft accidents. Thus early diagnosis and prevention of CAD in aircrew members is of importance to the Air Force. Several clinical factors (serum cholesterol levels, blood pressure, EKG changes etc.) are known to be associated with an increased risk of CAD in human subjects. This work unit focuses on the development of mathematical equations which numerically relate clinical risk factors to the occurrence of CAD in flying personnel such that these equations can actually be used in early disease diagnosis and prevention at significant costs savings to the Air Force.

The first step will be a computer implementation of the Walker-Duncan algorithm for fitting the multiple logistic risk function. This function, when properly fitted to Air Force data, will numerically indicate the presence of CAD and/or the potential to develop CAD in flying personnel as a function of available clinical risk factors. The Walker-Duncan algorithm must then be compared with discriminant analysis techniques for fitting the multiple logistic risk function. The clinical factors entering the risk function as predictors of disease will be freed of confounding side-conditions, including seasonal effects, and daily rhythms, using multivariate statistical techniques. To refine the diagnosis of CAD, statistical analyses of x-ray views of the heart vessels (coronary cineangiograms) will be accomplished to improve the delineation of disease severity. This work was formerly a part of project 6319 and was documented under work unit 02-10.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0016, BIOMEDICAL CRITERIA FOR ADVANCED RESPIRATORY LIFE SUPPORT SYSTEMS

F.W. Baumgardner, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322500)

The performance of aircrew breathing systems must insure adequate physiological function to users in diverse operational environments. In dynamic operation current inventory regulators waste oxygen, exhibit flow limitations, and impose physiologically stressful breathing pressures on the cardiopulmonary system of the user. The primary objective of this work unit is to establish concepts and data for the development of systems which optimize oxygen delivery to aircrew of advanced and conceptual aircraft. Additionally, individual ventilation requirements under various flight profiles and levels of physiologic stress will be assessed with reference to current equipment as well as the development of new generation oxygen delivery systems. These efforts are coordinated with ASD/AEL on a continual basis in accordance with letters of agreement and with ASD/ENECE in accordance with TN-ASD-AMD/SAM-0103-77-61. Close technical liaison is maintained with Oklahoma City ALC, ASD/ENESS, NADC and USAARL. Previous accomplishments in this area are documented under work units 71641717 and 71641718.

Laboratory studies as well as informal reports from the operating commands have indicated that current military specifications for oxygen supply and the delivery equipment do not adequately meet man's respiratory requirements in high performance aircraft now being deployed. Efforts through FY 78 will be oriented toward providing ASD with standards for revising Mil-R-83178, specification for oxygen regulators, and Mil-V-27296, oxygen mask inhalation, exhalation valve. These efforts will include investigation of physiologic parameters such as instantaneous ventilatory flow, ventilatory pressure, tidal volume, respiratory frequency, inspiratory acceleration, minute ventilation and oxygen consumption. The physiologic effects of current inventory equipment such as hose length between oxygen regulator and mask will also be examined. Standards derived from physiologic studies will be reported to ASD/ENECE, in accordance with the requirements of TN-ASD-AMD/SAM-0103-77-61, and to ASD/ENESS for incorporation in appropriate AFSC design handbooks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0017, BIOMEDICAL LIMITS FOR MOLECULAR SIEVE OXYGEN CONCENTRATOR SUBSYSTEMS

J.P. Cooke, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322250)

The purpose of this work unit is to determine and define the biomedical limits of the molecular sieve oxygen concentrator subsystem. This effort is necessitated in view of the increased inert gas load in the body caused by the concurrent production of argon by the subsystem at levels 5-10 times that normally found in the atmosphere. This work unit is established to implement a new technology planning objective as directed by HQ Aerospace Medical Division.

A systematic analytical determination will be made at ground level and at various altitudes in order to define the inert gas loads in the body resulting from the wash-in of oxygen-argon mixtures and the wash-out of nitrogen. Particular attention will be addressed to conditions when the gas requirements (high workloads) placed on the subsystem are high, resulting in decreased oxygen concentration and a concomitant increase in nitrogen concentration along with a 5-10 percent argon concentration. The resulting data will be used to define the boundaries of the molecular-sieve subsystem where decompression will not be hazardous to crew members.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0018, USAF CENTRAL ECG LIBRARY

D. Hickman, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322020)

Identify aircrew members having electrocardiographic abnormalities that are associated with potential risk in terms of sudden incapacitation/flying safety. Serve as a consultation service to the field in terms of interpretating and defining the significance of ECG findings, and the administrative aspects of the latter. Establish better criteria for the significance of specific electro-cardiographic abnormalities in terms of aircrew selection and retention.

The routine review of the electrocardiograms on aircrew members and the consultation aspects of the USAF Central ECG Library are those outlined in AFR 160-43 and AFR 160-17. Long-term followup studies of specific electrocardiographic abnormalities will be conducted using questionnaires and the results of the medical evaluations within the aeromedical consultation service. Methods for automating ECG interpretation, filing, and retrieval will be explored.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0019, FIREFIGHTER WORKLOAD FIELD STUDY-ANALYSIS BY TELEMETRY

L.G. Myhre, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323480)

To use the field study approach to realistically evaluate the physiological stresses imposed on USAF firefighters during simulated firefighting operations. Aircraft related firefighting tasks are unique to military and other aviation related organizations, and there is a need to objectively determine the physiological requirements of these tasks to facilitate the evaluation and development of appropriate life support equipment. Specific objectives of this effort are to determine the workloads associated with various USAF firefighting tasks and to use the data thus obtained for the purpose of evaluating the adequacy of current and future self-contained breathing devices. In addition, USAF firefighting activity may be classified according to the observed work stresses; such a classification may be useful in the appropriate assignment of personnel.

USAFSAM scientists will travel to nearby ALC, TAC, and SAC bases where they will monitor (via telemetry) EKG and body temperature responses to simulated firefighting activities. These data may be used to estimate the energy requirements of USAF firefighters performing selected firefighting tasks, and, thereby serve as a means for evaluating existing self-contained respirators and/or firefighters' protective clothing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0020, DEVELOPMENT OF AN ADVANCED DESIGN ANTI-G SUIT

R.M. Shaffstall, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF319880)

Develop anti-g suit design concepts to be used in the research and development of advanced anti-g suits. Experimental anti-g suits will be developed to determine advanced suit design which will offer improved g-protection. Anti-g suit design specifications will result from this effort which will terminate with a technology transfer to ASD/AEL.

Various anti-g suit design concepts will be evaluated on the SAM and NADC centrifuges with physiologic criteria of g-protection using experimental subjects. Design concepts to be considered include bladder sizes, capstans, inflation profiles, and the use of anti-exposure garments. The anti-g suit design which offers the greatest g protection with subject comfort will be integrated with the advanced anti-g valve (work unit 7930-12-06) for the fabrication of an advanced g-suit/valve system (work unit 7930-12-xx). Specifications of this advanced anti-g system will be transferred to ASD/AEL for incorporation into aircrew systems of high performance aircraft. Physiological evaluations of blood pressure and blood flow gradients in relation to anti-g suit abdominal pressure will be studied in experimental animals. This data will assist in the determination of optimal anti-g suit bladder pressures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0021, GLAUCOMA

T.J. Tredici, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323020)

Glaucoma has long been recognized as an important cause of ophthalmologic morbidity and removal from flying status in USAF aircrew personnel. A concerted effort is made at base level to identify affected aircrew personnel early, based on elevated intraocular pressure. This is most practically performed by using the Schiotz tonometer. The use of this instrument is taught to all flight surgeons during their course of instruction at USAFSAM. Further, the use of tonometer as part of the base level follow-up program is the most important part of the USAF policy on glaucoma. The objective of this work unit is to evaluate criteria for diagnosis, to delineate factors or characteristics which identify the point in the disease process when therapy should be instituted, to evaluate therapeutic modalities for both efficacy of treatment in absence of visual side effects which would contraindicate the performance of further flying duties, and where possible, to identify factors which causally relate progression of the disease.

The approach will involve careful and detailed ophthalmologic evaluation of each individual patient, with both follow-up interval and decision to commence therapy to be determined on an individual basis. The extensive and changing knowledge in literature in this field, both military and civilian sources, will be utilized as well as the accumulated expertise of the Ophthalmology Branch, Clinical Sciences Division, in follow-up and treatment of this disorder in aircrew personnel. The study will also include those patients with a diagnosis of glaucoma who are on therapy with epinephrine drops which is recognized as efficacious and accepted by the Surgeon General for chronic use while retaining flying status (AFR 160-12). Work under this unit was formerly conducted under 7755-09-05 and 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0022, NEUROPSYCHOLOGICAL SEQUELAE AND PATTERNS OF DEFICIT IN USAF AIRCREW MEMBERS WITH CLOSED HEAD INJURY

R.D. Wheatley, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324320)

To establish base rates and a collection of descriptive data regarding neuropsychological, and other psychometric, sequelae and patterns of deficit in USAF aircrew with closed head injury.

Compares the psychometric test performances of 50 closed-head-injured aircrew with those of 50 non-head-injured matched aircrew controls. Objective neuropsychological, intellectual, and personality measures are used. Inter-group as well as intro-individual comparisons will be carried out so that inferences derived from levels and patterns of performance can be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, THE EFFECT OF HIGH GZ FORCES ON SYMPATHETIC NERVOUS ACTIVITY

M.G. Ziegler, University of Texas, Medical Branch at Galveston, School of Medicine, Dept. of Pharmacology & Toxicology, *300 University Blvd., Galveston, Texas* 77550 (DF052300; AFOSR-78-3601)

AF function - aircrew personnel operating high performance aircraft are exposed to increasing levels of rapid onset, sustained, repetitive maneuvering forces. It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance and severely limit or restrict the capabilities of the aircrew. Deficiency - high performance combat aircraft are now capable of plus Gz forces in excess of those man can tolerate and still maintain consciousness. The primary physiologic means by which man tolerates plus Gz forces is through vasoconstriction and tachycardia regulated by sympathetic nervous activity. Recent animal studies indicate that high plus Gz forces may elicit sympathetic nervous activity so intense that it can cause cardiac lesions. Objective - the study is designed to measure the involvement of the sympathetic nervous system in man's response to high gravitational forces. Since norepinephrine is the neurotransmitter of the sympathetic nervous system, measurements of levels of plasma norepinephrine should provide a reliable index of sympathetic nervous activity. How research contributes - this research directly supports research and exploratory development on-going under Subarea 1.6, 'habitable crew environments in the Air Force operations' and ADM TP06, 'crew technology', respectively.

These experiments will determine the NE and DBH responses of men to stress and high plus Gz. The effect of duration and intensity of plus Gz on plasma NE will be measured and then some of these studies repeated with subjects wearing an anti-g-suit to see how effectively the suit decreases stress to the sympathetic nervous system. The M-1 maneuver is effective in increasing man's tolerance to high plus gz. Since muscular straining increases plasma NE, the M-1 maneuver may work partly through stimulation of sympathetic nervous activity. Plasma NE levels will be measured on subjects performing the

M-1 maneuver to determine how effective a stimulus this is to sympathetic nervous activity. The levels of NE elicited by plus Gz and the M-1 maneuver will be compared with those elicited by exhaustive exercise.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0024, AERODYNAMIC FORCES EXERTED ON AN ARTICULATED HUMAN BODY SUBJECTED TO WINDBLAST

D.J. Schneck, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (DF053540; AFOSR-78-3706)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including flail and impact. These forces are of special significance in relation to the incidence of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. Deficiency - this research will provide input data needed for an elaborate biomechanical computer model of the human body which has been developed to determine the stresses, strains and injury mechanisms due to windblast during ejection. Objective - development of the theory of windblast effects on the human body as initiated under USAF/ASEE summer faculty research program and a recent mini-grant effort, examine the contribution of flow separation to limb flail during ejection, provide data for wind tunnel tests and for the articulated total body model studies at AMRL. How research contributes - this research will contribute directly to subarea 1.8 'aircrew safety and effectiveness in mechanical force environments.'

The researcher will elucidate the contribution of flow separation to the factors which initiate limb-dislodgment forces during ejection. These data will provide input to the AMRL articulated total body model, which will analytically describe the dynamics of ejection. Specific attention shall be focused on elucidating the time-dependent characteristics of the limb-dislodging forces, and on extending the analysis to include the head/neck configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0025, ADVANCED INSTRUCTOR OPERATOR STATION DISPLAY EVALUATION TECHNIQUES

C. Elworth, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF228130; F33615-77-C-0017)

Develop techniques for scientifically measuring and quantifying display effectiveness as it relates to the performance monitoring task of an instructor pilot during aircraft simulator operation. Recent and current AF specifications require or permit the use of CRT displays for providing performance relevant information to the instructor pilot. When a CRT is used, there are a great number of ways by which flight and performance data may be illustrated. Justification for choosing or developing one method over another is seldom if ever provided in terms of hard data due to the virtual non-existence of such data. This work will develop techniques for providing this data.

The contractor will review instructor pilot duties at the IOS and devise tasks which are sensitive to display techniques and formatting. Contractor will also devise measures to be applied to this task which can be used to quantify the effectiveness of various alternate displays used in conjunction with this task.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NUMERICAL DYNAMIC ANALYSIS OF STRUCTURES BY THE FINITE DYNAMIC ELEMENT METHOD

K.K. Gupta, California Inst. of Technology, Graduate School, *1201 E. California Blvd., Pasadena, California* 91109 (DF046950; AFOSR-77-3276)

AF function - design of aerospace vehicles. Opportunity - the finite dynamic element method has been developed for efficient free vibration and dynamic response analysis of large and complex structures. Objective - the finite dynamic element method will be developed for the discretization of the continuum involving plane stress/strain, plate bending, shell and solid of revolution elements. How work contributes -more effective structure analysis techniques could develop from this work.

Using the concepts of the finite dynamic element method, six dynamic elements pertaining to various continuum will be developed and implemented in computer programs. Two eigenproblem solution procedures for the quadratic matrix equations will be studied and implemented. The free vibration analysis program will be extended to yield a dynamic response analysis capability. This will be achieved by the model superposition method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, NUMERICAL STUDY OF THE FLOW IN A SIMULATED WING-FUSELAGE JUNCTURE

W.R. Briley, Scientific Research Associates Inc., *Glastonbury, Connecticut* 06033 (DN775273; N00014-77-C-0075)

The development of accurate numerical methods to describe the flow about aircraft and missiles is essential for their design and optimization. This research will study, within the framework of the incompressible Navier-Stokes equations, the structure of the flow field in the vicinity of the intersection of a wall (with its accompanying boundary layer) and a wind rounded leading edge.

The flow in the vicinity of an airplane wing-fuselage juncture is extremely complex because, in addition to being three-dimensional, it usually involves both separation and the formation of vortices. These vortices can have a pronounced effect on the wing characteristics. Because of the complicated nature of the flow, analysis is of limited value and experiments would be both time consuming and costly. The present investigation isolates the juncture region as an element of the entire flow field. Within this element the flow will be studied by an alternating direction implicit method within the framework of the Navier-Stokes equations--the only reliable description of the flow.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0003, WAVES IN TURBULENT MEDIA AND RANDOM LINEAR HYPERBOLIC SYSTEMS 15452-M

P.L. Chow, Wayne State University, School of Liberal Arts, Dept. of Mathematics, *4841 Cass Ave., Detroit, Michigan* 48202 (DA0F9164; DAAG29-78-G-0042)

To study wave propagation in time-dependent random media with special stress on effects of turbulence on the statistical properties of wave parameters. Relevance - study of time-dependent wave propagation is of practical importance to radio and optical communications systems. Specifically, the proposed work may provide better quantitative tools for measuring wave propagation of radio waves in the ionosphere and pulsed laser beams through the atmosphere.

Develop asymptotic and approximate methods for random partial differential equations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0004, INVERSION OF ISOPARAMETRIC MAPPINGS AND APPLICATIONS OF COMPUTER GRAPHICS TO 3D FINITE ELEMENT ANALYSIS

C.A. Hall, University of Pittsburgh, School of Arts & Sciences, Dept. of Mathematics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DF044020; F44620-76-C-0104)

AF function - the design of 3D structures for future aerospace vehicles. Deficiency - more effective and versatile analytical and computational methods are needed for the design of 3D structures. Objective - this research intends to develop computational techniques for solving structural design problems by the use of numerical analysis and computer graphics techniques. How work contributes - a computational and graphical presentation technique for analyzing complex 3D structures will be developed.

The research effort includes (1) extending to 3D isoparametric elements the type of characterization of bijectivity already developed for 2D, (2) investigating efficient means of computing and graphically representing the solution of stress distributions in a given plane of intersection, (3) searching for an efficient algorithm to numerically invert the 20 node isoparametric mapping, (4) studying strategies for deciding numerically if a given set of nodes will lead to an invertible isoparametric mapping, (5) studying strategies for detecting anomalies in geometric data by graphically interrogating the data base.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, NUMERICAL METHODS FOR COMPUTER SOLUTION OF ENGINEERING PROBLEMS

S.L. Parter, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Computer Science, *Agriculture Hall, Madison, Wisconsin* 53706 (DN823218; N00014-76-C-0341)

Improvements in the design of both ships and aircraft and a better understanding of the Navy environment depend on more accurate and more rapidly obtainable numerical solutions to differential equations used for description, prediction, and control of physical phenomena. Such phenomena include fluid and gas dynamics, certain chemical reactions, and electrodynamic phenomena. The objective of this task is to develop accurate and efficient methods for the computer solution of differential equations which recur continually throughout engineering applications, with particular emphasis on fluid mechanics.

Both analytical results and numerical methods will be derived for two point boundary value problems (and singular perturbations thereof), nonlinear elliptic equations, free boundary value problems, and functional ordinary differential equations. Such problems often exhibit very delicate, and even pathological, behavior. Thus, an analytic understanding of the problems is often a necessary prelude to the development of successful numerical techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, FAR INFRARED SPECTROSCOPY

P.L. Richards, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720

Improved infrared techniques are being used to do experiments in areas of fundamental and applied infrared physics where their impact is expected to be large. Programs in progress include measurements of the infrared radiation left over from the creation of the universe, measurements of the radiation from dust clouds in our galaxy, measurements of the infrared spectra of impurities in semiconductors, and measurements of the absorption spectra of the surface layers of liquids and solids. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0002, ENERGY TRANSFER IN CHEMICALLY REACTING SYSTEMS AND IN SURFACE CHARACTERIZATION

D.O. Harris, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DF046710; AFOSR-77-3138)

AF function - increased capabilities in remote sensing, communication, and several other areas depend on developments in laser technology and surface characterization. Opportunity - chemical lasers indicate a high probability of fulfilling these needs through their properties of different wavelengths, high power, high operating efficiency and lower weight. Objective - perform detailed studies of optically pumped metal excimers including high resolution spectroscopy. Determine effects of well-characterized solid surface interfaces on chemical reactions and on excited states of small molecules.

Obtain improved molecular constants, radiative lifetimes and quenching cross-sections for electronically excited molecules including Ca2. Presently Ca2 is produced in a stainless steel heat-pipe oven which can reach temperatures as high as 1100 degrees C, corresponding to a calcium vapor pressure of about 10 torr. Using alumina (Al2O3) a new heat-pipe oven capable of reaching 1600 degrees C will be developed which will allow calcium vapor pressures to one atmosphere. The higher operating temperature also will allow the investigation of other molecules such as Cu2 which are unattainable at lower temperatures. Using laser photoluminescence and high resolution spectroscopy, other molecules such as Rb2, Ba2, Mg2 and Sr2 will be investigated as potential optically pumped lasers. An ultra-high vacuum system will be assembled and aluminum atom reactions will be investigated in rare gas matrices near aluminum and aluminum oxide surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0003, RADIATIVE COLLISIONS

J.L. Carlsten, University of Colorado, Boulder Campus, Joint Inst. for Lab. Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (DN675412; N00014-76-C-0611)

The technical objective of this work is to investigate new atomic and molecular interactions which ultimately may have application to the development of new laser sources and frequency standards for naval applications.

The approach is to study the interaction of intense light sources with atomic vapors in a collisional environment. In particular, both spontaneous and stimulated collision-induced fluorescence will be studied. The experimental technique uses a nitrogen pumped dye laser whose output is scattered by a metallic vapor in an oven in the presence of a buffer gas. This scattered light is spectrally resolved by a monochrometer and detected with a photomultiplier whose output is then fed into a boxcar averager and then to a chart recorder.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0004, PRECISION SPECTROSCOPY OF EXCITED STATES OF ATOMIC HYDROGEN AND HELIUM, AND FUNDAMENTAL ATOMIC COLLISION STUDIES

V. Hughes, Yale University, Graduate School, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (PHY7684469A01)

Research in the spectroscopy of excited states of atomic hydrogen and helium, as well as in fundamental atomic collisions involving processes in three-body atomic systems, will include the following; 1. measurements of the fine structure in the P23 state and the magnetic moment in the S123 state of helium; 2. laboratory studies of the atomic regime believed to present in the ground state of light atoms at the surface of pulsars using transitions from the S2 metastable state of atomic hydrogen to very highly excited states (n approximately 100) in very strong magnetic fields (approximately 50 kG); 3. high precision determination of differential Lamb shifts and fine-structure separation in atomic hydrogen; 4. merged beams experiments on eV-energy electron-transfer collisions of protons with hydrogen atoms; 5. determination of spin-exchange effects in electron-hydrogen atomic collisions.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0005, OPTICAL AND ELECTRONIC PROPERTIES OF LUMINESCENT SEMICONDUCTORS, AMORPHOUS MATERIALS AND METASTABLE SOLIDS 13412-P

F.E. Williams, University of Delaware, School of Arts & Sciences, Dept. of Physics, *Newark, Delaware* 19711 (DA0W5576; DAAG29 76 G0098)

To produce new fundamental information on the electronic states of luminescent semiconductors, amorphous materials and metastable solids. The proposed work on secondary explosives is very much in line with the goals of the Explosives Division at Picatinny Arsenal. It is expected that the results will be very useful in finding improved methods for initiation of secondary explosives.

A combined theoretical and experimental investigation will be performed on the luminescent spectra of associates of charged dopants in III-V semiconductors and metastable solids, and spectral changes with applied field for monotonically graded III-V mixed semiconductors; previously developed analysis techniques will be extended to the study of amorphous metals and on metastable solids with emphasis on secondary explosives such as ammonium nitrate.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0006, VACUUM UV RADIOMETRY

J.M. Bridges, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (2320472)

PROJECT OBJECTIVE: To establish the capability for making absolute measurements of the radiant power of light sources in the untraviolet region from about 50 NM to about 300 NM and provide efficient, convenient and accurate calibration services to users.

PROJECT APPROACH: Well-defined plasma sources are developed and are optimized for reproducibility, convenience and accuracy. The wall-stabilized hydrogen arc serves as the primary standard of radiance. Deuterium lamps and the argon mini-arc, recently developed at NBS, have been established as convenient transfer standards of radiance over the range from 120NM to 350NM and are now also devloped as standards of irradince. An argon maxi-arc is currently developed as a calibrated high intensity source for solar simulation in the UV-B region. Radiance and irradiance calibrations are performed for high priority users on a cost basis.

PRIOR YEAR ACCOMPLISHMENTS: An unexpectedly large demand for argon mini-arc calibration services arose from the leading nat. fusion labs (Princeton Oak Ridge, Gulf Atomic) and space res. grps. (Goddard Space Flight Ctr, LASP, NRL). A total of 7 mini-arc calibrations were performed during FY 77 and 4 more were in progress.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

8.0007, ANALYSIS OF SATELLITE PARTICLE OBSERVATIONS AND COINCIDENT AURORAL-E IONIZATION

J.R. Sharber, Florida Inst. of Technology, School of Science & Engineering, Dept. of Physics, *Country Club Rd., Melbourne, Florida* 32901 (DF052490; AFOSR-78-3625)

AF function - AF communication, detection and surveillance systems utilize paths through the ionosphere and their propagation characteristics are determined and perturbed by the state and fluctuations of the electron content of the polar ionosphere. Deficiency - at present, a determination of the total electron content of the polar ionosphere as a function of time and location and a forecast of its changes cannot be obtained from a knowledge of the plasma sheet particle population. Objective - to determine a quantitative relationship between spectral parameters of the plasma sheet particle population and routinely measured parameters of auroral-E layer ionization. Contribution - successful completion of this project will permit the determination of the approximate shape and total energy content of plasma sheet particle spectra solely from ionospheric soundings.

Data from two flights of the AFGL Airborne Ionospheric Observatory will be coordinated with coincident measurements from ionospheric sounders at ground observatories and the satellites ISIS-2 and VELA. The data consists of (1) Alaskan chain flight, Dec. 11, 1971 - to analyze the qualitative and quantitative relationship between particle spectra incident on top of the atmosphere and E-layer height and total energy content, (2) VELA intersection flight, Jan. 1974 - to compare particle spectra in the plasma sheet, particle spectra just above the auroral atmosphere and E-layer height and energy content.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0008, HIGH-RESOLUTION SPECTROSCOPY

H.M. Crosswhite, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (54700-01; EE-03-01-02)

Through FY 1979 the main emphasis of our research in high-resolution spectroscopy will be on the following problems: (1) examination near the ionization threshold of energy levels of atomic uranium, plutonium and several lighter elements such as Ba, including transition probability determinations (Hook method) and quadratic Zeeman effects. Relations between energy level positions and transition rates are analyzed by the multichannel quantum defect theory. These experiments are closely related to the laser isotope separation program. (2) theoretical analysis of empirical energy levels of U, Np, Pu and Es atomic and singly-ionized spectra, emphasizing configuration-mixing modeling relating to isotope-shift analysis and development of a systematic model for prediction of the electronic and thermodynamic properties of heavy and superheavy materials and plasmas. (3) experimental and theoretical studies of actinide ions (U through Es) in crystals, developing a model of 5F electronic energies for use in atomic and solid-state energy level calculations. (4) fundamental problems of simple diatomic molecular systems such as H2, D2, T2, OH, OT, N2 and N2 relating to verification of ab initio calculation methods and energy-transfer phenomena in atmospheric species. The basic experimental work will continue to use the large spectrographic facilities in a conventional way, but there will be increasing use of laser techniques for special investigations.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0009, CHEMICAL PHYSICS FOR INERTIAL CONFINEMENT FUSION BY HEAVY IONS

Y.K. Kim, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (ANL 56851; ERDA EE-03-01-03)

The purpose of this new program is to provide atomic and molecular collision data which are essential for feasibility and design studies for inertial confinement fusion by heavy ions. As is outlined in a report prepared by the ERDA Summer Study Group (Ref. 1, pp. 11-12), there are two unrelated types of collision cross-sections relevant to the ion-beam fusion scheme. The first and most urgent is the cross-section for charge transfer between heavy ions. This cross-section determines the lifetime of the ion beam in a storage ring, and therefore places constraints on the design of the accelerator from ion source to storage ring. The second type of cross-section needed is for ionizing collisions between the ion and background gases, particularly those in the storage ring. This information should enable one to estimate accurately requirements on the vacuum system.

SUPPORTED BY U.S. Dept. of Energy

8.0010, WEAPONRY - QUATERNARY SEMICONDUCTOR MATERIALS TO MEET MORE DEMANDING MILITARY SOLID STATE REQUIREMENTS

N. Holonyak, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DN775124; N00014-77-C-0086)

This work seeks means of synthesizing high purity gallium indium arsenide phosphide semiconductor materials for improved performance of Navy and other military solid state microwave amplifiers and injection lasers.

Both liquid phase and vapor phase epitaxial growth techniques will be pursued to grow various mole fraction ratios of gallium indium arsenide phosphide at various band gap energies

and lattice matched to either GaAs or InP substrates. Materials grown and their interfaces will be characterized by photoluminescence, photoconductance, and Van der Pauw means.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0011, THEORY OF THE RESPONSE OF MATERIALS TO ELECTROMAGNETIC RADIATION

M. Altarelli, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR7824155)

Research previously supported by DMR7622352.

Theoretical research on the electronic structure of materials will be carried out. A particular emphasis will be on phenomena connected with surfaces and interfaces. The aim of this research is a better understanding of the microscopic processes which occur when electromagnetic radiation is absorbed in a solid and its energy is tranferred to the electrons of the material. A better knowledge of these elementary processes should be of help in interpreting the results of optical and photoemission measurements and in extracting more information on the electronic structure of the investigated systems from such experiments. Emphasis will be given to semiconductor surfaces, in view of the present incomplete understanding of these technologically important systems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0012, ENERGY TRANSFER IN ATOMIC AND MOLECULAR SYSTEMS

D.H. Winicur, University of Notre Dame, Radiation Lab., *Notre Dame, Indiana* 46556

Studies planned include the following: molecular beam methods to determine the mechanisms, cross-sections, and intermediate species involved in the transformation of energy from one form to another. Crossed beams to measure differential scattering of electronically excited metastable rare-gas atoms by various small molecules (e.g., H2O, CO2, HBr, C6H6, N2, Br2). Time-of-flight techniques to measure the velocities and the identities of the scattered species; detailed information on the cross-sections for energy transfer between atoms and molecules; identification of states formed immediately after the initial energy transfer; determination of the potential-energy curves for the interacting atoms and molecules. Examination of the magnitudes and velocity dependencies of the integral energy exchange cross-sections between excited argon and HBr or CO2 by examining quenching of the differential scattering at large angles; potential-energy curves for the electronically excited states of atom-molecule complexes to examine the qualitative differences between these and the ground-state curves; effects of the initial relative kinetic energy and of the electronic excitation energy of the atom on the transfer of energy to small molecules. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0013, ELASTIC LIGHT SCATTERING INVESTIGATION OF THE DEFECT SUBSTRUCTURE OF REFRACTORY OXIDES

W.P. Unruh, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Physics & Astronomy, *112 Bailey Hall, Lawrence, Kansas* 66045 (DMR78-10824)

This research will be a coordinated light scattering investigation of the defect substructure of refractory oxides, with emphasis on magnesium oxide. The aggregation and phase separation of impurities, and their precipitation onto the internal substructure of crystals, will be probed nondestructively in high quality samples by means of three complementary elastic light scattering methods. The goal is to obtain fundamental information regarding the mobility, diffusion, nucleation and spatial distribution of phase-separated and aggregated impurities and defects in this important class of materials. Progressive changes in defect substructure will be followed as standard thermal sequences are applied to the materials. Because even trace impurities are inhomogeneously distributed, this substructure plays a dominant role in the transport, optical and mechanical properties of high quality transparent dielectric materials. This research will contribute to the fundamental understanding of the mechanisms which produce the highly inhomogeneous defect substructure in high quality refractories containing nominal impurity concentrations. It is expected that this knowledge will suggest ways in which inhomogeneities may be reduced or eliminated, a result which would significantly improve the technical applicability of these durable materials.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0014, LASER-PRODUCED PLASMAS AND RADIATION SOURCES

B. Lax, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF042150; F44620-76-C-0002)

AF function - operation of high altitudes vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of interactions between laser beams and plasmas in the presence of strong magnetic fields. Deficiency - the aforementioned information for the design of advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research program. Objective - this program will study the interaction of ionization waves and the effect of a strong magnetic field upon the backscattering of CO2 laser radiation from a laser produced plasma. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beams), the development of space and ionospheric communications, and the development of countermeasures.

This project will investigate theoretically the following areas: a. Stimulated backscattering and nonlinear acoustic wave interactions with the electron cyclotron motion. A detailed and refined approach will be used to provide more diagnostic information on the laser induced plasma, b. Head-on collisions between laser-driven ionization fronts. The 300 Joule CO2 laser is powerful enough to heat sufficiently the plasma and produce unambiguous measurements of the electron temperature jump in the collision zone. The laser beam will be split in two parts and focused by identical Cassegrainian optical systems onto the ends of a gas target, c. Coherent nonlinear Raman scattering from plasmas. A theoretical investigation will be performed of the third order nonlinear susceptibility in a simple plasma in two cases, 1. without a magnetic field and 2. with a magnetic field. For simplicity a collisionless plasma will be considered. They will study the properties of the nonlinear susceptibility and the resonances at the ion acoustic wave frequency and at the electron plasma frequency. These theoretical results will be used to guide the experimental program. In this project they are in close contact and cooperation with Profs. Ong and Duderstadt of Michigan (grant AFOSR 76-2904) who are doing theoretical work in this general area.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0015, INVESTIGATION OF THICK REFLECTION HOLOGRAMS

B.J. Chang, Environmental Research Inst. of Michigan, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (DF052120; F49620-78-C-0061)

AF function - future Air Force weapons systems will require the real-time processing of data obtained from a multitude of sensors at data rates which exceed current capabilities. The most promising solution at the present time is the use of the parallel processing capability of optics. Opportunity - optical processors currently require complex lenses which are heavy, bulky, and expensive. The proposed effort will investigate holographic optical elements (HOES) which offer advantages of a reduction in the mechanical stability problems of conventional

optical systems, a reduction in the number of optical elements, and a reduction in weight, size, and cost, all of which render these elements very applicable to the development of optical systems for aircraft and missiles. Objective - this research will formulate a theory that can adequately describe the behavior of thick reflection holograms. How work contributes - this effort advances optical processors for airborne and terminal guidance applications.

Various theoretical methods will be investigated that are capable of describing the behavior of practical thick reflection holograms having non-uniform, non-sinusoidal refractive index modulation. A computer program will be developed that will be capable of modeling reflection holograms using the theoretical technique that appears to be the most promising. This program would be compatible with the existing holographic optics analysis and design (HOAD) program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0016, INELASTIC MOLECULAR COLLISIONS--APPLICATIONS OF THEORETICAL METHODS TO PROBLEMS IN RELAXATION PHENOMENA AND LASER OPERATION

R. Rabitz, Princeton University, School of Natural Sciences, Dept. of Chemistry, *Box 430, Princeton, New Jersey* 08540

Aspects of molecular collision phenomena; new theoretical methods capable of handling realistic collision problems; variationally based decomposition methods along with effective Hamiltonian-type techniques; vibrational relaxation of HF; rotational state participation in vibrational relaxation. Modeling of HF lasing under various experimental conditions. Analysis of key physical factors controlling various types of collision behavior; temperature and quantum number scaling of vibration-vibration exchange rates. Chemical reaction theory based on a combination of decomposition methods and special channel coupling techniques; multichannel reactive cross-sections. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0017, SPECTROSCOPIC STUDIES OF THE ELECTRONIC STRUCTURE OF SEMICONDUCTOR INTERFACES

D.E. Eastman, International Business Machines Corp., *P.O. Box 218, Yorktown Heights, New York* 10598 (DF042670; F44620-76-C-0041)

AF function - modern aerospace electronic systems for command, control and communications, and for surveillance and reconnaissance depend heavily upon solid state electronic and optical devices. Opportunity- future improvement in performance of these devices requires a thorough understanding of the electronic structure and excitations processes in selected solids. Objective - the objective of this research is to provide knowledge of the electronic structure, electronic transitions and interactions, and optical properties at semiconductor interfaces that are vital to microwave device operations. How work contributes - this work will provide knowledge and understanding of interface states that will permit the development of more reliable and efficient microwave devices for the above system.

The electronic structure and properties of III-V semiconductors, selected group IV, and ternary III-V alloy semiconductors and of semiconductor interfaces, including metal-semiconductor Schottky barriers will be studied by a variety of techniques including photoelectric yield and photoelectric spectroscopy using synchrotron radiation, and electron energy loss spectroscopy, auger electron spectroscopy and low energy electron diffraction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0018, COMMUNICATIONS - CONDUCTIVITY AND OPTICAL EFFECTS IN ANISOTROPIC SEMICONDUCTORS

J.F. Schetzina, University of North Carolina, North Carolina State University, School of Liberal Arts, Dept. of Physics, *Raleigh, North Carolina* 27607 (DN223319; N00014-77-C-0470)

This work on the electrical transport and photovoltaic effect in semiconductors is applicable to the development and improvemewt of electronic devices, optical switching and electrical instrumentation used by the Navy in its communications operations.

Experimental observations of the photomagnetoelectric and anomalous photovoltaic effects in cadmium telleride films will be compared with theoretical predictions of a new model. This model is based on properties of a variably (with depth) anisotropic relaxation semiconductor. Optical absorption, x-ray diffraction, and x-ray fluorescence spectra will be obtained for well characterized films.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0019, SURFACE-STRENGTHENING MECHANISMS IN REACTION-SINTERED SILICON NITRIDE AND MIXED MODE SUBCRITICAL CRACK GROWTH

M.G. Mendiratta, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF049810; F49620-77-C-0124)

AF function - ceramic turbine engines for remotely piloted vehicles (RPV) are being developed for greater cost savings and higher performance. Opportunity - the reaction-sintered method of forming silicon nitride (RSSN) offers an attractive opportunity for cost savings in manufacturing turbine components. Objective - the objective of this research is to understand and develop surface-strengthening mechanisms for RSSN. How work contributes - since brittle ceramic fracture frequently originates at surface flaws, especially RSSN, surface treatments are expected to significantly increase the useful design strengths of these materials.

The major emphasis will be placed on the systematic correlation of mechanisms of oxidation and mechanisms of strength improvement/degradation. Full characterization of the surface scale and its effect on the fracture-mechanics will be evaluated. Dense silicon nitride coatings on RSSN will also be evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0020, LABORATORY STUDIES OF ATOMIC COLLISION PROCESSES 14656-P

M.A. Biondi, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DA0F8927; DAAG29 77 G0079)

To acquire reaction rate data for porcesses of importance in laser plasmas and to elucidate the nature of the atomic collision processes occurring in plasmas of the type encountered in gas lasers and in the ionosphere. Relevance - the program is relevant to the design of high power closed cycle electric carbon dioxide lasers and the middle atmospheric research program of the Atmospheric Sciences Laboratory.

The magnitudes of the recombination coefficients of complex ions such as CO(plus)CO, CO(plus)H sub 2 O, Xe3(plus), etc. and the variation with electron temperature will be studied over a wide range. The nature of cluster ion recombination processes will be investigated by using optical spectrometric techniques to characterize the final states produced by the recombination events. A 'drift tube will be used to study both dimer and polar molecule cluster ions and non-resonant charge transfer processes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0021, EXPERIMENTAL STUDIES OF SUPERCONDUCTIVITY IN AMORPHOUS METALS

D.G. Naugle, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (DMR7825003)

Research on amorphous superconductors initiated under NSF Grant No. DMR-7504364 will be continued and extended. Thermodynamic and electronic transport properties of superconducting amorphous transition metal alloys will be studied as functions of composition, magnetic field and temperature. These measurements will yield data on the electronic density of states at the Fermi level and the Debye temperature, two parameters which occupy a central position in the microscopic theory of the superconducting state. Amorphous foils will be fabricated via a hammer and anvil type 'splat-cooler' while amorphous films will be prepared by means of a high-vacuum code-position technique. Electron diffraction and X-ray techniques will be used to characterize the samples. In the later stages of this research superconductng tunneling techniques will be developed to obtain a direct measure of the superconducting energy gap and data relating to the phonon density of states. This work is important for our fundamental understanding of the microscopic interactions which give rise to the technologically important phenomenon of superconductivity.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, BAND STRUCTURE OF SOLIDS AND POINT DEFECTS IN CRYSTALS

C.C. Lin, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DMR7827575)

Research previously supported by DMR76-83684.

Theoretical research on the structure of solid surfaces and point defects in solids will be performed. The method of linear combinations of atomic orbitals (LCAO) has proved to be a useful and versatile tool for accurate calculations of electronic energy band structures of perfect crystals, amorphous silicon, and solid surfaces. The LCAO method not only produces accurate electronic energies and wave functions, but also provides a simple picture which enables us to correlate the properties of the solid with those of the constituent atoms. Theoretical studies of electronic structures of solids by the LCAO method will be continued. The specific topics of research can be divided into two broad categories: (1) studies of impurity atoms and associated vacancies in ionic crystals, including the excited states of the impurity atoms, distortion of the valence-band states of the host crystals, charge transfer transitions and other optical processes, (2) chemisorption of chlorine atoms on III-V compound semiconductor crystal surfaces with special reference to the (110) surface of GaAs and the surface states produced by adsorbate-substrate bonding. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0023, VIBRATIONAL SPECTROSCOPY AT HIGH PRESSURE

W.F. Sherman, University of London, Kings College, Dept. of Physics, *Strand, London, England, United Kingdom* (DA0C9456; DAERO 76 G0054)

Study on the lattice dynamics of crystals in a variety of systems as a function of pressure and temperature. Behavior near phase transitions is particularly important. New high pressure cells for use in Raman and infrared spectroscopy are to be designed and constructed. Such cells will not contain diamond anvils/windows and will attempt to extend the limit of pressure obtainable by less expensive materials. Such studies, techniques, and equipment have immediate application to a variety of current U.S. Army research interests in many areas including the fields of energetic materials and electronic materials. Additionally, a new and novel narrow bandwidth filter, tunable over frequencies from the IR to UV, is to be used in this effort. The concept of this filter is in the process of review for assistance in patenting by the U.S. Navy. It appears to represent orders of magnitude improvement in detection of low intensity lines, such as a Raman line, at frequencies very near a high intensity line, such as a laser line. Further development and improvement of this device holds significant potential for U.S. Army's programs in camouflage detection, chemical and pollution detection, and in most research efforts involving laser spectroscopy.

Infrared and Raman studies are to be carried out over wide ranges of pressure and temperature on a variety of crystalline materials. High pressure optical cells will be developed to extend where necessary the range of these experiments. The purpose of this work is to improve our understanding of intermolecular forces, molecular motion in solids, and the detailed mechanism of solid-solid phase changes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command, Research & Standardization Group

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, RELATIVISTIC ASTROPHYSICS

J.E. Gunn, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST7680801A02)

This proposal covers research in many different areas of astrophysics and relativity. The research will be primarily theoretical, but will also include some astronomical observations and some aspects of experimental relativity. The topics to be studied include: (a) the large-scale structure and cosmological evolution of the universe; (b) the origin, structure, and evolution of galaxies and clusters of galaxies; (c) the dynamics of globular clusters and the distribution of masses for the oldest stars in the universe; (d) late stages of stellar evolution and the structures of giant stars that have neutron stars or black holes in their cores; (e) close binary star systems and their roles as compact X-ray sources; (f) gravitational collapse and black holes; (g) the theory of the generation of gravitational waves and plans for a search for gravitational waves using Doppler tracking of interplanetary spacecraft; (h) design studies for new experiments to test general relativity theory.

This work is a continuation of work previously supported by NSF grant AST76-80801A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, SOLAR FLARES

H. Zirin, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (DF248780; F19628-77-C-0106)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions. Objective - determine the effect of chromospheric structures, motions and magnetic fields on the solar atmosphere and how each contributes to the environment for solar activity. How research contributes - provides the physical knowledge necessary for a sound cause-and-effect prediction technique for solar-induced disruptions.

Collaborative studies with the Sacramento Peak Observatory on the chromosphere to obtain maximum observational data on selected solar events.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

10.0003, THEORETICAL STUDIES OF THE STRUCTURE AND EVOLUTION AND CLOSE BINARY SYSTEMS

R.F. Webbink, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST7812309)

Support is for theoretical research in the structure and evolution of close binary star systems. Continuing studies by the principal investigator address a broad range of topics involving binary stars: conditions of mass exchange between stars, and its effect on the evolution of both stars; the stability of many ob-

served binary systems, especially novae and dwarf novae, against rapid mass exchange; and the role of close binaries in the evolution of star clusters and galaxies. Since most stars are members of close binary systems, solutions to these problems contribute to the understanding of stellar and galactic evolution. Emphasis will be placed on studies of the stability, nature and origin of the cataclysmic variable stars, and the evolution of binary stars to the cataclysmic binary stage.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, THEORETICAL STUDIES OF MAGNETIC DEGENERATE STARS

G. Chanmugam, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (AST7606807A01)

This research will be concerned with studies of the effects of magnetic fields and rotation on the structure and stability of white dwarf stars. Studies of this type will be valuable in determining whether similar phenomena take place in neutron stars.

In the past few years astronomers have identified a particular class of binary stars known as AM herculis binaries. These binary systems have, as one of their members, a white dwarf star which possesses an extremely strong magnetic field. The light from these systems is strongly circularly polarized. The origin of this polarization is not fully understood. A study of the origin of the polarized radiation field will be made.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0005, COMETS

B. Marsden, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31P-4P50-07)

Work is being continued on several aspects of orbital problems on comets and minor planets. In particular, our studies pertain to the examination of the non-gravitational forces acting on comets and to the behavior of objects in orbit close to the 2:1 mean-motion resonance with Jupiter.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0006, HIGH-SPEED SPECTROGRAPHS

L. Mertz, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (SRF-460123)

We propose to build two spectrographs of a novel design that provide extreme speed (f/0.9) with a sharp, stigmatic, flat, nonanamorphic field. The configuration is a concave diffraction grating with a hemispheric field lens and has become feasible only since the advent of holographically formed diffraction gratings because conventional ruling is limited to rather flat surfaces.

One spectrograph will serve for conventional applications, replacing Schmidt camera spectrographs. The other will have a special reticle in place of the entrance slit for development and testing of Fresnel convolution spectrography. The Fresnel convolution technique vastly augments the light acceptance without sacrificing resolving power and should be particularly beneficial to obtain spectra of faint diffuse sources such as nebulae and comets.

Both the Fresnel convolution technique and the spectrograph configuration are distinctly novel. Part of the reason for two spectrographs is that two hemispheres are fabricated from a single sphere, so that two are almost as inexpensive as one.

SUPPORTED BY Smithsonian Institution, Office of Fellowships & Grants

10.0007, MULTIPLE-MIRROR TELESCOPE (MMT)

F.L. Whipple, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (310-4050-02)

In cooperation with the University of Arizona, SAO is building a large astronomical telescope of radical design for both optical and infrared applications. The telescope will utilize six 72-inch mirrors clustered around a central core structure. The light-gathering power of such an instrument would be the equivalent of a conventional 175-inch telescope. As of June, 1975, the site at SAO's Mt. Hopkins Station has been prepared and the plans for the building completed. The yoke that supports the telescope is approaching completion under contract with Philco-Ford Western Development Labs. The computer control system is also approaching completion at SAO. The design of the optical support structure is completed, under contract to Simpson, Gumpertz, and Heger, Inc. The figuring of the optical elements is in progress at the University of Arizona Optical Sciences Center, and the active optical alignment system is being designed and constructed at Steward Observatory, University of Arizona.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0008, RED GIANT STARS

J.M. Scalo, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST7711883A01)

This research involves studies of red giant stars and will consist of the following projects: 1) There will be calculations of the predicted distribution of spectral types and luminosities of these stars and there will be a comparison of these calculations with observations. It has recently been found that there are large variations in the relative numbers of these stars in our galaxy as compared to the Magellanic Clouds, and the origin of this difference is not fully understood. 2) There will be theoretical calculations of the spectra which are expected to be observed from red giant stars. These calculations will be based on models that describe the physical processes that take place in the interiors of these stars, and there will be a comparison of such calculations with observations. 3) It is known that shells of gas and dust surround evolved stars. A study will be made of the gas phase and gas-grain photochemistry around such stars.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0009, THE CHEMICAL COMPOSITION OF LATE TYPE STARS

G. Wallerstein, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST7820405)

This research will be concerned with determining the abundances in certain types of giant stars which show unusual abundances of the elements barium and strontium. The surface composition of these stars is enriched in elements which have been produced by a certain class of thermonuclear reactions known as slow neutron capture reactions. Studies of the abundances in these stars will provide us with information on the role various thermonuclear reactions play in these particular stars.

Another topic of study will involve the giant stars known as long-period variables. These stars are known to vary in light output. The period of this luminosity variation is of the order of hundreds of days. The behavior of the outer atmosphere of these stars is quite complex, and spectroscopic techniques can be used to provide information about the structure of the atmosphere during the light variation. This information will then be used to determine the velocities in various parts of the atmosphere during the pulsation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

GENERAL

11.0001, MULTI-YEAR TASK CONTRACT FOR AEROSAT SYSTEMS

Unknown, Aerospace Corp., *P.O. Box 95085, Los Angeles, California* 90045 (FA77WA-3861; FA160311 (TRAIS NO.))

The total Systems Engineering Support efforts with which this contract is associated will encompass a variety of detailed tasks and extend over a period of years. A general list of expected tasks are as follows: Task 1. Development of National Plan; Task 2. Aerosat Program Implementation Plan; Task 3. System Engineering Support for Aerosat Program; Task 4. U.S. Aerosat System Integration; Task 5. International System Interfaces and Space Segment Integration; and Task 6. Operational System Planning and Analysis.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

11.0002, INVESTIGATION OF THE LONAR CRATER, INDIA

K. Fredriksson, Smithsonian Institution, Meteorites Div, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

The Lonar crater is of particular interest because it is located in the vast deccan basalt area and recent results of the U.S. Apollo missions to the moon indicate that large parts of the lunar surface are of basaltic composition. Drilling and trenching in and around the structure has been initiated by the Geological Survey of India and is continuing. Examination of the material recovered from this program has been initiated in our laboratory. Particular emphasis is being placed upon critical comparisons of the Lonar material with selected lunar material returned by the Apollo program.

SUPPORTED BY Smithsonian Institution, National Museum of Natural History

11.0003, AERO ENGINES IN MUSEUMS AROUND THE WORLD

R.B. Meyer, Smithsonian Institution, Dept. of Aeronautics, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

This is a list of 1,200 air-breathing engines (mostly piston gasoline and turbojets) in museums around the world.

It has been printed from punched cards and distributed to 100 supporting museums.

The additional information needed to produce a second and more complete edition is being collected. It is to be published in the summer of 1978.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N80-12991*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IN DEPTH REVIEW OF THE 1979 AIAA LIGHTER-THAN-AIR SYSTEMS TECHNOLOGY CONFERENCE
Mark D. Ardema Nov. 1979 20 p Conf. held at Palo Alto, Calif., 11-13 Jul. 1979
(NASA-TM-81158) Avail: NASA Ames Res. Center, Moffett Field, Calif. 94035 CSCL 02A

The lighter than air (LTA) systems technology conference is reviewed. Highlights of the conference were: (1) the interest shown in patrol and surveillance airships, particularly for coastal patrol missions; (2) the session devoted to overviews of foreign activity; and (3) heavy lift and long range transport aircraft design considerations. A.W.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-12992 Virginia Polytechnic Inst. and State Univ., Blacksburg.
EFFECTS OF WALL WAVINESS AND NONLINEAR WAVE INTERACTIONS ON THE STABILITY OF BOUNDARY-LAYER FLOWS Ph.D. Thesis
Ali Nahit Bozali 1979 186 p
Avail: Univ. Microfilms Order No. 7924092

The effects of wall undulations on the stability of and nonlinear mode-mode interactions of disturbance waves in boundary layer flows are investigated by using a combination of perturbation and numerical methods. Nonparallel flow effects are retained in most of the cases treated. The waviness on a plate which can stabilize or destabilize the flow, depending on the flow and waviness parameters is discussed. Stabilizing the flow by transferring energy from the unstable Tollmien-Schlichting mode to a higher stable mode through a resonant wave coupling mechanism is examined. First order linear secondary instabilities associated with a time dependent flow consisting of the superposition of a basic flow and a finite amplitude fundamental wave are analyzed. Dissert. Abstr.

N80-12993 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THREE-DIMENSIONAL VISCOUS HYPERSONIC FLOWS OVER GENERAL BODIES USING SHOCK-LAYER AND PARABOLIZED NAVIER-STOKES EQUATIONS Ph.D. Thesis
Prasada Rao Gogineni 1979 87 p
Avail: Univ. Microfilms Order No. 7924106

The three dimensional viscous hypersonic flowfield over blunted cones at large angles of attack, including crossflow separation, was solved using both viscous shock layer and parabolized Navier-Stokes equations (PNS). The viscous shock layer equations were used for the solution of windward region up to the crossflow separation point and the parabolized Navier-Stokes equations were used to complete the solution in the crossflow separated region. A fast implicit iterative technique known as the pseudo elimination method was used to solve the PNS equations, and the computing time was reduced by 35 percent. A computer code was developed using this technique, and calculations were made for two test cases, which typically encompass reentry flow conditions. Dissert. Abstr.

N80-12994*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUMMARY OF LOW-SPEED LONGITUDINAL AERODYNAMICS OF TWO POWERED CLOSE-COUPLED WING-CANARD FIGHTER CONFIGURATIONS
John W. Paulson, Jr. and James L. Thomas Washington Dec. 1979 92 p refs
(NASA-TP-1535; L-13157) Avail: NTIS HC A05/MF A01 CSCL 01A

Investigations of the low speed longitudinal characteristics of two powered close coupled wing-canard fighter configurations are discussed. Data obtained at angles of attack from -2 deg to 42 deg, Mach numbers from 0.12 to 0.20, nozzle and flap deflections from 0 deg to 40 deg, and thrust coefficients from 0 to 2.0, to represent both high angle of attack subsonic maneuvering characteristics and conventional takeoff and landing characteristics are examined. Data obtained with the nozzles deflected either 60 deg or 90 deg and the flaps deflected 60 deg to represent vertical or short takeoff and landing characteristics are discussed. A.W.H.

N80-12995*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INCLUSION OF UNSTEADY AERODYNAMICS IN LONGITUDINAL PARAMETER ESTIMATION FROM FLIGHT DATA
M. J. Queijo, William R. Wells (Wright State Univ., Dayton, Ohio), and Dinesh A. Keskar Washington Dec. 1979 52 p refs
(NASA-TP-1536; L-13009) Avail: NTIS HC A04/MF A01 CSCL 01A

A simple vortex system, used to model unsteady aerodynamic effects into the rigid body longitudinal equations of motion of an aircraft, is described. The equations are used in the development of a parameter extraction algorithm. Use of the two parameter-estimation modes, one including and the other omitting unsteady aerodynamic modeling, is discussed as a means of estimating some acceleration derivatives. Computer generated data and flight data, used to demonstrate the use of the parameter-extraction algorithm are studied. A.W.H.

N80-12996*# Princeton Univ., N. J. Flight Research Lab.
AN EXPLORATORY INVESTIGATION OF THE STOL LANDING MANEUVER Final Report
Patrick H. Whyte Washington NASA Dec. 1979 74 p refs
(Contract NAS2-7350)

(NASA-CR-3191; AMS-1231-T) Avail: NTIS HC A04/MF A01 CSCL 01A

The parameters influencing the STOL landing are identified and their effect on the ease and quality of the flare maneuver is discussed. Data from actual landings, supported by pilot commentary and pilot opinion rating, are analyzed. Hypotheses concerning the prediction of STOL handling qualities in the flare are proposed, and suggestions for future research are presented. A.W.H.

N80-12997*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

TRANSONIC AERODYNAMIC CHARACTERISTICS OF A SUPERSONIC CRUISE AIRCRAFT RESEARCH MODEL WITH THE ENGINES SUSPENDED ABOVE THE WING

Charles E. Mercer and George T. Carson, Jr. Dec. 1979 198 p refs

(NASA-TM-80145; L-12811) Avail: NTIS HC A09/MF A01 CSCL 01A

The influence of upper-surface nacelle exhaust flow on the aerodynamic characteristics of a supersonic cruise aircraft research configuration was investigated in a 16 foot transonic tunnel over a range of Mach numbers from 0.60 to 1.20. The arrow-wing transport configuration with engines suspended over the wing was tested at angles of attack from -4 deg to 6 deg and jet total pressure ratios from 1 to approximately 13. Wing-tip leading edge flap deflections of -10 deg to 10 deg were tested with the wing-body configuration. Various nacelle locations (chordwise, spanwise, and vertical) were tested over the ranges of Mach numbers, angles of attack, and jet total-pressure ratios. The results show that reflecting the wing-tip leading edge flap from 0 deg to -10 deg increased the maximum lift-drag ratio by 1.0 at subsonic speeds. Jet exhaust interference effects were negligible. R.E.S.

N80-12998*# Rockwell International Corp., Los Angeles, Calif.

AERODYNAMIC PRELIMINARY ANALYSIS SYSTEM. PART 1: THEORY Final Report

E. Bonner, W. Clever, and K. Dunn 1978 81 p refs (Contract NAS1-14686)

(NASA-CR-145284) Avail: NTIS HC A05/MF A01 CSCL 01A

A comprehensive aerodynamic analysis program based on linearized potential theory is described. The solution treats thickness and attitude problems at subsonic and supersonic speeds. Three dimensional configurations with or without jet flaps having multiple non-planar surfaces of arbitrary planform and open or closed slender bodies of non-circular contour may be analyzed. Longitudinal and lateral-directional static and rotary derivative solutions may be generated. The analysis was implemented on a time sharing system in conjunction with an input tablet digitizer and an interactive graphics input/output display and editing terminal to maximize its responsiveness to the preliminary analysis problem. Nominal case computation time of 45 CPU seconds on the CDC 175 for a 200 panel simulation indicates the program provides an efficient analysis for systematically performing various aerodynamic configuration tradeoff and evaluation studies. Author

N80-12999*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

AERODYNAMIC CHARACTERISTICS OF WHEELCHAIRS

Paul L. Coe, Jr. 1979 20 p refs

(NASA-TM-80191; L-13240) Avail: NTIS HC A02/MF A01 CSCL 01A

The overall aerodynamic drag characteristics of a conventional wheelchair were defined and the individual drag contributions of its components were determined. The results show that a fiftieth percentile man sitting in the complete wheelchair would experience an aerodynamic drag coefficient on the order of 1.4. A.R.H.

N80-13000*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

SUPERSONIC STABILITY AND CONTROL CHARACTERISTICS OF A CRUCIFORM MISSILE MODEL WITH DELTA WINGS AND AFT TAIL FIN CONTROL

William A. Corlett 1979 117 p refs

(NASA-TM-80171; L-13149) Avail: NTIS HC A06/MF A01 CSCL 01A

The static stability and control characteristics of a cruciform missile configuration with delta wings and aft tail fin controls were investigated during tests conducted in the Langley Unitary Plan wind tunnel at Mach numbers from 1.60 to 4.63 through an angle-of-attack range of -4 deg to 30 deg. Model roll orientation was varied from 0 deg to 135 deg. The results indicate good longitudinal stability and control characteristics throughout the test Mach number range. Relatively high induced rolling and yawing moments were apparent at asymmetric model roll angles for the lower test Mach numbers; however, sufficient roll and yaw control was available to trim to relatively high angles of attack and lift coefficients. A.R.H.

N80-13001*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

INVESTIGATION OF FLOW CHARACTERISTICS OVER MISSILE BODIES AT SUPERSONIC SPEEDS

Raymond L. Barger and Wallace C. Sawyer Dec. 1979 41 p refs

(NASA-TP-1579; L-13224) Avail: NTIS HC A03/MF A01 CSCL 01A

Three missile body shapes tested at Mach numbers of 1.50, 2.16, and 2.86 with angles of attack up to 30 degrees are described. The flow characteristics for each body shape are examined. The measured aerodynamic forces and moments are presented. The use of flow visualization techniques are described and the results such as vortex effects are discussed. A.W.H.

N80-13002*# National Aeronautics and Space Administration, Hugh L. Dryden Flight Research Center, Edwards, Calif.

EFFECTS OF FUSELAGE FOREBODY GEOMETRY ON LOW-SPEED LATERAL-DIRECTIONAL CHARACTERISTICS OF TWIN-TAIL FIGHTER MODEL AT HIGH ANGLES OF ATTACK

Peter C. Carr and William P. Gilbert Dec. 1979 73 p refs

(NASA-TP-1592; L-13270) Avail: NTIS HC A04/MF A01 CSCL 01A

Low-speed, static wind-tunnel tests were conducted to explore the effects of fighter fuselage forebody geometry on lateral-directional characteristics at high angles of attack and to provide data for general design procedures. Effects of eight different forebody configurations and several add-on devices (e.g., nose strakes, boundary-layer trip wires, and nose booms) were investigated. Tests showed that forebody design features such as fineness ratio, cross-sectional shape, and add-on devices can have a significant influence on both lateral-directional and longitudinal aerodynamic stability. Several of the forebodies produced both lateral-directional symmetry and strong favorable changes in lateral-directional stability. However, the same results also indicated that such forebody designs can produce significant reductions in longitudinal stability near maximum lift and can significantly change the influence of other configuration variables. The addition of devices to highly tailored forebody designs also can significantly degrade the stability improvements provided by the clean forebody. Author

N80-13003*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

FORCE AND MOMENT DATA FROM A WIND-TUNNEL TEST OF A TILT-NACELLE V/STOL PROPULSION SYSTEM WITH AN ATTITUDE CONTROL VANE

Mark D. Betzina Nov. 1979 108 p refs

(NASA-TM-81157; A-8013) Avail: NTIS HC A06/MF A01 CSCL 01A

A large scale, tilt nacelle V/STOL propulsion system, with an attitude control vane assembly mounted in the exhaust, was tested. The effectiveness of the control vane as well as the aerodynamic characteristics of the entire propulsion system were determined. The results, in the form of tabulated coefficients, for both the vane forces and moments and the total forces and moments produced by the propulsion system are presented. A.W.H.

N80-13004*# Southern Methodist Univ., Dallas, Tex. Dept. of Civil and Mechanical Engineering.

INVESTIGATION OF BLOWN BOUNDARY LAYERS WITH AN IMPROVED WALL JET SYSTEM Ph.D. Thesis. Final

Technical Report, 1 Jul. 1978 - Dec. 1979
K. R. Saripalli and R. L. Simpson Dec. 1979 321 p refs
(Grant NsG-1548)
(NASA-CR-162512) Avail: NTIS HC A14/MF A01 CSCL 01A

The behavior of two dimensional incompressible turbulent wall jets submerged in a boundary layer when they are used to prevent boundary layer separation on plane surfaces is investigated. The experimental set-up and instrumentation are described. Experimental results of zero pressure gradient flow and adverse pressure gradient flow are presented. Conclusions are given and discussed. J.M.S.

N80-13005# Sandia Labs., Albuquerque, N. Mex.
EXPERIMENTAL STUDY OF HEAT TRANSFER FROM A YAWED CYLINDER TO AIR WITH A CONSTANT WALL HEAT FLUX
Carolyn A. Pura Aug. 1979 152 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8022) Avail: NTIS HC A08/MF A01

The heat transfer from a yawed cylinder to air for constant wall heat flux boundary condition was studied. Yaws of 0, 20, 40, and 60 degrees were used with a Reynolds number based on a freestream velocity of 1.1 x 10 to the 5th power. The design of the apparatus, the numerical determination of heat conduction within the cylinder, comparison of normal (0 degrees) results with previously published results, and the data obtained for the yaws mentioned are presented. A.W.H.

N80-13006# Admiralty Marine Technology Establishment, Teddington (England).
ASSESSMENT OF A METHOD FOR PREDICTING THE DRAG AND BOUNDARY LAYER DEVELOPMENT ON A BODY OF REVOLUTION AT ZERO INCIDENCE
D. J. Atkins London HMSO Mar. 1979 38 p refs
(AMTE(N)-R-78111; BR67646) Avail: NTIS HC A03/MF A01

A comparison between experimental data and a boundary layer and drag prediction method for bodies of revolution at zero incidence and high Reynolds number is discussed. The only physical input to the prediction method is that of transition position. In general, drag predictions agree well with measurements both in trend and in absolute magnitude predicted velocity profiles on afterbodies with an included semi-angle of less than about 15 deg also agree well with measurements. Finally, a modification to the method was developed which gives a better agreement between predicted and measured velocity profiles on fuller afterbodies provided that no flow separation takes place. Author (ESA)

N80-13007# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Experimentelle Stroemgsmechanik.
LARGE SCALE COHERENT STRUCTURES IN THE WAKE OF AXISYMMETRIC BODIES
Helmut V. Fuchs, Edzard Mercker (Tech. Univ., Berlin), and Ulf Michel 1978 43 p refs
(DFVLR-FB-78-28) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 15,30

The unsteady flow past a circular disk was studied with hot-wire and microphone probes. The velocity and pressure signals are shown to be continuously dominated by large scale coherent motions enveloping the wake flow as a whole. This suggests narrowband two-point space correlations as an experimental tool for describing spatial coherence and phase of the basically random signals. The specific symmetry imposed by the axisymmetric boundary conditions of the disk enables a decomposition of the large scale flow phenomena into relatively simple elementary structures or modes. The resulting azimuthal constituents are quantified in terms of their respective magnitudes and individual power spectra. Comparisons are made with the corresponding structures found in circular jets. Author (ESA)

N80-13008# Universite des Sciences et Techniques de Lille (France).
UNSTEADY FLOW CHARACTERISTICS IN THE NEAR WAKE OF A TWO DIMENSIONAL OBSTACLE [QUELQUES PROPRIETES DE L'ECOULEMENT INSTATIONNAIRE DANS LE SILLAGE PROCHE D'UN OBSTACLE BIDIMENSIONNEL]
A. Dyment and P. Gryson Paris Assoc. Aeron. et Astronautique de France 1979 26 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-08; ISBN-2-7170-0535-5) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

The influence of the characteristics of the boundary layer separation on the formation of vortices and alternate paths in the wake of a bidimensional obstacle at high Reynolds numbers was studied using an ultra fast visualization system. It is shown that there are alternate paths for laminar and turbulent flows, with similar flow characteristics. The emission of vortices does not change substantially when the flow passes from laminar to turbulent. A film with a time scale change of 10,000 times illustrates some of the discussed phenomena. Author (ESA)

N80-13009# Association Aeronautique et Astronautique de France, Paris.
UNSTEADY TURBULENCE IN OSCILLATING FLOW [TURBULENCE INSTATIONNAIRE DANS DES ECOULEMENTS PERIODIQUES]
M. Favre-Marinet and G. Binder 1979 23 p refs In FRENCH; ENGLISH summary Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-11; ISBN-2-7170-0538-2) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

Turbulence measurements were made in a jet pulsating at high frequency (Strouhal number = 0.33). Overall averages of various turbulent quantities, in particular of the shear stress, demonstrate that the turbulent activity varies considerably during the cycle. It is shown that, under the conditions of this experiment, some closure assumptions of quasi-stationary models which have been applied to unsteady flow are not satisfactory. Author (ESA)

N80-13010# Royal Aircraft Establishment, Farnborough (England).
A THEORETICAL STUDY OF THE SUPERCRITICAL AEROFOIL NLR 7301, AND COMPARISON WITH EXPERIMENTS
R. C. Lock London HMSO Sep. 1978 48 p refs
(RAE-TR-78119; RAE-Aero-3444; BR66980) Avail: NTIS HC A03/MF A01

The airfoil NLR 7301, 16.5% thick, was designed using a generalized hodograph method to give supercritical (inviscid) shock-free flow at the design conditions M = 0.72, C sub L = 0.6. A theoretical study of this airfoil by the latest form of the 'VGK' method for calculating viscous effects in two dimensional transonic flows is described. Comparisons are given with experiments in the NLR pilot tunnel at a low Reynolds number (2,000,000). Large discrepancies are shown near the design condition and at higher Mach numbers which are ascribed to a laminar (transitional) shock wave/boundary layer interaction in the transition-free experiments; this causes an apparent weakening of the shock wave and a spuriously low level of the measured drag. Calculations were made at two higher Reynolds numbers, with transition fixed near the leading edge (10,000,000) to simulate conditions in a medium-sized wind tunnel; and 50,000,000, typical of full-scale conditions. Favorable scale effects are predicted on drag rise Mach numbers, for C sub L = 0.5, and on separation onset at all lift coefficients. Author (ESA)

N80-13011# European Space Agency, Paris (France). Inst. fuer Dynamik Verduennter Gase.
MOLECULAR TWO DIMENSIONAL FLOW OF MIXTURES OF LIGHT AND HEAVY GASES WITH DIFFUSE AND SPECULAR REFLECTION
Walter Wuest (DFVLR, Goettingen, West Germany) Dec. 1978 29 p refs Transl. into ENGLISH of "Molekulare ebene Stroemung von Gemischen leichter und schwerer Gase mit diffuser und spiegelnder Reflexion", DFVLR, Goettingen, West Ger. Report DLR-FB-77-51, 17 Nov. 1978 Original report in GERMAN previously announced as N78-31060 Original German report available from DFVLR, Cologne DM 14.40
(ESA-TT-508-Rev; DLR-FB-77-51) Avail: NTIS HC A03/MF A01

A simpler case of the proposed Spacelab experiment in which

the extreme vacuum at the lee side of a shield is utilized for flow experiments, is discussed. Two dimensional density fields are calculated for diffuse and specular reflection for the flow around a plate strip and a half cylinder, facing either the convex or the concave side of the flow. In the latter case the specularly reflected molecules are focused with strong compression (focused or caustic flow fields). Author (ESA)

N80-13012# European Space Agency, Paris (France).
EXPERIMENTAL INVESTIGATION OF THE LOCAL DENSITY AND TEMPERATURE DISTRIBUTION IN THE FLOW FIELD AROUND A SPHERE WITH HIGH THERMODYNAMIC NONEQUILIBRIUM USING THE ELECTRON BEAM TECHNIQUE
Gustav Schweiger (DFVLR, Cologne, West Germany) Jul. 1979 165 p refs Transl. into ENGLISH of "Experimentelle untersuchung der lokalen-dichte-und temperaturverteilung im stroemungsfeld um ein kugelmodell bei starkem thermodynamischen nichtgleichgewicht mit dem elektronestrahlverfahren", DFVLR, Cologne Report DLR-FB-77-29, 30 May, 1979 Original German report available from DFVLR, Cologne DM 51.50
(ESA-TT-516-Rev; DLR-FB-77-29) Avail: NTIS HC A08/MF A01

Measurements of the local density and temperature in the stagnation region of a spherical model in a hypersonic high enthalpy were made using the electron beam technique. The influence of quenching collisions, secondary electrons, and gas temperature on the density measurements is investigated. The various known excitation models and data reduction methods are described and compared. A data reduction scheme based on the Smith-model is developed, which is especially suitable at high gas temperatures. The experimental set up used for density and temperature measurements in the flow field around a sphere at high thermodynamic nonequilibrium is described. The influence of secondary electrons and nonequilibrium effects on the temperature measurements is analyzed. Temperature and density profiles on the stagnation line of a sphere in a M = 12, Re = 120 flow at Tw/To = 0.006 are presented. On the basis of this and similar measurements a modification of the present limitations of different flow regimes is proposed. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations, and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-13013°# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
WEAR, FRICTION, AND TEMPERATURE CHARACTERISTICS OF AN AIRCRAFT TIRE UNDERGOING BRAKING AND CORNERING
John L. McCarty, Thomas J. Yager, and S. R. Riccitiello (NASA Ames Res. Center) Washington Dec. 1979 40 p refs
(NASA-TP-1569; L-13239) Avail: NTIS HC A03/MF A01 CSCL 01C

An investigation to evaluate the wear, friction, and temperature characteristics of aircraft tire treads fabricated from different elastomers is presented. The braking and cornering tests performed on aircraft tires retreaded with currently employed and experimental elastomers are described. The tread wear rate is discussed in relation to the slip ratio during braking and yaw angle during cornering. The extent of wear in either operational mode is examined in relation to the runway surface. A.W.H.

N80-13014# Civil Aeromedical Inst., Oklahoma City, Okla.
EVALUATION OF SEATING AND RESTRAINT SYSTEMS CONDUCTED DURING FISCAL YEAR 1978
Richard F. Chandler and Edwin M. Trout Jun. 1979 228 p refs
(AD-A074881; FAA-AM-79-17) Avail: NTIS HC A11/MF A01 CSCL 01/2

Results are presented of test programs conducted by the Protection and Survival Laboratory to investigate the performance of prototype or operational seating and restraint systems relative to their ability to provide protection against crash injury and to validate the performance of the FAA Seat Occupant Model: Light Aircraft (SOMLA). M.M.M.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-13015 Cornell Univ., Ithaca, N. Y.
SATELLITE DOPPLER POSITIONING IN STRENGTHENING GEODETIC NETWORKS Ph.D. Thesis
Aderibigbe Akanni Tanwo 1979 157 p
Avail: Univ. Microfilms Order No. 7926975

The effective use of satellite Doppler positioning in strengthening terrestrial geodetic networks was geometrically analyzed with respect to scale and orientation. A rigorous mathematical model was used for combining satellite and terrestrial networks. Computations and analyses using real terrestrial and satellite Doppler network data from the Sudan survey department 9 point network and from the United States National Geodetic Survey 132 point network were performed and are presented. The results show that satellite Doppler derived positions used in combination with terrestrial geodetic positions can provide important geodetic parameters and information about a network through the use of a properly conceived mathematical model. The distortions in the network can be properly evaluated. Dissert. Abstr.

N80-13016# Systems Control, Inc., Palo Alto, Calif.
ESTABLISHMENT CRITERIA FOR DISTANCE MEASUREMENT EQUIPMENT (DME) WITH INSTRUMENT LANDING SYSTEM AND/OR LOCALIZER APPROACH Final Report
H. L. Solomon, W. Heine, and M. Venturino Dec. 1978 68 p refs
(Contracts DOT-FA77WAI-731; WI-78-3434-1)
(AD-A069818; FAA-ASP-78-7) Avail: NTIS HC A04/MF A01 CSCL 17/7

The benefit/cost analysis presented considers the following factors: (1) use of DME in lieu of ILS outer marker beacon; (2) reduced probability of approach accidents; (3) averted flight disruptions due to reduced localizer minima; (4) averted missed approaches due to additional information provided; and (5) expedited aircraft departures due to reduced departure flight path length. M.M.M.

N80-13017# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE AIRCRAFT REPLY AND INTERFERENCE ENVIRONMENT SIMULATOR (ARIES). VOLUME 3: PROGRAMMER'S MANUAL
Michael Goon and D. A. Spencer 22 Mar. 1979 63 p refs
(Contracts DOT-FA77WAI-261; F19628-78-C-0002; FAA Proj. 052-241-04)
(AD-A074424; ATC-87-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 09/2

The ARIES Programmer's Manual presented describes the operation, signal formats and protocols of the Lincoln Laboratory-built input/output devices controlled by the Eclipse computer. The descriptions are primarily concerned with the logic of the interface boards that reside in the computer chassis and the formats of the words transferred to and from the computer. The logic of the devices themselves is described only to the extent necessary to understand the interface protocols and data formats. M.M.M.

N80-13018# Ohio Univ., Athens. Avionics Engineering Center
IN-SERVICE IMPROVEMENTS AND MODERNIZATION OF

ALL COMPONENTS OF THE INSTRUMENT LANDING SYSTEMS. VOLUME 1: SECTIONS 1-10 Final Report
Jul. 1978 675 p refs
(Contract DOT-FA75WA-3549)
(AD-A074425; EER-35-1-Vol-1; FAA-RD-78-112-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 17/7

Improvements and alternative utilization of the instrument landing (ILS) glide slope and localizer systems are considered. It is concluded that the ILS is a highly flexible and important navigational aid, with many possibilities for alternative use waiting to be fully realized. J.M.S.

N80-13019# Ohio Univ., Athens. Avionics Engineering Center.
IN-SERVICE IMPROVEMENTS AND MODERNIZATION OF ALL COMPONENTS OF THE INSTRUMENT LANDING SYSTEMS. VOLUME 2: SECTIONS 11 AND 12 Final Report, Oct. 1974 - Jul. 1978
Jul. 1978 858 p refs 2 Vol.
(Contract DOT-FA75WA-3549)
(AD-A074426; EER-35-1-Vol-2; FAA-RD-78-112-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 17/7

Results of an evaluation of localizer and glide-slope systems are given emphasizing antenna and monitor performance, terrain effects, and the effects of obstructions. Also, details of analyses and flight evaluations of Alford and Hollins localizer systems are provided together with findings during evaluations of the Watts Mark 1, 2, and 3 endfire, glide-slope systems. Technical results of development and evaluation work on the FAA-suggested techniques for determining range-rate and position during approach using the localizer signal are given. Nondestructive instrument landing system (ILS) fault testing techniques are described, as is a plan for development of an airport systems control/display facility. Special devices and techniques for use in ILS field work such as a mini-laboratory for collection of airborne data, digital data collection system, time domain reflectometry, and mathematical modeling to predict localizer and glide slope performance and facilitate setups are discussed. J.M.S.

N80-13020*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTAL DETERMINATION OF POSITION-ESTIMATE ACCURACY USING BACK-AZIMUTH SIGNALS FROM A MICROWAVE LANDING SYSTEM
Charles E. Knox Dec. 1979 37 p
(NASA-TP-1574; L-13074) Avail: NTIS HC A03/MF A01 CSCL 17G

Flight tests using the Boeing 737 airplane to obtain position estimates with back azimuth signals from a microwave landing system (MLS) are discussed. The equations and logic used to generate a navigation position estimate in the MLS back azimuth signal environment are described. The error in the navigation position estimate is determined. A summary of the Boeing 737 position estimate update process is described. The navigation position estimate error calculated flight data and radar tracking information is analyzed. The position estimate error data using the MLS inputs are compared with error data obtained during dual distance measuring equipment updates. A.W.H.

N80-13021# Prakla-Seismos G.m.b.H., Hannover (West Germany).
FURTHER DEVELOPMENT OF THE RADIO-ANA-SYSTEM Final Report
Friedhelm Sender Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 94 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-78-05) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Ger. DM 19,75

The Radio-ANA-System for high seas navigation is presented and enhanced exploitation is discussed. Improvement of several aspects of the system is suggested. These are: expanding the usable range of the LORAN-C System by improved receiving techniques, integrating a navigation-reference-buoy into the VLF-radio navigation concept, and providing improved navigational software to solve the special problems of the Radio-ANA-System and Satellite Navigation network. Author (ESA)

N80-13022# European Space Agency, Paris (France). Inst. fuer Flugmechanik.
THE SUPERPOSITION OF TWO-DIMENSIONAL ERROR FIELDS AND ITS INFLUENCE ON FLIGHT SAFETY OF AIR TRAFFIC
Otto Weber (DFVLR, Brunswick, West Germany) Mar. 1979 59 p refs Transl. into ENGLISH of "Die Ueberlagerung Zweidimensionaler Fehlerfelder und ihr Einfluss auf die Flugsicherheit im Luftverkehr", DFVLR, Brunswick Report DLR-FB-77-64, 21 Dec. 1978 Original German report available from DFVLR, Cologne DM 27,20
(ESA-TT-527-Rev; DLR-FB-77-64) Avail: NTIS HC A04/MF A01

The superposition of two dimensional error fields and their effects on air traffic flight safety are discussed. Local error fields significant with regard to flight safety are investigated and described by means of error ellipses, 95% circles, and other curves representing the same probability. Taking the upper wind field over Schleswig as an example, conclusions are drawn concerning the frequency distributions of asymmetrical real phenomena. Statistical laws for determining the mean error vector and the covariance matrix of a superimposed field from the corresponding values of the original normal distribution error fields are also discussed, and rules are given regarding the shape and the error contour area of the superposition. The safety cushion provided by the superposition of a ring shaped or extreme radical distribution with a normal distribution is contrasted to that provided by the superposition of two error fields having normal distributions. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-13023# Sandia Labs., Albuquerque, N. Mex. Aerodynamics Dept. 5630.
AERODYNAMIC DESIGN OF AN EXTENDED-RANGE GUIDED BOMB
Randall C. Maydew 18 Jun. 1979 49 p refs Backup document for AIAA synoptic scheduled for publication in Journal of Aircraft on Mar. 1980
(Log-C3719) Avail: NTIS HC A03/MF A01

The extended range bomb designed to provide a low altitude, 15 km stand off or a 2.5 km turn radius, return to target delivery capability from aircraft at release speeds from 330 to 800 KCAS is examined. The rocket boosted, 41.9 cm diameter bomb utilizes two orthogonal pairs of pneumatically actuated canards for attitude control and lift. The guidance and control system consists of a strapdown inertial measurement unit and a digital computer containing an autopilot and navigator. Computer simulations which indicated the canards must provide high lift with nearly linear characteristics to angles of attack of about 20 deg are discussed. Wind tunnel tests conducted to optimize the canard design are described and the results evaluated. A.W.H.

N80-13024*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF MODIFIED PROFILE ANALYSIS TO FUNCTION TESTING OF THE MOTION/NO-MOTION ISSUE IN AN AIRCRAFT GROUND-HANDLING SIMULATION
Russell V. Parrish, Burnell T. McKissick, and George G. Steinmetz Washington Dec. 1979 24 p refs
(NASA-TP-1540; L-13028) Avail: NTIS HC A02/MF A01 CSCL 01C

A recent modification of the methodology of profile analysis, which allows the testing for differences between two functions as a whole with a single test, rather than point by point with multiple tests is discussed. The modification is applied to the examination of the issue of motion/no motion conditions as shown by the lateral deviation curve as a function of engine cut speed of a piloted 737-100 simulator. The results of this

application are presented along with those of more conventional statistical test procedures on the same simulator data. A.W.H.

N80-13025*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYTICAL INVESTIGATION OF THE LANDING DYNAMICS OF A LARGE AIRPLANE WITH A LOAD-CONTROL SYSTEM IN THE MAIN LANDING GEAR
John R. McGehee and Huey D. Carden Dec. 1979 85 p refs
(NASA-TP-1555; L-13250) Avail: NTIS HC A05/MF A01 CSCL 01C

The results of an evaluation of an active load-control landing gear computer program (ACOLAG) for predicting the landing dynamics of airplanes with passive and active main gears are presented. ACOLAG was used in an analytical investigation of the landing dynamics of a large airplane with both passive and active main gears. It was concluded that the program is valid for predicting the landing dynamics of airplanes with both passive and active main gears. It was shown that the active gear reduces airframe-gear forces and airplane motions following initial impact, and has the potential for significant reductions in structural fatigue damage relative to that which occurs with the passive gear. M.M.M.

N80-13026*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPLORATORY STUDY OF THE EFFECTS OF WING-LEADING-EDGE MODIFICATIONS ON THE STALL/SPIN BEHAVIOR OF A LIGHT GENERAL AVIATION AIRPLANE
Dec. 1979 98 p refs
(NASA-TP-1589; L-13143) Avail: NTIS HC A05/MF A01 CSCL 01C

Configurations with full-span and segmented leading-edge flaps and full-span and segmented leading-edge droop were tested. Studies were conducted with wind-tunnel models, with an outdoor radio-controlled model, and with a full-scale airplane. Results show that wing-leading-edge modifications can produce large effects on stall/spin characteristics, particularly on spin resistance. One outboard wing-leading-edge modification tested significantly improved lateral stability at stall, spin resistance, and developed spin characteristics. A.R.H.

N80-13027*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FRICTION CHARACTERISTIC OF STEEL SKIDS EQUIPPED WITH SKEGS ON A LAKEBED SURFACE
Walter J. Sefic Dec. 1979 16 p refs
(NASA-TM-81347; H-1111) Avail: NTIS HC A02/MF A01 CSCL 01C

The coefficient of friction was determined for steel skids with and without skegs. The addition of a 1.27 centimeter deep skeg caused the coefficient of friction to increase from an average value of .36 to .53, a 47 percent increase over the flat skid. The addition of a .64 centimeter deep skeg increased the friction coefficient from .36 to .46, a 16 percent increase over the flat skid. Comparisons are made with data for similar test conditions obtained during the X-15 program. A.R.H.

N80-13028*# Boeing Vertol Co., Philadelphia, Pa.
ANALYSIS AND CORRELATION WITH THEORY OF ROTOR LIFT-LIMIT TEST DATA
Marc Sheffler Nov. 1979 126 p refs
(Contract NAS1-14317)
(NASA-CR-159139) Avail: NTIS HC A07/MF A01 CSCL 01C

A wind tunnel test program to define the cruise performance and determine any limitations to lift and propulsive force of a conventional helicopter rotor is described. A 2.96 foot radius model rotor was used. The maximum lift and propulsive force obtainable from an articulated rotor for advance ratios of 0.4 to 0.67, and the blade load growth as the lift approaches the limit are determined. Cruise rotor performance for advance ratios of 0.4 to 0.67 and the sensitivity of the rotor forces and moments to rotor control inputs as the lift limit is approached are established. A.W.H.

N80-13029# Kaman Aerospace Corp., Bloomfield, Conn.
DESIGN ASSESSMENT OF ADVANCED TECHNOLOGY LIGHTWEIGHT, LOW-COST MISSION-CONFIGURED GONDOLA MODULES Final Report, Aug. 1978 - Mar. 1979
John D. Porterfield Jul. 1979 175 p refs
(Contract DAAK51-78-C-0012; DA Proj. 1L1-62209-AH-76)
(AD-A073554; R-1568; USARTL-TR-79-16) Avail: NTIS HC A08/MF A01 CSCL 15/5

The objectives of this program were to identify applicable high strength materials and efficient structural concepts for application to various elements of the helicopter external gondola system (HEGS) and to subsequently prepare preliminary design arrangements for the HEGS-10, HEGS-20, and HEGS-Palletized modules. GRA

N80-13030# Rockwell International Corp., El Segundo, Calif. Los Angeles Div.
MECHANICAL POWER SYSTEM FOR AIRCRAFT INTERMITTENT UTILITY FUNCTIONS Final Technical Report, Mar. 1975 - Feb. 1979
C. W. Helsley Apr. 1979 282 p refs
(Contract F33615-75-C-2011; AF Proj. 3145)
(AD-A073297; RI/LAD-NA-79-64; AFAPL-TR-79-2028) Avail: NTIS HC A13/MF A01 CSCL 01/3

The program reported upon herein is designed to develop a satisfactory method for utilizing flywheel energy in an aircraft control system. To attain this objective, the program will design, fabricate and demonstrate a mechanical power package (MPP) for controlling and powering a high-horsepower utility actuation function. The MPP will consist of a hydraulic motor, a flywheel, an adapter gearbox, a controller, and a screwjack actuator, and will be designed to replace an existing hydraulic actuator. GRA

N80-13031# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COMPUTER DESCRIPTION OF BLACK HAWK HELICOPTER Final Report
Gary G. Kuehl Jun. 1979 321 p refs Supersedes ARBRL-IMR-605
(AD-A073444; AD-E430285; ARBRL-TR-02172; ARBRL-IMR-605) Avail: NTIS HC A14/MF A01 CSCL 01/3

A computer description of the geometry of the Black Hawk Helicopter was made. This description was made using the technique of combinatorial geometry (COM-GEOM) and will be used as input to the GIFT computer code which generates data used in target vulnerability analyses. This report describes the method used in modelling the helicopter. The appendix contains computer listings of the data comprising the computer description of the vehicle. GRA

N80-13032# Northrop Research and Technology Center, Palos Verdes Peninsula, Calif.
INVESTIGATION OF ADVANCED PROGNOSTIC ANALYSIS TECHNIQUES Final Report
Ralph C. Grove Jun. 1979 261 p refs
(Contract DAAJ02-77-C-0054; DA Proj. 1L2-62209-AH-76)
(AD-A073553; NRTC-78-47R; USARTL-TR-79-10) Avail: NTIS HC A12/MF A01 CSCL 01/3

This report presents the results of an experimental program with the following objectives: to collect and process test data from six different UH-1 helicopter 90 degree gearboxes, tested for a total of 4712 hours under controlled conditions, and to perform a theoretical investigation and data analysis to develop and optimize trend detection and prediction algorithms for application to the processed test cell data in order to establish valid predictions of gearbox failure time. A variety of sensors were used to monitor the wear occurring in the gearboxes including oil debris monitors, accelerometers, a shock pulse analyzer, and temperature sensors. Spectrometric oil analyses of the gearbox oil were performed on daily samples from the gearbox oil reservoir. The gearboxes were disassembled and inspected for wear prior to and following each test. Wear measurement techniques included visual inspection by an expert, measurements of ball and ball track wear, dynamic noise testing of bearings, and scanning electron microscope photographs of the surface of one ball from each bearing. GRA

N80-13033# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
A COMPUTERIZED VSTOL/SMALL PLATFORM LANDING DYNAMICS INVESTIGATION MODEL Final Report
Ronald L. Nave 30 Sep. 1977 295 p
(WF41421203)
(AD-A073587; NADC-77024-30) Avail: NTIS
HC A13/MF A01 CSCL 01/2

A digital computer program has been developed to investigate the dynamic interaction between VSTOL aircraft and ships. The model includes the ship, aircraft, pilot, and air turbulence. At present the aircraft model is configured to represent the AV8A Harrier, but other aircraft may be simulated by simple program changes. GRA

N80-13034# ARO, Inc., Arnold Air Force Station, Tenn.
A-10 CARRIAGE LOADS TEST Final Report, 26 May - 3 Jun. 1978
T. O. Shadow AEDC Jun. 1978 48 p Sponsored by the Air Force
(AD-A073442; AEDC-TSR-78-P9) Avail: NTIS
HC A03/MF A01 CSCL 01/3

A wind tunnel test was conducted with a 0.05 scale model of the A-10 aircraft to obtain carriage loads data for various external store configurations. The external stores consisted of 14 different bombs and pods, four different loading racks, and three 600 gal ferrying tanks mounted in various combinations on all 11 pylons. The loads imposed by the stores on the pylons were measured on six of the 11 pylons with strain-gage balances mounted inside the pylons. Mach number was varied from 0.3 to 0.75 and aircraft sideslip angle was varied from -18 to 18 deg at constant angles of attack of 0, 5, 10, 15, and 20 deg. GRA

N80-13035# Royal Aircraft Establishment, Farnborough (England).
THE USE OF STRIP THEORY IN THE DYNAMICS OF DEFORMABLE AIRCRAFT
D. L. Woodcock London HMSO Aug. 1978 120 p refs
(RAE-TM-Struct-933; BR66481) Avail: NTIS
HC A06/MF A01

A detailed formulation of the equations of motion of a deformable aircraft is given. The development is from Lagrange's equations for an inertial frame and is made in terms of the position, orientation, force, and inertia properties of narrow strips of the aircraft which lie fore and aft in the unperturbed state. The latter is one of constant linear velocity and zero angular velocity. Particular account is taken of the deformation and loading in the unperturbed state. Author (ESA)

N80-13036# Royal Aircraft Establishment, Farnborough (England).
FORMULATION OF THE EQUATIONS OF MOTION OF A DEFORMABLE AIRCRAFT USING LAGRANGE'S EQUATIONS IN AN ARBITRARY NON-INERTIAL FRAME OF REFERENCE
D. L. Woodcock London Dec. 1978 101 p refs
(RAE-TM-Struct-941; BR66754) Avail: NTIS
HC A06/MF A01

The equations of motion of a deformable aircraft are developed in detail from Lagrange's equations for a non-inertial frame. By an appropriate choice of deformation modes the principal frame of reference can be specified as, for example, mean-body axes or body-fixed axes. Particular account is taken of the influence of the propulsive and effective forces produced by power units containing rotating parts. The development ventures to a certain extent into the non-linear regime. Author (ESA)

N80-13037# Royal Aircraft Establishment, Farnborough (England).
THE EQUATIONS OF MOTION OF AN AIRCRAFT EMBRACING ITS WHOLE-BODY AND DEFORMATIONAL DEGREES OF FREEDOM
C. H. E. Warren London HMSO Jan. 1979 58 p refs
(RAE-TR-79010; RAE-Struct-YSE/B/0778; BR67362) Avail: NTIS HC A04/MF A01

The problem of unifying and relating the approaches adopted by the flight dynamicist who makes small perturbation studies of the behavior of an aircraft in its whole-body degrees of freedom and by the structural dynamicist who makes similar studies of the behavior in its deformational degrees of freedom is considered. A framework for a common approach is outlined. It goes as far as deriving the equations of motion and shows how the terms, etc., in these equations relate to those traditionally used by the flight dynamicist and structural dynamicist. Author (ESA)

N80-13038# Royal Aircraft Establishment, Farnborough (England).
A SUGGESTION AS TO A GENERAL DERIVATION OF THE EQUATIONS OF MOTION OF A DEFORMABLE AIRCRAFT FOR SMALL PERTURBATIONS WHICH WILL BE MOST GENERALLY ACCEPTABLE
D. L. Woodcock London HMSO Jan. 1979 53 p refs
(RAE-TR-79011; RAE-Struct-BF/B/0777; BR67657) Avail: NTIS HC A04/MF A01

A general derivation of the equations of motion of a deformable aircraft for small perturbations is offered which, it is hoped, will be acceptable to all traditions and inclinations. The deformations are represented by an expression which is precisely linear in the generalized coordinates. Lagrange's equation for an arbitrary noninertial frame is used, along with the principles of momentum, and it is shown how the resulting equations of motion can be particularized to suit various tastes. An appendix considers to some extent the determination of the Phugoid and shows that the traditional structural dynamicist's approach is just as adequate as that of the flight dynamicist. Author (ESA)

N80-13039# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
BEAVER AIRCRAFT PARAMETER IDENTIFICATION: TECHNICAL PREPARATIONS AND PRELIMINARY RESULTS
Henry C. Garretson, III 1978 79 p refs
(DFVLR-Mitt-78-01) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 28.30

Various factors affecting aircraft parameter identification are examined. A review of the preparation/flight test phases of this research program is presented. The Beaver aircraft digital simulation program, aircraft flight test instrumentation, and test data processing are described. Input signal optimization techniques are discussed and signals optimized using four different methods are presented. Production of a tape which automatically applied the optimized input signals in flight is described. The flight test phase consisted of 14 flights and resulted in useful data for 110 individual maneuvers. Preliminary identification results from representative maneuvers are given. Author (ESA)

N80-13040# New Mexico Univ., Albuquerque. Technology Application Center.
REMOTELY PILOTED VEHICLES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979
Samuel C. Mauk Sep. 1979 47 p Sponsored by NTIS
(NTIS/PS-79/0875/9) Avail: NTIS HC $28.00/MF $28.00
CSCL 01C

Articles concerning aircraft design, flight tests, aircraft control, cost effectiveness automatic flight control, automatic pilots, and data links are presented. Civil aviation applications are included, although military uses of remotely piloted vehicles are stressed. Contains 181 citations. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-13041*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT TEST OF NAVIGATION AND GUIDANCE SENSOR ERRORS MEASURED ON STOL APPROACHES
David N. Warner and F. J. Moran Dec. 1979 42 p
(NASA-TM-81154; A-8008) Avail: NASA, Ames Res. Center,

Moffett Field, Calif. 20546 CSCL 01D

Navigation and guidance sensor error characteristics were measured during STOL approach-flight investigations. Data from some of the state sensors of a digital avionics system were compared to corresponding outputs from an inertial navigation system. These sensors include the vertical gyro, compass, and accelerometers. Barometric altimeter data were compared to altitude measured by a tracking radar. Data were recorded with the Augmentor Wing Jet STOL Research Aircraft parked and in flight. Author

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-13042# National Aviation Facilities Experimental Center, Atlantic City, N. J.

EXHAUST EMISSIONS CHARACTERISTICS FOR A GENERAL AVIATION LIGHT AIRCRAFT TELEDYNE CONTINENTAL MOTORS 6-285-B PISTON ENGINE Final Report

Eric E. Becker Aug. 1979 98 p refs

(AD-A074338; FAA-NA-79-30; FAA-RD-79-67) Avail: NTIS HC A05/MF A01 CSCL 21/7

The 6-285-B engine was tested to develop an exhaust emissions data base. The data base consists of current production baseline emissions characteristics, lean out emissions data, effects of leaning out the fuel schedule on cylinder head temperatures, and data showing ambient effects on exhaust emissions and cylinder head temperatures. A.W.H.

N80-13043*# Boeing Co., Seattle, Wash. Advanced Airplane Branch.

COMPUTER CODE FOR ESTIMATING INSTALLED PERFORMANCE OF AIRCRAFT GAS TURBINE ENGINES. VOLUME 1: FINAL REPORT

Edward J. Kowalski Dec. 1979 204 p refs 3 Vol.

(Contract NAS3-21238)

(NASA-CR-159691; D180-25481-1-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 21E

A computerized method which utilizes the engine performance data is described. The method estimates the installed performance of aircraft gas turbine engines. This installation includes: engine weight and dimensions, inlet and nozzle internal performance and drag, inlet and nacelle weight, and nacelle drag. A.W.H.

N80-13044*# Boeing Co., Seattle, Wash. Advanced Airplane Branch.

COMPUTER CODE FOR ESTIMATING INSTALLED PERFORMANCE OF AIRCRAFT GAS TURBINE ENGINES. VOLUME 2: USERS MANUAL

Edward J. Kowalski Dec. 1979 444 p 3 Vol.

(Contract NAS3-21238)

(NASA-CR-159692; D180-25481-2-Vol-2) Avail: NTIS HC A19/MF A01 CSCL 21E

A computerized method which utilizes the engine performance data and estimates the installed performance of aircraft gas turbine engines is presented. This installation includes: engine weight and dimensions, inlet and nozzle internal performance and drag, inlet and nacelle weight, and nacelle drag. A user oriented description of the program input requirements, program output, deck setup, and operating instructions is presented. A.W.H.

N80-13045*# Boeing Co., Seattle, Wash. Advanced Airplane Branch.

COMPUTER CODE FOR ESTIMATING INSTALLED PERFORMANCE OF AIRCRAFT GAS TURBINE ENGINES. VOLUME 3: LIBRARY OF MAPS

Edward J. Kowalski Dec. 1979 415 p refs 3 Vol.

(Contract NAS3-21238)

(NASA-CR-159693; D180-25481-3-Vol-3) Avail: NTIS HC A18/MF A01 CSCL 21E

A computerized method which utilizes the engine performance data and estimates the installed performance of aircraft gas turbine engines is presented. This installation includes: engine weight and dimensions, inlet and nozzle internal performance and drag, inlet and nacelle weight, and nacelle drag. The use of two data base files to represent the engine and the inlet/nozzle/aftbody performance characteristics is discussed. The existing library of performance characteristics for inlets and nozzle/aftbodies and an example of the 1000 series of engine data tables is presented. A.W.H.

N80-13046*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

FLUTTER SPECTRAL MEASUREMENTS USING STATIONARY PRESSURE TRANSDUCERS

A. P. Kurkov 1980 15 p refs Presented at the 25th Annual Intern. Gas Turbine Conf. and the 22d Annual Fluids Eng. Conf., New Orleans, 9-13 Mar. 1980; sponsored by ASME

(NASA-TM-79293; E-237) Avail: NTIS HC A02/MF A01 CSCL 21E

Engine-order sampling was used to eliminate the integral harmonics from the flutter spectra corresponding to a case-mounted static pressure transducer. Using the optical displacement data, it was demonstrated that the blade-order sampling of pressure data may yield erroneous results due to the interference caused by blade vibration. Two methods are presented which effectively eliminate this interference yielding the blade-pressure-difference spectra. The phase difference between the differential-pressure and the displacement spectra was evaluated. Author

N80-13047*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

ATOMIZING CHARACTERISTICS OF SWIRL CAN COMBUSTOR MODULES WITH SWIRL BLAST FUEL INJECTORS

Robert D. Ingebo 1980 11 p refs Presented at the 25th Annual Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by ASME

(NASA-TM-79297; E-248) Avail: NTIS HC A02/MF A01 CSCL 21E

Cold flow atomization tests of several different designs of swirl can combustor modules were conducted in a 7.6 cm diameter duct at airflow rates (per unit area) of 7.3 to 25.7 g/sq cm sec and water flow rates of 6.3 to 18.9 g/sec. The effect of air and water flow rates on the mean drop size of water sprays produced with the swirl blast fuel injectors were determined. Also, from these data it was possible to determine the effect of design modifications on the atomizing performance of various fuel injector and air swirler configurations. The trend in atomizing performance, as based on the mean drop size, was then compared with the trends in the production of nitrogen oxides obtained in combustion studies with the same swirl can combustors. It was found that the fuel injector design that gave the best combustor performance in terms of a low NOx emission index also gave the best atomizing performance as characterized by a spray of relatively small mean drop diameter. It was also demonstrated that at constant inlet air stream momentum the nitrogen oxides emission index was found to vary inversely with the square of the mean drop diameter of the spray produced by the different swirl blast fuel injectors. Test conditions were inlet air static pressures of 100,000 to 200,000 N/sq m at an inlet air temperature of 293 K. Author

N80-13048*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

ADVANCED CATALYTIC COMBUSTORS FOR LOW POLLUTANT EMISSIONS, PHASE 1 Final Report

W. J. Dodds Nov. 1979 159 p refs Sponsored in part by Air Force Engineering Services Center, Tyndall AFB, Fla.

(Contract NAS3-20820)

(NASA-CR-159535; CEEDO-TR-79-03) Avail: NTIS HC A08/MF A01 CSCL 21E

The feasibility of employing the known attractive and distinguishing features of catalytic combustion technology to reduce nitric oxide emissions from gas turbine engines during

subsonic, stratospheric cruise operation was investigated. Six conceptual combustor designs employing catalytic combustion were defined and evaluated for their potential to meet specific emissions and performance goals. Based on these evaluations, two parallel-staged, fixed-geometry designs were identified as the most promising concepts. Additional design studies were conducted to produce detailed preliminary designs of these two combustors. Results indicate that cruise nitric oxide emissions can be reduced by an order of magnitude relative to current technology levels by the use of catalytic combustion. Also, these combustors have the potential for operating over the EPA landing-takeoff cycle and at cruise with a low pressure drop, high combustion efficiency and with a very low overall level of emission pollutants. The use of catalytic combustion, however, requires advanced technology generation in order to obtain the time-temperature catalytic reactor performance and durability required for practical aircraft engine combustors. A.R.H.

N80-13049# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF AIRJET DISTORTION GENERATOR USED TO PRODUCE STEADY-STATE, TOTAL-PRESSURE DISTORTION AT THE INLET OF A GENERAL ELECTRIC F101-GE-100 TURBOFAN ENGINE Final Report, 30 Mar. - 31 May 1978
J. D. Hubble and R. E. Smith AEDC Aug. 1979 90 p refs
(AD-A072743; AEDC-TR-78-73) Avail: NTIS
HC A05/MF A01 CSCL 21/5

A performance evaluation of an airjet distortion generator (ADG) system used to produce steady-state, total-pressure distortion at the inlet to a turbine engine was conducted. The capability of the system to duplicate screen-generated, classical and composite patterns and to maintain a constant distortion pattern over a range of airflows is presented. The effect of Reynolds number on the system's capability to match patterns is also investigated. A comparison of the effects of inlet distortion produced by screens to that produced by the airjet distortion generator system on the stability characteristics of the General Electric F101-GE-100 turbofan engine is described. GRA

N80-13050# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
BUILD 2 OF AN ACCELERATED MISSION TEST OF A TF-41 WITH BLOCK 76 HARDWARE Final Report, 2 Aug. - 20 Sep. 1978
Robert J. May, Jr. Jul. 1979 189 p refs
(AD-A073436; AFAPL-TR-79-2063) Avail: NTIS
HC A09/MF A01 CSCL 21/5

An accelerated mission test (AMT) of a TF41 (S/N 142163) was conducted in the Air Force Aero Propulsion Laboratory's D Bay Sea-Level Engine Test Facility between 2 August 1978 and 20 September 1978. The primary objective of the test was to evaluate the structural reliability of a series of parts changes known as Block 76 hardware. A two-hundred-sixty-three hour test program was initially planned but only one-hundred-eighty-nine hours were actually completed due to the failure of a first stage high pressure turbine blade. Post-test teardown showed all of the Block 76 hardware to be in good condition. Engine performance deterioration was tracked and an exhaust gas temperature survey was performed and the data analyzed. This report describes the details of the test, including test objectives, approach, instrumentation, facility and results. GRA

N80-13051# Flight Dynamics Research Corp., Van Nuys, Calif.
HIGH SPEED EJECTORS Final Report, Sep. 1977 - Dec. 1978
Morton Alperin and Jiunn-Jenq Wu May 1979 92 p refs
(Contract F33615-77-C-3160)
(AD-A073378; FDRC-3160-12-78; AFFDL-TR-79-3048) Avail: NTIS HC A05/MF A01 CSCL 21/5

The performance of solid and jet-diffuser ejectors in motion in their thrust direction was analyzed under the assumption that all fluids are compressible and have arbitrary properties. Two solutions to the equations representing the laws of mass flow and energy conservation and the momentum theorem were obtained. The solutions were examined and only those regions that were consistent with the Second Law of Thermodynamics were utilized. In these valid regions, three distinct characteristic points were observed, and chosen as criteria for classification of ejector performance. These characteristic points determined which of nine possible ejector configurations provided optimal performance at any given flight and injected gas conditions. Detailed examination of the thermodynamic cycle was made for representative cases and data was presented to illustrate the influence of ejectors upon conventional gas generator performance. The influence of nozzle loss, skin friction and flow separation, incomplete kinetic and thermal mixing, and boundary layer ingestion were taken into consideration in the analysis. Correlation with existing stationary solid and jet-diffuser ejector experiments showed excellent agreement between theory and experiment. It has been shown that ejectors designed according to the methods described, can provide large improvement in propulsion system performance throughout the entire practical flight regime. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-13052*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
EFFECTS OF RELAXED STATIC LONGITUDINAL STABILITY ON A SINGLE-STAGE-TO-ORBIT VEHICLE DESIGN
Delma C. Freeman, Jr. and Alan W. Wilhite Washington Dec. 1979 138 p refs
(NASA-TP-1594; L-13243) Avail: NTIS HC A07/MF A01 CSCL 22B

The effect of relaxing longitudinal stability requirements on single stage to orbit space vehicles is studied. A comparison of the mass and performance characteristics of two vehicles, one designed for positive levels of longitudinal stability and the other designed with relaxed stability requirements in a computer aided design process is presented. Both vehicles, required to meet the same mission characteristics are described. Wind tunnel tests, conducted over a Mach number range from 0.3 to 4.63 to verify estimated aerodynamic characteristics, are discussed. A.W.H.

N80-13053*# Honeywell, Inc., Minneapolis, Minn.
ACTIVE FLUTTER CONTROL FOR FLEXIBLE VEHICLES, VOLUME 1 Final Report
J. K. Mahesh, W. L. Garrard, C. R. Stones, and P. D. Hausman Nov. 1979 78 p refs
(Contract NAS1-15486)
(NASA-CR-159160) Avail: NTIS HC A05/MF A01 CSCL 01C

An active flutter control methodology based on linear quadratic gaussian theory and its application to the control of a super critical wing is presented. Results of control surface and sensor position optimization are discussed. Both frequency response matching and residualization used to obtain practical flutter controllers are examined. The development of algorithms and computer programs for flutter modeling and active control design procedures is reported. A.W.H.

N80-13054# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DIGITAL LOAD CONTROL APPLIED TO FULL-SCALE AIRFRAME FATIGUE TESTS Final Report, Jan. 1976 - Jun. 1977
Nirmal K. Mondol and Richard M. Potter May 1979 175 p refs
(AD-A073588; AFFDL-TR-79-3011) Avail: NTIS
HC A08/MF A01 CSCL 01/3

The modeling, analysis and digital simulation of an analog servo controller and its successful application to a full-scale airframe fatigue tests is described. Primary emphasis is on the use of minicomputers for dynamic load control of multiple channels. Hardware and software used to generate functions and control load is described. A brief comparison of digital system performance versus conventional analog controllers is included. GRA

N80-13055# Royal Aircraft Establishment, Farnborough (England).
SOME MEASUREMENTS OF BUFFETING ON AN AEROELASTIC MODEL OF A SLENDER WING AIRCRAFT
D. G. Mabey, C. W. Skingle, and J. C. Copley London HMSO Dec. 1978 24 p refs
(RAE-TM-Struct-942; BR66853) Avail: NTIS HC A02/MF A01

Buffeting tests on an aeroelastic model of a slender wing aircraft at Mach numbers of 0.2 and 0.3 and at low densities, over an angle of incidence range of from 0 to 24 deg were made. In general, the wing root strains resembled those measured previously on an ordinary wind tunnel model, with almost the same shape. The total damping in the first and third symmetric modes was derived from tape records of the wing root strain signal. For both modes, the total damping was almost independent of angle of incidence, even in the region of vortex breakdown. For the first mode the measured aerodynamic damping was reasonably predicted by assuming that the model was a slender delta wing with attached flow. Author (ESA)

N80-13056# Association Aeronautique et Astronautique de France, Paris.
THE DEVELOPMENT OF ACTIVE CONTROL AND ITS APPLICATION TO FLUTTER SUPPRESSORS [RECENTS PROGRES SUR LES CONTROLES ACTIFS APPLIQUES AUX SUPPRESSEURS DE FLOTTEMENT]
R. Destuynder 1979 22 p refs In FRENCH; ENGLISH summary Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-02; ISBN-2-7170-0529-3) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

Wind tunnel tests were performed on an aeroelastic model of a fighter wing mounted on the tunnel wall with different types of stores such as a tank or wing tip stores, in order to investigate the possibility of controling the flutter instabilities by means of the introduction of a control law acting upon wing stiffness. The results of two wind tunnel experiments in the high subsonic flow zone show that a relatively simple law can be used to suppress fluttering with the help of some experimental data. The difficulties introduced in the study of fully automatic control by the interaction between superimposed active control systems are pointed out. Author (ESA)

N80-13307 Indian Inst. of Tech., Kanpur.
SOME RECENT TRENDS IN AIRCRAFT FLUTTER RESEARCH
P. N. Murthy *In* SVIC Shock and Vibration Digest, Vol. 11, No. 5 May 1979 p 7-12 refs (For primary document see N80-13306 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D.C. 20375 CSCL 01/3

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-13057# Federal Aviation Administration, Washington, D. C.
INSTALLATION CRITERIA FOR THE APPROACH LIGHTING SYSTEM IMPROVEMENT PROGRAM (ALSIP) Final Report
Steven Zaidman Nov. 1978 44 p
(AD-A070076; FAA-ASP-78-5) Avail: NTIS HC A03/MF A01 CSCL 01/5

An investment criteria for retrofit of runway approach lighting systems is presented. The retrofit of existing rigid light support structures with frangible mountings and the conversion of high intensity lighting systems to more energy efficient configurations is discussed. The criteria are developed by benefit versus cost analysis. A.W.H.

N80-13058*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
SYNTHESIS OF A CONTROL MODEL FOR A LIQUID NITROGEN COOLED, CLOSED CIRCUIT, CRYOGENIC NITROGEN WIND TUNNEL AND ITS VALIDATION Progress Report, period ending Sep. 1979
S. Balakrishna and G. L. Goglia Nov. 1979 142 p refs
(Grant NsG-1503)
(NASA-CR-162508) Avail: NTIS HC A07/MF A01 CSCL 01E

The details of the efforts to synthesize a control-compatible multivariable model of a liquid nitrogen cooled, gaseous nitrogen operated, closed circuit, cryogenic pressure tunnel are presented. The synthesized model was transformed into a real-time cryogenic tunnel simulator, and this model is validated by comparing the model responses to the actual tunnel responses of the 0.3 m transonic cryogenic tunnel, using the quasi-steady-state and the transient responses of the model and the tunnel. The global nature of the simple, explicit, lumped multivariable model of a closed circuit cryogenic tunnel is demonstrated. M.M.M.

N80-13059# European Space Agency, Paris (France). Inst. fuer Aeroelastik.
INVESTIGATIONS ON UNSTEADY PRESSURE DISTRIBUTION MEASUREMENTS IN ROTATING SYSTEMS
Karl Kienappel (DFVLR, Goettingen, West Ger.) Jan. 1979 49 p refs Transl. into ENGLISH of 'Untersuchung zur Messung instationaerer Druecke in rotierenden Systemen", DFVLR, Goettingen, West Ger. Report DLR-FB-77-43, Aug. 1977 Original report in GERMAN previously announced as N78-31135 Original German report available from DFVLR, Cologne DM 23.80
(ESA-TT-503-Rev; DLR-FB-77-43) Avail: NTIS HC A03/MF A01

The theoretical basic requirements for measuring unsteady periodical pressure distributions in a rotating system are discussed. An experimental test set-up to investigate the problems of the measurement technology is described. First results of this experiment made in a 3 m wind tunnel are presented and discussed. Author (ESA)

N80-13060# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aerolastik.
INDUSTRIAL TRIAL RUN OF THE AVA DERIVATIVE BALANCE ON AN ALPHAJET JET MODEL IN A 3 m WINDTUNNEL Final Report
Eberhard Schmidt Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1978 62 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-W-78-07) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13.05

As part of a project to study stability derivative measurements in wind tunnels, a multicomponent derivative balance was given a trial run in a low speed wind tunnel. For the purpose of determining the servicability and reliability of this apparatus, a light weight model of the Alpha jet was used on which independant derivative measurements had already been performed. The comparison of results shows that this instrument for measuring dynamic stability derivatives on airplane and missile models in combined longitudinal or lateral motions performs adequately. Author (ESA)

N80-13061# National Engineering Lab., East Kilbride (Scotland). Flow Measurement Div.
AIR FLOW MEASUREMENTS IN A LARGE IRREGULARLY SHAPED TUNNEL USING ANEMOMETER AND PITOT-STATIC TUBE TRAVERSE
A. McHugh, F. C. Kinghorn (Natl. Coal Board, Bretby, U.K.), J. Allan (Natl. Coal Board, Doncaster, U.K.), and B. Webster Oct. 1978 25 p refs Sponsored by Metrology and Std. Requirements Board
(NEL-660) Avail: NTIS HC A02/MF A01

A series of traverses using anemometers and pitot tubes to measure the flow rate of air through an explosion gallery were

carried out. Flow rates were also measured using a conical inlet fitted at the gallery outlet. Good agreement was found between the flow rates measured by the individual traverses, but these invariably gave a lower flow rate than the conical inlet, the average difference being about 6%. No definite explanation for this could be found, but conditions in the gallery could possibly cause the inlet to be read in error, although it did not show in subsequent scale model tests. Several methods of traversing the gallery were then used and a system for locating the measuring positions in such irregularly shaped ducts is proposed; these methods did not produce significantly different results, except for a 'continuously sweeping' method which gave flow rates higher than the others by about 2%. In an auxiliary study, it was shown that, unless great care is taken, serious errors can arise in anemometer calibrations. Author (ESA)

N80-13062# Royal Aircraft Establishment, Farnborough (England).
THE ACOUSTIC CHARACTERISTICS OF THE RAE 1.5m WIND TUNNEL
W. J. G. Trebble London HMSO Jan. 1979 50 p refs
(RAE-TR-79002; RAE-Aero-3447; BR67864) Avail: NTIS
HC A03/MF A01

Extensive modifications to the old 5 ft tunnel at RAE have provided an acoustic tunnel capable of airspeeds up to 60 m/sec. The drive-fan was replaced by a seven-bladed unit which is now mounted in the return circuit and acoustic splitters were installed in the circuit on both sides of the fan. An anechoic chamber lined with polyether foam was built around the test section to give good acoustic properties at frequencies above 1 kHz. The tunnel background noises level was reduced by more than 15 dB for frequencies below 5 kHz with less benefit at higher frequencies. Tests show that inside the airstream at 50 m/sec the noise level for third-octave bandwidths now drops from 75 dB at 1 kHz to 70 dB at 20 kHz. The noise level outside the airstream is some 5 to 10 dB quieter. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-13063*# Rockwell International Corp., Canoga Park, Calif.
SPACE CONSTRUCTION SYSTEM ANALYSIS, FINAL REVIEW. PART 1: EXECUTIVE SUMMARY
1979 50 p
(Contract NAS9-15718)
(NASA-CR-160286; PD79-18) Avail: NTIS HC A03/MF A01
CSCL 22A

Several large space system projects which would drive out specific requirements for space construction are considered. A data base was developed to provide designers of large systems with convenient systematic access to methods of space construction and associated requirements. The results obtained were applied to technologies other than the study project. M.M.M.

N80-13064*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
LIFE SCIENCE PAYLOADS PLANNING STUDY INTEGRATION FACILITY SURVEY RESULTS
G. W. Wells, N. E. Brown, and W. G. Nelson Nov. 1976 170 p refs
(Contract NAS9-14589)
(NASA-CR-160390; MDC-G6275) Avail: NTIS
HC A08/MF A01 CSCL 22A

The integration facility survey effort described is structured to examine the facility resources needed to conduct life science payload (LSP) integration checkout activities at NASA-JSC. The LSP integration facility operations and functions are defined along with the LSP requirements for facility design. A description of available JSC life science facilities is presented and a comparison of accommodations versus requirements is reported. A.W.H.

N80-13065*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
LIFE SCIENCE PAYLOADS PLANNING STUDY INTEGRATION FACILITY SURVEY: EXECUTIVE SUMMARY
G. W. Wells and N. E. Brown Nov. 1976 42 p refs
(Contract NAS9-14589)
(NASA-CR-160391; MDC-G6579) Avail: NTIS
HC A03/MF A01 CSCL 22A

Analyses of proposed life science shuttle era payload operations are discussed. A summary of results from a survey conducted to: (1) examine facility and equipment resources needed for life science payload integration, checkout, test and mission support activities; (2) identify presently available resources; and (3) determine methods by which operational era status may be implemented based on currently available resources, is presented. A.R.H.

N80-13066*# Teledyne Brown Engineering, Huntsville, Ala. Space Programs Div.
OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY PRELIMINARY REQUIREMENTS FOR SPACE SCIENCE AND APPLICATIONS PLATFORM STUDIES Final Report
Nov. 1979 108 p
(Contract NAS8-32711)
(NASA-CR-161346; SP79-MSFC-2391) Avail: NTIS
HC A06/MF A01 CSCL 22A

Needs and requirements for a free flying space science and applications platform to host groupings of compatible, extended mission experiments in earth orbit are discussed. A payload model which serves to define a typical set of mission requirements in the form of a descriptive data base is presented along with experiment leval and group level data summarizations and flight schedules. The payload descriptions are grouped by technology into the following categories: communications, materials (long term effect upon), materials technology development, power, sensors, and thermal control. A.W.H.

N80-13067*# Teledyne Brown Engineering, Huntsville, Ala. Space Systems Dept.
GUIDELINES FOR MISSION INTEGRATION, A SUMMARY REPORT
Nov. 1979 118 p
(Contract NAS8-32711)
(NASA-CR-161347; SP79-MSFC-2392) Avail: NTIS
HC A06/MF A01 CSCL 22A

Guidelines are presented for instrument/experiment developers concerning hardware design, flight verification, and operations and mission implementation requirements. Interface requirements between the STS and instruments/experiments are defined. Interface constraints and design guidelines are presented along with integrated payload requirements for Spacelab Missions 1, 2, and 3. Interim data are suggested for use during hardware development until more detailed information is developed when a complete mission and an integrated payload system are defined. Safety requirements, flight verificication requirements, and operations procedures are defined. R.E.S.

N80-13068*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE FABRICATION DEMONSTRATION SYSTEM. COMPOSITE BEAM CAP FABRICATOR DEVELOPMENT, PHASE 1 AND 2 Final Report
30 Nov. 1979 78 p
(Contract NAS8-32472)
(NASA-CR-161348; NSS-SFDS-RP015) Avail: NTIS
HC A05/MF A01 CSCL 22A

Pultrusion as a workable process for thermoset and thermoplastic graphite composite closed caps is discussed. The composite beam fabricator configuration is presented as are the beam cap properties. A.W.H.

N80-13069# European Space Agency, Paris (France).
MATERIAL SCIENCES IN SPACE
T. D. Guyenne, ed. and S. Adamy, ed. Jun. 1979 466 p refs
Partly in ENGLISH and FRENCH Proc. of lectures presented at 3d European Symp. on Mater. Sci. in Space, Grenoble, France, 24-27 Apr. 1979 Prepared in cooperation with CNES and CEA
(ESA-SP-142) Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

Materials science technology is assessed especially in regards to spaceborne research and development. Main topics included

phenomena encountered during fluid phases of materials space processing, gravitational and nongravitational (Marangoni) convection, the characteristics of floating zones as well as containerless melts. Recent results on the elaboration of crystal growth techniques, both on Earth and in orbit, are also covered. Preparation for the First Spacelab Payload is extensively discussed. Finally, the outlook for continuing research into spaceborne materials science is considered. For individual titles, see N80-13070 through N80-13125.

N80-13070# Academy of Sciences (USSR), Moscow. Inst. of Science Research.
THE MULTIPURPOSE APPARATUS CRYSTAL FOR PROCESS EXPERIMENTS IN SPACE **c35**
A. Yu. Malinin, R. Z. Sagdeev, V. T. Khryapov, E. T. Solomin, V. I. Seliverstov, Yu. M. Zhelanni, A. F. Podolinni, and D. V. Bocharov *In* ESA Mater. Sci. in Space Jun. 1979 p 5-8 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The multipurpose specialized apparatus 'Crystal' was designed for investigations of single crystal and semiconductor layer growth features under near-zero gravitation. Requirements for the specialized apparatus for process experiments onboard space stations, design features, and functional diagrams are discussed. The furnace associated with the system, the computerized control unit, and the data processing equipment are described. Possible applications onboard the Salyut 6 spacecraft, such as directional crystallization, sublimation, gas carrier transfer, and travelling melt solvent experiments, are cited. Author (ESA)

N80-13071# Academy of Sciences (USSR), Moscow.
STRUCTURAL AND PHYSICAL CHARACTERISTICS OF InSb SINGLE CRYSTALS GROWN UNDER NEAR-ZERO GRAVITY CONDITIONS **c76**
F. R. Khashimov et al. *In* ESA Mater. Sci. in Space Jun. 1979 p 9-15 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The results of the first experiments carried in space using the multipurpose apparatus 'Crystal' are reported. The main aim of the experiments was to study the growth features of semiconductor binary compounds (for example InSb) under weightlessness conditions. Furthermore, the influence of these conditions on crystalline perfection and homogeneity of electrophysical properties of crystals and also on impurity microsegregation behavior in grown crystals was studied. For this purpose the crystals were grown under the same temperature conditions on Earth and on board the orbital station Salyut 6.Author (ESA)

N80-13072# Academy of Sciences (USSR), Moscow.
THE INFLUENCE OF SPACE CONDITIONS ON DIRECTIONAL CRYSTALLIZATION OF GERMANIUM AND ITS PROPERTIES **c76**
E. V. Markov et al. *In* ESA Mater. Sci. in Space Jun. 1979 p 17-23 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The growth and properties of germanium crystals grown by a directional crystallization technique under near-zero gravity conditions onboard Salyut 6 and crystals grown on Earth using the same growing system (Crystal) were studied. The growth features studied by the surface morphology and properties of the crystals grown under weightlessness conditions were compared with those of the crystals grown on Earth by lateral and longitudinal directional crystallization techniques. The crystals were studied by analytical techniques involving optical and electron scanning microscopy for investigation of growth feature, surface morphology, and crystalline perfection. The homogeneity of electrophysical characteristics was determined by measuring the resistivity and Hall effect. The results obtained confirm the advantages of space conditions for growing semiconductor single crystals by directional crystallization and the possibility of growing the crystals with high structural perfection and chemical homogeneity. Author (ESA)

N80-13073# Academy of Sciences (USSR), Moscow.
CONVECTIVE PROCESSES AT LOW GRAVITY **c34**
V. I. Polezhaev *In* ESA Mater. Sci. in Space Jun. 1979 p 25-31 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

Convection under zero gravity conditions is reviewed. Some trends and properties of gravitational convection in weak body force fields and some typical patterns of convective interaction are treated. The results obtained by numerical solutions based on general equations of hydromechanics show that convective effects under weightlessness can be substantial. Author (ESA)

N80-13074# Academy of Sciences (USSR), Moscow.
INVESTIGATION OF THE STRUCTURE OF Te-Se SOLID SOLUTIONS OBTAINED UNDER DIFFERENT GRAVITY CONDITIONS ON BOARD THE SALYUT 6 STATION, IN A CENTRIFUGE **c25**
G. E. Ignatjev (Moscow Inst. of Steel and Alloys), A. S. Okhotin (Moscow Inst. of Steel and Alloys), Yu. S. Avraamov et al. *In* ESA Mater. Sci. in Space Jun. 1979 p 33-39 (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The structures of a Te-Se solid solution obtained onboard the Salyut 6 space station and of a similar solution grown on Earth are compared. Both solutions were obtained using a centrifuge the force field of which was 10 g (g = 9.8 m per sec squared). The structures of transverse and longitudinal specimens and of freely crystallized surfaces are given. Photomicrographs and X-ray images of the surfaces are presented. Results indicate that the formation of a dendrite structure which is related to the macroinhomogeneity of the solid solution grown on Earth is suppressed in space processing. Author (ESA)

N80-13075# Academy of Sciences (USSR), Moscow.
CRYSTAL GROWTH FROM THE VAPOR PHASE WITH AN INERT COMPONENT PRESENT **c76**
S. I. Aladiev and A. S. Okhotin *In* ESA Mater. Sci. in Space Jun. 1979 p 41-45 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The rates of crystal growth from the vapor gas medium are investigated. The conditions that are adequate to the growth process of the diffusion zone are discussed. The crystal growth rate is determined by the time elapsed when transporting the substance to the boundary with a phase transition or to the zone of a chemical reaction. It is assumed that both the phase transition and the chemical reaction rate develop rather quickly and are not the limiting stages. Author (ESA)

N80-13076# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
EXPERIMENT SYRENA 1, 2, 3: SPACE PROCESSING OF CdHgTe, CdHgSe AND PbSeTe **c24**
R. R. Galazka (Polish Acad. of Sci.), A. Jedrzejczak (Polish Acad. of Sci.), A. Szczerbakow (Polish Acad. of Sci.), T. Warminski (Polish Acad. of Sci.), J. Bak (Polish Acad. of Sci.), J. Auleytner (Polish Acad. of Sci.), A. S. Okhotin, R. P. Borovikova, I. A. Zubritskij, V. T. Khriapov et al. *In* ESA Mater. Sci. in Space Jun. 1979 p 47-51 (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The results of the investigations of materials crystallized onboard the space laboratory Salyut 6 are presented. Three component semiconducting solid solutions (CdTe-HgTe, CdSe-HgSe, and PbSe-PbTe) in the under zero-gravity conditions were crystallized. The homogeneity, crystallographic structure, rate of growth, and the influence of cavitation on crystal growth for CdHgTe solid solution are discussed. The partial results for CdHgSe and PbSeTe mixed crystals are also given. Author (ESA)

N80-13077*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
INFLUENCE OF THE SPACE ENVIRONMENT ON SOME MATERIALS PROCESSING PHENOMENA
R. F. Sekerka and S. R. Coriell (NBS, Washington, D.C.) *In* ESA Mater. Sci. in Space Jun. 1979 p 55-65 refs Sponsored by NASA (For primary document see N80-13069 04-12)
(Grants NSF DMR-75-09477; NSF DMR-78-22462)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120 CSCL 22A

The influence of the space environment on materials processing phenomena is studied by applying the principles of physical similarity to a system E on Earth and a system S in

the microgravity environment of space. If these systems can be characterized by a set of dimensionless groups, then they are similar if corresponding members of the set are equal for E and S. Similarity is often impractical or impossible if Q is larger than a few samples. For example, there is a simple law of similarity for an isothermal liquid zone floating between inert solids; however, similarity is lost if the zone becomes nonisothermal. A molten zone during crystal growth is so complex that a complete set cannot be identified with certainty. A second example is double-diffusive convection during unidirectional solidification of a binary alloy. Results show that buoyancy driven fluid dynamical instabilities couple with constitutionally related instabilities quite differently in E and S. Author (ESA)

N80-13078# Polytechnical Univ. of Madrid (Spain).
FLOATING ZONE STABILITY (EXP. 1-ES-331) c34
I. DaRiva and I. Martinez. *In* ESA Mater. Sci. in Space Jun. 1979 p 67-73 refs Sponsored by Spanish Natl. Comm. for Space Res. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

An experiment on floating liquid zones to be performed in the first Spacelab flight is presented. In this experiment, a liquid bridge is to be placed between two parallel coaxial disks (in the Fluid Physics Module) and subjected to disturbances in order to check the theoretical predictions about its stability limits and behavior under mechanical inputs (stretching of the zone, filling or removing the liquid, axial vibration, rotation, disalignment, etc.). Several aspects of the research are discussed, such as the relevance of the study, theoretical predictions of the liquid behavior regarding the floating zone stability limits and the expected response to vibrational and rotational disturbances, and ground support experiments using the Plateau technique or the small scale simulation. Instrumental aspects of the experiment include utilization of the Fluid Physics Module and post flight data analysis. Author (ESA)

N80-13079# Freiburg Univ. (West Germany).
PREPARATORY EXPERIMENTS FOR THE GROWTH OF SILICON SINGLE CRYSTALS IN THE MIRROR HEATING FACILITY OF SPACELAB c76
A. Eyer and R. Nitsche. *In* ESA Mater. Sci. in Space Jun. 1979 p 75-79 refs Sponsored by West Germany Federal Min. for Res. and Technol. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

Single crystals of silicon (up to 12 mm dia and 130 mm length) were grown by the floating zone technique. Radiation heating in a double ellipsoid mirror furnace was employed using halogen lamps as energy sources. The power requirement is 800 W, the pulling speed is in the range of 5 to 10 mm/min, and no rotation is necessary. By adapting the so-called necking process, the reproducible growth of dislocation free crystals became possible. The planned growth experiment for FSLP-mission is described. From comparison of the striation patterns in terrestrial and space crystals it is hoped to elucidate the influence of gravity-driven and Marangoni convection on the growth process. Author (ESA)

N80-13080# Bologna Univ. (Italy). Ist. di Fisica A. Righi.
DISPERSED GASEOUS AND SOLID PHASES IN MOLTEN AND SOLIDIFIED Cu c26
L. Castellani, P. Gondi, F. Barbieri, and N. Costa. *In* ESA Mater. Sci. in Space Jun. 1979 p 81-87 refs Sponsored by CNR-SAS (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The behavior during melting and solidification in zero gravity of pores and Al2O3 particles in sintered Cu was examined. Large numbers of microbubbles with diameters smaller than 1000 A remain. Depending on the compacting and sintering procedures, specimens with uniform or non-uniform distributions of A1203 particles are obtained. Large numbers of small elementary particles with diameters of approximately 500 A also remain, often associated with microbubbles, in the solid. With reference to the zero gravity conditions, results are discussed by considering the effects of Brownian motion and of settling on coalescence and the interactions of the bubbles and/or particles with the solidification front. Author (ESA)

N80-13081# Fulmer Research Inst. Ltd., Stoke Poges (England).
THE PREPARATION AND STABILITY OF METALLIC EMULSIONS IN A MICROGRAVITY ENVIRONMENT: AN EXPERIMENT FOR THE FIRST SPACELAB PAYLOAD (FSLP) c28
P. D. Caton and W. G. Hopkins. *In* ESA Mater. Sci. in Space Jun. 1979 p 89-94 refs Sponsored by UK Dept. of Ind. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The melting and casting of an immiscible alloy system in a microgravity environment, such as will be available on Spacelab, offers the opportunity to prepare a metallic emulsion and to study the relative importance of gravity induced and diffusion controlled growth mechanisms on the stability of such an emulsion. An experiment for the first Spacelab payload (FSLP) is described in which aluminum-lead alloys will be given a variety of heat treatments and their microstructures compared with 1 g reference samples. The experiment will be performed in the multi-user isothermal heating facility which will be incorporated in the materials sciences double rack. Author (ESA)

N80-13082# Bundesanstalt fuer Materialpruefung, Berlin (West Germany).
BRAZING UNDER MICROGRAVITY: TEXUS 2 EXPERIMENT c37
N. Philippovich (Vienna Univ.), R. Stickler (Vienna Univ.), K. Frieler (Vienna Univ.), and W. Bathke. *In* ESA Mater. Sci. in Space Jun. 1979 p 95-100 refs Sponsored in cooperation with Bundesmin. fuer Forsch. U. Technol. and Austrian Bundesmin. fuer Wiss. U. Forsch. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

In order to evaluate the effects of microgravity on vacuum brazing and the phenomena involved (i.e. flow of braze metal, joint filling, microstructure), an experiment was performed in the isothermal heating furnace of the TEXUS 2 sounding rocket. The sample, consisting of four Ni-cylinders inserted one inside the other to form a 200 micron cylindrical gap and a 0 to 2000 micron sickle-shaped gap, was brazed with a near eutectic Ag-Cu alloy. This brazing alloy contained a small amount of Li to promote spreading (58 Ag : 39 Cu : 3 Li at pct) and radioactive 110 Ag as a tracer metal. The sample was evaluated by autoradiography and metallographic techniques. This experiment was carried out in preparation of the FSLP-experiment ES 304/ES 305. Author (ESA)

N80-13083# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
SKIN TECHNOLOGY
H. Sprenger (MAN Neue Technol.), E. Erben (MAN Neue Technol.), H. Zeilinger (MAN Neue Technol.), and K. Schwertzer. *In* ESA Mater. Sci. in Space Jun. 1979 p 101-108 refs (For primary document see N80-13069 04-12)
(Contracts DFVLR-BPT-01-QV-276; DFVLR-BPT-01-QV-447)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The possibility of microstructural improvements by melting and solidification of pre-fabricated parts under microgravity is explored. The process is performed within a thin layer coating (skin) which has been deposited on the surface of the already shaped part on Earth. In space the skin should be able to retain the machined shape during the melting process. Preliminary Earth-based experiments with Al2O3 coated samples of an IN 100 alloy show that skin technology is feasible. This was confirmed by two sounding rocket experiments flown in TEXUS 1 and TEXUS 2 where the samples could be melted and resolidified without the severe deformations observed under the influence of hydrostatic pressure due to gravity. Further experiments are planned for the next TEXUS flights and the first Spacelab payload. Author (ESA)

N80-13084# Fiat Research Center, Turin, Italy.
FABRICATION OF COMPOSITE MATERIALS UNDER LOW GRAVITY (EXPERIMENT ES 310 OF THE FIRST SPACELAB PAYLOAD (FSLP)) [FABRICATION DE MATERIAUX COMPOSITES EN MICROGRAVITE (EXPERIENCE ES 310 DU PREMIER VOL SPACELAB)] c24
P. L. Antona. *In* ESA Mater. Sci. in Space Jun. 1979 p 109-114 In FRENCH Sponsored by CNR (For primary document see

N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

Results relative to the preparation of an experiment on the manufacture of aluminum matrix composite materials, covering various aluminum alloys, are presented. Reduced gravity is the variable and following the first Spacelab flight a comparison will be made between samples prepared on Earth and those prepared in space. The selection of specimen types as well as the development of an experimental specimen rack suited to the study of melting and solidifying Al2O3 steel reinforced sample materials are reported. Author (ESA)

N80-13085# Technische Hogeschool, Delft (Netherlands).
UNIDIRECTIONAL SOLIDIFICATION OF EUTECTIC IRON-CARBON ALLOYS AND THE SEGREGATION OF SULFUR c25
T. Luyendijk and H. Nieswaag. *In* ESA Mater. Sci. in Space Jun. 1979 p 115-122 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The experiment ES-325 for FSLP in which eutectic cast iron is unidirectionally solidified in order to study the segregation mechanism of sulphur and the growth process of the graphite is described. The experiment will be performed in the gradient facility of the isothermal heating furnace; four different growth rates will be imposed. The crucible of the specimen will be prepared using skin technology. Under terrestial conditions it appeared that during unidirectional solidification with the normal Bridgman technique, unexpected strong convective currents occur in the sulphur containing alloys. As a result during solidification the sulphur gradient in the remaining liquid is removed. The exact mechanism for this convection is not known. In phosphorus containing alloys the convective currents are much less effective, to a first approximation stirring can be neglected. Author (ESA)

N80-13086# Centro Informazioni Studi Esperienze, Milan (Italy).
UHV-CHAMBER: THEORETICAL BACKGROUND AND FACILITY DEVELOPMENT c35
N. Adorni, G. Ghersini, P. G. Sona, F. Rossitto (Milan Polytech.), and G. Cortelazzi (Control Systems). *In* ESA Mater. Sci. in Space Jun. 1979 p 125-132 refs Sponsored by CNR (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

A dynamic experiment is discussed on adhesion of metals, the goal of which is the characterization of surface forces and interface energies at the contact between real surfaces and the impulsive probing of transient phenomena associated with the adhesion mechanisms. A small metallic sphere impacts against a metal target, and restitution coefficients, contact times, and time behavior of contact forces are measured as a function of incoming sphere velocity and surface roughness of colliding bodies. Computer simulation indicates that conditions exist in which the colliding bodies stick together. To fulfill these conditions the experiment must be carried out in a micro-g laboratory under ultra high vacuum. The experimental device will be integrated into the Material Science Double Rack of the first Spacelab mission, and is now under construction. Its main characteristics are presented. Author (ESA)

N80-13087# Fiat Research Center, Turin, Italy.
THE FLUID PHYSICS MODULE: A CONTRIBUTION TO MATERIALS SCIENCE AND PHYSICS IN SPACE c34
G. Ceronetti and G. Rovera. *In* ESA Mater. Sci. in Space Jun. 1979 p 137-147 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The design concept, technical specifications, and hardware implementation of the fluid physics module (FPM) are reviewed. Some results of functional evaluations, performed on the FPM engineering model, are presented. Finally, the guidelines for a follow-on module, capable of independant operation in a standard Spacelab rack and with improved performances, are outlined. Author (ESA)

N80-13088# Battelle Inst., Frankfurt am Main (West Germany).
POSITIONING AND MIXING INSTRUMENTATION EMPLOYING ELECTROSTATIC AND ACOUSTIC PRINCIPLES c35
E. G. Lierke, W. M. Heide, R. Grossbach, and P. F. Clancy (ESTEC, Noordwijk, Netherlands). *In* ESA Mater. Sci. in Space Jun. 1979 p 149-157 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The implementation of hardware on board Spacelab for the contactless positioning of materials science samples is described. An electrostatic method was chosen as an alternative to other positioning principles. With a tetrahedral configuration of spherical electrodes and on operating voltage of 5 kV multidirectional sample repositioning against 1/10,000 to 1/1000 g can be achieved. Initial hardware was developed ensuring mating compatibility with the Isothermal and the Mirror Heating Facility of Spacelab. A 40 kHz ultrasonic mixer with mating compatibility to the Isothermal Heating Facility is also described. The system can operate at temperatures up to 1500 K and is able to micromechanically homogenize and disperse multicomponent materials with a metallic or nonmetallic fluid matrix prior to solidification. Terrestrially mixed samples demonstrate the potential of the mixer. Author (ESA)

N80-13089# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
A SERVICE SYSTEM FOR MATERIAL SCIENCES EXPERIMENTS ON SPACE SHUTTLE
M. Eyb and H. Siemann. *In* ESA Mater. Sci. in Space Jun. 1979 p 159-162 (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

At NASA, a program to fly small self-contained payloads on Space Shuttle, which allows material sciences experiments to be conducted in space at moderate cost, was established. A cylindrical contiainer will be provided to accomodate the experimental device. However, the experimenter has to supply his own service system, which takes over the function of standard laboratory equipment on the ground like power supplies, timers, microprocessors, recorders, etc. Such a system, designed to meet the requirements of the Space Shuttle, which has the flexibility to be adapted to various kinds of material sciences experiments is described. The heart of the system is a central service module which comprises a microprocessor combined with a timer and a tape recorder. This programmable unit can be used for timing, to implement feedback loops for process control, for data acquisition, processing, and storage and to do housekeeping. The central service module has its own power supply and thermal control system using phase change material which allows at least 200 hours of autonomous, mission-independent operation. Author (ESA)

N80-13090# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projekttraegerschaften.
PROCESS CHAMBER: PAYLOAD ELEMENT OF THE GERMAN MICROGRAVITY MISSION D 1
K. Gardy. *In* ESA Mater. Sci. in Space Jun. 1979 p 163-165 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

Three equipment groups of the process chamber double rack are discussed and illustrated: experiment modules, a central diagnostic station, and systems for power, cooling etc. The diagnostic station is especially emphasized. Pictures of two typical experiments practicable in the diagnostic station show how the laboratory equipment works. Author (ESA)

N80-13091# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
FUNCTIONAL PERFORMANCE OF THE ISOTHERMAL HEATING FACILITY FOR THE MATERIAL SCIENCE DOUBLE RACK c35
Joachim E. Geisel and Franz Hugo (Leybold Heraeus). *In* ESA Mater. Sci. in Space Jun. 1979 p 167-176 (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

For the first Spacelab payload, an experiment facility for material science experiments was developed. The material science double rack which includes the isothermal heating facility (IHF) allows for the performance of various melting experiments. The concept design and the performance of the IHF are described. Both static and dynamic behavior are provided for planning of experiment profiles, power consumption, etc. The IHF also provides

the possibility to conduct gradient experiments in the heating chamber. Author (ESA)

N80-13092# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
EXPERIMENT MODULES AND FACILITIES IN TEXUS 1 AND 2 c35
Joachim E. Geisel and Burkhard Franke. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 177-188. (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

Four experiment modules, called TEM, were developed for the TEXUS 1 launch. This experiment equipment has been the basis for further experiment modules. The modular concept provides an opportunity to refurbish the apparatus after flight and to modify the experiment equipment in order to adapt it to new experiments. The basic modules contain a multipurpose furnace, a furnace with the possibility for observation, a module for observation of boundary layer convection with Schlieren optics, and a module for electrolysis experiments. An overview of the performance of the modules is given and adaptability for different experiments is shown. Author (ESA)

N80-13093# Centre National d'Etudes Spatiales, Toulouse (France).
A CONTAINER FOR CONDITIONING SPACE EXPERIMENTS c35
F. Jamin Changeart and J. Cadars. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 189-199. In FRENCH and ENGLISH (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

A modular facility for scientific and technological experiments requiring protection against pollution and degradation hazards before and after their exposure to space environment is presented. The device was designed for a package of French experiments (FRECOPA) to be flown on the NASA Long Duration Exposure Facility (LDEF). The unit is described, consisting of an airtight canister, a support structure, an opening and closing mechanism, and a electronic control unit. Complete equipment specifications are provided and application of FRECOPA on the LDEF is outlined. Author (ESA)

N80-13094*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ENGINEERING EVALUATION OF EXISTING SPACE HARDWARE FOR UTILIZATION IN SMALL SELF-CONTAINED PAYLOADS c18
P. A. Lovoi (Intern. Tech. Assoc.) and W. Vardaman. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 205-210. refs (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120. CSCL 22B

The NASA small self-contained payload program allows research and development experiments of less than 5 cu ft to be flown in the Orbiter payload bay on a space available basis. Materials processing equipment available from Apollo, Skylab, SPAR, and MEA that include such items as furnaces for metallurgical processing and crystal growth, apparatus for measuring crystallization processes, and electrophoretic separators for cell separation are being offered by NASA through this program. Eighteen items for the self-contained payload program were evaluated and many were found to be suitable. Author (ESA)

N80-13095# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
CZECHOSLOVAKIAN PRELIMINARY PROGRAM OF MATERIAL RESEARCH IN SPACE
C. Barta (Acad. of Sci., Prague), A. Triska (Acad. of Sci., Prague), and A. S. Ochotin. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 213-214 (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

The survey of proposals is given which the Czechoslovakian working group for cosmic technology prepared in cooperation with the Soviet Space Research Institute of the Academy of Sciences within the framework of INTERCOSMOS. The proposed themes concern the study of crystal growth and of physical properties of single and polycomponent systems of selected dielectrics and semiconductors, research on semiconducting glassy systems, the study of solidification and physical properties of refractory and bearing alloys and alloys with specific magnetic properties as well as investigation into electromigratic separation of polymers. Author (ESA)

N80-13096# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
EXPERIMENT MORAVA ON BOARD SALYUT 6 c76
C. Barta (Acad. of Sci., Prague), J. Trnka (Acad. of Sci., Prague), A. Triska (Acad. of Sci., Prague), V. I. Khrjapov, A. S. Ochotin, and I. A. Zubritskij. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 215-219. refs (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

Crystallization of mercurous bromide dissolved in a eutectic melt with mercuric bromide was performed under zero, normal, and elevated gravity. The obtained samples were studied using optical and scanning electron microscopy. The external shape of the ingot solidified under zero gravity differs from the expected one. In contrast to another experiment with lead chloride, in this case, there is a considerable difference in the habitus of mercurous bromide crystals grown under different gravity. A short report is also given on preparations for further cosmic experiments with the eutectic system lead chloride - silver chloride. Under terrestrial conditions a filament structure with light-guiding properties has already been obtained. Author (ESA)

N80-13097# Royal Inst. of Tech., Stockholm (Sweden).
SOLIDIFICATION OF SOME EUTECTIC ALLOYS UNDER MICROGRAVITY CONDITIONS AND AT 1 g c26
T. Carlberg. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 221-231. refs. Sponsored by Swed. Board for Space Activities (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

A unidirectional solidification of an eutectic Al-Cu alloy was performed on Earth and in space. The fault density was evaluated, but the differences between the samples were less than the statistical errors. Thermal analysis was performed with a eutectic Al-Cu alloy both with and without Al2O3 particles and a method for the estimation of the growth in isothermally solidified samples is presented. Faceted growth of the Al-Al2 Cu eutectic is described. In a space sample with the same alloy the number of nuclei was lower than on Earth. In an eutectic Sn-Zn alloy grown in space a larger amount of the structure was of a normal eutectic type compared with Earth grown samples. In experiments with eutectic Al-Si alloys no structural differences between Earth samples and space samples could be detected. Author (ESA)

N80-13098# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Casting of Metals.
THE INFLUENCE OF MICROGRAVITY ON THE STRUCTURE OF Bi-Zn IMMISCIBLE ALLOYS c26
T. Carlberg and H. Fredriksson. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 233-243. refs (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

In the TEXUS 2 project four experiments in the system Bi-Zn with three different Bi contents (8%, 24%, and 38%) were performed. The samples were melted and homogenized above the miscibility gap and one of the samples was cooled with two different cooling rates. All were performed under microgravity. The samples showed different types of structure related to composition. The alloy with 8% Bi showed a dispersion of Bi-rich droplets in a Zn-matrix. The alloys with a larger Bi content showed larger areas of Bi-rich regions in a Zn-matrix together with Bi-rich droplets. The results are compared to other experiments in this field. A preliminary theoretical analysis of the results is also performed. Author (ESA)

N80-13099# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Materials Research.
STABILITY OF MULTICOMPONENT MIXTURES UNDER MICROGRAVITY CONDITIONS
H. U. Walter. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 245-253. refs (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

In the TEXUS Project Skylark-7 rockets are employed to provide microgravity conditions over a period of approximately 360 sec during the coasting phase of the rocket flight. Model

experiments to determine the stability of multicomponent mixtures during melting, thermal soak, and solidification under microgravity conditions were carried out during TEXUS 1 and TEXUS 2 flights. The results of the experiments are discussed in terms of possible mechanisms affecting the stability of mixtures under microgravity conditions, which is of importance in view of a variety of scheduled flight experiments having the objective to prepare composite materials. Author (ESA)

N80-13100# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
PREPARATORY STUDIES FOR AN EXPERIMENT IN DIRECTIONAL SOLIDIFICATION OF IMMISCIBLE Al-In ALLOYS ON BOARD A ROCKET VEHICLE [ETUDES DE BASE PREPARATOIRES DE L'EXPERIENCE DE SOLIDIFICATION DIRIGEE D'ALLANGES IMMISCIBLES Al-In EN FUSEE SONDE] **c26**
C. Potard. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 255-262 refs. In FRENCH (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

Results of preparatory research relative to a microgravity experiment on the capillary properties of Al-In alloys, the phenomena accompanying the phase transformations, and on the solidification structures are presented. The main parameters governing the properties of biphase liquids, such as phase boundaries, oversaturation, rate of liquid-liquid transformation, changes in volume associated with phase transformations, and the interphase capillary characteristics, were determined. Solidification structures were studied on the ground in function of the relative direction of the solidification rate vectors and of gravity. The results are discussed in terms of predicted results from the proposed rocket vehicle experiment. Author (ESA)

N80-13101# Technische Universitaet, Clausthal-Zellerfeld (West Germany). Lehrstuhl fuer Glas und Keramik.
REACTIONS BETWEEN GLASS MELTS **c27**
K. Herr, H. J. Barktage-Hilgefort, and G. H. Frischat. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 263-266 refs. Sponsored in cooperation with Bundesmin. fuer Forsch. u. Technol. and DFVLR (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

The ion exchange in the quasi binary system $Na_2O \cdot 3SiO_2$-$Rb_2O \cdot 3SiO_2$ was chosen as an example to study conditions avoiding influence of convection on diffusion experiments between glass melts during the TEXUS 19 rocket experiment. For comparison with the zero gravity experiment a 1 gravity reference experiment and capillary experiments were done. At 1160 C the zero gravity rocket experiment provided consistent diffusion coefficients, the 1 gravity reference experiment and even the capillary experiments failed at temperature > 1000 C. The obtained results allow for planning for Spacelab. Author (ESA)

N80-13102# Technische Univ., Berlin (West Germany). Inst. fuer Nichmetallische Werkstoffe.
FUNDAMENTAL EXPERIMENTS ON INTERFACIAL CONVECTION; PROJECT TEXUS 1 AND 2
Rolf Brueckner. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 267-272 refs. Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

Three experiments on interfacial convection, performed under microgravity and gravity conditions, are compared. The first experiment was to study the behavior of an induced concentration, the second the effect of thermally induced interfacial convection, both acting locally at an interface. In the third experiment the behavior of material exchange through interfacial convection combined with density instability was studied. Comparison of results obtained under microgravity with those under Earth normal gravity shows similar behavior in the first two cases, but totally different behavior in the third. It is concluded that the interfacial-energetic equalizing processes under microgravity are able to produce remarkable transport actions. Author (ESA)

N80-13103# Bristol Univ. (England). School of Chemistry.
FUNDAMENTAL AND APPLIED ASPECTS OF FLUID PHYSICS UNDER MICROGRAVITY **c34**
J. M. Haynes. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 275-279 refs. (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

The gravity dependence of various fluid-physical phenomena are surveyed. The use of the practically weightless environment of orbiting spacecraft, with the possibility of conducting relatively long duration manned operations under these conditions, is emphasized for the study of these phenomena. The influence of gravity on the shape of a fluid's boundary with contiguous fluids is discussed as regards theory. Surface tension effects are shown to dominate. Buoyancy driven convection is also treated. As regards other than gravity driven convection, Marangoni flow is cited. The possible applications of microgravity effects to space manufacturing are reiterated. Author (ESA)

N80-13104# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.
FLOW PHENOMENA IN ROTATING FLOATING ZONES WITH AND WITHOUT MARANGONI CONVECTION **c34**
Ch.-H. Chun and W. Wuest. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 283-288 refs. (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

The effects of floating zone rotation on flow phenomena with and without Marangoni convection are reported. Single and iso-rotation of the solid boundary of a floating zone are superimposed on the one-toroidal-vortex system of Marangoni convection. Counter and iso-rotation on the two-toroidal-vortex system of Marangoni convection, which may be expected to appear during crystal growth from a floating zone, is also discussed. The transitions of the flow patterns from the Marangoni-convection-dominated flow regime into the rotation-dominated regime were observed using thin-light-cut illumination with a laser. The details of the flow patterns on the meridian plane of the floating zone in the transition regime are discussed. Furthermore, it was verified that the oscillatory instability of Marangoni convection and accordingly, the temperature oscillation of the floating zone are suppressed by the application of iso-rotation. The implication of this effect of rotation may be of significance for the crystal growth process. Author (ESA)

N80-13105# Naples Univ. (Italy).
THERMODYNAMICS AND DYNAMICS OF LINE PHASES **c77**
L. G. Napolitano. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 289-296 refs. (For primary document see N80-13069 04-12) (Contract CNR/SAS-77-0061)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

The set of field equations are described for the confluence region between three immiscible volume phases modelled as a line-phase L in arbitrary motion and with thermodynamic and dynamic properties. The fluids are uncharged, unpolarized, nonelastic and nonmicro-polar. The crucial assumptions are those implied by a local formulation of the equilibrium thermodynamics of L. The set of equations derived comprises: integral and local forms of line balance equations for a scalar or vectorial extensive property, continuity tangential and normal momentum and energy equations; line entropy production. Features of the linear phenomenological relations for irreversible line diffusion and nonequilibrium exchanges of extensive properties between line and surface phases are discussed. Approximations implied in the simpler models so far used are discussed and commented upon. Results of the present more general theory yield, among other things, a generalization of Newmann equations. Author (ESA)

N80-13106# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
RECONSIDERATION OF MACROSEGREGATION DURING NONSTATIONARY SOLIDIFICATION [RECONSIDERATION DE LA MACROSEGREGATION EN SOLIDIFICATION NON STATIONNAIRE] **c25**
J. J. Favier. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 297-305 refs. In FRENCH (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

Several cases of macrosegregation during directional solidification, influenced by the effects of gravity, are discussed. The analysis of macrosegregation is reviewed, centering on a model

which includes both the establishment of a diffusion barrier at the interface and the increase in the mean concentration in the liquid. This model is applied to solidification in the presence of residual convection, observed on Earth as well as in space. The case of solidification of a sedimentary liquid is also covered. A nonstationary analysis of a Ge-Ga system exhibiting a coupling between transitory thermal and chemical regimes is then presented. Macrosegregation results are interpreted in terms of this analysis. Author (ESA)

N80-13107# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
NONSTATIONARY ANALYSIS OF THE MACROSEGREGATION DURING THE SOLIDIFICATION IN THE SPACE OF THE SYSTEM Ge-Ga [ANALYSE NON STATIONNAIRE DE LA MACROSEGREGATION PENDANT LA SOLIDIFICATION DANS L'ESPACE DU SYSTEME Ge-Ga] **c76**
J. J. Favier, P. Arragon, E. P. Martin (MIT), and A. F. Witt (MIT). *In* ESA. Mater. Sci. in Space. 1979. p. 306-308. refs. In FRENCH (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

The redistribution of solutes in the system Ge-Ga solidified under weightlessness conditions was analyzed taking into consideration, in particular, the nonstationary characteristics of the solidification velocity. Experimental data obtained by other authors in a space mission were used. The evolution of the Ga concentration during the solidification is compared with predictions from 3 models, resulting in a better fit for the proposed model. It is concluded that the growing process is controlled by a diffusion mechanism in the liquid before a front moving at increasing velocity. Author (ESA)

N80-13108*# Rensselaer Research Corp., Troy, N. Y. Dept. of Materials Engineering.
CONVECTIVE HEAT TRANSFER DURING DENDRITIC GROWTH **c76**
M. E. Glicksman and Shyh-Chin Huang. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 309-312. refs. Sponsored by NASA. (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120. CSCL 22A

Axial growth rate measurements were carried out at 17 levels of supercooling between 0.043 C and 2 C, a temperature range in which convection, instead of diffusion, becomes the controlling mechanism of heat transfer in the dentritic growth process. The growth velocity, normalized to that expected for pure diffusive heat transfer, displays a dependence on orientation. The ratio of the observed growth velocity to that for convection-free growth and the coefficients of supercooling are formulated. The dependence of normalized growth rate in supercooling is described for downward growing dendrites. These experimental correlations can be justified theoretically only to a limited extent. Author (ESA)

N80-13109# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
SPACE EXPERIMENTS ON CHEMICAL PATTERN FORMATION
A. Bewersdoff. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 313-316. refs. (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

Under appropriate conditions chemical reaction systems may develop instabilities, comparable to hydrodynamic systems. Coherent behavior, like homogeneous oscillations or spatial patterns, may then appear spontaneously beyond certain thresholds. These phenomena can be sensitive to convection. Microgravity, therefore, offers opportunities for investigations. Experimental evidence for a direct influence of hydromechanic shear on a chemical reaction is given. Objectives for space experiments are then discussed. The concept of a special reaction cell and the main requirements of experiments are presented. Author (ESA)

N80-13110# Little (Arthur D.), Inc., Cambridge, Mass.
EXPERIMENTS ON THE STABILITY OF CONICAL AND CYLINDRICAL LIQUID COLUMNS AT LOW BOND NUMBERS **c34**
A. A. Fowle, C. A. Wang, and P. F. Strong. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 317-325. refs. (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

A low Bond number simulation technique was used in conducting a number of experiments to establish the stability limits of cylindrical and conical floating liquid columns under conditions of isorotation, equal counter-rotation, rotation of one-end only, and parallel-axis offset. Tests which establish the conditions for resonance in cylindrical liquid columns perturbed by axial, sinusoidal vibration of one end-face are also reported. All tests were carried out under isothermal conditions with water and silicone fluids of various viscosities. With few exceptions, test data for rotating columns show that the onset of instability is in the C-mode and is correlated very well by a theoretical prediction based on isorotation. The onset of instability for a cylindrical column of silicone fluid having a viscosity 100 times of water under equal counter-rotation and single end-rotation is in the first asymmetric mode. An explanation for the rather surprisingly simple C-mode correlation is provided by the results of flow visualization studies. The data on the resonance of cylindrical columns are correlated very well by a prediction based on theory. Author (ESA)

N80-13111# Justus Liebig-Universitaet, Giessen (West Germany). Inst. fuer Physikalisches.
STEADY AND OSCILLATORY MARANGONI CONVECTION IN FLOATING ZONES UNDER 1g **c34**
D. Schwabe, A. Scharmann, and F. Preisser. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 327-333. refs. Sponsored by DFVLR (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

Experiments on Marangoni Convection (MC) in floating zones are described. Besides other observations MC was identified by its suppression with a viscous oil layer on the surface. The appearance of steady and oscillatory MC was studied. The critical Marangoni numbers for the onset of oscillations and the oscillation frequency were measured. A model for the oscillatory state of MC is given. Special problems with the geometric and thermal boundary conditions in a floating zone are discussed. Their significance for the appearance of steady and oscillatory MC in NaNO3 zones and real crystal growth is shown in experiments and discussed in terms of aspect ratio, capillary surface motion, interface shape and the involved thermal conductivities, and Prandtl numbers. The need for 1 gravity experiments on MC prior to microgravity experiments, their possibilities and limits are discussed. Author (ESA)

N80-13112# Karlsruhe Univ. (West Germany). Inst. fuer Stroemungslehre und Stroemungsmaschinen.
NUMERICAL AND EXPERIMENTAL SIMULATION OF MICROGRAVITY-CONVECTION
H. Oertel, Jr. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 335-340. refs. (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

Time dependent convection within a rectangular box was investigated theoretically and experimentally with respect to applications for material science experiments in a space laboratory. The onset of unsteady convection at different heating rates was calculated using linear stability theory. The results obtained demonstrate that convection needs time for developing; this is a nonlinear effect. Two dimensional calculations were carried out using nonlinear basic equations and an explicit finite difference method. This method was applied simulating the influence of time dependent accelerations on convective heat transfer in a space laboratory. In order to gain an initial concept of the influence of the transient accelerations, principle experiments on Earth were done. To demonstrate time dependent convection in space a self contained payloads experiment was prepared. The preliminary flight facility and the 1 gravity test experiments are also shown. Author (ESA)

N80-13113# Essen Univ. (West Germany).
MIGRATION OF GAS BUBBLES UNDER VARIOUS FORCE FIELDS IN A MICROGRAVITATIONAL ENVIRONMENT **c34**
J. Siekmann. *In* ESA. Mater. Sci. in Space. Jun. 1979. p. 341-347. refs. (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

The steady translational motion of a single noncondensable

bubble enclosed in a Hele-Shaw cell and subject to the action of buoyancy is investigated theoretically and experimentally. The motion of a bubble in a pure liquid is discussed and the effect of a surface film on the motion of a bubble is studied. The migration of a long bubble between parallel plane plates and the motion of a circular cylindrical bubble are examined. In both cases, the bubble is supposed to adhere to the upper plate of the test apparatus. It is shown that a bubble covered entirely by a layer of impurities dissipates much more energy into the surrounding liquid than a bubble without a surface film. Observations on the motion of a pair of bubbles are described.
Author (ESA)

N80-13114# Naples Univ. (Italy).
MARANGONI BOUNDARY LAYERS **c34**
L. G. Napolitano. *In* ESA. Mater. Sci. in Space. Jun. 1979 p. 349-358. refs (For primary document see N80-13069 04-12)
(Contract CNR/SAS-77-061)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

Marangoni boundary layers are defined and their mathematical modeling dealt with for fluids with a Prandtl number of order one. A first order boundary layer approximation of the volume and surface phase field equations is derived; conditions in which a Marangoni boundary layer is established are determined in terms of the problems data. Possible further simplified forms of the Marangoni boundary layer equations (consequent to the negligibility of buoyancy effects and/or to simplifications in the dynamic Laplace equations) are discussed. A priori criteria for the validity of these simplified field forms are derived. By considering eleven typical liquids having a Prandtl number of order one it is shown that there is a large variety of cases of practical interest, in both Earth or microgravitational environments, for which a boundary layer approximation of surface driven flows (in either full or simplified forms) is applicable. Thus, further theoretical and experimental investigations of the structure of this type of dissipative layer are warranted.
Author (ESA)

N80-13115# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.
MARANGONI CONVECTION IN A LIQUID LAYER SUBJECTED TO ROTATION ABOUT A TRANSVERSE AXIS **c34**
G. S. R. Sarma. *In* ESA. Mater. Sci. in Space. Jun. 1979 p. 359-362. refs (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

The possibilities for controlling surface tension driven convection, anticipated in space experiments involving fluid interfaces, the problem of thermocapillary stability of a thin liquid layer subjected to rotation about a transverse axis is considered. The vital role of the different boundary conditions and the destabilizing character of the long wave disturbances at the fluid-fluid interface are illustrated through typical neutral stability curves based on analytical solutions to the pertinent eigenvalue problem. The results indicate the generally beneficial stabilizing influence of rotation in increasing the stable domain especially at higher wave numbers.
Author (ESA)

N80-13116# Clermont-Ferrand Univ. (France). Lab. de Cristallographie et Physique des Milieux Condenses.
RESULTS OF FRENCH EXPERIMENTS ON CRYSTAL GROWTH FROM A VAPOR PHASE CONDUCTED ON THE GROUND AS A PART OF THE SPACE PROGRAM [RESULTATS DES EXPERIENCES FRANCAISES DE CROISSANCE EN PHASE VAPEUR EFFECTUEES AU SOL DANS LE CADRE DES PROJETS SPATAUX] **c76**
R. Cadoret. *In* ESA. Mater. Sci. in Space. Jun. 1979 p. 363-367. refs. In FRENCH. Sponsored by CNES (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

Thermodynamic studies of germanium transport by its iodides, a theoretical and experimental study on gas dynamic regimes in function of transport parameters, and an experimental study of the nucleation of mercuric iodide based on classical nucleation theories are reported. A simple classification of these systems, based on possible transport modes, is proposed.
Author (ESA)

N80-13117# Stuttgart Univ. (West Germany). Physikalisches Inst.
SOME 3-5-SEMICONDUCTOR CRYSTALS GROWN BY THE TRAVELING-HEATER METHOD **c76**
K. W. Benz and G. Mueller (Erlangen-Nuremberg Univ.). *In* ESA. Mater. Sci. in Space. Jun. 1979 p. 369-373. refs. Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

In preparing the experiment ES 323 Traveling Heater Growth of 3-5 compounds for the first Spacelab mission, several traveling heater method growth studies were performed taking GaSb as a model 3-5 semiconductor material. Vertical as well as horizontal growth systems were used. The solution temperature was varied between 420 C and 560 C for the growth of GaSb single crystals. At a 500 C growth temperature, the maximum growth rate of GaSb crystals was determined to be 2.5 + or - 0.5 mm/day.
Author (ESA)

N80-13118# Wisconsin Univ., Madison. Dept. of Metallurgical and Mineral Engineering.
SOLIDIFICATION OF HIGHLY UNDERCOOLED LIQUID METALS AND ALLOYS **c26**
J. H. Perepezko, C. Galaup, and D. H. Rasmussen (Clarkson Coll. of Technol., Potsdam, N.Y.). *In* ESA. Mater. Sci. in Space. Jun. 1979 p. 375-383. refs (For primary document see N80-13069 04-12)
(Grant DAAG29-78-G-0157)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

The amount of undercooling of liquids, usually restricted by the action of heterogeneous catalysts, is discussed. A useful method of generating high undercooling relies upon the dispersion of a liquid metal sample into a fine droplet form in order to isolate active nucleation catalysts. The maximum undercooling to nucleation for several pure metals was increased to about twice the previous value using this method. The application of the droplet technique in alloys allows an evaluation of the kinetic competition between equilibrium and nonequilibrium structures during solidification. For alloys exhibiting a monotectic reaction, thermal analysis was employed to follow the progress of phase separation in undercooled droplets. Further development of these studies is discussed in terms of the advantages offered by a space environment.
Author (ESA)

N80-13119# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY OF THE INFLUENCE OF GRAVITY ON THE SOLIDIFICATION OF IRREGULAR EUTECTIC ALLOYS [ETUDE DE L'INFLUENCE DE LA GRAVITE SUR LA SOLIDIFICATION DES EUTECTIQUES IRREGULIERS] **c26**
C. Lemaignan. *In* ESA. Mater. Sci. in Space. Jun. 1979 p. 385-389. refs. In FRENCH (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

The directional solidification of Ag-Ge eutectic alloys was conducted at rates between 1/50,000 and 3 cm per sec. A metallographic analysis of the structures obtained shows that the coupled growth of the eutectic is governed by the crystal growth mechanisms of germanium. This growth involves a system of different lattice types which vary with the rate of solidification. At slow rates, the lattices are oriented parallel to the vector of gravity. It is suggested that gravity driven convection is responsible for this orientation since the mechanism of nucleation responsible for the lattice structure is not completely understood. The F.S.L.P. experiments 1 ES 312 and 1 ES 317 are expected to provide further data on this problem.
Author (ESA)

N80-13120# Chalmers Univ. of Technology, Goteborg (Sweden).
AN EXPERIMENTAL METHOD FOR DETERMINATION OF MASS TRANSPORT IN LIQUID METALS TO BE APPLIED UNDER MICROGRAVITY **c26**
T. Persson. *In* ESA. Mater. Sci. in Space. Jun. 1979 p. 391-396. refs. Sponsored by Swedish Board for Space Activities (For primary document see N80-13069 04-12)
Avail: NTIS. HC A20/MF A01; ESA, Paris FF 120

An electrochemical method for the determination of diffusion and other transport coefficients in liquid metals is described. The fact that this method is intended for sounding rocket experiments imposes restrictions on the time available for performing an experiment. The basic theory underlying the function

of this device is discussed. Suitable applications of the method are also touched upon. Author (ESA)

N80-13121# British Aerospace Dynamics Group, Bristol (England).
SKYLARK SOUNDING ROCKET FACILITIES FOR MATERIALS SCIENCE EXPERIMENTS
D. J. Brown. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 399-404, refs. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

With the advent of the Space Shuttle in the 1980s many materials scientists are devising experiments which can take advantage of the near zero gravity conditions provided by Spacelab. In order that materials scientists can derive maximum benefit from Spacelab missions the advantages of carrying out preliminary experiments using sounding rockets and Shuttle getaway special payloads are worth serious consideration. Although the time available under microgravity conditions is less than Spacelab, a sounding rocket flight can provide comparable low acceleration levels so making it possible to establish the credibility of experiments at an early stage. The facilities provided by Skylark sounding rocket vehicles and systems that are suitable for material science experiments are described. A proposal to fit a Skylark payload module inside a NASA getaway special container is discussed. Author (ESA)

N80-13122# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
EXPERIMENT PERFORMANCE UNDER ZERO-G USING SMALL SELF-CONTAINED PAYLOADS (SSCP) AND OTHER AUTOMATIC EQUIPMENT
P. Vits and J. Schawer. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 405-410, refs. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

Many material science experiments do not need to be manned and can be performed automatically. If the volume of these experiments is below 100 liters a very economic way of performing experiments is by the use of SSCPs. SSCPs are autonomous payloads with certain limitations in volume, weight, energy, and heat dissipation. A concept for the layout of standard mechanical and electronic subsystems is presented and the characteristics of this standard equipment are discussed. Experiments that cannot meet the limitations of SSCPs can be performed on the SL-pallet using the capabilities of the pallet. Such equipment can be an automatic isothermal or gradient heating facility. Several facilities can be combined in a payload cluster on the pallet. Author (ESA)

N80-13123# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projekttraegerschaften.
OVERVIEW OF THE FUTURE OF THE TEXUS PROGRAM
D. Faust and B. Deserno. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 411-413 (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

Within the German Spacelab utilization program a preprogram named technological experiments under microgravity (TEXUS) was initiated in 1976. By means of sounding flights an zero gravity exposure of about six minutes is used for a variety of materials science experiments. The main objective of this preprogram was to acquire preliminary results as a basis for the preparation of experiments aboard Spacelab. Two projects were carried out. TEXUS 1, the first complete materials science payload in Western Europe (launched successfully on Dec. 13, 1977), and TEXUS 2, (launched successfully on Nov. 16, 1978) was equipped with substantially refurbished and modified hardware previously flown on TEXUS 1. Planning for further TEXUS missions has started due to the excellent scientific outcome of the TEXUS 1 and 2 missions. The modular concept of the TEXUS payloads allows repeated hardware use as well as the introduction of novel experiment equipment. The original plan to launch many rockets as a Spacelab preprogram exclusively was extended to make TEXUS an accompanying program instead. Author (ESA)

N80-13124# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
PROBLEMS POSED BY THE INTEGRATION OF MATERIALS SCIENCE EXPERIMENTS WITH SPACECRAFT SYSTEMS [PROBLEMES POSES PAR L'INTEGRATION D'EXPERIENCES DE SCIENCE DES MATERIAUX DANS UN VEHICLE SPATIAL]
J. P. Praizey and J. Berthier. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 415-425, refs. In FRENCH (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The planning of spaceborne experiments, especially as regards the compatibility of experimental equipment with existing spacecraft systems, is considered. Parameters such as the obtainable reduction in gravity, the duration of favorable experimental conditions, available power, the number of measurements to be made, and safety factors are discussed. The use of onboard furnaces in materials science research is emphasized. It is concluded that only through close cooperation between the researchers and the different space agencies involved can acceptable results be obtained. Author (ESA)

N80-13125# General Accounting Office, Washington, D. C.
THE NEAR-TERM POTENTIAL OF MANUFACTURING IN SPACE
E. Fritts and A. Byroade. *In* ESA. Mater. Sci. in Space, Jun. 1979, p. 427-432 (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

The near-term potential of space manufacturing is discussed. Near-term is defined as anytime between now and the year 2000. In response to that request, an overview of the National Aeronautics and Space Administration's materials processing program, a first step toward space manufacturing, is provided. It is presented in nontechnical terms. The views given represent the perspectives of 52 American scientists, economists, and industrialists who contributed to the study. Problems and obstacles that stand in the way of progress are identified, and some alternative courses of action are offered. Author (ESA)

N80-13126# Royal Aircraft Establishment, Farnborough (England).
TABLE OF SPACE VEHICLES: 1973 - 1978
J. A. Pilkington. London, Feb. 1979, 21 p. (RAE-TM-Space-271; BR67587) Avail: NTIS HC A02/MF A01

A list of all space vehicles successfully launched between January 1, 1973 and December 31, 1978 is given. Data are presented in tabular form and vehicles are classfied by orbital characteristics. Headings include heliocentric orbits, orbits in the Earth-Moon system, selenocentric orbits (Earth launch), selenocentric orbits (Moon launch), areocentric orbits (Earth launch), and orbits around Venus (Earth launch). Information on vehicle mass, shape, and size as well as brief comments on mission objectives are provided. Author (ESA)

N80-13127# Leitz (Ernst) G.m.b.H., Wetzlar (West Germany).
MANUFACTURING OF OXIDE GLASSES. CRITICAL COMMENT ON PROPOSALS FOR MELTING AND SOLIDIFICATION EXPERIMENTS UNDER ZERO-g CONDITIONS
Final Report
Heinz Broemer, Klaus Deutscher, and Emanuel Pfeil. Bonn, Bundesmin. fuer Forsch. u. Technol., Nov. 1978, 42 p. refs. In GERMAN; ENGLISH summary. Prepared in cooperation with Marburg Univ., West Germany
(Contracts BMFT-WRT-1075; DFVLR-01-QV-106)
(BMFT-FB-W-78-06) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8.85

The influence of a containerless melting and solidification process on the crystallization behavior of medium viscous oxide melts is discussed. In spite of the suppression of heterogeneous nucleation, homogeneous nucleation in the melt cannot be absolutely excluded. Experimental results with melts of low viscosity and theoretical considerations admit homogeneous nucleation in a containerless process as a volume and/or surface effect. Therefore modified crystallization behavior cannot be expected under zero-g conditions. The ratio of the cooling rate to nucleation rate in the melt remains crucial for glass formation in space. Author (ESA)

N80-13128# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.

SYSTEM DEFINITION STUDY FOR A GERMAN CONTRIBUTION TO THE JUPITER ORBITER PROBE PROJECT Final Report
Klaus Bohnhoff Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 44 p In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1076; DFVLR-01-OO-057A)
(BMFT-FB-W-78-24; MBB-URV-101(77)) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9.25

The Retro Propulsion Module and the Pre-Entry Science Package were studied. A more detailed definition of requirements is given along with major concept tradeoff as a basis for the concept definition, an investigation of design alternatives, comparison and preselection of components, an analysis of operation alternatives and characteristics, the identification of necessary preparatory technological work, and preliminary project planning are presented. Author (ESA)

N80-13129# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Hauptbereich PRV
CONCEPT STUDY OF A SHUTTLE-SATELLITE IN CONSIDERATION OF EUROPEAN SATELLITE DEVELOPMENTS AND LAUNCHER SYSTEMS FOR THE 1980'S Final Report
Klaus Mueller Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 100 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1076; DFVLR-01-YA-017)
(BMFT-FB-W-78-25) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.80

Development trends in European space programs were analyzed and the results used to define a basic shuttle-satellite configuration. Two options were considered. These are the use of the ARIANE launch vehicle and, alternatively, launch from the space shuttle orbiter. Planned European spaceborne experiments were also taken into account. As a result, two satellite configurations are foreseen as feasible: a shuttle satellite compatible with ARIANE, which means basically a limitation of satellite dimension by the ARIANE fairing constraints, and a specific space shuttle satellite of compact construction and smaller allocated launch costs compared to the shuttle/ARIANE satellite. Both satellites would have a geostationary mass of 700 to 1000 kg and be powered by a 1.5 to 5 kW solar generator. Author (ESA)

N80-13130# Standard Elektrik Lorenz A.G., Stuttgart (West Germany).
FEASIBILITY STUDY WITHIN THE SPACELAB UTILIZATION PROGRAM: COMMON EQUIPMENT, COMMUNICATION/NAVIGATION (COMNAV) Final Report
Georg Herzog, Peter Kreutzer, Tilmann Krieg, Arnim Rappold, and Rolf Staefel Bonn Bundesmin. Fuer Forsch. u. Technol. Dec. 1978 168 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1077; DFVLR-BPT-QV-437)
(BMFT-FB-W-78-36) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 35.30

An equipment module, the COMNAV common equipment, which can be used in different Spacelab missions for experiments in the disciplines of navigation, communications and wave propagation is defined. The proposed equipment consists of antennas, receivers, and signal and data processing equipment. In addition, a test system is included in the design. It is shown that for the proposed, or similar experiment, the usage of common equipment is feasible and cost effective. Author (ESA)

N80-13131# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
APPLICATION OF A TRACKING AND DATA RELAY SATELLITE SYSTEM (TDRSS) TO EUROPEAN REQUIREMENTS Final Report
Wolfgang Gieraths and Hans Martin Braun Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 48 p In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1076; DFVLR-BPT-01-YK-017)
(BMFT-FB-W-78-37) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9.80

Around 1981 NASA will phase out that part of its Earth station network that will have up to then served near Earth orbiting spacecraft. It will be replaced by the Tracking and Data Relay Satellite System (TDRSS). NASA offers partial use of the system to nonAmerican users. The consequences of this change over for European beneficiaries of American space facilities are analyzed. Two conceivable alternatives, i.e. two versions of a European Data Relay Satellite, are presented. Their facilities were tailored to the demands of expected European near Earth space activities in the eighties. They are compared for cost and intangibles related to leasing a comparable capability from the TDRS-System. It is shown that this comparison strongly favors one of the proposed European concepts. Author (ESA)

N80-13132# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE NUCLEAR AND IONIC CHARGE DISTRIBUTION PARTICLE EXPERIMENTS ON THE ISEE-1 AND ISEE-C SPACECRAFT Final Report
Dietrich Hovestadt, George Gloeckler (Maryland Univ.), Chung Y. Fan (Arizona Univ.), Len. A. Fisk (New Hampshire Univ.), Fred M. Ipavich (Maryland Univ.), Berndt Klecker, Joseph J. Ogallagher (Chicago Univ.), Manfred Scholer, Heinz Arbinger, John Cain (Maryland Univ.) et al Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 44 p refs
(Contracts BMFT-WRK-0274; DFVLR-BPT-01-DO-084)
(BMFT-FB-W-78-38) Avail: NTIS HC A03/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 9.25

The particle experiments on board ISEE-1 and ISEE-C are described. The instruments were designed to measure the elemental abundances, charge state composition, energy spectra, and angular distributions of energetic ions in the energy range 3 keV/charge to 80 MeV/nucleon, and of electrons between 75 and 1300 keV. The instruments consist of three different sensor systems. These are ULECA, and electrostatic deflection analyzer system (its energy range is 3 to 560 keV/charge), ULEWAT, a double dE/dX versus E thin-window flow-through proportional counter/solid-state detector telescope covering the energy range from 0.2 to 80 MeV/nucleon (Fe), and ULEZEQ, a sensor consisting of a combination electrostatic deflection analyzer and a thin window dE/dX versus E system with a thin-window proportional counter and a position-sensitive solid-state detector (the energy range is 0.3 MeV/nucleon to 6 MeV/nucleon). While the ULECA and the ULEWAT sensors are designed mainly for interplanetary and outer magnetospheric studies, the ULEZEQ sensor also obtains composition data in the trapped radiation zone. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-13133 California Univ., San Diego.
DELTA-RHO, A SECOND ORDER TRAJECTORY PERTURBATION TECHNIQUE Ph.D. Thesis
Louis Tramonti 1979 247 p
Avail: Univ. Microfilms Order No. 7926705

The Delta-Rho second order trajectory perturbation technique applicable to general trajectory problems was developed and, subsequently, verified for specific cases from the field of astrodynamics. This method can be described as an extension of Encke's perturbation technique to second order and to general problems. Unlike the Encke method, this method requires the definition and storage of a reference trajectory which includes all of the perturbations to be considered. Dissert. Abstr.

N80-13134*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
STAR TRACKER ERROR ANALYSIS: ROLL-TO-PITCH NONORTHOGONALITY
R. W. Corson (McDonnell Douglas Technical Services Co., Inc.) Oct. 1979 14 p refs
(NASA-TM-80835; JSC-16238; Rept-79-FM-43) Avail: NTIS HC A02/MF A01 CSCL 22A

An error analysis is described on an anomaly isolated in the star tracker software line of sight (LOS) rate test. The LOS rate cosine was found to be greater than one in certain cases which implied that either one or both of the star tracker measured

end point unit vectors used to compute the LOS rate cosine had lengths greater than unity. The roll/pitch nonorthogonality matrix in the TNB CL module of the IMU software is examined as the source of error. A.W.H.

N80-13135*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TWO-IMPULSE REORIENTATION OF ASYMMETRIC SPACECRAFT
C. William Martz Washington Dec. 1979 43 p refs
(NASA-TP-1554; L-12921) Avail: NTIS HC A03/MF A01 CSCL 22A

An investigation conducted to determine minimum maneuver costs for attitude reorientation of spacecraft of all possible inertial distribution over a wide range of maneuver angles by use of a two impulse coning method of reorientation is reported. Maneuver cost, proportional to the product of fuel consumed (total impulse) and time expended during a maneuver is discussed. Assumptions included external impulsive control torques, rigid body spacecraft rest-to-rest maneuvers, and no disturbance torques. Results are presented in terms of average cost and standard deviation for various maneuver ranges. Costs of individual reorientations are calculated with the computer program included. A.W.H.

N80-13136# Texas Univ., Austin.
ANALYSIS OF REENTRY VEHICLE TRAJECTORY RECONSTRUCTION AND PARAMETER IDENTIFICATION
J. L. McDowell, B. E. Schutz, and B. D. Tapley 1979 11 p refs Presented at Atmospheric Flight Mech. Conf., Boulder, Colo., 6 Aug. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1365C; CONF-790826-2) Avail: NTIS HC A02/MF A01

An analysis of a method for postflight reconstruction of reentry vehicle states and the identification of associated model parameters using the trajectory analysis program is presented. The present investigation focuses on the extent to which a reduced order dynamical model can be utilized to reconstruct reentry vehicle trajectories and to estimate aerodynamic coefficients from onboard observations of the vehicle motion. The feature of local arc trajectory partitioning is discussed and its application to the reentry vehicle problem is described. Numerical results derived from simulated measurements are presented which illustrate the feasibility of this approach. DOE

N80-13137# Royal Aircraft Establishment, Farnborough (England).
DETERMINATION AND GEOPHYSICAL INTEPRETATION OF THE ORBIT OF CHINA 2 ROCKET (1971-18B)
H. Hiller London HMSO Aug. 1978 49 p refs
(RAE-TR-78107; RAE-Space-557; BR66747) Avail: NTIS HC A03/MF A01

The orbit of China 2 rocket, 1971-18B, was determined at 114 epochs throughout its five year life using the orbit refinement program PROP 6 with more than 7000 radar and optical observations from 83 stations. The rocket passed slowly enough through the resonances 14:1, 29:2, 15:1, and 31:2 to allow lumped geopotential harmonic coefficients to be calculated for each resonance by least squares fittings of theoretical curves to the perturbation free values of inclination and eccentricity. The rotation rate of the upper atmosphere, at heights near 300 km, was estimated from the decrease in orbital inclination and values of 1.15, 1.10, and 1.05 rev/day were obtained between April 1971 and January 1976. From the variation in perigee height, 25 values of density scale height were calculated from April 1971 to decay. A further 1400 observation, made during the final 15 days before decay, were used to determine 15 daily orbits. Analysis of these orbits reveals a very strong west-to-east wind of 240 m/sec at a mean height of 195 km under winter evening conditions and gives daily values of density scale height in the last seven days before decay. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-13138# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
CONTROLLING THE CLEAN ROOM ATMOSPHERE
R. F. Meeks 1979 6 p refs Presented at the 19th Ann. Meeting of the Inst. of Environ. Sci., Seattle, 29 Apr. 1979
(Contract EY-76-C-04-0656)
(GEPP-OP-405; CONF-790445-5) Avail: NTIS HC A02/MF A01

Several types of clean rooms commonly in use are described. They include the conventional clean room, the horizontal laminar flow clean room, the vertical laminar flow clean room, and a fourth type that incorporates ideas from the previous types and known as a clean air bench or hood. The origin of contamination and methods for controlling the contamination are discussed. DOE

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-13139*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 1, PHASE 1: EXECUTIVE SUMMARY Final Report
16 Feb. 1979 29 p Sponsored in part by DOE. Prepared in cooperation with Gen. Elec., Fairfield, Conn., Grumman Aerospace Corp., Bethpage, N. Y., Little (Arthur D.), Inc., Cambridge, Mass., and TRW Defense and Space Systems Group., Redondo Beach, Calif. 7 Vol.
(Contract NAS9-15636)
(NASA-CR-160370; D180-25037-1-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22B

A systems definition study of the solar satellite system (SPS) is presented. The technical feasibility of solar power satellites based on forecasts of technical capability in the various applicable technologies is assessed. The performance, cost, operational characteristics, reliability, and the suitability of SPS's as power generators for typical commercial electricity grids are discussed. The uncertainties inherent in the system characteristics forecasts are assessed. A.W.H.

N80-13140*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 2, PHASE 1: SYSTEMS ANALYSES TRADEOFFS. Final Report
1 Mar. 1979 554 p Sponsored in part by DOE. Prepared in cooperation with Gen. Elec., Fairfield, Conn., Grumman Aerospace Corp., Bethpage, N. Y., Little (Arthur D.), Inc., Cambridge, Mass. and TRW Defense and Space Systems Group, Redondo Beach, Calif. 7 Vol.
(Contract NAS9-15636)
(NASA-CR-160371; D180-25037-2-Vol-2) Avail: NTIS HC A24/MF A01 CSCL 22B

A systems definition study of the solar power satellite system is presented. The satellite solar energy conversion and microwave power transmission systems are discussed. Space construction and support systems are examined including a series construction and equipment characteristics analysis. Space transportation for the satellite and the ground receiving station are assessed. A.W.H.

N80-13141*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 3: REFERENCE SYSTEM DESCRIPTION, PHASE 1 Final Report
1 Apr. 1979 362 p Sponsored in part by DOE. Prepared in cooperation with Gen. Elec., Fairfield, Conn., Grumman Aerospace Corp., Bethpage, N. Y., Little (Arthur D.), Inc., Cambridge Mass., and TRW Defense and Space Systems Group, Redondo Beach, Calif. 7 Vol.
(Contract NAS9-15636)
(NASA-CR-160372; D180-25037-3-Vol-3) Avail: NTIS HC A16/MF A01 CSCL 22B

An analysis of the solar power satellite system is presented. The satellite solar energy conversion and microwave power transmission systems are discussed including the structure, power distribution, thermal control, and energy storage. Space construction and support systems are described including the work support facilities and construction equipment. An assessment of the space transportation system for the satellite and the ground receiving station is presented. A.W.H.

N80-13142*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 4: SILICON SOLAR CELL ANNEALING TEST, PHASE 1 Final Report
Frank Walker Apr. 1979 95 p refs 7 Vol.
(Contract NAS9-15636)
(NASA-CR-160373; D180-25037-4-Vol-4) Avail: NTIS HC A05/MF A01 CSCL 22B

Laser annealing tests were conducted on ten 50 micron cells. Two were control cells that were not irradiated. These showed no loss in output due to exposure to the laser. Two cells were broken in handling. Six cells were successfully tested. All cells tested without breakage showed some recovery. One cell was subjected to two cycles and showed recovery on both cycles. Cells that were moderately degraded appeared to recover more completely than those more severly degraded. Exposure times ranged from two to ten seconds at 500 degrees centigrade. There was some indication that longer exposure was beneficial. R.C.T.

N80-13143*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 5, PHASE 1: EXECUTIVE SUMMARY Final Briefing
14 Nov. 1979 132 p Sponsored in part by DOE. Prepared in cooperation with Gen. Elec., Fairfield, Conn., Grumman Aerospace Corp., Bethpage, N. Y., Little (Arthur D.), Inc., Cambridge, Mass., TRW Defense and Space Systems Group, Redondo Beach, Calif. 7 Vol.
(Contract NAS9-15636)
(NASA-CR-160374; D180-25037-5-Vol-5) Avail: NTIS HC A07/MF A01 CSCL 22B

An analysis of the solar power satellite system is presented. Performance, cost, and operational characteristics are assessed. The photovoltaic system is described and investigated. Alternative construction concepts are discussed. The structural bay configuration is presented along with the antenna structure options. A.W.H.

N80-13144*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 6, PHASE 1: SPACE CONSTRUCTION AND TRANSPORTATION Final Briefing
14 Nov. 1979 286 p Sponsored in part by DOE. Prepared in cooperation with Gen. Elec., Fairfield, Conn. Grumman Aerospace Corp., Bethpage, N. Y., Little (Arthur D.), Inc., Cambridge, Mass. and TRW Defense and Space Systems Group, Redondo Beach, Calif. 7 Vol.
(Contract NAS9-15636)
(NASA-CR-160375; D180-25037-6-Vol-6) Avail: NTIS HC A13/MF A01 CSCL 22B

A systems definition study of the solar power satellite is presented. Highlighted are the space construction and space transportation systems. A.W.H.

N80-13145*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 7, PHASE 1: SPS AND RECTENNA SYSTEMS ANALYSES Final Briefing
14 Nov. 1979 280 p Sponsored in part by DOE Prepared in cooperation with Gen. Elec., Fairfield, Conn., Grumman Aerospace Corp., Bethpage, N. Y., Little (Arthur D.), Inc., Cambridge, Mass., and TRW Defense and Space Systems Group, Redondo Beach, Calif. 7 Vol.
(Contract NAS9-15636)
(NASA-CR-160376; D180-25037-7-Vol-7) Avail: NTIS HC A13/MF A01 CSCL 22B

A systems definition study of the solar power satellite systems is presented. The design and power distribution of the rectenna system is discussed. The communication subsystem and thermal control characteristics are described and a failure analysis performed on the systems is reported. A.W.H.

N80-13146# Royal Aircraft Establishment, Farnborough (England).
THE MIRANDA STAR SENSOR EXPERIMENT
G. W. Brown, P. Haskell, and B. Holloway London HMSO Sep. 1978 71 p refs
(RAE-TR-78112; RAE-Space-558; BR67363) Avail: NTIS HC A04/MF A01

The star sensor experiment in Miranda was investigated to determine the performance of the sensor in orbit and to demonstrate its compatibility with the spacecraft attitude control system when used to track a star. The basic design features of the sensor and the methods used to test and integrate it with the satellite are described. The various attitude control modes that were available in orbit are outlined and the way these were used to acquire and lock the control system onto the selected star is shown. Six successful star locks were achieved on either Canopus or Sirius at roughly one month intervals during the eight month operational lifetime of the satellite. On each of these occasions the control system remained in lock for its full scheduled period of about two days and only unlocked when commanded to do so. Author (ESA)

N80-13147# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.
STANDARDIZATION OF BOOM SYSTEMS FOR SOUNDING ROCKET EXPERIMENTS Final Report
Hermann Waldmann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 34 p In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1077; DFVLR-BPT-01-00-048)
(BMFT-FB-W-78-40) Avail: NTIS HC A03/MF A01; Fachinformationszentrum Karlsruhe, West Germany DM 7.15

Most of the boom systems used up to now were booms specially designed to fulfill the individual experiment requirements of particular sounding rockets. The standardization of boom systems is investigated. The general requirements for boom systems are shown and their fulfillment by several different boom systems is studied. As a result, a boom system is shown which is based on the telescope principle and which fulfills most of the stated requirements, but is, nonetheless, not an optimum solution for all requirements. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N80-13148*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PARAMETRIC STUDY OF THE ORBITER ROLLOUT USING AN APPROXIMATE SOLUTION
Benjamine J. Garland Nov. 1979 45 p refs
(NASA-TM-80837; JSC-16248; Rept-79-FM-44) Avail: NTIS

HC A03/MF A01 CSCL 22B

An approximate solution to the motion of the Orbiter during rollout is used to perform a parametric study of the rollout distance required by the Orbiter. The study considers the maximum expected dispersions in the landing speed and the touchdown point. These dispersions are assumed to be correlated so that a fast landing occurs before the nominal touchdown point. The maximum rollout distance is required by the maximum landing speed with a 10 knot tailwind and the center of mass at the forward limit of its longitudinal travel. The maximum weight that can be stopped within 15,000 feet on a hot day at Kennedy Space Center is 248,800 pounds. The energy absorbed by the brakes would exceed the limit for reuse of the brakes. Author

N80-13149*# Lockheed Electronics Co., Houston, Tex.
SPACELAB INTERFACE DEVELOPMENT TEST, VOLUME 1, SECTIONS 1-6 Final Report
L. H. Harris Nov. 1979 697 p
(Contract NAS9-15800)
(NASA-CR-160411; JSC-14822; LEC-13067) Avail: NTIS HC A99/MF A01 CSCL 22B

Data recorded during the following tests is presented: pulse coded modulator master unit to Spacalab (S/L) interface, master timing unit to S/L interface, multiplexer-demultiplexer/serial input-output to S/L interface, and special tests. A.R.H.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-13150*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DIGITAL COMPUTER PROGRAM FOR THE DYNAMIC INTERACTION SIMULATION OF CONTROLS AND STRUCTURE (DISCOS). VOLUME 4: SUPPLEMENTARY DOCUMENTATION
Harold P. Frisch Aug. 1979 53 p
(NASA-TM-80546) Avail: NTIS HC A04/MF A01 CSCL 22B

Additions made to the original version of the DISCOS computer programs are presented. They include demonstrations of problems and improved capabilities. Remarks are made pertaining new subroutines. M.M.M.

N80-13151*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
INVESTIGATION OF HIGH FREQUENCY OSCILLATIONS IN THE OV102 ELEVON ACTUATION SUBSYSTEMS USING CONTINUOUS SYSTEM MODELING PROGRAM SIMULATION
W. W. Powell, Sr. Jul. 1979 70 p
(Contract NAS9-15800)
(NASA-CR-160407; JSC-14765; LEC-13230; IN-79-EH-05)
Avail: NTIS HC A04/MF A01 CSCL 22B

Two theories emerged as the cause of undesired oscillations at frequencies between 40 and 60 Hz in the Orbiter Vehicle inboard and outboard elevon actuation subsystems during hardware testing. Both the 'hardover feedback' and 'deadspace' theories were examined using continuous system modeling program simulation. Results did not support the 'hardover feedback' theory but showed that deadspace in the torque feedback spring connections to the servospools must be considered to be a possible cause of the oscillations. Further investigation is recommended. A.R.H.

N80-13094*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ENGINEERING EVALUATION OF EXISTING SPACE HARDWARE FOR UTILIZATION IN SMALL SELF-CONTAINED PAYLOADS
P. A. Lovoi (Intern. Tech. Assoc.) and W. Vardaman *In* ESA Mater. Sci. in Space Jun. 1979 p 205-210 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-13152*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT TECHNOLOGY IMPROVEMENT
Dec. 1979 76 p Proceedings of workshop held at College Park, Md., 31 Jul. - 2 Aug. 1979
(NASA-CP-2101; L-13259) Avail: NTIS HC A05/MF A01 CSCL 22B

Shortcomings in spaceborne instrumentation technology are analyzed and recommendations are given for corrections and technology development. The technologies discussed are optical radiometric instruments and calibration, attitude control and determination, and electromechanical and power subsystems. For individual titles, see N80-13153 through N80-13157.

N80-13153*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUMMARY OF THE FLIGHT TECHNOLOGY IMPROVEMENT WORKSHOP
In its Flight Technol. Improvement Dec. 1979 p 1-7 (For primary document see N80-13152 04-19)
Avail: NTIS HC A05/MF A01 CSCL 22B

Spaceborne instrumentation technology deficiencies are summarized. Recommendations are given for technology development, improvements in existing technology, and policy changes needed to facilitate the use of improved technology. Optical radiometric instruments, attitude control, and electromechanical and power subsystems are considered. K.L.

N80-13154*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REPORT OF OPTICAL RADIOMETRIC INSTRUMENTS AND CALIBRATION PANEL
In its Flight Technol. Improvement Dec. 1979 p 9-26 (For primary document see N80-13152 04-19)
Avail: NTIS HC A05/MF A01 CSCL 22B

Measurement and accuracy needs for remote sensing are analyzed. Topics discussed include: (1) in orbit performance degradation due to contamination; (2) increased radiometric accuracy required for detecting small changes over long periods of time in environmental parameters; (3) references for verifying calibration in orbit; (4) high attenuation neutral density filters; (5) the sun as a radiation source for testing; (6) rejection of stray light; (7) development of spectrally flat detectors for flight sensors; and (8) long term stability of sensor components. K.L.

N80-13155*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

REPORT OF THE ELECTROMECHANICAL SUBSYSTEMS PANEL
In its Flight Technol. Improvement Dec. 1979 p 27-44 (For primary document see N80-13152 04-19)
Avail: NTIS HC A05/MF A01 CSCL 22B

Deficiencies in electromechanical flight technology are evaluated and development recommendations are made. Specific items discussed include magnetic bearings, lubrication for long life, signal and power transfer devices, servo sensing devices, deployment/retraction devices, cryogenic devices, data storage, and ordnance substitutes. K.L.

N80-13156*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REPORT OF THE POWER SUB SYSTEMS PANEL
In its Flight Technol. Improvement Dec. 1979 p 45-54 (For primary document see N80-13152 04-19)
Avail: NTIS HC A05/MF A01 CSCL 22B

Problems in spacecraft power system design, testing, integration, and operation are identified and solutions are defined. The specific technology development problems discussed include substorm and plasma design data, modeling of the power subsystem and components, power system monitoring and degraded system management, rotary joints for transmission of power and signals, nickel cadmium battery manufacturing and application, on-array power management, high voltage technology, and solar arrays. K.L.

N80-13157*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REPORT OF THE ATTITUDE CONTROL AND ATTITUDE DETERMINATION PANEL
In its Flight Technol. Improvement Dec. 1979 p 55-64 (For primary document see N80-13152 04-19)
Avail: NTIS HC A05/MF A01 CSCL 22B

Failures and deficiencies in flight programs are reviewed and suggestions are made for avoiding them. The technology development problem areas considered are control configured vehicle design, gyros, solid state star sensors, control instrumentation, tolerant/accomodating control systems, large momentum exchange devices, and autonomous rendezvous and docking. K.L.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-13158*# Hughes Research Labs., Malibu, Calif.
PRIMARY ELECTRIC PROPULSION TECHNOLOGY STUDY Final Report, 13 Sep. 1977 - 13 Jun. 1979
R. L. Poeschel and J. R. Beattie Nov. 1979 186 p refs
(Contract NAS3-21040)
(NASA-CR-159688) Avail: NTIS HC A09/MF A01 CSCL 01C

An investigation of the 30-cm engineering-model-thruster technology with emphasis placed on the development of models for understanding and predicting the operational characteristics and wear-out mechanisms of the thruster as a function of operating or design parameters is presented. The task studies include: (1) the wear mechanisms and wear rates that determine the useful lifetime of the thruster discharge chamber; (2) cathode lifetime as determined by the depletion of barium from the barium-aluminate-impregnated-porous-tungsten insert that serves as a barium reservoir; (3) accelerator-grid-system technology; (4) a verification of the high-voltage propellant-flow-electrical-isolator design developed under NASA contract NAS3-20395 for operation at 10-kV applied voltage and 10-A equivalent propellant flow with mercury and argon propellants. A model was formulated for predicting performance. M.M.M.

N80-13159*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
Hg ION THRUSTER COMPONENT TESTING
M. A. Mantenieks 1979 15 p refs Presented at 14th Intern. Conf. on Elec. Propulsion, Princeton, N. J., 30 Oct. - 1 Nov. 1979; sponsored by AIAA and DGLR
(NASA-TM-79287; E-230) Avail: NTIS HC A02/MF A01 CSCL 21C

Electron bombardment thrusters, under development to provide both auxiliary and primary propulsion functions for a large variety of space missions are tested. Thruster design verification which requires life tests of durations of the order of the time anticipated in space applications, are discussed. The life time and reliability of an electron bombardment thruster is dependent upon the performance of several critical components including cathodes, vaporizers, and isolators. The performances of the cathode, vaporizer, and propellant isolaters during fatigue analyses are examined. A.W.H.

N80-13160*# Rockwell International Corp., Canoga Park, Calif.
ORBITAL TRANSFER VEHICLE (OTV) ENGINE STUDY. PHASE A: EXTENSION Monthly Progress Report
A. J. Sobin 12 Nov. 1979 12 p
(Contract NAS8-32996)
(NASA-CR-161338; ASR79-116; MPR-2) Avail: NTIS HC A02/MF A01 CSCL 21H

An orbital transfer vehicle OTV engine study program was undertaken to provide additional expander and staged combustion cycle data in the design definition of the OTV engine. The proposed program effort optimizes the expander cycle engine concept (consistent with identified OTV engine requirements), investigates the feasibility of kitting the staged combustion cycle engine to provide extended low thrust operation, and conducts in-depth analysis of development risk, crew safety, and reliability for both cycles. Additional tasks to establish the cost of a 10K thrust expander cycle engine and to render support of OTV systems study contractors are reported. M.M.M.

N80-13161*# Rocketdyne, Canoga Park, Calif.
HIGH-PRESSURE LOX/CH4 INJECTOR PROGRAM Final Report, Oct. 1978 - Sep. 1979
D. B. Wheeler and F. M. Kirby Sep. 1979 94 p refs
(Contract NAS8-33206)
(NASA-CR-161342; RI/RD79-278) Avail: NTIS HC A05/MF A01 CSCL 21H

Two injector types, either coaxial or impinging elements, for high pressure LOX/CH4 operation with an existing 40K chamber are examined. A comparison is presented. The detailed fabrication drawings and supporting analysis are presented. A.W.H.

N80-13162*# Aerojet Liquid Rocket Co., Sacramento, Calif.
DESIGN, FABRICATION AND DELIVERY OF A HIGH PRESSURE LOX-METHANE INJECTOR Final Report
H. W. Valler 15 Nov. 1979 76 p
(Contract NAS8-33205)
(NASA-CR-161343; Rept-33205F) Avail: NTIS HC A05/MF A01 CSCL 21H

An injector for 3000 psia chamber pressure using liquid oxygen and gaseous methane propellants is presented. The injector is intended to be evaluated during a series of pressure-fed test firings using a water-cooled calorimeter chamber and a milled-slot regenerative chamber. Combustion efficiency, combustion stability, ignition and injector face heat transfer assessments were made for candidate injector body and pattern design approaches. This evaluation resulted in baselining an oxidizer post type manifold with a 60 element platelet coaxial swirler injector pattern. An axial acoustic resonator cavity was created at the injector/chamber interface. M.M.M.

N80-13163*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND EVALUATION OF HIGH PERFORMANCE ROCKET ENGINE INJECTORS FOR USE WITH HYDROCARBON FUELS
A. J. Pavli 1979 20 p refs Presented at the 16th JANNAF Combustion Conf., Monterey, Calif., 10-14 Sep. 1979
(NASA-TM-79319; E-275) Avail: NTIS HC A02/MF A01 CSCL 21H

The feasibility of using a heavy hydrocarbon fuel as a rocket propellant is examined. A method of predicting performance of a heavy hydrocarbon in terms of vaporization effectiveness is described and compared to other fuels and to experimental test results. Experiments were done at a chamber pressure of 4137 KN/sq M (600 psia) with RP-1, JP-10, and liquefied natural gas as fuels, and liquid oxygen as the oxidizer. Combustion length effects were explored over a range of 21.6 cm (8 1/2 in) to 55.9 cm (22 in). Four injector types were tested, each over a range of mixture ratios. Further configuration modifications were obtained by reaming each injector several times to provide test data over a range of injector pressure drop. J.M.S.

N80-13164*# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.
ANALYSIS OF COMBUSTION INSTABILITY IN LIQUID FUEL ROCKET MOTORS Ph.D. Thesis
Kin-Wing Wong and M. Ventrice Nov. 1979 119 p refs
(Grant NGR-43-003-015)
(NASA-CR-159733) Avail: NTIS HC A06/MF A01 CSCL 21H

The development of a technique to be used in the solution of nonlinear velocity-sensitive combustion instability problems is described. The orthogonal collocation method was investigated. It found that the results are heavily dependent on the location of the collocation points and characteristics of the equations, so the method was rejected as unreliabile. The Galerkin method, which has proved to be very successful in analysis of the pressure sensitive combustion instability was found to work very well. It was found that the pressure wave forms exhibit a strong second harmonic distortion and a variety of behaviors are possible depending on the nature of the combustion process and the parametric values involved. A one-dimensional model provides further insight into the problem by allowing a comparison of Galerkin solutions with more exact finite-difference computations. A.R.H.

N80-13165*# Tennessee Technological Univ., Cookeville.
STABILITY ANALYSIS OF A LIQUID FUEL ANNULAR COMBUSTION CHAMBER M.S. Thesis
G. H. McDonald Nov. 1978 151 p refs
(Grant NGR-43-003-015)
(NASA-CR-159734) Avail: NTIS HC A08/MF A01 CSCL 21H

High frequency combustion instability problems in a liquid fuel annular combustion chamber are examined. A modified Galerkin method was used to produce a set of modal amplitude equations from the general nonlinear partial differential acoustic wave equation in order to analyze the problem of instability. From these modal amplitude equations, the two variable perturbation method was used to develop a set of approximate equations of a given order of magnitude. These equations were modeled to show the effects of velocity sensitive combustion instabilities by evaluating the effects of certain parameters in the given set of equations. A.W.H.

N80-13166# Naval Research Lab., Washington, D. C. Communications Sciences Div.
A NUMERICAL SOLUTION FOR ROCKET ASCENT TRAJECTORY Final Report
Michael H. Reilly 16 Aug. 1979 67 p refs
(NRL Proj. R04-16)
(AD-A073346; AD-E000314; NRL-MR-4044) Avail: NTIS HC A04/MF A01 CSCL 22/3

A program for the numerical solution of rocket ascent trajectory is presented, which is particularly appropriate for large, multistage, unfinned rocket systems. FORTRAN listings of this program for DEC-10 and PDP-11/70 computer systems are given along with background information, examples, and prescriptions which clarify the usage of the program. Thrust increase and aerodynamic effects are specifically included, and the program is found to be both suitable and efficient for a wide variety of rocket trajectory problems. It is demonstrated how to modify the program results to include Earth's rotation effects. GRA

N80-13167# Los Alamos Scientific Lab., N. Mex.
EFFECTS OF ROCKET EXHAUST PRODUCTS IN THE THERMOSPHERE AND IONOSPHERE
J. Zinn, C. D. Sutherland, and M. B. Pongratz Jul. 1979 23 p refs
(Contract W-7405-eng-36)
(LA-7926-MS) Avail: NTIS HC A02/MF A01

The problem of ionospheric F-layer depletions produced by chemical effects of the exhaust gases from large rockets, with particular emphasis on the heavy lift launch vehicles (HLLV) proposed for use in the construction of solar satellites is examined. A computation of the effects of the Skylab I launch, for which experimental data exist is included. Detailed model computations of HLLV exhaust effects are described. DOE

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-13168# Materials Research Labs., Ascot Vale (Australia).
THE PARACHOR AND THE P YIELDS O BOND
Richard G. Gillis and R. Ian Tilley Jan. 1979 18 p refs
(AD-A073410; MRL-TN-418) Avail: NTIS HC A02/MF A01 CSCL 07/4

The bond parachors P (P - O) and P (P to O) have been determined as 21.4 and 17.3 respectively. This result supports the contention that the (P to O) bond in phosphates, phosphonates etc., is a two-electron dative bond and not a four-electron bond. The bond parachors P (P - H), P (P - C), and P (P - C1) have also been determined. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-13169 Michigan Univ., Ann Arbor.
FRACTURE TOUGHNESS OF GRAPHITE/EPOXY COMPOSITE LAMINATES ENHANCED BY THE INTERMITTENT INTERLAMINAR BONDING STRENGTH Ph.D. Thesis
Li-Chung Jea 1979 252 p
Avail: Univ. Microfilms Order No. 7925165

The intermittent-interlaminar bond concept was developed and employed to enhance the delamination of graphite/epoxy fiber reinforced composite laminates. A 7-micrometers thick perforated mylar was used to control the interlaminar bonding condition. The mechanism for the pull-out delamination mode of fracture was suggested and the energy consumed in pull-out of the plies was a very important work of fracture contributor to the fracture process. The optimum design conditions for high toughness, high tensile strength CFRP laminates under uniaxial stress are 18 percent interfacial contact and alpha + beta approximately 60 deg. These laminates have a toughness of 600 kJ/squared m which is 380 percent of the toughness of the untreated composite, and retain a tensile strength of 370 MPa and elastic modulus of 60 GPa, compared with 500 MPa and 60 GPa, respectively, for the untreated composite of the same ply lay-up. Dissert. Abstr.

N80-13170*# Lockheed Missiles and Space Co., Palo Alto, Calif.
HYGROTHERMAL DAMAGE MECHANISMS IN GRAPHITE-EPOXY COMPOSITES
Frank W. Crossman, R. Ernest Mauri, and W. John Warren Dec. 1979 156 p refs
(Contract NAS2-9563)
(NASA-CR-3189; LMSC-D626480) Avail: NTIS HC A08/MF A01 CSCL 11D

T300/5209 and T300/5208 graphite epoxy laminates were studied experimentally and analytically in order to: (1) determine the coupling between applied stress, internal residual stress, and moisture sorption kinetics; (2) examine the microscopic damage mechanisms due to hygrothermal cycling; (3) evaluate the effect of absorbed moisture and hygrothermal cycling on inplane shear response; (4) determine the permanent loss of interfacial bond strength after moisture absorption and drying; and (5) evaluate

the three dimensional stress state in laminates under a combination of hygroscopic, thermal, and mechanical loads. Specimens were conditioned to equilibrium moisture content under steady exposure to 55% or 95% RH at 70 C or 93 C. Some specimens were tested subsequent to moisture conditioning and 100 cycles between -54 C and either 70 C or 93 C. K.L.

N80-13171*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED FIBER RETENTION BY THE USE OF FILLERS IN GRAPHITE FIBER/RESIN MATRIX COMPOSITES
R. E. Gluyas and K. J. Bowles 1980 12 p refs Proposed for presentation at the 35th Ann. Conf. of the Reinforced Plastics/Composites Inst., New Orleans, 4-8 Feb. 1980; sponsored by Soc. of Plastics Ind.
(NASA-TM-79288; E-231) Avail: NTIS HC A02/MF A01 CSCL 11D

A variety of matrix fillers were tested for their ability to prevent loss of fiber from graphite fiber/PMR polyimide and graphite fiber/epoxy composites in a fire. The fillers tested included powders of boron, boron carbide lime glass, lead glass, and aluminum. Boron was the most effective and prevented any loss of graphite fiber during burning. Mechanical properties of composites containing boron filler were measured and compared to those of composites containing no filler. K.L.

N80-13172# SRI International Corp., Menlo Park, Calif.
PARTICLE IMPACT DAMAGE IN SILICON NITRIDE, PART 3 Annual Report
K. C. Dao, D. A. Shockey, L. Seaman, D. R. Curran, and D. J. Rowcliffe May 1979 116 p refs
(Contract N00014-76-C-0657; SRI Proj. PYU-4928)
(AD-A073570) Avail: NTIS HC A06/MF A01 CSCL 11/2

In the study of fracture in thick silicon nitride plates by particle impact and quasi-static indentation, we used three types of silicon nitride: hot pressed, reaction bonded, and oxidized hot pressed. The fracture damage occurred in well-defined progressive stages. For impact loads or quasi-static indentation loads that do not appreciably exceed the flow stress in the silicon nitride, the elastic radial tensile stresses cause ring and Hertzian cone cracks to form. In the dynamic case, the short duration of the tensile pulse restricts the formation of the ring cracks to the vicinity of the maximum contact radius of the impacting particle. In the quasi-static case, the ring cracks form well outside the maximum contact radius, suggesting that the fracture nucleation and growth kinetics play a significant role in determining the extent of damage. For dynamic loads that exceed the flow stress of the silicon nitride, the plastic flow reduces the tensile radial stress and produces tensile hoop stresses, which in turn, cause radial cracks to form and propagate. At still higher dynamic loads, lateral cracks form. The intersection of these later-stage cracks with the free surface causes material removal (erosion.) GRA

N80-13173# McDonnell-Douglas Research Labs., St. Louis, Mo. Chemical Physics Dept.
MAGNETIC RESONANCE STUDIES OF EPOXY RESINS AND POLYURETHANES Final Report, 3 Feb. 1978 - 3 May 1979
I. M. Brown, A. C. Lind, and T. C. Sandreczki 3 May 1979 111 p refs
(Contract N00019-78-C-0031)
(AD-A073590; MDC-Q0673) Avail: NTIS HC A06/MF A01 CSCL 11/9

Electron paramagnetic resonance (EPR) and proton nuclear magnetic resonance (NMR) have been used to investigate the changes in molecular motions that result in samples of the epoxy resin bisphenol-A diglycidyl ether (DGEBA) cured with diethylene triamine (DETA) and in samples of several polyester polyurethanes subjected to humid environments. The cured epoxy resin is known to show a lowering of the glass transition temperature following water sorption, whereas the polyester polyurethanes undergo hydrolysis and catastrophically depolymerize from rubbery solids to viscous liquids. GRA

N80-13174# Grumman Aerospace Corp., Bethpage, N.Y.
MANUFACTURING COST DATA COLLECTION AND ANALYSIS FOR COMPOSITE PRODUCTION HARDWARE Final Report, Sep. 1977 - Feb. 1979
B. I. Rachowitz, R. J. Coletti, and A. J. Tornabe May 1979 109 p refs
(Contract F33615-77-C-3022; AF Proj. 2401)
(AD-A073507; AFFDL-TR-79-3041) Avail: NTIS HC A06/MF A01 CSCL 11/4

This technical report documents the procedures used to validate the Advanced Composite Cost Estimating Model, by comparing the model output with actual costs measured during production fabrication. This validation also includes recommendations as to the limitations and improvements that can be made to the model. GRA

N80-13175# Syracuse Univ., N. Y. Dept. of Electrical Engineering.
MEASUREMENT OF THE ELECTRICAL PROPERTIES OF COMPOSITE MATERIALS IN THE FREQUENCY RANGE OF DC TO 30 MHz
W. J. Gajda Griffiss AFB RADC Aug. 1979 43 p refs Prepared in cooperation with Notre Dame Univ.
(Contracts F30602-75-C-0121; F30602-78-C-0083; AF Proj. 2338)
(AD-A073638; RADC-TR-79-203) Avail: NTIS HC A03/MF A01 CSCL 11/4

Work reported here is an extension of work reported in RADC-TR-78-156. A much higher conductivity for boron/epoxy is reported using better contacting techniques. For graphite/epoxy: coupled circuit theory is used to relate the conductivity to the measured resistance of a sample; the effect of absorbed moisture on the conductivity is reported; and the effective conductivity of a multiple laminate is reexamined. GRA

N80-13176# Sandia Labs., Albuquerque, N. Mex.
IDENTIFICATION OF THE ELASTIC CONSTANTS FOR COMPOSITES USING MODAL ANALYSIS
T. G. Carne and J. A. Wolf, Jr. (General Motors Res. Labs., Warren, Mich.) Mar. 1979 12 p refs Presented at Spring Meeting of Soc. for Exptl. Stress Anal., San Francisco, 20 May 1979
(Contract DE-AC04-76DP-00789)
(SAND-79-0527C; CONF-790503-5) Avail: NTIS HC A02/MF A01

A procedure is described for determining the elastic constants of isotropic materials based on an impact vibration test of freely supported panels. It is an attractive alternative to currently used techniques because of the ease and speed with which the determinations can be made. This is particularly applicable to fiber-reinforcad composites, since the calculations yield average elastic constants rather than those of a small localized specimen of the material. Panels of known metallic materials are evaluated; and the values of their elastic constants are reproduced to within 3% of their reference values. DOE

N80-13177# California Univ., Livermore. Lawrence Livermore Lab.
DEFORMATION AND FAILURE INFORMATION FROM COMPOSITE MATERIALS VIA ACOUSTIC EMISSION
M. A. Hamstad 1 Nov. 1978 32 p refs Presented at 96th Meeting of the Acoust. Soc. of Am., Honolulu, Hawaii, 27 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-81272; CONF-781186-1) Avail: NTIS HC A03/MF A01

Some principles of applying acoustic emission (AE) to the study of fiber-composite materials and structures are reviewed as well as the basics of using AE to monitor the deformation and fracture processes that occur when fiber-composite materials are stressed. New results in some areas of current research interest are presented. The following areas are emphasized: study of couplants for AE testing of composites, evaluation of a special immersion-type AE transducer, and wave propagation complications and the development of techniques for locating AE sources in Kevlar 49/epoxy composite pressure vessels. DOE

N80-13178# General Atomic Co., San Diego, Calif.
PROPERTY CHANGES IN GRAPHITE IRRADIATED AT CHANGING IRRADIATION TEMPERATURE
R. J. Price and G. Hapag (Kernforschungsanlage, Juelich G.m.b.H.,

West Germany) Jul. 1979 42 p refs
(Contract DE-AT03-76ET-35300)
(GA-A-15270) Avail: NTIS HC A03/MF A01

Routine irradiation tests on graphite were carried out at constant temperature and the resulting design data are presented in the form of families of isothermal plots showing the change in property as a function of fast neutron fluence. When service conditions require the irradiation temperature to change, design calculations must use combinations of isothermal plots to predict the graphite properties. Three alternative rules for transposing isothermal curves are discussed: (1) vertical transposition at equal fluence; (2) horizontal transposition at equal property value; and (3) horizontal transposition at scaled fluence. Experimental data from several programs in which the irradiation temperature of graphite specimens was systematically changed were reviewed. Measurements of changes in dimensions, Young's modulus, thermal conductivity, and thermal expansivity are plotted. Overall, the measurements agree well with predictions based on the third transposition rule, whereas the first and second rules sometimes give rise to false predictions or no predictions at all. R.E.S.

N80-13076# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
EXPERIMENT SYRENA 1, 2, 3: SPACE PROCESSING OF CdHgTe, CdHgSe AND PbSeTe
R. R. Galazka (Polish Acad. of Sci.), A. Jedrzejczak (Polish Acad. of Sci.), A. Szczerbakow (Polish Acad. of Sci.), T. Warminski (Polish Acad. of Sci.), J. Bak (Polish Acad. of Sci.), J. Auleytner (Polish Acad. of Sci.), A. S. Okhotin, R. P. Borovikova, I. A. Zubritskij, V. T. Khriapov et al *In* ESA Mater. Sci. in Space Jun. 1979 p 47-51 (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13084# Fiat Research Center, Turin, Italy.
FABRICATION OF COMPOSITE MATERIALS UNDER LOW GRAVITY (EXPERIMENT ES 310 OF THE FIRST SPACELAB PAYLOAD (FSLP)) [FABRICATION DE MATERIAUX COMPOSITES EN MICROGRAVITE (EXPERIENCE ES 310 DU PREMIER VOL SPACELAB)]
P. L. Antona *In* ESA Mater. Sci. in Space Jun. 1979 p 109-114 In FRENCH Sponsored by CNR (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-13179 Case Western Reserve Univ., Cleveland, Ohio.
OXYGEN DIFFUSION IN CLOSE PACKED OXIDES Ph.D. Thesis
Kamjula Pattabhi Rami Reddy 1979 249 p
Avail: Univ. Microfilms Order No. 7924809

Oxygen diffusion in alumina, magnesia, MgAl2O4 spinel, forsterite and hematite was studied by exchanging the samples with an O-18 enriched gas and measuring the O-18 profiles by proton activation analysis. The values of the pre-exponential term and the activation energy for oxygen lattice diffusion in single crystals of these oxides are presented. In close packed oxides there is a good correlation between the oxygen diffusion coefficients and the oxygen density and melting temperature of the oxide. The oxidation rate of Ni-Cr-Al alloys is controlled by oxygen grain boundary diffusion through the alumina scale formed on these alloys. Dissert. Abstr.

N80-13180 Virginia Polytechnic Inst. and State Univ., Blacksburg.
APPLICATION OF SYNTHETIC MOLECULAR SIEVE ZEOLITES AND SILICA GEL TOWARD THE SEPARATION OF SULFUR DIOXIDE FROM COMBUSTION GASES Ph.D. Thesis
George Todd Wright 1979 233 p
Avail: Univ. Microfilms Order No. 7924153

An evaluation of several commercial adsorbents for use as contacting media in a process for combustion gas desulfurization was performed. Sulfur dioxide loadings were greatest for the type 13X molecular sieve followed by AW500 molecular sieve. The effect of gas throughput was minimal which suggests that mass transfer was adsorbent side controlling. As gas temperature increased, sulfur dioxide adsorption decreased linearly for 100 percent sulfur dioxide concentration and nonlinearly for low concentrations (0.003 percent). Application of the molecular sieve adsorbents in a simulated combustion gas for sulfur dioxide removal was superior to several adsorbents for temperature range 21-76 C. However, as gas temperature increases, sulfur dioxide adsorption decreases. No adsorption of sulfur dioxide above 148 C (300 F) could be measured. Dissert. Abstr.

N80-13181 Northwestern Univ., Evanston, Ill.
CATALYST DEACTIVATION AND FIXED BED REACTOR MODELING Ph.D. Thesis
Rustom Billimoria 1979 275 p
Avail: Univ. Microfilms Order No. 7927296

An experimental study with concomitant modeling of the dynamic behavior of a quasi-adiabatic fixed bed catalytic reactor was effected. The model predicted the steady state hydrogenation temperature-distance profile and the deactivation from steady state temperature profiles satisfactorily for all the diluents employed. These simulations put the least strain on the model. Kinetic data were utilized in the region in which they were determined. Problems were encountered in simulating the ignition which imposes a severe stress on the model parameters. These problems are compounded for the metal-diluted systems for which there exists a large dissimilarity between the thermal properties of the active and inert zones. Dissert. Abstr.

N80-13182 Oklahoma State Univ., Stillwater.
TEMPERATURE DEPENDENCE OF THE VISCOSITY OF SOME CRUDE OILS AND PURE LIQUIDS Ph.D. Thesis
Mohamed B. Amin 1979 113 p
Avail: Univ. Microfilms Order No. 7928191

The temperature dependence of viscosity for crude oils and some pure liquids is examined. Correlations between the viscosity-temperature relationships of the liquids considered with certain other physical properties are investigated. The correlations were examined based on the reaction rate theory in order to predict the viscosity of liquids. The experimental viscosity data for the pure liquids were used to test several of the well known empirical models from the literature. The significance of the values of the parameters involved in some of these models was investigated. Dissert. Abstr.

N80-13183 Minnesota Univ., Minneapolis.
OPTICAL REFLECTANCE STUDIES OF ADSORPTION AND REACTION ON PLATINUM Ph.D. Thesis
Raul Alberto Caretta 1979 195 p
Avail: Univ. Microfilms Order No. 7926102

An optical spectrometer was constructed to study adsorption and reaction on polycrystalline platinum ribbons. The changes in reflectivity in the visible region as a function of temperature, wavelength, angle of incidence, and gas composition were examined. Changes in reflectivity upon cyclic exposure to NH3, H2, CO, and N2 and air were examined between 300 K and 1100 K. Simple models were used to interpret reflectivity changes as a function of the surface composition. During NH3 and CO oxidation reactions the delta R/R changes show an extensive etching of the surface able to be measured during the actual process. Etching in oxygen rich mixtures proves to be most damaging to the surface. Changes in concentration of the reactants feed were a accompanied by changes in reflectivity in qualitative agreement with delta R/R changes upon exposure to pure gases. Dissert. Abstr.

N80-13184 Pennsylvania Univ., Philadelphia.
COMPUTATIONAL OF PHYSICAL AND CHEMICAL EQUILIBRIA Ph.D. Thesis
Rajeev Gautam 1979 233 p

Avail: Univ. Microfilms Order No. 7978131

Several methods are reviewed for determining compositions in multiphase, reacting mixtures at equilibrium. Wolfe's quadratic programming algorithm is applied and results compared with the RAND method, NASA method and the George, et al. implementation of Powell's method. A phase-splitting algorithm is described which is coupled with the RAND method to improve its efficiency and reliability in determining the global minimum when the phase distribution is not known at equilibrium or when poor guesses for compositions at equilibrium are available as in process simulators. The RAND method was extended to compute equilibria in electrolytic solutions. Methods for estimating the properties of electrolytic solutions are reviewed, with emphasis on molecule-molecule, molecule-ion and ion-ion interactions. Dissert. Abstr.

N80-13185 Vanderbilt Univ., Nashville, Tenn.
MULTIPLICITY AND STABILITY OF NONADIABATIC HYDROGEN-OXYGEN-NITROGEN FLAMES Ph.D. Thesis
Robert Frederick Heinemann 1979 109 p
Avail: Univ. Microfilms Order No. 7926607

The multiple steady states of the rich hydrogen-oxygen-nitrogen flame were studied theoretically and experimentally. Flame multiplicity and stability is shown to be extremely sensitive to the kinetic mechanism used in the mathematical model of a nonadiabatic hydrogen flame stabilized on a flat flame burner. The model using a complex, seven-step mechanism predicts a thermal ignition temperature of 860 K - approximately 300 K higher than the prediction of the model employing a simpler, four-step mechanism. Results confirm that flat flames are stabilized by losing heat to the burner. As the inlet temperature is lowered, the flames lose less heat, are shifted away from the burner, and approach burn-out. This transition to adiabaticity is explained by the decreased reaction rate of the kinetic mechanism at lower temperatures. It is shown that ignition and burn-out are caused by specific chemical changes in the flame and that the hydrogen radical profile can be used to qualitatively predict the transition from one steady state to another. Dissert. Abstr.

N80-13186 Minnesota Univ., Minneapolis.
SEVERAL ASPECTS OF DYNAMIC BEHAVIOR IN NONLINEAR MATHEMATICAL MODELS OF CHEMICAL REACTION AND DIFFUSION Ph.D. Thesis
Clinton Robert Kennedy 1979 219 p
Avail: Univ. Microfilms Order No. 7926142

The mathematical modeling of chemical systems which exhibit dynamic behavior due to the interaction of chemical reaction and diffusion is described. Topics covered include (1) the structure of solutions to a simple spatially dependent population model involving growth and death; (2) the effect of spatial localization of reaction sites in enzyme reactions; and (3) exotic behavior in a model reaction-diffusion system. Dissert. Abstr.

N80-13187 Wisconsin Univ. - Madison.
OPTIMAL DESIGN OF FLEXIBLE CHEMICAL PROCESSES Ph.D. Thesis
Ranjan Kumar Malik 1979 464 p
Avail: Univ. Microfilms Order No. 7921571

Several techniques are presented based on two-stage design optimization with suitable allowances for uncertain specifications and future changes in economic parameters. Modifications were made to the Constrained Simplex search method in order to optimize noisy objective functions; these improve the computational efficiency of direct solution to the desired here-and-now problem of two-stage formulation. A procedure was developed to obtain conservative but highly flexible designs which are computationally economical. Dissert. Abstr.

N80-13188 Purdue Univ., Lafayette, Ind.
THE WATER SPLITTING LIGHT REACTION OF CHLOROPHYLL a DIHYDRATE. VISIBLE LIGHT SOLAR ENERGY CONVERSION AFTER THE PRIMARY REACTION IN PLANT PHOTOSYNTHESIS Ph.D. Thesis
Lory Galloway 1979 199 p
Avail: Univ. Microfilms Order No. 7926372

The catalysis of water photolysis by chlorophyll a dihydrate is examined. The photophysical and photochemical properties of chlorophyll a dihydrate are contrasted to those of the P700 dimer. It is established that P700 is not capable of catalyzing water photolysis owing to the finding that the dimer possesses a midpoint potential lower than that, required to oxidize water. The role of water on the photochemical activity of chlorophyll a is examined by a study of a photogalvanic cell consisting of a Pt/Chl a photocathode and a Chl a-free Pt anode. The photocurrents are observed to consist of a transient and irreversible component. The irreversible photocurrents are attributed to the photogalvanic splitting of water by chlorophyll a dihydrate. The flux dependence of the photogalvanic response of chlorophyll a dihydrate is analyzed in terms of a biphotonic excitation mechanism for the water splitting reaction. Dissert. Abstr.

N80-13189 Utah Univ., Salt Lake City.
AN ORBITAL LOCALIZATION METHOD AND AN ITERATIVE PROCEDURE FOR CALCULATING NUCLEAR MAGNETIC RESONANCE COUPLING CONSTANTS Ph.D. Thesis
Patrick Kaye Redington 1979 139 p
Avail: Univ. Microfilms Order No. 7927074

A method for obtaining localized orbitals based upon diagonalizing subunits of the density matrix is presented. Semiempirical calculation of nuclear magnetic resonance proton-proton coupling constants is described. Coupling constants are calculated via the mutual polarizability expression using the iterative extended huckel (IEHT) independent electron model. A single excitation configuration is developed and applied using the IEHT wave functions. Using second order perturbation theory, an iterative process which is equivalent to the finite order perturbation theory method is developed. A simple model which gives the coupling constants of the holomethane and haloethylene series as a linear function of the change in bond angle caused by the substitution and the electronegativity of the substituent is derived. Schemes for improving the iterative calculation utilizing localized orbitals are discussed. Dissert. Abstr.

N80-13190 California Univ., San Diego.
STUDIES OF PREMIXED HYDROGEN FLAMES Ph.D. Thesis
Tonru Mitani 1979 357 p
Avail: Univ. Microfilms Order No. 7915639

Propagation of premixed H_2-O_2-N_2 flames near the flammability limit were investigated in order to understand the extinction of premixed flames. A thermal extinction model of two reactant, curved flames is presented using an asymptotic expansion of a large nondimensional activation energy. The preferential diffusions of the two reactants modify the thermal extinction condition of the flames. The model was found to explain the characteristics observed in the quenching of hydrogen-oxygen flames. The heat loss postulated in the analysis was identified to be the convective heat transfer to the cold tube walls. The shift of the flammability limit curves from the constant flame temperature curve can be understood, if the preferential diffusions and incomplete burning of hydrogen caused by the anisotropic flame structure are taken into account. Dissert. Abstr.

N80-13191*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECT OF PRESSURE ON STRUCTURE AND NO SUB X FORMATION IN CO-AIR DIFFUSION FLAMES
Howard G. Maahs and Irvin M. Miller Oct. 1979 58 p refs (NASA-TP-1448; L-12731) Avail: NTIS HC A04/MF A01 CSCL 21B

A study was made of nitric oxide formation in a laminar CO-air diffusion flame over a pressure range from 1 to 50 atm. The carbon monoxide (CO) issued from a 3.06 mm diameter port coaxially into a coflowing stream of air confined within a 20.5 mm diameter chimney. Nitric oxide concentrations from the flame were measured at two carbon monoxide (fuel) flow rates: 73 standard cubic/min and 146 sccm. Comparison of the present data with data in the literature for a methane-air diffusion flame shows that for flames of comparable flame height (8 to 10 mm) and pseudoequivalence ratio (0.162), the molar emission index of a CO-air flame is significantly greater than that of a methane-air flame. M.M.M.

N80-13192*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Space Sciences Lab.

SAMPLE STREAM DISTORTION MODELED IN CONTINUOUS-FLOW ELECTROPHORESIS
P. H. Rhodes. Aug. 1979. 46 p.
(NASA-TM-78178) Avail: NTIS HC A03/MF A01 CSCL 07D

Buoyancy-induced disturbances in an electrophoresis-type chamber were investigated. Five tracer streams (latex) were used to visualize the flows while a nine-thermistor array sensed the temperature field. The internal heating to the chamber was provided by a 400 Hz electrical field. Cooling to the chamber was provided on the front and back faces and, in addition, on both chamber side walls. Disturbances to the symmetric base flow in the chamber occurred in the broad plane of the chamber and resulted from the formation of lateral and axial temperature gradients. The effect of these gradients was to retard or increase local flow velocities at different positions in the chamber cross section, which resulted in lateral secondary flows being induced in the broad plane of the chamber. As the adverse temperature gradients increased in magnitude, the critical Rayleigh number was approached and reverse (separated) flow became apparent, which, subsequently, led to the onset of time variant secondary flows. Author

N80-13193*# Tennessee Technological Univ., Cookeville. Dept. of Mechanical Engineering.
AMPLIFICATION OF REYNOLDS NUMBER DEPENDENT PROCESSES BY WAVE DISTORTION Final Report, 1 Jan. 1972 - 31 Oct. 1979
M. Ventrice. Nov. 1979. 59 p. refs.
(Grant NGR-43-003-015)
(NASA-CR-159732) Avail: NTIS HC A04/MF A01 CSCL 21B

The amplification of a Reynolds number dependent process by wave distortion and the possibility of applying the results to other similar Reynolds number dependent processes were investigated. The process investigated was that associated with the operation of a constant-temperature hot-wire anemometer. The application of vaporization limited combustion, the type of combustion typically associated with liquid propellant rocket engines, was studied. A series of experiments were carried out to determine the effect of wave distortion on a Reynolds number dependent process and to establish the analogy between the anemometer process and the combustion process. Parametric trends, behavior common to different chamber geometries, and stability boundaries were identified. The results indicate a high degree of similarity between the two processes and the possibility of using the anemometer system to investigate combustion instability. The nonlinear aspects of a Reynolds number dependent process appear to be the dominant mechanisms controlling instability. J.M.S.

N80-13194# Materials Research Labs., Ascot Vale (Australia).
A THERMOGRAVIMETRIC SYSTEM FOR INVESTIGATING GAS-METAL REACTIONS AT ELEVATED TEMPERATURES
Lawrence D. Palmer. Oct. 1978. 39 p. refs.
(AD-A073412; MRL-R-726; AR-001-357) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report describes the thermogravimetric system recently established at MRL to study the kinetics of reactions between solids and their gaseous environments at elevated temperatures. Changes in the weight of heated samples, due to reactions such as high-temperature oxidation of metals, are measured by a sensitive, large-capacity electrobalance. The sources of uncertainties in the measurement of both weight and temperature have been considered, and experimental techniques which have been introduced to minimize these uncertainties are discussed. GRA

N80-13195# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.
STUDIES OF IONIZATION PROCESSES Final Report, 1 Aug. 1975 - 30 Sep. 1978
Erhard W. Rothe. May 1979. 23 p. refs.
(Grant AF-AFOSR-2770-75; AF Proj. 2303)
(AD-A073823; AFOSR-79-0942TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

This is the final report for Grant AFOSR 75-2770. Advances in chemical dynamics are not usually achieved by a single experiment but rather by a blend of informations using a variety of techniques. As a consequence, the results of this research project may be classified in three separate categories: (a) preparation of the experiments with electronically excited atoms and molecules; (b) measurements of kinetic energy thresholds for ion-pair production from molecular collisions, with subsequent derivation of molecular binding energies and electron affinities; and (c) thermal energy chemi-ionization processes. GRA

N80-13196# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIRFLOW EFFECTS ON FIRES, PART 2 Final Report, Jun. - Aug. 1976
Thomas Weeks, Charles C. Gebhard, and Gilbert L. Camburn. May 1979. 70 p. refs.
(AD-A073486; JTCG/AS-76-T-006) Avail: NTIS HC A04/MF A01 CSCL 21/4

This report expands the knowledge of airflow effects on fuel fires initiated by nonnuclear combat damage obtained from previous work reported in JTCG/AS-T-75-001. An investigation is made into the influence of selected airflow parameters (coefficient of pressure and the boundary layer thickness) upon the blowout velocity for a variety of damage conditions and angles-of-attack. GRA

N80-13197# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
CHARACTERISTIC PARAMETERS IN COMBUSTION PROCESSES AND THEIR ACCESSIBILITY TO CURRENT AND FUTURE DIAGNOSTICS Progress Report, 1 Mar. 1978 - 31 May 1979
R. Goulard. 31 May 1979. 43 p. refs.
(Contract ER-78-S-05-5773)
(ORO-5773-T1) Avail: NTIS HC A03/MF A01

Some of the aspects of combustion diagnostics are presented in order to identify which techniques are best suited to each particular set of experiments. The criteria used for this evaluation is affected by techniques like real time data processing and sensor noise limitations. DOE

N80-13198# Hanford Environmental Health Foundation, Richland, Wash.
EXPERIMENTAL STUDY OF HYDROGEN JET IGNITION AND JET EXTINGUISHMENT
R. W. Wierman. Apr. 1979. 114 p. refs.
(Contract EY-76-C-14-2170)
(HEDL-TME-78-80) Avail: NTIS HC A06/MF A01

Two phases are described of an experimental study that investigated: (1) the ignition characteritics of hydrogen-sodium jets; (2) the formation of hydrogen in sodium-humid air atmospheres; and (3) the extinguishment characteristics of burning hydrogen-sodium jets. Test conditions were similar to those postulated for highly-improbable breeder reactor core melt-through accidents and included: jet temperature, jet velocity, jet hydrogen concentration, jet sodium concentration, atmospheric oxygen concentration, and atmospheric water vapor concentration. DOE

N80-13199# Argonne National Lab., Ill.
THERMAL STABILITY AND DECOMPOSITION KINETICS OF AMORPHOUS HYDROGENATED FILMS
J. A. McMillan and E. M. Peterson. 1979. 13 p. refs. Presented at Intern. Conf. on Met. Coatings, San Diego, Calif., 23 Apr. 1979.
(Contract W-31-109-eng-38)
(CONF-790442-12) Avail: NTIS HC A02/MF A01

The kinetics of decomposition of the equal to SiH2 and identical with SiH centers in amorphous hydrogenated silicon films were studied by thermomanometric analysis. The methods of preparation and analysis are described. Experimental values of the enthalpy and entropy of activation are given in both cases. Tentative reaction mechanisms are proposed on the basis of an interpretation of the results. DOE

N80-13200# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
THEORETICAL STUDIES ON HETEROGENEOUS COMBUSTION Progress Report, 1 Mar. 1978 - 28 Feb. 1979
Chung K. Law. 1979. 106 p. refs.

(Contract EG-77-S-02-4433)
(COO-4433-2) Avail: NTIS HC A06/MF A01

Numerical models are developed for unsteady droplet combustion in a reactive environment simulating the fuel spray interior. The classical droplet combustion theory, in which the instanteous rate of fuel vaporization from the droplet is equal to the rate of fuel consumption at the flame, is questioned; a theory is formulated which shows that a significant portion of the fuel vaporized is actually used in filling up the space between the droplet and the flame instead of being consumed at the flame. The effects of possible condensation of ambient moisture on the spary vaporization rate are investigated. DOE

N80-13201# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF LABORATORY APPARATUS DEDICATED TO THE STUDY OF HYDRIDE-DEHYDRIDE REACTIONS
R. P. Wemple and W. J. Kass Jul. 1979 30 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1803) Avail: NTIS HC A03/MF A01

Hydrogen-compatible laboratory apparatus designed and developed to study hydride-dehydride reactions at elevated pressures and temperatures is described. The system is operated at pressures and temperatures up to 34 MPa and 550 C during experiments conducted on LiAlH4 and NiZr. Instrumentation incorporated into the system also allows differential thermal analysis and acoustic emission data to be collected as the chemical reactions progress is also described. DOE

N80-13202# Sandia Labs., Albuquerque, N. Mex.
QUANTITATIVE GAS ANALYSIS USING FOURIER TRANSFORM INFRARED SPECTROSCOPY
Gary E. Rivord Jul. 1979 27 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0968) Avail: NTIS HC A03/MF A01

Experimental methods were developed for quantitative trace gas analysis using the Nicolet 7199 Fourier transform infrared (FTIR) spectrophotometer. High resolution (0.06/cm full width - half maximum) spectra were obtained for CO and N2O at approximately 1000, 100, and 5 ppM and CO2 at approximately 1000 ppM. These spectra were used to test the quantitative accuracy of the Beer-Lambert relationship and the linearity of the FTIR system. Two methods were used to analyze the spectra. The first involved the measurement of peak height of the maximum spectral feature of the sample compared to that of a known reference spectrum. The second used a computer-assisted method which correlates all the spectral information from the trace gas sample with that of a high signal-to-noise reference spectrum of the gas. A complete description of the spectral correlation method along with the computer program listing is presented. DOE

N80-13203# SRI International Corp., Arlington, Va.
LASER INDUCED PHOTOCHEMISTRY
W. Happer, J. Chamberlain, H. Foley, N. Fortson, J. Katz, R. Novick, M. Ruderman, and K. Watson Feb. 1979 39 p refs
(Contract EY-76-C-03-0115)
(SAN-115/136-1) Avail: NTIS HC A03/MF A01

The merits of lasers as applied to photochemistry in industry along with differences between conventional light sources and lasers are pointed out. The economic aspects remain the main problem facing this project. DOE

N80-13204# Sandia Labs., Albuquerque, N. Mex. Combustion Physics Div.
CARBON DIOXIDE CONCENTRATION AND TEMPERATURE IN FLAMES MEASURED BY RAMAN SPECTROSCOPY
R. J. Blint (Gen. Motors Res. Labs., Warren, Mich.), D. A. Stephenson, and J. H. Bechtel (Gen. Motors Res. Labs., Warren, Mich.) May 1979 21 p refs Presented at Spring Meeting on Western States Sect., and the Combust. Inst., Provo, Utah, 23 Apr. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8612; CONF-790434-5) Avail: NTIS HC A02/MF A01

The high temperature spectrum of CO2 is adequately described by the formalism of Courtoy, including his assignments of the degeneratively split levels. It was concluded that: (1) vibrational levels up to v sub l = 5 and l = 7 must be included to adequately describe the high temperature spectra; (2) the peaks above 1409/cm move in position as a function of thermal population; and (3) gas temperatures obtained from the Raman spectra of CO2 are in agreement with, but less accurate than those obtained from the N2 spectrum. DOE

N80-13205# Argonne National Lab., Ill. Chemical Engineering Div.
MEMBRANE OXYGEN ENRICHMENT COST AND APPLICATION EVALUATION
Jack Fischer and Lowell J. Burnett Mar. 1979 62 p refs
(Contract W-31-109-eng-38)
(ANL-78-108) Avail: NTIS HC A04/MF A01

Composite membranes that are both thin enough to provide a large gas flow and strong enough to withstand the driving pressure of the incoming gas are made by depositing a polymer on the finely porous surface of a fabric-reinforced supporting membrane. The resulting material is then formed into a spiral-wound element that provides a large amount of membrane area in a small volume. The technical feasibility of using such membranes to produce oxygen-enriched air was established. A preliminary analysis of membrane oxygen enrichment economics shows that oxygen enrichment could be profitable for combustion systems up to 100 tons of oxygen per day. A supporting economic study reaffirms the positive economics potential for a 1000 ton/d, 30% O2 enrichment plant. DOE

N80-13206# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
PHOTOCHEMISTRY OF DINITROGEN PENTOXIDE Ph.D. Thesis
Peter Steele Connell May 1979 164 p refs
(Contract W-7405-eng-48)
(LBL-9034) Avail: NTIS HC A08/MF A01

The gas phase photochemistry and thermal decomposition kinetics of dinitrogen pentoxide, N2O5 were examined. The products of photodecomposition and the quantum yield as a function of pressure were determined at a wavelength of 254 nm. The rate of thermal decomposition of N2O5 in the presence of excess NO were observed between 4 x 10 to the 14th power to 2.8 x 10 to the 19th power molecules/cubic cm and 282 to 307 K. The infrared absorptions of N2O5, NO2, and HNO3 were monitored. Absorption cross sections for these species were experimentally determined. The techniques used included closed cell decay profiles, with and without photolyzing light, constant illumination of flow systems and modulation of species in a flow system with intermittent photolytic illumination. DOE

N80-13207# Krupp (Fried.) G.m.b.H., Rheinhausen (West Germany). KRUPP Forschungsinstitut.
EXAMINATION AND SELECTION OF SUITABLE METHODS FOR MEASURING THE THERMAL CONDUCTIVITY OF LIQUIDS IN SPACELAB Final Report
Hubert Coenen, Theo Gast, and Peter Krischker Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1978 43 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Tech. Univ., Berlin
(Contracts BMFT-WRT-1075; DFVLR-01-QV-176)
(BMFT-FB-W-78-09) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9.42

The measurement of the thermal conductivity of liquids, without the adulterating influence of free convection, was studied assuming microgravity conditions, such as those obtainable in Spacelab. Results contributed to the selection of a suitable measuring method for this purpose are presented. Stationary and nonstationary methods were compared, the stationary measuring principle finally being chosen. A measuring cell was designed and built as per the determined specifications. Space qualification tests were successfully completed and the instrument is considered ready for flight. Author (ESA)

N80-13074# Academy of Sciences (USSR), Moscow.
INVESTIGATION OF THE STRUCTURE OF Te-Se SOLID SOLUTIONS OBTAINED UNDER DIFFERENT GRAVITY CONDITIONS ON BOARD THE SALYUT 6 STATION, IN A CENTRIFUGE
G. E. Ignatjev (Moscow Inst. of Steel and Alloys), A. S. Okhotin

(Moscow Inst. of Steel and Alloys). Yu. S. Avrasamov et al. *In* ESA Mater. Sci. in Space Jun. 1979 p 33-39 (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13085# Technische Hogeschool, Delft (Netherlands).
UNIDIRECTIONAL SOLIDIFICATION OF EUTECTIC IRON-CARBON ALLOYS AND THE SEGREGATION OF SULFUR
T. Luyendijk and H. Nieswaag. *In* ESA Mater. Sci. in Space Jun. 1979 p 115-122 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13106# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
RECONSIDERATION OF MACROSEGREGATION DURING NONSTATIONARY SOLIDIFICATION [RECONSIDERATION DE LA MACROSEGREGATION EN SOLIDIFICATION NON STATIONNAIRE]
J. J. Favier. *In* ESA Mater. Sci. in Space Jun. 1979 p 297-305 refs In FRENCH (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-13208 Case Western Reserve Univ., Cleveland, Ohio.
SPECIFICITY HYDROGEN AND STRESS CORROSION CRACKING IN AUSTENITIC STAINLESS STEEL Ph.D. Thesis
Richard Lee Shamakian 1979 151 p
Avail: Univ. Microfilms Order No. 7924903

The relationship between localized corrosion, film formation and SCC in the austenitic stainless steels is presented. SCC was not observed unless some form of localized attack, such as pitting, occurred. A trench crevice corrosion phenomenon tended to occur in some of these chloride solutions due to the breaking of the protective film by the applied stress. These trenches tended to look like cracks at low magnifications. However, this trenching phenomenon was not SCC but rather an occluded cell corrosion process which must occur before stress corrosion cracks develop in the metal. Evidence was obtained of an embrittled region ahead of the stress corrosion cracks. This was done through SEM and EDS work on samples partially stress corrosion cracked in LiCl solution and then pulled to failure in air. All the data are consistent with a hydrogen embrittlement mechanism of SCC.
Dissert. Abstr.

N80-13209 Syracuse Univ., N. Y.
AN ADSORPTION STUDY OF HYDROGEN ON IRON AND ITS RELATION TO HYDROGEN EMBRITTLEMENT Ph.D. Thesis
Craig Mitchell Ransom 1979 70 p
Avail: Univ. Microfilms Order No. 7925596

The adsorption isotherm and magnetization-adsorption isotherm for H2 on Fe at 77 K were determined to be Langmuirian. This, plus a first order adsorption rate are given as evidence for the existence of a chemisorbed molecular H2(+) ion at this temperature. The mechanical test data of other investigators for slow crack growth in gaseous H2 which show a non-monotonic increase of crack growth rate with temperature becomes explainable based on a measured decrease in the adsorption of H2 at temperatures above 300 K and a two step adsorption process. At temperatures below 300 K the formation of an H(-) ion from the adsorbed H2(+) ion is rate controlling because it is an activated process and the ion is the embrittling species. At temperatures above 300 K, the decreasing net adsorption rate of H2(+) becomes the limiting process. Adsorption data for H2S showed Temkin isotherm behavior and adsorption rates considerably greater than that for hydrogen. Dissert. Abstr.

N80-13210 Case Western Reserve Univ., Cleveland, Ohio.
SECTION SIZE EFFECTS ON TOUGHNESS OF VARIOUS CAST STEELS Ph.D. Thesis
Jose Ignacio Gomez-Gallardoy Latapi 1979 128 p
Avail: Univ. Microfilms Order No. 7924815

The tensile toughness and microstructure properties were determined for several commonly specified cast steels. These steels were provided in one, three and five inch plate thickness by several commercial foundries. The tensile strength of the quenched and tempered steels decreased somewhat with increasing section size; the effect of mass on the strength of the normalized and tempered steels was much smaller. The differences in elongation and reduction in area values at different section thickness are both small and erratic for both the quenched and tempered and normalized and tempered grades.
Dissert. Abstr.

N80-13211 Case Western Reserve Univ., Cleveland, Ohio.
THE INFLUENCE OF THERMAL HISTORY, DEFORMATION, AND COMPOSITION, ON STRESS CORROSION CRACKING OF FERRITIC STAINLESS STEELS Ph.D. Thesis
Terry Wallace Mohr 1979 130 p
Avail: Univ. Microfilms Order No. 7924826

The performance of several high chromium ferritic stainless steels in boiling chloride solutions was examined with the intent of identifying the influence of high temperature exposure, cold deformation, and nickel content on susceptibility to stress corrosion cracking, SCC. It was found that the immunity to SCC of these alloys can be lost by any high temperature treatment which increases the ferrite grain size beyond a specific level. Loss of SCC performance could not be recovered by any subsequent anneal at a lower temperature once a coarse grain size was developed. Activation of both brittle delayed failure phenomena at identical grain size suggests a similarity in basic failure mechanisms which emphasizes the role of hydrogen.
Dissert. Abstr.

N80-13212 Columbia Univ., New York.
DAMAGE OF METAL SURFACES BY A HOT, DENSE DEUTERIUM PLASMA Ph.D. Thesis
Nicholas Frank Panayotou 1979 95 p
Avail: Univ. Microfilms Order No. 7924954

The effect of differences in alloy chemistry and systematic changes in microstructural interface density on the occurrence of unipolar arcing are demonstrated. It was determined that unipolar arcing occurs on all metals and alloys tested; the surface area affected by unipolar arcing is surprisingly similar even for different metal systems; the effect of some alloying additions on unipolar arcing is minor, and arcing is very sensitive to microstructual interface density for nonrefractory metals. The significance of the work, in terms of actual power reactors is assessed and the need for further work defined. Dissert. Abstr.

N80-13213 Columbia Univ., New York.
CREEP BEHAVIOR OF PRECIPITATION AND OXIDE DISPERSION STRENGTHENED SUPERALLOYS Ph.D. Thesis
Timothy Evan Howson 1979 103 p
Avail: Univ. Microfilms Order No. 7924908

The intermediate and elevated temperature creep behavior of two new high temperature mechanical alloys is presented. One is an oxide dispersion strengthened (ODS) nickel-base solid solution, the other is a unique ODS nickel-base super-alloy that combines both inert dispersion strengthening and precipitation strengthening. A generalized expression was formulated for creep rates that separates the second phase particle contribution to the back stress from the matrix solid solution phase contribution. The matrix phase is seen to play an important role in the creep resistance of these particle strengthened alloys. Specifically, the stronger the matrix through solid solution strengthening, the less applied stress sensitive is the creep rate of the alloy. These findings are discussed with respect to alloy design for better creep resistance in multiphase alloys. Dissert. Abstr.

N80-13214 Northwestern Univ., Evanston, Ill.
CYCLIC CREEP BEHAVIOR OF PURE ALUMINUM AND 7050 ALUMINUM ALLOY Ph.D. Thesis
Herng-Der Chiou 1979 188 p
Avail: Univ. Microfilms Order No. 7927317

The cyclic creep acceleration (CCA) was characterized in pure aluminum at 295 K and for peak stress from 25.5 MPa to

35.3 MPa. The average cyclic creep rate calculated using loading time increased with increasing the amount of stress reduced during partial unloading and with an increase in the time duration of the unloading period. A theoretical model, developed to relate the internal stress to the cyclic creep behavior observed for pure metals, is described. The TEM observation indicates that the maximum aged 7050 aluminum alloy is characterized by the formation of narrow and distinct slip bands when it exhibits significant CCA. The theoretical calculation of internal stress confirmed this observation by predicting the lower internal stress by the formation of the narrower slip bands, thereby, enhanced CCA. A mechanism based on dislocation pile-up at the outer boundary of the 'soft' regions of the alloy was proposed to explain how cyclic loading promotes the formation of the narrow slip bands at the low stress level. In the CCD regime, observed at high peak stresses and/or high temperature, cyclic loading tended to widen the slip bands. This widening resulted in an increase in the internal stress. Dissert. Abstr.

N80-13215 Pennsylvania Univ., Philadelphia.
THE RATE OF DISSOCIATION OF CO2 ON LIQUID IRON AND NICKEL Ph.D. Thesis
Alan William Cramb 1979 143 p
Avail: Univ. Microfilms Order No. 7928119

A radioactive exchange technique was used to study the rate of dissociation of CO2 on liquid iron, nickel and iron nickel alloys. The basis of the exchange technique is the reaction, CO2 -14 yields CO2 -14 + O adsorbed on the surface, where measurements of the amount of CO-14 formed during a reaction lead to a measurement of the apparent rate constant for dissociation of CO2. This led to a method of determination of the adsorption coefficient of oxygen on liquid iron and liquid nickel. Dissert. Abstr.

N80-13216 Northwestern Univ., Evanston, Ill.
THE ELASTIC MODULUS AND DIFFUSION COEFFICENTS OF SILVER-PALLADIUM COMPOSITION MODULATED FOILS Ph.D. Thesis
Gerard E. Henein 1979 167 p
Avail: Univ. Microfilms Order No. 7927363

The biaxial elastic modulus Y [111] was measured on Cu-Au and Ag-Pd thin films containing short wavelengths composition modulations. The effective interdiffusion coefficients were maasured from the decay rate of X-ray diffraction satellite intensities at 375 C in 13 Ag-Pd modulated foils having wavelengths in the range 0.94-5.08 nm. When plotted versus the dispersion relation, the interdiffusion coefficient exhibited a sharp decrease at 2.3 nm and a gradual decrease between 4.0 and 5.0 nm. The screening singularity previously mentioned is considered to be responsible for the decrease at 2.3 nm and the drop at 4.0 nm would be consistent with a loss of coherency in the films. A non-linear regression fit to the interdiffusion coefficient vs the dispersion relation curve yielded the first four gradient energy coefficients. Dissert. Abstr.

N80-13217 Purdue Univ., Lafayette, Ind.
X-RAY MEASUREMENT OF CARBON-CAUSED ATOMIC DISPLACEMENTS IN Fe-Ni-C MARTENSITE Ph.D. Thesis
Pei Chen Chen 1979 137 p
Avail: Univ. Microfilms Order No. 7926352

Individual 200, 020, and 002 X-ray peaks were recorded for Fe-18 wt% Ni-0.98 wt% C martensite formed in an austenite single crystal after quenching in place in the X-ray diffractometer and after tempering at temperatures between -45 C and 400 C. The 200/020 and 002 peaks from Fe-18 wt% Ni-0.90 wt% C martensite formed in polycrystalline austenite were recorded using the same technique. Some regions of the as-quenched martensite formed in polycrystals are nearly cubic but the martensite formed in single crystals is all tetragenal. The nearly cubic regions may have been induced by intersections of martensite plates. Measurement of the locations and intensities of the peaks show that in the as-quenched martensite all the carbon is in the c sublattice of the octahedral interstitial sites and that the carbon displaces its nearest metal atoms by about 0.50 A.
Dissert. Abstr.

N80-13218*# Inco Research and Development Center, Suffern, N. Y.
CHARACTERIZATION OF AN OXIDE DISPERSION STRENGTHENED SUPERALLOY, MA-6000E, FOR TURBINE BLADE APPLICATIONS Final Report
Y. G. Kim and H. F. Merrick May 1979 37 p refs
(Contract NAS3-20093)
(NASA-CR-159493) Avail: NTIS HC A03/MF A01 CSCL 11F

Alloy MA 6000E was developed by the mechanical alloying process for turbine blade applications. The nominal composition of the experimental alloy is Ni-15CR-2Mo-4W-4.5Al- 2.5Ti-2Ta-.15Zr-.05C-.01B-1.1Y2O3. The 1000 hour rupture strength in the longitudinal direction is about 145 MPa at 1093 C and about 483 MPa at 760 C. The alloy displays normal three-stage creep behavior. Typically the creep elongation is 3.5% at 760 C and 2% at 1093 C. The alloy is notch ductile (K sub 1 = 3.5). The rupture properties of the alloy are not significantly degraded by thermal cycling or prior stress isothermal exposure. The alloy also has excellent longitudinal high and low cycle fatigue resistance. Limited testing indicates that MA 6000E posesses good off-axis mechanical properties. The transverse tensile elongation at 760 C is about 3%. The 100 hour transverse rupture strength is 331 MPa at 760 C and about 55 MPa at 1093 C. A.R.H.

N80-13219# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.
CORROSION CONTROL OF HARDENED INTERSITE CABLE SYSTEM (HICS) SPLICE CASE Final Report, Nov. 1975 - Mar. 1979
Thomas F. Lewicki May 1979 46 p
(AF Proj. 2054)
(AD-A073431; AFESC/ESL-TR-79-17) Avail: NTIS HC A03/MF A01 CSCL 09/1

Several thousand splice cases are in use on the hardened intersite cable system between the Strategic Air Command's Minuteman silos. These splice cases are exposed to severe galvanic corrosion caused by interconnection with the graphite impregnated, polyethylene cable sheath which acts as a large cathode. The Air Force Civil Engineering Center conducted laboratory and field tests to determine the magnitude of corrosion for the three different splice cases in use and to develop the surface potential criteria necessary to achieve adequate cathodic protection (CP). Test results showed that aluminum splice cases fail quicker than cast iron, and that bronze splice cases with bronze connecting hardware experience little corrosion. The interconnection of dissimilar metals (graphite and splice case) resulted in the surface potential criteria being significantly different from the standard CP criteria of either a -.85 volt surface potential or a negative 300 millivolt shift. The revised criteria for an aluminum splice case called for a surface potential of -.55 volt or a negative 409 millivolt shift, whereas the cast iron splice case required a surface potential of -.34 volt or a negative 510 millivolt shift. The revised surface potential criteria and the procedure developed to determine the degree of corrosion can be used on any underground metallic system with dissimilar metals. GRA

N80-13220# Israel Inst. of Tech., Haifa.
ELECTRONMICROSCOPIC STUDY OF SAND EROSION PROCESSES IN METALS Final Report, 1 Mar. 1978 - 28 Feb. 1979
Joseph Zahavi Jun. 1979 39 p refs
(Grant AF-AFOSR-3580-78; AF Proj. 2301)
(AD-A073497; EOARD-TR-79-523) Avail: NTIS HC A03/MF A01 CSCL 11/6

Knowledge and understanding of the variables, both environmental and metallurgical, affecting erosion of materials, are detrimental to predicting erosion behavior and minimizing erosion damage. In this study erosion behavior of composite aluminum alloys containing hard phase constituents such as silicon carbides and alumina has been investigated. Use has been made of electron microscopy techniques for examination of eroded surface morphology, structure and composition with special attention to the effect of hard phase particles on erosion processes i.e. material removal. It has been found that higher fraction of hard particles in metal alloy led to higher target weight loss under the same erosion conditions. Observations of eroded surface obtained by SEM suggest that erosion process or material removal

is composed of two basic processes: (a) local material removal from particle-free surface target and (b) complete removal of hard particles from the eroded target surface. The role of hard phase constituents on erosion process in composite metal alloys should be investigated further. GRA

N80-13221# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
LOSS OF LATTICE RIGIDITY IN AUSTENITE Technical Report, Oct. 1978 - Sep. 1979
Nicholas DeChristofaro (Allied Chem. Corp. Morristown, N. J.) and Roy Kaplow 2 Aug. 1979 9 p refs Submitted for publication
(Contract N00014-76-C-0171)
(AD-A073280; TR-2) Avail: NTIS HC A02/MF A01 CSCL 11/6

Mossbauer spectra were taken at and below room temperature in iron-2.4 wt.% nitrogen samples containing various amounts of stabilized martensite and austenite. The intensities of the martensite spectra increase with decreasing temperature as expected from the normal thermal variation of the recoilless fraction. Conversely, the intensities of the austenite spectra are smaller below room temperature and Ms, and decrease with decreasing temperature. This corresponds to a decreasing recoilless fraction, which is associated with a lessening of lattice resistance to excitations caused by the transference of the gamma-ray recoil momentum. This behavior is thought to be related to lattice instabilities in the austenite phase, possibly related to its transformation to martensite. The magnitude of the effect indicates that, although the excitations in themselves may be localized, these instabilities are characteristic of the bulk material and cannot be explained in terms of the conventional theory of pre-existing martensitic embryos. GRA

N80-13222# Massachusetts Inst. of Tech., Cambridge.
STRESS-ASSISTED ISOTHERMAL MARTENSITIC TRANSFORMATION AND TRANSFORMATION PLASTICITY
G. B. Olson and Morris Cohen Jul. 1979 8 p refs Presented at Joint U.S. - Japan Conf. on Mech. Behavior of Metals and Alloys Assoc. with Displacive Phase Transformations, Troy, N.Y. 12-15 Jun. 1979
(Contract N00014-76-C-0171)
(AD-A073433; TR-3) Avail: NTIS HC A02/MF A01 CSCL 11/6

Low-temperature plastic flow in TRIP steels has been found to be controlled by stress-assisted isothermal martensitic transformation. Under these conditions, theory of the transformation kinetics can be used to predict the temperature dependence of the flow stress, the shape of the stress-strain curve, and the dependence of flow properties on stress state. GRA

N80-13223# Illinois Univ. at Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.
APPLICATION OF RAPID SOLIDIFICATION TECHNIQUES TO ALUMINUM ALLOYS Technical Report, 1 Feb. 1978 - 30 Jun. 1979
R. Mehrabian, C. G. Levi, S. C. Hsu, and S. Kou Jul. 1979 86 p refs
(Contract N00014-78-C-0275; ARPA Order 3517)
(AD-A073443) Avail: NTIS HC A05/MF A01 CSCL 11/6

This program is being conducted for the purpose of developing a predictive model of heat flow and solidification for aluminum alloys produced under the high cooling rate conditions achievable in atomization and surface melting. It is a combined experimental and theoretical study of the relationship between the important solidification variables (e.g. cooling rate, temperature gradients, interface shape and velocity, supercooling and transformation kinetics) and the structure and microchemistry of rapidly solidified aluminum alloys. This report covers the theoretical aspects of the investigation to date. The first part addresses the solidification of spherical droplets subjected to high rates of heat extraction achievable in various atomization processes. The second part is concerned with the two-dimensional transient heat flow occuring during rapid surface melting and solidification of a bulk substrate subjected to a high intensity heat flux over a circular region on its bonding surface. GRA

N80-13224# Sandia Labs., Livermore, Calif.
CHEMISTRY AND HEAT TREATMENT EFFECTS ON MECHANICAL AND MICROSTRUCTURAL PROPERTIES OF HEAT-TREATED, BETA-EXTRUDED Ti-6Al-6V-2Sn
M. G. Ulitchny, H. J. Rack, and D. B. Dawson Apr. 1979 50 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-2170-Rev) Avail: NTIS HC A03/MF A01

The mechanical behavior of beta-extruded Ti6Al6V2Sn was examined after a variety of sub-transus heat treatments. The microstructural variations resulting from the range of heat treatments studied also were examined. A range of alloy chemistries, within commercial limits, was used to evaluate the effect of this variable on mechanical properties. The strength-toughness combinations obtained in beta-extruded Ti6Al6V2Sn ranged from about 895 MPa and 82.5 MPa square root of m for duplex annealed material to 1200 MPa and 54.9 MPa square root of m for solution treated and peak aged material. Chemistry variations had less effect on mechanical properties than would have been the case with alpha-beta processing. DOE

N80-13225# Brookhaven National Lab., Upton, N. Y.
NEUTRON SPECTROSCOPY OF FAST HYDROGEN DIFFUSION IN BCC TRANSITION METALS
D. Richter 1979 17 p refs Presented at Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wisc., 21 May 1979
(Contract EY-76-C-02-0016)
(BNL-26075; CONF-790538-1) Avail: NTIS HC A02/MF A01

Quasielastic neutron scattering reveals microscopic details of both the time and space development of the H-diffusion process on an atomic scale. After outlining the method on the example of PdH/sub x/, new results on the jump geometry in bcc metals are surveyed. In particular, the anomalous diffusion diffusion behavior of H in Nb, Ta, and V at elevated temperature is emphasized, where correlated jump processes are important. The influence of impurities on the H-diffusion process is demonstrated by experiments performed on NbH/sub x/ doped with nitrogen impurities, which act as trapping centers for the diffusing hydrogen. The results are discussed in terms of a two-state random walk model which includes multiple trapping and detrapping processes. The concentration and temperature dependence of the caputre and escape rates of traps are obtained. DOE

N80-13226# Oak Ridge National Lab., Tenn.
EFFECT OF PHASE INSTABILITIES ON THE CORRELATION OF NICKEL ION AND NEUTRON IRRADIATION SWELLING IN SOLUTION ANNEALED 316 STAINLESS STEEL
A. F. Rowcliffe, E. H. Lee, and P. S. Sklad 1979 21 p refs Presented at Conf. on Irradiation Behavior of Metallic Mater. for Fast Reactor Core Components, Corsica, France, 5 Jun. 1979
(Contract W-7405-eng-26)
(CONF-790657-2) Avail: NTIS HC A02/MF A01

Annealed 316 stainless steel specimens were neutron irradated to establish steady-state microstructures and then subjected to further high temperature irradations with approximately 180 C above reactor temperature. However, the precipitate microstructure developed during neutron irradiation is unstable during subsequent ion irradiation. As a result, the relative swelling rates at various reactor temperatures are not simulated correctly. DOE

N80-13227# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
DELAYED FAILURE OF VANADIUM-HYDROGEN ALLOYS
D. W. Chung and N. S. Stoloff 1979 10 p refs Presented at 3d Intern. Conf. on Mech. Behavior of Materials, Cambridge, England, 20 Aug. 1979
(Contract EY-76-S-02-3459)
(COO-3459-15; CONF-790820-2) Avail: NTIS HC A02/MF A01

Delayed failure experiments on vanadium and several hydrogenated alloys are presented. They resulted in two distinct patterns of behavior: ordinary stress-rupture behavior (nonembrittlement) in annealed vanadium and alloys with hydrogen in solution, and high susceptibility to delayed failure (embrittlement)

in the hydrided alloys. Reorientation of hydrides under stress was observed. Hydrogen in solution in vanadium did not play a major role in initiating delayed failure, although rupture stresses were lowered due to the enhancement of the local stress concentration factor by increasing flow stress. Hydrides did not crack at notch roots, suggesting that they produced an indirect effect on fracture behavior by increasing matrix yield stress, thereby reducing the blunting influence of the plastic zone at a crack tip. DOE

N80-13228# California Univ., Berkeley. Lawrence Berkeley Lab.
COMPUTER SIMULATION OF MARTENSITIC TRANSFORMATIONS IN IDEALIZED SYSTEMS Ph.D. Thesis
S. H. R. Chen Jun. 1979 172 p refs
(Contract W-7405-eng-48)
(LBL-9264) Avail: NTIS HC A08/MF A01

A straightforward computation of the elastic energy associated with an arbitrary distribution of defects in an elastically anisotropic body under the assumption that the body has uniform elastic constants and that anharmonic effects may be neglected is presented. The martensitic transformation is modeled as a transformation which occurs through the sequential formation of individual martensitic elements, each carries the elementary transformation strain. Statistical equations developed govern the selection of the transformation path, or sequence that elementary martensite particles appear in the model, and specifies the kinetic of transformation. A useful representative path is defined as the minimum energy path. The model is used for the detailed simulation of a martensitic transformation in a pseudo two-dimensional system. Virtually all interesting qualitative aspects of the developing martensitic transformation are shown to be inherently present within it. DOE

N80-13229# Brown Univ., Providence, R. I. Div. of Engineering.
COMBINED MACROSCOPIC AND MICROSCOPIC APPROACH TO THE FRACTURE OF METALS Progress Report
R. J. Asaro, J. Gurland, A. Needleman, and R. J. Rice Jun. 1979 58 p refs
(Contract EY-76-S-02-3084)
(COO-3084-69) Avail: NTIS HC A04/MF A01

Progress is reported on microscopic fracture mechanisms, including studies of void and crack initiation in steels in the absence and presence of hydrogen, the effects of hydrogen on ductile fracture in medium and high carbon steels; elastic-plastic crack growth including the quasi-stable growth of cracks in ductile solids under increasing load and conditions of instability; and elevated temperature rupture including analysis of the stress field near a crack tip in an elastic-nonlinear viscous material under tensile load as well as the processes of diffusion, and cavitation of grain boundaries in plastically creeping materials. DOE

N80-13230# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
IMPROVED BOUNDARY-INTEGRAL EQUATION METHOD FOR TIME-DEPENDENT INELASTIC DEFORMATION IN METALS
M. Morjaria and S. Mukherjee Feb. 1979 31 p refs
(Contract EY-76-S-02-2733)
(COO-2733-20) Avail: NTIS HC A03/MF A01

An efficient numerical implementation of the boundary integral equation method with a linear description of the relevant variables over each boundary element and a newly developed Euler type time-integration scheme with automatic time-step control for time integration is presented. Numerical results for plates in plane stress with and without cutouts, under different loading histories, are presented. A combined creep-plasticity constitutive theory with state variables is used to model material behavior. The results are more accurate and are obtained with much less computational effort compared to a previous attempt with a uniform description of variables over each boundary element and a predictor-corrector scheme for time-integration. The computer program developed is quite general and can handle plane stress problems for plates of arbitrary shapes subjected to arbitrary time-histories of loadings. DOE

N80-13231# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
ELONGATION UPON TORSION IN A THEORY FOR THE INELASTIC BEHAVIOR OF METALS
W. E. VanArsdale, E. W. Hart, and J. T. Jenkins Nov. 1978 31 p refs
(Contract EY-76-S-02-2733)
(COO-2733-1) Avail: NTIS HC A03/MF A01

The torsion of a thin-walled cylinder was studied using the low temperature of visco-plastic limit of Hart's state variable theory for the inelastic behavior of metals. For values of the shear stress lower than the hardness of the material, reversible elongation is found to accompany the recoverable twist. For shear stress exceeding the hardness, there are, in addition, a permanent twist and elongation. These predictions agree qualitatively with existing experiments. Quantitative results, for several loading histories, are obtained for nickel. DOE

N80-13232# Oak Ridge National Lab., Tenn.
ELEVATED TEMPERATURE EXPOSURE HAS SIGNIFICANT EFFECTS ON THE STRUCTURE OF AUSTENITIC STAINLESS STEEL WELDS
D. P. Edmonds and R. J. Gray 1979 11 p refs Presented at the Intern. Metallographic Soc. Conf., Montreal, Canada, 16 Jul. 1979
(Contract W-7405-eng-26)
(CONF-790736-1) Avail: NTIS HC A02/MF A01

An investigation of effects of aging and testing at 593 C on the structures of type 308 stainless steel weld metals was carried out. Shielded metal-arc (SMA) welds were made with electrodes formulated by a commercial manufacturer to produce four different concentration levels of delta-ferrite. By varying the chromium-to-nickel concentration ratios (within the type 308 limits) in the deposits, weld metals with nominally 2, 5, 10, and 15 FN were produced. Specimens from these materials were aged and creep tested in air at 593 C for times up to 36 Ms. Aged specimens were Charpy impact tested at room temperature. Both creep and impact-tested specimens were then examined metallographically. DOE

N80-13233# Rensselaer Polytechnic Inst., Troy, N. Y.
FATIGUE AND DELAYED FAILURE OF REFRACTORY METALS Annual Report
Norman S. Stoloff 15 Jan. 1979 22 p refs
(Contract EY-76-S-02-3459)
(COO-3459-14) Avail: NTIS HC A02/MF A01

Research is reported concerning delayed failure and fatigue behavior of polycrystalline vanadium and niobium and their alloys with hydrogen including delayed failure of Nb-H alloys, effect of temperature on fatigue life in vacuum, and crack propagation vs stress intensity. Previously reported results on delayed failure of hydride vanadium are reviewed with attention to details of the fracture process. Mechanical properties of candidate first wall materials are reviewed indicating the importance of fatigue and creep. DOE

N80-13234# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
STRAIN HARDENING AND DUCTILITY OF IRON: AXISYMMETRIC vs. PLANE STRAIN ELONGATION Progress Report
George Langford May 1979 37 p refs
(Contract EY-76-S-02-4072)
(COO-4072-2) Avail: NTIS HC A03/MF A01

The strain hardening of iron at high strains in plane strain elongation (strip drawing) is shown to fall increasingly below that of drawn iron wires at true strains above 2. This makes it unnecessary to invoke shear band formation simultaneously as a strengthening mechanism and as a ductility reducing mechanism in the drawn strip. Rather, shear bands may be a weakening mechanism in all contexts. A set of specimens of interstitial-free iron deformed in three of the four main classifications of deformation symmetry (wire, strip, and chips, representing axisymmetric elongation, and pure shear) was prepared in the form of mechanical test specimens and thin foils for high resolution selected area diffraction. A simple technique for rapid discovery of the < 110 > axis of foils of strongly textured bcc wire was worked out. DOE

N80-13235# Arizona Univ., Tucson. Optical Sciences Center.
METAL SILVER-LIQUID INTERFACE: OXIDE PROPERTIES FROM REFLECTANCE AND SCATTERED LIGHT SPECTROSCOPY
D. K. Cohen, S. O. Sari, and K. D. Scherkoske 1979 8 p refs Presented at the Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wis.
(Contract EG-77-S-02-4381)
(COO-4381-7; CONF-790538-14) Avail: NTIS HC A02/MF A01

Electrochemically oxidized silver foils were examined using a reflectance and scattered light spectroscopy. The effect of unintentional inhomogeneous oxide formation on rough silver metal reflectivity is given. In contrast, the reflectance contribution of an intentionally formed oxide overlayer may be separated from that of the metal substrate. If the scattering contribution of the oxide-covered silver is small, the differential reflectance between oxidized and clean metal foils may be used to determine the approximate overlayer optical constants. The distribution of oxide module sizes at the metal boundary may be estimated from contributions due to inhomogeneous oxide residues. These results are compared to electron microscopy of the same surfaces. DOE

N80-13236# California Univ., Berkeley. Lawrence Berkeley Lab.
ALLOYING AND HEAT TREATMENT OPTIMIZATION OF Fe/Cr/C STEELS FOR IMPROVED MECHANICAL PROPERTIES M.S. Thesis
Mehmet Sarikaya Jun. 1979 89 p refs
(Contract W-7405-eng-48)
(LBL-9260) Avail: NTIS HC A05/MF A01

The effects of alloying elements and heat treatments on the microstructural changes and strength-toughness properties were investigated in optimization of vacuum melted Fe/Cr/C base steels. The structure of the steels in the as-quenched conditions consisted of highly dislocated autotempered lath martensite (strong phase) and thin continuous interlath films of retained austenite (tough phase). It has been emphasized that the mechanical properties of the steels are sensitive to the amount and the stability of retained austenite. To increase the stability of retained austenite in the as-quenched condition 2 w/o Mn or 2 w/o Ni was added to the base steel, viz., Fe/3Cr/0.3C. Partial replacement of Cr by about 0.5 w/o Mo did not alter the beneficial microstructure. DOE

N80-13237# Argonne National Lab., Ill. Chemistry Div.
DOMAIN AND SURFACE STRUCTURES OF SODIUM TUNGSTEN BRONZES, Na/SUB x/WO3 (0.4 < x < 1)
Masao Atoji Sep. 1978 64 p refs
(Contract W-31-103-eng-38)
(ANL-78-63) Avail: NTIS HC A04/MF A01

Optical microscopy, supplemented by chemical methods, photoelectron spectroscopy, electron microscopy, etc. was used to study the domain and surface structures of metallic sodium tungsten bronzes. The birefringent, multidomain structure of the bronze is exhibited by a sodium-deficient, epitaxial surface film and hence is not, as reported elsewhere, a bulk property. The film can be synthesized by anodic electrolysis in alkaline solution and can exist only epitaxially with the substrate. It is chemically inert, translucent, and often laminated to a multilayered film. The film domain is hypersensitive to lateral stress and to thermal change, and appears to be modulated by minute structural changes of the substrate. This epitaxial modulation of the film is strikingly large at the phase transitions of the substrate induced by slightly different tiltings of the oxygen octahedra. The domain-wall movement is often slow enough to be visible, and that by thermal effect is occasionally accompanied by an audible, high-pitched, snapping sound. DOE

N80-13238# Brookhaven National Lab., Upton, N. Y.
SCANNING REFERENCE ELECTRODE TECHNIQUES IN LOCALIZED CORROSION
H. S. Issacs and B. Vyas Apr. 1979 57 p refs Presented at the ASTM Symp., Prog. in Electrochem. Tech., San Francisco, 20 May 1979
(Contract EY-76-C-02-0016)
(BNL-26094; CONF-790574-1) Avail: NTIS HC A04/MF A01

The principles, advantages, and implementation of scanning reference electrode techniques are reviewed. Data related to pitting, intergranular corrosion, welds and stress corrosion cracking are presented. The technique locates the position of localized corrosion and can be used to monitor the development of corrosion and changes in the corrosion rate under a wide range of conditions. DOE

N80-13239# California Univ., Berkeley. Lawrence Berkeley Lab.
INFRARED ABSORPTION OF SPECTROSCOPY OF CARBON MONOXIDE ON NICKEL FILMS: A LOW TEMPERATURE THERMAL DETECTION TECHNIQUE Ph.D. Thesis
R. B. Bailey Nov. 1978 136 p refs
(Contract W-7405-eng-48)
(LBL-8482) Avail: NTIS HC A07/MF A01

Sensitive vibrational spectra of carbon monoxide molecules adsorbed on evaporated nickel films were measured by attaching a thermometer to the sample, cooling the assembly to liquid helium temperatures, and recording the temperature changes which occur when infrared radiation is absorbed. The measurements were made in an ultrahigh vacuum chamber in which the sample surface was cleaned, heated, exposed to gas molecules and cooled to 1.6 K for the infrared measurements. The spectra of chemisorbed CO molecules are interpreted in terms of the linear and bridge adsorption sites on the nickel surface, and they show how the distribution of molecules among these sites changes when the CO coverage increases and intermolecular forces become important. The spectra of physically adsorbed molecules in both monolayer and multilayer films are also reported. DOE

N80-13240# Oak Ridge National Lab., Tenn.
ANALYTICAL ELECTRON MICROSCOPE STUDY OF THE OMEGA PHASE TRANSFORMATION IN A ZIRCONIUM-NOBIUM ALLOY Ph.D. Thesis - Illinois Univ. at Urbana-Champaign
N. J. Zaluzec Jun. 1979 323 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6705) Avail: NTIS HC A14/MF A01

An in-situ study of the as-quenched omega phase transformation in Zr-15% Nb was conducted between the temperatures of 77 and 300 K using analytical electron microscopy. The domain size of the omega regions observed in this investigation was on the order of 30 A, consistent with previous observations in this system. No alignment of omega domains along <222> directions of the bcc lattice was observed and in-situ thermal cycling experiments failed to produce a long period structure of alternating Beta and omega phase regions as predicted by one theory of this transformation. Several techniques of microstructural analysis were developed, refined, and standardized. Grouped under the general classification of analytical electron microscopy, they provide the experimentalist with a unique tool for the microcharacterization of solids, allowing semiquantitative to quantitative analysis of the morphology, crystallography, elemental composition, and electron structure of regions as small as 20 A in diameter. The microanalytical techniques employed are described. DOE

N80-13241# Oxford Univ. (England). Dept. of Engineering Science.
PLASTIC FLOW OF MILD STEEL UNDER PROPORTIONAL AND NON-PROPORTIONAL STRAINING AT A CONTROLLED RATE
S. A. Meguid (Oxford Polytech.), L. E. Malvern (Florida Univ. Gainesville), and J. D. Campbell 1979 26 p refs
(OUEL-1280/79) Avail: NTIS HC A03/MF A01

Thin tubular specimens of annealed mild steel (En8) were tested under combined straining using a tension-torsion, closed loop, servocontrolled, electrohydraulic testing machine. Two types of straining programs were used, proportional straining at constant strain rate and nonproportional straining in which the specimen was loaded to yield in pure torsion and then extended with the twist held constant. The resulting load and torque components were continuously recorded during each test as functions of time. Both proportional and nonproportional straining paths gave results in good agreement with the von Mises yield condition. Two theoretical analyses of the present problem are also included.

One uses Perzyna's constitutive laws for rate sensitive, but nonwork hardening material and the other uses a rate-independent theory. Comparison with the experimental results of the nonproportional straining program indicates that the time history of the neutral loading path was reasonably well matched by the prediction of both the rate-dependent and rate-independent theories. Author (ESA)

N80-13242# National Engineering Lab., East Kilbride (Scotland). Creep and Tribology Div.
AN INVESTIGATION OF MULTI-AXIAL CREEP CHARACTERISTICS OF METALS
J. Henderson Nov. 1978 27 p refs Sponsored by Engr. Mat. Requirements Board
(NEL-661) Avail: NTIS HC A03/MF A01

Conventionally, uniaxial creep test data provide the designer of engineering components with an assessment of the creep behavior at elevated temperatures of the metal with which he is concerned. For more rigorous design, methods are required whereby uniaxial creep data may be used to provide predictions of the behavior of those components for multi-axial stress conditions. Research into multi-axial creep relationship studied on a spectrum of engineering metals is described. Their use in the derivation of creep design methods for engineering components from tensile creep data is considered. Finally, an application of recently developed reference stress methods related to the prediction of the time dependent behavior of a representative engineering component under a complex stressing history is shown. Indications of the likely success of the reference stress technique as a tool for initial design assessment and its limitations are summarized. Author (ESA)

N80-13080# Bologna Univ. (Italy). Ist. di Fisica A. Righi.
DISPERSED GASEOUS AND SOLID PHASES IN MOLTEN AND SOLIDIFIED Cu
L. Castellani, P. Gondi, F. Barbieri, and N. Costa *In* ESA Mater. Sci. in Space Jun. 1979 p 81-87 refs Sponsored by CNR-SAS (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13081# Fulmer Research Inst. Ltd., Stoke Poges (England).
THE PREPARATION AND STABILITY OF METALLIC EMULSIONS IN A MICROGRAVITY ENVIRONMENT: AN EXPERIMENT FOR THE FIRST SPACELAB PAYLOAD (FSLP)
P. D. Caton and W. G. Hopkins *In* ESA Mater. Sci. in Space Jun. 1979 p 89-94 refs Sponsored by UK Dept. of Ind. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13097# Royal Inst. of Tech., Stockholm (Sweden).
SOLIDIFICATION OF SOME EUTECTIC ALLOYS UNDER MICROGRAVITY CONDITIONS AND AT 1 g
T. Carlberg *In* ESA Mater. Sci. in Space Jun. 1979 p 221-231 refs Sponsored by Swed. Board for Space Activities (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13098# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Casting of Metals.
THE INFLUENCE OF MICROGRAVITY ON THE STRUCTURE OF Bi-Zn IMMISCIBLE ALLOYS
T. Carlberg and H. Fredriksson *In* ESA Mater. Sci. in Space Jun. 1979 p 233-243 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13100# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
PREPARATORY STUDIES FOR AN EXPERIMENT IN DIRECTIONAL SOLIDIFICATION OF IMMISCIBLE Al-In ALLOYS ON BOARD A ROCKET VEHICLE [ETUDES DE BASE PREPARATOIRES DE L'EXPERIENCE DE SOLIDIFICATION DIRIGEE D'ALLANGES IMMISCIBLES Al-In EN FUSEE SONDE]
C. Potard *In* ESA Mater. Sci. in Space Jun. 1979 p 255-262 refs In FRENCH (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13118# Wisconsin Univ., Madison. Dept. of Metallurgical and Mineral Engineering.
SOLIDIFICATION OF HIGHLY UNDERCOOLED LIQUID METALS AND ALLOYS
J. H. Perepezko, C. Galaup, and D. H. Rasmussen (Clarkson Coll. of Technol., Potsdam, N.Y.) *In* ESA Mater. Sci. in Space Jun. 1979 p 375-383 refs (For primary document see N80-13069 04-12)
(Grant DAAG29-78-G-0157)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13119# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY OF THE INFLUENCE OF GRAVITY ON THE SOLIDIFICATION OF IRREGULAR EUTECTIC ALLOYS [ETUDE DE L'INFLUENCE DE LA GRAVITE SUR LA SOLIDIFICATION DES EUTECTIQUES IRREGULIERS]
C. Lemaignan *In* ESA Mater. Sci in Space Jun. 1979 p 385-389 refs In FRENCH (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13120# Chalmers Univ. of Technology, Goteborg (Sweden).
AN EXPERIMENTAL METHOD FOR DETERMINATION OF MASS TRANSPORT IN LIQUID METALS TO BE APPLIED UNDER MICROGRAVITY
T. Persson *In* ESA Mater. Sci. in Space Jun. 1979 p 391-396 refs Sponsored by Swedish Board for Space Activities (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-13243 Utah Univ., Salt Lake City.
FRACTURE STUDIES IN CERAMICS WITH PARTICULAR EMPHASIS ON BETA'-ALUMINA Ph.D. Thesis
Jitendra Prasad 1979 158 p
Avail: Univ. Microfilms Order No. 7925043

A model is presented to explain the strength versus grain size effects in polycrystalline brittle materials. Assuming that the polycrystalline fracture surface energy is approximately an order of magnitude larger than the single crystal fracture surface energy, the model demonstrates that the dynamics of crack propagation and arrest are an integral part of a strength measurement. Using two functional forms for the variation of fracture surface energy with crack length/grain size ratio, strength versus (grain size) 1 1/2 plots were constructed. The concept of energy balance and the dynamics of crack propagation were further extended to explain variation in the stress-corrosion susceptibility parameter (N). It was shown that the N value obtained from strength versus loading rate plots in dynamic fatigue experiments may not represent a material parameter. Dissert. Abstr.

N80-13244 Old Dominion Univ., Norfolk, Va.
CURING AND FLOW OF THERMOSETTING RESINS FOR COMPOSITE MATERIAL PULTRUSION Ph.D. Thesis
Howard L. Price, Jr. 1979 150 p
Avail: Univ. Microfilms Order No. 7925656

An investigation was carried out to: (1) test and analyze several present and potential pultrusion materials; (2) analyze two pultrusion processes which were used to manufacture pultruded stock; and (3) develop a model from the tests and analyses and test it on a laboratory-scale pultruder constructed for that purpose as part of this investigation. The pultrusion process was studied with the objective of developing a model of the process applicable to thermosetting resins. Dissert. Abstr.

N80-13245 Alfred Univ., N.Y.
STRUCTURES, SPECTRA AND RELATED PROPERTIES OF TITANIUM-, ZIRCONIUM-, AND HAFNIUM-DOPED VITREOUS SILICA Ph.D. Thesis
Peter Paul Bihubuak 1979 156 p
Avail: Univ. Microfilms Order No. 7926489

The structures, as deduced from vibrational spectra and related physical properties, were examined for titanium-, zirconium-, and hafnium-containing vitreous silicas. Linear functional relationships were found between partial molar volume, refractivity, viscosity, coefficient of thermal expansion and dopant coordination throughout the dopant range examined. These structural models were consistent with ion coordination predictions based upon physical property measurements. Heat treating the 6.9 wt% TIO2-containing sample resulted in a thermal expansion increase due to the exsolution of rutile from the parent glass as suggested by Raman spectral and TEM analyses. Dissert. Abstr.

N80-13246 Florida State Univ., Tallahassee.
THERMAL SHRINKAGE MECHANISMS OF POLY (ETHYLENE TEREPHTHALATE) FIBERS Ph.D. Thesis
Randall Richard Bresee 1979 50 p
Avail: Univ. Microfilms Order No. 7926723

Differential scanning calorimetry, wide angle X-ray diffraction and refractive index measurements were used to determine the relative influence of amorphous disorientation and selective melting/recrystallization shrinkage mechanisms in the thermally induced shrinkage of fibers containing poly (ethylene terephthalate). The role of each mechanism in shrinkage associated with temperatures extending from well above the glass transition temperature to the temperature of maximum melting is discussed although both mechanisms fail to describe shrinkage associated with the glass transition. Dissert. Abstr.

N80-13247 Mississippi State Univ., State College.
EVALUATION OF POLAR AND NON-POLAR PLASTICS COMPOUNDED WITH THERMOMECHANICAL WOOD FIBERS Ph.D. Thesis
Gilmer Giovanni GonzalezGracia 1979 125 p
Avail: Univ. Microfilms Order No. 7927088

High and low lignin thermomechanical fibers that differ in method of manufacture were separated by screening and the average fiber length was determined for each mesh fraction. Attenuated total reflectance infrared analysis was conducted to obtain qualitative information about the chemical characteristic of the surface of the fibers. It concluded that the surface of thermomechanical fibers is partially covered with lignin. Also, these fibers are more compatible with both polar and non-polar polymers than are either wood flour or peanut hull flour. The high and low lignin fibers show promise for use as a reinforcing extender for polar polymers such as styrene-acrylonitrile copolymers. Both types of fibers also show potential for use as good quality, low-cost extenders in non-polar plastics such as polypropylene or polystyrene. Dissert. Abstr.

N80-13248 Wisconsin Univ. - Madison.
A CORRELATION BETWEEN MORPHOLOGY AND FRACTURE PROPERTIES OF EPOXY RESINS Ph.D. Thesis
Jovan Mijovic 1978 300 p
Avail: Univ. Microfilms Order No. 7921572

Various epoxy resin formulations, based on diglycidyl ether of bisphenol A and cured with diethylene triamine were studied in bulk and adhesive form. Methods of linear elastic fracture mechanics were employed and all systems were characterized by the corresponding values of the critical strain energy release rate for crack initiation and crack arrest. Fracture morphology was studied by scanning electron microscopy and transmission electron microscopy of carbon-platinum surface replicas. An apparent correlation between morphology and ultimate mechanical properties is discussed. Dissert. Abstr.

N80-13249 Tennessee Univ., Knoxville.
PREPARATION AND CHARACTERIZATION OF POLYMERS FORMED BY IRRADIATION OF BETA-PINENE AND OTHER MONOMERS Ph.D Thesis
Ashok Mohan Adur 1979 237 p
Avail: Univ. Microfilms Order No. 7927022

The gamma radiation-induced cationic polymerization of pinene was carried out under super-dry conditions. Chemical characterization by means of nmr, ultraviolet, and infra-red spectroscopic techniques and elemental analysis determined that the repeat unit X-ray diffraction methods were used to obtain crystallinity data and other morphological information. Thermal and solubility characterizations were also carried out. Autooxidation of the polymer resulted in the formation of peroxy and ketonic groups. Elemental analysis was used to determine the amount of oxygen incorporated in the auto-oxidized polymer. These results are discussed in comparison to those obtained for the commercial Polyterpene Resin, prepared by Lewis acid catalysis. Dissert. Abstr.

N80-13250 Polytechnic Inst. of New York.
A STUDY OF TERNARY SYSTEMS CONTAINING AN ACIDIC COPOLYMER, A BASIC COPOLYMER AND A SOLVENT Ph.D. Thesis
Said Djadoun 1979 169 p
Avail: Univ. Microfilms Order No. 7920774

Increasing densities of interacting groups were introduced into the polymeric chains studied to show how this affects the equilibrium of ternary systems containing two incompatible polymers. Phase diagrams were determined for ternary systems containing homopolymers or a mixture of an acidic and a basic copolymer with dioxane, chloroform or butanone. The solvent was found to have a great influence on the nature of the phase diagrams even for systems where the major constituent of the polymeric chains is the same. Dissert. Abstr.

N80-13251 State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
FORMATION OF BLOCK POLYMERS INVOLVING POLY-(P-XYLELENE) BLOCKS Ph.D. Thesis
Anagnostis Efstathios Zachariades 1978 100 p
Avail: Univ. Microfilms Order No. 7920325

The synthetic feasibility of formation of block polymers involving poly-(p-xylelene) blocks was investigated by performing a series of reactions between p-xylelene and styrene, 2-vinyl pyridine, isoprene, butadiene, propylene sulfide, acrylonitrile, and tetrahydrofuran. The anionic polymerization of p-xylelene was initiated in solution at low temperature by electron transfer process and yielded a living poly-(p-xylelene) which is capable of growing further by the addition of other reactive monomers. Block polymers of p-xylelene and tetrahydrofuran were prepared through cationic polymerization in the presence of a suitable initiator. The block polymers prepared by this approach were isolated and characterized by qualitative and quantitative infrared spectroscopic analysis, elemental analysis, solubility tests and in some cases by X-ray diffraction analysis. Dissert. Abstr.

N80-13252 Utah State Univ., Logan.
CELL ADHESION AS INFLUENCED BY SUBSTRATE SURFACE PROPERTIES Ph.D. Thesis
Lee Merrill Smith 1979 115 p
Avail: Univ. Microfilms Order No. 7924340

A rotating shear disk is described for measuring short term (30 minute attachment) cell-substrate adhesion to selected substrates. Substrate surfaces are selected and prepared to obtain a wide variety of surface properties. Surface free energies are measured with captive air and octane angles on fully water extracted samples. Substrate surface chemistry is characterized via X-ray photoelectron spectroscopy for both bulk and spin cast thin films. Electrokinetic zeta potentials were measured via streaming potentials. The rotating shear disk has been demonstrated to reproducibly measure cell adhesion to a variety of substrates. Short term cell adhesion on adherent surfaces is a more consistent parameter than short term plating efficiency. On fairly nonadherent substrates, a measure of plating efficiency is more useful. Dissert. Abstr.

N80-13253# Federal Aviation Administration, Washington, D. C.
COMPARATIVE EVALUTION OF FIREFIGHTING FOAM AGENTS Final Report, Jul. 1974 - Aug. 1977
George B. Geyer, Lawrence M. Neri, and Charles H. Urban 1979 114 p refs
(Contract FAA-081-431-100)
(AD-A074490; FAA-NA-79-2) Avail: NTIS HC A06/MF A01 CSCL 14/2

The fire extinguishing effectiveness of eight aqueous-film-forming-foams (AFFF), 11 fluoroprotein foams (FPF), and three protein form (PF) agents was investigated. Large-scale fire tests were performed under fixed fire conditions employing air-aspirating and non-air-aspirating nozzles on 82.4, 101, and 143 foot diameter

jet A fuel fires. Experiments were performed with only one foam agent which was considered representative of each class. Experiments tend to validate the continuation of allowing a 30 percent reduction in the water requirement at certificated U.S. airports when AFFF is substituted for protein form (Federal Aviation Regulation (FAR) Part 139.49) and to maintain a 1:1 equivalency ratio when fluoroprotein foam is substituted for protein foam. The data also tend to substantiate the validity of allowing an equivalent reduction in water requirements at airports when the 3 percent AFFF, FPF, and PF agents are substituted for the 6 percent agents within each class. A.R.H.

N80-13254*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CHARACTERIZATION AND PROPERTIES OF CONTROLLED NUCLEATION THERMOCHEMICAL DEPOSITED (CNTD) SILICON CARBIDE

Sunil Dutta, Roy W. Rice (Naval Res. Lab., Washington, D.C.), Henry C. Graham (AFML, Wright-Patterson AFB, Ohio), and Madan C. Mendiratta (Systems Res. Lab., Dayton, Ohio) 1978 24 p refs Presented at 80th Annual Meeting of the Basic Sci. Div. of the Am. Ceramic Soc., Detroit, 6-11 May 1978
(NASA-TM-79277; E-210) Avail: NTIS HC A02/MF A01 CSCL 11G

The microstructure of controlled nucleation thermochemical deposition (CNTD) - SiC material was studied and the room temperature and high temperature bend strength and oxidation resistance was evaluated. Utilizing the CNTD process, ultrafine grained (0.01-0.1 mm) SiC was deposited on W - wires (0.5 mm diameter by 20 cm long) as substrates. The deposited SiC rods had superior surface smoothness and were without any macrocolumnar growth commonly found in conventional CVD material. At both room and high temperature (1200 - 1380 C), the CNTD - SiC exhibited bend strength approximately 200, 000 psi (1380 MPa), several times higher than that of hot pressed, sintered, or CVD SiC. The excellent retention of strength at high temperature was attributed to the high purity and fine grain size of the SiC deposit and the apparent absence of grain growth at elevated temperatures. The rates of weight change for CNTD - SiC during oxidation were lower than for NC-203 (hot pressed SiC), higher than for GE's CVD - SiC, and considerably below those for HS-130 (hot pressed Si_3N_4). The high purity, fully dense, and stable grain size CNTD - SiC material shows potential for high temperature structural applications; however problem areas might include: scaling the process to make larger parts, deposition on removable substrates, and the possible residual tensile stress. J.M.S.

N80-13255*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FIRE-RESISTANT MATERIALS FOR AIRCRAFT PASSENGER SEAT CONSTRUCTION

L. L. Fewell, G. C. Tesoro (MIT, Boston), A. Moussa (MIT, Boston), and D. A. Kourtides Nov. 1979 20 p refs
(NASA-TM-78617; A-7946) Avail: NTIS HC A02/MF A01 CSCL 11G

The thermal response characteristics of fabric and fabric-foam assemblies are described. The various aspects of the ignition behavior of contemporary aircraft passenger seat upholstery fabric materials relative to fabric materials made from thermally stable polymers are evaluated. The role of the polymeric foam backing on the thermal response of the fabric-foam assembly is also ascertained. The optimum utilization of improved fire-resistant fabric and foam materials in the construction of aircraft passenger seats is suggested. M.M.M.

N80-13256*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

REACTIONS OF CALCIUM ORTHOSILICATE AND BARIUM ZIRCONATE WITH OXIDES AND SULFATES OF VARIOUS ELEMENTS

Isidor Zaplatynsky Oct. 1979 16 p refs Prepared for DOE
(NASA-TM-79272; E-192; DOE/NASA/2593-79/9) Avail: NTIS HC A02/MF A01 CSCL 11G

Calcium orthosilicate and barium zirconate were evaluated as the insulation layer of thermal barrier coatings for air cooled gas turbine components. Their reactions with various oxides and sulfates were studied at 1100 C and 1300 C for times ranging up to 400 and 200 hours, respectively. These oxides and sulfates represent potential impurities or additives in gas turbine fuels and in turbine combustion air, as well as elements of potential bond coat alloys. The phase compositions of the reaction products were determined by X-ray diffraction analysis. $BaZrO_3$ and $2CaO\text{-}SiO_2$ both reacted with P_2O_5, V_2O_5, Cr_2O_3, Al_2O_3, and SiO_2. In addition, $2CaO\text{-}SiO_2$ reacted with Na_2O, BaO, MgO, and CoO and $BaZrO_3$ reacted with Fe_2O_3. K.L.

N80-13257*# Acurex Corp., Mountain View, Calif. Aerospace Systems Div.

SYNTHESIS OF IMPROVED POLYESTER RESINS Final Report

A. H. McLeod and C. B. Delano 5 Jul. 1979 83 p refs
(Contract NAS3-21374)
(NASA-CR-159665; FR-79-13/AS) Avail: NTIS HC A05/MF A01 CSCL 11G

Eighteen aromatic unsaturated polyester prepolymers prepared by a modified interfacial condensation technique were investigated for their solubility in vinyl monomers and ability to provide high char yield forming unsaturated polyester resins. The best resin system contained a polyester prepolymer of phthalic, fumaric and diphenic acids reacted with 2,7-naphthalene diol and 9,9-bis(4-hydroxyphenyl)fluorene. This prepolymer is very soluble in styrene, divinyl benzene, triallyl cyanurate, diallyl isophthalate and methylvinylpyridine. It provided anaerobic char yields as high as 41 percent at 800 C. The combination of good solubility and char yield represents a significant improvement over state-of-the-art unsaturated polyester resins. The majority of the other prepolymers had only low or no solubility in vinyl monomers. Graphite composites from this prepolymer with styrene were investigated. The cause for the observed low shear strengths of the composites was not determined, however 12-week aging of the composites at 82 C showed that essentially no changes in the composites had occurred. Author

N80-13258*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Materials and Processes Lab.

DEVELOPMENT AND EVALUATION OF AN ABLATIVE CLOSEOUT MATERIAL FOR SOLID ROCKET BOOSTER THERMAL PROTECTION SYSTEM

W. J. Patterson Oct. 1979 46 p refs
(NASA-TM-78241) Avail: NTIS HC A03/MF A01 CSCL 11G

A trowellable closeout/repair material designated as MTA-2 was developed and evaluated for use on the Solid Rocket Booster. This material is composed of an epoxy-polysulfide binder and is highly filled with phenolic microballoons for density control and ablative performance. Mechanical property testing and thermal testing were performed in a wind tunnel to simulate the combined Solid Rocket Booster trajectory aeroshear and heating environments. The material is characterized by excellent thermal performance and was used extensively on the Space Shuttle STS-1 and STS-2 flight hardware. K.L.

N80-13259# General Electric Co., Schenectady, N. Y.

LEAD ZIRCONATE TITANATE (LZT) CERAMICS Final Report, 1 May 1976 - 30 Apr. 1979

J. H. Rosolowski, R. H. Arendt, and J. W. Szymaszek Aug. 1979 59 p
(Contract N00014-76-C-0659)
(AD-A073564; SRD-79-123) Avail: NTIS HC A04/MF A01 CSCL 11/2

A method of producing homogeneous, fully reacted lead zirconate titanate powder, including additive elements, by reaction of the oxides of the constituent metals in a molten salt solvent was developed. Ceramics fired from different batches of powder made in this was showed good batch-to-batch reproducibility of electrical and piezoelectrical properties. Investigation of the influence on the properties of the resulting ceramic of variations in the way such powder is prepared for pressing and fired, revealed that nominally identical powders sometimes behaved differently. It is concluded that lead zirconate titanate powder still cannot be characterized so as to predict, except in a general way, the properties of the ceramic fired from it. GRA

N80-13260# Bendix Corp., Kansas City, Mo.
IMPROVED BONDABILITY TO RTV SILICONE ELASTOMER USING rf-ACTIVATED GAS
J. L. Bellah May 1979 25 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2157) Avail: NTIS HC A02/MF A01

Processing guidelines were developed, and a method was sought to satisfactorily bond RTV to the walls of a machined aluminum casting and to provide a surface on the RTV which would best accept bonding to an epoxy encapsulant. Processing parameters, such as gas type and flow rate, reaction chamber pressure, and rf power level, were developed. DOE

N80-13261# Argonne National Lab., Ill.
DEVELOPMENT OF TUNGSTEN COATINGS FOR THE CORROSION PROTECTION OF ALUMINA-BASED CERAMICS
R. M. Arons, J. T. Dusek, and J. W. Hafstrom 1979 7 p refs Presented at Intern. Conf. on Met. Coatings, San Diego, Calif., 23 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790442-13) Avail: NTIS HC A02/MF A01

A slurry of pure tungsten was prepared and applied by brush coating or slip casting on the alumina-3 wt % Yt small crucible. The composite was fired and a very dense ceramic crucible with a crack free tungsten coating was produced. DOE

N80-13262# Sandia Labs., Albuquerque, N. Mex.
FATIGUE AGING OF ADHESIVE BONDS
N. J. DeLollis 1979 15 p refs Presented at 10th US/UK Symp. on Neutron Generators, Albuquerque, N. Mex., 21 May 1979
(Contract EY-76-C-04-0789)
(SAND-78-1842C; CONF-790518-1) Avail: NTIS HC A02/MF A01

The effect of fatigue on the bond between two epoxy encapsulant formulations and a fused alumina disc was examined. The variables studied included isothermal aging at temperatures up to and including the cure temperature and cyclic thermal aging from +74 to -54 C. The encapsulants were glass microballoon filled epoxies differing only in curing agents. One was cured with an aromatic amine eutectic (Shell Curing Agent Z) and the other was cured with diethanolamine. The Z cured encapsulant bond failed completely at the bond interface with little or no aging; infrared evidence indicated a soluble interlayer as a possible cause of failure. The diethanolamine cured encapsulant survived a year of isothermal aging with little or no evidence of bond degradation. Cyclic thermal aging resulted in gradual bond failure with time. An extrapolation of the cyclic aging data indicates that the stresses induced by thermal cycling would result in complete bond failure in about 1200 days. DOE

N80-13263# California Univ., Livermore. Lawrence Livermore Lab.
CORONA-DISCHARGE TREATMENT OF POLYMERIC FILMS. 2: CHEMICAL STUDIES
J. F. Carley and P. T. Kitze (Colorado Univ.) May 1979 40 p refs Presented at 35th Annual Tech. Conf. of the Soc. of Plastic Engr. New Orleans, May 1979
(Contract W-7405-eng-48)
(UCRL-82709; CONF-790565-1) Avail: NTIS HC A03/MF A01

Polymeric films, chiefly polyethylenes, were subjected to corona-discharge treatment in a continuous treater at commercial rates in a program covering wide ranges of the main processing facrors. Electron-spin-resonance measurements on freshly treated films found no free radicals. The reactions of the treated surfaces with a free-radical compound, diphenyl picryl hydrazyl (DPPH), were studied focusing mainly on the rate effects. The evidence indicates that corona treatment produces fairly stable peroxide structures of the forms RO2R and RO3R on polyethylene surfaces. RO3R reacts rapidly with DPPH alone, while RO2R undergoes a slower reaction after addition of the catalyst, triethylene diamine. Regression analysis showed that air-gap thickness, relative humidity, and number of electrodes used also were significant factors, while dielectric thickness and corona frequence were not. DOE

N80-13264# Sandia Labs., Albuquerque, N. Mex.
SHOCK-INDUCED ELECTRICAL SWITCHING IN POLYMERIC FILMS
R. A. Graham 1979 9 p refs Presented at the 2d Intern. Conf. on Megagauss Magnetic Field Generation and Related Topics, Washington, D.C., 29 May 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(CONF-790540-11) Avail: NTIS HC A02/MF A01

Several compressed magnetic field generators use polymeric films to insulate explosively driven armatures from coils surrounding the armatures. Optimum device performance is achieved when the films remain electrically insulating prior to impact of the armatures but switch to highly conducting states upon impact on the film. The electrical switching properties of commercially available polymer films with high dielectric strength are reported. DOE

N80-13265# Oak Ridge National Lab., Tenn.
MODEL STUDIES OF MIXED-ION BETA-ALUMINAS
J. C. Wang, J. B. Bates, T. Kaneda, H. Engstrom, D. F. Pickett, Jr. (Hughes Aircraft Co., Los Angeles), and S. I. Choi (North Carolina Univ., Chapel Hill) 1979 13 p refs Presented at Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wis.)
(Contract W-7405-eng-26; Grant NSF DMR-78-2207)
(CONF-790538-8) Avail: NTIS HC A02/MF A01

Conductivity anomalies observed in mixed ion beta-aluminas were investigated by model calculations that included Coulomb, short range repulsive, and polarization energy terms. Results show that: (1) when large mobile cations are introduced into beta-aluminas having smaller cations, the large cations tend to occupy positions near Beevers-Ross sites alone; (2) small mobile cations introduced into a beta-alumina having larger mobile cations tend to form pairs either with themselves or with the larger cations; and (3) for a mixed ion pair, the activation energy of the larger ion to escape from the shared potential well is much higher than that of the smaller ion. DOE

N80-13266# Rosenthal-Stemag, Technische Keramik A.G., Selb (West Germany)
DEVELOPMENT OF HIGH TEMPERATURE RESISTANT, INCORRODIBLE, NON-METALLIC CERAMIC MATERIALS: THE USE OF SILICON NITRIDE FOR HEAT EXCHANGERS IN GAS TURBINE APPLICATIONS Final Report
Stefan R. Schindler and Axel Krauth Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 84 p In GERMAN; ENGLISH summary
(Contract BMFT-NTS-0007)
(BMFT-FB-T-78-51) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 17,65

As part of a project to develop ceramic materials for automobile gas turbines, the use of silicon nitride was investigated. The definition of suitable production techniques as well as the realization of heat exchanger prototypes and gas turbine components was emphasized. Construction and testing under simulated application conditions is reported on in support of the production techniques as defined. This materials test data was then used to produce combustion chambers and stators. Test results for these components are positive and are used to justify suggestions for further research and development in this application. Author (ESA)

N80-13101# Technische Universitaet, Clausthal-Zellerfeld (West Germany). Lehrstuhl fuer Glas und Keramik.
REACTIONS BETWEEN GLASS MELTS
K. Herr, H. J. Barklage-Hilgefort, and G. H. Frischat *In* ESA Mater. Sci. in Space Jun. 1979 p 263-266 refs Sponsored in cooperation with Bundesmin. fuer Forsch. u. Technol. and DFVLR (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-13267 Kansas Univ., Lawrence.
BIOLOGICAL TRANSFORMATION OF LIGHT ENERGY INTO METHANE USING AN ANAEROBIC FILTER Ph.D. Thesis
Vicente JonguitudFalcon 1979 225 p
Avail: Univ. Microfilms Order No. 7925875

The feasibility of a biological system in converting solar energy into the chemical energy of methane is demonstrated. The proposed system consists of two biological reactors, an algae unit and an anaerobic filter, working together to fix solar energy in the form of algae photoplasm which is then anaerobically digested to produce methane. The algae fixes light energy by synthesizing inorganic materials into new protoplasm. The algae protoplasm is fed to an anaerobic filter where it is metabolized by anaerobic microorganisms producing methane, CO_2, and inorganic end products. These inorganic end products are recycled back to the algae unit where they are reused to form more algae protoplasm. Dissert. Abstr.

N80-13268*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEMPERATURE AND FLOW MEASUREMENTS ON NEAR-FREEZING AVIATION FUELS IN A WING-TANK MODEL
Robert Friedman and Francis J. Stockemer 1980 18 p refs
To be presented at the 25th Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by ASME
(NASA-TM-79285; E-156) Avail: NTIS HC A02/MF A01 CSCL 21D

Freezing behavior, pumpability, and temperature profiles for aviation turbine fuels were measured in a 190-liter tank chilled to simulate internal temperature gradients encountered in commercial airplane wing tanks. When the bulk of the fuel was above the specification freezing point, pumpout of the fuel removed all fuel except a layer adhering to the bottom chilled surfaces, and the unpumpable fraction depended on the fuel temperature near these surfaces. When the bulk of the fuel was at or below the freezing point, pumpout ceased when solids blocked the pump inlet, and the unpumpable fraction depended on the overall average temperature. K.L.

N80-13269# Southwest Research Inst., San Antonio, Tex.
REFLECTED BLAST MEASUREMENTS AT SMALL SCALED DISTANCES FOR M26E1 PROPELLANT Final Report, Jan. - Dec. 1978
E. D. Esparza and J. J. Moroney Jun. 1979 54 p refs
(Contract DAAA21-76-C-0219)
(AD-A073409; AD-E400329; SwRI-02-4563-2; ARLCD-CR-79010) Avail: NTIS HC A04/MF A01 CSCL 19/1

This report describes an experimental program conducted in support of the US Army Modernization Program. Normal and oblique reflected blast parameters, including peak pressure and impulse, were measured to characterize the explosive output of multiperforated M26E1 propellant. Three sizes of spherical propellant charges were fired over a reflecting surface on which an array of pressure transducers was used to obtain pressure-time histories at scaled distances. A series of Pentolite tests was also conducted at similar scaled distances to establish a baseline for comparing the reflected blast parameters measured in the propellant experiments. The blast pressure and impulse data obtained showed that at the scaled distances tested the maximum explosive output of M26E1 propellant is comparable to Pentolite. GRA

N80-13270# Florida Univ., Gainesville. Dept. of Zoology.
LASER IGNITION OF SOLID PROPELLANT FORMULATIONS Final Report
Peter P. Ostrowski Jun. 1979 58 p refs
(Contracts DAAG29-78-C-0046; DAAK10-79-M-2239)
(AD-A073316; GC-TR-79-1036; ARO-16359.1-P) Avail: NTIS HC A04/MF A01 CSCL 21/9

The ignition of single grains of black powder using a pulsed laser (6943A) was investigated. The experiments were performed in air at atmospheric pressure with a laser which delivered total energy. The ignition process was monitored by streak interferometry, open shutter photography and by recording light emissions from the grain with a photodiode. The experiments showed that focussing of the laser beam was required in order to initiate combustion. Also, the ignition process for black powder was found to occur in a detonative mode. Combustion waves associated with the individual laser pulses were observed to originate at the surface of the grain and propagate outwards from the surface, forming a cloud of material in front of the grain. It was found that when the laser pulse was adjusted to deliver a powder density of 200,000 w/sq cm to the grain, self-sustained combustion could be achieved. At higher values of the power density, dynamic extinction of black powder occurred, i.e., combustion was not self-sustaining. Flame diagnostic measurements indicate that thermal mechanisms may be responsible for the observed phenomena. Additional experiments with double and triple based propellants show that other ignition mechanisms may prevail with these classes of propellants. GRA

N80-13271# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
CONVECTIVE IGNITION OF NITROCELLULOSE BASED PROPELLANTS IN UNSTEADY FLOW FIELDS Final Report, 1 Jul. 1978 - 30 Jun. 1979
Leonard H. Caveny, A. Birk, and W. A. Sirignano Jul. 1979 29 p refs
(Grant DAAG29-78-G-0153)
(AD-A073546; MAE-1445; ARO-15994.1-E) Avail: NTIS HC A03/MF A01 CSCL 21/9

This is a report on a continuing research directed at convective ignition of nitrocellulose-based propellants. The research encompasses flame theory, chemistry, and fluid dynamics. The primary objectives of the research are to determine the site and mode of convective ignition of propellant cylinders in crossflow and to determine the influence of igniter gas composition on the ignition events. Work is well under way to determine the conditions for which ignition occurs at the leading edge in the separation zone or in the wake. The laboratory approach developed (i.e., the use of a shock tunnel as the convective heating device) has been proved successful and over one hundred shock tunnel experiments have been conducted. All diagnostic devices (such as thin film gauges, miniature pressure transducer and radiation detectors) proposed last year were designed, fabricated and used successfully. Attention was focused on the different behavior of single, double and triple based propellants under the same test conditions, and on the importance of the transient boundary layer development time on ignition trends. To validate and substantiate the ignition trends, additional data collection and development of analytical models are needed. GRA

N80-13272# Sandia Labs., Albuquerque, N. Mex.
COAL LIQUEFACTION SHORT RESIDENCE TIME PROCESS RESEARCH Quarterly Report, 1 Oct. - 31 Dec. 1978
R. K. Traeger and T. C. Bickel Jul. 1979 27 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1400; QR-1) Avail: NTIS HC A03/MF A01

Preliminary concepts have been identified for residence time measurements and further studies are underway to evaluate performance under reaction conditions. Current concepts include: solid phase residence time-magnetic tracer particles or manganese oxide with neutron activation; and liquid phase residence time-reflectance IR or high speed sampling with an organic tracer, radioactive tracer. Limited viscosity and surface tension measurements have been performed in an effort to predict the reactor flow regime. DOE

N80-13273# Department of Energy, Bartlesville, Okla. Energy Technology Center.
PHYSICAL PROPERTIES OF GASOLINE/ALCOHOL AUTOMOTIVE FUELS
F. W. Cox 1979 14 p refs Presented at 3d Intern. Alcohol Fuels Technol. Symp., Asilomar, Calif., 28-31 May 1979
(CONF-790520-4) Avail: NTIS HC A02/MF A01

The physical property changes (both beneficial and detrimental) which occur when alcohols are added to gasoline as fuel extenders are considered. The experimental data and discussion of results cover four physical properly areas: water tolerance, vapor pressure, distillation characteristics, and octane quality. The alcohols include methanol, ethanol, n-propanol, i-butanol, and synthetic methyl fuel. Several additional alcohols were tested, but only as gasoline/methanol cosolvents. The interdependency among the variables which are responsible for the significant property changes was determined so that, where possible, gasoline/alcohol properties can be estimated from blend composition. Trends are also discussed in terms of the general influences of system variables. DOE

N80-13274# Department of Energy, Bartlesville, Okla.
DRIVING CYCLE COMPARISONS OF ENERGY ECONOMIES AND EMISSIONS FROM AN ALCOHOL AND GASOLINE FUELED VEHICLE
R. L. Bechtold and B. Pullman (Santa Clara Univ., Calif.) 1979 13 p refs Presented at 3d Intern. Alcohol Fuels Technol. Symp., Asilomar, Calif., 28 May 1979
(CONF-790520-7) Avail: NTIS HC A02/MF A01

A late-model vehicle was converted to operate using methanol, gasoline, or ethanol as fuel and experimental work was done to obtain energy economy and exhaust emissions data for each of the three fuels. Results are compared at equal equivalence ratios both with and without an oxidation catalyst in the exhaust system. Using a catalyst for emissions control, unburned hydrocarbon emissions were lowest during lean operating conditions and were nearly the same for all three fuels under those conditions. Oxides of nitrogen emissions typically were reduced by over 50 percent in changing from gasoline to methanol or ethanol. Photochemical reactivities were calculated and comparisons were made among the fuels during cold start and FTP weighted tests. Gasoline exhaust was often calculated to have the lowest total reactivity during the FTP; however, methanol exhaust reactivity was lowest for the stoichiometric condition with catalyst. DOE

N80-13275# Department of Energy, Bartlesville, Okla. Energy Technology Center.
THE 50,000 MILE METHANOL/GASOLINE BLEND FLEET STUDY Progress Report
K. R. Stamper 1979 14 p refs Presented at 3d Intern. Alcohol Fuels Technol. Symp., Asilomar, Calif., 28 May 1979
(CONF-790520-6) Avail: NTIS HC A02/MF A01

Seven current production automobiles are being used in a fleet study to obtain operational experience in using 10% methanol/90% gasoline blends as an automotive fuel. Data from chassis dynamometer tests (run according to the 1975-1978 Federal test procedure) show fuel economy and exhaust emissions of carbon monoxide, oxides of nitrogen, unburned fuel, methanol, and aldehydes. For each of the vehicles when operated on the 10% methanol blend, and on unleaded low octane Indolene. An average decrease in volumetric fuel economy (approximately 5%) and a reduction in carbon monoxide emissions were associated with the use of the 10% methanol blend. The most severe driveability problems encountered thus far are related to operating on a phase separated fuel and materials compatibility problems with an elastomer in the air-fuel control hardware of one vehicle. DOE

N80-13276# Karnataka Univ., Dharwar (India).
EVALUATION OF METHANOL FOR REDUCED EXHAUST EMISSIONS IN A SINGLE-CYLINDER RESEARCH ENGINE
B. S. Samaga, K. V. GopalaKrishnan (Indian Inst. of Tech., India), B. S. Murthy (Indian Inst. of Tech., India), R. K. Pefley (Santa Clara Univ., Calif.), R. L. Bechtold (DOE, Bartlesville, Okla.), and G. W. Edwards (DOE, Bartlesville, Okla.) 1979 12 p refs Presented at 3d Intern. Alcohol Fuels Tech. Symp., Asilomar, Calif., 28 May 1979
(CONF-790520-3) Avail: NTIS HC A02/MF A01

The influence of different operating parameters on the formation of oxides of nitrogen, carbon monoxide, unburned fuel, and the aldehydes in an internal combustion engine fueled by methanol and methanol-water mixtures is examined. Also, the effect of adding small quantities of aniline on the burning rate and aldehydes exhaust is explored. DOE

N80-13277# Brookhaven National Lab., Upton, N. Y.
REGENERATIVE PROCESS FOR DESULFURIZATION OF HIGH TEMPERATURE COMBUSTION AND FUEL GASES Quarterly Progress Report, 1 Jul. - 30 Sep. 1978
M.-S. Shen and J. M. Chen 1978 72 p refs
(Contract EY-76-C-02-0016)
(BNL-50944; QPR-10) Avail: NTIS HC A04/MF A01

A rotary kiln reactor was used to study the apparent solid-solid reaction between the sulfated limestone and the fly ash from a fluidized bed combustion. The experimental conditions were within the range for regeneration of the lime-based sorbents for fluidized-bed combustion. The measured SO2 concentrations were favorably interrelated with a derived mathematical model, with the major operating variables of the reactor, such as solid loading, temperature, gas flow rate, etc. The kinetic parameters of the regeneration reaction, the maximum attainable SO2 concentrations, and the effect of the molar ratio of C/S on the extent of CaSO4 conversion to CaO were obtained. Calcium silicate retained its activity when repeatedly cycled between sulfation and regeneration. A kiln reactor process for regenerating sulfated calcuim oxide reduces the environmental impact of fluid bed waste disposal and improves natural resource utilization. DOE

N80-13278# Purdue Univ., Lafayette, Ind. School of Chemical Engineering.
CONVERSION OF BIOMASS FROM AGRICULTURE INTO USEFUL PRODUCTS Final Report
George T. Tsao 31 Jul. 1978 37 p
(Contract EG-77-S-02-4298)
(COO-4298-1) Avail: NTIS HC A03/MF A01

The fermentation of the pentoses produced by the hydrolysis of hemicelluloses either to 2,3-butanediol by Klebsiella pneumoniae or to a mixture of 2,3-butanediol and ethanol by Aeromonas hydrophilia was studied to develop optimum conditions for the Klebsiella fermentation, confirm the xylose fermentation by Aeromona hydrophilia, and to study the growth of these microbes on pentoses and uronic acids and on actual hemicellulose hydrolyzates of corn stover. The results obtained in the solvent pretreatment in cellulose hydrolysis are reported. The solvents used were Cadoxen (solution of 5 to 7% cadmium oxide in 28% aqueous ethylene diamine), CMCS (an aqueous solution of 17% sodium tartrate, 6.6% ferric chloride, 7.8% caustic, and 6.2% sodium sulfite), and concentrated sulfuric acid. Almost quantitative yields of glucose can be obtained from the reprecipitated cellulose by enzymatic hydrolysis. DOE

N80-13279# Department of Energy, Washington, D. C.
ENVIRONMENTAL ANALYSIS OF SYNTHETIC LIQUID FUELS
12 Jul. 1979 144 p refs
(DOE/EV-0044) Avail: NTIS HC A07/MF A01

There appears to be no absolute environmentally related constraint identified for any of the first-generation surface conversion technologies (shale oil, coal liquefaction, and biomass production of ethanol). Second-generation processes run greater risks of major environmental problems. For in situ processes, the major risk is leaching of hazardous materials into water; for direct liquefaction, concern is potential worker and public exposure to toxic substances. Yet-to-be-defined regulations are perceived by developers as major technology development impediments. These include air quality standards (visibility, short-term nitrogen oxide and new PSD regulations), regulation of hazardous wastes and toxic products, underground injection guidelines, and worker safety regulations. Some risk exists that environmental R and D programs cannot fully satisfy all existing and expected regulatory demands, but these risks should be known by 1985 and it is expected that appropriate control adjustments can be made. DOE

N80-13280# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS (RISER CRACKING OF COAL) Quarterly Report, 1 Oct. - 31 Dec. 1978
Dennis A. Duncan Mar. 1979 46 p refs
(Contract EX-76-C-01-2307)
(FE-2307-46; QR-3) Avail: NTIS HC A03/MF A01

Work on processing of caking coals was continued, and

methods of pretreating caking coals were developed and demonstrated by sucessful runs in the bench-scale unit. Exploratory work done to evaluate the effects of bentonite clay, iron oxide, and heating rate on the reaction system show that both bentonite clay and iron oxide have beneficial catalytic effects. Depth of carbon conversion was found to be more a function of severity of thermal treatment than heating rate over the range studied. Construction of the process development unit (PDU) continued, and much of the major equipment was received. Contracts were awarded for supplying high-pressure gases to the PDU. Fabrication of the preheater coil was completed, and construction of the preheater furnace is underway. Tests were continued in a low pressure simulator of a PDU combustor section, and for a coaxial construction, ceramic shields in the vicinity of the oxygen injection point do not appear to be necessary. DOE

N80-13281# Institute of Gas Technology, Chicago, Ill.
PREPARATION OF A COAL CONVERSION SYSTEMS TECHNICAL DATA BOOK, PROJECT 61003 Annual Report, 1 May 1977 - 30 Apr. 1978
Feb. 1979 577 p refs
(Contract EX-76-C-01-2286)
(FE-2286-32) Avail: NTIS HC A25/MF A01

The calculation of gas phase fugacity in NH3-H2S-H2O and NH3-CO2-H2O systems is described. Vapor-Liquid Equilibrium data on cyclohexane-water and four binary hydrogen-solvent systems have been presented. Data obtained on true densities of low rank coals and their chars are plotted as a function of hydrogen content (wt %, daf). Results of an investigation of formulas for calculating the heating value of coal from its composition are given. A formula, developed from the available data and having the least standard deviation is also presented. Data on minor and trace elements in coal are reviewed. A table of basic properties of pure components of coal liquids is included. Properties of benzene are presented in both S.I. and British Units. The theory of coal cleaning was discussed. DOE

N80-13282# Avco Systems Div., Wilmington, Mass.
ARC-COAL ACETYLENE PROCESS DEVELOPMENT PROGRAM Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1978
10 Jan. 1979 29 p refs
(Contract EM-78-C-02-4507)
(COO-4507-4; AVSD-0344-78-CR; QTPR-4) Avail: NTIS HC A03/MF A01

Improvements in the reactor design yielding SER's well below 5.0 are discussed. The anode and cathode performed well with no visible degradation after minor adjustments in the geometry and operating procedures. The data taken to date, both with and without quench, underline the importance of commencing work on the 1 Mw Arc Coal Acetylene PDU where SER values between 3.5 and 4.0 are a clear probability. With values of SER in this range, the arc coal process is economically attractive as a competitor to the ethylene process for manufacturing vinyl chloride monomer and vinyl acetate monomer. DOE

N80-13283# Mueller Associates, Inc., Baltimore, Md.
STATUS OF ALCOHOL FUELS UTILIZATION TECHNOLOGY FOR STATIONARY GAS TURBINES
Richard L. Rentz and Thomas J. Timbario Apr. 1979 35 p refs
(Contract EX-76-C-01-2098)
(HCP/M2098-03) Avail: NTIS HC A03/MF A01

Efforts being made to establish the feasibility of alcohols as fuels for stationary gas turbines were reviewed to determine if the status of technology has been defined regarding modification necessary to convert existing stationary gas turbines for operation with alcohol fuels, and to determine if the status of technology has been defined for the design of new stationary gas turbines operating on alcohol fuels. Results are presented in a format which describes the test work performed and characterizes the status of alcohol fuels technology (relative to stationary gas turbines) based on this test work. An overview of various factors that, from a systems viewpoint, would need to be considered if a serious effort were made to utilize alcohols as fuels for stationary gas turbines is included. DOE

N80-13284# Monsanto Research Corp., Miamisburg, Ohio.
COALIFICATION REACTIONS UNDER PRESSURE
G. Huck and K. Patteisky Sep. 1978 16 p refs Transl. into ENGLISH from Fortschr. Geol. Rheinl. Westfalen (West Germany), no. 12, Dec. 1964 p 551-558 Prepared for Monsanto Facility, Miamisburg, Ohio Transl. by Farnhm (Frank C.) Co., Philadelphia, Pa.
(Contract EY-76-C-04-0053)
(MLM-2556(TR)) Avail: NTIS HC A02/MF A01

The relationship of the mutual effect of pressure and temperature on the coalification reactions are presented. It was shown, contrary to theories often expressed in the literature, that the intensifying influence of pressure on coalification may be excluded if the pressure charge operates through shear- and friction-forces, without temperature changes and that the use of spores as coalification thermometers is limited. It is shown that at higher pressure spores may be exposed to temperatures above 200 C without showing thermal modifications. DOE

N80-13285# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR COAL LIQUEFACTION
E. A. Loyd, B. C. Almuala, A. K. Ingberman, L. M. Joseph, N. Lobe, J. S. Siegel, M. I. Singer, and J. H. Smithson 1979 35 p
(TID-28846) Avail: NTIS HC A03/MF A01

The commercial readiness of coal liquids is evaluated and barriers to be overcome are identified. It is concluded that: (1) coal liquids will address a major segment of the energy economy, petroleum and petroleum derived products; (2) methanol and Fischer-Tropsch processes are technically ready but economically uncompetitive; (3) scale up of direct hydrogenation processes to verify commercial feasibility requires major government funding; (4) federal assistance will probably be required for all first-of-a-kind commercial facilities; and (5) coal liquids will be economically competitive with imported petroleum by late 1980's or early 1990's. DOE

N80-13286# Department of Energy, Washington, D. C.
COMMERCIALIZATION TASK FORCE FOR HIGH Btu GASIFICATION
P. Gallo, Richard Passman, Dave Beecy, Allyn Hemenway, Arthur Ingberman, and John Pulice 1979 38 p
(TID-28849) Avail: NTIS HC A03/MF A01

The commercial readiness of high Btu gasification was investigated. It is found that the principal barriers to the commercialization of high Btu gas are: (1) the availability of capital, and (2) uncertainties regarding the marketability of supplies. Unless these barriers are removed, timely production of high-Btu gas is not likely to occur. A Federal role is recommended that would assist the private sector in capital formation with incentives that spread the financial risk appropriately among project beneficiaries. Of the incentives studied, two appear most effective: rolled-in pricing is seen as an important ingredient, especially in the early years of plant operation because of the high initial cost of gas; Federal loan guarantees are effective in assuring capital availability for the industry. Until loan guarantees become available, regulatory mechanisms provide the only remaining option. DOE

N80-13287# Gulf Research and Development Co., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS Quarterly Report, Sep. 1978 - Nov. 1978
D. C. Succop and F. E. Wynne Dec. 1978 11 p
(Contracts EX-76-C-01-1800; E(49-18)-1800)
(FE-1800-33) Avail: NTIS HC A02/MF A01

Planned experiments to establish general ranges over which heater variables should be studied were completed. Unit modification was necessary to allow collection of high viscosity product from the heater outlet. Preliminary results indicate that increasing heater residence times and temperatures reduce the slurry viscosity by thermal cracking. At a low heater pressure of 1,000 psig and 2,000 scf/bbl of H2, heater slurry temperatures above 950 F resulted in increased viscosity and coking. DOE

N80-13288# Bituminous Coal Research, Inc., Monroeville, Pa.
GAS GENERATOR RESEARCH AND DEVELOPMENT: BI-GAS PROCESS Monthly Progress Report, Apr. 1979
May 1979 233 p refs Prepared in cooperation with Phillips Petroleum Co., Homer City, Pa.
(Contract EX-76-C-01-1207)
(FE-1207-62; MPR-92) Avail: NTIS HC A10/MF A01

A life test of two Ni/Mo catalysts, as well as their predecessors, was completed. The results showed that the sample tested was essentially the same as its predecessor. Generally, the activity of the catalyst was close to that predicted by the life test data. Analytical and computer services continued in support of the overall program. A written description of the fluidized-bed methanation PEDU automated data acquisition and reduction systems was generated and is included. DOE

N80-13289# Texaco, Inc., Montebello, Calif.
GASIFICATION OF RESIDUAL MATERIALS FROM COAL LIQUEFACTION Quarterly Report, Oct. - Dec. 1978
Allen M. Robin Mar. 1979 13 p
(Contract EX-76-C-01-2247)
(FE-2247-22) Avail: NTIS HC A02/MF A01

Materials from several coal liquefaction pilot plants were evaluated to determine their suitability as feedstocks for proprietary gasification processes. The chemical composition and physical properties of each material were determined. A preliminary pilot plant test was conducted. The operability of the process on the candidate feedstock was evaluated and estimates of preferred processing conditions, product gas yield and composition were made. R.E.S.

N80-13290# TRW Systems Group, McLean, Va. Energy Systems Planning Div.
METHANE RECOVERY FROM COALBEDS PROJECT. TECHNOLOGY TEST PROJECTS: EVALUATION OF CANDIDATE PROJECTS
Feb. 1979 25 p
(Contract EW-78-C-21-8089)
(METC-8089-T4) Avail: NTIS HC A02/MF A01

Twelve system test concepts for the recovery of methane from coalbeds and utilization of the gas in one or more applications are presented and evaluated. Four projects are recommended for further design development and analysis. R.E.S.

N80-13291# Gulf Research and Development Co., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS Quarterly Report, Jun. - Aug. 1978
D. C. Succop and F. E. Wynne Sep. 1978 13 p
(Contracts EX-76-C-01-1800; E(49-18)-1800)
(FE-1800-30) Avail: NTIS HC A02/MF A01

Experimental results confirmed the predicted product liquid and coke yields for delayed coking or bituminous coal with petroleum vacuum residue. The expected modest synergism for liquid production was accompanied by synergistic improvement in liquid quality. Synergism was somewhat greater when undried sub-bituminous coal was used, confirming that coal slurries can be charged to delayed cokers and thereby release residual oil for incremental charging to fluid catalytic cracking. These results were used as the basis for a preliminary economic assessment of this medium impact interim process when used in existing petroleum refinery delayed cokers. DOE

N80-13292# Amoco Oil Co., Naperville, Ill. Research and Development Dept.
CATALYST DEVELOPMENT FOR COAL LIQUEFACTION Final Annual Report
R. J. Bertolacini, L. C. Gutberlet, D. K. Kim, and K. K. Robinson Jun. 1979 179 p refs Sponsored by EPRI
(Research Proj. 408-1)
(EPRI-AF-1084; AR-3) Avail: NTIS HC A09/MF A01

New catalysts for the hydroliquefaction of coal to a clean-burning fuel for power generation were screened. The performance of the new catalysts is discussed along with the performance of various hydrogen donor solvents. Modifications in the product workup procedure are described. The effect of various impregnating aids, such as phosphoric acid, on initial performance was investigated. Numerous catalysts were tested further on the continuous pilot plant to establish how their aging behavior responds to changes in surface properties and catalytic metals. Aged catalysts were also characterized extensively to establish the reasons for deactivation. DOE

N80-13293# Department of Energy, Washington, D. C. Div. of Fossil Fuel Extraction.
UNDERGROUND COAL CONVERSION. PROGRAM DESCRIPTION
Jun. 1979 70 p refs
(DOE/ET-0100) Avail: NTIS HC A04/MF A01

Results of the program presented indicate that, while underground coal gasification (UCC) is technically feasible, it still contains some process unknowns, environmental risks, and economic risks that require R and D. In order to contribute to the national energy goals, a strong DOE program which incorporates maximum industry involvement is planned. Major projects are described in some detail. A strong program of supporting activities is expected to address specific problems identified in the field testing and in order to advance UCC technology. The elimination of the high-risk elements of UCC by resolving those technical, environmental, and economic uncertainties that remain, and to enable industry to assume responsibility for commercialization of the process was considered. DOE

N80-13294# Brookhaven National Lab., Upton, N. Y.
COAL CONVERSION IN FLASH HYDROPYROLYSIS REACTORS
Vi-Duong Dang and M. Steinberg May 1979 57 p refs Presented at the 87th AICHE Natl. Meeting, Boston, 19 Aug. 1979
(Contract EY-76-C-02-0016)
(BNL-26209; CONF-790822-5) Avail: NTIS HC A04/MF A01

Analytical correlations of the experimental results for the Flash Hydropyrolysis of coal to gaseous and liquid hydrocarbons are presented. A three step reaction mechanism together with a particle-fluid interaction model is used to describe the system. The application of nonlinear estimation methods produces fair agreement between the experimental results and the postulated model. Explicit kinetic expressions as a function of temperature, pressure and reaction time for the reaction yields are developed. Reaction parameters for fluidized bed, entrained bed and fast fluidized bed designs are derived from the kinetic model. DOE

N80-13295# Oak Ridge National Lab., Tenn.
REVIEW OF SUPPORTING RESEARCH AT OAK RIDGE NATIONAL LABORATORY FOR UNDERGROUND COAL CONVERSION
P. R. Westmoreland and L. S. Dickerson 1979 14 p refs Presented at the 5th Underground Coal Conversion Symp., Alexandria, Va., 18 Jun. 1979
(Contract W-7405-eng-26)
(CONF-790630-9) Avail: NTIS HC A02/MF A01

Chemical and physical properties of lignite, subbituminous coal, bituminous coal, and overburden were measured. Generally, large, monolithic blocks of sample were dried and pyrolyzed. Thermal data and product yields can be correlated to provide an extrapolation from powder pyrolysis to the pyrolysis steps in underground coal gasification. Significant results include correlation of block pyrolysis data for low-rank coals, interpretation of mechanisms, and comparison between low-rank and bituminous coals; heating tests of overburden cores from the Hoe Creek field gasification site; and measurement of physical properties, particularly thermal diffusivity and thermal conductivity of low-rank coals. Correlations, mechanisms, and property measurements are reviewed, and applications to underground coal gasification are discussed. DOE

N80-13296# Los Alamos Scientific Lab., N. Mex.
SYNFUEL (HYDROGEN) PRODUCTION FROM FUSION POWER
R. A. Krakowski, K. E. Cox, J. H. Pendergrass, and L. A. Booth 1979 6 p refs Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract W-7405-eng-36)

(LA-UR-79-1115; CONF-790803-9) Avail: NTIS HC A02/MF A01

A potential use of fusion energy for the production of synthetic fuel (hydrogen) is described. The hybrid-thermochemical bismuth-sulfate cycle was as a vehicle to assess the technological and economic merits of this potential nonelectric application of fusion power. DOE

N80-13297# Los Alamos Scientific Lab., N. Mex.
LIQUID HYDROGEN AS AN AUTOMOTIVE FUEL
W. F. Stewart 1979 17 p refs Presented at the 1979 Cryog. Eng. Conf., Madison, Wis., 21-24 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-621; CONF-790815-2) Avail: NTIS HC A02/MF A01

Hydrogen fuel projects involving six vehicles and six hydrogen liquid container designs are discussed. It is shown that service (refueling) stations and bulk distribution systems can be built using present technology. These can be similar in concept to the present service stations and distribution systems. Vehicle refueling and bulk liquid hydrogen transfer will probably be computer controlled as completely as possible. Liquid hydrogen can begin its entry into the automotive fuel picture as a fuel for fixed base vehicles such as trucks, buses, taxis, etc., and expand into the private sector as its availability increases. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-13298 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NUMBER 3
Mar. 1979 73 p refs
(AD-A066514/1) Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 13/9

Reviews of vibration analyses in relation to structural design and machinery are presented. Included are studies of dynamic snap-through of shallow arches and spherical caps, acoustic propagation in the ocean, and stability problems in rotary systems. For individual titles, see N80-13299 through N80-13301.

N80-13299 Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
DYNAMIC SNAP-THROUGH OF SHALLOW ARCHES AND SPHERICAL CAPS c39
S. M. Holzer *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 3 Mar. 1979 p 3-6 refs (For primary document see N80-13298 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington D. C. 20375 CSCL 20/11

The current literature on effects of asymmetric perturbation and the spatial distribution of the load on dynamic snap-through of shallow arches and spherical caps is reviewed. Two methods in the studies of asymmetric dynamic snap-through induced by symmetric loads are discussed. In one method conditions are sought that give rise to parametric excitation of the asymmetric motion. In the second method the Budiansky-Roth criterion is used to predict asymmetric dynamic snap-through from the nonlinear motion. A.W.H.

N80-13300 Naval Underwater Systems Center, New London, Conn.
A SURVEY OF FINITE ELEMENT-RELATED TECHNIQUES AS APPLIED TO ACOUSTIC PROPAGATION IN THE OCEAN. PART 1: FINITE ELEMENT METHOD AND RELATED TECHNIQUES c71
A. J. Kalinowski *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 3 Mar. 1979 p 9-16 refs (For primary document see N80-13298 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington D. C. 20375 CSCL 20/1

Finite element related techniques applied to acoustic propagation in the ocean are examined. Methods for modeling and simulation of boundary conditions are discussed including the related boundary solution method, and the boundary integral method. A.W.H.

N80-13301# Kobe Univ. (Japan).
STABILITY PROBLEMS ON ROTOR SYSTEMS c37
T. Iwatsubo *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 3 Mar. 1979 p 17-26 refs (For primary document see N80-13298 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington D. C. 20375 CSCL 13/9

Self excited lateral vibrations that cause instability of rotating machinery are examined. Instability phenomena are described and classified. The following causes of instability are described; internal damping, dry friction, journal bearing (oil whip), fluid forces, ball bearings, universal joint, and asymmetric factors. A.W.H.

N80-13302 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NUMBER 4
Apr. 1979 86 p refs
(AD-A067426/7) Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

Reviews of vibration analyses in relation to vibration properties, structural design, and machinery are presented. Included are the damping properties of turbine blades, acoustic propagation in the ocean, and the wind excited behavior of structures. For individual titles, see N80-13303 through N80-13305.

N80-13303 Rochester Inst. of Tech., N. Y.
DAMPING PROPERTIES OF TURBINE BLADES c37
N. F. Rieger *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 4 Apr. 1979 p 3-6 refs (For primary document see N80-13302 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 13/9

Damping properties of turbine blades, and metals and alloys is discussed. Damping literature pertaining to internal material damping, damping of steam turbine blade groups, and gas turbine blade damping is reviewed. A.W.H.

N80-13304 Naval Underwater Systems Center, New London, Conn.
A SURVEY OF FINITE ELEMENT-RELATED TECHNIQUES AS APPLIED TO ACOUSTIC PROPAGATION IN THE OCEAN. PART 2: TRANSPARENT BOUNDARY SIMULATION TECHNIQUES c71
A. J. Kalinowski *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 4 Apr. 1979 p 7-16 refs (For primary document see N80-13302 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/1

Finite element related techniques applied to acoustic propagation in the ocean are examined. Methods for modeling and simulation of boundary conditions are discussed including transparent boundary simulation techniques. A.W.H.

N80-13305 Loughborough Univ. of Technology (England).
WIND EXCITED BEHAVIOR OF STRUCTURES, 2 c39
D. J. Johns *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 4 Apr. 1979 p 17-29 refs (For primary document see N80-13302 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

The dynamic response and aeroelastic behavior of typical structural forms is discussed. Literature on wind excited responses of structures is reviewed. Responses such as vortex shedding, galloping oscillations, flutter, divergence and buckling, and turbulence are examined. A.W.H.

N80-13306 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NUMBER 5
Judith Nagle-Eshelman, ed. May 1979 92 p ref Presented

at the 50th Shock and Vibration Symp., Colorado Springs, 16-18 Oct. 1979
(AD-A069685/6) Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

Areas of vibration research and the development of techniques for vibration control are studied. Topics discussed include: aircraft flutter research; high temperature damping of dynamic systems; and reduction methods for problems of vibration of orthotropic plates. For individual titles, see N80-13307 through N80-13309.

N80-13307 Indian Inst. of Tech., Kanpur.
SOME RECENT TRENDS IN AIRCRAFT FLUTTER RESEARCH **c08**
P. N. Murthy *In* SVIC Shock and Vibration Digest, Vol. 11, No. 5 May 1979 p 7-12 refs (For primary document see N80-13306 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D.C. 20375 CSCL 01/3

The advances in research and development in the area of flutter are reviewed. Two innovations in aircraft configurations, oblique wings and control configured vehicles, are examined. A.W.H.

N80-13308 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
HIGH TEMPERATURE DAMPING OF DYNAMIC SYSTEMS **c39**
D. I. G. Jones *In* SVIC Shock and Vibration Digest, Vol. 11, No. 5 May 1979 p 13-18 refs (For primary document see N80-13306 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Four major areas of high temperature vibration control technology are examined. The areas discussed are: the measurement and characterization of damping behavior of enamels and glasses and high damping elastomers; the effects of composition on damping behavior of glasses and enamels; the practical design and application of damping treatments in industry and service; and the development of mechanical mechanisms of damping. A.W.H.

N80-13309 Chubu Inst. of Tech., Kasugai (Japan).
REDUCTION METHODS FOR PROBLEMS OF VIBRATION OF ORTHOTROPIC PLATES. PART 1: EXACT METHODS **c39**
T. Sakata *In* SVIC Shock and Vibration Digest, Vol. 11, No. 5 May 1979 p 19-26 refs (For primary document see N80-13306 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Three exact reduction methods for problems of vibration are described. A generalized reduction method is described and used to derive an approximate formula for estimating the natural frequency of an orthotropic plate. The natural frequencies of the isotropic plate are used. They are reduced without solving the differential equation governing free vibration of the orthotropic plate. A.W.H.

N80-13310 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NUMBER 7
Judith Nagle-Eshelman, ed. Washington DOD Jul. 1979 89 p
(AD-A072745/3) Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

Reviews of vibration analyses in relation to structural design and material tests. Included are discussions on the nonlinear distortion of nondispersive acoustic waves, the behavior of elastometric materials under dynamic loads, and techniques for plastic deformation of structures under impulsive loading. For individual titles, see N80-13311 through N80-13313.

N80-13311 Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
RECENT DEVELOPMENTS FOR THE NONLINEAR DISTORTION OF NON-DISPERSIVE ACOUSTIC WAVES. PART 1: PLANAR WAVES AND THE BASIC METHOD **c71**
J. H. Ginsberg *In* SVIC Shock and Vibration Digest, Vol. 11, No. 7 Jul. 1979 p 3-8 refs (For primary document see N80-13310 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/1

A perturbation procedure for investigating finite amplitude acoustic waves that depend on more than one spatial coordinate is described. The discussion focuses on wave motions that are nondispersive in the linear approximation, in which case amplitude dispersion and self refraction are the primary mechanisms for nonlinear distortion. Planar waves and the basic method are discussed. A.W.H.

N80-13312 General Dynamics Corp., Groton, Conn. General Boat Div.
BEHAVIOR OF ELASTOMETRIC MATERIALS UNDER DYNAMIC LOADS, 2 **c39**
E. C. Hobaica *In* SVIC Shock and Vibration Digest, Vol. 11, No. 7 Jul. 1979 p 11-18 refs (For primary document see N80-13310 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

The properties of rubber and other elastomers when they are subjected to small amplitude sinusoidal stresses. Testing methods and data on dynamic properties are given. A.W.H.

N80-13313 Southwest Research Inst., San Antonio, Tex.
APPROXIMATE TECHNIQUES FOR PLASTIC DEFORMATION OF STRUCTURES UNDER IMPULSIVE LOADING, 2 **c39**
W. E. Bakerm *In* SVIC Shock and Vibration Digest, Vol. 11, No. 7 Jul. 1979 p 19-24 refs (For primary document see N80-13310 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20735 CSCL 20/11

Approximate techniques for plastic deformation of structures under impulsive loading is summarized. Research oriented methods and design oriented methods are described. Several design-oriented methods, utilized by structural designers are examined. A.W.H.

N80-13314 Virginia Univ., Charlottesville.
A STUDY OF THE DISSIPATIVE MECHANISM IN THE FLOW OF SUPERFLUID HELIUM-4 USING CHARGED VORTEX RINGS Ph.D. Thesis
Bruce Michael Guenin 1978 180 p
Avail: Univ. Microfilms Order No. 7928040

A charge vortex ring CVR study of vorticity generated by a flow of superfluid helium-4 at a known superfluid velocity and chemical potential difference is presented. Measurements of the spatial distribution of the CVR currents in the beam are presented and discussed. The interaction between the CVR beam and the neutral vorticity is analyzed with respect to CVR beam attenuation, charge transferred to the neutral vorticity, and free ions produced. Dissert. Abstr.

N80-13315# Committee on Science and Technology (U. S. House).
STANDARD REFERENCE DATA PROGRAM AUTHORIZATION
Washington GPO 1978 98 p refs Hearing before Subcomm. on Sci., Res., and Technol. of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., 9 Feb. 1978
(GPO-25-887) Avail: Subcomm. on Sci., Res. and Technol.

Testimonies delivered and statements received in support of the standard reference data program are presented. R.E.S.

N80-13316*# TriTec, Inc., Columbia, Md.
INDUSTRIAL CAPABILITY TO CHEM-MILL ALUMINUM ALLOY 2219 IN T-37 AND T-87 Final Report
Charles Milewski, Jr. and Kevin C. S. Chen 31 Oct. 1979 15 p
(Contract NAS8-33510)
(NASA-CR-161349) Avail: NTIS HC A02/MF A01 CSCL 13H

Procedures and chemical baths were developed for chem-milling aluminum alloy 2219. Using a series of sample etchings,

it was found that good etching results could be obtained by using 'white plastic for porcelain repair (toluol, xylol, and petroleum distillates)' on top of cellosolve acetate as resist coatings and ferric chloride as on etchant. R.E.S.

N80-13317*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF CLEANERS FOR PHOTOVOLTAIC MODULES EXPOSED IN AN OUTDOOR ENVIRONMENT Final Report
W. D. Knapp Oct. 1979 17 p refs
(Contract DE-AI01-79ET-20485)
(NASA-TM-79248; E-204; DOE/NASA/20485-79/5) Avail: NTIS HC A02/MF A01 CSCL 13H

Power recovery of silicone encapsulated and glass covered photovoltaic modules, exposed for two years to a suburban environment, was measured after washing with a variety of cleaners including detergents, abrasive soap, and hydrocarbon solvents. Silicone encapsulated modules in operating environments may experience significant power losses or require extensive periodic cleaning. Glass front-faced modules in similar situations are much less affected. Organic hydrocarbon solvents or abrasives were found to be about five times more effective than mild detergents in cleaning encapsulated modules. Author

N80-13318# National Engineering Lab., East Kilbride (Scotland). Systems Engineering Div.
ENERGY SAVING IN INJECTION MOLDING
G. Gardiner Jan. 1979 35 p Presented at Rubber and Plastics Res. Assoc. Seminar, 1 Feb. 1978
(NEL-662) Avail: NTIS HC A03/MF A01

Power consumption in an injection molding plant was studied and tests on an injection molding machine during a specific work cycle were made. The results clearly establish the energy losses which are present in many injection molding plants. By converting the plant to hydraulic drives and centralized hydraulic power supply, most of the losses could be eliminated. Supporting results of tests on a converted injection molding machine operating from a single hydraulic power source, simulating a centralized hydraulic power supply are also included. Author (ESA)

N80-13319*# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
COMPARISON OF CENTRIFUGE AND FREEZING CALORIMETER METHODS FOR MEASURING FREE WATER IN SNOW
R. N. Jones May 1979 44 p refs Sponsored by NASA
(NASA-CR-162504; PB-296321/1; NBSIR-79-1604) Avail: NTIS HC A03/MF A01 CSCL 14B

A comparison of two popular methods; namely, the centrifuge and the freezing calorimeter is presented. Results from measurements over a two-month period in the Colorado mountains in the winter of 1978 indicate serious disagreement between these two methods. Some reasons for the disagreement are presented and verified. This raises some important questions pertaining not only to what the two methods actually measure, but also which methods may be appropriate for particular applications. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-13320 Syracuse Univ., N. Y.
A FILAMENTARY MULTIPOLE MODEL FOR CYLINDRICAL ANTENNAS Ph.D. Thesis
Tzeyang Jason Chou 1979 197 p
Avail: Univ. Microfilms Order No. 7925559

A Taylor series expansion is applied to the Green's function of the vector potential for an arbitrary body resulting in a multipole source representation for the surface current. The method is applied to treat moderately thin wires. The current flowing on the wire surface is represented by a set of electric and magnetic axial filamentary multipole currents. The method of moments is used to solve the current distributions. The quantities of interest such as near field, far field, backscattering cross sections, etc. are then derived. The appropriate end boundary conditions for the tube and flat cap antennas are considered. Two approaches to treat these conditions within the multipole model are presented. Computer programs are developed in FORTRAN 4 to treat (1) single wire with flat caps, (2) parallel tube wires, and (3) skewed tube wires. Dissert. Abstr.

N80-13321 Columbia Univ., New York.
MATHEMATICAL PROBLEMS ARISING FROM PASSIVE INTERMODULATION INTERFERENCE IN COMMUNICATIONS SATELLITES Ph.D. Thesis
Kai Yin Eng 1979 175 p
Avail: Univ. Microfilms Order No. 7924879

The mathematical problems of passive intermodulation (PIM), identified as a potential cause of interference to the ultrasensitive receiver onboard spacecraft are examined. An essential feature of the PIM problem is that the product causing interference is usually of a high order. The general behavior of the high-order intermodulation products (IMP's) is investigated and rate of decrease of the IMP's is shown to depend essentially on the degree of nonlinearity of the transfer function. Some IM output spectra are illustrated by using the Fourier series method of analysis and some hypothetical nonlinearities. It is demonstrated that many IMP's can exist at a particular frequency of interest, resulting in a very complicated output spectrum for the multiple carrier case. The type and order prediction problem is identified as the main problem. Dissert. Abstr.

N80-13322 Wisconsin Univ. - Madison.
ESTIMATION OF THE SPECTRAL MOMENTS AND QUADRATURE CROSS-CORRELATION FUNCTIONS AND THEIR APPLICATION TO TROPOSCATTER SYSTEMS Ph.D. Thesis
Ashok Kumar Gupta 1979 284 p
Avail: Univ. Microfilms Order No. 7918894

Aspects of statistical communication theory and signal processing are applied to troposcatter communications. Some of the techniques proposed require the estimation of the first moment (average frequency) and the third central moment (skew measure) of the spectrum of the received baseband complex process which is assumed to be a heterodyned narrow band Gaussian process when a CW carrier is transmitted. Pursuit of the simplified signal processing of these estimators resulted in distorting one or both quadrature components of the complex process by zero memory nonlinear devices, such as the hard clipper. Both variance and signal to noise ratio of these estimators of the spectral moments for distorted and undistorted quadrature components are computed to evaluate the performance of the proposed alignment techniques under various tropo-channel conditions. The variance of a class of correlation detectors, termed quadrature cross correlation detectors, which cross correlate two zero mean distorted and undistorted Gaussian quadrature components, are discussed. Dissert. Abstr.

N80-13323 Montana State Univ., Missoula.
A INTRUSIVE SLOTTED CYLINDER ANTENNA ARRAY FOR SUBSURFACE MOISTURE PROFILING Ph.D. Thesis
David Leo Herrick 1979 186 p
Avail: Univ. Microfilms Order No. 7925067

Theoretical analysis and measured performance of an intrusive microwave probe for sensing the distribution of soil moisture from near surface to root zone depths (1-2 m) are presented. The probe consists of a linear array of slot antennas mounted along the axis of a metal cylinder and is intended for borehole installation. Measurements of self and mutual slot antenna admittances are used to derive a discrete depth profile of the soil's complex permittivity. The moisture distribution is then deduced from this permittivity profile by empirical relations. Dissert. Abstr.

N80-13324 Syracuse Univ., N. Y.
A STUDY OF A REACTIVELY LOADED FINITE PLANAR RECTANGULAR WAVEGUIDE ANTENNA ARRAY Ph.D. Thesis

John L. Luzwick 1979 124 p
Avail: Univ. Microfilms Order No. 7925581

The antenna arrays considered have a single waveguide-fed aperture, no complex feed network to all of the apertures, and one reactive load (shorted waveguide) for each remaining aperture. Each antenna is characterized in terms of power gain, bandwidth, and match. Several examples of magnitude pattern synthesis are presented to show antenna pattern limitations for a given antenna geometry and excitation. In addition, an example using a double frequency synthesis procedure is given for reshaping gain versus frequency characteristics in the endfire direction. Numerical techniques (optimization algorithms) are used to find reactive loads for both maximum gain in a specified direction and synthesized pattern. A brief summary is given of the major computer program subroutines used in generating the calculated results. Dissert. Abstr.

N80-13325 Southern Methodist Univ., Dallas, Tex.
RADIATION FIELDS OF DIELECTRIC OPTICAL WAVEGUIDES Ph.D. Thesis
Marion Wayne Scott 1979 143 p
Avail: Univ. Microfilms Order No. 7925674

A method of measuring the far field radiation pattern of dielectric optical waveguides is presented. The patterns of three layer and five layer structures, obtained using this technique, are given. Matching the experimental results with patterns calculated using the theory of layered waveguides determines the geometry and index of refraction profile of the waveguide. Dispersion characteristics and radiation fields of an optical stripline waveguide radiating into free space are calculated. The halfpower beamwidth of the fundamental mode in a plane parallel to the dielectric layers is used as an indication of the degree of optical confinement under the stripe. Plots of the beamwidth versus the various waveguide parameters indicate the parameter values which give the best optical confinement. An approximate, and computationally simpler, method of calculating this beamwidth is also discussed. Dissert. Abstr.

N80-13326 Iowa State Univ. of Science and Technology, Ames.
HARMONIC CURRENT PROPAGATION ON AC SYSTEMS DUE TO HUDC LINKS Ph.D. Thesis
Richard Dean Shultz 1979 140 p
Avail: Univ. Microfilms Order No. 7924271

A method is presented for analyzing characteristic harmonic current propagation into an AC system due to an AC/DC conversion. Frequency dependent models of AC network elements were developed for the appropriate range of frequencies. These models are then assembled into a modified bus impedance matrix for analysis. The methodology was then applied to two different systems and the responses of individual elements and the system as a whole were observed. The harmonic current flows in the system appear to be related to certain characteristics of the system and its elements. Input impedances at harmonic frequencies, the magnitude of shunt capacitances of transmission lines, the size and location of the converters, and the representation of system loads are factors in determining the magnitude of harmonic current flows in system elements. Dissert. Abstr.

N80-13327 Stevens Inst. of Tech., Hoboken, N. J.
AN INVESTIGATION OF THE EFFECTS OF ANALOG AND DIGITAL SYSTEMS ON SIGNAL FIDELITY Ph.D. Thesis
Bahig Mikhail Philobos 1979 142 p
Avail: Univ. Microfilms Order No. 7925054

The distortion of the output of analog and digital filters caused by the deviation of their characteristics from the ideal filter characteristics is presented. Bounds on errors present in the output signals of analog and digital filters are evaluated in terms of the signal's effective bandwidth and energy and the filter's parameters. Design procedures for linear phase analog and digital filters, incorporating these bounds, are obtained. Dissert. Abstr.

N80-13328 Kansas Univ., Lawrence.
DESIGN AND FABRICATION ON MICROSTRIP DISK ANTENNA ARRAYS Ph.D. Thesis
Frank Gary Parks 1979 185 p
Avail: Univ. Microfilms Order No. 7925874

A microstrip array project was conducted to demonstrate the feasibility of designing and fabricating simple, low cost, low sidelobe phased arrays with circular disk microstrip radiating elements. Design data were presented for microstrip elements and arrays including the effects of the protective covers, the mutual interaction between elements, and stripline feed network design. Low cost multilayer laminate fabrication techniques were also investigated. Utilizing this design data two C-band low sidelobe arrays were fabricated and tested: an eight element linear and a sixty-four element planar array. These arrays incorporated stripline Butler matrix feed networks to produce a low sidelobe broadside beam. Dissert. Abstr.

N80-13329 Southern Methodist Univ., Dallas, Tex.
AUTOREGRESSIVE ACQUISITION AND INTERFERENCE-TEST CODING FOR SPREAD SPECTRUM COMMUNICATIONS Ph.D. Thesis
Ahmed Kamel Elhakeem 1979 155 p
Avail: Univ. Microfilms Order No. 7925422

Techniques for acquiring the codes used in Frequency Hopping (FH), Hybrid Frequency Hopping/Time Hopping (FH/TH), and Frequency Hopping/Direct Sequence (FH/DS) spread spectrum systems are presented. Autoregressive Spectral Estimation is employed to recover the FH code. Quadrature Processing is used for the DS code, while the TH gating code is recovered by a simple threshold test used in conjunction with the adaptive filter used for the spectral estimation. A wide margin of spectral estimation errors can be tolerated since an acquisition logic is used to estimate the FH code phase. The hardware implementation is quite simple and while other schemes of serial and parallel search require acquisition times of the order of the code lengths, the proposed techniques require acquisition times only of the order of the shift register generator lengths. Dissert. Abstr.

N80-13330 Wisconsin Univ. - Madison.
STIMULATED THOMSON SCATTERING Ph.D. Thesis
Ross Loren Spencer 1979 152 p
Avail: Univ. Microfilms Order No. 7921580

The theory of stimulated Thomson scattering is investigated both quantum mechanically and classically. Two monochromatic electromagnetic waves of like polarization travelling in opposite directions are allowed to interact for a time with the electrons in a collisionless plasma. With the difference frequency well above the plasma frequency, the rate at which energy is transferred from one wave to the other is calculated quantum mechanically, classically from a fluid theory, and classically from an independent electron theory. The rate is calculated in both the homogeneously broadened limit, and in the inhomogeneously broadened limit. In the unsaturated limit, the three calculations agree. The classical calculations yield the phase shift of the waves due to stimulated Thomson scattering. The fluid theory shows how stimulated Thomson scattering passes into stimulated Raman scattering as the difference frequency approaches the plasma frequency. The independent electron theory shows how the effect saturates due to nonlinear Landau damping. Dissert. Abstr.

N80-13331 California Univ., Los Angeles.
DIGITAL DETECTION BY DIGITAL SIGNAL PROCESSING TECHNIQUES Ph.D. Thesis
Sam Reisenfeld 1979 319 p
Avail: Univ. Microfilms Order No. 7926054

A digital receiver is modeled in which digital detection is accomplished by digital signal processing. A fundamental limitation of the achievable detection performance is the addition of quantization noise by the analog to digital converter to the detection statistic. The limitations of the error probability performance of a detector structurally constrained to operate upon L quantized samples of the filtered channel observation waveform are analytically derived. For a fixed quantizer, the minimum error probability post quantization signal processing structure is derived. The minimum error probability quantizer and performance are found, and these results are compared to the results for the case of the quantizer which maximizes the signal to noise ratio of the detection statistic. Dissert. Abstr.

N80-13332 Yale Univ., New Haven, Conn.
PARAMETER ESTIMATION NARROW-BAND PROCESSES WITH ARRAYS Ph.D. Thesis
1979 164 p

Avail: Univ. Microfilms Order No. 7927219

Array processing of narrow band signals in noise is examined with emphasis on the estimation of delay and bearing. Barankin bounds are derived for situations in which ambiguity errors are important. For sinusoidal signals the results indicate that sensor spacings of more than a half wavelength lead to unnecessary errors. In some (but not all) situations sensor spacings below a half wavelength also result in performance degradations. Hence the conventional half wavelength setting has a strong claim to optimality. For Gaussian signals and wide sensor spacing one finds that the Barankin bound exhibits a sharp threshold effect at a critical signal to noise ratio where ambiguity errors disappear. Various procedures for reducing ambiguity errors are discussed.
Dissert. Abstr.

N80-13333*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPERATIONAL PROCEDURES FOR GROUND STATION OPERATION: ATS-3 HAWAII-AMES SATELLITE LINK EXPERIMENT
Kenji Nishioka and Emanuel H. Gross Dec. 1979 31 p
(NASA-TM-81155; A-8011) Avail: NASA, Ames Research Center, Moffett Field, Calif. 94035 CSCL 17B

Hardware description and operational procedures for the ATS-3 Hawaii-Ames satellite computer link are presented in basic step-by-step instructions. Transmit and receive channels and frequencies are given. Details such as switch settings for activating the station to the sequence of turning switches on are provided. Methods and procedures for troubleshooting common problems encountered with communication stations are also provided.
R.E.S.

N80-13334*# Axiomatix, Los Angeles, Calif.
ORBITER CIU/IUS COMMUNICATIONS HARDWARE EVALUATION Summary Report no. 2
Gaylord K. Huth 30 Nov. 1979 411 p refs
(Contract NAS9-15409)
(NASA-CR-160404; R7911-5) Avail: NTIS HC A18/MF A01 CSCL 17B

The DOD and NASA inertial upper stage communication system design, hardware specifications and interfaces were analyzed to determine their compatibility with the Orbiter payload communications equipment (Payload Interrogator, Payload Signal Processors, Communications Interface Unit, and the Orbiter operational communications equipment (the S-Band and Ku-band systems). Topics covered include (1) IUS/shuttle Orbiter communications interface definition; (2) Orbiter avionics equipment serving the IUS; (3) IUS communication equipment; (4) IUS/shuttle Orbiter RF links; (5) STDN/TDRS S-band related activities; and (6) communication interface unit/Orbiter interface issues. A test requirement plan overview is included.
A.R.H.

N80-13335# Hughes Aircraft Co., Culver City, Calif. Radar Microwave Lab.
EQUIVALENCE PRINCIPLE AS APPLIED TO CONICAL ARRAYS Final Report
A. T. Villeneuve Apr. 1979 2 p
(Contract N00014-78-C-0617)
(AD-A073384; HAC-Ref-E3804) Avail: NTIS HC A02/MF A01 CSCL 09/5

The program 'Equivalence Principle As Applied To Conical Arrays' has been successfully completed. The equivalence principle pattern synthesis technique has been used to provide aperture distributions for an experimental conical array. The array consisted of thirty-seven crossed-slot elements on a cone of half-angle 10.25 degrees and was operated at 3.185 GHz. Radiation patterns were measured for two beam pointing directions, one 50 deg. from the cone tip and the second normal to the conical surface. Excellent agreement was obtained between measured patterns and calculated patterns. It is concluded that the technique can be used successfully to synthesize radiation patterns from arrays on conical and other curved surfaces.
GRA

N80-13336# Rome Air Development Center, Griffiss AFB, N.Y.
POSITIONAL ERROR ANALYSIS, A-10 AIRCRAFT ON THREE-AXIS GROUND MOUNT Technical In-house Report, Jun. 1977 - Dec. 1978
Jerome P. Scheiderich and William J. Bocchi Jul. 1979 71 p
(AF Proj. 2114)
(AD-A073600; RADC-TR-79-220) Avail: NTIS HC A04/MF A01 CSCL 13/9

This report describes a test that was performed to determine the truth orientation of an A-10 aircraft mounted on a Scientific Atlanta Inc., Model PAEA-85 three-axis positioner at the Rome Air Development Center Newport Antenna Test Annex, and to estimate the errors inherent in using the aircraft positioning system in the process of antenna pattern testing. The report describes the following aspects of this effort: (1)Establishment of a reference coordinate system for the aircraft, and alignment of the aircraft on the positioner, (2) Description of the inclinometer system used for determining the aircraft orientation, (3) Test procedures, (4) Discussion of results, (5) Summary of errors, and (6) Conclusions and recommendations for the guidance of personnel using the system for aircraft antenna pattern testing. The total system error was determined to be less than 0.683 degrees for a pitch maneuver, and less than 0.533 degrees for a roll maneuver.
GRA

N80-13337# Lee (J. S.) Associates, Inc., Arlington, Va.
ERROR PERFORMANCE OF DIFFERENTIALLY COHERENT DETECTION OF BINARY DPSK DATA TRANSMISSION ON THE HARD-LIMITING SATELLITE CHANNEL Final Report
Jhong Sam Lee, Robert H. French, and Yoon K. Hong Aug. 1979 101 p refs
(Contract N00014-77-C-0056)
(AD-A073377; JTR-79-06) Avail: NTIS HC A06/MF A01 CSCL 17/2

The error performance of a differentially coherent detection method of binary differential phase-shift keying (DPSK) system operating over a hard-limiting satellite channel is derived. The main objective of our derivation was to observe the extent of error rate degradation of a DPSK system due to unequal power levels and noise correlations between the two adjacent time slot pulses. In practice, the power imbalance, or equivalently SNR imbalance, is induced by such phenomena as intersymbol interference and/or errors in phase delay in the 'one-bit-delayed' reference input. The noise correlation is a practical assumption since the noise is necessarily band limited in the system. Error probabilities are given as a function of uplink SNR with different levels of SNR imbalances and different downlink SNR as parameters. It is discovered that, while SNR imbalance affects error performance, the probability of error is independent of noise correlation if the symbol probabilities are equal.
GRA

N80-13338# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
DYNAMIC BEHAVIOR OF SHORTEST PATH ROUTING ALGORITHMS FOR COMMUNICATION NETWORKS
Dimitri P. Bertsekas Aug. 1979 52 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A073487; LIDS-P-931) Avail: NTIS HC A04/MF A01 CSCL 17/2

Several proposed routing algorithms for store and forward communication networks, including one currently under implementation in the ARPANET, route mesages along shortest paths computed by using some set of link lengths. When these lengths depend on current traffic conditions as they must in an adaptive algorithm, dynamic behavior questions such as stability, convergence, and speed of convergence are of interest. This paper is the first attempt to analyze systematically these issues. It is shown that minimum queuing delay path algorithms tend to exhibit violent oscillatory behavior in the absence of a damping mechanism. Several easily implementable damping schemes are proposed and analyzed by using nonlinear stability theory techniques.
GRA

N80-13339# Guidance Systems, Inc., Andover, Mass.
OVERLAPPED SUB-ARRAY SCANNING ANTENNA STUDY Final Report
G. Ploussios Griffiss AFB, N.Y. RADC May 1979 70 p refs
(Contract F19628-78-C-0069; AF Proj. 4600)
(AD-A070939; RADC-TR-79-101) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report refers to an investigation of new phased array techniques using overlapping multiple beam elements. It is shown that this technique can be applied to a wide variety of electronically

scanned system requirements. Two designs, one for limited scan and the other for wide angle scan with a minimum number of elements and phase shifters were selected for the reported computer analysis. The results indicate extremely low sidelobe levels over most of the angular sector while limiting the close-in sidelobes to no more than -20 dB and grating lobe levels to peak values of about -14 dB for some scan locations. The limited scan design utilizes 18 eight-port Bulter matrices, 18 phase shifters, and 9 SP2T switches to achieve 20 BW's of a + or - 10 deg scan. The wide-angle design provides 90 BW's of scan + or - 45 deg) with 26 eight-port matrix elements, 26 phase shifters and 26 SP4T switches. The analysis of the new scan array technique indicates that the array performance can be further improved at the cost of additional elements and element complexity. GRA

N80-13340# SRI International Corp., Menlo Park, Calif.
LIDAR OBSERVATIONS AT 0.7-MICROMETERS AND 10.6-MICROMETERS WAVELENGTHS DURING DUSTY INFRARED TEST I (DIRT I)
Jan E. vanderLaan Jul. 1979 57 p
(Contract DAAG29-77-C-0001)
(AD-A073330; SRI-TR-3; ARO-13833.4-GS) Avail: NTIS HC A04/MF A01 CSCL 17/5

This technical report describes lidar measurements and results using a 10.6 micrometers lidar and the Mark 9 (0.7 micrometers) lidar systems during the Dusty Infrared Test I (DIRT I). Transmission comparisons are made between the two wavelengths with artillery barrages, TNT explosions, and oil/rubber fire-generated dust and smoke clouds in a test zone midway (1 km) along the lidar path. A target at the end of the lidar path provided a reference backscatter return for the transmission measurements. Backscatter properties of the dust and smoke clouds are also discussed. Results of the DIRT I program indicate that the broad particle size distribution present in the dust generated produced little if any wavelength dependent transmission effects. The few observed exceptions where greater 10.6 micrometers transmission is indicated generally can be explained by the presence of wavelength-dependent smoke along the optical path, which is also generated by the detonations. Backscatter-to-transmission relationships are grossly related but, in general, are quite nonlinear, as can be expected when multiple and specular scatter by the large particles, as well as strong attenuations, are involved. The oil/rubber fire generated dense black smoke that was totally opaque to the 0.7 micrometers lidar, while the 10.6 micrometers transmission measurements indicate a worse-case transmission of approximately 6%. GRA

N80-13341# California Univ., Livermore. Lawrence Livermore Lab.
EFFICIENT NUMERICAL PROCEDURE FOR MODELING ANTENNAS OVER LOSSY EARTH
G. J. Burke and J. N. Brittingham 12 Jul. 1979 9 p refs
Presented at AGARD Meeting, Spatind, Norway, 10 Sep. 1979
(Contract W-7405-eng-48)
(UCRL-82121; CONF-790908-1) Avail: NTIS HC A02/MF A01

A procedure is described which permits the direct use of the Sommerfeld integral in such a way that is fast, without compromising accuracy, and permits modeling antennas very close to the interface. An efficient interpolation technique is used to obtain the Sommerfeld integral values from a precomputed table. Also, the dominant singular component of the field is separated out and the integration of this component over the current is done analytically to permit evaluation for wires very close to the interface. DOE

N80-13342# Electro Magnetic Applications, Inc., Albuquerque, N. Mex.
RECEIVING PROPERTIES OF THE SMALL ANNULAR SLOT ANTENNA
D. E. Merewether, R. B. Cook, and R. Fisher 29 Sep. 1978 19 p refs
(Contract EY-76-C-04-0789)
(SAND-78-7067) Avail: NTIS HC A02/MF A01

An analytical formula for the effective height of an annular slot antenna is determined using the reciprocity theorem. The result generalizes the previously available monochromatic result and yields an equivalent circuit valid for computing the transient response of the smaller annular slot antenna. This method is compared with finite difference predictions of equivalent circuit parameters. DOE

N80-13343# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computer Science.
BRITISH POST OFFICE VIEWDATA INTERFACING TO A DATA COMMUNICATION NETWORK
A. T. Davies Aug. 1978 25 p refs
(NPL-DNACS-1/78) Avail: NTIS HC A02/MF A01

The transmission of textual and simple graphical information in serial form via modems connected to the P.O. Public Switched Telephone Network (VIEWDATA) is described. The system is interactive, making use of a keyboard for input, and usually a color television receiver modified to accept and display teletext type information for display. It provides for on line access to a data base of useful information for the general public and business community. The interfacing of VIEWDATA to the N.P.L. data communication network is described together with some consequences of the differences between terminal types and communication conventions. J.M.S.

N80-13344# Standard Elektrik Lorenz A.G., Stuttgart (West Germany). Unternehmensgruppe Nachrichtentechnik.
FEASIBILITY STUDY FOR SPACELAB USER PROGRAM: PROPAGATION OF ELECTROMAGNETIC WAVES Final Report
Andreas Bethmann, Georg Herzog, Peter Kreutzer, Dietrich Rother, Rolf Stiefel, and Kurt Taenzer Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1978 192 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1076; DFVLR-01-QV-376)
(BMFT-FB-W-78-10) Avail: NTIS HC A09/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 40.35

The feasibility of Spacelab experiments concerning electromagnetic wave propagation was studied. Propagation measurements between 10 KHz and 100 KHz were considered. Equipment and technology limitations are defined, following a survey of user requirements, state of the art, and near-term development possibilities. The influence of these factors on terrestrial and satellite transmission capabilities is noted. The characteristics of frequency dependence on propagation mode are shown. Finally, the availability of suitable ground stations to assist in these experiments as well as the availability of measuring devices and antennas are discussed. A system is then proposed that consists of pallet mounted steerable spacecraft antennas, a set of receivers, and means for automatic signal processing along with onboard data recording. Author (ESA)

N80-13345# Defence Research Information Centre, Orpington (England).
THE PROPAGATION OF VLF WAVES THROUGH THE INTERIOR OF THE EARTH
W. Bitterlich (Innsbruck Univ.) London Apr. 1979 41 p refs
Trans. into ENGLISH from Acta Phys. Austriaca (Austria), v. 26, no. 2/3, 1967 p 183-210 Sponsored by Procurement Executive Min. of Defence
(DRIC-Trans-5572; BR68392) Avail: NTIS HC A03/MF A01

The propagation of low frequency electromagnetic waves through solid media (interior of the Earth) was studied in theory and through experiments in the frequency range of 3 to 30 kHz/sec. The instruments used are described. The influence of the electrical parameters of rock on the wave propagation and their measurement is also discussed. Initial results are given and further investigations are suggested. Author (ESA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-13346 Drexel Univ., Philadelphia, Pa.
A FUNCTIONAL SIMULATION SYSTEM FOR MSI AND LSI SYSTEMS Ph.D. Thesis

Edward Lee Hepler 1979 147 p
Avail: Univ. Microfilms Order No. 7918484

The implementation of a functional digital logic simulation system is considered. Four programs which perform the simulation process are described. The first program compiles logic element descriptions which have been written in a high level hardware design language into tables which describe the function of each logic element. The logic elements which have been described may then be interconnected to form a circuit to be simulated. The second program compiles a network description of the circuit into a set of tables which includes each element's inputs and each signal's fanout. The third program uses the tables produced by the first two programs, along with input stimuli provided by the user to simulate the circuit functionally. The simulator is table driven and uses selective trace. Output from the simulation program may be formatted for increased readability by a fourth program. An example circuit, which uses typical MSI modules, is simulated. Dissert. Abstr.

N80-13347 George Washington Univ., Washington, D. C.
A NEW WEIGHTING COEFFICIENT FOR ADAPTIVE STATE ESTIMATION Ph.D. Thesis
Michael George Harris 1979 97 p
Avail: Univ. Microfilms Order No. 7924364

An adaptive filter for the continuous parameter vector case, using a finite bank of filters weighted by coefficients based on an estimated distance in the parameter space (rather than approximations to the conditional probability) is presented. The method requires the availability of an estimate of the parameter for use in the computation of the weighting coefficient. A description of an application to an aircraft estimation problem during some of the phases of the final approach is given. Results obtained from a digital simulation of the aircraft dynamics, and the adaptive filter using (microwave landing system) guidance data and on-board sensors are presented. A comparison of the adaptive filter and the least mean square error filter using simulation results is also made. Dissert. Abstr.

N80-13348 Carnegie-Mellon Univ., Pittsburgh, Pa.
PROCESS ORIENTED DESIGN AIDS FOR VERY LARGE SCALE INTEGRATED CIRCUITS Ph.D. Thesis
Masaaki Kamiya 1979 153 p
Avail: Univ. Microfilms Order No. 7919146

Process oriented circuit design aids to simulate the more complex circuits, and still accurately reflect the smaller size MOS transistor characteristics are developed. Precise device modeling for small size MOSFET's, process characterization in connection with device model parameters, and development of the presently available high level LSI logic circuit simulator (MOTIS), compatible with a general purpose circuit analysis program such as SPICE, are among the topics discussed. A narrow channel effect to complete the device model for small size MOSFET's is introduced along with automated model parameter extraction computer routines, associated with IC process characterization capable of accurate simulation of circuit functions from IC fabrication process and mask layout information alone. The development of MOTIS so that it can accurately simulate LSI logic circuits consisting of various size MOSFET's, reflecting not only short-channel effects but also narrow channel effects is included. The capability to simulate IC's with process and mask layout as input description is provided. Dissert. Abstr.

N80-13349 Michigan Univ., Ann Arbor.
CHARACTERISTICS OF TRAPATT AMPLIFIERS Ph.D. Thesis
Richard Keith Mains 1979 194 p
Avail: Univ. Microfilms Order No. 7925189

Computer programs were developed to separately simulate the TRAPATT diode and the circuit, and the two were coupled to perform device-circuit interaction simulations. The device program solves Poisson's equation, the continuity equation, and the expressions for current in one dimension. The circuit program simulates the traveling waves in a slug-tuned coaxial line, and also solves for voltages and currents in lumped element networks using the state variable technique. A circuit experimentally found to achieve broadband amplification is simulated. The device waveforms are shown over the frequency band of operation, and the mechanisms causing the gain to fall off above and below the center frequency are explained. A coaxial circuit experimentally found to operate as a TRAPATT oscillator is simulated as a narrow band locked oscillator. From an extrapolation of these results, a prediction of the maximum possible bandwidth achievable in a TRAPATT amplifier is given. Dissert. Abstr.

N80-13350 Columbia Univ., New York.
THEORETICAL AND EXPERIMENTAL STUDIES OF PERIODIC CURRENTS AND POTENTIALS IN ELECTROPLATING AND IN FAST KINETICS ON A ROTATING DISK ELECTRODE Ph.D Thesis
Krishnan Viswanathan 1979 136 p
Avail: Univ. Microfilms Order No. 7924996

A systematic investigation of mass transfer rates to a rotating disk electrode under periodic currents and potentials is presented. Included are: (1) A numerical solution was obtained for mass transfer to a rotating disk electrode under pulsed current conditions; (2) A method based on a combination of pulsed electrolysis and stirring was developed to study fast electrode reactions; (3) A general solution was derived for the mass transfer to a rotating disk electrode under periodic currents; (4) A numerical solution was presented to calculate the instantaneous current density under pulsed potential conditions for intermediate and large cycle times; (5) The calculation of the maximum electrolysis rates under intermittent potential conditions was discussed; and (6) A calculation was made on the current efficiencies when two competing but irreversible reactions take place at the electrode surface under pulsed current conditions. Dissert. Abstr.

N80-13351 City Univ. of New York, N. Y.
ON THE DESIGN AND REALIZATION OF TWO DIMENSIONAL DIGITAL FILTERS Ph.D. Thesis
Bu-Chin Wang 1979 174 p
Avail: Univ. Microfilms Order No. 7923775

A two-dimensional rectangular digital filter class is presented. Design methods applicable to this class of filter are presented and illustrated by several examples. A real-time parallel processing hardware realization method for 2-D finite-impulse-response and infinite-impulse-response filters was proposed and illustrated by examples. The realization of filters of high order was made possible by hardware saving techniques, such as the replacement of multipliers by ROM's. In the case of linear phase FIR filters, the additional techniques of system function factorization and of code conversion leads to further hardware saving. Two high-speed processing methods, one using section-by-section data processing and the other using microprocessor replacement of single hardware channels, were discussed. Future applications of 2-D parallel processors were described. Dissert. Abstr.

N80-13352 Oklahoma Univ., Norman.
COUNT STATE ANALYSIS OF A DIGITAL PHASE LOCKED LOOP Ph.D. Thesis
Joseph Herman Wenzel 1979 262 p
Avail: Univ. Microfilms Order No. 7925647

A summary is presented which considers the application of research on digital phase locked loops to the optimized design of an FM demodulator for 10.7 Mhz which employs synchronization to minimize digital jitter. Possible extensions of this research are discussed. Dissert. Abstr.

N80-13353 Oklahoma Univ., Norman.
FAULT TEST GENERATION FOR SEQUENTIAL CIRCUITS: A SEARCH DIRECTING HEURISTIC Ph.D. Thesis
Kofi Emmanuel Torku 1979 185 p
Avail: Univ. Microfilms Order No. 7923790

The use of Petri nets to model the register transfers and change of control states in a sequential machine described in a Computer Hardware Description Language (CHDL) with the aim of guiding state space searches is proposed. Each fault to be detected defines a set of goal nodes for the state space search. These goal nodes together with a CHDL description of the circuit are used to generate a Petri net. Some portions of this process are invariant with respect to the goal states, depending entirely on the CHDL description. Four case studies are presented to test the effectiveness of the guidance mechanism. The results

show that the developed model is a promising tool that can be used in fault test set generation in complex sequential circuits. Dissert. Abstr.

N80-13354 Southern Methodist Univ., Dallas, Tex.
TWO-DIMENSIONAL SEQUENTIAL ALGORITHMS FOR IMAGE RESTORATION AND ENHANCEMENT Ph.D. Thesis
John Andrew Jesudoss Rajan Ponnusamy 1979 109 p
Avail: Univ. Microfilms Order No. 7925421

The development of a mathematical model for restoration and enhancement of noisy images is described. Two spatially invariant two-dimensional Markov models are developed assuming separable, exponential, diamond symmetric and circularly symmetric image correlation functions. A sequential minimum variance estimation algorithm for a discrete two-dimensional image field modeled by a nonsymmetric half-plane model is derived. A modification of the algorithm to facilitate in-place computation is presented and its implementation discussed. Approximation techniques to reduce the processing time and memory requirements are presented. Dissert. Abstr.

N80-13355 Syracuse Univ., N. Y.
DETECTION AND MMSE ESTIMATION OF NONLINEAR MEMORYLESS FUNCTIONALS OF RANDOM PROCESSES USING THE VOLTERRA FUNCTIONAL EXPANSION Ph.D. Thesis
Richard Jos Kenefic 1979 200 p
Avail: Univ. Microfilms Order No. 7925641

A Volterra functional expansion is derived for the likelihood ratio used in the detection of a nonlinear memoryless functional of a random process. This expansion is reduced to well known results for the special case of detection of a Gaussian process. For the case of detection of a nonlinear memoryless functional of a stationary Gaussian random process, it is shown that the likelihood ratio has an asymptotic form for which performance can be obtained provided the nonlinearities and processes satisfy Sun's theorem. Dissert. Abstr.

N80-13356 Yale Univ., New Haven, Conn.
RESONANT RAMAN SCATTERING FROM ELECTRON-PHONON COUPLED MODES IN 3-V SEMICONDUCTORS Ph.D. Thesis
Roger Lee Farrow 1979 278 p
Avail: Univ. Microfilms Order No. 7927624

First-order Raman scattering in GaSb, InSb, and InAs was investigated for laser wavelengths near the E sub 1 and E sub 1 + delta sub 1 L-direction band gaps. At 90 K the intensity of the symmetry-forbidden LO peak in p-type GaSb and InSb was observed to increase rapidly as resonance was approached, accompanied by the appearance of a strong scattering background close to resonance. In addition, the LO lineshape became distorted when the background intensity was present, resembling the interference lineshapes described by Fano for interacting discrete-continuum scattering. Far above resonance, the phonon peak had a narrow, Lorentzian lineshape and the background intensity was absent. Two-phonon resonant Raman scattering in GaSb was investigated in an attempt to observe iterated electron-one-phonon contributions to second-order scattering at the E sub 2 and E sub 1 + delta sub 1 gaps. Dissert. Abstr.

N80-13357 Louisiana State Univ. and A&M Coll., Baton Rouge.
AN EXPLICIT STATE MODEL OF A SYNCHRONOUS MACHINE - TRANSFORMER - SCR BRIDGE UNIT Ph.D. Thesis
Farrokh Shokooh 1979 105 p
Avail: Univ. Microfilms Order No. 7927547

A rigorous mathematical model of a synchronous machine-transformer-thyristor bridge unit is presented in an explicitly expressed state space form with coefficients which are explicit functions of conventional parameters. The use of the model is demonstrated by considering the charging circuit of a high power pulse generating system as the dc network. An illustrative set of simulation results is shown from which relevant information is obtained. Comparison of the simulation results of the full order model and approximate models shows that the system can be accurately represented by a third order reduced model for the short term response and by a second order reduced model for the long term response. The results also show that the harmonics contents of the machine line currents are reduced by using a delta-Y or Y-delta transformed connection. Finally, it is found that the effect of the transformer magnetization current is negligible. Dissert. Abstr.

N80-13358 Minnesota Univ., Minneapolis.
ANALYSIS OF THE ANODE BOUNDARY LAYER OF A HIGH PRESSURE-HIGH CURRENT ARC Ph.D. Thesis
Horia Alexander Dinulescu 1979 246 p
Avail: Univ. Microfilms Order No. 7926116

The detailed structure of the anode boundary layer was investigated by solving the nonequilibrium plasma conservation equations. The plasma conservation equations for the arc as a whole were derived from Boltzmann's kinetic theory. The solution of the anode boundary layer equations was obtained by a numerical procedure with the aid of a FORTRAN computer program. Among the most significant findings are the occurrence of a negative anode potential fall and the counter-current motion of the positive ions in the immediate vicinity of the anode. The variation within the boundary layer of the species temperature, electric field, positive current, charge carrier number, as well as various transport properties employed in the conservation equations are given in graphical form for five values of the arc current density in the range from 600 A/squared cm to 3000 A/squared cm. Dissert. Abstr.

N80-13359*# Hughes Aircraft Co., Newport Beach, Calif. Solid State Products Div.
DESIGN, PROCESSING AND TESTING OF LSI ARRAYS, HYBRID MICROELECTRONICS TASK Final Report, 28 Sep. 1978 - 28 Sep. 1979
R. P. Himmel, S. M. Stuhlbarg, R. G. Ravetti, P. J. Zulueta, and C. W. Rothrock 15 Oct. 1979 122 p refs
(Contract NAS8-32607)
(NASA-CR-161337; FR-79-92-1187; HAC-E07711) Avail: NTIS HC A06/MF A01 CSCL 09C

Mathematical cost models previously developed for hybrid microelectronic subsystems were refined and expanded. Rework terms related to substrate fabrication, nonrecurring developmental and manufacturing operations, and prototype production are included. Sample computer programs were written to demonstrate hybrid microelectric applications of these cost models. Computer programs were generated to calculate and analyze values for the total microelectronics costs. Large scale integrated (LST) chips utilizing tape chip carrier technology were studied. The feasibility of interconnecting arrays of LSU chips utilizing tape chip carrier and semiautomatic wire bonding technology was demonstrated. R.C.T.

N80-13360*# LinCom Corp., Pasadena, Calif.
SHUTTLE GPS R/PA CONFIGURATION AND SPECIFICATION STUDY Final Report
R. W. D. Booth 30 Oct. 1979 56 p Sponsored in part by Rockwell Intern., Downey, Calif.
(Contract NAS9-15815)
(NASA-CR-160396; TR-1080-1779) Avail: NTIS HC A04/MF A01 CSCL 09C

Changes in the technical specifications for a global positioning system (GPS) receiving system dedicated to space shuttle use are presented. Various hardware functions including acquisition, tracking, and measurement are emphasized. The anti-jam performance of the baseline GPS systems are evaluated. Other topics addressed include: the impact on R/PA design of the use of ground based transmitters; problems involved with the use of single channel tests sets; utility of various R/PA antenna interconnections topologies; the choice of the averaging interval for delta range measurements; and the use of interferometry techniques for the computation of orbiter attitude were undertaken. R.C.T.

N80-13361*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF 22.4-kW NONLAMINATED-FRAME dc SERIES MOTOR WITH CHOPPER CONTROLLER Final Report
John R. Schwab Sep. 1979 25 p refs
(Contract EC-77-A-31-1044)

(NASA-TM-79252; DOE/NASA/1044-79/4; E-163) Avail: NTIS HC A02/MF A01 CSCL 09C

Performance data obtained through experimental testing of a 22.4 kW traction motor using two types of excitation are presented. Ripple free dc from a motor-generator set for baseline data and pulse width modulated dc as supplied by a battery pack and chopper controller were used for excitation. For the same average values of input voltage and current, the motor power output was independent of the type of excitation. However, at the same speeds, the motor efficiency at low power output (corresponding to low duty cycle of the controller) was 5 to 10 percentage points lower on chopped dc than on ripple free dc. The chopped dc locked-rotor torque was approximately 1 to 3 percent greater than the ripple free dc torque for the same average current. J.M.S.

N80-13362*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Power Conversion Electronics Dept.

HEAT PIPE COOLED POWER MAGNETICS Final Report

M. S. Chester Dec. 1979 176 p Revised

(NASA-CR-159659; TRW-33572-6001-RU-00) Avail: NTIS HC A09/MF A01 CSCL 09A

A high frequency, high power, low specific weight (0.57 kg/kW) transformer developed for space use was redesigned with heat pipe cooling allowing both a reduction in weight and a lower internal temperature rise. The specific weight of the heat pipe cooled transformer was reduced to 0.4 kg/kW and the highest winding temperature rise was reduced from 40 C to 20 C in spite of 10 watts additional loss. The design loss/weight tradeoff was 18 W/kg. Additionally, allowing the same 40 C winding temperature rise as in the original design, the KVA rating is increased to 4.2 KVA, demonstrating a specific weight of 0.28 kg/kW with the internal loss increased by 50W. This space environment tested heat pipe cooled design performed as well electrically as the original conventional design, thus demonstrating the advantages of heat pipes integrated into a high power, high voltage magnetic. Another heat pipe cooled magnetic, a 3.7 kW, 20A input filter inductor was designed, developed, built, tested, and described. The heat pipe cooled magnetics are designed to be Earth operated in any orientation. Author

N80-13363# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

RELIABILITY TEST AND EVALUATION OF MIL-M-38510 LINEAR MICROCIRCUITS Final Technical Report, Jul. 1976 - Nov. 1978

Roy C. Maurer Griffiss AFB, N.Y. RADC Jul. 1979 380 p (Contract F30602-76-C-0371; AF Proj. 2338)

(AD-A073455; RADC-TR-79-165) Avail: NTIS HC A17/MF A01 CSCL 09/5

The objective of this effort is to provide analysis and evaluation of high reliability linear microcircuits to assure adequate test methods, reliability prediction and specification for high reliability Air Force Electronics. Data from this effort including processing information, materials, design characteristics, electrical measurements, temperature coefficients, stabilities, application information, test methods, burn-in procedures, specification, and reliability data will be used by the Government to assure high reliability in systems using these devices. GRA

N80-13364# IBM Watson Research Center, Yorktown Heights, N.Y.

STUDY OF THE PHYSICS OF INSULATING FILMS AS RELATED TO THE RELIABILITY OF METAL-OXIDE SEMICONDUCTOR DEVICES Final Technical Report, 16 May - 30 Jun. 1978

Z. A. Weinberg, G. W. Rubloff, E. Bassous, J. M. Aitken, and D. J. DiMaria Griffiss AFB, N.Y. RADC Apr. 1979 185 p refs (Contract F19628-76-C-0249; ARPA Order 2180; AF Proj. 2180)

(AD-A073300; RADC-TR-79-117; Scientific-4) Avail: NTIS HC A09/MF A01 CSCL 09/1

These papers discuss the effects of radiation, heat treatment, thickness, measuring temperature and impurity content on the electron trapping characteristics of SiO2. The results of a comprehensive study of the photo conductivity and photo transmission of SiO2 are also included that make it possible to determine the band gap. The generation of donor states near the Si-SiO2 interface is described with a discussion of two alternate mechanisms involving excitons or hydrogen diffusion. GRA

N80-13365# Rockwell International Science Center, Thousand Oaks, Calif.

HETEROJUNCTION MATERIALS AND CHARACTERISTICS Final Report, 1 Mar. 1978 - 28 Feb. 1979

D. L. Miller and J. S. Harris May 1979 30 p refs (Contract N00014-78-C-0330)

(AD-A073792; SC5158.2FR) Avail: NTIS HC A03/MF A01 CSCL 09/1

Molecular beam epitaxy was used to provide samples for extremely abrupt GaAs/GaAlAs heterojunctions for AES profiling of the interface and ESCA measurements of the AlAs valence band structure. The latter samples consist of MBE AlAs layers covered with 50A to 100A of GaAs as protection against oxidation. MBE growth of n-type AlGaAs was studied also. N-type AlGaAs was produced although all the n-type conducting AlGaAs layers grown by MBE had low activation of the dopant (2%-40%) and relatively low room temperature mobilities (650 cu cm sq /v-sec to 1200 cu cm sq /v-sec). It was found that Al source design and background vacuum were important influences on the quality of n-type AlGaAs produced. Some initial measurements were made on the electrical properties of n-GaAs/n-AlGaAs and n-GaAs/n-AlGaAs/n-GaAs structures. I-Vf measurements on n-n structures at room temperatue showed no deviations from ohmic behavior, while C-V measurements on n-n-n structures were hampered by trapping effects in the AlGaAs. GRA

N80-13366# Mission Research Corp., Albuquerque, N. Mex.

EXPERIMENTAL METHODS FOR THE CHARACTERIZATION OF MULTICONDUCTOR CABLE SYSTEMS Final Report

Howard M. Fowles, Ashok K. Agrawal, Larry C. Scott, and Larry Simpson Mar. 1979 123 p refs

(Contract F29601-77-C-0040; AF Proj. 1209)

(AD-A073767; AMRC-R-120; AFWL-TR-78-82) Avail: NTIS HC A06/MF A01 CSCL 09/1

This report presents the results of an experimental investigation of pulse propagation on cross-sectional inhomogeneous multiconductor cable systems. Time domain and frequency domain measurement techniques are described and verified. The modal analysis of a 5-wire branched cable and the common mode analysis of a simple cable network are given in the time domain and verified experimentally. Some practical applications of the results of this study to measurements of multiconductor transmission line characteristics in situ are discussed. GRA

N80-13367# Virginia Univ., Charlottesville. School of Engineering and Applied Science.

DESIGN AND TESTING OF HIGH PERFORMANCE BRUSHES Annual Summary Report, 1 Jul. 1978 - Jun. 1979

Doris Kuhlmann-Wilsdorf Jun. 1979 33 p refs (Contract N00014-76-C-1009)

(AD-A073593; UVA/525324/MS79/102) Avail: NTIS HC A03/MF A01 CSCL 13/9

Electrical brushes made of very fine metal fibers have been made and tested. The results are most promising. Additionally the surface films on silver graphite brushes have been investigated. These appear to consist of a thicker layer of lubrication material and a thinner layer which presumably is a very thin layer of oxide and/or water. The former layer is subject to build-up and destruction in the course of running the brushes. A theory was made which is consistent with observations of fiber brushes. GRA

N80-13368# Honeywell, Inc., Hopkins, Minn. Defense Systems Div.

DEVELOPMENT OF TWO MONOLITHIC INTEGRATED CIRCUITS AND A 10-kHz TAPE AUTOMATED BONDED (TAB) HYBRID MICROCIRCUIT OSCILLATOR

Bernard Goblish and Kenneth Ceola Feb. 1979 182 p refs (Contract DAAG39-77-C-0056)

(AD-A073565; HDL-CR-79-056-1) Avail: NTIS HC A09/MF A01 CSCL 19/1

This report describes the development of two silicon

monolithic bipolar integrated circuits and a 10-kHz Tape Automatic Bonded (TAB) hybrid microcircuit oscillator (HMO) for use in the XM587/724 fuze. One of the monolithic integrated circuits was designed to replace the interface hybrid microcircuit. The other monolithic integrated circuit (amplifier) is used in the 10-kHz TAB HMO. The major objective of this effort was to reduce the cost of these two circuits. GRA

N80-13369# Sandia Labs., Albuquerque, N. Mex.
LATCH-UP AND RADIATION INTEGRATED CIRCUIT--LURIC: A TEST CHIP FOR CMOS LATCH-UP INVESTIGATION
D. B. Estreich Nov. 1978 76 p refs
(Contract EX-76-C-04-0789)
(SAND-78-1540) Avail: NTIS HC A05/MF A01

A CMOS integrated circuit test chip latch-up and radiation integrated circuit (LURIC), designed for CMOS latch-up and radiation effects research is described. The purpose of LURIC is (1) to provide information on the physics of CMOS latch-up; (2) to study the layout dependence of CMOS latch-up; and (3) to provide special latch-up test structures for the development and verification of a latch-up model. Test devices and related test structures of the LURIC are also described. DOE

N80-13370# Sandia Labs., Albuquerque, N. Mex.
ROM-BASED SEQUENTIAL CIRCUITS: AN ALTERNATIVE APPROACH TO CONVENTIONAL LOGIC DESIGN
J. L. Schoeneman Dec. 1978 29 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2333) Avail: NTIS HC A03/MF A01

An alternative to the conventional method of designing and implementing clocked sequential circuits is presented. A Read Only Memory was utilized as the main logical element. This approach inherently provides the user with a high degree of flexibility and ease of design. An example design problem which illustrates and clarifies this design procedure is presented. DOE

N80-13371# Georgia Inst. of Tech., Atlanta.
DEVELOPMENT OF AN ELECTRICAL LOAD DEMAND AND RESPONSE MODEL BASED ON A RATIONAL SYNTHESIS FROM ELEMENTARY DEVICES
Jul. 1979 89 p refs
(Contract EM-77-S-01-5109)
(DOE/ET-5109/1) Avail: NTIS HC A05/MF A01

A viable methodology is presented which can be used to synthesize models of power-system load to aid in the following major functions: on-line automatic generation control; short-term bus load forecasting; stochastic power-flow analysis; load management; operational planning; security assessment; and power system stability analysis. The scope of the project is limited to the development of methodology with all associated simulation programs. In order to avoid functioning in a vacuum, a limited amount of information obtainable from utilities and government agencies are utilized in providing a credible data base for the validation methodology and the tuning of model parameters. Although the developed models are primarily useful in the system operation context, the potential planning uses are properly delineated. The methodology develops two types of load models--load demand and load-response. DOE

N80-13372# California Univ., Livermore. Lawrence Livermore Lab.
QUASI-STATIC ELECTRIC FIELD BUILD-UP BETWEEN TWO SPHERICAL CONDUCTORS
K. S. Yee and J. Kasher Jun. 1979 82 p refs
(Contract W-7405-eng-48)
(UCID-18236) Avail: NTIS HC A05/MF A01

Electric fields (or electric potential) and charge density were calculated for spherical dielectric shells with inner and outer conducting surfaces which are traversed by an electron beam through the sphere's center. Poisson equations and partial differential equations were used to solve for the electric fields. DOE

N80-13373# Sandia Labs., Albuquerque, N. Mex. Solid State Devices Physics Div.
IVFOR: A USER ORIENTED PROGRAM CHARACTERIZING THE CURRENT-VOLTAGE PROPERTIES OF A TWO TERMINAL DEVICE
Greg R. Lyons and Jamie J. Wiczer May 1979 24 p
(Contract EY-76-C-04-0789)
(SAND-79-0972) Avail: NTIS HC A02/MF A01

A user-oriented computer program to measure the dc current-voltage characteristics of a two-terminal semiconductor device is described. A complete listing is presented of the necessary computer program steps, an example computer run, and a description of the hardware configuration required to make these measurements. The software reported here is primarily intended for use with BASIC-compatible minicomputers used in automatic or semiautomatic data acquisition systems. DOE

N80-13374# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT OF ALTERNATE SILICONE POTTING COMPOUNDS. VOLUME 5: DEVELOPMENT OF SUBSTITUTE NO. 1 FOR DOW CORNING'S AEROSPACE SEALANT DC93-122
W. E. Cady and A. T. Buckner 9 Feb. 1979 24 p refs
(Contract W-7405-eng-48)
(UCRL-52434-Vol-5) Avail: NTIS HC A02/MF A01

A substitute for Dow Corning DC93-122 silicone potting resin can be formulated from Sylgard 186, accelerator QCF3-6559, DC1107 fluid, and Cabosil Grade MS-75 SiO2. The substitute is a functional replacement that is fast-setting and nonflowing, but is stronger and harder than the material it replaces. Two lots of Sylgard 186 were evaluated and it was found that the variations in the cure rate of the 186 affect the amounts of accelerator and 1107 required to achieve a fast setup. The variation in the viscosity of the 186 affects the amount of SiO2 required to achieve a non-flow state. Using both accelerator and 1107 to speed up, 186 is preferred both to reduce the porosity of the potting and to achieve a suitable tack-free time. DOE

N80-13375# Sandia Labs., Albuquerque, N. Mex.
EFFECTS OF METALLURGICAL MICROSTRUCTURE OF ARMATURES ON COMPRESSED MAGNETIC FIELD GENERATORS
A. E. Binder and T. V. Nordstrom 1979 27 p refs Presented at the 2d Intern. Conf. on Megagauss Magnetic Field Generation and Related Topics, Washington, D.C., 29 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-0890C; CONF-790540-3) Avail: NTIS HC A03/MF A01

Methods for improving uniform expansion behavior of compressed magnetic field device armatures were studied. Initial microstructure of the copper tubes was altered in a controlled manner by using different forming techniques and alloying. Results show a 25 to 50 percent improvement in uniform explosive expansion radius for electroformed and spun copper armatures compared to standard armatures machined from drawn tubing. Expansion improvement was correlated with changes in the mechanical texture due to forming. The smoother expansion, however, did not result in a significantly higher electrical efficiency with the armature parameters tested. DOE

N80-13376# California Univ., Berkeley. Lawrence Berkeley Lab.
EIGHT-TESLA SYNCHROTON DIPOLES: DESIGN ALTERNATIVES
William S. Gilbert, Glen R. Lambertson, and Robert B. Meuser Mar. 1979 3 p refs Presented at the IEEE Particle Accelerator Conf., San Francisco, 12 Mar. 1979
(Contract W-7405-eng-48)
(LBL-8410; CONF-790327-150) Avail: NTIS HC A02/MF A01

The development of accelerator dipoles with significantly enhanced performance, into the 8 tesla range is described. Analytical design studies, based on idealized configurations, were done to trace the dependence of stresses within the coil and overall magnet size on the magnet aperture, coil current density, central magnetic field, structural ring stress, and magnetic induction in the iron flux-return yoke. The program includes: (1) development and measurements at 4.2 K of coil structures consistent with the requirements of the analytical design studies, (2) superfluid helium 2 at 1.8 K and at atmospheric pressure (large magnets as well as conductors will be tested);

(3) development and evaluation of aluminum stabilization and various superconductors; and (4) tests of various model dipoles with instrumentation to measure mechanical motion. DOE

N80-13377# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CLASSIFICATION AND TECHNICAL REVIEW OF dc-ac INVERTERS FOR USE IN PHOTOVOLTAIC POWER SYSTEMS
E. E. Landsman 30 Apr. 1979 37 p refs
(Contract EY-76-C-02-4094)
(COO-4094-25) Avail: NTIS HC A03/MF A01

A classification system is presented for stand-alone and utility-interactive dc-to-ac inverters used in photovoltaic systems in the 1-to-100-kVA power range. Additional inverter topologies, noted during the classification process, are introduced. To provide background, generally used dc-to-ac inversion technology is reviewed. Relative merits and liabilities of available power devices are discussed and device protective techniques are reviewed. Maximum power point tracking can enhance system value in utility-interactive no-battery photovoltaic power systems. This general theory is reviewed and an improved implementation is described. DOE

N80-13378# Westinghouse Electric Corp., Sharon, Pa. Medium Power Transformer Div.
FEASIBILITY STUDY OF AN ACTIVE SYSTEM FOR TRANSFORMER NOISE ABATEMENT
D. Yannucci May 1979 53 p refs
(Contract EE-77-C-02-4376)
(COO-4376-T1) Avail: NTIS HC A04/MF A01

The feasibility of noise abatement of medium power transformers by means of a novel concept for active sound suppression is presented. Noise abatement was accomplished by destructive interference of sound pressure fluctuations in three narrow frequency bands centered at 120, 240, and 360 Hz. The project included the design and construction of a model transformer; design, fabrication, and testing of two active sound cancellation units; and a cost analysis comparing the active system with conventional transformer sound abatement methods. Its ability to handle low-frequency, high-amplitude signals at about the same cost as high-frequency signals was reported. The potentials of a two-dimensional system under selected conditions were discussed. DOE

N80-13379# California Univ., Livermore. Lawrence Livermore Lab.
TEMPERATURE AND THERMAL STRESS ANALYSIS OF A SWITCHING TUBE ANODE
S. B. Sutton Jan. 1979 32 p refs
(Contract W-7405-eng-48)
(UCID-18049) Avail: NTIS HC A03/MF A01

Details of an analysis performed on a proposed tube anode are presented. The tube configuration is given. The problem was simplified to one dimensional approximations for both the thermal and stress analyses. The underlying assumptions and their implications are discussed. It was concluded that the temperature induced stresses must be minimized in order to maximize the life expectancy of the tube. DOE

N80-13380# Oak Ridge Y-12 Plant, Tenn.
DIGITAL FILTERING TECHNIQUES FOR USE IN MINI-COMPUTERS
C. M. Davenport Aug. 1979 24 p refs
(Contract W-7405-eng-26)
(Y-2184) Avail: NTIS HC A02/MF A01

Two digital filtering techniques are presented which are suitable for small computers (20 to 32K words of main memory). Explicit FORTRAN-coded routines are presented along with example runs. Low-pass and band-pass applications are discussed. DOE

N80-13381# Texas Univ. at Arlington. Energy Systems Research Center.
DETERMINING LOAD CHARACTERISTICS FOR TRANSIENT PERFORMANCES. VOLUME 3: PROCEDURE FOR MODELING POWER SYSTEM LOADS Final Report
M. S. Chen May 1979 101 p refs Sponsored by Elec. Power Res. Inst.
(EPRI-EL-849-Vol-3) Avail: NTIS HC A06/MF A01

The dynamic power response of loads when subjected to excursions of voltage and frequency is investigated. Responses of components (air conditioners, motors, lighting, etc.) to changes in voltage and frequency were measured and component load models were developed from the resulting data. The procedure for modeling power system loads is presented. The modeling philosophy and the prototype procedure for model building is described. Sensitivity analyses of the model building procedure are reported. A user's manual for the computer program developed for use in load modeling is included. DOE

N80-13382# Sandia Labs., Albuquerque, N. Mex.
LATCH-UP CONTROL IN CMOS INTEGRATED CIRCUITS
A. Ochoa, Jr., D. B. Estreich, and W. R. Dawes, Jr. 1979 15 p refs Presented at 1979 IEEE Ann. Conf. on Nucl. and Space Radiation Effects, Santa Cruz, Calif., 17 Jul. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0646C; CONF-790706-1) Avail: NTIS HC A02/MF A01

The potential for latch-up, a pnpn self-sustaining low impedance state, inherent in standard bulk CMOS structures is considered. Latch-up control methods presently employed are surveyed. Their adaptability to VSLI designs is analyzed. DOE

N80-13383# Brookhaven National Lab., Upton, N. Y.
SUPERCONDUCTING PROPERTIES OF (Nb,Ta)3Sn WIRES FABRICATED BY THE BRONZE PROCESS
M. Suenaga, K. Aihara, K. Kaiho, and T. S. Luhman 1979 19 p refs Presented at Cryog. Engr. Conf., Madison, Wis., 21 Aug. 1979
(Contract EY-76-C-02-0016)
(BNL-26391; CONF-790815-9) Avail: NTIS HC A02/MF A01

Measurements of the superconducting critical temperature, critical current density, and the critical magnetic field were made on bronze processed (Nb,Ta)3Sn monofilamentary wires. Ta content in the Nb3Sn compound was varied by alloying the Nb core prior to a reaction heat treatment. Core compositions and heat treatments for the reaction are discussed. The relation of the Ta content with each of the critical measurements during heat treatments is studied. DOE

N80-13384# Bendix Corp., Kansas City, Mo.
PLASMA CLEANING END-OF-PROCESS DETECTION
M. D. Smith 1979 14 p refs Presented at DOE Weapons Complex Ann. Adhesives Conf., Amarillo, Tex., 5 Jun. 1979
(Contract EY-76-C-04-0613)
(BDX-613-2229-Rev; CONF-790668-1) Avail: NTIS HC A02/MF A01

The application of optical emission techniques to detect the removal of trace organic residues was shown to be possible using a vendor's process monitor. Removal of as low as 5 mg total organic contamination was detected in an oxygen plasma. Auger analysis confirmed the cleanliness levels indicated by the end-point detector tested. The simplicity of this type of process monitor lends itself to production line use for the plasma cleaning of various parts and batch sizes. The monitoring of argon plasma cleaning processes using optical emission techniques was investigated. DOE

N80-13385# California Univ., Livermore. Lawrence Livermore Lab.
FAST OPENING SWITCHES CARRYING MULTIMEGAMPERE CURRENTS AND THEIR APPLICATION TO HIGH VELOCITY SHOCK WAVES IN XENON
D. J. Steinberg and J. W. Shearer 20 Feb. 1979 26 p refs Presented at 2d Intern. Conf. on Megagauss Magnetic Field Generation and Related Topics, Washington, D.C., 29 May 1979
(Contract W-7405-eng-48)
(UCRL-82134; CONF-790540-9) Avail: NTIS HC A03/MF A01

High explosive driven, magnetic field generators for use in shock tubes are examined. The development of an aluminum switch which is opened by the pressure produced by the high magnetic field and which will help compress the magnetic flux

faster is reported. The applications and functions of the switch are discussed. A.W.H.

N80-13386# Pisa Univ. (Italy). Ist. di Elettrotecnica.
THE INFLUENCE OF CERAMIC PERMANENT MAGNETS ON THE ARMATURE OF A SMALL POTENTIAL dc MOTOR [SULLA REAZIONE DI ARMATURA NEI MOTORI A CORRENTE CONTINUA DI PICCOLA POTENZA A MAGNETI PERMANENTI CERAMICI]
Adone Bramanti, Giovanni Gallanti, Lucio Taponecco, and Andrea Tellini Dec. 1976 7 p refs In ITALIAN Sponsored by CNR (Rept-1631) Avail: NTIS HC A02/MF A01

The amplitude of the radial and trangential components of the magnetic field due to the armature current are determined, allowing the identification of the permanent magnet areas in which irreversible demagnetization is possible. Some dimensioning criteria for the permanent magnets are also deduced and the increase in the number of rotor slots compatible with technology and economics is suggested. Author (ESA)

N80-13387# Danish Research Center for Applied Electronics, Hoersholm.
CERAMIC CAPACITORS: A COMPARATIVE INVESTIGATION OF THE QUALITY AND STABILITY OF 23 MANUFACTURES AND TYPES, INCLUDING DISC, PLATE AND MULTILAYER CAPACITORS
U. Fabricius and R. B. Jensen Mar. 1979 96 p
(ECR-87) Avail: NTIS HC A05/MF A01

Twenty-three different types of ceramic capacitors distributed by 12 manufacturers were investigated. The types tested include disks, plates, and multilayers representative of both type 1 and type 2 capacitors. Component quality ranges from general purpose to Mil-spec. The purpose of these tests was to obtain a basic understanding and knowledge of ceramic capacitors and to find the stability and relative quality level of the examined capacitors during environmental exposure. A general description of the construction, manufacture, and principle of operation of the capacitors is given and the environmental tests are described. The tests are comparative and all components were exposed to the same severity level, which means that some types were exposed in excess of the manufacturer's specifications. Results are presented in tabular form and by test group. Author (ESA)

N80-13388# National Technical Information Service, Springfield, Va.
COMPUTER AIDED DESIGN OF MICROCIRCUITS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1979
William E. Reed Sep. 1979 162 p Supersedes NTIS/PS-78/0821; NTIS/PS-77/0711
(NTIS/PS-79/0870/0; NTIS/PS-78/0821; NTIS/PS-77/0711)
Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Government-sponsored research covering the computer aided design, modeling, layout, and packaging of integrated and other microelectronic circuits is presented. Computer programs and the use of computer graphics are included. (This updated bibliography contains 154 abstracts, 15 of which are new entries to the previous edition.) GRA

N80-13389# National Technical Information Service, Springfield, Va.
COMPUTER AIDED DESIGN OF MICROCIRCUITS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1979
William E. Reed Sep. 1979 253 p Supersedes NTIS/PS-78/0822; NTIS/PS-77/0712
(NTIS/PS-79/0871/8; NTIS/PS-78/0822; NTIS/PS-77/0712)
Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

The computer aided design, modeling, layout, and packaging of integrated and other microelectronic circuits is reported. Computer programs and the use of computer graphics are included. This updated bibliography contains 246 abstracts, 40 of which are new entries to the previous edition. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-13390 City Univ. of New York, N. Y.
TWO-DIMENSIONAL JET BOUNDARY INTERACTION FOR SUBMERGED THERMAL DISCHARGES Ph.D. Thesis
Joseph Hoch 1979 184 p
Avail: Univ. Microfilms Order No. 7923734

A comprehensive theoretical and experimental study which investigates the jet-boundary interaction of a heated two dimensional jet discharging offset from and parallel to a solid wall is presented. The limiting case of a heated wall jet is also considered. An integral formulation of the conservation equations coupled with appropriate entrainment closure assumptions, provide for the solution of both the velocity and temperature fields, while accounting for the effects of ambient motion. The theoretical model is unique in that the base pressure and radius of curvature in the initial region of the jet are retained as variables. Various comparisons between predicted and measured values of velocity and temperature decay, maximum wall pressure, re-attachment length and recirculation region temperature were made. In general, agreement is good. Dissert. Abstr.

N80-13391 Johns Hopkins Univ., Baltimore, Md.
CENTRIFUGAL INSTABILITY OF DECELERATING SWIRL-FLOW WITHIN FINITE AND INFINITE CIRCULAR CYLINDERS Ph.D. Thesis
George Paul Neitzel, Jr. 1979 224 p
Avail: Univ. Microfilms Order No. 7924632

Centrifugal instability of the flow within a circular cylinder which is spun down is investigated. The cylinder is assumed to be infinitely long so that the flow is governed by simple viscous diffusion alone and the basic state is pure azimuthal flow. Cylinders of finite length are also considered. In this case, the basic state is fully three dimensional, being dominated by the effects of the endwall Ekman layers. The stability of this flow is examined by means of numerical experiments performed for a variety of Reynolds numbers, aspect ratios, and container spin histories. The axisymmetric Navier-Stokes equations are integrated using an existing program. Disturbances due to round-off and truncation errors are found to be sufficient to trigger centrifugal instabilities. Onset times for instabilities, vortex wavelength variation, torque and angular momentum histories, and the applicability of Rayleigh's criterion to this unsteady viscous flow are emphasized. Dissert. Abstr.

N80-13392 Illinois Univ. at Chicago Circle, Chicago.
A THEORY OF VISCOELASTIC ANALOGY FOR WAVE PROPAGATION IN ELASTIC AND VISCOELASTIC LAYERED MEDIA Ph.D. Thesis
Isao Mukunoki 1979 77 p
Avail: Univ. Microfilms Order No. 7925995

Plane wave propagation in the direction normal to the layering of a periodically layered medium is discussed. The layered medium is replaced by an 'equivalent' homogeneous, linear, viscoelastic material whose dynamic response is identical to that of the actual layered medium at the centers of the odd layers. Numerical examples are given for transient waves due to a step load applied at the left boundary. Both a semi-infinite elastic layered medium and a semi-infinite viscoelastic layered medium are considered. The theory is then extended to a finite layered medium. For elastic layered media, a comparison with the exact solution obtained by the ray theory shows that the present theory satisfactorily predicts transient wave responses at any point in the layered medium. This is true regardless of whether the point is near or far from the impact end. Dissert. Abstr.

N80-13393 Oklahoma State Univ., Stillwater.
HEAT-TRANSFER IN HELICALLY COILED TUBES WITH LAMINAR FLOW Ph.D. Thesis
Mohammad A. Abul-Hamayel 1979 194 p
Avail: Univ. Microfilms Order No. 7928188

Research on the heat transfer coefficient for laminar flow inside a helical coil were made. In particular, the possible effect of natural convection, which was found to be very significant at low Reynolds numbers was studied. The axial temperatures show large amplitude oscillations with axial distance, which decay and damp out in the fully developed region. Consequently, the oscillatory behavior was also present in the Nusselt number. The Nusselt number approaches an asymptotic value as the fully developed temperature field is approached. The peripherally-averaged Nusselt number, for the fully developed region, was correlated as a function of Dean, Grashof, Prandtl and Reynolds numbers. The correlation developed includes the contribution of the natural convection effects to the Nusselt number. A better understanding of the heat transfer mechanism in helical coils was obtained. Dissert. Abstr.

N80-13394 Minnesota Univ., Minneapolis.
THE GRADIENT THEORY OF FLUID INTERFACES Ph.D. Thesis
Bruce Stanley Carey 1979 468 p
Avail: Univ. Microfilms Order No. 7926103

The gradient theory of inhomogeneous fluids is extended to complex systems. Experimental planar tensions are used with the gradient theory to determine empirical correlations for the influence parameters of inhomogeneous fluids. The free energy density of homogeneous fluid is computed from the original van der Waals equation or a variation known to be quite accurate for nonpolar fluids. Binary tensions are then combined with the multicomponent gradient theory to determine mixing rules for the interspecies parameters. These parameters and their mixing rules furnish (in conjunction with the equation of state used) all information necessary for multicomponent predictions. The inability of the equation of state to model polar fluids restricts the model's quantitative application to nonpolar fluids. This does not mean, though, that the theory cannot be used at all for liquid-liquid systems. There are nonpolar polymer systems which separate into liquid phases entirely as a result of entropic (size) considerations. Dissert. Abstr.

N80-13395 Minnesota Univ., Minneapolis.
PHASE BEHAVIOR AND INTERFACIAL TENSION STUDIES OF SURFACTANT SYSTEMS Ph.D. Thesis
Elias I. Franses 1979 504 p
Avail: Univ. Microfilms Order No. 7926125

Parallel studies of isomerically pure sodium p (1-heptylnonyl) benzene sulfonate, Texas #1, its mixture with sodium dodecyl sulfate, SDS, and the petroleum sulfonate TRS 10-80 are presented. Phase behavior in water, in decane, and in water-decane mixtures were studied by spectroturbidimetry, polarizing light microscopy, ultracentrifugation, ultrafiltration, densitometry, conductimetry, isopiestic vapor pressure and C-13 and H-1 nuclear magnetic resonance spectroscopy. It is deduced that ultralow tensions arise from the dispersed microcrystallites which form a third, usually liquid crystalline, phase at the decane-brine interfacial region. It appears that neither molecular adsorption from solution nor micelles have anything to do with ultralow tensions, which are sensitive to the third phase microstructure. The implications of these results for the mechanism of ultralow tensions in surfactant flooding processes for enhanced petroleum recovery are discussed. Dissert. Abstr.

N80-13396 Purdue Univ., Lafayette, Ind.
THE EFFECTS OF JOULE HEAT ON TURBULENT DISPERSION OF TEMPERATURE IN HIGH REYNOLDS NUMBER FLOW Ph.D. Thesis
Donald Stuart Kendall 1979 164 p
Avail: Univ. Microfilms Order No. 7926395

The application of a uniform rate-of-strain model to derive the high-wavenumber portion of the temperature fluctuation spectrum is presented. The spectral results obtained, for this particular problem, display an enhancement in the strength of the fine-scale temperature fluctuations over that which would exist with no magnetic field present. This enhancement is the result of the dissipation of magnetic energy into Joule heat and manifests itself in the form of the spectrum function. This form depends strongly on the averaged rates-of-strain of the flow as well as on certain other parameters characteristic of the flow and fluid properties. Dissert. Abstr.

N80-13397 Cornell Univ., Ithaca, N. Y.
NONLINEAR SIMULATION OF TYPE 1 IRREGULARITIES IN THE EQUATORIAL ELECTROJET Ph.D. Thesis
Alice Lynne Newman 1979 220 p
Avail: Univ. Microfilms Order No. 7926940

Through a spectral analysis of many wavenumber modes after the saturation of the instability, the models discussed reproduce characteristic features of type 1 spectral irregularities observed by radar and resolve a number of theoretical questions. In particular, it was shown that (1) the phase velocity of dominant wavenumber modes tends to the acoustic velocity rather than to the electron drift velocity when quasilinear velocity reduction is allowed, and (2) the instability can establish a saturated state in less than a second. Assuming that the electrojet is turbulent on a scale of tens of meters or more, the isotropy of radar observations with respect to radar elevation angle is not inconsistent with our simulated results. Dissert. Abstr.

N80-13398 Florida State Univ., Gainesville.
A LARGE STRUCTURE MODEL OF TURBULENCE IN TWO-DIMENSIONAL JETS Ph.D. Thesis
Kuo-chang Chen 1979 81 p
Avail: Univ. Microfilms Order No. 7926730

A statistical model of the large structures of the turbulence in a fully developed two dimensional jet is presented. Second order turbulence statistics including single point Reynolds stress distribution, root mean square turbulent velocity component fluctuation distributions, root mean square turbulent pressure fluctuation distribution, power spectra, and two point correlation functions are predicted by the model. Numerical results of Reynolds stress and root mean square velocity component fluctuations compare favorably with experimental data. This lends strong support to the belief that the second order turbulence statistics of this flow are dominated by the contributions of the large structures. Dissert. Abstr.

N80-13399 Virginia Univ., Charlottesville.
MATHEMATICAL MODELING OF THE BREAKUP OF LAMINAR CAPILLARY JETS Ph.D. Thesis
Gerald Anthony Aiello 1978 116 p
Avail: Univ. Microfilms Order No. 7928057

A model describing the laminar breakup of a jet of Newtonian fluid issuing from a cylindrical tube is developed. It is shown how tube geometry can influence the breakup dynamics through the effect of the developing laminar velocity field, and through the generation of specific perturbations characteristic of the tube geometry. It is shown that the average drop size from a horizontal jet is influenced both by the laminar velocity field and the perturbations, while the average drop size from a vertical jet is determined primarily by the jet radius near the jet breakup point. The calculated results are compared with published experimental results. Dissert. Abstr.

N80-13400 Southern Methodist Univ., Dallas, Tex.
INVESTIGATION OF BLOWN BOUNDARY LAYERS WITH AN IMPROVED WALL JET STREAM Ph.D. Thesis
Kondala Rao Saripalli 1979 320 p
Avail: Univ. Microfilms Order No. 7927006

Measurements were made in a two dimensional incompressible wall jet submerged under a thick upstream boundary layer, with a zero pressure gradient and an adverse pressure gradient. The measurements included mean velocity and Reynolds stresses profiles, skin friction, and turbulence spectra. The measurements were confined to practical ratios (less than 2) of the jet velocity to the free stream velocity. The wall jet used in the experiments has an asymmetric velocity profile with a relatively higher concentration of momentum away from the wall. It was shown that an asymmetric jet velocity profile has distinct advantages over a uniform jet velocity profile, especially in the control of separation. Predictions were made using the method for blown boundary layers. The predictions clearly show the difference in flow development between an asymmetric jet velocity profile and a uniform jet velocity profile. Dissert. Abstr.

N80-13401*# Rice Univ., Houston, Tex.
EVAPORATIVE COOLING ON A GROOVED SURFACE M.S. Thesis
Dwight Yoder 5 May 1979 42 p refs

(Contract NAS9-65274)
(NASA-CR-160410) Avail: NTIS HC A03/MF A01 CSCL 20D

The transition point where water begins to accumulate on the surface during spray evaporative cooling was investigated experimentally to determine the temperatures and corresponding heat flux at which this transition occurs. Several pressure ranges were considered including one below the triple point of water. Additionally, the results using a grooved surface were compared to those using a smooth surface. It was determined that a grooved surface has no effect on the heat transfer. K.L.

N80-13402*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
AEROTHERMAL PERFORMANCE OF RADIATIVELY AND ACTIVELY COOLED PANEL AT MACH 6.6
Charles P. Shore and Irving Weinstein Dec. 1979 42 p refs
(NASA-TP-1595; L-13355) Avail: NTIS HC A03/MF A01 CSCL 20D

A flight-weight radiative and actively cooled honeycomb sandwich panel (RACP) was subjected to multiple cycles of both radiant and aerothermal heating. The 0.61 m by 1.22 m test specimen incorporated essential features of a full scale 0.61 m by 6.10 m RACP designed to withstand a heat flux of 136 kW/sq m. The panel consisted of heat shields, a thin layer of high temperature insulation, and an aluminum honeycomb sandwich panel with coolant tubes next to the sandwich skin. A 60/40 mass solution of ethylene glycol/water was used to cool the panel which successfully withstood a total of 3.5 hr of radiant heating and 137 sec exposure to an M = 6.6 test stream. Heat shield temperatures reached 1080 K (1945 deg R), and cooled-panel temperatures reached 382 K (687 deg R) midway between coolant tubes. Simulation of the full scale panel indicated that the full scale RACP would perform as expected. The tests revealed no evidence of coolant leakage or hot gas ingress which would seriously degrade the RACP performance. Author

N80-13403*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
MARANGONI BUBBLE MOTION IN ZERO GRAVITY
Robert L. Thompson and Kenneth J. DeWitt (Toledo Univ.) 1979 38 p refs Presented at the 72nd Ann. Meeting of the AICE, San Francisco, 25-29 Nov. 1979
(NASA-TM-79250; E-160) Avail: NTIS HC A03/MF A01 CSCL 20D

It was shown experimentally that the Marangoni phenomenon is a primary mechanism for the movement of a gas bubble in a nonisothermal liquid in a low gravity environment. A mathematical model consisting of the Navier-Stokes and thermal energy equations, together with the appropriate boundary conditions for both media, is presented. Parameter perturbation theory is used to solve this boundary value problem; the expansion parameter is the Marangoni number. The zeroth, first, and second order approximations for the velocity, temperature and pressure distributions in the liquid and in the bubble, and the deformation and terminal velocity of the bubble are determined. Experimental zero gravity data for a nitrogen bubble in ethylene glycol, ethanol, and silicone oil subjected to a linear temperature gradient were obtained using the NASA Lewis zero gravity drop tower. Comparison of the zeroth order analytical results for the bubble terminal velocity showed good agreement with the experimental measurements. The first and second order solutions for the bubble deformation and bubble terminal velocity are valid for liquids having Prandtl numbers on the order of one, but there is a lack of appropriate data to test the theory fully. K.L.

N80-13404*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COMBUSTION OF SOLID CARBON RODS IN ZERO AND NORMAL GRAVITY
C. M. Spuckler, F. J. Kohl, R. A. Miller, C. A. Stearns, and K. J. DeWitt (Toledo Univ.) 1979 32 p refs Presented at the 72nd Ann. AICE Meeting, San Francisco, 25-29 Nov. 1979
(NASA-TM-79303; E-255) Avail: NTIS HC A03/MF A01 CSCL 21B

In order to investigate the mechanism of carbon combustion, spectroscopic carbon rods were resistance ignited and burned in an oxygen environment in normal and zero gravity. Direct mass spectrometric sampling was used in the normal gravity tests to obtain concentration profiles of CO_2, CO, and O_2 as a function of distance from the carbon surface. The experimental concentrations were compared to those predicted by a stagnant film model. Zero gravity droptower tests were conducted in order to assess the effect of convection on the normal gravity combustion process. The ratio of flame diameter to rod diameter as a function of time for oxygen pressures of 5, 10, 15, and 20 psia was obtained for three different diameter rods. It was found that this ratio was inversely proportional to both the oxygen pressure and the rod diameter. K.L.

N80-13405*# Rice Univ., Houston, Tex.
A FUNDAMENTAL STUDY OF LIQUID SPRAY EVAPORATION AT A HEATED SURFACE Final Report
F. A. Wierum 25 Oct. 1979 7 p
(Contract NAS9-15274)
(NASA-CR-160409) Avail: NTIS HC A02/MF A01 CSCL 20D

The influence of feedwater temperature and the influence of pulsing nozzle flow on the heat transfer characteristics in the spray evaporative cooling process were investigated. A commercial water circulation heater was installed in the feedwater line between the supply reservoir and the nozzle. A pass through the heater provided water at temperatures up to 50 C at the nozzle; higher temperatures were obtained by multiple heater passes. A thermocouple installed in the water line just upstream of the nozzle provided a measure of the feedwater temperature. Initial tests were run with belljar exhaust orifice number two which provided a pressure in a range about 7mm Hg abs. The feedwater temperature was heated to a temperature of 45 C. Results indicate that for a given system operating pressure, there is an upper limit on the feedwater temperature above which the spray will flash to vapor before hitting the surface to be cooled. R.C.T.

N80-13406# Aerospace Corp., El Segundo, Calif. Aerothermodynamics Dept.
A NUMERICAL SOLUTION FOR TEMPERATURE DISTRIBUTIONS IN A DISCRETE INJECTION TRANSPIRATION-COOLED NOSETIP SYSTEM Final Report, Jun. - Sep. 1978
A. R. Karagozian 20 Aug. 1979 62 p refs
(Contract F04701-78-C-0079)
(AD-A073340; TR-0079(4550-73)-1; SAMSO-TR-79-52) Avail: NTIS HC A04/MF A01 CSCL 16/3

An analysis is performed to describe the thermodynamics behavior of 'fin' and fluid components of a transpiration-cooled nosetip system. Partial differential equations governing fin and fluid temperatures are derived and solved numerically to yield time-dependent distributions. Correlations used for the subcooled boiling heat transfer mechanism are found to over-predict the amount of heat removed from the fin in depth. A comparison of temperature distributions indicates that the fluid equation may be considered as steady state with a negligible effect on the solution. The numerical scheme used to solve the governing equations is strongly stable, even when drastic changes in parameters occur. GRA

N80-13407# Oak Ridge National Lab., Tenn.
INCAP: A FINITE ELEMENT PROGRAM FOR ONE-DIMENSIONAL NONLINEAR INVERSE HEAT CONDUCTION ANALYSIS
B. R. Bass Jul. 1979 93 p refs
(Contract W-7405-eng-26)
(ORNL/NUREG/CSD/TM-8; NUREG-CR-0832) Avail: NTIS HC A05/MF A01

The calculation of the surface temperature and surface heat flux from a measured temperature history at an interior point of a body, identified in literature as the inverse heat conduction problem, is examined. An inverse solution technique that utilizes a finite element heat conduction model and a nonlinear estimation procedure is presented. The technique is applicable to the one dimensional nonlinear model with temperature dependent thermophysical properties. A digital computer program INCAP (inverse heat conduction analysis program) is developed from the formulation and is used in a comparative study with the

finite difference inverse code ORINC (ORNL inverse code). Two representative thermocouple transients obtained from electrically heated composite rods during a simulated loss of coolant accident are analyzed with INCAP and ORINC and the results are compared. DOE

N80-13408# Idaho National Engineering Lab., Idaho Falls.
HORIZONTAL TWO-PHASE FLOW TRANSIT TIME MEASUREMENTS
A. G. Baker 1979 27 p refs Presented at Reactor Safety Instrumentation Rev. Group, Silver Spring, Md., 24 Jul. 1979
(Contract EY-76-C-07-1570)
(CONF-790745-2) Avail: NTIS HC A03/MF A01

A transit time flowmeter (TTF) indirectly determines fluid velocity by measuring the time of transit of the fluid between two sensors of known separation. The transit time is obtained by cross-correlation, and the velocity by dividing the intersensor separation distance by the transit time. Various sensors were tested for suitability. Performance was determined by comparison of the TTF velocity to that computed from or indicated by the instrumentation of the test facilities. Conductivity probes, single-beam gamma densitometers, and pitot tubes were tested in steady state air-water conditions. The densitometers performed best, followed by the conductivity probes and the pitot tubes. Stratification effects were detected in this horizontal flow application which confuse a straightforward interpretation of the TTF velocity. DOE

N80-13409# Idaho National Engineering Lab., Idaho Falls.
DRAG DEVICES FOR TWO-PHASE MASS FLOW MEASUREMENTS
J. L. Anderson (Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho) 1979 63 p refs Presented at Colloq. on Two-Phase Instrumentation, Idaho Falls, Idaho, 11 Jun. 1979
(Contract EY-76-C-04-1570)
(CONF-790655-5) Avail: NTIS HC A04/MF A01

Full flow drag devices were tested in steady state air-water mixtures and transient steam-water mixtures in order to obtain two-phase mass flow measurements. Modeling methods for obtaining mass flow rates are discussed along with the effects of two-phase flows on the drag coefficient of full flow multihole drag plates. DOE

N80-13410# California Univ., Livermore. Lawrence Livermore Lab.
SHOCK COMPRESSION OF LIQUID METHANE AND THE PRINCIPLE OF CORRESPONDING STATES
W. J. Nellis, A. C. Mitchell, M. Ross, and M. vanThiel 24 Jul. 1979 7 p refs Presented at the 7th Intern. AIRAPT Conf., La Creusot, France, 30 Jul. - 3 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-82127; CONF-790709-8) Avail: NTIS HC A02/MF A01

The principal Hugoniot of liquid methane was measured between 5 to 43 GPa and a doubly shocked state was measured at 91 GPa. The repulsive pair potential for methane and argon were demonstrated to obey the principle of corresponding states. DOE

N80-13411# California Univ., Livermore. Lawrence Livermore Lab.
EFFECTS OF CELLULAR STRUCTURE ON THE BEHAVIOR OF GASEOUS DETONATION WAVES UNDER TRANSIENT CONDITIONS
P. A. Urtiew and C. M. Tarver 16 Jul. 1979 39 p refs Presented at the 7th Intern. Colloq. on Gas Dyn. of Explosions and Reactive Systems, Gottingen, West Germany, 20-24 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-82270; CONF-790828-2) Avail: NTIS HC A03/MF A01

Assuming that the cellular structure of the detonation wave is responsible for its existence and its uniqueness, the effect of variation in the cross-sectional area of the tubes on the cell size and on the survival of the detonative process during the transition was investigated. A comparison of the results show that it is not the tube diameter nor the initial pressure of the medium that controls the survival of the wave, but that it is (1) the number of cells available to endure losses from flow effects generated by the transient conditions and (2) the number of cells remaining to regenerate new cells to revive the detonation process. DOE

N80-13412# Oak Ridge National Lab., Tenn. Engineering Tech. Div.
CONDENSATION AND EVAPORATION HEAT TRANSFER WITH LOW-BOILING TEMPERATURE FLUIDS
R. W. Murphy and H. W. Hoffman 1979 4 p Presented at Southeastern Seminar on Thermal Sci., SESTS, Boca Raton, Fla., 10 May 1979
(Contract W-7405-eng-26)
(CONF-790539-1) Avail: NTIS HC A02/MF A01

Heat transfer research related to OTEC and geothermal energy conversion power cycles is reviewed. DOE

N80-13413# Oak Ridge National Lab., Tenn.
TWO-PHASE FLOW MEASUREMENTS WITH ADVANCED INSTRUMENTED SPOOL PIECES AND LOCAL CONDUCTIVITY PROBES
K. G. Turnage and C. E. Davis 1979 33 p refs Presented at Reactor Safety Instrumentation Review Group Meeting, Silver Spring, Md., 25 Jul. 1979
(Contracts W-7405-eng-26; DOE-IA-40-551-75; DOE-IA-40-552-75)
(CONF-790745-1) Avail: NTIS HC A02/MF A01

A series of two phase, air water and steam water tests performed with instrumented spool pieces and with conductivity probes is described. The behavior of the three beam densitometer, turbine meter, and drag flowmeter is discussed in terms of two phase models. Application of some two phase mass flow models to the recorded spool piece data is made and preliminary results are shown. Velocity and void fraction information derived from the conductivity probes is presented and compared to velocities and void fractions obtained using the spool piece instrumentation. DOE

N80-13414# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
FLUIDIZED BED FLOW EQUATIONS
Nathan Ness and Jerome B. Fanucci Jul. 1978 253 p refs
(Contract EY-77-C-21-8087)
(METC/CR-78/10) Avail: NTIS HC A12/MF A01

The detailed derivation of the conservation equation of mass, momentum, and energy for a fluidized bed are presented. The development of the chemical production term is included. The equations contain momentum exchange terms, viscosity and thermal conductivity transport coefficients for the fluid and solid, and other flow quantities which require constitutive relations before a solution is attempted. An iterative procedure, involving fluidized bed test data and the solution of these flow equations, could be employed to model these constitutive relations. The equations are then specialized to the one dimensional, steady flow for a high temperature two phase chemically reacting multispecies fluid and a single species solid. Solutions to this system are discussed. DOE

N80-13415# General Atomic Co., San Diego, Calif.
MINT COMPUTER PROGRAM FOR NUMERICAL COMPUTATION OF TURBULENT FLOW: AN OVERVIEW
T. E. Burton May 1979 44 p refs
(Contracts DE-AT03-76ET-35300; EY-76-C-03-0167)
(GA-A-15148) Avail: NTIS HC A03/MF A01

The MINT finite difference code is described. The code solves the full Navier-Stokes momentum transport equations, the mass and energy transport equations, and two additional transport equations which model turbulence. MINT efficiently handles turbulent wall layers and implements most standard boundary conditions with a minimum of user effort. Flow geometries must be simple and each boundary surface must coincide with a grid point surface. No reentrant corners are permitted. DOE

N80-13416# Idaho National Engineering Lab., Idaho Falls.
PITOT TUBE AND DRAG BODY MEASUREMENTS IN TRANSIENT STEAM-WATER FLOWS
J. R. Fincke, V. A. Deason, and M. W. Dacus 1979 11 p refs Presented at 25th ISA Intern. Instrumentation Symp.,

Anaheim, Calif., 7 May 1979
(Contract EY-76-C-07-1570)
(CONF-790506-15) Avail: NTIS HC A02/MF A01

The use of full flow drag devices and rakes of water cooled Pitot tubes to measure the transient two phase mass flow during loss of coolant experiments in pressurized water reactor (PWR) environments is discussed. Mass flow rate measurements were obtained in high temperature and pressure environments, similar to PWRs, under transient conditions. Comparisons of the measured time integrated value of mass flow to the known system mass before depressurization are presented. DOE

N80-13417# Brookhaven National Lab., Upton, N. Y.
EXPERIMENTAL INVESTIGATIONS OF NONEQUILIBRIUM FLASHING OF WATER IN A CONVERGING-DIVERGING NOZZLE
G. A. Zimmer, B. J. C. Wu, W. J. Leonhardt, N. Abuaf, and O. C. Jones, Jr. Feb. 1979 38 p refs Presented at the 18th ASME Natl. Heat Transfer Conf., San Diego, Calif., Aug. 1979
(Contract EY-76-C-02-0016)
(BNL-NUREG-25716; CONF-790808-8) Avail: NTIS HC A03/MF A01

A steady water loop with well controlled flow and thermodynamic conditions was designed, built, and made operational to measure the net vapor generation rates under nonequilibrium conditions. The test section consists of a converging-diverging nozzle with 49 pressure taps and observation windows at the exit. First pressure distributions and photographic observations were recorded under various flashing conditions. The effect of the various parameters such as inlet pressure, inlet temperature, mass flux, and back pressure on the pressure distributions and flashing regimes were investigated. Under specific flashing conditions, a sharp increase in pressure (condensation shock) was observed in the diverging section (which accommodates the high back pressures). The experiments are being continued with a gamma densitometer to measure the void fraction distributions needed in the vapor generation rate calculations. DOE

N80-13418# Brookhaven National Lab., Upton, N. Y.
BASIC RESEARCH NEEDS IN FLUID MECHANICS
O. C. Jones, Jr. Mar. 1979 43 p refs
(Contract EY-76-C-02-0016)
(BNL-50995) Avail: NTIS HC A03/MF A01

The long-range needs for basic research in fluid mechanics are examined. The topics identified included: turbulence; multiphase flows; fluid structure interactions; boundary layer effects; biological, geological, and environmental fluid flow; and the need for new facilities and improved instrumentation. These areas are reviewed. DOE

N80-13419# Sandia Labs., Albuquerque, N. Mex. Numerical Mathematics Div.
HEAT CONDUCTION FROM A SPHERE TO AN INFINITE EXTERNAL REGION
Donald E. Amos Jul. 1979 21 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0366) Avail: NTIS HC A02/MF A01

The cooling of a sphere by heat conduction to an infinite external region is considered. Both regions are considered to have constant physical parameters with the internal sphere initially at temperature V and the external region initially at temperature zero. Conduction takes place across the boundary so that temperature and heat flux are continuous. Three separate cases involving differences in the thermal diffusivities k sub 1, k sub 2, and conductivities K sub 1, K sub 2 are considered: (1) k sub 1 = k sub 2 and K sub 1 = K sub 2; (2) k sub 1 not equal to k sub 2 and K sub 1 not equal to K sub 2; and (3) K sub 1 = infinity. In this latter case, the inner sphere has heat capacity, but zero thermal gradient. In each case, the temperature distributions are obtained as well as the short and long time asymptotic behavior. DOE

N80-13420# Technische Univ., Berlin (West Germany). Inst. fuer Chemieingenieurtechnik.
DEVELOPMENT OF A MASS TRANSFER MACHINE FOR GAS/LIQUID OPERATIONS IN THE ABSENCE OF GRAVITY Final Report
Heinz Brauer and Wilhelm Gaebelein Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 80 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-SLN-7761; DFVLR-BPT-01-QV-236)
(BMFT-FB-W-78-20) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16.80

The mass transfer machine that was developed for countercurrent gas/liquid operations is distinguished by an extremely high mass transfer efficiency per unit volume and by a very small overall volume. The design of the mass transfer machine, the experimental setup, the measuring equipment, and some of the results obtained are discussed. In order to understand the fluid dynamics of the two-phase system, the movement of gas and liquid is discussed separately. Comprehensive descriptions of the movement of the liquid film on the rotating surfaces, the disintegration of the liquid film in each stage as well as of the movement of the generated drops are given. The measured pressure drop in the gas and its correlation to the liquid flow are reported. Author (ESA)

N80-13421# Technische Universitaet, Hanover (West Germany). Inst. fuer Stroemungsmaschinen.
CONTRIBUTIONS TO MARANGONI CONVECTION IN CYLINDRIC MELTING ZONES: EXPERIMENTAL SIMULATION AND CALCULATION OF THE INFLUENCE OF GRAVITY Final Report
Chung-Hwan Chun Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 37 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-SLN-7761; DFVLR-BPT-01-QV-576)
(BMFT-FB-W-78-39) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlruhe, West Germany DM 7.60

The possibilities and limitations of the experimental simulation of microgravity effects relative to Marangoni convection are discussed. The experiments are useful in verifying theoretical results for the prediction of flow phenomena in Spacelab experiments with microgravity. The influence of gravity on Marangoni convection during silicon melting is also theoretically investigated, calculating the flow in a floating zone for crystal growth for experiments on earth. Results show that Marangoni convection predominates over thermal gravity convection even for conditions on Earth. Author (ESA)

N80-13422# National Engineering Lab., East Kilbride (Scotland). Applied Heat Transfer Div.
CONDENSOR OPERATED INVERSE THERMOSIPHONS
D. Chisholm, I. D. R. Grant, and P. J. D. Duncan Sep. 1978 23 p refs
(NEL-659) Avail: NTIS HC A02/MF A01

A form of inverse thermosiphon is described and procedures for its use in thermal hydraulic design are outlined. The use of these procedures in the design of devices containing water as the working fluid is emphasized and charts for use in estimating performance developed. The use of an evaporator with a capillary surface is then examined and equations for the lift ratio as a function of circulation rate are derived both for a condenser with and without a capillary surface. Equations relating lift ratio to dryness fraction for use with systems using water are shown. It is noted that the temperature difference between the vapor in the principal and ancillary condensers can be a major factor governing design of these devices. Suitable fluids for use in the temperature range zero to 200C are then discussed. Author (ESA)

N80-13423# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
A REVIEW OF RESEARCH INTO OSCILLATING BOUNDARY LAYERS [APERCU DES RECHERCHES SUR LES COUCHES LIMITES EN ENCOULEMENT PULSE]
Jean Cousteix Paris Assoc. Aeron. et Astronautique de France 1979 25 p refs In FRENCH; ENGLISH summary Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-04; ISBN-2-7170-0531-5) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

The state of the art in the field of unsteady boundary layer research is reviewed. The subjects discussed for laminar flow include oscillation with nul average flow, secondary flow induced by the oscillating motion (steady steaming), oscillation with a nonzero average flow, and the influence of phase velocity. For

turbulent flow, the subjects discussed include oscillation with a nul average, oscillation with a nonzero constant average, the influence of wave convection velocity, the influence of unfavorable average pressure gradients, and the separation problem and the singularities in boundary layer calculations. Author (ESA)

N80-13424# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
FIRST RESULTS OF A STUDY ON TURBULENT BOUNDARY LAYERS IN AN OSCILLATING FLOW WITH A MEAN ADVERSE PRESSURE GRADIENT [PREMIERS RESULTATS D'UNE ETUDE SUR LES COUCHES LIMITES TURBULENTES EN ENCOULEMENT PULSE AVEC GRADIENT DE PRESSION MOYEN DEFAVORABLE]
Robert Houdeville and Jean Cousteix Paris Assoc. Aeron. et Astronautique de France 1979 19 p refs In FRENCH; ENGLISH summary Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-05; ISBN-2-7170-0532-3) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

The development of unsteady turbulent boundary layer subjected to an average pressure gradient large enough to produce separation was studied in order to complete the results already obtained with flat plates. Hot wire anemometers and a laser velocimeter equipped with Bragg cells were used. It is shown that the boundary layer, as in the case of a flat plate, responds to the external excitation with forced pulsations and that the average position of the zero friction point oscillates at the same frequency as the applied external excitation. The average velocity profiles obtained at various times of the period compare well with profiles deduced from similitude solutions. Author (ESA)

N80-13425# National Technical Information Service, Springfield, Va.
NUMERICAL METHODS IN FLUID FLOW PROBLEMS, VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Sep. 1977 - Jul. 1978
Guy E. Habercom, Jr. Aug. 1979 130 p
(NTIS/PS-79/0851/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

Among the numerical techniques cited are finite difference theory, finite element analysis, and numerical integration of differential equations including the Navier Stokes equations. Areas studied include boundary layer, hypersonic, supersonic, transonic regimes, atmosphere entry, heat transfer, blunt and concave bodies, gas dynamics, nozzle gas flow, turbomachinery, and hydrodynamics. This updated bibliography contains 121 abstracts, none of which are new entries to the previous edition. GRA

N80-13426# National Technical Information Service, Springfield, Va.
NUMERICAL METHODS IN FLUID FLOW PROBLEMS, VOLUME 5. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Aug. 1978 - Jul. 1979
Guy E. Habercom, Jr. Aug. 1979 167 p Supersedes NTIS/PS-78/0824; NTIS/PS-77/0798; NTIS/PS-76/0740; NTIS/PS-75/643; and COM-74-11499
(NTIS/PS-79/0852/8; NTIS/PS-78/0824; NTIS/PS-77/0798; NTIS/PS-76/0740; NTIS/PS-75/643; COM-74-11499) Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

Among the numerical techniques cited in this report for analysis of fluid flow problems include finite difference theory, finite element analysis, and numerical integration of differential equations including the Navier Stokes equations. Areas studied include boundary layer, hypersonic, supersonic, transonic regimes, atmosphere entry, heat transfer, blunt and concave bodies, gas dynamics, nozzle gas flow, turbomachinery, and hydrodynamics. This updated bibliography contains 158 abstracts, all of which are new entries to the previous edition. GRA

N80-13073# Academy of Sciences (USSR), Moscow.
CONVECTIVE PROCESSES AT LOW GRAVITY
V. I. Polezhaev *In* ESA Mater. Sci. in Space Jun. 1979 p 25-31 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13078# Polytechnical Univ. of Madrid (Spain).
FLOATING ZONE STABILITY (EXP. 1-ES-331)
I. DaRiva and I. Martinez *In* ESA Mater. Sci. in Space Jun. 1979 p 67-73 refs Sponsored by Spanish Natl. Comm. for Space Res. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13087# Fiat Research Center, Turin, Italy.
THE FLUID PHYSICS MODULE: A CONTRIBUTION TO MATERIALS SCIENCE AND PHYSICS IN SPACE
G. Ceronetti and G. Rovera *In* ESA Mater. Sci. in Space Jun. 1979 p 137-147 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13103# Bristol Univ. (England). School of Chemistry.
FUNDAMENTAL AND APPLIED ASPECTS OF FLUID PHYSICS UNDER MICROGRAVITY
J. M. Haynes *In* ESA Mater. Sci. in Space Jun. 1979 p 275-279 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13104# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.
FLOW PHENOMENA IN ROTATING FLOATING ZONES WITH AND WITHOUT MARANGONI CONVECTION
Ch.-H. Chun and W. Wuest *In* ESA Mater. Sci. in Space Jun. 1979 p 283-288 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13110# Little (Arthur D.), Inc., Cambridge, Mass.
EXPERIMENTS ON THE STABILITY OF CONICAL AND CYLINDRICAL LIQUID COLUMNS AT LOW BOND NUMBERS
A. A. Fowle, C. A. Wang, and P. F. Strong *In* ESA Mater. Sci. in Space Jun. 1979 p 317-325 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13111# Justus Liebig-Universitaet, Giessen (West Germany). Inst. fuer Physikalisches.
STEADY AND OSCILLATORY MARANGONI CONVECTION IN FLOATING ZONES UNDER 1g
D. Schwabe, A. Scharmann, and F. Preisser *In* ESA Mater. Sci. in Space Jun. 1979 p 327-333 refs Sponsored by DFVLR (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13113# Essen Univ. (West Germany).
MIGRATION OF GAS BUBBLES UNDER VARIOUS FORCE FIELDS IN A MICROGRAVITATIONAL ENVIRONMENT
J. Siekmann *In* ESA Mater. Sci. in Space Jun. 1979 p 341-347 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13114# Naples Univ. (Italy).
MARANGONI BOUNDARY LAYERS
L. G. Napolitano *In* ESA Mater. Sci. in Space Jun. 1979 p 349-358 refs (For primary document see N80-13069 04-12) (Contract CNR/SAS-77-061)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13115# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.
MARANGONI CONVECTION IN A LIQUID LAYER SUBJECTED TO ROTATION ABOUT A TRANSVERSE AXIS
G. S. R. Sarma *In* ESA Mater. Sci. in Space Jun. 1979 p 359-362 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors, measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-13427*# Santa Clara Univ., Calif.
THE DEVELOPMENT OF A DRAG SENSING THREE DIMENSIONAL TURBULENT BALL PROBE
Dah Yu Cheng Dec. 1977 77 p refs
(Grant NGR-05-017-033)
(NASA-CR-152269) Avail: Issuing Activity CSCL 14B

A three dimensional turbulent fluctuating probe was developed which utilizes the drag properties of a sphere to measure real time fluctuations of velocities and density along three orthogonal axes. Real time Reynolds stress waves were measured directly. The working principle is discussed in depth, including the fluid mechanical consideration and nonideal dynamic systems of electromagnetic sensing properties. The probe and the electronic system were fabricated and tested as a three channel signal processor. The probe was calibrated and extensively tested with various tripping means at the leading edge of a flat plate with and without a cavity. Results are presented in terms of compliances, dynamic response, calibration, Reynolds stress waves, and spectra of different test models. K.L.

N80-13428 Northwestern Univ., Evanston, Ill.
A NEW THERMAL CONDUCTIVITY APPARATUS FOR SMALL CONDUCTING SPECIMENS AND MEASUREMEMTS ON NIOBIUM MONOXIDE Ph.D. Thesis
Ning Hsieh 1979 212 p
Avail: Univ. Microfilms Order No. 7927373

An apparatus for measuring the thermal conductivity and other transport properties of small conducting specimens was designed and constructed using the Kohlrausch-Callendar type method, where the heat source is the Joule heating of the specimen itself caused by passing an electric current through. The apparatus was used to measure the thermal conductivity, electrical resistivity, and the thermoelectric power of two NbO specimens in the temperature range of 100 to 650K. The Lorenz ratio showed a positive deviation from the Sommerfeld value for simple metals that was attributed to the energy band structure effect. The impact of the band structure effect in interpreting the temperature dependence of electrical resistivity was discussed. The results suggest that reservations should be made when the theory of normal metals is applied to conducting oxides and other compounds, because many of the nonmetal conductors are known to have complex energy band structures. Dissert. Abstr.

N80-13429*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A LOW ENERGY ELECTRON MAGNETOMETER
Jag J. Singh, George M. Wood, Jr., Grayson H. Rayborn (Univ. of Southern Missippi, Hattiesburg), and Frederick A. White (Rensselaer Polytechnic Inst., Troy, N. Y.) Washington Dec. 1979 24 p refs
(NASA-TM-80172; L-13329) Avail: NTIS HC A02/MF A01 CSCL 14B

The concept of a highly sensitive magnetometer based on the deflection of low energy electron beams in magnetic fields is analyzed. Because of its extremely low mass and consequently high e/m ratio, a low energy electron is easily deflected in a magnetic field, thus providing a basis for very low field measurement. Calculations for a specific instrument design indicate that a low energy electron magnetometer (LEEM) can measure magnetic fields as low as 1000 nT. The anticipated performance of LEEM is compared with that of the existing high resolution magnetometers in selected applications. The fast response time of LEEM makes it especially attractive as a potential instrument for magnetic signature analysis in large engineering systems. J.M.S.

N80-13430*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INSTRUMENT ERROR ANALYSIS AS IT APPLIES TO WIND-TUNNEL TESTING
Emanuel Rind Dec. 1979 61 p
(NASA-TP-1572; L-13222) Avail: NTIS HC A04/MF A01 CSCL 14B

Errors resulting from the instrumentation used to measure wind tunnel model parameters are analyzed. The pertinent parameters, their standard deviations, and the theoretical derivation of them, are given. Some BASIC programs and plots for the standard deviations of dynamic pressure, Mach number, and Reynolds number are included. K.L.

N80-13431# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF IN SITU MARINE SEISMIC AND GEOTECHNICAL INSTRUMENTATION SYSTEMS
E. W. Reece 1979 18 p refs Presented at DOE Symp. on Enhanced Oil and Gas Recovery and Improved Drillings Technol., Tulsa, Okla., 22 Aug. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0868C; CONF-790805-3) Avail: NTIS HC A02/MF A01

A pair of in situ marine geotechnical instrumantation systems, capable of operating unattended for extended periods of time in remote locations, were designed and fabricated, and are currently undergoing testing. The seafloor earthquake measurement system measures the response of marine sediments to strong and moderate seismic activity. The geotechnically instrumented seafloor probe measures the in situ pore pressure in soft marine clays. The two systems have many common characteristics. Both systems consist of two principal subsystems: a seafloor data gathering package and a shipboard command and recording package. The seafloor packages are totally self-contained, and incorporate microprocessor-based electronics which control data collection, processing, and storage. Data collected and stored by the seafloor packages are transmitted on command to the command and recording package by a high-data-rate acoustic telemetry system. DOE

N80-13432# Oak Ridge National Lab., Tenn.
OPTIMIZATION OF AN ANALYTICAL ELECTRON MICROSCOPE FOR X-RAY MICROANALYSIS: INSTRUMENTAL PROBLEMS
J. Bentley, N. J. Zaluzec, E. A. Kenik, and R. W. Carpenter 1979 15 p refs Presented at the Scanning Electron Microscopy Conf., Washington, D.C., 16 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790418-6) Avail: NTIS HC A02/MF A01

The complications which can arise in performing X-ray microanalysis in current analytical electron microscopes are discussed. Fluorescence by uncollimated radiation was studied. The source, distinguishing characteristics, effects on quantitative analysis and schemes for elimination or minimization as applicable to TEM/STEMs, D-STEMs and HVEMs are discussed. The local specimen environment is considered in the second major section, where again, detrimental effects on quantitative analysis and remedial procedures, particularly the use of low-background specimen holers, are highlighted. Finally, the detrimental aspects of specimen contamination, insofar as they affect X-ray microanalysis, are discussed. It is concluded that if the described preventive measures are implemented, reliable quantitative analysis is possible. DOE

N80-13433# Sandia Labs., Albuquerque, N. Mex.
PORTABLE HIGH-TEMPERATURE, HIGH-PRESSURE VISCOMETER DEVELOPMENT
R. C. Reineke Mar. 1979 23 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1409) Avail: NTIS HC A03/MF A01

A field instrument for measuring the rheological characteristics of drilling mud at temperatures up to 260 C and pressures of 12,500 psi was developed. This instrument allows a direct determination of fluid viscosity under simulated downhole conditions. The instrument is comprised of a rotational viscometer packaged in a high temperature, high pressure vessel and weighs approximately 60 pounds. The design and construction of the instrument are described and the results of measurements of

six different drilling fluid formulations are presented. These test results show that water based samples exhibit a marked increase in viscosity with increasing pressures. In oil based muds the thinning effect caused by increasing temperature is partially compensated for by the thickening effect of increasing pressure.
DOE

N80-13434# Allied Chemical Corp., Idaho Falls, Idaho.
LABORATORY DESIGN FOR MODERN ANALYTICAL INSTRUMENTS
G. V. Wheeler 1979 14 p refs Presented at Intern. Conf. on Atomic Spectroscopy, Cambridge, United Kingdom, 1 Jul. 1979 (Contract EY-76-C-07-1570)
(CONF-790702-1) Avail: NTIS HC A02/MF A01
The design of analytical chemistry laboratories housing spectroscopic instruments is discussed.
DOE

N80-13435# Royal Aircraft Establishment, Farnborough (England).
NOTES ON THE TRANSIENT RESPONSES AND ERRORS OF SHOCK ACCELEROMETERS WITH SECOND-ORDER FILTERS
W. R. Macdonald London HMSO Jan. 1979 28 p refs
(RAE-TM-IT-179; BR66839) Avail: NTIS HC A03/MF A01
The response of accelerometers, with second-order filters, is considered for 1/2 sin and sin squared acceleration pulses. The time history of their integrated (velocity) response is also treated. Graphs relating the error in measuring peak acceleration to the filter parameters are given and the results are related to practical situations experienced when calibrating accelerometers. The effect of accelerometer nonlinearity when calibrating by velocity-change methods is briefly investigated and a method of measuring the nonlinearity is suggested.
Author (ESA)

N80-13436# Oxford Univ. (England). Dept. of Engineering Science.
USER'S HANDBOOK FOR GT8 GALVANOMETER DRIVE AMPLIFIER SYSTEM
W. G. Wooster and M. L. G. Oldfield 1979 59 p
(OUEL-1284/79) Avail: NTIS HC A04/MF A01
The GT8 system of galvanometer drive amplifiers is described. The system was designed to prove as interface with multichannel ultraviolet chart recorders in such a way that the user is presented with a high input impedance voltage sensing input with a wide range of sensitivities. This, together with the type of input facilities expected of a modern cathode-ray oscilloscope, makes for a very versatile signal conditioning system. The design is particularly useful for the measurement of heat transfer measurements.
Author (ESA)

N80-13070# Academy of Sciences (USSR), Moscow. Inst. of Science Research.
THE MULTIPURPOSE APPARATUS CRYSTAL FOR PROCESS EXPERIMENTS IN SPACE
A. Yu. Malinin, R. Z. Sagdeev, V. T. Khryapov, E. T. Solomin, V. I. Seliverstov, Yu. M. Zhelanni, A. F. Podolinni, and D. V. Bocharov *In* ESA Mater. Sci. in Space Jun. 1979 p 5-8 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13086# Centro Informazioni Studi Esperienze, Milan (Italy).
UHV-CHAMBER: THEORETICAL BACKGROUND AND FACILITY DEVELOPMENT
N. Adorni, G. Ghersini, P. G. Sona, F. Rossitto (Milan Polytech.), and G. Cortelazzi (Control Systems) *In* ESA Mater. Sci. in Space Jun. 1979 p 125-132 refs Sponsored by CNR (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13088# Battelle Inst., Frankfurt am Main (West Germany).
POSITIONING AND MIXING INSTRUMENTATION EMPLOYING ELECTROSTATIC AND ACOUSTIC PRINCIPLES
E. G. Lierke, W. M. Heide, R. Grossbach, and P. F. Clancy (ESTEC, Noordwijk, Netherlands) *In* ESA Mater. Sci. in Space Jun. 1979 p 149-157 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13091# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
FUNCTIONAL PERFORMANCE OF THE ISOTHERMAL HEATING FACILITY FOR THE MATERIAL SCIENCE DOUBLE RACK
Joachim E. Geisel and Franz Hugo (Leybold Heraeus) *In* ESA Mater. Sci. in Space Jun. 1979 p 167-176 (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13092# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
EXPERIMENT MODULES AND FACILITIES IN TEXUS 1 AND 2
Joachim E. Geisel and Burkhard Franke *In* ESA Mater. Sci. in Space Jun. 1979 p 177-188 (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13093# Centre National d'Etudes Spatiales, Toulouse (France).
A CONTAINER FOR CONDITIONING SPACE EXPERIMENTS
F. Jamin Changeart and J. Cadars *In* ESA Mater. Sci. in Space Jun. 1979 p 189-199 In FRENCH and ENGLISH (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-13437 Maryland Univ., College Park.
PHYSICAL PROCESSES AFFECTING THE PERFORMANCE OF HIGH-POWER, FREQUENCY-DOUBLED SHORT-PULSE LASER SYSTEMS: ANALYSIS, SIMULATION, AND EXPERIMENT Ph.D. Thesis
John James Degnan, III 1979 587 p
Avail: Univ. Microfilms Order No. 7926507
A compilation of the physical mechanisms which affect the propagation of radiation in high peak power and high average power, solid state laser amplifier chains and frequency doublers is presented along with an assessment of their impact on system design. The numerical methods employed in a computer program PULSE are described. They simulate the propagation of a cylindrically symmetric CW wave or repetitive pulse train through single-pass and double-pass amplifiers, lenses, mirrors, hard and soft apertures, magnifying optics, curved dielectric surfaces, third-order nonlinear Kerr and thermal media, and frequency doublers. Results are presented of experiments characterizing the University of Maryland, Nd:YAG oscillator/regenerative amplifier system and its performance and to suggest, on the basis of the theoretical and numerical results, optimum amplifier and frequency doubler configurations for generating the high peak and average powers required for precise laser ranging to extraterrestrial targets.
Dissert. Abstr.

N80-13438*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
NUCLEAR-PUMPED LASERS
Dec. 1979 140 p refs Proc. of Workshop held at Hampton, Va., 25-26 Jul. 1979
(NASA-CP-2107; L-13386) Avail: NTIS HC A07/MF A01 CSCL 20E
The state of the art in nuclear pumped lasers is reviewed. Nuclear pumped laser modeling, nuclear volume and foil excitation of laser plasmas, proton beam simulations, nuclear flashlamp excitation, and reactor laser systems studies are covered. For individual titles, see N80-13439 through N80-13453.

N80-13439*# Florida Univ., Gainesville.
UNIVERSITY OF FLORIDA NUCLEAR PUMPED LASER PROGRAM
Richard T. Schneider *In* NASA Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 1-10 (For primary document see N80-13438 04-36)

Avail: NTIS HC A07/MF A01 CSCL 20E

The mechanism of excitation of laser gases by fast ions (triton, proton, or fission fragments) and especially any role UF6 might play in radiative deexcitation of these gases were investigated. Population densities of excited important for laser action were obtained. Nuclear pumped CW-laser systems, especially He-Ne and CO2, were studied using steady state reactors. It was demonstrated that He-Ne lases in a CW-mode with nuclear pumping at both the red and the infrared transition. The infrared transition was observed to be superradiant. J.M.S.

N80-13440*# Florida Univ., Gainesville.
NUCLEAR-PUMPED CO2 LASER
Michael Rowe *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 11-18 (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

The He-3 (n,p)T reaction was examined as an energy source for a CO2 laser. For this purpose He-3 was added to a functioning CO2 electrically excited laser. Initially the laser was run electrically with 12 torr total pressure. The gas mixture was 1:1:8, CO2:N2:He. At zero reactor power, the laser was tested in place next to the core of the Georgia Tech. Research Reactor. After verification of laser action He-3 was added to the system. The He-3 partial pressures of 10 torr, 50 torr, and 300 torr were added in three separate reactor runs. Reactor power ranged from zero to 5 million watts, which corresponds to a peak flux of 10 to the 14th power/sq cm. At reactor powers greater than 10 kW, gain of up to 30 percent was shown. However, indications are this may be due to gamma excitation rather than caused by the He-3 (n,p)T reaction. These results do agree with the data of past CO2 nuclear pumped laser experiments. J.M.S.

N80-13441*# Florida Univ., Gainesville.
EXPERIMENTAL SETUP FOR DECOMPOSITION OF UF6
Michael Rowe *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 19-24 (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

The rate at which UF6 decomposes into UF5 and UF4 was determined as a function of neutron fluence. To study UF6 decomposition rate, an absorption cell for VUV and the associated VUV spectroscopy system was used to measure UF6 while under irradiation. The cell contains 50 torr of UF6 at room temperature to insure that the UF6 is in a gaseous state. It is shown that by determining the absorption coefficient below 2100A for UF6, above 2100A for F2, and at 4100A for cell degradation, UF6 decomposition can be measured at a neutron flux of 10 to the 12th power/sq cm for 72 continuous hours. J.M.S.

N80-13442*# Florida Univ., Gainesville.
CW NUCLEAR PUMPED LASING OF 3He-Ne
B. Dudley Carter *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 25-32 (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

The results of a study on the CW nuclear pumped lasing of the He-Ne system are presented. Preliminary experiments measured single pass gain for the 6328.2A laser transition at neutron fluxes up to 1 x 10 to the 14th power neutrons/sq cm sec. Peak gain for a 300 torr (He-3)-Ne (5:1 mixture) was found to be 8.84 dB/meter at a 2 x 10 to the 12th power neutrons/sq cm sec neutron flux. Further experiments measured the gain in the flux region from one million to 2 x 10 to the 12th power neutrons/sq cm sec. In addition, gain vs. probe laser intensity at various neutron fluxes was measured. These measurements resulted in the construction of a laser cavity and the subsequent CW nuclear pumped lasing at 6328.2A in (He-3)-Ne. Experiments were also carried out on the 3.39 micrometer superradiant line in (He-3)-Ne. On three separate occasions, at two different facilities, lasing was observed. Although (He-3)-Ne was found to have the lowest threshold for lasing found so far, it also had the lowest output power on the order of tens of microwatts. J.M.S.

N80-13443*# Florida Univ., Gainesville.
SPECTRAL EMISSION OF NUCLEAR EXCITED XeBr*
R. A. Walters *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 33-36 refs (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

The vacuum-ultraviolet spectroscopy system and MCFIG capsule were filled with a He-3:Ar:Xe:Br (534:195:12:6) torr mixture and irradiatied by a CW flux of 17 x 10 to the 11th power neutrons/sq cm sec. The XeBr* emission was observed, but the Br2 emission normally observed in argon-bromine mixtures predominates. This spectrum is typical of these mixtures with XeBr* probably peaking with 0.1 percent Bromine in 2 atmosphere argon with 2 percent xenon. The addition of a large partial pressure of He-3 produces additional unknowns. The typical vibrational structure of XeBr* was not observed. Sapphire emission continuums were present. Energy deposition was 0.43 watts and the capsule output under the XeBr* and Br2 bands was 0.0016 watts, giving an efficiency of 0.37 percent. J.M.S.

N80-13444*# Illinois Univ., Urbana. Fusion Studies Lab.
UNIVERSITY OF ILLINOIS NUCLEAR PUMPED LASER PROGRAM
George H. Miley *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 37-39 refs (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

The development of nuclear pumped lasers with improved efficiency, energy storage capability, and UF6 volume pumping is reviewed. Results of nuclear pumped laser experiments using a TRIGA-type pulsed reactor are outlined. J.M.S.

N80-13445*# Illinois Univ., Urbana. Fusion Studies Lab.
NUCLEAR PUMPING MECHANISMS IN ATOMIC CARBON AND IN EXCIMERS
M. A. Prelas *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 41-43 refs (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

Results of atomic carbon and XeF* nuclear pumping experiments are briefly discussed. Features of escimer lasers important for nuclear pumping are included. J.M.S.

N80-13446*# Miami Univ., Coral Gables, Fla.
LaRC RESULTS ON NUCLEAR PUMPED NOBLE GAS LASERS
R. J. DeYoung *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 45-60 refs (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

The recent experiment and theoretical results obtained for noble gas nuclear laser systems are presented. It is shown that the noble gas lasers are among the easiest systems to pump by nuclear excitation and as a result, all of the noble gases except He have lased under nuclear excitation. The noble gas systems are not ideal for high-power applications but they do give valuable insight into the operation and pumping mechanisms associated with nuclear lasers. At present, the Ar-Xe system is the best noble gas candidate for (U-235)F6 pumping. It appears that the quenching of Ar-Xe lasing is a result of the fluorine and not the uranium or fission fragments themselves. Thus, to achieve lasing with UF6, a fluorine compatible system must be found. R.E.S.

N80-13447*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NUCLEAR EXCITATION OF CO2 AND CO
N. W. Jalufka *In its* Nucl.-Pumped Lasers Dec. 1979 p 61-68 refs (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

A technology assessment of CO2 and CO nuclear pumped laser experiments is presented. R.E.S.

N80-13448*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NUCLEAR PUMPED LASER MODELING
J. W. Wilson and A. Shapiro *In its* Nucl.-Pumped Lasers Dec. 1979 p 69-82 (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

A model for an indirectly nuclear pumped laser experiment

was developed. The apparatus consists of the usual cylindrical neutron moderator enclosing a gas filled quartz cell. The quartz cell in this case has two concentric compartments; the larger output compartment is filled with He-3 and fluorescent gases which are coupled radiatively to the inner compartment which is filled with a lasing gas for efficient optical pumping. The fluorescent gas in this study was a mixture of Ar, Kr and F2. Perfluoroalkyliodide was chosen as the lasant material of the inner compartment. The degree of photoabsorption in the lasant gas was calculated. The kinetic efficiencies of various gas combinations in the outer fluorescence tube were then evaluated in order to maximize the fluorescence output in the iodine pump band. R.E.S.

N80-13449*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
KINETICS OF A CO2 NUCLEAR PUMPED LASER
H. A. Hassan *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 83-90 (For primary document see N80-13438 04-36)
(Grant NsG-1058)
Avail: NTIS HC A07/MF A01 CSCL 20E

A detailed kinetic model is presented for the analysis of a nuclear pumped CO2-N2-He laser system. The model assumes that collisional recombination is the dominant pumping mechanism. The results show that, for mixtures typical of those employed in electric discharge systems, the gain coefficients are such that lasing is not expected to take place. On the other hand, concentrations of CO2 in the range 1/2 percent - 3 percent are optimal for direct nuclear pumping. Author

N80-13450*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NUCLEAR PUMPED LASER RESEARCH AT THE JET PROPULSION LABORATORY
Gary R. Russell *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 91-93 refs (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

Using a partially nuclear excited xenon flashlamp to pump an iodine laser, laser pulse shapes were analyzed with and without nuclear flashlamp augmentation. The pulse shapes indicate that the deposition of nuclear energy is equally as effective as electrical energy deposition in producing laser pulse energy output. The amplification of the E-beam pumped CF3I was measured at pressures of several atmospheres. Preliminary data shows that, for a part of the iodine laser pulse, amplification of almost a factor of two is measured. This measurement indicates that the gain in an E-beam pumped CF3I is an order of magnitude greater than in the coaxial laser tube. R.E.S.

N80-13451*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
NUCLEAR PUMPED LASERS: ADVANTAGES OF O2 (1 DELTA)
J. J. Taylor *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 109-112 (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

Nuclear pumped laser technology was evaluated as a possible future weapons contender. It was determined that in order to become a primary weapon the following engineering problems must be solved: shielding, heat dissipation, high efficiency fixed focus pumping, good beam quality, and thermal blooming. R.E.S.

N80-13452*# Army Missile Command, Redstone Arsenal, Ala.
SIMULATION STUDIES FOR A NUCLEAR PHOTON PUMPED EXCIMER LASER
Thomas G. Miller and John E. Hagefstration (Ballistic Missile Defense Advanced Technology Center, Huntsville, Ala.) *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 113-116 (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

Simulation studies were undertaken to determine the feasibility of a nuclear photon pumped excimer laser using a system where high pressure Xe is bombarded with electrons and protons to form 1720 A. Primary measurements included conversion efficiency and gain vs time measurements. R.E.S.

N80-13453*# United Technologies Research Center, East Hartford, Conn. Fluid Dynamics Lab.
CONCEPT FOR UF6-FUELED SELF-CRITICAL DNPL REACTOR SYSTEM
R. J. Rodgers *In* NASA. Langley Res. Center Nucl.-Pumped Lasers Dec. 1979 p 117-134 refs (For primary document see N80-13438 04-36)
Avail: NTIS HC A07/MF A01 CSCL 20E

An analytical study of a self-critical nuclear pumped laser system concept was performed. The primary emphasis was on a reactor concept which would use gaseous uranium hexafluoride (UF6) as the fissioning material. A reference configuration was selected which has a 3.2 cu m lasing volume as the reactor core. The core is composed of a series of hexagonal graphite tubes which are surrounded by a reflector-moderator composed either of heavy water or beryllium. Laser transitions requiring average fission power densities less than approximately 1 kW/cu cm for excitation are most attractive. Operation at wavelengths greater than approximately 400 nm may be required because of limitations imposed by the opacity of gaseous UF6. Further research directed toward identification of UF6 compatible lasing transitions is required. R.E.S.

N80-13454# Defence Research Establishment Valcartier (Quebec).
A PURELY CHEMICAL HBr LASER
S. J. Arnold and K. D. Foster Sep. 1978 19 p refs
(AD-A060841; DREV-R-4129/78) Avail: NTIS HC A02/MF A01 CSCL 20/5

Purely chemical laser action in HBr has been achieved for the first time. Chlorine atoms produced by the reaction of NO with Cl O2 were reacted with molecular bromine to form bromine atoms which in turn reacted with HIQTO FORM vibrationally excited HBr. Multiline HBr laser output of 0.58 W originated from the Ps ub 1 yields 0 (4), P sub 1 yields 0 (5), and P sub 1 yields 0(6) lines of the v = 1 yields 0 vibrational band. GRA

N80-13455# International Business Machines Corp., Hopewell Junction, N. Y. East Fishkill Labs.
LIFETIME CONTROL IN SILICON THROUGH FOCUSED LASER BEAM DAMAGE Technical Report, 1 May - 31 Dec. 1978
G. H. Schwuttke and K. H. Yang 5 Feb. 1979 86 p
(Contract N00173-76-C-0303; ARPA Order 3231)
(AD-A072909; TR-22.2260) Avail: NTIS HC A05/MF A01 CSCL 20/8

This report consists of two chapters. Chapter I discusses minority carrier lifetime degradation in silicon as a result of 200 Kev argon and 80 Kev silicon implantation. The lifetime degradation is studied for the implantation dose range of 10 to the 11th power to 10 to the 16th power ions/cm sq. The lifetime degradation is different for argon and silicon implantation. For low argon implantation the decrease in lifetime is impurity controlled. At a higher dose the decrease in lifetime is caused by the argon impurity and by the crystal defects generated by the recrystallization of the amorphous damage layer. For silicon implantations the decrease in lifetime is caused by crystal defects only and is minor up to a dose of 10 to the 14th power Si(-)/cm sq. Chapter II reports results on buried layer gettering through high energy oxygen and argon implantations. High energy argon gettering depends on the implantation dose. Maximum gettering is obtained for high dose implantation. Oxygen gettering shows no implantation dose dependency. Remarkable gettering efficiencies are obtained for an implentation dose of 10 to the 11th power O(-)/cm sq. GRA

N80-13456# Naval Research Lab., Washington, D. C. Material Science and Technology Div.
APPLICATION OF COATINGS BY HIGH ENERGY CW LASERS Semiannual Report, 1 Apr. - 1 Oct. 1978
R. J. Schaeffer, J. D. Ayers, and T. R. Tucker Mar. 1979 36 p
(ARPA Order 3579)
(AD-A073347; AD-E000312; NRL-MR-3953) Avail: NTIS HC A03/MF A01 CSCL 11/3

The objective of this program is to apply coatings to the surface of metals using the high energy density heating of CW lasers. The coatings are applied by either the laser spray process,

in which powder is heated and propelled to the substrate surface for deposition, or by plasma spraying with subsequent laser remelt. This report describes the development of methods for carrying out and analyzing these processes, the selection of materials, and the early experimental results. The kinetics of laser spraying of aluminum oxide in air are reported. GRA

N80-13457# Army Missile Research and Development Command, Redstone Arsenal, Ala.
COMPILATION OF DATA RELEVANT TO NUCLEAR PUMPED LASERS, VOLUME 5
E. W. McDaniel, M. R. Flannery, E. W. Thomas, H. W. Ellis, and K. J. McCann Feb. 1979 470 p
(AD-A073575; DRDMI-H-78-1-Vol-5) Avail: NTIS HC A20/MF A01 CSCL 20/5

This volume, and volumes 3 and 4, contain a compilation of data relevant to nuclear pumped lasers and are part of a series on atomic and molecular data for gas laser research and development. The first two volumes, contained: Compilation of Data Relevant to Rare Gas-Rare Gas and Rare Gas-Monohalide Excimer Lasers by E. W. McDaniel, M. R. Flannery, H. W. Ellis, F. L. Eisele, W. Pope, and T. G. Roberts. GRA

N80-13458# Case Western Reserve Univ., Cleveland, Ohio.
DIPOLAR DEFECT STRUCTURE OF LASER AND OTHER TRANSPARENT MATERIALS Final Report, May 1976 - May 1979
Carl Andeen and Donald E. Schuele 15 Jul. 1979 19 p refs
(Grant DAAG29-76-G-0222)
(AD-A073815; ARO-13440.7-P) Avail: NTIS HC A02/MF A01 CSCL 20/5

The dipolar defects resulting from rare-earths doped in alkaline earth fluorides have been measured by the method of dielectric relaxation. These measurements have been made over the temperature range 5 K to 400 K and, in some cases, as a function of pressure. New relaxation peaks were discovered, particularly at low temperatures. The strengths of the various defects did not scale monotonically with dopant concentration. Measurements on crystals with two or more dopants enabled a positive identification of clustering. Studies were also carried out on alkaline earth fluorides doped with alkali metals, a series of optical glasses, and some semiconductors. A microprocessor controlled automatic capacitance bridge was developed and constructed and is operational. Advancements were made on the high pressure dielectric gauge. GRA

N80-13459# Wisconsin Univ. - Madison.
EXPERIMENTAL EVALUATION OF NEW SOLID STATE LASER SCHEMES Final Report, Nov. 1977 - Oct. 1978
William M. Yen May 1979 13 p refs
(Contract N00014-76-C-0402)
(AD-A073656) Avail: NTIS HC A02/MF A01 CSCL 20/5

Various schemes for tunable solid state lasers are discussed. Results of measurements of excited state absorption for YAG:Ce(3-) are presented. The potential of color center lasers for blue-green emission is examined. GRA

N80-13460# Los Alamos Scientific Lab., N. Mex.
EFFECT OF DEVIATIONS FROM THE MAXWELL DISTRIBUTION ON NEUTRON PRODUCTION IN LASER TARGETS
D. B. Henderson and A. G. Petschek Nov. 1978 16 p refs
(Contract W-7405-eng-36)
(LA-7532-MS) Avail: NTIS HC A02/MF A01

The ion distribution and the deuterium tritium fusion reactivity (sigma v) were calculated. Results are presented for the ratio of (sigma v) for a monoenergetic isotropic distribution to that for a Maxwell distribution, for the rate of approach of (sigma v) to the equilibrium value, and for the decay of (sigma v) due to fast ion losses. The main effect in the last case is due to energy losses, not to non-Maxwellian distribution. The effect is substantially different than previously reported. DOE

N80-13461# California Univ., Livermore. Lawrence Livermore Lab.
TIME DEPENDENT PROPAGATION OF HIGH-ENERGY LASER BEAMS THROUGH THE ATMOSPHERE, 4
J. R. Morris and J. A. Fleck, Jr. 15 Dec. 1978 35 p refs
(Contract W-7405-eng-48)
(UCRL-52654) Avail: NTIS HC A03/MF A01

Calculations are presented for combined t to the 3d power blooming and overlap blooming of a multipulse laser beam whose beam shape is a uniformly illuminated square aperture. Thermal conduction and intensity saturation models for simulation of laboratory scale experiments are described. A comparison of experimental data with calculation of combined t to the 3d power blooming and overlap blooming is discussed. A return wave algorithm for computing phase compensation for steady state cw or multipulse thermal blooming of lasers that emit significant radiation on more than one spectral line is described. DOE

N80-13462# Sandia Labs., Albuquerque, N. Mex.
TRANSMISSION OF FREE-RUNNING LASER PULSES OF HIGH ENERGY AND POWER DENSITIES THROUGH PREVIOUSLY GAMMA RADIATED FIBER WAVEGUIDES
M. J. Landry Mar. 1979 26 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0441) Avail: NTIS HC A03/MF A01

Measurements of the coupling efficiency (output energy/input energy), input and output energy and power densities, the surface threshold damage levels and the optical damage in three types of fiber optic waveguides are described. The properties of fibers were measured using 400 micro s-duration Nd:glass laser pulses before and after irradiation with a Co -60 gamma ray source. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-13463 Stevens Inst. of Tech., Hoboken, N. J.
AN INVESTIGATION OF THE EFFICIENCY OF REGENERATIVE BLOWERS AND PUMPS Ph.D. Thesis
Joel Warren Hollenberg 1978 109 p
Avail: Univ. Microfilms Order No. 7925052

The parameters controlling the efficiency of regenerative pumps and blowers were investigated. Measurements made of the pressure, flow and torque at constant speed and clearance on a circular section regenerative blower were non-dimensionally correlated through an analysis based on the Euler equation, simplified and integrated, with the solution modified for viscous effects based on curved pipe flow studies. The correlation depends on a single experimental parameter. The correlation among torque, pressure and flow rate was used to examine the variation in efficiency-specific speed characteristic of regenerative turbomachines over the range of their probable designs. The maximum efficiency is shown to be a function of a radius ratio parameter and a friction head coefficient ratio. A computer generated parameter study based on these results is presented. Dissert. Abstr.

N80-13464 Northeastern Univ., Boston, Mass.
A FLUID MECHANICAL-KINETIC THEORY DESCRIPTION OF A SPHERICALLY SYMMETRIC DISCHARGE IN A NEUTRAL MEDIUM Ph.D. Thesis
Abdelhamid H. M. Hamdi 1978 219 p
Avail: Univ. Microfilms Order No. 7923535

The effect of negative corona discharge on a background of neutral atoms was studied. The boundary conditions at the discharging probe surface and a spherical shell located away from the probe surface were obtained. In spherical geometry, the governing differential equations were examined. It was found that the neutral particles have no mass flux with the assumption of spherical symmetry. Their number density showed an exponential decrease toward the probe surface. The ions' governing differential equations were reduced to one ordinary nonlinear differential equation which governs the potential distribution with a nondimensional parameter C [C alpha current x (probe radius) cubed] Dissert. Abstr.

N80-13465 Dayton Univ., Ohio.
TRANSIENT THERMAL EFFECTS IN DISC BRAKES Ph.D. Thesis
Ben Joseph Brookman, Jr. 1979 467 p

Avail: Univ. Microfilms Order No. 7925693

The development of a general theoretical model for predicting temperatures within the stators, rotors, rim, torque tube, tire, fuse plug and bead seat of a typical disc brake assembly is described with emphasis on: (1) temperature measurement analysis, (2) theoretical analysis of brake and component parts, and (3) full-scale brake tests. Correlation of results showed that the one-dimensional axial and the one-dimensional radial models predict peak temperatures during a brake stop that are up to 31 percent and 16 percent higher than experiment, respectively. The two-dimensional model predicts peak temperatures within 5 percent of experiment in three out of the four cases considered, with the fourth case less than 8 percent. The peak temperature predictions within the torque tube, fuse plug, derive lug, bead seat and contained air were within 10 percent of experiment for most cases. Dissert. Abstr.

N80-13466 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE PERFORMANCE ESTIMATION OF AN AXIAL-FLOW COMPRESSOR STAGE USING THEORETICALLY DERIVED BLADE ELEMENT CHARACTERISTICS WITH EXPERIMENTAL COMPARISON Ph.D. Thesis
Ralph Raymond Jones, III 1979 252 p
Avail: Univ. Microfilms Order No. 7924114

A method is developed for the calculation of steady, quasi-three-dimensional, subsonic, compressible flow through a two-dimensional cascade of blades which includes the effects of viscosity. The prediction technique allows the calculation of the typical blade element characteristics of deviation angle and total pressure loss coefficient for a wide range of incidence angles. The spanwise performance of an axial-flow compressor stage is estimated by integrating the radial component of the momentum equation at the inlet guide vane exit/rotor entrance and rotor exit stations. A three stage axial-flow compressor with a design speed and mass flow rate of 17,000 RPM and 24.5 lbm/sec respectively, and a nominal pressure ratio of 1.2 per stage is used to evaluate the prediction technique. Dissert. Abstr.

N80-13467 Virginia Polytechnic Inst. and State Univ., Blacksburg.
EXPERIMENTAL AND PREDICTED PERFORMANCE FOR THE COMBUSTION OF A LOW HEATING VALUE GAS IN A SWIRL BURNER Ph.D. Thesis
James G. Rice 1979 169 p
Avail: Univ. Microfilms Order No. 7924136

A finite difference analysis of the flow and combustion processes of a low heating valve gas in a swirl burner is developed. The solution algorithm is given the acronym CENCIS, derived from centered-cell-implicitly-staggered. To illustrate the incorporation of the algorithm into a computer code, a sample program is developed to solve a simplified problem which has a closed form solution. Calculations are presented for the swirl burner, and the predicted results are compared with experimental data. The program used for the calculation of swirl burner performance, PRIMCO, includes variable density and viscosity effects and incorporates a two equation turbulence model for the Reynolds stress terms. Because of the use of the nonstaggered grid system, the CENCIS solution algorithm is less complicated than previous algorithms. It requires approximately one third the computations of the staggered grid approach. Dissert. Abstr.

N80-13468 Wisconsin Univ. - Madison.
INTERNAL COMBUSTION ENGINE SAMPLING PROBES: A STUDY OF SAMPLE-GAS ORIGINS, FLOW DISTURBANCES AND QUENCH-LAYER BIAS Ph.D. Thesis
Stephen Robert Turns 1979 332 p
Avail: Univ. Microfilms Order No. 7918169

Several gas-sampling characteristics of an electromagnet operated, intermittent-flow sampling probe and a continuous-flow sampling probe were investigated. Of the many sources for error in species concentration measurement, three were chosen for investigation: the flow disturbance associated with a probe's sink action, the flow disturbance associated with a probe's presence, and the bulk-gas sample bias caused by flame quenching at the probe's surface. Investigation of these error sources also provided knowledge about the physical origins of the sampled gas. Flow disturbance errors were determined principally by experiment, while estimates of the quench-layer bias were determined principally by mathematical modeling. The experimental investigation used a steady-flow rig which provided reproducible velocity and concentration fields for sampling. Dissert. Abstr.

N80-13469 Iowa Univ., Iowa City.
OPTIMAL DESIGN OF OPEN-LINKAGE MECHANICAL SYSTEMS Ph.D. Thesis
Yong-San Yoon 1979 109 p
Avail: Univ. Microfilms Order No. 7924546

The problem of determining those particular human body motions that optimize performance criteria is discussed. The solution algorithm is derived for a general open linkage system that may exhibit intermittent discontinuous motions and applied to a four-bar planar open chain linkage system representing the human body during a standing vertical jump. An optimization problem (open loop control) is formulated in which the objective function is the maximum height reached by the distal tip of the upper extremity segment (finger tip). An optimal solution of this constrained nonlinear programming problem is found using the method of steepest descent. Once the optimal design is determined, the associated kinematic behavior of the open linkage system and the optimal joint torques are easily determined. Numerical results are presented, using body segment parameters for a typical adult male and reasonable constraint values. Dissert. Abstr.

N80-13470 Iowa Univ., Iowa City.
DESIGN SENSITIVITY ANALYSIS AND OPTIMIZATION OF CONSTRAINED DYNAMIC SYSTEMS Ph.D. Thesis
Narayan Chandra Barman 1979 179 p
Avail: Univ. Microfilms Order No. 7924454

A systematic theory was derived and corresponding general computer program was developed for the design of constrained dynamic systems. The method automatically integrating the equations of motion and design sensitivity adjoin equations. The following branches of mathematics and mechanics were used in developing the method: (1) optimization, (2) rigid body mechanics, (3) numerical integration, and (4) matrix manipulation. Dissert. Abstr.

N80-13471 Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN ANALYTICAL INVESTIGATION OF THREE-DIMENSIONAL VIBRATION IN GEAR-COUPLED ROTOR SYSTEMS Ph.D. Thesis
John William Daws 1979 423 p
Avail: Univ. Microfilms Order No. 7924099

An analysis of three dimensional forced vibration response of gear coupled rotor systems is presented. The time varying nature of the gear mesh stiffness is developed and compared to other published results. Hibner's branching technique is applied to the gear mesh to produce three dimensional coupling. The proposed analysis technique was used to predict the forced response of a set of high speed gear coupled turborotors for sixteen discrete frequencies. Bearing force level data obtained from the manufacturer is presented. Dissert. Abstr.

N80-13472*# Texas A&M Univ., College Station.
EFFECTS OF SOFT FOAM INSULATION IMPACT Final Report
James L. Rand and David J. Norton [1979] 96 p
(Contract NAS9-15962)
(NASA-CR-160400) Avail: NTIS HC A05/MF A01 CSCL 20L

High temperature reusable surface insulation (HTRSI) tiles were impacted by a variety of foam insulation materials typical of the debris expected to strike the shuttle orbiter during the initial phases of flight. Failure of the HIRSI coating was strongly dependent on the density and size of the projectile. The failure threshold was as low as 140 ft/sec for rubber and as high as 740 ft/sec for styrofoam. In addition, the impact pressure was measured for a variety of debris materials as a function of velocity. K.L.

N80-13473*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION INTO THE EFFECT OF PLASMA PRETREATMENT ON THE ADHESION OF PARYLENE TO VARIOUS SUBSTRATES
T. Riley, T. Cobo Mahuson, and K. Seibert 1979 20 p refs

Presented at the Seminar of Cleaning, Finishing and Coating Processes, Los Angeles, 5-6 Feb. 1979; sponsored by the Soc. for the Advan. of Mater. and Process Eng.
(NASA-TM-79224; E-119) Avail: NTIS HC A02/MF A01 CSCL 11A

A procedure is described for using argon and oxygen plasmas to promote adhesion of parylene coatings upon many difficult-to-bond substrates. Substrates investigated were gold, nickel, kovar, teflon (FEP), kapton, silicon, tantalum, titanium, and tungsten. Without plasma treatment, 180 deg peel tests yield a few g/cm (oz/in) strengths. With dc plasma treatment in the deposition chamber, followed by coating, peel strengths are increased by one to two orders of magnitude. A.R.H.

N80-13474*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
FEASIBILITY OF SiC COMPOSITE STRUCTURES FOR 1644 DEG GAS TURBINE SEAL APPLICATIONS Final Report, 28 Apr. - 30 May 1979
R. Darolia May 1979 109 p ref
(Contract NAS3-20082)
(NASA-CR-159597; R79AEG625) Avail: NTIS HC A06/MF A01 CSCL 11A

The feasibility of silicon carbide composite structures was evaluated for 1644 K gas turbine seal applications. The silicon carbide composites evaluated consisted of Si/SiC Silcomp (Trademark) - and sintered silicon carbide as substrates, both with attached surface layers containing BN as an additive. A total of twenty-eight candidates with variations in substrate type and density, and layer chemistry, density, microstructure, and thickness were evaluated for abradability, cold particle erosion resistance, static oxidation resistance, ballistic impact resistance, and fabricability. The BN-free layers with variations in density and pore size were later added for evaluation. The most promising candidates were evaluated for Mach 1.0 gas oxidation/erosion resistance from 1477 K to 1644 K. The as-fabricated rub layers did not perform satisfactorily in the gas oxidation/erosion tests. However, preoxidation was found to be beneficial in improving the hot gas erosion resistance. Overall, the laboratory and rig test evaluations show that material properties are suitable for 1477 K gas turbine seal applications. J.M.S.

N80-13475# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
DEVELOPMENT OF MAINSHAFT HIGH-SPEED CYLINDRICAL ROLLER BEARINGS FOR GAS TURBINE ENGINES Interim Report, 1 Apr. 1977 - 1 Oct. 1978
P. F. Brown, L. J. Dobek, J. D. Robinson, and J. R. Miner Oct. 1978 106 p refs
(Contracts N00140-76-C-0383; MIPR-FY-1455-76-00623)
(AD-A073381; FR-11453) Avail: NTIS HC A06/MF A01 CSCL 21/5

This combined analytical and experimental program is aimed at generating a manual that will permit the design of 3.0 MDN cylindrical roller bearings. The roller bearing analysis will be correlated with the results from a series of bearing tests designed to determine, by statistical methods, the effect of geometrical variables on bearing performance. An existing quasi-static design optimization system was previously upgraded and the basic analyses for use in developing a program to predict the dynamic behavior of roller bearing components was completed. A study identified a total of thirty separate bearing parameters that can influence roller skewing and skidding. Two groups of 124 mm roller bearing designs were then prepared using statistical design techniques and incorporating parameters from the list of thirty. Fabricated of full-scale bearing hardware was completed and testing was completed. Results indicate that roller end wear is significantly affected by roller corner radius runout. GRA

N80-13476# Babcock and Wilcox Co., Alliance, Ohio. Research and Development Div.
DEVELOPMENT OF AUTOMATED WELDING PROCESSES FOR FIELD FABRICATION OF THICK-WALLED PRESSURE VESSELS: ELECTRON BEAM METHOD Quarterly Report, 1 Jul. - 30 Sep. 1978
Charles M. Weber 1978 26 p refs
(Contract EF-77-C-01-2606)
(DOE/ET-2606/4; QR-4) Avail: NTIS HC A03/MF A01

The development of 4-1/2 inch deep partial penetration electron beam welding procedures is reported. A total of 257 welds were made to date. Several defects were encountered and successfully eliminated. The occurrence of a necklace defect, which has been shown to be a cold shut resulting from improper solidification, has not yet been eliminated. It was observed that the beam oscillation pattern is influential on the behavior of the weld cavity during welding. In the vertical welding position, it was determined that the use of a welding shoe is required. DOE

N80-13477# California Univ., Berkeley. Lawrence Berkeley Lab.
HYBRID RANDOM CHOICE METHOD WITH APPLICATION TO INTERNAL COMBUSTION ENGINES 2
G. A. Sod (Wisconsin Univ., Madison) Jun. 1979 16 p refs Presented at Intern. Symp. on Combust. Processes, Karpacz, Poland, 26 Aug. 1979
(Contracts W-7405-eng-48; EY-76-C-02-3077)
(LBL-9423; CONF-7908040-1) Avail: NTIS HC A02/MF A01

A numerical procedure was introduced for solving one-dimensional equations of gas dynamics for a cylindrically or spherically symmetric flow. This method was generalized to the two-dimensional equations of gas dynamics in a cylindrical geometry. This is coupled at the boundary with a new grid free method for introducing viscous effects, where the computational elements are segments of vortex sheets and circular vortex filaments. Examples are given for flow in a motored engine chamber during intake and compression strokes. DOE

N80-13478# Idaho National Engineering Lab., Idaho Falls.
AUTOMATED WELDING OF NUCLEAR PIPING SYSTEMS
D. W. Hood 1979 5 p refs Presented at AWS Maintenance Welding in Nuclear Power Plants Conf., Atlanta, 6 Aug. 1979
(Contract EY-76-C-07-1570)
(CONF-790841-1) Avail: NTIS HC A02/MF A01

Among various pipe welding processes, the only one developed for mechanized and automated nuclear piping welding is the gas tungsten arc welding (GTAW) process. Improvements in GTAW power supplies and control systems, aided commercialization of the process, but the main element and pacing item has been the welding head itself. The status of mechanized and automated nuclear pipe welding is reviewed with emphasis on basic process equipment, joint design, fit-up requirements, welding parameters, and productibility. Anticipated developments in automated systems are discussed. DOE

N80-13479# Sandia Labs., Albuquerque, N. Mex.
METHOD FOR DESCRIBING NEARLY NORMAL PENETRATION OF AN OGIVE NOSED PENETRATOR INTO TERRESTRIAL TARGETS
N. T. Davie Jun. 1979 61 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0721) Avail: NTIS HC A04/MF A01

The concept of an expanding spherical cavity is used as the basis of a method which allows the prediction of axial and lateral forces on the penetrator as well as complete trajectory information. Predictions based on this model compare favorably with experimental results. DOE

N80-13480# McAlvery and Associates, Hoboken, N. J.
IMPACT OF FLYWHEEL-TRANSMISSIONS ON AUTOMOBILE PERFORMANCE: A LOGICAL BASIS FOR EVALUATION
R. F. McAlvery, III 9 Apr. 1979 31 p refs
(Contract W-7405-eng-48)
(UCRL-52758) Avail: NTIS HC A03/MF A01

The application of flywheel-transmissions to electric vehicles and to petroleum-fueled automobiles was analytically investigated. Simple algebraic equations were developed that describe an automobile's total (laden) mass and energy economy as a function of mission requirements (i.e., payload, range, and drive-cycle acceleration demand). The equations can be used to evaluate the impact of a flywheel-transmission on an automobile's mass and energy economy. DOE

N80-13481# Oak Ridge National Lab., Tenn.
STATISTICAL TECHNIQUES FOR AUTOMATING THE

DETECTION OF ANOMALOUS PERFORMANCE IN ROTATING MACHINERY
K. R. Piety and T. E. Magette (Tennessee Univ., Knoxville) 1979 24 p Presented at the CAM-1 Intern. Spring Seminar, New Orleans, 9 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790435-2) Avail: NTIS HC A02/MF A01

The level of technology utilized in automated systems that monitor industrial rotating equipment and the potential of alternative surveillance methods are assessed. It is concluded that changes in surveillance methodology would upgrade ongoing programs and yet still be practical for implementation. An improved anomaly recognition methodology is formulated and implemented on a minicomputer system. The effectiveness of the monitoring system was evaluated in laboratory tests on a small rotor assembly, using vibrational signals from both displacement probes and accelerometers. Time and frequency domain descriptors were selected to compose an overall signature that characterizes the monitored equipment. Limits for normal operation of the rotor assembly were established automatically during an initial learning period. Thereafter, anomaly detection was accomplished by applying an approximate statistical test to each signature descriptor. DOE

N80-13482# Sandia Labs., Livermore, Calif. Model Shops and Inspection Div.
DATA ACQUISITION SYSTEM FOR THE HAMILTON STANDARD W2 ELECTRON BEAM WELDER
James Hopwood Jun. 1979 68 p
(Contract EY-76-C-04-0789)
(SAND-79-8014) Avail: NTIS HC A04/MF A01

The operation of a microprocessor-based program controller and calculator designed to perform on-line weld parameter sampling is described. The parameters sampled are beam current, accelerating voltage, focus-coil current, workpiece rpm, and filament voltage. Sampling in analog form occurs in preselected angular rotation increments from 1 to 9 degrees. There are three data printout options: (1) all data displayed; (2) only out of tolerance values displayed; and (3) differences between nominal and sampled values in excess of preselected error bands displayed. A magnetic tape cartridge unit allows long term data storage and easy retrieval. The logic principles, circuitry, and programming are described in detail. DOE

N80-13483# Columbia Univ., New York. School of Mines.
FATIGUE AND CREEP BEHAVIOR OF Si3N4 AND SiC FOR GAS TURBINE APPLICATIONS Final Report
J. K. Tien, R. M. Arons, and L. Roth May 1979 95 p refs (EPRI Proj. 271)
(EPRI-FP-1060) Avail: NTIS HC A05/MF A01

Creep characteristics were assessed in uniaxial tensile lading and fatigue properties were determined at ultrasonic frequencies. Mechanical response of these ceramics was found to be flaw size dependent. A threshold stress exists below which these ceramics are fatigue resistant. Creep response in hot-pressed silicon nitride was characterized by parallel processes, a persistent nonrecoverable plastic deformation and recoverable viscoelastic deformation. A steady-state component of creep was not found. An improved model for the creep process was developed to account for the creep and recovery behavior. DOE

N80-13484# Babcock and Wilcox Co., Alliance, Ohio. Research and Development Div.
DEVELOPMENT OF AUTOMATED WELDING PROCESSES FOR FIELD FABRICATION OF THICK-WALLED PRESSURE VESSELS: ELECTRON BEAM METHOD Quarterly Report, 1 Oct. - 31 Dec. 1978
C. M. Weber 1978 28 p
(Contract EF-77-C-01-2606)
(FE-2606-5; QR-5) Avail: NTIS HC A03/MF A01

An electron beam welding procedure for welding 8 in. thick SA 387 Grade 22 Class 2(2-1/4 Cr-1 Mo) steel was developed. A total of 324 welds were made. A beam oscillation pattern, the horseshoe pattern was successfully used to make defect-free, partial penetration welds in the horizontal position. An 8 in. thick, defect-free weld was made. Determination of the optimum welding procedure has not yet been made though. For welding in the vertical position, a shoe was designed and used to make void-free, partial penetration welds. DOE

N80-13485# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hardthausen (West Germany). Inst. fuer Chemische Antriebe und Verfahrenstechnik.
EXPERIMENTAL INVESTIGATION OF A SOLID FUEL RAMJET
Hendrik R. Lips, Robert H. Schmucker, and I. Lee Witbracht 1978 53 p refs
(DFVLR-FB-78-27) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 20.20

An experimental investigation of the internal ballistics, combustion efficiency, motor performance, and blow-off limits of a solid fuel ramjet motor was conducted in order to establish the design principles for the construction of a satisfactory combustor. In these connected-pipe test firings the effects of chamber pressure, air specific mass flow, burning time, flameholder design, inlet velocity, motor size, and fuel composition were investigated and correlations obtained. A simple theoretical model concerning flame stabilization, reattachment point and upper and lower combustion limits gives adequate agreement with the experimental test results. Author (ESA)

N80-13082# Bundesanstalt fuer Materialpruefung, Berlin (West Germany).
BRAZING UNDER MICROGRAVITY: TEXUS 2 EXPERIMENT
N. Philippovich (Vienna Univ.), R. Stickler (Vienna Univ.), K. Frieler (Vienna Univ.), and W. Bathke *In* ESA Mater. Sci. in Space Jun. 1979 p 95-100 refs Sponsored in cooperation with Bundesmin. fuer Forsch. U. Technol. and Austrian Bundesmin. fuer Wiss. U. Forsch. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13301# Kobe Univ. (Japan).
STABILITY PROBLEMS ON ROTOR SYSTEMS
T. Iwatsubo *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 3 Mar. 1979 p 17-26 refs (For primary document see N80-13298 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington D. C. 20375 CSCL 13/9

N80-13303 Rochester Inst. of Tech., N. Y.
DAMPING PROPERTIES OF TURBINE BLADES
N. F. Rieger *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 4 Apr. 1979 p 3-6 refs (For primary document see N80-13302 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 13/9

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-13486 Syracuse Univ., N. Y.
STOCHASTIC MODELLING FOR RELIABILITY AND OTHER PERFORMANCE MEASURES OF SOFTWARE SYSTEMS WITH APPLICATIONS Ph.D. Thesis
Kazuhira Okumoto 1979 215 p
Avail: Univ. Microfilms Order No. 7925593

The development of stochastic models for software failures in large scale systems is discussed. The models whose parameters have a physical interpretation, and which can yield various quantitative measures for software performance assessment are described. The applicability of the models over a broad class of software systems and the estimability of parameters when the available data is in the form of time between failures, or as number of failures in given time intervals is considered. A Markovian model is developed under the assumption of imperfect debugging, and expressions are derived for performance measures such as the distribution of time to a completely debugged system,

distribution of the number of remaining errors and software reliability. Methods are discussed for obtaining the maximum likelihood estimates and confidence regions for the parameters N (the initial error content), q (probability of imperfect debugging), and lambda (failure rate per error). Dissert. Abstr.

N80-13487 Cornell Univ., Ithaca, N. Y.
LIMIT THEOREMS FOR THE RELIABILITY OF SERIES-PARALLEL LOAD-SHARING SYSTEMS Ph.D. Thesis
Richard Lyttleton Smith 1979 156 p
Avail: Univ. Microfilms Order No. 7926964

The loading behavior of a series-parallel structure, in which individual elements are connected in parallel, are then arranged in series to form a system, and studied. Specifically, two loading behaviors were focused upon: equal load-sharing, in which the load is distributed equally over unfailed elements within each component, and local load-sharing, in which the whole of the load of failed elements is transferred to adjacent unfailed elements in a circular configuration. Mathematical models using techniques of the classical extreme value theory are presented for each type of load-sharing. Dissert. Abstr.

N80-13488*# Massachusetts Inst. of Tech., Cambridge.
ULTRASONIC ATTENUATION AS AN INDICATOR OF FATIGUE LIFE OF GRAPHITE/EPOXY FIBER COMPOSITE Final Report
James H. Williams, Jr. and Beth Doll Dec. 1979 22 p refs
(Grant NsG-3210)
(NASA-CR-3179) Avail: NTIS HC A02/MF A01 CSCL 14D

The narrow band ultrasonic longitudinal wave velocity and attenuation were measured as a function of the transfiber compression-compression fatigue of unidirectional graphite/epoxy composites. No change in velocity was detected at any point in fatigue life. For specimens fatigued at 80% of static strength, there was generally a 5% to 10% increase in attenuation, however, this increase does not appear to be a satisfactory indicator of fatigue life. On the other hand, there appears to be a correlation between initial attenuation (measured prior to cycling) and cycles to fracture. Initial attenuation as measured at 1.5 MHz and 2.0 MHz appears to be a good indicator of relative fatigue life. Author

N80-13489*# Massachusetts Inst. of Tech., Cambridge.
ULTRASONIC ATTENUATION AND VELOCITY IN AS/3501-6 GRAPHITE/EPOXY FIBER COMPOSITE Final Report
James H. Williams, Jr., Hamid NayebHashemi, and Samson S. Lee Dec. 1979 37 p refs
(Grant NsG-3210)
(NASA-CR-3180) Avail: NTIS HC A03/MF A01 CSCL 14D

The ultrasonic group velocity and attenuation were measured as a function of frequency for longitudinal and shear waves in the epoxy matrix (3501-6) and in the principal directions of the unidirectional graphite/epoxy composite (AS/3501-6). Tests were conducted in the frequency ranges 0.25 Mz to 14 MHz and 0.5 Mz to 3 MHz for longitudinal and shear wave modes, respectively. The attenuation increased with frequency for all wave modes, but the group velocity was independent of frequency for all wave modes. The effects of pressure and couplant at the transducer-specimen interface were studied and it was found that for each transducer type there exists a frequency dependent 'saturation pressure' corresponding to the maximum output signal amplitude. K.L.

N80-13490*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODIFIED AEROSPACE RELIABILITY AND QUALITY ASSURANCE METHOD FOR WIND TURBINES
William E. Klein 1980 9 p Proposed for presentation at the Ann. Reliability and Maintainability Symp., San Francisco, 22-24 Jan. 1980
(NASA-TM-79284; DOE/NASA/20370-79/18; E-211) Avail: NTIS HC A02/MF A01 CSCL 14D

The safety, reliability, and quality assurance (SR&QA) approach developed for the first large wind turbine generator project is described. The SR&QA approach was used to assure that the machine would not be hazardous to the public or operating personnel, would operate unattended on a utility grid, would demonstrate reliable operation and would help establish the quality assurance and maintainability requirements for future wind turbine projects. A modified failure modes and effects analysis during the design phase, minimal hardware inspections during parts fabrication, and three simple documents to control activities during machine construction and operation were presented. R.C.T.

N80-13491# Rome Air Development Center, Hanscom AFB, Mass.
RELIABILITY AND MAINTAINABILITY MANAGEMENT MANUAL
Anthony Coppola and Alan N. Sukert Jul. 1979 158 p refs
(AF Proj. 2338)
(AD-A073299; RADC-TR-79-200) Avail: NTIS
HC A08/MF A01 CSCL 09/2

This manual provides a guide to Air Force program managers, at all levels, for the planning, organizing, manning, leading and controlling of cost-effective reliability and maintainability programs in all phases of acquisition. It addresses both hardware and software reliability. GRA

N80-13492# Illinois Univ. at Chicago Circle, Chicago. Dept. of Mathematics.
EXTENSIONS OF A SIMPLE MODEL WITH APPLICATIONS IN RELIABILITY, EXTINCTION OF SPECIES, INVENTORY DEPLETION AND URN SAMPLING Interim Report
Emad ElNeweihi Jul. 1979 22 p refs
(Grant AF-AFOSR-3050-76; AF Proj. 2304)
(AD-A073814; AFOSR-79-0975TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A series parallel system which consists of cut sets is studied. Several equivalent expressions for the probability that a specified member of the cut set fails first are discussed. A generalization of the system is derived for the probability that a member of the cut set fails in the Rth place. Applications of this system in the study of reliability, extinction of species, inventory depletion, and urn sampling are discussed. A.W.H.

N80-13493# Oklahoma State Univ., Stillwater. Fluid Power Research Center.
MERADCOM/OSU HYDRAULIC SYSTEM RELIABILITY PROGRAM Final Report, Jun. 1978 - May 1979
May 1979 348 p refs
(Contract DAAK70-77-C-0097)
(AD-A073789; OSU-FPRC-9MI) Avail: NTIS
HC A15/MF A01 CSCL 13/7

The purpose of the Oklahoma State University/U.S. Army Mobility Equipment Research and Development Command Program is to provide the military with tools for the scientific appraisal of fluid power systems. Section I presents a detailed account of the project activities concerning hydraulic pump specifications. Included are an OSU proposed revision of Army pump specification MIL-P-52675 and two proposed test procedures for which no industrially recognized standards exist at present. Also included is a discussion and justification of the proposed specification and test procedures. Section II presents the details of the project activities concerning hydraulic valve specifications. Tests have been conducted based on Army specification MIL-V-52688 and the test results are discussed. OSU proposed revision of MIL-V-52688 is presented including additional test procedures that are considered necessary for Army valve specification. The project activities concerning hydraulic cylinder specifications are detailed in Section III. Included is an OSU proposed revision of Army cylinder specification MIL-L-52762. Also included is a summary of an industrial survey conducted on hydraulic cylinders and discussion and justification of the proposed specification and test procedures. GRA

N80-13494# Sandia Labs., Albuquerque, N. Mex.
METHOD FOR ACCELERATED AGING UNDER COMBINED ENVIRONMENTAL STRESS CONDITIONS
K. T. Gillen 1979 10 p refs Presented at JOWOG-28, Albuquerque, N. Mex., 11 Jun. 1979
(Contract DE-AC04-76DP-00789)
(SAND-79-0930C; CONF-790632-1) Avail: NTIS
HC A02/MF A01

An accelerated aging method which can be used to simulate

aging in combined stress environmental situations is described. It is shown how the assumptions of the method can be tested experimentally. Aging data for a chloroprene cable jacketing material in single and combined radiation and temperature environments are analyzed and it is shown that these data offer evidence for the validity of the method. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-13495 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NUMBER 2
Judith Nagle-Eshelman, ed. Feb. 1979 85 p refs
(AD-A065807) Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

Reviews of shock and vibration analyses in relation to structural design and design criteria are presented. Included are studies of structural optimization problems, frequency domain post test analysis of vibration data, and approximate methods for determining the vibrational modes of membranes. For individual titles, see N80-13496 through N80-13498.

N80-13496 Indian Inst. of Tech., Kanpur.
STRUCTURAL OPTIMIZATION UNDER SHOCK AND VIBRATION ENVIRONMENT
S. S. Rao *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 2 Feb. 1979 p 3-13 refs (For primary document see N80-13495 04-39)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

Structural optimization, defined as the evolution of a structural design that satisfies a set of functional requirements and that, in terms of a predefined criterion, is the best of all such acceptable designs is discussed. Structural optimization problems are presented and analyzed. The problems are classified according to major constraint-e.g., natural frequency, flutter, dynamic response, and chatter stability. Each class is discussed. Approximate analysis techniques and some recent work on optimization methods, as applied to the design of structures, are presented. Structural optimization problems in need of further investigation are summarized. A.W.H.

N80-13497 Polytechnic Inst. of Bucharest (Rumania).
ANALYSIS TECHNIQUES OF EXPERIMENTAL FREQUENCY RESPONSE DATA
M. Rades *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 2 Feb. 1979 p 15-24 refs (For primary document see N80-13495 04-39)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

Techniques for frequency domain post test analysis of vibration data are reviewed. Emphasis is on procedures for curve fitting algebraic expressions of transfer functions to experimentally measured frequency response data for systems with nonproportional damping and/or closely spaced modes. A.W.H.

N80-13498 Adelaide Univ. (Australia).
A REVIEW OF APPROXIMATE METHODS FOR DETERMINING THE VIBRATIONAL MODES OF MEMBRANES
J. Mazumdar *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 2 Feb. 1979 p 25-32 refs (For primary document see N80-13495 04-39)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

Approximate methods for determining vibrational modes of membranes are reviewed. The review is divided into linear analysis and nonlinear analysis. Included are discussions on free vibration, forced vibration, and future research areas. A.W.H.

N80-13499 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NUMBER 6
Judith Nagle-Eshelman, ed. Washington DOD Jun. 1979 91 p
(AD-A070464/3) Avail: SVIC, Code 8404, Naval Research Lab., Washington, D.C. 20735 CSCL 20/11

The effects of vibration on dynamic cable response are reviewed with emphasis given to developments in ocean cable analysis. Methods of reduction of vibration of orthotropic plates are considered. Instrumentation used to measure shock and vibration are described. For individual titles, see N80-13500 through N80-13501.

N80-13500 Portland State Univ., Oreg.
CURRENT METHODS FOR ANALYZING DYNAMIC CABLE RESPONSE
H. J. Migliore and R. L. Webster *In* SVIC Shock and Vibration Digest, Vol. 11, No. 6 Jun. 1979 p 3-16 refs (For primary document see N80-13499 04-39)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D.C. 20735 CSCL 20/11

Methods for analysis of cable dynamics are reviewed with emphasis given to developments in ocean cable analysis. Specific discussions are given on the lumped parameter, finite element methods, and the method of weighted residuals. R.C.T.

N80-13501 Chubu Inst. of Tech., Kasugai (Japan).
REDUCTION METHODS FOR PROBLEMS OF VIBRATION OF ORTHOTROPIC PLATES. PART 2: GENERALIZED REDUCTION METHOD FOR GENERALLY ORTHOTROPIC PLATES WITH ARBITRARY SHAPE
T. Sakata *In* SVIC Shock and Vibration Digest, Vol. 11, No. 6 Jun. 1979 p 19-22 refs (For primary document see N80-13499 04-39)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D.C. 20735 CSCL 20/11

A generalized reduction method to derive an approximate formula for estimating the natural frequency of an orthotropic plate is described. The natural frequencies of the isotropic plate are used. They are reduced without solving the differential equation governing free vibration of the orthotropic plate. R.C.T.

N80-13502 Iowa Univ., Iowa City.
DYNAMIC ANALYSIS OF FLEXIBLE MECHANISMS Ph.D. Thesis
Ji Oh Song 1979 126 p
Avail: Univ. Microfilms Order No. 7924533

A method for transient dynamic analysis of planar mechanisms consisting of flexible members is developed, accounting for coupled large displacements and small elastic deformations. A computer code that systematically constructs and solves the equations of motion of general planar flexible mechanisms is developed. Numerical results for four example problems are presented to demonstrate the effectiveness of the theory and numerical analysis methods. Agreement of results obtained by the present method and results available in the literature is good. The method provides a general formulation without linear superposition assumptions of small elastic deformations on large displacements. It consists of systematic geometry and automated generation and solution of the equations of motion.
Dissert. Abstr.

N80-13503 Syracuse Univ., N. Y.
MODELLING OF CRACK TIP DEFORMATION WITH FINITE ELEMENT METHOD AND ITS APLICATIONS Ph.D. Thesis
Chuang-Yeh Yang 1979 125 p
Avail: Univ. Microfilms Order No. 7925610

A finite element computer program using the initial stress approach of elastic-plastic analysis was developed. Crack closure stresses were calculated for three different models. It was concluded that: (1) the closure stress is highest in the strip necking model, lowest in the plane strain model, and intermediate in the plane stress model; and (2) the crack closure stress decreases if the separation occurs before the stress reaches the maximum value. Nonpropagating fatigue cracks in the two phase martensitic-ferritic steels were also investigated. Unzipping

increments were calculated for different crack lengths. At a prescribed stress intensity level, the shorter the crack length, the greater the unzipping increment is. This means that the shorter crack will grow faster than the longer one if both are subjected to the same K-level. Dissert. Abstr.

N80-13504 Virginia Polytechnic Inst. and State Univ., Blacksburg.
OPTIMAL DESIGN OF ELASTIC STRUCTURES FOR STABILITY UNDER MULTIPLE LOADS Ph.D. Thesis
Hari Kertonadi Turner 1979 216 p
Avail: Univ. Microfilms Order No. 7924150

The structure's buckling load was optimized by varying the mass distribution and by enlarging the stability boundary in the load-space as much as possible. The finite element technique is used, and optimization is carried out by an iterative procedure utilizing the gradient and optimality criterion methods. The elastic structures considered are: columns with pinned ends and clamped ends subjected to an axial end load and an axial distributed load due to self-weight; columns attached to an elastic foundation with pinned ends and clamped ends, also subjected to an axial end load and an axial distributed load due to self-weight; a pinned-pinned rotating shaft with an axial load; a pinned-pinned pipe conveying fluid and compressed by an axial load; a one-bay frame with clamped supports, subjected to two vertical loads; and a two-bay frame with clamped supports, subjected to three vertical loads. Dissert. Abstr.

N80-13505 Northwestern Univ., Evanston, Ill.
ELASTODYNAMIC DIFFRACTION AND RADIATION PROBLEMS Ph.D. Thesis
John Gregory Harris 1979 247 p
Avail: Univ. Microfilms Order No. 7927362

The diffraction of a cylindrical longitudinal pulse by a semi-infinite, traction free slit located in an elastic solid was solved both asymptotically and exactly. The effect of the curvature of the incident pulse on the scattered pulses was studied. In addition, the radiation emitted by a planar, growing crack with an edge of arbitrary curvature was treated asymptotically in order to determine the effect of the curvature of the growing crack edge on the radiated pulses. The asymptotic solutions are based upon a geometrical theory of wave propagation that gives an approximation to the various elastic pulses near their wave fronts. Dissert. Abstr.

N80-13506 Kentucky Univ., Lexington.
A NEW EQUILIBRIUM FINITE ELEMENT ANALYSIS OF STRESSES IN ORTHOTROPIC CYLINDERS WITH TEMPERATURE DEPENDENT MATERIAL PROPERTIES Ph.D. Thesis
Muhammad Abul Kalam 1979 164 p
Avail: Univ. Microfilms Order No. 7927685

An equilibrium finite element model was developed in order to determine thermal stresses in orthotropic cylinders with complicated material behavior. The model was based on the conditions of static equilibrium with no body forces in terms of a cylindrical coordinate system. The finite element method was utilized in determining steady state thermal stresses in an orthotropic elastic cylinder with temperature dependent material properties. The effect of the various parameters of anisotropy and temperature dependency of material properties on the maximum stress was demonstrated graphically. Results indicate that for traction free boundary conditions, the effect of anisotropy of the coefficients of thermal expansion is more predominant on the maximum stress than any other parameters. Dissert. Abstr.

N80-13507 Cornell Univ., Ithaca, N. Y.
MICROSCOPIC MECHANISMS AND MECHANICS OF CRAZE GROWTH AND FRACTURE IN POLYSTYRENE Ph.D. Thesis
Bruce Douglas Lauterwasser 1979 229 p
Avail: Univ. Microfilms Order No. 7926994

A new technique was developed for investigating the micromechanical properties of crazes. The technique utilizes quantitative measurements of mass thickness scattering in the electron microscope to determine the volume fraction of fibrillated material within a craze. Craze surface displacement profiles, craze surface stress profiles, and true stress in the craze fibrils are then computed from the fibril volume fraction. Using the technique, isolated air crazes in thin films of polystyrene were studied and the craze parameters were calculated. Dissert. Abstr.

N80-13508 Northwestern Univ., Evanston, Ill.
INITIATION AND GROWTH OF FATIGUE MICROCRACKS AND STRAIN-CONTROLLED FATIGUE PROPERTIES IN STEEL ALLOYS: MICROSTRUCTURE AND MECHANICS Ph.D. Thesis
Yong-Ho Kim 1979 179 p
Avail: Univ. Microfilms Order No. 7927385

Initiation and growth of fatigue microcracks were studied in vacuum degassed 4140 steel in three conditions (as-quenched, tempered at 400 C and tempered at 650 C) and on several microstructures of Nb and V-alloyed high strength-low alloy steels. In as-quenched 4140 steels, fatigue cracks initiated at grain boundaries; however, in the 400 and 650 C tempered specimens, they initiated near prominent slip bands which gave extrusions and intrusions from the to and fro motion of dislocations. Similarly, in the high strength low alloy steels investigated, fatigue cracks were also observed to initiate and initially grow along the extrusions and intrusions. Fatigue crack initiation resistance increased with the cyclic yield stress in the low strain amplitude region. Dissert. Abstr.

N80-13509 Virginia Univ., Charlottesville.
DYNAMIC ANALYSIS OF COMPLEX MULTI-LEVEL FLEXIBLE ROTOR SYSTEMS Ph.D. Thesis
Dennis Fuk-Kuen Li 1979 354 p
Avail: Univ. Microfilms Order No. 7928010

Theories were developed for calculating the vibrations of complex multicomponent flexible rotor systems based on the transfer matrix method and the component mode method. The methods were compared for accuracy and computational efficiency in the linear dynamic analysis of a two-spool gas turbine engine. The dynamic stiffness and damping matrices of a rotating flexible shaft element were studied. Based on this result, the modal representation of a rotor including the effects of shear deformation, dry hysteresis, and viscous internal friction was developed. The ability of the component mode method to analyze a wide spectrum of machinery was demonstrated by a nonlinear transient simulation of the two-spool gas turbine engine equipped with a squeeze film damper bearing, and by an unbalance response analysis of the space shuttle oxygen turbopump in which the dynamics of the rotor and the housing in all six spatial directions were considered. Dissert. Abstr.

N80-13510 Kentucky Univ., Lexington.
HERTZIAN FRACTURE OF PYREX GLASS AND ALPHA QUARTZ Ph.D. Thesis
Yu-Lin Chen 1979 179 p
Avail: Univ. Microfilms Order No. 7927666

Abraded and as-received surfaces of Pyrex glass were impacted by steel balls of various radii at ambient conditions. The coefficient or restitution of the indentor was always less than one, indicating some kinetic energy was lost during impact. The ratio of energy loss due to crack formation to the initial kinetic energy was found to be less than four percent. Combining the energy losses and with cone crack surface area measurements, the surface fracture energy of Pyrex glass was obtained. The results on Pyrex glass were used to rationalize Hertzian fracture for anisotropic materials such as quartz. Two methods of loading were performed on carefully abraded or polished surfaces of different orientations using steel balls with various radii. It was found that Hertzian equations may be applied to the anisotropic brittle materials such as quartz, if they are modified with the anisotropic elastic constants. Also, with the assistance of stereographic projection, the Hertzian fracture test might be an extremely useful method to determine the cleavage planes of brittle crystals. Dissert. Abstr.

N80-13511# National Aeronautical Establishment, Ottawa (Ontario).
APPLICATION OF FINITE ELEMENT PROGRAMS APES, ASAS AND MARC TO LINEAR FRACTURE MECHANICS
J. J. Kacprzynski Mar. 1979 158 p
(LTR-ST-1118) Avail: NTIS HC A08/MF A01

The Atkins stress analysis system (ASAS), the axisymmetric/

planar elastic structure (APES), and the MARC programs are described and applied in studies of edge-cracked plates. Results are compared. The calculated examples and previous experience indicate that APES is the best of the compared programs for two-dimensional, plane or axisymmetric, linear fracture mechanics applications. The program is simple in applications and input preparation, and the cost of execution is very low. For more general fracture mechahics problems, such as three-dimensional linear crack or nonlinear elastic-plastic 2D or 3D, MARC is recommended. ASAS with the 11-node crack element (CK11) gives incorrect results; good accuracy is obtained with the 7-node symmetric crack element (SCK7). The cost of ASAS execution is prohibitive. A.R.H.

N80-13512*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
ANALYSIS OF SURFACE CRACKS IN FINITE PLATES UNDER TENSION OR BENDING LOADS
J. C. Newman, Jr. and I. S. Raju (Joint Inst. for the Advancement of Flight Sciences, Hampton, Va.) Dec. 1979 46 p refs
(NASA-TP-1578; L-13053) Avail: NTIS HC A03/MF A01 CSCL 20K

Stress-intensity factors calculated with a three-dimensional, finite-element analysis for shallow and deep semielliptical surface cracks in finite elastic isotropic plates subjected to tension or bending loads are presented. A wide range of configuration parameters was investigated. The ratio of crack depth to plate thickness ranged from 0.2 to 0.8 and the ratio of crack depth to crack length ranged from 0.2 to 2.0. The effects of plate width on stress-intensity variations along the crack front was also investigated. A wide-range equation for stress-intensity factors along the crack front as a function of crack depth, crack length, plate thickness, and plate width was developed for tension and bending loads. The equation was used to predict patterns of surface-crack growth under tension or bending fatigue loads. A modified form of the equation was also used to correlate surface-crack fracture data for a brittle epoxy material within + or - 10 percent for a wide range of crack shapes and crack sizes. A.R.H.

N80-13513*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COMPARISON TESTS AND EXPERIMENTAL COMPLIANCE CALIBRATION OF THE PROPOSED STANDARD ROUND COMPACT PLANE STRAIN FRACTURE TOUGHNESS SPECIMEN
D. M. Fisher and R. J. Buzzard Nov. 1979 21 p refs
(NASA-TM-81379; E-284) Avail: NTIS HC A02/MF A01 CSCL 20K

Standard round specimen fracture test results compared satisfactorily with results from standard rectangular compact specimens machined from the same material. The location of the loading pin holes was found to provide adequate strength in the load bearing region for plane strain fracture toughness testing. Excellent agreement was found between the stress intensity coefficient values obtained from compliance measurements and the analytic solution proposed for inclusion in the standard test method. Load displacement measurements were made using long armed displacement gages and hollow loading cylinders. Gage points registered on the loading hole surfaces through small holes in the walls of the loading cylinders. Author

N80-13514# Ames Lab., Iowa.
SURFACE-CRACK CHARACTERIZATION BY USE OF DYNAMIC PHOTOELASTIC SPECTROSCOPY
L. W. Zachary, C. P. Burger, L. W. Schmerr, and A. Singh 1979 19 p refs Presented at Spring Meeting of Soc. for Experimental Stress Analysis, San Francisco, 20 May 1979
(Contract W-7405-eng-82)
(IS-M-211; CONF-790503-2) Avail: NTIS HC A02/MF A01

A combination of ultrasonic surface wave photoelasticity and spectroscopic techniques used to quantitatively characterize surface flaws. R.E.S.

N80-13515# Los Alamos Scientific Lab., N. Mex.
FINITE ELEMENT LINEAR MODELS FOR SYMMETRICALLY LOADED THIN SHELLS OF REVOLUTION
William A. Cook 1979 25 p refs Presented at the 5th Intern. Sem. on Computational Aspects of the Finite Element Method, Berlin, 20-21 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1321; CONF-790811-1) Avail: NTIS HC A02/MF A01

The models presented are: (1) a virtual work model that approximates equilibrium and uses two displacements and meridional rotation for the nodal variables; (2) a mixed model that approximates equilibrium and the meridional bending moment constitutive relation using two displacements and meridional bending moments for the nodal variables; (3) a virtual work model that approximates equilibrium using transverse shear deformation and uses two displacements and meridional rotation as the nodal variables; and (4) a virtual work model that approximates equilibrium using displacements and meridional rotation as nodal variables and includes transverse shear deformation and moments turning about the middle surface normal. Problems used to demonstrate the advantages of each model include a plate with a shear load, a cylindrical shell with a shear load, and a hemispherical shell with an applied moment. DOE

N80-13516# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
THERMOVISCOPLASTIC RESPONSE OF CYLINDRICAL STRUCTURES USING A STATE VARIABLE MODEL
S. Mukherjee Feb. 1979 28 p refs
(Contract EY-76-S-02-2733)
(COO-2733-19) Avail: NTIS HC A03/MF A01

A number of combined creep plasticity constitutive models with state variables, proposed to describe time dependent inelastic deformation of metals at elevated temperatures are reviewed. An efficient numerical solution of boundary value problems using constitutive models to predict the uniaxial responses of several metals and alloys to various types of loading histories is examined. Stresses and deformation in cylindrical structures subjected to time dependent axisymmetric mechanical and thermal loads are investigated. Several physically observed phenomena that cannot be simulated by traditional models are discussed. DOE

N80-13517# Brown Univ., Providence, R. I. Div. of Engineering.
ELASTIC PLASTIC ANALYSIS OF GROWING CRACKS
J. R. Rice, W. J. Drugan, and T. L. Sham May 1979 55 p refs Presented at the 12th Ann. Symp. on Fracture Mech., St. Louis, 21-23 May 1979
(Contract EY-76-S-02-3084)
(COO-3084-65; CONF-7905104-1) Avail: NTIS HC A04/MF A01

Results of an asymptotic analysis suggest the existence of a crack tip stress state similar to that of the classical Prandtl field, but containing a zone of elastic unloading between the centered fan region and the trailing constant stress plastic region. The model crack growth criterion requiring a critical rate of opening displacement at some fixed distance from the tip, is re-examined in light of the more accurate solution. Results suggest that the far field value versus crack length relation describing growth is dependent on the extent of yielding. It is suggested that this dependency might be small for highly ductile materials, provided that a similar triaxial constraint is maintained in all cases. DOE

N80-13518# Massachusetts Univ., Amherst. Dept. of Civil Engineering.
DYNAMIC PLASTIC BUCKLING OF SHELLS: A RECONSIDERATION OF THE VAUGHAN-FLORENCE ANALYSIS
G. Horvay, M. A. Veluswami, and F. D. Stockton Jan. 1979 22 p refs Presented at Intern. Conf. on Structural Mech. in Reactor Technol., Berlin, 13 Aug. 1979
(Contract EY-76-S-02-4122)
(CONF-790802-1) Avail: NTIS HC A02/MF A01

Extension of the Vaughan-Florence (VF) analysis to encompass axial variation of the impulse load revealed that the omega to the 2nd power term may not be neglected, because it constitutes only restraint on the motion that is caused by the departure from axial uniformity. This suggested reconsidering also the original VF analysis, for axial uniformity, with the omega to the 2nd power term retained. It was found that the maximum amplification is drastically reduced by retention of the omega to the 2nd

power term, by a factor close to 3 in VF's example, and is reached in a time about 25% below that given by VF. Various ramifications of the numerical integration scheme are also explored. It was found that about N - 20000 integration steps is optimal. DOE

N80-13519# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
EXPERIMENT AND PREDICTION IN THE BENDING OF A NICKEL BEAM AT 200 DEG C
J. A. Mautz and E. W. Hart May 1979 29 p refs
(Contract EY-76-S-02-2733)
(COO-2733-21) Avail: NTIS HC A03/MF A01

The bending response of a nickel prismatic beam under four point loading at 200 C is described. The specimens were subjected to histories of steady applied moment with a sequence of step changes both positive and negative. The measured results are compared with predictions based on Hart's constitutive equations. The experimental conditions and procedures are described. The experiment and the predictions are compared with prior studies. DOE

N80-13520# Department of Energy, Washington, D. C. Div. of Materials Sciences.
TIME-DEPENDENT FRACTURE OF MATERIALS AT ELEVATED TEMPERATURE
Stanley M. Wolf, ed. Jun. 1979 204 p refs Presented at Workshop on Time-Dependent Fracture of Mat., Germantown, Md., 15-16 Feb. 1979
(CONF-790238) Avail: NTIS HC A10/MF A01

Contents: (1) design considerations for high temperature components in fusion energy systems; (2) liquid-metal fast breeder reactor structural materials design considerations; (3) time-dependent fatigue phenomenology and life prediction; (4) creep mechanisms and constitutive relations in pure metals; (5) deformation mechanisms in cyclic creep and fatigue; (6) plastic creep flow processes in fracture at elevated temperatures; (7) deformation aspects of time dependent fracture; (8) report of subgroup on high temperature fracture; and (9) subgroup on engineering needs. DOE

N80-13521# General Atomic Co., San Diego, Calif.
RECOMMENDATION OF A TRIAXIAL FAILURE THEORY FOR GRAPHITE
P. Y. Tang May 1979 54 p refs
(Contracts EY-76-C-03-0167; DE-AT03-76ET-35300; Proj. 6400)
(GA-A-15333) Avail: NTIS HC A04/MF A01

Research was conducted on the application of triaxial failure theories to an anisotropic brittle solid. It was concluded that the strength tensor theory of Tsai and Wu appears most promising for high temperature gas cooled reactors (HTGR) structural graphites. The reduction of this theory to model the transversely isotropic nature of HTGR structural graphites is presented. The extensions to the ongoing biaxial stress experimental program, needed to provide the additional data required to verify this theory, are defined. DOE

N80-13522# Oak Ridge National Lab., Tenn.
FRACTOGRAPHIC STUDY OF A THICK WALL PRESSURE VESSEL FAILURE
D. A. Canonico, R. S. Crouse, and T. J. Hanson 1979 20 p refs Presented at Intern. Metallographic Soc. Conf., Tamiment, Pa., 8 Jul. 1979
(Contract W-7405-eng-26)
(CONF-790730-2) Avail: NTIS HC A02/MF A01

The intermediate test vessel 1 fabricated of SA508, Class 2 Steel was tested to failure at 54 C. The gross failure appeared to be a brittle fracture although accompanied by a measured strain of 0.9%. Seven regions of the fracture were examined in detail and the observed surfaces were compared to Charpy V-notch (C/sub V/) specimens of SA508, Class 2 steel broken at temperatures above and below the ductile to brittle transition temperature. Three samples from the vessel were taken in the region around the fatigue notch and four from areas well removed from the notch. All these were carefully examined both optically and by scanning electron microscopy. It was established that early crack extension was by ductile mode until a large flaw approximately 500 mm long 83 wide was developed. At this point the vessel could no longer contain the internal pressure and final rupture was by brittle fracture. DOE

N80-13523# California Univ., Livermore. Lawrence Livermore Lab.
DYNAMIC EDGE DISLOCATION DISPLACEMENTS AND PEIERLS STRAINS IN A LINEAR ELASTIC STRIP Ph.D. Thesis
W. C. Moss Jun. 1979 136 p refs
(Contract W-7405-eng-48)
(UCRL-52787) Avail: NTIS HC A07/MF A01

A Fourier transform image method, used to obtain the displacement field of an edge dislocation in a finite width strip is described. Static, subsonic, transonic, and supersonic solutions are presented. Using the static solution, the Peierls strain is calculated, as a function of the length and the width of the strip. DOE

N80-13524# Oak Ridge National Lab., Tenn. Engineering Technology Div.
APPLICATION OF STATIC AND DYNAMIC CRACK ARREST THEORY TO THERMAL SHOCK EXPERIMENT TSE-4
R. D. Cheverton and S. K. Iskander 10 May 1979 31 p refs
(Contract W-7405-eng-26)
(NUREG-CR-0767; ORNL/NUREG-57) Avail: NTIS HC A03/MF A01

A dynamic method of analysis for a crack run-arrest event was applied to thermal shock experiment TSE-4, which was conducted on an A508 steel cylinder with a quench only heat treatment. A long axial flaw with an initial depth of 11 mm propagated in a single jump to a depth of 23 mm and arrested. The dynamic analysis indicated that dynamic effects for the 12 mm extension were essentially negligible; thus the statically calculated arrest toughness (K/sub Ia/) was a good approximation of K/sub Im/. This K/sub Im/ (K/sub Ia/) value was 24% less than K/sub Ic/ at the same temperature. DOE

N80-13525# Stanford Univ., Calif.
ACOUSTIC TECHNIQUES FOR MEASURING STRESS REGIONS IN MATERIALS Interim Report
G. S. Kino and J. H. Shaw Apr. 1979 75 p refs Sponsored by Elec. Power Res. Inst.
(EPRI Proj. 609-1)
(EPRI-NP-1043) Avail: NTIS HC A04/MF A01

A computer controlled system that produces quantitative two-dimensional images of stress contours in planar metal samples was constructed and used to study stress distributions due to both residual and externally applied stress in aluminum, steel, and copper specimens. The measurement is based on the dependence of the velocity of propagation of longitudinal sound waves, launched by a mechanically scanned single transducer into the deformed sample, on the state of stress in the material. Very favorable comparisons of theory with experiments were mape for stress distribution around a hole in a large, uniformly stressed plane sample, including detection of regions where plastic yield has taken place. Detailed stress maps were made of the very inhomogeneous regions around edge cracks, showing excellent agreement with theoretical expectations. Similar very encouraging results were obtained from mapping residual stress in extruded aluminum and copper samples. DOE

N80-13526# Admiralty Marine Technology Establishment, Teddington (England).
THE EFFECT OF ANALYSIS BANDWIDTH ON THE ACCURACY OF MEASUREMENTS AND PREDICTIONS OF SINGLE DEGREE OF FREEDOM SYSTEM BEHAVIOR
A. W. Walker London HMSO Mar. 1979 25 p refs
(AMTE(N)-TM-79401; BR67702) Avail: NTIS HC A02/MF A01

The accuracy of measurements or predictions of the frequency response of a single degree of freedom system depends on the frequency resolution of the analysis technique. If the ratio of analysis bandwidth to the 3 dB bandwidth of the resonance is too great, negative bias errors occur at resonance in estimates of both power spectral levels and transfer function amplitudes. These errors, which were calculated numerically, are presented and compared with appropriate experimental data. Author (ESA)

N80-13527# Royal Aircraft Establishment, Farnborough (England).
THE IMPLEMENTATION AND PRACTICAL VERIFICATION OF A SUPERPOSITION METHOD FOR THE SOLUTION OF ELASTIC CRACK PROBLEMS
P. Bartholomew London HMSO Nov. 1978 20 p refs Presented at Inter. Conf. on Numerical Methods in Fracture Mech., Swansea, Engl., 9-13 Jan. 1978
(RAE-TM-Struct-940; BR66435) Avail: NTIS HC A02/MF A01

A superposition method which provides a practical and efficient way for solving linear elastic crack problems is demonstrated. The method approximates the linear elasticity solution over a substructure containing the crack tip by the superposition of appropriate singular stress fields and a relatively coarse finite element mesh. A hybrid variational principle is employed to ensure displacement compatibility between this substructure and adjoining ones employing finite elements alone. A key feature of the method is that it may be implemented by adding routines to existing finite element packages. The particular implementation discussed here is intended for use in the aircraft industry.
Author (ESA)

N80-13528# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Strength of Materials and Solid Mechanics.
A TESTING MACHINE WHICH FULFILLS FIXED BOUNDARY DISPLACEMENT CONDITIONS
Lars Dahlberg 1978 17 p refs Sponsored by Axel och Margaret Axson Johnsons Stiftelse foer Allmaennyttiga Aendmamaal
(TRITA-HFL-0022) Avail: NTIS HC A02/MF A01

A load test machine for the study of the limit of dynamic linear fracture mechanics with respect to nonelastic deformations in a body is described. The design and construction of the testing apparatus is discussed. The machine is intended for use with strip specimens. The theoretical characteristics of this type of specimen (an infinite elastic strip with a semi-infinite crack) are reviewed. Numerical calculations are compared to test results. It is shown that the energy flow to the crack tip is very little affected by the finite length of the strip specimen provided the crack tip is not too close to a boundary. Experimental studies of rapidly propagating cracks in steels, aluminum, brass, and polymers are cited. The machine can also be adapted to study creep and stress corrosion crack growth. Author (ESA)

N80-13299 Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
DYNAMIC SNAP-THROUGH OF SHALLOW ARCHES AND SPHERICAL CAPS
S. M. Holzer *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 3 Mar. 1979 p 3-6 refs (For primary document see N80-13298 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington D. C. 20375 CSCL 20/11

N80-13305 Loughborough Univ. of Technology (England).
WIND EXCITED BEHAVIOR OF STRUCTURES, 2
D. J. Johns *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 4 Apr. 1979 p 17-29 refs (For primary document see N80-13302 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

N80-13308 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
HIGH TEMPERATURE DAMPING OF DYNAMIC SYSTEMS
D. I. G. Jones *In* SVIC Shock and Vibration Digest, Vol. 11, No. 5 May 1979 p 13-18 refs (For primary document see N80-13306 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

N80-13309 Chubu Inst. of Tech., Kasugai (Japan).
REDUCTION METHODS FOR PROBLEMS OF VIBRATION OF ORTHOTROPIC PLATES. PART 1: EXACT METHODS
T. Sakata *In* SVIC Shock and Vibration Digest, Vol. 11, No. 5 May 1979 p 19-26 refs (For primary document see N80-13306 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

N80-13312 General Dynamics Corp., Groton, Conn. General Boat Div.
BEHAVIOR OF ELASTOMETRIC MATERIALS UNDER DYNAMIC LOADS, 2
E. C. Hobaica *In* SVIC Shock and Vibration Digest, Vol. 11, No. 7 Jul. 1979 p 11-18 refs (For primary document see N80-13310 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/11

N80-13313 Southwest Research Inst., San Antonio, Tex.
APPROXIMATE TECHNIQUES FOR PLASTIC DEFORMATION OF STRUCTURES UNDER IMPULSIVE LOADING, 2
W. E. Bakerm *In* SVIC Shock and Vibration Digest, Vol. 11, No. 7 Jul. 1979 p 19-24 refs (For primary document see N80-13310 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20735 CSCL 20/11

42 GEOSCIENCES (GENERAL)

N80-13529# European Space Agency, Paris (France).
MAGNETOSPHERIC BOUNDARY LAYERS
Bruce Battrick, ed. and Jacqui Mort, ed. Aug. 1979 411 p refs Proc. of lectures presented at ESA/Sydney Chapman Intern. Conf., Albach, Austria, 11-15 Jun. 1979; sponsored by Am. Geophys. Union, European Geophys. Soc., Austrian Solar and Space Agency and Max-Planck Inst. fuer Extraterrest.
(ESA-SP-148) Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Magnetospheric boundary layers as observed around the Earth as well as around other various astronomical bodies are considered. Theoretical discussions along with reports of recent satellite measurements are given. Main topics include the structure of magnetopause and boundary layers, the extension of boundary layers to lower altitudes, other magnetospheres than the Earth's, accreting neutron stars, transfer mechanisms, and the equilibrium structure of the magnetopause. For individual titles, see N80-13530 through N80-13581.

N80-13530*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOBAL ASPECTS OF THE EARTH'S MAGNETOPAUSE c46
D. H. Fairfield *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 5-13 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

Measurable characteristics of the magnetopause are discussed. The Earth's magnetopause is a thin magnetic discontinuity separating the shocked, magnetized plasma of the solar wind from a more tenuous plasma contained by the geomagnetic field. This external magnetosheath plasma flows around the magnetosphere with characteristics that are in approximate agreement with gas dynamic theory. The interplanetary magnetic field carried by this plasma becomes draped over the magnetosphere and its orientation relative to the local geomagnetic field determines the local magnetopause current. Solar wind pressure and interplanetary field direction control the geocentric distance to the magnetopause with high pressures and southware fields moving the equatorial magnetopause to a more earthward location. Evidence suggests that the magnetopause is Kelvin-Helmholtz unstable and surface waves are propagating toward the magnetotail. Author (ESA)

N80-13531# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
AN ELECTRIC-CURRENT MODEL OF THE MAGNETOSPHERE c46
H. Alfven *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 15-21 refs (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

A translation of the traditional field description of the magnetosphere into a particle (electric current) description is offered. Focus is on the energy transfer from the solar wind. The solar wind flow through the magnetic field acts as an electric generator. Its power is transferred to the magnetosphere through four main circuits. These are the magnetopause circuit, the solar wind/auroral circuit, the tail circuit, and the front circuit. A fifth circuit, the substorm circuit, is also very often energized. When the tail circuit flares, the current is partly redirected over the auroral zone, flowing in what is called the 'substorm circuit'.

Author (ESA)

N80-13532# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).

PLASMA STRUCTURE OF THE MAGNETOPAUSE AND BOUNDARY LAYER **c46**

G. Paschmann. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p 25-36. refs (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The large amount of data on the plasma properties in the magnetospheric boundary layers is reviewed. Starting with the global aspects of the layers, plasma parameter profiles in the various regions are compared and recent evidence for rapid temporal variations is presented. The boundary layer flow is taken up separately as well as the observed distribution functions. The plasma structure of the magnetopause is considered with emphasis on ISEE results. The observations are summarized in the framework of current ideas on plasma entry and transport.

Author (ESA)

N80-13533# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).

EXTERNAL PLASMA FLOW **c46**

N. Sckopke. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p 37-42. refs (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The magnetosheath plasma properties observed in the subsonic region and near the polar cusps, i.e. in regions where the flow deviates from the predictions of the axisymmetric gasdynamic model, are discussed. Stagnating flow, depletion, and turbulence in the subsonic region are dealt with. Plasma in the exterior cusp is then described. Observations from HEOS-2 are used to support the discussion.

Author (ESA)

N80-13534*# California Univ., Berkeley. Inst. of Geophysics and Planetary Physics.

ISEE-1 AND 2 MAGNETOMETER OBSERVATIONS OF THE MAGNETOPAUSE **c46**

R. C. Elphic and C. T. Russell. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p 43-50. refs (For primary document see N80-13529 04-42)

(Contract NAS5-20064)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

The ISEE 1 and 2 satellites were launched on October 22, 1977 into nearly identical highly elliptical orbits with an apogee of 23 Earth radii, carrying sophisticated field, particle, and plasma wave instrumentation. The unique feature of the mission is the variable separation of the two spacecraft in nearly identical orbits, permitting studies of the velocities of the boundaries relative to the satellites and making it possible to deduce the thickness of these boundaries. The ISEE measurements show that the magnetopause motion is rapid and irregular, and that thicknesses from 500 to 1600 km are observed, depending on magnetosheath field orientation. These data suggest that reconnection often occurs in discrete increments and enough flux is transported during these events to support substorm activity.

Author (ESA)

N80-13535# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

QUASISTATIC ELECTRIC FIELDS OBSERVED DURING A NUMBER OF MAGNETOPAUSE CROSSINGS BY ISEE-1 **c46**

U. V. Fahleson, C. G. Faelthammar, P. A. Lindqvist, F. S. Mozer (Calif. Univ., Berkeley), R. B. Torbert (Calif. Univ., Berkeley), A. Gonfalone (ESTEC, Noordwijk, Netherlands), and A. Pedersen (ESTEC, Noordwijk, Netherlands). *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p 51-65. refs (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Quasi-static electric field measurements with spherical double probes were carried out during magnetopause crossings on a number of ISEE 1 orbits. These measurements were made at magnetic latitudes below 30 deg and for different local times as well as for different magnetosheath magnetic field directions. The power dissipation at the magnetopause was estimated from measurements of the electric field and from the current, inferred from the magnetometer data. The power dissipation is found to be largest, of the order 200 micro W/sq m, near the frontside for a southward magnetic field in the magnetosheath and a somewhat compressed magnetosphere. No power dissipation is observed on the frontside for a northward magnetic field in the magnetosheath. On the dawn side, magnetopause power dissipation is also observed to be positive for a southward magnetosheath magnetic field. An approximate magnetosheath and magnetosphere convection is derived and it is also found that a component towards the magnetopause on both sides which is the expected signature for a reconnection process exists.

Author (ESA)

N80-13536# European Space Technology Center, Noordwijk (Netherlands). Space Science Dept.

MAGNETOPAUSE ELECTRIC AND MAGNETIC FIELD SIGNATURES AT TIMES OF MAGNETOSPHERIC COMPRESSIONS **c46**

R. Grard, A. Pedersen, F. Mariani (CNR, Frascati, Italy), and C. Signorini (CNR, Frascati, Italy). *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p 67-72. refs (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The magnetopause was observed near the geostationary orbit on the GEOS 2 satellite. Quasi-static electric and magnetic field observations provided information for different local times; one event in particular, on August 28, 1978, provided a unique opportunity when GEOS 2 travelled near the magnetopause for several hours. The electric field has a component in the direction of the magnetopause current during most crossings; the resulting power dissipation is of the order of 100 W/km sq. This implies that field line reconnection must be effective during this time. The derived electric field drift is found to have a component towards the magnetopause on the magnetospheric and magnetosheath sides. The electric field is probably due to the existence of a polarization layer generated by the penetration of magnetosheath ions into the magnetosphere.

Author (ESA)

N80-13537# European Space Technology Center, Noordwijk (Netherlands). Space Science Dept.

RADIAL DISCONTINUITIES IN LOW-ENERGY MAGNETOSPHERIC PLASMA OBSERVED ON GEOS-1 **c46**

K. Knott, R. Grard, and A. Pedersen. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p 75-79. refs (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The GEOS 1 orbit is ideally suited to studying the low latitude magnetosphere between three and seven Earth radii at all local times. The long-boom electric field sensors operated continuously in a negative current bias mode and therefore, provided plasma density as a by-product. These data were evaluated in terms of radial density gradients. A marked density reduction from 100 to 50/cu cm is normally observed around four Earth radii at all local times. In the local time sector near 16:00, the average density is high, often close to 50/cu cm, all the way out to seven Earth radii. At other local times, the density beyond four Earth radii falls rapidly to values in the range 5 to 20/cu cm and thereafter decreases only slightly with radial distance. A second decrease to less than 5/cu cm is often recorded as well, primarily in the dusk-midnight sector. This boundary coincides with previous observations of the inner edge of the plasma sheet and also agrees with the trend shown by the particle experiments on GEOS 1.

Author (ESA)

N80-13538# Kiruna Geophysical Inst. (Sweden).

FIRST OBSERVATIONS OF A HEATED PLASMA COMPO-

NENT IN THE PLASMA MANTLE c46

B. Hultqvist, R. Lundin, I. Sandahl, N. Pissarenko (Acad. of Sci., Moscow), and A. Zacharov (Acad. of Sci., Moscow) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 83-89 refs Sponsored in part by Swedish Board for Space Activities (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

A heated plasma component was found in the plasma mantle close to the magnetopause by means of the Swedish-Soviet collaborative experiment PROMICS onboard the highly eccentric orbit satellite Prognoz 7. Both electrons and ions are heated. The heated plasma is at least partly of ionospheric origin. The total amount of energy loss through the tailward flow of the heated plasma is estimated to be of the order of 100 giga W. Author (ESA)

N80-13539# Kiruna Geophysical Inst. (Sweden).

FIRST OBSERVATIONS OF THE HOT ION COMPOSITION IN THE HIGH ALTITUDE MAGNETOSPHERIC BOUNDARY LAYER BY MEANS OF PROGNOZ-7 c46

R. Lundin, I. Sandahl, B. Hultqvist, A. Galeev (Acad. of Sci., Moscow), O. Likhin (Acad. of Sci., Moscow), A. Omelchenko (Acad. of Sci., Moscow), N. Pissarenko (Acad. of Sci., Moscow), O. Vaisberg (Acad. of Sci., Moscow), and A. Zacharov (Acad. of Sci., Moscow) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 91-96 refs Sponsored in part by Swedish Board for Space Activities (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Plasma measurements were carried out during high latitude magnetopause crossing onboard the Prognoz 7 satellite by means of a plasma analyzer, SCS, and the PROMICS experiment which contains mass spectrometers besides electron and ion energy spectrometers. Data from ion measurements in the energy and mass range 0.2 to 17 keV and 1 to 20 AMU, respectively, made during the first inbound magnetopause crossing of Prognoz 7, demonstrate that keV O ions (of ionospheric origin) exist in the high latitude plasma mantle with fluxes amounting to a sizable fraction of the proton flux for the same energy interval in some regions. The energy spectrum of the O ions was harder than that of the protons in the mantle. The O ion spectrum in the keV range was also harder in the outer mantle than in the inner. The He/H ion ratio was lower just inside the magnetopause than just outside it. Some physical implications of the observations are discussed. Author (ESA)

N80-13540# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.

OBSERVATIONS OF ION AND ELECTRON DISTRIBUTIONS DURING THE JULY 29 AND JULY 30, 1977 STORM PERIOD c46

J. F. Fennell, P. F. Mizera, and D. R. Croley, Jr. *In* ESA Magnetospheric Boundary Layers 1979 p 97-111 refs (For primary document see N80-13529 04-42)

(Contract F04701-78-C-0079; Grant NSF ATM-78-03600)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Low energy ion and electron observations taken during the July 29-30, 1977 storm period aboard the S3-3 satellite are presented and discussed. The particle precipitation was very intense, especially on July 29. Enhanced fluxes of low energy particles were observed from the auroral regions down to the plasmasphere. There were observations of downward flowing ions with peaks near 800 eV in the near earth plasma sheet. There is evidence that heavy ions dominate the ring current at low energies. Examples of electron and ion accelerations along the magnetic field lines are presented. The July 29 auroral fluxes do not show broad inverted V structures. Such structures were observed on July 30 and examples of two such structures are discussed. A summary of the particle boundaries for this period is also presented. Author (ESA)

N80-13541# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).

MAGNETIC PULSATIONS OBSERVED ON BOARD GEOS-2 IN THE ULF RANGE DURING MULTIPLE MAGNETOPAUSE CROSSINGS c46

S. Perraut, R. Gendrin, P. Robert, and A. Roux *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 113-122 refs (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

During periods of large magnetic activity, GEOS 2 experienced multiple magnetopause crossings. The characteristics of the ULF waves which were detected during two of these crossings, the 28th of August and the 29th of September 1978, are described. For both events, the interplanetary magnetic field had a strong southward component. The most striking phenomenon which was observed is the existence of very strong turbulence, the intensity of which, integrated between 0.3 and 10 Hz, reaches values as high as 10 gamma. This turbulence is restricted to a small transition region (500 km) at the border of the magnetopause, within the magnetosheath. Its role with respect to the reconnection phenomenon is discussed. Further in the magnetosheath, the ULF noise has a much lower intensity which seems to be attributable to the presence of He ions. Author (ESA)

N80-13542# Danish Space Research Inst., Lyngby.

CRITICAL LEVEL BEHAVIOR OF ION-CYCLOTRON WAVES AT MAGNETOSPHERIC BOUNDARY LAYERS c46

J. F. McKenzie *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 123-127 refs (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The propagation characteristics of ion-cyclotron waves in a magnetized plasma in which the plasma density varies in a direction perpendicular to that of the ambient magnetic field is investigated. It is shown that such waves are trapped between a reflecting layer and a critical layer. Near the latter level, the wave field becomes large and across this level the Poynting flux jumps discontinuously from one constant value to another, with the implication that the plasma absorbs wave energy in the vicinity of a critical level. It is demonstrated that critical level behavior and field line resonance are related, but inversely, both arising from the same singularity in the governing wave equation. The relevance of critical level behavior to ion-cyclotron waves propagating in the vicinity of the plasmapause and magnetopause is discussed. Author (ESA)

N80-13543# Sheffield Univ. (England). Dept. of Physics.

A WAVE-PARTICLE-WAVE INTERACTION OBSERVED ON GEOS-2 c46

T. R. Kaiser *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 129-130 refs (For primary document see N80-13529 04-42)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Simultaneous pairs of emission bands were observed on GEOS 2; one below and one above half the electron gyrofrequency. It is suggested that the lower band is a whistler mode wave of frequency omega with a longitudinal component of the E-field. Longitudinally trapped particles (traveling at the wave phase velocity) then produce backward Doppler shifted cyclotron radiation which accounts for the upper emission band. Author (ESA)

N80-13544*# California Inst. of Tech., Pasadena.

ENERGETIC ELECTRON BURSTS IN THE MAGNETOPAUSE ELECTRON LAYER AND IN INTERPLANETARY SPACE c46

J. W. Bieber and S. C. Stone *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 131-135 refs (For primary document see N80-13529 04-42)

(Contract NAS5-11066; Grant NGR-05-002-160)

Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

The magnetopause electron layer in the distant magnetotail is an annular region encircling the magnetopause in which bursts of tailward-streaming energetic (E > 200 keV) electrons are almost continuously present. Sunward-streaming electron bursts with time scales and energy spectral indices similar to those of layer bursts are sometimes observed in interplanetary space upstream of the Earth. Evidence is presented to show that the layer bursts and the interplanetary bursts have a common source. With the aid of a new coordinate system, geocentric interplanetary medium coordinates, appropriate for describing the access of energetic charged particles in the inner magnetosheath to a spacecraft located in interplanetary space, it is shown that the interplanetary bursts occur predominantly on the sunward extension of the field lines associated with the magnetopause electron layer. Author (ESA)

N80-13545# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
ION AND ELECTRON LAYERS AT THE MAGNETOPAUSE: ISEE-2 **c46**
P. W. Daly, E. Keppler, and D. J. Williams (NOAA Space Environ. Lab.) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 137-141 refs Co-sponsored by Max-Planck Ges. (For primary document see N80-13529 04-42)
(Contract BMFT-RV-14-B30/73)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The medium energy particle spectrometer on board ISEE 2 was used to study dayside magnetopause crossings between local times noon to 0800. Evidence was found for a layer of ions (E > 20 keV) just outside the magnetosphere, with a thickness varying from 0.05 to 0.09 Earth radii, increasing from the nose to the flanks. The ion flow is along the boundary, at pitch angles of 180 deg to the magnetic field. The total rate of energy flow, when extrapolated around the entire magnetosphere is of the order of 10 peta ergs/sec. The electron layers are coincident with the ions, but are less intense. Their flow is sometimes the same as that of the ions, otherwise it tends to be isotropic. Author (ESA)

N80-13546# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.
PARTICLE AND FIELD CHARACTERISTICS OF THE DAYSIDE MAGNETOPAUSE ENERGETIC ELECTRON LAYER **c46**
Ching-I. Meng (Iowa Univ., Iowa City), L. A. Frank (Iowa Univ., Iowa City), and K. L. Ackerson *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 143-148 refs (For primary document see N80-13529 04-42)
(Contract NSF ATM-75-02621)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The presence of a layer of energetic electrons in the inner magnetosheath region is discussed. The particle and field characteristics in this region were studied by using data from three experiments aboard the IMP-5 satellite, namely, the University of California (Berkeley) medium energy particle detectors, the University of Iowa plasma detector (Lepedea), and the NASA Goddard magnetometer. Based on observations over the dayside high latitude magnetopause region, it is found that the enhanced energetic electron layer in the inner magnetosheath is only one of several manifestations of this layer located near the magnetopause. Intense magnetic noise, enhanced plasma number and energy densities, and a decrease of the magnetic field magnitude are also present in this layer. Author (ESA)

N80-13547*# Washington Univ., Seattle.
PARTICLE BOUNDARY STRUCTURES AT THE MAGNETOPAUSE AND THE PLASMA SHEET **c46**
G. K. Parks, C. S. Lin (California Univ., Berkeley), K. A. Anderson (Paul Sabatier Univ., Toulouse), R. P. Lin (California Univ., Los Angeles), H. Reme (John Hopkins Univ., Baltimore), F. Coroniti (Ecole Polytech., Paris), C. Meng, and R. Pellat *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 151-156 refs (For primary document see N80-13529 04-42)
(Contracts NAS5-20079; CNES-212)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

There are three classes of particle events in the vicinity of the magnetopause: a layer of particles right at the magnetopause which we identify with the boundary layer particles; spikes of particles just ahead of the magnetopause; and, sometimes, magnetosheath-like ions appearing inside the magnetosphere, the inclusion events. The energy spectra of these three classes of events are very similar, indicating a common particle source. The presence of a particle layer at the outer boundary of the plasma sheet is shown. This layer has typical dimensions of a few thousand km at 20 Earth radii. A typical velocity is a few tens of km/sec. These velocities and dimensions projected to ionospheric heights resemble those of visual auroras and suggest that aurorally associated particle phenomena are being detected. Author (ESA)

N80-13548# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
VARIATIONS OF ELECTRON AND ION DISTRIBUTIONS DURING DAYSIDE MAGNETOPAUSE CROSSINGS OF GEOS-2 **c46**
A. Korth, G. Kremser, B. Wilken, E. Amata (Lab. Plasma Spazio), and M. Candidi (Lab. Plasma Spazio) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 157-159 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The geostationary satellite GEOS 2 crossed the dayside magnetopause several times on August 28, 1978. The particle spectrometer provided observations of the distributions of electrons and ions with energies from 20 to 300 keV. Magnetometer data were used to determine the location of GEOS 2 relative to the magnetopause. The observed pitch angle distributions near the magnetopause were strongly asymmetric with respect to 90 deg and showed a strong field aligned flow along magnetosheath field lines. Author (ESA)

N80-13549# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
MULTIPLE-SATELLITE OBSERVATIONS OF LARGE SCALE TRAPPING BOUNDARY MOTIONS **c46**
B. Wilken, A. Korth, G. Kremser, and Th. A. Fritz (NOAA Space Environment Lab.) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 161-163 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Large rapid decreases in the energetic particle flux followed by even more rapid increases are frequently observed in and near geosynchronous altitude during geomagnetic storms. Correlated measurements from GEOS 1 and ATS 6 are used to analyze a flux drop-out observed during the disturbed period on December 11, 1977. The motion of the gradients in the energetic particle distribituions are determined from azimuthal anisotropies generated at the position of GEOS 1 at 26 deg geomagnetic latitude. These measurements are compared with observations in the geosynchronous orbit at approximately the same local time. Author (ESA)

N80-13550*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
LOW-ALTITUDE SIGNATURES OF THE BOUNDARY LAYERS **c46**
P. H. Reiff *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 167-173 refs (For primary document see N80-13529 04-42)
(Grants NGR-44-006-012; NSG-5286; NSF ATM-77-12619)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

Low altitude measurements reveal two distinct types of dayside boundary-layer plasmas. The first type is characterized by a proton distribution whose average energy decreases with increasing latitude and generally shows cool, unaccelerated electron fluxes. This type is observed only near noon and is correlated with southward interplanetary magnetic field (IMF). The second type is characterized by a 'V' signature in which the proton average energy first decreases then briefly increases as a function of latitude. The electron distribution in the latter case is hotter and often shows evidence of small scale acceleration regions. This type can be seen at all local times in the dayside and at noon is correlated with a northward IMF. It is suggested that the type 1 plasma is the low altitude signature of the plasma mantle and the type 2 plasma is the low altitude signature of the low latitude boundary layer. Author (ESA)

N80-13551*# Texas Univ., Dallas. Center for Space Sciences.
IONOSPHERIC CONVECTION AT HIGH LATITUDES **c46**
R. A. Heelis *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 175-181 refs (For primary document see N80-13529 04-42)
(Contract NAS5-11407; Grant NGR-44-004-120)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

The characteristics of the high latitude ionospheric convection pattern that results from the transmission of electric fields from the magnetosphere was examined by gathering data from ground based and in situ measurements. The Atmosphere Explorer C satellite measurements of the motion of the high latitude ionosphere show that the dayside and nightside convection patterns are influenced by the interplanetary magnetic field and that the relationships between the energetic particle precipitation

and the convection reversal boundaries are very complex. The existence of a magnetospheric boundary layer is consistent with the satellite observations, but its relationship to open and closed field lines cannot be determined. Author (ESA)

N80-13552# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
STARE IONOSPHERIC ELECTRON FLOWS DURING THE AUGUST 28, 1978 GEOS-2 MAGNETOPAUSE CROSSING c46
G. J. Sofko, R. A. Greenwald, A. Korth, and G. Kremser *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 183-185 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Selected GEOS 2 particle intensities (ions > 27 keV, electrons > 22 keV) and asymmetric pitch angle distributions are compared with STARE ionospheric electron flow patterns and scattering structures just after the August 28, 1978 magnetopause crossing at 0530 UT. The combined results indicate the presence at the magnetopause of eastward moving localized merging regions through which magnetopause plasma is expelled into the magnetosheath. Author (ESA)

N80-13553# Lockheed Missiles and Space Co., Palo Alto, Calif.
ION COMPOSITION IN THE DAYSIDE CUSP: INJECTION OF IONOSPHERIC IONS INTO THE HIGH LATITUDE BOUNDARY LAYER c46
E. G. Shelley *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 187-192 refs Sponsored in cooperation with Office of Naval Res. and NSF (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Ion composition measurements of the primary magnetosheath ions (H and He) in the lower altitude dayside cusp provide information on the processes acting on the plasma between the solar wind source and the point of observation. They suggest that at times the processes are purely adiabatic while at other times parallel electrostatic fields are implied. Measurements of ionospheric constituents (specifically O) reveal that these ions are continuously being accelerated to energies of the order of keV within the lower altitude cusp region and are being injected along with the plasma of magnetosheath origin into the high latitude boundary layers. Author (ESA)

N80-13554# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
BIRKELAND CURRENTS AND THE INTERPLANETARY MAGNETIC FIELD c46
T. A. Potemra and N. A. Saflekos (Boston Coll.) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 193-198 refs Sponsored in cooperation with Office of Naval Res. and NSF (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Magnetic field measurements acquired at low altitude with the ISIS 2 and TRIAD spacecraft confirm the close connection between the orientation and amplitude of the interplanetary magnetic field (IMF) and the spatial location, flow direction, and amplitude of Birkeland currents in the high latitude dayside region usually referred to as the cusp. These relationships demonstrate that the Birkeland currents are an important element in the electric circuit responsible for the close connection of surface magnetic disturbances in the polar regions with the orientation of the IMF. These same relationships support previous suggestions for magnetic merging in regions of anti-parallel IMF and geomagnetic field lines on the dayside boundary of the magnetosphere. Author (ESA)

N80-13555# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.
DAYSIDE AURORA AND SUBSTORM CURRENT SYSTEMS c46
R. H. Eather, S. B. Mende (Lockheed Res. Lab., Palo Alto, Calif.), and E. J. Weber (Air Force Geophysics Lab.) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 199-206 refs (For primary document see N80-13529 04-42)
(Contract NSF C-659)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Dayside cusp auroral signatures from South Pole keograms allow an investigation of the dependence of cusp movements on substorm activity and interplanetary magnetic field direction. Erosion of dayside field is not a direct result of southward turning, but is closely related to substorm timing and intensity. The dayside field reconfigurations result from increases in near-tail magnetopause currents, which connect through the nightside electrojet. This implies a substorm mechanism involving increased energy extraction from the solar wind, rather than a relaxation process of release of internally stored energy. Author (ESA)

N80-13556# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
COMMENTS ON THE LOW-ALTITUDE OPTICAL SIGNATURES OF MAGNETOSPHERIC BOUNDARY LAYERS c46
M. M. Shepherd and G. G. Shepherd *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 207-208 (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The production efficiency for 6300 A emission by energetic electrons was studied with the ISIS 2 spacecraft by comparing the optical emissions with the low energy electron fluxes. It is shown that the production efficiency falls sharply above about 300 eV, so that this emission is primarily produced by electrons with lower energies than that. Maps from ISIS 2 of the 6300 A emission may, therefore, be interpreted as fluxes of electrons with energies less than 300 eV. Author (ESA)

N80-13557# Cornell Univ., Ithaca, N. Y. School of Electrical Engineering.
LOW FREQUENCY WAVES AND IRREGULARITIES IN THE LOW ALTITUDE BOUNDARY LAYER c46
P. Kintner and M. Temerin (California Univ., Berkeley) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 209-216 refs (For primary document see N80-13529 04-42)
(Contract N00014-75-C-0780)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Within the low altitude boundary layer a variety of plasma wave processes occur. Two processes, high latitude turbulence and electrostatic hydrogen cyclotron (EHC) waves are reviewed. High altitude turbulence appears to be a fluid process whose behavior can be explained in part by nonlinear two dimensional fluid turbulence. In laboratory plasmas, EHC waves are produced by a resonant interaction with either ion beams or drifting electrons. There exists evidence that drifting electrons and ion beams are sources of free energy for the EHC wave observed by S3-3. There also exists evidence that EHC waves are a source of energy for ion conics. Author (ESA)

N80-13558*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
JUPITER'S MAGNETOPAUSE c91
E. J. Smith *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 221-224 refs (For primary document see N80-13529 04-42)
(Contract NAS7-100)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 03B

Some of the major conclusions regarding the magnetopause of Jupiter, based on Pioneer and Voyager observations, are discussed. Topics include the overall shape of the magnetosphere, the variability in the location of the magnetopause with changes in the solar wind, intrinsic magnetospheric motions, the character of the field and plasma just inside the magnetopause and evidence of magnetic merging. Author (ESA)

N80-13559*# Rice Univ., Houston, Tex.
THE JOVIAN BOUNDARY LAYER AS FORMED BY MAGNETIC-ANOMALY EFFECTS c91
A. J. Dessler *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 225-226 refs (For primary document see N80-13529 04-42)
(Grant NGR-44-006-137)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 03B

A model is presented in which a plasma boundary layer of Jupiter is formed from plasma of internal origin. It is proposed that, unlike the Earth's boundary layer, which is thought to consist principally of solar wind plasma, Jupiter's boundary layer consists principally of sulphur and oxygen from the Io plasma torus, plus a small component of hydrogen from Jupiter's ionosphere. Fresh

plasma is supplied to the boundary layer once each planetary rotation period by a convection pattern that rotates with Jupiter. Author (ESA)

N80-13560*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
EARTH AND JUPITER: COMPARISON OF MAGNETOPAUSE STRUCTURE c91
P. H. Reiff and C. W. Hill *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 227-228 refs (For primary document see N80-13529 04-42)
(Grants NGR-14-006-137; NSF ATM-78-21767)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 03B

Using published data from the Jovian magnetopause crossings of Pioneers 10 and 11, the apparent crossing times as determined from the solar wind plasma detector and from the vector magnetometer are comapred. There were 13 published crossings for which both plasma and magnetic-field signatures were clearly defined. The occurrence distribution of these 13 crossings with respect to the relative timing of plasma and field signatures is shown. Results indicate that Jupiter's magnetopause is more turbulent than the Earth's possibly as the result of the large velocity shear between the magnetosheath and the partially corotating Jovian plasma. However, it is noted that the data set considered is too small to justify a definitive interpretation. Author (ESA)

N80-13561*# California Univ., Los Angeles.
THE SOLAR WIND INTERACTION WITH VENUS c92
C. T. Russell, R. C. Elphic, and J. A. Slavin *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 231-239 refs (For primary document see N80-13529 04-42)
(Contract NAS2-9491)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 03B

The Pioneer Venus orbiter reveals that Venus has a well developed bow shock like the Earth's but on that is significantly weaker than the Earth's shock. The location of the bow shock is highly variable, more so than would have been expected for an obstacle of essentially fixed size. The altitude of the ionopause is also highly variable in response to changes in the solar wind. In the ionosphere, the field is often low. However, on some orbits, very large fields are seen as low as 150 km, and on most dayside orbits, thin magnetic structures of flux ropes are observed. At night, large fields are often observed which vary from orbit to orbit. Venus has a much smaller intrinsic magnetic moment than expected from scaling the terrestrial moment. Author (ESA)

N80-13562# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
INSTABILITIES OF ACCRETION DISK: MAGNETOSPHERE INTERFACES c90
U. Anzer and G. Boerner *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 259-261 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Configurations which consist of a Keplerian accretion disk and a magnetosphere with solid rotation are investigated. Because of the velocity difference between disk and magnetosphere the boundary between the two is unstable to the Kelvin-Helmholtz instability. This instability is strongest within a ring around the radius of corotation. It leads to turbulent diffusion of disk material into the magnetosphere, and thus gives a sufficiently high accretion rate. Author (ESA)

N80-13563# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
INTERACTION OF ACCRETION DISK AND ROTATING MAGNETIC FIELD OF NEUTRON STAR c90
U. Anzer and G. Boerner *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 263-264 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Utilizing the instabilities of the boundary between disk and magnetosphere, a model for the flow of disk material into the neutron star's magnetosphere is constructed. It is shown that within a thin ring around the corotation radius, gas flows over. The gas is partly accelerated towards the neutron star producing the accretion partly outwards. In terms of this model, certain observed properties of pulsating X-ray sources are explained. Author (ESA)

N80-13564# Bonn Univ. (West Germany). Inst. fuer Astrophysik.
SPINDOWN OF ROTATING MAGNETS c90
W. Kundt *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 265-267 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The torque exerted on a rotating magnet by impinging plasma was derived from certain general assumptions plus conservation laws. Its relevance to binary evolution (neutron stars, white dwarfs, and in particular binary X-ray sources AM Her, 4U 0115+63, SS 433), to the generation of cosmic rays, and to the (early) planets and their satellites is explained. Author (ESA)

N80-13565# California Univ., Berkeley. Dept. of Astronomy and Space Sciences.
THE MAGNETOSPHERES OF MAGNETIC A STARS AND OF PULSARS c90
J. Arons *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 271-279 refs (For primary document see N80-13529 04-42)
(Grants NSF AST-77-23069; NSF AST-78-21070)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Aspects of the hydromagnetic structure of the magnetospheres surrounding magnetic A stars are considered and the magnetopause radius is estimated. Typical sizes exceed 10 AU. The supply of mass to the magnetosphere from the star is considered; a model for formation of a corona is suggested which relies on heating by the auroral dissipation at the magnetic poles. Plasma supply from planets contained within the magnetosphere is considered along with the possibility of discovering these planets from photons emitted as a consequence of the planet-magnetosphere interaction. A number of mechanisms for rotational spin down of magnetic a stars are considered. A new spin down theory based on emission of interstellar magnetosonic modes from the shear unstable magnetopause is suggested. A comparison is made to certain classes of pulsar models. Author (ESA)

N80-13566# Sussex Univ., Brighton (England).
THE BOUNDARY OF A PULSAR MAGNETOSPHERE: GAMMA-RAY PULSARS c90
N. J. Holloway *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 281-284 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The energetics of an aligned or nearly aligned pulsar magnetosphere are considered and the boundary is interpreted as that region in which the principal energetic processes take place. It is argued that these processes occur at or near the light cylinder and that they consist primarily of gamma ray emission and classical magnetic dipole radiation. The gamma ray emission becomes dominant at very small angles of nonalignment as the dipole radiation is reduced by alignment. This dominance of the gamma ray emission represents the late stages of pulsar evolution. Author (ESA)

N80-13567# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
KINETIC THEORY OF THE BOUNDARY LAYER BETWEEN A FLOWING ISOTROPIC PLASMA AND A MAGNETIC FIELD c46
L. R. O. Storey and L. Cairo *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 289-293 refs Sponsored by UK. Sci. Res. Council. (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Assuming that the direction of flow is parallel to the applied magnetic field, conditions are defined on which the boundary layer can exist in static equilibrium at any flow speed. They are not met at the Earth's magnetopause, but could apply at similar boundaries in laboratory plasmas. Granted these conditions, the small scale structure of the layer was calculated by means of a simplified kinetic theory and results are presented for a hydrogen plasma with equal electron and ion velocity. The question of the stability of these structures remains open. Author (ESA)

N80-13568# Institut d'Aeronomie Spatiale de Belgique, Brussels.
A MICROSCOPIC DESCRIPTION OF INTERPENETRATED PLASMA REGIONS c46
M. A. Roth *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 295-309 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

A model of steady state tangential discontinuities is developed using the kinetic theory of multicomponents collisionless plasmas. The magnetopause layer and the inner edge of the plasma boundary layer are considered as regions where two different hydrogen plasmas are interpenetrated and the model is used to describe their microstructures. Large field-aligned currents are generated at the magnetopause and may constitute a part of the field-aligned currents observed in the cusps. A stability study shows that the electron layers are nearly always unstable. The thickness of stable ion layers increases with increasing values of the temperature ratio (T+/T-) and/or with decreasing density variations. This thickness represents also 2.5 ion gyroradii when (T+/T-) becomes larger than 5. A minimum magnetopause thickness is founp equal to 100 km. Author (ESA)

N80-13569# Institut fuer Weltraumforschung, Graz (Austria). Oesterreichische Akademie der Wissenschaften.
SOLUTION OF THE CHAPMAN-FERRARO PROBLEM WITHIN TWO DIMENSIONS c46
H. Ruckner and H. Biernat *In* ESA Magnetospheric Boundary Layer Aug. 1979 p 311-314 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The magnetic field structure of the Earth's magnetosphere and its boundary (the magnetopause) is calculated with the conformal mapping method. According to this method the solution is restricted to two dimensions, whereby the noon-midnight meridian plane is taken into consideration. Two boundary conditions define the potential problem which is determined in total self consistence. The normal component of the total magnetic field vanishes at the magnetopause and the kinetic plasma pressure of the solar wind balances the magnetic pressure. The configuration of the magnetopause and the magnetospheric field line structure is represented. The shape of the boundary is compared with other magnetopause models indicating a remarkable agreement. Author (ESA)

N80-13570# Technische Hochschule, Darmstadt (West Germany). Angewandte Geophysik.
INFLUENCE OF THE INTERPLANETARY MAGNETIC FIELD ON THE POSITION OF THE DAYSIDE MAGNETOPAUSE c46
G. H. Voigt *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 315-321 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The inward movement of the subsolar stagnation point of the Earth's magnetosphere when the interplanetary magnetic field turns from northward to southward in terms of the following assumptions: (1) there is a time averaged topology of interconnected field lines; ahd (2) the displacement of the subsolar point due to field line erosion can be described on the level of the fluid (MHD) theory for steady state conditions. Model calculations result in an analytical formula which expresses the stand off distance as a function of the solar wind plasma parameters and an IMF component. The IMF related difference in the average position of the stagnation point is not independent of the solar wind dynamical pressure. Author (ESA)

N80-13571*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
RATES OF MASS, MOMENTUM, AND ENERGY TRANSFER AT THE MAGNETOPAUSE c46
T. W. Hill *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 325-332 refs (For primary document see N80-13529 04-42)
(Grants NGR-44-006-137; NSF ATM-77-12619)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

Empirical estimates of the global rates of transfer of solar wind mass, tangential momentum, and energy at the Earth's magnetopause are presented for comparison against model estimates based on the four principal mechanisms that have been proposed to explain such transfer. The comparisons, although not quite conclusive, strongly favor a model that incorporates some combination of direct magnetic connection and anomalous cross field diffusion. An additional global constraint, the rate at which magnetic flux is cycled through the magnetospheric convection system, strongly suggests that direct magnetic connection plays a significant if not dominant role in the solar wind/magnetosphere interaction. Author (ESA)

N80-13572# Imperial Coll. of Science and Technology, London (England).
THE FORMATION AND PROPERTIES OF BOUNDARY LAYERS DOWNSTREAM FROM NEUTRAL LINES IN AN OPEN MAGNETOSPHERE c46
S. W. H. Cowley *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 333-342 refs Sponsored by UK Sci. Res. Council. (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The acceleration of plasma in the current sheets downstream from magnetic neutral lines is discussed in relation to both the dayside magnetopause and the geomagnetic tail. In both cases, the accelerated plasma is expected to form a layer adjacent to the current sheet on either side in which it streams along the field lines away from the neutral line through the incoming unaccelerated plasma. It is argued, however, that the properties of these boundary layer flows will be very different on the dayside and in the tail due to the different properties of the incoming source plasmas. The downstream plasma populations arising from these layers will also be different, due to the differing connectivities of the downstream reconnected field lines. Author (ESA)

N80-13573# California Univ., Los Angeles. Dept. of Atmospheric Sciences.
ANTIPARALLEL MERGING, THE HALF-WAVE RECTIFIER RESPONSE OF THE MAGNETOSPHERE, AND CONVECTION c46
N. U. Crooker *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 343-348 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

In some ways the magnetosphere behaves as if merging occurs only when the interplanetary magnetic field (IMF) is southward, and in other ways it behaves as if merging occurs for all IMF orientations. An explanation of this duality is offered in terms of a geometrical antiparallel merging model which predicts merging for all IMF orientations, but magnetic flux transfer to the tail only for southward IMF. Observations interpreted in terms of the model indicate that on the average, merging and viscous interaction contribute equally to magnetospheric convection. Author (ESA)

N80-13574*# Rice Univ., Houston, Tex.
INTERNAL MAGNETOSPHERIC PLASMA FLOW c46
J. W. Freeman *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 351-355 refs Co-sponsored by NASA and NSF (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

Experimental evidence indicates that there exist at least two separate circulation patterns within the magnetosphere which allow cold heavy plasmaspheric ions, which drift toward the dayside magnetopause, to be transported to the plasma sheet for acceleration and reinjection into the inner magnetosphere. The first of these results in the ions being transported over the polar regions in the plasma mantle. The mantle ultimately joins the plasma sheet at great distance in the tail via the lobe electric field. The second circulation pattern is embodied in the low latitude boundary layer. Recent data show that the extension of the low latitude boundary layer in the tail at 60 Earth radii turns inward to directly feed the plasma sheet. A means of estimating the fractional role played by each is to compare the electric potential drop across the low latitude boundary layer with the total cross tail convection electric potential. This was done for a set of tail crossings using ALSEP/SIDE data. The result is that the boundary layer contains about 20% of the potential drop across the tail. Author (ESA)

N80-13575*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
MAGNETOPAUSE KELVIN-HELMHOLTZ INSTABILITY c46
D. J. Southwood *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 357-364 refs (For primary document see N80-13529 04-42)
(Contract NAS5-20064; Grant NSF ATM-74-23464)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

The Kelvin-Helmholtz instability as it applies to the dayside magnetopause is reviewed. Simple theory suggests the boundary should generally be unstable to waves moving at a large angle to the Earth's field. Nonlinear effects, how amplitudes might be limited, and what dynamic role the instability could have in boundary regions in stimulating mass and momentum transfer are discussed. Examination of data from a particular ISEE spacecraft pass shows relatively small amplitude (750 km) waves present on the boundary. Corresponding wavelength estimates show wave momentum is not significant at the time of the pass. Author (ESA)

N80-13576# Institut d'Aeronomie Spatiale de Belgique, Brussels.
IMPULSIVE PENETRATION OF SOLAR WIND AND ITS EFFECTS ON THE UPPER ATMOSPHERE c46
J. Lemaire *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 365-373 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Impulsive penetration of solar wind plasma irregularities, which transfers energy, momentum, and particles into the magnetosphere, is studied. The effects on the upper atmosphere are examined and discussed. The heat deposition in the E-region (and above) due to Joule dissipation of depolarization current is evaluated and compared to the energy production due to the absorption of solar radiation. The wind speed imparted to ionospheric plasma in the throat region and over the polar cap is compared to the observed convection velocities. The impulsive injections of magnetosheath-like plasma observed at low altitudes in the dayside cusps are interpreted as consequences of field aligned expansions (spreadings) of engulfed solar wind filaments (intrusions) into the magnetosphere. Author (ESA)

N80-13577*# Texas Univ. at Dallas, Richardson. Center for Space Sciences.
IMPULSIVE PENETRATION AND VISCOUS INTERACTION c46
W. J. Heikkila *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 375-380 refs Co-sponsored by NSF (For primary document see N80-13529 04-42)
(Grant NsG-5085)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

How the magnetosheath plasma enters the entry layer and low latitude boundary layers, with the particle energy spectra almost unchanged is investigated. It was proposed by Lemaire that this is accomplished by impulsive penetration of plasma clouds of plasmoids. Once inside the magnetosphere, a plasmoid with its own momentum will polarize, to create its own electric field for continued motion. This voltage generator charges up the sides of the boundary layers, in the process creating the internal magnetospheric electric field. The entry layer particles will gradient and curvature drift, constituting still another generator, a current generator, to power magnetospheric plasma processes. This may be the explanation for the viscous interaction first proposed by Axford and Hines. Author (ESA)

N80-13578# Southampton Univ. (England). Dept. of Physics.
TOWARDS A MORE QUANTITATIVE UNDERSTANDING OF DAYSIDE MAGNETOPAUSE CURRENTS c46
M. A. Saunders and M. J. Rycroft *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 381-384 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

Considering the magnetopause as a thin current sheet, and applying Maxwell's third equation to a vector superposition of magnetic fields of different origins, the orthogonal components of the magnetopause current intensity can be determined. Analyses of ISEE and HEOS 2 magnetometer data for the dayside magnetopause, outer cusp, and near earth magnetotail regions show that the magnetopause current possesses both a magnetospheric magnetic field aligned component and a cross field (Chapman-Ferraro) component. Further, it appears that particularly at low latitudes near noon, the magnetospheric magnetic field aligned component is a useful parameter with which to these calculated magnetopause field aligned currents, and their variations with both the dawn-dusk component of the interplanetary magnetic field and local time, are investigated in relation to statistical studies of the high latitude ionospheric Birkeland current flow. Author (ESA)

N80-13579# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
INTERACTION BETWEEN THE MAGNETOSPHERIC BOUNDARY LAYERS AND THE IONOSPHERE c46
V. M. Vasyliunas *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 387-393 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

The high latitude ionosphere is connected by magnetic field lines to the various observed magnetospheric boundary layers as well as (via open magnetic field lines) to the magnetosheath. The electrodynamic interaction between the ionosphere and the boundary regions is governed by the same self consistent chain of equations as the ionosphere magnetosphere interaction at lower latitudes. The plasma flow in the boundary region interacts with the ionosphere analogously to an MHD dynamo. In response to the imposed electric fields, field aligned (Birkeland) currents flow into and out of the ionosphere. The theoretically deduced pattern of these Birkeland currents is qualitatively similar to their observed pattern. Pressure gradients within the ring current region interact, via ionospheric closure of their associated Birkeland currents, with the magnetosphere ionosphere MHD dynamo driven by boundary region flow. Author (ESA)

N80-13580# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
THEORY OF THE LOW ATTITUDE BOUNDARY LAYER c46
B. U. Oe. Sonnerup *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 395-397 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

A one dimensional steady state fluid mechanical model is developed of the low latitude plasma boundary layer inside the dawn and dusk magnetopause. Momentum transfer in the layer is produced by viscosity and/or mass diffusion. Coupling to the ionospheric is achieved via field aligned currents, the magnitude of which is limited by parallel potential drops. These currents flow into and out of the ionosphere in the manner described by Iijima and Potemra. The higher latitude (region 1) currents are associated with the boundary layer proper, the lower latitude (region 2) ones with a region of sunward return flow adjacent to the boundary layer. The parallel potential drops have the typically observed magnitude of 2 to 3 kV and a north south extent of 100 to 200 km. Ionospheric electric fields and field aligned current strengths are also in approximate agreement with observations. Author (ESA)

N80-13581*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTROMAGNETIC STRUCTURE OF THE MAGNETOPAUSE AND BOUNDARY LAYER c46
B. U. O. Sonnerup (Max-Planck-Inst. fuer Extraterrestrische Phys., Garching, West Germany) and B. G. Ledley *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 401-410 refs (For primary document see N80-13529 04-42)
(Grants NsG-7292; NSF ATM-74-08223)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

After a review of the properties and predictions of the closed and open models of the magnetopause, OGO-5 magnetometer data are used to illustrate various observed signatures of the magnetopause current layer and the adjacent plasma boundary layer. Among the topics touched upon are fluctuations, diamagnetic effects, and field aligned currents in the boundary layer; one dimensionality of the magnetopause; presence and absence of a magnetic field component perpendicular to the magnetopause; finite ion gyroradius effects. A brief summary is given of existing Vlasov theory for the description of tangential,

rotational, and contact discontinuities. Special attention is paid to the tangential momentum balance and the jump conditions at a rotational discontinuity. Low frequency fluctuations are discussed with emphasis on the signatures of the tearing mode. Author (ESA)

N80-13582# Department of Energy, Washington, D. C. Office of Basic Energy Sciences.
SUMMARIES OF PHYSICAL RESEARCH IN THE GEOSCIENCES
Aug. 1979 65 p refs
(DOE/ER-0030) Avail: NTIS HC A04/MF A01

The Earth, atmospheric, and solar/terrestrial sciences which relate to the development of energy technology are summarized. The topics covered include: geology, geophysics, and Earth dynamics; geochemistry; energy resource recognition, evaluation, and utilization; hydrologic and marine sciences; and solar-terrestrial/atmospheric interactions. R.C.T.

N80-13583# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Astronomische und Physikalische Geodaesie.
SATELLITE CONTRIBUTIONS TO TIDAL STUDIES
Demosthenes Christodoulidis 1978 35 p refs Sponsored by Deut. Forschungsgemeinschaft
(TUM-MITT-147) Avail: NTIS HC A03/MF A01

The earth's tidal potentials, including solid earth tides, oceanic tides, and atmospheric tides, are analyzed based on the perturbations in the orbits of the Earth's artificial satellites. Tidal parameters are derived from the mean Keplerian elements of satellite motion. The gathering of a sufficient quantity of satellite data of sufficient quality is discussed. Results show that the computation of tidal parameters based on this method is, at present, unsatisfactory. However, satellite data can be used to improve existing tidal models. Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-13584 Columbia Univ., New York.
LONG WATER WAVE PROPAGATION UNDER THE INFLUENCE OF THE DEPTH VARIATION. PART 1: LONG WATER WAVES INCIDENT UPON A TRANSITION ZONE OF AN EXPONENTIAL DEPTH VARIATION. PART 2: LONG WATER WAVES INCIDENT UPON A SEAMOUNT MODEL OF A LINEARLY CYLINDRICAL DEPTH VARIATION Ph.D. Thesis
Shao-Sin Lee 1979 144 p
Avail: Univ. Microfilms Order No. 7924926

Analytic solutions of wave height are obtained for the long water wave from the deep water zone obliquely incident upon the transition zone of an exponential depth variation to the shallow water zone of a continental slope. The transmission coefficient in the shallow water zone and the reflection coefficient in the deep water zone critically depend upon the width of the transition zone, the wavelength, and the angle of incidence of the incident wave. A seamount was represented by a topped-cone model with a radial depth variation. The incident plane wave was decomposed into a series of cylindrical wave modes of the Bessel function type, corresponding to the modes of cylindrical scattering into the deep water zone and the modes of transmission into the shallow water zone. Numerical evaluations of the scattering and transmission coefficients of each mode slow that these coefficients critically depend upon the incident wavelength, the radius of the seamount model, and the depth ratio of the deep water to the shallow water zones. The total response of wave height was obtained by summing all the modes. Dissert. Abstr.

N80-13585* National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES. A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 23
Oct. 1979 70 p
(NASA-SP-7041(23)) Avail: NTIS HC E05 CSCL 05B

This bibliography lists 226 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1, 1979 and September 30, 1979. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. J.M.S.

N80-13586 Northwestern Univ., Evanston, Ill.
THE FATE OF DISSOLVED ALUMINUM WITHIN THE OCEANS Ph.D. Thesis
Marc Andre Stoffyn 1979 167 p
Avail: Univ. Microfilms Order No. 7927458

The processes and mechanisms controlling the concentration and distribution of dissolved aluminum within the oceans were investigated using five vertical hydrographic profiles sampled in the Atlantic Ocean and in the Mediterranean Sea. The concentrations of dissolved silica and aluminum covary in the surface waters of high productivity areas and exhibit minima in the photic zone. A tentative cycle of dissolved Al within the oceanic system is presented. Biological cycling constitutes an important subcycle of dissolved Al within the oceans. However, to maintain the deep water reservoir of the oceans at steady state, dissolved Al must be removed from the deep waters by reactions with aluminum minerals or iron hydroxides. The cycle of dissolved Al presented maintains the entire oceanic system at steady state with respect to dissolved Al. Dissert. Abstr.

N80-13587*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A REPORT ON FIELD WORK IN THE CITY OF PARAGOMINAS (PA) [RELATORIO DO TRABALHO DE CAMPO NO MUNICIPIO DE PARAGOMINAS (PA)]
Nelson deJesusParada, Principal Investigator, Armando Pacheco dosSantos, Evlyn Marcia Leao deMoraesNovo, Valdete Duarte, and Francisco Luna Toledo May 1979 75 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10001; NASA-CR-162378; INPE-1481-RPE/028) Avail: NTIS HC A04/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-13588*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES Quarterly Progress Report, 16 Apr. - 15 Jul. 1979
Roger M. Hoffer, Principal Investigator Jul. 1979 8 p EREP
(Contract NAS9-15508)
(E80-10009; NASA-CR-160312; LARS-071579) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-13589*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EXPERIMENT PLAN FOR EVALUATION OF LANDSAT AGRONOMIC VARIABLES USING WHEAT INTENSIVE TEST SITES
D. E. Phinney, Principal Investigator Aug. 1979 27 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E80-10010; NASA-CR-160315; JSC-16020; LEC-13632) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-13590*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EVALUATION OF THE LACIE TRANSITION YEAR CROP CALENDAR MODEL
R. E. Cheffin and S. K. Woolley, Principal Investigators Jul. 1979 22 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E80-10011; NASA-CR-160314; JSC-16019; LEC-13482)
Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. The estimates of developmental stage dates from the LACIE adjustable crop calendar (ACC) winter wheat model was somewhat more accurate than the historical crop calendar after jointing. The ACC winter wheat model was not so accurate for the Texas Panhandle as it was for the other areas of the USPG-7 because dry soil conditions delayed fall planting in the Panhandle. Since the LACIE ACC winter wheat model does not contain a moisture term and it was started with historical planting dates, lengthy delays in planting mean that the ACC model will probably be started early and will estimate the developmental growth stages to occur too early in the season. The LACIE ACC spring wheat model was also started early in most areas because of late planting due to fields wet from melting snow and rain. The starter model used to estimate spring planting dates was not accurate under these wet soil conditions and tended to predict the developmental stages to occur earlier than the dates observed in the fields.

N80-13591*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). LIST SPECTRAL KEYS STUDY
T. B. Dennis and M. D. Pore, Principal Investigators Aug. 1979 19 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E80-10012; NASA-CR-160338; JSC-15042; LEC-13456)
Avail: NTIS HC A02/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-13592*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
EARTH OBSERVATIONS DIVISION EARTH RESOURCES DATA ANALYSIS CAPABILITIES
F. Tragni, Principal Investigator Jul. 1979 86 p refs Revised EREP
(Contract NAS9-15800)
(E80-10013; NASA-CR-160339; LEC-3949-Rev-D; JSC-16030-Rev-D) Avail: NTIS HC A05/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-13593*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PHASE 3 DIRECT WHEAT STUDY OF NORTH DAKOTA
M. C. Kinsler, J. D. Nichols, and A. L. Ona, Principal Investigators Apr. 1979 158 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E80-10014; NASA-CR-160340; JSC-14744; LEC-12980)
Avail: NTIS HC A08/MF A01 CSCL 02C

The author has identified the following significant results. The green number and brightness scatter plots, channel plots of radiance values, and visual study of the imagery indicate separability between barley and spring wheat/oats during the wheat mid-heading to mid-ripe stages. In the LACIE Phase 3 North Dakota data set, the separation time is more specifically the wheat soft dough stage. At this time, the barley is ripening, and is therefore, less green and brighter than the wheat. Only 4 of the 18 segments studied indicate separation of barley/other spring small grain, even though 11 of the segments have acquisitions covering the wheat soft dough stage. The remaining seven segments had less than 5 percent barley based on ground truth data.

N80-13594*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PHASE 3 LABELING ERROR CHARACTERIZATION Final Report
N. James Clinton, Principal Investigator Mar. 1979 77 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E80-10015; NASA-CR-160341; JSC-14745; LEC-13012)
Avail: NTIS HC A05/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-13595*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). A REVISED SCREENING PROCEDURE FOR LACIE PHASE 3 DATA IN THE US GREAT PLAINS
R. S. Chhikara, Principal Investigator Aug. 1979 9 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E80-10016; NASA-CR-160313; JSC-14852; LEC-12723)
Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. The screening procedure resulted in a substantial decrease in the official LACIE winter acreage estimate, bringing the two estimates into better agreement with corresponding USDA/ESCS estimates.

N80-13596*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEXAS APPLICATIONS SYSTEM VERIFICATION AND TRANSFER REMOTE SENSING INFORMATION SUB-SYSTEM: FUNCTIONAL DESIGN
M. L. Brown, Jr., Principal Investigator, A. M. Fails, M. V. Martin, A. S. Story, and E. A. Weisblatt Mar. 1979 405 p EREP
(Contract NAS9-15800)
(E80-10017; NASA-CR-160342; LEC-13258; JSC-14785)
Avail: NTIS HC A18/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-13597*# Institut National de la Recherche Agronomique, Paris (France).
ESTIMATES OF REGIONAL ET FROM HCMM DATA: SUMMARY OF 1977 EXPERIMENT AND FINAL ARRANGEMENT FOR 1978 IN SOUTHEASTERN FRANCE TEST SITE
Bernard Seguin, Principal Investigator [1979] 29 p refs Sponsored by NASA ERTS
(E80-10018; NASA-CR-162390) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-13598*# Commission of the European Communities, Ispra (Italy).
SOIL MOISTURE AND HEAT BUDGET EVALUATION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST Progress Report, 1 Apr. - 31 Aug. 1979
1978 50 p refs Sponsored by NASA ERTS
(Proj. TELLUS)
(E80-10019; NASA-CR-162391; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-13599*# Institute of Hydrology, Wallingford (England).
THE ESTIMATION OF SOIL MOISTURE CONTENT AND ACTUAL EVAPOTRANSPIRATION USING THERMAL INFRA-RED REMOTE SENSING
R. J. Gurney, Principal Investigator 1978 20 p refs Sponsored by NASA ERTS
(Proj. TELLUS)
(E80-10021; NASA-CR-162393) Avail: NTIS HC A02/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-13600*# Commission of the European Communities, Ispra (Italy).
BEAUCE TELLUS PROJECT [CAMPAGUE TELLUS BEAUCE]
30 Sep. 1977 21 p In FRENCH Sponsored by NASA ERTS
(E80-10024; NASA-CR-162396) Avail: NTIS
HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-13601*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF MINING GUIDANCE AND CONTROL SYSTEMS Annual Report, Oct. 1976 - Sep. 1977
May 1979 225 p refs
(Contract DI-BM-H0155092)
(NASA-TM-78226; ALW-11) Avail: NTIS HC A10/MF A01
CSCL 08I

New fundamental interface sensor concepts were identified and investigated including tabulation of the physical and performance characteristics of two new interface detector concepts: - natural background radiation and magnetic spin resonance. Studies of guidance and control techniques for the longwall miner identified three basic systems for use in automated/remote controlled longwall mining. The following projects were initiated: system study which will more completely define the longwall guidance and control system design concepts; integration of the various control functions (vertical, yaw, and roll); and hardware technical requirements. R.E.S.

N80-13602# Institute for Water Resources, Fort Belvoir, Va.
WETLAND VALUES CONCEPTS AND METHODS WETLANDS EVALUATION Final Report
Richard T. Reppert, Wayne Sigleo, Eugene Stakhiv, Larry Messman, and Caldwell D. Meyers Mar. 1979 117 p refs
(AD-A069088; IWR-RR-79-R1) Avail: NTIS
HC A06/MF A01 CSCL 08/6

This report presents concepts and methods for the evaluation of wetlands pursuant to Section 404, PL 92-500 (as amended), President Carter's May 24, 1977 Executive Order on wetlands protection, and other statutory and administrative authorities. The evaluation of wetlands is based on the analysis of their physical, biological and human use characteristics. The report discusses these functional characteristics and identifies specific criteria for determining the efficiency with which the respective functions are performed. Two potential wetlands evaluation methods are described. One is a nonquantitative method in which individual wetland areas are evaluated based on the deductive analysis of their individual functional characteristics. The other is a semi-quantitative method in which the relative values of two or more site alternatives are established through the mathematical rating and summation of their functional relationships. The specific functions and values of wetlands which are covered in this report are (1) natural biological functions, including food chain productivity and habitat, (2) their use as sanctuaries, refuges or scientific study areas, (3) shoreline protection, (4) groundwater recharge, (5) storage for flood and storm water, (6) water quality improvement, (7) hydrologic support, and (8) various cultural values. GRA

N80-13603# SRI International Corp., Menlo Park, Calif.
INTERACTIVE AIDS FOR CARTOGRAPHY AND PHOTO INTERPRETATION Semiannual Technical Report, 12 Oct. 1978 - 11 May 1979
Martin A. Fischler, G. J. Agin, H. G. Barrow, R. C. Bolles, L. H. Quam, J. M. Tenenbaum, and H. C. Wolf May 1979 31 p refs
(Contract DAAG29-76-C-0057; ARPA Order 2894)
(AD-A073452) Avail: NTIS HC A02/MF A01 CSCL 08/2

The central scientific goal of the ARPA Image-Understanding Project research program at SRI International is to investigate and develop ways in which diverse sources of knowledge may be brought to bear on the problem of interpreting images. The research is concerned with specific problems that arise in processing aerial photographs for such military applications as cartography, intelligence, weapon guidance, and targeting. A key concept is the use of a generalized digital map to guide the process of image analysis. In the present phase of our program, the primary focus is on developing a 'road expert,' whose purpose is to monitor and interpret road events in aerial imagery. The objectives, methodology, and current status of our research are described in this report. Particular technical topics include data base construction and shadow and anomaly analysis. GRA

N80-13604# Michigan State Univ., East Lansing. W. K. Kellogg Biological Station.
DISSOLVED ORGANIC MATTER AND LAKE METABOLISM Technical Progress Report, 1 Jul. 1978 - 30 Jun. 1979
R. G. Wenzel 1979 68 p refs
(Contract EY-76-S-02-1599)
(COO-1599-153-Pt-1) Avail: NTIS HC A04/MF A01

Qualitative and quantitative cycling and metabolism of particulate and dissolved organic carbon in lakes and their inflow sources (surface and subsurface) were investigated. Emphasis was placed on the sources, fates, and interactions of dissolved and particulate organic matter in relation to inorganic chemical cycling, allochthonous loading to the lake system, and the coupled nutrient physiology and metabolism of phytoplankton, bacterial populations, macrophytes, and attendent sessile algal-bacterial communities. Regulatory mechanisms of growth and rates of carbon and nutrient cycling were evaluated among the (1) inorganic-organic influxes of allochthonous sources as they are controlled by wetland littoral communities, (2) the littoral photosynthetic producer-decomposer complex, and (3) the microflora of the pelagial zone. DOE

N80-13605# Oak Ridge National Lab., Tenn.
GEOPRESSURE ENERGY RESOURCE EVALUATION
G. Samuels May 1979 76 p refs
(Contract W-7405-eng-26)
(ORNL/PPA-79/2) Avail: NTIS HC A05/MF A01

The geopressured aquifers that extend along the northern Gulf of Mexico are perhaps the largest potential source of geothermal energy and natural gas in the United States. Because of the high cost of completing wells into these formations and their relatively low temperatures (200 to 400 F), the utilization of the geothermal energy will be highly dependent on, and of secondary importance to, the value of the methane. The economics of extracting either the geothermal energy or natural gas from these aquifers does not look promising. The combined requirements of high well flow rates (40,000 bbl/day), long life (20 years), and the necessity for close well spacing to minimize the cost of the collection system may be incompatible with the actual characteristics of the reservoirs. These factors place such stringent requirements on the reservoir size, permeability, and compressibility, or specific storage coefficient, that the number of promising production areas may be severely limited. DOE

N80-13606# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
DEVELOPMENT OF AN AIRBORNE GAMMA RADIATION SYSTEM FOR SNOW SURVEYS
Allen E. Fritzsche 1979 10 p refs Presented at Workshop on Remote Sensing of Snow and Soil Moisture by Nucl. Techniques, Voss, Norway, 23 Apr. 1979
(Contract EY-76-C-08-1183)
(EGG-1183-1679; CONF-790495-1) Avail: NTIS
HC A02/MF A01

The use of NaI(Tl) gamma detectors with a full gamma energy spectrum pulse height analyzer together with a small computer provides a self contained and flexible system for snow surveys. The dual detector method determines atmospheric radon perturbations in the detection system. Detailed calibration experiments must be performed to determine twenty parameters that describe the physical nature of the system. Multiple high altitude and lake flights are used to obtain background components. Simulation pads, loaded with varying concentrations of K-40, Th-232, and U-238, yield photopeak stripping coefficients and basic system sensitivity. Multiple altitude flights over land lines provide air attenuation coefficients which may be converted to water attenuation coefficients. DOE

N80-13607# Department of Energy, Washington, D. C. Energy Information Administration.
CURRENT U. S. PETROLEUM SITUATION AND SHORT-TERM SUPPLY/DEMAND OUTLOOK

Emil L. Nelson, G. D. Butler, C. Dwyer, and S. Wagner Jun. 1979 50 p
(DOE/EIA-0184/5) Avail: NTIS HC A03/MF A01

Potential U.S. supply shortfalls indicate that U.S. consumption of petroleum products could not rise above the low end of the projected range without driving petroleum inventories down below generally accepted target levels to enter the 1979-1980 winter heating season. Preliminary data indicate that U.S. petroleum demand for the first quarter of 1979 appears to have been between the low and medium levels projected by the demand models. Estimated demand during April and May, when allocation of scarce supply appears to have limited the effective demand, falls below the low of the projected range by some 1/2 million barrels daily. Unless world supply conditions change significantly in the coming months, the analysis indicates that the United States may experience continual limitations on imports requiring effective efforts to limit consumption and make maximum use of alternative fuels. DOE

N80-13608# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projekttraegerschaften.
THE GEOSCIENTIFIC AIRBORNE REMOTE SENSING PROGRAM Final Report
Manfred Wahl Bonn Bundesmin. fuer Forsch. u. Technology Sep. 1978 233 p refs In GERMAN; ENGLISH summary Original contains color illustrations
(Contract BMFT-WE-0175)
(BMFT-FB-W-78-31) Avail: NTIS HC A11/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 48.75

The Airborne Remote Sensing program, carried out from 1974 to 1977 in the Federal Republic of Germany, is part of an international operational system of earth observation satellites. Within five selected test areas, numerous flights were performed using different multispectral sensors. The data were systematically evaluated using advanced image processing procedures. The extensive results verify the significant contribution of remote sensing to the solution of application-oriented problems, such as environmental monitoring, and justify the continuation of this space program. Author (ESA)

N80-13609# World Meteorological Organization, Geneva (Switzerland). Hydrology and Water Resources Dept.
SPACE OBSERVATIONS FOR WATER RESOURCES: A POTENTIAL TO BE DEVELOPED
A. J. Askew and J. Nemec 1978 14 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979
Avail: NTIS HC A02/MF A01

Information is presented concerning the data requirements that were established for work in hydrology and water resources and mention is made of the use of spacecraft for the transmission of hydrological data. It was concluded that a dialogue should be established between those supplying the data and investigating their potential uses and those actually engaged in the assessment and management of water resources. Author (ESA)

N80-13610# Centre National d'Etudes Spatiales, Paris (France). Direction des Programmes et de la Politique Industrielle.
SPOT, FRENCH PREOPERATIONAL REMOTE SENSING SATELLITE SYSTEM
Alain A. Scribot 1978 15 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979
Avail: NTIS HC A02/MF A01

The SPOT remote sensing satellite system is described, including mission objectives, choice of orbit parameters for the first SPOT mission, the SPOT system architecture, the payload and choice of sensor parameters, the standard platform, and the ground segment. The payload consists of two high resolution visible sensors scanning 60 km each with 20 m resolution in several bands and 10 m resolution in the 0.5 to 0.9 micron (panchromatic) band. SPOT is suited for vegetation and water studies, cartographic applications, and geology. Author (ESA)

N80-13611# Zurich Univ. (Switzerland). Dept. of Geography.
SNOW MAPPING FROM SPACE PLATFORMS
K. I. Itten 1979 23 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979 Submitted for publication
Avail: NTIS HC A02/MF A01

Present knowledge of snow mapping from space is reviewed, discussing the problems of optimum resolution, periodicity, features to be measured, and wavelength bands to be used. The requirements for analog and digital data analysis are described, recommendations given, and questions on the economic implementation of such methods raised. It is concluded that the various newly developed satellites for meteorology, Earth and marine resources do not yet constitute a major breakthrough in solving the task of snow mapping. Author (ESA)

N80-13612# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO GEOLOGY AND MINERALOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1973 - Jul. 1979
Audrey S. Hundemann Aug. 1979 189 p Updates NTIS/PS-76/0500 Supersedes NTIS/PS-78/0791; NTIS/PS-77/0676
(NTIS/PS-79/0844/5; NTIS/PS-78/0791; NTIS/PS-77/0676)
Avail: NTIS HC $28.00/MF $28.00 CSCL 08G

The use of LANDSAT satellites and other remote sensing methods in geological and mineralogical applications is discussed. Abstracts cover rock and soil mapping, terrain analysis, direct and indirect mineral exploration, fault tectonics, and general geologic studies of various countries. A few abstracts pertain to equipment and techniques used in the studies. This updated bibliography contains 180 abstracts, 33 of which are new entries to the previous edition. GRA

N80-13613# New Mexico Univ., Albuquerque. Technology Application Center.
REMOTE SENSING APPLIED TO GEOLOGY. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977 - Jun. 1979
Gerald F. Zollars Aug. 1979 53 p Sponsored by NTIS
(NTIS/PS-79/0822/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 08G

This bibliography cites 215 articles concerning LANDSAT images, satellite-borne photography, aerial photography, and radar techniques being used to conduct geological surveys. Articles concerning photomapping and photo interpretation techniques relating to resource exploration are stressed. GRA

N80-13614# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Audrey S. Hundemann Aug. 1979 176 p Supersedes NTIS/PS-78/0789; NTIS/PS-77/0674
(NTIS/PS-79/0842/9; NTIS/PS-78/0789; NTIS/PS-77/0674)
Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The application of remote sensing methods to air, water, and noise pollution problems is discussed. Topic areas cover characteristics of dispersion and diffusion by which pollutants are transported, eutrophication of lakes, thermal discharges from electric power plants, outfalls from industrial plants, atmospheric aerosols under various meteorological conditions, monitoring of oil spills, and application of remote sensing to estuarian problems. This updated bibliography contains 167 abstracts, 11 of which are new entries to the previous edition. GRA

N80-13615# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO URBAN AND REGIONAL PLANNING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Audrey S. Hundemann Aug. 1979 74 p Supersedes NTIS/PS-78/0790 and NTIS/PS-77/0675
(NTIS/PS-79/0843/7; NTIS/PS-78/0790; NTIS/PS-77/0675)
Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Urban and regional planning using aerial photography and satellite remote sensing methods is discussed. Abstracts cover the use of remote sensing in land use mapping, traffic surveys and urban transportation planning, and taking inventories of natural resources for urban planning. Abstracts dealing with land use

and residential quality associated with and acting as an influence on health and physical well-being are included. This updated bibliography contains 65 abstracts, 2 of which are new entries to the previous edition. GRA

N80-13616# Instituut voor Culturtechniek en Waterhuishouding, Wageningen (Netherlands).
ESTIMATION OF REGIONAL EVAPOTRANSPIRATION AND SOIL MOISTURE CONDITIONS USING REMOTELY SENSED CROP SURFACE TEMPERATURES
G. J. R. Soer. Sep. 1977. 31 p. refs.
(Rept-1003) Avail: NTIS HC A03/MF A01

The application of thermal infrared scanning to the measurement of aerial heat and water budgets of crop lands is considered. Emphasis is placed on obtaining regional evapotranspiration estimates, making water balance analyses for large areas more feasible. Also, crop production as correlated with the actual crop transpiration rate can be estimated. J.M.S.

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *85 Urban Technology and Transportation*.

N80-13617 Pittsburgh Univ., Pa.
THEORETICAL ANALYSIS OF MULTI-CELL, HIGH EFFICIENCY BROAD SPECTRAL SENSITIVITY SOLAR CELLS Ph.D. Thesis
Richard Joseph McPartland. 1978. 227 p.
Avail: Univ. Microfilms. Order No. 7924749

A new scheme for interconnecting cells with different band gaps is described. This scheme allows for epitaxial device fabrication without intervening metallic layers or grids by employing a tunnel junction as an interface between the cells. Using this interface, a two-cell solar cell structure is proposed; npp+n+pp+. The npp+n+ portion has a wider band gap than the pp+ portion of the cell. A theoretical model is developed to be used as a design aid prior to device fabrication, to allow optimization of the solar cell's design, and to predict conversion efficiencies. The three components of the model are: the npp+ low-high junction (L-H junction) homojunction solar cell model, the n+pp+ L-H junction heterojunction solar cell model, and the p+n+ tunnel junction model. The current-voltage characteristics of the tunnel junction are represented by surface-recombination-velocities (SRVs) at either side of the junction's space-charge-layer. Dissert. Abstr.

N80-13618 Dayton Univ., Ohio.
TRANSIENT THERMAL ANALYSIS OF PHASE CHANGE MATERIAL ENERGY STORAGE SYSTEM Ph.D. Thesis
Bedru Yimer. 1979. 156 p.
Avail: Univ. Microfilms. Order No. 7925695

An analytical model was developed to determine the temperature distribution and interface location of phase change material energy storage systems. The model covers the general three-dimensional case where internal longitudinal fins were included inside the thermal energy storage material and it handles various types of boundary conditions at the walls of the thermal energy storage material containers. In the analysis, thermophysical properties were taken as different between the solid and liquid phases, and also as temperature dependent. The initial system temperatures were taken to be at or above fusion temperature. In the development of the governing equations the enthalpy approach, where enthalpy and temperature are the dependent variables, was employed. After the governing equations were expressed in terms of dimensionless variables, they were written in finite difference form. The Gauss-Seidel iterative method with successive over-relaxation was used to numerically solve the resulting nonlinear simultaneous equations for one-dimensional axisymmetric and two-dimensional systems. Dissert. Abstr.

N80-13619 Florida Univ., Gainesville.
DISTRIBUTION AND MOVEMENT OF ELECTROLYTE IN FUEL CELLS AND BATTERIES Ph.D. Thesis
Hau La-Thann. 1979. 196 p.
Avail: Univ. Microfilms. Order No. 7921936

The wettability of a heterogeneous porous medium comprising differently-wetted materials is characterized, and the competitive capillary effects between adjacent, differently-wetted porous media are described. The investigations consist mainly of theoretical considerations, and mathematical derivations based on simple models. A unified expression is derived for the liquid meniscus between two dissimilar, parallel walls. The two walls are found to absorb liquid by capillary action, independently of each other. The contact angle of the system obeys Cassie's law of cosine-average. Dissert. Abstr.

N80-13620 Virginia Univ., Charlottesville.
OXYGEN ELECTRODES FOR ENERGY CONVERSION, STORAGE, AND CONSERVATION: INVESTIGATION OF SIMPLE AND MIXED OXIDES Ph.D. Thesis
Craig Ryan Davidson. 1978. 150 p.
Avail: Univ. Microfilms. Order No. 7928054

Several simple and mixed oxide systems were investigated for oxygen evolution and reduction performance. Kinetic parameters were determined as a function of temperature to evaluate the oxides for use in advanced energy systems at elevated temperatures. The mixed spinel, $NiCo_2O_4$, is shown to be a promising oxygen evolution electrode material which is now undergoing long term evaluation. The role of the surface oxides of nickel was determined at elevated temperatures for oxygen evolution. Results may indicate an optimum temperature for the use of nickel for this reaction. Dissert. Abstr.

N80-13621*# Silicon Technology Corp., Oakland, N. J.
DEVELOPMENT OF METHODS OF PRODUCING LARGE AREAS OF SILICON SHEET BY THE SLICING OF SILICON INGOTS USING INSIDE DIAMETER (I.D.) SAWS Quarterly Report, 1 May - Jun. 1979
Peter Aharonyan. 1979. 24 p. Sponsored in part by DOE.
(NASA-CR-162520; QR-1) Avail: NTIS HC A02/MF A01 CSCL 10A

Methods of producing large areas of silicon sheets were developed by using inside diameter (I.D.) saws to slice silicon ingots. A 16 inch automated I.D. slicing machine was modified to accept programmable electric feed system, a crystal rotating system and a dyna-track blade monitoring and control system. The saw and accessories were used to slice 75 mm diameter single crystal silicon ingots while rotating them. The automated saw automatically recovered the wafers and loaded them into a cassette. The amount of material lost during slicing was reduced by using smaller blades than ones normally used to slice the wafers. Slicing runs on 100 mm diameter silicon is the next goal. R.E.S.

N80-13622*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
PEP SOLAR ARRAY DEFINITION STUDY Final Programmatic Report
30 Oct. 1979. 82 p. refs.
(Contract NAS9-15870)
(NASA-CR-160398; TRW-35515-6002-RU-00) Avail: NTIS HC A05/MF A01 CSCL 10A

The power extension package (PEP) is a solar array system that will be used on the space transportation system to agument the power of the Orbiter vehicle and to extend the time the vehicle may stay in orbit. The baseline configuration of the PEP is reviewed. The programmatic aspects of the design covering the development plan, the manufacturing facility plan and the estimated costs and risks are presented. R.E.S.

N80-13623*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
MODIFIED POWER LAW EQUATIONS FOR VERTICAL WIND PROFILES
D. A. Spera and T. R. Richards. 1979. 13 p. refs. Presented

at the Wind Characteristics and Wind Energy Siting Conf., Portland, Oreg., 19-21 Jun. 1979. Sponsored by DOE, American Meteorological Soc., Pacific Northwest Lab.
(E(49-26)-1059)
(NASA-TM-79275; DOE/NASA/1059-79/4) Avail: NTIS HC A02/MF A01 CSCL 10A

Equations are presented for calculating power law exponents from wind speed and surface roughness data. Results are evaluated by comparison with wind profile data measured at a variety of sites. Author

N80-13624*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
LOW NO(X) HEAVY FUEL COMBUSTOR PROGRAM
Eric Lister (DOE, Germantown, Md.), Richard W. Niedzwiecki, and Lester Nichols [1979] 15 p. To be presented at 25th Ann. Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by ASME.
(Contract EC-77-A-31-1062)
(NASA-TM-79313; E-269; DOE/NASA/1062-79/3) Avail: NTIS HC A02/MF A01 CSCL 10B

The 'low nitrogen oxides heavy fuel combustor' program is described. Main program objectives are to generate and demonstrate the technology required to develop durable gas turbine combustors for utility and industrial applications, which are capable of sustained, environmentally acceptable operation with minimally processed petroleum residual fuels. The program will focus on 'dry' reductions of oxides of nitrogen, improved combustor durability, and satisfactory combustion of minimally processed petroleum residual fuels. Other technology advancements sought include: fuel flexibility for operation with petroleum distillates, blends of petroleum distillates and residual fuels, and synfuels (fuel oils derived from coal or shale), acceptable exhaust emissions of carbon monoxide, unburned hydrocarbons, sulfur oxides and smoke, and retrofit capability to existing engines. R.E.S.

N80-13625# Engelhard Minerals and Chemicals Corp., Edison, N. J. Research and Development Dept.
DESIGN AND DEVELOPMENT OF A 30 WATT SOLID POLYMER ELECTROLYTE FUEL CELL POWER SOURCE FUELED WITH CALCIUM HYDRIDE. Final Technical Report
O. Adlhart. 12 Dec. 1978. 26 p.
(Contract DAAK70-77-C-0222)
(AD-A071157) Avail: NTIS HC A03/MF A01 CSCL 10/2

In recent years MERDCOM has shown renewed interest in the Solid Polymer Electrolyte Hydrogen-Air Fuel Cell. It focuses on the broad spectrum of applications where power requirements are quite small ranging from fractions of a watt to a few hundred watts. Handling simplicity and versatility are of utmost importance in this power range. The SPE cell is uniquely suited. It is operative at ambient temperatures, is rugged and has excellent life characteristics. Combined with a solid hydrogen source such as calcium hydride or magnesium, high energy densities are attainable. A 24 volt, 30 watt device was developed under the contract consisting of a static SPE stack integrated with a hydrogen generator utilizing cartridge contained calcium hydride. Even in short missions of a few hours energy densities are well in excess of those obtained with secondary batteries. GRA

N80-13626# Atomics International Div., Golden, Colo.
CO-SPUTTERING OF ALUMINUM-SILVER ALLOY MIRRORS FOR SOLAR REFLECTORS
R. O. Adams, C. W. Nordin, F. J. Freiker, and R. D. Masterson. 1979. 12 p. refs. Presented at Intern. Conf. on Met. Coatings, San Diego, Calif., 23 Apr. 1979.
(Contract EY-76-C-04-3533)
(RFP-2896; CONF-790442-1) Avail: NTIS HC A02/MF A01

Films of aluminum-silver alloys of various compositions were produced for evaluation as solar reflectors are reported. Substrates were produced coated with aluminum and silver varying in composition from one end to the other. The films were characterized metallographically and compositionally, then the reflectivity and corrosion problems were determined. DOE

N80-13627# Idaho National Engineering Lab., Idaho Falls.
ANALYSIS OF BINARY THERMODYNAMIC CYCLES FOR A MODERATELY LOW-TEMPERATURE GEOTHERMAL RESOURCE
O. J. Demuth. Jul. 1979. 105 p. refs.
(Contract EY-76-C-07-1570)
(TREE-1365) Avail: NTIS HC A06/MF A01

Cycles were screened which included isobutane, pentane, cis-2-butene, and several mixed-hydrocarbon working fluids. Dual-and triple-boiling cycles were analyzed. Both shell-and-tube and direct-contact boilers, heaters, and condensers were assessed. A geothermal fluid (geo-fluid), typical of Raft River resource conditions was assumed, which has a temperature of 290 F and 52 parts per million dissolved nitrogen. Special emphasis in the analyses was directed toward investigation of several methods for keeping the loss of working fluid for the cycle at an acceptable level. It was concluded that for the Raft River geo-fluid, the direct-contact cycle has a potential for net geo-fluid utilization effectiveness values, (watt-hr/lbm geo-fluid) equivalent to those of the shell-and-tube cycle. Because of the lower cost of direct-contact components, a potential exists for the direct-contact plant to produce lower cost electrical energy than a comparable shell-and-tube plant. DOE

N80-13628# General Electric Co., Schenectady, N. Y. Electric Utility Systems Engineering Dept.
REQUIREMENTS ASSESSMENT OF WIND POWER PLANTS IN ELECTRIC UTILITY SYSTEMS. VOLUME 3: APPENDIXES Final Report
W. D. Marsh. Jan. 1979. 95 p. refs. Sponsored by Elec. Power Res. Inst.
(EPRI-ER-978-Vol-3) Avail: NTIS HC A05/MF A01

A rational approach to the consideration of wind power plants applied to electric utility systems was developed. Then a requirements assessment and preliminary impact and penetration analyses were performed by studying wind generation in three actual utility systems. Conventional utility loss-of-load probability and production simulation methods were used together with a wind turbine generator performance model developed for the study. Evaluations were based on comparison of total utility generation system costs with and without wind plants, and were expressed in terms of wind power plant value and cost. (Value is measured by the value of displaced energy and capacity of conventional power plants. Cost consists of the capital, and operating and maintenance costs of the wind plant.) DOE

N80-13629# Argonne National Lab., Ill.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 7: NUCLEAR FACILITY PROFILES, AG-CH
Jun. 1979. 254 p.
(Contract W-31-109-eng-38)
(ANL-PMS-79-2-Vol-7) Avail: NTIS HC A12/MF A01

Capsule summaries of pertinent facts regarding nuclear facilities are presented. The facilities described include the entire fuel cycle from resource recovery to waste management. Power plants and all U.S. facilities are excluded. DOE

N80-13630# Argonne National Lab., Ill.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 8: NUCLEAR FACILITY PROFILES, CO-HU
Jun. 1979. 234 p. refs.
(Contract W-31-109-eng-38)
(ANL-PMS-79-2-Vol-8) Avail: NTIS HC A11/MF A01

Pertinent facts regarding nuclear facilities are summarized. The entire fuel cycle from resource recovery through waste management is covered. The profiles are ordered by country name, and then by facility code. DOE

N80-13631# Oak Ridge National Lab., Tenn.
LOW-TEMPERATURE THERMAL ENERGY STORAGE PROGRAM ANNUAL OPERATING PLAN
D. M. Eissenberg and H. W. Hoffman. Aug. 1979. 65 p. refs.
(Contract W-7405-eng-26)
(ORNL/TM-6934) Avail: NTIS HC A04/MF A01

The development of technologies for storing thermal energy as low temperature sensible or latent heat is considered along with cost effective systems for collecting, storing, and discharging low thermal energy, which will have significant national impact on energy conservation in the near- and mid-term. Emphasis is placed on, seasonal thermal storage, and recovery and reuse of

waste heat. Fiscal data are summarized according to thrust area, individual efforts, and funding source. R.C.T.

N80-13632# Brookhaven National Lab., Upton, N. Y.
HYDROGEN-HALOGEN ENERGY STORAGE SYSTEM
J. McBreen, S. Srinivasan, F. J. Salzano, and A. H. Beaufrere Sep. 1978 60 p refs
(Contract EY-76-C-02-0016)
(BNL-50924) Avail: NTIS HC A04/MF A01

Electrochemical investigations, materials studies, and technoeconomic assessment were performed on the electrochemically regenerative hydrogen-chlorine energy storage system. Electrochemical studies confirmed the reversibility of the cell reactions and the possibility of using the same cell in the electrolysis and fuel cell mode. A detailed heat and mass balance analysis was carried out for the H2/Cl2 system for one method of reactant storage and two schemes of heat exchange between the hydrochloric acid storage subsystem and the reactant storage subsystems. Nafion membranes in H2/Cl2 cell were characterized. From a cost comparison on a 20 MW/200 MWh electrochemically regenerative hydrogen-halogen system it was concluded that the use of either chlorine or bromine or alternative methods of chlorine storage had an insignificant effect on the overall cost of the system. The most cost effective method of hydrogen storage is very dependent on the cost activated metal hydrides. DOE

N80-13633# Planco, Inc., Dallas, Tex.
SURVEY OF THE RESEARCH INTO ENERGY-ECONOMY INTERACTIONS. VOLUME 1: SURVEY
R. Coates, D. Hanson, S. Juenger, and J. Kennington Apr. 1979 248 p refs
(Contract EI-78-C-01-6346)
(HCP/I6346-01-1-Vol-1) Avail: NTIS HC A11/MF A01

A detailed and comprehensive review of recent (1960 to present) and on-going research into energy-economy interactions is presented. The results form theoretical and empirical analyses of energy-macroeconomics interactions, the different methodologies used, and the conceptual problems in this research are emphasized. The supply of energy, the price of energy, the world price of oil, energy capital requirements, energy R and D, conservation regulations, and stockpiling are among the variables studied. A conceptual framework for analyzing energy-economy models, the general features and methodologies of a large number of models, and the state of the art in modeling energy-economy interactions are included. Six different energy-economy models: Manne's ETA-MACRO and ETA, Hudson-Jorgenson's LIEM PILOT, Wharton Annual Energy, Reister-Edmonds, and Berkeley (Giassey-Benenson) are reviewed. Each review describes the methodology and general features embodied in the model, summarizes the types of energy-economy interactions addressed, and assesses the capabilities of the model. DOE

N80-13634# Los Alamos Scientific Lab., N. Mex.
ENERGY POLICY AND DECISION ANALYSIS; NEW CONCEPTS AND MECHANISMS
E. L. Kaufman and R. W. Vogel Jul. 1979 52 p refs
(Contract W-7405-eng-36)
(LA-7909-MS) Avail: NTIS HC A04/MF A01

Relevant portions of the energy-management problem and a technique wherein objective energy policy analysis can be performed in a short time frame are described. A precept for decision criteria is proposed and a set of fundamental concepts are described that allow quantitative assessment of policy and decision consequences for the total energy system. A decision conferencing is described wherein the technical assessment is combined with the political acumen of experienced decision makers to allow the best public-interest choice to be made. A rationale is also presented for the organizational placement of the analysis function, outside of government or industry. This placement provides a much needed level of credibility, higher than that which presently exists, and reduces bias and equitably balance the needs of the public, government, and industry. DOE

N80-13635# Midwest Research Inst., Golden, Colo.
SOLAR ENERGY PERSPECTIVES FOR PUBLIC POWER
N. H. Woodley Jun. 1979 22 p refs Presented at Am. Public Power Assoc., 1979 Natl. Conf., Seattle, 19 Jun 1979
(Contract EG-77-C-01-4042)
(SERI/TP-35-300; CONF-790685-1) Avail: NTIS HC A02/MF A01

Perspectives on the utilization of solar energy for electricity production and thermal energy utilization by the public are briefly summarized. Wind energy conversion, biomass conversion, solar thermal, OTEC, photovoltaics, and solar heating and cooling are discussed. DOE

N80-13636# Argonne National Lab., Ill.
ASSESSMENT OF STIRLING ENGINE POTENTIAL IN TOTAL AND INTEGRATED ENERGY SYSTEMS
T. J. Marciniak, J. C. Bratis, A. Davis, and C. Lee Feb. 1979 167 p refs
(Contract W-31-109-eng-38)
(ANL/ES-76) Avail: NTIS HC A08/MF A01

The advantages and disadvantages of large Stirling engines in total, or integrated, energy systems are discussed and the performance and cost characteristics of such engines are analyzed and compared with the main competitors (diesel engines and gas turbines) for such applications. The comparisons are made through simplified and detailed systems analyses. The requirements for the development of a large Stirling engine are outlined along with a suggested developmental program based on the systems studied and intercomparisons of competing technologies. Results indicate that, given the attributes of the competing technologies involved, the main advantage of the Stirling engine lies in its ability to use fuels other than distillates. This attribute must be developed further in order to provide engine technologies which can burn abundant fuels such as coal or coal-derived fuels. The potentially high efficiency of Stirlings would be especially advantageous in applications where a high electrical-to-thermal energy demand ratio exists. DOE

N80-13637# Department of Energy, Washington, D. C. Div. of Electric Energy Systems.
SYSTEMS ENGINEERING FOR POWER, PROGRAM REPORT
Jun. 1979 372 p
(DOE/ET-0012/2-Rev) Avail: NTIS HC A16/MF A01

The development of the conceptual tools needed for the planning, engineering, and operation of the electric energy systems of the future is discussed. Three areas of increased complexity in the electric energy field are addressed. They are the increasing degree of interconnection between operating areas, the development of new technologies, and a continual tightening of the constraints within which the electric energy system must operate, including financial, environmental and conservation constraints. Each of these driving forces has implication for system operation (control) and for system design (planning). The subprograms which have thus far been developed for control and planning are defined. DOE

N80-13638# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY SYSTEM IN THE FAR WEST: IMPACTS OF THE NATIONAL ENERGY ACT OF 1978
B. Hammond (California Univ., Berkeley), T. Bradshaw (California Univ., Berkeley), and D. Dorn 6 Apr. 1979 46 p refs
(Contract W-7405-eng-48)
(UCRL-52754) Avail: NTIS HC A03/MF A01

The impact of the National Energy Act of 1978 (NEA) on state energy systems in Federal Region IX (Arizona, California, Hawaii, and Nevada) is discussed. Data on the demographic and economic character of the region are presented along with an overview of the impact of the NEA on each energy industry in the region. The act's impact on interstate linkages and the reliability of energy supplies is also assessed. It is concluded that the NEA will serve to encourage actions already being taken by many of the utilities, but that it will not effect major changes in existing patterns of energy use. DOE

N80-13639# Oak Ridge National Lab., Tenn. Computer Science Div.
MATHEMATICAL MODELING OF PHASE CHANGE PROCESSES FOR LATENT HEAT THERMAL ENERGY STORAGE
A. D. Solomon Aug. 1979 137 p refs
(Contract W-7405-eng-26)

(ORNL/CSD-39) Avail: NTIS HC A07/MF A01

Some aspects of heat transfer and thermal energy storage are reviewed and then a liquid-solid phase change model without boundary conditions whose temperature distribution and phase boundary history can be found explicitly is examined. Phase change processes with boundary conditions are also discussed along with their approximate or exact solutions. Methods of finding elementary bounds on the components of simple phase change problems are given. A numerical method is presented for the case where the densities of the solid and liquid phases are not necessarily equal. K.L.

N80-13640# Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.

RECENT SPIN TEST OF TWO COMPOSITE WAGON WHEEL FLYWHEELS

A. K. Miller 1979 12 p refs

(Contract EY-76-C-04-0789)

(SAND-79-1669C) Avail: NTIS HC A02/MF A01

The dynamic behavior of two structurally dissimilar flywheels was compared. In one design, the graphite/epoxy rim was attached to the aluminum hub with twenty-four thin Kevlar-49/epoxy spokes, while in the other design eight thicker graphite/epoxy spokes connected the rim to the hub. Horizontal disturbances of the flywheel hub were detected for speeds less than approximately 6,000 rpm. These disturbances are believed to be associated with predicted modes of vibration for the flywheel-spin-turbine system. No modes of vibration were sensed for the predicted possible whirl and torsional resonances in the speed range between 6,000 rpm and 22,000 rpm. A squeeze film damper assembly successfully stabilized the flywheel-spin-turbine system when the damper functioned properly; however, low frequency retrograde instabilities were induced into the system by the damper assembly when it was not operated within prescribed parameters. DOE

N80-13641# Argonne National Lab., Ill.

HEAT TRANSFER IN LEAD-ACID BATTERIES

K. W. Choi and N. P. Yao 1978 11 p refs Presented at 2nd AIAA/ASME Thermophys. and Heat Transfer Conf., Palo Alto, Calif., 24 Sep. 1978

(Contract W-31-109-eng-38)

(CONF-7809102-1) Avail: NTIS HC A02/MF A01

Mathematical analysis was carried out for the heat transfer in lead-acid batteries designed for use in electric vehicles. Results indicate that the heat generated in the battery during recharge cycles may cause a noticeable rise of battery temperature in the absence of proper thermal management. Electrolyte circulation along the battery plates is found to be the most effective in removing heat and providing a uniform temperature field. Numerical solutions are provided for the engineering evaluation of heat-removal design during battery cycling processes. DOE

N80-13642# Sandia Labs., Albuquerque, N. Mex.

SOLAR THERMAL TEST FACILITY HELIOSTAT DEVELOPMENT

D. E. Arvizu Jun. 1979 57 p refs Presented at Intern. Symp. on Concentrating Solar Collector Technol., Albuquerque, N. Mex., 14 Jun. 1978

(Contract EY-76-C-04-0789)

(SAND-78-1177; CONF-7806153-1) Avail: NTIS HC A04/MF A01

The STTF heliostat system is described, and performance data are discussed. The STTF, which uses an array of 222 heliostats in a north field configuration, is capable of supplying 5 MWth energy onto a target on the tower. DOE

N80-13643# California Univ., San Diego.

NATIONAL ENERGY POLICY AND STATE COASTAL PROGRAMS: A CRITIQUE OF CURRENT EFFORTS TO BALANCE ENVIRONMENTAL PROTECTION AND ENERGY PRODUCTION ALONG THE COAST

R. Kanouse and J. Sorensen Apr. 1979 394 p refs

(Contract EY-76-S-03-0034)

(SAN-0034/263-1) Avail: NTIS HC A17/MF A01

Modifications to the Coastal Zone Management Act (CZMA) are proposed. The first four modifications clarify key provisions in the current Act. The latter four modifications focus upon attributes of the energy facility siting regulatory process that are either ignored or inadequately addressed in the current CZMA. These four proposed modifications are designed to minimize the impediments to an effective and efficient siting process that are caused by the inherent complexities of national energy policy and environmental protection programs. Two legislative options for amending the CZMA, both of which incorporate the eight suggested modifications, are proposed. DOE

N80-13644# Boeing Engineering and Construction, Seattle, Wash.

LINEAR CONCENTRATION SOLAR COLLECTOR IN AN AIR SUPPORTED ENCLOSURE. PRELIMINARY DESIGN STUDY Final Report

J. H. Laasko and D. K. Zimmerman Mar. 1979 96 p refs

(Contract EY-76-C-04-0789)

(SAND-78-7022) Avail: NTIS HC A05/MF A01

A preliminary design for a low cost linear parabolic concentrating solar collector in a pneumatically stabilized cylindrical plastic film enclosure is described. The collector configuration structural analyses, thermal performance modeling, mass-produced component costs, field assembly methods and maintenance requirements are discussed. Daily efficiencies in excess of 45% are predicted with estimated installed field collector costs of $90/sq m ($8.34/sq ft). Results of cost and performance studies indicate that the collector has potential for low cost and offers attractive cost/performance figures-of-merit with further development. DOE

N80-13645# Sandia Labs., Albuquerque, N. Mex.

PERFORMANCE TESTING OF THE GENERAL ELECTRIC ENGINEERING PROTOTYPE COLLECTOR

V. E. Dudley and V. E. Workhoven Jul. 1979 35 p refs

(Contract EY-76-C-04-0789)

(SAND-79-0514) Avail: NTIS HC A03/MF A01

The performance of a 5 meter parabolic dish solar concentrator was characterized. Thermal efficiency and thermal losses were investigated at temperatures from 100 C to 300 C. Significant improvements were made in the performance of the collector during the test cycle. Final efficiency performance ranged from about 60% at 100 C to about 53% at 300 C. Thermal losses varied significantly with changes in wind velocity. R.E.S.

N80-13646# United Technologies Corp., South Windsor, Conn. Power Systems Div.

INTEGRAL CELL SCALE-UP AND PERFORMANCE VERIFICATION Final Report

L. M. Handley, W. E. Houghby, W. H. Johnson, T. G. Schiller, and H. Y. Stryker Jun. 1979 57 p ref Sponsored by Elec. Power Res. Inst.

(EPRI-EM-1134) Avail: NTIS HC A04/MF A01

The integral cell configuration of the 4.8-MW demonstrator cell size was scaled and the full size packages were tested in short cell stacks to verify the acid management capability and document performance. Low cost cell stack construction techniques were refined, and materials were modified to produce improved cell stack components. A 1530-hour test of a 20-cell stack demonstrated that the performance of the integral cell configuration was equivalent to that of the 4.8-MW demonstrator configuration, and that increased acid inventories could be accommodated in the electrodes without severe performance penalties. Improvements in acid cell stack technology that would be sufficient to allow a 20 percent reduction in total active cell area relative to the demonstrator were investigated. Improvements to previously developed catalysts, catalyst layers, and application techniques were investigated, and subscale single cell endurance tests were conducted. A cell stack conceptual design incorporating the integral cell concept was initiated. DOE

N80-13647# California Univ., Livermore. Lawrence Livermore Lab.

TIDAL PRESSURE RESPONSE AS A RESERVOIR ENGINEERING TOOL

J. M. Hanson Jul. 1979 5 p refs Presented at Geothermal Resources Council Ann. Meeting, Reno, Nev., 24 Sep. 1979

(Contract W-7405-eng-48)

(UCRL-83012; CONF-790906-10) Avail: NTIS HC A02/MF A01

Fluid pressure oscillations resulting from tidal strain reflect

hydrologic and elastic properties of a reservoir. Precise measurement and interpretation of these pressure fluctuations has the potential of being a useful quantitative reservoir engineering tool. A procedure was developed that quantifies the spectral resolution in terms of an absolute confidence level in both amplitude and phase of the spectral estimate. Analysis of one week of data from a well in the Salton Sea is presented. DOE

N80-13648# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
CHARACTERIZATION OF SOLID-WASTE CONVERSION AND COGENERATION SYSTEMS
Ronald L. Ritschard, Kendall F. Haven, Mark Henriquez, Josh Kay, and William Walzer 15 Aug. 1978 226 p refs
(Contract W-7405-eng-48)
(LBL-7883) Avail: NTIS HC A11/MF A01

Three basic technologies for recovering energy from municipal solid wastes (MSW) are considered: (1) direct combustion using a waterwall incinerator in which heat from burning refuse is converted to steam by circulating water in steel tubes jacketing the interior of the incinerator; (2) manufacture of a relatively uniform shredded, pulverized, or pelleted refuse derived fuel for supplemental firing in a utility boiler; and (3) pyrolysis or destructive distillation of MSW to extract a low Btu fuel gas. End use applications of cogeneration systems include fluidized bed systems for use in the pulp and paper industry; diesel systems using the digested sewage gas of a sewage treatment plant for electricity generation, heating and pumping; and an enhanced oil recovery system. Comparisons are made of Landguard pyrolysis, Garrett flash pyrolysis, Union Carbide Purox process, direct combustion, refuse derived fuels, fluidized bed cogeneration, diesel cogeneration, and enhanced oil recovery. DOE

N80-13649# Midwest Research Inst., Golden, Colo.
REVIEW OF THE ENVIRONMENT EFFECTS AND BENEFITS OF SELECTED SOLAR ENERGY TECHNOLOGIES
Kathryn A. Lawrence May 1979 18 p refs
(Contract EG-77-C-01-4042)
(SERI/TP-53-114R) Avail: NTIS HC A02/MF A01

The environmental effects of photovoltaic cells, wind energy conversion (WEC), and the solar thermal central receiver are reviewed and summarized. The solar energy technologies are assumed to be deployed as centralized energy production facilities. The phase of resource extraction and component production is the most environmentally hazardous. Impacts of plant construction will be somewhat site specific but should approximate impacts associated with any large construction activity. The operation phase is relatively environmentally benign. The WEC operation produces low level noise pollution and presents minimal hazards to flying species. Solar thermal facilities equipped with wet cooling towers may affect local air quality via cooling tower drift. In addition, large installations of each option may alter local microclimate. Decommission of WEC, solar thermal, and photovoltaic facilities should prevent no environmental hazards, although disposal of CdS or GaAs cells will require care. DOE

N80-13650# Brookhaven National Lab., Upton, N. Y.
PROCESS OPTIMIZATION OF INDUSTRIAL ENERGY USE
D. A. Pilati and F. T. Sparrow (Purdue Univ.) 1979 7 p refs Presented at the Intern. Conf. on Energy Use Management, ICEUM-2, Los Angeles, 22-26 Oct. 1979 Submitted for publication
(Contract EY-76-C-02-0016)
(BNL-26482; CONF-791009-3) Avail: NTIS HC A02/MF A01

A set of industry-specific process optimization models are developed. These models are to be used for energy use projections, energy policy analyses, and process technology assessments. Applications of the models currently under development show that: (1) system wide energy impacts may be very different from engineering estimates; (2) selected conservation strategies may have the perverse effect of increasing energy use; and (3) a proper combination of energy taxes and investment tax credits is more socially desirable than either policy alone. DOE

N80-13651# Brookhaven National Lab., Upton, N. Y.
CASE STUDY OF THE BROWNELL LOW ENERGY REQUIREMENT HOUSE
R. F. Jones, R. F. Krajewski, and G. Dennehy May 1979 78 p refs
(Contract EY-76-C-02-0016)
(BNL-50968) Avail: NTIS HC A05/MF A01

The design and thermal performance of an innovative house built in 1977 in the Adirondacks area of New York State was evaluated. The house has a very tight and well-insulated envelope, with the rigid insulation board applied to the outside of the frame. Passive solar gain through south-facing glass, along with internal free sources of heat, are shown to provide a substantial part of the building's heating requirements. Effective integral thermal storage, provided by the exposed interior structure, serves to keep interior temperature excursions within acceptable limits. Additional remote storage is provided in the form of a large thermal storage sand bed, with air ducts, located below the basement floor. Calculations and measured performance data show that the house's space heating needs are only about 40 percent of those of a similar size house built to minimum property standards, and less than 25 percent of those of a typical inventory house in the Northeast United States. DOE

N80-13652# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
APPLICATION OF INERTIA WELDING TECHNOLOGY TO STEEL DISC-TYPE FLYWHEELS Final Report
29 Jun. 1979 79 p
(Contract W-7405-eng-48)
(UCRL-15045) Avail: NTIS HC A05/MF A01

The feasibility of applying inertia welding to the fabrication of steel flywheel assemblies for transportation application was investigated. In the inertia welding process, the weld is accomplished by friction and pressure. The parts are literally spun together. The inertia welding characteristics of three steel alloys (Hy-Tuf, 4340, and D6AC) were determined by welding both solid bars (1 in. OD) and tubular specimens (2 in. OD by 0.1 in. thick wall). In addition, characteristics of the weld and the weld flash (that material extruded from the weld mating surfaces during the welding process) were evaluated. Results indicated Hy-Tuf and 4340 have good welding characteristics, while D6AC is questionable. DOE

N80-13653# Los Alamos Scientific Lab., N. Mex.
ENERGY PLANNING WITH SOLAR AND CONSERVATIONS: INDIVIDUAL VALUES AND COMMUNITY CHOICE
S. A. Noll, F. Roach, and L. Palmiter 1979 6 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract W-7405-eng-36)
(LA-UR-79-1599; CONF-790541-24) Avail: NTIS HC A02/MF A01

Conflict among the priorities of individuals, private sector businesses, and government entities involving the transition to a renewable energy-resource base is considered. These conflicts are intensified by the overwhelming number of externalities created by the actions of each of these decision making groups. An illustrative example of the benefits to be derived from community energy planning is given. It is shown that community energy programs have the potential to stimulate household and community income, create job opportunities, develop a more resilient energy economy, and help mitigate environmental deterioration. DOE

N80-13654# Brookhaven National Lab., Upton, N. Y.
DESIGN, CONSTRUCTION, AND OPERATION OF THE SOLAR ASSISTED HEAT PUMP GROUND COUPLED STORAGE EXPERIMENTS AT BROOKHAVEN NATIONAL LABORATORY
P. D. Metz 1979 8 p refs Presented at the 4th Ann. Heat Pump Technol. Conf., Stillwater, Okla., 9 Apr. 1979
(Contract EY-76-C-02-0016)
(BNL-25908; CONF-790446-3) Avail: NTIS HC A05/MF A01

The design, construction, and initial operation of the first generation experiments are discussed. Four of these experiments involve buried tanks, and four use buried serpentine coils of 1 1/2 inch diameter flexible polyethylene pipe in various configurations and lengths. Heat is added to or removed from each experiment by hot water heaters or heat pumps. The amount of heat added or removed is determined by a computer

program which simulates all parts of the solar system except for the ground coupling device. Experiments conducted to determine ground thermal conductivity, heat capacity, diffusivity, and moisture content are also discussed. The overall research program plan and some early results are presented. DOE

N80-13655# Rosenblatt (M.) and Son, Inc., New York.
OTEC PLATFORM CONFIGURATION AND INTEGRATION. VOLUME 1: SYSTEMS ENGINEERING AND INTEGRATION Final Report
7 Jul. 1978 228 p refs
(Contract EG-77-C-01-4065)
(TID-29418) Avail: NTIS HC A11/MF A01

An evaluation methodology was developed for the purpose of analyzing the ocean system requirements against the site criteria and in arriving at the conclusions as far as hull, seawater system, positioning system, and other ocean systems characteristics. Feasibility studies and cold water pipe/hull stress analyses indicated that the best platform hull shape would be one that would have a submerged main body and the cold water pipe would be attached to it in a flexible joint type configuration, possibly with flexible joints along the length as well. The best positioning system would be a static mooring system, possibly 3-leg, using hollow cylindrical links for lines. DOE

N80-13656# Ocean Data Systems, Inc., Monterey, Calif.
OTEC THERMAL RESPONSE REPORT FOR PACIFIC PLANT SHIP, 5 TO 10 DEG N 90 TO 95 DEG W
W. A. Wolff May 1979 44 p refs
(Contract ET-78-C-01-2898)
(HCP/T2898-01/3) Avail: NTIS HC A03/MF A01

The temperature difference resource for the plant ship region between 5 to 10 North latitude and 90 to 95 West longitude is evaluated for potential OTEC use. Surface temperatures are consistently high with the monthly mean temperatures ranging from 26.5 C to 28.5 C. An annual mean delta T greater than 20 C is available at 550 meters. Bottom depths are much greater than 1500 meters for the entire plant ship region. The mixed layer depth is very shallow throughout the year, and may be nonexistent at times indicating a warm water intake near the surface. High winds and storms are not a major problem for this site, due in part to the proximity to the equator. Mean surface currents are somewhat larger in magnitude than other Pacific sites. The site chosen is located near the approximate limits of the North Equatorial Current and the Pacific Equatorial Countercurrent. Current shear may cause problems. DOE

N80-13657# Lockheed Missiles and Space Co., Sunnyvale, Calif.
OTEC SYSTEM RESPONSE AND CONTROL ANALYSIS
W. L. Owens 1979 7 p Presented at the 6th OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract ET-78-C-01-3407)
(CONF-790631-2) Avail: NTIS HC A02/MF A01

A mathematical model to analyze the system response along with response to changes in operating conditions is developed. Lumped conditions for line and heat exchanger vapor volumes and heat exchanger temperatures are assumed in the model. Examples are presented which calculate the appropriate time derivatives for the various system elements and provide the interaction between the various components when subjected to changes in the important forcing functions such as generator load, seawater flow, or temperature variations. Typical response curves are presented for pressures, temperatures, mass flow rates, and generator speed for an OTEC plant scheduled for operation. A.W.H.

N80-13658# Department of Energy, Washington, D. C. Energy Storage Systems Div.
MULTI-YEAR PLAN FOR THERMAL AND MECHANICAL ENERGY STORAGE PROGRAM
Jun. 1979 79 p refs
(DOE/ET-0109) Avail: NTIS HC A05/MF A01

Reliable, efficient, and inexpensive energy storage technologies to support other DOE end-use divisions in their substitution and energy-savings missions are discussed. In addition to thermal and mechanical technology development, the Technical and Economic Analysis subprogram which supports both the Thermal and Mechanical Storage Program and the Electrochemical (Battery) Storage Program is described. The DOE end-use organizations that benefit from development of thermal and mechanical storage technologies are: Central Solar Technology, Distributed Solar Technology, Solar Applications, Transportation Programs, Buildings and Community Systems, Industrial Energy Conservation, and Resource Applications. DOE

N80-13659# Gould, Inc., Rolling Meadows, Ill.
ASSESSMENT OF TECHNICAL AND ECONOMIC FEASIBILITY OF ZINC/BROMINE BATTERIES FOR UTILITY LOAD LEVELING Final Report
R. A. Putt May 1979 256 p refs Sponsored by Elec. Power Res. Inst.
(EPRI-EM-1059) Avail: NTIS HC A12/MF A01

The viability of zinc/bromine batteries for utility load leveling applications is examined. Comparisons of bromine and chlorine as positive reactants in flowing electrolyte cells are presented and discussed in relation to storing bromine, minimizing self discharge, controlling zinc dendrites, and developing a cost effective cell design. The development of the system components, testing of the cells and batteries, and a design and cost study of a 100 MWh battery are discussed. DOE

N80-13660# Aerojet Energy Conservation Co., Sacramento, Calif.
MULTI-USE GEOTHERMAL ENERGY SYSTEM WITH AUGMENTATION FOR ENHANCED UTILIZATION. NON-ELECTRIC APPLICATION OF GEOTHERMAL ENERGY IN SUSANVILLE, CALIFORNIA Final Report
G. K. Olsonn, D. L. Benner-Drury, and G. R. Cunnington Feb. 1979 200 p refs
(Contract ET-78-C-03-1740)
(DOE/ET-248447/1) Avail: NTIS HC A09/MF A01

Multi-use, augmented geothermal space/water heating and cooling systems were studied. The overall benefits in both the public and private sectors, of using low temperature (150 F to 240 F) geothermal resources are explored. Options considered, alone and in combination, include heat pumps, fossil-fuel peaking, user load balancing, and cascading from the geothermal system serving the public buildings into a private Park of Commerce development. A range of well temperatures, depths, flow rates, and drilling costs are considered to provide system cost sensitivites. A planned development is emphasized for ease of financing and expansion. A preliminary design of Phase A of a Susanville Public Building Energy System and a conceptual design of an integrated Park of Commerce, Phase 1, are included. This system was designed for a 150 F resource and can be used as a model for other communities with similar resource temperatures. DOE

N80-13661# Research Triangle Inst., Research Triangle Park, N. C.
NOVEL CONCENTRATOR PHOTOVOLTAIC CONVERTER SYSTEM DEVELOPMENT Final Report
S. M. Bedair, M. F. Lamorte, and J. R. Hauser Jul. 1979 207 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7040) Avail: NTIS HC A10/MF A01

The development, synthesis, and evaluation of a cascade solar cell having an AM 1 conversion efficiency of 30 percent or greater and capable of operating at both high illumination levels and elevated temperatures is discussed. A comparison of the cascade solar cells with conventional single junction solar cells is presented. A number of ternary and quaternary material systems which have potential application to the cascade solar cell are discussed. Demonstration cells built in the GaAs/AlGaAs material systems are examined. A.W.H.

N80-13662# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.
SOLAR THERMAL POWER SYSTEMS Annual Technical Progress Report, 1978
Jun. 1979 144 p refs
(DOE/ET-0078/T1) Avail: NTIS HC A07/MF A01

The development of solar thermal power system technology for midtemperature, solar total energy, small community, irrigation, and large power systems is discussed. Subsystem and component development is also described. K.L.

N80-13663# Bureau of Reclamation, Boulder City, Nev.
SOLAR THERMAL ELECTRIC PLANTS IN HYDROELECTRIC GRID Technical Progress Report, 9 Feb. - 9 May 1979
17 Jul. 1979 26 p refs
(Contract DE-AI03-79SF-10505)
(DOE/SF/10505-1) Avail: NTIS HC A03/MF A01

Factors to be used in candidate site selection were determined, factor maps were compiled, and the development of a hydrologic model of the river/reservoir system was initiated. In addition, initial performance and cost data were reviewed for three solar power systems. K.L.

N80-13664# Aerospace Corp., El Segundo, Calif. Information Processing Div.
SOLAR TOTAL ENERGY SYSTEMS (STES) SIMULATION PROGRAM USER'S GUIDE
B. R. Timmer 4 Jan. 1979 81 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-7525/2; ATR-79(7748)-2) Avail: NTIS HC A05/MF A01

A computer program which simulates the operations of a solar total energy systems (STES) facility and evaluates its annualized costs and energy displacement is described. The program contains a dynamic model which simulates the interaction of the insulation and electrical and thermal demands on an hourly basis. The program is flexible enough to allow thousands of different configurations to be simulated under a wide variety of conditions. Moreover, with this program, the sizes of the STES components can be adjusted to maximize the return on invested capital or the savings in fossil fuels. The program can also be used to simulate conventional fossil fuel total energy systems and solar thermal energy systems for comparison with STES. DOE

N80-13665# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EVALUATION OF COMBINED PHOTOVOLTAIC/THERMAL COLLECTORS
S. D. Hendrie 1979 6 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract EG-77-S-02-4577)
(COO-4577-8; CONF-790541-54) Avail: NTIS HC A02/MF A01

The thermal and electric performance of an air and a liquid type combined photovoltaic/thermal solar collector was evaluated, yielding close correlation with theoretical results. Maximum thermal efficiencies of 42.5% and 40% for the liquid and air collectors without electric power production decreased to 40.4% and 32.9% when electrical power were produced. Maximum electrical efficiencies of 6.8% were measured. DOE

N80-13666# Oak Ridge National Lab., Tenn.
EXPERIMENTAL AND ANALYTICAL OTEC STUDIES AT ORNL
J. W. Michel 1979 8 p refs Presented at 6th OTEC Conf., Washington, D. C., 19 Jun. 1979
(Contract W-7405-eng-26)
(CONF-790631-1) Avail: NTIS HC A02/MF A01

Ammonia condensation tests were performed on several vertical fluted tubes and on tubes inclined at 30 deg from the vertical position. The high condensation coefficients reported for fluted tubes were verified. They seemed to be insensitive to tube length over the range tested. Also, tilting the tubes significantly improved the performance of smooth tubes and caused a slight decrease in the performance of fluted tubes. The cost effectiveness of various types of heat transfer enhancement were evaluated and heat exchanger joinability was surveyed. DOE

N80-13667# Franklin Pierce Law Center, Concord, N. H. Energy Law Inst.
FUNDAMENTAL ECONOMIC ISSUES IN THE DEVELOPMENT OF SMALL-SCALE HYDRO
Peter W. Brown and M. Ringo 15 Mar. 1979 28 p
(Contract RA-23-216.00.0)
(DOE/RA-23-216.00.0-02) Avail: NTIS HC A03/MF A01

The analysis presented is based on literature reviews, case studies, on-site visits, and particularly information from the Franklin Pierce - Thayer project. Broadly stated, economic analysis to data suggests that legal and regulatory constraints are the major obstacles for the slow development of SSH development. The economic picture of a hydro site as if it were a typical small business is described. The discussion is broken down into four parts, namely: costs, supply, demand and profitability. DOE

N80-13668# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
SOLAR COOLING PERFORMANCE IN CSU SOLAR HOUSE 3
D. S. Ward, J. C. Ward, and H. S. Oberoi Jan. 1979 20 p refs
(Contract EY-76-S-02-2858)
(COO-2858-23) Avail: NTIS HC A02/MF A01

Preliminary performance and pertinent operating experience with a liquid-heating flat-plate solar collector integrated with a residential solar heating and cooling system is presented. Data for the months of July and August (1978) are included, along with an analysis of the operation of the solar cooling system which utilizes the Yazaki 2-ton lithium bromide absorption chiller and a cool storage subsystem. Results of the analysis provide clear indications of the critical importance of temperature differentials between the collector outlet and the absorption chiller generator inlet, the effects of alternative control strategies, the marginal feasibility of cool storage, the devastating effect on system performance of the heat losses from the thermal storage unit, and the importance of parasitic power requirements on the ultimate feasibility of solar absorption cooling. DOE

N80-13669# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
TECHNOLOGY DEVELOPMENT NEEDS FOR HIGH TEMPERATURE PROCESS HEAT
Robert J. Copeland Aug. 1978 62 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-35-047) Avail: NTIS HC A04/MF A01

The potential utilization of high temperature solar thermal process heat was investigated. The petroleum industry was reviewed in some detail, and one candidate technology using hydrogen for energy transport was also investigated. Costs, land availability, and energy transfer were the key problem areas. With appropriate development all problems appeared solvable. More detailed evaluations of each large user industry were recommended. DOE

N80-13670# RCA Labs., Princeton, N. J.
MATERIALS FOR SOLAR THERMAL CONVERSION Final Report, 1 Sep. 1977 - 31 Aug. 1978
J. I. Gittleman and E. K. Sichel Sep. 1978 22 p refs
(Contract EG-77-C-02-4557)
(COO-4557-1; PRRL-78-CR-42) Avail: NTIS HC A02/MF A01

Composite semiconductors were produced by cosputtering Ge and Si with CaF2 and their optical constants were measured. The normal specular reflectance of films sputtered on mirrored surfaces was measured. These data were used to compute the solar absorptance alpha/sub s/ and thermal emittance epsilon/sub th/. Thus at T = 500 C a conversion efficiency of 50 percent is possible at solar concentration ratios C of 7 to 8, and about 70 percent is possible for C approximately 40. It was concluded that a parabolic trough, a distributed receiver with a concentration ratio of 50 or less could be more economical for some applications than a central receiver for which C > 500, but the possiblity of using these and other highly selective absorbers for the economical conversion of solar energy should be considered. DOE

N80-13671# Virginia Univ., Charlottesville.
EXPERIMENTAL AND THEORETICAL EVALUATIOM OF A NOVEL CONCENTRATING SOLAR ENERGY COLLECTION SYSTEM
Alexander B. Maish and J. Taylor Beard 1979 5 p refs Presented at the 1979 Intern. Solar Energy Congr., Atlanta, 28-30 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-1053C; CONF-790541-3) Avail: NTIS HC A02/MF A01

A new concentrating solar energy system was evaluated theoretically and experimentally. The modular, two-axis tracking

collector combined an aluminized mylar reflector with a flat plate absorber. Radiation collected from the 7 sq m frontal area was concentrated by a factor of five, making the collector suitable for intermediate temperature applications. The thermal performance of the collector was determined theoretically on a digital computer using a nodal approach to model the heat transfer processes. Collector sensitivies to environmental parameters were calculated. An experimental testing program conducted according to testing standards verified the predicted results. DOE

N80-13672# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
TRANS-SEASONAL STORAGE OF SOLAR ENERGY: INNOVATIVE RESEARCH PROGRAM SUBTASK Final Report, Dec. 1977 - Sep. 1978
W. D. Kemper and W. R. Walker. Oct. 1978. 27 p. refs.
(Contract EG-77-S-02-4546)
(COO-4546-3) Avail: NTIS HC A03/MF A01

The efficiencies and economics of long term storage of solar energy as low temperature heat in shallow underground reservoirs constructed using in situ soil materials are evaluated. Simulation models for predicting the movement of water and heat in response to temperature and capillary pressure gradients in partially saturated porous media are developed and conditions which might predict the rate and extent to which dry insulating blankets of soil form around hot buried reservoirs are simulated. The effect of confining barriers which restrict vapor and liquid flow of water is also simulated. The thermal conductivities of low cost and in situ materials which may be used in the construction of underground heat reservoirs are evaluated and methods of optimizing the thermal conductivities of these materials are developed. DOE

N80-13673# Los Alamos Scientific Lab., N. Mex.
HOT DRY ROCK GEOTHERMAL ENERGY DEVELOPMENT PROGRAM Annual Report, 1978
M. C. Brown, comp., R. B. Duffield, comp., C. L. B. Siciliano, comp., and M. C. Smith, comp. Apr. 1979. 132 p. refs.
(Contract W-7405-eng-36)
(LA-7807-HDR) Avail: NTIS HC A07/MF A01

Run segments were completed in the prototype reservoir of the energy-extraction system at Fenton Hill, New Mexico. The tests yielded significant data on system flow parameters, water loss rates, geofluid chemistry, downhole flow impedance, operational constraints, mathematical modeling, technology and instrument capabilities, and environmental effects of operation. The technical results indicated that energy (thermal or electrical) from hot dry rock may be a feasible alternate energy source. Also, plans were prepared for a system with a commercial size reservoir that can demonstrate the production lifetime of such a system. DOE

N80-13674# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
WIND ENERGY INNOVATIVE SYSTEMS Technical Status Report, Jul. 1978
Irwin E. Vas. Aug. 1978. 58 p. refs.
(Contract EG-77-C-01-4042)
(SERI/PR-13-054) Avail: NTIS HC A04/MF A01

Economic and technical feasibility of innovative concepts and systems utilizing wind energy were investigated. Technical management of the 'wind energy innovative systems' program is discussed. The efforts of the current contracts are included within four major task areas: (1) theoretical thermodynamic and aerodynamic studies; (2) model design, fabrication, and test; (3) performance projections; and (4) economic evaluations. R.E.S.

N80-13675# Power Technologies, Inc., Schenectady, N. Y.
INDUCTION AND SYNCHRONOUS MACHINES FOR VERTICAL AXIS WIND TURBINES Final Report
E. N. Hinrichsen. Jun. 1979. 123 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-7017) Avail: NTIS HC A06/MF A01

The behavior of synchronous and induction generators driven by vertical axis wind turbines is described. The merits of the two types of machines are assessed. Major advantages of the synchronous generator are reactive power control and general acceptance by utility companies. The major advantage of the induction generator is excellent damping of torque pulsations. There is no significant difference in starting ability, efficiency, or voltage ripple. DOE

N80-13676# Oak Ridge National Lab., Tenn.
LAND-BASED APPLICATION OF AN OTEC OPEN-CYCLE POWER SYSTEM
F. C. Chen. 1979. 6 p. refs. Presented at 6th OTEC Conf., Washington, D.C., 19 Jun. 1979.
(Contract W-7405-eng-26)
(CONF-790631-3) Avail: NTIS HC A02/MF A01

Application of OTEC power component technology to many land-based low temperature heat resources including rejected heat from thermal plants and Federal nuclear facilities, as well as freshwater thermoclines is considered. For utilizing rejected heat from large thermal power plants where OTEC range cold water is economically available, it is more cost-effective to apply OTEC open-cycle steam turbine technology for additional turbine stages for the conventional thermal power plant cycle rather than to add a separate bottoming cycle system. For utilizing rejected heat from Federal nuclear facilities, the open-cycle power system has its advantage because it does not need isolation heat exchangers to avoid cross contamination between the working fluid and the hot water supply. A simple thermal performance model and the thermal analysis of a conceptual rejected heat open-cycle power system corresponding to binary cycle system studies are presented. DOE

N80-13677# Los Alamos Scientific Lab., N. Mex.
CONCEPTUAL DESIGNS FOR TWO REJECT HEAT SYSTEMS FOR A BRAYTON CLOSED-CYCLE CONVERTER
G. A. Bennett. May 1979. 32 p. refs.
(Contract W-7405-eng-36)
(LA-7821-MS) Avail: NTIS HC A03/MF A01

Designs for two candidate reject heat systems (RHS) developed for a Brayton closed-cycle space nuclear power system are described. The most important constraints imposed on the design are the size and mass limits and the rigid survival standard of 99% probability that the RHS be functional at full power at the end of a seven-year mission. The secondary loop design includes a pumped-NaK radiator and a heat-pipe heat exchanger. The radiator is of conventional design with armored flow tube passages and fins arranged in rectangular panels placed at right angles to each other. The heat exchanger is a cylindrical pressure vessel with four radiator loops and two converter loops. The direct-pumped gas RHS is designed with many thin-walled, finned heat pipes placed side by side to form rectangular radiator panels that are arranged at right angles to each other. The gas heat exchanger is an armored manifold composed of multiple parallel flow tubes placed at the evaporator end of the radiator heat pipes. J.M.S.

N80-13678# University of Southern California, Los Angeles. Dept. of Materials Science.
LOW COST SOLAR CELLS BASED ON AMORPHOUS SILICON ELECTRODEPOSITED FROM ORGANIC SOLVENTS Technical Quarterly Progress Report, 1 Dec. 1978 - 28 Feb. 1979
F. A. Kroeger. 1979. 5 p. refs.
(Contract EY-76-S-03-0113)
(SAN-0113-T3; TQPR-2) Avail: NTIS HC A02/MF A01

Electrodeposition studies using three possible silicon sources are reported. Improvements of the apparatus for the cathodic deposition of a-Si with the exclusion of air are discussed. Experiments are described which attempt to characterize the structure of the deposits. These include mass spectroscopy and X-ray diffraction analysis. DOE

N80-13679# Ames Lab., Iowa.
FOSSIL ENERGY PROGRAM. 1. MINING RESEARCH AND DEVELOPMENT: COAL PREPARATION AND ANALYSIS Technical Progress Report, 1 Oct. - 31 Dec. 1978
May 1979. 112 p.
(Contract W-7405-eng-82)
(IS-4655) Avail: NTIS HC A06/MF A01

The objectives and progress for eight areas of the fossil energy program are reported. Research topics presented include

the development of fine coal desulfurization and recovery technology, the microstructure of coal, the recovery of minerals from coal fly ash, and alloy evaluation for fossil fuel process plants. A.W.H.

N80-13680# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
THERMAL PERFORMANCE OF BUILDINGS AND BUILDING ENVELOPE SYSTEMS: AN ANNOTATED BIBLIOGRAPHY
William L. Carroll. Apr. 1979. 41 p. Presented at the DOE/ASTM Thermal Insulation Conf., Tampa, Fla., 23-24 Oct. 1978.
(Contract W-7405-eng-48)
(LBL-8925) Avail: NTIS. HC A03/MF A01

A bibliography of published papers describing models, measurement techniques, apparatus, and data for the thermal performance of whole buildings and building envelope systems is presented. Summary descriptions of the content of each citation are provided. Citations on analytical models are selective and concentrate on methodology that forms the basis of computer programs for whole building energy analysis. Approached to dynamic measurements, both in the laboratory and in the field, for envelope systems and for whole buildings are included. DOE

N80-13681# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
COGENERATION OPPORTUNITIES
1978. 268 p. refs. Presented at Cogeneration Opportunities. A Symp. on Prospects for Ind. and Utility Gas, Oil and Coal-Fired Cogeneration, St. Louis, 6-7 Jun. 1978.
(CONF-7806118) Avail: NTIS. HC A12/MF A01

Thirteen unedited papers from a symposium covering government, industry, and utility cooperation in the use of waste energy for generating electricity and heat are presented. Specific topics discussed include process economics, institutional barriers to cogeneration, industrial cogeneration options, and utility experiences in cogeneration. K.L.

N80-13682# Argonne National Lab., Ill.
DEVELOPMENT AND EVALUATION OF MATERIALS FOR HIGH TEMPERATURE LITHIUM/SULFUR RECHARGEABLE BATTERIES
R. B. Swaroop, J. A. Smaga, and J. E. Battles. Mar. 1979. 29 p. refs.
(Contract W-31-109-eng-38)
(DOE/TIC-10098) Avail: NTIS. HC A03/MF A01

Out-of-cell and in-cell tests are being conducted to identify the materials that are compatible with this cell environment. The corrosion test procedures, the nature and kinetics of the corrosion reactions, and the development and testing of electrode separators are discussed. DOE

N80-13683# Argonne National Lab., Ill.
DEVELOPMENT OF POROUS SINTERED-CERAMIC SEPARATORS FOR APPLICATION IN A Li-Al/LiCl-KCl/FeS BATTERY
G. Bandyopadhyay, J. T. Dusek, and T. M. Galvin. 1979. 17 p. refs. Presented at 4th Intern. Meeting on Modern Ceram. Tech., St. Vincent, Italy, 28 May 1979.
(Contract W-31-109-eng-38)
(CONF-790526-2) Avail: NTIS. HC A02/MF A01

The procedure for fabrication of porous sintered ceramic separators and the technical feasibility of using such separators in Li-Al/molten LiCl-KCl/FeS battery cells were investigated. Processing techniques were developed to fabricate 1.5 to 2.5 mm thick, 35 to 60% porous, flat, sintered Y2O3 and MgO separator plates with sufficient strength to allow handling prior to and during cell assembly. The performance of the separators in laboratory scale cells for up to 2000 h and 283 cycles was examined. DOE

N80-13684# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A LITHIUM ALLOY/IRON DISULFIDE, 60-MINUTE PRIMARY THERMAL BATTERY
R. K. Quinn, A. R. Baldwin, J. R. Armijo, P. G. Neiswander, and D. E. Zurawski. Apr. 1979. 41 p. refs.
(SAND-79-0814) Avail: NTIS. HC A03/MF A01

The development of a long life primary thermal battery is discussed. The feasibility of a 50 to 60 minute, 1 ampere, 28 volt, 400 cu cm primary battery is examined under ambient conditions. The active cell components, Li(Si)/LiCl, KCl/FeS2, of the electrochemical systems studies are described. DOE

N80-13685# Argonne National Lab., Ill.
ENGINEERING DEVELOPMENT OF LITHIUM/METAL SULFIDE BATTERY TECHNOLOGY FOR VEHICLE PROPULSION. Summary Report, Oct. 1977 - Sep. 1978
D. L. Barney, A. A. Chilenskas, W. H. DeLuca, E. R. Hayes, F. Hornstra, M. K. Farahat, J. A. E. Graae, and S. Box. Mar. 1979. 35 p. refs.
(Contract W-31-109-eng-38)
(ANL-79-1) Avail: NTIS. HC A03/MF A01

The research, development, and management activities done in preparation for in vehicle testing of engineering scale lithium/metal sulfide batteries are described. The equipment needed to evaluate the performance of this battery is described. Testing of this equipment is discussed. A portable charger/equalizer that has the capability of charging up to six lithium/metal sulfide cells is examined. DOE

N80-13686# General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
LARGE-SCALE ANNUAL-CYCLE THERMAL ENERGY STORAGE IN AQUIFERS
C. F. Meyer. Apr. 1979. 19 p. refs. Presented at Intern. Assembly on Energy Storage, Dubrovnik, Yugoslavia, 27 May 1979.
(Contract W-7405-eng-26)
(CONF-790515-3) Avail: NTIS. HC A02/MF A01

Thermal energy storage in aquifers is examined. Potential benefits of aquifer storage in a large district heating/cogeneration system proposed for an urban area are discussed. DOE

N80-13687# Lincoln Lab., Mass. Inst. of Tech., Lexington.
COST ANALYSIS OF PACKED BEDS FOR THERMAL ENERGY STORAGE
N. I. Hamilton. 3 Dec. 1978. 36 p. refs.
(Contract EX-76-A-01-2295)
(CAES-11) Avail: NTIS. HC A03/MF A01

A cost analysis of packed beds for thermal-energy storage (TES) in an adiabatic compressed-air-energy storage system is given. Capital costs based on the conceptual design of a TES unit are estimated and their sensitivity to system parameter variation is studied. Two TES conceptual designs were considered for: an excavated cavity, and an abandoned mine. A cost comparison is made between surface-sited and underground TES. A cost model was constructed to study the effect of pebble size, insulation thickness, temperature, storage pressure, storage capacity, and other TES components on the TES capital cost. DOE

N80-13688# Battelle Columbus Labs., Ohio.
PHOTOVOLTAIC CONCENTRATOR APPLICATION EXPERIMENT. PHASE 1: A 150 kW PHOTOVOLTAIC CONCENTRATOR POWER SYSTEM FOR LOAD-CENTER APPLICATIONS WITH FEEDBACK INTO THE UTILITY GRID. Final Report, 1 Jun. 1978 - 31 Mar. 1979
G. T. Noel, G. Alexander, L. H. Stember, G. H. Stickford, H. E. Smail, J. H. Broehl, and D. C. Carmichael. Apr. 1979. 123 p. refs.
(Contract ET-78-C-04-4267)
(DOE/CS-34267/1) Avail: NTIS. HC A06/MF A01

A 150 kW peak concentrator-type photovoltaic power system was designed for multiple building load application. The system will operate in parallel with the utility grid (which provides backup power) to supply either or both of two service commercial buildings and will feed surplus power into the utility grid. System performance analysis indicates that the system will supply approximately 147,000 kWh/year to the primary load and an additional 55,000 kWh/year to the utility grid, in the single-load operational mode. The system design and the daily and seasonal match of system output with the load are described in detail. Plans are also discussed for installation and for operational evaluation of performance, economics, and institutional issues. DOE

N80-13689# Argonne National Lab., Ill.
STATUS OF DEVELOPMENT, ENERGY AND ECONOMICS ASPECTS OF ALTERNATIVE TECHNOLOGIES
P. S. Farber, C. D. Livengood, K. E. Wilzbach, W. L. Buck, and H. Huang 1979 49 p refs Presented at 5th Flue Gas Desulfurization Symp., Las Vegas, Nev., 5 Mar. 1979
(Contract W-31-109-eng-38)
(CONF-790371-1) Avail: NTIS HC A03/MF A01

Several energy technologies under development throughout the world which either totally negate the need for flue gas desulfurization or require less than full flue gas scrubbing are examined. These processes remove sulfur either prior to coal combustion during combustion, or between two combustion stages. The status of development and/or demonstration of these technologies with respect to the possible application to the generation of electricity is reviewed. The overall coal to electrical energy efficiency and economics (capital costs and total annualized costs, mills/kWh) are explored, and compared for the various alternatives. DOE

N80-13690# Los Alamos Scientific Lab., N. Mex.
CRITICAL REVIEW AND ASSESSMENT OF ENVIRONMENTAL AND SAFETY PROBLEMS IN HYDROGEN ENERGY SYSTEMS Progress Report, 1 Oct. 1977 - 30 Sep. 1979
F. J. Edeskuty, comp. and N. N. Sheheen, comp. May 1979 249 p refs
(Contract W-7405-eng-36)
(LA-7820-PR) Avail: NTIS HC A11/MF A01

The safety aspects and environmental problems of using hydrogen in energy systems are examined. Topics include hydrogen embrittlement, hydrogen dispersion after a gas leak of liquid spill, hydrogen combustion, an assessment of regulations and standards for hydrogen development, and hydrogen transmission through pipelines. A.W.H.

N80-13691# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.
PHOTOVOLTAIC SYSTEMS. PROGRAM SUMMARY
Dec. 1978 366 p refs
(DOE/ET-0019/2) Avail: NTIS HC A16/MF A01

The photovoltaic systems program projects during fiscal year 1978 are described. The project sheets list the contractor, principal investigator, contract number and funding, and summarize the programs and status. The program is divided into various elements: program assessment and integration, research and advanced development, technology development, system definition and development, system application experiments, and standards and performance criteria. DOE

N80-13692# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TEST PLAN FOR THE MEAD 25-kW PHOTOVOLTAIC FLEXIBLE TEST FACILITY, 1979
R. F. Hopkinson 15 Mar. 1979 21 p ref
(Contract EY-76-C-02-4094)
(COO-4094-53) Avail: NTIS HC A03/MF A01

The operations of the Mead 25-kW Photovoltaic System are reported along with descriptions on how the flexible test bed is expected to be used in experiments with a variety of PV applications, including irrigation, crop drying and fertilizer manufacturing. The planned operations for the Mead site during 1979 are given, and a schedule is attached. DOE

N80-13693# Sandia Labs., Albuquerque, N. Mex.
SANDIA LABORATORIES OPERATIONAL EXPERIENCE WITH SMALL HEAT ENGINES IN SOLAR THERMAL POWER SYSTEMS
Joseph P. Abbin, Jr. 1979 5 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-78-2163C; CONF-790803-23) Avail: NTIS HC A02/MF A01

Hardware and operating experience obtained from the construction and testing of two small Rankine-cycle solar thermal power plants are described. The first plant is part of a prototype solar total energy system with an electrical generating capacity of 32 kW, and the second plant is part of a prototype solar irrigation unit with a shaft power output of 19 kW or an electrical output of 15 kW. DOE

N80-13694# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NOVEL CERAMIC RECEIVER FOR SOLAR BRAYTON SYSTEMS
Philip O. Jarvinen 1979 7 p Presented at ASME Gas Turbine Closed-Cycle Session, San Diego, Calif., 12-15 Mar. 1979
(Contract ET-78-S-02-4878)
(COO-4878-3; CONF-790305-7) Avail: NTIS HC A02/MF A01

Receivers for solar thermal heated air Brayton power systems are discussed. The ceramic domed cavity receiver concept is examined. The development of a high temperature seal for the solar heating air cavity receiver is reported. Mechanical dome sealing methods for this purpose are reviewed and investigations to establish the technological foundation of the seal concepts by demonstrating that ceramic domes can be designed to support the combined pressure, thermal stress, and temperature loads of a heated air receiver are presented. A.W.H.

N80-13695# Argonne National Lab., Ill.
MATERIALS TESTING FOR CENTRAL RECEIVER SOLAR-THERMAL POWER SYSTEMS
S. Majumdar 1978 13 p
(Contract W-31-109-eng-38)
(TID-29443) Avail: NTIS HC A02/MF A01

Biaxial creep-fatigue tests (constant tensile hoop stress and cyclic axial strain with hold times in compression) were performed on type 316H stainless steel superheater tubing. A comprehensive survey of information on sodium effects on candidate materials for solar-thermal electric piping and steam generators was conducted. Mechanical property data were generated in support of the ASME code development. DOE

N80-13696# Argonne National Lab., Ill.
OTEC POWER SYSTEMS
1979 14 p refs Presented at Offshore Technol. Conf., Houston, Tex., 30 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790444-2) Avail: NTIS HC A02/MF A01

The technical features of design studies of power systems using shell and tube heat exchangers and shell-less heat exchangers are presented. Heat exchanger design, biofouling control, rotating equipment, auxiliaries, plant layout, and system cost are among the areas discussed. The role of the power systems development program in the larger OTEC program is also discussed. DOE

N80-13697# Solarex Corp., Rockville, Md.
SILICON CONCENTRATOR SOLAR CELL MANUFACTURING DEVELOPMENT
C. Wrigley, G. Storti, and J. Wohlgemuth Nov. 1978 69 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7021) Avail: NTIS HC A04/MF A01

The program to design and develop the manufacturing technology for silicon solar cells suitable for low-cost photovoltaic concentrator systems is summarized. Detailed discussions are presented for the following tasks: concentrator design, manufacturing process development, solar cell measurement and evaluation, results experienced in cell manufacturing, and production cost estimates. Conclusions and recommendations are given. In particular, it is found that (1) large area concentrator cells with 15% efficiency at 50 suns are readily manufacturable; (2) DOE cost goals for 1981 to 1982 can be met today with market volumes at 200 to 1000 sq m per year; and (3) respectable manufacturing yields are achievable with the technology now developed. DOE

N80-13698# Foster Wheeler Corp., Livingston, N.J.
INTERIM STRUCTURAL DESIGN STANDARD FOR SOLAR ENERGY APPLICATIONS, PHASES 1 AND 2 Final Report
I. Berman, A. C. Gangadharan, G. D. Gupta, and T. V. Narayanan Jan. 1979 148 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-8183) Avail: NTIS HC A07/MF A01

Central receiver solar thermal power systems, relevant ASME codes, reliability considerations, and the criteria used to develop the interim design standard is reviewed. The interim design standard is presented. All criteria or rules chosen or adapted

from other codes are fully stated including all design data. A detailed paragraph-by-paragraph explanation of the interim design standard is provided. The test and development program needed to generate design data and to update the interim design standard are identified. DOE

N80-13699# Midwest Research Inst., Golden, Colo.
REVIEW OF SOLAR ENERGY Annual Report, 1977
Oct. 1978 179 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-54-066) Avail: NTIS HC A09/MF A01

A general review of national solar energy programs is provided. An executive summary and a brief history of the Federal solar energy program are presented. The issues and implications of the National Energy Plan that relate to solar energy development are discussed. The present Federal solar energy program is discussed, including the activities of several Federal agencies outside the Department of Energy. Some of the non-Federal solar energy programs are reviewed, including international programs in which the U.S. has some role, programs of state and local governments, college and university programs, the work of private industry, and individual and small scale activities. A synopsis of the major categories of solar technology is provided. A synopsis of major energy events of 1977; a glossary of technical terms, abbreviations, and acronyms, and a table of conversion factors are included. DOE

N80-13700# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SOLAR CENTRAL RECEIVER PROTOTYPE HELIOSTAT CDRL ITEM B.D., VOLUME 1 Final Report
C. R. Easton Aug. 1978 339 p
(Contract EG-77-C-03-1605)
(SAN-1605/7-Vol-1; MDC-G7399-Vol-1) Avail: NTIS HC A15/MF A01

The preliminary design of a heliostat for central receiver solar thermal power systems which projects to meet the DOE's goal of $72/square m R at production volumes as low as 25,000 units per year and reduces to less than $60/square m R in very high volume production (approximately 1,000,000 units per year) is presented. The manufacturing process, installation and checkout procedures, operation and maintenance procedures, and specification verification and optimization are described. DOE

N80-13701# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: WIND ENERGY CONVERSION
Jul. 1979 34 p refs
(DOE/EDP-0030) Avail: NTIS HC A03/MF A01

Projects or subprograms pertaining to windpower utilization that are likely to result in a demonstration or commercialization within the near term are presented. Projects that are expected to be considered in greater detail in the Environmental Development Plan update are identified. DOE

N80-13702# Ames Lab., Iowa.
FOSSIL ENERGY PROGRAM, 1. MINING RESEARCH AND DEVELOPMENT: COAL PREPARATION AND ANALYSIS Technical Progress Report, 1 Jan. - 31 Mar. 1979
Jun. 1979 31 p refs
(Contract W-7405-eng-82)
(IS-4703) Avail: NTIS HC A03/MF A01

The research and development technology in a number of areas in the fossil energy program are examined. Research topics discussed include the microstructure of coal, the development of an online monitoring instrument for pyrite and ash in coal, and coal blending experiments. A.W.H.

N80-13703# Electric Power Research Inst., Palo Alto, Calif.
SOLAR HEATING AND COOLING RESEARCH PROJECTS: A SUMMARY
Neal Lansing May 1979 30 p
(EPRI-ER-1095-SR) Avail: NTIS HC A03/MF A01

The major EPRI solar heating and cooling experiment projects are summarized. In addition to outlining each project and its purpose, the major features of the solar system are described. Also included are relatively detailed descriptions of the performance-monitoring equipment. As additional technical performance results are obtained and new projects added to the program, this document can be updated to include the new information. A basis for verification of analytic work aimed at determining the preferred solar system for any given utility service is provided, i.e., the system that provides the lowest total cost to the consumer and the utility. DOE

N80-13704# BDM Corp., Albuquerque, N. Mex.
PHOTOVOLTAIC TRANSIENT ANALYSIS PROGRAM USER'S GUIDE. VOLUME 1: EXECUTIVE SUMMARY
T. J. Lambarski, A. F. Malmberg, K. E. Melick, R. M. Turfler, and M. G. Semmens Oct. 1978 29 p refs
(Contract EY-76-C-04-0789)
(SAND-78-7038-Vol-1) Avail: NTIS HC A03/MF A01

A nonlinear, computer-aided circuit analysis program was designed for the analysis of electrical and thermal transients in large photovoltaic array systems. The program has time and frequency domain, Monte Carlo, and optimization solution capabilities and is capable of a wide range of analyses. The code can be used to address design issues on the individual cell level or up to megawatt arrays. Some of the issues that can be addressed include burnout analyses, illumination and load transients, fixed and propagating shadows, cell parameter optimization, collector and thermal system design trade-offs, power conditioning design analysis, aggregation pattern trade-offs, and many other types of analyses limited only by the user's imagination in applying this tool. The program objectives and capabilities are presented. DOE

N80-13705# Department of Energy, Washington, D. C. Office of Energy Research.
THIN FILM PROBLEMS AND RESEARCH IN ENERGY SYSTEMS
Jan. 1979 159 p refs Presented at ERDA/DPR Symp. on Thin Film Res., Pacific Grove, Calif., 1 Nov. 1976
(CONF-761168-Summ) Avail: NTIS HC A08/MF A01

Presentations and recommendations for future efforts in thin film research for energy related applications are presented. Long term thin film coating needs of three programs whose purpose is to develop national energy sources, are described along with the current state of the art of thin film related technologies. DOE

N80-13706# Argonne National Lab., Ill.
COMMUNITY HEATING AND COOLING SYSTEMS
J. M. Calm Apr. 1979 9 p refs Presented at 4th Ann. Heat Pump Technol. Conf., Stillwater, Okla., 9 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790446-6) Avail: NTIS HC A02/MF A01

Centralized, distributed, and cascaded heat pump centered integrated community energy systems (HP-ICES) approaches are discussed and an analysis showing their conservation potential is presented. Benefits of HP-ICES include reduction of adverse environmental effects, reliable production of services in view of increasingly frequent utility curtailments and interruptions, and provision of services at costs more favorable to consumers. DOE

N80-13707# Iowa State Univ. of Science and Technology, Ames.
ENERGY CONSERVATION VIA HEAT TRANSFER ENHANCEMENT Quarterly Progress Report, 1 Oct. - 31 Dec. 1978
A. E. Bergles, G. H. Junkhan, and R. L. Webb Mar. 1979 21 p refs
(Contract ET-78-S-02-4649)
(COO-4649-4) Avail: NTIS HC A02/MF A01

Research on energy conservation via heat transfer enhancement is summarized. Computerized retrieval files on technical literature, patents, and manufacturers were developed. DOE

N80-13708# Oak Ridge National Lab., Tenn.
INDUSTRIAL APPLICATIONS OF ADVANCED ENERGY SYSTEMS
J. E. Jones, Jr. 1979 3 p refs Presented at ANS Ann. Meeting, Atlanta, 3 Jun. 1979
(Contract W-7405-eng-26)
(CONF-790602-54) Avail: NTIS HC A02/MF A01

Industrial energy options based on coal and nuclear systems were assessed. Both high-temperature and low-temperature reactors were analyzed for heat process applications. In coal systems, a comparison was made of advanced energy conversion systems based on research and development experience. The important factors restricting the use of coal in industry were assessed. An atmospheric fluidized-bed combustion system for industrial cogeneration is discussed along with a preliminary market assessment for the technology. DOE

N80-13709# Sandia Labs., Albuquerque, N. Mex.
HYDRIDE ENGINES
A. A. Heckes, T. E. Hinkebein, and C. J. M. Northrup 1979 15 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract EY-76-C-04-0789)
(SAND-78-2303C; CONF-790803-19) Avail: NTIS HC A02/MF A01

Hydride engines are cyclically operated by first releasing hydrogen from metal hydrides at elevated temperatures. They perform work by moving an impermeable membrane. The hydrogen is subsequently reabsorbed at a lower temperature to return the system to the original state. Five engines which operate on this principle are described, two of which have been made operational. Efficiencies are discussed and comparisons made between Carnot, Rankine and Hydride engines which show that this engine is strongly competitive. DOE

N80-13710# Sandia Labs., Albuquerque, N. Mex.
WEIGHT MINIMIZATION OF SANDWICH TYPE SOLAR COLLECTOR PANELS
R. C. Reuter, Jr. 1979 13 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract EY-76-C-04-0789)
(SAND-78-2305C; CONF-790803-27) Avail: NTIS HC A02/MF A01

The existence, utilization and practicality of a minimum weight, adequately stiff design for sandwich panel construction in solar collector application was analytically evaluated. DOE

N80-13711# Rosenblatt (M.) and Son, Inc., New York.
OTEC PLATFORM CONFIGURATION AND INTEGRATION, EXECUTIVE SUMMARY Final Report
26 Jul. 1978 97 p
(Contract EG-76-C-01-4065)
(DOE/ET-4065/1) Avail: NTIS HC A05/MF A01

The commercialization of the ocean thermal energy conversion (OTEC) concept is discussed. Various areas of the OTEC plant development are examined. These include the design of a marine vessel to house the OTEC power cycle, the development of an OTEC power cycle, studies of the site environment, and the effects of biofouling and corrosion on any of the OTEC components. A.W.H.

N80-13712# Rosenblatt (M.) and Son, Inc., New York.
OTEC PLATFORM CONFIGURATION AND INTEGRATION. VOLUME 2: TECHNICAL CONCEPT Final Report
7 Jul. 1978 307 p refs
(Contract EG-77-C-01-4065)
(DOE/ET-4065/1-Vol-2) Avail: NTIS HC A14/MF A01

The configuration, integration, and evaluation studies performed for commercial OTEC applications are presented. The results of conceptual designs for the platforms, the facilities and equipment required for construction, deployment, operation of the OTEC platforms, and cost estimates and time schedules are discussed. DOE

N80-13713# Rosenblatt (M.) and Son, Inc., New York.
OTEC PLATFORM CONFIGURATION AND INTEGRATION, APPENDIXES TO VOLUME 2 Final Report
7 Jul. 1978 159 p
(Contract EG-76-C-01-4065)
(DOE/ET-4065/1-Vol-2-App) Avail: NTIS HC A08/MF A01

Detailed information and conceptual design drawings for the spar and sphere platforms for an OTEC commercial plant are presented. A work breakdown structure and a detailed estimate of the spar platform weight are included. DOE

N80-13714# Rosenblatt (M.) and Son, Inc., New York.
OTEC PLATFORM CONFIGURATION AND INTEGATION. VOLUME 3: PROJECT PLAN Final Report
7 Jul. 1978 64 p refs
(DOE/ET-4065/1-Vol-3) Avail: NTIS HC A04/MF A01

The spar and sphere offshore platforms were used to demonstrate the feasibility of a near full size ocean thermal energy conversion (OTEC) plant and to gather data for use in the construction, design and operation of commercial OTEC plants. A hull size suitable to support a 100 MWe net output plant was chosen. Construction of the hull and installation of all equipment is proposed for three sites: (1) a shoreside construction site; (2) an offshore site in sufficient water depth to complete the hull erection; and (3) installation of the cold water pipe at the demonstration site. DOE

N80-13715# National Technical Information Service, Springfield, Va.
GEOTHERMAL ENERGY. PART 1: EXPLORATION, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1976 - Jun. 1979
Audrey S. Hundemann Aug. 1979 264 p Supersedes NTIS/PS-78/0664; NTIS/PS-77/0561 Updates NTIS/PS-76/0463
(NTIS/PS-79/0814/8; NTIS/PS-78/0664; NTIS/PS-77/0561) Avail: NTIS HC $28.00/MF $28.00 CSCL 08I

The bibliography cites Federally-funded research on geophysical methods, such as electrical resistivity, seismology, magnetic anomaly, and electromagnetic measurements in geothermal site survey determination. Studies on well logging, remote sensing, geochemistry, mineralogy, radioactivity, mapping, volcanism, and structural geology are also cited. Criteria for location of geothermal areas are suggested in these abstracts. This updated bibliography contains 256 abstracts, 81 of which are new entries to the previous edition. GRA

N80-13716# National Technical Information Service, Springfield, Va.
GEOTHERMAL ENERGY. PART 2: CORROSION AND EQUIPMENT, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1976 - Jul. 1979
Audrey S. Hundemann Aug. 1979 165 p Supersedes NTIS/PS-78/0665; NTIS/PS-77/0562 Updates NTIS/PS-76/0463
(NTIS/PS-79/0815/5; NTIS/PS-78/0665; NTIS/PS-77/0562) Avail: NTIS HC $28.00/MF $28.00 CSCL 08I

Citations of Government-sponsored research reports on corrosion and equipment studies related to geothermal energy are presented. Studies on pumps, turbines, drilling equipment, pipes, nozzles, and well casings are covered, along with studies on materials including concretes, steels and nonferrous alloys. Silica precipitation and scale formation on equipment are also cited. Performance of equipment in working fluids and brines and the chemical processes affecting performance are included. This updated bibliography contains 157 abstracts, 70 of which are new entries to the previous edition. GRA

N80-13717# National Technical Information Service, Springfield, Va.
GEOTHERMAL ENERGY. PART 3: TECHNOLOGY AND GENERAL STUDIES, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1976 - Dec. 1977
Mona F Smith Aug. 1979 247 p Updates NTIS/PS-76/0463
(NTIS/PS-79/0816/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 08I

The bibliography covers Government-sponsored research on geothermal energy conversion, power plants, heat extraction, and space heating. Studies on fluid flow, heat transfer, rock fracturing, computerized simulation, pressure, and reservoir engineering are included. Reports on economics, legislation, technology assessment, comparative evaluation with other energy sources, Government policies, and planning are also cited. This updated bibliography contains 239 abstracts, none of which are new entries to the previous edition. GRA

N80-13718# National Technical Information Service, Springfield, Va.
GEOTHERMAL ENERGY, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, May 1976 - Jul. 1978
Mona F. Smith Aug. 1979 329 p
(NTIS/PS-79/0818/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 08I

Citations from worldwide literature on geothermal energy conversion, feasibility, development, and cost estimates are presented. Studies on geothermal exploration, drilling technology, fluid flow, convection, thermodynamics, heat extraction, and electric power plants are covered. Equipment, corrosion, reservoir engineering, and remote sensing are included. This updated bibliography contains 323 abstracts, none of which are new entries to the previous edition. GRA

N80-13719# National Technical Information Service, Springfield, Va.
GEOTHERMAL ENERGY. PART 3: TECHNOLOGY AND GENERAL STUDIES, VOLUME 4. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Jun. 1979
Audrey S. Hundemann Aug. 1979 203 p Supersedes NTIS/PS-78/0666, NTIS/PS-77/0563 Updates NTIS/PS-76/0463
(NTIS/PS-79/0817/1; NTIS/PS-78/0666; NTIS/PS-77/0563; NTIS/PS-76/0463) Avail: NTIS HC $28.00/MF $28.00 CSCL 08I

Research on geothermal energy conversion, power plants, heat extraction, and space heating is reported. Studies on fluid flow, heat transfer, rock fracturing, computerized simulation, pressure, and reservoir engineering are included. Reports on economics, legislation, technology assessment, and comparative evaluation with other energy sources, are presented. This updated bibliography contains 195 abstracts, all of which are new entries to the previous edition. GRA

N80-13720# National Technical Information Service, Springfield, Va.
GEOTHERMAL ENERGY, VOLUME 4. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Aug. 1978 - Jul. 1979
Audrey S. Hundemann Aug. 1979 149 p Supersedes NTIS/PS-78/0667, NTIS/PS-77/0565, NTIS/PS-76/0465
(NTIS/PS-79/0819/7; NTIS/PS-78/0667; NTIS/PS-77/0565; NTIS/PS-76/0465) Avail: NTIS HC $28.00/MF $28.00 CSCL 08I

Citations from worldwide literature on geothermal energy conversion, feasibility, development and cost estimates are presented. Studies on geothermal exploration, drilling technology, fluid flow, convection, thermodynamics, heat extraction, and electric power plants are covered. Equipment, corrosion, reservoir engineering, and remote sensing are included. This updated bibliography contains 143 abstracts, all of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution, environment monitoring, and contamination control.

N80-13721*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
AN ANALYTICAL STUDY OF NITROGEN OXIDES AND CARBON MONOXIDE EMISSIONS IN HYDROCARBON COMBUSTION WITH ADDED NITROGEN, PRELIMINARY RESULTS
David A. Bittker [1979] 17 p refs Proposed for presentation at the 25th Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by ASME
(Contract EF-77-A-01-2593)
(NASA-TM-79296; DOE/NASA/2593-79/10) Avail: NTIS HC A02/MF A01 CSCL 13B

The effect of combustor operating conditions on the conversion of fuel-bound nitrogen (FBN) to nitrogen oxides NO sub x was analytically determined. The effect of FBN and of operating conditions on carbon monoxide (CO) formation was also studied. For these computations, the combustor was assumed to be a two stage, adiabatic, perfectly-stirred reactor. Propane-air was used as the combustible mixture and fuel-bound nitrogen was simulated by adding nitrogen atoms to the mixture. The oxidation of propane and formation of NO sub x and CO were modeled by a fifty-seven reaction chemical mechanism. The results for NO sub x and CO formation are given as functions of primary and secondary stage equivalence ratios and residence times. R.E.S.

N80-13722# California Univ., Berkeley. Lawrence Berkeley Lab.
INSTRUMENTATION FOR ENVIRONMENTAL MONITORING
R. D. McLaughlin, M. S. Hunt, D. L. Murphy, and C. R. Chen Jun. 1979 14 p Presented at the 13th Ann. Conf. on Track Substances in Environ. Health, Columbia, Mo., 4-7 Jun. 1979
(Contract W-7405-eng-48)
(LBL-9323; CONF-790673-2) Avail: NTIS HC A02/MF A01

The selection of analytical instrumentation for the determination and monitoring of environmental pollutants is discussed. Air, water, and radiation media are considered. K.L.

N80-13723# Oregon State Univ., Corvallis. Air Resources Center.
CRITIQUE OF THE METEOROLOGICAL AND AIR QUALITY BASELINE MONITORING PROGRAM FOR THE PROTOTYPE OIL SHALE LEASEHOLDS. PART A: COMMENTS ON THE APPROACH TAKEN AND RECOMMENDATIONS FOR CONTINUING PROGRAM. PART B: COMMENTS ON THE DATA ACQUISITION AND MANAGEMENT
W. G. N. Slinn, M. A. Wolf, and J. P. Hennessey, Jr. Nov. 1978 58 p refs
(Contract EY-76-S-06-2227)
(DOE/EV-70031/4-Pt-A/B; RLO-2227-T31-4-Pt-A/B) Avail: NTIS HC A04/MF A01

The environmental impact is considered in the event that extensive oil shale resources of Colorado, Utah, and Wyoming are developed to augment the nation's energy needs. Reasons are suggested why existing knowledge is inadequate to provide a valid answer. A means is proposed for accomplishing this important task within a suitable time-period and at a reasonable level of funding. The probable cause of deficiences is identified in the meteorological and air quality data which were acquired over a two-year period on the Federal oil shale leaseholds and improved procedures for future data acquisition efforts are recommended. DOE

N80-13724# Dalton, Dalton, Little, and Newport, Inc., Cleveland, Ohio.
GUIDELINES FOR MULTIMEDIA ENVIRONMENTAL MONITORING OF DEPARTMENT OF ENERGY FOSSIL ENERGY RD AND D FACILITIES
Robert G. Rolan Nov. 1978 483 p
(Contract EX-76-C-01-2495)
(FE-2495-T13-Vol-2) Avail: NTIS HC A21/MF A01

The potential sensitivity of the environment to generators from DOE fossil energy activities is examined as a step in selecting parameters which should be monitored. Basic ecological concepts and terminology that will be needed in properly designing a monitoring program for a DOE fossil energy RD and D facility are introduced. Analytical hardware options available for monitoring, sampling and analytical methods, data recording, data processing and retrieval, and data quality control and assurance are discussed. DOE

N80-13725# Sandia Labs., Albuquerque, N. Mex.
CARBON PARTICULATE MEASUREMENTS IN A DIESEL ENGINE
S. C. Keeton Jun. 1979 42 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8210) Avail: NTIS HC A03/MF A01

Various optical techniques are considered for counting and sizing soot particles in the combustion chamber of diesel engines. Imaging and single-particle methods are not applicable because the majority of light scattering by the distribution of particles resulting from diesel combustion comes from particles which

are too small for those techniques. Many-particle scattering techniques, such as extinction and right angle scattering, show promise but will generate quantitative particle sizing information only if the particle diameter distribution function and index of refraction are known for the soot system being studied. The use of several laser wavelengths separated by at least several hundred Angstroms, however, would allow the use of a distribution function with several unknown parameters. DOE

N80-13726# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Abt. Meerestechnik.
STRATEGIES FOR THE SURVEILLANCE OF COASTAL WATERS OF THE FEDERAL REPUBLIC OF GERMANY Final Report
Helmut Kosche. Bonn: Bundesmin. fuer Forsch. u. Technol., Dec. 1977. 181 p. refs. In GERMAN; ENGLISH summary. Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-77-11) Avail: NTIS. HC A09/MF A01; ZLDI, Munich DM 37.80

Strategies for surveillance of anorganic and organic pollutants in coastal waters are necessary to fulfill international conventions. The development of a realistic strategy for the surveillance of low and slowly changing concentration levels is intended. The analysis of collected data show that the knowledge of anorganic pollutants surpasses the knowledge of organic pollutants. The necessary detection limits are in the range of ppb for anorganic and ppt for organic pollutants. Existing measuring devices are presented and discussed with regard to their useful ranges and merits. In addition, the possible potential and use of biological indicators as well as of remote sensing is discussed. The resulting proposed strategy consists of a three element approach (coordination of existing activities, installment of a central institution, special activities regarding accidents with pollutants) based on sampling, preparation, the use of laboratories, and scientific interpretation. Author (ESA)

46 GEOPHYSICS

Includes aeronomy, upper and lower atmosphere studies, ionospheric and magnetospheric physics, and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-13727 California Univ., San Diego.
CRUSTAL STRUCTURE IN AREAS OF ACTIVE CRUSTAL ACCRETION. Ph.D. Thesis
Leonard Dale Bibee. 1979. 169 p.
Avail: Univ. Microfilms. Order No. 7926689

The geophysical characteristics of the oceanic crust and upper mantle are studied in three areas where crust is presently being formed by a seafloor spreading process. The results of these investigations are combined with previous studies to place constraints on the geologic processes occurring during crustal formation and subsequent evolution. The areas discussed are the Mariana Trough, the East Pacific Rise at 10 deg S, and the Galapagos Rift at 86 deg W. Dissert. Abstr.

N80-13728 Alaska Univ., College.
RADAR MEASUREMENTS OF TEMPERATURES AND IONIC COMPOSITION IN THE HIGH LATITUDE IONOSPHERE. Ph.D. Thesis
John David Kelly. 1979. 143 p.
Avail: Univ. Microfilms. Order No. 7927661

Continuous ground based measurements of high latitude ionospheric temperatures and ion composition including both quiet and disturbed periods are presented. The measurements were made with the incoherent scatter radar located at Chatanika, Alaska (L = 5.6). The electron temperature increased as much as 1000 K above the neutral gas temperature during periods of energetic particle precipitation, and ion temperatures also increased by a similar amount during a large joule heating event. The largest change in the ion composition occurred during the large joule heating event. The transition altitude increased at least 50 km and remained elevated for several hours. A seasonal variation, similar to midlatitude observations, was also observed — the daytime transition altitude is approximately 15 km lower in the winter than in the summer. Dissert. Abstr.

N80-13729 Alaska Univ., College.
A THEORY FOR THE ASYMMETRY IN THE AURORAL IONIZATION DENSITY PROFILE FOR THE GENERATION OF AURORAL INFRASONIC WAVES. Ph.D. Thesis
Paul Albert Goodwin. 1979. 147 p.
Avail: Univ. Microfilms. Order No. 7927660

Theoretical calculations, beginning with a model of an auroral precipitation region, are presented to show that there can be a significant difference in the transverse ionization density profiles between an auroral arc that is moving equatorward and an arc that is moving poleward, for a given equatorward-directed E-region ambient electric field. The calculation was accomplished by solving the equations of motion and continuity for the cross-sectional ionization density profile associated with the transverse motion of a filamentary auroral electrojet. Thus it is shown that there is an asymmetry in the ionization profiles associated with moving arcs, and in their coupling, that is related to the relative direction of motion of the arc with respect to the ambient electric field, and that it is this asymmetry that is probably the cause of the observed AIW reception asymmetry. Dissert. Abstr.

N80-13730°# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
AN ASYMPTOTIC EXPANSION APPROACH TO THE INVERSE RADIATIVE TRANSFER PROBLEM
Richard I. Gomberg and James J. Buglia. Washington: Dec. 1979. 32 p. refs.
(NASA-TP-1587; L-13165) Avail: NTIS. HC A03/MF A01 CSCL 04A

An iterative technique which recovers density profiles in a nonhomogeneous absorbing atmosphere is derived. The technique is based on the concept of factoring a function of the density profile into the product of a known term and a term which is not known, but whose power series expansion can be found. This series converges rapidly under a wide range of conditions. A demonstration example of simulated data from a high resolution infrared heterodyne instrument is inverted. For the examples studied, the technique is shown to be capable of extracting features of ozone profiles in the troposphere and to be particularly stable. J.M.S.

N80-13731°# Ohio State Univ. Research Foundation, Columbus.
INVESTIGATIONS ON THE HIERARCHY OF REFERENCE FRAMES IN GEODESY AND GEODYNAMICS
Erik W. Grafarend, Ivan I. Mueller, Haim B. Papo, and Burghard Richter. Aug. 1979. 127 p. refs.
(Grant NsG-5265)
(NASA-CR-162499; Rept-289) Avail: NTIS. HC A07/MF A01 CSCL 08G

Problems related to reference directions were investigated. Space and time variant angular parameters are illustrated in hierarchic structures or towers. Using least squares techniques, model towers of triads are presented which allow the formation of linear observation equations. Translational and rotational degrees of freedom (origin and orientation) are discussed along with and the notion of length and scale degrees of freedom. According to the notion of scale parallelism, scale factors with respect to a unit length are given. Three-dimensional geodesy was constructed from the set of three base vectors (gravity, earth-rotation and the ecliptic normal vector). Space and time variations are given with respect to a polar and singular value decomposition or in terms of changes in translation, rotation, deformation (shear, dilatation or angular and scale distortions). R.E.S.

N80-13732# Sandia Labs., Albuquerque, N. Mex.
AVERAGE STRUCTURE OF THE UPPER EARTH MANTLE AND CRUST BETWEEN ALBUQUERQUE AND THE NEVADA TEST SITE
H. D. Garbin. Aug. 1979. 22 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-0975) Avail: NTIS. HC A02/MF A01

Models of Earth structure were constructed by inverting seismic data obtained from nuclear events with a 1600 m long

laser strain meter. With these models the general structure of the Earth's upper mantle and crust between Albuquerque and the Nevada Test Site was determined. DOE

N80-13733# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
IN SITU STRESS FIELD IN THE SOUTHEASTERN UNITED STATES AND ITS IMPLICATION
D. E. Stephenson and H. R. Pratt. 1979. 21 p. refs. Presented at 27th Ann. Meeting of the Southeastern Section of the Geological Soc. of Am., Blacksburg, Va., 26 Apr. 1979.
(Contract EY-76-C-09-0001)
(DP-MS-78-95; CONF-790497-2) Avail: NTIS HC A02/MF A01

Published and unpublished in situ stress measurements and studies of earthquake focal mechanisms in the southeastern United States are reviewed. These data, which provide information on the relative magnitude and orientation of existing stress fields, are analyzed in relation to the geologic characteristics of the Southeast and are compared with data for other areas in the United States. The relation of the stress fields to observed geology and present day tectonic processes is reviewed. Stress measurements reveal the existence of high horizontal stresses in the Appalachian complex. Different in situ stress states in the Appalachian complex, the Coastal Plain, and the stable interior region indicate different faulting mechanisms. Various techniques for determining in situ stress are consistent. DOE

N80-13734# Agbabian Associates, El Segundo, Calif.
REVIEW OF EARTHQUAKE VIBRATORY GROUND MOTION INTENSITY ATTENUATION RELATIONSHIPS
G. A. Young. 30 Sep. 1978. 104 p. refs.
(Contract EY-76-C-03-1011)
(SAN-1011/119) Avail: NTIS HC A06/MF A01

A review of earthquake vibratory ground motion intensity-distance-attenuation relationships is presented which depicts the evolution and limitations of currently used procedures. Two general procedures are considered: one procedure relates peak horizontal ground acceleration, earthquake magnitude, and distance, and the other relates epicentral modified Mercalli intensity (MMI), distance, and attenuated MMI. A conversion relationship between MMI and peak horizontal ground acceleration is used with the latter. DOE

N80-13735# Cincinnati Univ., Ohio. Sedimentology Lab.
DEVONIAN PALEOCURRENTS OF THE APPLACHIAN BASIN
Paul Edwin Potter, Wayne A. Pryor, Paul Lundegard, Neil Samuels, and J. Barry Maynard. May 1979. 66 p. refs.
(Contract DE-AC21-76MC-05201)
(METC/CR-79/22) Avail: NTIS HC A04/MF A01

The methodology of paleocurrent studies in shaly basins based on both outcrops and oriented cores is set forth as is the relationship between paleocurrents and gas potential. The paleocurrent system of the central and northern Appalachian basin was found to be uniformly oriented to the west. Paleocurrent indicators are at right angles to isopach of total Devonian thickness, which decreases westward from 12,000 ft in eastern Pennsylvania to a few hundred ft in west central Ohio. This clastic wedge is largely of Upper Devonian age and includes alluvial and delta plain environments as well as shelf, turbidite slope, and basin plain environments, the latter representing most of the black shales. The gradient of carbon isotopes, which shows more marine than terrestrial carbon in the western part of the basin, closely parallels the average paleocurrent direction of the basin. DOE

N80-13736# Max Planck Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
STUDIES ON THE THERMOSPHERE AND IONOSPHERE BASED ON A DETAILED ANALYSIS OF TOPSIDE IONOGRAMS. Final Report
Walter Becker. Bonn: Bundesmin. fuer Forsch. u. Technol. Nov. 1978. 45 p. refs. In GERMAN; ENGLISH summary.
(Contract BMFT-WRT-181)
(BMFT-FB-W-78-01) Avail: NTIS HC A03/MF A01. Fachinformationszentrum, Karlsruhe, West Germany DM 9.25

Alouette 1 ionograms (41,398) and ionograms (24,661) taken by the ISIS 2 satellite were converted to electron density height profiles of the upper ionosphere. A semi-automated scaling technique designed for this purpose, is briefly described. Included is an outline of the software. The invariant standard profile of the lower ionosphere obtained by midlatitude stations for a local noon interval was used in comparison. The standard deviations of the individual profiles from this standard profile do not show any remarkable difference. The relevance of this result for prediction work and theoretical studies is pointed out. No poor fits of simultaneous upper and lower electron density height profiles are reported for cases of a horizontally stratified ionosphere. Extreme critical frequency variations of the F layer from day to day could not be explained by distortions in the shape of the F layer. Author (ESA)

N80-13737# Royal Aircraft Establishment, Farnborough (England).
THE GRAVITY FIELD OF THE EARTH
D. G. King-Hele. London: HMSO. Nov. 1978. 26 p. refs.
(RAE-TR-78142; RAE-Space-560; BR66968) Avail: NTIS HC A03/MF A01

Progress in the determination of the Earth's gravitational field is briefly outlined. Some attempt is made to assess the accuracy of current geoid maps and were of harmonic coefficients as exemplified in the latest models derived at the Goddard Space Flight Center. The harmonic coefficients of order 14, 15, and 30 in the Goddard Earth Model (GEM) 10B are compared with values obtained independently by analysis of resonant orbits. The results suggest that the values in GEM are realistic for these orders, and presumably others. It appears that the accuracy of the geoid maps is now approaching 1 m. Author (ESA)

N80-13738# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
REPORT ON FRENCH RESEARCH INTO THE IONOSPHERE-MAGNETOSPHERE FROM 1975 TO 1978 [RAPPORT NATIONAL SUR LES TRAVAUX FRANCAIS EXECUTES DE 1975 A 1978 DANS LA DISCIPLINE "IONOSPHERE-MAGNETOSPHERE"]
C. Beghin. Jan. 1979. 28 p. refs. In FRENCH. Presented at I.A.G. de l'UGGI, Canberra, Australia, 1979.
(CRPE-DT-1039) Avail: NTIS HC A03/MF A01

French attempts from 1975 to 1978 to understand the phenomena and the laws controlling the stability and dynamics of the ionized environment around the Earth are summarized, including a description of the specific techniques for the study of the ionosphere and magnetosphere, the modeling of the ionized media, the study of the overall dynamics as well as macroscopic processes and particular phenomena. Author (ESA)

N80-13739# Lille Univ. (France).
ATMOSPHERIC CORRECTION OF SURFACE TEMPERATURE MEASUREMENTS IN A 10.5 TO 12.5 MICRON CHANNEL FROM AVHRR/TIROS-N
P. Y. Deschamps, T. Phulpin (Centre de Meteorol. Spatiale, Lannion, France), and B. Tournier (Centre de Meteorol. Spatiale, Lannion, France). 1978. 5 p. refs. Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979.
Avail: NTIS HC A02/MF A01

The algorithms needed for the atmospheric correction of the 10.5 to 12.5 micron window channel are studied, concluding that the space measurements of the surface temperature by means of the mentioned infrared channel may be corrected using data from the AVHRR experiment on board the TIROS-N satellite. Best results are obtained when associating the 3.7 and 12 micron infrared channels to obtain an absolute accuracy on the retrieved surface temperature better than 1 K. Author (ESA)

N80-13530*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
GLOBAL ASPECTS OF THE EARTH'S MAGNETOPAUSE
D. H. Fairfield. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 5-13. refs. (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120. CSCL 04A

N80-13631# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
AN ELECTRIC CURRENT MODEL OF THE MAGNETOSPHERE

H. Alfven. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 15-21. refs. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13532# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
PLASMA STRUCTURE OF THE MAGNETOPAUSE AND BOUNDARY LAYER
G. Paschmann. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 25-36. refs. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13533# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
EXTERNAL PLASMA FLOW
N. Schopke. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 37-42. refs. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13534*# California Univ., Berkeley. Inst. of Geophysics and Planetary Physics.
ISEE-1 AND 2 MAGNETOMETER OBSERVATIONS OF THE MAGNETOPAUSE
R. C. Elphic and C. T. Russell. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 43-50. refs. (For primary document see N80-13529 04-42)
(Contract NAS5-20064)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120. CSCL 04A

N80-13535# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
QUASISTATIC ELECTRIC FIELDS OBSERVED DURING A NUMBER OF MAGNETOPAUSE CROSSINGS BY ISEE-1
U. V. Fahleson, C. G. Faelthammar, P. A. Lindqvist, F. S. Mozer (Calif. Univ., Berkeley), R. B. Torbert (Calif. Univ., Berkeley), A. Gonfalone (ESTEC, Noordwijk, Netherlands), and A. Pedersen (ESTEC, Noordwijk, Netherlands). *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 51-65. refs. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13536# European Space Technology Center, Noordwijk (Netherlands). Space Science Dept.
MAGNETOPAUSE ELECTRIC AND MAGNETIC FIELD SIGNATURES AT TIMES OF MAGNETOSPHERIC COMPRESSIONS
R. Grard, A. Pedersen, F. Mariani (CNR, Frascati, Italy), and C. Signorini (CNR, Frascati, Italy). *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 67-72. refs. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13537# European Space Technology Center, Noordwijk (Netherlands). Space Science Dept.
RADIAL DISCONTINUITIES IN LOW-ENERGY MAGNETOSPHERIC PLASMA OBSERVED ON GEOS-1
K. Knott, R. Grard, and A. Pedersen. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 75-79. refs. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13538# Kiruna Geophysical Inst. (Sweden).
FIRST OBSERVATIONS OF A HEATED PLASMA COMPONENT IN THE PLASMA MANTLE
R. Hultqvist, R. Lundin, I. Sandahl, N. Pissarenko (Acad. of Sci., Moscow), and A. Zacharov (Acad. of Sci., Moscow). *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 83-89. refs. Sponsored in part by Swedish Board for Space Activities. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13539# Kiruna Geophysical Inst. (Sweden).
FIRST OBSERVATIONS OF THE HOT ION COMPOSITION IN THE HIGH ALTITUDE MAGNETOSPHERIC BOUNDARY LAYER BY MEANS OF PROGNOZ-7
R. Lundin, I. Sandahl, B. Hultqvist, A. Galeev (Acad. of Sci., Moscow), O. Likhin (Acad. of Sci., Moscow), A. Omelchenko (Acad. of Sci., Moscow), N. Pissarenko (Acad. of Sci., Moscow), O. Vaisberg (Acad. of Sci., Moscow), and A. Zacharov (Acad. of Sci., Moscow). *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 91-96. refs. Sponsored in part by Swedish Board for Space Activities. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13540# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.
OBSERVATIONS OF ION AND ELECTRON DISTRIBUTIONS DURING THE JULY 29 AND JULY 30, 1977 STORM PERIOD
J. F. Fennell, P. F. Mizera, and D. R. Croley, Jr. *In* ESA. Magnetospheric Boundary Layers. 1979. p. 97-111. refs. (For primary document see N80-13529 04-42)
(Contract F04701-78-C-0079; Grant NSF ATM-78-03600)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13541# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
MAGNETIC PULSATIONS OBSERVED ON BOARD GEOS-2 IN THE ULF RANGE DURING MULTIPLE MAGNETOPAUSE CROSSINGS
S. Perraut, R. Gendrin, P. Robert, and A. Roux. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 113-122. refs. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13542# Danish Space Research Inst., Lyngby.
CRITICAL LEVEL BEHAVIOR OF ION-CYCLOTRON WAVES AT MAGNETOSPHERIC BOUNDARY LAYERS
J. F. McKenzie. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 123-127. refs. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13543# Sheffield Univ. (England). Dept. of Physics.
A WAVE-PARTICLE-WAVE INTERACTION OBSERVED ON GEOS-2
T. R. Kaiser. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 129-130. refs. (For primary document see N80-13529 04-42)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13544*# California Inst. of Tech., Pasadena.
ENERGETIC ELECTRON BURSTS IN THE MAGNETOPAUSE ELECTRON LAYER AND IN INTERPLANETARY SPACE
J. W. Bieber and S. C. Stone. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 131-135. refs. (For primary document see N80-13529 04-42)
(Contract NAS5-11066; Grant NGR-05-002-160)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120. CSCL 04A

N80-13545# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
ION AND ELECTRON LAYERS AT THE MAGNETOPAUSE: ISEE-2
P. W. Daly, E. Keppler, and D. J. Williams (NOAA Space Environ. Lab.). *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 137-141. refs. Co-sponsored by Max-Planck Ges. (For primary document see N80-13529 04-42)
(Contract BMFT-RV-14-B30/73)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13546# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.
PARTICLE AND FIELD CHARACTERISTICS OF THE DAYSIDE MAGNETOPAUSE ENERGETIC ELECTRON LAYER
Ching-I. Meng (Iowa Univ., Iowa City), L. A. Frank (Iowa Univ., Iowa City), and K. L. Ackerson. *In* ESA. Magnetospheric Boundary Layers. Aug. 1979. p. 143-148. refs. (For primary document see N80-13529 04-42)
(Contract NSF ATM-75-02621)
Avail: NTIS. HC A18/MF A01; ESA, Paris FF 120

N80-13547*# Washington Univ., Seattle.
PARTICLE BOUNDARY STRUCTURES AT THE MAGNETOPAUSE AND THE PLASMA SHEET
G. K. Parks, C. S. Lin (California Univ., Berkeley), K. A. Anderson (Paul Sabatier Univ., Toulouse), R. P. Lin (California Univ., Los Angeles), H. Reme (John Hopkins Univ., Baltimore), F. Coroniti (Ecole Polytech., Paris), C. Meng, and R. Pellat *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 151-156 refs (For primary document see N80-13529 04-42)
(Contracts NAS5-20079; CNES-212)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

N80-13548# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
VARIATIONS OF ELECTRON AND ION DISTRIBUTIONS DURING DAYSIDE MAGNETOPAUSE CROSSINGS OF GEOS-2
A. Korth, G. Kremser, B. Wilken, E. Amata (Lab. Plasma Spazio), and M. Candidi (Lab. Plasma Spazio) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 157-159 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13549# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
MULTIPLE-SATELLITE OBSERVATIONS OF LARGE SCALE TRAPPING BOUNDARY MOTIONS
B. Wilken, A. Korth, G. Kremser, and Th. A. Fritz (NOAA Space Environment Lab.) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 161-163 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13550*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
LOW-ALTITUDE SIGNATURES OF THE BOUNDARY LAYERS
P. H. Reiff *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 167-173 refs (For primary document see N80-13529 04-42)
(Grants NGR-44-006-012; NSG-5286; NSF ATM-77-12619)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

N80-13551*# Texas Univ., Dallas. Center for Space Sciences.
IONOSPHERIC CONVECTION AT HIGH LATITUDES
R. A. Heelis *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 175-181 refs (For primary document see N80-13529 04-42)
(Contract NAS5-11407; Grant NGR-44-004-120)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

N80-13552# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
STARE IONOSPHERIC ELECTRON FLOWS DURING THE AUGUST 28, 1978 GEOS-2 MAGNETOPAUSE CROSSING
G. J. Sofko, R. A. Greenwald, A. Korth, and G. Kremser *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 183-185 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13553# Lockheed Missiles and Space Co., Palo Alto, Calif.
ION COMPOSITION IN THE DAYSIDE CUSP: INJECTION OF IONOSPHERIC IONS INTO THE HIGH LATITUDE BOUNDARY LAYER
E. G. Shelley *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 187-192 refs Sponsored in cooperation with Office of Naval Res. and NSF (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13554# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
BIRKELAND CURRENTS AND THE INTERPLANETARY MAGNETIC FIELD
T. A. Potemra and N. A. Saflekos (Boston Coll.) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 193-198 refs Sponsored in cooperation with Office of Naval Res. and NSF (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13555# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.
DAYSIDE AURORA AND SUBSTORM CURRENT SYSTEMS
R. H. Eather, S. B. Mende (Lockheed Res. Lab., Palo Alto, Calif.), and E. J. Weber (Air Force Geophysics Lab.) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 199-206 refs (For primary document see N80-13529 04-42)
(Contract NSF C-659)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13556# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
COMMENTS ON THE LOW-ALTITUDE OPTICAL SIGNATURES OF MAGNETOSPHERIC BOUNDARY LAYERS
M. M. Shepherd and G. G. Shepherd *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 207-208 (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13557# Cornell Univ., Ithaca, N. Y. School of Electrical Engineering.
LOW FREQUENCY WAVES AND IRREGULARITIES IN THE LOW ALTITUDE BOUNDARY LAYER
P. Kintner and M. Temerin (California Univ., Berkeley) *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 209-216 refs (For primary document see N80-13529 04-42)
(Contract N00014-75-C-0780)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13567# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
KINETIC THEORY OF THE BOUNDARY LAYER BETWEEN A FLOWING ISOTROPIC PLASMA AND A MAGNETIC FIELD
L. R. O. Storey and L. Cairo *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 289-293 refs Sponsored by UK. Sci. Res. Council. (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13568# Institut d'Aeronomie Spatiale de Belgique, Brussels.
A MICROSCOPIC DESCRIPTION OF INTERPENETRATED PLASMA REGIONS
M. A. Roth *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 295-309 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13569# Institut fuer Weltraumforschung, Graz (Austria). Oesterreichische Akademie der Wissenschaften.
SOLUTION OF THE CHAPMAN-FERRARO PROBLEM WITHIN TWO DIMENSIONS
H. Ruckner and H. Biernat *In* ESA Magnetospheric Boundary Layer Aug. 1979 p 311-314 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13570# Technische Hochschule, Darmstadt (West Germany). Angewandte Geophysik.
INFLUENCE OF THE INTERPLANETARY MAGNETIC FIELD ON THE POSITION OF THE DAYSIDE MAGNETOPAUSE
G. H. Voigt *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 315-321 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13571*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
RATES OF MASS, MOMENTUM, AND ENERGY TRANSFER AT THE MAGNETOPAUSE
T. W. Hill *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 325-332 refs (For primary document see N80-13529 04-42)
(Grants NGR-44-006-137; NSF ATM-77-12619)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

N80-13572# Imperial Coll. of Science and Technology, London (England).
THE FORMATION AND PROPERTIES OF BOUNDARY LAYERS DOWNSTREAM FROM NEUTRAL LINES IN AN OPEN MAGNETOSPHERE
S. W. H. Cowley *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 333-342 refs Sponsored by UK Sci. Res. Council. (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13573# California Univ., Los Angeles. Dept. of Atmospheric Sciences.
ANTIPARALLEL MERGING, THE HALF-WAVE RECTIFIER RESPONSE OF THE MAGNETOSPHERE, AND CONVECTION
N. U. Crooker *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 343-348 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13574*# Rice Univ., Houston, Tex.
INTERNAL MAGNETOSPHERIC PLASMA FLOW
J. W. Freeman *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 351-355 refs Co-sponsored by NASA and NSF (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

N80-13575*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
MAGNETOPAUSE KELVIN-HELMHOLTZ INSTABILITY
D. J. Southwood *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 357-364 refs (For primary document see N80-13529 04-42)
(Contract NAS5-20064; Grant NSF ATM-74-23464)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

N80-13576# Institut d'Aeronomie Spatiale de Belgique, Brussels.
IMPULSIVE PENETRATION OF SOLAR WIND AND ITS EFFECTS ON THE UPPER ATMOSPHERE
J. Lemaire *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 365-373 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13577*# Texas Univ. at Dallas, Richardson. Center for Space Sciences.
IMPULSIVE PENETRATION AND VISCOUS INTERACTION
W. J. Heikkila *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 375-380 refs Co-sponsored by NSF (For primary document see N80-13529 04-42)
(Grant NsG-5085)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

N80-13578# Southampton Univ. (England). Dept. of Physics.
TOWARDS A MORE QUANTITATIVE UNDERSTANDING OF DAYSIDE MAGNETOPAUSE CURRENTS
M. A. Saunders and M. J. Rycroft *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 381-384 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13579# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
INTERACTION BETWEEN THE MAGNETOSPHERIC BOUNDARY LAYERS AND THE IONOSPHERE
V. M. Vasyliunas *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 387-393 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13580# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
THEORY OF THE LOW ATTITUDE BOUNDARY LAYER
B. U. Oe. Sonnerup *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 395-397 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13581*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ELECTROMAGNETIC STRUCTURE OF THE MAGNETOPAUSE AND BOUNDARY LAYER
B. U. O. Sonnerup (Max-Planck-Inst. fuer Extraterrestrische Phys., Garching, West Germany) and B. G. Ledley *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 401-410 refs (For primary document see N80-13529 04-42)
(Grants NsG-7292; NSF ATM-74-08223)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-13740 Florida State Univ., Gainesville.
THE INFLUENCE OF THERMAL FRONTS UPON THE SOLUTIONS OF AN ANALYTICAL MODEL OF A MID-LATITUDE WAVE-CYCLONE Ph.D. Thesis
Richard Donald Grotjahn 1979 171 p
Avail: Univ. Microfilms Order No. 7926755

The stability and structure of wave-like perturbations imbedded in a zonal flow containing vertical and horizontal shear are examined via an analytical model of a midlatitude cyclone. The stability, structure, and energetics of some solutions are discussed. As the intensity of the front increases, the growth rate increases for most wavenumbers. As the meridional width of the east-west aligned frontal zone diminishes, the most unstable wavelength shifts to shorter wavelengths and the fastest moving wave shifts to longer wavelengths. The amplitude of the structure is increased in the vicinity of the front and the meridional scale of the eddy is decreased in proportion to the scale of the prescribed front. The phase of the eddy pressure field is changed by the front in two ways. Barotropically unstable tilts are introduced and the westward tilt with height is decreased in the upper region and increased in the lower part by the horizontal shear. Examination of the energy conversions indicates that the two instability mechanisms inhibit each other. Dissert. Abstr.

N80-13741 Florida State Univ., Gainesville.
THE IMPORTANCE OF EDDY MOMENTUM FLUX IN THE DYNAMICS OF A HURRICANE: A NUMERICAL APPROACH Ph.D. Thesis
Malakondayya Challa 1979 130 p
Avail: Univ. Microfilms Order No. 7926728

An axisymmetric hurricane model with parameterized horizontal eddy fluxes of momentum is used to study the efficacy of eddy momentum fluxes in enhancing or suppressing the development and intensification of a hurricane. The results show that there are appreciable differences in the rate of intensification and in the final intensity of the model hurricane with and without eddy fluxes of momentum and that the intensification rate and ultimate intensity of a hurricane depends on the distribution of eddy momentum flux. In one experiment with a supercritical sea surface temperature, but with a negative eddy momentum flux, the initial vortex decayed and the initial low pressure center filled. The amount of control that the eddy momentum flux appears to have on the information or development of a hurricane is revealed. Dissert. Abstr.

N80-13742*# Oklahoma Univ., Norman.
JET TRANSPORT PERFORMANCE IN THUNDERSTORM WIND SHEAR CONDITIONS
John McCarthy, Edward F. Blick, and Randall R. Bensch Dec. 1979 63 p refs
(Contract NAS8-31377)
(NASA-CR-3207) Avail: NTIS HC A04/MF A01 CSCL 04B

Several hours of three dimensional wind data were collected in the thunderstorm approach-to-landing environment, using an instrumented Queen Air airplane. These data were used as input to a numerical simulation of aircraft response, concentrating on fixed-stick assumptions, while the aircraft simulated an instrument landing systems approach. Output included airspeed, vertical displacement, pitch angle, and a special approach deterioration

parameter. Theory and the results of approximately 1000 simulations indicated that about 20 percent of the cases contained serious wind shear conditions capable of causing a critical deterioration of the approach. In particular, the presence of high energy at the airplane's phugoid frequency was found to have a deleterious effect on approach quality. Oscillations of the horizontal wind at the phugoid frequency were found to have a more serious effect than vertical wind. A simulation of Eastern flight 66, which crashed at JFK in 1975, served to illustrate the points of the research. A concept of a real-time wind shear detector was outlined utilizing these results. Author

N80-13743*# Universities Space Research Association, Boulder, Colo.
WARM/COLD CLOUD PROCESSES Progress Report, 1 Jul. - 30 Sep. 1979
David A. Bowdle 30 Sep. 1979 28 p
(Contract NAS8-33131)
(NASA-CR-161336) Avail: NTIS HC A03/MF A01 CSCL 04B

Technical assistance continued in support of the Atmospheric Cloud Physics Laboratory is discussed. A study of factors affecting warm cloud formation showed that the time of formation during an arbitrary expansion is independent of carrier gas composition for ideal gases and independent of aerosol concentration for low concentrations of very small aerosols. Equipment and procedures for gravimetric evaluation of a precision saturator were laboratory tested. A numerical feasibility study was conducted for the stable levitation of charged solution droplets by an electric field in a one-g static diffusion chamber. The concept, operating principles, applications, limits, and sensitivity of the levitation technique are discussed. A.R.H.

N80-13744# Naval Research Lab., Washington, D. C.
NUMERICAL SIMULATION OF SUDDEN STRATOSPHERIC WARNINGS
Mark R. Schoberl and Darrell F. Strobel 26 Jun. 1979 75 p refs Sponsored in part by NASA
(WF52551792)
(NASA-CR-162505; AD-A071249; NRL-MR-4013) Avail: NTIS HC A04/MF A01 CSCL 04/2

A mechanistic, quasigeostrophic model with a self consistent calculation of the mean zonal flow was used to numerically simulate sudden stratospheric warmings generated by a single zonal harmonic (m) planetary wave. The development of a warming depends critically on the two factors which govern the transmission of planetary waves to the upper stratosphere: (1) the strength of the westerly winds in the lower stratosphere and (2) the magnitude of wave damping in the same region. Major warmings can only develop when the prewarming lower stratospheric winds are strong. Damping controls the maximum amplitude that a warming can attain and the time constant for its growth rate. Long term integrations with a steady forced m = 1 wave show that the mean flow evolves to a steady, asymptotic state with net cooling in the polar mesosphere from planetary waves. But steady m = 2 forcing leads to multiple generation of warmings which are similar to stratospheric vacillations. GRA

N80-13745# National Climatic Center, Asheville, N. C.
NATIONAL WIND DATA INDEX Final Report
Michael J. Changery Dec. 1978 231 p ref
(Contract EX-76-A-29-1041; E(49-26)-1041)
(HCP/T1041-01) Avail: NTIS HC A11/MF A01

A guide is presented for the identification of all locations in the United States with original wind data in any form that have been archived at the National Climatic Center. DOE

N80-13746# National Oceanic and Atmospheric Administration, Washington, D. C. National Weather Service.
AUTOMATED PREDICTION OF BOUNDARY LAYER WINDS AND TURBULENCE FOR THE SAVANNAH RIVER LABORATORY Final Report
David B. Gilhousen 1979 26 p refs
(Contract EY-77-A-09-1007)
(NOAA-TR-NWS-1007-1) Avail: NTIS HC A03/MF A01

The development and testing of Model Output Statistics (MOS) wind forecasts for an instrumented TV tower located near the Savannah River Laboratory (SRL) is presented. These forecasts could serve as valuable guidance in case of a nuclear incident at the installation. Several applications of the MOS technique are reported. In addition to forecasts of wind speed and direction, forecasts of two turbulence parameters were developed and evaluated. These turbulence parameters were the standard deviations of both the azimuth and elevation of the wind. These quantities help to estimate the amount of plume and puff spread. Tests were conducted to see if MOS forecasts of each element were capable of resolving differences between tower levels. MOS forecasts were compared to two other types of forecasts to determine their utility. Short range persistence forecasts served as one type of comparison since SRL uses the current observed winds in their diffusion models. Climatology forecasts served as the other comparison set. DOE

N80-13747# Northrop Services, Inc., Huntsville, Ala.
SOLAR-CLIMACTIC STATISTICAL STUDY
Roger E. Bray Feb. 1979 570 p refs
(Contract EG-77-C-01-4016)
(HCP/T4016-01/2) Avail: NTIS HC A24/MF A01

Historic data (SOLMET) at 26 National Weather Service stations reporting hourly solar insolation and collateral meteorological information were examined to provide an estimate of future trends. Selected insolation and wind power conditions were investigated for their occurrence and persistence for defined periods of time on a monthly basis. Diurnal variations of wind power were also considered. Probability estimates of solar insolation and wind power, alone and in combination, occurring and persisting at or above specified thresholds are presented. Selected probability data for each station are presented graphically, and comprehensive plots for all stations are provided. Information of this nature is intended as an aid to preliminary planning activities for the design of solar and wind energy utilization systems. DOE

N80-13748# World Meteorological Organization, Geneva (Switzerland)
REPORT OF THE FIFTH PLANNING MEETING FOR THE MONSOON EXPERIMENT (MONEX). PART 1: WINTER MONEX Global Atmospheric Research Programme
1979 90 p refs Conf. held at Manila, 16-20 Oct. 1978
Prepared jointly with ICSU, Rome
(GARP-Spec-Rept-30) Avail: NTIS HC A05/MF A01; WMO, Geneva SWFR 15

The organization and implementation of the winter Monsoon Experiment conducted by GARP is reported on. Topics discussed include the winter MONEX observing system, national commitments to winter MONEX, activities of the International MONEX Management Center, and planned research activities during and after winter MONEX. The implementation and operations plan for the experiment, involving ship operations, aircraft operations, and satellite observations as well as overall data management plans, is also presented. Author (ESA)

N80-13749# Royal Netherlands Meteorological Inst., De Bilt. Div. of Oceanographic Research.
METEOROLOGICAL AND OCEANOGRAPHIC OBSERVATIONS ON BOARD DUTCH LIGHT VESSELS AND THE LIGHT PLATFORM 'GOEREE' IN THE NORTH SEA
1979 167 p In DUTCH and ENGLISH
(KNMI-141-26) Avail: NTIS HC A08/MF A01; Royal Netherlands Meteorol. Inst., De Bilt, Fl 17.50

Three-hourly meteorological and wave observations, hourly current observations, and salinity measurements made in the North Sea off the coast of the Netherlands are presented in tabular form. The methods of observation and the instruments used are briefly described. Parameters reported include air pressure, air temperature and wet bulb temperature, sea water temperature, amount of precipitation, and duration of precipitation and fog. Also provided are data on current, salinity, the fraction of the celestial dome covered by clouds, horizontal visibility, and comparison of past ad present weather for the observation interval. Direction of wind and sea, wind force, period of sea and swell as well as height of sea and swell are also shown. Author (ESA)

N80-13750# Royal Netherlands Meteorological Inst., De Bilt.
METEOROLOGICAL OBSERVATIONS IN THE NETHER-

LANDS FOR 1977 Annual Report
1979 74 p In DUTCH and ENGLISH
(KNMI-97-129) Avail: NTIS HC A04/MF A01; Royal Netherlands Meteorol. Inst., De Bilt, Fl 17.50

The results of observations made at 45 meteorological stations in the Netherlands are given in tabular form. Information on the exact location of the stations as well as the instruments used is also given. Meteorological parameters reported on include air pressure, wind direction, wind velocity, temperature, and relative humidity. Vapor pressure, global radiation, sunshine, amount of precipitation, and duration of precipitation are summarized as well for the reporting period. Author (ESA)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-13751 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE OCEAN TIDE AND WAVES BENEATH THE ROSS ICE SHELF, ANTARCTICA Ph.D. Thesis
Richard Turl Williams, III 1979 211 p
Avail Univ. Microfilms Order No. 7925388

Widely spaced tidal gravity records were used to determine the spatial and temporal variation of the ocean tide beneath the Ross Ice Shelf. Cotidal coamplitude maps were drawn for the six greatest harmonic constituents of the tide. These are K1, P1, O1, M2, S2, and N2. The tide is principally diurnal, the diurnal amplitudes being roughly 3 times longer than the semidiurnals. Theoretical calculations of the tidal current indicate that the semidiurnal and diurnal current constituents have roughly the same amplitude. Waves having periods shorter than 20 min were observed in the ice shelf. These were identified as flexural waves that are generated by the action of the ocean swell on the northern edge of the shelf. The observed speed of these waves was predicted within the uncertainty of the measurement by the classical flexural wave theory. Dissert. Abstr.

N80-13752 Columbia Univ., New York.
ISOPYCNAL TRANSPORT BY THE ANTARCTIC CIRCUMPOLAR CURRENT AND THE ANTARCTIC INFLUENCE AT INTERMEDIATE WATER DENSITIES Ph.D. Thesis
Eugene John Molinelli 1979 216 p
Avail Univ. Microfilms Order No. 7924943

The precepts of isopycnal analysis are reviewed and found applicable to the problem of Antarctic intermediate water (AAIW) formation. A probable precursor to this major water mass is found in the isohaline thermoclines of the southeast Pacific which occur with the densities of Atlantic AAIW. Distributions of depth, potential temperature, salinity, dissolved oxygen, and silicate on the 27.25 sigma sub 0 surface in the Southern Ocean are mapped using nearly 4,000 hydrographic stations. The distributions are interpreted to be consistent with the flow discerned from the isopycnal transports. An error analysis for isopycnal transport calculations is derived. Dissert. Abstr.

N80-13753*# EG and G Washington Analytical Services Center, Riverdale, Md.
A STUDY OF POSSIBLE SEA STATE INFORMATION IN THE SAMPLE AND HOLD GATE STATISTICS FOR THE GEOS-3 SATELLITE ALTIMETER Final Report
W. T. Wells, K. L. Borman, R. D. Mitchell (RCA/Missile and Surface Radar Div., Moorestown, N.J.), and D. J. Dempsey (RCA/Missile and Surface Radar Div., Moorestown, N.J.) Sep. 1979 36 p refs
(Contract NAS6-2497)
(NASA-CR-156858) Avail NTIS HC A03/MF A01 CSCL 08C

The statistical variations in the sample gate outputs of the GEOS-3 satellite altimeter were studied for possible sea state information. After examination of a large number of statistical characteristics of the altimeter waveforms, it was found that the best sea predictor for H-1/3 in the range of 0 to 3 meters was the 75th percentile of sample and hold gate number 11. R.E.S.

N80-13754# Mississippi State Univ., State College.
THE ANALYSIS OF SEDIMENT SAMPLES FOR HYDROCARBONS Final Report
Lewis Raymond Brown and Charles Douglas Minchew 30 Oct. 1978 72 p
(Contract DOT-CG-81-76-1476)
(AD-A073822; USCG-D-46-79; CGR/DC-12/79) Avail: NTIS HC A04/MF A01 CSCL 08/8

This document is a report on the hydrocarbon content of 1380 individual surficial samples obtained from areas in the vicinity of three proposed Deep Water Port (DWP) Sites in the Gulf of Mexico during six cruises taken between 1975 and 1978. The samples were analyzed using 2 different LC-fluorescent methods, one of which was selective for petrogenic hydrocarbons and one of which detected both petrogenic and biogenic hydrocarbons. Additionally, nutrient chemical analyses and microbiological analyses were performed on sediment obtained during the first two cruises. All data were evaluated statistically and discussed in terms of sources of inputs, effect on season, and significance for formulating an overall monitoring program for the DWP sites. The results of this study suggest that analysis for both petrogenic and biogenic hydrocarbons should be undertaken in order to more accurately reflect the sources of seasonal variation in hydrocarbon levels at sites of interest. A method of displaying the data is illustrated and discussed. It allows rapid comparisons of the hydrocarbon content of sediments from the various stations. GRA

N80-13755# Woods Hole Oceanographic Institution, Mass.
A COMPILATION OF MOORED CURRENT METER AND WIND RECORDER DATA. VOLUME 18: JASIN 1978, MOORINGS 651-653
Susan Tarbell, Melbourne G. Briscoe, and Robert A. Weller Jul. 1979 236 p refs
(Contracts N00014-76-C-0197; N00014-75-C-0152; Grant NSF OCE-77-25803; NR Proj. 083-400; NR Proj. 083-005)
(AD-A073581; WHOI-79-65-Vol-18) Avail NTIS HC A11/MF A01 CSCL 08/10

Summaries of current and temperature measurements from three moorings in the 1978 Joint Air-Sea Interaction Project (JASIN) are presented; the moorings are WHOI/JASIN numbers 651/W1, 652/W2, and 653/W3. The instruments were either Vector Averaging Current Meters (VACM), Scripps Institution of Oceanography Vector Measuring Currents Meters (VMCM), or Neil Brown Acoustic Current Meters (ACM). Displays include time series, histograms, progressive vector diagrams, scatter plots, and spectra; statistics are given for the entire deployment period (some 40 days) and for each 5 day segment. Additional measurements include pressure and vertical temperature gradient. Wind records and other meteorological observations from one of the moorings are given, as well as partial wind records from another JASIN mooring (H2). GRA

N80-13756# Naval Postgraduate School, Monterey, Calif.
TROPICAL DISTURBANCES IN AN OCEANIC GENERAL CIRCULATION MODEL WITH SEASONAL FORCING M.S. Thesis
Richard Duane LeRoy Jun 1979 68 p refs
(AD-A073602) Avail NTIS HC A04/MF A01 CSCL 08/3

A ten-level primitive equation ocean circulation model is used to investigate the formation and propagation of baroclinic wavelike responses to annual variations in wind stress forcing. At 12.2 N a thermal response to Ekman pumping is observed to be in phase across the entire longitudinal extent of the model Pacific Ocean. A zonal fluctuation in interior ocean current systems is also suggested. Eastern boundary disturbances not related to local forcing are observed to propagate poleward. At 6.1 N, main thermocline displacements are observed to propagate westward as the result of vertical advection induced by Ekman pumping. Surface layer temperature disturbances also exist which are produced by meridional advection of mean temperature (colder to the south) by surface Ekman currents. Eastern boundary disturbances also exist at this latitude and extend to a deeper level. All disturbances observed in this investigation are considered to be permanent features of the model circulation. Grid size limitations preclude detailed investigation of the observed boundary disturbances with this model. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-13757*# Florida Inst. of Tech., Melbourne. School of Science and Engineering.
PHOTOSYNTHETIC CARBON REDUCTION BY SEAGRASSES EXPOSED TO ULTRAVIOLET A RADIATION Final Report
15 Sep. 1979 38 p refs
(Contract NAS9-15846)
(NASA-CR-160397) Avail: NTIS HC A03/MF A01 CSCL 06C

The seagrasses Halophila engelmannii, Halodule wrightii, and Syringodium filiforme were examined for their intrinsic sensitivity to ultraviolet-A-UV-A and ultraviolet-B-UV-B radiation. The effect of UV-A on photosynthetically active radiation (PAR) was also determined. Ultraviolet-A and ultraviolet-B were studied with emphasis on the greater respective environmental consequence in terms of seagrass distribution and abundance. Results indicate that an intrinsic sensitivity to UV-A alone is apparent only in Halophila, while net photosynthesis in Halodule and Syringodium seems unaffected by the level of UV-A provided. The sensitivity of Halophila to UV-A in the absense of (PAR) indicates that the photosynthetic reaction does not need to be in operation for damage to occur. Other significant results are reported. R.C.T.

N80-13758*# Texas A&M Univ., College Station. Dept. of Plant Sciences.
A PRELIMINARY RESEARCH PLAN FOR DEVELOPMENT OF A PHOTOSYNTHETIC LINK IN A CLOSED ECOLOGICAL LIFE SUPPORT SYSTEM Final Report
Page W. Morgan Nov. 1979 135 p refs
(Contract NAS9-15873)
(NASA-CR-160399; Rept-79-556) Avail: NTIS HC A07/MF A01 CSCL 06C

The use of higher plants in a closed ecological life support system for long duration space missions involving large numbers of people is considered. The approach to planning and developing both the habitat for a long term space mission and closed ecological life support systems are discussed with emphasis on environmental compatibility and integrated systems design. The requirements of photosynthetic processes are summarized and evaluated in terms of their availability within a closed ecological life support environment. Specific references are recommended as a data base for future research on this topic. R.C.T.

N80-13759*# General Electric Co., Houston, Tex.
SYSTEM PARAMETERS FOR ERYTHROPOIESIS CONTROL MODEL: COMPARISON OF NORMAL VALUES IN HUMAN AND MOUSE MODEL
15 Dec. 1979 29 p refs
(Contract NAS9-15487)
(NASA-CR-160401; TIR-741-LSP-8024) Avail: NTIS HC A03/MF A01 CSCL 06C

The computer model for erythropoietic control was adapted to the mouse system by altering system parameters originally given for the human to those which more realistically represent the mouse. Parameter values were obtained from a variety of literature sources. Using the mouse model, the mouse was studied as a potential experimental model for spaceflight. Simulation studies of dehydration and hypoxia were performed. A comparison of system parameters for the mouse and human models is presented. Aside from the obvious differences expected in fluid volumes, blood flows and metabolic rates, larger differences were observed in the following: erythrocyte life span, erythropoietin half-life, and normal arterial pO2. R.E.S.

N80-13760# State Univ. of New York, Stony Brook.
DETERMINING BIOLOGICAL FINE STRUCTURE BY DIFFERENTIAL ABSORPTION OF SOFT X-RAY
B. J. Panessa-Warren and J. B. Warren (BNL) Jun. 1979 23 p refs Presented at the Conf. on Ultrasoft X-Ray Microscopy, N.Y., 13 Jun 1979 Submitted for publication
(Contract EY-76-C-02-0016)
(BNL-26282; CONF-790674-3) Avail: NTIS HC A02/MF A01

The use of soft X-ray contact microscopy in examining histo-chemically treated human tissue embedded in plastic and exposed as unstained thin sections is demonstrated. Preliminary data revealed that the histochemical reaction product, and the unstained biological fine structure of the surrounding tissues can be clearly imaged. Hydrated proteoglycan aggregates were examined. Proteoglycans are an essential component of the organic matrix of cartilage, and play a primary role in the retention and maintenance of extracellular water. To avoid any artifacts due to the introduction of exogeneous materials, and examine the proteoglycan aggregates in their hydrated, natural configuration, contact X-ray images of isolated proteoglycan aggregates in water were made. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-13761 Johns Hopkins Univ., Baltimore, Md.
THE EFFECTS OF CONTEXT ON THE STRUCTURE OF PAIN Ph.D. Thesis
Mark Harold Bradshaw 1979 138 p
Avail: Univ. Microfilms Order No. 7924603

Multidimensional scaling (MDS) was used to determine whether the structure of a set of pain descriptors varied as a function of the area of the body to which those descriptors referred. Three body areas (head, arms and legs, and torso) were chosen, and a set of 13 words were found which were judged by subjects to be highly applicable to the description of pain in all three body areas. These words, plus a few body-area-specific words, were used as stimuli in four MDS studies. In each of the studies pain descriptors were judged in the context of a specific body area. It was concluded that differences in the structure of the pain descriptors across different body areas were minimal to nonexistant. Thus, this research supports the view that a single taxonomy of pain descriptors can represent the major pain qualities in different parts of the body and that MDS is a good method for establishing such a taxonomy. Dissert. Abstr.

N80-13762* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 199
Nov. 1979 37 p
(NASA-SP-7011(199)) Avail: NTIS HC E03 CSCL 06E

This bibliography lists 82 reports, articles, and other documents introduced into the NASA scientific and technical information system in October 1979. Author

N80-13763 Virginia Univ., Charlottesville.
MODELING STUDIES OF THE PRESSURE-FLOW RELATIONSHIP OF THE CENTRAL AIRWAYS Ph.D. Thesis
David Burkman Reynolds 1978 249 p
Avail: Univ. Microfilms Order No. 7928032

The spacing of junctions that control the pressure flow relation of the bronchial tree was investigated. A mathematical model simulating these relations was developed. Airway models included single bifurcations, bifurcating networks, and a latex airway reproduction of a dog lung. The total flow rate of water and aqueous solutions of sucrose and sodium carboxymethyl cellulose and the static pressure at selected locations of the airway models was measured for steady and unsteady, inspiratory, and expiratory flow corresponding to tracheal Reynolds number in the range 1000-10,000. A dimensionless form of the Rohrer equation was used to simulate the data and to partition the total loss into that of an individual bifurcation. By appropriate sealing relationships, the results with aqueous solutions were extended to the flow of air. Dissert. Abstr.

N80-13764# Clemson Univ., S.C. Coll. of Engineering.
RESUSCITATION FROM HYPOTHERMIA: A LITERATURE REVIEW Final Report, 17 Jan. 1978 - 14 Feb. 1979
R. Michael Harnett, Fred R. Sias, and James R. Pruitt 14 Feb. 1979 64 p refs

(Contract DOT-CG-72074-A)
(AD-A069093; USCG-D-26-79) Avail: NTIS
HC A04/MF A01 CSCL 06/5

This report summarizes medical and scientific aspects of the general literature debate over rapid versus slow rewarming and selected specific rewarming approaches. The specific approaches were selected largely on the basis of being difficult to evaluate with in vivo experiments with human subjects. Findings in basic medical literature, research reports and clinical medical literature are analyzed leading to recommendations of the suitability of each specific therapy for use as a first-aid treatment in the field. GRA

N80-13765# Army Research Inst. of Environmental Medicine, Natick, Mass.

DEVELOPMENT AND DESCRIPTION OF A DEVICE FOR STATIC STRENGTH MEASUREMENT IN THE ARMED FORCES EXAMINATION AND ENTRANCE STATION

Joseph Knapik, Dennis Kowal, Patrick Riley, James Wright, and Michael Saoco 9 Jan. 1979 44 p refs
(AD-A068684; USARIEM-T-2/79) Avail: NTIS
HC A03/MF A01 CSCL 06/14

A device for muscular strength measurement designed for possible use in the AFEES is presented. Muscle groups involving the upper body, legs and trunk, were selected for measurement as being most representative of the functional muscle groups most relevant to the Army's needs. The isometric (static) mode of testing was selected due to its simplicity of administration, reliability and reduced susceptibility to motivational influences. Biomechanical factors including subject-machine couplings, anatomical angles and minimization of synkinetic movement patterns are considered. The apparatus and calibration techniques are described. Standardized postures, anatomical angles and instructions are included. Reliability coefficients of 0.97, 0.92 and 0.83 were obtained for the upper body, legs and trunk respectively. Descriptive statistics and histograms for a representative population are included. GRA

N80-13766# Coast Guard, Washington, D.C. Office of Research and Development.

RELIABILITY, VALIDITY AND APPLICATION OF AN IMPROVED SCALE FOR ASSESSMENT OF MOTION SICKNESS SEVERITY Final Report, Apr. 1978 - May 1979

S. F. Wiker, R. S. Kennedy (Naval Aviation Med. Res. Lab., New Orleans), M. E. McCauley (Human Performance Res., Inc., Goleta, Calif.), and R. L. Pepper (Naval Ocean Systems center, Kaila, Hawaii) May 1979 29 p refs
(AD-A069130; USCG-D-29-79) Avail: NTIS
HC A03/MF A01 CSCL 06/5

Three sea going vessels steamed side-by-side through slight seas off the coast of Oahu, Hawaii. A four-hour octagon was transmitted twice each day for three consecutive days while motion sickness symptomatology was recorded from eighteen enlisted men who alternated among the vessels. Dramatic differences in illness severity were obtained, whether comparisons were made using objective evidence of vomiting episodes, or subjective reporting of symptoms on questionnaires. Reliability of this scoring method was excellent ($r = .95$). In addition to face and construct validity, evidence is presented of the predictive validity of the scoring method in a separate octogonal steaming experiment; using a 95 ft Coast Guard Patrol Boat in an equivalent experimental paradigm. This study showed significant covariance between the magnitude of motion sickness symptomatology and the encounter direction of the vessel to the primary swell ($p < .01$). Additional significant correlations were found between sickness severity and test subject concentration, fatigue, urine production and urine specific gravity. The majority of these relationships would not have been disclosed had only the dichotomous criterion of vomit/nonvomit been employed in assessing motion sickness severity. Implications of these data as design criteria for marine vehicles are discussed. GRA

N80-13767# California Univ., Berkeley. Lawrence Berkeley Lab. Div. of Biology and Medicine.

EFFECTS OF IONIZING RADIATION ON THE LIGHT SENSING ELEMENTS OF THE RETINA Ph.D. Thesis

Michael J. Malachowski Jul. 1978 236 p refs
(Contract W-7405-eng-48)
(LBL-5683) Avail: NTIS HC A11/MF A01

Morphological and physiological effects of particles of high linear energy transfer on the retina, in comparison with X-ray effects were investigated. The particles used were accelerated atomic nuclei of helium, carbon, and neon at kinetic energies of several hundred MeV/nucleon. For morphological studies, scanning and transmission electron microscopy and light microscopy were used. Physiological studies consisted of autoradiographic data of the rate of incorporation of labeled protein in the structures (opsin) of the outer segment of visual cells. Structural changes were found in the nuclei, as well as the inner and outer segments of visual cells, rods and cones. At a low of dose of 10 rad, X-ray and helium had no statistically significant morphological effects, but carbon and neon beams did cause significant degeneration of individual cells, pointing to the existence of a linear dose effect relationship. Other significant results are reported. DOE

N80-13768# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

APPARATUS FOR MEASUREMENT OF TISSUE COMPLIANCE Final Report

Wolfgang Gerhard, Wolfgang Hepp, and Karl-Frieder Sahm Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 60 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1076; DFVLR-BPT-01-00-096)
(BMFT-FB-W-78-05) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12.60

It is supposed that the compliance of tissues under weightlessness produces changes in the distribution of fluids in the tissues which can be observed in space. These changes give rise to changes in the tissue thickness; analogous thickness variations can be produced by application of external pressure to tissue. A concept for measuring these variations in tissue thickness is studied. After a critical analysis of the experimental situation, possible procedures for thickness measurement are discussed. As a suitable procedure, an ultrasonic echo method was chosen which works with impulses similar to shock waves. For the application of pressure to the tissue a special pressure chamber was developed. Problems connected with coupling of the chamber and the ultrasonic probe to the tissue surface were solved. A laboratory test of the measuring equipment gives results which are reproducible and of adequate precision. Author (ESA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-13769*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.

EFFECT OF NOISE SPECTRA AND A LISTENING TASK UPON PASSENGER ANNOYANCE IN A HELICOPTER INTERIOR NOISE ENVIRONMENT

Sherman A. Clevenson and Jack D. Leatherwood Dec. 1979 26 p refs
(NASA-TP-1590; L-13233) Avail: NTIS HC A03/MF A01 CSCL 05I

The effects of helicopter interior noise on passenger annoyance were studied. Both reverie and listening situations were studied as well as the relative effectiveness of several descriptors (i.e., overall sound pressure level, A-weighted sound pressure level, and speech interference level) for quantifying annoyance response for these situations. The noise stimuli were based upon recordings of the interior noise of a civil helicopter research aircraft. These noises were presented at levels ranging from approximately 68 to 86 dB(A) with various gear clash tones selectively attenuated to give a range of spectra. Results indicated that annoyance during a listening condition is generally higher than annoyance during a reverie condition for corresponding interior noise environments. Attenuation of the planetary gear clash tone results in increases in listening performance but has negligible effect upon annoyance for a given noise level. The noise descriptor most effective for estimating annoyance response under conditions

of reverie and listening situations is shown to be the A-weighted sound pressure level. R.E.S.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-13770*# General Electric Co., Houston, Tex. Apollo Systems Dept.
ANALYSIS OF METABOLIC ENERGY UTILIZATION IN THE SKYLAB ASTRONAUTS
J. I. Leonard 19 Dec. 1977 97 p
(Contract NAS9-14523)
(NASA-CR-160402; TIR-741-MED-7018) Avail: NTIS HC A05/MF A01 CSCL 05H

Skylab biomedical data regarding man's metabolic processes for extended periods of weightlessness is presented. The data was used in an integrated metabolic balance analysis which included analysis of Skylab water balance, electrolyte balance, evaporative water loss, and body composition. A theoretical analysis of energy utilization in man is presented. The results of the analysis are presented in tabular and graphic format. R.E.S.

N80-13771*# General Electric Co., Houston, Tex. Apollo Systems Dept.
SKYLAB WATER BALANCE ERROR ANALYSIS
J. I. Leonard 5 May 1977 39 p refs
(Contract NAS9-14523)
(NASA-CR-160403; TIR-782-LSP-7006) Avail: NTIS HC A03/MF A01 CSCL 05H

Estimates of the precision of the net water balance were obtained for the entire Skylab preflight and inflight phases as well as for the first two weeks of flight. Quantitative estimates of both total sampling errors and instrumentation errors were obtained. It was shown that measurement error is minimal in comparison to biological variability and little can be gained from improvement in analytical accuracy. In addition, a propagation of error analysis demonstrated that total water balance error could be accounted for almost entirely by the errors associated with body mass changes. Errors due to interaction between terms in the water balance equation (covariances) represented less than 10% of the total error. Overall, the analysis provides evidence that daily measurements of body water changes obtained from the indirect balance technique are reasonable, precise, and relaible. The method is not biased toward net retention or loss. R.E.S.

N80-13772# Bendix Corp., Davenport, Iowa. Instruments and Life Support Div.
ANTI-SUFFOCATION VALVE BENDIX TYPE NO. 3267010-0101 Final Report
J. Mientus, R. Cramer, and J. Dunbar 16 Apr. 1979 26 p refs
(Contract N62269-76-C-0214)
(AD-A068927; NADC-79010-60) Avail: NTIS HC A03/MF A01 CSCL 06/11

The oxygen supply currently located in the RSSK (Rigid Seat Survival Kit) provides the aircrew member with an emergency source of oxygen in the event of an in-flight failure of the aircraft oxygen system, during parachute descent, or in the event of aircraft ditching. An inherent danger in the system is the suffocation of an unconscious aircrew member who cannot remove his mask in the event the emergency oxygen supply becomes depleted or is malfunctioning. The protection envelope currently provided the aircrew member will be greatly enhanced through the incorporation of an anti-suffocation valve, providing the capability of breathing ambient air when oxygen from the emergency supply is no longer available. The valve overcomes the danger of an aircrew member unknowingly breathing air during normal in-flight operation, and prevents the entrance of water during an underwater or flotation condition. GRA

N80-13773# ITT Electro-Optical Products Div., Roanoke, Va.
AVIATION NIGHT VISION GOGGLE Final Report, 13 Jul. 1977 - 16 Mar. 1979
Pete Hartman 29 Mar. 1979 54 p
(Contract DAAK70-77-C-0179)
(AD-A073296) Avail: NTIS HC A04/MF A01 CSCL 17/8

The intent of this program was to demonstrate the feasibility of a lightweight goggle which possessed a unique 'flip-up' capability and utilized the existing Generation II or (Gen III) lightweight image intensifier assembly. The contract consisted of the design, fabrication, test, and delivery of two Aviation Goggles with two minor design iterations. The contract modification consisted of retrofitting two sets of goggles with lightweight image intensifier. GRA

N80-13774# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.
SPACELAB ENVIRONMENT INVESTIGATION BY MASS SPECTROMETER Final Report
Gunther Kupfahl and Rolf Maisch Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1978 70 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1075; DFVLR-BPT-01-00-016)
(BMFT-FB-W-78-02) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14.50

The aptness of the extremely clean environment onboard Spacelab to scientific and technological experimentation is considered. The limitations of this cleanliness due to leakage and outgassing from the Shuttle-Spacelab system are defined. Contamination control, mandatory for certain missions, is described. The use of mass spectrometers, being best suited to this purpose, as measuring instruments is recommended. Type and preliminary specifications for this equipment are given. It is pointed out that this instrument can be used simultaneously for aeronomic research, because the undisturbed and contaminated atmosphere can be separated by an energy discriminator. A set of control mechanisms is suggested to cover at least one halfsphere of the space around is Spacelab. Author (ESA)

N80-13775# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
A FIELD OF VIEW SIMULATOR EQUIPPED FOR PERSPECTIVE TRANSFORMATION ON A TELEVISION RASTER [EIN SICHTSIMULATOR MIT PERSPEKTIVISCHER VERZEICHNUNG DES RASTERS VON FERNSEHBILDERN]
H. Heising Dec. 1977 78 p refs In GERMAN; ENGLISH summary
(FB-34) Avail: NTIS HC A05/MF A01; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. DM 10

For ergonomical investigations of visual simulation problems a system which simulates the outside visual environment as seen by an aircraft pilot was developed. Television technology was used for storage and display of moving images because of its low cost and technical maturity. High accuracy and fast computation requirements are accomplished with a specially built analog computing network which is described in detail. This visual simulation technique is applicable to a wide range of tasks and visual situations in which perspective transformations of images are desired. Author (ESA)

N80-13776# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
ON THE OPTIMIZATION OF SPRING ELASTICITY, DAMPING, AND INERTIA EFFECTS ON THE SPRING LOADING OF A CONTROL STICK [ZUR OPTIMIERUNG VON FEDER-, DAEMPFUNGS- UND MASSEANTEILEN BEIM BEWEGUNGSWIDERSTAND EINES LENKKNUEPPELS]
W. Krueger May 1978 41 p refs In GERMAN; ENGLISH summary
(FB-37) Avail: NTIS HC A03/MF A01; Forschungssinst. fuer Anthropotech., Meckenheim, West Germany DM 10

In manual control the performance of the human operator can be influenced by the design of controls. Deflection-resistance characteristics are of special interest due to the movement resistance of the control. In order to investigate several reaction forces of a joystick, a series of experiments was conducted. The optimal control forces as a combination of spring force (0, 1, 2, 3.5 N/cm) viscous damping (0, 0.2, 0.35 N/cm/sec), and inertia (0, 2 kg) were obtained. A second and third order tracking task (simplified longitudinal and lateral dynamics of an airplane) was

used. Results show that only spring force (1.0 to 3.5 N/cm), can improve tracking performance. Damping and inertia effects were negative using a low spring stiffness of 1.0 N/cm. Self adjusted stiffness by well trained subjects was 1.7 N/cm.
Author (ESA)

N80-13777# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
A COMPARISON OF CONTROL SIMULATORS HAVING FORCE INPUTS AND DISPLACEMENT FEEDBACK. APPLICATIONS TO THE MANUAL CONTROL OF UNDERWATER VEHICLES [UNTERSUCHLING EINES BEDIENELEMENTS MIT KRAFTEINGABE UND WEGRUECKMELDUNG BEI DER MANNELLEN LENKUNG VON UNTERWASSERFAHRZEUGEN]
H. E. Boller and W. Krueger May 1978 32 p refs In GERMAN; ENGLISH summary
(FB-38) Avail: NTIS HC A03/MF A01; Forschungsinst. fuer Anthropotech., Meckenheim, West Germany DM 10

In manual control, human operator performance can be improved by kinesthetic feedback of vehicle dynamic behavior. In a low-frequency system, the advantage of kinesthetic feedback may be reduced by slow system reactions. Two different single axis control yokes, each with the functional capability of either pure displacement inputs of force input with a displacement feedback as a kinesthetic display of vehicle response were compared. Eight subjects were used in controlling a simulated submarine while making several changes in depth. Results did not support a preference for the force yoke with a displacement feedback. It is recommended not to use this type of control device in steering such a one-axis low-frequency system.
Author (ESA)

N80-13778# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
ON THE PROBLEM OF SPRING LOADED RESISTANCE TO SIMPLE AND COMPLEX POSITIONING OF A CONTROL STICK [ZUM PROBLEM DES BEWEGUNGS- WIDERSTANDS BEI EINFACHEN UND KOMPLEXEN STELLBEWEGUNGEN DES ARMES]
G. Rothbauer Oct. 1978 150 p refs In GERMAN; ENGLISH summary
(FB-40) Avail: NTIS HC A07/MF A01; Forschungsinst. fuer Anthropotech., Meckenheim, West Germany DM 10

To provide good proprioceptive feedback in a manual control device for a designation task, spring resistance of a joystick was optimized by using the psychophysical method of cross modality matching. Designation with zero and first order systems showed that the coarse adjustment was insensitive to stick and certain task parameters, although it was influenced by some biomechanical parameters and the anticipated demands of the final control positioning. Only the more difficult fine adjustment is sensitive to parameter alteration and therefore suitable for optimization attempts. The strong centering of the stick by nonlinear degressive spring resistance facilitates fine adjustment. Through this, total adjustment time with the first order system is reduced by more than 30%, compared to a linear resistance. Tracking experiments confirm the usefulness and preference of nonlinear spring resistance.
Author (ESA)

N80-13779# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
THE AUTOMOBILE DRIVING SIMULATOR FOR ANTHROPOGENIC RESEARCH
E. Donges Jul. 1978 48 p refs In GERMAN; ENGLISH summary uft der fahrsimulator des forschungsinstituts fuer anthropotechnik
(FB-41) Avail: NTIS HC A03/MF A01; Forschungsinst. fuer Anthropotech., Meckenheim, West Germany DM 10

The setup of a driving simulator which is used for the investigation of human behavior in guiding motor vehicles is described. The front part of a fully equipped car body serves as a mock-up for the driver. The simulation of lateral and longitudinal vehicle dynamics is based on simplified motion equations and characteristics implemented on a digital process computer. An electronic visual outside world simulation generates a synthetic, central perspective view of a two lane road according to vehicle motions. The driving noise is composed of simulated engine, tire, and wind noise. The simulator mock-up can be rotated in degrees of freedom (roll and pitch) by an electro-hydraulic servosystem. Steering wheel forces are provided by an electromechanical servosystem corresponding to a static characteristic with hysteresis. The data transfer between the simulator components, the simulation mode control, and data acquisition is coordinated by a digital process computer which also solves the dynamic equations of vehicle motion in real time.
Author (ESA)

N80-13780# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
ON THE INTERACTION BETWEEN SYSTEM AND TASK PARAMETERS THROUGH CONTINUOUS MANUAL CONTROL [INTERAKTION VON SYSTEM- UND AUFGABENPARAMETERN BEI KONTINUIERLICHER MANUELLER REGFLUNG]
G. Rothbauer Mar. 1979 39 p refs In GERMAN; ENGLISH summary
(FB-42) Avail: NTIS HC A03/MF A01; Forschungsinst. fuer Anthropotech., Meckenheim, West Germany. DM 10

Experiments in pursuit tracking with a first order system were conducted. Tracking performance, depending on the forcing function bandwidth, the system parameters control gain and control spring resistance as well as their interactive influence, was investigated. These experiments, giving six subjects the possibility of self adjusting the system parameters according to the task, resulted in parameter settings which required an intraindividually constant average control force for the accomplishment of the task. It is noted that the average control deflection varied considerably. Results are interpreted according to the importance of proprioceptive force-feedback in continuous control.
Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-13781 Michigan Univ., Ann Arbor.
A STRUCTURED LOGICAL DATABASE DESIGN METHODOLOGY, VOLUMES 1 AND 2 Ph.D. Thesis
Beverly Katz Kahn 1979 458 p
Avail: Univ. Microfilms Order No. 7925171

Designing a data base is a difficult, complex and unstructured process. A methodology for improving that part of the data base design process that takes a set of many individual requirements specifications and transforms them into a single, consistent and complete logical data base structure for a specific data base management system is described. The logical data base design process proposed consists of sub processes which produce the

following outputs: (1) local information structure, (2) global information structure, (3) entity structure, (4) revised entity structure, and (5) logical data base structure. This decomposition of the data base design process provides a greater degree of data independence and more flexible data base than the traditional two-level decomposition. Dissert. Abstr.

N80-13782 Columbia Univ., New York.
A SPECIFICATION OF DATA STRUCTURES WITH APPLICATION TO DATA BASE SYSTEMS Ph.D. Thesis
Maurice Bach 1979 219 p
Avail: Univ. Microfilms Order No. 7924847

A 'universal' data base model was constructed in order to compare the efficiency of different data base systems. The descriptive language used is based on a fragment of first order logic without quantifiers but with free individual variables. The use of such a language has great advantages as it has a well understood syntax and semantics. Unfortunately, its disadvantages include its reliance on inductive definitions and the fact that it is not a compact language. The language was applied to the description of several constructs common to many programming languages. The language was also used to describe the different types of data bases which are used today, including relational, hierarchical and network data base systems. Procedures for translating the 'conceptual' data model to 'storage' models are presented. Dissert. Abstr.

N80-13783 Syracuse Univ., N. Y.
THE ANALYSIS OF PROCESSOR-TIME TRADE-OFF OPPORTUNITIES IN A RECONFIGURABLE MULTIPROCESSOR SYSTEM Ph.D. Thesis
Hendrik Spaanenburg 1979 145 p
Avail: Univ. Microfilms Order No. 7925601

The feasibility and attractiveness of a multimodality multiprocessor network are considered. The network is dynamically structurable into configuration modes that facilitate pipeline and parallel computations. The selection of structures made form a powerful set of computational alternatives. A distinction is made between the deterministic case where all relevant execution times are known, and the nondeterministic one where a certain amount of uncertainty is present. It is shown that in either case, the result is that a tradeoff opportunity exists between the number of processors used for a particular computation and the execution time involved. The exact shape of that tradeoff curve is a function of the accuracies of the assumptions involved. Dissert. Abstr.

N80-13784 Wayne State Univ., Detroit, Mich.
INTERCONNECTION NETWORKS IN MULTIPLE-PROCESSOR SYSTEMS Ph.D. Thesis
Chuan-lin Wu 1979 242 p
Avail: Univ. Microfilms Order No. 7921739

The methods for interconnecting a large number of functional units in a multiple processor system and the multistage interconnection networks were reviewed. The limitations of the conventional interconnection organizations were surveyed. Multistage interconnection networks which were proposed from significantly different viewpoints were studied. A wide variety of switching concepts and parameters, which a designer may have to encounter in planning and designing an interconnection network were summarized. A set of characteristics of interconnection networks for specifying the performance standard as well as the requirements of hardware facilities and communication protocols for cost effective implementations of interconnection networks were provided. A class of multistage interconnection networks was defined by introducing a baseline network and a condition of topological equivalence. Dissert. Abstr.

N80-13785 Washington Univ., Seattle.
THE APPLICATION OF FORMAL MODELS TO A FULLY ADAPTIVE GENERAL PURPOSE DIGITAL DATA COMPRESSION SYSTEM Ph.D. Thesis
George Branston Houston 1979 359 p
Avail: Univ. Microfilms Order No. 7927805

An efficient, practically realizable, general-purpose digital data compression system which can compress, in one pass, mixtures of data; achieve compression performance comparable to that of less general or less efficient systems; and can be used in applications where general compression systems were previously considered infeasible is presented. Formal models are used which capture essential similarities and differences between compression systems, and show how to decompose compression systems into practically useful primitive elements. They also enable a formal demonstration that integrity of the reconstructed data can be assured by imposing simple conditions on the primitive elements. Dissert. Abstr.

N80-13786 Washington Univ., Seattle.
A COMPILER DESIGN FOR MULTIPLE INDEPENDENT PROCESSOR COMPUTERS Ph.D. Thesis
Daniel Edward Lipkie 1979 200 p
Avail: Univ. Microfilms Order No. 7927831

A directed graph model for information flow in a multiple independent processor computer (MIP) is developed and used to present a compiler designed to run well on such a computer. The MIP compiler design is evaluated by performing trace driven simulations where data for driving the simulations is derived from the uniprocessor compiler. Simulation results show that the speedup in compilation due to concurrent separate compilation is linear in the number of processors available while the speedup due to concurrent multipass compilation is approximately logarithmic in the number of processors available. The selection of scheduling techniques is determined by the MIP computer's operational parameters, such as homogeneous or nonhomogeneous processors, and the cost of changing the process a processor is executing. Dissert. Abstr.

N80-13787 Washington Univ., Seattle.
PROCESSOR AND FILE ALLOCATION IN DISTRIBUTED DATA BASE SYSTEMS Ph.D. Thesis
Hugo Moorgat 1979 216 p
Avail: Univ. Microfilms Order No. 7927844

An integrated view of distributed computer networks, computer communications and distributed data base systems is provided. Design and operational issues of distributed data bases are classified and discussed in detail. Efforts to model distributed data bases are surveyed and critically reviewed. A taxonomy for distributed data base design optimization models is presented. A three-level decision model to determine optimal processor allocation, file allocation and transaction routing decisions is developed and formulated as a mixed integer linear program. Specialized algorithms based on Benders' decomposition are specified for this model. Dissert. Abstr.

N80-13788 Polytechnic Inst. of New York.
THE SELF-ORGANIZING DATA BASE Ph.D. Thesis
Marsha Moroh 1979 191 p
Avail: Univ. Microfilms Order No. 7920793

A relational data base design technique in which all relations are constructed dynamically is presented. Instead of a fixed structure in which different substructures are defined for different users, the relation structure described is constantly and automatically reorganized as new relationships are entered into the system. Thus, the single set of relations is derived from the various users' specifications and united in a single system view, and constantly changing to reflect current needs of users. A set of algorithms are described for synthesizing relations from functional dependencies by dynamic computation of the transitive closure and minimum covering set of relations. These algorithms form the core of an automated system which generates and manages many simultaneous differing views of the data, each of which incorporates the features of a conventional, statically-designed normalized relational data base. Dissert. Abstr.

N80-13789 Purdue Univ., Lafayette, Ind.
THE MODELING OF VIRTUAL MEMORY SYSTEMS Ph.D. Thesis
Peter J. Denning 1979 178 p
Avail: Univ. Microfilms Order No. 7926430

Approaches to modeling computing systems via queueing networks both analytic and discrete were considered. The models were of a generic virtual memory system comprising central processing unit(s), a paging device, an I/O system, and a source of jobs. The model of program behavior explicitly incorporates phase/transition and swapping behavior; its parameters were taken from real data. The analytic model was a multiclass queueing network capable of incorporating these different program states.

The model was used to compare three policies for reloading a program's resident set when the job is restarted after an inactive period. The assumptions used to transform program parameters into parameters of the queueing network model were studied. A discrete simulation model of the virtual memory system was compared with the analytic model. The results indicate that the simulator incorporates much more detail about memory management than does the analytic model. Dissert. Abstr.

N80-13790# Wright State Univ., Dayton, Ohio. Dept. of Computer Science.
PDP-11 COMPUTER MONITORING SYSTEM Final Report, 1 Apr. 1976 - 30 Nov. 1978
J. E. Brandeberry, L. A. Crum, R. D. Dixon, and C. B. Ross 17 Oct. 1978 86 p
(Contract F33615-76-C-1258; AF Proj. 2003)
(AD-A072966; AFAL-TR-78-192) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes a hardware system for controlling and accounting for use of up to 15 PDP-11's with up to 700 users. The system functions much like a software accounting system on a large time-sharing system and is designed for compatibility with DEC system-10 accounting packages. The hardware includes an SBC-80/10 microcomputer interface located in each PDP-11. The interface requires one system unit in the PDP-11 box. The interface becomes 'bus master' when the PDP-11 is turned on. It remains 'bus master' until the PDP-11 user has correctly 'logged on' to the system through the console terminal. The accounting data and user identification are stored on a PDP-11/04 system which communicates with each SBC-80/10 microcomputer via a serial RS232 communications link. The user identification is generated in a DEC system-10 and transferred to the PDP-11/04 over a serial asynchronous communication link. Account data is periodically transferred to the DEC system-10 via the same communications path. GRA

N80-13791# Yale Univ., New Haven, Conn. Dept. of Computer Science.
THE TRANSFER OF INFORMATION AND AUTHORITY IN A PROTECTION SYSTEM
Matt Bishop and Lawrence Snyder Jul. 1979 34 p refs
(Contract N00014-75-C-0752)
(AD-A073370; RR-166) Avail: NTIS HC A03/MF A01 CSCL 09/2

We distinguish between the transfer of information and the transfer of authority, and extend the Take-Grant Model to describe the former. The conditions under which information (but not authority) might be transferred are given, one characterization using the rules for transferring information alone, and another combining them with the previously-developed rules for transferring authority. GRA

N80-13792# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.
USE OF VIRTUAL MACHINES IN THE DEVELOPMENT OF DECISION SUPPORT SYSTEMS Final Technical Report, Sep. 1977 - Jan. 1979
John J. Donovan, Stuart E. Madnick, Chat-Yu Lam, and Tarek K. Abdel-Hamid Jul. 1979 251 p refs
(Contract F30602-77-C-0205; AF Proj. 5581)
(AD-A073748; RADC-TR-79-187) Avail: NTIS HC A12/MF A01 CSCL 09/2

This effort is composed of several studies that have been conducted to investigate the development of a software programming environment for decision support systems using virtual machine technology as an integrating tool. The final report combines the efforts of Reports 1-5 and highlights the merits of virtual machine technology as a software engineering tool. Report 1 examines various strategies for interfacing virtual machines. Report 2 examines these strategies and utilizes the CIS System to demonstrate their applicability. Report 3 highlights the components of a Composite Information System (CIS). This system demonstrates multiple access to incompatible data bases using virtual machines. Report 4 utilizes the CIS system to demonstrate potential for enhancing decision-making in critical areas of SPO management. Finally, Report 5 develops the framework for a Composite Data System (COMPDATA). This system studies the interface problems of coordinating multiple-user access to multiple incompatible data base systems. GRA

N80-13793# California Univ., Livermore. Lawrence Livermore Lab.
SLIC: AN INTERACTIVE MESH GENERATOR FOR FINITE ELEMENT AND FINITE DIFFERENCE APPLICATION PROGRAMS
M. A. Gerhard and R. C. Greenlaw 11 May 1979 18 p refs
Presented at Intern. Conf. on Structural Mech. in Reactor Tech., Berlin, 13 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-81931; CONF-790802-15) Avail: NTIS HC A02/MF A01

An interactive mesh program which builds and plots two and three dimensional continuum meshes from interactive terminal or disc input is described. The user inputs coordinates for certain key points and enters commands which complete the description of the geometry. Entire surfaces and volumes are then generated from the geometric skeleton. The program allows the user to correct input errors and saves the corrected command list for later reuse. The mesh can be plotted on a video display at any stage of development to evaluate the work in progress. Output is in the form of an input file to a user-selected computer code. DOE

N80-13794# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
EVALUATION OF A SIMULATION FRAME PROGRAM FOR THE EAI PACER 600 HYBRID-COMPUTER
Hans-Heinz Lange 1979 31 p refs
(DFVLR-Mitt-79-01) Avail: NTIS HC A03/MF A01

An example of a simulation program is given. It was developed for extended aircraft simulation problems, but it can be used in many simulation tasks. The computer used was a hybrid system with one analog console and two digital processors, EAI Pacer 600 Type. This program structure is compatible with other computer systems. Some operating features are pointed out being important for increasing the simulation power of the system in order to deal with more complex multivariable real time simulation problems are indicated. Author (ESA)

N80-13795# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
THE USE OF A MICROPROCESSOR FOR THE MANIPULATION AND REPRESENTATION OF LARGE AMOUNTS OF DATA ON A COLOR TELEVISION MONITOR [EINSATZ EINES MIKROPROZESSORS BEI DER UEBERICHTSDARSTELLUNG UND MANIPULATION GROSSER DATENMENGEN AUF FARBFERNSEHMONITOREN]
M. Haeusing, K.-P. Holzhausen, and P. Wolf Sep. 1978 77 p
In GERMAN; ENGLISH summary
(FB-39) Avail: NTIS HC A05/MF A01; Forschungsinst. fuer Anthropotech., Meckenheim, West Germany DM 10

A color raster scan display system which is composed of modules and which utilizes standard color TV monitors as display media is presented. The preprocessing of command and display data as well as control of man-system interaction via a terminal is performed by a microprocessor. Given the example of presenting large amounts of data as a two-dimensional color pattern, it is shown how display formats, associated display colors, and text can be manipulated in a very flexible manner. Author (ESA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-13796 North Carolina Univ. at Chapel Hill.
BUILDING EFFICIENT PASS-ORIENTED ATTRIBUTE GRAMMAR EVALUATORS Ph.D. Thesis
Diane Phylis Pozefsky 1979 247 p
Avail: Univ. Microfilms Order No. 7925956

Operations applicable to all attribute grammars are reviewed

including the identification and elimination of useless and local attributes, the removal of erasing productions from an attribute grammar, and methods of improving the set of semantic rules associated with a particular production. A subfamily of pass-oriented attribute grammar evaluators is identified whose evaluators can be produced easily by a single evaluator generator. Methods are then explored to improve the time and space requirements of the member evaluators. Improvements are made in the speed of the evaluators by eliminating the parse tree and controlling evaluation by files of calls. Storage improvements are made by identifying the useful life span of attributes, storing on a stack those that are only needed for a single pass, and dynamically allocating and freeing others. Profiles of attribute grammars for real languages are given to support the value of many of the features presented. Dissert. Abstr.

N80-13797 New York Univ., N. Y.
EXPRESSION CONTINUITY AND THE FORMAL DIFFERENTIATION OF ALGORITHMS Ph.D. Thesis
Robert Allan Paige 1979 386 p
Avail: Univ. Microfilms Order No. 7925508

Formal differentiation is a program optimization technique which generalizes the method of strength reduction and provides a convenient framework with which to implement a host of program transformations including 'iterator inversion'. This technique which captures a commonly occurring yet distinctive mechanism of program construction in which succinct algorithms involving costly repeated calculations are transformed into more efficient incremental versions, is described. Algorithms are presented which can implement formal differentiation transformations both automatically and semiautomatically for programming languages ranging from FORTRAN to SETL. A comprehensive semiautomatic implementation design for a restricted version of SETL called Subsetl is also presented. Dissert. Abstr.

N80-13798 New York Univ., N. Y.
COMPARISON OF DIRECT CODE GENERATION AND INTERMEDIATE LANGUAGE GENERATION FOR BOOTSTRAPPING THE MACHINE-INDEPENDENT COMPILER, LITTLE Ph.D. Thesis
Paul Benedict Schneck 1979 225 p
Avail: Univ. Microfilms Order No. 7925523

Two techniques for transporting the machine independent compiler, LITTLE, are compared. A code generator for the target machine is implemented and tested on the host machine and then used to compile the LITTLE compiler into a form suitable for execution on the target machine. In addition, the code generator for the host machine is replaced by a code generator for a hypothetical machine language and a translator is written and used to produce the target machine language from the intermediate language. Pitfalls in the implementation of machine independent compilers are discussed. It is concluded that the use of an intermediate language simplifies the transporting of a machine independent compiler with little or no penalty in performance. Dissert. Abstr.

N80-13799 California Univ., Santa Cruz
GENERATING CORRECT PROGRAMS FROM LOGIC SPECIFICATIONS Ph.D. Thesis
Ruth Ellen Davis 1979 198 p
Avail: Univ. Microfilms Order No. 7924588

A system that translates logic specifications into an intermediate language and then generates programs from the intermediate form was implemented in MACLISP on a DEC KL10. The specification language and the intermediate language are described using a context free grammar for the syntax and an axiomatic specification of the semantics. The mapping from specification language to intermediate language is described and it is proven that this mapping preserves the axiomatic semantics of the specifications. The mapping from the intermediate language to LISP is also described and proven correct. The implementations for LISP and PASCAL are discussed and guidelines are given for adding more languages to the system. Dissert. Abstr.

N80-13800 Carnegie-Mellon Univ., Pittsburgh, Pa.
COMPUTATIONAL EXPERIMENTS WITH ZERO-ONE PROGRAMMING ALGORITHMS AND HEURISTICS Ph.D. Thesis
Clarence H. Martin 1979 291 p
Avail: Univ. Microfilms Order No. 7925020

The development and computional testing of approaches to the solution of zero-one programming problems of general structure are discussed. Aspects of one or more of the three principal methods for solving zero-one programs, that is, enumeration, cutting planes, and heuristics are examined. The pivot and compliment procedure, a heuistic for finding approximate solutions to pure zero-one programs is introduced. Partitioning strategies for zero-one programs are developed. A cutting approach that uses disjunctive cutting planes generated by a branch and bound procedure is reported. An enumeration procedure based on cross branching is summarized. Two mathematical programming codes were expanded. Dissert. Abstr.

N80-13801 North Carolina State Univ. at Raleigh
PARALLEL INTERACTIVE PROCESSING IN SHADED COLOR GRAPHICS Ph.D. Thesis
Stavros Boinodiris 1979 133 p
Avail: Univ. Microfilms Order No. 7923035

Computing systems dealing with the parallel processing of multidimensional primatives are investigated. Interlinked investigations were executed to find an appropriate structure with modular independence. The various facets of an orderly decomposition of a system into a set of independent subsystems and the problems of optimizing such a decomposition were examined. The choice of a structure with the greatest modular independence among hierarchical structures was studied. Results are reported. Dissert. Abstr.

N80-13802 Pennsylvania Univ., Philadelphia
REAL-TIME EMULATION OF HARDWARE Ph.D. Thesis
Christian Lenz Cesar 1979 431 p
Avail: Univ. Microfilms Order No. 7928115

An approach is described for translating a description of a random-logic into microprocessor code that can execute fast enough to satisfy the hard real-time constraints imposed by the surrounding environment. This approach involves solving problems in different areas of computer and management sciences. In the area of hardware description languages, concepts and models are introduced for the systematic proceduralization of a nonprocedural language and give algorithms for this purpose. In the area of job-scheduling, a classical job-scheduling problem is extended by adding another precedence-type constraint on jobs and discussing its solution. Dissert. Abstr.

N80-13803 Carnegie-Mellon Univ., Pittsburgh, Pa.
PERFORMANCE MEASUREMENT AND ANALYSIS OF CERTAIN SEARCH ALGORITHMS Ph.D. Thesis
John Gary Gaschnig 1979 330 p
Avail: Univ. Microfilms Order No. 7925014

The methodology of analysis of algorithms to study certain combinatorial problems and search algorithms originating predominantly in the AI literature is discussed. The methodology is extended to include experiments in a complementary role. Experimental and analytic techniques are combined to measure and to predict the performance of the A* best first search algorithm, which solves path finding problems defined in terms of finite strongly connected graphs. Experimental results for a second problem domain are reported. Dissert. Abstr.

N80-13804 Washington Univ., Seattle
BOUNDED NONDETERMINISM AND THE PARALLEL PARSING OF CONTEXT FREE LANGUAGES Ph.D. Thesis
Paul Douglass Frank 1979 407 p
Avail: Univ. Microfilms Order No. 7927785

Several concepts of bounds on the amount of nondeterminism used in computations are proposed. A tree-like structure (a computation tree), and four different restrictions on the structures of such computation trees are introduced as bounds on nondeterminism itself; they are called the chain bound, the path bound, the width bound, and the read bound. The applications of these bounds on nondeterminism to three well known models of computation are explored in depth. Pushdown automata (PDA's) are considered in their role as recognizers of context free languages. Based on the degree of nondeterminism required in PDA computations, several infinite hierarchies of languages which fall in the gap between the deterministic context free languages

and the class of all context free languages are established. Decidability questions relating to bounds on nondeterminism for PDA's are also examined. Dissert. Abstr.

N80-13805 Washington Univ., Seattle.
THE DESIGN AND EVALUATION OF ALGORITHMS FOR PARALLEL PROCESSING Ph.D. Thesis
Carla Jean Ellis 1979 206 p
Avail: Univ. Microfilms Order No. 7927773

Modeling tools and design techniques to aid in developing correct parallel algorithms for multiple instruction stream - multiple data stream type multiprocessors were investigated. A design methodology based on the use of a graph model for parallel computation is described and a variety of parallelization techniques which can be applied to existing sequential solutions are illustrated. A major consideration is the impact of shared data structures on these on these methods for designing highly concurrent software. Two extensive case studies are presented. The first study focuses on the use of a model as a design tool. An extension of Petri Nets is employed in the modeling of an existing sequential compiler. The model contributes to an understanding of the sequential program and serves to identify conflicts in proposed parallel versions. The compiler is then modified to operate as a pipeline of three processes and its performance is measured. Simulation experiments indicate a speedup improvement of 2 to 1 and thus confirm the feasibility of this approach. Dissert. Abstr.

N80-13806 Northwestern Univ., Evanston, Ill.
EFFECT OF PROGRAM MODIFICATIONS ON SOFTWARE PERFORMANCE Ph.D. Thesis
James Samuel Collofello 1979 208 p
Avail: Univ. Microfilms Order No. 7927319

The possible ripple effect of software modifications during the maintenance phase on the performance of the system is analyzed. A maintenance technique for predicting which performance requirements in the system may be affected by a proposed modification is developed. Mechanisms for the propagation of performance changes from one part of the system to another are identified. Performance attributes and critical software sections are also reported. Dissert. Abstr.

N80-13807 Northeastern Univ., Boston, Mass.
ADAPTIVE ALGORITHMS FOR REDUCTION OF INTER-CHANNEL AND INTERSYMBOL INTERFERENCE IN DIGITAL COMMUNICATIONS Ph.D. Thesis
Howard Edward Nichols 1979 167 p
Avail: Univ. Microfilms Order No. 7923539

The problem of digital communication in a communication system where the primary limitation on the error performance is due to interchannel interference and intersymbol interference is considered. A number of adaptive algorithms are described as potential solutions to this problem. These algorithms may be broadly classified into two categories: (1) algorithms based on a minimum mean square error (MSE) criterion, and (2) algorithms based on a maximum likelihood detection (MLD) criterion. The MSE algorithms include both linear algorithms and nonlinear decision feedback equalization algorithms. The MLD algorithms are all nonlinear including both a MLD symbol detection algorithm for memoryless channels and a multichannel generalization of maximum likelihood sequence estimation. Performance results are presented for each algorithm in terms of the residual MSE (as appropriate) and the probability of bit error. Dissert. Abstr.

N80-13808 Wisconsin Univ. - Madison.
SUPERLINEARLY GLOBALLY CONVERGENT ALGORITHMS FOR NONLINEAR PROGRAMMING VIA SEQUENTIAL LINEAR PROGRAMS Ph.D. Thesis
Jerome Lawrence Kreuser 1979 211 p
Avail: Univ. Microfilms Order No. 7922813

Superlinearly globally convergent algorithms which solve nonlinear programming problems by solving a sequence of linear programming problems are presented. Algorithms are first developed for the minimization of a class of nondifferentiable functions using the convex function, the optimality function, and the descent direction. A generalized convergence theorem and a rate of convergence theorem are given. It is then shown that the subproblem which uses the convex approximation to determine descent directions can be solved as a linear programming problem. Classes of algorithms are proposed for the solution of general nonlinear programming problems and nonlinear systems of equalities and inequalities by reformulating the problem as the minimum of a nondifferentiable function. Dissert. Abstr.

N80-13809 Yale Univ., New Haven, Conn.
THE COMPLEXITY OF THE MAXIMUM SUBGRAPH PROBLEM Ph.D. Thesis
John Murchie Lewis 1979 101 p
Avail: Univ. Microfilms Order No. 7927636

The conditions that imply a problem to be NP-complete are described. A class of problems termed maximum subgraph problems are dealt with. Several infinite subclasses of these problems are defined. For each subclass, a general reduction scheme that allows any member of the subclass to be proved NP-complete is given. It was concluded that the maximum subgraph problem for a property is complete for NP if the property can be defined by a set of forbidden subgraphs having one of the following forms: (1) the forbidden subgraphs are all biconnected; (2) the forbidden subgraphs are all connected, and the set is finite; (3) the forbidden subgraphs are all homeomorphic from some connected graph; (4) the forbidden subgraphs are all connected, and one has a vertex of degree one; and (5) there is a single forbidden subgraph. Dissert. Abstr.

N80-13810 Maryland Univ., College Park.
HEURISTIC APPROACHES TO THE DECOMPOSITION OF SPARSE MATRICES Ph.D. Thesis
George Francis Lowe 1979 169 p
Avail: Univ. Microfilms Order No. 7926517

Heuristic algorithms were developed for several large sparse matrices problems. These algorithms are presented along with extensive computational tests and comparisons with the classical algorithms. Several theoretical results pertaining to those problems are also developed. Dissert. Abstr.

N80-13811 Northwestern Univ., Evanston, Ill.
ON SOME GRAPH-THEORETIC PROBLEMS IN PROGRAM TESTING Ph.D. Thesis
Simeon Christos Ntafos 1979 90 p
Avail: Univ. Microfilms Order No. 7927414

Various path cover problems arising in program testing are discussed. Dilworth's theorem for acyclic digraphs is generalized and two methods for finding a minimum path cover for the vertices (or the edges) of a digraph are given. The notions of required pairs and required paths are introduced to model interactions among code segments. It is shown that finding a minimum path cover for a set of required pairs is NP-hard. Other constrained path problems dealing with must pairs, must paths, and impossible paths are considered and their complexities are discussed. Then, structured digraphs are introduced and a labelling procedure which characterizes structured digraphs is described. The minimum path cover problem and the required pair and must pair problems are treated for an important family of structured digraphs. Dissert. Abstr.

N80-13812 Cornell Univ., Ithaca, N. Y.
VERIFICATION OF ENCAPSULATED IMPLEMENTATIONS OF ALGEBRAICALLY SPECIFIED DATA TYPES Ph.D. Thesis
Patrick Kirkpatrick Orr 1979 163 p
Avail: Univ. Microfilms Order No. 7926942

A simple programming language that supports encapsulation is presented with a method for verifying encapsulated type definitions with respect to algebraic specifications of those types, and an axiomatic system for verifying programs that use correct implementations of algebraically specified data types. An interpretation of theorems derivable from an algebraic specification that interprets those theorems as axiomatic formulas relating variables in the programming language is given. This interpretation was used to derive a set of verification conditions for an encapsulation of a type from an algebraic specification of that type. Significant results are reported. Dissert. Abstr.

N80-13813 California Univ., Los Angeles.
MEASUREMENT, MODELING AND MANAGEMENT OF PHASED PROGRAM BEHAVIOR Ph.D. Thesis

best copy available

Douglas Richard Partridge 1979 388 p
Avail: Univ. Microfilms Order No. 7926053

Phase level program behavior, its relationship to storage hierarchy performance, and its direct utilization by storage management techniques were explored. A cluster analysis procedure for partitioning program reference strings into phases was developed and demonstrated using recorded address traces from three separate programs. Characteristics of the detected phases were reported. A class of generative program behavior models based on the cluster analysis procedure was formulated and an instance validated for each of three programs using trace analysis techniques. Application of these models to the analysis of main memory management and cache replacement algorithms was demonstrated. Other applications were suggested.
Dissert. Abstr.

N80-13814*# Pennsylvania State Univ., University Park. Materials Research Lab.
AN INVESTIGATION OF OPTIMIZATION TECHNIQUES FOR DRAWING COMPUTER GRAPHICS DISPLAYS Final Report
Frederick R. Stocker [1979] 39 p
(Grant NsG-1328)
(NASA-CR-162509) Avail: NTIS HC A03/MF A01 CSCL 09B

Techniques for reducing vector data plotting time are studied. The choice of tolerances in optimization and the application of optimization to plots produced on real time interactive display devices are discussed. All results are developed relative to plotting packages and support hardware so that results are useful in real world situations.
K.L.

N80-13815*# Lockheed Electronics Co., Houston, Tex. Systems and Service Div.
SPACELAB INTERFACE DEVELOPMENT TESTS. SOFTWARE DESCRIPTION
J. W. Akers Aug. 1979 36 p
(Contract NAS9-15800)
(NASA-CR-160394; JSC-16193; LEC-13703) Avail: NTIS HC A03/MF A01 CSCL 09B

The software requirements for the Spacelab Interface Development Tests are described. The software operates in two modes. The multiplexer-demultiplexer mode transmits operator-controlled information to the Spacelab. The pulse coded modulation (PCM) mode records and displays operator selected PCM data for visual analysis.
R.C.T.

N80-13816*# Lockheed Electronics Co., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION FOR CAMS DEVELOPMENT DOT DATA SYSTEM (CDDDS)
Oscar Wehmanen Sep. 1979 159 p ref
(Contract NAS9-15800)
(NASA-CR-160395; LEC-14055; JSC-16253) Avail: NTIS HC A08/MF A01 CSCL 09B

The CAMS development dot data system is described. Listings and flow charts of the eight programs used to maintain the data base and the 15 subroutines used in FORTRAN programs to process the data are presented.
K.L.

N80-13817# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.
SOFTWARE FOR NONLINEAR FILTERING
R. S. Bucy, F. Ghovanlou, A. J. Mallinckrodt (Communications Res. Lab., Santa Ana, Calif.), and K. D. Senne (MIT, Lincoln Lab., Lexington, Mass.) Jun. 1979 134 p refs
(Contract F44620-76-C-0085; Grant AF-AFOSR-3100-76; AF Proj. 2305; AF Proj. 2304)
(AD-A073051; USCAE-53-4514-1787; USCAE-53-4514-1792; AFOSR-79-0923TR) Avail: NTIS HC A07/MF A01 CSCL 09/2

As part of a continuing search for the ideal architecture for performing the computations required to realize a non-linear filter, we have developed software for various machines over the past ten years. A description of the latest software is given in (1), while (2), (3), and (4) are useful for background information on the non-linear filtering problem as well as comments about software efficiencies relevant to various machines. We started our studies over 10 years ago using the CDC 6600 at the Aerospace Corporation and Kirkland AFB, and continuing at Eglin AFB, see (4). At the Institute for Advanced Computation, we gained access to the ILLIAC IV and of ICASE, NASA Langley, the Star 100, see (2). Access to the Cray was obtained through Cray Research and later NCAR. Experiments on the AP120B array processor were possible because of the acquisition of one here at USC used in conjunction with a PDP 11-55.
GRA

N80-13818# Union Coll., Schenectady, N.Y. Inst. of Administration and Management.
SEQUENTIAL ANALYSIS OF VARIANCE: MONTE CARLO SIMULATION, MULTIVARIATE NORMAL APPROXIMATION, AND ROBUSTNESS Final Report, 1 Jun. 1977 - 1 Aug. 1979
Robert W. Miller 1 Aug. 1979 181 p refs
(Contract N00014-77-C-0438)
(AD-A072629; AES-7907) Avail: NTIS HC A08/MF A01 CSCL 12/1

Monte Carlo simulation and a multivariate normal approximation are used to find the OC and ASN of the sequential analysis of variance test. It is shown that the SANOVA test is remarkably robust.
GRA

N80-13819# Polytechnic Inst. of New York, Brooklyn. Dept. of Electrical Engineering and Electrophysics.
SUMMARY OF TECHNICAL PROGRESS, INVESTIGATION OF SOFTWARE MODELS Interim Technical Report, 1 Jan. 1978 - 31 Jan. 1979
Martin L. Shooman and Henry Ruston Jul. 1979 43 p refs
(Contract F30602-78-C-0057; AF Proj. 2304)
(AD-A073639; POLY-EE-78-052; RADC-TR-79-188) Avail: NTIS HC A03/MF A01 CSCL 09/2

This interim report summarizes the research performed by Polytechnic Institute of New York for Rome Air Development Center. The principal topics covered are (1) software test models and implementation of automated test drivers to force-execute every program path, (2) development of new measures of program complexity based upon information theory, (3) models of software management and organizational structure, and (4) statistical measures relating the probability of finding a program error to the testing of that program.
GRA

N80-13820# Honeywell, Inc., Minneapolis, Minn.
PRELIMINARY REFERENCE MANUAL FOR THE GREEN PROGRAMMING LANGUAGE: A LANGUAGE DESIGNED IN ACCORDANCE WITH THE IRONMAN REQUIREMENTS
15 Apr. 1978 84 p refs
(Contract MDA903-77-C-0331)
(AD-A073661) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes the Green language. Designed in accordance with the Ironman requirements of the Department of Defense, the Green language represents a new attempt to combine classical language features with features often found only in specialized languages. These include facilities for handling exceptional conditions, parallel processing, representation specifications for data, encapsulated definitions, low level input-output, and access to system dependent parameters.
GRA

N80-13821# Science Applications, Inc., Englewood, Colo.
AN EXPLORATORY STUDY OF THE COGNITIVE STRUCTURES UNDERLYING THE COMPREHENSION OF SOFTWARE DESIGN PROBLEMS Technical Report, 3 Oct. 1977 - 3 Dec. 1978
Michael E. Atwood, Althea A. Turner, H. Rudy Ramsey, and Jean Nichols Hooper Jul. 1978 61 p refs
(Contract DAHC19-78-C-0005)
(AD-A073727; SAI-79-100-DEN; ARI-TR-392) Avail: NTIS HC A04/MF A01 CSCL 09/2

An experiment was conducted to evaluate a framework for the study of software complexity and comprehension. Basic to this framework is the concept that a person's knowledge of, and experience with, software design affects that person's ability to comprehend a software problem and its potential solutions. Past research on software complexity and comprehensibility has largely been based on the assumption that complexity is a function of surface properties, such as variable names and flow of control. Such measures, however, ignore the effects of experience. Research on expert-novice differences in problems solving

suggests that experts possess a large number of previously developed knowledge structures, or schemata, that can be used to understand or solve the current problem. Research on text comprehunsion provides theoretical concepts and experimental paradigms that are useful in determining the structure and content of these experience-related schemata. GRA

N80-13822# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PROGRAMMABLE VIDEO DIGITIZING SYSTEM (PVDS). FUNCTIONAL DESCRIPTION AND PRELIMINARY SOFTWARE CONSIDERATIONS
Lawrie E. Eaton. 5 Jun. 1979. 145 p. refs.
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A073756; ETS-46; ESD-TR-79-158) Avail: NTIS HC A07/MF A01 CSCL 09/2

A Programmable Video Digitizing System (PVDS) has been developed that will digitize selected portions of the return TV analog video from the Ebison camera at the GEODSS ETS. The digitized video can then be processed by either a microprocessor or a Modcomp Computer. From the data, the software may then determine object centroiding, night sky background calculations, signal/noise ratios and object rate/direction calculations for closed loop tracking. The system may also be used to process digitized data from future sensors, i.e., infrared or CCD. GRA

N80-13823# Naval Research Lab., Washington, D. C.
USING INTELLIGENT GRAPHICS TERMINALS IN REAL-TIME PROCESSING. Interim Report
Daniel Steiger. 24 Aug. 1979. 15 p. refs.
(AD-A073760; AD-E000320; NRL-MR-4055) Avail: NTIS HC A02/MF A01 CSCL 09/2

At the Naval Research Laboratory intelligent graphics terminals are being utilized for real-time acquisition, storage, processing and display of oceanographic data when mini-computer systems are inappropriate. The intelligent graphic terminal is a well packaged, low cost, reliable and highly portable micro-computer system capable of performing many of the functions required of mini-computer systems. Discussed in the paper are methods of configuring, implementing and utilizing the intelligent graphics terminal for real-time oceanographic processing. GRA

N80-13824# Georgia Inst. of Tech., Atlanta. School of Industrial and Systems Engineering.
METHODS FOR FACTOR SCREENING IN COMPUTER SIMULATION EXPERIMENTS. Final Report
Douglas C. Montgomery. Mar. 1979. 90 p. refs.
(Contract N00014-78-C-0312)
(AD-A073449) Avail: NTIS HC A05/MF A01 CSCL 09/2

The use of a computer simulation model may be viewed as an experiment in which a set of k input variables are combined to produce at least one output or response variable. As in any experimental situation, the design of a computer simulation experiment is important. In general, not all k input variables or factors will be equally important in their effect on the response variable(s). It is very common to find that only a subset, say g - k, of the original k factors are important in explaining the response. We usually do not know the value of g, or which g factors are important. The problem of experimentation and analysis to discover the size and composition of the subset of active factors g is called the factor screening problem. It is important to accurately identify the set of active factors. Failure to identify an active factor can result in serious bias in the analysis and conclusions drawn from the model, if that factor is subsequently ignored. Conversely, experimentation with negligible factors is undesirable as it consumes the resources of experimentation needlessly. This report contains a survey of the available statistical methodology useful in factor screening. It also discusses the relative merits of each approach, and provides guidelines for the development of a factor screening strategy. Several examples are presented that demonstrate the construction of factor screening experiments, and the interpretation of the results of such experiments. GRA

N80-13825# Utah Univ., Salt Lake City. Dept. of Computer Science.
SURFED: AN INTERACTIVE EDITOR FOR FREE-FORM SURFACES
R. Peter Dube (Maine Univ. at Orono), Gary J. Herron, Frank F. Little, and Richard F. Riesenfeld. Mar. 1978. 21 p. refs.
(Contract N00014-77-C-0157; Grant NSF MCS-74-13017)
(AD-A073424) Avail: NTIS HC A02/MF A01 CSCL 09/2

An editor is described for creating and modifying free-form surfaces. A modular system was developed in order to provide the researchers with a facility for communicating design ideas and new mathematical forms through an interactive graphical interface to a computer-based model. To achieve this it was necessary to invent a new graphical construct called a 'spider' for inputting 3-dimensional parameters. This experimental system has the essential features of a large-scale implementation, with the capability of utilizing many new surface forms that have not yet been tried in actual applications. GRA

N80-13826# Logicon, Inc., San Pedro, Calif.
RELIABLE MICROPROGRAMMING. Final Technical Report, 7 Feb. 1978 - 6 Feb. 1979
Jane Radatz, Jeffrey Laub, and Gordon Hamachi. Jul. 1979. 350 p. refs.
(Contract F30602-78-C-0079; AF Proj. 2531)
(AD-A073454; DS-R79001; RADC-TR-79-173) Avail: NTIS HC A15/MF A01 CSCL 09/2

This report presents the results of the Reliable Microprogramming Contract. Current technology for microprogram verification is surveyed, and a set of microprogramming tools is proposed. These tools are evaluated, and a recommended set is identified. A functional description and a system specification are provided for each recommended tool. GRA

N80-13827# Oak Ridge National Lab., Tenn.
UTILITY LANGUAGE FOR THE NMFECC
H. R. Hicks. 1978. 7 p. Presented at APS Plasma Phys. Meeting, Colorado Springs, Colo., 30 Oct. 1978.
(Contract W-7405-eng-26)
(CONF-781053-4) Avail: NTIS HC A02/MF A01

Routines handling a small number of message lines are considered. Desirable characteristics proposed for a utility language include the following: ability to accept present input, human engineering, hardware independence, and similarity to other systems. These characteristics are discussed and examples are given. DOE

62 COMPUTER SYSTEMS

Includes computer networks.

N80-13828 Pennsylvania Univ., Philadelphia.
DISTRIBUTED DATABASE ORGANIZATION FOR OPTIMAL COMPUTER NETWORK RESPONSE TIME. Ph.D. Thesis
Robert Michael Farrell. 1979. 180 p.
Avail: Univ. Microfilms Order No. 7928126

The problem of optimizing response time of accesses to shared programs and data in a computer network is investigated. The key characteristics of a data sharing network are defined and its attributes are modelled. These are contrasted with the characteristics of communications (packet switching) or resource sharing networks. Two network optimization models are developed: a deterministic model and a stochastic model. Search algorithms are presented which determine optimal solutions to each model and assessments of the complexity of each algorithm are developed. Since the deterministic algorithms are exponential in complexity, heuristic algorithms of polynomial complexity are developed, to allow application of the models to very large computer networks. Applications of the models to distributed data bases, as well as to centralized data management systems in computer networks are discussed. Guidelines for selection of the proper model for an application, based on expected access traffic, are also presented. Dissert. Abstr.

N80-13829# Sandia Labs., Albuquerque, N. Mex.
TFILE: A USER CALLABLE TAPE FILE ARCHIVING SYSTEM FOR NOS
G. L. Lane. Nov. 1978. 41 p.
(Contract EY-76-C-04-0789)
(SAND-78-2022) Avail: NTIS HC A03/MF A01

The TFILE operation is described along with information on the installation and maintenance procedures. DOE

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-13830 North Carolina Univ. at Chapel Hill.
QUEUES AND STORES WITH NONHOMOGENEOUS INPUT Ph.D. Thesis
Donna Katzman McClish 1979 173 p
Avail: Univ. Microfilms Order No. 7925945

It is shown that under a variety of circumstances, the presence of a periodic pattern of input is enough to insure that a quasi-limiting distribution of store content exists. For stores with nonhomogeneous Compound Poisson input and general release rule, a probabilistic approach is developed which allows equations to be written down easily for such quantities as the mean store content and the probability of an empty store. The formulas are series expansions in epsilon. A more in-depth look at the first two terms of the epsilon-expansion shows that for periodic phi(t), a general expression can be found for an approximation to the probability of an empty store. Applications of the formulas for stores with release rules r(x) = c, r(x) = a+bx and r(x) = alpha x are examined. For at least some instances of the M(t)/M/1 queue it is shown that the approximations developed are very good. The problem of a stochastic intensity function is also briefly considered. Dissert. Abstr.

N80-13831 Purdue Univ., Lafayette, Ind.
IMAGE SEGMENTATION BY STATISTICAL EDGE DETECTION AND SEQUENTIAL EDGE GROWING Ph.D. Thesis
Ahmad Salahi 1979 123 p
Avail: Univ. Microfilms Order No. 7926425

Algorithms are presented which effectively and efficiently segment the objects through detecting their boundaries. A two step procedure is developed to detect a clean and linear boundary for objects in pictures. Statistical hypotheses were used, testing to detect locations of local edges, and a sequential algorithm which moves around the boundary growing the edge by expanding and pruning local trees is described. In this way it removes the cracks, noise and parasitic branches. Dissert. Abstr.

N80-13832 Kentucky Univ., Lexington.
INFINITE SERVER QUEUING SYSTEMS WITH RENEWAL CLEARING AND RELATED MODELS Ph.D. Thesis
Donald Francis Linton 1979 87 p
Avail: Univ. Microfilms Order No. 7927692

Stochastic processes as related to infinite server queueing systems with renewal clearing are presented. A model is developed for an M/G infinity queue which removes the restriction of instantaneous restart at a renewal time by inserting a random setup time just after a clearing time. Customers are allowed to queue during the setup time period, but they all begin service at the end of the setup time period. The M/G infinite queueing system with renewal clearing is generalized to accommodate m < infinity customer types, one of which is served at a time. An extraneous Markov renewal process determines the successive type of customer served and the times at which changes in customer type are made. The relationship between this system and a system in a random environment is delineated. Dissert. Abstr.

N80-13833# Stanford Univ., Calif. Dept. of Operations Research.
TRANSIENTS EFFECTS IN M/G/1 QUEUES; AN EMPIRICAL INVESTIGATION
Michael R. Middleton Jun. 1979 161 p refs
(Contract N00014-76-C-0418; Grant NSF ENG-75-14847)
(AD-A073744; SU-TR-85; SU-TR-51) Avail: NTIS HC A08/MF A01 CSCL 12/1

This research provides numerical results for time-dependent expected server load (mean virtual waiting time) in single-server queues with Poisson arrivals and gamma distributed service times. The results are presented in tabular form to facilitate their use by practitioners involved in the study of operating systems. This research considers groups of server load processes whose parameters are selected so that the first and second moments of their net input processes are matched. An existing Laplace transform expression is employed to obtain transient expected server load at specified epochs. The tabulated results allow a comprehensive study of the error associated with using the Wiener process as an approximation of server load in queues. This study confirms that the Wiener process is always an upper bound and that the approximation is best for queues with a traffic intensity parameter near unity. The scaled results also indicate that the gamma input process and queueing process with deterministic service times provide tight lower and upper bounds, respectively, for expected server load in all queues with Poisson arrivals and gamma distributed service times. GRA

N80-13834# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
GAMMA-MINIMAX AND MINIMAX DECISION RULES FOR COMPARISON OF TREATMENTS WITH A CONTROL
Shanti S. Gupta and Woo-Chul Kim Aug. 1979 29 p refs
(Contract N00014-75-C-0455)
(AD-A073576; MMS-79-10) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper deals with the problem of partitioning treatments in comparison with a standard or control under a decision-theoretic formulation. It is assumed that pi sub i, the ith treatment population, is characterized by a random variable X sub i having strongly unimodal and symmetric density. Under the assumptions of a linear loss structure and incomplete prior information about theta sub i, i = 0,1,...k, optimal selection rules are derived for classifying the treatments into superior, equivalent, or inferior groups. These Gamma-minimax rules are compared with Bayes rules for the normal means problem. It is shown that the Gamma-minimax rules compare quite favorably with the Bayes rules. Minimax rules are also derived for the same problem. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-13835 Iowa Univ., Iowa City.
NUMERICAL SOLUTION OF TWO-DIMENSIONAL POTENTIAL THEORY PROBLEMS USING INTEGRAL EQUATION TECHNIQUES Ph.D. Thesis
Clayton Warren Miller 1979 215 p
Avail: Univ. Microfilms Order No. 7924505

The interior Dirichlet problem is solved numerically, using either a double-layer potential or a finite Taylor series. The approximate double-layer density for the potential is found from a Fredholm integral equation of the second kind by the Nystrom method. For boundaries possessing enough smoothness, rates of convergence are found for the double-layer density approximation and for the potential. The Taylor series approximation, and the error in the Taylor series, is computed using a potential which is a complex conjugate to the harmonic solution. The exterior Dirichlet problem, and the interior and exterior Neumann problems are solved by converting them numerically into interior Dirichlet problems using the Kelvin transformation. Error estimates derived for the interior Dirichlet problem are then applicable to these transformed problems. Dissert. Abstr.

N80-13836 Kentucky Univ., Lexington.
CONTROL KERNELS AND CONSTANT-RATE JUMP PROCESSES Ph.D. Thesis
James Allen Bain, Jr. 1979 171 p
Avail: Univ. Microfilms Order No. 7927664

Using control kernels, the expected payoff of a stochastic system as a conditional convolution of the payoff function against a control kernel is presented. A value function and optimality conditions are obtained. Control kernels were used to study continuous time dynamic programming by investigating a semi-group structure on a space of payoff functions. In the concrete example of completely observed (non-Markov) jump processes

which have a constant jump rate, all the control kernel axioms hold; moreover, control kernels allow discrete time dynamic programming to be adapted to prove the existence of optimal controls. Dissert. Abstr.

N80-13837 California Univ., San Diego.
NONLINEAR HARDY SPACES AND ELECTRICAL POWER TRANSFER Ph.D. Thesis
James Samuel Border. 1979. 107 p.
Avail: Univ. Microfilms. Order No. 7926691

An optimization problem which arises in the study of power transfer in electronic circuits and utilizes the elegant mathematical framework of finding the distance from a point in a manifold of functions to a smooth submanifold is presented. This general problem is considered and then looked at specifically in certain spaces of engineering interest and also some related spaces. These related spaces seem to be of interest in themselves and might be though of as nonlinear L superscript P spaces. In addition to power transfer, an important physical quantity in broadband matching is the input reflection. A condition is obtained for an arbitrary source to be able, through a matching network, to deliver at least a prescribed amount of power to a given load with at most a prescribed input reflection. Dissert. Abstr.

N80-13838 Missouri Univ., -Kansas City.
EVALUATION OF INTEGRALS WHOSE INTEGRANDS ARE OSCILLATORY AND SINGULAR Ph.D. Thesis
Bing-Yuan Ting. 1979. 142 p.
Avail: Univ. Microfilms. Order No. 7926598

Integrals whose integrands are oscillatory and contain singularities at the end points of the interval of integration are studied. Both f(x) and e(i theta x) can be expanded in series of orthogonal polynomials which are orthogonal over the interval of integration with respect to Z(x). There are two such expansions for f(x). One is an infinite series which follows from the usual orthogonality property. The other is a polynomial approximation plus a remainder. The relation between the coefficients in these representations are detailed and methods for the evaluation of these and for the coefficients in the expansion of e(i theta x) are analyzed. The formulas for G(theta) readily follow from the orthogonality property. Error analyses are provided. Several numerical examples are given. Dissert. Abstr.

N80-13839*# National Aeronautics and Space Administration, Washington, D. C.
MATHEMATICAL MODELING OF DIVERSE PHENOMENA
James C. Howard. [1979]. 402 p. refs.
(NASA-SP-437; LC-79-18506). Avail: NTIS. HC A18/MF A01. CSCL 12A.

Tensor calculus is applied to the formulation of mathematical models of diverse phenomena. Aeronautics, fluid dynamics, and cosmology are among the areas of application. The feasibility of combining tensor methods and computer capability to formulate problems is demonstrated. The techniques described are an attempt to simplify the formulation of mathematical models by reducing the modeling process to a series of routine operations, which can be performed either manually or by computer. J.M.S.

N80-13840*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. Mission Planning and Analysis Div.
OPS MCC LEVEL B/C FORMULATION REQUIREMENTS: AREA TARGETS AND SPACE VOLUMES PROCESSOR
Mack J. Bishop, Jr. (Computer Sciences Corp.). Oct. 1979. 140 p. ref.
(NASA-TM-80839; JSC-16029; Rept-79-FM-26-Rev-1). Avail: NTIS. HC A07/MF A01. CSCL 12A.

The level B/C mathematical specifications for the area targets and space volume processor (ATSVP) as well as the characteristics of the system are provided. The mathematical equation necessary to determine whether the spacecraft lies within the area target or space volume is presented. A semianalytical technique for predicting the acquisition of signal (AOS) and loss of signal (LOS) time periods is discussed. A functional overview of the ATSVP which includes an outline of the process required to determine precise AOS and LOS times are given. R.C.T.

N80-13841*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ANALYSIS OF NUMERICAL STABILITY AND AMPLIFICATION MATRICES: FOURTH-ORDER RUNGE-KUTTA METHODS
Euel W. Kennedy. Sep. 1979. 44 p. refs.
(NASA-TM-80836; JSC-16080; Rept-79-FM-32). Avail: NTIS. HC A03/MF A01. CSCL 12A.

Amplification matrices, numerical kernels, stable, and exponentially stable numerical solutions are examined. The various techniques involved in these concepts are applied to certain systems that have Jordan forms, which are nondiagonal, with particular interest in the case of imaginary or zero eigenvalues. R.C.T.

N80-13842# North Carolina Univ. at Chapel Hill.
A STARTING RULE FOR DATA COLLECTION IN QUEUEING SIMULATIONS
Veena G. Adlakha and George S. Fishman. Aug. 1979. 35 p. refs.
(Contract N00014-76-C-0302)
(AD-A073622; TR-79-3). Avail: NTIS. HC A03/MF A01. CSCL 12/1.

This paper proposes a rule for determining when to start collecting data in a queueing simulation. The rule is designed to reduce dependence between the empty (queue) and idle (servers) initial conditions and the collected sample record. The rule is an outgrowth of earlier work by Fishman and Moore (1978) and relies on a comparison between a priori information on the activity level (traffic intensity) and a corresponding sample estimate computed during the course of simulation. Experiments with simulations of the M/M/c queue with c = 1,2,4 and rho = .7,.8,.9,.95 reveal that the rule reduces and in most cases removes the dependence on the empty and idle initial conditions. In particular, the rule begins data collection when the simulation is in a congested state or in the steady state. The rule is well behaved in that it has low probabilities of requiring long runs before data collection is started. Although our data suggests an association between the rule's performance and activity level, the performance is insensitive to variation in the number of servers. Since the rule is based upon the activity level, a parameter that frequently can be computed from the input parameters of the simulation, the rule is easily generalized to a wider class of queueing simulations. GRA

N80-13843# North Carolina Univ. at Chapel Hill.
A STOPPING RULE FOR DATA COLLECTION IN QUEUEING SIMULATIONS
Veena G. Adlakha and George S. Fishman. Aug. 1979. 33 p. refs.
(Contract N00014-76-C-0302)
(AD-A073624; TR-79-4). Avail: NTIS. HC A03/MF A01. CSCL 12/1.

This paper proposes a stopping rule (Rule 2) for terminating data collection in a queueing simulation experiment. The appeal of the rule lies in the fact that data collected in this way can be used to compute interval estimates with coverage rates that compare favorably with theoretically specified rates. The rule relies on a comparison between a priori information on the activity level (traffic intensity) p and a corresponding sample estimator computed during the course of simulation. GRA

N80-13844# Air Force Weapons Lab., Kirtland AFB, N. Mex.
COMPUTATIONAL EXPERIMENTS ON TWO ERROR ESTIMATION PROCEDURES FOR ORDINARY DIFFERENTIAL EQUATIONS Final Report
Bernard Epstein and D. Hicks. Jun. 1979. 78 p.
(AF Proj. 9991)
(AD-A073768; AD-E200353; AFWL-TR-78-119). Avail: NTIS. HC A05/MF A01. CSCL 12/1.

Two error estimation procedures are compared. One is called the asymptotic error estimation procedure, the other, the error gradient estimation procedure. The theory underlying these procedures and the results of some numerical experiments are presented. GRA

N80-13845# Stanford Univ., Calif. Dept. of Statistics.
MAXIMUM LIKELIHOOD ESTIMATION OF THE AUTORE-

GRESSIVE COEFFICIENTS AND MOVING AVERAGE COVARIANCES OF VECTOR AUTOREGRESSIVE MOVING AVERAGE MODELS
Fereydoon Ahrabi Aug 1979 94 p refs
(Contract N00014-75-C-0442; NR Proj 042-034)
(AD-A073788; SU-TR-39) Avail NTIS HC A05/MF A01 CSCL 12/1

The purpose of this paper is to derive asymptotically efficient estimates for the autoregressive matrix coefficients and moving average covariance matrices of the vector autoregressive moving average (VARMA) models in both time and frequency domains. To do this we shall apply the Newton-Raphson and scoring methods to the maximum likelihood equations derived from modified likelihood functions under the Gaussian Assumption. GRA

N80-13846# Naval Ocean Systems Center, San Diego, Calif.
LEAST SQUARES, ADAPTIVE-LATTICE ALGORITHMS Research Report, Jan. - Apr. 1979
J. D. Pack and E. H. Satorius Apr 1979 32 p refs
(ZR0140811)
(AD-A073464; NOSC/TR-423) Avail NTIS HC A03/MF A01 CSCL 12/1

Recently, it has been shown by Morf, Lee and others that least squares, adaptive algorithms may be implemented in a lattice form. This result is of considerable interest due to the rapid convergence characteristics of least squares algorithms as well as the important properties of lattice structures (such as high insensitivity to round-off noise). This report provides an explicit derivation of the joint real process, scalar least squares lattice algorithm. Also, a FORTRAN subroutine listing of the algorithm is presented. GRA

N80-13847# North Carolina Univ. at Chapel Hill Dept. of Statistics.
SYSTEMS OF FREQUENCY CURVES GENERATED BY TRANSFORMATIONS OF LOGISTIC VARIABLES
P. R. Tadikamalla (Pittsburgh Univ., Pa.) and N. L. Johnson Jun. 1979 31 p refs
(Contract DAAG29-77-C-0035)
(AD-A073481; MMS-1226; ARO-14778.6-M) Avail NTIS HC A03/MF A01 CSCL 12/1

The lognormal (S sub L, S sub B and S sub U) systems of frequency curves are obtained by three simple transformations of the normal curve. By applying the same transformations to the logistic, systems L sub L, L sub B and L sub U are obtained. Some properties of these systems, and their relation to the S systems, are set out. Tables to facilitate fitting L sub U curves by moments are presented. GRA

N80-13848# North Carolina Univ. at Chapel Hill Dept. of Statistics.
EXTREME SAMPLE CENSORING PROBLEMS WITH MULTIVARIATE DATA, 2
N. L. Johnson Jul 1979 23 p refs
(Contract DAAG29-77-C-0035)
(AD-A073563; MMS-1237; ARO-1478.7-M) Avail NTIS HC A02/MF A01 CSCL 12/1

Indirect censoring is defined as the effect on observed variables of censoring on unobserved variables. Methods of testing for indirect censoring are discussed, and exemplified, using a bivariate Farlie-Gumbel-Morgenstern distribution. GRA

N80-13849# Oak Ridge National Lab., Tenn.
LECTURE NOTES ON ORDINARY DIFFERENTIAL EQUATIONS SOFTWARE, USER'S GUIDE FOR ODE, RKF45, GEAR AND EPISODE
J. A. Wenzel and R. E. Funderlic Aug 1979 89 p
(Contract W-7405-eng-26)
(ORNL/CSD/TM-64) Avail NTIS HC A05/MF A01

Four software packages for the numerical solution of initial value problems for systems of ordinary differential equations are demonstrated with sample problems and solutions. These packages are contained in the Core Library of Numerical Software of the Computer Sciences Division, ORNL. DOE

N80-13850# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF THE BOSON POLYNOMIALS OF U(n) TO PHYSICAL PROBLEMS
J. D. Louck Sep 1978 13 p refs Presented at Colloq. on Group Theoretical Methods in Phys., Austin, Tex., 11 Sep. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2395; CONF-780970-1) Avail NTIS HC A02/MF A01

A review is given of the properties of a general class of polynomials in the boson operators which were found useful for obtaining the explicit unitary irreducible representations of the unitary group itself, and to show how these same polynomials provide a unified approach for obtaining the explicit solutions to several classic problems in physics and chemistry. DOE

N80-13851*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
DOMINANT PARTITION METHOD
Robert M. Dixon (Morgan State Univ.) and Edward F. Redish (Maryland Univ., Coll. Park) Mar 1979 26 p refs
(Contract EY-76-S-05-5126)
(NASA-TM-80778; ORO-5126-57) Avail NTIS HC A03/MF A01 CSCL 12A

By use of the L'Huillier, Redish, and Tandy (LRT) wave function formalism, a partially connected method, the dominant partition method (DPM) is developed for obtaining few body reductions of the many body problem in the LRT and Bencze, Redish, and Sloan (BRS) formalisms. The DPM maps the many body problem to a fewer body one by using the criterion that the truncated formalism must be such that consistency with the full Schroedinger equation is preserved. The DPM is based on a class of new forms for the irreducible cluster potential, which is introduced in the LRT formalism. Connectivity is maintained with respect to all partitions containing a given partition, which is referred to as the dominant partition. Degrees of freedom corresponding to the breakup of one or more of the clusters of the dominant partition are treated in a disconnected manner. This approach for simplifying the complicated BRS equations is appropriate for physical problems where a few body reaction mechanism prevails. DOE

N80-13852# California Univ., Livermore. Lawrence Livermore Lab.
PIECEWISE CUBIC INTERPOLATION METHODS
F. N. Fritsch and R. E. Carlson Nov 1978 39 p Presented at the SIAM 1978 Fall Meeting, Knoxville, Tenn., 1 Nov. 1978 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-81230; CONF-781198-1) HC A03/MF A01

Interpolation of one dimensional data using piecewise cubic interpolants is considered. Methods are presented for modifying the derivative values in the Hermite representation in order to eliminate the bumps and wiggles that frequently plague the more common cubic spline or Akima interpolants. The resulting interpolant is C1, but generally not C2. DOE

N80-13853# Atomic Weapons Research Establishment, Aldermaston (England).
AN ITERATIVE UNFOLDING TECHNIQUE
P. E. Taylor London HMSO Apr 1979 19 p refs
(ARWE-O-25/79; BR67686; ISBN-0-85518132-X) Avail NTIS HC A02/MF A01; HMSO, London £1; PHI

A widely applicable iterative method for solving the folding equation S(t) = integral from - infinity to t, of f(t-k) Phi(K)dk' is described. Alternatively, the process may be regarded as a data smoothing technique. The method consists of using an arbitrary function g(t-k) in substitution of the unknown f(t-k) choosing appropriate parameter values for fitting to S(t), devising successive closer approximations by iteration. Solutions are also possible for nonlinear systems and in the closely related spectral unfolding problem. Two examples are shown. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-13854 Pittsburgh Univ., Pa.
AN EMPIRICAL POWER STUDY OF RECURSIVE OUTLIER

DETECTION PROCEDURES Ph.D. Thesis
Ram Baboo Jain 1979 505 p
Avail: Univ. Microfilms Order No. 7924721

The percentage points and their standard errors for five recursive procedures were computed by Monte Carlo methods for samples of size 20(5)50(10)100 for the presence of 1(1)5 outliers at alpha = .10, .05, .025, .01, and .005. The powers of these procedures were also studied under six different experimental situations formed by the combinations of the presence or absence of a masking effect with exact, under, and overspecification of the actual number of outliers present in the sample. The robustness of these procedures when the samples are drawn from the nonnormal symmetric distributions was also studied. The distributions used for the robustness study were the uniform and the double exponential distributions. The suitability of ESD both for flat and peaked symmetric distributions was established. Dissert. Abstr.

N80-13855 Virginia Polytechnic Inst. and State Univ., Blacksburg.
INVARIANT TESTS FOR SCALE PARAMETERS UNDER ELLIPTICAL SYMMETRY Ph.D. Thesis
Margaret Ann Chemilewski 1978 103 p
Avail: Univ. Microfilms Order No. 7924096

A number of standard tests for scale parameters is considered when the observations are not necessarily either Gaussian or independent. The distributions considered are the spherically symmetric vector laws and natural extensions of these to laws of random matrices. Using the principle of invariance, the invariant tests for certain hypotheses for all elliptically symmetric distributions are characterized. The particular problems treated are tests for the equality of k scale parameters, tests for the equality of k scale matrices, tests for sphericity, tests for block diagonal structure, tests for the uncorrelatedness of two variables within a set of m variables, and tests for the hypothesis of equi-correlatedness. In all cases except the last three, the null and nonnull distributions of invariant statistics are shown to be unique for all elliptically symmetric laws. Dissert. Abstr.

N80-13856 Wisconsin Univ. - Madison.
ESTIMATION OF SMOOTHING PARAMETERS TO SMOOTH NOISY DATA AND CONFIDENCE REGIONS FOR THE UNDERLYING FUNCTION Ph.D. Thesis
Heather Anne Lucas 1978 148 p
Avail: Univ. Microfilms Order No. 7918913

It is assumed that the function is a member of a periodic reproducing kernel Hilbert space of order m and the importance of determining the value of m from the data, if it is not otherwise known, is demonstrated. The choice of m for two classes of functions is discussed in detail and numerical results are given to support the theory. The problem of obtaining confidence regions for the true function is discussed. A confidence interval for the mean square error is derived. A confidence region for the function is defined in terms of the maximum absolute residual and a Bayesian approach for deriving its distribution is developed and is compared favorably with the usual approach. Dissert. Abstr.

N80-13857 Syracuse Univ., N. Y.
STATISTICAL ANALYSIS OF FINITE MIXTURES OF EXPONENTIAL AND WEIBULL DISTRIBUTIONS Ph.D. Thesis
Ali Riza Kaylan 1979 156 p
Avail: Univ. Microfilms Order No. 7925574

The use of optimization techniques on the statistical problem of parameter estimation for finite Weibull (including exponential) mixtures from complete and type-1 censored samples is investigated with a primary concern for iterative procedures for maximum likelihood estimation. Algorithmic schemes are devised and implemented successfully to obtain the maximum likelihood estimates with a special emphasis on the essential questions of convergence to the optimal solution and the rate of convergence. The convergence rate of existing iterative schemes for exponential mixtures is improved by employing second order equations in the vicinity of the optimum. The algorithms are extended to censored samples and applied to some data reflecting recidivism activities in criminal justice studies. Dissert. Abstr.

N80-13858 Kentucky Univ., Lexington.
DUALITY THEORY, STOCHASTIC REALIZATION AND INVARIANT DIRECTIONS FOR LINEAR DISCRETE-TIME STOCHASTIC SYSTEMS Ph.D. Thesis
Michele Pavon 1979 85 p
Avail: Univ. Microfilms Order No. 7927708

Invariant directions of the Riccati difference equation of Kalman filtering are shown to occur in a large class of prediction problems and to be related to a certain invariant subspace of the transpose of the feedback matrix. The discrete time stochastic realization problem is studied in its deterministic as well as probabilistic aspects. In particular a new derivation of the classification of the minimal Markovian representations of the given process z is presented which is based on a certain backward filter of the innovations. For each Markovian representation which can be determined from z, the space of invariant directions is decomposed into two subspaces, one on which it is possible to predict the state process without error forward in time and one on which this can be done backward in time. A stochastic variational approach to the duality between estimation and control is taken. The duality relation is derived by means of nonformal arguments. It is then compared with the variational principle underlying the Wiener-Hopf integral equation. The Kalman filter is also derived through nonformal duality. Dissert. Abstr.

N80-13859 Florida State Univ., Tallahassee.
NONPARAMETRIC FAMILIES OF LIFE DISTRIBUTIONS. 1: EXTREME POINTS. CHARACTERISTICS Ph.D. Thesis
Ramon Valentin Leon 1979 88 p
Avail: Univ. Microfilms Order No. 7926780

Nonparametric families of life distributions useful in the theory of reliability and biometry were studied. In particular it is shown that the class of discrete decreasing failure rate (DFR) life distributions is a convex class. The extreme points of this class are obtained, and how to represent any discrete DFR distribution as a mixture of these extreme points is shown. The extreme points of the convex class of DFR distributions are identified. Using Choquet's Theorem, it is shown that any DFR distribution can be represented as a mixture of these extreme points. In addition, partial results in identifying the extreme points of the convex set of distributions with decrasing failure rate average are presented. Characterizations are obtained of large classes of non-parametric life distributions, such as the increasing (decreasing) failure rate, increasing (decreasing) failure rate average, new better (worse) than used, etc., classes. The methods used differ from the usual functional equation methods used for the far more common characterizations of parametric families of life distributions. Dissert. Abstr.

N80-13860 Oregon State Univ., Corvallis.
STOCHASTIC INTEGRATION USING RANDOM POINT PROCESSES Ph.D. Thesis
Harvey Bennett Lipman 1979 67 p
Avail: Univ. Microfilms Order No. 7927130

The load modeling problem in electrical distribution networks leads to consideration of a second order stochastic differential equation. To find a solution to such an equation requires consideration of a stochastic integral. The theory chosen makes use of the belated calculus introduced by E. J. McShane. Assuming all integrals are McShane's belated stochastic integrals, it is proved that nth order integrals exist and are unique in the probabilistic sense for the integrator process. Having shown that all integrals of order greater than one vanish using this type of integrator, Ito's formula is introduced which gives a method of calculating a function, F(t, Y(t)), where Y(t) satisfies the stochastic differential equation, dY(t) = f(t, Y(t))dt + g(t, Y(t)d Psi (t). It is proved that the Ito's formula which is appropriate in this case is no more than the standard composite function formula of deterministic calculus. Dissert. Abstr.

N80-13861 Yale Univ., New Haven, Conn.
DETECTION OF MULTIVARIATE OUTLIERS Ph.D. Thesis
Steven Jay Schwager 1979 235 p
Avail: Univ. Microfilms Order No. 7928094

Techniques for detection of outliers in multivariate normal data are developed. Mean slippage and variance slippage are proposed as alternatives to the null hypothesis of no outliers from the given multivariate regression model: Y(nxp) = XB

+ U. The general outlier problem considered for the multivariate mean model: Y = 1 mu + U is shown to be invariant with respect to an extended group of transformations, which includes all affine transformations and permutations of the observations. The multivariate regression model single-outlier problem is shown to be invariant with respect to a natural group of transformations, and three families of matrix valued statistics are obtained and shown to be maximally invariant with respect to this group. For mean slippage alternatives, each observation is associated with a hypothesized distance from the null model if it is an outlier. For any set of n such distances, a class of decision rules is shown to be invariant admissible for the single-outlier problem. Dissert. Abstr.

N80-13862 California Univ., Riverside.
BAYESIAN PARAMETER AND RELIABILITY ESTIMATION FOR A MULTIVARIATE EXPONENTIAL DISTRIBUTION
Ph.D. Thesis
Adel Adelmonem Shamseldin 1979 151 p
Avail: Univ. Microfilms Order No. 7926487

The problem of Bayesian parameter and reliability estimation is studied for the bivariate exponential (BVE) distribution in the parallel sampling case and for the most general form of the k-dimensional multivariate exponential (MVE) distribution in series sampling. Joint and marginal posterior distributions are developed along with point and interval estimates. Special attention is given to the case of the BVE with identical marginals. In addition, joint and marginal posterior densities are derived for a (k+1)-parameter version of the k-dimensional MVE distribution in parallel sampling. Closed form Bayes estimators are derived and credibility intervals for individual parameters are constructed. Numerical examples are presented together with graphs of posterior distributions to illustrate the use of the developed methods of estimation. Dissert. Abstr.

N80-13863*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
EXTREME MEAN AND ITS APPLICATIONS
Ram Swaroop and James D. Brownlow Dec. 1979 37 p refs Prepared in cooperation with System Development Corp., Edwards, Calif.
(Contract NAS4-2334)
(NASA-TM-81346) Avail: NTIS HC A03/MF A01 CSCL 12A

Extreme value statistics obtained from normally distributed data are considered. An extreme mean is defined as the mean of p-th probability truncated normal distribution. An unbiased estimate of this extreme mean and its large sample distribution are derived. The distribution of this estimate even for very large samples is found to be nonnormal. Further, as the sample size increases, the variance of the unbiased estimate converges to the Cramer-Rao lower bound. The computer program used to obtain the density and distribution functions of the standardized unbiased estimate, and the confidence intervals of the extreme mean for any data are included for ready application. An example is included to demonstrate the usefulness of extreme mean application. J.M.S.

N80-13864# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ASYMPTOTIC THEORY FOR PROCESS LEAST SQUARES ESTIMATORS FOR DIFFUSION PROCESSES
B. L. S. Prakasa Rao and Herman Rubin Jul. 1979 29 p refs
(Contract N00014-75-C-0455; NSF MCS-76-08316)
(AD-A073577; MMS-79-13) Avail: NTIS HC A03/MF A01 CSCL 12/1

Strong consistency and asymptotic normality of an estimator related to least squares estimator for parameters involved in nonlinear stochastic differential equations are investigated by studying families of stochastic integrals using Fourier analytic methods. GRA

N80-13865# Stanford Univ., Calif. Dept. of Statistics.
MAXIMUM LIKELIHOOD ESTIMATION OF THE PARAMETERS OF A MULTIVARIATE NORMAL DISTRIBUTION
T. W. Anderson and I. Olkin Jul. 1979 22 p refs
(Contract N00014-75-C-0442; Grant NSF MCS-78-07736; NR Proj. 042-034)
(AD-A073796; SU-TR-38) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper provides an exposition of several alternative techniques used to obtain maximum likelihood estimators for the parameters of a multivariate normal distribution. In particular, matrix differentiaton, matrix transformations and induction are treated. These techniques are used to derive the maximum likelihood estimators of the covariances of a Wishart distribution, of the covariances when there are missing observations, and of the means under a rank constraint. Although the paper is mainly expository, some of the proofs are new. GRA

N80-13866# Texas A&M Univ., College Station. Inst. of Statistics.
A DENSITY-QUANTILE FUNCTION APPROACH TO CHOOSING ORDER STATISTICS FOR THE ESTIMATION OF LOCATION AND SCALE PARAMETERS
Randall Lester Eubank Research Triangle Park, N.C. ARO Jul. 1979 65 p refs
(Grant DAAG29-78-G-0180)
(AD-A073270; TR-A-10; ARO-16228.10-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

It has been shown that the estimation of location and scale parameters by linear systematic statistics may be formulated as a problem in regression analysis of a smoothed sample quantile process. In this dissertation, a general approach to optimal spacings selection is presented that utilizes design techniques for continuous parameter time series regression. This methodology is applied to several common distributions. The problems of optimal order statistic selection for estimation in censored samples, for quantile estimation and for the summarization of large data sets are also considered. GRA

N80-13867# Texas A&M Univ., College Station. Inst. of Statistics.
DISCUSSION OF PAPER BY GOOD AND GASKINS ON DENSITY ESTIMATION AND BUMP HUNTING
Emanuel Parzen Research Triangle Park, N.C. ARO Jul. 1979 14 p ref
(Grant DAAG29-78-G-0180)
(AD-A073269; TR-A-11; ARO-16228.11-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The view is expressed that the best way to evaluate the approach of Good and Gaskins is to compare it with alternative approaches to density estimation currently available. As a contribution towards this comparative study, this paper describes an analysis of their data using the density-quantile estimation approach proposed by Parzen (1979). GRA

N80-13868# Ohio State Univ., Columbus. Dept. of Statistics.
RECENT APPLICATIONS OF VARIATIONAL TECHNIQUES IN STATISTICS
J. S. Rustagi Aug. 1979 17 p refs
(Contract N00014-78-C-0543)
(AD-A073511; OSU-TR-186) Avail: NTIS HC A02/MF A01 CSCL 12/1

Recent applications of variational methods to problems of statistical inference are given. The problems of robustness, inadmissibility and penalized maximum likelihood estimates are discussed to exhibit their variational character. GRA

N80-13869# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
SOME CONTRIBUTIONS TO GAMMA-MINIMAX AND EMPIRICAL BAYES SELECTION PROCEDURES
Ping Hsiao Aug. 1979 144 p refs
(Contract N00014-75-C-0455)
(AD-A073574; MMS-79-16) Avail: NTIS HC A07/MF A01 CSCL 12/1

The inadequacies of classical tests of homogeneity, in certain situations of interest to the experimenter have long been known. Ranking and selection procedures which are formulated to overcome these shortcomings have provided realistic methods to handle the problems of comparing k populations. In this thesis, some results on gamma-minimax selection procedures and empirical Bayes selection procedure have been obtained. In Chapter 1, a problem of selecting populations close to a control

is considered. Our goal is to select those populations which are sufficiently close to the control. Chapter 2 deals with the problem of selecting the t-best populations. In Chapter 3, a problem of selecting populations better than a control is considered. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-13870 Maryland Univ., College Park.
THE CONSTRUCTION OF SPACETIMES FROM INITIAL DATA Ph.D. Thesis
James Allen Isenberg 1979 440 p
Avail: Univ. Microfilms Order No. 7926499

The practical application of the initial value method to the job of constructing general spacetimes is presented. General source fields are discussed and general topologies (e.g., how to evolve patch overlaps) are considered. The step-by-step procedure is quite straightforward, and should prove to be increasingly useful in studying real astrophysical and cosmological phenomena. Dissert. Abstr.

N80-13871 Yale Univ., New Haven, Conn.
ALGORITHMS FOR NETWORK FLOW PROBLEMS WITH CONVEX SEPARABLE COSTS Ph.D. Thesis
John Gregory Klincewicz 1979 250 p
Avail: Univ. Microfilms Order No. 7926258

Two iterative, feasible-direction algorithms for solving convex separable network flow problems are developed. The first is a 'scaled reduced gradient' (SRG) technique with general applicability. Its performance on a group of water distribution problems is compared to that of a reduced gradient and a convex simplex code. The second algorithm is an approach for implementing an exact Newton method for network flow problems. It uses preconditioned conjugate direction methods to calculate second-order estimates of the dual multipliers and depends heavily on the network structure of the constraint matrix. Computational results with this procedure indicate a trade-off between the time spent calculating dual variable estimates at each iteration and the total number of iterations required. Dissert. Abstr.

N80-13872 Wisconsin Univ. - Madison.
NEWTON'S METHOD FOR GENERALIZED EQUATIONS AND THE PIES ENERGY MODEL Ph.D. Thesis
Norman Harold Josephy 1979 108 p
Avail: Univ. Microfilms Order No. 7922122

A number of results concerning the convergence and convergence rates of Newton and quasi-Newton methods for generalized equations are proven. Examples are given to emphasize the application of these methods to generalized equations representing the nonlinear programming problem and the nonlinear complementarity problem. Computational results of Newton's method are presented as applied to the economic equilibrium problem of the Project Independence Evaluation System (PIES) Energy Model. Solutions to a simplified version of PIES are obtained using a Newton method, and comparisons are made to solutions which appeared in the literature. Dissert. Abstr.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-13873 Johns Hopkins Univ., Baltimore, Md.
ON CONGRUENCE SUBGROUP PROBLEM AND RELATED TOPICS Ph.D. Thesis
Jasbir Singh Chahal 1979 50 p
Avail: Univ. Microfilms Order No. 7924606

The congruence subgroup problem is studied for some algebraic groups which are not simply connected. The problem was solved in the affirmative for any solvable algebraic group defined over an arbitrary number field (whether totally imaginary or not). A special treatment was given to the algebraic torus defined by the Pell's equations and a stronger result was obtained, viz. that any subgroup of finite index in the group of units contains a congruence subgroup of index 1, 2, 4 or 8 in it. Some properties of those discontinuous subgroups of the orthogonal group in 2n(n > or equal to 3) variables which contain a congruence subgroup are discussed. Dissert. Abstr.

N80-13874 Temple Univ., Philadelphia, Pa.
INVARIANT SUBSPACES ASSOCIATED WITH DECOMPOSITION Ph.D. Thesis
Gary William Shulberg 1979 89 p
Avail: Univ. Microfilms Order No. 7924027

The spectral decomposition problem is discussed by investigating several classes of invariant subspaces arising from the theory of decomposable operators. Some n characterizations and spectral relationships for spectral maximal, absorbant, analytically invariant, paraclosed, and upsilon and mu spaces are given. A variation on the idea of asymptotic decomposability which yields results not unlike those for operators having decomposable spectra is presented. Decomposable extensions and restrictions of operators are discussed. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-13875# Los Alamos Scientific Lab., N. Mex.
CONTRIBUTIONS OF SHOCK-WAVE PHYSICS TO HIGH-PRESSURE STANDARDS
J. N. Fritz 1979 8 p refs Presented at the 7th Intern. AIRAPT High Pressure Technol. Conf., La Creusot, France, 30 Jul.-3 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2039; CONF-790709-10) Avail: NTIS HC A02/MF A01

The obtaining of a primary pressure standard by dynamic means is discussed. The evolution and current state of the copper Hugoniot curve and its reduction to an isotherm is given. Similar, but less complete considerations are given for tantalum. DOE

N80-13876# Sandia Labs., Albuquerque, N. Mex.
CONTROLLING MAGNETIC FIELD PROFILES
J. R. Freeman Apr. 1979 23 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0678) Avail: NTIS HC A02/MF A01

A method for designing solenoid magnets with controlled field profiles is discussed. The method minimizes both the field errors and the power consumption. An NOS time sharing computer program for the CDC 6600, entitled MAGCOR, constructed to provide an interactive magnet design capability is discussed. Results obtained during the design of magnets for a radial line electron accelerator are presented. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-13877 Northwestern Univ., Evanston, Ill.
AUDITORY DETECTION OF BANDPASS-FILTERED IMPULSES UNDER VARIOUS CONDITIONS OF MASKING Ph.D. Thesis
Jorge Rocafort 1979 130 p
Avail: Univ. Microfilms Order No. 7927434

An experiment designed to investigate a process analogous to prewhitening in human auditory detection is described. A class of signals, bandpass filtered impulses, the spectral structure of which allowed a simplified analysis of the hypothesized effect, was employed. Signal detectability was studied under three different conditions of noise masking: wide band, close matched,

and matched configurations. An energy detection scheme incorporating prewhitening was utilized as a working model for experimental design and data analysis. Threshold shift dependence upon signal spectral structure and frequency was examined.
Dissert. Abstr.

N80-13878*# Massachusetts Inst. of Tech., Cambridge.
RELATION OF ULTRASONIC ENERGY LOSS FACTORS AND CONSTITUENT PROPERTIES IN UNIDIRECTIONAL COMPOSITES Final Report
James H. Williams, Jr., Samson S. Lee, and Hamid NayebHashemi Washington NASA Dec. 1979 29 p refs
(Grant NsG-3210)
(NASA-CR-3181) Avail: NTIS HC A03/MF A01 CSCL 20A

A model is developed relating composite constituents properties with ultrasonic energy loss factors for longitudinal waves propagating in the principal directions of a unidirectional graphite/epoxy fiber composite. All the constituents are assumed to behave as linear viscoelastic materials with energy dissipation properties defined by loss factors. It is found that by introducing a new constituent called the interface material, the composite and constituent properties can be brought into consistency with simple series and parallel models. An expression relating the composite loss factors to the loss factors of the constituents is derived and its coefficients are evaluated. Author

N80-13879*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTAL STUDY OF ACOUSTIC LOADS ON AN UPPER-SURFACE-BLOWN STOL AIRPLANE CONFIGURATION
Conrad M. Willis and James A. Schoenster Dec. 1979 57 p
(NASA-TP-1577; L-13167) Avail: NTIS HC A04/MF A01 CSCL 20A

Fluctuating pressure levels were measured on the flap and fuselage of an upper-surface-blown jet-flap airplane configuration in a wind tunnel. The model tested had turbofan engines with a bypass ratio of 3 and a thrust rating of 10 kN. Rectangular nozzles were mounted flush with the upper surface at 35 percent of the wing chord. Test parameters were flap deflection angle, jet impingement angle, angle of attack, free-stream velocity, spanwise location of the engine, and jet dynamic pressure. Load levels were high throughout the jet impingement region, with the highest levels (about 159 dB) occurring on the fuselage and near the knee of the flap. The magnitude of the forward-velocity effect appeared to depend upon the ratio of free-stream and jet velocities. Good agreement was obtained between fluctuating pressure spectra measured at jet dynamic pressures of 7 and 22 kPa when the spectra were scaled by nondimensional functions of dynamic pressure, velocity, and the empirical relationship between dynamic pressure and overall fluctuating pressure level. Author

N80-13880*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF SOUND LEVEL FLUCTUATIONS ON ANNOYANCE CAUSED BY AIRCRAFT-FLYOVER NOISE
David A. McCurdy Dec. 1979 40 p refs
(NASA-TP-1576; L-13181) Avail: NTIS HC A03/MF A01 CSCL 20A

A laboratory experiment was conducted to determine the effects of variations in the rate and magnitude of sound level fluctuations on the annoyance caused by aircraft-flyover noise. The effects of tonal content, noise duration, and sound pressure level on annoyance were also studied. An aircraft-noise synthesis system was used to synthesize 32 aircraft-flyover noise stimuli representing the factorial combinations of 2 tone conditions, 2 noise durations, 2 sound pressure levels, 2 level fluctuation rates, and 2 level fluctuation magnitudes. Thirty-two test subjects made annoyance judgements on a total of 64 stimuli in a subjective listening test facility simulating an outdoor acoustic environment. Variations in the rate and magnitude of level fluctuations were found to have little, if any, effect on annoyance. Tonal content, noise duration, sound pressure level, and the interaction of tonal content with sound pressure level were found to affect the judged annoyance significantly. The addition of tone corrections and/or duration corrections significantly improved the annoyance prediction ability of noise rating scales. Author

N80-13881*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ASSESSMENT AT FULL SCALE OF EXHAUST NOZZLE TO WING SIZE ON STOL-OTW ACOUSTIC CHARACTERISTICS
U. VonGlahn and D. Grosbeck 1979 27 p refs Presented at 98th Meeting of the Acoustical Soc. of Am., Salt Lake City, 26-30 Nov. 1979
(NASA-TM-79279; E-215) Avail: NTIS HC A03/MF A01 CSCL 20A

On the basis of static aero/acoustic data obtained at model scale, the effect of exhaust nozzle size on flyover noise is evaluated at full scale for different STOL-OTW nozzle configurations. Three types of nozzles are evaluated: a circular/deflector nozzle mounted above the wing; a slot/deflector nozzle mounted on the wing; and a slot nozzle mounted on the wing. The nozzle exhaust plane location, measured from the wing leading edge, was varied from 10 to 46 percent of the wing chord (flaps retracted). Flap angles of 20 deg (takeoff) and 60 deg (approach) are included in the study. Initially, perceived noise levels (PNL) are calculated as a function flyover distance at 152m altitude. From these plots, static EPNL values (defined as flyover relative noise levels), are obtained as functions of nozzle size for equal aerodynamic performance (lift and thrust). The acoustic benefits attributable to nozzle size relative to a given wing chord size are assessed.
A.R.H.

N80-13882*# Hamilton Standard, Windsor Locks, Conn.
ADVANCED TURBO-PROP AIRPLANE INTERIOR NOISE REDUCTION-SOURCE DEFINITION Final Report
B. Magliozzi and Bennett M. Brooks Oct. 1979 90 p refs
(Contract NAS3-20614)
(NASA-CR-159668) Avail: NTIS HC A05/MF A01 CSCL 20A

Acoustic pressure amplitudes and phases were measured in model scale on the surface of a rigid semicylinder mounted in an acoustically treated wind tunnel near a prop-fan (an advanced turboprop with many swept blades) model. Operating conditions during the test simulated those of a prop-fan at 0.8 Mach number cruise. Acoustic pressure amplitude and phase contours were defined on the semicylinder surface. Measurements obtained without the semi-cylinder in place were used to establish the magnitude of pressure doubling for an aircraft fuselage located near a prop-fan. Pressure doubling effects were found to be 6dB at 90 deg incidence decreasing to no effect at grazing incidence. Comparisons of measurements with predictions made using a recently developed prop-fan noise prediction theory which includes linear and non-linear source terms showed good agreement in phase and in peak noise amplitude. Predictions of noise amplitude and phase contours, including pressure doubling effects derived from test, are included for a full scale prop-fan installation. Author

N80-13883# Battelle Pacific Northwest Labs., Richland, Wash.
PATTERN RECOGNITION METHODS FOR ACOUSTIC EMISSION ANALYSIS
P. G. Doctor, T. P. Harrington, and P. H. Hutton Jul. 1979 58 p refs
(Contract EY-76-C-06-1830)
(NUREG-CR-0910) Avail. NTIS HC A04/MF A01

The application of pattern recognition techniques to acoustic emissions is examined. Three methods of performing the pattern recognition analysis are discussed. They are interfeature correlations, cluster analysis, and multidimensional display techniques. The data acquisition system is described and the types of acoustic emissions are identified. A.W.H.

N80-13884# Argonne National Lab., Ill.
SCATTERING OF ULTRASONIC WAVES BY PERIODICALLY ROUGHENED SURFACES
K. J. Reimann and W. A. Ellingson 1979 6 p refs Presented at the 25th ISA Intern. Instrumentation Symp., Anaheim, Calif., 7 May 1979
(Contract W-31-109-eng-38)
(CONF-790505-17) Avail: NTIS HC A02/MF A01

Detection of surface erosion by ultrasonic methods of the interior surfaces of transport components used to contain two phase flow in coal conversion systems was investigated. The

effect of surface roughness on wall thickness measurements was examined during laboratory studies of acoustic scattering on periodically roughened samples with peak-to-peak distances of 1 to 5 mm and depths of 0.3 to 4.7 mm. Characterization of periodicity, angle, and depth of the roughened surfaces was performed by ultrasonic pulse echo techniques with signal analysis, utilizing computer averaging, fast Fourier transforms, and consideration of spectral energies. Data indicate that spectral analysis and signal enhancement yield reliable information on the depth and spatial frequency of the roughened surfaces. DOE

N80-13885# Admiralty Marine Technology Establishment, Teddington (England).
ESTIMATION OF THE RMS VALUE OF SUMMED SINUSOIDS AND THE APPLICATION TO ACOUSTIC NOISE MEASUREMENT IN SHALLOW WATER
A. W. Walker London HMSO Nov. 1978 41 p refs
(AMTE(N)-TM-78413; BR66838) Avail: NTIS HC A03/MF A01

The spatial variation of many measurable quantities, such as pressure or velocity, may generally be synthesized by the sum of a given number of sinusoids. The power average of a small number of random of samples is presented as a suitable estimate of the mean power contained in such a sum of sinusoids of random argument and equal amplitude. The confidence levels which apply to these estimates are presented and the technique is illustrated by its application to the measurement of acoustic radiated noise in shallow water by the appropriate use of vertical transducer arrays. Author (ESA)

N80-13886# Royal Aircraft Establishment, Farnborough (England).
THE SCATTERING OF SOUND BY A REGION OF FLUID IN SOLID BODY ROTATION AT LOW MACH NUMBER
K. Taylor London HMSO Aug. 1978 40 p refs
(RAE-TR-78100; RAE-Aero-3440; BR66370) Avail: NTIS HC A03/MF A01

This example, which is one of the simplest to exhibit vortex refraction of sound, is solved using an approximation which is uniformly valid at all frequencies and small Mach numbers. The region of solid body rotation is bounded by a vortex sheet which implies that the results obtained have little physical relevance. However, this flow field gives acoustic equations which are comparatively easy to solve and thus an ideal test case for the various approximate techniques used to investigate the effect of more realistic vortices on sound. An assessment of a method which sets out to express the acoustic pressure as an asymptotic power series in the Mach number is given. It is found that this approach produces an error which increases progressively as the frequency increases at a fixed Mach number. At higher frequencies it appears that the ray theory approximation is likely to be more accurate. Author (ESA)

N80-13887# National Gas Turbine Establishment, Pyestock (England).
A REVIEW OF THE RESEARCH AT NGTE CONCERNING THE EFFECTS OF FLIGHT ON ENGINE EXHAUST NOISE
W. D. Bryce London Sep. 1978 76 p refs
(NGTE-R-78007; BR65126) Avail: NTIS HC A05/MF A01

The problem of explaining the changes in engine exhaust noise when going from static to flight conditions has puzzled research workers for some years. Various experimental research programs which were carried out in regards to this topic over the last five years are reviewed. The step-by-step progress which was made in the analysis of the problem is described and the results from some recent tests are presented. Flight tests indicate that the engine noise reduces in the rear arc, but at 90 deg to the engine axis and in the forward arc the engine noise is increased. Wind tunnel results and static tests are used to characterize jet noise and internally generated engine noise. Analysis indicates, based on a model of the mechanisms dominating engine exhaust noise, that acoustic and aerodynamic effects arising from installation configurations of engines in aircraft consitute the main features responsible for this noise increase in flight. Author (ESA)

N80-13300 Naval Underwater Systems Center, New London, Conn.
A SURVEY OF FINITE ELEMENT-RELATED TECHNIQUES AS APPLIED TO ACOUSTIC PROPAGATION IN THE OCEAN. PART 1: FINITE ELEMENT METHOD AND RELATED TECHNIQUES
A. J. Kalinowski *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 3 Mar. 1979 p 9-16 refs (For primary document see N80-13298 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington D. C. 20375 CSCL 20/1

N80-13304 Naval Underwater Systems Center, New London, Conn.
A SURVEY OF FINITE ELEMENT-RELATED TECHNIQUES AS APPLIED TO ACOUSTIC PROPAGATION IN THE OCEAN. PART 2: TRANSPARENT BOUNDARY SIMULATION TECHNIQUES
A. J. Kalinowski *In* SVIC The Shock and Vibration Digest, Vol. 11, No. 4 Apr. 1979 p 7-16 refs (For primary document see N80-13302 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/1

N80-13311 Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
RECENT DEVELOPMENTS FOR THE NONLINEAR DISTORTION OF NON-DISPERSIVE ACOUSTIC WAVES. PART 1: PLANAR WAVES AND THE BASIC METHOD
J. H. Ginsberg *In* SVIC Shock and Vibration Digest, Vol. 11, No. 7 Jul. 1979 p 3-8 refs (For primary document see N80-13310 04-31)
Avail: SVIC, Code 8404, Naval Research Lab., Washington, D. C. 20375 CSCL 20/1

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-13888 Oregon Univ., Eugene.
PRECISION DETERMINATION OF ATOMIC LEVEL ENERGIES BY ABSORPTION SPECTROMETRY WITH SYNCHROTRON RADIATION Ph.D. Thesis
Marianne Breinig 1979 114 p
Avail: Univ. Microfilms Order No. 7927230

Accurate measurements of the absolute energies of the ArK, KrK, and XeL sub 1, 2, 3 levels were carried out by X-ray absorption spectroscopy. The measurements serve to test recent theoretical atomic electron binding energies in which the remaining uncertainties for inner shells reside primarily in the Breit interaction, vacuum polarization, self energy; and the effect of correlation. Each spectrum was theoretically modelled with at least 4 Lorentzians representing the lowest energy one electron dipole transitions to bound excited states and one arc tangent representing dipole transitions to higher bound states and to the continuum. Energy differences from optical spectral series were used to relate the excited state energies to the vacuum level. Dissert. Abstr.

N80-13889 Oregon Univ., Eugene.
MEASUREMENT OF THE INELASTIC X-RAY SCATTERING CROSS SECTION OF NEON WITH SYNCHROTRON RADIATION Ph.D. Thesis
Fernando Antonio de Freitas Costa Parente 1979 185 p
Avail: Univ. Microfilms Order No. 7927271

Inelastic differential X-ray scattering cross sections, which are sensitive to electron-electron Coulomb correlation, are discussed through an approach made possible by the high flux and tunability of synchrotron radiation. The incident X-ray energy was chosen so that detection of elastically scattered photons was suppressed by critical absorption with a suitable filter. The ratio of inelastically to elastically scattered photons reaching the detector was boosted by approximately two orders of magnitude. The coherent/incoherent cross section ratio was then determined with measurement of the filter absorption edge. The scattering by Ne at incident X-ray energies just above the K edges of Ti,

V, Co, Fe, Ni, Cu, and Zn was measured. Results were compared with theoretical predictions based on the impulse approximation, and on the Waller-Hartree theory with wave functions that include 86 percent of correlation. New theoretical calculations were performed, based on the excited state approximation.

Dissert. Abstr.

N80-13890 Wisconsin Univ. - Madison.
DESIGN AND ANALYSIS OF TRANSIENT HIGH VOLTAGE ELECTRICAL DEVICES: OZONE PRODUCTION IN FAST PULSED DIELECTRIC BARRIER DISCHARGES IN OXYGEN AND MODELING OF AN INTENSE RELATIVISTIC ELECTRON BEAM SOURCE Ph.D. Thesis
Louis Andrew Rosocha 1979 215 p
Avail: Univ. Microfilms Order No. 7922142

Electrical discharges in O2 gas initiated by fast transient high voltage pulses from a flat plate Blumlein circuit are examined. Oxygen gas was excited between the electrodes of a dielectric barrier discharge cell connected to the Blumlein pulse forming network. The electrical breakdown of the gas and subsequent plasma kinetic reactions, which resulted in the formation of appreciable number densities of O3 molecules, is discussed along with the ozone densities. Ozone concentrations were measured by the absorption of UV light of wavelength 2537 A. The time dependence of the absorption signal was measured to determine the time constants for the formation of O3 molecules at various pressures of O2 gas. The design and operation of an intense relativistic electron beam device capable of output voltages of approximately 1 MV and currents of approximately 100 kA is discussed. A theoretical model based on a time dependent Langmuir-Childs description was formulated to model the output field emission diodes of a Marx generator pulsed coaxial Blumlein device.

Dissert. Abstr.

N80-13891 Baylor Univ., Waco, Tex.
MOLECULAR APPLICATION TO THE EQUATIONS OF MOTIONS METHOD Ph.D. Thesis
Linda Pauline Kinslow 1979 205 p
Avail: Univ. Microfilms Order No. 7926669

Various approximations of the equations of motion method (EOM) were employed to study the excited states of C2H4, BF, and C3H4. In the EOM method the excitation energies are calculated directly, as opposed to the configuration interaction method. Gaussian basis sets were used to calculate the excitation energies of the excited states of ethylene and allene. The EOM values of the excitation energies for different excited states are discussed.

Dissert. Abstr.

N80-13892 Minnesota Univ., Minneapolis.
NEW METHODS FOR QUANTUM MECHANICAL CALCULATIONS OF INELASTIC ATOM-MOLECULE COLLISIONS AND ELECTRON SCATTERING Ph.D. Thesis
Nancy Mullaney Harvey 1979 378 p
Avail: Univ. Microfilms Order No. 7926131

The close coupling method and the derivation of the close coupling equations for several systems are discussed. The theoretical foundation for, and the application of a suitably modified version of the R matrix propagation method of Light and Walker, which are used to numerically solve the close coupling equations for inelastic scattering processes are described. The efficiency of the R matrix propagation method for vibrationally inelastic collinear atom molecule scattering, for rotationally inelastic atom molecule and electron molecule scattering, and for electronically inelastic electron atom scattering are illustrated. The advantages of expanding the system wavefunction in adiabatic basis functions are emphasized.

Dissert. Abstr.

N80-13893 Virginia Univ., Charlottesville.
LASER-INDUCED EMISSION FROM URANIUM-HEXAFLUORIDE Ph.D. Thesis
Stephen William Allison 1979 162 p
Avail: Univ. Microfilms Order No. 7927990

The emission which results when a pulsed N2 laser or dye laser is focused in gaseous UF6 is investigated. The emission is associated with electrical breakdown in the gas in the vicinity of the focal point. The intensity and spectrum of this emission is measured from 262 to 650 nm as a function of gas pressure, laser power, laser wavelength, and other parameters of the measurements. The lifetime (e-folding time) of the emission intensity decay is measured. Photon absorption and Rayleigh scattering by the breakdown plasma are examined as a function of laser power and gas pressure. The yield of positive ions produced by the N2 laser is measured, as a function of pressure (0.1 to 40 torr), laser power (20 to 195 kW), and ion collector potential (-300 to -900 V). Laser induced fluorescence from UF6 isolated in low temperature matrices, primarily Ar, is investigated. The apparatus and procedures used to obtain the data are described. Applications of the breakdown process as a flow diagnostic for UF6 are considered.

Dissert. Abstr.

N80-13894# California Univ., Livermore. Lawrence Livermore Lab.
K-L AND L-K VACANCY SHARING IN ION-ATOM COLLISIONS
R. J. Fortner Nov. 1978 5 p refs Presented at the 5th Conf. on the Appl. of Small Accelerators, Denton, Tex., 6-8 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-81947; CONF-781113-25) Avail: NTIS HC A02/MF A01

The sharing of K and L vacancies in highly symmetric collisions in low energy ion-atom collisions using the molecular model is summarized. The theoretical models available for vacancy sharing are reviewed.

DOE

N80-13895# California Univ., Livermore. Lawrence Livermore Lab.
STUDIES IN MOLECULAR DYNAMICS OF THE FRICTION COEFFICIENT AND THE LORENTZ GAS Ph.D. Thesis
W. E. Alley 1 Jul. 1979 185 p refs
(Contract W-7405-eng-48)
(UCRL-52815) HC A09/MF A01

Three hard sphere molecular dynamics studies are presented. The first describes a modification of Fick's diffusion law, required whenever long time correlations are present. The second study concerns the mass and size dependence of the friction coefficient as well as its dependence on boundary conditions. The study presents a molecular dynamics method which calculates the infinite mass friction coefficient of finite size hard sphere particles. The third study presents the applicability of hydrodynamics to describe fluctuations in fluids on the molecular level. This study shows that the fluctuations present in a system of hard spheres when placed between closely spaced parallel hard walls lead to an acoustical resonance for those wavelengths which correspond to the spacing, or integer fractions thereof.

DOE

N80-13896# Los Alamos Scientific Lab., N. Mex.
MULTIPLE-PHOTON EXCITATION OF POLYATOMIC MOLECULES IN A STRONG OPTICAL FIELD: A UNIVERSAL NORMALIZATION
C. P. Robinson and O. P. Judd 1979 93 p refs Presented at 4th Intern. Conf. on Laser Spectroscopy, Rottach-Egern, Tegernsee, West Germany, 11 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1524; CONF-790690-1) Avail: NTIS HC A05/MF A01

The phenomenon of Multiple Photon Excitation (MPE) of polyatomic molecules by a (laser) optical field is examined. A picture of the interaction which emphasizes the dynamics of absorption within a single vibrational manifold with rapid intramodal coupling to other vibrational modes is discussed. The similarity between this picture of the excitation process by an optical field and the de-excitation process for vibrational relaxation of polyatomics is examined. A universal curve for the MPE process by analogy to the Lambert-Salter correlation for relaxation processes is studied.

DOE

N80-13897# California Univ., Berkeley. Lawrence Berkeley Lab.
PERFORMANCE OF A PRESSURIZED MULTIWIRE PROPORTIONAL CHAMBER FOR NEUTRON RADIOGRAPHY M.S. Thesis
Bruce Director Jun. 1979 43 p refs
(Contract W-7405-eng-48)
(LBL-9316) Avail: NTIS HC A03/MF A01

The effect of gas density on resolution and efficiency of a

neutron sensitive multiwire proportional chamber is examined. Increasing the density will shorten the reaction products range. A pressure vessel, designed and constructed for 4 atm thereby reducing the range of the reaction products from the neutron converter by a factor of 4, compared to 1 atm is discussed. Two different materials, gadolinium and boron, were tested to improve the efficiency of the neutron converters. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-13898 Texas Univ. Health Science Center, Houston.
ENERGY AND SPECTRUM MEASUREMENTS OF HIGH ENERGY ELECTRONS BEAMS USING A CERENKOV DETECTOR Ph.D. Thesis
Carlos Eduardo Velosa DeAlmeida 1979 153 p
Avail: Univ. Microfilms Order No. 7925033

A gas Cerenkov detector was used to obtain the energy of therapy electrons from 4 - 40 MeV. It consists of a 60 cm long pipe with aluminum windows, a mylar mirror at 45 degrees, placed at the far end reflecting the Cerenkov light through a Lucite window onto the PM tube. Light output versus pressure were obtained and the pressure being the critical variable of the method was monitored by a pressure transducer of .05% accuracy calibrated at NASA Standard Laboratory. Results of beam energy measurements from different radiotherapy machines are presented. The energy distribution obtained from the light output for these various beams, showing the effect of the scattering foils in the energy distribution are reported. Dissert. Abstr.

N80-13899 Oregon Univ., Eugene.
CHARGE CARRIER MOBILITY AND TRANSMISSION ACROSS THE LIQUID-VAPOR INTERFACE FOR THE DIELECTRIC LIQUID HYDROGEN Ph.D. Thesis
Gary Edward Grimm 1979 143 p
Avail: Univ. Microfilms Order No. 7927244

A radioactive source is used to inject positive and negative charge carriers into the dielectric fluid, liquid hydrogen. The mobility of positive and negative charge carriers is measured. The negative charge carrier mobility is found to be greater than that of the positive charge carrier. Both mobilities are found to be temperature dependent. The radius of the charge carriers is determined from the Navier-Stokes equation and hydrodynamic arguments. This radius is compared with theoretical predictions, where the radius is determined by minimization of the total energy of the charge carrier. Experimental data for the transmission of charge carriers across the liquid-vapor interface of liquid hydrogen is presented. The trapping time at the interface is determined by direct measurements of the decay rate of charge trapped at the liquid surface. Dissert. Abstr.

N80-13900 Cornell Univ., Ithaca, N. Y.
GENERATION AND CONTROL OF A SLOW SPACE CHARGE WAVE ON A HIGH CURRENT ELECTRON BEAM AND ITS POTENTIAL AS A COLLECTIVE ION ACCELERATOR Ph.D. Thesis
George Michael Gammel 1979 144 p
Avail: Univ. Microfilms Order No. 7926897

The slow space charge wave was successfully grown, and techniques were developed to measure its phase velocity and electric field amplitude. The amplitude was large enough to be of interest for ion acceleration, but a beam instability prevented the attainment of a low phase velocity, controllable during a single shot. The experimental results indicated that the desired phase velocity properties could be achieved if the instability were eliminated, for example by increasing the strength of the guiding magnetic field. Dissert. Abstr.

N80-13901# Sandia Labs., Albuquerque, N. Mex.
RELATIVISTIC ELECTRON BEAM ENERGY DEPOSITION IN THIN GOLD AND ALUMINUM TARGETS
E. J. T. Burns, S. A. Goldstein, J. A. Halbleib, L. P. Mix, J. N. Olsen, J. W. Poukey, J. P. Quintenz, and M. M. Widner Jan. 1979 53 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2026) Avail: NTIS HC A04/MF A01

Relativistic electron beam energy deposition in thin gold and aluminum targets was investigated using radiation temperature measurements in the soft X-ray, vacuum ultraviolet and optical spectral regions on two different particle accelerators. Energy deposition measurements were compared with numerical calculations utilizing particle in cell diode codes, condensed history Monte Carlo codes, and coupled radiation hydrodynamic codes. The specific power deposited and the self magnetic field are discussed. DOE

N80-13902# Atomic Energy of Canada Ltd., Pinawa (Manitoba).
CONCEPTUAL DESIGN STUDY OF A CONCRETE CANISTER SPENT-FUEL STORAGE FACILITY
E. D. Lidfors, T. Tabe, and H. M. Johnson Jan. 1979 80 p refs
(AECL-6301) Avail: NTIS (US Sales Only) HC A05/MF A01; DOE Depository Libraries

Interim storage of CANDU (CANada Deuterium Uranium) spent fuel in concrete canisters is studied. The canisters are concrete flasks which contain fuel prepackaged in double steel containment, and are cooled by natural air convection. The facilities required and the operations involved, are described. A summary of costs, a survey of the monitoring requirements and a prediction of the personnel exposures associated with this method of storing spent fuel are reported. DOE

N80-13903# Stanford Linear Accelerator Center, Calif.
ELASTIC ELECTRON SCATTERING AT LARGE MOMENTUM TRANSFER
R. G. Arnold May 1979 6 p refs Presented at the Intern. Conf. on Nucl. Phys. with Electromagnetic Interactions, Mainz, West Germany, 5 Jun. 1979
(Contract DE-AC03-76SF-00515)
(SLAC-PUB-2334; CONF-790610-2) Avail: NTIS HC A02/MF A01

A review is given of elastic electron scattering at large momentum transfer (sq Q > 20/sq fm) from nuclei with A less than or equal to 4 are given. Recent experimental results are reviewed and the current problems in interpretation of these results are pointed out. Some questions for future experiments are posed, and a preview of possible future measurements is presented. DOE

N80-13904# Stanford Linear Accelerator Center, Calif.
PHENOMENOLOGY OF HEAVY LEPTONS AND HEAVY QUARKS
F. J. Gilman Nov. 1978 14 p refs Presented at the Kyoto Summer Inst. for Particle Phys., Kyoto, 1-5 Sep. 1978
(Contract EY-76-C-03-0575)
(SLAC-PUB-2226) Avail: NTIS HC A02/MF A01

The quark and lepton family are reviewed. Properties of the tau, SU(2) x U(1) classification of the tau and its decays, heavier leptons, the spectroscopy of heavy hadrons composed of quarks, their strong and electromagnetic decays, the weak interaction properties of the c, b, and t quarks, and the decays of hadrons containing them expected within the context of the standard SU(2) x U(1) mode are included. DOE

N80-13905# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Reactor Engineering Div.
SPENT FUEL RECEIPT AND LAG STORAGE FACILITY FOR THE SPENT FUEL HANDLING AND PACKAGING PROGRAM
J. E. Black and F. D. King Jan. 1979 281 p refs
(Contract EY-76-C-09-0001)
(DPSTD-SFHP-78-10) Avail: NTIS HC A13/MF A01

The operation and design of a spent light water reactor fuel storage plant is examined. The design bases including safety, operation, and the underwater handling and storage capabilities are discussed. A physical description of the plant with equipment requirements, support systems design, and safety criteria and

assurance is presented. The shipping and transportation of the light water to the plant is investigated. A.W.H.

N80-13906# Los Alamos Scientific Lab., N. Mex.
BASELINE DESIGN OF THE THERMOELECTRIC REACTOR SPACE POWER SYSTEM
W. A. Ranken and D. R. Koenig 1979 8 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1242; CONF-790803-21) Avail: NTIS HC A02/MF A01

An extensive review of design alternatives for a nuclear reactor space power system capable of delivering 10 to 100 kW/sub e/ has led to the selection of a heat-pipe-cooled fast spectrum reactor with a thermoelectric power conversion system. The reactor design features a laminated core configuration with sheets of molybdenum - extending across the full diameter of the core - interspersed between layers of UO2. Reactor heat is transferred by these sheets from the UO2 to an array of 90 Mo/Na heat pipes that are spaced so that each receives equal power from an essentially uniform fuel loading in the core. This heat is transported by these heat pipes around the LiH shield to a ring of high-power-density thermoelectric modules constructed from modified SiGe alloys. Conversion takes place over a temperature interval of 1375 to 775 K with an efficiency of 9 percent. Residual heat is rejected by a conical radiator that is constructed from cross-coupled beryllium heat pipes. DOE

N80-13907# California Univ., Berkeley. Lawrence Berkeley Lab.
VECTOR CURRENT SCATTERING IN TWO DIMENSIONAL QUANTUM CHROMODYNAMICS Ph.D. Thesis
N. L. Fleishon Apr. 1979 135 p refs
(Contract W-7405-eng-48)
(LBL-9022) Avail: NTIS HC A07/MF A01

The interaction of vector currents with hadrons is considered in a two dimensional SU(N) color gauge theory coupled to fermions in leading order in an N-1 expansion. After giving a detailed review of the model, various transition matrix elements of one and two vector currents between hadronic states are considered. A pattern is established whereby the low mass currents interact via meson dominance and the highly virtual currents interact via bare quark-current couplings. This pattern is especially evident in the hadronic contribution to inelastic Compton scattering, which is investigated in various kinematic limits. It is shown that in the dual Regge region of soft processes the currents interact as purely hadronic systems. Modification of dimensional counting rules is indicated by a study of a large angle scattering analog. In several hard inclusive nonlight cone processes, parton model ideas are confirmed. The impulse approximation is valid in a Bjorken-Paschos-like limit with very virtual currents. A Drell-Yan type annihilation mechanism is found in photoproduction of massive lepton pairs, leading to identification of a parton wave function for the current. DOE

N80-13908# California Univ., Livermore. Lawrence Livermore Lab.
REMOTE SYSTEMS REQUIREMENTS OF THE HIGH YIELD LITHIUM INJECTION FUSION ENERGY (HYLIFE) CONVERTER CONCEPT
P. E. Walker Oct. 1978 28 p refs Presented at the ANS Meeting, Washington, D.C., 12 Nov. 1978 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-81309) Avail: NTIS HC A03/MF A01

Remote systems required in the high yield lithium injection fusion energy converter power plant for inspection operations, viewing of the chamber interior and certain pumps, valve fittings, and welds are discussed. Ideas for remote maintenance of laser beam blast baffles, optics, and target material traps are described. Radioisotope sources and their distributions, and exposure rates at various points in the reactor vicinity are presented. DOE

N80-13909# Sandia Labs., Albuquerque, N. Mex.
EVALUATION OF THE PROPOSED WIPP SITE IN SOUTHEAST NEW MEXICO
W. D. Weart 1979 35 p refs Presented at 87th AICHE Natl. Meeting, Boston, 19 Aug. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1113C; CONF-790822-7) Avail: NTIS HC A03/MF A01

Five years of Earth science characterization of the proposed Waste Isolation Pilot Plant site provide a high level of assurance that the area is satisfactory for development of a geologic repository. Ecological investigations and socioeconomic studies have indicated only relatively benign impacts will occur from construction, operation and long-term aspects of the repository. DOE

N80-13910# Idaho National Engineering Lab., Idaho Falls.
X-RAY AND GAMMA RAY TRANSMISSION DENSITOMETRY
G. D. Lassahn, A. G. Stephens, D. J. Taylor, and D. B. Wood 1979 149 p refs Presented at the Intern. Colloq. on Densitometry, Idaho Falls, Idaho, 10 Jun. 1979
(Contract EY-76-C-07-1570)
(CONF-790692-1) Avail: NTIS HC A07/MF A01

Gamma and X-ray attenuation densitometers, systems in which measurements of the attenuation of one or several radiation beams are used to infer the density of the attenuating material are examined. Discussions of the theoretical and practical aspects of densitometer design, operation, and data interpretation are presented. DOE

N80-13911# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report, May 1979
W. J. Maraman, comp. Jul. 1979 43 p
(Contract W-7405-eng-36)
(LA-7952-PR) Avail: NTIS HC A03/MF A01

The studies related to the use of Pu-238O2 in radioisotopic power systems are reported. Research progress is reported on: (1) general purpose heat source development; (2) space nuclear safety; and (3) radioisotopic terrestrial safety. DOE

N80-13912# Oak Ridge National Lab., Tenn.
RECENT ADVANCES IN DESIGN FOR LOW AND MEDIUM-ENERGY HEAVY ION ACCELERATORS
J. A. Martin 1979 8 p refs Presented at IEEE Particle Accelerator Conf., San Francisco, 12 Mar. 1979
(Contract W-7405-eng-26)
(CONF-790327-7) Avail: NTIS HC A02/MF A01

Recent developments in the technology of electrostatic accelerators, linear accelerators, and cyclotrons for the acceleration of heavy ions are reviewed. The characteristics of each accelerator are presented. DOE

N80-13913# Los Alamos Scientific Lab., N. Mex.
TRANSFER MAP APPROACH TO THE BEAM-BEAM INTERACTION
A. J. Dragt Jun. 1979 31 p refs Presented at Symp. on Nonlinear Dyn. and the Beam-Beam Interaction, Upton, N. Y. 19 Mar. 1979 Prepared jointly with Maryland Univ., College Park
(Contract W-7405-eng-36)
(LA-UR-79-1752; CONF-790318-4) Avail: NTIS HC A03/MF A01

A model for the beam-beam interaction in ISABELLE using numerical methods and the recently developed method of transfer maps is described. The analytical transfer map calculations which account qualitatively for all the features of the model observed numerically are discussed. Preliminary evidence that within the model employed, the beam-beam interaction at its contemplated strengths should not lead to particle loss in ISABELLE is presented. DOE

N80-13914# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
LOW-COST RF SYSTEM FOR A 2-MEGAHERTZ HEAVY ION LINEAR ACCELERATOR
R. T. Sanders 10 Jan. 1979 15 p refs
(Contract EY-76-C-02-0016)

(BNL-50960) Avail: NTIS HC A02/MF A01

A low cost radio frequency power source for a low beta linear accelerator (Linac) is described. Details of the conversion of a 30 kW, 4 to 30 MHz communications transmitter to a 2 MHz parallel line resonator driver are included. Typical calculations required for the modifications and anticipated line dissipation are given. The results of actual high level operation are discussed, and power output requirements when driving a Wideroe linac are determined. DOE

N80-13915# Brookhaven National Lab., Upton, N. Y.
BNL THREE-STAGE TANDEM ACCELERATOR FACILITY
K. W. Jones 1979 13 p refs Presented at DOE/BES Res. Meeting on High Energy Atomic Phys., Manhattan, Kas., 5 Apr. 1979
(Contract EY-76-C-02-0016)
(BNL-26211; CONF-790438-2) Avail: NTIS HC A02/MF A01

An accelerator for use in atomic physics experiments which gives the experimenter free choice of the element to be accelerated, as well as the ability to specify the desired charge state and velocity is discussed. Reviewed are the present capabilities of a three stage MP tandem facility for producing beams for atomic physics research. The improvements that might be achieved with the addition of a booster accelerator are considered. DOE

N80-13916# Brookhaven National Lab., Upton, N. Y.
BUNCHED-BEAM p-p(-) AND p-p COLLISIONS
E. D. Courant and E. Keil 1978 9 p refs Presented at Workshop on Possibilities and Limitations of Accelerators and Detectors, 15 - 21 Oct. 1978
(Contract EY-76-C-02-0016)
(BNL-26240) Avail: NTIS MF A01

Collisions between bunched beams of protons and/or antiprotons are studied. It is assumed that the bunches collide head on, and that the two beams have the same number of particles N and rms beam radii sigma sub x and sigma sub y at the crossing point. The basic luminosity formula and the stored beam intensity are derived. DOE

N80-13917# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
US PROGRAM FOR THE IMMOBILIZATION OF HIGH-LEVEL NUCLEAR WASTES
J. L. Crandall 8 Jun. 1979 25 p Presented at the Am. Nucl. Soc. Meeting, Atlanta, 3-8 Jun. 1979
(Contract EY-76-C-09-0001)
(DP-MS-79-2; CONF-790602-69) Avail: NTIS HC A02/MF A01

A program developed for the term management of high level nuclear waste is described. The program is designed to immobilize the high level waste in forms that act as highly efficient barriers against radionuclide release to the disposal site and to provide technology for similar treatment of commercial high level waste in case reprocessing of commercial nuclear fuels is ever resumed. Descriptions of commercial wastes, program strategy, program expenditures, development of waste forms, evaluation and selection of waste forms, regulatory aspects of waste form selection, project schedules, and cost estimates for immobilization facilities are discussed. DOE

N80-13918# California Univ., Livermore. Lawrence Livermore Lab.
TECHNICAL CONCEPT FOR TEST OF GEOLOGIC STORAGE OF SPENT REACTOR FUEL IN THE CLIMAX GRANITE, NEVADA TEST SITE
L. D. Ramspott, L. B. Ballou, R. C. Carlson, D. N. Montan, T. R. Butkovich, J. E. Duncan, W. C. Patrick, D. G. Wilder, W. G. Brough, and M. C. Mayr 31 May 1979 73 p refs
(Contract W-7405-eng-48)
(UCID-18197) Avail: NTIS HC A04/MF A01

The spent fuel test in the Climax granite at the Nevada Test Site, a generic test in which spent fuel assemblies from an operating commercial nuclear reactor are emplaced at, and retrieved from, a plausible waste repository depth in a typical granite is described. Eleven canisters of spent fuel were emplaced in a storage drift 420 m below the surface along with six electrical simulator canisters. Two adjacent drifts contain electrical heaters which are operated so as to simulate the initial five years of the temperature stress displacement fields of a large repository. The site is described, and the preoperational measurement program and characteristics of the spent fuel are given. Both thermal and mechanical response calculations are summarized. The field instrumentation and data acquisition systems are described, as well as the system for handling the spent fuel. DOE

N80-13919# Idaho National Engineering Lab., Idaho Falls.
HEAT TRANSFER IN HIGH-LEVEL WASTE MANAGEMENT
B. R. Dickey and G. W. Hogg 1979 42 p refs Presented at the 87th AICHE Natl. Meeting, Boston, 19 Aug. 1979
(Contracts EY-76-C-07-1540; DE-AC07-76ID-01540)
(CONF-790822-1) Avail: NTIS HC A03/MF A01

Heat transfer in the storage of high-level liquid wastes, calcining of radioactive wastes, and storage of solidified wastes are discussed. processing and storage experience are summarized for defense high-level wastes; heat transfer in power reactor high-level waste processing and storage is also discussed. DOE

N80-13920# Pacifica Technology, Del Mar, Calif.
RETRIEVABLE STORAGE CONCEPT DESIGNS Final Report
Robert E. Nickell 1 Mar. 1979 28 p refs
(Contract W-7405-eng-48)
(UCRL-15018) Avail: NTIS HC A03/MF A01

The reference design of retrievable storage canisters for radioactive waste is described. The reference design is a sealed storage canister concept based upon the waste isolation pilot plant (WIPP) design, with slight modifications. The modifications consist of an alternate lifting yoke arrangement for the top head and a revised bottom head design for absorption of impact energy. The four failure modes that are deemed the most appropriate for the design of the reference canister are: (1) a loss of functional capability; (2) ductile rupture of the canister; (3) buckling of the structural members; and (4) stress corrosion cracking. Failure scenarios are provided for each of the relevant failure modes. In addition, a failure methodology based upon the distribution of demand and the distribution of capacity for the structural members, with respect to each failure mode, is given. DOE

74 OPTICS

Includes light phenomena.

N80-13921 Wisconsin Univ. - Madison.
DETERMINATION OF THE INTENSITY OF SCATTERED RADIATION AND THE PERFORMANCE OF GRIDS IN DIAGNOSTIC RADIOLOGY BY MONTE CARLO METHODS Ph.D. Thesis
Willi Alfred Kalender 1979 152 p
Avail: Univ. Microfilms Order No. 7918155

A method for determining data on scattered radiation in arbitrary radiological situations is presented. A computational method employing the Monte Carlo principle was chosen and is described in detail. The intensity of singly and multiply scattered radiation is calculated as a function of energy, field size and shape, object thickness, and object to detector distance in terms of the scatter fraction F, which is defined as the ratio of the intensities of scattered and total radiation. The energy dependence is investigated thoroughly. The influence of different detector thickness and materials on the scatter fraction results is determined. The distribution of scattered radiation in the image plane is determined under variation of the above parameters. An results are compared to available results of earlier investigations with generally good agreement. Possible applications of the method and data are briefly outlined. Dissert. Abstr.

N80-13922*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
OPTICAL DIGITAL TECHNIQUES Final Report
Feb. 1979 226 p refs
(Contract NAS9-15051)
(NASA-CR-160392; MDC-E2052) Avail: NTIS HC A11/MF A01 CSCL 20F

Optical interface losses between transmitter-to-fiber interface, connector-to-connector interface, and fiber-to-receiver interface were studied. System effects such as pulse dispersion, risetimes of the sources and detectors, type of fibers used, output power of the sources, and detector sensitivity were considered. Data bus systems such as TEE, Star, and Hybrid were analyzed. The matter of single fiber versus bundle technologies for future avionics systems was considered. The existing data bus system on Space Shuttle was examined and an optical analog was derived for a fiber bundle system, along with the associated power margin. System tests were performed on a feasibility model of a 9-port Star data bus system including BER, star losses, connector losses, etc. The same system was subjected to EMI between the range of 200 Hz to 10 GHz at 20V/m levels. A lightning test was also performed which simulated the conditions similar to those on Space Shuttle. The data bus system was found to be EMI and lightning hard. It is concluded that an optical data bus system is feasible for shuttle orbiter type vehicles. A.R.H.

N80-13923*# Stanford Univ., Calif. Edward L. Ginzton Lab.
ANTI-STOKES EMISSION AS A VUV AND SOFT X-RAY SOURCE
S. E. Harris, J. Lukasik, J. F. Young, and L. J. Zych. Jun. 1978. 10 p. refs.
(Grant NGL-05-020-103; Contracts N00014-75-C-1175; N00014-75-C-0632)
(NASA-CR-162266; AD-A070337; GL-2819) Avail: NTIS HC A02/MF A01 CSCL 20/6

A VUV and soft X-ray light source based on spontaneous anti-Stokes scattering from atomic population stored in a metastable level is described. Unique properties of this source include: narrow linewidth, tunability, linear polarization, picosecond time scale, and quite high spectral brightness. We show how the maximum source brightness, within its narrow linewidth, is that of a blackbody at the temperature T of a metastable storage level. GPA

N80-13924# Washington Univ., St. Louis, Mo. Semiconductor Research Lab.
GaAs WAVEGUIDE DETECTOR ARRAY FOR AN IOC SPECTRUM ANALYZER Final Technical Report, 1 Jun. 1978 - 31 May 1979
31 Jul. 1979. 29 p. refs.
(Contract N00173-78-C-0134)
(AD-A073552; Rept-64351-1) Avail: NTIS HC A03/MF A01 CSCL 14/2

Integrated optical circuits (IOCs) combining optical signal propagation with high-speed photoelectronic detection have a high potential for very fast analog or digital signal processing. A wideband, real-time spectrum analyzer using thermally grown oxides on a silicon substrate has been investigated by Anderson. Sun et al. have demonstrated the feasibility of a 3-channel time demultiplexing scheme. Data rates of 1 Mbps have been achieved using GaAs waveguide detectors, and frequency demultiplexing has also been investigated. Gallium Arsenide shows considerable promise as a semiconductor for use in IOC fabrication. A large variety of electronic and optical devices have been demonstrated in GaAs with the desirable attributes of high speed, low noise, and high efficiency. Lindley et al. have fabricated avalanche photodetectors with a large gain-bandwidth product (-50 GHz) and a signal-to-noise ratio of 30 dB. Stillman et al. have fabricated GaAs waveguides which operate with attenuation as low as 2 per cm at GaAs laser wavelengths. In addition, GaAs-AlGaAs double heterostructure lasers emitting at 9100 A have been integrated with high-purity GaAs waveguides. GRA

N80-13925# Efratom Systems Corp., Irvine, Calif.
AN INVESTIGATION OF THE TECHNICAL FEASIBILITY OF USING PULSED OPTICAL PUMPING TO ELIMINATE THE LIGHT SHIFT AND IMPROVE THE LONGTERM STABILITY OF PASSIVE RUBIDIUM FREQUENCY STANDARDS Final Report, 1 Sep. 1977 - 30 Apr. 1979
Thomas C. English and Ernst Jechart. 30 Aug. 1979. 58 p. refs.
(Contract N00014-77-C-0646)
(AD-A073757) Avail: NTIS HC A04/MF A01 CSCL 14/2

A pulsed optical pumping rubidium frequency standard has been constructed for the purpose of eliminating the light shift and investigation the long-term frequency stability in the absence of light shifts. The device used employs a very small physics package that occupies a total volume of only 260 cc. Initial measurements of the light shift for this device showed that the light shift was reduced by about an order of magnitude to approximately -1.5 times 10 to the -10th power fractional frequency shift for a 30% reduction in light intensity. Under these conditions, the square root of the Allan variance was determined to be of the order of parts in 10 to the 12th power for averaging times of 24 hrs and 48 hours. GRA

N80-13926# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL FLIR STUDY M.S. Thesis
James Powell Gruber. Jun. 1979. 80 p. refs.
(AD-A073361) Avail: NTIS HC A05/MF A01 CSCL 17/5

A single cell, serially scanned, thermal imaging FLIR system has been constructed. The system consisted of a Cassegrain type reflecting telescope with a convergent beam, oscillating mirror scan system and HgCdTe and InSb single cell infrared detectors. The system was first tested using visible light and then switched to the infrared wavelengths. The FLIR has imaged scenes with a temperature difference of 9 K above ambient. MTF measurements have shown it to be diffraction limited by the active area of the detector crystal and the optics. GRA

N80-13927# Los Alamos Scientific Lab., N. Mex.
NONLINEAR OPTICS: PARAMETRIC AMPLIFICATION AT 16 MICROMETERS AND OSCILLATOR MODE COMPETITION
R. G. Wenzel. May 1979. 111 p. refs.
(Contract W-7405-eng-36)
(LA-7850-T) Avail: NTIS HC A06/MF A01

The parametric amplification at 16 micrometers using a CdSe optical parametric amplifier is reported. The amplifier gain bandwidth was measured and compared with theory. The second order susceptibility for CdSe at 16 micrometers was measured and compared to results obtained at other wavelengths. The distributions of longitudinal modes of oscillation were determined for 3 configurations of an etalon narrowed CdSe OpO. A model was developed to predict the oscillation probability for OpO modes in terms of the pump intensity and duration, cavity losses, and etalon transmission. A.W.H.

N80-13928# Los Alamos Scientific Lab., N. Mex.
BROADLY TUNABLE PICOSECOND IR SOURCE
A. J. Campillo, R. C. Hyer, and S. L. Shapiro. 1979. 18 p. refs. Presented at Conf. on Optics, Los Alamos, N. Mex., 23 May 1979
(Contract W-7405-eng-36)
(LA-UR-79-1474; CONF-790529-4) Avail: NTIS HC A02/MF A01

A completely grating tuned (1.9 to 2.4 micrometers) picosecond traveling wave IR generator capable of controlled spectral bandwidth operation down to the Fourier Transform limit is reported. The generation of tunable 10 to 20 micrometers picosecond radiation by subsequent difference frequency mixing using CdSe is discussed. DOE

N80-13929# Optische Werke G. Rodenstock, Munich (West Germany). Referat Foto- und Sonderentwicklung.
MOUNTING PROCEDURE FOR HIGH QUALITY OPTICAL SYSTEMS Final Report
Peter Hanke. Bonn: Bundesmin. fuer Forsch. u. Technol. Nov. 1978. 74 p. refs. In GERMAN; ENGLISH summary
(Contract BMFT-NT-1011)
(BMFT-FB-T-78-19) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15.55

The difficulties encountered in manufacturing high quality optical systems by conventional methods are set forth. Based on a number of years' experience, a mounting process was developed, up to the series production level, whereby the lenses are places in the mount and secured by a potting compound. A method of construction was designed, various measuring and positioning techniques tested, suitable potting compounds selected, and a rational potting process evolved. The calculated unit cost based on this method of fabrication compares favorably with the cost of conventional procedures. Author (ESA)

N80-13930# European Space Agency, Paris (France).
A NEW METHOD FOR THE DESIGN OF RECURSIVE DIGITAL FILTERS AND ITS FIELDS OF APPLICATION
Gerhard Hirzinger (DFVLR, Oberpfaffenhofen, West Germany) Jul. 1979 34 p refs Transl. into ENGLISH OF "Ein Neues Verfahren zum Entwurf Rekursiver Digitaler Filter und seine Anwendungsmoeglichkeiten", Rept. DLR-FB-77-69 DFVLR, Oberpfaffenhofen, West Germany, Jan. 1979
(ESA-TT-530-Rev. DLR-FB-77-69) Avail: NTIS HC A03/MF A01

A technique for the design of recursive digital filters is presented which leads to a compromise between phase and amplitude response in one design step. The computational method is derived in the time domain and is based on solving a system of equations by least squares techniques. The method may be denoted as comparatively simple. It is shown that without major complications the technique may be extended to the design differentiating and integrating filter algorithms, where the systematic design of numerical integration formulas should be of great interest. Several examples are given to demonstrate how the presented technique may be applied usefully. Particular emphasis is laid on cases which are of interest in the control and simulation of dynamical systems. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-13931 Texas Technological Univ., Lubbock.
PHASE MEASUREMENTS OF FAST WAVE TOROIDAL EIGENMODES Ph.D. Thesis
Stephen O. Knox 1979 99 p
Avail: Univ. Microfilms Order No. 7920376

Phase resolved techniques were used to investigate the resonances, or eigenmodes, formed when a radio frequency wave (the fast Alfven wave) propagates in a toroidal plasma. A resonant structure was formed where the parameters of the plasma and the RF excitation frequency, plus the physical dimensions of the torus determined where the eigenmodes occur. At an eigenmode, the radio frequency wave amplitude in the plasma was greatly increased due to the buildup of oscillations within the torus. The exciting source supplied only the losses due to wave dissipation in the plasma and vessel walls. The relatively large stored energy was passed back and forth between the electric and magnetic fields of the radio frequency plasma wave. A large amount of energy was coupled into the plasma at an eigenmode resource. This energy was absorbed via several mechanisms within the plasma, resulting in a gain in kinetic energy by the plasma particles. Dissert. Abstr.

N80-13932 California Univ., Los Angeles.
KINETIC THEORY OF BALLOONING INSTABILITIES Ph.D. Thesis
James Walter VanDam 1979 237 p
Avail: Univ. Microfilms Order No. 7926070

A kinetic formulation is developed for long parallel wavelength ballooning instabilities in a weakly collisional plasma confined by a sheared magnetic field of arbitrary axisymmetric toroidal geometry. Modeling electron-ion collisions with a Doughterty collision operator and assuming collisionless ions, a closed system of equations which describe both electromagnetic and electrostatic modes in the rather collisional and in the diffusive semicollisional regimes is presented. An infinite series representation for high toroidal mode number modes is derived. The general global behavior of ballooning modes is described. The small scale, rapidly varying structure is described by an ordinary differential. The stability threshold for collisional electromagnetic modes is determined by shear and by the average favorable curvature of the magnetic field. The radially extended nonlocal mode structure is described by a set of slowly varying envelope equations. Imposing a quantization condition on the radial phase quantity which serves as the eigenvalue for the local analysis yields the complete two-dimensional frequency spectrum. Dissert. Abstr.

N80-13933 Washington Univ., Seattle.
LASER DRIVEN BREAKDOWN-HEATING WAVES IN MAGNETIZED HYDROGEN Ph.D. Thesis
David Woodward Scudder 1979 177 p
Avail: Univ. Microfilms Order No. 7927867

Laser-induced gas breakdown, beam trapping, effects of radial pressure, balance and mechanisms of ionization propagation, are reviewed. The plasma columns are generated experimentally with 400 J, 1 microsecond laser pulses in hydrogen in a 100 kG solenoid. Transverse holographic interferometry, Thomson scattering of a ruby laser, streak photography, and spectroscopic techniques are used to study the columns. The plasma columns were found to grow at a velocity of approximately 10 to the seventh power cm/sec over a wide range of target densities. The temperature observed was about 70 eV at a target density of 2 x 10 to the eighteenth power electrons/cu cm. Significant results are reported which indicate that plasma heating with CO2 lasers is highly efficient when the target density and field are chosen appropriately. Dissert. Abstr.

N80-13934 Maryland Univ., College Park.
ELECTROMAGNETIC LOWER HYBRID INSTABILITIES IN AN INHOMOGENEOUS PLASMA Ph.D. Thesis
Poh Hua Ng 1979 108 p
Avail: Univ. Microfilms Order No. 7926508

The electromagnetic properties of four microinstabilities in an inhomogeneous plasma with a temperature gradient are studied analytically and numerically. The evolution of the drift cyclotron loss cone instability as the loss cone velocity distribution is progressively filled with a warm Maxwellian component is studied. The addition of the warm plasma which results in both a lowering of the growth rate and a distortion and narrowing of the frequency spectrum is discussed. Dissert. Abstr.

N80-13935 Tennessee Univ., Knoxville.
THE STUDY OF MHD INSTABILITIES IN ELONGATED TOKAMAKS Ph.D. Thesis
Chang-Hyuk An 1979 116 p
Avail: Univ. Microfilms Order No. 7927023

Fixed boundary ideal magnetohydrodynamic (MHD) instabilities were studied analytically and computationally for highly elongated axisymmetric toroidal equilibria. The analytic results for high n ballooning modes were compared with computational results obtained by using ORNL BALOON code. The computational results reveal that high elongation, low aspect ratio, and broad pressure profile enhance the marginal beta for Beta sub P less than unity but severely reduce the marginal beta for Beta sub P larger than unity for the equilibrium profiles used. Dissert. Abstr.

N80-13936 Washington Univ., Seattle.
MULTIPLE-PASS CARBON DIOXIDE LASER HEATING OF A THETA-PINCH PLASMA Ph.D. Thesis
Robert Dick Brooks 1979 150 p
Avail: Univ. Microfilms Order No. 7927751

The multiple pass experiment which consisted of a coupled optical cavity with a 20 cm long theta pinch plasma as an active element is described. A 100 joule CO2 TEA laser was used in the coupled cavity with either an eight percent reflecting NaCl output coupler or a thirty percent reflecting germanium output coupler. The NaCl output coupler emphasized the effects of the coupled cavity while the germanium coupler provided significant single pass as well as multiple pass heating. Utilizing holographic interferometry, conditions were found which resulted in the formation of a reproducible plasma with a large density minimum on axis during a major portion of the first quarter cycle of the theta pinch discharge. With the NaCl output coupler the TEA laser output was dramatically affected by the dynamics of the theta pinch plasma when fired in the multiple pass configuration. A ruby laser scattering system indicated that the temperatures reached in the multiple pass configuration were dependent upon the time of the initiation of the laser pulse. Dissert. Abstr.

N80-13937# Argonne National Lab., Ill.
TECHNICAL SUPPORT FOR OPEN-CYCLE MHD PROGRAM Progress Report, Jul. - Dec. 1978
E. D. Doss, ed. Jun. 1979 87 p refs
(Contract W-31-109-eng-38)

(ANL/MHD-79-4) Avail: NTIS HC A05/MF A01

The development of the analytical tools needed to investigate the performance of the major components in the combined cycle MHD/steam power system is examined. The analytical effort is centered on the primary components of the system that are unique to MHD and also on the integration of these analytical representations into a model of the entire power producing system. The investigation includes modeling of the combustor, MHD channel, slag separator, and high temperature air heater. DOE

N80-13938# California Univ., Berkeley. Lawrence Berkeley Lab.

MULTIMEGAWATT NEUTRAL BEAMS FOR TOKAMAKS

W. B. Kunkel Mar. 1979 8 p refs Presented at IEEE Particle Accelerator Conf., San Francisco, 12 Mar. 1979

(Contract W-7405-eng-48)

(LBL-8891; CONF-790327-96) Avail: NTIS HC A02/MF A01

The use of high power neutral beam injectors to heat plasmas in Tokamak reactors is described. DOE

N80-13939# Oak Ridge National Lab., Tenn.

SCALING STUDIES OF BEAM-HEATED TOKAMAKS

S. C. Scott (MIT) and J. Sheffield Nov. 1978 19 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6584) Avail: NTIS HC A02/MF A01

Parametric scaling of neutral beam heated Tokamaks is examined to determine the trade off between beam energy and power. It is shown that over a wide range of plasma parameters and assumed transport properties, the center mean plasma temperature is a function of P sub A E sub B(delta), where E sub B and P sub A are the beam energy and power per unit area, respectively, and delta is a calculable constant of order unity. DOE

N80-13940# Science Applications, Inc., Albuquerque, N. Mex.

TECHNICAL REVIEW OF THE SANDIA LABORATORIES' PARTICLE BEAM FUSION PROGRAM

18 May 1979 39 p

(Contract EY-76-C-04-0789)

(SAND-79-7044) Avail: NTIS HC A03/MF A01

The technical aspects of the particle beam fusion program are considered and the program's initial goals, the progress made to date towards reaching those goals, and the future plans or methods of reaching those original or modified goals are examined. A summary of the effort, which seeks to demonstrate that high voltage pulsed power generated high current electron or light ion beams is used to ignite a deuterium or tritium pellet, is provided. DOE

N80-13941# Argonne National Lab., Ill.

FUSION POWER PROGRAM Quarterly Progress Report, Oct. - Dec. 1978

Apr. 1979 94 p refs

(Contract W-31-109-eng-38)

(ANL/FPP-78-4) Avail: NTIS HC A05/MF A01

Research and development areas in nuclear fusion are presented. Areas include: materials; energy storage and transfer; tritium containment, recovery and control; advanced reactor design; atomic data; reactor safety; fusion-fission hybrid systems; and alternate applications of fusion energy. Research progress is reported for each of the following areas: (1) savings in plasma support systems for a Tokamak hybrid reactor; (2) fusion reactor safety studies; (3) energy storage and transfer; (4) test results of the 1.5 MJ pulsed superconducting coil; and (5) atomic data studies. DOE

N80-13942# California Univ., Livermore. Lawrence Livermore Lab.

EQUILIBRIUM PLASMA CORONA SURFACES

Donald L. Ensley Jul. 1979 13 p

(Contract W-7405-eng-48)

(UCID-18228) Avail: NTIS HC A02/MF A01

The distribution of charge of one sign when the opposite charge density is given is determined. Poisson's equation is solved in plane geometry for a simple specified ion density. This gives the inverse solution for a given electron density, by reversing the sign of the potential. Some solutions which approximate a microwave confined corona, for very over-dense cases are discussed. Analysis procedures are presented. DOE

N80-13943# California Univ., Livermore. Lawrence Livermore Lab.

SURFACE MOTION AND CONFINEMENT POTENTIAL FOR A MICROWAVE CONFINED CORONA

Donald L. Ensley Jul. 1979 18 p refs

(Contract W-7405-eng-48)

(UCID-18227) Avail: NTIS HC A02/MF A01

Approximate time dependent solutions for surface velocities and potentials are given for a plane polarized microwave field confining a hot, over-dense plasma corona. Steady state solutions to Poissons, equation is applied to the time dependent case, with transit time effects included. The product of ion pressure and potential wave (surface) velocity which gives an average heating rate directly to the ions is calculated. DOE

N80-13944# Oak Ridge National Lab., Tenn. Fusion Energy Div.

NFREYA: A MONTE CARLO BEAM DEPOSITION CODE FOR NONCIRCULAR TOKAMAK PLASMAS

R. H. Fowler, J. A. Holmes, and J. A. Rome Jul. 1979 27 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6845) Avail: NTIS HC A03/MF A01

A computer code is described which calculates the initial fast ion deposition for neutral beam injection into noncircular Tokamak plasmas. The beam deposition is calculated by Monte Carlo techniques as a function of the poloidal flux function psi. The flux function and plasma parameters are obtained from the numerical solution of the axisymmetric MHD equilibrium equation. Bounce averages are performed over the initial ion orbits, and the deposition is weighted by the fraction of time the ion spends in each interval of the psi grid. The divergence, focusing, and shape of the neutral beam are modeled. The code described is a modification of FREYA. Comparisons of the beam depositions calculated with bounce averaging are - made with the ion birth depositions for the PDX and ISX-B Tokamaks. DOE

N80-13945# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

SOLUTION OF THE INITIAL VALUE PROBLEM AND ENERGY REDISTRIBUTION FOR ELECTRON AND ALFVEN WAVES IN INHOMOGENEOUS PLASMAS Thesis - Utrecht Univ.

A. E. P. M. vanMaanen-Abels Nov. 1978 95 p refs Sponsored by EURATOM and Ned. Organ. voor Zuiver-Wetenschappelijk Onderzoek (ZWO)

(Rept-78-115) Avail: NTIS HC A05/MF A01

The damping of waves in inhomogeneous plasmas caused by phase mixing of a continuous spectrum of waves and the resulting energy transport is investigated. The initial value problem is solved and the energy redistribution is found for both electron and Alfven waves in inhomogeneous plasmas. For a broad class of initial perturbations, the explicit solution of the initial value problem and the regime of its validity is given. From the time dependent solutions for the fields, the asymptotic energy density of the perturbations is derived. The redistribution of the energy as a function of the initial conditions is studied. First, this is done for a cold inhomogeneous plasma in slab geometry, then a low-beta diffuse plasma described by ideal magnetohydrodynamics in the same geometry is considered. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-13946 Stevens Inst. of Tech., Hoboken, N. J.

AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF MAGNETIC ORDERING IN YTTRIUM IRON GARNET Ph.D. Thesis

Louis Frank Dechiaro 1979 284 p

Avail: Univ. Microfilms Order No. 7925047

Laser Raman backscattering was used to experimentally study the two magnon spectrum of yttrium iron garnet (YIG) as a function of temperature both below and above the ferrimagnetic Curie temperature of 550 K. Raman spectra were obtained from single crystals of YIG using a krypton-ion laser, a double grating monochromator, and a photon counting detection system. The first observation of three new second-order Raman peaks at frequencies of 893 + or - 15/cm, 115 + or - 15/cm and 1415 + or - 15/cm. The peak at 893 + or - 15/cm is attributed to delta S = 0, two magnon mixed optic branch scattering on the basis of the temperature dependence of its intensity while the other peaks are attributed to a two phonon scattering mechanism. The observed first-order phonon spectra are in excellent agreement with previously reported experimental spectra. Dissert. Abstr.

N80-13947 Stevens Inst. of Tech., Hoboken, N. J.
FORMATION AND COALESCENCE OF EPITAXIAL CRYSTALLITES IN NICKEL ELECTRODEPOSITON IN AIR AND ARGON ATMOSPHERES Ph.D. Thesis
Kidambi Raghunathan 1979 137 p
Avail: Univ. Microfilms Order No. 7925055

The initial stages of epitaxial electrocrystallization of nickel on cube textured copper substrates were investigated in air and in argon atmospheres. The effects of additions of saccharin and phenosafranine to the electrolyte were also studied. The deposition potential was monitored during deposition and afterwards the structures of the deposits were determined by transmission electron microscopy. The initial electrocrystallization was under all conditions the formation of three dimensional epitaxial crystallites (TEC) having a lateral size of 5 to 8 nm. Three dimensional epitaxial crystallites (TEC) formed even when all preplating and plating solutions were purged of oxygen by argon bubbling and when deposition occurred under an argon atmosphere. Results indicate that TEC formation is not due to oxides on the substrate. Other significant results are reported. Dissert. Abstr.

N80-13948 Syracuse Univ., N. Y.
INITIAL EPITAXY AND INTERDIFFUSION PHENOMENA IN Au-Cu BILAYERS Ph.D. Thesis
John Eugene Macur 1979 89 p
Avail: Univ. Microfilms Order No. 7925644

The initial epitaxy and microstructure of Au-Cu bilayers was studied using transmission electron microscopy (TEM), transmission electron diffraction and reflection high energy electron diffraction. The room temperature modes of growth of Au/(111) Cu and Cu/(111) Au are described. For the former growth mode initial deposits (2.4A) of Au on Cu form smooth, flat islands delineated by coincidence lattice misfit dislocations. For 6.0A of Au deposit, both thick and thin Au areas were observed with almost complete substrate coverage. For a 10A deposit, surface coverage was complete. Strain measurements and dislocation densities obtained on the (111) Au/(111) Cu films suggest the presence of two separate misfit dislocation networks at the interface. The coincidence lattice networks were large enough for TEM observation but contributed little to total overlayer strain. Significant results are reported. Dissert. Abstr.

N80-13949 Cornell Univ., Ithaca, N. Y.
CHROMIUM DOPED SEMI-INSULATING GALLIUM ARSENIDE GROWN BY LIQUID PHASE EPITAXY Ph.D. Thesis
David William Woodard 1979 182 p
Avail: Univ. Microfilms Order No. 7926990

The technology for consistently producing buffer layers with ideal semi-insulating properties using Cr doped liquid phase epitaxy was investigated. Quantitative measurement of compensation, extraneous impurities, and deep acceptor concentration introduced by Cr doping were emphasized. Optical deep level transient spectroscopy is used to determine the Cr deep acceptor concentration in doubly doped n-type material following calibration of the procedure by measurements in n- and p-type material. The deep acceptor concentration obtained by this method was shown to be in good agreement with the amount of compensation determined by Hall measurements on Cr doped n-type material. The total ionized impurity density introduced by Cr doping was also found to correspond to the deep acceptor density. Results indicate that the growth procedures described, effectively remove all of the electrically active extraneous impurities originally present and noticeable even in spectroscopically pure Cr sources. Dissert. Abstr.

N80-13950 Virginia Univ., Charlottesville.
MELTING BEHAVIOR OF SMALL TIN CRYSTALLITES Ph.D. Thesis
Robert Alan Bayles 1979 129 p
Avail: Univ. Microfilms Order No. 7928016

Dark field electron microscope imaging was used to study the melting of individual crystallites of tin. High vacuum techniques combined with in-situ deposition of the tin reduced the specimen contamination. The melting temperature is examined in relation to the reciprocal of the radius over the entire range of sizes studied. Two distinct branches in the plot of the melting temperature versus the reciprocal of the radius were observed and it was concluded that the lower branch represented relatively uncontaminated particles while the upper branch represented particles which were partially oxidized. The role of surface curvature in the melting process is discussed. Dissert. Abstr.

N80-13951 Florida State Univ., Tallahassee.
RESISTIVITY AND HALL COEFFICIENT MEASUREMENTS OF IRON DOPED NIOBIUM DISELENIDE CRYSTALS Ph.D. Thesis
James Francis Garvin, Jr. 1979 134 p
Avail: Univ. Microfilms Order No. 7926751

A standard four lead arrangement was used to make d.c. resistivity measurements on Fe sub x NbSe2 single crystals. Two different configurations were used to measure the Hall coefficient of Fe sub x NbSe2 single crystals. The parallel configuration data indicated three distinct ranges of x values. The magnetization data at low temperatures for the crystals are dicussed in relation to the formation of a spin glass. The perpendicular configuration Hall data were compared to the parallel configuration. Room temperature X-ray diffraction data in relation changes in the crystal structure was examined. Dissert. Abstr.

N80-13952 Purdue Univ., Lafayette, Ind.
DIFFERENCE FREQUENCY MIXING IN INSULATING GaAs AND MAGNETOOPTICAL STUDIES IN Hg0.89MnO.11Te Ph.D. Thesis
Frederick Francis Geyer 1979 138 p
Avail: Univ. Microfilms Order No. 7926375

The generation of far infrared radiation by frequency mixing was studied for the case of phase matching by means of the noncollinearity of the generating beams. An exact theoretical treatment was performed for the case where the laser beams propagate linearly in the sample and for the case where the laser beams follow a zig zag path resulting from multiple internal reflections; the profile of each laser beam entering the sample is taken realistically to be a truncated Gaussian; sample absorption of the generating and generated radiations are taken into account. A single CO2 laser was modified to provide both generating beams, resulting in more consistent temporal overlap of the pulses in the two beams. An SF6 saturable absorption cell was used to select a single longitudinal mode, eliminating the fine structure in pulses of one beam and making the overlap of the pulses from the two beams tractable. Dissert. Abstr.

N80-13953 Oregon State Univ., Corvallis.
A THEORETICAL INVESTIGATION OF THE ELECTRONIC BAND STRUCTURE AND BULK PROPERTIES OF DIAMOND Ph.D. Thesis
Richard Alan Heaton 1979 69 p
Avail: Univ. Microfilms Order No. 7928214

A first principles self consistent calculation using the method of linear combination of atomic orbitals is described for diamond. The basis set was formed with optimized orbitals. The self consistent results were used to calculate the band structure, X-ray structure features, and Compton profiles. Theoretical procedures for accurately evaluating X-ray structure factors and Compton profiles are presented. Dissert. Abstr.

N80-13954 State Univ. of New York at Stony Brook.
HETERODYNE DETECTION AND GENERATION OF MICROWAVE RADIATION BY SUPERCONDUCTING MICRO-

BRIDGES IN A RESONANT STRUCTURE Ph.D. Thesis
William Hamilton Howard 1979 181 p
Avail: Univ. Microfilms Order No. 7926238

An adjustable resonant matching structure was used to couple microwave energy at 9.05 GHz into superconducting indium microbridges and microbridge arrays in a liquid helium bath. Heterodyne detection of signals at 9.05 and 10.32 GHz using the microbridge samples with an external local oscillator is described. Conversion efficiencies as high as -5 dB were measured with a single bridge. Noise temperatures of the mixer were typically 3000 to 4000 K. The observed bandwidth of the heterodyne detector was found to be narrower than the bandwidth for input coupling. Dissert. Abstr.

N80-13955 Oregon Univ., Eugene.
DEHASS-VANALPHEN MEASUREMENTS OF SPIN RESOLVED SCATTERING IN THE Cu(Mn) MAGNETIC IMPURITY SYSTEM Ph.D. Thesis
Rudolf Heinz Hendel 1979 200 p
Avail: Univ. Microfilms Order No. 7927249

Magnetic impurity systems are analyzed using spin resolved scattering data measured with the de Haas - van Alphen waveshape analysis method. The field and temperature dependence of the spin resolved scattering is compared with negative magnetoresistivity data. The behavior of the independent spins as a function of magnetic field or as a function of temperature is discussed. As a magnetic field increases, the scattering of one spin component stays approximately constant whereas the other decreases strongly. As the temperature increases the scattering of both spin components increases. The ratio of spin dependent scattering to exchange SDS/H sub ex is examined over the field and temperature range covered. Dissert. Abstr.

N80-13956 Yale Univ., New Haven, Conn.
STUDIES IN STRUCTURE AND MAGNETIC SHORT RANGE ORDER. 1: STRUCTURE IN AMORPHOUS GERMANIUM. 2: MAGNETIC INTERACTIONS IN GADOLINUM GALLIUM GARNET Ph.D. Thesis
Wayne Irving Kinney 1979 301 p
Avail: Univ. Microfilms Order No. 7927631

The atomic scale structure in amorphous germanium (a-Ge) was investigated. Inelastic neutron scattering measurements of evaporated a-Ge were compared with the calculated vibrational properties of tetrahedrally bonded, continuous random network models. X-ray diffraction experiments were performed to determine the atomic scale structure of the evaporated a-Ge sample. The measurement of magnetic interactions in gadolinium gallium garnet (GGG) and calculations to examine the thermodynamic properties of GGG are presented. The nondipolar magnetic interactions were determined for the first, second and third neighbor ions by analysis of high frequency susceptibility measurements. The measurements were performed on a single crystal sphere of GGG using an improved radio frequency susceptibility apparatus. Improvements included (1) better temperature control, (2) more stable oscillator circuitry, and (3) various high frequency shields which reduced spurious signals. The nondipolar interactions determined in the experiment were used in a Monte Carlo calculation of the specific heat. Dissert. Abstr.

N80-13957 Virginia Univ., Charlottesville.
INELASTIC ELECTRON TUNNELING SPECTROSCOPY OF RING COMPOUNDS ON ALUMINA Ph.D. Thesis
Charles Steven Korman 1978 233 p
Avail: Univ. Microfilms Order No. 7928024

A spectroscopic technique which uses inelastic electron tunneling spectroscopy, and is sensitive to the vibrations of impurities adsorbed on surfaces, was extended to complex molecules having one or more rings adsorbed on alumina. Tunneling intensities were shown to depend upon the detailed bonding of the molecule on the surface. Modifications of the elastic component of tunneling due to adsorbed species were studied and characterized by a two trapezoidal model of the barrier. Evidence is presented for a relationship between the electron phonon coupling constants as obtained from sideband structure in photoemission studies and tunneling intensities. Dissert. Abstr.

N80-13958 State Univ. of New York at Stony Brook.
PLANAR JOSEPHSON JUNCTION RADIATION DETECTOR Ph.D. Thesis
Ihor Taras Wacyk 1979 195 p
Avail: Univ. Microfilms Order No. 7928084

The radiation detection properties of a planar thin film Josephson junction device is investigated. The junction is fabricated along the edge of the base electrode film, resulting in a contact area whose normal is in the plane of the substrate. The Josephson devices, formed as an integral part of a microstrip transmission line to facilitate the coupling of microwave radiation into the junction, are described. The supercurrent frequency response and current steps in the dc current-voltage characteristic are examined. Dissert. Abstr.

N80-13959 Yale Univ., New Haven, Conn.
POLARIZATION PARAMETER MEASUREMENT FOR K+p ELASTIC SCATTERING BELOW 1 Ge/V/c Ph.D. Thesis
Barry Ray Lovett 1979 155 p
Avail: Univ. Microfilms Order No. 7927640

Polarization parameters in K(+)p elastic scattering from polarized protons were measured at incident kaon momenta of 650, 700, 845, and 940 MeV/c. A butanol type target was cooled to 0.55 K by a He3-He4 refrigerator system, and the free protons were polarized by the method of dynamic nuclear orientation. The scattered particles were detected by a scintillation counter proportional wire chamber system. The data are parametrized by Legendre polynomial expansions, and comparisons are made with predictions of partial wave analyses. Dissert. Abstr.

N80-13960 Washington Univ., Seattle.
THERMAL FACETING BEHAVIOR OF SINGLE CRYSTAL ALUMINUM OXIDE Ph.D. Thesis
Edward Hjalmar Randklev 1979 195 p
Avail: Univ. Microfilms Order No. 7927856

The thermal faceting behavior of polished surfaces of nominally undoped, and selectively doped, single crystal aluminum-oxide was characterized both qualitatively and quantitatively. Flame grown (Vernueil), melt grown (Czochralski), and a limited number of vapor grown crystals were investigated. Three forms of thermal facets occurred within orientation fields around several major crystallographic indexes in the system during high temperature heat treatment (1300 C - 2000+ C) under various atmospheres (vacuum oxygen, air, argon, and argon-hydrogen). For nominally undoped crystals, major thermal faceting fields of approximately 32 deg and approximately 21 deg were identified relative to the (c) /0001/ and (+ or - A) /11(-2)0/ orientations, respectively, and minor faceting fields of approximately 12 deg and approximately 5 deg were identified relative to the (r) /10(-1)1/ and (R) /10(-1)2/ orientations, respectively. The (c) /0001/ and (+ or - A) /11(-2)0/ facet systems were also observed in all but one of the selectively doped sapphire materials. Dissert. Abstr.

N80-13961 Northwestern Univ., Evanston, Ill.
EFFECT OF ELECTRON IRRADIATION ON THE STRENGTH OF NIOBIUM SINGLE CRYSTALS Ph.D. Thesis
Johsei Nagakawa 1979 165 p
Avail: Univ. Microfilms Order No. 7927409

The effect of electron irradiation on the plastic deformation of niobium single crystals was investigated at temperatures between 4.2 K and 77 K. Two different tensile axis orientations were chosen, i.e., one at the center of the standard triangle (designated as C) and the other on the /100/-/111/line, 45 degrees from the primary Burgers vector (designated as H). The C crystal deformed by the anomalous slip and the H crystal deformed by the primary slip. A significant difference in the deformation behavior between C and H crystals without irradiation is described. The effect of room temperature prestraining on the two crystals is discussed. Dissert. Abstr.

N80-13962 Yale Univ., New Haven, Conn.
DUAL PHOTOCONDUCTIVITY EFFECTS INDUCED BY THE INTERSUBBAND TRANSITIONS IN N-TYPE SILICON INVERSION LAYERS Ph.D. Thesis
Chih Chun Hu 1979 192 p
Avail: Univ. Microfilms Order No. 7926252

The physical mechanism of photoconductivity in n-channel MOSFET on (100) surface of silicon is investigated. The photoresponse, a combination of photoresistive intersubband transition, the resonant bolometric heating, and a Drude heating background is examined. Intersubband transitions observed in absorption, photoconductivity, and emission experiments are discussed. A discrepancy between the values of the resonant energy for the transitions between the ground subband and the excited subband is examined. Dissert. Abstr.

N80-13963 Pennsylvania Univ., Philadelphia.
EXPERIMENTAL INVESTIGATION OF THE ABSOLUTE TUNNELING CURRENT DENSITY IN FIELD EMISSION FROM TUNGSTEN (110) Ph.D. Thesis
Charles David Ehrlich 1979 154 p
Avail: Univ. Microfilms Order No. 7928123

The phenomenon of quantum mechanical tunneling of an electron through a barrier in the potential energy is discussed. The absolute current density is measured using the direct method of vacuum field emission from the (110) crystal face of a tungsten field emitting tip. The technique of vacuum field emission which involved the application of a high voltage between a fine metal wire that was etched to a sharp tip, and an anode, under ultrahigh vacuum conditions is described. The Fowler-Nordheim analysis for a free electron metal was used in order to translate the applied voltage into the electric field at the tip. The success of a free electron model in explaining emission from a transition metal surface is discussed. Calculations show that the bands contributing field emission current in the (110) direction have a large free electron component. This aspect of the analysis is examined in detail. Dissert. Abstr.

N80-13964 Polytechnic Inst. of New York.
SURFACE-WAVE SCATTERING BY DIELECTRIC GRATINGS WITH ARBITRARY PROFILES Ph.D. Thesis
Kai-Chiang Chang 1979 148 p
Avail: Univ. Microfilms Order No. 7920771

The guiding and scattering of electromagnetic surface waves by dielectric gratings having arbitrary profiles is investigated. The particular configurations considered assume that the grating is superimposed on a thin dielectric film backed by a thick substrate, so that both surface and leaky waves are supported. The relevant boundary value problem is examined by means of an exact solution, as well as by a simpler perturbation solution that lends itself to physical interpretation in terms of equivalent networks. The study reveals that a grating having a properly shaped right angled triangular profile can selectively radiate the power from an incident surface wave into either the air region above the grating or into the substrate below it. By viewing the grating as part of an extended two dimensional lattice, this directional discrimination is explained in terms of a Bragg reflection mechanism. A discussion of the mechanism in relation to improving the operation of optical beam couplers is presented. Dissert. Abstr.

N80-13965# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SOLITARY WAVE PROPAGATION IN THE THREE-DIMENSIONAL LATTICE
Jad H. Batteh and John D. Powell May 1979 42 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A071458; ARBRL-TR-02164; AD-E430261) Avail: NTIS HC A03/MF A01 CSCL 20/2

The properties of solitary waves in a three-dimensional, monatomic, face-centered cubic lattice are studied. The atoms of the lattice are assumed to interact via a Morse-type interatomic potential. For the discrete lattice, the equations of motion for the atoms are solved numerically using a computer-molecular-dynamic technique and, from their solution, the stability of the waves investigated. It is pointed out that the solitary waves are fairly stable to longitudinal planar oscillations, somewhat less stable to mutual collisions, and still less stable to transverse planar oscillations. It is also observed that under some conditions coupled longitudinal and transverse solitary waves can propagate in phase with the same propagation velocity in the lattice. The equations of motion are then derived in the long-wavelength, continuum limit and studied in some detail. A comparison of their solutions is made with the results for the discrete-lattice model and it is shown that the continuum equations are capable of predicting many of the same effects. GRA

N80-13966# Cornell Univ., Ithaca, N. Y. School of Electrical Engineering.
TRANSIENT PHENOMENA IN ELECTRON TRANSPORT IN SEMICONDUCTORS Final Report
31 Jan. 1979 22 p refs
(Grant AF-AFOSR-2717-74)
(AD-A073009; AFOSR-79-0928TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

Theoretical efforts at understanding the band structure of, and hence electron transport in, alloy semiconductor materials are described. In particular, calculations of band structure and transient and equilibrated velocity-field relationships are being performed for Ga(x)In(1-x)As and Ga(x)In(1-x)AsyP(1-y), materials which may be suitable for fast logic or microwave devices. Methods for describing pseudopotential variations and chemical disorder in alloys are discussed. GRA

N80-13967# Bendix Corp., Kansas City, Mo.
ELECTRON MICROPROBE ANALYSIS OF TANTALUM-NITRIDE THIN FILMS
D. L. Stoltz and J. P. Starkey Jun. 1979 18 p refs
(Contracts EY-76-C-04-0613; DE-AC04-76DP-00613)
(BDX-613-1198-Rev) Avail: NTIS HC A02/MF A01

Quantitative chemical analysis of 500 and 2000 angstrom tantalum-nitride films on glass substrates is reported using an electron microprobe X-ray analyzer. Modifications to the microprobe are described. A description of the calibration procedure, the method of analysis, and the quantitative results are discussed. DOE

N80-13968# California Univ., San Diego, La Jolla. Dept. of Physics.
ABSENCE OF CRYSTALLINE ORDER IN TWO-DIMENSIONS Technical Report, 15 Sep. 1978 - 24 Aug. 1979
Sudip Chakravarty and Chandan Dasgupta Aug. 1979 7 p refs
(Contract N00014-76-C-0050)
(AD-A073672; TR-51) Avail: NTIS HC A02/MF A01 CSCL 07/4

It is proved that in two dimensions a system of electrons embedded in a uniform neutralizing positive background and interacting by a potential given by e-squared/r, cannot exhibit long range crystalline order at any finite temperature. GRA

N80-13969# California Univ., San Diego, La Jolla. Dept. of Physics.
A UNIVERSAL MODEL FOR THE SURFACE ENERGY OF SOLIDS Technical Report, 15 Jun. 1978 - 15 Jul. 1979
Walter Kohn and A. Yaniv Jul. 1979 25 p refs
(Contract N00014-76-C-0050)
(AD-A073671; TR-50) Avail: NTIS HC A02/MF A01 CSCL 07/4

A universal model for computing the surface energy of solids is presented. The theory of surface energy is reviewed. The basic premise in the model, the surface energy is regarded as the work done in reversibly cleaving a bulk solid along some crystallographic plane, is described. A number of approaches are discussed and differences in this model with other approaches are delineated. A.W.H.

N80-13970# Argonne National Lab., Ill.
TRANSPORT PROPERTIES OF THE COMPOSITIONALLY MODULATED ALLOY Cu/Ni
I. Schuller, C. M. Falco, J. Hilliard (Northwestern Univ., Evanston, Ill.), J. Ketterson (Northwestern Univ., Evanston, Ill.), B. Thaler (Northwestern Univ., Evanston, Ill.), R. Lacoe (California Univ., Los Angeles), and R. Dee (California Univ., Los Angeles) 1979 6 p refs Presented at Intern. Conf. on Modulated Structures, Kailua-Kona, Hawaii, 22 Mar. 1979
(Contract W-31-109-eng-38)
(CONF-790341-8) Avail: NTIS HC A02/MF A01

Preliminary transport measurements, electrical resistivity, thermopower, Hall effect and magnetoresistance, of a number of Cu/Ni composition modulated alloy films over the temperature range 10 to 300 K and for magnetic field up to 70 kGauss are

reported. The results indicate nonmonotonic dependence of the transport properties on the modulation amplitude. The Hall coefficient saturates around 40 kGauss in contrast to the transverse magnetoresistance which does not show evidence for saturation up to 70 kGauss. DOE

N80-13971# Brookhaven National Lab., Upton, N. Y.
DETERMINATION OF THE VACANCY FORMATION ENTHALPY FOR HIGH PURITY Ni
K. G. Lynn, C. L. Snead, Jr., J. J. Hurst, and K. Farrell (Oak Ridge Natl. Lab., Tenn.) 1979 6 p refs Presented at 5th Intern. Conf. on Positron Annihilation, Lake Yamanaka, Japan, 8 Apr. 1979
(Contract EY-76-C-02-0016)
(BNL-26191; CONF-790437-11) Avail: NTIS HC A02/MF A01

Positron annihilation lifetime measurements, performed on pure nickel over the temperature range 4.2 to 1700 K, are examined. The monovacancy formation enthalpy and the temperature dependence of the positron lifetime before the onset of vacancy trapping are discussed. Possible mechanisms affecting the observed lifetime, such as thermal expansion, lattice vibration, self trapping, and shallow impurity traps are investigated. A.W.H.

N80-13972# Syracuse Univ., N. Y. Dept. of Chemical Engineering and Materials Science.
EPITAXY AND MISFIT DISLOCATIONS IN LARGE MISFIT SYSTEMS
R. W. Vook 1979 26 p refs Presented at Intern. Conf. on Met. Coatings, San Diego, Calif., 23 Apr. 1979
(Contract EG-77-S-02-4496)
(CONF-790442-17) Avail: NTIS HC A03/MF A01

The manner in which an epitaxial overgrowth is accommodated to a substrate composed of a different material is examined. The dependence of epitaxial overgrowth on such factors as the surface and interfacial energies and the lattice misfit is discussed. DOE

N80-13973# Los Alamos Scientific Lab., N. Mex.
PHOTONIC COMPRESSION
J. W. Shaner 1979 8 p refs Presented at the 7th Intern. AIRAPT Conf., La Creusot, France, 30 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2040) Avail: NTIS HC A02/MF A01

Lasers developed for fusion applications which have the capability of creating pressures in excess of 100 Mbar in the laboratory are discussed. The capability of these lasers for making high pressure equation of state measurements, progress toward that goal, and the problems which stand in the way are reviewed. DOE

N80-13974# Sandia Labs., Albuquerque, N. Mex.
SELECTED PAPERS ON PIEZOELECTRICITY AND IMPULSIVE 'PRESSURE' MEASUREMENTS
R. A. Graham, ed. and R. P. Reed, ed. Dec. 1978 219 p refs Presented at the Comm. on Dyn. Measurements Soc. for Exptl. Stress Analysis, Indianapolis, Ind., 24 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1911) Avail: NTIS HC A10/MF A01

Sixteen papers are presented on piezoelectricity and impulsive pressure measurements. Topics include the dynamic yield behavior of explosively loaded metals determined by a quartz transducer technique, mechanical and piezoelectric properties of shock loaded x-cut quartz, and conductivity in shock loaded x-cut quartz. A.W.H.

N80-13975# Illinois Univ., Urbana. Dept. of Physics.
INTERSTITIAL-IMPURITY TRAPPING IN Al-Fe AND Al-Zn Ph.D. Thesis
Kenneth Lowell Hultman 1979 147 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1267) Avail: NTIS HC A07/MF A01

Ultrasonic attenuation and velocity measurements were made as a function of polarization, temperature, frequency, and annealing before and after electron irradiation near 65 K of Al-Fe and Al-Zn dilute alloys. Multiple relaxation processes were observed in both alloys. In the case of Al-Zn, the simultaneous annealing near 130 K of resistivity diaelastic modulus changes, and a paraelastic relaxation peak in C prime allows for a characterization of the individual defects. The results provide strong evidence that below 130 K, the <100>-mixed dumbbell is the predominant interstitial trapping configuration. A second trapping configuration present in low concentration anneals out near 100 K, and probably arises from <111>-mixed defects. In Al-Fe, the observation of the diaelastic effect and a peak in the C prime mode not previously seen in earlier internal friction measurements, together with an identification of this peak with the major defect species resolves the apparent contradiction between the internal friction and channeling symmetry evidence. DOE

N80-13976# California Univ., Berkeley. Lawrence Berkeley Lab.
MICROSTRUCTURE, SINTERING AND STRENGTH OF POLYCRYSTALLINE SiC M.S. Thesis
M. F. Sung Jun. 1979 68 p refs
(Contract W-7405-eng-48)
(LBL-9257) Avail: NTIS HC A04/MF A01

The compound SiC sintered with additions of 1% boron and 1% carbon is examined. The roles of these dopants and the related sintering mechanism are discussed. A model which suggests that boron and carbon form a boundary phase which is the diffusion path during sintering is developed. A correlation of the microstructure of the samples supplied to their different mechanical strength versus temperature behaviors and to the sintering mechanism is discussed. A.W.H.

N80-13977# Oak Ridge National Lab., Tenn. Solid State and Chemistry Div.
PROPERTIES OF SINGLE CRYSTAL BETA-ALUMINAS
J. B. Bates, G. M. Brown, T. Kaneda, W. E. Brundage, J. C. Wang, and Herbert Engstrom 1979 19 p refs Presented at the Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wis., 21 May 1979
(Contract W-7405-eng-26)
(CONF-790538-9) Avail: NTIS HC A02/MF A01

The crystal growth of sodium beta alumina through slow evaporation of Na2O3 at 1690C from a mixture of Na2CO3, MgO, and A12O3 is described. Studies of this material and of Li, K, Rb, and Ag are surveyed. The results of model calculations, made in order to interpret the Raman scattering from sodium beta alumina and to understand the conduction mechanism in this material, are presented. The structure of an Ag beta alumina single crystal was investigated by neutron diffraction. A.W.H.

N80-13978# General Electric Co., Schenectady, N. Y.
CHARACTERIZATION OF HEAT TREATMENT INDUCED CHANGES IN Li-Na BETA-ALUMINA SINGLE CRYSTALS
R. R. Dubin, J. S. Kasper, J. B. Bates, and T. Kaneda 1979 19 p refs Presented at the Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wis., 21 May 1979
(Contract W-7405-eng-26)
(CONF-790538-6) Avail: NTIS HC A02/MF A01

Single crystals of lithium-sodium beta alumina with 40 to 95% substitution of Li(+) for Na(+) were annealed in air and in vacuum at temperatures up to 1000 C. The specimens were examined before and after each heat treatment by pulsed NMR, Raman scattering, infrared absorption, and X-ray diffraction. After annealing at 600 C or above, the two original Raman bands due to Li-7(+) vibrations merged into a single peak accompanied by a narrowing of spinel block phonon bands. The 1000 C annealing introduced a broad Li - 7 (+) NMR response and substantially reduced narrow line Li-7(+) intensity. X-ray diffraction patterns showed that a second phase grows epitaxially with the beta-alumina structure as a result of high temperature heat treatment. The thermal induced changes observed are due to diffusion of lithium out of the conducting plane and into the spinel-block. DOE

N80-13979# Brookhaven National Lab., Upton, N. Y.
COMPARISON OF PROCEDURES FOR QUANTITATIVE X-RAY ANALYSIS IN THIN FILMS
R. Sabatini and C. S. Pand 1979 14 p refs Presented at the 14th Ann. Meeting of the Microbeam Analysis Soc., San Antonia, Tex., 13 Aug. 1979
(Contract EY-76-C-02-0016)

(BNL-25759; CONF-790813-2) Avail: NTIS HC A02/MF A01

The research showed that: (1) for the case of microanalysis of 304 stainless steel, the Cliff-Lorimar technique and the Super ML Fitting technique seem to give equally reliable results; (2) the bulk standards present a problem, in that, if a standard is not a pure element, the correction factors using ZAP at 120 kV could be very large. The absorption effect for pure elements has to be either measured or calculated for the operating conditions; (3) the MTF program did not produce results that were as reliable as the first two. The most likely explanation for this is that the Cr in the sample is fluorescing; and (4) thickness greater or equal to 1000 A does not affect the relative X-ray intensities. DOE

N80-13980# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbeiter.
EPITAXY AT REDUCED TEMPERATURES Final Report
Peter Duro Braun Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 95 p refs In GERMAN; ENGLISH summary (Contract BMFT-NT-0552)
(BMFT-FB-T-78-52) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 19.75

Two different processes for epitaxial deposition of silicon at reduced temperatures are reported on. The first process is based on chemical vapor deposition from silane. In connection with a programmable dopant dosage control system, epitaxial layers can be produced with the desired dopant profiles. The second process uses a silicon/iodine transport system and leads to selective epitaxial deposition of silicon on a partially masked silicon substrate. Materials obtained using these processes are discussed and their dielectric characteristics are shown to be in good agreement with the desired results. Author (ESA)

N80-13071# Academy of Sciences (USSR), Moscow.
STRUCTURAL AND PHYSICAL CHARACTERISTICS OF InSb SINGLE CRYSTALS GROWN UNDER NEAR-ZERO GRAVITY CONDITIONS
F. R. Khashimov et al *In* ESA Mater. Sci. in Space Jun. 1979 p 9-15 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13072# Academy of Sciences (USSR), Moscow.
THE INFLUENCE OF SPACE CONDITIONS ON DIRECTIONAL CRYSTALLIZATION OF GERMANIUM AND ITS PROPERTIES
E. V. Markov et al *In* ESA Mater. Sci. in Space Jun. 1979 p 17-23 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13075# Academy of Sciences (USSR), Moscow.
CRYSTAL GROWTH FROM THE VAPOR PHASE WITH AN INERT COMPONENT PRESENT
S. I. Aladiev and A. S. Okhotin *In* ESA Mater. Sci. in Space Jun. 1979 p 41-45 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13079# Freiburg Univ. (West Germany).
PREPARATORY EXPERIMENTS FOR THE GROWTH OF SILICON SINGLE CRYSTALS IN THE MIRROR HEATING FACILITY OF SPACELAB
A. Eyer and R. Nitsche *In* ESA Mater. Sci. in Space Jun. 1979 p 75-79 refs Sponsored by West Germany Federal Min. for Res. and Technol. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13096# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
EXPERIMENT MORAVA ON BOARD SALYUT 6
C. Barta (Acad. of Sci., Prague), J. Trnka (Acad. of Sci., Prague), A. Triska (Acad. of Sci., Prague), V. I. Khrjapov, A. S. Ochotin, and I. A. Zubritskij *In* ESA Mater. Sci. in Space Jun. 1979 p 215-219 refs (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13107# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
NONSTATIONARY ANALYSIS OF THE MACROSEGREGATION DURING THE SOLIDIFICATION IN THE SPACE OF THE SYSTEM Ge-Ga [ANALYSE NON STATIONNAIRE DE LA MACROSEGREGATION PENDANT LA SOLIDIFICATION DANS L'ESPACE DU SYSTEME Ge-Ga]
J. J. Favier, P. Arragon, E. P. Martin (MIT), and A. F. Witt (MIT) *In* ESA Mater. Sci. in Space 1979 p 306-308 refs In FRENCH (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13108*# Rensselaer Research Corp., Troy, N. Y. Dept. of Materials Engineering.
CONVECTIVE HEAT TRANSFER DURING DENDRITIC GROWTH
M. E. Glicksman and Shyh-Chin Huang *In* ESA Mater. Sci. in Space Jun. 1979 p 309-312 refs Sponsored by NASA (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120 CSCL 22A

N80-13116# Clermont-Ferrand Univ. (France). Lab. de Cristallographie et Physique des Milieux Condenses.
RESULTS OF FRENCH EXPERIMENTS ON CRYSTAL GROWTH FROM A VAPOR PHASE CONDUCTED ON THE GROUND AS A PART OF THE SPACE PROGRAM [RESULTATS DES EXPERIENCES FRANCAISES DE CROISSANCE EN PHASE VAPEUR EFFECTUEES AU SOL DANS LE CADRE DES PROJETS SPATAUX]
R. Cadoret *In* ESA Mater. Sci. in Space Jun. 1979 p 363-367 refs In FRENCH Sponsored by CNES (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

N80-13117# Stuttgart Univ. (West Germany). Physikalisches Inst.
SOME 3-5-SEMICONDUCTOR CRYSTALS GROWN BY THE TRAVELING-HEATER METHOD
K. W. Benz and G. Mueller (Erlangen-Nuremberg Univ.) *In* ESA Mater. Sci. in Space Jun. 1979 p 369-373 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N80-13069 04-12)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-13105# Naples Univ. (Italy).
THERMODYNAMICS AND DYNAMICS OF LINE PHASES
L. G. Napolitano *In* ESA Mater. Sci. in Space Jun. 1979 p 289-296 refs (For primary document see N80-13069 04-12) (Contract CNR/SAS-77-0061)
Avail: NTIS HC A20/MF A01; ESA, Paris FF 120

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-13981 Clemson Univ., S.C.
DERIVATION OF A QUANTITATIVE MODEL TO ASSESS THE PERFORMANCE OF RESEARCH AND DEVELOPMENT ORGANIZATIONS Ph.D. Thesis
Wilhelm Andreas Haberkorn 1979 186 p
Avail: Univ. Microfilms Order No. 7925090

A methodology to derive estimates of research and development income is developed. The key element is a research and development revenue model which allows the user to classify research activities according to predetermined criteria. Portions of the model are used to evaluate the performance of an actual research organization. The results indicate that the proposed methodology is promising for practical application. Dissert. Abstr.

N80-13982*# Information Planning Associates, Inc., Gaithersburg, Md.
THE WORK REQUEST SYSTEM OF A NASA Q1 PACKAGE
15 Nov. 1979 61 p
(Contract NASw-3176)
(NASA-CR-162511) Avail: NTIS HC A04/MF A01 CSCL 05A

A computer package is described which can be used to track any type of work that is controlled on the basis of work requests and purchase orders/contracts. Run on any NASA QI, using floppy disks only, the system can handle about 1,200 requests per year, and provides performance and summary reports for management. The milestones tracked at Goddard are described as well as directions for installing the system. Sample reports and operator instructions are included. A.R.H.

N80-13983# Royal Aircraft Establishment, Farnborough (England).
THE GEORGE 3 AND 4 ACCOUNTING SYSTEM
Irene M. Cummings London HMSO Jul. 1978 74 p refs
(RAE-TR-78080; RAE-Math-Comp-233; BR66077) Avail: NTIS HC A04/MF A01

A comprehensive system for accounting for computer usage was developed for running under the George Operating System on the ICL 1904A and 1906S computers. It allows any resource to be accounted for and has been running successfully for the last three years. The mechanism of the accounting system is described in detail and the choice of resources actually accounted for as well as charges made are discussed. Author (ESA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-13984# Raytheon Co., Wayland, Mass. Equipment Div.
PAVE PAWS MODERN PROGRAMMING DATA COLLECTION SYSTEM Final Technical Report, Jul. 1977 - Feb. 1979
Benson H. Scheff, W. B. Vodges, and N. R. Hall Griffiss AFB RADC Jun. 1979 100 p
(Contract F30602-77-C-0141)
(AD-A073357; RADC-TR-79-137) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes the software development technologies which were utilized on the PAVE PAWS project and the techniques which were implemented to collect data to support on-going independent technology studies. At the request of the contracting agency, the emphasis of this report is on describing the software technology used on PAVE PAWS and providing an assessment of the effectiveness of those techniques. GRA

N80-13985# California Univ., Livermore. Lawrence Livermore Lab.
SCIENTIFIC LITERATURE: CAN WE KEEP IT FROM RUINING SCIENCE
H. L. Lentzner 24 Aug. 1978 15 p refs Presented at ACS Western Regional Meeting, San Francisco, Calif., 27 Sep. 1978
(Contract W-7405-eng-48)
(UCRL-81118; CONF-780976-1) Avail: NTIS HC A02/MF A01

The writing ability of authors specializing in scientific subjects was questioned. It was concluded that authors must carefully define their audience, thoughtfully organize their material, use concrete words, use the active voice, and take time to revise, and teachers and referees should be less tolerant of students and colleagues who write badly. DOE

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-13986*# Boeing Commercial Airplane Co., Seattle, Wash.
ECONOMIC STUDY OF MULTIPURPOSE ADVANCED HIGH-SPEED TRANSPORT CONFIGURATIONS Final Report
Nov. 1979 61 p refs
(Contract NAS1-14623)
(NASA-CR-159126; D6-48725) Avail: NTIS HC A04/MF A01 CSCL 05C

A nondimensional economic examination of a parametrically-derived set of supersonic transport aircraft was conducted. The measure of economic value was surcharged relative to subsonic airplane tourist-class yield. Ten airplanes were defined according to size, payload, and speed. The price, range capability, fuel burned, and block time were determined for each configuration, then operating costs and surcharges were calculated. The parameter with the most noticeable influence on nominal surcharge was found to be real (constant dollars) fuel price increase. A change in SST design Mach number from 2.4 to Mach 2.7 showed a very small surcharge advantage (on the order of 1 percent for the faster aircraft). Configuration design compromises required for an airplane to operate overland at supersonic speeds without causing sonic boom annoyance result in severe performance penalties and require high (more than 100 percent) surcharges. A.R.H.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-13987 Kansas Univ., Lawrence.
EVALUATION OF SURFACE AERATOR APPLICATIONS IN

THE ACTIVATED SLUDGE PROCESS Ph.D. Thesis
Valery N. Wahbeh 1979 199 p
Avail: Univ. Microfilms Order No. 7925876

Sludge plants utilizing surface aeration equipment with a total of 32,000 installed horsepower were evaluated in an attempt to review design practices in the areas of aesthetics, testing procedures, and methods of analysis and evaluation. Aesthetic conditions of the installations were reviewed. Many of he installations were aesthetically unacceptable because of spray and mist generated by the aerators. The causes of this condition were studied and remedies were suggested. In evaluating the raw data of performance tests by both the steady and nonsteady methods, new methods of analysis were developed. Recommendations for the design of surface aerator installations for aesthetic considerations and for methods of analysis and evaluation were made. Dissert. Abstr.

N80-13988# Committee on Science and Technology (U. S. House).
OVERSIGHT: FAA R AND D PROGRAMS
Washington GPO 1978 82 p refs Hearing before Subcomm. on Transportation, Aviation and Weather of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., 24 Aug. 1978
(GPO-38-212) Avail: Subcomm. on Transportation, Aviation and Weather

Major research and development projects related to increased automation in air traffic control, aircraft capacity, airspace use, and safety levels are considered as well as the rationale and timing of new technology. Particular emphasis is given to the use of microwave landing systems, the discrete address beacon system, and the automated traffic advisory and resolution service. The problems of California airports and collision avoidance are explored A.R.H.

N80-13989*# Mechanical Technology, Inc., Latham, N. Y. Stirling Engine Systems Div.
ASSESSMENT OF THE STATE OF TECHNOLOGY OF AUTOMOTIVE STIRLING ENGINES
Sep. 1979 329 p refs
(Contracts DEN3-32; EC-77-A-31-10040)
(NASA-CR-159631; DOE/NASA/0032-79/4; MTI-79ASE77RE2) Avail: NTIS HC A15/MF A01 CSCL 13F

The current status of automotive Stirling engine technology is considered. The energy is described and the history of its evolution is reviewed. Overall engine, component, subsystem and material problem areas are identified and recommendations are made for further development and testing. Potential improvements are also identified. Projected Stirling engine/vehicle performance is compared to that of vehicles using current internal combustion engine in terms of performance, fuel consumption, multifuel capability, emissions, and noise level. It is concluded that the potential for achieving 1984 program goals is clearly discernible. The program goals require at least a 30 percent reduction in fuel consumption, acceptable emissions, and the capability of satisfactorily operating with a variety of alternate fuels. A.R.H.

N80-13990# California Univ., Livermore. Lawrence Livermore Lab.
FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER. FAR WEST REGION LOCAL GOVERNMENT ASSISTANCE TASK FORCE Progress Report
C. F. Miller, ed. and A. A. Sjoholm, ed. Mar. 1979 45 p
(Contract W-7405-eng-48)
(UCID-18037-79-2; PR-2) Avail: NTIS HC A03/MF A01

The needs and problems of local government administrators due to the passage of Proposition 13 are considered in terms of methodologies by which the Federal Laboratory Consortium can increase the level of assistance it is providing. Special emphasis is given to the Energy Link Project and the Stress Disability Retirement Project. Applications of current technology and methods of transferring technology developed can be used in other jurisdictions. DOE

N80-13991# Systems Technology Corp., Xenia, Ohio.
A TECHNICAL AND ECONOMIC EVALUATION OF THE PROJECT IN BALTIMORE, MARYLAND, VOLUME 2 Progress Report, 1 Oct. 1975 - 30 Apr. 1978
Jun. 1979 345 p refs
(Contract EPA-68-01-4359)
(PB-297871/6; EPA-530/SW-175C.2) Avail: NTIS HC A15/MF A01 CSCL 13B

Problems encountered in the operation of a plant designed to thermally process (pyrolyze) 907 Mg (1000 tons) per day of mixed municipal solid waste, convert it to energy (in the form of steam), and recover magnetic metals and glassy aggregate are considered. GRA

N80-13992# Systems Technology Corp., Xenia, Ohio.
A TECHNICAL AND ECONOMIC EVALUATION OF THE PROJECT IN BALTIMORE, MARYLAND, VOLUME 3 Progress Report, 1 Oct. 1975 - 30 Apr. 1978
Jun. 1979 404 p
(Contract EPA-68-01-4359)
(PB-297872/4; EPA-530/SW-175C.3) Avail: NTIS HC A18/MF A01 CSCL 13B

Contents: kiln model description; mass and energy balance; economic evaluation; and kiln model computer program. A.R.H.

N80-13993# Systems Technology Corp., Xenia, Ohio.
A TECHNICAL AND ECONOMIC EVALUATION OF THE PROJECT IN BALTIMORE, MARYLAND, VOLUME 4 Technical Report, 1 Oct. 1975 - 30 Apr. 1978
Jun. 1979 97 p refs
(Contract EPA-68-01-4359)
(PB-297873/2; EPA-530/SW-175C.4) Avail: NTIS HC A05/MF A01 CSCL 13B

A complete technical, economic, and environmental evaluation is presented for a demonstration mixed-solid processing plant. Problems associated with most of the major innovations that proved ineffective, caused serious shutdowns, and required redesign or abandonment. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-13994 Utah Univ., Salt Lake City.
HIGH RESOLUTION ASTRONOMICAL IMAGING THROUGH THE TURBULENT ATMOSPHERE Ph.D. Thesis
Richard Lee Frost 1979 131 p
Avail: Univ. Microfilms Order No. 7925038

The digital reconstruction of star images observed with large ground telescopes is developed. Solutions to the problems affecting the production of accurate and detailed reconstructions of stars are provided. A modification of the Knox-Thompson phase difference estimator is used to produce more accurate estimates. The performance of this estimator is evaluated by simulation at various signal-to-noise ratios. A nonlinear super resolution algorithm which appears to exhibit the best accuracy of any such algorithm proposed to date is described. An emperical evaluation was also conducted. These two techniques were used to restore images of the stars Betelgeuse and Capella. Significant findings are reported. Dissert. Abstr.

N80-13995 Maryland Univ., College Park.
EVALUATION AND APPLICATION OF AN INTENSIFIED CCD ARRAY PHOTOMETER FOR ASTRONOMICAL OBSERVATIONS Ph.D. Thesis
John Lamar Johnson 1979 178 p
Avail: Univ. Microfilms Order No. 7926530

The testing, of an imaging array photometer system to obtain

astronomical data is described. The system is an intensified charge coupled device with the ability to operate in the photon counting mode with an S20 photocathode response, driven by a field minicomputer and special purpose electronics including a high speed, high capacity circulating semiconductor memory. The array's leakage current, the noise and gain of the on-chip amplifier, the dynamic range, the signal to noise ratio, the system noise components, the quantum efficiency, the temperature effects on the noise and the leakage current, and the amount of damage due to photoelectron bombardment were measured. Observations on the 36 in and 48 in telescope at Goddard Space Flight Center in Maryland provided much of the component and system testing and some open cluster photometry. Dissert. Abtr.

N80-13996# Utah Univ., Salt Lake City.
HIGH RESOLUTION ASTRONOMICAL IMAGING THROUGH THE TURBULENT ATMOSPHERE
Richard Lee Frost, Craig K. Rushforth, and Brent S. Baxter Jul. 1979 131 p refs
(Grant AF-AFOSR-3212-77)
(AD-A073434; UTEC-79-081) Avail: NTIS HC A07/MF A01 CSCL 03/1

This research is principally concerned with the digital reconstruction of star images observed with large ground-based telescopes, although the techniques developed here will have application to a broad class of reconstruction problems. Since the work of Labeyrie, the difficulty in producing accurate and detailed reconstructions of stars has stemmed primarily from the extreme degradation of the phase spectrum caused by the atmospheric turbulence, and secondarily from the low-pass filter characteristic of the telescope itself. In this research, we describe solutions to both problems. Our phase estimator is based on the Knox-Thompson phase difference estimator, which we have extended and modified to produce more accurate estimates. The performance of this estimator is evaluated by simulation at various signal-to-noise ratios. We also describe a new non-linear super-resolution algorithm which appears to exhibit the best accuracy and convergence characteristics of any such algorithm proposed to date. It is also evaluated empirically. These two techniques were then used to restore images of the stars Betelgeuse and Capella. In the latter restoration resolution is realized well beyond the diffraction-limit of the telescope. Both reconstructions are consistent with known astrophysical facts, and both appear to be of high quality. GRA

N80-13997# California Univ., Berkeley. Lawrence Berkeley Lab.
FIGURE CONTROL FOR A SEGMENTED TELESCOPE MIRROR
Terry S. Mast and Jerry E. Nelson Mar. 1979 38 p refs
(Contract W-7405-eng-48)
(LBL-8621) Avail: NTIS HC A03/MF A01

The properties of a system to control the figure of a large telescope primary mirror that is composed of many individual segments are studied. The geometry considered, employing hexagonal mirrors, allows a simple and economical control system. The system is reliable and effective in continuously maintaining the figure to the precision required for optical astronomy. DOE

N80-13998# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
IRON LINE EMISSION FROM THE ALFVEN SHELL IN X-RAY BINARIES
M. M. Basko 1979 49 p refs
(Pr-450) Avail: NTIS HC A03/MF A01

A model in which the iron line emission of 6 to 7 keV, discovered in the spectra of some X-ray binaries, is interpreted as a reradiation of the X-ray continuum in the gaseous shell at the Alfven surface. The radius of the Alfven shell is treated as a free parameter; the density in the shell is estimated and the temperature and the ionization equilibrium are determined by the interaction with the external X-ray flux. It is shown that the observed value of the line equivalent width can be explained if the radius of the Alfven shell is less than 0.1 times the radius of the generally accepted estimate for the Alfven radius. The problem of escape from the shell in the course of multiple resonance scattering is discussed in detail. Author (ESA)

N80-13999# European Southern Observatory, Munich (West Germany).
[REPORT ON EUROPEAN ASTRONOMICAL AND ASTROPHYSICAL ACTIVITIES] Annual Report, 1978
1978 55 p refs
Avail: NTIS HC A04/MF A01

A wide variety of research programs are reported. Studies encompassed contemporary astronomy and astrophysics, ranging over extragalactic phenomena, radio and X-ray sources, stars, and the structure of our own galaxy as well as interstellar matter. Apparatus utilized included a 3.6 m telescope equipped alternately with an image dissector scanner attached to a low dispersion spectrograph, mm and infrared detectors, and with Speckle interferometers. Design work underway on a cross-dispersed cassegrain echelle spectrograph is also reviewed. Author (ESA)

N80-14000# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
COMPTON SHIFT OF X-RAYS IN PLASMA CLOUDS: TYPICAL RADIATION SPECTRA
R. A. Sunyaev and L. G. Titarchuk 1979 74 p refs
(Pr-441) Avail: NTIS HC A04/MF A01

Solutions of the photodiffusion problem in a cloud of completely ionized plasma with distributed photon sources are presented. The stationary Kompaneets equation is solved by the Whitteker function and the radiation spectra due to Compton scattering both in cold and hot electron plasma clouds are obtained. The distribution of photon over their escape time is found to be similar to the radiation curve for X-ray spectra. The obtained formulas allow for the determination of the plasma temperature in the region of maximum energy release in the Cyg-11 source. The effect of Compton shift in the X-ray iron spectral line profiles is shown to be strongly dependent on the photon source distribution over the plasma cloud. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-14001# California Univ., Livermore. Lawrence-Livermore Lab.
STAR FORMATION
P. R. Woodward 27 Sep. 1978 101 p refs Presented at the Intern. School of Phys., Varenna, Italy, 26 Jun. - 7 Jul. 1978
(Contract W-7405-eng-48)
(UCRL-81758; CONF-7806119-1) Avail: NTIS HC A06/MF A01

Theoretical models of star formation are discussed beginning with the earliest stages and ending in the formations of rotating, self-gravitating disks or rings. A model of the implosion of very diffuse gas clouds is presented which relies upon a shock at the edge of a galactic spiral arm to drive the implosion. Models are presented for the formation of a second generation of massive stars in such a cloud once a first generation has formed. These models rely on the ionizing radiation from massive stars or on the supernova shocks produced when these stars explode. Calculations of the gravitational collapse of rotating clouds are discussed with special focus on the question of whether rotating disks or rings are the result of such a collapse. DOE

N80-13562# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
INSTABILITIES OF ACCRETION DISK: MAGNETOSPHERE INTERFACES
U. Anzer and G. Boerner *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 259-261 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13563# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
INTERACTION OF ACCRETION DISK AND ROTATING MAGNETIC FIELD OF NEUTRON STAR
U. Anzer and G. Boerner *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 263-264 refs (For primary document

see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13564# Bonn Univ. (West Germany). Inst. fuer Astrophysik.
SPINDOWN OF ROTATING MAGNETS
W. Kundt *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 265-267 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13565# California Univ., Berkeley. Dept. of Astronomy and Space Sciences.
THE MAGNETOSPHERES OF MAGNETIC A STARS AND OF PULSARS
J. Arons *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 271-279 refs (For primary document see N80-13529 04-42) (Grants NSF AST-77-23069; NSF AST-78-21070)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

N80-13566# Sussex Univ., Brighton (England).
THE BOUNDARY OF A PULSAR MAGNETOSPHERE: GAMMA-RAY PULSARS
N. J. Holloway *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 281-284 refs (For primary document see N80-13529 04-42)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-14002*# International Technology Associates, Inc., Long Beach, Calif.
PHOTOPOLARIMETRY OF SCATTERING SURFACES AND THEIR INTERPRETATION BY COMPUTER MODEL Final Report
Mile Wolff Nov. 1979 123 p refs
(Contract NASw-3201)
(NASA-CR-162514) Avail: NTIS HC A06/MF A01 CSCL 03B

Wolff's computer model of a rough planetary surface was simplified and revised. Close adherence to the actual geometry of a pitted surface and the inclusion of a function for diffuse light resulted in a quantitative model comparable to observations by planetary satellites and asteroids. A function is also derived to describe diffuse light emitted from a particulate surface. The function is in terms of the indices of refraction of the surface material, particle size, and viewing angles. Computer-generated plots describe the observable and theoretical light components for the Moon, Mercury, Mars and a spectrum of asteroids. Other plots describe the effects of changing surface material properties. Mathematical results are generated to relate the parameters of the negative polarization branch to the properties of surface pitting. An explanation is offered for the polarization of the rings of Saturn, and the average diameter of ring objects is found to be 30 to 40 centimeters. A.R.H.

N80-14003*# CosmoScience Associates, Inc., Stony Brook, N. Y.
SPACE ENVIRONMENT AND LUNAR SURFACE PROCESSES Final Report
George M. Comstock 25 Sep. 1979 64 p refs
(Contract NAS9-15582)
(NASA-CR-160363) Avail: NTIS HC A04/MF A01 CSCL 03B

The development of a general rock/soil model capable of simulating in a self consistent manner the mechanical and exposure history of an assemblage of solid and loose material from submicron to planetary size scales, applicable to lunar and other space exposed planetary surfaces is discussed. The model was incorporated into a computer code called MESS.2 (model for the evolution of space exposed surfaces). MESS.2, which represents a considerable increase in sophistication and scope over previous soil and rock surface models, is described. The capabilities of previous models for near surface soil and rock surfaces are compared with the rock/soil model, MESS.2. A.W.H.

N80-14004# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
THE SPECTROPHOTOMETRIC EXPERIMENT ON BOARD THE VENERA-11, VENERA-12 PROBES: SOME RESULTS FROM THE ANALYSIS OF THE VENUS DAY-SKY SPECTRUM
V. I. Moroz, B. E. Moshkin, A. P. Ekonomov, N. F. Sanko, N. A. Parfentev, and Yu. M. Golovin 1979 16 p refs
(D-270) Avail: NTIS HC A02/MF A01

The day-sky spectra of Venus within the 4500 to 12,000 A wavelength range and the angular distribution of the scattered radiation brightness were recorded during the descent from 65 km to the Venus surface. The spectra show the absorption bands of Co2, water, and some absorption bands attributed to gaseous sulfur. While the abundance of water to CO2 is 20 ppm, the relative abundance of sulfur is the order of 0.01 ppm in the lowest part of the atmosphere. About 6% of the solar flux reaches the planet surface near the subsolar region. The lower boundary of the clouds is at about 47 to 48 km. Author (ESA)

N80-14005# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
MASS SPECTROMETER MEASUREMENTS OF THE VENUS LOWER ATMOSPHERE COMPOSITION
V. G. Istomin, K. V. Grechnev, and V. A. Kotchnev 1979 16 p refs
(D-271) Avail: NTIS HC A02/MF A01

Mass spectrometer measurements were carried out by the Venera 11 and Venera-12 missions in order to obtain data on atmospheric composition, abundance of minor components, and isotopic composition. The block diagram of the measuring devices is presented. The results show a considerable amount of N (4.5%) in addition to the main component CO2. The isotopic composition of C resembles that for Earth. The isotopic composition of Ar shows a strong anomaly: the abundance of secondary radiogenic isotope Ar-40 is nearly equal to the total abundance of primary isotopes Ar-36 and Ar-38. On the other hand the relative abundance of both primary isotopes corresponds to that of the Earth atmosphere. Author (ESA)

N80-14006# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
ELECTRICAL DISCHARGES IN THE VENUS ATMOSPHERE
L. V. Ksanformaliti, N. M. Vasilchikov, O. F. Ganpantzerova, E. V. Petrova, A. P. Suvorov, G. F. Filippov, O. V. Yablonskaya, and L. V. Yabrova 1979 20 p refs
(D-272) Avail: NTIS HC A02/MF A01

The occurrence of electrical discharges and their characteristics were examined using data from the GROZA experiments during the Venera-11 and Venera-12 missions. A miniaturized sub-longwave spectra analyzer with a band range from 8 to 100 kHz was used. It is confirmed that electrical discharges occur in the cloud layer. Their energy is approximately the same as that of lightning on the Earth, but the mean frequency of discharge is much higher, reaching 30/sec. Author (ESA)

N80-14007# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
GAS CHROMATOGRAPH ANALYSIS OF THE VENUS ATMOSPHERE CHEMICAL COMPOSITION ON BOARD THE VENERA-12 AUTOMATIC INTERPLANETARY STATION
B. G. Gelman, V. S. Zolotukhin, L. M. Mukhin, N. I. Lamanov, B. W. Levchuk, D. F. Nenarokov, B. P. Okhotnikov, V. A. Kotin, and A. N. Lipatov 1979 13 p refs
(D-275) Avail: NTIS HC A02/MF A01

The results of the gas chromotography experiment onboard the Venera-12 automatic interplanetary station are presented. Eight samples of the Venus atmosphere were taken beginning

at a height of 42 km, going down to the surface of the planet. Nitrogen concentration in the Venus atmosphere was observed to be 2.5% + or - 0.5% by volume, that of argon was 40 ppm + or - 20 by volume, that of CO was 28 ppm + or - 14 by volume, that of SO2 was 130 ppm + or - 60 by volume. Upper limits of oxygen and water content were estimated to be 20 ppm and 100 ppm by volume, respectively. Author (ESA)

N80-13558*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
JUPITER'S MAGNETOPAUSE
E. J. Smith *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 221-224 refs (For primary document see N80-13529 04-42)
(Contract NAS7-100)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 03B

N80-13559*# Rice Univ., Houston, Tex.
THE JOVIAN BOUNDARY LAYER AS FORMED BY MAGNETIC-ANOMALY EFFECTS
A. J. Dessler *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 225-226 refs (For primary document see N80-13529 04-42)
(Grant NGR-44-006-137)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 03B

N80-13560*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
EARTH AND JUPITER: COMPARISON OF MAGNETOPAUSE STRUCTURE
P. H. Reiff and C. W. Hill *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 227-228 refs (For primary document see N80-13529 04-42)
(Grants NGR-14-006-137; NSF ATM-78-21767)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-14008# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
CONTRIBUTIONS TO THE FOURTH SOLAR WIND CONFERENCE
C. T. Dum, D. A. Gurnett (Iowa Univ.), E. Marsch, K.-H. Muelhaeuser, W. G. Pilipp, H. Rosenbauer (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), and R. Schwenn Apr. 1979 45 p refs Presented at 4th Solar Wind Conf., Burghausen, West Germany, 28 Aug. - 1 Sep. 1978 Submitted for publication
(MPI-PAE/Extraterr-154; ISSN-0340-8922) Avail: NTIS HC A03/MF A01

A series of six contributions to solar wind research are presented, mainly based on data from the Helios 1 and Helios 2 satellites. The subjects include on sound turbulence, alpha particles, proton velocity distribution, electron characteristics, boundary layers between fast and slow streams at the time of minimum solar activity, and radial gradients of plasma parameters in fast and slow streams at the time of minimum solar activity. For individual titles, see N80-14009 through N80-14014.
Author (ESA)

N80-14009*# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
ION SOUND TURBULENCE IN THE SOLAR WIND
C. T. Dum, E. Marsch, W. G. Pilipp, and D. A. Gurnett (Iowa Univ.) *In its* Contrib. to the 4th Solar Wind Conf. Apr. 1979 p 1-6 refs (For primary document see N80-14008 04-92)
(Contract NAS5-11279; Grant NGL-16-001-043)
Avail: NTIS HC A03/MF A01 CSCL 03B

A stability analysis for ion sound is carried out in order to contribute to clarifying the mechanism of some observed fluctuations, which directly uses detailed measured particle distributions rather than model distributions. Correlation with measured wave activity is satisfactory. Valuable information about the instability mechanism, transport processes, and the accuracy of measured distributions can be obtained by this method. An illustration from Helios 1 data is presented. Author (ESA)

N80-14010# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestriche Physik.
INITIAL RESULTS ON SOLAR WIND ALPHA PARTICLE DISTRIBUTIONS AS MEASURED BY HELIOS BETWEEN 0.3 AND 1 AU
E. Marsch, K.-H. Muelhaeuser, W. G. Pilipp, R. Schwenn, and H. Rosenbauer (Max Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany) *In its* Contrib. to the 4th Solar Wind Conf. Apr. 1979 p 7-13 refs (For primary document see N80-14008 04-92)
(Contract BMFT-WRS-10/7)
Avail: NTIS HC A03/MF A01

Alpha particle parameters in the solar wind (0.3 to 1 AU) based on the first four (0th, 1st, 2d, 3d) moments of three dimensional velocity distributions derived from Helios spacecraft electrostatic plasma analyzer data are presented and discussed. The tendency for the alpha particle population to be faster than the protons in high speed streams increases with decreasing distance from the sun. In fast stream near 0.3 AU differential bulk velocities as high as 150 km/sec are observed.
Author (ESA)

N80-14011# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestriche Phys.
SOME CHARACTERISTICS OF PROTON VELOCITY DISTRIBUTIONS IN THE SOLAR WIND AS OBSERVED BY THE HELIOS SOLAR PROBES
E. Marsch, W. G. Pilipp, R. Schwenn, K.-H. Muelhaeuser, and H. Rosenbauer (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany) *In its* Contrib. to the 4th Solar Wind Conf. Apr. 1979 p 14-20 refs (For primary document see N80-14008 04-92)
(Contract BMFT-WPS-10/7)
Avail: NTIS HC A03/MF A01

Three dimensional solar wind proton velocity distributions measured by the Helios spacecraft often show pronounced temperature anisotropies, field-aligned high energy shoulders, or double peaks. Part of these features of the proton distribution are well correlated with fluid parameters of the solar wind, mainly its speed and temperature. A phenomenological survey is given and the typical velocity, relative to the bulk velocity, of the protons carrying the heat flux is investigated. Whenever a second hump in the distribution can be detected, its velocity relative to the main peak is directed along the magnetic field and tends to be slightly higher on the average than the local Alfven speed.
Author (ESA)

N80-14012# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestriche Physik.
ELECTRON CHARACTERISTICS IN THE SOLAR WIND AS DEDUCED FROM HELIOS OBSERVATIONS
W. G. Pilipp, R. Schwenn, E. Marsch, K.-H. Muelhaeuser, and H. Rosenbauer (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany.) *In its* Contrib. to the 4th Solar Wind Conf. Apr. 1979 p 21-29 refs (For primary document see N80-14008 04-92)
Avail: NTIS HC A03/MF A01

Parameters characterizing the solar wind electron velocity distributions and their variation with different state of the solar wind are presented. Most electron spectra show a break-point energy between an isotropic component at low energies and an anisotropic as well as asymmetric component at larger energies, where the latter component has been termed as the 'strahl'. It is confirmed that the electron temperatures, the heat flux as well as the interplanetary electrostatic potential, usually tend to be higher in the slow solar wind than in high speed streams. However, marked decreases of these parameters are observed at the sector boundaries of the interplanetary magnetic field (IMP) inside of slow solar wind streams. Also the occurrence of the strahl tends to be correlated with the sector structure where the strahl is usually markedly pronounced within magnetic sectors but is weakened at the sector boundaries. It is suggested that these correlations with IMPF are caused by magnetic field line reconnection occurring at the sector boundaries. This interpretation

is supported further by simultaneous measurements onboard of Helios 1 and Helios 2. Author (ESA)

N80-14013# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestriche Physik.
TWO STATES OF THE SOLAR WIND AT THE TIME OF MINIMUM SOLAR ACTIVITY. PART 1: BOUNDARY LAYERS BETWEEN FAST AND SLOW STREAMS
R. Schwenn, K.-H. Muelhaeuser, and H. Rosenbauer (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany) *In its* Contrib. to the 4th Solar Wind Conf. Apr. 1979 p 30-37 refs (For primary document see N80-14008 04-92)
(Contract BMFT-WRS-10/7)
Avail: NTIS HC A03/MF A01

During the time of the past minimum in solar activity, the Helios probes were relatively close to each other in solar longitude and latitude as well as in radial distance. A comparison of the solar wind parameters as observed from the two spacecraft reveals features of the boundary layers separating fast and slow streams. For instance, the boundary layers at the front edges of fast streams are significantly thinner (in angular extent) at 0.3 AU than at 1 AU. Tangential discontinuities in these stream interfaces, often observed at 1 AU, were not found inside 0.52 AU. The latitudinal boundary layers of fast streams can be thinner than 5 deg. Evidence for the occurrence of enhanced nonstationary phenomena along the interaction regions was also found. Author (ESA)

N80-14014# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestriche Physik.
TWO STATES OF THE SOLAR WIND AT THE TIME OF MINIMUM SOLAR ACTIVITY. PART 2: RADIAL GRADIENTS OF PLASMA PARAMETERS IN FAST AND SLOW STREAMS
R. Schwenn, K.-H. Muelhaeuser, E. Marsch, and H. Rosenbauer (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany) *In its* Contrib. to the 4th Solar Wind Conf. Apr. 1979 p 38-42 refs (For primary document see N80-14008 04-92)
(Contract BMFT-WRS-10/7)
Avail: NTIS HC A03/MF A01

Eight radial line-up constellations between Helios 1 and 2 occurred in the years 1976 and 1977. From the short periods of plasma line-ups when the plasma seen from the inner probe also encounteres the outer probe radial gradients of the plasma parameters could be obtained directly. Significant differences were found in the average gradients between the slow and the fast solar wind: in the slow plasma (up to 400 km/sec) the flow speed v sub p increases by 52 + or - 11 km/sec per AU and the proton temperature T sub p decreases as r to the (-1.21) power i.e. nearly adiabatically. In the fast plasma v sub p remains nearly constant and T sub p decreases as r to the (-0.69 + or - 0.08) power. Further differences are found in the general shape of the distribution functions and their changes with radial distance as well as in the properties of the alpha particle component. Author (ESA)

N80-14015# California Univ., Berkeley. Lawrence Berkeley Lab.
MEASUREMENT AND ANALYSIS OF CIRCUMSOLAR RADIATION
D. F. Grether, D. Evans, A. Hunt, and M. Wahlig Apr. 1979 9 p refs
(Contract W-7405-eng-48)
(LBL-9214) Avail: NTIS HC A02/MF A01

The measurement of solar and circumsolar radiation for application to solar energy systems that employ concentrating collectors is discussed. The solar instruments which consist of scanning telescopes mounted on a precision solar tracker, and their locations are described. The data processing capabilitie which aid in the analysis of the performance of each instrument system are discussed. Recent colored filter data are shown and a comparison of circumsolar radiation data obtained at Atlanta and Barstow is given. DOE

N80-13561*# California Univ., Los Angeles.
THE SOLAR WIND INTERACTION WITH VENUS
C. T. Russell, R. C. Elphic, and J. A. Slavin *In* ESA Magnetospheric Boundary Layers Aug. 1979 p 231-239 refs (For primary document see N80-13529 04-42)
(Contract NAS2-9491)
Avail: NTIS HC A18/MF A01; ESA, Paris FF 120 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-14016# California Univ., Berkeley.
DIRECT MEASUREMENTS OF THE SPECTRUM OF THE NEAR MILLIMETER COSMIC BACKGROUND
P. L. Richards Jun. 1979 24 p refs Presented at Universe at Large Redshifts Conf., Copenhagen, 25 Jun. 1979
(Contract W-7405-eng-48)
(LBL-9374; CONF-790697-1) Avail: NTIS HC A02/MF A01

The spectrum of the cosmic background radiation which peaks at 6/cm and falls rapidly at higher frequencies is discussed. The experimental determination of this fact is described. The experimental difficulties which have plagued cosmic background measurements at and beyond the peak in the spectrum are described. A critical evaluation of the present status of the field is presented. DOE

99 GENERAL

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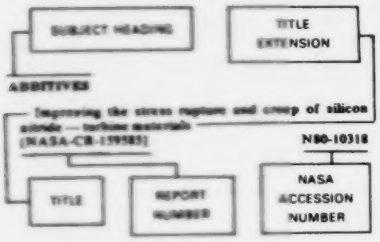

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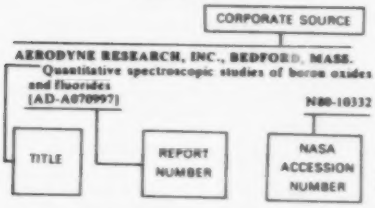

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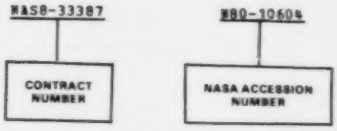

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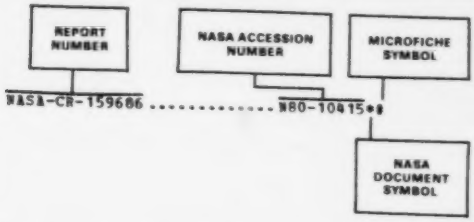

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

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01 AERONAUTICS (GENERAL) 553

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 566

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Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

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For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 576

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Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) N.A.

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26 METALLIC MATERIALS 582

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Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

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ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) 588

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35 INSTRUMENTATION AND PHOTOGRAPHY 601

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GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) N.A.

43 EARTH RESOURCES 608

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

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44 ENERGY PRODUCTION AND CONVERSION 615

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For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

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47 METEOROLOGY AND CLIMATOLOGY 634

Includes weather forecasting and modification.

48 OCEANOGRAPHY 638

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

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Includes genetics.

52 AEROSPACE MEDICINE 641

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 643

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 646

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

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61 COMPUTER PROGRAMMING AND SOFTWARE 653

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62 COMPUTER SYSTEMS 657

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63 CYBERNETICS 657

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For related information see also *54 Man/System Technology and Life Support*.

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67 THEORETICAL MATHEMATICS 662

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

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SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

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81 ADMINISTRATION AND MANAGEMENT 678
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 679
Includes information storage and retrieval technology; micrography; and library science.
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83 ECONOMICS AND COST ANALYSIS N.A.
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85 URBAN TECHNOLOGY AND TRANSPORTATION 680
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SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

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89 ASTRONOMY 683
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90 ASTROPHYSICS 684
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N80-10196*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey 3 Sep. 1979 409 p. refs
(Contract NAS1-15824)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01
CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, SOLID PROPELLANT ROCKET MOTOR INTERNAL BALLISTIC PERFORMANCE VARIATION ANALYSIS

R.H. Sforzini, Auburn University, School of Engineering, Dept. of Aerospace Engineering, *Auburn, Alabama* 36830 (NCA 8-130)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

1.0002, ANGULAR VIBRATION OF AIRCRAFT

W. Gibson, Anamet Lab. Inc., *Berkeley, California* (DF139980; F33615-77-C-3050)

Vibration adversely affects the performance of airborne optical systems which require high pointing accuracy. Aircraft structural vibrations are composed of linear and angular motions. Little is known of the latter and therefore the allowable angular motions among components of airborne optical systems in the low microradian range are difficult to define. To design such systems to operate with optimum performance and reliability requires the accurate prediction of angular vibrations. The objective of this work is to generate forced response prediction techniques for angular vibrations and to verify their accuracy with experimental data.

Techniques are available for estimating the low and high frequency forced linear vibration response of aircraft. Such techniques shall be considered for their limitations, flexibility and subsequent modifications resulting in angular vibration predictions. Unique combinations of these prediction techniques by optimizating their capabilities will also be examined to provide overall improvement in reliability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, STUDY TURBULENCE STRUCTURE

A. Demetriades, Ford Aerospace & Communications Corp., Aeronutronic Division, *Ford Rd., Newport Beach, California* 92663 (DF139560; F33615-77-C-3016)

The function of this program is to acquire detailed measurements of turbulent fluctuation properties and Reynolds stress under adverse pressure gradient. This effort is designed to improve the computational accuracy for turbulent flows on aerospace vehicles. Many of the Air Force current aerodynamic problems can be traced back to a lack of understanding of the fundamentals of turbulence. The technical objective is to systematically investigate the turbulence structure under adverse pressure gradients and to obtain the variation of Reynolds stress distribution under these conditions. The program's payoff to the Air Force will be the ability to predict turbulent boundary layer phenomena on supersonic aircraft.

The turbulent fluctuations will be measured experimentally by means of a hot wire anemometer and a laser Doppler velocimeter on a boundary layer over a curved ramp. Correlation of these measurements will be carried out to obtain Reynolds stresses. The final product shall be the variation of Reynolds stress distribution with pressure gradient.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, NEW STRATEGIC AIRLIFT CONCEPTS

F. Newton, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DF142580; F33615-78-C-3017)

An analysis of a future conflict between NATO and Warsaw Pact forces indicates intense fighting, with corresponding rapid consumption of military equipment. This equipment must be replaced, and supplemented, at a rate possible only with rapid airlift. This scenario is the consequence of the increasing size of the Warsaw Pact forces, and it places demand on MAC and the strategic airlift resources, which may require the design of a new AF cargo aircraft. The AFFDL has the responsibility to conduct design integration studies and technology development for future systems. A conceptual design program will be conducted to determine the feasibility of new strategic airlift aircraft.

A contractor shall conduct a design integration study within the context of a scenario involving airlift to NATO forces. The design requirements will incorporate the findings of the massive rapid resupply study contracts presently being performed. The analysis will define the vehicle in terms of range, payload, speed and related parameters, as well as force size, maintenance requirements, interface with Army equipment, and similar support requirements. The payload requirements will reflect projections of future Army weapons specifically designed for the intense NATO conflict. The findings from this study will be suitable for specifying future technology requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, DESIGN ASSESSMENT OF ADVANCED TECHNOLOGY, LIGHTWEIGHT, LOW-COST MISSION CONFIGURED GONDOLA MODULES

J. Porterfield, Kaman Aerospace Corp., *Old Windsor Rd., Bloomfield, Connecticut* 06002 (DA0E3839; DAAK51 78 C 0012)

To perform design trade-off analyses in conjunction with the assessment of advanced technology materials (metallic and non-metallic composites) and effective structural arrangements and provide preliminary designs and critical item development specification (CIDS) for a lightweight, low-cost system of gondolas.

Under prior R & D effort two experimental gondola systems were designed and fabricated. Operational suitability testing demonstrated the technical feasibility of the gondola concept and identified configuration and technological improvements essential to combat and combat service support missions. Current effort will perform design trade-off analyses for candidate advanced technology materials and structural arrangements and provide preliminary design and CIDS for a lightweight, low-cost, efficient gondola system. Follow-up effort will consist of detailed design of technology demonstrator gondola modules, fabrication, static testing and flight evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0006, ANALYSIS OF FLOWS WITH SHOCKS
D.A. Anderson, Iowa State University of Science & Technology, School of Engineering, Dept. of Aerospace Engineering, *496 Town Engineering Bldg., Ames, Iowa* 50011 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0007, MARITIME PATROL AIRSHIP STUDY
B.B. Levitt, Summit Research Corp., *1 W. Deer Park Rd., Gaithersburg, Maryland* 20760 (DN981125; N62269-78-RC-00021)

Establish methodology for a missions math model based on Coast Guard mission requirements. In support of work unit No. DH814 and Agency Accession No. 881665.

Based on Coast Guard mission experience construct and operate a computer math model to conduct missions analyses.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0008, AVIATION AUTOMATIC WEATHER OBSERVING SYSTEMS (AV-AWOS)
J.A. Cunningham, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Equipment Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (RD590713)

OBJECTIVE: To enhance AV-AWOS by adding and evaluating an improved thunderstorm detector and a laser present weather system.

APPROACH: 1. Completion of the AV-AWOS procurement specifications for the FAA. 2. Completion of report on AV-AWOS operational test at Patrick Henry Airport. 3. Design, development and testing of interface and software of FAA furnished thunderstorm detector for AV-AWOS enhancement. 4. Design, develop and test laser present weather system for AV-AWOS.

PROGRESS: The AV-AWOS system has been returned from the test area. The basic control system is being reinstalled at T&ED Sterling, Va. to be used in testing new sensors.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

1.0009, HELICOPTER IR RADIATION PREDICTION (SPRITE, MOD)
B. Wilton, General Electric Co., Aircraft Engine Group, *1000 Western Ave., East Lynn, Massachusetts* 01910 (DA0E3866; DAAK51 79 C 0012)

Improvement of Army's spectral plume radiation intensity target evaluation (SPRITE) computer program to include helicopter aircraft modeling, missile lock-on range, and more efficient computer predictions.

SPRITE will be expanded to provide helicopter airframe modeling and missile lock-on range predictions. The hot metal prediction modules will be revised to provide more efficient programing and computer core time.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0010, ADVANCED COMPOSITE CENTER FUSELAGE STRUCTURE DEVELOPMENT
L. Murrin, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN981065; N62269-78-C-0017)

The design and development of advanced composite center fuselage types of construction which can satisfy the configuration and structural loading requirements of future naval aircraft, and the fabrication of critical structural subcomponent test specimens.

This is an eighteen month program consisting of two phases. In phase 1 the basic preliminary design will be performed including definition of materials, material combinations, material forms, type of construction, method of fabrication and realistic cost impact. Element and coupon tests will be performed. The second phase will consist of prototype design and the design and fabrication of a critical subcomponent, and the preparation of detailed tests plans for this subcomponent.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0011, TURBULENCE STUDY
J.K. Luers, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (NAS 8-32111)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

1.0012, ELECTROMAGNETIC AND ELECTROSTATIC EFFECTS ON COMPOSITE MATERIALS
R. Lane, U.S. Dept. of Defense, Navy, Naval Air Development Center, Systems Directorate, *Warminster, Pennsylvania* 18974 (DN881505)

To develop and demonstrate ground and flight test facilities which support existing system analysis of the electromagnetic compatiblility of composite material aircraft.

NADC will assist NavAirSysCom with technical liaison/coordination; develop lightning specifications; determine the accuracy of the Boeing lightning analysis by comparing this analysis with F18, Culham laboratory and NavAirTestCen measurements; participate in composite metal joint investigation bimonthly review meetings; monitor the Boeing metal graphite/epoxy measuring instrumentation contract; and perform system analysis for composite aircraft in 1995 environments in concert with other efforts.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Command Control & Guidance Admin.

1.0013, HT 74-14- BALLISTIC TESTING, ARMY AIRCREW AND CRITICAL COMPONENT PROTECTIVE DEVICES
C.M. Pedriani, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Air Mobility Research & Development Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0D3912)

To provide ballistic testing of critical component and aircrew protective devices and to validate design criteria that increase the ballistic survivability of Army aircraft.

To conduct experimental firing programs in conjunction with design, fabrication, and ballistic tests to evaluate: (1) fuel fog inerting concepts to reduce inflight fuel fires in helicopters; (2) fuel tank materials to increase the survivability of the AH-1G to 14.5mm API projectiles; (3) fuel tank materials to increase the survivability of the AH-1G to 23mm HEI projectiles; (4) ballistic tolerant drive shafts/aircrew transparent and opaque armor upgrade; (5) support of other area missions (e.g., aircraft structures and flight controls); (6) miscellaneous support (e.g., installation, test, and evaluation UTTAS and HLH).

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0014, ADVANCED BRAKE CONTROL SYSTEM
S.M. Warren, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF141220; F33615-78-C-3408)

The level of USAF combat effectiveness depends in part on the capability of its aircraft to land during adverse weather conditions. Assuming that a controlled approach is possible, landing capability is further limited by lack of directional and braking control on the runway. The objective of this effort is to model and analyze an automatic landing control system that will make maximum use of available forces to successfully conclude the landing process once the aircraft has touched down. Such a system will reduce off-runway incidents and extend all weather landing capability for USAF aircraft.

A government-owned computer program for aircraft landing simulation will be modified to include more sophisticated landing gear and runway models. An automatic control system will also be included in the modified program. Computer simu-

lations will be run to show system effectiveness under adverse conditions. Subsequently, the models will be installed on an AF motion base simulator, which is coupled with existing aircraft hardware, and evaluated against pilot performance. A preliminary design and criteria will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, AN INVESTIGATION OF TOXIC HAZARDS FROM BURNING MATERIALS IN CONTROLLED FIRES
Unknown, California State University & Colleges, San Jose State University, Graduate School, *Washington Sq., San Jose, California* 95192 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0002, COMPOSITE MATERIAL E3
S. Jauregui, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN998066)

To support the NavAir program of electromagnetic systems design of advanced composite material aircraft.

Participate in AV8B composite wing EM tests and reduce data from tests. Analyze results of Porter P-static flight tests and identify areas of importance for continuation of experiments. Improve the performance and calibration of broadband omnidirectional EM field probes. Identify, demonstrate and recommend EM testing technology for composite aircraft sections which will produce needed improvements below 2 MHz.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0003, HYDROCARBON LOW TEMPERATURE VISCOSITY
C.T. Moynihan, Catholic University of America, School of Engineering & Architecture, Dept. of Materials Science, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (DN890105; N00019-78-C-0366)

One problem with the jet fuels derived from alternative energy sources such as shale oil and coal is expected to be the deleterious effect of an N-alkane content higher than present from petroleum sources. This program will study the freezing point and viscosity behavior at low temperature of mixtures of kerosene jet fuel hydrocarbon mixtures as a function of temperature and composition.

The viscosities (and densities) of the pure jet fuel type components will be measured over the temperature -60 to 50 degrees C and the data will be computer-fitted to deduce empirical equations for these hydrocarbons. The relationship between molecular shape and structure on the viscosity is to be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0004, THEORETICAL STUDIES IN CHEMISTRY
K.F. Freed, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (CHE75-01549 A03)

Professor Freed is developing theories and theoretical methods to further understanding of a number of important chemical problems in the areas of photochemical reaction dynamics, molecular relaxation processes, and the electronic structure of atoms and molecules. The research work includes the following projects: Development of a theory of the photodissociation processes of triatomic molecules which provides the wavelength dependence of the fragment vibrational, rotational, and translational energy distribution. Research on a Franck-Condon description of collinear chemical reactions. Further development of Freed's previous theory of collision-induced intersystem crossing, to consider the contribution to crossing rates from individual collisional processes, as well as the dependence of these rates on the intermolecular potentials. Consideration of a theory of vibrational relaxation of molecules in condensed media, to determine the nature of the various T1, T2, and coherence transfer processes that can arise. Development of a fully quantum-mechanical theory of the time-independent Green's function for molecules in coherent radiation fields. Critical assessment of many-body Green's function-equations of motion methods, to determine their accuracy and value in the prediction of ionization potentials, electron affinities and X-ray photoelectron spectra. Research on effective Hamiltonian theories, to examine the contribution of nonclassical effects to atomic and molecular electronic structure. This is a renewal of grant CHE-7501549.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0005, DENSITY FUNCTIONAL THEORY OF METALS AND METAL SURFACES
J.P. Perdew, Tulane University of Louisiana, Graduate School, *New Orleans, Louisiana* 70118 (DMR78-12398)

Theoretical research in metal physics will be carried out using the density functional theory of the inhomogeneous interacting electron gas. This method will be used to investigate the face-dependence of the metallic surface energy, work functions, lattice relaxation at a surface and the surface plasmon dispersion. Also, a variational study will be made of the relative stabilities of the paramagnetic state and the spin-and charge-density waves in metals. In addition, extensions of the theory will be developed, by adding the effects of local pseudopotentials and the exchange corrections to the random phase approximation.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0006, ADVANCED PROCESSING OF MAGNESIUM ALLOYS
M. Kumar, U.S. Dept. of Defense, Army, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab., *Picatinny Arsenal, Dover, New Jersey* 07801 (DA0B0678)

The overall objective is to improve the formability and toughness of magnesium alloys through the use of advanced processing techniques. In FY79, the superplastic characteristic of wrought magnesium alloys will be investigated. This work is directed towards the technology area of aircraft with a major thrust of skins/structures/components.

In FY79, work will be directed towards investigating the superplastic forming of magnesium alloys. This work will involve documenting those parameters necessary to achieve superplastic flow. The parameters to be investigated are grain size, deformation temperature and strain rates. Selected commerical alloys will be evaluated. The grain size will be varied by thermal-mechanical processing. Tensile specimens will be tested at different temperatures and strain rates.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab.

3.0007, MOLECULAR DYNAMICS IN CONDENSED MEDIA
B.J. Berne, Columbia University, School of Arts & Sciences, Dept. of Chemistry, *Broadway & W. 116th St., New York, New York* 10027 (CHE79-07820)

This grant supports research under the Structural Chemistry and Thermodynamics Program for computer simulation of systems with interesting physical and chemical properties. Professor Berne will develop new methodology for handling the following problems: 1. solvent effects on conformational equilibria, 2. solvent effects on the rates of chemical reactions, 3. the behavior of electrons in liquids, 4. nucleation freezing and surface properties of pure fluids and mixtures, and 5. interfacial phenomena in aqueous solutions. It is expected that this program will illustrate clearly how modern technology (i.e., the array processor) can be expected to provide a more detailed un-

derstanding of the liquid state phenomena. It is also anticipated that the development of efficient computer codes will favorably impact further utilization of array processors in many research areas, including process control.

This research is a continuation of that currently supported by Foundation Grant, CHE7611002.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, STUDIES IN DEFORMATION AND FRACTURE 16361-MS

C.R. Manning, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Materials Engineering, *Raleigh, North Carolina* 27607 (DA0G8902; DAAG29-78-G-0202)

The research will include: (1) a study of localized deformation and fracture in polymeric materials, with concentration on modification of existing deformation models to take into account the local structural and compositional factors that govern localized flow. (2) study of the relation of structural factors of polymeric foams to crack propagation in fatigue. (3) determination of the corrosion-fatigue behavior of metal-matrix composites. Relevance - structural foams are planned for Army applications such as vibrational and shock damping in a wide variety of vehicular structures. The establishment of foam structure and its relation to dynamic mechanical properties of foams is essential to this work. Metal-matrix composites are planned for a variety of structural applications in bridging and helicopters.

(1) Molecular weight and crystallinity determinations in localized deformation regions will assist in establishing new heat transfer parameters and a basis for modification of existing deformation models. (2) Stereological studies of cellular structures in various types and densities of polymeric foams will be used as base-lines for determining preferred crack paths in fatigue. (3) The corrosion fatigue behavior, as expressed by S-N and DA/DN data will be developed for various classes of AL/G and other systems to determine the roles of environment, stress level, and other factors in fatigue crack resistance.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0009, COMPOSITE SPECIMEN FABRICATION AND TEST

R.T. Achard, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF139700)

This work unit is supportive to preliminary design and evaluation of advanced structural composite materials and basic material processing techniques, and is to include activities related to construction and testing of standard specimens and representative structural geometries using advanced composite materials. The capability to explore technology under parallel investigation by civilian industry, on a much reduced scale, leads to a more thorough understanding and to some degree allows anticipation of problems related to technology development for Air Force aircraft structures application. The objectives of this effort are to perform in-house fabrication and assessment of payoff potential, through inspection and test, of composite structural concepts, arrangements, and geometries including bonded assemblies and hybrid assemblies where applicable. The in-house approach allows for direct dollar savings as well as indirect savings associated with more timely responses to current problems. Timely responses based on thorough understanding permits a more time- and cost-effective approach to the solution of problems inherent in advanced structural design and development.

Efforts within this work unit will include, but not be limited to, the following: fabrication of unique test specimens, analysis and test of composites in various simulated environments, fabrication of fracture mechanics coupons, development, fabrication and test of elastomeric tooling concepts, support of composite investigations by other laboratory agencies as requested, investigation of an automatic scanning dielectric spectrometer, for monitoring and improving composite cure cycle efficiency, creation and maintenance of displays illustrative of composite applications in airframes, and conducting of tours and presentations explanatory thereof as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0010, MATERIALS SUPPORT TECHNOLOGY - ADVANCED OPTICAL CERAMICS

S. Musikant, General Electric Co., Reentry & Environmental Systems Division, *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DN875696; N00014-78-C-0466)

There is a need for advanced guided missile sensor enclosures for higher Mach number operations which can operate at specific electromagnetic wavelengths and which have increased resistance to thermal shock and rain and dust erosion. The objective of this program is to investigate and characterize a family of advanced sensor window materials candidates that could decisively exceed performance capabilities of existing materials.

Candidate materials identified in the phase '0' study will be procured or synthesized. Selected physical properties including transmission, dielectric constant and loss, thermal expansion coefficient, strength etc., will be measured and the materials ranked according to thermal shock resistance. Various fracture toughness enhancement techniques will be investigated. Analytical assessments of performance in specific missions will be performed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0011, IMPROVE TURBINE ENGINE LUBRICANT

B.B. Baber, Southwest Research Inst., *8500 Culebra Rd., San Antonio, Texas* 78228 (DA0P3629; DAAK70 78 C 0001)

Develop improved turbine engine lubricant having increased load-carrying capacity and capable of operating at higher temperatures without sacrificing other performance characteristics.

A coordinated Army, Navy, Air Force effort is being made to determine the degree of lubricant improvement needed considering both Army helicopter turbine engines and the new AGT 1500 tank engine. High-temperature gear/lubricant tests will be conducted as new high-hot-hardness gear materials become available.

SUPPORTED BY U.S. Dept. of Defense, Army, Mobility Equipment Research & Development Command

3.0012, VIBRATIONAL-ROTATIONAL RELAXATION IN CHEMICAL LASERS

F.F. Crim, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Chemistry, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DN975429; N00014-76-C-0341)

Vibrational-rotational relaxation rates in molecular collisions are being determined directly. These are important in the naval areas of lasers and surveillance since they determine, for example, the state population distribution in a molecular laser and how nonequilibrium state distributions relax.

In the initial experiments, a relatively long pulse (microseconds) is used to produce a given excited vibrational-rotational state and a probe laser will measure the population growth in nearby vibrational levels. During this time a short pulse (nanoseconds) laser system will be set up so that rotational relaxation rates can be measured.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, ADAPTABLE WALL WIND TUNNELS FOR V/STOL RESEARCH

W.R. Sears, University of Arizona, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Tucson, Arizona* 85721 (DN975112; N00014-79-C-0010)

The ability to predict the performance of V/STOL aircraft in the vicinity of the ground and in transitional flight depends critically upon the accuracy of experimental data obtained in wind tunnels. Such data are plagued by uncertain corrections because of the presence of the tunnel constraining walls which interact with the highly deflected, vortical flows. The proposed research will examine the feasibility of the adaptable wall concept--a concept in which measurements made in the flow field far from the model are used in an active loop to control the flow through the walls--to minimize the wall interference effects for V/STOL flight.

To assess the value of the adaptable-wall concept in the V/STOL regime, a study will be undertaken of three-dimensional flows characterized by large lift coefficients (large deflections) and significant wake effect, to determine what the requirments of an adaptable wall tunnel are. Mathematically, the problem is to determine what boundary conditions, enforced in the mid-field of the flow about a real V/STOL configuration, uniquely determine the inner field and assure that it is part of the desired overall flow field. From a practical viewpoint, there are additional questions which must be addressed: what flow variables should be measured and where; what flow variables must be controlled and where to establish the proper boundary conditions accurately and rapidly.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0002, MATERIAL SUPPORT TECHNOLOGY - SOLID PHASE EPITAXIAL GROWTH

M.A. Nicolet, California Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *1201 E. California Blvd., Pasadena, California* 91109 (DN675034; N00014-75-C-0912)

With the increasing complexity of naval electronic systems, there exists a need to develop new fabrication techniques that will be suitable for precise processing for increased packing density of devices in large scale integrated systems. Solid-solid phase reactions and solid phase epitaxy coupled with ion implantation offer important new methods for realizing reasonably complex layered device structures with a minimum of processing complexity.

The investigator will investigate limits of concentrations of implanted ions in various semiconductor materials, both elemental and compound. Effects of sputtering under high dose rate conditions will be studied as a function of implanted ion mass. Annealing experiments to ascertain the degree of incorporation of impurities into the lattice will be investigated by electrical measurements along with ion beam analysis techniques, i.e., backscattering and channeling.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0003, DEVELOPMENT OF PERFORMANCE CRITERIA FOR LANDING SIGNAL OFFICERS (LSOS)

C.A. Brictson, Dunlap & Associates Inc., Wester Division, *La Jolla, California* 92037 (DN894024; N61339-78-C-0123)

LSO job performance and training standards, and measures of LSO performance variability will be developed.

A systematic, analytic approach will derive measurable LSO performance criteria describing in quantitative terms the relative effectiveness of the LSO. By relating criterion measures to LSO aircraft recovery functions, job relevant measures with inherent face validity will be provided.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

4.0004, SPECTRUM FATIGUE TESTING OF GRAPHITE/EPOXY BOLTED JOINTS

J.F. Haskins, General Dynamics Corp., Convair Division, *P.O. Box 1950, San Diego, California* 92112 (DN881109; N62269-77-C-0340)

To determine the sensitivity of a graphite/epoxy bolted step joint to environmental exposure when subjected to accelerated flight-by flight spectrum fatigue loading typical of naval aircraft. This work is in support of work unit ZA601, Aircraft Technology, Agency Accession No. DN 681080.

A four-step bolted joint between a graphite/epoxy laminate and a 7000 series aluminum alloy. Three series of tests will be performed to determine the statistical distributions of ultimate compression strength; constant amplitude fatigue life in compression; and the compression spectrum fatigue characteristics. Tests will be performed for two environmental conditions; viz. laboratory environment (75 degrees F and approximately 50 percent relative humidity) and after preconditioning for 120 days at 200 degrees F and 95 percent relative humidity.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - AIRFOIL OPTIMIZATION BY ADAPTIVE CONTROL OF CAMBER AND THICKNESS

E. Levinsky, General Dynamics Corp., Convair Aerospace Div, *P.O. Box 1950, San Diego, California* 92112 (DN475202; N00014-76-C-0742)

The objective of this investigation is to demonstrate the feasibility of a self-optimizing flexible technology (SOFT) wing which changes its shape (span-wise and chord-wise distribution of camber and thickness) in such a manner as to optimize a given merit function. Such a wing will be able to automatically adapt itself to provide optimal performance throughout the whole flight envelope. This technique will also overcome existing deficiencies in both analytic and wind tunnel methods for truly optimizing airfoil and wing geometries at high subsonic and transonic flight conditions.

The current phase of the research is being directed towards modification and refurbishment of the 1/6 scale semi-span SOFT wing wind tunnel model to correct deficiencies that were identified during the first wind tunnel test and to improve model reliability. When this redesign is completed, a second tunnel entry and test will be conducted with Air Force support at Arnold Engineering Development Center in Tunnel 16T at transonic flight conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, FINITE RATE CHEMICAL REACTIONS IN TURBULENT FLOW

M. Gerstein, University of Southern California, School of Engineering, Dept. of Mechanical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DN975395; N00014-79-C-0352)

The objective of this study is to develop a better understanding of turbulent reacting flows for finite rate chemistry. This information is needed both for improved prediction of the complex mixing and combustion processes within the combustors of aircraft turbojet engines, and to provide a basis for advanced combustor design. Ultimately it should lead to improved propulsion systems for naval weaponry applications.

A mixing region will be formed between two uniform liquid streams of different velocity, separated initially by a splitter plate, and mean velocity profiles will be determined with hot film probes. The extent of large-scale mixing will be established by studying non-reactive streams with dye tracers and, by adding salt to one of the streams, with conductivity probes. Molecular mixing will be studied by considering infinitely fast reactions between appropriate acid-base solutions, with one reactant in each stream. Acid-base indicators and ionization probes will be used to locate regions of varying degrees of mixedness and to determine composition profiles. Ultimately, finite rate isothermal chemistry will be studied by using appropriate hydrolysis reactions to produce acid solutions, again monitoring the flow with

indicators and ionization probes. Experimental results will be compared with available theoretical models.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0007, HIGH REYNOLDS NUMBER VISCOUS CASCADE ANALYSIS
M.J. Werle, United Technologies Corp., Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DN890145; N00019-78-C-0604)

Development of viscous/inviscid interaction models for high Reynolds number laminar and turbulent base flow, based on the asymptotic triple deck and interacting boundary layer concept.

Analytical study.

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0008, AUTONOMOUS SATELLITE SENSOR PROGRAM
F.L. Markley, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980065)

The purpose of this effort is to study the accuracy of determination of a spacecraft's attitude and ephemeris by autonomous navigation methods utilizing combinations of star sensors, landmark recognition systems, and inertial reference units and to study the influence of spacecraft nonrigidity on the accuracy attainable.

The study will utilize an error covariance analysis based on optimal estimation techniques and containing models of the spacecraft dynamics (linearized), various sensor configurations, and expected distributions of stars and landmarks. The study will analyze both the absolute accuracy of the spacecraft attitude and ephemeris determination as well as the accuracy with which the location of objects on the earth's surface relative to the landmarks can be established.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0009, THERMOPHOTOVOLTAIC SPACE POWER SUPPLY
J. Severns, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980130)

To gain sufficient understanding of the basic principles involved to permit confident design of a hardened, non-nuclear satellite power supply. Obtaining spacecraft insensitivity to the space radiation environments (both natural and man-made) has required use of a radio isotope heat source in the past. The design complexity involved in overcoming potential problems upon re-entry to our atmosphere makes radioactive materials difficult to use on satellites.

A solar fired, thermophotovoltaic system has been chosen for study. Two components essential to this system are not well understood - the thermophotovoltaic cell itself, and the high temperature thermal storage. Work on the cell will fall into two areas, isolating and eliminating the factors limiting performance in an existing P-I-N/ germanium cell, and consideration of new cells using different geometries, and different materials. The thermal storage component requires reliable containment of a storage material, over several years, at temperatures exceeding 1200 degrees C.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0010, VIRTUAL IMAGE DISPLAY SYSTEM
G. Derderian, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Advanced Simulations Concepts Lab., *Orlando, Florida* 32813 (DN794008)

This virtual image display system will be an efficient, lightweight, compact, low-cost virtual image device which is needed for synthetic flight trainers and tank drive simulators.

The virtual image display system will contain a combination of optical elements that convert a real image, such as a television tube, into a virtual image such that the scenery appears to be at the real world distances.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulation Concepts Lab.

4.0011, SUPERCRITICAL AIRFOIL PERFORMANCE
D.E. Hobbs, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DN890164; N00019-79-C-0229)

To provide experimental trailing edge aerodynamic information required for developing and verifying an analytical system for predicting exit air angle and total pressure loss for a supercritical airfoil.

Experimental/analytical study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0012, DESIGN OF DATA BASES FOR PROCESS PLANNING OF MACHINING OPERATIONS WITH APPLICATION TO END MILLING PROCESSES
R.E. DeVor, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical & Industrial Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

Machining processes such as end milling of aircraft structures possess two characteristics which inhibit process planning; these are (1) part geometries which produce tool paths with continually varying cut geometries, (2) engineering design specifications which do not allow for rework of parts scrapped by tool failure, poor surface finish or out of tolerance dimensions unless at high rework costs. As a result part programmers tend to program for 'worst case' conditions with resulting low efficiency and high machining costs. This research is developing a computer-based information system for the end milling process. Geometric models will relate part geometry to cut geometry. Force models based on cut geometry will help to predict cutter deflection and cutter breakage. Process performance characteristics derived from production floor/DNC feedback as well as machinability test will be modeled and stored for use in predicting process performance as a function of cut geometry and machining conditions.

SUPPORTED BY University of Illinois

4.0013, STUDIES OF EQUATORIAL GHZ SCINTILLATION PROBLEMS 14260-ELX
K.C. Yeh, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DA0E9192; DAAG29-78-G-0101)

To study experimentally and theoretically equatorial scintillation of transionospheric radio signals. Relevance - this study will address the problem of signal fading in the DOD-wide navigation (global positioning system) and communication systems. For optimum signal design and failure analysis, signal fadings have to be known at location of maximum occurrence (equator).

Emphasis will be placed on GHz scintillations and their relations to scintillations at lower frequencies. Experiments with ATS-O6 and other geostationary satellites are proposed to study multifrequency dependence, multiple scattering effects and climatology of scintillations. Experimental data will be compared with model computations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0014, DEVELOP RAY TRACE TECHNIQUES
K.C. Yeh, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DF243000; F19628-75-C-0088)

AF function - ionospheric ray tracing. Deficiency - need to deduce ionospheric structure from limited radio propagation measurements. Research - develop techniques for inversion of

oblique and backscatter ionogram data and for homing in 3-D ray tracing. How research contributes - this research will provide the basis for techniques of frequency management in OTH radars and other real-time applications which use ionospheric observations to optimize system parameters. It will also greatly improve existing techniques for system simulation and diagnosis in the presence of ionospheric irregularities.

Mathematical techniques will be developed, and implemented in the form of computer programs, to convert from measured ionogram data to inferred ionospheric profiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Cambridge Research Labs.

4.0015, WEAPONRY - RESEARCH SUPPORTING JET PROPULSION TECHNOLOGY (PROJECT SQUID)
S.N. Murthy, Purdue University, School of Engineering, Dept. of Mechanical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (DN524574; N00014-75-C-1143)

In the project 'Principles of Chemical Propulsion and Armaments', this task is a major effort in support of jet propulsion technology; it generates understanding and expansion of knowledge required for the development of jet devices used in naval aircraft, missiles and space vehicles. The objectives of SQUID are: (1) stimulate interests of scientists and engineers in solving Navy-related problems, (2) plan and support basic and applied research relating to jet propulsion, and (3) provide capability for conducting special studies, consulting and probing new avenues of relevant research.

Project SQUID headquarters office, upon approval of the power program, conducts a subcontracting program on physical and chemical processes of energy transformation in relevant scientific areas pertinent to jet propulsion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0016, AERODYNAMICS RESEARCH
T. Tai, U.S. Dept. of Defense, Navy, Naval Ship Research & Development Center, Aviation & Surface Effects Dept., *Bethesda, Maryland* 20084 (DN678328)

Conduct an analytical and experimental research program to identify attractive aerodynamic techniques for improving the performance of advanced Navy aircraft. Studies will include the development of theoretical methods to determine the viscous drag of three-dimensional bodies, with particular emphasis on interference drag.

A. 3-D drag - in subsonic case, the skin friction over a 3-D body will be determined by applying proper axisymmetric boundary layer solution along a streamline and summing up over the whole body surface. Equations for determining streamline pattern over 3-D general bodies will be formulated and coded in Fortran program. The required inviscid pressure distribution will be obtained either by using 3-D potential flow program or directly by experimental data. Interference drag will be evaluated by considering the effects of cross flow and flow separation. In supersonic case, existing 3-D techniques will be identified. Adaption and necessary modification of the technique will be pursued for applicability to advanced Navy aircraft. B. Airfoil research -experimental verification of an advanced airfoil previously theoretically derived under the present work unit for transonic buffet control will be carried out by testing a representative model. For economic reasons, the experimental program will be conducted in cooperation with NASA Ames.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0017, DIAMOND MACHINED LENS
R. Mergerian, Westinghouse Electric Corp., Defense & Electronic Systems Center, *P.O. Box 746, Balt-Wash Internat. Airport, Baltimore, Maryland* 21203 (DN980055)

To demonstrate the fabrication of corrected geodesic lens in Ti-In diffused waveguides using numericaly controlled diamond machining techniques. Accurate control of the focal point, profile and position of these lenses will be demonstrated. These lenses will be corrected for spherical aberrations using a suitable lens profile. Single and double lens combinations will be fabricated and evaluated. Characterization will include throughput loss, scatter, focal length, diffraction limited performance and acceptance angle. The lenses will be designed for incorporation into microoptical microwave spectrum analyzers jointly under Navy and Air Force development.

Using computer, numerical controlled diamond machining techniques, several microoptical lens will be fabricated. The profile of the lens has been theoretically determined and it allows for corrections for spherical aberrations. Edge rounding is accounted for in the program. Depth control of plus/minus 1 micron and placement of the focal point to better than 10 microns will be demonstrated. Using end-fire coupling techniques, the quality of lens will be examined through far field measurements. Finally, a two lens optical system will be fabricated on a substrate whose edges were precisely polished. Final characterization of the lens will be performed using the Westinghouse photodiode array butt-coupled to the waveguide/lens system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0018, NAVY VEHICLE DESIGN AND CONSTRUCTION - A MULTIPLE SCALES APPROACH TO THE ANALYSIS & SYNTHESIS OF CONTROL SYSTEMS WITH FAST & SLOW DYNAMICS
R. Ramnath, Charles Stark Draper Lab. Inc., *68 Albany St., Cambridge, Massachusetts* 02139 (DN975512; N00014-79-C-0462)

When high performance vehicles are operated at the extremes of their performance capabilities (i.e., V/STOL transition, aircraft maneuvering to high angle of attack, attack class submarine making rapid depth change or high speed turn, etc.), dynamic instabilities and loss of control may occur. Under these conditions, the equations of motion which describe the vehicle dynamics become time-varying (i.e., equation coefficients vary with time). Current analysis and design techniques are based on the simpler time-invariant systems (equation coefficients are constant) and can lead to erroneous predictions of stability for time-varying systems. The objective of this research is to develop analysis and synthesis methods for control of time-varying systems.

The method of approach will consist of the asymptotic theory of generalized multiple scales in conjunction with extended multi-dimensional Laplace transforms. The temporal behavior of the system response will be extended, by the general multiple scales theory, into multiple time dimensions after a suitable reparameterization based on the ratio of the time constants of the modes of the system response. Multiple Laplace transforms will be used. Each with respect to the respective time scale. The true Laplace transform of the system response will be represented asymptotically as a combination of the individual Laplace transforms, leading to an ordered hierarcy of transfer functions for time varying systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0019, MODEL REFERENCE ADAPTIVE SYSTEMS
R.V. Monopoli, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Electrical Engineering, *Amherst, Massachusetts* 01002 (ENG79-06641)

Adaptive control theory deals with control problems in the face of uncertainty. Uncertainty about or ignorance of the external environment or the internal system details often preclude the successful use of nonadaptive control theory. This research is directed toward one class of adaptive systems, the model reference adaptive systems. This class of systems encompasses parameter identifiers and adaptive observers as well as adaptive controllers. Emphasis in this work is on the adaptive controller, and there is both a theoretical and an experimental component. The theoretical part deals with the development of algorithms with improved stability and convergence properties. The experimental part deals with implementing a model reference adaptive control system on the University of Massachussetts Radio Astronomy Telescope.

The previous award number is NSF grant ENG-7616817.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0020, REACTIVE DOWNCONVERTERS FOR RADIO ASTRONOMY AT 75-140 GHZ

P.T. Parrish, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Electrical & Computer Engineering, *Amherst, Massachusetts* 01002 (ENG7813930)

A thorough theoretical and experimental investigation of millimeter reactive downconverters is being undertaken. A specific reactive downconverter of substantially new design is examined. This instrument converts 115 GHz electromagnetic energy to 20 or 40 GHz, with high conversion efficiency and low noise. This design incorporates three new, important features. First, the downconverter employs newly-developed, gallium arsenide Schottky barrier diodes with planar geometry and beam leads; as contrasted with conventional, whisker-contacted diodes. The use of this diode results in an electrically and mechanically superior downconverter compared to presently available units. Second, superconducting metallization and cryogenic operation of the downconverter reduces losses and thermal noise. Third, extremely low-noise, intermediate frequency MASER amplifiers are used, affording the lowest possible system noise temperature. Comparison of the reactive downconverter with the best resistive downconverters is made. This downconverter has immediate application wherever a low-noise millimeter receiver is needed. Potential applications are (1) radio astronomy and (2) ground-based millimeter communications and radar systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0021, NAVY ENVIRONMENT - 24 CHANNEL AMPLIFIER SYSTEM

K.E. Prada, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (DN975456; N00014-79-C-0071)

In the spring of 1980, an ice floe station, FRAM II, will be established. FRAM II will be an acoustic receiving station for acoustic energy generated by explosive sources and continuous sources from satellite camps.

The 24 channel system will allow a 3 degree azimuthal accuracy for recording of signal energy, as well as flexibility, in that a combination of geophones and hydrophones may be used on FRAM II. The system will be constructed at Woods Hole Oceanographic Institution.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0022, CORPS OF ENGINEERS REMOTE SENSING USER MANUAL

L.E. Link, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (31661)

OBJECTIVE: The objective of this work is to complete a camera-ready draft of a Corps of Engineers Remote Sensing User Manual.

APPROACH: Work accomplished by the WES under Work Unit 003, Remote Sensing of Environment, Task 01, Environmental Quality Management for Military Facilities, Project 4A162121A896, Environmental Quality for Construction and Operation of Military Facilities; work accomplished by the Battelle Corporation on contract through NASA (using Civil Works revolving funds); and ongoing work at the WES under the Earth Resources Satellite R&D program will be combined and molded into a final camera-ready draft user manual. The manual will have three major parts covering remote sensing in the Corps of Engineers, guidance for planning and management of remote sensing applications, and technical guidance. The main parts will be supplemented by appropriate appendices that provide detailed information on sources of available imagery, sources of new imagery missions, remote sensors and their general characteristics, and a user directory for the Corps of Engineers.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

4.0023, PREVENTION OF ICE FORMATION ON HELICOPTERS

Unknown, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (DA0C8149)

Improve methods of control, prevention, and alleviation of accretion and adhesion of ice on current and future Army helicopters to contribute to all weather operational capability.

Test rotor wing sections in icing conditions using anti-icing methods developed by CRREL and other agencies for helicopter and other applicators.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

4.0024, SYSTEM CONCEPTS

T. Hutchings, U.S. Dept. of Defense, Army, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab., *Picatinny Arsenal, Dover, New Jersey* 07801 (DA0B0713)

Evaluate new concept options in armament system technology for use on future helicopters, including AH, UH and OH types.

Three seed-type initial efforts will be considered for new armament system technology. One approach is the use of improved high performance heliborne, lightweight, compact armament systems in utility transports to improve operational effectiveness. Various lightweight armament system options will be evaluated to establish a set of options for future armament. Other concept options to be evaluated include a target sensing armament system, incorporating a target sensing projectile and remote piloted vehicle (RPV) armament for helicopter application.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab.

4.0025, AIRBORNE LASER PROPAGATION

B. Contreras, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (DF169570)

To evaluate the effects of the aerodynamic environment on laser beam propagation. These effects include absorption and scattering by aerosols, boundary layer and atmospheric turbulence, flow field perturbations and shockwave interactions.

Wind tunnel model testing will be compared with flight test and theoretical predictions of optical degradations due to boundary layer turbulence, flow field and shock effects. Optical measurements will also be made on free air atmospheric turbulence in conjunction with balloon-borne and aircraft-mounted micro-termal probes, and compared with meteorological data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0026, INTERFACE HARDWARE, DESIGN, CONSTRUCTION AND MAINTENANCE

R. Trapani, Trapani Engineering Inc., *Berwyn, Pennsylvania* 19312 (DN981028; N62269-78-C-0189)

To design and construct various items of interface hardware for the Basic Configuration No. 1 laboratory effort. To provide maintenance support for various items of interface hardware. This will support work unit ZC910, Agency Accession No. DN 681082.

To procure from the original manufacturer of several of GFE interface hardware the services and material necessary to perform above objective.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0027, MECHANISM OF INSERTION IN HIGH CONDUCTIVITY GRAPHITE INTERCALATION COMPOUNDS 15804-MS

F.L. Vogel, University of Pennsylvania, School of Engineering & Applied Sciences, Dept. of Electrical Engineering & Science, *4001 Spruce, Philadelphia, Pennsylvania* 19104 (DA0F9288; DAAG29-78-C-0037)

To understand and control the chemical processes of intercalation and de-intercalation, and to relate these processes to the electrical properties of the resulting materials. Relevance - the research is relevant to generation and transmission of electrical power, electronic warfare, composites for aircraft, mobility, etc. Electrical conductors which have conductivity/weight ratios greater than copper can have a great impact on the design of mobile power plants.

Preparation of materials from highly oriented pyrolytic graphite and intercalants such as iron halides and iron fluorides. Characterization of the materials using combustion analysis, electron beam microprobe, x-ray fluorescence, gas phase ESCA and electrical resistivity. Determination of the degree of charge transfer during intercalation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0028, INVESTIGATION OF MICROSTRIP AND MICROPATCH ANTENNA

E.S. Harris, U.S. Dept. of Defense, Navy, Naval Underwater Systems Center, *Newport, Rhode Island* 02840 (DN989107)

Investigate and develop the microstrip and micropatch antennas for submarine-satellite communications such as global positioning satellite. Particular emphasis will be in the frequenucy range above 1 GHz.

Investigation of previous work and applications of the microstrip and micropatch antennas. Design and development of antennas which could be mounted around the masts of a submarine. This would include development of a phasing network for an array of antennas and/or passive arrays to achieve an overhead pattern for satellite use.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

4.0029, GENERAL METHODS TO ENABLE ROBOTS WITH 'VISION' TO ACQUIRE, ORIENT AND TRANSPORT WORKPIECES

J.R. Birk, University of Rhode Island, School of Engineering, Dept. of Electrical Engineering, *Administration Bldg., Kingston, Rhode Island* 02881 (APR74-13935 A02)

This award continues NSF Grant APR74-13935.

This research effort seeks to develop general methods by which computer-controlled robots using visual sensors can: (1) acquire a workpiece (part) so that it may be brought to a fixture without a collision; (2) compute the orientation of a workpiece held in the robot hand; and (3) transport the workpiece to the fixture without collisions. The research is expected to result in new image processing techniques as well as kinematic equations for manipulators and a robot system architecture which will enable a class of presently unsolvable industrial problems to be attacked.

Planned activities include the following: Methods to acquire and orient workpieces with arbitrary resting states will be developed. Features which describe workpiece orientation will be investigated. Some of these features will be based on a partial image of the workpiece and others on the complete image. Features based on gray-scale pictures will be used when features based on binary pictures perform unsatisfactorily. Alternative methods to sample image data from different orientations during instruction will be examined. Graphs of image features versus orientation will be made. Procedures to make a decision about workpiece orientation will be developed which use multiple views of the workpiece. Obstacle avoidance techniques which employ a programmer's ability to specify a normal workpiece trajectory using a switchbox will be tested. Experiments will be performed employing an accurate six-degree-of-freedom robot and a special fixture which houses dial gauges to measure orientation and position. A probabilistic model of the overall process will be formulated in an effort to decrease the average cycle time.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Productivity Research & Technology

4.0030, THERMODYNAMICS AND KINETICS OF INTERSTITIAL SOLID SOLUTIONS 16089-MS

R.B. McLellan, Rice University, Graduate School, Dept. of Mechanical & Aerospace Engineering, *6100 Main St., Houston, Texas* 77001 (DA0G9084; DAAG29-79-C-0108)

To study the thermodynamics and kinetics of hydrogen dissolved interstitially in metal solid solutions, in order to obtain realistic thermodynamic models of such alloys. Relevance - the research is relevant to the synthesis and processing and subsequent properties of many metal alloys in current use in weapon components, ammunition, mobility and construction applications, and in the degradation of high strength steel and aluminum alloys used in aircraft and tank structures by hydrogen embrittlement.

Thermodynamic and kinetic measurements on a series of binary and ternary solid solutions containing dissolved hydrogen as a function of temperature and pressure to determine the nature of atomic interactions responsible for the quantities measured. Thermodynamic and kinetic measurements to determine deviations from ideality of the solubility of interstitials due to trapping sites and impurity atoms. Modelling of lattice occupancy sites by interstitials as a function of basic thermodynamic and kinetic parameters ranging from metallic solid solutions having low solubility (alloys of iron, aluminum, nickel) to those for which solubility is very high (body-centered cubic modifications of Nb, V, and Ta).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0031, ANALYSIS OF ATMOSPHERIC OZONE MEASUREMENT FROM SATELLITES USING MILLIMETER RADIOWAVES

A.W. Straiton, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: The molecular resonance radiation lines of ozone at 102.7 and 110.8 GHz provide a means by which the amount and distribution of this gas in the atmosphere might be measured from a satellite such as the space shuttle.

Observations from an orbiting satellite might provide global coverage in a short time span. This research investigated how such soundings might effectively be made.

A parametric model for vertical ozone distribution was chosen. The antenna temperature as measured at a satellite near the two frequencies under consideration was calculated in terms of the model parameters. The radiation from a particular elevation and the absorption before reaching the satellite were calculated. The integral effects of the background noise and the atmospheric radiation was used to determine the antenna temperature in the vicinity of the absorption lines.

Calculations suggested that a nadir angle of 80.5 degrees would be optimum for a satellite elevation of 275 km. This provides a path whose nearest approach is 11 km above the earth. The percent change in emission temperature between the resonant frequency of 101.7 GHz and a frequency shifted by 100 MHz is 91% which should provide for accurate measurements.

A computer routine was developed for determining the parameters in the ozone model chosen from experimental data.

SUPPORTED BY University of Texas

4.0032, IMPROVED STREAM MEASURING CAPABILITIES

W.R. Cook, U.S. Dept. of Defense, Army, Corps of Engineers, MGI Systems Div., *Fort Belvoir, Virginia* 22060 (DA0M8111)

To determine feasibility of developing optical sensors that will provide specific stream measurements such as water velocity, and stream width from remote positions such as in aircraft, armored or other vehicles and forward observation sites.

Utilizing reports and specifications resulting from previous USGS work in this area, conduct a design study for a state-of-the-art model. Based on results of study, build a brassboard model for use in conducting experiments to determine feasibility of technical objectives. Related ongoing efforts by other DOD agencies, industry, civil government agencies and allied nations will also be investigated to determine potential application to this effort. This will be a joint USAETL-USGS project. For those technical objectives that appear feasible, based on the results of these investigations, work will continue under project 4A763712D862 (ARTINS) commencing in FY 78.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Engineer Topographic Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, DEVELOPMENT OF ALABAMA RESOURCES INFORMATION MANAGEMENT SYSTEM

R.I. Vachon, Auburn University, School of Engineering, Dept. of Mechanical Engineering, *Auburn, Alabama* 36830 (NAS 8-32215)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0002, HIGH RESOLUTION TRANSMISSION ELECTRON MICROSCOPY OF LUNAR AND METEORITIC MINERALS

P.R. Buseck, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (EAR79-08507)

This work is a continuation of studies previously funded by NASA but which have been transferred to NSF. The project will obtain fundamental information regarding the histories of lunar and meteoritic minerals. The fine-scale structural details that can now be made visible by high resolution transmission electron microscopy will be studied. An attempt is then made to correlate these structural perturbations with associated geological events and processes. Specific tasks to be studied include the following: (1) exsolution textures and anti-phase domains in lunar and meteoritic pyroxenes, and their interpretation for determining cooling histories; (2) the possibility of trace amounts of water residing in normally anhydrous lunar and meteoritic minerals; (3) the nature of the sheet silicates in selected carbonaceous chondrite matrices; (4) possible structural distinctions between minerals in isotopically anomalous and 'normal' coarse-grained inclusions in the Allende meteorite; (5) the use of pyroxene fine-structures to resolve certain problems of the achondrites and chondrites, such as the shallow or deepseated origin of the Shaw meteorite.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0003, PLANETARY CARTOGRAPHY

R.M. Batson, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-01453)

The objective of this project is to prepare shaded relief, albedo, and/or contour maps of the planets and natural satellites with various kinds of remote sensing data (mostly digital television pictures from planetary spacecraft). Compilation of a series of controlled photomosaics of Mars at 1:2,000,000 will continue, along with revision of existing 1:5,000,000 shaded relief maps where appropriate. Compilation of special purpose maps of all planets for topical studies will continue. Compilation of maps of the Galilean satellites of Jupiter with Voyager data will begin.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0004, GLOBAL INVENTORY OF GLACIAL AND PERIGLACIAL FEATURES ON MARS

B.K. Lucchitta, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02377)

Preliminary survey of Viking images for ice-related features. Study of analogs in literature and on terrestrial satellite images and areal photographs. Classification of glacial and periglacial features identified. Selection of symbols and suitable criteria for portrayal of ice-related features on map. Systematic survey of all photomosaic subquadrangles of Mars at 1:1,250,000 and 1:2,000,000 scales as they become available, and plotting of location and extent of features on these maps.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, RADII AND MASSES OF PLUTO AND COMPANION

R.L. Wildey, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02352)

A refinement of the masses and radii of Pluto and its new satellite will be sought. The actual image elements of 42 images of the solar system pair will be treated as observations predicted by a mathematical model incorporating the 2 radii, 6 orbital elements, at least 2 atmospheric/astronomical 'seeing' parameters, and rotational parameters.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, ECOHYDROLOGY OF ARID REGION VEGETATION

R.M. Turner, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Federal Bldg. Room 4J, Tucson, Arizona* 85701 (WR 76-145)

Water is becoming increasingly scarce in the arid region of the United States. In his attempt to manage or control this essential resource, man is constantly modifying the regional hydrology by changing water-table elevations, altering surface drainage patterns, controlling streamflow, and altering erosion. These and other modifications may result in altered water quality and often result indirectly in vegetation changes that reflect the changed regional hydrology. Man also changes the vegetation directly through agricultural practices, urbanization, vegetation management activities, all of which have an impact on the region's hydrology.

To define the interrelationship between the region's hydrology and its vegetation. To measure the effect that the changing patterns of vegetation have on the regional water supply and, conversely, the effect that changes in water quality and quantity have on the vegetation.

Use historical documents and old photographs to determine the scope of vegetation changes. Use remote sensing products such as aerial photographs and satellite images to locate, map, and measure existing vegetation. Riparian and phreatic vegetation will be emphasized because, compared to the area they occupy, their hydrologic and ecological significance is disproportionately great. The communities are valuable wildlife habitats and recreation sites; at the same time they consume and transpire large amounts of water. Studies of desert plant populations will be made because vegetation changes at dry sites may be sensitive indicators of large-scale climatic change.

Work was begun on a compilation for Arizona of natural or man-made areas from which grazing has been excluded. Such range-reference areas provide base-line data for judging erosion rates and vegetation change. The report on evapotranspiration (ET) in saltcedar stands at Buckeye, Arizona was completed. The best method for estimating ET combines terms from energy-budget, mass-transfer, and stomatal-resistance methods.

Completion is planned of the following studies: Range-Reference Areas, Revegetation of Abandoned Lands, Estimating Moisture in Desert Soils. Work to begin on review of literature on unsaturated flow.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0007, REMOTE SENSED DATA BASE FOR HSPF

R. Johnson, Hydrocomp Inc., *201 San Antonio Cir., Suite 280, Mountain View, California* 94040 (79-R-X0563; K609A-464)

OBJECTIVE: This agreement between NASA and EPA provides for the testing of HSPF (Hydrologic Simulation Program Fortran) using a remote sensed data base as opposed to a normal one.

APPROACH: NASA is transferring funds to EPA to accomplish the task. The required test and output report will be accomplished via a specific task of the comprehensive contract outlined in Task 474.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Research Lab.

5.0008, REPLACEMENT OF XDS-930 COMPUTER AT THE CHATANIKA RADAR FACILITY

C.H. Dawson, S R I International, Radio Physics Laboratory, *300 Ravenswood Ave., Menlo Park, California* 94025 (ATM7823802)

The Chatanika Incoherent-Scatter Radar Facility is a ground-based diagnostic tool which, by remotely sensing a large number of atmospheric parameters, guides progress in understanding of high latitude phenomena and atmospheric dynamics. The facility has a strong history of service to a large segment of the atmospheric science community.

Usage of the Chatanika Incoherent-Scatter Radar Facility by visiting scientists still continues to increase, and more complex experiments are being proposed. The XDS-930 computer at Chatanika requires replacement to allow these scientists and their experiments to continue to be properly supported. This grant provides for: 1. Replacement of the XDS-930 with a Harris 123 virtual-memory computer. 2. Design, fabrication, and installation of digital hardware to mate the existing computer interface, integrator, and Versatec printer/plotter to the new computer. 3. The reprogramming of the on-line data acquisition program and associated revision of the users operating handbook.

These changes will make possible the continued leadership of the Chatanika facility in significantly advancing our understanding of the physics of the auroral and high latitude upper atmosphere, a region of pivotal importance to future development of the field.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0009, SEASAT PROGRAM - 'GROUND TRUTH VERIFICATION OF SEASAT-A DATA'

J.D. Jarrell, Science Applications Inc., Research Meteorology, *1200 Prospect St., La Jolla, California* 92037 (K7-932; MO-A01-78-00-4328)

OBJECTIVE: The following objectives are proposed: 1) Compare surface stress and wind estimates obtained from Seasat-A data to surface stress and wind values obtained from multi-level profile and fluctuation measurements made from a ship; 2) relate discrepancies between Seasat derived estimates and measured values to hydrostatic stability and wave age conditions; and 3) evaluate satellite derived sea surface temperatures on the basis of measured sea surface temperatures.

APPROACH: Measurements inferred from Seasat-A will be compared with available unique ground truth data collected in the satellite footprint by a cooperating agency's research vessel.

The approach anticipated is as follows: Design and coordinate analysis procedure to make results from both sets of sensors as compatible as possible for intercomparisons. Averaging periods for shipboard results will be established. Statistics which delineate temporal and spatial intermittence will be specified.

Specify and coordinate procedures which will provide optimal spatial and temporal coverage from shipboard measurements. This task will require comparisons of satellite and shipboard system.

Design and develop procedures to incorporate ship data not coincident with footprint and other synoptic data.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0010, SUMMARY OF GEOLOGIC HISTORY OF THE MOON

D.E. Wilhelms, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02364)

STATES TO WHICH PROJECT PERTAINS: California.

Prepare a summary of the geologic history of the surface of the Moon mostly as worked out by photogeologic investigations. Include a description of methods and a history of the investigations.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0011, MODELING CLIMATIC EFFECTS OF CARBON DIOXIDE INCREASES

J.B. Knox, University of California, Central Office, Lawrence Livermore Lab., *P.O. Box 808, Livermore, California* 94550 (3028; W-7405-ENG-48)

This project will use several models including the Livermore 2-dimensional Zonal Atmospheric Model (ZAM-2) and a simplified 1-dimensional climate/carbon reservoir model, to study the response of the global climate to increased atmospheric CO2 concentrations. An objective of this work is to narrow the range of uncertainty in assessing temperature changes by considering the effects of hydrologic balance, the vertical thermodynamic, kinetic and chemical structure of the atmosphere, and meridional transport. Other Livermore models, particularly the Stratospheric Chemistry/CO2 model will be used in conjunction with the ZAM-2 and simplified 1-D model to study the effect of changes in long and short wave radiation on atmospheric composition and the thermal effects due to increased CO2 on stratospheric ozone.

SUPPORTED BY U.S. Dept. of Energy, Office of Carbon Dioxide Research & Assessment

5.0012, THE SCRIPPS SATELLITE REMOTE SENSING FACILITY

R.L. Bernstein, University of California, San Diego Campus, Scripps Institution of Oceanography, Ocean Research Division, *P.O. Box 1529, La Jolla, California* 92038 (OCE78-19888)

This project supports the initial operation of a research oriented, satellite data receiving and processing facility. The facility, which is located at the Scripps Institution of Oceanography, is designed to serve a wide range of oceanographic investigators, including faculty and students from Scripps and other institutions. The facility will receive data both directly, from a local antenna, and indirectly by special telephone line and magnetic tape exchange, from the NIMBUS-G and TIROS-N satellites. A computer processing and display system will allow investigators to handle these data sets in near real-time, so that the data can help direct field investigations. The facility is designed to be operated by investigators themselves, with a minimum level of training. Emphasis of initial research efforts will be on the multi-spectral analysis of ocean emissions and reflectances covering the visible, infrared, and microwave portions of the spectrum, in order to provide information on a wide range of oceanographic phenomena. These include weather and climate related studies of oceanic rainfall and sea surface temperature variability; temperature and chlorophyll variability and their ecological significance; studies of optical properties of the sea surface; and studies of internal waves.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0013, THERMAL HISTORY OF ENSTATITE CHONDRITE METEORITES

J.M. Herndon, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (EAR-00932)

This work is a continuation of studies previously funded by NASA but which have been transferred to NSF. The project will obtain information about the thermal history of the enstatite chondrite meteorites. The micro-structure of the metal phases in the enstatite chondrites will be examined and the presence and morphology of the iron carbide phases will be used to determine the nature of thermal history which the meteorite has undergone. The study will attempt to determine the cooling rate of the metal within the meteorite as a function of sample location and construct thermal models in order to obtain the boundary conditions on the circumstances relating to the cooling of the meteorite.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0014, COHERENT LIDAR STUDIES

F.F. Hall, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AC44691)

PROJECT OBJECTIVE: Develop pulsed coherent CO2 lidars to measure atmospheric winds and concentration of gaseous species. Demonstrate wind and species concentration measurement capability, collect aerosol data, and verify system performance. Initiate development of airborne and satellite-based lidar systems.

CURRENT YEAR PLAN: Complete and test the laboratory pulsed coherent CO2 lidar system. Start integrating system into van. Perform system testing of EPA CW CO2 lidar at IR test range.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0015, GEOPHYSICAL INSTRUMENTATION DESIGN

C.J. Roubique, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9780-01757)

Design and engineering assistance will be provided for the development or modification of geophysical instrumentation used in minerals related studies including an airborne VLF EM system, a data acquisition system for aircraft use, a computer controlled IP receiver, and a system for EM scale model measurements.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0016, REMOTE SENSING GEOTHERMAL

K. Watson, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9790-00922)

To extend the use of a theoretical thermal model to more complex geological situations including topographic and surface-roughness effects, to develop computer methodology for registration of aircraft images acquired at different times in the diurnal cycle and apply these techniques to the analysis of multispectral data acquired for the island of Hawaii. Also to digitally enhance LANDSAT images of part of the Cascade Range, interpret these scenes for geologic linear features, and statistically analyze significant trend directions and spatial distribution patterns. Results of these analyses will be applied to delineating major geologic structures in the Cascade Range and evaluating their possible control on geothermal reservoirs.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0017, AIRBORNE OPERATIONS

R.A. Mills, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046 MS939, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-00917)

Major emphasis will be placed on the flying of our scheduled survey programs and the further refinement of systems and techniques. Planned programs include surveys in these categories and locations: Radiation and magnetics, Washington; Spectral reflectance, thermal infrared, Powder River, Wyoming; Radiation and magnetics, southwest states; Radiation and magnetics, Papago, Arizona; Spectral reflectance, thermal infrared, Nevada test site.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0018, TESTING OF SATELLITE UPLINKED REMOTE SURFACE WEATHER STATIONS IN THE SIERRA NEVADA

D. Rottner, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *Federal Ctr., Mail Stop 913, Denver, Colorado* 80225 (0035)

STATES TO WHICH PROJECT PERTAINS: California and Nevada.

The Automatic Environmental Surface Observation Platform (AESOP) has been developed to provide near real-time hydrometeorological data from remote sites to support weather modification research decisions. Cloud seeding opportunities are in part determined through an analysis of data received from the AESOP's.

During the 1977-1978 winter season tests were performed at manned sites in the Sierra Nevada. The following seasons will be a period of observing reliability in isolated settings with the information obtained being used as part of the project data base. With a successful comparison to other methods of data collection the use of the AESOP's will be expanded.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0019, HYDROLOGY OF ARKANSAS RIVER BASIN

J.L. Hughes, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Pueblo, Colorado* (CO 62-016)

The Arkansas River Valley in Colorado is an area of intensive water use and has a variety of water problems. Snowmelt from the mountains provides most of the streamflow but is supplemented by water from summer thundershowers and from transmountain diversions. Most of the yield is from the basin above Canon City, but most of the use is downstream from Pueblo and is for irrigation supplies between Pueblo and the Kansas state line. The stream is overappropriated and distribution of water in time and space needs improving to benefit the water users and the economy of the state. To effect better water management practices, models of the valley are needed so that predictions can be made of alternate water-management plans involving conjunctive use of ground water and surface water.

To improve our knowledge of the various facets of the hydrologic system. To collect, compile, and analyze hydrologic data needed for planning and administering water use in the Arkansas River Valley.

Provide a continuing inventory of both ground and surface water use, collect data on the natural variations of water availability, relate geologic and hydrologic phenomena, and develop digital computer models that will simulate the hydrologic system.

Continued to make seepage loss evaluations to assist in refinement of transit losses in Arkansas River Valley to Kansas state line, updated water-management model with new data collected, developed model to predict peak-discharge data at points in river system had Pueblo Reservoir not been constructed, made 1,095 water-level measurements in 693 wells, continued evaluation of water quality and hydrologic effect of irrigation return flow in river system, installed and made operational satellite equipment at surface-water site (Avondale) and collected and published surface-water records.

Evaluate results of 600 c.f. release from Pueblo Reservoir for transit losses in Arkansas River, calibrate and complete

report on effects of Pueblo Reservoir on flooding in river system, continue to collect and evaluate ground water, surface water, and water quality data to develop optimum hydrologic understanding of river system, and evaluate results of continued data collection on effects of irrigation return on quality of water in river system and publish results, publish results of reconnaissance of hydrologic setting in Crowley and Kiowa counties.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0020, LIDAR MEASUREMENTS OF AEROSOLS
K.M. Haught, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980205)

To measure the optical properties of atmospheric aerosols using laser radar (lidar) techniques. Lidar systems are being considered for a variety of remote sensing applications, and this effort potentially offers a methodology for extending lidar techniques to include aerosol monitoring.

A prototype lidar will be assembld by combining existing NRL components with a ND-YAG laser operating at 1.06 micrometers. The prototype will be constructed to be compatible with NRL's double-ended aerosol particle-size-distribution spectrometers. Additionally, a Biomation Model 8100 waveform analyzer will be integrated with a Nova 1210 mini-computer.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Ocean Systems Center

5.0021, ADVANCED TEST ASSESSMENT - WIDEBAND DATA
S.L. Ossakow, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN780162)

To describe the equatorial scintillating environment that the DNA Wideband Satellite will propagate through. The program will provide a predictive capability regarding the irregular structures and involve the interpretation of data collected with the satellite and associated equatorial in situ and ground-based measurement field programs. The ionospheric phenomena and their relation to the nuclear disturbed ionosphere will be addressed.

Use will be made of electrostatic plasma fluid type codes originally developed for nuclear cloud striation research and adapted for equatorial F region phenomena. Results will be obtained for different parameterizations of the environment. Information obtained will be made available to SRI International and other associated wideband research programs, and aid in interpretation of experimental results and suggesting new experiments.

SUPPORTED BY U.S. Dept. of Defense, Defense Nuclear Agency

5.0022, BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING FOR EFFECTS OF SPACE TRANSPORTATION SYSTEMS
D.H. Vickers, State University System of Florida, University of Central Florida, School of Natural Sciences, Dept. of Biological Science, *P.O. Box 25000, Orlando, Florida* 32816 (NAS10-8986)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Kennedy Space Center

5.0023, AIRCRAFT MEASUREMENTS OF AEROSOL OPTICAL PROPERTIES DURING THE MONEX PROGRAM
E.M. Patterson, Georgia Inst. of Technology, School of Geophysical Sciences, *Atlanta, Georgia* 30332 (ATM7820149)

The objective of this research is to obtain airborne measurements of the radiative properties of aerosol particles on aircraft operated as part of the Monsoon Experiment (MONEX), a regional subprogram of the Global Atmospheric Research Program (GARP), to be carried out during the First GARP Global Experiment (FGGE). Observations will be taken of aerosol size-number distributions, the spectral variation of the particle complex refractive index for visible radiation, and particle composition and shape using instrumentation mounted on NASA's Convair 990 aircraft during the Summer MONEX, May - June 1979. Similar observations from aboard the National Center for Atmospheric Research's (NCAR) Electra aircraft will be made during Winter MONEX, December 1978. These data will also be available for analyses under this program. Observations of the radiative characteristics of aerosol particles along the aircraft flight paths will be coordinated with those of other MONEX scientists who will be obtaining aircraft radiation data and ship-based aerosol and atmospheric turbidity measurements. These results will be used to determine the contribution of the aerosol particles to the rates of atmospheric heating measured by the radiation instrumentation installed on each aircraft for studies of the effects of heat sources on the monsoon circulation. MONEX is a major study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmosphere and ocean in monsoon regions. Three research areas have been identified for this experiment. They are the Arabian Sea, the Bay of Bengal and Indonesia-Malaysia. MONEX is important scientifically and also has significance for global agriculture, economics and politics. The initiative for MONEX is from the Government of India with the USSR and USA playing major roles. In addition to the benefits mentioned above, MONEX offers an excellent opportunity for scientific and technical cooperation between, and of mutual benefit to, the U.S., India and the USSR.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0024, NORTH PACIFIC EXPERIMENT (NORPAX) - CURRENT PROFILE SECTIONS ACROSS THE EQUATOR DURING THE NORPAX FGGE SHUTTLE
R.R. Harvey, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Oceanography, *2444 Dole St., Honolulu, Hawaii* 96822 (OCE7821320)

This project is part of the North Pacific Experiment (NORPAX). The long-range goal of NORPAX is to understand fluctuations in the upper layers of the Pacific Ocean with time scales of months to years and space scales in excess of 1,000 kilometers, and the relationship of these oceanographic fluctuations to the overlying and adjoining atmosphere. Achievement of this goal should eventually lead to improved weather/climate prediction for both the Pacific Ocean and North America.

One major component of NORPAX is a coordinated field experiment to monitor the space and time variability of the density and velocity fields of the upper layers of the equatorial Pacific current system. This field program will occur between January 1979 and June 1980 and will involve a number of scientists. Measurements will be made from ships, airplanes and moored instruments. This grant will provide Dr. Harvey with the funds to organize and direct the vertical profile current measurements that will be made from the monthly equatorial shuttle ship cruises. Dr. Harvey will ensure the quality of the data and make the initial examination of the data. In addition, he will make the data available to the other equatorial shuttle experimenters and assist in their utilization of these important measurements.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0025, DECATUR COUNTY LINEAMENT AND FRACTURE TRACE MAPPING
T.K. Greeman, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *1819 N. Meridian St., Indianapolis, Indiana* 46202 (IN 78-055)

Greensburg, Indiana, the primary supplier of water for Decatur County, has suffered near complete loss of their ground water supply wells during recent months. The county is underlain with limestone, dolostone and shales. Overlying these units are two unconsolidated units of till. Till thickness ranges from 0-100 feet within the county. Bedrock wells have the highest yield, but bedrock well yields are highly variable. Examination of aerial photographs indicated mappable lineations in the bed-

rock and wells with higher yields are probably situated in or near these lineations.

To study the relationship of permeability in the limestone and dolostone aquifer underlying much of Decatur County to the distribution and density of fracture traces and lineations mappable from aerial photos.

Drillers' logs have been examined to determine availability of lithologic, specific capacity and other data. Several hundred wells tapping the limestone-dolostone are distributed throughout the county. Specific capacity can be related to thickness of bedrock in each well. The examination indicated a wide range of specific capacity and permeability. The information from this and other logs will be related to the distribution and density of fracture traces and lineations at the land surface. Stereo aerial photography of the county will be obtained to determine the density of the fracture traces and lineations and a map showing their occurrence will be constructed.

Fracture traces have been marked on stereo aerial photographs and transferred to topographic maps. Field checking of existing domestic wells for location and verification of information on drillers' logs is complete. Determination of the distribution and density of fracture traces has been accomplished, but the application of the relationship of permeability to those fracture traces will be left to another study in FY 79 that will incorporate more data from other studies.

Publish topographic map with fracture traces, accompanied by a short, descriptive text.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0026, CONDUCT SHORT COURSES IN REMOTE SENSING

W.A. Franklin, Murray State University, School of Environmental Sciences, Dept. of Geography, *Murray, Kentucky* 42071 (NAS13-11)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0027, PROGRAM ADMINISTRATION

J.R. VanLopik, Louisiana State University, Agricultural & Mechanical College, Center for Wetlands Resources, *University Station, Baton Rouge, Louisiana* 70803 (M/A-1)

OBJECTIVES: Objectives are (a) to identify needs and opportunities that fit within the Sea Grant mission,; (b) to marshall intellectual talent and infrastructure of LSU and participating institutions for appropriate mission-oriented response to perceived needs and opportunities; (c) to maintain administrative functions of the Office of Sea Grant Development required for effective program operations, planning and fiscal accountability; (d) to scope Sea Grant efforts in terms of state priorities; and (e) to contribute Louisiana expertise and experience to national and international goals.

ANTICIPATED BENEFITS: (a) Efficient use of available resources in coherent thrust problem-solving will strengthen the University, advance the state, and increase national visibility for the Sea Grant federal-academic partnership and (b) advancement of a broad spectrum of economic, social, educational and governmental institutions in Louisiana's marine sector.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0028, AUTOMATIC DATA ACQUISITION

R.R. Reynolds, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Equipment Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8AA860)

OBJECTIVE: Develop two classes of automatic weather stations: 1. Sensor Processor And Display (SPAD) - a low-cost station for WSO, WSMO, etc. using NWS inventory of sensors. 2. Shipboard Environmental Data Acquisiton System (SEAS) - a shipboard system with forecast playback on CRT. SEAS I has manual entry of data only; SEAS II has complete sensor preprocessing of basic parameters.

APPROACH: 1. SPAD - New equipment will be interfaced to SPAD as it becomes available by designing interface cards for each. The SPADs delivered for evaluation must be maintained and upgraded as new interfaces become available. Problems found in software and hardware must also be corrected. A hobby computer system will be used to develop a SPAD. 2. SEAS - Award contract for prototype SEAS I and II without forecast input software.

PROGRESS: 1. SPAD - Development of the first phase demonstration units is completed. We will soon install one at Dulles International Airport. 2. SEAS - Development model installed on commercial container ship for further evaluation. Work has begun on specifications for prototype units.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0029, REQUIREMENTS AND SYSTEMS EVALUATION

M.T. Sikorski, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Integrated Systems Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8C27BB2)

OBJECTIVES: To serve as the NWS focal point for advanced ADP planning. Also, to serve as the NWS focal point for evaluation of new operational requirements as to their potential impact on the overall NWS system. Perform systems engineering studies to determine cost-effective alternatives for accomplishing NWS objectives so that NWS management has a solid basis from which to make decisions.

APPROACH: Through systems engineering analysis and design, take new stated functional requirements (from O/H, OM&O, OTS) and translate these requirements into alternative designs involving hardware, software, and procedural changes, if needed. Evaluate these alternatives in terms of effectiveness in meeting the requirement, cost, impact on the present system, etc. Make appropriate evaluations and present recommendations to NWS management. Also, inventory NWS ADP capability in order to evaluate future ADP needs. Evaluate proposed enhancements (to AFOS, data acquisition/dissemination, etc.), as if they are new requirements.

PROGRESS: 1. Serving as NWS ADP focal point. 2. Procurement package for Satellite Image Display System (SIDS) is complete.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0030, NATURALLY AND ARTIFICIALLY STIMULATED ELECTRON PRECIPITATION NEAR THE PLASMAPAUSE

T.J. Rosenberg, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (DPP76-82041 A01)

This is a supplement to NSF grant number DPP76-82041.

In this research project, naturally- and artificially-stimulated electron precipitation near the plasmapause will be investigated. The principal measurements will be of bremsstrahlung x-rays using balloon-borne scintillation counters. Complementary measurements of VLF emissions and possible DC electric field measurements will also be included on a number of flights.

The balloon-borne measurements will be carried out at Siple Station, Antarctica, in the austral summer of 1979-80. These measurements will be part of a combined rocket-balloon-satellite and ground-based study of Very-Low-Frequency wave interactions with energetic electrons in the earth's magnetosphere which is jointly sponsored by NSF and NASA.

Logistics support is required for four persons plus associated scientific equipment at Siple Station, Antarctica, during the austral summer of 1979-80.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0031, NAVY ENVIRONMENT - COOPERATIVE SUN EARTH DATA

R. Markson, Airborne Research Associates, *46 Kendal Common Rd., Weston, Massachusetts* 02193 (DN875511; N00014-78-C-0500)

As part of an international effort the objective of this research is to measure the mapping down of electric fields from the ionosphere into the troposphere. The information is necessary to an understanding of the mechanisms of solar terrestrial weather relationships for application to the naval weather forecast.

The principle investigator will measure the electric field and conductivity between 5 and 10 km altitude simultaneously with the balloon flights of Holzworth and Mozer of UCLA to be conducted at 24, 32, and 38 km at Thompson, Canada. The observations will be made during July or August 78 depending upon the GOES satellite schedule and will also be coordinated with the European 1978 SBARMO campaign (Scientific Balloon and Radiation Monitoring Organization).

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0032, TIME VARIATIONS IN THE GLOBAL CONCENTRATION OF OZONE AND IN THE SOLAR CONSTANT

P.V. Foukal, Atmospheric & Environmental Research Inc., *872 Massachusetts Ave., Cambridge, Massachusetts* 02138 (ATM77-26521 A01)

Study of solar flux ('constant') variations and global ozone statistics has yielded interesting new evidence for solar influences on ozone concentration at both high and low latitudes. This grant will continue an investigation of the effect of UV variations due to solar faculae on the ozone production rate. The program will include a test of specific destruction mechanisms of ozone at high latitudes, by the charged particles associated with solar coronal holes, which have recently been shown to account for a large fraction of auroral events. The statistical analysis of solar constant measurements from the NIMBUS-6 data for 1977-1978, the NIMBUS-G, and also the ACRIM on the Solar Maximum Mission (1979) will be initiated. The continued analysis will permit a decision as to whether the increase of solar constant seen in the ground-based measurement is present above the atmosphere, or whether uv faculae modulate atmospheric transmission through their influence on the concentration of ozone and NOx. The same statistical study of power spectra of the new solar constant data, and their cross-correlations and linear regressions with the projected areas of faculae and sunspots, will also permit significant constraints to be put on the effect of strong magnetic fields on energy transport near the photosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0033, MILLIMETER WAVE MEASUREMENTS OF ATMOSPHERIC MOLECULES

A.E. Lilley, Harvard University, Cambridge Campus, Harvard College Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (ATM79-05585)

A portable, ground-based millimeter wave spectrometer has been successfully developed under a previous National Science Foundation grant (ATM 75-15890) and used to obtain high-quality ozone emission profiles. Ozone observations are made on a regular basis at all times of the day and night with a 6% uncertainty in the millimeter wave profile strength that affects the derived ozone distribution.

A comprehensive evaluation of the millimeter wave spectrometer by simultaneous operation with a series of balloon and rocket flights and overpasses of the NIMBUS-G satellite is the basis of this grant. The spectrometer will be located at Wallops Flight Center site U-80. Operation of the millimeter wave spectrometer simultaneously with these other devices will provide a unique opportunity for direct comparison of the ozone distribution derived from the millimeter wave measurements with the results obtained by other ozone measuring techniques.

In addition to the major effort on ozone, the millimeter wave spectrometer will be used to continue the search for other molecular trace constituents.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0034, MELTING BEHAVIOR AND PHASE RELATIONS OF LUNAR SAMPLES

J.F. Hays, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Geological Sciences, *Cambridge Station, Cambridge, Massachusetts* 02138 (EAR79-06321)

This work is a continuation of previous studies funded by NASA but which have now been transferred to NSF. Experimental petrology will be applied toward the understanding of: 1) origin and crystallization history of lunar igneous rocks, and 2) planetary differentiation processes on Moon, Earth, and the parent bodies of achondritic meteorites. Mineral chemistry will be employed as a guide to source lithology or parent magma for lunar samples and meteorites.

Specific tasks will involve: 1) Controlled cooling-rate studies used to develop understanding of igneous rock textures and to establish criteria for estimating cooling-rates of natural rocks, 2) Petrographic and experimental studies of achondritic meteorites used to develop petrological and chemical models for interiors of planets and meteorite parent bodies, and 3) Models of crystal accumulation and melt segregation to be developed and applied to problems of planetary sizes and differentiation histories.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0035, SUPPORT OF THE MILLSTONE HILL INCOHERENT SCATTER RADAR DURING SOLAR MAXIMUM CONDITIONS

J.V. Evans, Massachusetts Inst. of Technology, Lincoln Lab., *244 Wood St., Lexington, Massachusetts* 02173 (ATM79-09189)

The Millstone Hill Incoherent Scatter radar has recently been considerably upgraded for studies of the ionosphere and upper atmosphere at auroral and subauroral latitudes through the addition of a full-steerable 150' antenna moved to the site (with support from the National Science Foundation). The new antenna permits almost the entire auroral convection pattern (60 degrees is less than A which is less than 75 degrees) to be observed in one day, and efforts to exploit these results in studies of the relationship of the convection pattern to the interplanetary solar magnetic field, the field-aligned current into the polar cap, the formation of the nighttime trough, and the variation of the electron densities, electron and ion temperatures at auroral and subauroral latitudes. These measurements form part of the U.S. program for the International Magnetosphere Study. They are being coordinated with observations at the other incoherent scatter radars, with balloon, whistler and aircraft observations over Canada and/or satellite observations. Other uses for the new antenna include studies of the electrodynamic coupling between the E- and F-regions through tidal generated polarization electric fields, the latitudinal variation (Hough functions) of tides propagating into the lower thermosphere, and for special events - such as the recent eclipse over Canada, or rocket launches from Wallops Island. The period funded under this grant includes the end of the observing phase of the International Magnetosphere Study and the commencement of a follow-on phase of data reduction and continuing observations during the maximum of the current solar cycle (expected to peak in 1981). This grant provides funds for operation of this facility.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0036, GLOBAL TRANSPORT PROCESSES AND INTERACTIONS WITH TRACE CONSTITUENTS

R.E. Newell, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (6443; EY-76-S-02-2195)

We are trying to understand the large-scale energy budget of the atmosphere-ocean-cryosphere system with the hope that we may then arrive at rational explanations for the observed changes in the energy budget. There has been much speculation that anthropogenic carbon dioxide, or tropospheric aerosol may, or will soon, influence climate. There has also been much consideration of possible changes of ozone to anthropogenic effects and the resulting possible changes on ultraviolet radiation received at the ground and on climate. It is desirable to understand in detail the operation of the system as it is presently constituted before one attempts to gauge the influence of potential changes. Our approach has been to study global observations in an effort to gain this understanding. Global data on wind, air, and sea temperature, pressure, moisture, and other trace constituents are studied. Computations of means, variances and covariances, empirical orthogonal representations, and trends are made. Correlation between results and measurements of total ozone, volcanic eruptions, stratospheric and tropospheric aerosol, and food production in several countries is developed. Computation of radiative heating rates by trace substances, such as carbon dioxide, water vapor and ozone is made. The data base for atmosphere and ocean has been developed at MIT. The ozone data was obtained from Atmospheric Environment Service, Canada.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0037, NAVY ENVIRONMENT - EXPLOSIVE OCEANIC CYCLOGENESIS

F. Sanders, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN975335; N00014-79-C-0384)

The ability of Navy weather forecasters to predict weather conditions to be encountered by Navy vessels and aircraft transitting vast ocean distances or participating in local fleet exercises has a significant impact on the safety and feasibility of such operations. The sudden, unexplained deepening of some oceanic, extratropical lows revealed a weakness of conventional analysis and the impact of this inadequacy on computer models. This research has as its goal the defining of those processes which contribute to explosive deepening of oceanic extratropical low pressure systems.

The contractor is conducting research to determine the effects sensible heat transfer from the sea has upon explosive deepening of oceanic extratropical low pressure systems. He is also investigating the influence of latent heat transfer on this explosive deepening. Satellite information is being utilized to determine the extent and influence of convective action on the process.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0038, INSTRUMENTATION DEVELOPMENT FOR LASII EQUATORIAL MEASUREMENTS

E. Trzcinski, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581110)

AF function - maintain communications between Air Force units during periods of small scale ionospheric irregularities. Opportunity -model can be developed to provide inputs to systems designer to mitigate the effects of small scale ionospheric irregularities on VHF/UHF transionospheric radio signals. Objective - develop an instrument capable of making positive ion composition measurements with a very high spatial resolution at satellite velocity. How research contributes -provides measurements essential to an understanding of the physical-chemistry and transport processes involved in the creation of ionospheric irregularities.

A quadrupole mass spectrometer instrument capable of making positive ion composition measurements with a spatial resolution of three meters at satellite velocity shall be developed. Three such instruments shall be fabricated for ensuing flights on STP Program NRL sponsored, LASSII satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0039, NAVY ENVIRONMENT - SYNTHETIC APERTURE RADAR SENSING OF THE OCEAN SURFACE

R.A. Shuchman, Environmental Research Inst. of Michigan, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (DN675694; N00014-76-C-1048)

All-weather remote assessment of coastal wave-spectra is desirable for a variety of naval and Marine Corps operations; it may also provide clues on underwater topography. Only the synthetic aperture radar offers sufficient resolution for this task. Theoretically, it is not known how this will work because the target moves but it has been shown that in many cases useful results can be obtained.

Contractor will use his own SAR data base for testing developed imagery models, develop a technique to accurately measure surface roughness by SAR, further develop direct Fourier derivation techniques for wave spectra and apply enhancement techniques. Application of results so far achieved under this contract to problems of Navy investigators, and participation in upcoming information SAR-using experiments will both be prepared.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0040, NAVY ENVIRONMENT - SIMULATIONS OF OCEANOGRAPHIC FLUCTUATIONS IN THE NORTH PACIFIC OCEAN

S. Jacobs, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (DN223750; N00014-76-C-0141)

Large-scale long-term variability in the temperature structure of the upper ocean has a pronounced effect on acoustic propagation conditions and hence on our surveillance systems. The objective of this project is to develop a dynamic ocean model using numerical techniques which will simulate and forecast the temperature, transport, and surface heat balance in the north Pacific Ocean. This project is an integral part of the North Pacific Experiment (NORPAX).

Because observed atmospheric data are used to 'drive' the ocean forecasting model, it is necessary to compile, analyze, and condense appropriate information such as solar radiation, humidity, air-sea temperature differences, surface winds, etc. The ocean forecasting model itself utilizes fundamental hydrodynamic principles and is programmed for a computer. Because observed oceanic data is used to test the model, it is necessary to compile appropriate information.

SUPPORTED BY U.S. Dept. of Defen :, Navy, Office of Naval Research

5.0041, DEFORMATION, TEMPERATURE, AND FABRIC STUDIES ALONG A FLOW LINE, BARNES ICE CAP, BAFFIN ISLAND, CANADA

R.L. Hooke, University of Minnesota, Minneapolis Campus, School of Earth Sciences, Dept. of Geology & Geophysics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (EAR77-21098 A01)

This project involves a continuation of studies on the flow mechanisms and temperature distribution along a vertical section extending from the divide to the margin of the Barnes Ice Cap, Baffin Island, Canada. Temperatures, horizontal velocities, and vertical strain rates will be measured in six holes, and cores taken for ice fabric studies. Four of the holes have been completed in the past three years and another started. The two remaining holes will be completed during the next year, and all holes resurveyed the following year. Data collected will be used to study anisotropy in the ice and its effect on the flow law and to study the feedback between the increase in flow rate caused by increase in temperature and the increase in temperature caused by increase in flow rate. The ultimate objective is to de-

velop and test a computer model of the flow field and temperature distribution in the ice cap.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0042, STATIC ENERGY ANALYSIS OF PROJECT SESAME DATA

G.L. Darkow, University of Missouri, Columbia Campus, Graduate School, Dept. of Atmospheric Sciences, *205 Jesse Hall, Columbia, Missouri* 65201 (ATM79-09988)

This research contributes two important elements to the SESAME (Severe Environmental Storms and Mesoscale Experiment) Regional Subprogram. An enhanced surface data set is being developed for experimental lays during April and May of 1979 by combining non-archived surface meteorological data in the SESAME region with data routinely archived at the National Climatic Center. Sources of supplemental surface meteorological data include power plants, agricultural experiment station experimental farms, forest fire observational networks, small airports, cooperative climatological observers, and air pollution monitoring stations. Data are carefully screened to insure high quality. This surface data set will be combined with the SESAME upper air data to perform a three-dimensional static energy analysis of the antecedent severe storm environment. There is particular interest in: (1) what influence the additional surface data along with the more frequent upper air and satellite information may have, using static energy as the analysis parameter, in pinpointing the time and location of subsequent severe storm development; (2) what influence the additional surface data may have on the ability to infer subsynoptic spatial variations in the mean heat and moisture content of the boundary layer by means of hourly analysis of the surface static energy fields.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0043, DEVELOP AIRBORNE NADIR LASER FOR MONITORING MOLECULAR POLLUTANTS IN THE TROPOSPHERE

R.T. Thompson, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab., *P.O. Box 15027, Las Vegas, Nevada* 89114 (J883A-039)

OBJECTIVE: Design, construct and interpret data from airborne nadir-viewing laser differential absorption systems. A CO2 laser system will be developed to measure ozone. A frequency-doubled dye laser system (approx. 300mm) will be developed to monitor sulfur dioxide. The use of differential absorption systems to monitor selected tracer gases will be investigated.

APPROACH: The systems each consist of two lasers, the wavelengths of which have been selected to optimize the difference in reflected signal due to the wavelength dependence of the pollutant or tracer gas. A computer code has been developed to simulate data tapes using a model atmosphere. Simulations are used to develop interpretive software and analyze system parameters.

PROGRESS: A prototype ozone system was ground tested successfully on a topographic target and a report has been written. A paper has been written evaluating candidate tracer gases which can be monitored using the differential absorption system. An airborne system for monitoring ozone has been constructed.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0044, SNOW COVER ANALYSIS IN NEW ENGLAND USING LANDSAT DIGITAL DATA

C.J. Merry, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (31584)

OBJECTIVE: To synoptically map snow cover and to determine if a relationship exists between the water equivalent of the snowpack and the associated radiance values obtained from LANDSAT computer compatible tapes (CCT's).

APPROACH: Digital processing of selected CCT's will be accomplished to map the areal extent of snow. A relationship between the water equivalent of the snowpack and the associated radiance values on the LANDSAT CCT's. Snow course data in two New England watersheds are providing the ground truth to enable this comparison to be made. In addition, a newly developed microwave sensor to quantitatively assess the water equivalent of the snowpack will be tested. LANDSAT spectral band ratios of the radiance for selected snow course sites that provide the most reliable information for correlation to the water equivalent of snow data will be evaluated. Ground truth information on vegetation, slope, aspect and elevation are being compared to the results of the computer classification maps. The number of ground truth data stations required when using the CCT's for prediction of water runoff associated with the snowpack will also be determined. Significant savings in costs can result if snow surveys can be accomplished using LANDSAT digital data rather than ground survey procedures. The results of this investigation will be presented in ETL's and technical reports for use in flood forecasting in cold regions.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0045, CONDUCT SHORT COURSES IN REMOTE SENSING

S.R. Morain, University of New Mexico, School of Arts & Sciences, Dept. of Geography, *University Hill N.E., Albuquerque, New Mexico* 87106 (NAS13-109)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0046, REMOTE OBSERVATIONS OF SEVERE STORMS

R.E. Orville, State University of New York, Albany Campus, School of Science & Mathematics, Dept. of Atmospheric Science, *1400 Washington Ave., Albany, New York* 12222 (NAS 8-33380)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0047, PUBLIC AWARENESS OF AND MANAGEMENT GUIDELINES FOR COASTAL ZONE VISUAL RESOURCES

D.B. Harper, State University of New York, College of Environmental Science & Forestry, School of Landscape Architecture, *Syracuse, New York* 13210 (R/P-16)

OBJECTIVES: 1. To determine the predictive value of quantitative shorescape descriptors for identifying viewer preferences and attitudes. 2. To increase a statewide public audience's awareness of the visual resources of the state's coastal zone. 3. To provide coastal planners and managers with methodological guidance in incorporating visual quality into the planning process.

ANTICIPATED BENEFITS: 1. Helping widen citizens' perspective on the diverse visual resources of New York's coasts: stimulating positive action by local environmental groups, providing illustrative educational material for coastal zone planners and managers, and providing educational material for high school and college environmental programs. 2. Assisting coastal planners and land-use decision-makers at the state, regional, and local levels in integrating into the comprehensive planning process the essential but often slighted consideration of visual quality.

IDENTIFIED BENEFITS TO DATE: (R/P-13, Visual Quality of New York State's Coastal Zone) Provided a forum in

which researchers, public agents, and coastal residents could hear about and discuss the concept of visual quality as it applies to the planning process and to the many other concerns of the coastal zone.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0048, ANTARCTIC METEORITES - CHEMISTRY, MINERALOGY AND PETROLOGY

J.J. Papike, State University of New York, Stony Brook Campus, Graduate School, Dept. of Geology, *Stony Brook, New York* 11790 (EAR78-21857)

The mineralogical and petrological characterization of selected Antarctic meteorites will be undertaken in this study. A complete model analysis and microprobe analyses of all phases in 10 to 20 meteorites will be carried out to obtain information regarding the types and petrologic grades present within the recently collected specimens. Research on basaltic achondrites will be carried out in order to study the nature of brecciated materials which may represent regolith samples from other planetary or asteroid bodies. The complete modal, petrographic, chemical and chronological study of the lithic fragments within the analyzed howardites will be obtained. This information will provide important insights into the surface geology and geochemical evolution of the basaltic achondrite parent bodies from which some of the Antarctic meteorites were derived.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0049, COASTAL METEOROLOGY

G.S. Raynor, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973 (000547; EY-76-C-02-0016)

This study is designed to obtain an understanding of meteorological processes in the coastal region that affect siting, operation, and safety of power-producing and related facilities located either offshore or near a coastline. The study involves climatological investigations, tracer experiments, wake-effects studies, mesoscale and micrometeorological observations, theoretical studies, and modeling programs. A major goal of the program is to develop a reliable system for describing diffusion conditions affecting releases from coastal or offshore sites and to predict them from measurable meteorological and surface parameters such as general synoptic situation, type of flow (sea-breeze or gradient), wind and temperature structure, sea-surface roughness, and coastal terrain. Meeting this goal involves an understanding of conditions in the transition region where over-ocean flow is modified by passage over land as well as over the water. Results of this program will include techniques for the prediction of over-ocean and coastal wind and temperature fields which not only transport and diffuse pollutants but are involved in air-sea interactions and oceanic processes. They will also include a rating of sites along the U.S. East and Gulf coasts in terms of onshore wind frequency, diffusion capacity, and severe weather prevalence.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0050, ANTARCTIC SEARCH FOR METEORITES

W.A. Cassidy, University of Pittsburgh, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DPP78-21104)

The University of Pittsburgh proposes to investigate areas of glacial ablation, moraines and other areas of accumulation on the antarctic ice caps for meteorites. This project is a follow-up of three very successful antarctic meteorite collection expeditions. Of major value are the basically contamination-free specimens, which are highly significant for the study of the chemical and physical evolution processes of the early solar system. The proposal addresses the important question of estimating a true fall flux of meteorites. This includes an attempt to determine the interrelationship of ice dynamics and meteorite accumulation.

During the 1979/80 summer season two scientists will do field work in the area of the Ellsworth Mountains, and four scientists will do field work in the McMurdo area. Using snow mobiles and helicopters for transportation, they will operate from one or two camps, followed by a continuation of the ice dynamics studies near the Allan Hills, which were started during the 1978/79 field season. There will be a total of four University of Pittsburgh scientists in Antarctica on this project during the 1979/80 summer season.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0051, SOLUTION THEORIES OF SILICATE MELTS - AN EXPERIMENTAL AND THEORETICAL STUDY OF LIQUID IMMISCIBILITY

P.C. Hess, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (EAR74-13378 A01)

This project concerns an experimental and theoretical analysis of the phase, structural, and solution characteristics of aluminous silicate melts. The research will include: (1) an experimental determination of liquid immiscibility in the systems CaO-Al2O3-SiO2, NaAlSi3O8-SiO2 and Mg2SiO4-KAlSi2O6-SiO2, (2) a determination of the composition of co-existing liquids in the system CaO-MgO-TiO-SiO2 which have been doped with small amounts of Al2O3 or K2O-Al2O3, (3) experimental determination of trace element fractionation between the two phases in naturally occurring immiscible silicate melts, and (4) a theoretical extension of solution models to include multicomponent melts. The results of these efforts will be applied to a better understanding of magmatic processes and will also be of use to glass technology.

This is a continuation of EAR74-13378.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0052, HISTORY OF BOTTOM CURRENT SCOUR IN THE SOUTHERN OCEAN

T. Huang, University of Rhode Island, Graduate School of Oceanography, *Administration Bldg., Kingston, Rhode Island* 02881 (DPP78-08511 A02)

This is a continuation of DPP78-08511.

The long-term objective of this three-year program is to examine the bottom current paleovelocity problem, and to compare the timing of scour events with climatic parameter to elucidate cause and effect relationships. Progress during the first year was very good, with identification of regional disconformities in the sedimentary record as the major objective. The work during the second year will include completing the determination of paleomagnetic polarities in the Islas Orcadas cores, the identification of hiatuses created during periods of increased bottom water flow originating in the Weddell Sea and in the Indian Ocean, and the preparation for a high southern latitude cruise of R/V Atlantis II in 1979-80.

The committed duration of this continuing grant is three years, 07/01/78 to 06/30/81.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0053, DIRECT OBSERVATIONS OF THE INTERIOR CHARACTERISTICS OF OKLAHOMA THUNDERSTORMS DURING SESAME 79

P.L. Smith, South Dakota School of Mines & Technology, Inst. of Atmospheric Sciences, *Rapid City, South Dakota* 57701 (ATM7827018)

This study involves collection and analysis of direct observations of the interior characteristics of Oklahoma thunderstorms during the Severe Environmental Storms and Mesoscale Experiment (SESAME) 1979 field program. The emphasis of the research is on determining the thermodynamic characteristics and the vertical air motions in the storm interiors, as well as

the hydrometeor (cloud droplets, raindrops, graupel, hail, and other particles) characteristics and growth processes. The analysis of the observations is directed towards improved understanding of the intrastorm processes and the storm-environment interactions, including studies of entrainment processes. The analysis is being carried out in coordination with the analysis of the other aircraft, radar, surface, and satellite meteorological observations to be collected under the SESAME 79 Storm Scale Sub-Program.

The observations are obtained using an armored T-28 aircraft equipped with an elaborate meteorological instrumentation system and digital data recording equipment. The work is being conducted as a cooperative endeavor involving the South Dakota School of Mines and Technology, the National Center for Atmospheric Research, and the National Severe Storms Laboratory.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0054, HIGHER PLANT RESPONSE TO ELEVATED ULTRAVIOLET IRRADIANCE

M.M. Caldwell, Utah Higher Education System, Utah State University, School of Natural Resources, Dept. of Range Science, *Main Bldg., Room 104, Logan, Utah* 84321 (NAS 9-14871)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Johnson Space Center

5.0055, REMOTE SENSING OF PORPHYRY COPPER ALTERATION ZONES

R.G. Schmidt, U.S. Dept. of the Interior, Geological Survey, Eastern Mineral Resources Branch, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9360-01942)

STATE TO WHICH PROJECT PERTAINS: Arizona.

The project will develop and test techniques of remote sensing of large sulfide deposits, especially porphyry copper type deposits, by digital processing of LANDSAT data. Attempts will be made to relate rock alteration zones, soil minerals, and reflectance characteristics as measured from near-surface with reflectances obtained by scanners in satellites. Methods devised will be tested by using them as evaluation tools in suitable incompletely explored areas that are regarded as favorable for the occurrence of porphyry copper deposits.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0056, ANTARCTIC MAPPING OPERATIONS

R.B. Southard, U.S. Dept. of the Interior, Geological Survey, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (DPP79-06412)

This interagency agreement continues support of the U.S. mapping operations in Antarctica. The geodetic, cartographic, and support activities of the U.S. Geological Survey include field control for mapping and for science projects, as needed. Support for international responsibilities of the U.S. under the Scientific Committee on Antarctic Research will be provided by exchange of cartographic materials with other countries and the preparation and maintenance of photographic and map files and indexes. The computation and adjustment of previously established control and the printing of aerial photography for mapping and for reference purposes will also be carried out.

Cartographic field work planned for 1979-80 and the winter of 1980 will be carried out by two USGS cartographic engineers on the satellite observations program at South Pole Station, and three USGS cartographic engineers in the Ellsworth Mountains area during the summer field season of 1979-80. Two NOAA engineers will observe weather satellite data at McMurdo during 1979-80.

Previous work on this project has been carried out under Interagency Agreement DPP77-17777.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

5.0057, OCEAN WAVE DATA ACQUISITION & MODELING FOR THE FACILITATION OF COASTAL MANAGEMENT DECISIONS IN ISRAEL & THE U.S. (ABBREV)

V. Goldsmith, Virginia Inst. of Marine Sciences, *Gloucester Point, Virginia* 23062

OBJECTIVES: Strengthen the marine research and development capabilities of Israel and the VIM Sea Grant Program by concentrating effort in the area of wave information, which is to all coastal planning and thereby encouraging sound CZM. Specifically, the tasks will be undertaken by: (a) transferring technology between VIMS and IOLR personnel, while (b) training personnel in use of this technology; (c) mutual development of new techniques and applications; (d) exchanging and comparing similarly obtained data; and (e) mutually developing and improving advisory service and CZM functions. Specific tasks for the first year include: (a) synthesis of existing, but widely varying kinds of wave data; (b) initiation of a strongly needed program in wave measurements; (c) improvement of IOLR's and VIMS' remote sensing abilities by evolving techniques for ocean wave photography; (d) refinement and extension of the Israeli Wave and Longshore Transport Model by application of it to the analysis of a proposed coastal development; (e) initiation of a program of computer modeling of shoreline changes and the effects from coastal structures calibrated with time series data measured by Golik in Israel.

ANTICIPATED BENEFITS: These projects will be initiated jointly at VIMS and completed at IOLR, with salary and other support from IOLR. Thus, specific products will result from the first year's effort which will significantly enhance Israel's capability in this area. Emphasis on advisory services and perhaps other disciplines is expected to evolve later. Additionally, this program is expected to benefit the VIMS Sea Grant Program through the exchange and comparison of similarly obtained data in contrasting shelf areas, by increasing the spectrum of applications, and through the mutual development and application of new projects such as coastal models calibrated with previously obtained Israeli shoreline data. Initial contacts have been made (Goldsmith spent five months in Israel in 1977), and mutual goals clearly identified. Thus, we anticipate an efficient program with concrete results at the end of the first year. This is a clear case where international cooperation will fulfill some very real and specific needs, in a geographic area where the benefits from such a program may well encourage additional cooperation.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., Sea Grant Office

5.0058, RESEARCH STUDY - STRENGTH AND CONSTITUTIVE BEHAVIOR OF SOILS IN A VERY LOW GRAVITATIONAL FIELD

S. Storre, Virginia Polytechnic Inst. & State University, Graduate School, *Blacksburg, Virginia* 24061 (NAS 8-33449)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

5.0059, MOUNTAIN-INFLUENCED AIRFLOW AND TURBULENCE IN THE FIRST KILOMETER ABOVE THE EARTH SURFACE (ABBREV)

J.R. Connell, Battelle Memorial Inst., Pacific Northwest Laboratories, *P.O. Box 999, Richland, Washington* 99352 (ATM79-00983)

The greastest deficiency in the current efforts to understand the influence of mountains on atmospheric flow is the lack of reliable observational data. This project is designed to alleviate this problem by making radiosonde and aircraft observations upwind and downwind respectively of a suitable mountain. Considerable thinking went into the selection of the site since this is most important to obtain comprehensive field observations.

The observational program will use the NCAR Queenair research aircraft for one two-week period in February 1978. Upwind data needed to initialize the model will be obtained

using radiosondes. The data collected will be used to validate the three-dimensional airflow model of Terry Clark at NCAR.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0060, OPTICAL EFFECTS OF ATMOSPHERIC AEROSOL

A.P. Waggoner, University of Washington, School of Engineering, Dept. of Civil Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (R800665-13; G832B-EA-014)

OBJECTIVE: To investigate the characteristics, causes, and effects of visibility degradation due to atmospheric aerosols.

APPROACH: Field studies are conducted at selected sites to determine the levels of visibility degradation and the species responsible. Special instrumentation and techniques are developed as needed.

PROGRESS: The light scattering coefficient and fine (less than 2.5 micron diameter) particle mass concentration were measured in urban, rural, and pristine areas. In all cases they were highly correlated (r greater than 0.95) and in the same ratio. The integrating plate method of measuring the light absorption coefficient has been further calibrated. Ambient measurements show that absorption typically accounts for 30-50% of extinction in urban areas and that it is caused by a graphitic material, probably elemental carbon.

SUPPORTED BY U.S. Environmental Protection Agency,
Office of Research & Development,
Environmental Sciences Research Lab.

5.0061, CHANNEL MORPHOLOGY AND SEDIMENTATION IN PHEASANT BRANCH NEAR MIDDLETON

R.S. Grant, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Madison, Wisconsin* (WI 77-084)

Severe channel and bank erosion in Pheasant Branch and accelerated sediment deposition in both Pheasant Branch Marsh and Lake Mendota are occurring within the basin. The problem is not unique to Pheasant Branch but occurs throughout the country. To study any more than a small percentage of these areas, remote sensing techniques need to be employed. On-site measurements of various erosion and water-quality parameters are needed to calibrate the remote-sensing imagery and evaluate the applicability of remote sensing in the detection and monitoring of sedimentation and water quality.

The objective of the project is threefold: (1) to evaluate sedimentation and stream-channel morphology in the Pheasant Branch Basin; (2) to obtain ground measurements of sediment transport, streamflow, and channel properties; and (3) to evaluate remote-sensing techniques with respect to detection and monitoring sediment loadings in small basins.

During the five-year project the following items will be completed for Pheasant Branch Basin: (1) evaluate the headwater erosion and stream-channel morphology; (2) analyze effects of urbanization on stream-channel morphology, sediment transport, and delta formation; (3) project changes in channel geometry, streamflow, and sediment transport; (4) delineate between stream-channel and upland erosion; (5) identify critical areas of erosion and suggest required management practices; (6) supply cooperator with sediment transport, streamflow, sediment-source, and channel-geometry data for remote-sensing imagery calibration.

Compared 1971 and 1977 channel surveys. Surveyed additional cross-sections at sites throughout basin. Installed additional recording grain gage at western edge of basin.

Continue monitoring streamflow and sediment at gaging stations. Resurvey 1977 channel cross-sections. Calibrate Middleton storm-water management model and use for various development conditions. Do bed material survey.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Water Resources Div.

5.0062, PRECIPITATION RATES FROM WAVE AND INFRARED RADIOMETRY AND USE OF SEASAT-A DATA TO DETERMINE HURRICANE PRECIPITATION (ABBREV)

J.A. Weinman, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (7-924; MO-AO1-78-00-4320)

OBJECTIVE: SEASAT-A SMMR data will be used to demonstrate the remote determination of rainfall rates by microwave radiometry. The proposed study will build upon experience gained in the analysis of NIMBUS-5 ESMR data, and an important objectve will be to utilize the SMMR data to monitor rainbands in hurricanes during the course of their evolution.

APPROACH: Develop rainfall analysis procedures taking advantage of SMMR multispectral microwave imagery supplemented mainly by infrared experience. Obtain ground truth from digitized radars, such as in the D-Radex and those in operational NWS networks which provide VIP displays. Raingage network data will be obtained for ground truth to check the rainfal rates inferred from SEASAT-A observations. Rainfall distributions from SEASAT-A will be tracked as hurricanes develop and travel westward across the Atlantic Ocean. The analysis will be extended to include the effects of capillary waves and foam.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., National
Environmental Satellite Service

5.0063, DIAGNOSTICS OF THE HEAT SOURCES AND SINKS OF THE ASIATIC MONSOON AND THE THERMALLY FORCED PLANETARY SCALE RESPONSE

D.R. Johnson, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Meteorology, *Agriculture Hall, Madison, Wisconsin* 53706 (ATM78-22384)

The objective of this research is to study the summer and winter Asiatic monsoonal circulations and their interaction with the planetary scale atmospheric circulations. The distribution of heat sources and sinks within the region of the Asiatic monsoons, as well as within the planetary scale, will be diagnosed by two methods. The first method will be to model the distribution of latent, sensible and radiative heating components in the monsoon region using conventional meterological data, results of other investigators, and satellite data. The second method will be to diagnose heating using a specialized model developed by the PI. The heating distribution from the two methods will be compared and studied. These results, together with conventional data, will be used to isolate the thermally forced mass, energy and angular momentum transport by the Asiatic monsoon and to study its interaction with other planetary circulations.

The data to be used for this study were obtained during the observational phases of the Global Weather Experiment (FGGE) and the Monsoon Experiment (MONEX). Both are subprograms of the Global Atmospheric Research Program (GARP) and took place from late 1978 through 1979.

This project adresses major scientific objectives of MONEX: (1) to obtain a clearer understanding of the interactions between the Asian monsoon and the global circulation, and (2) to obtain quantitative knowledge of heat sources and sinks of the Asian monsoon area.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0064, BALANCE OF THE TROPOSPHERIC OZONE AND ITS RELATION TO STRATOSPHERIC INTRUSIONS INDICATED BY COSMOGENIC RADIONUCLIDES

R. Reiter, Institut fur Atmospharische Umweltforschung der Fraun. Gesel, *Kreuzeckbahnstrasse 19 Frg, Garmisch Partenkirchen, Federal Republic of Germany* (6450; EY-76-C-02-3425)

The balance of the tropospheric ozone is governed by the distribution of ozone sources and sinks. The influx of the stratospheric ozone into the troposphere as a result of stratospheric intrusions and the portion of the tropospheric ozone due to photochemical production are under study. The influence of trace

gases and aerosols on ozone decay is examined. During interesting intervals of time the diurnal variations of the atmospheric ozone profiles are measured up to 35 km altitude by means of balloon sondes. Causes of the variations are discussed. A filter photospectrometer for the measurement of the total atmospheric ozone is tested as to its suitability by direct intercomparison with a Dobson spectrometer. Ozone concentrations greater than 70 ppB are observed in pure-air regions after stratospheric intrusions as well as due to photochemical production in the boundary layer. An observation series covering a period of 20 months of the stratospheric aerosol is presented.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0065, IONOSPHERIC ELECTRON CONTENT MEASUREMENT
Z. Houminer, Radio Observatory, *Haifa, Israel* (DA0E9305; DAERO 79 G0020)

The objective is the continuous monitoring of the total electron content above Haifa using the 136.14 MHz transmissions of the Sirio Satellite. The diurnal, seasonal and solar activity dependence on TEC will be determined.

The TEC measurements will be carried out at the radio observatory laboratories at Haifa using a plarimeter system received on loan from the US Army Communication Command.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, RESEARCH PSYCHOLOGY APPLIED TO MEDICALLY SIGNIFICANT PROBLEMS IN ARMY AVIATION (06)
K.A. Kimball, U.S. Dept. of Defense, Army, Medical Research & Development Command, Aviation Psychology Div., *Fort Rucker, Ozark, Alabama* 36360 (DA0D6738)

To provide US Army aviation information that is medically important about the human factor in the aircraft man-machine system, with special emphasis on the performance of this human factor and the variables that influence it.

The approach will involve the application of current research techniques applicable to the objective as well as developing new techniques as required.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, RESEARCH OF VISUAL PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION
R.W. Wiley, U.S. Dept. of Defense, Army, Medical Research & Development Command, Bio-Optics Div., *Fort Rucker, Ozark, Alabama* 36362 (DA0B6891)

To provide information about the visual sensory modality relating to capability of the human visual system and the impact of military equipment, environmental and operational influences on visual performance and integrity.

The approach will include psychophysical, electrophysiological, and other objective techniques to evaluate human visual performance with quantitative measures.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0003, RESEARCH OF BIOENGINEERING AND VIBRATION PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION
T.M. Erhardt, U.S. Dept. of Defense, Army, Medical Research & Development Command, Bioengineering & Life Support Equipment Div., *Fort Rucker, Ozark, Alabama* 36362 (DA0E6733)

To determine the short-term clinical effect of helicopter vibration on the musculoskeletal system and to develop an orthopaedically, anthropometrically sound helicopter crew seat to reduce vibration effects.

Prospective clinical and epidemiologic study using physical examination subjective reporting forms, Norland bone mineral analysis, biochemistry, and x-ray techniques. Seat design and validation will be accomplished statically and dynamically on a three-degree-of-freedom, man-rated vibration table using dynamic EMG techniques. Pilot performance and efficiency are studied. Animal models are used and the techniques of tetracycline bone labeling and scanning electron microscopy of the joint surfaces are employed.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0004, EFFECTS OF HEAT ACCLIMATION AND EXERCISE ON ACCELERATION TOLERANCE
C.H. Brown, California State University & Colleges, California State University, Hayward Campus, Graduate School, *25800 Carlos Bee Blvd., Hayward, California* 94542 (NCA 2-290801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, IN-FLIGHT BIO-MEDICAL ASSESSMENT OF NAVAL AIRCREW MEMBERS
D.H. Reid, U.S. Dept. of Defense, Navy, Pacific Missile Test Center, Crew Systems Branch, *Point Mugu, California* 93042 (DN777291)

The objective of this study is to acquire multi-parameter physiological and engineering data from aircrew men continuously throughout flight in order to assess human performance and reliability in wide spectrum of flight environments utilizing increasingly sophisticated and stressful weapons systems and platforms. Acquisition of these data is required in order to evaluate effects of higher sustained g loading and flight performance capability of pilots and naval flight officers in new generation tactical aircraft. A realistic physiological data base acquired during air combat maneuvering and tactical missile engagements and launch is required to objectively develop life support system specifications and for the study of the combined stressors of flight.

A man-borne tape transport instrumentation system is used to acquire and store bio-medical and engineering data in flight. Seven parameters are acquired throughout flight. Close collaboration/liaison with USAF has been maintained.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Medical Research & Development Command

6.0006, PERSONNEL TECHNOLOGY - COMPLEX CONTROL PROCESSES IN SKILLED MOTOR PERFORMANCE
D. Norman, University of California, San Diego Campus, Center for Human Information Processing, *P.O. Box 109, La Jolla, California* 92037 (DN975356; N00014-79-C-0323)

This work will formulate models of the cognitive control processes and knowledge structures responsible for skilled performance in tasks requiring complex psychomotor control. Examples of such tasks are keying in, formation flying, and skilled use of tools. The models devised in this effort will be able to account for the temporal pattern of motor actions, differences between expert and novice performers and the effects of varying the cognitive demands of the task in a variety of particular ways.

The models will be developed within the domain of transcription typing. Initial versions will consist of schemata which deal with input and output and a control structure for regulating and coordinating the schemata. The model will produce, via computer simulation, the temporal sequence of keystrokes in any normal transcription typing task. The pattern of errors and interstroke intervals produced by the model will be compared to that of typical skilled typists. Later versions of the model will account for performance in a variety of different tasks involving

secondary tasks, speed-accuracy trade-offs, etc. The model will also account for other forms of data such as eye movements and incipient finger movements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0007, QUALITY ASSURANCE SYSTEM IN CLINICAL PRACTICE SETTINGS
P. Chang, Howard University, School of Medicine, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAS 5-23799)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

6.0008, STUDY OF SODIUM HOMEOSTASIS AND RENIN-ALDOSTERONE DURING WATER IMMERSION
M. Epstein, University of Miami, School of Medicine, Dept. of Medicine, *1400 N.W. 10th Ave., Box 520875, Miami, Florida* 33152 (NAS 9-15473)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Johnson Space Center

6.0009, STUDY OF PREDICTIVE ECOLOGICAL MODELS USEFUL FOR THE MANAGEMENT AND CONSERVATION OF BERING SEA MAMMALS
G.C. Ray, Johns Hopkins University, School of Hygiene & Public Health, Dept. of Pathobiology, *615 N. Wolfe St., Baltimore, Maryland* 21205 (NAS 2-9300)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, STUDY OF PERFORMANCE OF INSTRUMENTED MANIKINS IN MEASURING THERMAL PROTECTION
E.T. Waldron, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0F4280)

Determine sensitivity levels and data acquisition adequacy of instrumented manikins (both Air Force and Army developed) used to measure the thermal protection provided by aviators' and tankers' uniforms.

Utilize manikins instrumented with 'true' skin simulants and predict protection through standard techniques, such as equating burns with a damage integral of 1.0.

SUPPORTED BY U.S. Dept. of Defense, Natick Research & Development Command, Natick Development Center

6.0011, ELECTROPHORESIS SEPARATION (77-E)
A.J. Johnson, New York University, School of Medicine, Dept. of Medicine, *550 1st Ave., New York, New York* 10016 (NAS 8-33099)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

6.0012, RESEARCH STUDY OF NON-INVASIVE MONITORING OF CARDIO-PULMONARY FUNCTION
L.E. Farhi, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (NAS 9-15802)

SUPPORTED BY U.S National Aeronautics & Space Admin., Johnson Space Center

6.0013, SPATIAL RESOLUTION THRESHOLDS DURING THE COURSE OF DARK ADAPTATION
P. Speros, Texas Tech University, School of Medicine, *P.O. Box 4340, Lubbock, Texas* 79409 (DA0C7888; DAMD17 77 C 7007)

The object of this research is to determine the visual capability of aircrew at different times during recovery from image intensifier adaptation. Optical image intensifiers serve to aid night vision by amplifying the amount of light reaching the retina. The result is an improvement of visual capability employing night vision devices. If the night vision device fails, as they do without warning, the operator will suddenly find himself visually impaired because of his elevated adaptation level. The time to full recovery of dark adapted vision varies from one to three minutes, depending upon the mean luminance preceeding the device failure. This research will determine visual capability of the operator at different times during recovery from image intensifier adaptation.

The approach is to measure dark adaptation of five young adult males following adaptation to the chromaticity and luminance levels which span the range of the AN-PVS 5 night vision optical image intensifier. All experimental parameters will be nested in a 3 (viewing conditions) by 3 (pre-adaptation luminance) by 2 (background luminance) matrix design. Thus, contrast sensitivity functions for selected post-adaptation times generated by determining the contrast threshold at each spatial frequency for a given post-adaptation time can be determined.

SUPPORTED BY U.S. Dept. of Defense, Army, Medical Research & Development Command

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, MARSHALL MATED ELEMENT SYSTEM TRANSLATOR
M.A. Woodfin, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (NAS 8-32230)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

7.0002, ADVANCED CIG DATA BASE DEVELOPMENT AND ANALYSIS
E.G. Monroe, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223760)

To enhance the capability of the advanced simulator for pilot training by providing the capability to generate and visually verify the computer image generation (CIG) data base in the offline mode. In addition, analyses of visual data base structures and advanced software algorithms will be performed. This will provide a broader base for behavioral research and facilitate man-machine interaction.

This effort will develop an automated approach to the generation of CIG visual data bases primarily through the development of software facilitating programs and the addition of interactive computer graphics equipment. The software will be used to generate and verify visual data base material in the offline mode through the use of the interactive graphics equipment. The first step is to complete the software to generate the visual data base. The second step is to install the computer graphics equipment and the third step is to complete the software for data base verification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

7.0003, NONLINEAR PROBLEMS OF CONTINUUM MECHANICS AND MATHEMATICAL PHYSICS
M.S. Berger, Inst. for Advanced Study, *Princeton, New Jersey* 08540 (DF051360; AFOSR-78-3558)

AF function - aerospace vehicle design techniques. Deficiency -weight reduction and other optimization lead to large structural distortions which are not well understood. Objective - to improve the self consistency and rigor of existing mathematical techniques and create new ones. How work contributes - through more dependable mathematical models.

Nonlinear problems in continuum mechanics and mathematical physics exhibit unique properties such as solitons, or bifurcation which are important to future engineering design. Techniques to be applied include functional analysis, calculus of vari-

ations in the large, and a study of the singularities of mappings. Applications may be expected in areas including the structural stability and plasticity of thin shells, parametric instability and resonance for Hamiltonian autonomous systems, soliton perturbation, and superconductivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, PERIODIC OPTIMAL CONTROL PROBLEMS
J.L. Speyer, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: The object of this study is to understand and extend the mathematics involved in periodic optimal control problems. Presently, optimal periodic control theory is a somewhat unexplored field within the framework of optimization theory having important applications. One interesting application, the fuel optimality of airplane cruise, is used to help understand the complex nature of cyclic optimization problems. It is found in this second year of a two year project that the steady state cruise arc for a large class of aircraft is not minimizing. Attempts to solve this problem using standard numerical techniques have not been satisfying. This is due in part to these classes of problems being characterized by such mathematic pathologies as conjugate points and singular surfaces.

SUPPORTED BY University of Texas

7.0005, STRUCTURING IMAGE DATA - SUBSETTING, INDEXING, ACCESS AND COMPACTION
S.L. Tanimoto, University of Washington, School of Arts & Sciences, Dept. of Computer Science, *Seattle, Washington* 98105 (ENG79-09246)

Detailed digital images, coming from satellites and other sources in ever increasing numbers, contain data that are awkward to work with because of their bulk and a lack of convenient manipulating methods. This research program is studying methods to meet this need. The project is roughly divided into the following areas: 1) subsetting (deriving a relevant portion of the original image or set of images), 2) indexing (providing association mechanisms to speed access to desired pictorial information), and 3) compaction (new ways to reduce storage requirements for image data). The structure being investigated will aid in such standard problems as segmentation by thresholding, region growing, and edge analysis; correlation matching of images with terrain models; and computation of transforms such as the two dimension Fourier, Harr and Walsh-Hadamard.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, REMOTE SENSING WORKSHOP
T.H. Hughes, University of Alabama, School of Arts & Sciences, Dept. of Geology & Geography, *Box 1937, University, Alabama* 35486 (NAS 8-31979)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0002, QUANTUM FLUIDS AND SOLIDS
A.L. Fetter, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (DMR7825258)

The theoretical low-temperature research in this project will study liquid 3He. The investigation of the superfluid's internal structure will include the response and stability in the presence of hydrodynamic flow, the effect of confining walls, and the behavior when subjected to uniform rotation. In each case, the effect of a static magnetic field will be considered along with the utility of nuclear magnetic resonance as an experimental probe of these systems. The motion of ions in uniform liquid 3He will be analyzed in various regions of the phase diagram. This study will involve the linear behavior at low electric fields and also the nonlinear regime for both the normal fluid and the superfluid. In addition, the use of ions to study nonuniform textures in superfluid 3He will be investigated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0003, COMPUTER SIMULATION OF PLASMAS
J.M. Dawson, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY79-01319)

A program of computer simulation of plasma phenomena will continue at UCLA. This will include: 1) further investigations of the free electron laser; 2) collective acceleration of particles by intense electromagnetic waves propagating through plasmas; 3) plasma and heat transport across magnetic fields: 4) generalizations of the particle MHD models.

This is a continuation of research previously supported by NSF grant PHY76-83686A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0004, A KINETIC THEORY APPROACH TO THE MAGNETOSPHERIC ELECTRIC FIELD
E.C. Whipple, University of California, San Diego Campus, Inst. for Pure & Applied Physical Sciences, *P.O. Box 109, La Jolla, California* 92037 (ATM79-11875)

This grant will support a continued effort in investigating a kinetic theory approach to magnetospheric problems. The emphasis in the research will be to extend previous work in the areas of magnetospheric convection electric field, the boundary layer configuration of both electric and magnetic fields, and comparison with measured particle velocity distribution data from the ATS and SCATHA spacecraft. A zero-order self-consistent magnetospheric electric field model will be sought by populating particle trajectories with realistic velocity distributions at their source and studying the processes which would be required to maintain quasi-neutrality. Work on the idealized problem of a magnetic dipole in a flowing plasma will be extended to include more realistic flow velocities and possibly scattering processes. Specific phenomena in satellite data which relate to these theoretical studies will be analyzed. Examples of such phenomena are plasma injections, field-aligned fluxes, and plasma drop-outs.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0005, NUMERICAL PLASMA HYDRODYNAMICS
F.T. Adler, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801

Many problems in plasma physics require the solution of the coupled hydrodynamic equations for ions, electrons, and neutral atoms. The existing numerical approaches are based either on direct simulation or on the use of the finite difference method; both methods require small time steps and large computation times. A Green's function method leading to simple integral equations has been developed for the one-dimensional case. In comparison to existing methods, the solution of these equations in terms of the Neumann series allows for a significant increase in the size of the time step without affecting the numerical stability of the procedure. Various analytical techniques have been developed and computationally tested for the necessary calculations of the kernels and their iterates of the integral equation.

SUPPORTED BY University of Illinois

8.0006, PARAMETRIC INSTABILITIES IN INHOMOGENEOUS PLASMAS

F.T. Adler, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801

While instabilities in infinite homogeneous plasmas have been investigated extensively, only limited knowledge exists about the onset of parametric instabilities in inhomogeneous warm plasmas. These instabilities influence the absorption of the incident electromagnetic radiation in finite inhomogeneous laser target plasmas. In the hydrodynamic approximation, the threshold for the onset of such instabilities and their temporal growth rates has been calculated for typical warm, non-magnetic laser target plasmas. For this purpose a system of eigenfunctions has been developed for a simple (slab) geometry that leads to a rapidly converging coupled mode expansion. These temporal modes are coupled through the spatial variations in the amplitude of the incident electromagnetic wave. Both effects have been included in the calculation; in this manner, a limit for the validity of the customarily-used dipole approximation has also been obtained. The effects of a blow-off region surrounding a fully or partially ionized plasma subject to an intense electromagnetic field have been investigated along similar lines.

SUPPORTED BY University of Illinois

8.0007, DEEP IMPURITY LEVELS IN TERNARY SEMICONDUCTORS

J. Dow, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801 (DN775630; N00014-77-C-0537)

Future Navy electronics systems will require improved and new semiconductor materials. Increased understanding of the role of impurities in these materials will result in better material control, cheaper materials and new electron device application.

This research will further develop the theoretical and experimental understanding of the role of isoelectronic impurities in the ternary alloy III-V semiconductors. A phenomenological model has elucidated some of the mechanisms involved in the high efficiency photoluminescence of gallium arsenide phosphide. The deformation potentials for such impurities will be calculated for an anisotropic medium to remove part of the phenomenology of the earlier model. These will be used to calculate binding energies for various nitrogen-nitrogen pairs and to calculate exciton interactions. Alloy disorder, phonon interactions, and strain field (caused by impurities) effects will be studied in relation to photoluminescence intensities and line shapes. Concepts will be generated leading to improved photoluminescence efficiency in ternary alloy semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0008, PLASMA PHYSICS

M. Raether, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801

Wave-wave Interactions - Studies of wave-wave interactions in an electron beam-plasma system led to the discovery of a spontaneous decay instability of a beam-plasma wave into an ion acoustic wave and an electron plasma wave. Good agreement was found with a theoretical model based on three wave coupling.

Statistical Properties of Plasma Turbulence - The objective of this research project is to obtain information about turbulent plasma states that goes beyond the traditional description of these states in terms of correlation functions and/or power spectra. A system has been constructed that allows the measurement of one and two point probability densities of electron density fluctuations in a field of ion acoustic turbulence in a low pressure discharge in helium.

SUPPORTED BY University of Illinois

8.0009, NUCLEAR SCATTERING AND NUCLEAR PROCESSES

D.G. Ravenhall, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801

Experiments which probe the structure of atomic nuclei by scattering electrons from them are carried out at several labs, including Illinois, and research is done on the theory of the scattering process. While the basic mechanism is simple, current and future measurements require corrections to it and a continuing program for application of these corrections to experiment is carried on. The expertise developed is also applied to nuclear scattering of more strongly interacting particles, such as protons and pions. Simple nuclear models, which have been tested by such research, are applied to astrophysical situations in which the extreme temperatures or pressures involved modify drastically the role played by atomic nuclei. The current application is to an equation of state suitable for calculations of stellar collapse and possible supernova production.

SUPPORTED BY (No Supporting Organization Reported)

8.0010, LIGHT-SCATTERING STUDIES OF PHONON INTERACTIONS IN PIEZOELECTRIC SEMICONDUCTORS

R. Bray, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR79-14618)

Light scattering studies of acoustic phonons in opaque materials and Raman scattering studies of non-equilibrium electron and phonon populations will be carried out. In the first category, intense acoustoelectrically-amplified beams of phonons will be used to facilitate studies of phonons in opaque materials by three very different techniques: (a) Brillouin scattering of light for interactions occurring at the surface of the material rather than in the bulk, (b) X-ray scattering where optical opacity is by-passed, and phonons can be studied in the tail of the Bragg peak or by their effect on anomalous transmission, (c) The optical detection of solitary mechanical pulses and 'echoes'--a new phenomenon believed to be generated in acoustoelectric domains by a piezoelectric shock mechanism. In the second category, the whole Raman spectrum, including Rayleigh wings and one- and two-phonon structures, will be used as a probe of transient changes in electron and phonon populations due to such agents as intense laser flux providing extrinsic and intrinsic excitation, high electric fields, and acoustoelectrically amplified phonon domains which affect the carrier distribution and provide high ac strains and piezoelectric fields.

This research was previously supported by DMR76-82090-A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, ULTRASONIC AND RELATED INVESTIGATIONS OF SOLIDS

R.J. Sladek, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR79-08538)

Ultrasonic and related investigations of acoustic phonon behavior will be carried out for the purpose of relating it to the electrical conductivity and crystal stability characteristics of other phonons or the magnetic properties of crystalline solids exhibiting metal-insulator transitions. Included are electronic conductors and superionic conductors. Measurements will be made of the velocity and attenuation of ultrasonic waves as a function of temperature, pressure, and magnetic field at low temperature, and in some cases the thermal expansivity and/or electrical impedance (to determine optical phonon and/or electronic behavior).

It is also proposed to investigate thoroughly a new post-electric-field ultrasonic attenuation enhancement in arsenic triselenide glass, which provides evidence for carrier injection, trapping, and recombination processes and implies that the two-level tunneling systems responsible for ultrasonic attenuation are valence alternation pairs. The approach will involve heat treat-

ments of samples, characterization of the sample surface, study of infrared quenching of the excess attenuation and detection of recombination radiation and/or changes in conductance due to the high dc field.

This research was previously supported by DMR 7708476. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0012, ELECTRICAL NATURE OF DISLOCATIONS IN SEMICONDUCTORS

J.S. Ahearn, Martin Marietta Corp., Martin Marietta Laboratories, *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DMR79-11914)

Dislocations degrade the performance, reliability, and production yield of a wide range of semiconductor devices. Problems related to dislocations (which act as recombination centers, microplasma generation sites, and electrical shorts) have been found in Si devices, in III-V semiconductor LEDs and lasers, and in II-VI photoelectrolytic devices. However, despite their importance, the mechanism by which dislocations degrade device performance is not well understood. A major barrier to understanding is the absence of reliable, fundamental knowledge of the nature of the defect state introduced into a variety of semi-conducting materials by dislocations. The aims of this program are to provide basic information on dislocation interactions with charge carriers, and thereby contribute to a general understanding of detrimental effects of dislocations in semiconductor devices. The approach for investigating dislocation energy states and their interactions in semiconductor materials is to make the semiconductor the working electrode of an electrolytic cell. In this way, the charge residing in the dislocation level(s), other defect levels, the conduction band, and the valence band can be altered by changing the cell potential. The effects of altering the charge on these levels will be detected by dark current, photocurrent, capacitance, and dislocation velocity measurements as a function of applied cell potential. In addition, by introducing redox couples into the electrolyte, the effect of direct charge transfer from redox couples to dislocation levels on cell dark current, photo-current, and capacitance will be examined. This approach will be undertaken on a model material--the wide band gap semiconductor ZnO. This is a continuation of research previously supported under NSF Grant DMR78-05717, and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, STUDY OF ATOMIC PROPERTIES OF ASTROPHYSIC IONS AND ATOMS

F.W. Martin, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NCA 5-65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0014, SIPLE LOW LIGHT LEVEL TV EXPERIMENT

R.H. Eather, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Physics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DPP78-23513)

An all-sky monochromatic imagery TV system will be designed, constructed, tested, and then installed at Siple Station during the austral summer of 1980-81 where it will be used to make observations during 1981 of proton and electron precipitation in the ionosphere caused by very-low-frequency wave interactions with these particles in the magnetosphere. The data obtained will be used to determine the size, shape, and location of the interaction regions in the ionosphere.

Logistics support is required for one person to visit Siple Station during the austral summer 1979-80.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

8.0015, MATHEMATICAL PHYSICS

A.M. Jaffe, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY79-16812)

Theoretical research at the interface between mathematics and physics will be done. The work will focus on studies in quantum field theory, which is the basis for our understanding of the elementary particles, and in statistical mechanics. Specific topics will include: Lattice gauge theories, Classical gauge theories, Quark confinement, Anomalies in field theory, Functional determinants, Phase transitions, Non-linear maps on an interval, Constructive quantum field theory, 1/N expansion.

This is the first year of a three year continuing grant; previous research was supported under NSF grant PHY77-18762A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0016, METALLIC MAGNETISM - EFFECTS OF PRESSURE AND OF MAGNETIC IMPURITIES IN SUPERCONDUCTORS

R.P. Guertin, Tufts University, Medford Campus, School of Arts & Sciences, Dept. of Physics, *Medford, Massachusetts* 02155 (DMR79-06659)

Experiments will be performed to investigate single impurity and collective magnetic effects in intermetallic compounds and alloys. The experiments are divided into two groups: the measurement of magnetic properties at high hydrostatic pressures and in high magnetic fields, and investigations of magnetic impurity effects in superconductors at very low temperatures and at high pressures.

In the first category, measurements will be made of the magnetization and susceptibility of the weak ferromagnets praesodymium selenide and non-stoichiometric praesodymium phosphide. In ferromagnetic Uranium-thorium antimonide the application of pressure is expected to give rise to a ferroto paramagnetic transition accompanied by a valence charge for the uranium ion. Also, a search for diamagnetic anomalies in high pressure phase of cuprous chloride will be carried out. In the second category, studies will be made of magnetic effects of representative iron group, rare earth and actinide impurities in thorium and other superconducting hosts. Measurements of the superconducting-normal phase boundary as a function of high pressure for two re-entrant cerium impurity Kondo systems will also be performed

Research previously supported by DMR 7705959 A01. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, THEORY OF INTERACTIONS OF MESONS AND NUCLEONS WITH NUCLEI

M.M. Sternheim, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Amherst, Massachusetts* 01002 (PHY77-07592 A02)

Research initiated under NSF grant PHY77-07592A01 on theoretical problems in the field of intermediate energy nuclear physics will continue.

Processes in which only incomplete information is obtained about the outgoing particles in an intermediate energy reaction are considered to be incoherent. The interference effects in a quantum mechanical calculation tend to cancel, so that semiclassical models are valid. The validity of various semiclassical approaches will be studied, and cross-sections for several processes of interest will be calculated.

Pion-nucleus scattering is described theoretically with the aid of an optical potential. Under the present NSF grant, it has

been shown recently that purely phenomenological approaches to finding this potential have serious ambiguities. The present program will study the comparison of theory and experiment in this area, with the goal of extracting nuclear information.

Finally, nuclear processes will be used to set limits on the masses of various particules hypothesized by particle theorists.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0018, ALIGNMENT AND ORIENTATION IN ATOMIC COLLISIONS

J. Macek, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (PHY79-06348)

Research in theoretical atomic physics initiated under NSF grant PHY77-07110A01 will be continued. A comprehensive program of research will be carried out on the origins of alignment and orientation of collision excited states. Professor Macek will seek to understand the underlying physical mechanisms responsible for anisotropy by numerical studies of select collision systems including heavy ion collisions and electron-ion collisions using appropriate theoretical approaches. In addition, conversion of alignment to orientation by magnetic fields and the influence of relativistic effects in ion-atom scattering will be studied. The research will advance fundamental knowledge of atomic collision dynamics.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, DATA PROCESSING EQUIPMENT FOR FAR INFRARED FOURIER TRANSFORM SPECTROMETER

K.D. Moeller, Fairleigh Dickinson University, Teaneck Hackensack Campus, School of Liberal Arts, Dept. of Physics, *1000 River Rd., Teaneck, New Jersey* 07666 (PRM79-20946)

Research in the molecular spectroscopy laboratory includes: 1) Determination of optical constants of powdered materials. 2) Development of far-infrared band pass filters to be used aboard NASA's COBE (cosmic background explorer) satellite for the measurement of emission from the cosmos. 3) Measurement of the far-infrared absorption coefficient of various liquids, of interest for the study of molecular dynamics in liquids. 4) Internal rotation of CH3 group in methylamine and deuterated methylamine.

The grant provides funds for data processing equipment to improve the efficiency of a Fourier transform spectrometer for low resolution measurements in the very far infrared and millimeter region.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management

8.0020, NAVY ENVIRONMENT - IONOSPHERIC ELECTRIC FIELD

M. Brook, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (DN675282; N00014-76-C-0574)

The aim of this research is to measure horizontal gradients of the ionized upper strata of the atmosphere including the ionosphere. It is necessary to obtain this data with longer term measurements than is possible with balloons for improving the predictive capability of ionospheric models. Ionospheric modeling is needed for design and operation of naval communication and surveillance systems.

In a reasonably pollution free area (flat open space of New Mexico) a 10 km antenna will be strung at a height of seven meters and insulated from the ground. Horizontal gradients in the ionosphere are estimated to be 10 mv/m, which figure is attenuated by a factor of a thousand 7m above the ground. An antenna of 10 km length will aquire a voltage drop of one tenth of a volt, an adequate magnitude to measure.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0021, MULTIEXPERIMENTAL STUDIES OF THE WIND AND WAVE PATTERNS IN THE UPPER ATMOSPHERE AND IONOSPHERE

M.C. Kelley, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (ATM79-05549)

Under this grant, research will be supported in the areas of Space Plasma Physics, Planetary Electrodynamics, and Neutral Atmospheric Dynamics. The program stresses combining multiple techniques. Both passive and active experiments will be performed to study equatorial spread F. One experiment will utilize a double barium release to create an electrodynamic uplift, another will involve an ionospheric hole created chemically by burning of the Space Shuttle engines over the diagnostic incoherent scatter radars at Arecibo and also west of Peru. It is anticipated that the equatorial hole will drift eastward and hopefully upward, as happens with naturally occurring plasma holes or bubbles. The Millstone Hill radar will be utilized to search for and study large electric fields which occur near the ionospheric projection of the plasmapause and which can create east-west drifts of several km/s in a narrow latitude range (approximately 1 degree). Data there will also be combined with: that from an auroral radar probe located in Ithaca but which sees a volume common with the Millstone Hill radar; a whistler receiver; and airborne observations relating electric field measurements with auroral excitation data. The Arecibo and Chatanika radars will be utilized to examine gravity wave motions in the troposphere and lower stratosphere, in conjunction with balloon and rocket ascents to test wave-mean flow interaction theory. Such studies may help determine the importance of gravity wave sources and sinks in the redistribution of energy and momentum in the troposphere and stratosphere. The Arecibo studies of cumulus towers is directed at providing information on scales sizes, which would contribute to understanding cloud growth.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0022, OPERATION OF THE STONY BROOK NUCLEAR STRUCTURE LABORATORY

D.B. Fossan, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (PHY77-10192 A02)

This work is the continuation of research carried out under National Science Foundation grant PHY75-11185A02. The program will center on a tandem Van de Graaff accelerator and associated experimental equipment. Major pieces of general equipment include a 30-inch precision scattering chamber, lithium drifted germanium and sodium iodide gamma-ray detectors, a superconducting magnet for nuclear moment measurements, as well as general-purpose electronics, oscilloscopes and multichannel analysers.

Studies will include measurements of g-factors and quadrupole moments of isomeric nuclear states, isomeric fission, intermediate structure in heavy-ion-induced reactons, macroscopic properties of nuclei and nuclear-atomic interactions. Studies of a superconducting linear accelerator are in progress aimed at providing additional acceleration capability.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0023, DEVELOPMENT AND CONSTRUCTION OF A SUPERCONDUCTING HEAVY-ION LINEAR ACCELERATOR

P. Paul, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (PHY79-12300)

This work is the logical extension of work presently in progress under NSF grant PHY76-80960 A01. Some related development work is also in progress at the California Institute of Technology under a separate grant, PHY79-09773.

The work consists of further development and construction of a superconducting booster accelerator for a model FN

Tandem Van de Graaff. The completed project will include a major upgrading of the accelerator including new accelerator tubes, a new-chain type charging system and a new high energy ion source. The post accelerator will consist of three bunchers, one before and two after the Van de Graaff accelerator, and eleven acceleration modules each of which consists of a cryostat containing several accelerating structures of the split ring type.

The accelerator will provide routinely and continuously 2.5 MV per meter of acceleration and may be run for shorter periods (up to a day) at 3.0 MV per meter using reserve helium supplies.

The work will include: 1) finalized design and manufacture of cryostats; 2) production and lead plating of split ring resonators; 3) assembly and testing of modules; 4) design of control computer system. Required magnets, beam lines, computer control systems and related hardware will be purchased and installed.

This is the first increment of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0024, STATISTICAL MECHANICS OF THE LIQUID STATE

G. Stell, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (CHE79-00838)

This grant supports research under the Structural Chemistry and Thermodynamics Program for theoretical studies of the liquid state using statistical mechanical methods. Thermodynamic, structural, and transport properties characteristics of the liquid state and of its phase boundaries will be investigated. Four broad topics will be emphasized: (1) the structure and thermodynamic properties of ionic solutions with particular attention to the higher valence aqueous electrolyte regime, (2) the thermodynamic and dielectric effects of long-range forces in molecular liquids, (3) a general statistical mechanical investigation of polydisperse systems, and (4) the transport properties of liquid mixtures using the revised Enskog theory as a starting point.

This research is a continuation of that currently supported by Foundation Grant, DMR-7307580.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, CURRENT CONTROLLED LIQUID PHASE EPITAXY

E.K. Stefanakos, University of North Carolina, North Carolina Agricultural & Technical State University, Graduate School, *N. Dudley St., Greensboro, North Carolina* 27411 (DMR77-19210)

This research will be a study of semiconductor crystal growth by current controlled liquid phase epitaxy (LPE), a method of producing high quality junctions and uniform epitaxial layers. The work will concentrate on the mechanisms responsible for the growth of epitaxial layers by current flowing across the semiconductor-melt interface. Two possibilities are: (a) diffusion of solute atoms to the interface in the presence of a temperature gradient, and (b) differential ion migration resulting from momentum exchange between electrons and solute atoms. The temperature and temperature gradient at the interface will be carefully measured by introducing thermocouples at about 0.5 mm intervals from the interface. This method will be used to grow epitaxial layers of indium arsenide on indium arsenide, indium phosphide on indium phosphide and gallium indium arsenide on indium phosphide.

After growth, specimens will be cleaved and examined with a phase contrast microscope to determine interface uniformity, thickness of grown region and presence of any strictions due to current pulses. In addition, Schottky barrier methods will be used for profile measurements.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, NUCLEAR MAGNETIC RESONANCE STUDIES OF ORIENTATIONAL ORDER IN LIQUID CRYSTALS

J.W. Doane, Kent State University, School of Arts & Sciences, Dept. of Physics, *Hilltop Dr., Kent, Ohio* 44240 (DMR79-04393)

A unique feature of the liquid crystalline phase of matter is that the molecules or parts of the molecules remain oriented throughout a single domain while maintaining a high degree of mobility. It is this feature which gives the biological membrane its ability to function and which provides for the use of liquid crystals in display devices. Liquid crystal phase transitions observed in thermotropic materials as well as those observed in the lamellar bilayer of membranes and simple soaps are accompanied by subtle but important differences in the molecular orientational order. Orientational order is, therefore, an important feature of liquid crystals, yet is probably one of the least understood aspects of these phases because only a few experimental techniques are sufficiently perceptive to measure and characterize it. One of the most useful techniques in this regard is nuclear magnetic resonance (NMR). NMR is sensitive not only to the orientational order of a molecule as a whole, but also to that of its individual segments.

In the present work, various orientational order parameters are measured using NMR. The principal goal is to test microscopic models and theories that have been offered for several of the liquid crystal phases. These include the smectic phases of the thermotropic systems, and the newly discovered lamellar phases of the lyotropic systems. Some of the measurements involve high pressure techniques.

First year of a three-year continuing grant; renewal of work supported by DMR76-21365.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, THEORETICAL STUDIES OF NON-UNIFORM MANY-BODY SYSTEMS

W.F. Saam, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DMR79-06934)

Research previously supported by DMR7521866.

Theoretical research, involving developments and applications of density-functional (DF) theory for non-uniform systems will be carried out. In addition, we propose studies of such systems using techniques other than DF theory for purposes of comparison of different theoretical approaches. Specifically: 1. Calculations designed to test the reliability of a sequence of new approximate DF theories which we have recently developed. This project involves both comparisons of predictions of the new theories among one another and with results of Monte-Carlo calculations recently undertaken in our group. 2. Completion of work on a DF theory of phase-separation in binary mixtures of classical Lennard-Jones fluids. Self-trapped electron states in these mixtures will also be explored. 3. Further work on the subject of phase nucleation in 3He-4He mixture systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, STUDIES IN GENERAL RELATIVITY THEORY

L. Witten, University of Cincinnati, Graduate School, Dept. of Physics, *305 Physics Bldg., Cincinnati, Ohio* 45221 (INT78-25663)

This collaborative effort between physicists at the University of Cincinnati and the Universidad Central de Venezuela is concerned with the discovery and study of the properties of exact solutions of the Einstein equations for sources that may be fluid or electromagnetic.

Three main subdivisions of the research are: (1) solution generation of the Einstein-Maxwell equations, including a comparative exploration of conserved quantities in the Yang-Mills theory; (2) examination of the properties of several specific solutions, such as those relating to collapsing systems. An understanding of the behavior of physically realistic collapsing systems is of great importance in astrophysics, and closely related problems are important in cosmology; (3) studies in general relativistic magnetohydrodynamics, focussing on force-free magnetic fields and the properties of conducting fluids in the presence

of strong electromagnetic and gravitational fields. These are relevant to the process of gravitational collapse in ordinary stars, and the production of radiation from a pulsar.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0029, CHARACTERIZATION OF THE OPTICAL PROPERTIES OF LASER AND PHOSPHOR CRYSTALS 16182-P

R.C. Powell, Oklahoma State University, School of Arts & Sciences, Dept. of Physics, *Agricultural Hall, Stillwater, Oklahoma* 74075 (DA0G8984; DAAG29-79-G-0048)

To better characterize and understand dynamical processes such as energy transfer and radiationless relaxation transitions in laser and phosphor materials. Relevance - this research is directly related to on-going efforts of the laser division of the night vision and electro-optics lab. In particular the characterization of dynamical processes such as energy transfer and concentration quenching in neodymium laser materials is of prime concern for the future design of laser rangefinder, mini-laser rangefinder and designator systems. The work on neodymium pentaphosphate, which is a precursor stoichiometric compound laser material, is essential to the development of future neodymium stoichiometric compound lasers.

Along with standard optical spectroscopy methods, the techniques of time-resolved spectroscopy, site selection spectroscopy, and photoacoustic spectroscopy will be applied to the study of laser and phosphor materials including neodymium pentaphosphate, neodymium doped yttrium vanadate, and neodymium doped lanthanum bryllate. In addition, coherent transient spectroscopy techniques will be developed to investigate coherent motion contributions to exciton migration and coherence destroying collision processes of ions in crystals.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0030, NOVEL LOW-DIMENSIONAL CONDUCTORS

M.M. Labes, Temple University, School of Liberal Arts, Dept. of Chemistry, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (DMR79-05979)

Intense efforts are currently under way to understand the relationship between crystal structure, chemical formula, and the highly directional physical properties of so called low-dimensional solids. Several molecular and polymeric 'metals' or semiconductors of this type have been prepared and studied, both theoretically and experimentally, in the last few years. It is highly desirable to synthesize new materials designed specifically to test theory and extend the range of phenomena observed, possibly creating totally new classes of conductors.

Three types of novel low-dimensional conductors will be prepared and studied. Hydrocarbon-halogen complexes are of interest because Professor Labes and coworkers have discovered that perylene 4 iodine has a metallic temperature dependence of its conductivity and may not be a simple segregated stock complex. Understanding its properties may result in a basic revision of the guidelines for the structure of metallic charge transfer complexes. Second, a class of channel-like inclusion compounds is of interest because both significant fast ion and electronic conductivity have been observed in these compounds. Last, this group is investigating the synthesis and properties of a new polymeric system and its charge transfer adducts which show promise of high conductivity.

This is the first year of a three-year continuing grant; renewal of work supported by DMR 77-01055.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, DESIGN AND STUDY OF NEW FERROELECTRIC ORGANIC POLYMER FILMS AND CRYSTALS

A. Garito, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DA0F1846; DAAK70 77 C 0045)

To synthesize and investigate polymers for pyroelectric, piezoelectric, and non-linear optical properties.

In order to achieve a maximum unit dipole charge on each molecular unit, a parallel sequence of charged dipoles arranged along individual polymer chains, and a parallel stacking of each polymer chain with respect to other chains in the solid, the solid-state polymerization of appropriately substituted diacetylenes will be used. The diacetylenes will have one electropositive and one electronegative substituent to get a maximum push-pull effect.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Night Vision & Electro Optics Lab.

8.0032, COOPERATIVE STUDIES OF RELATIVISTIC FREE-FREE TRANSITION PROCESSES

R.H. Pratt, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (INT79-00982)

This award provides travel funds for Dr. Richard H. Pratt, University of Pittsburgh, to cooperate with Dr. H.-K. Tseng, National Central University, Taiwan, on the study of the elementary process of bremsstrahlung, electromagnetic radiation produced by the sudden retardation of an electrical particle (as an electron or positron) in an intense electric field. Specifically the project concerns calculation of relativistic free-free transitions in the field of atoms and ions in the energy region around the bremsstrahlung edge, an energy region higher than that usually considered by atomic physicists and far too low to be considered by high-energy physicists. A comparison will be made between theoretical and experimental results on the basis of calculations using the partial-wave method of assessing radiative processes in this region. The information sought is of considerable potential interest to branches of physical sciences such as plasma- and astrophysics, and is pertinent through radiation hazards to public health, as well as to the generation of energy through fusion. Previous support for related work was provided by NSF award OIP-7503599.

The project has been approved under the U.S.-Taiwan Cooperative Science Program, and the Taiwan investigator will receive support for his participation in the project from the National Science Councilor equivalent counterpart agency.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0033, OPTICAL STUDIES OF ELECTRONIC STATES, VIBRATIONS AND RELAXATION PROCESSES IN AMORPHOUS SYSTEMS

J. Tauc, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR79-09819)

Studies will be carried out of electronic states in amorphous silicon doped with noble and transition metals, and of photoinduced optical absorption in amorphous hydrogenated silicon, silicon-germanium, and silicon-carbon systems. A subpicosecond mode-locked dye laser system will be used to study three relaxation processes in the picosecond range on amorphous hydrogenated silicon (and related materials) and/or chalcogenide glasses: dynamics of photoexcited absorption at the band edges, relaxation of a photoexcited state into the luminescent state and relaxation of Raman excitations, in particular as a function of temperature when the material passes through the glass transition.

This research was previously supported by DMR 7617443 A02.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, INTERACTION OF SLOW ELECTRONS WITH HIGH-PRESSURE GASES (QUASI-LIQUIDS)

L.G. Christophorou, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (006842)

Our work on the interaction of slow electrons with molecules in dense gases will continue with emphasis on atmospheric pollutants such as CO2, H2S, NO2. Accurate measurements of the rates and the cross-sections for attachment of slow electrons to molecules at various pressures and in various media will provide effective ways to elucidate the collision kinetics of electron-molecule interaction processes. Such information is necessary for understanding physicochemical reaction pathways in the atmosphere and helpful in unifying the modeling of gas-phase phenomena with those in the condensed phase. In addition, knowledge on slow electron-molecule interactions, especially on negative-ion states, is synthesized.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

8.0035, HIGH VELOCITY COLLISIONS OF HIGHLY IONIZED IONS WITH ATOMS AND MOLECULES

I.A. Sellin, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (PHY79-07344)

This activity includes a variety of accelerator-based atomic physics experiments concerning collisions of high velocity, highly ionized particles with target atoms, molecules, and solids (foils). The work is to be carried by a group of university users at major accelerator facilities at Oak Ridge, Brookhaven, Berkeley, Darmstadt (Fed. Rep. of Germany), and occasionally other sites. Specific experiments include but are not limited to: (1) investigation of the forward peak in electron emission accompanying ion-atom and ion-solid collisions; (2) delineation of the role of single vs. multiple electron excitation processes in the formation of the forward peak and in other collision processes by means of studying such collision events in coincidence with final ion scattering state; (3) auxiliary investigation of very low energy Auger electron emission arising from ion-atom and ion-solid collisions through use of the same coincidence techniques; (4) completion of an extensive study of electrostatic fine structure (delta n equals 0) transition probabilities in foil-excited ions; (5) study of orbital angular momentum state coherence in ion-atom collisions.

This is the first year of a three-year continuing grant, previously supported under NSF grant PHY77-05726.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0036, EXCITATION OF X-RAYS WITH ENERGY BELOW 1.5 KILOELECTRON VOLTS

H.D. Fetzer, St. Marys University, School of Arts & Sciences, Dept. of Physics, *2700 Cincinnati, San Antonio, Texas* 78228 (U-515)

Low energy characteristic x-rays excited by accelerated charged particles are being investigated. A new target chamber to accomodate a variable geometry end-window flow proportional counter has been developed and built. X-rays ranging in energy down to Titanium L, 0.45 KeV, excited by 150 KeV protons have successfully been observed with the proportional counter.

Different proportional counter end-windows are being tested to provide greater transmission of x-rays lower in energy than those already observed.

For the energy of charged particles involved (up to 150 KeV) and the energy of the x-rays being investigated target surface conditions are critical. Various methods are being tested for target surface cleaning. Argon-ion bombardment, or sputtering, appears to hold the most promise at present.

The efficiency of excitation of x-rays below 1.5 KeV by protons and electrons will be compared for particle energies ranging from 75 KeV to 150 KeV.

SUPPORTED BY Robert A. Welch Foundation

8.0037, NB3SN FORMATION KINETICS IN FILAMENTARY COMPOSITE SUPERCONDUCTORS

K.M. Ralls, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: In a continuing program we are investigating the formation kinetics of Nb3Sn in composite wires consisting of a niobium filament within a tin-bronze matrix. Previous work has established that small amounts of zirconium in the niobium filament increase the kinetics of Nb3Sn layer growth. Current studies are being conducted to see if this enhancement continues when larger amounts of zirconium are present.

SUPPORTED BY University of Texas

8.0038, PIONEER F/G DATA ANALYSIS OF THE SOLAR TERRESTIAL RELATIONS PORTION OF THE MAGNETIC FIELD EXPERIMENT

D.E. Jones, Brigham Young University, School of Physical & Mathematical Sciences, Dept. of Physics & Astronomy, *B-166 A S B, Provo, Utah* 84601 (NAS 2-7358)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0039, MANY-BODY METHODS WITH APPLICATIONS TO ATOMS AND MOLECULES

H.P. Kelly, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (PHY79-08241)

Research in theoretical physics initiated under NSF grant PHY77-07154 will be continued and expanded. Many-body calculations of atomic and molecular properties will be emphasized. Detailed studies of correlation effects on parity nonconservation calculations will be made for a number of atoms using relativistic atomic orbitals. Relativistic calculations including correlations will also be made for many other atomic properties of heavy atoms.

Photoionization calculations will be carried out for many systems including relativistic effects and electron correlations. Studies will be made of resonance structure in photoionization cross-sections with particular attention to transition metal and rare earth atoms. Photoionization cross-sections will also be calculated for core levels, for excited states, and for certain molecules. The process of double photoionization will be studied further. Multi-photon cross-sections will be studied as well as effects of electric and magnetic fields on photo cross-sections.

Studies will also be made of other properties including Auger rates, generalized oscillator strengths, and optical potentials for electron scattering.

This is the first year of a four-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0040, ACQUISITION OF EQUIPMENT FOR STUDIES OF SHOCK WAVES IN SOLIDS

G.E. Duvall, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DMR78-17809)

This grant will provide funds to upgrade the facilities of the Shock Dynamics Laboratory at Washington State University. A laser velocity interferometer will be acquired for measuring surface motion in complicated geometries, with the ability to record velocity-time histories of impulsively loaded specimens.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0041, REMOTE DETECTION OF ACCELERATOR-PRODUCED NEUTRINOS

P. Kotzer, Western Washington University, Bureau for Faculty Research, *Bellingham, Washington* 98225 (DN775423; N00014-77-C-0363)

The objective is to study the basic interactions and properties of high energy accelerator-produced neutrino beams at sites in the ocean, thousands of kilometers from the source, and to assess the potential of neutrino communication schemes for naval applications. Work involves the fundamental aspects of neutrino physics and environmental problems related to undersea neutrino detector arrays. This includes a study of the response characteristics and associated electronics of a linear array of prototype underseas Cerenkov detector modules to neutrino induced events when placed in line with the FERMILAB's neutrino beam.

The approach is to use existing accelerator facilities such as the Fermi National Accelerator Laboratory (FNAL) located near Chicago to produce narrow beams of high energy neutrinos for transmission experiments in water targets using Cerenkov detectors and time-of-flight techniques. Theoretical and experimental investigations are made of the fundamental aspects of neutrino physics including electron-muon neutrino oscillations, neutrino decays, neutrino-nucleon differential cross-sections and neutrino velocity. This includes work on understanding the principal sources of background to the Cerenkov mode of detection including sunlight, trace radioactivity, bioluminescence, and cosmic rays.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0042, THEORY OF ANISOTROPIC MAGNETIC PROPERTIES AND ASSOCIATED LATTICE BEHAVIOR IN ACTINIDE AND RARE EARTH MATERIALS

B.R. Cooper, West Virginia University, School of Arts & Sciences, Dept. of Physics, *Morgantown, West Virginia* 26506 (DMR79-07069)

Research previously supported by DMR7706721.

Theoretical research will be carried out on the magnetic properties of actinide and rare earth materials. A major focus will be on cerium and actinide monopnictides of the sodium chloride structure. By introducing covalent interations between the conduction and the localized f-electrons, the remarkably anisotropic equilibrium and dynamic magnetic properties of these materials will be investigated. Secondly, a study of fluorite-structure oxides will examine important questions of correlataion between magnetic behavior and lattice structural changes. Finally, other materials with related lattice and anisotropy effects will be studied. These will include praseodymium selenide, rare earth intermetallics and calcium or yttrium doped zirconia. Close coordination with experimental programs will be maintained.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0043, PHOTOACOUSTIC AND PHOTOTHERMAL SPECTROSCOPY OF IONS IN SOLIDS 16176-P

W.M. Yen, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DA0G8996; DAAG29-79-C-0040)

Development and application of photoacoustic and photothermal spectroscopy to the study of impurity ions in crystalline and glassy solids. Relevance - relevant to the design of future rare earth ion laser and solid state upconversion devices for mini-rangefinder applications.

Recent developments in photoacoustic and photothermal spectroscopy will be applied to the study of impurity ions in crystalline and glassy solids. Studies will include (1) measurements of quantum efficiencies and multiphonon relaxation of optical transitions, (2) intermodulation of photoacoustic signals for level isolation and (3) photocooling effects.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0044, COSMIC RAY SHOWERS

K.E. Turver, University of Durham, Dept. of Physics, *South Rd., Durham, England, United Kingdom* (DA0D9345; DAERO 77 G0068)

To observe and study the atmospheric 'Cerenkov' radiation produced by cosmic ray showers.

To undertake field observations in the next several months on the range at Dugway Proving Ground, Dugway, Utah. This will be joint between the University of Durham and University of Utah.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, FEASIBILITY OF COMMUTER AIRLINE SERVICE IN RURAL ALASKA

L. Gorsch, University of Alaska, Fairbanks Campus, Graduate School, *Fairbanks, Alaska* 99701 (0045023; ED-62-450-02-01-X1)

OBJECTIVE: Drawing on experience with studies of rural ambulance services, rural rental housing and similar services, develop a methodology to evaluate the economic feasibility of commuter air service in rural Alaska, which can be used by local businesses, local decision makers and federal agencies. Field test this methodology in selected Alaskan communities.

APPROACH: Develop procedures to estimate costs of providing commuter air service including, but not limited to, capital expenditures, labor, and other operating expenses such as airport usage fees, insurance and business services. Develop a procedure to estimate receipts from commuter air service. Field test these procedures to the feasibility of providing commuter air service in selected Alaskan communities which differ in social, economic and geographic characteristics.

SUPPORTED BY U.S. Dept. of Agriculture, Economics Statistical & Cooperative Service, Economic Development Div.

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, PHOTOELECTRIC OBSERVATIONS OF LUNAR OCCULTATIONS

N.M. White, Lowell Observatory, *P.O. Box 1269, Flagstaff, Arizona* 86001 (AST79-16150)

Photoelectric timings of occultations of stars by the Moon are an inexpensive way of providing basic data necessary to monitor changes in and improve the accuracy of the orbital elements of the Moon. The timings will enable the most accurate determination of the Moon's position relative to the stellar frame of reference. Photoelectric observations of 'shadow' diffraction pattern which sweeps across the surface of the Earth as the Moon passes in front of a star will provide the highest angular resolution yet obtained of multiple stellar system and diameters of stars cooler than the Sun. This resolution is equivalent to measuring the diameter of a dime 1,000 miles away. These observations will provide basic data which bear directly upon fundamental astrophysical and cosmological questions. The full potential of this program is being realized by a continuing observational program over a number of years at several observing sites.

Prior support was by NSF grant AST 76-82248A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, RADIO OBSERVATIONS OF THE SUN AT CENTIMETER AND MILLIMETER WAVELENGTHS
H. Zirin, California Inst. of Technology, Graduate School, Dept. of Astrophysics, *1201 E. California Blvd., Pasadena, California* 91109 (ATM79-06345)

This grant will support a program of research in solar radio astronomy at cm and mm wavelengths. The objectives are the determination of the properties of high energy electrons in solar flares and active regions, and to understand the radio emission of the quiet sun at cm and mm wavelengths. Interferometeric observations at Owens Valley Radio Observatory (OVRO) and the Very Large Array (VLA) will provide high spatial and time resolutions (0.1 sec and 4.6 arcsec at OVRO; 10 sec and better than 1 arcsec at the VLA). Cooperative observations with other radio observatories will also be undertaken. The specific programs listed are: (1) Analysis of data already in hand from a VLA run on flares, and several cooperative, multifrequency runs on flares, involving determination of the location and spatial distribution of the radio sources as a function of time, and compared with the active region magnetic fields. (2) New flare observations with 0.1 sec time resolution at OVRO. (3) Joint observation programs at different frequencies, including collaboration with the Flare Buildup study, the Solar Maximum Year and the SMM project. (4) Reduction of data expected to be obtained on the February 1979 eclipse. (5) VLA observations of solar flares. (6) Observations of the solar brightness distribution at 1.3 mm with the OVRO 10 meter mm dish. (7) Exploration of the solar atmosphere by solar occultation of radio sources at cm wavelengths.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0003, STUDIES OF RICH CLUSTERS OF GALAXIES
G.O. Abell, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (AST78-25648)

This project is a continuation of a study of rich clusters of galaxies with the following specific objectives: 1) completion of a photographic survey of southern clusters, the plates for which are being taken at Siding Spring, Australia; 2) preparation and publication of a new catalog of clusters of galaxies, consisting of corrections and annotation of the northern hemisphere catalog and a supplementary southern hemisphere section; 3) investigation of the distribution in space of the southern clusters and comparison of them to the northern clusters; 4) a detailed investigation of one or two southern superclusters; 5) completion of measurement of existing plates from the 48 inch Schmidt telescope on Mt. Palomer, California, of several rich clusters to obtain distributions in space and luminosity; and 6) study of the distributions in magnitude of faint galaxies by use of the COSMOS machine at Edinburgh, Scotland, which gives position, size, orientation, shape, and brightness of the images of the galaxies on the photographic plates.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0004, MEASUREMENT OF STELLAR PARALLAXES AND PROPER MOTIONS
A.R. Upgren, Wesleyan University, Graduate School, Dept. of Astronomy, *Middletown, Connecticut* 06457 (AST77-26554 A02)

Continued support is for the observation, measurement and reduction of astrometric plates to obtain parallaxes and proper motions of dwarf and subdwarf stars, mostly of spectral classes F through M. The program stars include nearby field dwarf stars taken from the McCormick lists as well as a number of similar members of the Hyades and Ursa Major clusters. A considerable number of nearby subdwarfs, mostly of classes F and G, have also been placed on the program. One of the continued aims of the program is the study of physical and kinematical characteristics of stars on the lower main sequence of the spectrum-luminosity diagram. Several investigations have already been completed which intercompare these properties for the K and M dwarf stars. Similar studies will be carried out as more parallaxes are determined. Two major studies show that the K-M dwarf stars of widely different ages, Hyades and field stars alike, define the same main sequence, but not the same local standard of rest. Young-disk stars have a collective outward motion (away from the galactic center) with respect to old-disk stars. Parallax errors will be studied. Prior support was by NSF grant AST 77-26554.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0005, P-MODE OSCILLATIONS OF THE SUN AS A PROBE OF LARGE-SCALE SOLAR ACTIVITY AND SOLAR-TERRESTRIAL RELATIONS
R.F. Howard, Carnegie Inst. of Washington, Hale Observatories, *1530 P St. N.W., Washington, District of Columbia* 20005 (ATM78-20420)

This grant is for the construction of a ground-based instrument which will be dedicated to the seismic probing of solar structure on a regular basis. Specifically, it will facilitate extensive digital observations of the solar photospheric velocity field in order to measure temporal variations in the photospheric and subphotospheric solar rotation rates on time scales ranging down to one day. In addition to studying solar rotation these observations will also permit an investigation of other aspects of the solar velocity fields, such as possible acoustic oscillations generated by solar flares, meridional flows, or variations in the amplitude and frequency of the solar p-mode oscillations themselves. Such observations will improve our knowledge of how solar variations affect our terrestrial environment.

The system to be used will utilize the existing 60-foot solar telescope at Mount Wilson, the telescope with which the 5-minute oscillations were discovered, and its associated spectrograph. Practically all the time on this telescope will be available for these observations. Large blocks of observing time are essential for the research project to be undertaken with this instrument. An integral part of the proposed system is a data processing system which will have sufficient speed and core capacity to carry out both the real-time observing and later data reduction tasks at the telescope on a daily basis. Subsequent analysis will be equally important to solar physics and solar-terrestrial relations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0006, A FINDING LIST FOR OBSERVERS OF CLOSE BINARIES (5TH EDITION)
F.B. Wood, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Astronomy & Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (AST78-07507 A01)

Support is for a new edition of the Finding List for Observers of Eclipsing Variable Stars; the 1963 edition of which has been an anachronism for more than 5 years. The editors contemplate a substantial broadening of the content of the Finding List so that it will more properly refer to close binaries, rather than only eclipsing variables. The source materials for the compilation are kept up to date at the University of Florida where the revision will be prepared. Camera-ready copy and the concomitant writing of the Finding List contents on magnetic tape will be undertaken for early publication and wide distribution.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, SOLAR RADIO PLASMA PHYSICS
D.G. Wentzel, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (ATM79-16583)

Active regions of the solar corona that lead to flares also experience many smaller instances of energy release. The coronal magnetic fields generally maintain themselves in a nearly unstressed state through these smaller energy releases. They involve plasma physics similar to those in flares, and they lead to localized heating and motions that may be observable by experiments on the Solar Maximum Mission. Moreover, they set the scene in which, occasionally, energy builds up to a flare. This award will support a theoretical investigation of these smaller energy releases; radio observations and plasma physics should combine to yield models of the sites of energy release and possible SMM-observable consequences, and they may indicate why energy releases generally are small but sometimes accumulate to cause a flare. The main evidence for the energy releases is provided by (1) type I solar radio bursts, whose very intense and localized emission suggests the presence of plasma waves and anomalous magnetic dissipation, (2) large solar radar signals, which seem to require rather intense plasma waves in many parts of the active-region corona, and (3) storm-type III radio bursts, the beginning and ends of which can yield information on the electron beams that cause the radio bursts. All three phenomena are correlated with active regions in which flares occur and thus relate to the criteria for flare build-up. The overall aim is to apply plasma theory to the situations described above in order to test the idea that small energy releases in the corona result from plasma waves. This will contribute to our understanding of energy flow from the sun.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Atmospheric Sciences

10.0008, SOLAR RADIO PROGRAMS AT THE HARVARD RADIO ASTRONOMY STATION

A. Maxwell, Harvard University, Cambridge Campus, Harvard College Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (ATM77-21453 A02)

This grant provides support for the continuation of a program in solar radio astronomy started under NSF Grant ATM77-21453. The primary aim of the program is the investigation of shock waves, generated by intense solar flares, as they propagate outward through the solar corona and then into the interplanetary medium.

Observations will be made of solar radio bursts of spectral type II, which are important diagnostics for the initial stages of the outward propagation of the shocks generated by flares. The radio data on the shocks will be compared with computer simulations of the passage of fast-mode magnetohydrodynamic shocks in the solar corona. The radio information and the computer simulations will then be compared with the characteristics of the shocks in the interplanetary medium, as determined by satellite observations.

The radio observations will be made at the Harvard Radio Astronomy Station, Fort Davis, Texas, with dynamic spectrum analyzers covering the frequency band 25-580 MHz.

This program forms part of the international Study of Travelling Interplanetary Phenomena (STIP), which in turn will form part of the international program for the Solar Maximun Year (SMY) when it commences in August 1979.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0009, A COMPLETE SURVEY OF GALAXY REDSHIFTS TO MV EQUALS 14.5 USING A PHOTON-COUNTING DETECTOR ARRAY

M. Davis, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (AST78-24856)

A two-line photon-counting detector array copied from the original design of Dr. S. Shectman has been constructed. The device is well suited for faint object spectroscopy and has been in nearly continuous use since February 1978 for a variety of scientific programs at Mt. Hopkins, Arizona. The primary emphasis is on the undertaking of a complete survey of the redshifts of all galaxies in the Northern Sky with mv less than 14.5 and galactic latitude greater than 40 degrees. The first results from the survey are encouraging and other exciting recent observations have been made. The completed redshift catalog will provide unique data for research in extragalactic astronomy. Intended uses of the catalog include: 1) improved understanding of the kinematics and dyanmics of galaxies within approximately 100 megaparsecs of the Milky Way, 2) direct measurement of the galaxy covariance function using the redshift as a distance indicator, and 3) improved determination of the luminosity distribution of galaxies and hence the luminosity density of galaxies. These questions are of direct relevance to the cosmological debate of whether the Universe is open or closed, and the result of the survey will play an important role in resolving the issue.

This is a continuation of AST-7622675.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, ASTRONOMICAL STUDIES RELATED TO OCCULTATIONS

J.L. Elliot, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST79-08376)

Occultations provide rare opportunities to obtain unique information about the outer planets of our solar system, as well as other astronomical objects. Based on occultations recently observed the following research projects will be carried out: A. Astrometric Analysis of the Uranian Rings - The main goal of the astrometric analysis of the Uranian rings is to determine the orbits of the nine rings; their semi-major axes, eccentricities, inclinations, and precession rates. B. Radius and Oblateness analyses of the occultation data by carefully examining how the uncertainty in the exact position of the ring center and the thermal structure in the atmosphere could cause systematic errors in the results. It is also proposed to determine whether the value for the oblateness is consistent with the value of J2 obtained by Nicholson et al from the precession of the e ring. C. Temperature Variations in the Uranian Atmosphere - It is planned to prepare for publication the results on the temperature structure of the Uranian atmosphere obtained from the Cape data, and to study the possible dynamic models that would explain the temperature variations discovered in the Uranian atmosphere. The Uranian atmosphere will be compared to that of the other planets.

Prior support was by NSF grant AST 76-14832.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, SOLAR SYSTEM DYNAMICS

F. Franklin, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31P-4P50-09)

With the aid of computer simulation of the solar system, and using traditional analytical methods of celestial mechanics, the evolution of the system of asteroids is studied. The hypothesis under test is that the asteroids were initially distributed uniformly from Mars to Saturn and beyond, and that the present distribution, which is confined to a relatively narrow belt between Mars and Jupiter, is the remnant of a much more extensive configuration. The bulk of the asteroids are hypothesized to have been removed by planetary perturbations, by physical collisions, and by aerodynamic drag of gas in the primeval solar nebulae. We are also beginning a search for isolating integrals of the elliptic restricted three body problem (using the method of surfaces of section) as another and powerful method of checking this hypothesis.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0012, ASTROMETRIC OBSERVATIONS OF COMETS AND ASTEROIDS AND SUBSEQUENT ORBITAL INVESTIGATIONS

R. McCrosky, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (NGR 09-015-212; 163663-31P)

Perform ground-based astrometric observations of comets, asteroids and planets of particular interest to NASA.

Evaluate field plate reduction as compared to use of usual astrographic catalogs.

Will perform orbital computations and examine 'nongravitational' anomalies of comets.

Astrometric observations of objects fainter than m equals 15 are photographed with the 61' reflector of the George R. Agassiz Station of the Harvard College Observatory.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0013, STELLAR PHYSICS

C. Whitney, Smithsonian Institution, Astrophysical Observatory, Solar & Stellar Physics Div, *60 Garden St., Cambridge, Massachusetts* 02138 (31S-4S50-04)

I have recently initiated a theoretical and observational program on extended stellar atmospheres, their structure and stability. Using a very general non-LTE atmosphere, I have begun a study of the thermal stability of the solar chromosphere and the atmospheres of B stars. My immediate purpose is to correct a substantial error in the latest published study of this problem by including the effects of radiative ionizations and departures from pure radiative equilibrium.

I am preparing an observational program to collect spectrum data on shell stars and binary systems containing a B star and an M supergiant (VV Cephei systems). These data will be analyzed with the non-LTE program.

In a related program, I am examining thermal dissipation through tidal distortion in close binary systems.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0014, OBSERVATIONAL AND THEORETICAL STUDIES OF INTERSTELLAR MOLECULAR CLOUDS

P. Solomon, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Astronomy, *Stony Brook, New York* 11790 (AST78-25021)

Observational and theoretical studies of molecular clouds will be carried out in the following areas: 1) giant molecular clouds in the galaxy and external galaxies; 2) observations of molecular cloud cores; 3) deuterium in interstellar molecular ions; and 4) theoretical research on the dynamics of molecular clouds. The observations and analyses of these past few years have shown that giant molecular clouds are the major components of interstellar matter and the proposed new research emphasizes investigations that may lead to an understanding of the dynamics and evolution of the clouds, the most massive objects in the galaxy. The observations primarily at millimeter wavelengths will be carried out principally at the Five College Radio Astronomy Observatory (FCRAO) new 45 foot millimeter wave antenna; the 36 foot antenna of the National Radio Astronomy Observatory and the 15 foot University of Texas antenna. The State University of New York at Stony Brook has provided substantial equipment for the FCRAO antenna and will have 20% of observing time available plus 15% for joint projects. Theoretical investigations will concentrate on energetic phenomena in molecular clouds and their effect on the cloud dynamics and evolution.

This is a continuation of AST-7611209AO1.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0015, INFRARED OBSERVATIONS OF THE GALACTIC ABUNDANCE GRADIENT

J.L. Pipher, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (AST78-12393)

Infrared observations of lines of heavy metals in young nebulae in our galaxy, the Milky Way, will be made. From these observations, we expect to observe whether a gradient in the abundance of the heavy metals exists as a function of distance from the center of the galaxy. These metals have been added to the interstellar gas by virtue of various mass loss mechanisms from older stars in the neighborhood, which have produced heavy elements in their interiors through nuclear reactions. In order to understand the evolution of the galaxy, we need to know the magnitude of the gradient. The research will be done in collaboration with airborne observers using the NASA C-141 airborne observatory.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0016, ANALYSIS OF ULTRAVIOLET STELLAR SPECTRA OBTAINED WITH SKYLAB EXPERIMENT S-019

K.G. Henize, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NAS 8-31459)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0017, SPECTROPHOTOMETRY OF VARIABLE QUASI-STELLAR OBJECTS

H. Netzer, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST78-15916)

Spectrophotometric observations of variable quasi-stellar objects (QSOs) will be made using modern digital detectors at McDonald Observatory. Variations in the emission-line strengths on a monthly time scale will be searched for and any such changes will be correlated with changes in the QSO continuum radiation. The results should put further constraints on theoretical models of QSOs.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0018, THE EVOLUTION AND DYNAMICS OF EXPLODING STARS

J.C. Wheeler, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST78-23326)

Several lines of evidence indicate that the progenitors of some supernovae may be helium stars of moderate or extreme hydrogen deficiency. The structure and evolution of helium stars and their possible connection to supernovae will be explored.

Some supernovae may explode within the dense confines of molecular clouds. Calculations which explore the outcome of such events will be made. A number of different cases will be considered. These will range from the case where the supernova takes place within a very dense cloud to the case where the explosion occurs in a cluster of young stars that has already formed. In the latter case the explosion may sweep away the remnant molecular gas surrounding the cluster.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0019, MEASUREMENT OF SOLAR ULTRAVIOLET SCATTERED LIGHT IN THE STRATOSPHERE AND DEDUCTION OF J-VALUES

L.L. Jensen, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (ATM78-17616)

Solar ultraviolet radiation dissociates molecules in the stratosphere and thereby initiates a complex chain of chemical reactions that determines the composition of the stratosphere, including the concentration of stratospheric ozone. In addition to the direct component of the solar ultraviolet, there is a substantial contribution to dissociation from scattered ultraviolet radiation. This research will measure the scattered flux at altitudes up to about 40 km with a balloon-borne spectrometer. The experimental results will be used to check the validity of single-scattering and multiple-scattering theoretical models and to calculate photodissociation rates based on the scattered fluxes. A search will also be conducted for unique atmospheric volumes where deviation from normal scattering occurs, possibly because of the presence of particulate material.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Atmospheric Sciences

10.0020, SCIENTIFIC INVESTIGATIONS IN SUPPORT OF THE SPACE TELESCOPE PROJECT

D.J. Schroeder, Beloit College, Graduate School, Dept. of Physics & Astronomy, *Beloit, Wisconsin* 53511 (NAS 8-32901)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

10.0021, AN INVESTIGATION OF THE CHEMISTRY, EXCITATION, AND DISTRIBUTION OF INTERSTELLAR AND CIRCUMSTELLAR POLYCYANOACETYLENES

E.B. Churchwell, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Astronomy, *500 Lincoln Dr., Madison, Wisconsin* 53706 (AST79-05578)

A two year program to investigate possible chemical pathways of interstellar polycyanoacetylenes will be carried out. The approach will be an empirical determination of the distributions and column densities of several simpler molecular species thought to be important precursors of cyanoacetylene (HC3N) in several small dark cloudlets where HC3N and heavier cyanoacetylene species are observed to be abundant. Equal importance is placed on the relative distributions of reactants and products as on their column densities since spatial coincidence can in some cases be an important test of chemical pathways. Specifically, the presence of cyanide, cyanic acid, and acetylene radical will be mapped to compare with the ammonia, HC3N and cyanodiacetylene distributions in several cloudlets in the Taurus region. High resolution spectra will be taken and the data reduced to analyze the dynamics and radiative transfer of line emission in these clouds. It appears that some condensations in the Taurus complex are enhanced in HCnN species. This question will be investigated further by searching to low noise levels for HCnN species outside the Taurus region. Recent detections of molecules in the infrared source IRC-10216 indicate that HCnN species are generally enhanced in carbon stars with extensive envelopes. Excitation of HCnN species is expected to be different in carbon star envelopes than in dark clouds. It seems important to pursue this further by searching for HCnN species in other carbon stars with fairly large infrared excesses. There will also be similar projects carried out which are related to the chemistry of interstellar molecules.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

GENERAL

11.0001, OPERATION OF A STATE TECHNOLOGY APPLICATION CENTER

Unknown, State University System of Florida, *Tallahassee, Florida* 32306 (NASW 3060)

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01 AERONAUTICS (GENERAL)

N80-14017# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
ADVANCES IN GUIDANCE AND CONTROL SYSTEMS USING DIGITAL TECHNIQUES
Aug. 1979 357 p refs In ENGLISH and FRENCH Presented at the Guidance and Control Panel Symp., Ottawa, 8-11 May 1979
(AGARD-CP-272; ISBN-92-835-0247-7) Avail: NTIS HC A16/MF A01

The application of digital methods to guidance and control systems is considered. Functional design concepts, trends, and requirements, advances in analytical and design techniques, and advances in digital system design and architecture to assure high integrity are among the topics covered. Data processing and computation techniques, software design validation techniques, including simulation, and operational and system development experience are included. For individual titles, see N80-14018 through N80-14043.

N80-14018*# Milco International, Inc., Huntington Beach, Calif.
STATE OF THE ART FOR DIGITAL AVIONICS AND CONTROLS, 1978 **c06**
Richard K. Smyth *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 20 p refs (For primary document see N80-14017 05-01)
(Contract NASw-2691)
Avail: NTIS HC A16/MF A01 CSCL 02A

A brief summary of a comprehensive state of the art survey is presented. The survey includes five broadly applicable technology areas: flight path management, aircraft control systems, crew station & human factors, integration & interfacing technology, and fundamental technology. In addition the survey included military technologies which have a technology transfer potential to the five broadly applicable technology areas. J.M.S.

N80-14019# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Flight Control Div.
A FLIGHT CONTROL SYSTEM USING THE DAIS ARCHITECTURE **c08**
A. P. DeThomas and R. A. Hendrix *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 9 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

The development of a digital flight control system simulation capability to examine advanced integrated control architectures, in order to increase system performance and availability, is described. Near term issues, such as multiplexing interfaces with other avionics functions and structuring of software, are covered. J.M.S.

N80-14020# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
TRENDS IN DIGITAL DATA PROCESSING AND SYSTEM ARCHITECTURE **c60**
A. A. Callaway *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 5 p (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

The utilization of airborne digital computers and methods for their integration into digital avionic systems are discussed. The architecture of two aircraft systems, one designed in the 1960s and one in the 1970s is described. The growth in complexity is discussed in terms of two factors: the total flow of data between the subsystems which form the elements of the system, and the total volume of the computing task in terms of the number of words of program required. Techniques which may assist in alleviating the growing complexity are then considered. These include: design management aids, such as requirement statement languages; architectural considerations, such as multiplex data busses and distributed processing; and software techniques, such as high level languages, MASCOT, and structured programming. J.M.S.

N80-14021# Societe Crouzet, Valence (France).
A METHOD FOR DESIGNING MULTIPROCESSOR ARCHITECTURES FOR AVIONICS FUNCTIONS [METHODOLOGIE DE CONCEPTION D'ARCHITECTURES MULTIPROCESSEURS POUR DES FONCTIONS D'AVIONIQUE] **c60**
C. Aleonard, A. Demoment, P. Romand, J. Gillon (CERT, Toulouse, France), and J. F. LeMaitre (CERT, Toulouse, France) *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 7 p In FRENCH (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

A digital technique is given for the design of high performance automatic systems. The evolution of digital techniques presents the automatist with the problem of the total design of a control system. It means going beyond algorithmic synthesis from the beginning, to take into account all the functional and operational aspects. Thus, it is possible to optimize the control system according to three important criteria: regard for the desired operating performances, the total cost, and the very important matter of operational safety (reliability, security, maintainability, and availability). Transl. by A.R.H.

N80-14022# Singer-Kearfott, Wayne, N. J.
FORTRAN FOR AVIONICS **c06**
Austin J. Maher *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 8 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

The approach taken to address the use of high order languages (HOL) is described. A review is presented of the interim languages stipulated by the DOD and the reasons for selecting FORTRAN as the basis of a compiler activity to provide competitive HOL capability. The rationale for selecting the oldest and least modern of the six interim languages, and the design approach to select a suitable language dialect for efficient implementation of avionic software without violating the stipulations of the ANSI Standard for FORTRAN are included. The success is described of the

effort to develop a low-cost compiler for the FORTRAN dialect which generates a highly efficient object code in the tradition of the many highly efficient FORTRAN compilers which have been developed for commercial computers. F.O.S.

N80-14023# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

AN OBSERVER SYSTEM FOR SENSOR FAILURE DETECTION AND ISOLATION IN DIGITAL FLIGHT CONTROL SYSTEMS c08

Norbert Stuckenberg *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 11 p refs (For primary document see N80-14017 05-01)

Avail: NTIS HC A16/MF A01

For the sensor part of a flight control system a sensor failure detection and isolation concept is presented based on analytic redundancy. A conventional triplex sensor system is replaced by a duplex sensor system without loss of the fail-operational property. In the case of a sensor failure, deterministic Luenberger observers provide the information about which of the two sensors of the duplex system actually failed. The proposed concept is applied to a command and stability system of a flight control system. Author

N80-14024# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).

AUTOMATIC RECOVERY AFTER SENSOR FAILURE ONBOARD c06

Marc Labarrere, Marc Pelegrin, and Marc Pircher *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 12 p refs (For primary document see N80-14017 05-01)

Avail: NTIS HC A16/MF A01

Two techniques are developed which provide reliable failure detection and isolation for a dual-redundant subset of sensors. A global procedure using a bank of stationary Kalman filters is described. Some difficulties of this technique lead to a sub-optimal procedure which is developed in order to give all the dynamic and static relationships between the measured outputs on the aircraft. These techniques are sucessfully applied to simulated sensor failure on a six degree of freedom aircraft simulation and are applying to sensor failures injected on flight data from the N262 aircraft. F.O.S.

N80-14025# Marconi Avionics Ltd., Rochester (England). Flight Automation Research Lab.

RECENT ADVANCES IN FIBRE OPTICS FOR HIGH INTEGRITY DIGITAL CONTROL SYSTEMS c08

R. P. G. Collinson *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 16 p (For primary document see N80-14017 05-01)

Avail: NTIS HC A16/MF A01

The methods for using fiber optic cables for interconnecting the elements of an active control system, and the advantages and disadvantages are discussed. The major factors in the use of fiber optics are practical ones, connectors, terminations, ruggedness, and environmental capability of cables. The techniques are described which were developed to make a fiber bundle a practical cable link. The use of multi-access optical highways, particularly for interfacing other systems with the flight control system, (e.g. Air Data and IN systems) is reviewed and principles of the candidate networks outlined. Finally, a new concept for a fiber optic multi-access network is presented which is fully compatible with the new data transmission specification. F.O.S.

N80-14026# General Dynamics/Fort Worth, Tex.

REDUNDANCY MANAGEMENT CONSIDERATIONS FOR A CONTROL-CONFIGURED FIGHTER AIRCRAFT TRIPLEX DIGITAL FLY-BY-WIRE FLIGHT CONTROL SYSTEM c08

John H. Watson, William J. Yousey, and James M. Railey *In* AGARD Advan. In Guidance and Control Systems Using Digital Tech. Aug. 1979 23 p ref (For primary document see N80-14017 05-01)

(Contract F33615-77-C-3036)

Avail: NTIS HC A16/MF A01

To preclude the shut down of the flight control computers for control configured fighter aircraft, redundant (parallel) processing is used in conjunction with redundancy management concepts. Using reliability requirements and goals as expressed in loss-of-control per flight hour, a digital flight control system architecture is evolved with specific emphasis placed on the input, processor and output subsystems. The incorporation of an analog cross strapping of lower reliability sensors is shown to be an effective means of increasing system reliability by retaining sensor redundancy after a computer failure. A technique called control law reconfiguration is developed which insures system survival after a second like sensor failure. Computer contribution to loss-of-control is reduced by the addition of system monitors which increase the computer self-test confidence level. The resultant architecture is shown to have an inherent reliability which is relatively insensitive to the configuration of the actuator interface, thus allowing this interface to be designed based on hardware/software complexity tradeoffs. A.R.H.

N80-14027# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.

FAILURE DETECTION, ISOLATION AND INDICATION IN HIGHLY INTEGRATED DIGITAL GUIDANCE AND CONTROL SYSTEM c08

Wolfgang J. Kubbat *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 17 p (For primary document see N80-14017 05-01)

Avail: NTIS HC A16/MF A01

A broad spectrum of modern failure detection and isolation techniques is discussed and it is shown that the failure problem can be significantly reduced with technology and design. Several advanced methods such as vector redundancy, dissimilar redundancy, and methods applied to computers are described and some are backed up by practical examples. Data bus orientated guidance and control systems are considered. Based upon a practical realization example, guidelines are given for the use of MIL STD 1553 B in redundant applications. A.R.H.

N80-14028# Electronique Marcel Dassault, St. Cloud (France).

THE INTEGRITY OF ONBOARD COMPUTER PROGRAMS: A SOLUTION [L'INTEGRITE DES LOGICIELS EMBARQUES: UNE SOLUTION] c06

G. Germain *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 8 p refs In FRENCH (For primary document see N80-14017 05-01)

Avail: NTIS HC A16/MF A01

A solution is provided for insuring the integrity of the operating system onboard aircraft and engines. The principle effect is to increase the security of the system so as to make it homogeneous with that of the material, which in the case considered, is very high. Interesting consequences are found in the level of reliability and maintainability of the system, as well as the costs of validation. The means used are the simplest and most economical possible. They are applied to the structure of the operating system and hardware of a computer well adapted for onboard applications. Emphasis is placed on mechanisms for controlling address, which prevents all untimely destruction of the software. Transl. by A.R.H.

N80-14029# Hamilton Standard, Farmington, Conn.

A REDUNDANT INERTIAL NAVIGATION SYSTEM FOR IUS c16

R. A. Baum, G. E. S. Morrison (Boeing Aerospace Co., Seattle, Wash.), and R. C. Peters (Aerospace Corp., Los Angeles, Calif.) *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 11 p refs (For primary document see N80-14017 05-01)

Avail: NTIS HC A16/MF A01

A high-performance strapdown redundant inertial navigation system (RINS) being developed for the space transportation system inertial upper stage (IUS) is described and an overview of the test results obtained to date is presented. The IUS RINS is the first navigation system specifically designed to provide a fully redundant configuration with self-contained redundancy management algorithms which will permit the system to experience an in-flight failure and then automatically detect, isolate, and eliminate the field element and continue the mission without loss or out-of-specification degradation of the guidance function. A.R.H.

N80-14030# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse de Systemes.
DEFINITION OF THE HIERARCHICAL NETWORK FOR AGGRESSIVE ENVIRONMENTS (RHEA) c32
M. Buis, J. C. Laprie, J. Marco, and D. R. Powell *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 15 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

The transmission level of a dependable data communication support system intended for the reliable and survivable interconnection of data processing units (subscribers) in an aggressive environment is described. The functional and dependability specifications of this system lead to the definition of a hierarchical architecture using a network-structured, damage and fault-tolerant global transmission medium and star-structured, fault-tolerant local transmission media. The contention method is used for control of access to the transmission media. A standard transmission-medium/subscriber interface is defined that implements an associative addressing scheme in order to cater for data broadcasting modes and facilitated dynamic system reconfiguration. Throughout the design, a top-down approach was adopted with the use of qualitative and quantitative evaluations at each level in order to make motivated choices among the different possible solutions. A.R.H.

N80-14031# Defence Research Establishment, Ottawa. (Ontario).
DEVELOPMENT OF AIDING GPS/STRAPDOWN INERTIAL NAVIGATION SYSTEM c04
D. F. Liang, D. B. Reid (Lapp (Philip A.) Ltd., Toronto), R. H. Johnson (S and S Software Ltd., Ottawa), and B. G. Fletcher *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 15 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

An overview is presented of the design and development of an integrated multisensor navigation system comprised of a NAVSTAR GPS receiver, an aiding strapdown inertial navigation system (ASIN) and a number of auxiliary sensors, namely, air data and strapdown magnetic sensors. In the present phase, comprehensive software packages were developed to simulate all the subsystems used. A modular and computationally efficient Kalman filtering algorithm was designed and implemented for the integration of the GPS and ASIN. During the course of the development, two techniques were developed. An exact algorithm was derived to transform inertially referenced data into geographic coordinates. Also, a dual channel attitude algorithm was formulated which increases the bandwidth of the attitude computation in the strapdown navigator. Other routines developed include the baro-damping algorithm, auxiliary sensor processing and calibration routines. To provide a baseline level of performance, simulation results were obtained for future flight testing of the hardware. M.M.M.

N80-14032# Standard Elektrik Lorenz A.G., Stuttgart (West Germany).
DIGITAL ARRAY SIGNAL PROCESSING TECHNIQUES APPLIED TO GUIDANCE AND NAVIGATION c32
S. Bloch *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 13 p (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

Spatial filtering, in particular virtual beam forming techniques, appropriate for guidance and precision landing operations, is discussed. Systems operating at L-Band are described demonstrating that when appropriate digital signal processing is applied, accuracy comparable to that of corresponding C-Band systems is achievable. Thus, the advantages of relatively low L-Band frequencies, may be exploited while maintaining a high degree of precision. M.M.M.

N80-14033# McMaster Univ., Hamilton (Ontario).
MICROCOMPUTER-BASED ON-LINE STATE ESTIMATION WITH APPLICATIONS TO SATELLITES c13
N. K. Sinha, S. Y. Law (Commun. Res. Centre, Ottawa), and R. Mamen *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 11 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

The use of a Luenberger-type observer with an adaptive filter is discussed for estimating the states of a nonlinear system from the noise-contaminated measurements of the output of the system. The proposed method requires much less computation than the extended Kalman filter and, therefore, can be implemented more easily on a microcomputer. Application to the determination of the orbital states of the unified state model of a satellite is considered. Author

N80-14034# Twente Univ. of Technology, Enschede (Netherlands). Dept. of Electrical Engineering.
METHODS FOR STRAP-DOWN ATTITUDE ESTIMATION AND NAVIGATION WITH ACCELEROMETERS c04
R. P. Offereins and M. J. L. Tiemego *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 20 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

Methods are presented for calculating the attitude of a vehicle from the signals of three linear and three angular accelerometers which are rigidly attached to the vehicle. Also course, velocity and position measurements relative to some object can be used. Apart from the attitude, the velocity and position, with respect to this object, are also obtained as output signals. In fire control systems, filters for target position prediction and attitude determination can be combined in this way. M.M.M.

N80-14035# Contraves Italiana, Rome.
DIGITAL SIGNAL PROCESSING TECHNIQUES IN A MONOPULSE TRACKING RADAR c32
U. Fazio, F. Ambrosioni, and C. DeBonis *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 12 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

A description of a special-purpose Signal Processor is given. Since the Processor is highly flexible, it can be applied in a wide range of modern ground or ship-borne tracking radars, such as, Fire Control Radar for rockets or for conventional artillery (ground or anti-aircraft), Instrumentation Radar, and Tracking Radar for Command to line-of-sight missile guidance. Illustrated are the three main functions of the processor, considered as being associated to a fully-coherent monopulse radar: signal enhancement based on an FFT (Fast Fourier Transform) algorithm, tracking errors computation and system logic control. A description is given, especially as regards the FFT part, of the practical realization of each block, based on a wide use of the most modern digital techniques and of microprogrammed controls in particular, that have enabled high flexibility and growth potential to be obtained. In the description, it can be seen how the design trade-off costs/performances have led to the predominant use of well-known techniques and widely used electronic circuitry, excluding custom components. M.M.M.

N80-14036# Lockheed-Georgia Co., Marietta.
AN ASSESSMENT OF AND APPROACH TO THE VALIDATION OF DIGITAL FLIGHT CONTROL SYSTEMS c08
D. B. Mulcare and W. G. Ness *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 12 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

Flight-critical digital flight control system functions are evaluated in the context of farther term implementations. The quality and safety associated with fault tolerant, highly integrated, control oriented system implementations are emphasized. Technology needs are addressed so that the verification and validation process for advanced digital flight control systems can be sufficiently developed and purposefully accomodated in system engineering methodologies. K.L.

N80-14037# Electronique Marcel Dassault, St. Cloud (France).
THE AVIONICS COMPUTER PROGRAM: PRACTICAL EXPERIENCES WITH A METHODOLOGY [LOGICIEL AVIONIQUE: EXPERIENCES PRATIQUES D'UNE METHODOLOGIE] c08
J. Perin *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 17 p In FRENCH (For primary document see N80-14017 05-01)

Avail: NTIS HC A16/MF A01

The organization and methodology used in the construction of operating systems in the principle computers of the Mirage F1 and Mirage 200 aircraft are described. Particular emphasis is placed on the definition phases and program validation.

Transl. by A.R.H.

N80-14038/j Westland Helicopters Ltd., Yeovil (England).
EXPERIENCE IN PRODUCING SOFTWARE FOR THE GROUND STATION OF A REMOTELY PILOTED HELICOPTER SYSTEM c08
J. P. Webby, P. L. Wescott, M. I. Tucker, and H. M. Smith. *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 9 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

A computer system to control the aircraft, produce graphic displays, and handle data received from the aircraft was produced using the Modular Approach to System Construction, Operation, and Test, written in CORAL 66 language. The overall design of the software and the methods used to design, code, and test the software system are described in detail.

K.L.

N80-14039*/j National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SIMULATION USE IN THE DEVELOPMENT AND VALIDATION OF HIMAT FLIGHT SOFTWARE c61
Albert Myers. *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 12 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01 CSCL 09B

The use of real time simulation in the development and validation of flight software for the highly maneuverable aircraft technology (HiMAT) remotely piloted research vehicle is described. Four simulations are interfaced with varying amounts of actual flight hardware to produce dynamic system operation.

K.L.

N80-14040/j Raytheon Co., Bedford, Mass. Missile Systems Div.
FEDERATED MICROCOMPUTER SYSTEMS FOR ONBOARD MISSILE GUIDANCE AND CONTROL c15
Frank J. Langley, David S. Siegel (ONR, Arlington, Va.), Wayne F. Savage (NSWC), and Rollin E. Wehman. *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 15 p refs Sponsored by ONR and NSWC (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

Modular digital missile guidance and control systems were analyzed, structured, and built using standard industry microprocessors/microcomputers and associated memory and input/output interface components. The types of missiles considered were air-to-air, ship-to-air, and ship-to-ship, while the guidance and control functions analyzed were target seeker signal processing, seeker head control and stabilization, state estimation, guidance laws, autopilots, ramjet engine throttle control, warhead fuzing, telemetry, and self test. Federal microcomputer systems were found to support hardware modularity at the system level, and a set of 'macrofunction' microcomputer modules provided the desired flexibility at the component level.

K.L.

N80-14041/j Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
COPRA: A NEW LINE OF ULTRARELIABLE RECONFIGURABLE COMPUTERS DESTINED FOR ONBOARD AEROSPACE APPLICATIONS [COPRA: UNE LIGNE NOUVELLE DECALCULAETEURS RECONFIGURABLES ULTRAFIABLES DESTINEE AUX APPLICATIONS AEROSPATIALES EMBARQUEES] c60
C. Meraud and F. Browseys. *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 23 p In FRENCH (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

A computer with automatic parallel reconfigurable organization, COPRA covers a gamut going from a redundant monoprocessor (200 kops/sec) to reconfigurable multiprocessors (400, 600, and 800 kops/sec). A model was constructed and a prototype is under development. It corresponds to a double-duplex configuration capable of surviving at least a first complete breakdown, as well as transitory breakdowns of a transparent kind during programming, which considerably simplifies the development of the application operating system. The microprogrammed means for error detection and for automatic recovery and reconfiguration are explained. Some technical aspects, notably the use of CMOS on SOS, are discussed. Some uses are predicted on a supervisory level for facilitating the programming of degradation of the mission. A Markov model permits a precise estimation of reliability which, for the configuration being developed, will be in the neighborhood of 95% over 5 years, with an undetected error rate on the order of .10 to the minus 10 power per hour.

Transl. by A.R.H.

N80-14042/j Litton Systems (Canada) Ltd., Rexdale, (Ontario).
A HIGH ACCURACY FLIGHT PROFILE DETERMINING SYSTEM c05
Peter Roy Vousden and Peter Jonathon Golloop. *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 16 p (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

The characteristics of a system that determines the flight profile of an aircraft in three orthogonal coordinates to an accuracy of a few feet are described. A standard commercial quality inertial navigation system provides the required aircraft dynamic and attitude data while a special infrared sensor provides periodic updates. A digital computer implements an 18 state Kalman filter for estimation of the inertial errors. Filter data is stored on magnetic tape for immediate reprocessing by a fixed interval Bryson-Frazier smoothing algorithm that further refines the system performance. The techniques, applied in real time, are controlled in a multitask environment by a software operating system. Applications for the systems capability are discussed with emphasis on the initial purpose of providing an accurate self contained trajectory measuring system for ILS and MLS flight checking. Other uses such as airborne surveying and weapon release determining systems are examined.

A.W.H.

N80-14043/j Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INTEGRATION OF FLIGHT AND FIRE CONTROL c06
Robert K. Huber. *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 9 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

An evaluation of an integrated flight and fire control (IFFC) system in modern fighter aircraft is described. The IFFC systems for air to air gunnery, air to ground gunnery, and bombing are outlined. The concept involves the coupling of fire control commands into the flight control system. The concept will be tested on a F-15B aircraft. Primary modifications to the F-15B aircraft include the addition of a digital computer for flight control and fire control signal processing, an electro-optical tracker, and a 1553A multiplex bus for communication between the F-15 central computer, the tracker, and the added digital computer. The IFFC concepts, the planned hardware implementation on the F-15B, and safety of flight considerations are discussed.

A.W.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-14044 Virginia Univ., Charlottesville.
MAGNUS EFFECT ON SPINNING BODIES OF REVOLUTION Ph.D. Thesis
Dinesh Satyaprakash Joshi 1979 94 p
Avail: Univ. Microfilms Order No. 7927978

A numerical finite difference method is developed to solve the three dimensional laminar/turbulent boundary layer equations on a spinning body of revolution at an angle of attack in supersonic flow. Influence of asymmetric transition and the presence of mixed boundary layers is considered to predict Magnus forces

and moments. Several contributions to the Magnus effects are considered. These include asymmetric boundary layer displacement thickness, centrifugal pressure, and primary and cross flow wall shear stress. Dissert. Abstr.

N80-14046*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SONIC-BOOM WAVE-FRONT SHAPES AND CURVATURES ASSOCIATED WITH MANEUVERING FLIGHT
Raymond L. Barger Dec. 1979 30 p refs
(NASA-TP-1611; L-13339) Avail: NTIS HC A03/MF A01 CSCL 01A

Sonic-boom wave shapes and caustic lines generated by an airplane performing a general maneuver are studied. The equations are programmed for graphical output as a perspective view of the wave shape. This quasi three-dimensional presentation provides a qualitative insight into the effects of the maneuver on the wave shape and the caustic locations. For the special case of planar maneuvers, the principal curvatures of the wave front are derived. These curvatures are needed to calculate the sound field in the vicinity of a caustic. The results of the analysis are applicable not only to sonic-boom studies but also to the calculation of noise generated by a supersonic rotor or propeller blade tip. Author

N80-14048*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AERODYNAMIC CHARACTERISTICS AT LOW REYNOLDS NUMBERS OF SEVERAL HEAT EXCHANGER CONFIGURATIONS FOR WIND-TUNNEL USE
William G. Johnson, Jr. and William B. Igoe Dec. 1979 54 p refs
(NASA-TM-80188; L-13307) Avail: NTIS HC A04/MF A01 CSCL 01A

In response to design requirements of the National Transonic Facility, aerodynamic tests were conducted to determine the pressure-drop, flow-uniformity, and turbulence characteristics of various heat-exchanger configurations as a function of Reynolds number. Data were obtained in air with an indraft flow apparatus operated at ambient temperature and pressure. The unit Reynolds number of the tests varied from about 0.06 x 10 to 6th power to about 1.3 x 10 to 6th power per meter. The test models were designed to represent segments of full-scale tube bundles and included bundles of round tubes with plate fins in both staggered and inline tube arrays, round tubes with spiral fins, elliptical tubes with plate fins, and an inline grouping of tubes with segmented fins. Author

N80-14047*# Nevada Univ., Las Vegas.
TWO DIMENSIONAL AERODYNAMIC INTERFERENCE EFFECTS ON OSCILLATING AIRFOILS WITH FLAPS IN VENTILATED SUBSONIC WIND TUNNELS
Joseph Fromme, Michael Golberg, and John Werth Washington NASA Dec. 1979 150 p refs
(Grant NaG-2140)
(NASA-CR-3210) Avail: NTIS HC A07/MF A01 CSCL 01A

The numerical computation of unsteady airloads acting upon thin airfoils with multiple leading and trailing-edge controls in two-dimensional ventilated subsonic wind tunnels is studied. The foundation of the computational method is strengthened with a new and more powerful mathematical existence and convergence theory for solving Cauchy singular integral equations of the first kind, and the method of convergence acceleration by extrapolation to the limit is introduced to analyze airfoils with flaps. New results are presented for steady and unsteady flow, including the effect of acoustic resonance between ventilated wind-tunnel walls and airfoils with oscillating flaps. The computer program TWODI is available for general use and a complete set of instructions is provided. Author

N80-14048*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
A THREE DIMENSIONAL VORTEX WAKE MODEL FOR MISSILES AT HIGH ANGLES ON ATTACK Final Report
J. Steven Sheffield and F. D. Deffenbaugh Jan. 1980 59 p refs
(Contract NAS2-9578)
(NASA-CR-3208; TRW-30584-6003-RU-00) Avail: NTIS HC A04/MF A01 CSCL 01A

A three dimensional model for the steady flow past missile and aircraft nose shaped bodies is presented based on augmenting a potential solution with a wake composed of vortex filaments. The vortex positions are determined by the requirement that they, in some sense, align with the flow. The aerodynamic loads on the body are compared with experimental values and used to evaluate the model. The vortex positions compare well with flow visualization results for slender bodies at high angles of attack. The approximations in the wake near the body cause peaks in the force distributions more severe than in the measured values. For given vortex strengths and body attachment points multiple steady vortex positions were not found. Author

N80-14049*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECT OF TIP PLANFORM ON BLADE LOADING CHARACTERISTICS FOR A TWO-BLADED ROTOR IN HOVER
John D. Ballard, Kenneth L. Orloff, and Alan B. Luebs (Gates Lear Corp., Wichita, Kan.) Nov. 1979 89 p refs
(NASA-TM-78615; A-7939) Avail: NTIS HC A05/MF A01 CSCL 01A

A laser velocimeter was used to study the flow surrounding a 2.13 m diam. two-bladed, teetering model-scale helicopter rotor operating in the hover condition. The rotor system employed interchangeable blade tips over the outer 25% radius. A conventional rectangular planform and an experimental ogee tip shape were studied. The radial distribution of the blade circulation was obtained by measuring the velocity tangent to a closed rectangular contour around the airfoil section at a number of radial locations. A relationship between local circulation and bound vorticity was invoked to obtain the radial variations in the sectional lifting properties of the blade. The tip vortex-induced velocity was also measured immediately behind the generating blade and immediately before the encounter with the following blade. The mutual influence between blade loading, shed vorticity, and the structure of the encountered vortex are quantified by the results presented and are discussed comparatively for the rectangular and ogee planforms. The experimental loading for the rectangular tip is also compared with predictions of existing rotor analysis. Author

N80-14050*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LASER ANEMOMETER MEASUREMENTS IN A TRANSONIC AXIAL FLOW COMPRESSOR ROTOR
Anthony J. Strazisar and J. Anthony Powell 1979 17 p refs
Presented at 25th Ann. Intern. Gas Turbine Conf. and 22d Ann. Fluids Engr. Conf., New Orleans, 9-13 Mar. 1970; sponsored by ASME
(NASA-TM-79323; E-279) Avail: NTIS HC A02/MF A01 CSCL 01A

A laser anemometer system employing an efficient data acquisition technique was used to make measurements upstream, within, and downstream of the compressor rotor. A fluorescent dye technique allowed measurements within endwall boundary layers. Adjustable laser beam orientation minimized shadowed regions and enabled radial velocity measurements outside of the blade row. The flow phenomena investigated include flow variations from passage to passage, the rotor shock system, three-dimensional flows in the blade wake, and the development of the outer endwall boundary layer. Laser anemometer measurements are compared to a numerical solution of the streamfunction equations and to measurements made with conventional instrumentation. Author

N80-14051*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODIFICATION OF AXIAL COMPRESSOR STREAMLINE PROGRAM FOR ANALYSIS OF ENGINE TEST DATA
Jeffrey G. Williams Nov. 1979 49 p refs
(NASA-TM-79312; E-268) Avail: NTIS HC A03/MF A01 CSCL 01A

An existing axial compressor streamline analysis computer program to allow input of measured radial pressure and temperature profiles obtained from engine or cascade data is described. The proposed modifications increase the input flexibility

and are accomplished without changing the computer program's input format. A.R.H.

N80-14052*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
THE QUASI-VORTEX-LATTICE METHOD FOR WINGS WITH EDGE VORTEX SEPARATION Final Report
Jenn-Louh Pao and Edward Lan Jan. 1980 25 p refs
(Grant NsG-1537)
(NASA-CR-162530; CRINC-FRL-385-1) Avail: NTIS HC A02/MF A01 CSCL 01A

The aerodynamic characteristics of wings with leading-edge vortex separation were predicted using a method based on a flow model with free vortex elements which are allowed to merge into a concentrated core. The calculated pressure distribution is more accurate than that predicted by methods with discrete vortex filaments alone. In addition, the computer time is reduced approximately by half. A.R.H.

N80-14053*# Old Dominion Univ. Research Foundation, Norfolk, Va.
THEORETICAL STUDY OF AERODYNAMIC CHARACTERISTICS OF WINGS HAVING VORTEX FLOW Report, 1 Feb. - 31 Aug. 1978
C. Subba Reddy Nov. 1979 63 p refs
(Contract NAS1-14193)
(NASA-CR-159184) Avail: NTIS HC A04/MF A01 CSCL 01A

The aerodynamic characteristics of slender wings having separation induced vortex flows are investigated by employing three different computer codes--free vortex sheet, quasi vortex lattice, and suction analogy methods. Their capabilities and limitations are examined, and modifications are discussed. Flat wings of different configurations: arrow, delta, and diamond shapes, as well as cambered delta wings, are studied. The effect of notch ratio on the load distributions and the longitudinal characteristics of a family of arrow and diamond wings is explored. The sectional lift coefficients and the accumulated span loadings are determined for an arrow wing and are seen to be unusual in comparison with the attached flow results. The theoretically predicted results are compared with the existing experimental values. A.W.H.

N80-14054*# Old Dominion Univ. Research Foundation, Norfolk, Va.
OPTIMIZED AERODYNAMIC DESIGN PROCESS FOR SUBSONIC TRANSPORT WING FITTED WITH WINGLETS
John M. Kuhlman Dec. 1979 184 p refs
(Contract NsG-1357)
(NASA-CR-159180) Avail: NTIS HC A09/MF A01 CSCL 01A

The aerodynamic design of a wind-tunnel model of a wing representative of that of a subsonic jet transport aircraft, fitted with winglets, was performed using two recently developed optimal wing-design computer programs. Both potential flow codes use a vortex lattice representation of the near-field of the aerodynamic surfaces for determination of the required mean camber surfaces for minimum induced drag, and both codes use far-field induced drag minimization procedures to obtain the required spanloads. One code uses a discrete vortex wake model for this far-field drag computation, while the second uses a 2-D advanced panel wake model. Wing camber shapes for the two codes are very similar, but the resulting winglet camber shapes differ widely. Design techniques and considerations for these two wind-tunnel models are detailed, including a description of the necessary modifications of the design geometry to format it for use by a numerically controlled machine for the actual model construction. Author

N80-14055*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A COMPUTERIZED METHOD FOR CALCULATING FLUTTER CHARACTERISTICS OF A SYSTEM CHARACTERIZED BY TWO DEGREES OF FREEDOM
Winifred A. Stalnaker and William F. Hunter Nov. 1979 52 p ref
(NASA-TM-80153) Avail: NTIS HC A03/MF A01 CSCL 01A

A formulation is given for calculating flutter frequency and flutter speed for a problem with two degrees of freedom. Two different solutions for evaluating the flutter determinant are presented and the results for each method are compared. A program flow diagram, partial program listing, and a sample problem with input and output for the two different methods are included. Although the method was developed for computing flutter characteristics of a pylon installed in the NASA Langley VSTOL tunnel, it is sufficiently general to solve any flutter system that can be characterized by two degrees of freedom. A.R.H.

N80-14056*# Boeing Commercial Airplane Co., Seattle, Wash.
AN INVESTIGATION OF SEVERAL FACTORS INVOLVED IN A FINITE DIFFERENCE PROCEDURE FOR ANALYZING THE TRANSONIC FLOW ABOUT HARMONICALLY OSCILLATING AIRFOILS AND WINGS
F. E. Ehlers, J. D. Sebastian, and W. H. Weatherill May 1979 89 p refs
(Contract NAS1-15128)
(NASA-CR-159143; D6-48852) Avail: NTIS HC A05/MF A01 CSCL 01A

Analytical and empirical studies of a finite difference method for the solution of the transonic flow about harmonically oscillating wings and airfoils are presented. The procedure is based on separating the velocity potential into steady and unsteady parts and linearizing the resulting unsteady equations for small disturbances. Since sinusoidal motion is assumed, the unsteady equation is independent of time. Three finite difference investigations are discussed including a new operator for mesh points with supersonic flow, the effects on relaxation solution converence of adding a viscosity term to the original differential equation, and an alternate and relatively simple downstream boundary condition. A method is developed which uses a finite difference procedure over a limited inner region and an approximate analytical procedure for the remaining outer region. Two investigations concerned with three-dimensional flow are presented. The first is the development of an oblique coordinate system for swept and tapered wings. The second derives the additional terms required to make row relaxation solutions converge when mixed flow is present. A finite span flutter analysis procedure is described using the two-dimensional unsteady transonic program with a full three-dimensional steady velocity potential. Author

N80-14057# Air Force Geophysics Lab., Hanscom AFB, Mass.
PROCEEDINGS OF THE 10TH AFGL SCIENTIFIC BALLOON SYMPOSIUM
Catherine L. Rice 1 Mar. 1979 519 p refs Proc. held at Portsmouth, N.H., 21-23 Aug. 1978
(AD-A074469; AFGL-TR-79-0053; AFGL-SR-217) Avail: NTIS HC A22/MF A01 CSCL 01/3

This publication contains the Keynote Address and twenty-nine papers presented at the Tenth AFGL Scientific Balloon Symposium, 21-23 August 1978, at Portsmouth, N. H. The five sessions were entitled: Balloon Technology - Progress and Problems; Manned Flights; Stratospheric Measurements; Airship Design Concepts; and Methods and Models. GRA

N80-14058# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
HIGH ANGLE OF ATTACK CHARACTERISTICS OF DIFFERENT FIGHTER CONFIGURATIONS
Helmut John and Kraus Werner 7 Sep. 1978 40 p refs Presented at Symp. on High Angle of Attack Aerodyn., Sandefjord, Norway, 4-6 Oct. 1978
(MBB-UFE-1443(O)) Avail: NTIS HC A03/MF A01

Basic aerodynamic characteristics of different fighter configerations at separated flow beyond maximum lift where the resultant derivatives are completely different from those associated with attached flow are reviewed. The change in trim conditions is primarily dependant on wing planform and overall aircraft configuration. Results are shown for the aerodynamic development of aircraft configurations which meet these requirements and, at the same time, minimize the resulting drag penalties in the conventional angle of attack regime. Furthermore, problem areas and deficiencies must be identified to allow the definition of concepts for stabilizing such configurations artificially by aid of a flight control system. It is shown that an auxiliary momentum generating system is necessary for controlling the aircraft at

flight conditions where aerodynamic control power is not sufficient. Author (ESA)

N80-14059# Poitiers Univ. (France).
SEPARATED TURBULENT FLOW BEHIND A STALLED AIRFOIL [CHAMP D'ECOULEMENT DECOLLE TURBULENT DERRIERE UN PROFIL DECROCHE]
J. Tensi Paris Assoc. Aeron. Astronautique de France 1979 55 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-12; ISBN-2-7170-0539-0) Avail: NTIS HC A04/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

The average and oscillating velocities in separated flow areas capable of generating buffeting in stable profiles were studied in a wind tunnel. The tests were made in an incompressible flow regime on NACA 65.012 and 'Faucille' profiles, one symmetric and the other strongly cambered (for bidimensional flow), and also on a delta wing profile for three dimensional flow. The velocity - distribution charts obtained at an angle of attack of 20 deg are included. Author (ESA)

N80-14060# Laboratoire d'Aerothermique du C.N.R.S., Meudon (France).
STUDY OF THE FORMATION OF LAMINAR FLOW SEPARATION INDUCED BY THE DEFLECTION OF A CONTROL SURFACE [ETUDE DE LA FORMATION D'UN DECOLLEMENT LAMINAIRE INDUIT PAR LE BRAQUAGE D'UNE GOUVERNE]
Marie-Francoise Scibilia and Daniel Durox Feb. 1979 16 p refs In FRENCH
(Rept-79-2; Publ-598) Avail: NTIS HC A02/MF A01

The laminar flow separation induced by aileron deflection in a rarefied gas medium characterized by a Mach number of 8, Reynolds number of 2200/cm, and simulated flight altitude of 60 km was studied measuring heat transfer and comparing results with previous work under similar conditions. A fixed nul incidance was adopted. The model was nickel plated; the metallic aileron was provided with a electromagnetic deflection system and the wind tunnel tests were done at 50 K temperature and 70 micro torr pressure. The experimental results of heat flow and visualization are in good agreement with the Cheng and Kemp theories. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-14061# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Technical and Resources Management Div.
AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS: ESCAPE, RESCUE AND SURVIVAL Annual report for calendar year 1979
Donald C. Kittinger Aug. 1979 30 p refs Supersedes ASD-TR-78-21
(AD-A074906; ASD-TR-79-5038; ASD-TR-78-21) Avail: NTIS HC A03/MF A01 CSCL 06/7

This report is a part of a compilation of formalized Technology Needs TN covering Equipment Subsystems as identified in the Aeronautical Systems Division. They are based on development/operational experience, systems studies and new concepts - all related to future system applications. Their presentation is to serve a threefold purpose, i.e., 1 guidance for technology program, 2 proven development potential, and 3 engineering data/requirements essential for technology use in systems. The identified needs delineate progress desired in performance, control, design flexibility, safety and cost. GRA

N80-14062# BioTechnology, Inc., Falls Church, Va.
NAVY COMBAT SEARCH AND RESCUE Final Report
Martin G. Every Sep. 1979 57 p refs
(Contract N00014-77-C-0253)
(AD-A074593) Avail: NTIS HC A04/MF A01 CSCL 06/7

Navy Combat Search and Rescue (SAR) information was collected from aircrewmen downed in Southeast Asia, Navy and Air Force records, and Missing and Killed in Action (MIA/KIA) files. This data was analyzed to evaluate the extent and effectiveness of Navy combat SAR, and to determine if indeed it functions as one continuous phase of the aircraft escape-to-rescue process. SAR mission success/loss rates are presented along with a discussion of the key factors which were causal in determining the success or failure of these missions. This report discusses possible alternatives to conventional combat SAR, such as mid-air recovery, and shows how the combat data collected can be used to model some of these alternatives. GRA

N80-14063# Air Force Engineering and Services Center, Tyndall AFB, Fla. Directorate of Environmental Planning.
AN EVALUATION OF THE BIRD/AIRCRAFT STRIKE HAZARD AT BARKSDALE AIR FORCE BASE, LOUISIANA (SAC) Final Report
Jeffrey J. Short and James S. Kent Feb. 1979 68 p
(AD-A074390; AFESC-TM-2-79) Avail: NTIS HC A04/MF A01 CSCL 06/6

Barksdale Air Force Base was surveyed from 31 January to 9 February 1979 by the Air Force Engineering and Service Center's Bird/Aircraft Strike Hazard Team. During this period, operational and environmental factors which combine to create bird strike hazards were observed. Specific recommendations based on observations are provided to reduce the bird strike hazard. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-14064# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AIR TRAFFIC DENSITY AND DISTRIBUTION MEASUREMENTS
W. H. Harman 3 May 1979 63 p refs
(Contract DOT-FA77WAI-817; FAA Proj. 052-241-04)
(AD-A073229; FAA-RD-78-45; ATC-80) Avail: NTIS HC A04/MF A01 CSCL 01/2

The measurements made in 1976 to determine the peak air traffic density, the spatial distribution, and the variation with time for transponder equipped aircraft in the Los Angeles area and at several locations on the east coast are presented. The use of these measurements for the design and evaluation of the discrete address beacon system and the air traffic control radar beacon system is discussed. A.W.H.

N80-14065# Fondazione Ugo Bordoni, Rome (Italy).
ON RADAR IN AIR TRAFFIC CONTROL Final Report [IL RADAR NEL CONTROLLO DEL TRAFFICO AEREO]
Jul. 1979 485 p refs In ITALIAN; ENGLISH summary Proc. of lectures at CNR Aiuti alla Navagazione e Controllo del Traffic Aereo, Rome 3-5 Jul. 1979
(FUB-11-1979) Avail: NTIS HC A21/MF A01

A collection of 41 papers is presented, grouped in the following main chapters: planning and operation of radar networks, automation in air traffic control, processing and visualization of radar data, developments in primary radar, radar antennas and wave propagation, and developments in secondary radar. For individual titles, see N80-14066 through N80-14105.

N80-14066# Aeronautica Militare Italiana, Rome.
PROBLEMS RELATED TO THE DESIGN AND CONSTRUCTION OF A RADAR NETWORK Final Report [PROBLEMATICHE NELL'IMPOSTAZIONE E REALIZZAZIONE DELLA RETE RADAR]
A. Tangorra *In* Fond. Ugo Bordoni On Radar in Air Traffic

Control Jul. 1979 p 14-23 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The radar planning for Italy, issued in 1976 by the Italian Air Force, is discussed. The more interesting features connected with the construction of a radar center are examined with special regard to operational availability, automation, and costs. Some of the problems of the execution phase are especially analyzed, including siting criteria, social and administrative problems, and coordination between various organizations involved.

Author (ESA)

N80-14067# Selenia S.p.A., Rome (Italy). Div. Radar e Sistemi Civili.
METHODOLOGY FOR THE EVALUATION OF A RADAR SITE Final Report [METODOLOGIA DI VALUTAZIONE DI UN SITO RADAR]
B. Labozzetta *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 25-30 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The technical and economical factors involved in a radar site selection are described. The operation requirements are expressed as covered volume, and data flow rate. The macrositing and micrositing criteria are discussed jointly with the analysis of the factors that determine the radar performance for reducting the candiuate sites. The fixed echoes, the angles, other signal interference, the overall visibility, and the impact on environment are examined as relevant to the procedure. The analysis is limited to implementation cost only. Running costs are deemed similarly structured.

Author (ESA)

N80-14068# Selenia S.p.A., Rome (Italy).
PERFORMANCE EVALUATION METHODS OF A SECONDARY RADAR NETWORK Final Report [METODI DI VALUTAZIONE DELLE PRESTAZIONI DI UNA RETE DI RADAR SECONDARI]
G. Fraschetti and U. Merlo (Fond. Ugo Bordoni, Rome) *In* Fond. Ugo Bordoni On radar in Air Traffic Control Jul. 1979 p 31-41 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

Interference in secondary surveillance radar is evaluated. Analytical and simulation methods for the evaluation of the effects of sensor network and transponder spatial density on detection probability, azimuth measurement, and code identification are proposed. Some results obtained under a typical Italian air traffic condition, taking into account propagative effects, are reported. Extention of the proposed methods to the case of monopulse radar is also outlined.

Author (ESA)

N80-14069# Compagnia Italiana Servizi Tecnici, Rome.
ORGANIZATION OF AN INTEGRATED GLOBAL MAINTENANCE SERVICE Final Report [ORGANIZZAZIONE DI UN SERVIZIO INTEGRATO DI MANUTENZIONE GLOBALE]
R. Grazi *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 43-54 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The development of integrated maintenance techniques is examined to better satisfy the requirements of a future comprehensive radar system. The present situation is described showing that the present organization for air traffic control is adequate for present and immediate future requirements. For the planned expansion of the radar network an automated, and centralized radar control is proposed. The details of the technical control centers and the organization of the new system are discussed.

Author (ESA)

N80-14070# Consiglio Nazionale delle Ricerche, Rome (Italy). Centro di Studi dei Sistemi di Controllo e Calcolo Automatici.
AUTOMATION OF FLIGHT ON-LINE STRATEGIC CONTROL: THE CASE OF SPEED CONTROL ON PRE-ESTABLISHED ROUTES Final Report [L'AUTOMAZIONE DEL CONTROLLO STRATEGICO ON-LINE DELVOLI: IL CASO DEL CONTROLLO DI VELOCITA' SU ROTTE PRESTABILITE]
L. Bianco, M. Cini, and L. Grippo *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 58-68 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The problem of on-line strategic control is examined with reference to speed control on preassigned routes, and under the hypothesis that planning is performed for each flight on the basis of the first in, first out discipline. The control problem is formulated as a constrained mathematical programming problem. A real time working algorithm is proposed.

Author (ESA)

N80-14071# Consiglio Nazionale delle Ricerche, Rome (Italy). Centro di Studi dei Sistemi di Controllo e Calcolo Automatici.
RADAR DATA UTILIZATION IN AUTOMATING THE SEQUENCING OF AIRCRAFTS IN TERMINAL AREAS Final Report [L'UTILIZZAZIONE DEI DATA RADAR NEL-L'AUTOMAZIONE DEL SEQUENZIAMENTO DEGLI AEREI IN AREA TERMINALE]
L. Bianco, S. Ricciardelli, G. Rinaldi, and A. Sassano *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 69-79 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

A mathematical model for aircraft sequencing is presented, and an optimizing algorithm is proposed including some tests results. The algorithm finds the optimum by progressively restricting the set of admisable sequences, and evaluating each time preset value function related to the given objectives. As a programming language FORTRAN 5 was used on a Univac 1110/22 computer for the test method. The results show satisfactory operation of the algorithm in the tested interval, especially in relation to the problem of real time operation.

Author (ESA)

N80-14072# Consiglio Nazionale delle Ricerche, Rome (Italy). Ist. di Automatica.
TACTICAL ANALYSIS OF CONFLICTS IN AN AIR TRAFFIC CONTROL SYSTEM: DESIGN AND IMPLEMENTATION OF A PROVISIONAL MODEL Final Report [ANALISI DEI CONFLITTI IN UN SISTEMA ATC SU BASE TATTICA: COSTRUZIONE DI UN MODELLO DI PREVISIONE E SUA IMPLEMENTAZIONE]
P. Bertolazzi and M. Lucertini *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 81-89 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

An algorithm for the conflict alert automated function in an air traffic control system is described. The influence of radar errors is analyzed and the numerical results on computing time and on reliability are presented. The program conflict analysis was tested with artificial data and with experimental data from Rome and Genoa. The results show that no false alarms occured, and that the average CPU time (Univac 1100/22) for a constant load of 30 artificial trajectories is in the order of one second.

Author (ESA)

N80-14073# Consiglio Nazionale delle Ricerche, Pisa (Italy). Ist. di Elaborazione dell'Informazione.
SIMULATION OF A SURVEILLANCE AND CONTROL SYSTEM OF SURFACE TRAFFIC IN AN AIRPORT Final Report [SIMULAZIONE DI UN SISTEMA DI SORVEGLIANZA E CONTROLLO DEL TRAFFICO SUPERFICIALE DI UN AEROPORTO]
M. Mercatanti, G. Bastianini, U. Ferri, and M. Saliba *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 91-101 refs In ITALIAN (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The main requirements of a program for the simulation of a surveillance and control system are examined for the case of a system using primary radar to control aircraft and service vehicles. Several complexity levels of the system are proposed corresponding to program modules. A minimum configuration of the program includes airfield definition data, simulation of radar signals from aircraft on the airport surface, recognition of the aircraft based upon radar signals and identification data given to the system at the landing stage, and representation on a video screen of the airport, and the aircraft identified by corresponding labels.

Author (ESA)

N80-14074# Selenia S.p.A., Rome (Italy).
TRACKING ALGORITHMS FOR MONO AND MULTIRADAR Final Report [ALGORITMI DI TRACKING MONO E MULTI RADAR]
S. Pardini, N. Del (Florence Univ.), and G. Zappa (Florence Univ.) *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 111-122 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

Some algorithms for target tracking by means of track-while-scan techniques are analyzed. Some models of target paths, matched to typical air traffic control trajectories, are shown. In the case of multiradar systems, additional causes of measurement error are discussed, and some ways to integrate information coming from different radars are compared. Author (ESA)

N80-14075# Selenia S.p.A., Rome (Italy). Div. Radar e Sistemi Civili.
A DISTRIBUTED PROCESSING SYSTEM FOR RADAR DATA PRESENTATION Final Report [SISTEMA DI PROCESSING E PRESENTAZIONE DATI RADAR A STRUTTURA DISTRIBUITA]
G. Barale *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 123-134 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The main processing functions used for radar data handling in air traffic control automated systems are described using the example of a distributed processing system based on a minicomputer architecture in which all the system functions are performed. Another example consisting of recent studies on a multiprocessor systems for air traffic control is also given. Author (ESA)

N80-14076# Selenia S.p.A., Rome (Italy). Div. Radar e Sistemi Civili.
FILTERING OF SYNTHETIC RADAR DATA Final Report [FILTRAGGIO DELL'INFORMAZIONE RADAR SINTETICA]
N. Iafolla and R. Petrioli (Fond. Ugo Bordoni) *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 135-142 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

Further processing of radar data coming out of the primary and secondary extractors is studied to reduce mistakes and noise level by using space and time correlations wider than those currently adopted in radar sensors and extractors. The most frequent anomalies of primary and secondary radar data are first reviewed. A detailed description of synthetic radar data filtering is presented, and then compared to a multiradar air traffic control system with distributed architecture. It includes the initial plot processing, the plot combination, the signature-plot association, the logic of signature characterization, and the multiradar combination and special processing. The aim is to simulate human operator data processing leading to a possibility of further automation of radar surveillance systems. Author (ESA)

N80-14077# Selenia S.p.A., Rome (Italy).
VISUAL DISPLAYS FOR AIR TRAFFIC CONTROL DATA Final Report [SISTEMI DI VISUALIZZAZIONE DEI DATI ATC]
Franco Odoardi *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 143-153 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

A review of visual displays for air traffic control data is presented. Topics discussed include: raw radar data and computer generated data mixed systems, maximum displayable load and readability of synthetic data in a very bright environment, dedicated displays and requirements, and color display and digital scan converter developments. Author (ESA)

N80-14078# Florence Univ. (Italy). Ist. di Elettronica.
EXPERIMENTAL CAMPAIGN FOR THE ANALYSIS OF DYNAMIC CLUTTER: THE DATA ACQUISITION SYSTEM Final Report [CAMPAGNA SPERIMENTALE PER L'ANALISI DEL CLUTTER DINAMICO: IL SISTEMA DI ACQUISIZIONE DATI]
A. Bolognin, G. DeFina (Segnalamento Marittimo ed Aereo S.P.A.), F. Fantacci, and F. Pirri *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 159-168 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

Dynamic clutter still impairs radar system performance. To improve the knowledge of some characteristics of this phenomena, a measurement activity devoted to the particular Italian environment was planned. In order to collect clutter echo recordings without special recording instruments, an interface machine was provided, which selects and samples clutter signals. The recordings are afterward converted into digital data and then processed. The interface operation and its use in the data acquisition system are described. Author (ESA)

N80-14079# Florence Univ. (Italy). Ist. di Elettronica.
EXPERIMENTAL CAMPAIGN FOR THE ANALYSIS OF DYNAMIC CLUTTER: PROCESSING OF RECORDED DATA Final Report [CAMPAGNA SPERIMENTALE PER L'ANALISI DEL CLUTTER DINAMICO: ELABORAZIONE DEI DATI REGESTRATI]
A. Bolognin, E. Giaccari (Selenia S.P.A.), D. Giuli, G. Pelosi, and F. Pirri *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 169-178 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

A method of processing the data collected from recordings of clutter echo signals is described. Digital data are first ordered and selected by means of special programs. Then an autoregressive method is used to obtain an estimation of clutter power spectrum from the sampled signal; the use of this method is briefly explained and justified for this purpose. Estimations of power spectra are made for both range and azimuth sequences, in order to determine the characteristics of dynamic clutter in the Italian environment. Author (ESA)

N80-14080# Selenia S.p.A., Rome (Italy).
DYNAMIC CLUTTER REDUCTION TECHNIQUES WITH MOVING TARGET INDICATED ADAPTIVE FILTERS Final Report [TECHNICHE PER LA RIDUZIONE DEL CLUTTER DINAMICO CON FILTRI MTI ADATTIVI]
G. Apolloni, E. DalleMese (Pisa Univ., Italy), G. Giaccari, and G. Picchi *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 179-187 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The state-of-the-art in adaptive moving target indicator (MTI) filtering is reviewed. Open loop adaptive MTI filters are examined with emphasis on two system block diagrams. Discussion of closed loop adaptive filters includes the description of a system in which adaptiveness is obtained changing the frequency and phase of a oscillator rather than the MTI filter coefficient. An analysis of the relative advantages and disadvantages of open and closed loop filters is also presented. Author (ESA)

N80-14081# Florence Univ. (Italy). Ist. di Elettronica.
PRELIMINARY STUDY ON THE UTILIZATION OF ADAPTIVE RADAR RECEIVERS WITH DIVERSITY POLARIZATION Final Report [STUDIO PRELIMINAIRE SULL'IMPIEGO DI RICHEVITORI RADAR ADATTIVI IN DIVERSITA' DI POLARIZZAZIONE]
G. Biffi Gentili and D. Giuli *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 189-207 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The advantages of using diversity polarization radar antennas is examined. It is shown that the average power of a partially polarized echo due to distributed targets can be reduced by determining the optimum signal linear combination of the two orthogonal polarization channels. The theoretical performance of an adaptive radar receiver is analyzed for the case of rain clutter. Author (ESA)

N80-14082# Pisa Univ. (Italy). Ist. di Elettronica e Telecomunicazioni.
THE RANGE REDUCTION OF PRIMARY RADAR DUE TO RAIN Final Report [SULLA RIDUZIONE DI PORTATA DEL

RADAR PRIMARIO SOTTO PIOGGIA]
U. Tiberio *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 209-218 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The calculation of the thermal and diffusion absorption surface of small raindrops, in the Raleigh band, is used to deduce the dissipation characteristics of the entire transmission media including the attenuation coefficient, the rain front reflection coefficient, and the differential phase shift. It is shown that the range reduction without considering clutter effects can be estimated from the given formulas under normal rain conditions. Possible improvements are discussed including alternative solutions for the reduction of the clutter influence. Author (ESA)

N80-14083# Selenia S.p.A., Rome (Italy).
PERFORMANCE EVALUATION OF A COHERENT CHAIN IN TRANSMISSION Final Report
Ennio Giaccari *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 219-227 (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

Some significant parameters of coherent chain in transmission are determined, considering two aspects of transmitter design, which are the transmitter stability and the waveform selection. Instead of using conventional formulas the true system behavior is found by employing a simulation technique. The results show that the minimization of the bandwidth occupation requires the control of the transmitted pulse shape, and that high valves of improvement factors are only obtained using modulators with very low pulse amplitude variation and pulse time jitter.
Author (ESA)

N80-14084# Palermo Univ. (Italy). Ist. di Elettrotecnica ed Elettronica.
THE INFLUENCE OF TRANSMITTER STABILITY ON PRIMARY RADAR PERFORMANCE Final Report [INFLUENZA DELL'INSTABILITA' DEL TRASMETTITORE SULLE PRESTAZIONI DI UN RADAR PRIMARIO]
G. Capponi, B. DiMaio, M. Sannino, and L. Zanforlin *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 229-238 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The features of the power device that are responsible for amplitude, phase and frequency instability of the radio frequency pulses are discussed. The updated values of the parameters expressing such performance suitable to those corresponding to modulator characteristics are then used to find the limiting figures of the moving target indicator. On the basis of these quantitative results, some transmitter arrangements are changed from the classical single-stage versions to advanced ones. The related main technical features are finally compared. Author (ESA)

N80-14085# Centro per la Ricerca Elettronica in Sicilia, Monreale (Italy).
PHASE-LOCKING IN POWER OSCILLATORS Final Report [CONSIDERAZIONI SULL'AGGANCIO DI FASE DI OSCILLATORI DI POTENZA]
E. Calandra and A. Sommariva *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 239-248 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

Equations describing the static and dynamic behavior of a phase locked microwave power oscillator are examined to analyze the locking gain and fast transient performance required for moving target indicator radar applications. The influence of the design parameters on typcial radar characteristics is graphically analyzed by means of practical examples. It is shown that the performance requirements be met only through direct control of the oscillation buildup. Author (ESA)

N80-14086# Selenia S.p.A., Rome (Italy).
IMPLEMENTATION OF AIR TRAFFIC CONTROL RADAR RECEIVERS WITH FAST FOURIER TRANSFORM PROCESSORS Final Report [INTEGRAZIONE COERENTE CON FFT NEI RICEVITORI RADAR PER ATC]
In Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 249-260 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The main radar problems concerning present and future air traffic control (ATC) radars are briefly reviewed with emphasis on moving clutter. The equivalence between a fast Fourier transform (FFT) processor and a Doppler filter bank is shown. A video FFT receiver for an ATC radar is described. Results on the performance of the FFT receiver are compared to that of the moving window receiver. It is concluded that in a clutter free environment the FFT receiver has greater losses, while in moving clutter it shows relevant advantages. Author (ESA)

N80-14087# Segnalamento Marittimo ed Aereo S.p.A., Florence (Italy).
DEVELOPMENT TRENDS OF AIRPORT SURFACE TRAFFIC CONTROL RADAR Final Report [PREVEDIBILI SVILUPPI DEL RADAR PER IL CONTROLLO DEL TRAFFICO SULLA SUPERFICIE AEROPORTUALE]
S. Betini, M. Piattelli, and G. Defina *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 261-267 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The systems in use, and development trends are examined, pointing out that surface traffic growth in airports makes economically attractive a generalized use of dedicated radar sensors. It is shown that trends at present are oriented towards the I and J band frequencies which are more reliable in rainfall, while some time ago the millimeter waves were studied because of their higher angular resolution. Some specific techniques, together with new electronic components suggest that it is possible to develop a fully operative, cost-effective device. Author (ESA)

N80-14088# Consiglio Nazionale delle Ricerche, Florence (Italy). Ist. di Ricerca sulle Onde Elettromagnetiche.
AN AIR TRAFFIC CHANNEL SIMULATION BY MEANS OF RAY-TRACING TECHNIQUES Final Report [LA SIMULAZIONE DEL CANALE AERONAUTICO PER MEZZO DI TECNICHE DI RAY-TRACING]
P. Beni, F. Bertini, and P. F. Pellegrini *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 277-285 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

A three-dimensional ray tracing procedure is described which was used for propagation studies on the secondary surveillance radar (SSR) RF aeronautical channels. This procedure is based on the numerical integration of the ray canonical equations originating from the geometric optics. Phenomena such as multipath (due to the specular reflections) and shadowing, can be investigated by means of this method of numerical computer simulation. The computed ray paths of the RF energy, utilizing an environment model (whichincludes a tridimensional true model of the ground surface and of the atmosphere, constructed from experimental data) can be compared with propagation data (measured) obtained in real situations. The theoretical formulation of ray tracing is summarized. A description is given of the procedure followed for modelling the ground surface, and an example of ray tracing is presented Author (ESA)

N80-14089# Consiglio Nazionale delle Ricerche, Rome (Italy). Centro di Studio per le Telecommunicazioni Spaziali.
COMPARISON BETWEEN THE FIRST PLUVIOMETRIC DATA OBTAINED WITH AN S-BAND RADAR AND ATTENUATION DATA AT 11.6 GHz OBTAINED SIMULTANEOUSLY BY MEANS OF THE SIRIO SATELLITE Final Report [CONFRONTO FRA I PRIMI DATI PLUVIOMETRICI OTTENUTI CON UN RADAR IN BANDA S E DATI DI ATTENUAZIONE A 11.6 GHz OTTENUTI SIMULTANEAMENTE PER MEZZO DEL SATELLITE SIRIO]
C. Capsoni, M. Mauri, A. Paraboni (Politecnico di Milano), and M. Politi *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 285-295 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

Rain intensity data from meteorological radar are compared

with attenuation data at 11.6 GHz directly obtained by the SIRIO satellite in order to implement optimum procedures so as to transform reflectivity data into attenuation data. As an example, it is shown how simultaneous radar and SIRIO data can be processed toghether and optimum matching procedures can be applied. Once the radar is well calibrated, it proves a very useful tool in investigating extensively the rain structures causing trouble in radio channels at centimetric and millimetric wavelengths. An example of this is also presented. Author (ESA)

N80-14090# Segnalamento Marittimo ed Aereo S.p.A., Florence (Italy).
SYNTHESIS OF LINEAR ARRAY RADIATION PATTERNS Final Report [SINTESI DI DIAGRAMMI DI IRRADIAZIONE MEDIANTE ARRAY LINEARI]
P. Lombardi *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 297-306 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

A computerized iterative sampling method for the synthesis of antenna radiation patterns is described. The method is used for the determination of the current distribution for the excitation of the arrays radiant elements to produce a given coefficient. To increase the speed of the iterative procedure the fast fourier transform is used. The most significative results, and the development trends are presented. Author (ESA)

N80-14091# Selenia S.p.A., Rome (Italy). Direz. Tecnica.
PRELIMINARY ANALYSIS AND SELECTION CRITERIA FOR AN ANTENNA FOR A SECONDARY RADAR SYSTEM Final Report [ANALISI PRELIMINARE E CRITERI DI SCELTA DI UN'ANTENNA PER UN SISTEMA PER RADAR SECONDARIO (DABS)]
A. Saitto, M. DiFausto, and B. Palumbo *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 307-317 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

A feasibility study was performed on the characteristics of an antenna for a secondary radar system (discrete address beacon system). A tradeoff study is presented of possible configurations fulfilling the requirements of the radiation pattern slope at the horizon, the sidelobe level, the elevation coverage and the monopulse operation, under the constraint of mechanical compatibility with the existing structures of the ATC radar antennas and rotation devices. After an analysis of the aperture distributions and a presentation of calculated performance of the antenna, a parabolic cylinder reflector antenna, fed by a linear array, and a planar array are described as candidate solutions. Author (ESA)

N80-14092# Consiglio Nazionale delle Ricerche, Florence (Italy). Ist. di Ricerca sulle Onde Elettromagnetiche.
L-BAND MEASUREMENTS IN THE AIR TRAFFIC CHANNEL TO CHARACTERIZE SECONDARY RADAR SYSTEMS Final Report [MISURE SUL CANALE AERONAUTICO IN BANDA L AI FINI DELLA CARATERRIZZAZIONE DI SISTEMI DI RADAR SECONDARI]
P. F. Pellegrini, R. Cappadona, R. Ruisi, M. Trambusti, and V. Venturi *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 323-332 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The equipment used to characterize secondary radar propagation channels is described. The equipment includes a transmitting system, a receiving system, and a data processing system. Part of the apparatus was designed to be airborne, and part to be used on the ground independently, or with a radar system. Author (ESA)

N80-14093# Rome Univ. (Italy). Ist. di Comunicazioni Elettriche.
MONOPULSE RECEIVER PERFORMANCE IN SSR AND DABS SYSTEMS Final Report [PRESTAZIONI DI RICEVITORI MONOPULSE IN SISTEMI SSR E DABS]
S. Cacopardi, G. Diblasio, G. Jacovitti, and P. Mandarini *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 333-346 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

A comparison analysis of various azimuth angle measurement methods employing monopulse techniques is presented. The different error causes affecting measurement precision were examined, and their effects on the monopulse performance are summarized for each method and related to the system parameters. Then, for each monopulse receiver scheme, a quality index was defined, evaluated, and utilized, applying some well known decision criteria for the optimum parameter determination. Finally, for comparison purposes, the behavior of the quality index in function of the signal-to-noise ratio and the off-boresight angle is given for each monopulse receiver scheme. Author (ESA)

N80-14094# Florence Univ. (Italy). Ist. di Elettronica.
INTERFEPENCE EFFECTS IN MONOPULSE ESTIMATION IN SECONDARY SURVEILLANCE RADAR (SSR) SYSTEMS Final Report [EFFETI DELLE INTERFERENCE SULLA STIMA MONOPULSE IN SISTEMI SSR]
G. Biffi Gentili and D. Giuli *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 347-358 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The behavior is analyzed of some monopulse receivers in the presence of interference which limits their performance when employed in SSR systems. Particularly some statistical parameters are evaluated which characterize adequately the effects of both active and passive interference. Some numerical results are presented which allow different receiver configurations to be compared. Author (ESA)

N80-14095# Istituto di Elettronica e Telecomunicazioni, Pisa (Italy).
ARCHITECTURE OF THE SINGLE REPLY DETECTOR-PROCESSOR OF THE SECONDARY SURVEILLANCE RADAR (SSR) OF A DISCRETE ADDRESS BEACON SYSTEM (DABS) Final Report [CARATTERISTICHE OPERATIVE DEL SOTTOSISTEMA RIVELATORE-QUANTIZZATORE PER LA FUNZIONE SSR DI UN SISTEMA DABS]
G. Marchetti, F. Russo, and L. Verrazzani *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 369-378 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The system architecture of a reply processor designed with particular regard to the decoding-degarbling problem of SSR replies in a DABS is described. The topics discussed include introductory remarks on the logical operations of the system, a pulse detector and a video pulse quantizer designed to accept a clock frequency equal to 16.55 MHz, a framing pulse pairs detector, and a decoder unit. Author (ESA)

N80-14096# Istituto di Elettronica e Telecomunicazioni, Pisa (Italy).
PERFORMANCE CHARACTERISTICS OF THE DETECTOR-QUANTIZER SUBSYSTEM OF THE SECONDARY SURVEILLANCE RADAR (SSR) FUNCTION OF A DISCRETE ADDRESS BEACON SYSTEM (DABS) Final Report [CARATTERISTICHE OPERATIVE DEL SOTTOSISTEMA RIVELATORE-QUANTIZZATORE PER LA FUNZIONE SSR DI UN SISTEMA DABS]
G. Marchetti, G. Picchi, and L. Verrazzani *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 369-378 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The pulse detection and estimation process in sweep time is analyzed and results are presented. A simplified model of the dectector-estimator is tested to evaluate the SSR receiver operating characteristics, i.e. pulse detection and false-alarm generation. The video pulse quantizer performances are also derived in the absence and in the presence of interference. It is shown that experimental results are in good agreement with the theoretical model, and that the proposed video pulse quantizer solves most of the cases of interference between two pulses. Author (ESA)

N80-14097# Istituto di Elettronica e Telecomunicazioni, Pisa (Italy).
AZIMUTH DISCRIMINATION OF THE SECONDARY SURVEILLANCE RADAR (SSR) SECTION OF A DISCRETE ADDRESS BEACON SYSTEM (DABS) Final Report [DISCRIMINAZIONE IN AZIMUTH DELLA SEZIONE SSR DI UN SISTEMA DABS]
G. Marchetti, G. Picchi, and L. Verrazzani *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 379-389 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The degarbling performance of a SSR data processing system is analyzed. The efficiency of such operation is shown to depend on the thermal noise effect on the angle estimation, since all other causes are stationary during a sweep period. A monopulse estimator in analyzed which compares the amplitudes of the signals obtained from the sum and the difference channels, using the first as a synchronous detector. Author (ESA)

N80-14098# Compagnia Italiana Servizi Tecnici, Rome.
ANALYSIS OF THE SIDE LOBE SUPPRESSION (SLS) AND RECEIVE SIDE LOBE SUPPRESSION (RSLS) FUNCTIONS OF SECONDARY RADAR Final Report [ANALISI DELLE FUNZIONI SLS ED RSLS PER IL RADAR SECONDARIO]
G. Marchetti, G. Picchi, and L. Verrazzani *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 391-401 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The SLS function of a secondary surveillance radar/discrete address system is analyzed, and the radiation pattern characteristics of the ideal control antenna are deduced. Regarding the RSLS function a new solution is suggested, consisting of the combined use of the three beams in order to obtain a steeper azimuth window. The optimal operative conditions were determined in the presence of differential lobing. The effects of interference on the RSLS is analyzed, and a simple implementation of the frame pulse pairs detector is proposed to reduce the probability of missing mainbeam replies. Author (ESA)

N80-14099# Florence Univ. (Italy). Ist. di Elettronica.
ANALYSIS OF THE CORRELATION ALGORITHMS USED BY THE MONOPULSE SECONDARY SURVEILLANCE RADAR DWELL-TIME PROCESSOR Final Report [ANALISI DEGLI ALGORITMI DI CORRELAZIONE UTILIZZATI DALL'ESTRATTORE SSR MONOPULSE A LIVELLO DI TEMPO DI ILLUMINAZIONE DEL BERSAGLIO]
G. Benelli, E. DalleMese (Pisa Univ., Italy), M. Fossi, and D. Giuli *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 403-413 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

An analytical procedure to evaluate the performance of the dwell-time processor (DTP) section of monopulse secondary surveillance radar (SSR) is described. The procedure utilizes a simplified version of the correlation algorithms of the signals processed by the SSR section of the discrete address beacon system. The analysis is based upon mathematical models of the data estimates developed by the reply time processor. The procedure allows for a parametric functional analysis of the DTP, and may be generalized by varying the correlation algorithm. Author (ESA)

N80-14100# Selenia S.p.A., Rome (Italy).
ANTIREFLECTION TECHNIQUES FOR DETECTING FALSE TRACKS IN AIR TRAFFIC SURVEILLANCE WITH SECONDARY RADAR Final Report [TECHNICHE ANTIRIFLESSIONE PER LA INDIVIDUAZIONE DELLE FALSE TRACCE NELLA SORVEGLIANZA AEREA CON RADAR SECONDARI]
G. Fraschetti, D. Giuli (Florence Univ.), and V. Sacco (Florence Univ.) *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 415-424 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

Algorithms are presented which allow the target reports to be processed for false target and false track detection in order to avoid the consequent problems in secondary surveillance radar systems. The procedure is based upon the following characteristics of false tracks due to reflections: (1) same codes for false and true reports, (2) same elevation, (3) larger distance for the false report, (4) corresponding azimuth of the false report with that of a fixed obstacle, and (5) correlation is kept between both reports of the same radar sweep. Experimental results are presented, showing that 2.74% of the reports were declared false, while 2.42% of those reports were correlated with a false track. Author (ESA)

N80-14101# Bologna Univ. (Italy). Ist. di Elettronica.
ARCHITECTURE AND ANALYSIS OF THE PERFORMANCE OF THE DATA PROCESSOR FOR THE SENSOR CHANNEL OF A DISCRETE ADDRESS BEACON SYSTEM Final Report [ARCHITETTURA ED ANALISI DELLE PRESTAZIONI DELL'ELABORATORE PER IL CONTROLLO DEL CANALE DEL SENSORE DABS]
G. Bucci, D. Maio, and P. Tiberio *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 425-438 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

Several requirements and constraints to increase system efficiency are discussed, starting with a description of the overall structure of a DABS channel management system. A method for evaluation the software overhead is presented and applied to the evaluation of the time spent in a synchronization primitive. A possible alternative architecture with increased through put capabilities is outlined. Author (ESA)

N80-14102# Selenia S.p.A., Rome (Italy).
A METHOD FOR THE FRAME DEFINITION OF A DISCRETE ADDRESS BEACON SYSTEM (DABS) Final Report [METODO PER LA DEFINIZIONE DELLA 'TRAMA' DI UN SISTEMA DABS]
G. Roselli and G. Fraschetti *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 439-450 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

A method to dimension the DABS frame is described. The environmental features, the main system parameters, and the scheduling algorithm employed are taken into account. First, the distribution of the number of interrogations is evaluated, assuming a certain number of aircraft in the beam, with a maximum of three interrogations per aircraft. Then the global detection probability is determined, taking into account factors such as duty cycle, scheduling time, and DABS frame structure. The SSR-DABS frame is dimensioned based upon the technical specifications, and the main system parameters. Author (ESA)

N80-14103# Selenia S.p.A., Rome (Italy). Industrie Elettroniche Associate.
THE IMPLEMENTATION OF A SECONDARY SURVEILLANCE RADAR (SSR)/DISCRETE ADDRESS BEACON SYSTEM (DABS) PROJECT Final Report [ASPETTO REALIZZATIVI CONCERNENTI IL PROGETTO SSR/DABS]
R. Chirici and R. Ronconi *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 451-465 In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The implementation of a solid state transmitter and a logarithm amplifier on a monopulse receiver are discussed, and attainable azimuth accuracy is evaluated. The selection of the power transistor type is referred to the waveform, duty cycle, and failure analysis. Several solutions for the implementation of the logarithmic receiver are examined, pointing out the linearity characteristics and the alignment between the two receiving channels referred to thermal disturbances. The azimuth accuracy is related to the effects of the logarithmic amplifier noise and to the antenna characteristics which are assumed to be of a conventional sum/difference type. Author (ESA)

N80-14104# Trieste Univ. (Italy). Ist. di Elettrotecnia ed Elettronica.
AUTOMATIC SYSTEMS FOR AIRPORT SURFACE MOBILE MEDIA SURVEILLANCE BASED ON THE USE OF SECOND-

ARY MEDIA Final Report [SISTEMI AUTOMATICI PER LA SORVEGLIANZA DEI MEZZI MOBILI SU UNA SUPERFICIE AEROPORTUALE BASATI SULL'USO DEL RADAR SECONDARIO]
E. Carli, T. Corzani, G. Falciasecca (Bologne Univ.), F. Ferdani (Fond. Ugo Bordoni), L. Mania, and F. Vatalaro *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 467-476 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

The studies carried out on airport surface surveillance systems suggest the use of secondary radar for a fully automated solution. Some techniques tried in other countries are first reviewed and then an original one is advanced. It is based on the combination of the hyperbolic/azimuth interrogation and the side lobe suppression technique. The system can be implemented with free space propagation, or by means of open waveguides. The open waveguide propagation is the more promising one but its feasibility is conditioned to the design of a suitable structure. Some significant results are presented. Author (ESA)

N80-14105# Politecnico di Torino (Italy). Ist. di Elettronica e Telecommunicazioni.
ONBOARD COLLISION AVOIDANCE SYSTEM: ENVIRONMENTAL INFLUENCE ON THE TRACKING ALGORITHM REQUIREMENTS Final Report [SISTEMI DI ANTICOLLISIONE DI BORDO: INFLUENZE DELL'AMBIENTE OPERATIVO SUI REQUISITI DEGLI ALGORITMI DI TRACKING]
V. Castellani and M. Pent *In* Fond. Ugo Bordoni On Radar in Air Traffic Control Jul. 1979 p 477-486 refs In ITALIAN; ENGLISH summary (For primary document see N80-14065 05-04)
Avail: NTIS HC A21/MF A01

A simulation program was studied to assess the performance of an airborne secondary surveillance radar collision avoidance system. Some first qualitative results are given, and the implementation of tracking and prediction algorithms is discussed. The problem of preventing interference effects is discussed showing the need for the development of suitable algorithms to that effect. Author (ESA)

N80-14106# Arinc Research Corp., Santa Ana, Calif.
AVIONICS INSTALLATION (AVSTALL) COST MODEL FOR USER EQUIPMENT OF NAVSTAR GLOBAL POSITIONING SYSTEM
W. Stewart, D. Allen, and P. Orth Jun. 1979 48 p
(Contract F04701-78-C-0124)
(AD-A073681; Rept-1727-04-1-1959) Avail: NTIS HC A03/MF A01 CSCL 17/7

An avionics installation (AVSTALL) cost model developed for application to the NAVSTAR Global Positioning System (GPS) is described. The model determines the aircraft-peculiar costs of installing avionics equipment--for example. GPS user equipment--into military aircraft. It is based on cost estimating relationships (CERs) developed from an analysis of 51 previous Class V avionics modifications to Air Force aircraft. The development and application of these CERs are explained in this report. GRA

N80-14031# Defence Research Establishment, Ottawa. (Ontario).
DEVELOPMENT OF AIDING GPS/STRAPDOWN INERTIAL NAVIGATION SYSTEM
D. F. Liang, D. B. Reid (Lapp (Philip A.) Ltd., Toronto), R. H. Johnson (S and S Software Ltd., Ottawa), and B. G. Fletcher *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 15 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14034# Twente Univ. of Technology, Enschede (Netherlands). Dept. of Electrical Engineering.
METHODS FOR STRAP-DOWN ATTITUDE ESTIMATION AND NAVIGATION WITH ACCELEROMETERS
R. P. Offereins and M. J. L. Tiernego *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 20 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N80-14107* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACOUSTICALLY SWEPT ROTOR Patent
Fredric H. Schmitz, Donald A. Boxwell, and Rande Vause, inventors (to NASA) Issued 25 Sep. 1979 23 p Filed 8 Sep. 1977 Supersedes N77-31130 (15 - 22, p 2893)
(NASA-Case-ARC-11106-1; US-Patent-4,168,939; US-Patent-Appl-SN-831633; US-Patent-Class-416-228; US-Patent-Class-416-238; US-Patent-Class-415-199) Avail: US Patent and Trademark Office CSCL 01C

Impulsive noise reduction is provided in a rotor blade by acoustically sweeping the chord line from root to tip so that the acoustic radiation resulting from the summation of potential singularities used to model the flow about the blade tend to cancel for all times at an observation point in the acoustic far field. Official Gazette of the U.S. Patent and Trademark Office

N80-14108* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
QUIET SHORT-HAUL RESEARCH AIRCRAFT FAMILIARIZATION DOCUMENT
Robert C. McCracken Nov. 1979 96 p
(NASA-TM-81149; A-7975) Avail: NASA. Ames Res. Center, Moffett Field, Calif. 94035 CSCL 01C

The design features and general characteristics of the NASA Quiet Short-Haul Research Aircraft are described. Aerodynamic characteristics and performance are discussed based on predictions and early flight-test data. Principle airplane systems, including the airborne data-acquisition system, are also described. The aircraft was designed and built to fulfill the need for a national research facility to explore the use of upper surface-blowing propulsive-lift technology in providing short takeoff and landing capability, and perform advanced experiments in various technical disciplines such as aerodynamics, propulsion, stability and control, handling qualities, avionics and flight-control systems, trailing-vortex phenomena, acoustics, structure and loads, operating systems, human factors, and airworthiness/certification criteria. An unusually austere approach using experimental shop practices resulted in a low cost and high research capability. Author

N80-14109# Aerospace Engineering Test Establishment, Cold Lake (Alberta).
DETERMINATION OF THE REPEATABILITY OF PEC
R. D. Michas 23 Oct. 1979 37 p refs
(AETE-PR-79/36; CF-5) Avail: NTIS HC A03/MF A01

Position error calibrations conducted on four CF-5A, six CF-5 A/R, and five CF-5D aircraft using the standard tower fly by and pacing methods are discussed. The variation in position error, between individual aircraft of each type is examined. Ammendments to the position error correction charts for the CF-5A and CF-5D Aircraft Operation Instruction and redesign of the correction cam are discussed. A.W.H.

N80-14110*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL INVESTIGATION OF THE FLOW CORRECTION FOR A MODEL-MOUNTED ANGLE OF ATTACK SENSOR AT ANGLES OF ATTACK FROM -10 DEG TO 110 DEG
Thomas M. Moul Nov. 1979 20 p refs
(NASA-TM-80189) Avail: NTIS HC A02/MF A01 CSCL 01C

A preliminary wind tunnel investigation was undertaken to determine the flow correction for a vane angle of attack sensor over an angle of attack range from -10 deg to 110 deg. The sensor was mounted ahead of the wing on a 1/5 scale model of a general aviation airplane. It was shown that the flow correction was substantial, reaching about 15 deg at an angle of attack of 90 deg. The flow correction was found to increase as the sensor was moved closer to the wing or closer to the fuselage. The

experimentally determined slope of the flow correction versus the measured angle of attack below the stall angle of attack agreed closely with the slope of flight data from a similar full scale airplane. Author

N80-14111# Dreyfuss-Pellman Corp., Stamford, Conn.
NON-CONTACTING ELECTRO-OPTICAL CONTOURING OF HELICOPTER ROTOR BLADES Final Report, Oct. 1977 Oct. 1978
Marc G. Dreyfus and Arnold Pellman 11 Dec. 1978 80 p
(Contract DAAK50-78-C-0008)
(AD-A070806; USAAVRADCOM-TR-79-30) Avail: NTIS HC A05/MF A01 CSCL 01/3

Non-contact contour measurements of helicopter rotor blades to accuracies of 0.0001 in. are possible via range finding by triangulation employing electro-optical techniques. A laboratory breadboard of such a system has been built and tested. The results of these tests indicate that the construction of a full prototype system is feasible and desirable. GRA

N80-14112# Army Missile Material Readiness Command, Redstone Arsenal, Ala. Cost Analysis Div.
TARGET MISSILE AIRFRAME COSTS
William P. Anderson Mar. 1979 22 p refs
(AD-A073314; DRSMI-FC-79-1) Avail: NTIS HC A02/MF A01 CSCL 05/1

A parametric method of estimating the production cost for a proposed TARGET Missile Airframe is presented in this report. A cost estimating relationship (CER) has been developed based upon an independent variable, the estimated airframe weight in pounds. The independent variable (Y) in the CER, Y = (A-Bx) squared, represents the average unit production cost for the first 700 airframes produced in terms of FY 77 constant dollars. The methodology used in developing this CER, as well as a presentation of data and TARGET Missile Technical Descriptions, is included for the benefit of the cost estimator. GRA

N80-14042# Litton Systems (Canada) Ltd., Rexdale, (Ontario).
A HIGH ACCURACY FLIGHT PROFILE DETERMINING SYSTEM
Peter Roy Vousden and Peter Jonathon Gollop *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 16 p (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14043# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INTEGRATION OF FLIGHT AND FIRE CONTROL
Robert K. Huber *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 9 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-14113*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIGITAL SYSTEM FOR DYNAMIC TURBINE ENGINE BLADE DISPLACEMENT MEASUREMENTS
Louis J. Kiraly 13 Mar. 1979 13 p refs Proposed for presentation at 25th Ann. Intern. Gas Turbine Conf. and the 22d Ann. Fluids Engr. Conf., New Orleans, 9-13 Mar. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81382; E-288) Avail: NTIS HC A02/MF A01 CSCL 21E

An instrumentation concept for measuring blade tip displacements which employs optical probes and an array of microcomputers is presented. The system represents a hitherto unknown instrumentation capability for the acquisition and direct digitization of deflection data concurrently from all of the blade tips of an operational engine rotor undergoing flutter or forced vibration. System measurements are made using optical transducers which are fixed to the case. Measurements made in this way are the equivalent of those obtained by placing three surface-normal displacement transducers at three positions on each blade of an operational rotor. M.M.M.

N80-14114*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY TEST RESULTS OF A FLIGHT MANAGEMENT ALGORITHM FOR FUEL CONSERVATIVE DESCENTS IN A TIME BASED METERED TRAFFIC ENVIRONMENT
Charles E. Knox and Dennis G. Cannon (Boeing Commercial Airplane Co., Seattle, Wash.) Nov. 1979 34 p refs
(NASA-TM-80194) Avail: NTIS HC A03/MF A01 CSCL 01D

A flight management algorithm designed to improve the accuracy of delivering the airplane fuel efficiently to a metering fix at a time designated by air traffic control is discussed. The algorithm provides a 3-D path with time control (4-D) for a test B 737 airplane to make an idle thrust, clean configured descent to arrive at the metering fix at a predetermined time, altitude, and airspeed. The descent path is calculated for a constant Mach/airspeed schedule from linear approximations of airplane performance with considerations given for gross weight, wind, and nonstandard pressure and temperature effects. The flight management descent algorithms and the results of the flight tests are discussed. A.W.H.

N80-14018*# Milco International, Inc., Huntington Beach, Calif.
STATE OF THE ART FOR DIGITAL AVIONICS AND CONTROLS, 1978
Richard K. Smyth *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 20 p refs (For primary document see N80-14017 05-01)
(Contract NASw-2691)
Avail: NTIS HC A16/MF A01 CSCL 02A

N80-14022# Singer-Kearfott, Wayne, N. J.
FORTRAN FOR AVIONICS
Austin J. Maher *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 8 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14024# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
AUTOMATIC RECOVERY AFTER SENSOR FAILURE ONBOARD
Marc Labarrere, Marc Pelegrin, and Marc Pircher *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 12 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14028# Electronique Marcel Dassault, St. Cloud (France).
THE INTEGRITY OF ONBOARD COMPUTER PROGRAMS: A SOLUTION [L'INTEGRITE DES LOGICIELS EMBARQUES: UNE SOLUTION]
G. Germain *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 8 p refs In FRENCH (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14037# Electronique Marcel Dassault, St. Cloud (France).
THE AVIONICS COMPUTER PROGRAM: PRACTICAL EXPERIENCES WITH A METHODOLOGY [LOGICIEL AVIONIQUE: EXPERIENCES PRATIQUES D'UNE METHODOLOGIE]
J. Perin *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 17 p In FRENCH (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-14115*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) ACOUSTIC AND AERODYNAMIC TESTS ON A SCALE MODEL OVER-THE-WING THRUST REVERSER AND FORWARD THRUST NOZZLE

D. L. Stimpert 18 Jan. 1978 85 p refs
(Contract NAS3-18021)
(NASA-CR-135254; R75AEG504) Avail: NTIS
HC A05/MF A01 CSCL 21E

An acoustic and aerodynamic test program was conducted on a 1/6.25 scale model of the Quiet, Clean, Short-Haul Experimental Engine (QCSEE) forward thrust over-the-wing (OTW) nozzle and OTW thrust reverser. In reverse thrust, the effect of reverser geometry was studied by parametric variations in blocker spacing, blocker height, lip angle, and lip length. Forward thrust nozzle tests determined the jet noise levels of the cruise and takeoff nozzles, the effect of opening side doors to achieve takeoff thrust, and scrubbing noise of the cruise and takeoff jet on a simulated wing surface. Velocity profiles are presented for both forward and reverse thrust nozzles. An estimate of the reverse thrust was made utilizing the measured centerline turning angle. Author

N80-14116*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). UNDER-THE-WING (UTW) ENGINE BOILERPLATE NACELLE TEST REPORT. VOLUME 2: AERODYNAMICS AND PERFORMANCE

31 Dec. 1977 61 p refs
(Contract NAS3-18021)
(NASA-CR-135250; R77AEG2122-Vol-2) Avail: NTIS
HC A04/MF A01 CSCL 21E

The initial phase of testing of the under the wing engine and boilerplate nacelle components is discussed. The aerodynamics and performance are outlined. M.M.M.

N80-14117*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

QUIET, CLEAN, SHORT-HAUL, EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) ENGINE ACOUSTIC DESIGN

H. D. Sowers and W. E. Coward Jan. 1978 62 p refs
(Contract NAS3-18021)
(NASA-CR-135267; R76AEG195) Avail: NTIS
HC A04/MF A01 CSCL 21E

The acoustic considerations involved in the low source noise basic engine design and the design procedures followed in the development of the under-the-wing (UTW) engine boilerplate and composite nacelle acoustic treatment designs are presented. Laboratory experiments, component tests, and scale model and engine tests supporting the UTW engine acoustic design are referenced. Acoustic design features include a near-sonic inlet, low fan and core pressure ratios, low fan tip speed, high and low frequency stacked core treatment, multiple thickness treatment, and fan frame and stator vane treatment. R.E.S.

N80-14118*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

QUIET, CLEAN, SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING (OTW) ENGINE ACOUSTIC DESIGN

H. D. Sowers and W. E. Coward Jun. 1978 58 p refs
(Contract NAS3-18021)
(NASA-CR-135268; R76AEG228) Avail: NTIS
HC A04/MF A01 CSCL 21E

The acoustic considerations involved in the low source noise basic engine design and the design procedures followed in the development of the over-the-wing (OTW) nacelle acoustic treatment design are presented. Laboratory experiments, component tests, and scale model and engine tests supporting the OTW engine acoustic design are referenced. Acoustic design features include a near-sonic inlet, low fan and core pressure ratios, low fan tip speed, high and low frequency stacked core treatment, multiple thickness treatment, and fan frame and stator vane treatment. R.E.S.

N80-14119*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) GRAPHITE/PMR COWL DEVELOPMENT

C. L. Ruggles Jul. 1978 75 p refs
(Contract NAS3-18021)
(NASA-CR-135279; R78AEG206) Avail: NTIS
HC A04/MF A01 CSCL 21E

The PMR process development, tooling concepts, testing conducted to generate materials properties data, and the fabrication of a subscale model of the inner cowl are presented. It was concluded that the materials, processes, and tooling concepts were satisfactory for making an inner cowl with adequate structural integrity. M.M.M.

N80-14120*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING (OTW) PROPULSION SYSTEM TEST REPORT. VOLUME 2: AERODYNAMICS AND PERFORMANCE

Jul. 1978 49 p refs
(Contract NAS3-18021)
(NASA-CR-135324; R77AEG474-Vol-2) Avail: NTIS
HC A03/MF A01 CSCL 21E

The design and testing of the over the wing engine, a high bypass, geared turbofan engine, are discussed. The propulsion system performance is examined for uninstalled performance and installed performance. The fan aerodynamic performance and the D nozzle and reverser thrust performance are evaluated. A.W.H.

N80-14121*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STATIC TEST-STAND PERFORMANCE OF THE YF-102 TURBOFAN ENGINE WITH SEVERAL EXHAUST CONFIGURATIONS FOR THE QUIET SHORT-HAUL RESEARCH AIRCRAFT (QSRA)

Jack G. McArdle, Leonard Homyak, and Allan S. Moore Nov. 1979 62 p
(NASA-TP-1556; E-019) Avail: NTIS HC A04/MF A01 CSCL 21E

The performance of a YF-102 turbofan engine was measured in an outdoor test stand with a bellmouth inlet and seven exhaust-system configurations. The configurations consisted of three separate-flow systems of various fan and core nozzle sizes and four confluent-flow systems of various nozzle sizes and shapes. A computer program provided good estimates of the engine performance and of thrust at maximum rating for each exhaust configuration. The internal performance of two different-shaped core nozzles for confluent-flow configurations was determined to be satisfactory. Pressure and temperature surveys were made with a traversing probe in the exhaust-nozzle flow for some confluent-flow configurations. The survey data at the mixing plane, plus the measured flow rates, were used to calculate the static-pressure variation along the exhaust nozzle length. The computed pressures compared well with experimental wall static-pressure data. External-flow surveys were made, for some confluent-flow configurations, with a large fixed rake at various locations in the exhaust plume. A.R.H.

N80-14122*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

FEASIBILITY OF SiC COMPOSITE STRUCTURES FOR 1644 K (2500 F) GAS TURBINE SEAL APPLICATION Final Report, 28 Apr. - 30 May 1979

R. Darolia Nov. 1979 120 p ref

(Contract NAS3-20082)
(NASA-CR-159597; R79AEG625) Avail: NTIS HC A08/MF A01 CSCL 21E

The silicon carbide composites evaluated consisted of Si/SiC and sintered silicon carbide as substrates, both with attached surface layers containing BN as an additive. A total of twenty-eight candidates with variations in substrate type and density, and layer chemistry, density, microstructure, and thickness were evaluated for abradability, cold particle erosion resistance, static oxidation resistance, ballistic impact resistance, and fabricability. BN-free layers with variations in density and pore size were later added for evaluation. The most promising candidates were evaluated for Mach 1.0 gas oxidation/erosion resistance from 1477 K (2200 F) to 1644 K (2500 F). The as-fabricated rub layers did not perform satisfactorily in the gas oxidation/erosion tests. However, preoxidation was found to be beneficial in improving the hot gas erosion resistance. Overall, the laboratory and rig test evaluations show that material properties are suitable for 1477 K (2200 F) gas turbine seal applications. Further improvements are needed in hot gas erosion resistance and abradability to demonstrate feasibility to 1644 K (250 F). A.R.H.

N80-14123*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC RESPONSE OF A MACH 2.5 AXISYMMETRIC INLET AND TURBOJET ENGINE WITH A POPPET-VALUE CONTROLLED INLET STABILITY BYPASS SYSTEM WHEN SUBJECTED TO INTERNAL AND EXTERNAL AIRFLOW TRANSIENTS
Bobby W. Sanders Washington Jan. 1980 102 p refs
(NASA-TP-1531; E-9467) Avail: NTIS HC A06/MF A01 CSCL 21E

The throat of a Mach 2.5 inlet that was attached to a turbojet engine was fitted with a poppet-valve-controlled stability bypass system that was designed to provide a large, stable airflow range. Propulsion system response and stability bypass performance were determined for several transient airflow disturbances, both internal and external. Internal airflow disturbances included reductions in overboard bypass airflow, power lever angle, and primary-nozzle area as well as compressor stall. For reference, data are also included for a conventional, fixed-exit bleed system. The poppet valves greatly increased inlet stability and had no adverse effects on propulsion system performance. Limited unstarted-inlet bleed performance data are presented. Author

N80-14124*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBOJET-EXHAUST-NOZZLE SECONDARY-AIRFLOW PUMPING AS AN EXIT CONTROL OF AN INLET-STABILITY BYPASS SYSTEM FOR A MACH 2.5 AXISYMMETRIC MIXED-COMPRESSION INLET
Bobby W. Sanders Jan. 1980 82 p refs
(NASA-TP-1532; E-9468) Avail: NTIS HC A05/MF A01 CSCL 21E

The throat of a Mach 2.5 inlet that was attached to a turbojet engine was fitted with large, porous bleed areas to provide a stability bypass system that would allow a large, stable airflow range. Exhaust-nozzle, secondary-airflow pumping was used as the exit control for the stability bypass airflow. Propulsion system response and stability bypass performance were obtained for several transient airflow disturbances, both internal and external. Internal airflow disturbances included reductions in overboard bypass airflow, power lever angle, and primary-nozzle area, as well as compressor stall. Nozzle secondary pumping as a stability bypass exit control can provide the inlet with a large stability margin with no adverse effects on propulsion system performance. Author

N80-14125*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF DEGREE OF FUEL VAPORIZATION UPON EMISSIONS FOR A PREMIXED PARTIALLY VAPORIZED COMBUSTION SYSTEM
Larry P. Cooper Jan. 1980 25 p refs
(NASA-TP-1582; E-010) Avail: NTIS HC A02/MF A01 CSCL 21E

An experimental and analytical study of the combustion of partially vaporized fuel-air mixtures was performed to assess the impact of the degree of fuel vaporization upon emissions for a premixing-prevaporizing flametube combustor. Data collected in this study showed near linear increases in nitric oxide emissions with decreasing vaporization at equivalence ratios of 0.6. For equivalence ratios of 0.72, the degree of vaporization had very little impact on nitric oxide emissions. A simple mechanism which accounts for the combustion of liquid droplets in partially vaporized mixtures was found to agree with the measured results with fair accuracy with respect to both trends and magnitudes. Author

N80-14126*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA BROAD-SPECIFICATION FUELS COMBUSTION TECHNOLOGY PROGRAM: STATUS AND DESCRIPTION
James S. Fear 1979 14 p refs Presented at 25th Ann. Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-79315; E-272) Avail: NTIS HC A02/MF A01 CSCL 21E

The program presented is a contracted effort to evolve and demonstrate the technology required to utilize broad-specification fuels in current and next generation commercial Conventional Takeoff and Landing aircraft engines, and to verify this technology in full-scale engine tests in 1983. The program consists of three phases: Combustor Concept Screening, Combustor Optimization Testing, and Engine Verification Testing. The development and screening of the combustion system designs for the CF6-80 engine and the JT9D-7 engine, respectively, in high-pressure sector test rigs are reported. M.M.M.

N80-14127*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
THE CF6 JET ENGINE PERFORMANCE IMPROVEMENT: NEW FRONT MOUNT
W. A. Fasching Dec. 1979 139 p refs
(Contract NAS3-20629)
(NASA-CR-159639; R79AEG366) Avail: NTIS HC A07/MF A01 CSCL 21E

The New Front Mount was evaluated in component tests including stress, deflection/distortion and fatigue tests. The test results demonstrated a performance improvement of 0.1% in cruise sfc, 16% in compressor stall margin and 10% in compressor stator angle margin. The New Front Mount hardware successfully completed 35,000 simulated flight cycles endurance testing. Author

N80-14128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LASER-OPTICAL BLADE TIP CLEARANCE MEASUREMENT SYSTEM
John P. Barranger and M. John Ford (Pratt and Whitney Aircraft Group, West Palm Beach, Fla.) 13 Mar. 1979 10 p refs Proposed for presentation at 25th Ann. Intern. Gas Turbine Conf. and the 22d Ann. Fluids Engr. Conf., New Orleans, 9-13 Mar. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81376) Avail: NTIS HC A02/MF A01 CSCL 21E

A laser-optical measurement system was developed to measure single blade tip clearances and average blade tip clearances between a rotor and its gas path seal in rotating component rigs and complete engines. The system is applicable to fan, compressor and turbine blade tip clearance measurements. The engine mounted probe is particularly suitable for operation in the extreme turbine environment. The measurement system consists of an optical subsystem, an electronic subsystem and a computing and graphic terminal. Bench tests and environmental tests were conducted to confirm operation at temperatures, pressures, and vibration levels typically encountered in an operating gas turbine engine. DOE

N80-14129*# Detroit Diesel Allison, Indianapolis, Ind.
STUDY OF TURBOPROP SYSTEMS RELIABILITY AND MAINTENANCE COSTS Final Report
Jun. 1978 304 p refs
(Contract NAS3-20057)
(NASA-CR-135192; EDR-9132) Avail: NTIS HC A14/MF A01 CSCL 21E

The overall reliability and maintenance costs (R&MC's) of past and current turboprop systems were examined. Maintenance cost drivers were found to be scheduled overhaul (40%), lack of modularity particularly in the propeller and reduction gearbox, and lack of inherent durability (reliability) of some parts. Comparisons were made between the 501-D13/54H60 turboprop system and the widely used JT8D turbofan. It was found that the total maintenance cost per flight hour of the turboprop was 75% higher than that of the JT8D turbofan. Part of this difference was due to propeller and gearbox costs being higher than those of the fan and reverser, but most of the difference was in the engine core where the older technology turboprop core maintenance costs were nearly 70 percent higher than for the turbofan. The estimated maintenance cost of both the advanced turboprop and advanced turbofan were less than the JT8D. The conclusion was that an advanced turboprop and an advanced turbofan, using similar cores, will have very competitive maintenance costs per flight hour. J.M.S.

N80-14130*# Avco Lycoming Div., Williamsport, Pa.
EXHAUST EMISSION REDUCTION FOR INTERMITTENT COMBUSTION AIRCRAFT ENGINES
R. N. Moffett Oct. 1979 114 p
(Contract NAS3-19754)
(NASA-CR-159757) Avail: NTIS HC A06/MF A01 CSCL 21E

Three concepts for optimizing the performance, increasing the fuel economy, and reducing exhaust emission of the piston aircraft engine were investigated. High energy-multiple spark discharge and spark plug tip penetration, ultrasonic fuel vaporization, and variable valve timing were evaluated individually. Ultrasonic fuel vaporization did not demonstrate sufficient improvement in distribution to offset the performance loss caused by the additional manifold restriction. High energy ignition and revised spark plug tip location provided no change in performance or emissions. Variable valve timing provided some performance benefit; however, even greater performance improvement was obtained through induction system tuning which could be accomplished with far less complexity. A.R.H.

N80-14131*# Universal Systems, Inc., Arlington, Va.
OBLIQUE DETONATION WAVE RAMJET
Richard B. Morrison Jan. 1980 87 p refs
(Contract NAS1-15344)
(NASA-CR-159192) Avail: NTIS HC A05/MF A01 CSCL 21E

Two conceptual designs of the oblique detonation wave ramjet are presented. The performance is evaluated for stoichiometric hydrogen-air equivalence ratios of phi = 1/3, 2/3 and 1 for a range of flight Mach numbers from 6 to 10. A.R.H.

N80-14132# Martin Marietta Aerospace, Denver, Colo.
PROPULSION OPTIONS FOR THE HI SPOT LONG ENDURANCE DRONE AIRSHIP Final Report, Nov. 1978 - Aug. 1979
William L. Marcy and Ralph O. Hookway 15 Sep. 1979 55 p refs
(Contract N62269-79-C-0204)
(AD-A074595; MCR-79-632; NADC-78193-60) Avail: NTIS HC A04/MF A01 CSCL 21/5

Airbreathing, monofueled, stored-energy, and solar-rechargeable propulsion systems have been studied for the HI SPOT Long Endurance Drone Airship, providing constant-level electrical power as well as variable aerodynamic thrust to maintain position in winds varying from 15 to 100 knots at high altitude. A hydrogen fueled airbreathing engine is optimum for mission lengths up to 30 days or more. GRA

N80-14133# Naval Postgraduate School, Monterey, Calif.
AN ADAPTATION AND VALIDATION OF A PRIMITIVE VARIABLE MATHEMATICAL MODEL FOR PREDICTING THE FLOWS IN TURBOJET TEST CELLS AND SOLID FUEL RAMJETS M.S. Thesis
Charles Albert Stevenson Jun. 1979 75 p refs
(AD-A074167) Avail: NTIS HC A04/MF A01 CSCL 21/5

An adaptation of a primitive variable, finite-difference computer program was accomplished in order to predict the non-reacting flow fields in turbojet test cells and the reacting flow fields in solid fuel ramjets. The study compares the predictions of the primitive variable computer model with an earlier computer model and empirical data. It was found that the new model reasonably predicted the flow fields in both geometries. In addition, the primitive variable model allowed simulation of test cell flows up to full engine throttle conditions and solid fuel ramjet flows which included an aft mixing chamber. GRA

N80-14134# ARO, Inc., Arnold Air Force Station, Tenn.
APPLICATION OF THE MULTISTAGE AXIAL-FLOW COMPRESSOR TIME-DEPENDENT MATHEMATICAL MODELING TECHNIQUE TO THE TF41-A-1 MODIFIED BLOCK 76 COMPRESSOR Final Report, Jan. 1978 - Mar. 1979
C. E. Chamblee AEDC Sep. 1979 99 p refs
(AD-A074478; AEDC-TR-79-39) Avail: NTIS HC A05/MF A01 CSCL 21/5

A one-dimensional, steady-state TF41-A-1 compressor mathematical model for stability assessment with undisturbed flow, and a three-dimensional time-dependent TF41-A-1 compressor mathematical model for analysis of distorted inflows and transient and dynamic disturbances were developed. Example problems and comparisons to experimental results are presented for both models. The problems using the one-dimensional, steady-state model consisted of determination of the steady-state stability limits (surge lines) with undisturbed flow for three distinct inlet guide vane schedules. Those problems using the three-dimensional, time-dependent model included determination of the stability limit (surge line) reduction caused by pure radial pressure inlet distortion, pure circumferential pressure, and pure circumferential temperature inlet distortion. The effects of rapid upward ramps of inlet temperature on compressor stability were also investigated. The TF41-A-1 compressor models computed the compressor stability limits with reasonable accuracy. GRA

N80-14135# Institut National des Sciences Appliquees, Lyon (France). Lab. de Mecanique de Structures.
ON THE USE OF VIBRATION SELF-DAMPING MATERIALS IN THE MANUFACTURE OF PARTS FOR ROTATING MACHINERY Final Report [UTILISATION DES MATERIAUX AMORTISSANTS POUR LA REALISATION D'ELEMENTS DE MACHINE TOURNANTE]
Michel Lalanne, Phillippe Trompette, David Jones, Johan DerHagopian, and Abdul Hommeida Oct. 1977 124 p refs
In FRENCH
(Contract DGRST-75-7-0968)
Avail: NTIS HC A06/MF A01

The control of structural vibration in rotating pieces in the 400C to 600C temperature range by the utilization of damping materials was studied. The test facilities and measuring systems developed for this study are described, including the high temperature measurement of complex modes and frequencies. A computing method for rotating structures with structural damping which was developed in this study is presented, and applied to real cases, such as a stator vane (three dimensional behavior) and a motor element (axisymmetrical structure). Author (ESA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-14136*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
SIMULATOR STUDY OF STALL/POST-STALL CHARACTERISTICS OF A FIGHTER AIRPLANE WITH RELAXED LONGITUDINAL STATIC STABILITY
Luat T. Nguyen, Marilyn E. Ogburn, William P. Gilbert, Kemper S. Kibler, Phillip W. Brown, and Perry L. Deal Washington Dec. 1979 226 p
(NASA-TP-1538; L-12854) Avail: NTIS HC A11/MF A01 CSCL 01C

A real-time simulation piloted was conducted to evaluate the high-angle-of-attack characteristics of a fighter configuration based on wind-tunnel testing of the F-16, with particular emphasis on the effects of various levels of relaxed longitudinal static stability. The aerodynamic data used in the simulation was conducted on the Langley differential maneuvering simulator, and the evaluation involved representative low-speed combat maneuvering. Results of the investigation show that the airplane with the basic control system was resistant to the classical yaw departure; however, it was susceptible to pitch departures induced by inertia coupling during rapid, large-amplitude rolls at low airspeed. The airplane also exhibited a deep-stall trim which could be flown into and from which it was difficult to recover. Control-system modifications were developed which greatly decreased the airplane susceptibility to the inertia-coupling departure and which provided a reliable means for recovering from the deep stall. Author

N80-14137*# Boeing Commercial Airplane Co., Seattle, Wash.
LINEAR SYSTEMS ANALYSIS PROGRAM, L224(QR). VOLUME 1: ENGINEERING AND USAGE Topical Report, Apr. 1978 - Oct. 1979
P. C. Shah and K. W. Heidergott Dec. 1979 180 p refs
(Contract NAS1-15346; BCS-G0061)
(NASA-CR-2861) Avail: NTIS HC A09/MF A01 CSCL 09B

The QR computer program is described as well as its use in classical control systems analysis and synthesis (root locus, time response, and frequency response). A.R.H.

N80-14138*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PILOT CONTROL THROUGH THE TAFCOS AUTOMATIC FLIGHT CONTROL SYSTEM
William R. Wehrend, Jr. Dec. 1979 42 p refs
(NASA-TM-81152; A-7996) Avail: NTIS HC A03/MF A01 CSCL 01C

The set of flight control logic used in a recently completed flight test program to evaluate the total automatic flight control system (TAFCOS) with the controller operating in a fully automatic mode, was used to perform an unmanned simulation on an IBM 360 computer in which the TAFCOS concept was extended to provide a multilevel pilot interface. A pilot TAFCOS interface for direct pilot control by use of a velocity-control-wheel-steering mode was defined as well as a means for calling up conventional autopilot modes. It is concluded that the TAFCOS structure is easily adaptable to the addition of a pilot control through a stick-wheel-throttle control similar to conventional airplane controls. Conventional autopilot modes, such as airspeed-hold, altitude-hold, heading-hold, and flight path angle-hold, can also be included. A.R.H.

N80-14139*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ALTITUDE RESPONSE OF SEVERAL AIRPLANES DURING LANDING APPROACH
William H. Phillips Nov. 1979 39 p refs
(NASA-TM-80186) Avail: NTIS HC A03/MF A01 CSCL 01C

The response in altitude and pitching velocity of the shuttle and of four other airplanes during the landing approach is compared. The effects of airplane type, pitch damping, center-of-gravity location, lift coefficient, and cockpit position are presented. The reasons for the differences observed and the effects of these differences on control characteristics are discussed. A.R.H.

N80-14140# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
EXCITATION AND ANALYSIS TECHNIQUE FOR FLIGHT FLUTTER TESTS
G. Haidl and M. Steininger 8 Sep. 1978 27 p refs Presented at 47th SMP/AGARD Meeting, Florence, 24-29 Sep. 1978
(MBB-UF-1446(O)) Avail: NTIS HC A03/MF A01

Excitation methods applied recently for flight flutter testing are surveyed. Examples of excitation by frequency sweep, pseudo-random, harmonic oscillation, and control loop are given and their effectiveness and adaptation to digital processing is discussed. Experience gained in generating aerodynamic forces by control surfaces or additional vanes is reported. The digital analysis of flight flutter test data is then considered. Recommendations for selection of analysis parameters and how to avoid errors due to digital processing are given. For data evaluation in flight flutter tests the autopower spectrum as well as transfer and coherence functions are used. Errors and effects of digital blockwise computation with analysis procedures like block overlapping, windowing, averaging, or curve fitting are demonstrated. The filter correlation and the modal analysis technique are applied for mode separation and damping evaluation based on the above mentioned functions. Practical experience and examples from wind tunnel, flight, and laboratory tests are discussed. An online computer program is presented for realtime calculation of resonance frequencies and damping factors. Author (ESA)

N80-14141# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
STABILITY AND CONTROL ASPECTS OF THE CCV-F104G
H. Beh, U. Korte, and G. Loebert Sep. 1978 33 p refs Presented at AGARD Flight Mech. Panel Meeting on Stability and Control, Ottawa, 25-28 Sept. 1978
(MBB-UFE-1447(O)) Avail: NTIS HC A03/MF A01

The CCV command system, its implementation, and the design of the control laws are described. The superior flight-mechanical performance of the CCV flight control system is compared with that of the basic F 104G on the basis of simulator results. The validity of these results is demonstrated by comparing the principal characteristics of longitudinal and lateral motion measured in flight with the corresponding predicted values. Author (ESA)

N80-14142# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
INVESTIGATION OF THE OSCILLATORY AND FLIGHT BEHAVIOR OF ROTOR SYSTEMS IN RELATION WITH ATMOSPHERIC TURBULENCE [UNTERSUCHUNGEN ZUM SCHWINGUNGS- UND FLUGVERHALTEN VON HUBSCHRAUBERN UNTER ATMOSPHAERISCHER TURBULENZ]
H. Dehl and D. Weger 1979 72 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVG-FBWT-79-5) Avail: NTIS HC A04/MF A01; DOKZENTBw, Bonn DM 30

The effects of stochastic atmospheric disturbances on the performance of various helicopter rotor systems was investigated in order to determine their gust sensitivity. A statistical description of turbulent excitations which permits sufficiently accurate simulation of helicopter oscillatory behavior resulting from gust disturbances was developed. Results show that during low altitude flight and slow speed flight the gust vector distribution over the helicopter is very nonuniform. At any instant therefore, the individual rotor blades are affected by very different gust velocities which leads to different responses of the blades. In conclusion, the investigations pursue the important objective of elaborating and clarifying possibilities for improvement of the flight characteristics of the investigated rotor systems, in so far as the inclusion of special gust reduction systems on helicopters is possible and profitable. Author (ESA)

N80-14143# European Space Agency, Paris (France).
FLIGHT TESTING OF THE BUFFETING BEHAVIOR OF COMBAT AIRCRAFT
G. Redeker Feb. 1979 44 p refs Transl. into ENGLISH of "Flugversuche zum Buffeting-Verhalten von Kampfflugzeugen", Rep. DFVLR-FB-IB-151-78/6 DFVLR, Brunswick, 18 Dec. 1979
(ESA-TT-523; DFVLR-FB-IB-151-78/6) Avail: NTIS HC A03/MF A01

The flight testing of buffeting behavior in combat aircraft is reviewed. After a description of the buffeting phenomenon and its effects on the pilot and the performance of a combat aircraft, flight testing techniques from several American reports are discussed. Author (ESA)

N80-14019# Air Force Flight Dynamics Lab., Wright-Pattersen AFB, Ohio. Flight Control Div.
A FLIGHT CONTROL SYSTEM USING THE DAIS ARCHITECTURE
A. P. DeThomas and R. A. Hendrix *In* AGARD Advan. in

Guidance and Control Systems Using Digital Tech. Aug. 1979 9 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14023# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
AN OBSERVER SYSTEM FOR SENSOR FAILURE DETECTION AND ISOLATION IN DIGITAL FLIGHT CONTROL SYSTEMS
Norbert Stuckenberg *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 11 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14025# Marconi Avionics Ltd., Rochester (England). Flight Automation Research Lab.
RECENT ADVANCES IN FIBRE OPTICS FOR HIGH INTEGRITY DIGITAL CONTROL SYSTEMS
R. P. G. Collinson *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 16 p (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14026# General Dynamics/Fort Worth, Tex.
REDUNDANCY MANAGEMENT CONSIDERATIONS FOR A CONTROL-CONFIGURED FIGHTER AIRCRAFT TRIPLEX DIGITAL FLY-BY-WIRE FLIGHT CONTROL SYSTEM
John H. Watson, William J. Yousey, and James M. Railey *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 23 p ref (For primary document see N80-14017 05-01)
(Contract F33615-77-C-3036)
Avail: NTIS HC A16/MF A01

N80-14027# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.
FAILURE DETECTION, ISOLATION AND INDICATION IN HIGHLY INTEGRATED DIGITAL GUIDANCE AND CONTROL SYSTEM
Wolfgang J. Kubbat *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 17 p (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14028# Lockheed-Georgia Co., Marietta.
AN ASSESSMENT OF AND APPROACH TO THE VALIDATION OF DIGITAL FLIGHT CONTROL SYSTEMS
D. B. Mulcare and W. G. Nass *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 12 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14029# Westland Helicopters Ltd., Yeovil (England).
EXPERIENCE IN PRODUCING SOFTWARE FOR THE GROUND STATION OF A REMOTELY PILOTED HELICOPTER SYSTEM
J. P. Webbly, P. L. Wascott, M. I. Tucker, and H. M. Smith *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 9 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangers and runways, aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-14144# Federal Aviation Administration, Washington, D. C.
REFLECTION CRACKING OF BITUMINOUS OVERLAYS FOR AIRPORT PAVEMENTS: A STATE OF THE ART Final Report
Aston L. McLaughlin May 1979 91 p refs
(AD-A073484; FAA-RD-79-57; ARD-430) Avail: NTIS HC A05/MF A01 CSCL 13/2

Methods and practices pursued by various pavement authorities in an effort to reduce the incidence of reflection cracking of bituminous overlays are discussed. The theoretical, analytical and laboratory efforts in this connection are presented. The mechanics of reflection cracking and criteria for design of overlay systems which are resistant to reflection cracking are examined. A.W.H.

N80-14145# Dayton Univ., Ohio.
FEASIBILITY OF UTILIZING LASER DOPPLER VELOCIMETER TECHNIQUES IN VERY CLEAN WIND TUNNELS Final Report, Oct. 1977 - Oct. 1978
James D. Trolinger, Anthony E. Smart, and Virgil A. Cline (Air Force Reserve Program, Wright-Patterson AFB, Ohio) Wright-Patterson AFB, Ohio AFFDL Aug. 1979 26 p refs Prepared in cooperation with Spectron Development Labs., Inc., Costa Mesa, Calif.
(Contract F33615-76-C-3145; AF Proj. 2404)
(AD-A074244; AFFDL-TR-79-3084) Avail: NTIS HC A03/MF A01 CSCL 14/2

A laser Doppler velocimeter was tested in a two-foot transonic wind tunnel under clean flow conditions without artificial seeding. Both the classical and photon correlation modes were tested. Both systems worked initially; however, as the tunnel cleaned up during operation, the classical system ceased producing data within a few minutes of run time and the photon correlation mode ceased function after about twenty minutes. The next step in developing a working system is described. GRA

N80-14146# Battelle Memorial Inst., Columbus, Ohio.
ARC-TUNNEL STAGNATION ENTHALPY MEASUREMENTS UTILIZING THE COPPER-LINE-RATIO METHOD CORRECTED FOR SELF-ABSORPTION EFFECTS Final Report, Nov. 1977 - Oct. 1978
Anthony A. Boiarski Jun. 1979 66 p refs
(Contract F33615-76-C-3145; AF Proj. 2404)
(AD-A074635; AFFDL-TR-79-3068) Avail: NTIS HC A04/MF A01 CSCL 14/2

Detailed measurements of the copper emission spectrum at 5106 A and 5153 A were obtained while observing radiation from the free-stream and model nosecap regions of an arc-heated wind tunnel flow. The ratio of peak line intensities and the absolute width of the 5106 A line were used to infer gas temperature (i.e., enthalpy) and copper density corrected for self-absorption effects. Line shift measurements were also obtained in order to corroborate the use of Lindholm's collision broadening theory in the self-absorption analysis. Final enthalpy results for the peaked profile mode of operation indicated that a significant correction to measured enthalpy resulted when self-absorption was taken into account. The resulting average stagnation enthalpy value of 5250 Btu/lbm was in good agreement with previously obtained results utilizing a combined heat flux and ptiot probe technique. GRA

N80-14147# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
INVESTIGATION OF NOISE HAZARDS IN THE ENGINE TEST CELL, CFB BADEN-SOELLINGEN
S. E. Forshaw Jun. 1979 22 p refs
(AD-A074391; DCIEM-TR-79-X23) Avail: NTIS HC A02/MF A01 CSCL 21/5

Although the sound pressure levels occuring in the engine test cell, CFB Baden-Soellingen, are extremely intense (137 dBA) with a J79 engine running at military power, the attenuation provided by Canadian Forces standard-issue earmuffs is sufficient to reduce the noise at operators' ears to more tolerable levels (108 dBA). Moreover, the noise doses sustained during engine check-outs permit average work periods of up to 49 minutes per day in the test cell with engines running. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N80-14148*# National Aeronautics and Space Administration, Washington, D. C.
ANNIVERSARY OF APOLLO 11 MOON LANDING PRESS CONFERENCE
20 Jul. 1979 19 p Tape Transcript
(NASA-TM-80844; P79-10191) Avail: NTIS Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

Proceedings from a conference with the astronauts from the Apollo 11 flight are presented. Topics range from the space shuttle to astronaut training programs. A.W.H.

N80-14149*# National Aeronautics and Space Administration, Washington, D. C.
TENTH ANNIVERSARY OF APOLLO 11 MOON LANDING
20 Jul. 1979 22 p Tape Transcript
(NASA-TM-80473; P79-10192) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The proceedings from the tenth anniversary of the Apollo 11 Moon landing are presented. Future direction of the space programs and space exploration are discussed. A.W.H.

N80-14150*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Sep. - Oct. 1979
15 Dec. 1979 118 p refs
(Contract NAS7-100)
(NASA-CR-162524; JPL-PR-42-54) Avail: NTIS HC A06/MF A01 CSCL 22D

Deep Space Network progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations is presented. For individual titles, see N80-14151 through N80-14162.

N80-14151*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Dec. 1979 p 1-3 (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N80-14152*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN RADIO SCIENCE SYSTEM, MARK III-80 c32
A. L. Berman *In its* The Deep Space Network 15 Dec. 1979 p 4-18 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

The key characteristics, functional operation, and functional requirements of the DSN Radio Science System, Mark III-80, are described. Particularly emphasized is 'medium bandwidth' capability, which will enable support of the Voyager Saturn Ring Experiment. R.E.S.

N80-14153*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT c15
N. Fanelli and H. Nance *In its* The Deep Space Network 15 Dec. 1979 p 19-23 (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 22B

Tracking and data acquisition for Project Voyager is presented and discussed for the postencounter period for Voyager 2 and the Saturn cruise period for Voyager 1. R.E.S.

N80-14154*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER 11 SATURN ENCOUNTER MISSION SUPPORT c91
R. B. Miller *In its* The Deep Space Network 15 Dec. 1979 p 24-27 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 03B

Pioneer 11 spacecraft flew by the planet Saturn in August and September 1979. The DSN performance during the support of the first Saturn encounter is described. Author

N80-14155*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STABILITY OF THE MULTIMEGABIT TELEMETRY CARRIER LOOP c17
D. W. Brown *In its* The Deep Space Network 15 Dec. 1979 p 28-33 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 09F

Basic sampled data loop stability is reviewed; the effect of an additional low-pass filter in the loop is analyzed. Resulting upper bounds on permissible loop bandwidth are established. Author

N80-14156*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN EXAMINATION OF ANCILLARY EQUIPMENT FOR A PROPOSED 34.3 GHz HIGH POWER GYROTRON TWT AMPLIFIER c33
A. Kupiszewski *In its* The Deep Space Network 15 Dec. 1979 p 34-40 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 09C

A short review of gyrotron developments and applications is given with attention to both theory and experiments. Parameters for a point design for a gyrotron traveling wave tube amplifier are listed and a detailed examination of ancillary equipment is made. A safety-interlock tree for insuring longer tube life under operating conditions is proposed, and a sequence for turn on/off of the proposed tube is given. In addition, reasoning for the expectation of multimode output is presented. R.E.S.

N80-14157*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EVALUATION OF THE VA-876P KLYSTRON FOR THE 20-kW X-BAND UPLINK TRANSMITTER c33
R. B. Kolbly *In its* The Deep Space Network 15 Dec. 1979 p 41-50 ref (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 09C

Initial evaluation test results of the proposed 20 kW X band uplink klystron are presented. Operating parameters are compared with the existing DSN 20 kW S band klystrons. Measured differential RF phase sensitivities vs operating parameter changes are exhibited. Author

N80-14158*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A COMPUTER-AIDED DESIGN SYSTEM FOR CUSTOM LARGE-SCALE INTEGRATED CIRCUITS c33
M. W. Sievers *In its* The Deep Space Network 15 Dec. 1979 p 51-61 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 09C

A high level descriptive language and a SIMULA based language interpreter for defining the logic core of an integrated circuit is described. The interpreter is running on the Caltech DEC SYSTEM 20 computer. It has been used to design a 16 bit self checking comparator of medium scale integration proportions. J.M.S.

N80-14159*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A STUDY OF THE INFLUENCE OF OIL SATURATION ON THE 64 METER ANTENNA HYDROSTATIC BEARING GROUT c37
H. P. Phillips, A. A. Riewe, M. Polivka (California Univ., Berkeley), and P. K. Mehta *In its* The Deep Space Network 15 Dec. 1979 p 62-70 (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 13I

The effect of oil saturation on the grout supporting the hydrostatic bearing runners in the DSN 64 m antennas was investigated. It is concluded that oil saturation as such did not significantly affect the strength of the concrete in either static

or cyclic loading. The possibility is raised that the presence of oil as the concrete is placed may inhibit the development of the full strength of the material. J.M.S.

N80-14160*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER 1979: UPDATE TO THE RADIAL AND SOLAR CYCLE VARIATIONS IN THE SOLAR WIND PHASE FLUCTUATION SPECTRAL INDEX **c92**
A. L. Berman and A. D. Conteas *In its* The Deep Space Network 15 Dec. 1979 p 71-81 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 03B

Columnar spectral index information that has been extracted from a sizable volume of Voyager 1979 solar conjunction Doppler phase fluctuation data is presented. The Voyager 1979 results, when compared to similar information derived from the 1976 Helios and Viking and 1978 Voyager solar conjunctions, lead to the following inferences: (1) there has been a significant change in the spectral index from 1976 to 1978/1979; (2) there is continuing evidence that favors a slight (positive) correlation between the spectral index and the solar (sunspot) cycle; and (3) there is little or no evidence in support of a radial variation of the spectral index. Recently, it has been hypothesized that a flattening of the phase fluctuation spectrum occurs near the sun; these data are at a variance with such a hypothesis. J.M.S.

N80-14161*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN EFFICIENT PROGRAM FOR DECODING THE (255,223) REED-SOLOMON CODE OVER GF (2 TO THE 8TH POWER) WITH BOTH ERRORS AND ERASURES, USING TRANSFORM DECODING **c61**
R. L. Miller, T. K. Truong, and I. S. Reed (Univ. of Southern California) *In its* The Deep Space Network 15 Dec. 1979 p 82-91 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 09B

To decode a (255,223) Reed-Solomon code over GF(2 to the 8th power), a fast Fourier-like transform over GF(2 to the 8th power) was developed to compute the syndromes and the error-erasure vectors of the transmitted code words. This simplified transform decoder is implemented in a program on a digital computer. The (255,223) Reed-Solomon code over GF(2 to the 8th power) is a NASA standard for concatenation with a convolutional code. In a simulation, random code words were corrupted by random error and erasure patterns, and decoded whenever theoretically possible. A matrix of execution times for this transform decoder under varying sets of errors and erasure patterns is included. This matrix demonstrates that the speed of the decoder is between 3 and 7 times faster than the standard R-S decoder, developed previously by NASA. J.M.S.

N80-14162*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE MICROPROCESSOR-BASED SYNTHESIZER CONTROLLER **c60**
H. Donnelly, M. R. Wick, R. W. Weller, G. B. Schaaf, B. Barber, and M. A. Stern *In its* The Deep Space Network 15 Dec. 1979 p 92-103 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 09B

The design and implementation plan of a microprocessor based controller for the Dana Digiphase Synthesizer is presented. Improvements over the present controller, POCA, are discussed, including greater operating capability, increased phase control accuracy and the addition of diagnostics. J.M.S.

N80-14163*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
DETERMINATION OF ASPS PERFORMANCE FOR LARGE PAYLOADS IN THE SHUTTLE ORBITER DISTURBANCE ENVIRONMENT
Claude R. Keckler, Kemper S. Kibler, and Lawrence F. Powell Oct. 1979 37 p refs
(NASA-TM-80136) Avail: NTIS HC A03/MF A01 CSCL 22A

A high fidelity simulation of the annular suspension and pointing system (ASPS), its payload, and the shuttle orbiter was used to define the worst case orientations of the ASPS and its payload for the various vehicle disturbances, and to determine the performance capability of the ASPS under these conditions. The most demanding and largest proposed payload, the Solar Optical Telescope was selected for study. It was found that, in all cases, the ASPS more than satisfied the payload's requirements. It is concluded that, to satisfy facility class payload requirements, the ASPS or a shuttle orbiter free-drift mode (control system off) should be utilized. A.R.H.

N80-14164*# Analytical Mechanics Associates, Inc., Jericho, N.Y.
RESEARCH IN NAVIGATION AND OPTIMIZATION FOR SPACE TRAJECTORIES Final Report, 1 Oct. 1975 - 30 Sep. 1979
S. Pines and H. J. Kelley 30 Sep. 1979 50 p
(Contract NAS9-14818)
(NASA-CR-160420; AMA-79-20) Avail: NTIS
HC A03/MF A01 CSCL 22A

Topics covered include: (1) initial Cartesian coordinates for rapid precision orbit prediction; (2) accelerating convergence in optimization methods using search routines by applying curvilinear projection ideas; (3) perturbation-magnitude control for difference-quotient estimation of derivatives; and (4) determining the accelerometer bias for in-orbit shuttle trajectories. A.R.H.

N80-14165# Centre National d'Etudes Spatiales, Toulouse (France).
FRENCH SPACE PROGRAMS [PROGRAMME SPATIAL FRANCAIS. RAPPORT AU COSPAR]
1979 154 p refs In FRENCH; ENGLISH summary Presented at 22d COSPAR Assembly, Bangalore, India, May - Jun. 1979 Prepared in cooperation with Comite Natl. Franc. de Rech. dans l'Espace, Paris
Avail: NTIS HC A08/MF A01

French activites during 1979 in space research and correlatad programs are summarized. The work accomplished in the fields of astronomy, solar system, planet studies, interplanetary medium, ionosphere and magnetospheric physics, aeronomy, meteorology, earth resources, geodesy, life sciences, and material sciences are discussed. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-14166# British Aerospace Dynamics (Space), Stevenage (England). Electronic and Space Systems.
PARAMETER ESTIMATION FROM SATELLITE TRACKING DATA Final Report
T. A. Morley and E. B. Crellin Jan. 1979 229 p refs
(Contract ESOC-3217/77)
(ESS/SS-919; ESA-CR(P)-1233) Avail: NTIS
HC A11/MF A01

The work carried out on processing satellite tracking data to determine improved estimates for many parameters, is described. In the extraction of information from COS-B observations, effort was concentrated on the estimation of measurement biases and the solar radiation pressure coefficient. In several cases convergence to a stable solution were not obtained due to the round off error that arises because of the almost negligible effect of solar radiation pressure on the evolution of the orbit over the duration of the measurement data spans. Consistent estimates for the range biases were not determined from OTS transfer orbit data. However, throughout the study it is evident that range rate measurements are greatly inferior to range measurements for providing information on either the orbital elements or the other uncertain parameters apart from their own associated biases. Some improvement was determined for the estimates of the OTS drag coefficient and the velocity increment of one of the reorientation maneuver. There is good reason to suppose that these estimations were accompanied by more accurate orbit determination. Author (ESA)

N80-14033# McMaster Univ., Hamilton (Ontario).
MICROCOMPUTER-BASED ON-LINE STATE ESTIMATION WITH APPLICATIONS TO SATELLITES
N. K. Sinha, S. Y. Law (Commun. Res. Centre, Ottawa), and R. Mamen *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 11 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-14151*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Dec. 1979 p 1-3 (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-14167*# National Aeronautics and Space Administration, Washington, D. C.
PRESS CONFERENCE ON SKYLAB
6 Jul. 1979 58 p Tape Transcript
(NASA-TM-80752; P79-10190) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

A discussion on the Skylab reentry date and its predicted effects is presented. The plans for a coordination center and its activities to monitor the reentry of Skylab are discussed. A.W.H.

N80-14168*# National Aeronautics and Space Administration, Washington, D. C.
PRESS BRIEFING: MAGSAT
22 Oct. 1979 27 p
(NASA-TM-80757; P79-10195) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

A discussion of the MAGSAT program is presented. The Earth magnetic mapping mission of the MAGSAT is described. A.W.H.

N80-14169*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
TORQUE EQUILIBRIUM ATTITUDE CONTROL FOR SKYLAB REENTRY
John R. Glasse and Hans F. Kennel Nov. 1979 173 p refs
(NASA-TM-78252) Avail: NTIS HC A08/MF A01 CSCL 22B

All the available torque equilibrium attitudes (most were useless from the standpoint of lack of electrical power) and the equilibrium seeking method are presented, as well as the actual successful application during the 3 weeks prior to Skylab reentry. M.M.M.

N80-14170# Air Force Geophysics Lab., Hanscom AFB, Mass.
ATS-5 AND ATS-6 POTENTIALS DURING ECLIPSE Interim Report
Allen G. Rubin and Henry B. Garrett 27 Sep. 1979 11 p refs
(AD-A074878; AFGL-TR-79-0218) Avail: NTIS HC A02/MF A01 CSCL 22/1

ATS-5 and ATS-6 data for spacecraft charging during eclipse conditions are analyzed. ATS-5 and ATS-6 charged to voltages greater than 100 volts for about 55% of the eclipse periods examined. The mean spacecraft potential during eclipse was 2 keV for ATS-5, and the highest potential measured was 10 kilovolts. For ATS-6, the mean potential during eclipse was 4 keV, the highest potential measured being 20 keV. The average measured spacecraft potentials for both ATS-5 and 6 depend, approximately linearly, upon K sub p. This relationship is due mainly to the dependence of electron current density on K sub p near midnight. Spacecraft potentials at geosynchronous orbit may, to a rough approximation, thus be inferred from ground-based measurements of K sub p, the planetary 3 hour index. GRA

N80-14171# Mark Resources, Inc., Marina Del Rey, Calif.
TMR PROCESSING PROCEDURES FOR GSRS SPIN AND ATTITUDE MEASUREMENTS Final Report, Aug. 1978 - Aug. 1979
B. D. Baker and W. B. Kendall Aug. 1979 77 p
(Contract DAAD07-77-C-0094; DA Proj. 1T6-65804-DE-93)
(AD-A074947; MRI-142-31) Avail: NTIS HC A05/MF A01 CSCL 17/9

The use of Target Motion Resolution (TMR) processing of data from the MPS-36 and FPS-16 instrumentation radars at WSMR to produce measurements of the spin and coning motion of the GSRS surface-to-surface missile is described in detail. Actual flight-test data are processed to illustrate the techniques described. New computer software produced for and installed at WSMR to do the described processing is documented. GRA

N80-14172# Control Dynamics Co., Huntsville, Ala.
APPLICATION OF DISCRETE GUIDANCE AND CONTROL THEORY Final Report
S. M. Seltzer Aug. 1979 227 p refs
(Contract DAAK40-78-C-0226)
(AD-A074782; CDC-79-2) Avail: NTIS HC A11/MF A01 CSCL 17/7

During Task II a stability analysis, summary, and implementation associated with the discrete control for a missile system was performed via the parameter space technique. Emphasis was placed upon the development of analytical tools to perform the design and analysis of the system. The three design tools developed under this contract are described: SAM, an Alternative to Sampled-Data Signal Flow Graphs; Determination of Digital Control System Response by Cross-Multiplication; and Sampled-Data Analysis in Parameter Space. The three techniques have been cast in a form amenable to implementation within digital computers or desktop calculators. GRA

N80-14173*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
REAL-TIME ISEE DATA SYSTEM
B. T. Tsurutani and D. N. Baker 1979 13 p refs Presented at the Intern. Solar Predictions Workshop, Boulder, Colo. 23 Apr. 1979 Prepared in cooperation with LASL
(Contracts NAS7-100; W-7405-eng-36)
(NASA-CR-162549; LA-UR-79-1660; CONF-790413-4) Avail: NTIS HC A02/MF A01 CSCL 05B

A real-time ISEE data system directed toward predicting geomagnetic substorms and storms is discussed. Such a system may allow up to 60+ minutes advance warning of magnetospheric substorms and up to 30 minute warnings of geomagnetic storms (and other disturbances) induced by high-speed streams and solar flares. The proposed system utilizes existing capabilities of several agencies (NASA, NOAA, USAF), and thereby minimizes costs. This same concept may be applicable to data from other spacecraft, and other NASA centers; thus, each individual experimenter can receive quick-look data in real time at his or her base institution. DOE

N80-14040# Raytheon Co., Bedford, Mass. Missile Systems Div.
FEDERATED MICROCOMPUTER SYSTEMS FOR ON-BOARD MISSILE GUIDANCE AND CONTROL
Frank J. Langley, David S. Siegel (ONR, Arlington, Va.), Wayne F. Savage (NSWC), and Rollin E. Wehman *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug.

1979 15 p refs Sponsored by ONR and NSWC (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14153*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT
N. Fanelli and H. Nance *In its* The Deep Space Network 15 Dec. 1979 p 19-23 (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 22B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N80-14174*# National Aeronautics and Space Administration, Washington, D. C.
PRESS BRIEFING ON DR. FROSCH'S MEETING WITH PRESIDENT CARTER REGARDING THE SPACE SHUTTLE
14 Nov. 1979 24 p Tape Transcript
(NASA-TM-80753; P79-10196) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22B

A discussion of the space shuttle program is presented. Topics include estimated costs, launch schedule, payload weight, and presidential support. A.W.H.

N80-14175*# IBM Federal Systems Div., Houston, Texas.
SOFTWARE DESIGN SPECIFICATION. PART 2: ORBITAL FLIGHT TEST (OFT) DETAILED DESIGN SPECIFICATION. VOLUME 3: APPLICATIONS. BOOK 2: SYSTEM MANAGEMENT
16 Oct. 1979 977 p
(Contract NAS9-14444)
(NASA-CR-160389) Avail: NTIS HC A99/MF A01 CSCL 22B

The functions performed by the systems management (SM) application software are described along with the design employed to accomplish these functions. The operational sequences (OPS) control segments and the cyclic processes they control are defined. The SM specialist function control (SPEC) segments and the display controlled 'on-demand' processes that are invoked by either an OPS or SPEC control segment as a direct result of an item entry to a display are included. Each processing element in the SM application is described including an input/output table and a structured control flow diagram. The flow through the module and other information pertinent to that process and its interfaces to other processes are included. J.M.S.

N80-14176*# Martin Marietta Corp., Denver, Colo.
THERMAL PROTECTION SYSTEM FLIGHT REPAIR KIT Final Report
Dec. 1979 75 p
(Contract NAS9-15969)
(NASA-CR-160417; MCR-79-682) Avail: NTIS
HC A04/MF A01 CSCL 22B

A thermal protection system (TPS) flight repair kit required for use on a flight of the Space Transportation System is defined. A means of making TPS repairs in orbit by the crew via extravehicular activity is discussed. A cure in place ablator, a precured ablator (large area application), and packaging design (containers for mixing and dispensing) for the TPS are investigated. A.W.H.

N80-14177*# National Aeronautics and Space Administration. John F Kennedy Space Center, Cocoa Beach, Fla.
SPACE TRANSPORTATION SYSTEM SHUTTLE TURN ABOUT ANALYSIS REPORT
R. E. Reedy 14 Aug. 1979 151 p refs
(NASA-TM-80840) Avail: NTIS HC A08/MF A01 CSCL 22A

The progress made and the problems encountered by the various program elements of the shuttle program in achieving the 160 hour ground turnaround goal are presented and evaluated. Task assessment time is measured against the program allocation time. R.E.S.

N80-14178# Martin Marietta Corp., Vandenberg AFB, Calif.
DOD STS GROUND SUPPORT SYSTEMS
Rolland E. Bruckner 15 Mar. 1978 74 p
(Contract F04701-76-C-0081)
(VCR-76-032-05) Avail: NTIS HC A04/MF A01

The ground operations systems functions and the turnaround time required to achieve a yearly launch rate of 20 space shuttle vehicles from Vandenburg Air Force Base using two orbiters and one launch pad were analyzed. The VAFB turnaround time requirements are defined. The design reference timelines (DRTs), the assessed timelines and the delta times by station set for the turnaround activities are presented. Problem areas impacting the station set design reference timelines are described and the corrective action, status, and results of related action items or trade studies are considered. Periodic significant scheduled tasks (PSSTs) and unplanned maintenance tasks in support of specific missions are examined. A.R.H.

N80-14179*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SHUTTLE ORBITER TPS FLIGHT REPAIR KIT DEVELOPMENT Final Report
Dec. 1979 100 p
(Contract NAS9-15971)
(NASA-CR-160416; MDC-G8261) Avail: NTIS
HC A05/MF A01 CSCL 22B

The design and application of a TPS repair kit is presented. The repair kit is designed for on orbit use by a crew member working in the manned maneuvering unit (MMU). The kit includes the necessary equipment and materials to accomplish the repair tasks which include the following: HRSI emittance coating repair, damaged tile repair, missing tile repair, and multiple tile repair. Two types of repair materials required to do the small area repair and the large area repair are described. The materials area cure in place, silicone base ablator for small damaged areas and precured ablator tile for repair of larger damaged areas is examined. The cure in place ablator is also used as an adhesive to bond the precured tiles in place. An applicator for the cure in place ablator, designed to contain a two-part silicon compound, mix the two components at correct ratio, and dispense the materials at rates compatible with mission timelines established for the EVA is described. A.W.H.

N80-14180*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLIGHT DESIGN SYSTEM-1 SYSTEM DESIGN DOCUMENT. VOLUME 9: EXECUTIVE LOGIC FLOW, PROGRAM DESIGN LANGUAGE
Dec. 1979 449 p
(NASA-TM-80841; JSC-12564) Avail: NTIS
HC A19/MF A01 CSCL 22B

The detailed logic flow for the Flight Design System Executive is presented. The system is designed to provide the hardware/software capability required for operational support of shuttle flight planning. J.M.S.

N80-14181*# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
THERMAL PROTECTION SYSTEM REPAIR KIT PROGRAM Final Report
28 Nov. 1979 145 p
(Contract NAS9-15970)
(NASA-CR-160418; Rept-79SDR2310) Avail: NTIS
HC A07/MF A01 CSCL 22B

The feasibility and conceptual design aspects of repair materials and procedures for in orbit repair of the space shuttle orbiter TPS tiles are investigated. Material studies to investigate cure in place materials are described including catalyst and cure studies, ablation tests and evaluations, and support mixing and applicator design. The feasibility of the repair procedures, the storage of the TPS, dispensing, and cure problems are addressed. A.W.H.

N80-14029# Hamilton Standard, Farmington, Conn.
A REDUNDANT INERTIAL NAVIGATION SYSTEM FOR IUS
R. A. Baum, G. E. S. Morrison (Boeing Aerospace Co., Seattle, Wash.), and R. C. Peters (Aerospace Corp., Los Angeles, Calif.) *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 11 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-14182*# Acurex Corp., Mountain View, Calif. Autodata Div.
PHASE-LOCKED TELEMETRY SYSTEM FOR ROTARY INSTRUMENTATION OF TURBOMACHINERY, PHASE 1 Final Report
Alan Adler and Bas Hoeks Sep. 1978 192 p
(Contract NAS3-20290; Acurex Proj. 6497)
(NASA-CR-159453; Acurex-78-284) Avail: NTIS HC A09/MF A01 CSCL 09F

A telemetry system for use in making strain and temperature measurements on the rotating components of high speed turbomachines employs phase locked transmitters, which offer greater measurement channel capacity and reliability than existing systems which employ L-C carrier oscillators. A prototype transmitter module was tested at 175 C combined with 40,000 g's acceleration. A.R.H.

N80-14155*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STABILITY OF THE MULTIMEGABIT TELEMETRY CARRIER LOOP
D. W. Brown *In its* The Deep Space Network 15 Dec. 1979 p 28-33 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-14183* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANTENNA DEPLOYMENT MECHANISM FOR USE WITH A SPACECRAFT Patent
William A. Leavy and Charles R. Griffin, inventor (to NASA) Issued 27 Nov. 1979 9 p Filed 18 Sep. 1978 Supersedes N78-32436 (16 - 23, p 3086)
(NASA-Case-GSC-12331-1; US-Patent-4,176,360; US-Patent-Appl-SN-943088; US-Patent-Class-343-883; US-Patent-Class-343-880) Avail: US Patent and Trademark Office CSCL 22B

A mechanical system is disclosed to deploy an antenna on a support which may, for example, be a spacecraft. A series of telescoping tubes are nested one within the other when the antenna is in a retracted stowed position. The outermost tube is rigidly attached to the support and the inner tubes are latched in the stowed position by a caging mechanism. The antenna is driven toward a deployed position by a dual motor driven cable which is terminated in a driving tube at the lower end of the innermost tube, from whence the cable is trained about pulleys at the tops and bottoms of successively large tubes of the antenna. The cable is wound on a drum at the lower end of the antenna and coaxial therewith. During deployment of the antenna, the drum rotates, thereby reeling in the deployment cable. The initial movement of the cable causes cam releasing of the latches in the caging device. Thereafter, the antenna tubes are extended until the final deployed position of the antenna is reached. A ratchet attached to the drum prevents reverse rotation of the drum and locks the antenna in the deployed position until the ratchet is released.

Official Gazette of the U.S. Patent and Trademark Office

N80-14184*# Acurex Corp., Mountain View, Calif.
GALILEO PROBE THERMAL PROTECTION: ENTRY HEATING ENVIRONMENTS AND SPALLATION EXPERIMENTS DESIGN Final Report
A. Balakrishnan, W. Nicolet, S. Sandhu, and J. Dodson Nov. 1979 133 p refs
(Contract NAS2-9909; Acurex Proj. 7396)
(NASA-CR-152334; FR-79-21/AS) Avail: NTIS HC A07/MF A01 CSCL 22B

A valid procedure was developed for predicting wall heating and ablation rates about the probe forebody. Entropy layer effects on convective heating rate were analyzed and the computed results are given. A feasibility study to perform an experiment, the selection of a candidate test facility, and the definition of a test matrix are described. The material selection, fabrication, and evaluation of the metal containing carbon-carbon composites for use on the Galileo probe are summarized. The effect of various Jovian atmospheric models on entry heating environment is considered as well as the effect of the nonspherical shape of the planet on entry trajectory. A.R.H.

N80-14185*# Thermacore, Inc., Leola, Pa.
METEOROID PROTECTION METHODS FOR SPACECRAFT RADIATORS USING HEAT PIPES Final Report
Donald M. Ernst Nov. 1979 99 p refs
(Contract JPL-955437)
(NASA-CR-162545) Avail: NTIS HC A05/MF A01 CSCL 22B

Various aspects of achieving a low mass heat pipe radiator for the nuclear electric propulsion spacecraft were studied. Specific emphasis was placed on a concept applicable to a closed Brayton cycle power sub-system. Three aspects of inter-related problems were examined: (1) the armor for meteoroid protection, (2) emissivity of the radiator surface, and (3) the heat pipe itself. The study revealed several alternatives for the achievement of the stated goal, but a final recommendation for the best design requires further investigation. R.E.S.

N80-14186# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE CURRENT STATUS OF PREDICTIONS OF LOW ENERGY PLASMA INTERACTIONS WITH SPACE SYSTEMS Air Force Surveys in Geophysics
Henry B. Garrett 4 Apr. 1979 38 p refs
(AD-A074523; AFGL-TR-79-0089; AFGL-AFSG-410) Avail: NTIS HC A03/MF A01 CSCL 22/1

The present status of low energy magnetospheric plasma interactions with space systems is reviewed. The role of predictions in meeting user needs in assessing the impact of such interactions is described. In light of the perceived needs of the user community and of the current status of modeling and prediction efforts, it is suggested that for most user needs more detailed statistical models of the low energy environment are required. In order to meet current prediction requirements, real-time in situ measurements are proposed as a near-term solution. GRA

N80-14187# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
GUIDELINES FOR SPACE MATERIALS SELECTION
Paris ESA Jul. 1979 120 p refs
(ESA-PSS-07/QRM-01-Issue-5) Avail: NTIS HC A06/MF A01

The different classes of materials used in spacecraft manufacture are reviewed, their chemical nature and physical aspects

are described, and processing and assembly methods are considered. Precautions to be taken and materials to be avoided are emphasized for each class. General effects of the space environment are also described. Some individual materials which are suitable for space application under certain conditions are mentioned. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-14188* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERCHARGED TOPPING ROCKET PROPELLANT FEED SYSTEM Patent
Warner L. Stewart, Ambrose Ginsburg, and Melvin J. Hartmann, inventors (to NASA) Issued 23 Oct. 1979 6 p Filed 21 Apr. 1966
(NASA-Case-XLE-02062-1; US-Patent-4,171,615; US-Patent-Appl-SN-545793; US-Patent-Class-60-203; US-Patent-Class-60-259) Avail: US Patent and Trademark Office CSCL 21H

A rocket propellant feed system utilizing a bleed turbopump to supercharge a topping turbopump is presented. The bleed turbopump is of a low pressure type to meet the cavitation requirements imposed by the propellant storage tanks. The topping turbopump is of a high pressure type and develops 60 to 70 percent of the pressure rise in the propellant.
Official Gazette of the U.S. Patent and Trademark Office

N80-14189*# Aerojet Liquid Rocket Co., Sacramento, Calif.
PERFORMANCE OF A TRANSPIRATION-REGENERATIVE COOLED ROCKET THRUST CHAMBER Final Report
H. W. Valler Sep. 1979 414 p refs
(Contract NAS3-21029)
(NASA-CR-159742) Avail: NTIS HC A18/MF A01 CSCL 21H

The analysis, design, fabrication, and testing of a liquid rocket engine thrust chamber which is gas transpiration cooled in the high heat flux convergent portion of the chamber and water jacket cooled (simulated regenerative) in the barrel and divergent sections of the chamber are described. The engine burns LOX-hydrogen propellants at a chamber pressure of 600 psia. Various transpiration coolant flow rates were tested with resultant local hot gas wall temperatures in the 800 F to 1400 F range. The feasibility of transpiration cooling with hydrogen and helium, and the use of photo-etched copper platelets for heat transfer and coolant metering was successfully demonstrated. A.R.H.

N80-14190# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
ASSESSMENT OF IN SITU DIAGNOSTICS FOR APPLICATION TO ROCKET PROPULSION PROBLEMS Final Report, Feb. 1977 - Mar. 1978
W. K. McGregor Jun. 1979 155 p refs
(AF Proj. 2308)
(AD-A073520; AFRPL-TR-78-62) Avail: NTIS HC A08/MF A01 CSCL 21/2

A compelling need for knowledge of the properties (temperature, density, velocity, composition, etc.) of the flows produced by propulsion systems has recently surfaced in many areas. Of specific interest to the Air Force Rocket Propulsion Laboratory (AFRPL) is knowledge of properties within combustion chambers, particularly for solid fueled motors employing metallized propellants, and properties affecting exhaust plume observables (e.g., smoke, infrared radiation signatures, ultra-violet radiation signatures, radar cross sections, etc.). Methods of making measurements within combustion flows must avoid influencing the very phenomena to be measured and, generally, must be made from without (nonintrusive) because of the harsh environment. This report is aimed at defining the needs for 'combustion diagnostics' associated with rocket propulsion, assessing the status and utility of the applicable techniques, and establishing a basis for the research and development required to provide techniques to meet the defined needs. GRA

N80-14191# Block Engineering, Inc., Cambridge, Mass.
THE 0.1 WAVENUMBER SPECTRAL MEASUREMENTS IN THE REGION FROM 2050 - 2410 WAVENUMBERS OF A STATIC, EXPERIMENTAL ROCKET MOTOR AT THREE PRESSURE ALTITUDES Final Report, Sep. - Nov. 1978
Merle J. Persky 21 Dec. 1978 177 p refs
(Contract N60530-78-C-0272)
(AD-A073704; BEI-78-761) Avail: NTIS HC A09/MF A01 CSCL 17/5

Development of military infrared systems dictates a need for high resolution, infrared spectral data on exhaust plume radiation as a function of altitude and spatial position. To satisfy this need, high resolution spectral measurements were performed on a small, experimental rocket motor. GRA

N80-14192# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
AN ANALYSIS OF EXTERNAL BURNING PROPULSION Final Technical Report, Nov. 1977 - Nov. 1978
D. W. Harvey Mar. 1979 83 p refs
(Contract F04611-78-C-0002; AF Proj. 5730)
(AD-A074639; MDC-G8090; AFRPL-TR-79-8) Avail: NTIS HC A05/MF A01 CSCL 21/2

A computer model of external burning propulsion of axisymmetric, supersonic vehicles is described. Reactive gaseous injectant issues from individual nozzles around the vehicle periphery near the base. At the base, these individual jets merge into an annulus of injectant surrounding the base cavity. Detailed individual-jet calculations in the region upstream of the base are made by an existing analysis developed for fuel-rich jet interaction. The injectant annulus is calculated assuming an adjustable fraction of the flow at equilibrium and the remainder frozen; mass and momentum are conserved, and the transverse pressure gradients are assumed negligible. Results and trends are presented for parameters including Mach number, altitude, vehicle geometry and injectant mass and momentum flux and composition. GRA

N80-14193# ARO, Inc., Arnold Air Force Station, Tenn.
BIPROPELLANT ENGINE PLUME CONTAMINATION PROGRAM. VOLUME 3: PERFORMANCE PREDICTIONS FOR THE AJ10-181 BI-PROPELLANT ROCKET ENGINE USING THE CONTAM/TCC CODE Final Report, Oct. 1977 - Sep. 1978
M. Kinslow and W. B. Stephenson AEDC Sep. 1979 112 p refs
(AD-A074914; AEDC-TR-79-28-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 21/9

A plume contamination test conducted in the AEDC Aerospace Chamber (10V) with the Aerojet AJ10-181 5-lb thrust bipropellant engine provided data for comparison with the CONTAM computer program. The Plume Contamination Effects Prediction Program (CONTAM), developed by McDonnell Douglas under Air Force Rocket Propulsion Laboratory (AFRPL) sponsorship, comprises several component codes which describe the gas dynamics and chemistry. GRA

N80-14194# ARO, Inc., Arnold Air Force Station, Tenn.
CONTAMINATION MEASUREMENTS FROM A 5 LB SUB

F THRUST BIPROPELLANT ENGINE, PHASE 2 Final Report
R. E. Alt, H. M. Powell, L. L. Price, D. F. Frazine, and W. B. Stephenson AEDC 22 Jan. 1979 52 p refs
(AD-A073871; AEDC-TSR-79-V4) Avail: NTIS
HC A04/MF A01 CSCL 21/9

A Bipropellant Rocket Engine plume contamination test program was conducted in the Aerospace Chamber (10V) between Sept. 25 and Oct. 20, 1978. During the four week test period a 5 lb sub F thrust rocket engine was fired over a range of engine operating parameters in a cryogenically pumped vacuum chamber where the background pressure was maintained below 1 x .0000001 torr. A vidicon image intensifier coupled spectrometer (VICS) system was used in conjunction with an electron beam to make number density and rotational temperature measurements of gas species (N2, CO, CO2, and H2/H2O) in the forward flow region of the rocket nozzle. A photomultiplier tube was used in place of the vidicon to make number density and temperature measurements of N2 in the plume backflow region. Forward flow laser light scattering measurements were made with the VICS system to characterize the particle size and particle number distributions in the plume core. Mass flux measurements were made in the plume backflow region (60 degrees-135 degrees off axis) with cryogenically cooled quartz crystal microbalances (QCM's). GRA

N80-14195# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France). Directeur de l'Energetique.
PERFORMANCE TESTS OF LINEAR ARRAYS OF NEEDLE POINTS AS PART OF A STUDY ON FIELD EFFECT CESIUM ENGINES [ESSAIS DE FONCTIONNEMENT DE RESEAUX LINEARES A FILS AFFUTES POUR LA CONDUITE D'ETUDES DE PROPULSEURS A EMISSION DE CHAMP AU CESIUM]
Jean Labbe and Joel Guernigou 30 Dec. 1976 158 p refs In FRENCH
(Contract ESTEC-2117/73-AK)
(ONERA-RTS-1/3127-EY; ESA-CR(P)-1240) Avail: NTIS
HC A08/MF A01

Tests to characterize the operation of cesium ion emitters, based on a field effect phenomenon are described. Twenty devices, consisting of linear arrays of fine pointed rods and different operating modes and geometries were tested. Results show the flux of nonlinear atoms, diffusing past an optical sensor, is approximately 5% and that a relatively high current (0.9 mA/cm) is generated under conditions of good stability. The essential factor for determining whether or not a dense and homogeneous ionic flux is obtainable is the coefficient of diffusion for the liquid cesium on the ends of the points in the arrays. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N80-14196*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BURNING CHARACTERISTICS AND FIBER RETENTION OF GRAPHITE/RESIN MATRIX COMPOSITES
Kenneth J. Bowles 8 Feb. 1980 14 p refs Proposed for Presentation at the 35th Ann. Conf. of the Reinforced Plastics/Composites Inst., New Orleans, 4-8 Feb. 1980; sponsored by Soc. of Plastics Ind.
(NASA-TM-79314; E-271) Avail: NTIS HC A02/MF A01 CSCL 11D

Graphite fiber reinforced resin matrix composites were subjected to controlled burning conditions to determine their burning characteristics and fiber retention properties. Small samples were burned with a natural gas fired torch to study the effects of fiber orientation and structural flaws such as holes and slits that were machined into the laminates. Larger laminate samples were burned in a modified heat release rate calorimeter. Unidirectional epoxy/graphite and polyimide/graphite composites and boron powder filled samples of each of the two composite systems were burn tested. The composites were exposed to a thermal radiation of 5.3 Btu/sq ft-sec in air. Samples of each of the unfilled composite were decomposed anaerobically in the calorimeter. Weight loss data were recorded for burning and decomposition times up to thirty-five minutes. The effects of fiber orientation, flaws, and boron filler additives to the resins were evaluated. A high char forming polyimide resin was no more effective in retaining graphite fibers than a low char forming epoxy resin when burned in air. Boron powder additions to both the polyimide and the epoxy resins stabilized the chars and effectively controlled the fiber release. A.R.H.

N80-14197*# General Dynamics/Convair, San Diego, Calif.
THERMOPHYSICAL PROPERTIES DATA ON GRAPHITE/POLYIMIDE COMPOSITE MATERIALS Final Report
M. D. Campbell and D. D. Burleigh Nov. 1979 69 p
(Contract NAS1-15103)
(NASA-CR-159164; GDC-NAS-79-002) Avail: NTIS
HC A04/MF A01 CSCL 11D

Experimental data for the thermal conductivity, thermal expansion, specific heat, and emittance of laminates of HTS/NR 150B2 and HTS/PMR 15 are presented. Measurements were made over the temperature range 116 K to 588 K. Results for the two materials were similar with some differences attributable to laminate quality. Higher expansion coefficients for the HTS/PMR 15 specimens in the resin-dominated directions indicate a higher coefficient for PMR 15 than NR 150B2. Author

N80-14198# Virginia Univ., Charlottesville. Dept. of Materials Science.
MICROSTRUCTURAL INVESTIGATION OF POLYCRYSTALLINE IRON WHISKERS Technical Report, 1 Feb. 1975 - 31 Jan. 1976
D. S. Lashmore, W. A. Jesser, D. M. Schladitz, H. J. Schladitz, and H. G. F. Wilsdorf Dec. 1976 18 p refs
(Contract N00014-75-C-0691)
(AD-A074708; UVA/525321/MS76/101) Avail: NTIS
HC A02/MF A01 CSCL 20/8

The microstructure of polycrystalline iron whiskers produced by chemical vapor decomposition in a magnetic field is found to consist of a core extending the length of the whiskers surrounded by a series of approximately cylindrical layers made up of particles whose diameters are about 1000 angstroms to 3000 angstroms. The grain size in both the core and the surrounding particles is found to be between 50 angstroms to 200 angstroms. The very high strength of these whiskers, 800 MPa, is considered a result of extreme grain refinement strengthening. GRA

N80-14199# Avco Systems Div., Wilmington, Mass.
PROTECTIVE COATINGS FOR AIRCRAFT COMPOSITES IN NUCLEAR ENVIRONMENTS Final Report, 1 Jan. - 30 Nov. 1977
J. G. Alexander and P. J. Grady 1 Apr. 1978 168 p refs
(Contract DNA001-77-C-0098)
(AD-A074889; AD-E300594; AVSD-0082-78-RR; DNA-4735F) Avail: NTIS HC A08/MF A01 CSCL 11/3

This program selected and experimentally evaluated several classes of protective coatings for nuclear flash for application on graphite epoxy and quartz polyimide composite aircraft skins. An analytical/experimental assessment was also performed to demonstrate the increased tensile capability of the two composite materials with the application of selected coatings. GRA

N80-14200# Ames Lab., Iowa.
GRAPHITE MORPHOLOGIES IN THE SOLIDIFICATION OF HIGH PURITY Fe-C-Si ALLOYS
B. Dhindaw and J. D. Verhoeven May 1979 50 p refs

(Contract W-7405-eng-82)
(IS-4693) Avail: NTIS HC A03/MF A01

Alloys of Fe-C-Si prepared from high purity metals were solidified in crucibles and by directional freezing techniques. It was found that the formation of graphite nodules required cooling rates in the 100 C to 200 C/min range. At very high rates no graphite formed and at low rates coral graphite formed. The use of very high purity Battelle Iron eliminated nodule formation unless an inoculant was used. Extensive chemical analyses were not able to detect the elements effective as nucleating agents, except to show that if an individual element were responsible it was effective at concentrations in the low ppM range. Possible mechanisms are proposed to account for the observed results.
DOE

N80-14201# Toulouse Univ. (France). Lab. de Genie Electrique.
STUDY OF THE TRANSFORMATION OF SYNTHETIC AND POLYPROPYLENE FIBERS UNDERGOING ELECTRICAL DISCHARGES AT HIGH PRESSURE [ETUDE LA TRANSFORMATION DE FIBRES SYNTHETIQUES, DU POLYPROPYLENE PAR L'ACTION DE DECHARGES ELECTRIQUES A HAUTE PRESSION]
C. Antonio and J. Sarlaboux Sep. 1978 27 p In FRENCH
Presented at Conv. de Rech. Action de l'Effluve sur les Surfaces, 1979
(Publ-369) Avail: NTIS HC A03/MF A01

The physical and chemical transformation of polyester fibers and polypropylene films subjected to a corona type discharge treatment was studied. The adsorption isotherms were obtained by inverse chromatography, and the specific surfaces were determined by the gas adsorption technique. The polyester (polyethylene terephtalate) initially shows a decrease in the adsorption capacity, and for longer treatments a progressive increase. The initial decrease appears to be associated with the hydrogen bonds. The polypropylene film shows a consistent reduction in electric ridigity with treatment time and large degradation effects at the electron microscope when treated in an oxydizing atmosphere.
Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-14202 Wisconsin Univ. - Madison.
THE GENERALIZED PHASE SHIFT APPROACH TO ROTATIONAL EXCITATION IN DILUTE DIATOMIC GASES Ph.D. Thesis
Kevin Richard Squire 1979 307 p
Avail: Univ. Microfilms Order No. 7921581

The molecular collision series of Curtiss is reviewed. The close-coupled scattering equations are derived and are rewritten in several angular momentum bases. The generalized phase shift (GPS) equations and their relation to the closecoupled equations are described. An operator solution of the GPS equations is developed which takes the form of a double series in powers of h and the anisotropic part of the intermolecular potential. Explicit expressions are given for operators sufficient to obtain a classical limit solution valid to third order in the potential anisotropy.
Dissert. Abstr.

N80-14203 Washington Univ., Seattle
VIBRATIONAL SPECTRA OF SOLID ETHANE; VIBRATIONAL SPECTRA OF DIBORANE IN AN ARGON MATRIX Ph.D. Thesis
Mark George Wisnosky 1979 257 p
Avail: Univ. Microfilms Order No. 7927890

The infrared and Raman spectra of polycrystalline ethane in the solid 2 phase, prepared at approximately 20 K, are presented and interpreted in terms of the crystal structures reported by van Nes and Vos. The spectra are found to be in complete agreement with the proposed monoclinic structure P2 sub 1/n, z = 2. A normal coordinate analysis of solid 2 ethane coordinates is also given. The infrared spectra of diborane, frozen in an argon matrix, are also presented. B2H6, B2D6 and partially deuterated diborane are all included. These spectra, along with gas phase Raman spectra obtained from the literature, are used in a force field calculation. A calculation of the force field for diborane by Blom and Muller was used as the starting point. Only minor variations from the results of Blom and Muller were required.
Dissert. Abstr.

N80-14204 Utah Univ., Salt Lake City.
CATALYTIC-SYNTHESIS OF LIGHT HYDROCARBONS FROM CARBON MONOXIDE/HYDROGEN OVER METAL CATALYSTS Ph.D. Thesis
Chen-hsyong Yang 1979 132 p
Avail: Univ. Microfilms Order No. 7927071

The synthesis of low molecular weight hydrocarbons from CO and H2 mixture over metal catalysts was studied. The catalysts evaluated were prepared by co-precipitation and impregnation techniques. The catalytic activities and selectivities were determined in a bench scale fixed-bed reactor. Iron catalysts appeared to have the most potential for synthesis of C2-C4 hydrocarbons. Reduced-and-nitrided iron catalysts were very active and gave better selectivity toward C2-C4 olefinic hydrocarbons than Co-C4 catalysts. Potassium was an effective promoter to increase activity but had no effect on hydrocarbon selectivity. The amount of potassium required for maximum activity was different for each iron catalyst system. Manganese was the most effective promoter.
Dissert. Abstr.

N80-14205 Purdue Univ., Lafayette, Ind.
COMPUTER CONTROLLED INTERNAL REFLECTION SPECTROELECTROCHEMICAL MEASUREMENTS OF FAST ELECTRON TRANSFER REACTIONS Ph.D. Thesis
John Charles Holland 1979 199 p
Avail: Univ. Microfilms Order No. 7926386

Studies of absorbance-time transients at platinum optically transparent electrodes (OTE) were undertaken to directly monitor concentration profiles using internal reflection spectroelectrochemistry (IRS). A laboratory computer performing real time data acquisition, signal averaging, rapid implicit digital simulation and curve fitting contributed to improved speed and accuracy. Also coulostatic charge injection, rugged Pt OTE, a stable, intense light source, and a vacuum compatible cell with adjustable reference electrode was combined to produce highly accurate IRS absorbance-time profiles for semi-infinite linear diffusion. Experimental profiles for di-p-anisylamine and tri-p-anisylamine oxidation were found to agree simultaneously with established optical, electrochemical, and diffusion theories.
Dissert. Abstr.

N80-14206 Wisconsin Univ. - Madison.
SPECTROSCOPIC INVESTIGATIONS OF CATHODE ELECTRODE VAPOR EXCITATION AND PROPAGATION IN HIGH VOLTAGE SPARK DISCHARGES Ph.D. Thesis
Robert John Klueppel 1979 412 p
Avail: Univ. Microfilms Order No. 7919803

Observations of the spark at high repetition rates (kHz range) reveal the process to consist of two physically distinct events: one is the formation of an initial filamentary structure bridging the electrodes and expanding outward in time to produce a torus, the other is a sheath of accumulated, toroidally-shaped material from the previous discharges in the high frequency train coaxially enveloping this expanding filament. The instrumental systems used to effect stroboscopic detection from positionally-stabilized discharges with temporal and spatial resolutions of 0.1 microseconds and 0.05 mm for the emission, absorption, and Schlieren experiments are detailed. Methods used for stabilizing, generating and activating discharge trains at high frequency are described as well as the optical, mechanical, and electronic coupling of the apparatus.
Dissert. Abstr.

N80-14207 Texas Univ. at Austin.
AN ELECTRON DIFFRACTION STUDY OF LASER EXCITED SULFUR HEXAFLUORIDE Ph.D. Thesis
Marsha Ann Multer Arvedson 1979 87 p
Avail: Univ. Microfilms Order No. 7928257

Gas-phase electron diffraction is applied to the study of molecules subjected to infrared laser radiation. A rise in the vibrational amplitudes of the interatomic distances in SF6 due to direct absorption of laser radiation was detected. The relative size of the increase in the mean amplitudes was inconsistent with a thermal distribution of absorbed energy. For the power densities used in this experiment, redistribution of energy from the pumped mode to other vibrational modes in the molecule is estimated to take longer than a microsecond. A scattering theory is derived and applied in the analysis of the data from the above experiment. The theoretical scattered intensity is corrected for the effects of intramolecular multiple scattering.

Dissert. Abstr.

N80-14208 Northwestern Univ., Evanston, Ill.
HYDROGENATION CATALYSTS DERIVED FROM Mo(CO)6/ALUMINA Ph.D. Thesis
Robert Glade Bowman 1979 270 p
Avail: Univ. Microfilms Order No. 7927303

A variety of catalysts were prepared by decomposing molybdenum hexacarbonyl on gamma-alumina. The catalytic characteristics of these materials were influenced by the activation temperature, the degree of hydroxylation of the alumina, and the carrier gas used in the activation. The stoichiometry of the catalysts formed was determined by measuring the gases evolved during activation. Various catalysts derived from Mo(CO)6/alumina catalyzed metathesis of olefins, hydrogenation of olefins, methanation of carbon monoxide, and hydrogenolysis of cyclopropane.

Dissert. Abstr.

N80-14209 Wisconsin Univ. - Madison.
HYDRODYNAMIC AND ELECTROSTATIC CHARACTERIZATION OF PARTICLES BY LIGHT SCATTERING Ph.D. Thesis
George Barrett Caflisch 1979 127 p
Avail: Univ. Microfilms Order No. 7921548

The use of light scattering for characterization of synthetic and biological particles is described, including elastic, quasi-elastic and electrophoretic techniques. Three distinct systems are investigated: bovine serum albumin, an amphoteric polymer latex, and the bovine retinal photoreceptor disk membrane. The electrophoretic mobility of bovine serum albumin measured by electrophoretic light scattering is found to vary with ionic strength according to Henry's law. A pH dependent variation in radius of the amphoteric latex is discussed in terms of a concentric sphere model where the outer shell consists of hydrophilic moieties and the inner core of hydrophobic polystyrene. Binding of Ca(2+) on bovine rod outer segment membrane vesicles is deduced from electrophoresis. There appears to be two types of binding sites, one of higher affinity with second order cooperativity, and another of lower affinity with no cooperativity.

Dissert. Abstr.

N80-14210 Northwestern Univ., Evanston, Ill.
A MINICOMPUTER SYSTEM FOR CHEMICAL EXPERIMENTATION, WITH APPLICATIONS TO ELECTROCHEMILUMINESCENCE AND CYCLIC DIFFERENTIAL PULSE VOLTAMMETRY Ph.D. Thesis
Kenneth Franklin Drake 1979 489 p
Avail: Univ. Microfilms Order No. 7927328

The minicomputer-based instrumental system presented is designed to perform the triple-step ECL (electrochemiluminescence) experiment with step times sufficiently short so that the kinetics of the homegeneous electron-transfer process can be investigated. Since the mass-transport and chemical kinetics are not subject to an analytical solution, a finite-difference program was written to simulate the experiment assuming various values of the homogeneous electron-transfer rate. ECL studies were performed on 9,10-diphenylanthracene and tris-(2,2'-bipyridine) ruthenium(II) perchlorate, but very unstable data were obtained, making a determination of the rate constant impossible. Definite perannihilation characteristics were observed. A combination of instrumental and chemical complications is suspected.

Dissert. Abstr.

N80-14211*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
METHODS FOR CALCULATION OF ENGINEERING PARAMETERS FOR GAS SEPARATION
D. D. Lawson 1 Oct. 1979 25 p refs Sponsored in part by DOE
(Contract NAS7-100)
(NASA-CR-162532; JPL-PUB-79-46) Avail: NTIS HC A02/MF A01 CSCL 07D

A group additivity method is generated which allows estimation, from the structural formulas alone, of the energy of vaporization and the molar volume at 25 C of many nonpolar organic liquids. Using these two parameters and appropriate thermodynamic relations, the vapor pressure of the liquid phase and the solubility of various gases in nonpolar organic liquids are predicted. It is also possible to use the data to evaluate organic and some inorganic liquids for use in gas separation stages or liquids as heat exchange fluids in prospective thermochemical cycles for hydrogen production.

K.L.

N80-14212*# Engineering Information Systems, Inc., San Jose, Calif.
SPAR THERMAL ANALYSIS PROCESSORS REFERENCE MANUAL, SYSTEM LEVEL 16. VOLUME 1: PROGRAM EXECUTION
M. B. Marlowe, R. A. Moore, and W. D. Whetstone Oct. 1979 262 p
(Contract NAS1-14464)
(NASA-CR-159162; EISI-TR-4007-2-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 07D

User instructions are given for performing linear and nonlinear steady state and transient thermal analyses with SPAR thermal analysis processors TGEO, SSTA, and TRTA. It is assumed that the user is familiar with basic SPAR operations and basic heat transfer theory.

J.M.S.

N80-14213# SRI International Corp., Menlo Park, Calif.
LASER FLUORESCENCE STUDIES OF CHEMILUMINESCENT CHEMICAL REACTIONS Final Report, Jun. 1975 - Jul. 1979
Graham Black 27 Jul. 1979 72 p refs
(Contract F44620-75-C-0083; AF Proj. 2301)
(AD-A073829; SRI-MP-79-54; AFOSR-79-0951TR) Avail: NTIS HC A04/MF A01 CSCL 20/10

Photodissociation of N2O (to produce O(1S)) and OCS (to produce S(1S)) has been studied in liquid argon and nitrogen. Emission spectra and lifetime information have been obtained. Synchrotron radiation has been used to produce XeF (B, C, and D) states from XeF2. Quantum yields, radiative lifetimes, and collisional rate coefficients with Ne, Ar, and N2 were determined.

GRA

N80-14214# Woods Hole Oceanographic Institution, Mass.
VOLATILE ORGANIC COMPOUNDS IN SEAWATER Ph.D. Thesis
Philip M. Gschwend Sep. 1979 277 p refs
(Contract N00014-74-C-0262; Grants NOAA-04-7-158-44104; NOAA-04-8-MO1-149; NSF OCE-22781)
(AD-A074179; WHOI-79-72) Avail: NTIS HC A13/MF A01 CSCL 07/3

Vapor phase stripping and solid adsorbent trapping were applied to seawater and related samples to concentrate volatile organic compounds. The concentrates were subsequently analyzed by glass capillary gas chromatography and combined gas chromatography-mass spectrometry. The compound identifies and the spatial and temporal distributions of their concentrations were used to determine some sources, transformations, and transport mechanisms of organic matter in the sea. Volatile organic compounds were determined in seawater samples from the Sargasso Sea, the western Equatorial Atlantic, and the upwelling region off Peru. Pentadecane was present in all three areas in surface samples of 10-40 ng/kg and decreased to 1-2 ng/kg in the deep water. A source related to the transformation of the algal fatty acid, hexadecanoic acid, by zooplankton is proposed since anthropogenic and direct phytoplankton sources are unlikely. C2-alkylated benzenes were found in the upwelled water off Peru at about 4 ng/kg in the surface (5 and 20m), 3 ng/kg below the thermocline (100m), and 2 ng/kg or less in deeper water. A surface or atmospheric source is required to produce this distribution. C8-C10 aldehydes were also found in seawater from off Peru. The direct correlation of their concentrations with chlorophyll A and with oxygen indicated that they

are derived from chemical oxidation of algal metabolites, for example, unsaturated fatty acids. Total volatiles in the oligotrophic Sargasso Sea were about 10-30 ng/kg while the biologically productive upwelling region off Peru contained up to 100 ng/kg. GRA

N80-14215# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ELECTRON SPIN RESONANCE STUDIES OF HYDROGEN AND DEUTERIUM BOMBARDMENT OF UNSATURATED HYDROCARBONS AT 77K
Cornelius U. Morgan and Kevin J. White Jul. 1979 30 p refs
(DA Proj. 1L1-61102-AH-60)
(AD-A074264; AD-E430296; ARBRL-TR-02178) Avail: NTIS HC A03/MF A01 CSCL 07/3

The interaction of free atoms and radicals with unsaturated compounds has been a field of considerable interest. In this present work, the reactions of solid unsaturated hydrocarbons at 77K with gaseous hydrogen atoms are studied by electron spin resonance (esr). The hydrogen atom adds directly to the terminal position of the double bond of trans-2-butene, 2,3-dimethyl-1, 3-butadiene, 2-methyl-1-butene-3-yne, 3,3-dimethyl-1-butene, isobutylene, ethylene, and propylene to produce the sec-butyl, 2,3-dimethyl-2-butenyl, 1,1-dimethyl-2-propynyl, 1,2,2-trimethyl propyl, t-butyl, ethyl, and isopropyl radicals, respectively. The addition reaction of H atoms to trans-1,3-pentadiene occurs at the terminal carbon atom of the terminal double bond to produce the 1-methyl-2-butenyl radical. Confirmation of an addition reaction was made by bombarding the unsaturate first with hydrogen and then with deuterium. The two radicals can be distinguished by their esr spectra. On bombardment of allene with H atoms the allenyl radical was observed. This radical was produced by an abstraction of a hydrogen atom from allene. GRA

N80-14216# Washington Univ., Seattle. Lab. for Chemometrics.
PSEUDOPOLAROGRAPHIC DETERMINATION OF METAL COMPLEX STABILITY CONSTANTS IN DILUTE SOLUTION BY RAPID SCAN ANODIC STRIPPING VOLTAMMETRY Interim Report
Steven D. Brown and Bruce R. Kowalski Sep. 1979 37 p refs
(Contract N00014-75-C-0536)
(AD-A074806; Rept-16) Avail: NTIS HC A03/MF A01 CSCL 07/4

By using a computer controlled anodic stripping voltameter with automatic background correction, pseudopolarograms can be obtained by plotting the peak area vs. the deposition potential for a series of stripping voltametric runs. With ASV as a method of amplification, the ligand number and stability constants are determined for metal complexes at concentration ranges expected of natural water systems. GRA

N80-14217# Callery Chemical Co., Pa.
CARBORANE SYNTHESIS Final Report, Oct. 1978 - Jun. 1979
28 Aug. 1979 22 p refs
(Contract DASG60-78-C-0146)
(AD-A074570; CCC-79-126) Avail: NTIS HC A02/MF A01 CSCL 07/3

This report describes Phase 1 work done in thermolysis of tetraethylammonium borohydride (1-), (Et4NBH4) to tetraethylammonium decahydrodecaborate(2(-)), ((Et4N)2B10H10). The objective of this Phase 1 program was to solve the heat transfer requirements occurring during thermolysis. The nature of this requirement was to identify and optimize the reaction conditions of scale-up using boron and non-boron based solvents in the conversion of Et4NBH4 by thermolysis to (Et4N)2B10H10. The critical steps in this requirement were to dissipate exothermic heat to minimize the (Et4N)2B12H12 by-product formation and to maximize the desired (Et4N)2B10H10 product. Thermolysis of Et4NBH4, using triethylamine borane (Et3NBH3) as a boron-based solvent was demonstrated on a 50 g scale with (Et4N)2B10H10 yields up to 60%. Thermolysis of Et4NBH4 using mineral oil as the non-boron based solvent, demonstrated 47% yields. GRA

N80-14218# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
MEASUREMENT OF THE RADIATIVE PROPERTIES OF AIR AT HIGH TEMPERATURES AND PRESSURES Final Report, Jun. 1977 - May 1979
A. Larson, R. T. Murray, D. Dodson, T. Salmon, and W. Christy Arnold Air Force Station, Tenn. AEDC Oct. 1979 42 p refs
(Contract F40600-77-C-0007)
(AD-A074825; AEDC-TR-79-67) Avail: NTIS HC A03/MF A01 CSCL 07/4

Steady air columns near 10,000 K and at pressures from 1 to 30 atm were studied spectroscopically from the side in emission and absorption experiments. Argon columns were used in auxiliary experiments. At 30 atm the effects of self-absorption within the air arc were treated along with corrections for absorption by the oxides of nitrogen in the environment surrounding the arc. Temperature profiles deduced from Abel-inverted emission data on the OI 844.6 nm and the NI 862.9 nm lines and corrected for the absorption effects are in excellent agreement. Laser transmission experiments at 632.8 nm show that ray refraction in the arc and its boundaries warrants attention at 30 atm in experiments in which intensities are being measured. A number of observations relating to work at still higher pressures were made. GRA

N80-14219# Colorado State Univ., Fort Collins. Dept. of Chemistry.
TWO PHOTON SPECTROSCOPY OF PYRAZINE AND TRIAZINE
J. D. Webb, K. M. Swift, and E. M. Bernstein Sep. 1979 10 p refs Submitted for publication
(Contract N00014-75-C-1179; NR Proj. 056-607)
(AD-A074055; TR-22) Avail: NTIS HC A02/MF A01 CSCL 07/4

Two photon absorption spectra, detected by fluorescence, phosphorescence, and photoacoustic methods are presented for pyrazine and triazine. Vibronic assignments are made in both systems based on polarization and contour analysis. For pyrazine, origin intensity is observed which suggests the (B)(3U) state does not possess inversion symmetry. Linear, quadratic, and pseudo-Jahn Teller couplings are discussed for triazine. GRA

N80-14220# Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
RAMAN AND INFRARED SPECTROSCOPY OF AQUEOUS CORROSION FILMS ON LEAD IN 0.1 M SULFATE SOLUTIONS
R. Thibeau, A. Goldfarb, C. Brown, and R. Heidersbach Sep. 1979 37 p refs
(Contract N00014-76-C-0889)
(AD-A074567; TR-7) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report contains the manuscript of a paper submitted for publication in the Journal of the Electrochemical Society. The Pb-H2O-SO4 Pourbaix diagram was investigated by examining potentiostatically oxidized lead samples using Raman and infrared spectroscopy. In 0.1 M sulfate solutions, surface film compositions were not in complete agreement with predictions of the calculated potential -pH diagram. The Pourbaix diagram did not predict the formation of PbO under any conditions; however, spectra indicated the presence of the oxide at certain potentials in acid and neutral solutions and at all potentials above the immunity region in basic solutions. Spectroscopic identification of insoluble surface species was in agreement with potentiodynamic polarization curves. GRA

N80-14221# IBM Watson Research Center, Yorktown Heights, N.Y.
PHOTOEMISSION STUDIES OF TIME-RESOLVED SURFACE REACTIONS: ISOTHERMAL DESORPTION OF CO FROM Ni(3)
G. W. Rubloff 27 Feb. 1979 20 p refs Presented at the 2d European Conf. on Surface Science, Cambridge, England, 26-29 Mar. 1979
(Contract N00014-77-C-0366)
(AD-A074953; TR-6) Avail: NTIS HC A02/MF A01 CSCL 07/4

A new dynamic approach to spectroscopic studies of surface

reactions is described. A fast-acting UHV gas dosing system is employed to prepare the adsorbed species in an initial chemisorption state under reaction conditions of elevated temperature and/or pressure (to approximately 1 torr). Individual reaction steps are then resolved in time using photoemission spectroscopy to probe the surface electronic structure, yielding information about the kinetics of individual reaction steps, the nature of chemisorbed species, and the surface reaction path. As a result application of this approach, the kinetics of isothermal desorption of CO from Ni(111) is studied for temperatures up to approximately 230 C. The coverage-dependence of the rate constants is revealed directly in the shape of each desorption curve. Preexponential (frequency) factors as well as desorption activation energies show significant variation with coverage. GRA

N80-14222# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
THE KINETICS AND SPECTROSCOPY OF AIRCRAFT AND ROCKET PLUME CONSTITUENTS Interim Scientific Report, 1 Jun. 1978 - 31 May 1979
F. P. Tully and A. R. Ravishankara 31 Jul. 1979 24 p refs
(Contract F49620-77-C-0111; AF Proj. 2308)
(AD-A074220; AFOSR-79-0969TR; ISR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

Utilizing the technique of flash photolysis-resonance fluorescence, the rate constants for the reactions of hydrozyl radicals (OH) with hydrogen, methane, carbon monoxide and ethane were measured at elevated temperatures as high as 1020 K. Distinct curvature was observed in the Arrhenius plots for all four reactions. The measured rate constants were compared with previous measurements in the literature. Future measurement plans were outlined. GRA

N80-14223# Battelle Pacific Northwest Labs., Richland, Wash.
EVALUATION OF POTENTIAL CHEMICAL/MECHANICAL DEGRADATION PROCESSES AFFECTING FUEL AND STRUCTURAL MATERIALS UNDER LONG-TERM WATER STORAGE
G. E. Zima May 1979 47 p refs
(Contract EY-76-Y-06-1830)
(NUREG-CR-0668; PNL-2379) Avail: NTIS HC A03/MF A01

A review is made of spent fuel leaching under the storage pool environment. A simple leaching significance index is proposed which, in addition to the leaching characteristics of selected radionuclides, is also sensitive to two important pool cleanup system parameters, namely the decontamination factor and the turn-around rate. Using recent spent fuel leaching data, indices are calculated for several radionuclides of interest and they indicate that, under quite conservative assumptions, leaching should pose no problem to the ISFSI system. DOE

N80-14224# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.
SUBSTRUCTURE AND PROPERTIES OF SODIUM BETA ALUMINA SOLID ELECTROLYTES Final Report
L. C. DeJonghe May 1979 135 p refs Sponsored by Electric Power Research Inst., Palo Alto, Calif.
(EPRI-FP-1058) Avail: NTIS HC A07/MF A01

A study was conducted to determine the relationship between the impurities and microstructure and the properties of sodium beta alumina solid electrolytes. An investigation is presented of certain aspects of the electrolyte fabrication, since the sintering process by which the electrolyte is made determines, to a large extent, the microstructure and impurity distribution. The methods used included high-resolution transmission electron microscopy and measurement of the response of the electrolyte to ac signals between 10 hertz and 10 megahertz (complex admittance). Specifically, the importance of transient liquids during the sintering process was clarified. The effects on ionic conductivity of the presence of silicon (as silicates), calcium (as calcium aluminates), and zinc (in solid solution) were quantified. The importance of the microstructure and, in particular, the role of the grain boundaries in the sodium ion conduction process were elucidated. DOE

N80-14225# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Chemistry.
ULTRAVIOLET SPECTROSCOPY OF NITROUS OXIDE (N2O): A TEMPERATURE-RESOLVED STUDY Ph.D. Thesis
G. S. Selwyn Mar. 1979 239 p refs
(Contract W-7405-eng-48)
(LBL-8739) Avail: NTIS HC A11/MF A01

The absorption spectra of nitrous oxide and its N-15 isotopes were studied from 172 to 330 nm. The long wavelength absorption above 265 nm is almost entirely due to Rayleigh scattering. This reduces the calculated rate of nitrous oxide photolysis in the troposphere to a very small value. The temperature dependence of the absorption from 173 to 240 nm was measured for use in atmospheric modeling of the photolysis of nitrous oxide. Spectra over the wavelength range 172 to 190 nm demonstrate that the diffuse bands are a separate pronounced absorption of nitrous oxide which is strongly affected by temperature. This banding is the result of transitions to discrete vibronic levels in an upper electronic state. DOE

N80-14226# California Univ., Berkeley. Lawrence Berkeley Lab.
BASIC ENERGY PROPERTIES OF ELECTROLYTIC SOLUTIONS DATABASE
Sidney L. Phillips, H. Ozbek, and R. J. Otto 1978 17 p refs Presented at the CODATA Conf., Palermo, Italy, 22 May 1978
(Contract W-7405-eng-48)
(LBL-7827; CONF-780587-3) Avail: NTIS HC A02/MF A01

A data center containing bibliographic and numerical data was established to provide evaluated basic energy data on aqueous electrolyte solutions to elevated temperatures and pressures. Correlation equations and data are given for the viscosity, thermal conductivity, density, and enthalpy of aqueous sodium chloride solutions. DOE

N80-14227# Battelle Pacific Northwest Labs., Richland, Wash.
SIMULTANEOUS MASS DETECTION FOR DIRECT INLET MASS SPECTROMETRY
R. L. Gordon May 1979 79 p refs
(Contract EY-76-C-06-1830)
(PNL-2728) Avail: NTIS HC A05/MF A01

A direct inlet mass spectrometry (DIMS) instrument is described which consists of an inlet system designed to permit particles entrained in the inlet air stream to strike a hot, oxidized rhenium filament which serves as a surface ionization source. A mass analyzer and detection system then permits identification of the elemental composition of particulates which strike the filament. DOE

N80-14228# Argonne National Lab., Ill. Chemistry Div.
ELECTRON SPIN ECHO SPECTROSCOPY AND PHOTOSYNTHESIS
J. R. Norris, M. C. Thurnauer, M. K. Bowman, and A. D. Trifunac 1978 12 p refs Presented at Frontiers of Biol. Energetics; Electrons to Tissues Symp., Phila., 19 Jul. 1978
(Contract W-31-109-eng-38)
(CONF-780741-4) Avail: NTIS HC A02/MF A01

The high-power ESE technique was applied to primary photosynthesis observing stationary state signals arising from the primary donor, the primary acceptors, and the triplet state observed in R. rubrum. Nanosecond time-resolved ESE-EPR studies were performed of green plant photosynthesis. The ESE method employs repetitive trains of two or three intense microwave pulses to induce signals in paramagnetic samples known as echoes. The most common pulse sequence is the 90 deg T, 180 deg two-pulse sequence where T is the time between the two pulses. In the spectrometer used the 90 deg pulse (P sub 90) is approximately 30 nsec wide. Before P sub 90 the net magnetization M/sub z/ is aligned only along the external magnetic field direction z. P sub 90, as its name implies, rotates the resonant electron spins of M/sub z/ 90 deg such that immediately after the pulse these spins are in the x,y plane normal to the magnetic field. DOE

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-14229* National Aeronautics and Space Administration Pasadena Office, Calif.

METHOD OF PURIFYING METALLURGICAL GRADE SILICON EMPLOYING REDUCED PRESSURE ATMOSPHERIC CONTROL Patent

William M. Ingle (Motorola, Inc., Phoenix, Ariz.), Stephen W. Thompson (Motorola, Inc., Phoenix, Ariz.), and Robert E. Chaney, inventors (to NASA) (Motorola, Inc., Phoenix, Ariz.) Issued 30 Oct. 1979 4 p Filed 23 Jun. 1978 Supersedes N78-27255 (16 - 18, p 2373) Sponsored by NASA Prepared in cooperation with Motorola, Inc., Phoenix, Ariz.

(NASA-Case-NPO-14474-1; US-Patent-4,172,883; US-Patent-Appl-SN-918537; US-Patent-Class-423-348; US-Patent-Class-423-149; US-Patent-Class-423-293; US-Patent-Class-423-417; US-Patent-Class-423-625) Avail: US Patent and Trademark Office CSCL 11F

A method in which a quartz tube is charged with chunks of metallurgical grade silicon and/or a mixture of such chunks and high purity quartz sand, and impurities from a class including aluminum, boron, as well as certain transition metals including nickel, iron, and manganese is described. The tube is then evacuated and heated to a temperature within a range of 800 C to 1400 C. A stream of gas comprising a reactant, such as silicon tetrafluoride, is continuously delivered at low pressures through the charge for causing a metathetical reaction of impurities of the silicon and the reactant to occur for forming a volatile halide and leaving a residue of silicon of an improved purity. The reactant which included carbon monoxide gas and impurities such as iron and nickel react to form volatile carbonyls.

Official Gazette of the U.S. Patent and Trademark Office

N80-14230 Vanderbilt Univ., Nashville, Tenn.

THE ROLE OF PHOSPHORUS IN THE INTERGRANULAR EMBRITTLEMENT OF Fe-3Si Ph.D. Thesis

Raymond George Thompson 1979 178 p

Avail: Univ. Microfilms Order No. 7926629

A study was undertaken to elucidate the role of phosphorus in promoting intergranular embrittlement. The embrittled bicrystals were cryogenically fractured at temperatures to 4.2 K. The measured fracture energy was used to determine the grain boundary fracture surface energy, 2 gamma prime sub s - gamma sub b, which was correlated with the phosphorus concentration of the boundary. The results are discussed in relation to existing and proposed models for intergranular failure. Conclusions are drawn on the potency of phosphorus in reducing the grain boundary fracture energy. The effect of a reduced fracture energy on such mechanical properties as crack tip plasticity, twinning and transition temperature are also addressed. Dissert. Abstr.

N80-14231 Northwestern Univ., Evanston, Ill.

THE INFLUENCE OF MICROSTRUCTURE ON THE METAL CUTTING BEHAVIOR OF AISI 1215 RESULFURIZED FREE MACHINING-STEELS Ph.D. Thesis

Lynda Piethe Riekels 1979 435 p

Avail: Univ. Microfilms Order No. 7927433

An investigation was made of the relationship between the microstructural characteristics and the metal cutting behavior of two ingots of AISI 1215 resulfurized free machining steel of similar composition, solidified at different rates in order to obtain different MnS inclusion size distributions. A linear relationship was obtained between the inclusion parameter, S-S/V sub v (S), the quotient of the inter-sulfide spacing to the sulfide volume fraction, and the cutting energy requirement to which a confidence level greater than 99.9 percent could be attached. There was also a very good linear relationship between the effective flow stress on the shear plane and the cutting energy requirement. Evidence of void initiation and growth was found around MnS inclusions of fractured surfaces of chips broken below the ductile-brittle transition temperature. Dissert. Abstr.

N80-14232*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IMPROVED REFRACTORY COATINGS AND METHOD OF PRODUCING THE SAME Patent Application

W. A. Brainard and D. R. Wheeler, inventors (to NASA) Filed 12 Jul. 1979 7 p

(NASA-Case-LEW-13169-1; US-Patent-Appl-SN-102003) Avail: NTIS HC A02/MF A01 CSCL 11F

A thin sputtered film that exhibits improved adherence to a substrate and has improved friction and wear characteristics is described. These improvements are achieved by coating the substrate by rf sputtering with a film of titanium carbide using an argon sputtering plasma. A small nitrogen partial pressure from about 0.5% to 2.5% is added in the initial stages of the deposition during which the interface is formed. The improvements in adhesion of the titanium carbide coating to the substrate results from the presence of both titanium nitride and a nitride of the substrate in the interfacial region. NASA

N80-14233# Materials Research Labs., Melbourne (Australia). Materials Research Labs.

CORROSION IN THE AUSTRALIAN DEFENCE SCENE. 1: THE ARMY AND ANCILLARY EQUIPMENT FOR THE RAAF

Jeffrey J. Batten Aug. 1979 21 p Presented at Meeting of TTCP Sub-Group P, Tech. Panel P1 (Metals), Melbourne, May 1979

(MRL-R-752; AR-001-832) Avail: NTIS HC A02/MF A01

Although Australia purchases much of its advanced military equipment from other TTCP countries, there are differences between Australia and these countries with respect to usage and expected life of that equipment. These differences carry with them considerable corrosion penalties. Case histories of some of the more recurrent types of corrosion problems are described. It is concluded that the choice of correct materials, techniques and design are essential to reduce the number of these problems. Further, the technology which would have prevented their occurrence was already in existence. Thus, they mostly arose through lack of technology transfer from the corrosion scientist to the market place. Author

N80-14234*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CORROSION RESISTANCE OF SODIUM SULFATE COATED COBALT-CHROMIUM-ALUMINUM ALLOYS AT 900 C, 1000 C, AND 1100 C

G. J. Santoro Nov. 1979 28 p refs

(NASA-TM-79311; E-267) Avail: NTIS HC A03/MF A01 CSCL 11F

The corrosion of sodium sulfate coated cobalt alloys was measured and the results compared to the cyclic oxidation of alloys with the same composition, and to the hot corrosion of compositionally equivalent nickel-base alloys. Cobalt alloys with sufficient aluminum content to form aluminum containing scales corrode less than their nickel-base counterparts. The cobalt alloys with lower aluminum levels form CoO scales and corrode more than their nickel-base counterparts which form NiO scales. M.G.

N80-14235*# AiResearch Mfg. Co., Phoenix, Ariz.

ABRADABLE COMPRESSOR AND TURBINE SEALS, VOLUME 1

D. V. Sundberg, R. E. Dennis, and L. G. Hurst May 1979 178 p

(Contract NAS3-20073)

(NASA-CR-159600; AiResearch-21-3213-1) Avail: NTIS HC A09/MF A01 CSCL 11A

The application and advantages of abradable coatings as gas-path seals in a general aviation turbine engine were evaluated for use on the high-pressure compressor, the high-pressure turbine, and the low-pressure turbine shrouds. Topics covered include: (1) the initial selection of candidate materials for interim full-scale engine testing; (2) interim engine testing of the initially selected materials and additional candidate materials; (3) the design of the component required to adapt the hardware to permit full-scale engine testing of the most promising materials; (4) finalization of the fabrication methods used in the manufacture of engine test hardware; and (5) the manufacture of the hardware necessary to support the final full-scale engine tests. A.R.H.

N80-14236# Connecticut Univ., Storrs. Inst. of Materials Science.

SURFACE HARDENING BY LASER SKIN MELTING Progress Report

Peter R. Strutt Jul. 1979 66 p refs

(Contract N00014-78-C-0580)

best copy available

(AD-A074166; PR-1) Avail: NTIS HC A04/MF A01 CSCL 11/6

A basic study has been initiated on the microstructural characterization of rapid quenched iron-base alloys produced by electron beam-glazing and laser-glazing. The quantitative effect of processing parameters (i.e., beam velocity, power, etc.) on melt zone geometry have been determined using M2 tool steel as a reference material. The conditions range from superficial surface melting with correspondingly high cooling rates (similar to 1/1000000 C) to the deep penetration mode, with a cooling rate of similar to 1/1000 C. The comparison of electron beam and laser-glazing was particularly striking, since the power efficiency in surface melting was ten times greater using an electron beam. Furthermore, electron beam-glazing produced (1) a uniform and smooth surface, (2) a constant depth of melting, and (3) a homogeneous microstructure. These highly desireable features were not achieved to the same degree in the laser-glazing experiment. GRA

N80-14237# Argonne National Lab., Ill.
IODINE STRESS-CORROSION CRACKING IN IRRADIATED ZIRCALOY CLADDING
R. F. Mattas, F. L. Yaggee, and L. A. Neimark 1979 15 p refs Presented at ANS Topical Meeting on Light Water Reactor Fuel Performance, Portland, Oreg., 29 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790441-7) Avail: NTIS HC A02/MF A01

Irradiated Zircaloy cladding specimens, were gas-pressure tested in an iodine environment to investigate their stress-corrosion cracking (SCC) susceptibility. The test temperatures and hoop stresses ranged from 320 to 360 C and 150 to 500 MPa, respectively. It was shown that irradiation, in general, increases the susceptibility of Zircaloy to iodine SCC. For specimens that experienced fluences > 2 x 10 to the 21st power n/sq cm (E > 0.1 MeV), the 24 h failure stress was 177 + or - 18 MPa, regardless of the preirradiation metallurgical condition. An analytical model for iodine SCC was developed which agrees reasonably well with the test results. DOE

N80-14238# Idaho National Engineering Lab., Idaho Falls.
ESTIMATING STRUCTURAL INTEGRITY OF TYPE 304 STAINLESS STEEL PLATES AND PIPES CONTAINING SMALL DEFECTS
1979 20 p refs Presented at the Intern. Conf. on Structural Mech. in Reactor Technol., Berlin, 13 Aug. 1979
(Contract EY-76-C-07-1570)
(CONF-790802-11) Avail: NTIS HC A02/MF A01

Preliminary test program results and some evaluations of reactor coolant piping as well as less ductile plate and piping models, specifically, the flow stress approach and the two-parameter fracture criterion are presented. The tests were conducted with annealed Type 304 stainless steel flat tensile specimens containing triangular, rectangular, or part-circular surface flaws, and pressurized pipe specimens with internal or external triangular surface defects. DOE

N80-14239# California Univ., Berkeley. Dept. of Materials Science and Mineral Engineering.
HIGH STRENGTH AUSTENITIC ALLOYS FOR GENERATOR RETAINING RINGS Interim Report
J. W. Morris, Jr. and G. Thomas Apr. 1979 93 p refs
(EPRI-FP-1061) Avail: NTIS HC A05/MF A01

A nonmagnetic, hydrogen resistant alloy which achieves strength levels near 200 ksi yield with good residual toughness while permitting processing primarily through thermal treatment was developed. Strength and toughness objectives were achieved through the use of alloys which have met the other necessary criteria. Fatigue and fracture toughness testing in hydrogen was initiated to determine suitability of precipitation hardened alloys based on the Fe-Ni-Ti-Ta system for use in a hydrogen environment. DOE

N80-14240# Argonne National Lab., Ill.
MICROSTRUCTURAL OBSERVATIONS ON TIME-DEPENDENT FAILURE IN WELD-DEPOSITED TYPE 16-8-2 STAINLESS STEEL
D. T. Raske and D. R. Diercks 1978 13 p refs Presented at Bolton Landing Conf., Lake George, N.Y., 27 Aug. 1978
(Contract W-7405-eng-38)
(CONF-780834-2) Avail: NTIS HC A02/MF A01

Type 16-8-2 stainless steel weld metal is less resistant to rupture than Type 316 stainless steel base metal under monotonic creep conditions, but is substantially more resistant to failure under conditions of fatigue and combined creep and fatigue. Fractographic and metallographic analyses indicate that specimens from the two types of tests differ in failure modes. In monotonic-creep tests, the Type 16-8-2 weld-metal specimens failed by intergranular and interphase separation followed by microvoid growth and coalescence. Under creep-fatigue conditions, failure occurred by a mixture of matrix and interphase cracking, with substantial transgranular cracking present. Results indicate that the resistance of Type 16-8-2 weld metal to creep-fatigue failure is directly related to its resistance to grain-boundary and interphase cracking. DOE

N80-14241# Sandia Labs., Livermore, Calif.
PALLADIUM SINTERING: SHRINKAGE KINETICS FOR A SPONGE POWDER
R. M. German and V. Ham Apr. 1979 18 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8207) Avail: NTIS HC A02/MF A01

Pellets pressed from sponge palladium powder were sintered both isothermally and with constant heating rates using a dilatometer. Computer analysis of the data is used to determine shrinkage and shrinkage rate behavior during the sintering operation. The data are used in conjunction with metallographic examination to correlate the shrinkage phenomena to the change in grain size and pore morphology. DOE

N80-14242# Oak Ridge National Lab., Tenn.
EFFECT OF OXIDIZING ENVIRONMENT ON MECHANICAL PROPERTIES OF MOLYBDENUM AND TZM
C. T. Liu, S. H. Anderson, and H. Inouye Oct. 1978 39 p refs
(Contract W-7405-eng-26)
(ORNL-5431) Avail: NTIS HC A03/MF A01

In low-pressure (1.3 mPa) oxygen at 1150 C, specimens of titanium zirconium molybdenum (TZM) picked up oxygen and lost carbon. The oxygen concentration increased linearly with exposure time, indicating that the chemisorption of oxygen molecules at the specimen surface, rather than bulk diffusion, controls the kinetics of oxygen absorption at 1150 C. Specimens of TZM increase in tensile strength and decrease in ductility with increasing oxygen content. Exposed TZM loses its ductility at elevated temperatures at an oxygen level of 500 ppM. Unalloyed molybdenum showed no internal oxidation at 1150 C. Results indicate that a trace of oxygen penetrated into molybdenum through its grain boundaries. This penetration raises the ductile-to-brittle transition temperature of molybdenum by 200 C and lowers the ductility above 900 C. The ductility of oxygen exposed molybdenum is virtually unaffected in the temperature range from 400 to 900 C. A ductility minimum (10 percent) is observed at 1350 C because of dynamic embrittlement effects. DOE

N80-14243# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France). Lab. Thermochimie et Frittage.
THE IMPROVEMENT OF REFRACTORY ALLOYS THROUGH POWDER METALLURGY INVOLVING SINTERING WITH SPINNING Final Report [ELABORATION D'ALLIAGES REFRACTAIRES PAR METALLURGIE DES POUDRES AU MOYEN DU FRITTAGE-FILAGE]
Andre Hivert, Michel Marty, and Andre Walder Aug. 1978 44 p refs In FRENCH
(Contracts DGRST-73-7-1813; DGRST-75-7-0992)
(ONERA-RT-12/1931-MY) Avail: NTIS HC A03/MF A01

Several powder metallurgy manufacturing processes for hot turbine disks using IN-100 and Astroloy alloys were tested in order to avoid the macro crystallization and phase separation introduced by casting. The influence of powder characteristics, compactation processes (spinning or isostatic hot compression), and of thermal treatments were studied in particular. It is concluded that powder metallurgy gives superior properties in the lower temperature range, up to 750 C. Spinning is the best compaction method for refractory alloys with normal carbon content. Author (ESA)

N80-14244# National Bureau of Standards, Washington, D.C.
MATERIALS STUDIES FOR MAGNETIC FUSION ENERGY APPLICATIONS AT LOW TEMPERATURES-II
F. R. Fickett, ed. and R. P. Reed, ed. Jun. 1979 495 p refs
Sponsored in part by DOE, Washington, D.C.
(PB-295288/1; NBSIR-79-1609) Avail: NTIS HC A21/MF A01 CSCL 11F

An evaluation is presented of the low temperature mechanical and physical properties of stainless steel base metal and welds, with particular emphasis on nitrogen strengthened stainless steels. Aluminum alloys received some consideration. Work was done on the production of nonmetallics, primarily industrial laminates for low temperature applications and on the measurement of their properties at cryogenic temperatures. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-14245 Texas Univ. at Austin.
POLYSTYRENE IN MIXED SOLVENTS Ph.D. Thesis
Tejraj Malleshappa Aminabhavi 1979 250 p
Avail: Univ. Microfilms Order No. 7928255

Polystyrene in mixed solvents was extensively studied both experimentally and theoretically from thermodynamic, hydrodynamic and optical viewpoints to achieve a better quantitative understanding of polymer solutions. The experimental techniques included precision refractometry, ultracentrifugation, densitometry and viscometry. The computer was used extensively to analyze the experimental data. Binary solvent mixtures and polymers in mixed solvents were investigated using densitometric and refractometric techniques. The diffusion coefficients which were obtained for binary solvent mixtures and for polystyrene samples in these mixtures were analyzed. Dissert. Abstr.

N80-14246 Polytechnic Inst. of New York.
SYNTHESES AND CHARACTERIZATION OF NEW FLUORINATED KETONE CONTAINING POLYMERS-SUBSTITUTED POLYSTYRENES AND THE STUDY OF THEIR REACTIONS WITH ALCOHOLS Ph.D. Thesis
Chung-Heng Cheng 1979 107 p
Avail: Univ. Microfilms Order No. 7920773

A series of new fluorinated ketone containing polymers, were prepared by the free radical polymerization of the corresponding monomers. These new substituted polystyrenes containing fluorinated ketone functionality were characterized by their ability (1) to react with active hydrogen compounds such as alcohols or water; (2) to have high glass transition temperatures and decreased solubility in nonpolar solvents (e.g., benzene) compared to polystyrene; and (3) to be converted into other functional groups such as alcohols or acids by treatment with the appropriate chemical reagents. Dissert. Abstr.

N80-14247 Alfred Univ., N.Y.
EFFECT OF SILVER ON THE STRUCTURE AND PROPERTIES OF ARSENIC-TRISULFIDE GLASS Ph.D. Thesis
Kewal Krishnan Verma 1977 145 p
Avail: Univ. Microfilms Order No. 7927210

The electrical properties and several structure sensitive properties of As2S3 glasses, containing up to 1.0 atomic percent silver were investigated. The electrical conductivity is found to increase by nearly three orders of magnitude when 1.0 percent Ag is added to As2S3. Structure sensitive properties such as density, glass transition temperature, and specific heat exhibit anomalous behavior in the same compositional range. Results are interpreted in terms of a self-trapped hole defect postulated to be present in the pure glass. The concentration of these defects depends on the preparation procedure, thermal history and silver content of the glass. Dissert. Abstr.

N80-14248*# National Aeronautics and Space Administration, Washington, D. C.
PROCEDURE FOR THE FORMATION OF A COATING ON AN OBJECT BY POLYMERIZATION BY LUMINESCENT DISCHARGE
Dec. 1979 11 p Transl. into ENGLISH of French Patent no. 1,488,513 (File no. 70,723, 25 Jul. 1966) 5 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75926) Avail: NTIS HC A02/MF A01 CSCL 07D

The object to be coated was placed in a reaction area located in a luminescent discharge chamber. By introducing the polymerizable material in this reaction area and applying an electrical field to this reaction, a polymerized film was obtained on the coating object under controlled conditions. By the use of thermomechanical treatment on the object, the undesirable effects of discoloration, brittleness, and viscosity can be controlled. M.M.M.

N80-14249*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FRICTION AND WEAR OF PLASMA-SPRAYED COATINGS CONTAINING COBALT ALLOYS FROM 25 DEG TO 650 DEG IN AIR
Harold E. Sliney and Thomas P. Jacobson 1979 20 p refs
(NASA-TM-79316; E-189) Avail: NTIS HC A02/MF A01 CSCL 11F

Four different compositions of self-lubricating, plasma-sprayed, composite coatings with calcium fluoride dispersed throughout cobalt alloy-silver matrices were evaluated on a friction and wear apparatus. In addition, coatings of the cobalt alloys alone and one coating with a nickel alloy-silver matrix were evaluated for comparison. The wear specimens consisted of two, diametrically opposed, flat rub shoes sliding on the coated, cylindrical surface of a rotating disk. Two of the cobalt composite coatings gave a friction coefficient of about 0.25 and low wear at room temperature, 400 and 650 C. Wear rates were lower than those of the cobalt alloys alone or the nickel alloy composite coating. However, oxidation limited the maximum useful temperature of the cobalt composite coating to about 650 C compared to about 900 C for the nickel composite coating. Author

N80-14250# Illinois Univ. at Urbana-Champaign. Dept. of Chemistry.
PREPARATION AND CATALYTIC OXIDIZING POTENTIAL OF POLYMER SUPPORTED CHELATING AMINE AND SCHIFF BASE COMPLEXES Interim Technical Report
Russell S. Drago, John Gaul, Alan Zombeck, and Darel K. Straub
10 Jul. 1979 36 p refs
(Contract N00014-78-C-0245; NR Proj. 346-675)
(AD-A073878; ONR-TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/3

Synthetic procedures for attaching multidentate amines to organic polymers are described. These materials form the basis for the preparation of a wide variety of macrocyclic and chelating ligands that can be covalently attached to polymers. The reaction to produce Schiff base chelates is described and a series of covalently attached metal complexes is prepared and identified. These systems have potential as catalysts for organic oxidations. GRA

N80-14251# Northwestern Univ., Evanston, Ill. Dept. of Chemistry and Materials Research Center.
CONDUCTIVE POLYMERS CONSISTING OF PARTIALLY OXIDIZED, FACE-TO-FACE LINKED METALLOMACROCYCLES Interim Report
Karl F. Schoch, Jr., Bhagyashree R. Kundalkar, and Tobin J. Marks 17 Sep. 1979 21 p refs Submitted for publication
(Contract N00014-77-C-0231; Grant NSF DMR-76-80847; NR Proj. 053-640)
(AD-A074538; TR-8) Avail: NTIS HC A02/MF A01 CSCL 07/4

This communication reports on an approach to control molecular stacking interactions in low-dimensional mixed valence materials by locking partially oxidized metallomacrocycles together in a face-to-face orientation. Iodine doping of the face-to-face linked oligomers produces electrically conductive polymers with a range of stoichiometries. Electronic and lattice structures have been studied by resonance Raman spectroscopy, which indicates the presence of I3(-) or I5(-) but no I2, and by X-ray powder

diffraction, which allows estimation of the interplanar (ring-ring) spacings. GRA

N80-14252# Westinghouse Research and Development Center, Pittsburgh, Pa.
MONOLITHIC TRANSFORMATION OF CERAMIC MATERIALS FROM METAL-ORGANIC SOLS AND GELS Final Report, 1 Jul. 1977 - 30 Jun. 1979
B. E. Yoldas, D. P. Partlow, and D. M. Mattox 20 Jul. 1979 43 p refs
(Contract DAAG29-77-C-0029)
(AD-A074181; ARO-13970.1-MS) Avail: NTIS HC A03/MF A01 CSCL 11/2

The process used to form monolithic transparent Al2O3 bodies from metal-organic starting materials at low temperature via the gel process involves essentially four steps: hydrolysis, peptization, gel formation, and pyrolysis. Each step has been systematically investigated by modification of associated variables in order to determine the combination of factors which produces optimum results. It has been found that the interparticle distance, that is, the extent of approach attained by colloidal particles, at the point of gelling is of critical importance in maintaining monolithicity during the gel-oxide conversion. Minimization of this distance not only reduces the amount of shrinkage necessary during liberation of organics, allowing the body to remain in one piece, but also appears to allow interparticle bond formation during drying and pyrolysis, possibly involving hydroxyl and alkyl groups. For this reason, the factors that provide for the closest approach of gel particles were given particular attention in this investigation. GRA

N80-14253# California Univ., Livermore. Lawrence Livermore Lab.
CHARACTERIZATION OF DC-S-2000 SILICONE RUBBER AS AN O-RING MATERIAL FOR LASER AMPLIFIER SYSTEMS
D. M. Hoffman 23 Mar. 1979 14 p refs
(Contract W-7405-eng-48)
(UCRL-52688) Avail: NTIS HC A02/MF A01

The mechanical, thermal, thermodynamic, and chemical properties of DC-S-2000, a silicone rubber filled with silica, were evaluated. The properties of a batch cured inhouse were compared with the manufacturer's specifications, and specific quality-control tests were developed to evaluate future production batches of this elastomer. Mechanical and thermal transitions not described in the manufacturer's bulletin were also considered. Because the silicone O-rings must function under prolonged compression, an examination of the compression properties of DC-S-2000 is recommended. DOE

N80-14254# Oak Ridge Y-12 Plant, Tenn.
INFRARED INTERFEROMETRIC THICKNESS MEASUREMENT OF POLYMERIC THIN FILMS AND COATINGS
N. R. Smyrl 26 Jun. 1979 20 p refs
(Contract W-7405-eng-26)
(Y-2176) Avail: NTIS HC A02/MF A01

Thickness measurements utilizing state of the art rapid-scan interferometric technology were demonstrated for possible future applications. DOE

N80-14255# Toulouse Univ. (France). Lab. de Genie Electriques.
THE USE OF CHELATES TO NEUTRALIZE DEFECTS GIVING RISE TO PARTIAL DISCHARGES IN INSULATING MATERIALS OTHER THAN POLYETHYLENE: THE PARTICULAR CASE OF EPOXY RESINS Progress Report [UTILISATION DES CHELATES COMME AGENTS CICATRISANTS DES DEFAUTS QUI SONT LE SIEGE DES DECHARGES PARTIELLES DANS LES ISOLANTS AUTRES QUE LE POLYETHYLENE. CAS PARTICULIER DES RESINES EPOXYDES]
BuiAi, Hurax, and Roger-Vercruysse Dec. 1978 22 p refs In FRENCH
(Publ-379) Avail: NTIS HC A02/MF A01

The effect of metallic chelates in increasing the insulating films partial discharge initiation voltage, as was already demonstrated for polyethylene, was explored for the case of epoxy resins. The results show that the direct current resistivity increases slightly, that a space charge is formed when the electric field is larger than 4 kV/mm, and that the electric rigidity under continuous tension increases strongly, but much less in the case of 50 Hz alternating current. Possible mechanisms of the chelate effect are discussed. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling, and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-14256# Lockheed-Georgia Co., Marietta.
AIRCRAFT FUEL SYSTEM SIMULATOR TESTS WITH ANTIMISTING KEROSENE (JET A FUEL WITH FM-9 ADDITIVE) Final Report, Oct. 1978 - May 1979
R. E. Pardue May 1979 50 p
(Contract DOT-FA78WAI-925)
(AD-A073237; FAA-RD-79-52) Avail: NTIS HC A03/MF A01 CSCL 21/4

Tests were conducted on a full-scale C-141 aircraft fuel system simulator to evaluate system and component operation using antimisting kerosene fuels (Jet A fuel with FM-9 additive). A typical aircraft flight profile was simulated with the tank-to-engine fuel feed system operating. Tests were also conducted to evaluate the tank quantity gaging system accuracy, tank refuel valve operation and fuel transfer ejector operation. Fuels tested included Jet A, 30% FM-9 AMK, 35% FM-9 AMK and 40% FM-9 AMK. Flammability tests were conducted on selected fuel samples to evaluate degradation caused by the above tests. Author

N80-14257*# National Bureau of Standards, Washington, D.C. Thermophysical Properties Div.
THERMODYNAMIC PROPERTIES OF NITROGEN GAS DERIVED FROM MEASUREMENTS OF SOUND SPEED
Ben Younglove and R. D. McCarty Washington NASA Dec. 1979 56 p refs
(NASA Order L-55450-A; NASA Order L-69159-A)
(NASA-RP-1051; NBSIR-79-1611; L-13308) Avail: NTIS HC A04/MF A01 CSCL 07D

A virial equation of state for nitrogen was determined by use of newly measured speed-of-sound data and existing pressure-density-temperature data in a multiproperty-fitting technique. The experimental data taken were chosen to optimize the equation of state for a pressure range of 0 to 10 atm and for a temperature range of 60 to 350 K. Comparisons are made for thermodynamic properties calculated both from the new equation and from existing equations of state. Author

N80-14258# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF THE STEAM-IRON PROCESS FOR HYDROGEN PRODUCTION, 9010 Quarterly Report, 1 Apr. - 30 Jun. 1978
Feb. 1979 62 p
(Contract EX-76-C-01-2435)
(FE-2435-32; QR-8) HC A04/MF A01

The operability of the two reactor steam-iron process was demonstrated for an extended period of time, and hydrogen was produced for the first time. Test 15 spanned a period of 24 days and included 106 hours of ore circulation, 36 hours of char feed, and 24 hours of self-sustained hydrogen production. The primary objective of this test was to demonstrate the operability of the steam-iron process. Producer bed temperatures were limited to 1600 F at 200 psig reactor pressure. The quantity of hydrogen produced, therefore, was low. Test 16, the second consecutive hydrogen-producing test, spanned a period of 7 days. Producer bed temperatures were increased to 1650 F to raise the production of hydrogen in the steam-iron reactor. As in Test 15, the reactor internals were completely clean and in excellent condition following the test. DOE

N80-14259# Naval Research Lab., Washington, D. C.
MICROBIAL DETERIORATION OF HYDROCARBON FUELS FROM OIL SHALE, COAL, AND PETROLEUM. 1: EXPLOR-

ATORY EXPERIMENTS Interim Report
Marian E. May and Rex A. Neihof 20 Aug. 1979 28 p refs
(ZF57571004)
(AD-A073761; AD-E000316; NRL-MR-4060) Avail: NTIS HC A03/MF A01 CSCL 21/4

As part of the Navy's program on alternative sources of hydrocarbon fuel, the susceptibility to microbial deterioration of JP-5 derived from oil shale and coal (referred to as synthetic fuels) was investigated and compared with that of petroleum JP-5. Six fungi, including three strains of Cladosporium resinae, a yeast (Candida) and a bacterium (Pseudomonas) which normally grow well in association with petroleum JP-5 were used as test organisms in two-phase systems containing fuel/aqueous media. Most of the test organisms were inhibited to various extents in the presence of the synthetic fuels. An exception was a Fusarium species (fungus) which grew equally well under all three fuels. In mixtures of 75% petroleum and 25% synthetic fuels, microbial growth was generally equivalent to that in 100% petroleum JP-5. A search was made among samples of soil, creosoted wood and tree resins for microorganisms that could thrive in the presence of synthetic fuels. This endeavor produced a strain of C. resinae that grew as well with oil shale JP-5 as with petroleum JP-5. These exploratory experiments indicate that microorganisms adapted to growth with conventional petroleum fuel tend to be inhibited by synthetic fuels, but that organisms probably exist in nature which can readily adapt to and grow in the presence of synthetic fuels. GRA

N80-14260# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
THE DEVELOPMENT OF IMPROVED NORMAL STRESS TRANSDUCERS FOR PROPELLANT GRAINS, VOLUME 1 Final Report, Mar. 1975 - Dec. 1978
E. C. Francis, R. E. Thompson, and W. E. Briggs Edwards AFB AFRPL Jun. 1979 271 p refs 2 Vol.
(Contract F04611-75-C-0042; AF Proj. 5730)
(AD-A073659; CSD-2548-FR-Vol-1; AFRPL-TR-79-34-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 09/1

This report details the CSD effort in the design, analysis, manufacturing, calibration, and embedded use of improved normal stress transducers. Prototype transducers from two different contractors were manufactured and tested as well as final production transducer models. Finite element analysis techniques used for transducer analysis are extensively covered and were used for design optimization and gage interpretation. Results covering gaseous nitrogen calibrations, long term stability, self-heating, diode effects, embedded thermal and pressurization loadings, and mechanical tests are presented and compared with design goals. Detailed manufacturing specifications are presented along with recommended calibration and installation techniques. The final transducer design is 0.130-in. high with an external prewired compensation package. Stability of the metal and epoxy bond has been optimized by special processing techniques which are presented. Several significant achievements were obtained during the program. The first computerized design tradeoff curves were generated for stress transducers. Successful electron beam welding of critical components on stress transducers was demonstrated. Transducer measured stress in the propellant was verified independently in the tension-compression-shear and TM-1 devices. Transducer response under high rate loading conditions was demonstrated. Agreement between predicted and measured stresses for a thermal loaded solid propellant motor using the thermal-mechanical interaction factor was achieved. GRA

N80-14261# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
THE DEVELOPMENT OF IMPROVED NORMAL STRESS TRANSDUCERS FOR PROPELLANT GRAINS. VOLUME 2: APPENDICES Final Report, Mar. 1975 - Dec. 1978
E. C. Francis, R. E. Thompson, and W. E. Briggs Edwards AFB AFRPL Jun. 1979 334 p
(Contract F04611-75-C-0042; AF Proj. 5730)
(AD-A073660; CSD-2548-FR-Vol-2; AFRPL-TR-79-34-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 09/1

The design, analysis, and calibration of normal stress transducers are appended. Final design specifications are presented along with test procedures and troubleshooting guides, temperature sensor specifications and calibrations, and results of long term stability and epoxy creep evaluation tests. K.L.

N80-14262# Space Sciences, Inc., Monrovia, Calif.
A MASS-SPECTROMETRIC INVESTIGATION OF THE DECOMPOSITION PRODUCTS OF ADVANCED PROPELLANTS AND EXPLOSIVES Annual Summary Report
Milton Farber and R. D. Srivastava Aug. 1979 43 p refs
(Contract N00014-75-C-0986)
(AD-A074963) Avail: NTIS HC A03/MF A01 CSCL 21/9

The results of a mass spectrometric study of several advanced propellants and explosives to determine the chemistry and kinetics of their decompositon are presented. The technical program involved three propellant groups: (1) ignition and thermal decomposition of advanced lead organic additive propellants; (2) sublimation and thermal decomposition of trinitro-triamino benzene; and (3) sublimation and thermal decomposition of 1,3,5,7-tetranitro-1,3,5,7-tetraazacyclooctane (HMX). GRA

N80-14263# Institute of Gas Technology, Chicago, Ill.
HIGH-Btu COAL GASIFICATION PROCESSES
C. F. Blazek, N. R. Baker, and R. R. Tison Jan. 1979 82 p refs Prepared for Argonne National Lab.
(Contract W-31-109-eng-38)
(ANL/CES/TE-79-2) Avail: NTIS HC A05/MF A01

Estimates of performance and cost data for advanced technology, high-Btu, coal gasification facilities are provided. The six processes discussed reflect the current state-of-the-art development. The information presented is based only on pilot-plant experience. Performance characteristics that were investigated include unit efficiencies, product output, and pollution aspects. Total installed plant costs and operating costs are tabulated for the various processes. The information supplied is expected to assist in selecting energy conversion units for an Integrated Community Energy System. DOE

N80-14264# SRI International Corp., Menlo Park, Calif.
PROCEEDINGS OF THE 1978 COAL CHEMISTRY WORKSHOP
S. B. Radding and Howard M. Peters Nov. 1978 204 p refs Conf. held at Menlo Park, Calif., 8-10 Mar. 1978
(Contract ET-78-X-01-2402)
(CONF-780372) Avail: NTIS HC A10/MF A01

The structural chemical analysis of coal and the chemistry of coal gasification and coal liquefaction are discussed. The DOE Fossil Energy Program is discussed in detail and recommendations for further research in coal gasification and coal liquefaction are made. DOE

N80-14265# Argonne National Lab., Ill.
EXPERIMENTAL VERIFICATION OF THE MERCURY-IODINE THERMOCHEMICAL CYCLE FOR THE PRODUCTION OF HYDROGEN FROM WATER, ANL-4
E. H. Appelman, F. Schreiner, and B. M. Abraham 1978 58 p refs Presented at the World Hydrogen Energy Conf., Zurich, 21 Aug. 1978
(Contract W-31-109-eng-38)
(CONF-780807-11) Avail: NTIS HC A04/MF A01

A flow diagram for the cycle described was constructed and an overall practical efficiency of 28% in terms of delta G/sub f (H2O)/total heat input) was estimated from the new data. A substantial portion of the total heat input is required for the isolation of the ammonium iodide. The cycle should be capable of producing hydrogen from water with reasonable efficiency and without requiring heat at an unduly high temperature. The cycle should therefore be suitable for a practical demonstration of the technical feasibility of thermochemical hydrogen generation. DOE

N80-14266# Department of Energy, Washington, D. C. Div. of Environmental Control Technology.
LIQUEFIED GASEOUS FUELS SAFETY AND ENVIRONMENTAL CONTROL ASSESSMENT PROGRAM Progress Report
May 1979 725 p refs
(Contracts EP-78-C-03-2057; EP-78-C-05-6020; EP-78-C-02-4734; EE-77-S-02-4204; EE-77-S-02-4447; EE-77-S-02-4548; EY-76-C-06-1830)
(DOE/EV-0036) Avail: NTIS HC A99/MF A01

Research is reported on the safety and environmental aspects of liquefied gaseous fuels including natural gas, petroleum gas, hydrogen, and ammonia. Spills and fires are among the handling, storage, and transportation hazards assessed. K.L.

N80-14267# California Univ., Livermore. Lawrence Livermore Lab.
HEATS AND PRODUCTS OF DETONATION OF TNT UNDER VARYING CONDITIONS OF CONFINEMENT AND DENSITY
D. L. Ornellas and R. R. McGuire 20 Jun 1979 9 p refs
(Contract W-7405-eng-48)
(UCID-18211) Avail: NTIS HC A02/MF A01

A detonation calorimeter was used to determine the heat and products of detonation of TNT. Values were obtained at density 1.53 g/cu cm for charges that were unconfined and for charges which were heavily confined in gold, Pyrex glass, and alumina and at density 1.0 g/cu cm for charges that were unconfined and heavily confined in gold and sodium chloride. The heats of detonation calculated from the heats of formation of TNT and the observed products are reported. Material recoveries are generally in good agreement with predictions based on previous experience. DOE

N80-14268# Natural Dynamics, Des Moines, Iowa.
FAST PRODUCTION OF METHANE BY ANAEROBIC DIGESTION, VOLUME 1 Final Report, 24 May 1976 - 31 Dec. 1978
C. D. Finney, R. S. Evans, II, and K. A. Finney Dec. 1978 123 p refs
(Contract EY-76-C-02-2900)
(COO-2900-17-Vol-1) Avail: NTIS HC A06/MF A01

For optimal performance in the production of methane from solid waste by anaerobic digestion, hydrolysis must be separated from gasification. Characterization with glucose as substrate revealed 70 C to be the maximal thermophilic temperature, since, beyond that limit, a buildup of acids was observed. Analysis of volumetric rate coefficients for the disappearance of reducing sugars, soluble COD, and volatile acids, and for the appearance of methane suggests that the region near 62 C is the optimal thermophilic temperature. There is a purely economic justification for a two-stage technology: the masses of bacterial cells and methane were seen to be about equal, and the protein content of the concentrated cells has potential as a premium agricultural feedstock. DOE

N80-14269# Midwest Research Inst., Golden, Colo.
ROUGH COST ESTIMATES OF SOLAR THERMAL/COAL OR BIOMASS-DERIVED FUELS
R. J. Copeland 1979 8 p refs Presented at AIAA Terrestrial Energy Systems Conf., Orlando, Fla., 4 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-35-279; CONF-790611-5) Avail: NTIS HC A02/MF A01

Cost data for one method of producing synthetic methane is presented. A hybrid approach was chosen, a combination of solar thermal and either coal or biomass. The magnitude of the solar thermal resource is estimated as well as projected cost. Cost projections for coal and biomass are accumulated. The cost of synthetic gas from a hybrid and a conventional fuel source are compared. DOE

N80-14270# Illinois Univ., Urbana. Dept. of Civil Engineering.
BIOLOGICAL CONVERSION OF BIOMASS TO METHANE Quarterly Progress Report, 1 Sep. - 30 Nov. 1978
J. T. Pfeffer Dec. 1978 14 p ref
(Contract EY-76-S-02-2917)
(COO-2917-12) Avail: NTIS HC A02/MF A01

The viability of wheat straw as a feedstock for methane production by anaerobic digestion was investigated and the results obtained compared with that obtained with corn stover. Poor conversion was obtained with the wheat straw under thermophilic conditions, but better than that obtained with corn. In addition the residue has no value as an animal feed. A mild thermochemical pretreatment of the corn prior to anaerobic digestion improved the conversion efficiency and the value of the residue as an animal feed. It is assumed that similar pretreatment of wheat straw would improve its conversion efficiency. Slurry and pumping characteristics of wheat straw particles were reported. DOE

N80-14271# Argonne National Lab., Ill.
FUSARIUM SPECIES: THEIR POTENTIAL FOR TRANSFORMING BIOMASS TO ETHANOL
Antonios A. Antonopoulos Feb. 1979 26 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-38) Avail: NTIS HC A03/MF A01

Unlike yeasts and other fungi, Fusaria can ferment both pentoses and hexoses (yeast can ferment only hexoses), and are able to saccharify the cell wall and middle lamella constituents and ferment the released sugar units. Existing research data support well the idea of utilizing selected Fusarium strains to decompose and convert biomass to ethyl alcohol. Since ethanol blends and performs effectively with gasoline (as gasohol), its yield through the Fusarium fermentative action should be exploited. Certain biological, technological, and economic limitations that constrain the application of biomass conversion to ethanol by Fusarium strains today, on a large scale, could be overcome through additional research and development. DOE

N80-14272# California Univ., Davis. Dept. of Agricultural Engineering.
PILOT PLANT GASIFICATION TEST ON BIOMASS FUELS Interim Report, Jun. - Nov. 1978
John R. Goss Jun. 1979 79 p Sponsored by Calif. State Energy Resources Conserv. and Develop. Comm.
(PB-299077/8; CAEC-36; CAEC-500-79-007) Avail: NTIS HC A05/MF A01 CSCL 07A

A scaled-up version of Swedish down-draft gasifiers, capable of producing 8 million Btu of gas per hour from agricultural and forestry residues, operated over 500 hours which included a continuous run of 330 hours. The gas from the gasifier was burned in a boiler to produce steam, burned in a low-Btu burner to produce heated air, and burned in a 60 kw diesel engine to generate electricity. Data are presented on the operating characteristics, environmental impacts, and equipment costs of the gasifier system. The technical feasibility and requirements of firing steam boilers with low-Btu gas from a gasifier fueled with wood chips was demonstrated. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-14273*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.
ASSESSMENT OF PRESENT STATE-OF-THE-ART SAWING TECHNOLOGY OF LARGE DIAMETER INGOTS FOR SOLAR SHEET MATERIAL Final Report, 1 Sep. 1977 - 28 Feb. 1978
H. I. Yoo 1978 126 p refs
(Contract JPL-954830)
(NASA-CR-162535; DOE/JPL-954830-78/2) Avail: NTIS HC A07/MF A01 CSCL 13H

Work is reported on: (1) slicing of the ingots with the multiblade slurry saw, the multiwire slurry saw and the I.D. saw, (2) characterization of the sliced wafers, and (3) analysis of add-on slicing cost based on Solar Array Manufacturing Industry Costing Standard. M.M.M.

N80-14274# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.
CONSTRUCTION OF AN ICE-RETARDANT OVERLAY
Robert J. Nittinger Jun. 1979 28 p refs
(PB-298876/4; FHWA/NY-79/RR-72; RR-79-72) Avail: NTIS HC A03/MF A01 CSCL 13B

A calcium chloride asphalt additive, developed to alleviate ice formation on pavements, is discussed. Problems encountered in batching operations and laboratory testing are reported. Construction procedures, skid resistance, and overall pavement appearance are documented. It was found that automated batching could not be used because the additive was held in the mineral filler bin and added after the introduction of bitumen. Manual

batching thus was required. Due to the additive's hygroscopic state, laboratory test results were erratic. No unusual problems were found during construction; the pavement became oily in appearance, but tests produced adequate skid numbers, and after two rainstorms and heavy traffic the pavement appeared dry. GRA

N80-14275# Maryland Univ., College Park. Dept. of Fire Protection Engineering.
A STUDY OF FIRE SAFETY EFFECTIVENESS STATEMENTS Final Report
Jack Watts, James A. Milke, John L. Bryan, Rachel Dardis, and Vincent Brannigan 2 Jan. 1979 172 p refs
(Contract USFA-C-7-35563)
(PB-299169/3) Avail: NTIS HC A08/MF A01 CSCL 13L

Key factors affecting life safety from fire in buildings are identified through analyses of variables obtained from a literature review. Existing systematic methods for grading fire safety are reviewed and evaluated for their potential in formulating Fire Safety Effectiveness Statements. None of the existing methods are found to be fully appropriate, hence utilization of the key life safety factors is suggested as a method to satisfy immediate needs to evaluate the level of fire safety in existing buildings. Concepts of implementation of Fire Safety Effectiveness Statements are addressed, specifically, measurability of key life safety factors, economic impact, and socio-legal utility. GRA

N80-14276# Urban Inst., Washington, D.C.
FIRE-CODE INSPECTIONS AND FIRE PREVENTION: WHAT METHODS LEAD TO SUCCESS Final Report
John R. Hall, Jr., Michael J. Karter, Jr., Margo Koss, Alfred H. Schainblatt, and Thomas C. McNerney Dec. 1978 141 p refs
Sponsored in part by Fire Administration
(Grant NSF APR-76-19148)
(PB-298991/1) Avail: NTIS HC A07/MF A01 CSCL 13L

Research is undertaken to determine whether some fire-code inspection practices result in fewer fires, lower fire loss, and fewer civilian casualties in properties covered by fire codes (excluding one and two-family residences) than do other fire-code inspection practices. The research involved (1) identifying the fires and civilian fire casualties that are potentially preventable by inspection and measuring the proportion of fires and casualties which are of that type; (2) relating differences in characteristics of fire-code inspection practices to differences in fire rates for a representative group of cities; and (3) examining the circumstances of major casualty incidents across the country to determine the relative preventability of those incidents. GRA

N80-14277# Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
COMPLETE STRESS-STRAIN CURVE OF CONCRETE AND NONLINEAR DESIGN Progress Report
S. H. Ahmad and S. P. Shah Aug. 1979 33 p refs
(Grant NSF PFR-78-22878)
(PB-299151/1) Avail: NTIS HC A03/MF A01 CSCL 13C

Difficulties of experimentally obtaining the descending part of the stress-strain curve of concrete in uniaxial compression and methods of overcoming these difficulties are described. The influence of testing parameters on the stress-strain curves are presented. Based on the experimentally observed stress-strain relationship, an analytical model was developed to predict the moment-curvature relationships of reinforced concrete sections. These moment-curvature relationships are compared with some available experimental data obtained and with those obtained by two other analytical models. GRA

N80-14278# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SURVEY OF SOLIDIFICATION/STABILIZATION TECHNOLOGY FOR HAZARDOUS INDUSTRIAL WASTES Interim Report
Jul. 1979 51 p refs
(PB-299206/3; EPA-600/2-79-056) Avail: NTIS HC A04/MF A01 CSCL 13B

Solidification/stabilization systems for industrial solid wastes are reviewed. The advantages and disadvantages of each approach are discussed. Abstracts from technical information furnished by companies developing or marketing solidification/stabilization processes or marketing equipment specifically for these processes are presented. GRA

N80-14279# General Accounting Office, Washington, D. C. Energy and Minerals Div.
THE SOLAR IN FEDERAL BUILDINGS DEMONSTRATION PROGRAM
10 Aug. 1979 24 p
(PB-298535/6; EMD-79-84) Avail: NTIS HC A02/MF A01 CSCL 13A

Recommendations are presented for DOE to develop a comprehensive strategy and plan for guiding and integrating conservation and solar efforts for Federal buildings in order to implement the Federal buildings solar program on the scale envisioned by the National Energy Plan and the Congress. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N80-14280 Utah Univ., Salt Lake City.
A CONSTANT PERCENTAGE BANDWIDTH TRANSFORM FOR ACOUSTIC SIGNAL PROCESSING Ph.D. Thesis
James Elden Youngberg 1979 121 p
Avail: Univ. Microfilms Order No. 7924343

A constant percentage bandwidth transform for acoustic signal processing is presented. Such a transform was shown to emulate behavior found in the human auditory system, making possible both the imitation or peripheral auditory analysis, and processing which was more closely linked to perception than is possible using constant bandwidth analysis. A synthesis transformation is developed to enable such processing. Various properties of the transform pair are derived, and a filterbank analogy is used to create a basis for intuitive understanding of the transform's operation and properties. The effects of spectral domain modification are described and shown to be related to the properties of the analysis window function. Principles governing discrete implementation of the transform pair are discussed, and relationships are formalized which specify the sampling of the spectral domain. Dissert. Abstr.

N80-14281* National Aeronautics and Space Administration, Pasadena Office, Calif.
ELECTROMAGNETIC POWER ABSORBER Patent
Richard S. Iwasaki, inventor (to NASA) (JPL) Issued 14 Aug. 1979 6 p Filed 15 Sep. 1977 Continuation of abandoned US Patent Appl. SN-703905, Filed 9 Jul. 1976 Sponsored by NASA
(NASA-Case-NPO-13830-1; US-Patent-4,164,718;
US-Patent-Appl-SN-834257; US-Patent-Class-333-81R;
US-Patent-Class-343-18A; US-Patent-Class-343-909;
US-Patent-Appl-SN-703905) Avail: US Patent and Trademark Office CSCL 20N

A structure is presented with a surface portion of dielectric material which passes electromagnetic radiation and with a portion below the surface which includes material that absorbs the radiation, the face of the structure being formed with numerous steep ridges. The steepness of the dielectric material results in a high proportion of the electromagnetic energy passing through the surface for absorption by the absorbing material under the surface. A backing of aluminum or other highly heat-conductive and reflective material lies under the face and has very steep protuberances supporting the absorbing and dielectric materials. Official Gazette of the U.S. Patent and Trademark Office

N80-14282 Arizona Univ., Tucson.
EXTRAPOLATION TECHNIQUES FOR THE EVALUATION OF DIGITAL COMMUNICATIONS EQUIPMENT Ph.D. Thesis
George Robert Davis 1979 269 p
Avail: Univ. Microfilms Order No. 7927579

A technique which extrapolates the desired information accurately from more readily obtainable data is presented. The

validity of the technique is established both analytically and experimentally. A procedure was discovered for the alignment of digital communications equipment that has potentially greater significance than the reduction of test time. The method is to perform final adjustments on the equipment while monitoring the bit error rate at a very low signal to noise ratio. Although analog alignment techniques are well established and necessary to obtain proper operation, these methods may not produce the best possible operational performance. The experimental results show that final alignment while monitoring bit error rate can produce the desired optimum performance. Dissert. Abstr.

N80-14283 Texas Univ. at Austin.
DISCRETE TIME DETECTION OF SIGNALS IN DEPENDENT NON-GAUSSIAN NOISE Ph.D. Thesis
Don Ray Halverson 1979 144 p
Avail: Univ. Microfilms Order No. 7928299

Several topics are presented within the general area of signal detection theory. Detection of a signal in symmetrically phi-mixing noise is considered. Applying the criterion of asymptotic relative efficiency, design of the optimal memoryless detector is specified and is seen to depend only on second-order statistical knowledge of the noise. It is shown that in many cases this design reduces to approximating the noise process with an m-dependent process, finding the corresponding nonlinearity as a solution to a Fredholm integral equation of the second kind, and obtaining the optimal nonlinearity through a limiting process. Conditions are given for the existence of a unique optimal nonlinearity. A bound on the performance of the optimal phi-mixing detector relative to that of the detector designed under an m-dependent assumption is given. Dissert. Abstr.

N80-14284 Purdue Univ., Lafayette, Ind.
ZINC OXIDE ON SILICON SURFACE ACOUSTIC WAVE CONVOLVERS AND MEMORY CORRELATORS Ph.D. Thesis
Fu-Chang Lo 1979 173 p
Avail: Univ. Microfilms Order No. 7926406

A significant improvement in the signal processing capabilities of metal-zinc oxide-silicon dioxide-silicon (MZOS) memory correlators was achieved by utilizing the high coupling characteristics of the Sezawa wave together with the superior storage characteristics of a pn diode array. A prototype Sezawa wave MZOS pn diode array memory correlator was fabricated and tested. The device displayed a bandwidth capability in excess of that associated with Rayleigh mode MZOS devices. Rayleigh mode MZOS pn diode array correlators were also fabricated and evaluated. A metal insulator semiconductor-oriented analysis for surface acoustic wave convolvers was developed and applied to both the MZOS configuration and the separated medium configuration. The predictions of this theoretical model are compared to alternative theories. Dissert. Abstr.

N80-14285 Tennessee Univ., Knoxville.
CLASSICAL THEORY OF RADIATIVE TRANSITIONS Ph.D. Thesis
John Thomas Freeman Barwick 1979 120 p
Avail: Univ. Microfilms Order No. 7927025

Schroedinger's original conception of the connection between the electric field and the wave function is reinterpreted and extended. The semiclassical approach to radiative transitions is based on the exact description of a particle undergoing a transition between two energy eigenstates. The physical existence of such a wave function during a transition allows for a simple classical explanation of the origin of radiation from quantum mechanical systems, both in the usual bound state cases and in some free particle transitions for which there have been no semiclassical accounts. The Compton effect is given a classical explanation which yields the Klein-Nishina cross section and demonstrates the classical origin of photon-like behavior of the incident and scattered radiation. Further confirmation of the classical nature of the electromagnetic field at the quantum mechanical level is presented in a derivation of the Lamb shift. A more complete discussion of the c sub 1(t) and c sub 2(t) transition coefficients is also carried out, leading to semi-classical treatments of spontaneous emission and the blackbody spectrum.

Dissert. Abstr.

N80-14286 British Broadcasting Corp., Kingswood (England). Engineering Div.
GROUND-WAVE PROPAGATION IN A REALISTIC TERRAIN
J. H. Causebrook Oct. 1979 19 p refs
(BBC-RD-1979/19) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Results of investigations into ground wave propagation in a realistic terrain are presented. The differences between wave propagation over a smooth terrain versus a realistic one, include a nonsimple relationship for field variation with distance, and a nonfree space relationship between electric and magnetic fields. The theory of why these occur is summarized and the measurements taken to demonstrate their nature are given. Also, descriptions are given of a computer calculation method which was developed in this research. M.M.M.

N80-14287 British Broadcasting Corp., Kingswood (England). Engineering Div.
LOCAL OSCILLATOR RADIATION FROM TELEVISION RECEIVERS
J. Middleton Nov. 1979 11 p refs
(BBC-RD-1979/21) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The ways in which local oscillator interference becomes apparent is examined along with recent measurements made to determine whether there has been any reduction in the level of radiation from modern receivers. It was concluded that there was no significant reduction. M.M.M.

N80-14288# Communications Research Centre, Ottawa (Ontario). Radio and Radar Research Branch.
VHF AND UHF PROPAGATION STUDIES IN THE CANADIAN ARCTIC
F. H. Palmer Oct. 1979 28 p refs
(CRC-1327) Avail: NTIS HC A03/MF A01

Measurements of path loss for various frequencies, polarizations, and transmitting and receiving antenna heights, were made at a number of receiving sites along several radials from each transmitter. Path lengths ranged from 1 to 100 km and covered land, water, and mixed types of terrain. The measurements were used to construct empirical models of path loss for these areas, and to form a data base with which to compare the predictions of the CRC VHF/UHF propagation prediction computer program. The measurement program and the empirical models which were derived from the results are described. M.M.M.

N80-14289*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RESONANT FREQUENCY OF MICROSTRIP ANTENNAS CALCULATED FROM TE-EXCITATION OF AN INFINITE STRIP EMBEDDED IN A GROUNDED DIELECTRIC SLAB
M. C. Bailey Nov. 1979 18 p refs
(NASA-TM-80190) Avail: NTIS HC A02/MF A02 CSCL 20N

The calculation of currents induced by a plane wave normally incident upon an infinite strip embedded in a grounded dielectric slab is used to infer the resonant width (or frequency) of rectangular microstrip antennas. By placing the strip inside the dielectric, the effect of a dielectric cover of the same material as the substrate can be included in the calculation of resonant frequency. A comparison with measured results indicated agreement of 1 percent or better for rectangular microstrip antennas constructed on Teflon-fiberglass substrate. Author

N80-14290*# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
HIGH FREQUENCY SCATTERING FROM A THIN LOSSLESS DIELECTRIC SLAB M.S. Thesis
K. W. Burgener Nov. 1979 77 p
(Grant NsG-1498)
(NASA-CR-162564; OSU-TR-710964-4) Avail: NTIS HC A05/MF A01 CSCL 20N

A solution for scattering from a thin dielectric slab is developed based on geometrical optics and the geometrical theory of diffraction with the intention of developing a model for a windshield of a small private aircraft for incorporation in an aircraft antenna code. Results of the theory are compared with experimental

measurements and moment method calculations showing good agreement. Application of the solution is also addressed. M.G.

N80-14291# Fondazione Ugo Bordoni, Rome (Italy).
RESEARCH ON CIRCULAR WAVEGUIDE COMMUNICATION SYSTEMS Progress Report, 1968 - 1977 [RICERCHE SUI SISTEMI DI COMMUNICAZIONE IN GUIDA D'ONDA CIROLARE]
Nov. 1978 436 p refs Partly in ITALIAN and ENGLISH (FUB-28) Avail: NTIS HC A19/MF A01

The Italian research program on circular waveguide systems is described. The program is aimed to provide theoretical and experimental results about feasibility, performance and cost of the transmission media, of the methods, of the regenerative repeaters and terminal equipment, and of the complete communication system. The reported results include the development of regenerative repeaters, the design of special circular waveguides and accessories, and various experimental measurements of equipment performance. For individual titles see N80-14292 through N80-14301.

N80-14292# Fondazione Ugo Bordoni, Rome (Italy).
ITALIAN RESEARCH ON MILLIMETRIC WAVEGUIDE SYSTEMS
Renato Kock *In its* Res. on Circ. Waveguide Commun. Systems Nov. 1978 p 15-19 Presented at Intern Conf on Millimetric Waveguide Systems, London, Nov. 1976 (For primary document see N80-14291 05-32)
Avail: NTIS HC A19/MF A01

The Italian research program on circular millimetric waveguide systems is reviewed, including the description of equipment, repeater performances, waveguide trunk design, and experimental investigation on waveguides. The history of the 'Millimetric Wave Center' near Bologna, where much of the research was conducted, is detailed. Author (ESA)

N80-14293# Politecnico di Milano (Italy).
GENERAL CONSIDERATIONS ABOUT CIRCULAR WAVEGUIDE SYSTEMS [CONSIDERAZIONI GENERALI SUI SISTEMI IN GUIDA D'ONDA CIRCOLARE]
Giovanni B. Stracca and Francesco Valdoni (Bologna Univ.) *In* Fond. Ugo Bordoni Res. on Circ. Waveguide Commun. Systems Nov. 1978 p 23-54 refs In ITALIAN (For primary document see N80-14291 05-32)
Avail: NTIS HC A19/MF A01

The systems engineering approach to circular waveguide systems is discussed. In particular the quality limitations and the extended attenuation bandwidth effects are analyzed, and these are referred to long distance digital communication networks. Feasibility and cost of such systems are examined, giving criteria for the technical and economical design optimization. Author (ESA)

N80-14294# Bologna Univ. (Italy).
PROPAGATION IN CIRCULAR WAVEGUIDES [PROPAGAZIONE IN GUIDA D'ONDA CIRCOLARE]
Gian Carlo Corazza and Gabriele Falciasecca *In* Fond. Ugo Bordoni Res. on Circ. Waveguide Commun. Systems Nov. 1978 p 57-85 refs In ITALIAN (For primary document see N80-14291 05-32)
Avail: NTIS HC A19/MF A01

The general method for determination of electromagnetic fields guided by metallic cylindrical structures is reviewed and applied to TE01 propagation in circular waveguides. The design criteria of propagation media are derived from the non-infinite conductivity of metallic walls and the propagation deformation effects on the TE01 mode. The effects of multi-mode propagation are discussed presenting a simplified model based on the coupled mode propagation equations, and the influence of curves and deformations are examined. The distortion and noise increase produced by mode reconversion are analyzed. Author (ESA)

N80-14295# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy). Elettronica S.p.A.
DESIGN OF THE TRANSMISSION MEDIA OF CIRCULAR WAVEGUIDES [PROGETTO DEL MEZZO TRASMISSIVO DI SISTEMI IN GUIDA D'ONDA CIRCOLARE]
Paolo Bernardi, Gabriele Falciasecca (Bologna Univ.), and Sergio Rogai (Ente Nazionale per l'Energia Electricca) *In* Fond. Ugo Bordoni Res. on Circ. Waveguide Commun. Systems Nov. 1978 p 89-167 refs In ITALIAN (For primary document see N80-14291 05-32)
Avail: NTIS HC A19/MF A01

The computer program PAGOM used for the design of circular waveguides is described and the design criteria adopted in preparing that program are explained. The PAGOM program is presented in two versions, one for the design analysis and another for automatic design. Results obtained in both cases illustrate the method potential. The characteristics of the resulting practical waveguide structures and the processes created for its production are summarized. Author (ESA)

N80-14296# Trieste Univ. (Italy).
GENERAL CRITERIA FOR THE DESIGN OF REPEATING STATIONS OF CIRCULAR WAVEGUIDE SYSTEMS [CRITERI GENERALI PER IL PROGETTO DELLA STAZIONE RIPETITRICE DI SISTEMI IN GUIDA D'ONDA CIRCOLARE]
Edoardo Carli, Tullio Corzani, and Giovanni B. Stracca (Politech. di Milan) *In* Fond. Ugo Bordoni Res. on Circ. Waveguide Commun. Systems Nov. 1978 p 171-270 refs In ITALIAN (For primary document see N80-14291 05-32)
Avail: NTIS HC A19/MF A01

Considerations made before starting a circular waveguide repeating stations project are discussed. The analysis include subjects such as: the selection criteria of repeater main parameters, the selection of the overall bandwidth and frequencies, the characteristics of the channel system, a comparison between channel distributions proposed by various administrations, the branch filter systems, the band filter systems, the selection criteria of the modulation type, the repeater structure, the selection of intermediate frequency, the transmission power, and equalizers. Author (ESA)

N80-14297# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy). Elettronica S.p.A.
SPECIAL PASSIVE COMPONENTS FOR CIRCULAR WAVEGUIDES [COMPONENTI SPECIALI PASSIVI IN GUIDA D'ONDA CIRCOLARE]
Paolo Bernardi and Franco Bertolani (Fond. Ugo Bordoni) *In* Fond. Ugo Bordoni Res. on Circ. Waveguide Commun. Systems Nov. 1978 p 273-298 refs In ITALIAN (For primary document see N80-14291 05-32)
Avail: NTIS HC A19/MF A01

The working principle and design basis of special passive components for circular waveguide links are described. The characteristics and performance tests of some of these components, which were built as prototypes, are presented, including a directional coupler between rectangular and circular waveguides, diameter adapters (tapers), small radius curves, quasi-optical elbows, mode filters and dilation joints. Author (ESA)

N80-14298# Bologna Univ. (Italy).
PROBLEMS AND INSTALLATION TECHNIQUE OF THE TRANSMITTING MEDIA OF A CIRCULAR WAVEGUIDE LINK [PROBLEMI E TECHNICHE DI INSTALLAZIONE DEL MEZZO TRASMISSIVO DI UN COLLEGAMENTO IN GUIDA D'ONDA CIRCOLARE]
Gian Carlo Corazza, Luigi Lo Vecchio (Fond. Ugo Bordoni), and Guido Magni (SIRTI) *In* Fond. Ugo Bordoni Res. on Circ. Waveguide Commun. Systems Nov. 1978 p 301-340 refs In ITALIAN (For primary document see N80-14291 05-32)
Avail: NTIS HC A19/MF A01

An experimental installation of a circular waveguide line was made at Ozzano (Emilia-Italy) to characterize and evaluate various commercial waveguide types and to study the installation techniques. A straight line (402 m) section and a large radius curve (215 m) section are provided. The auxiliary equipment and the installation techniques are described. Power spectra, equivalent curvature and alternation measurements are given. It is concluded that the experimental industrial-type installation procedure presents acceptable results as compared to a laser aligned installation, although an evaluation extended to several tenths of a kilometer is advisable. Author (ESA)

N80-14299# Bologna Univ. (Italy).
MEASUREMENT AND CHARACTERIZATION OF MANUFACTURING AND INSTALLATION IMPERFECTIONS OF CIRCULAR WAVEGUIDES [MISURE E CARATTERIZZAZIONE DELLE IMPERFEZIONI DI COSTRUZIONE E DI POSA DELLA GUIDA D'ONDA CIRCOLARE]
Gabriele Falciasecca, Luigi Lo Vecchio (Fond. Ugo Bordoni), and Guido Magni (SIRTI) *In* Fond. Ugo Bordoni Res. on Circ. Waveguide Commun. Systems Nov. 1978 p 343-367 refs In ITALIAN (For primary document see N80-14291 05-32)
Avail: NTIS HC A19/MF A01

Geometric deformations of circular waveguides influencing the mode conversion are analyzed. The criteria for test bench design, adapted to characterize TE01 mode propagation, are given. Test benches actually built and the characterization results of some waveguides are described. The similarity with the measuring systems independently developed in France and the United States is stressed. Author (ESA)

N80-14300# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
MEASURING METHODS OF THE ELECTROMAGNETIC CHARACTERISTICS OF CIRCULAR WAVEGUIDES [METODI DI MISURA DELLE CARATTERISTICHE ELETTROMAGNETICHE DELLA GUIDA D'ONDA CIRCOLARE]
Paolo Bernardi, Franco Bertolani (Fond. Ugo Bordoni), and Francesco Valdoni (Bologna Univ.) *In* Fond. Ugo Bordoni Res. on Circ. Waveguide Commun. Systems Nov. 1978 p 371-398 refs In ITALIAN (For primary document see N80-14291 05-32)
Avail: NTIS HC A19/MF A01

The tests benches for circular waveguide characterization are analyzed and the measuring systems already built, with corresponding practical examples, are described. The methods being examined include: measurement of the TE01 mode attenuation by resonance methods and by multiple echo methods; measurement of the propagation constant of undesirable modes by the substitution method and by the phase constant difference; measurement of mode conversion by a resonance method and by double resonance; link measurement by pulse echometry and by substitution with superheterodyne reception. Author (ESA)

N80-14301# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
MEASURING METHODS OF REPEATER CHARACTERISTICS FOR CIRCULAR WAVEGUIDE SYSTEMS [METODI DI MISURA DELLE CARATTERISTICHE DI APPARECCHIATURE RIPETITRICI PER SISTEMI IN GUIDA D'ONDA CIRCOLARE]
Luciano Buti *In* Fond. Ugo Bordoni Res. on Circ. Waveguide Commun. Systems Nov. 1978 p 401-425 refs In ITALIAN (For primary document see N80-14291 05-32)
Avail: NTIS HC A19/MF A01

The main characteristics of transmitter, receiver, connection network and phase equalizer of repeater apparatus are examined and appropriate measuring methods are presented. The group delay, the error rate and the insertion loss measurements, are considered in particular, presenting the experimental results in chart form to illustrate these methods. Author (ESA)

N80-14302# Decision-Science Applications, Inc., Arlington, Va.
A MODEL FOR SPACE RADAR CLUTTER Final Report, 15 Feb. 1978 - 15 Feb. 1979
P. G. Tomlinson Griffiss AFB, N.Y. RADC, Griffiss AFB, N.Y. Jun. 1979 107 p refs
(Contract F30602-78-C-0129; AF Proj. 4506)
(AD-A072990; DSA-116; RADC-TR-79-166) Avail: NTIS HC A06/MF A03 CSCL 17/9

A model for radar clutter as encountered from a space-based platform is developed. Included in the model are land, sea and airborne clutter with emphasis on land clutter. Parametric fits to existing reflectivity data are performed for seven generic terrain types: desert, forest, mountain, rural, urban, snow and ice and sea. The fits are parametric in frequency and grazing angle and, in the case of sea clutter, polarization. In addition to the mean values of clutter reflectivity, the variation about the mean is emphasized. The underlying causes of clutter variability nonhomogeneous terrain type, terrain undulation, etc., are discussed. Quantitative estimates of their effects are presented. A theory of probability density function of clutter based on the resolution cell size, correlation lengths, and underlying statistics of individual scatterers, is presented. Examples are worked out for five terrain types and a large resolution cell. The results are threshold settings required for given false alarm probabilities. Clutter spectra are discussed briefly. Finally, requirements and computer simulations are examined with particular attention to the advantages and disadvantages of three candidate measurement programs. GRA

N80-14303# Logicon, Inc., San Diego, Calif. Tactical and Training Systems Div.
VOCABULARY SPECIFICATION FOR AUTOMATIC SPEECH RECOGNITION IN AIRCRAFT COCKPITS Final Report, Sep. 1978 - Jun. 1979
Rohn J. Petersen, Nancey Lee, Catherine Meyn, Elaine Regelson, and William Satzer 31 Aug. 1979 92 p refs
(Contract N00014-78-C-0692)
(AD-A073703) Avail: NTIS HC A05/MF A01 CSCL 17/2

The general focus of this research was to design a communication media (a vocabulary) that is advantageous to both machine recognition and human production of speech events. The problem was analyzed from a human factors perspective that centered upon the man-computer dialogue (interaction) required for cockpit application of ASR. The results indicated that phrase familiarity and stimulus familiarity had major impact on the learning and utilization of the phrases in the paired-associate task. Phrase length and meaningfulness did not appear to differentially affect either the learning or utilization of the paired associate. In addition, pretraining of stimulus familiarity did not seem to result in improved performance. Acoustic lexical confusability also was discussed in general methodological terms. The results of the study were interpreted in terms of a contextualist viewpoint with the necessity of a broader contextual manipulation being pointed out as a requirement for further research. GRA

N80-14304# Naval Research Lab., Washington, D. C.
MAXIMUM ENTROPY WAVENUMBER ANALYSIS Interim Report
William R. King 20 Mar. 1979 39 p refs
(RR0210541)
(AD-A073290; AD-E000311; NRL-8298) Avail: NTIS HC A03/MF A01 CSCL 20/14

The maximum entropy spectral analysis (MESA) technique is applied to a linear spatial array of sensors to obtain wavenumber power spectra. The resultant wavenumber spectra are compared with conventional beamsteered antenna patterns using simulated signals mixed with Gaussian noise. The results indicate that the MESA technique, which is an all-pole model, may provide improved accuracy and improved spatial resolution of signals under varying signal-to-noise conditions. Some difficulties with MESA are noted, and further investigations are recommended. GRA

N80-14305# Computer Sciences Corp., Falls Church, Va.
EARTH TERMINAL SUBSYSTEM STUDY. VOLUME 1: SMALL TERMINAL COST ANALYSIS Final Report
Ross Winebarger May 1979 51 p Prepared by Harris Corp., Melbourne, Fla.
(Contract DCA100-76-C-0089)
(AD-A073429; AD-E100271) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report addresses the cost sensitivities of the major components of a small economical earth terminal. A baseline X-band terminal is proposed which has a G/T of 20 dB and an EIRP of 72 dBW. Parametric curves are developed which show the changes in hardware cost corresponding to moderate changes in component characteristics around the baseline values. Parametric cost curves are developed for changes in the antenna diameter, RMS surface accuracy, antenna efficiency, antenna wind performance, transmitter power, type of low-noise amplifier, oscillator stability, and phase noise performance. Cost data is then developed and presented for changes in the terminal G/T, EIRP, and availability around the baseline terminal performance. GRA

N80-14306# Computer Sciences Corp., Falls Church, Va.
EARTH TERMINAL SUBSYSTEM STUDY. VOLUME 4: TRANSMITTER COMBINING FOR SIMULTANEOUS TRANSMISSION OF FDMA AND TDMA CARRIERS Final Report

Ross Winebarger May 1979 40 p Prepared by Harris Corp., Melbourne, Fla.
(Contract DCA100-76-C-0089)
(AD-A073356; AD-E100272) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report addresses alternative methods of combining high-power TDMA and FDMA X-band carriers for simultaneous transmission from Defense Satellite Communications System (DSCS) earth terminals. The TDMA signal is assumed to be in Channel 1 of the DSCS III frequency plan, with the FDMA carriers in Channels 2 and 6 (on both sides of the TDMA signal). Three alternative diplexer configurations are described: (1) a conventional bandpass filter; (2) a band-stop filter; and (3) a dual E-stub filter. The three configurations are evaluated in terms of insertion loss, phase linearity, and complexity. It is concluded that the bandpass filter approach is the preferred approach, based on its low-loss characteristics and its design simplicity. GRA

N80-14307# Ohio State Univ., Columbus. Electroscience Lab.
COMMUNICATION APPLICATION OF ADAPTIVE ARRAYS Quarterly Report
R. T. Compton, Jr. Jun. 1979 7 p ref
(Contract N00019-79-C-0291)
(AD-A074558; ESL-711847-1) Avail: NTIS HC A02/MF A01 CSCL 17/2

Adaptive arrays for communication applications are summarized. Weight jitter and dynamics for improved lunar excursion module mission simulator loop were studied. A reference signal generation technique for frequency shift keying signals was investigated. A monograph on adaptive arrays was prepared. R.C.T.

N80-14308# Naval Ocean Systems Center, San Diego, Calif.
IMAGE TRANSMISSION VIA SPREAD SPECTRUM TECHNIQUES Annual Report, Jan. - Dec. 1977
E. H. Wrench and A. G. Weber 1 Jan. 1978 412 p
(DARPA Order 2303)
(AD-A074606; GIDEP-E123-0600; ARPA-QR8) Avail: NTIS HC A18/MF A01 CSCL 17/2

This report summarizes the work performed on the Image Bandwidth Reduction Program for ARPA by the Naval Ocean Systems Center during calendar year 1977. Appendices A through I detail the work done, both in-house and under contract. Topics covered include Bandwidth Reduction System, Command Language Summary, Frame-Store Memory Executive Program, Derivation of the Fast Cosine Transform, Human Factors Involved With Viewing Compressed Images From Remote Piloted Vehicles, Coding Techniques For RPV and SAR Images, Image Coding Techniques, Stochastic Image Models and Hybrid Coding, and Operator Performance Evaluation of Mini-RPV Video Image Bandwidth Reduction/Compression Techniques. GRA

N80-14309# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SPEECH ENHANCEMENT USING A SOFT-DECISION MAXIMUM LIKELIHOOD NOISE SUPPRESSION FILTER
Robert J. McAulay and Marilyn L. Malpass 19 Jun. 1979 40 p refs
(Contract F19628-78-C-0002)
(AD-A074082; TN-1979-31; ESD-TR-79-163) Avail: NTIS HC A03/MF A01 CSCL 17/2

One way of enhancing speech in an additive acoustic noise environment is to perform a spectral decomposition of a frame of noisy speech and to attenuate a particular spectral line depending on how much the measured speech plus noise power exceeds an estimate of the background noise. Using a two state model for the speech event (speech absent or speech present) and determining the maximum likelihood estimator of the speech power results in a new class of suppression curves which permits a tradeoff of noise suppression against speech distortion. The algorithm has been implemented in real time in the time domain, exploiting the structure of the channel vocoder. Extensive testing has shown that the noise can be made imperceptible by proper choice of the suppression factor. GRA

N80-14310# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CAPACITY ALLOCATION TECHNIQUES IN A MULTI-USER SATELLITE SYSTEM
John I. Capetanakis 18 Jul. 1979 38 p refs
(Contract F19628-78-C-0002; AF Proj. 2029)
(AD-A074018; TN-1979-34; ESD-TR-79-185) Avail: NTIS HC A03/MF A01 CSCL 17/2

The multiple accessing of satellite by a large number of independent users is considered. The messages are generated randomly, and they are of fixed length. Depending on the accessing protocol, such a system may exhibit congestion instabilities, long message delays, or low throughput. Several important protocols (that are applicable to such a system and which fall into the categories of direct access, reservation access, and polling access) are presented and evaluated. The E (delay) vs E (throughput) performances of the various protocols are obtained and compared. It is shown (for a specific example) that demand assignment access with a TREE reservation protocol is best for throughput up to about 70%, whereas polling access is best in heavier message traffic. GRA

N80-14311# Johns Hopkins Univ., Baltimore, Md. Dept. of Electrical Engineering.
ROBUST WAVEFORM DESIGN Final Report
H. L. Weinert and Abdel-Rahman H. El-Sawy Sep. 1978 47 p refs
(Contract N00014-77-C-0617; NRL Proj. R02-105)
(AD-A074932) Avail: NTIS HC A03/MF A01 CSCL 17/2

A test-bed package, Detector Performance Evaluation (DPE), designed to evaluate the performance of a wide class of detectors for different signal waveforms against arbitrary noise distributions is presented. R.E.S.

N80-14312# GTE Sylvania, Inc., Needham Heights, Mass. Electronics Systems Group.
SUBBAND CODER STUDY Final Report
Ronald S. Cheung and Raimond L. Winslow 2 Jul. 1979 128 p refs
(Contract DCA100-79-C-0001)
(AD-A074427; AD-E100278) Avail: NTIS HC A07/MF A01 CSCL 17/2

This report gives a detailed treatment of the theory and implementation of a speech waveform coding technique known as subband coders whose operations include the partitioning of the input speech band into subbands and the quantization of subbands individually. Both the integer-band sampling and the quadrature mirror filtering (QMF) approaches are studied and the result indicates that the latter method yields much improved speech quality as compared to the former one. In addition to the design of bandpass filters and subband quantizers, practical aspects in the implementation of subband coders are considered and they include (1) a more efficient digital interpolation scheme, and (2) a high speed multiplier-accumulator. GRA

N80-14313# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.
AFOSR WORKSHOP IN COMMUNICATION THEORY AND APPLICATIONS Final Report
P. Papantoni-Kazakos 20 Aug. 1979 147 p refs Workshop held at Provincetown, Mass., 17-20 Sep. 1978
(Grant AF-AFOSR-3715-78; AF Proj. 2304)
(AD-A074298; AFOSR-79-0955TR) Avail: NTIS HC A07/MF A01 CSCL 17/2

A workshop in communication theory and applications was held. There were 6 papers on stochastic processes related to communication problems. Six papers were presented on the subject of source coding. Five papers were presented on topics in statistical pattern recognition. Seven papers were presented in communication theory. Five papers were presented on computer networks. Six papers were presented on spread-spectrum multiple-access communications. Finally, five papers were presented on adaptive equalizers. GRA

N80-14314# California Univ., Los Angeles. Dept. of System Science.
ERROR CONTROL SYSTEMS FOR MULTI-ACCESS COMMUNICATION CHANNELS
Billy Hitoshi Saeki and Izhak Rubin Jun. 1979 292 p refs

(Contract N00014-75-C-0609; N00014-78-C-0778; Grant NSF ENG-77-20799; NR Proj. 042-291)
(AD-A074569; UCLA-ENG-7937) Avail: NTIS HC A13/MF A01 CSCL 17/2

Error control systems for multi access communication channels are investigated. Error detection and retransmission techniques, also referred to as automatic request repeat (ARQ) schemes, are integrated with basic channel access control disciplines. The channel access disciplines coordinate the transmissions by the distributed stations of the communication network to avoid simultaneous transmissions over the shared channel. The automatic request repeat system provides the necessary error recovery procedures to insure data transmission integrity. Automatic request repeat error control systems are applied to a multi access broadcast channel governed by a time division multiple access, a group random access (GRA), channel access control disciplines, a fixed scheduling discipline and a random access discipline, respectively. The TDMA channel is examined under Select and Repeat, Block, and Stop and Wait ARQ schemes. The GRA channel is investigated under acknowledgment schemes which either schedule acknowledgment transmissions or transmit acknowledgments on a random access basis. Author

N80-14315# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SPEECH COMPRESSION AND SYNTHESIS Annual Report, 6 Apr. 1978 - 7 Jun. 1979
Michael Berouti, Lynn Cosell, John Klovstad, John Makhoul, and Richard Schwartz Aug. 1979 114 p refs
(Contract F19628-78-C-0136; ARPA Order 3515)
(AD-A074497; BBN-4159) Avail: NTIS HC A06/MF A01 CSCL 17/2

This report describes our work for the past year on speech compression and synthesis. A real-time variable-frame-rate LPC vocoder operating was implemented at an average rate of 2000 bits/s. Mixed-source model as part of the vocoder was also tested. To improve the reliability of the extraction of LPC parameters, a range of adaptive lattice and autocorrelation algorithms was implemented and tested. For data rates above 5000 bits/s, a new high-frequency regeneration techinque, spectral duplication, was developed and tested which reduces the roughness in the synthetic speech. As part of an overall very-low-rate speech compression system, a program was designed and implemented for phonetic synthesis from diphone templates. The lengthy process of extracting the 3000 needed diphone templates has been half completed. GRA

N80-14316# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A NEW CLASS OF OPTICAL COMMUNICATION SYSTEMS. 1: EXPERIMENT
Paul H. Deitz, Gary L. Durfee, and Stephen S. Wolff Jul. 1979 26 p refs
(AD-A074313; AD-E430294; ARBRL-MR-02930) Avail: NTIS HC A03/MF A01 CSCL 17/2

A new class of optical communication schemes is described in which a message is coded spatially in a random phase process and detected at many points at the receiver. This process may be termed a spatial-multiplex, spatial-diversity optical communication scheme. The technique shows relative immunity to the effects of atmospheric turbulence. Also, relative security of the method is assured since detection can take place only when radiation is detected and processed at many points within the beam itself. GRA

N80-14317# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE, 3 SEPTEMBER - 30 DECEMBER 1978
Robert P. Pagliarulo, John P. Turtle, John E. Rasmussen, Robert L. Cooley, and Wayne Klemetti (Megapulse, Inc., Bedford, Maine) May 1979 83 p refs
(AF Proj. 4600)
(AD-A074475; RADC-TR-79-178) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplementary data. GRA

N80-14318# Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
SIMULATION OF COMMUNICATIONS PROTOCOLS FOR A TACTICAL RADAR NETWORK. PART 1: EXECUTIVE SUMMARY Final Report
C. J. Warner and J. D. Spragins 13 Aug. 1979 79 p
(Grant AF-AFOSR-3619-78; AF Proj. 2304)
(AD-A074157; AFOSR-79-0985TR) Avail: NTIS HC A05/MF A01 CSCL 17/9

An advanced forward area tactical radar network is now under conceptual development by the Air Force Electronic Systems Division. The proposed network will link together a number of short range radars, each with associated data processing equipment, so that each radar site has a complete file of tracks for all targets seen by any radar in the network. In addition, the communication network is expected to be used for transmission of a variety of other types of command and control messages. A new class of adaptive routing protocols for computer communication networks has been developed in this research using the radar network as a basis. These new routing protocols utilize new techniques for searching out and using both reciprocal paths over which messages can travel in either direction and non-reciprocal paths over which messages can travel in only one direction for directed message routing. A general process simulation system simulation model of a thirteen node radar network was used to determine the transient characteristics of the new routing protocols while adapting to various cases of network damage. Significant results are reported. Author

N80-14319# Colorado Univ., Boulder.
A GENERALIZED SIDELOBE CANCELLING STRUCTURE FOR ADAPTIVE ARRAYS Technical Report, 1 Apr. 1977 - 31 Mar. 1978
Lloyd J. Griffiths and Charles W. Jim Nov. 1978 53 p refs
Prepared for SRI Intern. Corp., Menlo Park, Calif.
(Contract N00014-75-C-0930; NR Proj. 088-076)
(AD-A074899; CU-SPL-78-2) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report introduces a new formulation, termed generalized sidelobe cancelling (GSC), for adaptive arrays. This formulation offers an alternative method or implementing older adaptive structures, as well as a method usable in formulating a new, wider class of adaptive beamformers. The GSC approach provides an implementation advantage in that the conventional beamformer is separated out as a distinct element in the overall processor. In addition, the linear constraints which ensure the absence of distortion in the main array lobe can be implemented as simple analog hardware elements. This approach is in contrast to previous approaches in which the constraints have been incorporated into the adaptive algorithm. Another advantage of the GSC formulation is that it clearly delineates the similarities and differences between P-vector and linearly constrained adaptive beamforming. To assess further the performance characteristics of adaptive processing of HF radar data, the GSC beamformer was used to study data collected at the Wide Aperture Research Facility operated by SRI International. Findings of this study are included. GRA

N80-14320# California Univ., Berkeley. Electronics Research Lab.
ANTENNA-COUPLED INFRARED DETECTORS Final Report
S. E. Schwarz 14 Jun. 1979 8 p
(Grant DAAG29-76-G-0284)
(AD-A074085; ARO-13770.6-EL) Avail: NTIS HC A02/MF A01 CSCL 17/5

Planar sub-millimeter and near-millimeter antennas have been studied. These antennas are suitable for integration with mixer diodes and infrared detectors. Antenna-coupled microbolometer far-infrared detectors have been built. These offer an advantageous combination of room-temperature operation, detectivity, and speed. Integrated antenna-coupled Schottky diode mixers are being developed. GRA

N80-14321# Rome Air Development Center, Griffiss AFB, N.Y.
GROUND-BASED PROPAGATION MEASUREMENTS IN SUPPORT OF FLIGHT EVALUATION OF THE E-3A OMEGA NAVIGATION SYSTEM, JUNE - NOVEMBER 1976
Paul A. Kossey, John E. Rasmussen, John P. Turtle, Robert P. Pagliarulo, and Charles B. Kalakowsky Feb. 1979 57 p
(AF Proj. 4600)
(AD-A074474; RADC-TR-79-61) Avail: NTIS HC A04/MF A01 CSCL 17/7

A summary is provided of ground-based propagation measurements made in conjunction with flight tests of the Air Force's E-3A aircraft OMEGA navigation system. Atmospheric noise data at 10.6 kHz and the signal strengths and time differences of OMEGA transmissions from Hawaii, Japan, and North Dakota are described, as recorded at Vandenberg AFB, California, and Almira, Washington, during the period of June - November 1976. GRA

N80-14322# Naval Postgraduate School, Monterey, Calif.
TECHNIQUES AND BENEFITS OF SHAPING THE PULSES OF BINARY SEQUENCES WITH APPLICATION TO SPREAD SPECTRUM RADIO COMMUNICATIONS M.S. Thesis
Panayiotis G. Mavraganis Mar. 1979 153 p refs
(AD-A073964) Avail: NTIS HC A08/MF A01 CSCL 17/2

This research is concerned with binary sequences. Such two-level voltage waveforms are used in some types of spread spectrum systems. Of interest in this work is the effect of shaping the normally rectangular pulses of the binary sequence. An objective is to find and tabulate particular sequences and specific shapes having desirable autocorrelation functions and power spectra. A direct and versatile method of shaping binary sequences is presented. Photographs of sequences having triangular, raised sine and ramp shapes are included in the report. Photographs of the autocorrelation function and spectra of selected shaped sequences are presented. The computer programs used to search for sequences of interest and used to calculate the autocorrelation function and spectra of particular shaped sequences are described. Shaped sequences having interesting spectra were discovered. For example, some spectra have very small side lobe levels; others have no discernible nulls in the spectra; some spectra have nulls which are not simply related to the sequence clock frequency (pulse rate). GRA

N80-14323# Harris Corp., Melbourne, Fla. Electronic Systems Div.
LINEAR MODULATION TECHNIQUES FOR DIGITAL MICROWAVE Final Report, Mar. 1977 - Nov. 1978
Robert C. Davis Griffiss AFB, N.Y. RADC Aug. 1979 334 p
(Contract F30602-77-C-0039; AF Proj. 4519)
(AD-A074047; RADC-TR-79-56) Avail: NTIS HC A15/MF A01 CSCL 17/2

The objective of this program was to study and develop modulation techniques and implementation methods applicable to a linear digital microwave radio operating in the 4 and 8 GHz frequency bands. Modulation techniques capable of providing 3 to 4.5 bits/sec/Hz under the FCC Docket 19311 spectral criterion are developed and included herein. Techniques for the practical implementation of spectrally efficient linear modulation (AM-PM) signal designs in conjunction with presently available microwave power amplifiers are developed. An adaptive predistortion technique for linearizing nonlinear power amplifiers (e.g., TWT's) for the purpose of counteracting AM/AM and AM/PM conversion effects is presented which is useful for linear digital signal designs. A new baseband adaptive equalization scheme which is suited to high rate digital modems is presented. M-ary Quadrature Amplitude Modulation (M-QAM) is chosen as the most efficient scheme for obtaining 3 to 5 bits/sec/Hz under FCC Docket 19311. Waveguide filtering is used to provide FCC Docket 19311 compliance with the M-QAM schemes. An error correction coding/decoding strategy which is applicable to M-QAM signal formats is presented. On the theoretical side, techniques for determining spectral and performance properties for constrained bandwidth digital signaling are discussed. GRA

N80-14324# Polytechnic Inst. of New York. Dept. of Electrical Engineering and Electrophysics.
SUPPRESSION OF INTERCHANNEL INTERFERENCE IN FM RECEIVERS Final Report, 30 Sep. 1977 - 29 Jun. 1979
Frank A. Cassara and Harry Schachter Jul. 1979 72 p refs
(Grant DAAG29-77-G-0232)
(AD-A074485; Poly-EE79-056; ARO-14941.1-EL) Avail: NTIS HC A04/MF A01 CSCL 17/2

In this work an FM detector capable of suppressing the degradation in receiver performance due to the presence of an interfering signal is presented. Optimum receiver structures based on maximum a-posteriori estimation procedures are first theoretically derived and then a practical demodulator based on the optimum receivers is examined. The receiver consists of two phase-locked loops (PLL) cross coupled in such a manner as to permit one PLL to lock on to and track the stronger received FM signal while the other loop tracks the weaker of the two received FM signals. The detector has the capability of demodulating both the desired received FM as well as the interferer even for the case when both signals are co-channel. Experimental results demonstrating such capability even in the presence of strong input Gaussian noise are presented along with a computer simulation study examining the transient acquisition behavior of the cross coupled PLL receiver structure. GRA

N80-14325# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
TARGET TRACKING USING DOPPLER-INFORMATION IN SENSOR ORIENTED COORDINATES WITH A THREE DIMENSIONAL ARRAY RADAR
G. vanKeuk Aug. 1978 33 p refs In GERMAN; ENGLISH summary
(Rept-270) Avail: NTIS HC A03/MF A01

Measurement statistics, expressed in three dimensional radar oriented coordinates, and the nonlinear equations of target motion are presented. An extended Kalman filter was developed to solve the problem of automatic target tracking. It consists of three decoupled filters, one of which processes Doppler information directly. Depending on target speed, distance, and flight direction of the object being tracked, the domain of applicability for the proposed method is derived. Doppler information is then used to improve the plot to track correlation. It is shown that this information is very sensitive for detecting target maneuvers in an adaptive tracing mechanism.
Author (ESA)

N80-14326# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
ADAPTIVE EQUALIZATION OF DELAY DISTORTED SIGNALS
K. Rosenbach Dec. 1978 50 p refs In GERMAN; ENGLISH summary
(Contract BMVg-GF-78)
(Rept-13-78) Avail: NTIS HC A03/MF A01

The equalization of delay distorted signals through the use of transversal filters is discussed. The advantages and disadvantages of FIR (finite impulse response) and IIR (infinite impulse response) filters are described. A combined FIR/IIR filter which contains the advantages of both filters is described. The problem of adaptive equalization of time variable transmission channels including unkown transmission signals is discussed. The necessary minimum filter length for practical applications is reported. The transient behavior of the filter parameters is computed. A comparison of the theoretical results with the measured transient behavior of an actual filter and with a computer simulated filter is presented. Author (ESA)

N80-14327# European Space Research and Technology Center, Noordwijk (Netherlands). Space Communications Div.
S + S/X BANDS COHERENT TRANSPONDER SPECIFICATION
Paris ESA Mar. 1979 84 p
(ESA-PSS-48(TTC.C.10)-Issue-1) Avail: NTIS HC A05/MF A01

A design requirement standard, related to the telemetry, tracking, command, and data handling standards of the European Space Agency (ESA), is presented. A class of S and S/X bands TTC and ranging transponders which will find increasing application on future ESA spacecraft is described. Since these spacecraft will impose different requirements on the transponder (frequencies, modulation schemes, etc.), a modular construction allowing maximum flexibility and reuse of the same fundamental hardware

in a succession of programs, without major costs for modification, is emphasized. The transponder in its various versions is to be fully compatible with ESA and NASA ground networks.
Author (ESA)

N80-14328# European Space Agency, Paris (France).
COMPUTATION OF THE RADIATION CHARACTERISTICS OF ANTENNAS ON COMPLICATED STRUCTURES IN THE HIGH FREQUENCY CASE. PRINCIPLE OF THE GEOMETRICAL THEORY OF DIFFRACTION
A. Schrott May 1979 109 p refs Transl. into ENGLISH of "Berechnung der Strahlungscharakteristik von Antennen auf Komplizierten Koerpern im Hochfrequenzfall: Prinzip der geometrishcen Beugungstheorie", Rept. DFVLR-FB-78-02 DFVLR, Oberpfaffenhofen, West Germany, 26 Jan. 1978 Original report in GERMAN previously announced as N79-16184
(ESA-TT-593; DFVLR-FB-78-02) Avail: NTIS HC A06/MF A01

The geometrical theory of diffraction is used to determine the radiation characteristics of antennas on complicated structures, such as satellites and aircrafts and the scattering at these structures in the high frequency case. For the solution, the complicated structures were divided into canonical forms which can be analyzed by rigorous asymptotic methods. Beside the ray-optical construction of the high frequency field, the important canonical problem of the diffraction at an edge was treated extensively. The diffraction coefficients for the computation of the diffracted field are presented. The problem of vertex diffraction is discussed.
Author (ESA)

N80-14329# Institute for Telecommunication Sciences, Boulder, Colo.
TELEVISION RECEIVING ANTENNA SYSTEM COMPONENT MEASUREMENTS
R. G. FitzGerrel, R. D. Jennings, and J. R. Juroshek Jun. 1979 127 p refs
(PB-298873/1) Avail: NTIS HC A07/MF A01 CSCL 09E

Relative gain of fifteen television receiving antennas was measured as a function of frequency and azimuth angle. Input voltage standing-wave ratio was measured as a function of frequency to determine the scalar impedance properties of the antennas. Insertion loss of a sample of system components, balanced-to-unbalanced line transformers and VHF/UHF signal splitters, was measured and transmission line attenuation was obtained from manufacturers' data. Antenna gain, component insertion loss, transmission line attenuation, and calculated dipole antenna constant are the significant components of a power budget equation, relating power flow in the TV signal field incident upon the antenna to the signal power available at the receiver.
GRA

N80-14030# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse de Systemes.
DEFINITION OF THE HIERARCHICAL NETWORK FOR AGGRESSIVE ENVIRONMENTS (RHEA)
M. Buis, J. C. Laprie, J. Marco, and D. R. Powell *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 15 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14032# Standard Elektrik Lorenz A.G., Stuttgart (West Germany).
DIGITAL ARRAY SIGNAL PROCESSING TECHNIQUES APPLIED TO GUIDANCE AND NAVIGATION
S. Bloch *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 13 p (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14035# Contraves Italiana, Rome.
DIGITAL SIGNAL PROCESSING TECHNIQUES IN A MONOPULSE TRACKING RADAR
U. Fazio, F. Ambrosioni, and C. DeBonis *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 12 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14152*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN RADIO SCIENCE SYSTEM, MARK III-80
A. L. Berman *In its* The Deep Space Network 15 Dec. 1979 p 4-18 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-14330* National Aeronautics and Space Administration, Pasadena Office, Calif.
MULTIPLE ANODE ARC LAMP SYSTEM Patent
Charles G. Miller (JPL) and Ralph E. Bartera, inventors (to NASA) (JPL) Issued 18 Jan. 1972 7 p Filed 29 Dec. 1969 Sponsored by NASA
(NASA-Case-NPO-10857-1; US-Patent-3,635,537; US-Patent-Appl-SN-888362; US-Patent-Class-315-145; US-Patent-Class-315-260; US-Patent-Class-315-334) Avail: US Patent and Trademark Office CSCL 09A

A high-intensity xenon arc lamp having a plurality of separate anodes axially disposed in a symmetrical pattern which spaced a discharge gap from a common cathode is presented.
Official Gazette of the U.S. Patent and Trademark Office

N80-14331 Stevens Inst. of Tech., Hoboken, N. J.
DETERMINATION OF THE VELOCITY-FIELD CHARACTERISTIC OF GALLIUM ARSENIDE FROM FRANZ-KELDYSH ELECTROABSORPTION Ph.D. Thesis
Donald Fairchild Guise 1979 222 p
Avail: Univ. Microfilms Order No. 7925051

An optical method for the measurement of the average electron drift velocity as a function of electric field for semiconductors which exhibit bulk negative differential resistivity was presented. The characteristic was determined from optical transmission measurements made on the semiconductor during the presence of a high-field Gunn-effect domain. The method utilized the Franz-Keldysh effect in which the transmission of laser light through the semiconductor was modulated by the electric field of the Gunn effect domain. By means of stable domain analysis, an analytic technique was given that relates the change in optical transmission and hence the domain profile to the velocity-field characteristic. The method was applied to the measurement of the velocity field characteristic of GaAs.
Dissert. Abstr.

N80-14332* National Aeronautics and Space Administration, Pasadena Office, Calif.
METHOD FOR ANALYZING RADIATION SENSITIVITY OF INTEGRATED CIRCUITS Patent
Michael K. Gauthier (JPL) and Alan G. Stanley, inventors (to NASA) (JPL) Issued 23 Oct. 1979 7 p Filed 30 Jun. 1978 Supersedes N78-27330 (16 - 18, p 2383) Sponsored by NASA
(NASA-Case-NPO-14350-1; US-Patent-4,172,228; US-Patent-Appl-SN-921627; US-Patent-Class-250-492A; US-Patent-Class-250-310; US-Patent-Class-324-158T) Avail: US Patent and Trademark Office CSCL 09C

A method for analyzing the radiation sensitivity of an integrated circuit is described to determine the components. The application of a narrow radiation beam to portions of the circuit is considered. The circuit is operated under normal bias conditions during the application of radiation in a dosage that is likely to cause malfunction of at least some transistors, while the circuit is monitored for failure of the irradiated transistor. When a radiation sensitive transistor is found, then the radiation beam is further narrowed and, using a fresh integrated circuit, a very narrow beam is applied to different parts of the transistor, such as its

junctions, to locate the points of greatest sensitivity.
Official Gazette of the U.S. Patent and Trademark Office

N80-14333 Mississippi State Univ., State College.
IDENTIFICATION OF LIMIT CYCLES IN MULTINONLINEARITY, MULTIPLE PATH SYSTEMS Ph.D. Thesis
Ottis Lamar Barron 1979 111 p
Avail: Univ. Microfilms Order No. 7927081

A method of analysis which identifies limit cycles in autonomous systems with multiple nonlinearities in multiple forward paths is reported. The nonlinearities may be any time- and frequency-invariant single input, single output type which can be adequately represented in piecewise-linear form. In addition, several harmonic components may be retained in the procedure. Included is the FORTRAN code for implementing the Harmonic Balance Algorithm. Using this code, limit cycles are identified in multi-path, multi-nonlinearity systems while retaining the effects of several harmonic components. Dissert. Abstr.

N80-14334 Virginia Univ., Charlottesville.
CHARGE-COUPLED DEVICE ARCHITECTURES FOR SIGNAL PROCESSING Ph.D. Thesis
Robert Walter Armstrong 1978 160 p
Avail: Univ. Microfilms Order No. 7928039

New charge-coupled device (CCD) architectures are developed for processing images to determine the position, range, and angular orientation of an object subject to translation and rotation within a three-dimensional coordinate system. Information required to establish an object's position and techniques for interpreting the information are presented. Factors affecting the two-dimensional image of a three-dimensional object are listed in detail and form the basis for selecting the features used to determine object position. Methods for horizontal and vertical position determination include an error analysis, estimates of processing time, and a stability analysis. Dissert. Abstr.

N80-14335 Northwestern Univ., Evanston, Ill.
ISOMETRICALLY DEFORMABLE SYNCLASTIC SURFACES AS FLEXIBLE WAVEGUIDES Ph.D. Thesis
Larry I-Hwa Kwan 1979 140 p
Avail: Univ. Microfilms Order No. 7927391

A way of designing flexible waveguides transmissive at infrared wavelengths with diffraction-limited characteristics is described. An approximate analysis shows that rays inside a torus, guided in whispering-gallery fashion, oscillate sinusoidally around the equator. Expressing the Helmholtz equation in toroidal coordinates yields the equivalent index of refraction. The equation can be solved, yielding Airy functions in the direction perpendicular to the surface. Along the surface the equation is similar to that for media with a quadratic index profile, the Hermite-Gaussian solutions of which follow sinusoidal trajectories pulsating in width. Experimental verification of these features is presented. Applications are suggested in the flexible delivery of high-power and/or high quality laser energy in the infrared and far-infrared regions of the electromagnetic spectrum.
Dissert. Abstr.

N80-14336 Yale Univ., New Haven, Conn.
OPTOELECTRONIC PROPERTIES OF METAL-TUNNEL OXIDE-SILICON JUNCTIONS Ph.D. Thesis
Stefan Kwong-Chiu Lai 1979 265 p
Avail: Univ. Microfilms Order No. 7927632

A new switching phenomenon was discovered in a simple Metal-Tunnel Oxide-N Silicon (MTOS) capacitor. Tunneling of holes prevents the build up of an inversion layer at the surface on application of negative bias and the semiconductor goes into deep depletion in which the junction impedance is high. Additional supply of holes from generation by light can increase surface hole concentration. When there is sufficient carrier generation, the surface can become inverted. In the process, the semiconductor voltage decreases and the oxide voltage is increased. Tunneling of electrons is controlled by oxide voltage and can be changed by orders of magnitude when the surface goes from deep depletion to inversion. The process described so far is reversible. The semiconductor goes back into deep depletion if generation by light is removed. Dissert. Abstr.

N80-14337 Oklahoma State Univ., Stillwater.
COEFFICIENT QUANTIZATION EFFECTS ON POLE LOCATIONS FOR STATE-MODEL DIGITAL FILTERS Ph.D. Thesis
James Dale Ledbetter 1979 128 p
Avail: Univ. Microfilms Order No. 7928218

A second order system matrix, capable of realizing poles throughout the unit circle, is introduced for digital filter applications. A technique for obtaining the eigenvalue, or pole, sensitivity of a system matrix from the sensitivity expressions of a companion matrix is presented and used to compare the sensitivity properties of the matrix to the properties of similar second order matrices presented in the literature. For each matrix, sensitivity expressions for determining the magnitude and the corresponding radial and angular components of a pole change due to variations in the matrix elements are presented. Both absolute and normalized element variations are considered. Minimum pole sensitivity regions within the unit circle of the z-plane are shown for each system matrix. The system matrices are also compared regarding coefficient wordlength requirements, realizable pole grids, overflow limit cycles, and roundoff noise. Dissert. Abstr.

N80-14338*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
LOW TEMPERATURE LATCHING SOLENOID Patent Application
William S. Wang, inventor (to NASA) (Consolidated Controls Corp., El Segundo, Calif.) Filed 29 Nov. 1979 27 p Sponsored by NASA
(NASA-Case-MSC-18106-1; US-Patent-Appl-SN-098568) Avail: NTIS HC A03/MF A01 CSCL 09A

A magnetically latching solenoid is disclosed which includes a pull-in coil and a delatching coil. Each of the coils is constructed with a combination of wire materials, including materials of low temperature coefficient of resistivity, to enable the solenoid to be operated at cryogenic temperatures while maintaining sufficient coil resistance. An armature is springbiased toward a first position that may extend beyond the field of force of a permanent magnet. When voltage is temporarily applied across the pull-in magnet, the induced electromagnetic forces overcome the spring force and pull the armature to a second position within the field of the permanent magnet, which latches the armature in the pulled-in position. Application of voltage across the delatching coil induces electromagnetic force which at least partially temporarily nullifies the field of the permanent magnet at the armature, thereby delatching the armature and allowing the spring to move the armature to the first position. NASA

N80-14339*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
NUMERICAL SIMULATION OF DYNAMICS OF BRUSHLESS DC MOTORS FOR AEROSPACE AND OTHER APPLICATIONS. VOLUME 1: MODEL DEVELOPMENT AND APPLICATIONS, PART B Final Report
N. A. O. Demerdash and T. W. Nehl [1979] 179 p refs
(Contract NAS9-15091)
(NASA-CR-160355) Avail: NTIS HC A09/MF A01 CSCL 09C

A mathematical model was developed and computerized simulations were obtained for a brushless dc motor. Experimentally obtained oscillograms of the machine phase currents are presented and the corresponding current and voltage waveforms for various modes of operation of the motor are presented and discussed.
A.W.H.

N80-14340*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
NUMERICAL SIMULATION OF DYNAMICS OF BRUSHLESS DC MOTORS FOR AEROSPACE AND OTHER APPLICATIONS. VOLUME 2: USER'S GUIDE TO COMPUTER EMA MODEL Final Report
N. A. O. Demerdash and T. W. Nehl [1979] 185 p
(Contract NAS9-15091)
(NASA-CR-160356) Avail: NTIS HC A09/MF A01 CSCL 09C

A description and user's guide of the computer program developed to simulate the dynamics of an electromechanical actuator for aerospace applications are presented. The effects of

the stator phase currents on the permanent magnets of the rotor are examined. The voltage and current waveforms present in the power conditioner network during the motoring, regenerative braking, and plugging modes of operation are presented and discussed. A.W.H.

N80-14341# Royal Aircraft Establishment, Farnborough (England).
INFLUENCE OF THE ENVIRONMENTAL CONDITIONS ON A QUARTZ RESONATOR
Michel Valdois May 1978 114 p refs Transl. into ENGLISH of "Influence des Conditions d'Environnement sur un Resonateur a Quartz", Rept. ONERA-TN-225 Onera, Paris 1974 114 p (RAE-Lib-Trans-1897; BR70941; ONERA-TN-225) Avail: NTIS HC A06/MF A01

The quartz resonator is studied both by itself, as a passive element placed in a transmitting circuit, and installed in an oscillator, which is its normal condition of usage. The accelerations to which the resonators were subjected were steady state, sinusoidal or random. The orientation of the acceleration relative to the quartz crystallographic axis, as well as its direction, were considered. The same tests were performed on oscillators containing the resonators previously studied. The results confirm the part played by the resonator in the degradation of the stability of a quartz oscillator subjected to external disturbances. M.M.M.

N80-14342# Syracuse Univ., N. Y. Dept. of Mechanical and Aerospace Engineering.
THERMAL STRESS ANALYSIS OF GLASS SEALS IN MICROELECTRONIC PACKAGES UNDER THERMAL SHOCK CONDITIONS Final Report
Klod Kokini, Richard W. Perkins, and Charles Libove Griffiss AFB, N.Y. RADC Jul. 1979 117 p
(Contract F30602-78-C-0083; AF Proj. 2306)
(AD-A073654; MAE-1233-T2; RADC-TR-79-201) Avail: NTIS HC A06/MF A01 CSCL 20/13

The objective of this effort was to develop a mathematical model for predicting the transient thermal stresses that occur in a typical annular lead-through glass seal of a microelectronic package during a thermal shock test. The study results show that the magnitude of the thermal stresses in the seal area depends upon the initial residual stresses that result from cooling the package to room conditions after the high temperature sealing process is completed. A computer program was developed to analyze the thermal stresses in any circular lead package while undergoing a thermal shock test. A method has been developed for predicting the stresses which are present in the lead-through seal area of a microelectronic package when subjected to a thermal shock test. GRA

N80-14343# Naval Weapons Center, China Lake, Calif.
PRELIMINARY STUDY OF SOME GRAPHITE ELECTRODE SURFACES RESPONSIVE TO IRON AND HEAVY METALS BY SINGLE-SWEEP VOLTAMMETRY
Gerald C. Whitnack Jan. 1979 14 p refs
(AD-A074605; GIDEP-E138-2687; NWC-TM-3665) Avail: NTIS HC A02/MF A01 CSCL 09/1

The objective of this preliminary study is to see if it is feasible to use some new chemically modified graphite surfaces as electrodes in the field analysis of iron and heavy metals such as copper, lead, cadmium, and zinc in aqueous solution by single-sweep peak voltammetry. This report presents data for iron and some heavy metals obtained from some preliminary experiments performed at NWC with the new graphite electrodes of Clem and NWC polarographic equipment. A short discussion of the results with some conclusions related to future work is given. GRA

N80-14344# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
DUAL BEAM DUAL MODE TWT Bimonthly Progress Report, 16 Apr. - 15 Jun. 1979
28 Aug. 1979 7 p refs
(Contract N00014-78-C-0791)
(AD-A074719; PT-5459; MPR-5) Avail: NTIS HC A02/MF A01 CSCL 09/1

The work described in this report is being done for the Office of Naval Research. The program is an outgrowth of work begun in 1974 for the ONR, directed towards building a 10 dB pulse-up, liquid cooled, ppm focused high band TWT. This program is intended to finish development of this tube in time for current and next generation system use and to establish two sources for the device. To achieve this objective, the resources of Raytheon and a subcontractor (Northrop) are being employed in a cooperative development program. The statement of work for this program is Raytheon proposal No PRP-4430-1 entitled 'Technical Proposal for a Dual Beam Dual Mode TWT', dated 8 June 1978. To insure that all essential system performance factors are adequately addressed, a complete tube specification is being used: specifically, the Dual Mode Steering Committee Dual Mode TWT specification (originally released 12 September 1977) as amended by O.E.M. submissions to the system statement of work received May 1, 1978. GRA

N80-14345# Arinc Research Corp., Annapolis, Md.
OPERATING-MANUAL FOR THE DYNAMIC TEST SET (DTS) FOR THE LOW VOLTAGE POWER SUPPLY PART OF THE AN/ALQ-119 V ELECTRONIC COUNTERMEASURES SYSTEM
J. R. White Sep. 1979 61 p
(Grant F09603-78-G-4125)
(AD-A074894; Rept-1552-11-2-2015) Avail: NTIS HC A04/MF A01 CSCL 10/2

This manual contains operating instructions for the Dynamic Test Facility (DTF) used for checkout and repair of interchangeable low voltage power supplies P/N 624R629G01 and P/N 634R149G01 of the AN/ALQ 119 (V) Electronic Countermeasures (ECM) Pod. Author (GRA)

N80-14346# Los Alamos Scientific Lab., N. Mex.
WAVE PROPAGATION IN A dc SUPERCONDUCTING CABLE. PART 1: ANALYSIS
P. Chowdhuri and Mary-Anne Mahaffy 1979 7 p refs Presented at the IEEE Summer Power Meeting, Vancouver, Canada, Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-226; CONF-790713-1) Avail: NTIS HC A02/MF A01

A dc superconducting cable design consisting of four concentric metallic cylinders, of which two carry the load current and two comprise the cryogenic enclosure, was studied. The surge-voltage propagation characteristics of a four-conductor dc superconducting cable for a step-function input voltage was analyzed. This analysis, although mainly directed to superconducting cables, is also applicable to other multiconductor transmission lines. DOE

N80-14347# Idaho National Engineering Lab., Idaho Falls.
DESIGN AND PERFORMANCE OF THE DRAG-DISC TURBINE TRANSDUCER
R. H. Averill, L. D. Goodrich, and R. E. Ford 1979 34 p refs Presented at the Colloq. on Two-Phase Instrumentation, Idaho Falls, Idaho, 11 Jun. 1979
(Contract EY-76-C-07-1570)
(CONF-790655-2) Avail: NTIS HC A03/MF A01

Mass flow rates are measured with the drag-disc turbine transducer (DTT). Operational description of the DTT and the developmental effort are discussed. Performance data and experiences with this transducer are presented. DOE

N80-14348# California Univ., Berkeley. Lawrence Berkeley Lab.
ENERGY-DEPENDENT LOSSES IN PULSED-FEEDBACK PREAMPLIFIERS
D. A. Landis, N. W. Madden, and F. S. Goulding Nov. 1978 18 p refs Presented at IEEE Nucl. Sci. Symp., Washington, D.C., 18 Oct. 1978
(Contract W-7405-eng-48)
(LBL-8135; CONF-781033-46) Avail: NTIS HC A02/MF A01

Energy dependent counting losses occur in most pulsed-feedback preamplifiers due to the loss of those pulses which activate the recharge system. A pulsed-feedback system that overcomes this inefficiency is described. Pulsed-light feedback as used with germanium gamma ray spectrometers is discussed

as used at high energies and high rates where those losses become significant. DOE

N80-14343# Department of Energy, Washington, D. C.
ELECTRIC AND HYBRID VEHICLES: COMMERCIALIZATION PHASE 3 PLANNING
R. C. Cluser Sep. 1978 37 p refs
(DOE/ERD-0004) Avail: NTIS HC A03/MF A01

A program to stimulate the commercialization of electric and hybrid vehicles (EHVs) as a partial solution to the oil consumption problem is presented. The commercialization of EHVs by the purchase or lease and demonstration of state-of-the-art and advanced vehicles through 1985 is described. The major vehicle categories are: (1) specific-mission electric vehicles; (2) general purpose electric vehicles; and (3) general purpose hybrid vehicles. The subjects covered are: the characteristics of the technology, status information on the technical and environmental research and development programs; a milestone chart representing a relationship between a considered commercialization schedule and relevant environmental research and development; and the environmental concerns significant to the technology. DOE

N80-14350# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
TEST SPECIFICATION FOR TWO-SIDED PRINTED CIRCUIT BOARDS (GOLD PLATED FINISH)
Paris ESA Aug. 1979 64 p
(ESA-PSS-05/QRM-10E ESTEC-Iss-2) Avail: NTIS HC A04/MF A01

The minimum test program required for ESA approval of production lines for two-sided printed circuit boards with gold-plated finish is defined. The mandatory test methods are described and details of accept/reject criteria are given. Author (ESA)

N80-14156*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN EXAMINATION OF ANCILLARY EQUIPMENT FOR A PROPOSED 34.3 GHz HIGH POWER GYROTRON TWT AMPLIFIER
A. Kupiszewski *In its* The Deep Space Network 15 Dec. 1979 p 34-40 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09C

N80-14157*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EVALUATION OF THE VA-878P KLYSTRON FOR THE 20-kW X-BAND UPLINK TRANSMITTER
R. B. Kolbly *In its* The Deep Space Network 15 Dec. 1979 p 41-50 ref (For primary document see N80-14150 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09C

N80-14158*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A COMPUTER-AIDED DESIGN SYSTEM FOR CUSTOM LARGE-SCALE INTEGRATED CIRCUITS
M. W. Sievers *In its* The Deep Space Network 15 Dec. 1979 p 51-61 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A08/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-14351 Minnesota Univ., Minneapolis.
VISCOUS FILM FLOWS WITH CONTACT LINES: FINITE ELEMENT SIMULATION, A BASIS FOR STABILITY ASSESSMENT AND DESIGN OPTIMIZATION Ph.D. Thesis
William James Silliman 1979 348 p
Avail: Univ. Microfilms Order No. 7926172

The problems of capillarity and of flows with free surfaces are solved in most instances by the finite element technique. An incidence-array analysis of the structure of the finite element equation sets settles a controversy regarding the correct way to handle flow calculations. Moreover, it leads to a method which is superior to any yet to appear. The approach is based on a Newton iteration and generates the framework for predicting ranges of influence of local features of the flow fields, continuing solution families by Euler-like expressions, and, in the future, determining stability. Dissert. Abstr.

N80-14352 Kansas State Univ., Manhattan.
AN EXPERIMENTAL STUDY OF NATURAL CONVECTION HEAT TRANSFER IN VERTICAL POROUS MEDIA Ph.D. Thesis
Ulysses Aquino Acasio 1979 182 p
Avail: Univ. Microfilms Order No. 7926543

The effect of different height-to-width ratios of the enclosure on the flow, velocity, and temperature profiles of a fluid in a vertically oriented porous medium was examined. The porous medium consisted of glass beads saturated with water. It was observed that the fluid near the wall flowed upward and was 2 to 3 times faster than the downward flow of the fluid in the porous bed center. The change from downward to upward flow of the fluid occurred at a location which was about 4/5 the distance from the center of the bed to the inner surface of the heated wall. It was observed that the angle at which a streamline approached the bottom corner of the enclosure changed with a corresponding change in the aspect ratio of the porous medium. The temperature distribution was linear in beds with aspect ratios less than 1.0 and decreased monotonically from the upper corner of the medium and diagonally toward the bottom center of the enclosure. With aspect ratios greater than 1.0 the isotherms advanced toward the bed's center and then bent downward as time progressed, indicating an enhancement of the heat transfer process because of convective flow. Dissert. Abstr.

N80-14353 California Univ., Los Angeles.
HYDRODYNAMICAL ASPECTS OF LOW FLOW VAPOR INJECTION INTO SUBCOOLED WATER Ph.D. Thesis
Chok-kau Binky Lee 1979 351 p
Avail: Univ. Microfilms Order No. 7926040

The condensation-induced hydrodynamic loads during low flow vapor injection (steam chugging) was studied. Systematic classification of characteristic patterns based on two parameters resulted in a condensation regime map. The basic regimes in the map are: the jet regime at high mass fluxes (>150 Kg/sq m/sec); the bubble oscillation regime at intermediate mass fluxes; and the steam chugging regime at low mass fluxes (<75 Kg/sq m/sec). The hydrodynamic loads measured at the pool bottom show mild oscillations (0.1 atm.) for internal chugs; moderate oscillations (3 atm) for detached bubble chugs; and large spiky oscillations (5 atm.) for encapsulating bubble chugs. Dissert. Abstr.

N80-14354*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
GIM CODE USER'S MANUAL FOR THE STAR-100 COMPUTER Final Report
Lawrence Spradley and Mark Pearson Nov. 1979 217 p refs (Contract NAS1-15341)
(NASA-CR-3157; LMSC-HREC-0568850) Avail: NTIS HC A10/MF A01 CSCL 20D

The General Interpolants Method (GIM), a three dimensional, time dependent, hybrid procedure for generating numerical analogs of the conversion laws, is described. The Navier-Stokes equations written for an Eulerian system are considered. The conversion of the GIM code to the STAR-100 computer, and the implementation of 'GIM-ON-STAR' is discussed. M.G.

N80-14355*# Wisconsin Univ. - Milwaukee.
UNSTEADY FLOW AND DYNAMIC RESPONSE ANALYSES FOR HELICOPTER ROTOR BLADES Final Progress Report, 2 Jan. 1971 - 30 Jun. 1979
Theodore Bratanow Nov. 1979 30 p refs
(Grant NGR-50-007-001)
(NASA-CR-159190) Avail: NTIS HC A03/MF A01 CSCL 02A

Research is presented on helicopter rotor blade vibration and on two and three dimensional analyses of unsteady incompressible viscous flow past oscillating helicopter rotor blades. A summary is presented of the two international research collaborations which resulted from the NASA project: the collaboration under the auspices of NATO between the University of Wisconsin-Milwaukee, University of Brussels, Belgium and the Aerodynamics Research Establishment in Goettingen, West Germany, and the collaboration under the auspices of the National Science Foundation between UWM and the University of Hamburg and the Ship Research Establishment in Hamburg, West Germany. A summary is given of the benefits from the NASA project to UWM, the College of Engineering and Applied Science, and the participants on the project. M.M.M.

N80-14356*# Scientific Research Associates, Inc., Glastonbury, Conn.

DEVELOPMENT OF A THREE-DIMENSIONAL SUPERSONIC INLET FLOW ANALYSIS Final Report

R. C. Buggeln, H. McDonald, R. Levy, and J. P. Kreskovsky Jan. 1980 122 p refs

(Contract NAS3-21003)

(NASA-CR-3218) Avail: NTIS HC A06/MF A01 CSCL 20D

A method for computing three dimensional flow in supersonic inlets is described. An approximate set of governing equations is given for viscous flows which have a primary flow direction. The governing equations are written in general orthogonal coordinates. These equations are modified in the subsonic region of the flow to prevent the phenomenon of branching. Results are presented for the two sample cases: a Mach number equals 2.5 flow in a square duct, and a Mach number equals 3.0 flow in a research jet engine inlet. In the latter case the computed results are compared with the experimental data. A users' manual is included. Author

N80-14357*# Illinois Inst. of Tech., Chicago.

ON THE QUESTION OF INSTABILITIES UPSTREAM OF CYLINDRICAL BODIES Final Report, 15 Nov. 1974 - 30 Apr. 1977

Mark V. Morkovin Dec. 1979 113 p refs

(Grant NsG-1120)

(NASA-CR-3231; R79-3) Avail: NTIS HC A06/MF A01 CSCL 20D

In an attempt to understand the unsteady vortical phenomena in perturbed stagnation regions of cylindrical bodies, a critical review of the theoretical and experimental evidence was made. Current theory is revealed to be incomplete, incorrect, or inapplicable to the phenomena observed experimentally. The formalistic approach via the principle of exchange of instabilities should most likely be replaced by a forced-disturbance approach. Also, many false conclusions were reached by ignoring that treatment of the base and perturbed flows in Hiemenz coordinate eta is asymptotic in nature. Almost surely the techniques of matched asymptotic expansions are expected to be used to capture correctly the diffusive and vorticity amplifying processes of the disturbances regarding the mean-flow boundary layer and outer potential field as eta and y/diameter approach infinity. The serious uncertainties in the experiments are discussed in detail. M.M.M.

N80-14358*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

POTENTIAL HEAT EXCHANGE FLUIDS FOR USE IN SULFURIC ACID VAPORIZERS

D. D. Lawson and G. R. Petersen 1 Oct. 1979 16 p refs

(Contracts NAS7-100; ET-78-I-01-3112)

(NASA-CR-162548; JPL-Pub-79-81) Avail: NTIS HC A02/MF A01 CSCL 20D

A series of perhalocarbons are proposed as candidate heat exchange fluids for service in thermochemical cycles for hydrogen production that involve direct contact of the fluid with sulfuric acid and vaporization of the acid. The required chemical and physical criteria of the liquids are described and the results of some preliminary high temperature test data are presented. M.G.

N80-14359*# Bionetics Corp., Hampton, Va.

THE TRANSFER OF CARBON FIBERS THROUGH A COMMERCIAL AIRCRAFT WATER SEPARATOR AND AIR CLEANER

Jerome A. Meyers Nov. 1979 22 p refs

(Contract NAS1-15238)

(NASA-CR-159183) Avail: NTIS HC A02/MF A01 CSCL 20D

The fraction of carbon fibers passing through a water separator and an air filter was determined in order to estimate the proportion of fibers outside a closed aircraft that are transmitted to the electronics through the air conditioning system. When both devices were used together and only fibers 3 mm or larger were considered, a transfer function of .001 was obtained. K.L.

N80-14360# Royal Aircraft Establishment, Farnborough (England).

THE CALCULATION OF INVISCID SEPARATED FLOW ABOUT A SLENDER CONE FOR LARGE ANGLES OF ATTACK

S. B. Zacharov May 1979 13 p refs Transl. into ENGLISH from Uch. Zap. TSAGI (USSR), v. 7, no. 6, 1976 13 p

(RAE-TR-2009) Avail: NTIS HC A02/MF A01

The symmetrical, separated flow about a circular cone was calculated using slender body theory. The configuration of vortex layers, the coefficients of the normal force, and the pressure distribution are determined. K.L.

N80-14361# Idaho National Engineering Lab., Idaho Falls.

ULTRASONIC DENSITY DETECTOR FOR VESSEL AND REACTOR CORE TWO-PHASE MEASUREMENTS

A. E. Arave 1979 25 p refs Presented at the Intern. Colloq. on Irradiation for Reactor Safety Programmes, Petten, Netherlands, 25 Jun. 1979

(Contract EY-76-C-07-1570)

(CONF-790646-5) Avail: NTIS HC A02/MF A01

A local ultrasonic density detector was developed for the Loss-of-Fluid Test reactor vessel and core two-phase flow density measurements. The principle of operating the sensor is the change in propagation time of a torsional ultrasonic wave in a metal transmission line as a function of the density of the surrounding media. A theoretical physics model is presented which represents the total propagation time as a function of the sensor modulus of elasticity and polar moment of inertia. DOE

N80-14362# Oak Ridge Gaseous Diffusion Plant, Tenn.

HYDRAULIC JUMPS IN A PARTIALLY FILLED ROTATING CYLINDER

T. S. Lundgren and A. S. Berman Jun. 1979 28 p

(Contract W-7405-eng-26)

(K/TS-2936) Avail: NTIS HC A03/MF A01

A nonlinear analysis is made of the fluid dynamics of a thin film of liquid completely spun up along the cylindrical wall of a rotating cylinder. The analysis allows for the possibility of hydraulic jumps on the liquid film. Conditions are simulated under which jumps can occur. Under the assumption that synchronous runouts are small relative to the film thickness, a sample calculation of jump position and extent for various operating frequencies is presented. Comparison with experimental observations indicate good qualitative agreement between the analysis and the experiment. Under the additional restriction of constant film thickness and a simple lumped-parameter dynamic model for the rotor and its supports, an analysis is also provided which predicts the amplitude and frequency of the asynchronous runout as a function of operating frequency. A numerical example of the results of such a calculation is provided. DOE

N80-14363# Idaho National Engineering Lab., Idaho Falls.

MASS FLOW RATE MEASUREMENTS IN TWO-PHASE MIXTURES WITH STAGNATION PROBES

J. R. Fincke and V. A. Deason 1979 79 p refs Presented at Colloq. on Two-Phase Instrumentation, Idaho Falls, Idaho, 11 Jun. 1979

(Contract EY-76-C-07-1570)

(CONF-790655-1) Avail: NTIS HC A05/MF A01

Applications of stagnation probes to the measurement of mass flow rate in two-phase flows are discussed. Descriptions of several stagnation devices, which have been evaluated at the Idaho National Engineering Laboratory, are presented along with modeling techniques and two-phase flow data. DOE

N80-14364# Hague International, South Portland, Maine.
HIGH PRESSURE CERAMIC HEAT EXCHANGER. PHASE 1: DEADHEAD EXPERIMENTAL VERIFICATION
20 Feb. 1979 54 p refs
(Contract EC-77-C-02-4236)
(COO-4236-3) Avail: NTIS HC A04/MF A01

The pressure containment capability of ceramic heat exchangers to be used in gas turbine power conversion systems was tested using a modified industrial recuperator. The results of cold and elevated temperature leakage experiments are described. K.L.

N80-14365# Argonne National Lab., Ill. Applied Mathematics Div.
NUMERICAL METHODS FOR A POROUS MEDIUM EQUATION
Michael E. Rose Aug. 1978 56 p refs
(Contract W-31-109-eng-38)
(ANL-78-80) Avail: NTIS HC A04/MF A01

The degenerate parabolic equation par. delta u/par. delta t = div (u/sup nu/grad u), nu >0 is used to model the flow of gas through a porous medium. Error estimates for continuous and discrete-time finite-element procedures to approximate the solution of this equation are proved, and a new regularity result is described. DOE

N80-14366# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
INVESTIGATION OF COHERENT STRUCTURES IN THE VELOCITY FIELD OF A FULLY DEVELOPED TURBULENT CHANNEL FLOW USING FLOW VISUALIZATION AND ANEMOMETRY
Michael Hofbauer 1978 103 p refs In GERMAN; ENGLISGH summary
(MPIS-Mitt-66; ISSN-0374-1257) Avail: NTIS HC A06/MF A01

Coherent structures observed in oil channel flow test are investigated. The Reynolds number, 8050, was based on the channel width and the mean center line velocity. A one to one correspondence of structures in the time signals of u and v as well as of visually recognized structures of the flow field, was found by simultaneously performing hot film measurements and taking pictures with a film camera. Due to the high spatial resolution in the oil channel it was possible to detect the cause of the lift up of the low speed streaks and to show that before the lift up there were no vortices. The Tollmien-Schlichting frequencies were seen in the power spectra of v. This supported Landahl's model of turbulence. A dualistic view of turbulent motions determined from the results is discussed. Author (ESA)

N80-14367# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EXPERIMENTS TO SHOW THE EXISTENCE OF THE LIQUEFACTION SHOCK WAVE IN RETROGRADE GASES
Georg Dettleff 1978 129 p refs In GERMAN; ENGLISH summary
(MPIS-Mitt-67; ISSN-0374-1257) Avail: NTIS HC A07/MF A01

The existence of the liquefaction shock wave in retrograde gases is investigated. Retrograde gases are characterized by a particular condensation behavior, are liquefied by means of isentropic compression and, under restricted conditions, by means of shock compression. The production of liquid by means of shock compression is proven by establishing the thermodynamic state. The pressure, the temperature, and the density are measured as is the velocity of the liquefaction shock wave. By means of photographs, a great number of ring shaped objects behind the liquefaction shock wave were observed. Their properties, such as size, growth, and lifetime were investigated. Possible interpretations of the ring shaped objects as bubbles, driplets, or ring vortices are discussed. Author (ESA)

N80-14368# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
AN INVESTIGATION OF THE FLUCTUATIONS OF THE WALL PRESSURE AND THE WALL PRESSURE GRADIENT BENEATH A TURBULENT BOUNDARY LAYER
Guenter Schewe 1979 89 p refs In GERMAN; ENGLISH summary
(MPIS-Mitt-68) Avail: NTIS HC A05/MF A01

Fluctuations of the wall pressure and wall pressure gradient were investigated in a wind tunnel designed for acoustic measurements. The Reynolds number based on momentum thickness was 1400. It was shown that the diameter of the small transducers developed for these measurements is small enough to resolve the essential structures of turbulence. Correlation measurements of the pressure gradients and visual analysis of the time functions lead to a mean frequency and a mean wave length for characteristic high amplitude structures. The existence of these pressure structures explains the increase in the RMS value with decreasing transucer diameter and the characteristic feature of the probability density distribution. In the power spectrum there are indications of the existence of Tollmien-Schlichting waves. Author (ESA)

N80-14369# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
WALL PRESSURE FLUCTUATIONS GENERATED BY A PAIR OF VORTICES [WANDDRUCKSCHWANKUNGEN ERZEUGT DURCH EIN WIRBELPAAR]
W. Moehring and Sayeed-ur-Rahman Feb. 1979 35 p refs In GERMAN; ENGLISH summary
(MPIS-6/1979) Avail: NTIS HC A03/MF A01

The wall pressure field generated by two potential vortices of equal circulation situated in the vicinity of a flat wall is calculated. This configuration is regarded as a strongly simplified flow model of the mutual influence between vortices and walls. Two different types of flow fields are distinguished. Either the vortices remain together, or one of them overtakes the other and separates from it increasingly. It is found that although the far field generated by two adjacent vortices is similiar to the velocity field of a single vortex of twice the circulation, the pressure field is quite different. Author (ESA)

N80-14370# Laboratoire d'Aerothermique du C.N.R.S., Meudon (France).
STABILITY OF A FLAT WALL JET [STABILITE D'UN JET PARIETAL PLAN]
Daniel Durox and Marie-Francoise Scibilia Feb. 1979 32 p refs In FRENCH
(Rept-79-5; Publ-597) Avail: NTIS HC A03/MF A01

A theoretical computation of plane wall jet stability is presented. The Galerkin method was applied to the Orr-Sommerfeld equation to establish the stability conditions. Computations were made using double precision FORTRAN language on an IBM 360/138 computer. The precision of the results is sufficient for a first approach to the instability critical point determination. The numerical values obtained in several examples are given and compared to those obtained by other methods. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-14371* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DISPLACEMENT PROBES WITH SELF-CONTAINED EXCITING MEDIUM Patent
Robert Miserentino and Bruce Flagge, inventors (to NASA) Issued 23 Oct. 1979 5 p Filed 26 Jul. 1978 (16 - 22, p 2943)
(NASA-Case-LAR-11690-1; US-Patent-4,171,645; US-Patent-Appl-SN-928129; US-Patent-Class-73-655; US-Patent-Class-73-661) Avail: US Patent and Trademark Office CSCL 14B

A transducer that combines a noncontacting displacement probe with a self-contained target is described. The target is

held in position against a vibrating surface by a housing which also supports the noncontacting probe. The target vibrates with the surface and the probe senses the vibrations of the target.
Official Gazette of the U.S. Patent and Trademark Office

N80-14372 Washington Univ., Seattle.
SIMULTANEOUS MULTIPLE CAMERA AND MULTIPLE FOCAL SETTING SELF-CALIBRATION IN PHOTOGRAMMETRY Ph.D. Thesis
Clive Simpson Fraser 1979 168 p
Avail: Univ. Microfilms Order No. 7927786

Theoretical and practical aspects of simultaneous multiple camera and multiple focal setting self-calibration techniques for metric cameras, are investigated. An experimental verification of the proposed analytical camera calibration methods is carried out. It was concluded that both reported techniques offer practical and theoretically rigorous alternatives to existing methods of close-range single and multiple camera system calibration.
Dissert. Abstr.

N80-14373# National Bureau of Standards, Washington, D.C. National Engineering Lab.
NBS INTERAGENCY TRANSDUCER PROJECT 1951 - 1979: AN OVERVIEW
Paul S. Lederer Aug. 1979 45 p refs Supersedes NBS-TN-469
(NBS-TN-1110; NBS-TN-469) Avail: SOD HC

The performance of sensory transducers, primarily those used in telemetry is presented. A description is provided of the background and history of the project, of its objectives, of some of the techniques and specialized facilities developed and used, and of some of the publications that were issued from the project.
M.M.M.

N80-14374*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEMPERATURE AND PRESSURE MEASUREMENT TECHNIQUES FOR AN ADVANCED TURBINE TEST FACILITY
Frank G. Pollack and Reeves P. Cochran 1980 12 p refs Proposed for presentation at the Intern. Gas Turbine Conf. and Ann. Fluids Engr. Conf., New Orleans, 9-13 Mar. 1980; sponsored by Am. Soc. Mech. Engr.
(NASA-TM-79278; E-212) Avail: NTIS HC A02/MF A01 CSCL 14B

A high pressure, high-temperature turbine test facility constructed for use in turbine cooling research is described. Several recently developed temperature and pressure measuring techniques are used in this facility. The measurement techniques, their status, previous applications and some results are discussed. Noncontact surface temperature measurements are made by optical methods. Radiation pyrometry principles combined with photoelectric scanning are used for rotating components and infrared photography for stationary components. Contact (direct) temperature and pressure measurements on rotating components are expected to be handled with an 80 channel rotary data package which mounts on and rotates with the turbine shaft at speeds up to 17,500 rpm. The data channels are time-division multiplexed and converted to digital words in the data package. A rotary transformer couples power and digital data to and from the shaft.
M.M.M.

N80-14375*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFICIENT LASER ANEMOMETER FOR INTRA-ROTOR FLOW MAPPING IN TURBOMACHINERY
J. Anthony Powell, Anthony J. Strazisar, and Richard G. Seasholtz 1979 11 p refs Proposed for presentation at the ASME 25th Ann. Intern. Gas Turbine Conf., and the 22nd Ann. Fluids Eng. Conf., New Orleans, 9-13 Mar. 1980
(NASA-TM-79320; E-276) Avail: NTIS HC A02/MF A01 CSCL 14B

A fringe type laser anemometer is described. Features of the anemometer include; a rapid and efficient data acquisition process; a detailed real time graphic display of the data being accumulated; and input laser beam positioning that maximizes the size of the intrarotor region being mapped. Results are presented that demonstrate the anemometer's capability in flow mapping within a transonic axial flow compressor rotor. A velocity profile, derived from 30,000 measurements along 1000 sequential circumferential positions covering 20 blade passages, was obtained in 30 seconds. The use of fluorescent seed particles allowed flow measurements near the rotor hub and the casing window.
R.C.T.

N80-14376# Royal Aircraft Establishment, Farnborough (England).
FUNCTION ANSD COMPUTATION OF TRANSDUCERS FOR THE CONTACT-FREE MEASUREMENT OF DISTANCE ON THE BASIS OF THE EDDY CURRENT EFFECT, PART 1
H. R. Loos Jun. 1979 22 p refs Transl. into ENGLISH from Tech. Messen ATM (West Germany), v. 7/8, 1976 p 229-234
(RAE-TR-2021) Avail: NTIS HC A02/MF A01

Contact free-measurements of distance can be made using inductive transducers. These operate by changes in the impedance of a coil by magnetic and eddy current effects. A simplified model is described.
Author

N80-14377# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
US ARMY TEST AND EVALUATION COMMAND TEST OPERATIONS PROCEDURES: PHOTOGRAPHIC AND VIDEO IMAGE SUPPORT AVIATION MATERIEL Final Report
17 Aug. 1979 16 p refs
(AD-A074883; TOP-7-3-519) Avail: NTIS HC A02/MF A01 CSCL 14/5

Photographic techniques can be utilized to obtain precise data in relation to time velocity, rates and characteristics of a developmental test event or simply to document a physical defect, deficiency or shortcoming in a human factors evaluation. This document provides requirements, suggestions and techniques for incorporating photographic coverage into the developmental test of aviation materiel.
GRA

N80-14378# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
FEI CAMERA SYSTEM, ACCEPTANCE TEST AND CHECK-OUT PROCEDURE, AS INSTALLED IN BQM-34 A/S AND BQM-34 E/T
Robert C. Bello and Frank X. Murphy 13 Sep. 1979 34 p (W06130000)
(AD-A074388; NADC-79233-60) Avail: NTIS HC A03/MF A01 CSCL 14/5

This report describes the acceptance test and checkout procedure for Firing Error Indicator Camera System. This system can be installed in the BQM-34A/S and BQM-34E/T aerial targets. The tests presented herein constitute a quality control check and acceptance test to be performed on each camera system.
GRA

N80-14379# California Univ., Livermore. Lawrence Livermore Lab.
LOW IMPEDANCE MANGANIN STRESS GAUGE SYSTEM FOR SEVERE SHOCK WAVE ENVIRONMENTS
R. Weingart, J. Chan, L. Erickson, J. Janzen, H. Vantine, and R. Lee 26 Apr. 1979 13 p refs Presented at the Transducer Workshop, Colorado Springs, Colo., 12 Jun. 1979 Prepared jointly with Kansas State Univ., Manhatten
(Contract W-7405-eng-48)
(UCRL-81605; CONF-790635-1) Avail: NTIS HC A02/MF A01

A manganin piezoresistive stress gauge system with an extended lifetime in severe hydrodynamic environments and a reproducibility better than 2% was developed.
DOE

N80-14380# Fulmer Research Inst. Ltd., Stoke Poges (England).
SPACE DOSIMETRY. VOLUME 1: PROJECT DESCRIPTION Final Report
A. Holmes-Siedle 1978 67 p refs
(Contract ESA-2440/74-HP)
(FRI-R646/3-Vol-1; ESA-CR(P)-1176-Vol-1) Avail: NTIS HC A04/MF A01

The dosimetry of radiation sources and the design as well as procurement of special dosimetric MOS devices (the TOT series) are discussed. The devices were first used for laboratory dosimetry and, later, incorporated in two ESTEC flight units which

are now monitoring internal radiation in geostationary orbit. The final transistors produced (TOT200 series) show good dosimetric properties and are more radiation-sensitive than any conventional transistor. Other support was given to ESTEC in the areas of physical analysis, thermoluminescence studies, the provision of a calibrated cobalt-60 source and some space environment analyses. Author (ESA)

N80-14381# European Space Agency, Paris (France).
SYNCHRONIZATION OF CLOCKS IN THE 100 ps RANGE
Jean-Patrick Moreau Oct. 1979 195 p refs Transl. into ENGLISH of "Synchronisation d'Horloges dans le Domaine 100 ps", Rept. ONERA-NT-1978-1 ONERA, Mar. 1978 Original report in FRENCH previously announced as N79-32968
(ESA-TT-578; ONERA-NT-1978-1) Avail: NTIS HC A09/MF A01

The development of a method for measuring, with high resolution (100 ps), the differences between distant atomic clocks is presented. The synchronization operation is analyzed and the main characteristics of the set of measuring units are determined. The principle of the system is described as the transfer of the time information by an optical channel using a semiconductor laser. The various instruments including time scalas, transducers, telescopes, and chronometers are described. The results of two experiments concerning the synchronization of clocks from 6 km apart to several thousand km apart are presented. The synchronization method by laser beam achieves the expected accuracy of 100 ps when the clocks are in direct view and is better than 1 ps when they are separated by several hundred kilometers. Author (ESA)

N80-14382# National Ocean Survey, Rockville, Md. Test and Evaluation Lab.
PERFORMANCE EVALUATION OF THE HORIBA INSTRUMENTS, INCORPORATED MODEL U-7 WATER QUALITY CHECKER
Jerald M. Peterson, Charles C. White, Barbara S. Pijanowski, and Gary K. Ward Jun. 1979 24 p refs
(PB-298815/2; NOAA-TM-NOS-24; NOAA-79070908) Avail: NTIS HC A02/MF A01 CSCL 14B

Test and evaluation results are reported for a general purpose, handheld water quality checker designed to measure temperature, conductivity, pH, dissolved oxygen, and turbidity. A system description, manufacturer's specifications, and performance results with associated figures and tables giving accuracy, precision, stability, and environmental effects are provided for all parameters with the exception of turbidity. GRA

N80-14995*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MONITOR PROPORTIONAL COUNTER
M. C. Weisskopf *In its* HEAO Sci. Symp. Nov. 1979 p 347-366 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-14383 Johns Hopkins Univ., Baltimore, Md.
MEASURED PERFORMANCE OF LASER INTENSITY SUBCARRIER DIRECT DETECTION OPTICAL COMMUNICATION RECEIVERS Ph.D. Thesis
Chung-Min Chao 1979 149 p
Avail: Univ. Microfilms Order No. 7924608

The filtering and detection methods associated with doubly stochastic Poisson processes were tested in the context of a direct detection optical communication system. Two types of transmission media were tested: a free space channel and a log-normal fading channel. The simplified sub-optimal estimation methods produced slightly less accurate estimates than the optimal ones but had a substantial reduction in processing time requirements. The intensity estimates obtained were used in the likelihood ratio test for the case of binary signal detection. It was found that, under certain conditions, the conventional radio frequency detector and estimator achieved the same performance as the doubly stochastic Poisson processes. In the case of binary signal detection, the direct detection of a subcarrier frequency shift key system achieved the same performance as a heterodyne detection optical frequency shift key system. The experiments showed the feasibility of an easily implemented optical communication system with the technology currently available. Dissert. Abstr.

N80-14384* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LASER APPARATUS Patent
Gerhard A. Koepf, inventor (to NASA) (NSF, Washington, D.C.) Issued 30 Oct. 1979 9 p Filed 29 Sep. 1977 Supersedes N78-10445 (16 - 01, p 0066) Sponsored by NASA
(NASA-Case-GSC-12237-1; US-Patent-4,173,001; US-Patent-Appl-SN-837795; US-Patent-Class-331-94.5C; US-Patent-Class-331-94.5P) Avail: US Patent and Trademark Office CSCL 20E

A laser apparatus having a pump laser device for producing pump laser energy upon being excited is disclosed. The pump laser device has a resonating cavity for oscillating and amplifying the pump laser energy. A source laser device is used for producing source laser energy upon being excited by the pump laser energy. The source laser device has a resonating cavity for oscillating and amplifying the source laser energy. The source laser's resonating cavity is coupled withih a portion of the pump laser's resonating cavity.
Official Gazette of the U.S. Patent and Trademark Office

N80-14385 Washington Univ., Seattle.
REMOTE SENSING OF MICROPARTICLES BY LASER SCATTERING FOR MEDICAL APPLICATIONS: APPROACH WITH TRANSPORT THEORY AND PICOSECOND OPTICAL RANGE-GATING Ph.D. Thesis
Koichi Shimizu 1979 300 p
Avail: Univ. Microfilms Order No. 7927871

Three techniques were developed for the remote sensing of microparticles by laser scattering. They were applied to the noninvasive probing of biological particles, namely bacteria in urine, cataracts in the eye, and platelets in blood, respectively. These are: (1) the Fourier transform inversion technique which determines the size distribution of tenuous scatterers from the forward scattering pattern; (2) the backward scattering pattern analysis technique which determines an average size and variance of tenuous scatterers from the backward scattering pattern; and (3) the pulse backscattering technique which evaluates the scattering and absorption characteristics of scatterers in a dense medium by means of backscattered pulses. Dissert. Abstr.

N80-14386*# Rasor Associates, Inc., Sunnyvale, Calif.
A CESIUM TELEC EXPERIMENT AT LEWIS RESEARCH CENTER Final Report
E. J. Britt Sep. 1979 59 p refs
(Contract NAS3-21149)
(NASA-CR-159729; NSR-8-1) Avail: NTIS HC A04/MF A01 CSCL 20E

The thermoelectronic laser energy converter (TELEC), was studied as a method of converting a 10.6 mm CO2 laser beam into electric power. The calculated characteristics of a TELEC seem to be well matched to the requirements of a spacecraft laser energy conversion system. The TELEC is a high power density plasma device which absorbs an intense laser beam by inverse bremsstrahlung with the plasma electrons. In the TELEC process, electromagnetic radiation is absorbed directly in the plasma electrons producing a high electron temperature. The energetic electrons diffuse out of the plasma striking two electrodes which are in contact with the plasma at the boundaries. These two electrodes have different areas: the larger one is designated as the collector, the smaller one is designated as the emitter. The smaller electrode functions as an electron emitter to provide continuity of the current. Waste heat is rejected from the collector electrode. An experiment was carried out with a high power laser using a cesium vapor TELEC cell with 30 cm active length. Laser supported plasma was produced in the TELEC device during a number of laser runs over a period of several days. Electric power from the TELEC was observed with currents in the range of several amperes and output potentials of less than 1 volt. The magnitudes of these electric outputs were smaller

than anticipated but consistent with the power levels of the laser during this experiment. J.M.S.

N80-14387# Cornell Univ., Ithaca, N. Y. Baker Lab.
KINETIC ASPECTS OF GAS PHASE METAL ATOM OXIDATION REACTIONS Final Report, 1 Jun. 1976 - 31 May 1979
John Wiesenfeld 31 Jul. 1979 17 p refs
(Grant AF-AFOSR-3039-76; AF Proj. 2303)
(AD-A074089; AFOSR-79-0956TR) Avail: NTIS
HC A02/MF A01 CSCL 07/2

The oxidation of Ge and Sn by various gases including N2O, has been studied by flash photolysis at room temperature and the kinetics determined. The rate of Sn - N2O is probably too slow to permit construction of a chemical laser based on this reaction. A new set of techniques involving laser pumping of alkaline Earth atoms is also described, which will permit the study of the kinetic behavior of their low-lying excited levels in bimolecular collisions. GRA

N80-14388# Dayton Univ., Ohio.
DEVELOPMENT AND APPLICATION OF A LASER VELOCIMETER TO MEASURE VERY HIGH SPEED PARTICLE VELOCITIES Final Report, Nov. 1977 - Sep. 1978
James D. Trolinger Wright-Patterson AFB, Ohio AFFDL Jun. 1979 35 p refs Prepared in cooperation with Spectron Development Labs., Inc., Costa Mesa, Calif.
(Contract F33615-76-C-3145; AF Proj. 2404)
(AD-A073859; AFFDL-TR-79-3067) Avail: NTIS
HC A03/MF A01 CSCL 14/2

A laser velocimeter was developed for the measurement of the velocity of particles in the size range from 10 to 100 micrometers diameter and velocities up to 5000 meters per second. The instrument was successfully employed in accelerator tests which were conducted during the development of a reentry nose tip erosion and ablation facility. GRA

N80-14389# Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio.
LASER POWER METER INTERCOMPARISON TEST EVALUATED BY TWO VARIABLE LINEAR REGRESSION ANALYSIS Project Report, Apr. - Sep. 1978
Willie Blackmon 21 Sep. 1978 33 p refs
(AD-A074526; AGMC-79-001-1) Avail: NTIS
HC A03/MF A01 CSCL 14/2

This report describes how the data collected in a laser power meter exchange program between the Directorate of Metrology and Brook AFB, Texas is analyzed in determining the errors in the intercomparison measurement process. GRA

N80-14390# Naval Ocean Research and Development Activity, Bay St. Louis, Mo. Mapping, Charting and Geodesy Development Group.
OPERATING SCENARIO FOR A HYDROGRAPHIC AIRBORNE LASER SOUNDER (HALS) Interim Report
H. J. Byrnes May 1979 36 p refs
(AD-A073872; NORDA-TN-34) Avail: NTIS
HC A03/MF A01 CSCL 08/10

This note is intended to acquaint interested parties with the anticipated deployment of Hydrographic Airborne Laser Sounder (HALS). Data acquisition, data processing, data reduction rationale, data density, test results, and environmental considerations are covered. The document is intended primarily as presolicitation information for the HALS procurement. GRA

N80-14391# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Sciences.
STUDY OF TWO-PHOTON ABSORPTION AND AMPLIFICATION PROCESSES IN GASES Final Report, 1 Aug. 1976 - 30 Jun. 1979
Lorenzo M. Narducci 1 Sep. 1979 84 p refs
(Grant DAAG29-78-G-0098)
(AD-A074951) Avail: NTIS HC A05/MF A01 CSCL 07/4

This report summarizes our theoretical and experimental findings. It is divided into 8 sections. Section 1 contains a general description of the problem and a summary of the main results. Section 2 contains the theory of two-photon amplification. Section 3 details the requirements for the selection of an appropriate active medium. Section 4 describes the pumping requirements and the handling and preparation of the vapor cell. Section 5 contains a description of the curve of growth method which has been used in the work to measure the density of calcium vapor. Section 6 describes the details of operation of the pump dye laser and of the second harmonic generation. Section 7 contains a description of the construction and operation of the infrared dye laser. Section 8 contains a description and technical details of the timing circuitry used to fire the pump and probe lasers in a preassigned temporal sequence. GRA

N80-14392# Virginia Univ., Charlottesville. Dept. of Chemistry.
NEW LASER DYE SYSTEMS BASED ON LUMINESCENT TRANSITION METAL COMPLEXES Annual Report, 1 Jun. 1978 - 31 May 1979
James N. Demas 30 Jul. 1979 8 p refs
(Grant AF-AFOSR-3590-78; AF Proj. 2303)
(AD-A074245; AFOSR-79-0983TR) Avail: NTIS
HC A02/MF A01 CSCL 11/3

Excited state interactions of luminescent ruthenium (II) complexes with laser dyes are being studied. Novel experimental tools including an ultra high accuracy quantum counter comparator, a microcomputer controlled nanosecond risetime boxcar integrator, a luminescent wavelength shifter method for correcting for the wavelength dependence of phototube transit times in decay time measurements, and a step excitation method for studying reversible excited state electron transfer have been developed to facilitate these studies. Energy transfer from the tris(2,2:-bipyridine)-ruthenium(II) complex to a variety of rhodamine and oxazine laser dyes have been demonstrated in both homogeneous solutions and in micellar assisted ones. In favorable cases energy transfer efficiencies from the charge transfer (CT) sensitizing state of the Ru(II) complex to the singlet state of the laser dyes exceed 80%. To date, energy transfer appears to be dominantly by a Forster resonance mechanism. In the micellar cases, the dye and complex are brought so closely together that contact quenching of the excited dye singlet state can occur. Applications of these systems to new binary laser dyes are under study. GRA

N80-14393# California Univ., Berkeley.
INFRARED LASER WINDOW COATING BY PLASMA POLYMERIZATION Final Technical Report, 1 Mar. 1975 - 31 Aug. 1978
M. Shen Griffiss AFB, N.Y. RADC Jun. 1979 118 p refs
(Contract F19628-75-C-0097; ARPA Order 2415)
(AD-A075008; RADC-TR-79-149) Avail: NTIS
HC A06/MF A01 CSCL 11/3

This is the final report on the DARPA contract No. 19628-75-C-0097 on Infrared Laser Window Coating by Plasma Polymerization to prepare protective and anti-reflection coatings for infrared laser windows by depositing a thin film from the hydrocarbon plasma. The introduction section outlines state-of-the-art knowledge of plasma polymerization and the rationale of this approach. Next, the details of plasma polymerization of several simple saturated hydrocarbons were investigated. Here the radiofrequency glow discharge method was used as the method of generating plasma. The effect of changing the frequency of the plasma on one of the most promising monomers, i.e., ethane was investigated. Finally, the preferred method of preparing laser window coating, namely the plasma polymerization of ethane using pulsed radiofrequency plasma is investigated. GRA

N80-14394# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif.
FORWARD AND BACKWARD STIMULATED RAMAN SCATTERING IN A MULTIMODE FIBER
C. H. Lin, M. A. Nelson, B. B. Marshall, and J. K. Theobald 1978 17 p refs Presented at Phys. of Fiber Optics Conf., Kingston, R. I., 22 Jun. 1978
(Contract EY-76-C-08-1183)
(CONF-780688-2) Avail: NTIS HC A02/MF A01

Several orders of forward and backward stimulated Raman scattering were generated by a pulsed dye laser in a multimode step-index fiber. Frequency spectra and temporal profiles at different power levels are recorded and discussed. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-14395* National Aeronautics and Space Administration. Pasadena Office, Calif.
APPARATUS FOR ELECTROLYTICALLY TAPERED OR CONTOURED CAVITIES Patent
Lynn A. Williams, inventor (to NASA) (Anocut Engineering Co., Chicago) Issued 14 Nov. 1967 6 p Filed 17 Jan. 1966 Division of US Patent Appl. SN-90438, Filed 20 Feb. 1961, US-Patent 3,257,300 Sponsored by NASA
(NASA-Case-XNP-08835-1; US-Patent-3,352,774; US-Patent-Appl-SN-534931; US-Patent-Class-204-224) Avail: US Patent and Trademark Office CSCL 13I

An electrolytic machining apparatus for forming tapered or contoured cavities in an electrically conductive and electrochemically erodible piece is presented. It supports the workpiece and an electrode for movement relatively toward each other and has means for pumping an electrolyte between the workpiece and the electrode.

Official Gazette of the U.S. Patent and Trademark Office

N80-14396 Engineering Sciences Data Unit, London (England).
CHARACTERISTICS OF DISC SPRINGS IN COMBINATION (TO BE USED IN CONJUNCTION WITH ITEM NO. 78043)
Jul. 1979 10 p
(ESDU-79010; ISBN-0-85679-254-3; ISSN-0141-4089) For information on availability of series, sub-series and other individual data items, write NTIS, attn: ESDU, Springfield, Va. 22161. HC $290.50

A method is presented for calculating the load/deflection behavior of stacks of coned disc springs (Belleville washers). Guidance on calculation of the stiffness of spring stacks is also given. The stresses in the springs of a stack were calculated for critical springs in the stack. Three types of stacks are dealt with, namely regular stacks of identical springs, irregular stacks of identical springs and stacks of non-identical springs. Nested stacks are also covered. Notes are provided on the effect of friction on stack behavior and on ways of decreasing or increasing the friction losses in spring stacks under single stroke or low rate cyclic loading. ESDU

N80-14397* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTROPHORETIC FRACTIONAL ELUTION APPARATUS EMPLOYING A ROTATIONAL SEAL FRACTION COLLECTOR Patent
Milan Bier, inventor (to NASA) Issued 9 Aug. 1977 12 p Filed 21 Dec. 1976
(NASA-Case-MFS-23284-1; US-Patent-4,040,940; US-Patent-Appl-SN-753103; US-Patent-Class-204-299R; US-Patent-Class-204-180G) Avail: US Patent and Trademark Office CSCL 13I

Electrophoretic fractional elution apparatus which has a column with a rotating seal joint is described. A thin jet of eluting buffer is directed across the lumen of the electrophoretic column in a direction perpendicular to that of electrophoretic migration. Either the content of the column is rotated with respect to the stationary jet, or the jet is rotated with respect to the column. The system may employ electrophoresis either in free solution or in packed columns.

Official Gazette of the U.S. Patent and Trademark Office

N80-14398* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COUPLING DEVICE FOR MOVING VEHICLES Patent
Arthur A. Rudmann, inventor (to NASA) Issued 6 Nov. 1979 11 p Filed 19 May 1978 Supersedes N78-25429 (16 - 16, p 2122)
(NASA-Case-GSC-12322-1; US-Patent-4,173,324; US-Patent-Appl-SN-907436; US-Patent-Class-244-161; US-Patent-Class-269-156; US-Patent-Class-294-86R; US-Patent-Class-294-113; US-Patent-Class-414-1) Avail: US Patent and Trademark Office CSCL 13I

A mechanical system is disclosed to capture and/or deploy a device or vehicle having relative motion with respect to another vehicle. The mechanism includes an onboard controlled collapsible iris assembly located at the end of a controlled manipulator system carried by one moving vehicle. The iris assembly by means of the manipulator system encircles a probe located on the other moving vehicle whereupon the iris assembly is activated and one or more iris elements close around the probe, thus capturing, and axially aligning the other vehicle with the iris assembly. Additionally, a rotator assembly is included for spinning the iris assembly in a manner adapted to engage the probe of a spinning vehicle. Deployment of the other vehicle is accomplished by reversing the capture procedure.

Official Gazette of the U.S. Patent and Trademark Office

N80-14399 Wisconsin Univ. - Madison.
MEASUREMENT OF FLUID MOTION IN A DIESEL ENGINE CYLINDER BY USE OF A TRACER GAS TECHNIQUE Ph.D. Thesis
Alfred Jacobsen Jessel 1979 268 p
Avail: Univ. Microfilms Order No. 7922809

A technique for measuring fluid motion in the cylinder of a fired or motored internal combustion engine was developed and tested. The method uses a rapid-acting valve to inject a small quantity of gaseous tracer at a specific position in the combustion chamber and at a specific time during each engine cycle. A short time after tracer injection, a similar valve extracts a small volume of cylinder gases at another specific location and time. Detection instrumentation analyzes the sampled gases for cycle-averaged tracer concentration and pure-tracer concentration. The data obtained showed the technique capable of quantifying swirl, squish, and piston-induced upward velocity. The effects of turbulent mixing forces were strongly manifested by the data.

Dissert. Abstr.

N80-14400*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SURFACE CONFORMING THERMAL/PRESSURE SEAL Patent Application
Martin L. Stevens, inventor (to NASA) (Fairchild Republic Co.) Filed 12 Dec. 1979 21 p Sponsored by NASA
(NASA-Case-MSC-18422-1; US-Patent-Appl-SN-102593) Avail: NTIS HC A02/MF A01 CSCL 11A

A sealing apparatus is described which serves both pressure and thermal sealing functions between adjacent and relatively movable elements of relatively large surfaces. The sealing apparatus has the flexibility required for large movable surfaces, and can accommodate moderate variations in the gap between such surfaces which may be affected by thermal distortion. Sealing is accomplished with a nonabrasive, low frictional material, creating as little resistance as possible to movement of control members and minimal wear and damage to surface coatings.

NASA

N80-14401# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMAL ROTATING COLUMN
Sarp Adali Mar. 1979 33 p refs
(CSIR-TWISK-76) Avail: NTIS HC A03/MF A01

The optimization of a column clamped to the rim of a wheel rotating at constant angular velocity is discussed. An optimal shape for a column of specified volume and minimum thickness and radius-to-length ratio is determined to maximize the critical rotational speed. In addition, the height-to-width ratio and thickness distribution of a uniform or optimal rectangular column are optimized so that the column buckles not only in the direction of one of the two principal axes, but assumes a buckled shape having displacement components along both axes. K.L.

N80-14402*# National Aeronautics and Space Administration, Washington, D. C.
PIPING AND TUBING TECHNOLOGY: A COMPILATION
1967 20 p
(NASA-SP-5903(01); C-67-03) Avail: NTIS HC A02/MF A01 CSCL 13K

Piping and tubing techniques which have potential industrial use are presented in summary form. R.E.S.

N80-14403*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-ACTING LIFT-PAD GEOMETRY FOR CIRCUMFERENTIAL SEALS: A NONCONTACTING CONCEPT
Gordon P. Allen Jan. 1980 11 p refs
(NASA-TP-1583; E-154) Avail: NTIS HC A02/MF A01 CSCL 11A

A segmented circumferential seal with lift pads for hydrodynamic action was analyzed over ranges of speed and sealed pressure. Performance predictions, which predicted noncontact operation for speeds as high as 600 revolutions per second at sealed pressures to 86 N/sq cm, are discussed. Performance tests were performed on the seals and compared with the performance predictions. A.W.H.

N80-14404# University Coll. of Swansea (Wales). Tribology Centre.
LOW TEMPERATURE LUBRICATION
A. R. Lansdown and H. M. Briscoe 27 Apr. 1978 229 p refs
(Contract ESTEC-3264/77-NL-PP(SC))
(STC-78/376; ESA-CR(P)-1120) Avail: NTIS HC A11/MF A01

A survey intended to provide designers of spacecraft systems and other users with guidance to the selection of an appropriate lubrication system for any low temperature application is presented. The available published literature on low temperature lubrication is reviewed and summarized. Because the information is relatively sparse, it was supplemented by data on the fundamentals of tribology as related to low temperature and on the effects of low temperatures on materials. Guidance to lubricant selection in relation to specific low temperature sitution is given. A full bibliography is also provided. Author (ESA)

N80-14159*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A STUDY OF THE INFLUENCE OF OIL SATURATION ON THE 64 METER ANTENNA HYDROSTATIC BEARING GROUT
H. P. Phillips, A. A. Riewe, M. Polivka (California Univ., Berkeley), and P. K. Mehta *In its* The Deep Space Network 15 Dec. 1979 p 62-70 (For primary document see N80-14150 05-12) Avail: NTIS HC A06/MF A01 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-14405*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
REACTOR FOR SIMULATION AND ACCELERATION OF SOLAR ULTRAVIOLET DAMAGE
E. Laue and A. Gupta 21 Sep. 1979 32 p Sponsored in part by DOE
(Contract NAS7-100; JPL Proj. 5101-35)
(NASA-CR-162533; JPL-Pub-79-92; DOE/JPL-1012-31) Avail: NTIS HC A03/MF A01 CSCL 14D

An environmental test chamber providing acceleration of UV radiation and precise temperature control (+ or -)1 C was designed, constructed and tested. This chamber allows acceleration of solar ultraviolet up to 30 suns while maintaining temperature of the absorbing surface at 30 C - 60 C. This test chamber utilizes a filtered medium pressure mercury arc as the source of radiation, and a combination of selenium radiometer and silicon radiometer to monitor solar ultraviolet (295-340 nm) and total radiant power output, respectively. Details of design and construction and operational procedures are presented along with typical test data. M.M.M.

N80-14406# Army Tropic Test Center APO, Miami 34004.
METHODOLOGY INVESTIGATION EXPOSURE/PERFORMANCE TEST OF SELECTED MATERIEL ITEMS Final Report, Jul. 1973 - Apr. 1975
George F. Downs and Robert J. Gorak Jan. 1979 74 p refs
(AD-A074001; USATTC-7901) Avail: NTIS HC A04/MF A01 CSCL 15/3

USATTC conducted a methodology investigation in the Canal Zone from July 1973 to April 1975 to study the relationships among performance of materiel, exposure, and materials deterioration. Representative items of Army materiel were selected, exposed in different modes in the humid tropics, and performance tested at regular intervals. Objectives were to learn how and when to measure performance, to relate the performance measures to materiel deterioration, and to learn how and when to apply nondestructive test (NDT) techniques. The pallet and tarpaulin-forest storage mode provided the most severe environment. Use of this storage mode in tropic surveillance tests will uncover materiel design weaknesses more rapidly than other common long-term storage modes. In general, exterior visible evidence of material degradation should not be used for item performance predictions. Test items exposed in the humid tropics should be performance tested and fully disassembled and examined to determine the full extent of tropic deterioration. Further studies are required to investigate techniques for quantifying the severity of microbial attack and distinguishing between destructive and nondestructive growth. Meaningful application of NDT techniques to test items during tropic surveillance testing requires further refinement. An investigation should be undertaken to examine state-of-the-art NDT techniques for application to tropic testing. GRA

N80-14407# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
ULTRAVIOLET SPECTROSCOPIC METHODS FOR QUALITY CONTROL
G. D. Simpson Apr. 1979 8 p refs
(Contract DE-AC04-76DP-00487)
(MHSMP-79-29) Avail: NTIS HC A02/MF A01

A test designed to provide instrumental quality control on the Perkin-Elmer 356 Double Wavelength Spectrophotometer is described. Properly implemented, this test provides a routine check on instrument performance, so that repair or adjustment can be made with a minimum loss of instrument downtime and of precision and accuracy in UV measurements. Results of the test are given. DOE

N80-14408# Oak Ridge National Lab., Tenn.
ULTRASONIC FLAW DETECTION AND CHARACTERIZATION IN STRUCTURAL MATERIALS BY SPECTRAL ANALYSIS
L. Adler, K. V. Cook, W. A. Simpson, D. K. Lewis, and D. W. Fitting Oct. 1978 26 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6456) Avail: NTIS HC A03/MF A01

A method of quantitavely determining size and location of simulated flaws in anisotropic materials such as stainless steel welds is described. Previous work demonstrated that spectral analysis of a broad-band ultrasonic pulse scattered from a defect can be used to determine its size orientation in isotropic materials if the velocity of sound in the materials is known. In an anisotropic structural material, stainless steel weld, centrifugally cast pipe, the velocity of sound, both shear and longitudinal, depends on the sound's direction. When anisotropy is not taken into account, defect location and size are frequently misjudged. The effect of this structural variation in materials must be considered to obtain the correct size and location of defects by frequency analysis. A theoretical calculation, including anistropy, of the scattered field from defects is also presented. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-14409 Oklahoma State Univ., Stillwater.
BIAXIAL BENDING ANALYSIS OF HYDRAULIC CYLINDERS

Ph.D. Thesis
Narayanarao Ravishankar 1979 147 p
Avail: Univ. Microfilms Order No. 7928229

A method of analysis which permits the investigation of stresses and deflections in a hydraulic cylinder was developed using a finite element analytical model to represent the actual structure. The hydraulic cylinder is modeled as an assemblage of space-frame elements with a fictitious rotary spring at the gland to take the crookedness angle effect into account. The influencing factors included are: the self-weight of the system, variation of the crookedness angle at the sliding connection, eccentricity of supports and of axial loads at any point along the length of the cylinder in any arbitrary direction, and the presence of external moments at any arbitrary point along the cylinder. The analysis is applicable to cylinders with hollow or solid rods, with or without fluid pressure A computer program is also presented. Dissert. Abstr.

N80-14410 Purdue Univ., Lafayette, Ind.
ACOUSTIC EMISSION: AN APPLICATION TO FRACTURE MECHANICS Ph.D. Thesis
Ronnie Keith Miller 1979 156 p
Avail: Univ. Microfilms Order No. 7926413

A practical theory was developed for analyzing the acoustic emissions from various engineering materials. An experimental system used to detect and record acoustic emissions was created in order to validate the proposed theory. Methods for reducing background noise as optional system features are introduced as well as the establishment of the Master Curves for different materials. Methods for measuring acoustic emission counts and the acoustic emission count rate (using threshold techniques) are also outlined. A theory is proposed relating acoustic emissions from Double-Edge-Cracked plates to the stress intensity factor and the crack length. Tests results from Aluminum 6061-T4, Cast Acrylic and Aluminum 2024-T3 DEC specimens are compared with theoretical predictions showing a close correlation. Dissert. Abstr.

N80-14411 Northwestern Univ., Evanston, Ill.
AN X-RAY STUDY OF THE REGION AROUND STATIC AND FATIGUE CRACKS Ph.D. Thesis
William Hillel Schlosberg 1979 247 p
Avail: Univ. Microfilms Order No. 7927442

The Warren-Averbach method of Fourier analysis of X-ray diffraction profiles was employed successfully in combination with a microbeam to observe the local deformation behavior attendant to a fatigue crack to obtain information about the structure of deformed metals. The plastic region and its surroundings were studied. Residual stress measurements with X-rays were also made to study the elastic response of the cracked samples. In both instances the effects of statically applied loads and fatigue loads were examined. The two-dimensional nature of each quantity was determined using a mini-computer controlled diffractometer. Dissert. Abstr.

N80-14412 Oklahoma State Univ., Stillwater.
A STUDY OF SURFACE ZONE DETERIORATION OF NICKEL LEADING TO FATIGUE CRACK INITIATION IN LOW CYCLE FATIGUE Ph.D. Thesis
Jesa H. Kreiner 1979 172 p
Avail: Univ. Microfilms Order No. 7928217

The effects of subjecting 35 specimens of fully annealed Nickel 200 material to completely reversed bending and the surface changes prior to crack initiation were observed. It was shown that a predictable pattern of hardening occurs in different surface strata. The pace of hardening decreased with the cycling. Some hardness values were obtained within the grains and at grain boundaries. Nickel 200 exhibited a planar slip behavior. Relationships describing hardening rates were developed. The material close to the surface plastically deformed more heavily than the material within. Dissert. Abstr.

N80-14413# National Aerospace Lab., Amsterdam (Netherlands).
FLIGHT SIMULATION FATIGUE TESTS ON LUGS WITH HOLES EXPANDED ACCORDING TO THE SPLIT-SLEEVE COLD WORK METHOD
J. Schijve, F. A. Jacobs, and A. E. Meulman 21 Nov. 1978 50 p refs
(NLR-TR-78131-U; ICAF-1104) Avail: NTIS HC A03/MF A01

Flight simulation tests were performed on 2024-T3 and 7075-T6 lug specimens. Geometrical distortions induced by the expansion were measured. The significance of residual stresses was analysed with reference to depth of penetration of cold work, the relaxation of residual stress by cyclic loads, and other practical aspects. The results indicated that significant fatigue life improvements were obtained with the split-sleeve method. K.L.

N80-14414# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
UNIFIED FORMALISM OF STRAIN AND STRESS
R. Roesel Mar. 1979 16 p
(CSIR-TWISK-77) Avail: NTIS HC A02/MF A01

The classical analysis of stress and strain pertaining to 'infinitesimal' deformations of arbitrary continuous bodies is reviewed. The concept of an exact sequence of sets and operators is introduced and the sequence diagram is presented as a mnemonic device embodying several theorems in one concept. K.L.

N80-14415# Naval Postgraduate School, Monterey, Calif.
VIBRATION ANALYSIS AND NONDESTRUCTIVE TESTING USING DOUBLE-EXPOSURE HOLOGRAPHIC TECHNIQUES M.S. Thesis
John Michael Fahey Jun. 1979 112 p refs
(AD-A073457) Avail: NTIS HC A06/MF A01 CSCL 20/11

Double-exposure holograms were made of aluminum 2024-T4 rectangular plates. The double-exposure technique was applied to an aluminum plate in a nonflawed and then a flawed condition. Results of these experiments, comparing the effects at various resonant frequencies, were then compared with results previously obtained in other studies to ascertain their applicability to Naval Engineering. The plate was then flawed with a 1 inch through-thickness vertical slit, and double-exposure holograms were generated. The resonant frequencies of the flawed plates were recorded, and the mode shape deviations were analyzed. A comparison was made of resonant frequencies and mode shapes of flawed and nonflawed plates to determine the applicability of holographic procedures to nondestructive testing of vibrating mechanical parts. Results of the experiments indicate that holographic nondestructive testing (HNDT) of vibrating objects in a shipboard environment holds promise for future applications. Further research is required to develop systems for use aboard ships. These procedures are being used successfully in the aerospace industry and automobile manufacturing. GRA

N80-14416# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
OFF-CENTER, LOW VELOCITY, TRANSVERSE NORMAL IMPACT OF A SIMPLY SUPPORTED PLATE Final Report
Richard E. Llorens and Edward J. McQuillen 11 Sep. 1979 61 p refs
(AD-A074946; NADC-79215-60) Avail: NTIS HC A04/MF A01 CSCL 14/2

A theoretical solution for the response of a simply supported plate to off center low speed transverse impact is presented. This solution is empirically corrected, on the basis of viscoelastic beam analysis, to admit damping. Comparison of the numerical predictions of the corrected theory with central impact test results on graphite-epoxy composite laminates shows good agreement. The structural dynamic response model consists of a special orthotropic plate impacted by a rigid mass. Initial displacement and velocity distributions were assumed and the solution method utilized the finite Fourier sine transform and Laplace transforms with respect to both space and time. GRA

N80-14417# AiResearch Mfg. Co., Phoenix, Ariz.
CONTACT STRESS ANALYSIS OF CERAMIC-TO-METAL INTERFACES Final Report
David G. Finger 21 Sep. 1979 35 p refs
(Contract N00014-78-C-0547)
(AD-A074491; AiResearch-21-3239) Avail: NTIS HC A03/MF A01 CSCL 14/2

The objective of this proposed 8-month program was to conduct analysis, specimen testing, and data correlation to provide

an improved understanding of the local contact conditions that prevail at an interface between ceramic and metal components for gas turbine engines. The program was specifically directed to study contact stresses at the interface between inserted ceramic turbine blades (hot-pressed silicon nitride) and a metal rotor, but the method of analysis, results, and conclusions also provided a better understanding of contact stresses at ceramic-to-metal and ceramic-to-ceramic interfaces for static components. A finite-element stress analysis procedure and structural evaluation technique consistent with the statistical nature of ceramic materials was generated. Specimen testing was conducted to obtain validation of these techniques and provide insight as to possible modifications of stress simulation or fracture prediction criteria. The objective was to develop a design methodology, which will improve on current design methods, thus permitting the design of interface configurations in which strengths more indicative of the inherent strength of ceramic materials can be realized. GRA

N80-14418# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.
CUMULATIVE DAMAGE UNDER TWO LEVEL CYCLING, SOME THEORETICAL PREDICTIONS AND TEST DATA
Zvi Hashin (Tel Aviv Univ., Israel) and Campbell Laird 15 Aug. 1979 16 p refs
(Contract N00014-78-C-0544)
(AD-A074488; TR-3) Avail: NTIS HC A02/MF A01 CSCL 12/2

Predictions of a new cumulative damage theory established by Hashin and Rotem (HR) are compared with an extensive series of test data for two-level shear strain cycling and a double linear exponential damage rule, all given by Miller and Zachariah (MZ), demonstrating good agreement. While MZ requires determination of parameters by fit to the two level test data, the only testing parameter needed for HR is the fatigue lifetime Ne beyond which the fatigue limit occurs. This parameter has here been estimated on the basis of recent advances in understanding cyclic deformation. GRA

N80-14419# California Univ., Livermore. Lawrence Livermore Lab.
PHOTOACOUSTIC STRESS
A. Rosencwaig and J. F. Scheimer 13 Apr. 1979 8 p refs Presented at Topical Meeting on Photoacoustic Spectry., Ames, Iowa, 1 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-82594; CONF-790819-1) Avail: NTIS HC A02/MF A01

The theory for photoacoustic-induced stress in condensed media is developed for both near-field and far-field conditions. DOE

N80-14420# Sandia Labs., Albuquerque, N. Mex.
TRIAXIAL MEASUREMENT OF STRESS WAVES IN THE FREE-FIELD
R. P. Reed 1979 22 p refs Presented at the Transducer Workshop, Colorado Springs, 12 Jun. 1979
(Contract EY-76-C-04-0789)
(SAND-78-2123C; CONF-790635-3) Avail: NTIS HC A02/MF A01

The characteristics of the dynamic stress fields are presented along with the response of sensors to triaxial loading. Described is a prototype gage being developed for general field application where triaxial measurement is required. DOE

N80-14421# General Atomic Co., San Diego, Calif.
MODIFIED WEIBULL THEORY FOR THE STRENGTH OF GRANULAR BRITTLE MATERIAL
F. Ho May 1979 27 p refs
(Contract DE-AT03-76ET-35300)
(GA-A-15228) Avail: NTIS HC A03/MF A01

A modified Weibull theory was developed to describe the strength of a granular brittle material. The statistical aspect of the strength for practical application of the theory is discussed. The Weibull distribution is briefly reviewed and tensile versus bend strength is discussed. Observations and results are summarized. R.C.T.

N80-14422# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
REVIEW OF INVESTIGATIONS INTO AERONAUTICS RELATED FATIGUE FEDERAL REPUBLIC OF GERMANY Status Report, May 1977 - Apr. 1979
D. Schutz and O. Buxbaum 1979 166 p refs Presented at 16th Conf. of Intern. Comm. Aeron. Fatigue, Brussels, 1979
(LBF-S-142; ICAF-CONF-1979) Avail: NTIS HC A08/MF A01

Investigations into fatigue and fatigue related disciplines, as they regard aeronautics, are reviewed. Studies treated are limited to those carried out in the Federal Republic of Germany. Subjects include measurement and analysis of operational loads, fatigue behavior of joints and notched specimens, fatigue life prediction, cyclic stress-strain behavior, and low cycle fatigue. Also considered are crack propagation, fracture mechanics, and residual static strength. Fatigue of fiber reinforced plastics and hybrid structures as well as some investigations of general interest with and without relation to aircraft are reported on. Finally, a bibliography of fatigue related documents by German authors is given. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-14423* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COAL-SHALE INTERFACE DETECTION SYSTEM Patent
Richard A. Campbell, Jerry L. Hudgins, Paul W. Morris, Harry Reid, Jr., and Joe E. Zimmerman, inventors (to NASA) Issued 12 Jun. 1979 9 p Filed 3 Nov. 1977
(NASA-Case-MFS-23720-2; US-Patent-4,157,655; US-Patent-Appl-SN-848421; US-Patent-Class-73-12; US-Patent-Class-73-82) Avail: US Patent and Trademark Office CSCL 08I

A coal-shale interface detection system for use with coal cutting equipment consists of a reciprocating hammer on which an accelerometer is mounted to measure the impact of the hammer as it penetrates the ceiling or floor surface of a mine. A pair of reflectometers simultaneously view the same surface. The outputs of the accelerometer and reflectometers are detected and jointly registered to determine when an interface between coal and shale is being cut through.

Official Gazette of the U.S. Patent and Trademark Office

N80-14424 State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
THE MAPPING OF IMPORTANT FARMLAND USING REMOTE SENSOR AND SOCIO-ECONOMIC VARIABLES Ph.D. Thesis
Jon Laurence Roberts 1979 233 p
Avail: Univ. Microfilms Order No. 7920317

A comprehensive digital data base of physical (land use) and socio-economic (zoning, agricultural districts, rental/ownership patterns) factors important to farming was created. LANDSAT land use data was collected over the Ontario County, New York study area and grouped into agriculture and forest classes. The socio-economic data was converted to an image-based format by causing the outlines of zones and districts to be digitized and filled in with pixels of a certain grey level. These images are then stored to create the data base. An accuracy check was made on the LANDSAT data using a color infrared U-2 image of the study area. A spectral land use classification was also

performed using digitized U-2 data. LANDSAT classification accuracy is 64% correct for the forest class. U-2 classification accuracy is 82% correct for the forest class. Dissert. Abstr.

N80-14425# Forest Service, Washington, D. C.
FORESTER'S GUIDE TO AERIAL PHOTO INTERPRETATION Agriculture Handbook no. 308
Thomas Eugene Avery Nov. 1978 47 p refs
Avail: NTIS HC A03/MF A01

A practical reference on techniques of aerial photo interpretation in forest inventory is provided. While oblique photographs are occasionally useful for interpretation, this manual emphasizes stereoscopic interpretation of vertical aerial photographs available from various agencies of the U.S. Department of Agriculture. A.R.H.

N80-14426# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
SCANLINE: A COMPUTER PROGRAM FOR CONVERTING RASTER MAPS INTO LINE MAPS
C. S. M. Mueller and A. H. J. Christensen Sep. 1978 42 p refs
(CSIR-TWISK-43) Avail: NTIS HC A03/MF A01

A computer program, algorithms and techniques are described that can be used for transforming a map digitized on a raster scanner, in bit matrix form, into a line map represented by a set of vectors, which is a format very suitable for processing by computer. By means of such a program and techniques of this kind, the conversion of a very large number of existing cartographic maps into digital line maps becomes economically feasible. Author

N80-14427# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany). Abt. 2 des Deutschen Geodaetischen Forschungsinstituts.
INFORMATION ON CARTOGRAPHY AND GEODESY. SERIES 1: ORIGINAL REPORT NUMBER 75
1978 218 p refs In GERMAN; ENGLISH summary Original contains color illustrations
Avail: NTIS HC A10/MF A01

Cartography and problems related to it are discussed. Quantification of syntactic symbols, automation of map drawing, computer programs developed for cartographic data processing, geographic information systems, data bases, generalization algorithms, and programs for automatic pattern recognition are included. For individual titles, see N80-14428 through N80-14439.

N80-14428# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
QUANTIFICATION OF SYNTACTIC INFORMATION CONTENT IN GRAPHICS USED FOR SOCIAL EMPIRICAL RESEARCH [QUANTIFIZIERUNG SYNTAKTISCHER ZEICHENINFORMATIONEN IN KARTEN FUER SOZIALEMPIRISCHE UNTERSUCHUNGEN]
Juergen Bollmann *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 9-32 refs In GERMAN; ENGLISH summary (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01

The information theoretical analysis procedure presented is based on the fact that in cartography the faculty of perception of user groups has to be studied by means of social empirical methods. When test patterns are necessary the information content has to be quantified. An analysis procedure is shown which quantitatively describes syntactic symbol characteristics. In this process, the computed information values can very simply be correlated with time parameters or with other interpretations. Author (ESA)

N80-14429# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
GRAPHICAL PROCESSING OF AREAL RELATED DATA. PROGRAM DEVELOPMENT DONE IN NORDRHEIN-WESTFALEN [FLAECHENBEZOGNE GRAPHISCHE DATENVERARBEITUNG -PROGRAMMENTWICKLUNG BEIM LANDESVERMESSUNGSAMT NORDRHEIN-WESTFALEN]
Heinz Brueggemann *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 33-49 refs In GERMAN; ENGLISH summary (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01

The automatic processing of areal related data requires a data structure which assists an areal proceeding. The subdivision of digitized areal data by means of a raster in combination with the realization of a graph structure for geometry and topology permits a simplification of such cartographic applications as digitizing, generalization, preparation of drawings, and computation of surfaces. Interactive correction possibilities are realized in a program adapted to this structure. Author (ESA)

N80-14430# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PROGRAM CONTROLLED CARTOGRAPHIC GENERALIZATION OF BUILDINGS, FOR 1:25000 TOPOGRAPHIC MAPS [PROGRAMMGESTEUERTE G FUER DIE TOPOGRAPHISCHE KARTE 1:25000]
Ernst-Dietrich Hoffmeister *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 51-62 refs In GERMAN; ENGLISH summary (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01

The results obtained by the program controlled cartographic generalization of large scale representations of buildings are presented. In addition to the capture of automation-compatible original data by digitizing available maps, the possibilities of applying a program system composed of modules demonstrated by a large capacity computer and an automation system for cartography are described. Finally, the programmed algorithms for the automatic processing of the basic rules of generalization (select, enlarge, simplify and merge) are discussed, illustrating them by means of plotter drawings of an automatically generalized representation of buildings. Author (ESA)

N80-14431# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AN INTERACTIVE EDITOR FOR CARTOGRAPHIC DATA [EIN INTERAKTIVER EDITOR FUER KARTOGRAPHICSHE DATEN]
W. Kleinoeder *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 63-76 refs In GERMAN; ENGLISH summary (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01

The concept and implementation of an editor for cartographic data are described. The EPIK program for interactive cartography is reveiwed, and the main functions of the editor program are discussed. The implementation as part of an information system requires that the data bank system permit access to particular objects as well as access to particular regions. Author (ESA)

N80-14432# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
OVPREC: A PROGRAM AUTOMATIC RECOGNITION OF OVERLAPPING ZONES OF BROADENED CARTOGRAPHIC LINE ELEMENTS [OVPREC - EIN PROGRAMM ZUR AUTOMATISCHEN ERKENNUNG DER UEBERLAPPUNGSSTELLEN VERBEITERTER LINIENHAFTER KARTENELEMENTE]
Roland Schittenhelm *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 77-83 refs In GERMAN; ENGLISH summary (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01

The program OVPREC, which is implemented in a cartographic automation system enabling a computer to find the overlapping zones of broadened cartographic line elements without external help, is described. As a recognition algorithm, OVPREC preceeds a displacement algorithm, which disentangles the overlapping zones found with the help of OVPREC. The conditions of the application of OVPREC and the program structure, as well as the functioning of the subroutines are surveyed. As a result, a vector containing the coordinates of the intersection points of the broadened line elements which overlap the keys of these elements as well as the number 0 or 1, depending on whether

the overlap begins or ends in that point, are obtained.
Author (ESA)

N80-14433# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CARTOGRAPHIC AUTOMATION STATUS IN A GERMAN HYDROGRAPHIC INSTITUTE [STAND DER AUTOMATION IN DER KARTOGRAPHIE DES DEUTSCHEN HYDROGRAPHISCHEN INSTITUTS]
Karl-Wilhelm Schrick *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 85-91 ref In GERMAN; ENGLISH summary (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01
For several years hydrographic surveying data have been largely obtained automatically and evaluated for the compilation or correction of charts. The numerically controlled drafting table Aristomat 8446, drafts and subdivides chart borders, represents hyperbolic lattices and enters figures. The recently acquired interactive digitizing table, Aristogrid CD 400, now enables the digitalization of chart contents for inclusion on new charts.
Author (ESA)

N80-14434# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ESTABLISHMENT OF A DATA BASE OF THE ADMINISTRATIVE BOUNDARIES OF GERMANY, SCALE 1:500,000 TO 1:1,000,000 [AUFBAU EINER DATENBANK FUER VERWALTUNGSGRENZENKARTEN IM MASSTAB 1:5000,000 BIS 1:1,000,000]
Helmut Uhrig *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 93-105 refs In GERMAN; ENGLISH summary (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01
The establishment of a data base of the administrative boundaries of the Federal Republic of Germany is described. First, the data are captured on punch tapes, then read into a data base on magnetic disks and processed interactively. Errors are eliminated, data updated and, furthermore, the statistical code numbers of the rural districts have been added as a supplementary description.
Author (ESA)

N80-14435# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
GENERALIZATION ALGORITHMS [ALGORITHMEN ZUR GENERALISIERUNG]
Jens Volkert *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 111-132 refs In GERMAN; ENGLISH summary Original contains color illustrations (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01
A method is described for automatic generalization subject to the condition that the maps produced have to be suitable for the interactive information system EPIK. The method satisfies all the cartography requirements, reducing the given data element lengths to one of the standard raster polygonal element lengths given in preestablished 4:1 ratios.
Author (ESA)

N80-14436# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THREE TYPES OF GEOGRAPHIC DATA STRUCTURE: SIMILITUDES, DIFFERENCES, AND POSSIBLE SYNTHESIS [DREI TYPEN GEOGRAPHISCHER DATENSTRUKTUREN: GEMEINSAMKEITEN, UNTERSCHIEDE UND EINE MOEGLICHE SYNTHESE]
Wigand Weber *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 133-157 refs In GERMAN; ENGLISH summary Presented at Adv. Study Symp. on Topological Data Struct. for Geograph. Inform. Systems, Dedham, Mass., Oct. 1977 (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01
Map data structures and their direct descendants are described along with the relations among them and with general principles of data base theory using CODASYL and Relational Model concepts as a base. The three types of data structures are: the polygonal data structure, which is based on two binary relations between the polygons and the modes of a planar boundary graph; the intersection graph data structure, describing intersections of features explicitly; and the gridded data structure, which contains relevant relations mostly in an implicit manner. Finally, attention is drawn to a fourth data structure, which essentially consists of a hierarchy of nested squares of different sizes superimposed on the map. This hierarchy is described by a binary tree, the branches of which contain the pool addresses of the linearly represented map features passing through the respective squares.
Author (ESA)

N80-14437# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
GEOGRAPHIC INFORMATION SYSTEMS: A REVIEW, WITH DISCUSSION OF FUTURE DEVELOPMENTS [GEOGRAPHISCHE INFORMATIONSSYSTEME - EIN UEBERBLICK UND GEDANKEN ZUR WEITEREN ENTWICKLUNG]
Wigand Weber *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 159-186 refs In GERMAN; ENGLISH summary (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01
A geographic information system (GIS) comprises locally related data in digital form. The user can interrogate such data selectively or results derived from them. The characteristics of a GIS are described, including its contents, its data structure, its possible evaluations, the algorithms used for that purpose, and the data processing installations, on which it runs (hardware). These characteristics are examined with regard to the conceptual fundamentals, where, as far as possible, alternatives are critically compared with the aim of drawing conclusions for the future development. The problems of standardization, data capture, economy, and exchange of experience in this field are also discussed.
Author (ESA)

N80-14438# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A PROGRAM FOR THE DESIGN OF GEOGRAPHICAL MAPS [EIN PROGRAMM ZUM ENTWERFEN UND ZEICHNEN GEOGRAPHISCHER NETZE]
Ingo Wilski *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 187-200 refs In GERMAN; ENGLISH summary (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01
A FORTRAN program for the design of geographical maps in the form of the presentation of the Earth's graticule and/or additional topographical information was developed. The characteristics and implementation of the program are described. Thirteen different projections are already available.
Author (ESA)

N80-14439# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AN ALGORITHM FOR THE LINEARIZATION OF RASTER IMAGES FOR MINICOMPUTERS [EIN ALGORITHMUS ZUR LINEARISIERUNG VON RASTERBILDERN FUER MINICOMPUTER]
Gerd Woetzel *In its* Inform. on Cartography and Geodesy. Ser. 1: Original Rept. No. 75 1978 p 201-210 refs In GERMAN; ENGLISH summary (For primary document see N80-14427 05-43)
Avail: NTIS HC A10/MF A01
Some results obtained when capturing automatically line structures by means of the raster scan method are presented. The algorithm used for the linearization is described. Finally, the possibility of implementation on minicomputers is pointed out.
Author (ESA)

N80-14440# European Space Agency, Paris (France).
SATELLITE REMOTE SENSING: APPLICATIONS IN AGROCLIMATOLOGY AND AGROMETEOROLOGY
Eric C. Barrett, ed. (Bristol Univ.) 1979 177 p refs Proc. of lectures of Joint ESA/Food and Agr. of UN/WMO Intern. Training Course, Rome, 2-13 Oct. 1978
(ESA-SP-1020; ISSN-0379-6566) Avail: NTIS HC A09/MF A01
The principles and potentials of satellite remote sensing as applied to agroclimatological and agrometeorological techniques

are considered. Major subjects of discussion include the theory behind remote sensing instrumentation and the interpretation of satellite observations. Various remote sensing programs are covered, such as the Earthnet program and the Agro-Ecological Zones Project. Also presented are numerous mathematical models which can be readily used with inputs of satellite imagery data. For individual titles, see N80-14441 through N80-14457.

N80-14441# Food and Agriculture Organization of the United Nations, Rome (Italy). Plant Production and Protection Div.
OVERVIEW OF AGROMETEOROLOGY
Michel Frere *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 3-7 (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

Agrometeorology, a branch of science which aims at using meteorological information to develop quantitatively and improve qualitatively the products of agriculture by taking maximum advantage of the favorable aspects of climate and minimizing the harmful effects of weather, is reviewed. Strategic aspects of agrometeorology, affecting long term planning of agriculture when envisaging agricultural projects or crop diversification in a given area, are considered. Tactical aspects of agrometeorology, concerning the short term influences of day to day weather on the development of crops and the evolution of their yield, are also discussed. Emphasis is placed on the interdisciplinary aspect of agrometeorology. Author (ESA)

N80-14442# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.
OVERVIEW OF REMOTE SENSING FOR AGRICLIMATOLOGY AND AGROMETEOROLOGY
John A. Howard *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 8-13 (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

The evolution of civilian applications of satellite remote sensing is reviewed. Emphasis is on the greater availability of sensing equipment and the application of more readily obtainable data to agrometeorology as well as to agroclimatology. A forward look into the development of satellite remote sensing is offered, considering Earth resources satellites and envir[illegible]ntal satellites. It is shown that good data on land surfaces, ocean surfaces, clouds, and atmospheric composition are now at the disposition of researchers and that emphasis should be placed on improving the quality and uniformity of these data. Author (ESA)

N80-14443# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.
PHYSICAL BACKGROUND OF REMOTE SENSING
W. D. Langeraar *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 14-19 (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

The physical principles of remote sensing are reviewed. After a brief discussion of the evolution of sensory data acquisition and interpretation, instruments, such as infrared detectors, seismometers, geiger-counters, and magnetometers, are considered. Emphasis is on the role of electromagnetic radiation in the detection of signals which would otherwise not be perceivable by human senses. Multispectral scanning data, like that available from LANDSAT, is taken as an example and spectral signatures are discussed. Finally, the spectral bands utilized by METEOSAT are also briefly treated. Author (ESA)

N80-14444# European Space Agency, Paris (France). Directorate of Planning and Future Programmes.
THE EARTHNET PROGRAMME
L. Mareli *In its* Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 20-27 (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

A European network for the acquisition, preprocessing, archiving, and distribution of remote sensing satellite data is decribed. Emphasis is placed on distribution of LANDSAT data and increased utilization of space derived remote sensing imagery. Establishment of a basic capacity to handle data from both American and European remote sensing satellites, to provide high standard products tailored to the needs of users, and to include second generation remote sensing missions such as LANDSAT-D, Seasat-B and C, space shuttle based remote sensing experiments, and planed European remote sensing missions for the first Spacelab flight is outlined. J.M.S.

N80-14445# Food and Agriculture Organization of the United Nations, Rome (Italy).
THE AGRO-ECOLOGICAL ZONES PROJECT
A. H. Kassam IN ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 32-33 refs (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

An estimate is made of what the production of the world's arable lands must be to support the world population in the year 2000. Different crops with widely varying climatic and soil requirements as well as different levels of agricultural technology are reviewed in order to assess the real world food production potential. The eleven crops considered are pearl millet, sorghum, maize, rice, wheat, phaseolus bean, soybean, cassava, sweet potato, white potato, and cotton. Results include a generalized map of agroclimatic suitability for the various crops and a land suitability assessment. Author (ESA)

N80-14446# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.
REMOTE SENSING APPLIED TO AGRICULTURE
J. A. Howard IN ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 36-42 ref (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

The ways in which remote sensing can be used to assist in providing information useful to food production are considered. In this respect remote sensing for agricultural crop estimates is seen as one of the most important inputs. The diagnostic characteristics used in analying remote sensing imagery, whether airborne or obtained by an Earth resources satellite, are discussed. They are summarized according to the type of sensing being undertaken. The formulation of agricultural crop estimates in then shown. Author (ESA)

N80-14447# Environmental Analysis and Remote Sensing, Delft (Netherlands).
THE APPLICATION OF THERMAL INFRARED REMOTE SENSING DATA TO SOIL MOISTURE AND EVAPORTATION DETERMINATION
I. A. Rosema *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 46-59 refs (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

The time and weather conditions that favor the extraction of information on soil moisture and evaporation from thermal imagery are discussed. Mathematical models of the relations in question are presented along with an algorithm for the interpretation of remotely sensed surface temperature imagery. Fields of application and the need for ground truth data are discussed. Application of the algorithm to crop irrigation is discussed. J.M.S.

N80-14448# European Space Operations Center, Darmstadt (West Germany). Meteosat Data Management Dept.
METEOSAT AND REMOTE SENSING APPLICATION
K. G. Lenhart *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 61-72 (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

The main characteristics of Meteosat and its associated ground system are described. The spacecraft orbit and attitude, mission objectives, and radiometer capabilities and image processing on the ground are discussed along with near real time image dissemination and the data collection platform sub-system. Remote sensing applications of Meteosat data are surveyed. J.M.S.

N80-14449# European Space Agency, Paris (France).
THE ESA REMOTE SENSING PROGRAM: PRESENT ACTIVITIES AND FUTURE PLANS
J. Plevin and I. Pryke *In its* Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 74-87 refs Presented

at ISP/IUERO Symp., Freiburg, July 1978 (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

The activities of the European Space Agency (ESA) concerning access to and development of remote sensing facilities are reviewed. European regional needs and priorities are emphasized, but aid programs to developing countries are also envisaged. Preparation of remote sensing experiments for use in Spacelab is discussed. The development of a metric camera and the microwave remote sensing experiment scheduled for the First Spacelab Payload are cited as examples. The organization of the Earthnet Program is then covered and ESA studies relating to the definition of other remote sensing satellite systems are summarized. Author (ESA)

N80-14450# Land Resource Research Inst., Ottawa (Ontario).
CROP WEATHER MODELS: CONCEPTS AND APPLICATIONS
W. Baier *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 88-93 refs (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

Various crop-weather analysis models are presented in order to illustrate the role of agrometeorology in scientific crop development. Those models presented include factorial yield models, empirical statistical yield models, and associated sub-models used in crop growth simulation studies. The separation of technological change from meteorological variability is then treated. An example showing time trends and weather variables in a multiple curvilinear regression analysis performed on data taken on the state of Illinois is cited. Finally, possible applications of crop-weather models are briefly assessed. Author (ESA)

N80-14451# Joint Research Centre of the European Communities, Ispra (Italy).
AGROCLIMATOLOGICAL METHODS INVOLVING REMOTE SENSING TECHNIQUES
G. Fraysse *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 94-115 refs (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

The application of remote sensing techniques to agrometeorology and crop monitoring is considered with emphasis on improving the agricultural productivity of developing countries. The data requirements for crop monitoring and yield forecasting models are discussed. The performance of Earth observation satellites and the advantages of the data collecting systems of the satellites are given. J.M.S.

N80-14452# Bristol Univ. (England). Climatology and Remote Sensing.
CROP ENVIRONMENT MONITORING: THE REMOTE SENSING SYSTEMS
E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 116-120 refs (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

Aircraft and LANDSAT imagery are evaluated for their usefulness in environmental monitoring programs. The favorable and unfavorable characteristics of weather satellite operations in this application are then outlined. A list of weather satellite systems which could contribute to crop environment monitoring is also given. Finally, the participation of weather satellites in international and national monitoring programs is reviewed. Author (ESA)

N80-14453# Bristol Univ. (England). Climatology and Remote Sensing.
PRACTICAL EXERCISE ON THE ANALYSIS OF VISIBLE AND INFRARED IMAGES FROM NOAA-5
E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 121-126 refs (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

A satellite nephanalysis (schematized cloud chart) of clouds portrayed by two simultaneous NOAA-5 images covering parts of the North Atlantic, North Africa, the Mediterranean, and southern Europe early in 1977 is prepared. The use of infrared imagery to assist interpretation and analysis of cloud fields is often profitable. General relationships between clouds in the visible and infrared are summarized. The conventional nephanalysis key is reproduced and a flow diagram setting out the sequence of constructional stages which should always be followed is given. Author (ESA)

N80-14454# Bristol Univ. (England). Climatology and Remote Sensing.
CROP ENVIRONMENT MONITORING: THE ASSESSMENT OF ENVIRONMENTAL PHENOMENA USING SATELLITE REMOTE SENSING DATA
E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 127-142 refs (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

The extension of agrometeorological statistics through the use of satellite data is examined. The environmental parameters or phenomena considered, ranked after the present utility and/or practicality of satellite remote sensing as an aid in their assessment, are: (1) rainfall, (2) temperature, (3) weather type and variability, and (4) cloud cover (radiation balance). For convenience, a differentiation is made between the atmospheric and pedologic environments of crops. In the first case the emphasis is on the utilization of weather satellite data for the extension of selected conventional meteorological statistics, the available in situ data are used as air or ground truth for the preparation, in effect, of meteorological trend surfaces upon which detail may be embroidered from satellite observations after these have been compared with, and calibrated by, the conventional data. In the second case there is a similar association of conventional and satellite soil intelligence, though in this case techniques to interdigitate the two have been less fully developed. Author (ESA)

N80-14455# Bristol Univ. (England). Climatology and Remote Sensing.
CROP MONITORING AND PREDICTION USING SATELLITE DATA
E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 149-158 refs (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

Analysis techniques used in making estimates of biomass (usually of natural or seminatural vegetation, especially in areas exploited for grazing) and in forecasting expected crop production (usually cultivated cereal crops) are studied. The use of LANDSAT spectral reflectance curves as prediction model inputs is emphasized. The use of statistical methods, agroclimatological methods, agrometeorological methods with crop prediction models is then considered. Results show clear advantages in the use of satellite data inputs for the monitoring of crops and in making harvest predictions. It is recommended that global schemes, based on these results, be initiated at least for certain crops in the near future in order to optimize agricultural resources. Author (ESA)

N80-14456# Bristol Univ. (England). Climatology and Remote Sensing.
SATELLITE REMOTE SENSING IN HAZARD MONITORING AND DISASTER EVALUATION
E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 157-163 refs (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

The potential applicability of satellite remote sensing to short term disaster monitoring is discussed. Emphasis is on different types of agricultural disasters, such as drought, high-intensity short-period rainfall and subsequent flooding as well as hurricanes or monsoons. It is shown that remote sensing can also be of assistance in the assessment of the areas, and therefore, the volumes and values of the crops involved. Finally, the use of satellite data as a check against qualitative data from other sources, especially for countries with an inadequate conventional network for the observation and reporting of environmental conditions, is suggested. Author (ESA)

N80-14457# Bristol Univ. (England). Climatology and Remote Sensing.
SATELLITE REMOTE SENSING FOR AGRICULTURAL ADVISORIES AND PLANNING
E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 164-185 (For primary document see N80-14440 05-43)
Avail: NTIS HC A09/MF A01

How an input of remote sensing data might be achieved to improve agroclimatological and related services in the various countries which stand to benefit from this technology is considered. Problems which commonly arise in the face of the implementation of new technologies are discussed. In spite of the individuals and organizations which would be interested in remote sensing data (farmers, farming communities, commercial firms, political organizations, humanitarian agencies), significant problems are foreseen in the widespread acceptance of remote sensing technology. Author (ESA)

N80-14458# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STUDY AND INVESTIGATION OF INFRARED MULTISPECTRAL TARGET CUEING TECHNIQUES Final Report, 22 Feb. - 6 Dec. 1978
Stephen R. Stewart and Jerry L. Beard Jun. 1979 156 p refs
(Contract DAAK70-77-C-0203)
(AD-A074799; ERIM-131500-9-F) Avail: NTIS HC A08/MF A01 CSCL 17/5

This report presents the results of a study to analyze and evaluate multispectral infrared target cueing algorithms using an infrared data base (in the 1 - 14 micrometers region) of tactical targets against real backgrounds. Using a modified M7 line scanner, simultaneous multispectral imagery of five bands in the 1 - 14 micrometers region were collected. A description of the collected infrared data base is given including discussions of the motivating factors in determining the spectral regions employed and target and background optical properties. Also, M7 system performance characteristics are examined. Finally, a preliminary evaluation of two different approaches to multispectral target cueing using the collected data base was accomplished. The results of both approaches, the first involving classical maximum likelihood classification using in-scene training and the second involving unsupervised spectral/spatial clustering followed by discrimination based upon size are reported. GRA

N80-14459# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
KALMAN FILTER PROCESSING OF POSITION AND DOPPLER RADAR MEASUREMENT IN COUPLED CARTESIAN COORDINATES
J. Buemmerstede Dec. 1978 84 p refs In GERMAN; ENGLISH summary
(Rept-274) Avail: NTIS HC A05/MF A01

An extended Kalman filter for processing three-dimensional RADAR data on fast maneuvering targets is presented. It takes into account the whole covariance matrix of measurement noise and includes the radial component of the velocity (Doppler) for the evaluation of the target state (position, velocity, and acceleration). The increase in calculation time induced by coupling the nine state components was restricted by systematic exploitation of the special structure of the algorithm such that the filter agrees with real time conditions. The filter is optimal in second order and allows for a considerably better estimation of state and separation of false echoes. The gain compared to simpler algorithms is shown. Author (ESA)

N80-14460# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
THREE DIMENSIONAL ADJUSTMENT OF THE 'WESTERN HARZ' TEST NETWORK [DREIDIMENSIONALE AUSGLEICHUNG DES TESTNETZES WESTHARZ]
Wolfgang Torge and Hans-Georg Wenzel 1978 60 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
(Ser-B-234; ISBN-3-7696-8532-6) Avail: NTIS HC A04/MF A01

The adjustment of the geodetic test network 'Western Harz' is carried out in a local three-dimensional Cartesian coordinate system. To investigate the weight of the different observation types (distances, horizontal angles, astronomic azimuths, latitudes and longitudes, reciprocal vertical angles, ellipsoidal height differences by geometric astronomic levelling) and their contribution to the coordinates, several different pre-adjustments are computed. The accuracy of the adjusted (mainly determined by the distances and the ellipsoidal height differences) is on the order of + or - 2 to 3 cm for the local x, y, and z axis. Finally, the adjusted coordinates are transformed to ellipsoidal coordinates referring to the DHDN datum and to three-dimensional geocentric coordinates with the help of vertical deflections and the geoid indulation computed from gravity anomalies. Author (ESA)

N80-14461# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
CALCULATION OF THE AZIMUTH OF THE SECTION BETWEEN HOHENPEISSENBERG AND TROMSOE FROM SIMULTANEOUS DIRECTION MEASUREMENTS OF A SATELLITE IN ORDER TO IMPROVE ON THE ORIENTATION OF THE EUROPEAN TRIANGULATION NETWORK (RETRIG) [BERECHNUNG DES AZIMUTS HOHENPEISSENBERG-TROMSOE AUS SIMULTANEN RICHTUNGSMESSUNGEN NACH SATELLITEN ZUR VERBESSERUNG DER ORIENTIERUNG DES EUROPAEISCHEN TRIANGULATIONS- NETZES (RETrig)]
Klaus Kaniuth and Rudolf Zernecke 1978 37 p refs In GERMAN; ENGLISH summary
(Contract SFB-78)
(Ser-B-236; ISBN-3-7696-8534-2) Avail: NTIS HC A03/MF A01

A formula system is given for deriving the azimuth of the normal section between two observation stations from simultaneous direction measurements of satellite positions considering all mathematical correlations. These formulas are applied to the computation of the azimuth between the trigonometric points Hohenpeissenberg (Federal Republic of Germany) and Tromsoe (Norway) from 27 points of photographic observation of the satellite Pageos. The result has an r.m.s. error of + or - 0.28 sec and agrees well with other satellite solutions. On the other hand, the azimuth derived from the first solution of adjustment phase 2 of the European Triangulation Network differs by 0.9 sec from the satellite azimuths. Author (ESA)

N80-14462# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON THE USE OF DIGITAL PHOTOGRAMMETRIC MEASUREMENTS IN THE COMPILATION OF TOPOGRAPHIC MAPS [BEITRAEGE ZUR DIGITALEN PHOTOGRAMMETRISCHEN MESSUNG FUER DIE HERSTELLUNG TOPOGRAPHISCHER KARTEN]
Hermann G. Neubauer 1978 125 p refs In GERMAN; ENGLISH summary Original contains color illustrations
(Ser-1-Original-Rept-76) Avail: NTIS HC A06/MF A01

The preparation of topographic maps is discussed. The technique where topographic maps are first prepared in the form of graphic manuscripts by applying photogrammetric methods is briefly reviewed. It is shown that attempts at a rationalization of map production leads, with the aid of digital data, to automated procedures. The measurements, the computations by means of electronic data processing equipment, and the output of field comparison documents are discussed. Author (ESA)

N80-14463# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 1: INTRODUCTION AND GENERAL SOCIAL CONTROLS Final Report, 1975 - 1978
Irving L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, Rodney K. Freed et al Mar. 1979 180 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
(Contract EPA-68-01-1916)
(PB-299177/6; EPA-600/7-79-060A-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 08I

The technologies likely to be used for development of coal,

oil shale, uranium, oil, natural gas, and geothermal resources in eight western states (Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming) are described. The technological activites such as exploration, extraction, and conversion for developing the resource, and laws and regulations which affect the development of more than one of the six resources are considered. GRA

N80-14464# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 2: COAL Final Report, 1975 - 1978
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, Rodney K. Freed et al Mar. 1979 395 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
(Contract EPA-68-01-1916)
(PB-299178/4; EPA-600/7-79-060B-Vol-2) Avail: NTIS HC A17/MF A01 CSCL 08I
The characteristics of coal resources in the western United States are described. A regional overview of number, size, and types of the coal mining operations conducted in Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming, is presented. Conversion technologies such as coal gasification, liquefaction, and electrical generation are discussed. R.C.T.

N80-14465# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 3: OIL SHALE Final Report, 1975 - 1978
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, Rodney K. Freed et al Mar. 1979 328 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
(Contract EPA-68-01-1916)
(PB-299179/2; EPA-600/7-79-060C-Vol-3) Avail: NTIS HC A15/MF A01 CSCL 08I
The development of oil shale resources in eight Western states (Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming) is discussed. The energy resource base, the technologies used to develop the resource, and the inputs and outputs for each technology development are summarized. The laws and regulations applying to the deployment and operation of each technology are examined. R.C.T.

N80-14466# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 4: URANIUM Final Report, 1975 - 1978
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, and Rodney K. Freed Mar. 1979 255 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
(Contract EPA-68-01-1916)
(PB-299180/0; EPA-600/7-79-060D-Vol-4) Avail: NTIS HC A12/MF A01 CSCL 08I
The technologies, inputs, outputs, laws and regulations associated with the development of uranium resources in eight western States (Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming) are described. The exploration, mining, and milling of uranium are discussed and technological alternatives which represent potential development options are sited. Input requirements such as manpower, materials and equipment, economics, water, land, and ancillary energy are reported. Residuals that may pose environmental hazards are surveyed. R.C.T.

N80-14467# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 5: OIL AND NATURAL GAS Final Report, 1975 - 1978
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, and Rodney K. Freed Mar. 1979 231 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
(Contract EPA-68-01-1916)
(PB-299181/8; EPA-600/7-79-060E-Vol-5) Avail: NTIS HC A11/MF A01 CSCL 08I
The quantity and location of crude oil are discussed. The development of crude oil from exploration to treatment of finished products and enhanced recovery techniques are described. The social controls for crude oil transportation are reported. R.C.T.

N80-14468# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 6: GEOTHERMAL Final Report, 1975 - 1978
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Marth Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, Rodney K. Freed et al Mar. 1979 221 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
(Contract EPA-68-01-1916)
(PB-299182/6; EPA-600/7-79-060F-Vol-6) Avail: NTIS HC A10/MF A01 CSCL 08I
The input requirements and outputs identified with the development and utilization of the geothermal resources of Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming are summarized. The characteristics of geothermal resources are discussed in terms of geology, location, quantity, physical and chemical characteristics and ownership. R.C.T.

N80-14469# Texas Technological Univ., Lubbock. Water Resources Center.
GROUNDWATER RESOURCES OF THE TEXAS HIGH PLAINS: STATE-OF-THE-ART AND FUTURE RESEARCH NEEDS Final Report
Robert M. Sweazy, Lloyd V. Urban, C. C. Reeves, Jr., and George A. Whetstone Nov. 1978 139 p refs Sponsored by NSF
(PB-298147/0; NSF/RA-780571) Avail: NTIS HC A07/MF A01 CSCL 13B
A comprehensive review of the Texas High Plains area is presented highlighting the problems, solution, and research needs where groundwater is the primary source supply for agriculture. Quantity related research studies that require research to develop methods of enabling these arid and semi-arid areas to be agriculturally productive include hydraulic properties of aquifers, irrigation efficiency, cultivation and cropping practices, well modification, and water reuse and importation. Quality related studies to be addressed are irrigation efficiency, reuse, infiltration, nitrate pollution, sludge disposal, and microbiological investigations. Among the most pressing economic studies needed in the field of irrigated agriculture are those related to economic models, energy, and water values. GRA

N80-14470# Environmental Monitoring and Support Lab., Las Vegas, Nev.
SURFACE WATER QUALITY PARAMETERS FOR MONITORING OIL SHALE DEVELOPMENT Final Report
W. L. Kinney, A. N. Brecheisen, and V. W. Lambou Mar. 1979 157 p refs
(PB-297984/7; EPA-600/4-79-018) Avail: NTIS HC A08/MF A01 CSCL 13B
Listings of chemical, physical, and biological parameters which can be used to assess the environmental impact of oil shale development on surface water resources are given. Each of the potential water-related problems is addressed in the context of the probable cumulative regional impact of a maturing, commercial oil shale industry and in terms of local impact resulting from the prototype operation initially planned on leased public lands. The possible effects of potential pollutants on ambient water quality and the resulting impact on aquatic life, public water supplies, livestock, irrigation agriculture, and selected industries are evaluated. GRA

N80-14471# New Mexico State Univ., Las Cruces.
DEEP TERRESTRIAL HEAT FLOW MEASUREMENTS IN NEW MEXICO AND NEIGHBORING GEOLOGIC AREAS Final Report, 1 Sep. 1976 - 30 Jun. 1978
Marshall Reiter Jun. 1979 85 p refs Prepared jointly with New Mexico Energy and Minerals Dept., Santa Fe and New Mexico Inst. of the Mining and Technology, Socorro
(Grant NSF GI-32482)
(PB-299489/5; NMEI-38) Avail: NTIS HC A05/MF A01 CSCL 08I

Experimental aspects of continuous temperature logging, vertical groundwater movement correction for heat flow, and terrestrial heat flow and crustal radioactivity in northeastern New Mexico and southern Colorado are described. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-14472* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-RECONFIGURING SOLAR CELL SYSTEM Patent
Robert P. Gruber, inventor (to NASA) Issued 20 Nov. 1979 10 p filed 19 Jun. 1978 Supersedes N78-27520 (16 - 18, p 2408)
(NASA-Case-LEW-12586-1; US-Patent-4,175,249; US-Patent-Appl-SN-916655; US-Patent-Class-323-15; US-Patent-Class-307-63; US-Patent-Class-307-66; US-Patent-Class-323-19) Avail: US Patent and Trademark Office CSCL 10A

A self-reconfiguring solar cell array is disclosed wherein some of the cells are switched so that they can be either in series or in shunt within the array. This feature of series or parallel switching of cells allows the array to match the load to achieve maximum power transfer. Automatic control is used to determine the conditions for maximum power operation and to switch the array into the appropriate configuration necessary to transfer maximum power to the load.

Official Gazette of the U.S. Patent and Trademark Office

N80-14473* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR CONCENTRATOR Patent
John G. Simpson, inventor (to NASA) Issued 6 Nov. 1979 6 p Filed 30 Nov. 1977 Supersedes N78-13556 (16 - 04, p 0499)
(NASA-Case-MFS-23727-1; US-Patent-4,173,397; US-Patent-Appl-SN-856465; US-Patent-Class-350-295; US-Patent-Class-126-438; US-Patent-Class-350-296; US-Patent-Class-126-442) Avail: US Patent and Trademark Office CSCL 10A

An improved solar concentrator is characterized by a number of elongated supporting members arranged in substantial horizontal parallelism with the axis and intersecting a common curve. A tensioned sheet of flexible reflective material is disposed in engaging relation with the supporting members in order to impart to the tensioned sheet a catenary configuration.

Official Gazette of the U.S. Patent and Trademark Office

N80-14474* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD FOR FORMING A SOLAR ARRAY STRIP Patent
Robert I. Mueller (JPL) and Robert K. Yasui, inventors (to NASA) (JPL) Issued 13 Nov. 1979 7 p Filed 29 Mar. 1978 Supersedes N78-25560 (16 - 16, p 2138) Division of US Patent Appl. SN-809890, filed 24 Jun. 1977, US Patent-4,133,697 sponsored by NASA
(NASA-Case-NPO-13652-3; US-Patent-4,173,820; US-Patent-Appl-SN-891358; US-Patent-Class-29-572; US-Patent-Class-29-588; US-Patent-Class-29-627; US-Patent-Class-136-89P; US-Patent-Appl-SN-809890; US-Patent-4,133,697) Avail: US Patent and Trademark Office CSCL 10A

A flexible solar array strip is formed by a method which lends itself to automatic production techniques. Solder pads are deposited on printed circuitry deposited on a flexible structure. The resultant substrate is stored on a drum from which it is withdrawn and incrementally advanced along a linear path. Solderless solar cells are serially transported into engagement with the pads which are then heated in order to attach the cells to the circuitry. Excess flux is cleaned from the cells which are encapsulated in a protective coating. The resultant array is then spirally wound on a drum.

Official Gazette of the U.S. Patent and Trademark Office

N80-14475 Oklahoma State Univ., Stillwater.
A PROBABILISTIC STUDY OF WIND-ELECTRIC CONVERSION SYSTEMS FROM THE POINT OF VIEW OF RELIABILITY AND CAPACITY CREDIT Ph.D. Thesis
Raghvendrarao Girirao Deshmukh 1979 167 p
Avail: Univ. Microfilms Order No. 7928197

Probabilistic models developed for wind energy conversion systems (WECS) are integrated with models of other power system components in order to evaluate the reliability of WECS assisted utility systems. A mathematical Weibull distribution function is used to model the actual wind speed distribution. It is shown that with a fixed wind regime and generation mix, an increase in the load demand causes only a slight increase in the risk index as long as the load value is less than or equal to the conventional generation capacity in the system. A load model based on the Markov chain with hourly peak load values is utilized in determining the load carrying capability of WECS assisted systems. The effect of including a transmission line is studied using two basic system configurations. It is shown that the interconnection of two WECS located in different wind regimes increases the availabilities of different capacities. Dissert. Abstr.

N80-14476 Mississippi State Univ., State College.
VISUALIZATION OF NATURAL CONVECTION IN FLAT PLATE SOLAR COLLECTORS Ph.D. Thesis
Benjamin Okechukwu Okeke 1979 154 p
Avail: Univ. Microfilms Order No. 7927095

The effects of variations in gap spacing on the convective heat flow patterns between the collector surface and the glazing were determined. Visual and photographic observations were made through transparent plexiglas side walls, using tobacco smoke to make the flow patterns visible. Results indicate that the critical Rayleigh number was only marginally dependent on variations to the air gap width. A substantial increase in the critical Rayleigh number was observed as the horizontal temperature gradient was increased. The first sign of natural convection was seen to be a set of steady side-by-side transverse rolls increasing in size towards the higher temperature end of the test enclosure. Representative still photographs of the observed flow patterns are presented. Dissert. Abstr.

N80-14477 Kentucky Univ., Lexington.
PHOTOVOLTAIC ENERGY CONVERSION IN POLYMER FILMS Ph.D. Thesis
Harin Shrinivas Ullal 1979 219 p
Avail: Univ. Microfilms Order No. 7927725

Photovoltaic energy conversion in poly-n-vinyl carbazole (PVK) and 2,4,7-trinitro-9-fluorenone (TNF) in the ratio (1:1) was investigated. It was determined that the maximum photovoltaic energy conversion efficiency is controlled by two critical parameters, namely the barrier height and the film thickness. The energy conversion efficiency was found to increase significantly by using low work function metal electrodes such as Sm. Conversely, by using high work function metal electrodes such as Pt, there is a marked decrease in the energy conversion efficiency. Also, there is a dramatic change in the energy conversion efficiency when there is a change in the film thickness. Model predictions and results of photoemission, dark current, and photocurrent studies are given. Dissert. Abstr.

N80-14478# PRC Energy Analysis Co., McLean, Va.
SATELLITE POWER SYSTEM (SPS): AN OVERVIEW OF PROSPECTIVE ORGANIZATIONAL STRUCTURES IN THE SOLAR SATELLITE FIELD
H. G. Edler Oct. 1978 19 p refs
(Contract EG-77-C-01-4024)
(TID-29094) HC A02/MF A01

A literature survey, interviews with acknowledged experts in the fields of organizational entities, space, solar energy, and the SPS concept, and an analysis of these inputs to identify the organizational alternatives and make judgments as to their feasibility to serve as patterns for a future SPS entity are presented. Selection and evaluation criteria were determined to include timeliness, reliability, and adequacy to contribute meaningfully to the U.S. supply; political feasibility (both national and international) and cost-effectiveness (including environmental and other external costs). Based on these criteria, four organizational alternatives are discussed which offer reasonable promise as potential options for SPS. These included three domestic alternatives and one international alternative. DOE

N80-14479*# National Aeronautics and Space Administration, Washington, D. C.
POWER FACTOR CONTROLLER
28 Feb. 1979 41 p Conf. held at Washington, D.C., 28 Feb. 1979 Tape Transcript
(NASA-TM-80755; P79-10188) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 10B

The power factor controller, and energy-saving device for electric motors, is presented. The commercialization of the device is discussed and its applications are described. R.E.S.

N80-14480*# Power Electronics Associates, Inc., Lincoln, Mass.
BI-DIRECTIONAL FOUR QUADRANT (BDQ4) POWER CONVERTER DEVELOPMENT Final Report
Francis C. Schwarz 20 Dec. 1979 249 p refs
(Contract NAS3-30363)
(NASA-CR-159660) Avail: NTIS HC A11/MF A01 CSCL 10B

The feasibility for implementation of a concept for direct ac/dc multikilowatt power conversion with bidirectional transfer of energy was investigated. A 10 kHz current carrier was derived directly from a common 60 Hz three phase power system. This carrier was modulated to remove the 360 Hz ripple, inherent in the three phase power supply and then demodulated and processed by a high frequency filter. The resulting dc power was then supplied to a load. The process was implemented without the use of low frequency transformers and filters. This power conversion processes was reversible and can operate in the four quadrants as viewed from any of the two of the converter's ports. Areas of application include: power systems on air and spacecraft; terrestrial traction; integration of solar and wind powered systems with utility networks; HVDC; asynchronous coupling of polyphase networks; heat treatment; industrial machine drives; and power supplies for any use including instrumentation. R.C.T.

N80-14481*# Burt, Hill, Kosar, Rittleman, and Associates, Butler, Pa.
RESIDENTIAL PHOTOVOLTAIC MODULE AND ARRAY REQUIREMENTS STUDY, APPENDICES Final Report
S. L. Nearhoof and J. R. Oster Jun. 1979 560 p Sponsored by NASA Prepared for JPL and DOE
(Contract JPL-955149)
(NASA-CR-162529; DOE/JPL-955149-79/1-App) Avail: NTIS HC A24/MF A01 CSCL 10B

Regional building code variations, federal and city codes, and the national electric code are reviewed for their possible effects on the design of photovoltaic modules. Problems that photovoltaic arrays may impose on the insurability of residences are also discussed. Mounting configurations are developed for the modules, and grounding, wiring, terminal, and voltage requirements are established. Installation and materials costs are presented along with performance criteria. K.L.

N80-14482*# Burt, Hill, Kosar, Rittleman, and Associates, Butler, Pa.
RESIDENTIAL PHOTOVOLTAIC MODULE AND ARRAY REQUIREMENTS STUDY Final Report
S. L. Nearhoof and J. R. Oster Jun. 1979 64 p refs Prepared for JPL and DOE
(Contract JPL-955149)
(NASA-CR-162528; DOE/JPL-955149-79/1) Avail: NTIS HC A04/MF A01 CSCL 10B

Design requirements for photovoltaic modules and arrays used in residential applications were identified. Building codes and referenced standards were reviewed for their applicability to residential photovoltaic array installations. Four installation types were identified - integral (replaces roofing), direct (mounted on top of roofing), stand-off (mounted away from roofing), and rack (for flat or low slope roofs, or ground mounted). Installation costs were developed for these mounting types as a function of panel/module size. Studies were performed to identify optimum module shapes and sizes and operating voltage cost drivers. It is concluded that there are no perceived major obstacles to the use of photovoltaic modules in residential arrays. However, there is no applicable building code category for residential photovoltaic modules and arrays and additional work with standards writing organizations is needed to develop residential module and array requirements. K.L.

N80-14483*# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF AN ACCELERATED TEST DESIGN FOR PREDICTING THE SERVICE LIFE OF THE SOLAR ARRAY AT MEAD, NEBRASKA Final Report
G. B. Gaines, R. E. Thomas, G. T. Noel, T. S. Shilliday, V. E. Wood, and D. C. Carmichael 7 Jun. 1979 61 p refs Prepared for JPL and DOE
(Contract JPL-954328)
(NASA-CR-162534; DOE/JPL-954328-79/13) Avail: NTIS HC A04/MF A01 CSCL 10A

An accelerated life test is described which was developed to predict the life of the 25 kW photovoltaic array installed near Mead, Nebraska. A quantitative model for accelerating testing using multiple environmental stresses was used to develop the test design. The model accounts for the effects of thermal stress by a relation of the Arrhenius form. This relation was then corrected for the effects of nonthermal environmental stresses, such as relative humidity, atmospheric pollutants, and ultraviolet radiation. The correction factors for the nonthermal stresses included temperature-dependent exponents to account for the effects of interactions between thermal and nonthermal stresses on the rate of degradation of power output. The test conditions, measurements, and data analyses for the accelerated tests are presented. Constant-temperature, cyclic-temperature, and UV types of tests are specified, incorporating selected levels of relative humidity and chemical contamination and an imposed forward-bias current and static electric field. R.E.S.

N80-14484*# General Electric Co., Cincinnati, Ohio.
A CONCEPTUAL DESIGN STUDY ON THE APPLICATION OF LIQUID METAL HEAT TRANSFER TECHNOLOGY TO THE SOLAR THERMAL POWER PLANT Final Report
W. F. Zimmerman, C. S. Robertson, C. L. Ehde, S. M. Divakaruni, and L. E. Stacy 25 Sep. 1979 166 p refs Sponsored by NASA Prepared for JPL and DOE
(Contract JPL-955018)
(NASA-CR-162544; DOE/JPL-1060/28; GEAEP-54) Avail: NTIS HC A08/MF 01 CSCL 10A

Alkali metal heat transfer technology was used in the development of conceptual designs for the transport and storage of sensible and latent heat thermal energy in distributed concentrator, solar Stirling power conversion systems at a power level of 15 kWe per unit. Both liquid metal pumped loop and heat pipe thermal transport were considered; system configurations included: (1) an integrated, focal mounted sodium heat pipe solar receiver (HPSR) with latent heat thermal energy storage; (2) a liquid sodium pumped loop with the latent heat storage, Stirling engine-generator, pump and valves located on the back side of the concentrator; and (3) similar pumped loops serving several concentrators with more centralized power conversion and storage. The focus mounted HPSR was most efficient, lightest and lowest in estimated cost. Design confirmation testing indicated satisfactory performance at all angles of inclination of the primary heat pipes to be used in the solar receiver. Author

N80-14485*# Coors Porcelain Co., Golden, Colo.
DEVELOPMENT OF MULLITE SUBSTRATES AND CONTAINERS Final Report, 7 Oct. 1977 - 15 Apr. 1979
J. D. Sibold 20 Apr. 1979 55 p Sponsored by NASA Prepared for JPL and DOE
(Contract JPL-954878)
(NASA-CR-162543; DOE/JPL-954878-79/5) Avail: NTIS HC A04/MF A01 CSCL 10A

The mullite-molten silicon interaction was evaluated through fabrication of a series of bodies made with variations in density, alumina-silica ratio, and glass-crystalline ratio. The materials were tested in a sessile drop technique. None of the variations stood up to extended exposure to molten silicon sufficiently to be recommended as a container material. However, directional solidification experiments suggest that, under proper conditions, contamination of the silicon by mullite containers can be minimized. To improve an already good thermal expansion match between mullite and silicon, compositional variations were studied. Altering of the alumina-silica ratio was determined to give a continuously varying thermal expansion. A standard mullite composition was selected and substrates 40 x 4 x .040 inches were fabricated. Slotted substrates of various configurations and various compositions were also fabricated. R.E.S.

N80-14486*# Springborn Labs., Inc., Enfield, Conn.
INVESTIGATION OF TEST METHODS, MATERIAL PROPERTIES, AND PROCESSES FOR SOLAR CELL ENCAPSULANTS Annual Report
P. B. Willis and B. Baum Jun. 1979 122 p Prepared for DOE and JPL
(Contracts NAS7-100; JPL-954527)
(NASA-CR-162542; DOE/JPL-954527-79/10) Avail: NTIS HC A06/MF A01 CSCL 10A

The reformulation of a commercial grade of ethylene/vinyl acetate copolymer for use as a pottant in solar cell module manufacture was investigated. Potentially successful formulations were prepared by compounding the raw polymer with antioxidants, ultraviolet absorbers and crosslinking agents to yield stabilized and curable compositions. The resulting elastomer was found to offer low cost (approximately $0.80/lb.), low temperature processability, high transparency (91% transmission), and low modulus. Cured specimens of the final formulation endured 4000 hours of fluorescent sunlamp radiation without change which indicates excellent stability. R.E.S.

N80-14487*# Purdue Univ., Lafayette, Ind.
ANALYSIS AND SIMULATION OF WIND ENERGY SYSTEMS Final Report
P. C. Krause Nov. 1979 60 p refs
(Grant NsG-3237)
(NASA-CR-162538) Avail: NTIS HC A04/MF A01 CSCL 10A

Using a wind fluctuation model, simulation results of the mechanical and electrical systems were obtained for the MOD-2 wind turbine generator system. The dynamic performance of the MOD-2 was studied during wind gusts of the 1-cos form from a constant wind velocity. If these are the type of wind fluctuations to which the wind systems will be subjected to, then the design of the MOD-2 appears adequate. There was one exception to this; with a rate limit incorporated in the pitch controller, an instability occurred during a 'down' gust which caused continuous, unbounded switching between the high and low modes. This is a control design problem which appears to be correctable. R.E.S.

N80-14488*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
APPLICATION OF FIELD-MODULATED GENERATOR SYSTEMS TO DISPERSED SOLAR THERMAL ELECTRIC GENERATION
R. Ramakumar 15 Aug. 1979 94 p refs Sponsored in part by DOE
(Contract NAS7-100; JPL Proj. 5102-136)
(NASA-CR-162536; JPL-Pub-79-83; DOE/JPL-1060-25) Avail: NTIS HC A05/MF A01 CSCL 10A

The state-of-the-art of field modulated generation system (FMGS) is presented, and the application of FMGS to dispersed solar thermal electric generation is discussed. The control and monitoring requirements for solar generation system are defined. A comparison is presented between the FMGS approach and other options and the technological development needs are discussed. R.E.S.

N80-14489*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ENVIRONMENTAL TESTING OF BLOCK 3 SOLAR CELL MODULES. PART 1: QUALIFICATION TESTING OF STANDARD PRODUCTION MODULES
John S. Griffith 1 Sep. 1979 21 p refs Sponsored in part by DOE
(Contract NAS7-100)
(NASA-CR-162547; JPL-Pub-79-96; DOE/JPL-1012-30) Avail: NTIS HC A02/MF A01 CSCL 10A

Qualification tests of solar cell modules are described. These modules continue to show improvement over earlier type modules tested. Cell cracking and delamination are less prevalent, and interconnect problems and electrical degradation from environmental testing are now rare. R.E.S.

N80-14490*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FRACTURE STRENGTH OF SILICON SOLAR CELLS
C. P. Chen 15 Oct. 1980 69 p refs
(Contracts NAS7-100; EX-76-A-29-1012; JPL Proj. 5101-137)
(NASA-CR-162540; DOE/JPL-1012-32; JPL-Pub-79-102) Avail: NTIS HC A04/MF A01 CSCL 10A

A test program was developed to determine the nature and source of the flaw controlling the fracture of silicon solar cells and to provide information regarding the mechanical strength of cells. Significant changes in fracture strengths were found in seven selected in-process wafer-to-cell products from a manufacturer's production line. The fracture strength data were statistically analyzed and interpreted in light of the exterior flaw distribution of the samples. R.E.S.

N80-14491*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SOLAR THERMAL POWER SYSTEMS ADVANCED SOLAR THERMAL TECHNOLOGY PROJECT, ADVANCED SUBSYSTEMS DEVELOPMENT Semiannual Progress Report, 1 Oct. 1978 - 1 Apr. 1979
15 Aug. 1979 110 p Original contains color illustrations
(Contracts NAS7-100; DE-AI01-79ET-20307; JPL Proj. 5102-117)
(NASA-CR-162546; DOE/JPL-1060-20; JPL-Pub-79-107; SAPR-3) Avail: NTIS HC A06/MF A01 CSCL 10B

The preliminary design for a prototype small (20 kWe) solar thermal electric generating unit was completed, consisting of several subsystems. The concentrator and the receiver collect solar energy and a thermal buffer storage with a transport system is used to provide a partially smoothed heat input to the Stirling engine. A fossil-fuel combustor is included in the receiver designs to permit operation with partial or no solar insolation (hybrid). The engine converts the heat input into mechanical action that powers a generator. To obtain electric power on a large scale, multiple solar modules will be required to operate in parallel. The small solar electric power plant used as a baseline design will provide electricity at remote sites and small communities. Author

N80-14492*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SILICON MATERIALS OUTLOOK STUDY FOR 1980-1985 CALENDAR YEARS
E. Costogue, R. Ferber, W. Hasbach, R. Pellin, and C. Yaws 1 Nov. 1979 74 p refs Sponsored in part by DOE
(Contract NAS7-100; JPL Proj. 5230-1-Rev-A)
(NASA-CR-162541; JPL-Pub-79-110; DOE/JPL-1012-33) Avail: NTIS HC A04/MF A01 CSCL 10A

The polycrystalline silicon industry was studied in relation to future market needs. Analysis of the data obtained indicates that there is a high probability of polycrystalline silicon shortage by the end of 1982 and a strong seller's market after 1981 which will foster price competition for available silicon. R.E.S.

N80-14493*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF THE DOE/NASA CRITICAL GAS TURBINE RESEARCH AND TECHNOLOGY PROJECT
John S. Clark 1980 21 p refs Proposed for presentation the 25th Annual Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by the Am. Soc. of Mech. Engineers
(Contract EF-77-A-01-2593)
(NASA-TM-79307; DOE/NASA/2593-79/11; E-263) Avail: NTIS HC A02/MF A01 CSCL 10B

Activities performed in order to provide an R&T data base for utility gas turbine systems burning coal-derived fuels are described. Experiments were run to determine the corrosivity effects of trace metal contaminants (and potential fuel additives) on gas turbine materials and these results were correlated in a corrosion-life prediction model. Actual fuels were burned in a burner rig hot corrosion test to verify the model. A deposition prediction model was assembled and compared with results of actual coal-derived fuel deposition tests. Thermal barrier coatings were tested to determine their potential for protecting gas turbine hardware from the corrosive contaminants. Several coatings were identified with significantly improved spallation-resistance (and, hence, corrosion resistance). A.R.H.

N80-14494# Rensselaer Polytechnic Inst., Troy, N. Y. Center for Architectual Research.
BARRIERS TO THE APPLICATION OF WIND ENERGY CONVERSION SYSTEMS IN URBAN SETTINGS
Robert E. Duffy, Walter M. Kroner, ed., Michael Kwartler, and George W. Ulseth Dec. 1979 176 p refs Sponsored by New York State Energy Res. and Develop. Authority
Avail: NTIS HC A09/MF A01

The issues which arise through such activities as the planning/building regulatory process, location selection, mounting or installation, and operation and maintenance of wind energy conversion systems (WECS) were identified and analyzed in relation to their legal environmental, technical, institutional, economic, safety, and social impacts. Case studies and simulation were performed, and potential differences in barriers described in national publications were compared with conditions unique to the northeast region and/or to New York State. Those urban areas in New York State where sufficiant wind power is available for WECS consideration were identified, and the legal instruments and jurisdictional constraints relevant to them were analyzed. A.R.H.

N80-14495*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT AND TESTING OF THE JUNKEEPER CONTROL CORPORATION INTEGRATED PROGRAMMABLE ELECTRONIC CONTROLLER AND HYDRONICS PACKAGE Final Report
James D. Hankins Aug. 1979 21 p refs
(NASA-TM-78244) Avail: NTIS HC A02/MF A01 CSCL 10A

Additional developmental work on the existing programmable electronic controller and hydronic package for use with solar heating and cooling systems is summarized. The controller/hydronics subsystems passed all acceptance tests and performance criteria. The subsystems were shown marketable for public use. R.E.S.

N80-14496*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT AND TESTING OF THE RHO SIGMA INCORPORATED MICROPROCESSOR CONTROL SUBSYSTEM Final Report
James D. Hankins Oct. 1979 23 p refs Sponsored in part by DOE
(Contract NAS8-32256)
(NASA-TM-78246) Avail: NTIS HC A02/MF A01 CSCL 10A

Product development and performance tests of three programmable microprocessor controllers for use with solar heating and cooling systems are presented. The products were developed to be marketable for public use. R.E.S.

N80-14497*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
THERMAL PERFORMANCE EVALUATION OF THE SUNCATCHER SH-11 (LIQUID) SOLAR COLLECTOR
Jul. 1980 22 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161253) Avail: NTIS HC A02/MF A01 CSCL 10A

The procedures used and the results obtained during the evaluation test program on the Solar Unlimited, Inc., Suncatcher SH-11 (liquid) solar collector are presented. The flat-plate collector case assembly is made of .08 inch aluminum 3003 H14 riveted with fiberglass board insulation. The absorber consists of collared aluminum fins mechanically bonded to 3/8 inch copper tubing and coated with 3M Nextel black. Water is used as the working fluid. The glazing is made of a single glass, 1/8 inch water white, tempered and antireflective. The collector weight is 85 pounds with overall external dimensions of about 35.4 in x 82.0 in x 4.0 in. Thermal performance data on the Solar Unlimited Suncatcher SH-11 solar collector under simulated conditions were conducted using the MSFC Solar Simulator. M.M.M.

N80-14498*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT AND TESTING OF THE SOLAR CONTROL CORPORATION MODULAR CONTROLLER AND SOLARSTAT SUBSYSTEM Final Report
James D. Hankins Aug. 1979 15 p refs Prepared for DOE Prepared by Solar Control Corp., Boulder, Colo.
(Contract NAS8-32258)
(NASA-TM-78243) Avail: NTIS HC A02/MF A01 CSCL 10A

Results of development work on an existing controller and solarstat subsystem for use with solar heating and cooling systems are presented. The deliverable end items, program objectives, and how they were accomplished are described. It is shown that the products developed are marketable and suitable for public use. J.M.S.

N80-14499*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT, TESTING AND CERTIFICATION OF THE SIGMA RESEARCH, MAXI-THERM-S-101 THERMOSYPHON HEAT EXCHANGER Final Report
James D. Hankins Oct. 1979 19 p refs
(NASA-TM-78245) Avail: NTIS HC A02/MF A01 CSCL 10A

A thermosyphon liquid-to-air heat exchanger developed for use in heating systems in residential single family dwellings and small commercial applications is described. The cabinet design, rationale for the horizontal positioning of the exchanger, and design of the shut-off valve are discussed. The performance of the heating module is given in tabular form. J.M.S.

N80-14500*# Wyle Labs., Inc., Huntsville, Ala.
RESULTS OF THERMAL PERFORMANCE EVALUATION OF THE OWENS-ILLINOIS SUNPACK LIQUID SOLAR COLLECTOR AT INDOOR CONDITIONS
10 Oct. 1979 28 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161189) Avail: NTIS HC A03/MF A01 CSCL 10A

Test procedures and results of the thermal performance of a liquid, evacuated tube, solar collector under simulated conditions are presented. The collector tested was a module used on the early demonstration projects. R.E.S.

N80-14501*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPUTER PROGRAM FOR ASSESSING THE ECONOMIC FEASIBILITY OF SOLAR ENERGY FOR SINGLE FAMILY RESIDENCES AND LIGHT COMMERCIAL APPLICATIONS
J. Alan Forney (Systems Analysis and Integration Lab.), David Walker (Computer Sciences Corp., Huntsville, Ala.), and Mike Lanier (Computer Sciences Corp., Huntsville, Ala.) Sep. 1979 147 p
(NASA-TM-78251) Avail: NTIS HC A07/MF A01 CSCL 10B

Computer program, SHCOST, was used to perform economic analyses of operational test sites. The program allows consideration of the economic parameters which are important to the solar system user. A life cycle cost and cash flow comparison is made between a solar heating system and a conventional system. The program assists in sizing the solar heating system. A sensitivity study and plot capability allow the user to select the most cost effective system configuration. M.G.

N80-14502# Boston Univ., Mass. Dept. of Chemistry.
PHOTOSENSITIZATION MECHANISMS FOR ENERGY STORING ISOMERIZATIONS Technical Report, 1 Nov. 1976 - 28 F[illegible] 1979
Guilford Jones, II, Phan Thanh Xuan, and Sheau Hwa Chiang 1 Jul. 1979 32 p refs
(Contract N00014-76-C-0442)
(AD-A074968; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/4

The results of a study of photochemical storage of radiant energy in organic molecules are reviewed and prospects for the reversible storage of solar energy outlined. A number of intramolecular cycloaddition reactions are identified as candidates for efficient photochemical energy storage and findings concerning the mechanisms of these reactions are discussed. Strategies for the photosensitization of reactions to visible light are evaluated. The use of wavelengths past 500 nm is demonstrated for an energy storing isomerization which is efficiently driven by a triplet energy transfer mechanism. GRA

N80-14503# Boston Univ., Mass. Dept. of Chemistry.
ENERGY STORING ORGANIC PHOTOREACTIONS Final Report, 1 Nov. 1975 - 28 Feb. 1979
G. Jones, II 1 Aug. 1979 11 p refs
(Contract N00014-76-C-0442)
(AD-A074915) Avail: NTIS HC A02/MF A01 CSCL 10/3

Results of a study of energy storing organic photoreactions are summarized. Discussion includes criteria for efficient photon energy storage, quantum yield and other quantitative results for a variety of photoisomerization and photoaddition reactions, the nature of intermediates for these photoreactions, photochemistry of charge-transfer complexes, and prospects for photochemical storage of solar energy. GRA

N80-14504# Dayton Univ., Ohio. School of Engineering.
ANALYSIS OF REMOTE SITE ENERGY STORAGE AND GENERATION SYSTEMS Final Technical Report, Jul. 1978 - Jun. 1979
J. N. Crisp, W. S. Bishop, J. D. Pinson, and L. A. Anderson Jul. 1979 148 p refs
(Contract F33615-77-C-2004)
(AD-A074869; UDR-TR-79-35; UDSE-TR-79-02; AFESC/ESL-TR-79-20) Avail: NTIS HC A07/MF A01 CSCL 10/2

This report presents the results of an investigation and analysis of energy storage systems and alternate energy sources for remote site applications. The first phase of the effort centered on the broad based study of hydrogen storage, thermal storage, batteries, and flywheels as energy storage systems along with wind turbine, solar photovoltaic, and solar thermionic energy converters. A wind turbine battery system was recommended based on performance, cost and availability. Effort under the second phase of the program concentrated on a system using two separate nominal eight kilowatt wind turbine modules in conjunction with a lead-acid battery energy storage unit. The system was specified to operate in conjunction with an existing power grid system located at Bar Main, Barter Island, Alaska. Specific system concepts and recommendations are presented with supporting analyses. A design checklist is included with specific items for consideration in the preparation of a design specification. GRA

N80-14505# GTE Sylvania, Inc., Needham Heights, Mass. Communications Systems Div.
LITHIUM INORGANIC ELECTROLYTE BATTERY DEVELOPMENT Interim Report, Jun. 1977 - Oct. 1978
F. Goebel Apr. 1979 60 p refs
(Contract F33615-77-C-2021; AF Proj. 3145)
(AD-A073858; AFAPL-TR-79-2026) Avail: NTIS HC A04/MF A01 CSCL 10/3

This report presents the results of the first half of a three year program to conduct exploratory development to improve the safety/performance characteristics of lithium anode/inorganic electrolyte batteries. Development has been conducted in 3 major areas: capacity retention of cylindrical cells, low temperature capability of cylindrical cells, and abuse tests of cylindrical and prismatic cells. Significant accomplishments include providing capacity down to the 3.0 volt level cutoff at -40 degrees and no venting or explosion of cells during abuse tests, except during incineration when it is expected. GRA

N80-14506# Eagle-Picher Industries, Inc., Joplin, Mo. Couples Dept.
IMPROVED THERMAL BATTERY PERFORMANCE Final Report, Jun. 1976 - Feb. 1979
James A. DeGruson Jun. 1979 79 p refs
(Contract F33615-76-C-2074; AF Proj. 3145)
(AD-A073856; AFAPL-TR-79-2042) Avail: NTIS HC A05/MF A01 CSCL 10/3

During the course of this program, Eagle-Picher Industries, Inc. has developed a thermal battery which has demonstrated an energy density in excess of 17 watt-hours per pound. This advancement of approximately three times the energy density of thermal batteries was accomplished with the lithium aluminum iron disulfide system. The technology necessary to manufacture a thermal battery which will produce 28 volts at 30 amperes for 30 minutes has been achieved. GRA

N80-14507# Coast Guard Research and Development Center, Groton, Conn.
EVALUATION OF SOLAR PHOTOVOLTAIC ARRAYS FOR USE ON MARINE AIDS TO NAVIGATION Final Report, May 1974 - Jul. 1978
R. K. Kostuk 30 Mar. 1979 32 p refs
(AD-A074893; CGR/DC-7/79; USCG-D-43-79) Avail: NTIS HC A03/MF A01 CSCL 10/2

During the period from May 1974 to July 1978, four test and evaluation programs of solar photovoltaic arrays were conducted to evaluate the potential of these energy sources for use on marine aids to navigation. Array testing consisted of: long-term rooftop exposure; field deployment on buoys in Alaska, Florida, and Massachusetts; field deployment on buoys in Long Island Sound; and initial development of a screening test to evaluate performance in a short time frame. The results of these tests are presented. GRA

N80-14508# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR HYDROTHERMAL ELECTRIC AND DIRECT HEAT APPLICATION
R. A. Black, J. V. Dionne, L. Falick, and E. B. Harvey [1979] 98 p
(TID-2884-Draft) Avail: NTIS HC A05/MF A01

The use of vapor dominated hydrothermal resources for production of electric power is discussed. The ability to handle high temperature, low to moderate-salinity geofluids and convert the heat to usable power using existing technology is reviewed. The use of high temperature, high salinity brines, and moderate temperature resources is examined for economic operation. Technical risks and environmental acceptability are discussed along with technical, market/economic, environmental, institutional readiness, and benefit analysis. A commercialization plan for hydrothermal electric and direct heat applications is presented. DOE

N80-14509# Oak Ridge National Lab., Tenn.
OUTLOOK FOR NUCLEAR FISSION ENERGY
T. D. Anderson 1978 14 p refs Presented at 2d Ann. Intern. Conf. on Energy, Washington, D.C.
(Contract W-7405-eng-26)
(CONF-7811126-1) Avail: NTIS HC A02/MF A01

The status of nuclear power as an energy source is discussed. The development of light water breeder reactors for electric power generation is examined. Present nuclear energy research and development are reported. The electric utility industry's commitment to nuclear power and the effects of the energy crisis on the nuclear power inudstry are examined. A.W.H.

N80-14510# Little (Arthur D.), Inc., Cambridge, Mass.
ENERGY ANALYSIS OF THE BASIC MATERIALS UTILIZED IN ELECTRIC POWER TRANSMISSION SYSTEMS
30 Apr. 1979 353 p
(Contract EC-77-C-01-5043)
(HCP/T5043-01) Avail: NTIS HC A16/MF A01

The energy content per mile of installed underground and overhead power transmission systems was calculated for the following types of systems: self contained oil filled cables; HPOF pipe type cables; extruded dielectric cables; compressed gas insulated systems; overhead lines (ac and dc); and two proposed superconducting systems (ac and dc). The system operating voltages analyzed included 138, 230, 345, 500, 765 and 1,200 kV for ac systems. Systems were not analyzed at the higher voltages. Installation energy requirements, generally 10% or less of the inherent system energy content based on the materials used in each system, are discussed. The energy content of 36 materials and basic products, in terms of Btu per ton, was calculated. Substitution of conductor materials (e.g., aluminum for copper) in cable systems are examined in relation to total system energy content. DOE

N80-14511# Tennessee Univ., Knoxville. Dept. of Civil Engineering.
SIMULATION APPROACH FOR BASE-LINE ENERGY-SITING ANALYSIS
R. L. Church and E. L. Hillsman (Oak Ridge Natl. Lab., Tenn.) 1979 16 p refs Presented at Instrument Soc. of Am., Pittsburgh Modeling and Simulation Conf., Pittsburgh, 25 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790459-22) Avail: NTIS HC A02/MF A01

A simulation model for predicting regional energy-siting patterns is discussed. The model results are used to project regional environmental and economic impacts for DOE. Emphasis is placed on modifications, which include casting the siting decision within a multiobjective framework and including intermediate optimizing capabilities to meet water resource and other constraints. DOE

N80-14512# Brookhaven National Lab., Upton, N. Y.
HIGHLIGHTS OF THE ENERGY TECHNOLOGY PROGRAMS Annual Report
Dec. 1978 49 p
(Contract EY-76-C-02-0016)
(BNL-50959) Avail: NTIS HC A03/MF A01

Activities in: electrolysis based hydrogen energy storage systems; an electrochemically regenerative hydrogen-halogen energy storage system; fuel cells (materials and electrolysis); high temperature water electrolysis; and hydrogen energy storage systems for automobile propulsion are summarized. Energy programs reported on include: solar assisted heat pump systems; solar cooling subsystems and systems; solar demonstration projects; hardware simulators for tests of solar cooling/heating systems; fossil energy programs; catalytic process for conversion of synthesis gas to methanol; coal fired heater; coal/oil mixture combustion; rotating fluidized bed containing limestone for removal of sulfur from hot gases; improved oil and gas burners; and residue and waste fuels. DOE

N80-14513# Sandia Labs., Albuquerque, N. Mex.
Li/FeS2 SYSTEM FOR THERMAL BATTERIES
D. M. Bush Jun. 1979 29 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0470) Avail: NTIS HC A03/MF A01

Lithium alloys were substituted for the Mg anodes in both platen-heated single cells and pyrotechnically activated batteries and gave 0.5 V or 33% more voltage per cell than Mg. Both Li-Al(20 w/o Li) and Li-Si(40 to 53 w/o Li) alloys were evaluated. During single-cell tests, Li-Al performed as well as Mg and Li-Si gave longer life for the same weight anode. Ten and 16 cell batteries were tested. Best results were obtained with the Li-Si anodes; a 16 cell battery discharged at 50 mA/sq cm had a life of 63 min to 24.0 V in a 12.7 cm diam can, and 59 min in a 11.4 cm can. While the cell voltage was somewhat lower, the ability of the Li-Si/FeS2 battery to operate for an hour at the higher current density resulted in twice the volumetric specific energy when compared to a Ca/CaCrO4 battery which had been discharged at 15 mA/sq cm. DOE

N80-14514# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.
DYNAMIC ENERGY SYSTEM OPTIMIZATION MODEL
E. A. Cherniavsky, L. L. Juang, and H. Abilock May 1979 119 p
(Contract EY-76-C-02-0016)
(EPRI-EA-1079) Avail: NTIS HC A06/MF A01

The dynamic energy system optimization model (DESOM) developed to investigate the roles of different technologies in the energy system over an extended period of time is discussed. Means to improve computational features of the program, to incorporate electric sector detail into the existing version of DESOM, and to transfer the DESOM model to EPRI are examined. DOE

N80-14515# Department of Energy, Washington, D. C. Office of State and Local Governments.
REPORT TO THE CONGRESS ON THE COORDINATION OF FEDERAL ENERGY CONSERVATION PROGRAMS INVOLVING STATE AND LOCAL GOVERNMENTS
May 1979 117 p
(DOE/TIC-10127) Avail: NTIS HC A06/MF A01

Four laws which authorize the government to develop and implement specific energy conservation programs are discussed. The development, implementation, and administration of the energy programs are examined and the coordination activities between Federal, State, and Local governments on the energy programs are analyzed. A.W.H.

N80-14516# Illinois Univ., Urbana. Center for Advanced Computation.
NEW HYBRID 1971 ENERGY INTENSITIES, PART 1 Final Report
P. S. Penner, R. A. Herendeen, and T. Milke Dec. 1978 9 p refs
(Contract EM-78-S-02-4628)
(COO-4628-4-Pt-1) Avail: NTIS HC A02/MF A01

A set of hybrid energy intensities from 1971 direct energy use data and 1967 economic input/output information are computed and discussed. Energy intensities represent the total energy used through the economy to produce one unit of output from each of the 90 sectors defined as spanning the U.S. economy in 1967. The data base discussed contains, among other items, data on the consumption of over 100 fuel types by 154 consuming sectors in the U.S. economy. DOE

N80-14517# California Univ., Livermore. Lawrence Livermore Lab.
US ENERGY FLOW IN 1978
W. J. Ramsey 11 Jun. 1979 6 p
(Contract W-7405-eng-48)
Avail: NTIS HC A02/MF A01

An energy flow diagram for the U.S. for 1978 is presented. Some significant differences between 1977 and 1978 are: total energy use increased 1.8%; oil imports decreased to 17.4 quads, more than 7% below 1977; coal and natural gas remained about constant; the industrial sector remains unique in that its energy use decreased somewhat due to conservation efforts; delivered nuclear power increased by 8%, supplying one-eighth of all electricity; and a trend toward electrification continued with distributed electrical energy increasing by 3.9%. DOE

N80-14518# Midwest Research Inst., Golden, Colo.
APPLICATION OF DIFFUSION RESEARCH TO SOLAR ENERGY POLICY ISSUES
J. D. Roessner Mar. 1979 35 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-51-194) Avail: NTIS HC A03/MF A01

Two types of information requirements that appear to be basic to DOE solar energy policy decisions are examined: (1) how can the future market success of solar energy technologies be estimated, and (2) what factors influence the adoption of solar energy technologies, and what specific programs could promote solar energy adoption most effectively? The ability of a body of research, referred to here as diffusion research, to supply information that could partially satisfy these requirements is assessed. The strengths and limitations of current knowledge about the diffusion of innovations are summarized, the applicability

of both existing knowledge and the diffusion approach to the identified solar energy policy issues are discussed, and ways are suggested in which diffusion approaches can be modified and existing knowledge employed to meet short and long term goals of DOE. DOE

N80-14519# Midwest Research Inst., Golden, Colo.
IMPLEMENTATION OF STATE SOLAR INCENTIVES: LAND-USE PLANNING TO ENSURE SOLAR ACCESS
P. Pollock Mar. 1979 41 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-51-163) Avail: NTIS HC A03/MF A01

State incentives in land use planning to ensure solar access are examined to determine issues in program design and implementation. These incentives include broad legislative grants of solar rights, application of nuisance law to solar collector shading, removal of restrictive covenants or establishment of covenants to protect solar access, provision for privately negotiated solar easements, and land use planning and regulation to include passive solar design and provision for active solar collection in land use development. Oregon is engaged in a statewide, mandated local comprehensive planning process which includes consideration of energy conservation and renewable energy sources. California has two solar access related bills which address private solar easements, subdivision design, restrictive covenants, and shading by vegetation. New Mexico has a broad legislative grant of solar rights based on water rights law. Minnesota authorized the inclusion of solar energy as a factor in local land use planning and established a private easement procedure. DOE

N80-14520# Midwest Research Inst., Golden, Colo.
IMPLEMENTATION OF STATE SOLAR INCENTIVES: A PRELIMINARY ASSESSMENT
J. Ashworth, B. Green, P. Pollock, R. Odland, R. Saltonstall, and L. J. Perelman Jan. 1979 238 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-51-159) Avail: NTIS HC A11/MF A01

The implementation of official state solar energy incentives programs was investigated. Questions of incentive design and program effectiveness are addressed in certain portions of the text, but the bulk of the research effort is directed toward examining how laws and legislative mandates have been transformed into rules, regulations, eligibility criteria, standards, comprehensive land use plans, grants, tax deductions, and demonstration projects. Most of the programs discussed will be official governmental actions, although the roles of private groups, advisory councils, and universities are addressed. Programs were examined in Arizona, California, Florida, Maine, Massachusetts, Minnesota, Montana, New Mexico, and Oregon. DOE

N80-14521# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR ENERGY FROM URBAN WASTES
D. Walter, S. Levy, and C. Rines [1979] 48 p
(TID-28852-Draft) Avail: NTIS HC A03/MF A01

Three broad technologies are potentially available to recover energy and energy-intensive materials from urban wastes: mechanical, thermal, and biological. Worldwide experience indicates that commercialization is feasible although there are a number of technical, economic, and institutional barriers that currently limit the use of wastes. From a technical standpoint the daily variability of urban waste makes control and optimization of any process difficult. Further development and optimization of equipment is necessary to improve efficiency and reduce capital costs although there are no foreseen technological barriers and basic breakthroughs are not needed. Technical, market/economic, environmental, and insitutional readiness and benefits analysis are discussed. The commercializations strategy is summarized. DOE

N80-14522# Brookhaven National Lab., Upton, N. Y. Energy and Environment Dept.
SOLID ELECTROLYTE FUEL CELL FOR ELECTRIC POWER GENERATION
S. Srinivasan and H. S. Isaacs 1979 10 p refs Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5-10 Aug. 1979
(Contract EY-76-C-02-0016)
(BNL-26238; CONF-790803-29) Avail: NTIS HC A02/MF A01

The development of high temperature fuel cells with molten carbonates or solid electrolytes are described. The advantages of solid electrolyte over the molten electrolyte fuel cells including: higher projected efficiencies; higher attainable current densities; and no cell corrosion problems are discussed. The design, fabrication, and testing of multicell stacks (5 cells) are discussed. The operating cell characteristics are examined in respect to meeting power plant performance goals. A.W.H.

N80-14523# Institute of Gas Technology, Chicago, Ill.
FUEL CELL OPTION
K. F. Blurton Oct. 1978 13 p Presented at Conf. on Nat. Energy Econ. 2, Tulsa, Okla., 18-20 Sep. 1978
(Contract EM-78-C-03-1735)
(CONF-7809137-1) Avail: NTIS HC A02/MF A01

Fuel cell technology and its potential application is discussed. The strategy of fuel cell development is examined and the attributes of fuel cell power plants are described. DOE

N80-14524# Illinois Univ., Urbana. Center for Advanced Computation.
ENERGY CONSERVATION IN THE US ECONOMY FROM INCREASED RECYCLE OF OBSOLETE STEEL SCRAP Final Report
J. R. Brodrick Nov. 1978 110 p refs
(Contract EY-76-S-02-2893)
(COO-2893-10) Avail: NTIS HC A06/MF A01

Energy consumption in the steel industry is discussed and a recycling method is proposed for energy conservation. A model is presented to define the energy savings for the steel industry, the labor impact, and the economic factors of recycling scrap metal. A.W.H.

N80-14525# Argonne National Lab., Ill.
DEFINITION AND ANALYSIS OF THE BARRIERS TO THE IMPLEMENTATION OF URBAN ENERGY RECOVERY SYSTEMS
May 1979 22 p
(Contract W-31-109-eng-38)
(ANL/CNSV/TM-2) Avail: NTIS HC A02/MF A01

Major barriers to the implementation of urban energy recovery systems and the identification of Federal programs believed to be the most effective in developing these systems are presented. A survey of 40 persons experienced in the implementation of urban energy recovery systems, which provides the results, is analyzed. DOE

N80-14526# Los Alamos Scientific Lab., N. Mex.
APPLICATIONS OF FUEL CELLS IN TRANSPORTATION
B. McCormick, R. Bobbett, D. Lynn, S. Nelson (DOE, Washington, D.C.), S. Srinivasan (Brookhaven National Lab.), and J. McBreen (Brookhaven National Lab.) 1979 11 p Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5-10 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-628; CONF-790803-16) Avail: NTIS HC A02/MF A01

A detailed technical and economic evaluation of potential applications for fuel cells in transportation is given. Four vehicle types were evaluated: city bus, highway bus, delivery van, and consumer car, using fuel cell and reformer data. Various fuel options and performance vs economic tradeoffs were considered and final recommendations are presented. DOE

N80-14527# Sandia Labs., Albuquerque, N. Mex.
THERMAL AGING CHARACTERISTICS OF ELECTRODEPOSITED BLACK CHROME SOLAR COATINGS
R. B. Pettit and R. R. Sowell 1979 5 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract EY-76-C-04-0789)
(SAND-78-2094C; CONF-790541-32) Avail: NTIS HC A02/MF A01

By reducing the trivalent chromium concentration of Chromonyx black chrome plating bath, coatings with improved thermal stability characteristics were obtained. For trivalent chromium concentrations as low as 8 g/l, solar absorptance

values decreased only a few percent from initial values of approximately 0.97 after heating in air at 400 C for over 3600 hours. Coating composition and structure were studied using transmission electron microscopy, scanning electron microscopy, and sputter Auger-profiling. Initial results indicate that the coatings from the nominal bath composition are composed of small particles, with diameters in the range 65 to 90 nm. When the trivalent chromium concentration is reduced, these particles agglomerate into larger clusters that are 150 to 250 nm in size. Upon heating in air, all coatings experience a substantial amount of oxidation, but the stable coatings maintain a significantly higher metallic chromium content. DOE

N80-14528# California Univ., Livermore. Lawrence Livermore Lab.
NON-TRACKING INFLATED CYLINDRICAL SOLAR CONCENTRATOR
J. W. Gerich 22 May 1979 18 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract W-7405-eng-48)
(UCRL-82721; CONF-790541-12) Avail: NTIS HC A02/MF A01

A concentrating solar collector able to produce pressurized hot water up to a temperature of 175 C was developed. The collector structure consists mainly of an inflated thin film plastic cylinder that is clear on the upper portion and is an aluminized reflector on the lower portion. The reflector concentrates sunlight on a receiver tube which is jacketed with a heat transfer suppressing, thin film plastic cylinder. The first experimental collectors verified performance modeling codes. The second generation collectors now being constructed address cost considerations and ease of fabrication, installation, and maintenance. It was found that the installed cost of the inflated concentrator is likely to be one-fifth that of parabolic trough concentrators. An experimental apparatus was developed to measure the total hemispherical emittance of full size receiver tubes. Test results indicate a rather dramatic increase in the room temperature value at typical concentrator operating temperatures. R.E.S.

N80-14529# California Univ., Livermore. Lawrence Livermore Lab.
LAWRENCE LIVERMORE LABORATORY GEOTHERMAL ENERGY PROGRAM: A STATUS REPORT ON THE DEVELOPMENT OF THE TOTAL-FLOW CONCEPT M.S. Thesis
A. L. Austin and A. W. Lundberg 2 Oct. 1978 77 p refs
(Contract W-7405-eng-48)
(UCRL-50046-77) Avail: NTIS HC A05/MF A01

The technology development activities of the Geothermal Energy Program at the Lawrence Livermore Laboratory are summarized. Significant progress toward development of the total-flow concept was made. The results show that the original goal of 70% engine efficiency for the total-flow impulse turbine is achievable; that a total-flow system is competitive economically with conventional systems; and that the total-flow concept offers the benefit of more efficient utilization of geothermal resources for electric power production. The evaluation of several liquid expanders designed for low-temperature (including geopressured) resources suggests that if development were continued, these expanders could be used in combination with conventional systems to increase overall system efficiency. DOE

N80-14530# Argonne National Lab., Ill.
LITHIUM/METAL SULFIDE BATTERY DEVELOPMENT
R. K. Steunenberg 1979 15 p refs Presented at Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wis., 21 May 1979
(Contract W-31-109-eng-38)
(CONF-790538-10) Avail: NTIS HC A02/MF A01

Lithium/metal sulfide batteries developed for electric vehicle propulsion and for stationary energy storage applications such as load leveling are described. The battery cells consist of lithium-aluminum or lithium-silicon negative electrodes, iron sulfide (FeS or FeS2) positive electrodes, and molten LiCl-KCl electrolyte. The cells are enclosed in a thermally insulated jacket to maintain an operating temperature of 400 to 500 C. A 40 kWh electric vehicle battery consisting of 120 Li-Al/FeS cells is described. DOE

N80-14531# Argonne National Lab., Ill.
ADVANCED BATTERIES FOR ELECTRIC VEHICLES: A LOOK AT THE FUTURE
William J. Walsh 23 Apr. 1979 23 p refs Presented at the APS Meeting, Washington, D.C., 23 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790484-1) Avail: NTIS HC A02/MF A01

Battery systems which are potential candidates for electric motor vehicles are discussed. These include lead acid, nickel-iron, nickel-zinc, zinc-chlorine, lithium-metal sulfide and sodium-sulfur (ceramic electrolyte). The characteristics of these batteries are discussed. Each individual battery system is found to have less than 50% probability of successful development and commercialization; however, the cumulative probability that at least one of the batteries would be successfully developed is judged to be greater than 75%. It is predicted that the magnitude of the market penetration of electric motor vehicles will depend on the severity of future liquid-fuel shortages along with the cost and quality of the advanced batteries. DOE

N80-14532# Sandia Labs., Livermore, Calif.
DISSOCIATION PRESSURE MEASUREMENTS ON SALTS PROPOSED FOR THERMOCHEMICAL ENERGY STORAGE
Robert W. Carling Jul. 1979 40 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8033) Avail: NTIS HC A03/MF A01

Chemical heat pumps employ salt hydrates, ammoniates, or methanolates for energy storage. The efficient operation of a chemical heat pump depends strongly upon the reaction energies and pressure/temperature relationships of these salts. An apparatus was assembled to measure pressure/temperature relationships and derive reaction energies. A sensitive cantilever balance used to prepare salt samples in situ so that the stoichiometry of the salt hydrate, ammoniate, or methanolate is known prior to the pressure measurements is incorporated in this apparatus. The apparatus is described and results on two systems are presented: $MgCl_2.nH_2O$ (where n = 6.1, 6, or 4) and $CaCl_2.nNH_3$ (where n = 8, 4, 2, or 1). DOE

N80-14533# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
PROCEEDINGS OF THE THERMAL ENERGY STORAGE IN AQUIFERS WORKSHOP
Dec. 1978 134 p refs Conf. held at Berkeley, Calif., 10-12 May 1978
(Contract W-7405-eng-48)
(LBL-8431; CONF-7805140) Avail: NTIS HC A07/MF A01

Contents: thermal energy storage in aquifer workshop; seasonal storage--prospects and problems; hydrogeology and reservoir engineering; energy management objectives and economics of heat storage wells; institutional aspects of utilizing heat storage in aquifers--a proposal for a prototype test; environmental aspects of low temperature thermal energy storage in aquifers; mathematical modeling of thermal energy storage in aquifers; confined aquifer experiment; thermal storage of cold water in ground water aquifers for cooling purposes; air conditioning Kennedy Airport with winter cold; high temperature underground thermal energy storage. R.E.S.

N80-14534# Battelle Pacific Northwest Labs., Richland, Wash.
COMPRESSED AIR ENERGY STORAGE TECHNOLOGY PROGRAM Annual Report, 1978
W. V. Loscutoff Jun. 1979 180 p refs
(Contract EY-76-C-06-1830)
(PNL-2935) Avail: NTIS HC A09/MF A01

Results of studies performed to establish design and stability criteria for compressed air energy storage (CAES) underground reservoirs are presented along with advanced concepts that will eliminate dependence of the CAES concept on petroleum fuels. Reservoirs examined include aquifers, hard rock caverns, and salt caverns. Equipment evaluation and development studies are cited together with feasibility studies of alternative fuels and technologies such as adiabatic systems, hybrid systems utilizing thermal energy storage and fuel, coal fired fluidized processes, and coal fired low Btu gasifiers. J.M.S.

N80-14535# Los Alamos Scientific Lab., N. Mex.
SUPERCONDUCTING MAGNETIC ENERGY STORAGE FOR ELECTRIC POWER SYSTEM DYNAMIC STABILIZATION
Robert Turner 1979 7 p refs Presented at Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1220; CONF-790803-07) Avail: NTIS HC A02/MF A01

A superconducting magnetic energy storage (SMES) system developed for a dynamic stabilizer to be installed in the Bonneville Power Administration (BPA) power system at Tacoma, Washington, by 1982 is described. This unit is an alternate stabilization method to the dc modulator now used to stabilize the 900 mile, ac intertie between BPA and Southern California. The SMES unit consists of a 30 MJ solenoid, a 10 MW convertor, a liquid helium dewar and auxilary systems. The SMS dynamic stabilizer design is presented with status information about the superconducting coil, the converter, and other components of the SMES dynamic stabilizer summarized. DOE

N80-14536# Elliott Co., Jeannette, Pa.
PRELIMINARY DESIGN OF AXIAL FLOW HYDROCARBON TURBINE/GENERATOR SET FOR GEOTHERMAL APPLICATIONS Final Report
N. A. Samurin and J. R. Shields May 1979 179 p refs Sponsored by Elec. Power Res. Inst.
(EPRI-ER-513) Avail: NTIS HC A09/MF A01

The design of a 65 MW (e) gross turbine generator set in which a hydrocarbon gas mixture is used as the motive fluid is outlined. The turbine generator set is part of a geothermal binary cycle electric power plant proposed for the Heber site in the Imperial Valley, California. Aerodynamic design considerations and estimated unit performance for three hydrocarbon gas mixtures are presented. Real gas properties and equations of state are reviewed as they affect the turbine design and the thermodynamic cycle. The mechanical designs for the casing, rotor dynamics, shaft sealing and unit construction are detailed. Support systems such as the lube and seal supply system, turbine controls, etc., are reviewed. An extensive hydrocarbon turbine general specification is also included. DOE

N80-14537# Southern California Edison Co., Rosemead.
COMMERCIAL SOLAR AUGMENTED HEAT PUMP SYSTEM
J. Wilborn Mar. 1979 79 p refs Sponsored by Elec. Power Res. Inst.
(EPRI-ER-1004) Avail: NTIS HC A05/MF A01

A solar energy augmented water source heat pump system was installed on an administration building located on the campus of the Golden West College in Huntington Beach, California. Testing began in mid-1978 and will continue for two years. Solar energy is collected from 600 square feet of solar collector panels mounted on the administration building roof. Buried tanks having a total capacity of 4,000 gallons store thermal energy. A complete and automated operation control system and instrumentation package are included. The system features flexible operation and operates in multiple modes. These modes of operation allow testing with and without solar collectors and with and without thermal storage. Solar augmentation, thermal storage, and heat pumps are to be evaluated. DOE

N80-14538# Sandia Labs., Albuquerque, N. Mex.
DARRIEUS WIND TURBINE PROGRAM AT SANDIA LABORATORIES
P. C. Klimas 1979 12 p refs Presented at Wind Energy Innovative Sys. Conf., Colorado Springs, 23 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-0997C; CONF-790501-2) Avail: NTIS HC A02/MF A01

The design and development of vertical axis wind turbines (VAWTs) are discussed. Aerodynamic, structural, testing, and systems analyses capabilites for the development program are reported. The aerodynamic and structural characteristics of the VAWT are presented. A.W.H.

N80-14539# PRC Energy Analysis Co., McLean, Va.
ENGINEERING CONCERNS IN SOLAR SYSTEM DESIGN AND OPERATION
James L. Easterly Mar. 1979 24 p refs
(Contract EG-77-C-01-2522)
(SOLAR/0811-79/01) Avail: NTIS HC A02/MF A01

Engineering concerns associated with the startup and operation of solar heating and cooling installations are discussed. Recommendations are also made regarding the design and installation phases to help in avoiding these problems. DOE

N80-14540# Mound Lab., Miamisburg, Ohio.
STUDIES OF DIRECTLY ABSORBING FLUIDS FOR MID-TEMPERATURE SOLAR THERMAL APPLICATIONS
A. R. Burke, D. E. Etter, C. J. Wiedenheft, and L. J. Wittenberg 1979 6 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract EY-76-C-04-0053)
(MLM-2625-OP; CONF-790541-17) Avail: NTIS HC A02/MF A01

Thermal, photochemical, and optical absorptivity studies at elevated temperatures on various heat transfer fluids containing chromophoric materials are discussed. The solar absorption efficiency of the fluids and chromophores were calculated at ambient and elevated temperatures. Density, viscosity, and heat capacity measurements for specific solutions were determined. Eight chromophoric solutions are identified as candidates for directly absorbing fluids for use up to 300 C. DOE

N80-14541# Mound Lab., Miamisburg, Ohio.
CONSTRUCTION AND INITIAL OPERATION OF THE MIAMISBURG SALT-GRADIENT SOLAR POND
R. S. Bryant, R. P. Bowser, and L. J. Wittenberg 1979 5 p refs Presented at the Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract EY-76-C-04-0053)
(MLM-2626-OP; CONF-790541-16) Avail: NTIS HC A02/MF A01

The largest salt-gradient solar pond in the U.S. occupies an area of 2020 sq mi in Ohio and was installed for only $35/sq mi. A technique was successfully demonstrated for the formation of the gradient zone, approximately 1 m thick, in which fresh water was injected horizontally below the surface of the concentrated salt solution. Without any useful heat removed, the storage layer water, approximately 18.5% NaCl, reached a peak temperature of 51.1 C in October 1978 and a minimum temperature of 28.4 C during February 1979. The pond is predicted to deliver 281,000 kW hr/yr to be used principally for heating an outdoor swimming pool in the summer and a recreation building from October to December. The projected heat cost is 2.5 cents/kW hr, based upon amortization of 10%/yr. DOE

N80-14542# Department of Energy, Washington, D. C.
GEOTHERMAL ENERGY: PROGRAM SUMMARY
Jun. 1979 316 p refs
(DOE/ET-0101) Avail: NTIS HC A14/MF A01

Descriptions of geothermal projects for the fiscal year 1978 are presented. Each summary gives the project title, contractor name, contract number, funding level, dates, location, and name of the principal investigator. Objectives and strategies for each program are provided. DOE

N80-14543# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR SMALL WIND SYSTEMS
Louis V. Divone, R. Blaunstein, J. Gros, A. K. Ingberman, W. L. R. Rice, and S. J. Taylor [1979] 46 p refs
(TID-28844-Draft) Avail: NTIS HC A03/MF A01

The commercial readiness of small wind systems is addressed. Barriers to be overcome before this technology is ready to be used commercially are cited and possible actions that might be considered to remove specific barriers are identified. The full implications of the various proposed actions have not been fully developed and many actions listed undoubtedly have substantial problems associated with them. DOE

N80-14544# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR LARGE WIND SYSTEMS
Louis V. Divone, R. Blaunstein, J. Gros, A. K. Ingberman, W. L. R. Rice, and S. J. Taylor [1979] 41 p

(TID-28843-Draft) Avail: NTIS HC A03/MF A01

The commercialization of wind turbines is analyzed concerning technical readiness; market and economic aspects; environmental impacts; institutional acceptance; benefit analysis; and commercialization development strategy. DOE

N80-14545# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR SOLAR WATER HEATING
Frederick H. Morse and J. M. Davis [1979] 35 p refs
(TID-28856-Draft) Avail: NTIS HC A03/MF A01

The commercial readiness of solar hot water heating is discussed. Some barriers to be overcome before this technology is ready to be used commercially are identified. Also identified are possible actions that might be considered to remove specific barriers. Technical, market/economics, environmental, and institutional readiness, and benefits analysis are discussed. DOE

N80-14546# Midwest Research Inst., Golden, Colo.
THERMAL ENERGY STORAGE FOR SOLAR APPLICATIONS: AN OVERVIEW
Charles Wyman Mar. 1979 123 p refs
(Contract EG-77-C-01-4042)
(SERI/TP-34-089) Avail: NTIS HC A06/MF A01

The economic role of storage for solar home heating and stand-alone electric plants are examined. Factors which affect the economics of storage are discussed. The costs and storage capacities of representative sensible and latent heat storage materials are summarized. Various modes of operation are also presented for thermal storage by reversible chemical reactions. Containers and heat exchangers are reviewed to illustrate possible approaches to reducing storage costs. Reversible reaction storage, and gas-solid reactions are shown to have desirable attributes for solar energy storage. DOE

N80-14547# Midwest Research Inst., Golden, Colo.
A REVIEW OF THE ECONOMICS OF SELECTED PASSIVE AND HYBRID SYSTEMS
Deborah L. Buchanan Jan. 1979 27 p refs
(Contract EG-77-C-01-4042)
(SERI/TP-61-144) Avail: NTIS HC A03/MF A01

Performance and economic information on passive and hybrid systems were compiled as part of solar commercial readiness activities. The results of selected performance simulation and cost estimate studies are presented as well as actual cost and performance data from operating buildings. Systems representative of each major passive design concept are included: direct gain, indirect gain (thermal storage wall, thermal storage roof), and isolated gain (convective loop/thermosiphon, attached sunspace/greenhouse). Results are presented in tables structured by major design concept. Data for simulated and actual systems are presented separately. Comparison of individual system design specifications, performance, incremental solar cost, and cost of delivered energy are made by major design concept and by simulated or actual data source. In addition, results are aggregated to derive cost and performance ranges over all data sources, by design concept and by simulated or actual system. DOE

N80-14548# Midwest Research Inst., Golden, Colo.
COMMERCIALIZING SOLAR ARCHITECTURE
Gregory Franta Mar. 1979 38 p refs Presented at SERI Architectural Planning Seminar, Golden, Colo., 10 Jul. 1978
(Contract EG-77-C-01-4042)
(SERI/TP-62-113; CONF-780792) Avail: NTIS HC A03/MF A01

Barriers to solar technology commercialization through architecture are considered. Attitudes of architects, their clients, government officials, and design/construction professionals are discussed along with technical issues related to the environment, building design and construction, operation, and maintenance. Performance evaluation of solar heating and cooling of buildings (SHACOB) and the general lack of technical awareness by architects regarding non-SHACOB technologies (wind, biomass, process heat, and photovoltaic cells) are included. Institutional issues related to law and government and the solar infrastructure are identified as important. Suggestions related to information, development, acquisition, and dissemination, education and training, demonstrations and design competitions, and other actions aimed at integration of solar technology into the total energy-conscious design process are given. J.M.S.

N80-14549# California Univ., Berkeley. Lawrence Berkeley Lab.
THERMAL DEGRADATION OF A BLACK CHROME SOLAR SELECTIVE ABSORBER COATING: SHORT TERM
Carl M. Lampert May 1979 6 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract W-7405-eng-48)
(LBL-8857; CONF-790541-37) Avail: NTIS HC A02/MF A01

The energy absorption properties and chemical microstructure of Chrom Onyx were investigated using electron microscopy and X-ray diffraction techniques. Different temperatures for short annealing times were used to evaluate the coating's temperature resistance limitations, along with possible degradation mechanisms for various stagnation situations. Samples were tested in both air and vacuum. It is concluded that for all practical considerations, black chrome optically degrades between 500 - 600 C during short exposure times. M.G.

N80-14550# Aerospace Corp., El Segundo, Calif.
THE 10 MW SOLAR THERMAL PILOT PLANT DYNAMIC SIMULATION. VOLUME 1: COMPUTER PROGRAM DESCRIPTION
1 Dec. 1978 154 p refs 2 Vol.
(Contract ET-78-C-03-2028)
(ATR-78(7747)-1-Vol-1) Avail: NTIS HC A08/MF A01

A digital computer simulation of a prototype solar 10 MW (electric) pilot power plant near Barstow, California is presented. The simulation program has been designated STMPPS (Solar Ten Megawatt Pilot Plant Simulation). This simulation is operative on the Control Data Corporation (CDC) 7600 digital computer, with use of the CDC SCOPE 2.1 operating system. Logic and analytical details on which the program is based are described. DOE

N80-14551# Aerospace Corp., El Segundo, Calif.
THE 10 MW SOLAR THERMAL PILOT PLANT DYNAMIC SIMULATION. VOLUME 2: COMPUTER PROGRAM SOURCE LISTING
1 Dec. 1978 271 p 2 Vol.
(Contract ET-78-C-03-2028)
(ATR-78-(7747)-2-Vol-2) Avail: NTIS HC A12/MF A01

The actual computer source listing of program STMPPS is presented. All routines specifically developed to simulate the solar thermal pilot plant are included. The listing contains a generous amount of nonprogrammatic comment lines to aid in interpretation of program logic. DOE

N80-14552# Brookhaven National Lab., Upton, N. Y.
EVLAUTION OF PERFORMANCE ENHANCEMENT OF SOLAR POWERED ABSORPTION CHILLER WITH AN IMPROVED CONTROL STRATEGY USING THE BNL-BUILT HARDWARE SIMULATOR
P. C. Auh 1979 5 p refs Presented at the Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract EY-76-C-02-0016)
(BNL-26218; CONF-790541-21) Avail: NTIS HC A02/MF A01

Transient and cycling performance characteristics of an advanced, solar absorption chiller were investigated. The results of the various combinations of on/off cycling runs showed that the net capacity loss during the start-up transient period could be significantly reduced when the residual cooling capacity generated during the off-period is compensated to the initial loss. Furthermore, the experimental investigation showed that the performance degradation, due to inherent transient behavior of a chiller, could be significantly improved by a simple control modification. The degree of performance under the modified control mode, as a function of the cycle period and such effects on the integrated chiller performance, were investigated. Under the modified control mode, the need of a large cold-side storage may no longer exist. This may offer significant economical advantages, especially for small residential cooling systems, without sacrifice in their performances. DOE

N80-14553# Miami Univ., Coral Gables, Fla. Clean Energy Research Inst.
FIFTH OCEAN THERMAL ENERGY CONVERSION CONFERENCE, VOLUME 2, SECTIONS 4-5
A. Lavi, ed. and T. N. Veziroglu, ed. Sep. 1978 592 p refs Conf. held at Miami Beach, Fla., 20-22 Feb. 1978
(Grant EG-77-G-05-5550)
(CONF-780236-P2) Avail: NTIS HC A25/MF A01

Contents: ocean thermal energy conversion (OTEC) platform design optimization; considerations in selection of OTEC platform size and configuration; OTEC-1 early ocean test project; preliminary engineering design of an OTEC pilot plant; operational sea state and design wave criteria; OTEC platform station keeping analysis; OTEC cold water pipe design loads; dynamic loads induced by severe storms in elastic cold water pipes attached to OTEC ships by fixed and hinged connections; conceptual design of an OTEC power system using modular heat exchangers; power system module configuration using aluminum heat exchangers. R.E.S.

N80-14554# Miami Univ., Coral Gables, Fla. Clean Energy Research Inst.
FIFTH OCEAN THERMAL ENERGY CONVERSION CONFERENCE, VOLUME 3, SECTIONS 6-7
A. Lavi, ed. (DOE, Washington, D.C.) and T. N. Veziroglu, ed. Sep. 1978 520 p refs Conf. held at Miami Beach, Fla., 20-22 Feb. 1978
(Grant EG-77-G-05-5550)
(CONF-780236-P3) Avail: NTIS HC A22/MF A01

The ocean engineering aspects of the ocean thermal energy conversion (OTEC) program are discussed. Economic and commercialization topics are addressed. Topics include the power system development, the heat exchangers system, alternate power cycles, and biofouling and corrosion effects on the the cold water pipe system. A.W.H.

N80-14555# Miami Univ., Coral Gables, Fla. Clean Energy Research Inst.
FIFTH OCEAN THERMAL ENERGY CONVERSION CONFERENCE, VOLUME 1, SECTIONS 1-3
A. Lavi, ed. (DOE, Washington, D.C.) and T. N. Veziroglu, ed. Sep. 1978 695 p refs Conf. held at Miami Beach, Fla., 20-22 Feb. 1978
(Grant EG-77-G-05-5550)
(CONF-780236-P1) Avail: NTIS HC A99/MF A01

The advancements made in the past year in the ocean engineering aspects of the ocean thermal energy conversion (OTEC) program are described. Commercial plant studies are presented on the power system, coal water pipe system, and the seawater system. Topics discussed include the power system development, the heat exchangers system, alternate power cycles, and biofouling and corrosion effects. A.W.H.

N80-14556# Sandia Labs., Livermore, Calif.
WIND TUNNEL TEST OF A FULL-SCALE HELIOSTAT
S. G. Peglow Jun. 1979 18 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8034) Avail: NTIS HC A02/MF A01

The wind tunnel tests performed on a prototype heliostat are described and a comparison of the data with analytically derived results is presented. The testing, which consisted of obtaining loads, moments, dynamic behavior (via servo accelerometers), and flow visualization for the entire range of operational and survival configurations are discussed. DOE

N80-14557# Sandia Labs., Albuquerque, N. Mex.
HELIOS AND RECONCENTRATORS
C. N. Vittitoe, F. Biggs, L. K. Matthews, and L. O. Seamons 1979 6 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract EY-76-C-04-0789)
(SAND-78-1600C; CONF-790541-18) Avail: NTIS HC A02/MF A01

The HELIOS computer code for modeling solar energy collection by reflecting systems is discussed. Extensions to HELIOS which include application to reconcentrators and to the evaluation of heliostats are described. The comparison of HELIOS predictions with image data produced by 23 heliostats and with data from a single facet, chosen partially because of exceptionally large distortion, is discussed. The method of treating reconcentrators is presented. DOE

N80-14558# Sandia Labs., Livermore, Calif.
SYSTEMS STUDIES FOR CENTRAL SOLAR THERMAL ELECTRIC
Oct. 1978 492 p refs Workshop held at Houston, Tex., 27-30 Mar. 1978
(Contracts EY-76-C-04-0789; AT(29-1)-789)
(CONF-780383) Avail: NTIS HC A21/MF A01

Twenty-one articles are presented which focus on the current technical and economic status of central receiver solar thermal electric systems and future program direction. The planning and operational differences which the electric utilities foresee solar electric will encounter are discussed. Methodologies associated with utility network planning and operation are presented. National energy models are discussed along with their implications with respect to the future of various solar electric options. R.E.S.

N80-14559# InterTechnology Corp., Warrenton, Va.
PHOTOVOLTAIC POWER SYSTEMS MARKET IDENTIFICATION AND ANALYSIS Final Report, Jan. 1977 - Feb. 1978
May 1979 551 p refs
(Contract EG-77-C-01-4022)
(HCP/T4022-01) Avail: NTIS HC A23/MF A01

The marketing of near and intermediate term photovoltaic power applications was analyzed. The current uses of photovoltaic systems, both domestic and international, were surveyed and the usage of those systems was projected into the future. Products were defined and a market survey was carried out. A detailed scenario which forecasts sales, barriers to market acceptance, and technological innovations required for proper introduction of the products was developed. DOE

N80-14560# Electric Power Research Inst., Palo Alto, Calif.
ELECTRIC UTILITY SOLAR ENERGY ACTIVITIES, 1978
W. L. York May 1979 197 p
(EPRI-ER-966-SR) Avail: NTIS HC A09/MF A01

The scope of solar energy projects sponsored by electric utilities in the United States is presented. Brief descriptions of 600 projects being conducted by 165 utility companies are given. Also included are a list of participating utilities with information contacts and addresses, a list of utilities with projects designated by category, a list of utilities organized by states, and a list of available reports on utility-sponsored projects. DOE

N80-14561# Department of Energy, Washington, D. C. Div. of Solar Applications Developments.
PHOTOVOLTAIC INCENTIVES OPTIONS
R. M. Terry Aug. 1978 227 p
(HCP/CS-0023) Avail: NTIS HC A11/MF A01

The options available to the Federal Government to encourage adequate growth of the solar photovoltaic industry are identified. Appropriate incentives, strategies and options (combinations of strategies) were identified by defining the policy objectives to be achieved by promoting the growth of the photovoltaic industry. Policy objectives, defined by interpreting: (1) general policy statements on energy policy and on the commercialization of new energy technologies; (2) general and specific policy statements on solar energy and on photovoltaics; and (3) specific photovoltaic program goals, are discussed. The definitions of policy objectives derived from these sources were treated as assumptions for the purpose of this study. A determination of the steps for the attainment of policy objectives is presented. DOE

N80-14562# Argonne National Lab., Ill.
OVERVIEW OF THE DEPARTMENT OF ENERGY'S RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAM FOR THE RECOVERY OF ENERGY AND MATERIALS FROM URBAN WASTE
Alan S. Cohen 1979 15 p refs Presented at the US EPA Res. Symp. on Res. on Gas and Leachate and Landfills and Resource Recovery, Orlando, Fla., Mar. 1979
(Contract W-31-109-eng-38)
(CONF-790373-1) Avail: NTIS HC A02/MF A01

Technological options available for reprocessing waste into fuels, metals, glass, paper, ammonia, glucose, fertilizer, and other

energy-intensive products are discussed with emphasis on some of the approximate 80 projects comprising the Urban Waste Technology Branch's R, D, and D program. Projects are grouped as being primarily related to mechanical, thermal, or biological processes. To date, the majority of R and D funding is devoted to biological processes including anaerobic and enzymatic digestion, energy production and conservation in water and waste water treatment, and energy generation and recovery in sanitary landfills. However, demonstration activities, representing slightly less than half the program effort, are focused on the thermal/mechanical systems. If successful, approximately 3% of the nation's energy needs could be supplied by reprocessing wastes. DOE

N80-14563# Energy Technology Engineering Center, Canoga Park, Calif.
OTEC-1 TEST CONDUCTOR PROGRAM
P. Archbold and J. O. Bates 1978 13 p Presented at Seminar on Testing Solar Energy Mater. and Systems, Washington, D.C., 22 May 1978
(Contract EY-76-C-03-0700)
(CONF-780550-9) Avail: NTIS HC A02/MF A01

The involvement of the test director contractor (TDC) in the OTEC-1 test program is outlined. The preparation for and testing of the initial test heat exchangers and auxiliary equipment are considered. Interfaces, TDC/SIC (Systems Integration Contractor) test relationship, test request, test procedures, data handling, and biofouling laboratory are discussed. DOE

N80-14564# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
RECENT INVESTIGATIONS OF METAL OXIDE/CdTe HETEROJUNCTION SOLAR CELLS
A. L. Fehrenbruch, J. Aranovich, F. Courreges, T. Chynoweth, and R. H. Bube 1978 7 p refs Presented at the IEEE Photovoltaic Specialists Conf., Washington, D.C., 5 Jun. 1978
(Contract EY-76-S-03-0326)
(CONF-780619-25) Avail: NTIS HC A02/MF A01

The properties of ZnO and indium-tin oxide (ITO) films both on glass and as components of single crystal p-CdTe based heterojunction solar cells are described. The ZnO films deposited by rf sputtering or spray pyrolysis which can be brought within the desired conductivity range for solar cell performance are discussed. The properties of heterojunctions of n-ITO/p-CdTe prepared by rf sputtering are presented. The results of heat treatments on both ZnO and ITO cells are discussed. DOE

N80-14565# Sandia Labs., Albuquerque, N. Mex.
HAZARDOUS PROPERTIES AND ENVIRONMENTAL EFFECTS OF MATERIALS USED IN SOLAR HEATING AND COOLING (SHAC) TECHNOLOGIES: INTERIM HANDBOOK
J. Q. Searcy Dec. 1978 225 p refs
(DOE/EV-0028) Avail: NTIS HC A11/MF A01

General background information related to SHAC systems and codes and standards are given. Materials are categorized according to their functional use in SHAC systems as follows: (1) heat transfer fluids and fluid treatment chemicals; (2) insulation materials; (3) seals and sealant materials; (4) glazing materials; (5) collector materials; and (6) storage media. The information presented includes general properties, chemical composition, thermal degradation products, and thermoxidative products of some commercial materials. Toxic properties and other potential health effects, fire hazard properties, and environmental effects of and disposal methods for SHAC materials are also presented. DOE

N80-14566# PRC Energy Analysis Co., McLean, Va.
SYSTEM TESTS AND APPLICATIONS PHOTOVOLTAIC PROGRAM
May 1979 336 p refs
(Contract EG-77-C-01-4024)
(HCP/T4024-01/15) Avail: NTIS HC A15/MF A01

Progress in developing photovoltaic solar energy conversion systems to reduce dependence on fossil fuels is summarized. Exhibits designed to acquaint the general public to photovoltaics are included along with component field tests conducted to monitor module reliability under actual environmental conditions. Major test facilities are described. DOE

N80-14567# Department of Energy, Washington, D. C.
ENERGY POLICY AND CONSERVATION ACT (PUBLIC LAW 94-163) AS AMENDED BY THE NATIONAL ENERGY CONSERVATION POLICY ACT (PUBLIC LAW 95-619). TITLE 10: ENERGY. CHAPTER 2: DEPARTMENT OF ENERGY. SUBCHAPTER D: ENERGY CONSERVATION. PART 430: ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS
1979 19 p
(DOE/CS-0056) Avail: NTIS HC A02/MF A01

The text of Part B, Energy Conservation Program for Consumer Products Other Than Automobiles, from Energy Policy and Conservation Act as amended by National Energy Conservation Policy Act (PL-619) is presented. The text includes the following subjects: coverage, test procedures, labeling, energy efficiency standards, requirements of manufacturers, effect on other law, rules, authority to obtain information, exports, imports, prohibited acts, enforcement, injunctive enforcement, citizen suits, administrative procedure and judicial review, consumer education, annual report, and authorization of appropriations. DOE

N80-14568# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
PERFORMANCE OF RESIDENTIAL SOLAR HEATING AND COOLING SYSTEM WITH FLAT-PLATE AND EVACUATED TUBULAR COLLECTORS: CSU SOLAR HOUSE 1
W. S. Duff, T. M. Conway, G. O. G. Loef, D. B. Meredith, and R. B. Pratt 1978 8 p refs Presented at Meeting of the Am. Section of the Intern. Solar Energy Soc., Denver, 28 Aug. 1978
(Contract EY-76-S-02-2577)
(COO-2577-16; CONF-780808-24) Avail: NTIS HC A02/MF A01

Measurements in Solar House One at Colorado State University provided comparison data on space heating, water heating, and cooling by systems in which flat plate collectors and evacuated tube collectors were used. Data were procured on 47 days during operation of the flat plate collector and on 112 days when the house was heated or cooled by the evacuated tube collector system. It is concluded that the system comprising an evacuated tubular collector, lithium bromide absorption water chiller, and associated equipment is highly effective in providing solar heating and cooling to a small building, that it can supply up to twice the space heating and several times the cooling obtainable from an equal occupied area of good quality flat-plate collectors, and that a greater fraction of the domestic hot water can be obtained by supplying its heat from main storage. DOE

N80-14569# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
REALISTIC SIZING OF RESIDENTIAL SOLAR HEATING AND COOLING SYSTEMS
D. S. Ward 1978 10 p refs Presented at Meeting of the Am. Section of the Intern. Solar Energy Soc., Denver, 28 Aug. 1978
(Contract EY-76-S-02-2858)
(COO-2858-14; CONF-780808-23) Avail: NTIS HC A02/MF A01

The accuracy of technical and economic sizing methods for solar heating and cooling systems in specific installations is demonstrated to be strongly dependent upon the accuracy of the input data. Variations in the solar radiation data due to the inherent errors in previous solar measurements, and the difficulty in calculating heating and cooling loads to a desired level of accuracy are shown to result in calculated fractions of the load, f, of values with 10 to 15% errors. For specific installations where the heating load was calculated (and not measured experimentally), the fraction of the load carried by solar could therefore, be calculated to only one significant figure. Similarly, the inability to accurately predict inflation rates and certain other costs of the life cycle of a solar system, in addition to errors in the calculated heating load and fraction of the load, f, were shown to reduce the accuracy of economic costs of a solar system to values of + or - 25%. DOE

N80-14570# Mound Lab., Miamisburg, Ohio.
EVALUATION OF FUEL RESOURCES AND REQUIREMENTS FOR THE MAGNETIC FUSION ENERGY PROGRAM
T. B. Rhinehammer and L. J. Wittenberg 31 Oct. 1978 106 p refs

(Contract EY-76-C-04-0053)
(MLM-2419) Avail: NTIS HC A06/MF A01

The potential tritium requirements in the presently formulated development plan were assessed and possible sources for the required tritium were identified. The availability of lithium was surveyed also because the only practical production method for tritium is the neutron irradiation of lithium. The estimates of world-wide resources of lithium available to supply such an industry are reviewed. Additionally, the isotopic separation techniques for lithium-6 enrichment are discussed. The resources and requirements for mercury are included because of its potential use in a lithium isotopic separation technique. The availability of helium-3 and helium-4 is briefly discussed. R.E.S.

N80-14571# California Univ., Livermore. Lawrence Livermore Lab.
PROCESS DESIGN AND ECONOMIC ANALYSIS OF THE ZINC SELENIDE THERMOCHEMICAL HYDROGEN CYCLE
H. H. Otsuki and O. H. Krikorian 6 Sep. 1978 35 p refs
(Contract W-7405-eng-48)
(UCRL-52546) Avail: NTIS HC A03/MF A01

A detailed preliminary design for a hydrogen production plant was developed based on an improved version of the ZnSe thermochemical cycle for decomposing water. In the latest version of the cycle, ZnCl2 is converted directly to ZnO through high temperature steam hydrolysis. This eliminates the need for first converting ZnCl2 to ZnSO4 and also slightly reduces the overall heat requirement. The ZnSe cycle is driven by a very high temperature nuclear reactor (VHTR) that provides a high temperature (1283 K) helium working gas for process heat and power. The plant is sized to produce 27.3 Mg/Hs/h and requires specially designed equipment to perform the critical reaction steps in the cycle. Conceptual designs were developed for several of the important process steps to make cost estimates. A cycle efficiency of about 40% and a hydrogen production cost of about $14/GJ were obtained. DOE

N80-14572# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROCEEDINGS OF THE DOE CHEMICAL/HYDROGEN ENERGY CONTRACTOR REVIEW SYSTEMS
Aug. 1978 380 p refs Presented at DOE Ann. Chem. Energy Storage and Hydrogen Energy System Contracts Rev., Baltimore, 16 Nov., 1977
(Contract EC-77-A-31-1035)
(CONF-771131) Avail: NTIS HC A17/MF A01

Chemical/hydrogen energy system contracts were reviewed. The review served as an effective means to (1) give all contracts an insight into the background and objectives of thirty-nine hydrogen-related tasks, (2) show the status of the studies or technical effort, (3) relate any problems that had impeded the progress, and (4) state projected solutions for resolving the identified problems. DOE

N80-14573# Argonne National Lab., Ill.
REVIEW OF INDUSTRIAL PARTICIPATION ON THE ANL LITHIUM/IRON SULFIDE BATTERY DEVELOPMENT PROGRAM
E. C. Gay, W. E. Miller, and R. F. Malecha 1978 30 p refs Presented at 13th IECEC Conf. of the Soc. of Automotive Engr., Detroit, 20-25 Aug. 1978
(Contract W-31-109-eng-38)
(CONF-780852-1) Avail: NTIS HC A03/MF A01

The development and fabrication of industrial cells is reviewed. Industrial cells that contained FeS2 in the positive electrode achieved a specific energy of 100 Wh/kg at a 4 hr discharge rate and a peak power of 100 W/kg. Some of these cells showed good performance for up to 300 deep discharge cycles. Industrial cells that contained FeS in the positive electrode maintained good performance through 1000 deep discharge cycles. Present cell development efforts are directed toward improving specific energy and power in the cells that contain FeS and improving cycle life in cells that contain FeS2. DOE

N80-14574# Solar Energy Information Services, San Mateo, Calif.
ENGINEERS GUIDE TO SOLAR ENERGY
Yvonne Howell and Justin A. Bereny Feb. 1979 328 p
(PB-297043/2; SEIS-79/1; ISBN-0-930978-04-8; LC-78-62956) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13A

Information on solar heating technology is presented. The following subjects are covered: (1) an overview of the six basic solar technologies; (2) a comprehensive discussion of the solar resource, including a compendium of worldwide solar radiation data; (3) an introduction to passive solar technology; (4) extensive discussion of active solar systems, including applications for heating swimming pools, domestic hot water, and space heating; (5) methodology for calculating building heat loss and gain, including worldwide design temperature data; (6) an introduction to solar systems sizing through utilization of the f-chart method, including examples and worksheets; (7) a solar heating product directory divided into four sections: collectors, controls, pumps, and storage. GRA

N80-14575# General Accounting Office, Washington, D. C. Energy and Minerals Div.
COMMERCIALIZING SOLAR HEATING: A NATIONAL STRATEGY NEEDED Report to the Congress
20 Jul. 1979 86 p refs
(PB-297882/3; EMD-79-19) Avail: NTIS HC A05/MF A01 CSCL 13A

The adequacy of the Nation's efforts to commercialize solar heating systems is discussed. Constraints facing the use of solar heating systems, the effectiveness of ongoing efforts to overcome these constraints, and the potential effectiveness of the National Energy Act in encouraging the use of solar heating systems are covered. GRA

N80-14576# Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.
WAVE POWER SYSTEMS
Norman Doelling 1 Jul. 1979 33 p refs
(PB-299851/6; MITSG-79/16; NOAA-79080910; Opportunity-Brief-15) Avail: NTIS HC A03/MF A01 CSCL 10A

Ocean wave power was investigated as a usable, renewable, alternative energy source. The results suggest that both Salter cams and Cockerell rafts can be designed to convert wave motion to relative mechanical motion and mechanical forces. Mooring problems and costs suggest that Salter cams will be much more expensive than Cockerell rafts. A major problem is converting the available mechanical power to a more useful form, i.e., hydraulic or electric power. Upper limits on the amount of power that can be extracted from waves were investigated along with lower cost bounds. GRA

N80-14577# Ohio State Univ., Columbus. Solar Energy Lab.
OHIO EXPOSITION CENTER SOLAR HOME PROJECT Final Progress Report
R. V. DeVore, P. D. McWane, and D. L. Wineland 15 Jun. 1979 186 p refs
(PB-298541/4; OSU-SEL-5-510X) Avail: NTIS HC A09/MF A01 CSCL 13A

The operation of an active liquid-based 615 square foot solar collector array installed on a 2200 square foot residence is reported. Data are presented for the four solar energy utilization subsystems: domestic hot water, direct solar heating, LiBr water absorption air conditioner, and solar-assisted heat pump. Daily insolation records are included for a one year period. GRA

N80-14578# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
GEOTHERMAL ENERGY MARKET STUDY ON THE ATLANTIC COASTAL PLAIN. ECONOMIC EVALUATION MODEL FOR DIRECT USE OF MODERATE TEMPERATURE, UP TO 250 F, GEOTHERMAL RESOURCES IN THE NORTHERN ATLANTIC COASTAL PLAIN
Richard Weissbrod (Johns Hopkins Univ., Baltimore, Md.), William Barron (Johns Hopkins Univ., Baltimore, Md.), Peter Kroll (Johns Hopkins Univ., Baltimore, Md.), and William J. Toth Jun. 1979 71 p refs
(Contract EX-76-A-36-1008)
(PB-298785/7; APL/JHU/GEMS-003; APL/JHU/QM-79-002)

Avail: NTIS HC A04/MF A01 CSCL 13A

The Geothermal Resource Economic Evaluation System developed to calculate the average cost per million Btu of geothermal energy that is delivered either to residential and commercial users through a community heating system or to industrial process heat users is examined. The basic assumptions and the methods used in the model are presented. Results of the current studies indicate that, under a number of market conditions, i.e., for high-density residential housing or for large industrial users, and for a large range of resource conditions, geothermal energy costs are well below the costs of electrical space heating. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-14579* National Aeronautics and Space Administration. Pasadena Office, Calif.

OZONATION OF COOLING TOWER WATERS Patent

Marshall F. Humphrey (JPL), Kenneth R. French (JPL), and Ronald D. Howe, inventors (to NASA) (JPL) Issued 30 Oct. 1979 5 p Filed 29 Sep. 1978 Supersedes N79-10167 (17 - 01, p 0023) Sponsored by NASA

(NASA-Case-NPO-14340-1; US-Patent-4,172,786; US-Patent-Appl-SN-946992; US-Patent-Class-210-57; US-Patent-Class-210-63Z; US-Patent-Class-422-9) Avail: US Patent and Trademark Office CSCL 13B

Continuous ozone injection into water circulating between a cooling tower and heat exchanger with heavy scale deposits inhibits formation of further deposits, promotes flaking of existing deposits, inhibits chemical corrosion and controls algae and bacteria.

Official Gazette of the U.S. Patent and Trademark Office

N80-14580 Washington Univ., Seattle.

A BOX MODEL STUDY FOR GLOBAL AND REGIONAL SULFUR CIRCULATIONS Ph.D. Thesis

Tsan-Ying Steven Yuen 1979 143 p

Avail: Univ. Microfilms Order No. 7927893

Linear eight-box tropospheric global and regional sulfur mass-balanced models are developed to study the nature of global and regional sulfur circulation and distribution. It is found that the calculated sulfur burdens, concentrations, scale heights, turnover times, SO2/SO4(-2) ratios, scattering coefficients, and scattering optical depths agree well with available data. Comparison of the results in our global and regional models suggest that lower tropospheric sulfur concentrations over pollution regions are one to two orders of magnitude larger than global average values, whereas the upper tropospheric sulfur concentrations over polluted regions are of same order of magnitude as their global counterparts. The radiation calculation indicates that the present albedos of the Earth-atmosphere system in the eastern and middle United States are 13% lower and 11% higher than a clean atmosphere respectively. Dissert. Abstr.

N80-14581*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SULFATE AND NITRATE COLLECTED BY FILTER SAMPLING NEAR THE TROPOPAUSE

Francis M. Humenik, Erwin A. Lezberg, and Dumas A. Otterson Jan. 1980 30 p refs

(NASA-TP-1567; E-073) Avail: NTIS HC A03/MF A01 CSCL 13B

Filter samples collected near the tropopause with an F-106 aircraft and two Boeing 747 aircraft were analyzed for sulfate and nitrate ion content. Within the range of routine commercial flight altitudes (at or below 12.5 km), stratospheric mass mixing ratios for the winter-spring group averaged 0.26 ppbm for sulfate and 0.35 ppbm for nitrate. For the summer-fall group, stratosphere mixing ratios averaged 0.13 ppbm and 0.25 ppbm for sulfate and nitrate, respectively. Winter-spring group tropospheric mass mixing ratios averaged 0.08 ppbm for sulfate and 0.10 ppbm for nitrate, while summer-fall group tropospheric mixing ratios averaged 0.05 ppbm for sulfate and 0.08 ppbm for nitrate. Correlations of the filter data with available ozone data suggest that the sulfate and nitrate are transported from the stratosphere to the troposphere. K.L.

N80-14582# Commission of the European Communities, Luxembourg. Directorate-Gen. Res., Sci. and Ed.

ENVIRONMENT AND THE QUALITY OF LIFE Final Report

1978 460 p refs Partly in ENGLISH, GERMAN and FRENCH

(EUR-5970; ISBN-92-825-0185-X) Copyright. Avail: NTIS HC A20/MF A01

One hundred twenty-seven contracts, conducted between 1973 and 1975, are summarized under six headings. These are epidemiologixal surveys, harmful effects of lead pollution, health effects of micropollutants, ecological effects of water pollutants, remote sensing of air pollution, and establishment of a data bank on environmental chemicals. Epidemiological studies were mostly concerned with the relationship between air pollution and respiratory disease in children. Micropollutant health effects cover a range of substances, including nitrogen compounds, asbestos fibers, detergents, heavey metals, and pesticides with their effects on various tissues. The Environmental Chemical Data and Information Network is also discussed. Author (ESA)

N80-14583# Little (Arthur D.), Inc., Cambridge, Mass.

RESEARCH AND DEVELOPMENT OF METHODS FOR ESTIMATING PHYSICOCHEMICAL PROPERTIES OF ORGANIC COMPOUNDS OF ENVIRONMENTAL CONCERN Final Report, Sep. 1978 - Feb. 1979

Warren J. Lyman, Judith C. Harris, Leslie H. Nelken, and David H. Rosenblatt (Army Med. Bioeng. Res. and Develop. Lab., Fort Detrick, Md.) Feb. 1979 138 p refs

(Contract DAMD17-78-C-8073; DA Proj. 3E1-62720-A-835) (AD-A074829; ADL-C-82426) Avail: NTIS HC A07/MF A01 CSCL 07/3

This study was the first phase of a program designed to prepare a handbook of estimation methods for the environmentally important physicochemical properties of organic chemicals. A review of environmental fate models, hazard ranking schemes, federal regulations and other material led first to the identification of about 50 physicochemical properties of interest. Those properties that are estimable with available methods were then identified; these properties will be included in the handbook to be prepared in the next phase. GRA

N80-14584# Los Alamos Scientific Lab., N. Mex.

ENVIRONMENTAL OPTIONS FOR COAL USE

J. R. Bartlit 1979 13 p refs Presented at Energy and Environ. Technol. Training Conf., Tsaile, Ariz., 29 May 1979

(Contract W-7405-eng-36)

(LA-UR-79-1393; CONF-790550-1) Avail: NTIS HC A02/MF A01

The options for coal development are described and their environmental impacts discussed. The various options for better or worse air pollution controls are discussed including the legal options available for requiring the better (cleaner) levels of control if those are desired. DOE

N80-14585# California Univ., Livermore. Lawrence Livermore Lab.

IMPERIAL VALLEY ENVIRONMENTAL PROJECT: AIR QUALITY ASSESSMENT

D. L. Ermak, R. A. Nyholm, and P. H. Gudiken Apr. 1979 21 p refs

(Contract W-7405-eng-48)

(UCRL-52699) Avail: NTIS HC A02/MF A01

The potential impact on air quality of geothermal development in California's Imperial Valley is assessed. The assessment is based on the predictions of numerical atmospheric transport models. It is predicted that at the 3000 MW level (with no abatement), the California 1 h standard for H2S(42 micron g/cubed m) would be violated at least 1% of the time over an area of approximately 1500 km squared. An H2S emission rate below 0.8 g/s per 100 MW unit is needed to avoid violations of the standard beyond a distance of 1 km from the source. DOE

N80-14586# Brookhaven National Lab., Upton, N. Y.

INTERRELATIONSHIPS BETWEEN MAN, ENERGY, AND

WATER QUALITY: A NEW METHODOLOGY FOR INTEGRATIVE ANALYSES
E. Kaplan and H. C. Thode, Jr. 9 May 1979 56 p Presented at EPA/STORET User Conf., Bethany, W. Va., 7 May 1979
(Contract EY-76-C-02-0016)
(BNL-26188; CONF-790567-1) Avail: NTIS HC A04/MF A01

County aggregated data for nineteen water quality parameters were examined in terms of their ability to describe qualitative chemical characteristics of water. Anion-cation balances as well as expected relationships between conductivity and other parameters were correctly accounted for. Factor analysis indicated the existence of three principal components describing patterns between metal ions, nonmetal ions, and alkalinity-bicarbonate, respectively. These factors were used in place of the original complete set of water quality parameters in a structural equation approach describing relationships between variables of man's activities. It was found that counties with high industrial electric consumption, farming, and mineral shipments tended to have increased levels of most water quality parameters. It was also found that simpler path diagrams may be indicated to reduce the effects of redundancy in adequately describing energy-water relationships. DOE

N80-14587# Princeton Univ., N. J. Guggenheim Labs. for the Aerospace Propulsion Sciences.
FUNDAMENTAL AND SEMI-GLOBAL KINETIC MECHANISMS OF HYDROCARBON COMBUSTION Annual Report, 1 Oct. 1977 - 30 Sep. 1978
F. L. Dryer and I. Glassman 1 Dec. 1978 30 p refs
(Contract EC-77-S-02-4372)
(COO-4272-3) Avail: NTIS HC A03/MF A01

The development of simplified chemical kinetic models to represent combustion chemistry is discussed. Studies of paraffin, olefin, and alcohol hydrocarbons are reviewed. Appropriate global models are presented and compared with experimental data. The results clearly demonstrate that the turbulent flow reactor facility can be used to develop accurate global models for a variety of important fuels. DOE

N80-14588# Dames and Moore, Los Angeles, Calif.
THE MISSISSIPPI, ALABAMA, FLORIDA, OUTER CONTINENTAL SHELF BASELINE ENVIRONMENTAL SURVEY, MAFLA, 1977/1978. VOLUME 2-A: COMPENDIUM OF WORK ELEMENT REPORTS Final Report
26 Jan. 1979 537 p refs
(Contract DI-AA55-CT7-34)
(PB-299686/6; Rept-08699-008-88-Vol-2-A; BLM/YM/ES-79/08-Vol-2-A) Avail: NTIS HC A23/MF A01 CSCL 13B

The surface sediments of the eastern Gulf of Mexico continental shelf were investigated. Samples from two replicate box cores at different stations for each season were taken. A large number of replicates were collected at each of the relatively small amount of stations in order to determine small scale variability. Ancillary data for sediment chemistry and benthic biological studies are provided. R.C.T.

N80-14589# Dames and Moore, Los Angeles, Calif.
THE MISSISSIPPI, ALABAMA, FLORIDA, OUTER CONTINENTAL SHELF BASELINE ENVIRONMENTAL SURVEY, MAFLA, 1977/1978. VOLUME 2-B: COMPENDIUM OF WORK ELEMENT REPORTS Final Report
26 Jan. 1979 546 p refs
(Contract DI-AA55-CT7-34)
(PB-299687/4; Rept-08699-008-88-Vol-2-B; BLM/YM/ES-79/09-Vol-2-B) Avail: NTIS HC A23/MF A01 CSCL 13B

The incidence of pathological conditions in representative marine invertebrates in the Mississippi, Alabama, and Florida area were studied. Hydrocarbons and trace metal concentrations in the animals and their surrounding sediments were determined. Demersal fishes were collected during four sampling periods and several undescribed species were discovered. Families containing species of special concern to the Mississippi, Alabama, and Florida area goals are discussed. R.C.T.

N80-14590# Air Pollution Technology, Inc., San Diego, Calif.
EFFECTS OF CONDITIONING AGENTS ON EMISSIONS FROM COAL-FIRED BOILERS: TEST REPORT NO. 1 Final Report, Jan. - Apr. 1978
R. G. Patterson, P. Riersgard, R. Parker, and S. Calvert Apr. 1979 72 p refs 2 Vol.
(Contract EPA-68-02-2628; EPA Proj. EHE624A)
(PB-299191/7; EPA-600/7-79-104A) Avail: NTIS HC A04/MF A01 CSCL 13B

A field performance test of an electrostatic precipitator (ESP) which uses SO3 as the conditioning agent was conducted. The ESP was at an electric utility power plant burning approximately 1% sulfur coal. The ESP performance was characterized in terms of particle collection efficiency and the chemical composition of particulate and gaseous emissions. Fly ash resistivity and dust opacity were also measured. Results show an average increase in overall efficiency from 80% to 95% with injection of the SO3. This is accompanied by a decrease in fly ash resistivity, a decrease in opacity, and an increase in SO3 concentration entering and leaving the ESP. Approximately 80% of the injected SO3 escaped the ESP. GRA

N80-14591# Air Pollution Technology, Inc., San Diego, Calif.
EFFECTS OF CONDITIONING AGENTS ON EMISSIONS FROM COAL-FIRED BOILERS: TEST REPORT NO. 2 Final Report, Apr. - Jul. 1978
R. G. Patterson, J. Long, R. Parker, and S. Calvert Apr. 1979 59 p 2 Vol.
(Contract EPA-68-02-2628; EPA Proj. EHE624A)
(PB-299192/5; EPA-600/7-79-104B) Avail: NTIS HC A04/MF A01 CSCL 13B

A field performance test of an electrostatic precipitator (ESP) which uses LPA 445 and LAC 51B flue gas conditioning agents was performed. The ESP is at an electric utility power plant burning approximately 1% to 2% sulfur coal. The ESP performance was characterized in terms of particle collection efficiency, chemical composition of particulate and gaseous emissions, fly ash resistivity, and dust opacity. Measurements show that there was no significant change in overall efficiency (99.6%) between the conditioned and unconditioned tests. There was some evidence that the conditioning agents reduced entrainment during electrode rapping and possibly improved the fractional efficiency slightly for particles smaller than about 5 micrometers in diameter. GRA

N80-14592# Research Triangle Inst., Research Triangle Park, N. C. Operations Analysis Div.
THE AIR QUALITY DATA HANDLING SYSTEM USER'S GUIDE Final Report
Larry R. McMaster May 1979 896 p refs
(Contract EPA-68-02-3011)
(PB-298996/0; EPA-450/4-79-009) Avail: NTIS HC A99/MF A01 CSCL 09B

Step by step procedures are given for the operation of each program in the Air Quality Data Handling System (AQDHS-2) developed to provide the capability to create and maintain air quality data bases and to retrieve data and generate reports from those data bases. Each program is described. File formats, options, error messages, cataloged JCL (LBM), warning and special instruction, cost considerations, and related programs and procedures are included. GRA

N80-14593# Arizona Univ., Tucson.
FUGITIVE AND FINE PARTICLE CONTROL USING ELECTROSTATICALLY CHARGED FOG Final Report, Oct. 1977 - Dec. 1978
Stuart A. Hoening Mar. 1979 103 p refs
(Grant EPA-R-805228)
(PB-298069/8; EPA-600/7-79-078) Avail: NTIS HC A05/MF A01 CSCL 13B

Control of industrial pollutants using electrostatically charged fog was evaluated on pollutants ranging from silica flour to SO2 and fly ash. Results indicate that: (1) significant suppression of pollution occurs with a minimum of water fog; (2) electrostatic hoods and screens can be used to push or direct pollutants to the proper area for collection; and (3) the system is well suited to control of moving fugitive dust sources where the usual duct and baghouse systems are ineffective or too costly. Development

of charged fog systems for controlling fugitive dust, demonstration testing of the systems in industrial locations, and designing and constructing a high temperature stack simulator for fog gun testing are among the topics considered. GRA

N80-14594# Environmental Measurements, Inc., San Francisco, Calif.
ACCURRACY OF REMOTELY SENSED SO2 MASS EMISSION RATES Final Report, Jun. 1976 - Dec. 1978
R. B. Sperling, M. A. Peache, and W. M. Vaughan May 1979 62 p refs
(Contract EPA-68-02-2711)
(PB-298077/9; EPA-600/2-79-094) Avail: NTIS HC A04/MF A01 CSCL 13B

Remote sensing data of single-stack power plant emissions and local wind speed were analzyed to determine SO2 mass flux for comparison with EPA referenced methods. Four days of SO2 data were gathered from a moving platform by three upward-viewing remote sensors, two ultraviolet absorption spectrometers and an infrared gas filter spectrometer. Wind velocity data were gathered by a laser Doppler velocimeter (LDV); supplemental data were obtained from a tethered balloon (telemetered) and pilot balloons (optical theodolite). The SO2 mass fluxes were derived from the remote sensing data. Comparisons were made between these SO2 fluxes (averages for 20 minutes and 60 minutes) and those derived from in-stack measurements. GRA

N80-14595# Battelle Columbus Labs., Ohio.
ENVIRONMENTAL ASSESSMENT OF THE FLUIDIZED-BED COMBUSTION OF COAL: METHODOLOGY AND INITIAL RESULTS
Keshava S. Murthy, Herman Nack, and D. Bruce Henschel (EPA) 1978 10 p refs Repr. from J. of Air Pollution Control Assoc., v. 28, no. 3, Mar. 1978 p 213-220 Presented at 70th Ann. APCA Meeting, Toronto, Jun. 1977 Revised Prepared in cooperation with Ind. Environ. Res. Lab.
(Contract EPA-68-02-2138)
(PB-298473/0; EPA-600/J-78-111; Paper-77-26.6-Rev) Avail: NTIS HC A02/MF A01 CSCL 13B

A program being conducted by the U.S. Environmental Protection Agency (EPA), aimed at complete environmental assessment (EA) of the fluidized-bed combustion (FBC) of coal is discussed. It reviews the EA methodology being developed by EPA: (1) identification of current technology and environmental background, including development of a list of the universe of potential pollutants; (2) development of environmental objectives via the Multimedia Environmental Goals chart; (3) comprehensive analysis of emissions from operating FBC systems; (4) assessment of existing control technology analysis of environmental control alternatives, using a Source Analysis Model approach; and (5) identification of further data and technology. GRA

N80-14596# Gulf South Research Inst., New Orleans, La.
DEVELOPMENT OF TREATMENT AND CONTROL TECHNOLOGY FOR REFRACTORY PETROCHEMICAL WASTES Final Report, 2 Feb. 1972 - 28 Feb. 1977
John H. Coco, Elias Klein, Donna Howland, James H. Mayes, and William A. Myers Apr. 1979 238 p refs
(Grant EPA-S-800773)
(PB-299291/5; EPA-600/2-79-080) Avail: NTIS HC A11/MF A01 CSCL 13B

The treatment of biorefractory organic pollutants emanating from petrochemical processing plants was investigated. Specifically, application of the unit operations of (1) carbon adsorption, (2) steam stripping, (3) solvent extraction, and (4) ozonation to a number of process effluents from halogenated hydrocarbon, isocyanate, acetylene, and styrene manufacturing industries was studied. In addition to these unit operation evaluations, an activated carbon was developed from a by-product soot which results from the manufacture of acetylene. Quantities of raw soot were dried, pretreated, pelletized, and activated to yield a product with commercial potential which had about 80 percent as much adsorption capacity as a similar commercial product. GRA

N80-14597# Environmental Protection Agency, Washington, D.C. Facility Requirements Div.
ENVIRONMENTAL ASSESSMENT OF CONSTRUCTION GRANTS PROJECTS
Jan. 1979 75 p
(PB-299209/7; EPA-430/9-79-007; FRD-5) Avail: NTIS HC A04/MF A01 CSCL 13B

The procedures and content for the environmental assessments that are required elements of facilities plans are described. The information is intended for consultants who most often develop these assessments, and citizens and local officials who wish to become more knowledgeable about the issues to be covered in an environmental assessment. GRA

N80-14598# Chamber of Commerce, Houston, Tex.
HOUSTON AREA OXIDANTS STUDY, PROGRAM SUMMARY Final Report
Jul. 1979 391 p
(PB-299638/7; HAOS-28) Avail: NTIS HC A17/MF A01 CSCL 13B

A detailed description of the Houston Area Oxidants Study (HAOS), a comprehensive, regional research program organized to investigate the extent, causes, and impacts of airborne oxidants and haze in the Houston area is presented. Measurements of ozone concentrations were made. Data on local air quality, meteorology, emissions, public health, and socioeconomics were analyzed and the potential impacts of proposed emission control strategies were identified. Program conclusions and results are summarized. Comprehensive summaries of each of the HAOS technical projects are presented. GRA

N80-14599# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
AEROMETRIC DATA ANALYSIS FOR THE HOUSTON AREA OXIDANT STUDY, VOLUME 2 Final Report
F. L. Ludwig and J. Raul Martinez Jul. 1979 332 p refs Prepared for Radian Corp., Houston, Tex.
(SRI Proj. 7106)
(PB-299648/6; HAOS-28-Vol-2) Avail: NTIS HC A15/MF A01; Also available in set of 3 reports HC E12, PB-299646-SET CSCL 13B

The relationships between air quality and meteorological and emissions conditions are considered. Emphasis is given to conditions that seem to be unique to the Houston area. Implications for future air quality studies and control measures are presented. GRA

N80-14600# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
AEROMETRIC DATA ANALYSIS FOR THE HOUSTON AREA OXIDANT STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
F. L. Ludwig and J. Raul Martinez Jul. 1979 58 p Prepared for Radian Corp., Houston, Tex.
(SRI Proj. 7106)
(PB-299647/8; HAOS-27-Vol-1) Avail: NTIS HC A04/MF A01; Also available in set of 3 reports HC E12, PB-299646-SET CSCL 13B

The results of a study to use available data to describe the air quality and meteorological conditions in the Houston area are given. Emissions (both anthropogenic and natural) in the Houston area are also described. The linkages that relate air quality in the Houston area to meteorological and emissions conditions are examined. GRA

N80-14601# Environmental Research and Technology, Inc., Westlake Village, Calif.
PARTICULATE SAMPLING AND ANALYSIS Final Report
S. L. Heisler Jan. 1979 112 p refs Prepared for Radian Corp., Houston, Tex.
(PB-299637/9; ERT-P-5190; HAOS-12) Avail: NTIS HC A06/MF A01 CSCL 13B

Particulate samples were collected at five sites in the Houston area. Particles smaller than approximately 2.5 micrometers aerodynamic diameter were collected at all sites using sequential filter samplers equipped with cyclone preseparators at the inlets. A second sampler without a preseparator was located at the downtown site to collect all particles smaller

than about 15 micrometers diameter. All samples were analyzed gravimetrically to determine ambient mass concentrations. A subset of 264 samples taken during stagnant air or near-stagnant conditions was selected for chemical analysis. The quantities of sulfate, nitrate, and chloride on the samples were determined by ion exchange chromatography. GRA

N80-14602# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
AEROMETRIC DATA ANALYSIS FOR THE HOUSTON AREA OXIDANT STUDY. VOLUME 3: DATA SUMMARIES FOR THE HOUSTON AREA OXIDANT STUDY Final Report
F. L. Ludwig, J. Raul Martinez, and Kenneth C. Niz Jul. 1979 272 p
(Contract DA-1; SRI Proj. 7106)
(PB-299649/4; HAOS-29-Vol-3) Avail: NTIS HC A12/MF A01; Also available in set of 3 reports HC E12, PB-299646-SET CSCL 13B

Results are presented of a study to use data collected during the Houston Area Oxidant Study and other available data to: describe the air quality and meteorological conditions in the Houston area; describe emissions (both anthropogenic and natural) in the Houston area; examine the linkages that relate air quality in the Houston area to meteorological and emissions conditions; and examine some of those conditions that seem to be unique to the Houston area. Implications for future air quality studies and control measures are presented. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-14603* National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR REAL-TIME CRUSTAL DEFORMATION MONITORING Patent
Peter F. MacDoran, inventor (to NASA) (JPL) Issued 9 Oct. 1979 7 p Filed 21 Dec. 1977 Supersedes N78-17529 (16 - 08, p 1043) Sponsored by NASA
(NASA-Case-NPO-14124-1; US-Patent-4,170,776; US-Patent-Appl-SN-863024; US-Patent-Class-343-112D; US-Patent-Class-343-100ME) CSCL 08G

A system is described for use in detecting earth crustal deformation using an RF interferometer technique for such purposes as earthquake predictive research and eventual operational predictions. A lunar based RF transmission or transmissions from earth orbiting satellites are received at two locations on Earth, and a precise time dependent phase measurement is made of the RF signal as received at the two locations to determine two or three spatial parameters of the antenna relative positions. The received data are precisely time tagged and land-line routed to a central station for real-time phase comparison and analysis. By monitoring the antenna relative positions over an extended period of months or years, crustal deformation of the Earth can be detected.

Official Gazette of the U.S. Patent and Trademark Office

N80-14604 Minnesota Univ., Minneapolis.
STUDIES WITH A SMALL SEISMIC ARRAY IN EAST-CENTRAL MINNESOTA Ph.D. Thesis
Stewart Alan Greenhalgh 1979 356 p
Avail: Univ. Microfilms Order No. 7926130

Relative arrival times from 120 mine blasts at distances of 80 to 350 km from the Central Minnesota Seismic Array were statistically analyzed to yield a crustal velocity-depth function for the area. A long range refraction profile, extending from the Mesabi Iron Range in northern Minnesota to the seismic array, was also carried out. A striking feature of the profile is the absence of direct P waves in the distance range 60 to 120 km, suggesting the presence of a fault or fracture zone near 60 km. Dispersion relations for the fundamental mode Rayleigh wave, observed on Mesabi mine blast record, were interpreted to reveal a 1.2 km thick surface layer of shear velocity 2.7 km/s overlying a half space of shear velocity 3.3 km/s. The geologic interpretation of the model is that of the Animikie Group metasediments overlying the Lower Precambrian gneisses and granities. Dissert. Abstr.

N80-14605 Washington Univ., Seattle.
CRUSTAL DEFORMATION IN CENTRAL CALIFORNIA: MULTI-WAVELENGTH GEODETIC OBSERVATIONS AND INTERPRETATIONS Ph.D. Thesis
John Oliver Langbein 1979 213 p
Avail: Univ. Microfilms Order No. 7927822

A precision geodetic experiment was conducted on a segment of the Calaveras fault near Hollister, Calif., which had been previously instrumented for surface creep. The experiment utilized a multi-wavelength distance measuring (MWDM) device which produced daily distance determinations of nine baselines ranging from 3 to 9 km in length with a measurement precision approaching 0.1 micron strain. Analysis of the MWDM data reveals the following: (1) Long-term trends over the 2-1/2 years sampled are consistent with rigid block displacement across the Calaveras fault zone. (2) The present strain release mechanism appears to be episodic aseismic slip on the Calaveras fault with a characteristic time of about one month. (3) Maximal inversion of the baseline displacement shows that Calaveras slip episodes could result from either a small amount of slip distributed over a large fault area or a large amount distributed over a small fault area. Dissert. Abstr.

N80-14606 Washington Univ., Seattle.
THE IMPLICATION OF Pn AMPLITUDES FOR VELOCITY GRADIENTS IN THE UPPERMOST OCEANIC MANTLE Ph.D. Thesis
James Steven McClain 1979 104 p
Avail: Univ. Microfilms Order No. 7927837

The amplitudes of critically refracted (Pn) seismic head waves are compared with those generated by synthetic seismograms to estimate the velocity gradients in the uppermost oceanic mantle. It is shown that the critical temperature gradients for all samples of materials present in the upper mantle (dunite, harzburgite, eclogite) are exceeded by the oceanic geotherm. Therefore, velocity must decrease with depth if the Earth is homogeneous and nonporous. A number of petrologic models are discussed as explanations for the apparent positive velocity gradient at a 65 million year old sea floor site. One possibility is the presence of a basaltic residuum in the upper mantle, decreasing with depth. Another is the possibility of slight serpentinization of the upper mantle with depth, requiring either native or meteoric water to be present in the upper mantle. Dissert. Abstr.

N80-14607 Cornell Univ., New York.
INSTABILITY OF GRAVITY WAVES IN A SHEAR FLOW Ph.D. Thesis
Miguel Folkmar Larsen 1979 77 p
Avail: Univ. Microfilms Order No. 7926923

The behavior of gravity waves propagating through a sheared medium is examined by using an approximate dispersion relation found by the WKB method. It is found that the dispersion relation for gravity waves in an isothermal, inviscid, nonrotating medium with a vertical shear of the horizontal background wind yields the Richardson number criterion for instability. The stability analysis is carried out using a method for plasma processes. Implications for previous analyses of gravity waves in a sheared medium are discussed. The results indicate that an absolute instability occurs when the Richardson number is less than 1/4. It is also found that a convective instability exists when the Richardson number lies between 1/4 and 1/2. The convective instability does not generate turbulence, but does amplify waves propagating through the unstable region. Therefore, it would be expected that turbulence would be maintained when the Richardson number is between 1/4 and 1/20. Dissert. Abstr.

N80-14608*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROCKET OZONE SOUNDING NETWORK DATA Quarterly Report, Mar. 1977 - May 1977
D. U. Wright, A. J. Krueger, and G. M. Foster (NOAA, Wallops Island, Va.) Wallops Flight Center, Wallops Island, Va. Nov. 1979 34 p

(NASA-TM-73283) Avail: NTIS HC A03/MF A01 CSCL 04A

During the period March 1977 through May 1977, three regular monthly ozone profiles were measured at Wallops Flight Center and three regular monthly ozone profiles were measured at the Churchill Research Range. One additional flight was conducted at Wallops Flight Center in support of Nimbus 4 SBUV. Data results and flight profiles for the period covered are presented. Author

N80-14609# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).

SPEECHES AND LECTURES DELIVERED ON THE OCCASION OF PROFESSOR DOCTOR WALTER DIEMINGER'S RETIREMENT AS DIRECTOR OF THE MAX-PLANCK INSTITUTE FOR AERONOMY [ANSPRACHEN UND VORTRAEGE ANLAESSLICH SEINER FEIERLICHEN VERABSCHIEDUNG AUS SEIN EM AMT ALS DIREKTOR DES MAX-PLANCK-INSTITUTS FUER AERONOMIE AM 9 UND 10 1975]

G. Pfotzer 1977 121 p refs Partly in GERMAN and ENGLISH Lectures presented at Landau, West Germany, 9-10 Jul. 1975 (Rept-55/1977; ISBN-3-540-08327; ISBN-0-38-08327-8)
Avail: NTIS HC A06/MF A01

Besides a number of speeches in appreciation of Dr. Dieminger's career, four papers are presented concerning the state of ionosphere and solar-terrestrial physics. Emphasis is on possible explanations for F region behavior during solar eclipses, a description of the ionosphere polar regions which is coherent with sounding observations to date, and on the likely analogy between the Earth's ionosphere and those of other planets. An assessment of Sun-weather relationships and their impact on man's environment is also given. For individual titles, see N80-14610 through N80-14613.

N80-14610# Graz Univ. (Austria). Inst. fuer Meteorologie und Geophysik.

UNSOLVED PROBLEMS OF THE UPPER ATMOSPHERE [UNGELOESTE PROBLEME DER OBEREN IONOSPHERE]

O. M. Burkard *In* Max-Planck Inst. fuer Aeronomie Speeches and Lectures delivered on the occassion of Prof. Dieminger's Retirement 1977 p 53-66 refs In GERMAN (For primary document see N80-14609 05-46)
Avail: NTIS HC A06/MF A01

Ionizing radiation observations made from 1952 to date during solar eclipses are reviewed. An attempt is made to relate solar flux to changes in the electron production rate and recombination coefficient of the upper ionosphere during eclipses. It is noted that the decrease in ion recombination at the beginning of an eclipse and the subsequent recovery following the eclipse are not symmetrical, although total flux density is the same before and after the event. The influence of the uneven distribution of sunspots across the solar disk is offered as a possible explanation for this phenomenon. Author (ESA)

N80-14611# Oulu Univ. (Finland). Abt. fuer Elektrotechnik.

POLAR IONOSPHERE [POLARE IONOSPHERE]

J. Oksman *In* Max-Planck Inst. fuer Aeronomie Speeches and Lectures delivered on the Occasion of Prof. Dieminger's Retirement 1977 p 67-89 refs In GERMAN (For primary document see N80-14609 05-46)
Avail: NTIS HC A06/MF A01

A brief definition of the polar ionosphere is offered, then the results of joint German-Finnish ionospheric observations and soundings are reviewed. Radio frequency absorption and reflection at the polar caps are considered. Satellite observations of electron flux density are cited along wtih data obtained during balloon-borne measurements. A model of the ionosphere-magnetosphere configuration around the Earth is suggested, taking into consideration solar wind effects, magnetopause currents, and plasmasphere orientation. Variations in the polar ionospheric characteristics are discussed and possible coupling mechanisms between the solar wind and the magnetosphere hypothesized. The need for further data is emphasized. Author (ESA)

N80-14612*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PLANETARY IONOSPHERES [PLANETARE IONOSPHAEREN]

S. J. Bauer *In* Max-Planck Inst. fuer Aeronomie Speeches and Lectures delivered on the Occasion of Prof. Dieminger's Retirement 1977 p 91-99 refs In GERMAN (For primary document see N80-14609 05-46)
Avail: NTIS HC A06/MF A01 CSCL 03B

An analogy is drawn between the Earth's ionosphere and the existence of ionospheres around other planets or natural satellites. An ionosphere is defined as a series of layers (D, E, E1, F2) and their characteristics are discussed. Emphasis is on the role of solar wind impacting with the potential ionosphere and the subsequent chemical and diffusion processes that can be observed. Data from the MARINER and PIONEER space programs are cited concerning measured electron density and ionospheric refractivity of extraterrestrial ionospheres, then an attempt is made to model these atmospheres based on Earth ionosphere theory. Author (ESA)

N80-14613# Appleton Lab., Slough (England).

SUN-WEATHER RELATIONSHIPS: A BRANCH OF SOLAR-TERRESTRIAL PHYSICS

J. W. King *In* Max-Planck Inst. fuer Aeronomie Speeches and Lectures delivered on the Occasion of Prof. Dieminger's Retirement 1977 p 101-114 refs (For primary document see N80-14609 05-46)
Avail: NTIS HC A06/MF A01

Various ways in which the lower atmosphere is influenced by solar phenomena ranging from short lived events such as flares to the 11 year and 22 year sunspot cycles are described. The effects on rainfall, scale height, surface pressure, and geomagnetism are specifically covered. Some important consequences for mankind of these Sun-weather relationships are discussed, including energy budgeting, electricity distribution, food production, and the alleviating of famine. Also considered are inadvertent man-made weather modifications such as electrical power distribution system VLF emissions in the magnetosphere. Finally, the influence of solar cycle induced meteorological effects on the economics of industrialized nations is brought to light. Author (ESA)

N80-14614# Lincoln Lab., Mass. Inst. of Tech., Lexington.

SEISMIC DISCRIMINATION Semiannual Technical Report, 1 Oct. 1978 - 31 Mar. 1979

Michael A. Chinnery 31 Mar. 1979 76 p refs
(Contract F19628-78-C-0002; ARPA Order 512)
(AD-A073772; ESD-TR-79-41) Avail: NTIS HC A05/MF A01 CSCL 17/10

Lincoln Laboratory has embarked on the task of carrying out the design and specification of a U.S. Data Center which will fulfill U.S. obligations that may be incurred under a possible future Comprehensive Test Ban Treaty. This report includes 17 contributions, relating progress in the Data Center design and associated seismic research. These contributions are grouped as follows: seismic data management system (5 studies), locations and travel times (5 studies), and general seismology (7 studies). Author (GRA)

N80-14615# Dow Chemical Co., Walnut Creek, Calif.

EVALUATION OF ALTERNATE VANADIUM COMPOUNDS FOR USE IN FIBERGLASS REINFORCED PLASTIC SOIL SURFACING Final Report

Theo John West Sep. 1979 35 p refs
(Contract N68305-77-C-0005)
(AD-A074871; CEL-CR-79.013) Avail: NTIS HC A03/MF A01 CSCL 08/13

The purpose of this investigation was to develop an alternate vanadium compound for the previously used vanadium neodecanoate (Vanadium Ten Cem) in formulating fiberglass-reinforced plastic surfacings. The study was limited to commercially available products. It was found that Accelerator VN-2 can be used in place of Vanadium Ten Cem under dry conditions but is not usable under wet conditions. Vanadyl and vanadium acetylacetonate and vanadyl naphthenate were also evaluated and were ineffective under wet conditions and inferior to Accelerator VN-2 under dry conditions. The flexural strengths of laminates prepared using Accelerator VN-2 at 320 F and 750 F substantially exceeded contract specifications. GRA

N80-14616# Naval Postgraduate School, Monterey, Calif.
POWER SPECTRA OF GEOMAGNETIC FLUCTUATIONS BETWEEN 0.4 AND 40 Hz M.S. Thesis
Frederick William Clayton Jun. 1979 63 p refs
(AD-A074378) Avail: NTIS HC A04/MF A01 CSCL 08/14

Power spectra of the fluctuations of the geomagnetic field were obtained for the frequency range of 0.4-40 Hz using an optically pumped Cesium vapor magnetometer. The spectra display a gradual decrease in slope at low frequencies with zero slope occurring between approximately 5 Hz and 15 Hz followed by a slight increase in slope. Data was collected at local midnight (0000-0200), local morning (0800-1000) and local afternoon (1600-1800). The morning and afternoon specta exhibit what is believed to be a Schumann resonance peak at 8.0 Hz. A peak at 2.2 Hz and its first harmonic (4.4 Hz) were also observed, but are believed to be a man-made phenomenon or a sensor related instrumentation effect. Considerable high frequency disturbances (20-40 Hz) were observed around local midnight and are believed to be ELF: Sferics. A comparison between a magnetically disturbed day (Fredericksburg Index of 7-) and a quiet day (Fredericksburg Index of 2-) at the same time period (0800-1000) showed a difference of 7-9 dB in power spectral density. GRA

N80-14617# Midwest Research Inst., Golden, Colo.
INSOLATION MODELS, DATA AND ALGORITHMS Annual Report, 1978
R. L. Hulstrom Dec. 1978 83 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-36-110) Avail: NTIS HC A05/MF A01

Operational computer models for thermal (broadband) and spectral insolation were developed along with a data base (SOLMET) for the U.S. geographical distribution of thermal insolation. Preliminary research measurements of the thermal insolation on tilted surfaces were performed and a complete design concept of advanced instrumentation to measure automatically the insolation on 37 tilted surfaces at various orientations was developed. DOE

N80-14618# Department of Energy, Washington, D. C. Div. of Solar Technology.
URBAN-RURAL INSOLATION CORRELATION STUDY
Apr. 1979 56 p refs
(DOE/ET-0092) Avail: NTIS HC A04/MF A01

Simultaneous measurements of incident solar radiation from six locations in metropolitan St. Louis, MO, were analyzed. Atmospheric pollutants over the center of metropolitan St. Louis reduced incident all-wave solar irradiation by about 3 percent. At two suburban sites, the irradiation depletion averaged 1 percent and 2 percent for summer and winter seasons, respectively. For cloudless days during the complete experiment, two suburban sites and a rural site north of the city received about 3.5 percent more relative irradiation with north than south winds. The explanation for this wind direction effect is that pollutants were advected from major sources near the city center. With north winds, the suburban and northern rural sites showed about 2 percent to 3 percent more relative irradiation on all days than on cloudless days for both the summer period and the complete experiment. A climatology is presented of hourly measured irradiation averaged over all network sites during the experiment. DOE

N80-14619# Alaska Univ., College. Geophysical Inst.
OPERATION OF A TELEMETERED SEISMIC NETWORK ON THE ALASKA PENINSULA
Feb. 1979 17 p refs
(Contract EY-76-S-06-2229)
(DOE/ER-70006-6; RLO-2229-T6-6) Avail: NTIS HC A02/MF A01

Operation and maintenance of the network on the Alaska Peninsula and the southern offshore area between the Semidi Islands and the western coast of Kodiak Island are discussed. Some of the seismic data obtained during the past few years are shown, and interpretations of the results are given. Data from the network were used for generating fault plane solutions in order to investigate the state of stress in the Benioff zone. Data was also used to invert travel time data into a seismic velocity structure of the area using the Hodhog method. R.C.T.

N80-14620# Los Alamos Scientific Lab., N. Mex.
HOMOMORPHIC PROCESSING OF SEISMIC SIGNALS
J. E. Brolley Jun. 1979 13 p refs
(Contract W-7405-eng-36)
(LA-7876-MS) Avail: NTIS HC A02/MF A01

An introduction to homomorphic processing of time series is presented. The basic concept is discussed and one form of implementation is adduced. Examples of reverberation problems are illustrated. Simple applications to real time series associated with underground nuclear explosions and earthquakes are presented. DOE

N80-14621# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
AN ATTEMPT TO TRIGGER IONOSPHERIC BUBBLES AND EQUATORIAL SPREAD F WITH THE DOUBLE BARIUM CLOUD TECHNIQUE
Gerhard Haerendel Feb. 1979 34 p refs
(MPI-PAE/Extraterrestr-152) Avail: NTIS HC A03/MF A01

An experiment is described that is expected to trigger an ionospheric bubble in the equatorial F region, i.e. the rise of a flux tube with low plasma content from the bottom of the post sunset F region. The disturbance which will be applied to this region by means of sounding rockets consists of two barium plasma injections at an altitude of 280 km, separated by 50 km in the east-west direction. The low density space between the two clouds is expected to act as the nucleus of bubble formation. It is demonstrated that two conventional barium releases, if placed at the right altitude, are sufficient to create the desired initial perturbation. The development of the bubble can be observed by various optical and radio techniques, such as incoherent scatter, backscatter, ionosonde, and radio scintillation measurements from the ground and from aircraft. The long range perturbations introduced by the rising flux tube will be monitored by airborne airglow measurements in the southern Appleton anomaly. Two rockets will be flown from the Punta Lobos range south of Lima, Peru, on a westward trajectory with a range of about 400 km. Author (ESA)

N80-14622# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
GRAVIMETRIC VERTICAL DEFLECTION DETERMINATION FOR THE NORTH SEA REGIONS (GVDNS 1)
Hans-Georg Wenzel 1978 28 p refs Sponsored by Deut. Forschungsgemeinschaft
(Ser-B-235; ISBN-3-7696-8533-4) Avail: NTIS HC A03/MF A01

Gravimetric vertical deflections were computed for the North Sea region in a grid with 0.25 deg spacing in latitude and 0.5 deg spacing in longitude. Measurements involve combination of GEM 10 spherical harmonics complete to degree and order 22 and 2154 mean free air gravity anomalies in 1 deg by 1 deg blocks and 14185 mean free air gravity anomalies in 6 min by 10 min blocks. The accuracy of the computed gravimetric vertical deflections was estimated to be better than + or - 1 sec by comparison with astrogeodetic vertical deflections around the North Sea. Author (ESA)

N80-14623# National Ocean Survey, Rockville, Md.
PROCEEDINGS OF SECOND INTERNATIONAL SYMPOSIUM ON PROBLEMS RELATED TO THE REDEFINITION OF NORTH AMERICAN GEODETIC NETWORKS
1978 630 p refs Conf. held at Arlington, Va., 24-28 Apr. 1978
(PB-299260/0; NOAA-79072401) Avail: NTIS HC A99/MF A01 CSCL 08E

The progress of the new adjustment of the North American datum since 1974 is discussed. A compilation of the technical papers are presented which cover the redefinition of the horizontal control network of North America. The status, methods and procedures, and future directions of the network are discussed. A.W.H.

N80-14624# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Data and Information Service.
UNITED STATES EARTHQUAKES, 1977
Jerry L. Coffman and Carl W. Stover 1979 87 p refs Prepared jointly with Geological Survey, Reston, Va.

(PB-300863/8; NOAA-79081308) Avail: NTIS HC A05/MF A01 CSCL 08K

Earthquakes that were reported felt in the United States and nearby territories in 1977 are described. Each description includes date, origin time, hypocenter and hypocenter source of the earthquake, maximum intensity (Modified Mercalli), and macroseismic effects reported in the area. A chronological list of earthquakes by state and a summary of marcroseismic data reported for each earthquake are presented. Information on crustal movement studies, tsunamis, and principal earthquakes of the world, and 'strong-motion seismograph data' is also presented. GRA

N80-14625# Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.

TOWARD IMPROVED TECHNIQUES FOR PREDICTING SOIL STRENGTH IN OFFSHORE ENVIRONMENTS

Norman Doelling 1 Jul. 1979 24 p refs

(PB-299960/5; MITSG-79/17; Opportunity-Brief-16; NOAA-79080911) Avail: NTIS HC A02/MF A01 CSCL 08M

Fugro cone and special piezometer probes were used as in situ testing devices for estimating the engineering properties of subsea sites. Theoretical models of the interaction of cones and soils were derived to relate the parameters obtained from the test devices to the engineering properties of soils. The models provided a framework for the analysis and calibration of field test data. Field tests were made at sites which have been studied in detail and whose engineering properties have been studied extensively by other means of field testing, by laboratory tests, and also by hindcasting a planned and calibrated embankment failure. GRA

N80-14626# National Technical Information Service, Springfield, Va.

ATMOSPHERIC ECHO SOUNDING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1979

Audrey S. Hundemann Sep. 1979 106 p Supersedes NTIS/PS-78/0916; NTIS/PS-77/0815; NTIS/PS-76/0698; NTIS/PS-75/641; NTIS/PS-75/045

(NTIS/PS-0989/8; NTIS/PS-78/0916; NTIS/PS-77/0815; NTIS/PS-76/0698; NTIS/PS-75/641; NTIS/PS-75/045) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Abstracts pertaining to equipment, design, and use of acoustic sounders are presented. Use of the sounders to sense the atmosphere for weather changes, temperature inversions, aircraft wakes, ionospheric properties, and other characteristics is discussed. (This updated bibliography contains 98 abstracts, 8 of which are new entries to the previous edition.) GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-14627 Cornell Univ., Ithaca, N. Y.

A UTILIZATION OF THE NESTED GRID APPROACH IN THE DEVELOPMENT OF A SEVERE WEATHER INDEX Ph.D. Thesis

James Thomas Moore 1979 185 p

Avail: Univ. Microfilms Order No. 7926935

A cascade hypothesis of severe storm development is described which is based upon the premise that macroscale systems control when and where mesoscale wave phenomena develop. The nested grid design of numerical modeling is found to be helpful in simulating these scale interactions with a primitive equation model. A flow regime in which subsynoptic scale, upper level subsidence, together with quasi-horizontal dry air advection, forms a subsidence inversion is also hypothesized. At smaller scales of motion, low level convergence and upward vertical motions overwhelm the upper level divergence and release the potential instability established by the macroscale flow. A variety of severe storm case studies are examined which test these hypothesized motions. A severe weather index is then developed which is defined to be the product of the greatest horizontal moisture convergence in the moist layer, the greatest vertical decrease of the equivalent potential temperature in the layer, and the depth of that layer over which it occurs. Dissert. Abstr.

N80-14628 Georgia Inst. of Tech., Atlanta.

METEOR WIND OVER ATLANTA, 34 DEG NORTH, 84 DEG WEST Ph.D. Thesis

Prakash Madhao Dolas 1979 133 p

Avail: Univ. Microfilms Order No. 7926675

Wind data generated by an all sky, continuous wave radio meteor wind facility is analyzed and the horizontal, meridional, and vertical components of the prevailing wind over the height range of 80 to 100 km, at 2 km interval, were obtained. The quasi-periodic warming pulses felt in the stratosphere are singled out as directly influencing the wind regime in the meteor zone. Harmonic analyses of the prevailing wind components show the presence of oscillation with a period of approximately 15 days. An apparent correlation is found between the near 15 day period oscillation in the meteor wind and the high latitude warming pulses in the stratosphere during winter. It is proposed that the mesopause at high latitudes during the winter should exhibit a near 15 day periodicity in temperature. It is also proposed that the extent of the quasi-periodic warmings of the mesopause will depend significantly upon the thermal structure of the stratosphere. Dissert. Abstr.

N80-14629 Florida State Univ., Gainesville.

THE DESIGN OF METEOROLOGICAL FIELD EXPERIMENTS WITH APPLICATIONS TO THE MESOSCALE Ph.D. Thesis

Kenneth Wilcey Johnson 1979 154 p

Avail: Univ. Microfilms Order No. 7926770

A methodology for the optimum placement of multivariate sensors in observation field programs is developed. The methodology relies on spatial correlation estimates, interpolation error estimates as provided by a multivariate optimum interpolation scheme, and a nonlinear programming algorithm. The sensor placement methodology is applied to the design of a mescoscale surface network for the sampling of severe storms. Spatial correlation functions among the variables of wind, pressure, and temperature were computed for use in the placement algorithm. The algorithm indicated that stations added to the existing National Severe Storms Laboratory's mesonetwork should be placed at selective nodes of a grid with a mesh increment of 10 km. Results from these experiments suggest that an inadequate data base exists for the computation of severe storm statistics. The reliability of the experiment design results is reduced as a consequence. Dissert. Abstr.

N80-14630 Oregon State Univ., Corvallis.

A STATISTICAL ANALYSIS OF EXTREME CHINOOKS IN MONTANA AS THEY RELATE TO LARGE SCALE CIRCULATION CHANGES Ph.D. Thesis

Roland Lester Grant 1979 203 p

Avail: Univ. Microfilms Order No. 7927126

Daily changes in the maximum and minimum temperatures were used to identify 36 dates of intense chinooks. A mean chinook situation was identified which indicated that a critical pattern of the surface flow always contained a Polar or Arctic airmass which overspread the prairie areas of Eastern Montana to the Rocky Mountain front just prior to the onset of chinook. On Chinook-Day this surface flow changes to directions from the south-southeast to south-southwest. This surface pattern was accompanied by a strong 500 MB flow from the northwest on Chinook-Day. Dissert. Abstr.

N80-14631 International Solar Energy Society, London (England).

METEOROLOGY FOR SOLAR ENERGY APPLICATIONS

1979 130 p refs Conf. held at London, Jan. 1979

(ISSN-0306-7874) Copyright. Avail: Issuing Activity

The effects of meteorological conditions on the amount of solar radiation reaching the surface for solar energy applications is discussed. Topics include: the radiance distribution of clear and overcast skies, the influence of environmental parameters on flat plate solar collector performance, and climatological values of the turbidity coefficient in the United Kingdom for different classes of radiation. A.W.H.

N80-14632 Washington Univ., Seattle.
SEA BREEZES ON THE ALASKAN ARCTIC COAST
Ph.D. Thesis
Thomas Leslie Kozo 1979 207 p
Avail: Univ. Microfilms Order No. 7927819

Atmospheric environmental data collected in August 1976 and 1977 (when nearshore waters are relatively ice free) along the Beauford Sea Coast of Alaska were examined for circumstantial and direct evidence of the existence of sea breezes at 70 N latitude. A numerical, nonlinear, time dependent, two dimensional sea breeze model was formulated using typical measured conditions as input to simulate the dominant physical factors responsible for the atmospheric boundary layer of the wind with height as seen in pilot balloon data. The sea breeze influence on boundary layer turning with height is largely responsible for the increased persistence of surface onshore (northeasterly and easterly) winds documented for the Alaskan arctic coast. The model gave evidence that sea breeze circulation could be strengthened by weak offshore (southwesterly and westerly winds) opposing synoptic winds. The model and data also showed reduced inland penetration of sea breezes with offsetting synoptic winds.
Dissert. Abstr.

N80-14633*# Tennessee Univ. Space Inst., Tullahoma.
PROCEEDINGS, THIRD ANNUAL WORKSHOP ON METEOROLOGICAL AND ENVIRONMENTAL INPUTS TO AVIATION SYSTEMS
Dennis W. Camp, ed. and Walter Frost, ed. Apr. 1979 190 p refs Proc. held at Tullahoma, Tenn., 3-5 Apr. 1979; sponsored by NASA, NOAA, and FAA
(Contract NAS8-32692)
(NASA-CP-2104; FAA-RD-79-49) Avail: NTIS HC A09/MF A01 CSCL 04B

The proceedings of a workshop on meteorological and environmental inputs to aviation systems are reported. The major objectives of the workshop are to satisfy such needs of the sponsoring agencies as the expansion of our understanding and knowledge of the interaction of the atmosphere with aviation systems, the better definition and implementation of services to operators, and the collection and interpretation of data for establishing operational criteria, relating the total meteorological inputs from the atmospheric sciences to the needs of aviation communities. The unique aspect of the workshop was the achievement of communication across the interface of the boundaries between pilots, meteorologists, training personnel, accident investigators, traffic controllers, flight operation personnel from military, civil, general aviation, and commercial interests alike. Representatives were in attendance from government, airlines, private agencies, aircraft manufacturers, Department of Defense, industries, research institutes, and universities. Full-length papers addressed the topics of training, flight operations, accident investigation, air traffic control, and airports. Winds and wind shear; icing and frost; atmospheric electricity and lightning; fog, visibility and ceilings; and turbulence were discussed. For individual titles, see N80-14634 through N80-14640.

N80-14634*# Saint Cloud State Coll., Minn.
METEOROLOGICAL INPUT TO GENERAL AVIATION PILOT TRAINING
John R. Colomy *In* Tennessee Univ. Space Inst. Proc., 3d Ann. Workshop on Meteorological and Environ. Inputs to Aviation Systems Apr. 1979 p 30-36 (For primary document see N80-14633 05-47)
Avail: NTIS HC A09/MF A01 CSCL 04B

The meteorological education of general aviation pilots is discussed in terms of the definitions and concepts of learning and good educational procedures. The effectiveness of the metoeorological program in the training of general aviations pilots is questioned. It is suggested that flight instructors provide real experience during low ceilings and visibilities, and that every pilot receiving an instrument rating should experience real instrument flight.
F.O.S.

N80-14635*# Air Transport Association of America, Washington, D.C.
NEEDED WEATHER INFORMATION WHERE IT BELONGS; IN THE COCKPIT
H. Grady Gatlin *In* Tennessee Univ. Space Inst. Proc., 3d Ann. Workshop on Meteorological and Environ. Inputs to Aviation Systems Apr. 1979 p 37-45 (For primary document see N80-14633 05-47)
Avail: NTIS HC A09/MF A01 CSCL 04B

The availability of inflight weather data to the cockpit is discussed. The need for real-time information systems to warn of hazardous weather conditions is emphasized. It is suggested that the Weather Service severe weather radar network be collocated with the FAA radar to provide information for real-time decision making.
F.O.S.

N80-14636*# National Transportation Safety Board, Washington, D. C.
ACCIDENT INVESTIGATION
Alan I. Brunstein *In* Tennessee Univ. Space Inst. Proc., 3d Ann. Workshop on Meteorological and Environ. Inputs to Aviation Systems Apr. 1979 p 46-57 (For primary document see N80-14633 05-47)
Avail: NTIS HC A09/MF A01 CSCL 04B

Aircraft accident investigations are discussed with emphasis on those accidents that involved weather as a contributing factor. The organization of the accident investigation board for air carrier accidents is described along with the hearings, and formal report preparation. Statistical summaries of the investigations of general aviation accidents are provided.
F.O.S.

N80-14637*# Atlanta Air Route Traffic Control Center, Hampton, Ga.
ATLANTA AIR ROUTE TRAFFIC CONTROL CENTER'S INVOLVEMENT IN AVIATION WEATHER
W. Don Wood *In* Tennessee Univ. Space Inst. Proc., 3d Ann. Workshop on Meteorological and Environ. Inputs to Aviation Systems Apr. 1979 p 58-62 (For primary document see N80-14633 05-47)
Avail: NTIS HC A09/MF A01 CSCL 04B

The distribution of weather information throughout the Air Traffic Control System is discussed along with the development of meteorological radar, and the modifications to the Air Route Traffic Control Center radars for locating and determining the severity of storms' cells. The planned improvements in the availability of weather data to the control centers are listed.
F.O.S.

N80-14638*# Port Columbus International Airport, Ohio.
EFFECT OF WEATHER CONDITIONS ON AIRPORT OPERATIONS
Daniel F. Ginty *In* Tennessee Univ. Space Inst. Proc., 3d Ann. Workshop on Meteorological and Environ. Inputs to Aviation Systems Apr. 1979 p 63-66 (For primary document see N80-14633 05-47)
Avail: NTIS HC A09/MF A01 CSCL 04B

The effect of adverse weather on airport operations are discussed. The meteorological conditions discussed included rain and hydroplaning, snow and slush, and icing.
F.O.S.

N80-14639*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECT OF SPANWISE GUST VARIATIONS
John C. Houbolt *In* Tennessee Univ. Space Inst. Proc., 3d Ann. Workshop on Meteorological and Environ. Inputs to Aviation Systems Apr. 1979 p 72-79 (For primary document see NR0-14633 05-47)
Avail: NTIS HC A09/MF A01 CSCL 04B

The spanwise, vertical force, and rolling moment effects of random gusts encountered by aircraft are analyzed. Mathematical models are given for approximating atmospheric turbulence.
F.O.S.

N80-14640*# South Dakota School of Mines and Technology, Rapid City.
THE T-28 THUNDER/HAILSTORM PENETRATION AIRCRAFT
John Prodan *In* Tennessee Univ. Space Inst. Proc., 3d Ann. Workshop on Meteorological and Environ. Inputs to Aviation Systems Apr. 1979 p 80-97 (For primary document see N80-14633 05-47)
Avail: NTIS HC A09/MF A01 CSCL 04B

Modifications to the T-28 Aircraft to make it safe for penetrating hailstorms to take scientific measurements are described. F.O.S.

N80-14641*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STRATOSPHERE: PRESENT AND FUTURE
Robert D. Hudson, ed. and Edith I. Reed, ed. Dec. 1979 443 p refs
(NASA-RP-1049) Avail: NTIS HC A19/MF A01 CSCL 04B

The present status of stratospheric science is discussed. The three basic elements of stratospheric science-laboratory measurements, atmospheric observations, and theoretical studies are presented along with an attempt to predict, with reasonable confidence, the effect on ozone of particular anthropogenic sources of pollution. For individual titles, see N80-14642 through N80-14648.

N80-14642*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LABORATORY MEASUREMENTS
In its The Stratosphere: Present and Future Dec. 1979 p 1-64 (For primary document see N80-14641 05-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

In addition to kinetic and photochemical data, sections on the following topics as they relate to the stratosphere are presented: heterogeneous chemistry, ionic processes, and infrared spectroscopy. All laboratory data for these areas are discussed in general terms and references to available literature are given. M.M.M.

N80-14643*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODELS
In its The Stratosphere: Present and Future Dec. 1979 p 65-81 (For primary document see N80-14641 05-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A variety of models used in the study of stratospheric phenomena are examined. Each type of model is important in its own right, and has made a significant contribution to the knowledge stratospheric processes. Particular models allow in-depth study of selected processes and the possibility of developing suitable parameterizations of these processes. Specific attention is given to three important processes: chemistry, radiative transfer, and motions. Since all of these processes depend on solar radiation, models of the Earth's radiation balance and vertical temperature structure are included. M.M.M.

N80-14644*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BUDGETS
In its The Stratosphere: Present and Future Dec. 1979 p 83-142 (For primary document see N80-14641 05-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The current knowledge of the sources, sinks, and distributions of those atmospheric species that are important in determining the physical and chemical state of the stratosphere are presented. These species are the halocarbons, nitrous oxide, odd-nitrogen, carbon dioxide, water vapor, methane and nonmethane hydrocarbons, and sulfur compounds. M.M.M.

N80-14645*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADICALS, RESERVOIRS, AND IONS
In its The Stratosphere: Present and Future Dec. 1979 p 143-197 (For primary document see N80-14641 05-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A study of those molecules chemically formed in the stratosphere is presented. Included are: (1) a review of the available library of data on those constituents which are currently believed to be of primary importance to stratospheric ozone photochemistry, (2) the identification of emerging problems by comparing calculated and observed concentration profiles of those constituents for which a developing data base exists, such as NO, NO2, HNO3, OP-3, Cl, ClO, OH, HO2, HCl, and ClONO2; and (3) the appraisal of emerging research objectives in the field of observational stratospheric ozone photochemistry. M.M.M.

N80-14646*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METEOROLOGY OF THE STRATOSPHERE
In its The Stratosphere: Present and Future Dec. 1979 p 199-280 (For primary document see N80-14641 05-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

An assessment is provided as to how far existing observational and theoretical efforts have progressed toward the understanding of stratospheric processes and toward the ability to use this knowledge to predict future states of the stratosphere. In this connection, gaps in present knowledge are pointed out, and the necessary research areas identified. A discussion is given of the present understanding of chemical exchange processes, dynamical coupling processes, radiative interactions, and electrical coupling between the troposphere and stratosphere. The role of stratospheric measurements with an indication of the advantages and shortcomings of various types of data in testing meteorological theories is given. Then, various techniques are discussed for obtaining the geographical and temporal distributions of measured parameters from the collection of discrete measurements that are taken at different locations and times. M.M.M.

N80-14647*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG PERIOD CHANGES IN STRATOSPHERIC PARAMETERS
In its The Stratosphere: Present and Future Dec. 1979 p 281-332 (For primary document see N80-14641 05-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

An attempt is made to determine whether analysis of records can be used to find out what long period changes on the ozone distribution pattern (if any) exist and to what extent (if any) they can be ascribed to human activity. The first problem is purely statistical; that is, to determine the best trend from a set of ozone observations. The second problem involves the interpretations of these trends. The emphasis is on conventional total ozone records, which exist for a relatively long period, but for which the models predict only modest changes. Commentary is made on the vertical distributions of ozone in the upper stratosphere, where predicted changes are large, but where the records are relatively short. Also included are analyses of the evidence for long-term changes in atmospheric temperatures and in trace constituents important to the stratosphere. M.M.M

N80-14648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODEL PREDICTIONS
In its The Stratosphere: Present and Future Dec. 1979 p 333-362 (For primary document see N80-14641 05-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The effects on ozone of anthropogenic sources of CFCl3 and CF2Cl2 are presented along with other forms of pollution identified as being potentially capable of producing significant ozone changes. Predictions are made of effects of ground level releases of CH3CCl3 and of chemicals produced by aircraft, rockets, and atmospheric nuclear explosions. Changes in N2O, H2O, CO and CO2 are also considered. M.M.M.

N80-14649# Ceskoslovenska Akademie Ved, Prague. National Committee of Geodesy and Geophysics.
NATIONAL REPORT: METEOROLOGY FOR 1975-1979
1979 53 p refs Presented at the 17th Gen. Assembly of the Intern. Union of Geodesy and Geophys., Canberra, Australia, 1979
Avail: NTIS HC A04/MF A01

Research activities conducted in 14 Czechoslovakian organizations concerned with weather and climate are summarized. Specific areas of interest include: weather forecasting; ozone distribution; air pollution; the atmospheric boundary layer and ground level; anthropogenic influences on weather and climate; aviation meteorology; cloud physics; atmospheric chemistry; agroclimatology; bioclimatology; the quasibiennial atmospheric cycle; and the hydrological function of forests. Participation in international symposia is also reported. A.R.H.

N80-14650# Committee on Science and Technology (U. S. House).
SEVERE STORMS RESEARCH

Washington GPO 1979 229 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 13-15 Jul. 1979
(GPO-52-135) Avail: Subcomm. on Space Sci. and Applications.

The Subcommittees on Space Science and Applications and the Environment and Atmosphere conducted hearings to better understand what weather forecasting research efforts were currently underway and to assess what efforts should be expended in the future. To accomplish the objective of the investigation, the Subcommittee held hearings at the following facilities: (1) National Severe Storms Forecast Center, Kansas City, Mo.; (2) National Center for Atmospheric Research, Boulder, Colo.; and (3) Space Science and Engineering Center, University of Wisconsin, Madison, Wis. M.M.M.

N80-14651*# Tennessee Univ. Space Inst., Tullahoma.
CURRENT RESEARCH ON AVIATION WEATHER (BIBLIOGRAPHY), 1979
Barry S. Turkel and Walter Frost Jan. 1980 96 p refs
(Contract NAS8-32692)
(NASA-CR-3214) Avail: NTIS HC A05/MF A01 CSCL 04B

The titles, managers, supporting organizations, performing organizations, investigators and objectives of 127 current research projects in advanced meteorological instruments, forecasting, icing, lightning, visibility, low level wind shear, storm hazards/severe storms, and turbulence are tabulated and cross-referenced. A list of pertinent reference material produced through the above tabulated research activities is given. The acquired information is assembled in bibliography form to provide a readily available source of information in the area of aviation meteorology. A.R.H.

N80-14652*# Stanford Univ., Calif. Div. of Applied Mechanics.
STOCHASTIC MODELING OF THE TIME-AVERAGED EQUATIONS FOR CLIMATE DYNAMICS Annual Report, 15 Mar. 1978 - 14 Mar. 1979
J. R. Spreiter 1979 22 p refs
(Grant NsG-5254)
(NASA-CR-162527) Avail: NTIS HC A02/MF A01 CSCL 04B

Two analyses on climate dynamics are presented, both based on a simplified set of barotropic equations for representing large scale non-linear atmospheric circulation characteristics. The statistical properties of the set of equations were investigated for small values of a parameter k sub o, corresponding to the physical case of large zonal westerlies and relatively weak eddy motions. The effect of seasonal type forcing on the solution of these equations was also studied and some preliminary numerical results are presented. R.E.S.

N80-14653# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
RELATIONSHIPS BETWEEN IR EXTINCTION, ABSORPTION AND LIQUID WATER CONTENT OF FOGS
R. G. Pinnick, S. G. Jennings (Manchester Univ., England), Petr Chylek (Harvard Univ., Cambridge), and H. J. Auvermann (New Mexico State Univ., Las Cruces) Aug. 1979 91 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A074395; ERADCOM/ASL-TR-0037) Avail: NTIS HC A05/MF A01 CSCL 04/2

It is well known that atmospheric fog and haze particles degrade the performance of DOD electro-optical sensors. A quantitative assessment of these effects unfortunately requires knowledge of droplet size distributions, which generally have complex spacial and temporal variations. The problem would be simplified considerably if estimates of the radiative properties of fog and haze particles could be made without detailed knowledge of their size distributions. In this report, an attempt is made to find relationships between the radiative properties of fogs and hazes (in particular the volume extinction and absorption coefficients) and their liquid water content, that are relatively independent on droplet size distribution. GRA

N80-14654# Meteorology International, Inc., Monterey, Calif.
METHODS AND PROGRAMS TO UTILIZE SATELLITE INDIRECT SOUNDINGS IN ENVIRONMENTAL ANALYSIS AND PREDICTION Final Report
Manfred M. Holl Sep. 1977 73 p refs
(Contract N00228-76-C-3174; WF52551000)
(AD-A074772; MII-M-225) Avail: NTIS HC A04/MF A01 CSCL 04/2

This report describes CLRBLOK, a comprehensive programmed capability for the diagnosis of blocks of scanlines of multi-channel radiances measured by Special Sensor E of Defense Meteorological Satellite Program spacecraft. The measured radiances are diagnosed for their clear-column radiance components and for the associated estimates of reliability. The solution of the blending system of linear equations is accomplished by application of a novel method: Blending by Weighted Spreading with the algorithm shifting into an SOR mode for those elements which have attained a prescribed criterion of absolute relevance. Also included is a method for assimilating the information in clear-column radiances, weighted as to reliability of the individual radiances and channel calibrations, for direct enhancement of the atmospheric thermal structure. This method includes the option to constrain the thermal structure to be statically stable. These information processing developments are applications of the Fields by Information Blending (FIB). GRA

N80-14655# Marlatt and Associates, Fort Collins, Colo.
ASSESSMENT OF THE APPLICABILITY OF THE NATIONAL FIRE WEATHER DATA LIBRARY TO WIND ENERGY ANALYSES Final Report
W. E. Marlatt, P. Tierney, P. Meilke, M. Baer, and J. Childs May 1979 115 p refs
(Contract EY-76-C-06-1830)
(PNL-2538) Avail: NTIS HC A06/MF A01

A program to review the fire weather library for stations with usable records, develop statistical summaries for selected individual stations and screen summaries for common windy areas, develop statistical comparisons of fire weather stations with nonfire weather stations having multiple observations per day, develop frequency spectra of wind periods above threshold values, and estimate seasonal and geographic distributions of wind energy is described. The use of the data from the program for selection of sites with wind characteristics favorable for maximizing the wind energy potential is discussed. DOE

N80-14656# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE FIFTH PLANNING MEETING FOR THE MONSOON EXPERIMENT MONEX. PART 2: SUMMER MONEX
1979 76 p refs Meeting held at New Delhi, 19-23 Feb. 1979 Prepared in cooperation with Intern. Council of Sci. Unions, Rome
(GARP-Spec-Rept-32) Avail: NTIS HC A05/MF A01; WMO, Geneva SWFR 15

The international MONEX operations plan was discussed in detail. Topics covered include field phase organization and implementation, ship operations, aircraft operations, telecommunication, satellite data acquisition, and radar observation. Author (ESA)

N80-14657# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE SECOND SESSION OF THE WAMEX SCIENTIFIC AND MANAGEMENT REGIONAL COMMITTEE
1979 118 p refs In ENGLISH and FRENCH Presented at Douala, United Republic of Cameroon, 26-30 Mar. 1979 Prepared in cooperation with Intern. Council of Sci. Unions, Rome
(GARP-Spec-Rept-33) Avail: NTIS HC A06/MF A01

This conference was the last planning meeting prior to the field phase of the experiment. The significance of the WAMEX program to agricultural and economic problems of African countries was related. The revised draft of the WAMEX implementation/operations plan was discussed, and a final version was adopted. The discussion on scientific planning and research aspects are also summarized. Complementary information is given in ten appendixes. Author (ESA)

N80-14658# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH. REGIONAL ASSOCIATION 4

(NORTH AND CENTRAL AMERICA) HURRICANE OPERATIONAL PLAN
1979 55 p
(WMO-524; ISBN-92-63-10524-3) Avail: NTIS HC A04/MF A01; WMO, Geneva SWFR 23

The purpose of the plan is to enhance the cooperative efforts of members within World Meteorological Organization Region 4 in carrying out their roles in preparing for issuing forecasts and warnings of all tropical cyclones affecting the area. Responsibilities of members are defined. Observational platforms, including land-based radar, satellites and aircraft reconnaissance are discussed. Communication procedures are outlined with special emphasis on headings required to assure proper computer processing and distribution of messages. A list of hurricane names is included. Author (ESA)

N80-14659# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH. WMO TROPICAL CYCLONE PROJECT, SUBPROJECT NO. 6. OPERATIONAL TECHNIQUES FOR FORECASTING TROPICAL CYCLONE INTENSITY AND MOVEMENT
1979 128 p refs
(WMO-528; ISBN-92-63-10528-6) Avail: NTIS HC A07/MF A01; WMO, Geneva SWFR 40

Tropical cyclone climatology, track forecasting methods, forecasting development and changes in intensity, and verification of tropical cyclone forecasts are reviewed in order to provide an up to date summary of the existing prediction techniques. Statistical, empirical, and dynamical techniques are described and their applicability is discussed. The track forecast error characteristics are examined and definitions of the displacement error and the positioning error are given. Author (ESA)

N80-14660# World Meteorological Organization, Geneva (Switzerland).
COMPENDIUM OF METEOROLOGY FOR USE BY CLASS ONE AND CLASS TWO METEOROLOGICAL PERSONNEL. VOLUME 2, PART 3: MARINE METEOROLOGY
Aksel Win-Nielsen, ed. and R. Fotheringham 1979 130 p refs 2 Vol.
(WMO-364) Avail: NTIS HC A07/MF A01

Lecture notes in marine meteorology based on corresponding syllabi for the fundamental training of class one and class two personnel are given. The following areas are covered: physical properties of sea water; dynamics of the upper ocean; heat balance of the ocean; air-sea interaction; water masses, oceanic fronts and thermoclines; platforms and instruments; ocean resources; sea ice; sea waves; swells; tsunamis and storm surges; and underwater acoustics. Author (ESA)

N80-14661# California Univ., Davis. Dept. of Land, Air and Water Resources.
WIND FIELD ANALYSES OF SEVERE STORMS FOR COMPASS (COOPERATIVE OBSERVATIONAL AND MODELING PROJECT FOR THE ANALYSIS OF SEVERE STORMS) Final Report, 1 Jun. 1978 - 31 May 1979
Kit K. Wagner May 1979 25 p refs
(Grant NOAA-04-78-B01-18)
(PB-300298/7; NOAA-79080803) Avail: NTIS HC A02/MF A01 CSCL 04B

A computer program for correlating radar reflectivity patterns at different times was developed. A method of producing three dimensional images with stereo-pair figures was also developed. Combining the two above, a complete procedure for computing three dimensional trajectories in thunderstorms was developed. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-14662 Cornell Univ., New York.
LANGMUIR CIRCULATIONS AS A CONVECTIVE INSTABILITY MECHANISM AND ITS EFFECT ON THE OCEAN MIXED LAYER Ph.D. Thesis
Samuel Paolucci 1979 228 p
Avail: Univ. Microfilms Order No. 7926947

The current system in the stratified upper layer of the ocean is discussed. It is shown that the interaction of the wind-driven current and surface waves produces Langmuir circulation through an instability mechanism for some values of the nondimensional parameters occurring in the problem. A global bound is predicted for stability to two dimensional disturbances of the wind wave mechanism. Comparisons are made between the critical value and the bound for convective instability in order to demark the region of parameter space in which subcritical instabilities are allowable. This region is found to be very small, so that confidence is gained that both the linear and energy theories reasonably capture the essential physics of the onset. By considering three dimensional disturbances, it is shown that the present wind-wave mechanism is most unstable to their two dimensional counterparts, stressing the relevance of the two dimensional finite amplitude numerical computations. Dissert. Abstr.

N80-14663# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE RELATIONSHIP BETWEEN OCEANIC CHEMICAL MESOSCALE AND SEA SURFACE THERMAL STRUCTURE AS DETECTED BY SATELLITE INFRARED IMAGERY M.S. Thesis
Don Alan Nestor Jun. 1979 93 p refs
(AD-A074186) Avail: NTIS HC A05/MF A01 CSCL 08/10

In recent years the study of ocean fronts and eddies has become increasingly important to the U.S. Navy for they are of vital importance in understanding underwater sound transmission. From the history of satellite pictures for the area of the ocean off the central California coast, it appears that cold water which has come to the surface as a result of upwelling has become intertwined within the California current. The persistent thermal features in the sea surface which are formed were the subject area of this study. Direct telephone contact was established with the satellite receiving station which afforded real time satellite information as to the thermal structure of the sea surface on a mesoscale. This satellite sensed thermal structure was then compared with in situ nutrient and temperature data collected on three cruises on board the research vessel ACANIA. The agreement between the in situ data and the satellite imagery was very strong and the utilization of satellite imagery was shown to be a very effective method to localize an ocean front. GRA

N80-14664# Polar Research Lab., Inc., Santa Barbara, Calif.
ARCTIC RESEARCH IN ENVIRONMENTAL ACOUSTICS (AREA). TECHNICAL REPORT NO. 8: ARCTIC LEAD-AIRDROP DATA BUOY
Beaumont M. Buck, Samuel P. Burke, and John O. Anderson 25 Jul. 1979 22 p refs
(Contract N00014-79-C-0042)
(AD-A074731; PRL-TR-8) Avail: NTIS HC A02/MF A01 CSCL 20/1

Arctic data buoys are capable of data collection that is impractical of accomplishment by manned-station techniques primarily because of high logistics costs. These cost differentials can be even further reduced by buoy paradrop. Size, weight, and power limit the usefulness of such devices, but their most serious drawback has been automatic deployment of sensors under the ice. A new concept which employs a data buoy that is designed for airdrop into open water leads of opportunity, is powered for up to a year's life, and uses the new TIROS-N ARGOS system for position and data recovery which offers promise in solving these problems. The configuration of the buoy, called 'LAD' (Lead Air Droppable), is described along with the results of preliminary Arctic field tests of the concept. Because of the limited nature of those tests, viability of the approach is not yet established, and additional trials are planned for spring 1980. GRA

N80-14665# Naval Research Lab., Washington, D. C. Space Science Div.
OCEAN WAVE SPECTROMETER MEASUREMENTS IN THE GULF STREAM EXPERIMENT Final Report
Davidson T. Chen, Donald L. Hammond, and Paul Bay 20 Aug. 1979 54 p refs
(WF52553000; RR0310343)

(AD-A074369; AD-E000321; NRL-MR-4070) Avail: NTIS HC A04/MF A01 CSCL 08/3

By assuming finite conducting, Gaussian-distributed, statistically stationary and homogeneous ocean surface, the ocean wave spectrometer measurements made in the Gulf Stream Experiment have demonstrated the capability of inferring the directional wave number slope spectra by using the specular point model for look-angles of less than 20 degrees. These measurements have also demonstrated the necessity of independent measurements of wind direction, mean square surface slope, and foam and spray. The results also indicate that at least four independent directional measurements with spatial resolution of 0.1 meters or smaller and spatial coverage of 750 to 1000 meters are necessary. GRA

N80-14666# Naval Environmental Prediction Research Facility, Monterey, Calif.

AIRBORNE EXPENDABLE BATHYTHERMOGRAPH (AXBT) OBSERVATIONS IMMEDIATELY BEFORE AND AFTER PASSAGE OF TYPHOON PHYLLIS IN AUGUST OF 1975 Ph.D. Thesis - Naval Postgraduate School Final Report

William G. Schramm Aug. 1979 45 p

(NR Proj. 083-275)

(AD-A074809; NEPRF-TR-79-05) Avail: NTIS HC A03/MF A01 CSCL 08/10

Ocean thermal response to a major typhoon is analyzed on the basis of data collected during the passage of Typhoon PHYLLIS in August 1975 in the Philippine Sea. This unique set of data was collected using calibrated Airborne Expendable Bathythermographs dropped from a Navy P-3 aircraft. There were three flights: the first was made 14 hours before storm passage, the second 10 hours after passage, and the third two days later. GRA

N80-14667# Centre Oceanologique de Bretagne, Brest (France).

THE ANTIPROD-1 CAMPAIGN ON BOARD THE MARION DUFRESNE, 1-28 MARCH 1977. [CAMPAGNE ANTIPROD 1. MARION DUFRESNE. 1-28 MARS 1977.]

Brest, France Sect. Doc. Centre Oceanog. Bretagne 1978 153 p refs In FRENCH; ENGLISH summary

(CNEXO-16-1978) Avail: NTIS HC A08/MF A01

During the cruise Antiprod I of the supply ship, Marion-Dufresne, the characteristics of planktonic production and of the factors which condition it were studied in the Indian Ocean on the region of influence of the antarctic divergence at the end of the summer. The essential data of the work done in the scope of a descriptive study is presented; 29 stations, situated along a N-S line between 40 and 62 deg S, West of the Kerguelen islands, are mentioned. The most interesting results are the demonstration of an unusual structure in the Antarctic, with Antarctic and subtropical convergencies joining, the marked poverty of phytoplankton since the maximal biomass and the resulting transparency of the waters can be compared to the oligotroph seas, such as the Mediterranean, and the very particular behavior of the silicates which are used up (or are not renewed) much more quickly than the other nutrients when the waters of the divergency drift northwards. Author (ESA)

N80-14668# National Ocean Survey, Rockville, Md. Office of Marine Technology.

THE COST EFFECTIVENESS OF AIRBORNE LASER HYDROGRAPHY

David B. Enabnit, Lowell R. Goodman, G. K. Young, and W. J. Shaughnessy Dec. 1978 63 p refs

(PB-299057/0; NOAA-TM-NOS-26; NOAA-79072308) Avail: NTIS HC A04/MF A01 CSCL 08J

A cost model was developed which gives the cost per unit area of surveying with an airborne laser bathymetric system. Input parameters of the model were estimated and the model was exercised. From the computed cost per unit area of surveying, conclusions are drawn on the potential economic value of laser bathymetry. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-14669 California Univ., San Diego.

KINEMATIC ANALYSIS OF OSMOTIC PROCESSES UNDER NON-EQUILIBRIUM CONDITIONS Ph.D. Thesis

Huacuz Villamar 1979 126 p

Avail: Univ. Microfilms Order No. 7926696

The general conditions for osmotic flow are derived theoretically. It is shown that when a binary mixture is separated from one of its components by means of a barrier permeable only to that same component, a necessary and sufficient condition for the balance of linear momentum in the system is the flow of mass into the mixture, across the semipermeable barrier. The equations for osmotic equilibrium under different sets of forces are derived from the general equation of motion for the osmotic system. It is concluded that the presence of a semipermeable membrane is a sufficient condition for the net motion of the binary mixture from its original equilibrium position, but it is not necessary since the membrane could be substituted by any other 'external' force acting selectively on one of the components of the mixture. It is also concluded that osmotic flow in a binary mixture is a necessary and sufficient condition to balance the linear momentum of the system. The results are applied to a series of membranes of different permeabilities and are used to explain the process of water transport in living organisms. Dissert. Abstr.

N80-14670# Materials Research Labs., Melbourne (Australia).

MICROBIAL COLONIZATION OF MATERIALS AT INNISFAIL, QUEENSLAND

F. John Upsher Aug. 1979 26 p refs Original contains color illustrations

(MRL-TN-428; AR-001-836) Avail: NTIS HC A03/MF A01

Materials were exposed under a glass canopy to investigate microbial colonization. Two series of exposures were made; one starting in the cool dry winter, the other in the hot-wet season. Growth of microorganisms was slow, particularly of algae which were not apparent until 30 weeks; tardiness was attributed to the samples being protected from rain so that the organisms were dependent upon atmospheric moisture and dew. An increase in the amount of growth was apparent after any week in which the mean relative humidity exceeded 87% or when 80% was exceeded for more than 125 hours. Cotton and wood provided the earliest growth and also supported the greatest amount and variety of fungi. Heavier growths were observed on acrylic paint and poly(vinyl chloride) after prolonged exposure. Cladosporium was the dominant fungal genus, being present on almost every occasion any fungus was detected. R.E.S.

N80-14671*# National Aeronautics and Space Administration, Washington, D. C.

MICROMORPHOLOGY OF NEUROHYPOPHYSIS OF RATS UNDER EXPERIMENTAL CONDITIONS

E. R. Meitner and E. Proksova Dec. 1979 7 p refs Transl. into ENGLISH from Biologia (Bratislava), v. 25, no. 12, 1970 p 857-860 Transl. by SCITRAN, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75947) Avail: NTIS HC A02/MF A01 CSCL 06C

The changes of the quantity of neurosecretory substance in neurohypophysis of rats under various experimental conditions are investigated. Comparing to the norm the quantity of neurosecretion after a long stay in the dark was larger. In animals subjected to immobilization stress the picture of neurohypophysis remained unchanged. It changed only in correlation with the administered water. Results indicate that the immobilization stress, in contradistinction to dolorose stress, has no substantial influence upon the quantity of neurosecretion in neurohypophysis. R.C.T.

N80-14672*# National Aeronautics and Space Administration, Washington, D. C.

RNA CONTENT IN MOTOR AND SENSORY NEURONS AND SURROUNDING NEUROGLIA OF MOUSE SPINAL CORD UNDER CONDITIONS OF HYPODYNAMIA AND FOLLOWING NORMALIZATION

V. A. Brumberg and L. Z. Pevzner Dec. 1979 15 p refs Transl. into ENGLISH from Tsitologiya (USSR), v. 10, no. 11, 1968 p 1452-1459 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Academy of Sci. (Leningrad)

(Contract NASw-3199)
(NASA-TM-75983) Avail: NTIS HC A02/MF A01 CSCL 06C

Male white mice were subjected to two and three week hypodynamia and then decapitated. Cytoplasmic RNA content per cell was measured by means of ultraviolet cytospectrometry. Changes in RNA content are shown, and the dynamics of the reparative processes of cells are discussed. R.C.T.

N80-14673*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECTS OF HYPODYNAMIA AND HYPOKINESIA ON THE ARTERIAL BED OF PELVIC LIMB MUSCLES IN THE RABBIT
N. E. Sokolov Dec. 1979 9 p refs Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (USSR), v. 62, no. 4, 1972 p 48-52 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Pavlov First Leningrad Medical Inst.
(Contract NASw-3199)
(NASA-TM-75984) Avail: NTIS HC A02/MF A01 CSCL 06C

The effects of hypodynamia on the arterial bed in the muscles and adjacent structures in limbs of rabbits were subject to investigation. Anatomical methods of study showed that hypodynamia produced morphological changes in the intraorganic arterial system in the muscles, fascia, and adipose tissue of the immobilized limb. These changes proved stable and were retained for six months. Author

N80-14674*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF RHYTHMIC PHOTOSTIMULATION ON MONKEYS WITH HYPERKINESIS OF POST-ENCEPHALITIC GENESIS
I. V. Danilov (USSR Academy of Medical Sciences) and N. N. Kudrayatseva (USSR Academy of Medical Sciences) Dec. 1979 12 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR, (USSR), v. 68, no. 4, 1972 p 511-516 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75986) Avail: NTIS HC A02/MF A01 CSCL 06C

In hyperkinetic monkeys a response opposite to that of healthy monkeys was observed during rhythmic photostimulation (frequency 3, 9, 18, 20, and 25/sec), i.e., the hyperkinesis disappeared. The significance of rhythmic excitatory cycles for interconnections between different brain structures is discussed. Author

N80-14675*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A CONTROLLED RATE FREEZE/THAW SYSTEM FOR CRYOPRESERVATION OF BIOLOGICAL MATERIALS
V. J. Anselmo and R. G. Harrison 1 Jun. 1979 182 p Prepared for Union Carbide Co.
(Contract NAS7-100)
(NASA-CR-162531; JPL-Pub-79-91) Avail: NTIS HC A09/MF A01 CSCL 06B

A system which allows programmable temperature-time control for a 5 cc sample volume of an arbitrary biological material was constructed. Steady state and dynamic temperature control was obtained by supplying heat to the sample volume through resistive elements constructed as an integral part of the sample container. For cooling purposes, this container was totally immersed into a cold heat sink. Sample volume thermodynamic property data were obtained by measurements of heater power and heat flux through the container walls. Using a mixture of dry ice and alcohol at -79 C, sample volume was controlled from +40 C to -60 C at rates from steady state to + or - 65 C/min. Steady state temperature precision was better than 0.2 C while the dynamic capability depends on the temperature rate of change as well as the thermal mass of the sample and the container. R.C.T.

N80-14676*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
INVESTIGATION OF EFFECTS OF TEMPERATURE, SALINITY, AND ELECTRODE DESIGN ON THE PERFORMANCE OF AN ELECTROCHEMICAL COLIFORM DETECTOR
David C. Grana Nov. 1979 54 p refs
(Contract EPA-IAG-D7-0053)
(NASA-TM-80130; EPA-600/4-79-07b) Avail: NTIS HC A04/MF A01 CSCL 06B

The results of two research programs to determine the optimum detector design for measuring fecal coliforms in saline waters for operational systems are presented. One program was concerned with the effects of temperature and salinity on endpoint response time, and the other, the interaction between electrode configurations and the test organisms. Test results show that the endpoint response time is related to salinity and seawater temperature; however, these results can be minimized by the correct choice of growth media. Electrode configurations were developed from stainless steel, Parlodion-coated stainless steel, and platinum that circumvented problems associated with the commercial redox electrodes. M.G.

N80-14677# European Space Agency, Paris (France).
BIOLOGY AND MEDICINE IN SPACE: RESEARCH OPPORTUNITIES OFFERED BY SPACELAB. AN INVITATION TO EUROPEAN INVESTIGATORS
Hilding Bjurstedt, ed. Aug. 1979 56 p refs
(ESA-BR-01) Avail: NTIS HC A04/MF A01; ESA, Paris FF 50

The results and experience gained from experiments in space, the current position, and the research opportunities envisaged for the future are reviewed by biologists and medical scientists for the purpose of encouraging investigators to propose experiments, and to disseminate information to the life sciences community. The main subjects covered are: Spacelab, areas of research opportunity, human physiology, cell and developmental biology, plant biology, radiobiology, exobiology and bioengineering. Author (ESA)

N80-14678# Advisory Group for Aerospace Research and Development, Paris (France).
RECENT ADVANCES IN AERONAUTICAL AND SPACE MEDICINE
Raymond H. Murray, ed. (Mich. State Univ., East Lansing) Sep. 1979 80 p refs In ENGLISH and FRENCH Presented at the Aerospace Med. Panel's Spec. Meeting, Brussels, 22-26 Jan. 1979
(AGARD-CP-265; ISBN-92-835-0250-7) Avail: NTIS HC A05/MF A01

The selection and life support of aircrews and spacecrews, including the European payload specialists for shuttle/Spacelab missions are discussed. Physiological factors in space operations are examined, as well as the medical and physiological problems addressed during the development and operation of commercial supersonic vehicles. For individual titles, see N80-14679 through N80-14683.

N80-14679# Advisory Group for Aerospace Research and Development, Paris (France).
PROBLEMS RELATED TO MEDICAL CRITERIA FOR THE SELECTION OF MILITARY NAVIGATION PERSONNEL [PROBLEMES RELATIFS AUX CRITERES MEDICAUX DE SELECTION DU PERSONNEL NAVIGANT MILITAIRE] c52
E. Evrard *In its* Recent Advan. in Aeron. and Space Med. Sep. 1979 22 p refs In FRENCH (For primary document see N80-14678 05-51)
Avail: NTIS HC A05/MF A01

Visual, auditory and vestibular, and psychological or psychiatric criteria for personnel selection are considered. Specific problems discussed relate to (1) special possible criteria for determining precociousness and the immediate problem of the specialization of operational personnel; (2) a possible raising of the standards for aviators destined to pilot new generation fighter aircraft; and (3) female navigational personnel. The standardization of visual and auditory criteria is recommended as well as additional research on the problems considered in order to reduce the rate of elimination during the pilot training course. Transl. by A.R.H.

N80-14680# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
AN ADVANCED OXYGEN SYSTEM FOR FUTURE COMBAT

AIRCRAFT c54
J. Ernsting *In* AGARD Recent Advan. in Aeron. and Space Med. Sep. 1979 17 p refs (For primary document see N80-14678 05-51)
Avail: NTIS HC A05/MF A01

The operational and physiological requirements for an advanced oxygen system for future high performance combat aircraft are considered and reviewed. It is concluded that such an oxygen system should employ a molecular sieve on board oxygen generation system, pressure premix for dilution of the oxygen by air and a twin demand regulator package. The principles of operation of such a system are considered and a design is proposed. Author

N80-14681# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fuer Flugmedizin.
THE EUROPEAN APPROACH TO THE SELECTION AND TRAINING OF SL PAYLOAD SPECIALISTS c53
K. E. Klein and J. R. Hordinsky *In* AGARD Recent Advan. in Aeron. and Space Med. Sep. 1979 12 p refs (For primary document see N80-14678 05-51)
Avail: NTIS HC A05/MF A01

The completed selection of European payload specialists (PS) for the first Spacelab mission (SL-1) is described. Future developments in European selection programs are projected. The immediate training requirements for the SL-1 PS are described. The integration of such varied training catagories as biomedical and physical with the more general SL experiment training is reviewed. The usefulness of mission simulations is also discussed. Author

N80-14682*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PHYSIOLOGICAL FACTORS IN SPACE OPERATIONS. EMPHASIS ON SPACE SHUTTLE c52
Sam L. Pool, Paul C. Rambaut, and Jerry L. Homick *In* AGARD Recent Advan. in Aeron. and Space Med. Sep. 1979 12 p refs (For primary document see N80-14678 05-51)
Avail: NTIS HC A05/MF A01 CSCL 06P

Problems such as space motion sickness, redistribution of body fluids, and cardiovascular deconditioning are of concern in short-duration space shuttle flights. The expanded participation of nonastronaut crewmembers or payload specialists in these flights increases the life scientists' interest in the space shuttle flights. Problems such as loss of skeletal mass, decreased red blood cell production, and numerous endocrine changes are of more concern on long-duration flights. The Life Sciences Program is therefore concerned with a wide variety of problems that range from the applied to the basic. The common thread is biology; the context is space. Several physiological factors associated with space shuttle operations are summarized including space motion sickness, cardiovascular deconditioning, bone and muscle loss, hematology, fluid and electrolyte changes, reentry g-forces, radiation safety, noise, atmosphere, extravehicular activity, toxicology, nutrition, biowaste, and health maintenance. Author

N80-14683# Medical de l'Aeronautique Civile, Paris (France).
SUPERSONIC AERIAL TRANSPORT: MEDICAL AND PHYSIOLOGICAL ASPECTS [LE TRANSPORT AERIEN SUPERSONIQUE ASPECTS MEDICO-PHYSIOLOGIQUES] c52
Jean Raboutet *In* AGARD Recent Advan. in Aeron. and Space Med. Sep. 1979 7 p In FRENCH (For primary document see N80-14678 05-51)
Avail: NTIS HC A05/MF A01

From 1964 to 1974, two medical subgroups, one French and one British, researched the medical and physiological problems presented by supersonic air transportation. All the problems were addressed by committees of specialists that included physicians, physicists, chemists, and engineers. Thus, the loss of pressurization, ozone, ionizing radiation, noise, visual problems, and air conditioning were the objects of profound study. Very satisfying solutions were found. In certain cases, notably ozone and cosmic radiation, it could be proved that it was a matter of false problems, and that supersonic flight at 17,000 meters offered no danger. As the consequence of all the favorable results obtained, the Concorde could easily obtain the authorization necessary for flight.
Transl. by A.R.H.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-14684* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTRA-OCULAR PRESSURE NORMALIZATION TECHNIQUE AND EQUIPMENT Patent
Edward F. Baehr, inventor (to NASA) Issued 12 Jun. 1979 5 p Filed 31 Aug. 1977 Supersedes N77-30736 (15 - 21, p 2839)
(NASA-Case-LEW-12955-1; US-Patent-4,157,718; US-Patent-Appl-SN-829318; US-Patent-Class-128-276) Avail: US Patent and Trademark Office CSCL 06B

A method and apparatus is described for safely reducing abnormally high intraocular pressure in an eye during a predetermined time interval. This allows maintenance of normal intraocular pressure during glaucoma surgery. A pressure regulator of the spring-biassed diaphragm type is provided with additional bias by a column of liquid. The hypodermic needle can be safely inserted into the anterior chamber of the eye. Liquid is then bled out of the column to reduce the bias on the diaphragm of the pressure regulator and, consequently, the output pressure of the regulator. This lowering pressure of the regulator also occurs in the eye by means of a small second bleed path provided between the pressure regulator and the hypodermic needle.
Official Gazette of the U.S. Patent and Trademark Office

N80-14685 Kansas State Univ., Manhattan.
MODELING OF BLOOD FLOW IN VESSELS OF THE MICROCIRCULATION Ph.D. Thesis
Pattarapan Prasassarakich 1979 178 p
Avail: Univ. Microfilms Order No. 7926572

A mathematical model of blood flow in rigid straight cylindrical and tapered tubes was developed. The similarity between blood flow in small vessels with oil water flow in glass tubes was investigated. A concentric annular flow (CAF) model with a cell free plasma layer surrounding a continuous core of cells was proposed to describe blood flow in small tubes < 400 micrometers. The resulting pressure flow behavior calculated from this model agrees very well with experimental results. The plasma layer was found to be a constant; independent of shear stress, tube diameter, and feed hematocrit. Results also indicate that the CAF model qualitatively predicts the Fahraeus effect and quantitatively predicts the Fahraeus-Lindqvist effect.
Dissert. Abstr.

N80-14686 California Univ., Riverside.
THE INTERACTION OF OZONE WITH THE HUMAN ERYTHROCYTE Ph.D. Thesis
Alan Edward Koontz 1979 246 p
Avail: Univ. Microfilms Order no. 7924289

In order to examine the biochemical events of oxidant injury which lead to edema, the human red blood cell studied after exposure in vitro to high concentrations (45 nMoles or O3/10 to the 6th power cells maximum) of oxone for short periods. Changes in outdated cells, pre-incubated with adenosine to restore ATP levels, in outdated cells not pre-incubated, and in resealed ghosts produced from the outdated cells are described. The sensitivity of certain membrane sites such as glyceraldehyde-3-phosphate dehygrogenase and the ouabain binding site evidences the reactivity of oxone with a relatively small number of membrane components, which may be responsible for the generation of a permeability change, cation pump inhibition, or membrane structural modification in the absence of gross internal oxidation, leading to edematous conditions in red cells and other tissues exposed to oxidants. Dissert. Abstr.

N80-14687* National Aeronautics and Space Administration. Pasadena Office, Calif.
DIALYSIS SYSTEM Patent
William A. Mueller, inventor (to NASA) (JPL) Issued 13 Jun.

1978 6 p Filed 28 Feb. 1977 Sponsored by NASA
(NASA-Case-NPO-14101-1; US-Patent-4,094,775; US-Patent-Appl-SN-772434; US-Patent-Class-210-22; US-Patent-Class-210-321B) Avail: US Patent and Trademark Office

The improved hemodialysis system utilizes a second polymeric membrane having dialyzate in contact with one surface and a urea decomposition solution in contact with the other surface. The membrane selectively passes urea from the dialyzate into the decomposition solution, while preventing passage of positively charged metal ions from the dialyzate into the solution and ammonium ions from the solution into the dialyzate.

Official Gazette of the U.S. Patent and Trademark Office

N80-14688*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF PROLONGED HYPOKINESIA ON TISSUE BLOOD FLOW

Z. P. Levites and V. F. Fedotova Dec. 1979 7 p refs Transl. into ENGLISH from Eksp. Khir. Anesteziol. (USSR) no. 3, May/Jun. 1974 p 79-80 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76005) Avail: NTIS HC A02/MF A01 CSCL 06P

The influence of hypokinesia on the blood flow in the tissues of rabbits was studied. Motor activity of animals was restricted during 90 days and blood flow recorded through resorption rate of NaI-131. Perfusion of tissues under the influence of hypokinesia was found to be reduced. Author

N80-14689*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SYNTHESIS AND BIOLOGICAL SCREENING BY NOVEL HYBRID FLUOROCARBON HYDROCARBON COMPOUNDS FOR USE AS ARTIFICIAL BLOOD SUBSTITUTES Second Annual Report, Jul. 1977 - Jul. 1978

J. Moacanin, K. Scherer, A. Toronto (Utah Biological Test Lab., Salt Lake City), D. Lawson, T. Terranova, A. Yavrouian, L. Astle (Utah Biological Test Lab., Salt Lake City), S. Harvey (Utah Biological Test Lab., Salt Lake City), and D. H. Kaaelble (Rockwell Intern., Thousand Oaks, Calif.) 15 Oct. 1979 276 p refs Sponsored in part by NIH
(Contract NAS7-100)
(NASA-CR-162537; JPL-Pub-79-36) Avail: NTIS HC A13/MF A01 CSCL 06A

A series of hybrid fluorochemicals of general structure R(1)R(2)R(3)CR(4) was prepared where the R(i)'s (i = 1,2,3) is a saturated fluoroalkyl group of formula C sub N F sub 2n+1, and R(4) is an alkyl group C sub n H sub 2n+1 or a related moiety containing amino, ether, or ester functions but no CF bonds. Compounds of this class containing approximately eight to twenty carbons total have physical properties suitable for use as the oxygen carrying phase of fluorochemical emulsion artificial blood. The chemical synthesis, and physical and biological testing of pure single isomers of the proposed artificial blood candidate compounds are included. Significant results are given. R.C.T.

N80-14690# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

DERIVATION OF PRESBYCUSIS AND NOISE INDUCED PERMANENT THRESHOLD SHIFT (NIPTS) TO BE USED FOR THE BASIS OF A STANDARD ON THE EFFECTS OF NOISE ON HEARING

Daniel L. Johnson Sep. 1978 53 p refs Sponsored in part by EPA
(AF Proj. 7231)
(AD-A071310; AMRL-TR-78-128) Avail: NTIS HC A04/MF A01 CSCL 06/19

This report provides various sets of tables that attempt to summarize much of the existing knowledge of the expected effects of noise on the hearing threshold levels of a population. Relations between noise exposure and Noise Induced Permanent Threshold Shift (NIPTS) for different audiometric frequencies are provided. Six different data sets of presbycusis (the effects of aging on hearing thresholds) are provided. Details for combining the effect of NIPTS to different presbycusis bases are provided. Three methods are suggested for presentation of hearing loss data. These are: (1) direct use of NIPTS, (2) calculation of hearing risk (the change in percent of the population whose hearing exceeds a certain value, and (3) use of a value (called units of potential compensation) that is related to the total compensation that might be paid due to hearing loss. The last method is new and was developed especially because of criticisms of the first two methods. The combined average of the frequencies of 500 Hz, 1000 Hz, 2000 Hz and 3000 Hz are analyzed in great detail and 10 tables are provided for describing the effects of noise on this frequency combination. A computer program for calculating hearing risk and units of potential compensation is provided. GRA

N80-14691# Army Research Inst. of Environmental Medicine, Natick, Mass.

THREE INSTRUMENTS FOR ASSESSMENT OF WBGT AND A COMPARISON WITH WGT (BOTSBALL)

B. Onkaram, L. A. Stroschein, and R. F. Goldman 14 Sep. 1979 28 p refs
(DA Proj. 3E1-62777-A-845)
(AD-A074979; USARIEM-M-24/79) Avail: NTIS HC A03/MF A01 CSCL 06/19

Environmental heat stress, expressed as the ambient wet bulb globe temperature (WBGT), was measured using three different WBGT instruments: (a) the conventional shaded dry bulb, 15.2 cm black globe and naturally convected wet bulb thermometers; (b) a miniaturized thermometer kit; (c) a commercial WBGT instrument using thermistor sensors, and the WBGT was compared with (d) the ambient wet globe temperature (WGT) measured by a Botsball. Visual observations were made on the instruments at regular intervals and an automated data collection system was also used to obtain data from thermocouples attached to the instruments. Statistically significant differences in WBGT readings were found among the instruments; however, the difference for a given environment was usually less than 0.5 C. Readings taken by visual observations resulted in WBGT values which differed by less than 0.3 C from those calculated from the automated data collection system. By using an equation derived for the Botsball, WBGT - 1.044 WGT - 0.187 in C, it is possible to convert the Botsball thermometer dial to indicate the conventional WBGT for outdoor environments; it then becomes a simple instrument for assessing environmental heat stress at the work site. GRA

N80-14692# Anthropology Research Project, Yellow Springs, Ohio.

ANTHROPOMETRIC SIZING, FIT-TESTING AND EVALUATION OF THE MBU-12/P ORAL-NASAL OXYGEN MASK

Milton Alexander (Aerospace Med. Res. Lab.), John T. McConville, and Ilse Tebbets Wright-Patterson AFB ARML Aug. 1979 33 p refs
(Contract F33615-79-C-0511; AF Proj. 7184)
(AD-A074723; AMRL-TR-79-44) Avail: NTIS HC A03/MF A01 CSCL 06/17

This report describes the anthropometric sizing procedures used in the developement of the MBU-12/P oral-nasal oxygen mask and documents results of subsequent fit-testing and evaluation of the mask. A successor to the MBU-5/P, the MBU-12/P is designed to withstand the G and Q forces in the newer high performance aircraft as well as to provide a better fit and improved visibility. Sizing analysis and fit-testing revealed that four sizes of the MBU-12/P are sufficient to cover the USAF male flying population; the anthropometry and statistics upon which this decision was based are described in this report. Also documented here are the results of a number of ground and flight tests conducted over a period of four years which provide both objective and subjective evidence that the MBU-12/P is a well fitting mask which successfully achieves its design objectives. Subjects of all the tests were experienced aircrew whose head and face measurements were representative of a full range of the USAF flight crew population. Results of all the fit test/evaluations revealed a high degree of user acceptance and a decided preference for the MBU-12/P when compared to the older MBU-5/P. GRA

N80-14693# Armed Forces Radiobiology Research Inst., Bethesda, Md.

EARLY TRANSIENT INCAPACITATION: A REVIEW WITH

CONSIDERATION OF UNDERLYING MECHANISMS
D. O. Carpenter Apr. 1979 19 p refs
(AD-A071803; AFRRI-SR-79-1) Avail: NTIS HC A02/MF A01 CSCL 06/18

Early transient incapacitation (ETI), which is a decrement in the performance of a specified task resulting from the effects of supralethal ionizing radiation exposures, has been observed in a number of animal species. Since nuclear weapons result in radiation fields sufficient to cause ETI in personnel that may be exposed, an understanding of the mechanism of this phenomenon is essential for the development of a rational plan for preventing or reversing the effect. This report is a review of the behavioral experiments concerning ETI and presents a critical analysis of available experimental information as to the cause of the phenomenon. It appears that the primary cause of ETI in experimental animals is probably faintness resulting from a fall in cerebral blood flow due to the direct action of histamine on blood vessel smooth muscle cells. GRA

N80-14694# Naval Postgraduate School, Monterey, Calif.
A CONSIDERATION OF FACTORS CONTRIBUTING TO STRENGTH DIFFERENCES IN MEN AND WOMEN M.S. Thesis
Theodore M. Printy Jun. 1979 80 p refs
(AD-A072671) Avail: NTIS HC A05/MF A01

The expansion of opportunities for women in today's military has increased the importance of understanding how and why men and women differ in strength, stamina, and work capacity. The present effort discusses how the different physiological/anatomical characteristics of the sexes form a basis for physical strength differences. Other factors, such as age, stature, weight, cultural influences, biomechanics, and training contribute to the significant differences in physical strength capabilities which are demonstrated both as to scope and degree. With an understanding of the strength capabilities of men and women and a comprehensive understanding of job requirements, the effective and efficient utilization of both sexes may be achieved. GRA

N80-14695# Ohio State Univ., Columbus. Dept. of Engineering Mechanics.
MEASUREMENT OF RESISTIVE TORQUES IN MAJOR HUMAN JOINTS Final Report, 1 Apr. 1976 - 30 Sep. 1978
Ali Erkan Engin Wright-Patterson AFB AMRL Apr. 1979 156 p refs
(Contracts F33615-76-C-0505; DOT-HS-6-01331; AF Proj. 2312)
(AD-A071170; AMRL-TR-79-4) Avail: NTIS HC A08/MF A01 CSCL 06/16

The major articulating joints considered are the shoulder, knee, hip, elbow and ankle. Due to drastic postmortem changes of the biomechanical response of the body tissues, the research is conducted with some obvious limitations on live human subjects. The major components of the specially designed and built experimental apparatus are a subject restraint system, a global force applicator (GFA), and an exoskeletal device (ESD). The ESD is used in monitoring the kinematics of the motion between the fixed and the moving body segments and the forces are applied to the moving body segment by means of the GFA. Design of both the ESD and GFA are similar, each containing eight high precision potentiometers. The experimental apparatus and the associated theoretical concepts are utilized to achieve at least three major tasks. These tasks are the quantitative determination of (a) the voluntary range of motion (b) the resistive force and moments and (c) the resistive torques for the rotational motion of the body segments about their long bone axes. Although the majority of the results presented are on the passive resistive force, moment and torques for the major articulating joints of three subjects, some results on the magnitudes of the active resistive muscle force, moment and torque vectors are also presented for the same subjects. GRA

N80-14696# Illinois Univ. at the Medical Center, Chicago. School of Public Health.
HEALTH EFFECTS OF AEROSOLS EMITTED FROM AN ACTIVATED SLUDGE PLANT
B. Carnow, R. Northrop, R. Wadden, S. Rosenbert, and J. Holden May 1979 232 p refs
(Grant EPA-R-805003)
(PB-299583/5; EPA-600/1-79-019) Avail: NTIS HC A11/MF A01 CSCL 06F

The health of persons residing near sewage treatment plants was studied to determine whether or not the health of persons exposed to aerosols emitted by a sewage treatment plant is significantly different from persons living in lesser exposed areas around the plant site. GRA

N80-14679# Advisory Group for Aerospace Research and Development, Paris (France).
PROBLEMS RELATED TO MEDICAL CRITERIA FOR THE SELECTION OF MILITARY NAVIGATION PERSONNEL [PROBLEMES RELATIFS AUX CRITERES MEDICAUX DE SELECTION DU PERSONNEL NAVIGANT MILITAIRE]
E. Evrard *In its* Recent Advan. in Aeron. and Space Med. Sep. 1979 22 p refs In FRENCH (For primary document see N80-14678 05-51)
Avail: NTIS HC A05/MF A01

N80-14682*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PHYSIOLOGICAL FACTORS IN SPACE OPERATIONS. EMPHASIS ON SPACE SHUTTLE
Sam L. Pool, Paul C. Rambaut, and Jerry L. Homick *In* AGARD Recent Advan. in Aeron. and Space Med. Sep. 1979 12 p refs (For primary document see N80-14678 05-51)
Avail: NTIS HC A05/MF A01 CSCL 06P

N80-14683# Medical de l'Aeronautique Civile, Paris (France).
SUPERSONIC AERIAL TRANSPORT: MEDICAL AND PHYSIOLOGICAL ASPECTS [LE TRANSPORT AERIEN SUPERSONIQUE ASPECTS MEDICO-PHYSIOLOGIQUES]
Jean Raboutet *In* AGARD Recent Advan. in Aeron. and Space Med. Sep. 1979 7 p In FRENCH (For primary document see N80-14678 05-51)
Avail: NTIS HC A05/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-14697*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY INVESTIGATION OF PILOT SCANNING TECHNIQUES OF DIAL POINTING INSTRUMENTS
Randall L. Harris, Sr. Nov. 1979 22 p refs
(NASA-TM-80079) Avail: NTIS HC A02/MF A01 CSCL 05H

Two pilots' methods of looking at instruments with needle pointers in a fixed base helicopter simulation were observed. A total of 45 runs were analyzed for each pilot. The data indicated that two apparently different techniques were being used; one looking at the needle point, the other looking at a fixed spot on the instrument and reading the needle direction parafoveally. The latter technique is found to be somewhat faster with both pilots accomplishing the flying task. M.G.

NPO-14698# Decisions and Designs, Inc., McLean, Va.
VALIDATION AND ERROR IN MULTIPLICATIVE UTILITY FUNCTIONS Research Report, Oct. 1977 - Dec. 1978
F. Hutton Barron Dec. 1978 52 p refs Prepared in cooperation with Univ. of Southern California
(Contract N00014-76-C-0074)
(AD-A073362; USC-001922-2-T; SSRI-RR-78-2) Avail: NTIS HC A04/MF A01 CSCL 05/10

In this report an approach to the concept of error in utility assessment is proposed. Three components of error are considered and each component is related to four separate elicitation methods-all in the context of a general multiplicative multiattribute utility model. The methods are Keeney-Raiffa (1976) procedure, SMART (Edwards, 1977), a social judgment theory (SJT) based regression model (Hammond, Stewart, Brehmer and Steinmann, 1975) and a new method called Holistic Orthogonal

Parameter Estimation or HOPE (Barron and Person, 1978). If a general multiplicative model can be assumed to be an appropriate representation of the decision maker's basic preference structure, error can occur in the direct estimation of the scaling constants and univariate utility functions for decomposition methods (Keeney-Raiffa and SMART), or in the holistic assessments for holistic methods (SJT and HOPE). Individual estimates may be merely noisy or may be fundamentally incorrect. Furthermore, the utility model may be incorrectly specified; for example, an additive model, rather than a multiplicative model, may be used. The four assessment methods are considered in conjunction with errors of each kind. Author (GRA)

N80-14699# University of Southern California, Los Angeles. Social Science Research Inst.
A CRITERION VALIDATION OF MULTIATTRIBUTE UTILITY ANALYSIS AND OF A GROUP COMMUNICATION STRATEGY Research Report, Oct. 1977 - Dec. 1978
Lee C. Eils, III and Richard S. John Dec. 1978 53 p refs
Prepared for Decisions and Designs, Inc., McLean, Va.
(Contract N00014-76-C-0074)
(AD-A073364; USC-001922-4-T; SSRI-RR-78-4) Avail: NTIS HC A04/MF A01 CSCL 05/10

This study investigates the use of an external criterion for validating additive utility assessments under certainty. Utilities were elicited from twenty-four groups via consensus judgment for ten hypothetical applicants for bank credit cards. The research design completely crossed two factors relevant to group utility assessment: (1) using a decomposition (MAUA) procedure or not, and (2) using a formal group communication strategy or not. The quality of each group's utility judgments was defined to be the Pearson produce-moment correlation between the group's judged utilities and utilities output from a configural (nonlinear) model used by Security Pacific National Bank in evaluating applicants for Master Charge. Group satisfaction measures were also obtained. The decomposition methodology and the group communication strategy both aided groups in making assessments that are more consistent with those of the bank model, which is based on a systematic collection and interpretation of a large amount of relevant data. Simplified procedures for obtaining weight parameters in the multi-attribute utility analysis yielded better overall utilities than more complicated ratio-estimation techniques. GRA

N80-14700# Decisions and Designs, Inc., McLean, Va.
IMPORTANCE WEIGHT ASSESSMENT FOR ADDITIVE, RISKLESS PREFERENCE FUNCTIONS: A REVIEW Research Report, Oct. 1977 - Dec. 1978
Richard S. John and Ward Edwards Dec. 1978 72 p refs
Prepared in cooperation with Univ. of Southern California
(Contract N00014-76-C-0074)
(AD-A073365; USC-001922-5-T; SSRI-RR-78-5) Avail: NTIS HC A04/MF A01 CSCL 05/10

One of the more useful tools in decision analysis is the riskless, additive multiattribute utility (MAU) model. The most difficult task in the application of MAU models is that of estimating the importance weight parameters. Two general approaches to the weight estimation problem are extensively reviewed in the present paper: direct subjective estimation and indirect holistic estimation. Various methods for directly assessing importance weights are catalogued, including ranking, fractionation, subjective-estimate methods, and paired-comparison procedures, and their relationship to one another is discussed. The so-called indirect holistic methods, including unbiased and biased regression analyses, the ANOVA and fractional ANOVA paradigms, and the indifference techniques of pricing out and trading off to the most important dimension, are all explained with particular emphasis on their common relationship to the general linear model. Author (GRA)

N80-14701# Decisions and Designs, Inc., McLean, Va.
ARE IMPORTANT WEIGHTS SENSITIVE TO THE RANGE OF ALTERNATIVES IN MULTIATTRIBUTE UTILITY MEASUREMENT Research Report, Oct. 1977 - Dec. 1978
William F. Gabrielli, Jr. and Detlof VonWinterfeldt Dec. 1978 47 p refs Prepared in cooperation with Univ. of Southern California
(Contract N00014-76-C-0074)
(AD-A073366; USC-001922-6-T; SSRI-RR-78-6) Avail: NTIS HC A03/MF A01 CSCL 05/10

Scaling factors in multiattribute utility measurement can either be assessed directly as importance weights or indirectly by indifference judgments. Critics of the importance weight interpretation of scaling factors argue that importance weights are not sensitive to ranges of alternatives and thus cannot be used to match standardized single attribute utility functions. To examine the range sensitivity of importance weight judgments two experiments were designed. In the first experiment college students gave relative importance weight judgments for a number of attributes when evaluating apartments and liquified natural gas plant locations. After the initial importance weight assessments the range of alternatives in one attribute was changed and subjects reassessed their weights. Although subjects were explicitly instructed to take ranges into account when making these judgments, they were unable to adjust their weights appropriately. To magnify possible range effects a second experiment examined a very simple two attribute car evaluation problem. Subjects were asked directly if weights should change after the range in one attribute was doubled. Most subjects indicated that there should be no change. The results of these experiments suggest that subjects have plausible ranges in mind when assessing importance weights and that they are unwilling to change weights after relatively spurious changes in the alternative set. Author (GRA)

N80-14702# Decisions and Designs, Inc., McLean, Va.
SUBJECTIVE VERSUS STATISTICAL IMPORTANCE WEIGHTS. A CRITERION VALIDATION Research Report, Oct. 1977 - Dec. 1978
Richard S. John and Ward Edwards Dec. 1978 52 p refs
Prepared jointly with Univ. of Southern Calif., Los Angeles
(Contract N00014-76-C-0074)
(AD-A073367; SSRI-RR-78-7; USC-001922-7-T) Avail: NTIS HC A04/MF A01 CSCL 05/10

The present paper proposes a research paradigm for comparing weight estimates to empirically derived 'true' weights, thus obtaining a measure of the criterion validity of different weight estimation techniques. Subjects are first taught a multi-attribute utility (MAU) model via multiple-cue probability learning (MCPL) and outcome feedback. Then, various assessments of the importance weight parameters for the model attributes are obtained. Composites formed from these weights are subsequently compared to composites formed from optimal statistical weights derived from outcome feedback. Data are reported from 17 subjects who were taught one of three 'diamond worth' MAU models in 100 feedback trials. The models all involved four attributes (cut, color, clarity, and carat weight), and varied in the 'environmental correlations' among the dimensions (either (1) all uncorrelated, (2) one large positive correlation, or (3) two large negative correlations). The results of the present study are discussed from both an applied and theoretical perspective. To the decision analyst in the field, the present results give support to the belief that the parameter estimates obtained from clients define a 'true' normative preference function. Theoretically, the findings of this study are strong evidence that people are aware of their own cognitive processes. GRA

N80-14703# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFECT OF PERIPHERALLY PRESENTED VISUAL SIGNALS ON PILOT PERFORMANCE DURING FLIGHT SIMULATION Final Technical Report, Oct. 1977 - Sep. 1978
John M. Bermudez, Jock C. H. Schwank, Thomas M. Longridge, Thomas M. McCloy, and Bruce A. Smith Jun. 1979 21 p refs
(AF Proj. 7184)
(AD-A073604; AMRL-TR-78-120) Avail: NTIS HC A02/MF A01 CSCL 05/5

Recent theoretical developments have stimulated interest in the development and testing of peripheral vision displays which could be used to monitor the control of aircraft attitude. This study investigated the ability of pilots to attend to peripherally presented attitude information via LED displays while simultaneously engaging in foveal processing of an instrument array during a complex maneuver in flight simulator. Twenty-four pilots were divided into two groups of twelve. One group performed vertical

S maneuvers using an LED display that indicated an out-of-tolerance condition in compass heading (steady LED). The second group used an LED that provided both out-of-tolerance information and rate-of-error information (strobe LED). All pilots were pre-trained to criterion. Both groups performed under each of three display conditions: Normal (standard round compass dial), Redundant (dial and LED), and Peripheral (LEDs-only). There were no statistically significant differences between the steady LED display and the strobing LED display. Overall, the results suggest that peripheral displays are at least as effective as compass dials for monitoring purposes, and such displays might prove useful as adjunct training aids with the potential for improving safety. Author (GRA)

N80-14704# Army Military Personnel Center, Alexandria, Va.
A STUDY IN PROCEDURAL MANIPULATION OF LOCUS OF CONTROL M.S. Thesis - North Carolina Central Univ. Final Report
Vernon Webster Hatley 13 Apr. 1979 72 p refs
(AD-A068658) Avail: NTIS HC A04/MF A01 CSCL 05/10

Specific locus of control change techniques were developed, examined and tested on one hundred twenty-eight (128) matched students in a general psychology class at North Carolina Central University during the spring semester of 1979. This study investigated the possibility of changing locus of control orientation in college students. Additionally, pretest locus of control scores of students who dropped the course were compared with those completing it. The experimental design was a two by four (2 x 4) matched group design. Presumed change in pretest-posttest locus of control scores as measured by Rotter's Internal External Locus of Control Scale and pretest locus of control scores of students who dropped the course were the dependent variables. Results revealed that locus of control scores in the experimental group shifted significantly (p less than .05) in the internal direction while those in the control condition moved toward an external orientation. Externals in the experimental group contributed significantly (p less than 0.5) to the overall change. Internals were found to move toward externality. The findings confirmed the contention that locus of control orientation can be influenced toward internality. Recommendations are offered for use of locus of control intervention techniques in academic settings.
Author (GRA)

N80-14705# Johns Hopkins Univ., Baltimore, Md. Div. of Behavioral Biology.
EXTENDED ANALYSIS OF SMALL GROUP PERFORMANCE AND THE EFFECTS OF CONTINGENCY MANAGEMENT IN A PROGRAMMED ENVIRONMENT
H. H. Emurian and J. V. Brady 16 Apr. 1979 30 p refs
(Contract N00014-77-C-0498; NR Proj. 170-855)
(AD-A068665; TR-4) Avail: NTIS HC A03/MF A01 CSCL 05/10

Volunteer subjects have participated in a series of experimental group missions involving continuous residence for varying periods in the programmed environment. The methodology involved in these ongoing studies extends the applications of performance programming technologies detailed in prior publications. The experiments focus upon an explicit analysis of the conditions under which interrelationships between participants and experimenters influence performance effectiveness. To assess potential interrelationships between physiological status and performance effectiveness and productivity, four measures were obtained while subjects concurrently operated the performance battery: (1) heart rate, (2) frontalis EMG, (3) skin temperature, and (4) skin conductance. Urine free cortisol levels were also determined from analyses of total urine volume which was collected throughout the mission. A strong overall relationship was observed between individual productivity and mean daily urine free cortisol. These observations together suggest that the stress of sustained high productivity along with prolonged performance accuracy on a demanding task may render an individual vulnerable to disruptive emotional reactions such as those provoked by the avoidance phase of the study. Author (GRA)

N80-14706# Maryland Univ., College Park. Dept. of Psychology.
ABILITY, INVOLVEMENT AND CLIMATE AS MULTIPLE AND INTERACTIVE PREDICTORS OF PERFORMANCE
R. Gene Hoffman Apr. 1979 41 p refs
(Contract N00014-75-C-0884; RR0420402)
(AD-A068891; RR-21) Avail: NTIS HC A03/MF A01 CSCL 05/10

Student ability, involvement in the class, and classroom climate created by the instructor activities were examined as multiple and interactive predictors of course performance for 915 students in 74 sections of a mathematics course. Climate was defined in two ways: (1) as individual perceptions and (2) as shared perceptions. Two parallel analyses were conducted using the two definitions of climate. Each analysis resulted in ability, involvement and climate contributing unique variance in the prediction of student examination performance on a common exam. Climate dimensions contributing to performance were coordination of class activities, instructor skill, and the extent of critical demands (a negative relationship). The most significant difference between the two analyses was the appearance of a significant ability X coordination interaction in the analysis using shared climate perceptions. This difference was interpreted to be the result of a confounding of the interaction in the individual perceptions of coordination. The relationship between the interaction and predictive accuracy was explored. GRA

N80-14707# Maryland Univ., College Park. Dept. of Physics.
WORK PERFORMANCE AS A FUNCTION OF THE INTERACTION OF ABILITY, WORK VALUES, AND THE PERCEIVED WORK ENVIRONMENT
Robert Lee Hannon Apr. 1979 165 p refs
(Contract N00014-75-C-0884; RR0420402)
(AD-A068893; RR-22) Avail: NTIS HC A08/MF A01 CSCL 05/10

Literature pertaining to the prediction of performance from ability, motivation and their interaction was reviewed. Three personal traits (achievement motivation, locus of control, and bureaucratic values) are examined as possible antecedents of work motivation and performance. A model of work motivation that depends on the strength of the personal traits interacting with their environmental compatibility was developed. An empirical study on 417 police officers was conducted to test hypotheses generated from the models. Measures of the personal traits were developed and administered along with a questionnaire used to ascertain perceptions of the work environment. Supervisor's ratings of performance were collected as well as demographic and ability measures. Moderated multiple regression analyses found strong evidence for the performance-related validity of the work motivation model. Neither ability nor the ability-motivation interaction showed any relationship to performance. GRA

N80-14708# Maryland Univ., College Park. Dept. of Psychology.
METHODOLOGICAL AND CONCEPTUAL ISSUES IN UNDERSTANDING ABILITY-PERFORMANCE RELATIONSHIPS Final Report
Benjamin Schneider Apr. 1979 36 p refs
(Contract N00014-75-C-0884; RR0420402)
(AD-A068894; RR-25) Avail: NTIS HC A03/MF A01 CSCL 05/10

This final report presents summaries of a series of technical reports concerned with individual non-ability and contextual variables as contributions to ability-performance relationships and the prediction of work performance. Theoretical papers and laboratory and field research efforts are summarized. It was concluded that situational variables conceptualized and operationalized in a number of different ways contribute additively, but not interactively, to the prediction of performance. Also included in this report is a list of publications accomplished under this contract. GRA

N80-14709# Arizona State Univ., Tempe. Dept. of Educational Technology.
RULE LEARNING AND SYSTEMATIC INSTRUCTION IN PILOT TRAINING Final Report, 1 Oct. 1977 - 31 Dec. 1978
Vernon S. Gerlach Mar. 1979 30 p
(Grant AF-AFOSR-2900-76; AF Proj. 2313)
(AD-A068906; TD-3; AFOSR-79-0609TR) Avail: NTIS HC A03/MF A01 CSCL 05/9

Four related lines of endeavor were pursued. Central to these

activities was the research on algorithmized instruction as a form of rule learning and its effect on the acquisition of complex human behaviors. This theme was implemented in studies on the role of performance objectives in instructional systems design, on the role of self-evaluation and its relationship to performance measurement, on the use of computer models in defining algorithms involving rule-using behavior, and an observation regarding the use of the Pearson product-moment correlation in performance measurement. GRA

N80-14710# Maryland Univ., College Park. Dept. of Psychology.
RATING ERRORS OF INCONSISTENCY AS A FUNCTION OF DIMENSIONALITY OF BEHAVIORAL ANCHORS
Bruce L. Katcher and C. J. Bartlett May 1979 25 p
(Contract N00014-75-C-0884; RR0420402)
(AD-A068922; RR-24) Avail: NTIS HC A02/MF A01

The present study focuses upon rating errors of inconsistency in multidimensional behavior-specific rating scales used for purposes of performance appraisal. The hypothesis that rating scales which are more nearly unidimensional will result in a fewer rating errors of inconsistency was tested using a Mixed Standard Rating Scale developed for police supervisory personnel. Two measures of unidimensionality were used. The correlations between the indices of unidimensionality and rating inconsistency across ten rating dimensions were significant and in the predicted direction, confirming the hypothesis. The implications of the results for behaviorally anchored rating scales are discussed. GRA

N80-14711# Computer Sciences Corp., Huntsville, Ala.
A MIND/BRAIN/MATTER MODEL CONSISTENT WITH QUANTUM PHYSICS AND UFO PHENOMENA
T. E. Bearden 1979 41 p
(AD-A068988) Avail: NTIS HC A03/MF A01 CSCL 05/10

The author introduces a speculative model of mind and matter and their interaction that is consistent with the experimental basis of physics, and which offers mechanisms for paranormal phenomena of all types, including UFO phenomena. Certain conclusions are reached by a new fourth law of logic, which is briefly described and summarized. A new photon interaction model of quantized observable change is also presented. A solution to the problem of the nature of mind is generated, using the author's fourth law of logic, and a seven-dimensional hyperspatial physical model of a living biosystem is developed. Using this basic model, an infinite-dimensional cotemporal hyperspatial model of the physical universe complete with all its life forms is constructed. Levels of unconsciousness-including the collective human species unconscious--emerge naturally as types of crosstalk between hyperframes. By the author's formula, the psychokinetic power of a mind level increases exponentially as the number of biosystem stages involved. At the level of the collective human species unconscious, the psychokinesis is sufficient to materialize symbolic tulpoids (thought forms), given a sufficient stress stimulus in large groups. Using the cold war as the major stress stimulus on mankind since World War II, the author shows that most major UFO waves in the literature precisely fit the model. GRA

N80-14712# Ohio State Univ. Research Foundation, Columbus.
PROCESS MODEL OF HOW THE HUMAN OPERATOR TRACKS DISCONTINUOUS INPUTS Final Report, 1 Jul. 1977 - 30 Sep. 1978
Richard J. Jagacinski, Walter W. Johnson, E. James Hartzell, Sharon Ward, and Kaile Bishop Dec. 1978 32 p refs
(Grant AF-AFOSR-3288-77; AF Proj. 2312)
(AD-A069001; OSURF-760640/784688; AFOSR-79-0607TR)
Avail: NTIS HC A03/MF A01 CSCL 05/10

Two basic research projects were pursued. In conjunction with personnel at the 6570th Aerospace Medical Research Laboratory, Human Operator Effectiveness Branch, experiments determined that the time to acquire stationary targets with position and velocity control systems was a linear function of an Index of Difficulty measure. This measure is a logarithmic function of initial target displacement and target width. The linear relationship with capture time represents an extension of Fitts' Law, known to hold for discrete movements performed with a physical stylus. The slope of the linear relationship between capture time and the Index of Difficulty was considerably steeper for the velocity control system and was slightly steeper for greater initial target uncertainty. The second project investigated the capture of moving targets with three different control systems: (1) two independent position controls, PP; (2) two independent velocity controls, VV; and (3) one position and one velocity control, PV. The PV system yielded significantly faster capture times than the PP system. However, due to the development of two different control strategies with the VV system the difference between the VV and the other systems was not statistically significant. Further research is recommended to clarify this latter result. GRA

N80-14713# Rochester Univ., N. Y. Center for Visual Science.
A FACILITATION EFFECT IN ORIENTATION DISCRIMINATION
John Lott Brown and Iris M. Kortela 1976 29 p refs
(Contracts N00014-76-C-0189; NEI-ROI-EY-00680)
(AD-A072726; TR-76-2) Avail: NTIS HC A03/MF A01 CSCL 06/16

The minimal stimulus for orientation discrimination consists of two spots of light which define the orientation of an imaginary line. Luminance thresholds for discrimination of orientation were measured with two 5 min test spots, separated by 10, 20, 30 or 40 min of arc, located approximately 2 deg from the fovea. Test flashes were of 2 msec duration and varied in temporal relation from simultaneity to nearly 0.5 sec asynchrony. When measurements were made by an ascending method of limits with both test flashes increasing together, luminance thresholds for orientation discrimination were close to light detection thresholds and were uninfluenced by the temporal relation. When one of the flashes was presented by a constant luminance 0.6 log unit above detection threshold and the luminance of the other was the dependent variable, the luminance threshold for discrimination of orientation of the two spots varied with their temporal and spatial relations. For 30 min separation it was approximately 0.4 log unit below light detection threshold when the variable luminance spot preceded the fixed luminance spot by about 140 msecs for each of two observers. Results with haploscopic presentation suggest that the effect may represent facilitation at the cortex. GRA

N80-14881# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fuer Flugmedizin.
THE EUROPEAN APPROACH TO THE SELECTION AND TRAINING OF SL PAYLOAD SPECIALISTS
K. E. Klein and J. R. Hordinsky *In* AGARD Recent Advan. in Aeron. and Space Med. Sep. 1979 12 p refs (For primary document see N80-14678 05-51)
Avail: NTIS HC A05/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-14714 Dutch Air Line Pilots Association, Amstelveen.
SLEEP AND BODY RHYTHM DISTURBANCE IN LONG-RANGE AVIATION. THE PROBLEM AND A SEARCH FOR RELIEF
Frank H. Hawkins Sep. 1978 98 p refs
Copyright. Avail: Issuing Activity

The effect of sleep disturbance and deprivation and body rhythm disruption in long-range aviation and on the performance of flight crews was investigated. The theory of sleep and body rhythms is presented and discussed. Human performance and sleep is also discussed. Current relief efforts are described along with possible alternative ways for relief. Some of the alternatives are autogenic training, progressive relaxation, auto-hypnosis, yoga, meditation, and biofeedback. The study concludes that for safety, social, and economic reasons, it would be advisable to research more fully the sleep problem in aviation. R.E.S.

N80-14715*# National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGIES FOR THE HANDICAPPED AND THE AGED
Trudy E. Bell Jul. 1979 48 p
(NASA-TM-80842) Avail: NTIS HC A03/MF A01 CSCL 05H

Examples of the technology transferred from advanced aerospace research projects to the needs of the handicapped and the elderly are presented. The booklet is divided into six sections, concentrating on technology respectively applied to the heart, limbs, senses, diagnostic tools, treatment and overall lifestyle. Within each section, the projects are organized roughly in chronological order, from those already completed and in the marketplace to those on the engineer's drawing board or still a concept in a physician's mind. R.E.S.

N80-14716*# National Aeronautics and Space Administration, Washington, D. C.
SIMULATION OF PHYSIOLOGICAL SYSTEMS IN ORDER TO EVALUATE AND PREDICT THE HUMAN CONDITION IN A SPACE FLIGHT
V. V. Verigo Dec. 1979 26 p refs Transl. into ENGLISH of conf. paper from Inst. of Med. and Biol. Problems, Min. of Health USSR Moscow, 1979 p 1-23 Presented at the 10th Conf. of the Joint Soviet-Am. Working Group on Space Biol. and Med., Houston, Tex., Oct. 1979
(Contract NASw-3198)
(NASA-TM-76016) Avail: NTIS HC A03/MF A01 CSCL 06S

Simulation models were used to study theoretical problems of space biology and medicine. The reaction and adaptation of the main physiological systems to the complex effects of space flight were investigated. Mathematical models were discussed in terms of their significance in the selection of the structure and design of biological life support systems. R.C.T.

N80-14717*# National Aeronautics and Space Administration, Washington, D. C.
BIOLOGICAL SYSTEMS FOR HUMAN LIFE SUPPORT: REVIEW OF THE RESEARCH IN THE USSR
Ye. Ya. Shepelev Dec. 1979 26 p refs Transl. into ENGLISH from Obzor. Issled. v SSSR, Inst. of Med. and Biol. Problems, Ministry of Health (Moscow), 1979 p 1-24 Presented at the 19th Conf. of the Joint Soviet-Am. Working Group on Space Biol. and Med., Houston, Tex., Oct. 1979 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76018) Avail: NTIS HC A03/MF A01 CSCL 06K

Various models of biological human life support systems are surveyed. Biological structures, dimensions, and functional parameters of man-chlorella-microorganism models are described. Significant observations and the results obtained from these models are reported. R.C.T.

N80-14718*# Life Systems, Inc., Cleveland, Ohio.
REGENERATIVE CO2 REMOVAL FOR PLSS APPLICATION Final Report
D. B. Heppner, R. R. Woods, and F. H. Schubert Oct. 1979 64 p refs
(Contract NAS9-15218)
(NASA-CR-160419; LSI-TR-319-31-6) Avail: NTIS HC A04/MF A01 CSCL 06K

Various concepts for the design of the nonelectrochemical absorber were defined and evaluated. A preliminary design based on the use of hollow fiber membranes was developed. Small scale bench testing demonstrated the carbon dioxide removal capability and provided design data for scale-up to the one person level. A full scale conceptual design of the absorbent regeneration hardware using six electrochemical cells was also completed. The design was supported by single cell testing and showed that a full scale regeneration system, operating continuously over 24 hours, can regenerate the absorbent from one extravehicular activity mission. The single cell regeneration hardware was operated for over 800 hours. R.E.S.

N80-14719# Systems Technology, Inc., Hawthorne, Calif.
MODELING BIODYNAMIC EFFECTS OF VIBRATION, FIFTH YEAR Final Scientific Report
Henry R. Jex and Raymond E. Magdaleno Aug. 1979 73 p refs
(Contract F44620-73-C-0075; AF Proj. 2312)
(AD-A073819; STI-1037-5; AFOSR-79-0960TR) Avail: NTIS HC A04/MF A01 CSCL 05/5

The biomechanical feedthrough of vertical and/or fore-aft vibration from a seat, to (and through) various parts of the torso, limbs, hands, and head, to a spring-restrained control stick has been modeled over a 5-year effort using prior Air Force and other data bases. This final report summarizes the project results and provides a User's Guide to BIODYN-78, an interactive, remote-access, digital computer program for exercising the model. The model involves 77 postural and physiological parameters to define a broad range of seating/control/display arrangements from supine to erect. An internal routine automatically trims the Torso/Head/Limb system at the desired angles and computes linearized equations of motion, which are solved for their eigenvalues and resulting transfer functions using highly refined computing routines. In distinction from most past models, this model represents several degrees-of-freedom simultaneously, e.g., vertical and fore/aft shoulder motion, angular head-bobbing, constrained elbow motion, stick-grip-interface force, muscle forces, and stick angular motion, among many others. GRA

N80-14720# Advanced Research Resources Organization, Washington, D.C.
METHODS FOR EVALUATING THE PHYSICAL AND EFFORT REQUIREMENTS OF NAVY TASKS: METABOLIC, PERFORMANCE, AND PHYSICAL ABILITY CORRELATES OF PERCEIVED EFFORT Technical Report, 1 May 1978 - 30 Apr. 1979
Joyce C. Hogan, George D. Ogden, Deborah L. Gebhardt, and Edwin A. Fleishman Apr. 1979 73 p refs
(Contract N00014-78-C-0430)
(AD-A072497; ARRO-3034-R79-3) Avail: NTIS HC A04/MF A01 CSCL 06/16

Two studies examined the reliability and validity of an index of perceived physical effort for assessing the metabolic and ergonomic costs of task performance. In each study, tasks whose actual performance costs were either available from work physiology literature or were calculated mathematically were rated by subjects who had no work cost information on physical effort required in the task. In the first study, subjects (N=50) completed pencil and paper ratings of tasks whose metabolic costs were known using physical ability dimensions and the index of perceived physical effort. Results indicated high correlations between metabolic costs and ratings of physical effort as well as ratings of various strength and stamina factors. In the second study, subjects (N=20) performed 24 diverse manual materials handling tasks whose ergonomic costs were calculated and rated each completed task on the index of physical effort. Results indicated a substantial relationship between actual ft-lbs. of work and ratings of physical effort. Implications of the results are discussed in terms of the inherent psychometric properties of the index and its applied utility for determining criterion performance standards and job-related training. GRA

N80-14721# Anthropology Research Project, Yellow Springs, Ohio.
DESIGN CRITERIA FOR CHARACTERIZING INDIVIDUALS IN THE EXTREME UPPER AND LOWER BODY SIZE RANGES
Kathleen Robinette and Thomas Churchill Wright-Patterson AFB, Ohio AMRL Jun. 1979 92 p refs
(Contract F33615-78-C-0508; AF Proj. 7184)
(AD-A072353; AMRL-TR-79-33) Avail: NTIS HC A05/MF A01 CSCL 06/14

Designers commonly attempt to represent a range of human body sizes by using human manikins, three-dimensional forms, computer simulations, and various other models. These analogues are developed from a limited number of body size groupings, often utilizing 5th, 50th, or 95th percentile values. There are serious limitations to this percentile approach, exemplified by the fact that at the ends of the distribution, percentile values are not additive. Focusing on the ends of the distribution,

where limitations are most intense, this report pinpoints and illustrates problems associated with the use of percentile values, and describes two alternative approaches: subgroup and regression values. Either of these altneratives offers significant improvement over the percentile approach and can be used to characterize any portion of the body size distribution. Regression equations for predicting dimensions from weight and stature and from weight and sitting height are provided to aid designers in computing dimensional body size data needed for cockpit and other work station layouts. GRA

N80-14722# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
TIME SIMULATION OF AN AIR SURVEILLANCE TASK WITH VARYING AMOUNTS OF RADAR INFORMATION
William H. Pearson Jun 1972 28 p refs
(AD-A074866; AMRL-TR-72-74) Avail: NTIS
HC A03/MF A01 CSCL 17/7

Subjects observed a computer display unit simulating radar noise and radar trails of 150 and 500 mph aircraft, one per minute on the average, over a 1000 mile square area. Radar information was stored, cycle by cycle, up to a limit of 3,5,7 and 9 twenty second cycles and then presented sequentially rapidly enough to give an illusion of movement in the trails. Subjects detected the presence of aircraft and controlled computer processing by lightpen and keyboard actions. Time-to-detect increased with radar information for 500 mph tracks but not for 150 mph tracks. Probability of detection increased with radar information for 150 mph trails but not for 500 mph trails. These results were interpreted as showing the disruptive effect of (1) simulated radar noise confounded with the amount of radar information because of information storing and (2) the interference of the easier-to-find 500 mph aircraft with the 150 mph aircraft. GRA

N80-14723# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
MOTOR VEHICLE MANUFACTURERS ASSOCIATION (MVMA) TWO-DIMENSIONAL CRASH VICTIM SIMULATION TUTORIAL SYSTEM: SELF-STUDY GUIDE Final Report
Bruce M. Bowman, D. Hurley Robbins, and Robert O. Bennett 28 Jun. 1979 423 p Sponsored in part by Motor Vehicle Manufacturers Assoc.
(PB-299256/8; UMICH-HSRI-79-7-1) Avail: NTIS
HC A18/MF A01 CSCL 13F

A mathematical model used for predicting occupant dynamics in a crash environment is described. A self study guide divided into thirteen segments is presented. The data requirements of a set of related model features are included in each segment. Text, illustrations, and example problems are given. R.C.T.

N80-14724# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
MOTOR VEHICLE MANUFACTURERS ASSOCIATION (MVMA) TWO-DIMENSIONAL CRASH VICTIM SIMULATION TUTORIAL SYSTEM: AUDIO-VISUAL PROGRAM Final Report
Bruce M. Bowman, D. Hurley Robbins, and Robert O. Bennett 28 Jun. 1979 303 p Prepared jointly with Motor Vehicle Manuf. Assoc. of the US
(PB-299257/6; UMICH-HSRI-79-7-2) Avail: NTIS
HC A14/MF A01 CSCL 13F

A mathematical model used for predicting occupant dynamics in a crash environment is described. An audio visual program divided into thirteen segments is presented. The data requirements of a set of related model features are included in each segment. The narration text and figures used for the 35 mm slides is given. R.C.T.

N80-14725# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
MVMA TWO-DIMENSIONAL CRASH VICTIM SIMULATION, VERSION 4, VOLUME 1 Final Report
Bruce M. Bowman, Robert O. Bennett, and D. Hurley Robbins 29 Jun. 1979 233 p refs Prepared jointly with Motor Vehicle Manuf. Assoc. of the US
(PB-299305/3; UMICH-HSRI-79-5-1-Vol-1) Avail: NTIS
HC A11/MF A01; Also available in set of 3 reports HC E13, PB-299304-SET CSCL 13P

The coordinate systems describing occupant position are defined and the formulation of the equations of motion using Lagrangian techniques is detailed. The addition of forces to the equations of motion is described in general, supplemented by specific analyses for vehicle-occupant contact, gravity, joints, and restraint systems. R.C.T.

N80-14726# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
MVMA TWO-DIMENSIONAL CRASH VICTIM SIMULATION, VERSION 4, VOLUME 2 Final Report
Bruce M. Bowman, Robert O. Bennett, and D. Hurley Robbins 29 Jun. 1979 294 p refs Prepared jointly with Motor Vehicle Manuf. Assoc. of the US
(PB-299306/1; UMICH-HSRI-79-5-2-Vol-2) Avail: NTIS
HC A13/MF A01; Also available in set of 3 reports HC E13, PB-299304-SET CSCL 13F

The data required to operate the MVMA two dimensional model and program output generated using simple data sets are described. Specifications for the input data cards together with a detailed description of input data quantities are presented. Normal output options and certain normal output quantities are described. Input and output is given for two sample exercises of the computer model. GRA

N80-14727# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
MVMA TWO-DIMENSIONAL CRASH VICTIM SIMULATION, VERSION 4, VOLUME 3 Final Report
Bruce M. Bowman, Robert O. Bennett, D. Hurley Robbins, and Judith M. Becker 29 Jun. 1979 338 p refs Prepared jointly with Motor Vehicle Manuf. Assoc. of the US
(PB-299307/9; UMICH-HSRI-79-5-3-Vol-3) Avail: NTIS
HC A15/MF A01; Also available in set of 3 reports HC E13, PB-299304-SET CSCL 13F

The organization of the computer program into live processors and their interactions is presented. Description of program organization and flow, packing techniques, binary output formats, and auxiliary program output is presented for each of the five processors. Design information concerning certain special output subprocessors is provided. Conversion of the computer program for use of various computer systems is discussed. GRA

N80-14728# Advisory Group for Aerospace Research and Development, Paris (France).
MAINTENANCE OF AIR OPERATIONS WHILE UNDER ATTACK WITH CHEMICAL AGENTS
J. Ernsting, ed. (RAF Inst. of Aviation Med., Farnborough, U.K.) Sep. 1979 51 p Presented at the Aerospace Med. Panel's Specialists' Meeting, Brussels, 22-26 Jan. 1979
(AGARD-CP-264-Suppl; ISBN-92-835-0251-5) Avail: NTIS
HC A04/MF A01

The capability of NATO Forces to maintain air operations while under attack with chemical agents depends on effective personal and collective protection for the aircrew and ground personnel while allowing them to perform adequately their operational duties. Topics cover the effects and detection of chemical warfare agents as well as protection against them. For individual titles, see N80-14729 through N80-14738.

N80-14729# Aberdeen Proving Ground, Md. Biomedical Lab.
THE EFFECTS OF ACUTE AND CHRONIC LOW DOSE EXPOSURE TO ANTICHOLINESTERASES
F. C. Cadigan and M. Chipman *In* AGARD Maintenance of Air Operations While Under Attack with Chem. Agents Sep. 1979 3 p refs (For primary document see N80-14728 05-54)
Avail: NTIS HC A04/MF A01

Acute sublethal and chronic subclinical exposures to toxic anticholinesterases may result in long term neurobehavioral deficits. The deficits most likely to occur include: slowed reaction times, erratic mood swings, sleep disturbances, and impaired visual memory. Individuals who operate high performance equipment and are acutely exposed should be kept off the job until examinations of brain function are normal. Author

N80-14730# School of Aerospace Medicine, Brooks AFB, Tex.
CONSIDERATION OF PYRIDOSTIGMINE AS A PROPHYLACTIC AGENT FOR AIRCREW
B. Richardson *In* AGARD Maintenance of Air Operations While Under Attack with Chem. Agents Sep. 1979 2 p refs (For primary document see N80-14728 05-54)
Avail: NTIS HC A04/MF A01

The carbamate pyridostigmine shows considerable promise as a first-generation prophylatic for nerve agent poisoning. Although it is unlikely to yield all the benefits desirable, the potential utility of pyridostigmine in conjunction with appropriate therapy warrants detailed study. Author

N80-14731# Norwegian Defence Research Establishment, Kjeller. Toxicology Div.
THE EFFECT OF LOCALLY APPLIED ORGANOPHOSPHATES ON MIOSIS AND ACETYLCHOLINESTERASE ADAPTATION TO CHRONIC TREATMENT
Didrik Malthe-Sorenssen, Nils E. Soli, and Frode Fonnum *In* AGARD Maintenance of Air Operations While Under Attack with Chem. Agents Sep. 1979 5 p refs (For primary document see N80-14728 05-54)
Avail: NTIS HC A04/MF A01

Topical administration of organophosphates to the eye of guinea pigs inhibited acetylcholinesterase of different parts of the eye to a different degree. The differences reflected most likely dilution of the agent caused by diffusion into the eye. The effect of locally applied organophosphates was ascribed to an effect on the iris and ciliary muscle and not on the retina. The degree of miosis and recovery of pupillary function after soman treatment correlated better to inhibition of external acetylcholinesterase than total acetylcholinesterase. Chronic treatment with soman reduced the miotic potency of soman and reduced the recovery time of the miosis. This adaptation was dependent on other factors than cholinergic. Local treatment of miosis with topical application of oximes to the eye reduced the miosis and reactivated acetylcholinesterase in the cornea and iris. The reactivation was enhanced in the presence of benzalkonium. Author

N80-14732# Federal Armed Forces Medical Coll., Munich (West Germany). Dept. of Toxicology and Pharmacology.
THERAPY ON NERVE AGENT POISONING
Nikolaus P. Weger *In* AGARD Maintenance of Air Operations While Under Attack with Chem. Agents Sep. 1979 4 p refs (For primary document see N80-14728 05-54)
Avail: NTIS HC A04/MF A01

The therapeutic properties of various combinations of the bispyridinium salts HS-3 and HS-6 and the cholinolytics atropine and benactyzine against soman poisoning were investigated in unanesthetized male beagles. Present data demonstrate that from all antidotes tested HGG-12-Cl and HGG-42-J in doses effective for treatment of men show good therapeutic effects in beagles poisoned with soman, sarin, and Vx. Best effect has HGG-42-J in a dose of 30 micron Mol/kg(= 18.27 mg/kg). In soman poisoning no reactivation of serum cholinesterase and cholinesterase in erythrocytes was observed. Other mechanisms of therapeutic activity must be explored. A.R.H.

N80-14733# Air Force Systems Command, Wright-Patterson AFB, Ohio. Life Support System Program Office.
APPROACHES TO CW AGENT AREA DETECTION SYSTEMS FOR AIRFIELDS
Francis T. Crimmins and John J. McCambridge *In* AGARD Maintenance of Air Operations While Under Attack with Chem. Agents Sep. 1979 10 p (For primary document see N80-14728 05-54)
Avail: NTIS HC A04/MF A01

United States Air Force (USAF) efforts to develop a chemical agent area detection system for the protection of air bases are examined. Point detection techniques which might provide a limited and interim area detection capability are discussed and the A/E23D-3 Chemical Agent Automatic Alarm and its characteristics are described. The USAF requirement for an instrument which will detect toxic chemical agents before they reach the intended target along with the capabilities such a detector must possess are presented. The Air Force's present views on how such a system might operate are explored. A.R.H.

N80-14734# Air Force Systems Command, Wright-Patterson AFB, Ohio. Life Support System Program Office.
PHILOSOPHY OF PROTECTION OF US AIRCREWS AGAINST CHEMICAL WARFARE AGENTS
John J. McCambridge and D. E. Root *In* AGARD Maintenance of Air Operations While Under Attack with Chem. Agents Sep. 1979 2 p (For primary document see N80-14728 05-54)
Avail: NTIS HC A04/MF A01

In 1975, the USAF recognized the need to provide protective equipment to aircrews that would allow them to accomplish their operational missions after having been attacked by an enemy using chemical warfare agents. This requirement was deemed to be an urgent one; thus, a two phase program was initiated. Phase one was the development and production of near term equipment which would provide the required operational capability with delivery of equipment to the field to begin within two years. Phase two consists of a longer term program to provide more complete protection with a reduced operational burden. Author

N80-14735# Service Technique de l'Aeronautique, Paris (France).
CONCERNING INDIVIDUAL EQUIPMENT FOR FIGHTER PILOTS IN THE AIR FORCE [A PROPOS DES EQUIPEMENTS INDIVIDUELS DES PILOTES DE CHASSE DE L'ARMEE DE L'AIR]
P. H. V. Gaspa *In* AGARD Maintenance of Air Operations While Under Attack with Chem. Agents Sep. 1979 3 p In FRENCH (For primary document see N80-14728 05-54)
Avail: NTIS HC A04/MF A01

In addition to the protection provided for all the armed services by way of protective suits, gloves, foot coverings, and masks for filtering particles, aircraft pilots require equipment that must be integrated with the aircraft, with parachutes, with the oxygen supply, and with survival equipment. It must meet the particular specification to provide minimal comfort needed to maintain the potential psychophysiology of the pilots, so they can accomplish their mission (which is always delicate in three dimensional space) in the midst of toxic flight factors and enemy intervention. There must be no thermal nor respiratory constraints. The design of equipment cannot impede pilot movements, the observation of parameters useful for flight, the carrying out of certain commands, nor the tactile agility of the fingers. Transl. by A.R.H.

N80-14736# Air Force Systems Command, Wright-Patterson AFB, Ohio. Life Support System Program Office.
US AIRCREW CHEMICAL DEFENSE ASSEMBLIES
Charles H. Leone and Paul F. Fallon *In* AGARD Maintenance of Air Operations While Under Attack with Chem. Agents Sep. 1979 7 p (For primary document see N80-14728 05-54)
Avail: NTIS HC A04/MF A01

The current aircrew chemical defense ensemble which is divided into four subsets: eye/respiratory/head, body, hand and foot protection is described. The associated chemical agent and flight qualification testing is discussed for each piece of equipment. The status of follow on development efforts which concentrate on the aircrew chemical defense eye/respiratory/head protection is reviewed. A.R.H.

N80-14737# Bluecher G.m.b.H. Duesseldorf (West Germany).
FRG AIRCREW CHEMICAL DEFENCE ASSEMBLIES
Hubert vonBluecher *In* AGARD Maintenance of Air Operations While Under Attack with Chem. Agents Sep. 1979 4 p (For primary document see N80-14728 05-54)
Avail: NTIS HC A04/MF A01

Topics covered include: (1) nonbattle casualty (NBC)-protection gloves for high performance aircraft pilots; (2) SAr spherical adsorber systems; (3) the NBC-protective suit (or garment) for German propeller-aircraft pilots with emphasis on construction of the materials, life-time, and influence of water and sweat; and (4) flame-proofing for NBC-protective clothing. A.R.H.

N80-14738# Air Force Systems Command, Wright-Patterson AFB, Ohio. Life Support System Program Office.
INTEGRATION OF PROTECTION AGAINST CHEMICAL WARFARE AGENTS WITH AIRCREW PERSONAL EQUIPMENT
John J. McCambridge and Charles H. Leone *In* AGARD

Maintenance of Air Operations While Under Attack with Chem. Agents Sep. 1979 3 p (For primary document see N80-14728 05-54)
Avail: NTIS HC A04/MF A01

Protection of the aircrew member through personal equipment is a concept which assumes that such protection can not be provided in any other way. Current efforts to incorporate chemical defensive capabilities into protective equipment for the eyes, respiratory system, body, hands, and feet are described. Integration of chemical agent protection into life support systems on a superior plane would eliminate the need for providing protection through personal equipment - a shirt sleeve environment, so to speak. Such a concept would require protection of the cockpit interior at all times from the introduction of chemical agents and would require the effective filtration of influent air by the environmental control systems. A.R.H.

N80-14739# Advisory Group for Aerospace Research and Development, Paris (France).
SURVEY OF METHODS TO ASSESS WORKLOAD
Bryce O. Hartman, ed. (School of Aerospace Med.) and Richard E. McKenzie, ed. (School of Aerospace Med.) Aug. 1979 160 p refs
(AGARD-AG-246; ISBN-92-835-1332-0) Avail: NTIS HC A08/MF A01

Methods of measuring aircrew workload are reviewed. The methods reviewed include areas of systems design engineering, operations research, the behavioral sciences, aerospace medicine, physiology, biochemistry, and biotechnology in general. The measurement domains include measures of sensory threshold, measures of sensory integration, cognitive function tests, measures of motor function, vigilance, reaction time, psychophysiologic responses, and physiologic and biochemical changes. For individual titles, see N80-14740 through N80-14758.

N80-14740# Gartner (Walter B.) and Murphy (Miles R.), Menlo Park, Calif.
CONCEPTS OF WORKLOAD
Walter B. Gartner and Miles R. Murphy *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 1-2 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

A summary of the attempts made to quantify the workload imposed on a pilot by a particular aircraft design or operational procedure, or to access the effects of fatigue upon system performance are discussed in regard to the more precise specification of workload and fatigue concepts and to the adequacy of assessment criteria and techniques. The principle unresolved issues in conceptualizing and measuring pilot workload and fatigue are addressed. The conception of workload is divided into three functionally related components: (1) input load, (2) operator effort, and (3) work result. A.W.H.

N80-14741# Gartner (Walter B.) and Murphy (Miles R.), Menlo Park, Calif.
CONCEPTS OF FATIGUE
Walter B. Gartner and Miles R. Murphy *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 3-5 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

A survey of the concepts of pilot fatigue is reviewed. The problem in defining the concept of fatigue and dealing effectively with fatigue is discussed. Factors such as task demands or protracted effort toward fatigue are investigated. Factors such as individual differences in personality, motivation, physical fitness, and life style are considered in the investigation. A.W.H.

N80-14742# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
CONCEPTS OF STRESS
Richard E. McKenzie *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 7-9 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

A survey of studies on the concept of stress from flight fatigue is presented. The physiological and psychological factors resulting from stress are examined. Relaxation as an adaptive response to stress is discussed. The use of biofeedback as an adaptive strategy for stress is studied. A.W.H.

N80-14743# Italian Air Force Medical Service H. Q., Rome.
SOME CONSIDERATIONS CONCERNING METHODS TO EVALUATE AND ASSESS WORKLOAD IN AIRCRAFT PILOTS
Gaetano Rotondo *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 11-12 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

Methods for analyzing the various stressing and fatiguing factors that act on the body and psyche of aircrafts' pilots during their specific activity are examined. The variations in the urinary excretion of corticosteroids and especially catecholamine during stress and fatigue are discussed. A.W.H.

N80-14744# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
PHYSIOLOGIC ASPECTS OF WORKLOAD/FATIGUE/STRESS
Layne P. Perelli *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 13-16 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

The physiological mechanisms of the aircraft pilot reacting to the effects of workload, the effects of fatigue, or the effects of stress are described. The long term physiological indicators of stress, workload and fatigue recovered from pilots and measured as urinary metabolites are examined. The cardiac activity indicators, heart rate and heart rate variability, are discussed as a tool in evaluating pilot workload. A.W.H.

N80-14745# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
SOME INSIGHTS RELATIVE TO THE MAN-MACHINE SYSTEM: AN OVERVIEW OF TEN YEARS OF RESEARCH
Richard E. McKenzie and Bryce O. Hartman *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 17-18 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

The operator skills and the specific tasks involved in current operational aircraft, airborne weapons systems, and space systems are discussed in relation to pilot performance. The effects of fatigue and/or stress upon the pilot operating the systems are reviewed through past research methods. The relationship between information processing ability and aircrew performance is examined. A.W.H.

N80-14746# Virginia Polytechnic Inst. and State Univ., Blacksburg.
AIRCREW WORKLOAD ASSESSMENT TECHNIQUES
Walter W. Wierwille, Robert C. Williges, and Samuel G. Schiflett (NATC, Patuxent River, Md.) *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 19-54 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

A classification scheme is presented which summarizes a survey and analysis of aircrew workload assessment techniques relevant to inflight test and evaluation considerations. Two dimensions consisting of universal operator behaviors and workload assessment methodologies were used in the classification scheme. The universal operator behaviors were classified into categories including perceptual, mediational, communication, and motor processes; whereas the workload assessment methodologies were cataloged under the general categories of subjective opinion, spare mental capacity, primary task, and physiological measures. An applicability matrix based on this classification scheme is presented which summarizes existing research on workload assessment methodologies. Procedures are described whereby this matrix is used as a guide for selecting candidate aircrew workload assessment measures for inflight evaluation. A brief overview of the various workload assessment techniques is presented along with a set of critical criteria that need to be considered in evaluating the feasibility of these measures for inflight environments. A.W.H.

N80-14747# Air Force Systems Command, Wright-Patterson AFB, Ohio. Human Engineering Div.
WORKLOAD ASSESSMENT METHODOLOGY DEVELOPMENT

Billy M. Crawford *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 55-67 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

The development of a method to determine efficient crew compositions, appropriate assignments of duties and responsibilities to crew members, and effective allocations of functions and tasks among men, machines and computers is discussed. The use of the method to identify the critical periods in a task or mission during which the operator's performance is particularly prone to degradation or failure because of work overload stress is examined. Emphasis is placed on man computer interactions and information processing/decision making functions which are not adequately accounted for by conventional human performance metrics, task analysis, time and motion, and time line methods. A.W.H.

N80-14748# School of Aerospace Medicine, Brooks AFB, Tex.
QUANTITATIVE MILITARY WORKLOAD ANALYSIS
Richard A. Albanese *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 69-71 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

A method of tradeoff analysis as applied to workload analysis in the military environment is discussed. It is suggested that workload studies be performed in a tradeoff setting which allows the analyst to estimate the return on investment he has earned through his proposed system modifications. The methodologies described employ mathematical modeling techniques, and it is reinforced that these techniques are an adjunct to, and not a replacement of, more traditional methods of workload analysis. K.L.

N80-14749# Army Aeromedical Research Lab., Fort Rucker, Ala.
VISUAL PERFORMANCE: A METHOD TO ASSESS WORKLOAD IN THE FLIGHT ENVIRONMENT
R. Simmons, M. Sanders, and K. Kimball *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 73-81 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

A method of assessing the workload requirements imposed on the visual system is discussed. The results suggest that the theory is a valuable tool in testing and determining what the visual workload level should be for combat proficient pilots, how long pilots with varying degrees of proficiency should be expected to fly in the combat environment, and aircraft design requirements (such as stability) to reduce the onset of fatigue-induced errors. Additionally, the theory can be utilized to test and determine varying mission related workload, as well as the workload required by special equipment such as the night vision goggles, navigation equipment, and experimental flight displays. K.L.

N80-14750# Royal Aircraft Establishment, Bedford (England).
HANDLING QUALITIES, WORKLOAD AND HEART RATE
Alan H. Roscoe *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 83-91 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

Examples are given of the use of heart rates to augment pilots' opinions of handling and workload during various flight trials. It is shown that this technique gives reasonably good indications of the workload generated by particular handling qualities. Raw data in the form of beat-to-beat heart rate are invaluable for revealing rapid and short duration changes in handling qualities which affect workload. K.L.

N80-14751# Office of Naval Research, Arlington, Va.
BRAIN WAVES AND THE ENHANCEMENT OF PILOT PERFORMANCE
G. H. Lawrence *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 93-102 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

Aspects of brain wave research and brain-behavior relationships that are potentially useful in simulated aircraft crew stations are discussed. A pilot performance research paradigm for studying the use of brain waves is presented. K.L.

N80-14752# California Univ. at Los Angeles. Dept. of Psychology.
PUPILLOMETRIC METHODS OF WORKLOAD EVALUATION: PRESENT STATUS AND FUTURE POSSIBILITIES
Jackson Beatty *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 103-109 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

The use of pupillometric measures in the evaluation of pilot workload is discussed. The innervation of the pupil is described with respect to its connections with brainstem activation systems. Modern methods for pupillometric measurement are described and a series of experiments describing pupillary response in a variety of information processing tasks is reviewed. K.L.

N80-14753# Dunlap and Associates, Inc., La Jolla, Calif.
AIRCREW PERFORMANCE RESEARCH OPPORTUNITIES USING THE AIR COMBAT MANEUVERING RANGE (ACMR)
Clyde A. Brictson and Anthony P. Ciavarelli *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 111-113 refs (For primary document see N80-14739 05-54)
(Contract N61339-77-C-0167)
Avail: NTIS HC A08/MF A01

Three years of aircrew performance measurement using the Navy's ACMR are presented as evidence of ACMR's research potential. Performance assessment methods used to evaluate pilot proficiency are described. The aircrew assessment methods are used to identify squadron performance differences, evaluate competitive exercises, and provide diagnostic training feedback to operational users. The use of continuously recorded quantitative measures from systems such as ACMR should stimulate more aircrew performance field research ideas. The availability of objective performance criteria promises to be of substantial benefit to both the operational user and the research community in such areas as pilot selection and training, fleet combat readiness, and pilot workload and stress. K.L.

N80-14754# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
SPEECH PATTERNS AND AIRCREW WORKLOAD
R. Cannings *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 115-127 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

Research into the use of speech patterns for workload analysis is reviewed in terms of a simple speech production model. The applications of analysis techniques are considered. K.L.

N80-14755# National Aviation Facilities Experimental Center, Atlantic City, N. J.
AN EXPLORATORY STUDY OF PSYCHOPHYSIOLOGICAL MEASUREMENTS AS INDICATORS OF AIR TRAFFIC CONTROL SECTOR WORKLOAD
Richard E. McKenzie, Edward P. Buckley, and Kiriako Sarlanis *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 129-133 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

The possibility of relating physiological measures to some aspects of the controller's task (ie. traffic density and the occurrence of aircraft conflicts) was explored. It was found that galvanic skin response changes in the subjects were more detectable using variations in measured amplitude as compared to frequency of galvanic skin response changes. K.L.

N80-14756# National Aviation Facilities Experimental Center, Atlantic City, N. J.
INDIVIDUAL AND SYSTEM PERFORMANCE INDICES FOR THE AIR TRAFFIC CONTROL SYSTEM
Edward P. Buckley, William F. OConnor, and Tom Beebe *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 135-136 (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

The relationships between field air traffic controller perform-

ance indices and system performance measures were examined. Performance criteria developed within the controller's home facility where he controlled live traffic, and with a specially designed microsystem with simulated traffic were used. K.L.

N80-14757# Civil Aeromedical Inst., Oklahoma City, Okla. Aviation Physiology Lab.
WORKLOAD AND STRESS IN AIR TRAFFIC CONTROLLERS
Carl E. Melton *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 137-144 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

Data collected at 14 air traffic control facilities regarding air traffic controller (ATCS) workload and urinary stress indicator hormone excretion is reviewed. The data show a significant relationship between objective workload measures (radio transmission time and traffic counts) and indexes of catecholamine excretion. Mean epinephrine excretion by ATCS's at six air traffic control towers, ranging from very low to very high traffic density, was significantly (R = 0.96) related to annual traffic counts at those towers. The sympatho-adrenomedullary axis that prepares the organism for fight or flight is applicable to ATCS's. The question of underload, optimum load, and overload is discussed. K.L.

N80-14758# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
ASSESSMENT CORRELATES OF WORKLOAD AND PERFORMANCE
Richard E. McKenzie *In* AGARD Surv. of Methods to Assess Workload Aug. 1979 p 145-161 refs (For primary document see N80-14739 05-54)
Avail: NTIS HC A08/MF A01

Psychological, physiological, stress, and central nervous system correlates of assessment that may help in measuring and assessing human workload and performance are reviewed. Psychophysiological monitoring of central nervous function is discussed. K.L.

N80-14880# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
AN ADVANCED OXYGEN SYSTEM FOR FUTURE COMBAT AIRCRAFT
J. Ernsting *In* AGARD Recent Advan. in Aeron. and Space Med. Sep. 1979 17 p refs (For primary document see N80-14678 05-51)
Avail: NTIS HC A05/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-14759 Washington Univ., Seattle.
THE MEGAPROCESSOR: A MULTIPLE-PROCESSOR ARCHITECTURE BASED UPON EXPRESSION TREE PIPELINING Ph.D. Thesis
Jerry Robert Vanaken 1979 264 p
Avail: Univ. Microfilms Order No. 7927883

The basic features of a multiple processor architecture called the Megaprocessor are presented. The Megaprocessor provides a powerful numerical processing system at an inexpensive dollar cost compared to computers with similar capabilities due to the fact that the modularity of the hardware and the limited number of switching interconnections permit its major functions to be implemented using low cost, large scale integrated circuitry. The heart of the Megaprocessor is the expression tree pipeline, or X-pipe, a binary tree multiple-processor structure through which expression trees are pipelined intact. Scalar processing capability is achieved using a simple system of logical interlocks. High speed vector processing is attained through efficient static processor-scheduling algorithms and is supported by the data streaming facilities of the interface between the register space and X-pipe. Treating both scalar and vector processing tasks in similar fashion permits essentially the same hardware to be used in performing both types of computation. Dissert. Abstr.

N80-14760*# IBM Federal Systems Center, Gaithersburg, Md.
ON-BOARD MULTISPECTRAL CLASSIFICATION STUDY
D. Ewalt Dec. 1979 307 p refs
(Contract NAS1-15119)
(NASA-CR-3134) Avail: NTIS HC A14/MF A01 CSCL 09B

The factors relating to onboard multispectral classification were investigated. The functions implemented in ground-based processing systems for current Earth observation sensors were reviewed. The Multispectral Scanner, Thematic Mapper, Return Beam Vidicon, and Heat Capacity Mapper were studied. The concept of classification was reviewed and extended from the ground-based image processing functions to an onboard system capable of multispectral classification. Eight different onboard configurations, each with varying amounts of ground-spacecraft interaction, were evaluated. Each configuration was evaluated in terms of turnaround time, onboard processing and storage requirements, geometric and classification accuracy, onboard complexity, and ancillary data required from the ground. M.M.M.

N80-14761# IIT Research Inst., Chicago, Ill.
BASELINE SOFTWARE DATA SYSTEM. VOLUME 1: SYSTEM DESCRIPTION
Lorraine M. Duvall Griffiss AFB, N.Y. RADC Jul. 1979 45 p refs
(Contract F30602-77-C-0052; AF Proj. 5550)
(AD-A073358; RADC-TR-79-185-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

Volume I of this report provides a feature evaluation of the Management Data Query System (MDQS), a discussion of the contents of the Baseline databases, and a summary of the data required for software reliability modelling. Volume II is a reference guide for defining and retrieving data from the Baseline databases. GRA

N80-14762# IIT Research Inst., Chicago, Ill.
BASELINE SOFTWARE DATA SYSTEM. VOLUME 2: DATABASE REFERENCE MANUAL Final Technical Report, Feb. 1977 - Aug. 1978
Lorraine M. Duvall and Christine Curtis Griffiss AFB, N.Y. RADC Jul. 1979 89 p refs
(Contract F30602-77-C-0052; AF Proj. 5550)
(AD-A073359; RADC-TR-79-185-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 09/2

The purpose of this manual is to provide the user of the Baseline Software Data System with a general capability for retrieving information from the data bases. GRA

N80-14763# Naval Postgraduate School, Monterey, Calif.
ANALOG AND DIGITAL HARDWARE DEVELOPMENT FOR A MICROCOMPUTER CONTROLLED DATA ACQUISITION SYSTEM FOR ACOUSTICAL IMAGING M.S. Thesis
Reid Owen Carlock Jun. 1979 98 p refs
(AD-A074446) Avail: NTIS HC A05/MF A01 CSCL 09/2

This thesis presents the design and testing of a microcomputer controlled data acquisition system for an acoustical imaging system. Analog sinusoidal signals are processed through a 256 channel analog multiplexer to high speed phase and amplitude detection channels. Analog to digital conversion is accomplished with a microcomputer peripheral module. Data storage then follows in a 64k byte peripheral memory. Interface with a cassette tape recording system is accomplished for data transferral. GRA

N80-14764# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
A REGULAR LAYOUT FOR PARALLEL ADDERS Interim Report
R. P. Brent (Australian National Univ., Canberra) and H. T. Kung Jun. 1979 20 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-78-236-76)
(AD-A074455; CMU-CS-79-131) Avail: NTIS HC A02/MF A01 CSCL 09/2

With VLSI architecture the chip area is a better measure of cost than the conventional gate count. We show that addition of n-bit binary numbers can be performed on a chip in time proportional to log n and with area proportional to n log n. GRA

N80-14765# Bendix Corp., Kansas City, Mo.
DEVELOPMENT OF A COMPARATIVE ANALYZER FOR MICROPROCESSOR
E. J. Rolfe Oct. 1978 19 p
(Contract EY-76-C-04-0613)
(BDX-613-2060-Rev) Avail: NTIS HC A02/MF A01

A method of troubleshooting a microprocessor-based product using a reference unit comparison technique was developed. This use of a comparative analyzer has significant advantages over conventional digital troubleshooting techniques. The basic concept is readily adaptable to a variety of microprocessor applications. DOE

N80-14766# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
INVESTIGATION OF SECURITY CLASSIFICATIONS FOR SECURE INFORMATION FLOW
W. Storz Dec. 1978 42 p refs In GERMAN; ENGLISH summary
(Rept-275) Avail: NTIS HC A03/MF A01

A security classification system composed of security class algorithms was analyzed. It was shown that the components of each security class must guarantee a restricted information flow if a secure information flow is to be obtained. Algorithms for isolating contradictions or loopholes in security classifications are presented. A security classification which is suitable for handling data under special protection or having need-to-know status is presented. Some characteristics of this classification algorithm which bear on its implementation are summarized. Author (ESA)

N80-14767# Calculon Corp., Philadelphia, Pa.
COMPARISON OF HIGH SPEED PRINTER INTERFACE CHARACTERISTICS Final Report
31 Jul. 1979 144 p
(Contract NBS-8-3631)
(PB-298943/2; CALCULON-3050-R; NBS-GCR-79-182) Avail: NTIS HC A07/MF A01 CSCL 09B

The high speed printers considered are placed into three general types according to their arrangement of hammer drive signals, i.e., those with individual hammer drive signals, those with coded hammer address signals, and those which include a line buffer and control electronics within the printer and therefore accept coded data signals representing successive characters in the line to be printed. Among each of these three types of printers, only the third type exhibits significant commonality of interface among the various printers and suppliers. GRA

N80-14020# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
TRENDS IN DIGITAL DATA PROCESSING AND SYSTEM ARCHITECTURE
A. A. Calloway *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 5 p (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14021# Societe Crouzet, Valence (France).
A METHOD FOR DESIGNING MULTIPROCESSOR ARCHITECTURES FOR AVIONICS FUNCTIONS [METHODOLOGIE DE CONCEPTION D'ARCHITECTURES MULTIPROCESSEURS POUR DES FONCTIONS D'AVIONIQUE]
C. Aleonard, A. Demoment, P. Romand, J. Gillon (CERT, Toulouse, France), and J. F. LeMaitre (CERT, Toulouse, France) *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 7 p In FRENCH (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14041# Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
COPRA: A NEW LINE OF ULTRARELIABLE RECONFIGURABLE COMPUTERS DESTINED FOR ONBOARD AEROSPACE APPLICATIONS [COPRA: UNE LIGNE NOUVELLE DECALCULAETEURS RECONFIGURABLES ULTRAFIABLES DESTINEE AUX APPLICATIONS AEROSPATIALES EMBARQUEES]
C. Meraud and F. Browaeys *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 23 p In FRENCH (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01

N80-14162*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE MICROPROCESSOR-BASED SYNTHESIZER CONTROLLER
H. Donnelly, M. R. Wick, R. W. Weller, G. B. Schaaf, B. Barber, and M. A. Stern *In its* The Deep Space Network 15 Dec. 1979 p 92-103 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-14768 Vanderbilt Univ., Nashville, Tenn.
A MICROPROCESSOR-BASED RANDOM-DOT STEREOGRAM SYSTEM Ph.D. Thesis
Sudhakar Sooda Shetty 1979 144 p
Avail: Univ. Microfilms Order No. 7926627

A stereogram uniquely suited for investigation of binocular vision and stereopsis is presented. The system for stereogram generation has several advantages over earlier methods and is well suited both for basic research and clinical testing. The system consists of three major sections: 1) the display unit; 2) the microprocessor unit; and 3) the interface unit. The system was used for the investigation of visually evoked cortical potentials. The experiments revealed the neural activity correlated with the processing of the stereoscopic stimulus. Further, the latencies of the potential confirmed the earlier reports indicating that perception of global stereopsis requires more time than does physically defined stimuli. Dissert. Abstr.

N80-14769 Northwestern Univ., Evanston, Ill.
ANALYSIS OF LOGICAL RIPPLE EFFECT OF PROGRAM MODIFICATION Ph.D. Thesis
Terry Ellis MacGregor 1979 271 p
Avail: Univ. Microfilms Order No. 7927398

A tool is presented which identifies program areas which require additional maintenance activity to ensure their logical consistency with an initial change. Identification is done using a

ripple effect analysis technique to statically characterize the program with respect to the proposed modification. Following characterization, the maintenance practitioner identifies program areas undergoing change to define a starting point for an algorithm to compute ripple effect. An intramodule error flow model emulates error flow within a module and an intermodule error flow model emulates error flow between modules. Both models work in a complementary fashion to emulate error flow within the software system. In addition to aiding the maintenance practitioner in making program modifications, the tool computes a measure of the effect that the modification has on the overall program structure, and an estimate of the work required to implement the change and accommodate ripple effect. Dissert. Abstr.

N80-14770 Southern Methodist Univ., Dallas, Tex.
RESTORATION AND ENHANCEMENT OF IMAGES OBSERVED IN MULTIPLICATIVE NOISE Ph.D. Thesis
Daryl Otis Lee 1979 67 p
Avail: Univ. Microfilms Order No. 7926665

Digital computer technology was applied to image processing particularly the restoration and enhancement of noise corrupted images. Algorithms that provide restoration and enhancement for images with a multiplicative noise model are presented. Examples and significant results are reported. Dissert. Abstr.

N80-14771*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTATIONAL METHODS FOR ANALYZING THE TRANSMISSION CHARACTERISTICS OF A BETA PARTICLE MAGNETIC ANALYSIS SYSTEM
Jag J. Singh Dec. 1979 53 p
(NASA-TM-80179; L-13345) Avail: NTIS HC A04/MF A01 CSCL 09B

Computational methods were developed to study the trajectories of beta particles (positrons) through a magnetic analysis system as a function of the spatial distribution of the radionuclides in the beta source, size and shape of the source collimator, and the strength of the analyzer magnetic field. On the basis of these methods, the particle flux, their energy spectrum, and source-to-target transit times have been calculated for Na-22 positrons as a function of the analyzer magnetic field and the size and location of the target. These data are in studies requiring parallel beams of positrons of uniform energy such as measurement of the moisture distribution in composite materials. Computer programs for obtaining various trajectories are included. A.R.H.

N80-14772*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
CLUSTERING ALGORITHM EVALUATION AND THE DEVELOPMENT OF A REPLACEMENT FOR PROCEDURE 1
R. K. Lennington and J. K. Johnson Nov. 1979 80 p refs
(Contract NAS9-15800)
(NASA-CR-160424; LEC-13945; JSC-16232) Avail: NTIS HC A05/MF A01 CSCL 09B

An efficient procedure which clusters data using a completely unsupervised clustering algorithm and then uses labeled pixels to label the resulting clusters or perform a stratified estimate using the clusters as strata is developed. Three clustering algorithms, CLASSY, AMOEBA, and ISOCLS, are compared for efficiency. Three stratified estimation schemes and three labeling schemes are also considered and compared. K.L.

N80-14773*# Boeing Commercial Airplane Co., Seattle, Wash.
FORTRAN SUBROUTINES FOR OUT-OF-CORE SOLUTIONS OF LARGE COMPLEX LINEAR SYSTEMS Final Report
Elizabeth L. Yip Nov. 1979 42 p refs
(Contract NAS1-15128)
(NASA-CR-159142; BCS-40283) Avail: NTIS HC A03/MF A01 CSCL 09B

The design and usage of two main subprograms using direct methods to solve large linear complex systems, of the form Ax = b, whose coeffficient matrices are too large to be stored in core are described. The first main subprogram is for systems whose coefficient matrices are of a particular sparse structure, namely, the matrix A can be written in the form B + D, where B is a block-banded system, and D has only a few columns of nonzeros. Key elements of the algorithms used in the subprograms include: the data structure, the strategy for preserving numerical stability, the adaptability of the algorithms for dense systems as well as for block-profile systems. M.M.M.

N80-14774# Yale Univ., New Haven, Conn. Dept. of Computer Science.
KNOWLEDGE-BASED PARSING Ph.D. Thesis
Anatole V. Gershman Apr. 1979 179 p refs
(Contract N00014-75-C-1111)
(AD-A068666; RR-156) Avail: NTIS HC A09/MF A01 CSCL 05/7

A model for knowledge-based natural language analysis is described. The model is applied to parsing English into Conceptual Dependency representations. The model processes sentences from left to right, one word at a time, using linguistic and non-linguistic knowledge to find the meaning of the input. It operates in three modes: structure-driven, position-driven, and situation-driven. The first two modes are expectation-based. In structure driven mode concepts underlying new input are expected to fill slots in the previously built conceptual structures. Noun groups are handled in position-driven mode which uses position-based pooling of expectations. When the first two modes fail to account for a new input, the parser goes into the third, situation-driven mode which tries to handle a situation by applying a series of appropriate experts. Four general kinds of knowledge are identified as necessary for language understanding: lexical knowledge, world knowledge, linguistic knowledge, and contextual knowledge. GRA

N80-14775# Amherst Systems, Inc., Buffalo, N.Y.
IMAGE PROCESSING SYSTEM SOFTWARE. VOLUME 1: USERS MANUAL Final Technical Report, Feb. - Nov. 1978
Edward G. Eberl and Philip T. Glinski Griffiss AFB, N.Y. RADC Jun. 1979 146 p 2 Vol.
(Contract F30602-78-C-0077; AF Proj. 6244)
(AD-A073652; AMHERST-0077-Vol-1; RADC-TR-79-52-Vol-1)
Avail: NTIS HC A07/MF A01 CSCL 09/2

This document is the final report describing the effort by Amherst Systems, Inc. to convert a portion of the RADC image processing software to RSX-11M to allow execution on DEC PDP 11/45 computer located at WPAFB OH, AFAL. A section of this report is written in the form of a user's manual for personnel engaged in the operation of converted software. A companion document is the programmer's manual which describes the new material incorporated into the system. GRA

N80-14776# Amherst Systems, Inc., Buffalo, N.Y.
IMAGE PROCESSING SYSTEM SOFTWARE. VOLUME 2: PROGRAMMING MANUAL Final Technical Report, Feb. - Nov. 1978
Edward G. Eberl and Philip T. Glinski Griffiss AFB, N.Y. RADC Jun. 1979 215 p 2 Vol.
(Contract F30602-78-C-0077; AF Proj. 6244)
(AD-A073653; AMHERST-0077-Vol-2; RADC-TR-78-52-Vol-2)
Avail: NTIS HC A10/MF A01 CSCL 09/2

Contents: Software System Design; Programmer's Manual; FORTRAN 4-Plus Interface; and Program Descriptions. GRA

N80-14777# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
A COMPUTER PROGRAM FOR ESTIMATION OF PARAMETERS OF THE WEIBULL INTENSITY FUNCTION AND FOR THE CRAMER-VON MISES GOODNESS OF FIT TEST
Edward F. Balbot Jul. 1979 68 p refs
(DA Proj. 1R7-65706-M-541)
(AD-A074764; AMSAA-TR-279) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes the structure and use of a digital computer program written in Standard FORTRAN, which can be used to obtain the maximum likelihood estimates of the parameters of the Weibull intensity function. The program also performs the Cramer-Von Mises goodness of fit test. GRA

N80-14778# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.
A SYSTEMATIC METHODOLOGY FOR DESIGNING THE ARCHITECTURE OF COMPLEX SOFTWARE SYSTEMS

S. L. Huff and S. E. Madnick Sep. 1979 609 p refs
(Grant N00039-78-G-0160)
(AD-A074911; CISR-P010-7906-12; CISR-TR-12) Avail: NTIS HC A99/MF A01 CSCL 09/2

Designers of complex software systems, finding the scope of the problem beyond their cognitive abilities to grasp all at once, often attempt to cope by decomposing the original design problem into more manageable sub-problems. In software design, this decomposition is usually carried out in an ad hoc, intuitive fashion by the system architect. Software research has shown that poor decisions during this preliminary design state can lead to serious problems, difficult to correct during later stages of the system development cycle. The aim of the present research is to help develop a new software design method--the Systematic Design Methodology, or SDM. SDM is intended to aid the software architect in carrying out preliminary design activities, and in synthesizing a design problem structure for the system under consideration. Using SDM involves developing a graph model of a system's functional requirements and their implementation interdependencies, then decomposing the graph using heuristic techniques such as cluster analysis or graph partitioning algorithms. A quantified objective function possessing high strength, with low coupling between subproblems, is used to locate the best graph decomposition. GRA

N80-14779# RAND Corp., Santa Monica, Calif.
A NETWORK GRAPHICAL CONFERENCING SYSTEM Interim Report
M. T. OBrien Aug. 1979 32 p refs
(Contract MDA903-78-C-0029; ARPA Order 3460)
(AD-A074610; RAND/N-1250-ARPA) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report describes design goals for a network-oriented, color graphical conferencing system designed to allow several people to confer simultaneously over a network. Users share a common display, divided into individual 'windows' for each user, and a common graphical 'blackboard' window where users sketch and modify a full-color display. The display uses bit-map color raster-scan technology. Each user's window is identified with his name and location. Text appears in the window as it is typed. Several users may type text simultaneously. A special identifying symbol appears in the window of a user who is sketching. Several simultaneous conferences can be accommodated; users may request a display showing who is participating in which conferences. Conferences may be 'locked' to prevent others from joining. GRA

N80-14780# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
TWO FORTRAN PROGRAMS FOR THE COMPUTATION OF THE MEAN BEAM PATTERN OF A PERTURBED ARRAY
F. Dommermuth Nov. 1978 40 p refs In GERMAN; ENGLISH summary
(Contract BMVG-T/RF-37/71501/71300)
Avail: NTIS HC A03/MF A01

Two FORTRAN programs which perform the computation of the mean beam pattern of a sinusoidally perturbed towed array with respect to a signal having a Gaussian spectrum are presented. A mathematical expression for calculating the mean pattern, in the case of normally distributed array perturbations, is derived. Author (ESA)

N80-14781# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Mathematik.
MODULAR PROGRAMS FOR THE FAST SOLVING OF LINEAR ELLIPTIC EQUATIONS BY REDUCTION METHODS: TR2D01, TR2D02 TO SOLVE THE DIRICHLET PROBLEM FOR HELMHOLTZ EQUATION; USER'S MANUAL CONCERNING THE CLUB MODULEF
Hartmut Foerster 1978 27 p refs
(GMD-Mitt-47) Avail: NTIS HC A03/MF A01

The modular programs TR2D01 and TR2D02 are described. Both modules can be used to solve the Helmholtz equation of a rectangle with Dirichlet's boundary conditions where the given problem is approximated by a system of linear equations. To this system the method of total reduction by Schroder and Trottenberg is applied. The data structure out is generated to contain the solution of the discrete boundary value problem. The difference between module TR2D01 and module TR2D02 lies in the discretization. Making use of a five point formula gives order 2 in TR2D01, while a nine point formula yields order 4 in TR2D02. This manual is a modified version of a preprint. The modifications concern the terminology and the programming conventions of the Club MODULEF (IRIA/LABORIA, Paris). These conventions, especially the program and data structures, are supposed to be known. Author (ESA)

N80-14782# Marconi Co. Ltd., Chelmsford (England). Theoretical Support Services.
ANALYTIC TECHNIQUES FOR PROCESSING SIGNAL AND NOISE THROUGH A NONLINEAR CHANNEL USING MODSIM. VOLUME 2: MODSIM SOFTWARE DESCRIPTION
S. G. Brazier and B. G. West Dec. 1977 112 p refs 3 Vol.
(Contract ESTEC-2327/74-hp)
(ESA-CR(P)-878-Vol-2) Avail: NTIS HC A06/MF A01

A description of the computer program implementation of an analytic technique is presented, which was developed to study the behavior of a signal in a noisy nonlinear channel. Greater economy in the running of the simulation program MODSIM can be achieved by using analytical techniques to account for the effect of noise instead of performing multiple runs with different noise samples where it is difficult to assess the confidence limits. Three mathematical techniques were studied which can be used to perform the analysis. The method most applicable uses a polynomial expansion of the nonlinear device characteristics. The noise after the nonlinear device is characterized by its autocorrelation function. For volumes 1 and 3 see ESA 93206 and 93208. Author (ESA)

N80-14783# Marconi Co. Ltd., Chelmsford (England). Mathematical Physics and Circuitry Group.
ANALYTIC TECHNIQUES FOR PROCESSING SIGNAL AND NOISE THROUGH A NONLINEAR CHANNEL USING MODSIM. VOLUME 3: CURVE FITTING SOFTWARE DESCRIPTION
S. G. Brazier Dec. 1977 109 p refs 3 Vol.
(Contract ESTEC-2327/74-hp)
(ESA-CR(P)-878-Vol-3) Avail: NTIS HC A06/MF A01

The curve fitting software implementation of the analytic techniques developed for processing signal plus noise in a nonlinear channel is described. The method which provides an economic alternative to the Monte Carlo methods used in simulation programs such as MODSIM is described. The program fits either a polynomial or a series of Bessel functions to a set of data defining the complex voltage transfer characteristics of a device. FORTRAN 4 language was used in an ICL 4/70 computer. Author (ESA)

N80-14784# Marconi Co. Ltd., Chelmsford (England). Theoretical Support Services.
ANALYTIC TECHNIQUES FOR PROCESSING SIGNAL AND NOISE THROUGH A NON-LINEAR CHANNEL USING MODSIM. VOLUME 1: ANALYSIS METHODS AND PRELIMINARY RESULTS
G. A. Richards, S. G. Brazier, and P. G. Wright Dec. 1977 135 p refs 3 Vol.
(Contract ESTEC-2327/74-hp)
(ESA-CR(P)-1228-Vol-1) Avail: NTIS HC A07/MF A01

The analytic techniques that have been developed for processing signal plus noise in a nonlinear channel are described. The purpose is to provide an economical alternative to the Monte-Carlo methods used in simulation programs such as MODSIM. Channels are considered which consist of a filter followed by a memoryless nonlinear device and then a further filter. A program was developed to generate the moments of the noise at the output of the nonlinear device. The method for further processing is to approximate the noise probability density function by a weighted sum of gaussian density functions. The joint density function in time is obtained by matching the noise moments to the second order properties of the noise. Processing through the second filter is then achieved using characteristic functions. The initial results show that unless there is a low signal to noise ratio, the performance of these methods is adequate. A Monte Carlo simulation was also carried out and

the resulting histograms show reasonable agreement with the described methods. Author (ESA)

N80-14785# Marconi Co. Ltd., Chelmsford (England). Theoretical Support Services.
SUPPLEMENT TO: ANALYTIC TECHNIQUES FOR PROCESSING SIGNAL AND NOISE THROUGH A NONLINEAR CHANNEL USING MODSIM. VOLUME 2: MOMENT SOFTWARE DESCRIPTION
S. G. Brazier and P. G. Wright Dec. 1977 60 p refs 3 Vol.
(Contract ESTEC-1327/74-hp-Rider-1)
(ESA-CR(P)-1228-Vol-2) Avail: NTIS HC A04/MF A01

The moment software implementing the analytic techniques that were developed for processing signal plus noise in a non-linear channel is described. The purpose of the method is to provide an economical alternative to the Monte-Carlo methods used in simulation programs such as MODSIM. Channels are considered which consist of a filter followed by a memoryless non-linear device and then a further filter. A program was developed to generate the moments of the noise at the output of the non-linear device. The noise probability density function is approximated by a weighted sum of Gaussian density functions. The joint density function in time is obtained by matching the noise moments to the second order properties of the noise. Processing through the second filter is then achieved using characteristics functions. Author (ESA)

N80-14786# Marconi Co. Ltd., Chelmsford (England). Theoretical Support Services.
ANALYTIC TECHNIQUES FOR PROCESSING SIGNAL AND NOISE THROUGH A NONLINEAR CHANNEL USING MODSIM. VOLUME 3: GENERAL THEORETICAL TECHNIQUES
L. M. McLaughlin 1977 245 p refs 3 Vol.
(Contract ESTEC-2327/74-hp)
(ESA-CR(P)-1228-Vol-3) Avail: NTIS HC A11/MF A01

The general theoretical techniques used to develop the analytic techniques used for processing signal plus noise in a non-linear channel are described. The purpose is to provide an economical alternative to the Monte-Carlo methods used in simulation programs such as MODSIM. Channels are considered which consist of a filter by a memoryless nonlinear device and then a further filter. A program was developed to generate the moments of the noise at the output of the non-linear device. The noise probability density function is approximated by a weighted sum of gaussian density functions. The joint density function in time is obtained by matching the noise moments to the second order properties of the noise. Processing through the second filter is then achieved using characteristics functions. Author (ESA)

N80-14787# European Space Agency, Paris (France).
A SIMPLE PROCEDURE FOR SIMULATION OF HOMOGENEOUS MARKHOV CHAINS ON A COMPUTER
Theodor Dahlem Mar. 1979 48 p refs Transl. into ENGLISH of 'Ein einfaches Verfahren zur Simulation homogener Markoffscher Ketten auf einem elektronischen Rechner', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-FB-77-66, Mar. 1978 Original German report available from DFVLR, Cologne DM 17.70
(ESA-TT-529; DLR-FB-77-66) Avail: NTIS HC A03/MF A01

The simulation of a sample set of a homogeneous Markov chain with a finite number of states using a sequence of uniform pseudo random numbers generated on a computer is described. The probability distributions corresponding to the row vectors of the transition matrix of the Markov chain are used to transform the set to a new sequence of random numbers. These are values of a member function of the stochastic process to be simulated. Two examples are presented. Author (ESA)

N80-14788# European Space Agency, Paris (France).
'PROCOPES'. (CONVERSATIONAL PROGRAM FOR SIGNAL ANALYSIS): EVOLVEMENT OF AN INTERPRETATIVE CONTROL LANGUAGE Ph.D. Thesis - Univ. de Paris-Sud.
Jean-Paul Boisseau Oct. 1979 170 p refs Transl. into ENGLISH of 'PROCOPES'. (Programme Conversationnel pour l'Etude du Signal): Evolution vers un Langage de Commande Interpretatif', ONERA, Paris Report ONERA-NT-1978-8, 6 Sep. 1978 Original report in FRENCH previously announced as N79-32883
(ESA-TT-581; ONERA-NT-1978-8) Avail: NTIS HC A08/MF A01

Results of work with a computer piloted signal processing system are reported. The complexity of the analysis instrumentation, the diversity of processing requested by the users, and the orientation toward self-service showed the necessity of implementing an evolutive, conversational system with a simple command language which, at the same time, optimizes the use of the computer central unit. The first version of PROCOPES, has been operational since 1974 and, since then, its evolution has been partly guided by the remarks or needs of users. The study of a more sophisticated command language is presented. The work was carried out, on now obsolescent hardware, within the framework of signal processing based on digitization, a processing method that has become generalized with the appearance of new hardware, such as Array Processors associated with minicomputers of the new generation. Two examples of the use of this command language are presented. The interest of integrating this type into present-day hardware is discussed. Author (ESA)

N80-14789# European Space Agency, Paris (France).
RAY TRACING AND APPLICATION OF THE GEOMETRICAL THEORY OF DIFFRACTION FOR CALCULATING THE SCATTERED FIELDS OF COMPLICATED STRUCTURES
A. Schrott May 1979 81 p refs Transl. into ENGLISH of 'Konstruktion der Strahlenwege und Anwendung der geometrischen Beugungstheorie zur Berechnung von Streufeldern komplizierter Koerper', DFVLR, Oberpfaffenhofen, West Ger. Report DFVLR-FB-78-19, 18 Oct. 1978 Original German report available from DFVLR, Cologne DM 28.90
(ESA-TT-595; DFVLR-FB-78-19) Avail: NTIS HC A05/MF A01

For important basic structures of satellites and aircraft, such as polyhedral convex bodies and circular or elliptical cylinders, the ray tracing is treated in detail. Ray tracing for composite structures is described for the example of an aircraft which is approximated by an elliptical cylinder with flat plates as wings. The programs used for the computation of antennas on complicated structures are discussed. The field of application and the accuracy of the geometrical theory of diffraction is demonstrated with numerous computed examples. Author (ESA)

N80-14790# European Space Agency, Paris (France).
COMPUTATION OF THE ELECTRODYNAMIC BEHAVIOR OF COMPLICATED STRUCTURES BY MEANS OF THE INTEGRAL EQUATION METHOD
Volker Stein May 1979 55 p refs Transl. into ENGLISH of 'Berechnung der elektrodynamischen Eigenschaften komplizierter Strukturen mit Hilfe der Integralgleichungsmethode - Anwendungsbeispiele Original German report available from DFVLR, Cologne DM 20.70
(ESA-TT-598; DFVLR-FB-78-18) Avail: NTIS HC A04/MF A01

The computer programs based on the integral equation method are briefly described. Using these programs numerous examples are computed, in order to demonstrate the wide field of application of the integral equation method. The accuracy of the method is determined by comparing the computed values with experimental results or with the results of other methods. Author (ESA)

N80-14039*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SIMULATION USE IN THE DEVELOPMENT AND VALIDATION OF HIMAT FLIGHT SOFTWARE
Albert Myers *In* AGARD Advan. in Guidance and Control Systems Using Digital Tech. Aug. 1979 12 p refs (For primary document see N80-14017 05-01)
Avail: NTIS HC A16/MF A01 CSCL 09B

N80-14161*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN EFFICIENT PROGRAM FOR DECODING THE (255,223) REED-SOLOMON CODE OVER GF (2 TO THE 8TH POWER) WITH BOTH ERRORS AND ERASURES, USING TRANSFORM DECODING
R. L. Miller, T. K. Truong, and I. S. Reed (Univ. of Southern

California) *In its* The Deep Space Network 15 Dec. 1979 p 82-91 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N80-14791*# Illinois Univ. at Urbana-Champaign. Dept. of Computer Science.
A PROJECT TO INVESTIGATE MECHANISMS AND METHODOLOGIES FOR THE DESIGN AND CONSTRUCTION OF COMMUNICATING CONCURRENT PROCESSES IN REAL-TIME ENVIRONMENTS Yearly Report, 1979
R. H. Campbell and K. Horton 21 Dec. 1979 55 p refs
(Grant NsG-1471)
(NASA-CR-162557; UIUCDCS-R-79-998) Avail: NTIS HC A04/MF A01 CSCL 09B

Research undertaken in 1979 into effective and appropriate mechanisms to aid in the design and construction of software for use in the flight research programs undertaken by NASA is presented. M.M.M.

N80-14792# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
BOOTSTRAPPING FOR A BCPL COMPILER
J. vonderDecken and N. Haak Aug. 1978 45 p refs In GERMAN; ENGLISH summary
(Rept-271) Avail: NTIS HC A03/MF A01

The implementation of a basic combined programming language (BCPL) compiler on a Siemens 4004/150 computer is treated. An ALGOL-type language (BCPL) based on CPL was developed in the middle sixties. The BCPL compiler, which is written in BCPL, is a highly portable program which has been successfully applied to a number of different systems. An interpreter, a code generator, and a BCPL interface routine were written for the BCPL compiler construction, the software of which are presented and studied. Author (ESA)

N80-14793# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
A COMMUNICATION PROBLEM IN A COMPUTER NETWORK
G. Buehler Aug. 1978 27 p refs In GERMAN; ENGLISH summary
(Rept-272) Avail: NTIS HC A03/MF A01

A special problem of synchronization of independent processes in a computer network is considered. In the solution described the network keeps working despite the failure of any individual component. Data routing is discussed and remote job entry protocol is outlined for the system hypothesized. Solutions for input/output problems on different protocol levels are given and the associated software is presented. Author (ESA)

N80-14794# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
A COST OPTIMAL SOLUTION FOR DEADLOCKED PROCESSES
Wolfgang Schulze Sep. 1978 28 p refs In GERMAN; ENGLISH summary
(Rept-273) Avail: NTIS HC A03/MF A01

The cheapest process combination for removing deadlocks from a system of deadlocked processes with given backup cost is discussed. A method is presented which finds a minimum cut in a graph with node values after detecting the deadlock and after the elimination of redundant processes by evaluation of maximum flow. Estimates of the run times for single subtasks show that the method is applicable in practice. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N80-14795 Northwestern Univ., Evanston, Ill.
SIMULATION AND REAL-TIME SYSTEM DESIGN: AN INTEGRATED APPROACH Ph.D. Thesis
Sandra Lynn Ward 1979 162 p
Avail: Univ. Microfilms Order No. 7927475

A methodology for incorporating system simulation into the development cycle for real time, process control systems was investigated. A formalism to compare the simulations so arising to their real time counterparts is developed. An implementation for an existing real time environment is discussed. Experimental results are presented which demonstrate the strength of the approach in predicting real time performance. Dissert. Abstr.

N80-14796# Dynamic Systems, Urbana, Ill.
WORKSHOP ON ADAPTIVE CONTROL Final Report
J. B. Cruz, Jr. 15 Jul. 1979 204 p Workshop held at Champaign, Ill., 8-10 May 1979
(Contract F49620-79-C-0056; AF Proj. 2304)
(AD-A072723; R79-1; AFOSR-79-0911TR) Avail: NTIS HC A10/MF A01 CSCL 09/2

A workshop on Adaptive Control, with thirty four participants, examined the status of the field, discussed potential applications, and agreed on directions for future research. Three working groups were formed, one on robust control, one on model reference adaptive control and self-tuning regulators, and one on stochastic adaptive control. Areas were identified where concepts from robust control would combine with those from active adaptive control to provide a powerful approach. Numerous suggestions for future research were generated. GRA

N80-14797# Stanford Univ., Calif. Dept. of Computer Science.
SEARCH. A SECTION OF THE HANDBOOK OF ARTIFICIAL INTELLIGENCE
Anne Gardner Jun. 1979 113 p refs
(Contracts MDA903-77-C-0322; NIH-RR-00785-06; ARPA Order 3423)
(AD-A074078; SU-STAN-CS-79-742; HPP-79-12) Avail: NTIS HC A06/MF A01 CSCL 06/4

In the handbook we intend to cover the breadth and depth of AI, presenting general overviews of the scientific issues, as well as detailed discussions of particular techniques and important AI systems. Throughout we have tried to keep in mind the reader who is not a specialist in AI. As the cost of computation continues to fall, new areas of application of computers become potentially viable. For many of these areas, there do not exist mathematical 'cores' to structure calculational use of the computer. Such areas will inevitably be served by symbolic models and symbolic inference techniques. Yet those who understand symbolic computation have been speaking largely to themselves for twenty years. We feel that it is urgent for AI to 'go public' in the manner intended by the handbook. Several other writers have recognized a need for more widespread knowledge of AI and have attempted to help fill the vacuum. Lay reviews, in particular Margaret Boden's Artificial Intelligence and Natural Man, have tried to explain what is important and interesting about AI, and how research in AI progresses through our programs. In addition, there are a few textbooks that attempt to present a more detailed view of selected areas of AI, for the serious student of computer science. But no textbook can hope to describe all of the sub-areas, present brief explanations of the important ideas and techniques, and review the 40 or 50 most important AI systems. GRA

N80-14798# Stanford Linear Accelerator Center, Calif.
MICROCOMPUTER-BASED MONITORING AND CONTROL SYSTEM
D. Talaska Mar. 1979 13 p refs
(Contract EY-76-C-03-0515)
(SLAC-TN-79-3) Avail: NTIS HC A02/MF A01

A version of the control system presented is operating at

the one meter liquid hydrogen bubble chamber augmenting the conventional pneumatic and human feedback system. Its use has greatly improved the controlled tolerances of temperature and pulse shape, and it has nearly eliminated the need for operating personnel to adjust the conventional pneumatic control system. The latter is most important since the rapid cycling machine can demand attentions beyond the operator's skill. Similar microcomputer systems are being prepared to monitor and control cryogenic devices situated in regions of radiation which preclude human entry and at diverse locations which defy the dexterity of the few operators assigned to maintain them. An IMSAI 8080 microcomputer is basic to the system. The development of unique interface circuitry is reported. DOE

N80-14799# Technische Universitaet, Brunswick (West Germany). Inst. fuer Angewandte Mathematik.
THE DECOMPOSITION OF MIXTURES AND CLASSIFICATION USING THE GRADIENT TECHNIQUE [DEKOMPOSITION VON MISCHUNGEN UND KLASSIFIKATION MIT GRADIENTENVERFAHREN]
I. Grotrian-Steinweg, L. Schueler, and H. Wolff 1979 153 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVG-FBWT-79-07) Avail: NTIS HC A08/MF A01; DOKZENTBw, Bonn DM 40

The classification problem, a well known and important part of the theory of pattern recognition, is dealt with. The mixture of densities governing the incoming pattern process must be decomposed. A variety of algorithms for the decomposition of these mixtures is offered. Next, a classification procedure for the case of an unknown number of pattern classes is proposed and studied in detail. It is based on estimation of the gradient of the mixture by trigonometric series expansion. Other classification methods using the gradient technique are treated as well. Also included are studies on the reduction of dimensionality. Finally, linear algorithms which are able to follow an unknown trend are presented. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-14800 Wisconsin Univ. - Madison.
STRETCHING THE CIRCULAR CYLINDRICAL ELASTIC SHEET Ph.D. Thesis
Bonita Fay Bowman 1979 105 p
Avail: Univ. Microfilms Order No. 7922109

The behavior of the exact equations for an elastic circular cylinder which is deformed by a uniform pull at the ends keeping the end radii fixed was determined. It was found that the stresses were statistically determinant and that the equations reduced to a single nonlinear ordinary differential equation with boundary values. This equation was converted into a nonlinear integral equation. Using this equation, existence and uniqueness were proven and the appropriate linear theory for small values of the strains was determined. All results were verified by numerically solving the integral equation using Simpson's rule and the nonlinear Gauss-Seidel method. The truncation error was analyzed. The numerical results were also compared to the Bromberg-Stoker theory, and to another exact strain treatment due to Stoker. Dissert. Abstr.

N80-14801 Washington Univ., Seattle.
CONTRIBUTIONS TO CONSTRAINED OPTIMIZATION Ph.D. Thesis
Henry Parker Brandis, III 1979 86 p
Avail: Univ. Microfilms Order No. 7927749

A constructive descent algorithm is presented to find stationary points for the minimization of f(x) with x belonging to E, when f is a lower semi-continuous function and E is a member of a broad class of closed subsets of R sup n including convex sets and sets with nondifferentiable boundaries. The method used is similar to gradient projection type methods, and uses Clarke's tangent cone. A pseudo-projection having several properties analogous to those of the nearest point map for convex sets is developed and used in the algorithm to produce feasible points. In order to judiciously determine this mapping, a theory of approximating cones is developed, which also provides the algorithm with an anti-jamming property near corners of the constraint set. Convergence of the algorithm is proven using Goldstein's step-size technique. Computational results are given for several examples. Dissert. Abstr.

N80-14802 Washington Univ., Seattle.
STRONG SHAPE THEORY Ph.D. Thesis
Frederick William Cathey 1979 183 p
Avail: Univ. Microfilms Order No. 7927758

Strong shape theory using principles of general homotopy theory in the sense of Quillen was studied. It is shown that the strong shape category arises as a certain localization of the homotopy category of compacta. Of central importance in the development of strong shape theory are the notions of S-embedding and 'fibrant space'. An S-embedding is the shape version of a cofibration which is a homotopy equivalence, and a fibrant space is a metrizable space which is 'fibrant' with respect to the class of S-embeddings. It is shown that every compactum can be S-embedded in a fibrant space and that the correspondence determines a functor. Applications of the theory of S-embeddings and fibrant spaces are discussed. Dissert. Abstr.

N80-14803 State Univ. of New York at Stony Brook.
SPECTRAL INVARIANCE FOR NORMAL OPERATIONS UNDER TRACE CLASS PERTURBATIONS Ph.D. Thesis
Scott OHare 1979 100 p
Avail: Univ. Microfilms Order No. 7926462

An important result of perturbation theory known as the Kato-Rosenblum theorem is discussed. This theorem asserts that the absolutely continuous parts of two self adjoint operators whose difference is trace class are unitarily equivalent. Techniques for the treatment of spectral invariance problems are developed. The direct integral representation for normal operators is used throughout; unitary equivalence of the absolutely continuous parts (with respect to a sigma-finite Borel measure mu) translates in this context to the mu essential equality of the spectral multiplicity functions. For a subset gamma of the complex plane, and mu as above, the Kato-Rosenblum result holds for (gamma, mu) provided the spectral multiplicity functions of normal operators N sub 1, N sub 2 are mu essentially equal whenever N sub 1 - N sub 2 is trace class, and the spectra of N sub 1, N sub 2 lie in gamma. Dissert. Abstr.

N80-14804# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Mathematical Statistics.
THE ASYMPTOTIC EXPANSION OF THE STEIN ESTIMATOR FOR THE MATRIX CASE WITH COVARIANCE MATRIX SIGMA HYPERON UNKNOWN
A. J. VanDermerwe and O. G. Nel Mar. 1979 14 p refs Sponsored by CSIR and UOFS Res. Fund
(TR-41) Avail: NTIS HC A02/MF A01

The method used to determine the existence of estimators which dominate the maximum likelihood estimators for the problem of simultaneously estimating the means of three or more random variables was extended from the vector case to the matrix case. The asymptotic distribution, mean and variance of the Stein estimator was derived as well as that of the quadratic loss function for the matrix case with covariance matrix Sigma unknown. M.M.M.

N80-14805# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AUTOMATED NUMERICAL INTEGRATION OVER A TRIANGLE
D. P. Laurie Apr. 1979 21 p refs
(CSIR-TWISK-78) Avail: NTIS HC A02/MF A01

The metalgorithm concept is applied to automatic cubature over triangular regions. Special consideration is given to the computer representation of the smaller triangles generated. The design of cubature formulae with a built-in error estimate is discussed, and a 19-point formula of degree 8 that includes the points of the 7-point formula of degree 5 is derived. K.L.

N80-14806# National Research Inst. for Mathematical Sciences, Pretoria (South Africa). Operations Research and Statistical Div.

FINDING THE ROOT OF A MONOTONIC FUNCTION
Douglas M. Hawkins and J. S. Galpin Mar. 1979 12 p refs
Sponsored in part by Control Data
(CSIR-TWISK-75) Avail: NTIS HC A02/MF A01

A FORTRAN algorithm is presented for solving the equation F(x) = y sub 0 where F is continuous and strictly monotonic. The algorithm is a generalization of the secant method, uses no derivatives, and is fast and stable. Author

N80-14807# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A MODEL FOR THE COMPUTATIONAL DETERMINATION OF PARAMETER VALUES OF ANTHROPOMORPHIC SEGMENTS
H. Hatze May 1979 65 p refs
(CSIR-TWISK-79) Avail: NTIS HC A04/MF A01

A model is presented for determining by computation the parameter values of anthropomorphic segments from a battery of 242 anthropometric measurements taken directly from the subject. The model consists of 17 segments, includes the shoulders as separate entitites, and subdivides segments into small mass elements of different geometrical structures, thus allowing the shape and density fluctuations of a segment to be modelled in detail. The model differentiates between male and female subjects (exomorphic differences, different density functions and mass distributions), adjusts the densities of certain segmental parts according to the value of a special subcutaneous-fat indicator, and fully accounts for the specifities of pregnancy and obesity. The input data errors are drastically reduced by performing direct anthropometric measurements rather than indirect measurements from photo images and the overall accuracy of the model is better than 3% with a maximum error of about 5%. M.M.M.

N80-14808# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A NEW TEST FOR MULTIVARIATE NORMALITY AND HOMOSCEDASTICITY
Douglas M. Hawkins Sep. 1978 17 p refs
(CSIR-TWISK-45) Avail: NTIS HC A02/MF A01

Given data X sub ij j=1 to n sub i i=1 to g, a test was performed to determine whether the X sub ij are normal with common covariance matrix. Letting X sub i denote the mean of the i-th group and S the pooled covariance matrix, the quantities V sub ij = (X sub ij-X sub i) prime 1/S (X sub ij-X sub i) are used in the test. The exact null distribution of V sub ij is noted, and the Anderson-Darling statistic proposed for testing whether the data fit this null distribution. The test has several advantages over the tests currently being used. M.M.M.

N80-14809# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
LIMITS AND ADJOINT SITUATIONS IN MATHEMATICAL STRUCTURES
Gert Naude Mar. 1979 20 p refs
(CSIR-TWISK-67) Avail: NTIS HC A02/MF A01

Category theory is considered as a unifying language for various branches of mathematics. The concepts 'limit' and 'adjoint functor', as well as their duals, are introduced in a heuristic manner. The particular importance of the preservation of limits is stressed, and examples are given of adjoint functors found in algebra, topology and analysis. Finally various adjoint functors in categorical systems theory are discussed. Author

N80-14810# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
INDICATING CONES AND THE INTERSECTION PRINCIPLE FOR TANGENTIAL APPROXIMANTS IN ABSTRACT MULTIPLIER RULES
D. H. Martin, R. J. Gardner, and G. G. Watkins (South Africa Univ., Pretoria) Feb. 1979 32 p refs Sponsored in part by Control Data
(CSIR-TWISK-68) Avail: NTIS HC A03/MF A01

A partial ordering is established by generality among several specific notions of tangential approximation in the literature. The theory is unified through the introduction of an indicating cone. For solid cones, all notions of tangential approximant considered coincide. K.L.

N80-14811# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
GLOBAL SADDLE-POINT THEOREMS INVOLVING CONJUGATE-LIKE OPERATORS, FOR GENERAL AND QUASI-CONCAVE PROGRAMS
Jocob Flachs Mar. 1979 36 p refs Sponsored in part by Control Data
(CSIR-TWISK-72) Avail: NTIS HC A03/MF A01

General and quasi-concave nondifferentiable cases of the maximization problem are considered. With the aid of duality theory for mathematical programming involving conjugate-like operators, a bifunction that generates a class of perturbations is defined. Saddle-point theorems are presented, and equivalence is proved between the existence of a saddle-point and the existence of a certain cone-supporting property of the perturbation function. Possible improvements are suggested in multiplier methods. M.M.M.

N80-14812# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMAL STEERING OF A RANDOM MOTION OF A POINT MASS
Yaakov Yavin (Ben-Gurion Univ., Beer-Sheva, Israel) and Alida Jordan Mar. 1979 23 p refs Supported in part by Control Data
(CSIR-TWISK-71) Avail: NTIS HC A02/MF A01

A stochastic system is introduced representing the kinetics of a two dimensional random motion of a point mass. The point mass velocity is subjected to two different kinds of perturbations, the first represented by a vector of independent standard Wiener processes and the second by a vector of a generalized type of Poisson process. The control function is theta while v is kept fixed. The problem discussed is aimed at finding an optimal control law theta* = theta*(x), such that the point mass will reach a given target set in such a manner that the expected duration of its motion will be minimized and its probability of reaching the target set maximized. Sufficient conditions on optimal controls, of a dynamic programming type, are derived. These conditions require the existence of a smooth solution to a nonlinear partial integro-differential equations, which is solved here by applying a finite differences scheme. Numerical examples indicate that in many cases the line-of-sight control law can serve as a good approximation to an optimal control law. M.M.M.

N80-14813# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
COMPUTATION OF MOMENTS OF FUNCTIONALS OF A SOLUTION TO A STOCHASTIC DIFFERENTIAL EQUATION
Yaakov Yavin (Ben-Gurion Univ., Beer-Sheva, Israel) and W. C. Huisman (Twente Univ. of Technology, Enschede, Netherlands) Mar. 1979 32 p refs
(CSIR-TWISK-73) Avail: NTIS HC A03/MF A01

A set of partial integro-differential equations for the computation of E sub x (z(x;v) to the k power, k = 1,2,....., is derived. A nonlinear stochastic second order system is given as a test case and two finite difference algorithms for the computation of E sub x (x(x;v*)) to the k power, k = 1,2,....., are suggested, where v* is a control law that maximizes E sub x z(x;v) on a class U of admissible controls. It is shown numerically that for L(x) = 1 there is a significant increase in the values of E sub x (z(x;v)) to the k power and m sub k (x;v) in comparison with the corresponding values of E sub x (z(x;0) to the k power and m sub k (x;0), when E sub x z(x;v) is maximized on U for k = 2,....5 at least. K.L.

N80-14814*# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
APPROXIMATE AND EXACT NUMERICAL INTEGRATION OF THE GAS DYNAMIC EQUATIONS
Timothy S. Lewis and Lawrence Sirovich 1979 57 p refs
(Grant NsG-1617)
(NASA-CR-162554) Avail: NTIS HC A04/MF A01 CSCL 12A

A highly accurate approximation and a rapidly convergent

numerical procedure are developed for two dimensional steady supersonic flow over an airfoil. Examples are given for a symmetric airfoil over a range of Mach numbers. Several interesting features are found in the calculation of the tail shock and the flow behind the airfoil. K.L.

N80-14815*# Institute for Atmosphere Optics and Remote Sensing, Hampton, Va.
ANALYTIC MODELING OF AEROSOL SIZE DISTRIBUTIONS
Aosarsh Deepack and Gail P. Box Nov. 1979 165 p refs
(Contract NAS1-15198)
(NASA-CR-159170) Avail: NTIS HC A08/MF A01 CSCL 12A

Mathematical functions commonly used for representing aerosol size distributions are studied parametrically. Methods for obtaining best fit estimates of the parameters are described. A catalog of graphical plots depicting the parametric behavior of the functions is presented along with procedures for obtaining analytical representations of size distribution data by visual matching of the data with one of the plots. Examples of fitting the same data with equal accuracy by more than one analytic model are also given. K.L.

N80-14816*# Old Dominion Univ. Research Foundation, Norfolk, Va.
INTEGRATING MATRICES FOR ARBITRARILY SPACED GRID POINTS Final Report, 30 May - 30 Aug. 1979
William D. Lakin Nov. 1979 33 p refs
(Contract NAS1-15648)
(NASA-CR-159172) Avail: NTIS HC A03/MF A01 CSCL 12A

Integrating matrices are derived for arbitrarily spaced grid points using either interpolating or least squares fit orthogonal polynomials. Several features of the equally spaced grid case are also discussed. K.L.

N80-14817# Los Alamos Scientific Lab., N. Mex.
CONTRIBUTION MONTE CARLO
A. Dubi and S. A. W. Gerstl Mar. 1979 56 p refs
(Contract W-7405-eng-36)
(LA-7849-MS) Avail: NTIS HC A04/MF A01

A comprehensive description of the contribution Monte Carlo method and its implementation in the general purpose MCNP code is presented along with results of the method for realistic nonhomogeneous, energy-dependent problems. DOE

N80-14818# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Planungs- und Entscheidungssysteme.
COMPARISON OF REGRESSION, DIFFERENCE AND RATIO ESTIMATES IN SAMPLE THEORY
Peter Hoschka and Hermann Schunck 1977 21 p refs
(GMD-Mitt-42) Avail: NTIS HC A02/MF A01

Different methods for the expansion of sample characteristics to the total population from regression estimates are discussed. Well known results from regression and difference estimates are summarized and a generalized ratio estimate is suggested. All estimates are derived from one general form which also allows direct computation from a sample. Various sample designs are discussed; simple criteria for the comparison of the different expansion methods are suggested which are helpful especially for experimental purposes. Author (ESA)

N80-14819# European Space Agency, Paris (France).
FIELD COMPUTATION BY THE GEOMETRICAL THEORY OF DIFFRACTION
A. Schrott May 1979 94 p refs Transl. into ENGLISH of 'Feldberechnungen mit Hilfe der geometrischen Beugungstheorie', DFVLR, Oberpfaffenhofen, West Ger. Report DFVLR-FB-78-06, 16 Jun. 1978 Original German report available from DFVLR, Cologne DM 33.00
(ESA-TT-594; DFVLR-FB-78-06) Avail: NTIS HC A05/MF A01

The canonical problems of diffraction by a convex surface and the diffraction by a wire, which are of great practical interest, are treated. The first case is treated for the source placed away from and on the surface. For the illuminated region, the shadow region and the transition region separate solutions are derived. The problem of the field computation at caustics is investigated in detail for a circular edge. Applying the concept of the so called equivalent edge currents caustic correction factors for the field of the geometrical theory of diffraction at caustics are derived. Author (ESA)

N80-14820# European Space Agency, Paris (France).
SOLUTION OF ELECTROMAGNETIC BOUNDARY VALUE PROBLEMS OF COMPLICATED STRUCTURES. THEORY OF THE INTEGRAL EQUATION METHOD
Volker Stein May 1979 93 p refs Transl. into ENGLISH of 'Loesung elektromagnetischer Bandwertprobleme bei komplizierten Struckturen. Grundlagen der Integralgleichungsmethode', DFVLR, Oberpfaffenhofen, West Ger. Report DFVLR-FB-78-01, 26 Jan. 1978 Original report in GERMAN previously announced as N79-16184 Original German report available from DFVLR, Cologne DM 30.40
(ESA-TT-596; DFVLR-FB-78-01) Avail: NTIS HC A05/MF A01

The theory for the determination of the radiation and scattering behavior of complicated structures with the aid of the integral equation method was studied. These structures may be complicated isolated radiators or shapes like helicopters or satellites, which are excited by an electromagnetic wave. The objective of the integral equation method is the determination of the surface currents, from which all electromagnetic parameters may be computed. For this reason two independent integral equations for the electric and magnetic field are derived from the vector wave equations by means of the second Greens' theorem. The field of application of these two equations is discussed in detail. Author (ESA)

N80-14821# European Space Agency, Paris (France).
NUMERICAL SOLUTION OF THE ELECTRIC AND MAGNETIC FIELD INTEGRAL EQUATIONS
Volker Stein May 1979 102 p refs Transl. into ENGLISH of 'Numerische Loesung der Integralgleichungen fuer das elektrische und magnetische Feld', DFVLR, Oberpfaffenhofen, West Ger. Report DFVLR-FB-78-05, 16 June 1978 Original German report available from DFVLR, Cologne DM 34.60
(ESA-TT-597; DFVLR-FB-78-05) Avail: NTIS HC A06/MF A01

The currents on the surface of a structure, excited by an electromagnetic wave, are determined by numerical solution of an integral equation for the electric or magnetic field. The integral equation is converted into a linear system of equations with the aid of the method of moments. This system of equations is also obtained by applying the reaction concept. Both methods are treated in detail. Mathematical models for the surface as well as some special numerical procedures are described extensively. Special attention is paid to the problem of minimizing computer storage space and computation time. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-14822 Florida State Univ., Tallahassee.
QUALITATIVE DEPENDENCY AMONG RANDOM VARIABLES, WITH APPLICATIONS IN PROBABILITY AND STATISTICS Ph.D. Thesis
Abdul-Hadi Ahmed 1979 108 p
Avail: Univ. Microfilms Order No. 7926707

A basic theorem was obtained showing that generalized association was inherited under certain commonly encountered mixing processes. Applications of this theorem were made by considering particular types of ordering, such as absolute value ordering, unimodal ordering as well as the standard linear ordering of the real numbers. Properties and theory for positive orthant dependence, a multivariate extension of Lehmann's positive quadrant dependence, and right tail increasing in sequence dependence, a multivariate extension of Esary and Proschan's bivariate right tail increasing dependence were developed. Applications were obtained in the form of inequalities and

monotonicity in a wide variety of multivariate statistical problems, including MANOVA, contingency tables, dependence measurement, competing risk models, reliability of series systems, and distribution theory. Dissert. Abstr.

N80-14823 Purdue Univ., Lafayette, Ind.
ON BAYES AND GAMMA-MINIMAX SUBSET SELECTION RULES Ph.D. Thesis
Woo-Chul Kim 1979 116 p
Avail: Univ. Microfilms Order No. 7926398

A study of the problem of selecting good populations from a set of given populations is presented as well as the problem of partitioning k treatment populations with regard to control population. A selection problem arising in reliability theory is discussed along with the selection in terms of scale parameters. Dissert. Abstr.

N80-14824 Cornell Univ., Ithaca, N. Y.
RANDOMIZATION PROCEDURES FOR A TWO WAY ANALYSIS OF ORIENTATION DATA Ph.D. Thesis
Thomas Spring Graves 1979 200 p
Avail: Univ. Microfilms Order No. 7926901

Several likelihood ratio and goodness of fit tests are developed for the analysis of a two way classification of discrete directional data. The problem is formulated to represent the directions as the vertices of a rotatable regular polygon. A single vertex emits a signal which may or may not affect a test animal placed at the center and allowed to move in any of the available directions. The null hypothesis is that the signaling vertex has no effect upon the test animal. The alternative is that the test animals do orient themselves with respect to the rotatable signal. Two cases of the alternative are examined. In the first case all test animals are assumed to be independently governed by the same probability distribution of directional responses to the signal. In the second case, the response distributions are assumed to be unique to the individual animals. Tests are developed for each case, of the alternative, and the asymptotic distributions of these tests are ascertained for the number of vertices, approaching infinity. Simulation results show that no single test is uniformly most powerful for all sample sizes and under all alternative distributions. Dissert. Abstr.

N80-14825 Virginia Univ., Charlottesville.
AN INVESTIGATION OF THE POWER EFFICIENCY OF THE FRIEDMAN NONPARAMETRIC ANOVA TEST WITH RESPECT TO THE ONE FACTOR REPEATED MEASURES ANOVA F-TEST Ph.D. Thesis
Pamela Rose Getson 1978 174 p
Avail: Univ. Microfilms Order No. 7928046

The Friedman two-way analysis of variance and the one factor additive model repeated measures analysis of variance were applied to Monte-Carlo generated data in order to explicate trends in relative power efficiency for the two tests under small sample cases. The Friedman was found to be generally slightly less powerful than the parametric repeated measures analysis of variance F test. Power efficiency computed as a grand average over all 700 conditions and all alpha levels was .7506. When relative power efficiency is calculated without the cases requiring exact probability testing, it was .7773. Deleting these cases and testing at alpha > 01 yielded a relative power efficiency of .8170. Dissert. Abstr.

N80-14826 Oklahoma State Univ., Stillwater.
A GENERAL SOLUTION TO MAKING INFERENCES ABOUT THE PARAMETERS OF MIXED LINEAR MODELS Ph.D. Thesis
Mohamed Kadri Gharraf 1979 44 p
Avail: Univ. Microfilms Order No. 7928206

The variance components in mixed linear models are estimated. The conditional posterior distribution of the fixed effects, random effects, error variance, and variance components are obtained using Bayesian approach. Improper prior distribution for the fixed effects is considered, and conjugate type prior distributions are considered for the random effects, the error precision, and the inverse of the variance components. The vector of the fixed effects is estimated by the location vector of the p-variate t distribution. An approximation of the mode of the marginal posterior distribution of the vector of random effects is used as a conditioning value. The approximate posterior mode is the same as the least square estimator in the reduced model. The estimators of the variance components and error variance are the conditional posterior means of these parameters, conditioned on the least square estimate of the random effects. Dissert. Abstr.

N80-14827 Minnesota Univ., Minneapolis.
CATEGORICAL DATA MODELS FOR COMPLEX SAMPLING SCHEMES Ph.D. Thesis
Stephen Samuel Brier 1979 148 p
Avail: Univ. Microfilms Order No. 7926096

Models for contingency tables arising from complex sampling schemes are considered. The notion of a superpopulation is used to represent both stratified and cluster sampling schemes. In stratified samples, Bayesian methods are used to estimate cell probabilities and although some potentially useful results are obtained, these methods are somewhat intractable. For cluster sampling the Dirichlet-Multinomial distribution is used to model the superpopulation and leads to relatively simple extensions of results for multinomial distributions. In particular, it is shown that goodness of fit statistics are easily modified to test the fit of log-linear models under cluster sampling. It is shown that these modified tests behave well, both in terms of power and in terms of agreement with asymptotic approximations. Dissert. Abstr.

N80-14828# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMAL CONTROLS THAT MAXIMIZE THE PROBABILITY OF HITTING A SET OF TARGETS: A NUMERICAL STUDY
Yaakov Yavin (Ben-Gurion Univ., Beer-Sheva, Israel) and Alida M. Jordan May 1979 39 p Supported in part by Control Data
(CSIR-TWISK-81) Avail: NTIS HC A03/MF A01

An optimal control law to be maximized on a given class of admissible control laws is discussed. Sufficient conditions on optimal controls, of a dynamic programming type, are derived. These conditions which require the existence of a smooth solution to a nonlinear partial integro-differential equation, is solved by applying a finite difference scheme. Two examples are dealt with numerically. M.M.M.

N80-14829# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMAL SELECTION FROM A RANDOM SEQUENCE WITH OBSERVATION ERRORS
T. J. Stewart Mar. 1979 26 p refs
(CSIR-TWISK-69) Avail: NTIS HC A03/MF A01

A form of sequential decision problem is introduced in which options are presented in sequence, with no recall of rejected options (as in the secretary problem), but in which the value of each option may only be inferred from experiments. Decisions have thus to be made concerning both the acceptance and rejection of each option and the degree of experimentation. General properties of the optimal policy are derived, and an algorithm is obtained for the solution in a special case. This special case suggests a heuristic rule for more general situations, the performance of which rule has been investigated by a Monte Carlo study. Author

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-14830# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
TWO-TARGET PURSUIT-EVASION DIFFERENTIAL GAMES IN THE PLANE
W. M. Getz and M. Pachter Mar. 1979 30 p refs Supported in part by Control Data
(CSIR-TWISK-74) Avail: NTIS HC A03/MF A01

Two-target versions of the two cars game and the homicidal chauffeur game are introduced. A generic example of the

two-target homicidal chauffeur game is considered in detail and maps of the game and its corresponding winning strategies are found using Lyapunov methods of analysis. The effects of altering the speed and maneuverability ratios and the weapon system parameters are presented. It is found that certain winning strategies include a swerve type maneuver and that for certain sets of parameters, regions of 'stagnation' and different modes of draw occur. K.L.

N80-14831# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Analysis and Prediction Div.
SPECTRAL ESTIMATION FROM IRREGULAR ARRAYS
F. P. Bretherton and J. C. McWilliams May 1979 180 p refs
(Grant NSF ATM-77-23757)
(PB-299363/2; NCAR/TN-138+STR) Avail: NTIS
HC A09/MF A01 CSCL 12B

The problem of spectral estimation from data sampled at irregularly distributed measurement locations is considered from the point of view of an optimal fit of a spectral model when the amount of data available is large but finite. Several methods are shown to be asymptotically equivalent to the optimal one (as the amount of data becomes large), but several others, previously advocated, are shown to be either biased estimations or to have significantly larger estimation uncertainties than the optimal one. This problem is then reconsidered in a Bayesian formulation. The estimation problem is a combination of the prior prejudices of the investigator and the ability of the data to yield further information beyond the initial prejudices. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-14832 Yale Univ., New Haven, Conn.
BOOLEAN VALUED MODELS AND GALOIS THEORY FOR COMMUTATIVE REGULAR RINGS Ph.D. Thesis
Kay Ellen Smith 1979 103 p
Avail: Univ. Microfilms Order No. 7928097

An equivalence is established between the category of B-fields, where B is a complete Boolean algebra, and the category of commutative regular self-injective rings whose Boolean algebra of idempotents is equal to B. This equivalence is used along with the fact that ZFC is true in the universe of Boolean valued sets to develop a Galois theory for commutative regular self-injective rings. The necessary and sufficient conditions on a ring extension for the corresponding B-field extension to be Galois and algebraic are determined. Closed and patchable subgroups of a Galois group are defined and it is proven that the Galois group of a ring extension is patchable. The concepts of a finite dimensional ring extension and a bar-finite group of automorphisms are introduced and the associated dimension and order functions are defined. Galois Correspondence Theorems are obtained for both finite dimensional and infinite dimensional ring extensions. Dissert. Abstr.

N80-14833# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
RESULTS AND CONJECTURES ON COVERING METRIC SPACES
R. J. Gardner Feb. 1979 15 p refs
(CSIR-TWISK-70) Avail: NTIS HC A02/MF A01

A semiquantitative theory of covering metric spaces is studied. General results are obtained on fine covers, and are put forth. Most of these remain unanswered for subsets of the real line. K.L.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-14834# Naval Research Lab., Washington, D. C. Plasma Physics Div.
EQUILIBRIUM AND PROPAGATION OF A ROTATING RELATIVISTIC ELECTRON BEAM IN THE ABSENCE OF AN EXTERNAL GUIDE FIELD Interim Report
J. D. Sethian, K. A. Gerber, D. N. Spectro, and A. E. Robson 28 Sep. 1979 36 p refs
(AD-A074803; NRL-MR-4071) Avail: NTIS
HC A03/MF A01 CSCL 20/7

This paper describes an experimental and theoretical study of a charge-neutralized, hollow, rotating relativistic electron beam propagating inside a metal tube in the absence of an external magnetic guide field. A model has been developed in which the radial equilibrium is derived from the force balance on the beam interacting with its self-field, and the velocity of propagation of the beam is derived from the power balance. The experimental results show close agreement with the predictions of the model. GRA

N80-14835# Metal Properties Council, Inc., New York.
DEVELOPMENT OF A STANDARD METHODOLOGY FOR THE CORRELATION AND EXTRAPOLATION OF ELEVATED TEMPERATURE. VOLUME 1: A SUMMARY OF A STATE-OF-THE ART REVIEW AND A WORKSHOP Final Report
R. M. Goldhoff, S. S. Manson, J. B. Conway, C. R. Ensign, G. V. Smith, L. H. Sjodahl, and M. K. Booker Apr. 1979 214 p refs Sponsored by Electric Power Research Inst., Palo Alto, Calif.
(EPRI-FP-1062-Vol-1) Avail: NTIS HC A10/MF A01

A standard time temperature parametric procedure for the reliable correlation and extrapolation of elevated temperature creep and rupture data for the design of utility equipment is developed. The role of statistics in the procedure is discussed. The standardization of the technology of creep rupture data evaluation is discussed. A.W.H.

N80-14836# General Electric Co., Sunnyvale, Calif. Advanced Reactor Systems Dept.
LIQUID WEIGHING BY BUOYANCY TECHNIQUE
D. W. Jeter, D. E. Hafer, L. T. Hagie, and E. F. Kurtz Apr. 1979 26 p refs Presented at the 20th Ann. Meeting of the Inst. of Nucl. Mater. Management, Albuquerque, N. Mexico, 18 Jul. 1979
(Contract EN-77-C-03-1464)
(GEFR-SP-158; CONF-790707-26) Avail: NTIS
HC A03/MF A01

A method to indirectly measure the mass of liquid in a tank is developed. This method (the bob displacement technique), which is based on Archimedes Buoyancy Principle, is described. The working equation is developed and reduced to a linear response equation which is unaffected by density. A prototype design for use on a plutonium/uranium nitrate feed tank was developed and is described. The water testing of this hardware is discussed. Typical fuel cycle applications and the material accountability considerations are included. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-14837 Maryland Univ., College Park.
A MONOLITHIC SURFACE ACOUSTIC WAVE CHARGE TRANSFER DEVICE Ph.D. Thesis
Nicholas Alexandrou Papanicolaou 1979 184 p
Avail: Univ. Microfilms Order No. 7926509

The excitation and propagation of surface acoustic waves in multilayered media is investigated. A SAW computer program is used to determine the optimum transducer configuration and structure dimensions to produce the highest coupling in the excitation of the piezoelectric waves. The conditions for the injection and capture of the trapped charge in the device, as well as the behavior of the charge in a travelling well are also examined. Fabrication, techniques such as substrate preparation, diffusion, oxidation, rf sputtering, metallization and other processes are discussed. Finally, charge transfer action in a SAW-CTD device

is demonstrated and possible applications in recirculating memory and imaging are discussed. Other applications may include signal processing such as pure analog delay at high frequency with low pass. Dissert. Abstr.

N80-14838 Cornell Univ., Ithaca, N. Y.
HIGH FREQUENCY BROADBAND ROTOR NOISE Ph.D. Thesis
Young-Nam Kim 1979 184 p
Avail: Univ. Microfilms Order No. 7926922

A method to find the absolute spectral level of high frequency far field sound of a subsonic aerodynamic rotor in terms of random load fluctuations on the rotor blades was developed. The analysis deals with frequencies where the radiated sound spectrum is smooth, i.e., above 300 to 400 Hz for a typical helicopter. A point load approximation with spanwise loading corrections is used to represent the blade loadings. The method is applied to atmospheric turbulence induced loadings and to the calculation of trailing edge noise from a rotor. Dissert. Abstr.

N80-14839 Wisconsin Univ. - Madison.
ULTRASONIC BROAD BAND PULSE-ECHO BEAM PROFILE ANALYSIS IN NONATTENUATING AND ATTENUATING MEDIA Ph.D. Thesis
Richard Alan Banjavic 1979 172 p
Avail: Univ. Microfilms Order No. 7921544

Ultrasonic pulse echo beam profiles are examined as a means of estimating the resolution capabilities of a transducer pulser receiver network when such a system is employed for clinical scanning. The broad band pulse echo beam profiles are determined for paths containing soft tissues or tissue equivalent media which is similar to tissue in physical density and acoustic speed of sound and attenuation coefficient. These profiles are compared to similar profiles derived in nonattenuating media and to predictions derived from models based on continuous wave transmission. Dissert. Abstr.

N80-14840*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF HELICOPTER NOISE DUE TO B BLADE-VORTEX INTERACTION FOR FIVE TIP CONFIGURATIONS
Danny R. Hoad Dec. 1979 80 p refs Prepared jointly with AVRADCOM, Hampton, Va.
(DA Proj. 1L2-62209-AH-76)
(NASA-TP-1608; AVRADCOM-TR-80-B1; L-13207) Avail: NTIS HC A05/MF A01 CSCL 20A

The effect of tip shape modification on blade vortex interaction induced helicopter blade slap noise was investigated. Simulated flight and descent velocities which have been shown to produce blade slap were tested. Aerodynamic performance parameters of the rotor system were monitored to ensure properly matched flight conditions among the tip shapes. The tunnel was operated in the open throat configuration with treatment to improve the acoustic characteristics of the test chamber. Four promising tips were used along with a standard square tip as a baseline configuration. A detailed acoustic evaluation on the same rotor system of the relative applicability of the various tip configurations for blade slap noise reduction is provided. R.C.T.

N80-14841# Materials Research Labs., Melbourne (Australia).
UNDERWATER SOUND SCATTERING BY MARINE ORGANISMS. A REVIEW
Ian C. Dunstan Aug. 1979 29 p refs
(MRL-R-756; AR-001-838) Avail: NTIS HC A03/MF A01

Scattering of acoustic energy by inhomogeneities within the water column, or volume reverberation, is a major source of interference to underwater sonar systems. As naval defence systems have a high dependence on acoustic detection, knowledge of the factors that affect sonar interference is relevant to defence interests. The literature on interference to sonar propagation by marine organisms is reviewed, with particular emphasis on Australian waters. Acoustic scattering in the ocean generally occurs in discrete layers called deep scattering layers. Theoretical and experimental investigations show conclusively that the scattering is caused by marine organisms. Reverberation profiles are dominated by the resonance back-scattering from gas-filled swimbladders of midwater fish, particularly at frequencies between 0.5 and 20 kHz. At higher frequencies, scattering from fish tissue and planktonic organisms becomes significant. Information on the identity and acoustic properties of sound scattering organisms within the Australian region is sparse. Author

N80-14842*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
EFFECTS OF FRICTION AND HEAT CONDUCTION ON SOUND PROPAGATION IN DUCTS
Patrick Huerre and K. Karamcheti Aug. 1976 159 p refs
(Grants NsG-2007; NGL-05-020-275; NGL-05-020-526)
(NASA-CR-162556; JIAA-TR-4) Avail: NTIS HC A08/MF A01 CSCL 20A

The theory of sound propagation is examined in a viscous, heat-conducting fluid, initially at rest and in a uniform state, and contained in a rigid, impermeable duct with isothermal walls. Topics covered include: (1) theoretical formulation of the small amplitude fluctuating motions of a viscous, heat-conducting and compressible fluid; (2) sound propagation in a two dimensional duct; and (3) perturbation study of the inplane modes. A.R.H.

N80-14843*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTIC CONSIDERATIONS OF FLIGHT EFFECTS ON JET NOISE SUPPRESSOR NOZZLES
U. vonGlahn 1979 26 p refs Presented at the AIAA 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980
(NASA-TM-81377; E-282; AIAA-Paper-80-0164) Avail: NTIS HC A03/MF A01 CSCL 20A

The inflight acoustic characteristics of high velocity jet noise suppressor nozzles for supersonic cruise aircraft were reviewed. The inflight effects at the peak noise level were discussed. Both single and inverted velocity profile multistream suppressor nozzles were considered. The importance of static spectral shape on the noise reduction due to inflight effects was stressed. R.C.T.

N80-14844# Naval Research Lab., Washington, D. C.
RAYSTC: A COMPUTER CODE FOR CALCULATING SINGLE RAY-PATH STATISTICS, ASSUMING THE GARRETT-MUNK MODEL OF INTERNAL WAVES Interim Report
M. L. Blodgett 25 Jul. 1979 32 p refs
(ZF52552003)
(AD-A073762; AD-E000317; NRL-8304) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report describes a computer program designed to calculate root-mean-square values for the acoustic phase, phase rate, and log-intensity fluctuation for a single ray path in an ocean in which the sound-speed fluctuations are the result of internal-wave activity. It is assumed that the internal waves can be described by the Garrett-Munk internal-wave model and that the theory of sound propagation developed by Munk and Zachariasen is valid. GRA

N80-14845# Pennsylvania State Univ., University Park. Applied Research Lab.
DIGITAL WAVEFRONT RECONSTRUCTION FOR ACOUSTICAL APPLICATIONS
Robert L. Cohen 12 Jul. 1979 223 p refs
(Contract N00024-79-C-6043)
(AD-A073775; ARL/PSU/TM-79-132) Avail: NTIS HC A11/MF A01 CSCL 17/1

The work presented is an extension of research in acoustical holography as a tool for sound source location; this research being centered on digital processing and computer graphics imaging. Holographic images of plates vibrating below coincidence frequency show radiation from regions of discontinuity and not from other regions. Digitally reconstructed images from acoustic holograms show the radiating part (far-field component) of the pressure at the source location. The image may be interpreted as a monopole distribution which would generate the same far field as did the original source distribution. A near-field scan records the entire field and yields an image which is proportional to the surface velocity of the plate. It shows the modal pattern of the plate vibration. The holographic far-field image is approximately equivalent to the near-field image with the high wave numbers filtered out. Since the far field contains spatial frequencies only up to 1/lambda, image resolution is limited by

the acoustic wavelength; i.e., the ideal image is convolved with an Airy pattern. GRA

N80-14846# Pennsylvania State Univ., University Park. Applied Research Lab.
RADIATED NOISE DUE TO BOUNDARY-LAYER TRANSITION
G. C. Lauchle 23 Jul. 1979 52 p refs
(Contract N00024-79-C-6043)
(AD-A073491; ARL/PSU/TM-79-135) Avail: NTIS
HC A04/MF A01 CSCL 17/1

A theory is presented for the noise radiated by incompressible boundary-layer transition that occurs on an infinite, rigid flat plate. It is hypothesized that it is the intermittency of the boundary-layer flow within the transition zone that is dominant in noise production. Using Lighthill's analogy, it is shown that dipole, quadrupole, and octupole sources are generated. The dipole sources are attributable to the shear stress fluctuations that occur in transitional flow while the others are due to fluctuating Reynolds stresses and their images. Under the assumption that dipole sources are more efficient than quadrupoles or octupoles when the Mach number is very small, the power spectrum of the radiated noise due to the dipole contribution is derived. The spectral level rises at 6 db/octave, peaks at a frequency corresponding to the time it takes for a turbulence burst to move through the transition region, and then drops off again at 6 dB/octave. The radiation efficiency is analyzed and found to be quite low; it is only 20 percent of that for a fully-developed turbulent boundary layer flow. GRA

N80-14847# Pennsylvania State Univ., University Park. Applied Research Lab.
TRANSIENT RESPONSE OPTIMIZATION OF PIEZOELECTRIC DISC TRANSDUCERS BY TIME DOMAIN TECHNIQUES Ph.D. Thesis
Henry Alan Wolf 23 Jul. 1979 252 p refs
(Contract N00024-79-C-6043)
(AD-A073818; ARL/PSU/TM-79-139) Avail: NTIS
HC A12/MF A01 CSCL 17/1

The goals of this research have been to find and demonstrate design procedures for reducing the mechanical ringing of piezoelectric disc transducers under impulsive electrical excitation. The transducer has been treated as a three-port device: the two mechanical ports and one electrical port. Improvements to the transient response have been sought through the determination of appropriate matching networks at the ports. The optimization of specified time domain characteristics is accomplished by performing a gradient search over a parameter space defining the port matching configurations. It is assumed that only one mechanical port radiates into the acoustic medium. The transducer and mechanical matching sections are modeled using the Mason equivalent circuit and the distributed parameter wave guide model, respectively. Transformation to the time domain is achieved using a numerical approximation to the Laplace transformation. GRA

N80-14848# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 125: F-105D AIRCRAFT, NEAR AND FAR-FIELD NOISE
Robert G. Powell Oct. 1978 132 p
(AF Proj. 7231)
(AD-A073616; AMRL-TR-75-50-Vol-125) Avail: NTIS
HC A07/MF A01 CSCL 01/3

The USAF F-105-D is a multipurpose, adverse weather fighter-bomber aircraft powered by a J75-P-19W turbojet engine. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for five engine-power conditions. Near-field data are reported for eight locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise levels, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-14849# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 129: F-100 AIRCRAFT IN THE AF32A-16 NOISE SUPPRESSOR, NEAR AND FAR-FIELD NOISE
Robert G. Powell Nov. 1978 86 p
(AF Proj. 7231)
(AD-A073793; AMRL-TR-75-50-Vol-129) Avail: NTIS
HC A05/MF A01 CSCL 01/3

Measured and extrapolated data defining the bioacoustic environments produced by an F-100 operating in a noise suppressor for four engine power configurations. Near-field data are reported for three locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. Refer to volume 1 of this handbook, 'USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application', AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. GRA

N80-14850# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 137: F-101B AIRCRAFT, NEAR AND FAR-FIELD NOISE
Robert G. Powell Oct. 1978 134 p
(AF Proj. 7231)
(AD-A073617; AMRL-TR-75-50-Vol-137) Avail: NTIS
HC A07/MF A01 CSCL 01/3

The USAF F-101B is a long-range, all-weather supersonic fighter-interceptor aircraft powered by two J57-P55 turbojet engines. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for five engine-power conditions. Near-field data are reported for ten locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise levels, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75 - 8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-14851# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 138: F-102A AIRCRAFT, NEAR AND FAR-FIELD NOISE
Robert G. Powell Oct. 1978 127 p refs
(AF Proj. 7231)
(AD-A073618; AMRL-TR-75-50-Vol-138) Avail: NTIS
HC A07/MF A01 CSCL 01/3

The USAF F-102A is a remotely controlled aircraft and was a supersonic all-weather fighter-interceptor aircraft powered by one J57-P-23 turbojet engine. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for five engine-power conditions. Near-field data are reported for six locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors.

Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75 - 8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-14852# National Bureau of Standards, Washington, D.C. Center for Mechanical Engineering and Process Technology.
RECENT IMPROVEMENTS TO THE ASTM-TYPE ULTRASONIC REFERENCE BLOCK SYSTEM Final Report, 1 Jan. 1976 - 31 Jan. 1979
Daniel J. Chwirut Jul. 1979 57 p refs
(Contract F33615-76-F-6751; AF Proj. 7381)
(AD-A074724; AFML-TR-79-4080) Avail: NTIS
HC A04/MF A01 CSCL 14/2

Recent activities aimed toward improving the ASTM-type ultrasonic reference block system are described. On the aluminum block system (ASTM E127 and NBS TN 924), efforts were focused on better definition of the measurement equipment (transducer and instrument), the implementation of a Measurement Assurance Program and Loaner Block Service, and modeling of the distance-amplitude relationship. It is shown that a large increase in the precision of reference block readings is easily achievable by implementing simple changes and controls in the measurement procedure. On steel and titanium blocks (e.g. ASTM E-428), efforts were directed toward quantifying the extent of reproducibility possible among blocks fabricated by both conventional drilling and by diffusion bonding. Reasonable reproducibility is achievable by both, with the diffusion-bonding process offering both advantages and disadvantages. GRA

N80-14853# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE ANALYSIS OF SOUND PROPAGATION IN JET ENGINE DUCTS USING THE FINITE DIFFERENCE METHOD Interim Report, Nov. 1975 - Nov. 1978
Dennis W. Quinn Jun. 1979 60 p refs
(AD-A074233; AFFDL-TR-79-3063) Avail: NTIS
HC A04/MF A01 CSCL 20/1

In this report, the author derives the partial differential equations which describe sound propagation in jet engine ducts and then presents a finite difference approach for solving these equations. Also included is a computer program listing, sample input and sample output. The program can handle uniform rectangular and cylindrical ducts with or without uniform flow. In addition, if a mapping function which maps a nonuniform duct to a uniform duct is specified, the program can determine sound fields in nonuniform ducts in the absence of flow. GRA

N80-14854# Johns Hopkins Univ., Baltimore, Md. School of Engineering.
OPTICAL PROBING OF ACOUSTIC EMISSION WAVES Final Report, 15 Feb. 1976 - 30 Jun. 1979
C. Harvey Palmer and Robert E. Green, Jr. 31 Aug. 1979 75 p refs
(Grants DAAG29-76-G-0160; DAAG29-78-G-0050)
(AD-A074160; ARO-13666.6-MSX) Avail: NTIS
HC A04/MF A01 CSCL 20/1

Optical probing is a newly developed technique for quantitative study of acoustic emission. It has great advantages over other techniques, especially piezoelectric probing: it is non-contract and does not disturb the signals, it is absolutely calibrated, has a sensitive area only tens of microns in diameter, can make measurements within a millimeter of a source, can be used to probe internally in transparent materials, and has an extremely wide, flat bandwidth. With the optical probe we have measured extremely short rise times, amplitudes of 1 to 10 angstroms, and signals characteristics of their sources, at least in some cases. GRA

N80-14855# Science Applications, Inc., McLean, Va.
ACOUSTIC IMPLICATIONS OF MESOSCALE OCEANOGRAPHIC PHENOMENA Final Report
Lorna S. Blumen and John S. Hanna 31 May 1979 114 p refs Original contains color plates
(Contract N00014-77-C-0696)
(AD-A074456; SAI-80-926-W/A) Avail: NTIS
HC A06/MF A01 CSCL 20/1

This volume documents an investigation into the effects of mesoscale oceanographic features on underwater acoustic propagation. A recent eddy model is evaluated for its application to acoustic analysis. The effects of range-dependence, source-receiver geometry, and source frequency are examined. Descriptive statistics are used to provide a quantitative measure of the energy redistribution caused by the presence of an eddy. GRA

N80-14856# Los Alamos Scientific Lab., N. Mex.
SOUND VELOCITY AND EQUATION-OF-STATE MEASUREMENTS IN HIGH PRESSURE FLUID AND SOLID HELIUM
D. H. Liebenberg, R. L. Mills, and J. C. Bronson 1979 6 p refs Presented at the Intern. AIRAPT Conf., La Creusot, France, 30 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-721; CONF-790709-1) Avail: NTIS
HC A02/MF A01

A piston-cylinder apparatus was used to obtain P, V, T, and simultaneous values of longitudinal sound velocity in helium fluid throughout the ranges 75 to 300 K and 3 to 20 kbar. Measurements of the compressibility are compared with those obtained along the 4 K isotherm up to 20 kbar. The use of helium as a pressure medium in high pressure diamond anvil cells is discussed. DOE

N80-14857# California Univ., Livermore. Lawrence Livermore Lab.
MEASUREMENT OF SOUND VELOCITY IN LIQUID METALS
G. R. Gathers 10 May 1979 19 p refs
(Contract W-7405-eng-48)
(UCID-18171) Avail: NTIS HC A02/MF A01

Techniques for measuring sound velocity in liquid metals using transducers are reviewed. A dynamic noncontacting method intended to measure sound velocity in liquid uranium and which uses an argon-ion laser with a displacement interferometer is described. Measurements with liquid lead, and liquid uranium are discussed. DOE

N80-14858# Advisory Group for Aerospace Research and Development, Paris (France).
SPECIAL COURSE ON ACOUSTIC WAVE PROPAGATION
Aug. 1979 224 p refs In ENGLISH; partly in FRENCH Presented at the Von Karman Inst., Rhode-Saint-Genese, Belgium, 28 May - 1 Jun. 1979
(AGARD-R-686; ISBN-92-835-0248-5) Avail: NTIS
HC A10/MF A01

The propagation of acoustic waves in inhomogeneous and moving media of both unlimited and finite extent is discussed with particular emphasis on modelling of the phenomena involved and on prediction methods, as well as standardization aspects. Measurement techniques and data analysis are also considered. Applications of the material presented occur in aeroacoustics, industrial acoustics and atmospheric propagation. For individual titles, see N80-14859 through N80-14876.

N80-14859# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A GENERAL SURVEY OF STUDIES ON ACOUSTIC WAVE PROPAGATION [APERCU GENERAL DES ETUDES SUR LA PROPAGATION DES ONDES ACOUSTIQUES]
M. Perulli *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 5 p refs In FRENCH Prepared jointly with Univ. de Technologie de Compiegne, France (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

A brief historical review of theoretical and experimental research in acoustic wave propagation is presented. Some of the different themes which must be addressed in order to increase the state of knowledge in this particular domain of acoustics concern popagation in ideal and nonideal media.
Transl. by A.R.H.

N80-14860# Southampton Univ. (England). Inst. of Sound and Vibration Research.
ACOUSTIC EQUATIONS IN MOVING FLUIDS
P. E. Doak *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 6 p refs (For primary document see

N80-14858 05-71)
Avail: NTIS HC A10/MF A01

The full transport equations of mass, momentum and energy of an arbitrarily moving, thermally inhomogeneous, fluid are considered, and also appropriate definitions of 'acoustic motion' in such circumstances, leading to the partial differential equations and boundary conditions governing such motion. The fundamental nature of the convective, refractive, diffractive and diffusive effects of the fluid motion and thermal inhomogeneity on the acoustic motion is made evident. A classification is made of types of problems that have been, and can be, solved, and of the kinds of interactions that can occur between acoustic and other kinds of motions. Author

N80-14861# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FUNDAMENTALS OF SOUND REFLECTION AND REFRACTION IN INHOMOGENEOUS MEDIA
Roland Stuff *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 19 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

The historical development of geometrical acoustics is reviewed and sound wave propagation is examined including the effects of temperature and wind gradients. Analytical solutions of the wave equation are presented for an isothermally and a polytropically stratified still atmosphere and for an atmosphere with wind gradients and wind direction changes as well. These solutions are valid beyond the scope of geometrical acoustics. The dispersion of infrasound is also considered. A.R.H.

N80-14862# Southampton Univ. (England). Inst. of Sound and Vibration Research.
MATHEMATICAL TECHNIQUES FOR ACOUSTIC PROPAGATION PROBLEMS
P. E. Doak *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 7 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

The principal mathematical techniques for the solution of both steady state and transient acoustic propagation and boundary value problems, for both forced and free motion, are reviewed. These include separation of variables methods and the associated techniques for the resulting ordinary differential equations, Green function methods, Fourier, Laplace and other transform methods, finite element and other numerical methods, and certain special techniques including Wiener-Hopf. Emphasis is placed on the relative merits of the various methods for specific types of problems. Author

N80-14863*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DIRECTIVITY OF ACOUSTIC RADIATION FROM SOURCES
Donald L. Lansing *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 11 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01 CSCL 20A

The radiation properties of acoustic monopoles and dipoles are described, as well as the directivity of radiation from these sources in a free field and in the presence of an absorptive surface. The kinematic effects on source radiation due to translation and rotation are discussed. Experimental measurements of sound from an acoustic monopole in motion and the characteristics of helicopter rotor and propeller noise are reviewed. Several essential concepts required by noise control engineers making measurements of noise from moving sources in the proximity of the ground are introduced. A.R.H.

N80-14864# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROPAGATION IN DUCTS [PROPAGATION DANS LES CONDUITS]
M. Perulli *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 23 p in FRENCH Prepared jointly with Univ. de Technologie de Compiegne, France (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

The study of acoustic wave propagation in ducts is accomplished by beginning with a wave equation in which the following come into play: duct geometry, the median heights and fluctuations characterizing the fluid, and the acoustic properties of the walls. Generally, this equation can be solved only by complex numerical methods and, to this day, only the particular cases which correspond to simple geometries can be treated analytically. Numerous physical properties are presented and the case is discussed for an infinite duct of any section but constant, in which a uniformly homogeneous fluid flows; the acoustic impedance of the walls can or can not be absorbent. An expression for the pressure field is given for different duct geometries (rectangular, annular, and cylindrical).
Transl. by A.R.H.

N80-14865# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Dept. de Genie Macanique.
PROPAGATION IN ACOUSTICALLY ABSORBENT MATERIALS
M. Perulli and P. E. Doak (Inst. of Sound and Vibration Research) *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 6 p refs Prepared jointly with Southampton Univ., England (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

Models for representing the dynamics of porous and other acoustically absorbent materials are reviewed. Propagation in significantly absorbent materials widely used in practice, or commonly occurring, for example, as outdoor ground surfaces, is discussed. Non-linear high amplitude effects and mean flow effects are briefly described. A.R.H.

N80-14866# Southampton Univ. (England). Inst. of Sound and Vibration Research.
ACOUSTIC ENERGY
C. L. Morfey *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 7 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

Acoustic energy equations are shown to be a consequence of the linearized equations of motion. Definitions of acoustic energy density and flux are given for sound fields in fluids at rest, and in various types of mean flow. Several applications to flow-acoustic problems are discussed, involving the transmission of sound through jets and shear layers and along lined flow ducts. Author

N80-14867# Southampton Univ. (England). Inst. of Sound and Vibration Research.
ABSORPTION OF SOUND WAVES IN THE ATMOSPHERE
C. L. Morfey *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 12 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

Absorption processes for sound waves in gases are described, with particular emphasis on atmospheric propagation over the frequency range 10 Hz to 10 to the 5th power Hz. The topics covered include molecular transport processes (viscosity, heat conduction and diffusion in mixtures); rotational relaxation in air; vibrational relaxation of N2 and O2 molecules in air and the influence of humidity; radiative heat transfer due to water vapor; viscothermal absorption due to suspended particles, and the additional effects arising from droplet evaporation in fogs. In each case, graphs or formulae for estimating atmospheric attenuation are provided, together with references to further information. Dissipative effects in nonlinear waves, sonic boom rise times in the atmosphere, and the spectral distortion of high-intensity noise are considered. A.R.H.

N80-14868*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTAL MEASUREMENTS OF MOVING NOISE SOURCES
L. Maestrello and T. D. Norum *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 12 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01 CSCL 20A

The far-field pressure was measured from three different types of moving sources: a point monopole, a small model jet,

and an aircraft. Results for the pressure time history produced by the point source show good agreement with those predicted analytically. Both actual and simulated forward motion of the model jet show reductions in noise levels with forward speed at all angles between the source and observer. Measurement with the aircraft over both an anechoic floor and over the ground yields a method for evaluating the transfer function for ground reflections at various angles between the moving aircraft and measurement position. A.R.H.

N80-14869# Southampton Univ. (England). Inst. of Sound and Vibration Research.
PROPAGATION FROM MOVING SOURCES IN FLOWS
C. L. Morfey *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 13 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

The theory of sound radiation from moving sources is outlined, first for uniform media and then for certain cases of nonuniform flow. Various applications are discussed which relate to aircraft noise in flight. K.L.

N80-14870*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. Aeroacoustics Branch.
APPLICATIONS OF DIFFRACTION THEORY TO AEROACOUSTICS
Donald L. Lansing, Chen-Huei Liu, and Thomas D. Norum *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 12 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01 CSCL 20A

The fundamentals of diffraction theory were reviewed and applied to several problems of aircraft noise generation, propagation, and measurement. The general acoustic diffraction problem is defined and the governing equations were set down. Diffraction phenomena are illustrated using the classical problem of the diffraction of a plane wave by a half-plane. Infinite series and geometric acoustic methods for solving diffraction problems are described. Four applications of diffraction theory are discussed: the selection of an appropriate shape for a microphone, the use of aircraft wings to shield the community from engine noise, the reflection of engine noise from an aircraft fuselage, and the radiation of trailing edge noise. K.L.

N80-14871# Centre National de la Recherche Scientifique, Marseilles (France). Dept. of Acoustics.
RANDOM PROPAGATION AND RANDOM SCATTERING
C. Gazanhes *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 11 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

The treatment of random propagation problems using geometrical optics, the Born approximation, the Rytov method, and parabolic equations is reviewed. The case of scattering by a cloud of random scatters is considered. K.L.

N80-14872# Centre National de la Recherche Scientifique, Marseilles (France). Dept. of Acoustics.
UNDERWATER ACOUSTIC PROBLEMS
C. Gazanhes *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 9 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

Basic principles which simplify underwater acoustics problems are reviewed. A static description of the medium is given, transmission loss is defined, and the effects of fluctuations in the medium on acoustical transmission are discussed. Propagation problems are considered from the ray and mode point of view. K.L.

N80-14873*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. Inst. for Computer Application in Science and Engineering.
EXPERIMENTAL AND NUMERICAL RESULTS OF SOUND SCATTERING BY A BODY
L. Maestrello and A. Bayliss *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 12 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01 CSCL 20A

The interaction of aerodynamic noise with a fuselage shaped body is discussed. A numerical technique is presented which permits the computation of the scattering of an acoustic source by a body at rest for frequencies of aeroacoustic interest. A parallel experiment is described which confirms the results of the computations. A numerical study of varying the geometry of the scattering is presented. In addition, the effect of forward motion on the mean velocity and static pressure profiles in the wake of such a body with a jet exiting from it is simulated. Experimental results are presented and a similarity law is given. K.L.

N80-14874# Technical Univ. of Denmark, Lyngby. Acoustics Lab.
FINITE-AMPLITUDE WAVE PROPAGATION
Leif Bjorno *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 15 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

The historical development of finite amplitude wave propagation in fluids is reviewed. The theoretical basis for the propagation of plane, cylindrical, or spherical finite amplitude waves through lossless, thermoviscous, or relaxing fluids is presented and characteristic features of the distortion course observed by finite amplitude waves in various regions of propagation are emphasized. Some experimental procedures and results are mentioned. K.L.

N80-14875# Technical Univ. of Denmark, Lyngby. Acoustics Lab.
NONLINEAR INTERACTION OF FINITE-AMPLITUDE SOUND WAVES
Leif Bjorno *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 10 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

The history and the fundamental theory of nonlinear interaction of finite amplitude sound waves is reviewed and the concept of parametric acoustic arrays is introduced. Low amplitude wave interactions in absorption and spreading-loss limited parametric transmitting arrays are discussed for continuous and pulsed primaries and for field points outside or inside the interaction region. High amplitude wave interactions leading to nearfield saturation limited parametric transmitting arrays are further treated for field points outside and inside the interaction region. The parametric receiving array for low and high amplitude pump waves is discussed and possibilities for obtaining an improvement of the parametric conversion efficiency for low and high amplitude wave interactions are given. K.L.

N80-14876# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.
AEROACOUSTIC MEASURING TECHNIQUES IN OR OUTSIDE TURBULENT FLOWS
Helmut V. Fuchs *In* AGARD Special Course on Acoustic Wave Propagation Aug. 1979 27 p refs (For primary document see N80-14858 05-71)
Avail: NTIS HC A10/MF A01

The motion of aerodynamic or acoustic sources relative to the fluid and/or the measuring instrument is discussed. Some practically important effects on the pressure and velocity fields in and outside the active source region are deduced from linearized wave equations with simple source functions. Limitations on fluctuating aerodynamic and acoustic pressure measuring techniques employing special microphone probes are discussed. Applications include: (1) the pressure pulsations induced in the near fields of jet, wake, and duct flows; and (2) the effects of source convection and forward speed on the far field radiation characteristics of jets or other aeroacoustic sources in motion. K.L.

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-14877* National Aeronautics and Space Administration, Pasadena Office, Calif.
HIGH RESOLUTION THRESHOLD PHOTOELECTRON SPECTROSCOPY BY ELECTRON ATTACHMENT Patent
Ara Chutjian (JPL) and Joseph M. Ajello, inventors (to NASA) (JPL) Issued 19 Jun. 1979 6 p Filed 30 Nov. 1977 Supersedes N78-13917 (16 - 04, p 0546)
(NASA-Case-NPO-14078-1; US-Patent-4,158,775; US-Patent-Appl-SN-856466; US-Patent-Class-250-423P; US-Patent-Class-250-281; US-Patent-Class-250-282) Avail: US Patent and Trademark Office CSCL 20H

A system is provided for determining the stable energy levels of a species ion, of an atomic, molecular, or radical type, by application of ionizing energy of a predetermined level, such as through photoionization. The system adds a trapping gas to the gaseous species to provide a technique for detection of the energy levels. The electrons emitted from ionized species are captured by the trapping gas, only if the electrons have substantially zero kinetic energy. If the electrons have nearly zero energy, they are absorbed by the trapping gas to produce negative ions of the trapping gas that can be detected by a mass spectrometer. The applied energies (i.e. light frequencies) at which large quantities of trapping gas ions are detected, are the stable energy levels of the positive ion of the species. SF6 and CFCl3 have the narrowest acceptance bands, so that when they are used as the trapping gas, they bind electrons only when the electrons have very close to zero kinetic energy.

Official Gazette of the U.S. Patent and Trademark Office

N80-14878*# Williams Coll., Williamstown, Mass.
EFFECTS OF HYDROGEN ATOM SPIN EXCHANGE COLLISIONS ON ATOMIC HYDROGEN MASER OSCILLATION FREQUENCY Final Technical Report, 1 Dec. 1977 - 30 Nov. 1979
Stuart B. Crampton 1979 15 p refs
(Grant NsG-5218)
(NASA-CR-162525) Avail: NTIS HC A02/MF A01 CSCL 20H

Frequency shifts due to collisions between hydrogen atoms in an atomic hydrogen maser frequency standard are studied. Investigations of frequency shifts proportional to the spin exchange frequency shift cross section and those proportional to the duration of exchange collisions are discussed. The feasibility of operating a hydrogen frequency standard at liquid helium temperatures is examined. A.W.H.

N80-14879*# Xavier Univ. of Louisiana, New Orleans. Dept. of Physics/Pre-Engineering.
CALCULATION OF TOTAL CROSS SECTIONS FOR CHARGE EXCHANGE IN MOLECULAR COLLISIONS Final Report
Juliette Ioup 31 Dec. 1979 32 p refs
(Grant NsG-1361)
(NASA-CR-162560) Avail: NTIS HC A03/MF A01 CSCL 20H

Areas of investigation summarized include nitrogen ion-nitrogen molecule collisions; molecular collisions with surfaces; molecular identification from analysis of cracking patterns of selected gases; computer modelling of a quadrupole mass spectrometer; study of space charge in a quadrupole; transmission of the 127 deg cylindrical electrostatic analyzer; and mass spectrometer data deconvolution. A.R.H.

N80-14880# Washington Univ., Seattle. Dept. of Chemistry.
COLLISIONAL RELAXATION OF TRANSIENT VIBRATIONAL ENERGY DISTRIBUTIONS IN A THERMAL UNIMOLECULAR SYSTEM: THE VARIABLE ENCOUNTER METHOD
D. F. Kelley, L. Zalotai, and B. S. Rabinovitch 15 Sep. 1979 42 p refs Submitted for publication Sponsored in part by NSF
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A074163; TR-011) Avail: NTIS HC A03/MF A01 CSCL 07/3

The Variable Encounter Method is described in detail together with theoretical modes for deconvolution of data. A relation is developed between mean first passage time and 'incubation' time. Application is made to the study of the transient region in vibrational accommodation of cyclopropane-d2 at high temperature surfaces. Collision efficiency declines with rise of temperature. Surface collisions are more efficient than binary gas phase encounters. GRA

N80-14881# New York Univ., N. Y. Dept. of Physics.
THEORETICAL STUDIES RELATING TO THE INTERACTION OF RADIATION WITH MATTER: ATOMIC COLLISION PROCESSES OCCURRING IN THE PRESENCE OF RADIATION FIELDS Annual Report, 1 Aug. 1978 - 31 Jul. 1979
P. R. Berman 15 Aug. 1979 9 p refs
(Contract N00014-77-C-0553)
(AD-A074183; AR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

Work is reported in the areas of: collisional studies using laser spectroscopy; the nature and validity of collision kernels; strong field effects in laser spectroscopy; collisionally-aided radiative excitation, including a model potential calculation; radiative collisions including model potential calculations; collisional studies using photon echoes or Optical Ramsey Fringes; photon echoes produced by standing-wave fields; and photoionization by pulsed laser fields. GRA

N80-14882# Wisconsin Univ. - Madison. Dept. of Physics.
MOLECULAR REACTION RATES Final Report, 1 Aug. 1973 - 30 Sep. 1978
Chun C. Lin and Sunggi Chung 30 Oct. 1978 115 p refs
(Contract F19628-73-C-0274; AF Proj. 2310)
(AD-A073851; AFGL-TR-78-0282) Avail: NTIS HC A06/MF A01 CSCL 07/4

Theoretical excitation/dissociation cross sections of H2 molecule by electron impact have been calculated by Born approximation and by the method of close-coupling. The ab initio calculations have been facilitated by using the Gaussian-type orbital technique. In the case of dissociation of O2 via the Schumann-Runge system, the theoretical calculations are based on the multiconfiguration self-consistent-field wave functions. GRA

N80-14883# California Univ., Livermore. Lawrence Livermore Lab.
SOME DOUBLE RESONANCE AND MULTIPLE QUANTUM NMR STUDIES IN SOLIDS Ph.D. Thesis
D. E. Wemmer Aug. 1978 295 p refs
(Contract W-7405-eng-48)
(LBL-8042) Avail: NTIS HC A13/MF A01

The theory and experimental applications to analysis of molecular motion of chemical shielding lineshapes obtained with high resolution double resonance NMR techniques are presented. Analysis of C-13 powder lineshapes in hexamethylbenzene and decamethylferrocene show that these molecules reorient in a jumping manner about the symmetry axis. Analysis of proton chemical shielding lineshapes of residual protons in heavy ice show that protons are exchanged among the tetrahedral positions of neighboring oxygen atoms, consistent with motion expected from defect migration. The application of Fourier transform double quantum NMR to measurement of chemical shielding of deuterium in powder samples is described. The general multiple quantum spectroscopy in dipolar coupled spin systems is discussed. Theoretical description is made for creation and detection of coherences between states without quantum number selection rules. Descriptions of techniques for partial selectivity of order in preparation and detection of multiple quantum coherences are made. The effects on selectivity and resolution of echo pulses during multiple quantum experiments are discussed. DOE

N80-14884# Columbia Univ., New York. Dept. of Physics.
ORDERING OF ATOMIC ENERGY LEVELS IN EXCITED STATES
H. M. Foley 1978 13 p refs
(Contract EY-76-C-02-2271)
(CU-TP-135) Avail: NTIS HC A02/MF A01

A consistent odering of excited atomic states with the

quantity k = n + 1, for small values of the orbital angular momentum 1, pointed out by Sternheimer is examined. The ordering is interpreted in terms of the variation of the quantum defects with 1. The simple rules for the k ordering are given. The reasons for the observed variation of the quantum defects are understood in terms of the accumulation of zero energy scattering phase shifts with 1 and with zeta, as calculated from a realistic atomic potential. DOE

N80-14885# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
CATALYSIS AND SURFACE SCIENCE
G. A. Somorjai. Mar. 1979. 15 p. Presented at European Conf. on Surface Sci., 2, Cambridge, England, 26 Mar. 1979.
(Contract W-7405-eng-48)
(LBL-9043; CONF-790356-2) Avail: NTIS HC A04/MF A01

The dynamics of the elementary surface reaction steps on the atomic scale and the relationship of the atomic surface structure and surface composition to the catalytic process are reviewed. The surface science techniques employed and the special instrumentation developed to couple the low pressure environment necessary for the application of these techniques and the high pressure conditions utilized in catalysis are discussed. The model studies using well characterized surfaces are discussed in relation to the importance of surface irregularities and surface additives in controlling the rate and the product distribution in the surface reactions. Research topics reviewed include: (1) the atomic scale investigation of proven catalytic systems, (2) studies of catalyst deactivation and poisoning, and (3) attempts to build new catalysts. DOE

N80-14886# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Chemistry.
PHOTODISSOCIATION PROCESSES IN MOLECULAR BEAMS. Ph.D. Thesis
L. R. Carlson. May 1979. 145 p. refs.
(Contract W-7405-eng-48)
(LBL-9219) Avail: NTIS HC A07/MF A01

Photo-fragmentation translational spectroscopy was utilized to observe the photodissociation dynamics of ozone. Using a supersonic molecular beam and a 10 nanosecond pulsed laser at lambda = 266 nm, the velocities of the fragment products are measured by the method of time of flight. The resolution of the time of flight spectrum of ozone is sufficiently high that the electronic and vibrational states are clearly resolved and identified. The quantum yield for the production of O (1 D) above the threshold (1 lambda < 310 nm) is discussed. Energy distributions are compared with photodissociation models along with the polarization dependence of the dissociative process which was also measured. DOE

N80-14887# California Univ., Livermore. Lawrence Livermore Lab.
FORMATION OF HYDROGEN NEGATIVE IONS BY SURFACE AND VOLUME PROCESSES WITH APPLICATION TO NEGATIVE ION SOURCES
J. R. Hiskes. 27 Jun. 1979. 43 p. refs. Presented at 15th Intern. Conf. on Phenomena in Ionized Gases, Grenoble, France, 9-13 Jul. 1979.
(Contract W-7405-eng-48)
(UCRL-82989; CONF-790708-3) Avail: NTIS
HC A02/MF A01

The need for negative ions as a means for generating high energy neutral beams is discussed. Methods for generating negative ion beams which, in the past, have relied upon synchrotron concepts are reviewed. The requirements for magnetic fusion are presented. Proposed source modules would accelerate an order of 10 A of beam current and deliver several megawatts of beam power. Both hydrogen and deuterium ion beams are considered for application in different reactor systems. Proposals for development of negative ion beams are discussed. These are: the double charge exchange method for converting a positive ion beam into a negative ion beam; the electron volume processes wherein low energy electrons interacting with molecular species lead to negative ion products via dissociative attachment or recombination; and third, generation of negative ions in surface interactions, principally via desorption and backscattering. DOE

N80-14888# California Inst. of Tech., Pasadena.
CAPTURE OF MUONS IN ATOMS
P. Vogel. 1978. 34 p. refs. Presented at Nordic Spring Symp. on Inner Shell Phenomena, Geilo, Norway, 17 Apr. 1978.
(Contract EY-76-C-03-0063)
(CALT-63-304; CONF-7804144-1) Avail: NTIS
HC A03/MF A01

The theoretical framework is described for the formation of mesic atom and the initial part of the atomic cascade. The observable phenomena are reported and the mechanics are discussed. DOE

N80-14889# Argonne National Lab., Ill.
INTERACTION OF FAST MOLECULAR IONS WITH MATTER
D. S. Gemmell. 1979. 14 p. refs. Presented at 6th Intern. Congr. Symp. on Radiation Res. and Stem Cells, Tokyo, 13 May 1979.
(Contract W-31-109-eng-38)
(CONF-790524-8) Avail: NTIS HC A02/MF A01

The interactions of fast ions with matter are discussed using molecular ion projectiles. At high velocities, these projectiles dissociate rapidly upon entering a solid, resulting in a tight cluster of fragments which continue into the solid closely correlated in space and in time. High resolution studies on the trajectories of such fragments, the energy losses, the shifts in angle and energy and the charge states, are discussed in terms such as stopping power, radiation damage, and the interactions of fast ions with the plasma oscillations they induce in solids. DOE

N80-14890# Brookhaven National Lab., Upton, N. Y.
HIGH RESOLUTION MAGNETIC SPECTROMETER FOR ANTIPROTON PHYSICS AT REST AND LOW ENERGIES
D. I. Lowenstein, D. C. Peaslee (DOE, Washington, D.C.), R. A. Lewis (Michigan State Univ.), R. Miller (Michigan State Univ.), B. Y. Oh (Michigan State Univ.), M. Pratap (Michigan State Univ.), G. A. Smith (Michigan State Univ.), J. Whitmore (Michigan State Univ.), T. Brando (Syracuse Univ.), T. E. Kalogeropoulos (Syracuse Univ.) et al. 1978. 14 p. refs. Presented at 4th European Anti-Proton Symp., Strasbourg, 26 Jun. 1978.
(Contract EY-76-C-02-0016)
(BNL-24662; CONF-7806108-1) Avail: NTIS
HC A02/MF A01

The principles and details of the spectrometer being installed in a high intensity antiproton beam are presented. TOF scintillation counters which will measure particle and gamma ray energies with high resolution, as well as identify particles, are described. The spectrometer is being installed to look for peaks in the gamma spectra coming from annihilations at rest by converting them in a thin radiator before a magnet. The question of gamma excess in antinucleon-nucleon annihilations at rest and the ability of the spectrometer to study the annihilations is discussed. A.W.H.

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-14891# Rome Air Development Center, Griffiss AFB, N.Y.
GAMMA ENERGY SPECTRA FOR THE RADC/ES COBALT 60 SOURCE. Interim Report
A. R. Frederickson. Apr. 1979. 23 p. refs.
(AD-A073557; RADC-TR-79-68) Avail: NTIS
HC A02/MF A01 CSCL 20/8

A Monte Carlo photon transport code has been used to calculate the photon energy distributions produced by several in-use intense CO60 sources at RADC/ES (formerly at AFCRL). In addition, the energy-angle spectra has been determined for photons exiting collimators used with these sources. These spectra may be helpful in understanding the responses of devices and materials irradiated by the source photons. GRA

N80-14892# Naval Surface Weapons Center, White Oak, Md.
RIGID-ROTOR EQUILIBRIUM OF INTENSE RELATIVISTIC ELECTRON BEAM Final Report
Han S. Uhm 15 Mar. 1979 73 p refs
(ZR00001; ZR01109)
(AD-A073318; NSWC/WOL/TR-78-182) Avail: NTIS HC A04/MF A01 CSCL 20/8

Understanding of the equilibrium properties of intense relativistic electron beams is extremely important in various areas, including microwave generation and beam propagation in the atmosphere. This report examines the equilibrium properties of the intense relativistic electron beam described by the rigid-rotor equilibrium distribution function. Beam properties including an axial velocity profile, a beam temperature, a beam density, and equilibrium self-field profiles are calculated for a broad range of system parameters. GRA

N80-14893# Los Alamos Scientific Lab., N. Mex.
MISSIONS AND PLANNING FOR NUCLEAR SPACE POWER
D. Buden 1979 7 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1240; CONF-790803-06) Avail: NTIS HC A02/MF A01

Requirements for electrical and propulsion power for space are discussed. Nuclear power is examined as a source for some deep space missions and a major competitor for many orbital missions, especially those at geosynchronous orbit. A technology program on reactor components is evaluated. The missions that are foreseen, the current reactor concept, and the technology program plan are described. DOE

N80-14894# Department of Energy, Washington, D. C. Div. of Nuclear Power Development.
NUCLEAR POWER PROGRAM INFORMATION AND DATA: UPDATE, MARCH - APRIL 1979
1979 153 p refs
(DOE/TIC-10119) Avail: NTIS HC A08/MF A01

Information on nuclear power development, nuclear power plant construction, and nuclear power plant operation is presented. The economics of nuclear power and the fuel requirements and performance of nuclear generating units are discussed. The NRC review of the Three Mile Island accident is presented. A.W.H.

N80-14895# Maryland Univ., College Park. Dept. of Physics and Astronomy.
PION NUCLEON INTERACTION AT LOW ENERGY
Manoj K. Banerjee Mar. 1979 10 p refs Presented at 2d Intern. Conf. on Meson-Nucl. Phys., Houston, Tex., 5 Mar. 1979
(Contract EY-76-S-05-5126)
(ORO-5126-60; CONF-790347-10; PT-79-066; TR-79-076; PP-79-165) Avail: NTIS HC A02/MF A01

A theory of the pion nucleon interaction at low energy is described. An analogy is made with an unusual approach to potential scattering theory. Phase shifts, cross sections, and scattering amplitudes and lengths are calculated. DOE

N80-14896# Columbia Univ., New York. Dept. of Physics.
HIGH ENERGY HADRON-NUCLEUS COLLISIONS
A. H. Mueller 1978 6 p refs
(Contract EY-76-C-02-2271)
(CU-TP-137) Avail: NTIS HC A02/MF A01

The forward elastic scattering of a hadron of momentum p off a nucleus of radius R is studied. It is concluded that the parton wave function of a fast hadron is far from being a short range correlated object in rapidity even in the intermediate mass range. Both the parton approach and the more formal arguments without understanding a detailed space-time description are considered. The AKG cutting rules which tie the parton theory with the formal Pomeron exchange description are discussed. DOE

N80-14897# Brookhaven National Lab., Upton, N. Y.
SUPERCONDUCTING MAGNETS IN HIGH ENERGY PHYSICS
A. G. Prodell 1978 29 p refs Presented at Instr. Soc. of Am. Meeting, Philadelphia, 16 Oct. 1978
(Contract EY-76-C-02-0016)
(BNL-24818; CONF-781025-3) Avail: NTIS HC A03/MF A01

The applications of superconducting magnets in high energy physics are discussed. These developments which include high magnetic field, large volume detectors, such as bubble chambers, required for effective resolution of high energy particle trajectories, particle beam transport magnets, and superconducting focusing and bending magnets for the very high energy accelerators and storage rings are examined. Some of the superconducting magnets and associated systems being used in and being developed for high energy physics are described. DOE

74 OPTICS

Includes light phenomena.

N80-14898 Utah Univ., Salt Lake City.
IMAGING IN A FABRY-PEROT INTERFEROMETER Ph.D. Thesis
Douglas Harry Ulmer 1979 180 p
Avail: Univ. Microfilms Order No. 7927898

The propagation of millimeter wave (MMW) and optical images through a Fabry-Perot interferometer (FPI) as well as the electric field enhancing effects inside the FPI are investigated. It was proposed that images, whose electric field distributions are strengthened in an FPI, might be used to modulate laser light in 43 m crystals using the electrooptic effect to make MMW images visible. The properties of the degree to which an image passes through an FPI undisturbed and of the degree to which the fields are enhanced are examined. The behavior of images passing through an FPI was shown to be the transmission of discrete spatial frequencies corresponding to the approximate modes. An expression was derived which details the spatial frequency passage of the FPI. The construction of a MMW FPI at 140 GHz and the subsequent measurement of the quality of the passage of images through it is discussed. Dissert. Abstr.

N80-14899 Carnegie-Mellon Univ., Pittsburgh, Pa.
A STUDY ON SELECTED WIDEBAND GUIDED-WAVE ACOUSTOOPTIC AND ELECTROOPTIC DEVICES Ph.D. Thesis
Bumman Kim 1979 192 p
Avail: Univ. Microfilms Order No. 7919147

Guided wave acoustooptic (A-O) interactions and devices, and an electrooptic switching/coupling device are described. In guided wave acoustooptic interaction, guided optical beams and surface acoustic waves (SAW) are employed and LiNbO3 was used as an interaction medium. Guided modes in a graded index medium were analyzed using the method of multiple scale. The SAW in LiNbO3 was also reviewed. Bragg diffraction of guided waves in LiNbO3 was analyzed in detail using the coupled mode technique. Dissert. Abstr.

N80-14900*# Arkansas Univ., Fayetteville. Dept. of Physics.
SCALABLE STANDARD OPTICAL SOURCES IN THE VUV: EMISSIONS FROM ELECTRON IMPACT ON METALS Final Report
Ray Hughes Jan. 1980 12 p refs
(Grant NsG-7106)
(NASA-CR-162562) Avail: NTIS HC A02/MF A01 CSCL 20F

The use of electron impact on metals in the development of a compact optical standard lamp in the vacuum ultraviolet is described. Two different mechanisms are exploited, transition radiation and bremsstrahlung. Transition radiation will be used as a primary standard from 1200A to 3000A using 10 keV electron impact on tungsten. Bremsstrahlung will be used in the soft X-ray region below 1200A to less than 5A as an optical transfer standard from 4 keV electron impact on tantalum or tungsten. A.R.H.

N80-14901# Optical Sciences Co., Placentia, Calif.
ANALYSIS OF TECHNIQUES FOR IMAGING THROUGH THE ATMOSPHERE Final Technical Report, Nov. 1978 - Apr. 1979

David L. Fried Griffiss AFB, N.Y. RADC, Griffiss AFB, N.Y. Jul. 1979 96 p refs
(Contract F30602-77-C-0021; ARPA Order 2646)
(AD-A073640; R-138; RADC-TR-79-190) Avail: NTIS HC A05/MF A01 CSCL 20/6

This report is concerned with the application of speckle imagery to space object identification for deep space objects. A novel type of variable Michelson Stellar Interferometer setup for forming speckle image data is described. Also, the theory of noise in speckle imagery is developed on a rigorous basis. This report is the final technical report on this contract. GRA

N80-14902# Naval Research Lab., Washington, D. C.
THE FUNDAMENTALS OF THERMAL IMAGING SYSTEMS Interim Report
John B. Goodell, George L. Harvey, ed., Walter W. Lawson, James A. Ratches, Robert E. Roberts, Fred A. Rosell, ed., Robert L. Sendall, and David L. Schumaker 10 May 1979 263 p refs
(NRL Proj. N01-29; ZF323910)
(AD-A073763; AD-E000318; NRL-8311; EOTPO-46) Avail: NTIS HC A12/MF A01 CSCL 17/5

The purpose of this book is to provide the reader with a document which brings together under one cover an overview of radiometric and photometric concepts involved in thermal imaging systems. Governing equations are derived from simple fundamental concepts. Also, models used for the visual discrimination i.e., detection, recognition, or identification, of real scene objects are discussed. It is hoped that the text will be useful to FLIR designers, evaluators, and thermal imaging system modelers, as well as those whose sole interest is a grasp of the concepts involved in thermal imaging. GRA

N80-14903# Rockwell International Science Center, Thousand Oaks, Calif.
DEVELOPMENT OF CHARGE TRANSFER DEVICES FOR 1-2 MICRON IMAGING Final Report, 10 May 1977 - 9 Dec. 1978
Ira Deyhimy Dec. 1978 65 p refs
(Contract DAAK70-77-C-0109)
(AD-A074653; SC5111.16FR) Avail: NTIS HC A04/MF A01 CSCL 17/5

There is considerable interest in the development of an imaging system within the wavelength range of 1.0 - 1.8 micrometers. The concept of charge coupled devices emerges as one of the viable candidates for such an application. The advantages of a non-MIS, Schottky barrier, buried channel CCD are discussed. A suitable material system for the 1.0 - 1.8 micrometer CCD application is the n-GaAlSb/p+-GaSb hetero-system. Substantially improved surface morphology for this system is reported. This is achieved by the addition of As to the AlGaSb layer, thus forming the quaternary: GaAlAsSb. Characterization of Schottky barriers to this material are reported. The Schottky barrier height is found to be = 0.7eV. GRA

N80-14904# Naval Research Lab., Washington, D. C. Electro-Optical Technology Program Office.
PASSING INFRARED SURVEILLANCE - NEW METHODS OF ANALYSIS Interim Report
Richard A. Steinberg 24 Sep. 1979 168 p refs
(AD-A074742; EOTPO-55; NRL-MR-4078) Avail: NTIS HC A08/MF A01 CSCL 17/5

A new theoretical procedure is presented for calculating the performance of scanning background-limited (BLIP) infrared sensors with adaptive threshold signal processing logic. The performance predictions obtained with this model are background-conditional, i.e., are valid only for a given infrared background scene, presumably specified as a radiance map of arbitrary (but deterministic) structure. The non-stationary statistical nature of the photocurrent is explicitly taken into account. The basic approach involves a combination of some results from optical communications theory with a formalism for the threshold-crossing statistics of nonstationary noises, originally developed by Rice, Cramer, and Leadbetter. GRA

N80-14905# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
INFRARED MEASUREMENTS OF VEHICLES AND WEAPONS Final Report
18 Jul. 1979 26 p Supersedes MTP-2-2-812
(AD-A074487; TOP-2-2-812; MTP-2-2-812) Avail: NTIS HC A03/MF A01 CSCL 17/5

Techniques and instrumentation methods are described for measuring infrared (IR) radiation during development and production tests of military ground vehicles and weapons. The report covers measurements of IR signatures of vehicles and IR temperature measurements of weapon tubes during firing programs. Pertinent areas/surfaces/conditions for survey and sample plots, graphs, and photographs for reporting results are included. Tests are applicable to those conducted on land. GRA

N80-14906# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
AN ALGEBRAIC MODEL OF ADAPTIVE OPTICS FOR CONTINUOUS-WAVE THERMAL BLOOMING
Cynthia Whitney Jan. 1979 60 p refs
(Contract DAAK40-78-C-0117)
(AD-A074741; R-1235) Avail: NTIS HC A04/MF A01 CSCL 20/6

This paper presents a simple algebraic model for a continuous-wave laser beam delivered on target with spreading due to both random and deterministic phase aberrations. The number of deterministic Zernike mode phase aberrations included are sufficient to give a realistic representation for thermal blooming. The aberrations modeled generally include those applied by an adaptive optics system to compensate the naturally occurring ones. For the random phase aberrations, compensation is a linear process the net result of which is a simple scaling down. By contrast, the thermal-blooming aberrations are complicated nonlinear functions of the applied compensations. Consequently, for this case, the interaction of applied and natural aberrations must be modeled in detail. The model shows that sometimes conventional adaptive optics concepts can produce counter-intuitive and very disappointing results when applied to thermal blooming. However, the analysis suggests novel remedies that will tend to optimize the corrections made, thus better realizing the full potential of adaptive optics. GRA

N80-14907# Edgerton, Germeshausen and Grier, Inc., Los Alamos, N. Mex. Energy Measurement Group.
THICK FILM FIBER OPTICS TO INTEGRATED OPTICS INTERFACE
I. Aeby 1979 6 p refs Presented at SPIE, Washington, D.C., 17 Apr. 1979
(Contract EY-76-C-08-1183)
(EGG-1183-5104; CONF-790448-1) Avail: NTIS HC A02/MF A01

Thick film optical waveguides integrated with mechanical fiber optics connectors on a single substrate are considered. Micron alignment accuracies made possible by photolithographically fabricating the mechanical fiber guides in the same medium as the optical waveguides allow efficient coupling of light from optical fibers to the thick film light guides. Coupling losses of less than 1 dB are experimentally verified. Mass producibility, low cost, and flexibility of design make these integrated optics very useful as fiber optics connectors and splitters as well as fiber optics to integrated optics interfaces. DOE

N80-14908# Addis Translations International, Portola Valley, Calif.
ULTRA-RAPID ELECTROOPTICAL ANGULAR DEFLECTOR OPERATING IN THE NANOSECOND RANGE: APPLICATIONS
M. Blanchet, J. C. Dupont, E. Bazelaire, J. P. Chambaret, and M. Franco 1978 12 p refs Presented at the Congr. on High Speed Photography and Photonics, Tokyo, 20 Aug. 1978
(UCRL-Trans-11428; CONF-780804-14-Trans) Avail: NTIS HC A02/MF A01

An angular deflector consisting of a set of electro-optical prisms immersed in an index fluid operating in the vicinity of the Curie temperature was devised. The device makes it possible to obtain a deflection of one degree at an angular speed of one degree per nanosecond with a dynamic resolution of the order of 25 points. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-14909 Texas Univ. at Austin.
A MULTIPLE SPECIES ION ENERGY ANALYZER APPLIED TO LASER-INDUCED PLASMA EXPERIMENTS
Ph.D. Thesis
Sangkoo Francisco Hahn 1979 122 p
Avail: Univ. Microfilms Order No. 7928297

A mass spectrometer which employs parallel electric and magnetic fields in combination with an array of collectors and accompanying electronic circuits was developed to measure the energy distributions of several different ion species generated by irradiating a pulsed ruby laser on a LiH target surface. This device has an array of simple integrating charge collectors situated in the same plane as the entrance aperture, and the electric and magnetic fields are set parallel to this collector plane. Ions complete one-half of a helical trajectory before being collected. The collectors are arranged so that each row collects ions of a given mass-to-charge ratio, while each column of a row preserves energy per charge information of the ions detected. The separation of ion species into rows and their energies into columns leads to an automatic interpretation of the resulting data.
Dissert. Abstr.

N80-14910# Nagoya Univ. (Japan). Inst. of Plasma Physics.
INVERSE METHOD FOR THE MIXED NONLINEAR SCHROEDINGER EQUATION AND SOLITON SOLUTIONS
T. Kawata, J. Sakai, and N. Kobayashi Sep. 1979 35 p refs
(IPPJ-417) Avail: NTIS HC A03/MF A01

A mixed nonlinear Schroedinger equation which has a usual cubic nonlinear term and a derivative cubic nonlinear term is exactly solved by the inverse scattering method under the nonvanishing boundary condition. The N-soliton solution is obtained and we find that the one-soliton solution generally pulsates but becomes stationary and further algebraic in some special cases. Both limiting cases corresponding to the nonlinear Schroedinger equation and the derivative nonlinear Schroedinger equation are made clear. This problem is applied to solve the Alfven wave, propagating parallel to the magnetic field, under the plane wave boundary condition. A peculiar structure of spiky modulation is shown analytically.
Author

N80-14911# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ION HEATING BY THE CURRENT-DRIVEN TURBULENCE IN AN INHOMOGENEOUS PLASMA
Kouzi Matsunaga Oct. 1979 35 p refs
(IPPJ-423) Avail: NTIS HC A03/MF A01

Basic experiments of turbulent heating are performed in a non-isothermal and inhomogeneous plasma. A high frequency drift wave (HFDW) is excited by the parallel electron current. From detailed measurements of the ion energy distribution, it is found that ions are heated isotropically and nonlocally. The ion heating is always accompanied with the large amplitude HFDW turbulence. The ion heating rate can be well explained by the semi-phenomenological quasi-linear stochastic heating theory.
Author

N80-14912# Nagoya Univ. (Japan). Inst. of Plasma Physics.
POST COLLISION INTERACTION IN PHOTOEXCITED ARGON LMM AUGER PROCESSES
H. Hanashiro (Tokyo Univ.), Y. Suzuki (Tokyo Univ.), A. Mikuni (Tokyo Univ.), T. Sasaki (Tokyo Univ.), T. Takayanagi (Sophia Univ.), K. Wakiya (Sophia Univ.), H. Suzuki (Sophia Univ.), A. Danjo (Niigata Univ.), S. Ohtani, and T. Hino Sep. 1979 13 p refs
(IPPJ-422) Avail: NTIS HC A02/MF A01

The L(2)L(3)M(23)M(23) Auger-electron spectra of argon produced by photoionization were studied. The range of photon energy is from 249 eV, just above the L(3) edge, to 270 eV. The closer the photon energy is to the threshold, the more conspicuously is the post-collision interaction observed as a shift of the peak and asymmetric profile in each Auger line. The observed dependence of the energy shift upon the kinetic energy of the photoelectron is compared with the semi-classical theory after Niehaus, and the mean lifetime for Auger decay of the inner-shell hole is deduced to be 2.4 x 10 to the -14th power sec.
Author

N80-14913# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ENHANCEMENT OF D-T REACTION RATE DUE TO D-T CONTACT
Shigehisa Hitoki, Masatada Ogasawara, and Osamu Aono Sep. 1979 29 p refs
(IPPJ-419) Avail: NTIS HC A03/MF A01

The reaction rate that is appropriate for magnetized nonuniform plasma is numerically calculated to investigate the enhancement of the D-T reaction rate. Spatial separation of the guiding center distributions of D and T which enhances the reaction rate is discussed. Cases of several guiding center configurations are investigated. The largest enhancement is obtained when both guiding center distributions are delta functions which are separated by a length that corresponds to the Gamow peak energy. Cases of the guiding center distributions with finite widths are also investigated.
A.W.H.

N80-14914# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STABILITY OF HIGH DENSITY PLASMA IN A MULTIPLE MIRROR
M. Inutake, A. Komori (Tohoku Univ., Sendai, Japan), R. Hatakeyama (Tohoku Univ., Sendai, Japan), and N. Sato (Tohoku Univ., Sendai, Japan) Jul. 1979 6 p refs
(IPPJ-418) Avail: NTIS HC A02/MF A01

Confinement and stability for a low beta plasma in a multiple mirror were investigated by using Q machines. Measurements were also made on gun produced and theta pinch plasmas with high beta value. Characteristic behaviors of low frequency plasma instabilities are discussed using a quasi steady, high density, helium plasma.
A.W.H.

N80-14915# Nagoya Univ. (Japan). Inst. of Plasma Physics.
INVESTIGATION OF MOLYBDENUM IMPURITY DIFFUSION DURING HYDROGEN GAS PUFFING IN JIPP T-11 PLASMA
M. Sato, R. Sugihara, and K. Miyamoto Oct. 1979 28 p refs
(IPPJ-412) Avail: NTIS HC A03/MF A01

In JIPP T-2 Tokamak plasma, a decrease of molybdenum density in the plasma center was observed by soft X-ray measurement during the strong gas puffing. A model based on the neoclassical concept in the Pfirsch-Schloeter regime is presented to explain the decrement. The model indicates that the combination of a decrement of inward flux in the plasma center region and an increment of outward flux causes the decrement of the central molybdenum ion density.
A.W.H.

N80-14916# Nagoya Univ. (Japan). Dept. of Electrical Engineering.
NONLINEAR SHIFT OF RESONANCE VELOCITY IN INTERACTIONS BETWEEN PARTICLES AND PLASMA CYCLOTRON WAVES
K. Ide Sep. 1979 14 p refs
(IPPJ-421) Avail: NTIS HC A02/MF A01

Two types of wave-particle interactions are clarified in finite-amplitude cyclotron waves (whistler, electron cyclotron, and ion cyclotron waves). Further, the wave nonlinearity was found to cause the shift of cyclotron resonance velocity from the linear value, (omega - Omega sub o) /K, where Omega sub o denotes the cyclotron frequency. The effect of this shift on the wave propagation is suggested.
Author

N80-14917# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONADIABATIC ENERGY TRANSFER BETWEEN COUPLED L-C RESONATORS AND ITS POSSIBLE APPLICATIONS TO HIGH-POWER RF PULSE GENERATION
Ikken Sato (Tokyo Inst. of Technology, Japan), Kazuo Minami (Tokyo Inst. of Technology, Japan), and Kazushige Ishii Sep. 1979 53 p refs
(IPPJ-32) Avail: NTIS HC A04/MF A01

A principle of high-power RF pulse generation available in nuclear fusion research is proposed. The RF energy stored in L-C resonators with variable resonant frequencies is transferred to a load resonator when the frequency crossing occurs. Successive

energy transfers from resonators result in a sustained RF oscillation at the load. It is emphasized that the successive triggering is not required in the present method. This simplifies substantially the operation of the RF generators. The principle is analyzed and numerically calculated for practical experimental conditions. An example of the conceptual designs of the variable inductor used in the present method is shown. At the frequency 1 MHz (4 MHZ), the output 110 kW (440 kW) and the pulse width 24 sec (6 micron sec) are expected, if one uses tow toroidal ferrite cores with a major radius 0.5m and a minor radius 0.2m. Author

N80-14918# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SUPER-BANANA LIMITER AS A POSSIBLE EDGE COOLING SCHEME
K. Ikuta and M. Okamoto Nov. 1979 11 p refs
(IPPJ-425) Avail: NTIS HC A02/MF A01

An edge cooling scheme is proposed where energetic impurity atoms are injected into the plasma periphery in which the ripple of toroidal field is vertically asymmetric. By the asymmetric ripple, the injected impurity ion forms a super-banana which drifts outward to the wall, enhancing the radiation cooling in the plasma periphery without impurity accumulation. The impurity beam is thus called a super-banana limiter. Author

N80-14919# Nagoya Univ. (Japan). Inst. of Plasma Physics.
BEHAVIOUR OF LASER-PRODUCED PLASMA IN A UNIFORM MAGNETIC FIELD: PLASMA INSTABILITIES
Shigefumi Okada, Kohnosuke Sato, and Tadashi Sekiguchi Nov. 1979 34 p refs
(IPPJ-424) Avail: NTIS HC A03/MF A01

The production of a column of a laser produced plasma successfully made in a uniform magnetic field is described. The radius of the column increases and then decreases. On the surface of this plasma column, where the steep density gradient exists with the scale length shorter than the ion Larmor radius, an azimuthal modulation appears in the plasma luminosity. This is indicative of the flute like instability with the azimuthal wave number. The dispersion equation based on the linearized Vlasov equation with the local approximation is derived and the occurrence of the lower hybrid drift instability is predicted. A.W.H.

N80-14920# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTRON SPECTRA RESULTING FROM AUTOIONIZATION IN LOW-ENERGY Li(+) + He COLLISIONS
A. Yagishita, K. Wakiya, T. Takayanagi, H. Suzuki, F. Koike, and S. Ohtani Sep. 1979 55 p refs
(IPPJ-420) Avail: NTIS HC A04/MF A01

Spectra of electrons ejected from doubly excited states of helium were extensively measured at several observation angles of impact with lithium ions at energies lower than 5 keV. 'Molecular-autoionization' spectra were found at forward observation angles, and analyzed in terms of the Gerber-Niehaus theory with modification. The spectral shapes of atomic-autoioniztion peaks are discussed in relation to both the Barker-Berry effect and the Doppler effect. Excitation cross sections of autoionizing states are determined by a method that uses simultaneous impact of ions and electrons. Author

N80-14921*# United Technologies Research Center, East Hartford, Conn.
HIGH TEMPERATURE UF6 RF PLASMA EXPERIMENTS APPLICABLE TO URANIUM PLASMA CORE REACTORS
Ward C. Roman Oct. 1979 101 p refs
(Contract NAS1-14329)
(NASA-CR-159159) Avail: NTIS HC A06/MF A01 CSCL 20I

An investigation was conducted using a 1.2 MW RF induction heater facility to aid in developing the technology necessary for designing a self critical fissioning uranium plasma core reactor. Pure high temperature uranium hexafluoride (UF6) was injected into an argon fluid mechanically confined, steady state, RF heated plasma while employing different exhaust systems and diagnostic techniques to simulate and investigate some potential characteristics of uranium plasma core nuclear reactors. The development of techniques and equipment for fluid mechanical confinement of RF heated uranium plasmas with a high density of uranium vapor within the plasma, while simultaneously minimizing deposition of uranium and uranium compounds on the test chamber peripheral wall, endwall surfaces, and primary exhaust ducts, is discussed. The material tests and handling techniques suitable for use with high temperature, high pressure, gaseous UF6 are described and the development of complementary diagnostic instrumentation and measurement techniques to characterize the uranium plasma, effluent exhaust gases, and residue deposited on the test chamber and exhaust system components is reported. A.W.H.

N80-14922*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF VELOCITY OVERSHOOT ON THE PERFORMANCE OF MAGNETOHYDRODYNAMIC SUBSONIC DIFFUSERS
Mahesh S. Greywall (Wichita State Univ.) and J. Marlin Smith 1980 10 p refs Presented at Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; Sponsored by AIAA
(Contract EF-77-A-01-2674)
(NASA-TM-79305; DOE/NASA/2674-79/8; E-257) Avail: NTIS HC A02/MF A01 CSCL 20I

The evolution of an overshoot velocity distribution was studied in a plane two dimensional diffuser as a function of diffuser divergence angle. The diffuser performance for velocity overshoot was compared to that for a fully developed inlet velocity profile. Results indicate that the ratio of peak-to-center line velocity increases along the diffuser for a diffuser half angle greater than some critical value. It was also found that irrespective of the accompanying inlet temperature distribution, the wall shear stress and the wall heat flux is substantially larger when the inlet velocity profile has an overshoot than that for a fully developed inlet velocity profile. R.C.T.

N80-14923*# Colorado State Univ., Fort Collins. Dept. of Physics.
INTERACTION OF HIGH VOLTAGE SURFACES WITH THE SPACE PLASMA Annual Report
Harold R. Kaufman and Raymond S. Robinson May 1979 81 p refs
(Grant NsG-3196)
(NASA-CR-159731) Avail: NTIS HC A05/MF A01 CSCL 20I

Tests were conducted using plasma densities of approximately 10 to the 5th power - 10 to the 6th power/cu cm. Insulating materials tested were polyimide (Dapton), mica and glass. Surface-area effects were found to be substantially reduced from those previously reported at lower plasma densities. The difference in typical plasma density was felt to be the major cause of this change, although a saturation effect may also be involved. At the 10 to the 5th power/cu cm plasma density range, surface effects on collection current appear limited to roughly 1 cm from the hole. A factor of several reduction of collected current was obtained with both surface scribing and a 2 x 2 cm conducting mesh. It appears possible that the effects of surface treatment might be more significant at lower plasma densities. Effects of repeated tests were also noted, with current collection decreasing with successive tests. Depending on the materials involved, the effect appeared due to either the smoothing of the inside of the insulator hole or the sputtering of insulator on the exposed conductor. A general conclusion was made from a variety of observations, that the generation of vapor is a major factor in the enhancement of collected current. A.R.H.

N80-14924# Oak Ridge National Lab., Tenn. Fusion Energy Div.
VERY SMALL ASPECT RATIO TOKAMAKS
Y. K. M. Peng and R. A. Dory 1978 47 p refs
(Contract W-7405-eng-26)
(CONF-780811-32) Avail: NTIS HC A03/MF A01

Tokamak experiments which achieved good plasma confinement and high temperatures are discussed. Conceptual design studies of Tokamak fusion reactors based on extrapolation of conventional values of plasma parameters are examined. Magnetohydrodynamic stability analyses for Tokamak equilibria are discussed. The effects of strong toroidicity on Tokamak currents driven by neutral beam ions, bootstrap effects, and net rf momentum are reported. Comparisons of the very small aspect

ratio Tokamaks with other magnetic fusion concepts, such as the relativistic electron ring and the field reversed theta pinch, are presented. A.W.H.

N80-14925# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
SOFT X-RAY MEASUREMENTS FOR INVESTIGATING PLASMA FOCUS DYNAMICS
B. Nahrath 1978 80 p refs In GERMAN; ENGLISH summary
(IPF-78-1) Avail: NTIS HC A05/MF A01

In a Mather-type plasma focus, short time soft X-ray pictures were taken to study the local development of electron temperature with a time resolution of 3 nanoseconds. The measured electron temperatures were roughly in accordance with the results of magnetohydrodynamic calculations up to maximum compression. During a later phase, characterized by the occurrence of m=0 instabilities, localized plasma regions with high densities and high electron temperatures of about 600 eV were observed. A slowly decaying plasma with local electron temperature values of about 300 eV and large diffuse structures was identified for several hundred nanoseconds. During this 'late phase' of the focus most of the neutron emission takes place. There is no correlation between the value of electron temperature and the rate of neutron emission. Author (ESA)

N80-14926# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
MEASUREMENT OF THE ION PROFILE BY STATIONARY CO2 LASER SCATTERING FROM A HYDROGEN PLASMA
H. Hailer 1978 93 p refs In GERMAN; ENGLISH summary
(IPF-78-5) Avail: NTIS HC A05/MF A01

Collective laser light scattering with a cw CO2 laser is applied to a magnetically stabilized hydrogen arc. In the experimental geometry (theta = 90 deg, lambda = 10.6 microns) the scattering parameter is alpha = 7. With a laser power of 160 W and a Ge:Hg detector NEP of 60 pico W/(sq. root of Hz), sufficient signal to noise ratios are achieved using lock in techniques. Spectral resolution is performed by pressure scanning with a Fabry-Perot spectrometer with Ge plates. The measured ion profiles agree with theory for a thermal plasma. Values for the ion temperatures are obtained. Author (ESA)

N80-14927# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
NON-AXIAL-SYMMETRIC ALFVEN WAVES IN CYLINDRICAL, RADIAL INHOMOGENEOUS PLASMAS
E. Raeuchle Aug. 1978 44 p refs In GERMAN; ENGLISH summary
(IPF-78-6) Avail: NTIS HC A03/MF A01

The propagation of nonaxisymmetric Alfven waves is investigated theoretically. Eigenfunctions and dispersion relations are calculated numerically for radial inhomogeneous cylindrical plasmas. Resistivity, neutral particle loading, and ion cyclotron effects are included in the magnetohydrodynamic treatment. The investigations are of importance for plasma heating by Alfven waves. Author (ESA)

N80-14928# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
LIGHT SCATTERING FROM AN ARC PLASMA WITH STATIONARY CO2 LASER AND HETERODYNE DETECTION
J. H. Massing 1978 67 p refs In GERMAN; ENGLISH summary
(IPF-78-8) Avail: NTIS HC A04/MF A01

Collective high scattering experiments with IR lasers on fusion oriented plasmas using optical heterodyne detection are discussed. Heterodyne detection is combined with a modulation technique to improve the receiver sensitivity in the experiment. The scattering arrangement was applied to a hydrogen arc plasma. With a power of less than 20 W for the stationary CO2 laser, thermal density fluctuations were recorded with a 20 sec duration of measurement. The spectra obtained with a scattering angle of 38 mrad is discussed in relation to theory. Author (ESA)

N80-14929# Academy of Sciences (USSR), Moscow. Inst. of Space Resarch.
ANOMALOUS ELECTRON THERMAL CONDUCTIVITY ACROSS DESTROYED MAGNETIC SURFACES
A. A. Galeev and L. M. Zeleny 1979 20 p refs
(PR-501) Avail: NTIS HC A02/MF A01

A plasma slab model is discussed, in which the magnetic surfaces are parallel to the plane YZ, presenting sheared magnetic field lines in the presence of magnetic fluctuations perpendicular to the undisturbed magnetic surfaces. The magnetic fluctuations are assumed to be quasistatic, for which a restriction is imposed on the frequency of the fluctuations. The velocity of the cross-field transport of electrons due to these fluctuations is determined, showing that the calculated coefficient corresponds to the cross-field anomalous electron thermal conductivity. A new semicollisional regime of anomalous thermal conductivity is described, being an intermediate state between the collisionless and hydrodynamic regimes. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-14930 Virginia Univ., Charlottesville.
EXPERIMENTAL STUDIES OF METAL-AMMONIA SOLUTIONS; RAMAN SCATTERING AND SUSCEPTIBILITY Ph.D. Thesis
Peter James Osina 1978 261 p
Avail: Univ. Microfilms Order No. 7928029

Two experiments performed on metal-ammonia solutions are described in this dissertation. A description of the solvent is given with reasons why metals might be expected to dissolve in ammonia. The discovery and early work on metal-ammonia solutions is traced and a number of their important properties are enumerated with various models reviewed. The first experiment describes an attempt to Raman scatter from dilute solutions of sodium, potassium, and calcium in ammonia to test the cavity model of the solvated electron. No scattering center attributed to the solvated electron was found nor were the ammonia Raman bands altered by the presence of the solute. The second experiment deals with report of superconductivity in sodium ammonia solutions frozen quickly (quenched) in liquid nitrogen (77 K) or liquid oxygen (90 K). The use of two SQUID susceptometers and their operation is described. Static susceptibility measurements for the temperature range 1.2 to 300 K are presented for liquid helium (1.2 to 4.2 K), vitreous quartz, sodium, ammonia (liquid and solid), and sodium-ammonia solutions. Dissert. Abstr.

N80-14931 Minnesota Univ., Minneapolis.
HEAT CAPACITY OF AMORPHOUS AND DISORDERED Nb3Ge THIN FILMS Ph.D. Thesis
Navalgund Anant Hemant Kumar Rao 1979 194 p
Avail: Univ. Microfilms Order No. 7926162

Heat capacity measurements on 1000 - 1500 A thick amorphous Nb3Ge and granular Al films were carried out using an ac technique in order to study the effect of thermal fluctuations, both above and below the superconducting transition temperature T sub c, in dirty, short meanfree path materials. Since only changes in the heat capacity near T sub c were wanted, no attempt was made to determine the absolute value of the heat capacity of the film. By carrying out a consistent fit to the data both above and below T sub c, the thermodynamic transition temperature T sub BCS was determined. By subtracting the extrapolated value of the fit from the measured heat capacity, close to T sub BCS, the excess heat capacity both above and below T sub BCS which represents deviations from the mean field behavior could also be determined. Low temperature resistivity measurements on some dilute Pd(Fe) alloy films are also discussed. Dissert. Abstr.

N80-14932 Virginia Univ., Charlottesville.
DYNAMIC DISLOCATION PHENOMENA IN SINGLE CRYSTALS OF ALPHA-PHASE BINARY AND TERNARY COPPER ALLOYS Ph.D. Thesis
Sudipta Kumar Ray 1979 234 p
Avail: Univ. Microfilms Order No. 7928004

Single crystals of Cu-x-at.%-Ni-x-at.%-Pd and Cu-x-at.%-Pd alloys (x = 1 to 6), were deformed in tension at 300 K and 4.2 K. All the crystals had the /331/ ((-1)10) ((-1)(-1)6) orientation which has two equivalent ((-1)(-1)1) <011> and <111> and <101> primary glide systems. With the Cu-Ni-Pd alloy single crystals significant source hardening with reduced frictional resistance to dislocation motion was attained. This is due to the compensating effects of the size and modulus contributions to solute hardening. The Cu-Pd alloys also exhibited extensive source hardening. The concentration dependence of the critical resolved shear stress (CRSS) at the yield point for both the alloy series was given by a linear relation of the form CRSS (T K) = A(T) + B(T) c(alpha) where A and B are constants for one alloy series at a temperature of T K and c is the total solute concentration in atomic percent. Dissert. Abstr.

N80-14933 Purdue Univ., Lafayette, Ind.
MICROWAVE MAGNETOPLASMA EFFECTS IN SEMICONDUCTOR POWERS AND ARRAYS OF SPHERES Ph.D. Thesis
Jean Ellen Sansonetti 1979 148 p
Avail: Univ. Microfilms Order No. 7926426

Microwave interactions with powdered semiconductors and arrays of semiconductor spheres were investigated. The electrical transport properties of the bulk material and the general problem of electromagnetic wave interactions with particulate samples were examined. Three distinct, but closely related investigations are presented. (1) The dielectric constant of silicon powders at 35 GHz as a function of magnetic field, temperature, and resistivity were investigated. The dependence of the powder dielectric constant upon the dielectric constant of the grains of power was analyzed. (2) The interaction of microwaves with powders made from semiconductors containing paramagnetic ions was studied. The dependence of the electron paramagnetic resonance line shape upon such factors as the grain size and the constitutive parameters of the grain material was emphasized. The interparticle interactions within clusters of spherical InSb grains were examined. Dissert. Abstr.

N80-14934 Washington Univ., Seattle.
ORDERING TRANSITIONS IN HELIUM-4 SUBMONOLAYERS: A HEAT CAPACITY STUDY Ph.D. Thesis
Manu Jamnadas Tejwani 1979 203 p
Avail: Univ. Microfilms Order No. 7927877

The heat capacity of several submonolayer He-4 films absorbed on bare graphite foam and on krypton plated graphite foam were measured at temperatures from 1 to 4.2 K. A model calculation using a tight binding formalism is presented, aimed at understanding the comparative effect of various rare gas platings on the low density helium specific heat. The substrates are described by a single parameter. For various values of this parameter, the second virial contribution to the helium specific heat is calculated and compared with experimental data. Dissert. Abstr.

N80-14935 Polytechnic Inst. of New York.
EXPERIMENTAL DETERMINATION OF THE PHASES OF X-RAY REFLECTIONS Ph.D. Thesis
Po-wen Wang 1979 115 p
Avail: Univ. Microfilms Order No. 7920805

In general, the phases of individual X-ray reflections from single crystals can not be determined experimentally from measurements of the intensities in conventional two-beam diffraction. It is readily shown that the phase is lost in such diffraction. This dissertation is divided into two major portions. The first is concerned with the detailed calculations of the values of various physical quantities such as dispersion surface, absorption and excitation for selected triplets of reflections, for the positive and negative phases. The second aspect is concerned primarily with the experimental investigation of the indicated phase relationships and the possible extension of Post's work to four-beam and higher order cases. The phases of several groups of reflections from germanium and aluminum oxide single crystals were determined. Dissert. Abstr.

N80-14936 Rice Univ., Houston, Tex.
THE USE OF RESONANCE EPITHERMAL NEUTRON SCATTERING FOR THE STUDY OF CONDENSED MATTER Ph.D. Thesis
Robert Earl Wood 1979 137 p
Avail: Univ. Microfilms Order No. 7919646

Resonant epithermal neutron scattering studies provide a new regime for the study of the properties of condensed matter. The differential scattering cross section is developed in a resonant correlation function formalism involving the positions of two scattering centers at four different times. The resonant correlation functions contain information which cannot be obtained from a study of the Van Hove correlation functions for thermal neutron scattering, and these resonant correlation functions enable one to observe phenomena which are beyond the scope of thermal neutron scattering. It is shown that the lowest order correction to the short collision time limit yields a force density correlation function. Resonant neutron scattering provides a means of determining the amplitudes of specific anharmonic phonon interactions of cubic order. When this method is turned to the study of diffusion, higher order diffusive propagators are obtained which give the conditional probabilities for diffusion over two distinct intervals of time. Using the resonant selection of virtual excited states enables the diffusion of molecules in definite states of vibrational excitation to be observed. Dissert. Abstr.

N80-14937 California Univ., Los Angeles.
THE ELECTRON-PHONON INTERACTION SPECTRUM IN PROXIMITY EFFECT COPPER Ph.D. Thesis
Jerry Allen Wilson 1979 128 p
Avail: Univ. Microfilms Order No. 7926075

The electron-phonon interaction spectrum in non-superconducting metals was determined from measurements of the single electron density of states. The density of states is measured by tunneling into the N side of a proximity effect junction. The extremely powerful gap inversion algorithm developed by W. L. McMillian for superconductive tunneling is extended, applied to Cu and Ag. This gives directly the unitless electron-phonon coupling constant for Cu and Ag as .12 and .11 respectively. The results of the calculation are given and compared and to similar quantities determined for superconductors. The computer program and a conversion table to tie the computer variables of the physical parameters are included. The format of the input data is also discussed. Dissert. Abstr.

N80-14938 Oklahoma State Univ., Stillwater.
LASER TIME-RESOLVED SITE SELECTIONS SPECTROSCOPY OF Nd3+ IONS IN MIXED GARNET CRYSTALS Ph.D. Thesis
Masud Zokai 1979 132 p
Avail: Univ. Microfilms Order No. 7928247

The effects of mixed crystal host on the spectra of Nd(3+) ions were investigated and energy transfer among Nd(3+) ions in various garnet crystals was characterized at low and high temperatures. The techniques of site-selection and time-resolved spectroscopy were used. The mixed crystal nature of the host was found to produce both distinct structure and inhomogeneous broadening in the Nd(3+) spectra. The migration and trapping processes require thermal activation and the temperature dependence of the transfer is consistent vath a two-photon assisted process. The efficiency of energy transfer was found to be greater in mixed crystals than in unmixed garnet hosts, and it is shown that this is associated with the increase in the transition matrix elements in the mixed crystals. Dissert. Abstr.

N80-14939 Maryland Univ., College Park.
THE IONIZATION AND NEUTRALIZATION OF SPUTTERED ATOMS Ph.D. Thesis
Theodore Ralph Lundquist 1979 122 p
Avail: Univ. Microfilms Order No. 7926532

The mechanisms for ionization or neutralization of sputtered atoms was observed to be related to both the electronic density of states at the surface and the local chemical bonding. Various theoretical models are discussed in regard to their ability to predict the dependence of this probability on the energy of the sputtered atoms. To obtain this dependence, the energy distributions of both the sputtered neutrals and ions were measured. The dependence on chemical bonding was investigated by measuring the ion energy distributions for different oxygen exposures. The ionization probabilities were found to increase with the energy of the sputtered atoms. A.W.H.

N80-14940# Stanford Univ., Calif.
QUANTUM FIELD THEORY METHODS APPLIED TO THE PHYSICS OF CONDENSED MATTER Final Report, 1 Nov. 1976 - 31 Mar. 1979
S. Doniach 9 Aug. 1979 12 p refs
(Grant DAAG29-76-G-0053)
(AD-A073509; ARO-13422.1-P) Avail: NTIS
HC A02/MF A01 CSCL 20/12

This report summarizes briefly research performed under the grant. A complete list of Ph.D.'s awarded and associated researchers working with total or partial support is included. The report contains a full list of publications resulting from the research. GRA

N80-14941*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXTENDED SOFT-CUBE MODEL FOR THE THERMAL ACCOMMODATION OF GAS ATOMS ON SOLID SURFACES
John R. Burke and D. J. Hollenbach Jan. 1980 61 p refs
Prepared in cooperation with San Francisco State Univ.
(NASA-TM-81163; A-8047) Avail: NTIS HC A04/MF A01 CSCL 20K

A numerical soft cube model was developed for calculating thermal accommodation coefficients alpha and trapping fractions f sub t for the interaction of gases incident upon solid surfaces. A semiempirical correction factor c which allows the calculation of alpha and f sub t when the collision times are long compared to the surface oscillator period were introduced. The processes of trapping, evaporation, and detailed balancing were discussed. The numerical method was designed to treat economically and with moderate (+ or - 20 percent) accuracy the dependence of alpha and f sub t on finite and different surface and gas temperatures for a large number of gas/surface combinations. Comparison was made with experiments of rare gases on tungsten and on alkalis, as well as one astrophysical case of H2 on graphite. The dependence of alpha on the soft cube dimensionless rameters is presented graphically. R.C.T.

N80-14942# Stanford Univ., Calif. Center for Materials Research.
THE PREPARATION AND CHARACTERIZATION OF InP AND RELATED 3-5 SINGLE CRYSTALS AND EPITAXIAL LAYERS PRODUCED BY MOLTEN SALT ELECTROLYSIS Final Report, 1 Mar. 1977 - 30 Apr. 1979
Robert S. Feigelson, Richard H. Bube, and Dennis Elwell Jun. 1979 36 p refs
(Grant DAAG29-77-G-0109)
(AD-A073421; SU-CMR-79-4; ARO-14210.1-MS) Avail: NTIS
HC A03/MF A01 CSCL 20/12

This report summarizes the results of a two-year investigation of the viability of electrodeposition as a means of preparing indium phosphide, ultimately for electronic device applications. InP proved to be a difficult material to prepare by this technique, mainly because of the restrictions imposed on the maximum temperature of deposition by decomposition of InP and volatilization of In2O3 solute. A major portion of the total effort was spent on finding an optimum solvent to meet the requirement that the maximum deposition temperature should not exceed 600 C, and the Na,K/PO3,F quaternary eutectic was found to give best results. Reproducible InP deposits of fairly uniform thickness were made onto (0001) single crystal CdS substrates at potentials of -0.90 to 1.00V (versus graphite) with current densities of 1-3mA/sq cm. In spite of these low current densities, deposits thicker than 1 micron were found to be polycrystalline. The purity of the deposits was not sufficiently high for device applications, but a marked improvement with length of deposition time was demonstrated. Deposits of InP on (111) InP substrates were also polycrystalline and of less uniform thickness. GRA

N80-14943# University of Southern California, Los Angeles. Electronic Sciences Lab.
GROWTH AND CHARACTERIZATION OF EPITAXIAL PIEZOELECTRIC AND SEMICONDUCTOR FILMS Final Report, 1 Mar. 1977 - 31 May 1979
K. M. Lakin and S. K. Tiku Jul. 1979 40 p refs
(Grant AF-AFOSR-3235-77; AF Proj. 2306)
(AD-A073813; AFOSR-79-0954TR) Avail: NTIS
HC A03/MF A01 CSCL 20/2

This report includes the details of research work on this two-year project on the growth and characterization of thin films for piezoelectric applications. The report covers the results on A1N and ZnO growth by the metal-organic process. The problems associated with the A1N on sapphire system have been discussed. In the case of ZnO films, low temperature CVD system (DEZ/H2O and DEZ/CO2) have been developed. It is seen that the films grown by the DEZ/CO2 system do not need any post-growth diffusion, as the as-grown resistivity is quite high. GRA

N80-14944# ARO, Inc., Arnold Air Force Station, Tenn.
IR OPTICAL PROPERTIES OF THIN H2O, NH3, AND CO2 CRYOFILMS Final Report, 1 Oct. 1977 - 15 Mar. 1979
J. A. Boux, B. E. Wood, and A. M. Smith AEDC Sep. 1979 110 p refs
(AD-A074913; AEDC-TR-79-57) Avail: NTIS
HC A06/MF A01 CSCL 09/2

The infrared spectral transmittance of cryofilms formed by H2O, NH3, CO2, and mixtures of these constituents in an N2 matrix were measured. These 0.25 to 14 micrometer thick films were cryopumped onto 20 and 77 K germanium substrates; the deposition pressure for the films deposited at 20 K and that for the 77 K films was approximately 2 times 10 to the minus 6 torr. Transmission spectra were obtained for the 500 to 1/3,700 cm wave number range with a Fourier transform spectrometer. Values of the complex index of refraction for the H2O, NH3, and CO2 cryodeposits were derived from the experimental data using an analytical model and the nonlinear least-squares method. The analytical model treats the germanium as a thick noninterfering film and the deposit as a thin film. Results from the least-squares method are compared with a Kramers-Kronig determination of the real part of the index of refraction. The optical properties (n, k) of such cryofilms are essential for predicting the degradation of contaminated cryocooled optical surfaces. GRA

N80-14945# Michigan Univ., Ann Arbor. Electron Physics Lab.
ELECTRICAL COMPENSATION IN InP PRODUCED BY BACKGROUND IMPURITIES AND STRUCTURAL DEFECTS Final Report
B. L. Mattes Aug. 1979 32 p refs
(Contract N00019-78-C-0406)
(AD-A074178) Avail: NTIS HC A03/MF A01 CSCL 20/2

Liquid phase epitaxial layers of InP have been grown at 475 C by a steady-state growth technique that maintains the substrate at a constant temperature. The growth system has excellent temperature control, fast thermal response, uniform temperature profiles and up to 50 degrees of C/cm temperature gradients that can be induced normal to the substrate. To achieve uniform nucleation on InP substrates at these low temperatures, a submersed-displacement cleaning procedure was developed that uses a dilute HCl-methanol etch to remove oxides. The initial layers were discontinuous and had poor electrical properties due to oxide contamination in the In-melt and to substrate oxidation during the heat-up cycle. New in and the covering of the substrate with InP during heat-up appears to have solved this problem. Thermodynamic models of the growth system indicate that the graphite growth cell increases the decomposition of fused quartz and introduces C, O and Si into the In-melt. GRA

N80-14946# Battelle Columbus Labs., Ohio.
INFLUENCE OF STOICHIOMETRY ON IMPINGEMENT EROSION OF LEAD SULFIDE AND ZINC SELENIDE Final Report, 1 Jun. 1978 - 30 Apr. 1979
R. G. Hoagland and I. G. Wright 14 Aug. 1979 18 p refs
(Grant AF-AFOSR-3283-77; AF Proj. 2306)
(AD-A073955; AFOSR-79-0959TR) Avail: NTIS
HC A02/MF A01 CSCL 20/2

The results of a series of water droplet impingement erosion experiments on lead sulfide and zinc selenide are described. The work with single crystal lead sulfide sought to correlate the mechanisms of surface damage with mechanical strength, lead sulfide affording an opportunity to study the effect of a range of hardness, caused by a shift in stoichiometry into the p-type

range, in specimens otherwise similar in elastic properties and pre-existing dislocation substructures. Dislocations involved in the deformation resulting from water droplet impacts were revealed by etch pitting. The size and nature of the impact sites on all the lead sulfide specimens studied, using 0.42 mm water droplets impacting at 100-168 m/s, were found to be in fact highly stochastic. The deformation produced was strongly dependent upon the pre-existing arrangement of dislocations at the impact site, and considerable effort was expended in obtaining suitably dislocation-free crystal surfaces. The polycrystalline zinc selenide examined is a prime candidate material for windows for IR imaging devices. The grain boundaries in this material appeared to act as flaw sites which, upon repeated impact, led to the encirclement of complete grains by cracks, with consequent material loss.
GRA

N80-14947# Massachusetts Inst. of Tech., Cambridge.
GRAIN BOUNDARY STRUCTURE AND PROPERTIES
R. W. Balluffi May 1979 20 p refs
(Contract ER-78-S-02-5002)
(COO-5002-3) Avail: NTIS HC A02/MF A01
The properties of grain boundaries which are relevant to the problem of the time dependent fracture of high temperature structural materials are examined. These include the basic phenomena associated with cavitation and cracking at grain boundaries during service and with the more general microstructural changes which occur during both processing and service. The current state of knowledge of these fundamentals is reviewed.
DOE

N80-14948# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
DIFFUSION INDUCED GRAIN BOUNDARY MIGRATION
J. W. Cahn (NBS, Washington, D.C.), J. D. Pan, and R. W. Balluffi May 1979 8 p refs
(Contract ER-78-S-02-5002; Grant NSF DMR-76-20662)
(COO-5002-2) Avail: NTIS HC A02/MF A01
Evidence that diffusion itself can induce boundary migration is reviewed. Experiments documenting this fact using zinc-iron alloys are discussed. The relationship of grain boundaries with bulk composition change due to boundary migration is examined.
A.W.H.

N80-14949# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
DIFFUSIONAL MASS TRANSPORT IN POLYCRYSTALS CONTAINING STATIONARY OR MIGRATING GRAIN BOUNDARIES
J. W. Cahn (NBS, Washington, D.C.) and R. W. Balluffi May 1979 5 p refs
(Contract ER-78-S-02-5002; Grant NSF DMR-76-20662)
(COO-5002-1) Avail: NTIS HC A02/MF A01
Regimes of diffusion transport behavior which exist in a polycrystalline material are classified taking into account the possibility that the grain boundaries are either stationary or migrating. The increase of mass transport in polycrystalline materials by diffusion along grain boundaries is discussed. The temperature effects on lattice diffusion rates is examined. The effect of migrating grain boundaries during diffusion is discussed.
A.W.H.

N80-14950# Stanford Linear Accelerator Center, Calif.
TOPICS IN THE QCD PHENOMENOLOGY OF DEEP-INELASTIC SCATTERING
L. F. Abbott Mar. 1979 12 p refs Presented at Orbis Scientiae 1979 Conf., Coral Gables, Fla., 15 Jan. 1979
(Contract EY-76-C-03-0515)
(SLAC-PUB-2296; CONF-790150-4) Avail: NTIS HC A02/MF A01
The status of QCD with respect to recent results from deep inelastic neutrino scattering is described. The theoretical uncertainties coming from effects of nonleading order in 1/sq Q and in alpha sub s is emphasized.
DOE

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-14951 Texas Univ. at Austin.
VACUUM POLARIZATION IN CURVED SPACETIME
Ph.D. Thesis
Richard Walter Guy 1979 106 p
Avail: Univ. Microfilms Order No. 7928296
The stress tensor is determined by utilizing the zeta-function method of regularization and renormalization. The form of the renormalized stress tensor is first tested in various examples of flat spacetimes. It is shown to vanish in Minkowski space and to yield the accepted value of the energy density in the Casimir effect. Next, the stress tensor is calculated in two spacetimes of constant curvature, the Einstein universe and the deSitter universe, and the results are shown to agree with those given by an expression of the stress tensor that is valid in conformally flat spacetimes. The stress tensor is determined on the horizon of a Schwarzschild black hole by approximating the radial part of the eigenfunctions and the metric in the vicinity of the horizon. The stress tensor at this level of approximation is found to be pure trace. The approximated forms of the Schwarzschild metric describes a conformally flat spacetime that possesses horizons.
Dissert. Abstr.

N80-14952# California Univ., Berkeley. Lawrence Berkeley Lab.
STATISTICAL MECHANICS AND FIELD THEORY
S. A. Samuel May 1979 339 p refs
(Contract W-7405-eng-48)
(LBL-9168) Avail: NTIS HC A15/MF A01
Field theory methods are applied to statistical mechanics. Statistical systems are related to fermionic-like field theories through a path integral presentation. Considered are the Ising model, the free-fermion model, and close-packed dimer problems on various lattices. Graphical calculational techniques are developed. They are powerful and yield a simple procedure to compute the vacuum expectation value of an arbitrary product of Ising spin variables. From a field theorist's point of view, this is the simplest, most logical derivation of the Ising model partition function and correlation functions. By the above methods a model named the 128 pseudo-free vertex model is solved. Statistical mechanics intuition is applied to field theories. It is shown that certain relativistics field theories are equivalent to classical interacting gases. Using this analogy many results are obtained, particulary for the Sine-Gordon field theory. Quark confinement is considered.
DOE

N80-14953# Iowa State Univ. of Science and Technology, Ames. Dept. of Materials Science and Engineering.
ANALYSIS OF THE THERMODYNAMICS AND PHASE RELATIONSHIPS OF A PORTION OF THE VANADIUM-OXYGEN SYSTEM
J. F. Smith 1979 10 p refs Presented at the Calculations of Phase Diagrams Calphad Meeting, Stockholm, 21 May 1979 Prepared in cooperation with Ames Lab.
(Contract W-7405-eng-82)
(IS-M-212; CONF-790506-1) Avail: NTIS HC A02/MF A01
The thermodynamics and phase equilibria in the vanadium-oxygen system are examined. An assimulation of the data is made to generate a self consistent set of Gibbs energy functions to describe the known details of the phase equilibria in order to predict the unknown details. An initial assessment of data for the congruently melting phases and the development of composition dependent Gibbs functions for beta VO2 and for oxygen rich liquid is described.
DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N80-14954# Argonne National Lab., Ill.
DISTRIBUTION AND CLASSIFICATION OF LOCAL SOCIO-ECONOMIC IMPACTS FROM ENERGY DEVELOPMENT
D. J. Santini and D. W. South 1979 20 p refs Presented at the 2nd Ann. Conf. on the Small City and Regional Community, Stevens Point, Wis., 15 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790481-1) Avail: NTIS HC A02/MF A01

Present and proposed energy facility siting patterns are examined and their socio-economic impact is assessed. Results show that: (1) new electric capacity will shift from oil and gas to coal and nuclear fuels; (2) coal and nuclear plants require more labor per megawatt than oil and gas plants; (3) coal and nuclear plants are larger than gas or oil plants; (4) new coal and nuclear plants will be larger than such existing plants; (5) among regions, greater shares of energy production will occur in those regions less able to assimilate employment growth; and (6) within regions, greater shares of energy production will occur in counties less able to assimilate employment growth. These results clearly demonstrate that socio-economic impact from energy development will be greater in the future than in the past. DOE

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-14955*# Information Planning Associates, Inc., Gaithersburg, Md.
FUNCTIONAL DESIGN SPECIFICATION: NASA FORM 1510 Final report
15 Nov. 1979 99 p
(NASA-CR-162513) Avail: NTIS HC A05/MF A01 CSCL 05A

The 1510 worksheet used to calculate approved facility project cost estimates is explained. Topics covered include data base considerations, program structure, relationship of the 1510 form to the 1509 form, and functions which the application must perform: WHATIF, TENENTER, TENTYPE, and data base utilities. A sample NASA form 1510 printout and a 1510 data dictionary are presented in the appendices along with the cost adjustment table, the floppy disk index, and methods for generating the calculated values (TENCALC) and for calculating cost adjustment (CONSTADJ). Storage requirements are given. A.R.H.

N80-14956*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
USER REQUIREMENTS FOR A PATIENT SCHEDULING SYSTEM
W. Zimmerman 1 Dec. 1979 73 p refs
(Contract NAS7-100)
(NASA-CR-162539; JPL-Pub-79-119) Avail: NTIS HC A04/MF A01 CSCL 05A

A rehabilitation institute's needs and wants from a scheduling system were established by (1) studying the existing scheduling system and the variables that affect patient scheduling, (2) conducting a human-factors study to establish the human interfaces that affect patients' meeting prescribed therapy schedules, and (3) developing and administering a questionnaire to the staff which pertains to the various interface problems in order to identify staff requirements to minimize scheduling problems and other factors that may limit the effectiveness of any new scheduling system. A.R.H.

N80-14957# Army Concepts Analysis Agency, Bethesda, Md.
MANAGEMENT ANALYSIS OF KEY RESOURCE OPERATIONS (MAKRO), VOLUME 1 Final Report
Frank A. Distasio, Jr., George E. Armstrong, Samuel K. Wasaff, Jr., and Samuel M. Burney, Jr. 30 Mar. 1979 242 p refs 3 Vol.
(AD-A069016; CAA-SR-79-6-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 05/1

The MAKRO study analyzes the planning, programming, and budget formulation phases of Army PPBS and suggests ways to improve the system. The principal PPBS Activities at HQDA were identified, then subjected to rigorous analysis, and documented. The methodology included development and implementation of a computer-based graphics routine to create network diagrams. Network diagrams were constructed for 21 distinct Army PPBS processes that were identified in the analysis. The network diagrams are published separately. Specific prescriptive measures were nominated to improve certain PPBS processes. The paramount MAKRO study insight is that the Army PPBS is responsive to higher authorities at the expense of time for rigorous analysis. The study presents two alternatives which singly or together could enhance the quality of analysis supporting army PPBS: (1) seek relief from the highly interactive/reactive dialogue with higher echelons that is conducted particularly during programming and budgeting; and (2) expand the scope of planning to provide more detail of resource sensitive issues for use in programming. Author (GRA)

N80-14958# Army Concepts Analysis Agency, Bethesda, Md.
MANAGEMENT ANALYSIS OF KEY RESOURCE OPERATIONS (MAKRO). VOLUME 2, APPENDIX E: NETWORKS. ANNEXES 1 AND 2: PLANNING AND PROGRAMMING Final Report
Frank A. Distasio, Jr., George E. Armstrong, Samuel K. Wasaff, Jr., and Samuel M. Burney, Jr. 30 Mar. 1979 375 p 3 Vol.
(AD-A069017; CAA-SR-79-6-Vol-2-App-E-Ann-1) Avail: NTIS HC A16/MF A01 CSCL 05/1

Planning and programming network diagrams constructed for 21 distinct Army Planning, Programming, and Budgeting System processes are presented. J.M.S

N80-14959# Army Concepts Analysis Agency, Bethesda, Md.
MANAGEMENT ANALYSIS OF KEY RESOURCE OPERATIONS (MAKRO). VOLUME 3, APPENDIX E: NETWORKS. ANNEX 3: BUDGET FORMULATION Final Report
Frank A. Distasio, Jr., George E. Armstrong, Samuel K. Wasaff, Jr., and Samuel M. Burney, Jr. 30 Mar. 1979 329 p 3 Vol.
(AD-A069018; CAA-SR-79-6-Vol-3-App-E-Ann-3) Avail: NTIS HC A15/MF A01 CSCL 05/1

Budget formulation diagrams constructed for Army Planning, Programming, and Budgeting processes are presented. J.M.S.

N80-14960# Martin Marietta Aerospace, Orlando, Fla.
US ROLAND 2 LOGISTICS MODEL (ROLOG): USER'S GUIDE
T. E. Wilkerson, J. Neale, S. Dunkin, Edwin Schwemmer, and Bradley B. Dunn Oct. 1978 61 p refs
(Contract DAAK40-76-C-0198)
(AD-A074449) Avail: NTIS HC A04/MF A01 CSCL 09/2

The US ROLAND Logistics Model (ROLOG) is a series of computer programs for processing LSAR data, updating the data base, performing logistic support effectiveness calculations, and reporting data in both graphic and tabular formats. This document is intended to assist the user in executing the programs to achieve realism in the outputs specific to the operational and support scenarios being evaluated. GRA

N80-14961# General Accounting Office, Washington, D. C. Program Analysis Div.
ASSESSING THE OUTPUT OF FEDERAL COMMERCIALLY DIRECTED R/D
27 Aug. 1979 49 p
(PB-299228/7; PAD-79-69) Avail: NTIS HC A03/MF A01 CSCL 05A

To assess the output of Federal commercially directed R&D spending it is necessary to understand the role played by R&D in embodying a laboratory result in a commercially acceptable product or process. The process is complex and the approach to assessing the output of commercially directed research and development is outlined. The interactions occurring between research and development spending and other types of Federal incentives necessary to achieve program goals are analyzed. The

Department of Energy's Solar Photovoltaics program is examined to illustrate the complexities. GRA

N80-14962# Arizona Univ., Tucson. Office of Arid Lands Studies.
WEST COAST FORUM ON APPROPRIATE TECHNOLOGY Final Report
Kennith E. Foster, Roger L. Caldwell, Terry Triffet, and Lina K. Robinson Feb. 1979 56 p Forum held at Tucson, Ariz., 21 Sep. 1978
(Contract NSF CISP-78-22989)
(PB-298986/1; NSF/RA-790003) Avail: NTIS
HC A04/MF A01 CSCL 05A

Scientific research support to promote successful performance of appropriate technology (AT) projects is considered including the provision of a scientific educational base as well as an understanding of the societal and economic impacts related to the adoption of AT. Some of the predominant topic areas identified for research include alternative energy sources, small-scale urban organic agriculture technology, alternative waste disposal systems, and water conservation technology. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-14963# California Univ., Los Angeles. Graduate School of Management.
ASSESSMENT OF TECHNOLOGY FOR INFORMATION SERVICES PLANNING
Bennet P. Lientz Aug. 1979 27 p refs
(NR Proj. 049-345)
(AD-A073315) Avail: NTIS HC A03/MF A01 CSCL 05/2

Computer and communication technology is changing at an increased rate. New technologies are emerging; the price-performance of current technology is improving. There is a need to assess the impact of technology on new information systems projects, particularly those dealing with distributed processing and electronic office systems. Such as assessment provides direction and guidance in long range and intermediate term information services planning. It can potentially prevent costly conversion efforts. An approach is developed for obtaining this assessment. Two case examples of applications are also provided which illustrate the method, results, and benefits. GRA

N80-14964# Computer Corp. of America, Cambridge, Mass.
SPATIAL DATA MANAGEMENT SYSTEM Quarterly Research and Development Technical Report, 1 Sep. - 30 Nov. 1978
Christopher F. Herot, David Kramlich, Richard Carling, Mark Friedell, and Jerry Farrell 30 Nov. 1978 83 p refs
(ARPA Order 3487)
(AD-A068863) Avail: NTIS HC A05/MF A01 CSCL 05/2

This fourth quarter of work on the design and implementation of a prototype Spatial Data Management System (SDMS) resulted in the first operational version of the system. The bulk of this effort was devoted to constructing the mechanism through which a user can create, modify, and view an image plane. An image plane is a flat surface upon which a user can store information. As that surface may be considerably larger than the display screen, the SDMS provides a window which can be moved over that surface in order to view parts of it. As the window is moved, the window's position is indicated on an auxiliary screen which serves as a navigational aid containing a map of the entire image plane. This implementation of SDMS at CCA is the first such system to integrate the I-Space creation and viewing operations so that a user can create and modify a database without the need of a skilled computer professional. GRA

N80-14965# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.
THE IMS DATA STORAGE HIERARCHY: DSH-1
Chat-Yu Lam and Stuart E. Madnick Aug. 1979 44 p refs
(Grant N00039-78-G-0160)
(AD-A073375; CISR-M010-7908-02; CISR-TR-2) Avail: NTIS
HC A03/MF A01 CSCL 09/2

To achieve high performance, large capacity, and high availability, the IMS data base computer takes the approach of implementing the logical information management functions by means of a pipeline of parallel microprocessors and makes use of a storage hierarchy with distributed control for the physical storage and manipulation of very large databases. The data storage hierarchy (DSH) of IMS provides a very large byte addressable virtual address space accessible by the large number of processors that implement the logical information management functions of IMS. A highly parallel structure is used by the DSH to support asynchronous processing of a large number of data requests in order to attain very high throughput. Use of multiple block sizes across the storage levels and use of efficient data movement algorithms contribute to the high performance of DSH. The use of distributed control as well as multiple data redundancy gives DSH the capability to tolerate hardware failures without suffering data loss or availability of service. This report describes the design objectives and the structure of a general data storage hierarchy (DSH-1). Research issues in DSH-1 are also discussed. GRA

N80-14966# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.
THE IMS DATA STORAGE HIERARCHY: DSH-2
Chat-Yu Lam and Stuart E. Madnick Aug. 1979 53 p refs
(Grant N00039-78-G-0160)
(AD-A073376; CISR-M010-7908-03; CISR-TR-3) Avail: NTIS
HC A04/MF A01 CSCL 09/2

The need for efficient storage and processing of very large data bases coupled with advances in Large Scale Integration (LSI) technology have motivated various proposals to develop specialized computers for data base processing. The IMS data base computer (DBC) approach to this problem is to implement the logical functions of a data base management system by means of a hierarchy of microprocessors and to use a data storage hierarchy for efficient storage and retrieval of very large data bases. GRA

N80-14967# Battelle Columbus Labs., Ohio.
ANNUAL SUMMARY OF TECHNICAL AWARENESS IN THE NONFERROUS METALS INDUSTRY Final Report, 1 May 1977 - 30 Apr. 1978
E. S. Bartlett and B. G. Koehl Apr. 1979 177 p ref
(Grant EPA-R-805095-01)
(PB-299285/7; EPA-600/2-79-092) Avail: NTIS
HC A09/MF A01 CSCL 05B

Methods and procedures for maintaining current awareness of technology and commercial trends in the U.S. nonferrous metal mining and manufacturing industry are considered. The principal effort resulted in the publication of six bimonthly technical awareness bulletins during the first year. Items culled from the technical and trade literature are presented as news notes, brief patent and foreign technology abstracts and where the article content warranted, brief analytical summaries of pertinent technology. Examples of the product are appended. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-14968* National Aeronautics and Space Administration, Washington, D. C.
PRESS CONFERENCE: FY 1980 BUDGET
20 Jan. 1979 36 p
(P79-10182) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 05C

Both the President's space policy and OMB's anti-inflation policy are reflected in appropriations for NASA's space science, applications, and advances of technology in aeronautics and space programs. Increases in the budgets for each of these areas are examined in the light of the inflation factor and its impact on program management and mission plans. Possible new starts for the future budgets are indicated. A.R.H.

N80-14969* National Aeronautics and Space Administration, Washington, D. C.
THE NASA FY 1980 BUDGET
22 Jan. 1979 8 p
(P79-10183) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 05C

While the NASA budget being submitted to Congress totals just over $4.7 billion, and represents an overall increase of some $160 million over fiscal 1979, it falls short of the inflation rate and does not accommodate new programs. Combined with the requirements of the Civil Service Reform Act, the budget will necessitate significant civil service personnel ceiling reductions in the agency. The budget does provide for increased emphasis on the exploration of space, on the practical applications of space capabilities to problems on Earth, and on the advancement of the technology necessary to maintain U.S. leadership in aeronautics and space. It provides full support for the important programs in all areas already underway, and leaves room in the years ahead for the selection of new projects from the many worthy candidates now under consideration. The priority of bringing the space transportation system into operation is again emphasized. A.R.H.

N80-14970# Committee on Science and Technology (U. S. House)
THE SPACE INDUSTRIALIZATION ACT OF 1979
Washington GPO 1979 291 p refs Hearings on H.R. 2337 before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 22-23 May, 26-27 Jun. 1979
(GPO-50-404) Avail: Subcomm. on Space Sci. and Applications

Issues associated with the prospects for commercial ventures in space, the role of the Federal Government, and the appropriate mechanisms for fostering entry of the private sector are examined. Federal legislation to establish a Space Industrial Corporation to provide means for financing the development of new products, processes, and industries using the properties of the space environment is assessed. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-14971*# National Aeronautics and Space Administration, Washington, D. C.
A REVIEW OF NASA INTERNATIONAL PROGRAMS
1 Jan. 1979 112 p refs
(NASA-TM-80845) Avail: NTIS HC A06/MF A01 CSCL 05A

A synoptic overview of NASA's international activities to January 1979 is presented. The cooperating countries and international organizations are identified. Topics covered include (1) cooperative arrangements for ground-based, spaceborne, airborne, rocket-borne, and balloon-borne ventures, joint development, and aeronautical R & D; (2) reimbursable launchings; (3) tracking and data acquisition; and (4) personnel exchanges. International participation in NASA's Earth resources investigations is summarized in the appendix. A list of automatic picture transmission stations is included. A.R.H.

N80-14972# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR ELECTRIC AND HYBRID VEHICLES
P. Brown, P. Davis, G. Hagey, and M. Katz [1979] 91 p
(TID-28858-Draft) Avail: NTIS HC A05/MF A01

Barriers to the commercialization of electric powered vehicle technology are identified, along with possible actions to remove specific barriers. Technical, economic, environmental, and institutional readiness are assessed. Recommended commercialization strategies and goals are presented. K.L.

N80-14973# California Univ., Livermore. Lawrence Livermore Lab.
ASSESSMENT OF THE APPLICABILITY OF MECHANICAL ENERGY STORAGE DEVICES TO ELECTRIC AND HYBRID VEHICLES. VOLUME 1: EXECUTIVE SUMMARY M.S. Thesis
M. W. Schwartz 1 May 1979 17 p refs
(Contract W-7405-eng-48)
(UCRL-52773-Vol-1) Avail: NTIS HC A02/MF A01

The power and energy required in a storage device to realize specific improvements upon current and near-term electric vehicle performance specifications are calculated. A review of candidate mechanical energy storage devices concludes that only flywheels and, for some applications, hydraulic accumulators are practical in this context. With respect to each performance specification, data is presented on the vehicle-mass fraction of the mechanical energy storage system as a function of its specific energy and the overall vehicle mass. Mechanical energy storage devices may or may not improve range, depending on the particular configuration of the vehicle and the driving cycle. DOE

N80-14974# California Univ., Berkeley. Inst. of Governmental Studies.
AN INVESTIGATION OF THE REPROCESSING AND WASTE MANAGEMENT REQUIREMENTS OF PRESENT AND ALTERNATIVE NUCLEAR FUEL CYCLES, VOLUME 1 Final Report
G. I. Rochlin Jun. 1979 162 p refs Sponsored by California Energy Commission
(PB-299105/7; CAEC-38-Vol-1; CAEC-300-79-003-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 08J

Various nuclear fuel cycles are examined with regard to economics, health and safety, and proliferation implications. The question of whether reprocessing of nuclear fuel is required in particular fuel cycles is emphasized. This emphasis is prompted by California state law which prohibits (under certain conditions) the licensing of nuclear fission thermal power plants requiring the reprocessing of fuel rods. It is concluded that there are several fuel cycles, including the light water reactor cycle, which do not require reprocessing on technical or resource/economic grounds. The final decision to reprocess in many cases depends upon the resolution of environmental, health, and safety issues. GRA

N80-14975# California Univ., Berkeley. Inst. of Governmental Studies.
AN INVESTIGATION OF THE REPROCESSING AND WASTE MANAGEMENT REQUIREMENTS OF PRESENT AND ALTERNATIVE NUCLEAR FUEL CYCLES. VOLUME 2: APPENDICES Final Report
G. I. Rochlin Jun. 1979 147 p refs Sponsored by California Energy Commission 2 Vol.
(PB-299106/5; CAEC-39-Vol-2; CAEC-300-79-004) Avail: NTIS HC A07/MF A01 CSCL 18J

Detailed descriptions of alternative nuclear fuel cycles

together with material flow sheets, resource consumption, and other data are presented. K.L.

N80-14976# Department of Energy, Bartlesville, Okla. Bartlesville Energy Research Center.
AMBIENT TEMPERATURE, FUEL ECONOMY, EMISSIONS, AND TRIP LENGTH Final Report, Feb. - Sep. 1977
B. H. Eccleston Aug. 1979 123 p
(Contract DOT-TSC RA-76-48)
(PB-298847/5; DOT-TSC-NHTSA-79-43; DOT-HS-803-668)
Avail: NTIS HC A06/MF A01 CSCL 13F

The relationship among automotive fuel economy, ambient temperature, cold start trip length, and drive-train component temperatures of four 1977 vehicles is examined. Fuel economy, exhaust emission, and drive-train temperatures were measured at temperatures of 20 F, 45 F, 70 F, and 100 F using the 1975 Federal Test Procedure and EPA highway fuel economy test. GRA

88 SPACE SCIENCES (GENERAL)

N80-14977*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEAO SCIENCE SYMPOSIUM
Carroll Dailey, ed. and Wendell Johnson, ed. Nov. 1979 463 p refs Symp. held at Huntsville, Ala., 8-9 May 1979
(NASA-CP-2113) Avail: NTIS HC A20/MF A01 CSCL 03A

Scientific results from the early analysis of data from the HEAO 1 mission are presented. Development of astronomical catalogs and maps, X-ray variability, extragalactic astronomy, X-ray iron line emission, and optical identification and spectroscopy of X-ray sources are among the topics discussed. Results from HEAO 2 imaging and nonimaging instruments are included. For individual titles, see N80-14978 through N80-15000.

N80-14978*# Naval Research Lab., Washington, D. C.
X-RAY VARIABILITY OBSERVED WITH HEAO A-1 **c89**
Herbert Friedman *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 10-29 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

Results from the HEAO A-1 instrument which observed X-ray source variability over a wide range of accessible timescales are surveyed. The objects observed include quasars, BL Lacertae, and active galactic nuclei. A high sensitivity search for X-ray pulsars, known black hole candidates, period fluctuation in binary pulsars, and X-ray and gamma ray bursts are among the topics covered. J.M.S.

N80-14979*# Naval Research Lab., Washington, D. C.
PROGRESS OF THE HEAO A-1 CATALOG **c89**
Kent Wood *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 30-48 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

Results from the A-1 all sky survey are used to develop a catalog of X-ray sources. Various techniques used to identify and position the detected sources are discussed. J.M.S.

N80-14980*# California Inst. of Tech., Pasadena.
THE SCIENTIFIC RESULTS OF THE LOW ENERGY PORTION OF A-2 **c89**
Gordon Garmire *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 49-81 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

Galactic phenomena observed using the HEAO 1 detectors are discussed. A source map of the soft X-ray sky is presented. Specific topics covered include the optical outburst of U Geminorum, low energy RS CVn stars, and the dwarf nova SS Cygni. Aspects of the SS Cygni pulsations are analyzed. J.M.S.

N80-14981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAO A-2 EXTRAGALACTIC RESULTS **c89**
Elihu Boldt *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 82-100 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

Results from the HEAO A-2 experiment concerning the extragalactic X-ray sky are discussed. All-sky maps of hard X-ray sources detected are presented reflecting the temporal variability of the sources that make up the extragalactic X-ray sky. Most of the identified extragalactic objects are not clusters of galaxies but isolated galaxies. Spectra for sources representing classes of active galz galaxies, BL Lacertae ojbects, and N galaxies are discussed in order of luminosity. J.M.S.

N80-14982*# Massachusetts Inst. of Tech., Cambridge.
A-3 SCIENTIFIC RESULTS **c89**
Roger Doxsey *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 101-113 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

The scanning modulation collimator experiment designed to identify the optical counterparts of celestial X-ray sources is described. Identification of galactic sources is discussed. Results concerning active galaxies are presented. J.M.S.

N80-14983*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A-3 SCIENTIFIC RESULTS - EXTRAGALACTIC **c89**
Daniel A. Schwartz *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 114-139 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

The results of the HEAO A-3 experiment are summarized. Specific contributions of the experiment to extragalactic astronomy are emphasized. The discovery of relatively condensed X-ray emission in the cores of those clusters of galaxies which are dominated by a giant elliptical or cD galaxy, the discovery of extended X-ray emitting plasma in groups of galaxies, and the demonstration that BL Lac objects are a class of X-ray sources are among the topics discussed. J.M.S.

N80-14984*# Massachusetts Inst. of Tech., Cambridge.
HIGH ENERGY X-RAY RESULTS FROM HEAO-1: X-RAY PULSARS, AND THE ALL SKY SURVEY **c89**
Alan Levine *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 140-165 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

Results of the sky survey performed with the high energy X-ray detectors of the A-4 experiment onboard the HEAO 1 spacecraft are presented. The data prusented cover the energy range from 13 to 80 keV. Strong sources are idantified by visual inspection and azimuthal superpositions are performed in order to find weak sources. Time variability is also examined. Results of studies of X-ray pulsars are given including a brief description of an X-ray pulsar in terms of current theory. J.M.S.

N80-14985*# California Univ., San Diego.
A-4 SCIENTIFIC RESULTS **c89**
James Matteson *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 166-194 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

Observations of galactic sources, extragalactic sources and gamma bursts with the A-4 instrument at energy 1 energies of between 0.1 to 10 MeV are discussed. Azimuthal scans are presented. The Crab Nebula and its spectrum and the spectrum of Cygnus Z-1 are described. R.E.S.

N80-14986*# Iowa State Univ. of Science and Technology, Ames.
X-RAY EMISSION FROM THE REGION OF GAMMA 195+5 **c93**
R. C. Lamb *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 201-208 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B

X-ray observations of nineteen unidentified discrete celestial

best copy available

gamma ray sources are discussed. Results show some indication of X-rays from the gamma ray source region. On the assumption that the results are valid, it is concluded that the source error box is smaller than what it was. R.E.S.

N80-14987*# Northwestern Univ., Evanston, Ill.
DIFFUSE X-RAY EMISSION FROM ABELL CLUSTERS c93
Melvin Ulmer. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 209-213 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B
Abell clusters of galaxies, specifically Abell 401 and Abell 399 regions, are discussed. Two sets of satellite observations were made. One was a lunar occultation pointed observation where there were two orbits in which to look at the regions while the moon scanned over it. The other was a scanning observation through the area. Two diffuse models of the X-ray emission were developed. Also, during the investigation three binary cluster systems were found where at least one member was an X-ray source. They were Abell 508, 509, 2177, 2178, 2204, and 2210. R.E.S.

N80-14988*# Indiana Univ., Bloomington.
CORRELATED GROUND BASED OBSERVATIONS IN SUPPORT OF THE HEAO-1 X-RAY OBSERVATORY c93
Stewart Mufson. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 214-222 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B
Using X-ray and optical photometry of UBVRI fluxes, energetic compact extragalactic sources were studied, such as BL Lacerta (Lac) and BL Lac objects-Markarian (Mrk) 421, Mrk 501, and B2 1308+32. BL Lac and BL Lac objects were found to have predominantly nonthermal spectrums. Photometric and spectroscopic properties of X Persei, an unusual Be star associated with an intrinsically weak X-ray source, were also studied. Both its X-ray and optical emission show complex variability on many different time scales. R.E.S.

N80-14989*# Illinois Univ., Urbana.
THE HEAO-1 NEUTRON STAR TIMING EXPERIMENT c90
F. K. Lamb. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 223-243 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B
The HEAO-1 neutron star timing experiment is presented. The scientific motivation for the experiment, the reasons for the choice of Her X-1 and Vela X-1 as promising sources to study, the methodology, and the current status of the experiment are summarized. R.E.S.

N80-14990*# Middlebury Coll., Vt.
X-RAY IRON-LINE EMISSION FROM THE SN 185 REMNANT c93
P. F. Winkler. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 244-250 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B
Radio and optical research was carried out in order to show that the supernova remnant RCW86 is a remnant of the earliest supernova event ever recorded in history (185 AD). The results are as follows: (1) an iron-line emission was found at 6.7 keV; (2) the temperature measured from HEAO-1 was approximately 6 keV; and (3) the equivalent width was consistent within the uncertainties with a cosmic iron abundance. These results support the identification of the supernova remnant RCW86 (it's X-ray source) with the historic supernova event. R.E.S.

N80-14991*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
OPTICAL IDENTIFICATION AND SPECTROSCOPY OF X-RAY SOURCES PRECISELY POSITIONED WITH A-3 c93
Richard Griffiths. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 251-260 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B
Using a scanning modulation collimator, the optical identification of X-ray sources by means of precise positioning was carried out. Two galactic identifications (4U2129+47 and 2A0311-227) and two extragalactic identifications (NGC 526a and Parkes H2155-304) are described. R.E.S.

N80-14992*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A HIGH ENERGY ASTRONOMY OVERVIEW c89
Riccardo Giacconi. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 262-291 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A
A technology assessment of extrasolar X-ray astronomy is presented. The role and significance of the Einstein Observatory is described. R.E.S.

N80-14993*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NONDISPERSIVE SPECTROSCOPY OF CELESTIAL X-RAY SOURCES c89
Stephen Holt. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 292-328 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A
The spectroscope aboard the Einstein Observatory which utilizes nondispersive techniques is presented. Examples of kinds of thermal and nonthermal features that can be seen as well as the possibility of seeing small traces of thermal features in either much higher temperature objects or nonthermal objects are considered. M.M.M.

N80-14994*# Massachusetts Inst. of Tech., Cambridge.
HIGH RESOLUTION X-RAY SPECTROSCOPY ON THE EINSTEIN OBSERVATORY c89
George W. Clark. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 329-248 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A
The X-ray spectroscope presented features both spectral and one dimensional spatial resolution. The capabilities of observing sources like supernova remnants, X-ray stars, and the halo surrounding galaxies are discussed. M.M.M.

N80-14995*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MONITOR PROPORTIONAL COUNTER c35
M. C. Weisskopf. *In its* HEAO Sci. Symp. Nov. 1979 p 347-366 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 14B
An Uhuru class Ar-CO2 gas filled proportional counter sealed with a 1.5 mil beryllium window and sensitive to X-rays in the energy bandwidth from 1.5 to 22 keV is presented. This device is coaligned with the X-ray telescope aboard the Einstein Observatory and takes data as a normal part of the Observatory operations. M.M.M.

N80-14996*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
EINSTEIN OBSERVATIONS OF EXTENDED GALACTIC X-RAY SOURCES c93
F. D. Seward. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 368-389 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B
Features of the X-ray pictures taken aboard the space observatory are presented. Imaging proportional counter pictures in three broad X-ray energy ranges were obtained. The X-ray spectrum of supernova remnants is described. M.M.M.

N80-14997*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
EINSTEIN OBSERVATIONS OF ACTIVE GALAXIES AND QUASARS c89
Ethan J. Schreier. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 390-408 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

The radio galaxies Centaurus A and Signus B are discussed. In both these sources, a comparison of the radio and imaged X-ray flux is allowed for the measurement of the magnetic fields. Einstein observations of quasars are discussed. The number of known X-ray emitting QSO's was increased from 3 to 22 and the distances where these QSO's were seen to correspond to an age of 15 billion years. It was shown that these quasars contributed significantly to the X-ray background. M.M.M.

N80-14998*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE STRUCTURE AND EVOLUTION OF X-RAY CLUSTERS OF GALAXIES c90
C. Jones. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 409-421 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B

The structure of clusters is described from observations at the Einstein Observatory. It was concluded that the nature of the X-ray emission is complex and varies from broad and highly clumped to smooth and centrally peaked. The clusters whose emission is clumped tend to be rich in spirals and to have X-ray temperatures in the few kilovolt range and low velocity dispersions. The smooth centrally peaked clusters are spiral poor, and have higher temperatures and larger velocity dispersions. For many of the clusters, the emission is irregular and cannot be described by the simple, spherically symmetric models for a hot isothermal or adiabatic gas. For these clusters, the low density, intracluster gas is influenced by the potential of individual bright galaxies. M.M.M.

N80-14999*# Columbia Univ., New York.
COLUMBIA/EINSTEIN OBSERVATIONS OF GALACTIC X-RAY SOURCES c93
Knox S. Long. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 422-438 refs (For primary document see N80-14977 05-88)
(Contract NAS8-30753)
(Contrib-179) Avail: NTIS HC A20/MF A01 CSCL 03B

The imaging observations of galactic clusters are presented. These fall into three categories: pre-main-sequence stars in the Orion nebulae, isolated-main-and-post main-sequence stars, and supernova remnants SNR. In addition to SNR, approximately 30 sources were detected. M.M.M.

N80-15000*# Columbia Univ., New York.
COLUMBIA/EINSTEIN OBSERVATIONS OF EXTRAGALACTIC X-RAY SOURCES c93
William H.-M. Ku. *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 439-459 refs (For primary document see N80-14977 05-88)
(Contract NAS8-30753)
(Contrib-180) Avail: NTIS HC A20/MF A01 CSCL 03B

Results are presented of the analysis of data from observations of extragalactic objects with the imaging proportional counter on board the Einstein Observatory. Surveys of normal galaxies, radio galaxies, active galaxies, quasars and BL Lacs, and clusters of galaxies were studied in order to improve the understanding of the origin of the Milky Way Galaxy. M.M.M.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-15001 State Univ. of New York at Stony Brook.
A STUDY OF P CYGNI STARS Ph.D. Thesis
Keun-Myung Lee 1979 145 p
Avail: Univ. Microfilms Order No. 7926271

Model envelopes of the early B-type P Cygni stars are presented. The envelope is assumed to be expanding radially with a supersonic speed, and roughly in radiative equilibrium with the photosphere of the star. The P Cygni profiles of the Balmer lines are used as diagnostic tools for the determination of the mass loss rate and velocity law. The Sobolev method is used to solve the equation of statistical equilibrium for hydrogen atoms in the envelope. Models of four selected P Cygni stars, HD 190603, Chi sup 2 Ori, zeta sup 1 Sco, and P Cyg show reasonable agreement with observations in the profiles of the Balmer lines, and continuous energy distribution. The velocity laws obtained from these models show outward accelerations. The characteristic slopes of the velocity laws for these stars are found to be correlated with their mass loss rates. Dissert. Abstr.

N80-15002 Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
HARD X-RAY OBSERVATION OF CYGNUS-3
C. Reppin, W. Pietsch, J. Truemper, W. Voges, E. Kendziorra (Tuebingen Univ., West Ger.), and R. Staubert (Tuebingen Univ., West Ger.) May 1979 14 p refs Submitted for publication Sponsored by Deut. Forschungsgemeinschaft
(MPI-PAE/Extraterrest-155) Copyright. Avail: NTIS HC A02

During a balloon observation on October 18, 1977, the high energy X-ray spectrum (20 to 90 keV) of Cyg X-3 was measured with high statistical accuracy. It was found to be consistent with a thermal bremsstrahlung spectrum with kT = 17.5 + 3.1 or - 2.6 keV or a power low E to the minus gamma of the differential photon flux spectrum with gamma equal to 3.6 + or - 0.3. The extrapolation of the observed spectrum to 100 MeV yields a gamma ray intensity which is at least three orders of magnitude below the intensity found by SAS-2. This indicates that the overall spectral behavior of Cygnus X-3 is much different from that of the Crab and Vela pulsars.
Author (ESA)

N80-15003*# Planetary Science Inst., Tucson, Ariz.
PLANETARY ASTRONOMY Final Report
Clark R. Chapman Nov. 1979 122 p refs
(Contract NASw-3134)
(NASA-CR-162526) Avail: NTIS HC A06/MF A01 CSCL 03A

Activities summarized relate to spectrophotometric observations and analysis of asteroids; further observations of the peculiar asteroid 624 Hektor; the search for further asteroid close encounters suitable for mass determination; the infrared search for intra-Mercurial bodies; the search for Venus ashen light; multicolor areal photometry of Uranus and Neptune; and ground-based observations of the Galilean satellites to support the Voyager mission. The following topics are examined: (1) Hektor: the largest highly elongated asteroid; (2) Uranus: disk structure within the 7300 Angstrom methane band; (3) Neptune: limb brightening within the 7300 Angstrom methane band; (4) Neptune's rotation period: a correlation and a speculation on the effect of the disk brightness distribution; (5) observing report on 1979 activities at Kitt Peak National Observatory; and (6) dynamical evolution of intra-Mercurial planetesimals. A.R.H.

N80-15004# Rome Air Development Center, Griffiss AFB, N.Y.
SPECKLE INTERFEROMETRY FOR A PARTIALLY COHERENT SOURCE
Ronald L. Fante Mar. 1979 16 p refs
(AF Proj. 2305-17)
(AD-A074540; RADC-TR-79-96) Avail: NTIS HC A02/MF A01 CSCL 14/5

The spatial frequency transfer function are obtained for speckle interferometry for the case when the source is partially coherent (spatially) and can be approximated by the quasi-stationary model. The transfer function has been examined, and relatively simple approximations to it have been found for the limiting cases of low and high spatial frequencies. These results reduce to previous results in the limiting case when the source is completely incoherent. GRA

N80-15005# Observatoire de Paris-Meudon (France).
THE HIGH SPATIAL RESOLUTION OF INTERFEROMETRY IN THE NEAR INFRARED [LA HAUTE RESOLUTION SPATIALE PAR INTERFEROMETRIE DANS LA PROCHE INFRAROUGE]
Pierre Lena (Univ. Paris 7) 1979 19 p refs In FRENCH; ENGLISH summary Presented at Colloq. de Bordeaux, 6-8 Mar. 1979 Submitted for publication
Avail: NTIS HC A02/MF A01

Methods of restoring spatial coherence in the wave front,

partly destroyed by the turbulent state of the earth atmosphere, are reviewed. A first approach called speckle interferometry which provides the spectral density of several objects such as protostars or stars with extended envelopes, is described. This method achieves high sensitivity and short integration and provides a good frequency coverage of the object. The second approach is Michelson interferometry or aperture synthesis. It may be carried out either with broadband incoherent detection (white light), or with a narrow band (heterodyne). A comparison in terms of merit factor versus wavelength is given. Author (ESA)

N80-14978*# Naval Research Lab., Washington, D. C.
X-RAY VARIABILITY OBSERVED WITH HEAO A-1
Herbert Friedman *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 10-29 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14979*# Naval Research Lab., Washington, D. C.
PROGRESS OF THE HEAO A-1 CATALOG
Kent Wood *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 30-48 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14980*# California Inst. of Tech., Pasadena.
THE SCIENTIFIC RESULTS OF THE LOW ENERGY PORTION OF A-2.
Gordon Garmire *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 49-81 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAO A-2 EXTRAGALACTIC RESULTS
Elihu Boldt *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 82-100 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14982*# Massachusetts Inst. of Tech., Cambridge.
A-3 SCIENTIFIC RESULTS
Roger Doxsey *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 101-113 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14983*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A-3 SCIENTIFIC RESULTS - EXTRAGALACTIC
Daniel A. Schwartz *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 114-139 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14984*# Massachusetts Inst. of Tech., Cambridge.
HIGH ENERGY X-RAY RESULTS FROM HEAO-1: X-RAY PULSARS, AND THE ALL SKY SURVEY
Alan Levine *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 140-165 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14985*# California Univ., San Diego.
A-4 SCIENTIFIC RESULTS
James Matteson *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 166-194 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14992*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A HIGH ENERGY ASTRONOMY OVERVIEW
Riccardo Giacconi *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 262-291 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14993*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NONDISPERSIVE SPECTROSCOPY OF CELESTIAL X-RAY SOURCES
Stephen Holt *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 292-328 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14994*# Massachusetts Inst. of Tech., Cambridge.
HIGH RESOLUTION X-RAY SPECTROSCOPY ON THE EINSTEIN OBSERVATORY
George W. Clark *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 329-246 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

N80-14997*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
EINSTEIN OBSERVATIONS OF ACTIVE GALAXIES AND QUASARS
Ethan J. Schreier *In* NASA. Marshall Space Flight Center HEAO Sci. Symp Nov. 1979 p 390-408 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-15006 Virginia Univ., Charlottesville.
STUDIES OF INTERPLANETARY DUST Ph.D. Thesis
John Edward Stanley 1979 86 p
Avail: Univ. Microfilms Order No. 7928000

Data from two sets of interplanetary dust detection experiments are analyzed allowing tentative conclusions concerning the nature and origin of the zodiacal cloud to be made. The small meteoroid detection experiment flown on the Earth orbiting satellite Explorer used semiconductor capacitors to detect submicronsized particles. The sensitivity of these detectors was controlled by the dielectric thickness. The SMDE data taken during the time when major meteor showers were visually observed indicate the presence of small shower associated particles. This result shows that comets are an efficient supplier of small dust particles. Analyses of the data from the meteoroid detection experiment and the imaging photopolarimeter aboard Pioneer 10 and 11 is presented and a comparison between the two is discussed. Dissert. Abstr.

N80-15007# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
THE VELOCITY OF CLUSTERS OF GALAXIES RELATIVE TO THE MICROWAVE BACKGROUND. THE POSSIBILITY OF ITS MEASUREMENT
R. A. Sunyaev and Y. B. Zeldovich 1975 19 p refs (PR-488) Avail: NTIS HC A02/MF A01

The use of microwave background radiation intensity and polarization to determine the radial and tangential relative velocity components of clusters of galaxies is proposed. It is shown that measurements of (delta T/T) on 3 cm and 2 mm wavelengths, with a precision of several percent permits the detection of radial velocities on the order of our galaxy's motion relative to the microwave background. It is also shown that it is possible to find the tangential velocity component by measuring the polarization of the scattered radiation. The existence of two different polarization mechanisms is discussed. Author (ESA)

N80-14989*# Illinois Univ., Urbana.
THE HEAO-1 NEUTRON STAR TIMING EXPERIMENT
F. K. Lamb *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 223-243 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B

N80-14998*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE STRUCTURE AND EVOLUTION OF X-RAY CLUSTERS OF GALAXIES
C. Jones *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 409-421 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-15008*# National Aeronautics and Space Administration, Washington, D. C.
NEWS CONFERENCE ON VOYAGER-2-JUPITER ENCOUNTER
30 May 1978 53 p Tape transcript
(NASA-TM-80854; P79-10189) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

The proceedings of a news conference on the Voyager 2 Jupiter project are presented. Topics include the instrumentation on the Voyager 2, Jupiter's atmosphere and magnetic field, the Jupiter moons, and the observations of lightning on Jupiter. A.W.H.

N80-15009*# National Aeronautics and Space Administration, Washington, D. C.
PIONEER SATURN ENCOUNTER NEWS BRIEFING
21 Aug. 1979 52 p Tape transcript
(NASA-TM-80353; P79-10193) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

The Pioneer 11 spacecraft, its instruments, data transmission capabilities, and technical problems affecting the scientific objectives of the mission during encounter with Saturn are described. Six far encounter photographs of the planet and a two minute animated film of the impending close encounter are examined. A.R.H.

N80-15010*# National Aeronautics and Space Administration, Washington, D. C.
FUTURE OF PLANETARY EXPLORATION
Robert A. Frosch 14 Sep. 1979 16 p Talk given in San Francisco, 14 Sep. 1979 Tape transcript
(NASA-TM-80352; P79-10194) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

Space exploration missions are discussed in terms of missions completed and missions proposed. The reasons for the exploration of the planets are reviewed including the use of chemical and physical information received from exploration of Mars, Venus, and Jupiter. A.W.H.

N80-15011*# Saint Marys Univ., San Antonio, Tex.
X-RAY DIFFRACTION STUDIES OF SHOCKED LUNAR ANALOGS Final Report
Robert E. Hanss 26 Dec. 1979 33 p refs
(Grant NsG-9039)
(NASA-CR-162555) Avail: NTIS HC A03/MF A01 CSCL 03B

The X-ray diffraction experiments on shocked rock and mineral analogs of particular significance to lunar geology are described. Materials naturally shocked by meteorite impact, nuclear-shocked, or artificially shocked in a flat plate accelerator were utilized. Four areas were outlined for investigation: powder diffractometer studies of shocked single crystal silicate minerals (quartz, orthoclase, oligoclase, pyroxene), powder diffractometer studies of shocked polycrystalline monomineralic samples (dunite), Debye-Scherrer studies of single grains of shocked granodiorite, and powder diffractometer studies of shocked whole rock samples. Quantitative interpretation of peak shock pressures experienced by materials found in lunar or terrestrial impact structures is presented. A.W.H.

N80-15012*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
PRELIMINARY RESULTS OF PENETRATOR FIELD TEST PROGRAM, TONOPAH, NEVADA, 16-28 APRIL 1979
Maxwell B. Blanchard, Uel Clanton, Mischelle Dalbey (LPI, Houston, Tex.), Victor Rhoper, and James P. Murphy (NASA, Ames Res. Center, Moffett Field, Calif.) Oct. 1979 36 p refs
(NASA-TM-58222; JSC-16221) Avail: NTIS HC A03/MF A01 CSCL 03B

Subscale (0.63 scale) penetrators impacted various sizes of volcanic rocks resting on and within compacted playa sediments. All penetrators were identical in size, shape, weight, and impact velocity. Although minor variations in impact angle were documented, the final orientation of the buried penetrators was primarily a consequence of the size, shape, and depth of the rocks encountered during impact. In situ measurements of impacted penetrators revealed that surface and buried layers of rocks having diameters up to 3 times the penetrator diameter caused only small (< 10 deg) angles of deflection. Only large single rocks greater than 10 times the penetrator diameter caused deflections appreciably greater than 10 deg. The large deflection angles followed by the penetrator were strongly influenced by fracture planes that developed in the rock as it broke apart. No catastrophic failure of the penetrator occurred during these tests. A cross section of the path of each penetrator through the ground is shown together with details on orientation before, during, and after the tests. Comparisons are made with results of previous subscale penetrator tests, and conclusions are drawn with respect to full-scale Mars penetrator performance. M.G.

N80-15013*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
INTRODUCTION TO THE APOLLO COLLECTIONS: PART 2: LUNAR BRECCIAS
P. E. McGee (Lockheed Electronics Co., Inc., Houston, Tex.), C. H. Simonds (Northrop Services, Inc., Houston, Tex.), J. L. Warner, and W. C. Phinney Feb. 1979 206 p refs
(NASA-CR-162559) Avail: NTIS HC A10/MF A01 CSCL 03B

Basic petrographic, chemical and age data for a representative suite of lunar breccias are presented for students and potential lunar sample investigators. Emphasis is on sample description and data presentation. Samples are listed, together with a classification scheme based on matrix texture and mineralogy and the nature and abundance of glass present both in the matrix and as clasts. A calculus of the classification scheme, describes the characteristic features of each of the breccia groups. The cratering process which describes the sequence of events immediately following an impact event is discussed, especially the thermal and material transport processes affecting the two major components of lunar breccias (clastic debris and fused material). A.R.H.

N80-15014# Los Alamos Scientific Lab., N. Mex.
APOLLO 12 FELDSPATHIC BASALTS 12031, 12038, AND 12072; PETROLOGY, COMPARISON
D. W. Beaty, S. M. R. Hill, A. L. Albee, and W. S. Baldridge 1979 42 p refs Presented at the 10th Lunar Sci. Conf., Houston, Tex., 24 Apr. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1117; CONF-790476-2) Avail: NTIS HC A03/MF A01

Comparison of Modal and chemical data which indicate that 12072, 12038, and 12031, the Apollo 12 feldspathic basalts, form a well defined group which are not related to the other Apollo 12 rock types is presented. The 12072 contains phenocrysts of olivine and pigeonite and microphenocrysts of Cr-spinel set in a fine grained, variolitic groundmass. The 12038 is a medium grained, equigranular basalt with a texture indicating it was multiply saturated. The 12031 is a coarse grained rock with granular to graphic intergrowths of pyroxene and plagioclase; it was multiply saturated. Petrologic observations, as well as

the bulk chemistry, are consistent with the interpretation that 12031 was derived from 12072 through fractionation of Cr-spinel, olivine, and pigeonite, the observed phenocryst assemblage. The general petrologic similarities between 12072, 12031 and the other Apollo 12 basalts are discussed. DOE

N80-15015# Los Alamos Scientific Lab., N. Mex.
PETROLOGY OF THE APOLLO 12 PIGEONITE BASALT SUITE
W. S. Baldridge, D. W. Beaty, S. M. R. Hill, and A. L. Albee 1979 65 p Presented at the 10th Lunar Sci. Conf., Houston, Tex., 24 Apr., 1979
(Contract W-7405-eng-36)
(LA-UR-79-1116; CONF-790476-1) Avail: NTIS HC A04/MF A01

A comparative petrologic study of the Apollo 12 pigeonite basalt suite is presented to understand the textural and petrologic variations within the pigeonite suite and to consider whether these variations are consistent with the hypothesis that the pigeonite basalts are related by crystal fractionation to the olivine basalts. Texturally, the pigeonite basalts range from porphyritic samples with a very fine grained variolitic groundmass to coarse grained microgabbro samples with ophitic to graphic textures. The abundances of olivine and Cr spinel continuously decrease with increasing grain size, whereas the abundances of plagioclase and ilmenite steadily increase. Petrologically, increasing grain size is accompanied by increased Ca in plagioclase, increased Fe in pyroxene, olivine and spinel, and less Al, Ti, and Cr in pyroxene. These changes, including the differences in bulk chemistry, are explained by near surface fractionation of olivine, pigeonite, and Cr spinel with the compositions of the observed phenocryst phases. DOE

N80-15016# Argonne National Lab., Ill.
REGOLITH LAYERING PROCESSES BASED ON STUDIES OF LOW-TEMPERATURE VOLATILE ELEMENTS IN APOLLO CORE SAMPLES
S. Jovanovic and G. W. Reed, Jr. 1979 28 p refs Presented at 10th Lunar and Planetary Sci. Conf., Houston, Tex., 19 Mar. 1979
(Contract W-31-109-eng-38)
(CONF-790381-1) Avail: NTIS HC A03/MF A01

The concentrations of Hg released at < or = 130 C in stepwise heating experiments on core samples from near the lunar surface increase with depth in response to heating of the surface which during the lunar day are examined. The steepness of the slopes and the depths to which the gradients extend are determined by the color, density and possibly the grain size of the soils. Earlier surface layers are identified and, in general, are in agreement with other indicators of such layers. Low temperature volatilized Br which exhibits trends that parallel those of Hg in a number of cases is studied. The coherence, especially in high temperature fractions, between these chemically dissimilar elements implies a common physical process of entrapment; possibly one related to the presence of vapor deposits on surfaces and to opening and closing of microcracks and pores. DOE

N80-15017# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
NOBLE GASES IN THE ATMOSPHERE OF VENUS, EARTH, AND MARS. THE PROBLEM OF THE ORIGIN OF PLANETARY ATMOSPHERES
M. N. Izakov 1979 27 p refs Submitted for publication
(PR-482) Avail: NTIS HC A03/MF A01

The Venus atmosphere noble gases concentration measurements, performed by means of the Venera 11 and Venera 12 spacecraft mass spectrometers, are presented. These results are used to study the origin of planetary atmospheres by comparing the relative abundance of noble gas isotopes in the atmospheres of terrestrial planets. It is concluded that the process of accretion of gas from the protoplanetary nebula formed most of the Venus atmosphere, a large part of the Earth atmosphere, and part of the Mars atmosphere. Author (ESA)

N80-15018# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
STRUCTURE OF THE MARS LOWER AND MIDDLE ATMOSPHERE BASED ON MARS 5 ULTRAVIOLET PHOTOMETRY DATA
V. A. Krasnopolsky, V. A. Parshev, A. A. Krysko, and V. N. Rogachev 1979 58 p refs
(PR-483) Avail: NTIS HC A04/MF A01

A two channel ultraviolet photometer at 2600 and 2800 A was installed on board the Mars-5 orbiter to study some important components of the Mars atmosphere, such as water vapor and ozone as well as temperature profiles, transport processes, and photochemistry in the lower and middle atmosphere (up to 60Km). One ozone layer and two aerosol layers were found. The ozone layer is 7 km thick and 35 to 40 km high, with a day density number of 10 to the 10th power per cu cm, decreasing by a factor of 3 in the evening. The upper aerosol layer apparently consists of ice particles, it is located at a height of 25 to 40 km in the morning and rises to 60 km in the evening. The lower aerosol layer has on upper boundary at 20 km and single scattering albedo of 0.25 at 2800 A and 0.4 at 2600 A. Author

N80-14154*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER 11 SATURN ENCOUNTER MISSION SUPPORT
R. B. Miller *In its* The Deep Space Network 15 Dec. 1979 p 24-27 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-15019# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 412, DECEMBER 1978. PART 1: PROMPT REPORTS, DATA FOR NOVEMBER 1978, OCTOBER 1978
Helen E. Coffey, ed. Dec. 1978 168 p
(PB-300877/8; SGD-412-Pt-1; NOAA-79011603) Avail: NTIS HC A08/MF A01 CSCL 03B

The alert period, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, spacecraft observations, coronal holes, inferred IP magnetic field polarities, mean solar magnetic field, solar wind measurements and Boulder geomagnetic substorm log are presented for November 1978. The daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar radio waves, cosmic rays, geomagnetic indices, and radio propagation indices are provided for October 1978. GRA

N80-15020# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 412, DECEMBER 1978. PART 2: COMPREHENSIVE REPORTS, DATA FOR JUNE-MAY 1978, AND MISCELLANEA
Helen E. Coffey, ed. Dec. 1978 83 p refs
(PB-300878/6; SGD-412-Pt-2; NOAA-79011604) Avail: NTIS HC A05/MF A01 CSCL 03B

The active regions, synoptic solar maps, solar flares, solar radio waves, and energetic solar particles and plasma are presented for June 1978. A synoptic chart, abbreviated calendar record, and regional flare index for May 1978 are provided. The solar radio waves for September 1978 and stacked magnetograms for selected events in 1977 are presented. GRA

N80-15021# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 419, JULY 1979. PART 1: PROMPT REPORTS, DATA FOR JUNE 1979, MAY 1979
Helen E. Coffey, ed. Jul. 1979 170 p
(PB-300836/4; SGD-419-Pt-1; NOAA-79082101) Avail: NTIS HC A08/MF A01 CSCL 03B

The alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, coronal holes, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, and Boulder geomagnetic substorm log data are presented for June 1979. The daily solar activity

center, sudden ionospheric disturbances, solar X-ray radiation, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices are provided for May 1979. GRA

N80-15022# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 419, JULY 1979. PART 2: COMPREHENSIVE REPORTS, DATA FOR JANUARY 1979, DECEMBER 1978
Helen E. Coffey, ed. Jul. 1979 99 p
(PB-300837/2; SGD-419-Pt-2; NOAA-79082102) Avail: NTIS HC A05/MF A01 CSCL 03B

The active regions, synoptic solar maps, solar radio emission, energetic solar particles and plasma, and solar X-ray radiation are presented for January 1979. Synoptic charts and abbreviated calendar records for December 1978 are provided. The miscellaneous data includes solar radio emission, daily solar activity center errata, cosmic rays, geomagnetic indices for April 1979, solar flares for December 1978, and regional flare index for November 1978. GRA

N80-14160*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER 1979: UPDATE TO THE RADIAL AND SOLAR CYCLE VARIATIONS IN THE SOLAR WIND PHASE FLUCTUATION SPECTRAL INDEX
A. L. Berman and A. D. Conteas *In its* The Deep Space Network 15 Dec. 1979 p 71-81 refs (For primary document see N80-14150 05-12)
Avail: NTIS HC A06/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-15023*# National Aeronautics and Space Administration, Washington, D. C.
POSSIBLE RADIO EMISSION MECHANISM FOR PULSARS
Yu. A. Kovalev Nov. 1979 25 p refs Transl. into ENGLISH of "Vozmozhnyy Mekhanizm Radioizlucheniya Pulsarov", Rept. Pr-326 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-25 Original language document was announced as A79-45277 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75715; PR-326) Avail: NTIS HC A02/MF A01 CSCL 03B

A mathematical model is presented and discussed as a possible mechanism to describe radio emission from pulsars. The model determines that the magnetic field in the neutron proton electron (npe) layer of a neutron star results from a quasistationary eddy current of superconducting and normal protons relative to normal electrons, which generates radio emission by the Josephson effect. The radiation propagates in the magnetically active medium, from the optically thick npe layer to the magnetosphere through breaks in the crust. As a result, hot radio spots form on the surface of the star, and a radiation pattern forms near the magnetic poles, the cross section of which gives the observed pulse structure. Due to the specific properties of the mechanism, variations of the quasistationary current are converted to amplitude frequency variations of the radiation spectrum. Variations of the fine structure of the spectrum pulse amplitude and spectral index, as well as their correlation are discussed. A.W.H.

N80-15024# Princeton Univ., N. J. Plasma Physics Lab.
PLASMA PHYSICS OF TRAPPING OF COSMIC RAYS AROUND SUPERNOVA
R. M. Kulsrud Jun. 1979 8 p refs Presented at 16th Intern. Cosmic Rays Conf., Kyota, Japan, 6 Aug. 1979
(Contract EY-76-C-02-3073)
(PPPL-1558; CONF-790836-1) Avail: NTIS HC A02/MF A01

Two problems associated with the question of whether a large number of cosmic rays produced in the early stages of expansion of a supernova bubble would be trapped in it are discussed. They are the determination of the manner in which the cosmic ray anisotropy and the Alfven wave energy density, driven unstable by this anisotropy evolve towards equilibrium balance and how the singularity associated with standard quasilinear theory for resonant interaction, which occurs for pitch angles near 90 degrees, are treated by inclusion of other nonlinear effects. A.W.H.

N80-14986*# Iowa State Univ. of Science and Technology, Ames.
X-RAY EMISSION FROM THE REGION OF GAMMA 195+5
R. C. Lamb *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 201-208 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B

N80-14987*# Northwestern Univ., Evanston, Ill.
DIFFUSE X-RAY EMISSION FROM ABELL CLUSTERS
Melvin Ulmer *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 209-213 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B

N80-14988*# Indiana Univ., Bloomington.
CORRELATED GROUND BASED OBSERVATIONS IN SUPPORT OF THE HEAO-1 X-RAY OBSERVATORY
Stewart Mufson *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 214-222 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B

N80-14990*# Middlebury Coll., Vt.
X-RAY IRON-LINE EMISSION FROM THE SN 185 REMNANT
P. F. Winkler *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 244-250 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B

N80-14991*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
OPTICAL IDENTIFICATION AND SPECTROSCOPY OF X-RAY SOURCES PRECISELY POSITIONED WITH A-3
Richard Griffiths *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 251-260 (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B

N80-14996*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
EINSTEIN OBSERVATIONS OF EXTENDED GALACTIC X-RAY SOURCES
F. D. Seward *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 368-389 refs (For primary document see N80-14977 05-88)
Avail: NTIS HC A20/MF A01 CSCL 03B

N80-14999*# Columbia Univ., New York.
COLUMBIA/EINSTEIN OBSERVATIONS OF GALACTIC X-RAY SOURCES
Knox S. Long *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 422-438 refs (For primary document see N80-14977 05-88)
(Contract NAS8-30753)
(Contrib-179) Avail: NTIS HC A20/MF A01 CSCL 03B

N80-15000*# Columbia Univ., New York.
COLUMBIA/EINSTEIN OBSERVATIONS OF EXTRAGALACTIC X-RAY SOURCES
William H.-M. Ku *In* NASA. Marshall Space Flight Center HEAO Sci. Symp. Nov. 1979 p 439-459 refs (For primary document see N80-14977 05-88)

(Contract NAS8-30753)
(Contrib-180) Avail: NTIS HC A20/MF A01 CSCL 03B

99 GENERAL

N80-15025*# Illinois Univ., Urbana. Aeronomy Lab.
RESEARCH IN AERONOMY Progress Report, 1 Oct. 1978 - 31 Mar. 1979
Belva Edwards, ed. 31 Mar. 1979 76 p refs Sponsored by NASA and NSF
(NASA-CR-162558; PR-79-1) Avail: NTIS HC A05/MF A01 CSCL 05B

Topics covered include planetary wave dynamics; nitric oxide and planetary waves in the lower ionosphere; ellipse launches; Nike Orion payloads, energy budget, energetic particles in the midlatitude and equatorial zones; electron density in the nighttime ionosphere; partial-reflection drift measurements in the D-region, the structure and variability of atmospheric tides; coherent scatter-radar; and a laser system for measuring the distribution of atmospheric sodium in the 80 km to 100 km altitude. A.R.H.

N80-15026# Department of Defence, Canberra (Australia).
AERONAUTICAL RESEARCH LABORATORIES Annual Report, 1977 - 1978
1978 95 p refs
(RM78/30107) Avail: NTIS HC A05/MF A01

Research and development in the areas of aerodynamic configurations and aeronautical engineering for design purposes and/or operational aspects of aircrafts is presented. Wind tunnel tests, materials tests, engine tests, and aircraft structural analysis are discussed. A.W.H.

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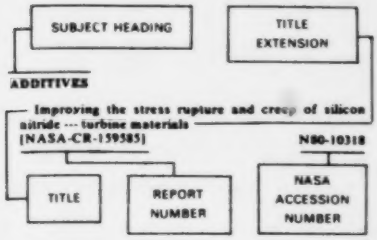

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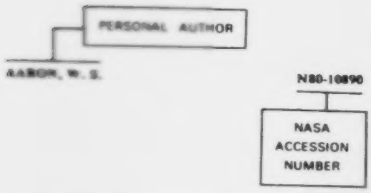

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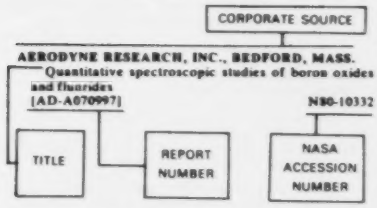

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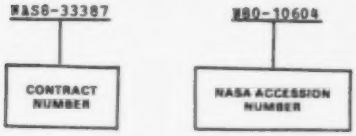

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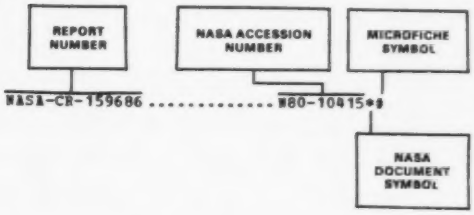

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SPECIAL NOTICE

A compilation of the summary portions of the Research and Technology Objectives and Plans *(RTOPS)* used for management and control of research currently in progress throughout NASA has been published under the title *Research Technology Objectives and Plans Summary, Fiscal Year 1980*. It is announced as accession number N80-15974, NASA-TM-80744, on page 810 of this issue of *STAR*.

RTOP SUMMARY FY1980, also should help expedite the NASA program of technology transfer to the private sector.

RTOP SUMMARY FY1980 may be purchased from the National Technical Information Service, Springfield, Virginia, 22161, for $9.25 in paper copy or $3.50 in microfiche. (The cost for customers outside the United States is $18.50). The accession number N80-15974 (NASA-TM-80744) should be specified when ordering this publication.

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For related information see also *Astronautics*.

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28 PROPELLANTS AND FUELS 722

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) 725

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 726

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 729

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 733

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 735

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 736

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 739

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 740

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 741

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) 744

43 EARTH RESOURCES 744

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 757

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 768

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 775

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 778

Includes weather forecasting and modification.

48 OCEANOGRAPHY 784

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 785

Includes genetics.

52 AEROSPACE MEDICINE 786

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 790

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 790

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 791

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 792

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS N.A.

Includes computer networks.

63 CYBERNETICS 794

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 795

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY N.A.

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 796

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS N.A.

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

70 PHYSICS (GENERAL) N.A.

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 797
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 798
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 800
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 803
Includes light phenomena.

75 PLASMA PHYSICS 804
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 806
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 809
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 810
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 811
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 812
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 812
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 812
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 814
Includes radio and gamma-ray astronomy, celestial mechanics; and astrometry.

90 ASTROPHYSICS N.A.
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 814
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 815
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION N.A.
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 816

Note: N.A. means that no abstracts were assigned to this category for this issue.

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NASA ACCESSION NUMBER → N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif ← CORPORATE SOURCE

TITLE → STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

PUBLICATION DATE

AUTHOR → D J Mourey 3 Sep 1979 409 p refs

CONTRACT OR GRANT → (Contract NAS1-15624)

AVAILABILITY SOURCE

REPORT NUMBER → (NASA-CR-159149) Avail NTIS HC A18/MF A01

CSCL 01C ← COSATI CODE

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A W H

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, NAVY ENVIRONMENT - TRI-TURBO PROP AIRCRAFT

B.M. Buck, Polar Research Lab. Inc., *123 Santa Barbara St., Santa Barbara, California* 93101 (DN975107; N00014-79-C-0002)

In response to the 5 year arctic planning guide AD OPNAV Inst. S3470.5, the arctic research program is shifting from the western arctic to the eastern arctic. This redirection requires a change in the traditional reliance on NARL and its fleet of short range aircraft. This proposal is to introduce the tri-turbo prop aircraft into use as a logistic support platform over a 3 year period from 1 March to 30 May.

This aircraft would be, as its capabilities are demonstrated, folded into the logistic support plans for FRAM I, subsequent field efforts in FY 80-85. The funds provided would configure the aircraft for polar operations including specialized land gear equipment, navigation and communications equipment and a cold weather package. The funds would provide about 270 flight hours per year over the three year period.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0002, INVESTIGATION OF TIME-VARIANT AERODYNAMICS OF HIGH TURNING BLADE ELEMENTS

S. Fleeter, General Motors Corp., Detroit Diesel Allison Division, *4700 W. 10th St., Indianapolis, Indiana* 46206 (DN890143; N00019-79-C-0087)

To obtain fundamental experimental data on unsteady aerodynamic phenomena in high inlet Mach number, large turning, turbine rotor cascade.

Fundamental data will be obtained at each of four operating points, such that both subsonic and transonic flow regimes are investigated. This data will include the blade surface steady-state, quasi-static and time-variant pressure distributions as well as the cascade steady state aerodynamic performance. All of the data obtained will be correlated with appropriate state-of-the-art predictions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0003, FRETTING FATIGUE IN THE PRESENCE OF OVERLOADS

J. Alic, Wichita State University, School of Engineering, Dept. of Mechanical Engineering, *1845 Fairmont N., Wichita, Kansas* 67208 (DF140960; AFOSR-77-3422)

Structural safety of USAF aircraft is a continuing problem. To insure that prescribed levels of safety are achieved, methods must be developed to account for crack initiation at latent damage sites. The objective of this study is to explore the applicability of equivalent initial quality (EIQ) concepts for modeling fretting fatigue initiated crack damage. These methods will lead to improved crack growth analyses providing increased safety and reduced cost of ownership for USAF aircraft.

The basic procedure will be to experimentally investigate the influence of load interaction on fretting fatigue. This will be accomplished by concentrating on the possible effects of residual stress fields at localized stress concentrations such as crack nuclei and microcracks. Fretting fatigue tests will be conducted with periodic tensile or compressive half-cycles of large load amplitude (overloads) spaced throughout an otherwise constant amplitude load sequence. The results will be compared with constant amplitude tests (without overloads). Quantitative information on crack growth rates as well as the apparent or equivalent initial flaw size of fretting damage will be acquired and presented in forms usable in design analyses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab

1.0004, VATOL FIGHTER STUDY

C. Martin, U.S. Dept. of Defense, Navy, Naval Ship Research & Development Center, Aviation & Surface Effects Dept., *Bethesda, Maryland* 20084 (DN878681)

To quantify the pilot performance required to fly vertical attitude takeoff and land (VATOL) aircraft, and the performance potential of this type aircraft in fighter/attack missions.

3-DOF and 6-DOF simulations will be made of the control system in the critical takeoff and landing modes. Performance predictions of conceptual aircraft will be made. Preparations for 6-DOF, moving base simulation will be made.

SUPPORTED BY U.S. Dept. of Defense, Navy, David W. Taylor Naval Ship Research & Development Center

1.0005, AN EXPERIMENTAL AND ANALYTICAL STUDY OF HELICOPTER AERODYNAMICS IN GROUND EFFECT 16061-E

H.C. Curtiss, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Sciences, *Box 430, Princeton, New Jersey* 08540 (DA0F9283; DAAG29-78-G-0194)

To investigate the aerodynamics of rotors in ground effect with particular emphasis on the influence of ground proximity on stability and control of helicopters. Relevance - the research is directly relevant to improving the stability and control of Army helicopters operating in the nap-of-the-earth environment.

An isolated helicopter rotor moving over a fixed ground plane in the Princeton Dynamic Model Track facility will be employed for the experimental investigations. Experimental measurements will include forces and moments acting on an isolated rotor in and out of ground effect, and surveys of the average air flow velocities in the rotor wake. Results will be analyzed and correlated with theory.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0006, FORWARD SWEPT WING V/STOL AIRCRAFT STUDY

D. Migdal, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890210; N00019-79-C-0435)

Recent developments in composite structures technology have indicated that it should be feasible to develop a forward swept wing of comparable weight as an equivalent aft swept

wing. Analysis and wind tunnel tests have shown the forward swept wing to have lower transonic drag, greater maneuverability and high natural spin resistance when compared with a conventional aft swept wing. In addition, the forward swept wing appears to offer added advantages for V/STOL applications. The objective of this work is to docuement the benefits of the forward swept wing concept applied to fighter/attack V/STOL aircraft.

The advantages of the forward swept wing concept will be evaluated initially through preliminary design studies, followed by small scale tests to determine suckdown losses (or gains) and control effectiveness using vanes in the jet blast. A preliminary simulator investigation of the estimated flying qualities, particularly with regard to translational/rotational coupling, will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0007, ACTUATION SUBSYSTEM EFFECTIVENESS ENHANCEMENT

G.D. Jenney, Dynamic Controls Inc., *Dayton, Ohio* (DF139940; F33615-77-C-3077)

Actuation subsystems now contribute over 50 percent of the total cost of the flight control system and account for a large share of the logistics support requirements of military aircraft. The objective is to reduce the flight control initial and life cycle costs by developing less complex systems more suitable for universal applications, developing lower cost component parts and developing criteria for increased commonality. Simpler componentry and modularization will reduce acquisition and life cycle costs. Particular emphasis shall be applied to the development of a basic 'fly-by-wire' redundancy scheme of superior performance for general application. The resulting 'predesigned' systems shall be optimized to exhibit improved reliability and maintainability. Matching the performance requirements of the aircraft with the control surface actuators will eliminate oversizing of actuators or sacrificing of performance at key portions of the flight envelope.

Investigate and develop techniques to simplify or eliminate major subassemblies, to promote modularization of actuators, to reduce component complexity and cost and to perform required functions (e.g. position and rate sensing) via alternate methods. Demonstrate the application of higher bandwidth actuators, investigate improved interfacing techniques, alternate redundancy schemes and methods for reducing life cycle costs for flight control systems. Set up and conduct evaluation tests, in the flight control actuation and hydraulic facility located in Building 145, Wright-Patterson AFB, on equipment such as integrated actuator package and integrated valve-actuator assemblies. In addition, wind tunnel test a flutter suppression actuator to evaluate advanced actuation equipment developed during a prior program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, ANALYSIS DEVELOPMENT FOR DYNAMICS DATA REDUCTION

P.G. Bolds, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF139060)

This work unit supports the functions of the vibration and aeroelasticity facility for providing analysis of dynamics data. The broad problem is to provide state-of-the-art capabilities required for the recovery, analysis, and presentation of dynamics data which describe the operating environment of military flight vehicles and assess the accuracy of analytical prediction methods. The objective of this work unit is to integrate hardware to increase data recovery capabilities and to develop software for the analysis system that will advance the existing analysis and graphics capabilities. This will result in improved performance and advanced capabilities in the analysis of vibration and acoustic problems that occur during military operations.

The dynamics data analysis process consists of four parts: (1) data recovery and analog analysis, (2) analog-to-digital conversion, (3) digital analysis, and (4) graphic data presentation. The capabilities in the data recovery and A/D conversion areas will be increased by optimizing and upgrading the existing system components and by integrating new hardware into the system. The data analysis and graphics capabilities will be advanced by developing software and digital processing techniques to apply more sophisticated analysis procedures and to provide more graphic data presentation formats to increase the overall interpretability of the analysis results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, HELICOPTER LIFE MONITORING FEASIBILITY BENEFITS ANALYSIS

Unknown, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DN890159; N00019-79-C-0069)

Identify the utility of in-service fatigue monitoring of Navy/Marine helicopters to acquire information concerning life expenditure of critical rotating and non-rotating components.

A study will be made up to evaluate the feasibility of life monitoring systems to gather information on the rate-of-damage-accumulation of critical structural and dynamic components based upon designed service information available for H-46 helicopters. Components suitable for direct and transfer function monitoring will be identified and a benefits/costs analysis will be conducted for various monitoring approaches.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0010, REPEATED ACCELERATION EXPOSURE EFFECTS

E. Hendler, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881086)

To determine the psychophysiological effects of repeated exposures to acceleration loads, as applied by the dynamic flight simulator (DFS) to volunteer human subjects.

Volunteer subjects shall be repeatedly exposed to predetermined levels, patterns and durations of acceleration loads using the DFS. Time between successive exposures shall vary from fractions of a minute to hours. Exposures shall be made on relaxed subjects as well as on subjects protected from acceleration effects (i.e. through the use of the anti-g suit M1 starting maneuver and reclined seat). Physiological and performance measures as well as clinical assessments shall be made before, during and after acceleration exposures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, PAN PRECURSOR - CARBON FIBER STRUCTURE RELATIONS

W.C. Tincher, Georgia Inst. of Technology, School of Textile Engineering, *Atlanta, Georgia* 30332 (DN975478; N00014-79-C-0523)

Carbon fibers with increased tensile strength, increased strain to failure, and decreased electrical conductivity are required for use in advanced aerospace systems such as nose tips, rocket nozzles, and carbon fiber reinforced composites used in military aircraft. To date there has been little systematic study of the influence of the composition and microstructure of the acrylic precursor fiber on the ultimate carbon fiber properties. Because the microstructure of the precursor fiber depends upon chemical composition, molecular weight, spinning conditions, and post-spinning treatments, a study will be undertaken to determine which parameters of the precursor fiber control the properties of the ultimate carbon fiber in order to permit fibers to be produced with improved properties at lower cost.

The Georgia Institute of Technology has equipment available to prepare the precursor polymer, spin fibers, stabilize the fibers, and carbonize the fibers. Facilities will be added to be able to graphitize the fibers. Comonomer type, copolymer composition, microstructure developed in fiber extrusion, and precursion orientation will be related to carbon fiber structure,

morphology, modulus strain to failure, tensile strength, and electrical conductivity. A team of four faculty members will combine their special talents, namely, polymer production, acrylic fiber spinning, carbon fiber processing, and microstructural characterization, to determine how precursor properties relate to the ultimate carbon fiber properties.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0002, ADVANCED AIRCRAFT STRUCTURAL SKINS

T.V. Hynes, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0H4679)

Previous research has evolved designs for lightweight/high strength skins which address a multiplicity of actual and potential blast, ballistic, radar and high-energy laser threats. This work unit will develop a specific design to meet the mechanical load requirements of the system and integrate specified levels of laser protection and significant levels of radar levels of radar camouflage. Designs will be fabricated and tested in panel configuration.

Mechanical requirements will be specified and an initial composite design developed based on the generic designs previously tested. An electrical design compatible with the mechanical configuration will be developed and the design relaxed to allow radar bandwidth and attenuation to be optimized. An improved mechanical design to meet flight load specifications and a second iteration of the design to re-optimize the radar properties will be made. The mechanical design will be constrained to be compatible with blast and ballistic protection. Materials will be chosen for high energy laser resistance.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0003, NAVY VEHICLE DESIGN AND CONSTRUCTION - RARE EARTH ADDITIONS TO TITANIUM ALLOYS

C.R. Whitsett, McDonnell Douglas Corp., Research Laboratory, *P.O. Box 516, St. Louis, Missouri* 63166 (DN675493; N00014-76-C-0626)

Titanium alloys are important lightweight structural materials for use in aircraft and ships. Alloy microstructure and mechanical properties can be controlled by effective use of alloying and processing. This research will explore the effects of rare-earth additions to titanium alloys.

The effects of rare earth additions to Ti-8Al, Ti-10Al and Ti-100 alloys will be determined. Erbium and yttrium additions (0 to 0.5 wt. percent) will be introduced to the alloys and structural changes correlated with mechanical properties, particularly tensile strength and ductility, toughness, hot workability, and creep strength.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0004, THE EFFECT OF PHOSPHORUS ON THE DEVELOPMENT OF THE STRUCTURE OF IRON METEORITES

J.I. Goldstein, Lehigh University, School of Engineering & Physical Science, Dept. of Metallurgy & Materials Science, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (EAR79-00995)

The major objective of this research is to measure the diffusion coefficients and solubility limits in the Fe-Ni and Fe-Ni-P system at temperatures less than 600 degrees C. STEM techniques will be used to obtain the compositions of the various phases which are less than 1 micron in size. These measured parameters will be used to understand the growth patterns of the Widmanstatten structure in iron meteorites. The second part of the research will try to experimentally grow the Widmanstatten pattern in P containing Fe-Ni alloys. A comparison of the composition gradients with calculated gradients using the computer simulation programs should establish the validity of the calculation scheme and should give a clearer picture as to how the Widmanstatten pattern forms during the slow cooling of the iron meteorites in their parent body.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, TURBULENCE STRUCTURE IN COMPLEX HEATED FLOWS

D.M. McEligot, University of Arizona, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Tucson, Arizona* 85721 (ENG79-07806)

Experimental and numerical studies of complex turbulent and transitional flows are conducted. Three situations are examined: (1) vertical air flow through a circular tube with strong heating, (2) a radially converging flow of water or air between two parallel plates, and (3) periodic, recirculating flow between baffles. The goal is to develop the ability to predict mean temperature and velocity profiles and wall parameters, such as heat transfer coefficients and friction factors, reliably in turbulent and transitional flows subject to the following important complications: interacting shear layers, lateral convergence, buoyancy or streamline curvature, longitudinal acceleration and severe variation of molecular transport properties. Time-mean distributions of the velocities, temperature, Reynolds shear stress and turbulence heat flux are measured with hot wire anemometry, laser Doppler anemometry and resistance thermometry in conjunction with digital data acquisition. The wall region and its viscous (buffer) layer are emphasized. These data are compared to existing turbulent predictive methods and documented to serve as useful tests of advances in turbulence models hypothesized later.

This research continues work carried out under NSF Grant No. ENG-7303513.A03.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0002, VORTICITY MEASUREMENTS IN TURBULENT SHEAR FLOW

P.E. Dimotakis, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (ENG7810246)

A single component vorticity measuring device, using Laser Doppler velocimetry techniques will be developed and utilized to make preliminary vorticity measurements of coherent structure in turbulent free shear layers. An understanding of the dynamics and entrainment characteristic of such flows can contribute to advances in combustion engineering and jet noise reduction.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0003, SEMICONDUCTOR OPTOELECTRONICS

A. Yariv, California Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Applied Physics, *1201 E. California Blvd., Pasadena, California* 91109 (ENG79-09972)

The goal of this research program is the realization of integrated optoelectronics for use in high speed, terrestrial optical communication systems. Toward achieving this goal, the following tasks are being pursued: (1) Monolithic integrated optoelectronic circuits on semi-insulating gallium arsenide; (2) The behavior of semiconductor injection lasers under conditions of direct modulation in the multi-gigahertz regime; (3) New laser configurations on semi-insulating substrates; (4) Quaternary alloy photodiodes in the 1.1-1.3 micron range; (5) Fabrication of microwave quatenary alloy amplifiers.

This research was previously supported under NSF Grant ENG76-04927 AO3.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0004, INVESTIGATION TO DETERMINE THE FEASIBILITY OF APPLYING THE SMIDS CONCEPT TO THE M-65 TOW GUIDED MISSILE ARMAMENT SUBSYSTEM
R. Depaul, Detex Systems Inc., *17871 Santiago Blvd., Villa Pk. Suite 221, Orange, California* 92667 (DA0E3865; DAAK51 79 C 0013)

The objective of this study is to determine the feasibility of applying the SMIDS concept to the maintenance of the M-65 tow missile subsystem of the AH-1S aircraft.

This objective will be accomplished by a detailed study of the functional elements of the M-65 subsystem and by describing the maintenance procedures of these elements at the three levels of maintenance now used in the Army system. A determination as to the feasibility of applying SMIDS at these levels will then be made.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

4.0005, Q BAND 250W TRAVELING WAVE TUBE DEVELOPMENT
J. Vaszari, Hughes Aircraft Co., *3100 W. Lomita Blvd., Torrance, California* 90509 (DN987685; N00123-77-C-0900)

Develop a Q band 250 watt traveling wave tube (TWT) for use as a transmitter for EHF SATCOM systems. This contract supports dn988682.

Design and fabricate six TWT's with design iterations for each two tubes. Perform life and environmental tests on two tubes.

SUPPORTED BY U.S. Dept. of Defense, Naval Ocean Systems Center, Electronics Engineering & Sciences Dept.

4.0006, FLAT BUS FAULT SENSORS
E. Young, Rockwell International Corp., Autonetics Division, *3370 Miraloma Ave., Anaheim, California* 92803 (DN981064; N62269-78-C-0213)

To investigate and develop an electric power distribution fault sensing technique for use on the 270 v dc two wire ungrounded power distribution system for operation in composite aircraft structures. This contract supports work unit ZA601, Agency Accession No. DN681080.

To study system hazards of lightning, EMP radiation and electric system faults to establish an operational philosophy for the 270 v dc system for operation in composite aircraft structures. With this operational philosophy investigate and develop fault sensors for use on the electric power system utilizing flat bus electric power conductors.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0007, DISTRIBUTED AIRBORNE INFORMATION PROCESSING SYSTEMS ARCHITECTURE
H.F. Wong, U.S. Dept. of Defense, Navy, Naval Electronics Lab. Center, Communication Processing Div., *San Diego, California* 92152 (DN787559)

Investigate the problem of control for a distributed information processing architecture which can readily adapt to and recover from hardware failures.

Review latest distributed processing architecture advances. Update the distributed architecture design developed by NELC and UCLA. A distributed processing laboratory model will be implemented for detailed investigations of distributed control, fault detection and system recovery techniques. An airborne application will be investigated for possible implementation with the laboratory model.

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0008, SYSTEM PERFORMANCE
K. Yao, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Systems Science, *405 Hilgard Ave., Los Angeles, California* 90024 (DN675573; N00014-76-C-0875)

The objective of this project will be to develop analytic methods to measure and predict the reliability of naval communications links.

The technical approach is theoretical and analytical with experimental validation of the performance measures and predictions. Analytical results obtained for several specific systems characteristics will be extended to nonlinear satellite systems, noncoherent detection systems, and the robustness of the technique will be evaluated by testing the results in the presence of non-Gaussian noise. The mathematical tractability of the moment-space error bounding technique will be evaluated as well as the adaptability of the technique to shift its own parameters in real time to optimize the signal to noise ratio on the link.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, CARS INVESTIGATIONS IN TURBULENT, SOOTING FLAMES
A.C. Eckbreth, United Technologies Corp., Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DN975394; N00014-79-C-0351)

The objective of this research program is the development of a remote, spatially precise, in-situ diagnostic technique capable of measuring temperature probability distributions over a broad range of combustor operating conditions. The polarization properties of coherent anti-Stokes Raman spectroscopy (CARS) is under investigation in an attempt to reduce or cancel the nonresonant susceptibility contributions to the CARS signal which limit species detectability levels. This information is needed to enhance modeling theories and to provide understanding necessary for improved empirical engine design procedures, combustion efficiency, and component lifetime and to reduce pollutant formation in jet engines.

Currently, experiments are being conducted with CARS utilizing sooting flames. To eliminate possible complications from turbulence, steady laminar flames are utilized. Following this, studies will be extended to unsteady, turbulent sooting flames.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, WEAPONRY - TURBULENT STRUCTURE DETERMINATION BY RAMANOGRAPH
R.K. Chang, Yale University, Graduate School, Dept. of Engineering Science, *206 Elm, New Haven, Connecticut* 06520 (DN975315; N00014-79-C-0254)

The objective of this work is to investigate by Ramanography, (1) the species concentration profile of reactive and nonreactive gases emerging from well characterized nozzles under turbulent and nonturbulent conditions, (2) develop pulsed Ramanography for instantaneous studies on large scale structures and entrainment in the turbulent mixing layer, and (3) measure the instantaneous temperature of combustion flames under equilibrium and nonequilibrium conditions. This experimental data on well characterized nozzles and new measurement techniques is needed for the study of combustors, turbine and nozzle entry flows, and engine exhaust flows, all to provide understanding to enhance future design of jet engines.

Raman and MIE scattering will be detected by a low light level TV camera to obtain instantaneous and simultaneous recording of concentration profile.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0011, NETWORK STUDY FOR INTRA-TASK FORCE COMMUNICATIONS
N. Kyriakipoulos, George Washington University, School of Engineering & Applied Sciences, Dept. of Engineering, *725 23rd*

St. N.W., Washington, District of Columbia 20037 (DN880377; N00173-78-RQ-07134)

To investigate two new multiple access schemes for applicability to intra-task force networking. Compare each scheme with standard multiple access schemes.

Among the various multiple access schemes used or considered in packet radio and satellite communications at least two have been developed to fit the special requirements of naval intra-task force communication networks. These two are the stochastic TDMA (STDMA) and the interleaved-frame reservation-contention (IFRC) schemes. The analysis of these schemes has progressed considerably. The purpose of this task is to evaluate the performance of these two schemes and compare each to the performance of standard/multiple access schemes such as TDMA and slotted ALOHA, and their variants. Since the analysis is primarily based on Poisson user statistics, a simulation study will be performed on the robustness of the performance of the different schemes relative to the Poisson assumption.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0012, ADVANCED TECHNIQUES IN ORBIT DETERMINATION

B. Kaufman, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980002)

The purpose of this effort is to apply advanced techniques in celestial mechanics to the problems of accurately determining and predicting satellite orbits. These methods will be incorporated into an orbit determination program capable of accurately and rapidly determining the orbit from observational data. The techniques to be developed appear to offer the high accuracy of numerical approaches. The computational speeds approach those of analytical methods and provide great flexibility in physical modelling.

The approach to be utilized in this effort is that of the method of averaging which is a semi-analytical method. Analytical single averaging will be used to eliminate the short period terms in the disturbing function. The equations of motion will then be numerically integrated. The averaging will allow the integration to use much larger step sizes thereby greatly increasing the speed. Recovery of the short period terms will be done in a recursive mannner to obtain the desired accuracy. Formulation of the disturbing forces due to drag, asphericity of the earth and third body disturbances will be investigated in order to obtain the optimum formulation for speed and accuracy. The choice of a numerical integration program will be made based on the characteristics of the equations of motion in order to obtain a method that is best suited to the large step size that will be used. A matching interpolator will be used to obtain the solution at intermediate times.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0013, RADIATION HARDENING OF POWER SYSTEMS

R.L. Statler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980059)

The objective is to develop the technology for improved, hardened primary power systems for remote military applications such as earth-orbiting satellites and strategic and tactical applications relating to surveillance, communication, and weapon systems. The near term objectives are to compare technical advantages and limitations of state-of-the-art non-fossil fuel power sources, such as radioisotope thermal generators, thermal electric and photovoltaic. The hardness of these energy sources will be assessed for particle and gamma radiation environments.

Comparative parametric studies of various state-of-the-art power sources will be made in connection with specific operating environments, including space and terrestrial. Limitations in the adaptation or utilization of power source options will be determined. Data from unattended prolonged operation will be analyzed. Radiation hardness of power source materials will be investigated by analysis and experimental investigation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0014, THEORETICAL ANALYSIS OF AFTERBODY DRAG OF ROCKETS DURING BALLISTIC (UNPOWERED) FLIGHT PHASES

H.H. Korst, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical & Industrial Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

The approximate method of sequential centered expansion is utilized to establish the inviscid supersonic flow field past axisymmetric forces and afterbodies including the slipstream configuration along the near wake. Special attention is given to viscous jet mixing within the transitional (dual layer) shear region along the wake boundary and to the refinement of closure conditions involving the pressure rise near the end of the wake and the recirculating flow within the near wake. Solutions for the base pressure and overall afterbody drag are determined which include the effects of sting interference, base bleed, internal and external heat addition and external wake interference. Extensive computer programs have been developed which are utilized to evaluate the merits of this analysis through comparison with experimental data.

SUPPORTED BY University of Illinois

4.0015, UNSTEADY LIFTING SURFACE THEORY

J.E. Yates, Aeronautical Research Associates of Princeton Inc., *50 Washington Rd., Princeton, New Jersey* 08540 (DN675261; N00014-77-C-0616)

The development of accurate methods for the calculation of unsteady loads on wings is essential for the prediction of their response to gusts, and for the prediction of their aeroelastic behavior. The objective of this research is to extend inviscid unsteady aerodynamic theory for thin airfoils to include viscous effects at the trailing edge, and then to extend this result to three-dimensional wing theory.

Unsteady analyses for aerodynamic design have been based largely on inviscid linearized theories which incorporate Kutta condition modeling. This research is directed to the development of a thin, viscous airfoil theory to better describe the flow about airfoils and about wings in general. The equations of motion used in thin airfoil theory will be modified to include the viscous terms and a solution of the resulting equations sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0016, STUDIES OF THE EQUATORIAL IONOSPHERE

D.T. Farley, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (ATM73-06598 A03)

This grant funds experimental and theoretical work on ionospheric irregularities and plasma instabilities. In particular, it funds: 1. a study of the neutral temperature and the east-west wind velocity in the electrojet region (i.e., around 100 km), using a recently installed multiple-beam antenna array and radar system at the Jicamarca, Peru, incoherent-scatter radar facility; 2. upgrading of the Jicamarca facility to allow more accurate measurements of the winds and temperatures; and 3. studies of equatorial spread F, and of the plasma instabilities responsible for the spread F. Completion of these studies will add significantly to our understanding of some of the processes at work in the atmosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0017, SIGNIFICANCE OF LARGE SCATTER OF COMPOSITE PROPERTIES TO RELIABILITY OF AIRCRAFT STRUCTURES

P.C. Chou, Drexel University, School of Engineering, Dept. of Mechanical Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (DN981096; N62269-78-C-0267)

To assess the adequacy of current structural design practices based on experience with metallic structural materials to structures constructed of advanced composite materials. Develop guidelines for future design criteria and structural validation testing to insure the adequacy of composite aircraft structures. This contract supports work unit DG 602, Agency Accession No. DN 133126.

A statistical parametric study will be conducted for a hypothetical fleet of aircraft using typical composite strength properties. Certain critically flawed structural locations will be assumed to exist in each aircraft and different series parallel arrangements of these flaws will be considered. The number of aircraft failures will be calculated for different confidence levels.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0018, RESEARCH INITIATION - INSTABILITY MEASUREMENTS IN HIGH SPEED SUBSONIC JETS

G.L. Morrison, Texas A & M University, College Station Campus, School of Engineering, Dept. of Mechanical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (ENG79-08002)

The noise produced by a jet of air is one of the major noise problems confronting the United States at this time. To date, the most commonly used method to reduce noise has been the reduction of the exit velocity of the jet since the acoustic power output is proportional to U^8 (where U is the exit velocity of the jet). Therefore, other methods of noise control are being sought. These other methods have been, to a large extent, simply trial and error since the noise production mechanisms are not fully understood. It therefore appears that in order to more effectively reduce noise emissions with minimal economic costs and performance losses one must know the noise generation mechanism.

There are several theories which hypothesize that the large scale organized flow fluctuations (coherent structure) in the jet are of fundamental importance in the noise generation process for both subsonic and supersonic jets.

An experimental investigation will be carried out to examine coherent structure in high speed subsonic jets (0.7 less than or equal to M less than or equal to 0.9) and determine its role in the development of the flow field. Subsequent experiments will measure the noise radiated by the jet and determine the amount of noise radiated by the coherent structure and the manner in which it propagates away from the jet. From this information, the importance of the coherent structure in the production of jet noise may be determined.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0019, COMPUTATIONAL TRANSONICS

G.F. Carey, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: A program of research in transonic airfoil computations has been initiated and is directed both to the underlying theoretical formulation of this compressible flow problem and also practical computations. A variational principle suitable for finite element analysis of shockless transonic airfoils has been devised (to appear in Journal of Computational Methods in Engineering). A finite element program has been developed and numerical studies are now being conducted at low and moderate Mach numbers for full potential flows with small supercritical regions. Convergence studies at various Mach numbers are being explored, particularly at the higher mixed flow levels. Mr. Pan presented some preliminary studies and numerical results at the Southwest Graduate Student Symposium during March 1978.

SUPPORTED BY University of Texas

4.0020, MECHANICS OF TERRESTRIAL PENETRATOR

C.H. Yew, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

Although our country has sent astronauts to the moon and brought them home safely, and has soft-landed successfully spacecrafts on the surface of Mars, the most economical means for the future geological exploration of these planets appears to be the use of high speed terrestrial penetrators. The penetrator, equipped with proper soil property investigation package, can be dropped to the target area by some proper means. Since the penetrator approaches the target with a high velocity, it penetrates deeply into the target. The tail section of the penetrator can be so designed that it would separate from the body of the penetrator and be left on the surface of the target to be used as a signal transmitting and receiving station. Once the penetrator is in the soil, the onboard instrument can be instructed to perform the necessary experiments and to send the results to the remote monitoring station. In principle, a great many in situ experiments on the soil property can be performed if a group of penetrators can be dropped into the general area because, with proper design, the penetrators can be made to communicate with each other and thus to be used as a signal generator as well as a signal receiver in the soil proper experiment. By doing so, the terrestrial properties of the general area can be obtained. It should be pointed out here that since the penetrator penetrates deeply into the soil, the use of the penetrator provides a convenient means of obtaining the soil properties at a depth; and since the penetrator is situated deeply in the soil, it would be better protected than the surface instruments. The present research is to develop a method for estimating the magnitude of force exerted on the penetrator resulting from high speed impact.

SUPPORTED BY University of Texas

4.0021, EXPERIMENTAL DEFINITION OF TOP-MOUNTED INLET FLOW FIELDS

W.W. Rhoades, Vought Corp., Advanced Tech Center Inc, *P.O. Box 5907, Dallas, Texas* 75222 (DF139550; F33615-78-C-3003)

Recent investigations of technology development needs for future air-to-surface fighters suggest that combat survivability can be enhanced significantly by reducing radar cross-section. Top-mounted inlets can reduce radar visibility of aircraft. They also facilitate aircraft weight reduction and improved weapon integration. In order to generate top-mounted inlet design criteria, flow fields approaching the inlet must be known. The objective of this program is to generate flow field data typical of top-mounted inlet installations on air-to-surface aircraft.

Existing wind tunnel model hardware will be modified as necessary and tested from Mach 0.9 to 2.0 in the AEDC PWT 4T facility over a representative set of maneuver attitudes. The model will facilitate testing with variations of leading edge geometry and canopy-fuselage intersection in order to explore a variety of flow fields. A remotely actuated cone probe will be used to define inviscid flow properties on one side of the model while boundary layer rakes gather viscous data on the opposite side. The contractor will provide reduced data to USAF engineers who will analyze the data and present the results in a USAF report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, VIKING CARTOGRAPHY

H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-00988)

Publication of two controlled mosaics of the Chryse Planitia Region of Mars, which includes the area where the Viking 1 spacecraft landed, has completed the Viking landing site series of maps. Chryse Planitia, one of the lowest areas on Mars, ap-

pears to have been the cachement basin for several large martian channel systems.

The Sinuous Channel, Bahram Vallis, and smaller dendritic channels, Vedra and Maumee Valles, cut the highlands of Lunae Planum to the west of the Chryse lowland plain. The four largest martian channels, Ares, Tiu, Simud and Shalbatana Valles, rise in the southern highlands region south of these map areas. Notched mare ridges, tear-shaped 'islands', and braided and scoured areas, indicate that the surface has been modified by fluvial erosion near the landing site, which is as much as 300 km from the channel source areas.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0002, MARS STRATIGRAPHIC STUDIES

D.H. Scott, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02370)

Stratigraphic studies along the plains-highlands boundary will be continued in places where good quality Viking photos are available. The work will be extended to the north along the boundary between the lowland plains and mottled terrain which nearly encircles the planet above 55 degrees N latitude. Morphologic characteristics of the mottled terrain are not clearly distinguishable and Viking images may require special processing for the subdivision of this large unit into several lithologic categories. Stratigraphic correlations will be made between various rock units forming the lowland plains; these relationships will be compared with crater frequency distributions calculated for the individual units.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0003, MULTIWAVE AEROSOL LIDER

R. Schotland, University of Arizona, School of Liberal Arts, Dept. of Atmospheric Sciences, *Tucson, Arizona* 85721 (DN975354; N00014-79-C-0313)

If this atmospheric aerosol remote sensing system can be demonstrated, it will be possible to predict the effects of aerosols on naval electrooptical surveillance and weapon guidance systems.

Several different wavelength lidars will be used to show the feasibility of a remote sensing system to determine atmosphere particulate size distributions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0004, NAVY ENVIRONMENT - CONSULTING AND GUIDANCE FOR NORTH SEA REMOTE SENSING EXPERIMENT

O. Shemdin, (No Performing Organization Reported), *California* (DN875510; N00014-78-C-0438)

The objective of this effort is to insure the proper coordination and experimentation in the multinational North Sea Experiment so that we can derive the maximum new knowledge on coastal geography and shallow-water oceanography and on satellite application in maritime remote sensing from this total experiment.

Approximately eight nations with more than thirty groups will apply satellite data, instrumented aircraft, ships, buoys and measurements from three or two research platforms in the sea and from islands during two months in the fall of 1979. Dr. Shemdin, under this contract, will be tasked to conduct negotiations, by telephone, correspondence and travel (including overseas) for the preparation of this experiment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0005, REMOTE SENSING APPLICATIONS TO ALUNITE RESOURCES, NEVADA

R.P. Ashley, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9320-01941)

STATE TO WHICH PROJECT PERTAINS: Nevada.

The project objective is to develop a semiquantitative tool for mapping variations in total alunite/clay content in hydrothermally altered rocks, using aircraft scanner images for spectral bands at 1.6 and 2.2 microns. Field and laboratory spectral reflectance data and preliminary petrographic data show that the depth of absorption at 2.2 microns (measured by the ratio of bands at 1.6 and 2.2 microns) is proportional to the total amounts of these minerals present. The task remaining is to attempt, using additional petrographic and chemical data, to better quantify the relationship between reflectance characteristics and percentages of these minerals.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, MEASUREMENTS OF NATURAL RADIOCARBON

H.E. Suess, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (EAR78-15183)

This is a continuation of research previously supported by NSF grant EAR76-22623. The objectives of the research are (1) to determine the character of the secular variations of the atmospheric radiocarbon level in order to elucidate the causes of these variations, and (2) to establish the absolute radiocarbon time scale. Far reaching conclusions from this research can be expected concerning problems of climatology and the global carbon cycle. In the field of oceanography, investigation of banded corals will give information of upwelling conditions of the past. Also, determinations of sedimentation rates will be continued. Contributions to archaeological research include work on calibrated radiocarbon dating in general and the dating of Neolithic sites in particular.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0007, RESEARCH AIRBORNE

F.C. Frischknecht, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9780-00353)

A coil assembly for a ground-transmitter-airborne receiver EM system will be developed and installed in the tail boom of the survey's Fairchild Porter aircraft. Preliminary tests of the hybrid EM system will be made using components of an existing ground based ELF system. Scale model studies of the system will be carried out.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0008, THERMAL MODELING INVESTIGATIONS

K. Watson, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9790-01703)

To extend the theoretical thermal model to more complex geological situations including topographic and surface roughness effects, to develop the computer methodology for registration of aircraft images acquired at different times in diurnal cycle and to complete aircraft/scanner modifications for navigation, spectral response and multichannel digitizing.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0009, DISTRIBUTION OF LAVA FLOWS IN THE THARSIS REGION OF MARS

D.H. Scott, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *Box 25046 MS939, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9580-02358)

Geologic mapping of lava flows in the Tharsis region will be extended from Arsia Mons to those emanating from the other large volcanic centers including Pavonis, Ascraeus, and Olympus Montes. This mapping will cover parts of Lunae palus, Arcadia, Diacria, Amazonis, Memnonia, Phaethontis, and Coprates quadrangles. Crater distribution and thickness measurements

will be made for individual flows and their probable source vents determined. Work will be compiled on the new series subquadrangle maps at a scale of 1:2 million.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0010, CLOUD TOP TEMPERATURE MONITORING

O.H. Foehner, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *Federal Ctr., Mail Stop 913, Denver, Colorado* 80225 (E-0036)

STATES TO WHICH PROJECT PERTAINS: California and Nevada.

An objective wide area analysis of cloud top temperatures and mesoscale features will be obtained for several intensive case study periods during the winter of 1978-79 in the Sierra Nevada as part of the Sierra Cooperative Pilot Project. These analyses will use digital imagery collected from the GOES-West satellite by the Colorado State University direct readout ground station. Ditital radar, rawinsonde, cloud physics instrumented aircraft, snowgage, and dual-Doppler data will supplement the analyses of satellite imagery to determine the three-dimensional structure and major precipitation producing characteristics of the orographic systems affecting the Sierra Nevada. Analysis of cloud top temperature will be used to define the temporal and spatial extent of the seeding temperature 'window.' Mesoscale features observed in the satellite imagery will be related to the location, time, and intensity of precipitation in the SCPP. These two analyses of digital satellite imagery will: (1) improve our understanding of winter orographic systems, (2) enable us to develop better methods to enhance precipitation from these systems and (3) improve the statistical design of these experiments to filter out the large mesoscale natural variability.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0011, HYDROLOGY OF ESTUARINE INTERTIDAL ENVIRONMENTS

J.L. Glenn, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Bldg. 53 Denver Federal Ctr., Mail Stop 415 Box 25046, Lakewood, Colorado* 80225 (CR 74-097)

Estuaries are subject to natural and artificial stresses that combine to threaten their continued utility to man. Many estuaries are filling with sediments from external (rivers and the ocean) and internal (shore erosion and biological production) sources. As a result, navigation often is difficult or impeded, maintenance of navigational channels is costly and continually necessary, and the value of recreational and commercial fisheries is diminishing. Estuarine intertidal and supratidal environments are particularly subject to man-induced stresses which directly alter valuable nursery and feeding grounds for many desirable forms of estuarine life.

(1) To establish and to evaluate qualitatively and quantitatively the sources of sediments in estuaries, with initial emphasis on the intraestuarine (intertidal and supratidal) source(s); (2) to characterize the nature and composition of sediments in, from, and beneath intraestuarine sources as an aid to understanding erosional, transportational, and depositional phenomena; (3) to document changes in intraestuarine sources as a result of man-induced stresses and to relate the changes to causative factors; (4) to provide data for making more intelligent predictions of the effects of nature and man in estuaries.

Aerial photographs and hydrographic and topographic data will be combined with field observations and samples in a reconnaissance survey of sedimentologic, geomorphic, and biologic attributes of intraestuarine sources. The stratigraphy of source areas will be investigated to aid in reconstructing the course of events that produced the present environments and in predicting the future course of events. Detailed field studies of modern sediment erosion, transport, and deposition in selected source areas will follow the stratigraphic phase and will be accompanied by laboratory determinations of the nature and composition of surface, subsurface, and suspended sediments. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0012, SERVICES OF POLAR STAR AND GLACIER, ANTARCTIC SEASON 1978-79

R.H. Overton, U.S. Dept. of Transportation, U.S. Coast Guard, *400 7th St. S.W., Washington, District of Columbia* 20590 (DPP77-01365 A02)

Annually, the U.S. Coast Guard has deployed icebreakers to Antarctica to break a ship channel (about 20 miles) through the ice into McMurdo Station. Once the channel is broken and cleared of floating ice, the supply tanker and the stores ship can enter McMurdo Sound and off-load the fuel and other logistics support materials for the annual resupply of Pole Station, Siple Station, and McMurdo Station. Normally, this is a two icebreaker operation in case one of the icebreakers becomes beset in the ice.

While the supply ships are transiting the ice channel, they are escorted or tended by one icebreaker in case the channel refills with floating ice. The second icebreaker is free to support science projects which can be in the Ross Sea and/or the Weddell Sea. These projects are sometimes in the open ocean but more frequently take place at the edge of, or inside, the heavy ice pack.

The Foundation pays a user charge for the icebreaker services.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0013, FIELD MEASUREMENTS OF MESOSCALE WEATHER SYSTEMS

J.J. Stephens, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Meteorology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (ATM7827420)

The primary goal of this research is to develop comprehensive data sets that serve to (1) verify numerical mesoscale models and provide real data model initialization and (2) yield statistics suitable for the experimental design of a complete mesoscale experiment. During the first year support is provided for the analysis of previous data and for the collection and reduction of data from two Doppler radars, an automated mesoscale surface meteorological network, and two meteorologically instrumented aircraft which are participating in SESAME (Severe Environmental Storms and Mesoscale Experiment) in Oklahoma during the spring of 1979. Additional radar, surface, rawinsonde and aircraft data will be available from other SESAME participants and will be included in the subsequent comprehensive data sets and their analysis. In addition to providing unique data sets for numerical modeling studies the observational program will provide data to develop improved experimental designs for future mesoscale experiments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0014, EVALUATION OF REMOTE-DATA ACQUISITION SYSTEMS IN WEST-CENTRAL FLORIDA

W.M. Woodham, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tampa, Florida* (FL 76-263)

Increasing number of developments on water-front property that is subject to frequent and severe flooding and demands being placed on available water resources in west-central Florida require current hydrologic information on existing ground and surface water conditions in the Southwest Florida Water Management District. Current hydrologic data must be available for water managers to protect local and regional water resources. Current data needs include water levels of key lakes and over developed well field areas, and monitoring extreme flow conditions.

Objectives include acquisition, testing, and evaluation of a telemeter system composed of satellite and land-line telemeters. Results obtained in this evaluation will be used as bases for developing a large-scale telemeter system for the Southwest Florida Water Management District.

Battery powered digital telemeters will be obtained and operated at key data stations. Six telemeters will be operated via

GOES Satellite, two by LANDSAT Satellite, and one by telephone line. Telemetry data will be processed on the Survey computer system and a locally owned minicomputer. Operational characteristics of the system will be evaluated and a brief report prepared.

Network stations installed and operated during year include 5 additional GOES Satellite Convertible Data Collection Platforms (CDCP). A total of 6 CDCPs, 2 LANDSAT, and 1 land line telemeter were operational by end of FY78. Telemetry data are continuing to be evaluated and report is in review process.

Continue evaluation of data from present network and prepare a final report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0015, EXPERIMENTAL SATELLITE DATA COMMUNICATIONS BETWEEN SHIPS AND SHORE

O.B. Brown, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, Dept. of Meteorology & Physical Oceanography, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (OCE78-07802 A01)

This award will provide the support for the second year of an experimental ship-to-shore message and data handling communications system. The program is testing the feasibility and utility of real-time data and voice communication via the ATS satellite in the conduct of oceanographic research and operations. A principal function of the grant will be to provide support for the University of Miami to act as liaison between NASA and the academic fleet to facilitate and coordinate use of the ATS system.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0016, SEA-AIR EXCHANGE (SEAREX) - PHYSICAL ASPECTS OF SEA-AIR EXCHANGE BUBBLES AND SPRAY

E.B. Kraus, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, Dept. of Atmospheric Sciences, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (OCE79-14616)

The SEAREX project is a multidisciplinary study of materials transport across the air-sea interface. Investigators will test the hypothesis that a major fraction of pollutants introduced to the ocean and atmosphere is removed by particle scavenging. Sampling stations at Enewetok in the North Pacific and American Samoa in the South Pacific provide equatorial coverage of a major ocean away from human activities. Aerosol compositions will be measured at these stations, and estimates will be made of net transport to the ocean during times covering both wet and dry seasons. Results from these studies will provide the first measures of fluxes of substances representative of the uncontaminated marine atmosphere. Sources of these substances will be determined and processes controlling their exchange across the air-sea interface will be studied.

The SEAREX project is conducted by investigators from ten research institutions as follows: University of Rhode Island, California Institute of Technology, Centre National de la Recherche Scientifique, Yale University, Woods Hole Oceanographic Institution, Texas A & M University, University of Miami, University of Connecticut, University of Illinois and the University of East Anglia. Coordination with GAMETAG (Global Atmospheric Measuring Experiments on Tropospheric Aerosols and Gases) will continue.

This award supports studies of bubbles and spray in various sea states and their role in the production of sea salt aerosols. Measurements will be made of number density, size, residence time, displacement from the surface and changes in the near-surface aerosols. Additional meteorological support will be provided by this award using information from weather satellites.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0017, NAVY ENVIRONMENT - SEDIMENT DYNAMICS OF A MACROTIDAL COASTAL EMBAYMENT

D. Nummedal, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Geology, *University Station, Baton Rouge, Louisiana* 70803 (DN875690; N00014-78-C-0612)

The objective of this task is to delineate, and subsequently model, the dynamic behavior of intertidal and subtidal sand bodies in a high-tide coastal environment of low offshore lope gradient. Such environments comprise an important class of coastal environments as a whole and include several strategic regions in which Navy and Marine Corps forces could be called upon to undertake operations.

Field research will concentrate on the short-term (hours to days) variability of sand features with lesser emphasis on the long-term (months to years) variations. Sand structure will be mapped on an hourly/daily basis using beach survey tools, fathometer, and aerial photography. Extensive hydrographic measurement of select areas will be made during spring, mean, and neap phases of the tide. Direct determinations of sand transport will be made with dye tracers and bedform trenching. Tide and meteorological data will be acquired from coastal observation stations of the local government. The field site chosen for this work is the German Bight between Ringkobing, Denmark, and Den Helder, Netherlands.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0018, SEASAT PROGRAM - 'SEASAT-A ALTIMETER OVERLAND TRACKING ANALYSIS'

R.L. Brooks, E G & G Inc., Wolf Research & Development Group, *2150 Fields Rd., Rockville, Maryland* 20850 (K7-933; MO-A01-78-4333)

OBJECTIVE: To evaluate SEASAT-A satellite radar altimetry as a tool to accurately and rapidly profile terrain features.

APPROACH: The resultant satellite altimeter-derived profiles will be compared with existing topographic maps and recent leveling surveys to determine the agreement or disagreement. In addition, terrain profiles from repeating ground traces of the satellite altimeter will be inter-compared to assess the repeatability and internal consistency of the altimeter data. The altimeter's performance will be evaluated over as many differing terrain types as possible.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0019, HYDROLOGIC-OCEANOGRAPHIC INTERRELATIONS

F.A. Kohout, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Woods Hole, Massachusetts* 02543 (NR 66-042)

Geophysical and drilling programs are being developed to evaluate the potential value of energy resources on the outer continental shelf (OCS) for lease sales and to appraise the environmental impact of development. At the inner margin of the OCS lies the arbitrarily defined coastal zone which includes strand line, estuaries, bays, rivers and contiguous land areas adjacent to the coast. At present one-half of the U.S. population lives in the coastal zone and 80% is projected for the year 2000. Thus, the need for an interdisciplinary study is obvious.

The position of the transition zone between fresh and salt water in coastal aquifers is an important initial boundary condition required for predictive mathematical modeling of salt-water intrusion. A technical objective is to investigate water circulations between the ocean, estuaries and bays and the underlying permeable strata and observe the various phenomena of groundwater discharge such as submarine springs. A second objective is to provide liaison with the Geologic Division, USGS, in OCS investigations. Identification of the seaward extension of aquifers and geologic formations in OCS drill holes will aid (1) in evaluating the energy and mineral resources of the OCS, (2) in appraising the impact of OCS resource development on environmental values of the coastal zone, (3) in fixing the position of the fresh-salt transition zone in ground water for predictive mathematical model studies of salt-water intrusion.

Investigation of water, energy, and mineral resources is accomplished by correlating chemical, thermal, turbidity, and remote sensing observations of surface and ground waters with geologic and bathymetric features of the OCS and coastal zone determined by geophysical surveys and exploratory drilling. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0020, USE OF AUTOMATED PROCEDURES FOR CHANGE DETECTION AND LAND USE MAPPING FROM SATELLITE DATA

H.W. West, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0W8184)

To develop and demonstrate automated procedures for obtaining land-use classifications from satellite data that are acceptable for use by the Corps divisions and districts in detecting land use changes and producing land-use maps.

Computer procedures will be developed that will automatically and/or interactively (a) locate and extract spectral data from satellite magnetic data tapes for specified geographic regions and sort the data into unique signatures on the basis of radiance values recorded for each pixel for four spectral bands, (b) remove instrument noise and correct radiance values for the effects of terrain slopes, shadows, and atmospheric conditions, (c) rectify positions of satellite pixel elements to the UTM coordinate system of topographic base maps, (d) classify the sorted radiance values on the basis of spectral signatures for five land-use types (water, woods, open or cultivated fields, urban, and other) and verify at a specific location, and (e) compare radiance values from two satellite fly-overs and portray changes in land use on a map overlay. The accuracy of land-use mapping by these procedures will be demonstrated for Baton Rouge, LA, and vicinity. If time permits these procedures will be applied to other areas.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

5.0021, FIELD OBSERVATIONS OF ICE JAMS

G. Frankenstein, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (31355)

OBJECTIVE: To collect field data necessary to undertake other basic ice jam studies, to provide a better insight into shore erosion affected by ice, and to provide a comprehensive background of the nature and range of relevant parameters associated with the wide variety of ice jam types experienced in nature. To aid and advise Corps Districts and Divisions during emergency ice conditions.

APPROACH: An active program of visits to ice jam and erosion sites will be undertaken, primarily at the time of ice cover, but also supplemented by field visits to the specific sites both before and after the ice cover. Qualitative and quantitative information will be obtained at each site on the general ice jam structure or morphology, its dimensional ice characteristics such as thicknesses, shapes, and size of the constituent blocks; flow data such as depths, velocities, and distribution; channel characteristics in the ice jam vicinity; man-made features such as bridges, dams, or levees which affect ice jam formation; climatic parameters affecting ice jam development and deterioration; techniques used, if any, to alleviate the ice jam, and their degrees of success. The geographical scope of the effort will be nationwide, except that the erosion work will concentrate on the St. Marys River.

Many ice jams resulting from the late January 1976 thaw were observed in the New England, New York and Baltimore Districts of Corps of Engineers. Two jams in the Chicago District were also observed. Aerial photographic coverage of the local jams on the Ammonoosuc, Waits, White Pemigewassett, Ottauquechee and Connecticut Rivers was obtained. Field surveys on the Ottauquechee were continued. A contract with Dr. George Alger was made to study erosion and near shore sediment movement during winter conditions on the St. Marys River. On-site consulation on ice jam and related winter navigation problems was given to New England Division, New York, Buffalo, Pittsburg; Huntington, Louisville, St. Louis and St. Paul District of the Corps. The use of a Hovercraft to break-up the Mississippi jam did not take place.

A draft Ice Engineering Manual was completed and used during presentation of a course to C of E personnel.

For the erosion studies, the observation program on the St. Marys River will be continued on a less intensive but broader scope. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0022, VERTICAL DEFORMATION STUDIES IN THE ALEUTIAN SHUMAGIN ISLANDS SEISMIC GAP

R.G. Bilham, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (14-08-0001-17679)

STATE TO WHICH PROJECT PERTAINS: Alaska.

We plan to install a network of seven devices to monitor mean sea level to a precision of 1mm in the Shumagin Islands of Alaska. These islands extend more than 100 km toward the deep sea trench in a part of the Aleutian seismic zone that we believe will soon experience a major earthquake (Mb is greater than 7). If we can obtain differences in sea level for monthly periods with accuracies better than 1 cm we believe that we will be in a strong position to monitor precursory seismic deformation. In the first year of this project we plan to obtain estimates of sea level noise resulting from atmospheric disturbances. The network will be telemetered via satellite. The aims of the experiment are to investigate whether sea level can provide a precursory warning of earthquake imminence, and to study earthquake mechanism should one occur during the duration of the project.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0023, SEASAT PROGRAM - GEODETIC STUDIES WITH SEASAT-A

M. Talwani, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (7-927; MO-AO1-78-00-4324)

OBJECTIVE: To examine altimeter data in the 100-200 km wavelength range for studying geoid anomalies related to specific geological and tectonic features, and finally to map oceanographic anomalies.

APPROACH: Gravimetric geoids will be constructed in the western North Atlantic and in the western Pacific for comparison with SEASAT-A data. These data are based on all available gravity data which have been carefully checked and are expected to yield the most accurate gravimetric geoids in those areas. Comparison between altimeter-determined sea surface heights and the gravimetric geoid will be used in estimating the sea surface topography attributed respectively to oceanographic phenomena and to gravity variations. The time varying part of sea surface topography may also be determined. The association of the geoid with several morphological and tectonic features of the world's oceans will then be established and refined; attempts will also be made to interpret the geoid undulation in geological and geophysical terms.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0024, EQUILIBRIUM AND FRACTIONAL CRYSTALLIZATION OF LUNAR MAGMAS - COTECTIC AND SULPHUR SOLUBILITIES

M.J. Rutherford, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (EAR79-08511)

This is a continuing study which had previously been supported by NASA but transferred to the NSF for support. Work to be done this year consists of (1) High pressure experiments on ilmenite and Ca-pyroxene saturation in 15382 and a LKFM derivative to further investigate possible high Ti mare source cumulates. (2) High pressure experiments on different LKFM basalts to determine Ca-pyroxene saturation and further evaluate proposed lunar magma compositions. (3) Continued experimen-

tal work on sulphur solubility in mare and non-mare basalts at low and high pressure. (4) Experiments to determine the liquid-solid equilibria of such phases as apatite, whitlockite and Ba-rich feldspar in highly evolved lunar magmas.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0025, RESERVOIR QUALITY CLASSIFICATION
J.M. Higgins, U.S. Tennessee Valley Authority, *401 Chestnut St., Room 268 - 248 401 Bldg., Chattanooga, Tennessee* 37401

The objectves of this work are to quantify the general quality (trophic status) of TVA reservoir; to compare the quality of each with desirable levels; to establish acceptable nutrient and waste loading levels; and to develop models for using LANDSAT imagery to economically monitor spatial and seasonal quality variations. During 1978 nutrient (N and P) loading rates were determined for the 18 largest TVA reservoirs. During 1979 field data were collected at these reservoirs to quantify quality and provide ground truth data for satellite monitoring. Current work includes model development and comparative studies based on the 1978-79 work.

SUPPORTED BY U.S. Tennessee Valley Authority

5.0026, OPERATIONAL REMOTE SENSING TECHNIQUES FOR TRANSPORTATION MAPPING
Hansen, University of Tennessee, Central Office, Space Inst., *Tullahoma, Tennessee* 37388 (193063 (HRB NO.))

Develop training course on remote sensing and interpretation methods of aerial photography.

SUPPORTED BY U.S. Dept. of Transportation, Office of Development, Implementation Div.

5.0027, OPERATIONAL REMOTE SENSING TECHNIQUES FOR TRANSPORTATION MAPPING
Hansen, University of Tennessee, Central Office, Space Inst., *Tullahoma, Tennessee* 37388 (FH-11-9270; FH162204 (TRAIS NO.))

The contractor shall develop training course on remote sensing and interpretation methods of aerial photography.

SUPPORTED BY U.S. Dept. of Transportation, Federal Highway Admin.

5.0028, EXPERIMENTAL INVESTIGATIONS INTO THE COOLING HISTORIES OF LUNAR ROCKS
L.A. Taylor, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Geological Sciences, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (EAR79-06318)

This study is a continuation of investigations previously funded by NASA and now transferred to NSF for support. This work involves determination of various kinetic data important to interpretations of crystallization under near-surface conditions (i.e., hypabyssal-extrusive). Studies of opaque minerals and the development of a new technique for paleointensity measurements will also be carried out. Specific tasks to be undertaken by this study involve: (1) investigation of the effects of cooling rate on: a) pyroxene chemistry, b) armalcolite-ilmenite relations, c) plagioclase nucleation and growth, and d) olivine vitrophyre fractional crystallization; (2) study of the kinetics of diffusive reequilibration for use in models on minerals as cooling speedometers: a) olivine and b) mineral pairs; (3) characterization of native FeNi metal from certain Apollo 12 soils in coordination with siderophile chemistry of the soils; (4) perfection of a technique for the measurement of paleointensities of lunar rocks at elevated temperatures while keeping the sample in pristine condition.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0029, OBSERVATIONS OF TOPOGRAPHIC ROSSBY WAVES AND GULF STREAM MEANDERS ALONG THE CONTINENTAL SLOPE
D.A. Brooks, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Oceanography, *College Station, Texas* 77843 (OCE79-06710)

This project, which involves field observations and data analysis, is designed to study topographic and meteorological forcing of observed meanders of the Gulf Stream along the continental slope south of Cape Hatteras, North Carolina. A field study consisting of four-month long winter and summer mooring periods will examine the detailed structure and time history of the current and temperature fluctuations along the continental slope off North Carolina. Vertical and cross-slope structure and along-shore propagational characteristics will be determined. Correlation of the current and temperature data with wind data, and comparison of direct current data with satellite imagery of sea-surface temperature patterns will be done to investigate the possibilities of wind or lee-wave forcing. Field data will be compared with theory to assess the importance of stable topographic Rossby wave propagation and instability processes in the Stream. This is a three year project with the field work occurring during the first and second years. The first year of the study was supported by NSF Grant Number ICE77-25682 to North Carolina State University at Raleigh.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0030, WATER QUALITY LABORATORY FOR CHESAPEAKE BAY AND ITS TRIBUTARIES AT HAMPTON INSTITUTE
Unknown, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (R806229; Q771 -Q145)

OBJECTIVE: This study will evaluate a helicopter sampling system for applicability to wide area Bay Sampling scheduled to coincide with TELSAT pass-over for water truth comparision with the Satellite data. The study will also determine the economics of helicopter sampling versus boat sampling.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab.

5.0031, NAVY ENVIRONMENT - GEOPHYSICAL DATA ANALYSIS
S.A. Vincent, Phoenix Corp., *1600 Anderson Rd., McLean, Virginia* 22102 (DN975375; N00014-79-C-0409)

Satellite altimetry and aeromagnetic data will be analysed for studies of ocean gravity anomalies, ocean tides, and geomagnetic field fluctuations.

GEOS-3 Satellite altimetry data will be analyzed for ocean tidal components in the northeast Pacific. A detailed background review will be conducted on the relevant physical aspects of the various sources of temporal geomagnetic field variations and their quantitative indicators.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0032, GEOLOGICAL THERMOMETRY - NASA
J.S. Huebner, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9710-01155)

Determine the physical properties and phase relations of pyroxenes, using a combination of optical and electron microprobe analyses, X-ray and electron diffraction, and experimental petrology. Apply the results to problems in lunar petrogenesis such as basaltic magma genesis; extent and conditions of metamorphic equilibration; and the dating of events which caused mineral transformations. The major topics of investigation will be: 1) Interpret the thermal and structural histories of pyroxenes, estimating the lengths of time that each structural state was annealed at temperatures that we will determine from our data on pyroxene phase relations. We are interested in all processes from the nucleation of pyroxene in basalts at high tempera-

ture to the low-temperature annealing that imposes the texturally mature fabric, the extensive chemical reequilibration, and the high degree of cation order in 'Apollonian' metamorphic rocks. 2) Determine, experimentally and from analysis of lunar samples, the volume diffusion rates of calcium, magnesium and iron in pyroxenes in order to calculate the lengths of time necessary to grow pyroxene lamellae during lunar annealing processes. 3) Complete an experimental investigation of the partial melting of pyroxenes (orthopyroxene, pigeonite, augite) and model lunar mantle peridotite and pyroxenite. Continue to refine our models for the derivation of lunar basaltic magmas, and characterize the solid residues of such processes. 4) Complete a study of the occurrence, crystal chemistry, and significance of protoenstatite. 5) By providing samples and mineralogical expertise, participate in cooperative investigations of the calorimetric properties, electrical conductivity, and radiative heat transfer of pyroxenes.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0033, LOCATING GROUND-WATER SUPPLIES BY REMOTE SENSING - RANDOLPH COUNTY, WEST VIRGINIA

W.A. Hobba, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Morgantown, West Virginia* (WV 78-034)

Determine where supplies of ground water of adequate quantity and quality can be developed to augment existing surface water supplies for growing communities.

(1) Map lineaments and faults from satellite and aircraft imagery; (2) inventory, sample, and perform single-well aquifer tests on selected domestic wells; (3) drill 3 test wells in one area where well yield and water quality are likely to be best; (4) perform aquifer tests on the test wells to determine aquifer characteristics and sample water for complete chemical analysis; and (5) prepare a concise report describing techniques, findings, and interpretations.

The area to be investigated is a valley about 15 miles long and 4 miles wide between Elkins and Mill Creek, WV. The approach will be to first map the lineaments in the valley by video analog enhancement of satellite and aircraft imagery. After the lineaments are mapped, domestic wells on or near elected lineaments will be inventoried, sampled, and pumped. Based on this information, and the needs of the county, three test wells will be installed and aquifer tests performed to evaluate the aquifer.

Satellite imagery of area and all field reconnaissance completed. Drilled test wells.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0034, WATER AND ITS RELATION TO ECONOMIC DEVELOPMENT IN THE GREEN RIVER AND GREAT DIVIDE BASINS IN WYOMING

H.W. Lowham, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Cheyenne, Wyoming* (WY 75-030)

Development of extensive coal, oil, gas, trona, and oil-shale resources in the project area will require a projected increase in water consumption of 480,000 acre-feet per year by 1990. Development of energy resources in other parts of the state also will require large amounts of water; transbasin diversion of Green River water to other areas could total an additional 270,000 acre-feet per year. Water planners and managers need much more information about available ground and surface water, present quality of the waters, and the impacts on water supply and quality caused by development of energy resources.

The study will be designed to gather information, and make available to interested industrial, agricultural, and governmental people, interpretive reports that describe: (1) the distribution and quality of surface water in space and time, (2) relationships between surface water and ground water, (3) the distribution, quantity, and quality of ground water, and (4) hydrology-related aspects of the environment. Efforts of the study will be directed towards: (1) describing the water resources and hydrologic relationships that presently exist, (2) developing predictive methods that may be used to describe future conditions, including reactions to increased water development, (3) establishing monitoring programs for detecting possible changes in water parameters.

Compile and evaluate existing water data. Conduct literature search for present hydrologic knowledge of the area. Prepare planning report during first year of project, outlining the specific techniques to be used in subsequent phases. Regarding water quality, particular attention will be given to trace metals, biological parameters, and trend analysis. Channel-geometry techniques, ERTS imagery, and detailed statistical analyses will be applied to surface-water studies. Aquifer tests and bore hole and surface geophysical surveys will be used in ground-water studies. Digital models will be developed for chemical-quality and surface-water systems.

An intensive sampling program was conducted during the Fall and the Spring, using a helicopter and 8 hydrologists. Water-quality samples and field measurements were collected at several hundred surface- and ground-water sites. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, RESEARCH OF BIOENGINEERING PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION (07)

J.L. Haley, U.S. Dept. of Defense, Army, Medical Research & Development Command, Bioengineering & Life Support Equipment Div., *Fort Rucker, Ozark, Alabama* 36362 (DA0D6735)

To provide valid, meaningful and medically pertinent information, new designs and equipment developments based on research with respect to immediate field aeromedical problem areas found in US Army aviation.

Approach will always be based on sound and accepted experimental methodology, though particular techniques of application will vary as a function of the problem under investigation.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, DEVELOPMENT AND EVALUATION OF ADVANCED INSTRUCTIONAL FEATURES METHODS IN ASPT

R. Hughes, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224020)

1. To develop through active experimental manipulation effective applications of ASPT advanced instructional features to air-to-surface training. 2. To identify factors affecting the effective management of ASPT advanced instructional features within the context of A-10 air-to-surface training. 3. To develop and evaluate candidate measures of instructional effectiveness.

Two phases are proposed. Phase I is a developmental phase in which a series of mini-studies will be conducted to identify promising applications of ASPT instructional features in the training of air-to-surface attack skills on the A-10. The emphasis in phase II represents a shift in focus from the student to the instructor and the manner in which the instructor is able to utilize the instructional features as an aid to training. A chief concern in phase II will be upon the instructor's allocation of instructional time and practice time and the effects of such allocation upon student performance. Measures of effectiveness such as performance gain per unit of instructional time will be evaluated for their sensitivity to different strategies of employing advanced instructional features.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, SUBJECTIVE PERFORMANCE MEASUREMENT

E.L. Martin, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223710)

1. To develop a pilot performance measurement system and methodology for airborne application. 2. To develop an efficient and effective observer training program.

A series of at least three studies will be conducted in order to accomplish objectives. Candidate task measurement formats for selected tasks will be developed analytically. The prerecorded demonstration capability of the ASPT will be used to provide controlled measurement observation set for data collection. IPs will serve as subjects. Task formats, observation intervals, and training procedures will be selected so as to optimize reliability and validity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, INVESTIGATION OF BRAINSTEM AUDITORY EVOKED RESPONSES AS A NEW MEASURE OF SENSORINEURAL PERFORMANCE OF NAVAL AVIATION PERSONNEL

J.D. Mosko, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., *Pensacola, Florida* 32512 (DN877423)

Recent research and clinical applications of brainstem auditory evoked response technology indicate that this measure may provide a sensitive means for the early detection of sensorineural changes that occur (1) as a function of aging, both natural and premature, and (2) as a result of exposure to environmental stressors. It will be the objective of this work unit to conduct exploratory research that will evaluate the potential contributions of brainstem technology to the medical management of naval aviation personnel.

Before brainstem technology can find application in the evaluation of naval aviation personnel, baseline data must be collected which define the normative range of responses for this broad age-spectrum population. Although all forms of electrophysiological measures require normative references to be effective, the need is specific for brainstem responses in that the latency of the predominant waveforms is strikingly age dependent. Since this feature in itself may serve to quantify sensorineural aging of naval personnel, first priority will be given to the acquisition of brainstem data from naval aviation personnel stationed at Pensacola ranging in age from 20 years to 50 years. This population will be subdivided into six equal increment age categories with a minimum of 30 individuals in each category. The collection of these baseline data is considered to be an essential cornerstone to follow-up research that will deal with modifications of the brainstem response by various environmental stressors.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0005, DEVELOPMENT OF PSYCHO-PHYSIOLOGICAL MEASURES PREDICTIVE OF AVIATION PERFORMANCE

R.E. Doll, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept., *Pensacola, Florida* 32512 (DN977562)

OBJECTIVE: The objective of this work unit is the measurement and evaluation of psycho-physiological human ability measures that have the potential to significantly predict aviator performance in replacement training squadrons (RTS) and fleet squadrons. Due to the great length of time required to determine the relationship to psycho-physiological human ability measures to aviator performance in RTS and fleet operational environments, preliminary investigations will be concerned with human performance in an undergraduate flying environment. Early criteria to be used to evaluate the utility of psycho-physiological human ability measures will include (1) primary flight performance, (2) intermediate flight performance (strike, maritime and helo), (3) advance flight performance (strike, maritime, and helo), and successful undergraduate performance. Ultimately, RTS and fleet squadron standardized summary performance grades and certain fleet performance indices will be related to the psycho-physiological human ability measures. Since the present BUMED United States Navy and Marine Corps aviation selection tests are primarily perceptual and cognitive pencil-and-paper test instruments, it is anticipated that the development of psycho-physiological human ability measurement instruments will provide for an improved capability to select aviators who will have a greater flying fitness capability in operation environments. Additionally, the psycho-physiological measures have the potential for improved primary, secondary selection, and pipeline assignment, thereby affecting important naval aviation cost savings. In addition, it is anticipated that performance measurements will be accumulated for psycho-physiological measures on the basis of age. With time, such measurements may be used to evaluate skill maintenance levels, and provide a basis other than age for assigning service group flying categories.

The research effort will obtain psycho-physiological human ability measures on a substantial Navy population. The first psycho-physiological measure to be investigated is: multilimb coordination ability: the ability to quickly and accurately perform coordination movement of body muscle systems as a result of the perceptual and kinesthetic recognition of velocity and speed movements in a dynamic three-dimensional environment, is a highly important psycho-physiological attribute. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0006, PREVENTION OF MOTION SICKNESS IN FLIGHT TRAINING BY TRANSFER OF ADAPTATION EFFECTS ACQUIRED IN THE LABORATORY

A. Graybiel, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Biological Sciences Dept., *Pensacola, Florida* 32508 (DN777277)

Restoration to flight status of motion-sick Navy flyers by measures which include transfer of adaptation effects acquired in the laboratory.

The approach will continue to feature (1) an initial interview, (2) a battery of assessments, (3) identification of a long-term antimotion sickness drug, (4) adaptation in the slow rotation room, and (5) validation in actual flight. Additional use will be made of plots that describe the rates of acquisition and decay of adaptation effects, e.g., adaptation under medication levels-off and suggests continuance without medication. Looking ahead, the possible use of a passive head-movement device will be tested both at the center of adaptation and at a radius of 19 feet. Also, additional adaptation effects will be explored using visual inputs (movies projected on a cinematic screen) and an off-vertical chair that selectively stimulates receptor systems in the otolith organs.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0007, THE DEVELOPMENT OF SATELLITE TRACKING AND AUTOMATIC POSITION/ACTIVITY MONITORING FOR SELECTED ANTARCTIC VERTEBRATES

D.B. Siniff, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Ecology & Behavioral Biology, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (DPP79-21713)

The University of Minnesota proposes to begin the development of technology (and its biological application) which will open the way for remote monitoring of movements of free-ranging antarctic vertebrates. Specific objectives include: (1) the development of telemetry packages for tracking the Weddell Seal and the Antarctic Cod; (2) obtain data on the local movements of these species while developing the instrumentation and attachment procedures; (3) develop a data collection system for the McMurdo Sound area which will telemeter data from key position monitoring stations to a central laboratory or to a satellite; and (4) conduct tagging and census studies of the Weddell Seal population in McMurdo Sound. The long term goals are (1) to use the instrumentation developed to begin to understand the movements of vertebrates from one region of Antarctica to another, (2) use the movement, activity, and other data realized to better understand the antarctic ecosystem, and (3) to inte-

grate the data collected with other studies to assist in making management and conservation recommendations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

6.0008, ELECTRORETINOGRAM (ERG) IMPLICIT TIME 16272-L

J.B. Siegfried, Pennsylvania College of Optometry, Graduate School, Dept. of Physiology, *Philadelphia, Pennsylvania* 19141 (DA0G9078; DAAG29-79-C-0103)

To elucidate the region or regions in the human visual system that account for the long time constants of the blue color system. Relevance - related to night vision processes where exposure to white and yellow flashes interfere with red and green systems. Will apply to pilots and aircraft controllers in night operations.

A two color increment threshold paradigm will be used in addition to electroretinogram (ERG) measures of amplitude and implicit time of test flash luminances close to psychophysical increment thresholds. Foveal test flashes will be superimposed on steady, peripheral adaptation. Computer signal to noise enhancement will be used.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

6.0009, COST-EFFECTIVENESS METHODOLOGY FOR AIRCREW TRAINING DEVICES

B.R. Girshaw, Analytic Services Inc., *400 Army Navy Dr., Arlington, Virginia* 22202 (DF223850; F33615-77-C-0072)

To develop a cost-effectiveness methodology for aircrew training devices that is consistent over a broad range of training situations, flexible in accommodating differences in data inputs and outputs, sufficiently comprehensive to permit inclusion of a variety of significant factors, and simple to use. It will be applicable to the analysis of both existing and future aircrew training systems. It will also contribute to the analysis of many aspects of training effectiveness to include determination of device cost-effectiveness, the optimum mix of several devices, and the optimum deployment and utilization strategies for training devices.

A systems approach will be taken to encompass the total aircrew training program including intital and continuation training. The study will be accomplished in phases. Phase I will serve to familiarize the contractor with AFHRLS flying training research program and allow finalization of research approach. Phase II will provide a workable methodology for evaluating the cost-effectiveness of aircrew training systems employing a mix of training devices. Phase III will require a validation of the proposed methodology using data from a current Air Force weapon system aircrew training program. Phase IV will apply the methodology to a proposed Air Force training system. Phase V will document results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, DEVELOPMENT OF A MATHEMATICAL MODEL TO CORRELATE OBSERVED FROST HEAVE OF HIGHWAY AND AIRPORT PAVEMENTS WITH LABORATORY PREDICTIONS

Berg, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (135563 (HRB NO.))

The aim of this project is to develop a mathematical model of frost heave in terms of the significant physical, environmental and climatic factors, and make a sensitivity analysis of the various parameters. Also, a work plan, including staffing and instrumentation requirements, will be developed to correlate laboratory results with field observations by use of the mathematical model.

SUPPORTED BY U.S. Dept. of Transportation, Office of Research, Materials Div.

7.0002, SOFTWARE SYSTEMS FOR PROCESSING ADVANCED SATELLITE DATA

L.P. Murphy, U.S. Dept. of Defense, Army, Corps of Engineers, Engineer Topographic Lab., *Fort Belvoir, Virginia* 22060 (31580)

OBJECTIVES: Analyze, model, develop techniques, software, and perform feasibility testing of algorithms for extracting useful terrain data from advanced (LANDSAT-D) satellite systems for selected CoE applications; hardware/software trade-offs and costs for computer processing of the advanced high resolution (30 m/pixel) Thematic, Mapper, LANDSAT-D, digital data.

APPROACH: Under contract in FY 79, a study will be performed to develop a preliminary assessment of systems costs, hardware/software trade-offs for processing LANDSAT-D Thematic Mapper (TM) data (8 times that of current systems) for selected Corps remote sensing applications. In FYs 79 and 80, in-house and contracted experiments and studies will be conducted for the development of optimal algorithms and systems for extracting the required CoE terrain/landuse data. LANDSAT-3 RBV data and aircraft or simulated data will be used to simulate the TM. In FY 81, all efforts under this work unit will be consolidated and updated to result in a detailed assessment of costs, hardware/systems trade-offs for the implementation of LANDSAT-D data processing within the Corps; this assessment will include a go or no-go recommendation to Corps headquarters for acquisition or lease of a central data processing facility and/or the use of commercially available systems or services.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Engineer Topographic Lab.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, TRANSIENT EVAPORATION OF IONIC CRYSTALS

Z. Munir, University of California Davis Campus, School of Engineering, Dept. of Mechanical Engineering, *Davis, California* 95616 (DMR79-09020)

This grant is to continue fundamental studies on the mechanisms of transient evaporation of ionic semiconductors, such as cadmium sulfide and zinc oxide, particularly as vaporization relates to surface charge. The dependence of the transient behavior on surface charge will be examined in terms of crystallographic orientation, original stoichiometry (or doping) and temperature. Additionally, the effect of extrinsic doping on the transient evaporation rate will be undertaken. Isothermal rates will be measured utilizing torsion and microbalance techniques. Surface ledge spacing and height will be determined in a low energy electron diffraction (LEED) apparatus. These parameters will be examined as a function of the initial ledge spacing, the initial degree of nonstoichiometry, and the degree of undersaturation during evaporation. Relative changes in the point defect concentration accompanying evaporation will be determined from Hall Coefficient and electrical resistivity measurements.

The work is a continuation of research initiated under NSF grant DMR77-08472, and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, HIGH-ENERGY PHYSICS STUDIES
J. Schultz, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (EY-76-S-03-0034 PA 149)

The study concentrates on a search for resonant and bound states in the nucleon-antinucleon system, understanding of production of such states by antiproton interaction in deuterium, and elucidation of mechanisms of pd annihilation. An experiment to be run imminently at Brookhaven National Laboratory (AGS-701) will use an array of counters, multi-wire proportional chambers, and NaI detector to observe outgoing charged pions, recoil nucleons and photons from p annihilations in a deuterium target. Bound or resonant NN states will be observed by recoil nucleon spectroscopy, and radiative or pionic transitions between levels can be detected. The experiment is a collaborative effort with the University of New Mexico and Temple University. In addition, a complementary study of pd interactions is using part of a 240,000 picture exposure of the Argonne National Laboratory 12-foot bubble chamber to investigate pd interactions from 700 MeV/c to rest, yielding photons, neutral mesons, and strange particles. Events with photons and recoil protons will complement the BNL counter experiment search for new states. The strange particle data will be combined with a pd exposure in the BNL 30-inch chamber to provide information on kaon and lambda production up to 900 MeV/c.

Another aspect of the program is the development of high energy detection techniques, in particular, investigation of the acoustic radiation of charged particles and the potential use of acoustic detectors. Other types of new detectors are also being studied in participation in the planning of very large scale high energy neutrino experiments.

SUPPORTED BY U.S. Dept. of Energy, Div. of High Energy & Nuclear Physics

8.0003, PHASE TRANSITIONS AND DISORDER IN SOLIDS BY LIGHT SCATTERING
S. Ushioda, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (DMR77-10083 A02)

Structural phase transitions and disorder in solids will be investigated by means of Raman and Brillouin scattering. The systems to be studied are superionic conductors, organic charge transfer solids and perovskite ferroelectrics. Superionic conductors are translationally disordered and some of the organic charge transfer compounds are orientationally disordered. The study will focus on the liquid-like nature and the phase transitions of these systems. In perovskite ferroelectrics, the main interest will be in the anharmonicity of the soft modes and its relation to the structural phase transitions.

Research previously supported by DMR 73-02480.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, EXPERIMENTAL STUDIES OF QUASI-ONE-DIMENSIONAL CRYSTALS
P.M. Chaikin, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR79-08560)

Certain crystals (such as donor-acceptor complexes involving tetracyanoquinodimethane (TCNQ), and certain layered transition metal dichalcogenides) have electrical properties that are very much different in one direction from the other two. They are of interest because theoretical models for such quasi 1- or 2-dimensional systems are more readily solved than those for 3-dimensional. The small bandwidths, large electron-electron repulsions, and restricted dimensionality make these materials ideal candidates for the study of several questions of basic physical interest. Thus, one-dimensional metals are intrinsically unstable against a metal in insulator transition. The effects of disorder and of impurities also are singular in one dimension, causing severe electron localization.

The present work involves a series of transport measurements (thermoelectric power, thermal conductivity, Hall effect) on several classes of these compounds (including charge transfer salts such as bis(tetrathiatetracene) triiodide and anisotropic metals such as niobium triselenide). The thermopower study is aimed at determining the role played by coulomb correlations and phonon drag; the thermal conductivity and Hall effect studies are aimed at determining the nature of the charge carries involved. Some of these experiments may be performed in high electric fields to study nonlinear transport.

First year of three-year continuing grant; renewal of work supported by DMR76-83421.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, IONS AT THE SURFACE OF LIQUID HELIUM
G.A. Williams, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR78-17049)

An experimental study of two-dimensional ion systems near the surface of liquid helium will be undertaken. A newly developed low frequency capacitance technique will be employed for measurements of ion mobilities. Systems of interest include electrons above the helium surface as well as both positive and negative ions just underneath the surface. Such data will yield information about the nature of the interactions between electrons and the elemental excitations in this unique quantum fluid.

First year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0006, APPARATUS FOR NONLINEAR MIXING SPECTROSCOPY OF CONDENSED MEDIA
M.D. Levenson, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR77-27512)

A tunable narrowband C.W. dye laser will be obtained and used in the NSF supported research program to develop and use spectroscopic techniques based upon third-order optical frequency mixing. This additional laser will supplement the capabilities of the present three-frequency coherent Raman spectrometer by providing a tunable optical frequency source devoid of troublesome intensity fluctuations. This quiet source will then permit the use of optical heterodyne techniques to detect signals produced by the Raman induced Kerr effect and by anisotropic saturation in abosrbing systems. Resonance and relaxation effects in the nonlinear susceptibility tensor will be studied more conveniently and more precisely.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0007, DYNAMICS OF MOLECULES IN CRYSTALS AND ON SURFACES
N.S. Gillis, Colorado State University, School of Science, Dept. of Physics, *Fort Collins, Colorado* 80523 (DMR76-18738 A01)

Research previously supported by DMR76-18738.

Theoretical research in condensed matter physics will be carried out. The main thrust of the work will be in the areas of the dynamics of motion of molecules in crystals and on surfaces. This will involve an investigation of the rotational excitations of molecules in these environments as well as the coupling of the rotational molecular motions with one another and with other degrees of freedom of these systems, such as phonons. Two specific areas will be studied: (1) Structural phase transitions in molecular solids, particularly the family of the inorganic azides. (2) Rotational motion of substitutional impurities of molecular nitrogen in rare gas matrices.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0008, MEASUREMENTS TO TEST FOR THE VARIABILITY OF THE SOLAR CONSTANT
D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM79-03877)

Professor Murcray (University of Denver) has developed a high precision balloon-borne system for measuring the solar irradiance. With previous NSF support he has shown that the solar irradiance has possibly changed by as much as 0.4% between 1967/68 and 1978. This result is potentially very important to many research areas and, therefore, it is important to check it. This support will enable Dr. Murcray to conduct two balloon flights in 1979 and 1980 for just this reason.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0009, MEASUREMENT OF EMISSION CROSS-SECTIONS OF IMPORTANCE IN THE UPPER ATMOSPHERE

B. VanZyl, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM76-80282 A02)

This grant funds experimental measurements of emission cross-sections of importance in the upper atmosphere. Energy-variable atomic beams of electrons, protons, and hydrogen atoms, will be used to investigate light emissions resulting from their collisions with typical atmospheric atoms and molecules. While the emphasis will be on hydrogen atom and proton scattering, an electron beam is included in the system for absolute calibration of the optical detectors. This provision also allows direct comparison of certain light emissions from target molecule excitations by the three projectile species in the same system under identical conditions. The projectile energy range covered will be from a few keV on down, an important range in the atmosphere, and one for which the existing information is sparse or altogether lacking.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0010, LASER DEVELOPMENT FOR FUSION AND ISOTOPE SEPARATION (ABBREV)

M.S. Lubell, Yale University, Graduate School, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (ES-77-S-02-4199 A000)

The proposed research has as its objective the study of depletion mechanisms of metastable states of rare gas atoms by electron impact. Depopulation of these metastable states significantly affects the operation of rare gas halide lasers, since the formation of the excited state of the rare gas halide excimer, RX*, relies to a great degree upon the kinetic process R* plus X2 yields RX* plus X, where R is a rare gas atom and X is a halogen atom. If the depopulation of the metastables proceeds via a one or multiple step ionization process, then the stability of the discharge which produces the metastables can be destroyed.

While the RX* formation kinetics and the X2 electron attachment process have both undergone considerable study, there has been little experimental attention devoted to the electron impact phenomena involving the excited states of the rare gas atoms. It is already known that cross-sections for excitation of the metastable rare gas s-valence electron to the next higher lying p orbital are large (greater than or equal to 10 to the minus 14th power sq.cm). Thus multiple step ionization process may play a significant role.

The proposed research program employs a triple crossed beams configuration with a metastable rare gas beam incident along one axis, an electron beam along a second axis, and a tunable laser radiation along a third axis. The use of a duoplasmatron ion source and an alkali resonant charge transfer cell is expected to produce an atom beam that has greater than or equal to 30% metastable content with a metastable density greater than or equal to 10 the the 9th power/cu.cm. A spherical electron monochromator/spectrometer will be used to study elastic, inelastic, and superelastic scattering as well as impact ionization from both metastable and laser excited states. Incident electron energies will range from 1 to 100 eV.

Construction and testing in progress.

SUPPORTED BY U.S. Dept. of Energy, Div. of Laser Fusion

8.0011, A STUDY OF THE ROLE OF TIME-DEPENDENT PHENOMENA IN DETERMINING SUPERCONDUCTING DEVICE CHARACTERISTICS

R.A. Peters, Catholic University of America, School of Arts & Sciences, Dept. of Physics, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (ENG76-11553 A02)

This program is concerned with establishing the way in which the superconducting phase slip and electron-phonon collision times determine: (a) the upper frequency limit for SQUID (Superconducting Quantum Interference Device) operation; (b) the relation between bridge separation and frequency limits of arrays of Josephson junctions; (c) the length of a weak link and the frequency dependence of its hysteretic effects; (d) the time necessary to nucleate a normal region in a superconductor. The program will test extensions of the quasiparticle diffusion theory into the rf region. For a given material, this work will predict maximum bridge separation of arrays as a function of frequency, the length of the weak link as a function of frequency for non-hysteretic behavior in SQUIDS, and maximum pump frequency for SQUIDS.

SUPPORTED BY U.S. National Science Foundation, Div. of
Engineering

8.0012, PLASMA ETCHING

R. Kaplan, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980203)

To obtain a basic knowledge of the chemistry and physics of plasma etching of Si and compound semiconductors, with particular emphasis on those aspects relating to fabrication of small, accurately dimensioned structures required for large scale integrated circuits. To investigate the possibility of achieving orientation-dependent plasma etching, with application to the tailoring of etched-wall profiles.

Plasma etching will be conducted in a system compatible with ultra-high vacuum instrumentation (auger spectroscopy, low energy electron diffraction, quadrupole mass analyzer) in order to obtain structural and chemical information regarding substrate surfaces during processing. Simple devices will be fabricated in order to evaluate etched surface electronic properties. Chemical species involved in etching will be studied by detecting their emitted optical radiation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval
Research Lab.

8.0013, NUCLEAR REACTIONS AND STRUCTURE

R.H. Davis, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (PHY78-11560 A01)

This is a continuation of work presently supported under NSF grant PHY77-08145.

A wide variety of work is proposed in both basic and applied physics. Work will include studies of elastic and inelastic scattering of heavy ions, heavy-ion fusion, reaction mechanisms and heavy-ion resonance phenomena. Some light ion work on back angle resonances and spectroscopy will also be done. Characterization of high spin states also will be studied. Particle-gamma coincidence methods will be used.

Applied work includes the identification of air pollutants, use of electron beams in electrostatic precipitators, and construction of a proton microprobe.

Considerable work on accelerator modification and instrument development will continue.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0014, REACTIONS AND TRANSPORT PROPERTIES OF ATMOSPHERIC IONS

E.W. McDaniel, Georgia Inst. of Technology, School of Sciences & Liberal Studies, Dept. of Physics, *Atlanta, Georgia* 30332 (ATM79-06109)

A high-pressure-drift-tube-mass spectrometer will be used to obtain measurements of the transport properties of ion-gas combinations of atmospheric interest such as NO3, O2, NO2, and CO3 in N2 and NO3, NO, and O2 in O2 over a temperature range of 190 degrees-650 degrees K. Mobility values will also be obtained as a function of E/N (electric field intensity divided by drift gas number density). The results will yield accurate, well-defined transport properties which can be used in calculating ion-ion recombination rates; in modeling atmospheric ion transport and the resulting ion concentrations at high altitudes; and in providing a testing ground for ion transport properties, reaction rate schemes, and calculated atmospheric ion concentrations derived from lower pressure measurements.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0015, A LOW-TEMPERATURE INVESTIGATION OF AMORPHOUS MATERIALS

A.C. Anderson, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR77-08599 A02)

This research was previously supported by DMR 75-09366.

The purpose of this research is to provide a consistent picture of the low-temperature thermal behavior of amorphous materials (glasses, plastics and glassy metals). The work will be directed toward the manipulation and identification of the localized excitations which are generally attributed to the reorientation of small groups of atoms through the mechanism of quantum mechanical tunneling. In particular, the energy dependence and densities of excitations will be studied by the use of ballistic phonon techniques and by noting the concomitant changes in specific heat, thermal conductivity, thermal expansion and other properties. Glassy metals will also be studied to determine the influence of localized excitation on the electronic properties of amorphous materials and to test current ideas of glass formation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, ATOMIC EMISSION SPECTROSCOPY

K.L. Andrew, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (PHY79-08644)

Research in atomic physics will combine theoretical and experimental approaches to study the spectra of heavy atoms and compare it with the predictions of Slater-Condon theory. The new techniques of Fourier spectroscopy will be employed.

This research is a continuation of that previously supported under NSF grant PHY77-02087A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0017, INTERMEDIATE VALENCE PHENOMENA IN SOLID SOLUTIONS OF SAMARIUM SULFIDE

J.W. Schweitzer, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (DMR77-26410 A01)

The phenomenon of intermediate or 'mixed' valence associated with rare earth ions in certain compounds and alloys will be studied. Emphasis will be given to the study of the magnetic properties of these materials. There will be a systematic study of solid solutions of SmS with various samarium monopnictides where there is evidence for a chemically induced state of mixed configuration associated with the Sm ions. The lattice parameters, magnetic susceptibility, resistivity, and Hall constant will be measured as a function of temperature. A theoretical study of configuration mixing will be carried out to develop a description for the chemically-induced transitions and magnetic properties.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, THEORY OF ATOMIC STRUCTURE

B.R. Judd, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (PHY77-22488 A01)

Research in theoretical Atomic Physics initiated under NSF grant PHY73-05195 A03 will be continued. Analyses will concentrate on atoms and ions in various environments and external fields, particularly those produced by lasers. The principal topics of study are (a) The Jahn-Teller effect for trapped electrons or for ions at sites of various symmetries in crystals; (b) Correlation crystal fields for Lanthanide ions; (c) Quantum optics, with emphasis on multiphoton ionization; (d) Autoionizing states in highly ionized atoms; (e) Lifetimes of Rydberg states; and (f) Photoionization cross-sections. The aim of the work is to improve our understanding of the fundamental processes inherent in atomic systems and to develop the relevant mathematical techniques.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, STRONG LANGMUIR TURBULENCE IN MAGNETIZED SPACE PLASMAS

C.S. Liu, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (ATM78-25248)

This grant will support a computer study of the collapse of plasma waves in a magnetic field excited by electron beams or intense electromagnetic radiation. This work will use computer codes already produced for laboratory plasmas. The application will be space plasmas, e.g., auroral streamers, type III solar radio bursts and electron streams in solar flares. This will lead to a study of the nonlinear physics associated with the wave collapse process. In particular, the following will be studied: (a) evolution of wave collapse; (b) the final steady state of such a wave collapse; (c) the turbulent spectrum of plasma waves.

Finally, detailed comparison between theory and observation will be made.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0020, COSMIC RAY SPECTRA AND INVESTIGATION OF THE TIME STRUCTURE OF THE HADRONIC COMPONENTS OF AIR SHOWERS

R.W. Ellsworth, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (PHY79-09272)

This project consists of two parts. The first is a direct measurement of the energy spectrum of primary cosmic ray protons in the energy range 100 to 50,000 CeV. This uses a balloon-carried spectrometer, an ionization calorimeter, to measure energies. In the other experiment, which is ground-based at sea level, they study the cascade of particles produced by high energy cosmic ray particles striking the atmosphere - an extensive air shower. This group will measure the energies and relative arrival times of protons and other nuclear particles with respect to the very fast particles of the cascade. They have learned from previous experiments that this time structure is sensitive to the presence of heavy nuclei (e.g., iron) in the primary composition, at extremely high energies. This experiment will find the relative magnitude of the primary iron component at energies up to 50 million GeV. These data will provide crucial tests of theories of the origin and propagation of cosmic rays.

In addition, their sea level experiment is sensitive to the production of new massive elementary particles, since these will be delayed and also carry considerable energy. Some evidence for such production has already been found in smaller scale experiments. Confirmation of the existence of new massive states would be an important development in the understudy of fundamental components of matter.

This is the first year of a three-year continuing grant, previously supported under NSF grant PHY77-01438 A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, THEORETICAL STUDIES OF GRAVITY

C.W. Misner, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (PHY79-09281)

Theoretical research in physics will be done on topics in field theory which bear on gravity physics and on elementary particle physics.

The principal area of research currently contemplated is the development of non-linear quantum field theories (Harmonic Maps) that model a type of gravitational non-linearity different from that modelled by Yang-Mills theories. These theories also incorporate a style of symmetry breaking that occurs in general relativity (where local GL(4,R) symmetry is broken by the metric to give local Lorentz invariance), and the possible employment of this style of symmetry breaking in particle physics will be surveyed. Other problems will also be studied when they seem apt for solution and significant for a fundamental understanding of gravity and its relationship to the rest of physics or astrophysics.

This is the first year of a two year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0022, LABORATORY INVESTIGATION OF TWO IMPORTANT REGIONS OF THE ATMOSPHERIC SPECTRUM

W. Benesch, University of Maryland, College Park Campus, School of Engineering, Dept. of Physical Science & Technology, *College Park, Maryland* 20742 (ATM79-01040)

This grant funds a research program directed to the study of Laboratory spectra considered necessary for the support of observational and theoretical investigations of the aurora. Particular emphasis is placed on the ultraviolet and infrared as regions currently receiving special attention on the basis of evolving technology.

This program consists of a group of related experiments to elucidate the atomic and molecular processes which lead to auroral and airglow emission in the 2000 A and the 1 to 2 micron wavelength regions. Emphasis will be placed on the low-lying excited states of the nitrogen molecule, N2, and the nitrogen molecular ion, N2. The investigations will encompass molecular structure, transition probabilities, and excitation mechanisms. The wave-length regions to be studied are the vacuum ultraviolet and the near infrared beyond the reach of the photographic plate. The work will be carried out using the spectroscopic facilities (notably the 5-meter spectrographs) of the University of Maryland and Johns Hopkins University.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0023, COMPOSITION AND ELECTRONIC STRUCTURE OF ALLOY SURFACES

R.L. Park, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DMR7900323)

Research previously supported by DMR-7684576.

A study of metal and alloy surfaces using novel core level probes will be carried out to determine the interaction between the constituents of alloys in the surface region and surface energy effects and absorbed gas layers. Understanding the electronic structure of such complex systems requires surface probes that are capable of separately examining the electronic states of each constituent element. The basic tool in these studies is appearance potential spectroscopy, which measures the probability for inelastic electron scattering from core state electrons. In the past, appearance potential studies have focused on spectral features near the scattering thresholds, which are related to the conduction bond density of states. However, fine structure can be observed extending hundreds of electron volts above the thresholds. This structure, which is analogous to X-ray absorption fine structure, provides information on the bonding geometry in the surface region. The study will also involve more conventional probes such as low energy electron diffraction and Auger electron spectroscopy.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0024, PHASE TRANSITIONS AND CRITICAL PHENOMENA

J.V. Sengers, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics, *College Park, Maryland* 20742 (DMR79-10819)

A joint theoretical-experimental research program will be carried out in the area of phase transitions and critical phenomena. Attention will be given to studies of fluctuations in systems exhibiting critical points and the effects of these fluctuations on a variety of physical properties. Specifically, the crossover of the scaling properties immediately near the critical point to mean-field behavior far away from it will be investigated both theoretically and experimentally. Simultaneous neutron and light scattering data for the same system (deuterated isobutyric acid-heavy water) will be obtained in order to relate the correlation function to critical parameters. Thermal conductivity and viscosity of liquids near the gas-liquid critical point will be investigated to relate them to theoretical scaling predictions. Finally, spinodal decomposition of a binary liquid mixture (3-methylpentane-nitroethane) will be studied using a novel pressure-quenching technique.

This research previously supported by DMR 7682345 A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, STRUCTURAL STUDIES OF LIQUID CRYSTALS

R.B. Meyer, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR79-15149)

This project is concerned with the first quantitative measurement of the fundamental defect structure of smectic A liquid crystals. A number of observations on the fluid properties of these materials had suggested that dislocations must be present, but these defects have first been seen by Dr. Meyer only in the last year. Such information is essential for understanding the fluid and mechanical properties of smectic liquid crystals, whose potential for use in display technology is just being appreciated. It is expected to be useful also for understanding dislocations in general, including magnetic flux quanta in superconductors and vortices in superfluid helium. The ability to see these defects in samples at equilibrium by non-invasive techniques, and to watch their response to known applied stresses is unique.

The dislocations are made visible as phase boundaries at the smectic A-smectic C transition. Precisely controlled stresses are applied to the sample, and the resulting strains and dislocation response are measured. A time-lapse video recording method allows analysis of the dislocation dynamics. The experiments are aimed at measuring dislocation energy and mobility, pinning effects, interdislocation interactions, and coupling to fluid flow. Measurements will be made also as a function of smectic A ordering approaching the smectic A-smectic C-nematic multicritical point. Finally, the dislocations will be used to attempt to make visible small steps on otherwise perfect surfaces.

First year of a three-year continuing grant; renewal of work supported by DMR76-22452.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, GROWTH OF RUBY CRYSTALS BY THE HEAT EXCHANGER METHOD

C.P. Khattak, Crystal Systems Inc., *35 Congress St., Salem, Massachusetts* 01970 (DAR79-17180)

Solid-state laser systems are presently being considered for laser fusion applications. Two of the main obstacles in this area are the availability of large size crystals and uniform dopant distribution. This research is directed to grow ruby crystals by the Heat Exchanger Method (HEM) for laser applications. At the present time ruby is grown commercially in sizes up to one inch diameter. Besides lack of availability of large sizes, the distribution of chromium dopant in the crystals is non-uniform, making it difficult for use in stringent optical applications. In the HEM process, crystal growth occurs under stabilizing temperature gradients with no movement of crystal, crucible or heat zone. The solid-liquid interface is submerged and surrounded by the melt; therefore, very uniform temperature gradients exist at the interface. These features allow uniform distribution of dopant, homogeneity in grown crystals and controlled cool-down to minimize normal stresses and prevent shattering.

During the proposed Phase I, it is intended to grow three-inch diameter ruby crystals by HEM and concentrate on the evaluation of crystal quality, distribution of chromium dopant, and uniformity of refractive index. Samples will be tested at the Lawrence Livermore Laboratory for stringent optical quality. The feedback from the quality assurance will be used to improve crystal growth process to achieve the desired objectives.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Applied Research

8.0027, NUCLEAR RESONANCE

R.V. Pound, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DMR79-07023)

Nuclear resonant techniques such as nuclear magnetic resonance (NMR), nuclear quadrupole resonance (NQR), and Mossbauer spectroscopy provide a means for measuring extremely small changes in energy. In this project, Mossbauer and NQR techniques will be employed in order to develop a spectroscopy for examining energy shifts in zinc-67 and tantalum-181 which have extremely narrow resonant line shapes. Thus, these isotopes offer the most sensitive opportunities for observing small energy shifts.

Tantalum-181 will be used to extend the measured accuracy of the gravitational red shift of the nuclear gamma rays. A flat glass wave guide will be constructed in order to transport the radiation from the source to the absorber--effectively focusing the radiation on the absorber.

High field, low temperature NMR experiments on solid hydrogen will be carried out in order to study the dynamic polarization of the nuclei. Phases of purely nuclear ordering in the solid will be sought.

This is the first year of a three-year continuing grant.

This research was previously supported under DMR 7684497 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, INVESTIGATION OF ATOMIC AND MOLECULAR PROCESSES WITH MODERN PREVISION SPECTROSCOPY

A. Javan, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (PHY79-14521)

This research program covers a broad area of investigation of basic atomic and molecular processes, as well as research relating to novel laser technologies. An important part of the program will be further work in the area of electron tunneling spectroscopy of submicron tunneling junctions (relating to novel quantum electronic applications). In a different area, near UV laser spectroscopy will be performed utilizing novel intense monochromatic frequency tunable UV gas laser sources. Other work of the laboratory will consist of laser-initiated-chemistry (in the IR and the visible range), nonlinear Doppler free spectroscopy, energy transfer and molecular relaxation studies, upconversion of an optical field and several long-term projects in the specified areas.

This research is a continuation of that previously supported under NSF grant PHY77-18761A02.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0029, ATOMIC AND MOLECULAR PHYSICS

G. Victor, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31A-4A50-01)

Methods and computation programs have been developed for constructing theories and models of the basic atomic and molecular processes in the creation, generation, and dissipation of energy. This theoretical research helps establish the parameters for study of terrestrial, stellar, and planetary atmospheres, as well as the interstellar and intergalactic mediums.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

8.0030, NUCLEAR STRUCTURE THEORY

K.T. Hecht, University of Michigan, Ann Arbor Campus, School of Liberal Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY77-15273 A01)

This work is in the field of theoretical physics with emphasis on the study of the nucleus.

Group theoretical techniques and SU(3) recoupling technology are being exploited in various applications to nuclear structure problems: (1) Symplectic SP(6,R) symmetry and SU(3) symmetry are being used in a study of the decay modes, structure, and fragmentation of isoscalar giant quadrupole resonances in nuclei in the A equals 12-40 range. (2) The fine structure and decay properties of the 12C plus 12C molecular resonances are being studed in a microscopic framework with emphasis on branching ratios into decay channels 12C plus 12C, 16O plus 8Be, 20Ne plus S, 23Na plus p,...(3) By combining SU(3) recoupling and Bargmann-Segal integral transform techniques, new methods are being developed for nuclear cluster problems with emphasis on multi-cluster problems and systems of binary clusters made up of heavy fragments. (4) A microscopic study of band crossing, backbending, and rotational alignment phenomena in heavy deformed nuclei in a shell model framework is made possible by combining normal parity shell model configurations severely truncated in a pseudo-SU(3) basis with wrong-parity high-j intruder configurations.

This work is a continuation of that currently supported under NSF grant PHY77-15273.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0031, ACOUSTIC MEASUREMENTS OF THERMAL AND MOMENTUM ACCOMMODATION COEFFICIENTS

D.F. Shields, University of Mississippi, University Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *University, Mississippi* 38677 (DN875606; N00014-78-C-0583)

To study gas-surface interactions and especially to measure the energy and tangential-momentum accommodation coefficients at the surface. The proposed measurements of energy and momentum accommodation coefficients are relevant to Navy problems such as calculation of drag coefficients on satellites and space vehicles and calculation of heat transfer and pumping speeds in rarified gases.

It has been shown that the velocity and absorption of sound waves propagated through a low pressure gas confined to a tube are changed significantly when adsorbed gas molecules are re-

moved from the tube wall. This phenomena is used as a basis for developing a method for simultaneous measurement of the energy and tangential-momentum accommodation coefficients.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0032, A STUDY OF THE COSMIC-RAY MODULATION USING GROUND-BASED NEUTRON MONITORS AND SPACECRAFT COSMIC-RAY DETECTORS
J.A. Lockwood, University System of New Hampshire, University of New Hamsphire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM77-08971 A01)

This grant supports a study of the cosmic-ray modulation near the onset of the new solar activity cycle (21). Cosmic-ray data will be drawn from neutron monitors, Pioneer spacecraft cosmic-ray telescopes, IMP cosmic-ray monitors and the new cosmic-ray telescope on Voyager. The continued operation of the Mt. Washington neutron monitor will provide coverage through the beginning of the new cycle and the necessay baseline data for these studies. The first objective is to study the relationship between the cosmic-ray intensity at various distances outward from the earth (1AU to approximaely 15 AU) and the relationship between the observed Forbush decreases and the 11 year variation. The second objective is to continue a study of the large ground level enhancements on May 7, 1978, and November 22, 1977. In the May event, the large anisotropy, rapid onset, and hard rigidity spectrum make it an ideal event to test ideas about energetic solar particle events. The third objective is to investigate the large Forbush decreases on February 14, 1978, and April 30, 1978, to sharpen the detailed features of a physical model proposed for Forbush decreases. Fourth, from the investigaion of transient variations at large distances from earth it should be possible to develop more fully the model for Forbush decreases.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0033, THEORETICAL PHYSICS
J.D. Bahcall, Inst. for Advanced Study, *Princeton, New Jersey* 08540 (PHY79-19884)

Research will be performed in several areas of theoretical physics, including astrophysics, relativity, and particle physics. The astrophysics group will emphasize problems in stellar dynamics, including galaxy stability, the characteristics of disks, and the evolution of many-body systems, as well as studying aspects of X-ray sources, stellar evolution, the interstellar medium, and extragalactic phenomenology. Work will continue in the area of relativity including especially supergravity and classical fermion solutions. Some possibly related aspects of gauge field theory in particle physics will also be investigated.

This is the first four months of a forty month grant, previous research supported under NSF grant PHY77-20612.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0034, QUANTUM SOLIDS AND THIN HELIUM FILMS AT LOW TEMPERATURES
J.G. Daunt, Stevens Inst. of Technology, Graduate School, Dept. of Physics & Engineering Physics, *Castle Point Station, Hoboken, New Jersey* 07030 (DMR77-09938 A01)

This research is a continuation of work supported under NSF Grant No. DMR-7709938. The experimental program encompasses two broad areas: a) NMR techniques will be used to study phase changes occurring in solid hydrogen, with low ortho-concentrations, at or below 0.3K, and b) Adsorption isotherm techniques will be used in studies of the phase changes occuring in two-dimensional helium-3, hydrogen and deuterium films adsorbed on substrates at low temperatures.

These latter measurements rely on the use of a recently developed low-temperature, high-precision capacitance pressure gauge.

This work will lead to an increase in fundamental knowledge about solid state phase changes in quantum solids as well as the role which reduced dimensionality plays in such transitions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, USE OF MOSSBAUER AND OTHER SPECTROSCOPIES IN STUDIES OF ELECTRONIC AND VIBRATIONAL STRUCTURE
G.M. Rothberg, Stevens Inst. of Technology, Graduate School, Dept. of Physics, *Castle Point Station, Hoboken, New Jersey* 07030 (DMR79-08546)

The electronic and vibrational structure in solids will be studied by means of conversion electron Mossbauer spectroscopy (CEMS) and other electron spectroscopies. Through observation of photoelectrons and of internal conversion electrons produced in radioactive decay or after Mossbauer absorption, new kinds of experiments are possible. Measurements of electron spin densities in magnetic materials, dealing with fundamental aspects of magnetism in solids as manifested by core and conduction electron spin polarizations, will be continued. Work will also be carried out on the depth dependence of the Mossbauer effect in which the energy loss by the conversion electrons or auger electrons in traversing the Mossbauer absorber is used to determine the depth at which they were produced.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, ITINERANT ELECTRON ANTIFERROMAGNETISM AND LOCALIZED MAGNETIC MOMENTS
S. Araji, Clarkson College of Technology, Graduate School, Dept. of Physics, *31 Main St., Potsdam, New York* 13676 (DMR76-09198 A01)

Magnetization and resistivity experiments will be carried out on chromium alloys with iron, cobalt and manganese. This research is directed at increasing our understanding of localized magnetic moments in an itinerant electron antiferromagnetic matrix. The results may be important for the related areas of spin glasses and mictomagnetism.

This research was previously supported under DMR 7609198.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, MODEL SYSTEMS
B. McCoy, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (DMR79-08556)

Research previously supported by DMR7707863.

Theoretical research on systems with an infinite number of degrees of freedom will be carried out, including both statistical mechanical systems and quantum field theories. In particular, the recently calculated n-spin correlations of the two-dimensional Ising model at zero magnetic field will be used to extend the studies of both spin correlation and free energy for non-zero field both below and above the critical temperature. Also, the two-dimensional Heisenberg model and four-dimensional gauge theories will be investigated. The emphasis will be on obtaining exact results on the properties of these systems.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0038, COMMUNICATIONS - DISORDERED SOLIDS
D.G. Haase, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (DN975200; N00014-79-C-0133)

This work involves investigation of a model system for disorder in solids. Future naval systems for communication and information storage may utilize disordered materials.

The pressure and specific heat of solid hydrogen will be studied as a function of temperature and orthohydrogen concentration in a regime where it serves as an analogue of spin glass.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0039, ELECTRON EMISSION CROSS-SECTIONS OF ATMOSPHERIC GASES FOR THE VACUUM ULTRAVIOLET LIGHT STANDARD PROJECT

J.S. Risley, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (ATM77-19643 A02)

The grant funds research on secondary absolute light standards for the calibration of monochromators in the vacuum ultraviolet region (500-1500A) and extreme ultraviolet region (50-500A). The basic concept of the light standard relies on the fact that line radiation is emitted when an energetic beam of electrons passes through a gas. If the emission cross-section for a line is known for a particular electron impact energy, the flux of radiation can be determined from the current of electrons and the density of the target gas. Using the well-parametered synchrotron radiation from the NBS storage ring as the primary absolute light source, the sensitivity of a monochromator will be calibrated from measuring numerous emission cross-sections relevant for a secondary light standard. Initially, the overall accuracy of the emission cross-sections is expected to be better than 15 percent with a long-term goal of 2-5 percent depending on the transition. The vacuum ultraviolet light standard project ultimately should lead to the development of a highly useful tool for a broad range of scientists working with vacuum ultraviolet radiation. This proposal, specifically, is concerned with measuring the electron emission cross-section for VUV light (500-1500A) emitted by gas targets of O2, N2, NO and H2O.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0040, THERMAL AND OPTICAL STUDY OF LIQUID CRYSTAL PHASES AND PHASE TRANSITIONS

D.L. Johnson, Kent State University, School of Arts & Sciences, Dept. of Physics, *Hilltop Dr., Kent, Ohio* 44240 (DMR7906330)

Liquid crystals are well known because of their widespread use in display devices (as in pocket calculators) and temperature indicators. The present interest, however, is primarily scientific. This experimental program is designed to reveal the positions occupied by the various liquid crystal phases (also called 'mesophases') in the hierarchy of phases of condensed matter and to provide new challenges to the modern theory of critical phenomena and phase transitions. The information obtained should be useful, also, in providing guidance for construction of molecular theories of liquid crystal behavior.

The experiments are primarily high resolution a.c. (alternating current) microcalorimetry measurements of heat capacities and transition entropies associated with liquid crystal phase transitions, complemented by selected light scattering and magnetic measurements. In designing each set of experiments, the authors have assumed as a working hypothesis that the various liquid crystal phases belong to certain more general categories of phase of condensed matter known as universality classes. Where there have been predictions of the appropriate universality class, experiments are chosen that offer a definitive test of these predictions. The primary emphasis is on the nematic-smectic A, smectic A-smectic C, nematic-smectic C, smectic A (or C)-smectic Bt (tilted) phase transitions and on certain special critical points called multicritical points.

First year of three-year continuing grant; renewal of work supported by DMR76-21346.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0041, POSSIBLE QUANTUM CROSSOVER EFFECTS IN PURE FLUIDS NEAR THEIR CRITICAL POINTS

M.H. Chan, University of Toledo, School of Arts & Sciences, Dept. of Physics, *2801 W. Bancroft St., Toledo, Ohio* 43606 (DMR7825014)

A high-precision, systematic study of the equation of state of oxygen, argon, para-hydrogen and deuterium fluids will be carried out in the vicinity of the respective critical points. In order to investigate the predicted 'quantum-crossover' effect, three different critical exponents will be obtained in two concurrent experiments based on the use of cryogenic sample cells containing small parallel plate capacitors filled with the fluid under investigation. Measurements of the dielectric constant in the one and two phase regions allow one to derive the isothermal compressibility, density differences and isotherms of the various fluids from which their critical exponents are derived. This study will provide a definitive test for the existence of the quantum crossover phenomenon and as such is important for our fundamental understanding of quantum liquids.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0042, VELOCITY AUTOCORRELATION

Y.W. Kim, Lehigh University, School of Arts & Sciences, Dept. of Physics, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (PHY79-09267)

This project studies the details of the behavior and properties of gasses at the molecular level, and measures the microscopic fluctuations and persistences of motion that, integrated, make up the macroscopic properties. An experimental program of determining the persistent velocity autocorrelation function for Brownian and molecular fluctuations will be continued. The velocity autocorrelation function is measured directly for Brownian motion as a function of gas density by a new technique currently set up for measuring particle positions at the rate of 100 MHz and up to 8 million times per run. In a second experiment, consequences of the persistent velocity autocorrelation for molecular motion are investigated by studying pulsed plasmas undergoing decay in very dense hydrogen and argon.

This research is a continuation of that currently supported under NSF grant PHY77-07858A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0043, TIME-OF-FLIGHT AND OPTICAL STUDIES OF THE ELECTRON-IMPACT EXCITATION AND DISSOCIATION OF MOLECULAR GASES OF AERONOMIC INTEREST

E.C. Zipf, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (ATM78-20538)

We have learned during the past several years that much of the chemistry and energetics determining the nature of the upper atmosphere depends importantly upon atmospheric particles not in their ground-level state, but in excited states. Our need for this knowledge has motivated a set of research activities in the difficult, and intricate, but necessary area of laboratory studies tracing the evolution of specific states of reactant species.

This grant funds a series of complementary experiments that will bring us significantly closer to the goal of completing our knowledge of the fundamental ways in which N2 and O2 dissociate, at providing a comprehensive set of absolute cross-sections for each loss channel, and at studying in detail the aeronomic consequences of the excited species produced by dissociation induced by electron impact and by EUV photo-absorption.

Specifically, in this continuing effort, experiments will be carried out which exploit optical and Time-of-Flight techniques: (1) to measure absolute optical cross-sections for the interpretation of airglow and auroral data in the wavelength range 400A to 1.5 micrometer; (2) to determine the identity of the final atomic and molecular species with particular emphasis on such

metastable species as N(2D), N(2P), O(1S), O(1D), and N2(A3 plus sigma micron units) which play an important role in the overall thermal economy of the upper atmosphere and in its ion and neutral chemistry; (3) to measure the kinetic energy distribution of the 'hot' atoms and ions produced by a variety of dissociative processes with particular interest in the effects of these processes on enhanced exospheric escape and on accelerated ion and neutral chemistry caused by hot atoms.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0044, ATOMIC AND MOLECULAR PHYSICS
L.G. Christophorou, U.S. Dept. of Energy, Oak Ridge National Lab., Health & Safety Research Div., *Oak Ridge, Tennessee* 37830 (00722; W-7405-ENG-26)

The objectives are to: (1) study in detail the elementary processes which accompany the interaction of radiation with matter; (2) investigate the effects of the nature and density of the environment on the elementary photophysical and charge transfer properties of biomolecules and the elementary processes that accompany the interaction of radiation (ionizing and nonionizing) with matter; and (3) link the physical and chemical properties of biomolecules in gases with these in the condensed phase. Quantitative and integrated experimental and theoretical studies on low-energy electron-molecule interaction processes, negative ions, electron transport and photoionization of molecules in low- and high-pressure gases in liquids will be employed to obtain this objective.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

8.0045, 1 MM WAVELENGTH OBSERVATIONS OF SOUTHERN HEMISPHERE SOURCES
J.J. Condon, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Physics, *Blacksburg, Virginia* 24061 (INT79-10830)

Under this award three U.S. physicists and astronomers, James J. Condon of Virginia Polytechnic Institute and State University, and James R. Houch and T. Roellig of Cornell University, will work from August through September 1979 with Australian colleagues, principally J.G. Bolton and D.L. Jauncey of the CSIRO Division of Radiophysics and K.H. Elliott of the Anglo-Australian Observatory, on a program of astronomical observations of the southern skies at wavelengths near one millimeter. The southern heavens contain a wealth of objects of astrophysical interest that are inaccessible to northern observatories and remain virtually unexplored at wavelengths near alpha equals 1 mm. In order to carry out the collaborative observations, the Americans will take with them a helium-3 bolometer to be installed on the 3.9 meter optical Anglo-Australian Telescope (AAT) on Siding Spring Mountain in New South Wales. The objects to be observed at 1 mm wavelength include the galactic center, the Magellanic Clouds, variable X-ray/radio sources (e.g., Cir X-1 and Sco X-1) and several Seyfert galaxies, QSOs, BL Lac objects, etc.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0046, EQUIPMENT FOR RESEARCH ON QUANTUM THEORY OF MOLECULAR SCATTERING
K. Tang, Pacific Lutheran University, School of Arts & Sciences, Dept. of Physics, *P.O. Box 2068, Tacoma, Washington* 98447 (PRM79-21430)

This research equipment grant makes it possible to establish a computer RJE terminal at Pacific Lutheran University for Dr. K.T. Tang to carry out his research in theory of molecular scatterings. This research is centered on the adiabatic distorted wave model and the polarized target coupling model. Based on T-matrix formalism of the quantum theory of scattering, these approaches couple the incident atom with target molecule and thus are realistic three-dimensional methods. In certain cases, extensive calculations can already be carried out; in others, developments which are also essentially computational are needed. An RJE terminal connected with the National Resource For Computation in Chemistry at Lawrence Berkeley Laboratory will make this work possible.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management

8.0047, TOPIC IN THE THEORY OF TRANSITION-METAL SURFACES AND APERIODIC MATERIALS
J.J. Rehr, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR79-07238)

Research previously supported by DMR7682112. Aperiodic materials are those which lack the periodic translational symmetry that simplifies the theory of crystalline solids; these include solids with surfaces or impurities or disorder, etc. This research consists of three topics which deal with such systems from a local-environment viewpoint: (1) The theory of the Extended X-ray Absorption Fine Structure (EXAFS) deals with a new experimental technique for determining local atomic structure in aperiodic materials. Two factors which reduce EXAFS amplitudes in solids will be studied: the many-body 'shake-up' and 'shake-off' processes, and the Deby-Waller factor. These studies should improve the determination of coordination numbers and vibrational structure from EXAFS. (2) The second topic is a generalization of the recursion method, a recently developed theoretical technique for determining local electronic structure in aperiodic materials, permitting in addition, calculations of the electron density. An application calculation of the d-electron contributions at noble and transition metal surfaces will be carried out. (3) A final topic is the theory of sub-monolayer helium films, physisorbed on rare gas overlayers. A new tight-binding theory which makes use of the recursion method to calculate the low-temperature thermodynamics of these quantum systems will be evaluated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, REFURBISHMENT OF THE LUNATIC MASS SPECTROMETERS
G.J. Wasserburg, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sci, *1201 E. California Blvd., Pasadena, California* 91109 (EAR77-26082)

The proposal is a request for funds to upgrade two mass spectrometers. The spectrometers are twelve-years old and need thorough overhauling, since now they have a down time of about 50%. The major causes of failure lie in the electronic systems. The projects that will make use of the spectrometers include: 1) determination of the primitive isotopic composition of Sr in the early solar nebula; 2) determination of the Rb-Sr and U-Th-Pb ages of stoney and iron meteorites; 3) discovery of extinct 26-Al; 4) measurement of neutron capture effects in meteorites and in lunar materials; 5) determination of the chronology of the moon; 6) application of the new Sm-Nd dating technique to lunar and terrestrial samples.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

10.0002, THEORETICAL INVESTIGATIONS OF X-RAY SOURCES
J. Arons, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST78-21070)

This project will be concerned with theoretical investigations of galactic X-ray sources. The model to be adopted is one in which the observed X-ray emission is due to the infall of

matter onto a magnetized, rotating neutron star in a binary system. Within the context of this model, there will be studies of neutron stars with slow, medium and fast rotation rates in an effort to model the observed sources. The models that are obtained will be compared with observational data in order to gain insight into the origin and evolution of neutron stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0003, OBSERVATIONAL AND THEORETICAL STUDIES OF PRE-MAIN SEQUENCE EVOLUTION

L.V. Kuhi, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST79-02866)

This research will make use of the current spectroscopic data that exist on the very young stars to construct models for the atmospheres of such stars and for the interaction of their winds with the surrounding interstellar medium.

The stars to be studied are known as T Tauri stars. They are found in dark clouds and must be very young. It appears that they are still in a stage of contracting towards the main sequence and are among the youngest objects that can be considered stars. The stars have a mass similar to that of the sun.

The models to be constructed will be based on an approach where it is assumed there is a chromosphere that begins deeper in the atmosphere and has a steeper temperature rise than the solar chromosphere which is responsible for the observed emission features. A global, self-consistent stellar wind model will be constructed. Comparison will be made with observations of emission line intensities in the nebula surrounding the young star T Tauri. Further observations will be undertaken to determine the time scale on which emission features in T Tauri stars vary.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0004, MAGNETIC STRUCTURES AND FIELD RECONNECTION - MECHANISMS OF SOLAR-TERRESTRIAL ACTIVITY

G. Van Hoven, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (ATM79-11912)

The present program has a number of related objectives. They include a study of energy-transport and resistivity-transition effects on magnetic tearing, with application to phase changes in flares. The influence of finite boundaries and thin turbulent sheets on the resistive stability of coronal loops will also be investigated. The recent thermal-instability calculation will be extended to include other parameter ranges and some presently neglected physical effects. Finally, an attempt will be made to devise a new, more detailed method for the computation of small-scale force-free fields.

The long-term aim of this research is the synthesis of a comprehensive description of the resistive and radiative instabilities of a sheared magnetic field, which will then represent a nearly complete flare model, and to predict empirical tests which will demonstrate its reality. The impending Solar Maximum (spacecraft) Mission represents a unique focus for this program.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0005, THEORETICAL NUCLEAR ASTROPHYSICS

S.E. Woosley, University of California, Santa Cruz Campus, Lick Observatory, *Mount Hamilton, California* 95140 (AST79-09102)

This research will be devoted to a numerical study of stars having masses in the range of fifteen to one million solar masses. This study will analyze the evolution of these stars and the role such objects, especially supernovae, may have played in creating the elements heavier than helium. The detailed nucleosynthesis resulting from the normal evolution and explosion of stars having masses 15, 20, 25, 35, 50, 100, and 150 times that of the sun will be studied. In addition the collapse and possible explosion of supermassive stars (having masses in the range of one hundred thousand to one million solar masses) will be examined using one- and two-dimensional hydrodynamic computer codes that contain the detailed nuclear physics appropriate to such events.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, THEORETICAL INVESTIGATION OF THE INVERSION OF INFRARED SOLAR OCCULTATION MEASUREMENTS

D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (9-315; NA79AA-D-00021)

OBJECTIVES: To develop theoretical techniques for inverting satellite infrared solar occultation measurements to obtain distributions of concentrations of trace gases in the stratosphere.

APPROACH: The University of Denver will simulate the response of a multi-channel radiometer viewing the setting sun through the earth's atmosphere. They will develop mathematical techniques for inverting response-versus-viewing angle curves to obtain concentrations of trace gases in the stratosphere. This work includes the development of simple and accurate models for computing the absorption by such gases as nitric acid, freons, water vapor, and ozone in limb paths.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., National
Environmental Satellite Service

10.0007, RELATIVISTIC ASTROPHYSICS AND GRAVITATION THEORY

D.M. Eardley, Yale University, School of Arts & Sciences, Dept. of Physics & Astronomy, *206 Elm, New Haven, Connecticut* 06520 (PHY79-16482)

Theoretical research in relativistic astrophysics initiated under NSF grant PHY76-82353A01 will be continued. Among the topics to be investigated are: 1. Gravitational Collapse; a) pertubations of spherical collapse; b) ellipsoidal models; c) growth of asymmetry during core bounces; d) nonaxisymmetric numerical relativity. 2. Global Analysis of Gravitational and Yang-Mills fields; a) linearization stability; b) singularities and maximal slices. 3. Black Holes and Gravitational Waves; 4. Source and Detection of Gravitational Waves; a) pulsars as sources and detectors; 5. Quantum Gravity.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

10.0008, IMAGE INTENSIFIER SYSTEMS

W.K. Ford, Carnegie Inst. of Washington, Dept. of Terrestrial Magnetism, *1530 P St. N.W., Washington, District of Columbia* 20005 (AST79-03432)

The cascaded image intensifier systems developed by the Carnegie Institution have had widespread success in obtaining many diverse types of astronomical observations. Among the advantages of this detector are relatively high efficiencies compared with photographic plates and a large number of picture elements compared with the presently available digital detectors. The image intensifier systems are simple to operate and require little maintenance for routine observatory operation. Early versions of these tubes have been used extensively at the Las Campanas Observatory and at the Lowell Observatory. Systems incorporating more recently produced tubes are heavily scheduled at the Kitt Peak National Observatory, the Cerro Tololo Interamerican Observatory and on the duPont Telescope at the Las Campanas Observatory. This grant will provide for devel-

opment of a new, higher quality tube which will improve and enhance the observational capability of the present systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, PHOTOMETRIC STUDIES OF ALGOL-TYPE BINARY STARS IN THE RED, NEAR INFRARED AND ULTRAVIOLET WAVELENGTH REGIONS

K. Chen, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Astronomy, *208 Tigert Hall, Gainesville, Florida* 32601 (AST78-07169 A01)

Support is for observation and analysis of selected Algol-type eclipsing binary stars. In this type of close binary system, the primary (more massive) components are main sequence stars fitting well into the mass-luminosity relation. The secondary components are of later spectral type, overluminous for their mass and spectral class and, in general, fill their critical Roche lobes so that mass exchange is usually underway. The planned red and infrared photometric observations will contribute to a better understanding of the cooler secondary components and the geometric and photometric elements of the systems.

Spectrometric data on Beta Persdi (Algol) in the ultraviolet were obtained jointly with F. B. Wood as guest investigators on the Copernicus satellite. Identification of ultraviolet lines will be continued, and observed line profiles determined and compared with theoretical profiles at the partial eclipse phases to test the geometrical model of the Algol system.

The results of these investigations will be published along with tables calculated by J. E. Merrill for determining elements of eclipsing binaries with elliptic orbits.

Prior support was by NSF grant AST 78-07169.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, THE YERKES OBSERVATORY ASTROMETRIC PROGRAM

K.M. Cudworth, University of Chicago, School of Physical Sciences, Dept. of Astronomy & Astrophysics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (AST78-01657 A01)

A feature of the Yerkes program is the study of proper motions of stars in open and globular star clusters, important as indicators of the course of stellar evolution, as tracers of galactic structure, and as examples of dynamical systems in various states of relaxation. Their study also contributes to the calibration of the luminosities of various types of stars as well as the distance of the galaxy and the universe. The relative proper motions of cluster stars with sufficient accuracy to determine membership in such clusters will be continued. Pairs of plates made with the Yerkes long-focus 40-inch refracting telescope over a long base line in time will be used. Emphasis will be on globular clusters and the Ursa Minor dwarf spheroidal galaxy.

Another emphasis is on determination of the important parameter of distance of stars in the solar neighborhood through measurement of the parallactic shift of the stars as the earth circles the sun. The development of observing, measuring, and reduction techniques to substantially increase the accuracy of these trigonometric parallaxes will also be continued. Objects currently being observed include red dwarf stars, white dwarf stars, and stars in the Hyades cluster as part of an international campaign.

Prior support was by NSF grant AST 78-01657.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, THEORETICAL INVESTIGATIONS IN STELLAR DYNAMICS

P.O. Vanderwoort, University of Chicago, School of Physical Sciences, Dept. of Astronomy & Astrophysics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (AST7821884)

The research deals with the development and numerical testing of theories of stellar orbits in galaxies, the study of galactic dynamics in terms of such theories, and the investigation of dynamical processes which depend on special properties of the orbits. Such investigations provide a fundamental understanding of the forms of galaxies and of the patterns of stellar motions in galaxies. They also provide a basis for the interpretation of computer simulations of galaxies. One part of this work concerns the contribution of resonant stars to the excitation and maintenance of spiral structure in galaxies. Detailed studies will be made of (1) the exchange of energy and angular momentum between resonant stars and spiral density waves or other nonaxisymmetric disturbances and (2) processes by which stars become trapped in resonant orbits. The second part of this research deals with the dynamics of rotating galactic bars. The principal effort will be devoted to the enumeration of the isolating integrals of the motion of stellar orbits and to the incorporation of the integrals into equilibrium models of galactic bars. The possibility will be investigated that resonant stars play an important role in the dynamics of galactic bars as is suggested by recent computer simulations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0012, RADIO AND OPTICAL STUDIES OF INTERSTELLAR CLOUDS

R.M. Crutcher, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST76-20810 A01)

This project is to study abundances and physical conditions in interstellar clouds. Three areas will be studied: 1) interstellar magnetic fields. A new approach is to be used which will give a factor of 10 higher sensitivity, namely using Zeeman splitting in the hydroxyl radical (OH); 2) excitation and abundance of the OH molecule. The possibility of anomalies in the strengths of the OH lines in the wavelength region of 18 centimeters will be investigated both observationally and theoreticaly; and 3) diffuse clouds by means of optical observations of interstellar potassium and lithium and the molecules CH ion and CH in stars which are much more highly reddened than those previously studied.

This research should lead to a better understanding of the physical conditions in interstellar clouds and the process of star formation.

This is a continuation of AST-7620810.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0013, HIGH RESOLUTION STUDIES OF SOLAR ACTIVE REGIONS, FLARES AND PROMINENCES AT CENTIMETER AND MILLIMETER WAVELENGTHS

D. Kundu, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (ATM78-21762)

This grant continues the use of existing large interferometers such as the Very Large Array (VLA), the Westerbork Synthesis Radio Telescope (WSRT), and the Mat Creek interferometer for making high resolution observations of solar active regions, flares and prominences at centimeter and millimeter wavelengths. It is intended to produce maps of active regions with high spatial resolution from observations over a period of 8-12 hours, using the VLA and the WSRT. These maps will provide information on the distribution of temperature (Te), (Ne) and magnetic field in active regions. Comparison of these maps with x-ray maps to be obtained from the Solar Maximum Mission with a resolution of a few arc seconds which give Te and Ne fairly accurately, should lead to a better understanding of the generating mechanism of radio emission from active regions and should result in a better estimate of coronal magnetic fields. It is also intended to study the increases in intensity and polarization in the active region core and identify them with specific features in soft x-rays, in order to understand better the flare build-up process. The spatial resolution will

answer the question of whether in a complex region the flaring kernel is the one that undergoes pre-heating.

The radio data will permit an understanding of the mechanisms responsible for the release of energy during the impulsive phase and the acceleration of electrons, and to determine the site of electron acceleration. In combination with hard x-ray data to be obtained from SMM they will also permit critical examination of the existing flare theories and X-ray flare models with particular reference to the magnetic field configuration.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0014, MULTIPLE GEOSYNCHRONOUS SATELLITE OBSERVATIONS OF GEOMAGNETIC PULSATIONS

W.J. Hughes, Boston University, School of Liberal Arts, Dept. of Astronomy, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (ATM79-11899)

Geomagnetic pulsations, long considered an interesting phenomenon in their own right, are rapidly becoming important diagnostic tools for observing the state of the magnetosphere and solar wind. Their usefulness in this respect will be greatly enhanced by a better understanding of the mechanisms by which they are produced and by which they propagate in the magnetosphere and to the ground.

Early in this decade rapid advances in our understanding of pulsations were made by using chains of magnetometers along a line of constant longitude. These results led directly to the development of new theories of pulsation structure and the resonance of geomagnetic field lines, but an important parameter which helps distinguish between competing theories of pulsation production remained unmeasured. This parameter is the East-West wavelength of pulsations. Very recently a few measurements of East-West phase difference have been made, and both direction of propagation and East-West wave-length could be deduced. Some results fitted expectations but many did not and more work needs to be done. The research supported here will extend one of the earliest studies of East-West structure, and the only one made in space. A fortuitous grouping of three geosynchronous satellites equiped with similar magnetometers occured for three months in early 1975, and so formed a de facto East-West chain of magnetometers in space. An examination of data from six dayside passes has produced many new results. One of these is that the nightside appears to be an important source of many dayside pulsations, and this fact has been corroborated by recent results from a ground network. This grant permits a comprehensive analysis to address this question in particular. The aim is to provide insight into the major production mechanisms of geomagnetic pulsations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0015, MODEL ATMOSPHERES

R. Kurucz. Smithsonian Institution, Astrophysical Observatory, Solar & Stellar Physics Div, *60 Garden St., Cambridge, Massachusetts* 02138 (31S-4S50-03)

Analysis of solar photospheric rocket spectra of W. Parkinson, E. Reeves, and J. Kohl. The stages of the analysis are definition of a wavelength scale, identification of the lines, and finally comparison of the predicted intensities to those observed. Information should be forthcoming on the reliability of gf values, damping constants, photoionization cross-sections, abundances, solar models, and the rocket calibration.

Through spectral synthesis the analysis of rocket and satellite data for early stars was found to be much more complicated than has been generally assumed. Many of the observed features are, in fact, blends of a number of lines, so that simple analysis in terms of equivalent widths is not possible and detailed spectral synthesis is required.

A preliminary theoretical solar model photosphere was published and work is continuing on improving the line data which goes into the calculation.

In collaboration with J. Lester and A. Dupree, analysis of their stellar observations from the Copernicus satellite. Also guest investigator on Copernicus for observations of Vega and Sirius.

Production of a grid of line-blanketed model atmospheres for F, A, B, and O stars for a range of gravities down to the radiation pressure limit, for abundances 10, 3, 1, 1/3, 1/10, 1/30, and 1/100 solar, and for a range of microturbulent velocities. These models will be used to determine the variation of any observable quantity (colors, energy distributions equivalent widths, line profiles) with temperature, gravity, abundance, and microturbulent velocity. These models should resolve differences between galactic clusters, microturbulence in A stars, metallicity, and population differences.

Research on gf values for the iron group, gf values for interstellar lines, and a gf value compendium (with E. Peytremann).

Research on several aspects of the problems associated with calculating realistic line-blanketed model stellar atmospheres.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0016, REDEVELOPMENT OF THE CONTROL DATA CORPORATION-LUYTEN MEASURING ENGINE

R.M. Humphreys, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (AST78-07961 A03)

The Control Data Corporation-Luyten measuring engine was originally developed to determine the positions of large numbers of stars. This supplement will provide funds to test its present performance, to determine the suitability of use of this instrument for more general astrometric problems such as the determination of colors and magnitudes of stars, star and galaxy counts, and pattern recognition (nonstellar images) problems and to move the measuring engine to the University of Minnesota.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0017, A THEORETICAL STUDY OF THE RR-LYRAE AND CEPHEID VARIABLE STARS

N.R. Simon, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (AST79-05290)

This research will be concerned with a theoretical analysis of variable stars. While most stars have a constant luminosity over long periods of time, there are several types of stars that are observed to be variable. This variation is periodic and, depending on the star, may range from a fraction of a day to several weeks. The physical origin of this change in the luminosity of a star is now known. Nevertheless, a number of problems still remain. In particular, different results for the masses of these stars are obtained from stellar pulsation theory as compared to stellar evolution theory. Some stars are observed to have two distinct pulsation periods. These periods cannot be reconciled with standard assumptions regarding evolution, pulsation and chemical abundances. This problem, plus related problems in stellar pulsation theory, will form the basis of this research project.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0018, STABILITY OF STARS AND CIRCUMSTELLAR FLOW

R.F. Stellingwerf, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (AST77-26993 A01)

The research to be carried out under this grant will involve the study of pulsation in different types of stars as well as the study of transient hydrodynamic phenomena in stellar objects. The topics to be studied include: 1. Work on nonlinear periodic pulsations and stability of the limit cycle of variable stars. The stars to be studied inclde lower Cepheid strip variables and Beta

Cepheid variables. 2. The analyses of the pulsation periods of variable star; 3. Linear and nonlinear analyses of protostellar collapse and transient X-ray sources. Application to stellar pulsation and stellar winds is planned.

SUPPORTED BY U.S. National Science Foundation,
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10.0019, INVESTIGATIONS OF GALACTIC AND EXTRAGALACTIC RADIO FREQUENCY BURSTS

I.R. Linscott, Dudley Observatory, *69 Union Ave., Schenectady, New York* 12308 (AST79-11142)

Radio frequency bursts of galactic and extragalactic origin will be investigated using the dispersion deconvolution signal processing that has been recently developed. Preliminary observations to detect weak, highly dispersed radio bursts from the directions of Virgo A, and Sagittarius A at 327 MHz using a preliminary configuration of the dispersion signal processing have been made on Dudley Observatory's 30-meter diameter radio telescope. The current combination of hardware and software signal processing has a high sensitivity for radio bursts but a very low (10 to the minus 4th power) detection efficiency. The detection efficiency will be improved and searches will be made for additional sources of asynchronous radio bursts. Radio bursts carry information on the density and turbulence of plasmas both in the vicinity of the burst source and within interstellar or intergalactic clouds. The radio bursts then provide a singular opportunity to measure the physical conditions with these plasmas. The physical conditions will be estimated by measuring the plasma dispersion and scintillation constants of the individual radio bursts. These constants will be measured using a simple extension of the current deconvolution signal processing incorporating additional high speed arithmetic processing.

This is s continuation of AST-7807406.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0020, THE MASTER LIST OF NON-STELLAR OPTICAL OBJECTS

R.S. Dixon, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (AST78-24455)

The Master List of Non-Stellar Optical Objects (or Master Optical List, MOL) is the first systematic listing of all known non-stellar objects made since Dreyer published his final IC in 1908. All known catalogs (about 250) of non-stellar objects have been combined together into a single, uniform listing, having about 185,000 entries. The types of objects included are galaxies, clusters of galaxies, planetary nebulae, reflection nebulae, absorption nebulae, emission nebulae, blue objects, quasi-stellar objects, and many others. Each listing includes the name, position (1950.0), angular diameter, diameter, magnitude and type of object.

This work will be published by the Ohio State University press, and partial support of the publication is granted.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0021, LONG-TERM CONTINUOUS OBSERVATIONS OF LARGE SCALE MOTIONS AND STRUCTURES ON THE SUN

M.A. Pomerantz, Franklin Inst. of the State of Pennsylvania, Bartol Research Foundation, *Swarthmore, Pennsylvania* 19081 (DPP78-22467)

A solar telescope will be installed at the Amundsen-Scott Station at the South Pole at the beginning of the austral summer of 1979-1980. During the austral summers of 1979-80 and 1980-81 this instrument will be used to make an extensive study of: 1. the lifetime of supergranules on the sun, 2. the morphology of solar flares, and 3. the potential of the South Pole site for more technically complex solar observations. The detailed analysis of the data obtained will be performed during the third year of this grant.

Logistic support is required for three persons during the austral summer of 1979-80 and 1980-81.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

10.0022, THE CONSTRUCTION OF NEW ASTROMETRIC INSTRUMENTATION FOR THE DETECTION OF EXTRASOLAR PLANETARY SYSTEMS

G.D. Gatewood. University of Pittsburgh, School of Arts & Sciences, Dept. of Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (AST78-01662 A01)

The research to be carried out under this grant will be devoted to the development of a detector which will allow the relative positions of stars to be measured to a very high precision. The eventual precision of such a device would be such as to enable the detection of planetary systems around nearby stars. In order to attain such precision, a number of new engineering concepts must be tested. This project will involve construction of some instrumentation to test out some of the proposed methods.

This is a supplement to NSF grant AST 78-01662.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0023, AN INVESTIGATION OF THE PRODUCTION, RELAXATION, AND DISSOCIATIVE RECOMBINATION OF VIBRATIONALLY EXCITED IONS OF AERONOMIC IMPORTANCE

E.C. Zipf, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (ATM79-06920)

The compositional and thermal structure of the upper atmosphere depends importantly on the chemistry of its constitutent species formed in energy states other than the ground level state. We have much yet to learn about such chemistry.

This grant funds a program of research on the dissociative recombination of molecular ions of aeronomic importance. In this continuing effort experiments will be carried out that exploit newly developed laser-induced photofluorescence techniques: (1) To measure the dissociative recombination coefficients for specifically identified rotational and vibrational levels; (2) To determine the identity and absolute production rates of the important metastable species (e.g. N(2P), N(2D), O(1S), and O(1D) formed by this process as a function of the rotational and vibrational temperature of the ions and the electron temperature of the plasma; (3) To study the vibrational and rotational relaxation of hot plasma ions; and (4) To investigate the ion-molecule reactions of vibrationally excited ions.

SUPPORTED BY U.S. National Science Foundation,
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Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0024, MILLIMETER SPECTROSCOPY OF INTERSTELLAR MOLECULES

P.A. VandenBout. University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST77-28475 A01)

The spectral lines emitted by interstellar molecules at radio wavelengths will be studied. The main instrument used will be the 4.9 meter millimeter-wave antenna of The University of Texas at Austin. Observations will be made with other radio telescopes and with infrared telescopes when necessary. The observed spectral lines are analyzed to infer the physical conditions in the interstellar molecular clouds. Knowledge of these physical conditions is essential to an understanding of the star formation process taking place in these clouds. A variety of interstellar clouds from very simple ones where star formation has

not begun to progressively more complex ones will be observed. The association of star-forming clouds with supernova remnants will also be studied. The spectral lines of certain molecules will be observed throughout ranges of galactic latitude and longitude to infer the distribution of molecular material throughout the Galaxy and the role played by the spiral density wave in forming stars. The association of molecular material with astronomical objects of known or suspected youth will also be investigated. A program of observations of interstellar molecules in external galaxies will be begun. Several astrochemical studies will be attempted: searching for new interstellar molecules and new lines of known interstellar molecules; and studying certain deuterated molecules in a variety of clouds to define chemical production mechanisms and the degree to which fractionation of deuterium into these molecules has occurred.

This is a continuation of grant AST-7728475.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0025, INVESTIGATION OF LOW INTENSITY EMISSION LINES FROM THE INTERSTELLAR MEDIUM

F.L. Roesler, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Physics, *Agriculture Hall, Madison, Wisconsin* 53706 (AST79-08416)

The development of the 15-cm Fabry-Perot spectrometer and associated observing facility at the University of Wisconsin, Madison, has enabled us to carry out an intensive program of observations of extremely faint optical emission lines from the interstellar gas. The observations have provided important information about the distribution, temperature, ionization state, electron density, and filling factor for a widely distributed, ionized component of the interstellar medium as well as for more localized regions of ionization. The observations and data analysis will continue in more detail to study the diffuse emitting regions, including also faint filamentary structures which we have recently discovered. Furthermore, the spectral scope of our work will be extended into the infrared, where the Fabry-Perot spectrometer shows considerable promise for high resolution studies of infrared emission lines such as the quadrupole lines of H2 and the Brackett line of atomic hydrogen.

This is a continuation of AST-7707840AO1.

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N80-15027* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING. A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 115
Nov. 1979 92 p
(NASA-SP-7037(115)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 273 reports, articles, and other documents introduced into the NASA scientific and technical information system in October 1979. Author

N80-15028*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
LANDING APPROACH AIRFRAME NOISE MEASUREMENTS AND ANALYSIS
Paul L. Lasagna, Karen G. Mackall, Frank W. Burcham, Jr., and Terrill W. Putnam Jan. 1980 36 p refs
(NASA-TP-1602) Avail: NTIS HC A03/MF A01 CSCL 20A

Flyover measurements of the airframe noise produced by the AeroCommander, JetStar, CV-990, and B-747 airplanes are presented for various landing approach configurations. Empirical and semiempirical techniques are presented to correlate the measured airframe noise with airplane design and aerodynamic parameters. Airframe noise for the jet-powered airplanes in the clean configuration (flaps and gear retracted) was found to be adequately represented by a function of airplane weight and the fifth power of airspeed. Results show the airframe noise for all four aircraft in the landing configuration (flaps extended and gear down) also varied with the fifth power of airspeed, but this noise level could not be represented by the addition of a constant to the equation for clean-configuration airframe noise. M.G.

N80-15029# Boeing Aerospace Co., Seattle, Wash.
FLEET HARDNESS VARIATION Final Report, Jan. - Sep. 1978
E. N. York and S. L. Strack 29 Sep. 1978 45 p refs
(Contract DNA001-78-C-0138)
(AD-A074849; AD-E300588) Avail: NTIS HC A03/MF A01 CSCL 01/3

The variation of nuclear hardness in a fleet of aircraft is considered and the potential hardness degradation mechanisms identified. These include cracks, corrosion, paint deterioration, and aging of equipment. Methods are developed whereby the variation in hardness in a fleet could be estimated for each of these degradation mechanisms. GRA

N80-15030# Technology, Inc., Dayton, Ohio. Instruments and Controls Div.
APPLICATION OF THE SIRS CONCEPT TO NAVY HELICOPTERS
1 Oct. 1979 112 p refs
(Contract N00019-77-C-0318)
(AD-A074801; TI-0798-05-02) Avail: NTIS HC A06/MF A01 CSCL 01/3

In an effort to determine the feasibility of applying the U.S. Army-developed SIRS recording system to U.S. Navy helicopters, a study was conducted into the specific application of SIRS on the RH-53D helicopter. A fatigue damage assessment model was formulated for nine fatigue-critical dynamic components of the RH-53D helicopter, and two possible flight condition monitoring systems were synthesized. Both systems were found to be technically acceptable, but only one was practical based on current recording technology. The resulting system was analyzed from a life-cycle cost viewpoint and found to be cost-effective. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-15031*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTER PROGRAM TO PREPARE AIRFOIL CHARACTERISTIC DATA FOR USE IN HELICOPTER PERFORMANCE CALCULATIONS
Henry E. Jones Dec. 1977 57 p
(DA Proj. 1L1-61102-AH-45)
(NASA-TM-78627; L-11608) Avail: NTIS HC A04/MF A01 CSCL 01A

A computer program developed to prepare wind tunnel generated airfoil data for input into helicopter performance prediction programs is described. The program provides for numerically cross plotting the data, plotting the data, and tabulating and punching the tabulated result into computer cards for use in the rotorcraft flight simulation model. A.W.H.

N80-15032# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
STUDIES OF NON-LINEAR AERODYNAMIC CHARACTERISTICS OF FINNED SLENDER BODIES AT HIGH ANGLES OF ATTACK
J. Rom and D. Almosnino Nov. 1978 81 p refs
(TAE-349) Avail: NTIS HC A05/MF A01

A method is described for the computations of longitudinal aerodynamic characteristics of complex wing configurations at high angles of attack, and in subsonic flow, including nonlinear vortex lift caused by leading edge or side edge separations. The effects of jets injected near the nose of a body, on the side forces and yawing moments appearing at high angles of attack at subsonic and transonic speeds is presented. It was concluded that a great reduction of side force and yawing moment can be achieved using small amounts of air injection by this method. Further study is needed especially within the high subsonic and the transonic regions. M.M.M.

N80-15033*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CLASSICAL AERODYNAMIC THEORY
R. T. Jones, comp. Dec. 1979 308 p refs
(NASA-RP-1050; A-7556) Avail: NTIS HC A14/MF A01 CSCL 01A

A collection of papers on modern theoretical aerodynamics is presented. Included are theories of incompressible potential flow and research on the aerodynamic forces on wing and wing sections of aircraft and on airship hulls. For individual titles, see N80-15034 through N80-15047.

N80-15034*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
APPLICATIONS OF MODERN HYDRODYNAMICS TO AERONAUTICS. PART 1: FUNDAMENTAL CONCEPTS AND THE MOST IMPORTANT THEOREMS. PART 2: APPLICATIONS
L. Prandtl *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 1-56 refs Transl. into ENGLISH of unidentified German document (For primary document see N80-15033 06-02)
(NACA-116) Avail: NTIS HC A14/MF A01 CSCL 01A

A discussion of the principles of hydrodynamics of nonviscous fluids in the case of motion of solid bodies in a fluid is presented. Formulae are derived to demonstrate the transition from the fluid surface to a corresponding 'control surface'. The external forces are compounded of the fluid pressures on the control surface and the forces which are exercised on the fluid by any solid bodies which may be inside of the control surfaces. Illustrations of these formulae as applied to the acquisition of transformations from a known simple flow to new types of flow for other boundaries are given. Theoretical and experimental investigations of models of airship bodies are presented. M.M.M.

N80-15035*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
THE MECHANISM OF FLUID RESISTANCE
Th. vonKarman and H. Rubach *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 57-66 refs Transl. into ENGLISH from Phys. Z. (East Germany), 15 Jan. 1912 8 p (For primary document see N80-15033 06-02)
Avail: NTIS HC A14/MF A01 CSCL 01A

The mechanism of fluid resistance within the limit of the square law is presented. It was concluded that the investigations should be extended and completed in two directions, namely by an investigation of stable vortex configurations in space, and by considering the perfect fluid as the limiting case of a viscous fluid and then limiting the law of vortex of formation with the condition that only those fluid particles which were in contact with the surface of the body can receive rotation. M.M.M.

N80-15036*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
PRESSURE DISTRIBUTION ON JOUKOWSKI WINGS
Otto Blumenthal *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 67-83 ref Transl. into ENGLISH from Z. fuer Flugtech. und Motorluftschiffahrt (Germany), 31 May 1913 16 p (For primary document see N80-15033 06-02)
(NACA-TM-336) Avail: NTIS HC A14/MF A01 CSCL 01A

The hydrodynamics and mathematical models as applied to the potential flow about a Joukowski wing are presented. M.M.M.

N80-15037*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
GRAPHIC CONSTRUCTION OF JOUKOWSKI WINGS
E. Trefftz *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 84-93 Transl. into ENGLISH from Z. fuer Flugtech. und Motorluftschiffahrt (Germany), 31 May 1913 p 130-131 (For primary document see N80-15033 06-02)
(NACA-TM-336) Avail: NTIS HC A14/MF A01 CSCL 01A

A plot of the cross sectional outline of a Joukowski wing is presented. M.M.M.

N80-15038*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
THE MINIMUM INDUCED DRAG OF AEROFOILS
Max M. Munk *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 95-110 (For primary document see N80-15033 06-02)
(NACA-121) Avail: NTIS HC A14/MF A01 CSCL 01A

Equations are derived to demonstrate which distribution of lifting elements result in a minimum amount of aerodynamic drag. The lifting elements were arranged (1) in one line, (2) parallel lying in a transverse plane, and (3) in any direction in a transverse plane. It was shown that the distribution of lift which causes the least drag is reduced to the solution of the problem for systems of airfoils which are situated in a plane perpendicular to the direction of flight. M.M.M.

N80-15039*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
THE AERODYNAMIC FORCES ON AIRSHIP HULLS
Max M. Munk *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 111-126 refs (For primary document see N80-15033 06-02)
(NACA-184) Avail: NTIS HC A14/MF A01 CSCL 01A

The new method for making computations in connection with the study of rigid airships, which was used in the investigation of Navy's ZR-1 by the special subcommittee of the National Advisory Committee for Aeronautics appointed for this purpose is presented. The general theory of the air forces on airship hulls of the type mentioned is described and an attempt was made to develop the results from the very fundamentals of mechanics. M.M.M.

N80-15040*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
ELEMENTS OF THE WING SECTION THEORY AND OF THE WING THEORY
Max M. Munk *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 127-149 refs (For primary document see N80-15033 06-02)
(NACA-191) Avail: NTIS HC A14/MF A01 CSCL 01A

Results are presented of the theory of wings and of wing sections which are of immediate practical value. They are proven and demonstrated by the use of the simple conceptions of kinetic energy and momentum only. M.M.M.

N80-15041*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
REMARKS ON THE PRESSURE DISTRIBUTION OVER THE SURFACE OF AN ELLIPSOID, MOVING TRANSLATIONALLY THROUGH A PERFECT FLUID
Max M. Munk *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 151-160 refs (For primary document see N80-15033 06-02)
(NACA-TM-196) Avail: NTIS HC A14/MF A01 CSCL 01A

The pressure distribution over ellipsoids when in translatory motion through a perfect fluid is calculated. A method to determine the magnitude of the velocity and of the pressure at each point of the surface of an ellipsoid of rotation is described. A.W.H.

N80-15042*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
THE INERTIA COEFFICIENTS OF AN AIRSHIP IN A FRICTIONLESS FLUID
H. Bateman *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 161-174 refs (For primary document see N80-15033 06-02)
(NACA-164) Avail: NTIS HC A14/MF A01 CSCL 01A

The apparent inertia of an airship hull is examined. The exact solution of the aerodynamical problem is studied for hulls of various shapes with special attention given to the case of an ellipsoidal hull. So that the results for the ellipsoidal hull may be readily adapted to other cases, they are expressed in terms of the area and perimeter of the largest cross section perpendicular to the direction of motion by means of a formula involving a coefficient kappa which varies only slowly when the shape of the hull is changed, being 0.637 for a circular or elliptic disk, 0.5 for a sphere, and about 0.25 for a spheroid of fineness ratio. The case of rotation of an airship hull is investigated and a coefficient is defined with the same advantages as the corresponding coefficient for rectilinear motion. A.W.H.

N80-15043*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
FLOW AND DRAG FORMULAS FOR SIMPLE QUADRICS
A. F. Zahm. *In* NASA. Ames Res. Center. Classical Aerodyn. Theory. Dec. 1979. p 175-196. refs (For primary document see N80-15033 06-02)
(NACA-253) Avail: NTIS. HC A14/MF A01. CSCL 01A

The pressure distribution and resistance found by theory and experiment for simple quadrics fixed in an infinite uniform stream of practically incompressible fluid are calculated. The experimental values pertain to air and some liquids, especially water; the theoretical refer sometimes to perfect, again to viscid fluids. Formulas for the velocity at all points of the flow field are given. Pressure and pressure drag are discussed for a sphere, a round cylinder, the elliptic cylinder, the prolate and oblate spheroid, and the circular disk. The velocity and pressure in an oblique flow are examined. A.W.H.

N80-15044*# Naval Ship Research and Development Center, Washington, D. C.
FLOW AND FORCE EQUATIONS FOR A BODY REVOLVING IN A FLUID
A. F. Zahm. *In* NASA. Ames Res. Center. Classical Aerodyn. Theory. Dec. 1979. p 197-235. refs (For primary document see N80-15033 06-02)
(NACA-323) Avail: NTIS. HC A14/MF A01. CSCL 01A

A general method for finding the steady flow velocity relative to a body in plane curvilinear motion, whence the pressure is found by Bernoulli's energy principle is described. Integration of the pressure supplies basic formulas for the zonal forces and moments on the revolving body. The application of the steady flow method for calculating the velocity and pressure at all points of the flow inside and outside an ellipsoid and some of its limiting forms is presented and graphs those quantities for the latter forms. In some useful cases experimental pressures are plotted for comparison with theoretical. The pressure, and thence the zonal force and moment, on hulls in plane curvilinear flight are calculated. General equations for the resultant fluid forces and moments on triaxial bodies moving through a perfect fluid are derived. Formulas for potential coefficients and inertia coefficients for an ellipsoid and its limiting forms are presented. A.W.H.

N80-15045*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
BEHAVIOR OF VORTEX SYSTEMS
A. Betz. *In* NASA. Ames Res. Center. Classical Aerodyn. Theory. Dec. 1979. p 237-255. refs (For primary document see N80-15033 06-02)
Avail: NTIS. HC A14/MF A01. CSCL 01A

Application of the Kutta-Joukowski theorem to the relationship between airfoil lift and circulation is described. A number of formulas concerning the conduct of vortex systems derived from the theorem are presented. The application of this line of reasoning to several problems of airfoil theory and the observed relations are discussed. A.W.H.

N80-15046*# National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.
GENERAL POTENTIAL THEORY OF ARBITRARY WING SECTIONS
Theodore Theodorsen and I. E. Garrick. *In* NASA. Ames Res. Center. Classical Aerodyn. Theory. Dec. 1979. p 257-289. refs (For primary document see N80-15033 06-02)
(NACA-452) Avail: NTIS. HC A14/MF A01. CSCL 01A

The problem of determining the two dimensional potential flow around wing sections of any shape is examined. The problem is condensed into the compact form of an integral equation capable of yielding numerical solutions by a direct process. An attempt is made to analyze and coordinate the results of earlier studies relating to properties of wing sections. The existing approximate theory of thin wing sections and the Joukowski theory with its numerous generalizations are reduced to special cases of the general theory of arbitrary sections, permitting a clearer perspective of the entire field. The method which permits the determination of the velocity at any point of an arbitrary section and the associated lift and moments is described. The method is also discussed in terms for developing new shapes of preassigned aerodynamical properties. A.W.H.

N80-15047*# National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.
GENERAL THEORY OF AERODYNAMIC INSTABILITY AND THE MECHANISM OF FLUTTER
Theodore Theodorsen. *In* NASA. Ames Res. Center. Classical Aerodyn. Theory. Dec. 1979. p 291-311 (For primary document see N80-15033 06-02)
(NACA-496) Avail: NTIS. HC A14/MF A01. CSCL 01A

The aerodynamic forces on an oscillating airfoil or airfoil-aileron combination of three independent degrees of freedom were determined. The problem resolves itself into the solution of certain definite integrals, which were identified as Bessel functions of the first and second kind, and of zero and first order. The theory, based on potential flow and the Kutta condition, is fundamentally equivalent to the conventional wing section theory relating to the steady case. The air forces being known, the mechanism of aerodynamic instability was analyzed. An exact solution, involving potential flow and the adoption of the Kutta condition, was derived. The solution is of a simple form and is expressed by means of an auxiliary parameter k. The flutter velocity, treated as the unknown quantity, was determined as a function of a certain ratio of the frequencies in the separate degrees of freedom for any magnitudes and combinations of the airfoil-aileron parameters. A.W.H.

N80-15048*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
CALCULATION OF TWO-DIMENSIONAL INLET FLOW FIELDS IN A SUPERSONIC FREE STREAM BY AN IMPLICIT MARCHING CODE WITH NONORTHOGONAL MESH GENERATION: USER'S MANUAL Final Report
S. H. Biringen and O. J. McMillan. Jan. 1980. 27 p. refs
(Contract NAS1-15305)
(NASA-CR-3222; NEAR-TR-193) Avail: NTIS
HC A03/MF A01. CSCL 01A

An implicit, shock-capturing finite-difference code which is used to calculate two-dimensional inlet flow fields in a supersonic free stream is explained. The Euler equations are subjected to general nonorthogonal transformation and a body-fitted coordinate system is employed. The mathematical formulation of the problem is given along with the numerical algorithm. Initial and boundary conditions, numerical stability, program limitations, and accuracy is discussed. An overall program logic as well as instructions for program use and operation are also furnished. Author

N80-15049*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
A SUPERSONIC, THREE-DIMENSIONAL CODE FOR FLOW OVER BLUNT BODIES: USER'S MANUAL Final Report
D. S. Chaussee and O. J. McMillan. Jan. 1980. 27 p. refs
(Contract NAS1-15305)
(NASA-CR-3223; NEAR-TR-189) Avail: NTIS
HC A03/MF A01. CSCL 01A

A computer code is described which may be used to calculate the steady, supersonic, three-dimensional, inviscid flow over blunt bodies. The theoretical and numerical formulation of the problem is given (shock-capturing, downstream marching), including exposition of the boundary and initial conditions. The overall flow logic of the program, its usage, accuracy, and limitations are discussed. A.R.H.

N80-15050*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PARAMETRIC WING DESIGN STUDY FOR A MODERN LAMINAR FLOW WING
John A. Koegler, Jr. Dec. 1979. 44 p. refs
(NASA-TM-80154) Avail: NTIS. HC A03/MF A01. CSCL 01A

The results of a parametric wing design study using a modern laminar flow airfoil designed to exhibit desirable stall characteristics while maintaining high cruise performance are presented. It was found that little is sacrificed in cruise performance when satisfying the stall margin requirements if a taper ratio of 0.65 or greater is used. M.G.

N80-15051*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
SUMMARY OF ADVANCED METHODS FOR PREDICTING HIGH SPEED PROPELLER PERFORMANCE
L. A. Bober 1980 14 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-81409) Avail: NTIS HC A02/MF A01 CSCL 01A

Three advanced analyses for predicting aircraft propeller performance at high subsonic speeds are described. Two of these analyses use a lifting line representation for the propeller blades and vortex filaments for the blade wakes but differ in the details of the solution. The third analysis is a finite difference solution of the unsteady, three dimensional Euler equations for the flow between adjacent blades. Analysis results are compared to data for a high speed propeller having eight swept blades integrally designed with the spinner and nacelle. Author

N80-15052*# Boeing Commercial Airplane Co., Seattle, Wash.
A USERS GUIDE FOR A344: A PROGRAM USING A FINITE DIFFERENCE METHOD TO ANALYZE TRANSONIC FLOW OVER OSCILLATING AIRFOILS Final Report
Warren H. Weatherill and F. Edward Ehlers Nov. 1979 65 p refs
(Contract NAS1-15128)
(NASA-CR-159141; D6-48837) Avail: NTIS HC A04/MF A01 CSCL 01A

The design and usage of a pilot program for calculating the pressure distributions over harmonically oscillating airfoils in transonic flow are described. The procedure used is based on separating the velocity potential into steady and unsteady parts and linearizing the resulting unsteady differential equations for small disturbances. The steady velocity potential which must be obtained from some other program, was required for input. The unsteady equation, as solved, is linear with spatially varying coefficients. Since sinusoidal motion was assumed, time was not a variable. The numerical solution was obtained through a finite difference formulation and either a line relaxation or an out of core direct solution method. R.C.T.

N80-15053# Naval Postgraduate School, Monterey, Calif.
A CONCEPTUAL DESIGN OF A LIGHTER-THAN-AIR TEST AND RESEARCH VEHICLE M.S. Thesis
Richard Patrick Glover Jun. 1979 69 p refs
(AD-A074760) Avail: NTIS HC A04/MF A01 CSCL 01/3

An analysis of conventional lighter-than-air vehicles was conducted to determine if a modular design approach was feasible. Once this was accomplished, a conceptual design using the modular approach was presented for a vehicle to serve as a platform for conducting lighter-than-air flight tests and research. In addition, a general discussion is included on the program management organization, flight tests, and instrumentation of such a vehicle. GRA

N80-15054# Martin Marietta Labs., Baltimore, Md.
SEPARATION JUMP AND SUDDEN STALL OVER AN ELLIPSOIDAL WIND AT INCIDENCE
K. C. Wang May 1979 51 p refs
(Contract F49620-76-C-0004; AF Proj. 2304)
(AD-A074260; MML-TR-22C; AFOSR-79-0965TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

To obtain complete and rigorous solutions of the three-dimensional, laminar boundary layer over a finite airplane wing, a flat ellipsoid was chosen as a model to generate concrete results. Initial efforts were directed toward calculating the inviscid flow and the selection of coordinate system, and this was followed by a detailed investigation of the boundary layer restricted to the symmetry-plane. This investigation showed that as the incidence increases, the separation point on the upper surface does not always move continuously forward; instead, it first moves forward and later rearward. Then, at a critical incidence, it jumps forward and moves thereafter close to the leading edge. This 'separation jump' phenomenon was further found to be little affected by varying the span, but critically dependent on the chord: a longer chord prompts a larger jump. Although such separation jump has been reported for a body of revolution, it has not yet been reported for wing surfaces. The significance of this phenomenon is apparent when one considers that the separation jump may well occur on airplane wings in general and probably accounts for what we might call 'sudden stall'. GRA

N80-15055# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF THE AERODYNAMIC CHARACTERISTICS OF A 1/20-SCALE A-10 MODEL AT MACH NUMBERS FROM 0.30 TO 0.75 Final Report
Phillip L. Yeakley AEDC Sep. 1979 90 p refs
(AF Proj. 329A)
(AD-A074867; AEDC-TR-78-66; AFATL-TR-78-103) Avail: NTIS HC A05/MF A01 CSCL 20/4

A 1/20-scale model of the A-10 aircraft was tested to determine the aerodynamic and control characteristics of the basic aircraft, evaluate the effect of external store configurations on the static stability and drag characteristics of the aircraft, and investigate the effects of Reynolds number, boundary layer transition grit, and aerodynamic hysteresis on the data. Data were obtained at angles of attack from -4 to 20 deg and at sideslip angles from -10 to 10 deg. The Mach number range was from 0.30 to 0.75, and the Reynolds number range was from 0.7 to 4.9 million per foot. GRA

N80-15056# Aerospace Corp., Los Angeles, Calif.
AERODYNAMIC HEATING ON A MULTI-HUNDRED WATT HEAT SOURCE BASED ON WIND TUNNEL TESTS Final Report
Mamoru Masaki Kirtland AFB, N. Mex. AFWL Jul. 1979 21 p refs
(Contract F04701-77-C-0078; AF Proj. 2007)
(AD-A074312; AD-E200359; AFWL-TR-78-160) Avail: NTIS HC A02/MF A01 CSCL 20/4

The General Electric Space Division conducted aerodynamic heating tests of the multi-hundred watt heat source configuration of the NASA Mariner-Jupiter/Saturn spacecraft. Curve fit approximations of the data were obtained so that aerodynamic heating studies with any angle of attack history can be performed in a simple manner. Characteristics of theoretical and semi-empirical results for the type of configuration were utilized in obtaining the approximations due to some discrepancies in the data. GRA

N80-15057# Tennessee Univ. Space Inst., Tullahoma. Gasdynamics Div.
FUNDAMENTAL STUDIES OF SUBSONIC AND TRANSONIC FLOW SEPARATION. PART 3: THIRD PHASE SUMMARY REPORT Final Report, Nov. 1975 - Sep. 1978
J. M. Wu, A. Valkili-Dastjerd, E. G. Collins, K. C. Reddy, and T. H. Moulden Arnold Air Force Station, Tenn. AEDC Oct. 1979 157 p refs
(Contract F40600-76-C-0006)
(AD-A074868; AEDC-TR-79-48-Pt-3) Avail: NTIS HC A08/MF A01 CSCL 20/4

The work reported herein represents the third phase of a fundamental study of transonic flow separation with extensive experimental measurements and some numerical Navier-Stokes solutions for high Reynolds number two-dimensional flow. The flow conditions have been extended to include low supersonic free-stream cases. The tests were performed over a Mach number range of 0.6 and 1.32 and Reynolds number range of 4 to 200 million. Simple geometrical surface and flow discontinuities of different sizes (such as ramps, rearward and forward-facing steps, cylinders, etc.) were selected to cause upstream disturbances and/or generate downstream adverse pressure gradient regions strong enough to produce local flow separation. The incipient separation angle in flow over ramp compression corner was measured. An average incipient separation angle of 22.5 deg was confirmed, with no Reynolds number effect in the above range of free-stream flow parameters. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-15058*# Dayton Univ. Research Inst., Ohio.
A FIRST LOOK AT THE EFFECT OF SEVERE RAINFALL UPON AN AIRCRAFT
Jan. 1980 34 p refs
(Grant NsG-6026)
(NASA-CR-162569) Avail: NTIS HC A03/MF A01 CSCL 01C

An aircraft penetrating heavy rain can be affected aerodynamically in at least four ways: (1) raindrops striking the fuselage and wings of the aircraft impart a downward momentum to the aircraft; (2) increased aircraft drag results from the aircraft striking the raindrops head on; (3) at any instant of time the aircraft will contain a thin layer of water over most of its surfaces which will give additional mass to the aircraft; and (4) the water on the airfoil will result in a roughened airfoil surface that could produce significant aerodynamic penalties. An order of magnitude calculation was made for the penalty associated with the factors one two and three. The roughness factor required detailed modeling and boundary layer calculations and was studied using the 'aerodynamic effects of frost model'. The results achieved on each of the penalty factors are described and the factors most likely to cause significant performance degradation are indicated. R.E.S.

N80-15059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULTANEOUS CABIN AND AMBIENT OZONE MEASUREMENTS ON TWO BOEING 747 AIRPLANES, VOLUME 1
Porter J. Perkins, J. D. Holdeman, and G. D. Nastrom (Control Data Corp., Minneapolis, Minn.) Jul. 1979 826 p refs
(NASA-TM-79166; FAA-EE-79-05; E-196) Avail: NTIS HC A99/MF A01 CSCL 01C

Measurements of zone concentrations both outside and in the cabin of an airline operated Boeing 747SP and Boeing 747-100 airliner are presented. Plotted data and the corresponding tables of observations taken at altitude between the departure and destination airports of each flight are arranged chronologically for the two aircraft. Data were taken at five or ten minute intervals by automated instrumentation used in the NACA Global Atmospheric Sampling Program. M.M.M.

N80-15060*# National Aeronautics and Space Administration, Washington, D. C.
NASA TECHNICAL ADVANCES IN AIRCRAFT OCCUPANT SAFETY
John H. Enders 1978 28 p refs Presented at the SAE Congr. and Exposition, Detroit, 27 Feb. - 3 Mar. 1978
(NASA-TM-80851; ISSN-0148-7191) Avail: NTIS HC A03/MF A01 CSCL 01C

NASA's aviation safety technology program examines specific safety problems associated with atmospheric hazards, crash-fire survival, control of aircraft on runways, human factors, terminal area operations hazards, and accident factors simulation. While aircraft occupants are ultimately affected by any of these hazards, their well-being is immediately impacted by three specific events: unexpected turbulence encounters, fire and its effects, and crash impact. NASA research in the application of laser technology to the problem of clear air turbulence detection, the development of fire resistant materials for aircraft construction, and to the improvement of seats and restraint systems to reduce crash injuries are reviewed. A.R.H.

N80-15061# General Accounting Office, Washington, D. C. Community and Economic Development Div.
AIRCRAFT DELAYS AT MAJOR US AIRPORTS CAN BE REDUCED
4 Sep. 1979 36 p refs
(PB-299442/4; CED-79-102) Avail: NTIS HC A03/MF A01 CSCL 01E

In 1977, aircraft delays cost U.S. airlines over $800 million; detained the traveling public over 60 million hours; and caused the airlines to use an additional 700 million gallons of fuel, over 8 percent of their total consumption. Generally, aircraft delays result from excessive air traffic and bad weather. Many major U.S. airports have peak, congested periods when air traffic exceeds runway capacity and aircraft delays occur. To reduce delays at major airports, the Congress and Secretary of Transportation should take actions to shift traffic from peak to off-peak periods or to other airports by amending the Airport and Airway Development Act of 1970. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-15062*# Magnavox Government and Industrial Electronics Co., Torrance, Calif. Advanced Products Div.
DESIGN STUDY OF A LOW COST CIVIL AVIATION GPS RECEIVER SYSTEM Final Report
R. Cnossen and G. Gilbert (GAC Assoc.) Dec. 1979 150 p refs
(Contract NAS1-15343)
(NASA-CR-159176; R-6132) Avail: NTIS HC A07/MF A01 CSCL 17G

A low cost Navstar receiver system for civil aviation applications was defined. User objectives and constraints were established. Alternative navigation processing design trades were evaluated. Receiver hardware was synthesized by comparing technology projections with various candidate system designs. A control display unit design was recommended as the result of field test experience with Phase I GPS sets and a review of special human factors for general aviation users. Areas requiring technology development to ensure a low cost Navstar Set in the 1985 timeframe were identified. R.C.T.

N80-15063*# Ohio Univ., Athens. Avionics Engineering Center.
EXPERIMENTAL LOOP ANTENNAS FOR 60 KHz TO 200 KHz
Ralph W. Burhans Dec. 1979 9 p refs
(Grant NGR-36-009-017)
(NASA-CR-162729; TM-71) Avail: NTIS HC A02/MF A01 CSCL 17G

The design and design data for broadband loop antenna systems are presented. An investigation of some simple systems for possible Loran C receivers which require a bandwidth of greater than 20 KHz is discussed. Designs are presented for a 60 KHz WWVB antenna, several Loran C variations, and some 1750 meter band antennas. Signals received on all these, including one airborne experiment where a Loran C receiver gave the correct time difference reading within 1 microsecond while flying on a straightline course are examined. The phase reversal in the Loran C when the direction of travel changes 180 degrees is discussed and possible corrections are studied. A.W.H.

N80-15064*# Ohio Univ., Athens. Avionics Engineering Center.
DATA REDUCTION SOFTWARE FOR LORAN-C FLIGHT TEST EVALUATION
Joseph P. Fischer Dec. 1979 43 p refs
(Grant NGR-36-009-017)
(NASA-CR-162730; TM-72) Avail: NTIS HC A03/MF A01 CSCL 17G

A set of programs designed to be run on an IBM 370/158 computer to read the recorded time differences from the tape produced by the LORAN data collection system, convert

them to latitude/longitude and produce various plotting input files are described. The programs were written so they may be tailored easily to meet the demands of a particular data reduction job. The tape reader program is written in 370 assembler language and the remaining programs are written in standard IBM FORTRAN-IV language. The tape reader program is dependent upon the recording format used by the data collection system and on the I/O macros used at the computing facility. The other programs are generally device-independent, although the plotting routines are dependent upon the plotting method used. The data reduction programs convert the recorded data to a more readily usable form; convert the time difference (TD) numbers to latitude/longitude (lat/long), to format a printed listing of the TDs, lat/long, reference times, and other information derived from the data, and produce data files which may be used for subsequent plotting. M.M.M.

N80-15065*# Ohio Univ., Athens. Avionics Engineering Center.
LORAN DIGITAL PHASE-LOCKED LOOP AND RF FRONT-END SYSTEM ERROR ANALYSIS
Daryl L. McCall. Dec. 1979. 19 p.
(Grant NGR-39-009-017)
(NASA-CR-162731; TM-73) Avail: NTIS. HC A02/MF A01 CSCL 17G

An analysis of the system performance of the digital phase locked loops (DPLL) and RF front end that are implemented in the MINI-L4 Loran receiver is presented. Three of the four experiments deal with the performance of the digital phase locked loops. The other experiment deals with the RF front end and DPLL system error which arise in the front end due to poor signal to noise ratios. The ability of the DPLLs to track the offsets is studied.

N80-15066# Transportation Systems Center, Cambridge, Mass.
THE EFFECTS OF PRIMARY POWER TRANSMISSION LINES ON THE PERFORMANCE OF LORAN-C RECEIVERS IN EXPERIMENTAL TERRESTRIAL APPLICATIONS. Final Report, May - Jul. 1979
Peter G. Mauro and John D. Gakis. Jul. 1979. 171 p. refs.
Sponsored by DOT
(PB-301367/9; DOT-TSC-RSPA-79-8) Avail: NTIS. HC A08/MF A01 CSCL 17G

The effect generated by high voltage transmission lines with and without supervisory carrier signals on the performance of typical LORAN-C receivers was measured. Four high voltage transmission line configurations were used and tested with 60Hz power impressed and absent and carrier signals impressed and absent. Data are plotted for three secondary time differences measured using the East Coast LORAN-C chain. Signal to noise ratios for the secondaries as well as the master were measured and recorded. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-15067*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA/ARMY XV-15 TILT ROTOR RESEARCH AIRCRAFT WIND-TUNNEL TEST PROGRAM PLAN
James A. Weiberg and Martin D. Maisel (AVRADCOM Res. and Technol. Labs.). Mar. 1979. 73 p. refs.
(NASA-TM-78562; A-7740; AVRADCOM-TR-79-7(AM)) Avail: NASA. Ames Research Center, Moffett Field, Calif. 94035 CSCL 01C

To ensure that the XV-15 tilt rotor research aircraft will meet the requirements of the program plan and the contract model specification and statement of work, one of the two aircraft will be tested in the Ames 40 x 80 foot wind tunnel to provide an initial assessment of the aerodynamic characteristics, structural loads, and rotor/pylon/wing dynamics in a simulated flight environment for correlation with estimated values. The tests will also serve to verify the functional operation of the aircraft systems and on-board instrumentation in a flight environment. The management structure, operational plan, support requirements and responsibilities, safety provisions and reporting requirements for conduct of the wind tunnel tests are defined and related to other phases of the program. A.R.H.

N80-15068*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
LOADING TESTS OF A WING STRUCTURE FOR A HYPERSONIC AIRCRAFT
Roger A. Fields, Lawrence F. Reardon, and William H. Siegel. Jan. 1980. 72 p. refs.
(NASA-TP-1596; H-1046) Avail: NTIS. HC A04/MF A01 CSCL 01C

Room-temperature loading tests were conducted on a wing structure designed with a beaded panel concept for a Mach 8 hypersonic research airplane. Strain, stress, and deflection data were compared with the results of three finite-element structural analysis computer programs and with design data. The test program data were used to evaluate the structural concept and the methods of analysis used in the design. A force stiffness technique was utilized in conjunction with load conditions which produced various combinations of panel shear and compression loading to determine the failure envelope of the buckling critical beaded panels. The force-stiffness data did not result in any predictions of buckling failure. It was, therefore, concluded that the panels were conservatively designed as a result of design constraints and assumptions of panel eccentricities. The analysis programs calculated strains and stresses competently. Comparisons between calculated and measured structural deflections showed good agreement. The test program offered a positive demonstration of the beaded panel concept subjected to room-temperature load conditions. Author

N80-15069*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECTS OF MOTION AND g-SEAT CUES ON PILOT SIMULATOR PERFORMANCE OF THREE PILOTING TASKS
Thomas W. Showalter and Benton L. Parris. Jan. 1980. 45 p. refs.
(NASA-TP-1601; A-7875) Avail: NTIS. HC A03/MF A01 CSCL 01C

Data are presented that show the effects of motion system cues, g-seat cues, and pilot experience on pilot performance during takeoffs with engine failures, during in-flight precision turns, and during landings with wind shear. Eight groups of USAF pilots flew a simulated KC-135 using four different cueing systems. The basic cueing system was a fixed-base type (no-motion cueing) with visual cueing. The other three systems were produced by the presence of either a motion system or a g-seat, or both. Extensive statistical analysis of the data was performed and representative performance means were examined. These data show that the addition of motion system cueing results in significant improvement in pilot performance for all three tasks; however, the use of g-seat cueing, either alone or in conjunction with the motion system, provides little if any performance improvement for these tasks and for this aircraft type. Author

N80-15070*# Lockheed-Georgia Co., Marietta.
EXPLORATORY STUDIES OF THE CRUISE PERFORMANCE OF UPPER SURFACE BLOWN CONFIGURATION: EXPERIMENTAL PROGRAM, HIGH-SPEED FORCE TESTS
J. A. Braden, J. P. Hancock, K. P. Burdges, and J. E. Hackett. Langley Res. Center, Hampton, Va. NASA. Oct. 1979. 231 p. refs.
(Contract NAS1-13871)
(NASA-CR-159134; LG77ER0028) Avail: NTIS. HC A11/MF A01 CSCL 01C

The work to develop a wing-nacelle arrangement to accommodate a wide range of upper surface blown configuration is reported. Pertinent model and installation details are described. Data of the effects of a wide range of nozzle geometric variations are presented. Nozzle aspect ratio, boattail angle, and chordwise

position are among the parameters investigated. Straight and swept wing configurations were tested across a range of nozzle pressure ratios, lift coefficients, and Mach numbers. F.O.S.

N80-15071*# Lockheed-Georgia Co., Marietta.
EXPLORATORY STUDIES OF THE CRUISE PERFORMANCE OF UPPER SURFACE BLOWN CONFIGURATIONS: EXPERIMENTAL PROGRAM, HIGH-SPEED PRESSURE TESTS
J. A. Braden, J. P. Hancock, K. P. Burdges, and J. E. Hackett Langley Res. Center, Hampton, Va. NASA Oct. 1979 226 p refs
(Contract NAS1-13871)
(NASA-CR-159135; LG77ER0028) Avail: NTIS HC A11/MF A01 CSCL 01C

Basic pressure data are presented which was obtained from an experimental study of upper-surface blown configurations at cruise. The high-speed (subsonic) experimental work, studying the aerodynamic effects of wing-nacelle geometric variations, was conducted around semi-span model configurations composed of diversified, interchangeable components. Power simulation was provided by high-pressure air ducted through closed forebody nacelles. Nozzle geometry was varied across size, exit aspect ratio, exit position and boattail angle. Both 3-D force and 2-D pressure measurements were obtained at cruise Mach numbers from 0.5 to 0.8 and at nozzle pressure ratios up to about 3.0. The experimental investigation was supported by an analytical synthesis of the system using a vortex lattice representation with first-order power effects. Results are also presented from a compatibility study in which a short-haul transport is designed on the basis of the aerodynamic findings in the experimental study as well as acoustical data obtained in a concurrent program. High-lift test data are used to substantiate the projected performance of the selected transport design. Author

N80-15072*# Lockheed-Georgia Co., Marietta.
EXPLORATORY STUDIES OF THE CRUISE PERFORMANCE OF UPPER SURFACE BLOWN CONFIGURATIONS: PROGRAM ANALYSIS AND CONCLUSIONS
J. A. Braden, J. P. Hancock, J. E. Hackett, and V. Lyman Langley Res. Center, Hampton, Va. NASA Oct. 1979 349 p refs
(Contract NAS1-13871)
(NASA-CR-159136; LG77ER0028) Avail: NTIS HC A15/MF A01 CSCL 01C

The experimental data encompassing surface pressure measurements, and wake surveys at static and wind-on conditions are analyzed. Cruise performance trends reflecting nacelle geometric variations, and nozzle operating conditions are presented. Details of the modeling process are included. F.O.S.

N80-15073*# Rockwell International Corp., El Segundo, Calif.
ANALYSES AND TESTS OF THE B-1 AIRCRAFT STRUCTURAL MODE CONTROL SYSTEM Final Report
John H. Wykes, Thomas R. Byar, Cary J. MacMiller, and David C. Greek Jan. 1980 268 p refs
(Contract NAS4-2519)
(NASA-CR-144887; H-1109; NA-79-405) Avail: NTIS HC A12/MF A01 CSCL 01C

Analyses and flight tests of the B-1 structural mode control system (SMCS) are presented. Improvements in the total dynamic response of a flexible aircraft and the benefits to ride qualities, handling qualities, crew efficiency, and reduced dynamic loads on the primary structures, were investigated. The effectiveness and the performance of the SMCS, which uses small aerodynamic surfaces at the vehicle nose to provide damping to the structural modes, were evaluated. R.E.S.

N80-15074*# Lockheed-California Co., Burbank.
HYPERSONIC CRUISE AIRCRAFT PROPULSION INTEGRATION STUDY, VOLUME 1 Final Report, Jun. 1978 - Sep. 1979
R. E. Morris and G. D. Brewer Sep. 1979 96 p ref
(Contract NAS1-15057)
(NASA-CR-158926-Vol-1; LR-28651-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 01C

A hypersonic cruise transport conceptual design is described. The integration of the subsonic, supersonic, and hypersonic propulsion systems with the aerodynamic design of the airframe is emphasized. An evaluation of various configurations of aircraft and propulsion integration concepts, and selection and refinement of a final design are given. This configuration was used as a baseline to compare two propulsion concepts - one using a fixed geometry dual combustion mode scramjet and the other a variable geometry ramjet engine. Both concepts used turbojet engines for takeoff, landing and acceleration to supersonic speed. R.C.T.

N80-15075*# Lockheed-California Co., Burbank.
HYPERSONIC CRUISE AIRCRAFT PROPULSION INTEGRATION STUDY, VOLUME 2 Final Report, Jun. 1978 - Sep. 1979
R. E. Morris and G. D. Brewer Sep. 1979 244 p refs
(Contract NAS1-15057)
(NASA-CR-158926-Vol-2; LR-28651-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 01C

Conceptual vehicle configuration and propulsion approach for a Mach 6 transport aircraft capable of carring 200 passengers 9260 km was investigated. Wind tunnel test data for various hypersonic transport configurations were examined. Canidates for baseline reference vehicles were selected. An explanation of technical methods which were used and configuration details which were significant in the final vehicle concept are given. R.C.T.

N80-15076*# Rensselaer Polytechnic Inst., Troy, N. Y.
COMPOSITE STRUCTURAL MATERIALS Semiannual Report, Apr. - Sep. 1979
George S. Ansell, Robert G. Loewy, and Stephen E. Wiberly Dec. 1979 107 p refs Sponsored in part by AFOSR
(Grant NGL-33-018-003)
(NASA-CR-162578; SAR-37) Avail: NTIS HC A06/MF A01 CSCL 01C

A multifaceted program is described in which aeronautical, mechanical, and materials engineers interact to develop composite aircraft structures. Topics covered include: (1) the design of an advanced composite elevator and a proposed spar and rib assembly; (2) optimizing fiber orientation in the vicinity of heavily loaded joints; (3) failure mechanisms and delamination; (4) the construction of an ultralight sailplane; (5) computer-aided design; finite element analysis programs, preprocessor development, and array preprocessor for SPAR; (6) advanced analysis methods for composite structures; (7) ultrasonic nondestructive testing; (8) physical properties of epoxy resins and composites; (9) fatigue in composite materials, and (10) transverse thermal expansion of carbon/epoxy composites. A.R.H.

N80-15077# Boeing Vertol Co., Philadelphia, Pa.
CH-46 COMPOSITE ROTOR BLADE FLIGHT STRESS SURVEY DATA. VOLUME 3: PLOTTED FORWARD ROTOR BLADE CHORD, TORSION AND ABSOLUTE LOADS
R. Aiello and J. Bendo 1978 324 p refs
(Contract N00019-75-C-0396)
(AD-A075612; D210-11168-3-Vol-3) Avail: NTIS HC A14/MF A01 CSCL 01/3

Data plots are presented of flight stress tests performed on the CH-46 aircraft composite rotor blades. M.M.M.

N80-15078# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRCRAFT ANTI-ICING/DE-ICING Final Report
31 Aug. 1979 21 p
(AD-A074128; TOP-7-3-528) Avail: NTIS HC A02/MF A01 CSCL 01/3

This document provides information, methodology and techniques necessary to plan, conduct and document a development test of an aircraft anti-icing/de-icing system. A development test of an aircraft anti-icing/de-icing system will determine the degree to which a subject system and its associated documentation, tools and auxiliary equipment meets the requirements of the Army Materiel Needs documents. GRA

N80-15079# Textron Bell Helicopter, Fort Worth, Tex.
ANALYSIS OF LOW-SPEED HELICOPTER FLIGHT TEST DATA Final Report, Mar. 1977 - Mar. 1979
James L. Tangler Aug. 1979 145 p refs
(Contract DAAJ02-77-C-0022; DA Proj. 1L2-62209-AH-76)

(AD-A074141; BHT-699-099-103; USARTL-TR-79-19) Avail: NTIS HC A07/MF A01 CSCL 01/3

The purpose of this study was to investigate the aerodynamic behavior of a helicopter rotor operating in the low-speed flight regime, particularly in the nap-of-the-Earth (NOE) evasive mode. The effort consisted of reducing and analyzing existing AH-1G flight test response data acquired for simulated NOE flight under contract DAAJ02-73-C-0105. Specific areas of interest analyzed in this study include blade/vortex interaction at 50 knots and angle-of-attack data derived from hot-wire measurements taken in hover. GRA

N80-15080# Naval Air Test Center, Patuxent River, Md.
JA-6A CIRCULATION CONTROL WING CONTRACTOR FLIGHT DEMONSTRATION
R. W. Boyd 28 Aug. 1979 25 p refs
(AD-A074888; NATC-TM-79-2-SA) Avail: NTIS HC A02/MF A01 CSCL 01/3

A Circulation Control Wing (CCW) Flight Demonstrator was designed and built by Grumman Aerospace Corporation (GAC) using a modified A-6A airplane. The design was a joint effort by David Taylor Naval Ship Research and Development Center (DTNSRDC) and GAC based on research originated by DTNSRDC. The airplane demonstrated significant STOL potential. Compared to the basic A-6A airplane, takeoff and landing roll distances were improved by 36% and 43%, respectively. Maximum CL was increased by 80%. Some Handling Qualities problems are discussed. The CCW concept was shown to be a viable, simple, and powerful STOL tool for use in future designs. GRA

N80-15081# Army Research and Technology Labs., Fort Eustis, Va.
MODEL 540 ROTOR BLADE CRACK PROPAGATION INVESTIGATION Final Report, Jan. - Feb. 1978
Danny E. Good Aug. 1979 35 p refs
(DA Proj. 1F2-62209-AH-76)
(AD-A074734; USARTL-TR-79-26) Avail: NTIS HC A03/MF A01 CSCL 01/3

The rate of crack propagation from an induced defect in a metal Bell Helicopter 540 main rotor blade was investigated. A controlled crack front was introduced into the top surface of the blade spar. Fatigue testing was conducted at maximum level flight loads and the crack growth was monitored. Experimental data was then compared with analytical predictions to measure the ability to predict crack growth characteristics. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-15082# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
VISUAL ACCOMMODATION RESPONSES IN A VIRTUAL IMAGE ENVIRONMENT Phase Report
Gloria Twine Chisum and Phyllis E. Morway 1979 15 p refs
(WR041010101)
(AD-A074415; NADC-79213-60) Avail: NTIS HC A02/MF A01 CSCL 05/5

The virtual images generated for helmet mounted displays and head-up displays are reflected by beam splitters to the eyes of a user. The influence of the beam splitters, with and without images reflected, on the accommodation responses of observers was measured utilizing an eyetracker which continuosly monitored the accommodation response. The results indicate that the presence of the beam splitter aids in maintaining accommodation at or near infinity. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-15083*# General Electric Co., Washington, D. C. Aircraft Engine Group.
DEMONSTRATION OF SHORT-HAUL AIRCRAFT AFT NOISE REDUCTION TECHNIQUES ON A TWENTY INCH (50.8 cm) DIAMETER FAN, VOLUME 1
D. L. Stimpert and R. A. McFalls May 1975 131 p refs 3 Vol.
(Contract NAS3-18021)
(NASA-CR-134849; R75AEG252-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 21E

Tests of a 20 inch diameter, low tip speed, low pressure ratio fan which investigated aft fan noise reduction techniques are reported. These techniques included source noise reduction features of selection of vane-blade ratio to reduce second harmonic noise, spacing effects, and lowering the Mach number through a vane row. Aft suppression features investigated included porosity effects, variable depth treatment, and treatment regenerated flow noise. Initial results and selected comparisons are presented. J.M.S.

N80-15084*# General Electric Co., Washington, D. C. Aircraft Engine Group.
DEMONSTRATION OF SHORT-HAUL AIRCRAFT AFT NOISE REDUCTION TECHNIQUES ON A TWENTY INCH (50.8) DIAMETER FAN, VOLUME 2
D. L. Stimpert Apr. 1975 307 p 3 Vol.
(Contract NAS3-18021)
(NASA-CR-134850; R75AEG252-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 21E

Aft fan noise reduction techniques were investigated. The 1/3 octave band sound data were plotted with the following plots included: perceived noise level vs acoustic angle at 2 fan speeds; PWL vs frequency at 2 fan speeds; and sound pressure level vs frequency at 2 aft angles and 2 fan speeds. The source noise plots included: band pass filter sound pressure level vs acoustic angle at 2 fan speeds; and 2nd harmonic SPL acoustic angle at 2 fan speeds. R.C.T.

N80-15085*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
DEMONSTRATION OF SHORT HAUL AIRCRAFT AFT NOISE REDUCTION TECHNIQUES ON A TWENTY INCH (50.8 cm) DIAMETER FAN, VOLUME 3
D. L. Stimpert Apr. 1975 725 p 3 Vol.
(Contract NAS3-18021)
(NASA-CR-134851; R75AEG252-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 21E

Tests of a twenty inch diameter, low tip speed, low pressure ratio fan which investigated aft fan noise reduction techniques are reported. The 1/3 octave band sound data are presented for all the configurations tested. The model data are presented on 17 foot arc and extrapolated to 200 foot sideline. J.M.S.

N80-15086*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER THE WING (OTW) DESIGN REPORT Final Report
Jun. 1977 530 p
(Contract NAS3-18021)
(NASA-CR-134848; R75AEG443) Avail: NTIS HC A23/MF A01 CSCL 21E

The design, fabrication, and testing of two experimental high bypass geared turbofan engines and propulsion systems for short haul passenger aircraft are described. The propulsion technology required for future externally blown flap aircraft with engines located both under the wing and over the wing is demonstrated.

Composite structures and digital engine controls are among the topics included. R.C.T.

N80-15087*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). AERODYNAMIC AND AEROMECHANICAL PERFORMANCE OF A 50.8 cm (20 INCH) DIAMETER 1.34 PR VARIABLE PITCH FAN WITH CORE FLOW
R. G. Giffin, R. A. McFalls, and B. F. Beacher Aug. 1977 133 p refs
(Contract NAS3-18021)
(NASA-CR-135017; R75AEG445) Avail: NTIS
HC A07/MF A01 CSCL 21E

The fan aerodynamic and aeromechanical performance tests of the quiet clean short haul experimental engine under the wing fan and inlet with a simulated core flow are described. Overall forward mode fan performance is presented at each rotor pitch angle setting with conventional flow pressure ratio efficiency fan maps, distinguishing the performance characteristics of the fan bypass and fan core regions. Effects of off design bypass ratio, hybrid inlet geometry, and tip radial inlet distortion on fan performance are determined. The nonaxisymmetric bypass OGV and pylon configuration is assessed relative to both total pressure loss and induced circumferential flow distortion. Reverse mode performance, obtained by resetting the rotor blades through both the stall pitch and flat pitch directions, is discussed in terms of the conventional flow pressure ratio relationship and its implications upon achievable reverse thrust. Core performance in reverse mode operation is presented in terms of overall recovery levels and radial profiles existing at the simulated core inlet plane. Observations of the starting phenomena associated with the initiation of stable rotor flow during acceleration in the reverse mode are briefly discussed. Aeromechanical response characteristics of the fan blades are presented as a separate appendix, along with a description of the vehicle instrumentation and method of data reduction. R.C.T.

N80-15088*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) PRELIMINARY UNDER THE WING FLIGHT PROPULSION SYSTEM ANALYSIS REPORT
D. F. Howard Feb. 1976 261 p refs
(Contract NAS3-18021)
(NASA-CR-134868; R75AEG349) Avail: NTIS
HC A12/MF A01 CSCL 21E

The preliminary design and installation of high bypass, geared turbofan engine with a composite nacelle forming the propulsion system for a short haul passenger aircraft are described. The technology required for externally blown flap aircraft with under the wing (UTW) propulsion system installations for introduction into passenger service in the mid 1980's is included. The design, fabrication, and testing of this UTW experimental engine containing the required technology items for low noise, fuel economy, with composite structure for reduced weight and digital engine control are provided. R.C.T.

N80-15089*# General Electric Co., Cincinnati, Ohio. Group Engineering Div.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). THE AERODYNAMIC AND MECHANICAL DESIGN OF THE QCSEE OVER-THE-WING FAN
Apr. 1976 98 p
(Contract NAS3-18021)
(NASA-CR-134915) Avail: NTIS HC A05/MF A01 CSCL 21E

The aerodynamic and mechanical design of a fixed-pitch 1.36 pressure ratio fan for the over-the-wing (OTW) engine is presented. The fan has 28 blades. Aerodynamically, the fan blades were designed for a composite blade, but titanium blades were used in the experimental fan as a cost savings measure. R.E.S.

N80-15090*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING ENGINE DIGITAL CONTROL SYSTEM DESIGN REPORT
Jan. 1978 321 p refs
(Contract NAS3-18021)
(NASA-CR-134920; R75AEG483) Avail: NTIS
HC A14/MF A01 CSCL 21E

A digital electronic control was combined with conventional hydromechanical components to operate the four controlled variables on the under-the-wing engine: fuel flow, fan blade pitch, fan exhaust area, and core compressor stator angles. The engine and control combination offers improvements in noise, pollution, thrust response, operational monitoring, and pilot workload relative to current engines. R.E.S.

N80-15091*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING ENGINE SIMULATION REPORT
Jul. 1977 103 p refs
(Contract NAS3-18021)
(NASA-CR-134914; R75AEG444) Avail: NTIS
HC A06/MF A01 CSCL 21E

Hybrid computer simulations of the under-the-wing engine were constructed to develop the dynamic design of the controls. The engine and control system includes a variable pitch fan and a digital electronic control. Simulation results for throttle bursts from 62 to 100 percent net thrust predict that the engine will accelerate 62 to 95 percent net thrust in one second. R.E.S.

N80-15092*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING CONTROL SYSTEM DESIGN REPORT
Dec. 1977 249 p refs
(Contract NAS3-18021)
(NASA-CR-135337; R77AEG664) Avail: NTIS
HC A11/MF A01 CSCL 21E

A control system incorporating a digital electronic control was designed for the over-the-wing engine. The digital electronic control serves as the primary controlling element for engine fuel flow and core compressor stator position. It also includes data monitoring capability, a unique failure indication and corrective action feature, and optional provisions for operating with a new type of servovalve designed to operate in response to a digital-type signal and to fail with its output device hydraulically locked into position. R.E.S.

N80-15093*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). CORE ENGINE NOISE MEASUREMENTS
H. D. Sowers and W. E. Coward Dec. 1977 52 p ref
(Contract NAS3-18021)
(NASA-CR-135160; R75AEG511) Avail: NTIS
HC A04/MF A01 CSCL 21E

Noise measurements were taken on a turbofan engine which uses the same core, with minor modifications, employed on the quiet clean short-haul experimental engine (QCSEE) propulsion systems. Both nearfield and farfield noise measurements were taken in order to determine the core internally generated noise levels. The resulting noise measurements were compared to predicted combustor and turbine noise levels, to verify or improve the predicted QCSEE combustor and turbine noise levels. Author

N80-15094*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Engineering Div.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) ENGINE COMPOSITE NACELLE TEST REPORT. VOLUME 1: SUMMARY, AERODYNAMIC AND MECHANICAL PERFORMANCE
Apr. 1979 214 p refs
(Contract NAS3-18021)
(NASA-CR-159471; R78AEG573-Vol-1) Avail: NTIS
HC A10/MF A01 CSCL 21E

The performance test results of the final under-the-wing engine configuration are presented. One hundred and six hours of engine operation were completed, including mechanical and performance checkout, baseline acoustic testing with a bellmouth inlet, reverse

thrust testing, acoustic technology tests, and limited controls testing. The engine includes a variable pitch fan having advanced composite fan blades and using a ball-spline pitch actuation system. R.E.S.

N80-15095*# General Electric Co., Cincinnati, Ohio. Group Engineering Div.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) PRELIMINARY OVER-THE-WING FLIGHT PROPULSION SYSTEM ANALYSIS REPORT
D. F. Howard Jun. 1977 174 p refs
(Contract NAS3-18021)
(NASA-CR-135296; R77AEG305) Avail: NTIS
HC A08/MF A01 CSCL 21E

The preliminary design of the over-the-wing flight propulsion system installation and nacelle component and systems design features of a short-haul, powered lift aircraft are presented. Economic studies are also presented and show that high bypass, low pressure ratio turbofan engines have the potential of providing an economical propulsion system for achieving the very quiet aircraft noise level of 95 EPNdB on a 152.4 m sideline. R.E.S.

N80-15096*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). UNDER-THE-WING (UTW) ENGINE BOILERPLATE NACELLE TEST REPORT, VOLUME 1 Summary Report
31 Dec. 1977 65 p 3 Vol.
(Contract NAS3-18021)
(NASA-CR-135249; R77AEG2121-Vol-1) Avail: NTIS
HC A04/MF A01 CSCL 21E

The design and testing of high bypass geared turbofan engines with nacelles forming the propulsion systems for short haul passenger aircraft are considered. The test results demonstrate the technology required for externally blown flap aircraft for introduction into passenger service in the 1980's. The equipment tested is described along with the test facility and instrumentation. A chronological history of the test and a summary of results are given. J.M.S.

N80-15097*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). UNDER-THE-WING (UTW) ENGINE BOILERPLATE NACELLE TEST REPORT. VOLUME 3: MECHANICAL PERFORMANCE
31 Dec. 1977 128 p refs 3 Vol.
(Contract NAS3-18021)
(NASA-CR-135251; R77AEG212-Vol-3) Avail: NTIS
HC A07/MF A01 CSCL 21E

Results of initial tests of the under the wing experimental engine and boilerplate nacelle are presented. The mechanical performance of the engine is reported with emphasis on the advanced technology components. Technology elements of the propulsion system covered include: system dynamics, composite fan blades, reduction gear, lube and accessory drive system, fan frame, inlet, core cowl cooling, fan exhaust nozzle, and digital control system. J.M.S.

N80-15098*# General Electric Co., Cincinnati, Ohio.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). COMPOSITE FAN FRAME SUBSYSTEM TEST REPORT
C. L. Stotler, Jr. and J. H. Bowden Sep. 1977 71 p
(Contract NAS3-18021)
(NASA-CR-135010; R76AEG233) Avail: NTIS
HC A04/MF A01 CSCL 21E

The element and subcomponent testing conducted to verify the composite fan frame design of two experimental high bypass geared turbofan engines and propulsion systems for short haul passenger aircraft is described. Emphasis is placed on the propulsion technology required for future externally blown flap aircraft with engines located both under the wing and over the wing, including technology in composite structures and digital engine controls. The element tests confirmed that the processes used in the frame design would produce the predicted mechanical properties. The subcomponent tests verified that the detail structural components of the frame had adequate structural integrity. J.M.S.

N80-15099*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING (OTW) BOILERPLATE NACELLE DESIGN REPORT
May 1977 78 p
(Contract NAS3-18021)
(NASA-CR-135168; R77AEG300) Avail: NTIS
HC A05/MF A01 CSCL 21E

A summary of the mechanical design of the boiler plate nacelle for the QCSEE over the wing (OTW) engine is presented. The nacelle, which features a D-shaped nozzle/thrust reverser and interchangeable hard wall and acoustic panels, is utilized in the engine testing to establish the aerodynamic and acoustic requirements for nozzles and reversers of this type. J.M.S.

N80-15100*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) COMPOSITE NACELLE SUBSYSTEM TEST REPORT
C. L. Stotler, Jr., E. A. Johnston, and D. S. Freeman Jul. 1977 83 p refs
(Contract NAS3-18021)
(NASA-CR-135075; R76AEG420) Avail: NTIS
HC A05/MF A01 CSCL 21E

The element and subcomponent testing conducted to verify the under the wing composite nacelle design is reported. This composite nacelle consists of an inlet, outer cowl doors, inner cowl doors, and a variable fan nozzle. The element tests provided the mechanical properties used in the nacelle design. The subcomponent tests verified that the critical panel and joint areas of the nacelle had adequate structural integrity. J.M.S.

N80-15101*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). BALL SPLINE PITCH CHANGE MECHANISM DESIGN REPORT
Apr. 1978 73 p refs
(Contract NAS3-18021)
(NASA-CR-134873; R77AEG327) Avail: NTIS
HC A04/MF A01 CSCL 21E

Detailed design parameters are presented for a variable-pitch change mechanism. The mechanism is a mechanical system containing a ball screw/spline driving two counteracting master bevel gears meshing pinion gears attached to each of 18 fan blades. R.E.S.

N80-15102*# General Electric Co., Cincinnati, Ohio.
ACOUSTIC ANALYSIS OF AFT NOISE REDUCTION TECHNIQUES MEASURED ON A SUBSONIC TIP SPEED 50.8 cm (TWENTY INCH) DIAMETER FAN
D. L. Stimpert and A. Clemons Jan. 1977 149 p refs
(Contract NAS3-18021)
(NASA-CR-134891; R75AEG368) Avail: NTIS
HC A07/MF A01 CSCL 21E

Sound data which were obtained during tests of a 50.8 cm diameter, subsonic tip speed, low pressure ratio fan were analyzed. The test matrix was divided into two major investigations: (1) source noise reduction techniques; and (2) aft duct noise reduction with acoustic treatment. Source noise reduction techniques were investigated which include minimizing second harmonic noise by varying vane/blade ratio, variation in spacing, and lowering the Mach number through the vane row to lower fan broadband noise. Treatment in the aft duct which includes flow noise effects, faceplate porosity, rotor OGV treatment, slant cell treatment, and splitter simulation with variable depth on the outer wall and constant thickness treatment on the inner wall was investigated. Variable boundary conditions such as variation in treatment panel thickness and orientation, and mixed porosity combined with variable thickness were examined. Significant results are reported. R.C.T.

N80-15103*# Curtiss-Wright Corp., Wood-Ridge, N.J. Power Systems.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) MAIN REDUCTION GEARS TEST PROGRAM Final Report
O. W. Misel Mar. 1977 220 p refs
(Contract NAS3-18021)
(NASA-CR-134669; CW-WR-77-008) Avail: NTIS
HC A10/MF A01 CSCL 21E

Sets of under the wing (UTW) engine reduction gears and sets of over the wing (OTW) engine reduction gears were fabricated for rig testing and subsequent installation in engines. The UTW engine reduction gears which have a ratio of 2.465:1 and a design rating of 9712 kW at 3157 rpm fan speed were operated at up to 105% s feed at 60% torque and 100% speed at 125% torque. The OTW engine reduction gears which have a ratio of 2.062:1 and a design rating of 12,615 kW at 3861 rpm fan speed were operated at up to 95% speed at 50% torque and 80% speed at 109% torque. Satisfactory operation was demonstrated at powers up to 12,172 kW, mechanical efficiency up to 99.1% UTW, and a maximum gear pitch line velocity of 112 m/s (22,300 fpm) with a corresponding star gear spherical roller bearing DN of 850,00 OTW. Oil and star gear bearing temperatures, oil churning, heat rejection, and vibratory characteristics were acceptable for engine installation. R.C.T.

N80-15104*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) CLEAN COMBUSTOR TEST REPORT
Oct. 1975 66 p refs
(Contract NAS3-18021)
(NASA-CR-134916; R75AEG449) Avail: NTIS
HC A04/MF A01 CSCL 21E

A component pressure test was conducted on a F101 PFRT combustor to evaluate the emissions levels of this combustor design at selected under the wing and over the wing operating conditions for the quiet clean short haul experimental engine (QCSEE). Emissions reduction techniques were evaluated which included compressor discharge bleed and sector burning in the combustor. The results of this test were utilized to compare the expected QCSEE emissions levels with the emission goals of the QCSEE engine program. R.C.T.

N80-15105*# Curtiss-Wright Corp., Wood-Ridge, N.J.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) MAIN REDUCTION GEARS BEARING DEVELOPMENT PROGRAM Final Report
Dec. 1975 40 p
(Contract NAS3-18021)
(NASA-CR-134890) Avail: NTIS HC A03/MF A01 CSCL 21E

The viability of proposed bearing designs to operate at application conditions is described. Heat rejection variables were defined for the test conditions. Results indicate that there is potential for satisfactory operation of spherical roller bearing in the QCSEE main reduction gear application. R.C.T.

N80-15106*# Curtiss-Wright Corp., Wood-Ridge, N.J.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) MAIN REDUCTION GEARS DETAILED DESIGN REPORT Final Report
A. Defeo and M. Kulina Jul. 1977 221 p
(Contract NAS3-18021)
(NASA-CR-134872; CW-WR-77-024) Avail: NTIS
HC A10/MF A01 CSCL 21E

Lightweight turbine engines with geared slower speed fans are considered. The design of two similar but different gear ratio, minimum weight, epicyclic star configuration main reduction gears for the under the wing (UTW) and over the wing (OTW) engines is discussed. The UTW engine reduction gear has a ratio of 2.465:1 and a 100% power design rating of 9885 kW (13,256 hp) at 3143 rpm fan speed. The OTW engine reduction gear has a ratio of 2.062:1 and a 100% power design rating of 12813 kW (17183 hp) at 3861 rpm fan speed. Details of configuration, stresses, deflections, and lubrication are presented. J.M.S.

N80-15107*# Hamilton Standard, Windsor Locks, Conn. Aircraft Systems Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE): HAMILTON STANDARD CAM/HARMONIC DRIVE VARIABLE PITCH FAN ACTUATION SYSTEM DETAIL DESIGN REPORT
Mar. 1976 159 p
(Contract NAS3-18021)
(NASA-CR-134852; HSER-7001) Avail: NTIS
HC A08/MF A01 CSCL 21E

A variable pitch fan actuation system was designed which incorporates a remote nacelle-mounted blade angle regulator. The regulator drives a rotating fan-mounted mechanical actuator through a flexible shaft and differential gear train. The actuator incorporates a high ratio harmonic drive attached to a multitrack spherical cam which changes blade pitch through individual cam follower arms attached to each blade trunnion. Detail design parameters of the actuation system are presented. These include the following: design philosophies, operating limits, mechanical, hydraulic and thermal characteristics, mechanical efficiencies, materials, weights, lubrication, stress analyses, reliability and failure analyses. Author

N80-15108*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING ENGINE COMPOSITE FAN BLADE DESIGN REPORT Final Report
R. Ravenhall and C. T. Salemme Feb. 1977 61 p refs
(Contract NAS3-18021)
(NASA-CR-135046; R77AEG177) Avail: NTIS
HC A04/MF A01 CSCL 21E

A total of 38 quiet clean short haul experimental engine under the wing composite fan blades were manufactured for various component tests, process and tooling, checkout, and use in the QCSEE UTW engine. The component tests included frequency characterization, strain distribution, bench fatigue, platform static load, whirligig high cycle fatigue, whirligig low cycle fatigue, whirligig strain distribution, and whirligig overspeed. All tests were successfully completed. All blades planned for use in the engine were subjected to and passed a whirligig proof spin test. R.C.T.

N80-15109*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE): THE AERODYNAMIC AND MECHANICAL DESIGN OF THE QCSEE UNDER-THE-WING FAN
Mar. 1977 144 p
(Contract NAS3-18021)
(NASA-CR-135009; R75AEG484) Avail: NTIS
HC A07/MF A01 CSCL 21E

The design, fabrication, and testing of two experimental high bypass geared turbofan engines and propulsion systems for short haul passenger aircraft are described. The aerodynamic and mechanical design of a variable pitch 1.34 pressure ratio fan for the under the wing (UTW) engine are included. The UTW fan was designed to permit rotation of the 18 composite fan blades into the reverse thrust mode of operation through both flat pitch and stall pitch directions. R.C.T.

N80-15110*# General Electric Co., Cincinnati, Ohio.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) COMPOSITE FAN FRAME DESIGN REPORT
S. C. Mitchell Sep. 1978 97 p refs
(Contract NAS3-18021)
(NASA-CR-135278; R77AEG439) Avail: NTIS
HC A04/MF A01 CSCL 21E

An advanced composite frame which is flight-weight and integrates the functions of several structures was developed for the over the wing (OTW) engine and for the under the wing (UTW) engine. The composite material system selected as the basic material for the frame is Type AS graphite fiber in a Hercules 3501 epoxy resin matrix. The frame was analyzed using a finite element digital computer program. This program was used in an iterative fashion to arrive at practical thicknesses and ply orientations to achieve a final design that met all strength and stiffness requirements for critical conditions. Using

this information, the detail design of each of the individual parts of the frame was completed and released. On the basis of these designs, the required tooling was designed to fabricate the various component parts of the frame. To verify the structural integrity of the critical joint areas, a full-scale test was conducted on the frame before engine testing. The testing of the frame established critical spring constants and subjected the frame to three critical load cases. The successful static load test was followed by 153 and 58 hours respectively of successful running on the UTW and OTW engines. J.M.S.

N80-15111*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UTW FAN PRELIMINARY DESIGN
Feb. 1975 107 p
(Contract NAS3-18021)
(NASA-CR-134842; R75AEG213) Avail: NTIS
HC A06/MF A01 CSCL 21E

High bypass geared turbofan engines and propulsion systems designed for short-haul passenger aircraft are described. The propulsion technology required for future externally blown flap aircraft with engines located both under the wing and over the wing is emphasized. The aerodynamic and mechanical preliminary design of the QCSEE under the wing 1.34 pressure ratio fan with variable blade pitch is presented. Design information is given for two pitch change actuation systems which will provide reverse thrust. J.M.S.

N80-15112*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE): THE AERODYNAMIC AND PRELIMINARY MECHANICAL DESIGN OF THE QCSEE OTW FAN
Feb. 1975 80 p
(Contract NAS3-18021)
(NASA-CR-134841; R75AEG381) Avail: NTIS
HC A05/MF A01 CSCL 21E

The aerodynamic and mechanical preliminary design of the QCSEE over the wing 1.36 pressure ratio fan is presented. Design information is given for both the experimental and flight designs. J.M.S.

N80-15113*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING ENGINE COMPOSITE FAN BLADE DESIGN
May 1975 57 p
(Contract NAS3-18021)
(NASA-CR-134840; R75AEG278) Avail: NTIS
HC A04/MF A01 CSCL 21E

The design and analysis of a composite fan blade for the under the wing (UTW) QCSEE is presented. The blade is designed for a variable pitch, 18 bladed rotor and is constructed from a hybrid composite combination of materials consisting of Kevlar-49, type AS graphite, boron, and S-glass fibers in a PR288 epoxy resin matrix. The blade has an attached platform which is constructed of AS-graphite, PR278 epoxy resin matrix and aluminum honeycomb. The blade is designed to satisfy aerostability and cyclic life and strength requirements with a light weight construction. The attached platform is designed for a fail-safe condition in that it is retainable by the blade, under centrifugal force loading, even in the event of blade to platform bond separation. Details of the blade design and the results of stress, vibration, and impact analysis are included. J.M.S.

N80-15114*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING ENGINE AND CONTROL SIMULATION RESULTS
Oct. 1978 107 p refs
(Contract NAS3-18021)
(NASA-CR-135049; R76AEG218) Avail: NTIS
HC A06/MF A01 CSCL 21E

A hybrid-computer simulation of the over the wing turbofan engine was constructed to develop the dynamic design of the control. This engine and control system includes a full authority digital electronic control using compressor stator reset to achieve fast thrust response and a modified Kalman filter to correct for sensor failures. Fast thrust response for powered-lift operations and accurate, fast responding, steady state control of the engine is provided. Simulation results for throttle bursts from 62 to 100 percent takeoff thrust predict that the engine will accelerate from 62 to 95 percent takeoff thrust in one second. J.M.S.

N80-15115*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) BALL SPLINE PITCH-CHANGE MECHANISM WHIRLIGIG TEST REPORT
Sep. 1978 64 p refs
(Contract NAS3-18021)
(NASA-CR-135354; R77AEG394) Avail: NTIS
HC A04/MF A01 CSCL 21E

The component testing of a ball spline variable pitch mechanism is described including a whirligig test. The variable pitch actuator successfully completed all planned whirligig tests including a fifty cycle endurance test at actuation rates up to 125 deg per second at up to 102 percent fan speed (3400 rpm). J.M.S.

N80-15116*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) BOILER PLATE NACELLE AND CORE EXHAUST NOZZLE DESIGN REPORT
Oct. 1976 104 p
(Contract NAS3-18021)
(NASA-CR-135008; R76AEG222) Avail: NTIS
HC A06/MF A01 CSCL 21E

The mechanical design of the boiler plate nacelle and core exhaust nozzle for the QCSEE under the wing engine is presented. The nacelle, which features interchangeable hard-wall and acoustic panels, is to be utilized in the initial engine testing to establish acoustic requirements for the subsequent composite nacelle as well as in the QCSEE over the wing engine configuration. J.M.S.

N80-15117*# Hamilton Standard, Windsor Locks, Conn.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) WHIRL TEST OF CAM/HARMONIC PITCH CHANGE ACTUATION SYSTEM Contractor Report, 10 Nov. 1975 - 16 Feb. 1976
Apr. 1976 208 p refs
(Contract NAS3-18021)
(NASA-CR-135140; HSER-7002) Avail: NTIS
HC A10/MF A01 CSCL 21E

A variable pitch fan actuation system, which incorporates a remote nacelle mounted blade angle regulator, was tested. The regulator drives a rotating fan mounted mechanical actuator through a flexible shaft and differential gear train. The actuator incorporates a high ratio harmonic drive attached to a multitrack spherical cam which changes blade pitch through individual cam follower arms attached to each blade trunnion. Testing of the actuator on a whirl rig, is reported. Results of tests conducted to verify that the unit satisfied the design requirements and was structurally adequate for use in an engine test are presented. J.M.S.

N80-15118*# General Electric Co., Cincinnati, Ohio.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING (OTW) PROPULSION SYSTEMS TEST REPORT. VOLUME 4: ACOUSTIC PERFORMANCE
D. L. Stimpert Feb. 1979 144 p refs
(Contract NAS3-18021)
(NASA-CR-135326; R77AEG476-Vol-4) Avail: NTIS
HC A07/MF A01 CSCL 21E

A series of acoustic tests were conducted on the over the wing engine. These tests evaluated the fully suppressed noise levels in forward and reverse thrust operation and provided insight into the component noise sources of the engine plus the suppression achieved by various components. System noise levels using the contract specified calculation procedure indicate that the in-flight noise level on a 152 m sideline at takeoff and

approach are 97.2 and 94.6 EPNdB, respectively, compared to a goal of 95.0 EPNdB. In reverse thrust, the system noise level was 106.1 PNdB compared to a goal of 100 PNdB. Baseline source noise levels agreed very well with pretest predictions. Inlet-radiated noise suppression of 14 PNdB was demonstrated with the high throat Mach number inlet at 0.79 throat Mach number. R.E.S.

N80-15119*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) COMPOSITE NACELLE Final Design Report
E. A. Johnston Aug. 1978 128 p
(Contract NAS3-18021)
(NASA-CR-135352; R77AEG588) Avail: NTIS
HC A07/MF A01 CSCL 21E

The detail design of the under the wing experimental composite nacelle components is summarized. Analysis of an inlet, fan bypass duct doors, core cowl doors, and variable fan nozzle are given. The required technology to meet propulsion system performance, weight, and operational characteristics is discussed. The materials, design, and fabrication technology for quiet propulsion systems which will yield installed thrust to weight ratios greater than 3.5 to 1 are described. R.C.T.

N80-15120*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) Final Report
William S. Willis Aug. 1979 408 p refs
(Contract NAS3-18021)
(NASA-CR-159473; R79AEG478) Avail: NTIS
HC A18/MF A01 CSCL 21E

The design, fabrication, and testing of two experimental propulsion systems for powered lift transport aircraft are given. The under the wing (UTW) engine was intended for installation in an externally blown flap configuration and the over the wing (OTW) engine for use in an upper surface blowing aircraft. The UTW engine included variable pitch composite fan blades, main reduction gear, composite fan frame and nacelle, and a digital control system. The OTW engine included a fixed pitch fan, composite fan frame, boilerplate nacelle, and a full authority digital control. Many acoustic, pollution, performance, and weight goals were demonstrated. R.C.T.

N80-15121*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). DOUBLE-ANNULAR CLEAN COMBUSTOR TECHNOLOGY DEVELOPMENT REPORT
D. W. Bahr, D. L. Burrus, and P. E. Sabla May 1979 149 p refs
(Contract NAS3-18021)
(NASA-CR-159483; R79AEG397) Avail: NTIS
HC A07/MF A01 CSCL 21E

A sector combustor technology development program was conducted to define an advanced double annular dome combustor sized for use in the quiet clean short haul experimental engine (QCSEE). A design which meets the emission goals, and combustor performance goals of the QCSEE engine program was developed. Key design features were identified which resulted in substantial reduction in carbon monoxide and unburned hydrocarbon emission levels at ground idle operating conditions, in addition to very low nitric oxide emission levels at high power operating conditions. Their significant results are reported. R.C.T.

N80-15122*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE): ACOUSTIC TREATMENT DEVELOPMENT AND DESIGN
Art Clemons May 1979 353 p refs
(Contract NAS3-18021)
(NASA-CR-135266; R76AEG379-1) Avail: NTIS
HC A16/MF A01 CSCL 21E

Acoustic treatment designs for the quiet clean short-haul experimental engines are defined. The procedures used in the development of each noise-source suppressor device are presented and discussed in detail. A complete description of all treatment concepts considered and the test facilities utilized in obtaining background data used in treatment development are also described. Additional supporting investigations that are complementary to the treatment development work are presented. The expected suppression results for each treatment configuration are given in terms of delta SPL versus frequency and in terms of delta PNdB. R.E.S.

N80-15123*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QSCEE). PRELIMINARY ANALYSES AND DESIGN REPORT, VOLUME 1
Oct. 1974 372 p
(Contract NAS3-18021)
(NASA-CR-134838; R74AEG479-Vol-1) Avail: NTIS
HC A16/MF A01 CSCL 21E

The experimental propulsion systems to be built and tested in the 'quiet, clean, short-haul experimental engine' program are presented. The flight propulsion systems are also presented. The following areas are discussed: acoustic design; emissions control; engine cycle and performance; fan aerodynamic design; variable-pitch actuation systems; fan rotor mechanical design; fan frame mechanical design; and reduction gear design. R.E.S.

N80-15124*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). PRELIMINARY ANALYSES AND DESIGN REPORT, VOLUME 2
Oct. 1974 330 p
(Contract NAS3-18021)
(NASA-CR-134839; R74AEG479-Vol-2) Avail: NTIS
HC A15/MF A01 CSCL 21E

The experimental and flight propulsion systems are presented. The following areas are discussed: engine core and low pressure turbine design; bearings and seals design; controls and accessories design; nacelle aerodynamic design; nacelle mechanical design; weight; and aircraft systems design. R.E.S.

N80-15125*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING (OTW) PROPULSION SYSTEM TEST REPORT. VOLUME 1: SUMMARY REPORT
Jan. 1978 67 p
(Contract NAS3-18021)
(NASA-CR-135323; R77AEG473-Vol-1) Avail: NTIS
HC A04/MF A01 CSCL 21E

Sea level, static, ground testing of the over-the-wing engine and boilerplate nacelle components was performed. The equipment tested and the test facility are described. Summaries of the instrumentations, the chronological history of the tests, and the test results are presented. R.E.S.

N80-15126*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE WING (OTW) PROPULSION SYSTEM TEST REPORT. VOLUME 3: MECHANICAL PERFORMANCE
Feb. 1978 121 p
(Contract NAS3-18021)
(NASA-CR-135325; R77AEG475-Vol-3) Avail: NTIS
HC A06/MF A01 CSCL 21E

The mechanical performance of the over-the-wing engine is described with emphasis on the advanced technology components. The overall dynamic response of the engine was excellent. R.E.S.

N80-15127*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUIET POWERED-LIFT PROPULSION
1979 426 p refs Conf. held at Cleveland, Ohio, 14-15 Nov. 1978
(NASA-CP-2077; E-9906) Avail: NTIS HC A19/MF A01 CSCL 21E

Latest results of programs exploring new propulsion technology for powered-lift aircraft systems are presented. Topics discussed include results from the 'quiet clean short-haul experimental engine' program and progress reports on the 'quiet short-haul research aircraft' and 'tilt-rotor research aircraft' programs. In addition to these NASA programs, the Air Force AMST YC 14 and YC 15 programs were reviewed. R.E.S.

N80-15128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIRECT INTEGRATION OF TRANSIENT ROTOR DYNAMICS
Albert F. Kascak Washington Jan. 1980 23 p refs
(NASA-TP-1597; AVRADCOM-TR-79-42; E-101) Avail: NTIS HC A02/MF A01 CSCL 21E

An implicit method was developed for integrating the equations of motion for a lumped mass model of a rotor dynamics system. As an aside, a closed form solution to the short bearing theory was also developed for a damper with arbitrary motion. The major conclusions are that the method is numerically stable and that the computation time is proportional to the number of elements in the rotor dynamics model rather than to the cube of the number. This computer code allowed the simulation of a complex rotor bearing system experiencing nonlinear transient motion and displayed the vast amount of results in an easily understood motion picture format - a 10 minute, 16 millimeter, color, sound motion picture supplement. An example problem with 19 mass elements in the rotor dynamics model took 0.7 second of central processing unit time per time step on an IBM 360-67 computer in a time sharing mode. R.C.T.

N80-15129*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EVALUATION OF APPROXIMATE METHODS FOR THE PREDICTION OF NOISE SHIELDING BY AIRFRAME COMPONENTS
Warren F. Ahtye and Geraldine McCulley (Informatics, Inc., Palo Alto, Calif.) Washington Jan. 1980 105 p refs
(NASA-TP-1004; A-6961) Avail: NTIS HC A06/MF A01 CSCL 21E

An evaluation of some approximate methods for the prediction of shielding of monochromatic sound and broadband noise by aircraft components is reported. Anechoic-chamber measurements of the shielding of a point source by various simple geometric shapes were made and the measured values compared with those calculated by the superposition of asymptotic closed-form solutions for the shielding by a semi-infinite plane barrier. The shields used in the measurements consisted of rectangular plates, a circular cylinder, and a rectangular plate attached to the cylinder to simulate a wing-body combination. The normalized frequency, defined as a product of the acoustic wave number and either the plate width or cylinder diameter, ranged from 4.6 to 114. Microphone traverses in front of the rectangular plates and cylinders generally showed a series of diffraction bands that matched those predicted by the approximate methods, except for differences in the magnitudes of the attenuation minima which can be attributed to experimental inaccuracies. The shielding of wing-body combinations was predicted by modifications of the approximations used for rectangular and cylindrical shielding. Although the approximations failed to predict diffraction patterns in certain regions, they did predict the average level of wing-body shielding with an average deviation of less than 3 dB. M.M.M.

N80-15130*# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
THEORY OF DEPOSITION OF CONDENSIBLE IMPURITIES ON SURFACES IMMERSED IN COMBUSTION GASES Semiannual Report, 15 Jan. - 14 Jul. 1979
Daniel E. Rosner 1979 11 p refs
(Grant NsG-3107)
(NASA-CR-159716; SAR-6) Avail: NTIS HC A02/MF A01 CSCL 21E

The components resulting from the deposition of inorganic salts (e.g., Na2S04) and oxides present in the combustion products from gas turbine engines were investigated. Emphasis was placed on the effects of multicomponent vapor transport, thermophoretic transport of vapor and small particles to actively cooled surfaces, variable fluid properties within mass transfer boundary layers, and free stream turbulence. R.C.T.

N80-15131*# Yale Univ., New Haven, Conn. High Temperature Chemical Reaction Engineering Lab.
EXPERIMENTAL STUDIES OF THE FORMATION/DEPOSITION OF SODIUM SULFATE IN/FROM COMBUSTION GASES Semiannual Report, 15 May - 15 Dec. 1979
Daniel E. Rosner Dec. 1979 10 p refs
(Grant NsG-3169)
(NASA-CR-159753; SAR-4) Avail: NTIS HC A02/MF A01 CSCL 21E

An optical polarization (ellipsometric) technique was developed for measuring rapidly growing and evaporating transparent liquid condensate films (e.g., boric oxide) on solid surfaces exposed to combustion product gases. Results for the B2O3 deposition rate from BCl3-seeded propane/air flames are shown to agree well with the results of earlier interference measurements, and also with theoretical CVD predictions. Evaporation rates (from platinum ribbons into seeded propane air flames) are estimated using the polarization technique. It appears that, compared with the interference method, the polarization technique places less stringent requirements on surface quality, which may justify the added optical components needed for such measurements. It is concluded that the complementary optical methods of polarization (ellipsometry) and interference hold considerable promise for application to the rapid measurement of condensation and evaporation rates in high temperature (e.g., combustion product) environments. A.R.H.

N80-15132*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER SIMULATION OF ENGINE SYSTEMS
L. H. Fishback 1980 26 p refs Presented at the 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-79290; E-234) Avail: NTIS HC A03/MF A01 CSCL 21E

The use of computerized simulations of the steady state and transient performance of jet engines throughout the flight regime is discussed. In addition, installation effects on thrust and specific fuel consumption is accounted for as well as engine weight, dimensions and cost. The availability throughout the government and industry of analytical methods for calculating these quantities are pointed out. M.M.M.

N80-15133*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPACT OF NEW INSTRUMENTATION ON ADVANCED TURBINE RESEARCH
Robert W. Graham Mar. 1980 25 p refs Proposed for presentation at the 1980 Spring Ann. Meeting, New Orleans, 5-13 Mar. 1980; sponsored by ASME
(NASA-TM-79301; E-251) Avail: NTIS HC A02/MF A01 CSCL 21E

A description is presented of an orderly test program that progresses from the simplest stationary geometry to the more complex, three dimensional, rotating turbine stage. The instrumentation requirements for this evolution of testing are described. The heat transfer instrumentation is emphasized. Recent progress made in devising new measurement techniques has greatly improved the development and confirmation of more accurate analytical methods for the prediction of turbine performance and heat transfer. However, there remain challenging requirements for novel measurement techniques that could advance the future research to be done in rotating blade rows of turbomachines. M.M.M.

N80-15134*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF A SHORT S-SHAPED SUBSONIC DIFFUSER OF A SUPERSONIC INLET
Harvey E. Neumann, Louis A. Povinelli, and Robert E. Coltrin 1980 14 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan 1980; sponsored by AIAA
(NASA-TM-81406; E-320) Avail: NTIS HC A02/MF A01 CSCL 21E

A subscale HiMAT forebody and inlet was investigated over a range of Mach numbers to 1.4. The inlet exhibited a transitory separation within the diffuser but steady state data indicated reattachment at the diffuser exit. A finite difference procedure for turbulent compressible flow in axisymmetric ducts was used to successfully model the HiMAT duct flow. The analysis technique was further used to estimate the initiation of separation and delineate the steady and unsteady flow regimes in similar S-shaped ducts. R.C.T.

N80-15135# Boeing Aerospace Co., Seattle, Wash.
AN EXTENSION OF ENGINE WEIGHT ESTIMATION TECHNIQUES TO COMPUTE ENGINE PRODUCTION COST Final Report
E. Onat and F. F. Tolle 31 Aug. 1979 38 p refs
(Contract N62269-78-C-0286)
(AD-A074454; NADC-78103-60) Avail: NTIS HC A03/MF A01 CSCL 05/1

As a follow-on to previously developed engine weight estimation work, a preliminary design engine cost estimating code has been produced. The code relies on engine thermodynamic characteristics and weight as computed by earlier developed codes to select raw material types and quantities required to produce the engine. An existing Navy technique is then used to convert this data into engine cost. The code was used to predict the cost of three existing engines; errors ranged form 1 to 8% of actual costs as reported to NADC. GRA

N80-15136# Kentucky Univ., Lexington. Dept. of Engineering Mechanics.
THERMO-MECHANICAL STRESS ANALYSIS OF ADVANCED TURBINE BLADE COOLING CONFIGURATION Final Report, 1 May 1975 - 15 Jul. 1979
F. J. Rizzo and D. J. Shippy Jul. 1974 68 p refs
(Grant AF-AFOSR-2824-79; AF Proj. 2307)
(AD-A074098; UKY-TR111-79-EM17; AFOSR-79-0953TR)
Avail: NTIS HC A04/MF A01 CSCL 20/11

A thermo-mechanical stress analysis capability, based on the Boundary Integral Equation Method (BIE) is developed and described. The capability is used to provide a thermoelastic analysis of stress in the vicinity of cooling holes in turbojet blades with transpiration or film cooling. Details involved in the formulation, numerical procedures, mathematical modelling, and data from solved problems are presented. GRA

N80-15137# TRW Equipment Labs., Cleveland, Ohio. Materials Technology Dept.
FRS COMPOSITES FOR ADVANCED GAS TURBINE ENGINE COMPONENTS Final Report
D. M. Essock May 1979 46 p refs
(Contract N62269-77-C-0217; SF54592201)
(AD-A074287; ER-7969-F; NADC-77015-30) Avail: NTIS HC A03/MF A01 CSCL 20/5

A number of FRS design concepts involve use of varying volume fraction of fiber, varying fiber diameter, and cross-ply construction. Key properties of such composites were evaluated to determine whether there are any adverse effects. Based upon elevated temperature tensile, creep, and thermal fatigue testing, equivalent mechanical properties are obtained if placement of plies is varied in a symmetrical layup. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-15138*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF PRIMARY ROTOR PARAMETERS ON FLAPPING DYNAMICS
Robert T. N. Chen Jan. 1980 63 p refs
(NASA-TP-1431; A-7777) Avail: NTIS HC A04/MF A01 CSCL 01A

The effects of flapping dynamics of four main rotor design features that influence the agility, stability, and operational safety of helicopters are studied. The parameters include flapping hinge offset, flapping hinge restraint, pitch-flap coupling, and blade lock number. First, the flapping equations of motion are derived that explicitly contain the design parameters. The dynamic equations are then developed for the tip-path plane, and the influence of individual and combined variations in the design parameters determined. The steady state flapping response is examined with respect to control input and aircraft angular rate which leads to a feedforward control law for control decoupling through cross feed, and a feedback control law to decouple the steady state flapping response. The condition for achieving perfect decoupling of the flapping response due to aircraft pitch and roll rates without using feedback control is also found for the hover case. It is indicated that the frequency of the regressing flapping mode of the rotor system can become low enough to require consideration in the assessment of handling characteristics. J.M.S.

N80-15139# Calspan Advanced Technology Center, Buffalo, N.Y.
DESIGN CRITERIA FOR OPTIMAL FLIGHT CONTROL SYSTEMS Final Report, Jan. - Nov. 1978
K. S. Govindara, E. G. Rynaski, and A. T. Fam 7 Sep. 1979 95 p refs Prepared in cooperation with the State Univ. of New York at Buffalo
(Contract N00014-78-C-0155)
(AD-A074092; CALSPAN-6248-F-1; ONR-CR-215-259-1F)
Avail: NTIS HC A05/MF A01 CSCL 01/3

Discussed is the application of linear optimal control to the design of a multicontroller feedback system to satisfy aircraft flying qualities criteria. The problem addressed is that of relating the performance index weighting matrices to the poles and zeros of the closed-loop transfer functions. Two sequential design procedures, one computing the Riccati solution from a set of linear equations and the other computing the closed-loop eigenvectors, are presented that determine, at each step, the pole-zero movements of the closed-loop transfer functions as the weighting matrix on the states is varied for a given weighting matrix on the controls. The performance index matrix constructed at each step to move the poles and zeros is added to get a final performance index matrix that moves the open-loop poles and zeros to more desirable locations. A control system design example with the X-22A V/STOL aircraft as the model, and using the first sequential design procedures, is presented. Two alternative design techniques are also presented. The first is based upon the Riccati equation solution and the control weighting matrix rather than on the weighting matrices on the states and control, and in the second design technique, the change in the pole-zero locations is determined under perturbations in the performance index matrices. GRA

N80-15140# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE 28TH GUIDANCE AND CONTROL PANEL SYMPOSIUM ON ADVANCES IN GUIDANCE AND CONTROL SYSTEMS USING DIGITAL TECHNIQUES
Morris A. Ostgaard (AFFDL, Wright-Patterson AFB, Ohio) Nov. 1979 14 p Symp. held at Ottawa, 8-11 May 1979
(AGARD-AR-148; ISBN-92-835-1314-X) Avail: NTIS HC A02/MF A01

A summary of the conclusions and recommendations resulting from audience comments and participation and technical assessment of the papers and the meeting is presented. Some of the conclusions are as follows: (1) there is a rapid emergence of digital processor application to guidance and control that represent integration opportunities heretofore unavailable in analog systems; (2) there appears to be a proliferation of microprocessor device application and architectures that, by themselves, limit potential for generalized application; (3) with the availability of more information from the data buss and the power of the computational capability, the multi-variable design techniques are offering significant potential for improving system performance and reducing equipment complexity; and (4) there is a strong need for fundamental studies in functional architecture that can employ microprocessors and still retain standards that permit

the application of emerging electronic technology without restructuring the total system. R.E.S.

N80-15141# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
LOW COST AIRCRAFT FLUTTER CLEARANCE
Sep. 1979 110 p Papers presented at the 48th Meeting of the Structures and Mater. Panel, Williamsburg, Va., 4 Apr. 1979
(AGARD-CP-278; ISBN-92-835-0245-0) Avail: NTIS HC A06/MF A01

An evaluation of the usage of low cost aircraft flutter clearance procedures is presented. Some results occurring from such procedures (weight efficiency, safety, flight incidents, and overall costs) were discussed relative to those from methods using advanced state of the art. The relative technological-financial position of the small light weight aircraft manufacturer was also discussed. For individual titles, see N80-15142 through N80-15148.

N80-15142# Lockheed-Georgia Co., Marietta.
COMPARISON OF INTERNATIONAL FLUTTER REQUIREMENTS AND FLUTTER FREEDOM SUBSTANTIATION OF LIGHT AIRCRAFT IN THE USA
H. F. Hunter and G. E. Goodblood (FAA) *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 10 p refs (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

A comparison of current flutter specification requirements for light aircraft produced by NATO and other free-world countries is presented as well as an overview of flutter substantiation procedures presently used in the USA by the Federal Aviation Administration. Current flutter assessment procedures for light aircraft parallel very nearly those for transport-type aircraft. Significant deviations could occur because specific requirements for follow-on flight verification are lacking. The lack of such requirements has not created a great problem, since certain elements of the flight structure call for flight demonstration, in most cases. The body of data acquired may be something less than that derived for a transport program. The attempt is made, however, to acquire sufficient data to validate the analysis from a safety standpoint. M.M.M.

N80-15143# Beech Aircraft Corp., Wichita, Kans. Structural Dynamics Dept.
THE STATE-OF-THE-ART OF FLUTTER SUBSTANTIATION PROCEDURES AMONG US GENERAL AVIATION MANUFACTURERS
E. H. Hooper *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 19 p ref (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

An overview is presented of the state of the art of flutter substantiation procedures among U.S. general aviation manufacturers to serve as a guide to the small plane designer in the prevention of flutter, aileron reversal, and wing divergence. The material presented relies upon: (1) a statistical study of the geometric, inertia, and elastic properties of those airplanes which had experienced flutter in flight, and the methods used to eliminate the flutter; (2) limited wind-tunnel tests conducted with semi-rigid models. These were solid models of high rigidity with motion controlled at the root by springs to simulate wing bending and torsion. Springs at the control surface were used to simulate rotation; and (3) analytic studies based on the two dimensional study of a representative section of an airfoil. M.M.M.

N80-15144# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany)
AN EMPIRICAL APPROACH FOR CHECKING FLUTTER STABILITY OF GLIDERS AND LIGHT AIRCRAFT
F. Kiessling *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 17 p refs (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

Data of flutter accidents and computations of gliders and light aircraft are presented, and the empirical rules of a simplified flutter investigation are applied. A procedure for checking the flutter stability of small airplanes is proposed, which takes into account the varying levels of knowledge with conventional and unconventional designs. M.M.M.

N80-15145# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DYNAMIC IDENTIFICATION OF LIGHT AIRCRAFT STRUCTURES AND THEIR FLUTTER CERTIFICATION
Gerard Piazzoli and Jean-Louis Meurzec *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 19 p refs In FRENCH; ENGLISH summary (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

Within the framework of the general orientation of the treatment of the light aircraft structures, and with a view to determining specifications for their aeroelastic certification, the following points are discussed: (1) application of fast identification methods and of technological means to be implemented during the tests; (2) exploitation of flutter onset calculations, coupled on the computer with the experimental data, making it possible, in most cases, to define in situ a remedy (such as a new mass balance of the control surface) and to check its efficiency; (3) development of mixed methods, based on the theoretical definition of the participation of the control surfaces in the structural modes revealed by the test, with a view to palliating the possible orthogonality defects of the experimental modal basis on which the definitive flutter prediction calculations are established; and (4) methods and techniques used during the aeroelastic flight test, carried out in the particular cases where flutter certification cannot be based only on the calculation file because of insufficient safety margins. M.M.M.

N80-15146# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
A SIMPLIFIED GROUND VIBRATION TEST PROCEDURE FOR SAILPLANES AND LIGHT AIRCRAFT
N. Niedbal *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 11 p refs (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

A test procedure to obtain all characteristic modal data for an aeroelastic analysis is presented. It is shown that by taking into consideration the beam-like structural behaviour of such aircraft, and the comparatively small bandwidth of the design variables, substantial simplifications are possible when the dynamic behavior of similar aircraft structures is known. The mechanical steering mechanism of the control surfaces causes high damping and nonlinear effects, which require a separate examination and analysis of the control surfaces. M.M.M.

N80-15147# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
A FLUTTER-SPEED FORMULA FOR WINGS OF HIGH ASPECT RATIO
U. T. Niblett *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 14 p refs (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

Flutter-speed formulae for unswept wings of high aspect ratio and not carrying concentrated masses are derived. A high aspect ratio wing was defined as one whose fundamental torsional frequency is well above its first overtone flexural frequency. Because of the comparative fewness of the factors governing the flutter of such wings, flutter-speed formulae aimed at giving a lower bound for the flutter speed is of simple form. M.M.M.

N80-15148# British Aerospace Aircraft Group, Weybridge (England). Weybridge-Bristol Div.
THE MINIMUM COST APPROACH TO FLUTTER CLEARANCE
B. W. Payne and R. E. J. Brazier *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 11 p (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

Flutter prediction methods are assessed using criteria and simple flutter analyses. The difference in cost of these alternative approaches is no longer great, and the better data, available from the flutter analysis, answer far more of the questions which arise when obtaining a flutter clearance. Current regulations,

although not making flutter calculations mandatory, do insist on ground and flight resonance testing. Data from a flutter analysis can allow a substantial saving in flight test time. It is concluded that flutter calculations provide the swiftest, surest and safest route to flutter clearance of the orthodox design and the only route for the unorthodox. Author

N80-15149# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AERODYNAMIC CHARACTERISTICS OF CONTROLS
Sep. 1979 510 p Presented at the Fluid Dyn. Panel Symp., Poznan, Italy, 14-17 May 1979
(AGARD-CP-282; ISBN-92-835-0252-3) Avail: NTIS HC A22/MF A01

The rapidly expanding flight envelopes of aircraft, the growing applications of active control technology (ACT) and the associated development of control configured vehicles (CCV) are considered. Conventional and novel methods of control, prediction methods, experimental data derived from wind tunnel and flight measurements, and flight experience of ACT and CCV are included. For individual titles, see N80-15150 through N80-15178.

N80-15150# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Design Aerodynamics.
THEORETICAL AERODYNAMIC METHODS FOR ACTIVE CONTROL DEVICES
Horst Koerner *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 28 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The theoretical aerodynamic aspects of active control devices are surveyed. Various calculation methods for subsonic, transonic, and supersonic attached flow are reviewed followed by comments on separated flow. Typical correlations between theoretical and experimental results for steady and unsteady characteristics of control are presented along with the shortcomings of the theoretical approaches and some recommendations for future efforts. J.M.S.

N80-15151# Royal Aircraft Establishment, Farnborough (England).
A SURVEY OF EXPERIMENTAL DATA ON THE AERODYNAMICS OF CONTROLS, IN THE LIGHT OF FUTURE NEEDS
A. Jean Ross and H. H. B. M. Thomas *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 48 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Control data for current aircraft are used to provide material for discussion, principally to describe trends and to highlight gaps in knowledge. Both direct and indirect effects for a range of conventional and unconventional motivators are included. Maximum control power at the extremes of the flight envelope is particularly emphasized, since that available at high angle of attack and high subsonic speed is likely to be the critical design case. The indirect and coupling effects are also more marked at high angle of attack and/or high control deflection, and are of importance in the control system design. Hinge moment characteristics are described, although experimental data published recently are sparse. Some thought is given to the means of generating required control powers for aircraft configurations made possible by Active Control Technology, and to the integration of the motivators in the control system. J.M.S.

N80-15152# McDonnell Aircraft Co., St. Louis, Mo.
CORRELATION OF F-15 FLIGHT AND WIND TUNNEL TEST CONTROL EFFECTIVENESS
J. W. Agnew and J. F. Mello *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 11 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The F-15 aerodynamic configuration and control system development relied on data obtained in an extensive wind tunnel test program. Subsequently, a large body of flight test data was obtained. Control surface effectiveness characteristics were derived from flight test data and were compared with the data obtained in the wind tunnel test program. Data correlations are available for the ailerons, rudders, and stabilators. The latter surfaces are deflected symmetrically for longitudinal control and are deflected differentially for roll control. Primary axis effectiveness is addressed for each of these control surfaces. Significant secondary axis contributions (e.g., yawing moments due to aileron deflection) are also addressed. In addition to the conventional control surfaces, the longitudinal control effectiveness of the F-15 movable inlet ramp is discussed. As a result of the excellent resistance to departure from controlled flight, the spin resistance and spin recovery characteristics of the F-15, it was possible to flight test and to obtain control effectiveness data to 90 deg angle of attack at low speeds and to approximately 40 deg at transonic speeds. Thus, the correlation of control effectiveness is addressed for a large range of conditions. J.M.S.

N80-15153# Royal Aircraft Establishment, Farnborough (England).
SOME WIND TUNNEL MEASUREMENTS OF THE EFFECTIVENESS AT LOW SPEEDS OF COMBINED LIFT AND ROLL CONTROLS
D. S. Woodward, R. F. A. Keating, and C. S. Barnes *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 36 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Using a half-model technique, measurements were made, at low speeds, of the effectiveness of spoilers for direct lift or roll control, with high lift devices deployed. The wing planform was representative of that of a transport aircraft outboard of the trailing edge crank. Results are presented which show that appropriate venting beneath the leading edge of hinged plate spoilers, together with venting through the flap shroud, achieved acceptably linear spoiler characteristics. Similarly, linear characteristics were obtained for a vented spoiler formed by moving the rear of the flap shroud. No reversal of spoiler effectiveness was found at any test condition within the normal operating range of incidence. In the same way, measurements were made of the maximum lift and roll performance of a typical swing wing fighter aircraft, for which the design of the leading and trailing edge controls was totally determined by the need to maximize the maneuverability at high speed. The maximum lift performance is compared with that obtainable from conventional slate and slotted flaps. Somewhat surprisingly, it is found that adequate rolling moments can be obtained by using full-span plain flaps differentially about a basic drooped position of 30 deg. J.M.S.

N80-15154# Boeing Military Airplane Development, Seattle, Wash. Flight Control Technology.
FLIGHT CONTROL AND CONFIGURATION DESIGN CONSIDERATIONS FOR HIGHLY MANEUVERABLE AIRCRAFT
William T. Kehrer *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 11 p (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Working within wing geometry and other design constraints, the controllable limits of instability and the maneuver capabilities of various design approaches were investigated. Preliminary studies conducted to evaluate competitive configuration arrangements indicate that an aft-tail controller concept will be superior to canard and tailless delta configurations. The latter configurations suffer controllability limitations that compromise the ability to achieve design goals for maneuverability and efficient supersonic cruise. Thrust vectoring was explored as a means of improving maneuver load factor capability. R.E.S.

N80-15155# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
WIND TUNNEL MEASUREMENTS AND ANALYSIS OF SOME UNUSUAL CONTROL SURFACES ON TWO SWEPT WING FIGHTER CONFIGURATIONS
D. Welte and S. Ehekircher *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 10 p (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Force measurements were made in a low speed and in a high speed wind tunnel with a 1:20 scale, 35 deg swept wing fighter configuration model. Surfaces which are deflected for longitudinal trim are: horizontal tail, leading- and trailing-edge flaps, a strake and a strake leading-edge flap. For lateral control

the following surfaces are deflected: ailerons, tiperons, flaperons and a strake leading-edge flap. The main conclusions are: (1) trailing edge flaps are very useful to trim an unstable configuration and have minimum drag; (2) tiperons are very effective means for roll-yaw control up to very high angles of attack; and (3) differentially deflected leading edge flaps and a vortex fin, positioned on the wing upper surface, decrease the directional instability at high angles of attack. In addition, low speed tests were made with a new wing concept for a future fighter configuration, so called supersonic biplane, to investigate the effectiveness of the upper- and lower-wing trailing edge flaps. As supplement to the wind tunnel measurements some flight mechanical maneuver calculations were made to check the suitability and to compare the effectiveness of the different controls. R.E.S.

N80-15156# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
ROLL CONTROL BY DIGITALLY CONTROLLED SEGMENT SPOILERS
Klaus Jonas (Dornier-Werke G.m.b.H.), Horst Wuennenberg (Dornier-Werke G.m.b.H.), and Karl-Heinz Horstmann *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 8 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

To realize total wing span flaps for improving the maneuvering and landing performances of a combat aircraft the roll control has to be realized by spoilers. To overcome the nonlinearity and control reversal problems at low deflections, the continuously deflected spoiler is replaced by a certain set of digitally controlled single spoilers, which provide only three discrete deflections. It was found by simulator tests that by a proper combination of these segment spoilers it is possible to provide a roll control, which is judged as continuous by the pilot, with a relatively low number of single spoilers. Wind tunnel programs were performed to investigate system efficiency and aerodynamic effectiveness. Several roll spoiler configurations were tested in two and three dimensional configurations with and without landing flaps at different spanwise positions, spoiler deflections and -spans. It is shown that the effectiveness related to the deflection is linear for flaps-up and highly nonlinear for flaps-down configurations. The spoiler span is of no more influence at a certain value and the optimum spanwise location is about 0.8 of the semispan. Furthermore the effectiveness and the influence on lift and pitching moment for a possible test aircraft are shown. The practical application within an intended flight test program is discussed. R.E.S.

N80-15157# Boeing Aerospace Co., Seattle, Wash.
THE YC-14 UPPER SURFACE BLOWN FLAP: A UNIQUE CONTROL SURFACE
Alan H. Lee *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 8 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The application of powered-lift technology applied to the Boeing YC-14 is assessed. The YC-14 can be controlled during short takeoff landings using conventional pilot techniques. That capability stems from the use of its upper surface blown (USB) flaps as control surfaces. The USB flaps are used to help control aircraft lift and airspeed. They are positioned automatically by the flight control system to eliminate undesired lift changes caused by thrust changes or external disturbances and to work with the autothrottle to attain and hold a selected airspeed. The aerodynamic and physical characteristics of USB flaps are described. R.E.S.

N80-15158# Northrop Corp., Los Angeles, Calif.
FLAPERON CONTROL: THE VERSATILE SURFACE FOR FIGHTER AIRCRAFT
John F. Moynes and Wallace E. Nelson, Jr. *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 18 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The versatility of a flaperon is presented for roll performance and for several longitudinal active control modes. Particular emphasis is given to the advantages of a segmented flaperon over a full span for a YF-17 type aircraft. The areas of ride smoothing, direct lift, pitch pointing, vertical flight path control and flight control system reconfiguration are addressed for the active longitudinal control modes. The effect of flaperon pitching moment on the implementation of these modes is discussed. Author

N80-15159# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AFFDL EXPERIENCE IN ACTIVE CONTROL TECHNOLOGY
Robert P. Johannes and Robert A. Whitmoyer *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 20 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The evolution of active control technology (ACT) from the viewpoint of the Air Force Flight Dynamics Laboratory (AFFDL) is presented. Emphasis is placed on the aerodynamic control forces necessary to exploit ACT and in describing AFFDL development programs which merge these two disciplines and transition technology into operational flight equipment. Specific ACT programs described are: (1) the LAMS program; (2) the CCV B-52 program; (3) the SFCS F-4 program; (4) the CCV/PACT F-4 programs; (5) the Variable Stability NT-33 program; (6) the CCV YF-16 program; (7) the A-7D Digital Multimode program; (8) the IFFC I/FIREFLY III program; and (9) the AFTI-16 program. Experiences indicating areas of need for extension of fluid dynamics technology are also discussed. M.M.M.

N80-15160*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
CONTROL CONSIDERATIONS FOR CCV FIGHTERS AT HIGH ANGLES OF ATTACK
Luat T. Nguyen, William P. Gilbert, and Sue B. Grafton *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 10 p ref (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01 CSCL 01C

Wind tunnel and piloted simulation studies were conducted to investigate the potential high angle of attack control problems that are introduced by the use of the CCV concept of relaxed static pitch stability (RSS) on fighter aircraft. A conventional wing/aft tail design incorporating modest levels of static instability and a close-coupled canard/wing design exhibiting very high levels of instability was investigated. Two types of high angle of attack control problems can result from the use of RSS: pitch departures caused by coupling and deep stall trim. Avoidance of these problems requires that the airplane have sufficient nose-down pitch control at high angles of attack. The effectiveness of several pitch control configurations were investigated including conventional aft-mounted stabilators, wing-mounted elevators, canard-mounted flaps, and all-moveable canards. Varying the incidence of the canards was the most effective scheme; however, very large deflections may be required on highly unstable configurations to prevent pitch departure without sacrificing roll performance and to avoid deep stall trim. For situations where the high angle of attack pitch control requirement is not met, control laws were developed to inhibit the departure and to allow deep stall recovery. However, these schemes involve limiting airplane roll capability and therefore can potentially compromise maneuverability. M.M.M.

N80-15161# British Aerospace Aircraft Group, Brough (England).
FIN DESIGN WITH ACT IN THE PRESENCE OF STRAKES
D. J. Walker *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 6 p (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Wind tunnel tests on a combat aircraft model are reported in which the effect of fin size and various types of fin controls were investigated. It was shown that a rudder (rather than an all moving fin) using active control technology is probably the best solution for incidences of up to about 50 deg. Also the use of such a system would allow a 20% reduction in the size of the basic fin. M.M.M.

N80-15162# McDonnell Aircraft Co., St. Louis, Mo.
CONTROL INTEGRATION TECHNOLOGY IMPACT
Charles A. Scolatti *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 6 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Some of the essential elements of an integrated technology development program are presented. The integrated flight and fire control system programs, called IFFC I/FIREFLY III, is used as an example. The operational relevance of the example is discussed. The major problems in air-to-ground attack, and the introduction of maneuvering weapon delivery (with IFFC mechanization required to achieve bombing solutions), are covered. The impact of this IFFC technology, and its extension on other areas of technology, such as aerodynamics, is indicated. M.M.M.

N80-15163# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DIRECT SIDE FORCE AND DRAG CONTROL WITH THE AID OF PYLON SPLIT FLAPS
Peter Esch and Horst Wuennenberg *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 9 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Two configuratinns of split flaps are examined, a long one with small deflections and a short one with large deflections. The short one led to the same effectiveness at reduced values of hinge moments and cross coupling effects. Due to high interference effects it was not possible to get the effects of all flaps by superposition of the single flap results. The angle of attack, the landing flap setting and the lateral projection area of the external stores have a significant influence on the effectiveness whereas the Mach number is less important. The examination of the wind tunnel results led to the necessary control laws for the operation of the flaps and the compensation equipment. The flight test program with an Alpha Jet preproduction aircraft is expected to start in 1980. M.M.M.

N80-15164°# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONTROL OF FOREBODY THREE-DIMENSIONAL FLOW SEPARATIONS
David J. Peake and F. Kevin Owen (Owen Intern., Inc., Palo Alto, Calif.) *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 49 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01 CSCL 01C

The development of the turbulent symmetric and asymmetric vortex flow about the lee side of a 5 deg semiangle conical forebody at high relative incidence was investigated. The cone was immersed in a Mach 0.6 airstream at a Reynolds number of 13.5 x 10 to the 6th power based on the 1.4 m axial length of the cone. Small amounts of air injected normally or tangentially to the cone surface, but on one side of the leeward meridian and beneath the vortex farthest from the wall, were effective in biasing the asymmetry. With this reorientation of the forebody vortices, the amplitude of the side force could be reduced to the point where its direction was reversed. This phenomenon was obtained either by changing the blowing rate at constant incidence or by changing incidence at constant blowing rate. Normal injection appeared more effective than tangential injection. The contrarotating vortices in the penetrating jet flow were of opposite hand to the rotational directions of the forebody vortices. A distinctively organized and stable flow structure emerged with the jet vortices positioned above the forebody vortices. K.L.

N80-15165# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
IN-FLIGHT MEASURED CHARACTERISTICS OF COMBINED FLAP-SPOILER DIRECT LIFT CONTROLS
O. Rix and D. Hanke *In* AGARD Aerodyn. characteristics of Controls Sep. 1979 22 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The influence of direct lift control on longitudinal aircraft dynamics and the requirements for the characteristics of direct lift controls for large transport aircraft in the landing approach phase are discussed. The characteristics of flaps, spoilers, and the influence of surface rate on aircraft behavior are also described. Flight tests were carried out with the DFVLR HFB 320 In-Flight Simulator to determine in-flight flap and spoiler characteristics and the characteristics of simultaneously deflected flaps and spoilers as a DLC device. The results show that flap and spoiler characteristics can be described by linear models for flap and spoiler inputs up to + or - 10 deg and + or - 30 deg, respectively, and relatively high surface rates of 10 deg/sec and 62 deg/sec. In addition, combined flap-spoiler deflections show no nonlinear or unsteady effects and the aircraft response is described by simple linear modelling. The spoiler derivatives valid for combined flap-spoiler deflections are identified. K.L.

N80-15166# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
WIND TUNNEL INVESTIGATION OF CONTROLS FOR DF ON A FIGHTER-TYPE CONFIGURATION OF HIGHER ANGLES OF ATTACK
Wolfgang Sonnleitner *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 11 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Stability and control characteristics of a fighter-type model were investigated at incidences up to 40 deg. Isolated and combined effects of different control shapes and control in different positions were demonstrated. K.L.

N80-15167# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROBLEMS OF UNSTEADY AERODYNAMICS RAISED BY THE USE OF CONTROL SURFACES AS ACTIVE CONTROLS [PROBLEMES D'AERODYNAMIQUE INSTATIONNAIRE POSES PAR L'UTILISATION DES GOUVERNES DANS LE CONTROLE ACTIF]
Roger Destuynder *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 17 p refs In FRENCH; ENGLISH summary (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The unsteady aerodynamic forces created by spoilers or auxiliary surfaces are investigated. Control problems concerning turbulence, gust control, and flutter phenomena are studied considering both subcritical and supercritical flows. Theoretical and mixed methods based on corrections defined after wind tunnel tests are applied. K.L.

N80-15168# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNSTEADY EFFECTS OF A CONTROL SURFACE IN TWO DIMENSIONAL, SUBSONIC AND TRANSONIC FLOW [EFFETS INSTATIONNAIRES D'UNE GOUVERNE EN ECOULEMENT BIDIMENSIONNEL SUBSONIQUE ET TRANSSONIQUE]
Richard Grenon, Andre Desopper, and Jacques Sides *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 14 p refs In FRENCH; ENGLISH summary (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The unsteady effects of an oscillating surface are studied. The experimental results of steady and unsteady pressure measurements carried out in subsonic and transonic flow on a 16% relative thickness supercritical airfoil, equipped with a trailing edge flap, are compared with those obtained by various methods of steady and unsteady inviscid flow calculations. Calculation results are presented in which viscous effects have been taken into account, for both steady and unsteady flows. K.L.

N80-15169# Royal Aircraft Establishment, Bedford (England). Structures Dept.
AERODYNAMIC CHARACTERISTICS OF MOVING TRAILING-EDGE CONTROLS AT SUBSONIC AND TRANSONIC SPEEDS
D. G. Mabey, D. M. McOwat, and B. L. Welsh *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 26 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Oscillatory pressures calculated and measured at high subsonic speeds for a swept back wing of aspect ratio 6 with a part span trailing edge flap were compared. The flap was driven at frequencies of 1 Hz (quasi-steady) and 90 Hz at Mach numbers from 0.40 to 0.95 with both fixed and free transition over a range of Reynolds numbers from 1 million to 4 million. The measured oscillatory pressures depended strongly on the boundary layer displacement thickness at the hinge line.

Extrapolation from model to full scale required great care. In subsonic flow, tests with free transition gave the thinnest turbulent boundary layer at the hinge line and come nearest to full scale. At transonic speeds, transition was fixed at a safe distance upstream of the most forward excursion of the shock wave to obtain results appropriate to higher Reynolds number. Tests with flap driven simultaneously at two frequencies (90 Hz and 131 Hz) at subsonic and transonic speeds produced the same oscillatory pressures at 131 Hz as when driven independently. The principle of superposition applies, at least for small amplitude motions with attached flows. R.C.T.

N80-15170# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.

UNSTEADY AERODYNAMICS OF TWO-DIMENSIONAL SPOILERS AT LOW SPEEDS

S. R. Siddalingappa and G. J. Hancock. *In* AGARD. Aerodynam. Characteristics of Controls. Sep. 1979. 13 p. refs (For primary document see N80-15149 06-08)

Avail: NTIS. HC A22/MF A01

Complementary aspects of spoiler behavior are reviewed. The emphasis is on the understanding of the local flow about a spoiler. A two dimensional spoiler on the floor of a small blower tunnel (solid floor, and side walls but open at the top) was investigated. Steady pressures were measured along the tunnel floor for various steady spoiler angles and gap sizes between the bottom of the spoiler and the tunnel floor. Transient pressures were recorded following sudden changes in spoiler angle and for oscillating spoilers. A two dimensional spoiler attached to a two dimensional airfoil was investigated. The manner in which the spoiler affects the overall pressure distribution on the airfoil plus spoiler combination was emphasized. Both the airfoil and the spoiler were pressure plotted. The results of steady pressures, transient pressures following rapid and slower ramp changes in spoiler angle, and transient pressures when the spoiler is moving in simple harmonic motion are included. R.C.T.

N80-15171# Rome Univ. (Italy). School of Aerospace Engineering.

TRAJECTORY BEHAVIOUR OF A CONTROL CONFIGURATED AIRCRAFT SUBJECTED TO RANDOM DISTURBANCES

Achille Danesi, Scott Smolka (Boston Univ.), and Francesco Bornini. *In* AGARD. Aerodyn. Characteristics of Controls. Sep. 1979. 17 p. refs (For primary document see N80-15149 06-08)

Avail: NTIS. HC A22/MF A01

The longitudinal behavior of a Boeing V-747 aircraft with some of its original aerodynamic effectors operating as active controllers in addition to the conventional elevators were studied. The ailerons were collectively used as outboard active flaps and the inboard section of the high lift triple slotted flaps was employed as inboard active flaps. The flight control system structure was implemented as an optimal model following system in which the optimal feedback gains were computed to minimize the integral performance index. Errors in dynamical response, in wing root bending moment, and in aerodynamic drag computed as deviations from the same quantities related to a specified model responding satisfactorily to disturbances with zero increments in wing root bending moment and aerodynamic drag in flight maneuver at given load factor, were considered. At the same time the minimum effectors activity was included as a design objective. A lighter wing structure was realized as the result of wing loads reduction and further weight saving (reduced tail size) was obtained by taking advantage of the beneficial effect of the active controller activity in reducing the elevator deflections required in the pull up maneuver. R.C.T.

N80-15172# Northrop Corp., Hawthorne, Calif. Aircraft Group.

FOREBODY VORTEX BLOWING: A NOVEL CONTROL CONCEPT TO ENHANCE DEPARTURE/SPIN RECOVERY CHARACTERISTICS OF FIGHTER AND TRAINER AIRCRAFT

Andrew M. Skow, William A. Moore, and Dale J. Lorincz. *In* AGARD. Aerodyn. Characteristics of Controls. Sep. 1979. 17 p. refs (For primary document see N80-15149 06-08)

Avail: NTIS. HC A22/MF A01

Active blowing concepts which control the asymmetric orientation of the vortex system emanating from an aircraft forebody at high angles of attack are described. The side force generated by the asymmetric nature of the vortices was utilized. The choice between these two preferred positions was influenced strongly by very small geometric imperfections in an otherwise symmetric model and by small asymmetries in the upstream flow such as are caused by flow angularity or turbulent eddies in the free stream. The magnitude of the side force was very large due to the fluid amplification afforded by the vortex growth. The results of water tunnel flow visualization studies and a wind tunnel test program are presented which bear out this assumption and show that tangential blowing can effectively alter the forebody vortex system at angles of attack between 25 and 55 deg. and can generate yawing moments comparable to those produced by a conventional rudder at low angles of attack. The results of a six deg of freedom digital simulation are presented which show that this concept can substantially enhance departure recovery characteristics and could have potential as a departure inhibitor for some aircraft. The results of a preliminary system design indicate that such a system could be applied to aircraft. R.C.T.

N80-15173# Nielsen Engineering and Research, Inc., Mountain View, Calif.

NONLINEAR AERODYNAMICS OF ALL-MOVABLE CONTROLS

Charles A. Smith and Jack N. Nielsen. *In* AGARD. Aerodyn. Characteristics of Controls. Sep. 1979. 20 p. refs (For primary document see N80-15149 06-08)

(Contract N00014-74-C-0050)

Avail: NTIS. HC A22/MF A01

The nonlinear effects and their consequences on control effectiveness are described. Both independent control effectiveness (e.g., pitch control) as well as control cross coupling (e.g., pitch control in the presence of yaw control) are discussed. It is shown that, at sufficiently high angles of attack, the presence of these nonlinearities can completely dominate control effectiveness. The current status of techniques to predict control effects using both analytical and data correlation techniques are reviewed. R.C.T.

N80-15174# Ruhr Univ., Bochum (West Germany).

ON THE EFFECT OF WING WAKE ON TAIL CHARACTERISTICS

K. Gersten and D. Glueck. *In* AGARD. Aerodyn. Characteristics of Controls. Sep. 1979. 8 p. refs (For primary document see N80-15149 06-08)

Avail: NTIS. HC A22/MF A01

A nonlinear theory was developed to calculate lift and moment forces for airfoils in a two dimensional flow field. The oncoming velocity distribution is approximated by a series of step functions which results in a flow field composed of a number of potential flow fields. The potential flow fields are matched properly at several dividing streamlines where the total pressure changes discontinuously. The solution of the problem is determined by using vortex distributions on both the contour of the airfoil and the dividing streamlines. A special approach makes it possible to calculate the flow field when one of the dividing streamlines merges with the profile. A comparison between theoretical and experimental results for the aerodynamic characteristics of a tail unit placed in the wake of a wing is presented. A prediction method for the tail characteristics at high angles of attack (super stall) is discussed. A.W.H.

N80-15175# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

AERODYNAMIC INTERACTION ON A CLOSE-COUPLED CANARD WING CONFIGURATION [INTERACTION AERODYNAMIQUE ENTRE UN CANARD PROCHE ET UNE VOILURE]

Yves Brocard and Volker Schmitt. *In* AGARD. Aerodyn. Characteristics of Controls. Sep. 1979. 11 p. refs. In FRENCH; ENGLISH summary (For primary document see N80-15149 06-08)

Avail: NTIS. HC A22/MF A01

Half model tests performed on a close coupled canard wing configuration in a low speed, pressurized wind tunnel are discussed. Results are presented in terms of longitudinal aerodynamic characteristics and pressure distribution on the main

wing. The effects of canard deflection and of Reynolds number variation are investigated. Surface oil flow pattern on the wind tunnel model and water tunnel visualization on a smaller model are examined. Comparisons between the experimental results and theoretical predictions are presented. A.W.H.

N80-15176# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.
ON THE EFFECTS OF GAPS ON CONTROL SURFACE CHARACTERISTICS
C. Michael and G. J. Hancock *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 13 p ref (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

A two dimensional airfoil comprising an elliptic nose, parallel section of 5% t/c ratio, and a 20% trailing edge control surface was investigated at low speeds. Three different geometries of the rear of the main airfoil were investigated. Gaps were created by moving the control surface aft of the main airfoil. Extensive pressure plotting is presented for the above range of gaps and control surface angular deflections up to 8 degrees and a range of measurements of mean boundary layer profiles in the neighborhood of the gap are discussed. The variations of the overall lift coefficient with control angle and gap size for the three geometries are reported. A.W.H.

N80-15177# MATRA Service Aerodynamique, Velizy-Villacoublay (France).
AERODYNAMIC STUDY OF MISSILE CONTROL SURFACES [ETUDE AERODYNAMIQUE DES GOUVERNES DE MISSILE]
J. Perinelle and L. Mifsud *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 19 p In FRENCH; ENGLISH summary (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The basic characteristics of low aspect ratio surfaces for missile control surfaces are reviewed. After a review of the different aerodynamic configurations and their implications on performances, the aerodynamic of canard missiles control surfaces are discussed in relation to the maximum lift at high angles of attack and the hinge moment. A.W.H.

N80-15178# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany). Commercial Aircraft Div.
SOME INVESTIGATIONS CONCERNING THE EFFECTS OF GAPS AND VORTEX GENERATORS ON ELEVATOR EFFICIENCY AND OF LANDING FLAP SWEEP ON AERODYNAMIC CHARACTERISTICS
Herbert Neppert and Richard Sanderson *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 12 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The effect of gaps and vortex generators on elevator effectiveness and drag is examined. The effect of single rudder deflection on the effectiveness of a split rudder is discussed. Wind tunnel results and proposals for improving the aerodynamic characteristics of a tailplane by means of a reduction in the sweep on the landing flap hinge line are described. A.W.H.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities, and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-15179*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LOX/GOX MECHANICAL IMPACT TESTER ASSESSMENT
J. W. Bransford (NASA, Marshall Space Flight Center), C. J. Bryan, G. W. Frye (NASA, Johnson Space Center), and S. L. Stohler (Rocketdyne, Canoga Park, Calif.) Feb. 1980 103 p refs
(NASA-TM-74106) Avail: NTIS HC A06/MF A01 CSCL 14B

The performances of three existing high pressure oxygen mechanical impact test systems were tested at two different test sites. The systems from one test site were fabricated from the same design drawing, whereas the system tested at the other site was of different design. Energy delivered to the test sample for each test system was evaluated and compared. Results were compared to the reaction rates obtained. R.C.T.

N80-15180# Air Force Human Resources Lab., Brooks AFB, Tex.
EFFECTS OF VARYING VISUAL DISPLAY CHARACTERISTICS OF THE T-4G, A T-37 FLIGHT SIMULATOR Final Report, Aug. 1974 - Dec. 1977
Robert R. Woodruff Jun. 1979 17 p refs
(AF Proj. 1123)
(AD-A071410; AFHRL-TR-79-17) Avail: NTIS HC A02/MF A01 CSCL 05/9

Two experiments were conducted using the T-4G, a T-37 flight simulator, to investigate the benefit to simulation of visual displays which have color or are collimated. Thirty-two Air Force undergraduate pilots learned approach and landing in the T-4G using either black and white or colored imagery. Thirty-eight instructor pilots performed approach and landing with visual displays that had collimation or reduced collimation. No statistically significant differences were found in either experiment. Power analysis shows that each of these experiments would have detected a practically significant difference, if one existed, with a probability of more than .75. There are no psychophysical reasons to use either color or collimation. User acceptance is another thing, and if color and collimation improve acceptance, they should be used. GRA

N80-15181# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
CLIMATIC CHAMBER TESTING AIRCRAFT, ENGINES ARMAMENT AND AVIONICS; TEST OPERATIONS PROCEDURE Final Report
31 Aug. 1979 35 p Supersedes MTP-7-3-521
(AD-A074049; TOP-7-3-521; MTP-7-3-521) Avail: NTIS HC A03/MF A01 CSCL 01/3

This document provides information, guidance and methodology for planning and conducting an environmental climatic chamber developmental test of aviation materiel. Environmental climatic chamber developmental testing in general, determines the degree to which aviation materiel meets the developmental requirements of the US Army Materiel Needs (MN) documents, when subjected to the environmental conditions developed in the climatic chamber. GRA

N80-15182# Avco-Everett Research Lab., Mass.
DESIGN STUDY FOR ATA VACUUM SYSTEM APERTURE
S. Hibbs 26 Jul. 1979 24 p refs
(Contract W-7405-eng-48)
(UCRL-15050) Avail: NTIS HC A02/MF A01

A vacuum system aperture for the advanced test accelerator is analyzed. An axial aerowindow, a suction type aerowindow, and a combination suction/axial aerowindow are examined. The combination suction/axial aerowindow is recommended due to the estimated leakage rate and the projected cost. DOE

N80-15183# General Applied Science Labs., Inc., Westbury, N.Y.
CONCEPTUAL DESIGN AND PERFORMANCE ESTIMATES FOR A SUPERSONIC AERODYNAMIC WINDOW FOR THE ATA VACUUM SYSTEM APERTURE Final Report
J. I. Erdos Jun. 1979 39 p refs
(Contract W-7405-eng-48)
(UCRL-15051) Avail: NTIS HC A03/MF A01

The design of an aerodynamic window for the aperture in a system of interconnecting cavities is discussed. Two types of windows are considered and evaluated for the system. They are a supersonic jet operating transverse to the aperture axis and a supersonic jet operating coaxially about the aperture. A.W.H.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-15184# Committee on Science and Technology (U. S. House).
INTERNATIONAL SPACE ACTIVITIES, 1979
Washington GPO 1979 250 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 5-6 Sep. 1979
(GPO-53-451) Avail: Subcom. on Space Sci. and Applications

International space activities in the year 1979 are reviewed. Among the subjects discussed are broadcasting satellite service, solar power satellites, radio astronomy, technology development, and future directions in space research. A.W.H.

N80-15185*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SIMPLE COMPUTATIONS FOR NEAR-OPTIMUM ASCENT AND ABORT MANEUVER TARGETS AND DEORBIT IGNITION TIME
R. Leroy McHenry Jan. 1980 24 p refs
(NASA-TM-80850; JSC-16318; Rept-80-FM-3) Avail: NTIS HC A02/MF A01 CSCL 22A

Closed-form solutions are presented for a two-burn orbit insertion, AOA, and ATO maneuver targets, and for time of ignition of a one-burn deorbit. Based on the assumption that the orbits involved deviate only to the first order about a reference circular orbit, these solutions are nearly fuel-minimum. They are expressed in terms of linear terminal velocity constraint shuttle guidance targets and, thus, are readily applicable to both ground and onboard software use. In addition to potential application to real-time targeting, the equations may be used as a mission design aid in preliminary definition of target loads and definition of abort mode boundaries. A.R.H.

N80-15186*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED GEOSYNCHRONOUS MISSION REQUIREMENTS AND SYSTEMS ANALYSIS STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Ron E. Boyland, Stanley W. Sherman, and Henry W. Morfin 7 Nov. 1979 42 p refs 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160429) Avail: NTIS HC A03/MF A01 CSCL 22A

The crew capsule of the MOTV was studied with emphasis on crew accommodations, crew capsule functional requirements, subsystem interface definition between crew module and propulsion module, and man rating requirements. Competing mission modes were studied covering a wide range of propulsion concepts. These included one stage, one and one half stage, and two stage concepts using either the standard STS or an augmented STS. Several deorbit concepts were considered, including all propulsive modes, direct re-entry, and aeromaneuvering skip in skip out in the upper reaches of Earth's atmosphere. A five year plan covering costs, schedules, and critical technology issues is discussed. A.W.H.

N80-15187*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED ORBITAL TRANSFER VEHICLE (MOTV). VOLUME 2: MISSION HANDBOOK Final Report
Ron E. Boyland, Stanely W. Sherman, and Henry W. Morfin 7 Nov. 1979 138 p 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160430) Avail: NTIS HC A03/MF A01 CSCL 22A

The use of the manned orbit transfer vehicle (MOTV) for support of future space missions is defined. Some 20 generic missions are defined each representative of the types of missions expected to be flown in the future. These include the service and update of communications satellites, emergency repair of surveillance satellites, and passenger transport of a six man crew rotation/resupply service to a deep space command post. The propulsive and functional capabilities required of the MOTV to support a particular mission are described and data to enable the user to determine the number of STS flights needed to support the mission, mission peculiar equipment requirements, parametrics on mission phasing and requirements, ground and flight support requirements, recovery considerations, and IVA/EVA trade analysis are presented. A.W.H.

N80-15188*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED ORBITAL TRANSFER VEHICLE (MOTV). VOLUME 3: PROGRAM REQUIREMENTS DOCUMENTS Final Report
Ron E. Boyland, Stanley W. Sherman, and Henry W. Morfin 7 Nov. 1979 65 p 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160431) Avail: NTIS HC A04/MF A01 CSCL 22A

The requirements for geosynchronous orbit capability using the manned orbit transfer vehicle (MOTV) are defined. The program requirements, the mission requirements, and the system and subsystem requirements for the MOTV are discussed. The mission requirements include a geosynchronous Earth orbit vehicle for the construction, servicing, repair and operation of communications, solar power, and Earth observation satellites. A.W.H.

N80-15189*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED ORBITAL TRANSFER VEHICLE (MOTV). VOLUME 4: SUPPORTING ANALYSIS Final Report
Ron. E. Boyland, Stanley W. Sherman, and Henry W. Morfin 7 Nov. 1979 106 p 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160432) Avail: NTIS HC A06/MF A01 CSCL 22A

Generic missions were defined to enable potential users to determine the parameters for suggested user projects. Mission modes were identified for providing operation, interfaces, performance, and cost data for studying payloads. Safety requirements for emergencies during various phases of the mission are considered with emphasis on radiation hazards. F.O.S.

N80-15190*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED ORBITAL TRANSFER VEHICLE (MOTV). VOLUME 5: TURNAROUND ANALYSIS Final Report
Ron E. Boyland, Stanley W. Sherman, and Henry W. Morfin 7 Nov. 1979 130 p 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160433) Avail: NTIS HC A07/MF A01 CSCL 22A

The development of a low-cost reliable turnaround process to employ the MOTV in enhancing the utilization of the geosynchronous space region is analyzed. It is indicated that a routine effective turnaround/maintenance plan must make maximum use of flight data for maintenance planning, a high degree of test automation, and MOTV maintainability features in order to minimize tests, facilitate repair, and reduce manpower requirements. An effective turnaround plan provides a payback of reduced risks. F.O.S.

N80-15191*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED ORBITAL TRANSFER VEHICLE (MOTV). VOLUME 6: FIVE YEAR PROGRAM PLAN Final Report
Ron E. Boyland, Stanley W. Sherman, and Henry W. Morfin 7 Nov. 1979 36 p 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160434) Avail: NTIS HC A03/MF A01 CSCL 22A

The five year program plan for the manned orbit transfer vehicle (MOTV) is presented. The planning, schedules, cost estimates, and supporting data (objectives, constraints, assumptions, etc.) associated with the development of the MOTV are discussed. The plan, in addition to the above material, identifies the supporting research and technology required to resolve issues critical to MOTV development. A.W.H.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-15192# Naval Surface Weapons Center, Dahlgren, Va.
PERTURBATIONS IN PERIGEE AND ECCENTRICITY AT

THE CRITICAL INCLINATION Final Report
Claus Oesterwinter Dec. 1978 29 p refs
(AD-A073975; NSWC/DL-TR-3724) Avail: NTIS
HC A03/MF A01 CSCL 22/3

A cluster of three satellites showed large, unpredicted orbital perturbations shortly after launch. There was immediate concern for the success of its mission which depends on the stability of the cluster geometry. The Naval Surface Weapons Center found the zonal harmonics of degree five and seven to cause most of the observed perturbations. Subsequently, the three orbits were computed for the time frame June 1976 to July 1984. It was also shown that the cluster configuration remains unaffected by the large orbital perturbations, and the mission appears safe. GRA

N80-15193# Naval Surface Weapons Center, Dahlgren, Va.
COMPARISON OF C-BAND RADAR AND DOPPLER GEOCEIVER ACCURACIES IN ORBIT DETERMINATION Final Report
Carol G. Branch Nov. 1978 22 p refs
(AD-A073877; NSWC/DL-TR-3719) Avail: NTIS
HC A02/MF A01 CSCL 22/3

A study is made herein of the relative consistency of C-band and Doppler station navigations with respect to a Doppler-derived orbit. The procedure, results, error analyses, and accuracy criteria are included. It is concluded that C-band radar tracking data are not an adequate substitute for Doppler geoceiver data in computing orbits of satellites when precise altitudes are required for satellite altimeter applications. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities, ground support equipment, mobile transporters, and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-15194*# Bendix Corp., Teterboro, N. J. Guidance Systems Div.
SPACE CONSTRUCTION BASE CONTROL SYSTEM Final Report
R. F. Kaczynski 1 Sep. 1979 479 p refs
(Contract NAS8-32660)
(NASA-CR-161353) Avail: NTIS HC A21/MF A01 CSCL 22B

Several approaches for an attitude control system are studied and developed for a large space construction base that is structurally flexible. Digital simulations were obtained using the following techniques: (1) the multivariable Nyquist array method combined with closed loop pole allocation, (2) the linear quadratic regulator method. Equations for the three-axis simulation using the multilevel control method were generated and are presented. Several alternate control appraches are also described. A technique is demonstrated for obtaining the dynamic structural properties of a vehicle which is constructed of two or more submodules of known dynamic characteristics. Author

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-15195*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY
Nov. 1979 39 p Prepared in cooperation with General Elec. Co., Fairfield, Conn., Grumman Aerospace Corp., N. Y., Little (Arthur D.), Inc., Cambridge, Mass.; TRW, Inc., Cleveland, Ohio; Brown and Root, Inc., Houston, Tex.
(Contract NAS9-15636)
(NASA-CR-160442; D180-25461-1) Avail: NTIS
HC A03/MF A01 CSCL 11B

Configuration concepts, option sizes, and systems definitions study design evolutions are reviewed. The main features of the present reference design silicon solar cell solar power satellite are described, as well as the provisions for space construction and support systems. The principal study accomplishments and conclusions are summarized according to the following tasks: (1) baseline critique; (2) construction and maintenance; (3) industrial complex needs, cost estimates, and production capacity; (4) launch complex requirements at KSC or at an offshore facility; (5) integration of the SPS/ground power network; (6) technology advancement and development; (7) costs and schedules; and (8) exploratory technology: laser annealing of solar cells degraded by proton irradiation, and a fiber-optic phase distribution link at 980 MHz. A.R.H.

N80-15196# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIFFERENTIAL ORBIT CORRECTION FOR NEAR-STATIONARY ARTIFICIAL SATELLITES
Laurence G. Taff and John M. Sorvari 17 Jul. 1979 35 p refs
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A074231; TN-1979-38; ESD-TR-79-184) Avail: NTIS
HC A03/MF A01 CSCL 22/3

This report presents a new concept for the differential correction of orbits. It is developed in detail for near-stationary artificial satellites. For these satellites a few observations over a short time interval allows the reacquisition of the satellite an hour later. Moreover, with only slightly more data points over a slightly longer time interval it is capable of producing an excellent set of orbital elements. The technique is self-starting and does not use any of the classical initial orbit determination procedures. It can be used by a radar or extended to include angular velocity data. Its success appears to be based on the ability to find a coordinate system in which the object's motion is nearly stationary, and the extensive use of analytical procedures. Extensions of the theory to include all first-order perturbations and to all orbital types are possible. GRA

N80-15197# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
HIGH SPEED FUNCTION GENERATION FOR RESEARCH AND PROJECT SUPPORT
Charles L. Lewis, Gary M. Griner, and Larry H. Hazel Jun. 1979 34 p refs
(AD-A073973; DRDMI-T-79-66) Avail: NTIS
HC A03/MF A01 CSCL 09/2

Since 1972, the US Army Missile Research and Development Command (MIRADCOM) has maintained and operated a real-time hardware-in-the-loop (HWIL) homing missile simulation at Redstone Arsenal, Alabama. Because of the need for a detailed, accurate simulation, and to support the US Army Modular Missile research program and other advanced missile research, a decision was made to upgrade the HWIL simulation by adding a special purpose digital processor. The processor selected was the Applied Dynamics, Inc., AD 10. This report described the work performed to program the AD 10 and modify the existing simulation for the Homing and Laser Simulation Facility (HALS). GRA

N80-15198# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
NUCLEAR POWERED SATELLITE STUDIES Annual Progress Report, 1 Jul. 1978 - 30 Jun. 1979
M. H. Kaplan Jun. 1979 71 p refs
(Contract EY-76-S-02-4045)
(COO-4045-4) Avail: NTIS HC A04/MF A01

The development of tools and inputs to be used in evaluating applications of nuclear power to satellites is discussed. Considerations include new constraints of the space transportation system, projected missions through the 1990's, and technology advances in nuclear power supplies. The topics addressed include satellite simulation software, GPHS reentry stability, nuclear

reactor technology, ion engine technology, and orbit considerations. A.W.H.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-15199*# Pennwalt Corp., King of Prussia, Pa. Technical Div.
DEVELOPMENT OF A SPECIAL PURPOSE SPACECRAFT INTERIOR COATING, PHASE 3
H. D. Gillman and P. Nannelli Apr. 1979 15 p refs
(Contract NAS9-14403)
(NASA-CR-160441) Avail: NTIS HC A02/MF A01 CSCL 22B

A variety of intumescent coatings based on a fluorocarbon latex resin modified with either an acrylic resin or an epoxy resin were prepared. Several intumescent systems were used for these studies including some based on ammonium polyphosphate and others based on sulfanilamide. The best coatings developed had a high concentration (60-70% by wt.) of intumescent additives and had to be applied thick, approximately 100 mils, in order to have adequate intumescent/fire protection properties. Author

N80-15200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONFIGURATION EFFECTS ON SATELLITE CHARGING RESPONSE
C. K. Purvis 1980 20 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-81397; E-307) Avail: NTIS HC A02/MF A01 CSCL 22B

The response of various spacecraft configurations to a charging environment in sunlight was studied using the NASA Charging Analyzer Program code. The configuration features geometry, type of stabilization, and overall size. Results indicate that sunlight charging response is dominated by differential charging effects. Shaded insulation charges negatively result in the formation of potential barriers which suppress photoelectron emission from sunlit surfaces. Sunlight charging occurs relatively slowly: with 30 minutes of charging simulations, in none of the configurations modeled did the most negative surface cell reach half its equilibrium potential in eclipse. R.C.T.

N80-15201*# Old Dominion Univ. Research Foundation, Norfolk, Va.
CONTROL SYSTEMS DESIGN FOR LARGE FLEXIBLE SPACE STRUCTURES Final Report, 15 Nov. 1977 - 14 Jan. 1980
Suresh M. Joshi and A. S. Roberts, Jr. (Old Dominion Univ.) Jan. 1980 21 p refs
(Grant NsG-1473)
(NASA-CR-162582) Avail: NTIS HC A02/MF A01 CSCL 22B

Several approaches for the design of reduced-order linear-quadratic-Gaussian type controllers for large space structures were proposed and evaluated using a continuous model of a long free-free beam. Sufficient conditions were derived for the asymptotic stability with this type of controller. A finite-element model of a free-free-free-free square plate was obtained for use in control systems studies. A method was developed for optimal damping enhancement in large space structures. Author

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-15202*# Rocketdyne, Canoga Park, Calif.
LIQUID OXYGEN/LIQUID HYDROGEN AUXILIARY POWER SYSTEM THRUSTER INVESTIGATION Final Report, Oct. 1976 - Feb. 1979
E. E. Eberle and L. Kusak Dec. 1979 186 p refs
(Contract NAS3-20373)
(NASA-CR-159674; RI/RD79-217) Avail: NTIS HC A09/MF A01 CSCL 21H

The design, fabrication, and demonstration of a 111 newton (25 lb) thrust, integrated auxiliary propulsion system (IAPS) thruster for use with LH2/LO2 propellants is described. Hydrogen was supplied at a temperature range of 22 to 33 K (40 to 60 R), and oxygen from 89 to 122 K (160 to 220 R). The thruster was designed to operate in both pulse mode and steady-state modes for vehicle attitude control, space maneuvering, and as an abort backup in the event of failure of the main propulsion system. A dual-sleeve, tri-axial injection system was designed that utilizes a primary injector/combustor where 100 percent of the oxygen and 8 percent of the hydrogen is introduced; a secondary injector/combustor where 45 percent of the hydrogen is introduced to mix with the primary combustor gases; and a boundary layer injector that uses the remaining 45 percent of the hydrogen to cool the thrust throat/nozzle design. Hot-fire evaluation of this thruster with a BLC injection distance of 2.79 cm (1.10 in.) indicated that a specific impulse value of 390 sec can be attained using a coated molybdenum thrust chamber. Pulse mode tests indicated that a chamber pressure buildup to 90 percent thrust can be achieved in a time on the order of 48 msec. Some problems were encountered in achieving

ignition of each pulse during pulse trains. This was interpreted to indicate that a higher delivered spark energy level (> 100 mJ) would be required to maintain ignition reliability of the plasma torch ignition system under the extra 'cold' conditions resulting during pulsing. Author

N80-15203*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ADVANCED OXYGEN-HYDROCARBON ROCKET ENGINE STUDY Monthly Progress Report, 15 Oct. - 30 Nov. 1979
C. J. OBrien 10 Dec. 1979 31 p
(Contract NAS8-33452)
(NASA-CR-161350; MPR-33452M-1) Avail: NTIS HC A03/MF A01 CSCL 21H

A consistent engine system data base was generated for defining advantages and disadvantages, system performance and operating limits, engine parametric data, and technology requirements for candidate high pressure LO2/HC engine systems. Optimum LO2/HC engine power cycles were synthetized and representative conceptual engine design generated for a specified advanced surface to orbit transportation system. M.M.M.

N80-15204*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF GaAs AND Si SOLAR CELL ARRAYS FOR EARTH ORBITAL AND ORBIT TRANSFER MISSIONS
Kent D. Jeffries 1980 9 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81383; E-291) Avail: NTIS HC A02/MF A01 CSCL 21C

Silicon and gallium arsenide arrays were studied and compared for low earth orbit (LE), geosynchronous orbit (GEO), and LEO to GEO electric propulsion orbit transfer missions. The sensitivities of total cost to parameters such as mission duration, array cost, cover glass thickness, and concentration ratio were determined along with cost tradeoffs between silicon and gallium arsenide arrays for selected mission classes. Results indicate that development of the technology for low cost, light weight concentrators should be increased and that cost reduction efforts for gallium arsenide cells be pursued. R.C.T.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N80-15205*# Clemson Univ., S.C. Dept. of Mechanical Engineering.
ANALYSIS OF A UNIDIRECTIONAL COMPOSITE CONTAINING BROKEN FIBERS AND MATRIX DAMAGE Annual Report
James G. George and Robert S. Gross Oct. 1979 36 p refs (Grant NsG-1297)
(NASA-CR-159185) Avail: NTIS HC A03/MF A01 CSCL 11D

An analytical solution is developed for the determination of the stresses and displacements in a unidirectional fiber-reinforced composite containing an arbitrary number of broken fibers as well as longitudinal yielding and splitting of the matrix. The solution is developed using a materials-modeling approach which is based on a shear-lag stress transfer mechanism. The equilibrium equation in the axial direction gives a pair of integral equations which are solved numerically. Excellent agreement is shown to exist between the solution and experimental results for notched unidirectional boron/aluminum laminates without splitting. For brittle matrix composites (i.e. epoxy) equally good results are indicated for both matrix yielding and splitting. For yielding without splitting the fracture strength depends on crack length while for large splitting it is crack length independent. Author

N80-15206# Northwestern Univ., Evanston, Ill.
DYNAMICS OF COMPOSITE MATERIALS AND ELASTIC STRUCTURAL ELEMENTS WITH VARIABLE DIMENSIONS Final Report, 15 Aug. 1978 - 20 Sep. 1979
S. Nemat-Nasser Sep. 1979 8 p refs
(Contract DAAG29-78-G-0149)
(AD-A074592; ARO-15872.2-E) Avail: NTIS HC A02/MF A01 CSCL 11/4

In this project effective methods have been sought for estimating bounds on eigenvalues and vibration characteristics of nonuniform rotor blades, composite plates, and other structural elements which consist of materials with nonuniformly varying properties. GRA

N80-15207# Stanford Univ., Calif. Applied Mechanics Div.
STEADY-STATE POINT-SOURCE EXCITATION OF A LAMINATED COMPOSITE Interim Report
G. S. Beaupre and G. Herrmann Jun. 1979 26 p refs
(Contract N00014-76-C-0054)
(AD-A074336; SU-DAM-79-3) Avail: NTIS HC A03/MF A01 CSCL 11/4

Steady-state periodic excitation at a point of an extended periodically laminated elastic composite is considered in anti-plane strain. The curves of constant phase are determined in the geometric optics approximation. The associated distribution of group velocity is also calculated. GRA

N80-15208# Oklahoma Univ., Norman. School of Aerospace Mechanical and Nuclear Engineering.
CLASSICAL ANALYSES OF LAMINATED BIMODULUS COMPOSITE-MATERIAL PLATES
Charles W. Bert Aug. 1979 42 p refs Supersedes AD-A072276
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A074125; OU-AMNE-79-10A; TR-4A; AD-A072276) Avail: NTIS HC A03/MF A01 CSCL 11/4

A differential-equation formulation is presented for the equations governing the small-deflection elastic behavior of thin plates laminated of anisotropic bimodulus materials (which have different elastic stiffnesses depending upon the sign of the fiber-direction strains). As a basis for comparative evaluation of a finite-element formulation presented in Technical Report No. 3 of the contract, exact closed-form solutions are presented for two cross-ply-laminated plate problems: (1) a freely supported rectangular plate subjected to a sinusoidally distributed normal pressure, and (2) a fully clamped elliptic plate subjected to uniform normal pressure. For the special case of isotropic bimodulus material, simplified approximate solutions are deduced from the exact ones. Good agreement is obtained among the two solutions presented here, as well as with numerical results existing in the literature for special cases and with the finite-element results. Also, for the first time a closed-form solution for a rectangular plate arbitrarily laminated of anisotropic ordinary (not bimodulus) material is presented. GRA

N80-15209# Washington Univ., St. Louis, Mo. Materials Research Lab.
FATIGUE FAILURE OF COMPOSITE LAMINATES Interim Report, May 1977 - Apr. 1978
Nhan Q. Nguyen and J. L. Kardos Wright-Patterson AFB, Ohio AFML Apr. 1979 36 p
(Contract F33615-77-C-5053; AF Proj. 2419)
(AD-A073899; AFML-TR-79-4035) Avail: NTIS HC A03/MF A01 CSCL 11/4

This program is to provide fatigue data on a graphite-epoxy composite. AS/3501-5A was selected as the test material. Unidirectional composites with 0 and 90 degree ply orientations were tested. Both static and fatigue strength were measured. Multidirectional laminates with + or - 45 and 02/90/+ or - 45 ply orientations were also tested. The fatigue data were analyzed using Weibull parameters. The frequency of testing was kept low in order to limit the temperature use below 5 C. More

extensive data will be generated and analyzed under this contract. GRA

N80-15210# Virginia Univ., Charlottesville. Dept. of Materials Science.
INVESTIGATION OF ELONGATION AND ITS RELATIONSHIP TO RESIDUAL STRESSES IN BORON FILAMENTS
Franklin E. Wawner, Jr., J. W. Eason, and Robert A. Johnson Sep. 1979 103 p refs
(Contract N00014-76-C-0694)
(AD-A074440; UVA/525322/MS79/102; TR-2) Avail: NTIS HC A06/MF A01 CSCL 11/6

Elongation in boron filament during fabrication was investigated and found to be as great as 16% under certain conditions. It was also found to obey a relatively simple empirical relationship which yielded effective activation energies. A model for the elongation was proposed, and a computer program was designed to simulate the deposition and elongation of boron on a tungsten wire substrate. Internal residual stress distribution of boron/tungsten filament were also generated by the computer program. Good agreement was found between the proposed model and experimental results. Negative elongation (contraction) of boron filament was observed during annealing and found to be dependent upon the concentration of oxygen present in the annealing atmosphere. The contraction was also found to be the result of void formation at the core-boron sheath interface. The contraction obeyed an empirical relationship, which represented an exponential decay toward equilibrium from a non-equilibrium state and an effective activation energy was determined for boron/tungsten filament. GRA

N80-15211# Los Alamos Scientific Lab., N. Mex.
PREPARATION OF UNIDIRECTIONAL FIBER REINFORCED TANTALUM CARBIDE COMPOSITES
L. R. Newkirk, R. E. Riley, H. Sheinberg, F. A. Valencia, and T. C. Wallace 1979 12 p refs Presented at the Intern. Conf. on Chem. Vapor Deposition, Los Angeles, 14 Oct. 1979 Sponsored in part by NSWC
(Contract W-7405-eng-36)
(LA-UR-79-951; CONF-791017-5) Avail: NTIS HC A02/MF A01

A process is described for uniformly infiltrating 3000 filament carbon yarn with Ta and subsequent densification by hot pressing. The Ta deposition rate is characterized as a function of deposition temperature, reactant flows, yarn pull rate, and coating chamber geometry for yarn pull rates from 2 to 50 m/h and Ta loadings from 40 to 350 wt % gain. Densification procedures for unidirectional pressings are described and data is presented which shows significant improvement in flexure strength over conventional TaC-C powder composites. DOE

N80-15212# California Univ., Livermore. Lawrence Livermore Lab.
FILAMENT WINDING EPOXY RESINS FOR ELEVATED TEMPERATURE SERVICE
J. A. Rinde, E. T. Mones, and H. A. Newey 9 Oct. 1978 10 p
(Contract W-7405-eng-48)
(UCRL-52577) Avail: NTIS HC A02/MF A01

Six epoxy resin systems suitable for wet filament winding of high-performance flywheels were formulated and evaluated. The resins were judged on five criteria: (1) low viscosity, (2) long gel time, (3) high glass transition temperature, (4) high tensile strength with high modulus, and (5) good retention of mechanical properties upon accelerated heat aging. From the results of mechanical and physical tests, resin 1 (Ciba 0510/RD-2/APCO 2330) is the best resin for the intended application. Resin 2 (Ciba 0510/Tonox 60-40) is the second choice; it offers a lower tensile strength and a larger loss in strength upon heat aging than resin 1 but has the highest glass transition temperature. DOE

N80-15213# California Univ., Livermore. Lawrence Livermore Lab.
CHARACTERISTICS OF THICK NON-PLANAR SiO2 COATINGS
S. F. Meyer and E. J. Hsieh 11 Apr. 1979 13 p refs Presented at Intern. Conf. on Met. Coatings, San Diego, Calif., 23 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81842; CONF-790442-15) Avail: NTIS HC A02/MF A01

A process was developed for making strong, smooth, thick SiO2 films on hemispherical Kovar mandrels of various sizes designed for multishell laser fusion targets. The surface finish obtainable with a 13 micron m thick coating on a 260 micron m dia. mandrel is approximately 30 nm peak-to-peak, with a few defects of roughly 0.3 micron m deep. The RF magnetron sputtered SiO2 films were dense and crystalline. DOE

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-15214# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
INFLUENCE OF GEOMETRIC AND KINEMATIC FACTORS ON COMBUSTION PERFORMANCE
C. Presser, Y. Goldman, and Y. Manheimer-Timnat Nov. 1978 78 p refs
(TAE-350) Avail: NTIS HC A05/MF A01

Factors effecting changes in the flame configuration are studied for swirl air/liquid fuel burners. The variation of fuel spray angle for providing a more uniform particle distribution, the effect of swirl impeded secondary air flow for enhancing secondary-air/fuel mixing, and the effect of combustion gas recirculation on fuel droplet evaporation which develops from the presence of a sudden expansion in the burner tunnel geometry are considered. It was shown that wider spray angles produce a more uniform air/fuel distribution throughout the diffusive combustion region with an apparent shortening and widening in flame shape. For increased swirl number, turbulent mixing is enhanced, thereby creating a flame whose ignition occurs closer to the burner and a seemingly shorter flame in the combustion chamber. It was concluded that the influence of these variables on the combustion process enhances the capability of controlling the flame shape and of utilizing combustion properties more effectively. M.M.M.

N80-15215*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
COMBUSTION NOISE
Warren C. Strahle Aug. 1977 71 p refs
(NASA-CR-162571; SU-JIAA-TR-7) Avail: NTIS HC A04/MF A01 CSCL 21B

A review of the subject of combustion generated noise is presented. Combustion noise is an important noise source in industrial furnaces and process heaters, turbopropulsion and gas turbine systems, flaring operations, Diesel engines, and rocket engines. The state-of-the-art in combustion noise importance, understanding, prediction and scaling is presented for these systems. The fundamentals and available theories of combustion noise are given. Controversies in the field are discussed and recommendations for future research are made. J.M.S.

N80-15216# IBM Watson Research Center, Yorktown Heights, N.Y.
TIME-RESOLVED SPECTROSCOPIC STUDIES OF SURFACE REACTIONS
G. W. Rubloff 15 Feb. 1979 20 p refs Presented at the 4th Symp. on Fluid-Solid Surface Interactions, Gaithersburg, Md., 18-20 Oct. 1978
(Contract N00014-77-C-0366)
(AD-A074952) Avail: NTIS HC A02/MF A01 CSCL 20/6

A new dynamic approach to surface reactions is described. A fast-acting UHV gas dosing system is employed to prepare the adsorbate in an initial state under reaction conditions of

elevated temperature and/or pressure (to approx. 1 torr). Individual reaction steps are then resolved in time using photoemission spectroscopy to probe the surface electronic structure, yielding information about the nature of chemisorbed species, the reaction path, and the kinetics of individual reaction steps. Preliminary results are given for an initial application of this approach - the measurement of desorption kinetics for CO on Ni (111). GRA

N80-15217# Tennessee Univ., Knoxville. Dept. of Physics.
VACUUM ULTRAVIOLET ELECTRONIC PROPERTIES OF LIQUIDS Annual Progress Report, 1 Nov. 1978 - 31 Oct. 1979
L. R. Painter 1979 13 p refs
(Contract EY-76-S-05-3861)
(ORO-3861-28) Avail: NTIS HC A02/MF A01

The following materials were studied: formamide, hexamethyl phosphoric triamide, polyethylene, Kapton, anthracene, and several aromatics. Properties determined included optical and related properties. DOE

N80-15218# California Univ., Berkeley. Lawrence Berkeley Lab.
EXPERIMENTAL STUDY OF COMBUSTION IN A TURBULENT BOUNDARY LAYER
R. K. Cheng, R. G. Bill, Jr., F. Robben, R. Schefer, and L. Talbot 1979 10 p refs Presented at the 2d Symp. on Turbulent Shear Flows, London, 2-4 Jul. 1979
(Contract W-7405-eng-48)
(LBL-8946; CONF-790721-1) Avail: NTIS HC A02/MF A01

The effect of H2-air combustion on induced turbulence in a heated boundary layer was studied through time and space resolved measurements of velocity and density. The experimental conditions covered equivalence ratio from 0 to 0.3 wall temperature between 1100 to 1300 K and free stream velocity from 14 to 22 m/sec. Three modes of combustion were indicated: (1) surface reaction; (2) surface reaction combined with gas phase reaction in the boundary layer; and (3) flame-like structure situated at the edge of the boundary layer. Velocity fluctuation of about 4% in the nonheated boundary layer were reduced to 2% by wall heating. Density fluctuations of 8 to 10% were observed in the heated boundary layer both with and without combustion. The maximum density gradient region of the flame-like structure was found to fluctuate at a fairly regular rate of 0.5 to 1.25 Khz depending on various conditions. DOE

N80-15219# California Univ., Livermore. Lawrence Livermore Lab.
DYNSYL: A GENERAL-PURPOSE DYNAMIC SIMULATOR FOR CHEMICAL PROCESSES
G. K. Patterson and R. B. Rozsa 5 Sep. 1978 97 p refs
(Contract W-7405-eng-48)
(UCRL-52561) Avail: NTIS HC A05/MF A01

The design and implementation of the dynamic chemical plant simulation program DYNSYL are presented. This program can be used to generate process data or to provide estimates of process performance; it simulates both steady-state and dynamic behavior. The MCA methods that may have to be evaluated range from sophisticated on-line material trackers such as Kalman filter estimators, to relatively simple material balance procedures. The overall structure of DYNSYL is described and some example problems are included. The code is still in the experimental stage and revision is continuing. DOE

N80-15220# Department of Energy, Washington, D. C.
ANALYSIS OF HYDROGEN IN SOLIDS
R. L. Schowebel, ed. and J. L. Warren, ed. Apr. 1979 181 p refs Presented at the Workshop on Analysis of Hydrogen in Solids, Albuquerque, N. Mex., 23 Jan. 1979
(Contract DE-AC04-76DP-00789)
(DOE/ER-0026; CONF-790127) Avail: NTIS HC A09/MF A01

The ways to determine the state and dynamics of hydrogen in solids are presented and requirements are formulated for techniques in this capacity. Topics include: the properties of hydrogen in insulating materials; ion channeling studies of hydrogen lattice location; hydrogen depth profiling using elastic recoil detection; and neutron scattering as a technique for the study of hydrogen in metals. A.W.H.

N80-15221# Northwestern Univ., Evanston, Ill.
STUDIES OF METAL-SEMICONDUCTOR INTERFACES IN CATALYSIS AND ENERGY CONVERSION Annual Report, 15 Jun. 1978 - 14 Jun. 1979
Y. W. Chung Mar. 1979 17 p refs
(Contract ER-78-S-02-4946)
(COO-4946-1) Avail: NTIS HC A02/MF A01

The installation of a multiple-technique surface analytical system capable of Auger, photoemission (UPS and XPS), low-energy electron diffraction, thermal desorption and thin-film evaporation studies was completed. An isolation cell attachment was designed for high-pressure gas-phase (1 to 1000 torr) reaction studies. By depositing nickel onto a clean ordered TiO2(110) surface held at room temperature, an ordered overlayer was obtained as evidenced by LEED. Both energy loss and uv photoemission studies showed that there is an electron transport from nickel to TiO2, resulting in an increase of the surface Ti+3 concentration and the formation of an accumulation layer on the TiO2(110) surface. In addition, the Ni atoms and the surface Ti+3 are well dispersed on the TiO2 surface. DOE

N80-15222# Florida Univ., Gainesville.
RADIATION CHEMISTRY OF HYDROCARBON AND ALKYL HALIDE SYSTEMS Progress Report, 1 Aug. 1978 - 30 Aug. 1979
R. J. Hanrahan 1979 23 p refs
(Contract EY-76-S-05-3106)
(ORO-3106-71) Avail: NTIS HC A02/MF A01

Deactivation of excited atomic iodine in the P(-2)/sub 1/2/ state was studied. Products of gamma radiolysis of CO-H2 were identified. The photolysis of CF3I-CH3I was studied. DOE

N80-15223# Massachusetts Inst. of Tech., Cambridge.
THEORY OF CHEMICAL KINETICS Progress Report, 16 Jan. 1978 - 15 Jan. 1979
John Ross Jan. 1979 11 p refs
(Contract EY-76-S-02-2873)
(COO-2873-3) Avail: NTIS HC A02/MF A01

The Franck-Condon approximation was applied to chemical dynamics with success. It was used to study angular distributions of reaction products in atom-diatom reactions. Long range transitions in stochastic models were considered. The hydrodynamic stability of stationary and oscillatory convection in binary fluids was also studied along with the efficiency of thermal engines. DOE

N80-15224# Oak Ridge National Lab., Tenn. Analytical Chemical Div.
SINGLE-STAGE MASS SPECTROMETRIC ANALYSES OF RESIN BEAD SAMPLES Progress Report
David H. Smith, R. L. Walker, L. K. Bertram, and J. A. Carter Oct. 1978 16 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6563) Avail: NTIS HC A02/MF A01

The resin bead sample loading technique was applied to a conventional single-stage mass spectrometer equipped with pulse counting. Data obtained are comparable to those obtainable from similar instruments using conventional techniques. DOE

N80-15225# Brookhaven National Lab., Upton, N. Y.
SYNCHROTRON RADIATION: A NEW TOOL FOR BIOPHYSICAL SPECTROSCOPY IN THE VISIBLE AND ULTRAVIOLET
J. C. Sutherland 1978 42 p refs Presented at Synchrotron Radiation Appl. to Biophys., Biochem. and Biomed. Res., Frascati, Italy, 20 Aug. 1978
(Contract EY-76-C-02-0016)
(BNL-24811; CONF-780856-4) Avail: NTIS HC A03/MF A01

Comparisons of synchrotron radiation with conventional sources suggests that the greatest improvements will be realized in the far and vacuum ultraviolet regions-wavelengths less than about 300 nm. Consideration of the transitions of the valence electrons of most organic and biologically important materials indicate that wavelengths less than about 120 nm will not be

especially informative. In addition, spectroscopic experiments at wavelengths less than 105 nm become more difficult because of the loss of window materials and surfaces with high normal incidence reflectance. The characteristic visible and ultraviolet absorption bands of proteins, nucleic acids, and sugars are reviewed. Important spectroscopic techniques such as absorption, natural and magnetic circular dichroism, fluorescence and various fluorescence polarization spectroscopies are described and their potential use in the far and vacuum ultraviolet, (120 to 300 nm) using synchrotron sources is discussed. DOE

N80-15226# Oak Ridge National Lab., Tenn.
MASS AND EMISSIONS SPECTROMETRY IN THE ANALYTICAL CHEMISTRY DIVISION OF OAK RIDGE NATIONAL LABORATORY
D. H. Smith, ed., J. A. Carter, R. L. Walker, L. K. Bertram, D. C. Canada, W. H. Christie, D. L. Donohue, R. E. Eby, J. C. Franklin, L. Landau et al. Nov. 1978 136 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6485) Avail: NTIS HC A07/MF A01
Many different areas of mass spectrometric expertise are represented in the laboratory: gas analysis, high abundance sensitivity measurements, high- and low-resolution organic analyses, spark source trace constituent analysis, and ion micro-probe analysis of surfaces. These capabilities are complemented by emission spectrometry. The instruments are described along with a few applications, some of which are unique. DOE

N80-15227# Brookhaven National Lab., Upton, N. Y.
HIGH TEMPERATURE ELECTROLYSIS
J. R. Powell 1978 6 p refs Presented at the Am. Nucl. Soc. Meeting, San Francisco, 12 Nov. 1979
(Contract EY-76-C-02-0016)
(BNL-26331; CONF-791103-16) Avail: NTIS HC A02/MF A01
An idealized flowsheet for a high temperature electrolysis fusion synthetic fuel plant is given. Two blanket module types are indicated, the first type heats steam or CO2 to high temperatures for the HTE cells (T > or = 1000 C) while the second heats a working fluid for an electrical power cycle and breeds tritium. DOE

N80-15228# National Academy of Sciences - National Research Council, Washington, D. C.
AN EVALUATION OF ACTIVATED CARBON FOR DRINKING WATER TREATMENT
1979 232 p refs
(Contract EPA-68-01-3169)
(PB-299968/8) Avail: NTIS HC A11/MF A01 CSCL 07D
The efficacy of granular activated carbon and related adsorbents to treat drinking water was considered. The potentially harmful health effects that relate to the use of these adsorbents were examined. The pertinent literature was reviewed as well as the scientific data base. A review was included of work on adsorption efficiency, microbial activity on adsorbers, physiochemical interactions, regeneration of adsorbents, and analytical methods to monitor adsorption processes. GRA

N80-15229# Research Triangle Inst., Research Triangle Park, N. C.
STUDY OF THE NATURE OF OZONE, OXIDES OF NITROGEN, AND NONMETHANE HYDROCARBONS IN TULSA, OKLAHOMA. VOLUME 1: PROJECT DESCRIPTION AND DATA SUMMARIES
W. C. Eaton, C. E. Decker, J. B. Tommerdahl, and F. E. Dimmock Apr. 1979 221 p refs
(Contract EPA-68-02-2808)
(PB-300481/9; EPA-450/4-79-008A) Avail: NTIS HC A10/MF A01 CSCL 07D
An air pollution sampling and monitoring project is presented. The monitoring network consisted of eight RTI ground sites and two Tulsa City/County Health Department sites. An airborne measurements program employing a Piper Navaho B was an integral part of the study and is described in detail. Surface data are summarized through tables of mean daily concentrations, cumulative frequency distributions, and diurnal plots. Also included are: descriptions and results of the quality control and quality assurance aspects of the field study; an appendix describing the sampling and analytical methodology for GC/FID identification of hydrocarbons; and an appendix describing the sampling and analysis collected on TENAX-GC polymer. GRA

N80-15230# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
CORRELATION AND ESTIMATION OF HYDROCARBON VAPOUR-LIQUID EQUILIBRIUM CONSTANTS AND APPLICATION IN THE CALCULATION OF DEW- AND BUBBLE POINTS OF MULTICOMPONENT MIXTURES
J. D. Raal Aug. 1979 21 p refs
(PB-300477/7; CSIR-CENG-290; ISBN-0-7988-1622-8) Avail: NTIS HC A02/MF A01 CSCL 07D
The logarithm of the equilibrium constant is correlated as a cubic polynomial in temperature for several pressures. Values at intermediate pressures are found by a cubic spline interpolation using a transformed pressure variable. Equilibrium data on the De Priester nomographs for twelve common hydrocarbons ranging from methane to octane are reproduced with very good accuracy for the pressure range 345 kPa to 4.83 MPa and for temperatures from 10 C to about 200 C. For pressures above 4.83 MPa, where composition effects cannot be ignored, extrapolation based on the concept of convergence pressure produces predictions in fair agreement with experimental data. GRA

N80-15231# National Materials Advisory Board, Washington, D. C. Commission on Sociotechnical Systems.
TEST EQUIPMENT FOR USE IN DETERMINING CLASSIFICATIONS OF COMBUSTIBLE DUSTS
1979 45 p refs
(Contract DOL-J-9-F-5-0070)
(PB-300615/2; NMAB-353-2) Avail: NTIS HC A03/MF A01 CSCL 21B
Methods are presented for determining the layer ignition temperature and the electrical resistivity of dusts. The procedures for these recommended tests are described. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion, and metallurgy.

N80-15232*# Wyoming Univ., Laramie. Composite Materials Research Group.
ENERGY ABSORPTION MECHANISMS DURING CRACK PROPAGATION IN METAL MATRIX COMPOSITES Interim Report, Aug. 1978 - Aug. 1979
Daniel P. Murphy and Donald F. Adams Oct. 1979 92 p refs
(Grant NsG-3217)
(NASA-CR-162574; UWME-DR-901-103-1) Avail: NTIS HC A05/MF A01 CSCL 11F
The stress distributions around individual fibers in a unidirectional boron/aluminum composite material subjected to axial and transverse loadings are being studied utilizing a generalized plane strain finite element analysis. This micromechanics analysis was modified to permit the analysis of longitudinal sections, and also to incorporate crack initiation and propagation. The analysis fully models the elastoplastic response of the aluminum matrix, as well as temperature dependent material properties and thermal stress effects. The micromechanics analysis modifications are described, and numerical results are given for both longitudinal and transverse models loaded into the inelastic range, to first failure. Included are initially cracked fiber models. M.M.M.

N80-15233*# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
AN INVESTIGATION OF THE INITIATION STAGE OF HOT CORROSION IN Ni-BASE ALLOYS Semiannual Report, 1 Mar. 1979 - 31 Aug. 1979
T. T. Huang and G. H. Meier 1979 70047 p refs
(Grant NsG-3214)
(NASA-CR-159718; SETEC-MME-79-61; SAR-2) Avail: NTIS HC A03/MF A01 CSCL 11F
The commercial nickel base alloy, IN-738, and high purity

laboratory alloys were prepared to simulate the effects of the major elements in IN-738. Results indicate that the initiation of hot corrosion attack of IN-738 and other similar alloys is the result of local penetration of molten salt through the protective oxide scale. R.C.T.

N80-15234*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION AND FRICTION OF IRON-BASE BINARY ALLOYS IN CONTACT WITH SILICON CARBIDE IN VACUUM
Kazuhisa Miyoshi and Donald H. Buckley. Jan. 1980. 13 p. refs.
(NASA-TP-1604; E-126) Avail: NTIS. HC A02/MF A01. CSCL 11F

Single pass sliding friction experiments were conducted with various iron base binary alloys (alloying elements were Ti, Cr, Mn, Ni, Rh, and W) in contact with a single crystal silicon carbide /0001/ surface in vacuum. Results indicate that atomic size and concentration of alloying elements play an important role in controlling adhesion and friction properties of iron base binary alloys. The coefficient of friction generally increases with an increase in solute concentration. The coefficient of friction increases linearly as the solute to iron atomic radius ratio increases or decreases from unity. The chemical activity of the alloying elements was also an important parameter in controlling adhesion and friction of alloys, as these latter properties are highly dependent upon the d bond character of the elements. R.C.T.

N80-15235*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF SODIUM, POTASSIUM, MAGNESIUM, CALCIUM, AND CHLORINE ON THE HIGH TEMPERATURE CORROSION OF IN-100, U-700, IN-792, AND MAR M-509
Carl E. Lowell, Steven M. Sidik, and Daniel L. Deadmore. 1980. 28 p. refs. Proposed for presentation at 25th Ann. Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by the ASME
(Contract EF-77-A-01-2593)
(NASA-TM-79309; E-265; DOE/NASA/2593-79/12) Avail: NTIS. HC A03/MF A01. CSCL 07D

The effects of potential impurities such as Na, K, Mg, Ca, and Cl, in coal-derived liquid fuels on accelerated corrosion of IN-100, U-700, IN-792, and Mar M-509 were investigated using a Mach 0.3 burner rig for times to 200 hours in one hour cycles. These impurities were injected in combination as aqueous solutions into the combustor. Other variables were time, temperature, and fuel-to-air ratio. The experimental matrix was a central composite fractional fractional design divided into blocks to allow modification of the design as data was gathered. The extent of corrosion was determined by metal consumption. The time exponent was near 1.0 for the least corrosion resistant alloys, U-700 and IN-100; near 0.8 for the moderately resistant IN-792; and close to Mar M-509, the most corrosion resistant alloy. As anticipated, corrosion rapidly increased with increasing temperature as well as Na and K concentrations, while corrosion decreased somewhat as the Ca concentration increased for all alloys. Mg was beneficial for the Ni-base alloys but had little effect on the Co-base alloy. Surprisingly, the effect of increasing Cl was to decrease the corrosion of all alloys. Little interaction among the dopants was noted. A.R.H.

N80-15236# Rockwell International Science Center, Thousand Oaks, Calif.
TREATMENT OF AM 355 STEEL FOR ADHESIVE BONDING Final Report, 12 Jun. 1978 - 31 May 1979
Ron Haak and Tennyson Smith. Jul. 1979. 66 p. refs.
(Contract DAAK10-78-C-0227)
(AD-A074113; SC5169.16FR) Avail: NTIS. HC A04/MF A01. CSCL 11/1

Surface treatments for Am 355 prior to adhesive bonding have been developed. A sulfuric acid-dichromate immersion treatment and nitric acid anodization treatment have produced extremely strong durable bonds. Wedge test values (at 50 C using 0.040 in. (0.102 cm) stock) are about 0.05-0.06 in./24 hr (0.13-0.15 cm/24 hr). Using a method now in use (HP4-121) results of greater than 1 in./day (2.5 cm) are obtained. Stress durability (ASTM D2919, 60 C, 100% RH, 2000 psi (13.8 mPa)) tests show an average time to failure of about 500 hrs compared to the less than 1 hour time to failure obtained using the present method. It was found that increased bond durability, measured by the wedge test, was directly related to the increased chromium content of the surface oxide layer produced using these and other treatments. Experiments indicate that Am 355 is essentially impermeable to hydrogen, i.e., the diffusion coefficient was unmeasurable using an electrochemical technique sensitivite to 0.1 ppm of mobile hydrogen. Although both methods mentioned above are commercially applicable, the HNO3 anodize appears the best because of the absence of carcinogenic dichromates, the lower production cost and slightly better bond results. GRA

N80-15237# Westinghouse Research and Development Center, Pittsburgh, Pa.
ENVIRONMENTAL HYDROGEN CRACKING OF HY STEEL WELD METALS Final Report, 1 May 1977 - 30 Jun. 1979
E. W. Johnson and B. J. Shaw. 15 Aug. 1979. 175 p. refs.
(Contract N00014-77-C-0372)
(AD-A074104; Rept-79-9D9-HONRY-R1) Avail: NTIS. HC A08/MF A01. CSCL 11/6

Techniques used in a program to develop HY steel weld metals with improved resistance to environmental hydrogen cracking include (1) levitation melting and chill casting of Charpy-size specimens, and (2) accelerated environmental testing by the H2S rising-load method. The measured values of K(or), the stress intensity of crack-growth onset, had satisfactory reproducibility as well as sensitive response to composition. However, K(or) is larger than the threshold stress intensity K(arr) (or K(Iscc)) by an amount that varies directly with t(io), the incubation-time constant. Since t(io) is short relative to design life, only k(arr) has design significance. Two new accelerated methods of determining K(arr) are (1) a modified rising-load test in which the displacement is held constant after crack-growth onset, and (2) a similar procedure substituting environmental fatigue precracking for the rising-load phase. GRA

N80-15238# Naval Postgraduate School, Monterey, Calif.
HIGH-STRENGTH ALUMINUM-MAGNESIUM ALLOYS: THERMOMECHANICAL PROCESSING, MICROSTRUCTURE AND TENSILE MECHANICAL PROPERTIES M.S. Thesis
Raymond Arthur Grandon. Mar. 1979. 74 p. refs.
(AD-A074185) Avail: NTIS. HC A04/MF A01. CSCL 11/6

Microstructures and mechanical properties of thermomechanically processed aluminum-magnesium alloys were investigated in this research. Magnesium content of the alloys ranged from 7 to 12 weight percent and an alloy containing 10 percent Mg and 0.5 percent Cu was also examined. Thermomechanical processing treatments involved solution treatment followed by warm isothermal rolling. Temperature for this warm rolling was typically 300 C, and this is below the solvus temperature for the alloy. Such processing results in a fine dispersion of the intermetallic compound Al3Mg2 (beta) in a solid solution matrix. Typical mechanical properties are an ultimate tensile strength of 520 Mpa (75000 psi), with 12 percent elongation to fracture. Such a material may be further cold worked to ultimate tensile strengths of 620 Mpa (90000 psi), with 6 percent elongation to fracture. Dynamic recrystallization is necessary to achieve a uniform dispersion of the intermetallic in subsequent processing. GRA

N80-15239# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
ANOMALIES IN X-RAY RESIDUAL STRESS MEASUREMENTS IN COLD-ROLLED STEELS
Heiner Doelle and Jerome B. Cohen. 7 Sep. 1979. 29 p. refs.
(Contract N00014-75-C-0580; Grant NSF DMR-76-80847)
(AD-A074802; TR-25) Avail: NTIS. HC A03/MF A01. CSCL 11/6

In residual stress measurements with X-rays, the interplanar spacing is assumed to alter monotonically with the tilt psi of the specimen to the X-ray beam; the calculation of the stresses is based on this assumption when either the well-known two-tilt or sin sq psi methods are employed. But in materials with strong texture, large oscillations have sometimes been reported. A method proposed in the literature for evaluating stresses in such a situation

as resulting from anisotropy has been tested and shown to provide a reasonable stress system; the texture must be known in detail, so as to calculate the effective elastic constants. More importantly, the theory predicts that the simpler methods and measured X-ray elastic constants can be used, and without knowledge of the texture, if hoo and hhh reflections are employed; this has been verified experimentally in this study. It is recommended that such reflections be employed in the future, rather than the common ones now utilized. GRA

N80-15240# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering, and Mechanics.

UNIAXIAL CREEP, CYCLIC CREEP AND RELAXATION OF AISI TYPE 304 STAINLESS STEEL AT ROOM TEMPERATURE: AN EXPERIMENTAL STUDY

D. Kujawski, V. Kallapur, and E. Krempl. Aug. 1979. 45 p. refs. Sponsored in part by NSF.
(Contract N00014-76-C-0231; NR Proj. 064-571)
(AD-A074958; RPI-CS-79-4) Avail: NTIS. HC A03/MF A01. CSCL 11/6

A servocontrolled testing machine and strain measurement at the gage length were used to study the uniaxial rate (time) dependent behavior of AISI Type 304 Stainless Steel at room temperature. The creep strain accumulated in a given period of time depends strongly on the stress rate preceding the creep test. In constant stress rate zero-to-tension loading the creep strain accumulated in a fixed time period at a given stress level is always higher during loading than during unloading. Continued cycling causes an exhaustion of creep ratchetting which depends on the stress rate. Periods of creep and relaxation introduced during completely reversed plastic cycling show that the curved portions of the hysteretic loop exhibit most of the inelasticity. In the straight portions creep and relaxation are small and there exists a region commencing after unloading where the behavior is similar to that at the origin for virgin materials. This region does not extend to zero stress. The results are at variance with creep theory and with viscoplasticity theories which assume that the yield surface expands with the stress. They support the theory of viscoplasticity based on total strain and overstress. GRA

N80-15241# Georgia Inst. of Tech., Atlanta. School of Physics.

THEORETICAL INVESTIGATION OF THE EXCITATION STRUCTURE AND OPTICAL PROPERTIES OF TITANIUM, VANADIUM AND THEIR OXIDES. Annual Report, 1 Oct. 1976 - 30 Sep. 1977

Martin W. Ribarsky. 8 Jul. 1979. 13 p. refs.
(Grant AF-AFOSR-3108-76; AF Proj. 2301)
(AD-A074222; AFOSR-79-0971TR) Avail: NTIS. HC A02/MF A01. CSCL 11/6

An investigation of the electronic excitation structure of the transition metal oxides was begun which included the effects of correlation of the excited electron with the surrounding medium, relaxation of the electrons around the hole left by the excitation, and the interaction of the excited electron with the hole. Recent theoretical and experimental work has shown that all these effects must be included in order to obtain a detailed understanding of the excitation structure, optical properties, lattice dynamics, and dielectric response of these oxides and many other materials. Local orbitals instead of the usual spatially extended Bloch representation were used. The local orbitals are especially useful in describing the d-electrons, which are localized in position and energy. The extensive codes necessary for the efficient calculation of multicenter integrals were constructed and assembled during the past year. The methods necessary for transforming the band states from the Bloch to the local orbitals representation were developed, and the methods for diagonalizing very large array were investigated. GRA

N80-15242# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

PROGRESS IN CALCULATIONS OF THE SUPERCONDUCTING PROPERTIES OF TRANSITION METALS

W. H. Butler. 1979. 14 p. refs. Presented at Conf. on Superconductivity in d- and f-band Metals, San Diego, Calif., 21 Jun. 1979.
(Contract W-7405-eng-26)
(CONF-790653-4) Avail: NTIS. HC A02/MF A01

First principles, calculations of the electron-phonon parameters of d-band metals are performed to an accuracy of about 10% for averaged quantities such as the mass enhancement or the room temperature resistivity. Quantities such as the spectral function or the phonon linewidth which describe the electron-phonon interaction in more detail are also calculated. Agreement between calculated and experimental phonon linewidths is generally good but there are differences between the experimental and calculated versions of the spectral function. Calculations of the thermodynamic critical field and the upper critical field for Nb agree well with experiment. DOE

N80-15243# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

EFFECTS OF AIR MELTING ON Fe/0.3/3Cr/0.5Mo/2Mn AND Fe/0.3C/3Cr10.5Mo/2Ni STRUCTURAL ALLOY STEELS. M.S. Thesis

B. Steinberg. Jun. 1979. 50 p. refs.
(Contract W-7405-eng-48)
(LBL-9103) Avail: NTIS. HC A03/MF A01

A base alloy of Fe/03C/3Cr/0.5Mo with either 2Mn or 2Ni added was produced by air melting, and its mechanical properties and microstructure were compared to an identical vacuum melted steel. Significant differences in mechanical behavior, morphology, and volume fraction of undissolved inclusion were observed as a function of composition following air melting. For the alloy containing manganese, all properties remained very close to vacuum melted values but the 2Ni alloy displayed a marked loss in Charpy impact toughness and plane strain fracture toughness. This loss is attributed to an increase in volume fraction of secondary particles in the nickel alloy, as opposed to both the Mn alloy and vacuum melted alloys, as well as to substantially increased incidence of linear coalescence of voids. Microstructural features are discussed. DOE

N80-15244# California Univ., Berkeley. Lawrence Berkeley Lab.

DESIGN OF DUPLEX LOW-CARBON STEELS WITH CARBIDE FORMING ELEMENTS

P. K. Costello. Dec. 1978. 65 p. refs.
(Contract W-7405-eng-48)
(LBL-8628) Avail: NTIS. HC A04/MF A01

Duplex ferrite-martensite (DFM) steels with carbide forming elements were investigated. The alloys Fe/0.14C/1.45 Si/XX (XX being the substitutional alloying element of Mos or Nb) were selected. The DFM microstructures are controlled by the type of alloy element and the subsequent thermal treatment. The tensile properties of specimens subjected to either the intermediate quench (IQ) or the intermediate air cool (IAC) heat treatments were correlated with their respective microstructures. Dispersion hardening as a secondary strengthening mechanism is found to limit the ductility and increasing the strength due to carbide precipitation in the ferrite. The differences in properties displayed by the alloys between the IQ and IAC thermal treatments are primarily attributed to the connectivity of the martensite particles. The IQ treatment provided strength and elongation ductility combinations which are superior to those of the IAC process. Specifically, the niobium steel displayed the best mechanical properties. DOE

N80-15245# Northwestern Univ., Evanston, Ill.

EFFECT OF POINT DEFECTS ON MECHANICAL PROPERTIES OF METALS. Progress Report, 1 Jan. - 30 Nov. 1978

M. Meshii. Nov. 1978. 24 p. refs.
(Contract EY-76-S-02-1367)
(COO-1367-97) Avail: NTIS. HC A02/MF A01

Progress is reported on deformation behavior of niobium single crystals below 77 K, the effect of electron irradiation on the deformation behavior of niobium single crystals, and surface film softening phenomenon in Ni plated iron single crystals. DOE

N80-15246# Wright State Univ., Dayton, Ohio.

LOW TEMPERATURE ELECTRON IRRADIATION AND ANNEALING OF PURE CADMIUM. Ph.D. Thesis

M. A. Menendez. 1979. 74 p. refs. Prepared jointly with Illinois Univ. at Urbana-Champaign.
(Contract EY-76-C-02-1198)

(COO-1199-1274) Avail: NTIS HC A04/MF A01

Cadmium was studied after electron irradiation below 2 K, and the damage production rate in Dc was 1/(4.13 + or - .16) x 10 to the twenty sixth power Omega cm/(e(-)/sq cm) for irradiation with 2.5 MeV electrons at 1.5 K. New annealing peaks were observed at 1.925 K and at about 2 K. The peak at about 2 K exhibits dose-dependence, but it is better described by first order kinetics; this peak is believed to correspond to the long-range migration of the self-interstitial, preferentially to impurities where they form clusters. It was found that subthreshold irradiation results in the annealing of damage already present. This radiation annealing effect may be a contributing factor to the seesaw effect. Another physical process may contribute to the seesaw effect, namely, the trapping of interstitials at impurities and their subsequent detrapping during annealing. DOE

N80-15247# Argonne National Lab., Ill.

PHOTOELECTRON SPECTRA OF TRINUCLEAR METAL CLUSTER COMPLEXES

W. C. Trogler (Northwestern Univ., Evanston, Ill.) and J. Berkowitz 1979 5 p Presented at the Ann. Conf. on Mass Spectry. and Allied Topics, Seattle, 3 Jun. 1979

(Contract W-31-109-eng-38)

(CONF-790658-7) Avail: NTIS HC A02/MF A01

The photoelectron spectra of Re3Cl9, Ru3(CO)12, and Os3(CO)12 were studied. Probable molecular structures in the vapor phase are discussed. DOE

N80-15248# Ames Lab., Iowa

EFFECT OF NITROGEN CONCENTRATION ON TEMPERATURE DEPENDENT MECHANICAL PROPERTIES OF VANADIUM

O. N. Carlson, D. K. Rehbein, and K. E. Bogacik (Babcock, and Wilcox Co., Lynchburg, Va.) 1979 13 p refs Presented at 5th Intern. Conf. on the Strength of Metals and Alloys, Aachen, W. Germany, Aug. 1979

(Contract W-7405-eng-82)

(IS-M-195; CONF-790801-1) Avail: NTIS HC A02/MF A01

The critical resolved shear stress and strain rate sensitivity of vanadium were determined for vanadium-nitrogen alloys over the temperature range of 77 K to 400 K for concentrations of 1 to 500 wt ppM nitrogen. The concentration dependence of the hardening rate agrees quite well with either the Fleischer or Labusch strengthening model, but the combined temperature and concentration dependence follows more closely the form predicted by Ono and Sommer. The strain rate sensitivity exhibits a peak at 140 K which decreases with increasing nitrogen content but above 250 K there is a reversal in this effect. DOE

N80-15249# Foreign Resources Associates, Fort Collins, Colo.

EVALUATION OF FORGEABILITY OF STEELS BY NOTCH COMPRESSION METHOD

F. Morozumi and M. Hirasuka Mar. 1979 15 p refs Translated into ENGLISH from Zairyo (Kawasaki), v. 45, no. 3, 1970 p 97-102 Sponsored by DOE

(RFP-Trans-273) Avail: NTIS HC A02/MF A01

Notched specimens prepared from carbon, low alloy, and alloy steels were compressed by impact energy, and the relationship between the behavior of forging defects produced at the notch bottom and the amount of compression was investigated. It was ascertained that the critical impact compression amount has a close relation with individual metallurgical factors such as material and conditions. Furthermore, this notch compression method proved to be an effective means for understanding the generation of flaws in the forging. DOE

N80-15250# Oak Ridge National Lab., Tenn.

FATIGUE CRACK PROPAGATION IN 21/4 Cr-1 Mo STEEL

W. R. Corwin, M. K. Booker, B. L. P. Booker, and C. R. Brinkman 1979 8 p refs Presented at Intern. Conf. on Structural Mech. in Reactor Technol., Berlin, 13 Aug. 1979

(Contract W-7405-eng-26)

(CONF-790802-41) Avail: NTIS HC A02/MF A01

The fatigue crack propagation of 2 1/4 Cr-1 Mo steel was examined in air over a wide range of experimental conditions. The fatigue crack growth rate was found to: generally increase monotonically with increasing temperature from 172 to 866 K, except in the range where dynamic strain aging occurs, near 644 K; increase with decreasing frequency at room temperatures above 783 K - this frequency dependence was not observed below 783 K; and increase with increases in mean stress. The results were evaluated, and a simple empirical model was developed to yield estimates of average and upper limit crack growth rates as a function of temperature, frequency, and effective stress intensity. The model is not applicable in the low region where threshold effects become important since insufficient data were available in that range. DOE

N80-15251# General Atomic Co., San Diego, Calif.

AGING BEHAVIOR OF ALLOY 800H AND ASSOCIATED MECHANICAL PROPERTY CHANGES

G. Y. Lai and O. F. Kimball Nov. 1978 27 p refs

(Contract EY-76-C-03-0167)

(GA-A-15194) Avail: NTIS HC A03/MF A01

Aging behavior of five different heats of Alloy 800H was investigated in the temperature range 538 to 816 C for times up to 8,000 h. Significant age-hardening was observed at low temperatures in most heats. One of the heats, however, exhibited less hardening. Microstructural changes occurring during aging were evaluated by optical metallography, transmission electron microscopy, and X-ray diffraction. Effects of thermal aging on both tensile properties and impact toughness properties were evaluated. The results show that the alloy exhibits good residual impact toughness and tensile ductility after aging up to 8,000 h. DOE

N80-15252# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

CORROSION OF SEVERAL ALLOYS IN SUPERHEATED STEAM AT 482 AND 538 DEG CENTIGRADE

J. C. Griess and W. A. Maxwell (NUS Corp., Clearwater, Fla.) Nov. 1978 39 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6465) Avail: NTIS HC A03/MF A01

The corrosion of several ferritic steels, Incoloy Alloy 800, Inconel 617, and type 304 stainless steel in superheated steam at 482 and 538 C was investigated. Specimens of the alloys, including welds and U-bends in some cases, are mounted in a once-through loop that receives steam from a fossil-fired power plant. The data obtained during the first 12,000 h of a planned 30,000-h test is presented. All ferritic steels showed similar weight gains and to this time no significant oxide exfoliation has occurred. The other materials corroded at very low rates. Incoloy Alloy 800 that was intergranularly corroded during pickling showed no further intergranular penetration in steam. Type 304 stainless steel was oxidized in a nonuniform manner, but even in the effected areas attack was slight. Welded and highly stressed U-bend specimens of Inconel 617 and of Incoloy Alloy 800 welded either to itself or to 2 1/4 Cr-1 Mo steel, showed no evidence of cracking nor any unusual oxide loss. DOE

N80-15253# Sandia Labs., Albuquerque, N. Mex.

REFRACTORY METALS FOR ULTRASONIC THERMOMETRY APPLICATION

Gary A. Carlson and H. G. Plein Oct. 1978 74 p refs

(Contract EY-76-C-04-0789)

(NUREG-CR-0368; SAND-78-1382) Avail: NTIS HC A04/MF A01

The acoustic velocity and acoustic attenuation characteristics of 13 refractory metals were determined over a range of temperatures in order to explore potential new ultrasonic thermometry materials. Stainless steel, titanium, rhodium, rhenium, and 2 percent thoriated tungsten wires show superior properties for ultrasonic thermometry over different temperature ranges from room temperature to 2900 C. Applications to reactor safety experiments are discussed. DOE

N80-15254# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.

GOLD PLATING METALLIZED ALUMINA CERAMICS

T. J. Gillespie and R. J. Antepenko 30 Oct. 1978 44 p

(Contract EY-76-C-04-0656)

(GEPP-TIS-380) Avail: NTIS HC A03/MF A01

Problems with gold plating a metallized ceramic part were investigated. The production process was improved by increasing the amounts of conductive plating salts and brightener in the

plating bath and increasing the bath agitation. Various surface activation processes, retort sintering of the gold plate and seven cyanide gold plating baths were evaluated. The long-range study shows that the most effective activation for metallized ceramic is a cathodic treatment for approximately one minute at low current density using a 10 percent sulfuric acid solution. One plating bath provided excellent surface texture and blister-free surface when used with a strike process in conjunction with activation and retort furnace sintering. DOE

N80-15255# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.

MODIFICATIONS IN OPTOELECTRONIC BEHAVIOR OF PLASMA-DEPOSITED AMORPHOUS SEMICONDUCTOR ALLOYS VIA IMPURITY INCORPORATION

R. W. Griffith, F. J. Kampas, P. E. Vanier, and M. D. Hirsch 1979 7 p refs Presented at the Intern. Conf. on Amorphous and Liquid Semiconductors, Cambridge, Mass., 27 Aug. 1979

(Contract EY-76-C-02-0016)

(BNL-26646; CONF-790851-3) Avail: NTIS HC A02/MF A01

Electronic properties of plasma-deposited a-Si:H alloys are discussed as functions of oxygen and nitrogen impurities. Data show anomalous behavior in photoconductivity versus temperature for films deficient in either, or both, impurities (peaks appear that are associated with thermal-quenching processes and supralinearity). Modification to classic behavior in photoconductivity owing to synergistic effects of oxygen and nitrogen is also demonstrated. Correlations with photoluminescence are presented. Optical emission spectroscopy is discussed within the context of an emerging spectroscopy for the detection of emitting reactive species in the plasma. The presence of impurities, particularly N2, can be diagnosed. DOE

N80-15256# California Univ., Livermore. Lawrence Livermore Lab.

TANTALUM FABRICATION

P. L. Studt 11 Apr. 1979 20 p refs

(Contract W-7405-eng-48)

(UCID-18152) Avail: NTIS HC A02/MF A01

The as-fabricated metallurgical state of the tantalum was examined. The microstructure, hardness, and chemical composition of the component material was evaluated. Both as-received tantalum starting sheets and a formed component were evaluated. Results indicate that these components were given an anneal that relieved stresses but did not recrystallize the material. The components were thus stronger than necessary. DOE

N80-15257# Atomics International Div., Golden, Colo. Rocky Flats Plant.

ALTERNATE IMMERSION STRESS CORROSION TESTING OF 5083 ALUMINUM

J. L. Briggs, M. R. Dringman, D. E. Hausburg, and R. L. 13 Nov. 1978 17 p refs

(Contract EY-76-C-04-3533)

(RFP-2645; TID-4500-R66) Avail: NTIS HC A02/MF A01

The stress corrosion susceptibility of an aluminum-magnesium alloy in plate form and press formed shapes was determined in the short transverse direction. The C ring specimens were exposed to alternate immersion in a sodium chloride solution. The test equipment and procedure, with several innovative features, are described in detail. Statistical test results are listed for seven thermomechanicaal conditions. A certain processing scheme was shown to yield a work strengthened part that is not sensitized with respect to stress corrosion cracking. DOE

N80-15258# General Electric Co., Schenectady, N. Y.

NITROGEN-STRENGTHENED AUSTENITIC STAINLESS STEEL FOR CRYOGENIC MAGNET STRUCTURES

F. N. Mazandarahy, D. M. Parker, R. F. Koenig, and D. T. Read 1979 20 p refs Presented at the Cryogenic Engineering Conf., Madison, Wisc., 21 Aug. 1979 Prepared jointly with NBS, Washington, D.C.

(Contract W-7405-eng-26)

(CONF-790815-13) Avail: NTIS HC A02/MF A01

An extensive test program was initiated to verify expected base metal properties, to develop weld processes and to establish weld and base metal design allowables. The results of the tests which involved testing and evaluation of 25 mm thick Type 316 LN plate, shielded metal arc weld deposits selected for structural welds, gas tungsten arc weld and gas metal arc weld deposits selected for seal welds are presented. The welding development effort measurements of impact properties at RT and 77 K; chemical analyses; measurements of magnetic permeabilities and weld ferrite contents, metallographic and radiographic examinations of welds, and measurements of tensile, fracture toughness and fatigue crack growth rate properties from RT to 4 K. DOE

N80-15259# Argonne National Lab., Ill.

LONG-TERM EROSION MONITORING OF METALLIC CONDUITS BY ULTRASONIC PULSE-ECHO TECHNIQUES

C. A. Youngsdahl and W. A. Ellingson 1979 11 p refs Presented at 12th Symp. on Nondestructive Evaluation, San Antonio, Tex., 24 Apr. 1979

(Contract W-31-109-eng-38)

(CONF-790480-1) Avail: NTIS HC A02/MF A01

Monitoring metallic transfer lines and fittings in pressurized equipment used to process particulate matter, such as pulverized coal or ash, can prevent unexpected component failures and contribute to improved equipment designs. Nondestructive, ultrasonic pulse-echo techniques to detect erosion were developed for high-temperature (approximately 650 C) on-line measurements and applied to various stainless steel and carbon steel components of coal-gasification and liquefaction pilot plants. The techniques are described, together with successful methods of accounting for varying specimen temperatures, long monitoring times (months to years), and exposure of transducers and couplant to weather. Measurement characteristics peculiar to erosion monitoring are discussed. DOE

N80-15260# National Technical Information Service, Springfield, Va.

TITANIUM AND TITANIUM ALLOY CREEP. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Sep. 1979

William E. Reed Sep. 1979 202 p Supersedes NTIS/PS-78/0970; NTIS/PS-77/0803; NTIS/PS-76/0645; NTIS/PS-75/538

(NTIS/PS-79/0984/9; NTIS/PS-78/0970; NTIS/PS-77/0803; NTIS/PS-76/0645; NTIS/PS-75/538) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Research is cited on creep of titanium and its alloys with regard to composition, stress corrosion, fatigue, fracture, and microstructure. Tests are described on varying conditions of temperatures, pressures, and atmospheres. Processing and metal working are covered for their relationship to creep resistance. Many reports deal with applications to aircraft, spacecraft, and nuclear reactors. This updated bibliography contains 194 abstracts, 14 of which are new entries to the previous edition. GRA

N80-15261# National Center for Resource Recovery, Washington, D. C.

TECHNICAL BARRIERS TO THE REUSE OF ALUMINUM RECOVERED FROM MUNICIPAL REFUSE

E. Joseph Duckett Mar. 1979 34 p refs

(Grant NSF APR-75-13864)

(PB-300436/3; NSF/RA-790147; TI79-5) Avail: NTIS HC A03/MF A01 CSCL 11F

The recovery of aluminum from municipal solid wastes (MSW) is examined. Since organic contaminants are present in recovered aluminum, and since the mixing of aluminum and other nonmagnetic metal alloys found in MSW are potential barriers to the use of recovered aluminum, these problems and methods available to overcome them are presented. Techniques for recovering aluminum from MSW described include the principle of eddy current separation (both wet and dry methods), dense media separation, jigging, and electrostatic separations. Types of aluminum alloys and other alloys are listed according to classification and usage. Specifications used as a basis for judging the quality of aluminum recovered from U.S. plants are outlined. GRA

N80-15262# Industry and Trade Administration, Washington, D.C.

PRODUCTION OF IRON BY DIRECT REDUCTION

William S. Kruppa May 1979 19 p
(PB-300533/7) Avail: NTIS HC A02/MF A01 CSCL 11F

World-wide iron ore direct reduction units are described. The descriptions of these units include location, owners or planners, status of development-in operation or some stage of construction or planning, design capacity, and actual or intended use of the iron product. A summation of the data present the world-wide current and projected direct reduction process design capacity. Limited data are also presented which show current and projected actual direct iron production. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-15263*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
SINTERED SILICON NITRODE RECUPERATOR FABRICATION Final Report
A. Gatti, W. S. Chiu, and L. R. McCreight Jan. 1980 40 p refs
(Contract DEN3-54)
(NASA-CR-159706; DOE/NASA/0054-79/1) Avail: NTIS HC A03/MF A01 CSCL 11B

The preliminary design anp a demonstration of the feasibility of fabricating submodules of an automotive Stirling engine recuperator for waste heat recovery at 370 C are described. Sinterable silicon nitride (Sialon) tubing and plates were fabricated by extrusion and hydrostatic pressing, respectively, suitable for demonstrating a potential method of constructing ceramic recuperator-type heat exchangers. These components were fired in nitrogen atmosphere to 1800 C without significant scale formation so that they can be used in the as-fired condition. A refractory glass composition (Al_2O_3 x 4.5 CaO.MgO x 11SiO_2) was used to join and seal component parts by a brazing technique which formed strong recuperator submodules capable of withstanding repeated thermal cycling to 1370 C. The corrosion resistance of these materials to Na_2SO_4 + NaCl carbon mixtures was also assessed in atmospheres of air, hydrogen and CO_2-N_2-H_2O mixtures at both 870 C and 1370 C for times to 1000 hours. No significant reaction was observed under any of these test conditions. M.M.M.

N80-15264*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ANALYSES OF MOISTURE IN POLYMERS AND COMPOSITES
L. E. Ryan and R. W. Vaughan 11 Jan. 1980 99 p refs
(Contract NAS3-20406)
(NASA-CR-159745; TRW-31782-6082-RU-00) Avail: NTIS HC A05/MF A01 CSCL 07C

A suitable method for the direct measurement of moisture concentrations after humidity/thermal exposure on state of the art epoxy and polyimide resins and their graphite and glass fiber reinforcements was investigated. Methods for the determination of moisture concentration profiles, moisture diffusion modeling and moisture induced chemical changes were examined. Carefully fabricated, precharacterized epoxy and polyimide neat resins and their AS graphite and S glass reinforced composites were exposed to humid conditions using heavy water (D_2O), at ambient and elevated temperatures. These specimens were fixtured to theoretically limit the D_2O permeation to a unidirectional penetration axis. The analytical techniques evaluated were: (1) laser pyrolysis gas chromatography mass spectrometry, (2) solids probe mass spectrometry, (3) laser pyrolysis conventional infrared spectroscopy, and (4) infrared imaging thermovision. The most reproducible and sensitive technique was solids probe mass spectrometry. The fabricated exposed specimens were analyzed for D_2O profiling after humidity/thermal conditioning at three exposure time durations. R.C.T.

N80-15265# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
THE PHYSICAL AND CHEMICAL CHARACTERIZATION OF TEN MILITARY TURBINE ENGINE LUBRICANTS Final Report, Jul. - Sep. 1979
Frank M. Newman and Leo L. Stavinoha Sep. 1979 32 p refs
(Contract DAAK70-79-C-0142)
(AD-A074073; AFLRL-115) Avail: NTIS HC A03/MF A01 CSCL 11/8

Four MIL-L-23699B and six MIL-L-7808G turbine engine lubricants have been characterized from the physical properties and chemical composition of their basestocks. The four MIL-L-23699 lubricants were found to be 100% polyol esters. Of the six MIL-L-7808 lubricants, four were mixtures of polyol esters and diesters, one was 100% polyol ester, and one was 100% diester. Correlation of the chemical data is made to some of the physical properties wherever possible. GRA

N80-15266# Naval Surface Weapons Center, White Oak, Md.
MOISTURE SORPTION AND DIFFUSION IN KEVLAR 49 ARAMID FIBER Progress Report, Oct. 1977 - Oct. 1978
Joseph M. Augl 30 Mar. 1979 48 p refs
(AD-A074547; NSWC/TR-79-51) Avail: NTIS HC A03/MF A01 CSCL 11/9

Kevlar is being used increasingly as a reinforcement for fibrous composites. Since moisture affects the mechanical properties of organic matrix composite it is of importance to understand the sorption and transport of moisture in this material. The purpose of this work was to measure the sorption equilibrium of Kevlar with moisture and its diffusion coefficient as a function of concentration. Kevlar 49 has an unusually low diffusion coefficient compared to other polymers, so that the moisture transport in composites is governed by the organic matrix, or by other mechanisms such as microporosity, yet the equilibrium concentrations as a function of relative humidity are similar to most epoxy resins. GRA

N80-15267# Army Inst. of Dental Research, Washington, D. C. Dental Materials Div.
APPARENT VISCOSITIES OF SETTING ELASTOMERS
Stanley G. Vermilyea, Eugene F. Huget, and Laszlo B. DeSimon 2 Oct. 1979 12 p refs
(AD-A074843) Avail: NTIS HC A02/MF A01 CSCL 11/9

The flow behavior of five elastomeric impression materials was determined by extrusion viscometry. Initial viscosity ranged from 400 to 5,100 poise at a shear rate of 2.2 reciprocal seconds. All of the elastomers showed initial non-Newtonian behavior and increased viscosity with time. The data suggest that clinical impression making procedures should be tailored to produce rates of shear commensurate with those required to optimize the flow properties of modern impression materials. GRA

N80-15268# Texas Technological Univ., Lubbock. Dept. of Chemistry.
STUDIES OF HnFn OLIGOMERIC SPECIES Final Report, 1 Jun. 1978 - 31 May 1979
Richard L. Redington 27 Jul. 1979 40 p refs
(Grant AF-AFOSR-3616-78; AF Proj. 2302)
(AD-A074177; AFOSR-79-0950TR) Avail: NTIS HC A03/MF A01 CSCL 11/9

Infrared matrix-isolation spectra of HF and HF/H_2O mixtures suspended in solid argon have been obtained in the range 1/400-4000 cm. Bands attributed to HF and to HF-H_2O oligomers were observed. HF stretching modes were assigned to dimer, chain trimer, cyclic tetramer, and cyclic hexamer of HF. Some of the FH. F angle deformation modes were observed for these molecules. The oligomers are formed during matrix deposition and the chain trimers appear to be matrix stabilized in a double substitution site in argon. Application of a nonideal gas model to the literature vapor phase data on HF suggests that the dimer and the hexamer are the dominant vapor phase oligomers, with the hexamer most important near saturation vapor pressures. The tetramer is the next most important vapor phase oligomer, but it contributes only weakly to the vapor phase properties. Minimal basis set STO-3G computations on chain and cyclic HF trimer and tetramer molecules suggest the marked increase in stability that arises on catenation or (unstrained) cyclization of HF systems. GRA

N80-15269# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
DISPLACEMENT CHARACTERISTICS OF A GLASS-CERAMIC INSULATOR IN A VACUUM TUBE ENVELOPE SEALING PROCESS
R. K. Spears. 12 Oct. 1979. 16 p.
(Contract EY-76-C-04-0656)
(GEPP-TIS-445) Avail: NTIS HC A02/MF A01

The flow characteristics of two glass-ceramic compositions (used for high voltage insulation in a vacuum tube envelope) were examined during sealing to molybdenum by determining the temperature at which the glass starts to flow and the temperature at which it becomes fully deformed. The initial softening temperature was between 630 and 715 C, the deformation temperature ranged from 890 to 1010 C. DOE

N80-15270# Sandia Labs., Albuquerque, N. Mex.
ELECTRICAL ACTIVITY IN SHOCK-LOADED POLYMERS
R. A. Graham. 1979. 9 p. refs. Presented at the 7th Intern. AIRAPT Conf., Le Creusot, France, 30 Jul. 1979.
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-0592C; CONF-790709-14) Avail: NTIS HC A02/MF A01

Studies concerning shock-induced conduction and shock-induced polarization phenomena in polymers are summarized and recent results presented. DOE

N80-15271# Ames Lab., Iowa.
PULSE AND MULTIPLE PULSE N.M.R. STUDIES OF CRYSTALLINITY AND MOLECULAR DYNAMICS OF SOLID STATE POLYMERS
Armin James Paff. May 1979. 64 p. refs.
(Contract W-7405-eng-82)
(IS-T-860) Avail: NTIS HC A04/MF A01

Pulse and multiple pulse N.M.R. techniques were used to study polypropylene and polyethylene. The degree of crystallinity of two polypropylene samples was investigated by analyzing the time decays of a simple pi/2 pulse and the more complex eight-pulse cycle. The single pulse experiment gives the superposition of two decays, the short component being attributed to the rigid region while the long component to the mobile region. Heating of the samples to 88 C produced a situation where the rigid and mobile regions become synonymous with the crystalline and noncrystalline regions. DOE

N80-15272# California Univ., Livermore. Lawrence Livermore Lab.
ENVIRONMENTALLY ENHANCED CRAZING IN POLYMERS
R. J. Morgan and E. T. Mones. 29 Mar. 1979. 8 p. refs. Presented at Am. Chem. Soc. Natl. Meeting, Washington, D.C., 10 Sep. 1979.
(Contract W-7405-eng-48)
(UCRL-82488; CONF-790917-2) Avail: NTIS HC A02/MF A01

The effects of low molecular-weight chemicals on the physical integrity and failure modes of amorphous but crystallizable polycarbonate and crosslinked epoxy glasses are presented. Solvent-induced crystallization (SINC) is shown to play a role in the solvent-crazing mechanism of polycarbonate. A mechanically weak, cavitated, crazed surface layer is produced in polycarbonate as a result of a combination of volume decreases caused by SINC and liquid-induced dilational swelling stresses together with the relaxation of fabrication stresses. The mechanism by which surface crazing in polycarbonate is enhanced by handling is also reported. In the epoxy studies, sorbed moisture plasticizes these crosslinked glasses and causes their mechanical properties to deteriorate. Studies of the initiation cavity and mirror regions of the fracture topographies of these epoxies indicate that sorbed moisture enhances the craze initiation and propagation processes. DOE

N80-15273# Sandia Labs., Albuquerque, N. Mex.
SYNTHESIS AND CHARACTERIZATION OF NEW POLYETHER BASED SOLUBLE POLYURETHANES
J. A. Wagner and C. Arnold, Jr. 1979. 8 p. refs. Presented at the Am. Chem. Soc. Natl. Meeting, Washington, D.C., 10 Sep. 1979.
(Contract EY-76-C-04-0789)
(SAND-78-1866C; CONF-790917-3) Avail: NTIS HC A02/MF A01

A removable material which would have properties similar to crosslinked, insoluble encapsulants but allow rework capability was developed. A series of polyether-based soluble polyurethanes was synthesized and a number of mechanical and electrical properties were measured. The polyurethanes were formulated using bitolylene diisocyanate polytetramethylene ether glycol (several molecular weights were tried) and two different diols. A number of formulations were tried and efforts concentrated on the two most promising materials. Since it was determined that the cure was not complete after the standard length of time (16 hours, verified by an isocyanate absorption in the infrared scan at 2280/cm), a post cure of sixteen hours was carried out. DOE

N80-15274# National Technical Information Service, Springfield, Va.
HIGH TEMPERATURE LUBRICANTS AND OILS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE. Progress Report, 1975 - Aug. 1979
Diane M. Cavagnaro. Oct. 1979. 234 p. Supersedes NTIS/PS-78/0948; NTIS/PS-77/0861.
(NTIS/PS-79/1032/6; NTIS/PS-78/0948; NTIS/PS-77/0861) Avail: NTIS HC $28.00/MF $28.00 CSCL 11H

This bibliography of worldwide research citations discusses the properties, uses, composition, performance, and wearing ability of hydraulic fluids, oils, greases, and solid lubricants. This updated bibliography contains 226 abstracts, 33 of which are new entries to the previous edition. GRA

N80-15275# National Bureau of Standards, Washington, D.C.
MEASUREMENTS AND STANDARDS FOR RECYCLED OIL - 2
Donald A. Becker, ed. and Helen Anne Hurd. Sep. 1979. 218 p. refs. Presented at NBS Conf., Gaithersburg, Md., 29-30 Nov. 1977.
(PB-299951/4; NBS-SP-556; LC-79-600126) Avail: NTIS HC A10/MF A01 CSCL 11H

Progress in the development of measurement methods and test procedures, as well as standards, for recycled oil is reported. Areas of legislation which affect the recycled oil program are discussed along with environmental issues. Other topics covered include oil recycled as engine oils, nonlubricating end uses, and additional recycled oil activities. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N80-15276# SRI International Corp., Menlo Park, Calif.
MISSION ANALYSIS FOR THE FEDERAL FUELS FROM BIOMASS PROGRAM. VOLUME 3: FEEDSTOCK AVAILABILITY. Final Report
R. K. Ernest, R. H. Hamilton, N. S. Borgeson, F. A. Schooley, and R. L. Dickenson. Jan. 1979. 79 p. refs.
(Contract EY-76-C-03-0115)
(SAN-0115-T1) Avail: NTIS HC A05/MF A01

The biomass supply in the United States is estimated through the year 2020. The biomass supply represents the combined tonnages of agricultural, logging, and mill residues, other forest residues, and energy crop output. Two scenarios were used for the projections: a base case and an optimistic case reflecting increases in land and water availability for production of energy crops resulting from an array of government incentives. An appendix tabulates the feedstock availability by region, type, price, year, and scenario. DOE

N80-15277# Puerto Rico Scientific Research Lab., Inc., Rio Piedras. Agricultural Experiment Station.
PRODUCTION OF SUGARCANE AND TROPICAL GRASSES

AS A RENEWABLE ENERGY SOURCE Quarterly Report, 1978 - 1979
A. G. Alexander, M. Garcia, C. Gonzalex-Molina, and J. Ortez-Velez 1979 62 p refs
(Contract ET-78-S-05-5912)
(DOE/CS/5912-T1; QR-2) Avail: NTIS HC A04/MF A01

Candidate grasses were identified for short-rotation crops having potentially greater versatility than Sordan 70A. Field-plot studies were performed on the optimization of N-fertilization and seeding rates for Sordan 70A. Field-plot data were recorded on sugarcane and napier grass responses to harvest frequency and row spacing. These results underscore a superiority of first-ratoon yields over plant-crop yields, of napier grass over sugarcane (up to 4 months), and delayed harvests over frequent harvests. Breeding tests were successful in producing F1 seedlings from crosses between an unknown and early-tasseling wild S. Spontaneum hybrid and late-tasseling commercial sugarcane hybrids. DOE

N80-15278# Institute of Gas Technology, Chicago, Ill.
LNG INDUSTRY: AN OVERVIEW OF PROJECTS AND COSTS
J. Glenn Seay, Philip J. Anderson, and Edward J. Daniels 1978 29 p Presented at ASME Energy Tech. Conf., Houston, Tex., 5 Nov. 1978
(Contract EE-76-C-02-4234)
(CONF-7811112-2) Avail: NTIS HC A03/MF A01

A summary of the LNG projects that are currently in various stages of development is presented. These projects account for a potential international LNG trade of about 765 million cu m (27 billion CF) per day. The operating experiences of some of the currently operational projects are reviewed with an emphasis on the natural gas liquefaction facilities. DOE

N80-15279# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
PROJECT PLANNING DOCUMENT: HIGHWAY VEHICLE ALTERNATIVE FUELS UTILIZATION PROGRAM (AFUP)
Jul. 1979 66 p
(DOE/CS-0093) Avail: NTIS HC A04/MF A01

Criteria and guidelines for the evaluation and development of nonpetroleum based highway vehicle fuels derived from domestic resources are developed. Five basic classes of alternative fuels are presented. Within each class, general areas of R & D that were addressed are illustrated in terms of a matrix format, while specific project relationships are identified by a corresponding flow chart. An overview of the evaluation of and relationships between these several alternative fuels classes intended to progress toward a uniform and independent domestic highway transportation system is presented. The mechanism for implementation is outlined. DOE

N80-15280# Department of Energy, Washington, D. C.
ETHANOL/GASOLINE BLENDS AS AUTOMOTIVE FUELS
J. R. Allsup and D. B. Eccleston 1979 13 p refs Presented at the 3rd Intern. Alcohol Fuels Technol., Asilomar, Calif., 28 May 1979
(CONF-790520-5) Avail: NTIS HC A02/MF A01

An experimental study of gasoline and 10% ethanol/90% gasoline blends was made using five late-model vehicles operated on a climate controlled chasis dynamometer. Data were obtained to permit comparisons of fuel economy, emissions, and other significant operational characteristics observed in tests with the two fuels. Volumetric fuel economy was shown to be slightly decreased, while energy economy was slightly increased using the ethanol/gasoline blend. Compared with the results using base gasoline, the use of the ethanol/gasoline blend had no adverse effect upon regulated emissions at test temperatures within the range 20 to 75 F; at 100 F there were mirror increases in emissions using the ethanol/gasoline blends. DOE

N80-15281# Argonne National Lab., Ill.
ENVIRONMENTAL PLANNING AND ASSESSMENT FOR HIGHWAY VEHICLE USE TO ALCOHOL FUELS
M. J. Bernard, III and O. M. Bevilaqua 1979 12 p refs Presented at 3d Intern. Alcohol Fuels Technol., Asilomar, Calif., 28 May 1979
(Contract W-31-109-eng-38)
(CONF-790520-2) Avail: NTIS HC A02/MF A01

The DOE environmental evaluation process designed to implement the National Evnironmental Policy Act policies and guidance is presented. In particular, it focused on that process as it is being used for DOE's alcohol fuels project within the Office. DOE

N80-15282# California Univ., Livermore. Lawrence Livermore Lab.
SIMULATION OF LNG VAPOR SPREAD AND DISPERSION BY FINITE ELEMENT METHODS
S. T. Chan, P. M. Gresho, and R. L. Lee Jul. 1979 36 p refs Presented at Natl. Conf. on Numerical Methods in Heat Transfer, College Park, Md., 24 Sep. 1979
(Contract W-7405-eng-48)
(UCRL-82441; CONF-790915-1) Avail: NTIS HC A03/MF A01

Two finite element models (one based on solving the time dependent, two dimensional conservation equations of mass, momentum, and energy, with buoyancy effects included via the Boussinesq approximation; the other based on solving the otherwise identical set of equations except using the hydrostatic assumption) are described and applied to predict some aspects of the vapor dispersion phenomena associated with liquefied natural gas (LNG) spills. A number of controlled numerical experiments, representing a reasonable expected range of LNG spill scenarios and atmospheric conditions, were carried out. Data regarding the applicability and limitations of the hydrostatic assumption for predicting LNG vapor spread and dispersion are established on comparing the results obtained with these finite element models. DOE

N80-15283# Natural Dynamics, Des Moines, Iowa.
FAST PRODUCTION OF METHANE BY ANAEROBIC DIGESTION. VOLUME 2: APPENDICES Final Report, 24 May 1976 - 31 Dec. 1978
C. D. Finney, R. S. Evans, II, and K. A. Finney Dec. 1978 174 p
(Contract EY-76-C-02-2900)
(COO-2900-17-Vol-2) Avail: NTIS HC A08/MF A01

The following are appended: (1) data from the system containing the digesters; (2) thermophilic temperature experiments; (3) agitational experiments; (4) data from the pressure experiment; (5) a body of data taken on a second digestion system for a loading experiment conducted under conditions of elevated temperature, reduced pressure, and vigorous agitation; and (6) the conversion of RDF to soluble COD. DOE

N80-15284# Colorado Energy Research Inst., Golden.
HYDROGEN AND METHANE SYNTHESES THROUGH RADIATION CATALYSIS Progress Report, 1 Jun. 1977 - 31 Aug. 1978
J. G. Morse Sep. 1978 149 p refs
(Contract EG-77-C-02-4258)
(COO-4258-1) Avail: NTIS HC A08/MF A01

Preliminary testing was performed of the concept of an electronic theory of catalysis to relate electrical properties of the catalysis to increased rates in radiation-induced reactions. The first system selected for study was the radiolysis of water as stimulated by absorption of gamma radiation. Early results indicate a significant correspondence between hydrogen gas yield and the forbidden band gap (Eg) of the catalyst substrate, when Eg approximates the energy of the hydrogen-oxygen bond in the water molecule. Catalysts tested were TiO_2, $SrTiO_3$, Sb_2O_3, MoO_3, Nb_2O_5, SnO_2, CaO, HfO_2, In_2O_3, and V_2O_5. Equipment to measure dielectric properties of solids was built and calibrated, and will be applied to pre- and post-irradiation testing of the catalysts used. The appendices review existing analytical models of photoelectrochemical cells and present a theoretical modeling of semiconductor-electrolyte interfaces. DOE

N80-15285# Argonne National Lab., Ill. Reactor Analysis and Safety Div.
LIQUID-LIQUID CONTACT IN VAPOR EXPLOSION Ph.D. Thesis - Northwestern Univ.
A. Segev Aug. 1978 343 p refs
(Contract W-31-109-eng-38)
(ANL/RAS-78-37) Avail: NTIS HC A15/MF A01

A theoretical study was performed to check the possibility

of vapor film squeezing (between a drop in film boiling and a surface) as a controlling mechanism for making liquid-liquid contact. Using experimental data, the film thickness was calculated and it was found to be too thick for any conceivable film rupture mechanism. It was suggested that the coalescence is a two-stage process, in which the controlling stage depends mainly on temperature and surface properties and can be described as the ability of cold liquid to spread on a hot surface. DOE

N80-15286# Brookhaven National Lab., Upton, N. Y.
PROCEEDINGS OF THE HYDRIDE STORAGE RESERVOIR SYMPOSIUM/WORKSHOP
M. J. Rosso, Jr. 1978 79 p refs Symp. held at Upton, N.Y., 20 Jun. 1978
(Contract EY-76-C-02-0016)
(BNL-26523; CONF-7806165) Avail: NTIS HC A05/MF A01

Problems related to hydride reservoir internal engineering design and container materials, hydride bed heat and mass transfer, and the fundamental properties of hydrides, addressed at the workshop are listed. The abstracts of 12 papers delivered are presented. The texts of two papers not delivered are included. These discuss development of low cost nickel-rare earth hydrides for hydrogen storage and an exact solution of diffusion and absorption of hydrogen in uranium followed by fracture of the hydride. DOE

N80-15287# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR RECOVERY OF NATURAL GAS FROM UNCONVENTIONAL SOURCES
J. Ham, S. E. Atkinson, and L. Dewey 1978 90 p refs
(TID-28848-Draft) Avail: NTIS HC A05/MF A01

Tight gas sands and Devonian shale are ready for commercialization, although higher than historical gas prices, improved recovery technology, and an aggressive commercialization program are required to fully develop these resources. Coalbed methane for local (non-pipeline) markets appears ready for commercialization for the local (self-help) industrial or municipal market. Coalbed methane for pipeline markets does not appear ready for commercialization in the near term due to highly uncertain geologic properties, economic uncertainties, perceived safety hazards, and limited interest by mine operators. Geopressured aquifers do not appear ready for commercialization in the near term because of vast geologic, technical, and environmental uncertainties and high production costs. Given a gap in domestic supplies to 6 to 8 Tcf in 1990, gas from the unconventional, domestic sources could fill 3 to 6 Tcf of this gap. DOE

N80-15288# Sandia Labs., Albuquerque, N. Mex.
LOW TEMPERATURE REACTION PATH FOR COAL LIQUEFACTION
M. G. Thomas and R. K. Traeger 1979 14 p refs Presented at the Am. Chem. Soc. Natl. Meeting, Washington, D.C., 10 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0738C; CONF-790917-7) Avail: NTIS HC A02/MF A01

The applicability of advanced, two-stage liquefaction processes which could lead to the development of new, low temperature and pressure liquefaction schemes is evaluated. DOE

N80-15289# Los Alamos Scientific Lab., N. Mex.
NEW HEAT TRANSFER GEOMETRY FOR HYDRIDE HEAT ENGINES AND HEAT PUMPS
W. A. Steyert Jul. 1979 7 p refs
(Contract W-7405-eng-36)
(LA-7822) Avail: NTIS HC A02/MF A01

A porous metal hydride (LiNi5H6) composite is presented that provides both mechanical stability to hydride beds and excellent heat transfer to the hydride when used in the appropriate configuration. DOE

N80-15290# Department of Energy, Washington, D. C.
REPORT OF THE ALCOHOL FUEL POLICY REVIEW
Jun. 1979 117 p
(DOE/PE-0012) Avail: NTIS HC A06/MF A01

Policy studies were conducted to assess the potential of alcohol fuels as an alternative source of energy. The conclusions of the analysis are summarized and recommendations to stimulate the use of alcohol fuels from renewable resources are presented, including major policies that the President has endorsed. R.E.S.

N80-15291# Arizona State Univ., Tempe. College of Engineering and Applied Sciences.
CONVERSION OF CELLULOSIC AND WASTE POLYMER MATERIAL TO GASOLINE
J. L. Kuester 28 Mar. 1979 52 p refs
(COO-2982-38) Avail: NTIS HC A04/MF A01

The present status and future plans for a project to convert cellulosic (biomass) and waste synthetic polymer materials to quality liquid fuels is presented. A thermal gasification approach was utilized followed by catalytic liquid fuels synthesis steps. Potential products include a medium quality substitute for natural gas or liquid fuel equivalents of diesel fuel, kerosene or high octane gasoline. The process appears very flexible with regard to ability to handle different sources of feedstock. Results to date indicate quality products can be produced. Product yields need to be improved with the main thrust centered on improvement of pyrolysis gas composition. Other items to be addressed are study of alternate economic feedstocks, waste stream characterization, and liquid fuels synthesis and tailoring with particular attention on the effects of alternate feedstocks. A description of a proposed 10 ton/day pilot plant is presented with flow sheet, material balance and cost estimates. DOE

N80-15292# California Univ., Livermore. Lawrence Livermore Lab. Dept. of Chemistry and Materials Sciences.
CRYOGENIC HYDROGEN DATA PERTINENT TO MAGNETIC FUSION ENERGY
P. C. Souers 15 Mar. 1979 90 p refs
(Contract W-7405-eng-48)
(UCRL-52628) Avail: NTIS HC A05/MF A01

The measured physical and chemical properties of the hydrogens below 30 K were analyzed and correlated. Properties are estimated for deuterium--deuterium tritide--tritium (D2-DT-T2) fusion fuel. DOE

N80-15293# Oregon State Univ., Corvallis.
INVESTIGATION OF THE VIABILITY AND COST EFFECTIVENESS OF SOLID FUEL GASIFIERS CLOSE COUPLED TO INTERNAL COMBUSTION ENGINES FOR 200 kWe POWER GENERATION Progress Report
J. G. Mingle and D. C. Junge Jan. 1979 52 p refs
(Contract EY-76-S-06-2227)
(DOE/RL-90476-13; PR-9; RLO-2227-T22-13) Avail: NTIS HC A04/MF A01

The viability and cost effectiveness of a 200 kWe engine generator unit fueled by a direct coupled, solid fuel gasifier were studied. Fuel and gasifier technology, gas treatment (clean up) for engine use, engine use technology, other uses for gasifiers, the viability of close coupled units, and an estimate of cost effectiveness are discussed. Present small experimental gasifier systems were found to perform as expected and have served to demonstrate the technology. Certain needed development efforts are discussed. DOE

N80-15294# TRW Defense and Space Systems Group, Redondo Beach, Calif.
COAL SULFUR MEASUREMENTS Final Report, Jan. 1976 - Dec. 1978
J. W. Hamersma and M. L. Kraft Jul. 1979 76 p refs
(Contract EPA-68-02-2165)
(PB-299575/1; EPA-600/7-79-150) Avail: NTIS HC A05/MF A01 CSCL 08I

A technique for sulfur forms analysis based on low temperature oxygen plasma ashing is presented. It involves analyzing the low-temperature plasma ash by modified ASTM techniques after selectively removing the organic material. The procedure was tested on 25 coals and compared with ASTM analyses with excellent results. A separate set of experiments showed that it is also feasible to determine organic sulfur directly by trapping SOx in the plasma ash effluent. GRA

N80-15295# National Bureau of Standards, Boulder, Colo. Thermophysical Properties Div.
ISOBUTANE: PROVISIONAL THERMODYNAMIC FUNC-

TIONS FROM 114 TO 700 K AT PRESSURES TO 700 BAR
Robert D. Goodwin Jul. 1979 192 p refs
(PB-299361/6; NBSIR-79-1612) Avail: NTIS HC A09/MF A01 CSCL 07D

The pure component of LNG, namely methane, ethane, propane, n-butane, and isobutane were analyzed. Thermophysical properties of isobutane are tabulated at integral temperatures along isobars over the entire range of fluid states. Results for the compressed liquid, from the triple- to the boiling-point, were estimated by use of the highly constrained, nonanalytic equation of state, because experimental P-rho-T data are lacking in this region. GRA

N80-15296# Purdue Univ., Lafayette, Ind. School of Materials Engineering.
SULFUR FIXATION DURING COAL GASIFICATION Final Report, 1 Mar. 1975 - 28 Feb. 1978
R. Schuhmann, Jr., R. H. Spitzer, and A. J. Mehta 15 Dec. 1978 107 p refs
(Grant NSF AER-75-02665)
(PB-301104/6; PRF-8601) Avail: NTIS HC A06/MF A01 CSCL 07A

The development of basic engineering data for design of a coal gasification process in which the sulfur is fixed and separated in chemical combination with iron is reported. Results of thermodynamic calculations and phase equilibrium studies conducted for the ternary condensed systems Fe-O-S and Fe-C-S, and for equilibria of condensed phases in these systems with gases containing various combinations of C, O, H, and S are given. It is shown that iron oxides, metallic iron, and iron silicates should be effective sulfur fixation agents over wide ranges of gas compositions and gasification temperature, both below and above the melting point of iron sulfide. GRA

N80-15297# Texas A&M Research Foundation, College Station. Dept. of Chemical Engineering.
CONVERSION OF COAL-BASED METHANOL TO ETHYLENE AND A GASEOUS FUEL Final Report, 1 Oct. 1975 - 30 Sep. 1978
Rayford G. Anthony 1 Dec. 1978 47 p ref
(Grant NSF AER-74-20135)
(PB-301256/4; NSF/RA-780616) Avail: NTIS HC A03/MF A01 CSCL 07A

Development of a catalytic process which converts methanol into ethylene and a gaseous fuel similar to natural gas is reported. An AW500 type catalyst proved to be the best catalyst for converting methanol into ethylene. 80 to 98 percent of the alcohol being converted into 16 to 60 percent yields of ethylene. Coal-based methanol was converted into a gaseous mixture composed of 50 percent dimethyl ether, 33.3 percent hydrogen and 16.7 percent carbon monoxide by passing the alcohol over alumina and zinc chromite catalysts at 300-500 C. The major cost of producing ethylene or gaseous fuel is the initial cost of synthesis gas produced from coal that is subsequently used to produce methanol. GRA

N80-15298# New Mexico Energy Inst., Las Cruces.
ECONOMIC ANALYSIS OF SMALL SCALE BIOCONVERSION UNITS IN NEW MEXICO Final Report, 1 Sep. 1977 - 31 May 1979
Wendell Hull and Eugene E. Staffeldt Jun. 1979 156 p refs
(Contract EMD-77-2202)
(PB-301390/1; NMEI-37) Avail: NTIS HC A08/MF A01 CSCL 21D

Three New Mexico agribusinesses were analyzed to find an economic method for converting biomass from agricultural sources to methane. Primary design goals were simplicity, least-cost construction, and safe operation. Two basic digestion systems were designed. They vary only in digester vessel and related component size, not in operation. Each system was evaluated with respect to cost and operational characteristics. Recommendations are given for each business studied. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-15299*# Old Dominion Univ. Research Foundation, Norfolk, Va.
SOIL ANALYSES AND EVALUATIONS AT THE IMPACT DYNAMICS RESEARCH FACILITY FOR TWO FULL-SCALE AIRCRAFT CRASH TESTS Final Report, 24 May - 31 Aug. 1977
Robert Y. K. Cheng Dec. 1977 36 p refs
(Contract NAS1-14193)
(NASA-CR-159199) Avail: NTIS HC A03/MF A01 CSCL 08M

The aircraft structural crash behavior and occupant survivability for aircraft crashes on a soil surface was studied. The results of placement, compaction, and maintenance of two soil test beds are presented. The craters formed by the aircraft after each test are described. J.M.S.

N80-15300*# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
DIRECTIONAL SOLIDIFICATION AT ULTRA-HIGH THERMAL GRADIENT Final Report
M. C. Flemings, D. S. Lee, and M. A. Neff Jan. 1980 34 p refs
(Grant NsG-3046)
(NASA-CR-159797) Avail: NTIS HC A03/MF A01 CSCL 13H

A high gradient controlled solidification (HGC) furnace was designed and operated at gradients up to 1800 C/cm to continuously produce aluminum alloys. Rubber 'O' rings for the water cooling chamber were eliminated, while still maintaining water cooling directly onto the solidified metal. An HGC unit for high temperature ferrous alloys was also designed. Successful runs were made with cast iron, at thermal gradients up to 500 C/cm. K.L.

N80-15301# California Inst. of Tech., Pasadena.
LEADING EDGE FLUTTER OF A SUPERCAVITATING HYDROFOIL Ph.D. Thesis
Kiam Thian Oey 1979 150 p refs
(Contract N00014-75-C-0379)
(AD-A074636) Avail: NTIS HC A07/MF A01 CSCL 20/4

Leading edge flutter is a problem that is unique to a supercavitating hydrofoil. At high speed, the leading edge portion has been observed to oscillate while the trailing edge remains motionless. In this study, several flat plate hydrofoils were tested. The experimental results indicate that the phenomenon is a complex function of speed, angle of attack, cavitation number and mass ratio. Leading edge flutter was also observed to cause cavity pinching. A theoretical study was also conducted. Two mathematical models are presented here. The first one models the flexible chord foil as a rigid chord foil hinged at the trailing edge; the second model treats the fluid-structure interaction problem of a flexible chord foil cantilevered at the trailing edge. Both models resemble leading edge flutter near zero cavitation number in some respects. At short and moderate cavity lengths, leading edge flutter phenomenon is influenced by the cavity closure condition. GRA

N80-15302# Total Environmental Action, Inc., Harrisville, N.H.
DESIGN OF RESIDENTIAL BUILDINGS UTILIZING NATURAL THERMAL STORAGE Final Report
D. Lewis, C. Michal, and P. Pietz Jun. 1979 239 p refs
(Contract EY-76-C-02-0016)
(DOE/TIC-10143) Avail: NTIS HC A22/MF A01

The technical and economic feasibility of the uses of natural thermal storage NTS in residential construction in the north central and northeast U.S. is examined. For many NTS applications, the percentage savings in heating and cooling are impressive, but the actual value of the energy saved is found to be insufficient to justify the incremental cost of NTS over reasonable levels of insulation and other energy strategies. NTS in the form of modified Trombe walls, when combined with energy conserving construction methods, is found to be an effective, available and marketable

system. A prototypical residence incorporating this NTS system is designed for instrumentation and as a demonstration of NTS principles. Annual space conditioning costs are reduced to one-third of those found in new construction built to current codes, and less than one-fifth the costs found in typical existing homes. DOE

N80-15303# California Univ., Livermore. Lawrence Livermore Lab.
ELASTIC-PLASTIC ANALYSES FOR SEISMIC RESERVE CAPACITY IN POWER PLANT BRACED FRAMES
T. A. Nelson and R. C. Murray 4 Oct. 1978 89 p refs
(Contract W-7405-eng-48)
(UCRL-52614) Avail: NTIS HC A05/MF A01

Elastic and elastic-plastic seismic analyses were conducted on a braced steel frame using eight time-history records. In order to ensure operability, a frame model incorporating a piping system was subjected to the above seismic loadings using elastic analyses. It was found that the piping system components controlled the seismic capacity of the combined structure. The average results show a reserve capacity of 2.6 times the seismic design level. DOE

N80-15304# New Brunswick Electric Power Commission, Fredericton. Commercial Div.
MEASUREMENT OF ENERGY TO HEAT HOUSES: INITIAL STUDY
Verne Ireton 6 Jun. 1979 35 p refs
(PB-299448/2) Avail: NTIS HC A03/MF A01 CSCL 13A

A program of measurement of the energy consumed for residential space heating was instituted during the summer of 1978. It was felt that heat loss calculations are very conservative and that there is a much larger difference between the energy consumed by a combustion system and an electrical system than that calculated by assuming a furnace efficiency' or a 'seasonal performance factor'. The results obtained during the 1978/79 heating season are presented. GRA

N80-15305# Transportation Research Board, Washington, D.C.
PAVEMENT EVALUATION AND OVERLAY DESIGN: A SYMPOSIUM AND RELATED PAPERS
Mohamed Y. Shahin, Michael I. Darter, Starr D. Kohn, W. A. Phang, and Richard A. Weiss 1979 121 p refs
(PB-299896/1; TRB/TRR-700; ISBN-0-309-02848-5; LC-79-18461) Avail: NTIS HC A06/MF A01; Hard copy also available from Transportation Research Board, 2101 Constitution Ave., N.W. Washington, D.C. 20418, HC $6.20 CSCL 13B

Pavement condition ratings and rehabilitation needs are discussed along with pavement overlay design techniques based on layered elastic theory, vibratory nondestructive testing, falling weight deflectometer measurements, visible pavement distress, and road test data. The minimization of reflection cracking in bituminous concrete overlays on portland cement pavements and in asphalt concrete overlays is also discussed. K.L.

N80-15306# Transportation Research Board, Washington, D.C.
QUALITY ASSURANCE: PERFORMANCE, SEALERS AND MATERIALS VARIATION
Richard M. Weed, Davis A. Law, Gerald L. Anania, E. Otte, and S. N. Runkle 1979 28 p refs
(PB-299895/3; TRB/TRR-697; ISBN-0-309-02846-9) Avail: NTIS MF A01; Paper copy available from Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D.C. CSCL 13B

The following topics are discussed: optimum performance under a statistical specification; acceptance sampling of neoprene joint sealers; variations in quality of treated materials arising during construction; and highway quality assurance. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-15307*# Axiomatix, Los Angeles, Calif.
SHUTTLE ORBITER S-BAND PAYLOAD COMMUNICATIONS EQUIPMENT DESIGN EVALUATION Final Report
James C. Springett and Robert G. Maronde 30 Nov. 1979 181 p refs
(Contract NAS9-15792)
(NASA-CR-160438; R7911-4) Avail: NTIS HC A09/MF A01 CSCL 17B

The analysis of the design, and the performance assessment of the Orbiter S-band communication equipment are reported. The equipment considered include: network transponder, network signal processor, FM transmitter, FM signal processor, payload interrogator, and payload signal processor. F.O.S.

N80-15308*# Texas Univ. at Austin. Electrical Engineering Research Lab.
CTS ATTENUATION AND CROSS POLARIZATION MEASUREMENTS AT 11.7 GHz Final Report, 1 Feb. 1978 - 31 Jan. 1979
W. J. Vogel May 1979 138 p refs
(Contract NAS5-22576)
(NASA-CR-159952) Avail: NTIS HC A07/MF A01 CSCL 20N

Attenuation and cross-polarization isolation at 11.7 GHz, measured at Austin, Texas by receiving the circularly polarized emissions from the CTS satellite are presented. A 12 month summary for Feb 78 to Jan 79 is presented. For .016 percent of the time the attenuation was greater than 10 dB, the isolation was less than 21 dB and the rainrate exceeded 55 mm/hr. Ice depolarization was observed frequently. M.M.M.

N80-15309# Texas Instruments, Inc., Dallas.
LIMITED VOCABULARY CONTINUOUS WORD RECOGNITION Final Technical Report, Aug. 1977 - Jan. 1979
Robert L. Davis, Bruce G. Secrest, and Craig J. Cato Griffiss AFB RADC Aug. 1979 121 p refs
(Contract F30602-77-C-0139; AF Proj. 4027)
(AD-A074206; RADC-TR-79-204) Avail: NTIS HC A06/MF A01 CSCL 17/2

The capability of recognizing a limited vocabulary (20 words) from continuous speech, independent of a limited number of speakers was developed. Emphasis was placed on three major areas: (1) high performance, speaker independent, connected digit recognition for syntactically unconstituted digit sequences; (2) clustering algorithms for use in the development of sets of reference patterns for speaker independent word recognition; and (3) automatic enrollment for speaker dependent, connected word recognition for syntactically unconstrained word sequences of 20 words. The program culminated in the installation of the speaker independent, connected digit recognition program on the base installation security system's advanced development model speaker verification system. R.C.T.

N80-15310# Ohio State Univ., Columbus. Electroscience Lab.
ANALYSIS OF WIRE ANTENNAS MOUNTED NEAR OR AT THE EDGE OF A HALF-PLANE
D. M. Pozar and E. H. Newman Aug. 1979 51 p refs
(Grant DAAG29-76-G-0331)
(AD-A074450; ESL-784569-9; ARO-14012.5-EL) Avail: NTIS HC A04/MF A01 CSCL 09/5

The problem of a monopole antenna mounted near or at the edge of a half-plane is solved using a hybrid moment method solution with an integral expression for the exact half-plane Green's function, and by the MM/GTD method. Results are presented for input impedance of a lambda/4 monopole vs distance from the half-plane edge, and vs. angle for an edge-mounted antenna. Simple expressions for the surface current density induced on the half-plane are derived and used to synthesize an attachment mode for use with the author's previously developed surface patch moment method solution when a wire is attached at or near an edge of a finite plate. GRA

N80-15311# Ohio State Univ., Columbus. Electroscience Lab.
POWER OPTIMIZATION IN ADAPTIVE ARRAY: A TECHNIQUE FOR INTERFERENCE PROTECTION
R. T. Compton, Jr. Jul. 1979 32 p refs

(Contract N00019-79-C-0281)
(AD-A074429; ESL-711847-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report describes a weight control algorithm that may be used in a 2-element adaptive array to protect a desired signal from an interference signal. The algorithm is a constrained gradient technique that either maximizes or minimizes array output power. It is shown that by choosing appropriately between minimization and maximization, a useful desired signal-to-interference-plus-noise ratio can be maintained at the array output over a wide range of signal powers. GRA

N80-15312# Naval Weapons Center, China Lake, Calif.
SYNTHESIS OF SPREAD SPECTRUM SIGNALS FROM THE NON-BINARY GALOIS FIELD
W. O. Alltop May 1978 40 p refs
(AD-A074604; GIDEP-E117-0706; NWC-TM-3475) Avail: NTIS HC A03/MF A01 CSCL 09/4

Maximal linearly recurring sequences over GF(p) are used to construct periodic, polyphase, spread spectrum signals, for p any odd prime. Sequences over GF(q), where q is a power of p, are also employed in the synthesis of pairs and triples of orthogonal signals. The orthogonal signals are ternary, utilizing the two phases 0 and pi as well as intervals of shutdown. Spectral properties of the ternary codes are discussed. The difficulties of high-speed generation of linear sequences for odd primes are also presented. Although the linear sequences over GF(p) have been known for at least four decades, they have not yet been as well exploited in signal design as have binary sequences. GRA

N80-15313# Naval Postgraduate School, Monterey, Calif.
DESIGN OF THE DIGITAL CONTROL AND TEST UNIT SUBSYSTEMS FOR A SATELLITE SIGNAL ANALYZER M.S. Thesis
Clyde Musgrave Jun. 1979 143 p refs
(AD-A073928) Avail: NTIS HC A07/MF A01 CSCL 09/5

The Satellite Signal Analyzer (S.S.A.) will provide Real Time Spectrum Analysis of Communication Satellite UHF Signals. This thesis documents the digital control and test unit subsystems of this S.S.A. The digital control subsystem was designed and built to interface the PDP 11/34 MINICOMPUTER to all digitally controlled devices within the system. The control bus (CIB) provides 32 BITS of digital control on a single board. The TEST UNIT subsystem was designed and built to provide the capability to monitor various signals within the S.S.A. as well as conduct self-checks. The TEST UNIT is capable of measuring the Noise Figure/Temperature of the system receivers, monitoring the level and frequency of system signals, injecting signals into the receivers and transmitting signals to satellites. GRA

N80-15314# Naval Postgraduate School, Monterey, Calif.
NARROWBAND VOICE SYSTEM M.S. Thesis
Raymond Roy Hitchcock Jun. 1979 65 p refs
(AD-A074445) Avail: NTIS HC A04/MF A01 CSCL 09/4

The problem of how to accommodate more simultaneous users in a given bandwidth communications channel was examined. It was determined that voice signals could be reduced in bandwidth by 50 percent. Two speech formants, F1 and F3, were filtered from the speech signal and frequency translation performed to form a compact audio signal. At the receiver this process is reversed and the formants returned to their normal spectral positions. Intelligibility scores of 94 percent were obtained in a listening test conducted using the two formants F1 (250-650 Hz) and F3 (1950-2450 Hz). GRA

N80-15315# ITT Defense Communications Div., Nutley, N.J.
PHASED ARRAY ANTENNA AMPLIFIER EXPLORATORY DEVELOPMENT MODEL Final Report, Jun. 1977 - Jun. 1979
P. Muscianesi, J. Irvine, and J. Ranghelli Fort Monmouth, N.J. Army Communications Research and Development Command Aug. 1979 325 p
(Contract DAAB07-77-C-0146; DA Proj 1L7-62701-AH-92)
(AD-A074961; CORADCOM-77-0146-F) Avail: NTIS HC A14/MF A01 CSCL 09/5

This final report describes the design characteristics and test results of a scale model (mechanically steerable) Phase Array Antenna Amplifier. As a result of this development investigation, a design approach for a 1 KW system is presented. This report is prepared in two parts. The first part describes the development effort for the scale model system including specifications, design details, photographs, system diagram, test results, and trade off analyses. The second part of this report covers the design approach selected for a 1 KW system. This design approach is based upon the technical accomplishments resulting from the scale model development. GRA

N80-15316# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.
SHOCK PROPAGATION IN THE THREE-DIMENSIONAL LATTICE, 2. METHOD OF CALCULATION
John D. Powell Jun. 1979 61 p
(DA Proj. 1L1-61102-AH-43)
(AD-A074263; AD-E430290) Avail: NTIS HC A04/MF A01 CSCL 20/11

A computer-molecular-dynamic (CMD) technique for simulating shock propagation in a three-dimensional, face-centered-cubic lattice has been developed. The first report in this sequence described the model used and the results of the calculation. This report contains the details of the calculation, a listing of the computer code, definitions of major symbols, and a brief description of the subprograms. GRA

N80-15317# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
THE USE OF CLASSIFIERS AND MICROPROCESSORS FOR TARGET IDENTIFICATION ON USING MILLIMETER WAVE SIGNATURES
P. Martin Alexander Apr. 1979 50 p refs
(AD-A074840; DRDMI-T-79-50) Avail: NTIS HC A03/MF A01 CSCL 09/2

The problem of implementing three basic classification techniques for target acquisition in millimeter wave guided weapon systems is discussed in this report. The three classifiers are: (1) the maximum likelihood classifier, (2) the nearest neighbor classifier, and (3) the linear classifier. The mathematics of each classifier is explicitly delineated in order to assess memory storage and computation load requirements. Using these results, the applicability of microprocessors for implementing these classifiers into fieldable systems is considered. It is shown that the classifiers are easily adaptable to experimental target signatures and that the use of microprocessors is requisite. GRA

N80-15318# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE, 23 APRIL - 2 SEPTEMBER 1978
Robert P. Pagliarulo, John P. Turtle, John E. Rasmussen, Wayne I. Klemetti, and Robert L. Cooley Mar. 1979 90 p refs
(AF Proj. 4600)
(AD-A074762; RADC-TR-79-100) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplementary information. GRA

N80-15319# Physics International Co., San Leandro, Calif.
PULSER FOR VERTICALLY POLARIZED DIPOLE FACILITY (VPD-2) Final Report
Jul. 1979 83 p ref
(Contract F29601-76-C-0048; AF Proj. 1209)
(AD-A074838; AD-E200365; PI-FR-900; AFWL-TR-78-243) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report will provide an outline of the pulser system design features and will give an account of both the factory and site acceptance test procedures and results. During the testing periods certain modifications were found to be necessary in order to improve the performance. These modifications are described. Ultimately, a performance limitation was realized when the pulser was operated into the full VPD-II antenna structure, a limitation which could not be removed without a major redesign of the output peaking circuit. This will be discussed in the report summary

and some tentative suggestions for a future-up-grading will be offered. GRA

N80-15320# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
ELECTROMAGNETIC TRANSMISSION THROUGH AN ANNULAR APERTURE IN AN INFINITE CONDUCTING SCREEN
Chung-Chi Cha and Roger F. Harrington Sep. 1979 93 p refs
(Contract N00014-76-C-0225)
(AD-A074831; TR-79-11) Avail: NTIS HC A05/MF A01 CSCL 20/14

Electromagnetic transmission through an annular aperture in an infinite conducting screen of zero thickness is investigated. The circular aperture is included as a special case. The fields on both sides of the screen are obtained from the free space Green's function by means of the equivalence principle and image theory. An integral equation for the equivalent magnetic current in the aperture is established by enforcing the continuity of the tangential components of both the electric and the magnetic field. This integral equation is solved by the method of moments to obtain the magnetic current, from which other transmission characteristics are obtained. GRA

N80-15321# Air Force Weapons Lab., Kirtland AFB, N. Mex.
ELECTROMAGNETIC PULSE INTERACTION NOTES: EMP 3-39 Final Report
Carl E. Baum Jul. 1979 416 p refs Sponsored in part by DOE
(AF Proj. 9996)
(AD-A074265; AD-E200363; AFWL-TR-79-402) Avail: NTIS HC A18/MF A01 CSCL 20/14

This is a series of notes on electromagnetic pulse interaction. Subjects covered are: Electromagnetic Penetration Through a Circular Aperture in a Plane Screen Separating a Conducting Medium and a Nonconducting Medium; Small Aperture on a Multiconductor Transmission Line Filled with Inhomogeneous Dielectrics; On the Electromagnetic Field Excitation of Unshielded Multiconductor Cables; A Coupling Model for a Pair of Skewed Transmission Lines; On the Analysis of General Multiconductor Transmission-Line Networks; Field Excitation of Multiconductor Transmission Lines; Diffraction through a Circular Aperture in a Screen Separating Two Different Media; and The Receiving Properties of the Small Annular Slot Antenna GRA

N80-15322# RAND Corp., Santa Monica, Calif.
NOMOGRAMS FOR THE CALCULATION OF PROPAGATION EFFECTS ON TACTICAL MILLIMETER WAVE RADIO LINKS Interim Report, 1 Jan. - 1 Jul. 1979
William Sollfrey Aug. 1979 36 p refs
(Contract DAAB07-77-C-0142)
(AD-A073900; CORADCOM-77-0142-1) Avail: NTIS HC A03/MF A01 CSCL 20/14

Description of the development and use of nomograms for calculating propagation effects on tactical millimeter-wave radio links are investigated. The principal causes of attenuation in the millimeter-wave band (35-75 GHz) are oxygen absorption, which depends on radio frequency, and rain scattering, which depends on frequency and rain rate. The nomograms display these dependencies and the range equation, and may be used to calculate communication system performance as a function of range, frequency, and rain rate by simply drawing straight lines between scales. Use of the nomograms is illustrated by several worked examples. By following the techniques demonstrated in the examples, the user should be able to solve link performance problems speedily and simply. Author (GRA)

N80-15323# CNR, Inc., Needham, Mass.
HF MODEM EVALUATIONS FOR THE ADVANCED NARROWBAND DIGITAL VOICE TERMINAL (ANDVT) Final Report
David Chase, Phillip A. Bello, Charles Boardman, Leslie Pickering, and Robert Pinto Nov. 1978 129 p
(Contract N00173-78-C-0041)
(AD-A073674) Avail: NTIS HC A07/MF A01 CSCL 17/2

During this program, the specifications for the ANDVT HF modem have been refined and detailed evaluation and simulation of the new technical features within this modem have been conducted. These include a multiple-tone signal detection format with an adaptive threshold, a multiple-tone/multiple-stage Doppler estimation algorithm, a matched filter frame estimation algorithm utilizing PN correlation properties, a low-rate error-correction coding approach for protection of the KG sync sequences, an error-correction coding approach specifically designed to protect the critical speech parameters, use of soft-decision (channel measurement) information obtained from the demodulator, and decision-directed Doppler tracking utilizing information from all data tones. The analytical and simulation results provide the desirable result that the preamble can be successfully received at a lower SNR than is required for the reception of high-quality 2400-b/s digitized voice. GRA

N80-15324# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
METHOD OF OPTIMAL TRUNCATION: A NEW T-MATRIX APPROACH TO ELASTIC WAVE SCATTERING
W. M. Visscher 1979 16 p refs Presented at the Conf. on Focus on the T-Matrix Approach, Columbus, Ohio, 25 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1954; CONF-7906109-1) Avail: NTIS HC A02/MF A01

A family of matrix theories of elastic wave scattering is derived, and one, which is in a certain sense optimal, is developed. The method of optimal truncation (MOOT), results from a minimum principle and is shown to yield a convergent sequence of approximations. Numerical results for scattering cross sections for longitudinal incident waves with ka less than or equal to 10 from fixed rigid obstacles and voids with axial symmetry are obtained using MOOT, and are compared with results of other matrix theories. Shapes considered include spheres, oblate and prolate spheroids, pillboxes, and cones. Convergence is demonstrated. Extension of the method to elastic and fluid inclusions is discussed, as is its application to cracks, which may be accomplished by simulating the crack with an incompletely bonded identical inclusion. Implications of reciprocity and time reversal invariance are discussed. DOE

N80-15325# National Technical Information Service, Springfield, Va.
ANTENNA SIDELOBE AND INTERFERENCE REDUCTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1979
William E. Reed Oct. 1979 171 p Supersedes NTIS/PS-78/0983; NTIS/PS-77/0889; NTIS/PS-76/0776
(NTIS/PS-79/1013/6; NTIS/PS-78/0983; NTIS/PS-77/0889; NTIS/PS-76/0776) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Research covering techniques for sidelobe cancellation and interference rejection is presented. Techniques include signal processing, beam forming, null steering, adaptive systems, phase shifters, element spacing, filters, and electromagnetic absorbing materials. (This updated bibliography contains 163 abstracts, 15 of which are new entries to the previous edition.) GRA

N80-15326# New Mexico Univ., Albuquerque.
HORN ANTENNAS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Aug. 1979
Gerald F. Zollars Oct. 1979 37 p Sponsored by NTIS
(NTIS/PS-79/1018/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Citations to the international literature concerning studies of horn antennas are presented. Antenna design, antenna radiation patterns, and antenna feeds are the major topics included. Contains 154 citations. GRA

N80-15327# National Technical Information Service, Springfield, Va.
LIGHT COMMUNICATION SYSTEMS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jun. 1976 - Aug. 1979
William E. Reed Oct. 1979 289 p Supersedes NTIS/PS-78/0873; NTIS/PS-77/0591; NTIS/PS-76/0511; NTIS/PS-75/412

(NTIS/PS-79/0998/9; NTIS/PS-78/0873; NTIS/PS-77/0591; NTIS/PS-76/0511; NTIS/PS-75/412) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

The design, performance, and application of laser, infrared, and visual communication systems are covered in the cited research report. Transmission and equipment studies for space, atmospheric, and underwater light communication are presented. Topics covered include lasers, fiber optics, signal processing, transmission links, and data transmission. This updated bibliography contains 283 abstracts, 52 of which are new entries to the previous edition. GRA

N80-15328# East-West Communication Inst., Honolulu, Hawaii.
SATELLITE TELEVISION IN INDONESIA Final Report, Sep. 1977 - Feb. 1979
Godwin C. Chu Aug. 1979 343 p
(Grant NSF INT-77-15160)
(PB-299524/9; NSF/INT-15160) Avail: NTIS HC A15/MF A01 CSCL 17B

Surveys, program content analysis, and an examination of policy goals and institutional factors, are presented in order to explain the long-term social impact of television in Indonesia. Specific areas covered include cognitive and cultural effects, behavioral effects, intra-institutional relations, and inter-institutional relations. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g. tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-15329# Rand Afrikaans Univ., Johannesburg (South Africa). Dept. of Electrical and Electronic Engineering.
AN EXPERIMENTAL STUDY OF THE INSTABILITY OF THYRISTOR CONTROLLED SYSTEMS
A. J. Pienaar Jan. 1977 42 p refs
(RAU-EI-74-2-4; ISBN-0-86970-105-3; RR-77-22) Avail: NTIS HC A03/MF A01

Experimental investigation of the stability of an analog speed control system by means of a controlled thyristor bridge for a 75kW dc-motor is described. State space techniques with pole assignment are used to find a suitable system decription in terms of the motor parameters and gain constants. The method of pulse forming and shifting is described in detail. It is also demonstrated that because of too fast armature current loop, ripple instability results by increasing the gain of the current error amplifier to a critical value. The effect of greater pulse error on the system is shown for continuous and discontinuous armature current. M.G.

N80-15330# Varian Associates, Palo Alto, Calif. Central Research Lab.
INDIUM PHOSPHIDE GUNN DEVICES (26-60GHz) Final Report, 1 May 1977 - 31 Mar. 1979
J. D. Crowley, S. B. Hyder, and B. R. Cairns 15 Aug. 1979 135 p refs
(Contract N00123-77-C-0459)
(AD-A074549; NOSC/TD-275) Avail: NTIS HC A07/MF A01 CSCL 09/5

The program described is directed to the development of InP material and devices for low noise, broad bandwidth amplifier operation in the 26.5 to 40.0 and 40.0 to 60.0 GHz bands. Final objectives are low noise amplifiers covering the 26.5 to 40.0 GHz and low noise amplifiers with bandwidth greater than 10% covering the 40.0 to 60.0 GHz band. GRA

N80-15331# Research Advisory Inst., Inc., South Laguna, Calif.
SUPERCONDUCTING MICROWAVE PULSE AMPLIFIER Final Report
D. L. Birx, G. J. Dick, W. A. Little, J. E. Mercereau, and D. J. Scalapino Jul. 1979 24 p refs
(Contract N00014-75-C-1115)
(AD-A074056; RAI-111) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report summarizes the preliminary research and development of a new and novel technique for very high power microwave pulse amplification. The technique is based on the principle of time compression and is most efficient when utilized in conjunction with superconducting (cryogenic) components. However, it has also been shown to be applicable as a purely ambient temperature device. Very high power microwave pulses appear to be feasible with this technique. GRA

N80-15332# Rome Air Development Center, Griffiss AFB, N.Y.
TWO-POLE VARACTOR-TUNED HELICAL RESONATOR FILTERS Technical Report, Jan. 1977 - Mar. 1979
Martin R. Stiglitz Jun. 1979 21 p refs
(AF Proj. 4600)
(AD-A074476; RADC-TR-79-182) Avail: NTIS HC A02/MF A01 CSCL 09/5

Two-pole varactor-tuned helical resonator filters that operate in the 960 to 1215 MHz band have been designed and built. They exhibit group delays of less than 10 microsec, and can be constructed to have insertion losses of 3 dB or less. Two designs have been investigated, one where both sections of the filter were tuned with a single bias source, and the other where each section was tuned individually. Varactor diodes are sensitive to changes in input power level and they are saturated at rf power levels above 0.3 mW. Tunin- speeds of 10 microsec are possible when care is taken to minimize the inductances in the bias circuits. GRA

N80-15333# Purdue Univ., Lafayette, Ind. Turner Lab. for Electroceramics.
THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Quarterly Report no. 2, 1 May - 31 Jul. 1979
R. W. Vest 31 Aug. 1979 48 p refs
(Contract N00019-79-C-0240)
(AD-A074907; QR-2) Avail: NTIS HC A03/MF A01 CSCL 09/1

Measurements of the high temperature viscosities and surface tensions of thick film glasses, as a function of temperature and amount of AlsiMag 614 substrate dissolved in the glasses, were completed. Both glass properties were observed to increase with increasing amount of dissolved substrate at all temperatures. The non-sintered contacts occurring in the RuO2 networks of thick film resistors were modeled using MIM devices. The dominant charge transport mechanism for glass films = 7nm at room temperature and above was Schottky emission; for thinner films and/or lower temperature, quantum mechanical tunneling becomes important. GRA

N80-15334# Naval Postgraduate School, Monterey, Calif.
GEOMETRIC DESIGN TECHNIQUE FOR TWO-DIMENSIONAL ANALOG AND DIGITAL FILTERS M.S. Thesis
Coskun Zumrutkaya Jun. 1979 154 p refs
(AD-A073963) Avail: NTIS HC A08/MF A01 CSCL 09/3

A technique for the use of semi-infinite planes to approximate the log magnitude versus log frequency characteristics of two-dimensional filters is presented (Extended Bode approach). This technique is applied to quarter plane filters and works well for separable transfer functions. Other non-separable canonic (basic) transfer functions are also studied in terms of their planar approximation. The general technique is shown to be useful for the insight it provides as well as being a simple approach to design. The double bilinear z-transform is studied for use with the two-dimensional analog transfer functions to convert them to the digital domain. GRA

N80-15335# Microwave Associates, Inc., Burlington, Mass.
Ka-BAND MICROWAVE INTEGRATED CIRCUIT SPDT SWITCH DEVELOPMENT Final Report, 11 Sep. 1977 - 30 Jun. 1979
Charles Buntschuh Jun. 1979 83 p refs
(Contract N00173-77-C-0246)
(AD-A074602) Avail: NTIS HC A05/MF A01 CSCL 09/1

The report describes the design and development of Ka-band

(26.5 - 40 GHz) microstrip and finline microwave integrated circuit SPDT switches with drivers. The report describes the plated heat sink PIN diodes and the waveguide to microstrip and fineline transitions used in the designs. Final performance data are presented and compared for both types of switches. It concludes that microstrip is the superior medium for integrated circuit switches. GRA

N80-15336# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
LOW PRESSURE, HIGH VOLTAGE DISCHARGES FOR THE PRODUCTION OF ENERGETIC ELECTRON BEAMS Final Report, 20 May 1975 - 20 May 1979
J. T. Verdeyen Sep. 1979 25 p refs
(Grant DAHC04-75-G-0132)
(AD-A074556; ARO-12528.1-P) Avail: NTIS HC A02/MF A01 CSCL 09/5

The fundamental theories of gas discharges offer widely varying predictions for the relative power input to the negative glow. Calorimetric measurements have been made in a planar helium discharge of the power input to the negative glow relative to the total input power. These measurements show that the limiting efficiency of devices working in this region (e.g., hollow cathode lasers) is approximately 30-40%. To aid in the interpretation of the experimental results a simplified theoretical model was derived. GRA

N80-15337# Harry Diamond Labs., Adelphi, Md.
CHARACTERISTICS OF OROTRON OSCILLATION AND AMPLIFICATION. 1. POWER AND FREQUENCY CHARACTERISTICS
Richard P. Leavitt Jul. 1979 17 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A074761; HDL-TR-1899) Avail: NTIS HC A02/MF A01 CSCL 09/5

Power and frequency characteristics of orotron oscillation and amplification are derived from an equivalent circuit representation of the orotron. Feedback in the orotron (beam bunching) is represented by a negative conductance in parallel with a complex admittance representing the passive open resonator. This system is driven by a current source that represents either noise (Smith-Purcell radiation) in the oscillator mode or an external driver in the amplifier mode. Conditions for excitation of the orotron as an oscillator are derived, and the line width of the output radiation is computed below and above threshold. It is shown that the orotron acts as a linear amplifier below threshold and the product delta(o)(Ap) to 1/2 power remains constant as a function of beam current, where to 1/2 power is the half bandwidth of the device and (Ap) is the small-signal power gain. Amplification characteristics are investigated for excitation by a driver with a finite frequency spread. GRA

N80-15338# Naval Postgraduate School, Monterey, Calif.
AN IN-DEPTH STUDY OF THE SENSITIVITY OF WAVE DIGITAL FILTERS
Masoud Sanaie-Fard Jun. 1979 241 p refs
(AD-A073862) Avail: NTIS HC A11/MF A01 CSCL 09/2

A detailed analytical and experimental study of the sensitivity of Wave Digital Filters has been conducted. The results indicate that the wave digital filter tends to achieve the same low sensitivity characteristic as the analogue circuit from which it was derived. Other results indicate relatively higher sensitivity to terminating resistance values compared with internal element values, lower sensitivity for algorithms derived from simple rather than multiple elements, and higher sensitivity at the critical frequencies. Finally the rms error due to the quantization in the number of bits in the multiplier coefficients has been measured at approximately 3 db per bit for the many examples tested. GRA

N80-15339# Naval Ocean Systems Center, San Diego, Calif.
SPECTRAL, FAR-FIELD, AND NEAR-FIELD MEASUREMENTS OF FIVE LIGHT-EMITTING DIODES Progress Report, Apr. - May 1979
C. R. Zeisse and S. A. Miller Jul. 1979 50 p
(AD-A074517; NOSC/TD-265) Avail: NTIS HC A03/MF A01 CSCL 09/1

Contents: Spectral Measurement; Far-Field Measurements; Near-Field Measurements; Appendix A: Geometry of the Far-Field Goniometer; Appendix B: Coordinate System for Far-Field Grey Scale and Contour Representations. GRA

N80-15340# Spire Corp., Bedford, Mass.
RESEARCH ON LOW TEMPERATURE, DIRECTED ENERGY PROCESSING OF VERY LARGE SCALE INTEGRATED STRUCTURES Semiannual Report, 1 Jan. - 30 Jun. 1979
Anton Greenwald Jul. 1979 60 p refs
(Contract MDA903-79-C-0212; ARPA Order 3713)
(AD-A074127; SAR-79-10065-01) Avail: NTIS HC A04/MF A01 CSCL 09/1

The goal of this research program is to demonstrate processing techniques which can eliminate the need for high temperature thermal cycling of silicon wafers in fabricating very large scale integrated (VLSI) devices. Maintaining low temperatures for all processing reduces plastic deformation, diffusion and autodoping problems which would limit the application of submicron geometry design rules. Pulsed electron beam surface heating of the top micron of material is being investigated for annealing of ion-implantation damage and epitaxial regrowth of low temperature chemical-vapor-deposition (CVD) polycrystalline silicon films. Initial research has demonstrated the epitaxial regrowth of 0.3 micron films deposited at 800 C. Annealing of ion-implantation damage typical of buried layer applications has also been demonstrated. Effective uniformity of processing has been improved to + or - 4 percent in one (electron beam) pulse covering the surface of a 3-inch-diameter wafer. Research planned in the next 6 months will stress lower deposition temperatures and pulsed nonmelting techniques for annealing implantation damage. The program is about 2 months ahead of schedule. GRA

N80-15341# Harry Diamond Labs., Adelphi, Md.
A REFLEX TRIODE WITH GEOMETRIC FOCUSSING
Alan Bromborsky, Howard E. Brandt, and R. Alan Kehs Jun. 1979 14 p refs
(DA Proj. 1L1-61102-AH-44)
(AD-A074453; HDL-TM-79-5) Avail: NTIS HC A02/MF A01 CSCL 09/1

Experimental results show that the ion beam generated by a simple reflex triode can be geometrically focussed, yielding an order of magnitude increase in current density (1.1 kA/sq cm) over a comparable nonfocussing triode geometry. Details are given for shaping the anode and cathode surfaces so that significant focussing can be achieved. GRA

N80-15342# Princeton Univ., N. J. Dept. of Electrical Engineering.
STUDY OF ELECTRONIC TRANSPORT AND BREAKDOWN IN THIN INSULATING FILMS
Walter C. Johnson 1 Dec. 1978 87 p refs
(Contract DAAG53-76-C-0059; ARPA Order 3466)
(AD-A074457; NVL-0059-009; SATR-6) Avail: NTIS HC A05/MF A01 CSCL 11/6

Recent progress is reported in an ongoing program of studies of high-field effects in thin insulating films on semiconducting substrates. The investigations reported here include further studies of the high-field generation of interface states in the Si-SiO2 system, a comparison between the effects of ionizing radiation and high-field stress in generating interface states in MOS capacitors, and a study of the characteristics of charge trapping in CVD Al2O3 on silicon. GRA

N80-15343# Physics International Co., San Leandro, Calif.
DEVELOPMENT OF A HIGH-VOLTAGE LINEAR ACTUATOR AMPLIFIER SYSTEM Final Report
D. Smart Kirtland AFB AFWL Jul. 1979 200 p
(Contract F29601-77-C-0047; AF Proj. 317J)
(AD-A074266; AD-E200364; PI-FR-1052; AFWL-TR-78-123) Avail: NTIS HC A09/MF A01 CSCL 20/5

A lightweight, compact, 61-channel linear switching amplifier system has been developed for aircraft use. Each channel accepts input in the + or - 10 V range and outputs + or - 1500 V into a capacitive load of 0.05 microfarads. The design employs a system of incremental resonant charging of the load, controlled by a system clock. Internal losses are minimized to hold size and weight to a minimum. The amplifiers as designed are flat

in frequency response dc to 400 Hz without slew rate limitation. Linearity is better than 1% full scale. The system is intended to drive piezoelectric actuators of an adaptive optics mirror system. An overall design of the system with computer modeling was completed and a two-channel breadboard was constructed, debugged, and tested. The tests showed that system design requirements were met with only minor deficiencies in maximum voltage and slew rate, correctable with nominal development efforts. GRA

N80-15344# Science Applications, Inc., Berkeley, Calif.
TRANSIENT ANALYSIS OF MULTICONDUCTOR TRANSMISSION LINE NETWORKS: A COMPARISON OF EXPERIMENTAL AND NUMERICAL RESULTS Final Report
S. K. Chang, F. M. Tesche, D. V. Giri, and T. K. Liu Kirtland AFB AFWL Feb. 1979 108 p refs
(Contract F29601-78-C-0002; AF Proj. 3763)
(AD-A074950; AD-E200369; AFWL-TR-78-152) Avail: NTIS HC A06/MF A01 CSCL 20/14

This report computes the transient responses of some multiconductor transmissionline networks, e.g., (a) a three-wire line, (b) a T-network, and (c) an H-network. These computations, which make use of the QV7T computer code were then compared with the available experimentally measured data. Very good agreement was seen between the numerical and experimental results for both pulse and step function driving waveforms. In addition, the transient response of the power cable in the TACAMO aircraft was also computed under certain approximations. The power cable consists of seven wires for the 3-phase power system, and measurements were made earlier on this cable in the ATHAMAS I (HPD) facility at AFWL. Considering all the approximations that had to be made in the numerical computations and the difficulties encountered in the TACAMO EMP testing, the agreement between the calculated and measured responses is seen to be fair. GRA

N80-15345# Los Alamos Scientific Lab., N. Mex.
OVERVOLTAGE PROTECTION BY POINT-PLANE SPARK GAPS
W. R. Scarlett and Kenneth B. Riepe 1979 11 p refs Presented at the Conf. on Electrical Insulation and Dielectric Phenomena, Whitehaven, Pa., 22 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1655; CONF-791028-2) Avail: NTIS HC A02/MF A01

A passive (self-breakdown) point-plane spark gap was developed and successfully used in the Helios power amplifiers which operate at voltages up to 300 kV. A gap of similar design is planned for use in the Antares power amplifiers which operate at 550 kV. These gaps must reliably hold off the normal discharge voltage, but break down with short delay if overvoltaged, diverting the discharge energy to a resistor. A prototype of the Antares gap was built and is undergoing tests. Parameters being investigated include voltage polarity, gap spacing, gas composition, and gas pressure. Results of these measurements and the operational experience of the Helios gaps was presented. DOE

N80-15346# Brookhaven National Lab., Upton, N. Y.
PARTIAL DISCHARGE PERFORMANCE OF LAPPED PLASTIC INSULATION FOR SUPERCONDUCTING POWER TRANSMISSION CABLES AND THE DIELECTRIC STRENGTH OF SUPERCRITICAL HELIUM GAS
A. J. Pearmain (University College, Dublin, Ireland), M. Kosaki (Nagoya Univ., Japan), and R. A. Thomas 1978 11 p refs Presented at Conf. on Elec. Insulation and Dielectric Phenomena, Pocono Manor, Pa., 29 Oct. 1978
(Contract EY-76-C-02-0016)
(BNL-24779; CONF-781027-2) Avail: NTIS HC A02/MF A01

A superconducting power transmission cable was designed using a flexible ac cable with Nb3Sn superconductor force cooled by supercritical helium. A lapped, multilayer plastic tape construction was selected for the electrical insulation with supercritical helium gas filling the butt spaces between tapes. Evaluation of many different tapes showed biaxially oriented laminated polypropylene tape to be a promising dielectric. A series of tests on short samples of insulation wound in a cable-type configuration enabled improvements to be made in screen design and winding techniques. Some partial discharge results from short sample tests are described, and an apparatus with variable electrode spacing developed for studying the effect of electrode material, spacing and area on the breakdown strength of supercritical helium is discussed. DOE

N80-15347# Sandia Labs., Albuquerque, N. Mex.
HIGH CURRENT TESTING OF LIGHTNING ARRESTOR CONNECTORS
E. F. Ehrman Aug. 1979 58 p refs
(Contract EY-76-C-04-0789)
(SAND-74-0326) Avail: NTIS HC A04/MF A01

Simulated severe lightning flash current (approximately 200 kA) testing of lightning arrestor connectors (LAC's) (the MC2796 eighteen pin and MC2797 thirty-two pin) is described. The current generator, electrical circuitry, currents, voltages and test results are discussed. The generator provided 3 components (strokes) with 60 milliseconds between strokes. Fifty LAC's (25 MC2796 and 25 MC2797) were subjected to the tests. The maximum voltage measured at the solder cup terminals of the LAC's was 1325 V which is well within the specified 2000 V limit. The average was 746 V. Melting of the internal parts (web and pins) occurred. Some burning and melting at the mating connector interface was observed. The LAC's functioned as required during exposure to the simulated severe lightning flash current. DOE

N80-15348# Wisconsin Univ. - Madison.
ASSESSMENT OF RESEARCH DIRECTIONS FOR HIGH VOLTAGE DIRECT CURRENT POWER SYSTEMS Quarterly Progress Report, 1 Apr. - 30 Jun. 1979
W. F. Long Aug. 1979 8 p
(Contract ET-78-S-02-5014)
(COO-5014-9) Avail: NTIS HC A02/MF A01

The question of whether a high voltage direct current (HVDC) circuit breaker is needed in the HVDC power system is addressed. The ratings the circuit breaker must have regarding speed of operation, energy absorption, continuous and interrupting current, and voltage are examined. A.W.H.

N80-15349# Illinois Univ., Urbana.
ACTIVATION VOLUMES OF SOME SUPERIONIC CONDUCTORS WITH THE FLUORITE STRUCTURE
J. M. Oberschmidt and D. Lazarus 1979 12 p refs Presented at the Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wis., 21 May 1979
(Contract EY-76-C-02-1198)
(COO-1198-1264; CONF-790538-12) Avail: NTIS HC A02/MF A01

Information about defect and conduction mechanisms of ionic conductors can be obtained by studying the pressure and temperature dependence of the electrical conductivity. The existence of several activated regions of conduction was found. The activation volumes, which are extracted from the pressure data, are small and positive throughout the temperature range investigated. Frenkel defects are dominant up to near the melting points of the materials examined. DOE

N80-15350# Argonne National Lab., Ill.
ANALYSIS OF THE MULTIPHASE INDUCTOR-CONVERTER BRIDGE
Mehrdad Ehsani, R. L. Kustom, and R. E. Fuja 1979 8 p refs Presented at the Pulsed Power Conf., Lubbock, Tex., 12 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-790622-26) Avail: NTIS HC A02/MF A01

Analytical derivations are presented for inductor-converter bridge (ICB) circuits in which energy is transferred from a storage inductor to a load inductor with solid state bridges. These derivations provide complete analytical circuit solution in contrast to previously available numerical (nonanalytical) procedures. The analysis is based on two parallel methods: Fourier expansion of the inverter waveforms; and a novel method based on the inherent waveforms of the ICB, labeled square functions. These analytical values of power flow, inductor currents, and voltages compare favorably with the results of a three-phase ICB experiment at Argonne National Laboratory. DOE

N80-15351# Oak Ridge National Lab., Tenn.
PROPAGATION OF NORMAL ZONES IN THERMALLY INSULATED SUPERCONDUCTORS
Lawrence Dresner 1979 17 p refs Presented at the Cryogenic Eng. Conf., Madison, Wisc., 21 Aug. 1979
(Contract W-7405-eng-26)
(CONF-790815-16) Avail: NTIS HC A02/MF A01

A comparison of measured and calculated propagation velocities for superconductors thermally insulated by silicon grease shows that the grease makes a significant contribution to the effective specific heat of the conductor and substantially reduces the propagation velocity compared with what would be expected for perfectly insulated conductors. DOE

N80-15352# Oak Ridge National Lab., Tenn.
ELECTRIC CHARACTERISTICS OF ION-IMPLANTED LASER-ANNEALED SILICON
R. T. Young, J. Narayan, C. W. White, R. F. Wood, J. W. Cleland, R. D. Westbrook, and P. M. Mooney Aug. 1978 8 p refs Presented at the Conf. on Ion Beam Modification of Mater., Budapest, 4 Sep. 1978 Prepared jointly with the State Univ. of New York, Albany
(Contracts W-7405-eng-26; N00014-75-C-0919)
(CONF-780932-4) Avail: NTIS HC A02/MF A01

The results of electrical measurements on Si implanted with n-type dopants such as P and As and laser annealed are presented. DOE

N80-15353# Stanford Linear Accelerator Center, Calif.
RF POWER SAVING IN LARGE STORAGE RINGS
Z. D. Farkas 15 May 1979 22 p refs
(Contracts EY-76-C-03-0515)
(SLAC-TN-79-2) Avail: NTIS HC A02/MF A01

The application of CARTOP, constant amplitude rf to pulse converter is considered in order to obtain average and peak power gains in large e (- or -) rings. CARTOP is a scheme where energy storage and modulation converts a continuous radio frequency (rf) wave into periodic rf pulses. A system with CARTOP is shown. The modulated rf goes through an energy storing network that contains at least one energy storing cavity which acts as a flywheel. Between pulses, it takes energy from the klystron and during the pulse it delivers energy to an accelerating cavity. DOE

N80-15354# California Univ., Riverside Dept. of Physics
THEORY OF LOW DIMENSIONAL SUPERCONDUCTORS Biennial Report
E. Simanek Jul. 1979 23 p refs
(Contract EY-76-S-03-0034)
(SAN-0034-T5) Avail: NTIS HC A02/MF A01

The results of works completed during the period June 1, 1977-July 31, 1979 are outlined. The DOE-research project for this period, Theory of Low Dimensional Superconductors, was initiated at the beginning of 1977 in an attempt to explain the anomalies of the behavior of the order parameter in inhomogeneous superconducting films and the nuclear spin relaxation measurements in Al and Sn fine particle samples. Two major contributions emerged out of these efforts. The first is concerned with the calculation of the order parameter in an inhomogeneous superconductor. In the other, a theory of the thermodynamic order parameter fluctuations in small superconducting grains coupled by Josephson coupling was developed. A detailed description of these results is presented. Subsequent efforts were aimed into the area of superconducting alloys with high Kondo temperature such as Al-Mn, Al-V, and Al-Cr. DOE

N80-15355# Sandia Labs., Albuquerque, N. Mex.
SYMPATHETIC BREAKDOWN ON GAPS IN AIR
J. P. Brainard and L. A. Andrews 1979 10 p refs Presented at Conf. on Electrical Insulation and Dielectric Phenomena, Whitehaven, Pa., 21 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0598C; CONF-791028-3) Avail: NTIS HC A02/MF A01

A gap at a distance as great as 0.4 m from an initiating gap was found to sympathetically break down at fields as low as 55 percent of the normal breakdown field. Sympathetic breakdown occurred over a wide range of discharge currents from mA to kA. A relationship between the electric field in a gap and the breakdown initiation time after the introduction of ultraviolet light was determined. DOE

N80-15356# Oak Ridge National Lab., Tenn.
COMPUTATION OF TRANSIENT 3-D EDDY CURRENT IN NONMAGNETIC CONDUCTOR
H. T. Yeh 1978 11 p refs Presented at COMPUMAG Conf., Grenoble, France, 4 Sep. 1978
(Contract W-7405-eng-26)
(CONF-780939-1) Avail: NTIS HC A02/MF A01

A numerical procedure was developed to solve transient three-dimensional (3-D) eddy current problems for nonmagnetic conductors. Integral equation formulation in terms of vector potential is used to simplify the matching of boundary conditions. The resulting equations and their numerical approximation were shown to be singular and to require special handling. Several types of symmetries were introduced. They not only reduce the number of algebraic equations to be solved, but also modify the nature of the equations and render them nonsingular. Temporal behavior was obtained with the Runge-Kutta method. The program is tested in several examples of eddy currents for its spatial and temporal profiles, shielding, boundary surface effects, and application of various symmetry options. DOE

N80-15357# General Dynamics/Convair, San Diego, Calif.
GENERAL DYNAMICS CONVAIR DIVISION APPROACH TO STRUCTURAL ANALYSIS OF LARGE SUPERCONDUCTING COILS
R. W. Baldi 21 Mar. 1979 16 p refs Presented at the Intern. Conf. on Structural Mech. in Reactor Technol., Berlin, 13 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-13975; CONF-790802-31) Avail: NTIS HC A02/MF A01

Integrated procedures developed and applied to analyze large superconducting magnets for nuclear fusion research are examined. Computer programs currently employed to support the analysis phases of the superconducting magnets are described. The computer programs perform a linear elastic, finite element analysis of three dimensional structures and use input data such as coil geometry and specifications, electromagnetic operating forces, and cooldown/warmup temperature gradients. A.W.H.

N80-15358# California Univ., Livermore Lawrence Livermore Lab.
VERY FAST, HIGH-PEAK-POWER, PLANAR TRIODE AMPLIFIERS FOR DRIVING OPTICAL GATES
M. M. Howland, S. J. Davis, and W. L. Gagnon 12 Jun. 1979 17 p refs Presented at the IEEE Intern. Pulsed Power Conf., Lubbock, Tex., 12-14 Jun. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-82538) Avail: NTIS HC A02/MF A01

A simplified procedure is described for designing very fast pulse amplifiers to drive optical gates within high power Nd glass laser chains. The use of bridged-T constant resistant networks to transform load capacitance into pure resistance independent of frequency is pointed out. DOE

N80-15359# Oak Ridge National Lab., Tenn.
ANALYSIS AND COMPUTER PROGRAMS FOR EDDY CURRENT COILS CONCENTRIC WITH MULTIPLE CYLINDRICAL CONDUCTORS
C. W. Nestor, Jr., C. V. Dodd, and W. E. Deeds (Tennessee Univ., Knoxville) Jul. 1979 135 p refs
(Contract W-7405-eng-26)
(ORNL-5220) Avail: NTIS HC A07/MF A01

A general derivation is performed to determine the vector potential produced by eddy current coils concentric with multiple cylindrical conductors. The conductors may be inside the coils, encircling the coils, or both. From the vector potential certain physical phenomena, such as coil impedence, mutual coupling between coils, effect of defects, and ohmic heating, are calculated. The coils may be placed in electrical circuits and the voltages produced are calculated. DOE

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-15360*# Arizona State Univ., Tempe.
MULTIPLE JET IMPINGEMENT HEAT TRANSFER CHARACTERISTIC: EXPERIMENTAL INVESTIGATION OF IN-LINE AND STAGGERED ARRAYS WITH CROSSFLOW Final Report
L. W. Florschuetz, D. E. Metzger, D. I. Takeuchi, and R. A. Berry. Jan. 1980. 88 p. refs
(Grant NsG-3075)
(NASA-CR-3217; ERC-R-79034) Avail: NTIS HC A05/MF A01 CSCL 20D

Heat transfer characteristics were obtained for configurations designed to model the impingement cooled midchord region of air cooled gas turbine airfoils. The configurations tested were inline and staggered two-dimensional arrays of circular jets with ten spanwise rows of holes. The cooling air was constrained to exit in the chordwise direction along the channel formed by the jet orifice plate and the heat transfer surface. Tests were run for chordwise jet hole spacings of five, ten, and fifteen hole diameters; spanwise spacings of four, six, and eight diameters; and channel heights of one, two, three, and six diameters. Mean jet Reynolds numbers ranged from 5000 to 50,000. The thermal boundary condition at the heat transfer test surface was isothermal. Tests were run for sets of geometrically similar configurations of different sizes. Mean and chordwise resolved Nusselt numbers were determined utilizing a specially constructed test surface which was segmented in the chordwise direction. R.C.T.

N80-15361*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR GENERATING INPUT FOR ANALYSIS OF IMPINGEMENT-COOLED, AXIAL-FLOW TURBINE BLADE
David Rosenbaum. Jan. 1980. 57 p. refs. Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, Ohio.
(NASA-TP-1603; AVRADCOM-TR-79-34) Avail: NTIS HC A04/MF A01 CSCL 20D

A computer program, TACTGRID, was developed to generate the geometrical input for the TACTI program, a program that calculates transient and steady state temperatures, pressures, and cooling flows in an impingement cooled turbine blade. Using spline curves, the TACTGRID program constructs the blade internal geometry from the previously designed external blade surface and newly selected wall and channel thicknesses. The TACTGRID program generates the TACTI calculational grid, calculates arc length between grid points required by TACTI as input, and prepares the namelist input data set used by TACTI for the blade geometry. In addition, TACTGRID produces a scaled computer plot of each blade slice, detailing the grid and calculational stations, and thus eliminates the need for intermediate drafting. J.M.S.

N80-15362*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
PRESSURE FLUCTUATIONS ON THE SURFACE OF A CYLINDER IN UNIFORM FLOW
Alfred Ayoub and K. Karamcheti. Jun. 1976. 121 p. refs
(Grants NGR-05-020-676; NsG-2007)
(NASA-CR-162468; SU-JIAA-TR-3) Avail: NTIS HC A06/MF A01 CSCL 20D

The problem of determining the pressure fluctuations induced on the surface of a cylinder by the fluctuating wake behind it is formulated. A formal solution relating the unsteady surface pressure field to the velocity field in the wake is derived and used to obtain general results independent of cylinder shape and Reynolds number. The case of the circular cylinder is then examined in detail. K.L.

N80-15363*# Stanford Univ., Calif.
FULL-COVERAGE FILM COOLING ON FLAT, ISOTHERMAL SURFACES: DATA AND PREDICTIONS Summary Report
M. E. Crawford, W. M. Kays, and R. J. Moffat. Jan. 1980. 116 p. refs
(Contract NAS3-14336)
(NASA-CR-3219; SU-HMT-23) Avail: NTIS HC A06/MF A01 CSCL 20D

The heat transfer and fluid mechanics characteristics of full-coverage film cooling were investigated. The results for flat, isothermal plates for three injection geometries (normal, slant, and compound angle) are summarized and data concerning the spanwise distribution of the heat transfer coefficient within the blowing region are presented. Data are also presented for two different numbers of rows of holes (6 and 11). The experimental results summarized can be predicted with a two dimensional boundary layer code, STANCOOL, by providing descriptors of the injection parameters as inputs. J.M.S.

N80-15364*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTATION OF THREE-DIMENSIONAL FLOW IN TURBOFAN MIXERS AND COMPARISON WITH EXPERIMENTAL DATA
L. A. Povinelli, B. H. Anderson, and W. Gerstenmaier. Jan. 1980. 12 p. refs. Presented at the AIAA Aerospace Sciences Meeting, Pasadena, Calif., 14-16 Jan. 1980
(NASA-TM-81410; E-324) Avail: NTIS HC A02/MF A01 CSCL 20D

A three dimensional, viscous computer code was used to calculate the mixing downstream of a typical turbofan mixer geometry. Experimental data obtained using pressure and temperature rakes at the lobe and nozzle exit stations were used to validate the computer results. The relative importance of turbulence in the mixing phenomenon as compared with the streamwise vorticity set up by the secondary flows was determined. The observations suggest that the generation of streamwise vorticity plays a significant role in determining the temperature distribution at the nozzle exit plane. K.L.

N80-15365*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL SIMULATION OF SUPERSONIC INLETS USING A THREE-DIMENSIONAL VISCOUS FLOW ANALYSIS
B. H. Anderson and C. E. Towne. Jan. 1980. 17 p. refs. Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-81411; E-325) Avail: NTIS HC A02/MF A01 CSCL 20D

A three dimensional fully viscous computer analysis was evaluated to determine its usefulness in the design of supersonic inlets. This procedure takes advantage of physical approximations to limit the high computer time and storage associated with complete Navier-Stokes solutions. Computed results are presented for a Mach 3.0 supersonic inlet with bleed and a Mach 7.4 hypersonic inlet. Good agreement was obtained between theory and data for both inlets. Results of a mesh sensitivity study are also shown. K.L.

N80-15366# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
DYNAMICS OF VORTICES AND SHOCK WAVES IN NONUNIFORM MEDIA Interim Report, 1 Jul. 1978 - 30 Jun. 1979
B. Sturtevant. Jun. 1979. 26 p. refs
(Contract F49620-77-C-0107; AF Proj. 2307)
(AD-A072842; AFOSR-79-0898TR; GALCIT-134B) Avail: NTIS HC A03/MF A01 CSCL 20/4

The effect of the length of the driver section of the shock tube vortex generator on the properties and behavior of high energy vortex rings with very thin rotational cores was studied. Preliminary results were obtained using ultra-short drivers. A retraction mechanism to rapidly retract the mouth of the tube away from the vortex shortly after it is produced, to aid in the development of vortices generated by the ultra-short drivers, was tested. With this device, the velocity of vortices produced with several different driver lengths was measured. K.L.

N80-15367# JAYCOR, Alexandria, Va.
CONTINUED DEVELOPMENT OF FLUID DYNAMICS MODELS Final Report, 1 Apr. 1978 - 1 Apr. 1979
Philip J. Moffa and Simon W. Chang 6 Apr. 1979 36 p ref
(Contract N00173-78-C-0421)
(AD-A073848) Avail: NTIS HC A03/MF A01 CSCL 20/4

A program of continuing development of several fluid dynamic models has been carried out for NRL by JAYCOR. Specifically, major developments and modifications of several large computer codes have been accomplished. This has been done to provide NRL with an expanded capability of modelling diverse physical phenomena, all of which are amenable to analysis utilizing advanced hydrodynamic computational techniques. GRA

N80-15368# Douglas Aircraft Co., Inc., Long Beach, Calif.
A HIGHER ORDER PANEL METHOD FOR THREE-DIMENSIONAL POTENTIAL FLOW Final Report
John L. Hess Jun. 1979 90 p refs
(Contract N62269-77-C-0437)
(AD-A074751; MDC-J8519; NADC-77166-30) Avail: NTIS HC A05/MF A01 CSCL 20/4

The method described here is a higher-order three-dimensional surface panel method. It utilizes four-sided panels on the actual surface of the body about which flow is to be computed and is thus applicable to arbitrary configurations. In contrast to a first-order panel method that uses flat panels, usually with constant source and/or vorticity density, the present method uses curved panels of second degree with linearly varying source and vorticity density. The mathematical problem solved is that of incompressible potential flow but the calculation can be extended to subsonic flow by means of well-known compressibility corrections. This report presents a discussion of the techniques adopted and some alternatives. A rigorous derivation of the higher-order formulation is carried out. All formulas and logic required by the method are included, except that the report on the corresponding first-order method is relied on for formulas and procedures common to the two techniques. First-order and higher-order calculated results are compared with each other and with exact solutions. GRA

N80-15369# DCW Industries, Studio City, Calif.
DEVELOPMENT OF AN ALTERNATIVE TO THE E9 PROCEDURE FOR PREDICTING BOUNDARY-LAYER TRANSITION Final Report, 15 Sep. 1978 - 14 Mar. 1979
David C. Wilcox Jun. 1979 53 p refs
(Contract N00014-78-C-0799; RR0230183)
(AD-A074071; DCW-R-23-01; ONR-CR-298-005-2F) Avail: NTIS HC A04/MF A01 CSCL 20/4

A method has been devised which can be used in conjunction with linear-stability theory for predicting boundary-layer transition. As with the classical e(9) procedure, for a given frequency, the growth of a disturbance is computed downstream of the initial point of instability using the linearized equations of motion. In contrast to the e(9) procedure in which the linearized equations are used all the way to the inferred transition point, an approximate set of long-time averaged equations which account for nonlinearity is used to describe the ultimate nonlinear growth of the disturbance. Because the new method accounts for nonlinear processes it holds promise as a more physically sound procedure than the e(9) method for determining the point at which a boundary layer undergoes transition to turbulence. GRA

N80-15370# Computational Mechanics Consultants, Knoxville, Tenn.
A NUMERICAL VISCOUS-INVISCID INTERACTION ALGORITHM FOR PREDICTION OF NEAR-FIELD VSTOL JET-INDUCED FLOWFIELDS Final Report, Oct. 1977 - Sep. 1978
A. J. Baker and P. D. Manhardt Feb. 1979 84 p refs
(AD-A074070; NADC-77167-30) Avail: NTIS HC A05/MF A01 CSCL 20/4

A turbulent-inviscid numerical interaction algorithm is derived and evaluated for detailed determination of the near-field flow of a jet injected perpendicular to a crosswind. The two distinct solution domains are pressure coupled through a Poisson equation solution, and entrainment-induced mass flux is an iteration variable. Finite element procedures are employed for solution of the resulting non-linear initial-boundary value equations. Key results are discussed documenting viability for analysis of a round-jet at a velocity ratio equal to eight. GRA

N80-15371# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
NUMERICAL PREDICTION OF FLOWS OVER AND IN THE NEAR WAKE BEHIND AXISYMMETRIC, SELF-PROPELLED BODIES
M. C. Hyman, S. C. Houlihan, J. A. Hill, D. L. Dwoyer, and C. H. Lewis Mar. 1979 72 p refs
(AD-A074971; VPI-AERO-095) Avail: NTIS HC A04/MF A01 CSCL 20/4

A technique is presented for the calculation of laminar, transitional and/or turbulent flows over and in the near wake behind bodies of revolution including the effects of separated flow and an operating propeller. The technique uses an interactive boundary-layer program to obtain a viscous solution over a nonseparating body and to provide upstream boundary conditions for a second program which solves the full Navier-Stokes equations for the propeller, separated flow and near wake regions. The results of calculations made using individual elements of, and the complete system of codes were compared with good agreement against both experimental and numerical data and are included in the present work. GRA

N80-15372# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
USER'S GUIDE FOR A SYSTEM OF COMPUTER PROGRAMS TO PREDICT FLOWS OVER AND IN THE NEAR WAKE BEHIND AXISYMMETRIC, SELF-PROPELLED BODIES
M. C. Hyman, S. C. Houlihan, J. A. Hill, D. L. Dwoyer, and C. H. Lewis Nov. 1978 308 p
(AD-A074972; VPI-AERO-096) Avail: NTIS HC A14/MF A01 CSCL 20/4

A system of computer programs has been developed to predict flows around and in the near wake behind an axisymmetric body including a propeller at the tail of the vehicle. The system is capable of calculating laminar and/or turbulent, attached and separated flows. Interactive boundary-layer theory is used to predict the flow on the nonseparating region over the body and the full Navier-Stokes equations are solved for the separated, propeller and near wake flow regions. Details of the theory and results are included in a separate engineering report. The programs, subroutines, variables in common and input and output data are described. Listings of the program code, input and output data for a sample case are included. GRA

N80-15373# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.
FORCED TWO PHASE HELIUM COOLING OF LARGE SUPERCONDUCTING MAGNETS
M. A. Green, W. A. Burns, and J. D. Taylor Aug. 1979 24 p refs Presented at the 21st Cryogenic Eng. Conf., Madison, Wis., 21-24 Aug. 1979
(Contract W-7405-eng-48)
(LBL-9701; CONF-790815-27) Avail: NTIS HC A02/MF A01

The advantages of two phase cooling in many magnet systems are shown. The design of a two phase helium system, with its control dewar, is presented. Pressure drop of a two phase system, stability of a two phase system and the method of cool down of a two phase system are discussed. Included are the results of cool down and operation of superconducting solenoids. DOE

N80-15374# Sandia Labs., Livermore, Calif.
CALCULATION OF PLANE SUDDEN EXPANSION FLOW VIA VORTEX DYNAMICS
W. T. Ashurst Jul. 1979 14 p refs Presented at 2nd Symp. on Turbulent Shear Flows, London, 2 Jul. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8679; CONF-790721-2) Avail: NTIS HC A02/MF A01

The method of discrete vortex dynamics is used to reproduce the flow that occurs in symmetric channels that have sudden expansion. The flow over a single backward facing step is calculated. Detailed comparison with experimental results indicates that the calculated turbulent shear stress depends upon the inlet

shear layer thickness. A calculational shear layer with the experimental thickness results in a recirculation length longer than the experimental value. This is caused by less entrainment across the separated shear layer. The lack of spanwise fluctuations (stream-wise vorticity components) is the cause of reduced entrainment in the two-dimensional calculation when compared to two-dimensional flow experiments. The results show the ability of the discrete vortex dynamic method to simulate turbulent flows. DOE

N80-15375# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Explosives Engineering Div.
VESSEL DISCHARGE BY FRICTION DOMINATED TUBE FLOW
C. S. Landram. Jun. 1979. 16 p. Presented at Gas Dyn. Conf., Livermore, Calif., 22 May 1979.
(Contract W-7405-eng-48)
(UCRL-82801; CONF-790583-1) Avail: NTIS HC A02/MF A01

The analytical complexities associated with predicting the discharge of a contained gas from its vessel through a long isothermal tube are simplified. The choking and unchoking temporal regions are shown to be dependent upon the form taken for friction factor, and the solution is therefore shown to depend rather intimately on such forms. Measured and calculated vessel pressure histories are favorably compared for the case of an ideal gas (He) discharging to the atmosphere in laminar flow through a tube of length to diameter ratio 1.2 x 10 to the 4th power. DOE

N80-15376# Argonne National Lab., Ill. Components Technology Div.
NUMERICAL PROCEDURE FOR CALCULATING STEADY/UNSTEADY, SINGLE-PHASE/TWO-PHASE THREE-DIMENSIONAL FLUID FLOW WITH HEAT TRANSFER
V. L. Shah, W. T. Sha, H. M. Domanus, J. L. Krazinski, C. C. Miao, R. C. Schmitt, S. P. Vanka, and S. V. Patankar (Minnesota Univ., Minneapolis). Jun. 1979. 89 p. refs. Prepared for Nucl. Regulatory Comm., Washington, D.C.
(Contract W-31-109-eng-38)
(NUREG-CR-0782; ANL-CT-79-31) Avail: NTIS HC A05/MF A01

A general numerical procedure for the calculation of steady/unsteady, single phase/two phase, three dimensional fluid flow is described. The procedure is based on the control volume approach, which enables the derivation of physically meaningful finite difference equations. The conservation equations employed are based on a two fluid model. Surface permeabilities and volume porosities are included in the finite difference formulations to account for dispersed solid objects in a flow domain. The derivation of the equations and the required iteration scheme are presented, and flow charts are provided for the planning and design of a computer program. DOE

N80-15377# Sandia Labs., Albuquerque, N. Mex.
FLUFLOW: AN APPENDED CODE FOR CALCULATING HEAT TRANSFER TO A FLUID
L. V. Griffith. Oct. 1978. 23 p. refs.
(Contract EY-76-C-04-0789)
(SAND-78-8271) Avail: NTIS HC A02/MF A01

The mathematical formulations used in FLUFLOW, a set of subroutines for calculating heat transfer to a fluid, are given. The formulations include a statement of the energy balance and temperature dependent equations for thermal conductivity, specific heat, density, viscosity, pressure drop, friction factors, and Nusselt number. The fluids may be quasi-static or moving at velocities up to Mach numbers around 0.5. Free convection in a quasi-static fluid is calculated with a user-supplied heat transfer coefficient. For a moving fluid, FLUFLOW calculates the heat transfer due to conduction, convection, and advection as a function of the temperature dependent parameters above. DOE

N80-15378# California Univ., Livermore. Lawrence Livermore Lab.
WAVE PROPAGATION IN VISCOELASTIC MEDIA
R. C. Y. Chin. 18 Jul. 1979. 61 p. refs. Presented at Intern. School of Physics Enrico Fermi, Varonna, Italy, 23 Jul. - 4 Aug. 1979.
(Contract W-7405-eng-48)
(UCRL-83019) Avail: NTIS HC A04/MF A01

The mathematical formulations of the wave propagation problem in a linear viscoelastic solid are reviewed from the point of view of constitutive equations and the theory of linear physical systems. Various general results from the theory of propagating singular surfaces and from the mathematical theory of hyperbolic equations are applied to the analysis of the wave propagation process. The impulse response of three viscoelastic media are analyzed by use of asymptotic methods. The three material models are the standard linear solid, the standard linear solid with a continuous spectrum of relaxation times, and the power law solid. DOE

N80-15379# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
TWO-PHASE VAPOUR-LIQUID FLOW WITH PHASE CHANGE, REVIEW
M. J. Ellman. Jul. 1979. 96 p. refs.
(PB-299905; CSIR-CENG-286; ISBN-0-7988-1615-5) Avail: NTIS HC A05/MF A01 CSCL 20D

Theories, models, and measurement techniques for boiling, condensation, or two phase liquid-vapor flow are reviewed. It is recommended that a comprehensive and integrated theory of two phase flow with boiling be developed and that mathematical models be derived which account for phase interactions and which cover the full range of flow regimes. It is also recommended that the parameters involved be evaluated only with the aid of reliable well-documented sets of data and that improved measurement techniques be developed for this field so that data sets can be obtained. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-15380*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
PRESSURE MODULATOR RADIOMETER (PMR) TESTS
E. L. G. Odell, F. M. Cosmi, A. E. Kreft, G. W. Racette, T. J. Maresca, F. O. Pancoast, D. J. Rutecki, and W. C. Yager. 25 Sep. 1979. 81 p.
(Contract NAS1-15044)
(NASA-CR-159175) Avail: NTIS HC A05/MF A01 CSCL 14B

The pressure modulator technique was evaluated for monitoring pollutant gases in the Earth's atmosphere of altitude levels corresponding to the mid and lower troposphere. Using an experimental set up and a 110 cm sample cell, pressure modulator output signals resulting from a range of gas concentrations in the sample cell were examined. Then a 20 cm sample cell was modified so that trace gas properties in the atmosphere could be simulated in the laboratory. These gas properties were measured using an infrared sensor. R.E.S.

N80-15381*# Honeywell Electro-Optics Center, Lexington, Mass.
CLOUD TOP SCANNING RADIOMETER (CTS) Final Report
Jun. 1978. 158 p.
(Contract NAS5-22459)
(NASA-CR-159954; HONEYWELL-7804-5) Avail: NTIS HC A08/MF A01 CSCL 14B

A scanning radiometer to be used for measuring cloud radiances in each of three spectral regions is described. Significant features incorporated in the Cloud Top Scanner design are: (1) flexibility and growth potential through use of easily replaceable modular detectors and filters; (2) full aperture, multilevel inflight calibration; (3) inherent channel registration through employment of a single shared field stop; and (4) radiometric

sensitivity margin in a compact optical design through use of Honeywell developed (Hg,Cd)Te detectors and preamplifiers. M.M.M.

N80-15382# Los Alamos Scientific Lab., N. Mex.
PROSPECTS OF USING LARGE VACUUM PHOTODIODES WITH GAS SCINTILLATION PROPORTIONAL COUNTERS
D. F. Anderson 1979 7 p refs Presented at the IEEE Nucl. Sci. Symp., San Francisco, 17 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1246; CONF-791037-1) Avail: NTIS HC A02/MF A01

The use of CsI and Cs2Te as photocathode materials for the detection of ultraviolet light from noble gas scintillators is discussed. Calculated energy resolution for a gas scintillation proportional counter using Cs2Te vacuum photodiodes is compared with the same counter with a photomultiplier tube. Problems which must be solved to permit fabrication of large Cs2Te vacuum photodiodes are mentioned. DOE

N80-15383# Oak Ridge National Lab., Tenn.
LIMITATIONS OF THERMOCOUPLES IN TEMPERATURE MEASUREMENTS
R. L. Anderson, R. K. Adams, and D. C. Duggins 1979 33 p refs Presented at the ISA Intern. Instrumentation Symp., Anaheim, Calif., 7 May 1979
(Contract W-7405-eng-26)
(CONF-790505-14) Avail: NTIS HC A03/MF A01

Factors limiting the accuracy of temperature measurements with type K and type S sheathed thermocouple assemblies are discussed. The effect of short range ordering in Chromel is shown to limit the accuracy of temperature measurements made with type K thermocouple to about 1 percent. Errors of as much as 150 percent were observed in type K thermocouples in magnetic fields at temperatures below the Curie temperature of Alumel. Both positive and negative errors were observed when the orientations of the applied magnetic field, the temperature gradient and the a is of the Alumel wire were such as to produce an emf along the thermocouple wire due to the Nernst-Ettingshausen effect. DOE

N80-15384# Idaho National Engineering Lab., Idaho Falls.
PERFORMANCE EVALUATION OF A DRAG-DISC TURBINE TRANSDUCER AND THREE-BEAM GAMMA DENSITOMETER UNDER TRANSIENT TWO-PHASE FLOW CONDITIONS
C. L. Nalezny, L. L. Chen, and C. W. Solbrig (Commonwealth Edison Co., Chicago) 1979 19 p refs Presented at the 2nd Multiphase Flow and Heat Transfer Symp. Workshop, Miami Beach, Fla., 16 Apr. 1979
(Contract EY-76-C-07-1570)
(CONF-790423-15) Avail: NTIS HC A02/MF A01

The transducer combination was performance tested under transient conditions in the blowdown loop. Partial blowdowns of different durations starting from the same initial conditions are included. The reference mean mass flow rate was determined by measuring the amount of water required to reestablish initial conditions after each partial blowdown. The average mass flow rates computed from the output of the drag disc, turbine, and gamma densitometer were compared to the reference mean mass flow rates over three blowdown intervals. Results indicate that the equal phase velocity mass measurement model provided excellent results through the use of the turbine and densitometer, and drag disc and densitometer when the phase velocities were nearly equal. DOE

N80-15385# Brookhaven National Lab., Upton, N. Y.
RESPONSE CHARACTERISTICS OF OPTICAL PROBES
N. Abuaf, O. C. Jones, Jr., and G. A. Zimmer 1978 12 p refs Presented at Am. Soc. of Mech. Engr. Meeting, San Francisco, 10 Dec. 1978
(Contract EY-76-C-02-0016)
(BNL-NUREG-24479; CONF-781202-17) Avail: NTIS HC A02/MF A01

An optical probe capable of measuring local void fraction and interface velocities in water-air or water-steam environments was developed, constructed, and calibrated in an air-water loop. The probe was found to be sensitive to both the interface velocity and the phase present at the probe tip. The dependence of the output on the bubble velocity was related to a thin water film left on the probe tip during the passage of the bubble, whose thickness was increasing with the bubble velocity. The various probe tip geometry response characteristics were evaluated using a computer program. DOE

N80-15386# National Ocean Survey, Rockville, Md. Test and Evaluation Lab.
PERFORMANCE EVALUATIONS OF THE ORBISPHERE LABORATORIES MODELS 2702 AND 2709 OXYGEN MEASURING SYSTEMS
Jerald M. Paterson, Charles C. White, Barbara S. Pijanowski, and Gary K. Ward Jun 1979 20 p
(PB-300721/8; NOAA-TM-NOS-22; NOAA-79071203) Avail: NTIS HC A02/MF A01 CSCL 14B

Test and evaluation results are reported for two portable systems designed to measure temperature and dissolved oxygen concentrations. System descriptions, manufacturer's specifications, and performance results are provided with associated figures and tables summarizing accuracy, precision, stability, and environmental effects. GRA

N80-15387# National Bureau of Standards, Boulder, Colo. Building Thermal and Service Systems Div.
EVALUATION OF HAND-HELD INFRARED THERMOMETERS FOR WALL THERMAL RESISTANCE DETERMINATIONS
Stephen J. Treado and Douglas M. Burch Jul. 1979 27 p refs Sponsored in part by DOE
(PB-298057/1; NBSIR-79-1736) Avail: NTIS HC A03/MF A01 CSCL 10A

Hand-held infrared (IR) noncontact surface thermometers from two manufacturers were tested to evaluate their effectiveness in measuring surface temperatures for the determination of the thermal resistance of walls. Two phases of the test were performed, first a laboratory test of a wood-frame wall, followed by a field test of a brick veneer wood-frame wall. During both phases of testing, additional measurements of thermal resistance were made for comparative purposes, using multi-junction thermopiles and heat flow meters. An error analysis of the thermal resistance measurement procedure using IR surface thermometers was also performed. GRA

N80-15388# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
DATA ACQUISITION AND REDUCTION FOR A HIGH-RESOLUTION FIELD IONISATION MASS SPECTROMETER
T. G. Tonkin May 1979 66 p
(PB-299936/5; CSIR-CENG-281; ISBN-0-7988-1602-3) Avail: NTIS HC A04/MF A01 CSCL 07D

Data from a mass spectrometer under the control of a DGC NOVA3 minicomputer, are converted into an integrated molecular mass spectrum using programs written in the multi-task version of DGC Extended BASIC. The mathematical processing of the raw spectrum is done by means of deconvolution technique. The spectrum is presented in a table of molecular mass and quantity. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-15389# Columbia Univ., New York.
OPTICALLY PUMPED LASER ACTION AND ENERGY TRANSFER IN POLYATOMIC MOLECULES Final Report, 1 May 1975 - 30 Apr. 1977
George W. Flynn 20 Jun. 1978 14 p refs
(Contract N00014-75-C-1106)
(AD-A074985; TR-1) Avail: NTIS HC A02/MF A01 CSCL 20/5

Energy transfer and chemical decomposition processes have been studied in a number of molecules using laser fluorescence and time resolved thermal lensing techniques. Vibrational relaxation of OCS, and vibrational energy exchange between isotopic species of CH3F, and the laser driven, CH3F sensitized

decomposition of tetramethyl dioxetane have all been investigated. GRA

N80-15390# Army Electronics Research and Development Command, Fort Monmouth, N. J. Night Vision and Electro-optics Labs.
ADVANCED EXCITATION TECHNIQUES FOR TUNABLE INFRARED LASERS
T. F. Ewanizky Jul. 1979 16 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A074632; DELNV-TR-79-2) Avail: NTIS
HC A02/MF A01 CSCL 20/5

This report describes the theoretical concept and experimental progress initiated to devise a tunable laser source, broadly tunable over the middle infrared wavelength range. The concept derives from frequency conversion by scattering from coherently driven Raman vibrations in hydrogen or methane gas. This investigation concentrated on the feasibility of producing a wide-band tunable, infrared source using a designator energy category Nd:YAG pump laser to simultaneously drive a lithium niobate parametric oscillator and coherent Raman mixing in gaseous media. GRA

N80-15391# Atomic Weapons Research Establishment, Aldermaston (England).
THE CONSTRUCTION AND PERFORMANCE OF TEAL
P. L. Eggins, R. J. Prosser, and A. C. Simmons Jun. 1979 36 p refs
(AD-A074746; AWRE-O-9/79; DRIC-BR69056) Avail: NTIS
HC A03/MF A01 CSCL 20/5

The construction of TEAL (Transversely Excited Atmospheric pressure Laser) is described with reference to the required specification for single pulse thermal blooming experiments. All the major performance parameters are described, such as energy, temporal profile, spectrum and stability. In particular, several different measurements of the spatial profile are compared with theoretical predictions, which in general predict well the main features but not the finer details. Also the results of pulse stretching experiments are described, in which the pulse is lengthened from 3 to 14 microsec. GRA

N80-15392# Naval Postgraduate School, Monterey, Calif.
A SIMPLE MODEL FOR CALCULATING THE INDEX OF REFRACTION OF NEON I AND NEON (3S) IN THE CAVITY OF A XENON FLUORIDE LASER M.S. Thesis
James Etchechury Jun. 1979 54 p refs
(Contract N00014-79-WR-90174; ARPA Order 3747)
(AD-A074380; NPS69-79-005) Avail: NTIS
HC A04/MF A01 CSCL 20/5

A model for calculating the index of refraction of atomic species present in the cavity of a Xenon Fluoride Laser is applied to Neon and Neon*(3s). The model considers the variation from unity to be a function of the absorption cross section. Below the ionization threshold, the cross section is a set of discrete transitions between the various energy levels of the species of concern. Above the 5p level, the discrete transitions become indistinct and the continuum cross section function is extended into this region. The continuum cross section function is a polynomial function fitted to independent research results. The results for Neon I agree with previous theoretical and experimental results. The model is extended to Neon*(3s). Comparison with the results of independent research of the polarizability and cavity phase shift derived from the calculation indicate accuracy is within ten percent. GRA

N80-15393# Missouri Univ. -St. Louis. Dept. of Physics.
POTENTIAL LASER ACTION IN THE He-METAL VAPOR MIXTURES Final Report
Jacob J. Leventhal 24 Sep. 1979 3 p refs
(Contract N00014-76-C-0760)
(AD-A074594; Rept-3) Avail: NTIS HC A02/MF A01 CSCL 20/5

Energy transfer in atomic and molecular interactions is experimentally studied by analyzing photons from radiative decay of excited species formed in the collision process. Emphasis is on production of excited states that radiate in the soft x-ray and optical regions of the spectrum. Selective excitation in such processes can lead to the inverted state distributions necessary for the laser or superradiant operation. GRA

N80-15394# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF PLASMA PROCESSES IN ELECTRONIC TRANSITION LASERS Technical Report, 1 Jul. 1978 - 1 Jul. 1979
William L. Nighan 1 Sep. 1979 38 p refs
(Contract N00014-76-C-0847)
(AD-A074892; UTRC/R79-922617-4) Avail: NTIS
HC A03/MF A01 CSCL 20/5

This paper reports the results of an analysis of basic kinetic and plasma processes in fast-pulse (about 100 nsec) electric discharges containing mixtures of the mercuric-bromide molecule HgBr2, ahp N2 in a Ne background. Formation of the laser molecule HgBr (B 2 Sigma(-)) is shown to occur as a result of dissociative excitation transfer following quenching of N2 (A 3 Sigma(-) sub u) by HgBr2. GRA

N80-15395# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
LASER INTRACAVITY MODULATION AND STABILIZATION
Richard A. Curtis May 1979 25 p refs
(AD-A074879; DRDMI-T-79-69) Avail: NTIS
HC A02/MF A01 CSCL 20/5

The description of a method of generating optical-frequency sensitivity signals in single mode lasers is presented in this report. The technique involves controlled coupling of energy from the optical mode having gain to other laser cavity resonances using an intracavity phase modulator. The theory which applies to this work was obtained from the coupled mode equations of Harris and McDuff and is based on single mode laser stabilization theory of McDuff and Curtis. Experiments were performed which verified the theory using a single mode, carbon dioxide laser and a cadmium telluride (CdTe) electro-optic modulator. A closed loop system was constructed which was similar to that used by Targ, Osterink and French with a multimode, HELIUM-NEON laser. GRA

N80-15396# Naval Postgraduate School, Monterey, Calif.
STIMULATED EMISSION BY RELATIVISTIC ELECTRONS TRAVERSING A PERIODIC MAGNETIC FIELD M.S. Thesis
Robert Boyce Ellis Jun. 1979 72 p refs
(AD-A073888) Avail: NTIS HC A04/MF A01 CSCL 20/5

A historical survey of scientific developments predating the free electron laser (FEL) concept is presented. A general theory of operation of the FEL is discussed. The use of electromagnets to generate a static periodic magnetic field of alternating polarity (as a pump wave source) is proposed. Preliminary measurements with respect to the proposed electromagnet design are analyzed. GRA

N80-15397# Naval Research Lab., Washington, D. C.
ANALYTIC ANALYSIS OF LINEAR GROWTH RATES OF GYROTRON FOR TElns MODE WITH ZERO-TEMPERATURE BEAM ELECTRONS
Joon Y. Choe (Maryland Univ.) and Saeyoung Ahn 29 Jun. 1979 57 p ref
(AD-A074368; AD-E000324; NRL-MR-4035) Avail: NTIS
HC A04/MF A01 CSCL 20/5

The approximate expression for the growth rate of the transverse electric (TE) mode with the azimuthal mode number 'l', the radial mode number 'n', and the magnetic harmonic number 's' of the electron cyclotron maser instability with zero-temperatured beam electrons is derived and analytically examined. It has been found that there exist two branches of instabilities distinguished by their axial wavenumbers; the short and the long wavelength modes, and the estimates of their growth rates have been obtained. With maximization processes of the growth rates, the optimum conditions on various parameters have been found. In particular, it has been found that 's' equals 'l' mode with the beam center coinciding with the axis yields the highest growth rate. The exponential behavior of the growth with respect to the magnetic harmonic number 's' is also obtained. GRA

N80-15398# Visidyne, Inc., Burlington, Mass.
ROCKETBORNE LASER BACKSCATTER EXPERIMENT Final

Report, 6 May 1976 - 15 Feb. 1979
O. Shepherd, A. G. Hurd, W. H. Sheehan, and R. D. Bucknam Hanscom AFB, Mass. AFGL 15 Mar. 1979 164 p refs
(Contract F19628-76-C-0253; AF Proj. 6690)
(AD-A073853; VI-475; AFGL-TR-0081) Avail: NTIS HC A08/MF A01 CSCL 20/6

A previously flown rocket payload designed to measure atmospheric density in the thermosphere through Rayleigh, backscatter of a dye laser signal, was modified and refurbished. In its earlier field test the payload failed to provide any data, apparently because of a timing problem. Relaunched, the laser failed to operate because of a minor component failure. However, measured background intensities were orders of magnitude higher than anticipated. The source of the background signals has not been positively identified since the rocket aspect data have not been finalized. The most likely source appears to be scattering from the Earth's atmosphere illuminated by the below horizon sun. GRA

N80-15399# Hughes Aircraft Co., Culver City, Calif. Electro-Optical and Data Systems Group.
HIGH ENERGY OPTICAL RESONANCE TRANSFER LASER STUDY. VOLUME 1: LABORATORY EXPERIMENTS Final Report, 24 Jul. 1978 - 23 Jun. 1979
P. Baily, J. Finzi, C. Lovejoy, and J. Wang Aug. 1979 82 p refs
(Contract N00173-78-C-0470; DARPA Order 2062)
(AD-A074126; HAC-FR-79-73-999-Vol-1;
HAC-REF-E2380-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 20/5

This report describes characterization experiments investigating an HF intramolecular Optical Resonance Transfer Laser (ORTL), with variation in pump laser characteristics, ORTL volume and ORTL medium composition, pressure, and flow velocity. Input coupling, conversion, and overall efficiency were characterized in several different geometries. Maximum values of 83 per cent for conversion efficiency and 29 per cent for overall efficiency were observed. Initial temporal measurements revealed no dynamic feedback interaction in the intra-cavity configuration. Diffraction limited ORTL beam quality was observed. GRA

N80-15400# Los Alamos Scientific Lab., N. Mex.
INVESTIGATION OF EFFICIENCY OPTIMIZATION IN FREE ELECTRON LASERS
T. J. Kwan 1979 25 p refs Presented at ONR Workshop on Electron Generators of Coherent Radiation, Telluride, Colo., 13-17 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2176; CONF-790853-2) Avail: NTIS HC A02/MF A01

The dynamics of trapped particles in the presence of the wiggler magnetic field and the electromagnetic radiation field in free electron lasers were investigated. From the results of computer simulations, it was found that, for a given set of parameters, the efficiency of energy extraction from the electron beam maximizes at a particular intensity of the electromagnetic radiation. Based on the physical argument of the dynamics of the trapped particles, a criterion which predicts accurately the optimum intensity of the electromagnetic radiation was obtained. DOE

N80-15401# California Univ., Livermore. Lawrence Livermore Lab.
MICRO-FRESNEL STRUCTURES FOR MICROSCOPY OF LASER GENERATED BRIGHT X-RAY SOURCES
N. M. Ceglio, D. C. Shavers (Lincoln Lab., MIT, Lexington), D. C. Flanders (Lincoln Lab., MIT, Lexington), and H. I. Smith (Lincoln Lab., MIT, Lexington) 5 Jun. 1979 30 p Presented at Conf. on Ultrasoft X-ray Microscopy, New York, 13 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82684; CONF-790674-1) Avail: NTIS HC A03/MF A01

A brief parametric survey of the X-ray characteristics of a gold micro-disk irradiated at 3 x 10 to the 14th power watt/sq cm by a 1 nsec Nd-glass laser pulse was provided as an example of a laser generated bright X-ray source. It was shown that a simple phenomenological model of the laser generated X-ray source as a microscopic equilibrium plasma radiating as a blackbody for a finite time determined by its hydrodynamic disassembly and radiation losses, serves to provide an adequate approximation to the X-ray characteristics of such sources. The current state of X-ray microscopy within the LLL laser fusion program was briefly reviewed. DOE

N80-15402# Los Alamos Scientific Lab., N. Mex.
TUNABLE LASERS FOR WASTE MANAGEMENT PHOTOCHEMISTRY APPLICATIONS
F. T. Finch, comp. Sep. 1978 59 p refs
(Contracts W-7405-eng-36; EY-76-C-02-0016)
(LA-7113-MS) Avail: NTIS HC A04/MF A01

The recent literature on dye-laser characteristics was reviewed and summarized, with emphasis on those parameters that most likely affect the scaling of dye lasers in photochemical applications. Current costs are reviewed and correlated with output power. A new class of efficient uv lasers that appear to be scalable in both energy output and pulse rate, based on rare-gas halide excimers and similar molecules, is certain to find major applications in photochemistry. Because the most important developments are too recent to be adequately described in the literature or are the likely outcome of current experiments, the basic physics underlying the class of excimer lasers is described. The technical characteristics of the various classes of lasers in the ir are summarized. DOE

N80-15403# Brookhaven National Lab., Upton, N. Y.
PRINCIPLES, CALIBRATION AND PROCESS EXPERIENCE FOR A NEW LASER AEROSOL DETECTOR SYSTEM
F. M. Shofner, W. E. Harrison, Jr., and A. C. Miller, Jr. 1978 24 p refs Presented at the 71st Meeting of the AICHE, Miami, Fla., 12 Nov. 1978 Prepared in cooperation with Process Particulate Monitors, Inc., Knoxville, Tenn.
(Contract EY-76-C-02-0016)
(BNL-25018; CONF-781110-4) Avail: NTIS HC A02/MF A01

A laser particulate detection instrument which has proved extremely valuable in the design and monitoring of oil removal systems for cryogenic refrigeration systems is described. When located at the inlet of a refrigerator, any aerosol or particulates that could be harmful to the operation of the refrigerator would be detected. Its main features include: in situ measurement of particulates in the high pressure helium, continuous monitoring with alarm capabilities which permits automatic shutdown of attended or unattended systems, sensitivity down to a few parts per billion, long term stability on the order of 10 ppB, and straightforward data interpretation. The concept of continuous automatic calibration and baseline zero adjustment relieves the operator of any manual adjustments or loss of confidence in the signal levels recorded. The 1-second response time allows instant turnoff if the filters experience an oil breakthrough or if an operator inadvertently opens bypass valves around the oil removal system. DOE

N80-15404# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.
PULSED DYE LASER OAS WITH A HELMHOLTZ RESONATOR CELL
R. W. Shaw 1979 10 p refs Presented at Meeting on Photoacoustic Spectry, Ames, Iowa, 1 Aug. 1979
(Contract W-7405-eng-26)
(CONF-790819) Avail: NTIS HC A02/MF A01

A Helmholtz resonator cell for simplifying pulsed dye laser excited optoacoustic signals is described and employed for high resolution optoacoustic spectroscopy of holmium oxide powder. DOE

N80-15405# Los Alamos Scientific Lab., N. Mex.
MIRROR QUALITY REQUIRED BY THE ANTARES LASER SYSTEM
W. C. Sweatt 1979 8 p refs Presented at the Conf. on Optics, Los Alamos, N. Mex., 23 May 1979
(Contract W-7405-eng-36)
(LA-UR-79-2058; CONF-790529-8) Avail: NTIS HC A02/MF A01

The mirror surface specifications are refined to a physically meaningful set based on the performance of the system. The optical specification for Antares is that 80 percent of the energy from each beam should be deliverable inside a 400 micron cycle.

The diffraction limited focal spot is 160 microns across, so small amounts of low spatial frequency wavefront aberrations are acceptable. The figure error is specified separately from the higher spatial frequency subfigure errors that diffract light out of the 400 micron circle. DOE

N80-15406# Avco-Everett Research Lab., Mass.
TRIPLING OF CO2 LASER RADIATION IN DBr, DCI AND Se Final Report, 1 May 1977 - 31 Jan. 1979
M. J. Yoder Mar. 1979 129 p refs
(Contract ES-77-C-02-4253)
(COO-4253-7) Avail: NTIS HC A07/MF A01

Frequency tripling of CO2 lasers in deuterium chloride (DCI), deuterium bromide (DBr), and selenium (Se) gases is discussed. Theoretical tripling equations are reviewed and summarized. Third order nonlinear susceptibilities, chi (3), for DCI, DBr, and Se are calculated. Experimental measurements of frequency tripling in high pressure DCI and DBr are discussed. Resonantly enhanced four-wave sum-frequency generation in Se using simultaneous 9.5 and 10.6 micrometer CO2 laser pulses is demonstrated. The necessary selenium vapor density is generated in a shock tube. All of the experiments are in relatively good agreement with theory and results in chi (3) values of 1.4 x 10 to the minus 37th power ESU for DBr, 2.0 x 10 to the minus 36th power for DCI, and 1.1 x 10 to the minus 33rd power for Se at 2000 K. Scaling equations are discussed which predict frequency conversion efficiencies of > 50 percent in DCI and Se using gigawatt power, nanosecond pulsed CO2 lasers and reasonably sized conversion cells. DOE

N80-15407# California Univ., Livermore. Lawrence Livermore Lab.
COMPACT 5 x 10-12 AMP/SEC RAIL-GUN PULSER FOR A LASER PLASMA SHUTTER
L. P. Bradley, E. L. Orham, and I. F. Stowers 12 Jun. 1979 15 p refs Presented at the 2nd IEEE Intern. Pulsed Power Conf., Lubbock, Tex., 12-14 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82539; CONF-790622-21) Avail: NTIS HC A02/MF A01

A rail-gun plasma source that produces a plasma of (10 to the 12th power)/cu cm particle density and projects it with a velocity of 3.9 cm/microsec was developed. The device will be used in an output spatial filter to project a critical density plasma across an optical beam path and block laser retroreflected light. The design of pulser appropriate to the laser fusion facility and the preliminary design of a higher current prototype pulser for the laser fusion research facility are described. DOE

N80-15408# California Univ., Livermore. Lawrence Livermore Lab.
APPLYING A COMPENSATED PULSED ALTERNATOR TO A FLASHLAMP LOAD FOR NOVA
B. M. Carder and B. T. Merritt 12 Jun. 1979 16 p refs Presented at the Pulsed Power Conf., Lubbock, Tex., 2 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82473; CONF-790622-23) Avail: NTIS HC A02/MF A01

The compensated pulsed alternator (CPA), a large rotating machine that will convert mechanical, rationally stored energy into a single electrical impulse of very high power, is discussed. It is being optimized for driving flashlamps in a very large NOVA Nd glass laser system. A circuit that will provide start-up current and assist in triggering the flashlamps is described and tested with a 200 kilojoule capacitor bank. Formulae that will assist in matching the flashlamp load to any given size CPA machine are also presented. DOE

N80-15409# National Technical Information Service, Springfield, Va.
ATMOSPHERIC EFFECTS ON LASER BEAMS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Sep. 1979
Brian Carrigan Sep. 1979 254 p Supersedes NTIS/PS-78/0992; NTIS/PS-77/0831; NTIS/PS-76/0843; NTIS/PS-75/670
(NTIS/PS-79/0981/5; NTIS/PS-78/0992; NTIS/PS-77/0831; NTIS/PS-76/0843; NTIS/PS-75/670) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

The compilation cites recent research on laser beam transmission through the atmosphere. Studies on molecular attenuation, turbulence, thermal blooming, atmospheric window flows, atmospheric composition, aerosols, infrared lasers, computerized simulation, and water vapor are included. The effects of attenuation on optical radar, optical communications, and infrared detection, are covered. This updated bibliography contains 246 abstracts, 36 of which are new entries to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-15410*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF PREDICTED AND EXPERIMENTAL PERFORMANCE OF LARGE-BORE ROLLER BEARING OPERATING TO 3.0 MILLION DN
Harold H. Coe and Frederick T. Huller Jan. 1980 20 p refs
(NASA-TP-1599; E-063) Avail: NTIS HC A02/MF A01 CSCL 13I

Bearing inner and outer race temperatures and the amount of heat transferred to the lubricant were calculated by using the computer program CYBEAN. The results obtained were compared with previously reported experimental data for a 118 mm bore roller bearing that operated at shaft speeds to 25,500 rpm, radial loads to 8,900 N (2000 lb), and total lubricant flow rates to 0.0102 cu m/min (2.7 gal/min). The calculated results compared well with the experimental data. Author

N80-15411*# Detroit Diesel Allison, Indianapolis, Ind.
PLASMA-SPRAYED DUAL DENSITY CERAMIC TURBINE SEAL SYSTEM Final Report
D. L. Clingman, B. Schechter, K. R. Cross, and J. R. Cavanagh Oct. 1979 67 p refs
(Contract NAS3-21263)
(NASA-CR-159739; EDR-10085) Avail: NTIS HC A04/MF A01 CSCL 11A

Dual density, plasma sprayed ceramic coating systems were investigated for possible application as abradable turbine tip seal systems in small gas turbine engines. Abradability, erosion resistance, internal leakage, and microstructural characterization were investigated for polyester and cenosphere filled zirconium oxide composites. Results indicate the polyester system is more abradable but displays significantly less erosion resistance than the cenosphere system. It is also stated that the absence of significant blade tip damage during abradability testing of both systems suggests additional effort may result in a more nearly optimum balance of abradability and erosion resistance. M.G.

N80-15412*# Battelle Columbus Labs., Ohio.
EVALUATION OF WORN SSME LOW PRESSURE LIQUID OXYGEN TURBOPUMP BEARING Final Report
K. F. Dufrane and J. W. Kannel 14 Dec. 1978 29 p refs
(Contract NAS8-33576)
(NASA-CR-161367) Avail: NTIS HC A03/MF A01 CSCL 13I

The larger of two ball bearings used to support the rotor of the low pressure liquid oxygen turbopump in each of the shuttle main engines was analyzed to identify the cause of severe internal wear. The actual operating loads were calculated along with their direction and length of time at each load based on the size and location of the race contact paths. It is suggested that the engine component design be modified to reduce bearing stress and enhance lubrication. K.L.

N80-15413# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF 100 mm BORE BEARINGS AFTER ACCELERATED TESTING IN A SIMULATED SPACE ENVIRONMENT Interim Report, Oct. 1976 - Sep. 1977
Wayne E. Ward Jul. 1979 50 p refs

(AF Proj. 2421)
(AD-A074527; AFML-TR-79-4083) Avail: NTIS HC A03/MF A01 CSCL 22/2

The Despin Mechanical Assembly (DMA) is that mechanism by which satellite antenna platforms are despun with respect to the remainder of the vehicle in order to permit data transfer as well as navigational command and control. A major component of this assembly is a set of DMA bearings. Because of the extended duration of most satellite missions, the DMA itself as well as the individual components undergo rigorous life and accelerated life testing. On occasion, a test article fails to meet the desired or anticipated performance level. This report describes the analysis of a set of specially fabricated DMA type bearings which experienced such a failure during an accelerated life test. Physical, chemical, and pictorial evidence is presented to support the postulated cause of failure. GRA

N80-15414# Illinois Univ. at Urbana-Champaign. Dept. of Mechanical and Industrial Engineering.
PRELIMINARY STUDY OF A RECOIL MECHANISM USING COULOMB FRICTION. Final Report
C. Cusano and H. J. Sommer, III. Jul. 1979. 78 p. refs.
(Contract DAAK10-78-C-0152)
(AD-A074203) Avail: NTIS HC A05/MF A01 CSCL 19/6

This report is an investigation of the possible use of Coulomb friction for recoil energy dissipation in a friction recoil mechanism (FRM) for large bore cannon. Basic concepts and experimental friction material characteristics contributing to FRM functional and logistic feasibility are presented. From practical considerations, a recoil mechanism should be a relatively passive system incorporating automatic or intrinsic actuation prior to or at firing, should be self-contained, and should be tolerant of or compensate for variations in recoil travel. From a logistics standpoint, a recoil mechanism should demonstrate an extended in-service life, allow simple field servicing and repair, and permit long-term storage with rapid field recommission. The ultimate consideration of such a recoil system is its reliability over repeated firings. A single failure may cause catastrophic equipment damage and/or personnel injury. The comparative simplicity of conceptualized FRM hardware should allow superior performance in all three logistic areas stated above. FRM live/service interval would be a calculable function of the friction material wear rate and not a statistical estimate of effective seal life before failure. The simplicity and mechanical nature of FRM design should permit less complex service procedures. GRA

N80-15415# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
ANALYTICAL MODELS AND EXPERIMENTAL STUDIES OF CENTRIFUGAL-PUMP PERFORMANCES IN TWO-PHASE FLOW. Final Report
D. G. Wilson, T. Chan, and J. Manzano-Ruiz. May 1979. 221 p. refs.
(EPRI Proj. 493)
(EPRI-NP-677) Avail: NTIS HC A10/MF A01

Two phase flow data and models for centrifugal pumps are reviewed. A method is then developed for predicting two phase pump performance for steady state and transient conditions, assuming that pump geometry and normal single phase pump characteristics are known. The method is used to accurately predict the first-quadrant two phase performance of a pump. K.L.

N80-15416# Sandia Labs., Albuquerque, N. Mex.
STRUCTURAL MODELING OF A THICK-RIM ROTOR
A. K. Miller. 1978. 6 p. refs. Presented at 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978.
(Contract EY-76-C-04-0789)
(SAND-78-1941C; CONF-781046-7) Avail: NTIS HC A02/MF A01

A NASTRAN structural model is constructed of a thick-rim rotor having six discrete overwrapped bands forming twelve pairs of spokes--the wagon-wheel rotor. The results of an experimental modal analysis of an actual rotor, using Fast Fourier transform techniques, are used to aid in the definition and refinement of the numerical model. A description of the structural model is given and the resulting calculated normal mode shapes and frequencies are presented. These mode shapes and frequencies are compared to those obtained from the experimental modal analysis. DOE

N80-15417# Westinghouse Electric Corp., Lester, Pa. Steam Turbine Div.
TURBINE CYCLE PERFORMANCE IMPROVEMENT THROUGH TITANIUM LP BLADES. Interim Report
W. G. Steltz. Sep. 1978. 34 p. refs. Sponsored by EPRI.
(EPRI-AF-903) Avail: NTIS HC A03/MF A01

A coordinated study comprising thermodynamic, mechanical, and economic analyses was made of the application of long titanium low pressure steam turbine blades in power generating units. Turbine cycle heat rate improvements of 1% for fossil units and 2% for nuclear units are indicated for machines utilizing increased last row blade lengths of 30 to 40%. DOE

N80-15418# National Technical Information Service, Springfield, Va.
LASER WELDING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE. Progress Report, 1970 - Aug. 1979
William E. Reed. Oct. 1979. 285 p. Supersedes NTIS/PS-78/0984; NTIS/PS-77/0816.
(NTIS/PS-79/1028/4; NTIS/PS-78/0984; NTIS/PS-77/0816) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Reports from worldwide research are cited which deal with the development of techniques and procedures for laser welding and with the characteristics of the resulting welds. Process control, automation, and applications are also investigated. Materials welded include stainless steels, dissimilar metals, titanium, ceramics, and plastics. This updated bibliography contains 278 abstracts, 29 of which are new entries to the previous edition. GRA

N80-15419# Connecticut Univ., Storrs. Dept. of Civil Engineering.
EXPERIMENTAL EVALUATION OF A PORTABLE ENERGY ABSORBING SYSTEM FOR HIGHWAY SERVICE VEHICLES. Final Report, Jun. 1977 - Dec. 1978
John F. Carney, III. Apr. 1979. 61 p. refs.
(PB-299168/5; CE-79-125; FHWA/CT/RD-402-F-79-1) Avail: NTIS HC A04/MF A01 CSCL 13F

A portable energy absorbing system which is attached to the rear of a standard 14,000 pound highway service vehicle used in maintenance operations was designed and fabricated. A full scale crash testing program was conducted to evaluate the structural integrity and performance of the portable energy absorbing system. The results demonstrate that this energy absorbing system provides protection during a collision for both the errant motorist and the state personnel working in the service vehicle. GRA

N80-15420# Environmental Protection Agency, Ann Arbor, Mich. Inspection and Maintenance Staff.
EFFECTS OF INSPECTION AND MAINTENANCE PROGRAMS ON FUEL ECONOMY
Mar. 1979. 15 p. refs.
(PB-297583/7; IMS-001/FE/1) Avail: NTIS HC A02/MF A01 CSCL 13B

The primary goal of inspection and maintenance (I/M) programs is to improve air quality by reducing emissions from motor vehicles. Many studies indicate that I/M programs will achieve this goal. In addition several studies indicate that fuel economy improvement can be expected to occur as a result of maintenance performed on vehicles failing an I/M test. Most studies looked at pre-1975 model year vehicles and had expert mechanics performing the maintenance work. Both the results from past studies and the results from more recent studies are considered to provide EPA's best estimates of fuel economy benefit which can be attributed to I/M maintenance. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques, and quality control.

N80-15421# Aeronautical Research Labs., Melbourne (Australia).
THE APPLICATION OF IMAGE PROCESSING TO THE

DETECTION OF CORROSION BY RADIOGRAPHY
M. E. Packer Feb. 1979 29 p
(ARL/MAT-Rept-109; AR-001-598) Avail: NTIS HC A03/MF A01

The improvement of radiographic corrosion detection through computer processing of digitized radiographs was investigated. Linearization of the image-density distribution was used to enhance the contrast of details associated with corrosion, but no conclusive evidence was obtained that image processing results in the detection of corrosion not already apparent on an unprocessed radiograph. A potential method for analyzing the history of a corrosion site was discovered. K.L.

N80-15422*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTOVOLTAIC POWER SYSTEM RELIABILITY CONSIDERATIONS
Vincent R. Lalli 1980 9 p refs Presented at the Ann. Reliability and Maintainability Symp., San Francisco, 22-24 Jan. 1980
(Contract DE-AB29-76EI-20370)
(NASA-TM-79291; DOE/NASA/20370-79/19; E-235) Avail: NTIS HC A02/MF A01 CSCL 14D

An example of how modern engineering and safety techniques can be used to assure the reliable and safe operation of photovoltaic power systems is presented. This particular application is for a solar cell power system demonstration project designed to provide electric power requirements for remote villages. The techniques utilized involve a definition of the power system natural and operating environment, use of design criteria and analysis techniques, an awareness of potential problems via the inherent reliability and FMEA methods, and use of fail-safe and planned spare parts engineering philosophy. J.M.S.

N80-15423*# Raytheon Co., Sudbury, Mass.
CARE 3, PHASE 1, VOLUME 1 Final Report
J. J. Stiffler, L. A. Bryant, and L. Guccione Nov. 1979 111 p refs Sponsored in part by AFAL, Wright-Patterson, AFB, Ohio 2 Vol.
(Contract NAS1-15072)
(NASA-CR-159122) Avail: NTIS HC A06/MF A01 CSCL 14D

A computer program to aid in accessing the reliability of fault tolerant avionics systems was developed. A simple mathematical expression was used to evaluate the reliability of any redundant configuration over any interval during which the failure rates and coverage parameters remained unaffected by configuration changes. Provision was made for convolving such expressions in order to evaluate the reliability of a dual mode system. A coverage model was also developed to determine the various relevant coverage coefficients as a function of the available hardware and software fault detector characteristics, and subsequent isolation and recovery delay statistics. R.C.T.

N80-15424*# Raytheon Co., Sudbury, Mass.
CARE 3, PHASE 1, VOLUME 2 Final Report
J. J. Stiffler, L. A. Bryant, and L. Guccione Nov. 1979 220 p refs Sponsored in part by AFAL, Wright-Patterson AFB, Ohio 2 Vol.
(Contract NAS1-15072)
(NASA-CR-159123) Avail: NTIS HC A10/MF A01 CSCL 14D

A computer program was developed as a general purpose reliability tool for fault tolerant avionics systems. The computer program requirements, together with several appendices containing computer printouts are presented. R.C.T.

N80-15425# Oak Ridge National Lab., Tenn.
METALLOGRAPHIC QUALITY CONTROL OF WELDING AND BRAZING
G. M. Slaughter 1979 22 p refs Presented at Intern. Metallographic Soc. Conf., Taniment, Pa., 8 Jul. 1979
(Contract W-7405-eng-26)
(CONF-790730-1) Avail: NTIS HC A02/MF A01

The value of metallography in assuring integrity in the fabrication of metal and components in energy systems is summarized. The role of metallography in the quality control of welded and brazed joints is discussed. DOE

N80-15426# Los Alamos Scientific Lab., N. Mex.
EXTENDED LIKELIHOOD INFERENCE IN RELIABILITY
H. F. Martz, Jr., R. J. Beckman, and R. A. Waller Oct. 1978 34 p refs
(Contract W-7405-eng-36)
(LA-7517-MS) Avail: NTIS HC A03/MF A01

Several extended likelihood methods of inference are developed in which subjective information in the form of a prior distribution is combined with sampling results by means of an extended likelihood function. The extended likelihood function is standardized for use in obtaining extended likelihood intervals. The extended likelihood intervals are derived for the mean of a normal distribution with known variance, the failure rate of an exponential distribution, and the parameter of a binomial distribution. The extended second-order likelihood methods are developed and used to solve several prediction problems associated with the exponential and binomial distributions. In particular, such quantities as the next failure time, the number of failures in a given time period, and the time required to observe a given number of failures are predicted for the exponential model with a gamma prior distribution on the failure rate. In addition, six types of life testing experiments are considered. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-15427# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE EFFECT OF INITIAL TWIST ON THE TORSIONAL RIGIDITY OF BEAMS: ANOTHER POINT OF VIEW
Aviv Rosen Apr. 1978 28 p
(TAE-360) Avail: NTIS HC A03/MF A01

The known theory on the effect of initial twist on the torsional rigidity of beams is examined. A few weak points and inaccuracies of the theory are pointed out, and a completely different explanation of the phenomenon is presented. It is shown that in special cases where there was a very good agreement between theory and experiments, the new theory gives results which are identical to those obtained using the old theory. R.E.S.

N80-15428*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A RELATION BETWEEN SEMIEMPIRICAL FRACTURE ANALYSES AND R-CURVES
Thomas W. Orange Jan. 1980 45 p refs
(NASA-TP-1600; E-9963) Avail: NTIS HC A03/MF A01 CSCL 20K

The relations between several semiempirical fracture analyses (SEFA) and the R-curve concept of fracture mechanics are examined and the conditions for equivalence between a SEFA and an R-curve are derived. A hypothetical material is employed to study the relation analytically. Equivalent R-curves are developed for several real materials using data from the literature. For each SEFA there is an equivalent R-curve whose magnitude and shape are determined by the SEFA formulation and its empirical parameters. If the R-curve is indeed unique, then the various empirical parameters cannot be constant, and vice versa. However, for one SEFA the differences are small enough that they may be within the range of normal data scatter for real materials. Author

N80-15429# Aeronautical Research Labs., Melbourne (Australia). Aeronautical Research Labs.
THE FRACTURE OF A PARACHUTE HOOK: A CASE STUDY OF THE ROLE OF MATERIALS PARAMETERS IN RELIABILITY ANALYSIS
L. R. F. Rose and B. J. Wicks Jul. 1979 27 p refs

(AR-001-591; ARL-MAT-NOTE-125) Avail: NTIS HC A03/MF A01

A detailed analysis of the risk of failure for the particular case of a parachute hook is used to illustrate what information is required for that purpose, how much of it is readily available, and in what areas further research is needed. The analysis relies on the use of a full scale test to identify the mode of failure, and hence the relevant strength parameter. It is concluded that an important role of materials research is to provide an understanding of the factors which can affect mechanical properties, so that the characteristics of the relevant population of structures or components may be more precisely defined, and the variability in strength which can be expected in service may be estimated. Author

N80-15430*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

STRESS-INTENSITY FACTORS AND CRACK-OPENING DISPLACEMENTS FOR ROUND COMPACT SPECIMENS

J. C. Newman, Jr. Oct. 1979 30 p refs

(NASA-TM-80174) Avail: NTIS HC A03/MF A01 CSCL 20K

A two dimensional, boundary collocation stress analysis was used to analyze various round compact specimens. The influence of the round external boundary and of pin-loaded holes on stress intensity factors and crack opening displacements was determined as a function of crack-length-to-specimen-width ratios. A wide-range equation for the stress intensity factors was developed. Equations for crack-surface displacements and load-point displacements were also developed. In addition, stress intensity factors were calculated from compliance methods to demonstrate that load-displacement records must be made at the loading points and not along the crack line for crack-length-to-specimen-width ratios less than about 0.4. K.L.

N80-15431# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.

A THEORY OF THERMOVISCOPLASTICITY FOR UNIAXIAL MECHANICAL AND THERMAL LOADING

E. P. Cernocky and E. Krempl Jul. 1979 41 p refs

(Contract N00014-76-C-0231)

(AD-A074957; RPI-CS-79-3) Avail: NTIS HC A03/MF A01 CSCL 20/11

A previously proposed three dimensional isotropic theory of Thermoviscoplasticity based on total infinitesimal strain is specialized to a uniaxial state of stress. This uniaxial theory consists of a first order differential constitutive equation linear in the mechanical strain rate and the stress rate but nonlinear in the mechanical strain, the temperature, and the stress. This equation is coupled to a constitutive heat equation where the work in a homogeneous, adiabatic cycle which starts and ends at zero stress is completely converted into temperature change. In cyclic loading, the mechanical constitutive equation is augmented through a procedure which we call 'storage and updating'. The qualitative solution properties of this system of differential equations are investigated. Assuming adiabatic conditions, it is shown that near the stress-strain-temperature origin or under large instantaneous changes in the strain (stress) rate, the predicted material behavior is thermoelastic. The solutions for large time under monotonic loadings are given. A set of material constants is assumed; the equations are numerically integrated to simulate homogeneous monotonic loading and cycling and corresponding deformation-induced temperature changes. Other examples include thermal monotonic and cyclic loading under constraint (thermal fatigue cycling) and mechanical cycling with simultaneous rapid heating. GRA

N80-15432# Missouri Univ. -Rolla. Dept. of Engineering Mechanics.

RESPONSE OF NONLINEAR STRUCTURAL PANELS SUBJECTED TO HIGH INTENSITY NOISE Final Report, 18 Jun. - 20 Aug. 1979

Chuh Mei Aug. 1979 42 p refs

(Contract F49620-79-C-0169; AF Proj. 2307)

(AD-A074986; AFOSR-79-0987TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

A theoretical research program has been carried out over the past two summers to establish preliminary sonic fatigue design information for estimating the responses of aircraft panels subjected to high intensity broadband acoustic excitation. It was demonstrated that a better correlation between theory and experiment can be achieved when large deflection geometrical nonlinearity effect was considered in the analysis. Results were also presented in graphical form, and they can be used as guides for preliminary design of aircraft panels. GRA

N80-15433# Ohio State Univ. Research Foundation, Columbus.

ON THE MULTIPLE SCATTERING OF WAVES FROM OBSTACLES WITH SOLID-FLUID INTERFACES Progress Report, 1 Oct. 1978 - 31 Jul. 1979

Bo. Peterson, V. V. Varadan, and V. K. Varadan Jul. 1979 29 p refs

(Contract N00014-78-C-0559)

(AD-A074057; OSURF-761251/711) Avail: NTIS HC A03/MF A01 CSCL 20/11

The purpose of this article is to present a T-matrix formalism for elastic wave scattering by multilayered regions with solid-fluid interfaces. Here the layers are not necessarily consecutively enclosing and thus in some regions there may be several different scatterers. We are using the Green's dyadic in an integral representation although the T-matrix can be obtained without using any Green's dyadic. GRA

N80-15434# Naval Ship Research and Development Center, Bethesda, Md.

ANALYTICAL SOLUTIONS FOR OPEN NONSHALLOW SPHERICAL SHELL VIBRATIONS

Gau-Feng Lin Sep. 1979 81 p refs

(AD-A074269; DTNSRDC-79/075) Avail: NTIS HC A05/MF A01 CSCL 20/11

This report is concerned with axisymmetric as well as nonsymmetric vibrations of open nonshallow thin elastic spherical shells. Without employing the usual auxiliary variables for reduction of shell motion equations introduced by VanderNeut and Berry, independent analytical solutions for middle-surface displacements are obtained and explicitly expressed in terms of associated Legendre functions. In order to gain physical insights into the free-vibration characteristics of an open nonshallow shell, theoretical calculations together with asymptotic descriptions are made of natural frequencies and mode shapes of a hemispherical shell with a free edge. Five families of natural frequencies, i.e., low Rayleigh bending, mixed bending-membrane, torsional, bending and membrane frequencies, are found. The corresponding mode shapes exhibit distinctive displacement patterns. GRA

N80-15435# Southwest Research Inst., San Antonio, Tex.

CRACK TIP PLASTICITY ASSOCIATED WITH CORROSION ASSISTED FATIQUE Interim Report, Jun. 1978 - Jun. 1979

D. L. Davidson and J. Lankford 31 May 1979 36 p refs

(Contract N00014-75-C-1038)

(AD-A073835; SWRI-02-4268) Avail: NTIS HC A03/MF A01 CSCL 11/6

A newly developed technique for measuring in-plane crack tip displacements and strains has been applied to the ongoing study of the effect of a water vapor environment on fatigue crack propagation in low-carbon steel. This stereoimaging technique allows the determination of the in-plane displacements with both high resolution and accuracy at numerous points in the near crack tip region. From these displacements the in-plane elements of the strain tensor and the principal strains and shear strains may be calculated. The principal effect of a water vapor environment on crack tip plasticity is that it causes a decrease in strain magnitude which the material at the crack tip supports, corroborating previous results derived from the measurement of subgrain size distribution. Information on the effect of environment on crack opening loads and on the 'compressive displacements' at the tip of the unloaded crack are also given, as are some preliminary results on the interrelationships between loading frequency, environment and crack propagation rate. GRA

N80-15436# Argonne National Lab., Ill. Components Technology Div.

SCALE MODELING OF FINITE LENGTH FLUID ANNULAR GAPS FOR FLOW-INDUCED VIBRATION TESTING

T. M. Mulcahy and A. J. Miskevics Jun. 1979 30 p refs
(Contract W-31-109-eng-38)
(ANL-CT-79-40) Avail: NTIS HC A03/MF A01

Possible scale model distortions for structural vibration testing are discussed. Conditions for which fluid energy dissipation is expected to be larger in a reduced scale model than in the prototype are defined. This unconservative and sometimes undesirable distortion is confirmed by testing of a vibrating rod surrounded by a finite length fluid filled annulus. A theory for estimating the magnitude of the distortion is presented. DOE

N80-15437# California Univ., Livermore. Lawrence Livermore Lab.
HUGONIOT ELASTIC LIMITS AND COMPRESSION PARAMETERS FOR BRITTLE MATERIALS
W. H. Gust 20 Jul. 1979 11 p refs Presented at the Intern. AIRAPT Conf., La Creusot, France, 30 Jul. 1979
(Contract W-7405-eng-48)
(UCRL-83020; CONF-790709-12) Avail: NTIS HC A02/MF A01

The Hugoniot elastic limit and dynamic yield strength in compression are determined for brittle materials using a free surface approximation for the elastic and phase transitional waves. Sound velocity, deviatoric stress, and Hugoniot data are given for a number of polycrystalline ceramics. K.L.

N80-15438# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
INELASTIC ANALYSIS OF TRANSVERSE DEFLECTION OF PLATES BY THE BOUNDARY ELEMENT METHOD
Mahesh Morjaria and Subrata Mukherjee Jun. 1979 54 p refs
(Contract EY-76-S-02-2733)
(COO-2733-24) Avail: NTIS HC A04/MF A01

The complicated boundary value problem for an arbitrarily shaped plate is solved by using a novel combination of the boundary element method and finite element methodology. The number of unknowns, however, depends upon the boundary discretization and is therefore less than in a finite element model. A combined creep-plasticity constitutive theory with state variables is used to model material behavior. The computer code developed can solve problems for an arbitrarily shaped plate with clamped or simply supported boundary conditions and an arbitrary loading history. Some illustrative numerical results for clamped and simply supported rectangular and triangular plates, under various loading histories, are presented and discussed. DOE

N80-15439# Los Alamos Scientific Lab., N. Mex.
LINEAR AND NONLINEAR SYMMETRICALLY LOADED SHELLS OF REVOLUTION APPROXIMATED WITH THE FINITE ELEMENT METHOD
William A. Cook Oct. 1978 64 p refs
(Contract W-7405-eng-36)
(LA-7538-MS) Avail: NTIS HC A04/MF A01

Nuclear material shipping containers have shells of revolution as a basic structural component. Analytically modeling the response of these containers to severe accident impact conditions requires a nonlinear shell-of-revolution model that accounts for both geometric and material nonlinearities. Present models are limited to large displacements, small rotations, and nonlinear materials. A first approach to developing a finite element nonlinear shell of revolution model that accounts for these nonlinear geometric effects is discussed. The approach uses incremental loads and a linear shell model with equilibrium iterations. Sixteen linear models are developed, eight using the potential energy variational principle and eight using a mixed variational principle. Four of these are suitable for extension to nonlinear shell theory. A nonlinear shell theory is derived, and a computational technique used in its solution is presented. DOE

N80-15440# Oak Ridge National Lab., Tenn. Engineering Technology Div.
UNIFIED CREEP-PLASTICITY MODEL FOR STRUCTURAL METALS AT HIGH TEMPERATURE
D. N. Robinson Oct. 1978 61 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5969) Avail: NTIS HC A04/MF A01

A constitutive theory for use in high-temperature structural analysis of breeder reactor components is presented. It is unified in the sense that plastic and creep strains are considered to arise from similar physical mechanisms. The theory is presented in multiaxial terms along with a discussion of its underlying assumptions, its relationship to other theories and the experimental observations upon which it is based and is intended to model. The results of an extensive parameter sensitivity study are reported which provide understanding of the influence of the various model parameters on the critical features of predicted response. DOE

N80-15441# O'Donnell and Associates, Inc., Pittsburgh, Pa.
MORE EFFICIENT CREEP RATCHETING BOUNDS
J. S. Porowski and W. J. ODonnell Oct. 1978 45 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-7322/1) Avail: NTIS HC A03/MF A01

The O'Donnell-Porowski upper bound solutions for creep ratcheting are extended to include material hardening effects and temperature dependent yield properties. Energy methods are introduced in order to obtain more efficient bounds for loading histograms involving a limited number of severe cycles in the plastic ratcheting regime, interspersed with cycling of lesser magnitude. DOE

N80-15442# Sandia Labs., Albuquerque, N. Mex.
HONDO II: A FINITE ELEMENT COMPUTER PROGRAM FOR THE LARGE DEFORMATION DYNAMIC RESPONSE OF AXISYMMETRIC SOLIDS
S. W. Key, Z. E. Beisinger, and R. Krieg Oct. 1978 98 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0422) Avail: NTIS HC A05/MF A01

A finite element method computer program designed to calculate the large deformation elastic and inelastic transient dynamic response of two dimensional solids is presented. To accommodate a wide variety of applications, finite strain calculations are incorporated. Spatially, the program employs a four node isoparametric quadrilateral element. In time, the program performs the integration using a central difference method time integrator. Since the time integration scheme is only conditionally stable with respect to step size, the program continuously monitors the step size and adjusts it to keep the calculation stable. The program contains five material subroutines covering elastic, viscoelastic, elastic-plastic, crushable foam, and soil behavior. Initial conditions on velocity but not displacement are allowed. Pressure loadings are allowed. Thermal loads are not implemented. The program functions entirely in core, and because no stiffness matrices are calculated and stored, rather large problems are easily accommodated. DOE

N80-15443# Massachusetts Univ., Amherst. Dept. of Civil Engineering.
MITIGATING EFFECTS IN THE PLASTIC FAILURE OF SHELLS SUBJECTED TO AXIALLY DEPENDENT DYNAMIC PRESSURE LOADINGS
G. Horvay and M. A. Veluswami Jul. 1979 89 p refs
(Contract EY-76-S-02-4122)
(COO-4122-27) Avail: NTIS HC A05/MF A01

Plastic buckling of shells is analyzed incorporating a hoop restoring force term into the membrane deflection equation. The effects of a nonuniform pressure pulse and nonuniform stiffness of the shell in the axial direction are investigated. K.L.

N80-15444# Oak Ridge Gaseous Diffusion Plant, Tenn.
MODIFYING THE GNATS MESH GENERATION CODE TO IMPROVE THE MODELING OF BRANCHED STRUCTURES
S. V. McGrath and L. I. Schlemper May 1979 23 p
(Contract W-7405-eng-26)
(K/CSD/TM-26) Avail: NTIS HC A02/MF A01

Modifications to a mesh generator program that permit geometrically accurate representations of branched structures are described. These modifications delete additional elements employed to approximate branched structures and merge the common boundaries of the deleted elements. DOE

42 GEOSCIENCES (GENERAL)

N80-15445*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BAROCLINIC INSTABILITY WITH VARIABLE GRAVITY: A PERTURBATION ANALYSIS
Albert C. Giere (Univ. Space Res. Assoc.), William W. Fowliss, and Salvador Arias. Jan. 1980. 30 p. refs
(NASA-TP-1586; M-293) Avail: NTIS HC A03/MF A01 CSCL 08G

Solutions for a quasigeostrophic baroclinic stability problem in which gravity is a function of height were obtained. Curvature and horizontal shear of the basic state flow were omitted and the vertical and horizontal temperature gradients of the basic state were taken as constant. The effect of a variable dielectric body force, analogous to gravity, on baroclinic instability for the design of a spherical, baroclinic model for Spacelab was determined. Such modeling could not be performed in a laboratory on the Earth's surface because the body force could not be made strong enough to dominate terrestrial gravity. A consequence of the body force variation and the preceding assumptions was that the potential vorticity gradient of the basic state vanished. The problem was solved using a perturbation method. The solution gives results which are qualitatively similar to Eady's results for constant gravity; a short wavelength cutoff and a wavelength of maximum growth rate were observed. The averaged values of the basic state indicate that both the wavelength range of the instability and the growth rate at maximum instability are increased. Results indicate that the presence of the variable body force will not significantly alter the dynamics of the Spacelab experiment. The solutions are also relevant to other geophysical fluid flows where gravity is constant but the static stability or Brunt-Vaisala frequency is a function of height. R.C.T.

N80-15446*# Lamont-Doherty Geological Inst., Palisades, N. Y.
SHAPE OF THE OCEAN SURFACE AND IMPLICATIONS FOR THE EARTH'S INTERIOR: GEOS-3 RESULTS
M. E. Chapman, M. Talwani, H. Kahle, and J. H. Bodine. Wallops Flight Center, Wallops Island, Va. NASA. Nov. 1979. 189 p. refs
(Contract NAS6-2519)
(NASA-CR-156859) Avail: NTIS HC A09/MF A01 CSCL 08G

A new set of 1 deg x 1 deg mean free air anomalies was used to construct a gravimetric geoid by Stokes' formula for the Indian Ocean. Utilizing such 1 deg x 1 deg geoid comparisons were made with GEOS-3 radar altimeter estimates of geoid height. Most commonly there were constant offsets and long wavelength discrepancies between the two data sets; there were many probable causes including radial orbit error, scale errors in the geoid, or bias errors in altitude determination. Across the Aleutian Trench the 1 deg x 1 deg gravimetric geoids did not measure the entire depth of the geoid anomaly due to averaging over 1 deg squares and subsequent aliasing of the data. After adjustment of GEOS-3 data to eliminate long wavelength discrepancies, agreement between the altimeter geoid and gravimetric geoid was between 1.7 and 2.7 meters in rms errors. For purposes of geological interpretation, techniques were developed to directly compute the geoid anomaly over models of density within the Earth. In observing the results from satellite altimetry it was possible to identify geoid anomalies over different geologic features in the ocean. Examples and significant results are reported. R.C.T.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-15447*# Ministero dell'Agricoltura e delle Foreste, Rome (Italy).
TOPOGRAPHICAL CHARACTERISTICS THROUGH THE STUDY OF THE THERMAL AND HYDROLOGICAL DISUNIFORMITY OF THE SOIL FROM THE MESOSCALE. AN APPPLICATION TO LOCAL FORECASTING OF AMBIENT TEMPERATURE FROM THE TELLUS PROJECT [IL TELERILEVAMENTO PER LO STUDIO A MESOSCA LA DELLE DISUNIFORMITA TERMICHE ED IDRICHE DEL SUOLO. APPLICAZIONE ALLA PREVISIONE LOCALE DEI TEMPORALI NELL'AMBITO DEL PROGETTO TELLUS]
E. Rosini and P. Caponigro, Principal Investigators. 1977. 6 p. In ITALIAN. ERTS
(E80-10020; NASA-CR-162392) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-15448*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCEEDINGS OF TECHNICAL SESSIONS, VOLUMES 1 AND 2: THE LACIE SYMPOSIUM
Jul. 1979. 1095 p. refs. Symp. held at Houston, Tex., 23-26 Oct. 1978. Sponsored by NASA, NOAA, and USDA. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198. ERTS
(E80-10030; NASA-TM-80811; JSC-16015-Vol-1; JSC-16015-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 02C

The technical design of the Large Area Crop Inventory Experiment is examined and data acquired over 3 global crop years is analyzed with respect to (1) sampling and aggregation; (2) growth size estimation; (3) classification and mensuration; (4) yield estimation; and (5) accuracy assessment. Seventy-nine papers delivered at conference sessions cover system implementation and operation; data processing systems; experiment results and accuracy; supporting research and technology; and the USDA application test system. For individual titles, see N80-15449 through N80-15525.

N80-15449*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SAMPLING, AGGREGATION, AND VARIANCE ESTIMATION FOR AREA, YIELD, AND PRODUCTION IN LACIE
C. R. Hallum, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), A. H. Feiveson, and A. G. Houston, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2. Jul. 1979. p. 3-18. refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

An approximately 2% sampling error was achieved in LACIE by sampling only approximately 2% of the sampling frame. The sample design in the yardstick region for which historical data were available down to a substratum level to support missing data resulting from cloud cover provided the most accurate estimate possible. The implemented strategy provided data of sufficient quality and quantity to support required performance levels and also to satisfy the existing constraints. The allocation scheme appeared to provide the most efficient usage of the available data and gave segment coverage of major producing areas and thus improved the probability of an accurate estimate. Author

N80-15450*# Department of Agriculture, Columbia, Md.
ECONOMETRIC MODELS FOR PREDICTING CONFUSION CROP RATIOS
D. E. Umberger, M. H. Proctor, J. E. Clark (Oregon State Univ., Corvallis), L. M. Eisgruber (Oregon State Univ., Corvallis), and C. B. Braschler, Principal Investigators (Missouri Univ., Columbia). *In* NASA. Johnson Space Center. Proc. of Tech. Sessions, Vol. 1 and 2. Jul. 1979. p. 19-46. refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Results for both the United States and Canada show that econometric models can provide estimates of confusion crop ratios that are more accurate than historical ratios. Whether these models can support the LACIE 90/90 accuracy criterion is uncertain. In the United States, experimenting with additional model formulations could provide improved methods models in

some CRD's, particularly in winter wheat. Improved models may also be possible for the Canadian CD's. The more aggressive province/state models outperformed individual CD/CRD models. This result was expected partly because acreage statistics are based on sampling procedures, and the sampling precision declines from the province/state to the CD/CRD level. Declining sampling precision and the need to substitute province/state data for the CD/CRD data introduced measurement error into the CD/CRD models. A.R.H.

N80-15451*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE SAMPLING DESIGN
A. H. Feiveson, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), and C. R. Hallum, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 47-52. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C
The sampling design in LACIE consisted of two major components, one for wheat acreage estimation and one for wheat yield prediction. The acreage design was basically a classical survey for which the sampling unit was a 5- by 6-nautical mile segment; however, there were complications caused by measurement errors and loss of data. Yield was predicted by sampling meteorological data from weather stations within a region and then using those data as input to previously fitted regression equations. Wheat production was not estimated directly, but was computed by multiplying yield and acreage estimates. The allocation of samples to countries is discussed as well as the allocation and selection of segments in strata/substrata. A.R.H.

N80-15452*# Lockheed Electronics Co., Houston, Tex.
LACIE AREA SAMPLING FRAME AND SAMPLE SELECTION
C. J. Liszcz, Principal Investigator. *In* NASA Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 53-56. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C
Transparent acetate overlays containing agricultural boundaries within each of the LACIE countries were prepared and registered to operational navigation charts (ONC's). Full frame LANDSAT color-infrared images of the same scale as the ONC's (1:1 million) were used to identify agricultural boundaries based on discernible agricultural field patterns. Preliminary steps taken in the preparation of the base map overlay, and the construction of an overlay of the base map physical features are described as well as the construction of the agricultural and nonagricultural delineation overlay. A.R.H.

N80-15453*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE LARGE AREA ACREAGE ESTIMATION
R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.) and A. H. Feiveson, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 57-65, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C
A sample wheat acreage for a large area is obtained by multiplying its small grains acreage estimate as computed by the classification and mensuration subsystem by the best available ratio of wheat to small grains acreages obtained from historical data. In the United States, as in other countries with detailed historical data, an additional level of aggregation was required because sample allocation was made at the substratum level. The essential features of the estimation procedure for LACIE countries are included along with procedures for estimating wheat acreage in the United States. A.R.H.

N80-15454*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE AREA AGGREGATION AND MEAN-SQUARED PREDICTION ERROR ESTIMATION FOR LACIE YIELD AND PRODUCTION FORECASTS
R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.) and A. H. Feiveson, Principal Investigator. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 67-71, ref. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C
Aggregation formulas are given for production estimation of a crop type for a zone, a region, and a country, and methods for estimating yield prediction errors for the three areas are described. A procedure is included for obtaining a combined yield prediction and its mean-squared error estimate for a mixed wheat pseudozone. A.R.H.

N80-15455*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CLASSIFICATION AND MENSURATION OF LACIE SEGMENTS
R. P. Heydorn, R. M. Bizzell, J. A. Quirein (Lockheed Electronics Co., Houston, Tex.), K. M. Abotteen (Lockheed Electronics Co., Houston, Tex.), and C. A. Sumner, Principal Investigators (Lockheed Electronics Co., Houston, Tex.). *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 73-86, refs. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C
The theory of classification methods and the functional steps in the manual training process used in the three phases of LACIE are discussed. The major problems that arose in using a procedure for manually training a classifier and a method of machine classification are discussed to reveal the motivation that led to a redesign for the third LACIE phase. A.R.H.

N80-15456*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LACIE REGISTRATION PROCESSING
Gerald J. Grebowsky, Principal Investigator. *In* NASA Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 87-97, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C
The basic requirements for the LACIE processing system are to extract specified test sites (sample segments) from LANDSAT MSS data, and to apply geometric corrections and perform correlations to ensure registration between successive data acquisitions to within 1 pixel (root mean square). The general flow within the LACIE processing system is described with emphasis on (1) determination of line and pixel location of a search area within an MSS frame; (2) determination of the geometric correction coefficient and the application of geometric corrections; (3) edge detection; and (4) correlation by coincidence of edges. A.R.H.

N80-15457*# Environmental Data and Information Service, Washington, D. C.
DEVELOPMENT OF LACIE CCEA-1 WEATHER/WHEAT YIELD MODELS
N. D. Strommen, C. M. Sakamoto (Environmental Data and Information Service, Columbia, Mo.), S. K. LeDuc (Environmental Data and Information Service, Columbia, Mo.), and D. E. Umberger, Principal Investigators (USDA Economics, Statistics, and Cooperative Service, Columbia, Mo.). *In* NASA Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 99-108, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C
The advantages and disadvantages of the casual (phenological, dynamic, physiological), statistical regression, and analog approaches to modeling for grain yield are examined. Given LACIE's primary goal of estimating wheat production for the large areas of eight major wheat-growing regions, the statistical regression approach of correlating historical yield and climate data offered the Center for Climatic and Environmental Assessment the greatest potential return within the constraints of time and data sources. The basic equation for the first generation wheat-yield model is given. Topics discussed include truncation, trend variable, selection of weather variables, episodic events, strata selection, operational data flow, weighting, and model results. A.R.H.

N80-15458*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
GROWTH STAGE ESTIMATION
V. S. Whitehead, D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), and W. E. Crea, Principal Investigators. *In its* Proc. of

best copy available

Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 109-114, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A09/MF A01 CSCL 02C

Of the three candidate approaches to adjustment of the crop calendar to account for year-to-year weather differences, the Robertson triquadratic unit, a function of a nonlinear function of maximum and minimum temperature and day length, best described the rate of phenological development of wheat. The adjustable crop calender (ACC) as implemented for LACIE is used to calculate the daily increment of development through six physiological stages of growth. Topics covered include dormancy modeling, the spring restart model, spring wheat starter model, winter starter model, winter wheat starter model, inclusion of the moisture variable, and display of crop stage estimation results. Assessment of the ACC accuracy over the period of LACIE operation indicates that the adjustable crop calendars used provided more accurate information than would have been available using historical norms. The models performed best under the conditions from which they were derived (Canadian spring wheat) and most poorly for the dwarf varieties and Southern Hemisphere applications. A.R.H.

N80-15459*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
ACCURACY ASSESSMENT: THE STATISTICAL APPROACH TO PERFORMANCE EVALUATION IN LACIE
A. G. Houston, A. H. Feiveson, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), and E. N. Hsu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.). *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 115-130, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A09/MF A01 CSCL 02C

A statistical methodology was developed to check the accuracy of the products of the experimental operations throughout crop growth and to determine whether the procedures are adequate to accomplish the desired accuracy and reliability goals. It has allowed the identification and isolation of key problems in wheat area yield estimation, some of which have been corrected and some of which remain to be resolved. The major unresolved problem in accuracy assessment is that of precisely estimating the bias of the LACIE production estimator. Topics covered include: (1) evaluation techniques; (2) variance and bias estimation for the wheat production estimate; (3) the 90/90 evaluation; (4) comparison of the LACIE estimate with reference standards; and (5) first and second order error source investigations. A.R.H.

N80-15460*# California Univ., at Berkeley.
MANUAL INTERPRETATION OF LANDSAT DATA
C. M. Hay, Principal Investigator. *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 131-146, refs. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A09/MF A01 CSCL 02C

The task of the analyst throughout LACIE phases 1 and 2 consisted of outlining representative areas (fields) for all spectral classes within a segment on the basis of their appearance on the LANDSAT image products, and then labeling the crop type (wheat/nonwheat) within the selected training areas. For LACIE phase 3, a procedure was developed and implemented which incorporated clustering for spectral class definition and training statistics generation. The only analyst's task was crop type identification. The logical processes involved in interpretation are described, rather than a step-by-step description of analyst procedures. A.R.H.

N80-15461*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ACQUISITION AND PREPROCESSING OF LANDSAT DATA
T. N. Horn (GE Space Div., Beltsville, Md.), L. E. Brown, and W. H. Anonsen, Principal Investigators. *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 147-155, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A09/MF A01 CSCL 02C

The original configuration of the GSFC data acquisition, preprocessing, and transmission subsystem, designed to provide LANDSAT data inputs to the LACIE system at JSC, is described. Enhancements made to support LANDSAT -2, and modifications for LANDSAT -3 are discussed. Registration performance throughout the 3 year period of LACIE operations satisfied the 1 pixel root-mean-square requirements established in 1974, with more than two of every three attempts at data registration proving successful, notwithstanding cosmetic faults or content inadequacies to which the process is inherently susceptible. The cloud/snow rejection rate experienced throughout the last 3 years has approached 50%, as expected in most LANDSAT data use situations. A.R.H.

N80-15462*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
ANCILLARY DATA ACQUISITION FOR LACIE
B. E. Spiers (USDA Agricultural Stabilization and Conservation Service, Houston, Tex.) and R. L. Patterson, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 157-162, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A09/MF A01 CSCL 02C

The design, implementation, and operational functions of the three phases of LACIE supported the data needs of all other elements of the project and required several types of data in addition to LANDSAT multispectral digital data. The nonelectronic data base consisted of statistical data, printed reports, periodicals, ground observed data received from intensive test sites and operational segments, and full-frame multispectral scanner CIR photographs. The following data were collected for the test sites in the United States and Canada: land use inventories, periodic crop observations, solar radiometer measurements, rainfall, and wheat yield for selected fields. A.R.H.

N80-15463*# Lockheed Electronics Co., Houston, Tex.
LACIE DATA HANDLING TECHNIQUES
G. H. Watts, Principal Investigator. *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 163-167. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A09/MF A01 CSCL 02C

Techniques implemented to facilitate processing of LANDSAT multispectral data between 1975 and 1978 are described. The data that were handled during the large area crop inventory experiment and the storage mechanisms used for the various types of data are defined. The overall data flow, from the placing of the LANDSAT orders through the actual analysis of the data set, is discussed. An overview is provided of the status and tracking system that was developed and of the data base maintenance and operational task. The archiving of the LACIE data is explained. Author

N80-15464*# Lockheed Electronics Co., Houston, Tex.
THE ACQUISITION, STORAGE, AND DISSEMINATION OF LANDSAT AND OTHER LACIE SUPPORT DATA
L. F. Abbotts and R. M. Nelson, Principal Investigators. *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 169-177. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A09/MF A01 CSCL 02C

Activities performed at the LACIE physical data library are described. These include the researching, acquisition, indexing, maintenance, distribution, tracking, and control of LACIE operational data and documents. Much of the data available can be incorporated into an Earth resources data base. Elements of the data collection that can support future remote sensing programs include: (1) the LANDSAT full-frame image files; (2) the microfilm file of aerial and space photographic and multispectral maps and charts that encompasses a large portion of the Earth's surface; (3) the map/chart collection that includes various scale maps and charts for a good portion of the U.S. and the LACIE area in foreign countries; (4) computer-compatible tapes of good quality LANDSAT scenes; (5) basic remote sensing data, project data, reference material, and associated publications; (6) visual aids to support presentation on remote sensing projects; and (7) research acquisition and handling procedures for managing data. A.R.H.

N80-15465*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
THE CLASSIFICATION AND MENSURATION SUBSYSTEM

K. M. Abotteen (Lockheed Electronics Co., Houston, Tex.) and R. M. Bizzell, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 179-201, refs. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

From an operational standpoint, the most significant item the classification and mensuration subsystem (CAMS) had to overcome in providing the acreage component of the wheat production estimates for LACIE was the scope (segment volume processing required). Peak processing requirements per day increased from 18 to 20 for phase 1 with 700 total segments, to 35 to 40 per day for phase 2 with 1700 total segments, to 75 to 80 per day for phase 3 with 3000 total segments. Key issues regarding interrelationships between man and machines were identified during phase 1 using first generation technology. Procedure 1, tested and evaluated during phase 2 and continued through the initial phase 3 processing period for winter wheat, showed the need for software modification, procedures development, and analyst training. CAMS operations are described with emphasis on the training backgrounds of the analysts, the available data, and the labeling logic. A.R.H.

N80-15486*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
CONCEPTS LEADING TO THE IMAGE-100 HYBRID INTERACTIVE SYSTEM
T. F. Mackin and J. M. Sulester, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 203-209. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

As LACIE Procedure 1 evolved from the Classification and Mensuration Subsystem smallfields procedures, it became evident that two computational systems would have merit-the LACIE/Earth Resources Interactive Processing System based on a large IBM-360 computer oriented for operational use with high computational throughput, and a smaller, highly interactive system based on a PDP 11-45 minicomputer and its display system, the IMAGE-100. The latter had advantages for certain phases; notably, interactive spectral aids could be implemented quite rapidly. This would allow testing and development of Procedure 1 before its implementation on the LACIE/Earth Resources Interactive Processing System. The resulting minicomputer system, called the Classification and Mensuration Subsystem IMAGE-100 Hybrid System, allowed Procedure-1 operations to be performed interactively, except for clustering, classification, and automatic selection of best acquisitions, which were offloaded to the LACIE/Earth Resources Interactive Processing System. Author

N80-15487*# Department of Agriculture, Houston, Tex.
USDA ANALYST REVIEW OF THE LACIE IMAGE-100 HYBRID SYSTEM TEST
P. Ashburn, K. Buelow, H. L. Hansen (USDA Soil Conservation Service, Houston, Tex.), and G. A. May, Principal Investigators (USDA Economics, Statistics, and Cooperatives Service, Houston, Tex.). *In* NASA, Johnson Space Center, Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 211-215. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Fifty operational segments from the U.S.S.R., 40 test segments from Canada, and 24 test segments from the United States were used to provide a wide range of geographic conditions for USDA analysts during a test to determine the effectiveness of labeling single pixel training fields (dots) using Procedure 1 on the 1-100 hybrid system, and clustering and classifying on the Earth Resources Interactive Processing System. The analysts had additional on-line capabilities such as interactive dot labeling, class or cluster map overlay flickers, and flashing of all dots of equal spectral value. Results on the 1-100 hybrid system are described and analyst problems and recommendations are discussed. A.R.H.

N80-15488*# National Oceanic and Atmospheric Administration, Houston, Tex.
OPERATION OF THE YIELD ESTIMATION SUBSYSTEM
D. G. McCrary, J. L. Rogers (USDA Federal Crop Insurance Corp., Houston, Tex.), and J. D. Hill, Principal Investigators. *In* NASA, Johnson Space Center, Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 217-225. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The organization and products of the yield estimation subsystem (YES) are described with particular emphasis on meteorological data acquisition, yield estimation, crop calendars, weekly weather summaries, and project reports. During the three phases of LACIE, YES demonstrated that it is possible to use the flow of global meteorological data and provide valuable information regarding global wheat production. It was able to establish a capability to collect, in a timely manner, detailed weather data from all regions of the world, and to evaluate and convert that data into information appropriate to the project's needs. A.R.H.

N80-15469*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
THE CROP ASSESSMENT SUBSYSTEM: SYSTEM IMPLEMENTATION AND APPROACHES USED FOR THE GENERATION OF CROP PRODUCTION REPORTS
W. E. McAllum, R. E. Hatch (Department of Agriculture, Houston, Tex.), S. M. Boatwright (Ford Aerospace and Communications Corp., Houston, Tex.), C. J. Liszcz (Lockheed Electronics Co., Houston, Tex.), and S. M. Evans, Principal Investigators (Department of Agriculture, Houston, Tex.). *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 227-241, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The primary responsibility of the crop assessment subsystem (CAS) during the three phases of LACIE was to produce crop reports that included estimates of wheat area, yield, and production, as well as a specified set of associated statistical descriptors. The operations of CAS are described with emphasis on sampling strategy, input/output data, evolution of aggregation/reporting system capabilities, and CAS aggregation procedures. A.R.H.

N80-15470*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
LACIE STATUS AND TRACKING
V. M. Dauphin, C. H. Jeffress (Lockheed Electronics Co., Houston, Tex.), and J. M. Everette, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 243-248. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The operational requirements and development of a system designed to meet LACIE needs for data to be available at given stations simultaneously, to measure throughput rates, and perform efficiency analyses are described. The final automated status and tracking system (ASATS) is defined and problems encountered during its evolutionary process are discussed. A.R.H.

N80-15471*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
LACIE QUALITY ASSURANCE
G. L. Gutschewski, Principal Investigator. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 249-255, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Topics covered include (1) development of the LACIE quality assurance program; (2) LACIE quality assurance responsibilities of all organizational elements; (3) internal quality assurance support; and (4) accomplishments. A.R.H.

N80-15472*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
ACCURACY ASSESSMENT SYSTEM AND OPERATION
D. E. Pitts, A. G. Houston, G. Badhwar, M. J. Bender, M. L. Rader (Lockheed Electronics Co., Houston, Tex.), W. G. Eppler (Lockheed Missiles and Space Co., Palo Alto, Calif.), C. W. Ahlers (Lockheed Electronics Co., Houston, Tex.), W. P. White (Lockheed Electronics Co., Houston, Tex.), R. R. Vela, and E. M. Hsu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.). *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 265-288, refs. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198

ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The accuracy and reliability of LACIE estimates of wheat production, area, and yield is determined at regular intervals throughout the year by the accuracy assessment subsystem which also investigates the various LACIE error sources, quantifies the errors, and relates then to their causes. Timely feedback of these error evaluations to the LACIE project was the only mechanism by which improvements in the crop estimation system could be made during the short 3 year experiment. A.R.H.

N80-15473*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE APPLICATIONS EVALUATION SYSTEM EFFICIENCY REPORT
Timothy T. White, Principal Investigator. *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 281-288 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The scope of the three LACIE phases is discussed as well as the system efficiencies which had to be implemented to cope with the resulting LANDSAT data load. The methodologies used in system analysis, some of the specific data collected, and the inferences of these data and their implication on future systems are also discussed. A.R.H.

N80-15474*# Lockheed Electronics Co., Houston, Tex.
CARTOGRAPHY: LACIE'S SPATIAL PROCESSOR
M. L. Rader and R. R. Vela, Principal Investigators. *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 291-296 ref. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The spatial processing needs of LACIE include the location of agricultural test sites, and the registration of ground truth to LANDSAT imagery. The technological aspects of LACIE cartographic support, the need for cartography in satellite crop surveys, and proposed improvements which would enhance support of future programs are discussed. A.R.H.

N80-15475*# IBM Federal Systems Div., Houston, Texas.
THE LACIE DATA BASES: DESIGN CONSIDERATIONS
L. E. Westberry, Principal Investigator. *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 297-306 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The implementation of direct access storage devices for LACIE is discussed with emphasis on the storage and retrieval of image data. Topics covered include the definition of the problem, the solution methodology (design decisions), the initial operational structure, and the modifications which were incorporated. Some conclusions and projections of future problems to be solved are also presented. A.R.H.

N80-15476*# IBM Federal Systems Div., Houston, Texas.
MAN-MACHINE INTERFACES IN LACIE/ERIPS
Barbara B. Duprey, Principal Investigator. *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 307-315 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

One of the most important aspects of the interactive portion of the LACIE/ERIPS software system is the way in which the analysis and decision-making capabilities of a human being are integrated with the speed and accuracy of a computer to produce a powerful analysis system. The three major man-machine interfaces in the system are (1) the use of menus for communications between the software and the interactive user; (2) the checkpoint/restart facility to recreate in one job the internal environment achieved in an earlier one; and (3) the error recovery capability which would normally cause job termination. This interactive system, which executes on an IBM 360/75 mainframe, was adapted for use in noninteractive (batch) mode. A case study is presented to show how the interfaces work in practice by defining some fields based on an image screen display, noting the field definitions, and obtaining a film product of the classification map. A.R.H.

N80-15477*# IBM Federal Systems Div., Houston, Texas.
LACIE/ERIPS SOFTWARE SYSTEM SUMMARY
C. L. Johnson, Principal Investigator. *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 317-332 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The Earth resources interactive processing system (ERIPS) supports LACIE by classifying LANDSAT sensed data on the basis of the statistical similarity to those portions which were identified by analysts. The development and capabilities of the ERIPS software system are described with emphasis on (1) system requirements; (2) LACIE/ERIPS hardware; (3) system functions; (4) pattern recognition concept; and (5) LACIE/ERIPS data bases. Algorithms used in LACIE/ERIPS for statistics, divergence, feature selection, classification, registration, adaptive clustering, iterative clustering, clustering report functions, Sun angle correction, mean level adjustment, and bias correction are appended. A.R.H.

N80-15478*# Lockheed Electronics Co., Houston, Tex.
CONSIDERATIONS FOR DESIGN OF FUTURE RESEARCH AND DEVELOPMENT INTERACTIVE IMAGE ANALYSIS SYSTEMS
T. B. Wilkinson, Principal Investigator. *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 333-344 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Future interactive image analysis systems must provide for the increased processing requirements imposed by a thermal channel to LANDSAT-3 and the increased number of spectral channels with significantly higher spatial resolution provided by the LANDSAT-D thematic mapper. Other design considerations must include the rapidly changing technology in memories and special purpose processors, as well as the analyst-machine interface and the human factors involved. The centralized and distributed system approaches are examined in relation to the optimum design configuration of future systems. A.R.H.

N80-15479*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
VERY HIGH SPEED PROCESSING: APPLICABILITY OF PERIPHERAL DEVICES TO PIXEL-DEPENDENT TASKS
J. C. Lyon, Principal Investigator. *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 345-354 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Early options studied in the satisfaction of LACIE implementation computational demands are described as well as the ultimate selection and development of an array processing solution to the problem. The economic justification, as a function of required LANDSAT analysis, is provided. The suitability of such processors for LACIE and other applications is discussed. A.R.H.

N80-15480*# IBM Federal Systems Div., Houston, Texas.
A LOOK AT COMPUTER SYSTEM SELECTION CRITERIA
E. W. Poole, F. L. Flowers, and W. I. Stanley, Principal Investigators. *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 355-396 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

There is no difficulty in identifying the criteria involved in the computer selection process; complexity arises in objectively evaluating various candidate configurations against the criteria, based on the user's specific needs. A model for formalizing the selection process consists of two major steps: verifying that the candidate configuration is adequate to the user's programming requirements, and determining an overall system evaluation rating based on cost, usability, adaptability, and availability. A 36 step instruction for computer sizing evaluation is included in the appendix along with a sample application of the configuration adequacy model. Selection criteria and the weighting process are also discussed. A.R.H.

N80-15481*# Mitre Corp., Houston, Tex.
COST AND PERFORMANCE CHARACTERISTICS OF DATA SYSTEM CONFIGURATIONS FOR PROCESSING REMOTELY SENSED DATA
P. J. Gregor and J. F. Spitzer, Principal Investigators. *In* NASA, Johnson Space Center. Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p 397-408, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Some alternative approaches to constructing a large remote-sensing data system are explored. The cost and performance implications of using a collection of 'small' computers versus using one large computer are examined. Several architectures and associated costs for the large data system supporting a single data center are presented. Recurring cost factors (maintenance and operations) currently slightly favor the single large-machine architecture, but other factors may dictate the choice of one of the two multimachine architectures discussed. A.R.H.

N80-15482*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
THE LACIE CROP YEARS: AN ASSESSMENT OF THE CROP CONDITIONS EXPERIENCED IN THE THREE YEARS OF LACIE
J. D. Hill (NOAA Environmental Data and Information Service, Houston, Tex.) and D. R. Thompson, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p 411-429. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Meteorological data and LANDSAT spectral data from growing regions in the U.S. Great Plains, the U.S.S.R., and Canada were used to assess growing conditions and to document where anomalies such as drought, floods, and freezes were impacting the crop yield and appearance of spring and winter wheat. In the United States, the weekly rainfall and temperature data were used to estimate soil moisture, which was then related to crop needs by a crop moisture index. The transformation of LANDSAT digital data into a green index number provided a procedure whereby data from a LACIE segment could be classified as drought affected or not. The growing seasons encountered in each LACIE country during the three phases are described. A.R.H.

N80-15483*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
APPLICATION OF LANDSAT DIGITAL DATA FOR MONITORING DROUGHT
D. R. Thompson and O. A. Wehmanen, Principal Investigators (Lockheed Electronics Co., Houston, Tex.). *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p 431-438, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

A technique utilizing transformed LANDSAT digital data for detection of agricultural vegetative water stress was developed during the 1976 South Dakota drought, and expanded to the U.S. Great Plains the following year to evaluate its effectiveness in detecting and monitoring vegetative stress water stress over large areas. This technique, the green index number (GIN), indicated when the vegetation within a segment was undergoing stress. Segments were classified as either moisture-stressed or normal using remote sensing techniques combined with a knowledge of crop condition. The remote sensing-based information was compared to a weekly ground-based index (the crop moisture index) provided by the U.S. Dept. of Commerce. The approaches used and the results from the GIN monitoring program are presented. A.R.H.

N80-15484*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: U.S. GREAT PLAINS
Duane L. Marquis, Principal Investigator. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p 439-479. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The accuracy and reliability of the LACIE design was tested using the nine states of the U.S. Great Plains where comparison data was available. The three phases of LACIE are discussed with respect to the scope; sampling; LANDSAT data; estimates of area, yield, and production; accuracy of the estimates; and technical issues related to each phase. A.R.H.

N80-15485*# Department of Agriculture, Houston, Tex.
LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: U.S.S.R.
J. R. Hickman, Principal Investigator. *In* NASA, Johnson Space Center. Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p 481-512, ref. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

No estimates were generated for the U.S.S.R. during LACIE phase 1. Phase 2 effort was limited to two indicator regions: winter wheat areas where 385 segments were allocated, and spring wheat areas with 362 allocated segments. The level of activity for phase 3 was extended to the entire country which automatically increased the segment workload from 747 to 1947 segments. Production, area, and yield estimates, and their accuracy are discussed for phases 2 and 3 with emphasis on scope, sampling strategy, data base, LANDSAT data, yield analysis for winter and spring wheat, area and production analysis for winter and spring wheat, and technical issues and problems. A.R.H.

N80-15486*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: CANADA
Delanne Conte (USDA Foreign Agricultural Service, Houston, Tex.), A. G. Houston, and L. O. Lovfald, Principal Investigators (USDA Economics, Statistics, and Cooperatives Service, Houston, Tex.). *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p 513-526. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Sampling segment allocation for Canada placed 283 segments within three provinces: Saskatchewan (170), Alberta (75), and Manitoba (38). The data base was comprised of five data sets: allocation, historical, ratio, LANDSAT, and yield. In-season area, yield, and production estimates were generated only during phase 2. These data are presented and analyzed. A.R.H.

N80-15487*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
ACCURACY AND PERFORMANCE OF LACIE AREA ESTIMATES
J. F. Potter (Lockheed Electronics Co., Houston, Tex.), E. M. Hsu (Lockheed Electronics Co., Houston, Tex.), A. G. Houston, and D. E. Pitts, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p 527-573, refs. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Results for the three crop years between 1974 and 1977 are presented in 25 tables for four regions of the U.S. Great Plains. Topics covered include error source analyses and special studies during each phase. Abnormal signature and boundary problems still under investigation are examined. A.R.H.

N80-15488*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
ACCURACY AND PERFORMANCE OF LACIE YIELD ESTIMATES IN MAJOR WHEAT PRODUCING REGIONS OF THE WORLD
D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), R. G. Stuff, A. G. Houston, E. M. Hsu (Lockheed Electronics Co., Houston, Tex.), and M. H. Trenchard, Principal Investigators (Lockheed Electronics Co., Houston, Tex.). *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p 575-587, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The LACIE yield models developed, implemented, and tested during the three phases of the experiment represent the first generation of models designed for the large-scale prediction of wheat production. The models are capable of supporting the

stated project goal of being within 10 percent of the actual wheat production 90 percent of the time. The limitations of the models are inherent in their nature. The temporal resolution limits their ability to handle the erratic weather occurring in critical situations. The relatively large spatial resolution of the individual models limits the capture of localized but important episodic events. A.R.H.

N80-15489*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACCURACY AND PERFORMANCE OF LACIE CROP DEVELOPMENT MODELS
S. K. Woolley (Lockheed Electronics Co., Houston, Tex.), V. S. Whitehead, R. G. Stuff, and W. E. Crea, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 589-604, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Of the three principal phenological crop calendar models evaluated for LACIE, Robertson's trigquadratic model which predicts the rate of progression of wheat through its biological development, was selected. Daily maximum and minimum temperatures and day length are the input variables, and the principal output is a daily increment of development through six physiological growth stages. Because wheat corresponds differently to the environment during each growth stage, five different equations are required. The estimated and observed crop development data were compared in order to establish a measure of confidence in the model and to identify consistent discrepancies that would adversely affect LACIE operation. Although the model provided reliable estimates for various wheat growing regions of the world, it was found that there are still areas in need of further model improvement or development. A.R.H.

N80-15490*# Department of Agriculture, Washington, D.C.
ECONOMIC EVALUATION: CONCEPTS, SELECTED STUDIES, SYSTEM COSTS, AND A PROPOSED PROGRAM
Frank H. Osterhoudt, Principal Investigator. *In* NASA, Johnson Space Center, Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 605-616, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The more usual approaches to valuing crop information are reviewed and an integrated approach is recommended. Problems associated with implementation are examined. What has already been accomplished in the economic evaluation of LACIE-type information is reported including various studies of benefits. The costs of the existing and proposed systems are considered. A method and approach is proposed for further studies. A.R.H.

N80-15491*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHODS FOR SEGMENT WHEAT AREA ESTIMATION
R. P. Heydorn, M. C. Trichel, and J. D. Erickson, Principal Investigators. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 621-632. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The major research conducted during the three years of LACIE to solve problems associated with segment wheat area estimation is reviewed. Topics covered include proportion estimation, clustering, feature extraction, and signature extension. It would appear that LANDSAT-1 and LANDSAT-2 data do not contain enough information to discriminate between crop types perfectly all the time and, therefore, a basic problem arises when no ground truth data on crop types in the area are available. New approaches are needed to reduce labeling error. Perhaps better use of multiyear LANDSAT data, a more detailed understanding of the cropping practices in the area, better crop calendar prediction, and a better understanding of the limiting sources of error in LANDSAT data related to crop discrimination may provide the insight required to develop improved designs. A.R.H.

N80-15492*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ESTIMATING CROP PROPORTIONS FROM REMOTELY SENSED DATA
A. H. Ferveson, Principal Investigator. *In its* Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 633-646, refs. ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The classification/pixel-count method for estimating the proportion of wheat in each segment is theoretically biased even if all distributional assumptions are met. Alternative ways to estimate crop proportions are examined and their performance testing is considered. Topics covered include general linear functional estimates, the method of moments, and maximum likelihood estimators. A.R.H.

N80-15493*# Texas A&M Univ., College Station.
ON THE CLUSTERING OF MULTIDIMENSIONAL PICTORIAL DATA
J. D. Bryant, Principal Investigator. *In* NASA, Johnson Space Center, Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 647-659, refs. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS (For primary document see N80-15448 06-43)
(Contract NAS9-14689)
Avail: NTIS HC A99/MF A01 CSCL 02C

Obvious approaches to reducing the cost (in computer resources) of applying current clustering techniques to the problem of remote sensing are discussed. The use of spatial information in finding fields and in classifying mixture pixels is examined, and the AMOEBA clustering program is described. Internally, a pattern recognition program, from without, AMOEBA appears to be an unsupervised clustering program. It is fast and automatic. No choices (such as arbitrary thresholds to set split/combine sequences) need be made. The problem of finding the number of clusters is solved automatically. At the conclusion of the program, all points in the scene are classified; however, a provision is included for a reject classification of some points which, within the theoretical framework, cannot rationally be assigned to any cluster. A.R.H.

N80-15494*# Lockheed Electronics Co., Houston, Tex.
ON EVALUATING CLUSTERING PROCEDURES FOR USE IN CLASSIFICATION
M. D. Pore, T. E. Moritz, D. T. Register, S. S. Yao, and W. G. Eppler, Principal Investigators. *In* NASA, Johnson Space Center, Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 661-669, refs. ERTS (For primary document see N80-15448 06-43)
(Contract NAS9-15200)
Avail: NTIS HC A99/MF A01 CSCL 02C

The problem of evaluating clustering algorithms and their respective computer programs for use in a preprocessing step for classification is addressed. In clustering for classification the probability of correct classification is suggested as the ultimate measure of accuracy on training data. A means of implementing this criterion and a measure of cluster purity are discussed. Examples are given. A procedure for cluster labeling that is based on cluster purity and sample size is presented. A.R.H.

N80-15495*# Lockheed Electronics Co., Houston, Tex.
CLASSY: AN ADAPTIVE MAXIMUM LIKELIHOOD CLUSTERING ALGORITHM
R. K. Lennington and M. E. Rassbach, Principal Investigators (Elogic, Inc., Houston, Tex.). *In* NASA, Johnson Space Center, Proc. of Tech. Sessions, Vol. 1 and 2, Jul. 1979, p. 671-689, refs. ERTS (For primary document see N80-15448 06-43)
(Contract NAS9-15200)
Avail: NTIS HC A99/MF A01 CSCL 02C

The CLASSY clustering method alternates maximum likelihood iterative techniques for estimating the parameters of a mixture distribution with an adaptive procedure for splitting, combining, and eliminating the resultant components of the mixture. The adaptive procedure is based on maximizing the fit of a mixture of multivariate normal distributions to the observed data using its first through fourth central moments. It generates estimates of the number of multivariate normal components in the mixture as well as the proportion, mean vector, and covariance matrix for each component. The basic mathematical model for CLASSY and the actual operation of the algorithm as currently implemented are described. Results of applying CLASSY to real and simulated LANDSAT data are presented and compared with those generated

by the iterative self-organizing clustering system algorithm on the same data sets. A.R.H.

N80-15496*# Houston Univ., Tex.
LINEAR FEATURE SELECTION WITH APPLICATIONS
H. P. Decell, Jr. and L. F. Guseman, Jr., Principal Investigators (Texas A and M Univ., College Station) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 691-703 refs ERTS (For primary document see N80-15448 06-43)
(Contracts NAS9-15000; NAS9-14689)
Avail: NTIS HC A99/MF A01 CSCL 02C

Several ways in which feature selection techniques were used in LACIE are discussed. In all cases, the methods require some a priori information and assumptions; in most, the classification procedure (Bayes optimal) was chosen in advance. The transformations used for dimensionality reduction are linear, that is, the variables in feature space are always linear combinations of the original measurements. Several numerically tractable criteria developed for LACIE, which provide information about the probability of misclassification, are discussed. Recent results on linear feature selection techniques are included. Their use in LACIE is discussed. Related open questions are mentioned. A.R.H.

N80-15497*# Environmental Research Inst. of Michigan, Ann Arbor.
FEATURE EXTRACTION APPLIED TO AGRICULTURAL CROPS AS SEEN BY LANDSAT
R. J. Kauth, P. F. Lambeck, W. Richardson, G. S. Thomas, and A. P. Pentland, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 705-721 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The physical interpretation of the spectral-temporal structure of LANDSAT data can be conveniently described in terms of a graphic descriptive model called the Tassled Cap. This model has been a source of development not only in crop-related feature extraction, but also for data screening and for haze effects correction. Following its qualitative description and an indication of its applications, the model is used to analyze several feature extraction algorithms. A.R.H.

N80-15498*# Environmental Research Inst. of Michigan, Ann Arbor.
COMPENSATION FOR ATMOSPHERIC EFFECTS IN LANDSAT DATA
P. F. Lambeck and J. F. Potter, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 723-738 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Preprocessing algorithms were developed to remove or reduce the variations in multispectral data caused by variations in Sun angle and by changes in the atmospheric aerosol and water vapor levels. The two most significant algorithms developed by using mathematical models to define interrelations between the required multiplicative and additive correction factors so that just a few statistical characteristics of a LANDSAT distribution model would be sufficient to drive the mathematical model and to calculate the preprocessing corrections are examined. These are the atmospheric correction (ATCOR) computer program and the XSTAR haze correction algorithm. Neither the ATCOR nor the XSTAR algorithm provides an explicit compensation for the effects of changing LANDSAT view angle. Development efforts are underway to address this aspect of the preprocessing problem. A.R.H.

N80-15499*# California Univ. at Berkeley.
DEVELOPMENT OF PARTITIONING AS AN AID TO SPECTRAL SIGNATURE EXTENSION
R. W. Thomas, C. M. Hay, and J. C. Claydon, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 739-755 refs ERTS (For primary document see N80-15448 06-43)
(Contract NAS9-14565)
Avail: NTIS HC A99/MF A01 CSCL 02C

Lists of spectrally similar LACIE sample segments may be constructed with the use of three basic information types: static, seasonal, and pass-specific variables. All are related directly or indirectly to spectral signature behavior and can be used to define spatial domains over which crop-specific signatures should be extendable. Topics covered include: (1) static spectral stratification; (2) evaluation of static partitions relative to variance control objectives; (3) evaluation of the relative importance of static versus seasonal and pass-specific partitioning variables in spectral variability; and (4) a current perspective on partitioning. A.R.H.

N80-15500*# Lockheed Electronics Co., Houston, Tex.
METHODS OF EXTENDING CROP SIGNATURES FROM ONE AREA TO ANOTHER
T. C. Minter, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 757-800 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Efforts to develop a technology for signature extension during LACIE phases 1 and 2 are described. A number of haze and Sun angle correction procedures were developed and tested. These included the ROOSTER and OSCAR cluster-matching algorithms and their modifications, the MLEST and UHMLE maximum likelihood estimation procedures, and the ATCOR procedure. All these algorithms were tested on simulated data and consecutive-day LANDSAT imagery. The ATCOR, OSCAR, and MLEST algorithms were also tested for their capability to geographically extend signatures using LANDSAT imagery. Author

N80-15501*# Environmental Research Inst. of Michigan, Ann Arbor.
SIGNATURE EXTENSION METHODS IN CROP AREA ESTIMATION
R. J. Kauth and W. Richardson, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 801-823 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The Procedure B multispectral processing system is both multisegment and multistratum. It uses data from several LACIE-sized segments together and makes a proportion estimate for the entire group of segments as well as for the individual segments. In the clustering of data features, Procedure B produces multiple classes or strata rather than just two strata (as in Procedure 1), and performs stratified sampling on each of these mutliple strata in order to make a proportion estimate. Tests results for the components and for the overall performance of Procedure B are presented, and conclusions that can be drawn from these tests are discussed. The rationale for signature extension for crop area estimation is summarized. A.R.H.

N80-15502*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN EVALUATION OF PROCEDURE 1
S. G. Wheeler (IBM, Houston, Tex.), R. P. Heydorn, P. N. Misra (IBM, Houston, Tex.), W. Lee, Jr. (IBM, Houston, Tex.), and R. T. Smart, Principal Investigators (IBM, Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 825-842 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

LACIE Procedure 1 has undergone continuous testing and evaluation, starting with analytical and experimental studies even before it was implemented in ERIPS software and continuing to the present with performance evaluations using blind-site data. The strengths and weaknesses of the procedure are indicated and some areas for possible improvement are identified. Results from three of the experiments performed and an evaluation of LACIE Procedure 1 proportion estimates for some blind-site segments are discussed. A.R.H.

N80-15503*# Department of Agriculture, Houston, Tex. Foreign Agricultural Service.
THE VEGETATIVE INDEX NUMBER AND CROP IDENTIFICATION
P. Ashburn, Principal Investigator *In* NASA. Johnson Space

Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 843-855 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

A vegetative index number of numerical value was calculated from the digital values of the LANDSAT system to provide some measure of green growing vegetation. The usefulness of the green numbers for schemes in crop identification and acreage estimation is investigated and the Ashburn vegetation index (AVI) is compared with the Kauth-Thomas vegetation index (KVI) for crop identification schemes. Results of wheat acreage estimation using LACIE Procedure 1 and the AVI for eight sample segments are given. Tables show comparisons between the AVI and the KVI as well as visual results of the AVI. A.R.H.

N80-15504*# California Univ. at Berkeley.
MANUAL LANDSAT DATA ANALYSIS FOR CROP TYPE IDENTIFICATION
C. M. Hay, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 857-866 ref ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The process of manual identification of crop type by human analysts and problems associated in LACIE that were associated with manual crop identification measurement procedures are described. Research undertaken in cooperation with LACIE operations by the supporting research community to effect solutions to, or obtain greater understanding of the problems is discussed. A.R.H.

N80-15505*# Lockheed Electronics Co., Houston, Tex.
LACIE ANALYST INTERPRETATION KEYS
J. G. Baron, R. W. Payne, and W. F. Palmer, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 867-886 ref Original contains imagery. Original photography may be purchased from the EROS data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Two interpretation aids, 'The Image Analysis Guide for Wheat/Small Grains Inventories' and 'The United States and Canadian Great Plains Regional Keys', were developed during LACIE phase 2 and implemented during phase 3 in order to provide analysts with a better understanding of the expected ranges in color variarion of signatures for individual biostages and of the temporal sequences of LANDSAT signatures. The keys were tested using operational LACIE data, and the results demonstrate that their use provides improved labeling accuracy in all analyst experience groupings, in all geographic areas within the U.S. Great Plains, and during all periods of crop development. A.R.H.

N80-15506*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
COLORIMETRIC CONSIDERATION OF TRANSPARENCIES FOR A TYPICAL LACIE SCENE
R. D. Juday, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 887-897 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The production film converter used to produce LACIE imagery is described as well as schemes designed to provide the analyst with operational film products. Two of these products are discussed from the standpoint of color theory. Colorimetric terminology is defined and the mathematical calculations are given. Topics covered include (1) history of product 1 and 3 algorithm development; (2) colorimetric assumptions for product 1 and 3 algorithms; (3) qualitative results from a colorimetric analysis of a typical LACIE scene; and (4) image-to-image color stability. A.R.H.

N80-15507*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
GENERATION OF UNIFORM CHROMATICITY SCALE IMAGERY FROM LANDSAT DATA
R. D. Juday, F. Johnson, R. A. Abotteen (Lockheed Electronics Co., Houston, Tex.), and M. D. Pore, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 899-910 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

An algorithm is presented for generating uniform chromaticity scale (UCS) imagery from multispectral data. A computer program was written to implement the algorithm, and UCS film products were generated. The colors in the film and their temporal change are consistent with those expected for the particular scaling of Krauth components into the (lab) color space. The film product was not subjected to the practical test of competing with previous transformations. Preliminary examination indicates that the product offers the following possibilities: (1) a single film product that will supplant two film products in current use; (2) improved visibility of data differences in regions in data space that are critical to crop identification; and (3) an analytic route to the determination of data-space transformations that will be optimal for particular discrimination problems. A.R.H.

N80-15508*# Lockheed Electronics Co., Houston, Tex.
IMAGE AND NUMERICAL DISPLAY AIDS FOR MANUAL INTERPRETATION
R. A. Abotteen, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 911-921 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Four color image display techniques, developed to aid in interpreting LANDSAT imagery, are described. These are the cluster image, the principal component transformation, the principal component greenness transformation, and the color-coded spectral plot. Experimental results show that the four techniques are useful in selecting and/or identifying representative samples of signatures in a given LANDSAT scene. A.R.H.

N80-15509*# Lockheed Electronics Co., Houston, Tex.
A PROGRAMMED LABELING APPROACH TO IMAGE INTERPRETATION
M. D. Pore and R. A. Abotteen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 923-935 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Manual labeling techniques require the analyst-interpreter to use not only production film converter products but also agricultural and meteorological data and spectral aids in an integrated, judgmental fashion. To control an anticipated high variance in these techniques, a semiautomatic labeling technology was developed. The product of this technology is label identification from statistical tabulation (LIST) which operates from a discriminant basis and has the ability to measure the reliability of the label and to introduce an arbitrary bias. The development of LIST and its properties are described. Numerical results of an application are included and the evaluation of LIST is discussed. A.R.H.

N80-15510*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STATUS OF YIELD ESTIMATION TECHNOLOGY: A REVIEW OF SECOND-GENERATION MODEL DEVELOPMENT AND EVALUATION
R. G. Stuff, T. L. Barnett, G. O. Boatwright, D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), and V. S. Whitehead, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 937-950 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Multiple regression models were studied in order to determine their yield estimation capability for any arbitrary unit area and to obtain greater responsiveness and accuracy through the use of additional data sources applied at smaller spatial and temporal scales. It was concluded that data base inadequacy

was the factor limiting performance in the models studied and that each of the models has more yield predicting capability than was reached during LACIE. K.L.

N80-15511*# Kansas State Univ., Manhattan.
A UNIVERSAL MODEL FOR ESTIMATING WHEAT YIELDS
A. M. Feyerherm and G. M. Paulsen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 951-959 refs ERTS (For primary document see N80-15448 06-43)
(Contracts NAS9-14282; NAS9-14533)
(CONTRIB-78-268-A) Avail: NTIS HC A99/MF A01 CSCL 02C

A universal wheat yield model applicable to both fall- and spring-planted wheat was developed to show separate and joint effects of weather and culture on yields. Data from state experiment stations in a wide range of climates in the U.S. Great Plains were used to build basic relationships among yields, weather, and culture. The application of the model on a macroclimatic scale in the U.S., the U.S.S.R., and India is discussed along with potential improvements. K.L.

N80-15512*# Lockheed Electronics Co., Houston, Tex.
THE LAW OF THE MINIMUM AND AN APPLICATION TO WHEAT YIELD ESTIMATION
R. B. Cate, D. E. Phinney, and M. H. Trenchard, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 961-969 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The adaptation of the law of the minimum (LOM) to wheat yield estimation is discussed. It is demonstrated through a trial application that the LOM concept is a valuable tool for model building when regression tools are inadequate. K.L.

N80-15513*# National Oceanic and Atmospheric Administration, Columbia, Mo. Center for Climatic and Environmental Assessment.
CCEA SECOND-GENERATION WHEAT YIELD MODEL FOR HARD RED WHEAT IN NORTH DAKOTA
S. K. LeDuc, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 971-979 refs Presented at the Crop Modeling Workshop, Columbia, Mo., 3-5 Oct. 1977 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The problem of estimating wheat yields for years with unusual planting dates and/or unusual phenological development is investigated. A yield model developed for hard red spring wheat in North Dakota using historical yields for crop reporting districts in conjunction with meteorological predictor variables based on weekly data is assessed. K.L.

N80-15514*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PREDICTION OF WHEAT PHENOLOGICAL DEVELOPMENT: A STATE-OF-THE-ART REVIEW
M. W. Seeley (Lockheed Electronics Co., Houston, Tex.), M. H. Trenchard (Lockheed Electronics Co., Houston, Tex.), D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), J. R. Baker, and R. G. Stuff, Principal Investigators (Fort Lewis Coll., Durango, Colo.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 981-989 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The merits and shortcomings of LACIE wheat development models are described. The effects of planting dates, spatial errors in the variables, and model forms on accuracy are discussed. K.L.

N80-15515*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NEW DEVELOPMENTS IN SAMPLING AND AGGREGATION FOR REMOTELY SENSED SURVEYS
A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 991-993 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Sampling techniques used to construct large area crop estimates are briefly reviewed. Problem areas in sampling and aggregation are covered. The natural sampling strategy, two phase sampling, weighted aggregation, and multiyear estimation are among the topics discussed. J.M.S.

N80-15516*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NATURAL SAMPLING STRATEGY
C. R. Hallum and J. P. Basu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 995-1013 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

A natural stratum-based sampling scheme and the aggregation procedures for estimating wheat area, yield, and production and their associated prediction error estimates are described. The methodology utilizes LANDSAT imagery and agrophysical data to permit an improved stratification in foreign areas by ignoring political boundaries and restratifying along boundaries that are more homogeneous with respect to the distribution of agricultural density, soil characteristics, and average climatic conditions. A summary of test results is given including a discussion of the various problems encountered. J.M.S.

N80-15517*# Texas A&M Univ., College Station.
MULTIYEAR ESTIMATES FOR THE LACIE SAMPLING PLANS
H. O. Hartley, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1015-1028 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

An approach that may be useful in improving the estimates of the wheat acreages for the LACIE countries for each year by using the short-time series of estimates made in the sequence of consecutive years is presented. A simple 'synthesis' based method of variance component estimation is described. A general theorem concerning weighted least squares, referred to as the Aiken method, is proved. J.M.S.

N80-15518*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WEIGHTED AGGREGATION
A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1029-1036 ref ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The use of a weighted aggregation technique to improve the precision of the overall LACIE estimate is considered. The manner in which a weighted aggregation technique is implemented given a set of weights is described. The problem of variance estimation is discussed and the question of how to obtain the weights in an operational environment is addressed. J.M.S.

N80-15519*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DESIGN, IMPLEMENTATION, AND RESULTS OF LACIE FIELD RESEARCH
M. E. Bauer (Purdue Univ., Lafayette, Ind.), M. C. McEwen, W. A. Malila (ERIM, Ann Arbor, Mich.), and J. C. Harlan, Principal Investigators (Texas A and M Univ., College Station) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1037-1066 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The capability to acquire, process, and interpret remotely sensed multispectral measurements of the energy reflected and emitted from crops, soils, and other Earth surface features is considered. The LACIE Field Measurements Project is described including project objectives, the experimental approach, the data acquisition program, and selected results based on field data. The key accomplishments and results of the experiment and recommendations for future field research are summarized. J.M.S.

N80-15520*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE APPLICATION TEST SYSTEM: AN APPROACH TO TECHNOLOGY TRANSFER

A. C. Aaronson (Dept. of Agriculture, Houston, Tex.), K. Buelow (Dept. of Agriculture, Houston, Tex.), F. C. David (Dept. of Agriculture, Houston, Tex.), R. L. Packard (Dept. of Agriculture, Houston, Tex.), and F. W. Ravet, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1069-1074 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The latest satellite and computer processing and analysis technologies were tested and evaluated in terms of their application feasibility. Technologies evaluated include those developed, tested, and evaluated by the LACIE, as well as candidate technologies developed by the research community and private industry. The implementation of the applications test systdm and the technology transfer experience between the LACIE and the applications test system is discussed highlighting the approach, the achievements, and the shortcomings. J.M.S.

N80-15521*# Department of Agriculture, Houston, Tex.
FUNCTIONAL DEFINITION AND DESIGN OF A USDA SYSTEM
S. M. Evans, E. R. Dario, and G. L. Dickinson, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1075-1084 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The fundamental definition and design of a U.S.D.A. system utilizing the LACIE technology avaliable as of June 1976, is discussed. The organization and methods described are focused on LACIE technology in terms of its transfer for use applications. The simulation of a feasible system design provided timely answers to system design questions, such as the ability of a minicomputer to handle the proposed geometrical correction of MSS data. M.M.M.

N80-15522*# Department of Agriculture, Houston, Tex.
DATA BASE DESIGN FOR A WORLDWIDE MULTICROP INFORMATION SYSTEM
W. G. Driggers, J. M. Downs, J. R. Hickman, and R. L. Packard, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 (Jul. 1979 p 1085-1096 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

A description of the USDA Application Test System data base design approach and resources is presented. The data is described in detail by category, with emphasis on those characteristics which influenced the design most. It was concluded that the use of a generalized data base in support of crop assessment is a sound concept. The IDMS11 minicomputer base system is recommended for this purpose. M.M.M.

N80-15523*# Ford Aerospace and Communications Corp., Houston, Tex.
THE APPLICATION TEST SYSTEM: TECHNICAL APPROACH AND SYSTEM DESIGN
J. L. Benson, D. R. McClelland, J. D. Tarbet, and R. F. Purnell, Principal Investigators (Dept. of Agriculture, Houston, Tex.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1097-1101 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

An insight is provided of the technical approach which was applied to the system design of the USDA Applications Test Program. Included are: identification of requirements, assessment of remote sensing contributions, evaluations of existing techniques, and cost effective development of a system design which utilizes techniques and procedures consistent with requirements. M.M.M.

N80-15524*# Department of Agriculture, Houston, Tex.
RESOURCE MODELING: A REALITY FOR PROGRAM COST ANALYSIS
L. D. Fouts and R. L. Hurst, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jun. 1979 p 1103-1120 ref ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The approach, implementation, operation, and utilization of a model to establish capital investment and operational costs for the Program is presented. These are based on their interrelationships, dependencies, and alternative actions. M.M.M.

N80-15525*# Department of Agriculture, Houston, Tex.
THE APPLICATION TEST SYSTEM: EXPERIENCES TO DATE AND FUTURE PLANS
G. A. May, P. Ashburn, and H. L. Hansen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Session, Vol. 1 and 2 Jul. 1979 p 1121-1125 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The ATS analysis component is presented focusing on methods by which the varied data sources are used by the ATS analyst. Analyst training and initial processing of data is discussed along with short and long plans for the ATS. M.M.M.

N80-15526*# Geological Survey, Reston, Va.
CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM, VOLUME 1 Final Report
Robert H. Alexander, Prinicipal Investigator 26 Sep. 1979 384 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG; Proj. CARETS)
(E80-10031; NASA-CR-162442) Avail: NTIS HC A17/MF A01 CSCL 08F

The author has identified the following significant results. LANDSAT data showed the test region in 1972 to be 9% urban and built-up land, 38% agriculture, 50% forest, 3% nonforested wetlands, and less than 1% barren land, exclusive of water-covered areas. A comprehensive user evaluation revealed greatest demand for high-altitude aerial photography and the detailed maps and data products that can be derived from the metropolitan areas agencies, found relatively little use for LANDSAT imagery at 1:250,000 scale and corresponding manually interpreted land use maps.

N80-15527*# Instituto Geografico Nacional, Madrid (Spain).
THERMAL MAPPING, GEOTHERMAL SOURCE LOCATION, NATURAL EFFLUENTS AND PLANT STRESS IN THE MEDITERRANEAN COAST OF SPAIN Progress Report
Rudolfo NunezdelasCuevas, Fernando LopezdeSagredo, D. Joaquin Melia Miralles, D. Pedro Herranz Araujo, D. Jesus Paredes Perlado, D. Antonio Parrilla, D. J. Luis Picon, D. J. Luis Labrandero, and F. Gonzalez Bernaldez, Principal Investigators 30 Sep. 1979 47 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10032; NASA-CR-162443; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-15528*# Stanford Univ., Calif. School of Applied Earth Sciences.
GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A, HEAT CAPACITY MAPPING MISSION Progress Report, 1 Jul. - 30 Sep. 1979
R. J. P. Lyon and A. E. Prelat, Principal Investigators 30 Sep. 1979 2 p ERTS
(Contract NAS5-24232)
(E80-10033; NASA-CR-162444) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N80-15529*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Jul. - Sep. 1979
Helen N. Paley, Anne B. Kahle, and Stuart E. Marsh, Principal Investigators Nov. 1979 5 p ERTS
(Contract NAS7-100)
(E80-10035; NASA-CR-162446) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N80-15530*# Canada Centre for Remote Sensing, Ottawa (Ontario).
USE OF THERMAL INFRARED AND COLOUR INFRARED IMAGERY TO DETECT CROP MOISTURE STRESS Interim Report
R. C. McKenzie, N. F. Clark, and J. Cihlar, Principal Investigators Mar. 1979 36 p refs Sponsored by NASA ERTS
(E80-10036; NASA-CR-162447) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. In the presence of variable plant cover (primarily percent cover) and variable available water content, the remotely sensed apparent temperatures correlate closely with plant cover and poorly with soil water. To the extent that plant cover is not systematically related to available soil water, available water in the root zone values may not be reliably predicted from the thermal infrared data. On the other hand, if plant cover is uniform and the soil surface is shown in a minor way, the thermal data indicate plant stress and consequently available water in the soil profile.

N80-15531*# Canada Centre for Remote Sensing, Ottawa (Ontario). Applications Div.
HCMM/SOIL MOISTURE EXPERIMENT Progress Report
Josef Cihlar, Principal Investigator 31 Aug. 1979 12 p refs Sponsored by NASA ERTS
(E80-10037; NASA-CR-162448) Avail: NTIS HC A02/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-15532*# California Inst. of Tech., Pasadena.
PHYSICS OF MANTLE AND CORE MINERALS Ph.D. Thesis
Raymond Jeanloz, Principal Investigator 10 Aug. 1979 412 p refs Sponsored by NASA and NSF ERTS
(E80-10038; NASA-CR-162449) Avail: NTIS HC A16/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N80-15533*# Department of Agriculture, Phoenix, Ariz. Water Conservation Lab.
HEAT CAPACITY MAPPING MISSION (HCMM) Quarterly Progress Report, 1 Aug. - 31 Oct. 1979
Ray D. Jackson, Principal Investigator 31 Oct. 1979 1 p ERTS
(NASA Order S-40255-B)
(E80-10039; NASA-CR-162450) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-15534*# Environmental Research Inst. of Michigan, Ann Arbor.
ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 7 Jun. - 14 Sep. 1979
R. Cicone, E. Crist, Q. Holmes, R. J. Kauth, W. A. Malila, and W. Pont, Principal Investigators Oct. 1979 151 p EREP
(Contract NAS9-15476)
(E80-10040; NASA-CR-160362; ERIM-132400-28-P) Avail: NTIS HC A08/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-15535*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
DEMONSTRATION OF WETLAND VEGETATION MAPPING IN FLORIDA FROM COMPUTER-PROCESSED SATELLITE AND AIRCRAFT MULTISPECTRAL SCANNER DATA
M. Kristine Butera Oct. 1979 27 p refs
(NASA-TP-1553; S-492) Avail: NTIS HC A03/MF A01 CSCL 08B

The success of remotely mapping wetland vegetation of the southwestern coast of Florida is examined. A computerized technique to process aircraft and LANDSAT multispectral scanner data into vegetation classification maps was used. The cost effectiveness of this mapping technique was evaluated in terms of user requirements, accuracy, and cost. Results indicate that mangrove communities are classified most cost effectively by the LANDSAT technique, with an accuracy of approximately 87 percent and with a cost of approximately 3 cent per hectare compared to $46.50 per hectare for conventional ground survey methods. R.C.T.

N80-15536*# EG and G Washington Analytical Services Center, Riverdale, Md.
PRECISE RELATIVE LOCATION ESTIMATION FROM SATELLITE LASER OBSERVATIONS
Peter J. Dunn 15 Mar. 1979 19 p refs
(Contract NAS5-25028)
(NASA-CR-159953; Rept-003-79) Avail: NTIS HC A02/MF A01 CSCL 08B

Laser data from the Greenbelt, Bermuda, and Grand Turk Island tec tracking stations, and from observation at Patrick Air Force Base were used in an experiment to determine precise inter-station baselines and relative heights in short orbital arcs of no more than 12 minutes duration. The relative locations obtained are sensitive to reasonable variations in the gravity field to less than 15 cm in inter-station baseline and less than 35 cm in relative height. The formal standard deviations for range measurements at the observed 7 cm noise level are less than 10 cm for either baseline or relative height determinations from the twenty-arc combination solution. The method of data analysis is described, the baseline and relative height results are presented, and gravity model dependence is considered. A.R.H.

N80-15537*# National Aeronautics and Space Administration, Washington, D. C.
VALUE OF CROPS: QUANTITY, QUALITY AND COST PRICE
C. Meyer Dec. 1979 21 p Transl. into ENGLISH of "La Valeur des Recoltes; Quantite, Qualite, Prix de Revient", (Paris), 1969 p 41-55 Original language document was announced as N69-40766 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-75925) Avail: NTIS HC A02/MF A01 CSCL 02C

Possibilities of using algae as a nutritional supplement are examined. The nutritional value and protein content of spirulines of blue algae are discussed. A cost analysis of growing them artificially is presented. M.G.

N80-15538*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POSSIBLE METHODS FOR DISTINGUISHING ICEBERGS FROM SHIPS BY AERIAL REMOTE SENSING
Walton L. Howes Dec. 1979 36 p refs
(NASA-TM-79310; E-266) Avail: NTIS HC A03/MF A01 CSCL 08L

The simplest methods for aerial remote sensing which are least affected by atmospheric opacities are summarized. Radar is preferred for targets off the flight path, and microwave radiometry for targets along the flight path. Radar methods are classified by ability to resolve targets. Techniques which do not require target resolution are preferred. Among these techniques, polarization methods appear most promising, specifically those which differentiate the expected relatively greater depolarization by icebergs from that by ships or which detect doubly-reversed circular polarization. R.C.T.

N80-15539*# International Business Machines Corp., Gaithersburg, Md.
ON-BOARD MULTISPECTRAL CLASSIFICATION STUDY. VOLUME 2: SUPPLEMENTARY TASKS
D. Ewalt Dec. 1979 173 p refs
(Contract NAS1-15119)
(NASA-CR-159178) Avail: NTIS HC A08/MF A01 CSCL 22A

The operational tasks of the onboard multispectral classification study were defined. These tasks include: sensing characteristics for future space applications; information adaptive systems architectural approaches; data set selection criteria; and onboard functional requirements for interfacing with global positioning satellites. R.C.T.

N80-15540# Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.
CONCEPT DEVELOPMENT OF AUTOMATED IMAGE ANALYSIS. AUTOMATED CONTOUR RECOGNITION AND CLASSIFICATION IN AERIAL PHOTOGRAPHY BY MEANS OF ANGLES AND CURVATURE Final Report
Henning F. Harmuth 31 Aug. 1979 96 p refs
(Contract DAAK70-78-C-0147)
(AD-A074439; ETL-0194) Avail: NTIS HC A05/MF A01 CSCL 09/4

The automated contour recognition and classification in aerial photography requires a feature of contours that is invariant to shift, rotation and scaling. General polygons are characterized by their angles and their normalized sides. The normalization of the sides may be achieved by dividing either with the longest side or with the circumference of the polygon. For a curved contour, the simplest invariant under shift and rotation is the curvature. To make the curvature invariant to scaling, one may divide it by the largest curvature or multiply it with the length of the contour; the multiplication with the length of the contour is better because of the finite resolution of photographs and equipment. The principle of contour recognition and classification based on angles and curvature is worked out for practical displays that produce square patterns, such as liquid crystal or plasma tube displays. The mechanical and electronic design for experimental equipment is carried out based on a plasma tube display with 512 x 512 resolved points. GRA

N80-15541# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
REMOTE SENSING OF CROSSWIND PROFILES USING THE CORRELATION SLOPE METHOD Final Report
Richard Barakat and Tommy E. Buder Aberdeen Proving Ground, Md. BRL Jul. 1979 29 p refs
(Contract DAAD05-76-C-0730; DA Proj. 1T1-61101-A-91A)
(AD-A074848; AD-E430298; ARBRL-CR-00402) Avail: NTIS HC A03/MF A01 CSCL 04/2

The correlation slope method relates the slope of the space-time covariance function at zero lag time to the crosswind component along a path via an integral equation of the first kind through the intermediary of a function of the distance between detectors. The integral equation is inverted to find the crosswind profile using the method of singular value decomposition. The effect of noise in the measurement of the correlation slope is considered as well as the influence of finite detector separation. Some numerical results are shown. GRA

N80-15542# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF AGRICULTURAL RESOURCES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Oct. 1973 - Sep. 1979
Audrey S. Hundemann Oct. 1979 245 p Supersedes NTIS/PS-78/0969; NTIS/PS-77/0867; NTIS/PS-76/0714; NTIS/PS-75/668; NTIS/PS-75/068
(NTIS/PS-79/0993/0; NTIS/PS-78/0969; NTIS/PS-77/0867; NTIS/PS-76/0714; NTIS/PS-75/668; NTIS/PS-75/068) Avail: NTIS HC $28.00/MF $28.00 CSCL 03D

Results of agricultural resources surveys using remote sensing techniques for crop identification, acreage measurement, land mapping, and forest density studies are discussed. A few abstracts pertain to identification of plant diseases and insect pests and fishery resource assessment. This updated bibliography contains 239 abstracts, 28 of which are new entries to the previous edition. GRA

N80-15543# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
SURVEY OF SATELLITE SENSORS AND DATA WITH APPLICATION TO OTEC RESOURCE AND OPERATIONS REQUIREMENTS
George A. Maul, Fred M. Vukovich, Mark Bushnell, and Bobby W. Crissman Mar. 1979 80 p refs
(PB-300297/9; NOAA-TM-ERL-AOML-37; NOAA-79081002) Avail: NTIS HC A05/MF A01 CSCL 22A

The existing instruments and the capability of those instruments for observing geophysical variables that contribute to surface thermal resource fluctuations, the operating environment, and the impact of an ocean thermal energy conversion plant on the ocean are summarized. It is emphasized that remote sensing is not capable at this stage in its development to independently provide all the observations necessary for measurement of a given variable. Only an integrated in situ and remotely sensed measurement system can offer high quality data needed for environmental research. GRA

N80-15544# Bureau of Mines, Denver, Colo. Mining Research Center.
THREE POTENTIAL LONGWALL MINING METHODS FOR THICK COAL SEAMS IN THE WESTERN UNITED STATES
Richard H. Oitto 1979 41 p refs
(PB-299568/6; BM-IC-8792) Avail: NTIS HC A03/MF A01 CSCL 08I

Three longwall mining methods practiced in foreign countries are described. Potential for increasing underground recovery and productivity in thick coalbeds of the western United States is emphasized. The methods are multislice longwalling, longwall caving, and high-face longwalling. Foreign practices and possible application in the United States are discussed. GRA

N80-15545# Ultrasystems, Inc., Irvine, Calif.
COAL MINE COMBUSTION PRODUCTS IDENTIFICATION AND ANALYSIS: PROCECURES AND SUMMARY Final Research Report, 1 Nov. 1977 - 1 Sep. 1978
K. L. Paciorek, R. H. Kratzer, J. Kaufman, and J. H. Nakahara Sep. 1978 141 p refs
(Contract DI-BM-HO-133004)
(PB-299559/5; BM-OFR-109-79) Avail: NTIS HC A07/MF A01 CSCL 08I

The potential hazard arising from the evolution of toxic products upon thermal oxidative decomposition of compositions employed in underground mining was assessed. Testing procedures and a basis for realistic regulations for materials to be permitted in underground operations are provided. The thermal oxidative decomposition products of specific compositions were determined on a weight/weight basis and their potential toxic hazard was evaluated. R.C.T.

N80-15546# National Ocean Survey, Rockville, Md. Office of Marine Technology.
TECHNICAL PAPERS ON AIRBORNE LASER HYDROGRAPHY Technical Memorandum, Mar. - Dec. 1978
Gary C. Guenther, Robert W. L. Thomas (EG and G Washington Anal. Serv. Center, Inc., Rockville, Md.), Lowell R. Goodman, David B. Enabnit, and Robert N. Swift (EG and G Washington Anal. Serv. Center, Inc., Rockville, Md.) Feb. 1979 74 p refs
(PB-299321/0; NOAA-TM-NOS-25; NOAA-79072309) Avail: NTIS HC A04/MF A01 CSCL 08J

Early results of an experimental and theoretical investigation into the technical aspects of airborne laser bathymetry are presented in the following papers: (1) Laser Bathymetry for Near-Shore Charting Application (A Status Report); (2) Laser Hydrography; (3) Bathymetry Intercomparison: Laser vs. Acoustic; (4) Laser Application for Near-Shore Nautical Charting; (5) Laser Bathymetry for Near-Shore Charting Application (Preliminary Field Test Results); and (6) Theoretical Characterization of Bottom Returns for Bathymetric Lidar. GRA

N80-15547# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT ALEUTIAN ISLANDS NATIONAL WILDLIFE RANGE. PROJECT 8: CONSERVATION OF NATURAL AREAS AND OF THE GENETIC MATERIAL THEY CONTAIN
Janet Bonner, comp. 1979 45 p
(PB-297931/8) Avail: NTIS HC A03/MF A01 CSCL 08G

Photographs and images of biosphere reserves taken from spacecraft and aircraft provide a significant data base showing broad views and details of the landscape and are invaluable in searching for changes and trends in forest cover, water area, and other diagnostic landscape features. Each data report lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can

make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

N80-15548# Bureau of Mines, Washington, D. C.
MINERALS IN THE US ECONOMY: TEN-YEAR SUPPLY-DEMAND PROFILES FOR NONFUEL MINERAL COMMODITIES (1968-77)
May 1979 105 p
(PB-299536/3; BM-SP-5-79) Avail: NTIS HC A06/MF A01 CSCL 08I

The supply-demand diagrams and 10-year tables for nonfuel mineral commodities are presented. Essential data required by government, industry, and others to formulate policies and programs that can help assure an adequate and continuing supply of mineral raw materials are included. The 10-year data base terminates with 1977 figures because adequate world information was not available beyond that date. GRA

N80-15549# Economics, Statistics and Cooperatives Service, Washington, D. C. Statistical Research Div.
OBTAINING TIMELY CROP AREA ESTIMATES USING GROUND-GATHERED AND LANDSAT DATA
George Hanuschak, Richard Sigman, Michael Craig, Martin Ozga, and Raymond Luebbe Aug. 1979 35 p refs
(PB-300825/7; TB-1609) Avail: NTIS HC A03/MF A01 CSCL 02C

The NASA Earth resources monitoring satellites, LANDSAT 2 and 3, were used with conventional ground-gathered data to estimate planted crop areas for the 1978 Iowa corn and soybean crops. Estimates that used LANDSAT data and ground data jointly were substantially more precise than those made from ground data alone. These estimates were one of several data sources used in determining the official year-end Annual Crop Summary for Iowa. Problems associated with total project cost, timely delivery of LANDSAT data to the USDA, and cloud cover must be solved prior to any planning for an operational program. GRA

N80-15550# Geological Survey, Tucson, Ariz.
STATISTICAL SUMMARIES OF ARIZONA STREAMFLOW DATA
T. W. Anderson and Natalie D. White Jan. 1979 422 p Prepared jointly with Arizona Water Comm., Phoenix
(PB-299354/1; USGS/WRI-79/5) Avail: NTIS HC A18/MF A01 CSCL 08H

Streamflow data for 143 gaging stations in Arizona are presented in tables. Statistical summaries are given for all active streamflow-gaging stations at which flow is unregulated, for discontinued stations that have at least 5 years of record, and for a few stations at which the flow is partly regulated. The summaries include log-Pearson Type III flood-frequency data for selected streamflow-gaging stations, annual peak discharges and gage heights and annual volumes, duration tables of daily discharges, lowest mean discharges, highest mean discharges, statistics on normal monthly mean discharges, and statistics on normal annual mean discharges. GRA

N80-15551# Hydrocomp, Inc., Palo Alto, Calif.
WATERSHED EROSION AND SEDIMENT TRANSPORT MODEL Final Report, Jul. 1975 - Jun. 1977
K. M. Leytham and R. C. Johanson Mar. 1979 373 p refs (Grant EPA-R-803726-01)
(PB-299070/3; EPA-600/3-79-028) Avail: NTIS HC A16/MF A01 CSCL 08H

The development and initial testing of the Watershed Erosion and Sediment Transport (WEST) Model is described. The movement of water and sediment through a channel system is simulated using the CHANL model. In the CHANL model the channels of a watershed are represented by a network of reaches. Hydraulic routing is performed using the kinematic wave approximation. The results are fed to the sediment algorithms which explicitly represent the processes of deposition, scour, armoring, and advection. The model is designed to handle any mixture of cohesive and cohensionless sediment. GRA

N80-15552# North Carolina Water Resources Research Inst., Raleigh.
USE OF FLUVIAL PROCESSES TO MINIMIZE ADVERSE EFFECTS OF STREAM CHANNELIZATION
Nelson R. Nunnally (North Carolina Univ., Charlotte) and Edward Keller (California Univ., Santa Barbara) Jul. 1979 128 p refs (Contract DI-14-34-0001-6103)
(FB-299934/0; UNC-WRRI-144; W79-09672; OWRT-B-089-NC(8)) Avail: NTIS HC A07/MF A01

Stream restoration, a means for restoring flow efficiency in streams that have become debris choked and eroded due to the direct or indirect actions of humans is discussed. Such degraded streams are typically characterized by debris jams, severe bank erosion, overwide channels, and heavy sediment discharge brought on by altered stream regimes, land use changes or prior channelization. Stream restoration is accomplished by removing debris jams and providing fairly uniform channel cross-sections and gradients while preserving meanders, leaving as many trees as possible along stream banks, and stabilizing banks with vegetation and riprap where necessary. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-15553*# Technical Report Services, Rocky River, Ohio.
EVALUATION OF FEASIBILITY OF PRESTRESSED CONCRETE FOR USE IN WIND TURBINE BLADES
Seymour Leiblein, D. S. Londahl, Donn B. Furlong, and Mark E. Dreier Sep. 1979 119 p refs Prepared in cooperation with Tuthill Pump Co., San Rafael, Calif. and Paragon Pacific, Inc., El Segundo, Calif.
(Contracts NAS3-20596; NAS3-30813; EX-76-I-01-1028; NASA Order C-25906)
(NASA-CR-159725; DOE/NASA/5906-79/1) Avail: NTIS HC A06/MF A01 CSCL 10B

A preliminary evaluation of the feasibility of the use of prestressed concrete as a material for low cost blades for wind turbines was conducted. A baseline blade design was achieved for an experimental wind turbine that met aerodynamic and structural requirements. Significant cost reductions were indicated for volume production. Casting of a model blade section showed no fabrication problems. Coupled dynamic analysis revealed that adverse rotor tower interactions can be significant with heavy rotor blades. R.C.T.

N80-15554*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
SPACE SOLAR CELLS: HIGH EFFICIENCY AND RADIATION DAMAGE
Henry W. Brandhorst, Jr. and Daniel T. Bernatowicz 1980 12 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81387; E-297) Avail: NTIS HC A02/MF A01 CSCL 10A

The progress and status of efforts to increase the end-of-life efficiency of solar cells for space use is assessed. High efficiency silicon solar cells, silicon solar cell radiation damage, GaAs solar cell performance and radiation damage and 30 percent devices are discussed. R.E.S.

N80-15555*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
OPEN-CIRCUIT VOLTAGE IMPROVEMENTS IN LOW RESISTIVITY SOLAR CELLS
M. P. Godlewski, T. M. Kluchar, G. A. Mazaris, and V. G. Weizer 1980 11 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81388; E-298) Avail: NTIS HC A02/MF A01 CSCL 10A

Improvements in the open circuit voltage of 0.1 ohm-cm silicon solar cells were achieved using a multistep diffusion technique. Experimental details are given along with the results of an analysis that indicate that anomalous behavior of the electron mobility in the cell base limits attainment of higher voltages.
Author

N80-15556*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BACK SURFACE REFLECTORS FOR SOLAR CELLS
An-Ti Chai Chai 1980 10 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81390; E-300) Avail: NTIS HC A02/MF A01 CSCL 10A

Sample solar cells were fabricated to study the effects of various back surface reflectors on the device performance. They are typical 50 micrometers thick, space quality, silicon solar cells except for variations of the back contact configuration. The back surfaces of the sample cells are polished to a mirror like finish, and have either conventional full contacts or grid finger contacts. Measurements and evaluation of various metallic back surface reflectors, as well as cells with total internal reflection, are presented. Results indicate that back surface reflectors formed using a grid finger back contact are more effective reflectors than cells with full back metallization and that Au, Ag, or Cu are better back surface reflector metals than Al. R.C.T.

N80-15557*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATION DAMAGE IN LITHIUM-COUNTERDOPED N/P SILICON SOLAR CELLS
A. M. Hermann (Tulane Univ.), C. K. Swartz, H. W. Brandhorst, Jr., and I. Weinberg 1980 13 p refs Presented at the 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980, sponsored by IEEE
(NASA-TM-81391; E-301) Avail: NTIS HC A02/MF A01 CSCL 10A

Lithium counterdoped n+/p silicon solar cells were irradiated with 1 MV electrons and their post irradiation performance and low temperature annealing properties were compared to that of the 0.35 ohm cm control cells. Cells fabricated from float zone and Czochralski grown silicon were investigated. It was found that the float zone cells exhibited superior radiation resistance compared to the control cells, while no improvement was noted for the Czochralski grown cells. Room temperature and 60 C annealing studies were conducted. The annealing was found to be a combination of first and second order kinetics for short times. It was suggested that the principal annealing mechanism was migration of lithium to a radiation induced defect with subsequent neutralization of the defect by combination with lithium. The effects of base lithium gradient were investigated. It was found that cells with negative base lithium gradients exhibited poor radiation resistance and performance compared to those with positive or no lithium gradients; the latter being preferred for overall performance and radiation resistance. M.G.

N80-15558*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATION DAMAGE ANNEALING MECHANISMS AND POSSIBLE LOW TEMPERATURE ANNEALING IN SILICON SOLAR CELLS
Irving Weinberg and Clifford K. Swartz 1980 10 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81392; E-302) Avail: NTIS HC A02/MF A01 CSCL 10A

The defect responsible for reverse annealing in 2 ohm/cm n(+)/p silicon solar cells was identified. This defect, with energy level at e sub v + 0.30 eV was tentatively identified as a boron oxygen-vacancy complex. Results indicate that its removal could result in significant annealing for 2 ohm/cm and lower resistivity cells at temperatures as low as 200 C. These results were obtained by use of an expression derived from the Shockley-Read-Hall recombination theory which relates measured diffusion length ratios to relative defect concentrations and electron capture cross sections. The relative defect concentrations and one of the required capture cross sections are obtained from Deep Level Transient Spectroscopy. Four additional capture cross sections are obtained using diffusion length data and data from temperature dependent lifetime studied. These calculated results are in reasonable agreement with experimental data. M.G.

N80-15559*# Solarex Corp., Rockville, Md.
ECONOMICAL SPACE POWER SYSTEMS
Joel H. Burkholder Jan. 1980 161 p refs
(Contract NAS3-21353)
(NASA-CR-159696) Avail: NTIS HC A08/MF A01 CSCL 10B

A commercial approach to design and fabrication of an economical space power system is investigated. Cost projections are based on a 2 kW space power system conceptual design taking into consideration the capability for serviceability, constraints of operation in space, and commercial production engineering approaches. A breakdown of the system design, documentation, fabrication, and reliability and quality assurance estimated costs are detailed. M.G.

N80-15560*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CANDIDATE THERMAL ENERGY STORAGE TECHNOLOGIES FOR SOLAR INDUSTRIAL PROCESS HEAT APPLICATIONS
Edward R. Furman 1979 12 p refs Presented at Solar Industrial Process Heat Conf., Oakland, Calif., 31 Oct. - 2 Nov. 1979; sponsored by Solar Energy Res. Inst.
(Contract EC-77-A-31-1034)
(NASA-TM-81380; DOE/NASA/1034-79/6; E-285) Avail: NTIS HC A02/MF A01 CSCL 10A

A number of candidate thermal energy storage system elements were identified as having the potential for the successful application of solar industrial process heat. These elements which include storage media, containment and heat exchange are shown. R.C.T.

N80-15561*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GLOBAL CALIBRATION OF TERRESTRIAL REFERENCE CELLS AND ERRORS INVOLVED IN USING DIFFERENT IRRADIANCE MONITORING TECHNIQUES
Henry B. Curtis 1980 12 p refs Presented at the 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(Contract DE-AI01-79ET-20485)
(NASA-TM-81393; DOE/NASA/20485-79/6; E-303) Avail: NTIS HC A02/MF A01 CSCL 10A

The feasibility of global calibration of terrestrial reference cells is discussed. A simple, accurate 'secondary' calibration technique based on ratios of test to reference cell currents measured in natural sunlight is described. Different techniques for monitoring incident irradiance during solar cell performance measurements are also examined and assessed, including the techniques of black-body detectors, calibrated reference cells, and the convolution of spectral response with solar irradiance.
M.G.

N80-15562*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Materials and Processes Lab.
CHARACTERIZATION OF THREE TYPES OF SILICON SOLAR CELLS FOR SEPS DEEP SPACE MISSIONS. VOLUME 1: CURRENT-VOLTAGE CHARACTERISTICS OF OCLI BSF/BSR 10 ohm-cm, AND BSR 2 ohm-cm CELLS AS A FUNCTION OF TEMPERATURE AND INTENSITY
A. F. Whitaker, S. A. Little, C. F. Smith, Jr., and V. A. Wooden Nov. 1979 93 p refs
(NASA-TM-78253) Avail: NTIS HC A05/MF A01 CSCL 10A

Three types of high performance silicon solar cells, BSF/BSR 10 ohm-cm, BSR 10 ohm-cm, and BSR 2 ohm-cm, were evaluated for their low temperature and low intensity performance. Sixteen cells of each type were subjected to ten temperatures and nine intensities. The BSF/BSR 10 ohm-cm cells provided the best performance at 1 solar constant and +25 C with an efficiency of 14.1% while the BSR 2 ohm-cm cells had the highest low temperature and low intensity performance with an efficiency of

22.2% at 0.04 solar constant and -170 C and the most consistent cell-to-cell characteristics. R.E.S.

N80-15563*# Alabama Univ., Huntsville.
A SURVEY OF PHOTOVOLTAIC SYSTEMS
Aug. 1979 213 p. Sponsored in part by DOE
(Contract NAS8-31293)
(NASA-CR-150696) Avail: NTIS HC A10/MF A01 CSCL 10A

Solar photovoltaic manufacturers and suppliers are listed. Data sheets on specific products and typical operating, installation, or maintenance instructions and procedures are appended. R.E.S.

N80-15564# California Univ., Livermore. Lawrence Livermore Lab.
NOVEL SCHEME FOR MAKING CHEAP ELECTRICITY WITH NUCLEAR ENERGY
J. A. Pettibone 24 Aug. 1979 23 p. refs
(Contract W-7405-eng-48)
(UCID-18153-Rev-1) Avail: NTIS HC A02/MF A01

Nuclear fuels should produce cheaper electricity than coal, considering their high specific energy and low cost. To exploit these properties, the scheme proposed here replaces the expensive reactor/steam-turbine system with an engine in which the expansion of a gas heated by a nuclear explosion raises a mass of liquid, thereby producing stored hydraulic energy. This energy could be converted to electricity by hydroelectric generation with water as the working fluid or by magnetohydrodynamic (MHD) generation with molten metal. A rough cost analysis suggests the hydroelectric system could reduce the present cost of electricity by two-thirds, and the MHD system by even more. Such cheap power would make feasible large-scale electrolysis to produce hydrogen and other fuels and chemical raw materials. DOE

N80-15565# Los Alamos Scientific Lab., N. Mex.
DECENTRALIZED SOLAR PHOTOVOLTAIC ENERGY SYSTEMS
M. C. Krupta Jun. 1979 110 p. refs
(Contract W-7405-eng-36)
(LA-7866-TASE) Avail: NTIS HC A06/MF A01

A model residential photovoltaic system which utilizes a solar cell array roof shingle combination is discussed in relation to developing and generating the environmental data for decentralized solar photovoltaic systems. Material requirements, operating residuals, land requirements, water requirements, production processes, and production residuals for the systems operation are examined. Environmental, health, safety, and resource availability impacts are reported. A.W.H.

N80-15566# Sandia Labs., Albuquerque, N. Mex.
DESIGN OF PHOTOVOLTAIC SYSTEMS FOR RESIDENTIAL APPLICATIONS IN THE UNITED STATES
G. J. Jones 1979 7 p. refs Presented at the Photovoltaic Solar Energy Conf., West Berlin, 23 Apr. 1979
(Contract DE-AC04-76DP-00789)
(SAND-78-2186C; CONF-790457-3) Avail: NTIS HC A02/MF A01

Photovoltaic system configurations for single family residences were analyzed to determine the optimum design. Cost effectiveness and the effect of climate on the 15 regions studied were determined as factors in the analysis. The interaction of the residential photovoltaic system with the local utility is discussed and the economic viability of onsite energy storage is examined. A.W.H.

N80-15567# Mechanical Technology, Inc., Latham, N. Y.
FREE-PISTON STIRLING ENGINE DEMONSTRATION TEST PLAN
15 Dec. 1978 52 p.
(Contract EY-76-C-02-2764)
(COO-2764-T3) Avail: NTIS HC A04/MF A01

The plan for testing the demonstrator of a free-piston Stirling engine power system is presented. The test hardware is a free-piston Stirling engine prime mover driving a linear alternator. The demonstrator system is basically a modular assembly. The modules are the reciprocating alternator section, engine section, heater head insulation package assembly, and the pressure vessel. The test objective is to demonstrate a system with greater than 30 percent overall efficiency at 1 kW, 45 Hz operating conditions, and to identify and isolate engine losses to provide a basis for future engine improvements. DOE

N80-15568# California Univ., Berkeley. Lawrence Berkeley Lab.
GEOTHERMAL ENERGY DEVELOPMENT FROM THE SALTON TROUGH TO THE HIGH CASCADES
N. E. Goldstein Jan. 1979 15 p. refs Presented at the 3rd Natl. Conf. and Exhibition on Technol. for Energy Conserv., Tucson, Ariz. 23-25 Jan. 1979
(Contract W-7405-eng-48)
(LBL-8703; CONF-790107-10) Avail: NTIS HC A02/MF A01

Operations at Cerro Preto, the only water-dominated geothermal field currently generating electric power in North America, were assessed to identify potential problems which might face U.S. producers in the Imperial Valley. Geological hydrogeological, geochemical, and geophysical characteristics of the Salton Trough were investigated, as well as those of Mt. Hood, Oregon, where drilling was conducted, as a preliminary to determining the geothermal potential of the entire Cascade Range. A.R.H.

N80-15569# EIC, Inc., Newton, Mass.
CORROSION PROTECTION OF SOLAR-COLLECTOR HEAT EXCHANGERS WITH ELECTROCHEMICALLY DEPOSITED FILMS Semiannual Report, 15 May - 30 Nov. 1978
S. B. Brummer, V. R. Koch, and G. H. Schnaper Jan. 1979 44 p. refs
(Contract EM-78-C-04-4297)
(COO-4297-1; SAR-1) Avail: NTIS HC A03/MF A01

A novel corrosion protection technique is presented for the common solar collector metals: Al, Cu, and Fe as mild steel. The technique involves the potentiostatic electrochemical deposition of thin, adherent polymer films on the interior of heat exchanger tubes by application of a current in the presence of a suitable dissolved organic monomer. Tetramethylphenol (TMP) was shown to film Al/Zn samples, although complete coverage was not achieved. Copper and iron readily accommodate dimethylphenol and metaphenylenediamine as well as TMP films. As in the case of Al, holidays or cracks in the film were apparent thus precluding good corrosion protection. DOE

N80-15570# Midwest Research Inst., Golden, Colo.
SERAPH IMPLEMENTATION PLANS
J. Castle, W. Su, D. A. Dougherty, and J. D. Wright May 1979 45 p. refs
(Contract EG-77-C-01-4042)
(SERI/RR-34-152) Avail: NTIS HC A03/MF A01

The Solar Energy Research and Applications in Process Heat test facility (SERAPH) will provide the capability of addressing many of the technical issues that currently hamper industrial solar thermal energy system implementation. The initial capability of producing steam will be at a rate of 900 lb/h (410 kg/h) which corresponds to an energy delivery rate of 1.5 million Btu/h (1.6 x 10 to the 6th power) at 430 F (220 C) with expansion capability to approximately 600 F (315 C). The initial system controls will be analog with supervisory and direct digital control to follow. The issues to be addressed at SERAPH will be computer predictive model validation and refinement, control strategy development, solar equipment evaluation, and the accumulation of operating and maintenance experience. A consistent theme throughout the planning and operation of SERAPH is the need to develop and follow practices that are consistent with conventional industrial operating procedures. DOE

N80-15571# Midwest Research Inst., Golden, Colo.
ALTERNATE CYCLES APPLIED TO OCEAN THERMAL ENERGY CONVERSION
B. Shelpuk and A. Lewandowski Feb. 1979 14 p. refs Presented at the 11th Ann. Offshore Technol. Conf., Houston, Tex., 30 Apr. - 3 May 1979
(Contract EG-77-C-01-4042)
(SERI/TP-34-180; CONF-790444-3) Avail: NTIS HC A02/MF A01

Four open cycle OTEC concepts are described. These are: (1) single, vertical-axis turbine; (2) multiple, horizontal-axis turbine,

(3) foam lift/hydraulic turbine; and (4) mist lift/hydraulic turbine. A preliminary assessment of achievable performance is made in addition to a description of the subsystem performance objectives which would support the achievement of the full potential inherent in these concepts. The results and conclusions include a description of the research objectives, achievement of which make open cycle OTEC a viable alternative as a national energy source.
DOE

N80-15572# Ichthyological Associates, Inc., Absecon, N.J.
REVIEW OF WATER INTAKE SCREENING OPTIONS FOR COASTAL WATER USERS WITH RECOMMENDATIONS FOR OCEAN THERMAL ENERGY CONVERSION (OTEC) PLANTS
D. L. Thomas May 1979 43 p refs
(Contract W-31-109-eng-38)
(ANL/OTEC-BCM-005) Avail: NTIS HC A03/MF A01

Static screens (particularly the profile wire screen and the carrousel screen) have the potential advantage for OTEC for operating in a completely submerged state and of being cheaper to operate and maintain than traveling screens. However, there is no operational history with these static screens for large intake systems. The most promising traveling screen options for OTEC are the dual flow screens. They offer more screening surface and less head loss than through flow screens of similar size. They also have been operated in seawater for large intake systems. More detailed designs of potential OTEC plants, particularly screen wells, conduit and surge tank construction and head losses need to be determined before the best alternative intake screen can be selected.
DOE

N80-15573# Argonne National Lab., Ill.
QUALIFICATION OF ALUMINUM FOR OTEC HEAT EXCHANGERS
F. L. LaQue May 1979 32 p refs
(Contract W-31-109-eng-38)
(ANL/OTEC-BCM-003) Avail: NTIS HC A03/MF A01

Structural design criteria of aluminum tube heat exchangers to be used in OTEC are discussed. A number of aluminum alloys are considered for further study based on the requirements of the OTEC environment. The requirements include the resistance to penetration by pitting and crevice corrosion. The design considerations include the effects of vibration and fluid velocity, the dimensions of tubes, and physical properties of the tube materials and the properly related spacing of tube supports.
A.W.H.

N80-15574# Sandia Labs., Albuquerque, N. Mex.
METHODOLOGY FOR DETERMINING THE CONFIGURATION OF THE OPTIMUM SOLAR TOTAL ENERGY SYSTEM
R. R. Peters May 1979 59 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0422) Avail: NTIS HC A04/MF A01

A methodology for determining the configuration of the most economical solar total energy system (STES) for a particular application is presented. The methodology is examined by using it to design a STES for a certain function. The results are presented and the sensitivity of the system design to changes in economic parameters, system location, and limits on the amount of purchased energy are discussed.
A.W.H.

N80-15575# Sandia Labs., Albuquerque, N. Mex.
USER'S MANUAL FOR COMPUTER CODE SOLTES-1 (SIMULATOR OF LARGE THERMAL ENERGY SYSTEMS)
M. E. Fewell and N. R. Grandjean Jun. 1979 318 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1315-Rev) Avail: NTIS HC A14/MF A01

A user's manual for the computer code SOLTES-1, to be used on the CDC 6600 computer is presented. The code simulates the steady state response of thermal energy systems to time varying data such as weather and loads. The use of the code for simulation of solar power total energy systems, fossil fired power plants, nuclear fired power plants, solar energy heating and cooling, and geothermal energy systems is discussed.
A.W.H.

N80-15576# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS (MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL) Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1979
Y. K. Ahn, R. J. Brumberg, H. C. Chen, E. T. Nelson, R. P. Stringer, and R. C. Bailie (Environmental Energy Engineering, Inc., Morgantown, W. Va.) 1979 23 p
(Contract ET-78-C-02-5022)
(COO-5022-5) Avail: NTIS HC A02/MF A01

The development of a linear programming model to determine the mix of biomass resources an conversion processes to produce fuel is summarized. A market analysis of the need for biomass derived fuel and the regional availability of biomass resources on seasonal bases is discussed. Biomass conversion profiles (gasification, pyrolysis, and direct combustion) are discussed for 100 biomass materials. The materials include wood species, bagasse, sugar cane, wheat, and rice straw.
A.W.H.

N80-15577# Sandia Labs., Albuquerque, N. Mex.
DESIGN AND PERFORMANCE OF SILICON SOLAR CELLS UNDER CONCENTRATED SUNLIGHT
H. T. Weaver and R. D. Nasby 1979 4 p refs Presented at the Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-1165C; CONF-790541-39) Avail: NTIS HC A02/MF A01

Measurements and numerical calculations of performance of silicon solar cells, designed for operation under concentrated sunlight, are presented. Two design strategies are discussed and data from cells of each type are used for comparison with theory. The calculations ignore degeneracy and high effects but include Auger and trap recombination. Experimental base lifetimes are used for modeling.
DOE

N80-15578# Sandia Labs., Albuquerque, N. Mex.
STATUS OF THE US DEPARTMENT OF ENERGY PHOTOVOLTAIC CONCENTRATOR DEVELOPMENT PROJECT
B. D. Shafer, E. C. Boes, M. W. Edenburn, and D. G. Schueler 1979 8 p refs Presented at the 1979 Photovoltaic Solar Energy Conf., West Berlin, 23 Apr. 1979
(Contract DE-AC04-76DP-00789)
(SAND-78-2187C; CONF-790457-2) Avail: NTIS HC A02/MF A01

The development of a photovoltaic concentrator technology which results in low costs, long life photovoltaic arrays at a price of less than $0.50 per peak watt is discussed. The development work in the areas of concentrator cells, concentrator modules, and complete arrays is surveyed. The various designs of the concentrator cells and concentrator modules are presented and evaluated in regard to their ability to produce cost effective energy.
A.W.H.

N80-15579# Midwest Research Inst., Golden, Colo.
APPLICATION OF MONTE CARLO TECHNIQUES TO INSOLATION CHARACTERIZATION AND PREDICTION Status Report, 1 Oct. 1978 - 1 Jun. 1979
R. Bird and R. Hulstrom Jul. 1979 20 p refs
(Contract EG-77-C-02-4042)
(SERI/RR-36-306) Avail: NTIS HC A02/MF A01

The Monte Carlo method can be used to investigate solar radiation transport through the atmosphere and its reflection from the Earth's surface. The rigorous model used allows a detailed understanding of the various aspects of the radiation field at the Earth's surface. This knowledge can be used to compare and formulate simple models that are more appropriate for work on solar applications. This report is preliminary in nature in that it is primarily a description of the Monte Carlo method itself and its applications rather than a detailed presentation of results used in solar radiation transport calculations.
DOE

N80-15580# National Climatic Center, Asheville, N. C.
INPUT DATA FOR SOLAR SYSTEMS
V. Cinquemani and R. G. Baldwin Nov. 1978 203 p refs
(Contract EX-76-I-01-1041)
(DOE/TIC-10193) Avail: NTIS HC A10/MF A01

Normals (30 year mean values) of maximum, minimum, and

average temperatures for a month or year, and of heating and cooling degree days are tabulated. Average daily values of total hemispheric (global) solar radiation on a horizontal surface were based on corrected hourly measurements for 26 stations and derived values from the corrected measurements for the remaining 222 stations. Most of the average values are based on a 24-25 year period. DOE

N80-15581# Oak Ridge National Lab., Tenn.
HEAT TRANSFER STUDIES IN SALT AND GRANITE
R. A. Juist. Oct. 1978. 89 p. refs
(Contract W-7405-eng-26)
(ORNL/ENG/TM-14) Avail: NTIS HC A05/MF A01

The feasibility of using a multi-layer terminal repository design in both salt and granite formations to store either high-level waste or spent fuel was studied. Calculations were made to determine temperature profiles within the repository and to provide an estimate of the thermal uplift that can be expected. Near-field models developed to compare temperature profiles in the regions close to the waste canisters indicate that maximum thermal gradients and maximum temperature increases could be significantly reduced by changing from a single to a multi-layer repository design. The far-field models used to provide qualitative comparisons of the maximum thermal uplift indicates that the thermal uplift is roughly proportional to the energy supplied to the formation. Changing from a single- to a multi-layer repository but keeping the area loading constant results in increased thermal uplifts. DOE

N80-15582# New Mexico Univ., Albuquerque. Dept. of Economics.
DISTRICT SPACE HEATING POTENTIAL OF LOW TEMPERATURE HYDROTHERMAL GEOTHERMAL RESOURCES IN THE SOUTHWESTERN UNITED STATES
P. K. McDevitt and C. R. Rao (New Mexico Energy Inst.) Oct. 1978. 74 p. refs. Prepared jointly with New Mexico State Univ., Las Cruces.
(Contract EC-77-S-04-3992)
(NMEI-10-1) Avail: NTIS HC A04/MF A01

A computer simulation model (GIRORA-Nonelectric) developed to study the economics of district space heating using geothermal energy is described. GIRORA-Nonelectric is a discounted cashflow investment model which evaluates the financial return on investment for space heating. The model consists of two major submodels: the exploration for and development of a geothermal anomaly by a geothermal producer, and the purchase of geothermal fluid by a district heating unit. A sensitivity analysis of the model subject to changes in physical and economic parameters is presented. The economic analysis and technological screening criteria are used to examine all the low temperature geothermal sites in Southwestern United States for economic viability for space heating application. DOE

N80-15583# Midwest Research Inst., Golden, Colo.
LOW TEMPERATURE THERMAL ENERGY STORAGE: A STATE-OF-THE-ART SURVEY
F. Baylin. Jul. 1979. 120 p. refs
(Contract EG-77-C-01-4042)
(SERI/RR-54-164) Avail: NTIS HC A06/MF A01

The preliminary version of an analysis of activities in research, development, and demonstration of low temperature thermal energy storage (TES) technologies having applications in renewable energy systems is presented. Three major categories of thermal storage devices are considered: sensible heat; phase change materials; and reversible thermochemical reactions. Both short-term and annual thermal energy storage technologies based on principles of sensible heat are discussed. Storage media considered are water, earth, and rocks. Annual storage technologies include solar ponds, aquifers, and large tanks or beds of water, earth, or rocks. All program processes from basic research through commercialization efforts are investigated. Nongovernment-funded industrial programs and foreign efforts are outlined as well. Data describing low temperature TES activities are presented also as project descriptions. DOE

N80-15584# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
MELTING IN PHASE-CHANGE THERMAL STORAGE MEDIA
Final Report
E. M. Sparrow and J. W. Ramsey. 1978. 90 p. refs
(Contract EY-76-S-02-2993)
(COO-2993-1) Avail: NTIS HC A05/MF A01

Research on melting caused by a tubular heat source embedded in a solid phase-change medium is presented. Separate studies were performed with the heater positioned with its axis horizontal and with its axis vertical. Both orientations were investigated because they correspond to those of proposed bulk-type storage configurations. In addition, the direction of the gravity force relative to the heating surface is different in the two cases and this causes differences in the buoyancy forces that act on the liquid generated by the melting process. Two phase-change media were employed in the experiments: (1) the eutectic mixture of sodium nitrate and sodium hydroxide--melting temperature of 244 C; and (2) naphthalene--melting temperature of 80 C. The analysis was carried out on a specific fluid or a temperature level. The experimental results encompass information on both the heat transfer coefficient at the heated surface and on the size and shape of the melt zone. DOE

N80-15585# Sandia Labs., Albuquerque, N. Mex. Fluid Mechanics and Heat Transfer Div.
EVALUATION OF THE EVACUATED SOLAR ANNULAR RECEIVERS USED AT THE MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY (MSSTF)
A. C. Ratzel. Jul. 1979. 56 p. refs
(Contract EY-76-C-04-0789)
(SAND-78-0983) Avail: NTIS HC A04/MF A01

A parabolic cyclindrical collector field subsystem used in tests to evaluate the vacuum integrity characteristics of ten glass to metal sealed concentric cylinder receivers is described. Tests and test results on the vacuum integrity and the collector system performance with evaluated receiver annuli and with receiver annuli maintained at atmospheric pressure are described. Heat loss reductions for different annulus gas pressures and under different receiver tube operating temperatures are presented. The collector's efficiency dependence upon operating temperature, annulus pressures, and insolation is discussed. A.W.H.

N80-15586# Higgins, Auld and Associates, Albuquerque, N. Mex.
ANALYSIS OF FIELD TEST RESULTS FOR SINGLE-AXIS-TRACKING SOLAR COLLECTOR FOUNDATIONS
H. E. Auld. Jul. 1979. 36 p. refs
(Contract EY-76-C-04-0789)
(SAND-79-7023) Avail: NTIS HC A03/MF A01

Five reinforced concrete cylindrical piers, typical of foundations utilized for single-axis-tracking solar collector systems, were tested to determine eccentric horizontal and vertical failure loads. The results from these tests were found to compare favorably with the results from theoretical calculations which incorporate the geotechnical parameters of the test site. Recommendations are made for the incorporation of these results into the design of foundations for future solar collector systems. DOE

N80-15587# Argonne National Lab., Ill. Components Technology Div.
STABILITY CONSIDERATIONS AND A DOUBLE-DIFFUSIVE CONVECTION MODEL FOR SOLAR PONDS
E. I. H. Lin, W. T. Sha, and S. L. Soo. Apr. 1979. 42 p. refs. Prepared jointly with Illinois Univ., Urbana.
(Contract W-31-109-eng-38)
(ANL-CT-79-34) Avail: NTIS HC A03/MF A01

A brief survey is made on the basic principles, current designs and economic advantages of salinity-gradient solar ponds as solar collectors and reservoirs. Attention is focused on the subject of stability, and pertinent existing results are summarized and discussed. Details of the derivation of three-dimensional stability criteria for thermohaline convection with linear gradients are presented. Ten key questions pertaining to stability are posed, whose answers must be sought through extensive analytical and numerical studies. Possible methods of approach toward enhancing solar-pond stability are also discussed. For the numerical studies of pond behavior and stability characteristics, a double-diffusive convection model is proposed. The model can be constructed by extending the three-dimensional thermohydrody-

namic computer code COMMIX-SA, following the necessary steps outlined; computational plans are described. DOE

N80-15588# Alabama Univ., University. Bureau of Engineering Research.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEMS DEVELOPMENT
W. J. Schaetzle and C. Everett Brett Mar. 1979 174 p refs
Prepared for Argonne Natl. Lab., Ill.
(Contract W-31-109-eng-38)
(ANL/ICES-TM-30) Avail: NTIS HC A08/MF A01

The design, operation, economics, environmental impacts, and expected performance of heat pump centered integrated community energy systems are discussed in detail. DOE

N80-15589# Argonne National Lab., Ill. Energy and Environmental Systems Div.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS; SYSTEM DEVELOPMENT Interim Report
R. E. Crane (Franklin Res. Center), H. G. Lorsch (Franklin Res. Center), and R. G. Werden Feb. 1979 196 p refs
(Contract W-31-109-eng-38)
(ANL/ICES-TM-26) Avail: NTIS HC A09/MF A01

The concept of a heat pump centered integrated community energy system (HP-ICES) was explored based on a reference community located in the Northeast with a population of 10,000. Engineering and economic analyses were performed for the HP-ICES and for conventional heating/cooling systems. Sensitivity analyses were used to determine variations in results from changes in: community size; community energy density; waste heat utilization; energy cost escalation; maintenance and operating personnel; and central HP-ICES ownership. The effect of each of the critical parameters on the economic viability of HP-ICES is shown. Conditions of equal 20-year life cycle costs for HP-ICES and for conventional systems are given. DOE

N80-15590# Little (Arthur D.), Inc., Cambridge, Mass.
UTILIZATION OF WASTE HEAT FROM FEDERAL FACILITIES Final Report
Feb. 1979 182 p refs
(Contract EC-77-C-05-5523)
(ORO-5523-T1) Avail: NTIS HC A09/MF A01

The technical and economic feasibility of using waste heat from the Oak Ridge Gaseous Diffusion Plant (ORGDP), Paducah Plant, Portsmouth Gaseous Diffusion Plant (PFDP), and the Savannah River Plant (SRP) for industrial process heat, space heating, power generation, or in agriculture or aquaculture is evaluated. Recommended uses and the cost of implementing waste heat utilization near each site are discussed. The recommended uses at Oak Ridge include district heating, greenhouse heating, and heat pump enhanced temperature elevation of the ORGDP waste heat for subsequent process heat use in a textile mill. At Paducah, the recommendation is to use heat pumps to raise the waste heat temperature for preheating feedwater for a 1000 MW coal-fired power plant. At Portsmouth, greenhouse heating is recommended. At the SRP aquacultural and greenhouse, uses and utilization for power generation by means of a Rankine cycle process are recommended. DOE

N80-15591# Air Products and Chemicals, Inc., Allentown, Pa.
DEMONSTRATION OF A NITROGEN BASED CARBURIZING ATMOSPHERE: ENERGY CONSUMPTION OF THE ENDOTHERMIC GENERATOR Quarterly Report, 1 Oct. - 30 Dec. 1978
R. J. Peartree Jan. 1979 22 p
(Contract EM-78-C-01-5058)
(CONS/5058-T1; QR-1; ID-12027-1) Avail: NTIS HC A02/MF A01

The energy consumption of an endothermic generator is documented. Two different sized generators were studied and found to have basically the same energy usage characteristics. The energy consumption was found to be dependent on generator output, with less energy consumption per unit volume at higher outputs. DOE

N80-15592# Department of Energy, Washington, D. C. Energy Information Administration.
THE 1985, 1990 AND 1995 MIDTERM ENERGY MARKET MODEL RESULTS UNDER THREE SCENARIOS OF FUEL USE ACT REGULATIONS
W. D. Montgomery, III May 1979 621 p refs
(DOE/EIA-0182/2) Avail: NTIS HC A99/MF A01

The incremental impacts of the Powerplant and Industrial Fuel Use Act regulations are analyzed as a function of the stringency of the economic test under which exemptions are granted. To carry out this analysis, the Mid-Term Energy Market Model (MEMM) is used to generate projections of energy supply, demand, and price under the specified assumptions. Industrial fuel demand is modeled by using a separate fuel-choice model to determine the share of oil, gas, and coal; these shares are then imposed on the MEMM solution. For electric utilities, impacts are modeled by altering the capital costs in the MEMM submodel. Preliminary numerical results of some of the model runs are presented. DOE

N80-15593# Department of Energy, Washington, D. C. Energy Information Administration.
ENERGY SUPPLY AND DEMAND IN THE SHORT TERM: 1979 AND 1980
Jun. 1979 127 p refs
(DOE/EIA-0184/4) Avail: NTIS HC A07/MF A01

Overall energy supply and demand balances as well as a detailed discussion of the elements of end-use consumption of coal, natural gas, petroleum products, and electricity are presented. Analyses of the operations of utilities and refineries, the domestic production of coal, natural gas, crude oil, and electricity, and the supply and demand balances for each fuel are provided. Projections of domestic production as well as supply and demand balances, synthetics and imports, and projections for the electric utility sector are included for the short-term. DOE

N80-15594# Department of Energy, Washington, D. C. International Energy Analysis Div.
INTERNATIONAL ENERGY ASSESSMENT Analysis Report
W. C. Kilgore May 1979 74 p refs
(DOE/EIA-0184/1; AR/IA/79-27) Avail: NTIS HC A04/MF A01

A comprehensive assessment of the international energy situation between now and the year 1995 is given. Forecasts of energy supply and demand for each region of the world are included along with estimates of future world oil prices and a sensitivity analysis of the critical factors affecting those prices. The analysis projects that world energy consumption will rise at a rate of between 2.8 and 3.9% per year, over the forecast period, while the demand for petroleum is expected to grow at a rate of 2.0 to 3.5% per year. This growth in consumption is projected to occur during a period in which world economic activity is increasing at the rate of 3.8 to 4.6% per year, such that the estimated ratio of world energy growth to economic growth falls from its historic 1960-1976 ratio of 0.94, to a ratio of 0.71 to 0.85 over the 1976-1995 period. World oil prices are found to be highly uncertain with real prices by 1995 ranging between $16.50 and $31.50 per barrel across five projection series. DOE

N80-15595# Illinois Univ., Urbana. Office of Vice Chancellor for Research.
ENERGY OPTIMAL USE OF WASTE PAPER Final Report
T. L. Gunn Nov. 1978 188 p refs
(Contract EY-76-S-02-2893)
(COO-2893-9) Avail: NTIS HC A09/MF A01

The mix of burning and recycling of waste paper that would minimize the total US energy used to make and dispose of the 1974 production of paper is assessed. Five cases are analyzed to determine the effects of various assumptions about how the energy in wood and paper will be treated. In one case, both wood and paper are assumed to have an energy value. In another, neither wood nor paper is assumed to have an energy value. In the other three cases, paper, but not wood, is assumed to have an energy value which is utilized differently in each case. It is found in each case that it is worthwhile in terms of energy conservation to recycle as much high grade de-inking waste paper as can be collected. How much of the other grades of waste paper would be recycled depends on which of the various energy-accounting schemes is used. It is further found that the

greatest energy savings are accomplished when both wood and waste paper are acknowledged to have an energy value. DOE

N80-15596# Acres American, Inc., Buffalo, N. Y.
FEASIBILITY OF COMPRESSED AIR ENERGY STORAGE AS A PEAK SHAVING TECHNIQUE IN CALIFORNIA, VOLUME 2 Final Report
Sep. 1978 523 p refs
(Contract EY-76-C-03-1331)
(SAN-1331-T1) Avail: NTIS HC A22/MF A01

The technical, economic, and siting feasibility, on a preliminary basis, of the use of compressed air energy storage in the state of California was investigated. The analysis was performed on a parametric basis using gas turbines and combined cycle plants as a comparison. The methodology, base data, and results are presented along with the computer program used. The design sites for porous media and compensated hard rock are documented along with an alternate site for each type of plant and the plant designs for porous media and hard rock storage. Developments in gas turbine generators and CAES plant designs are projected as both technologies are expected to advance in the near term. Cost estimates and construction schedules prepared for the plant designs are presented. Results and conclusions are given. DOE

N80-15597# Institute of Gas Technology, Chicago, Ill.
APPLICATION ANALYSIS OF SOLAR TOTAL ENERGY SYSTEMS TO THE RESIDENTIAL SECTOR. VOLUME 4: MARKET PENETRATION Final Report
Jul. 1979 320 p refs
(Contract EG-77-C-04-3787; Proj. 8987)
(ALO-3787-4) Avail: NTIS HC A15/MF A01

The residential consumption of energy in each of the 11 solar total energy systems (STES) regions is given by fuel type and end-use category. The current and projected costs and availability of fossil fuels and electricity for the STES regions are reported. Projections are made concerning residential building construction and the potential market for residential STES. The effects of STES ownership options, institutional constraints, and possible government actions on market penetration potential are considered. Capital costs for two types of STES are determined, those based on organic Rankine cycle (ORC) heat engines and those based on flat plate, water-cooled photovoltaic arrays. Both types of systems utilize parabolic trough collectors. The capital cost differential between conventional and STE systems is calculated on an incremental cost per dwelling unit for comparison with projected fuel savings in the market penetration analysis. Results of a market analysis are summarized. DOE

N80-15598# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
NATIONAL PROGRAM PLAN FOR PASSIVE AND HYBRID SOLAR HEATING AND COOLING Interim Report
Jun. 1979 131 p
(DOE/CS-0089) Avail: NTIS HC A07/MF A01

A definition of a passive solar system is given, as well as background of Federal involvement in passive solar heating and cooling, program goals and objectives, and an overall implementation approach. Background information on the status of and the strategy and emphasis for technology development is provided, followed by descriptions of passive heating and passive cooling systems and an overview of task classifications for technology development. The technology utilization program is also presented. DOE

N80-15599# Utah Univ., Salt Lake City.
CONFERENCE ON PERFORMANCE MONITORING TECHNIQUES FOR EVALUATION OF SOLAR HEATING AND COOLING SYSTEMS
1978 353 p refs Conf. held in Washington, D.C., 3 Apr. 1978
(Contract EG-77-S-04-4094)
(CONF-780432) Avail: NTIS HC A16/MF A01

A general review of solar energy monitoring systems, their relationship to data users and their needs, and a methodology for developing instrumentation systems and performance evaluation techniques based on a systematic procedure for addressing the actual needs of the data user are provided. DOE

N80-15600# Sandia Labs., Albuquerque, N. Mex. Solar Technical Liaison Div.
DYNAMIC STORAGE IN SOLAR TOTAL ENERGY PROGRAMS
R. P. Stromberg 1978 27 p refs Presented at the Seminar on Solar Energy Storage, Trieste, Italy, 4 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0958C; CONF-780944-1) Avail: NTIS HC A03/MF A01

A program of research and development to establish the feasibility of the Solar Total Energy Concept is described. The major items of actual hardware are a 32 kW Midtemperature Solar Systems Test Facility at Albuquerque, NM; and two planned Large Scale Experiments at Shenandoah, GA, and Ft. Hood, TX. These programs are described with reference to current literature. DOE

N80-15601# Sandia Labs., Albuquerque, N. Mex.
DEPARTMENT OF ENERGY LARGE SOLAR CENTRAL POWER SYSTEMS SEMIANNUAL REVIEW
Nov. 1978 305 p refs Conf. held at Dallas, 19-21 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-8511) Avail: NTIS HC A14/MF A01

Progress in the development of large solar power systems is reported. Hydraulic stability of solar boilers, closed cycle Brayton solar thermal electric power plants, heliostat development, and central receiver systems are discussed along with distributed collectors and total energy and hybrid systems. J.M.S.

N80-15602# Sandia Labs., Albuquerque, N. Mex.
DEPARTMENT OF ENERGY LARGE SOLAR CENTRAL POWER SYSTEMS SEMIANNUAL REVIEW
May 1978 262 p refs Conf. held at Reston, Va., 21-22 Mar. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8508) Avail: NTIS HC A12/MF A01

Thirty papers are presented each discussing various aspects of the large solar central power systems program. R.E.S.

N80-15603# Research Triangle Inst., Research Triangle Park, N. C.
SEA-SURFACE TEMPERATURE VARIABILITY ANALYSIS OF POTENTIAL OTEC SITES UTILIZING SATELLITE DATA Final Report
F. M. Vukovich, B. W. Crissman, M. Bushnell, and W. J. King
Aug. 1978 159 p refs
(Contract EG-77-C-05-5444)
(ORO-5444-1) Avail: NTIS HC A08/MF A01

An analysis of the constancy of the sea-surface temperature in candidate locations for ocean thermal energy conversion (OTEC) siting was performed. Satellite infrared data were used to identify and locate major thermal fronts at the sea surface. These data were then used to glean certain statistics on these fronts. In situ data were used, when available, to determine temperature difference across specified thermal fronts. The study was performed in three regional locations of interest to OTEC. The specific regions are: Region I, Eastern Gulf of Mexico (bounded by 22 N to 30 N and 91 W to the west coast of Florida including the Straits of Florida); Region II, the east coast of Florida (bounded by 23 N to 32 N and the east coast of Florida to 79 W); and Region III, Puerto Rico and vicinity, (bounded by 17 to 19 N, 64 to 68 W). Results are presented and discussed. DOE

N80-15604# Ohio State Univ., Columbus. Engineering Experiment Station.
FUEL UTILIZATION IN RESIDENCES
C. Sepsy, M. F. McBride, R. S. Blanchett, and C. D. Jones
Sep. 1978 251 p Presented at ASHRAE, Philadelphia, 28 Jan. - 1 Feb. 1979
(EPRI Proj. 137-1)
(EPRI-EA-894) Avail: NTIS HC A12/MF A01

A mathematical model and digital computer program were developed for accurately calculating the energy required by residential housing units on an hourly, daily, monthly, and seasonal basis. The model and program were used to establish an accurate procedure for determining the monthly and seasonal energy

requirements of all types of residential structures. The response-factor technique was used to calculate the dynamic load responses of a residential structure. The model and program take into account all the internal and external dynamic loads imposed on the structure; they were verified by extensive calculations and field measurements applied to nine residential dwelling units in the Columbus, Ohio, area. All contained conventional space heating and cooling equipment, either natural gas or electric forced-air furnaces. A dynamic model for simulating hourly attic space air temperatures was developed and incorporated in the thermal-load calculation procedures. DOE

N80-15605# Department of Energy, Washington, D. C.
NUCLEAR STRATEGY OF THE DEPARTMENT OF ENERGY
Apr. 1979 89 p
(DOE/ER-0025/D) Avail: NTIS HC A05/MF A01

An analysis of the technical and economic parameters related to the timing and future deployment of nuclear power is presented. A set of alternative nuclear strategies are presented and evaluated. The strategies involve decisions on breeder commercialization, fuel cycle development, and strengthening the nuclear option. A.W.H.

N80-15606# Wharton (E. F. A.), Inc., Philadelphia, Pa.
WHARTON ANNUAL ENERGY MODEL: DEVELOPMENT AND SIMULATION RESULTS Final Report
W. Finan and G. R. Schink Jul. 1979 93 p refs
(EPRI Proj. 440-1)
(EPRI-EA-1115) Avail: NTIS HC A05/MF A01

The energy sector of a commercially available macroeconomic model was expanded in order to develop a tool for examining future energy-economy interactions. The specific methodologies employed are described and a set of energy policy simulations using the newly expanded model is presented. DOE

N80-15607# Sandia Labs., Albuquerque, N. Mex. Exploratory Batteries Div. and Photometrics and Optical Development Div.
THERMAL MODEL OF A THERMAL BATTERY
D. M. Bush and R. L. Hughes Jul. 1979 48 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0834) Avail: NTIS HC A03/MF A01

A thermal model was developed to predict the effect of design changes, such as an increase in insulation thickness, on the temperature-time profile of the battery. The model is based on a quarter section of the battery, which is divided into a 10 x 20 grid consisting of 200 nodes. A method of calculating an effective conductivity/distance term between nodes negated the need for special boundary temperature calculations at material interfaces. A separate routine was used to account for the heat of fusion released by the buffer pellets. Actual design changes selected to check the model were internal heat generation, removal of stack end plates, new electrochemical system, increased side insulation, and internal electric heater. Results of model runs reflecting these changes are compared with temperature-time histories recorded from battery tests, and a close correlation is obtained in each case. DOE

N80-15608# Sandia Labs., Albuquerque, N. Mex.
LONG-TERM LITHIUM BATTERY TESTS
S. C. Levy Jun. 1979 16 p ref
(Contract EY-76-C-04-0789)
(SAND-79-0487) Avail: NTIS HC A02/MF A01

A six year program for testing ambient temperature in lithium batteries is discussed. Lithium sulfur dioxide cells and lithium polycarbon monofluoride cells are included in the tests. The test plan includes capacity versus rate, storage, and simulated operation. Data, taken six months into the test, is presented for storage at room temperature and capacity versus rate data is plotted for the cells. A.W.H.

N80-15609# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FLYWHEEL ENERGY STORAGE INTERFACE UNIT FOR PHOTOVOLTAIC APPLICATIONS
A. R. Millner and R. D. Hay 1979 6 p refs Presented at the Intersociety Energy Conf., Boston 5 Aug. 1979
(Contract EY-76-C-02-4094)
(COO-4094-44, CONF-790803-42) Avail: NTIS HC A02/MF A01

The design of a flywheel energy storage and conversion system is presented. The system which will serve as an interface between a solar photovoltaic array and an ac load, providing output waveform regulation as well as energy storage is evaluated. Features of the system include magnetic bearings, an ironless armature motor generator, and a low cost flywheel rotor. A preliminary economic analysis is provided. DOE

N80-15610# California Univ., Livermore. Lawrence Livermore Lab.
ANALYTICAL MODELING OF HEAT PUMP UNITS AS A DESIGN AID AND FOR PERFORMANCE PREDICTION M.S. Thesis - Calif. Univ., Berkeley
Jack Edwin Flower 8 Dec. 1978 149 p refs
(Contract W-7405-eng-48)
(UCRL-52618) Avail: NTIS HC A07/MF A01

Three computer programs for simulating the operating characteristics of heat pump units are described. Program THERMO calculates heat pump performance coefficients of idealized units based purely on thermodynamic considerations. Program DESIGN computes heat exchanger size requirements and operating information for a desired heat pump cycle based on input saturation temperatures in the evaporator and condenser, and heat exchanger configuration. Program PREDICT enables a model of the operation of an existing or proposed heat pump unit, given certain physical dimensions, to be designed. DOE

N80-15611# Argonne National Lab., Ill. Chemical Engineering Div.
LITHIUM/IRON SULFIDE BATTERIES FOR ELECTRIC VEHICLES
P. A. Nelson, A. A. Chilenskas, and R. K. Steunenberg 1978 24 p refs Presented at the 5th Intern. Electric Vehicle Symp., Philadelphia, 2-5 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-781006-2) Avail: NTIS HC A02/MF A01

Recent progress in the development of LiAl/FeS/sub x/ batteries for electric vehicles is assessed. The possibility of near-term commercialization of a version of the battery that utilizes monosulfide (FeS) positive electrodes in conjunction with low cost, iron alloy current collectors is indicated. Multiple-electrode cells having a specific energy of about 100 Wh/kg are now under test. Conceptual design problems for a compact insulating jacket, which will maintain the battery temperature at 450 C, appear to be solved. Work is also underway on a version of the battery that would utilize FeS2 positive electrodes, which use molybdenum current collectors at present, and may require the future development of less expensive current collectors to be commercially attractive. These batteries would ultimately have about 30 to 40% higher specific energy and 50 to 75% higher specific power than the FeS-type batteries. DOE

N80-15612# California Univ., Livermore. Lawrence Livermore Lab.
LAMINATED DISK FLYWHEEL PROGRAM
Richard G. Stone 24 Oct. 1978 9 p refs Presented at the Inform. Exchange Conf., Luray, Va., 24 Oct. 1978
(Contract W-7405-eng-48)
(UCRL-81772, CONF-781046-4) Avail: NTIS HC A02/MF A01

A program to develop the technology for high energy density, fiber composite flywheels based on the laminated disk concept is described. Progress toward optimizing the flywheel energy system with respect to low volume, low weight, manufacturability, and economy is reported. Program planning areas including the manufacturing of test model flywheels and developing a hub attachment are discussed. A.W.H.

N80-15613# Institute of Gas Technology, Chicago, Ill.
PREDICTION OF CURRENT DISTRIBUTION IN A MOLTEN CARBONATE FUEL CELL
V. Sampath, J. R. Selman, and A. F. Sammells 1978 30 p refs Presented at the 2d Intern. Symp. on Molten Salts, Pittsburgh, 15-20 Oct. 1978. Sponsored by the Electrochem. Soc., Inc.
(Contract EM-78-C-03-1735)
(CONF-781063-1) Avail: NTIS HC A03/MF A01

A mathematical model was developed to predict the performance of a molten carbonate fuel cell as a function of

anode and cathode gas compositions, gas flow rates, and polarization characteristics. The effect of gas flow modes such as crossflow and coflow and the effect of higher pressures on the current distribution were studied. The predicted polarization curves agree well with the experimentally generated polarization curves. Conditions for incorporating a microscopic porous electrode model into the overall model development are briefly outlined. DOE

N80-15614# Argonne National Lab., Ill.
DEVELOPMENT OF Li-Al/FeS CELLS WITH LiCl-RICH ELECTROLYTE
F. J. Martino, L. G. Bartholme, E. C. Gay, and H. Shimotake 1978 15 p refs Presented at the Symp. on Battery Design and Optimization, Pittsburgh, 15-20 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-7810135-2) Avail: NTIS HC A02/MF A01

Rechargeable lithium-aluminum/iron sulfide cells using the LiCl-KCl eutectic (44 wt % LiCl) electrolyte were developed. The utilization of these cells at high discharge rates was hindered by the formation of J phase LiK6FeS26Cl in the FeS electrodes. To overcome this problem, four engineering size cells (approximately 100 Ah theoretical capacity) were built with LiCl-rich electrolyte (54 wt % LiCl). At the 4-h rate, the utilization of these cells was improved by more than 40% over that of cells containing the eutectic electrolyte. DOE

N80-15615# Department of Energy, Washington, D. C.
ALL-UNION SCIENTIFIC AND TECHNICAL CONFERENCE ON USE OF THE EARTH'S HEAT FOR THE PRODUCTION OF ELECTRIC POWER - SUMMARY OF REPORTS
Oct. 1978 138 p refs Transl. into ENGLISH of Vsesoyuznoye Naucho-Tekhnicheskoye Soveshchaniye. Ispol'zovaniye tepla zemli dlya Proizvodstva Electroenergii (Tezisy Dokladov), USSR Ministry of Power and Electrification, 1975 186 p Conf. held at Moscow, 10-14 Dec. 1975
(CONF-751270-Summ) Avail: NTIS HC A07/MF A01

The use and effectiveness of geothermal energy for producing electric power is discussed. Topics include the operation of geothermal electric stations and power plants, systems for the extraction of heat from the Earth's crust, drilling of geological prospecting boreholes for steam, and geophysical methods for monitoring the parameters of underground heat boilers. A.W.H.

N80-15616# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
PERFORMANCE OF RESIDENTIAL SOLAR HEATING AND COOLING SYSTEM WITH FLAT-PLATE AND EVACUATED TUBULAR COLLECTORS: CSU SOLAR HOUSE 1
W. S. Duff, T. M. Conway, G. O. G. Loef, D. B. Meredith, and R. B. Pratt 1978 14 p refs Presented at the CCMS Meeting, Dusseldorf, W. Germany, 19 Apr. 1978
(Contract EY-76-S-02-2577)
(COO-2577-17; CONF-7804101-1) Avail: NTIS HC A02/MF A01

Performance data were procured on 47 days during operation of the flat plate collector and on 112 days when the house was heated or cooled by the evacuated tube collector system. It was concluded that the system comprising an evacuated tubular collector, lithium bromide absorption water chiller, and associated equipment is highly effective in providing space heating and cooling to a small building, that it can supply up to twice the space heating and several times the cooling obtainable from an equal occupied area of good quality flat plate collectors, and that a greater fraction of the the domestic hot water can be obtained by supplying its heat from main storage. A summary of monthly and annual energy use for space heating, domestic hot water heating, and space cooling is presented. DOE

N80-15617# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A PORTABLE SPECULAR REFLECTOMETER FOR FIELD MEASUREMENTS OF SOLAR MIRROR MATERIALS
J. M. Freese Oct. 1978 23 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1918) Avail: NTIS HC A02/MF A01

A portable reflectometer designed for in the field measurements of solar mirror materials was developed. This instrument is of a convenient size for use by one operator in an outdoor environment. Instrument design, operation, and calibration are discussed. It is shown that the instrument responds linearly (+ or - 0.006 transmission units) to variations of intensity of incident and reflected beams and that the readings are not affected by the presence of stray light. The mirror materials measured with the portable instrument include samples of polished aluminum, metallized plastic film and silvered glass. The reflectance values of these materials were within + or - 0.005 reflectance units of the values obtained from appropriately averaging reflectance versus wavelength data taken with a laboratory bidirectional reflectometer. DOE

N80-15618# California Univ., Berkeley. Lawrence Berkeley Lab.
AQUIFER THERMAL ENERGY STORAGE
C. F. Tsang 1978 27 p refs Presented at the Symp. on Advanced Technol. for Storing Energy, Chicago, 10 Jul. 1978
(Contract W-7405-eng-48)
(LBL-7070; CONF-780714-2) Avail: NTIS HC A03/MF A01

The concept of thermal energy storage is examined through the storage of waste hot water from power plants or from solar energy collectors in aquifers. The hydrodynamic and thermal behaviors of the storage system are analyzed and illustrated. A computer model developed to study the physical conditions and parameters and to make realistic predictions of the energy storage and retrieval efficiencies is described. A.W.H.

N80-15619# Oak Ridge National Lab., Tenn.
INTERMEDIATE REPORT ON THE PERFORMANCE OF PLATE-TYPE ICE-MAKER HEAT PUMPS Progress Report
V. D. Baxter Oct. 1978 43 p refs
(Contract W-7405-eng-26)
(ORNL/CON-23) Avail: NTIS HC A03/MF A01

Two ice maker heat pumps were tested and compared for the effect of harvesting scheme and evaporator plate loading on performance in both water chilling and ice making modes. The systems design of each heat pump is reported with two major differences, the type of harvest scheme employed and the evaporator and compressor size, examined for efficiency and relative performance. The effect of thermostatic type cyclic operation on performance of the pumps is investigated. A.W.H.

N80-15620# Oak Ridge National Lab., Tenn. Engineering Technology Div.
CHARACTERIZATION OF OPERATING CONDITIONS FOR GAS/WATER HEAT RECOVERY STEAM GENERATORS
R. L. Graves 13 Oct. 1978 21 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6622) Avail: NTIS HC A02/MF A01

The possible operating points of air/water and helium/water steam generators are parametrically presented. Calculation procedures and a sample computer program listing are provided. Multiple saturated steam conditions are shown to be attainable with the same gas inlet and exit temperatures. Design considerations of heat transfer surface area and pumping requirements are also discussed. DOE

N80-15621# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN OCEAN THERMAL ENERGY CONVERSION
Aug. 1979 53 p
(DOE/EDP-0034) Avail: NTIS HC A04/MF A01

The present status and goals of the OTEC program are described, and potential environmental, health, safety, and sociolegal-economic impacts relevant to the program are identified. A management plan is presented for conducting and coordinating environmental research in concert with the development of appropriate technology. Five major classes of environmental concerns associated with the deployment and operation of an OTEC system are discussed. They are changes in oceanic properties, chemical pollution, operation of a manned platform, legal and institutional matters, and secondary impacts associated with site selection, construction, and operation of OTEC plants. DOE

N80-15622# Oklahoma Univ., Norman.
CRITICAL SPEEDS AND NATURAL FREQUENCIES OF

RIM-TYPE COMPOSITE-MATERIAL FLYWHEELS
C. W. Bert, T. L. C. Chen, and C. A. Kocay Sep. 1978 108 p refs
(Contract EY-76-C-04-0789)
(SAND-78-7049) Avail: NTIS HC A06/MF A01

An analytical investigation conducted on a 0.56 kWh composite material flywheel energy storage system for application in hybrid automotive vehicles is reported. The investigation calculated the critical speeds and natural frequencies of a rim type flywheel which is flexibly mounted on a finite hub, which in turn, is attached to an elastic shaft. The specific modes covered include whirling, torsional, and axial modes involving band, shaft and support flexibilities and in-plane bending, combined out of plane bending/twisting, and extensional modes of the flywheel rim. The phenomena occurring during acceleration through critical speeds and the effect of creep stress relaxation on the supporting bands are examined. DOE

N80-15623# Sandia Labs., Albuquerque, N. Mex.
OVERVIEW OF FLYWHEEL ENERGY STORAGE COMPONENT DEVELOPMENT
R. O. Woods [1978] 7 p refs Presented at 1st Inform. Exchange Conf., Luray, Va. 24 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1999C; CONF-781046-8) Avail: NTIS HC A02/MF A01

Composite flywheel design, bearings, shaft seals, and general vacuum technology are reviewed. K.L.

N80-15624# Sandia Labs., Albuquerque, N. Mex.
SANDIA COMPOSITE-RIM FLYWHEEL DEVELOPMENT
E. D. Reedy, Jr. [1978] 13 p refs Presented at 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1865C; CONF-781046-3) Avail: NTIS HC A02/MF A01

A series of flywheel spin tests and the status of the rotor development program are discussed. Two designs incorporating a 20 in. OD graphite/epoxy rim were tested. Each design utilized a different method of attaching the rim to an aluminum hub with Kevlar 49/epoxy bands. Data on rotor performance, dynamics, and failure modes are presented. DOE

N80-15625# Oak Ridge National Lab., Tenn.
ANALYSIS OF POTENTIAL IMPLEMENTATION LEVELS FOR WASTE HEAT UTILIZATION IN THE NUCLEAR POWER INDUSTRY
M. Olszewski and H. R. Bigelow Oct. 1978 34 p refs
(Contract W-7405-eng-26)
(ORNL/TM-63-2) Avail: NTIS HC A03/MF A01

An assessment of land available at nuclear power stations was performed in an effort to determine the limitations land availability would impose on the implementation of reject heat utilization systems. A waste heat utilization factor was defined for all operating and planned nuclear power stations. This factor is the percentage of the station's reject heat that could be utilized on the land available for such use at the site. An estimate of the potential for implementation at fossil stations was performed. DOE

N80-15626# California Univ., Livermore. Lawrence Livermore Lab.
ENVIRONMENTAL OVERVIEW OF GEOTHERMAL DEVELOPMENT: THE GEYSERS-CALISTOGA KGRA. VOLUME 1: ISSUES AND RECOMMENDATIONS
D. L. Ermak and P. L. Phelps 4 Oct. 1978 21 p refs
(Contract W-7405-eng-48)
(UCRL-52496-Vol-1) Avail: NTIS HC A02/MF A01

Priorities of the impacts of geothermal resource development on local communities and environments are assessed and recommendations are given particularly in the hydrogen sulfide emissions from the geysers steam evolved. Other high priority needs are related to controlling noise from geothermal development, land-use conflicts between geothermal and other potential uses, impacts from landslide and soil erosion induced by geothermal development and protection of rare and endangered species in the region. DOE

N80-15627# Sandia Labs., Albuquerque, N. Mex.
PULSAR: AN INDUCTIVE PULSE POWER SOURCE
E. C. Cnare, W. P. Brooks, and M. Cowan 1979 4 p refs Presented at the Pulsed Power Conf., Lubbock, Tex., 12 Jun. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1246C; CONF-790622-19) Avail: NTIS HC A02/MF A01

The pulsar concept of inductive pulsed power source which uses a flux compressing metallic or plasma armature rather than a fast opening switch to transfer magnetic flux to a load is discussed. The inductive store is a relatively unsophisticated dc superconducting magnet. The development of much faster plasma armatures for use in larger systems of one and two meters diameter is examined. Techniques used to generate the required high magnetic Reynolds number flow are described. DOE

N80-15628# Hawaii Univ. at Manoa, Honolulu. Hawaii Natural Energy Inst.
SOLAR/WIND HANDBOOK FOR HAWAII: TECHNICAL APPLICATIONS FOR HAWAII, THE PACIFIC BASIN AND SITES WORLDWIDE WITH SIMILAR CLIMATIC CONDITIONS
W. Falicoff, G. Koide, and P. Takahashi May 1979 647 p refs Prepared jointly with Hawaii Univ., Hilo and Hawaii State Dept. of Planning and Economic Development
(Contract W-7405-eng-48)
(UCRL-15053) Avail: NTIS HC A99/MF A01

The techniques are presented for using solar energy and wind power in applications such as domestic hot water production, space cooling, process heating, and power generation. The findings and information are based upon conditions in Hawaii, but can apply to locations with similar environments such as the entire Pacific area. DOE

N80-15629# Argonne National Lab., Ill.
TURBOMACHINERY OPTIONS FOR AN UNDERGROUND PUMPED HYDROELECTRIC STORAGE PLANT
C. A. Blomquist, S. W. Tam, and A. A. Frigo 1979 11 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790803-50) Avail: NTIS HC A02/MF A01

Various turbomachinery options for underground pumped hydroelectric storage (UPHS) plants are reviewed. Current technology indicates that the maximum head for single-stage, reversible, Francis-type pump turbines is 625 m; for separate, single-stage, Francis-type turbines and multistage pumps, 672 m; for tandem units consisting of separate multijet impulse turbines and multistage pumps, 1440 m; and for multistage, reversible, ungated Francis-type pump turbines, 1290 m. Engineering design studies indicate that heads for the single-stage reversible units could be extended to 1000 m, developing 500 MW output per unit. The studies also indicate that two stage, reversible, Francis-type pump turbines with adjustable wicket gates could be developed for power outputs up to 500 MW at operating heads as high as 1500 m. DOE

N80-15630# Department of Energy, Washington, D. C. Office of Consumption Data System.
FEDERAL ENERGY DATA SYSTEM (FEDS) STATISTICAL SUMMARY UPDATE
J. P. Galliker Jul. 1979 854 p
(DOE/EIA-0192) Avail: NTIS HC A99/MF A01

The Federal energy data system statistical summary update displays state level energy consumption by major economic sectors for the years 1960 to 1977. The data are displayed in both calorific units and physical units. Fuels are divided into categories, i.e., highway gasoline in the transportation sector; kerosene in the residential sector; coking coal and petroleum coke in the industrial sector; and diesel in the transportation sector. DOE

N80-15631# Department of Energy, Washington, D. C. International Energy Analysis Div.
ENERGY DEMAND IN THE DEVELOPING COUNTRIES
J. Child and Mark Rodekohr Apr. 1979 20 p refs
(DOE/EIA-0183/10) Avail: NTIS HC A02/MF A01

An analysis of the demand for energy in developing countries

is summarized. A model of developing country energy demand which is econometric in nature and is designed to forecast demand for oil, coal, and natural gas - excluding non-fossil fuels is described. The model and data used in the analysis are defined, and results generated with the 1978 model and the 1977 model based on identical sets of assumptions are compared. DOE

N80-15632# California Univ., Livermore. Lawrence Livermore Lab.
LLL MATERIALS PROGRAM FOR FIBER-COMPOSITE FLYWHEELS
J. A. Rinde 26 Jul. 1979 13 p refs Presented at the Mech. and Mag. Energy Storage Contractor, Washington, D.C., 19 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-83043; CONF-790854-2) Avail: NTIS HC A02/MF A01

Fiber composite flywheels were studied in the areas of matrix resins, stress rupture, static engineering properties, fatigue, and time dependent engineering properties. Results are reported for physical and mechanical tests of a low cost matrix-resin system suitable for service up to 150 C. Results of stress rupture tests on E-glass are reported. Static engineering properties on a Kevlar-49/rubberized-epoxy composite are reported for tests at 25 and 75 C. Creep and fatigue tests were performed over a wide range of stress levels. Both input loads and material response strains were measured and used to correlate times to failure under creep and fatigue loading histories. DOE

N80-15633# SRI International Corp., Menlo Park, Calif.
ECONOMIC IMPACTS OF ENERGY CONSERVATION AND RENEWABLE ENERGY SOURCES
R. C. Carlson 1979 21 p refs
(Contract W-7405-eng-48)
(UCRL-15087) Avail: NTIS HC A02/MF A01

An overall theory of the economic impacts of alternative energy developments is developed. Literature on such impacts is reviewed and economic impacts of alternative energy development scenarios for California are projected. Economic impacts include changes in aggregate employment, unemployment, real income, and real output. Changes in each of these measures are analyzed in circumstances that include incentives or mandates for increased energy conservation or use of renewable energy resources. DOE

N80-15634# Brookhaven National Lab., Upton, N. Y.
MARKAL: A MULTIPERIOD LINEAR-PROGRAMMING MODEL FOR ENERGY SYSTEMS ANALYSIS (BNL VERSION)
H. Abilock, C. Bergstrom, J. Brady et al 1979 23 p refs Presented at the Energy Systems Analysis Intern. Conf., Dublin, 9 Oct. 1979
(Contract EY-76-C-02-0016)
(BNL-26390; CONF-791007-3) Avail: NTIS HC A02/MF A01

A computer program, MARKAL, a demand-driven, multiperiod, LP model of energy supplies and demands, is described. Its intended application is at the level of an entire nation. MARKAL takes exogenously supplied energy-demand figures and determines the optimal energy-supply and end-use-device network that can meet the demand. The computer systems design and requirements are discussed. The use of MARKAL for assessing the merits of energy technologies and characterizing their likely technological and economic characteristics is examined. DOE

N80-15635# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FLYWHEEL ENERGY STORAGE AND CONVERSION SYSTEM FOR PHOTOVOLTAIC APPLICATIONS
A. R. Millner 1979 15 p Presented at the Intern. Assembly on Energy Storage, Dubrovnik, Yugoslavia, 27 May 1979
(Contract EY-76-C-02-4094)
(COO-4094-48; CONF-790515-4) Avail: NTIS HC A02/MF A01

The design of a flywheel energy storage and conversion system is examined. The system serves as an interface between a solar photovoltaic array and an ac load, providing output waveform regulation as well as energy storage. Characteristics of the system include magnetic bearings, an ironless armature motor generator, and a low cost flywheel rotor. An economic analysis is presented. DOE

N80-15636# Acres American, Inc., Buffalo, N. Y.
FEASIBILITY OF COMPRESSED AIR ENERGY STORAGE AS A PEAK SHAVING TECHNIQUE IN CALIFORNIA. VOLUME 1: EXECUTIVE SUMMARY Final Report
[1979] 21 p
(Contract EY-76-C-03-1331)
(SAN-1331-T2) Avail: NTIS HC A02/MF A01

The feasibility of compressed air energy storage use based upon an analysis of the status of both underground and aboveground technology, the economic feasibility, and siting feasibility for California is studied. The power plant operation and energy use are examined and a conceptual design for a compressed air energy storage system is presented. A.W.H.

N80-15637# Sandia Labs., Albuquerque, N. Mex. Systems Analysis Div.
SOLAR MECHANICAL ENERGY STORAGE PROGRAM OVERVIEW AND SYSTEMS ANALYSIS RESULTS
B. C. Caskey 1979 6 p refs Presented at the Mechanical and Mag. Energy Storage Contractor, Washington, D.C., 19 Aug. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1642C; CONF-790854-1) Avail: NTIS HC A02/MF A01

The mechanical energy storage modes that are used in conjunction with solar inputs supplying small to intermediate loads are evaluated. Energy storage systems considered are flywheels, a pneumatic energy storage system, and low head pumped hydro storage. The development of low cost stationary flywheel technology is discussed. A computer program for systems analysis of the energy storage systems is described which uses economic parameters, system size, collector output and load demand based on hourly weather data for input data. A.W.H.

N80-15638# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DESCRIPTION OF THE MIT/LINCOLN LABORATORY PHOTOVOLTAIC SYSTEMS TEST FACILITY
S. B. Sacco 30 Jun. 1979 25 p ref
(Contract EY-76-C-02-4094)
(COO-4094-41) Avail: NTIS HC A02/MF A01

The test facility and the mechanical and electrical interfaces for items to be tested are described. These interfaces include those for the solar array, batteries, inverters, and for backup dc power sources. Permanent power and instrumentation wiring at the facility are depicted in sufficient detail to permit test plans to be drawn up from these descriptions. DOE

N80-15639# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
ROLE OF THE GOVERNMENT IN THE DEVELOPMENT OF SOLAR ENERGY
M. D. Yokell 1979 29 p refs Presented at the Ann. Meeting Assoc. for the Advan. of Sci., Houston, Tex., 4 Jan. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-52-138; CONF-790122-3) Avail: NTIS HC A03/MF A01

The economic rationale for a Federal solar energy subsidy program, the type of program required, and methods for determining the proper funding level for each program are discussed. An introduction offers a brief description of solar technologies. A summary of the current Federal solar subsidy program is also provided. DOE

N80-15640# Department of Energy, Washington, D. C. Office of Leasing Policy Development.
FEDERAL LEASING AND OUTER CONTINENTAL SHELF ENERGY PRODUCTION GOALS
Jun. 1979 426 p refs
(DOE/RA-0037) Avail: NTIS HC A19/MF A01

The growing U.S. dependence on foreign energy sources, coupled with a limited mid-term supply of newer energy sources, has focused national energy policy on expanding domestic production of fossil fuels. Considering that up to 60 percent of the nation's undiscovered energy resources may be located on the Outer Continental Shelf (OCS) and that new opportunities

exist for redirecting Federal management of OCS lands, the energy potential of the OCS was assessed. Oil and natural gas production goals for the OCS were established and are presented. The goals were determined by adding the production from existing OCS leases and estimated production from lease sales appearing on proposed lease schedules. R.E.S.

N80-15641# Sandia Labs., Albuquerque, N. Mex. System Analysis Div.
SOLAR ENHANCED OIL RECOVERY: AN ASSESSMENT OF ECONOMIC FEASIBILITY
K. D. Bergeron May 1979 51 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0787) HC A04/MF A01

An assessment of the potential economic viability of solar enhanced oil recovery (EOH) is presented. The technical and physical aspects of the merging of solar energy with EOR are examined. A cost model of the system based on a number of assumptions including operating lifetime, nonsteam costs, tax credits, and fuel prices is presented. A.W.H.

N80-15642# Electric Power Research Inst., Palo Alto, Calif. Fossil Fuel and Advanced Systems Div.
FEASIBILITY STUDY FOR ENHANCING THE DEVELOPMENT OF FUSION ENERGY
N. A. Amherd, ed. and J. H. Vanston, ed. Mar. 1979 158 p refs
(EPRI-ER-778-SR) Avail: NTIS HC A08/MF A01

Areas of work, as well as contributions to fusion program planning are presented. The feasibility of a comprehensive project addressing programmatic issues was investigated. A historical examination of the commercial development of selected large scale technologies, together with the specification of the methods for examining the compatibility of the fusion program with the electric utilities needs, and a plan for a detailed study of the safety and environmental issues of fusion power is given. Summaries of interviews with several people who have played key roles in the management of high technology development programs are reported. R.C.T.

N80-15643# Los Alamos Scientific Lab., N. Mex.
WATER USE ALTERNATIVES FOR NAVAJO ENERGY PRODUCTION
D. Abbey 1979 17 p refs Presented at the Navajo Energy and Environ. Technol. Training Conf., Tsaile, Ariz., 30 May 1979
(Contract W-7405-eng-36)
(LA-UR-79-1598; CONF-790550-3) Avail: NTIS HC A02/MF A01

The technologies and estimate costs ($/af saved) for those activities for which water conservation is feasible are described. The range of water requirements compared to energy and water resource estimates, alternative criteria for energy and water resource management are discussed: (1) promote energy activities with the lowest minimum water requirements; (2) require industry to use low quality water resources and the most effective water conservation technology; and (3) maximize the economic return on Navajo water reqources ($/af consumed). DOE

N80-15644# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: NBS/DOE WORKSHOP, STABILITY OF (THIN FILM) SOLAR CELLS AND MATERIALS
David E. Sawyer, ed. and Harry A. Schafft, ed. Aug. 1979 185 p refs Workshop held at Gaithersburg, Md., 1-3 May 1978 Sponsored in part by DOE
(PB-299964/7; NBS-SP-400-58; LC-79-600098) Avail: NTIS HC A09/MF A01 CSCL 10B

Long term stability of terrestrial solar cells using thin film materials and device technologies is discussed. Papers relating to solar cells of the following three material groupings: (1) Cu2S/(CdZn)S, Cu-ternaries/CdS, and amorphous Si; (2) polycrystalline, metal-insulator-semiconductor and conducting-oxide Si; and (3) polycrystalline, and antireflection-coated metal-oxide-semiconductor GaAs are presented. GRA

N80-15645# New Mexico Energy Inst., Las Cruces.
USE OF GEOTHERMAL ENERGY FOR DESALINATION IN NEW MEXICO: A FEASIBILITY STUDY Final Report, 7 Jan. 1977 - 30 May 1979
Lokesh Chaturvedi, Conrad G. Keyes, Jr., Chandler A. Swanberg, Yash P. Gupta, Marion Michael Hightower, and Ray Jay Davis (Arizona Univ.) Jun. 1979 142 p refs
(PB-299271/7; NMEI-42) Avail: NTIS HC A07/MF A01 CSCL 07C

The availability versus the requirements of water in the New Mexico area is examined. The use of geothermal energy for the desalinization of water in order to increase the water supply to the area is studied. Geothermal desalinization technology is reported along with potential geothermal desalinization sites. Saline and geothermal aquifer well fields design are described. Environmental, legal, and institutional considerations are outlined. A.W.H.

N80-15646# National Bureau of Standards, Washington, D.C. National Engineering Lab.
MEASUREMENT TECHNIQUES FOR SOLAR CELLS Quarterly Report, 1 Apr. - 30 Jun. 1978
D. E. Sawyer, H. K. Kessler, and H. A. Schafft Oct. 1979 30 p refs Prepared for DOE, Washington, D.C.
(PB-301309/1; NBSIR-79-1909) Avail: NTIS HC A03/MF A01 CSCL 10B

The technique of employing cell forward-biasing during scanning to reveal cell defects was implemented. Using an electrical current source, cell cracks and metallization regions disconnected from the cell output electrode were readily revealed. The mathematical analysis work supporting the experimental scanning of cells was extended to more realistic cell geometries than the one-dimensional one. Developments in scanner equipment and ancillary techniques include the completion of the high intensity insolation source for forward-biasing cells with light during scanning, an improvement in coupling biased and scanned cells to the display screen electronics, and an increase in the cell scanning area. R.E.S.

N80-15647# Syracuse Research Corp., N. Y. Energy Research Center.
PROJECT EVALUATION AND QUALITY CONTROL
Arthur Levy Jan. 1979 18 p
(Grant CSA-30200-L-76-01)
(PB-301048/5; SRC-TR-555.20) Avail: NTIS HC A02/MF A01 CSCL 13A

Quality control and evaluation of weatherization/energy programs are discussed. Among the issues presented are truck and tool maintenance, inventory control, work evaluation, and personnel evaluation and training. K.L.

N80-15648# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAM AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Apr. - Jun. 1979
W. J. Toth, R. W. Henderson, W. F. Barron, A. C. Goodman, and C. S. Leffel, Jr. Jul. 1979 46 p refs
(PB-310245/7; APL/JHU/EQR-79-2) Avail: NTIS HC A03/MF A01 CSCL 10A

Topic areas covered include: geothermal energy development planning, hydroelectric power development, energy conversion and storage techniques, power plant site evaluation, and ocean thermal energy conversion development. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-15649*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCEEDINGS OF SHUTTLE ENVIRONMENTAL EFFECTS PROGRAM REVIEW
Andrew E. Potter, ed. Washington Jan. 1980 124 p refs Conf. held at Kennedy Space Center, Fla., 21-22 Mar. 1978

(NASA-CP-2110; S-489) Avail: NTIS HC A06/MF A01 CSCL 13B

Measurements of Titan exhaust cloud effluents are documented and compared, mesoscale and microphysical acid rain models are described, and a submesoscale model is proposed. Various instruments and facilities for measuring ice nuclei and other constituents of solid rocket motor exhaust effluents are discussed. Regional air quality monitoring and rain collection systems are described, and the ecological impact of solid rocket motor exhaust effluents is examined. The potential effect of space shuttle launches is estimated where data are adequate. For individual titles, see N80-15650 through N80-15659.

N80-15650*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CLOUD VOLUME STUDIES
R. J. Bendura *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 1-4 (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

A time history of cloud growth for the Titan 3 launch was obtained by using optical data provided by three Askania trackers (position of the cloud) and three Hasselblad cameras (cloud volume). Two quasi-independent measurements of ground cloud volume as a function of time were obtained. Aircraft time in the cloud, as measured by the rapid response nephelometer onboard the aircraft, was used for determining cloud volume. Cloud volume from aircraft measurements for the entire operation is summarized. A.W.H.

N80-15651*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IN SITU EXHAUST CLOUD MEASUREMENTS
Dewey Wornom *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 5-7 (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

Airborne in situ exhaust cloud measurements were conducted to obtain definitions of cloud particle size range, Cl2 content, and HCl partitioning. Particle size distribution data and Cl2 measurements were made during the May, August, and September 1977 Titan launches. The measurements of three basic effluents - HCl, NO sub X, and particles - against minutes after launch are plotted. The maximum observed HCl concentration to the maximum Cl2 concentration are compared and the ratios of the Cl2 to the HCl is calculated. A.W.H.

N80-15652*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MEASUREMENT OF PARTICULATES
D. Woods *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 9-12 (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

The size distributions of particles in the exhaust plumes from the Titan rockets launched in August and September 1977 were determined from in situ measurements made from a small sampling aircraft that flew through the plumes. Two different sampling instruments were employed, a quartz crystal microbalance (QCM) cascade impactor and a forward scattering spectrometer probe (FSSP). The QCM measured the nonvolatile component of the aerosols in the plume covering an aerodynamic size ranging from 0.05 to 25 micrometers diameter. The FSSP, flown outside the aircraft under the nose section, measured both the liquid droplets and the solid particles over a size range from 0.5 to 7.5 micrometers in diameter. The particles were counted and classified into 15 size intervals. The presence of a large number of liquid droplets in the exhaust clouds is discussed and data are plotted for each launch and compared. A.W.H.

N80-15653*# Naval Weapons Center, China Lake, Calif.
ICE NUCLEI MEASUREMENTS FROM SOLID ROCKET MOTOR EFFLUENTS
Edward E. Hindman, II *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 13-26 (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

The ice crystal forming nuclei (IN) measured in solid rocket motor (SRM) exhaust products is discussed in relation to space shuttle exhaust. Preliminary results from laboratory investigations and flight preparations for March 1978 Titan launch are discussed. The work necessary to provide adequate measurements of IN and cloud condensation nuclei (CCN) in the stabilized ground clouds from SRM's is studied. A.W.H.

N80-15654*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GROUND-BASED MEASUREMENTS OF DM-2 ROCKET EXHAUST EFFLUENTS USING FIXED-FLOW SAMPLERS AND ELECTRETS
Michael Susko *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 27-32 (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

Electret devices were used to collect samples of rocket exhaust products. The samples were analyzed by X-ray spectroscopy. The performance of the electrets was compared with that of Thiokol fixed flow samplers during the static test firing of a solid rocket motor (SRM) demonstration model. A vertical profile of wind speed, wind direction, and air temperature, used as inputs to the multilayer diffusion model for the SRM static test is presented. A.W.H.

N80-15655*# Michigan Univ., Ann Arbor.
ACID RAIN: MESOSCALE MODEL
Hsiao-ming Hsu *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 33-63 refs (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

A mesoscale numerical model of the Florida peninsula was formulated and applied to a dry, neutral atmosphere. The prospective use of the STAR-100 computer for the submesoscale model is discussed. The numerical model presented is tested under synoptically undisturbed conditions. Two cases, differing only in the direction of the prevailing geostrophic wind, are examined: a prevailing southwest wind and a prevailing southeast wind, both 6 m/sec at all levels initially. A.W.H.

N80-15656*# Michigan Univ., Ann Arbor.
ACID RAIN: MICROPHYSICAL MODEL
A. N. Dingle *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 65-82 refs (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

A microphysical model was used to simulate the case of a ground cloud without dilution by entrainment and without precipitation. The numerical integration techniques of the model are presented. The droplet size spectra versus time and the droplet molalities for each value of time are discussed. A.W.H.

N80-15657*# Department of Agriculture, Washington, D.C.
RESPONSE OF SELECTED PLANT AND INSECT SPECIES TO SIMULATED SRM EXHAUST MIXTURES AND TO EXHAUST COMPONENTS FROM SRM FUELS
Walter W. Heck *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 85-99 refs (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

The possible biologic effects of exhaust products from solid rocket motor (SRM) burns associated with the space shuttle are examined. The major components of the exhaust that might have an adverse effect on vegetation, HCl and Al2O3 are studied. Dose response curves for native and cultivated plants and selected insects exposed to simulated exhaust and component chemicals from SRM exhaust are presented. A system for dispensing and monitoring component chemicals of SRM exhaust (HCl and Al2O3) and a system for exposing test plants to simulated SRM exhaust (controlled fuel burns) are described. The effects of HCl, Al2O3, and mixtures of the two on the honeybee, the corn earworm, and the common lacewing and the effects of simulated exhaust on the honeybee are discussed. A.W.H.

N80-15658*# Florida Technological Univ., Orlando.
ECOLOGICAL BASELINE STUDIES
Dave Vickers *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 101-115 (For

primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

Environmental studies of Merritt Island are discussed. Five areas of the island's ecology are examined. They include: a terrestrial community analyses, a plant community study, a small mammal population study, a rainfall study, and an ichthyological analyses. A.W.H.

N80-15659*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AIR QUALITY MONITOR AND ACID RAIN NETWORKS
Hans Rudolph *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 117-123
(For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

The air quality monitor program which consists of two permanent air monitor stations (PAMS's) and four mobile shuttle pollutant air monitor stations (SPAMS's) is evaluated. The PAMS measures SO sub X, NO sub X particulates, CO, O3, and nonmethane hydrocarbons. The SPAMS measures O3, SO2, HCl, and particulates. The collection and analysis of data in the rain monitor program are discussed. A.W.H.

N80-15660*# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
ANALYSIS OF THE MEASURED EFFECTS OF THE PRINCIPAL EXHAUST EFFLUENTS FROM SOLID ROCKET MOTORS Final Report
R. Dawbarn, M. Kinslow, and D. J. Watson Washington NASA Jan. 1980 149 p refs
(NASA Order H-19386-B)
(NASA-CR-3136) Avail: NTIS HC A07/MF A01 CSCL 13B

The feasibility of conducting environmental chamber tests using a small rocket motor to study the physical processes which occur when the exhaust products from solid motors mix with the ambient atmosphere was investigated. Of particular interest was the interaction between hydrogen chloride, aluminum oxide, and water vapor. Several types of instruments for measuring HCl concentrations were evaluated. Under some conditions it was noted that acid aerosols were formed in the ground cloud. These droplets condensed on Al2O3 nuclei and were associated with the rocket exhaust cooling during the period of plume rise to stabilization. Outdoor firings of the solid rocket motors of a 6.4 percent scaled model of the space shuttle were monitored to study the interaction of the exhaust effluents with vegetation downwind of the test site. Data concerning aluminum oxide particles produced by solid rocket motors were evaluated. R.E.S.

N80-15661# Utah State Univ., Bedford, Mass. Electro-Dynamics Labs.
INTERPRETATION OF NO AND OH EMISSION FROM 1976 AIRBORNE MEASUREMENTS
John H. Schummers and Ronald J. Huppi 1 Jan. 1979 58 p refs Sponsored in part by DNA
(Contract F19628-78-C-0018; AF Proj. 7670)
(AD-A073898; EDL-SRL-79-1; DNA-HAES-80; AFGL-TR-79-0027; SR-1) Avail: NTIS HC A04/MF A01 CSCL 04/1

Measured infrared emission enhancements and backgrounds in the 2.83 to 3.04 micron region are analyzed. The measurements used for the analyses were collected from the AFGL NKC-135A flying laboratory during the 1976 DNA/AFGL ICECAP program. Chemiluminescence from hydroxyl fundamental chemistry was found to be the major background emitter in the measurement region, and aurorally excited, nitric oxide first overtone chemistry is believed to account for large observed enhancements. Assuming the enhancements result from NO chemistry, calculations were made to determine the percentage of the total auroral electron energy which is radiated as first overtone nitric oxide photons. The calculated percentage was found to vary from one measurement period to the next. It ranged from 4% to 1.0%, which probably indicates that the excitation is dependent on the auroral penetration depths and characteristics. GRA

N80-15662# Army Construction Engineering Research Lab., Champaign, Ill.
INTERACTIVE ENVIRONMENTAL IMPACT COMPUTER SYSTEM (EICS) USER MANUAL Final Report
Robert Baran Sep. 1979 31 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A074890; CERL-TR-N-80) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes the Environmental Impact Computer System (EICS) and provides instructions for obtaining and using output for the current interactive version of the system. It is recommended that the instructions be used to obtain the most efficient use of the system. GRA

N80-15663# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN PHOTOVOLTAICS
Sep. 1979 34 p refs
(DOE/EDP-0031) Avail: NTIS HC A03/MF A01

Potential environmental, health, safety, and socioeconomic impacts relevant to solar photovoltaic systems are identified. A management plan is then presented for conducting and coordinating environmental research in concert with the technology development effort to ensure that the identified environmental issues are resolved prior to significant public deployment of the technology. DOE

N80-15664# Argonne National Lab., Ill. Energy and Environmental Systems Div.
OTEC PHYSICAL AND CLIMATIC ENVIRONMENTAL IMPACTS
J. D. Ditmars and R. A. Paddock 1979 10 p refs Presented at OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-790631-11) Avail: NTIS HC A02/MF A01

The Department of Energy program for the development and application of analyses and models for the prediction of the physical aspects of OTEC impacts is reviewed. The effects of intake/discharge designs and of ambient ocean conditions on recirculation and near field effluent plume behavior were investigated by means of physical models. Further study of the intake flow fields may be necessary to make estimates of intake impingement and entrainment effects. Mathematical analysis of intermediate field mixing of plant effluents showed that effluent plumes may have vertical dimensions on the order of meters and lateral dimensions on the order of kilometers. Basin-wide resource renewal and physical environmental effects are being studied by means of a numerical model of the Gulf of Mexico with detailed vertical resolution. Concerns regarding climatic impacts presently are focused on atmospheric CO2 loading and modification of air-sea heat exchange processes due to OTEC operation. DOE

N80-15665# San Jose State Univ., Calif. Dept. of Meteorology.
SURVEY OF STATISTICAL TECHNIQUES USED IN VALIDATION STUDIES OF AIR POLLUTION PREDICTION MODELS
R. D. Bornstein Mar. 1979 48 p refs
(Contract EY-76-S-02-2874)
(COO-2874-50) Avail: NTIS HC A03/MF A01

Graphical, tabular, and summary techniques used to validate predictions made by air pollution models are surveyed. Some of the practical problems associated with verification are also discussed. Characteristics desired in any validation program are listed and a suggested combination of techniques that possess many of these characteristics is presented. GRA

N80-15666# California Univ., Livermore. Lawrence Livermore Lab.
MAN'S EFFECT ON STRATOSPHERIC OZONE
H. W. Ellsaesser Aug. 1979 23 p refs Presented at the 4th Intern. Symp. on Environmental Biogeochemistry, Canberra, Australia, 26-31 Aug. 1979 Sponsored in part by FAA
(Contract W-7405-eng-48)
(UCRL-82556) Avail: NTIS HC A02/MF A01

The modification of the stratospheric ozone uv shield by man-induced mechanisms is discussed. The mechanisms reviewed include: (1) the atmospheric release of stable Br compounds such as the soil fumigant CH3Br; (2) the release of chlorocarbons; (3) the release of IR absorbing gases such as CO2; and (4) the

release of nitrogen oxides through the detonation of nuclear devices, the use of fertilizers, and combustion. K.L.

N80-15667# Department of Energy, Bartlesville, Okla. Energy Technology Center.
EMISSIONS CHARACTERISTICS OF SIX HIGH-SPEED DIESEL ENGINES
W. F. Marshall Oct. 1978 14 p refs
(BETC/TPR-78/7) Avail: NTIS HC A02/MF A01

Emissions characteristics of six high speed diesel engines were determined in order to assess the potential for use of this type of engine in underground mines. Emissions of nitrogen oxide were low; carbon monoxide and smoke levels were reduced to acceptable levels by limiting the maximum power capability of the engines. The relatively high power densities of these engines, along with these emissions characteristics, indicate good potential for their use in underground mines. DOE

N80-15668# California Univ., Livermore. Lawrence Livermore Lab.
IDENTIFICATION OF ENVIRONMENTAL CONTROL TECHNOLOGIES FOR GEOTHERMAL DEVELOPMENT IN THE IMPERIAL VALLEY OF CALIFORNIA
D. F. Snoeberger and J. H. Hill 5 Oct. 1978 33 p refs
(Contract W-7405-eng-48)
(UCRL-52548) Avail: NTIS HC A03/MF A01

Control technologies to manage environmental impacts from geothermal developments in California's Imperial Valley are discussed. Included are descriptions of methods for managing land subsidence by fluid injection; for preventing undesirable induced seismicity or mitigating the effects of seismic events; for managing liquid wastes through pretreament or subsurface injection; for controlling H2S by dispersal, reinjection, and chemical treatment of effluents; and for minimizing the impact of noise from power plants by setting up buffer zones and exclusion areas. DOE

N80-15669# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: ELECTRIC ENERGY SYSTEMS
Aug. 1979 58 p refs
(DOE/EDP-0038) Avail: NTIS HC A04/MF A01

The Electric Energy Systems (EES) program is discussed. The program includes the following projects: electric field effects, underground transmission, high-voltage dc technology, advanced transformer and generator concepts, compact stations, and dispersed storage and generation. The projects were examined to identify their environmental impact and the resulting concerns. Management plans for meeting the environmental requirements are identified, along with the organizations responsible for managing the environmental research associated with the EES program. DOE

N80-15670# Oak Ridge Associated Universities, Tenn.
DEVELOPMENT OF THE ROCKY MOUNTAIN ENERGY AND ENVIRONMENTAL TECHNOLOGY CENTER: A PRELIMINARY ANALYSIS
T. McKinley, J. Doggett, and J. Little Jun. 1979 34 p
(Contract EY-76-C-05-0033)
(ORAU-158) Avail: NTIS HC A03/MF A01

The events that contributed to the evolution of RME and ETC are emphasized. All of the organizations which have aided the development of RME and ETC are identified. The private and shared agendas of each are explored. A historical synopsis is presented to provide a chronological time frame for program development. Training programs in machining, word processing, and chemical operating are described. Characteristics of the total 79 trainees enrolled are presented; terminations and placements to date are cited. RME and ETC represents one coordinated approach to industry-based CETA skills training. The key elements that contributed to the current RME and ETC are identified. Recommendations are offered for present and future program implementation. DOE

N80-15671# National Technical Information Service, Springfield, Va.
MANEUVERING AIRCRAFT: NOISE POLLUTION AND CONTROL, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Aug. 1979
Guy E. Habercom, Jr. Sep. 1979 167 p Supersedes NTIS/PS-78/0930; NTIS/PS-77/0786; NTIS/PS-76/0733; NTIS/PS-75/ 762; NTIS/PS-75/060
(NTIS/PS-79/0973/2; NTIS/PS-78/0930; NTIS/PS-77/0786; NTIS/PS-76/0733; NTIS/PS-75/762; NTIS/PS-75/060) Avail: NTIS HC $28.00/MF $28.00 CSCL 20A

Methods for alleviating noise created by maneuvering aircraft are cited. Flyby, turning flight, takeoffs, and landings are the maneuvers investigated. (The updated bibliography contains 159 abstracts, 18 of which are new entires to the previous edition.) GRA

N80-15672# Air Pollution Technology, Inc., San Diego, Calif.
EVALUATION OF GRANULAR BED FILTERS FOR HIGH-TEMPERATURE/HIGH-PRESSURE PARTICULATE CONTROL
Shui-Chow Yung, Ronald Patterson, Richard Parker, and Seymour Calvert Jan. 1979 242 p refs
(Contract EPA-68-02-2183)
(PB-299195/8; EPA-600/7-79-020) Avail: NTIS HC A11/MF A01 CSCL 13K

The status and potential of granular bed filter (GBF) technology for fine particulate control was critically reviewed and evaluated with emphasis on high temperature and pressure (HTP) applications. Available theoretical models and experimental data were evaluated and found to be inadequate for predicting the performance of industrial GBF systems. Additional experimental data were obtained with a bench scale GBF. These data were used as the basis for a clean bed performance model based on inertial impaction as the primary collection mechanism. Predictions were in good agreement with data from industrial GBF systems. GRA

N80-15673# Research Triangle Inst., Research Triangle Park, N. C.
CAPTIVE AIR BAG DESIGN STUDY Final Report
R. S. Wright and J. E. Sickles, II Apr. 1979 92 p refs
Sponsored by Houston Chamber of Commerce
(PB-299636/1; RTI/1623/00-07F; HAOS-16) Avail: NTIS HC A05/MF A01 CSCL 13B

The design and field testing of a suitable large captive air bag is presented. A photochemical reactor designed for use in captive air experiments, to construct a full-scale demonstration prototype of the reactor, and to evaluate the physical and pneumatic integrity of this prototype under conditions which realistically simulate captive air experiments is described. GRA

N80-15674# Research Triangle Inst., Research Triangle Park, N. C.
HOUSTON AREA OXIDANT STUDY DETAILED HYDROCARBON ANALYSES Final Report
R. B. Denyszyn, E. Pellizzari, J. M. Harden, and D. L. Hardison Apr. 1979 283 p refs
(PB-299629/6; RTI/1456/00-01F; HAOS-18) Avail: NTIS HC A13/MF A01 CSCL 13B

The volatile organic species present in the Houston ambient air were identified. Several gas chromatographic techniques were used to perform analyses for organic species on the samples collected. The samples collected were analyzed for 49 organic species ranging from C1 to C10 molecules. R.C.T.

N80-15675# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
ANALYTICAL DIFFUSION MODEL FOR LONG DISTANCE TRANSPORT OF AIR POLLUTANTS Final Report
James A. Fay and Jacob J. Rosenzweig Jun. 1979 31 p refs
(Grant EPA-R-804891)
(PB-299358/2; EPA-600/4-79-037) Avail: NTIS HC A03/MF A01 CSCL 13B

A steady-state two dimensional diffusion model suitable for predicting ambient air pollutant concentrations averaged over a long time period (e.g., month, season, or year) and resulting from the transport of pollutants for distances greater than about 100 km from the source is described. Analytical solutions are derived for the primary pollutant emitted from a point source and for secondary pollutant formed from it. The analytical theory

for the dispersion of a primary pollutant is compared with the numerical predictions of a plume trajectory model and the theory for the dispersion of a secondary pollutant is compared with measurements of the annual average sulfate concentration in the U.S. GRA

N80-15676# Hittman Associates, Inc., Columbia, Md.
ENVIRONMENTAL ASSESSMENT REPORT: SOLVENT REFINED COAL (SRC) SYSTEMS Final Report, May 1978 - May 1979
K. J. Shields, H. T. Hopkins, E. E. Weir, and Carolyn Thompson Jun. 1979 847 p
(Contract EPA-68-02-2162)
(PB-300383/7; EPA-600/7-79-146) Avail: NTIS HC A99/MF A01 CSCL 13B

Air emissions, water effluents, solid wastes, toxic substances, control/disposal alternatives, environmental regulatory requirements, and environmental effects associated with solvent refined coal (SRC) systems are evaluated. The SRC-1(solid product) and SRC-11(liquid product) variations of solvent refining are considered in terms of a hypothetical facility to produce 7950 cum/day liquefied coal products. Control and disposal options are surveyed to determine their applicability to subject discharges. Potentially applicable regulatory requirements are reviewed and compared to estimated after-treatment discharge levels. Analyses indicate that solid wastes produced by SRC systems are the greatest source of current environmental concern. GRA

N80-15677# Geological Survey, Bay Saint Louis, Miss. Gulf Coast Hydroscience Center.
ONE-DIMENSIONAL STEADY-STATE STREAM WATER-QUALITY MODEL Final Water-Resources Investigations
Daniel B. Bauer, Marshall E. Jennings, and Jeffrey E. Miller Mar. 1979 218 p refs
(PB-300327/4; USGS/WRD/WRI-79/035; USGS/WRI-79/45) Avail: NTIS HC A10/MF A01 CSCL 13B

A computer program, based on a one dimensional mathematical model which predicts the stream water quality response characteristics from waste source inputs, is described and documented. Variables predicted include dissolved oxygen, biochemical oxygen demand, nitrogen forms, total and fecal-coliform bacteria, orthophosphate-phosphorus, and various conservative substances. The model formulation is based on a steady-state assumption which requires constant flow rate of waste and stream discharges and associated parameters. To achieve a problem solution, each reach of a stream system is broken into a given number of subreaches, generally defined by locations of waste or tributary inflow points. GRA 8

N80-15678# Monsanto Co., Alvin, Tex.
THE BERYLLIUM-7 PROGRAM OF THE HOUSTON AREA OXIDANTS STUDY Final Report
Harry M. Walker Jul. 1979 83 p refs Sponsored by Houston Chamber of Commerce, Tex.
(PB-299632/0; HAOS-30) Avail: NTIS HC A05/MF A01 CSCL 13B

Levels of beryllium-7 in the ambient air of Houston, Texas were measured during 1977. Beryllium-7 is taken to be a valid parameter measuring the presence of stratospheric air and consequently the presence of stratospheric ozone during the study period. Some conclusions are reached regarding the possible role stratospheric air plays in the initiation of photochemical ozone episodes. GRA

N80-15679# Rice Center for Community Design and Research, Houston, Tex.
SOCIO-ECONOMIC IMPACT ANALYSIS OF SELECTED AIR POLLUTION CONTROLS IN THE HOUSTON-GALVESTON REGION Final Technical Report
Mar. 1979 148 p refs Sponsored by the Houston Chamber of Commerce, Tex.
(PB-299635/3; HAOS-23) Avail: NTIS HC A07/MF A01 CSCL 13B

The results of a study to develop a methodology appropriate for identifying and assessing the social and economic impacts of air pollution control programs and apply the methodology to the Houston region in order to assess the likely effects of control programs on air quality and the social and economic costs, or benefits, that would accrue to the region are presented. The scope of the study was limited to a geographic area of eight counties in and around the Houston metropolitan area. They are Harris County, Brazoria County, Fort Bend County, Chambers County, Galveston County, Liberty County, Montgomery County, and Waller County. GRA

N80-15680# Physical Dynamics Northwest, Bellevue, Wash.
AN ANALYSIS OF ATMOSPHERIC VISIBILITY DATA IN THE HOUSTON AREA Final Report
John M. Lansinger and Deborah A. Miller May 1979 115 p refs Sponsored by Houston Chamber of Commerce, Tex.
(PB-299633/8; PD/NW-78/186R; HAOS-31) Avail: NTIS HC A06/MF A01 CSCL 13B

The analysis of data related to atmospheric visbility, obtained during the Houston Area Oxidant Study (HAOS), and the measurements of visibility and visual range are described. Three methods of measuring visibility or visual range were employed during the HAOS project: human observations and instrumental measurements using a telephotometer and nephelometers. The combined measurements provided not only a means of confirming the results but also comparison of the techniques. GRA

N80-15681# Mathtech, Inc., Princeton, N. J.
EVALUATION OF THE ENVIRONMENTAL EFFECTS OF WESTERN SURFACE COAL MINING, VOLUME 1 Final Report, Jun. 1975 - Jun. 1977
Frank Cook May 1979 154 p refs
(Contract EPA-68-03-2226)
(PB-300375/3; EPA-600/7-79-110-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13B

The methods presently used for surface mining of coal in the western United States are described and evaluated. The effects that use of those methods have on the environment are described and ways in which the methods might be altered to reduce both long term and short term environmental damage are presented. GRA

N80-15682# PEDCo-Environmental, Inc., Cincinnati, Ohio.
EPA UTILITY FGD (FLUE GAS DESULFURIZATION) SURVEY: DECEMBER 1978 - JANUARY 1979
M. Smith, M. Melia, T. Koger, R. McKibben, and J. Uihlein May 1979 453 p refs
(Contract EPA-68-02-2603)
(PB-299399/6; EPA-600/7-79-022C) Avail: NTIS HC A20/MF A01 CSCL 10B

The scope of design data for operating flue gas desulfurization (FGD) systems is expanded, section formats are revised, and a new section includes operational particulate scrubbers. Information contributed by the utility industry, process suppliers, regulatory agencies, and consulting engineering firms is summarized. Systems are tabulated alphabetically by development status (operational, under construction, or in planning stages), utility company, process supplier, process, waste disposal practice, and regulatory class. Data on system design, fuel sulfur content, operating history, and actual performance are presented as well as unit by unit dependability parameters. Problems and solutions associated with the boilers and FGD systems are considered. Process flow diagrams and FGD system economic data are appended. Current data show 46 operating FGD systems, 45 systems under construction, and 67 planned units. Projected 1988 FGD capacity is about 70,000 MW. GRA

N80-15683# Environmental Research Lab., Gulf Breeze, Fla.
AMERICAN-SOVIET SYMPOSIUM ON CHEMICAL POLLUTION OF THE MARINE ENVIRONMENT, 1ST Final Report
Karl K. Turekian and Anatoliy I. Simonov Dec. 1978 209 p refs Symp. held at Odessa, USSR, 24-28 May 1977
(PB-298343/5; EPA-600/9-78-038) Avail: NTIS HC A10/MF A01 CSCL 07D

The impact of chemical pollution on the world's oceans is assessed. The fate of heavy metals in estuaries and the Gulf of Mexico, transport of natural radionuclides in shelf waters of the eastern U.S. and the distribution and dynamics of trace metals in pore water and sediment are among the topics covered. Biogeochemical research on metals in the world's oceans, monitoring chemical pollution and forecasting its biological consequences; arsenic, antimony, and mercury in seawater, and

oil and oil products in surface waters of the Atlantic, Pacific, and Indian Oceans are included. Methods of sampling water from the ocean surface microlayer and the technical composition of the microlayer, a method for determining mercury, scientific aspects of marine pollution problems, and the management of the quality of the marine environment are covered. GRA

N80-15684# Battelle Columbus Labs., Ohio.
CHEMICAL ASPECTS OF AFTERBURNER SYSTEMS Final Report, Mar. 1977 - Mar. 1979
R. H. Barnes, M. J. Saxton, R. E. Barrett, and A. Levy Apr. 1979 121 p
(Contract EPA-68-02-2629)
(PB-298465/6; EPA-600/7-79-096) Avail: NTIS
HC A06/MF A01 CSCL 07D

The chemistry and reaction kinetics of oxidation and pyrolysis reaction that occur in afterburners (or fume incinerators) that are used to destroy organic pollutants in air or gas streams are reviewed. Chemical kinetic rate data are compiled for both complex and global reaction mechanisms of interest for the design and analysis of afterburner systems. Direct-flame, thermal, and catalytic afterburner systems are covered. Details are also given on techniques for estimating chemical rate data when experimental data are unavailable. Appropriate equations are given for calc rlating the chemical performance characteristics of afterburner systems, and recommendations are made for using chemical rate data for the analysis of afterburner systems. GRA

N80-15685# Environmental Monitoring and Support Lab., Las Vegas, Nev.
WESTERN ENERGY SULFATE/NITRATE MONITORING NETWORK Progress Report, Jan. 1975 - Jun. 1978
Michael J. Pearson, Marc Pitchford, and Robert Snelling Mar. 1979 50 p refs
(PB-299238/6; EPA-600/7-79-074) Avail: NTIS
HC A03/MF A01 CSCL 13B

Little sulfate-nitrate data are available to establish a baseline and evaluate the impact of coal utilization. The number of locations monitoring sulfate and nitrate in the Western Energy Resource Development Area was increased by augmenting the existing particulate sampling networks. To evaluate and improve the quality of data obtained, a quality assurance program was established. The data reported thus far indicate generally low values in this area. Typically, sulfate values are less than 6 micrograms per cubic meter (microgram/cu m) and nitrate values are less than 3 microgram/cu m. GRA

N80-15686# Industrial Environmental Research Lab., Research Triangle Park, N. C. Particulate Technology Branch.
IN-STACK PLUME OPACITY FROM ELECTROSTATIC PRECIPITATOR/SCRUBBER SYSTEM AT HARRINGTON UNIT 1
Leslie E. Sparks May 1979 33 p refs
(PB-299215/4; EPA-600/7-79-118) Avail: NTIS
HC A03/MF A01 CSCL 13B

Results are given of theoretical modeling of particulate emission and in-stack plume opacity for the electrostatic precipitator (ESP)/scrubber system at Southwestern Public Service Company's Harrington Unit 1. It was shown that 20% opacity can be achieved (1) by increasing specific collector area of the ESP and leaving the scrubber pressure drop alone, (2) by increasing scrubber pressure drop and leaving the ESP alone, (3) by replacing the existing marble bed scrubber with a venturi scrubber, increasing the pressure drop by 20%, and leaving the ESP alone, or (4) by doubling the SCA of the ESP and removing the scrubber. GRA

N80-15687# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
PILOT SCALE EVALUATION OF NOx COMBUSTION CONTROL FOR PULVERIZED COAL, PHASE 2 Final Report, Jun. 1973 - Jan. 1978
R. A. Brown, J. T. Kelly, and Peter Neubauer Jun. 1979 321 p
(Contract EPA-68-02-1885)
(PB-299325/1; EPA-600/7-79-132; Rept-78/293) Avail: NTIS HC A14/MF A01 CSCL 13B

Advanced NOx control techniques were investigated on a pilot scale test facility firing pulverized coal. Baseline and control technology tests were performed on three coal types over a range of parameters. First and second stage parameters investigated include stoichiometry, excess air, temperature, mixing residence time, and coal composition. A minimum NO level was achieved at a stoichiometric ratio between 0.75 and 0.85, depending on fuel and furnace configuraton, and the longer first-stage residence times gave lower stack NO levels. To obtain NO levels below 150 ppm, first-stage residence times of up to 3 seconds were required. Second-stage parameters were found to be of second-order importance. GRA

N80-15688# Clemson Univ., S.C. Dept. of Mechanical Engineering.
ENERGY CONSERVATION THROUGH POINT SOURCE RECYCLE WITH HIGH TEMPERATURE HYPERFILTRATION Final Report, Jul. 1975 - Dec. 1978
J. L. Gaddis, C. A. Brandon, and J. J. Porter Jun. 1979 187 p refs
(Grant EPA-R-803875)
(PB-299183/4; EPA-600/7-79-131) Avail: NTIS
HC A09/MF A01 CSCL 13B

The reuse of water, energy, and chemicals in the textile industry can be best achieved if separations are applied to individual point-source streams rather than to total-plant mixed effluents. Five wet processes comprise a large fraction of total textile operations and require over half of the total energy used. Each process effluent was sampled and analyzed to determine which membrane, hyperfiltration or ultrafiltration, should be used. Two small equipment skids allowed membrane operation at the plant sites. The permeable water in each case was reusable. Estimates of energy recoverable per mass of cloth processed (kJ/kg) for each operation are: rope preparation, 2646; open-width preparation, 5766; continuous dyeing, 2449; atmospheric beck dyeing, 20115; high-pressure dyeing, 3910; and low-pressure beck dyeing, 1964. GRA

N80-15689# Radian Corp., Austin, Tex.
FIELD AND LABORATORY STUDIES FOR THE DEVELOPMENT OF EFFLUENT STANDARDS FOR THE STEAM ELECTRIC POWER INDUSTRY Final Report, Jul. 1977 - Apr. 1978
Frank G. Mesich and Milton L. Owen Nov. 1978 201 p refs
(Contract EPA-68-02-2608)
(PB-299097/6; EPA-600/7-78-209) Avail: NTIS
HC A10/MF A01 CSCL 13B

Results of an evaluation of carbon absorption chemical precipitation, reverse osmosis and vapor compression distillation (VCD) as removal technologies for priority pollutants from wastewater streams of utility power plants are given. Samples of plant make-up water cooling tower blowdown, ash pond effluent, and effluent waters from the treatment technologies were analyzed for priority organic and inorganic pollutants. Carbon absorption and reverse osmosis removed priority pollutants, but low concentrations prevented definitive conclusions on their removal effectiveness. Chemical precipitation, reverse osmosis, and VCD effectively reduced low concentration inorganic compounds, including arsenic, copper, and lead, all of which were present in significant concentrations in at least one wastewater stream. GRA

N80-15690# Geological Survey, Bay Saint Louis, Miss. Gulf Coast Hydroscience Center.
ESTIMATING THE GAS AND DYE QUANTITIES FOR MODIFIED TRACER TECHNIQUE MEASUREMENT OF STREAM REAERATION COEFFICIENTS Final Report
R. E. Rathbun Feb. 1979 53 p refs
(PB-299015/8; USGS/WRD/WRI-79/029; USGS/WRI-79/27)
Avail: NTIS HC A04/MF A01 CSCL 13B

Stream reaeration coefficients were measured with a modified tracer technique by injecting ethylene or ethylene and propane together and a rhodamine-WT dye into the stream. The movement of the tracers through the stream reach is described by a one-dimensional diffusion equation. Equations estimating the gas flow rates, the quantities of gases, the dye concentration, and the quantity of dye together with procedures for determining the variables in these equations are presented. GRA

N80-15691# Dravo Corp., Pittsburgh, Pa.
MANAGEMENT OF COAL PREPARATION FINE WASTES WITHOUT DISPOSAL PONDS Final Report, Jul. 1977 - Jun. 1978
D. C. Hoffman, R. W. Briggs, and S. R. Michalski. Jan. 1979. 63 p. refs.
(Contract DI-G-ET-79-11270)
(PB-299100/8; EPA-600/7-79-007; FE-11270-1) Avail: NTIS HC A04/MF A01 CSCL 13B

The physical/chemical properties of a diverse sampling of fine coal refuse were investigated along with the effect of chemical stabilization. It was shown that chemical stability can be employed to drastically improve some physical/chemical properties of the fine refuse for better handling and disposal. The proprietary chemical, Calcilox (Trademark) additive, is the most effective over the range of samples tested. Portland Type 1 cement is also effective but greatly influenced by waste solids concentration. The final chemical tested, lime, is inferior to the other two chemicals and generally ineffective in improving the fine waste's physical/chemical properties. GRA

N80-15692# Engineering-Science, Inc., McLean, Va.
INVENTORY OF RESOURCES WITH EMISSIONS GREATER THAN 100 TONS/YEAR SUBJECT TO ORGANIC MATERIAL REGULATIONS IN METROPOLITAN BOSTON AQCR
John R. Busik and Peter Hagerty. Jul. 1979. 62 p. refs.
(Contract EPA-68-01-4146)
(PB-298879/8; EPA-901/1-79-008) Avail: NTIS HC A04/MF A01 CSCL 13B

An inventory of volatile organic pollutant point sources is presented. The methodologies utilized in identifying and surveying potential sources are outlined. An analysis of how the emissions levels were estimated is given. GRA

N80-15693# Battelle Columbus Labs., Ohio.
THE COST OF CLEAN AIR AND WATER REPORT TO CONGRESS
Aug. 1979. 339 p. refs.
(Contract EPA-68-01-4360)
(PB-300446/2; EPA-230/3-79-001) Avail: NTIS HC A15/MF A01 CSCL 05C

The cost of compliance with the Clean Air and the Federal Water Pollution Control Act is discussed. In 1977 it was estimated that industries spent 12.8 billion dollars in incremental annual costs (including capital charges and operating and maintenance expenses) to comply with Federal air and water legislation. Federal, State and local governments spent $4.6 billion and consumers spent $5.8 billion directly on mobile source emission control. Projected future incremental investment costs for the period 1977-1986 will be $79.7 billion as a result of the Clean Air Act and $61.6 billion due to the Federal Water Pollution Control Act. GRA

N80-15694# Connecticut Univ., Storrs. Inst. of Water Resources.
USE OF INDICATOR SPECIES OF ALGAE TO DETERMINE WATER QUALITY
F. R. Trainor and P. A. Siver. Sep. 1979. 29 p. refs.
(Contract DI-14-34-0001-7146)
(PB-299953/0; W79-09674; OWRT-B-011-CONN(1)) Avail: NTIS HC A03/MF A01 CSCL 06F

Scenedesmus strain 170 formed unicells in response to nitrogen, primarily as ammonium. The response was due to large uptake pulses of nitrogen. Source of nitrogen, cell pretreatment, nutrition, light intensity and temperature all affected nitrogen uptake, and the resulting unicell percentages. Triggering of the unicellular stage is a complex process involving a variety of factors. The sensitivity of the morphological response, i.e., control of the unicellular stage, to many factors in addition to nitrogen made use of Scenedesmus 170 questionable for an assay for nitrogen. A second Scenedesmus, AP 1, was studied in the laboratory and field. Colonies formed in older Bristols cultures, or in densely populated young cultures. GRA

N80-15695# California Inst. of Tech., Pasadena. Dept. of Chemical Engineering.
PHOTOCHEMICAL AEROSOL DYNAMICS Final Report, Apr. 1973 - Mar. 1978
S. K. Friedlander. May 1979. 47 p. refs.
(Grant EPA-R-802160)
(PB-299212/1; EPA-600/3-79-052) Avail: NTIS HC A03/MF A01 CSCL 04A

New data are reported on (1) the rate of formation of condensable chemical species by photochemical reactions, (2) the effect of the reaction products on the particle size distribution and (3) the distribution of reaction products as a function of particle size. Gas-to-particle conversion for cyclopentene, cyclohexene and 1,7--octadiene, ranged from 5 to 39 percent of the initial gas-phase carbon concentrations. Size distribution data for cyclohexene were correlated by a diffusion controlled growth law with Kelvin cutoff diameter at about 0.25 micrometer. In polluted atmospheres, some new particle formation takes place as a result of homogeneous gas phase reactions even though an aerosol is already present. GRA

N80-15696# Abcor, Inc., Wilmington, Mass. Walden Div.
STATISTICAL ANALYSIS OF THE SOURCE-RECEPTOR RELATIONSHIPS FOR OZONE AND HAZE IN THE HOUSTON AREA Final Report
Peter H. Guldberg and Harvey E. Jeffries. 25 May 1979. 202 p. refs.
(PB-299634/6; HAOS-24) Avail: NTIS HC A10/MF A01 CSCL 04A

A combination of theoretical description, cause-and-effect relationships and a statistical analysis of field data was used to synthesize a cause-and-effect model of photochemical ozone and haze formation in the Houston area. The model, its results, and conclusions are presented. Recommendations are made on further work to quantify model error bounds and to expand the data base. GRA

N80-15697# Southwest Research Inst., San Antonio, Tex.
AIRBORNE AEROALLERGEN MEASUREMENTS IN HOUSTON, TEXAS Final Report
J. T. Ivy. Mar. 1979. 115 p. refs.
(SRI Proj. 01-4901)
(PB-299643/7; HAOS-19) Avail: NTIS HC A06/MF A01 CSCL 13B

Houston air was sampled for aeroallergens on a daily schedule for a period of four months to identify major aeroallergens which might contribute to allergic responses in humans. Daily variations and seasonal trends of aeroallergens were observed which were comparable with expectations for the Houston area. For application to analysis of allergic response, aeroallergens present in the Houston area may be categorized in three major groups: ragweed pollen (Ambrosia), grass pollens (Gramineae), and total mold spores. GRA

N80-15698# Geological Survey, Lakewood, Colo. Water Resources Div.
QUANTITY AND QUALITY OF URBAN RUNOFF FROM THREE LOCALITIES IN THE DENVER METROPOLITAN AREA, COLORADO Final Report
Sherman R. Ellis and William M. Alley. May 1979. 69 p. refs.
Sponsored by Denver Board of Water Commissioners, Colo.; Denver Regional Council of Governments, Colo.; Urban Drainage and Flood Control District, Denver, Colo.
(PB-299859/9; USGS/WRD/WRI-79/046; USGS/WRI-79/64) Avail: NTIS HC A04/MF A01 CSCL 13B

Considerable variation in constituent concentrations was shown in urban runoff data for 1975-77 from three metropolitan Denver drainage basins. Constituent concentrations, greatest during initial rainfall runoff, generally peaked midday of snowmelt runoff, corresponding with maximum melting and runoff. Days since last street sweeping or antecedent precipitation had no apparent effect; snowmelt-runoff loads apparently increased with number of days snow had been on the ground. Urban storm runoff may significantly contribute total ammonia nitrogen, total nonfiltrable residue, total copper, total iron, total lead, and total zinc; and snowmelt runoff may significantly contribute sodium and chloride, to local receiving waters. GRA

N80-15699# Environmental Protection Agency, Ann Arbor, Mich. Technology Assessment and Evaluation Branch.
INVESTIGATION OF THE EFFECTS OF THE INSTALLATION OF AN OXIDATION CATALYST ON A DIESEL POWERED VEHICLE

Edward Anthony Barth Mar. 1979 20 p
(PB-299928/2; TAEB-79-7) Avail: NTIS HC A02/MF A01 CSCL 13B

The use of an oxidation catalyst in diesel powered vehicles was investigated for it's effects on gaseous and particulate emissions, fuel economy, and vehicle performance. K.L.

N80-15700# Environmental Protection Agency, Washington, D.C. Div. of Stationary Source Enforcement.
COMPLIANCE STATUS OF MAJOR AIR POLLUTION FACILITIES Final Report
Jun. 1979 767 p
(PB-299959/7; EPA-340/1-79-007) Avail: NTIS HC A99/MF A01 CSCL 13B

The probable compliance status and related facility information for major stationary sources of air pollution are presented. The U.S. Environmental Protection Agency's Compliance Data System generated a report of those facilities of interest to the States or the Agency for further investigation. GRA

N80-15701# Battelle Columbus Labs., Ohio.
EVALUATION OF STATIONARY SOURCE PARTICULATE MEASUREMENT METHODS. VOLUME 5: SECONDARY LEAD SMELTERS Interim Report, Oct. 1973 - Jun. 1977
J. E. Howes, Jr., R. N. Pesut, and W. M. Henry Jun. 1979 42 p refs
(Contract EPA-68-02-0609)
(PB-300337/3; EPA-600/2-79-116) Avail: NTIS HC A03/MF A01 CSCL 13B

As part of an overall program to evaluate the EPA Method 5 procedure for measurement of particulate emissions, an experimental study was made of its specific applicability to secondary lead plant emissions. The study was carried out with two Method 5 sampling train systems operated simultaneously at a single point in the stack emission stream. A series of six statistically designed tests was conducted over a 5 day period to obtain data on the reliability of Method 5, the sensitivity of the method to variation of such key parameters as sampling system temperature, filter media, and particulate loading and to characterize the chemical composition of the emissions. GRA

N80-15702# PEDCo-Environmental, Inc., Kansas City, Mo.
EVALUATION OF PARTICULATE EMISSION FACTORS FOR VEHICLE TIRE WEAR Final Report
Joseph Corvitti Jun. 1979 30 p refs
(Contract EPA-68-02-2585)
(PB-300443/9; EPA-450/4-79-011) Avail: NTIS HC A03/MF A01 CSCL 13B

Particles from tire wear were identified by microscopic analysis as a significant component of samples taken from roadside high volume particulate samplers. The currently available emission estimate for tire wear, presented in Compilation of Air Pollutant Emission Factors (AP-42), is 0.20 g/veh-mi for a four-wheeled light duty vehicle. This emission factor is widely used in regional particulate analyses to estimate emissions from tire wear; however, this factor needs to be reviewed, based on studies and test data released since its publication. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-15703*# Florida Univ., Gainesville.
INFLUENCE OF CLOUDS ON UV-B PENETRATION TO THE EARTH'S SURFACE Final Report, 1 Sep. 1976 - 30 Sep. 1979
A. E. S. Green Sep. 1979 105 p refs
(Contract NAS9-15114)
(NASA-CR-160428) Avail: NTIS HC A06/MF A01 CSCL 04B

Radiometric measurements of cloud influence on ultraviolet B radiation (UV-B) were obtained. Mathematical models of the influence were defined to lay the groundwork for the construction of the global UV-B climatology from satellite determined ozone data. More refined measurements comparing UV-B radiation with total solar radiation were carried out. The cloudy case is referred to the cloudless sky irradiance and convenient transmission ratios are given. An approach to the inversion of scattering data is summarized. An improved characterization of the UV-B radiation from a cloudless sky is also presented. R.C.T.

N80-15704*# National Aeronautics and Space Administration, Washington, D. C.
THE REACTION OF THE ATMOSPHERE TO SOLAR DISTURBANCES
V. V. Mikhnevich Jun. 1979 14 p refs Transl. into ENGLISH from Transactions Leningrad, 1974 p 168-180 Presented at the 1st All-Union Conf. on Sun Atmosphere Relations in Climate Theory and Weather Forecasts, Moscow, 30 Oct. - 1 Nov. 1972 Original language document previously announced as A74-37713 Transl. by Scientific Translation Service, Box 5456, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75500) Avail: NTIS HC A02/MF A01 CSCL 04A

The effect of solar flares on the thermosphere and the troposphere is investigated. It is found that during periods of geoeffect solar disturbances, there is a connection between phenomena in the upper and lower atmospheres and that variations in atmospheric parameters correlate with changes in the geomagnetic index. K.L.

N80-15705*# Business and Technological Systems, Inc., Seabrook, Md.
GLOBAL CRUSTAL RESPONSE MODEL Semiannual Report, 3 Apr. - 3 Oct. 1978
20 Oct. 1978 22 p
(Contract NAS5-25010)
(NASA-CR-159955) Avail: NTIS HC A02/MF A01 CSCL 08G

A computer program was developed for calculating the radial displacement due to the body tide as a function of spatial position and time. The positions of the moon and sun were evaluated by means of the Hill-Brown and Newcomb theories, respectively. Green's functions were utilized to simulate the elastic Earth responses due to point loads, a convolution program has been developed to evaluate the elastic Earth responses due to ocean loading by a given ocean tide constituent. These responses include radial and horizontal displacement, tilt and gravity acceleration, and strain tensor components. A.W.H.

N80-15706*# Miami Univ., Fla. Div. of Meteorology and Physical Oceanography.
NUMERICAL MODELING OF BAROCLINIC INSTABILITY Final Report, 2 Jun. 1978 - 14 Jun. 1979
J. F. Geisler 15 Dec. 1979 2 p
(Contract NAS8-32898)
(NASA-CR-161363) Avail: NTIS HC A02/MF A01 CSCL 04A

The Eady model of baroclinic instability applied to a rotating channel with Ekman layers at the top and bottom is extended to a beta-plane channel. Changes in the shape and position of the boundary separating the regions of axially symmetric and wavelike motion are predicted. K.L.

N80-15707*# Stanford Univ., Calif. Radioscience Lab.
THE INVESTIGATION OF MAN-MADE MODIFICATIONS OF THE IONOSPHERE Progress Report, 1 Sep. 1978 - 31 Dec. 1979
P. A. Bernhardt, A. V. daRosa, and K. M. Price Jan. 1980 16 p refs
(Grant NGR-05-020-001)
(NASA-CR-162579; SU-TR-19) Avail: NTIS HC A02/MF A01 CSCL 04A

Topics covered include: (1) the application of ionosphere modifications models to the simulation of results obtained when rocket-borne explosives were detonated in the ionosphere; (2) the problem of hypersonic vapor releases from orbiting vehicles; (3) measuring the electron content reduction resulting from the

firing of a Centaur rocket in the ionosphere; and (4) the preliminary design of the critical frequency tracker which displays the value of electron concentration at the peak of the F 2 region, in real time. A.R.H.

N80-15708*# Alaska Univ., Fairbanks. Geophysical Institute.
ACTIVE EXPERIMENTS USING ROCKET-BORNE SHAPED CHARGE BARIUM RELEASES
Eugene M. Wescott and T. N. Davis 15 Jan. 1980 84 p refs
(Grant NsG-6014)
(NASA-CR-162581) Avail: NTIS HC A05/MF A01 CSCL 04A

A reliable payload system and scaled down shaped charges were developed for carrying out experiments in solar-terrestrial magnetospheric physics. Four Nike-Tomahawk flights with apogees near 450 km were conducted to investigate magnetospheric electric fields, and two Taurus-Tomahawk rockets were flown in experiments on the auroral acceleration process in discrete auroras. In addition, a radial shaped charge was designed for plasma perturbation experiments. K.L.

N80-15709# Naval Research Lab., Washington, D. C.
A GLOBAL IONOSPHERIC MODEL
Joe Thomason, Glenn Skaggs, and John Lloyd 20 Aug. 1979 56 p refs
(ZF12151001)
(AD-A074370; AD-E000323) Avail: NTIS HC A04/MF A01 CSCL 04/1

This paper describes a global ionospheric model used by NRL to analyze the performance of high-frequency radar systems. The model described is based primarily on numerical maps derived from reports by a network of vertical sounding stations. Indices for the E, F sub 1, and F sub 2 layers are used to generate electron density profiles. An exponential tail is added to the E-region profile to account for D-region effects. Numerical maps of the sporadic-E indices are available but are not included in the electron density profile. This paper also describes several applications of the ionospheric model and includes an atlas of plasma frequency contour maps generated with the model. GRA

N80-15710# Naval Environmental Prediction Research Facility, Monterey, Calif.
MODELING THE REFRACTIVE INDEX STRUCTURE PARAMETER IN THE MARINE PLANETARY BOUNDARY LAYER Final Report
S. D. Burk, Andreas K. Goroch, Alan I. Weinstein, and Hans A. Panofsky (Pennsylvania State Univ., University Park) Jun. 1979 58 p refs
(AD-A074275; NEPRF-TR-79-03) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report summarizes the proceedings, conclusions and recommendations of a two-day workshop (30-31 Jan. 1979) on refractive index structure parameter, Cn(2), in the marine planetary boundary layer (MPBL). Scaling laws are described that are adequate to predict Cn(2) in the surface layer to an accuracy of approximately a factor of two. A stepwise procedure is described to predict Cn(2) using these scaling steps. No generally accepted quantitative scaling laws exist in the upper MPBL. Simple second-moment turbulence models hold the best promise for Cn(2) prediction in the upper MPBL at this time. After verification these models can be used by themselves or to generate upper MPBL scaling laws. GRA

N80-15711# Rhode Island Univ., Kingston. Dept. of Mathematics.
EXTREMELY HIGH LATITUDE AURORAS, PART 1 Final Report, 1 Jan. 1977 - 30 Sep. 1978
M. Susan Gussenhoven (Webb Associates, Yellow Springs, Ohio) Aug. 1979 73 p refs
(Contract F49620-77-C-0050; AF Proj. 2311)
(AD-A074989; AFOSR-79-1059TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

The work under this contract had as its goal the time-dependent phenomenological modeling of the polar cap regions. The vehicle for modeling the caps has been to analyze the following collection of data: DMSP images showing polar cap auroras; DMSP electron measurements; hourly averages of the interplanetary magnetic field; ground magnetometer data from Thule; and magnetic indices. DMSP images for the winters of 1972-1973 and 1974-1975 provided consistently good records of the northern polar cap region and were used as the primary basis of the study. The DMSP images for these periods were traced and gridded in corrected geomagnetic coordinates and local geomagnetic time. The subset of cases for which auroras occur at above 80 degrees corrected geomagnetic latitude was identified and further categorized by local time interval of occurrence (morning, midnight, evening sectors). The occurrence of extremely high latitude aurora in each category was correlated with magnetic indices, magnetometer response at Thule, and solar wind parameters. The correlation of cap size as determined by poleward auroral boundaries, and the time variation of these with the above parameters was also made. GRA

N80-15712# Rice Univ., Houston, Tex. Dept. of Physics and Astronomy.
BIRKELAND CURRENTS AND RING CURRENTS IN THE COMPUTER SIMULATION OF THE SUBSTORM OF 19 SEPTEMBER 1976
M. Harel, R. A. Wolf, P. H. Reiff, and M. Smiddy 7 Feb. 1979 28 p refs
(Contract F19628-77-C-0005; AF Proj. 2311)
(AD-A073852; SR-1; AFGL-TR-79-0041) Avail: NTIS HC A03/MF A01 CSCL 04/1

Several computer runs simulating the behavior of the inner magnetosphere during a substorm-type event that occurred on 19 September 1976, have been completed and analyzed. The computer model simulates many aspects of the behavior of the closed-field-line portion of the Earth's magnetosphere, and the auroral and subauroral ionosphere. For these regions, the program self-consistently computes electric fields, electric currents, hot-plasma densities, plasma velocities and other parameters. Presented here are some highlights of the results of the event simulation. Predicted electric fields for several times during the event agree reasonably well with corresponding data from satellite S3-2. Detailed discussion is presented for a case of rapid subauroral flow that was observed on one S3-2 pass and is predicted by computer runs. The computed global distribution of Birkeland current agrees reasonably well with the observations of Iijima and Potemra. In the simulated substorm-type event, plasma-sheet ions are injected earthward of synchronous orbit near midnight and drift westward, forming a ring half-way around the Earth by the end of the simulation, 3 hours after substorm onset. The dispersion of ion energies on the dusk side near synchronous orbit has the form commonly observed by McIlwain and collaborators. It appears that the ions would form a complete ring if the simulation were continued for several more hours. Author (GRA)

N80-15713# Air Force Geophysics Lab., Hanscom AFB, Mass.
AN ATMOSPHERIC TEMPERATURE PROFILE MEASURED WITH AN IN-SITU INFRARED RADIOMETER
R. A. McClatchey and A. D. dAgati May 1979 30 p refs
(AF Proj. 7670)
(AD-A074471; AFGL-TR-79-0100; AFGL-ERP-661) Avail: NTIS HC A03/MF A01 CSCL 04/1

A side-looking infrared radiometer operating in a narrow spectral interval in the 15 micrometers carbon dioxide band was flown on a balloon platform. Data were obtained over the altitude range from 9.4 to 30 km. The resulting radiance measurements are compared with calculations making use of independent rawinsonde measurements obtained during the balloon flight. These comparisons indicate a systematic discrepancy of a few percent at lower altitudes increasing to 20 percent near 20 km. This discrepancy is found to be consistent with a previous study of satellite based radiances. Possible sources of this discrepancy are investigated and rejected, leading the authors to question the assumption that the source function is equal to the Planck intensity. GRA

N80-15714# Air Force Geophysics Lab., Hanscom AFB, Mass.
TIME AND SPACE VARIATION OF DENSITY IN THE TROPICS
Arthur J. Kantor and Allen E. Cole 10 May 1979 18 p refs
(AF Proj. 6670)
(AD-A074472; AFGL-TR-79-0109; AFGL-ERP-662) Avail:

NTIS HC A02/MF A01 CSCL 04/1

A preliminary analysis of the time and space variability of atmospheric density over tropical regions was developed and is presented herein. Emphasis is placed on horizontal distances out to 200 nmi (370 km) and on time periods of from 1 to 12 hrs. Estimated rms differences to 200 nmi and the rms variability of density with time are provided for altitudes up to 60 km. GRA

N80-15715# Air Force Geophysics Lab., Hanscom AFB, Mass.
MIXING IN BILLOW TURBULENCE AND STRATOSPHERIC EDDY DIFFUSION
E. M. Dewan 10 Apr. 1979 33 p refs
(AF Proj. 6687)
(AD-A074466; AFGL-TR-79-0091; AFGL-ERP-659) Avail: NTIS HC A03/MF A01 CSCL 04/1

In order to estimate the rate of vertical transport due to turbulence in the stratosphere, it is necessary to know the degree of mixing that takes place in 'Kelvin-Helmholtz billow events.' This is estimated by means of a discrete model and the results are compared with published experimental observations. From these considerations it is concluded that a very large degree of mixing probably takes place in such events, and that, therefore, one must use the relation between the bulk vertical eddy diffusivity and layer diffusivity originally proposed by Rosenberg and Dewan instead of the simple one usually employed. GRA

N80-15716# Cornell Univ., Ithaca, N. Y. Lab. of Plasma Studies.
TEMPORAL AND SPATIAL POWER SPECTRUM STUDIES OF NUMERICAL SIMULATIONS OF TYPE 2 GRADIENT DRIFT IRREGULARITIES IN THE EQUATORIAL ELECTROJET
M. J. Keskinen, R. N. Sudan, and R. L. Ferch Jun. 1978 70 p refs
(Contract N00173-77-C-0240)
(AD-A073467; LPS-243) Avail: NTIS HC A04/MF A01 CSCL 04/1

Temporal and spatial power spectra from computer simulations of the equations modeling Type II irregularities in the equatorial electrojet are presented. The power spectra are computed using the code of Ferch and Sudan, averaging over times as long as 20 seconds. The dependence of the average frequencies and linewidths on wavelength and angle from the electrojet drift is studied. The mean frequencies obtained agree well with linear theory except at short wavelengths while the linewidths are greater than those predicted by the linear damping rates. The spatial power spectra were also computed and found to be approximately isotropic. GRA

N80-15717# Air Force Geophysics Lab., Hanscom AFB, Mass.
AIRBORNE ALL-SKY IMAGING OF EQUATORIAL AIRGLOW Final Report
E. J. Weber, J. Buchau, and J. G. Moore 21 Sep. 1980 45 p refs
(AF Proj. 4643)
(AD-A073716; AFGL-TR-78-0224) Avail: NTIS HC A03/MF A01 CSCL 04/1

Radio wave and optical experiments were conducted in March 1977 and March 1978 at low magnetic latitudes to investigate the effects of F region electron density irregularities on transionospheric communications links. Imaging photometer, ionosonde, 50 MHz backscatter radar and satellite amplitude scintillation measurements were used to arrive at a description of equatorial F-region disturbances. After sunset, regions of low electron density propagate from the bottomside, through the F-region peak and often reach to 1000 km altitude. These regions of low density, called bubbles or plumes, are visible as depletions in the 6300 A OI airglow; therefore, the size and motion of these depletions can be measured with an all sky imaging photometer. Electron density irregularities, with scale sizes from 3 m to 10 km, are found within these plumes, and give rise to amplitude scintillation, 50 MHz backscatter and spread F. This report presents a review of the experimental measurements used to arrive at the current description of equatorial F region plumes and associated irregularities. GRA

N80-15718# Los Alamos Scientific Lab., N. Mex.
FINITE ELEMENT METHOD FOR STUDYING THE TRANSIENT NONLINEAR THERMAL CREEP OF GEOLOGICAL STRUCTURES
C. A. Anderson and R. J. Bridwell Jun. 1979 36 p refs
(Contract W-7405-eng-36)
(LA-7883-MS) Avail: NTIS HC A03/MF A01

A finite element theory, suitable for describing the long term transient thermal creep of geomechanical structures where the material obeys an arbitrary type of creep law, is presented. The method takes into account large deformation effects, is stable for the large time steps required to model geophysical phenomena, and accurately simulates changing, incompressible, plastic flow fields. Applications of the theory to the prediction of long term creep and creep rupture of simple engineering structures are given. The theory is also applied to predict the thermal creep of layered media to study the mechanics of folding and rift formation. DOE

N80-15719# California Univ., Berkeley. Lawrence Berkeley Lab.
ARMA MODELS FOR EARTHQUAKE GROUND MOTIONS
M. K. Chang, J. W. Kwiatkowski, R. F. Nau, R. M. Oliver, and K. S. Pister Jan. 1979 86 p refs
(Contract W-7405-eng-48)
(UCRL-15084; ORC-79-1) Avail: NTIS HC A05/MF A01

Four major California earthquake records were analyzed by use of a class of discrete linear time domain processes commonly referred to as autoregressive/moving-average models. The traditional continuous models with parameter estimates based on spectral analysis were compared to the discrete models with parameters estimated by various maximum likelihood techniques applied to digitized acceleration data in the time domain. The methodology proposed is suitable for simulating earthquake ground motions in the time domain, and appears to be easily adapted to serve as inputs for nonlinear discrete time models of structural motions. DOE

N80-15720# California Univ., Livermore. Lawrence Livermore Lab.
GLOBAL OBSERVATION OF ATMOSPHERIC OZONE BY SATELLITE
J. E. Lovill, J. S. Ellis, and P. P. Weidhaas 2 Jul. 1979 7 p refs Presented at Intern. Conf. of Global Atmospheric Pollution, Boulder, Colo., 22 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-82028; CONF-790842-1) Avail: NTIS HC A02/MF A01

Infrared radiance data from a new series of satellites, the block 5D Defense Meteorological Satellite Program (DMSP) system, are presented. The accuracy of the satellite multichannel filter radiometer total ozone measurements is discussed. Comparisons are made against a specially selected network of surface-based total ozone measurement observations as well as total ozone measurements made by another satellite sensor. A map of satellite measured total ozone is presented and compared against the temperature analysis from radiosonde ascents made during the Southern Hemisphere winter. DOE

N80-15721# National Technical Information Service, Springfield, Va.
ATMOSPHERIC ECHO SOUNDING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1979
Audrey S. Hundemann Sep. 1979 106 p Supersedes NTIS/PS-78/0916; NTIS/PS-77/0815; NTIS/PS-76/0698; NTIS/PS-75/641; NTIS/PS-75/045
(NTIS/PS-79/0989/8; NTIS/PS-78/0916; NTIS/PS-77/0815; NTIS/PS-76/0698; NTIS/PS-75/641; NTIS/PS-75/045) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Abstracts pertaining to equipment, design, and use of acoustic sounders are presented. Use of the sounders to sense the atmosphere for weather changes, temperature inversions, aircraft wakes, ionospheric properties, and other characteristics is discussed. (This updated bibliography contains 98 abstracts, 8 of which are new entries to the previous edition.) GRA

N80-15722# National Bureau of Standards, Washington, D.C. National Measurement Lab.
CHEMICAL KINETIC DATA NEEDS FOR MODELING THE LOWER TROPOSPHERE Final Report

John T. Herron, Robert E. Huie, and Jimmie A. Hodgeson. Aug. 1979. 108 p. refs. Workshop held at Reston, Va., 15-17 May 1978, sponsored in part by EPA.
(PB-299439/0; NBS-SP-557; LC-79-600125) Avail: NTIS HC A06/MF A01 CSCL 04A

Six key problem areas in tropospheric chemistry are addressed: reactions of olefins with hydroxyl radicals and ozone; reactions of aldehydes; free radical reactions; reactions of oxides of nitrogen; reactions of aromatic compounds; and reactions of oxides of sulfur. The summary and list of major recommendations for further work, review papers, discussion summaries, contributed comments, recommendations, and an attendance list are included. GRA

N80-15723# Louisiana State Univ. and A&M Coll., Baton Rouge. Div. of Engineering Research.
EVALUATION OF THE VANE SHEAR TEST IN LOUISIANA Final Report
Jack K. Poplin, Ara Arman, and Niaz Ahmad (McClelland Engineers, Inc., Houston, Tex.) Dec. 1978. 219 p. refs. Sponsored in part by Louisiana Dept. of Transportation and Development, Baton Rouge.
(PB-298872/3; BULL-118; FHWA/LA-78-207L) Avail: NTIS HC A10/MF A01 CSCL 08M

In situ shear strengths measured by the vane shear test were compared with undrained shear strengths determined by laboratory unconfined and triaxial compression tests on samples taken by conventional tube sampling and on a few hand-carved samples. In situ shear strengths as determined by the vane shear test were from 2.0 to 2.5 times the shear strengths from laboratory tests on tube samples and were more comparable to shear strengths of hand-carved samples. Miniature vane shear tests on tube samples indicated shear strengths more comparable to laboratory strengths. Sensitivity indicated by in situ remolding with the vane was greater than sensitivity as determined by triaxial compression tests. GRA

N80-15724# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Technology Div.
SUMMER FELLOWSHIP IN SCIENTIFIC COMPUTING
Jeanne C. Adams, ed. and Linda C. Besen, ed. Apr. 1979. 179 p. refs.
(Grant NSF ATM-77-13757)
(PB-301297/8; NCAR-TN-135+PROC) Avail: NTIS HC A09/MF A01 CSCL 04B

Contents: Nitrous oxide production in a shallow water environment; a study of the vertical vorticity field from numerical model simulations of a Colorado convective storm; An exactly reversible calculation of the rotational and divergent wind potentials in a limited area; Normal models of the GISS Global Circulation Model; Towards a two-dimensional model for odd nitrogen in the thermosphere; Secular variation of solar zenith angle--A factor in climatic change; An isentropic cross-section processor for an isentropic fine mesh numerical analysis model; and A method for computing parcel trajectories for a two-dimensional isentropic coordinate primitive equation model. GRA

N80-15725# Princeton Univ., N. J. Dept. of Civil Engineering.
AN ANALYTIC METHOD FOR STRONG MOTION STUDIES IN LAYERED MEDIA
H. Engin, A. Askar, and A. S. Cakmak. 30 Jun. 1979. 67 p. (Grant NSF 76-20027)
(PB-301116/0; NSF/RA-790128; Rept-79-SM-4) Avail: NTIS HC A04/MF A01 CSCL 08K

An analytic method is presented for calculating strong motion spectra and the response to arbitrary input in layered media. It is based on the removal of secular terms at resonance of the equations with polynomial linearity. Through a convenient parametrization of the frequency, the procedure allows one to deal with linear equations and permits the extension of the method to multilayer systems by use of transfer matrices. Analytical methods studied lead to nonlinear algebraic equations for the amplitudes of oscillation and are untractable in multilayer systems. This method is applied to wave amplification studies in geotechnical engineering. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-15726*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STRATOSPHERIC AEROSOL MODIFICATION BY SUPERSONIC TRANSPORT OPERATIONS WITH CLIMATE IMPLICATIONS
O. B. Toon, R. P. Turco (R and D Assoc., Marina Del Rey, Calif.), J. B. Pollack, R. C. Whitten, I. G. Poppoff, and P. Hamill (Systems and Applied Sciences Corp., Hampton, Va.) Jan. 1980. 20 p. refs.
(NASA-RP-1058; A-7938) Avail: NTIS HC A02/MF A01 CSCL 04B

The potential effects on stratospheric aerosols of supersonic transport emissions of sulfur dioxide gas and submicron size soot granules are estimated. An interactive particle-gas model of the stratospheric aerosol is used to compute particle changes due to exhaust emissions, and an accurate radiation transport model is used to compute the attendant surface temperature changes. It is shown that a fleet of several hundred supersonic aircraft, operating daily at 20 km, could produce about a 20% increase in the concentration of large particles in the stratosphere. Aerosol increases of this magnitude would reduce the global surface temperature by less than 0.01 K. Author

N80-15727*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
DOBSON SPECTROPHOTOMETER OZONE MEASUREMENTS DURING INTERNATIONAL OZONE ROCKETSONDE INTERCOMPARISON
C. L. Parsons. Jan. 1980. 19 p. refs.
(NASA-TM-73284) Avail: NTIS HC A02/MF A01 CSCL 04B

Measurements of the total ozone content of the atmosphere, made with seven ground based instruments at a site near Wallops Island, Virginia, are discussed in terms for serving as control values with which the rocketborne sensor data products can be compared. These products are profiles of O3 concentration with altitude. By integrating over the range of altitudes from the surface to the rocket apogee and by appropriately estimating the residual ozone amount from apogee to the top of the atmosphere, a total ozone amount can be computed from the profiles that can be directly compared with the ground based instrumentation results. Dobson spectrophotometers were used for two of the ground-based instruments. Preliminary data collected during the IORI from Dobson spectrophotometers 72 and 38 are presented. The agreement between the two and the variability of total ozone overburden through the experiment period are discussed. A.W.H.

N80-15728*# City Coll. of the City Univ. of New York.
INVESTIGATION OF MODELS FOR LARGE-SCALE METEOROLOGICAL PREDICTION EXPERIMENTS Final Report
Jerome Spar. 31 Dec. 1979. 19 p. refs.
(Grant NGR-33-016-086)
(NASA-CR-162572) Avail: NTIS HC A02/MF A01 CSCL 04B

Forecast and climate simulation experiments were conducted with a medium mesh (8 degrees of latitude by 10 degrees of longitude) 7 layer climate model. The outputs emphasized are: (1) monthly mean forecasts for the months of October 1976 through February 1977 generated from global initial conditions for the first day of each month; and (2) a model climatology generated by running the model for five simulated years from one set of initial conditions (1 December 1967) and averaging the 5 outputs for each of the 12 calendar months. R.C.T.

N80-15729# Woods Hole Oceanographic Institution, Mass.
WOODS HOLE OCEANOGRAPHIC INSTITUTION COLLECTION OF CLIMATOLOGY AND AIR/SEA INTERACTION (CASI) DATA
Roger A. Goldsmith and Andrew F. Bunker. Aug. 1979. 84 p. refs.
(Contract N00014-74-C-0262; Grant NSF ATM-77-01475)
(AD-A075009; WHOI-79-70) Avail: NTIS HC A05/MF A01 CSCL 04/2

Scientists at Woods Hole routinely collect and analyze a considerable amount of data relating to the oceans of the world. Of the many different kinds of data, one particular subset concerns those events occurring at the sea surface. A large number of sea surface environmental observations have been collected at Woods Hole. These data, and the subsequent analyses generated from the Air/Sea Heat Flux and the Climatology study projects, have been collected and archived. This document describes the W.H.O.I./Climatology and Air/Sea Interaction (WHOI/CASI) data collection and provides an initial index to its various components. GRA

N80-15730# Naval Postgraduate School, Monterey, Calif.
REFINEMENT OF A STATISTICAL DIAGNOSTIC MODEL OF MARINE FOG USING FNWC MODEL OUTPUT PARAMETERS M.S. Thesis
Steve Oneal Ouzts Jun. 1979 91 p refs
(AD-A073959; NPS63-79-002) Avail: NTIS
HC A05/MF A01 CSCL 04/2

This study represents a continuation of the development of a model output statistics scheme to specify marine fog over the open ocean and in coastal waters. Thirty-seven direct and derived Fleet Numerical Weather Central model output parameters, monthly climatological fog frequencies, combinations of the aforementioned parameters (i.e. interactive parameters) and a persistence parameter are used as predictors in a stepwise multiple linear regression approach to estimate a predictand defined as marine fog probability. The predictand is categorized in two ways, in one case (FOGCAT 1) as smoothed probabilities for 0 to 100% as a function of present weather, past weather, visibility and low cloud type; and, in another case (FOGCAT 2) as a limited number of discrete probabilities (to include 0 and 100%) derived from present weather, past weather and visibility only. This study derives diagnostic regression equations only, using as a dependent data sample over 24,000 surface synoptic ship observations at 0000 GMT for June through August 1976 and 1977. The predictor parameters contributing most significantly to the variance are sensible and evaporative heat fluxes, monthly climatologial fog frequencies, and meridional wind speed. GRA

N80-15731# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
EVALUATION OF THE SATURATION RESISTANT CROSSWIND SENSOR
Ruben Rodriguez and William J. Vechione Jul. 1979 68 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A074276; ERADCOM/ASL-TR-0035) Avail: NTIS
HC A04/MF A01 CSCL 04/2

Integrated path crosswinds were measured at Biggs Optical Range, Biggs Army Airfield, Fort Bliss, Texas, during the period of 31 January to 8 March 1978 with the Saturation Resistant Crosswind Sensor, a bistatic system that measures crosswinds by detecting and analyzing the movement of atmospheric scintillations. Data collected with this sensor were compared to integrated path wind averages measured by the calibrated anemometer array. This report presents X-Y scatter plots, derived weighting functions, and wind measurement comparison plots. The results of the tests show that the major weighting (or contribution of thermal turbulence) to the system optics with a 500 m baseline is centered about 350 m from the receiver and approximates a slope intercept form $Y = 0.85X - 10.02$. With a 2,000 m baseline, the weighting function maximum is shifted to about 1400 m and approximates the slope intercept form $Y = 1.57X - 0.43$. GRA

N80-15732# City Univ. of New York, N. Y. Inst. of Marine and Atmospheric Sciences.
TWINDX: A PLANETARY BOUNDARY LAYER MODEL FOR THE WINDS IN EXTRATROPICAL AND TROPICAL OCEAN AREAS Final Report
Willard J. Pierson Jun. 1979 93 p refs
(Contract N00014-77-C-0206; WF52551792)
(AD-A074337; NEPRF-CR-79-02) Avail: NTIS
HC A05/MF A01 CSCL 04/2

The theory and programming details of a planetary boundary layer model that describes the winds from the surface of the ocean to several hundred meters in the tropics and from the surface to the gradient wind level in extratropical regions are given. The model, called TWINDX for Trade Winds and Wind Expanded Scale, is for use on a 123 by 123 polar stereographic projection. The required input fields are the atmospheric pressure at the sea surface, and the sea surface temperature for the extratropical regions. For the tropical regions, the sea surface pressure field and field for the height of the lifting condensation level are needed. Various options are given, and additional options and improvements are described. The outputs are the vector wind at an elevation of 19.5 meters and the vector wind that would have been measured in a neutrally stratified atmosphere at an elevation of 19.5 meters, along with other fields, as options, that are useful for analysis and interpretation. The vector wind for a neutral stratification can then be compared with the output of the SASS on SEASAT to remove aliases and provide a wind field that can, in turn, be used to improve on the initial values required for a numerical weather prediction. Since the preparation of this report, additional material on SEASAT winds and the planetary boundary layer has appeared; a list of supplementary references has been added. GRA

N80-15733# Naval Environmental Prediction Research Facility, Monterey, Calif.
A PRELIMINARY ANALYSIS OF MESOSCALE EFFECTS OF TOPOGRAPHY ON TROPICAL CYCLONE-ASSOCIATED SURFACE WINDS Final Report
S. Brand, R. P. Chambers, H. J. C. Woo, J. E. Cermak, and J. J. Lou Jul. 1979 42 p refs
(WF52551792)
(AD-A074812; NEPRF-TR-79-04) Avail: NTIS
HC A03/MF A01 CSCL 04/2

An analysis is made of the influence of topography on tropical cyclone-associated strong surface wind conditions for Subic Bay, Republic of the Philippines, by means of an environmental wind tunnel. Surface flow patterns were deduced by smoke and surface oil films, while isotach and gust values were obtained by hot wire anemometers. Laboratory results show the significant effects of the mountainous regions surrounding the Subic Bay harbor complex and indicate preferred shelter locations. These results are compared with synoptic observations and a high-resolution (0.19 n mi) diagnostic, one-level, primitive equation model. Where direct comparisons can be made, all techniques appear to show qualitative agreement. GRA

N80-15734# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
EDWARDS AFB, LANCASTER, CALIFORNIA, REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO) Final Report
9 Feb. 1979 501 p
(AD-A074691; USAFETAC/DS-79/051) Avail: NTIS
HC A22/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Edwards AFB, Lancaster, California. It contains the following parts: (A) weather conditions; atmospheric phenomena; (B) precipitation, snowfall and snow depth (daily amounts and extreme values); (C) surface winds; (D) ceiling versus visibility; sky cover; (E) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (F) pressure summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-15735# Air Force Geophysics Lab., Hanscom AFB, Mass.
CIRRUS PARTICLE DISTRIBUTION STUDY, PART 4
Donald J. Varley and Arnold A. Barnes, Jr. 18 Jun. 1979 91 p refs
(AF Proj. 317J)
(AD-A074763, AFGL-TR-79-0134-Pt-4; AFGL-AFSG-413-Pt-4)
Avail: NTIS HC A05/MF A01 CSCL 04/2

This is the fourth in a series of reports presenting particle distribution data acquired in cirrus clouds over the western U.S. The data herein were obtained 21 March 1978 by an instrumented MC-130E near Albuquerque, N. Mex. The area was under the influence of a slight upper level ridge, and the cirrus appeared related to jet stream winds. No significant surface weather was present at the time. Results include the following: (1) the largest particles measured were near 2500 micrometers, but there were only one or fewer of these per m3; (2) occasional particles as large as 1300 micrometers were recorded in what visually was cloud-free air; (3) few of the particles could be recognized in any known classification system but those most frequently recognized were bullet rosettes; (4) the PMS 2-D data revealed particle-type changes occurring in 5 sec or less of flight time; (5) a halo around the sun was periodically seen when mixed-type crystals containing bullet rosettes were recorded; (6) varying numbers of small particles (the difference between 1 to 28 micrometers) were recorded almost continually, even in clear air, while the aircraft was between 23,000 ft (7.0 km) and 27,300 ft (8.3 km) MSL; (7) computed ice water content values generally decreased with height and increased with temperature in the cirriform clouds sampled; (8) particle size spectra were seldom exponential for particles smaller than approximately 250 micrometers; and (9) bimodal peaks were frequent in the population distribution near 100 and 250 micrometers. GRA

N80-15736# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 1702A GSRS, MISSILE NUMBER 306, ROUND NUMBER B-26, 9 JULY 1979
Jul. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073394; ERADCOM/ASL-DR-1043) Avail: NTIS
HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19702A GSRS, Missile Number 306, Round Number B-26, are presented in tabular form. GRA

N80-15737# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19701A GSRS, MISSILE NUMBERS 304, 305, 307, ROUND NUMBERS B-22, B-23, B-24, 5 JULY 1979
Jul. 1979 18 p
(DA Proj. 1T6-65702-D-126)
(AD-A073392; ERADCOM/ASL-DR-1041) Avail: NTIS
HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19701A GSRS, Missile Numbers, 304, 305, 307, Round Numbers B-22, B-23, B-24, are presented in tabular form. GRA

N80-15738# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBER 321, ROUND NUMBER B-25, 9 JULY 1979
Jul. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073393; ERADCOM/ASL-DR-1042) Avail: NTIS
HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19702A GSRS, Missile Number 321, Round Number B-25, are presented in tabular form. GRA

N80-15739# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19701A GSRS, MISSILE NUMBER 022, ROUND NUMBER B-21, 5 JULY 1979
Jul. 1979 17 p
(DA Proj. 1T6-65702-D-126)
(AD-A073391; ERADCOM/ASL-DR-1040) Avail: NTIS
HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19701A GSRS, Missile Number 022, Round Number B-21, are presented in tabular form. GRA

N80-15740# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE DYNAMICS OF MATERIAL LAYERS
William D. Ohmstede Jul. 1979 50 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A073728; ERADCOM/ASL-TR-0036) Avail: NTIS
HC A03/MF A01 CSCL 04/2
Shallow-fluid equation models have been applied to several Army problem areas, especially those associated with atmospheric transport and diffusion. The objective of this report is to present the development of a system of equations which govern the behavior of material atmospheric layers and which retain the advantages of the shallow-fluid equations but are more generally suitable for atmospheric analysis. The report consists of three major sections. The first section presents a formal derivation of what therein is defined as the 'Material Layer Equations.' The second section addresses some of the practical considerations involved in applications of the material layer equations. Although the presentation of numerical algorithms for specific applications of the material layer equations is beyond the scope of this report, the third section does present elementary examples of how the material layer equations may be specialized to address specific atmospheric analysis problems. It is concluded that the material layer approach is most useful when the matter of concern is the transport and diffusion of material such as from NBC weapons or smoke. GRA

N80-15741# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 14822B LANCE, MISSILE NUMBER 4390, ROUND NUMBER 334-AST
Jun. 1979 30 p
(DA Proj. 1T6-65702-D-126)
(AD-A073387; ERADCOM/ASL-DR-1036) Avail: NTIS
HC A03/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 14822 Lance, Missile Number 1036, Round Number 334-AST, are presented in tabular form. GRA

N80-15742# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19304DT GSR, MISSILE NUMBERS 1070 AND 1048, ROUND NUMBERS V-47 AND V-48, 28 JUNE 1979
Jun. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073389; ERADCOM/ASL-DR-1038) Avail: NTIS
HC A02/MF A01
Meteorological data gathered for the launching of 19304DT GSRS, Missile Numbers 1070 and 1048, Round Number V-47 and V-48, are presented in tabular form. GRA

N80-15743# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19304B GSRS, MISSILE NUMBERS 1029, 1050, 1054, 1073, 1074, 1056, ROUND NUMBERS V-49, V-50, V-51, V-52, V-53, V-54, 2 JULY 1979
Jul. 1979 19 p
(DA Proj. 1T6-65702-D-126)
(AD-A073390; ERADCOM/ASL-DR-1039) Avail: NTIS
HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19304B GSRS, Missile Nos. 1029, 1050, 1054, 1073, 1074, 1056, Round, Nos. V-49, V-50, V-51, V-52, V-53, V-54, are presented in tabular form. GRA

N80-15744# Weather Wing (3rd), Offutt AFB, Nebr.
MOISTURE ADVECTION AND THE SANGSTER CHART
Carl A. Johnson 18 Jun. 1979 49 p refs
(AD-A073432; Rept-3-WW-TN-79-1) Avail: NTIS
HC A03/MF A01 CSCL 04/2
This technical note discusses clouds, precipitation and upper low movements as they were observed to occur with certain type boundary layer moisture advection patterns. Moisture advection was calculated using Sangster chart winds and surface mixing ratios. GRA

N80-15745# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS (SSMO). SELECTED SOUTH PACIFIC ISLAND MARINE AREAS, VOLUME 2. AREA 9: ISLE WALLIS. AREA 10: SAMOA ISLANDS. AREA 11: NEW CALEDONIA.

AREA 12: NEW HEBRIDES ISLANDS. AREA 13: FIJI ISLANDS. AREA 14: TONGA ISLANDS. AREA 15: NIUE ISLAND. AREA 16: RAROTONGA ISLAND (LOWER COOK ISLANDS)
Sep. 1979 644 p
(AD-A073446) Avail: NTIS HC A99/MF A01 CSCL 04/2

This report presents marine climatological data for areas 9 through 16 in 21 different tables including weather occurrence, wind direction and speed, cloud amount, ceiling height, visibility, precipitation, dry bulb, relative humidity, air-sea temperature difference, sea height and period sea surface temperature and sea level pressure. GRA

N80-15746# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS (SSMO). SELECTED SOUTH PACIFIC ISLAND MARINE AREAS, VOLUME 1. AREA 1: NAURU ISLAND AND OCEAN ISLAND. AREA 2: GILBERT ISLANDS. AREA 3: CANTON AND PHOENIX ISLANDS. AREA 4: CHRISTMAS AND JARVIS ISLANDS. AREA 5: SOLOMON ISLANDS, NORTHEAST. AREA 6: SOLOMON ISLANDS, SOUTHWEST. AREA 7: FUNAFUTI ATOLL. AREA 8: MARQUESAS ISLANDS
Sep. 1979 643 p
(AD-A073445) Avail: NTIS HC A99/MF A01 CSCL 04/2

This report presents marine climatological data for areas 1 through 8 in 21 different tables including weather occurrence, wind direction and speed, cloud amount, ceiling height, visibility, precipitation, dry bulb, relative humidity, air-sea temperature difference, sea height and period, sea surface temperature and sea level pressures. GRA

N80-15747# State Univ. of New York at Buffalo. Atmospheric Sciences Research Center.
CONSIDERATIONS IN THE OPTICAL CHARACTERIZATION OF THE ATMOSPHERE
James E. Jiusto and Richard D. H. Low, ed. White Sands, N. Mex. Army Electron. Res. and Develop. Command Jul. 1979 26 p refs
(Contract DAAG29-76-D-0100; DA Proj. 1L1-62111-AH-71)
(AD-A073480; ERADCOM/ASL-CR-79-0100-3) Avail: NTIS HC A03/MF A01 CSCL 04/2

The U.S. Army uses various types of electro-optical devices involving wavelengths from the visible to the near infrared. The performance of these sensors can be adversely affected by turbid atmospheres, especially those containing fog and haze. This report provides a brief review of the characteristics of fogs and hazes and offers a few recommendations on fog and haze measurements. In particular, attempts are made to answer such questions as: (1) whether the fog and haze characteristics found in some United States localities are comparable to those in certain places in West Germany, (2) whether the present standard meteorological measurements made at weather stations are suitable for determining fog optical properties, (3) whether the current fog numerical modeling would be relevant to field operations, and (4) what basic measurements are needed to describe adequately the foggy and hazy environments. Finally, an example of fog and haze measurements conducted on the campus of the State University of New York at Albany is briefly described. GRA

N80-15748# Science Applications, Inc., McLean, Va. Ocean Science Div.
THE EFFECT OF INACCURACIES IN METEOROLOGICAL PARAMETERS ON ONE-DIMENSIONAL FORECASTS OF UPPER OCEAN THERMAL STRUCTURE Final Report, Feb. 1978 - Aug. 1979
R. Michael Clancy Jul. 1979 63 p refs
(Contract N00014-78-C-0287)
(AD-A073539; SAI-79-880-WA) Avail: NTIS HC A04/MF A01 CSCL 04/2

A one-dimensional model has been used to investigate the effect of inaccuracies in meteorological parameters on forecasts of upper ocean thermal structure. Vertical eddy fluxes of heat, salinity, and momentum in the oceanic mixed layer are parameterized using the Level-2 turbulence closure model of Mellor and Yamada (1974). Surface eddy fluxes of sensible heat, latent heat, and momentum are related to the imposed meteorological parameters through a bulk aerodynamic formulation. Surface fluxes of solar and infrared radiation are parameterized with the formulas of Wyrtki (1965). The temperature anomaly in the ocean forecast produced by inaccuracies in the meteorological parameters diffuses rapidly downward from the surface to within a few meters of the mixed layer base. Its downward diffusion is much slower below this level and this tends to produce a relatively large vertical gradient in temperature anomaly near the base of the mixed layer which may have important implications for acoustic modeling. Both the depth of the mixed layer and the magnitude of the mixed layer temperature anomaly are found to be nonlinear functions of the inaccuracies in the potential temperature, humidity, and wind speed of the atmospheric mixed layer. Estimates of the time evolution of the inaccuracies in the air temperature, humdity, and wind speed during an actual operational forecast situation are made. GRA

N80-15749# Science Applications, Inc., McLean, Va. Ocean Science Div.
A MODEL OF DIURNAL VARIABILITY OF THE OCEAN-ATMOSPHERE SYSTEM IN THE UNDISTURBED TRADE WIND REGIME Final Report, Feb. 1978 - Aug. 1979
R. Michael Clancy Jul. 1979 130 p refs
(Contract N00014-78-C-0287)
(AD-A073540; SAI-79-807-WA) Avail: NTIS HC A07/MF A01 CSCL 04/2

One-dimensional coupled air-sea models are used to compare the responses to diurnal heating of a diffusive model and a bulk model of the oceanic mixed layer, and to investigate the diurnal variability of the upper ocean and lower atmosphere in the undisturbed trade wind regime. The diffusive model of the oceanic mixed layer uses the Level-2 turbulence closure theory of Mellor and Yamada (1974) while the bulk model uses the entrainment hypothesis and mean-turbulent-field modeling technique of Garwood (1977). The diurnal fluctuation of the surface sensible plus latent heat flux is controlled by both direct radiational heating of the atmosphere and direct radiational heating of the ocean. However, the amplitude of this fluctuation is about two orders of magnitude smaller than the amplitude of the surface solar flux which is primarily responsible for driving the diurnal sea surface temperature fluctuation. Although the sea surface temperature fluctuation alters the surface solar flux through its influence on cloud cover, this alteration is extremely small. Consequently, the feedback loop between the ocean and the atmosphere is exceedingly weak at the diurnal time scale. GRA

N80-15750# Oregon State Univ., Corvallis. Dept. of Atmospheric Science.
SOLAR ENERGY METEOROLOGICAL RESEARCH AND TRAINING SITE, REGION 5 Annual Report, 30 Sep. 1977 - 29 Sep. 1978
C. R. N. Rao and E. W. Hewson Jan. 1979 33 p refs
(Grant EY-77-G-06-1059)
(DOE/ET/20172-1) Avail: NTIS HC A03/MF A01

The primary facility for the acquisition of research quality solar radiation and solar energy related meteorological data is described. The training program established with the introduction of two, two-quarter courses on solar radiation and meteorological measurements and on atmospheric radiative processes is discussed. Global irradiance measurements made at the five sites described are presented. DOE

N80-15751# Los Alamos Scientific Lab., N. Mex.
NORTHWEST NEW MEXICO BOUNDARY LAYER EXPERIMENT
J. A. Archuleta, S. Barr, R. C. Carlos, W. E. Clements, J. Labry, L. Wangen, and S. K. Wilson Oct. 1978 37 p refs
(Contract W-7405-eng-36)
(LA-7525-MS) Avail: NTIS HC A03/MF A01

A 24 hour meteorological experiment was performed in the San Juan Basin of northwestern New Mexico with an emphasis on the diurnal variations of boundary layer wind, temperature, and turbulence structure. Hourly profiles of wind and temperature were observed to an altitude of 3 km above ground concurrently with photographs of a nearby power plant plume. The plume behavior is discussed in relation to the meteorological conditions at its elevation, and with surface based meteorological observations. DOE

N80-15752# National Technical Information Service, Springfield, Va.
CLEAR AIR TURBULENCE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1979
Guy E. Habercom, Jr. Sep. 1979 309 p Supersedes NTIS/PS-78/0938; NTIS/PS-77/0857; NTIS/PS-76/0705; NTIS/PS-75/761; NTIS/PS-75/008
(NTIS/PS-79/0972/4; NTIS/PS-78/0938; NTIS/PS-77/0857; NTIS/PS-76/0705; NTIS/PS-75/761; NTIS/PS-75/008) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Clear air turbulence and its relationship to air transportation is documented in the cited research reports. Its meteorological occurrences, its detection, and aircraft encounters with the phenomena are investigated. This updated bibliography contains 293 abstracts, 5 of which are new entries to the previous edition. GRA

N80-15753# National Weather Service, Silver Spring, Md. Office of Hydrology.
PRECIPITABLE WATER OVER THE UNITED STATES. VOLUME 2: SEMIMONTHLY MAXIMA
Francis P. Ho and John T. Riedel Jul. 1979 369 p refs Sponsored in part by Corps of Engr., Washington, D.C. and Soil Conserv. Serv., Washington, D.C.
(PB-300870/3; NOAA-TR-NWS-20-Vol-2; NOAA-79082201) Avail: NTIS HC A16/MF A01 CSCL 04B

The observed semimonthly maxima and means of the series of semimonthly maxima precipitable water are presented in tabular, graphical, and map form for all radiosonde stations in the contiguous United States for the period 1946-72 and for Alaska for the period 1950-69. The data are given by layers from the surface to 400 mb from twice daily observations. GRA

N80-15754# National Weather Service, Honolulu, Hawaii.
APPLICATION OF THE ZERO RELATIVE VORTICITY LINE IN SYNOPTIC FORECASTING
Hans E. Rosendal Aug. 1979 40 p refs
(PB-300790/3; NOAA-TM-NWS-PR-20; NOAA-79082005) Avail: NTIS HC A03/MF A01 CSCL 04B

The concept of relating, via the 500 mb zero relative vorticity line, surface convergence, as expressed in active weather and fronts, to a narrow zone of divergence aloft associated with the upper jet is examined. The application of this technique towards weather forecasting is discussed. GRA

N80-15755# National Severe Storms Lab., Norman, Okla.
AN ANALYSIS OF CLEAR AIR PLANETARY BOUNDARY LAYER WIND SYNTHESIZED FROM NSSL'S DUAL DOPPLER-RADAR DATA
Myron I. Berger and R. J. Doviak Jun. 1979 78 p refs (Contract DOT-FAA76WAI-622)
(PB-300865/3; NOAA-TM-ERL-NSSL-87; NOAA-79081601) Avail: NTIS HC A05/MF A01 CSCL 04B

Acquisition of wind data and synthesis of the data to grid points are discussed, and it is shown by correlation techniques that the theoretically estimated velocity variance at a grid point caused by measurement technique is small enough to detect true kinematic features in the perturbation wind fields. The kinematic structure of these perturbation wind fields is analyzed and compared to results produced by analytical and numerical models. Spatial spectrum analysis and band-pass filtering of the Doppler synthesized winds are used to aid in interpreting the structure of the wind fields. It is shown that the data are consistent with model predictions for a convectively unstable and moderately sheared PBL that existed during data collection. GRA

N80-15756# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
SESAME (SEVERE ENVIRONMENTAL STORMS AND MESOSCALE EXPERIMENT), 1979 PLANS FOR OPERATION AND DATA ARCHIVAL
Ronnie L. Alberty, ed. (National Severe Storms Lab., Norman, Okla.) and Stanley L. Barnes, ed. Apr. 1979 75 p
(PB-299878/9; NOAA-79081001) Avail: NTIS HC A04/MF A01 CSCL 04B

Summaries are given on the following presentations: regional subprogram requirements; boundary layer subprogram requirements; applications subprogram requirements; storm scale subprogram requirements; satellite observations; aircraft observations, radar and surface network observations; joint Doppler operational project for 1979; operational strategies and priorities; and data archival. GRA

N80-15757# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
SYSTEM CONSIDERATIONS OF A LONG RANGE COHERENT LIDAR WIND SENSOR WITH PARTICULAR EMPHASIS ON REAL WEATHER EFFECTS
F. J. Pratt, R. M. Huffaker, T. R. Lawrence, and R. Loveland (Army Electronics Command, White Sands Missile Range, N. Mexico) Jun. 1979 153 p refs Sponsored in part by Army Electronics Command, White Sands Missile Range, N. Mexico
(PB-299972/0; NOAA-TM-ERL-WPL-42; NOAA-79080904) Avail: NTIS HC A08/MF A01 CSCL 04B

The performance of a pulsed coherent lidar system for remote wind measurements in the troposphere is documented. Transmitted peak power pulse width, mirror sizes, and receiver sensitivity are specified. The response of the system in clean air is considered, and the effects of turbulence and the nature of the return from the aerosol are estimated. The climatologies of central Germany and Missouri are used to estimate the performance of the system in cloudy weather. GRA

N80-15758# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
METEOROLOGICAL EFFECTS OF OIL REFINERY OPERATIONS IN LOS ANGELES
R. F. Pueschel, F. P. Parungo, E. W. Barrett, D. L. Wellman, and H. Proulx Jul. 1979 68 p refs
(PB-300720/0; NOAA-TM-ERL-APCL-22; NOAA-79081403) Avail: NTIS HC A04/MF A01 CSCL 04B

From airborne in situ measurements of gases and aerosol size distributions and from post-flight chemical analyses of sample particles, it was found that oil refinery operations in southern Los Angeles can modify clouds in the vicinity. The refinery effluents increased the concentration of aerosols in the size range between 0.05 micro m and 23.5 micro m particle radius. Furthermore, although the sulfate aerosol in the area has a stabilizing effect on clouds, the clouds downwind of the refineries were found to be destabilized by the nitrate aerosol. GRA

N80-15759# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.
ERROR CHARACTERISTICS OF SATELLITE-DERIVED WINDS
Lester F. Hubert and Albert Thomasell, Jr. Jun. 1979 44 p refs
(PB-300754/9; NOAA-TR-NESS-79; NOAA-79081401) Avail: NTIS HC A03/MF A01 CSCL 04B

Errors of winds derived from geostationary satellite measurements are estimated by analysis of differences between satellite and rawin observations. It is estimated that the NESS winds contain root mean square errors of 4.7 m/s for low levels and 8.5 m/s for upper levels. It was concluded that the accuracy of these data can be increased by reducing system noise, but improving their meteorological value can be realized only by modifying procedures to enable clouds to be traced in meteorologically active regions. GRA

N80-15760# Mississippi Univ., University. Dept. of Physics and Astronomy.
STORM RESEARCH Final Report, 1 Mar. - 30 Jun. 1978
Roy T. Arnold Jun. 1978 24 p refs
(Grant NOAA-04-B01-9)
(PB-300299/5; NOAA-79080802) Avail: NTIS HC A02/MF A01 CSCL 04B

Lightning observations made from a mobile laboratory jointly equipped with support by NSSL, UM and ONR are presented. Topics covered are: (1) electrical measurements made on severe storms with the mobile laboratory; (2) a description of a portable TV monitor which was used successfully to document lightning flashes and some cloud features; (3) cloud-to-ground lightning flash electric field change records obtained for both positive and negative flashes; and (4) very short duration bright, multiply branched CG flashes occurring near the radar weak echo region

of severe storms 'near' the time that either tornadoes or changing wall cloud features are observed. GRA

N80-15761# Meteorology Research, Inc., Altadena, Calif.
CHANGES IN CLOUD BASE PRECIPITATION PARTICLE SIZE-DISTRIBUTIONS AS A RESPONSE VARIABLE TO SEEDING Technical Report, Jan. - Apr. 1979
D. M. Takeuchi 26 Jun. 1979 31 p refs
(Contract DI-14-06-D-7699)
(PB-299549/6; MRI-79-TR-1683) Avail: NTIS HC A03/MF A01 CSCL 04B

Precipitation particle size distribution measurements made near the base regions of summertime convective clouds near Miles City, Montana are evaluated. For given intensities, it is shown that the natural size spectra differs significantly among natural clouds producing precipitation of three primary types: (1) snow, (2) rain and/or graupel, and (3) hail with graupel and/or rain. Primary differences occur at the larger particle sizes with the hail spectra showing significantly higher number concentrations than the other two spectra types. Seeding is shown to increase (decrease) the number concentrations of the larger (smaller) particles in snow producing clouds. GRA

N80-15762# National Weather Service, Salt Lake City, Utah.
ARIZONA COOL SEASON CLIMATOLOGICAL SURFACE WIND AND PRESSURE GRADIENT STUDY
Ira S. Brenner May 1979 20 p ref
(PB-298900/2; NOAA-TM-NWS-WR-144; NOAA-79070603) Avail: NTIS HC A02/MF A01 CSCL 04A

The average sea-level pressure gradients which produce sustained surface winds above 8 kts for at least six consecutive hours during the cool season at predetermined key stations in or adjacent to Arizona are investigated. Only wind directions from northerly or easterly components are included in the developmental data sample. Graphs are provided in the development data sample. Graphs are provided which relate the derived pressure gradients to varying surface wind speeds at each key station. GRA

N80-15763# Control Data Corp., Minneapolis, Minn.
DIFFUSION COEFFICIENTS FROM METRAC SYSTEM TURBULENCE MEASUREMENTS Final Report
W. H. Jasperson May 1979 70 p refs
(Contract EPA-68-02-2444)
(PB-300339/9; EPA-600/4-79-034) Avail: NTIS HC A04/MF A01 CSCL 04B

The results from 34 'constant level' tetroon flights made near St. Cloud, Minnesota, and tracked with the Metrac positioning system are presented. These flights were made throughout the year and primarily at heights between 700 and 1400 meters above the surface. Flight times ranged in length from 2100 to 6000 seconds. Three dimensional velocity variances, autocorrelation functions, power spectra and diffusion coefficients are presented. Relationships showing an increase of vertical velocity variance with decreasing atmospheric stability and with increased wind speed are illustrated. GRA

N80-15764# National Weather Service, Silver Spring, Md. Meteorological Services Div.
LOW-LEVEL WIND SHEAR: A CRITICAL REVIEW
Julius Badner Apr. 1979 90 p refs
(PB-300715/0; NOAA-TM-NWS-FCST-23) Avail: NTIS HC A05/MF A01 CSCL 04B

Theoretical and observational background information on the occurrence of low-level wind shear is provided. Aircraft takeoff, approach and landing incidents related to wind shear are cited. Graphs and tables which can aid in the forecasting of low level wind shear under various conditions are provided. The occurrence of wind shear with synoptic scale systems and with convective systems is described. GRA

N80-15765# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
GATE RADAR CAPPI DERIVATION FOR THREE-DIMENSIONAL REFLECTIVITY ANALYSES
Peter J. Pytlowany, Frank P. Richards, and Michael D. Hudlow Jul. 1979 38 p refs
(PB-301263/0; NOAA-TM-EDIS-27; NOAA-79083002) Avail: NTIS HC A03/MF A01 CSCL 04B

Methodology and processing techniques used in deriving constant-altitude, plan-position-indicator (CAPPI) arrays of mean reflectivities from GATE Oceanographer radar tilt-sequence data are presented. Input data adjustments and corrections are specified and basic assumptions and motivations relating to particular decisions are discussed. The defining equations and algorithms applied in generating CAPPI arrays are developed for a mean GATE atmosphere. Computer aspects are discussed and performance results are summarized. Data problems and limitations are discussed, and an assessment of data quality and potential sources of error is given to aid in characterizing the quantitative and qualitative aspects of the data. GRA

N80-15766# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Analysis and Prediction Div.
DAILY HIGH-LATITUDE 150 mb PRESSURE MAPS FROM TWERLE (TROPICAL WIND, REFERENCE LEVEL AND ENERGY CONVERSION EXPERIMENT) AND RAWINSONDES. PART 1: 16 NOVEMBER 1975 - 31 JANUARY 1976
Nadav Levanon, Yona Eyal, Paul R. Julian, Dennis Shea, and Verner E. Suomi Jul. 1979 97 p refs Prepared in cooperation with Tel-Aviv Univ., Israel and Wisconsin Univ.-Madison
(Grant NSF ATM-77-23757)
(PB-301343/0; NCAR-TN-141+STR) Avail: NTIS HC A05/MF A01 CSCL 04B

Winds, temperatures, pressures, and altitudes were used to prepare daily 150 mb constant pressure charts for the austral summer 1976 for latitudes poleward of 45 S. Conventional rawinsonde upper air data were used when available. In addition, full hemispheric charts for two selected days in January 1976 are shown. These charts, analyzed by hand, are shown to illustrate another method of accomodating the asynoptic and Lagrangian nature of the TWERLE data. Some discussion of these maps is included. GRA

N80-15767# National Center for Atmospheric Research, Boulder, Colo. Convective Storms Div.
FIELD OBSERVATIONS OF KINEMATICS OF HAILSTONES
Richard Matson and Arlen W. Huggins Jun. 1979 79 p refs
(Grant NSF ATM-77-23757)
(PB-301387/7; NCAR-TN-139+STR) Avail: NTIS HC A05/MF A01 CSCL 04B

The kinematic behavior of naturally falling hailstones was studied using stroboscopic photography in a mobile van. About 84 percent of the hailstones photographed were classified spheriodal, the remainder being roughly conical. Rotational rates were measured for 6 percent of the stones sampled and found to have a median value of 40 Hz. Velocity data were obtained for 621 hailstones in the diameter range 5-25 mm. Hailstone fallspeed and hailstone axis ratio are shown to be negatively correlated. Hailstone drag coefficients, inferred from vertical velocity measurements, are found to be much higher than most commonly quoted values. The time dependence of hailstone parameters is presented for two storms and the implication of these and the other findings is discussed. GRA

N80-15768# Florida State Univ., Tallahassee. Dept. of Meteorology.
ATMOSPHERIC STRUCTURAL VARIATIONS THAT RESULT IN UPWELLING OFF OREGON M.S. Thesis
Jeffrey Dale Hawkins Feb. 1979 86 p refs
(Grants NSF ATM-77-02520; NSF OCE-77-27735)
(PB-301240/8; FSU-MET-STU-79-1; NSF/IDOE-79-59; NSF/IDOE/CUEA/TR-52) Avail: NTIS HC A05/MF A01 CSCL 04B

The lower atmospheric structural variations along Oregon's central coast are studied before and during an upwelling event. The effect of these fluctuations on the surface ocean layer are documented. A vast array of meteorological and oceanographic observations were taken by aircraft, pilot balloons, rawinsondes, buoys, land stations, and ships during the Coastal Upwelling Experiment 1 in the summer of 1972. The winds, currents, air and water temperatures from the surface ocean layer to 1.5 km

are compared for a week-long period of southerly winds followed by a similar period with northwesterly winds. GRA

N80-15769# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
APPLICATION OF A TWO-DIMENSIONAL CLOUD MODEL TO CLOUD SEEDING EXPERIMENTS Final Report, 1 Jul. 1975 - 31 Jan. 1979
Harold D. Orville, Richard D. Farley, Fred J. Kopp, John H. Hirsch, and Eirh-Yu Hsie Apr. 1979 99 p
(Contract DI-5-07-DR-12100)
(PB-298997/8; Rept-79-4) Avail: NTIS HC A05/MF A01 CSCL 04B

A two dimensional, time dependent cloud model was compared with observations and used to simulate cloud seeding experiments. The model is a set of partial differential equations that expresses conservation of momentum, energy, air mass, and various water masses, such as rain, hail, cloud water, and cloud ice. The model was run with atmospheric soundings from Miles City, Montana, and Big Spring, Texas, and shows quantitatively the difference in precipitation processes between the two sites. Both dry ice and silver iodide seeding techniques were tested. A first generation model in which the dry ice seeding is assumed to effect directly an increase in precipitating ice and a second generation seeding model in which a seeding agent field is traced throughout the model and interacts with the supercooled cloud water to form cloud ice are examined. GRA

N80-15770# Washington Univ., Seattle. Cloud Physics Group.
AIRBORNE STUDIES OF ATMOSPHERIC AEROSOL IN THE HIGH PLAINS AND THE STRUCTURES OF NATURAL AND ARTIFICIALLY SEEDED CLOUDS IN EASTERN MONTANA Final Report, Jun. 1976 - Sep. 1978
Peter V. Hobbs, Marcia K. Politovich, David A. Bowdle, and Lawrence F. Radke Dec. 1978 424 p refs
(Contract DI-6-07-DR-20110)
(PB-299026/5; Cloud-Physics-Research-13; Rept-1) Avail: NTIS HC A18/MF A01 CSCL 04B

A study is described of atmospheric aerosol over the High Plains of the United States, and of cloud structures, precipitation-producing mechanisms, and the potential for precipitation modification by various types of cloud seeding in SE Montana. Frequency distributions of cloud condensation nucleus (CCN) concentrations are represented by the superposition of two log-normal distributions. CCN concentrations varied cyclically over several days between low concentrations near widespread rain and high concentrations in dry weather. During these variations, CCN concentrations at high supersaturations were similar to dry weather values while concentrations at low supersaturations were similar to rainy weather values. GRA

N80-15771# National Center for Atmospheric Research, Boulder, Colo. Convective Storms Div.
TECHNIQUES EMPLOYED IN THE PROCESSING OF PARTICLE SIZE SPECTRA AND STATE PARAMETER DATA OBTAINED WITH THE T-28 AIRCRAFT PLATFORM
Andrew J. Heymsfield and Joanne L. Parrish May 1979 89 p refs
(Grant NSF ATM-77-23757)
(PB-299362/4; NCAR-TN-137+1A) Avail: NTIS HC A05/MF A01

Computer software was developed to process particle size spectrometer and thermodynamic data obtained with the T-28 hail research aircraft. Five computer programs were developed to optimize the data reduction techniques. Program one reduces the standard meteorological data and presented 2D images. Program two is used to plot the standard meteorological data. Program three is used for reducing and plotting particle size spectra measurements, and in deriving microphysical parameters. Program four is used to derive the liquid water depletion time constants, dBZ growth rate, ice particle temperature, and sedimentation velocities within the upraft. Program five is used to derive the microphysical parameters from a programmable calculator. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-15772# Environmental Data and Information Service, Washington, D. C.
INTERNATIONAL DECADE OF OCEAN EXPLORATION, VOLUME 7 Progress Report, Apr. 1977 - Apr. 1978
Oct. 1978 108 p refs
(NOAA-S/T-78-211-Vol-7) Avail: NTIS MF A01; SOD HC

A number of programs concerned with the use of the ocean and it's resources are presented. Specific programs dealing with environmental quality, improving environmental forecasting, expanding sea bed assessment activities, and developing an ocean monitoring system are described. Information, data inventories, and lists of scientific reports derived from U.S. IDOE projects are presented. A.W.H.

N80-15773# Brookhaven National Lab., Upton, N. Y.
CORRELATION BETWEEN WAVE SLOPES AND NEAR-SURFACE OCEAN CURRENTS
S. SethuRaman 1978 12 p refs Presented at the 10th Colloq. on Ocean Hydrodyn., Liege, May 1978
(Contract EY-76-C-02-0016)
(BNL-25068; CONF-7805132-1) Avail: NTIS HC A02/MF A01

The development of wind generated currents in the ocean was studied with simultaneous observations of mean wind speed, wind directions, surface wave parameters, and near surface ocean current. A high correlation between wave slope and near surface current which indicates the possibility of wave age playing a significant role in the generation of current is discussed. The wind generated current found to have a broad spectral peak as compared with tidal currents and found to occur at approximately the same frequency as wind speed spectral peak is described. DOE

N80-15774# Skidaway Inst. of Oceanography, Savannah, Ga.
TRACE ELEMENT GEOCHEMISTRY OF THE SOUTH ATLANTIC BIGHT Progress Report
H. L. Windom and C. T. Wallace 2 Mar. 1979 25 p refs
(Contract EY-76-S-09-0890)
(DOE/EV-00890-3) Avail: NTIS HC A02/MF A01

The role of frontal zones in the nearshore region on trace element transport and dispersion and the role of particulate matter in the geochemistry of trace elements in the South Atlantic Bight were investigated along with instrusion source water trace element characteristics. It was found that the concentration of both particulate and total trace metals decreases sharply across the nearshore front, and rapidly approaches values found in oligotrophic open ocean surface waters. Compositional analysis of the particulate phase when combined with total metal analysis suggests that Cu may preferentially associate with particulate organic matter, even in the clay-mineral-rich, turbid nearshore zone. DOE

N80-15775# Woods Hole Oceanographic Institution, Mass.
ANALYSIS AND INTERPRETATION OF TIDAL CURRENTS IN THE COASTAL BOUNDARY LAYER Ph.D. Thesis - MIT, Cambridge
Paul Wesley May Jul. 1979 203 p refs
(Contract DE-AC02-79EV-10005)
(PB-299428/3; WHOI-79-59) Avail: NTIS HC A10/MF A01 CSCL 08C

The coastal boundary layer transect experiment was conducted within 12 km of the south shore of Long Island, New York, to elucidate the characteristics of the coastal boundary layer in the Middle Atlantic Bight. Data from this experiment show that 35 percent of the kinetic energy of currents averaged over the 30 m depth are due to the semidiurnal and diurnal tides. Tidal ellipses show considerable vertical structure which can be explained adequately by a local constant eddy viscosity model with a slippery bottom boundary condition. Internal oscillations of tidal frequency also occur in the data. These are primarily at diurnal frequencies and may be Doppler-shifted by the mean currents of the coastal region. GRA

N80-15776# National Marine Fisheries Service, Seattle, Wash.
SURFACE CIRCULATION IN THE NORTHWESTERN GULF OF MEXICO AS DEDUCED FROM DRIFT BOTTLES
Robert F. Temple and John A. Martin May 1979 22 p refs
(PB-299078/6; NOAA-TR-NMFS-SSRF-730;
NOAA-79071102) Avail: NTIS HC A02/MF A01 CSCL 08C

Of the total 7,863 drift bottles released at predetermined stations in the northwestern Gulf of Mexico, 12 percent (953) were recovered within 30 days after release. Analysis of the monthly recoveries revealed seasonal shifts in the flow of surface waters. Between September and February the dominant flow was west along the Louisiana and east Texas coasts, shifting southwest along the southern Texas coast. Between March and May, currents underwent a transitional period, shifting to the north and onshore, particularly along the south and central Texas coast. Converging currents, also apparent along the south Texas coast, appeared to progress up the coast with time. In June and July the surface flow was to the northeast and east. August was another transitional period with currents appearing to weaken and turning on-shore. Movements of surface waters appeared directly related to prevailing winds. GRA

N80-15777# Washington Univ., Seattle. Dept. of Oceanography.
FAR-FIELD MATCHING FOR TIDAL CALCULATIONS IN NEARSHORE REGIONS
Carl Pearson Feb. 1979 41 p refs
(Grants NOAA-04-7-158-44021; NSF OCE-76-00406)
(PB-299016/6; WSG-79-1; Contrib-1061; NOAA-79070205)
Avail: NTIS HC A03/MF A01 CSCL 08C

Tidal current calculations in bays and estuaries show that the solution is sensitive to the tidal boundary condition imposed at the mouth of the bay. The difficulty is resolved by replacing the boundary condition at the mouth of the bay by a matching requirement between far-field and nearshore solutions; for tidal problems, such a procedure is complicated by the importance of the Coriolis term as well as by bathymetric and topographic complexities. A number of matching methods which can be used are described. These methods are based on integral equation, finite elements, variational methods, transform methods, series solution, or on a combination of such methods. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-15778*# National Aeronautics and Space Administration, Washington, D. C
INFLUENCE OF HYPOKINESIS ON PHYSIOLOGICAL FUNCTIONS IN FOWL
J. Nvota, D. Lamosova, D. Tesarova, V. Cierna, and P. Vyboh Dec. 1979 14 p refs Transl. into ENGLISH from Vet. Med. (Prague), v. 22, no. 7, 1977 p 425-432 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75999) Avail: NTIS HC A02/MF A01 CSCL 06B

The effects of hypokinesis and postincubation stress (which are characteristic for modern techniques of poultry cage keeping) on the endocrine functions, metabolic reactions, body weight growth and proteosynthesis in the muscle of cocks was investigated. The stress due to hypokinesis was observed in growing cocks housed in metallic cages in which they could hardly turn around. The findings obtained indicate that a 35-day hypokinesis did not exert any more significant influence both on physiological functions and body weight growth as well as on proteosynthesis in the muscle of cocks under study; however, it speeded up the protein metabolism in the muscle. The postincubation stress modified significantly the hypokinesis effect. Findings recorded in birds differed considerably from findings obtained in laboratory mammals, in which the hypokinesis induced significant changes in endocrine functions, body weight decrease and proteosynthesis disorders. A good tolerance of hypokinesis by fowl can be interpreted not only by the phylogenetic remoteness of the compared species but also by the domestication. R.E.S.

N80-15779*# National Aeronautics and Space Administration, Washington, D. C.
THE COURSE OF EXPERIMENTAL STAPHYLOCOCCUS INFECTION IN ALBINO MICE DURING ACTION OF CERTAIN FACTORS OF SPACE FLIGHT
V. Ya. Prokhorov, V. M. Shilov, and E. A. Borman Jan. 1980 8 p refs Transl. into ENGLISH from Zh. Mikrobiol., Epidemiol. i Immunol. (USSR), v. 47, no. 11, 1970 p 82-86 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75973) Avail: NTIS HC A02/MF A01 CSCL 06C

A study was made of the effect of certain factors of space flight, acceleration and hypokinesia, on the course of experimental staphylococcus infection in mice. Combined action of hypokinesia and acceleration caused a marked depression of the phagocytic activity of leukocytes and formation of a considerable amount of alpha toxin. Author

N80-15780*# National Aeronautics and Space Administration, Washington, D. C.
EVOKED POTENTIALS IN IMMOBILIZED CATS TO A COMBINATION OF CLICKS WITH PAINFUL ELECTROCUTANEOUS STIMULI
M. A. Gilinskiy and I. A. Korsakov Nov. 1979 18 p refs Transl. into ENGLISH from Zh. Vyssh. Nerv. Deyatel. (Moscow), v. 23, no. 4, 1973 p 855-863 Transl. by Scientific Translation Service, Box 5456, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75941) Avail: NTIS HC A02/MF A01 CSCL 06C

Averaged evoked potentials in the auditory, somatosensory, and motor cortical zones, as well as in the mesencephalic reticular formation were recorded in acute experiments on nonanesthetized, immobilized cats. Omission of the painful stimulus after a number of pairings resulted in the appearance of a delayed evoked potential, often resembling the late phases of the response to the painful stimulus. The characteristics of this response are discussed in comparison with conditioned changes of the sensory potential amplitudes. K.L.

N80-15781*# National Aeronautics and Space Administration, Washington, D. C.
ACTIVITY OF CHOLINESTERASES OF BLOOD AND HEART IN RATS OF DIFFERENT SEX AND AGE DURING MUSCULAR LOADS AND HYPOKINESIA
V. D. Rozanova and G. A. Antonova Dec. 1979 14 p refs Transl. into ENGLISH from Fiziolhk. Zh. SSSR (USSR), v. 64, no. 7, 1978 p 999-1003 Transl. by Scientific Translation Service, Box 5456, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75951) Avail: NTIS HC A02/MF A01 CSCL 06C

The activity of acetylcholinesterase (Ache) and butyrilcholinesterase (Bche) in the blood and the heart of 3 and 13 month old control male rats is considerably lower than in female rats. In 25 month old rats, no sex differences in the Ache and Bche were revealed in the heart. In 3 and 13 month old male and female rats, under conditions of muscular exercises, the Ache and Bche activity is lower, and in hypokinetic male rats -- higher than that in respective control animals. In all the rats, irrespective of sex, age, and motor conditions, Ache and Bche activity tended to decrease from the sinoatrial node to the heart apex. Author

N80-15782*# National Aeronautics and Space Administration, Washington, D. C.
RAT REACTION TO HYPOKINESIA AFTER PRIOR ADAPTATION TO HYPOXIA
Z. I. Barashova and O. I. Tarakanova Jan. 1980 13 p refs Transl. into ENGLISH from Fiziolhk. Zh. SSSR (USSR), v. 15, no. 3, 1974 p 434-439 Original language document previously announced as A74-31091 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75964) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of prior hypoxia adaptation on body tolerance to hypokinesia was investigated. Rats trained to a 50 day period

of hypokinesia and hypoxia with a preliminary month of adaptation to hypoxia showed less weight loss, higher indices for red blood content, heightened reactivity of the overall organism and the central nervous system to acute hypoxia, and decreased modification of the skeletal muscles compared to rats subjected to hypokinesia alone. K.L.

N80-15783*# National Aeronautics and Space Administration, Washington, D. C.
STUDY ON THE NEURONAL CIRCUITS IMPLICATED IN POSTURAL TREMOR AND HYPOKINESIA
L. J. Poirier (Canadian Med. Res. Council), G. Bouvier (Canadian Med. Res. Council), P. Bedard (Canadian Med. Res. Council), R. Boucher (Canadian Med. Res. Council), L. Larochelle (Canadian Med. Res. Council), A. Oliver (Canadian Med. Res. Council), and P. Singh (Laval Univ.) Jan. 1980 43 p refs Transl. into ENGLISH from Rev. Neurol. (Paris), v. 120, no. 1, 1969 p 15-40 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76004) Avail: NTIS HC A03/MF A01 CSCL 06C

The effect of various tegmentary lesions at the level of the pontomesenchphalon in monkeys on motor function was observed. The importance of the monoaminergic mechanisms of the brainstem is discussed. The results also show the importance of the descending tegmentary rubral system and the rubroolivocerebellar circuit in controlling peripheral motor activity. The destruction of the sensory motor cortex proves to be a more effective way of eliminating spontaneous or harmaline induced tremor than the complete interruption of the pyramidal system on the level of the cerebral peduncle. Author

N80-15784# Argonne National Lab., Ill.
CHARGE SEPARATION IN SYNTHETIC PHOTO-REACTION CENTERS
J. J. Katz 1978 22 p refs Presented at the Workshop on Light-Induced Charge Separation at Interfaces in Biol. and Chem. Systems, West Berlin, 16 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-781048-1) Avail: NTIS HC A02/MF A01

On the basis of electron paramagnetic resonance studies, there is good reason to suppose that the primary electron donor in plant and bacterial photo-reaction centers is a special pair of chlorophyll molecules. The donor-acceptor coordination interactions characteristics of chlorophyll are used to suggest a structure for the chlorophyll special pair. Chlorophyll special pairs with the suggested structure were prepared in the laboratory. These synthetic reaction centers mimic the essential features of P700 and P865 and provide a useful route to the study of electron transfer from in vivo photo-reaction centers. DOE

N80-15785# Rensselaer Polytechnic Inst., Troy, N. Y.
COMPARISON OF DIURNAL FLUCTUATIONS OF DISSOLVED INORGANIC CARBON AND ALGAL PRODUCTIVITY ESTIMATES IN AN OLIGOTROPHIC AND MESOTROPHIC FRESHWATER ENVIRONMENT
Paul A. Amodeo, Jr. and Nicholas L. Clesceri Jul. 1979 31 p refs
(Contract DI-14-34-0001-7172)
(PB-301201/0; OWRT-B-060-NY(1); WB0-00002) Avail: NTIS HC A03/MF A01 CSCL 06C

Factors influencing the daily periodicity of algal carbon incorporation were investigated. Carbon, in the form of dissolved CO_2, is proposed as a major limiting nutrient in both an oligotropic and mesotrophic environment. A relationship between diurnal fluctuations of dissolved inorganic and algal carbon uptake was demonstrated by use of carbon-14 as a radio-carbon tracer. A possible correlation of the above fluctuations with the excretion of organic matter by algae is proposed. Work was conducted at Gull Bay, Lake George, New York and Willsboro Bay, Lake Champlain, New York. GRA

N80-15786# Utah State Univ., Logan. Utah Water Research Lab.
WASTE STABILIZATION LAGOON MICROORGANISM REMOVAL EFFICIENCY AND EFFLUENT DISINFECTION WITH CHLORINE Final Report, Aug. 1975 - Aug. 1976
Bruce A. Johnson, Jeffrey L. Wight, David S. Bowles, James H. Reynolds, and E. Joe Middlebrooks Jul. 1979 386 p refs
(Contract EPA-68-03-2151)
(PB-300631/9; EPA-600/2-79-018) Avail: NTIS HC A17/MF A01

The project objectives are to evaluate: (1) the amenability of algae-laden lagoon effluent to chlorine disinfection; and (2) the performance of a multi-cell lagoon system in removing coliform bacteria by natural means without the need for disinfection. Results indicate that adequate disinfection was obtained with combined chlorine residual within a contact period of 60 minutes. Filtered effluent was found to exert less chlorine demand than unfiltered. Temperature, sulfide, and total chemical oxygen demand were the most important factors affecting the chlorine dose necessary to achieve a specified bacteriological quality. A mathematical model was developed for use in selecting the optimal chlorine dosages needed for achieving prescribed levels of disinfection. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-15787* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 200
Dec. 1979 68 p
(NASA-SP-7011(200)) Avail: NTIS HC E03 CSCL 06E

This bibliography lists 204 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1979. Author

N80-15788*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE PHYSIOLOGICAL BASIS FOR SPACECRAFT ENVIRONMENTAL LIMITS
J. M. Waligora, comp. Washington Nov. 1979 229 p refs
(NASA-RP-1045; S-487) Avail: NTIS HC A11/MF A01 CSCL 06K

Limits for operational environments are discussed in terms of acceptable physiological changes. The environmental factors considered are pressure, contaminants, temperature, acceleration, noise, rf radiation, and weightlessness. For individual titles, see N80-15789 through N80-15795.

N80-15789*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ATMOSPHERE
D. J. Horrigan *In its* The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 1-15 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06K

The physiological basis of the limits established for atmospheric pressure as well as the partial pressures of oxygen, carbon dioxide, water vapor, and diluent gas are reviewed. K.L.

N80-15790*# Southwest Foundation for Research and Education, San Antonio, Tex.
CONTAMINANTS
H. L. Kaplan *In* NASA. Johnson Space Center The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 17-56 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06K

Spacecraft contaminants, their sources, and their toxicological effects are summarized. The problems of identifying toxic hazards, establishing standards for their concentrations, and designing removal systems are discussed. K.L.

N80-15791*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THERMAL ENVIRONMENT
J. M. Waligora *In its* The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 57-69 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06K

The physiological effects, discomfort, and performance degradation associated with an imbalanced thermal environment are discussed. Temperature tolerance limits are set using thermoregulation models and experimental results. The effects of interacting environmental factors, individual variations, and exposure duration on tolerance limits are considered. K.L.

N80-15792*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
PHYSICAL FORCES GENERATING ACCELERATION, VIBRATION, AND IMPACT
J. M. Waligora *In its* The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 71-107 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06K

The physiological effects of forces resulting in radial acceleration, sustained linear acceleration, impact, or vibration are identified. Tolerance limits are presented for these forces. K.L.

N80-15793*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
SOUND AND NOISE
J. L. Homick *In its* The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 109-147 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06K

The effects of audible sound and noise, infrasound, and ultrasound on man are discussed. Those factors which have potential relevance to the space flight situation are emphasized. K.L.

N80-15794*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
RADIOFREQUENCY RADIATION
D. S. Nachtwey *In its* The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 149-167 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06R

Sources, biophysical characteristics, and potential biological effects of rf radiation are described. Standards are given for exposure of spacecraft personnel to rf radiation. K.L.

N80-15795*# General Electric Co., Houston, Tex.
WEIGHTLESSNESS
D. J. Grounds *In* NASA. Johnson Space Center The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 169-185 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06S

The general physiological effects of weightlessness are discussed with emphasis on the physiological effects that could limit mission durations in the absence of effective countermeasures. K.L.

N80-15796*# National Aeronautics and Space Administration, Washington, D. C.
JOINT SOVIET-AMERICAN EXPERIMENT ON HYPOKINESIA: EXPERIMENTAL RESULTS
N. N. Burovskiy Dec. 1979 320 p refs Transl. into ENGLISH of "Sovmestnyy Sovetsko-Amerikanskiy Eksperiment po Giopokinezii. Otchet. Rezul'taty Sovmestnogo Eksperiments", USSR Acad. of Sci. and Ministry of Health, Moscow, Oct. 1979 p 1-372 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76013) Avail: NTIS HC A14/MF A01 CSCL 06S

Comprehensive results are reported from the Soviet portion of a joint Soviet-American experiment involving hypokinesia. The main emphases are on chemical analyses of blood and urine, functional tests, and examination of the cardiovascular system by electrocardiography, echocardiography, and plethysmography. Author

N80-15797*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF MEDICAL STUDIES DURING LONG-TERM MANNED FLIGHTS ON THE ORBITAL SALYUT-6 AND SOYUZ COMPLEX
A. D. Yegorov, comp. Nov. 1979 245 p refs Transl. into ENGLISH of "Rezultaty Meditsinskikh Issledovaniy vo Vremya Dlitel'nykh Pilotiruyemykh Polyetov na Orbital'nom Kompleksе 'Salyut-6--Soyuz'", USSR Acad. of Sci., Inst. of Med. and Biol. Problems, Moscow, 1979 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76014) Avail: NTIS HC A11/MF A01 CSCL 06P

Results of tests made on the crews of the Salyut-6 and Soyuz complex are presented. The basic results of studies made before, during and after 96-day and 140-day flights are presented in 5 sections: characteristics of flight conditions in the orbital complex; the cardiovascular system; the motor sphere and vestibular analyzer; biochemical, hematologic and immunologic studies; and recovery measures in the readaptation period. Author

N80-15798*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES OF SOME BLOOD INDICES AND MYOCARDIAL ELECTROLYTE CONTENT DURING HYPOKINESIA
B. M. Fedorov, V. P. Krotov, and Ye. N. Zhuravleva Nov. 1979 12 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 6, Nov. - Dec. 1973 p 27-31 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75954) Avail: NTIS HC A02/MF A01 CSCL 06S

Using special hypokinetic cages, the volume changes of circulating blood, its hematocrit and protein content, volume ratios between extra- and intracellular liquids in the body, as well as electrolyte content in the blood and myocardium during hypokinesia were investigated experimentally in rabbits. R.E.S.

N80-15799*# National Aeronautics and Space Administration, Washington, D. C.
MECHANISM OF DISORDER OF PLASTIC PROCESSES IN TISSUE DURING PROLONGED HYPOKINESIA
G. A. Makarov Nov. 1979 11 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 4, Jul. - Aug. 1974 p 41-45 Transl. by Scientific Translation Service, Box 5456, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75955) Avail: NTIS HC A02/MF A01 CSCL 06S

The subcellular structures of the myocardium, skeletal muscles, liver and kidneys of adult rats subjected to hypokinesia (in immobilization chambers) for 15, 30, and 45 days were studied. An anabolyser (retabolil) and vitamin D (a Ca metabolism regulator) were administered to two groups of rats. On the second week of hypokinesia, inhibition of synthesis processes was observed. Administration of retabolil increased protein synthesis both in the normal and hypokinesia-subjected rats; however, in the latter group, synthesis did not completely normalize, especially in the myocardium. Administration of vitamin D also stimulated protein synthesis, apparently by normalizing Ca tissue metabolism. The combined action of both preparations was the most effective in normalizing protein synthesis intensity. It was concluded that inhibition of synthesis is related to weakening of hormone synthesis induction and disorder of Ca metabolism. Author

N80-15800# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
DAYTIME VISUAL ACUITY OF OBSERVERS THROUGH A WINDOW WITH AND WITHOUT BINOCULARS
Herschel C. Self and Steve A. Heckart Jul. 1979 23 p
(AF Proj. 7184)
(AD-A074722; AMRL-TR-79-23) Avail: NTIS HC A02/MF A01 CSCL 05/5

Visual acuity with and without hand-held M-19 7x50 binoculars was tested inside and outside the cab of a Master Surveillance Control Facility (MSCF) Tower. High, medium and low contrast 3 bar resolution test charts were used at a 400 foot distance. Except for low contrast bar patterns, where loss was not large, unaided eye visual acuity was not impaired by cab windows. With binoculars there was a statistically significant, though not large, window-caused loss of visual acuity for all contrasts. Even so, binocular visual acuity for high, medium and

low contrast patterns was 5.6, 5.5, and 4.8 times, respectively, better than unaided eye acuity. Recommendations for the MSCF, based on this study, were made. A section of the report examines visual considerations in fence surveillance. GRA

N80-15801# IIT Research Inst., Chicago, Ill.
BIOLOGICAL EFFECTS OF HIGH-VOLTAGE ELECTRIC FIELDS, AN UPDATE. VOLUME 2: BIBLIOGRAPHY Final Report
Jul. 1979 268 p refs Sponsored by Elec. Power Res. Inst.
(EPRI Proj. 957-1)
(EPRI-EA-1123-Vol-2) Avail: NTIS HC A12/MF A01

Literature on the biological effects of power frequency electric fields are reviewed. The general findings of this update conclude that it is highly improbable that electric fields from transmission lines have significant biological effects on healthy individuals who encounter such fields in a normal way under ordinary conditions. However, further research is still needed in order to understand the nature and extent of any effects that could be harmful. DOE

N80-15802# California Univ., Berkeley. Lawrence Berkeley Lab.
SPECIAL SESSION ON VISION
F. S. Montalvo May 1979 13 p refs Presented at the ACM/SIGGraph 1979 Conf. on Computer Grahics and Interactive Techniques, Chicago, Aug. 1978
(Contract W-7405-eng-48)
(LBL-9160; CONF-780806-5) Avail: NTIS HC A02/MF A01

Some results of the visual structuring that occurs in the human visual system were demonstrated. It is shown why some features stand out instanteously and others do not. Knowledge of the human input device and its importance in structuring the design of effective computer output devices and displays is discussed. DOE

N80-15803# Gulf South Research Inst., New Orleans, La.
TOXIC POLYPEPTIDES AND UREMIA Final Progress Report, 1 Jun. 1978 - 31 May 1979
K. Ehrlich, E. Klein, F. F. Holland, Jr., and T. Turnham 2 Jul. 1979 47 p refs
(Contract N01-AM-8-2205)
(PB-301063/4; AK-1-8-2205F-79) Avail: NTIS HC A03/MF A01 CSCL 06C

Uremic serum ultrafiltrate was concentrated and fractionated on Bio-Gel P2 and Sephadex G15 columns. Sephadex fractions were tested for toxicity to human cells in culture. Fractions 1 and 2, containing peptide species with molecular weights greater than 700 daltons, inhibited 3H-thymidine uptake by HeLa and skin fibroblast cells more than the low molecular weight Sephadex material and an iso-osmolar control (saline). Fraction 2, containing molecules with molecular weights of angiotensin and vitamin B-12, inhibited 3H-thymidine incorporation the most (at 774 hours, the incorporation rate was only 2 percent of that of the control for one of the uremic ultrafiltrate concentrates). GRA

N80-15804# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
ELECTROMAGNETIC FIELDS IN BIOLOGICAL MEDIA. PART 2: THE SCAT PROGRAM, MULTILAYERED SPHERE, THEORY AND APPLICATIONS Final Report
Stanley M. Neuder Aug. 1979 30 p refs
(PB-300904/0; DHEW/PUB/FDA-79/8072;
FDA/BRH-79/114) Avail: NTIS HC A02/MF A01 CSCL 08R

The theory and applications of a computer program, SCAT, for calculating the scattering and power absorption of radiofrequency and microwave radiation by spherical lossy dielectric bodies exposed to linearly polarized plane wave fields are described. The irradiated body may be a homogeneous sphere or multilayered, spherically concentric regions of arbitrary radii. Each region can be made to simulate biological tissue by assigning the appropriate dielectric properties. Induced fields and absorbed power density within these regions may then be calculated for preselected irradiation frequencies. Several applications of the SCAT program are described and associated computer plots are presented and discussed. GRA

N80-15805# Research Triangle Inst., Durham, N. C.
BIOLOGICAL SCREENING OF COMPLEX SAMPLES FROM INDUSTRIAL/ENERGY PROCESSES Progress Report, Sep. 1978 - Jul. 1979
Aug. 1979 24 p refs
(Contract EPA-68-02-2688)
(PB-300459/5; EPA-600/8-79-021) Avail: NTIS HC A02/MF A01 CSCL 06T

A biological screening program for complex samples from industrial and energy processes is described. Program elements and their application to various complex environmental samples are summarized. Results from the application of this program show that it is effective for screening complex mixtures. The data formating procedures used to report results from a diversity of biological tests in a meaningful way are also described. GRA

N80-15806# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
SLEEP, WAKEFULNESS AND CIRCADIAN RHYTHM
Sep. 1979 283 p refs Lectures held in London, 1-2 Oct. 1979, in Paris, 4-5 Oct. 1979, and in Toronto, 9-10 Oct. 1979
(AGARD-LS-105; ISBN-92-835-0249-3) Avail: NTIS HC A13/MF A01

Papers concerning the physiological and psychological aspects of sleep, and the adaptation of man to disturbed sleep are presented. The management of irregular rest and activity is also discussed. For individual titles, see N80-15807 through N80-15819.

N80-15807# Centre National de la Recherche Scientifique, Paris (France). Lab. de Physiologie.
CIRCADIAN AND CIRCANNUAL RHYTHMS IN HEALTHY ADULTS
Alain Reinberg *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 13 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

Physiological processes in any living organism including man are not constant as a function of time: regular and predictable variations with period, tau, of about 24 hours (circadian), about 1 year (circannual) etc. can be detected. Each rhythm can be characterized by estimating such parameters as: acrophase theta (crest time), amplitude A and mesor M (rhythm adjusted mean). The estimation of tau, theta, A and M of a set of variables under specified experimental conditions enable the visualization of an aspect of the temporal organization (or biologic time structure). Aims of chronobiology are to quantify and investigate mechanisms of biological time structures. Biological rhythms and the related temporal organization are genetic in origin. However, one or several rhythm parameters may be influenced by cyclical variations of environmental factors (synchronizers or Zeitgeber). The latter has practical implications since phase shifts of synchronizers may occur with transmeridian flights, night-working and shift-working. Chronobiology also involves the study of rhythmic changes in endocrine activities (chronoendocrinology) and in drugs effects (chronopharmacology). F.O.S.

N80-15808# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fuer Flugmedizin.
CIRCADIAN RHYTHMS OF HUMAN PERFORMANCE AND RESISTANCE: OPERATIONAL ASPECTS
Karl E. Klein and Hans-M. Wegmann *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 17 p refs Also presented at the 4th Ann. Sci. Meeting of the Aerospace Med. Assoc., Bal Harbour, Fla., 13 May 1976 (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

Circadian rhythmicity of mental and physical efficiency, and resistance to noxious hazards are reviewed. The interaction with internal and operational factors and implications are given for the management of human operations. The significance of the biorhythm concept for the prediction of human behavior, and the occurrence of man-related accidents are discussed. F.O.S.

N80-15809# Montefiore Hospital, New York. Dept. of Neurology.
SLEEP STAGE ORGANIZATION: NEURO ENDOCRINE RELATIONS

Elliot D. Weitzman *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 9 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The circadian and shorter term episodic patterns of hormone systems are discussed. These include ACTH-cortisol; growth hormone (GH); prolactin; and the gonadotrophins, luteinizing hormone (LH), and follicle stimulation hormone (FSH). F.O.S.

N80-15810# Naval Health Research Center, San Diego, Calif.
SLEEP DISTURBANCES IN HUMANS
Laverne C. Johnson *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 18 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

Disturbed sleep results in feelings of fatigue and, usually, in impaired performance regardless of whether the disturbed sleep is due to excessive noise or a chronic sleep disorder. In addition to noise, some other environmental factors that disturb sleep are temperature, unscheduled operational demands that fragment sleep time, rotating shift-work schedules, and operational requirements that result in air travel across several time zones. While appropriate attention to sleep logistics may minimize the environmental causes of disturbed sleep, resolution of the disturbed sleep of those with sleep disorders is more difficult. The focus in sleep disorders must be on the individual. The major sleep complaint is insomnia, not enough sleep, usually due to prolonged sleep latency. A more serious medical problem, however, may be the complaint of excessive daytime sleep or hypersomnia. Most patients with complaints of hypersomnia are usually diagnosed as having narcolepsy or sleep apnea. Relative to narcolepsy, sleep apnea (episodes of respiratory arrest during sleep) has only recently received attention. In addition to a sleep problem, sleep apneic patients may have hypertension and/or cardiac arrhythmia. F.O.S.

N80-15811# Centre de Recherches du Service de Sante des Armees, Lyons (France).
VIGILANCE AND ATTENTION
M. Defayolle *In* AGARD Sleep, Wakefulness, and Circadian Rhythm Sep. 1979 13 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The relations between vigilance and attention are considered using computer, psychological and physiological techniques. After considering the different types of available measures, the factors influencing attention are reviewed. The characteristics of signals, the environmental conditions, the individual features and the possible interactions between these factors are then studied. The various theories are reviewed and a mathematical model is proposed which integrates activation, the use of processing ability and filtering, taking into consideration the data relative to the environment and to motivation. In conclusion, different methods are proposed from ergonomical, psychological and pharmacological viewpoints. F.O.S.

N80-15812# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
BIOCHEMICAL INDICES OF STRESS: BIOCHEMICAL ASPECTS OF THE STRESS RESPONSE
Bryce O. Hartman and James P. Ellis *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 32 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The release of hormones in response to acute flight stresses was investigated in fighter pilots. The biochemical indices discussed include: hormones, hormone precursors, hormone metabolites, nonhormone metabolites, and enzymes of hormone formation/production. Abstracts and operational applications of previously published reports are presented. F.O.S.

N80-15813# Montefiore Hospital, New York. Human Chronophysiology Lab.
BIOLOGICAL RHYTHMS OF MAN LIVING IN ISOLATION FROM TIME CUES
Elliot D. Weitzman, Charles A. Czeisler, and Martin C. MooreEde *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 9 p refs Prepared in cooperation with Harvard Med. School (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The results are presented of prolonged measurements of sleep-waking functions in human subjects for periods of 25 to 105 calendar days in an environment free of all time cues. It was found that the biological rhythms of human beings free-run at periods greater than 24 hours, typically at approximately 25 hours. During free-running, the sleep to total time ratio remains constant, approximately .30. F.O.S.

N80-15814# Naval Health Research Center, San Diego, Calif.
SLEEP DISTURBANCE AND PERFORMANCE
Laverne C. Johnson *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 15 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

While the type of sleep obtained does not appear to be an important factor in performance, the time of day the sleep is obtained and when the performance occurs are very important. Time-of-day effects are a more crucial factor in performance than the preceding sleep patterns. The effect of total sleep loss becomes pronounced after 48 to 60 hours, consistent performance decrement following reduced sleep or fragmented sleep was not found. Feelings of fatigue, however, are a consistent finding in all sleep-loss studies. A significant relation between sleep quality (good vs. poor sleep) and performance is not easily found. The deleterious effect of hypersomnia, especially that due to narcolepsy is discussed. F.O.S.

N80-15815# Centre National de la Recherche Scientifique, Paris (France). Lab. de Physiologie.
TOLERANCE TO SHIFT WORK: A CHRONOLOGIC APPROACH
Alain Reinberg *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 11 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The hypotheses was tested of possible relationships between the amplitude A of the circadian rhythm of oral temperature on the speed of adjustment during shift work, and tolerance to shift work. Study 1 involved 25 oil refinery operators. A negative correlation ($r = -0.63$; P less than 0.01) was found between the mean A and the acrophase shift delta O resulting from the first night-shift: the larger the A, the smaller the delta O. Study 2 involved 23 steel industry workers and 25 chemical industry workers with either good or poor tolerance to shift work. Tolerance was evaluated conventionally according to 3 types of complaints: digestive troubles, persistant fatigue, sleep alterations. Circadian A of oral temperature is larger in subjects who tolerate to shift work than in intolerant subjects. The study 3 involved 29 oil refinery operators and was designed to retest both hypothesis, their complementarity and to take different age groups into account. Good tolerance to shift work, over many years, appears to be associated with a large circadian amplitude and a slow adjustment during night-shifts (small delta O). F.O.S.

N80-15816# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fuer Flugmedizin.
CIRCADIAN RHYTHMS IN AIR OPERATIONS
Karl E. Klein and Hans-M. Wegmann *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 25 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

After a brief introduction into the principles of environmental and biological timing systems, the phenomenology of post-transmeridian de- and re-synchronization of circadian rhythms is presented, its control and modification through external and internal factors described, and the consequences for human efficiency and health discussed. There are conclusions drawn as to possible relief measures, formulas and models which define the physiological processes, and predict work loads occurring in transmeridian flight operations. Finally, the incorporation of circadian rhythm aspects into Rest/Duty Regulations is described. Author

N80-15817# Centre de Recherches du Service de Sante des Armees, Lyons (France).
PSYCHOSTIMULANTS
M. Defayolle *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 12 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The state-of-the-art of psychostimulants is reviewed, and a brief historical and geographical survey are presented. The basic neurochemical data on vigilance are considered and the various systems of mediators involved in synaptic conduction are differentiated. The methodology of therapeutic tests on psychotropes is then discussed. The effects induced by the use of the various types of drugs: noo-analeptics, nootropes, thymo-analeptics and metabolic adjuvants are considered. These data are incorporated into a general model of vigilance including the data handling capacity and filtering concepts. The indications and contraindications in the use of psychostimulants are presented. F.O.S.

N80-15818# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
HYPNOTICS AND THE MANAGEMENT OF DISTURBED SLEEP
A. N. Nicholson, R. G. Borland, and Barbara M. Stone *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 11 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The effects of hypnotics on visuo-motor performance are discussed. The hypnotics studied include barbiturates, benzodiazepines, diazepam and its hyroxylated metabolites, and nordiazem. The effects of hypnotics on sleep are also discussed. F.O.S.

N80-15819# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
MANAGEMENT OF IRREGULAR REST AND ACTIVITY
Bryce O. Hartman *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 13 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

Biomedical aspects of the irregularity of air operations are discussed in terms of the requirements of aircrews to work without regards for the clock. In practice, operational managers consider the crew limitations and develop workable compromises between these limitations and mission requirements. That variables that must be considered are listed. Data collected from airlift missions are analyzed along with tactical operations. Sleep and the work-rest cycle during missions are discussed. F.O.S.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-15820# Los Alamos Scientific Lab., N. Mex.
MENTAL DYNAMICS
F. H. Harlow Jul. 1979 22 p
(Contract W-7405-eng-36)
(LA-7946-MS) Avail: NTIS HC A02/MF A01

The nonphysical life activity within an organism is described mathematically by means of a basic formulation to which numerous variations and embellishments are appended as required. The fundamental principle of overall activity normalization is presented and discussed in terms of its practical and philosophical consequences. Discrimination is introduced as a necessary complement to intelligence and creativity in the structure of genius. Future directions for development are described in terms of both deterministic and stochastic analysis for the organism as an isolated unit, as a member of society, and as an interacting element of the natural universe. DOE

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-15821*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
SOME HUMAN FACTORS ISSUES IN THE DEVELOPMENT AND EVALUATION OF COCKPIT ALERTING AND WARNING SYSTEMS
Robert J. Randle, Jr., William E. Larsen, and Douglas H. Williams Washington Jan. 1980 65 p refs
(NASA-RP-1055; A-7696) Avail: NTIS HC A04/MF A01 CSCL 05H

A set of general guidelines for evaluating a newly developed cockpit alerting and warning system in terms of human factors issues are provided. Although the discussion centers around a general methodology, it is made specifically to the issues involved in alerting systems. An overall statement of the current operational problem is presented. Human factors problems with reference to existing alerting and warning systems are described. The methodology for proceeding through system development to system test is discussed. The differences between traditional human factors laboratory evaluations and those required for evaluation of complex man-machine systems under development are emphasized. Performance evaluation in the alerting and warning subsystem using a hypothetical sample system is explained. R.C.T.

N80-15822*# National Aeronautics and Space Administration, Washington, D. C.
MODEL TASK FOR THE DYNAMICS OF AN UNDERWATER TWO-LEGGED WALKER
V. V. Beletskiy, V. V. Golubkov, and Ye. A. Stepanova Nov. 1979 49 p refs Transl. into ENGLISH of "Modelnaya Zadacha Dinamiki Podovnoy Dvunogoy Khodby", Rept. Preprint-42 Acad. of Sci. USSR, Inst. of Appl. Math., Moscow, 1979 p 1-58 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75697; Preprint-42) Avail: NTIS HC A03/MF A01 CSCL 05H

A model task of two-legged underwater walking was examined. Characteristics of the walking were established. The underwater walking device is a substantial sphere, which moves on dual-member legs. The dynamics of the device were investigated with the calculation of the buoyancy of Archimedes, and the force of hydrodynamic resistance. R.E.S.

N80-15823# Perceptronics, Inc., Woodland Hills, Calif.
MAN-MACHINE COMMUNICATION IN COMPUTER-AIDED REMOTE MANIPULATION Progress Report, 2 Feb. 1978 - 1 Feb. 1979
William H. Crooks, Efraim Shaket, Yee-Yeen Chu, and Yoram Alperovitch Mar. 1979 167 p refs
(Contract N00014-76-C-0603)
(AD-A074566; PATR-1034-79-3) Avail: NTIS HC A08/MF A01 CSCL 05/8

Automated Remote Manipulation is a prime example of a new type of man-machine interaction in which the human operator must supervise and control a complex and often adaptive man-computer system. Computerized control offers the possibilities of improved performance times and reduced operator workloads with teleoperator systems. Computers can be used at various levels of control, ranging from control augmentation, where the computer performs difficult coordinate transformations which simplify operator control requirements, through complete autonomy in which the computer performs all of the required activities with no intervention by the operator. However, with the introduction of computer-based control techniques, the communication between the operator and the teleoperator becomes an important determinant of work system performance. Rather than controlling directly every action of the manipulator, the operator of a computer-controlled manipulator plans the tasks, commands goal-directed actions, monitors task performance, and intervenes when appropriate. This report describes an analytical and experimental study to investigate the effective-

ness of command language structures and the methods for providing feedback information through the use of sensors and displays. GRA

N80-15824# Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services
TELEOPERATORS UNDER THE SEA
Norman Doelling 1 Jul. 1979 26 p refs
(PB-299883/9; MITSG-79-15, Opportunity-Brief-14; NOAA-79080909; Index-79-715-MOT) Avail: NTIS HC A03/MF A01 CSCL 13J

Research projects being carried out to design, develop, test and extend the capabilities of undersea vehicles are described. The projects relate primarily to untethered, unmanned vehicles, in part because such vehicles offer the greatest challenge and in - part because solution to the difficult problems associated with such systems will have useful applications in tethered and/or manned systems now being developed, built, and used. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-15825*# General Electric Co., Huntsville, Ala. Space Div.
DATA BASE MANAGEMENT SYSTEM CONFIGURATION SPECIFICATION
James W. Neiers Oct. 1979 111 p
(Contract NAS8-33374)
(NASA-CR-161351; Rept-79HV013) Avail: NTIS HC A06/MF A01 CSCL 09B

The functional requirements and the configuration of the data base management system are described. Techniques and technology which will enable more efficient and timely transfer of useful data from the sensor to the user, extraction of information by the user, and exchange of information among the users are demonstrated. R.C.T.

N80-15826# Naval Underwater Systems Center, New London, Conn. New London Lab.
PERFORMANCE AND TIMELINESS IN A DATABASE
Lynn A. DeNoia 3 Jul. 1979 232 p refs
(ZF61112001)
(AD-A074552; NUSC-TR-6099) Avail: NTIS HC A11/MF A01 CSCL 05/2

A methodology is presented for evaluating the system cost/performance of alternative approaches to distributed database management. For each type of database transaction, the management schemes are analyzed to identify the specific control paths and data flow requirements. Then the control and data flow information is used to develop a queueing network model of the entire system. Specific cost/performance analyses can be made when assumptions about particular operating characteristics (such as communication delays, processor power, and disk rates) are incorporated into the model. Average system response time and average network traffic are computed for four management approaches: centralized, a master/slave scheme, a sychronized scheme, and a new scheme called delayed synchronization. The new scheme is based on daily operation without synchronizing updates, supported by nightly merging to produce identical data copies throughout the system. Timeliness information is associated with every individual data item and users are given a choice in retrieval transactions between quick response and most recently updated values. GRA

N80-15827# Maryland Univ., College Park. Dept. of Information Systems Management.
DATA MODEL PROCESSING: AN APPROACH TO STANDARDIZATION OF DATABASE MANAGEMENT SYSTEMS Technical Report, 1 Sep. 1978 - 25 Jul. 1979
W. Terry Hardgrave and Edgar H. Sibley 27 Jul. 1979 27 p refs
(Grant DAAG29-78-G-0162)
(AD-A074601; IFSM-TR-45; ARO-15712.3-A-EL) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper outlines a general philosophy and framework for the specification of a data model. Extracts from scenarios that have been developed for specification of several well-known data models (e.g., DBTG, relational, TDMS) are given and discussed. These extracts are preliminary and incomplete, but they are used to illustrate the feasibility of the Data Model Processor Approach. The scenarios are intended for implementation of an augmented positional processor that will be able to support different data models and, through transformation, serve in defining and testing new DBMS standards. GRA

N80-15828# Naval Postgraduate School, Monterey, Calif.
DISTRIBUTED, SECURE DESIGN FOR A MULTI-MICROPROCESSOR OPERATING SYSTEM M.S. Thesis
James Steven OConnell and Larry Don Richardson Jun. 1979 90 p refs
(AD-A073923) Avail: NTIS HC A05/MF A01 CSCL 09/2

This thesis applies the state of the art techniques for methodical design of secure operating systems to a distributed, multi-microprocessor environment. Explicit process structure and utilization of virtual environments are the fundamental concepts that form a basis for the design presented. The primary design techniques utilized in the design are segmentation, distributed operating system, security kernel, multiprocessing, 'cache' memory strategy and multiprogramming. The resulting design is for a family of distributed operating systems that can provide the power of yesterday's large computer in a microprocessor environment. Security, configuration independence, and a loop free structure are the primary characteristics of the design. The design, although hardware independent, was formulated with the Zilog Z8000 or a similar microprocessor in mind. GRA

N80-15829# Naval Postgraduate School, Monterey, Calif.
THE DESIGN AND IMPLEMENTATION OF AN INEXPENSIVE MICROPROCESSOR DEVELOPMENT SYSTEM FOR THE Z-80 MICROPROCESSOR M.S. Thesis
Douglas Floyd Corteville Jun. 1979 103 p refs
(AD-A073927) Avail: NTIS HC A06/MF A01 CSCL 09/2

The Radio Shack home computer system, TPS-80, configured with Level II Basic ROM's, 16K of RAM, its expansion interface, a single disk drive, and a line printer interface to the TELETYPE model 40 line printer is being used as a microprocessor development aid for the Z-80 microprocessor. Basic language programs are resident on the mini-disk and are used to load, to store, to dump, and to execute assembled assembly language programs. GRA

N80-15830# International Computer Co., Bethesda, Md.
VTS PROCESSING DISPLAY SUBSYSTEM DESIGN Final Report, Apr. 1978 - Jan. 1979
C. C. Henson, F. T. Mickey, R. S. Graham, and B. A. McIntosh Jan. 1979 308 p refs

(Contract DOT-CG-81-78-1833)
(AD-A074053; USCG-D-54-79; CGR/DC-13/79) Avail: NTIS HC A14/MF A01 CSCL 09/2

A distributed function, multiple bus coupled minicomputer system architecture will be used for the Vessel Traffic Services (VTS) Processing/Display Subsystem. Four critical issues are examined including: Reliability; Programming Language Selection; Interprocessor Bus Design; and Multicomputer Operating System Design. System availability requirements can be met with partial redundancy with software controlled reconfiguration and recovery based on both hardware and software error and failure detection. PASCAL is the best programming language available for VTS. A relatively low cost interprocessor bus capable of transmitting at 1.5 megabits per second can be built using off-the-shelf LSI components. The VTS operating system will feature explicit message and answer communications between processes for interprocess communication and synchronization. Error detection and reporting and system reconfiguration and recovery will be controlled by the operating system. The top level of the software design is structured as a group of cooperating sequential processes which use the operating system facility for interprocess communication and synchronization, providing flexibility in assigning processes to processors. Hardware configurations are developed for three possible combinations of functional and traffic handling capabilities. Hardware requirements are included for processors, buses, discs, tapes, graphics units, CRTs, printers, and keyboards. GRA

N80-15831# Stanford Linear Accelerator Center, Calif.
ASPECTS OF COMPUTER CONTROL FROM THE HUMAN ENGINEERING STANDPOINT
T. V. Huang Mar. 1979 4 p refs Presented at the Intern. Colloq. on Circuit and Systems, Taipei, Taiwan, 23 Jul. 1979
(Contracts DE-AC03-76SF-00515)
(SLAC-PUB-2307; CONF-790717-1) Avail: NTIS HC A02/MF A01

A Computer Control System includes data acquisition, information display and output control signals. In order to design such a system effectively the required operational mode: automatic control (closed loop), computer assisted (open loop), or hybrid control are determined. The choice of operating mode will depend on the nature of the plant, the complexity of the operation, the funds available, and the technical expertise of the operating staff, among many other factors. Once the mode has been selected, consideration must be given to the method (man/machine interface) by which the operator interacts with this system. The human engineering factors are of prime importance to achieving high operating efficiency and very careful attention must be given to this aspect of the work if full operator acceptance is to be achieved. These topics are discussed along with the experience gained in setting up the computer control system in Main Control Center for Stanford University's Accelerator Center (a high energy physics research facility). In this complex system both open and closed loop computer controls are used, as well as large numbers of manual functions. DOE

N80-15832# National Technical Information Service, Springfield, Va.
MINICOMPUTERS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1975 - Aug. 1979
Brian Carrigan Sep. 1979 290 p Supersedes NTIS/PS-78/0935; NTIS/PS-77/0755; NTIS/PS-76/0673; NTIS/PS-75/572; NTIS/PS-74/102
(NTIS/PS-79/0978/1; NTIS/PS-78/0935; NTIS/PS-77/0755; NTIS/PS-76/0673; NTIS/PS-75/572; NTIS/PS-74/102) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Reports on the design and applications of minicomputers are presented. A few of the areas of application include audio recorders, chemical analysis, radiation detection, process control, reactor control, production control, ocean sciences, and tracking systems. Supporting software for solving the problems and processing the data in the many areas of application are included. This updated bibliography contains 283 abstracts, 54 of which are new entries to the previous edition. GRA

N80-15833# National Bureau of Standards, Washington, D.C. Inst. for Computer Science and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: COMPUTER PERFORMANCE EVALUATION USERS GROUP (CPEUG), 15TH Final Report
James E. Weatherbee Oct. 1979 244 p refs Meeting held at San Diego, Calif., 15-18 Oct. 1979
(PB-300468/6; NBS-SP-500-52) Avail: NTIS HC A11/MF A01 CSCL 09B

Changes in CPE techniques that will occur in an era of increased use of distributed processing techniques are discussed. Specific topics covered include application of CPE in installation management, and methods and tools of CPE as a technical discipline. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-15834# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
SEMI-ANALYTICAL FORMULAE FOR REAL-TIME IMPLEMENTATION OF OPTIMAL MISSILE AVOIDANCE STRATEGIES
Y. Rotsztein and J. Shinar Dec. 1978 31 p refs
(Grant AF-AFOSR-3458-77)
(TAE-352) Avail: NTIS HC A03/MF A01

Approximated formulae for the optimal evasive maneuver sequence and the resulting miss distance are presented. These formulae are useful for the analysis of missile performance against optimally-evading targets. Their most appealing application is for real-time airborne implementation of optimal missile avoidance strategies. F.O.S.

N80-15835# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
A DIFFERENTIAL DYNAMIC PROGRAMMING ALGORITHM FOR THE SOLUTION OF THE THREE-DIMENSIONAL OPTIMAL MISSILE AVOIDANCE
J. Shinar and D. Blank Nov. 1978 35 p refs
(Grant AF-AFOSR-3458-77)
(TAE-351) Avail: NTIS HC A03/MF A01

A first order differential dynamic programming algorithm is applied to the numerical solution of the three dimensional optimal evasion with linearized kinematics. The results obtained show that the first order algorithm solves the problem in a small number of iterations even for poorly guessed initial controls. K.L.

N80-15836*# TRW Defense and Space Systems Group, Houston, Tex.
DETAILED DESCRIPTION OF THE HP-9825A HFRMP TRAJECTORY PROCESSOR (TRAJ)
S. M. Kindall and S. W. Wilson 20 Nov. 1979 278 p refs
(Contract NAS9-14723)
(NASA-CR-160440; TRW-28415-H011-RO-00) Avail: NTIS HC A13/MF A01 CSCL 09B

The computer code for the trajectory processor of the HP-9825A High Fidelity Relative Motion Frogram is described in detail. The processor is a 12-degrees-of-freedom trajectory integrator which can be used to generate digital and graphical data describing the relative motion of the Space Shuttle Orbiter and a free-flying cylindrical payload. Coding standards and flow charts are given and the computational logic is discussed. K.L.

N80-15837*# National Aeronautics and Space Administration, Washington, D. C.
PROBLEMS IN PROCESSING MULTIZONAL VIDEO INFORMATION AT SPECIALIZED COMPLEXES
V. A. Shamis Dec. 1979 12 p Transl. into ENGLISH of "Voprosy Obrabotki Mnogozonal'noy Video Informatsii na Spetsializirovannykh Kompleksakh", Rept. Pr-345 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-14 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75919; Pr-345) Avail: NTIS HC A02/MF A01 CSCL 09B

Architectural requirements of a minicomputer-based special-

ized complex for automated digital analysis of multizonal video data are examined. The logic structure of multizonal video data and the complex mathematical provision required for the analysis of such data are described. The composition of the specialized complex, its operating system, and the required set of peripheral devices are discussed. It is noted that although much of the analysis can be automated, the operator-computer dialog mode is essential for certain stages of the analysis. K.L.

N80-15838# ARO, Inc., Arnold Air Force Station, Tenn.
SOFTWARE TECHNIQUES FOR THE ACQUISITION OF OPTICAL DATA FROM A MINICOMPUTER-BASED IMAGE-INTENSIFIER-VIDICON SYSTEM Final Report, 1 Mar. - 31 Oct. 1978
J. H. Jones Arnold AFS AEDC Sep. 1979 87 p refs
(AD-A074844; AEDC-TR-79-43) Avail: NTIS
HC A05/MF A01 CSCL 09/5

The software required to support a new technique for acquiring large amounts of optical data in a short time period has been developed. The data acquisition system incorporates an image intensifier and vidicon tube in combination. It is controlled by a minicomputer utilizing the software described. The software handles all control of the image-intensifier-vidicon system, acquires the data from the system, and stores the data for subsequent retrieval and reduction. The software incorporates a disk operating system for a single floppy disk drive. This disk operating system utilizes a specially designed technique that optimizes the rate of writing data onto the disk. The system was implemented to acquire temperature and density data from the flow of a rocket engine exhaust plume. This application coupled the system with an electron beam mechansim to acquire the data using and electron beam fluorescence technique. This application was used to verify that the system meets the requirements set forth for it. GRA

N80-15839# Stanford Univ., Calif. Stanford Electronics Lab.
DESIGN AND VERIFICATION OF RELIABLE SOFTWARE Annual Report, 1 Jan. - 31 Dec. 1978
Susan S. Owicki Jul. 1979 11 p refs
(Contract F49620-77-C-0045; AF Proj. 2304)
(AD-A074224; AFOSR-79-0978TR; AR-2) Avail: NTIS
HC A02/MF A01 CSCL 05/2

This research project is concerned with methods for developing provably correct system programs. Two complementary approaches have been pursued. The first is the development of basic tools for describing and verifying concurrent programs; the aim is to find ways of managing the complexity which arises from concurrent interactions between system components. Specification and proof methods for invariant properties of modular programs have been developed. They allow independent verification of each module and provide a sufficient basis for reasoning about a wide class of concurrent systems. Tools for stating and verifying other types of requirements, e.g. that a message is eventually delivered, are in an earlier stage. Techniques have been designed that use temporal logic, a logical system that allows statements about future events. GRA

N80-15840# Military Academy, West Point, N. Y. Dept. of Earth Space and Graphic Services.
INTERACTIVE GRAPHIC TECHNIQUES FOR CONCEPTUAL ENGINEERING DESIGN Final Report
Glenn A. Porter 20 Apr. 1979 10 p refs Presented at the DECUS Conf., New Orleans, 17-20 Apr. 1979
(AD-A073837; USMA-ESGS-03) Avail: NTIS
HC A02/MF A01 CSCL 09/2

Conceptual design is the initial and most creative phase of an engineering design project. The effective use of interactive computer graphics to enhance this design phase is dependent upon a highly developed interaction between the designer and the computer. This paper presents an analysis of the environment of conceptual design and proposes techniques for the creation of a successful man-machine interface which fosters the use of interactive computer graphics GRA

N80-15841# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
PRIME AND PDQ SORTS: EFFICIENT MINIMAL STORAGE SORTING ALGORITHMS Final Report, Nov. 1976 - Mar. 1978
Roy R. Hilbrand Aug. 1979 63 p refs Prepared for the Joint Tech. Coordinating Group on Aircraft Survivability
(AD-A073567; JTCG/AS-78-V-004) Avail: NTIS
HC A04/MF A01 CSCL 09/2

One of the problems involved in computer programs for vulnerability assessment is that of rapidly sorting and arranging large sets of data. Two sorting algorithms, designated PRIME and PDQ, have been developed at ASD to more efficiently perform this function in vulnerability programs such as SESTEM and FASTEGEN II. The results are compared to those obtained with three other algorithms, SHELLSORT, TREESORT3, and SINGLETON. The newly developed sorts are showed to be significantly faster on the ASD CDC 6600 computer than the existing sorts. When used in an ASD missile endgame model SESTEM, the average run time was reduced by 20 to 25%. Program listings, flow charts, and typical output data are presented. GRA

N80-15842# Honeywell Systems and Research Center, Minneapolis, Minn.
RATIONALE FOR THE DESIGN OF THE ADA PROGRAMMING LANGUAGE: VOLUME 14, NO. 6, PART B
Jean D. Ichbiah, Jean-Claude Heliard, Olivier Roubine, John G. P. Barnes, and Bernd Krieg-Brueckner Jun. 1979 268 p refs
(Contract MDA903-77-C-0331)
(AD-A073854) Avail: NTIS HC A12/MF A01 CSCL 09/2

This document, the rationale for the design of the Green programming language, and the companion Reference Manual, are the two defining documents for the Green language. They serve different purposes. The Reference Manual contains a complete and concise definition of the language. Following Wirth, we believe in the virtue of having a rather short reference manual. This has the advantage of providing the information in a form that can easily be consulted, read and reread several times, as the basis for developing a good familarity with the language. GRA

N80-15843# Alabama Univ., Huntsville. School of Science and Engineering.
AN ASSESSMENT OF SOFTWARE QUALITY ASSURANCE Final Report, 8 Jun. 1978 - 7 Jul. 1979
Pei Hsia and Frederick E. Petry Jul. 1979 24 p refs
(Contract DASG60-78-C-0088)
(AD-A074213) Avail: NTIS HC A02/MF A01 CSCL 09/2

This final report describes three tasks which can strengthen the Ballistic Missile Defense Systems Command overall research objectives in software systems development. The three tasks are: preprocessor for Verifiable PASCAL (V-PASCAL), evaluation of Software Quality Laboratory (SQLAB) tools and techniques, and testing research - a new approach. V-PASCAL is a language designed by GRC to extend PASCAL to permit experimentaion with new language constructs which will aid in the development of BMD software. These capabilities can be implemented with a preprocessor which accepts an input source code written in V-PASCAL, and generates standard PASCAL for compilation, or which extracts for verification purposes descriptive information about the source text. The feasibility of a preprocessor for V-PASCAL has been investigated, and a conclusion is that a revised design of the GRC produced V-PASCAL preprocessor will suffice for the present. GRA

N80-15844# Maryland Univ., College Park. Computer Science Center.
THE FLEX SYSTEM: USER AND CARETAKER'S MANUAL
Stephen A. Sutton Jun. 1979 79 p ref
(Grant AF-AFOSR-3181-77)
(AD-A073997; CSC-TR-765) Avail: NTIS HC A05/MF A01
CSCL 09/2

The FLEX Design System is a design language and its Processor that form a tool for use in computer software design activities. This report presents a detailed definition of the FLEX language, directions for using the Processor, and guidelines for installing, maintaining, and modifying the Processor software. GRA

N80-15845# Harry Diamond Labs., Adelphi, Md.
QINTEG: A PROGRAM FOR COMPUTING GAUSSIAN QUADRATURE COEFFICIENTS

Theodore H. Hopp Aug. 1979 35 p refs
(DA Proj. 1L1-61102-AH-44)
(AD-A073974; HDL-TR-1890) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report presents a program (QINTEG) to compute Gaussian quadrature coefficients for integration with respect to a weighting function. Discontinuities, singularities, or oscillatory behavior of integrands make many problems unsuited to numerical solution using existing general purpose integration programs. When the undesirable behavior of the integrand can be absorbed into the weighting function, numerical integration using the coefficients computed by QINTEG can be accomplished. Improvement of nearly two orders of magnitude in execution time over an existing program was achieved for a problem involving oscillatory integrands. A program listing is included. GRA

N80-15846# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
ADDITIONAL SOFTWARE DEVELOPMENTS FOR THE HP-21 MX
Michael C. Pitruzzello and Jerrel R. Mitchell 26 Jun. 1979 71 p
(AD-A074068; DRDMI-T-79-65) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report contains the description of four computer codes developed for the HP-21 MX minicomputer system housed in the Control System Branch of the Guidance and Control Directorate of the US Army Missile Research and Development Command (MIRADCOM). These codes (programs) were developed to aid in analyzing fire control systems being developed by the US Army. GRA

N80-15847# Mound Lab., Miamisburg, Ohio.
UTILITY AND MATH SUBROUTINES FOR THE M6800 MICROPROCESSOR
R. E. Bowman 31 Oct. 1978 89 p refs
(Contract EY-76-C-04-0053)
(MLM-2564) Avail: NTIS HC A05/MF A01

Programming the M6800 microprocessor for data acquisition and instrument control is done in assembly language. A large group of subroutines are presented in a single package to simplify the work of the assembly language programmer. The routines available include utility routines for input/output, code interconversion, delay, etc., and math routines for both integer and floating-point arithmetic. DOE

N80-15848# Argonne National Lab., Ill.
SOFTWARE DEVELOPMENT SYSTEM FOR SMALL DEDICATED AND FRONT-END MICROCOMPUTER (LSI-11) APPLICATIONS
J. W. Tippie and P. E. Rynes 1978 5 p refs
(Contract W-31-109-eng-38)
(CONF-7811112-1) Avail: NTIS HC A02/MF A01

The development of software for small dedicated microcomputer applications is frequently impeded or complicated by lack of adequate peripherals, utilities, and operating systems. A software development system for the LSI-11 microcomputer is described, along with some of its anticipated applications and some of the software problems. The term small dedicated application is used to refer to one or few-of-a-kind systems based on the LSI-11 that lack a device suitable to support an operating system, and that are not subject to frequent software changes. DOE

N80-15849# California Univ., Livermore. Lawrence Livermore Lab.
REBEL/BASIC: LANGUAGE, A USER'S GUIDE
M. C. Zarnstorff and J. R. Greenwood 12 Mar. 1979 104 p
(Contract W-7405-eng-48)
(UCRL-52668) Avail: NTIS HC A06/MF A01

A programmer's reference manual for the REBEL/BASIC computer language is described. In the first section, the generic features of the language are described, including statements, types, execution modes and operators. The second section describes each valid statement in REBEL/BASIC in detail. The statements are discussed in alphabetical order and thus this section is suitable for use as a language reference manual. DOE

N80-15850# National Technical Information Service, Springfield, Va.
PROGRAMMING LANGUAGE DESIGN. A BIBLIGRAPHY WITH ABSTRACTS Progress Report, 1970 - Aug. 1979
Brian Carrigan Sep. 1979 188 p Supersedes NTIS/PS-77/0864; NTIS/PS-76/0747; NTIS/PS-75/588; NTIS/PS-78/0963
(NTIS/PS-79/0979/9; NTIS/PS-78/0963; NTIS/PS-77/0864; NTIS/PS-76/0747; NTIS/PS-75/588) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Research reports on the design, development, and implementation of programming languages are presented. Specifications and applications for the programming languages in systems development, and their use in specific cases are included as well as research on language compilers, syntax, semantics, and logic modules. This updated bibliography contains 181 abstracts, 10 of which are new entries to the previous edition. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-15851# Wisconsin Univ. - Madison. Dept. of Mechanical Engineering.
INVESTIGATION OF ADAPTIVE CONTROL FOR RECOIL MECHANISMS Final Report, 1 Mar. 1977 - 31 Mar. 1979
S. M. Wu and A. Ma Aug. 1979 92 p
(Grants DAAG29-77-G-0076; DAAG29-78-G-0075)
(AD-A074024; ARO-14618.1-A-E) Avail: NTIS HC A05/MF A01 CSCL 09/2

The Continuous System Simulation Language (CSSL) computer programs are developed in conjunction with the derivation of the mathematical models and optimum algorithm to study the effect of various orifice control laws on the optimal control for the M-37 recoil mechanism. The optimal control greatly decreases the average rod pull peak force and causes the force to level out to a nearly constant value following the peak. Based on the analysis of the acceleration signals of the recoil mechanism, a microprocessor based digital controller is designed to control the orifice area controller. GRA

N80-15852# Pittsburgh Univ., Pa. Dept. of Computer Science.
SYSTOLIC PRIORITY QUEUES Interim Report
Charles E. Leiserson Apr. 1979 18 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-22255)
(AD-A074494) Avail: NTIS HC A02/MF A01 CSCL 09/2

Advances in microelectronics have made the realization of smart data structures a practical reality. VLSI gives us the capability of building logic-in-memory hardware that will drastically change how things are computed. Models of computation based solely on the Von Neumann architecture will be insufficient to evaluate algorithms. Multiprocessor devices like the systolic multiqueue will introduce new cost functions to the sequential algorithm designer. But much work must be done to define and examine the models of parallel computation that lie between the mathematical world of computable functions and the physical world of space and time. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-15853*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ANALYSIS TECHNIQUES FOR MULTIVARIATE ROOT LOCI
Peter M. Thompson, Gunter Stein, and Alan J. Laub Jan. 1980 37 p refs
(Contract NsG-1551)
(NASA-CR-162570; LIDS-P-965) Avail: NTIS HC A03/MF A01 CSCL 12A

Analysis and techniques are developed for the multivariable root locus and the multivariable optimal root locus. The generalized eigenvalue problem is used to compute angles and sensitivities for both types of loci, and an algorithm is presented that determines the asymptotic properties of the optimal root locus. Author

N80-15854*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDIES IN ASTRONOMICAL TIME SERIES ANALYSIS: MODELING RANDOM PROCESSES IN THE TIME DOMAIN
Jeffrey D. Scargle Dec. 1979 215 p refs
(NASA-TM-81148; A-7959) Avail: NTIS HC A10/MF A01 CSCL 12A

Random process models phased in the time domain are used to analyze astrophysical time series data produced by random processes. A moving average (MA) model represents the data as a sequence of pulses occurring randomly in time, with random amplitudes. An autoregressive (AR) model represents the correlations in the process in terms of a linear function of past values. The best AR model is determined from sampled data and transformed to an MA for interpretation. The randomness of the pulse amplitudes is maximized by a FORTRAN algorithm which is relatively stable numerically. Results of test cases are given to study the effects of adding noise and of different distributions for the pulse amplitudes. A preliminary analysis of the optical light curve of the quasar 3C 273 is given. K.L.

N80-15855# Los Alamos Scientific Lab., N. Mex.
GENERAL LEAST-SQUARES FITTING PROCEDURES TO MINIMIZE THE VOLUME OF A HYPERELLIPSOID
E. A. Wadlinger 1979 5 p refs Presented at Linear Accelerator Conf., Montauk, N.Y., 10-14 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2330; CONF-790927-2) Avail: NTIS HC A02/MF A01

Several methods for determining the shape parameters, which in two dimensions are the Courant-Snyder parameters, and the volume of an ellipse or hyperellipse that represent a set of phase-space points in a two or more dimensional hyperspace are presented. The ellipse parameters are useful for matching a beam to an accelerating or transport system and in studies of emittance growth. The fitting procedure minimizes the total volume of a hyperellipse by adjusting the ellipse shape parameters. The total volume is the sum of the individual particle volumes defined by the hyperellipse that passes through the phase-space point of a particle. A two-dimensional space is considered first; the results are then generalized to higher dimensions. Computer programs using these techniques were written. DOE

N80-15856# Los Alamos Scientific Labj, N. Mex.
SNEX: SEMIANALYTIC SOLUTION OF THE ONE-DIMENSIONAL DISCRETE ORDINATES (S/n) TRANSPORT EQUATIONS WITH DIAMOND DIFFERENCED ANGULAR FLUXES
B. R. Wienke Jun. 1979 28 p refs
(Contract W-7405-eng-36)
(LA-7879-MS) Avail: NTIS HC A03/MF A01

A standard is provided for comparisons of spatial differencing schemes as well as an exact numerical solution to the discrete ordinates equations in one dimensional geometries. Full solutions are generated by numerically integrating the inhomogeneous source terms and adding them to the homogeneous (analytic) solutions in the standard fashion. Simple relationships between angular quadratures permit application of the method to plane, cylindrical and spherical geometries. Analysis is confined to isotropic scattering. Simple theory and methodology are presented and discussed. A code listing and sample problems are also included. DOE

N80-15857# Los Alamos Scientific Lab., N. Mex.
METHODS FOR NUMERICAL CONFORMAL MAPPING
R. Menikoff and C. Zemach Jul. 1979 65 p refs
(Contract W-7405-eng-36)
(LA-7836-MS) Avail: NTIS HC A04/MF A01

Nonlinear integral equations for the boundary functions that determine conformal transformations in two dimensions are developed and analyzed. One of these equations has a nonsingular logarithmic kernel and is especially well suited for numerical computations of conformal maps including those that deal with regions having highly distorted boundaries. Numerical procedures based on interspersed Gaussian quadrature for approximating the integrals and a Newton-Raphson technique to solve the resulting nonlinear algebraic equations are described. The Newton-Raphson iteration converges reliably with very crude initial approximations. Numerical examples are given for the mapping of a half-infinite region with periodic boundary onto a half-plane, with up to 9 figure accuracy for values of the map function on the boundary and for its first derivatives. A differential equation is derived that relates changes in the map function to changes of the boundary. DOE

N80-15858# Brookhaven National Lab., Upton, N. Y.
NUMERICAL METHODS FOR HELMHOLTZ TYPE EQUATIONS IN UNBOUNDED REGIONS
C. I. Goldstein May 1979 21 p refs
(Contract EY-76-C-02-0016)
(BNL-26543) Avail: NTIS HC A02/MF A01

Numerical methods for approximately solving Helmholtz type equations in unbounded regions in two and three dimensional space subject to appropriate radiation conditions at infinity, are described. DOE

N80-15859# California Univ., Berkeley. Lawrence Berkeley Lab.
FINITE ELEMENT METHOD FOR THE SOLUTION OF A POTENTIAL THEORY INTEGRAL EQUATION
M. J. Friedman Aug. 1979 11 p refs
(Contract W-7405-eng-48)
(LBL-9504) Avail: NTIS HC A02/MF A01

A finite element approximation for an integral equation of the second kind deduced from a potential theory boundary value problem in two variables is discussed. The equation is shown to admit a unique solution, to be variational and coercive in the Hilbert space of functions sigma an element of H/sup 1/2/ (gamma), integral/sub gamma/sigma d gamma = 0. The Galerkin method with finite elements as trial functions is shown to lead to an optimal rate of convergence. DOE

N80-15860# Argonne National Lab., Ill.
ERGODIC THEOREMS FOR NONLINEAR CONTRACTION SEMIGROUPS IN A HILBERT SPACE
H. G. Kaper and G. K. Leaf Jun. 1979 20 p refs
(Contract W-31-109-eng-38)
(ANL-79-50) Avail: NTIS HC A02/MF A01

Two ergodic theorems are presented for means of nonlinear contraction semigroups in a Hilbert space. These means are generated by a class of averaging kernels which includes the usual Abel and Cesaro-(C, alpha) kernels. DOE

N80-15861# Sandia Labs., Livermore, Calif. Applied Mathematics Div.
NUMERICAL RANK DETERMINATION IN LINEAR LEAST SQUARES PROBLEMS
T. A. Manteuffel Aug. 1979 52 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8243) Avail: NTIS HC A04/MF A01

An interval analysis approach is proposed. A set of matrices A/sup I/ that contains all possible perturbations of A due to uncertainties is defined, and A/sup I/ is called rank deficient if any member of A/sup I/ is rank deficient. A modification to

the Q-R decomposition method of solution of the least-squares problem allows a determination of the rank of A/sup I/. The additional computational effort is O(N squared), where N is the column dimension of A. DOE

N80-15862# Oak Ridge National Lab., Tenn.
REGULARITY OF SOLUTIONS TO AN INHOMOGENEOUS DIFFERENTIAL EQUATION IN BANACH SPACE
C. C. Travis 1979 14 p refs Presented at the Functional Differential and Integral Equations Conf., Morgantown, W. Va., 18 Jun. 1979
(Contract W-7405-eng-26)
(CONF-7906102-1) Avail: NTIS HC A02/MF A01

The class of strongly continuous semigroups was characterized for a weak solution of the equation v(t) = T(t)x + integral equation/sup t/T(t-s)f(s)ds (Eq. B) which is a strong solution when f is an element of C([o, r] X). It is shown that equation du(t)/dt = Au(t) + f(t), u(o) = x is a strong solution of eq. B for every continuous function f if the semigroup T(t), t > or = 0, is of bounded semivariation. DOE

N80-15863# Argonne National Lab., Ill. Applied Mathematics Div.
EQUIVALENCE BETWEEN RESOLVENT CONSISTENCY AND CONVERGENCE FOR NONLINEAR QUASI-CONTRACTIVE ALGORITHMS
S. Reich Jun. 1979 17 p refs
(Contract W-31-109-eng-38)
(ANL-79-53) Avail: NTIS HC A02/MF A01

A reflexive Banach space E with a uniformly Gateaux differentiable norm; D, a closed convex subset of E; and C, a nonexpansive retract of D is considered. DOE

N80-15864# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
COMPARISON OF BOUNDARY ELEMENT AND FINITE ELEMENT METHODS IN TWO-DIMENSIONAL INELASTIC ANALYSIS
M. Morjaria, V. Sarihan, and S. Mukherjee May 1979 34 p refs
(Contract EY-76-S-02-2733)
(COO-2733-22) Avail: NTIS HC A03/MF A01

Planar time-dependent inelasticity problems were considered using the finite element method and the boundary element method. A constitutive model with state variables was used to describe material behavior. The accuracy and computational efficiency of these two methods were compared. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

No abstracts in this category.

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-15865*# SRI International Corp., Menlo Park, Calif.
DOCUMENTATION OF THE ANALYSIS OF THE BENEFITS AND COSTS OF AERONAUTICAL RESEARCH AND TECHNOLOGY MODELS, VOLUME 1 Final Report
J. C. Bobick, R. L. Braun, and R. E. Denny Jul. 1979 203 p
(Contract NAS2-10026; SRI Proj. 7759)
(NASA-CR-152278) Avail: NTIS HC A10/MF A01 CSCL 12B

The analysis of the benefits and costs of aeronautical research and technology (ABC-ART) models are documented. These models were developed by NASA for use in analyzing the economic feasibility of applying advanced aeronautical technology to future civil aircraft. The methodology is composed of three major modules: fleet accounting module, airframe manufacturing module, and air carrier module. The fleet accounting module is used to estimate the number of new aircraft required as a function of time to meet demand. This estimation is based primarily upon the expected retirement age of existing aircraft and the expected change in revenue passenger miles demanded. Fuel consumption estimates are also generated by this module. The airframe manufacturer module is used to analyze the feasibility of the manufacturing the new aircraft demanded. The module includes logic for production scheduling and estimating manufacturing costs. For a series of aircraft selling prices, a cash flow analysis is performed and a rate of return on investment is calculated. The air carrier module provides a tool for analyzing the financial feasibility of an airline purchasing and operating the new aircraft. This module includes a methodology for computing the air carrier direct and indirect operating costs, performing a cash flow analysis, and estimating the internal rate of return on investment for a set of aircraft purchase prices. R.C.T.

N80-15866*# SRI International Corp., Menlo Park, Calif.
DOCUMENTATION OF THE ANALYSES OF THE BENEFITS AND COSTS OF AERONAUTICAL RESEARCH AND TECHNOLOGY MODELS (ABC-ART). VOLUME 2: APPENDICES Final Report
J. C. Bobick, R. L. Braun, and R. E. Denny 1980 160 p
(Contract NAS2-10026; SRI Proj. 7759)
(NASA-CR-152279) Avail: NTIS HC A08/MF A01 CSCL 12B

Fleet variables are defined, and source codes for each module are presented. R.C.T.

N80-15867# Pittsburgh Univ., Pa. Inst. for Statistics and Applications.
ESTIMATION OF VARIANCE COMPONENTS Interim Report
C. Radhakrishna Rao and Jurgen Kleffe Jul. 1979 63 p refs
(Contract F49620-79-C-0161; AF Proj. 2304)
(AD-A074223; TR-79-1; AFOSR-79-0974TR) Avail: NTIS HC A04/MF A01 CSCL 12/2

The paper describes a number of methods for estimating variance components in a general linear model. Explicit expressions are obtained for locally minimum variance unbiased estimators with and without the invariance condition. The principle of MINQE is described and a series of MINQE estimators satisfying one or more of the conditions - unbiasedness, invariance, nonnegative definiteness - are derived. Corresponding to each MINQE estimator, an iterated MINQE (IMINQE) is defined. It is shown that the ML (maximum likelihood) estimator is IMINQE satisfying the invariance condition and the RML (restricted maximum likelihood estimator) is IMINQE satisfying both the invariance and unbiasedness conditions. Some comments are made on the numerical algorithms for computing MINQE, ML and RML estimators. GRA

N80-15868# General Research Corp., McLean, Va. Operations Analysis Group.
ANALYSIS TO DETERMINE FUNCTIONAL AND SYSTEMS REQUIREMENTS FOR AN ON-LINE STRUCTURE AND COMPOSITION SYSTEM (SACS). REPORT OF TASK E: ANALYSIS OF CURRENT AND DEVELOPING SYSTEMS WHICH INTERFACE WITH LOGSACS AND PERSACS TO DETERMINE TO WHAT EXTENT THEY DO OR DO NOT SUPPORT THE DATA REQUIREMENTS OF AN ON-LINE SACS Final Report
Francis O. Deppner, John J. Anderson, and Whitney C. Scully Jun. 1979 28 p refs
(Contract MDA903-78-C-0445)
(AD-A074638; GRC-1070-04-79-CR) Avail: NTIS HC A03/MF A01 CSCL 05/1

There are current and developing systems which either provide, or will be required to provide, data to SACS. These systems were analyzed to determine if they do/do not support an improved/on-line SACS. The support provided is very limited; therefore, the shortcomings of each of the systems were identified and recommendations for their improvement were provided. Recommendations were also provided for a new system to support phasing plus some new managerial procedures. Report of

Task E - analyze the current and developing systems which interface with LOGSACS and PERSACS to determine to what extent they support or do not support the data requirements of an on-line SACS. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-15869*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

CHARACTERIZATION OF ACOUSTIC DISTURBANCES IN LINEARLY SHEARED FLOWS

S. P. Koutsoyannis Jul. 1978 40 p refs
(Grants NsG-2215; NsG-2233; NsG-2007)
(NASA-CR-162577; SU-JIAA-TR-12) Avail: NTIS
HC A03/MF A01 CSCL 20A

The equation describing the plane wave propagation, the stability, or the rectangular duct mode characteristics in a compressible inviscid linearly sheared parallel, but otherwise homogeneous flow, is shown to be reducible to Whittaker's equation. The resulting solutions, which are real, viewed as functions of two variables, depend on a parameter and an argument, the values of which have precise physical meanings depending on the problem. The exact solutions in terms of Whittaker functions are used to obtain a number of known results of plane wave propagation and stability in linearly sheared flows as limiting cases in which the speed of sound goes to infinity (incompressible limit) or the shear layer thickness, or wave number, goes to zero (vortex sheet limit). The usefulness of the exact solutions is then discussed in connection with the problems of plane wave propagation and the stability of a finite thickness layer with a linear velocity profile. Author

N80-15870*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

FEATURES OF SOUND PROPAGATION THROUGH AND STABILITY OF A FINITE SHEAR LAYER

S. P. Koutsoyannis Aug. 1977 19 p refs Presented at 13th Ann. Meeting of the Soc. of Eng. Sci., Hampton, Va. Sponsored by NASA
(NASA-CR-162465; JIAA-TR-5) Avail: NTIS
HC A02/MF A01 CSCL 20A

The plane wave propagation, the stability, and the rectangular duct mode problems of a compressible, inviscid, linearly sheared, parallel, homogeneous flow are shown to be governed by Whittaker's equation. The exact solutions for the perturbation quantities are essentially the Whittaker M-functions where the nondimensional quantities have precise physical meanings. A number of known results are obtained as limiting cases of the exact solutions. For the compressible finite thickness shear layer it is shown that no resonances and no critical angles exist for all Mach numbers, frequencies, and shear layer velocity profile slopes except in the singular case of the vortex sheet. K.L.

N80-15871*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

AN EXPERIMENTAL STUDY OF THE STRUCTURE AND ACOUSTIC FIELD OF A JET IN A CROSS STREAM

Ivan Camelier and K. Karamcheti Jan. 1976 134 p refs
(Grants NGL-05-020-526; NsG-2007)
(NASA-CR-162464; SU-JIAA-TR-2) Avail: NTIS
HC A07/MF A01 CSCL 20A

The plane of symmetry of a high speed circular jet was surveyed to measure the mean and turbulent velocity fields by using constant temperature hot wire anemometry. The intensity of the noise radiated from the jet was determined in the tunnel test section by utilizing the cross-correlation at a particular time delay between the signals of two microphones suitably located along a given direction. Experimental results indicate that the turbulent intensity inside the crossflow jet increases by a factor of $(1 + 1/2)$ as compared to the turbulent intensity of the same jet under free conditions, with r indicating the ratio of the jet velocity by the cross stream velocity. The peak observed in the turbulence spectra obtained inside the potential core of the jet has a frequency that increases by the same factor with respect to the corresponding frequency measured in the case of the free jet. The noise radiated by the jet becomes more intense as the crossflow velocity increases. The measured acoustic intensity of the crossflow jet is higher than the value which would be expected from the increase of the turbulent intensity only. A.R.H.

N80-15872*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.

ON THE OUTPUT OF ACOUSTICAL SOURCES

H. Levine May 1979 35 p refs
(Grant NsG-2215)
(NASA-CR-162576; SU-JIAA-TR-16) Avail: NTIS
HC A03/MF A01 CSCL 20A

Contents: (1) a theoretical basis for local power calculation; (2) source radiation in the presence of a half-plane; (3) radiation from a line source near an edge at which a Kutta condition holds; (4) radiation by a point source above a plane independence boundary; and (5) power output of a point source in a uniform flow. A.R.H.

N80-15873*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

ACOUSTIC RESONANCES AND SOUND SCATTERING BY A SHEAR LAYER

S. P. Koutsoyannis, K. Karamcheti, and D. C. Galant (NASA, Ames Research Center, Moffett Field, Calif.) Sep. 1979 46 p refs
(Grants NsG-2233; NsG-2308)
(NASA-CR-162575; SU-JIAA-TR-20) Avail: NTIS
HC A03/MF A01 CSCL 20A

The energy reflection coefficient is evaluated numerically for plane waves incident on a plane shear layer having a linear velocity profile. The shear layer is found to exhibit no resonances and no Brewster angles. The behavior of the reflection coefficient depends crucially on the parameter tau, a nondimensional measure of the disturbance Strouhal number with respect to the disturbance Mach number in the mean flow direction. For moderate values of tau, the amplified reflection regime degenerates into the total reflection one, whereas in the ordinary reflection regime the variation of the reflection coefficient with tau depends on whether or not the corresponding vortex sheet has a Brewster angle. The results indicate that caution should be exercised in uncritically modeling a finite thickness shear layer by a corresponding vortex sheet. K.L.

N80-15874*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A STUDY OF PARTIAL COHERENCE FOR IDENTIFYING INTERIOR NOISE SOURCES AND PATHS ON GENERAL AVIATION AIRCRAFT

James T. Howlett Dec. 1979 17 p refs Presented at 98th Acoust. Soc. of Am. Meeting, Salt Lake City, 26-30 Nov. 1979
(NASA-TM-80197) Avail: NTIS HC A02/MF A01 CSCL 20A

The partial coherence analysis method for noise source/path determination is summarized and the application to a two input, single output system with coherence between the inputs is illustrated. The augmentation of the calculations on a digital computer interfaced with a two channel, real time analyzer is also discussed. The results indicate possible sources of error in the computations and suggest procedures for avoiding these errors. M.G.

N80-15875*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SUMMARY AND EVALUATION OF SEMI-EMPIRICAL METHODS FOR THE PREDICTION OF HELICOPTER ROTOR NOISE
Robert J. Pegg Dec 1979 96 p refs
(NASA-TM-80200) Avail: NTIS HC A05/MF A01 CSCL 20A

Existing prediction techniques are compiled and described. The descriptions include input and output parameter lists, required equations and graphs, and the range of validity for each part of the prediction procedures. Examples are provided illustrating the analysis procedure and the degree of agreement with experimental results. M.G.

N80-15876*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF INLET SUPPRESSOR DATA WITH APPROXIMATE THEORY BASED ON CUTOFF RATIO
Edward J. Rice and Laurence J. Heidelberg [1979] 28 p refs
Presented at the AIAA Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980
(NASA-TM-81386; E-294) Avail: NTIS HC A03/MF A01 CSCL 20A

Inlet suppressor far-field directivity suppression was quantitatively compared with that predicted using an approximate linear design and evaluation method based upon mode cutoff ratio. The experimental data was obtained using a series of cylindrical point-reacting inlet liners on a YF102 engine. The theoretical prediction program is based upon simplified sound propagation concepts derived from exact calculations. These indicate that all of the controlling phenomenon can be approximately correlated with mode cutoff ratio which itself is intimately related to the angles of propagation within the duct. The theory-data comparisons are intended to point out possible deficiencies in the approximate theory which may be corrected. After all theoretical refinements are made, then empirical corrections can be applied. A.R.H.

N80-15877# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
MICROCOMPUTER-CONTROLLED ULTRASONIC DATA ACQUISITION SYSTEM
W. A. Simpson, Jr. Nov 1978 53 p
(Contract W-7405-eng-26)
(ORNL/TM-6531) Avail: NTIS HC A04/MF A01

A mobile, high-speed data acquisition and storage system was developed. The system is controlled by an Intel 8080A microprocessor. The MCS80-SDK microcomputer board was chosen, and magnetic tape is used as the storage medium. A detailed description is provided of both the hardware and software developed to interface the magnetic tape storage subsystem to Biomation 8100 and Biomation 805 waveform recorders. A boxcar integrator acquisition system is also described for use when signal averaging becomes necessary. Both assembly language and machine language listing are provided for the software. DOE

N80-15878# Sandia Labs., Albuquerque, N. Mex. Environmental Research Div.
ATTEMPT TO MEASURE SONIC BOOM CAUSTICS SUPERSONIC HVAR ROCKET SLEDS
J. W. Reed Jun 1979 42 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1541) Avail: NTIS HC A03/MF A01

Fifteen rocket sled tests were performed in an attempt to measure extreme overpressure magnifications in the sonic boom caustic created by accelerating supersonic vehicles. These sleds with 25-HVAR-rocket motors were accelerated to about 425 m/s, Mach 1.25, on a 1500 m track. It was established that sonic boom bow waves from these events were not strongly focused by propagation to 600 to 900 m from the track. It appears that nonlinear acoustic aperture effects prevented sharp focusing. Only 15 to 30% overpressure magnifications were recorded by an array of pressure gages. DOE

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-15879# Oak Ridge National Lab., Tenn.
ELECTRON IMPACT IONIZATION OF MULTICHARGED IONS
D. H. Crandall, D. C. Gregory, and R. A. Phaneuf Sep 1979 36 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7020) Avail: NTIS HC A03/MF A01

Experimental data are presented in tabular and graphical form for electron impact ionization cross sections of the ions B(3+), C(3+), C(4+), N(3+), N(4+), N(5+), O(3+), O(4+), O(5+), and Ar(4+) energies between the ionization thresholds and 1500 eV, with absolute accuracy varying between +-6% and +-17%. At present there are no other measurements of comparable accuracy for ions of initial charge greater than 2+. Calculated cross sections from the Lotz formula and scaled-Coulomb-Born prescription are compared with the data. Ionization rate coefficients for plasmas with Maxwellian electron energy distribution were computed from the measured cross sections for each ion species. These rates are compared with available theoretical and measured plasma ionization rates. DOE

N80-15880# Texas A&M Univ., College Station.
FAST NUMERICAL CALCULATIONS OF ION-ATOM COLLISIONS
J. F. Reading, A. L. Ford, and R. L. Becker 1979 25 p refs
Presented at the Workshop on Inner Shell Processes, Linz, Austria, 14 May 1979. Prepared in cooperation with ORNL
(Contract W-7405-eng-26)
(CONF-7905111-1) Avail: NTIS HC A02/MF A01

When a ion impinges on an atom, the cross sections for electronic transitions can be described in the independent electron model by functions of single electron amplitudes. A single centered expansion of the time-dependent wave function of an electron about the heavier nucleus, with charge Z/sub N/, is shown to be moderately successful in explaining the dependence of K-shell hole production on the charge, Z/sub p/, of the projectile. However, capture of electrons by the projectile is important for a complete understanding and can be incorporated, in principle, in the single-center approach by evaluation of a transition matrix element involving a final state on the projectile. A method was devised which allows convergence in the truncated expansion of Hilbert states. Comparisons are made to experiment. Future developments are discussed. DOE

N80-15881# California Univ., Livermore. Lawrence Livermore Lab.
SCALED HYDROGENIC APPROXIMATION WAVE FUNCTIONS
B. W. Shore Sep 1979 12 p refs
(Contract W-7405-eng-48)
(UCID-18167) Avail: NTIS HC A02/MF A01

Analytic expressions for atomic wave functions are presented and discussed. An approach which employs hydrogenic functions, suitably scaled, as approximate wave functions is described. The typical inaccuracies to be expected from such approximations are discussed. DOE

N80-15882# Massachusetts Inst. of Tech., Cambridge.
DEFORMED SHAPES OF HADRONS
J. Parmentola Jun 1979 21 p refs
(Contract EY-76-C-02-3069)
(COO-3069-T1) Avail: NTIS HC A02/MF A01

The possibility that the shape of the ground state configuration of a system of quarks interacting with a real scalar field is nonspherical is examined. The application of the variational principle to a simple model field theory of quarks coupled linearly to a real scalar field is used for the investgation. The model is applied to hadron spectroscopy for low lying nonstrange baryons. DOE

N80-15883# Stanford Linear Accelerator Center, Calif.
QUARK STRUCTURE FUNCTIONS OF MESONS, FRAGMENTATION FUNCTIONS, HIGHER-TWIST EFFECTS IN QCD, DEEP INELASTIC SCATTERING, AND THE DRELL-YAN PROCESS
E. L. Berger Jul. 1979 23 p refs Presented at the Intern. Conf. on High Energy Phys., Geneva, 27 Jun. 1979
(Contract EY-76-C-03-0515)
(SLAC-PUB-2362; CONF-790642-5) Avail: NTIS HC A02/MF A01

The specific effects associated with constituent binding in hadronic wave functions are examined. The wave functions are shown to be nonscaling, nonfactorizing 1/Q to the second power contributions to cross sections for semi-inclusive deep inelastic scattering, the Drell-Yan process, and other hard scattering reactions. Predictions for the 1/Q to the second power higher-twist terms and for the azimuthal angle dependence of the cross sections are discussed. DOE

N80-15884# Pennsylvania State Univ., University Park.
MULTICONFIGURATION HARTREE-FOCK METHOD FOR ATOMIC ENERGY LEVELS AND TRANSITION PROBABILITIES
C. F. Fischer 1978 17 p refs Presented at the 6th Intern. Conf. on Atomic Phys., Riga, 17-22 Aug. 1978
(Contract EG-77-S-02-4264)
(COO-4264-3; CONF-7808110-1) Avail: NTIS HC A02/MF A01

The effect of correlation in the motion of electrons in a many electron system is considered in the theoretical determination of atomic properties. The correlation effects are computed using the configuration interaction. Restriction is made to the discussion of outer processes of neutral atoms or ions of low degree of ionization in which the relativistic effects are small. The multiconfiguration Hartree-Fock method is used for cases which are treated as two electron systems. The first order theory and f values in the presence of crossovers are discussed. DOE

N80-15885# Texas A&M Univ., College Station. Dept. of Physics.
NUCLEON-NUCLEON SCATTERING PHASE SHIFTS
R. Bryan 1978 19 p refs Presented at the Conf. on Few Body Sys. and Nucl. Forces, Graz, Austria, 24 Aug. 1978
(Contract EY-76-S-05-5223)
(ORO-5223-12; CONF-780833-7) Avail: NTIS HC A02/MF A01

A number of nucleon-nucleon elastic and inelastic phase parameters from 0 to 800 MeV are presented and described. Phase shifts for the 1 = 1 states and the 1 = 0 states are examined. A.W.H.

N80-15886# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy.
SOME FEATURES OF RAYLEIGH SCATTERING FROM LIGHT ATOMS AND IONS
J. C. Parker and R. H. Pratt 18 Jul. 1979 21 p refs
(Contract W-7405-eng-48)
(UCRL-15046) Avail: NTIS HC A02/MF A01

The Rayleigh scattering cross sections for atoms and ions of low nuclear charge, particularly for photon energies in the vicinity of the threshold for photoionization from the K-shell are discussed. A sequence of resonances in the elastic scattering amplitude which occur at an energy corresponding to the excitation of a K-shell electron to a higher unfilled shell is examined. An isonuclear sequence is discussed in which the K-shell amplitudes share a common curve differing only in the position of the threshold. DOE

N80-15887# Oak Ridge National Lab., Tenn.
DIAGNOSTIC NEUTRAL BEAMS FOR SPECTROSCOPIC STUDIES OF IMPURITIES BY CHARGE-TRANSFER REACTIONS
R. C. Isler and J. F. Lyon 1979 6 p refs Presented at DOE Workshop on Plasma Wall Interactions, Germantown, Md., 31 May 1979
(Contract W-7405-eng-26)
(CONF-790585-2) Avail: NTIS HC A02/MF A01

Charge transfer reactions between hydrogen atoms and impurities are examined as a means for measuring the concentrations of fully stripped ions which exist throughout the volume of a confined plasma. An example is presented of a measurement of O(8+) from the ISX-B Tokamak where a heating neutral beam provides a source of neutral hydrogen in the plasma center. The possibility of more systematic analysis with better spatial resolution using a diagnostic beam is discussed. DOE

N80-15888# California Univ., Berkeley. Lawrence Berkeley Lab.
HEAVY ION COLLISIONS AT RELATIVISTIC ENERGIES
S. Nagamiya Jul. 1979 70 p refs Presented at Symp. on Heavy Ion Phys. from 10-200 MeV/A, Upton, N.Y., 16 Jul. 1979
(Contract W-7405-eng-48)
(LBL-9494; CONF-790743-3) Avail: NTIS HC A04/MF A01

The current understanding of the reaction mechanism is reviewed and described with the major interests related to geometry and dynamics. Also recent measurements of some new phenomena which cannot be easily explained within the framework of the available theoretical tools, phenomena that were observed at beam energies of 0.4 to 2 GeV/A are described. Topics for future study are briefly mentioned especially in connection with the study of collisions at beam energies of 10 to 200 Mev/A. DOE

N80-15889# Ames Lab., Iowa.
BILOCAL FIELD THEORY AND A MODEL FOR MESON SPECTROSCOPY, PART 1. TRIDENT PRODUCTION BY HIGH ENERGY CHARGED PARTICLES ON NUCLEI, PART 2 Ph.D. Thesis - Iowa State Univ.
K. Mita May 1979 135 p refs
(Contract W-7405-eng-82)
(IS-T-861) Avail: NTIS HC A07/MF A01

Bilocal field theory for quark confinement is considered in a combination of bilocal field theory with the covariant harmonic oscillator quark model. The formalism is viewed as a direct generalization of local Lagrangian field theory. The variational principle which is used to find the Euler-Lagrange equation for the bilocal field is discussed. A class of Lagrangian densities satisfying a boundary condition on the hypersurface of the internal domain, which is called the cell, are determined and the Lagrangian density with an internal covariant harmonic oscillator interaction is introduced to describe the static properties of the mesons. Calculations of trident production by high energy charged particles on nuclei in the framework of covariant perturbation theory are presented. The lowest order calculations are described in detail for pair production by charged bosons. Cross section formulas for the fermion primary, which is taken to be the proton for concreteness, are presented. DOE

N80-15890# American Univ., Washington, D. C.
LARGE MOMENTUM TRANSFER ELECTRON SCATTERING FROM FEW-NUCLEON SYSTEMS
R. G. Arnold Aug. 1979 18 p refs Presented at Intern. School of Intermediate Energy Nucl. Phys., Ariccia, Italy, 18 Jun. 1979
(Contract EY-76-C-03-0515)
(SLAC-PUB-2373) Avail: NTIS HC A02/MF A01

The experimental results from a series of measurements of large momentum transfer electron scattering at forward angles from nuclei with A less than or equal to 4 are reviewed. Theoretical interpretations of these data in terms of traditional nuclear physics models and in terms of quark constituent models are described. Some physics questions for future experiments are explored, and a preview of possible future measurements of magnetic structure functions of light nuclei at large Q to the 2nd power is given. DOE

N80-15891# Stanford Linear Accelerator Center, Calif.
PRODUCTION OF NEUTRINOS AND NEUTRINO-LIKE PARTICLES IN PROTON-NUCLEUS INTERACTIONS
Ph.D. Thesis
J. P. Dishaw Mar. 1979 82 p refs
(Contract EY-76-C-03-0515)
(SLAC-216) Avail: NTIS HC A05/MF A01

The direct production of neutrinos or neutrino like particles, i.e., neutral particles which interact weakly with hadrons, in proton-nucleus interactions at 400 GeV incident proton energy was examined. Possible sources of such particles include the semi-leptonic decay of new heavy particles such as charm, and the direct production of a light neutral Higgs particle such as the axion. The production of these particles was inferred by energy nonconservation in the collision of a proton with an iron nucleus. The total visible energy of the interaction was measured using a sampling ionization calorimeter. Energy nonconservation in the data is manifest as a non Gaussian distribution on the low side of the calorimeter measured energy. Model calculations which yielded the fraction of events expected in this non Gaussian behavior for the various sources of neutrinos or neutrino like particles are discussed. DOE

N80-15892# Los Alamos Scientific Lab., N. Mex.
QUANTITATIVE COMPARISON OF MULTIPLE-PHOTON ABSORPTION IN POLYATOMIC MOLECULES
O. P. Judd 1979 56 p refs Presented at 4th Intern. Conf. on Laser Spectry., Rottach-Egern, West Germany, 11 Jun. 1979
(Contract W-7405-eng-36)
(CONF-790690-3) Avail: NTIS HC A04/MF A01

A quantitative comparison of multiple photon absorption for a number of polyatomic molecules is presented. A basis for this comparison was developed which takes into account the different experimental conditions and molecular parameters, and provides suitable normalization of the fluence and absorption parameters. The normalization, and consequently the generalized interaction process is specified in terms of the spectroscopic absorption cross section of the molecule and the effective fraction of molecules that interact with the radiation field. The results of the study indicate that in terms of the normalized absorption variables, multiple-photon absorption is a general phenomena that is qualitatively the same for all molecules. Quantitative values of the radiation field and the functional dependence of eta(PHI) on the experimental parameters such as gas pressure, optical bandwidth, and optical pulse duration are derived. These results are compared with the anharmonic oscillator model for multiple photon excitation of polyatomic molecules. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-15893# Department of Energy, Washington, D. C. Office of Nuclear Energy Programs.
FISSION ENERGY PROGRAM OF THE U.S. DEPARTMENT OF ENERGY, FY 1980
Apr. 1979 315 p refs
(DOE/ET-0089) Avail: NTIS HC A14/MF A01

The fission energy program and program objectives are discussed. The program management and program strategy are described and the program budget is presented. The topics in the program which are discussed include thermal reactor technology, advanced isotope separation technology, water cooled breeders, gas cooled breeders, and space power applications. A.W.H.

N80-15894# California Univ., Livermore. Lawrence Livermore Lab.
SEISMIC SAFETY IN NUCLEAR-WASTE DISPOSAL
D. W. Carpenter and Donald Towse 26 Apr 1979 62 p refs
(Contract W-7405-eng-48)
(UCID-18125) Avail: NTIS HC A04/MF A01

Data on damage to underground equipment and structures from earthquakes, the record of associated motions, and the conventional methods of seismic safety-analysis and engineering are considered. Safety considerations may be divided into two classes: those during the operational life of a disposal facility, and those pertinent to the post-decommissioning life of the facility. Operational hazards may be mitigated by conventional construction practices and site selection criteria. Events that would materially affect the long-term integrity of a decommissioned facility appear to be highly unlikely and can be substantially avoided by conservative site selection and facility design. These events include substantial fault movement within the disposal facility and severe ground shaking in an earthquake epicentral region. Techniques need to be developed to address the question of long-term earthquake probability in relatively aseismic regions, and for discriminating between active and extinct faults in regions where earthquake activity does not result in surface ruptures. DOE

N80-15895# Dames and Moore, White Plains, N. Y.
APPLICABILITY OF A GENERIC MONITORING PROGRAM FOR RADIOACTIVE WASTE BURIAL GROUNDS AT OAK RIDGE NATIONAL LABORATORY AND IDAHO NATIONAL ENGINEERING LABORATORY
Jul. 1978 92 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-7167-1) Avail: NTIS HC A05/MF A01

Because data available on the burial grounds were insufficient for an adequate understanding of radionuclide migration patterns and accordingly, inadequate for the design of reliable monitoring programs, preliminary monitoring programs were designed in order to obtain additional data for a later implementation of reliable monitoring programs. The monitoring programs designed for ORNL consist primarily of the installation of surface water monitoring stations, the surveillance of trench sump wells, a test boring program to study subsurface geologic conditions, a ground water sampling program and the installation of instrumentation, specifically infiltrometers and evaporation pans, to develop data on the water balances. The program designed for the INEL burial ground includes installation of trench sumps, a ground water monitoring program, test borings to further define subsurface geohydrologic conditions and the installation of instrumentation to develop data on the site water balance. The estimated costs of implementing the recommended programs are included. DOE

N80-15896# California Univ., Livermore. Lawrence Livermore Lab.
GEOLOGIC FACTORS IN NUCLEAR WASTE DISPOSAL
M.S. Thesis
Donald Towse Jul. 1978 29 p refs
(Contract W-7405-eng-48)
(UCRL-52522) Avail: NTIS HC A03/MF A01

The geosciences and their relation to nuclear waste disposal and management are discussed. The problems of nuclear waste disposal and the hydrology, chemistry, and geometry of the nuclear waste migration process are examined. A computer simulation program developed to model and calculate nuclear waste migration from the repository to the biosphere is presented. The factors of the waste migration process are delineated including risk calculations of different media, geometries, potential individual and population dose, and radiation effects. A.W.H.

N80-15897# Brookhaven National Lab., Upton, N. Y.
FUSION ENERGY FOR HYDROGEN PRODUCTION
J. A. Fillo, J. R. Powell, M. Steinberg, R. Benenati (N.Y. Polytechnic Inst.), V. Dang (Burns and Roe), S. Fogelson (Burns and Roe), H. Isaacs (Burns and Roe), H. Kouts (Burns and Roe), M. Kuschner (Burns and Roe), and O. Lazareth 1978 7 p refs Presented at the 10th Symp. on Fusion Technol., Padova, Italy, 4-8 Sep. 1978
(Contract EY-76-C-02-0016)
(BNL-24906; CONF-780953-6) Avail: NTIS HC A02/MF A01

The use of thermonuclear fusion for the production of hydrogen from water is described. A conceptual design coupling fusion with high temperature electrolysis for the production of hydrogen is examined. Elements in the systems' design discussed are the

fusion blanket, the high temperature electrolyzers, the coupling of the fusion and electrolyzer systems, and the power conversion system. A.W.H.

N80-15898# California Univ., Berkeley. Lawrence Berkeley Lab.
PROSPECTS FOR HIGH ENERGY HEAVY ION ACCELERATORS
Christoph Leemann Mar. 1979 8 p refs Presented at the IEEE Particle Accelerator Conf., San Francisco, 12 Mar. 1979
(Contract W-7405-eng-48)
(LBL-8899; CONF-790327-110) Avail: NTIS HC A02/MF A01

The use of synchrotrons for the acceleration of heavy ions to relativistic energies is examined. The beam performance obtained or projected for the near future at operating facilities is evaluated. The requirements for the design of an ion accelerator such as ion masses beam intensity and desired energy are discussed. The utilization of superconducting magnets and the factor of injector brightness are discussed in relation to the adaption of a synchrotron to an ion acceleration. A.W.H.

N80-15899# California Univ., Livermore. Lawrence Livermore Lab.
TECHNICAL CONCEPT FOR A TEST OF GEOLOGIC STORAGE OF SPENT REACTOR FUEL IN THE CLIMAX GRANITE, NEVADA TEST SITE
L. D. Ramspott, L. B. Ballou, R. C. Carlson, D. N. Montan, T. R. Butkovich, J. E. Duncan, W. C. Patrick, D. C. Wilder, W. G. Brough, and M. C. Mayr 15 Jun. 1979 51 p refs
(Contract W-7405-eng-48)
(UCRL-52796) Avail: NTIS HC A04/MF A01

Spent fuel assemblies from an operating commercial nuclear reactor are to be placed in the Climax granite at the Nevada Test Site with six electrical simulator canisters in a storage drift and their effects compared. The test objectives, the technical issues, the site, and the preoperational measurement program are described along with thermal and mechanical response calculations, the characteristics of the spent fuel, the field instrumentation and data acquisition systems, and the system for handling the spent fuel. DOE

N80-15900# McElroy (Ralph) Co., Austin, Tex.
PARTICLE DYNAMICS IN ION LINEAR ACCELERATOR OPERATING IN DOUBLE FREQUENCY REGIME
V. A. Bomko, V. I. Volkov, Yu. Meleshkova, and N. A. Khiznyak 1979 34 p refs Transl. into ENGLISH of "Dinamika Chastits v Lineinom Uskoritele Ionov v Rezhime Uskoreniva Na Dvukh Volnakh s Kratnoi Chastotoi" Rept No. KhFTI-77-40 AN Ukrainskoj SSR, Kharkov, Fiziko-Tekhnicheskij Inst., 1977 34 p
(LA-TR-79-19; KHFTI-77-40) Avail: NTIS HC A03/MF A01

The particle dynamics of particle acceleration in an accelerating device of a cavity resonator with type drift tubes under the effect of an electric field is studied. The electric field is the result of the superposition of two simultaneously excited waves with the frequency of the secondary wave being an integral multiple of the primary wave frequency. The phase characteristics of the particle dynamics were determined, the formation process of the bunches and their dynamics along the accelerator were investigated, and the monoenergetic character of the beam at various stages of acceleration was examined. A.W.H.

N80-15901# Kanner (Leo) Associates, Redwood City, Calif.
CALCULATION OF QUADRIPOLAR FOCUSING OF A LINEAR ACCELERATOR AND OF BEAM ADAPTATION IN THE PRESENCE OF A SPACE CHARGE
B. Bru 1979 41 p Transl. into ENGLISH of "Calcul de la Focalisation Quadripolaire d'un Linac et de l'Adaption du Faisceau en Presence de Charge d'Espace" Report No. MPS/LIN/70-10 European Organ. for Nucl. Res., Geneva, 5 Nov. 1970 41 p
(LA-TR-79-18; MPS/LIN/70-10) Avail: NTIS HC A03/MF A01

The focusing structure of a proton accelerator (as well as the parameters adapted to this structure) in the presence of space charge forces is determined. The method is described in which the beam is likened to a uniformly charged ellipsoid, and the space charge forces are calculated as a function of its three dimensions. DOE

N80-15902# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report
W. J. Maraman, comp. Aug. 1979 44 p
(Contract W-7405-eng-36)
(LA-7980-PR) Avail: NTIS HC A03/MF A01

The use of Pu(-238)O2 in radioisotopic power systems is discussed. The three programs involved are the following: (1) general-purpose heat source development; (2) space nuclear safety; and (3) radioisotopic terrestrial safety. DOE

N80-15903# Battelle Human Affairs Research Centers, Seattle, Wash.
PUBLIC POLICY ISSUES IN NUCLEAR WASTE MANAGEMENT
S. M. Nealy and L. M. Radford Oct. 1978 98 p refs
(Contract EW-78-C-06-1076)
(PNL-2743) Avail: NTIS HC A05/MF A01

Issues analyzed include temporal equity; geographic and socioeconomic equity; implementation of a nuclear waste management system; and public involvement. DOE

N80-15904# California Univ., Berkeley. Lawrence Berkeley Lab.
ANGULAR MOMENTUM AND THE COLLECTIVE MODES EXCITED IN DEEP-INELASTIC PROCESSES AND IN FISSION
L. G. Moretto May 1979 20 p refs Presented at Conf. on Large Amplitude Collective Nucl. Motion, Lake Balaton, Hungary, 10 Jun. 1979
(Contract W-7405-eng-48)
(LBL-9173; CONF-790660-5) Avail: NTIS HC A02/MF A01

The angular momentum effects in deep inelastic processes and fission were studied in the limit of statistical equilibrium. The model consists of two touching liquid drop spheres. Angular momentum fractionation was found to occur along the mass asymmetry coordinate. Thermal excitation of fragment spin is predicted to occur in the degrees of freedom which can bear angular momentum, like wriggling, tilting, bending, and twisting. DOE

N80-15905# Los Alamos Scientific Lab., N. Mex.
RELATIVISTIC ELECTRON BEAM PROPAGATION: TWO-STREAM THEORY Progress Report, Jan. 1978 - Jan. 1979
B. S. Newberger Jul. 1979 48 p refs
(Contract W-7405-eng-36)
(LA-7912-MS) Avail: NTIS HC A03/MF A01

The two stream instability theory as it pertains to the propagation of relativistic electron beams through low pressure neutral gases is examined. A mathematical model is described which simulates both aspects of the stability issue: linear stabilization of the two stream mode and the nonlinear state of an unstable system. DOE

N80-15906# Oak Ridge National Lab., Tenn.
COMPATIBILITY OF STRUCTURAL MATERIALS WITH FUSION REACTOR COOLANT AND BREEDER FLUIDS
J. H. DeVan 1979 8 p refs Presented at 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790125-77) Avail: NTIS HC A02/MF A01

Fusion reactors which are characterized by a lithium containing blanket, a heat transfer medium that is integral with the blanket and first wall, and a heat engine that couples to the heat transfer medium are described. A variety of lithium containing substances identified as potential blanket materials, including molten lithium metal, molten LiF-BeF2, Pb-Li alloys, and solid ceramic compounds such as Li2O are examined for use in fusion reactors. The materials factors that underlie the selection of workable combinations of blankets and coolants are studied and the materials compatibility problems generic to those blanket coolant combinations currently being considered in reactor design studies are discussed. DOE

N80-15907# Princeton Univ., N. J. Plasma Physics Lab.
FUSION-SUPPORTED DECENTRALIZED NUCLEAR ENERGY SYSTEM

D. L. Jassby Apr. 1979 29 p refs Presented at the Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract EY-76-C-02-3073)
(PPPL-1555; CONF-790803-36) Avail: NTIS HC A03/MF A01

A decentralized nuclear energy system using mass produced pressurized water reactors in the size range 10 to 300 MW (thermal) is evaluated. Attention is given to maximizing the refueling interval with no interim batch shuffling in order to minimize fuel transport, reactor downtime, and opportunity for fissile diversion. The requirement of a substantial fissile enrichment due to the above objectives is discussed with U-233 reported as the preferred fuel. Application of the neutral beam driven Tokamak fusion neutron source to a U-233 breeding pilot plant is examined. DOE

N80-15908# Sandia Labs., Albuquerque, N. Mex.
PULSED POWER FOR FUSION
T. H. Martin 1979 7 p refs Presented at the Pulsed Power Conf., Lubbock, Tex., 12 Jun. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0933C; CONF-790622-7) Avail: NTIS HC A02/MF A01

Research conducted in support of the pulsed power approach to fusion resulted in the creation of an extendable accelerator technology that could be used at levels up to 100 TW and 30 MJ. These types of accelerators are efficient (about 30 to 50 percent) and for ion outputs in the 1 to 3 MJ range they may provide an approach to economically feasible 200 MW electric power reactor. Repetitive pulsing of the pulsed power system for > 10 to the 9th power short lifetimes must be solved along with ion beam concentration, bunching, and drifting. DOE

N80-15909# Idaho National Engineering Lab., Idaho Falls.
ENVIRONMENTAL SURVEILLANCE REPORT FOR THE INEL RADIOACTIVE WASTE MANAGEMENT COMPLEX Annual Report, 1978
L. E. Adams, D. H. Janke, and P. T. Dickman Jun. 1979 58 p refs
(Contract EY-76-C-07-1570)
(TREE-1357) Avail: NTIS HC A04/MF A01

Data from and discussions about routine radiological monitoring of atmospheric, hydrologic, geologic, and biotic environments of the radioactive waste management complex (RWMC) are given. It is concluded that: (1) RWMC operations have not adversely affected local, existing environment; (2) environmental conditions within the transuranic storage area are not corrosive enough to adversely affect transuranic waste storage containers; and (3) the addition of lake bed soil to pit, trench, and soil test plot areas has altered the moisture cycle characteristic of RWMC soil. DOE

N80-15910# California Univ., Livermore. Lawrence Livermore Lab.
THERMAL-STRESS ANALYSIS OF ROCK FORMATIONS FOR NUCLEAR FUEL AND WASTE STORAGE
R. C. Greenlaw and M. A. Gerhard 11 Jun. 1979 30 p refs Presented at ADINA Conf., Cambridge, Mass., 1 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-81992; CONF-790827-2) Avail: NTIS HC A03/MF A01

The use of the computer programs ADINA and ADINAT for analysis of heat flow, temperature distribution, and underground stresses and deformations due to excavation and storage of nuclear fuel and/or waste canisters in hard rock formations is discussed. Successful and unsuccessful combinations of elements and properties for both the thermal and the stress analyses are determined. A discussion of code testing and verification of the programs is presented and an apparent error due to differences in the way in which ADINA interpolates the temperature and strain fields within each element is examined. DOE

N80-15911# California Univ., Berkeley. Lawrence Berkeley Lab.
ROCK MASS CHARACTERIZATION FOR STORAGE OF NUCLEAR WASTE IN GRANITE
P. A. Witherspoon, P. Nelson, T. Doe, R. Thorpe, B. Paulsson, J. Gale (Waterloo Univ., Ontario), and C. Forster (Waterloo Univ., Ontario) Feb. 1979 37 p refs Presented at the 4th Congr. of Intern. Soc. for Rock Mech., Montreux, Switzerland, 2-8 Sep. 1979
(Contract W-7405-eng-48)
(LBL-8570; SAC-18) Avail: NTIS HC A03/MF A01

The rock mass characterization in granite adjacent to an iron mine at Stripa, Sweden is described. The responses to thermal loading of jointed rock in situ, and mechanical tests on cores from 25 mm to 1 m in diameter are presented. Geological characterization included detailed surface mapping, subsurface mapping, and core mapping. Geophysical characterization used a variety of borehole techniques, with emphasis on sonic methods. The hydrologic characterization was done through injection tests, pump tests, water pressure measurements, and controlled inflow tests to tunnels. Mapping studies were useful in defining continuity and fracture system geometry. They did not give aperture, a factor significant in terms of both water flow and the displacements due to heating. Of the geophysical techniques, sonic methods were bound to be most effective in fracture definition. Hydrologic work yielded primarily aperture data, which with fracture geometry was used to calculate directional permeabilities. DOE

N80-15912# Los Alamos Scientific Lab., N. Mex.
SHALLOW LAND BURIAL: EXPERIENCE AND DEVELOPMENTS AT OAK RIDGE AND LOS ALAMOS
J. L. Warren 1979 35 p ref Presented at Intern. Symp. on Underground Disposal of Radioactive Wastes, Otaniemi, Finland, 2 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1039; CONF-790711-1) Avail: NTIS HC A03/MF A01

Guidelines which regulate the construction of waste disposal facilities, burial and storage operations, disposal site maintenance and restoration, and documentation of all waste disposal activities are presented. Monitoring programs at the past and current solid waste disposal sites are discussed. DOE

N80-15913# South Carolina Univ., Columbia. Inst. of Archeology and Anthropology.
INTENSIVE ARCHEOLOGICAL SURVEY OF A POTENTIAL DEFENSE WASTE PROCESSING FACILITY SITE, SAVANNAH RIVER PLANT, AIKEN AND BARNWELL COUNTIES, SOUTH CAROLINA. RESEARCH MANUSCRIPT SERIES 148
R. D. Brooks and G. T. Hanson 1979 35 p refs
(Contract EW-78-S-09-1072)
(DOE/SR-01072-3) Avail: NTIS HC A03/MF A01

No archeological remains were uncovered in the proposed DWPF construction area. To assure preservation of any buried sites well beneath the present ground surface in the construction area, it is suggested that the Department of Energy arrange to have an archeologist monitor the excavation of the building sites for the DWPF. It is recommended that process be devised by which an archeologist makes daily checks of the spoil piles for archeological material. Regarding related construction on the periphery of the main construction area (e.g., roads, powerlines, waterlines), it is recommended that the triangle formed by the roads F, 4 and E be cleared for construction of any type for archeological purposes and that the archeologists be notified to monitor the construction for possible buried sites. Although the site 38AK281 is not considered to be significant to present or future research, it is recommended that an archeologist be notified when construction in that area is to take place in order to monitor any archeological materials uncovered. DOE

N80-15914# South Carolina Univ., Columbia. Inst. of Archeology and Anthropology.
INTENSIVE ARCHEOLOGICAL SURVEY OF A POTENTIAL INDEPENDENT SPENT FUEL STORAGE FACILITY, SAVANNAH RIVER PLANT, AIKEN AND BARNWELL COUNTIES, SOUTH CAROLINA. RESEARCH MANUSCRIPT SERIES 141
G. T. Hanson Dec. 1978 77 p refs
(Contract EW-78-S-09-1072)
(DOE/SR-01072-1) Avail: NTIS HC A05/MF A01

A complete inventory and evaluation of the archeological resources within the 550 acre parcel of the proposed ISFSF

area is presented. Eight previously unrecorded sites were found during the survey, with only one occuring within the main construction area. Three sites showed evidence of prehistoric occupations while the remaining sites were attributable to the historic period. Maps of the sites, the environmental setting, and the archeological background are discussed. DOE

74 OPTICS

Includes light phenomena.

N80-15915# Stanford Univ., Calif.
ACOUSTICALLY SCANNED OPTICAL IMAGING DEVICES Semiannual Report, 1 Jan. - 30 Jun. 1979
G. S. Kino, D. Behar, J. Bowers, B. Khuri-Yakub, and H. Olaisen Aug. 1979 48 p refs
(Contract N00014-76-C-0129; ARPA Order 2778)
(AD-A074954; GL-3006; SAR-8) Avail: NTIS HC A03/MF A01 CSCL 09/5

A storage correlator has been operated for the first time as an inverse filter by operating in a feedback loop to iteratively converge via the LMS algorithm to the desired filter. A pulse and a ghost echo have been deconvolved to a single pulse with the sidelobe level 9 dB below the original echo level. The ZnO magnetron sputtering system is operating well; ZnO on Si convolvers have been constructed with better efficiency (-55 dBm) than any we have previously made. A -45 dBm efficiency Delta(v)/v waveguide convolver has been constructed. GRA

N80-15916# Texas A&M Univ., College Station. Dept. of Physics.
PHASE MATRIX MEASUREMENTS FOR ELECTROMAGNETIC SCATTERING BY SPHERE AGGREGATES
Jerold R. Bottiger, Edward S. Fry, and Randall C. Thompson 4 Sep. 1979 18 p refs
(Contract N00014-75-C-0537)
(AD-A074464; TR-2; Rept-2EX) Avail: NTIS HC A02/MF A01 CSCL 20/3

An instrument which permits accurate measurement of all elements of the phase matrix simultaneously has been constructed. Aggregates consisting of attached polystyrene spheres are suspended in an electric field and the phase matrix is measured. GRA

N80-15917# Ballistic Research Labs., Aberdeen Proving Ground, Md.
STATISTICS OF OPTICAL RADIATION SCATTERED FROM ROUGH SURFACES
Paul H. Deitz and Tommy E. Buder Jul. 1979 16 p
(DA Proj. 1L1-61102-AH-43)
(AD-A074351; AD-E430293; ARBRL-MR-02929) Avail: NTIS HC A02/MF A01 CSCL 20/6

When coherent illumination is scattered from a rough surface, the resulting pattern of light (speckle pattern) has stochastic variations in irradiance which relate to the scattering surface itself. A computer simulation for a particular scattering geometry has been made in which four statistical parameters of speckle patterns have been related to various pairwise combinations of surface height and correlation interval for a Gaussian scattering surface. The corresponding optical analogue of this simulation has potential application to studies of gun erosion. GRA

N80-15918# Arizona Univ., Tucson. Dept. of Physics.
DETERMINATION OF OPTICAL CONSTANTS FOR POWDERED MATERIALS IN THE 10 MICRON INFRARED REGION Final Report
Donald R. Huffman 3 Sep. 1979 62 p refs
(Contract N00019-78-C-0479)
(AD-A074485) Avail: NTIS HC A04/MF A01 CSCL 20/6

In order to successfully tailor the aerosol to the specific need we should be able to engineer the optical properties of the particulates, that is to calculate the performance of various systems and to produce the one that most closely fits the desired characteristics. In order to accomplish this optical engineering of aerosols the following two things are necessary: (1) a catalogue of the wavelength-dependent optical constants for various solids and liquids; and (2) adequate theoretical representation of how extinction is related to such factors as particle size, shape, and coatings. GRA

N80-15919# Stanford Univ., Calif. Edward L. Ginzton Lab.
ACOUSTIC MICROSCOPY AT CRYOGENIC TEMPERATURES Annual Summary Report, 1 Jul. 1978 - 30 Jun. 1979
C. F. Quate and J. Heiserman Sep. 1979 20 p refs
(Contract N00014-77-C-0412)
(AD-A074502; SU-GL-3008) Avail: NTIS HC A02/MF A01 CSCL 20/6

We report progress in work on a cryogenic acoustic microscope. Results in liquid argon and nitrogen at about 4300 angstrom wavelength are discussed. Images of gratings and integrated circuits are presented as examples of resolution and contrast. Work on producing effective matching layers to improve acoustic power transfer between solids and helium is summarized. Finally we present images taken in superfluid helium held at 1.95 degrees K. A wavelength of 3600 angstrom was attained, the shortest wavelength ever achieved in an acoustic microscope. GRA

N80-15920# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESTORATION OF SPECKLE IMAGES
Jae S. Lim and Hamid Nawab 3 Jul. 1979 29 p refs
(Contracts F19628-78-C-0002; N00014-75-C-0951; AF Proj. 649L)
(AD-A074626; TN-1979-52; ESD-TR-79-167) Avail: NTIS HC A03/MF A01 CSCL 20/6

In this report, several techniques to reduce speckle noise (more generally signal independent multiplicative noise) in images are studied. The techniques include gray scale modification, frame averaging, low-pass filtering in the intensity and density domain, and application of the short space spectral subtraction image restoration technique in the density domain. Some discussions on the theoretical basis of the techniques studied are given and their performances are illustrated by way of examples. GRA

N80-15921# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
RAY AND WAVE OPTICS OF INTEGRABLE AND STOCHASTIC SYSTEMS
S. W. McDonald and A. N. Kaufman Jul. 1979 11 p refs
Presented at the Intern. Workshop on Intrinsic Stochasticity in Plasmas, Cargese, Corsica, France, 18 Jun. 1979
(Contract W-7405-eng-48)
(LBL-9465; CONF-7906106-1) Avail: NTIS HC A02/MF A01

The generalization of WKB methods to more than one dimension is discussed in terms of the integrability or non-integrability of the geometrical optics (ray Hamiltonian) system derived in the short-wave approximation. In the two-dimensional case the ray trajectories are either regular or stochastic, and the qualitative differences between these types of motion are manifested in the characteristics of the spectra and eigenfunctions. These are examined for a model system which may be integrable or stochastic, depending on a single parameter. DOE

N80-15922# Texas A&M Univ., College Station. Dept. of Physics.
MEASUREMENT OF POLARIZED LIGHT SCATTERING VIA THE MUELLER MATRIX
Randall C. Thompson, Jerold R. Bottiger, and Edward S. Fry 4 Sep. 1979 45 p refs
(Contract N00014-75-C-0537)
(AD-A074431; TR-3) Avail: NTIS HC A03/MF A01 CSCL 20/6

A new instrument for rapid and accurate measurement of the Mueller matrix is described. Distinct measurements of all sixteen elements are made simultaneously and with an absolute accuracy of 1 percent to 5 percent. The instrument employs electro-optic modulators. Results are presented for several simple optical devices and systems. GRA

N80-15923# National Center for Atmospheric Research, Boulder, Colo.

MIE SCATTERING CALCULATIONS, ADVANCES IN TECHNIQUE AND FAST, VECTOR-SHAPED COMPUTER CODES
Warren J. Wiscombe Jun. 1979 98 p refs
(PB-301388/5; NCAR-TN-140+STR) Avail: NTIS HC A05/MF A01 CSCL 20F

Two MIE scattering codes are presented. The first, MIEV0, attains as much vector speed as possible using the minimum possible memory and is suitable for almost any computer, whether or not it has vector capabilities. The second, MIEV1, attains maximum vector speed at the expense of using more money than MIEV0. It is most suitable for vector-processing computers. MIEV1 is from 10 percent to 300 percent faster on the CRAY-1 than MIEV0. GRA

N80-15924# National Technical Information Service, Springfield, Va.
FIBER OPTICS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1977 - Aug. 1979
Brian Carrigan Oct. 1979 227 p Supersedes NTIS/PS-78/0714; NTIS/PS-77/0581; NTIS/PS-76/0490; NTIS/PS-75/420; COM-74-10869
(NTIS/PS-79/1006/0; NTIS/PS-78/0714; NTIS/PS-77/0581; NTIS/PS-76/0490; NTIS/PS-75/420; COM-74-10869) Avail: NTIS HC $28.00/MF $28.00 CSCL 20F

Federally-funded research is cited on design, theory, fabrication, performance, and testing of fiber optical materials, components, and systems. Research on cables, transmission lines, waveguides, couplers, connectors, and lasers is covered. Fiber optics application in optical communications, data transmission systems, signal processing, display systems, integrated optical circuits, measuring instruments, detectors, avionics, fire control systems, recording systems, and underwater communications are included. Symposia are also cited. This updated bibliography contains 219 abstracts, 116 of which are new entries to the previous edition. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-15925# Villanova Univ., Pa. Dept. of Electrical Engineer.
INVESTIGATION OF MICROWAVE CIRCUITS THAT ARE SUITABLE FOR APPLICATION TO INTEGRATE WITH THE PRASAD-LEIBYS' PLASMA MILLIMETER WAVE TUBE
Hsu Tse-Wen 15 Sep. 1979 116 p refs
(Grant AF-AFOSR-3664-78)
(AD-A074988; AFOSR-79-1046TR) Avail: NTIS HC A06/MF A01 CSCL 09/1

It is the purpose of this research study to investigate theoretically several microwave circuits which are suitable to integrate with a beam-plasma millimeter wave tube, and the problems associated with them. Three microwave structures have been studied: (1) The hollow dielectric tube waveguides, (2) The cylindrical metal waveguide partially filled with a coaxial dielectric tube, and (3) The hollow dielectric tube waveguide supported by a conducting cylinder. They all employ dielectric tube as their basic element, and they all operate in the circularly symmetric transverse electric modes. The field problems have been solved and the resulting transcendental mode equations are solved graphically in conjunction with their respective dispersion relations. It is found that a critical frequency exists for all three structures, and below which no propagation waves can take place. As a circuit element or cavity both types I and II structures are shown to have the very desirable property of confining, and re-directing the emitted electromagnetic radiation from the plasma tube. Both of these structures are capable of single mode operation at very short wavelengths. It is a surprise to find that when type II structure is operated at the very high frequency mode, the structure behaves as if it is a dielectric tube waveguide, limited on the outside by a conducting surface of the cylindrical metal wall, and on the inside by a medium of small dielectric constrant. GRA

N80-15926# Naval Research Lab., Washington, D. C.
DEVELOPMENT OF IMPLODING LINER SYSTEMS FOR THE NRL LINUS PROGRAM Interim Report
P. J. Turchi, R. L. Burton, A. L. Cooper, R. D. Ford, and D. J. Jenkins 28 Sep. 1979 13 p refs
(RR0110941)
(AD-A075005; NRL-MR-4092) Avail: NTIS HC A02/MF A01 CSCL 20/9

For nearly two decades, the idea of creating fusion plasmas by the implosion of cylindrical shells or liners has appealed to workers interested in high energy density systems. A variety of schemes have been offered over the years to accomplish the adiabatic compression of plasmas at megagauss magnetic field levels by imploding liner magnetic flux compression techniques. The two main elements of such schemes have been the implosion of an electrically conducting cylindrical liner and the creation of an initial plasma suitable for compression by the surrounding liner. Some progress has been made both experimentally and conceptually in regard to plasmas that could be compressed by liner implosion, but no experimental test has yet been accomplished successfully in which the energy and temperature of the magnetically-confined plasma has been increased into a significant regime by liner implosion. Considerable progress has been made, however, in developing liner implosion techniques suitable for both experimental development and eventual imploding liner fusion reactors. The principal development has been the achievement of controlled, reversible liner implosions with excellent symmetry and surface quality. This paper reviews some of the highlights of the development of liner implosion systems at the Naval Research Laboratory and indicates directions of future work. GRA

N80-15927# Michigan Univ., Ann Arbor.
ANALYSIS OF THE EARLY PHASE OF TOKAMAK PLASMA OHMIC HEATING
E. vonValtier Apr. 1979 92 p refs Prepared for Westinghouse Electric Corp., Pittsburgh
(Contract EG-77-C-02-4231)
(WFPS-TME-79-018) Avail: NTIS HC A05/MF A01

Ohmically heated Tokamak systems were studied in which the evolution of the plasma is followed through the initiation period up to 100 eV. A zero dimensional model of the bulk plasma is utilized, with a one dimensional model of the plasma inductance. Losses due to ionization and oxygen impurity processes are evaluated using the available atomic data. The total ohmic heating system energy expended in forming and heating the plasma up to a reference temperature of 100 eV is calculated and found to be a function of the maximum induced loop voltage. DOE

N80-15928# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY COUPLING IN THE PLASMA FOCUS
T. E. Wainwright, W. L. Pickles, H. L. Sahlin, and D. F. Price 23 Apr. 1979 14 p refs Presented at 2nd Intern. Conf. on Energy Storage, Compression and Switching, Venice, 5 Dec. 1979
(Contract W-7405-eng-48)
(UCRL-81907; CONF-781247-4) Avail: NTIS HC A02/MF A01

A 125 kJ plasma focus was used to investigate mechanisms for rapid coupling of inductively stored energy into plasmas. The coupling which takes place through the formation of an electron or ion beam that deposits its energy in a target or directly by the penetration of the magnetic field into a resistive plasma is discussed. Some preliminary results from experiments of both types are described. The experiments use a replaceable conical anode tip that is intended to guide the focus to within a few millimeters of the axis, where it can suddenly deliver energy either to a small target or to particles that are accelerated. X-ray and fast ion diagnostics were used to study the effects. DOE

N80-15929# California Univ., Berkeley. Lawrence Berkeley Lab.
EQUILIBRIUM AND STABILITY IN STRONGLY INHOMOGENEOUS PLASMAS Ph.D. Thesis
H. E. Mynick Oct. 1978 222 p refs

(Contract W-7405-eng-48)
(LBL-8528) Avail: NTIS HC A10/MF A01

The equilibrium of strongly inhomogeneous, collisionless, slab plasmas, was studied. A generalized version of a formalism previously developed, which permits the generation of self consistent equilibria, for plasmas with arbitrary magnetic shears, and variation of magnetic field strength was used. A systematic procedure was developed for deriving the form of the guiding center Hamiltonian K, for finite eta, in an axisymmetric geometry. An expression for the first adiabatic invariant (the gyroaction) was derived. A formalism was developed for the study of the stability of strongly inhomogeneous, magnetized slab plasmas and applied to the ion drift cyclotron instability. DOE

N80-15930# California Univ., Davis. Dept. of Mechanical Engineering.
RESEARCH ON THE HYLIFE LIQUID-FIRST-WALL CONCEPT FOR FUTURE LASER FUSION REACTORS Final Report, Sep. 1977 - Mar. 1979
M. A. Hoffman Mar. 1979 40 p refs
(Contract W-7405-eng-48)
(UCRL-15033; FR-4) Avail: NTIS HC A03/MF A01

Protection of the structural walls of a laser fusion reactor with a curtain or wall of liquid lithium jets is examined. Planar sheet water jets issuing vertically downward from slit nozzles are evaluated for this application. The nozzles were subjected to forced harmonic excitation to simulate the vibrational environment of the laser fusion reactor, and experiments were run at both 1 atm and 0.2 atm pressure. Linear temporal stability theory is shown to predict the onset of the unstable regime and the spatial growth rates reasonably well for the cases where the amplitudes of the nozzle excitation are not too large and the waveform is nearly sinusoidal. DOE

N80-15931# Los Alamos Scientific Lab., N. Mex.
PARAMETRIC STUDY OF THE TORMAC FUSION REACTOR CONCEPT
R. L. Miller, R. A. Krakowski, and C. G. Bathke Aug. 1979 62 p refs
(Contract W-7405-eng-36)
(LA-7935-MS) Avail: NTIS HC A04/MF A01

A preliminary power balance for the D-T tormac magnetic fusion reactor concept is examined parametrically in order to establish general scaling relationships, tradeoffs, and constraints. The results are based on the simplifying assumptions of steady state operation, a homogeneous plasma, and ideal thin sheath, mirror-like confinement. Crucial physics uncertainties requiring further theoretical and experimental research attention were identified. Representative reactor physics operating points are generated to illustrate anticipated tormac reactor embodiments. DOE

N80-15932# Illinois Univ., Urbana.
MONTE CARLO SIMULATION OF NEUTRAL-BEAM INJECTION FOR MIRROR FUSION REACTORS Ph.D. Thesis
R. L. Miller 1979 153 p refs
(Contract EY-76-S-02-2218)
(COO-2218-133) Avail: NTIS HC A08/MF A01

Computer simulation techniques using the Monte Carlo method are developed for application to the modeling of neutral-beam injection into mirror-confined plasmas of interest to controlled thermonuclear research. The energetic neutral-beam particles interact with the target plasma through electron-atom and ion-atom collisional ionization as well as ion-atom charge-transfer collisions to give a fractional trapping of the neutral beam and a loss of charge-transfer-produced neutrals which escape to bombard the reactor first wall. Appropriate interaction cross sections for these processes are calculated for the assumed anisotropic, non-Maxwellian plasma ion phase-space distributions. DOE

N80-15933# California Univ., Livermore. Lawrence Livermore Lab.
SUPERCONDUCTIVITY FOR MIRROR FUSION
C. D. Henning Sep. 1978 23 p Presented at Appl. Superconductivity Conf., Pittsburgh, 25 Sep. 1978
(Contract W-7405-eng-48)
(UCRL-81693; CONF-780952-39) Avail: NTIS HC A02/MF A01

The use of mirror magnets in fusion reactors due to the high and steady magnetic fields they generate and the capacity to negate pulsed field is discussed. The past and present development of mirror magnets is reviewed and mirror fusion experiments are reported. A.W.H.

N80-15934# Los Alamos Scientific Lab., N. Mex.
GLOBAL PROPERTIES OF OHMICALLY HEATED REVERSED-FIELD PINCHES
R. A. Gerwin 1979 13 p refs
(Contract W-7405-eng-36)
(LA-UR-79-2344) Avail: NTIS HC A02/MF A01

The simultaneous requirements of power balance and pressure balance are considered in ohmically heated reversed field pinches. The treatment generalizes the Pease-Braginskii pinch current limit by including toroidal magnetic field, anomalous resistivity, nonradiative losses, and time dependent fields. The rise of the temperature to a state of power balance is discussed. The practical parameter windows implied by the joint action of power balance and pressure balance are displayed. DOE

N80-15935# California Univ., Los Angeles.
OBSERVATION OF STIMULATED BRILLOUIN SCATTERING IN A MICROWAVE PLASMA INTERACTION EXPERIMENT
H. E. Huey, E. Masz, and N. C. Luhmann, Jr. Jul. 1979 13 p refs
(Contract EY-76-C-03-0010)
(PPG-422) Avail: NTIS HC A02/MF A01

Stimulated Brillouin scattering of microwave radiation is investigated in an underdense laboratory plasma. The energy and momentum selection rules are seen to be satisfied for a variety of incident wavelengths and ion species (He, Ne, Ar and Kr). The threshold power, growth rate, and scattered power appear to be consistent with the finite interaction length theory. Saturation of the backscatter is observed and compared with existing theories. DOE

N80-15936# Princeton Univ., N. J. Plasma Physics Lab.
THEORY OF DRIFT-WAVE EIGENMODES IN TOROIDAL PLASMAS
L. Chen and C. Z. Cheng Jul. 1979 37 p refs
(Contract EY-76-C-02-3073)
(PPPL-1562) Avail: NTIS HC A03/MF A01

The eigenmode equation describing ballooning drift waves in toroidal plasmas is analyzed using the WKB method. Two branches of eigenmodes are identified. One is slab like and the other is a branch induced by the finite toroidicity. The slab like eigenmodes correspond to unbounded states and experience finite shear damping. The toroidicity induced eigenmodes correspond to local quasibounded states with negligible shear damping. Corresponding analytical theories are presented. DOE

N80-15937# Los Alamos Scientific Lab., N. Mex.
PHYSICAL CONDITIONS IN REVERSED FIELD PINCHES AND THETA PINCHES AS INFERRED FROM SIMULATIONS
A. Sgro 1979 14 p refs Presented at Intern. School of Plasma Phys., Varenna, Italy, 27 Aug. - 8 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2368) Avail: NTIS HC A02/MF A01

The nature of the transport in certain pinches is investigated by comparing experimental data with computational predictions of the AURORA code. The presence of anomalous resistivity and anomalous thermal conduction during the implosion phase of the ZT-S reversed field pinch is examined. Evidence is presented indicating that a low density wall emitted plasma occupies the region between the main plasma column and the wall. Simulations of a theta pinch show that anomalous heating of the ions due to microturbulent fields makes a noticeable contribution to the ion energetics. DOE

N80-15938# California Univ., Livermore. Lawrence Livermore Lab.
NEAR AND LONG TERM PULSE POWER REQUIREMENTS FOR LASER DRIVEN INERTIAL CONFINEMENT FUSION
W. L. Gagnon 12 Jun. 1979 24 p refs Presented at the

2nd IEEE Intern. Pulsed Power Conf., Lubbock, Tex., 12-14 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82661; CONF-790622-22) Avail: NTIS HC A02/MF A01

The development of large, ND:glass laser systems in order to address the basic physics issues associated with light driven fusion targets is discussed. The development of lasers as drivers for fusion power plants which exhibit higher efficiencies and shorter wavelengths is reported. The pulse power technology which was developed to meet the near and far term needs of the laser fusion program is evaluated. A.W.H.

N80-15939# California Univ., Livermore. Lawrence Livermore Lab.
PLASMA CROWBARS IN CYLINDRICAL FLUX COMPRESSION EXPERIMENTS
L. J. Suter 18 May 1979 28 p refs Presented at the 2d Intern. Conf. on Megagauss Magnetic Field Generation and Related Topics, Washington, D.C., 29 May - 1 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82142; CONF-790540-13) Avail: NTIS HC A03/MF A01

A series of one and two dimensional calculations of hard core zeta pinch flux compression experiments, to study the effect of a plasma on these systems, are discussed. These calculations show that including a plasma can reduce the amount of flux lost during the compression. Flux losses to the outer wall of such experiments and flux which is lost into the center conductor are discussed. The effect of a plasma conducting sheath on the flux loss for each case is reported. DOE

N80-15940# Los Alamos Scientific Lab., N. Mex.
STATISTICAL THEORY OF LANGMUIR TURBULENCE
D. F. DuBois, H. A. Rose, and M. V. Goldman (Colorado Univ., Boulder) 1979 8 p refs Presented at the 14th Conf. Intern. sur les phenomenes d'ionisation dans les gaz, Grenoble, France, 9 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-576; CONF-790708-1) Avail: NTIS HC A02/MF A01

A statistical theory of Langmuir turbulence is presented. The theory is developed by applying a generalization of the direction interaction approximation of Kraichnan to the Zakharov equations describing Langmuir turbulence. DOE

N80-15941# Princeton Univ., N. J. Plasma Physics Lab.
ITERATIVE METRIC METHOD FOR SOLVING THE INVERSE TOKAMAK EQUILIBRIUM PROBLEM
J. Delucia, S. C. Jardin, and A. M. M. Todd Jul. 1979 51 p refs
(Contract EY-76-C-02-3073)
(PPPL-1564) Avail: NTIS HC A04/MF A01

A method is presented for solving the toroidal magnetohydrodynamic equilibrium equation in a coordinate system based on the magnetic field lines. Both fixed boundary (conducting shell) and free boundary (external coil) boundary conditions are considered. A comparison with a special analytic solution is made. DOE

N80-15942# Argonne National Lab., Ill.
TECHNICAL SUPPORT FOR OPEN-CYCLE MHD PROGRAM Progress Report, Apr. - Jun. 1978
D. H. Bomkamp, ed. Jul. 1979 76 p ref
(Contract W-31-109-eng-38)
(ANL/MHD-78-11) Avail: NTIS HC A05/MF A01

The analysis of a magnetohydrodynamic/steam system is discussed. The major components of the system are examined including the combustor, the nozzle channel diffuser, the slag separator, and the high temperature air heaters. The development of a model for the heat transfer and slag flow and a model to estimate the effective emissivities and absorptivities of coal combustion gas containing slag droplets are discussed. A.W.H.

N80-15943# Oak Ridge National Lab., Tenn.
MATERIALS EXPERIENCE WITH TOKAMAK PLASMAS
R. J. Colchin 1979 6 p refs Presented at the Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790125-54) Avail: NTIS HC A02/MF A01

The primary effects of using various wall and limiter materials are examined in relation to the amount and kind of impurities they introduce into the plasma. The materials tested and discussed include gold, stainless steel, inconel, glass, alumina, and titanium for first walls and carbon; stainless steel, inconel, alumina, silicon carbide, boron carbide, molybdenum, tantalum, titanium, and tungsten for limiters and diverters. DOE

N80-15944# California Univ., Livermore. Lawrence Livermore Lab.
STOCHASTIC MOTION OF PARTICLES IN MIRROR MACHINES
R. H. Cohen 15 Jun. 1979 12 p refs
(Contract W-7405-eng-48)
(UCRL-82481) Avail: NTIS HC A02/MF A01

Applications of stochasticity theory to particle motion in quiescent mirror machines are discussed. The problem of magnetic moment jumps in a conventional mirror machine, and the role of stochasticity in extending the mirror loss cone are reviewed. Magnetic moment jumps in a flat bottomed magnetic well, such as the solenoid of a tandem mirror machine are examined. The motion of guiding centers in a nonaxisymmetric tandem mirror solenoid are studied. DOE

N80-15945# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
TWO-STREAM INSTABILITY FOR A SCATTERED BEAM PROPAGATING IN A COLLISIONAL PLASMA
B. S. Newberger and L. E. Thode 1979 9 p refs Presented at the Intern. Topical Conf. on High Powered Electron and Ion Beam Research and Technology, Novosibirsk, (USSR), 3 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1687; CONF-790723-2) Avail: NTIS HC A02/MF A01

Significant progress was made in the understanding of the collisional stabilization of the high-frequency two-stream instability in a relativistic electron beam through a rigorous Vlasov treatment. Substantially different scaling with parameters are obtained in comparison with previous, essentially phenomenological, models and we have gained insight into the mechanism of the stabilization process. Further investigation of the 2D case remains to be done. The issue of stabilization of the two-stream instability in finite geometry is as yet unexplored as is that of nonlinear saturation, by trapping, of the instability in the presence of momentum spread on the beam and collision on the plasma electrons. These are important in the application of relativistic electron beams to the heating of dense plasmas and possibly in the interpretation of neutral gas propagation experiments. Extension of our research into these areas will necessarily rely on the investigations outlined above. DOE

N80-15946# General Accounting Office, Washington, D. C. Energy and Minerals Div.
FUSION: A POSSIBLE OPTION FOR SOLVING LONG-TERM ENERGY PROBLEMS
28 Sep. 1979 60 p
(PB-300692/1; EMD-79-27) Avail: NTIS HC A04/MF A01 CSCL 18A

The concepts of nuclear fusion and the nuclear fusion reactor are reviewed. The topics addressed are plasma confinement, fusion-fission hybrid reactors, and thermonuclear power generation. A.W.H.

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-15947# Electronics Research Lab., Adelaide (Australia).
LIQUID PHASE EPITAXIAL GROWTH OF GALLIUM ARSENIDE
M. Folkard Jul. 1979 37 p refs

(AR-001-668; ERL-0078-TR) Avail: NTIS HC A03/MF A01

Two methods of liquid phase epitaxial (LPE) growth were applied to the compound semiconductor gallium arsenide, and a mathematical description for each was developed using a diffusion-limited model. The properties of the epitaxial layers grown under various experimental conditions are discussed, and the observed growth rates compared with those predicted by the mathematical models. From the differences observed, it is concluded that processes additional to simple diffusion of solute through the melt are occurring. Convective mixing caused by horizontal temperature gradients within the melt is suggested as an explanation for these differences. A.R.H.

N80-15948*# McDonnell-Douglas Research Labs., St. Louis, Mo.

ADVANCED METHODS FOR PREPARATION AND CHARACTERIZATION OF INFRARED DETECTOR MATERIALS Quarterly Progress Report, 5 Jun. - 4 Sep. 1979

S. L. Lehoczy Sep. 1979 23 p refs

(Contract NAS8-33107)

(NASA-CR-161352) Avail: NTIS HC A02/MF A01 CSCL 20B

Crystal growth of Hg sub 1-x Cd sub x Te and density measurements of ingot slices are discussed. Radial compositional variations are evaluated from the results of infrared transmission edge mapping. The pseudo-binary HgTe-CdTe phase diagram is examined with reference to differential thermal analysis measurements. The phase equilibria calculations, based on the 'regular association solution' theory (R.A.S.) are explained and, using the obtained R.A.S. parameters, the activities of Hg, Cd, and Te vapors and their partial pressures over the pseudo-binary melt are calculated. M.G.

N80-15949# Brown Univ., Providence, R. I. Dept. of Chemistry.

ELECTRICAL AND OPTICAL PROPERTIES OF HIGH PURITY P-TYPE SINGLE CRYSTALS OF GeFe2O4

Pierre Strobel, Frank P. Koffyberg, and Aaron Wold Sep. 1979 26 p refs Submitted for publication

(Contract N00014-77-C-0387; Grant NSF GF-39737)

(AD-A073998; TR-7) Avail: NTIS HC A03/MF A01 CSCL 09/1

Single crystals of the spinel GeFe2O4, grown by the chemical vapor transport technique, are p-type semiconductors with an acceptor ionization energy of 0.39 eV. The material is a heavily compensated band-type semiconductor, with a typical hole concentration of 3/10 to the 14 power cm near room temperature, and a temperature independent Hall mobility of 2 sq cm/Vs. Optical absorption measurements show the optical band gap to be 2.3 eV; the octahedral field splitting of the Fe(2-) d-levels is 10200 1/10200 cm. Magnetic measurements show that n(eff) is 5.26, from which a trigonal field splitting of 1/950 cm is derived. GRA

N80-15950# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 Feb. - 30 Apr. 1979

Alan J. McLaughlin and Alan L. McWhorter 15 May 1979 19 p

(Contract F19628-78-C-0002; AF Proj. 649L)

(AD-A074083; ESD-TR-79-74) Avail: NTIS HC A02/MF A01 CSCL 20/12

This Quarterly Technical Summary covers the period 1 February through 30 April 1979. It consolidates the reports of Division 2 (Data Systems) and Division 8 (Solid State) on the Advanced Electronic Technology Program. GRA

N80-15951# Mission Research Corp., La Jolla, Calif.

NEUTRON HARDNESS ASSURANCE GUIDELINES FOR SEMICONDUCTOR DEVICES Contractor Report, Jul. 1979

Robert A. Berger Sep. 1979 103 p refs

(Contract DAAK21-79-M-3448)

(AD-A074882; MRC-SD-R-36; HDL-CR-79-0448) Avail: NTIS HC A06/MF A01 CSCL 20/12

This guideline document develops a systematic approach to guarantee system survival at some specified probability of survival and neutron environmental level. The approach is analogous to a filtering process in which increasingly complex and costly levels of effort are applied until all system piece-parts have acceptable probabilities of survival. Branch decisions in the procedure are based on a statistical evaluation of manufacturer-to-manufacturer and lot-to-lot variations in piece-part neutron responses. Hardness assurance is part of the total quality assurance effort and includes all control, monitoring, and evaluation efforts needed to procure systems whose nuclear hardness equals or exceeds that of the design-hardened engineering prototype throughout production and system life. Hardness assurance efforts during the production phase are made part of the piece-part procurement specification. Example procurement specifications are given in this document for bipolar transistors, diodes, transistor-transistor logic integrated circuits, operational amplifiers (101A, 741, and 108A types), and junction-field effect transistors. GRA

N80-15952# North Texas State Univ., Denton. Dept. of Physics.

OPTICALLY INDUCED HOT ELECTRON EFFECTS IN SEMICONDUCTORS Summary Report, 1 Sep. 1978 - 31 Aug. 1979

Arthur L. Smirl 1 Jun. 1978 194 p refs

(Contract N00014-76-C-1077)

(AD-A073920) Avail: NTIS HC A09/MF A01 CSCL 20/12

We report our progress in using the high electric fields and ultrashort pulses from mode-locked lasers to study the temporal evolution of the saturable optical properties of semiconductors on a picosecond time scale. In these studies, the excite and probe technique is employed to obtain information concerning the ultrafast dynamics of photogenerated electron-hole plasmas. Germanium has been chosen for the initial investigations since its bandgap energy is comparable to but less than the photon energy of the Nd: glass lasers. GRA

N80-15953# Illinois Univ. at Chicago Circle, Chicago. Dept. of Physics.

TOPOGRAPHIC EXAMINATION OF SEMICONDUCTOR SYSTEMS Annual Technical Report, 1 Jun. 1978 - 30 Jun. 1979

R. L. Brown, S. Sundaram, and P. M. Raccah Jul. 1979 58 p refs

(Contract N00173-78-C-0437)

(AD-A075007) Avail: NTIS HC A04/MF A01 CSCL 20/12

Using the electrolyte electroreflectance (EER) technique, a systematic characterization of GaAs and InP as well as quaternary alloy InGaAsP has been made. Those materials grown at the Naval Research Laboratory include unimplanted samples and those implanted with Be, Se, and Si ions. Besides topographic examination of uniformity of carrier concentration, the spectra have been analyzed and effects of implantation and anneal procedures on the transition energies have been examined. The results of characterization have been provided as feed back information for the materials growth program at NRL. The EER technique is shown to be an unusually sensitive tool in the characterization of these semiconducting materials. GRA

N80-15954# Applied Electronic Research Corp., Gainesville, Fla.

TWO-DIMENSIONAL AVALANCHE BREAKDOWN IN Pt-Si SCHOTTKY BARRIER DIODES Final Report

David P. Kennedy Griffiss AFB, N.Y. RADC Jul. 1979 146 p refs

(Contract F19628-77-C-0220; AF Proj. 2305)

(AD-A075010; RADC-TR-79-189) Avail: NTIS HC A07/MF A01 CSCL 20/12

The development of a two-dimensional computer model was undertaken for calculating avalanche breakdown in a Pt-Si Schottky barrier diode. A principal objective of this program was to develop such a computer program, and make the source-code and operational data available to other workers in the field. Further, as a means to verify the applicability of this program junction, breakdown computations were to be undertaken throughout a wide range of physical parameters and ambient temperatures. GRA

N80-15955# Oklahoma Univ., Norman. Dept. of Chemistry.

THE CRYSTAL STRUCTURE AND VARIABLE TEMPERATURE Sn-119m MOESSBAUER STUDY OF TRIMETHYLTIN GLYCINATE, A ONE-DIMENSIONAL, AMINO-BRIDGED POLYMER

B. Y. K. Ho, K. C. Molloy, J. J. Zuckerman, F. Reidinger, and J. A. Zubieta 4 Sep. 1979 34 p refs Submitted for publication
(Contract N00014-77-C-0432; NR Proj. 053-636)
(AD-A074383; TR-9) Avail: NTIS HC A03/MF A01 CSCL 11/9

The crystal structure of trimethyltin glycinate has been determined by Patterson Fourier techniques to a final 'R'-factor of 0.066 for 1103 unique reflections. The crystals are tetragonal with space group P41 or P43 with a = b = 7.839(9) and c = 14.659(11)Angstom, Z = 4, and are composed of stacks of linearly polymeric trimethyltin glycinate molecules bridged axially at tin through the amino nitrogen atoms of the amino acid. There is hydrogen bonding between carbonyl oxygen and amino group N-H moieties along the chains and between the chains to produce a perpendicular weave of one-dimensional polymer threads. GRA

N80-15956# Sandia Labs., Albuquerque, N. Mex.
AUGER LINESHAPE ANALYSIS OF MOLECULES AND SOLIDS
D. R. Jennison 1979 20 p refs Presented at the 26th Natl. Vacuum Symp., New York, 2 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1240C; CONF-791013-4) Avail: NTIS HC A02/MF A01

Core-valence-valence Auger lineshape analysis may often be successfully made in terms of the molecular orbital structure of the molecule or the band structure of the solid. This approach assumes a priori that the final state hole motion is uncorrelated. Limitations to this approach include the highly correlated final states observed in ionic and narrow band solids (as Cu). Complications to this approach include the initial state valence screening of the core hole which affects the Auger decay probabilities. However, much useful information about the local density of states (local chemical environment) may be extracted in covalent and metallic materials. Examples from molecular (CH4, C2H4, C2H6, C3H8, and H2O) and solid state (Cu and Be) spectra are presented and the state of understanding of lineshape analysis is summarized. DOE

N80-15957# Bendix Corp., Kansas City, Mo.
METHOD OF NORMALIZING THE MEASURED SCATTERED LIGHT FROM A SURFACE DEFECT LOCATED ARBITRARILY IN A GAUSSIAN INTENSITY DISTRIBUTION INCIDENT ON A SURFACE
P. E. Klingsporn Aug. 1979 31 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2287) Avail: NTIS HC A03/MF A01

A method of normalization is described which makes direct use of the Gaussian intensity distribution of the TEM/sub infinity/mode. By this method, the amount of light scattered by a defect is normalized to the value which would be observed if the defect were located at the center of the beam, for a defect small in size compared with the 1/e to the second power diameter of the Gaussian profile. The normalization requires that three measurements be made of the scattering by the defect for an arbitrary location of the defect relative to the center of the beam. Experimental data is presented which verifies the theory. DOE

N80-15958# Los Alamos Scientific Lab., N. Mex.
HYDROGEN SCATTERING CROSS SECTION, 1H(n,n)1H
Leona Stewart Jul. 1979 17 p refs
(Contract W-7405-eng-36)
(LA-7899-MS) Avail: NTIS HC A02/MF A01

The status of the hydrogen scattering cross section is reviewed with particular emphasis on standards applications. The ENDF/B-V evaluation is described in detail and compared with experimental data. DOE

N80-15959# Oak Ridge National Lab., Tenn.
ITINERANT ELECTRON MAGNETISM IN 3D-TRANSITION METALS
J. F. Cooke May 1979 24 p refs Presented at Joint INTERMAG-MMM Conf., New York, N.Y., 17 Jul. 1979 Submitted for publication
(Contract W-7405-eng-26)
(CONF-790738-1) Avail: NTIS HC A02/MF A01

Inelastic neutron scattering experiments were performed on the 3 dimensional transition metal ferromagnets. Of particular importance was the disappearance of the spin wave mode above a certain cut off wave vector, the existence of the spin wave mode above a certain cut off wave vector and the existence of the spin waves well above the Curie temperature. At low temperatures, quantitative predictions of the itinerant electron theory calculations were found to be in excellent agreement with experiment. These calculations predicted the existence of an optical spin wave mode in nickel. DOE

N80-15960# Argonne National Lab., Ill.
FERMI SURFACE MEASUREMENTS IN A-15 COMPOUNDS
A. J. Arko, G. W. Crabtree, and Z. Fisk 1979 16 p refs Presented at Superconductivity in d and f-Band Metals, San Diego, Calif., 21 Jun. 1979 Prepared jointly with California Univ., San Diego, La Jolla
(Contract W-31-109-eng-38)
(CONF-790653-13) Avail: NTIS HC A02/MF A01

New dHvA data in Nb3Sb are presented and compared with the various band calculations. Progress of Fermi surface measurements in A-15 compounds in general is reviewed. DOE

N80-15961# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
OBTAINING NUMERICAL VALUES FOR THE ELLIPTIC EMISSION FUNCTIONS USED IN CALCULATING ELECTRON EMISSION FROM SURFACES
H. C. Miller 7 Sep. 1979 36 p refs
(Contract EY-76-C-04-0656)
(GEPP-TIS-443) Avail: NTIS HC A03/MF A01

The four elliptic emission functions v(y), t(y), s(y) and the ta(y) [or f/sub mg/(y)] are used in calculating electron emission from surfaces under the influence of temperature and external electric fields. Critical evaluations are made of the published tables of these functions. Several existing approximation equations for the emission functions are given together with some additional polynomial approximations. The estimated accuracies of these approximation equations range from five to six significant figures for the most complex approximations to + or -1% or so for the simplest. DOE

N80-15962# Arizona State Univ., Tempe. Dept. of Physics.
IMAGING OF SURFACES AND DEFECTS OF CRYSTALS Progress Report, 1 May 1978 - 30 Apr. 1979
J. M. Cowley Apr. 1979 18 p refs
(Contract EY-76-S-02-2995)
(COO-2995-3) Avail: NTIS HC A02/MF A01

The possibility of obtaining electron diffraction patterns from very small specimen regions combined with high resolution imaging by use of scanning transmission electron microscopy (STEM) allows the detailed study of small nuclei of reaction products or of crystal defects. The capabilities of this method were extended by the design and construction of a TV system for the viewing and recording of microdiffraction patterns from STEM so that clear patterns can be obtained from regions as small as 10A in diameter. This system was applied to the study of initial stages of oxidation of chromium films, revealing the presence of very small oxide nuclei and identifying these crystals as having a previously unsuspected spinel structure. Initial results were also obtained on the surface structure of oxides such as MgO. The imaging of crystal surfaces by the use of medium-to-low energy electrons (15 to 1 KeV) allowed a much more complete understanding of the contrast-producing mechanisms. Application to the study of pyrolytic graphite surfaces is discussed. DOE

N80-15963# Wisconsin Univ., Madison.
STIMULATED THOMSON SCATTERING Ph.D. Thesis
R. L. Spencer Mar. 1979 150 p refs
(Contract EY-76-S-02-2387)
(COO-2387-104) Avail: NTIS HC A07/MF A01

The theory of stimulated Thomson scattering is investigated both quantum mechanically and classically. Two monochromatic electromagnetic waves of like polarization travelling in opposite directions are allowed to interact for a time tau with the electrons

in a collisionless plasma. The electromagnetic waves have frequencies well above the plasma frequency, and their difference frequency is allowed to range upward from the plasma frequency. With the difference frequency well above the plasma frequency, the rate at which energy is transferred from one wave to the other is calculated quantum mechanically, classically from a fluid theory, and classically from an independent electron theory. The rate is calculated in both the homogeneously broadened limit, and in the inhomogeneously broadened limit. DOE

N80-15964# Sandia Labs., Albuquerque, N. Mex.
AIMS AND ACCOMPLISHMENTS OF SURFACE THEORY
P. J. Feibelman 1979 28 p refs Presented at 26th Natl. Vacuum Symp., New York, 2 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1150C; CONF-791013-1) Avail: NTIS HC A03/MF A01

Research on surface structure, transport and chemistry is presented. In order to develop a predictive capability regarding surface structure, a variety of intrinsic surface properties are being studied, including the nature of bonds at transition metal surfaces, the meaning of bond locality in extended systems, and the electronic factors underlying the forces which govern surface geometry. The main thrust of current work - empirical and predictive surface structure determination is considered. These points are illustrated with examples from recent research and ways in which experimental surface work might assist theoretical efforts are indicated. DOE

N80-15965# Sandia Labs., Albuquerque, N. Mex.
DIELECTRIC STRENGTH OF SiO2 IN A CMOS TRANSISTOR STRUCTURE
J. M. Soden 1979 7 p refs Presented at the Elec. Overstress/Electrostatis Discharge Symp., Denver, 25 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1715C; CONF-790936-1) Avail: NTIS HC A02/MF A01

The distribution of experimental dielectric strengths of SiO2 gate dielectric in a CMOS transistor structure is shown to be composed of a primary, statistically-normal distribution of high dielectric strength and a secondary distribution spread through the lower dielectric strength region. The dielectric strength was not significantly affected by high level (1 x 10 to the 6th power RADS (Si)) gamma radiation or high temperature (200 C) stress. The primary distribution breakdowns occurred at topographical edges, mainly at the gate/field oxide interface, and the secondary distribution breakdowns occurred at random locations in the central region of the gate. DOE

N80-15966# California Univ., Riverside.
LOCAL ELECTRONIC PROPERTIES OF DILUTE MAGNETIC ALLOYS Ph.D. Thesis
S. Yoksan Dec. 1978 114 p refs
(Contract EY-76-S-03-0034)
(SAN-0034-T4) Avail: NTIS HC A06/MF A01

Some local properties of dilute magnetic alloys are studied in the normal and the superconducting states. The effects of elastic and inelastic scattering are considered. It is found that near the transition temperature, the spatial variation of the superconducting order parameter around a single magnetic impurity at large distances has a characteristic 1/r dependence with an amplitude proportional to the depression of T/sub c/, whereas at short distances, the spatial dependence is of the form (a + bcos2k/sub f/r)/sq r + c/r. A microscopic calculation is presented for the host nuclear spin-lattice relaxation time in the presence of 3d-transition metal impurities in a host as a function of impurity-host distance. Two important mechanisms are considered; the relaxation due to the localized spin fluctuations, and the kinematic change because of the resonant scattering of conduction electrons. DOE

N80-15967# Oklahoma State Univ., Stillwater. Dept. of Physics.
ELECTRONIC STRUCTURE OF DEFECTS IN OXIDES Progress Report, 1 Dec. 1978 - 30 Nov. 1979
G. P. Summers 1979 24 p refs
(Contract EY-76-S-05-4837)
(ORO-4837-6) Avail: NTIS HC A02/MF A01

Models of the electronic structure of simple defects in oxides are discussed. The models are based on the following studies described: the optical absorption and emission near the band edge of SrO; radiation damage in MgAl2O4; the temperature dependence of fluorescence yield and lifetime of F-+ centers in SrO; and the temperature dependence of fluorescence from F centers in alpha-Al2O3. A.W.H.

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-15968# Illinois Univ. at Urbana-Champaign. Dept. of Physics.
ON 1/N EXPANSIONS AND THE PHASED DIAGRAM OF DISCRETE LATTICE GAUGE THEORIES WITH MATTER FIELDS
John B. Kogut Jan. 1980 42 p refs
(Grant NSF PHY-79-00272)
Avail: NTIS HC A03/MF A01

Ising lattice guage theory with matter fields is generalized to a family of gauge invariant N-state models. These models are soluble in the N yields infinity limit. In both two and three spatial dimensions, the N yields infinity limits of these models possess three phases separated by lines of first order transitions. One phase admits free charge, the second confines and the third experiences the Higgs phenomenon. The 1/N corrections are calculable and terminate the boundary between the confining and Higgs phases. A closed region of free charge persists for all N > or - 1. Author

N80-15969# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.
PHASE CHANGE HEAT CONDUCTION IN GENERAL ORTHOGONAL CURVILINEAR COORDINATES Final Report, 1967 - 1968
Leon Bledjian 15 Feb. 1979 50 p refs
(Contract F04701-78-C-0079)
(AD-A074896; TR-0079-4901-01-1; SAMSO-TR-79-81) Avail: NTIS HC A03/MF A01 CSCL 20/13

The approximate method of London and Seban for predicting the solidification rate and for melting in or around slabs, cylinders, and spheres has been reformulated in general orthogonal curvilinear coordinates. Closed-form solutions are presented for the rate of phase change and temperature drop as a function of a nondimensional time, STeFo (product of Stefan and Fourier numbers), for various geometries including elliptic cylinders, spheroids of varying eccentricites, and bicylindrical problems. Both convection and flux boundary conditions which can vary with time are considered. The effect of Biot number on phase change times and the resulting boundary temperature are presented in graphical form for some of the geometries considered. The method's degree of approximation is investigated by comparison with published analytical results. The approximate applicability of the equations to some special phase change conduction problems is demostrated. GRA

N80-15970# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
QUANTUM MECHANICS WITH APPLICATIONS TO QUARKONIUM
C. Quigg and J. L. Rosner Feb. 1979 77 p refs
(Contract EY-76-C-02-1764)
(COO-1764-360) Avail: NTIS HC A05/MF A01

Some methods of nonrelativistic quantum mechanics which are particularly useful for studying the variation of bound-state parameters with constituent mass and excitation energy are reviewed. These techniques rely upon elementary scaling arguments and on the semiclassical (WKB) approximation. They

are of general interest, but are applied here to the study of bound systems of a heavy quark and antiquark. Properties of the interquark interaction are extracted from information about masses and leptonic widths of the Psi and T families. It is shown how general methods can be applied to the determination of the electric charge of quarks and to the prediction of properties of new families. DOE

N80-15971# Massachusetts Inst. of Tech., Cambridge.
BIFURCATION AND STABILITY IN YANG-MILLS THEORY WITH SOURCES
R. Jackiw. Jun. 1979. 47 p. refs.
(Contract EY-76-C-02-3069)
(COO-3069-655) Avail: NTIS. HC A03/MF A01.

Recent work on solutions to classical Yang-Mills theory is dicussed. The investigations summarized include the field equations with static, external sources. A pattern allowing a comprehensive description of the solutions and stability in dynamical systems are covered. A list of open questions and problems for further research is given. DOE

N80-15972# Harvard Univ., Cambridge, Mass. Science Center.
INTEGRABILITY CONDITIONS FOR THE EXISTENCE OF A LAGRANGIAN IN NEWTONIAN MECHANICS AND FIELD THEORY. Annual Progress Report, 1 Mar. 1978 - 31 May 1979
S. Sternberg and R. M. Santilli. 1979. 18 p. refs.
(Contract ER-78-S-02-4742)
(COO-4742-1) Avail: NTIS. HC A02/MF A01.

The principle of general covariance is considered as well as its application to particle motion and continuum mechanics. A method for microlocal analysis was developed and applied to integral geometry, geometric quantization, and the fine structure of spectra. The experimental verification of the validity or invalidity of Pauli's exclusion principle and other basic physical laws for the nuclear and hadronic structure was proposed. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-15973*# National Aeronautics and Space Administration, Washington, D. C.
DECISION MAKING AND PROBLEM SOLVING WITH COMPUTER ASSISTANCE
F. Kraiss. Jan. 1980. 61 p. refs. Transl. into ENGLISH of "Entscheiden und Problemlorsen mit Rechneruntersteutzung", Rept. FB-36, Forschungsinstitut fuer Anthropotechnik, Meckenheim, West Germany, Feb. 1978. p. 1-73. Original language document was announced as N79-28048. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASW-3199)
(NASA-TM-76008; FB-36) Avail: NTIS. HC A04/MF A01. CSCL 05A.

In modern guidance and control systems, the human as manager, supervisor, decision maker, problem solver and trouble shooter, often has to cope with a marginal mental workload. To improve this situation, computers should be used to reduce the operator from mental stress. This should not solely be done by increased automation, but by a reasonable sharing of tasks in a human-computer team, where the computer supports the human intelligence. Recent developments in this area are summarized. It is shown that interactive support of operator by intelligent computer is feasible during information evaluation, decision making and problem solving. The applied artificial intelligence algorithms comprehend pattern recognition and classification, adaptation and machine learning as well as dynamic and heuristic programming. Elementary examples are presented to explain basic principles. Author

N80-15974*# National Aeronautics and Space Administration, Washington, D. C.
RESEARCH AND TECHNOLOGY OBJECTIVES AND PLANS SUMMARY (RTOPS). RESEARCH AND TECHNOLOGY PROGRAM, FISCAL YEAR 1980
1980. 201 p.
(NASA-TM-80744) Avail: NTIS. HC A10/MF A01. CSCL 05A.

A compilation of the summary portions of each of the Research and Technology Objectives and Plans (RTOPS) used for management review and control research currently in progress throughout NASA is presented. Indexes include: subject, technical monitor, responsible NASA organization, and RTOP number. A.R.H.

N80-15975# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
LINEAR MULTIPLE OBJECTIVE PROBLEMS WITH INTERVAL COEFFICIENTS
Gabriel R. Bitran. Aug. 1979. 26 p. refs.
(Contract N00014-75-C-0556)
(AD-A073967; TR-167) Avail: NTIS. HC A02/MF A01. CSCL 12/2.

This paper considers linear multiple objective programs with coefficients of the criteria given by intervals. This class of problems is of practical interest since in many instances it is difficult to determine precisely the coefficients of the objective functions. A subproblem to test if a feasible extreme point is efficient in the problem considered is obtained. A branch and bound algorithm to solve the subproblem as well as computational results are provided. Extensions are discussed. GRA

N80-15976# National Technical Information Service, Springfield, Va.
MANAGEMENT BY OBJECTIVES. A BIBLIOGRAPHY WITH ABSTRACTS. Progress Report, 1964 - Aug. 1979
Mary E. Young. Sep. 1979. 93 p. Supersedes NTIS/PS-78/0976; NTIS/PS-77/0892.
(NTIS/PS-79/0958/3; NTIS/PS-78/0976; NTIS/PS-77/0892) Avail: NTIS. HC $28.00/MF $28.00. CSCL 05A.

The bibliography cites studies relating to the philosophy of Management by Objectives (MBO) as well as positive and negative factors where MBO has been implemented. Case studies of implementation include health care planning, urban planning, local governments, housing, military management, R & D organizations, etc. This updated bibliography contains 85 abstracts, 19 of which are new entries to the previous edition. GRA

N80-15977# Washington State Univ., Pullman. College of Economics and Business.
A PROGRAM OF MANAGEMENT AND TECHNICAL ASSISTANCE IN THE STATE OF WASHINGTON. Final Report
Gene Hansen. Sep. 1979. 132 p.
(Grant EDA-07-06-01792-1)
(PB-299276/6; EDA-79-0139) Avail: NTIS. HC A07/MF A01. CSCL 05A.

A program to support economic growth of Washington by making the existing resources of Washington State University and other cooperating institutions accessible and by delivering competent management and technical assistance in support of specific economic development is discussed. Several exhibits are included. GRA

N80-15978# Little (Arthur D.), Inc., Cambridge, Mass.
FACTORS RELATED TO THE IMPLEMENTATION AND DIFFUSION OF NEW TECHNOLOGIES: A PILOT STUDY
Jun. 1979. 126 p.
(Grant NSF ERS-77-03286)
(PB-298998/6; ADL-80978; NSF/PRA-7703286) Avail: NTIS. HC A07/MF A01. CSCL 05A.

Case studies of 14 technologies were carried out in order

to develop an understanding of how government intervention affects the processes of implementation and diffusion of new technologies. The technologies studied were: automobiles, broadcast radio, frozen foods, black and white TV, color TV, polio vaccine, supersonic transport, fluoridation of water supplies, computer-aided instruction, basic oxygen process for steel, numerical control in manufacturing, digital computers, lasers, and integrated circuit. The key factors, their motivations for implementing/adopting the technology (or not doing so), the interactions among the key factors, and how these affected implementation/adoption are examined. GRA

N80-15979# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
SCHEDULING OF FLEXIBLE FLOWSHOPS (SYSTEMS ASPECTS OF FLEXIBLE MANUFACTURING SYSTEMS)
K. L. Hitz Mar. 1979 78 p refs
(Grants NSF DAR-78-17826; NSF APR-76-12036)
(PB-301218/4; LIDS-R-879; NSF/RA-790103) Avail: NTIS
HC A05/MF A01 CSCL 05A

The scheduling of production in a deterministic Flexible Flow Shop is discussed. This is a serial arrangement of buffered multipurpose machines connected by a conveyor system which allows fully mechanized parts handling. Machines can be bypassed, and simultaneous processing of parts with different machine routes is possible. The problem of producing a range of part types of specified ratios, with known fixed transport and processing times is considered. Optimal schedules are characterized as periodic loading sequences which minimize idle time on bottleneck machines once they have begun operating, while satisfying constraints on buffer capacity. The computation of optimal schedules by an implicit enumeration algorithm is discussed. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-15980* National Aeronautics and Space Administration, Washington, D. C.
NASA PUBLICATIONS
Sep 1978 15 p
(NASA-TM-80852) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240
CSCL 05B

A list of NASA educational publications is presented along with abstracts. Prices and ordering instructions are included. K.L.

N80-15981# Library of Congress, Washington, D. C. Network Development Office.
STUDY OF MESSAGE TEXT FORMATS: BIBLIOGRAPHIC SEARCH QUERIES
Philip L. Long and David C. Hartmann, ed. 1979 31 p
(ISSN-0160-9742) Avail: NTIS HC A03/MF A01

Efforts toward the development of a national network of libraries and information services are reviewed. Seven existing bibliographic systems were surveyed in order to collect applications message queries and response formats for appropriate catagorization and classification. In order to compare search arguments used on various systems, a metalanguage was developed to described the format and syntax of the search arguments. Topics discussed include search argument metalanguage and formats; status/error message format; and search query responses.A.R.H.

N80-15982# Planning Research Corp., McLean, Va.
INVERTED FILE FACILITY: USER'S GUIDE Final Report
S. Tamberrino 31 Aug. 1977 97 p
(Contract DCA100-73-C-0015)
(AD-A074081; PRC-706-22) Avail: NTIS HC A05/MF A01
CSCL 05/2

The Inverted File Facility (INVFF) is an extension of the Indexed Sequential Processor (ISP) which allows the user to build, retrieve from, and update inverted data bases. In addition to the ISP's data file and index file, the INVFF uses an inverted index file which provides the following additional file processing capabilities: (1) the ability to distinguish each data record as being a specific type and (2) the ability to process data records randomly through the specification of values contained within a record. GRA

N80-15983# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
AERODYNAMIC DATA BASE USERS GUIDE
George M. Landingham 5 Jun. 1979 27 p
(AD-A074448; DRDMI-T-79-62) Avail: NTIS
HC A03/MF A01 CSCL 05/2

A data base system has been developed for storage and interactive analysis of data. This report is intended as a description of the system and as a user's guide. The equipment on which the data base system is implemented is detailed. A description of the data base structure and detailed instructions for using the system are included. GRA

N80-15984# Operations Research, Inc., Silver Spring, Md.
DEVELOPMENT OF A QUALITY ASSURANCE METHODOLOGY FOR THE TECHNICAL INFORMATION GENERATION SUBSYSTEM OF NTIPS Final Report, Apr. - Dec. 1978
Don D. Deardorff, Kenneth C. Hageman, Wilburn Hehs, and James M. Norton Mar. 1979 102 p refs Prepared in cooperation with Hageman, Inc., Fort Worth, Tex.
(Contract N00019-78-C-0175)
(AD-A074299) Avail: NTIS HC A06/MF A01 CSCL 05/1

Volume I of this report provides: (1) a brief description of current Technical Publications development and Quality Assurance programs, (2) a description of NTIPS (Navy Technical Information Presentation System), (3) a detailed discussion of the content generation phase of NTIPS, and (4) a detailed discussion of a Quality Assurance program designed for contractor implementation during the contract generation phase. Volume II of the report is a draft Quality Assurance Specification for Technical Publications and supporting Data Item Descriptions (DID's). GRA

N80-15985# Stanford Univ., Calif. Dept. of Computer Science.
A STRUCTURAL MODEL FOR DATABASE SYSTEMS
Gio Weiderhold and Ramez El-Masri Feb. 1979 59 p refs
(Contract MDA903-77-C-0322)
(AD-A074077; SU-STAN-CS-79-722) Avail: NTIS
HC A04/MF A01 CSCL 09/2

This report presents a model to be used for database design. Because our motivation extends to providing guidance for the structured implementation of a database, we call our model the Structural Model. We derive the design using criteria of correctness, relevance, and performance from semantic and operational specifications obtained from multiple sources. These sources typically correspond to prospective users or user groups of the database. The integration of such specifications is a central issue in the development of an integrated structural database model. The structural model is used for the design of the logical structures that represent a real-world situation. However, it is not meant to represent all possible real-world semantics, but a subset of the semantics which are important in database modeling. GRA

N80-15986# Ford Aerospace and Communications Corp., Palo Alto, Calif.
PRELIMINARY DESIGN OF A NETWORK VIRTUAL DATA BASE SYSTEM Final Report
Griffiss AFB, N.Y. RADC Aug. 1979 151 p refs
(Contract F30602-77-C-0158; AF Proj. 0173)
(AD-A074205; RADC-TR-79-102) Avail: NTIS
HC A08/MF A01 CSCL 09/2

Development of the Network Virtual Data Base System (NVDBS) and the Adaptive User Interface (AUI) address several needs of DOD intelligence systems. The NVDBS could provide a bridge between different data base management systems (DMBSs) on different host computers (nodes) linked through a network, without being required to know how to access each DBMS directly. The network level description of the information and its logical structures would be interactively available to the

casual user. The informed user could then 'navigate' through the Network Data Model (NDM). Further, the analyst could discover and link correlated data, for the NVDBS will support 'virtual linkages' between records physically located on different DBMSs of the NVDBS network. For a DBMS to be accessible on the NVDBS network, it must be on a node of the network, and must be linked to the NVDBS through an interface tailored to the idiosyncrasies of the particular DBMS and node. The NVDBS will behave as an ordinary user of each DBMS on the network. The NVDBS also will support the creation of 'virtual linkages' between record instances physically located on different hosts. This report overviews the preliminary design study. GRA

N80-15987# Stanford Univ., Calif. Dept. of Computer Science.
INDUCTION OVER LARGE DATA BASES
J. R. Quinlan May 1979 21 p refs
(Contract MDA903-77-C-0322)
(AD-A074075; SU-STAN-CS-79-739; HPP-79-14) Avail: NTIS HC A02/MF A01 CSCL 09/2

Techniques for discovering rules by induction from large collections of instances are developed. These are based on an iterative scheme for dividing the instances into two sets, only one of which needs to be randomly accessible. These techniques have made it possible to discover complex rules from data bases containing many thousand of instances. Results of several experiments using them are reported. GRA

N80-15988# Los Alamos Scientific Lab., N. Mex. Computer Science and Services Div.
COMMON FILE SYSTEM REFERENCE MANUAL, PIM-5
Jun. 1979 115 p
(Contract W-7405-eng-36)
(LA-5525-M-Vol-5) Avail: NTIS HC A06/MF A01

A brief overview of the features of the common file system is presented. Specific information about how to use the system is included. The structure of the file organization and a utility called MASS, which is used to access the common file system are described. DOE

N80-15989# QEI, Inc., Bedford, Mass.
INFORMATION MANAGEMENT PROBLEMS RELATING TO NUMERIC DATA BASE SERVICES FOR DOE Interim Report for Phase 2 of QEI Proj. 4191
J. W. Kuipers and R. W. Thorpe 13 Apr. 1979 51 p refs
(Contract EV-78-C-01-6182)
(DOE/TIC-10144; QEI-Report-9413) Avail: NTIS HC A03/MF A01

Problems of numeric data are examined as these relate to the question of possible steps toward implementation of an integrated national information system. It is proposed that policy and organization changes be made in order to centralize and upgrade information management. Eight points to be emphasized in such a program are set forth. DOE

N80-15990# National Technical Information Service, Springfield, Va.
ON-LINE INFORMATION RETRIEVAL SYSTEMS, VOLUME 2: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Sep. 1979
Mary E. Young Sep. 1979 124 p Supersedes NTIS/PS-78/0979; NTIS/PS-77/0817; NTIS/PS-76/0755; NTIS/PS-75/513
(NTIS/PS-79/0971/6; NTIS/PS-78/0979; NTIS/PS-77/0817; NTIS/PS-76/0755; NTIS/PS-75/513) Avail: NTIS HC $28.00/MF $28.00 CSCL 05B

On-line computer systems for retrieval of information are described in the 118 reports cited. Systems development, formats of large and small systems, instructions for use and comparisons of operating networks are included. This updated bibliography contains 118 abstracts, 45 of which are new entries to the previous edition. GRA

N80-15991# North Carolina Univ. at Chapel Hill.
NTIS: CONCEPT OF THE CLEARINGHOUSE, 1945 - 1979 M.S. Thesis
Mary Glen Chitty Mar. 1979 74 p refs
(PB-300947/9) Avail: NTIS HC A04/MF A01 CSCL 05B

The functions of Federal Technical Information Agencies in serving as a central source for dissemination of the results of federally funded scientific and technical research reports, are examined. Changes in emphasis and scope are contrasted with consistency of adherence to the original directives. Discrepancies between stated objectives and actual areas of concentration are noted. Administrative policies and constraints are considered in relation to their impact on the agency and its users. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-15992# Commerce Dept., Washington, D.C. Industry and Trade Administration.
PETROCHEMICALS: THEIR ECONOMIC SIGNIFICANCE IN THE DOMESTIC ECONOMY
Harry Pfann Jul. 1979 91 p refs
(PB-299733/6) Avail: NTIS HC A05/MF A01 CSCL 05C

The economic significance of petrochemicals within the domestic economy is considered along with their importance in U.S. export trade and their requirements for energy and feedstocks. The importance of fuels and of feedstocks to the industry is noted and data are presented on the quantity of hydrocarbons which are used by the industry for both feedstocks and as energy. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-15993# Department of Energy, Washington, D. C. Office of Analytical Services.
REPORT TO CONGRESS ON THE ECONOMIC IMPACT OF ENERGY ACTIONS AS REQUIRED BY PUBLIC LAW 93-275, SECTION 18-D
Sep. 1978 198 p
(DOE/PE-0007) Avail: NTIS HC A09/MF A01

Economic impact analyses are summarized for: (1) two regulatory changes pertaining to crude oil production in California; (2) a change in price regulations for resale of crude oil; and (3) energy efficiency targets for 13 appliances. A recommendation is presented for Federal Programs of employment or economic assistance to minimize the effect of energy shortages or energy actions. K.L.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-15994# Committee on Science and Technology (U. S. House).
TOWARD THE ENDLESS FRONTIER: HISTORY OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY 1959 - 1979
Ken Hechler 1980 1107 p refs
(GPO-35-120) Avail: SOD HC

The history of the Committee on Science and Technology is reviewed from its beginning in 1959 through the year 1979. Topics include space missions, space science, international scientific cooperation, energy technology, aeronautics and

transportation, and natural resources and the environment. A.W.H.

N80-15995# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY STORAGE SYSTEM FOR AUTOMOBILE PROPULSION, 1978 STUDY. 2: DETAILED REPORT
E. Behrin, C. J. Anderson, H. Bomelburg, M. Farahat, H. C. Forsberg, C. L. Hudson, B. C. Kullman, L. G. O'Connell, G. Strickland, and W. J. Walsh 15 Dec. 1978 294 p refs
(Contract W-7405-eng-48)
(UCRL-52553-Vol-2) Avail: NTIS HC A13/MF A01

The results for FY 1978 of a national, multilaboratory study of energy storage propulsion systems for automobiles are presented including an evaluation of how changing the relationship between specific peak power and specific energy affects electric vehicle performance. Also included are an update of previous results based on new information obtained from ongoing research and development programs, as well as the results of a national energy impact and market penetration analysis of representative future energy storage vehicles. DOE

N80-15996# Sandia Labs., Albuquerque, N. Mex.
PATHOGEN REDUCTION IN SLUDGES BY IRRADIATION
J. R. Brandon 1978 18 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1957C) Avail: NTIS HC A02/MF A01

The use of ionizing radiation to disinfect municipal waste water and sludge is discussed. Pathogenic bacteria, parasites, and viruses are reviewed and studies concerning their investigation by ionizing radiation are summarized. K.L.

N80-15997# Argonne National Lab., Ill.
SCRAP: THEORY AND MODELING CONSIDERATIONS
T. J. Moran Jul. 1979 28 p refs
(Contract W-31-109-eng-38)
(ANL-CT-79-49) Avail: NTIS HC A03/MF A01

The theoretical basis for the FORTRAN IV computer code SCRAP is presented. Guidance for modeling fast reactor core structures with the code is included. DOE

N80-15998# Georgia Inst. of Tech., Atlanta. School of Civil Engineering
EFFECT OF INFRARED RADIATION ON COMPACTION OF MUNICIPLE WASTEWATER SLUDGES Final Report
R. S. Ingols, S. C. Havlicek, M. H. Poythress, and J. D. Lupton 1979 56 p
(Grant NSF ENV-77-15086)
(PB-298296/5; NSF/RA-790047) Avail: NTIS HC A04/MF A01 CSCL 13B

An unusually strong infrared-induced compaction of poorly settling sludges observed at Macon's Rocky Creek wastewater treatment facility was studied. It was discovered that the phenomenon has two components-that which is induced by heat alone and that which is induced by the irradiation alone. Furthermore, the phenomenon was generally observed in poorly settling sludges during the early stages of bulking. Other finds were: (1) IR wavelengths of 2200-2300/cm seemed to be the most effective; (2) irradiated sludge, when resuspended, settled better than untreated sludge; (3) added polyelectrolytes vastly improved settling regardless of irradiation; and (4) lignosulfonate, a major constituent of pulpmill wastes, had little effect on the phenomenon. GRA

N80-15999# Transportation Research Board, Washington, D.C.
URBAN TRANSPORTATION PLANNING, EVALUATION, AND ANALYSIS
James M. Witkowski, William C. Taylor, Edward Beimborn, David F. Schulz, and Kenneth R. Yunker 1979 59 p refs
(PB-300749/9; TRB/TRR-707; ISBN-0-309-02953-8; LC-79-607099) Avail: NTIS HC A04/MF A01; Paper copy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C., 20418, HC $3.40 CSCL 13B

The topics discussed include: (1) urban transportation planning under energy constraints; (2) long-range transportation planning in southeastern Wisconsin; (3) preliminary screening of transit corridor alternatives; (4) highway location selection; (5) macroanalysis for transit integration; (6) discrete optimization in transportation networks; (7) residential area location preference surfaces; and (8) ethics of politically oriented transportation planning. GRA

N80-16000# Transportation Research Board, Washington, D.C.
NEW TRANSPORTATION SYSTEMS AND TECHNOLOGY, 1979: TRANSPORTATION RESEARCH RECORD 708
Jeffrey M. Zupan, Donald E. Ward, Granville E. Paules, Steven E. Shladover, and Waheed Siddiqee 1979 34 p refs
(PB-300747/3; TRB/TRR-708; ISBN-0-309-02954-6; LC-79-607112) Avail: NTIS HC A03/MF A01; Hard copy also available from Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D.C., 20418, HC $3.00 CSCL 13B

Contents: patronage estimate for downtown people movers; development of efficient central management strategies for advanced group rapid transit systems; electric cars for urban transportation; and assessment of market potentials for electric vehicles. GRA

N80-16001# Municipal Environmental Research Lab., Cincinnati, Ohio. Wastewater Research Div.
PROGRESS IN WASTEWATER DISINFECTION TECHNOLOGY Final Report
Albert D. Venosa, (ed.) Jun. 1979 298 p refs Presented at National Symp., Cincinnati, 18-20 Sep 1978
(PB-299338/4; EPA-600/9-79-018) Avail: NTIS HC A13/MF A01 CSCL 13B

Contents: (1) chlorination; (2) chlorine dioxide- analytical measurement and pilot plant evaluation; (3) ultraviolet light; (4) ozone; (5) viruses and organics; and (6) planning and implementation. GRA

N80-16002# California Univ., Los Angeles. Environmental Science and Engineering.
INSTITUTIONAL BARRIERS TO WASTEWATER REUSE
Laura M. Lake and Richard L. Perrine 1979 340 p refs
(Contract Di-14-34-0001-7814)
(PB-299027/3; W79-09050; OWRT-R-0064-7814-2) Avail: NTIS HC A15/MF A01 CSCL 13B

Institutional barriers to enhanced reuse of wastewater as a supplement or replacement for added freshwater supply are assessed. Four areas of critical institutional concern are analyzed: (1) issues related to the administrative and institutional framework within which operations must be managed; (2) the legal framework which applies to reuse; (3) the economics, financing and pricing of reclaimed wastewater; and (4) issues growing from the risk to public health of reuse of treated wastewater. Conclusions on issues of major importance are presented and recommendations are given in the report. GRA

N80-16003# General Accounting Office, Washington, D. C. Community and Economic Development Div.
IMPROVING THE SCIENTIFIC AND TECHNICAL INFORMATION AVAILABLE TO THE ENVIRONMENTAL PROTECTION AGENCY IN ITS DECISION MAKING PROCESS Report to the Congress
21 Sep. 1979 71 p
(PB-300580/8; CED-79-115) Avail: NTIS HC A04/MF A01 CSCL 05A

Formal procedures for the assessment of scientific and technical information in governmental decision making are suggested: formal participation of science organizations, the establishment of issue oriented commissions, and a 'science court' for ventilating scientific disputes during the decision making process are discussed and contrasted. M.G.

N80-16004# National Bureau of Standards, Washington, D.C. National Engineering Lab.
INTERNATIONAL ACTIVITIES: THE FISCAL YEAR 1978 SURVEY OF INTERNATIONAL PROGRAMS AT NEL
Samuel Kramer and Michael Olmert Aug. 1979 122 p
(PB-300491/8; NBSIR-79-1792) Avail: NTIS HC A06/MF A01 CSCL 05A

An international survey of engineering research activities is presented. Production engineering, communications, electron devices, fiber optics, ergonomics, housing and construction, fire safety engineering, materials engineering, cryogenics, alternative

energy sources, electron microscopy, and superconductors are included. M.G.

N80-16005# American Association for the Advancement of Science, Washington, D.C. Office of Opportunities in Science.
A RESEARCH AGENDA ON SCIENCE AND TECHNOLOGY FOR THE HANDICAPPED
Janet Welsh Brown and Martha Ross Redden Jan. 1979 58 p refs
(Contract NSF OPA-78-25354)
(PB-301220/0; NSF/RA-790053) Avail: NTIS HC A04/MF A01 CSCL 05K

A research agenda was developed in science and technology for the handicapped designed to provide support for planning a new research program. High and low technology, adults and children, basic and applied research, and hardware developments and social science research are discussed. Recommendations are categorized first by major disability groups and then listed by those recommendations that cut across disabilities, especially those with policy, educational and training implications. Included are: mobility impairment; neuromuscular/skeletal disabilities; visual disability; hearing impairment; vocal impairment; psychological and social issues for research; economic issues for research; and principles for operating a program of search and development for the physically handicapped. GRA

N80-16006# Gurnham and Associates, Inc., Chicago, Ill.
PERFORMANCE EVALUATION OF THE EXISTING THREE LAGOON WASTEWATER TREATMENT PLANT AT PAWNEE, ILLINOIS Final Report, 1975 - 1977
C. Fred Gurham, B. A. Rose, and W. T. Fetherston Jul. 1979 151 p
(Grant EPA-R-803900)
(PB-299740/1; EPA-600/2-79-043) Avail: NTIS HC A08/MF A01 CSCL 13B

Data gathered over a one-year period of monitoring the lagoon system at Pawnee, Illinois are presented and treatment plant performance is compared to design loading rates and the Federal secondary treatment standards. Removal of BOD5 and fecal coliforms was found to be excellent. The lagoons performed satisfactorily during the winter months, and anaerobic conditions did not develop despite a thick ice layer. GRA

N80-16007# Polytechnic Inst. of New York. Transportation Training and Research Center.
A METHODOLOGY FOR EVALUATING THE EFFECTIVENESS OF TRANSPORTATION IMPROVEMENTS FOR THE ELDERLY AND HANDICAPPED Final Report, Sep. 1977 - Nov. 1978
John Falcocchio Washington, D.C. DOT Jun. 1979 112 p
(Contract DOT-OS-70084)
(PB-300440/5; TR-78/503; DOT-RSPA-DPB-50-79-2) Avail: NTIS HC A06/MF A01 CSCL 13B

Transportation services were evaluated from the viewpoint of the elderly and handicapped users. A cost-effectiveness methodology for evaluating existing services and transportation improvements, and service design standards for different types of handicap severity were developed. The transportation services considered are the city transit system (bus and subway); taxi service; EASYRIDE service; and the ambulette service. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-16008*# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
LYMAN ALPHA INITIATED WINDS IN LATE-TYPE STARS
B. M. Haisch, J. L. Linsky, and K. A. vanderHucht [1979] 11 p refs
(Contract NAS5-23274; Grant NGL-06-003-057)
(NASA-CR-162467) Avail: NTIS HC A02/MF A01 CSCL 03A

The IUE survey of late-type stars revealed a sharp division in the HR diagram between stars with solar type spectra (chromosphere and transition region lines) and those with non-solar type spectra (only chromosphere lines). Models of both hot coronae and cool wind flows were calculated using stellar model chromospheres as starting points for stellar wind calculations in order to investigate the possibility of having a supersonic transition locus in the HR diagram dividing hot coronae from cool winds. From these models, it is concluded that the Lyman alpha flux may play an important role in determining the location of a stellar wind critical point. The interaction of Lyman alpha radiation pressure with Alfven waves in producing strong, low temperature stellar winds in the star Arcturus is examined. A.R.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

No abstracts in this category.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-16009*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HANDBOOK OF LUNAR MATERIALS
Richard J. Williams, ed. and James J. Jadwick, ed. (Lockheed Electronics Co., Houston, Tex.) Feb. 1980 133 p refs
(NASA-RP-1057) Avail: NTIS HC A07/MF A01 CSCL 03B

The physical, chemical, thermodynamic, and geologic data on lunar rocks, minerals, and processes are summarized, and a set of data metals that might be extracted from lunar materials is presented. Author

N80-16010*# National Aeronautics and Space Administration, Washington, D. C. Planetary Div.
REPORTS OF PLANETARY GEOLOGY PROGRAM, 1979 - 1980
P. Wirth, (comp.), R. Greeley, (comp.), and R. D'Alli, (comp.) Jan. 1980 409 p refs
(NASA-TM-81776) Avail: NTIS HC A18/MF A01 CSCL 03B

Abstracts of 145 reports are compiled addressing the morphology, geochemistry, and stratigraphy of planetary surfaces with some specific examinations of volcanic, aeolian, fluvial, and periglacial processes and landforms. In addition, reports on cartography and remote sensing of planet surfaces are included. M.G.

N80-16011*# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
THE CHEMISTRY OF VENUS' ATMOSPHERE Annual Project, Jul. 1977 - Jul. 1978
Nien Dak Sze and William H. Smith Jul. 1978 63 p refs
(Contract NAS5-24164)

(NASA-CR-159951) Avail: NTIS HC A04/MF A01 CSCL 03B

A model for the Venus atmosphere involving photochemistry of oxygen, hydrogen, chlorine and sulfur species is presented. Sulfur reaction schemes and hydrogen and chlorine reaction schemes were included. The impact of sulfur on the oxygen budget and the subsequent production of H2SO4 molecules for the Venus cloud deck were explored. A major new reaction scheme for production of H2SO4 molecules involving sulfur and oxygen chemistry was established shown to dominate over the odd hydrogen scheme proposed earlier. The efficiency of the scheme in formation of H2SO4 is only about 50%, with the remaining sulfur residing in SO2 molecules. The calculated downward flux of H2SO4 may be sufficient to maintain a steady state sulfuric acid cloud if the resident time of H2SO4 droplets in the cloud is as long as a few years. If however, the resident time is half a year or shorter, additional chemistry capable of more efficient conversion of SO2 to SO3 is required. A.R.H.

N80-16012*# Alaska Univ., Fairbanks. Geophysical Inst.
AIRBORNE MEASUREMENTS OF SOLAR AND PLANETARY NEAR ULTRAVIOLET RADIATION DURING THE NASA/ESA CV-900 SPACELAB SIMULATION Final Report
G. G. Sivjee Apr. 1977 33 p refs
(Grant NsG-2053)
(NASA-CR-162566) Avail: NTIS HC A03/MF A01 CSCL 03B

Results from a comparative study of the feasibility of employing experiment operators on the space shuttle to acquire scientifically worthwhile data are presented. The experiments performed during these tests included spectral observations of the Sun and Venus in the near ultraviolet region. The solar measurements were analyzed to determine ozone abundance in the terrestrial atmosphere. Using a detailed spectral matching technique to compare airborne solar UV measurements with synthetic spectric profiles of sunlight, it is deduced that in winter the total atmospheric ozone abundance is about 0.33 atm/cm at midlatitudes in the northern hemisphere. M.G.

N80-16013*# Massachusetts Inst. of Tech., Cambridge.
CRYSTALLIZATION, FLOW AND THERMAL HISTORIES OF LUNAR AND TERRESTRIAL COMPOSITIONS Final Report
D. R. Uhlmann 1979 75 p refs
(Grant NGR-22-009-646)
(NASA-CR-162445) Avail: NTIS HC A04/MF A01 CSCL 03B

Contents: a kinetic treatment of glass formation; effects of nucleating heterogeneities on glass formation; glass formation under continuous cooling conditions; crystallization statistics; kinetics of crystal nucleation; diffusion controlled crystal growth; crystallization of lunar compositions; crystallization between solidus and liquidus; crystallization on reheating a glass; temperature distributions during crystallization; crystallization of anorthite and anorthite-albite compositions; effect of oxidation state on viscosity; diffusive creep and viscous flow; high temperature flow behavior of glass-forming liquids, a free volume interpretation; viscous flow behavior of lunar compositions; thermal history of orange soil material; breccias formation by viscous sintering; viscous sintering; thermal histories of breccias; solute partitioning and thermal history of lunar rocks; heat flow in impact melts; and thermal histories of olivines. A.R.H.

N80-16014*# Texas A&M Univ., College Station. Dept. of Geophysics.
VELOCITY MODEL OF THE SHALLOW LUNAR CRUST Final Report
Anthony F. Gangi 1 Jan. 1980 159 p refs
(Grant NsG-7417)
(NASA-CR-162573) Avail: NTIS HC A08/MF A01 CSCL 03B

The travel times of the seismic waves obtained for the Apollo-14 and -16 active seismic experiments and the Apollo-16 grenade launches are shown to be consistent with a powder-layer model of the shallow lunar crust. The velocity variation with depth determined from these data is: V(z) = approximately 110 z to the 1/6 power m/sec for z less than 10 meters and V(z) is nearly = to 250 m/sec for z greater than 10 meters. The velocity values found for the 10 meter depth are similar to those found by Kovach, et al. (1972). The z to the 1/6 power depth dependence for the velocity of the topmost layer is that predicted on the basis of a powder layer (Gangi, 1972). The Amplitude variation of the direct waves as a function of source-to-receiver separation, x, is A(x) = A(o)x to the -n power exp(-ax) where 1.5 < n < 2.2 and a is nearly = to 0.047 neper/m. Velocity-spectra analyses of the direct, surface-reflected, bottom-reflected and refracted waves give results that are consistent with the velocity model inferred from the traveltime data. Author

N80-16015*# Hawaii Univ., Honolulu. Inst. of Geophysics.
GEOCHEMISTRY OF LUNAR AND PLANETARY PROCESSES Final Technical Report, 15 Jul. 1978 - 30 Sep. 1979
John A. Philpotts Sep. 1979 22 p refs
(Grant NsG-9071)
(NASA-CR-162583) Avail: NTIS HC A02/MF A01 CSCL 03B

Progress is reported in the following areas: (1) consideration of silica in excess of stoichiometry in lunar feldspars; (2) calculation of equilibration temperatures for meteorites and lunar samples; (3) investigation of the effect of rapid crystallization in lunar mare basalts on element partitioning; and (4) development of a technique for suppressing oxide interference during mass spectrometric analysis for rare earth elements. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-16016*# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF X-RAY AND EUV SPECTRA OF SOLAR ACTIVE REGIONS Final Report
Keith T. Strong and Loren W. Acton 1979 205 p
(Contract NAS8-33195)
(NASA-CR-161364) Avail: NTIS HC A10/MF A01 CSCL 03B

Data acquired by two flights of an array of six Bragg crystal spectrometers on an Aerobee rocket to obtain high spatial and spectral resolution observations of various coronal features at soft X-ray wavelengths (9-23A) were analyzed. The various aspects of the analysis of the X-ray data are described. These observations were coordinated with observations from the experiments on the Apollo Telescope Mount and the various data sets were related to one another. The Appendices contain the published results, abstracts of papers, computer code descriptions and preprints of papers, all produced as a result of this research project. A.R.H.

N80-16017# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
THE SUDDEN COMMENCEMENT SOLAR PROTON FLUX ENHANCEMENT OF 31 OCTOBER 1972 Interim Report
J. Bernard Blake and George A. Paulikas 31 Aug. 1979 29 p refs
(Contract F04701-78-C-0079)
(AD-A074546; TR-0079-4960-05-5; SAMSO-TR-79-94) Avail: NTIS HC A03/MF A01 CSCL 04/1

The sudden commencement (sc) solar proton enhancement of 31 October 1972 is examined in detail. The flux of 5-21 MeV protons observed by ATS-1 increased by a factor of 25 as a result of the sudden commencement. Drift echoes (indicating trapped particles) were seen clearly following the sc with a period of the order of 70 seconds as expected for protons with energies just above 5 MeV. Decay times ranging from 17 to 56 minutes were seen during the decay. The decay time changed as the magnetosphere reacted to varying solar wind conditions which were indicated by ground-based magnetometer records. It is also shown that plasma intrusions into the outer magnetosphere from the solar wind, as discussed by Lemaire and colleagues, can serve as strong scattering centers, providing access for and greatly reducing the otherwise expected trapping lifetimes of sc-enhanced solar protons. GRA

N80-16018# Naval Research Lab., Washington, D. C.
SOLAR FLARE SPECTROSCOPIC DIAGNOSTICS FOR WAVELENGTHS LESS THAN 2000 ANGSTROMS. Interim Report
G. A. Doschek and U. Feldman. 27 Jun. 1979. 33 p. refs.
(AD-A070569; NRL-8307) Avail: NTIS HC A03/MF A01 CSCL 03/2

We discuss the use of intensity ratios of emission lines for determining the electron density and temperature in flare plasmas. The availability diagnostics cover the temperature range from about 40,000 K to about 10,000,000 K. We summarize the current work on flare density diagnostics and review the applications of this theory to available flare spectra. We discuss the importance of line profiles for determining nonthermal mass motions in the plasma and for estimating path lengths along the line of sight. We review the current information on line profiles in flare spectra. We comment on determining departures from ionization equilibrium using line ratios in the X-ray and EUV regions. GRA

N80-16019# Los Alamos Scientific Lab., N. Mex.
IMAGING X-RAY SPECTROMETER TO STUDY SOLAR ACTIVITY IN CONJUNCTION WITH THE SCADM PROGRAM
R. L. Blake. 1979. 16 p. refs. Presented at Solar Cycle and Dyn. Mission Conf., Wellesley, Mass., 14 Jun. 1979.
(Contract W-7405-eng-36)
(LA-UR-79-1921; CONF-7906111) Avail: NTIS HC A02/MF A01

An experiment to study solar active region dynamics and evolution is reported. A spectrometer imaging X-rays (SIX) is discussed in relation to the capacity of simultaneous high resolution imaging, spectral dispersion, and time resolution for observing the processes involved in the buildup and release of energy in the solar corona. A tabular summary of the main SIX experiment characteristics is presented. A.W.H.

N80-16020# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 414, SUPPLEMENT, FEBRUARY 1979. PART 2: COMPREHENSIVE REPORTS. DTA FOR DECEMBER 1978, NOVEMBER 1978 AND MISCELLANEA
Helen E. Coffey, ed. Jun. 1979. 81 p.
(PB-299340/0; SGD-418-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 03B

The data for December 1978 on: active regions, synoptic solar maps, solar radio emission, energetic solar particles and plasma, and solar x ray radiation are presented. Synoptic charts and an abbreviated calender record for November 1978 are provided. GRA

N80-16021# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR GEOPHYSICAL DATA NUMBER 418, JUNE 1979. PART 1: PROMPT REPORTS. DATA FOR MAY 1979, APRIL 1979. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 414 (SUPPLEMENT) FEBRUARY 1979
Helen E. Coffey, ed. Jun. 1979. 168 p.
(PB-299694/0; SGD-418-Pt-1; NOAA-79072310) Avail: NTIS HC A08/MF A01 CSCL 03B

The data for May 1979 on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, coronal holes, solar wind measurements, infrared interplanetary magnetic field polarities, and mean solar magnetic field are presented. The data for April 1979 on: daily solar activity center, sudden ionospheric disturbances, solar x-ray radiation, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices are included. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

99 GENERAL

N80-16022# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT. Quarterly Report, 1 Apr. - 30 Jun. 1979
30 Jun. 1979. 103 p.
(AD-A074885; DME/NAE-1979-2) Avail: NTIS HC A08/MF A01 CSCL 01/3

Progress in research applicable to aeronautics is summarized. Specific attention is given to the development of a minicomputer based controller designed for gas pipeline station control. The role of computer models and simulation techniques is emphasized. A railway switch car designed to operate in snow and ice is also described. Design modifications recommended to improve the mechanical performance and endurance of the switch are included. J.M.S.

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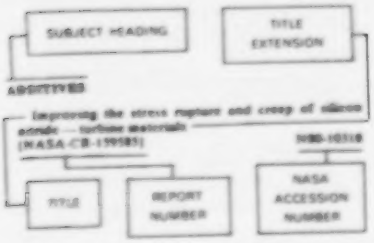

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A

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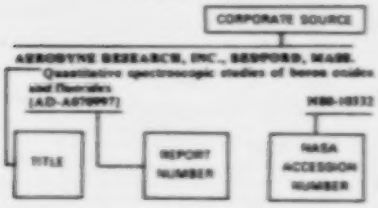

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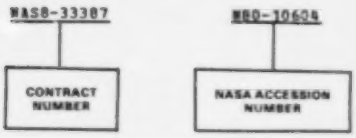

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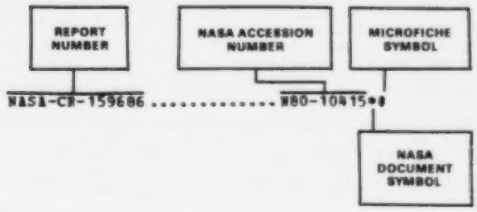

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 817

02 AERODYNAMICS 817

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 819

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 820

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 821

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION N.A.

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 822

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 823

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 823

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 825

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 826

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 826

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

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For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 827

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION **N.A.**

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20 SPACECRAFT PROPULSION AND POWER **828**

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

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24 COMPOSITE MATERIALS **828**

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For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS **833**

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **836**

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **839**

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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32 COMMUNICATIONS **849**

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34 FLUID MECHANICS AND HEAT TRANSFER **853**

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37 MECHANICAL ENGINEERING **859**

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38 QUALITY ASSURANCE AND RELIABILITY **862**

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **863**

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

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44 ENERGY PRODUCTION AND CONVERSION 876
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For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *85 Urban Technology and Transportation*.

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Includes weather forecasting and modification.

48 OCEANOGRAPHY 905
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

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54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 910
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55 PLANETARY BIOLOGY N.A.
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

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61 COMPUTER PROGRAMMING AND SOFTWARE 913
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PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
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Includes elementary and nuclear particles; and reactor theory.
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SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

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SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

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Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

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Includes cosmology; and interstellar and interplanetary gases and dust.

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N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey 3 Sep. 1979 409 p refs
(Contract NAS1-15624)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01
CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, SOFTWARE DEVELOPMENT AND APPLICATION FOR DYNAMIC ANALYSIS OF THE TILT ROTOR RESEARCH AIRCRAFT

J.E. Grimes, California State University & Colleges, California Polytechnic State University, School of Science & Mathematics, Dept. of Computer Science & Statistics, *San Luis Obispo, California* 93407 (NAS 2-10364)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0002, RESEARCH STUDY ON C3 FOR NAVAL AIRCRAFT

R.C. Hansen, R.C. Hansen Inc., *Tarzana, California* 91356 (DN890180; N00019-79-M-0401)

Research study of the needs, deficiencies, and technical frontiers in communications, command, and control technology.

This study will survey sources to establish needs, deficiencies, and technical frontiers for communications, command and control in naval aircraft for such functions as weapon control, electronic warfare, reconnaissance and surveillance, communications, etc. The eventual intent is to provide a rationale for research activities that is solidly based on expected operational needs and scenarios.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0003, EIGENVECTOR AND EIGENVALUE ANALYSIS OF FINITE DIFFERENCE SCHEMES USED TO SOLVE THE EULER EQUATIONS

R.S. Shevell, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCA 2-745001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0004, SUPPORT EQUIPMENT FOR MADAIR

W. Goree, Superconduction Technology Corp., *Mountain View, California* (DN981089; N62269-78-C-0143)

Support equipment will be utilized for preliminary integration, the MADAIR sensor and the towed bird. This contract supports work unit ZU 701, Agency Accession No. DN 681083.

A convertible horizontal liquid helium Dewar with shock mounts, card cage support structure and gradiometer support structure will be designed and fabricated.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

1.0005, MATERIALS RESISTANT TO EFFECTS OF V/STOL AIRCRAFT ON PAVEMENTS AND SUPPORT AREAS

R.B. Brownie, U.S. Dept. of Defense, Navy, Civil Engineering Lab., Naval Construction Battalion Center, *Port Hueneme, California* 93043 (DN987059)

To determine the potential magnitude and seriousness of exhaust blast effects of future planned V/STOL aircraft on pavements and support areas and to identify materials technology to alleviate these effects.

The technical approach is to (1) identify V/STOL aircraft planned or under development, (2) determine landing and takeoff characteristics of jet exhaust (velocity, temperature, direction, duration, etc.) from V/STOL aircraft, (3) determine the impact of high temperature erosion characteristics on maintenance and repair of existing pavements and support facilities, and (4) identify technical approaches for new materials for use in pavements and other facilities to support V/STOL aircraft operations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Facilities Engineering Command

1.0006, AIRCREW GLIDING ESCAPE SYSTEM

J. Matsuo, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN695409)

To provide ejecting aircrew men with a reliable aerodynamic decelerator that will, in addition to its present capability of operating reliably (both in a low speed, low altitude, or a high speed ejection from a jet aircraft), incorporate provisions for gliding flight. A high degree of maneuverability, configuration, packaging and deployment of this system is to be such that it will be compatible with ejection seat-equipped Navy aircraft of 1978 and beyond.

Conduct an initial survey to identify desirable features of current gliding parachute configurations and identify critical performance parameters. (Innovative design studies will devise means to overcome opening time, opening shock and high speed reliability problems.) Generate a performance specification and devise testing and evaluation techniques unique to maneuverable gliding parachutes. An in-house design effort, exploiting advanced technology, materials, and packing methods will result in a prototype system which will be evaluated against contractor designs. Results of evaluation will provide a basis for a design specification. Fleet evaluation and preparation of a procurement package will complete the program.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0007, FAA NOW-CASTS

D. Haugen, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (RAA7662B)

PROJECT OBJECTIVE: To evaluate the effectiveness of meteorological satellite data products in improving local weather services to the aviation community.

CURRENT YEAR PLAN: To establish a computer-driven communication and satellite imagery display between Colorado State University, Fort Collins, CO., and the National Weather Service Forecast Office, Denver, CO.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0008, PROGRAMS OF RESEARCH IN FLIGHT SCIENCES

H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0009, INVESTIGATION OF OPTIMUM WING CONFIGURATIONS WITH EDGE SEPARATION

C.E. Lan, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0010, ENERGETIC MATERIALS FOR CARTRIDGES AND CARTRIDGE ACTUATED DEVICES (CADS)

D.H. Brooks, U.S. Dept. of Defense, Navy, Naval Ordnance Station, *Indian Head, Maryland* 20640 (DN996201)

To develop and demonstrate feasibility of (1) a new percussion primer system which will incorporate a thermally stable formulation and designs which are resistant to environmental and structural effects, and (2) a series of propellants which will meet the specified performance requirements for cartridge actuated device (CAD) applications.

This program will consist of the following two major efforts: (1) new primer design, and (2) new propellant series. (1) New primer design - this portion of the overall program will consist of the following two efforts: (1) primer design, and (2) forumlation development. (a) Primer design - in FY 79, various design concepts will be developed and evaluated with emphasis upon eliminating composition dusting and dimensional variability as well as providing a hermetic sealing capability. In FY 80, a primer design will be selected for feasibility testing. The primer design will be configured to replace the M42 series primer which is the most common configuration employed in aircrew automated escape system (AAES) applications. (b) Primer formulation -candidate formulations will be processed in FY 80 and analyzed from the standpoint of critical operational and performance parameters (i.e., high temperature stability, resistance to moisture and dusting, and input energy requirements). In FY 81, the optimum formulation will be selected and in conjunction with the new primer design, testing will be conducted in FY 82 to evaluate stability, sensitivity, hermetic sealing capability, reliability, vibration/shock, cartridge compatibility, and ballistic evaluation. (2) New propellant series - computer modeling, developed under past category 6.2 effort, of typical CAD systems will be employed to define optimized thermophysical constants required for a new CAD propellant series. Upon precisely defining desired characteristics, a research level effort will be initiated in FY 80 to develop a propellant to conform with these requirements. Of special concern will be products of reaction, flame temperature burning rate at various ambient temperatures in the pressure range of interest and future cost potential.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0011, DEVELOPMENT OF THE OCV, PART III

M. Rudd, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF140940; F33615-77-C-3012)

Current airspeed indicating systems for military aircraft are accurate to a minimum speed indication of 50 knots (approximately). Present sensing system errors in the low speed range are significant and are of sufficient magnitude to cause safety-of-flight problems when hovering or approaching land for V/STOL vehicles. The objective of this study is to further develop the optical convolution velocimeter, examine operational suitability and equipment environmental requirements, and test the device. The device is to be capable of accurate sensing and displaying airspeed in the range of V/STOL type aircraft.

The Air Force Flight Dynamics Laboratory has been developing various time-of-flight sensing techniques for velocity measurement. Of particular promise on the effort is the optical convolution velocimeter. This device has been patented. Dr. M. Rudd of BB&N has developed an appropriate theory for single sensor detector and has designed, fabricated, and tested a prototype unit. The approach is to proceed with further development with a) examining environmental requirements for such a device, b) improving operational characteristics and c) testing and evaluation. Three prototype units will be designed, fabricated, and tested. This approach has been suggested in an unsolicited proposal by Bolt, Beranek and Newman, Inc., of Cambridge, MA.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0012, COCKPIT DISPLAY OF TRAFFIC INFORMATION (CDTI) CREW FUNCTION ASSESSMENT

J.R. Tole, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0013, PREDICTION OF AERODYNAMIC HEATING TO GENERALIZED THREE-DIMENSIONAL SHAPES

H.W. Kipp, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF139390; F33615-77-C-3003)

At high speeds, above Mach 3.5, aerodynamic heating becomes a design constraint for missiles and aircraft. Therefore, definition of the heating to the flight vehicle is required to adequately design the structure and define the operating limits. Poor definition of the heating can result in weight increases, degraded performance and increased cost. The objective of this effort is the development of an analysis tool for the prediction of heating to flight vehicles. This will improve the ability to determine heating levels thereby decreasing uncertainties in design.

Several programs have been developed for the prediction of heat transfer rates to flight vehicles. All of these programs have limitations which significantly restrict their use. These programs will all be reviewed and the most promising one will be selected for modification. After existing limitations have been removed, the program will be extended to more general flows such as the complex flow in the fin region.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, DEVELOPMENT OF ADVANCED FLIGHT CONTROL ACTUATION SYSTEM CONCEPTS FOR NAVAL AIRCRAFT

R. Fucht, Bendix Corp., Flight Systems Laboratory, *200 Holister Rd., Teterboro, New Jersey* 07608 (DN981063; N62269-78-C-0247)

The general objective of this task is to examine the broad spectrum of new flight control actuation concepts with respect to potential advantages and interrelationships with other aircraft systems. The resultant effect of these new concepts will be evaluated against projected aircraft mission and maintenance requirements. Recent advancements in on-board computers, electrical power equipment and solid-state processing components may offer advantages to new aircraft, especially with growing emphasis on combat survivability and simplified squadron maintenance. The specific objective of this effort is to determine how a contractor-developed actuation concept can be adapted for aircraft primary flight controls. The unique feature of this concept is the use of two different power mediums, electricity and bleed air, to drive a single actuator. This contract supports work unit ZA601, Agency Accession No. DN681080.

An actuator will be designed to T 2C aircraft rudder specifications. It will be fabricated, lab tested and flight demonstrated on a T 2C test bed. Ultimate application is aimed at V/STOL aircraft.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0015, NAVY VEHICLE DESIGN AND CONSTRUCTION - MICROPROCESSOR DIGITAL FLIGHT CONTROL INVESTIGATION

R.F. Stengel, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DN975352; N00014-78-C-0257)

Future Navy aircraft will utilize digital logic to perform the complex flight control functions demanded by their severe mission objectives. Cost factors may dictate microprocessor implementation of these digital control laws. While hardware cost may ultimately reach low levels, the development costs associated with microprocessor technology will not be trivial. This investigation is directed towards developing new methodologies required for the design, analysis, and flight evaluation of advanced low cost digital flight control systems.

During this second year's effort, two input/two output longitudinal and lateral-directional command augmentation systems will be designed using optimal control theory and implemented using microprocessor technology. Various strategies of redundancy management for multiple processors will be examined. System failures of several types will be simulated in a lab and in flight, and the performance of the redundant system will be determined. A variable stability navigation aircraft will be flown for 20 hours to conduct these tasks.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0016, AIRCRAFT MANEUVER LOADS PREDICTION DEFICIENCY STUDY

Unknown, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890158; N00019-79-C-0061)

Identify deficiencies in the practices/methodologies used to predict aircraft maneuver loads.

Systematically review recent practices and existing wind tunnel and flight loads data to identify and categorize problems followed by preliminary evaluation of procedures to overcome deficiencies.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0017, ADVANCED FUEL DELIVERY SYSTEM

R.E. Anderson, General Electric Co., Aircraft Engine Group, *1 Jimson Rd., Cincinnati, Ohio* 45215 (DN796803; N00140-75-C-0040)

Design, develop, and demonstrate a lightweight, compact, containment resistant, fuel delivery system for use on advanced augmented gas turbine engines.

The overall program has four phases: Phase I - (12 months) -preliminary system design, dynamic model, starting element development, centrifugal filtration investigation completed, as reported under Accession Number DN596806, by publication of GE report R73AEG420 of November 1973; Phase II - (13 months) - engine fuel delivery system component design, fabrication and bench testing. Completed by publication of GE report R76AEG318 of May 1976; Phase III - (7 months) -bench testing of a complete fuel delivery and control system and a preliminary design layout of flight weight fuel delivery components. Scheduled for completion April 1978; and Phase IV - (14 months) -procure and test a new vane start element for the unitized pump under contract N00140-78-C-0059 (DN889779).

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0018, DETERMINE THE IFR OPERATION PROFILE OF THE GENERAL AVIATION SINGLE PILOT

G.S. Weislogel, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aviation, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAS 1-15969)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0019, BASIC RESEARCH IN STRUCTURES AND DYNAMICS

J.J. Olsen, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141950)

This work unit supports the technical base functions of the Structural Mechanics Division of the Air Force Flight Dynamics Laboratory. It addresses the problem areas of transonic unsteady aerodynamics, flutter, aeroelastic optimization and integration of aeroelastic disciplines. The goal is to create a numerical, analytical and experimental array of techniques to integrate the aeroelastic design, analysis and testing of aircraft structures to reduce the cost of design, acquisition and operation of new aircraft. This work unit will obtain substantial improvements in our ability to design, analyze and optimize aircraft structures for unsteady aerodynamic forces, vibrations, flutter, loads and aeroelastic control system interactions.

Initial developments will include the development of a three-dimensional transonic unsteady aerodynamic computer program for flutter applications. Finite element structural programs will also be modified to automate the input of data and the presentation of results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, IMPROVED COMPUTATIONAL METHODS FOR NONLINEAR AEROELASTIC OPTIMIZATION

F.K. Bogner, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF141890; AFOSR-78-3487)

This work unit supports the technical base functions of the Structural Mechanics Division of the Air Force Flight Dynamics Laboratory. It addresses the problem areas of transonic unsteady aerodynamics, flutter, aeroelastic optimization and integration of aeroelastic disciplines. The goal is to create an array of techniques to integrate the aeroelastic design and analysis of aircraft structures to reduce the cost of design, acquisition and operation of new aircraft. This work unit will obtain substantial improvements in our ability to optimize aircraft structures for unsteady aerodynamic forces, vibrations, flutter, loads and aeroelastic control system interactions.

Initial developments will include the application of transonic unsteady aerodynamic computer programs to strength/flutter optimization problems. Finite element structural programs will also be modified to automate the input of data and the presentation of results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, ADVANCED PAYLOAD SYSTEMS SPECIFICATION AND USER GUIDE FOR NEW COD/VOD AIRCRAFT

J. Shefrin, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DN981013; N62269-78-C-0318)

This effort is intended to provide comprehensive guidance for structuring the payload systems section of detail specifications for applicable new Navy aircraft. An advanced system will be defined making use of emerging technologies for payload systems handling/restraint to provide optimized crashworthiness and personnel survivability. The output of this effort, a specification with user guide, will optimize future Navy payload systems design requirements during the conceptual phases of aircraft development.

Current and planned operational roles of COD/VOD type aircraft will be analyzed along with cargo types and cargo/passenger mixes. Peace time/wartime environmnts will be considered in defining aircraft reconfiguration requirements for various payload types. Handling/restraint concept trade-offs will include leg type restraints, barrier nets, net to pallet systems, modularized packaging, and other advanced concepts. Crashworthiness concepts will be emphasized, using advanced energy management hardware to substantially reduce loads reacted through the restraint system to the aircraft interfaces, while reducing handling/restraint time. The cargo/passenger interface will be analyzed, with concept trade-offs including energy absorbing barrier nets, cargo forward of passengers, and palletized

seating to enhance crash survivability and reduce payload handling and reconfiguration time.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0022, HELICOPTER LANDING GEAR DESIGN AND TESTING CRITERIA INVESTIGATION
J.D. Crist, Bell Helicopter Textron of Textron Inc., *Hwy. 183, P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3860; DAAK51 79 C 0011)

To develop new landing gear design criteria/military specifications for all classes of Army helicopters. Main thrust of program is to derive a single specification that will incorporate design, testing, crashworthiness, handling, etc., for both wheel- and skid-type Army helicopter landing gear.

A survey of helicopter landing gear design, test, accident, etc., related documentation will be performed. These findings will be used to modify existing landing gear specifications and assess Mil-L-XXXX specification (proposed). The resulting criteria will be evaluated for conformity of application to all classes of Army helicopters. Either Mil-L-XXXX will be recommended for adoption as a totally new specification or the existing design specifications will be modified as required.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0023, NAVY VEHICLE DESIGN AND CONSTRUCTION - AIRCRAFT NONLINEAR DYNAMIC/AERODYNAMIC INTERACTIONS
A.H. Nayfeh, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (DN975184; N00014-79-C-0103)

Modern combat aircraft are required to perform and maneuver in the nonlinear aerodynamic regime usually with separated flow over a significant portion of the wing and body. The dynamics of aircraft at high angles-of-attack is also nonlinear, hence there is a nonlinear coupling of the dynamics and aerodynamics of modern fighter aircraft. The objective of this research investigation is therefore to develop a technique for predicting the motion of an aircraft caused by a prescribed time-dependent configuration of the control surfaces while at high angles-of-attack.

The principal investigator will couple the fully nonlinear dynamical equations of motion to a general unsteady nonlinear vortex-lattice model of the flow-field which includes leading edge vortex separation. The unsteady vortex-lattice model will predict the nonlinear aerodynamic forces and moments of the aircraft including a history of the time-dependent flow-field. These forces and moments are computed simultaneously with the equations of motion of the aircraft to determine its motion in maneuvering flight.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0024, STOL AIRCRAFT VIBRATION CONTROL
C.S. Doherty, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF139920; F33615-77-C-3035)

STOL aircraft vibration is expected to be substantially higher than for conventional aircraft, especially at low frequencies, due to the size, spacing, and exhaust impingement required of STOL engines. This environment could affect personnel and the reliability of all major sub-systems, and the low frequencies may render conventional vibration isolators ineffective. The objective of this work is to predict STOL aircraft vibration and to assess its impact on equipment and isolator design. The result could be new design and test requirements for STOL aircraft equipment, revised handbooks and specifications, and a final payoff in increased system reliability.

The vibration induced by blown flaps of AMST prototypes will be studied and the resulting aircraft vibration will be predicted. The predictions will be confirmed and refined by comparison with measured AMST vibration to the extent that such data are available. The resulting interior vibration environment will be compared to present vibration design requirements, and methods for minimizing this vibration will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, ANALYSIS OF DOD CONDUCTED RESEARCH AND TECHNOLOGY PROGRAMS/BENCHMARK MEASUREMENTS IN THREE-D SUBSONIC DIFFUSERS
J. Whitelow, University of London, Imperial College of Science & Technology, *Prince Consort Rd., South Kensington, England, United Kingdom* (NASW 3258)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, ANALYSIS OF SATELLITE NAVIGATION SYSTEMS
B.E. Schutz, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

Satellite navigation is now in extensive use for surveying and point positioning applications. These systems use the U.S. Navy Transit Satellite; however, the next generation system Global Positioning Satellite will enter initial check-out and validation in 1977. To evaluate the hardware and software requirements for various applications as well as to introduce state-of-the-art astronautical systems into the classroom, a JMR-1 Doppler Positioning system has been acquired. Integration of this hardware with a computer system will provide real-time satellite tracking capability for laboratory applications and systems analysis.

SUPPORTED BY University of Texas

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, STEP-GROWTH PROPAGATION OF HIGH MOLECULAR WEIGHT RIGID ROD POLYMERS
J.E. Wolff, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF053530; F49620-78-C-0110)

AF function - advanced AF aircraft will require lightweight, high strength, readily processible polymeric materials to meet high performance flight requirements. Deficiency - current fiber reinforced composite structures experience problems of fiber-matrix debonding and strength reduction due to environmental effects. Objective - the objective of this research is to define the parameters and factors which govern the efficient propagation of rigid rod polymers in solution. How work contributes - this work will contribute to the processing science base which is essential to the design and fabrication of molecular or self-reinforced structural composites.

A systematic study of the effect of monomer concentration, stoichiometric balance, heating and stirring rates, and reaction time on the polymerization, molecular weight distribution and solution characteristics of p-phenylene-2, 6-benzo-bisthiazole polymer will be conducted. The parameters of the solvents required for the polymerization medium of the aforementioned model polymer and the kinetics of rigid rod reactions will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, INFLUENCE OF FLUID RHEOLOGY AND AIR RESISTANCE ON THE BEHAVIOR OF LIQUID JETS AND DROPS
S.L. Goren, University of California, Berkeley Campus, School of Chemistry, Dept. of Chemical Engineering, *Berkeley, California* 94720 (NCA 2-50001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0003, OPTIMAL ADDITIVES TO PRODUCE ANTI-MISTING FUELS
M.C. Williams, University of California, Berkeley Campus, School of Chemistry, Dept. of Chemical Engineering, *Berkeley, California* 94720 (NCA 2-50905)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0004, IMPROVEMENT IN MECHANICAL PROPERTIES OF LOW CONDUCTIVITY CARBON FIBERS BY IMPREGNATING WITH POLYMERS AND METALS
H.L. Needles, University of California, Davis Campus, School of Agriculture & Environmental Sciences, Dept. of Textiles & Clothing, *Davis, California* 95616 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0005, A STUDY OF DRY-CHEMICAL FIRE-EXTINGUISHING MECHANISMS
E.L. Knuth, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Energy & Kinetics, *405 Hilgard Ave., Los Angeles, California* 90024 (NCA 2-390903)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0006, MATERIALS SUPPORT TECHNOLOGY - SIC FIBER REINFORCED GLASS MATRIX COMPOSITES
J.J. Brennan, United Technologies Corp., United Technologies Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DN875788; N00014-78-C-0503)

The use of fiber reinforced composite materials in naval aircraft is increasing because of their low density, strength, and stiffness. Present materials are limited to use at relatively low temperatures, however; composites with higher temperature capabilities are needed. The objective of this task is to study composite systems that appear to offer potential for use at higher temperatures.

A comprehensive fabrication parameter study of composites composed of SIC monofilament and SIC yarn incorporated into high temperature glass or glass-ceramic matrices will be conducted. Fabrication parameters such as hot pressing temperatures, pressure, time and atmosphere will be studied and their effect on composite density and microstructure will be investigated. Micrographic and fractographic analysis will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0007, PRECIOUS METAL OXIDES AS SUPERCONDUCTOR CANDIDATES
B.L. Chamberland, University of Connecticut, Storrs Campus, Graduate School, Dept. of Chemistry, *Storrs, Connecticut* 06268 (INT7717719)

The aim of this award is to contribute to the general knowledge of superconducting oxides and to develop means for predicting superconducting behavior in oxide materials (i.e., reduced electrical resistance in compounds consisting of oxygen and an element or radical). The research -- which has potential applications in areas such as power transmission, high-speed computers, and generators -- will explore the crystal chemistry and physical properties of a family of precious metal oxides (AxPt3O4 and AxPd3O4) as possible superconductors and catalysts.

The project will involve scientists from the University of Connecticut, who will prepare, purify and grow the oxide crystals, and French scientists from laboratories in Grenoble who will conduct the crystallographic and neutron diffraction experiments as well as the superconductivity tests.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

3.0008, THE MATRIX-ISOLATION INFRARED-LASAR-RAMAN STUDY OF THE MOLECULAR STRUCTURE OF CHLORINE NITRATE
J.H. Hall, Morehouse College, Graduate School, *223 Chestnut St. S.W., Atlanta, Georgia* 30314 (NSG 7652)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

3.0009, PROPERTIES AND CHARACTERISTICS OF SHAPE MEMORY ("MARMEM") MATERIALS
C.M. Wayman, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mining Engineering & Metallurgy, *207 Engineering Hall, Urbana, Illinois* 61801 (DMR77-00363)

This is a continuation of research on the basic mechanism(s) of the shape memory effect in non-ferrous metallic materials for selected compositions, associated microstructural characteristics, and mechanical properties. Shape memory processes have been studied primarily on single-crystal copper-zinc and copper-zinc-aluminum alloys at specified compositions under this program. A phenomenological model has been advanced to describe observations on shape memory behavior for these alloys. In order to check the generality of the model, with the goal of elucidating the basic mechanism(s) of shape memory behavior, critical experiments will be carried out on selected compositions for the following systems: titanium-nickel, copper-zinc, copper-zinc-aluminum, and silver-cadmium. In addition, advanced studies will continue on the nature of the martensite-to-martensite transformation for a few shape-memory materials. This is a renewal of NSF Grant DMR74-23684 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0010, MATERIALS SUPPORT TECHNOLOGY - SILICON CARBIDE METAL-MATRIX COMPOSITES
J.A. Cornie, Avco Corp., Specialty Materials Division, *Lowell Industrial Park, Lowell, Massachusetts* 01851 (DN975393; N00014-79-C-349)

The Navy has a need for improved high performance materials in aircraft structures, jet engines and missiles. This program will examine the use of silicon carbide filaments to reinforce metal alloys thereby providing high specific strength and stiffness in the resulting metal-matrix composite. Metal-matrix composites have potential for reducing weight of structural components and increasing allowable temperatures.

The role of the surface carbon layer in imparting high strength to silicon carbide filaments will be explored. Alternative types of coatings such as silicon, titanium nitride, and titanium carbide will be attempted in order to improve the bonding strength of silicon carbide to metal matrices such as aluminum and titanium. Effects of surface layer thickness and variations in compositional profiles on filament strength will be found. Promising surface treatments for filaments will be employed to produce silicon carbide-aluminum composites and the mechanical properties of these composites will be determined. Microstructural-flaw relationships will be explored for the filaments with their various surface coatings.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0011, STRUCTURE AND MECHANICAL PROPERTIES OF HIGH TEMPERATURE GLASSY AND MICRO-CRYSTALLINE ALLOYS 16219-MS
N.J. Grant, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgy & Materials Science, *77 Massachu-*

setts Ave., Cambridge, Massachusetts 02139 (DA0G9069; DAAG29-79-C-0077)

Production, characterization, and evaluation of metallic glasses with high glass transition temperatures, and thermally stable microcrystalline alloys. Study of the factors which influence the toughness and ductility of initially amorphous or microcrystalline alloys. Relevance - the research has the potential for forming the basis of new high-toughness forged components of aircraft, gun, and armor systems, and thermally stable erosion-resistant linings for gun tubes.

Introduction of mechanically 'soft' energy absorbing crystallization products in initially glassy alloys, and the rapid upquenching of initially glassy structures to produce a very fine grain size.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0012, CRYSTALLIZATION AND THERMAL HISTORIES OF LUNAR AND TERRESTRIAL COMPOSITIONS

D.R. Uhlmann, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgy & Materials Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EAR79-08761)

This study is a continuing investigation which was previously funded by NASA but transferred to NSF. The investigation is concerned with the flow and crystallization behavior of lunar compositions; the formation of lunar glasses; the thermal regimes in impact melts; the phenomena of solute partitioning and diffusional homogenization in phases in rocks; the growth and dissolution of gas bubbles in silicate melts; and quite generally with thermal histories of partly-glassy breccias and highly crystalline rocks.

The study will include an experimental determination, over wide ranges of temperature, of nucleation, crystal growth and viscous flow of plagioclase compositions as well as the matrix compositions by partly glassy lunar breccias. Improved theoretical descriptions of concentration profiles in olivines and solute partitioning under continuous cooling conditions will be carried out and will be used to determine the thermal histories of lunar and terrestrial rocks. Viscous sintering under conditions of continuous cooling will be studied, as will the processes by which gas bubbles are eliminated from complex silicate melts.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

3.0013, NONHOMOGENEOUS FLOW OF MACROMOLECULAR SOLUTIONS AND MELTS

M.V. Tirrell, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Chemical Engineering & Materials Science, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DMR78-26629)

This research deals with the behavior of macromolecular solutions and melts. It is based on the thesis that there are differences in the behavior of such liquids when they are flowing in systems where the velocity gradient is uniform everywhere, and when the velocity gradient varies spatially. One of the effects that appears in the latter situation is that of macromolecular migration; i.e., macromolecules will migrate from regions of high-velocity gradient to regions of low-velocity gradient. Specifically, the flows to be examined are: Poiseuille flow in a capillary, flow between rotating flat disks, flow in a packed chromatography column, and flow into an injection molding cavity. It is proposed to examine quantitatively the nature and extent of macromolecular migration and to test various theories that can explain this behavior. The ultimate aim is to gain a detailed understanding at the molecular level of this largely unexplored phenomenon.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0014, PROBLEMS IN MOLECULAR COLLISION THEORY

P. Pechukas, Columbia University, School of Arts & Sciences, Dept. of Chemistry, *Broadway & W. 116th St., New York, New York* 10027 (CHE7820066)

This grant supports research under the Quantum Chemistry Program in the general area of molecular collision theory. Particular attention will be given to new formulations of scattering processes. Beginning with results based on classical mechanics or semiclassical theory, Professor Pechukas will attempt to develop a tractable, systematic method for including quantum effects, which are often important in the interpretation of molecular beam data. In this way, the conceptually simpler theories of chemical reactivity may be improved in quantitative accuracy while remaining computationally feasible.

Professor Pechukas will also continue theoretical investigations of three other classes of important problems. These deal with: (1) classical mechanics of chemical reactions and transition state concepts, (2) semiclassical representations of non-adiabatic processes, and (3) connections between potential energy surface topography and molecular symmetry. An aim of the research is to relate statistical theory to molecular collision dynamics.

This is a renewal of research currently supported by NSF grant CHE7515458 at Columbia University.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0015, DEVELOPMENT OF FATIGUE RESISTANT TITANIUM ALLOYS

J. Kennedy, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890142; N00019-78-C-0505)

To evaluate fatigue improvement/heat treatment for Ti-6Al-4V.

The effect of solution treating and water quenching on the axial fatigue life of Ti-6Al-4V will be examined. Variables such as alloy composition, product form, solution treating temperature and stress amplitude will be considered.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0016, LIQUID-STATE PHOTOELECTRON SPECTROSCOPY

P. Delahay, New York University, Washington Square & University College of Arts & Sciences, Dept. of Chemistry, *421 1st Ave., New York, New York* 10012 (CHE77-07025 A02)

Current work in liquid-state photoelectron spectroscopy will be continued to include: (1) extension to high photon energies from 10 eV up to 40.8 eV to enhance emission of unscattered (in the liquid) electrons and obtain spectra with band structure similar to gas-phase photoelectron spectra; (2) extension to higher vapor pressures from approximately 100 microns up to 5 torrs to achieve conditions for general application to almost any liquid and to water in particular. The angular distribution of low-energy photoelectrons will also be studied to obtain information required for the derivation of threshold functions and the calculation of the barrier energy at liquid-vacuum interfaces (conversion from external to internal photoionization energy). Interpretation of results will be carried out in three main ways: (1) analysis of energy distribution curves and second derivative curves by summation of contributions of scattered and unscattered electrons; (2) interpretation of surface and bulk photoionization energies in terms of asymmetric electronic polarization near the liquid-vacuum interface; (3) calculation of the gas-liquid red shifts (approximately 1 eV) in photoionization energy for neutral substances and the gas-liquid blue shift (approximately 2 to 3 eV) for anions. This is a renewal of support for research currently supported by Foundation grant CHE-7517019.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0017, THE MECHANISM OF FRETTING FATIGUE CRACK INITIATION IN MEDIUM STRENGTH STEELS 15979-MS

D.J. Duquette, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Metallurgical Engineering, *110 8th St., Troy, New York* 12181 (DA0G8994; DAAG29-79-C-0013)

To perform systematic studies of the basic mechanisms of crack initiation in fretting-corrosion-fatigue. Relevance - fretting and its extensions in fretting-corrosion-fatigue have been of serious consequence in engine and rotating structural components of Army aircraft. Such phenomena may also be responsible for some classes of problems in high-rate-of-fire weapons, and in ground vehicular components.

Experiments will be performed on a 4130 steel which develops a wide range of structures and properties upon heat treatment. Variables to be studied include differential hardness of flying surfaces, amplitude of slip, frequency, environment, temperature, and surface hardness.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0018, MAGNETIZATION CHANGES IN SMALL VOLUME ELEMENTS BY STRESS CONTROL

K. Schroder, Syracuse University, L.C. Smith College of Engineering, Dept. of Metallurgy, *Link Hall, Syracuse, New York* 13210 (NSG 1654)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0019, VAPOR PHASE DIAMOND GROWTH TECHNOLOGY

J.C. Angus, Case Western Reserve University, School of Engineering, Dept. of Chemical Engineering, *University Cir., Cleveland, Ohio* 44106 (NAS 3-21965)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0020, DEVELOPMENT OF A DATA SYSTEM FOR MULTI-CHANNEL SPECTROMETERS

R. Megargle, Cleveland State University, School of Arts & Sciences, Dept. of Chemistry, *1983 E. 24th, Cleveland, Ohio* 44115 (NSG 3308)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0021, HOT CORROSION OF METALS AND ALLOYS BY FUSED SALTS

R.A. Rapp, Ohio State University, Columbus Campus, School of Engineering, Dept. of Metallurgical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DMR79-11910)

This is a fundamental investigation to determine the mechanisms of the accelerated oxidation of metals and alloys beneath thin films of fused salts. The solubilities of several oxides in the fused salts Na2SO4 and Na2CO3 at 1200K and 1173K, respectively, have been established as functions of the oxygen and sodium oxide activities. Electrochemical corrosion and polarization studies of metals coated by thin salt films will be studied. The results will be compared with theoretical predictions of models for the acid or basic dissolution and reprecipitation of the protective oxide in the salt film. The pure metals Fe, Ni, Co and Cr and the alloys Fe-Cr, Ni-Cr, Co-Cr, NiAl, Fe-Cr-Al, and Co-Cr-Al will be studied via electrochemical thin film methods for salt films of alkali sulfate, carbonate, chloride and vanadate in various oxidizing gases. Metal corrosion rates and activity gradients and shifts in the fused salt will be derived from the electrochemical studies for comparison with theoretical predictions.

This is a continuation of research previously supported by NSF Grant DMR75-172-4A01. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0022, RESEARCH ON REFRACTORY D.S. EUTECTIC COMPOSITES T ENGINES

M.K. Thomas, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN833093)

To identify, produce and characterize new high-meltig-point directionally solidifed eutectic alloys which show promse for utilization in 1150 - 1370 C engine environments. This wrk was previously funded under Aircrft Materials Block Progm, Accession No. DN 681081, work unit ZM601.

The microstructure of arc melted refractory metal baseCB and Cr) and Fe, Ni, Co base (based on a Battelle study) ulticomponent alloy buttons are examined and the most promsing are directionally solidified and tested for strength and oxidtion resistance.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval A Systems Command

3.0023, NAVY VEHICLE DESIGN AND CONSRUCTION - ORIENTED POLYMERS

J.L. White, University of Tennessee, Knoxville Campus,school of Engineering, Dept. of Chemical & Metallurgical Engieering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DN775285; N00014-77-C-0236)

New polymeric compositions of high strength areof interest to the Navy for improved lightweight composite because lightweight organic structural materials can provide such improved payload/weight ratios in aircraft and surfe effect ships. The proposed research will provide new materials and theoretical models to meet Navy needs in this area.

This work will be directed toward the preparatin of biaxially oriented aromatic polyamide films from liquidcrystalline polymer solutions. Experiments will be carried out t determine whether the successful one-dimensional approach utilized for fiber spinning can be extended to other shapes an structures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0024, IMPACT TESTING ON ORBITER HIGH-TEMPERATURE REUSEABLE SURFACE INSULATION TILES

D.J. Norton, Texas A & M University, College Station Campus, School of Engineering, Dept. of Aerospace Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAS 9-5962)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

3.0025, ANALYSIS OF SULFUR RETENION BY ASH SORBENTS DURING FLUIDIZED BED IGNITE COMBUSTION

T.F. Edgar, University of Texas, Austin Campus, School of Engineering, Dept. of Chemical Engineering, *20 W. 21st, Austin, Texas* 78712

DESCRIPTION: Laboratory experimentions and mathematical modeling are being used to examin the behavior of Texas lignite during fluidized bed combustion Of specific interest is the determination of the effects of alkline ash materials and how they promote the retention of sulfurin the ash (e.g., as CaSO4) and ash re-injection. A fluidized bedtest rig to process 2kg/hr. of lignite has been constructed and est runs are being performed. Data trends from the lab plant will be analyzed and a computer simulation program will be developed to aid in modeling the trends. The important process variables appear to be temperature, fluidizing velocity, and particle size, as well as the coal ash properties.

SUPPORTED BY University of Texas

.0026, THE TERRESTIAL GROWTH OF LEAD-TIN-ELLURIDE BY TECHNIQUES RELATED TO LOW-RAVITY GROWTH

.A. Jesser, University of Virginia, School of Engineering & pplied Science, Dept. of Materials Science, *Garrett Hall, Charlesville, Virginia* 22903 (NSG 1652)

SPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

ENGINEERING

Inodes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Informatn See Also Physics.

4.001, LIGHT PROPAGATION THROUGH CLOUDS (COMUNICATIONS)

D.P.Woodman, GTE Sylvania Inc., Electronic Systems Group & Western Division, *Mountain View, California* (DN975090; N00014-78-C-0716)

(A) Experimentally demonstrate that it is possible to communiate through clouds with substantial optical thicknesses. (B) Obtai data which can be used to evaluate models for the propagatio of light pulses through clouds.

Laer pulses will be transmitted from a high flying aircraft, throug a cloud, to a ground-based receiver. Observed pulse attenuatin and distortion will be compared against the predictions opropagation models.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0002, SURVEILLANCE - VIBRATIONAL RAMAN UV DOWN ONVERSION

E.A. Stapaerts, Northrop Corp., Research & Technology Center, *Research Park, Palos Verdes Peninsula, California* 90274 (DN87565; N00014-78-C-0832)

The ojective of this work unit is to contribute to the developmoent of a satellite-mounted blue-green laser that is suitable for Navy cmmunication and surveillance applicatons.

To acomplish the proposed objective, experiments and analyses wi be conducted to demonstrate efficient frequency down conveson of UV excimer laser output to the blue-green spectral regin. The experimental approach will involve the use of multiple order vibrational Raman scattering in a novel Raman oscillator/amplifier configuration that employs a noncorrosive molecular gas. To maximize the speed of data acquisition the third harmonic of a high repetition rate ND:YAG laser will be used as a Raman pump during the initial system optimization phase of the program. The YAG laser will then be replaced by an E-beam XCL excimer laser, and experiments will be carried out to demonstrate greater than 30% conversion efficiency into the blue-green.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0003, PREPARATION & PROPERTIES OF AL(X)GA/(1-X) AS CHROMIUM SINGLE CRYSTALS

G.L. Pearson, Staford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DN880268; N00014-78-C-0297)

This work seks to develop methods of preparing semi-insulating layers of III-V semiconductors suitable for application in MIS FET structues. It further seeks to answer questions concerning the interactions and stability of chromium in gallium arsenide with aluminm substitution.

To prepare byliquid phase epitaxy single crystals of chromium doped gallium arsenide and gallium aluminum arsenide. To investigate the physical and electronic properties by various techniques including transient capacitance and photocapacitance and to apply these results towards preparing MIS FET structures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0004, HUMAN FACTORS ENGINEERING

R.A. Erickson, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN482058)

To perform human factors engineering, research, and development on aircraft weapon systems and subsystems, including associated target acquisition display systems.

Mathematical modeling, human factors analysis, laboratory experiments, and flight tests will be conducted as appropriate to relate control, display, and sensor system characteristics to operator/aircrew performance. Analysis will be conducted to evaluate the observer submodel of several mathematical models of target acquisition by forward looking infrared systems (FLIR), and to develop an improved submodel based upon available experimental data. In-house and contracted laboratory research will be conducted on ship identification with a raster imaging system. Television adjusted to simulate FLIR imagery will be used to measure operator performance as a function of signal-to-noise ratio, horizontal and vertical resolution and target aspect. The usefulness of color coding symbology, scales, and alphanumbers in strike aircraft cockpit displays will be evaluated in laboratory experiments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0005, EXPERIMENTAL MEASUREMENTS OF UNSTEADY TURBULENT MIXING PHENOMENA ASSOCIATED WITH AERONAUTICAL SYSTEMS

C.M. Ho, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DN775391; N00014-77-C-0314)

Turbulent mixing phenomena play a central role in many fluid dynamic applications ranging from the flow at the trailing edge of a wind to the flow in a chemical laser. The proposed research will examine, experimentally, the mixing between two co-flowing jets in which periodic oscillations will be introduced.

In recent years significant progress has been made in the interpretation of the nature of the turbulent mixing of two, steady, planar, co-flowing jets. The planned experimental work will extend this understanding to the unsteady case and, hopefully, will illuminate, for example, the nature of the unsteady flow at the trailing edge of an oscillating airfoil. The experiments will be conducted, initially, in water for visualization purposes, and subsequently, in air where detailed turbulence measurements will be made. The periodic disturbances will be introduced by oscillating vanes in the settling chambers upstream of the co-flowing jets.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, KINETICS OF HALOGEN GAS REACTIONS ON LIQUID AND SOLID SURFACES

P.G. Nordine, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (ENG77-04122 A02)

Experimental studies will be done on the kinetics of halogen atom and molecule gasification of liquids, and their extension to halogen gasification of non-metallic condensed phase. The investigation will be carried out under experimental conditions which allow kinetic-parameter determinations and mechanistic interpretations. This program would make use of a new aerodynamic levitation flow reactor technique and CO2 laser or induction heating of levitated specimens in a unique approach to kinetic studies with corrosive gases and reactive condensed phase materials. It will include: (a) Extension of pilot F,F2/U(s,l) studies to obtain quantitative gasification rates, including measurements with supercooled liquid metal, if possible. (b) Survey of chlorination reactions for non-metallic condensed phases, with particular emphasis on chlorine gasification of metal oxides under reducing conditions. (c) Detailed kinetic studies of halogen/non-metallic solid or liquid systems selected on the basis of the exploratory results. (d) Interpretation of the gas/solid, liquid kinetic data in terms of the operative elementary steps and thermochemical properties of the reactants and products. Testing of useful new generalization and hypotheses. Critical evaluation of new observations on halogen gas/liquid,

solid systems reported in the current scientific and engineering literature.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0007, ELECTRONIC TRANSITION LASERS
M. Krauss, U.S. Dept. of Commerce, National Bureau of Standards, Molecular Spectroscopy Div., *Washington, District of Columbia* 20234 (DN975325; N00014-79-F-0043)

The objective of this work is to study the effect of relativistic interactions on transition rates between electronic states of molecules. The effect of the mixing of various spin-free states will also be studied. The Navy has need for such information since these are important parameters in electronic transition lasers for naval communications and surveillance.

The contractor is determining the x doublet sigma, a doublet pi, b doublet sigma and c doublet sigma curves for the group II chlorides and computing the spin-orbit mixing of these states.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, EUV PLASMA SPECTROSCOPY
G.A. Doschek, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980042)

Determine physical conditions such as electron temperature, density, turbulence, and mass motions in million degree laboratory plasmas. Develop new laboratory spectrographs based on recent developments in astronomical detector technology.

Modify and adapt existing solar physics spectrographs and hardware to laboratory facilities. Plasmas to be studied include laser-produced plasmas, low inductance vacuum spark plasmas, electron-ion beam plasmas and TOKAMAK plasmas.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0009, HIGH ACCURACY RADIATION EFFICIENCY MEASUREMENT TECHNIQUES - STUDY IS RELATED TO SATELLITE POWER SYSTEMS
D.J. Kozakoff, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAS 8-33605)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0010, PLUME-INDUCED FLOW SEPARATION ON AXISYMMETRIC BODIES DURING POWERED SUPERSONIC FLIGHT
A.L. Addy, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical & Industrial Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

A computer program has been developed to predict, for given separation models, the separation location on axisymmetric afterbodies during powered supersonic flight. At this stage, the base pressure and separation location are predicted based on the separation model and separation criterion. This program is being used: (1) to study the sensitivity of flow-separation location and base pressure subject to variations in the functional form of the separation criterion, and (2) to plan an experimental program to investigate plume-induced flow separation.

SUPPORTED BY University of Illinois

4.0011, NAVIGATION - SUPPORT FOR SATELLITE NAVIGATION SYSTEMS AN/WRN-4
J. Stelle, Magnavox Government & Industries Electronics Co., *1313 Production Rd., Fort Wayne, Indiana* 46808 (DN123404; N00014-77-C-0184)

Advance design satellite navigation equipments model AN/WRN-4 have been procured in limited quantity to provide high accuracy, all weather, global positioning capability required to support at sea r/d efforts. These systems are fully automatic, completely integrated, compact in size and lightweight to facilitate transfer between users while preserving high reliability and maintainability. Centralization of spare parts and repair facilities for those sophisticated and unique equipments assures continued quality control, accurate performance history and minimum investment in back-up spares.

The investigator will provide a bonded warehouse for maintaining a pool of spare parts and a supervisor to maintain liaison with equipment users in equipment trouble-shooting and spare parts replacement; will maintain inventory records, parts failure analyses and equipment performance data; will ensure timely repair of faulty parts, their inspection and their return to stock in accordance with proposed procedures, with funding limitation (96K) prescribed; will maintain three GFE model AN/WRN-4 (MX706MA) equipments for emergency back-up equipments spares; and will provide support for software modifications required as specifically directed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0012, PRE-COOPERATIVE ENGINEERING EDUCATION PROGRAM
D.E. Holec, Purdue University, Graduate School, *Executive Bldg., West Lafayette, Indiana* 47907 (NGT 15-005-790)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0013, NAVY VEHICLE DESIGN AND CONSTRUCTION - TOTAL SYNTHESIS ALGORITHMS FOR MULTIVARIABLE CONTROL SYSTEMS
M.K. Sain, University of Notre Dame, School of Engineering, Dept. of Electrical Engineering, *Notre Dame, Indiana* 46556 (DN975422; N00014-79-C-0475)

Digital technology permits the consideration of advanced new design concepts for aircraft and engine control systems not previously explored. Practitioners in control design have experienced limitations in the use of current control design techniques in meeting the challenges brought about by digital technology and the increasing sophistication of modern aircraft and engines. The objective of this research effort is to develop new methods for the direct synthesis of multivariable control systems. The synthesis methods will provide the capability to achieve desired (pre-specified) transient behavior and final response characteristics as well as pre-specified levels of insensitivity of those characteristics to inaccuracies in, or changes from, the assumed plant model.

Previous research by the principal investigator has laid the basic foundations for the total synthesis method, and the results for the decoupled multivariable control system are encouraging. This research effort will extend the theoretical basis to include the coupled multivariable control system as well as include desired robustness characteristics directly into the synthesis procedure.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0014, LARGE SCALE FIRE TEST AND EVALUATION OF CLOSED HEAD SPRINKLER SYSTEMS FOR AIRCRAFT HANGARS
L.M. Krasmer, Factory Mutual Research Corp., *1151 Boston Providence Tpke., Norwood, Massachusetts* 02062 (DN987037; N68305-78-C-0054)

Evaluate performance of closed-head sprinkler systems using aqueous film forming foam by determining effects of head temperature ratings and sprinkler spacing on large scale fuel spill fires in high bay aircraft hangar areas. Results of the tests to be used in revision of design criteria for future Navy installations. This work supports work unit YF53.534.091.01.500, DN587075.

Contractor's test facility will be used to carry out tests with 900 sq. ft. pool fires with JP-4. Sprinkler head actuation times, spraying rates, fire containment and extinguishment times will be determined for the 60 ft. high test area with sprinkler head spacing 10 by 13-ft. for head temperature ratings of 165 degrees F (74 degrees C) and 268 degrees F (131 degrees C) or 360 de-

grees F (182 degrees C). Evaluate and compare test results with similar previous test results and document the results of the work.

SUPPORTED BY U.S. Dept. of Defense, Civil Engineering Lab., Naval Construction Battalion Center

4.0015, ENERGY CONVERSION - STUDIES OF TRANSONIC TURBINES WITH FILM-COOLED BLADES

J.F. Louis, Massachusetts Inst. of Technology, Div. of Sponsored Research, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN975229; N00014-79-C-0132)

The objective of this project is to gather the necessary data essential in developing design procedures for high performance, cooled, highly loaded transonic turbine stages. The effort is theoretical and experimental in nature and is aimed at reducing the amount of cooling required per unit of work extracted. The research will contribute to increased performance of gas turbine engines needed particularly for naval aircraft propulsion, but useful as well to marine power plants and fixed installations.

Study will be made of heat transfer and shock-film interaction in the blade passages, in optimizing performance and design of blade passages, and secondary flow injection. A linear cascade is utilized to test performance of an optimum film cooled blade row, with study of blade shapes, angles of coolant injection, and angle of attack. Emphasis will center on the effect of unsteadiness on the pressure and heat transfer distribution around the blades.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0016, APPLICATION OF THE DELAMINATION THEORY OF WEAR

N.P. Suh, Massachusetts Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN475061; N00014-76-C-0068)

The objective of the research is to examine wear problems associated with spline gears and improve their life cycle by application of the delamination theory of wear utilizing specific types of surface coatings.

The investigator is continuing experimental investigations of the delamination theory of wear that are aimed at the prevention of wear of aircraft splines by the application of soft metallic coatings. A detailed wear analysis of surface and surface coatings, before, during, and after the experiments will be conducted. Also bonding characteristics of the coating to substrate and their effect on the induction period will be investigated by using ionplated specimens. Upon project termination, this wear minimization technique will be ready for field testing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0017, SOFT LANDING CONCEPTS

W. Nykvist, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0H4395)

Determine the feasibility and practicability of employing 'soft landing' techniques to eliminate paper honeycomb energy dissipator material, simplify rigging, and to provide a 'drive-on/drive-off' capability.

Conduct studies and analyses of concepts utilizing primarily impulse-reaction (retrorocket) and pneumatic (airbag) techniques. Acquire an air-bag system from Bertin and Cie, France and evaluate it.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0018, CONCEPTS FOR A NEW PERSONNEL RESERVE PARACHUTE SYSTEM

H. Weber, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0G4372)

This development will explore various concepts for a new steerable reserve parachute.

Investigate various types of steerable reserve canopies, parachute assemblies and harnesses.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0019, DETERMINATION OF FATIGUE CRACK CLOSURE STRESS AS A FUNCTION OF CRACK LENGTH, YIELD STRESS, STRESS RATIO AND ENVIRONMENT (ABBREV)

C.Q. Bowles, University of Missouri, Columbia Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *103 Engineering, Columbia, Missouri* 65201 (ENG79-08102)

The objective of this research program is to resolve the differences between conflicting results on crack closure recently reported in the literature. These are: 1) The effect of crack length on crack opening stress. 2) The effect of yield strength and prior strain history on crack opening stress. 3) The relation between mean stress (R-ratio) and crack closure. 4) The influence of environment on crack closure.

Additionally, it is believed that sufficient data will be obtained to provide functional relationships between the experimental variables and the crack opening stress for the first three items.

Three alloy systems are being studied, each of which has different fatigue properties and characteristics. These are 2024 aluminum alloy, 4130AQ (aircraft quality) steel and Ti-6Al-4V titanium alloy. The aluminum alloy and the steel are being tested in two heat treat conditions thereby providing two levels of yield strength. Finally, the aluminum alloy and the steel are being tested in two cyclic strain hardened conditions to determine the influence of prior strain history.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0020, SECOND-ORDER CLOSURE MODELING OF TURBULENT COMBUSTION

A.K. Varma, Aeronautical Research Associates of Princeton Inc., *50 Washington Rd., Princeton, New Jersey* 08540 (DN975373; N00014-79-C-0335)

The objective of this study is to develop a computation procedure for determining turbulent reacting flows in realistic geometries. This information is needed both for a better understanding of the complex flow-field within the combustors of aircraft turbojet engines and to provide a basis for advanced combustor design. Ultimately it should lead to improved propulsion systems for naval weaponry applications.

An evaluation will be made of a previously developed three species joint probability density function for modeling scalar correlations in an exact time-averaged formulation of turbulent reacting flows. These correlations will be used in a complete second-order closure analysis for simple parabolic axisymmetric and planar configurations. The results will be compared with available experimental measurements and will be studied to identify the most important interactions of the turbulence and combustion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0021, FUNDAMENTAL STUDIES ON TURBULENT SWIRLING JET IGNITION

W.A. Sirignano, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DN975314; N00014-79-C-0300)

The object of this research is to develop understanding, via analysis and experimentation, of the basic phenomena affecting the ignition, flame stabilization, and combustion and to develop predictive techniques useful for actual combustor design. This information is needed to enhance future design of jet engines for military aircraft, ramjets and rockets.

Numerical integration of governing partial differential equations and laser Doppler velocimetry measurements in cold and hot flows. Present analytic work is utilizing several models of

turbulence with different methods of solution and the results compared to experimental data. The governing time-averaged partial differential equations for turbulent, reactive, axisymmetric flows will be developed and the theory extended to obtain solutions for axisymmetric swirling flows. Concurrently, experimental concepts, utilizing a swirl generator with tangential injection of part of the fluid through slots into cylindrical ducts, is being developed to measure velocity correlations in cold swirling flows and flows with combustion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0022, ANALYTICAL TRANSONIC FLOW
L. Sirovich, Applied Science Research Associates Inc., *37 Riverside Dr., New York, New York* 10023 (DN623024; N00014-77-C-0359)

The determination of theoretical methods for the accurate prediction of the flows about high speed bodies is essential for the design of missiles and aircraft. This research is directed to the development of a very fundamental understanding of the steady and unsteady flow fields about bodies at transonic and supersonic flight.

A major effort is being directed to the analytical study of transonic and supersonic flows to complement the many ongoing numerical and experimental programs. Particular emphasis will be devoted to the study of the structure of the flow field within the framework of the Navier-Stokes equations and within the framework of higher order approximate equations, both viscous and inviscid. The direction of the research will be to exploit analysis as much as possible to develop a deeper understanding of the flow, as well as to leading to improved numerical procedures for attacking such flows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0023, ROCKET-BASED STUDIES OF THE ELECTRIC FIELDS AND PLASMA DENSITY ABOVE THE SIPLE VLF TRANSMITTER
M.C. Kelley, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DPP78-23514)

Rocket-borne measurements of electric fields and plasma density will be measured during VLF-wave and particle events over Siple Station, Antarctica, during the austral summer of 1979-80 as part of the multi-group Balloon and Rocket Campaign to study wave-particle interactions in the magnetosphere. Four payloads will be launched from Siple on Nike-Tomahawk rockets provided by NASA. One payload will be used to look for parametric decay of VLF waves, a phenomenon that has application in controlled nuclear fusion research. A small side research effort will involve field testing of a recently developed automatic digital electric field ground station.

This is a renewal of grant number DPP76-21596.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

4.0024, THEORETICAL STUDY OF IONOSPHERIC IRREGULARITIES AND PLASMA INSTABILITIES IN THE MAGNETOSPHERE
R.N. Sudan, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (ATM78-26770)

This grant funds investigation in the areas of: ionospheric irregularites; triggered Whistler emissions; terrestrial kilometric radiation; and plasma convection.

Turbulence is a key interdisciplinary scientific issue. The ionosphere is one of nature's few examples of rather clean two-dimensional turbulence. This investigation, allowing comparison of ionospheric experience with computation simulation and analytic analysis promises significant progress in this area. The study of triggered Whistler emissions is likewise a study of importance to plasma physics in a much wider context than merely the terrestrial environment. The terrestrial kilometric radiation study, again, is a case of seeking to explain a specific observation in our terrestrial environment, with the underlying motivation of explaining the nature of a more basic wave-particle interaction process. The plasma convection studies, involving strong convection of a finite pressure plasma in a magnetic field driven by thermal and density gradients, should be a valuable theoretical contribution to the understanding of magnetospheric gross behavior.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0025, PRELIMINARY STUDY ON THE POTENTIAL USEFULNESS OF ARRAY PROCESSOR TECHNIQUES FOR STRUCTURAL SYNTHESIS
L.J. Feeser, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Civil Engineering, *110 8th St., Troy, New York* 12181 (NSG 1636)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0026, BIOMEDICAL APPLICATION OF ION THRUSTER TECHNOLOGY
D.F. Gibbons, Case Western Reserve University, School of Engineering, Dept. of Biomedical Engineering, *University Cir., Cleveland, Ohio* 44106 (NAS 3-22259)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0027, RESEARCH INITIATION - A STUDY OF DUAL RESONANCE IN HAMILTONIAN SYSTEMS
D.L. Richardson, University of Cincinnati, School of Engineering, Dept. of Engineering Science, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (ENG78-05536)

The problem of resonance in Celestial Mechanics is to be considered for dynamical systems which possess simultaneously two commensurabilities among the frequencies of motion.

The system Hamiltonian H is assumed to have only two critical arguments so that canonical perturbation methods can be applied to reduce the system to a two-degree-of-freedom form. A solution for the motion within the regions of dual-deep resonance will constitute the major objective of the research. Some consideration is to be given toward the construction of a regularized solution which is valid both inside and outside the dual-deep resonance regimes.

The theory will be applied to specific problems in artificial satellite theory. The problem of the motion of a geosynchronous satellite with an orbital inclination close to the critical value of 63 degrees will be the subject of one such application.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0028, EVALUATION OF THE PERFORMANCE OF WIND TURBINE CONCEPTS AND OPERATING WIND TURBINES
T.G. Keith, University of Toledo, School of Engineering, Dept. of Electrical Engineering, *2801 W. Bancroft St., Toledo, Ohio* 43606 (NCC 3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0029, LOW-COST AIR VEHICLE PARAMETER DATA ACQUISITION SYSTEM
J.M. Licht, U.S. Dept. of Defense, Navy, Naval Air Development Center, Engineering Support Group, Engineering Support Group, *Warminster, Pennsylvania* 18974 (DN981196)

To develop and procure a low-cost air vehicle parameter data acquisition system to be installed on NADC resident aircraft. This system is to have the capability to measure various parameters associated with aircraft performance such as throttle angle, turbine outlet temperature, and other parameters as necessary for useful project conformation. Features which must be

available within the system are standard digital format and a minimum of nine data tracks.

Study the current center needs for parameter identification and ascertain the most efficient system for meeting those needs. Design, fabricate and/or procure subsystem components such as (1) a digital recording subsystem, a data collection, digitizing and interface system, (2) temporary connections to existing and new sensor points in aircraft, (3) install, test and certify the installation in the aircraft, and (4) provide data transposing facilities in the laboratory for entry of the collected data in our CDC 6600 computer complex for analysis and data reduction operations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0030, PRE-COOPERATIVE ENGINEERING EDUCATION PROGRAM

M.J. Malkani, State University & Community College System of Tennessee, Tennessee State University, School of Engineering & Technology, Dept. of Electrical Engineering, *Nashville, Tennessee* 37203 (NGT 43-014-790)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0031, DESIGN OF A FOOD SERVICE HABITAT FOR A LARGE-SCALE SPACE STATION

L. Bell, University of Houston, Graduate School, *3801 Cullen Blvd., Houston, Texas* 77004 (NAS 9-15944)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0032, DESIGN AND CONTROL OF REMOTE MANIPULATORS

C.C. Smith, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Remote manipulators have application in a wide variety of fields, including radiation 'hot box' manipulation, space exploration, industrial automation, undersea exploration/fabrication, etc. Basic factors to be considered in manipulator design include strength, weight, speed and precision of response, etc. These factors are very much influenced by the type and location of actuators used in the design. This study concentrates upon the trade-offs between actuators located in joints and actuators located remote to a joint coupled to the joint via cables, etc. Comparisons will be made on the basis of dynamic response, precision, etc. and various classifications of tasks will be explored. This is the third year of a continuing endeavor.

SUPPORTED BY University of Texas

4.0033, NONLINEAR ESTIMATION THEORY

B.D. Tapley, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

By the application of the Martingale Theory and smoothing properties to the study of nonlinear stochastic dynamic systems, an approximate nonlinear estimation algorithm has been developed. In order to determine its effectiveness, the nonlinear estimation algorithm as well as the extended Kalman filter are applied to the problem of estimating the trajectory of a planetary spacecraft using range, range-rate, sun-planet and star-planet angle measurements. The result of the computer-simulated study shows that the nonlinear algorithm is superior to the extended Kalman filter when the measurements are highly non-linear. A comparison of the algorithm with other nonlinear estimation algorithms is being made also, in a continuing line of research expected to extend for several years.

SUPPORTED BY University of Texas

4.0034, TIRE NONLINEAR MODEL

C.M. Andersen, College of William & Mary, Williamsburg College, Graduate School, *Ewell Hall, Williamsburg, Virginia* 23185 (NAS 1-15965)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0035, MANAGEMENT, OPERATION, AND MAINTENANCE OF THE SPACE RADIATION EFFECTS LABORATORY

W. Heeman, College of William & Mary, Williamsburg College, Graduate School, *Ewell Hall, Williamsburg, Virginia* 23185 (NAS 1-9990)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0036, COMPOSITE MATERIALS RESEARCH AND EDUCATION

C.T. Herakovich, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, A STUDY OF THE MIDDAY AURORAS AT THE SOUTH POLE STATION

S.S. Akasofu, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (DPP79-20630)

An all-sky-camera will be operated at South Pole Station, Antarctica, during the period 1978 through 1980 to collect auroral data. This data will be used in conjunction with DMSP satellite photographs and interplanetary magnetic field data to investigate the interaction between the solar wind and the magnetosphere.

The all-sky-camera will be operated by the technician for another project, so no logistic support is required for this project.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0002, GALILEO (JOP AND NIMS)

H. Mazursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02236)

A near-infrared mapping spectrometer is being designed, to be flown on the upcoming Galileo mission. This instrument will map the mineral distribution of the surfaces of the satellites at spatial resolutions of 5 to 30 km. The individual phases and mixtures that are present will be defined, and the mineralogic provinces will be related to geologic provinces that are delineated by a multispectral, high resolution CCD imaging camera. Image and composition data will be correlated with magnetics and gravity.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0003, RADAR BACKSCATTER MODELING

G.G. Schaber, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02040)

STATE TO WHICH PROJECT PERTAINS: California.

During FY 79 we will complete the Death Valley radar backscatter studies manuscript and submit it for publication. The radar backscatter research efforts will be moved into the region

of north-central Arizona where Pliocene to Pleistocene age volcanic rock overlies vegetation-free sedimentary rocks. This region should represent an excellent Venus analog surface for radar analysis. Surface calibration procedures for roughness statistics and empirical backscatter models developed in the Death Valley study will be tested and/or modified for use in the volcanic and sedimentary terrains.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0004, MARS CHRONOLOGY

L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02369)

During the current fiscal year a new element of the project is being investigated. That is to use Viking Orbiter digital image data to extract precise brightness and albedo profiles and integrated topographic profiles for martian craters as they are being counted. This will provide information on not only the size-frequency distribution or number of craters per unit area in each diameter class, but will also provide information on the distribution of slope and shape. Such information is invaluable in trying to sort out surface processes which are in the process of degrading and obliterating craters and in understanding how complete crater populations are so that they can reflect accurately relative ages. It may also be possible to segregate depositional and erosional processes based on the distributions of shapes of craters as a function of size as well as intensity of such processes.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, HYDROGEOLOGIC AND GEOCHEMICAL INVESTIGATION OF THE BOONE LIMESTONE AQUIFER IN BENTON COUNTY, ARKANSAS

A.E. Ogden, University of Arkansas, Fayetteville Campus, School of Arts & Sciences, Dept. of Geology, *Fayetteville, Arkansas* 72701 (A-044-ARK)

The proposed study will make a thorough investigation of the shallow Boone Limestone aquifer of Benton County, Arkansas. The water bearing capacity of the aquifer will be evaluated through pumping test and drillers' information. Well yields will then be correlated with photo-lineaments (fractures) mapped from low altitude BXW (1:20,000) and U-2 color photography.

A piezometric surface map for the Boone aquifer will be prepared for the study area. From this, recharge and discharge areas will be determined as will areas of groundwater mining. Monitoring of water levels in selected wells will enable predictions of seasonal effects to the piezometric surface.

The overall water quality of the aquifer will be determined from extensive well sampling and measurements of major ions and bacteria. Pollution sources will be located, and using geostatistical methods, water quality will be correlated to photo-lineament (fracture) proximity.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0006, INTERNAL FRICTION AND MODULUS MEASUREMENTS IN ROCKS

B.R. Tittmann, Rockwell International Corp., *1049 Camios Dos Rios, Thousand Oaks, California* 91360 (EAR79-06709)

The high seismic Q in the lunar crust and upper mantle, the uncertainties in the depth-profiles of the temperature and rock composition, the viscosity of the crust, and the non-hydrostatic shape of the moon have raised many related questions which impact the current models of the structure, evolution and thermal state of the moon. This research will shed light on these questions by means of laboratory measurements of the elastic and anelastic properties of rocks representative of the lunar crust and mantle under in-situ conditions and at frequencies and strain amplitudes approaching the corresponding seismic values.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0007, BIOLOGY AND CONTROL OF FOREST INSECTS IN CALIFORNIA

R.H. Smith, U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Forest & Range Experiment Station, *P.O. Box 245, Berkeley, California* 94701 (0000343; PSW-2201)

OBJECTIVE: Determine the ecological effects and develop the methods to assess economic impacts of destructive insects on forest resources of California; develop guidelines and procedures for minimizing adverse effects of such insects and for protecting values and productivity of these resources.

APPROACH: Methods to measure, analyze, and interpret bark beetle population levels are inadequate (dynamics); alternative methods of control for western pine beetle and mountain pine beetle are needed to replace or reduce the use of toxic, broad-spectrum insecticides (behavior); influence of the host on bark beetle fluctuations and the depredations is not understood well enough to be useful for resource management under most conditions (resistance); methods of managing insect pests of coniferous seed, cone, and regeneration are inadequate to insure temporal and spatial success of stand regeneration and to reduce the loss of growth in young stands (regeneration).

PROGRESS: A model for predicting the average level of white fir mortality associated with engravers and borers based on weather and fir growth rate patterns was developed. The preliminary formula, tree resistance equals f (resin quantity, resin quality divided by beetle attack density, beetle quality), was developed from small field experiments with altered individual trees, which accounted for all parameters except beetle quality. The 'trap-out' technique, with a synthetic sex attractant mixture, was used against western pine beetle. Overall effect was a reduction and redistribution in numbers of beetles and severity of damage. Closely related species of Ips showed cross-attraction; distantly related species showed no cross-attraction. OTHER PROGRESS: Preliminary critera were established in developing a risk-rating system for harvesting and thinning true fir. Verbenone, a western pine beetle antiattractant, has adequate potency to protect individual trees. Four systemic insecticides as foliar sprays were not effective in killing Eucosma shoot borer in ponderosa and Jeffrey pine because translocation was from old needles to new needles rather than to pith. A trunk spray of 0.3% lindane emulsion kills many beetles but does not protect the tree. A bivariate regression model permits fitting control points and tree mortality spots from aerial photos of flat terrain to medium scale base maps. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Forest & Range Experiment Station

5.0008, PHYSICAL PROPERTIES OF THE VIKING LANDING SITES

H.J. Moore, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02374)

The objectives of this project are: (1) to analyze data relevant to the physical properties of surface materials at the Viking Landing Sites, Mars, and (2) perform experiments in the laboratory using a Surface Sampler Assembly in materials that simulate the Martian surface materials.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0009, RATES & PROCESSES OF EROSION & SEDIMENTATION IN NATURAL & DISTURBED FORESTED DRAINAGE BASINS IN THE DOUGLAS-FIR REGION OF PACIFIC COAST

R.J. Janda, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *345 Middlefield Rd., Menlo Park, California* 94025 (WR 74-089)

Most of the timber harvested annually from the Douglas-fir region is taken from virgin forests by clearcutting. Logging and associated road construction significantly increase stream sediment loads, and considerable controversy exists concerning the magnitude and persistence of the impact of present silvicultural practices. Crucial management and legislative decisions concerning forest practices are being made in an atmosphere of considerable public pressure and controversy. Better understanding of

the geomorphic processes operating in this region will provide a more rational basis for pending decisions, and permit objective assessment of the effectiveness of practices proposed to mitigate sedimentation impacts.

The overall objective is to understand better natural rates and processes of erosion as well as the magnitude and persistence of man's impact on those phenomena. The relative importance of mass movement and of fluvial erosion in providing sediment to the streams in different parts of the Douglas-fir region especially needs to be quantitatively documented. This project will collate and study isolated pieces of sediment yield data collected by various government agencies as well as collect new data about processes responsible for observed sediment yields, downstream and downslope impacts of forest practices, and types of sediment transported by streams flowing through areas of differing land use. Special attention is focused on interactions between stream channels, streamside hillslopes, and vegetation.

Available hydrologic, sedimentologic, and slope stability data will be compiled along with factors that control types and rates of erosion processes. Study areas are selected on the basis of available data, personal experience, and inspection of aerial photographs. Erosional phenomena are studied and mapped on aerial photographs and in the field. Landslide activity and channel geometry changes are documented through repeated surveying. Stream sediment loads are measured during storms. Emphasis is given to study sites scheduled to undergo land-use changes, but sites that will remain in a natural state for the foreseeable future are also established as bench-mark stations. Erosion in recently logged basins will be compared with that in less disturbed basins.

We will continue surveys of hillslope erosion and channel geometry at established sites in the drainage basins of Redwood Creek and Mill Creek. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0010, PB AND K ISOTOPIC INVESTIGATIONS OF MARE BASALTS AND SOILS

G.R. Tilton, University of California, Santa Barbara Campus, Graduate School, Dept. of Geology, *Santa Barbara, California* 93106 (EAR79-05714)

This study is a continuation of tasks, originally funded by NASA, which have been transferred to NSF. This project involves three separate areas of study: (a) Determination of internal U-Pb isochrons for selected mare basalts, (b) Investigation of possible 39K/41K fractionations in lunar soils, and (c) A study of the isotopic composition of U in the high temperature silicate phases of the Allende chondrite. The studies of the internal U-Pb isochrons for selected lunar basalts should yield better knowledge about the duration of volcanism at the various lunar landing sites, early differentiation history of the moon, the possible role of mare basalts in producing the parentless radiogenic lead found in lunar soils and to detect occurrences of post-crystallization disturbances of the U-Pb systems. The studies of the isotopic compositions of potassium in lunar soils has the potential for answering problems associated with volatilization of selected elements in the lunar environment during heating events. The study of the isotopic composition of uranium in the early condensates found in the Allende meteorite should provide information about early solar system processes (e.g. prior to incorporation into the meteorite).

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0011, STUDY OF BUILDING EFFECTS ON EXHAUST PLUME

R.N. Meroney, Colorado State University, School of Engineering, Dept. of Civil Engineering, *Fort Collins, Colorado* 80523 (NAS 1-15925)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0012, UTAH VISIBILITY STUDY

P. Allee, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (RAC40232)

PROJECT OBJECTIVE: 1. Continue baseline measurements of visibility, meteorology and air quality. 2. Evaluate data. 3. Furnish final report.

PROGRESS REPORT: 1. Extremes in visibilities between 285 km and 87 have been observed. 2. A comparison of the photographic technique with the telescopic technique shows that the latter more closely resembles the response of the human eye. 3. No relationship has been found between changes in visibility and human activities.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Land Management

5.0013, EPOCS AIRCRAFT METEOROLOGY

B.R. Bean, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8C696801)

PROJECT OBJECTIVE: EPOCS consists of two major parts: an oceanographic field study of anomalies of the equatorial Pacific Ocean surface temperature and a study of associated anomalies of the atmospheric circulation. The oceanographic program is designed to utilize NOAA's strengths in ocean measurement, instrument development, and modeling, and, at the same time, to complement the oceanographic research carried out by other groups in the tropical regions. The atmospheric program draws heavily on NOAA's role in weather and climate, empirical modeling with historical data, theoretical modeling with existing General Circulation Models (GCM), and atmospheric observations with satellites and aircraft.

CURRENT YEAR PLAN: 1. To obtain thermal cross-section of the Pacific equatorial currents between 90 degrees W to 145 degrees E concurrently with heat, water vapor and momentum exchange between the sea and the air. 2. To examine the internal structure of the atmosphere on long trade-wind trajectory flights.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0014, SEISMOLOGICAL OBSERVATORY OPERATIONS AT SOUTH POLE STATION

J. Taggart, U.S. Dept. of the Interior, Geological Survey, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (DPP78-16676)

The U.S. Geological Survey maintains a seismological station at the South Pole Station. Personnel from the USGS that are responsible for the satellite geoceiver station at the South Pole also operate the seismic station. The grant will support training of the geoceiver operators in the maintainance and operation of the seismographs, basic data reduction and evaluation of the seismic records, and new parts and equipment for the seismometers. The data from the seismological station is used 1) to record earthquakes occurring, not only in the Antarctic Tectonic Plate, but in all areas of the southern hemisphere, 2) to furnish radio earthquake reports daily to Golden, Colorado, for use in the World-wide Epicenter Progran of the USGS, 3) to further delineate continental and oceanic structure of the Antarctic Tectonic Plate, 4) to study propagation of body waves through the mantle and core for earth structure, and 5) to make available to research seismologists the data produced from this uniquely located seismic station.

One qualified electronics technician will make an onsite evaluation of the South Pole seismological station during the 1979-1980 season and make appropriate modifications to upgrade the data.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0015, MINERAL AND ROCK SPECTROSCOPY
G.R. Hunt, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046 MS939, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-01864)

Project objectives for 1979 are: (a) to record and interpret visible and near infrared spectra of minerals, rocks, soils, and vegetation to determine and explain their characterizing and diagnostic features; (b) to complete construction and testing of prototype portable near-infrared spectrometer and use it in the field to explore any differences from laboratory spectra that occur as a function of the natural environment; (c) to complete testing and then use the aircraft scanner modification to produce images through a variety of bandpass filters to determine the optimum filters for satellite instrumentation; (d) to extend spectral studies further into the mid-infrared and perform emission studies.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0016, NUTATION AND POLAR MOTION OF THE EARTH LAGEOS NUMBER THREE
M.L. Smith, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NAS 5-25887)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0017, INVESTIGATION OF IONIZATION EFFECTS IN THE STRATOSPHERE AT HIGH LATITUDES
J.R. Barcus, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM79-01183)

This grant will support an investigation of electrical conductivity and related quantities in the polar stratosphere. Previous research has been successful in obtaining baseline measurements by balloon-borne instrumentation over Greenland during a period near solar minimum. During that time, ionization in the middle and lower stratosphere was dominated by galactic cosmic rays. The results obtained, when taken together with relevant measurements of ionization and other electrical parameters, have helped to establish the state of polar stratospheric electricity during a time of relative geophysical calm. This program will concentrate on investigating stratospheric modifications produced at high latitude by transient sources of ionization (e.g., solar protons and nuclear gamma-rays, solar and auroral x-rays) expected to occur frequently near solar maximum. The total program continues to be a joint US/Danish effort involving the University of California (Berkeley), the Technical University of Denmark, and the University of Denver. The overall objective is to understand the electrodynamics of the polar middle atmosphere, especially as it relates to solar-terrestrial coupling.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0018, SEASAT SAR IMAGERY PRODUCTS
I. Jurkevich, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880325)

To provide ONR/Code 460 designated principal investigators in need of SEASAT SAR imagery products the opportunity to selectively acquire such imagery in limited quantities, suitable for supporting their specific research programs and objectives.

Acquire selected raw data frames of the SEASAT SAR experiment as received at the NASA STADAN STES, process them in the NRL Digital Image Processing Laboratory (DIPL), and offer them to the user community in one of the following forms: computer compatible tapes (CCT), hard copy imagery (HCI) (film products), or a combination of both. The DIPL will also attempt to furnish enhanced hard copies of the imagery per user specifications. Enhancement options include linear and nonlinear grey scale stretching or compression, brightness contouring, edge or line enhancement, color mapping, color composites, magnetization mosaicing binarization, histogram construction, annotation and pixel by pixel manipulation and read-out throughout an image scene.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0019, MARINE ATMOSPHERE (NORSEX)
L. Ruhnke, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980184)

There is a three-fold objective of this research. The first is to provide a well documented marine data base to further refine the existing relationship between standard marine meteorological observations and the vertical water distribution under various cloud conditions. The second is to provide a test set of non-fair-weather total precipitable water content data in the vertical column to compare with similar data deduced from algorithms of both satellite and aircraft multichannel passive microwave radiometer measurements. The third is to provide a survey involving both the vertical distribution of CCN and water vapor to ascertain the suitability of certain platforms in the North Sea to serve as transmission paths for long term GEOMET studies.

Full advantage will be taken to exploit the large amount of marine meteorological data which will become available on a cooperative basis from the international NORSEX Project. Aircraft flights will be made during a 3-week period in March 1979 off of the southwestern coast of Norway. These flights will provide soundings of water vapor, liquid water and cloud condensation nuclei concentrations which, when coupled together with the reduced data from the other investigators, will provide the information necessary to fulfill the three-fold objective of the project.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0020, RAPID INTERPRETATION OF AIRCRAFT SCANNER DATA USING COMPUTER INTERACTIVE SYSTEMS
Ealy, U.S. Dept. of Transportation, Federal Highway Admin., *400 7th St. S.W., Washington, District of Columbia* 20590 (153631 (HRB NO.))

Multispectral aircraft scanner tapes of the Tampa, Florida bypass (I-75) will be analyzed to classify the salsand geology. Results will be compared to conventional mapping methods for accuracy and cost effectiveness.

SUPPORTED BY U.S. Dept. of Transportation, Office of Research, Materials Div.

5.0021, PROJECT AIRSTREAM
A.J. Calio, U.S. National Aeronautics & Space Admin., *600 Independence Ave. S.W., Washington, District of Columbia* 20553 (6807; EX-76-A-28-3152)

The objective is to document the concentrations of selected aerosols and gases in the stratosphere and upper troposphere as a function of latitude, altitude and season in the northern hemisphere. Project Airstream uses a WB-STF aircraft as a sampling platform. Missions are flown in spring, summer and fall. The latitude coverage extends from 75 degrees N to the equator. Four altitudes are sampled, ranging from 40K ft to 63K ft. Vertical profiles at Panama, Alaska and Texas provide tropospheric samples. Filters and whole air samples are analyzed by the DOE Environmental Measurements Laboratory or subcontractors. Tritium analysis is done by the University of Miami. Interpretative analysis of data is done by EML and the Air Resources Laboratory, NOAA.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0022, PLANNING THE MONEX/OCEANOGRAPHY PROGRAM
D.W. Moore, Nova University, Fort Lauderdale Campus, Ocean Sciences Center, *Fort Lauderdale, Florida* 33314 (ATM79-07889)

The purpose of this grant is to continue to provide funds for the planning and implementation of the oceanographic component of the Monsoon Experiment (MONEX). This will include continued support of the MONEX/Oceanography Project Office (previously called the Indian Ocean Experiment (INDEX) Office) at Nova University and meetings of the MONEX/ Oceanography Organizing Committee (previously called the INDEX Organizing Committee). The INDEX, a pilot research project that was conducted during FY 1975-1977 has successfully developed the oceanographic part of MONEX and so the program is now called MONEX/ Oceanography. Although field work has continued since the inception of INDEX, during this year the major and most coordinated field activities will take place.

The MONEX is a major study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmosphere and the ocean in monsoon regions. The major objective of MONEX/ Oceanography is to understand the time-dependent response of the Indian Ocean to the wind forcing due to the monsoons, and the nature of the feedback that the ocean produces on the monsoon regime itself. MONEX is important scientifically and also has significance in global agriculture, economics and politics. The NSF is responsible for supporting the costs of research, logistics, equipment and management of U.S. participation in MONEX which is a regional subprogram under the Global Atmospheric Research Program (GARP).

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0023, WETLANDS DELINEATION, CENTRAL VOLUSIA COUNTY

P.W. Bush, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Orlando, Florida* (FL 76-260)

Volusia County on the Florida central east coast plans development of a central supply well field in a limestone aquifer that is overlain by a water-table sand aquifer. The two aquifers are hydraulically connected and, under natural conditions both are full and lose potential recharge to runoff and ET. Well field development will divert part of the rejected water to recharge; changes in the amount of wetted land area and/or vegetation may also occur. The county would like to be in a position to document those changes in the wetlands caused by pumping and those due to natural hydrologic fluctuations.

Document pre-well field vegetation and shallow aquifer water-level conditions in the approximately 150-square-mile potential recharge area of central Volusia County; also relate shallow aquifer hydrology to the various plant communities.

Construct a series of vegetative maps of the central wetlands area using low-level color aerial photos and field reconnaissance. Establish a network of shallow aquifer wells and staff gages to document seasonal water level fluctuations relative to land surface in the various plant communities. An attempt will be made to use LANDSAT imagery to document the seasonal variation in percentage of wetted land surface.

The vegetative mapping was completed as was the text and illustrations for the WRI map. Report 70 percent completed. Preparation for publishing the vegetative maps on the 1:24,000 scale with text is about 70 percent complete.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Water Resources Div.

5.0024, MEASUREMENTS OF AEROSOL OPTICAL PROPERTIES AS A PART OF THE GAMETAG PROGRAM

G.W. Grams, Georgia Inst. of Technology, School of Geophysical Sciences, Dept. of Meteorology, *Atlanta, Georgia* 30332 (ATM7810091)

The objective of this project is to provide an initial assessment of concentrations and types of natural airborne aerosol particles. This will be achieved by analysing the tropospheric aerosol data collected with the NCAR Electra aircraft during the GAMETAG field program. During the data analysis, particular emphasis will be placed on the properties of the particulates that are of importance in determining their effect on the radiative balance of the atmosphere and thereby on the earth's climate.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0025, STUDIES OF IONOSPHERIC SCINTILLATION PROBLEMS

C.H. Liu, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engin, *207 Engineering Hall, Urbana, Illinois* 61801 (ATM77-22485)

Recent coordinated observations have now provided a sufficiently meaningful data base defining the equatorial ionospheric irregularities that quantitative modeling is possible. One of the most striking results is the Jicamarca incoherent scatter observation of plume like structures which now have led many to view the instabilities as due to instabilities associated with upwelling of depleted plasma density regions (bubbles) from the lower F regions. Radar, in situ, and scintillation data provide a broad spectral picture of the phenomenon.

This grant will fund the processing and analysis of this data with emphasis on the possible link to the phenomenon of rising bubbles. Preliminary calculations for the satellite transmission data base have shown one a priori viable hypothesis, ducting in the field aligned bubbles, to be unlikely; while another hypothesis, multi-path type refractive scattering at the extreme sharp density gradients at the 'walls' of the bubbles, appears feasible. This will be examined in detail. It has been suggested that a hierarchy of instabilities may be operative during equatorial spread F to produce the full wave number spectrum of irregularities. The modeling will test scintillation dependence for a multi-frequency (amplitude and phase) data base.

SUPPORTED BY U.S. National Science Foundation, Div. of
Atmospheric Sciences

5.0026, PREPROCESSING AND ANALYSIS OF GEOPHYSICAL REMOTE-SENSING DATA

P.E. Anuta, Purdue University, Lab. for Applications of Remote Sensing, *West Lafayette, Indiana* 47906 (ENG78-20466)

This research effort addresses the problem of preprocessing and analysis of geophysical remote sensing data which carries information on the subsurface nature of the earth rather than surficial phenomena. In part one of the problem, information derived from aeromagnetic gravity and gamma ray sensor sources is examined to define methods for placing this data in a uniform multivariate grid format for input to analysis algorithms. In part two, research on methods of analysis of the multi-image geophysical data is conducted to define algorithms and analysis steps which will transform a geophysical sample vector into an information quantity relating to the presence of mineral and other subsurface resources.

This research is a continuation of a program previously supported under NSF grant ENG-7614400.

SUPPORTED BY U.S. National Science Foundation, Div. of
Engineering

5.0027, ELECTROMAGNETIC BACKSCATTERING AND EMISSION FROM VEGETATION AND SNOW

A.K. Fung, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Electrical Engineering, *Learned Hall, Lawrence, Kansas* 66044 (ENG79-09374)

This research effort is directed toward an investigation of the interaction of electromagnetic energy and natural terrains such as vegatation cover, snow cover, or ice cover. Theoretical studies are being carried out to establish backscatter and emission models for inhomogeneous media with irregular boundaries, illuminated by microwave remote sensing systems. The scatter models are designed to account for both polarized and cross-polarized returns observed in reported measurements, while the emission models are designed for both vertical and horizontal polarization. In addition, the theoretical studies explore the relative importance of the contributions from volume

and surface scattering mechanisms to the total backscattering coefficient or brightness temperature.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

5.0028, LAND COVER MAPPING USING REMOTE SENSING IMAGERY
M.D. Ashley, University of Maine, Orono Campus, School of Forest Resources, McIntire Stennis Program, *302 Boardman Hall, Orono, Maine* 04473 (0074928; ME09614)

OBJECTIVE: Common forest cover base data needs between forest resource managers and other natural resource managers in Maine at the private, state and federal levels will be identified and then remote sensing imagery and techniques will be evaluated to find which of these can be used to satisfy these common data needs.

APPROACH: The common forest land cover base data needs will be identified through interviews with state, private and federal forestry personnel. After analyzing these interviews, a common compatible system of forest land cover codes will be developed. LANDSAT satellite, small scale aircraft and conventional scale imagery will then be studied to find which of these can most accurately and efficiently provide the needed common cover data.

PROGRESS:

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Maine

5.0029, WETLAND SOILS AND DRAINAGE MAPPING USING AIRBORNE SENSING TECHNIQUES
Breault, General Electric Co., *5030 Herzel Pl., Beltsville, Maryland* 20705 (192782 (HRB NO.))

Objectives of study are to demonstrate and document the cost-effectiveness of using remote sensing methodology to map wetlands engineering soils data.

SUPPORTED BY U.S. Dept. of Transportation, Office of Research, Materials Div.

5.0030, SEASAT-PROGRAM - 'DETERMINING THE UTILITY OF THE SEASAT-A SYNTHETIC APERTURE RADAR FOR OCEAN WAVE DETECTION'
R.C. Beal, Johns Hopkins University, Applied Physics Lab., *Johns Hopkins Rd., Laurel, Maryland* 20810 (7-973; MO-A01-78-00-4330)

OBJECTIVE: Determine performance range over which SEASAT-SAR accurately measures predominant ocean wavelengths and direction and find the small gravity wavelength region for which the isotrophic roughness modulation model is most valid. Results contribute to definition of optimum radar wavelength choice for future oceanographic satellites.

APPROACH: Data will be collected from each of the three to five test sites and recorded simultaneously with the SEASAT-A overflights during the first six months. Then the data from each of the sensors will be converted to a useful format for sensor cross-correlations, primarily involving optical Fourier transform effort. The last phase will involve data analysis and reporting in which correlations between sensors and optical Fourier transform data are examined for significant implications.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0031, SENSOR DEVELOPMENT FOR BASIC SURFACE OBSERVATIONS - CEILING
D.T. Acheson, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Equipment Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8AA8104)

OBJECTIVE: To develop a laser ceilometer which doesn't have the problems of procurement, installation and maintenance that the RBC has.

APPROACH: To continue work on three systems: 1. Pulsed Laser Ceilometer: a. To evaluate the Sperry RVR/CBHI Navy instrument as a ceilometer and RVR Sensor, interfacing it with digital recording equipment at T&ED. b. To design and fabricate a digitally modulated continuous wave HeNe or GaAs laser ceilometer. c. To follow commercial progress in laser ceilometer development. 2. Continuous Wave (CW) Laser Ceilometer: Using pulse compression techniques on receive, develop a system around digitally modulated, commercially available Helium-Neon or near-Infrared source. 3. Stereo Radiometer: a. Develop data processing and display techniques for the acquisition of cloud data in stereo. b. Evaluate the Stereo Radiometric Measurement on cloud distributions varying from simple to complex, using an 'all-sky' camera for ground truth.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0032, MICROCRACKS IN LUNAR ROCKS
M.G. Simmons, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EAR79-07033)

This is a project to study the microcracks in lunar rock samples. During the grant period the following tasks will be accomplished: 1: Measure the effects of thermal cycling on microcracks in rocks. Use the results to determine whether the microcracks in returned lunar samples have been affected significantly by thermal cycling. 2. continue to develop the technique of observing microcracks in samples that are stressed in the SEM. Examine the cracks in several lunar samples with this technique. 3. Determine, if possible, whether the microcracks in returned lunar samples are representative of the microcracks of samples in situ buried in the Moon. 4. Continue to reconnoiter cracks that are present in lunar samples. 5. Continue to develop methods of characterizing cracks in rocks. 6. Interpret the observational data on cracks in terms of: a. the processes that have operated on each lunar sample, b. the intensity of the processes, c. the distribution with depth in the Moon of crack spectra of lunar rocks, and d. the variation with depth of various physical properties of rocks in the Moon. 7. Report the results in the usual scientific journals and in summary form in an annual report to NSF.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0033, PETROLOGICAL AND MINERALOGICAL STUDIES
U. Marvin, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31P-4P50-02)

In an effort to better understand the distribution of elements in materials of the early solar system, a project was begun to correlate mineralogy with rare earth elements in the Allende meteorite. Forty-six selected particles from the meteorite were analyzed for minor elements by neutron activation at the University of Oregon and returned to me for petrographic study by use of optical microscopes, X-ray diffraction, and the electron microprobe. Most of this work will be done in the coming year.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

5.0034, LAND USE CHANGE IN CARROLL COUNTY, GEORGIA
J.F. Hart, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Geography, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (G-12)

STATE TO WHICH PROJECT PERTAINS: Georgia.

Through use of air photos, maps, and field research, the changing patterns of land use in Carroll County, Georgia are being studied.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0035, SURVEY TECHNOLOGY

A.J. Kemmerer, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Marine Fisheries Service, Southeast Fisheries Center, *Bay St. Louis, Mississippi* 39520 (SEC-207)

Overall objective is to provide technical options for achieving NMFS goals through satellite and remote sensing applications, development of sampling and data management systems, programs planning (system engineering), and technology transfer and coordination. Satellite studies include SEASAT-A surface layer transport and fisheries surveillance, CZCS fishery applications, satellite tracking of porpoises and marine turtles, and development of satellite image analyses; remote sensing applications include photography and LLLTV demonstrations, remote mapping of submerged sea-grasses and support of RUFAS-II; sampling systems include turtle and porpoise tags, turtle tracking, and development of trawl door ST. Data management efforts relate to EPA studies, SEFC data, and optimized cruise tracks. Program planning includes SEFC turtle PDP support, and planning support for NOAA. Technology transfer and coordination impacts the national focus of NFEL and includes NOAA technical management of CZCS program, NMFS coordination of SEASAT projects, support of ICES aerospace remote sensing group, and participation in IOCARIBE and MEXUS. Program and project activities normally involve cooperative investigations with technology related research agencies (e.g., NASA, U.S. Navy, etc.), and user groups (e.g., fishing industries, EPA, BLM, Fish & Wildlife Service, etc.). Emphasis is on planning, coordination, and analysis and evaluation of results for NMFS application.

SUPPORTED BY U.S. Dept. of Commerce, National Marine Fisheries Service, Southeast Fisheries Center

5.0036, TROPHIC CLASSIFICATION OF LAKE MEAD UTILIZING CONTACT AND LANDSAT DATA

D.H. Boland, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., Water & Land Quality Branch, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J613A-022)

OBJECTIVE/APPROACH: The general objective is to determine the utility of LANDSAT multispectral scanner data for the investigation of the spatial-temporal aspects of trophic indicators and trophic state in a large lake (Lake Mead). Specific objectives include: 1. Development and evaluation of models to predict the magnitude of selected trophic indicators. 2. Development and evaluation of models to predict the trophic state of a lake. 3. Generation and evaluation of thematic photomaps which depict trophic indicator magnitudes and trophic index values within a lake.

Water quality data were collected from Lake Mead on 8 different dates during 1976 concurrently or near-concurrently with LANDSAT and NASA aircrafts. Remotely sensed data were acquired by multispectral scanners and aerial mapping cameras. Multispectral data from 20 LANDSAT scenes are being compared with water quality data obtained from some 40 lake sampling sites and, if statistically significant relationships are found, thematic photomaps will be generated. The maps will display the temporal-spatial aspects of trophic indicators and a trophic index.

FINAL OUTPUT: A report will be written describing the project results for use by other EPA, Federal, and State Agency monitoring personnel.

PROGRESS: Significant correlations between remote data and Water Quality parameters have been identified.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0037, DEVELOP LASER FLUOROSENSORS FOR MONITORING SURFACE WATER CHLOROPHYLL A

M. Bristow, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., *P.O. Box 15027, Las Vegas, Nevada* 89114 (J884A-045)

OBJECTIVE: Develop an airborne laser fluorosensor capable of measuring and mapping surface water chlorophyll A concentrations and monitoring fluorescent tracing dyes. By making repeated passes in a fixed or rotary wing aircraft, produce a map of chlorophyll fluorescence-to-water Raman ratio for use as an indicator of surface water chlorophyll A concentration.

APPROACH: The airborne laser fluorosensor employs a flashlamp pumped dye laser tuned to the absorption peak of chlorophyll A. The laser-induced fluorescence is collected by a telescope and focussed onto a detector. Correction for variation in water transmission is made by monitoring the laser-induced water OH stretch Raman band. The signal is displayed on a CRT, digitized and recorded on magnetic tape.

PROGRESS: The system is currently being evaluated in a helicopter, at the height of 1000 ft. above the water surface. Good signal-to-noise ratios are obtained for surface chlorophyll concentrations of the order of 1 microgram/l Raman-corrected fluorescent returns correlated with surface water values for chlorophyll concentrations as obtained using in situ measurements.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0038, AIRBORNE AIR QUALITY MEASUREMENTS SYSTEMS DEVELOPMENT

J. van Ee, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., *P.O. Box 15027, Las Vegas, Nevada* 89114 (J763A-05)

OBJECTIVE: Design and test-fly an airborne air quality measurements system that can be easily moved from aircraft to aircraft. The system is to be as compact and lightweight as possible with minimum electrical power requirements, and be tailored to withstand the vibration and rapid temperature and pressure changes in aircraft. The system should reduce costs and inflexibility currently associated with dedicated air quality measurements aircraft.

APPROACH: Develop an instrument package for measurement of temperature, dew point, altitude, position, ozone, particulates, and oxides of nitrogen which can be quickly installed in the nose and cabin areas of a small twin-engine private plane. Existing air pollution instruments will be modified in varying degrees and miniaturizing electronics employed to achieve a small lightweight system.

PROGRESS: The design phase has begun.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0039, REMOTE ICE THICKNESS AND STRENGTH DETERMINATION

A. Kovacs, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (DA0C8144)

The technical objective is to evaluate remote sensing techniques for detection of ice thickness and strength. The purpose is to provide methodology which can be used by the Army in the field for determining if an ice sheet (river, lake or sea) will support tactical vehicles. Information will be transferred to other government agencies.

The approach will be to evaluate electromagnetic methods for measuring ice thickness and physical properties which can be used to evaluate the bearing capacity of a desired ice crossing by military vehicles. This will include the evaluation of platforms needed to transport the remote sensing equipment. From this evaluation system concepts for determining, by remote techniques, the trafficability of an ice sheet will be developed.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0040, TURBULENCE AND TURBULENT DISPERSION FOR A TWO-DIMENSIONAL SIMULATED BAROCLINIC ATMOSPHERIC MODEL

R.L. Peskin, Rutgers the State University of New Jersey, New Brunswick Campus, School of Engineering, Dept. of Mechanical Industrial & Aerospace Engineering, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (ATM7901694)

The objective of this research is to study processes controlling turbulence dispersion in large scale atmospheric motions. A two-dimensional numerical simulation model will be constructed by using equatorial heating, polar cooling, and an appropriate thermal energy equation. Turbulent structure will be investigated with emphasis on energy and momentum flux balances.

Lagrangian particle tracking will be employed to study single point and relative two-point dispersion. Data from the First GARP Global Experiment (FGGE) balloon releases will be used to study single and two-point Lagrangian separation processes. These data will be compared to similar studies of previous balloon releases as well as the numerical simulation results.

Atmospheric diffusion and turbulence processes are difficult, but very important areas of atmospheric science. An increased understanding of these processes is necessary in order to overcome a major obstacle in our efforts to improve medium- and long-range weather predictions.

This is a new award for continued work on a previously funded project.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0041, LONG RANGE AIR QUALITY EFFECTS STUDY (FORMERLY PROJECT DAVINCI)

B.D. Zak, Sandia Lab., *P.O. Box 5800, Albuquerque, New Mexico* 87115 (1520; EY-76-C-04-0789)

The primary objective of the Long Range Air Quality Effects Study is to provide the information necessary to describe the large scale regional (50 to 1000 km) and subcontinental scale air quality problems associated with NEP scenarios. The primary approach of the project is to conduct studies of the pollutant transport and transformation in a Lagrangian mode utilizing an instrumented superpressure balloon in the vicinity of the source. The balloon provides a Lagrangian marker of the air mass volume. Spatial mapping about the balloon of pollutants and meteorology would be conducted using instrumented aircraft. Another facet of the project will include using the automated data collection package suspended by a helicopter to conduct close-in sampling of plumes.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0042, NATURAL AND ARTIFICIAL INFRASOUND AS AN ATMOSPHERIC PROBE

W.L. Donn, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (ATM79-08350)

Interfering ocean waves radiate continuous infrasound into the atmosphere. Also, infrasound is generated during the supersonic part of the many daily flights of the Concorde aircraft. This grant funds the recording of these sounds at long range on arrays of sensors after the signal has been refracted through the upper atmosphere. This remote, inexpensive, passive probe of the atmosphere provides information on the speed and direction of the winds in the stratosphere and lower thermosphere. The continuous signal from sea waves and the regular signal from the Concorde will be digitally recorded to develop a procedure for providing a continuous monitor of the upper atmosphere. The digital analysis will: (1) increase the resolution of wind determinations, particularly when more than one infrasound source is present; and (2) decrease the time required to obtain results in a large-scale operation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0043, DEVELOPMENT OF A 0.4 TO 2.5 MICRON SPECTRORADIOMETER INSTRUMENT SYSTEM FOR AIRBORNE REMOTE SENSING

J.T. Kuo, Columbia University, School of Mines, Dept. of Mining Metallurgical & Mineral Engineering, *Broadway & W. 116th St., New York, New York* 10027 (ENG78-24432)

The objective of this research is to assemble a variety of 'off-the-shelf' electronic components such as detectors and data processing units into an airborne remote sensing instrument capable of high resolution measurements of the in-situ spectral properties of geologic materials and botanical overcover.

The system uses parallel optical input to all spectral channels with a simultaneous spectral range of 0.4 to 2.5 microns. The detector module uses a 512 channel silicon diode linear array to cover the 0.4 to 1.4 mm bandwidth. A 48 element lead sulphide detector array covers the 1.1 to 2.5 micron region with variable bandwidths having the greatest spectral resolution in the 2.0 to 2.5 micron region. Dispersion optics are designed to display the digital form in real-time and stored on computer compatible tapes. Continuous and automatic data acquisition is allowed during airborne operations and a motorized 35 mm camera to record ground track and a CRT display to allow real-time monitoring are included features.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

5.0044, DATA ACQUISITION AND PATH SELECTION DECISION-MAKING FOR AN AUTONOMOUS ROVING VEHICLE

S.W. Yerazunis, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Chemical & Environmental Engineering, *110 8th St., Troy, New York* 12181 (NASW 3279)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

5.0045, SPECTROSCOPIC INVESTIGATION OF THE UPPER ATMOSPHERE IN THE PLASMAPAUSE REGION

J.S. Kim, State University of New York, Albany Campus, School of Science & Mathematics, Dept. of Atmospheric Science, *1400 Washington Ave., Albany, New York* 12222 (ATM78-05739 A02)

This grant funds a program for collecting and analyzing data which will allow extension of our understanding of important transport and dynamical effects in the sub-auroral upper atmosphere. The program incorporates a 6-inch high-resolution Fabry-Perot interferometer system designed to achieve high optical throughput while maintaining high resolving power. For the next 18 months, a period encompassing the International Magnetospheric Study (IMS) and the maximum activity years of the current solar cycle, the instrument will measure temperatures and neutral winds through Doppler interferometric measurements of the atomic oxygen emission line at 6300A. This will be observed in nightglow, aurora and SAR arcs from a field station in the vicinity of Albany, New York. In addition, observations will be made of the atmospheric emissions associated with precipitating particles (5577A, 6300A, 4278A, and 4861A) and of SAR arcs (6300A) in the vicinity of the plasmapause and the underlying neutral atmosphere by means of a multicolor airglow photometer which sweeps along the geomagnetic meridian plane of the observing station. These measurements are to be closely coordinated with the operation of the Millstone Hill incoherent-scatter radars which are located in Westford, Massachusetts. The program emphasis will be on collecting and analyzing data on the neutral winds in the same thermospheric volume as probed by the Millstone Hill radar. It is notable that both Westford and Albany lie near the plasmapause transition, and that the upcoming solar activity maximum is expected to be a large one, possibly comparable to the 57-58 maximum, the strongest in recent history.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0046, ACQUISITION OF A SCANNING ELECTRON MICROSCOPE

W.J. Meyers, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (EAR78-22444)

The scanning electron microscope will be used in the fields of paleobiology, carbonate diagenesis and sedimentology, lacustrine and associated terrestrial sedimentology, evaporite diagenesis, geochemistry, and lunar rock surface studies. Also the instrument will be used as a teaching and research tool for advanced undergraduates, graduate students and faculty. In general, the instrument will provide a facility that can be used to do much of the groundwork micro-petrography on many types of samples that will be analyzed on the STEM, analogous to doing careful light petrography before electron microprobe analyses.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0047, AIRCRAFT OPERATIONS

R.W. Garber, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973 (002355; EY-76-C-02-0016)

A twin-engine aircraft has been leased for exclusive use to carry out research projects which are part of the Atmospheric Sciences programs at Brookhaven National Laboratory (BNL). The aircraft is used for atmospheric sampling and analysis experiments. Routine observation of the horizontal and vertical distribution of pollutants which are conducted for the MAP3S program require about one-half of its scheduled flight time. Plume studies which are part of the MAP3S program require about one-quarter of the scheduled flight time. The remaining scheduled flight time is used principally for cooperative atmospheric studies with observation teams from other organizations which are part of the MAP3S program. Other BNL Atmospheric Sciences programs may obtain flight time on this aircraft on a cost-recoverable basis. For certain studies which are conducted for the MAP3S program and for other Atmospheric Sciences programs, utilization of a second small aircraft is necessary. Additional aircraft will be obtained on a short-term rental basis and outfitted with easily-installed equipment for the purposes of the specific study. As part of Aircraft Operations, a program of equipment testing, calibration, and modification is required to maintain an effective atmospheric sampling and analysis system for the aircraft.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0048, CUYAHOGA COUNTY CENTRALIZED MANAGEMENT AND INSTRUMENTATION, MONITORING AND PROCESS CONTROL STUDY

S.J. Sebesta, Cuyahoga County Sanitary Engineering Dept., *75 Public Sq., 2nd Floor, Cleveland, Ohio* 44113 (R806330; C821B-02TD44)

OBJECTIVE: The objective of this research is to evaluate the cost benefits of low-cost field-proven sensors and telecommunication equipment in monitoring package sewage treatment plants.

APPROACH: EPA/MERL-WRD has developed a centralized management model for operating a group of small treatment plants. The model will be calibrated using field data and implemented at Cuyahoga County, Ohio.

PROGRESS: The grant was processed in August 1978. Cuyahoga County has selected a contractor to aid in procurement and installation of the remote sensors.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Municipal Environmental Research Lab.

5.0049, SATELLITE IMAGERY ANALYSIS OF MEDITERRANEAN SEA

J.J. Gallagher, U.S. Dept. of Defense, Navy, Naval Underwater Systems Center, *Newport, Rhode Island* 02840 (DN989003)

Use available data to locate and characterize ocean fronts in the Mediterranean Sea. Determine spatial and temporal changes of frontal locations and relative radiative sea surface temperature (SST) gradients.

Using the unique data set of available NOAA very high resolution (VHRR) enhanced visible and infrared satellite imagery and the NUSC (code 343) optical microdensitometer determine relative SST gradients referenced to calibrated gray shade wedges. Translate the locations and SST gradient information to a standardized base map in a color scheme related to the STEPU wedge. These data could be animated for follow-on investigations of adjective frontal dynamics. Use the archival data processing and display capability at the Saclant ASW Centre, U Laspezia, Italy to determine the in-situ density and sound velocity structures of the observed thermal frontal features; this effort will also identify those regions where in-situ environmental data are lacking.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

5.0050, STABILITY OF NAVIGATIONAL CHANNELS AND SHOALING IN SOUND ENTRANCES, SOUTHERN HALF OF THE SOUTH CAROLINA COAST

M.O. Hayes, University of South Carolina, School of Science & Mathematics, Dept. of Geology, *Admin. Bldg., Room 115, Columbia, South Carolina* 29208 (R/CZ-2)

OBJECTIVES: 1. Determine historical changes of navigable tidal creeks and rivers in South Carolina salt marshes. This would include location of unstable, eroding portions as well as those areas prone to rapid shoaling. 2. Incorporate data on migration of tidal inlets generated by USC-Coastal Research Division Sea Grant Project of 1977-78. 3. Carry-out an historical analysis of inlet migration (using sequential aerial photographs) for all major tidal inlets south of Charleston Harbor, not already included in this year's (1977-78) inlet study. 4. Determine channel stability at the entrances to St. Helena and Port Royal Sounds.

ANTICIPATED BENEFITS: 1. Location of problem areas and variability of tidal channels in salt marshes should aid in coastal zone management. 2. Provide a basis for decision-making regarding building of coastal structures, (e.g., jetties), dredging permits, set-back lines, etc. 3. Location of stable channel configurations will aid in the logical development and maintenance of dredging programs. 4. Determination of shoaling behavior within the sounds should aid in eliminating navigational problems.

IDENTIFIED BENEFITS TO DATE: Information gained through this project is being used by the principal investigator to formulate advice on several questions raised by the Coastal Commission of the State of South Carolina.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0051, RESOLVING THE AGRICULTURAL/RESIDENTIAL IMAGE CLASSIFICATION CONFLICT

E.D. Miller, Texas A & M University, College Station Campus, Graduate School, *College Station, Texas* 77843 (NAS 5-25846)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0052, SEASAT PROGRAM - DETERMINATION OF A PRECISE SEASAT EPHEMERIS AND OCEAN TOPOGRAPHY USING LASER & ALTIMETER MEASUREMENTS FOR MODEL IMPROVEMENTS

R.E. Schutz, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712 (7-928; MO-AO1-78-00-4325)

OBJECTIVE: Determination of a continuous long duration orbit using lasers and altimeter data, resulting in an improved force model for use in determining SEASAT orbits at other times.

APPROACH: To achieve the objective, a simultaneous solution which includes a set of epoch orbital elements, a set of time-dependent atmospheric resistance parameters, a set of time-dependent solar radiation pressure parameters, a set of parameters associated with other non-gravitational forces, a truncated

set of geopotential coefficients, measurement model parameters, and other parameters deemed necessary as the result of preliminary studies will be obtained. The approach will be to use a single continuous dynamically consistent orbit of as long as possible to ensure uniform sampling of the oceanic surface by the altimeter. In addition, the reference equipotential surface will be completely consistent with the geopotential used for computing the orbit and will be close to the geoid.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0053, THEORETICAL AND OBSERVATIONAL STUDIES OF NEUTRAL ATOM PRECIPITATION

B.A. Tinsley, University of Texas, Dallas Campus, Center for Space Sciences, *Richardson, Texas* 75082 (ATM79-13211)

This grant will permit measurements of optical emissions due to the precipitation of energetic neutral atoms into the middle and low latitude upper atmosphere at McDonald Observatory (W. Texas, Magnetic dip latitude 40 degrees), Mt. Haleakala (Maui, Hawaii, magnetic dip latitude 22 degrees), and Huancayo Peru (magnetic dip latitude 0.6 degrees). Precipitating hydrogen, helium and oxygen atoms originate at several earth radii when the parent ring current ions capture an electron from geocoronal hydrogen atoms. The influx is strongest during main phases of large geomagnetic storms, and the ionization produced by it can be an order of magnitude greater than normal at night in the upper E region. Even at quiet times the influx and ionization production is non-zero. During storms there may be significant heating effects at middle and low latitudes.

Theoretical work on the subject of energetic neutral precipitation will also be undertaken. Thus far, the only calculation with the correct physics is for a two-dimensional approximation, and it only yields the latitude variation of the influx. New three-dimensional calculations will be made. Height profiles of energy deposition and ionization production in the ionosphere will then be calculated, and the efficiency of production of the low altitude equatorial belt of trapped particles.

The observations would be made for at least two years with emphasis on magnetic storm periods, but also during moderately distubed and quiet condition. The observation period (mid 1979-mid 1981) would include the approaching solar maximum period. The observations will serve to test the models and provide a measure of the total energy input rate for the neutral atom precipitation process.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0054, PLANNING, IMPLEMENTATION, EVALUATION OF REMOTE SENSING (PIERS)

D.E. Lichy, U.S. Dept. of Defense, Army, Corps of Engineers, Coastal Engineering Research Center, *Kingman Bldg., Fort Belvoir, Virginia* 22060 (31581)

OBJECTIVE(S): To plan, implement and evaluate the state-of-the-art of remote sensing technology related to coastal engineering. Although the use of remote sensing techniques has been utilized to a high degree in various technical disciplines, the application in coastal engineering has lagged because of a lack of a coherent plan and guide for use by coastal engineers and scientists.

APPROACH: Review research related to coastal engineering and implement where applicable remote sensing techniques. Evaluate the cost-effect and relate to operation Corps needs. Develop algorithms for the use of remote sensing in coastal engineering. This will involve multi-sensor evaluation such as LANDSAT, SEASAT, HCMM, TIROS-N, NIMBUS-G, scanners, multi-spectral, laser and conventional aerial photography.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Coastal Engineering Research Center

5.0055, PREDICTION OF WAVE TRANSFORMATION IN SHALLOW WATER

L. Vincent, U.S. Dept. of Defense, Army, Corps of Engineers, Coastal Engineering Research Center, *Kingman Bldg., Fort Belvoir, Virginia* 22060 (31592)

OBJECTIVE(S): To determine the most satisfactory procedures for estimating wave conditions near shore from a knowledge of offshore waves for a variety of realistic conditions; to develop improved procedures for conditions in which available procedures are not adequate.

APPROACH: Aerial photographs and radar images will be used to determine actual refraction and diffraction patterns as waves move into shallow water. The results of refraction and diffraction calculations will be displayed as computer drawn maps of wave crests for comparison with the photographs and images mentioned above. Gage records of waves in deep and shallow water will be compared in this evaluation whenever practical.

Simultaneously with the above empirical study, the theory of energy propagation by gravity waves will be examined in a more fundamental way than that used in most operation theories of wave modification in the coastal zone. Theoretical analyses will be used in designing the empirical tests. Results of the empirical tests will be used in planning theoretical improvements for operational models.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Coastal Engineering Research Center

5.0056, LANDSAT EVALUATION FOR AUTOMATED TERRAIN DATA EXTRACTION

R.D. Tynes, U.S. Dept. of Defense, Army, Corps of Engineers, MGI Data Div., *Fort Belvoir, Virginia* 22060 (DA0M8067)

To evaluate the image record characteristics of remote sensor systems such as LANDSAT, infrared, and radars to determine the image parameters and data content which can contribute to automated extraction of information required for topographic maps and MGI.

Through exploitation of the technical literature and other available data concerning systems imaging characteristics and applications, LANDSAT, radar and infrared systems will be analyzed for image record content and how it may contribute to automated terrain data extraction. Image processing and interpretation techniques will be identified along with computer processing software or algorithms. This work will utilize representative imagery collected under the work titled 'Imagery Reference Set for Automated Terrain Data Extraction.'

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Engineer Topographic Lab.

5.0057, X-RAY SPECTROSCOPY

H.J. Rose, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9770-00452)

X-ray spectroscopy, electron microprobe, and transmission and scanning electron microscopy are main areas of instrumentation. Major objectives are the development of methods and techniques for the bulk and micro-analysis of geologic specimens. An automated fully-focusing X-ray spectrometer has been built and is currently being tested for automatic trace element analysis as well as indicating a 10 to 20 fold increase in intensity for the elements F to Si.

Studies currently in progress include chemical and mineralogical characterization of polished coal mounts, peats and coal ashes, unconsolidated sediments from the Atlantic Coastal Plain, as well as the active support of other survey investigations requiring micro-mineralogical and chemical analysis. Participation in the Viking Mars program will continue with the preparation and analysis of Martian analog samples. Automated sample preparation techniques are also under study.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0058, STRUCTURAL ANALYSIS OF KENTUCKY
D.F. Black, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9510-01964)

STATE TO WHICH PROJECT PERTAINS: Kentucky.

As part of a summary of geologic findings that have resulted from the recently completed geologic mapping of the state of Kentucky, work is in progress to collect, analyze, and interrelate all available data bearing on the tectonic evolution of the region. The project is divided into three parts: (1) An analysis of fault-associated dolomitization of limestone formations in central Kentucky. (2) A comparative analysis made of geologic structural features defined by detailed mapping in northern, central, and southern Kentucky with other mapped, imaged, and subsurface sectional data compiled using geophysical, remote-sensing, and other geological techniques. (3) Preparation of a statewide map of structural features to be a companion to the general geologic map and geophysical maps also in preparation.

Part 1 is completed. Part 2 is about half completed. Part 3 is about one-third completed.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0059, FLUID INCLUSIONS IN MINERALS - NASA
E. Roedder, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9710-01151)

Studies of the origin, mode of formation, composition, and significance of fluid inclusion (including silicate, sulfide, and gas phases) in lunar and meteoritic samples have yielded much data on the magnetic and geologic history of these samples and the processes they have undergone. Some of this information is not otherwise obtainable. Extrapolations to terrestrial sample analogs have been particularly fruitful.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0060, SATELLITE IMAGE ATLAS OF GLACIERS
R.S. Williams, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092 (E-0051)

STATES (AND FOREIGN COUNTRIES) TO WHICH PROJECT PERTAINS: Global project: Antarctica, Greenland, Iceland, Europe, Asia, Middle East, Africa, West Iran, New Zealand, South America, Mexico, Canada, United States (Colorado, Montana, Idaho, Oregon, Washington, Alaska, California, Utah, Nevada, Wyoming).

In FY 1979 it is planned to complete the identification and selection of the best LANDSAT and other satellite imagery over those areas of the world that have extant glaciers. The imagery will be sent to the various cooperating scientists of many domestic and foreign organizations from the U.S., Canada, USSR, PRC, United Kingdom, Chile, Argentina, France, Switzerland, Austria, Turkey, India, Japan, New Zealand, Iceland, Denmark, and Norway who will be authoring the geographic and topical chapters. The authors will complete the text of their chapters during the following 6-9 months and return it to the editors for the initial editing and cartographic work in preparation for publication as a U.S. Geological Survey Professional Paper. By the end of FY 1979 most, if not all, of the text and rough graphics should be in the editing process.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0061, WATER RESOURCES DIVISION SATELLITE DATA RELAY PROJECT
W.G. Shope, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (WD 70-111)

There is a rapidly developing satellite data transmission technology that may provide the Water Resources Division with an economical means for collecting and disseminating in real-time data from remote sampling sites. Tests of the NASA LANDSAT and NOAH/NESS GOES data collection system have demonstrated the feasibility of mating USGS field instruments with field radios and routinely relaying the data. Yet to be determined are final specifications for an operational system, cost, benefits, and the feasibility of using a commercial service.

The objectives are to test and evaluate the performance characteristics of LANDSAT, GOES, COMSAT General, and subsequently available satellite data systems as potential operational tools. The results of these tests will be used to design and implement an operational satellite data telemetry system to support the collection of hydrologic data.

A number of LANDSAT DCS experiments have been conducted and will continue. The GOES-DCS was tested in 1976-77 and will continue to be tested through 1978. The COMSAT General 11 site demonstrations end June 19, 1978. A follow-up on COMSAT General pilot project involving 101 sites is expected to be tested in early 1979. This project will have overall responsibility for the program of testing these systems. The program will consist of technical coordination and direction from the project leader in Reston. Computer software support is being developed in the WRD Automatic Data Section.

LANDSAT and GOES are operational. The number of LANDSAT DCPs has decreased to 30. The GOES DCPs are slowly increasing and now stand at 110. The COMSAT General 11 site demonstration has been successfully completed. The computer software development has been progressing with the assistance of contractor support.

LANDSAT and GOES DCS activities will continue to receive support from this project. WRD will be continuing to support changes in the GOES system so that DCP problems can be detected automatically and data can be sent directly from NESS to the USGS MULTICS computer in Reston. Plans are also being considered to test a hydrologic data service from a commercial source.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0062, DEVELOP MICRO AND MACRO TEXTURE MEASURES FOR LANDSAT SCENES
R.M. Havalick, Virginia Polytechnic Inst. & State University, Graduate School, *Blacksburg, Virginia* 24061 (NAS 5-25839)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0063, STUDIES OF THE ATMOSPHERE USING AEROSPACE PROBES
V.E. Suomi, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (8-012; 04-6-158-44087 MOD. #5)

TECHNICAL OBJECTIVES: Investigate empirically and theoretically the use of satellite data, principally images from geostationary satellites, but augmented with polar orbiting data and conventional data in active areas -- as a means of attaining a more continuous picture both spatially and temporally of the evolution of severe weather systems.

APPROACH: Archive rapid scan GOES images with conventional data, which in turn will expand the data base from which observational studies of severe weather can be made. Examine cloud motion winds from these and other GOES sequences in particular cases to determine the advantages of using rapid scan imagery in identifying critical dynamical features associated with severe weather. Combine these case studies with theoretical studies to provide a fertile dynamical basis for the diagnosis, integration, and prediction of subsynoptic scale flow features influencing clouds, winds, and associated severe weather over a 12 hour period.

PROGRESS: Archiving of all data for all rapid scan cases in the past year has been achieved both on tape and in hard copy. Some case studies were initiated where it was found that many of the overshooting convective towers were colder than the surrounding anvils and were associated with severe weather events at the ground. Some projects nearing completion are: 1) generation mechanisms and the theory of inertial instability, 2) subsynoptic surface fields over the mountainous western states,

3) theory of steady state downstream adjustment, and 4) modeling the adjustment of mass and velocity fields near a strong jet.

SUPPORTED BY U.S. Dept. of Commerce, National Environmental Satellite Service, Meteorological Satellite Lab.

5.0064, SYNOPTIC-DYNAMIC APPLICATIONS OF METEOROLOGICAL SATELLITE DATA
L.H. Horn, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Meteorology, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (8-612; NA79AA-H-00011)

TECHNICAL OBJECTIVES: a) Evaluation of satellite data, especially temperature profiles, with emphasis on their application to weather prediction. b) Development of techniques to maximize usefulness of data in forecast related problems, especially in the short term for the field forecaster.

APPROACH: a) Evaluation of TIROS-N vertical temperature/moisture soundings over the U.S. by synoptic case study utilizing satellite and coincident rawinsonde data independently and in combination. b) Combination of satellite soundings and satellite wind vectors to the advantage of both using balance relationships to establish dynamic consistency. c) Monitor propagating jet streams with 4/day soundings and relate movement to severe weather outbreak. d) Monitor cyclogenesis with emphasis on determining early indications of the onset of major weather changes.

SUPPORTED BY U.S. Dept. of Commerce, National Environmental Satellite Service, Meteorological Satellite Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, DIRECT FIELD RESEARCH SUPPORT TO IMMEDIATE ARMY AEROMEDICAL PROBLEMS (02)
J. Treanor, U.S. Dept. of Defense, Army, Medical Research & Development Command, Bioengineering & Life Support Equipment Div., *Fort Rucker, Ozark, Alabama* 36362 (DA0D6734)

Provide US Army Aviation with sound and timely bioengineering information to solve operational problems generated in the interface of the physical and life sciences.

The techniques employed will vary, depending on the problem area, but will be based on sound accepted experimental methodology designed to provide the required information as expeditiously as possible.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, AUDITORY AND VISUAL INFORMATION PROCESSING
S.R. Parkinson, Arizona State University, School of Liberal Arts, Dept. of Psychology, *Tempe, Arizona* 85281 (DF223170; F33615-77-C-0053)

To investigate the information processing involved in instrument cross-check skills and task load stress.

An analysis of differences in visual scanning strategies employed by students and instructor pilots will be conducted. Visual scanning will be evaluated by both classical behavioral measures and film records of eye focus points. Task load problems will also be investigated. This research will be conducted in four phases: (1) The first phase will evaluate the effects of different amounts of exposure (using visual scanning tasks) on instrument displays measuring cross-checking capability. This phase should determine the amount of exposure which will result in maximum improvement in performance. (2) The second phase will examine critical features of instrument displays to see if presenting to trainees a variety of instrument displays early in training will facilitate more efficient critical feature analysis. The SS will also be presented with novel aircraft displays to determine if this training procedure will enhance ability to learn efficient scanning strategies. (3) the third phase will employ a central light display with dynamic scanning requirements similar to those of the flight task. Response latency measures will be taken on both pilots and non-pilots to compare differences in use of the information obtained from the central light display. Response latencies for IPS and trainees on cued trails will also be compared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, AIR FORCE SKILLS MAINTENANCE AND REACQUISITION TRAINING RESEARCH PROGRAM PHASE I - PRELIMINARY EVALUATION
E.E. Eddowes, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223960)

Develop and validate comprehensive, quantitative, objective procedures which will permit the Air Force to manage an individualized flying training program which will provide acceptable mission readiness at minimum cost. This work unit will document the planning and management of the Air Force Skills Maintenance and Reacquisition Training Research Program (Project SMART).

The objective of this research will be achieved through the sequential accomplishment of the following four phases: 1. Preliminary evaluation of Project SMART methodology. 2. Identify and define critical flying skills and develop and validate objective procedures for measuring them. 3. Measure the retention of mission readiness skills as a function of the duration of nonflying period. 4. Evaluate the effectiveness of alternative flying training programs designed to maintain or foster rapid reacquisition of mission readiness skills.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, A-10 TRAINING RESEARCH SUPPORT
S.T. Hannan, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223450)

To modify Cockpit A of the Advanced Simulator for Pilot Training (ASPT) to an A-10 configuration to provide a tactial weapons delivery capability, heads up display, A-10 flight and weapon scoring in support of transition training research and air-to-surface research capabilities.

The necessary hardware modifications will be performed on-site under the ASPT maintenance contracts. The flight dynamics for the A-10 will be developed under a joint in-house/contractor effort. The A-10 project has been segmented into two phases. Phase I addresses the modifications required for transition training/research and should be completed in the first quarter of FY 78. Phase II will provide the capability for air-to-surface research and is scheduled to begin 1 Jan 78. Efforts in phase II will refine the ASPT handling characteristics to approximate the A-10 performance as closely as possible. This phase will continue for 12-14 months.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, PSYCHOTROPIC DRUGS AND FLYING ABILITY
D.S. Janowsky, U.S. Veterans Admin., Dept. of Medicine & Surgery, Medical Center, *3350 La Jolla Village Blvd., San Diego, California* 92161 (571-50-3144; 664-002-F)

This project found that 10 marijuana intoxicated pilots showed marked deterioration in simulated flying ability following smoking 6 mg delta-9 THC. This effect lasted for 1 to 2 hours, was definitely gone by 6 hours, and was intensified by social doses of ethanol.

During the past year, the role of the cholinergic nervous system in mood and neuro-endocrine regulation has been explored in 20 psychiatric patients. Discoveries include: 1) intravenous physostigmine (1 mg/100 lb.) caused transient depression in 7 euthymic depressives, but not in 8 alcoholics, and 2) in 20 psychiatric patients, physostigmine increased serum prolactin, cortisol, and growth hormone levels and changes in prolactin correlated with physostigmine-induced mood changes. Thus,

physostigmine may have potential as an affective disorder psychodiagnostic agent; and cholinergic factors may influence the regulation of growth hormone, cortisol, and prolactin.

Project resources have been utilized to determine some of the interpersonal effects of marijuana and methylphenidate. Marijuana (delta-9 THC equals 6 mg), in contrast to placebo, was found, in 20 normal volunteers, to decrease the accurate perception of affect. Also, the ability of 20 psychotherapists to express interpersonal skills as rated by their normal volunteer patients was decreased. Intravenous methylphenidate (0.5 mg/kg) was found to increase patient perceptions of being highly regarded in 20 psychiatric patients. In these patients, both at baseline and after methylphenidate, increases or decreases in perceived warmth, empathy, genuineness, and regard in a psychotherapist-interviewer occurred depending on patient mood state and/or mood changes respectively. This study has clinical implications in terms of defining the role of mood state and drug-induced mood changes in influencing interpersonal perceptions, and may suggest a motivational basis for stimulant abuse.

SUPPORTED BY U.S. Veterans Admin., Dept. of Medicine & Surgery

6.0006, DEVELOPMENT AND EVALUATION OF AN ION-BEAM SPUTTER-VENTILATED VENTRICULAR CATHETER
E.L. Foltz, University of California, Irvine Campus, California College of Medicine, Dept. of Surgery, *Irvine, California* 92664 (NAS 3-21963)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

6.0007, BONE RESORPTION AND CALCIUM ABSORPTION IN RATS DURING SPACEFLIGHT
C. Cann, University of California, San Francisco Campus, Graduate School, *551 Parnassus Ave., San Francisco, California* 94122 (NAS 2-10350)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, COMPUTERIZED TOMOGRAPHIC DETERMINATION OF SPINAL BONE MINERAL CONTENT
H.K. Genant, University of California, San Francisco Campus, Graduate School, *551 Parnassus Ave., San Francisco, California* 94122 (NAS 9-15887)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0009, COSMOS 1979 EXPERIMENT - BONE MODELING/REMODELING IN THE RAT MANDIBLE
R. Baron, Yale University, Graduate School, *206 Elm, New Haven, Connecticut* 06520 (NAS 2-10338)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, DEVELOPMENT OF A NEW NON-INVASIVE METHOD TO DETERMINE BONE INTEGRITY IN VIVO
J.A. Albright, Louisiana State University, Shreveport Campus, School of Medicine, Dept. of Orthopaedics, *Shreveport, Louisiana* 71105 (NAS 9-15950)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0011, COSMOS 1979 EXPERIMENT - TRABECULAE AND MINERALIZATION IN THE LONG BONES
J.L. Matthews, Baylor College of Medicine, School of Medicine, *1200 Moursund Ave., Houston, Texas* 77025 (NAS 2-10354)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0012, GROWTH RATE AND HISTOLOGY OF LONG BONES AND VERTEBRAE
W.S. Jee, Utah Higher Education System, University of Utah, School of Medicine, Dept. of Anatomy, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NAS 2-10308)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0013, DUAL PHOTON ABSORPTIOMETRY SYSTEM FOR GROUND-BASED MEASUREMENTS OF THE LUMBAR SPINE IN MAN
R. Mazess, University of Wisconsin, Madison Campus, Medical School, Dept. of Radiology, *307 N. Charles St., Madison, Wisconsin* 53706 (NAS 2-10359)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, SOFTWARE AND HARDWARE DESIGN FABRICATION TESTING AND DOCUMENTATION OF MICRO COMMUNICATION SYSTEM
J.L. McIver, Colorado State University, Graduate School, *Fort Collins, Colorado* 80523 (NAS 5-25760)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0002, A STUDY IN MATHEMATICAL PHYSICS
F. John, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (MCS76-07521 A02)

This is a continuation of research previously supported under MCS73-08466AO2.

F. John will work on the study of singularities occurring in the motion or equilibrium of elastic bodies. Three different effects contributing to singularity formation can be recognized: focussing, shock formation and change in type; each of these three effects is relevant to certain situations in elastic media. F. John will continue the analysis of their development.

D. Ebin will continue his work on applications of modern analysis to fluid dynamics. He has worked on flow, satisfying the Euler equations, and more recently on the relation between compressibility and incompressibility in particular, on the asymptotic approach to incompressibility if the coefficient of compressibility tends to zero. This is a degenerate behavior since in the resulting equations there is pressure but it has no longer any connection to density.

G. Kriegsmann will investigate numerical solutions of the reduced wave equation with a variable index of refraction, including negative indices, and will apply geometric optics to problems connected with inner and outer expansions for complicated diffraction problems.

SUPPORTED BY U.S. National Science Foundation, Div. of Mathematical & Computer Sciences

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, COMPILATION OF ATOMIC ENERGY LEVEL AND GROTRIAN DIAGRAMS FOR ALL STAGES OF IONIZATION FOR ALL ELEMENTS
S. Bashkin, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (PHY79-06546)

Financial assistance will be provided to support the continuation of a compilation of atomic energy-level and Grotrian

diagrams. These diagrams will summarize present knowledge of the structure of each type of atom in each of its states of ionization.

This research is a continuation of that currently supported under NSF Grant PHY76-22667 A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0002, HIGH POWER SURFACE RESISTANCE AND CRITICAL MICROWAVE FIELDS OF TYPE I AND TYPE II SUPERCONDUCTORS FOR MICROWAVE RESONATORS

J.E. Mercereau, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (PHY79-09773)

This is a continuation of work done under PHY76-81713 A05.

This work represents part of a program to design, test and construct a prototype of a superconducting LINAC to be used as a post-accelerator for the SUNY Stony Brook Tandem Van de Graaf. The work to be supported under this grant will be the continued preparation and testing of superconducting surfaces, mainly lead-plated copper, and the design and construction of a resonator with a large beta to be used in the second half of a LINAC post-accelerator when the ion velocities have increased.

This group will also be working on the demonstration of the feasibility of producing higher beta modules with the desired characteristics under industrial conditions. This work will be done under separately funded subcontract with the Stony Brook Group.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0003, MEASUREMENT OF ATOMIC TRANSITION PROBABILITIES

W. Whaling, California Inst. of Technology, Graduate School, Dept. of Physics, *1201 E. California Blvd., Pasadena, California* 91109 (AST7826033)

This project will be concerned with the measurement of atomic transition probabilities useful for the quantitative analysis of hot gases and plasmas. Transitions selected for study are those that are prominent in astrophysical spectra. For neutral and singly charged ions, the experimental procedure includes a comparison with solar equivalent widths to test the internal consistency of the measured transition probabilities.

During the grant period this project will (1) continue measurements in progress on the resonance lines of doubly-ionized iron (Fe III), (2) determine transition probabilities in cobalt, and (3) explore the use of the one meter Fourier Transform Spectrometer at the Kitt Peak National Observatory as a tool for measuring transition probabilities.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0004, NEW SUPERCONDUCTING MATERIALS PRODUCED BY SPUTTERING

A.C. Lawson, Claremont Colleges, Pomona College, Undergraduate School, Dept. of Physics, *Claremont, California* 91711 (PRM79-13192)

Superconductivity above 15K is found in only distinct crystal structures: the beta-tungsten structure, the defect NaCl structure, the Chevrel phase structure, and the Pu2C3 structure. It is finally possible to synthesize Nb3Ge with a transition temperature in excess of 23K with the use of sputtering, a technique which has proved its usefulness only with the elapse of twenty years after the initial discovery of superconductivity in the beta-tungsten structure. We now propose to investigate the superconductivity of (Th,Y)2C3 materials produced by sputtering. The dependence of the superconducting properties on sputtering conditions will be determined. The synthesis of the unstable cubic Laves phases will also be investigated for the purpose of determining the extent to which sputtering can be applied to the problem of metallurgical instability.

The NSF award provides essential equipment for this research, including a wafering machine, vacuum pumps, a residual gas analyzer, and other items.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management

8.0005, ELECTRON SCATTERING BY LASER EXCITED ATOMS

S. Trajmar, U.S. National Aeronautics & Space Admin., Jet Propulsion Lab., *4800 Oak Grove Dr., Pasadena, California* 91103 (PHY79-05971)

This project in atomic physics will study the scattering of electrons by atoms excited to specific states by a laser. A tunable dye laser will be used to populate individual hyperfine levels of specific isotopes and to prepare the target with known alignment and orientation (magnetic sublevel populations). Collision of nearly monoenergetic electrons with these excited species will be studied and the laboratory measurements will yield scattering amplitudes and relative phases as well as cross-sections for the various collision processes.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0006, SCALING BEHAVIOR NEAR VALENCE INSTABILITIES

J.M. Lawrence, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (DRM79-06578)

Thermodynamic experiments such as susceptibility, electrical resistivity, and thermal expansion will be carried out to examine the scaling behavior of the effective moment in certain mixed valence materials. A Cerium-Tin-Indium alloy, a periodic mixed valence system, has given indications that some features of single impurity scaling theory are valid. Experiments in other cerium intermetallics will be carried-out to test the general validity of the scaling results. These experiments will be done on systems in which the valence can be altered smoothly by alloying, from trivalence to intermediate valence to tetrovalence.

This research was previously supported under DMR 7682109.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, THEORETICAL INVESTIGATIONS OF SURFACE EFFECTS IN SOLIDS AND THE PROPERTIES OF SEMICONDUCTORS

A.A. Maradudin, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (DMR7809430)

The purpose of this research program is to increase our understanding of surface physics and semiconductor physics. The study of surface physics will emphasize lattice dynamical properties. The results should be useful in understanding the phenomena of attenuation, second harmonic generation, and refraction of surface elastic waves. A first-principle quantum mechanical calculation will be made of the atomic force constants at a metal surface which should be useful in interpreting experiments on low-energy electron diffraction. Studies will also be made of the effect of spatial dispersion on surface plasmons which should be of interest in connection with electron energy-loss experiments. The investigations of semiconductor physics will include studies of impurity states and electronic Raman scattering in inversion of metal-oxide-semiconductor devices. The results should improve our understanding of these devices. Impurity states will also be studied in compensated semiconductors in magnetic fields. Excitations known as interface polaritons will be investigated for planar interfaces between two semiconductors differing in such properties as carrier concentration and polar character.

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This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, LOW-TEMPERATURE ACOUSTICS

I. Rudnick, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DN523202; N00014-75-C-0246)

Cryogenic techniques and devices, including power generation, gyroscopes, and signal processors, have been proposed for the Navy of the future. It is the objective of this research to support those efforts by developing a comprehensive and fundamental theoretical and experimental description of the physics of liquid helium.

Means for generating and detecting the four or more types of sound which propagate in liquid helium are devised, and these sounds in turn are used as tools to probe the superfluid medium.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0009, ARTIFICIAL STIMULATION OF AURORAL PLASMAS

A.Y. Wong, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DN875505; N00014-78-C-0754)

The objectives are to develop a better understanding of the auroral phenomena that lead to disruption of naval communications through active experiments, and to investigate the possible generation of radio waves at VLF frequencies and below through modulation of the earth's field-aligned currents.

A high-frequency pulsed ionospheric heater is being planned to carry-out the active experiments. It will be located in the auroral zone beneath the region where the nearly vertical field-aligned currents flow through the ionosphere. Currently theoretical analyses of expected effects and preliminary design of experimental equipment are being performed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0010, THERMODYNAMICS, METALLURGY AND PHASE STABILITY OF HIGH-TEMPERATURE SUPERCONDUCTORS

G.W. Webb, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (DMR77-23774)

An investigation will be made of the properties of high transition temperature superconductors. The study will focus on thermodynamic stability and normal state electrical resistivity. The microscopic factors leading the very high values of room temperature resistivity in certain high transition temperature compounds will be investigated. Heat capacity measurements will be used as probes of the thermodynamic stability. The connection between unusual features of the resistivity and heat capacity will be experimentally explored in a number of superconducting compounds.

Research previously supported under DMR75-04019. This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, STUDIES RELATED TO DROPLET BURNING AT ZERO G

F.A. Williams, University of California, San Diego Campus, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *P.O. Box 109, La Jolla, California* 92037 (NSG 3296)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0012, MEASUREMENT OF X-RAYS IN THE MESOSPHERE

J.R. Barcus, University of Denver, School of Arts & Sciences, Dept. of Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (NAS 5-25862)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0013, LOW-ENERGY INELASTIC ATOMIC AND MOLECULAR COLLISIONS 16515-P

E. Pollack, University of Connecticut, Storrs Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Storrs, Connecticut* 06268 (DA0G9099; DAAG29-79-C-0125)

To study low-energy atom-atom, ion-atom, ion-diatomic molecule collisions to understand the dynamics of excitation processes, obtain selection rules and scaling laws for both outer and inner shell processes. Relevance - the research has long-range potential relevance to diverse fields including ion implantation and surface physics, laser plasma excitation mechanisms, and some aspects of atmospheric modeling.

Inelastic energy loss (conversion of projectile energy into internal electronic excitation), observation of emitted photons and electrons in delayed coincidence, measurement of absolute differential elastic and inelastic cross-sections, total optical and x-ray emission cross-sections, and measurement of polarization.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0014, CROSS-SECTIONS AND EQUILIBRIUM FRACTIONS FOR D ION AND D2 ION IN COLLISION WITH METHYL VAPORS

T.J. Morgan, Wesleyan University, School of Liberal Arts & Sciences, Dept. of Physics, *Middletown, Connecticut* 06457 (EY-76-S-02-4022)

OBJECTIVE: Obtain atomic physics collision information needed for design of neutral injection into fusion devices.

BACKGROUND: Almost no information available on alkaline targets and on D2 ion collisions.

PLAN: Measure cross-sections for single and double electron capture and negative ion equilibrium fractions for 1 to 100 rev D ion and D2 ions in collisions with alkaline earths.

RESULTS: Cross-sections in Mg, Ba for D ion. Equilibrium fractions in Ba for D ion.

SUPPORTED BY U.S. Dept. of Energy, Div. of Magnetic Fusion Energy

8.0015, ELECTRONIC STRUCTURE, SEMICONDUCTORS, METALS

B.M. KLein, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980103)

Self-consistent augmented-plane-wave band-structure calculations will be performed for the semiconductors Si, Ge, Sn, GaP, GaAs, GaSb, InP, InAs, InSb, ZnSe and CdTe. Densities of states will be calculated and used in computations of optical reflectivity spectra. Charge densities, charge transfer, and ionicity will be determined and chemical bonding will be investigated. Band effective masses will be determined and compared with experiment.

The basic tool for calculating the electronic structure is the augmented-plane-wave (APW) method. The output of these calculations, electronic energies and wave-functions, are used with the appropriate theory and computer codes to calculate the properties of interest.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0016, THIRD SOUND - A STUDY OF THE SUPERFLUID FILM

K.L. Telschow, Southern Illinois University, Carbondale Campus, School of Science, Dept. of Physics & Astronomy, *Carbondale, Illinois* 62901 (DMR78-16749)

A newly developed high resolution technique for measuring the phase velocity of third sound will be used to study the properties of static and flowing helium-4 films. This technique shows promise of being able to measure Doppler shifted phase velocities to one part per million. These studies will concentrate on films ranging from three to twenty atomic layers in thickness and will invovle both subcritical and critical flows. In the case of static films, efforts will emphasize measurements of the superfluid fraction as close as possible to the transition temperature. Measurements of the Doppler shifted third sound for flowing films provide the only method of direct measurement of the superflow velocity via knowledge of the superfluid fraction as a function of velocity. Dissipation in the flowing film will be measured with high resolution; the flow velocity will be directly recorded under both driven and persistent current conditions. Such measurements will be the first to record all phases of dissipation within a single geometry. If the envisioned one part per million resolution is achieved--current limit is eighty parts per million--one should be able to use the Doppler shift technique to observe singly quantized circulation states. These studies are important for our fundamental knowledge of quantum hydrodynamics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0017, MAGNETIC ORDER IN ALLOYS

H. Claus, University of Illinois, Chicago Circle Campus, School of Liberal Arts & Sciences, Dept. of Physics, *601 S. Morgan St., Chicago, Illinois* 60680 (DMR76-22125)

Magnetization measurements will be performed to investigate the low-temperature magnetic order of selected transition metal alloys near the critical composition for the onset of ferromagnetism. Initially, to investigate the change-over from long-range ferromagnetic order to spin glass type ordering, the low field a.c. susceptibility will be determined both as function of composition and of the degree of atomic short-range order. Emphasis will be placed on how the atomic short-range order affects the magnetic ordering and on information about the kinetics of atomic short-range order and the metallurgical homogeneity of the samples used. Then, on selected samples, detailed magnetization measurements will be performed to determine the important characteristics of the different types of magnetic ordering. The purpose of this study is to gain a better understanding of the approach to magnetic order in random alloys.

This research previously supported under DMR 7622125.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0018, LUMINESCENCE AND LASER STUDIES ON III-V SEMICONDUCTORS

N. Holonyak, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DMR79-09991)

This research on luminescence studies of III-V semiconductors will provide the fundamental underpinning for the development of electronic devices such as quantum-well lasers and light-emitting diodes. The classes of materials to be studied include aluminum gallium arsenide/gallium arsenide heterostructures prepared by vapor phase epitaxy and indium gallium phosphorous arsenide prepared by liquid phase epitaxy. Attempts will be made to develop finer microstructures (thin films) by these methods. The liquid phase epitaxy growth method will be improved to grow coupled quantum-well heterostructures. The chemical vapor deposition crystal growth will be done by researchers at Rockwell International.

Studies will include determining the conduction behavior along quantum-well channels and a determination of the effects of doping in the wells and in the confining layers. The recombination characteristics will be examined to determine the phonon properties of quantum-well devices and to assess how strong phonon coupling can be used to improve device performance.

This research is a continuation of that initiated under NSF Grant DMR76-81432. This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0019, RESONANCE IONIZATION SPECTROSCOPY OF ATOMS

M.H. Nayfeh, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801

The structure and interatomic interactions of atoms can be investigated by the resonance ionization spectroscopy method (RIS) using pulsed dye lasers. The method allows the investigation of low abundancy systems such as helium excited states or positronium atoms. Moreover, the method is very useful in searches for rare events, such as atoms with free quarks embedded in their nuclei. The RIS process also provides a highly sensitive method for resolution of binary collisions, since optically thin samples are used where many-body collisions or dimer absorption are essentially eliminated. These high-density problems cause loss of sensitivity in the traditional absorption and fluorescence methods.

SUPPORTED BY University of Illinois

8.0020, INTERACTING FERMI SYSTEMS

A.W. Overhauser, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR78-00545 A01)

Research formerly supported by DMR74-03464.

Theoretical research will be carried-out with the objective of a deeper understanding of electron-electron interactions in solids. Several types of phenomena will be investigated, such as one-electron energy spectra, collective phase transformations, collective excitations and dynamic scattering phenomena.

Also, some types of physical properties which have been found experimentally to exhibit anomalous behavior will be studied. These include the unusual magnetoresistance of sodium and potassium, the unexpected dependence with magnetic field of acoustic wave generation in aluminum and potassium and the thermal resistance of potassium at high magnetic fields.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0021, CONDUCTION ELECTRONS AND MAGNETISM

R.E. Prange, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DMR79-08819)

Research previously supported by DMR7708602.

A comprehensive theory of the magnetism of itinerant electron materials, such as iron and nickel, has been developed. This theory will be further elaborated and extended to other classes of materials. The work relies on the idea that there is short-range magnetic order in these systems even when long-range order vanishes above the Curie temperature. A way has been found to take account of this order, and it has been shown that electronic properties in these materials are little affected by the large-scale magnetic disorder near and above the phase transition. In particular, short wavelength spin waves are predicted to exist well above the Curie temperature, as is found experimentally. The origin of the short-range order will be investigated, using numerical techniques and simplified expressions derived for the effective spin-spin interaction. Also, recent experiments which claim to measure electronic properties in nickel near the critical point will be analyzed. These confirm in a general way the prediction of small changes in these properties but have some puzzling features. Further the new ideas will be applied to weak ferromagnets, amorphous metallic ferromagnets and possibly spin glasses and antiferromagnets. Finally, various transport phenomena in magnetic metals will be examined to see if the un-

derstanding of the interaction of electrons with magnetic disorder aids in their elucidation.

This is the first year of a three year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, PURCHASE OF FOUR-WIRE CONDUCTANCE BRIDGE AND TEMPERATURE SENSOR

S.B. Crary, Amherst College, School of Liberal Arts, Dept. of Physics, *Box 65, Amherst, Massachusetts* 01002 (PRM79-19651)

A low-power, 4-wire conductance bridge incorporating a germanium sensor will be purchased for use in an investigation of the low temperature thermal properties of monolayer films of helium-3. Data will be obtained in the temperature range from 0.08 Kelvin to 4.2 Kelvin.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management

8.0023, ALL-SKY MONOCHROMATIC TV OBSERVATIONS OF AIRGLOW EMISSIONS FROM ARECIBO

R.H. Eather, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Physics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (ATM78-22601)

Over the past decade we have grown increasingly aware of the presence and importance of dynamics in the upper atmosphere. Separately, there has been a growing interest in electron concentration structure, as related to transport and instability and communication effects. This grant funds deployment of a state-of-the-art instrument that significantly extends our ability to make measurements improving our morphological and phenomenological understanding in both of these areas.

In the past, time continuous altitude profile (multi-parameter) measurements by incoherent scatter radars at the Arecibo Observatory have significantly expanded our knowledge of low latitude dynamics, transport, and structure in the thermosphere and ionosphere. However, such data are limited by time resolutions of order minutes, and special coverage of one line of sight nominally overhead. This grant funds deployment of an instrument that will measure airglow intensities at night, with a time resolution of seconds, and special coverage of an area exceeding 1000 km across. The instrument will monitor atmospheric emissions dependent upon electron and atmospheric concentrations in the mid thermosphere (6300A) and upon atmospheric concentration in the lower thermosphere (5577A). These 'overview' data and the Arecibo radar 'detailed' data will each be significantly more meaningful within the context of the other, in identifying and understanding a number of thermospheric dynamical effects.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0024, NUCLEATION AND GROWTH OF SOLID-STATE TRANSFORMATIONS

M. Cohen, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR79-15196)

The mechanisms of nucleation and growth in martensitic transformations are being investigated theoretically and experimentally toward the ultimate objective of understanding and controlling the overall reaction kinetics as well as the morphology of the transformation product. There will be a progressive shift of emphasis in this work from the nucleation phenomena under previous and current study, to the structure of the generated interphase boundaries, and then to the propagation dynamics of such interfaces. The interface-velocity law will involve a generalized thermodynamic driving force for the non-isothermal, non-adiabatic conditions at play, the dislocation structure of the interphase boundary as determined by the crystallography of the lattice and lattice-invariant deformations, and the degree of elastic vs. plastic accomodation of the operative transformational shape change. The closely-coupled interactions among these processes are also likely to govern the fine structure of the transformation product and, hence, to play a guiding role in the manipulation of certain structure-property relationships.

This is a continuation of research previously supported under NSF Grant DMR76-22993-A02. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, SUPERRADIANCE - NEW METHODS OF PRODUCTION AND DETAILED STUDIES OF NEW EFFECTS

M.S. Feld, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (PHY78-18120)

This research in atomic physics will study certain aspects of superradiance which is a fundamental effect involving the coherent spontaneous emission of light by a collection of atoms or molecules. The program will include the study of superradiance by two new methods: (1) creation of a fully inverted (pi) initial state by adiabatic inversion of an optically-thick sample and (2) preparation of an optically-thick system in a pi/2 configuration by suddenly terminating a resonant saturating field. The research will also study basic features of superradiant emission and explore theoretical predictions using these new techniques of producing superradiant radiation, as well as now standard optical pumping methods.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0026, INVESTIGATION OF TOPICS IN OPTICAL ELECTRONICS AND GENERATION OF FAR-IR RADIATION 16225-P

A. Javan, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0G9032; DAAG29-79-C-0028)

(1) To study the fundamental physics of high speed metal-barrier-metal junctions and their application to optical electronics. (2) To search for novel approaches and perform experiments that will lead to generation of intense coherent radiation in the FIR and millimeter wave regions. Relevance - tunneling junctions are of fundamental importance to the detection and production of electromagnetic radiation. This directly impacts Army systems in the MW, FIR, and IR spectral regions. The fabriction techniques raise the possibility of the manufacture to sophisticated IR systems at low cost. The FIR generation work bears directly on the Army's NMMW thrust.

To deposit junctions of very small size and controlled barrier thickness in the visible, IR, FIR, MW, and RF spectral regions in order to observe their response as a function of applied bias. The ultimate goal is to extend microelectronic techniques into the optical spectral region. For the production of FIR radiation, they will consider rotational nonequilibrium, low-lying vibrational states, excitation by slow electrons and impurity levels in semi-conductors.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0027, ATMOSPHERE EXPLORER, DYNAMICS EXPLORER, AND SAN MARCO DATA SOFTWARE DEVELOPMENT

G.R. Carignan, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical Engineering, *Ann Arbor, Michigan* 48104 (NAS 5-25916)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0028, QUANTUM DYNAMICS OF MOLECULAR INTERACTIONS

W.R. Gentry, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (CHE79-08346)

This research is in the area of quantum chemistry; it involves molecular beam scattering. Drs. Gentry and Giese intend to continue pulsed molecular beam measurements of differential cross-sections for state-resolved rotational transitions in atom-diatom and diatom-diatom collisions, and to extend this research to the study of vibrational-rotational energy transfer processes. Taking advantage of the unique capabilities offered by the combination of a pulsed molecular beam and a pulsed laser, they also plan to study bimolecular reactive collisions of excited molecules, and the dynamics of unimolecular fragmentation following vibrational or electronic excitation under collision-free conditions. This research represents a continuation of that currently supported by Foundation grant CHE7611368.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0029, SURVEILLANCE - DISSOCIATIVE CHARGE TRANSFER EXCITATION

J.J. Leventhal, University of Missouri, St. Louis Campus, School of Arts & Sciences, Dept. of Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (DN675483; N00014-76-C-0760)

Charge transfer processes occur in many gaseous lasers, in the ionosphere, and plasmas. Radiative charge transfer is an important means of producing population inversion in metal vapors. Thus, it is important to the naval areas of communications and surveillance to obtain a better understanding of the mechanisms involved in charge transfer excitation of metal vapors which have potential laser application.

The present apparatus is being modified so that VUV and soft x-rays can be observed. Then collisions of He (2 plus) with Li will be studied. It has been predicted theoretically that this should lead to a selective population of the He-plus (31) states. Collisions between other low Z ions and Li will also be studied if time permits.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0030, STUDY OF GEOLOGICAL MATERIALS BY THE METHODS OF PARTICLE TRACKS, THERMOLUMINESCENCE AND RARE GASES

R.M. Walker, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (EAR7822440)

This is a continuation of research supported under NSF grant EAR76-22697 and A01.

A continuing search for superheavy elements is proposed using low-level spontaneous fission counting experiments on plastic track detectors. The samples to be used in these experiments will be separated fractions of the Allende meteorite and hot springs extracts obtained from Russia. The anomalous fission events in these samples may indicate the presence of superheavy elements.

The discovery of large numbers of meteorites in Antarctica opens up an exciting new chapter in meteoritics. These meteorites give the first opportunity to look at the behavior of cosmic rays at discrete intervals of time in the past. Also these meteorites make it possible to determine if the nature of the meteorite flux hitting the earth has changed in time. The time factors in various age determinations will be measured using the radiation damage (fossil track technique in films) and measurements of radioisotopes such as 26Al and 53Mn, etc.

Thermoluminescence measurements will be made routinely as a method of measuring terrestrial ages and delineating those meteorites with unusual orbital elements.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

8.0031, SUPERCONDUCTIVITY IN FILAMENTARY EUTECTIC COMPOSITES

M.P. Zaitlin, Dartmouth College, School of Arts & Sciences, Dept. of Physics & Astronomy, *P.O. Box 833, Hanover, New Hampshire* 03755 (ER-78-S-02-4938)

High quality filamentary eutectic composites of Nb-Th and Nb-Y have recently been developed by Prof. J.D. Verhoeven at the Ames Research Laboratory. These materials consist of very small (i.e. approximately 100A) diameter superconducting filaments embedded in a normal metal matrix. Measurements of the thermal and electrical conductivity of these materials will be made near the superconducting transition temperature to observe the effects of thermodynamic fluctuations. Josephson coupling between filaments is expected to play an important role in the superconducting properties of these materials. This coupling can be varied by changing the distance between filaments which can be done by drawing down the wire or using different normal metal matrix materials. If necessary, the normal metal may be etched away at several points along the wire to eliminate the coupling. The fluctuation conductivity will be studied as a function of filament spacing.

This coupling is also expected to produce a crossover from one-dimensional to three-dimensional superconductivity which could be detected in the electrical conductivity near Tc. Evidence for such a crossover has been observed in granular films but the relevant physical parameters are better characterized and easier to adjust in a filamentary eutectic.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0032, HYPERFINE INTERACTIONS AND ELECTRONIC STRUCTURE BY MOSSBAUER/CONVERSION ELECTRON SPECTROSCOPY

N. Koller, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR79-00816)

The microscopic origins of the hyperfine interactions at nuclei in magnetic environments will be investigated using a high transmission, high resolution electron spectrometer. This spectrometer will detect conversion electrons resulting from Mossbauer transitions in isotopes of iron and tin. These experiments make possible the direct measurement of the charge and spin density of the electrons at the nuclear site and provide a sensitive test of electronic wave function calculations. It will also be possible to measure the effect of the chemical environment in various materials. This research previously supported under DMR 7602053 AO2. This is the first of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, SPIN ALIGNED ELECTRONS IN SEMICONDUCTORS

R.R. Alfano, City University of New York, City College, School of Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DMR7817805)

Picosecond time resolved spectroscopy will be used to study the dynamics of optically spin aligned electrons in semiconductors. The interactions among and between spin aligned electrons and plasmons will be investigated. The spin dephasing time will be measured as a function of temperature, photon energy of the exciting light pulse, and carried density of P-type and N-type semiconductors. The effect of intervalley and intravalley scattering processes on the spin alignment will be investigated by measuring the transient development of the distribution function of the photo-generated electrons and holes. The polarization kinetics of the 'hot' photoluminescence spectrum will be studied to obtain information on the energy, momentum and spin-relaxation of the electrons in gallium arsenide and other III-V and II-IV semiconductors. This program will provide fundamental insight into the underlying mechanisms for the relaxation of optical spin aligned electrons in semiconductors.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, RESONANCE PHYSICS
S.R. Hartmann, Columbia University, School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (DMR79-06382)

The spectroscopic and relaxation properties of rare earth ions in lase: quality host materials, particularly lanthanum fluoride, will be studied by a variety of optical resonance techniques. Nuclear double resonance techniques involving either continuous-wave laser hole burning or stimulated photon echoes will be used to obtain hyperfine structure and associated linewidths. Photon echo experiments will be used to obtain relaxation behavior from thermal and concentration dependent sources and modulation behavior from interferences among hyperfine levels.

This research was previously supported by DMR 7705995 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, THEORETICAL RESEARCH IN CONDENSED MATTER PHYSICS
V. Ambegaokar, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR77-18329)

This research was previously supported under grant DMR-7423494.

Theoretical research will be carried-out on a wide range of topics in condensed matter theory. Among the problems which will be considered are: (1) Non-equilibrium effects in superconductors. (2) Chemical kinetics. (3) Superfluidity of liquid 3He. (4) Dense conducting fluids, especially their behavior near the liquid-vapor transition; (5) optical properties of metallic systems, including generalizations to electron energy loss phenomena. (6) Photoemission, including an attempt to understand the microscopic fields near surfaces and how they may bear on the interpretation of angle integrated and angle resolved photoemission. (7) Zero temperature freezing and melting of Bose and Fermi systems. (8) Exact simulations of bulk helium four in both solid and liquid phases. (9) Surface and bulk singularities in the A-phase of 3He, their topological necessity and their bearing on the stability of superflow. (10) Local moment/valence fluctuation systems. (11) Transport processes across a liquid 3He-solid interface. (12) Low-temperature properties of solid bcc 3He.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, COMBUSTION THEORY FOR CLOUDS OF POROUS SOLIDS AT REDUCED GRAVITATIONAL CONDITIONS
A.L. Berlad, State University of New York, Stony Brook Campus, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *Stony Brook, New York* 11794 (NSG 3298)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0037, GENERAL RELATIVITY
P.G. Bergmann, Syracuse University, School of Arts & Sciences, Dept. of Physics, *Hall of Languages, Syracuse, New York* 13210 (PHY79-08887)

Research in theoretical gravitational physics initiated under NSF grant PHY78-06721 will be continued. Among the topics to be investigated are: A. Classical Relativity Theory - 1. Uncertain relations between electric and magnetic components of the Riemann tensor; 2. the definitions of multipole structure in the non-linearized theory. B. Quantization and Alternative Theories - 1. Phase integral quantization as a preliminary approach to quantization of the gravitational field; 2. the canonical quantization of general relativity by realizing the constraints as non-Hermitian operators; 3. supergravity with and without Grassman elements; 4. deformed twistor spaces in which self-dual gauge fields or H-spaces have been encoded to understand their role in the quantization of these fields.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0038, MOSSBAUER SURFACE STUDIES
R.W. Hoffman, Case Western Reserve University, Graduate School, Dept. of Physics, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (DMR79-09078)

Free surfaces of solids, particularly nickel, will be studied by in-situ Mossbauer Effect Emission Spectroscopy (MEES) combined with other surface analytical techniques. MEES is an extremely sensitive technique, requiring only 10 to the 14th power radioactive cobalt-57 atoms cm to the negative 2nd power to provide measurable values of conduction electron density, electric field gradients and hyperfine fields at the nucleus. Combining low-temperature cobalt-57 deposition with clean surfaces gives quantitative free surface information not obtainable by other techniques. The MEES technique will be used to measure the surface magnetization and surface anisotropy of ferromagnetic crystals, surface Debye tempratures, surface site identification, and charge transfer at free and overlayered surfaces. Results will allow distinction between the theories for surface magnetism and provide a well-chracterized basis for some steric systems.

This research previously supported by DMR 7710640.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0039, RADIATION-INDUCED VOIDS BY POSITRON ANNIHILATION
J.D. McGervey, Case Western Reserve University, Graduate School, Dept. of Physics, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (DMR79-06726)

Radiation-induced voids and other defects in aluminum, aluminum alloys and other materials will be studied by measuring positron lifetimes and the angular correlation of positron annihilation radiation. Samples will be irradiated at the Oak Ridge National Laboratory Reactor, and the new National Center for Small-Angle Scattering Research will be used to test the samples and compare results with the positron results. Quenched samples will also be studied to further clarify the nature of the defects by comparing the annealing behavior in the various samples. This comparison will clarify the role of impurities in the formation of voids and other defects, because transmutation-produced silicon and helium are present in irradiated aluminum. Aluminum-silicon and aluminum-magnesium alloys will be investigated by performing direct equilibrium measurements of binding energies between vacancies and impurity atoms, using an improved technique to eliminate uncertainties in previous measurements.

Research previously supported by DMR 7407190 AO1.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0040, ION PHOTODISSOCIATION AND PHOTOFRAGMENT SPECTROSCOPY
J.T. Moseley, Oregon State Higher Education System, University of Oregon, School of Arts & Sciences, Dept. of Physics, *Johnson Hall, Eugene, Oregon* 97403 (CHE79-18074)

This resarch is in the area of quantum chemistry. Various techniques of ion photofragment spectroscopy will be used to investigate the potential surfaces, structural properties, and dissociations of molecular ions. These techniques yield spectroscopic information on gas-phase ions, uniquely detailed measurements on the evolution of near-threshold dissociation, accurate potential curves for diatomic ions, and lifetimes of predissociat-

ed states. Measurements will be extended to polyatomic ions such as O3 ion, O3-, CO3-, CH3I ion, H2O ion, CH2 ion, and N2O ion and to shorter wavelengths, using newly developed lasers. New techniques of fast ion spectroscopy will also be developed and applied to these ions. The techniques to be used allow measurements to be made with nearly Doppler-free resolution and permit the energy and angular distributions of photofragment ions to be determined. In some cases, all relevant quantum numbers involved in the transition can be specified, leading to the possibility of very detailed comparison with theoretical calculations. Cooperative research with the French group at Orsay will involve the measurement of high resolution kinetic energy distributions and of branching ratios in predissociation, investigation of the superposition of states in dissociation, and analysis and interpretation of experimental measurements relating to these problems. This resarch represents a continuation of that currently supported at SRI International by Foundation grant CHE7700428.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0041, THEORY OF CRYSTAL GROWTH, ONE- AND TWO-DIMENSIONAL QUANTUM PHYSICS AND DEFECTS IN SOLIDS

S. Chui, Franklin Inst. of the State of Pennsylvania, *20th & Benjamin Franklin Pkwy., Philadelphia, Pennsylvania* 19103 (DMR79-18697)

Several projects in theoretical solid-state physics will be carried-out. (1) The theory of crystal growth will be studied, particularly the theory of the dynamics of crystal growth. (2) The theory of the renormalization group will be applied to the study of one-dimensional materials, especially the one-dimensional Hubbard model. The methods will also be extended to the two-dimensional Hubbard model. (3) Calculations will be carried-out demonstrating the applicability of renormalization group ideas to quantitatively calculate defect states in solids.

This is a continuation of research previously supported under DMR-7611338.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0042, MASS ANALYSIS OF NEUTRAL PARTICLES AND IONS RELEASED DURING ELECTRICAL BREAKDOWNS ON SPACECRAFT SURFACES

B.R. Kendall, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (NSG 3301)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0043, INDUSTRY-UNIVERSITY COOPERATIVE RESEARCH ACTIVITY - FAST RESPONSE ELECTRON SPECTROSCOPY

E.W. Plummer, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DMR79-06535)

A new electron energy analyzer system, whose time-response and data-acquisition rates are orders-of-magnitude larger than existing systems, will be designed and constructed. The improvement will be achieved by use of a 100-strip multichannel detector, with output stored for processing in a digital computer. The increased data-acquisition rate will be useful for experiments with intrinsically low signal, such as extended x-ray absorption fine structure (EXAFS) from atoms adsorbed on surfaces, and for experiments where fast time response is critical, such as surface measurements where processes occurring at lower temperatures may be studied before contamination occurs, or time-dependent rate studies. This project will be a collaborative effort between scientists at the University of Pennsylvania and the Xerox Webster Research Center.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0044, THEORETICAL STUDIES OF THE ELECTRONIC STRUCTURE OF SMALL METAL CLUSTERS

K.D. Jordan, University of Pittsburgh, Graduate School, *1028H Cathedral of Learning, Pittsburgh, Pennsylvania* 15213 (NSG 2407)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0045, ATOMIC COLLISIONS AND PLASMA PHYSICS 16723-P

M.A. Biondi, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DA0G9009; DAAG29-79-C-0043)

To study atomic collisions related to the upper atmosphere. Relevance - this research provides basic information for ballistic missile defense systems, and has the potential for contributing parameters for studies of laser propagation in the atmosphere.

Experimental investigations of ion-molecule reactions and electron-ion recombination under conditions, and for species, of interest to DNA.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0046, PICOSECOND SPECTROSCOPY APPLIED TO THE STUDY OF SEMICONDUCTOR INTERFACES

H.J. Gerritsen, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR79-09701)

Picosecond optical techniques will be applied to the study of excess carrier recombination at semiconductor interfaces. Of specific interest are group III-V semiconductors with bare surfaces, insulated interfaces, and heterojunctions. The novel experimental technique is based on the excitation of a region near an interface in a semiconductor by absorption of an ultrashort light pulse followed by a real-time measurement of the subsequent decay by time delayed ultrashort probe pulses. Specific information about the character of interface states as traps and recombination centers for electrons and holes will be obtained. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0047, HIGH RESOLUTION LASER SPECTROSCOPY

R.F. Curl, Rice University, School of Natural Sciences, Dept. of Chemistry, *6100 Main, Houston, Texas* 77001 (CHE78-26572)

This research is in the area of quantum chemistry. Drs. Curl and Tittel intend to continue a program of research in three areas of laser spectroscopy and in corresponding areas of laser development. The three areas are visible dye laser studies of reactive small molecules, microwave optical double resonance studies of Van der Waals molecules in a supersonic jet (near UV region using doubled CW dye lasers), and Zeeman modulated intracavity absorption near infrared studies of the X-H stretch (X equals N,O,C) of the small free radicals NH2, HO2, CH2, CH3, and CH using a color center laser. In the visible dye laser region the development of a new optical-optical double resonance technique for studying nuclear hyperfine structure employing two CW single mode dye lasers frequency stabilized with respect to each other is planned. The application of this technique and of saturation spectroscopy to sorting out part of the perturbation mixing of the ground state with the excited state in NH and laser spectroscopy studies of BH2, BS, CS ion, and HCO are planned. Observation of microwave frequency rotational transitions using microwave optical double resonance of the He-pyrimidine complexes formed by supersonic nozzle expansion is to be carried out. The absorption spectra of small free radicals will be studied using Zeeman modulation by formation of the radicals in a flowing gas system inside the laser cavity. Finally, it is planned to use color center lasers to study the X-H stretch of hydride free radicals such as NH2, HO2,

CH3, CH2, and CH. This research represents a continuation of that currently supported by Foundation grant CHE7606103.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0048, SPIN DEPENDENCE OF ION-ATOM COLLISIONS AND HYPERFINE STRUCTURE OF SIMPLE IONS BY REORIENTATION SPECTROSCOPY OF STORED IONS

H.A. Schuessler, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (PHY79-09099)

This research project studies the details of ion-atom and ion-molecule reactions by suspending a number of ions in a specific orientation in an electromagnetic field for many minutes, and bombarding them with a similarly well-defined beam of atoms or molecules. The results show the effects of isolated quantum-mechanical effects, and can be compared directly with theory. The study of simple systems, such as collisions between noble gas ions, and polarized alkali atoms, is emphasized. Molecular alignment by the dynamics of photodissociation will be studied. The spin dependent collisions are then used to measure fundamental atomic properties by reorientation spectroscopy. The magnetic moments of the electron, bound in the simplest atom, 4He ion (no hfs) and of the simplest molecule, H2 ion and measured to test basic relativistic and radiative contributions to the atomic structure. Hyperfine structure splittings of H2 ion and of its istopic variants will be investigated to test ab initio molecular theories. Certain aspects of the experiments are relevant to plasma in controlled thermonuclear reactions. The charge transfer reactions are possible mechanisms for lasers in the far ultraviolet region. Reactions involving molecular hydrogen and molecular hydrogen ions are important processes in steller atomospheres.

This research is a continuation of that previously supported under NSF grant PHY76-81827A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0049, STRUCTURE AND BONDING IN AMORPHOUS AND QUASI-AMORPHOUS SOLIDS

S.C. Moss, University of Houston, School of Natural Sciences & Mathematics, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (E-578)

Work has been concentrated on the application of X-ray absorption spectroscopy to the attachment and association of alkali ions to various molecular constituents. In particular both EXAFS and near-edge spectroscopy have been performed on the potassium K edge to denote differences in bonding among the simple hydrated state, the crystalline state in salts and cryptates and the associated state in various complexes in solution. It has been shown (in collaboration with H. Huang of Rice University) that potassium is not 'free,' as in aqueous solutions, in frog blood cells. Work continues on an analysis of the extended edge fine structure (EXAFS) in many of these materials.

In another area of disordered solids, a careful measurement of the lattice parameters of pure Pb and a Pb-0.0918 percent Au sample shows that Au in both monomer and tetramer defect states produces lattice contraction with the tetramer somewhat remarkably having the larger effect per atom. The observed monomer contraction suggests that the majority site occupancy for Au is substitutional and that the rapid Au diffusion must therefore involve a substitutional-interstitial mechanism.

SUPPORTED BY Robert A. Welch Foundation

8.0050, STUDY OF GRAVITATIONAL THEORY AND GENERAL RELATIVITY

R.A. Matzner, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (INT78-22553)

Physicists from the Center for Relativity at the University of Texas at Austin will be collaborating with counterparts at the Center for Nuclear Studies of the National Autonomous University of Mexico. These scientists will be working toward elaboration of mathematical models of general relativity in which solutions of the equations differ in some important details from the Einstein model. Favorable results would lead to important developments in our understanding of stellar phenomena and the cosmos.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0051, COOPERATIVE OBSERVATIONS OF OPTICAL EMISSIONS DUE TO ENERGETIC NEUTRAL ATOM PRECIPITATION (THE EQUATORIAL AURORA)

B.A. Kinsley, University of Texas, Dallas Campus, Graduate School, *Richardson, Texas* 75080 (INT79-03438)

Professor B.A. Tinsley of the University of Texas at Dallas and Dr. Y. Sahai and Dr. N. Teixeira of Brazil's Institute of Space Studies will study optical emissions from the equatorial upper atmosphere. Such emissions have been observed from satellites and Dr. Tinsley has performed theoretical analysis of the emission effect. Analysis of the relative intensities and time variations of the emissions from hydrogen, helium, oxygen and nitrogen will give information on the time variation of ionic composition and energy distributions of ions in the atmosphere's ring current. The observation site near Sao Jose dos Campos, Brazil is at the optimum latitude for observation of the energetic particle effects. Existing equipment will be modified and tested in the U.S. and then shipped to the Cachoeira Paulista site between Sao Paulo and Rio de Janerio.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0052, INSULATORS FOR PLUMBUM-STANNUM-TELLURIUM METAL-INSULATOR-SEMICONDUCTOR DEVICES

A. Sher, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (NSG 1653)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0053, STORED ION SPECTROSCOPY FREQUENCY STANDARD

D.J. Larson, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DN775566; N00014-78-C-0772)

Stored ion spectroscopy may provide a means of improving and simplifying highly accurate timing devices. Accurate timing is of interest to the Navy through improved positioning and missile accuracy. It may also be of importance in the areas of rapid transmission of digital data and long base line interferometry.

The microwave spectrum of S(minus), i.e., the fine structure transitions, is now being studied. The apparatus is being redesigned so that the S(minus) is produced by dissociative detachment from a pulsed beam of OCS rather than from a background gas of OCS since the latter reacts with S(minus) to form S(2)(minus). The photodetachment of S(2)(minus) is also being studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0054, MEDIUM-ENERGY NUCLEAR PHYSICS STUDIES

C.E. Stronach, Virginia State College, Graduate School, Dept. of Physics, *Petersburg, Virginia* 23806 (NSG 1646)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0055, GRAVITY, QUANTIZED FIELDS, AND RELATIVISTIC ASTROPHYSICS

L. Parker, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Physics, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (PHY77-07111)

Research initiated under NSF Grant PHY72-05161 A02 will be continued. In addition to the areas of research under the previous grant, new topics in relativistic astrophysics will be investigated. John Friedman, who has recently joined the university as an Assistant Professor, is included in the present project as co-investigator.

Research under way on vacuum polarization and particle creation by strong gravitational fields will continue. Work on the quantum treatment of the damping of expansion anisotrophy in the early universe will be generalized and extended. A new type of infrared divergence occurring for quantized gravitational and scalar fields will be investigated. Other topics in quantum field theory on curved backgrounds will also be studied.

Research on the analogue for curved space-time of the Dirac charge quantization condition will be continued. A related area of research involves quantizing test electromagnetic fields on curved space-times with non-trivial topologies. The possible existence of spinor fields acted on by the group of diffeomorphisms on a space-time will also be investigated.

In recent work, John Friedman showed that all rotating Newtonian stars are unstable or marginally unstable to gravitational radiation; a key aim of his current research is to establish analogous results in general relativity.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SUPPORT FOR ASTRONOMICAL RESEARCH AT STEWARD OBSERVATORY OF THE UNIVERSITY OF ARIZONA

P.A. Strittmatter, University of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (AST78-25539)

Support will be provided for personnel to maintain, improve and operate equipment necessary for the scientific programs at the Steward Observatory of the University of Arizona. The growing complexity and sophistication of modern astronomical instrumentation has placed increasing demands on observatory personnel. Such personnel are required for operation of the telescope and for data acquisition and reduction. The main observational facilities of the Steward Observatory are the 90-inch, 36-inch, and 20-inch telescopes. The 90-inch is a general purpose telescope equipped with a wide range of instruments; the 36-inch telescope has been committed to a near-infrared sky survey. Instrumentation on the 90-inch telescope includes a Boller and Chivens spectrograph, a cassegrain echelle spectrograph, and a Fourier transform spectrometer.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, PIONEER VENUS PROBE ANOMALIES IN LOWER VENUS ATMOSPHERE

J.K. Goodman, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCA 2-675908)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0003, DIGITAL DESIGN AND PARTS DOCUMENTATION FOR SOLAR FLARE X-RAY DETECTOR

D.A. Anderson, University of California, Berkeley Campus, Graduate School, *2200 University Ave., Berkeley, California* 94720 (NAS 5-25876)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0004, SOLAR X-RAY FLARE EXPERIMENT FOR THE INTERNATIONAL SOLAR POLAR MISSION

D.A. Anderson, University of California, Berkeley Campus, Graduate School, *2200 University Ave., Berkeley, California* 94720 (NAS 5-25892)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0005, PHYSICAL CONDITIONS IN WARM MOLECULAR CLOUDS

J.I. Silk, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NCA 2-50904)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0006, THEORETICAL STUDIES OF THE INTERSTELLAR MEDIUM

M.A. Jura, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (AST78-22676)

Theoretical investigations of physical processes in the interestellar medium will be carried out. Specific goals of this program are: (1) an elucidation of the formation mechanism of interstellar CH ion; (2) an improved determination of the ultraviolet albedo and phase function of interstellar grains; (3) a construction of models for scattering by dust grains to explain the observed optical polarization in external spiral galaxies. Achievment of these goals would substantially advance our knowledge of the interstellar medium and therefore lead to a better understanding of star formation and the evolution of galaxies.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0007, STELLAR PROPER MOTIONS AND PARALLAXES

A.R. Klemola, University of California, Santa Cruz Campus, Lick Observatory, Dept. of Astronomy & Astrophysics, *Mount Hamilton, California* 95140 (AST79-09098)

Astrometry is the field of astronomy concerned with the measurements of position and motions of celestial objects. This work is fundamental to all branches of astronomy, although perhaps not the most glamorous, particularly since it is necessary to pursue the measurements over long time base-lines. This project utilizes the distant galaxies as the fundamental reference system, thus providing a true inertial system. The first epoch photographic plates were obtained in the period 1947 through 1954. This project will obtain the second epoch plates. Since 1971, the start of this project, about 70 percent of the 1246 fields observable from Mt. Hamilton, California have been obtained and half of these measured. The phase of the project represented by this grant will continue this work. The specific goals of the analyses to be carried-out are: 1. Study of the general galactic rotation and possible deviations from a smooth pattern; 2. Study of the solar motion with respect to the nearby stars and determination of local systematic corrections to the fundamental system of coordinates as defined by the basic modern catalog AGK3 for the northern sky. Other projects which may be done include the measurement of distances of selected nearby stars and the positions and motions of objects of high immediate interest, such as comets, minor planets, and selected stars.

Prior support was by NSF AST 78-14276.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0008, EXPERIMENTAL TEST FOR VIOLATIONS OF THE EQUIVALENCE PRINCIPLE BY WEAK INTERACTIONS

P.D. Parker, Yale University, Graduate School, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (NAS 8-33572)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

10.0009, STELLAR PARALLAXES AND PROPER MOTION

W.F. VanAltena, Yale University, Graduate School, Dept. of Astronomy, *206 Elm, New Haven, Connecticut* 06520 (AST76-81339 A02)

A program of astrometric research, with increasing emphasis on southern hemisphere coverage, will be continued. The determination of stellar parallaxes and proper motions by astrometric methods furnishes basic data important to other areas of astronomy. A star's distance from parallax measures permits finding the true brightness of the star and its position in space. The motions, from a comparison of stellar positions made with an interval of several years between observations, help to determine the sun's path among the stars and its position within our galaxy. The yardstick for all cosmic distances ultimately depends on these astrometric researches.

Over the next years the Yale investigators will work to reduce the deficiency of astrometric observations in the southern skies. Completion of the Yale Southern Proper Motion Program first epoch observations in Argentina, and an extension of the overlap with the Lick Observatory Northern Program, will be given top priority. Stellar parallax determinations, in part from early Yale observations in South Africa, will be continued. Membership determinations in southern star clusters from proper motion studies will be undertaken with the Yale astrometric telescope at Cerro Tololo Inter-American Observatory in Chile. A continuing effort will be made towards improving astrometric instrumentation and deriving all relevant positional information from photographic images to better utilize existing and future plate material.

Prior support was by NSF grant AST76-81339 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, RESEARCH WITH A PHOTON-COUNTING IMAGE INTENSIFIER SPECTROMETER AT THE LAS CAMPANAS OBSERVATORY

L. Searle, Carnegie Inst. of Washington, *1530 P St. N.W., Washington, District of Columbia* 20005 (AST76-20839 A02)

The 2.5 meter DuPont telescope at the Las Campanas Observatory has now gone into operation. It will be equipped with a large Cassegrain spectrograph, a television system for acquisition of faint objects, and a photon-counting image intensifier detector system. This system will be upgraded to the point where it may be used routinely for observational programs by all staff members.

The first program to be done is an investigation of the stellar content of star clusters in the Magellanic clouds in order to determine the distribution of the age and chemical composition of these subsystems and to assess their significance to the chemical and dynamical evolution of galaxies. The second program is a radial velocity survey of galaxies brighter than sixteenth magnitude in the Zwicky catalog in order to investigate the structure of galaxy clustering in velocity space and to map the extent of the perturbation of the velocity field around rich clusters of galaxies.

This is a supplement to work previously supported under NSF grant AST 76-20839A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, RESEARCH ON SOLAR CORONAL ACTIVITY

M.K. McCabe, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (ATM76-10323 A02)

This grant will continue support of research on solar coronal activity at the University of Hawaii. This support has permitted the development of a technique for deriving whole sun infrared maps in the spectral line Me I 10830 that show coronal holes clearly. With this technique it is possible to obtain detailed time-series observations of structure, velocity and brightness fluctuations in the photosphere and chromosphere underlying holes, quiet regions and active regions.

The research objective of this grant is to use the 10830 maps to study the morphology and evolution of holes and other large-scale solar features. A further objective is to make a detailed study of the fine structure, velocity and brightness fluctuations, and the systematic velocity fields underlying holes, quiet regions and active regions at the photospheric and chromospheric levels. A major aim of this work is to understand the deposition of wave energy and momentum in coronal holes as contrasted with quiet and active regions. These observations will be used to develop improved methods for detecting holes using ground-based chromospheric observations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0012, AN EQUIPMENT PURCHASE FOR THE MIDWESTERN ASTRONOMICAL DATA REDUCTION AND ANALYSIS FACILITY

C.M. Anderson, Northwestern University, Evanston Campus, Graduate School, *633 Clark St., Evanston, Illinois* 60201 (AST79-00894)

This grant will provide funds for purchase of equipment for the reduction and analysis of astronomical data. Much of the data gathered at telescopes requires a great deal of sophisticated measuring and analysis apparatus. This equipment will be located on the campus of the University of Wisconsin and will be available for use by astronomers throughout the Midwest. The equipment to be purchased includes a P.D.S. microdensitometer, an interactive picture processor, tape and disk storage units, terminals and other input/output devices, and a minicomputer for the control of the entire system.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0013, DYNAMICAL INVESTIGATIONS OF GALACTIC STRUCTURE PROBLEMS

R.H. Miller, University of Chicago, School of Physical Sciences, Dept. of Astronomy, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (AST76-14289)

A theoretical study to simulate by computer the processes that cause disk galaxies to take the shapes they do and how they can maintain those shapes as long as they must will be carried-out. Disk galaxies include barred and normal spirals, strongly flattened SO's, ellipticals, and ring galaxies. Numerical experimentation with simulated disk galaxies is the best way at present to investigate a variety of important problems in galactic dynamics. The physical stability of spiral galaxies is not understood. The velocity dispersions required for stable models are much greater than observed in our galaxy in the solar neighborhood. The problems of how our galaxy can be stable, or if it is stable, of how it can support a spiral pattern will be considered.

The computer simlations of the dynamics will be made into motion pictures to display the problems of galactic structure.

The motion pictures and other graphical displays will help both scientists and the public understand the problems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0014, THEORY OF PULSAR ATMOSPHERES

E.A. Jackson, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801

One of the exciting discoveries in astronomy during the past decade has been the existence of roughly 150 pulsars, which are stars which exhibit rapid, large-scale, periodic oscillations in their radiation. The pulsars are believed to be very dense (neutron) stars which have an intense magnetic field that rotates with the star. Associated with such a rotating field is a large electric field which can accelerate charged particles to high energies, producing the observed periodic radiation by a 'Lighthouse' effect. To confirm the neutron star hypothesis and explain the variety of observations, a theory is required for the plasma (ionized gas) atmosphere about such a star. This new type of stellar atmosphere, which is quite different than, for example, the sun's, can also occur in many other rotation magnetic stars which are not pulsars, and therefore may have much wider implications.

SUPPORTED BY University of Illinois

10.0015, VERY LONG BASELINE INTERFEROMETRY AT NORTH LIBERTY RADIO OBSERVATORY

R.L. Mutel, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (AST79-10128)

A research program to conduct very long baseline interferometry (VLBI) experiments using the 18.3 meter radio telescope at the North Liberty Radio Observatory (NLRO) near Iowa City, Iowa, will be carried-out. The NLRO telescope constitutes one part of the VLBI Network, a national consortium of radio observatories conducting joint experiments at regular scheduled intervals. The Observatory's central geographic location and full-sky coverage ability make it an important addition to the Network by providing improved coverage of intermediate angular resolutions. Research projects at the University of Iowa which will benefit from the use of NLRO are the high resolution studies of hydroxyl masers surrounding stars and compact structure in extragalactic radio sources. The research on stellar OH masers will include VLBI maps of main radio spectral line emission from several supergiant stars, a determination of the relative position of the main line versus 1612 MHz spectral line masers in several objects, and a survey of compact structure in unidentified hydroxyl radical/infrared (OH/IR) astronomical objects. The continuum VLBI research includes mapping (using phase closure) the structure of several extragalactic radio sources, particularly the radio sources NRAO 150 and 30395. Monitoring the compact flux of a large number of variable sources at regular intervals will also be carried-out.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0016, THEORETICAL RESEARCH IN COSMOLOGY AND RELATIVITY

D.R. Brill, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (PHY79-06940)

A number of problems in general relativity and cosmology will be pursued. These problems include (a) the connection between topology of extremal surfaces and physical properties in solutions of the Einstein equations, (b) mathematical and physical properties of constant curvature surfaces in asymptotically flat space-times, (c) the structure of solutions in the neighborhood of a linearization instability, and (d) applications of fiber-bundle techniques.

This is the first year of a three year continuing grant, previously supported under NSF grant PHY77-05299A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

10.0017, OPERATION OF CLARK LAKE RADIO OBSERVATORY

W.C. Erickson, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (AST79-08942)

Support is to cover a program of observations with the University of Maryland Teepee Tee Telescope at the Clark Lake Observatory in southern California and to complete the expansion of the present system into a multi-frequency radioheliograph. The radio spectra of quasars, supernova remnants, flare stars, and clusters of galaxies will be observed, along with compact and variable sources at decameter wavelengths, which will help to identify the energy generation and radio emission processes. Also planets and other objects of interest will be observed. Studies of the radio emission from the quiet and the active Sun are planned, with emphasis on coordination of investigations with the Solar Maximum Mission experiments. This will permit study of the nature and origin of coronal transients in collaboration with the White Light Coronagraph Experiment aboard SMM. Similarly, two-dimensional images of drifting bursts with time resolution of 10 milliseconds will assist in understanding the nature of hard x-ray spike bursts, their quasi-periodicity and the electron acceleration process. Images of type II and type IV sources associated with hard x-rays will be crucial in answering the question of origin of coronal hard x-rays, and in studying the physical processes involved.

Prior support was by NSF grant AST077-12282A02.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0018, RADIATIVE TRANSFER - GRAVITATIONAL DYNAMICS

G. Rybicki, Smithsonian Institution, Astrophysical Observatory, strophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31T-4T50-05,06)

Work in radiative transfer theory has been in the area of resonance line transfer, transfer in multilevel atoms, spherical media and media with inhomogeneities. There has been particular involvement with basic methodology of these problems, especially in those adaptable to digital computation. Recent work on the newly discovered Q integral of the equation of transfer has been extended to another integral, called the P integral.

Collaborations with P. Noerdlinger on radiative transfer in rapidly expanding clouds (Astrophys. Journ., in press), have been completed as well as continuing joint efforts with P.G. Martin on radiative transfer through circumstellar dust shells. This latter work should aid understanding of the infrared spectrum of such objects.

In the field of gravitational dynamics Dr. Rybicki has worked on the statistical mechanics of gravitating systems and on methods of simulating galactic dynamics. He has completed experiments with Mr. G. Zimmermann on a new method of simulating solutions to the linearized Vlasov equation, the method of perturbation particles. Also, with Dr. Lecar and Miss M. Schaefer he has developed a method of relating surface mass densities of flattened systems, such as spiral galaxies, to the law of force in the plane of these systems. This method is also being applied to the inverse problem of finding surface mass densities from observed rotation curves of spiral galaxies.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0019, A SEARCH FOR SPHERICAL HALOS OF SPIRAL GALAXIES

D.J. Hegyi, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (AST76-22109 A02)

A new photometric instrument, an annular scanning photometer (ASP), has recently been used to detect an optical halo surrounding the giant spiral galaxy NGC 4565. The halo is visible out to a distance of 34 kpc from the plane of the disk, a distance equal to 63 percent of the optical disk radius visible on the Palomar Sky Survey red prints. At this distance, the halo surface brightness was 1 part in 1,000 of the night sky in the spectral band of the instrument. Based on some preliminary V-I photometric data and the lack of other possible sources for the optical emission, it was concluded that the halo is composed of K7 or redder type stars and may be quite massive.

Observations will be extended to other galaxies and to obtain measurements out to greater radial distances. Most significantly, it will be attempted to determine the mass in halos. To do this, it will be necessary to conduct a major program in multicolor photometry. At this time the ASP is the most suitable instrument for this program.

This is a continuation of research being done under AST-7622109A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0020, STUDIES OF SUPERNOVAE AND SUPERNOVA REMNANTS

R.P. Kirshner, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Astronomy, *Ann Arbor, Michigan* 48104 (AST77-17600 A01)

This project will be concerned with studies of the properties of supernovae. Spectrophotometry of extragalactic supernovae will be carried-out in order to establish the type and age of supernovae. The spectra will be used to obtain a physical and chemical analysis of these objects. Distances to these supernovae will also be determined. Supernova remnants in our galaxy and the Andromeda galaxy will be observed in order to obtain information on the evolution of the remnants and conditions in the interstellar medium.

The work will make use of the facilities at the McGraw-Hill Observatory at Kitt Peak. The telescope is equipped with a television guider that will permit easy acquisition of objects as faint as 18th magnitude. Spectral scans will be obtained with a 2000-channel intensified reticon scanner.

SUPPORTED BY U.S. National Science Foundation,
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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0021, STUDIES OF THE DYNAMICS OF ELLIPTICAL GALAXIES

M. Schwarzschild, Princeton University, Graduate School, Dept. of Astrophysical Sciences, *205 Nassau Hall, Princeton, New Jersey* 08540 (AST78-23796)

Elliptical Galaxies have long been considered as giant stellar systems, each rotating around its axis and having a symmetrical figure around this axis (such as oblate spheroids). In recent years, however, observtional and theoretical indications have been uncovered which suggest that this earlier picture may be an oversimplification and that the true figures of Elliptical Galaxies may be significantly more complicated (such as tri-axial elipsoids). The question then arises whether tri-axial stellar systems can exist in long-lasting dynamical equilibrium, a necessary condition for models of Elliptical Galaxies. It is here proposed to approach this question numerically, but not by N-body calculations. In contrast to this latter approach, tri-axial configuration appropriate for an Elliptical Galaxy is chosen from the outset. Next, the gravitational force exerted by this configuration on any star within it is derived. Third, stellar orbits following this force are computed, one at a time, in contrast with N-body computations. Finally, according to the proposed plan, each orbit is statistically occupied by a certain number of stars such that all the stars on all the orbits together reproduce the configuration chosen at the outset. If this last step succeeds in as conclusive a manner as can be hoped for from a numerical approach (in contrast to a basic mathematical approach, if feasible), then tri-axial configurations would appear likely better models for the majority of Elliptical Galaxies than the earlier axially symmetrical ones and new questions regarding their mode of origin would arise.

This is a continuation of AST-7522924A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0022, STUDIES OF THE STRUCTURE AND DISTRIBUTION OF INTERSTELLAR MOLECULAR CLOUDS AND THE THEORY OF WATER MASERS

M. Morris, Columbia University, School of Arts & Sciences, Dept. of Astronomy, *Broadway & W. 116th St., New York, New York* 10027 (AST79-02601)

There are four facets to the research on interstellar molecular gas. The first is an observational study of cloud edges. The goal is to determine the relative depths of the many layers of neutral hydrogen (HI), molecular hydrogen (H2), ionized carbon, (C ion), carbon monoxide (CO), at the interfaces between molecular clouds and the interstellar medium. Theories of molecule formation will be tested by deriving a model for the interstellar ultraviolet radiation field. The second project is an observational study of filamentary molecular clouds. Known examples will be studied in order to determine their mass, their alignment with the local galactic magnetic field, and their detailed velocity field. The third area of research is the molecular cloud component of external galaxies. Observations with a new generation of receivers will be made of the CO distribution in nearby spiral galaxies. The direct determination of CO (thus H2) distributions, in tandem with 21-cm. observations, is of great importance for models of galactic evolution. A comparison of the molecular gas in nearby spirals with that in the galaxy will be made. The fourth area is a theoretical study of water (H2O) masers from star formation regions. Radiative transfer calculations will be undertaken within the previously-proposed geometrical framework of a molecular disk surrounding a luminous star. The goal will be to make predictions about the shapes of individual maser spots that can be tested.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0023, STUDIES OF DEGENERATE STARS

H.M. VanHorn, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (AST79-09391)

This project will be concerned with several areas of degenerate star research. The atmospheres, the internal structure and evolution, and the nonradial oscillations of white dwarf stars will be studied. The effects of accretion upon the surface layers of white dwarf stars will be examined. There will be a study of the structure and evolution of cooling and accreting neutron stars. Work on the development of computer codes to permit the calculation of self-consistent, quasi-static models of the evolution of rotating neutron stars will be continued. There will also be research on the evolution of magnetic fields in degenerate stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0024, OBSERVATIONS OF BINARY AND PROPER-MOTION STARS

W.D. Heintz, Swarthmore College, Graduate School, Dept. of Astronomy, *Swarthmore, Pennsylvania* 19081 (AST79-06379)

Visual observations by micrometer, spectroscopic, and photographic measurements jointly assist in revealing the properties of binary and multiple stars and of nearby dwarf stars. Principal goals are: Improvement and increase of data on orbital motions, periods, and masses in binary systems; search for undiscovered binary stars, or additional components in known binaries; study of the apparently low incidence of binaries among faint red

stars, and study of small proper-motion errors in connection with the problem of the apparently low incidence of nonluminous companions.

The 61 cm refractor at Swarthmore college is the principal instrument used by the Investigator with the micrometer, to about 12 or 15% of telescope time. Additional micrometer work and other observations are planned at Kitt Peak and Cerro Tololo Observatories.

Prior support was under NSF grant AST 77-12236.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0025, GENERAL THEORETICAL STUDIES OF STELLAR CHROMOSPHERES, CORONAE, AND TRANSITION LAYERS

B. Erika, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST78-21024)

The temperature of a star generally decreases as one goes from the interior to the outer atmosphere. We know, however, that in the outer layers of the Sun the temperatre increases from 5800 degrees at the base of the photosphere to 10,000 degrees in the chromosphere to 1.5 million degrees in the corona. If the only form of energy transport is through radiative processes, then such temperatures could not occur in the corona. It is clear that the chromosphere and corona of the Sun must be heated by some form of nonthermal energy like soundwaves, shockwaves, or magneto-hydrodynamic waves. The exact manner in which the solar chromosphere and corona are heated and how this heating depends on height remains uncertain.

It is now possible to observe chromospheres and coronae in other stars. Observations of different stars show large variations in radiation from these layers. The studies that will be carried-out will be aimed at determining how the temperature and pressure stratifications and the radiation from the chromosphere and transition layer depend on the heating mechanisms. This will enable one to determine how the observed differences in the observations relate to differences in chromospheric structure and heating.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0026, PUBLICATION OF THE ATLAS OF THE ANDROMEDA GALAXY

P.W. Hodge, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105

An extensive photographic atlas of the Andromeda Galaxy has been prepared with the help of a grant from the National Geographic Society. The photographs for the atlas were taken at the Kitt Peak National Observatory, using the 158-inch telescope. The result is the first complete, large-scale identification atlas of this galaxy, which is the nearest spiral galaxy to ours. The atlas consists of forty 10-inch by 10-inch photographic charts, along with overlays giving the brightness contours of the galaxies, and is accompanied by extensive tables of data on the objects identified on the charts. These various objects include all known globular star clusters, all known open star clusters, the stellar associations, the dark nebulae, and several other kinds of identified features in the galaxy. Altogether, these total over 2,000 objects. The atlas is intended for astronomers and astronomy students, who can gain understanding of the structure and content of spiral galaxies from its study and who can use the charts at the telescope to plan and carry-out new research.

SUPPORTED BY National Geographic Society

10.0027, SURVEY OF SPECTRAL AND POLARIMETRIC VARIABLE QUASI-STELLAR OBJECTS

K.H. Nordsieck, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Astronomy, *500 Lincoln Dr., Madison, Wisconsin* 53706 (AST77-06977 A02)

The project involves an observational search for members of the class of quasi-stellar objects often called 'violent variables,' using a portable multi-channel spectropolarimeter built at the University of Wisconsin, mounted on the Cassegrain spectrograph of the 4-meter telescope of the Kitt Peak National Observatory. This instrument is particularly suited for such a project in that it obtains the spectrum (9 Angstrom resolution) and polarization (50-200 Angstrom resolution) of an object simultaneously over 4000 Angstroms. A Kitt Peak compatible version of this instrument has been completed as part of the first phase of this project. Polarized variable candidates for these observations will be obtained from lists of optically identified quasi-stellar objects (QSOs) and radio compact variable sources. Members of this class would be rapidly identified from their characteristically large optical polarization (often 5-30 percent). Additional integration time will give a more exact value of the polarization and the details of the spectrum would be available. Unprofitable telescope time on chance foreground stars would thus be avoided. This class of objects is important in that the variability provides clues to the still mysterious central energy source of quasi-stellar objects and to the relationship of the optical and radio objects. With a moderate list of active sources, a correlation of variability and spectrum could be attempted, and the chances of any one object exhibiting rapid variability during an observing session would be enhanced.

This is a continuation of AST-7706977.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0028, IMPROVED INFRARED ARRAY SPECTROMETER SYSTEMS AT THE UNIVERSITY OF WYOMING

R.D. Gehrz, University of Wyoming, School of Arts & Sciences, Dept. of Physics & Astronomy, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (AST79-05131)

A new program to develop improved array detectors for infrared astronomy will be started at the University of Wyoming. Construction of new and efficient spectrometers of advanced design will be completed. They will be provided with arrays of state-of-the-art photoconductive detectors. The new detectors will enable the full potentialities of the new spectrometer systems to be fully realized.

The array spectrometer systems will be used in observational programs now being conducted with the 92-inch telescope of the Wyoming Infrared Observatory. The scientific thrust of these programs is to improve our understanding of the formation and death of stars. Observations of regions of high stellar formation activity such as the Orion Nebula will be continued as will studies of such highly-evolved stellar systems as classical novae, Wolf Rayet stars and old dust cocoon stars.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-16023* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 116
Dec. 1979 166 p
(NASA-SP-7037(116)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 550 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1979. Author

N80-16024*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
NASA QUIET SHORT-HAUL RESEARCH AIRCRAFT EXPERIMENTERS' HANDBOOK
Robert C. McCracken Jan. 1980 29 p
(NASA-TM-81162; A-8053) Avail: NASA Ames Research Center, Moffett Field, Calif. 94035 CSCL 02A

A summary of guidelines and particulars concerning the use of the NASA-Ames Research Center Quiet Short-Haul Research Aircraft for applicable flight experiments is presented. Procedures for submitting experiment proposals are included along with guidelines for experimenter packages, an outline of experiment selection processes, a brief aircraft description, and additional information regarding support at Ames. J.M.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-16025 Virginia Univ., Charlottesville.
PREDICTING TRANSITION TO TURBULENCE IN THE COMPRESSIBLE BOUNDARY LAYER FLOW OVER A SPINNING CONE Ph.D. Thesis
Peter A. Torpey 1979 134 p
Avail: Univ. Microfilms Order No. 8002543

A method was developed for theoretically predicting where the transition from laminar to turbulent flow occurs in the boundary layer over a spinning cone at an angle of attack in supersonic flight. It is based on the linear stability theory for a viscous, compressible fluid. Using this theory, small disturbances are followed as they amplify and propagate along the surface of the cone. By correlating theoretically obtained disturbance amplitudes with experimental data, it is possible to develop a meaningful criterion for determining the location of transition. The method is successful in correlating theory and experiment for a 10 half-angle cone in supersonic flight. The results presented indicate how the location of transition over the cone is influenced by spin rate, angle of attack, and Mach number. Dissert. Abstr.

N80-16026 California Univ., Los Angeles.
THE MOTION OF A VORTEX PAIR IN A STRATIFIED MEDIUM Ph.D. Thesis
Jack Dickran Tomassian 1979 133 p
Avail: Univ. Microfilms Order No. 8001414

An experiment was constructed to simulate and study the motion of a vortex pair in a stratified atmosphere. The vortex trajectories indicate that the pair initially accelerates and its separation decreases when stratification is dominating, in agreement with Crow's theoretical predictions. However, a short time later, the speed of the pair decreases and its separation increases in the stratified as well as the unstratified cases. A peak in the trajectories is observed to occur at an Nt of 2.4 for all Nb sub 0/V sub 0, in agreement with observations from real aircraft. The increase in separation is caused by turbulence, and the data agree with recent numerical computations of vortex pair trajectories in a stratified medium with turbulence. As stratification is increased, the separation and the speed of the pair decreases relative to the unstratified case due to counter-sign vorticity at the boundary of the recirculation cell. Dissert. Abstr.

N80-16027 Cincinnati Univ., Ohio.
MAXIMUM LIKELIHOOD IDENTIFICATION OF AIRCRAFT PARAMETERS WITH UNSTEADY AERODYNAMIC MODELLING Ph.D. Thesis
Dinesh Achyut Keskar 1979 105 p
Avail: Univ. Microfilms Order No. 8002115

A simplified aerodynamic force model based on the physical principle of Prandtl's lifting line theory and trailing vortex concept has been developed to account for unsteady aerodynamic effects in aircraft dynamics. An indicial lift function associated with circulation has been derived for tapered, swept wings in incompressible flow by representing the wings with a simple vortex system. Similarly, an equation is developed to compute downwash at the tail caused by wing lift. The equations derived are approximated by the convenient exponential functions. A family of curves is plotted for the constants in the exponential functions for various aspect ratios, taper ratios and sweep angles at the wing quarter-chord line. The results from these approximations compare well with the limited available results from more rigorous and complex methods. Dissert. Abstr.

N80-16028 Stanford Univ., Calif.
A GENERAL METHOD TO DETERMINE THE STABILITY OF COMPRESSIBLE FLOWS Ph.D. Thesis
Rolf Adolf Guenther 1979 133 p
Avail: Univ. Microfilms Order No. 8001932

The stability equation based on one dependent variable was found and was examined to determine the stability of a compressible swirling jet. The results obtained were very similar to those of Lallas for finite domains. There are differences that could be explained to slight changes in initial assumptions and also due to the fact that the interval of integration is all space rather than a finite subspace. The second approach was that of

using a Lagrangian approach to the problem. Since the equations developed were based on different assumptions, the condition of stability was compared only for the Rayleigh problem of a swirling flow, both examples reduce to the Rayleigh criterion. The second method allows including the viscous shear terms which is not possible in the first method. The same problem was again examined to see what effect shear has on stability.
Dissert. Abstr.

N80-16029 Engineering Sciences Data Unit, London (England).
AVERAGE GUST FREQUENCIES SUBSONIC TRANSPORT AIRCRAFT
1979. 43 p. Supersedes ESDU-69023.
(ESDU-69023-A-B-C; ESDU-69023; ISBN-0-85679-259-4). For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $578.50.

Data is provided for compilation of the cumulative frequency gust spectrum experienced by an aircraft structure. An estimation of fatigue loading encountered by aircraft wing structures in flight is presented.
ESDU

N80-16030*# McDonnell Aircraft Co., St. Louis, Mo.
INVESTIGATION OF GROUND EFFECTS ON LARGE AND SMALL SCALE MODELS OF A THREE FAN V/STOL AIRCRAFT CONFIGURATION
E. P. Schuster, T. D. Carter, and D. W. Esker. Jul. 1979. 149 p. refs.
(Contract NAS2-9690)
(NASA-CR-152240; MDC-A5702). Avail: NASA, Ames Research Center, Moffett Field, Calif. Attn: Hervey Quigley. CSCL 01A.

Induced lift of a subsonic, three fan, lift/cruise, V/STOL aircraft configuration was investigated using scale models of a multimission aircraft whose design incorporates a nose mounted lift fan and two lift/cruise units located over the wing. Configuration effects were assessed for lift improvement devices, lift/cruise nozzle rails, nozzle perimeter plates, and alternate nose fan exit hubs. Tests were conducted at four model heights (H/D = 0.95, 1.53, 3.06 and 6.45, where D is the average nozzle exit diameter equal to 0.997 m.) Results are presented and discussed.
A.R.H.

N80-16031*# Vought Corp., Dallas, Tex.
APPLICATION OF NUMERICAL OPTIMIZATION TO THE DESIGN OF WINGS WITH SPECIFIED PRESSURE DISTRIBUTIONS. Final Report
H. P. Haney and R. R. Johnson. Feb. 1980. 108 p.
(Contract NAS2-9653)
(NASA-CR-3238). Avail: NTIS. HC A06/MF A01. CSCL 01A.

A practical procedure for the optimum design of transonic wings is demonstrated. The procedure uses an optimization program based on the method of feasible directions coupled with an aerodynamic analysis program which solves the three-dimensional potential equation for subsonic through transonic flow. Two new wings for the A-7 aircraft were designed by using the optimization procedure to achieve specified surface pressure distributions. The new wings, along with the existing A-7 wing, were tested in the Ames 11 ft transonic wind tunnel. The experimental data show that all of the performance goals were met. However, comparisons of the wind tunnel results with the theoretical predictions indicate some differences at conditions for which strong shock waves occur.
Author

N80-16032*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
WIND-TUNNEL/FLIGHT CORRELATION STUDY OF AERODYNAMIC CHARACTERISTICS OF A LARGE FLEXIBLE SUPERSONIC CRUISE AIRPLANE (XB-701). 2: EXTRAPOLATION OF WIND-TUNNEL DATA TO FULL-SCALE CONDITIONS
John B. Peterson, Jr., Michael J. Mann, Russell B. Sorrells, III, Wallace C. Sawyer, and Dennis E. Fuller. Feb. 1980. 80 p. refs.
(NASA-TP-1515; L-12688). Avail: NTIS. HC A05/MF A01. CSCL 01A.

The results of calculations necessary to extrapolate performance data on an XB-70-1 wind tunnel model to full scale at Mach numbers from 0.76 to 2.53 are presented. The extrapolation was part of a joint program to evaluate performance prediction techniques for large flexible supersonic airplanes similar to a supersonic transport. The extrapolation procedure included: interpolation of the wind tunnel data at the specific conditions of the flight test points; determination of the drag increments to be applied to the wind tunnel data, such as spillage drag, boundary layer trip drag, and skin friction increments; and estimates of the drag items not represented on the wind tunnel model, such as bypass doors, roughness, protuberances, and leakage drag. In addition, estimates of the effects of flexibility of the airplane were determined.
J.M.S.

N80-16033*# McDonnell-Douglas Corp., St. Louis, Mo.
DEVELOPMENT OF PANEL METHODS FOR SUBSONIC ANALYSIS AND DESIGN. Final Report
D. R. Bristow. Feb. 1980. 84 p. refs.
(Contract NAS1-15369)
(NASA-CR-3234). Avail: NTIS. HC A05/MF A01. CSCL 01A.

Two computer programs, developed for subsonic inviscid analysis and design are described. The first solves arbitrary mixed analysis design problems for multielement airfoils in two dimensional flow. The second calculates the pressure distribution for arbitrary lifting or nonlifting three dimensional configurations. In each program, inviscid flow is modelled by using distributed source doublet singularities on configuration surface panels. Numerical formulations and representative solutions are presented for the programs.
A.W.H.

N80-16034# Naval Air Development Center, Warminster, Pa.
THE AERODYNAMICS OF A JET IN A CROSSFLOW. Final Report
K. T. Yen. 11 Dec. 1978. 62 p. refs.
(AD-A076375; NADC-78291-60). Avail: NTIS. HC A04/MF A01. CSCL 01/1.

The aerodynamics of a jet in a crossflow considered as the key problem in transition aerodynamics for VSTOL aircraft were reviewed. Experimental results on the flow structure of the jet, the contrarotating vortices, the jet entrainment phenomenon, and the surface pressure distributions were analyzed. The influences on these characteristics by the jet parameters such as the velocity ratio, injection angle and jet orifice shape were considered based on available measurements. In the theoretical area, particular attention was directed to the methods of prediction and analysis, and the fundamental physical bases of these methods. Current developments in transition aerodynamics, and some recent work on the formation of contrarotating vortices and the wake flow are described.
F.O.S.

N80-16035*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
WING FLAPPING WITH MINIMUM ENERGY
R. T. Jones. Jan. 1980. 18 p. refs.
(NASA-TM-81174; A-9076). Avail: NTIS. HC A02/MF A01. CSCL 01A.

For slow flapping motions it is found that the minimum energy loss occurs when the vortex wake moves as a rigid surface that rotates about the wing root - a condition analogous to that determined for a slow-turning propeller. The optimum circulation distribution determined by this condition differs from the elliptic distribution, showing a greater concentration of lift toward the tips. It appears that very high propulsive efficiencies are obtained by flapping.
Author

N80-16036*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
A COMPARISON OF CALCULATED AND EXPERIMENTAL LIFT AND PRESSURE DISTRIBUTIONS FOR SEVERAL HELICOPTER ROTOR SECTIONS
John Conlon. Jan. 1980. 33 p. refs.
(NASA-TM-81160; A-8029). Avail: NTIS. HC A03/MF A01. CSCL 01A.

The use of computational techniques in predicting lift coefficients and pressure distributions of two dimensional airfoil sections was studied. The computer code FLO6/IBL was used to solve the compressible, two dimensional flow about four different airfoil sections. The lift coefficients of the airfoils were

calculated at various angles of attack at subsonic Mach numbers and compared with experimental data. A.W.H.

N80-16037# Systems Research Labs., Inc., Newport News, Va. RASA Div.
SUMMARY OF THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF VORTEX LIFT AT HIGH ANGLES OF ATTACK. Final Report, 1 Jan. 1974 - 31 Mar. 1979
D. S. JanakiRam, Satish S. Samant, and Richard P. White, Jr. May 1979 166 p refs
(Contract N00014-74-C-0091)
(AD-A074483; RASA/SRL-14-79-03; ONR-CR-212-223-5-F) Avail: NTIS HC A08/MF A01 CSCL 20/4

This summary report presents the development and verification of a theoretical prediction method for predicting aerodynamic characteristics of low aspect ratio and delta wings at high angles of attack. A summary of the experimental measurements made on low aspect ratio swept wings with leading edge vortex devices is presented as well as a discussion of the final computer program that was developed and correlated with experimental data obtained on swept and delta wings during the last year of the contract effort. GRA

N80-16038# Sandia Labs., Albuquerque, N. Mex. Aeroballistics Projects Div.
INSTRUMENTATION MODELING TECHNIQUE USED IN THE IDENTIFICATION OF AERODYNAMIC COEFFICIENTS FROM FLIGHT TEST DATA
W. E. Williamson Jr. 1978 13 p refs Presented at the Astronautical Congr., Dubrovnik, Yugoslavia, 1 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0721C; CONF-781037-1) Avail: NTIS HC A02/MF A01

A number of estimation methods used to compute aerodynamic coefficients of ballistically flown spinning vehicles often ignore possible phase shifts between data and the model of the motion. Some of these problems occur because onboard instrumentation such as rate gyros or accelerometers behave like spring mass systems. If the vehicle motion is near the resonance frequency of the instrument, then the output of the instrument is shifted in phase from the actual motion and probably the model representation of the motion. In order to demonstrate this problem, the aerodynamic coefficients of a spinning vehicle are computed from actual flight test data using a standard least squares estimation scheme. The problem just described is shown to exist for that data. A modeling scheme is derived to compensate for the instrumentation-induced changes in the data. The results obtained using the instrumentation modeling scheme are shown to be much better than those obtained using a standard scheme. DOE

N80-16039# Sandia Labs., Albuquerque, N. Mex. System Studies Dept.
AERODYNAMIC COEFFICIENT ESTIMATION BY MEANS OF AN EXTENDED KALMAN FILTER
James R. Kelsey 1979 19 p refs Presented at the Atmospheric Flight Mech. Conf., Boulder, Colo., 6 Aug. 1979 Prepared in cooperation with New Mexico Univ., Albuquerque
(Contract EY-76-C-04-0789)
(SAND-79-0411C; CONF-790826-1) Avail: NTIS HC A02/MF A01

An extended, augmented Kalman filter is used to study several dynamic models of vehicle motion aimed at estimating the aerodynamic moment coefficients. These models consider various state representations as well as various measurement sets. Linear and cubic symmetric moments are considered as well as linear asymmetric moments. Computer generated data representative of a reentry vehicle flight are used as the simulated measurement information. Coefficient estimates and error estimates are given for each of the models studied. The computer time required for estimate convergence is also shown, indicating that near-real-time estimation is possible. DOE

N80-16040# Maryland Univ., College Park. Dept. of Mechanical Engineering.
A STUDY OF AERODYNAMIC METHODS FOR IMPROVING TRUCK FUEL ECONOMY
Frank T. Buckley, Jr., Colin H. Marks, and William H. Walston, Jr. Dec. 1978 404 p refs
(Grant NSF SIA-74-1843)
(PB80-101272; NSF/RA-780680) Avail: NTIS HC A18/MF A01 CSCL 13F

Results of a 3-year program to investigate aerodynamic means to reduce fuel consumption of tractor-trailer trucks are reported. The study considers the benefit of aerodynamic add-on devices to reduce the aerodynamic drag on existing vehicles, and the influence of design alternatives in reducing the drag of future vehicles. Drag reductions of both commercial and newly-developed retrofit drag reducing devices are evaluated. Full scale test results indicate that wind turbulence effects cause the full-scale drag reductions produced by retrofit devices to be generally less than those found in the wind tunnel. The decrease is found to be a function of the design of the device and the ambient conditions in which it is used. GRA

N80-16041# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
THE AERODYNAMICS OF TRACKED RAM AIR CUSHION VEHICLES - EFFECTS OF PITCH ATTITUDE AND UPPER SURFACE FLOW. Final Report, Sep. 1973 - Feb. 1979
T. M. Barrows, H. C. Curtiss, Jr., and W. F. Putman Oct. 1979 141 p refs
(Contract DOT-TSC-682)
(PB80-101827; MAE/TR-1426; DOT-TSC-RSPA-79-17) Avail: NTIS HC A07/MF A01 CSCL 13F

Three types of experiments were conducted on geometrically similar models of a Tracked Ram Air Cushion Vehicle (TRACV): (1) wind tunnel tests with the vehicle model positioned within a short segment of stationary guideway; (2) the vehicle model was towed through a 300-foot guideway and the equilibrium position was measured as a function of model weight and center-of-gravity location; and (3) a moving carriage which held the model at a fixed orientation relative to the guideway. Simplified theories are developed for the flow over the upper surface of the model and for the effect of pitch attitude on the flow under the lower surface. The level of agreement between the theory and the various testing techniques is discussed. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-16042*# National Aeronautics and Space Administration, Washington, D. C.
POSSIBLE MARKETS FOR DIRIGIBLES
Dec. 1979 110 p Transl. into ENGLISH of "Les Marches Possibles du Dirigeable". Rept. from Secretariat d'Etat aupres du Ministre de l'Equipement (Transports), Paris, Sep. 1977 p 1-132 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Transconsult, Paris
(Contract NASw-3199)
(NASA-TM-75937) Avail: NTIS HC A06/MF A01 CSCL 01C

The use of mini, small, medium, and heavy dirigibles for the transportation of passengers and cargo, for aerial handling of materials, for the support of scientific platforms, and for use in agriculture and forest management is evaluated. The operational efficiency of one or more dirigibles in view of possible integration into the general transport system is described. A.R.H.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-16043# National Aviation Facilities Experimental Center, Atlantic City, N. J.
AIR TRAFFIC CONTROL/FULL BEACON COLLISION AVOIDANCE SYSTEM, KNOXVILLE SIMULATION Final Report, Apr. - May 1978
B. Billmann, T. Morgan, R. Strack, and J. Windle Aug. 1979 47 p refs
(FAA Proj. 052-241-310)
(AD-A074555; FAA-RD-79-25) Avail: NTIS
HC A03/MF A01 CSCL 17/7

The interaction between a full beacon collision avoidance system (BCAS) and the present air traffic control (ATC) system in a real-time simulation environment was investigated to determine the impact of BCAS on controllers and control procedures, the requirement of BCAS information to be displayed to the controller, and the effectiveness of alarm threshold desensitization in a terminal area. An additional objective was to evaluate the BCAS algorithm performance in terms of number, duration, and location of alerts and resolution effectiveness. Analysis of results indicates that the presence of BCAS in a moderate-density ATC terminal environment has no adverse effect on controllers or control procedures because of an extremely low positive command rate. A high number of BCAS advisory alerts which were displayed to aircraft but not to controllers had no effect on aircraft flightpaths. Many of these alerts were generated for aircraft navigating on established airways with proper ATC separation. A significant number of participating controllers favored the use of BCAS as a backup to the ATC system. A.R.H.

N80-16044# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE AIRCRAFT REPLY AND INTERFERENCE ENVIRONMENT SIMULATOR (ARIES). VOLUME 1: PRINCIPLES OF OPERATION
Michael Goon and David A. Spencer 22 Mar. 1979 268 p
(Contracts DOT-FA77WAI-261; F19628-78-C-0002; FAA Proj. 052-241-04)
(AD-A074542; FAA-RD-78-96; ATC-87-Vol-1) Avail: NTIS
HC A11/MF A01 CSCL 17/7

The operation of ARIES hardware and software is presented. Descriptive information, supported by block diagrams, simplified schematic diagrams and flow diagrams, is provided. M.M.M.

N80-16045# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE AIRCRAFT REPLY AND INTERFERENCE ENVIRONMENT SIMULATOR (ARIES). VOLUME 2: APPENDICES TO THE PRINCIPLES OF OPERATION
Michael Goon and David A. Spencer 22 Mar. 1979 112 p
(Contracts DOT-FA77WAI-261; F19628-78-C-0002; FAA Proj. 052-241-04)
(AD-A074482; FAA-RD-78-96; ATC-87-Vol-2) Avail: NTIS
HC A05/MF A01 CSCL 17/7

Articles are appended to provide: (1) explanations of design and programming aspects of the ARIES; (2) data format and data structure definitions; (3) detailed explanations of the meaning of ARIES error messages and an analysis of certain effects which may be expected when more than one ARIES simulators are interconnected to permit testing adjacent to DABS sensors. M.M.M.

N80-16046# Quanta Systems Corp., Rockville, Md.
OPTIMUM INTENSITY SETTING OF APPROACH AND RUNWAY LIGHT SYSTEMS Final Report, period ending 20 Aug. 1979
Charles A. Douglass 20 Aug. 1979 86 p refs
(Contracts DOT-FA77WAI-786; N68335-78-C-2022)
(AD-A075485; FAA-RD-79-87) Avail: NTIS
HC A05/MF A01 CSCL 17/7

Criteria for determining the optimum intensity settings of approach and runway lights as a function of atmospheric transmissivity and/or meteorological visibility, were developed. In determining the optimum intensity settings, consideration was given to past practices, theoretical and experimental studies, and to the effects of the intensity setting on runway visual range. Changes in the present intensity setting criteria are recommended. J.M.S.

N80-16047# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Command and Control Div.
DIPOLE BROADSIDE GLIDE SLOPE ARRAY Final Report, Nov. 1973 - May 1979
R. S. Littlepage and R. Rajnic Washington DOT May 1979 94 p
(Contract DOT-FA74WA-3353)
(AD-A077042; FAA-RD-79-69) Avail: NTIS
HC A05/MF A01 CSCL 09/5

The analysis and design, and the fabrication and test of an improved glide slope antenna system are presented. It is capable of providing CAT II performance over level ground, rising ground, and severe broken ground associated with problem sites. It is broadband and can operate at any ILS glide slop frequency with no special tuning. A monitoring technique was developed which is applicable to any antenna system consisting of a large number of radiators. The report contains the results of antenna range measurements and flight check data taken at a typical site. M.M.M.

N80-16048# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TRANSPONDER PERFORMANCE ANALYZER (TPA) Final Report, Mar. 1976 - Mar. 1978
Carl Hazelwood Oct. 1979 33 p
(FAA Proj. 031-241-830)
(AD-A075783; FAA-RD-79-54; ANA-180) Avail: NTIS
HC A03/MF A01 CSCL 17/7

The Transponder Performance Analyzer (TPA) used for measurement of aircraft beacon transponder performance characteristics is described. The system was developed at NAFEC utilizing both in-house designed and commercially available equipment. The system is fully self-supporting, is housed in a mobile bus, and has been used for ramp testing of transponders operating in general aviation aircraft and for bench testing of off-the shelf units. M.M.M.

N80-16049# Mitre Corp., McLean, Va. Metrek Div.
EVALUATION OF THE POTENTIAL FOR REDUCED LONGITUDINAL SPACING ON FINAL APPROACH
William J. Swedish Washington DOT Aug. 1979 126 p refs
(Contract DOT-FA79WA-4184)
(AD-A076434; FAA-EM-79-7; MTR-79W00280) Avail: NTIS
HC A07/MF A01 CSCL 17/7

The feasibility of reduced IFR separation standards on final approach is addressed as well as the identification of the characteristics of the ATC system which affect or are affected by the separation standards. The conditions were limited to those times during which wake turbulence is not a factor. Given this assumption, separation reduction is limited by the need to avoid simultaneous runway occupancy by successive arrivals. Various technical improvements now under development may make it possible to operate a 2.0 nmi minimum with average runway occupancies as great as 45-50 seconds. Adequate communications and surveillance for the controller, and enforcement of current ATC procedures are also required for operations with reduced separations. An alternative solution to the runway occupancy problem is to use a pair of closespaced, dependent (dual-lane) runways and alternate arrivals between them. Reduced separation on approach to a single runway cannot be realized until the wake vortex problem is resolved. Although there do not appear to be any other technical or operational barriers to reduced separation standards, additional research is required before reduced standards can be implemented. M.M.M.

N80-16050# Federal Aviation Agency, Washington, D.C. Office of Systems Engineering Management.
REPORT OF THE FAA TASK FORCE ON AIRCRAFT

SEPARATION ASSURANCE. VOLUME 1: EXECUTIVE SUMMARY
N. A. Blake Jan. 1979 37 p refs
(AD-A075352; AEM-2; FAA-EM-78-19-1-Rev-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/7

A task force developed FAA engineering and development consensus on the integrated aircraft separation assurance system for the National Airspace System is presented. A study of system errors, mid-airs, and near mid-airs to define the problem is described. The system element requirements are defined to provide two levels of backup to the air traffic control system: a separation violation warning and a final fail safe collision advisory and resolution function. R.E.S.

N80-16051*# Ohio Univ., Athens. Avionics Engineering Center.
RESULTS OF A LORAN-C FLIGHT TEST USING AN ABSOLUTE DATA REFERENCE
Joseph P. Fischer Jan. 1980 22 p refs
(Grant NGR-36-009-017)
(NASA-CR-162751; TM-74) Avail: NTIS HC A02/MF A01 CSCL 17G

A closed circuit flight test was conducted in the Boston area using VOR's and NDB's as reference points. The Loran-C data collected during the flight was then compared against a reference provided by the Discrete Address Beacon System (DABS) facility at Lincoln Laboratories. A MIT crew used a commercial receiver and recorded Loran-C time differences which would also be compared with the data provided by the DABS facility and eventually with the data collected by Ohio University. The Ohio University low-cost receiver was used for this test which was conducted in the Ohio University DC-3 flying laboratory. The Loran-C time-difference data was recorded with a microcomputer data collection system and stored on magnetic tape for subsequent analysis. The MIT receiver was also on board the DC-3, and recorded its data on a cassette tape which was later used by the MIT crew for data analysis. The equipment configuration in the aircraft, the flight procedure and the results obtained from the data collected with Ohio University's receiver and recording system are described. A.R.H.

N80-16052# Hawaii Univ., Honolulu.
LONG-RANGE ELECTRONIC NAVIGATION SYSTEMS IN THE HAWAIIAN ARCHIPELAGO
James Kennedy, Susan Holt, and Peter Hendricks May 1979 6 p refs
(PB-300842/2; UNIHI-SEAGRANT-AB-79-06;
NOAA-79082107) Avail: NTIS HC A02/MF A01 CSCL 17G

Electronic navigation systems operational in the Hawaiian Archipelago are considered. These include: Loran-A, Loran-C, Omega, and satellite navigation. The Loran-A system is scheduled to be phased out and users must switch to an alternative system. Information on the three continuing systems is given in order to help the navigator select an appropriate system. Fix accuracy (absolute and repeatable), area coverage, and receiver cost are given for each system. The Loran-C system is emphasized. GRA

N80-16053# National Technical Information Service, Springfield, Va.
COLLISION AVOIDANCE SYSTEMS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1979
Guy E. Habercom, Jr. Sep. 1979 391 p Supersedes NTIS/PS-78/0883; NTIS/PS-77/0765; NTIS/PS-76/0682; NTIS/PS-75/671; NTIS/PS-75/036
(NTIS/PS-79/0960/9; NTIS/PS-78/0883; NTIS/PS-77/0765; NTIS/PS-76/0682; NTIS/PS-75/671; NTIS/PS-75/036) Avail: NTIS HC $28.00/MF $28.00 CSCL 01B

Collision avoidance systems in three modes of transportation (i.e. air, surface, marine) are investigated. Traffic scheduling, automatic ground based stations, and on board warning systems for air transportation are discussed. The sensors and detectors relative to marine transportation collision avoidance are examined. Engineering research relative to highway and rail collision avoidance is reported. This bibliography contains 383 abstracts, 45 of which are new entries to the previous edition. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-16054 Cincinnati Univ., Ohio.
PARAMETER IDENTIFICATION OF FLEXIBLE FLIGHT VEHICLES ASSUMING A LOW-REDUCED-FREQUENCY AERODYNAMIC REPRESENTATION Ph.D. Thesis
Robert Charles Schwanz 1979 184 p
Avail: Univ. Microfilms Order No. 8002138

The derivation and numerical demonstration of a recursive, sequential least squares method that may be used to identify the steady and unsteady aerodynamic parameters of a flexible vehicle from its flight test measurements is discussed. The state and measurement equations employed result from mathematical approximations of the vehicle dynamics developed using a state reduction procedure. The aerodynamics mathematical approximation considered is based upon a low reduced-frequency expansion of the potential flow equations. These approximations are most applicable to low aspect ratio flight vehicles operating at subsonic and supersonic speeds. It is demonstrated that the aerodynamic parameters may be estimated if the static aeroelastic measurement residual is employed to guide the reduction of state, the selection of control inputs, and the location of sensors. Dissert. Abstr.

N80-16055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEANS FOR CONTROLLING AERODYNAMICALLY INDUCED TWIST Patent Application
Wolf Elber, inventor (to NASA) Filed 28 Sep. 1979 10 p
(NASA-Case-LAR-12175-1; US-Patent-Appl-SN-079913) Avail: NTIS HC A02/MF A01 CSCL 01C

A wing twist deformation control mechanism which provides active compensation for aerodynamically induced twist deformation of high aspect ratio wings is described. The twist deformation control mechanism consists of a torque tube, internal to each wing and rigidly attached near the tip of each wing, and an actuator located in the aircraft fuselage. As changes in the aerodynamic loads on the wings occur, the torque tube is rotated to compensate for the induced wing twist. NASA

N80-16056# Kaman Avidyne, Burlington, Mass.
AN EVALUATION OF THE ADINA FINITE ELEMENT PROGRAM FOR APPLICATION TO AIRCRAFT OVERPRESSURE VULNERABILITY Final Report, 12 Nov. 1977 - 31 Oct. 1978
Thomas R. Stagliano and Lawrence J. Mente Feb. 1979 80 p refs
(Contract DNA001-78-C-0057)
(AD-A074261; AD-E300579; KA-TR-162; DNA-4876F) Avail: NTIS HC A05/MF A01 CSCL 01/3

In aircraft overpressure vulnerability, stiffened thin-walled panel configurations are subjected to surface pressure loadings of varying time histories. These dynamic loads subject the impinged structural components to large deflections and an elastic-plastic material response. The ability to predict accurately the deflection and strain time histories of complex aircraft structures of arbitrary geometry has become of increasing importance. The ADINA (Automatic Dynamic Incremental Nonlinear Analysis) computer code is evaluated to determine if it is a numerically accurate, computationally efficient means of analyzing these complex structures under transient pressure loading. In this initial evaluation, the ADINA solutions for clamped beams, simply supported, and clamped flat unstiffened panels and flat stiffened panels subjected to transient pressure loadings are compared with solutions from other nonlinear structural codes. ADINA was found to be an efficient and accurate computer code which provides the full nonlinear capability required for aircraft vulnerability analysis. Shortly, a new version of ADINA will be available that contains a desirable thin shell element. However, ADINA finite elements would still have to be extended to include various shaped stringer and frame cross sections and multilayered skin configurations associated with aircraft structures. GRA

N80-16057# New Mexico Univ., Albuquerque.
TECHNOLOGICAL FORECASTING-AIRCRAFT DESIGN. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Aug. 1979
Gerald F. Zollars. Oct. 1979. 32 p. Sponsored by NTIS
(NTIS/PS-79/1017/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

Citations to the international literature of technological forecasts of aircraft design changes are reported. Forecasts dealing with the configuration of both civil and military aircraft are included. Specific topics stressed are fuel consumption, avionics, and cost and noise reduction. (Contains 110 citations). GRA

N80-16202*# Rockwell International Corp., El Segundo, Calif.
STATUS OF CAVITY NOISE PHENOMENA MEASUREMENT AND SUPPRESSION ON THE B-1 AIRCRAFT
A. G. Tipton and C. H. Hodson. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 1. Sep. 1979. p. 59-66 refs (For primary document see N80-16198 07-16)
Avail: NTIS HC A09/MF A01 CSCL 20A

N80-16226*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
APPLICATION OF RANDOM TIME DOMAIN ANALYSIS TO DYNAMIC FLIGHT MEASUREMENTS
S. R. Ibrahim. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1979. p. 165-170 refs (For primary document see N80-16211 07-31)
(Grant NsG-1459)
Avail: NTIS HC A10/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices, and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-16058*# Grumman Aerospace Corp., Bethpage, N.Y.
INFRARED MEASUREMENTS OF A SCRAMJET EXHAUST Final Report
R. A. Reed and M. W. Slack. Jan. 1980. 27 p. refs
(Contract NAS1-15395)
(NASA-CR-3242) Avail: NTIS HC A03/MF A01 CSCL 21E

Diagnostic 2 - 5 mm infrared spectra of a hydrogen burning scramjet exhaust were measured with an interferometer spectrometer. Exhaust gas temperatures and water vapor partial pressures were determined from the observed intensity and spectral profile of the H2O 2.7 mm infrared emission band. Overall engine combustion efficiencies were derived by combining these measurements with the known engine operating conditions. Efficiencies fall (70 - 50 percent) as fuel equivalence ratios rise (0.4 - 1.0). Data analysis techniques and sensitivity studies are also presented. Author

N80-16059# National Bureau of Standards, Boulder, Colo. Thermophysical Properties Div.
TITANIUM COMBUSTION IN TURBINE ENGINES Final Report
Thomas R. Strobridge, John C. Moulder, and Alan F. Clark. Washington DOT, Jul. 1979. 131 p. refs
(Contract DOT-FA78WAI-831)
(AD-A075657; NBSIR-79-1616; FAA-RD-79-51) Avail: NTIS HC A07/MF A01 CSCL 11/6

Pure and alloyed titanium components are routinely used in aircraft turbine engines because of their uniquely high strength-to-weight ratios among structural metals, combined with excellent fatigue and corrosion resistance. Like most other metals, titanium is combustile under certain conditions of temperature, pressure and oxygen concentration and in fact there have been several instances of titanium combustion in service engines. Contemporary titanium use in aircraft turbine engines and the limits of that use are explored. Combustivn incidents and their causes are discussed as well as the typical extent of damage. Current preventative measures are outlined. For better understanding, the fundamentals of metal combustion and the experimental research related to titanium combustion are thoroughly treated and analytical combustion models are presented. Finally, the relevant experimental combustion data are correlated as a function of static temperature and Reynolds number and compared to the model predictions. Author

N80-16060*# Massachusetts Inst. of Tech., Cambridge.
AIR POLLUTION FROM AIRCRAFT
John B. Heywood, James A. Fay, and Norman A. Chigier (Sheffield Univ.). Oct. 1979. 47 p. refs
(Grant NGR-22-009-378)
(NASA-CR-159712) Avail: NTIS HC A03/MF A01 CSCL 21E

A series of fundamental problems related to jet engine air pollution and combustion were examined. These include soot formation and oxidation, nitric oxide and carbon monoxide emissions mechanisms, pollutant dispension, flow and combustion characteristics of the NASA swirl can combustor, fuel atomization and fuel-air mixing processes, fuel spray drop velocity and size measurement, ignition and blowout. A summary of this work, and a bibliography of 41 theses and publications which describe this work, with abstracts, is included. A.R.H.

N80-16061*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CORE NOISE INVESTIGATION OF THE CF6-50 TURBOFAN ENGINE Data Report, 1978 - 1979
V. L. Doyle. Jan. 1980. 357 p.
(Contract NAS3-21260)
(NASA-CR-159598; R79AEG247) Avail: NTIS HC A16/MF A01 CSCL 21E

Acoustic data obtained during the running of the CF6-50 turbofan engine on an outdoor test stand are presented. The test was conducted to acquire simultaneous internal and far-field measurements to determine the influence of internally generated noise on the far-field measurements. The data includes internal and far-field narrowband and one-third octave band pressure spectra. R.E.S.

N80-16062*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CORE NOISE INVESTIGATION OF THE CF6-50 TURBOFAN ENGINE Final Report
V. L. Doyle and M. T. Moore. Jan. 1980. 520 p. refs
(Contract NAS3-21260)
(NASA-CR-159749; R79AEG395) Avail: NTIS HC A22/MF A01 CSCL 21E

The contribution of the standard production annular combustor to the far-field noise signature of the CF6-50 engine was investigated. Internal source locations were studied. Transfer functions were determined for selected pairs of combustor sensors and from two internal sensors to the air field. The coherent output power was determined in the far-field measurements, and comparisons of measured overall power level were made with component and engine correlating parameters. R.E.S.

N80-16063*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
EXPANDED STUDY OF FEASIBILITY OF MEASURING IN-FLIGHT 747/JT9D LOADS, PERFORMANCE, CLEAR-

ANCE, AND THERMAL DATA
G. P. Sallee and R. L. Martin (Boeing Commercial Airplane Co., Seattle, Wash.) 4 Feb. 1980 107 p
(Contract NAS3-20632)
(NASA-CR-159717; PWA-5512-46) Avail: NTIS HC A06/MF A01 CSCL 21E

The JT9D jet engine exhibits a TSFC loss of about 1 percent in the initial 50 flight cycles of a new engine. These early losses are caused by seal-wear induced opening of running clearances in the engine gas path. The causes of this seal wear have been identified as flight induced loads which deflect the engine cases and rotors, causing the rotating blades to rub against the seal surfaces, producing permanent clearance changes. The real level of flight loads encountered during airplane acceptance testing and revenue service and the engine's response in the dynamic flight environment were investigated. The feasibility of direct measurement of these flight loads and their effects by concurrent measurement of 747/JT9D propulsion system aerodynamic and inertia loads and the critical engine clearance and performance changes during 747 flight and ground operations was evaluated. A number of technical options were examined in relation to the total estimated program cost to facilitate selection of the most cost effective option. It is concluded that a flight test program meeting the overall objective of determining the levels of aerodynamic and inertia load levels to which the engine is exposed during the initial flight acceptance test and normal flight maneuvers is feasible and desirable. A specific recommended flight test program, based on the evaluation of cost effectiveness, is defined. A.R.H.

N80-16064# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Mechanical Engineering.
RESEARCH ON THE FLUTTER OF AXIAL TURBOMACHINE BLADING
Fernando Sisto and Mark Ward Sep. 1979 41 p refs
(Contract N00014-76-C-0540; NR Proj. 094-363)
(AD-A074597; ME-RT-79004) Avail: NTIS HC A03/MF A01 CSCL 20/4

Typical aerodynamic moment and free flutter measurements are presented for negative stagger of thin airfoils in an annular cascade. The parameters of interest for the free flutter measurements are incidence angle, torsional amplitude, and reduced frequency (reduced velocity). For moment measurements, the significant parameters are mean incidence angle, interblade phase angle, and amplitude of oscillation. Since measurements take the form of a continuous record of moment versus angular position, the symbolic name 'moment loops' is used. The characteristics of the experimental data are discussed and comparison is made with earlier test data for positive stagger angle with the same airfoil. GRA

N80-16219*# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
DESIGN OF TURBINE BLADES FOR EFFECTIVE SLIP DAMPING AT HIGH ROTATIONAL SPEEDS
David I. G. Jones and Agnieszka Muszynska (Polish Acad. Sci.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 87-96 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-16065*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
DIGITAL ADAPTIVE CONTROLLERS FOR VTOL VEHICLES. VOLUME 1: CONCEPT EVALUATION Final Report
G. L. Hartmann, Gunter Stein, and Stephen G. Pratt Nov. 1979 196 p refs 2 Vol.
(Contract NAS1-14921)
(NASA-CR-159154-Vol-1; HONEYWELL-2825-41592-Vol-1)
Avail: NTIS HC A09/MF A01 CSCL 01C

A digital self-adaptive flight control system was developed for flight test in the VTOL approach and landing technology (VALT) research aircraft (a modified CH-47 helicopter). The control laws accept commands from an automatic on-board guidance system. The primary objective of the control laws is to provide good command-following with a minimum cross-axis response. Three attitudes and vertical velocity are separately commanded. Adaptation of the control laws is based on information from rate and attitude gyros and a vertical velocity measurement. The final design resulted from a comparison of two different adaptive concepts--one based on explicit parameter estimates from a real-time maximum-likelihood estimation algorithm, the other based on an implicit model reference adaptive system. The two designs were compared on the basis of performance and complexity. A.R.H.

N80-16066*# Honeywell, Inc., Minneapolis, Minn.
DIGITAL ADAPTIVE CONTROLLERS FOR VTOL VEHICLES. VOLUME 2: SOFTWARE DOCUMENTATION Final Report
G. L. Hartman, Gunter Stein, and Stephen G. Pratt Nov. 1979 90 p 2 Vol.
(Contract NAS1-14921)
(NASA-CR-159154-Vol-2; HONEYWELL-2825-41592-Vol-2)
Avail: NTIS HC A05/MF A01 CSCL 01C

The VTOL approach and landing test (VALT) adaptive software is documented. Two self-adaptive algorithms, one based on an implicit model reference design and the other on an explicit parameter estimation technique were evaluated. The organization of the software, user options, and a nominal set of input data are presented along with a flow chart and program listing of each algorithm. A.R.H.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N80-16067# Braslau (David) Associates, Inc., Minneapolis, Minn.
GROUND RUN-UP NOISE CONTROL FACILITIES FOR CIVIL AIRCRAFT: A SURVEY
David Braslau 30 Jan. 1979 123 p
(Contract W1-78-5339-1)
(AD-A075348; FAA-RD-79-17; ARD-410) Avail: NTIS HC A06/MF A01 CSCL 01/4

This survey of existing ground run-up suppressors and barriers for civil aircraft includes a review of acoustical, aerodynamic, and mechanical effects associated with facilities in the United States, Europe, and Japan. Evaluations were made of each suppressor based upon published and unpublished reports, and supplemented where necessary by direct questionnaires to the operators, designers, and users of the facilities. Acoustical data where available was compiled for near and far field points at all directions from aircraft heading. Aerodynamic and mechanical effects on airframe and engine performance during run-up have been identified in terms of exhaust gas reingestion, engine or airframe damage, or restrictions on facility operation. The potential for standards development is discussed with respect to available information with recommendations for additional studies needed before such standards could be promulgated. M.M.M.

N80-16068*# Washington Univ., Seattle.
RECENT RESEARCH ON V/STOL TEST LIMITS AT THE UNIVERSITY OF WASHINGTON AERONAUTICAL LABORATORY Final Report
Shojiro Shindo and William H. Rae, Jr. Feb. 1980 27 p refs
(Grant NGL-48-002-035)
(NASA-CR-3237) Avail: NTIS HC A03/MF A01 CSCL 14B

The occurence of flow breakdown during the wind tunnel testing of a powered V/STOL aircraft was studied. Flow breakdown is the low forward speed test limit in a solid wall wind tunnel

and is characterized by a vortex which forms on the floor and walls of the wind tunnel thereby failing to simulate free air conditions. The flow is caused by the interaction of the model wake and tunnel boundary layer and affects the model's aerodynamic characteristics in such fashion as to negate their reliability as correctable wind tunnel data. The low speed test limit was examined using a model that possessed a discretely concentrated powered lift system using a pair of lift jets. The system design is discussed and the tests and results which show that flow breakdown occurs at a velocity ratio of approximately 0.20 are reported. A.W.H.

N80-16069# BDM Corp., McLean, Va. Systems Research and Development Service.
INFRARED RUNWAY COLLISION AVOIDANCE SYSTEM ANALYSIS Final Report, Sep. 1978 - Mar. 1979
P. E. Powell and G. H. Greenleaf Apr. 1979 87 p refs
(Contract DOT-FA78WA-4196)
(AD-A078131; FAA-RD-79-32; BDM/W-79-099-TR) Avail: NTIS HC A05/MF A01 CSCL 01/5

The applicability and effectiveness of active and passive infrared devices for use in runway collision avoidance systems during low visibility airport operations are addressed. Emphasis is placed on the optical attenuation caused by conditions of fog and haze as a function of detector system wavelength. Two feasible approaches to the use of infrared techniques in runway collision avoidance systems are presented. The recommended approach involves the use of a runway-mounted active CO2 laser system which provides an unambiguous indication of aircraft on the runway. The CO2 laser application has several desirable characteristics which include required all weather conditions. The alternative approach involves the use of a runway-mounted two-color passive IR system for jet engine heat detection. The two-color system is feasible but falls short of providing satisfactory detection range in fog without excessive hardware deployment. The recommended approach to development of a system specification which would include experimental tests and design of a prototype system is discussed. J.M.S.

N80-16070*# Franklin Inst. Research Labs., Philadelphia, Pa.
FEASIBILITY AND CONCEPT STUDY TO CONVERT THE NASA/AMES VERTICAL MOTION SIMULATOR TO A HELICOPTER SIMULATOR Final Report
C. A. Belsterling, R. C. Chou, E. G. Davies, and K. C. Tsui Sep. 1978 150 p
(Contract NAS2-9884; NASA Order C-4952-1)
(NASA-CR-152193) Avail: NTIS HC A07/MF A01 CSCL 14B

The conceptual design for converting the vertical motion simulatior (VMS) to a multi-purpose aircraft and helicopter simulator is presented. A unique, high performance four degrees of freedom (DOF) motion system was developed to permanently replace the present six DOF synergistic system. The new four DOF system has the following outstanding features: (1) will integrate with the two large VMS translational modes and their associated subsystems; (2) can be converted from helicopter to fixed-wing aircraft simulation through software changes only; (3) interfaces with an advanced cab/visual display system of large dimensions; (4) makes maximum use of proven techniques, convenient materials and off-the-shelf components; (5) will operate within the existing building envelope without modifications; (6) can be built within the specified weight limit and avoid compromising VMS performance; (7) provides maximum performance with a minimum of power consumption; (8) simple design minimizes coupling between motions and maximizes reliability; and (9) can be built within existing budgetary figures. R.E.S.

N80-16071*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN CONSIDERATIONS FOR ATTAINING 200-KNOT TEST VELOCITIES AT THE AIRCRAFT LANDING LOADS AND TRACTION FACILITY
Gary L. Giles and Sandy M. Stubbs May 1979 75 p refs
(NASA-TM-80096) Avail: NTIS HC A04/MF A01 CSCL 14B

Design studies are presented which consider the important parameters in providing 200 knot test velocities at the landing loads and traction facility. Two major components of this facility, the hydraulic jet catapult and the test carriage structure, are considered. Suitable factors are determined to correlate analytical data for characteristics of the hydraulic jet catapult with data measured from the existing catapult system. The resulting equations are used to calculate test velocities for a range of jet nozzle diameters and carriage masses with both the current 122 m and an increased 183 m catapult stroke. Using the catapult characteristics, a target design point is selected and a carriage structure is sized to meet the target point strength requirements. A.W.H.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-16072*# National Aeronautics and Space Administration, Washington, D. C.
MISSION OPERATION REPORT. SOLAR MAXIMUM MISSION (SMM)
11 Feb. 1980 35 p
(NASA-TM-80939; S-826-80-01) Avail: NTIS HC A03/MF A01 CSCL 22A

Contents: (1) scientific background; (2) mission description; (3) mission objectives; (4) observatory description; (5) experiment descriptions; (6) launch vehicle description; (7) mission support; (8) project management; and (9) SMM project costs. M.M.M.

N80-16073*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
SOLAR MAXIMUM MISSION PANEL JETTISON ANALYSIS REMOTE MANIPULATOR SYSTEM Final Report
R. B. Bauer Houston, Tex. NASA. Johnson Space Center Jan. 1980 88 p refs
(NASA-CR-162466; JSC-16333; Rept-80-FM-6) Avail: NTIS HC A05/MF A01 CSCL 22A

A study is presented of the development of the Remote Manipulator System (RMS) configurations for jettison of the solar panels on the Solar Maximum Mission/Multimission Satellite. A valid RMS maneuver between jettison configurations was developed. Arm and longeron loads and effector excursions due to the solar panel jettison were determined to see if they were within acceptable limits. These loads and end effector excursions were analyzed under two RMS modes, servos active in position hold submode, and in the brakes on mode. M.M.M.

N80-16074# New Mexico Univ., Albuquerque. Technology Application Center.
MANUFACTURING IN SPACE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Oct. 1979
Gerald F. Zollars Oct. 1979 86 p Sponsored by NTIS
(NTIS/PS-79/1053/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Articles from worldwide literature concerning manufacturing in space are presented. The effects of weightlessness on a variety of manufacturing processes such as crystal growth, welding, zone melting, casting, and the construction of structures are highlighted. Articles concerning materials science research in the European Spacelab program are included. Three hundred and thirty three citations are included. GRA

N80-16075# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SPACE, NO. 1
20 Dec. 1979 59 p Transl. into ENGLISH from various Russian journals
(JPRS-74805) Avail: NTIS HC A04/MF A01

Reports are presented on Soviet space exploration, including all aspects of the manned space program, space science, interplanetary research, space engineering, space research applications (communications, satellite geodesy, space meteorology, remote sensing), and space policy and administration. For individual titles, see N80-16076 through N80-16078.

N80-16076# Joint Publications Research Service, Arlington, Va.
INTERNATIONAL INVESTIGATION OF THE MAGNETOSPHERE **c46**
V. V. Migulin and B. I. Silkin *In its* USSR Rept.: Space, No. 1 (JPRS-74805) 20 Dec. 1979 p 3-14 refs Transl. into ENGLISH from Priroda (USSR) no. 6, 1979 p 2-8 (For primary document see N80-16075 07-12)
Avail: NTIS HC A04/MF A01

Topics covered in these investigations of the magnetosphere include: study of regions of abrupt turning of the direction of the magnetic field; investigation of convection of magnetospheric plasma; interaction of waves with particles; wave propagation through magnetic field nonuniformities; large scale instability of plasma; and instabilities associated with electric currents in circumterrestrial space. M.M.M.

N80-16077# Joint Publications Research Service, Arlington, Va.
SPACE VEHICLE APPROACH PROCEDURES DESCRIBED **c18**
B. Pokrovskiy *In its* USSR Rept.: Space No. 1 (JPRS-74805) 20 Dec. 1979 p 28-37 Transl. into ENGLISH from Aviats. Kosmon. (USSR), no. 8, 1979 p 36-37 (For primary document see N80-16075 07-12)
Avail: NTIS HC A04/MF A01

The approach of the Soyuz spacecraft to the Salyut space station is described. This process is divided into two parts: distant and close. During the first stage, the ship is placed into the station orbit in the effective zone of the on-board 'Igla' automatic system. During the second stage, the spacecraft is placed into the mooring stage and docking is accomplished. M.M.M.

N80-16078# Joint Publications Research Service, Arlington, Va.
TELEMETRY FROM ORBIT **c17**
L. Labutin *In its* USSR Rept.: Space, No. 1 (JPRS-74805) 20 Dec. 1979 p 38-44 Transl. into ENGLISH from Radio (Moscow), no. 3, 1979 p 18-19 (For primary document see N80-16075 07-12)
Avail: NTIS HC A04/MF A01

The principles for constructing the telemetric system are discussed in order to encourage new detachments of radio enthusiasts to participate in space experiments. M.M.M.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-16079 Stanford Univ., Calif.
ORBITS NEAR CRITICAL INCLINATION, INCLUDING LUNISOLAR PERTURBATIONS Ph.D. Thesis
Michael Ernest Hough 1979 409 p
Avail: Univ. Microfilms Order No. 8001938

An improved theory is developed of long period perigee motion for near-Earth orbits (semimajor axes less than 6 Earth radii) near the critical inclinations 63.4 deg and 116.6 deg. The inclusion of lunisolar perturbations and all known zonal harmonic coefficients in the geopotential are significant improvements over existing theories. Hamiltonian terms up to and including degree four in eccentricity are modeled. Two different Earth models are compared. Atmospheric drag is not modeled because the orbits analyzed have perigee altitudes above 700 km. The theory is applicable in the orbit determination and long term orbit prediction of such critical inclination satellites as GPS (Global Positioning System) which, due to their high altitudes (20,000 km), are significantly perturbed by the Sun and Moon. Very slow fluctuations (100 year periods) in the perigee location and altitude are predicted near the critical inclinations because there is no average change in perigee location due to oblateness.
Dissert. Abstr.

N80-16080*# Michigan Univ., Ann Arbor.
OPTIMUM REENTRY TRAJECTORIES OF A LIFTING VEHICLE Final Report
Jeng-Shing Chern and Nguyen Xuan Vinh Feb. 1980 121 p refs
(Grant NsG-1448)
(NASA-CR-3236) Avail: NTIS HC A06/MF A01 CSCL 22A

Research results are presented of an investigation of the optimum maneuvers of advanced shuttle type spacecraft during reentry. The equations are formulated by means of modified Chapman variables resulting in a general set of equations for flight analysis which are exact for reentry and for flight in a vacuum. Four planar flight typical optimum manuevers are investigated. For three-dimensional flight the optimum trajectory for maximum cross range is discussed in detail. Techniques for calculating reentry footprints are presented. Author

N80-16081*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
EVALUATION OF USE OF MPAD TRAJECTORY TAPE AND NUMBER OF ORBIT POINTS FOR ORBITER MISSION THERMAL PREDICTIONS
Robert A. Vogt Nov. 1979 126 p refs
(NASA-TM-80946; JSC-16303) Avail: NTIS HC A06/MF A01 CSCL 22A

The application of using the mission planning and analysis division (MPAD) common format trajectory data tape to predict temperatures for preflight and post flight mission analysis is presented and evaluated. All of the analyses utilized the latest Space Transportation System 1 flight (STS-1) MPAD trajectory tape, and the simplified '136 note' midsection/payload bay thermal math model. For the first 6.7 hours of the STS-1 flight profile, transient temperatures are presented for selected nodal locations with the current standard method, and the trajectory tape method. Whether the differences are considered significant or not depends upon the view point. Other transient temperature predictions are also presented. These results were obtained to investigate an initial concern that perhaps the predicted temperature differences between the two methods would not only be caused by the inaccuracies of the current method's assumed nominal attitude profile but also be affected by a lack of a sufficient number of orbit points in the current method. Comparison between 6, 12, and 24 orbit point parameters showed a surprising insensitivity to the number of orbit points. R.E.S.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-16082*# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
CONTROL OF LARGE SPACE STRUCTURES Final Report
R. Gran, M. Rossi, H. G. Moyer, and F. Austin Apr. 1979 134 p refs
(Contract NAS8-32587)
(NASA-CR-161369; RE-589) Avail: NTIS HC A07/MF A01 CSCL 22B

The control of large space structures was studied to determine what, if any, limitations are imposed on the size of spacecraft which may be controlled using current control system design technology. Using a typical structure in the 35 to 70 meter size category, a control system design that used actuators that are currently available was designed. The amount of control power required to maintain the vehicle in a stabilized gravity gradient pointing orientation that also damped various structural motions was determined. The moment of inertia and mass properties of this structure were varied to verify that stability and performance were maintained. The study concludes that the structure's size is required to change by at least a factor of two before any stability problems arise. The stability margin that is lost is due to the scaling of the gravity gradient torques (the rigid body control) and as such can easily be corrected by changing the control gains associated with the rigid body control. A secondary

conclusion from the study is that the control design that accommodates the structural motions (to damp them) is a little more sensitive than the design that works on attitude control of the rigid body only. R.E.S.

N80-16083*# Howard Univ., Washington, D. C. School of Engineering.
STUDY OF FOLDABLE ELASTIC TUBES FOR LARGE SPACE STRUCTURE APPLICATIONS, PHASE 1 Final Report
Irving W. Jones, Collins Boateng, and Caster D. Williams Jan. 1980 58 p refs
(Grant NsG-1320)
(NASA-CR-162652) Avail: NTIS HC A04/MF A01 CSCL 22B

Structural members that might be suitable for strain energy deployable structures, are discussed with emphasis on a thin-walled cylindrical tube with a cross-section that is called 'bi-convex'. The design of bi-convex tube test specimens and their fabrication are described as well as the design and construction of a special purpose testing machine to determine the deployment characteristics. The results of the first series of tests were quite mixed, but clearly revealed that since most of the specimens failed to deploy completely, due to a buckling problem, this type of tube requires some modification in order to be viable. A.R.H.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-16084*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE TIME TRANSFER VIA TRACKING AND DATA RELAY SATELLITE SYSTEM (TDRSS) AND APPLICATIONS
Andrew R. Chi Dec. 1979 23 p refs Presented at the 11th Ann. Precise Time and Time Interval Applications and Planning Meeting, Greenbelt, Md., 27-29 Nov. 1979
(NASA-TM-80605) Avail: NTIS HC A02/MF A01 CSCL 22A

With two geosynchronous relay satellites the tracking and data relay satellite system (TDRSS) can provide nearly worldwide coverage for communication between all near orbiting satellites and the satellite control center at Goddard Space Flight Center. Each future NASA satellite will carry a TDRSS transponder with which the satellite can communicate through a TDRSS to the ground station at White Sands, New Mexico. It is using this system that the ground station master clock time signal can be transmitted to the near Earth orbiting satellite in which a clock may be maintained independently to the accuracy required by the experimenters. The satellite time transfer terminal design concept and the application of the time signal in autonomously operated spacecraft clock are discussed. Some pertinent TDRSS parameters and corrections for the propagation delay measurement as well as the time code used to transfer the time signal are given. A.R.H.

N80-16085# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
DYNAMIC ANALYSIS OF BEAM-RIDER MISSILE PERFORMANCE
J. Shinar, E. Besner, and Y. Rotsztein Aug. 1979 29 p refs
(TAE-376) Avail: NTIS HC A03/MF A01

Performance of a point defense beam rider missile system with linearized trajectory equations is analyzed taking into account the dynamics of the guidance loop. It is shown that adding a lead term, proportional to the line of sight turn rate, to the guidance command improves the system performance against maneuvering targets at the expense of increased noise sensitivity. A formal solution to the problem of optimal avoidance of beam rider missiles is also presented indicating a 'bang-bang' type evasive maneuver. Author

N80-16086*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, PHASE 2. VOLUME 2: REFERENCE SYSTEM DESCRIPTION
Nov. 1979 464 p 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160443; D180-25461-2) Avail: NTIS HC A20/MF A01 CSCL 22B

System descriptions and cost estimates for the reference system of the solar power satellite program are presented. The reference system is divided into five principal elements: the solar power satellites; space construction and support; space and ground transportation; ground receiving stations; and operations control. The program scenario and non-recurring costs are briefly described. R.E.S.

N80-16087# National Environmental Satellite Service, Washington, D. C. Office of System Engineering.
GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE/DATA COLLECTION SYSTEM
Jul. 1979 89 p refs
(PB-301276/2; NOAA-TR-NESS-78; NOAA-79090701) Avail: NTIS HC A05/MF A01 CSCL 22A

A description to potential users of the carrier system and its data processing capabilities are given. User qualifications and requirements for participation in the Data Collection System are also defined. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-16088# Committee on Science and Technology (U. S. House).
SPACE SHUTTLE OPERATIONAL PLANNING, POLICY AND LEGAL ISSUES
Washington GPO 1979 272 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 25-26 Sep. 1979
(GPO-53-649) Avail: Subcomm. on Space Sci. and Applications

Government policies and agencies; regulations; user charges; provisions for launch assurance and priorities; user liabilities insurance and indemnity provisions; protection of individual and private property, as well as patents and proprietary rights involve questions of legal and business importance which can have a significant effect on the extent to which the space transportation system will promote private venture. Approaches to the organizativn and management of an operational space transportation system in the 1980's are examined. A.R.H.

N80-16089*# Remtech, Inc., Huntsville, Ala.
SPACE SHUTTLE BASE HEATING ANALYSIS Final Report
11 Jan. 1980 16 p refs
(Contract NAS8-29270)
(NASA-CR-161375; RTR-014-10) Avail: NTIS HC A02/MF A01 CSCL 22B

Work performed in support of radiation and convective base heating predictions in developing the space shuttle thermal environment is described. Topics discussed include plume radiation predictions and the development of prediction methods; convective base heating predictions due to both reversed flow and direct plume impingement; and evaluation testing of a gas temperature probe used in short-duration base heating model tests. A.R.H.

N80-16199*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
THE DEVELOPMENT OF A METHOD FOR PREDICTING THE NOISE EXPOSURE OF PAYLOADS IN THE SPACE SHUTTLE ORBITER VEHICLE
John F. Wilby and Larry D. Pope *In* Shock and Vibration Inform.

Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 5-30 refs Sponsored by NASA, Washington and SAMSO (For primary document see N80-16198 07-31)
(Contracts NAS5-22832; NAS9-15231)
Avail: NTIS HC A09/MF A01 CSCL 20A

N80-16203*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE SOLID ROCKET BOOSTER AFT SKIRT REENTRY NOISE INDUCED BY AN AERODYNAMIC CAVITY-FLOW INTERACTION
L. A. Schutzenhofer, P. W. Howard, W. W. Clever, and S. H. Guest *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 67-82 refs (For primary document see N80-16198 07-31)
Avail: NTIS HC A09/MF A01 CSCL 20A

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-16090*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GROUPED BINARY TIME CODE FOR TELEMETRY AND SPACE APPLICATIONS
Andrew R. Chi Dec. 1979 25 p refs Presented at Intern. Telemetering Conf., San Diego, Calif., 19-21 Nov. 1979
(NASA-TM-80606) Avail: NTIS HC A02/MF A01 CSCL 09F

A computer oriented time code designed for users with various time resolution requirements is presented. It is intended as a time code for spacecraft and ground applications where direct code compatibility with automatic data processing equipment is of primary consideration. The principal features of this time code are: byte oriented format, selectable resolution options (from seconds to nanoseconds); and long ambiguity period. The time code is compatible with the new data handling and management concepts such as the NASA End-to-End Data System and the Telemetry Data Packetization format. M.M.M.

N80-16078# Joint Publications Research Service, Arlington, Va.
TELEMETRY FROM ORBIT
L. Labutin *In its* USSR Rept.: Space, No. 1 (JPRS-74805) 20 Dec. 1979 p 38-44 Transl. into ENGLISH from Radio (Moscow), no. 3, 1979 p 18-19 (For primary document see N80-16075 07-12)
Avail: NTIS HC A04/MF A01

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-16091*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER LANDING LOADS MATH MODEL DESCRIPTION AND CORRELATION WITH ALT FLIGHT DATA
David A. Hamilton, John A. Schliesing, and George A. Zupp, Jr. Washington Jan. 1980 27 p refs
(NASA-RP-1056; JSC-16202; S-498) Avail: NTIS HC A03/MF A01 CSCL 22B

Results of the space shuttle approach and landing test are examined in order to assess landing gear characteristics and performance and verify landing dynamic analyses. The landing gears were instrumented with load-calibrated strain gages, a wheel-speed sensor, and strut stroke measurement devices. The mathematical procedure used in predicting the shuttle touchdown loads and dynamics is presented together with the comparisons between measured flight data and the analytical predictions. Conclusions from these data are also presented. J.M.S.

N80-16092*# Columbia Univ., New York. School of Engineering and Applied Science.
RESEARCH STUDY: SPACE VEHICLE CONTROL SYSTEMS Final Report
Peter W. Likins and Richard W. Longman Nov. 1979 247 p refs
(Contract NAS8-32212)
(NASA-CR-161368) Avail: NTIS HC A11/MF A01 CSCL 22B

From the control point of view, spacecraft are classified into two main groups: those for which the spacecraft is fully defined before the control system is designed; and those for which the control system must be specified before certain interchangeable parts of a multi-purpose spacecraft are selected for future missions. Consideration is given to both classes of problems. M.M.M.

N80-16093*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF SECONDARY YIELD PARAMETER VARIATION ON PREDICTED EQUILIBRIUM POTENTIAL OF AN OBJECT IN A CHARGING ENVIRONMENT
Carolyn K. Purvis 1979 21 p refs Presented at the Ann. Conf. on Nucl. and Space Radiation Effects, Santa Cruz, Calif., 16-20 Jul. 1979; sponsored by IEEE
(NASA-TM-79299; E-117) Avail: NTIS HC A02/MF A01 CSCL 22B

The sensitivity of predicted equilibrium potential to changes in secondary electron yield parameters was investigated using MATCHG, a simple charging code which incorporates the NASCAP material property formulations. The equilibrium potential was found to be a sensitive function of one of the two parameters specifying secondary electron yield due to proton impact and of essentially all the parameters specifying yield due to electron impact. The information on the electron generated secondary yield parameters was discovered to be obtainable from monoenergetic beam charging data if charging rates as well as equilibrium potentials are accurately recorded. A.W.H.

N80-16094*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTED VOLTAGE DISTRIBUTIONS AROUND SOLAR ELECTRIC PROPULSION SPACECRAFT
N. John Stevens 1979 20 p refs Presented at 14th Intern. Conf. on Elec. Propulsion, Princeton, N.J., 30 Oct. - 1 Nov. 1979; sponsored by AIAA and DGLR
(NASA-TM-79286; E-225) Avail: NTIS HC A02/MF A01 CSCL 22B

The NASA Charging Analyzer Program is used to conduct preliminary computations of the voltage distributions around such large spacecraft in geomagnetic substorm environments at geosynchronous altitudes. Both a standard operating voltage (+ or - 150 volts on solar arrays) and direct-drive (+1200 volts on arrays) configurations are considered. Thruster-off simulations are computed for both operating voltage configurations while the effect of simulated thruster-on conditions are evaluated only for direct-drive configuration. These simulated thruster-on conditions are evaluated only for direct-drive configuration. These simulated thruster operations appear to alleviate surface charging. M.M.M.

N80-16077# Joint Publications Research Service, Arlington, Va.
SPACE VEHICLE APPROACH PROCEDURES DESCRIBED
B. Pokrovskiy *In its* USSR Rept.: Space No. 1 (JPRS-74805) 20 Dec. 1979 p 28-37 Transl. into ENGLISH from Aviats. Kosmon. (USSR), no. 8, 1979 p 36-37 (For primary document

see N80-16075 07-12)
Avail: NTIS HC A04/MF A01

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-16095*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEALED-CELL NICKEL-CADMIUM BATTERY APPLICATIONS MANUAL
Willard R. Scott and Douglas W. Rusta Dec. 1979 533 p refs
(NASA-RP-1052) Avail: NTIS HC A23/MF A01 CSCL 10B

The design, procurement, testing, and application of aerospace quality, hermetically sealed nickel-cadmium cells and batteries are presented. Cell technology, cell and battery development, and spacecraft applications are emphasized. Long term performance is discussed in terms of the effect of initial design, process, and application variables. Design guidelines and practices are given. M.G.

N80-16096*# Boeing Aerospace Co., Seattle, Wash.
ELECTRIC PROPULSION FOR NEAR-EARTH SPACE MISSIONS Final Report, Feb. 1978 - Apr. 1979
C. H. Terwilliger and W. W. Smith Jan. 1980 206 p
(Contract NAS3-21346)
(NASA-CR-159735; D180-25475-1) Avail: NTIS HC A10/MF A01 CSCL 21C

A set of missions was postulated that was considered to be representative of those likely to be desirable/feasible over the next three decades. The characteristics of these missions, and their payloads, that most impact the choice/design of the requisite propulsion system were determined. A system-level model of the near-Earth transportation process was constructed, which incorporated these mission/system characteristics, as well as the fundamental parameters describing the technology/performance of an ion bombardment based electric propulsion system. The model was used for sensitivity studies to determine the interactions between the technology descriptors and program costs, and to establish the most cost-effective directions for technology advancement. The most important factor was seen to be the costs associated with the duration of the mission, and this in turn makes the development of advanced electric propulsion systems having moderate to high efficiencies (> 50 percent) at intermediate ranges of specific impulse (approximately 1000 seconds) very desirable. Author

N80-16097*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UPPER STAGES UTILIZING ELECTRIC PROPULSION
David C. Byers 1980 21 p refs Presented at the JANNAF Propulsion Meeting, Monterey, Calif., 11-13 Mar. 1980
(NASA-TM-81412; E-330) Avail: NTIS HC A02/MF A01 CSCL 21C

The payload characteristics of geocentric missions which utilize electron bombardment ion thruster systems are discussed. A baseline LEO to GEO orbit transfer mission was selected to describe the payload capabilities. The impacts on payloads of both mission parameters and electric propulsion technology options were evaluated. The characteristics of the electric propulsion thrust system and the power requirements were specified in order to predict payload mass. This was completed by utilizing a previously developed methodology which provides a detailed thrust system description after the final mass on orbit, the thrusting time, and the specific impulse are specified. The impact on payloads of total mass in LEO, thrusting time, propellant type, specific impulse, and power source characteristics was evaluated. A.W.H.

N80-16098# Tennessee Univ. Space Inst., Tullahoma.
PARTICLE SIZE MEASUREMENTS IN SOLID PROPELLANT ROCKET EXHAUST PLUMES Final Report, 11 Jul. 1977 - 30 Jun. 1978
Kenneth E. Harwell and W. Michael Farmer 30 Jun. 1978 47 p
(Contract N00174-77-C-0234)
(AD-A073556) Avail: NTIS HC A03/MF A01 CSCL 21/9

Particle sizing interferometer measurement of particle size distributions, velocity and number density in samples of rocket propellant exhaust is described. Signal visibility and scattered intensity for individual particles were measured for a nominal size range of 0.3 to 6 micrometers. Calibration tests of the instrument were obtained by firing small propellant samples into a 20 cu cm chamber and comparing the measured particle size distributions with those obtained from estimates using multiple wavelength transmissometers and a commercial optical particle counter. Particle sizing interferometer estimates of particle size distributions and number densities required the development of models which could account for sample space dependence on particle size and illuminating fringe contrast variation. Results obtained by using these models on particle size data from calibration and rocket motor test firings show the need for well-controlled insitu perturbationless particle size measuring techniques for hostile environments. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-16099# Rockwell International Corp., Richland, Wash. Hanford Operations.
DETERMINATION OF WATER SOLUBILITY IN ORGANIC LIQUIDS
C. H. Hunter and C. B. Honaker Jun. 1979 10 p refs Presented at 34th Northwest Regional Meeting of the Am. Chem. Soc., Richland, Wash., 13 Jun. 1979
(Contract EY-77-C-06-1030)
(RHO-SA-113; CONF-790666-5) Avail: NTIS HC A02/MF A01

It is necessary to determine the solubility of water in organic liquids such as cyclohexanone, when the amount of dissolved water would affect the extractive power of the organic liquid. Methods previously used to determine the solubility of water in organic liquids include titration, gas chromatography and refractive index measurements. Use of a tritium tracer is an easier and more accurate method. The limits of detection are lower and the dynamic range is larger. The method in this study determines the uptake of water in cyclohexanone by using a tritium tracer. Samples are spiked with tritiated water and aliquots of the organic phase are counted by liquid scintillation. The experimental procedure is described and results are discussed. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N80-16100*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

NOVEL APPROACHES FOR ALLEVIATION OF ELECTRICAL HAZARDS OF GRAPHITE-FIBER COMPOSITES
Kumar Ramohalli 15 Oct. 1979 47 p refs
(Contract NAS7-100)
(NASA-CR-162683; JPL-Pub-79-63) Avail: NTIS HC A03/MF A01 CSCL 11D

Four basically different approaches were considered: gasification of fibers, retention in the matrix, clumping to prevent entrainment, and electrical insulation of fibers. The techniques used to achieve them are described in some detail. These involved surface treatment of fibers to improve the wettability of fibers and coating the fibers with the selected substances before laying them up for composite fabrication. Thermogravimetric analyses were performed on the plain and treated fibers in inert (nitrogen, argon) and reactive (air) atmospheres. The treated fibers embedded in epoxy were ignited in a Bunsen flame to determine the efficiency of these treatments. A simple apparatus was assembled to detect the time for the first short circuit (in a typical electrical circuit) when exposed to the combustion products from a graphite fiber composite fire. The state-of-the-art and treated fibers cast in typical epoxy were burned and ranked for potential success. It was inferred that the gasification schemes appear promising when reduction or oxidation is tried. It was also found that some very promising candidates were available for the clumping and for the electrical insulation of fibers. A.R.H.

N80-16101*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
COMPOSITE MATERIALS RESEARCH AND EDUCATION PROGRAM: THE NASA-VIRGINIA TECH COMPOSITES PROGRAM Final Report
Carl T. Herakovich Feb. 1980 18 p refs
(Grant NGR-47-004-129)
(NASA-CR-162719) Avail: NTIS HC A02/MF A01 CSCL 11D

Major areas of study include: (1) edge effects in finite width laminated composites subjected to mechanical, thermal and hygroscopic loading with temperature dependent material properties and the influence of edge effects on the initiation of failure; (2) shear and compression testing of composite materials at room and elevated temperatures; (3) optical techniques for precise measurement of coefficients of thermal expansion of composites; (4) models for the nonlinear behavior of composites including material nonlinearity and damage accumulation and verification of the models under biaxial loading; (5) compressive failure of graphite/epoxy plates with circular holes and the buckling of composite cylinders under combined compression and torsion; (6) nonlinear mechanical properties of borsic/aluminum, graphite/polyimide and boron/aluminum; (7) the strength characteristics of spliced sandwich panels; and (8) curved graphite/epoxy panels subjected to internal pressure. A.R.H.

N80-16102*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FRACTURE MODES OF HIGH MODULUS GRAPHITE/EPOXY ANGLEPLIED LAMINATES SUBJECTED TO OFF-AXIS TENSILE LOADS
J. H. Sinclair 1980 22 p refs Presented at 35th Ann. Conf. of the Reinforced Plastics/Composites Inst., New Orleans, 4-8 Feb. 1980; sponsored by Soc. of Plastics Ind.
(NASA-TM-81405; E-319) Avail: NTIS HC A02/MF A01 CSCL 11D

Angelplied laminates of high modulus graphite fiber/epoxy were studied in several ply configurations at various tensile loading angles to the zero ply direction in order to determine the effects of ply orientations on tensile properties, fracture modes, and fracture surface characteristics of the various plies. It was found that fracture modes in the plies of angleplied laminates can be characterized by scanning electron microscope observation. The characteristics for a given fracture mode are similar to those for the same fracture mode in unidirectional specimens. However, no simple load angle range can be associated with a given fracture mode. Author

N80-16103*# North Carolina Agricultural and Technical State Univ., Greensboro. School of Engineering.
EFFECT OF TEMPERATURE ON COMPOSITE SANDWICH STRUCTURES SUBJECTED TO LOW VELOCITY IMPACT Final Report
Avva V. Sharma Feb. 1980 34 p refs
(Grant NsG-1296)
(NASA-CR-162718) Avail: NTIS HC A03/MF A01 CSCL 11D

The effect of low velocity projectile impact on sandwich-type structural components was investigated. The materials used in the fabrication of the impact surface were graphite-, Kevlar-, and boron-fibers with appropriate epoxy matrices. The testing of the specimens was performed at moderately low- and high-temperatures as well as at room temperature to assess the impact-initiated strength degradation of the laminates. Eleven laminates with different stacking sequences, orientations, and thicknesses were tested. The low energy projectile impact is considered to simulate the damage caused by runway debris, the dropping of the hand tools during servicing, etc., on the secondary aircraft structures fabricated with the composite materials. The results show the preload and the impact energy combinations necessary to cause catastrophic failure in the laminates tested. A set of faired curves indicating the failure thresholds is shown separately for the tension-and compression-loaded laminates. The specific-strengths and -modulii for the various laminates tested are also given. A.R.H.

N80-16104*# National Aeronautics and Space Administration, Washington, D. C.
COMPOSITE COMPONENTS UNDER IMPACT LOAD AND EFFECTS OF DEFECTS ON THE LOADING CAPACITY
R. Aoki and D. Wurzel Sep. 1979 47 p Transl. into ENGLISH of conf. paper "Composite-bautseileunter Schlagbelastung und Auswirkung von Defekten auf die Belastbarkeit", DGLR-78-190 DGLR, West Germany, 1978 48 p Presented at the DGLR Symp. Fatigue Strength of Airplanes and Mod. Construct. Tech., Darmstadt, West Germany, 22 Sep. 1978 Original language document announced as A79-20491 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75351; DGLR-78-190) Avail: NTIS HC A03/MF A01 CSCL 11D

Investigations were carried out on a horizontal tail assembly made of carbon fiber reinforced plastic for the Alpha Jet. The possibility of obtaining a leading edge nose design lighter but not more expensive than a metal version was studied. An important consideration was sufficient resistance of the leading edge against impact of stones and hailstones combined with high degree of stiffness. The improvement of energy reception characteristics of the materials through suitable laminate design was considered. Since certain defects occur in structural components, the effects of such defects on the characteristics of the parts were also studied. K.L.

N80-16105*# Boeing Aerospace Co., Seattle, Wash.
MANUFACTURING PROCESSES FOR FABRICATING GRAPHITE/PMR 15 POLYIMIDE STRUCTURAL ELEMENTS Contractor Report, Aug. 1977 - Feb. 1979
C. H. Sheppard, J. T. Hoggatt, and W. A. Symonds Feb. 1979 295 p
(Contract NAS1-15009)
(NASA-CR-159129; D180-20545-2) Avail: NTIS HC A13/MF A01 CSCL 11D

Investigations were conducted to obtain commercially available graphite/PMR-15 polyimide prepreg, develop an autoclave manufacturing process, and demonstrate the process by manufacturing structural elements. Controls were established on polymer, prepreg, composite fabrication, and quality assurance. Successful material quality control and processes were demonstrated by fabricating major structural elements including flat laminates, hat sections, I beam sections, honeycomb sandwich structures, and molded graphite reinforced fittings. Successful fabrication of structural elements and simulated section of the space shuttle aft body flap shows that the graphite/PMR-15 polyimide system and the developed processes are ready for further evaluation in flight test hardware. A.R.H.

N80-16106*# Michigan Univ., Ann Arbor.
INCREASED FRACTURE TOUGHNESS OF GRAPHITE-EPOXY COMPOSITES THROUGH INTERMITTENT INTERLAMINAR BONDING Final Report, Nov. 1978 - Oct. 1979
David K. Felbeck and Li-Chung Jea Jan. 1980 36 p refs
(Grant NGR-23-005-528)
(NASA-CR-159198) Avail: NTIS HC A03/MF A01 CSCL 11D

Intermittent interlaminar bonding, which can lead to a large increase in the fracture surface area, was achieved through the introduction of thin perforated Mylar between the layers of a multi-layer continuous-filament graphite-epoxy composite. For the best optimum condition included in this study, fracture toughness was increased from about 100 kJ/sq m for untreated specimens to an average of about 500 kJ/sq m, while tensile strength dropped from 500 MPa to 400 MPa, and elastic modulus remained the same at about 75 GPa. An approximate analysis is presented to explain the observed improvement in toughness. A.R.H.

N80-16107*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PREDICTION OF FIBER COMPOSITE MECHANICAL BEHAVIOR MADE SIMPLE
C. C. Chamis 1980 26 p refs Presented at the 35th Ann. Conf. of the Reinforced Plastics/Composites Inst., New Orleans, 4-8 Feb. 1980; sponsored by the Soc. of Plastics Ind.
(NASA-TM-81404; E-331) Avail: NTIS HC A03/MF A01 CSCL 11D

The elastic properties and failure stresses of angleplied fiber composite laminates were determined using a pocket calculator. The procedure uses simple equations and appropriate graphs of elastic properties versus angle plies, and can handle all types of fiber composites including hybrids. The versatility and generality of the method is illustrated in several step-by-step numerical examples. A.R.H.

N80-16108# California Univ., Livermore. Lawrence Livermore Lab.
SINTERING KINETICS OF PURE AND DOPED BORON CARBIDE
R. G. Lange, Z. A. Munir, and J. B. Holt 11 Jun. 1979 12 p refs Presented at the 5th Intern. Conf. on Sintering and Related Phenomena, Notre Dame, Ind., 18 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82515; CONF-790682-3) Avail: NTIS HC A02/MF A01

The sintering of pure and doped boron carbide was investigated over the temperature range 1898 K to 2380 K and at additive levels ranging from 0.75 to 10.0 percent. The addition of 0.75 and 3.8 wt percent of AlF3, Ni, Fe, and Cu deactivated the sintering of B4C at all temperatures. In contrast, the addition of 10.0 wt percent these additives resulted in enhanced shrinkage in B4C for the temperatures 1898 K and 2133 K. At the highest temperature, 2380 K, the addition of 10.0 wt percent AlF3 was the only case where enhanced shrinkage was observed. In this case, X-ray analysis showed the formation of a B12C2Al compound and the release of fluorine. These results are interpreted in terms of a grain-boundary diffusion process for pure and doped B4C. DOE

N80-16109# Los Alamos Scientific Lab., N. Mex.
PREPARATION OF FIBER REINFORCED TITANIUM DIBORIDE AND BORON CARBIDE COMPOSITE BODIES
L. R. Newkirk, R. E. Riley, H. Sheinberg, F. A. Valencia, and T. C. Wallace 1979 11 p refs Presented at the Intern. Conf. on Chem. Vapor Deposition, Los Angeles, 14 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-969; CONF-791017-3) Avail: NTIS HC A02/MF A01

A process is described for uniformly infiltrating woven carbon cloth with either titanium diboride or boron carbide at reduced pressure (15 to 25 torr). The effects of deposition temperature on the uniformity of penetration and on coating rate are described for temperatures from 750 to 1000 C and deposit loadings from 20 to 43 volume percent. For the boron carbides, boron composition is discussed and evidence is presented suggesting that propene is the dominant rate controlling reactant. DOE

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-16110 Colorado State Univ., Fort Collins.
ENVIRONMENTAL PARTICULATES: CHARACTERIZATION BY HELIUM PLASMA AND ELUCIDATION OF FORMATION PROCESSES Ph.D. Thesis
Christopher Francis Bauer 1979 343 p
Avail: Univ. Microfilms Order No. 7928503

An evolved gas analysis/emission spectrometer system capable of identifying inorganic compounds at trace levels in solid samples, especially environmental particulates, is described. Identification of a given compound is based on the coincident observation of its metal and nonmetal components at its temperature of vaporization. This coincidence exists for the pure halide, sulfide, and sulfate salts of Cd, Hg, Pb, and Zn. In real samples, however, a number of obstacles may hamper identification, most importantly, chemical reactions in the sample which alter the identity of compounds before vaporization. Nevertheless, most of the compounds, when vaporized from a silica matrix, retained the coincidence between metal and nonmetal, despite the fact that reactions did occur. Dissert. Abstr.

N80-16111 California Univ., Berkeley.
HEAVY HYDROCARBONS FROM COAL GASIFICATION VAPOR PRESSURES AND DEW POINT Ph.D. Thesis
Albert Brian Macknick 1979 110 p
Avail: Univ. Microfilms Order No. 8000429

Experimental vapor pressure data at near-ambient temperatures were measured for seven heavy hydrocarbons. Semitheoretical methods are recommended for extrapolating the data to higher temperatures. Because it is not always feasible economically to determine experimentally all vapor pressure data required, a group contribution method is presented which gives parameters for a vapor pressure equation, where all parameters are obtained from molecular structure only. Techniques are presented which allow classification of heavy hydrocarbon mixtures so that vapor pressures and molecular weights needed for dew point calculations can be estimated with a minimum amount of experiment effort. A computer program is used to predict conditions for two tars obtained from coal gasification pilot plants. Dissert. Abstr.

N80-16112 California Univ., Berkeley.
MASS TRANSFER CONTROLLED REACTIONS IN PACKED BEDS AT LOW REYNOLDS NUMBERS Ph.D. Thesis
Peter S. Fedkiw 1979 254 p
Avail: Univ. Microfilms

Mass-transfer data were experimentally taken in a transport controlled, flow-through porous electrode to test the theoretical calculations and to provide data presently unavailable for deeper beds. It was found that the sinusoidal PCT model could not fit the data of this work or that available in the literature. However, all data could be adequately described by a model which incorporates a channeling effect. The bed was successfully modeled as an array of dual sized straight tubes. Dissert. Abstr.

N80-16113 California Inst. of Tech., Pasadena.
THE DEVELOPMENT AND UTILIZATION OF INELASTIC ELECTRON TUNNELING SPECTROSCOPY AS A TOOL FOR INVESTIGATING FUNDAMENTAL CATALYTIC PROCESSES Ph.D. Thesis
Howard Edwin Evans 1980 270 p
Avail: Univ. Microfilms Order No. 8002586

A diverse number of reactant/catalyst systems were investigated utilizing inelastic electron tunneling spectroscopy (IETS) to probe the vibrational structures of the various surface species. These studies include observation of an ethoxide-to-acetate transformation above 470 K for ethanol on alumina, demonstrating that IETS effectively monitors surface reactions. Characterization of surface acetates formed on alumina is obtained via analysis of IET spectra, as is information on the initial

adsorption mechanism for each species. Results obtained for ethanol adsorption on alumina-supported silver particles extend the use of IETS into areas of supported metal catalysis. The IETS technique was also used to characterize the structure of Zr(BH4)4 supported on aluminum oxide. Dissert. Abstr.

N80-16114 Notre Dame Univ., Ind.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF ETHYLENE OXIDATION IN A FIXED-BED REACTOR
Ph.D. Thesis
Stephen Carl Paspek, Jr. 1980 144 p
Avail: Univ. Microfilms Order No. 8002621

The intrinsic kinetics of ethylene oxidation, in excess oxygen, over supported platinum catalyst was determined in a spinning basket-type gradientless reactor. The same catalyst was then introduced into both adiabatic and non-adiabatic fixed-bed reactors. Using a mixture of ethylene and oxygen as the reactor feed, the behavior of both reactors was experimentally determined over a wide range of operating conditions. Overall conversions, as well as axial temperature profiles were recorded. Employing the most accurate model, predictions of experimental reactor behavior were made, and the accuracy of the predictions was determined by subsequent experimentation. Results indicate that a one-dimensional two-phase model, including solid conduction, can accurately predict the behavior of this experimental fixed-bed reactor system for a variety of operating conditions.
Dissert. Abstr.

N80-16115 Ohio State Univ., Columbus.
THE REDUCTION OF SILICA AND MULLITE IN HYDROGEN
Ph.D. Thesis
Chung-I Chen 1979 185 p
Avail: Univ. Microfilms Order No. 8001706

A theory was developed to deal with kinetics, thermodynamics, and mass transport phenomena simultaneously for reactions which generate gaseous products. The reaction of fused silica with hydrogen was investigated using this theory. For reactions controlled by product transport, the partial pressures of gaseous reactants and products were assumed to be in equilibrium at the reaction surface with the transport rate of the gaseous products proportional to the equilibrium partial pressures. The thermodynamic properties, the transport properties, and the kinetic model were solved by relating the equilibrium constant and mass transfer equation. Dissert. Abstr.

N80-16116* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CATALYSTS FOR POLYIMIDE FOAMS FROM AROMATIC ISOCYANATES AND AROMATIC DIANHYDRIDES Patent
Salvatore R. Riccitiello, Paul M. Sawko, and Carlos A. Estrella, inventors (to NASA) Issued 4 Dec. 1979 5 p Filed 24 Feb. 1978 Supersedes N78-221156 (16 - 13, p 1674)
(NASA-Case-ARC-11107-1; US-Patent-4,177,333; US-Patent-Appl-SN-883961; US-Patent-Class-521-124; US-Patent-Class-521-125; US-Patent-Class-521-127; US-Patent-Class-521-157; US-Patent-Class-528-73) Avail: US Patent and Trademark Office CSCL 07D

Polyimide foam products having greatly improved burn-through and flame-spread resistance are prepared by the reaction of aromatic polyisocyanates with aromatic dianhydrides in the presence of metallic salts of octoic acid. The salts, for example stannous octoate, ferric octoate and aluminum octoate, favor the formation of imide linkages at the expense of other possible reactions.
Official Gazette of the U.S. Patent and Trademark Office

N80-16117*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRENDS IN MATERIALS' OUTGASSING TECHNOLOGY
Joe A. Colony Nov. 1979 27 p
(NASA-TM-80585) Avail: NTIS HC A03/MF A01 CSCL 07D

Test sample acquisition and chemical analysis techniques for outgassing products from spacecraft, experiment modules, and support equipment is described. The reduction of test data to a computer compatible format to implement materials selection policies is described. A list of the most troublesome outgassing species is given and several materials correlations are discussed. Outgassing from solar panels, thermal blankets, and wire insulation are examined individually. M.G.

N80-16118*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
NITROGEN DIOXIDE VAPOR PENETRATION OF CHLORO-BUTYL RUBBER SCAPE UNDER OPERATIONAL CONDITIONS
Thomas A. Schehl and Thomas W. Beall Feb. 1980 78 p refs
(NASA-TP-1605) Avail: NTIS HC A05/MF A01 CSCL 07D

Operational self contained atmospheric protective ensembles (SCAPE suits) and fabric from the suits were subjected to a series of tests designed to determine the amount of exposure a wearer of the suit would receive if a spill of the hypergolic oxidizer nitrogen tetroxide (N2O4) should occur nearby. The results of these tests show that a wearer of a 'stock' SCAPE suit equipped with a standard liquid air pack, if exposed to a spill resulting in a 26 percent increase of oxidizer in the surrounding atmosphere, will experiment no detectable concentration of nitrogen dioxide (NO2) inside the suit for 15 minutes. Thereafter, the NO2 concentration within the suit will increase for 35 minutes at a rate of 0.07 ppm per minute and then at a gradually decreasing rate until an equilibrium concentration of 3.4 ppm is attained after 100 minutes. Momentary increases of as much as 1.6 ppm can be expected if the wearer were to rise quickly from a squatting position, but the additional NO2 would be dissipated within three minutes. The effect of liquid and vapor N2O4 and of liquid monomethylhydrazine on permeation rates and tensile strength of the SCAPE suit fabric was also investigated. Author

N80-16119# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
A NUMERICAL MODEL OF HIGH INTENSITY CONFINED HYDROCARBON FLAMES
H. A. Arbib, Y. Goldman, J. B. Greenberg, and Y. M. Timnat Oct. 1978 65 p refs
(TAE-322) Avail: NTIS HC A04/MF A01

A computer program was developed for predicting flow field properties and species concentration distributions in side an axisymmetrical combustion chamber. A complex combuster geometry was considered, with an initial diffuser with divergence half angle of 45 degrees, and a short tunnel followed by a sudden expansion, in order to produce a strong recirculating pattern to stabilize the flame. The fuel (kerosene) and oxidant (air) emerged, premixed and in gaseous form from the central injection nozzle. A two equation model of turbulance was employed, and the complex kenetics of kerosene-air combustion by a three step global mechanism, for hydrocarbon attack, CO oxidation, and water formation are described. R.C.T.

N80-16120# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Chemistry.
CHARACTERISTICS OF VERY CONCENTRATED AQUEOUS SOLUTIONS
K. S. Pitzer Aug. 1979 53 p refs Presented at the Nobel Symp. on Chem. and Geochem. of Solutions at High Temperature and Pressure, Bofors, Karlskoga, (Sweden), 16 Sep. 1979
(Contract W-7405-eng-48)
(LBL-9660) Avail: NTIS HC A04/MF A01

The electrical conductance and thermodynamic properties (activities) are described for the aqueous electrolytes which have been investigated over the full range from fused salt to pure water. The activities are well represented by a simple equation originally proposed for nonelectrolytes. Comments are made concerning the properties of various strong electrolytes up to saturation concentration and their dependence on temperature up to 300 C. These properties are accurately represented by virial-coefficient equations. DOE

N80-16121# Illinois Inst. of Tech., Chicago. Dept. of Chemical Engineering.
ELECTROCHEMISTRY OF ACETYLIDES, NITRIDES AND CARBON CATHODES IN MOLTEN HALIDES
J. R. Selman May 1979 9 p refs
(Contract EG-77-S-02-4445)
(COO-4445-T1) Avail: NTIS HC A02/MF A01

The Delta G/sub f/ of Li2C/sub x/ and CaC/sub x/ were determined to be -47.02 kcal/mole at 700 K and -31.44 kcal/mole at 823 K, respectively. They confirm that the potential of carbon electrodes in acetylide melts is a mixed potential, governed by lithium or calcium intercalation simultaneously with acetylide-ion discharge: Li(+) + x C yields LiC/sub x/e(-), and C2(2-) yields 2C + 2e(-). DOE

N80-16122# Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry.
NATURE OF OXYGEN CONTAINING RADICALS IN RADIATION CHEMISTRY AND PHOTOCHEMISTRY OF AQUEOUS SOLUTIONS. Annual Progress Report, Sep. 1978 - Jul. 1979
G. Czapski. 1979. 42 p.
(Contract EY-76-C-02-3221)
(COO-3221-60). Avail: NTIS. HC A03/MF A01.

The properties of HO2, O2(-), and O were studied in relation to their role in biological systems. The redox potentials of free radicals were determined with emphasis on the redox potential of O2(-). The possibility of formation of OH from O2(-), the role of OH, O2(-), and oxygen in radiation damage to cells, and the mechanism of oxygen toxicity in biological processes are among topics discussed. Recommendations for further research are given. J.M.S.

N80-16123# Los Alamos Scientific Lab., N. Mex.
HIGH RESOLUTION SATURATION SPECTROSCOPY WITH CO2 LASERS. APPLICATION TO THE NU SUB 3 BANDS OF SF6 AND OsO4
C. J. Borde, M. Ouhayoun, A. VanLerberghe, C. Salomon, S. Avrillier, C. D. Cantrell, and J. Borde. 1979. 14 p. refs. Presented at the 4th Intern. Conf. on Laser Spectry., West Berlin, 11-15 Jun. 1979. Prepared in cooperation with Paris XIII Univ., Villetaneuse, France and Chicago Univ., Ill.
(Contract W-7405-eng-36)
(LA-UR-79-1913; CONF-790690-2). Avail: NTIS. HC A02/MF A01.

Topics covered include: (1) the frequency-controlled saturation spectrometer; (2) application to the rotational fine structure of the V3 band of (S-32)F6 and determination of a new set of spectroscopic parameters; (3) magnetic hyperfine structure of the SF6 lines, evidence for a spin-vibration interaction; (4) direct optical observation of the ground state octahedral splittings of SF6 and violation of the delta C = D selection rule; and (5) fine and hyperfine structure studies in the V3 band of OsO4. DOE

N80-16124# North Carolina State Univ. at Raleigh. Dept. of Nuclear Engineering.
HYDROGEN DIFFUSION, DISSOLUTION AND PERMEATION OF NONMETALLIC SOLIDS
T. S. Elleman, D. Rao, K. Verghese, and L. Zumwalt. 1979. 187 p. refs.
(Contract EY-76-S-05-4721)
(ORO-4721-T1). Avail: NTIS. HC A09/MF A01.

Hydrogen diffusion, dissolution, and permeation in metal oxides, carbides, nitrides, halides, and hydrides are reviewed. These data are for the development of fusion reactor blankets but should also be generally useful in technologies that involve interactions between hydrogen and nonmetals. DOE

N80-16125# Oak Ridge National Lab., Tenn.
CONVERSION OF ISOTOPE COMPOUNDS TO METAL BY REDUCTION-DISTILLATION METHODS
E. H. Kobisk. 1978. 26 p. refs. Presented at the Conf. of the Intern. Nucl. Target Develop. Soc., Munchen-Garching, West Germany, 11 Sep. 1978.
(Contract W-7405-eng-26)
(CONF-780943-2). Avail: NTIS. HC A02/MF A01.

The reduction of a solid compounded isotope, followed by metal distillation into a noncontaminating collector vessel is discussed. A variety of isotope metal vapor condensation-collection methods and subsequent treatment of the product to form various physical forms are discussed. Limitations of this technique with regard to reducible cations other than those noted earlier are discussed, together with the consequences of volatilization of some metal suboxides in this process. DOE

N80-16126# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
COMBUSTION OF MULTICOMPONENT FUEL DROPLETS. Final Report
H. S. Homan. Jul. 1979. 28 p. refs.
(Contract EC-77-S-02-4449)
(COO-4449-2). Avail: NTIS. HC A03/MF A01.

The vaporization and burning of liquid fuel droplets which contain more than one chemical component were investigated. The prediction of the transient rate of changes in chemical composition of multi-component liquid fuel droplets during vaporization and burning in convective flow was considered. A model is provided of droplet burning which is more relevant to droplet vaporization and combustion in fuel sprays than the droplet combustion models which assume spherical symmetry, single-component fuel, and constant droplet properties. The model is expected to impact the models of combustion in diesel engines, gas turbines, and furnaces especially for the heavy shale and coal-derived fuels. DOE

N80-16127# California Univ., Livermore. Lawrence Livermore Lab.
APPARATUS AND TECHNIQUES FOR THE STUDY OF PRECIPITATION OF SOLIDS AND SILICA FROM HYPERSALINE GEOTHERMAL BRINE
J. H. Hill, J. E. Harrar, C. H. Otto, Jr., S. B. Deutscher, H. E. Crampton, R. G. Grogan, and V. H. Hendricks. 5 Jul. 1979. 12 p. refs.
(Contract W-7405-eng-48)
(UCRL-52799). Avail: NTIS. HC A02/MF A01.

Apparatus and techniques for the collection and examination of geothermal brine samples under anaerobic conditions and within minimum cooling are discussed. The concentration of suspended solids is measured gravimetrically after filtration, and the concentration of dissolved silica is measured by atomic absorption spectrophotometry. Well site data illustrate the typical results of the procedures. DOE

N80-16128# California Univ., Berkeley. Lawrence Berkeley Lab. Physics, Computer Science and Mathematics Div.
THEORETICAL STUDY OF A REACTION-DIFFUSION MODEL FOR FLAME PROPAGATION IN A GAS. Ph.D. Thesis
S. S. Lin. Jul. 1979. 114 p. refs.
(Contract W-7405-eng-48)
(LBL-9487). Avail: NTIS. HC A06/MF A01.

Assuming the existence of a positive ignition temperature, it was proven that, for an arbitrary Lewis number, (1) there is a unique flame front associated with each unburned gas state. When the Lewis number is one, the model equation can be reduced to a scalar reaction-diffusion equation. It was proven further that (2) if the initial gas states are close to a flame front, then the gas mixture evolves into the flame front at an exponential rate. In particular, each flame front is stable under finite amplitude perturbation. (3) For general initial gas states, the gas mixture evolves asympotically into a suitable combination of flame fronts. DOE

N80-16129# Department of Energy, Pittsburgh, Pa. Energy Technology Center.
STABILITY STUDIES OF COAL LIQUIDS
F. R. Brown and F. S. Kam. Aug. 1979. 23 p. refs.
(PETC/TR-79/5). Avail: NTIS. HC A02/MF A01.

The aging characteristics of liquid products derived from the hydrogenation of coal were studied. Viscometric, spectrometric, ultimate analysis, solvent separations, and oxygen consumption measurements were employed to monitor the storage properties of the coal liquids under a variety of environmental conditions. Using viscosity measurements as the primary probe of changes in the stored samples, the rate of product degradation was found to be related to the initial viscosity of the sample, the storage temperature and the concentration of oxygen in the gaseous environment over the samples. Fractions of gross coal liquid samples obtained by solvent separation methods were monitored for their rates of oxygen consumption in order to more accurately determine those materials most susceptible to oxidation, and concurrent degradation of the product. The results show that coal liquids are very susceptible to oxidative degradation. DOE

N80-16130# Department of Energy, Bartlesville, Okla.
DEVELOPMENT OF HIGH TEMPERATURE SUBTRACTIVE COLUMN AND CHROMATOGRAPHIC ANALYSIS OF HYDROCARBONS PRESENT IN DIESEL EXHAUST
Clarence J. Raible and D. E. Seizinger Dec. 1978 11 p refs
(BETC/RI-78/12) Avail: NTIS HC A02/MF A01

A high-temperature subtractive column was developed for distinguishing diesel fuel and exhaust hydrocarbons into two classifications, i.e., saturated and unsaturated hydrocarbons. Duplicate samples were collected with and without a subtractive column and subsequently analyzed by gas liquid chromatography to determine boiling range distribution of exhaust hydrocarbons. Comparison of the resulting chromatographic data permitted determination of hydrocarbon class as well as boiling range distribution. The analytical procedure was developed for classification of hydrocarbons in the range C7 to C22. The loss of saturated compounds within the subtractive column was a reproducible 6 percent over the analyzed hydrocarbon range. Compensation for losses during sample transfer was accomplished by including the transfer steps in the calibration procedure. DOE

N80-16131# Versar, Inc., Springfield, Va.
SURVEY OF POTENTIAL CHLORINE PRODUCTION PROCESSES Final Report
Apr. 1979 196 p refs Prepared for Argonne Natl. Lab., Ill.
(Contract W-31-109-eng-38)
(ANL/OEPM-79-1) Avail: NTIS HC A09/MF A01

A computerized literature search of past and current chlorine generation methods was performed to identify basic chlorine production processes. Over 200 pertinent references are cited involving 20 separate and distinct chlorine processes. Each basic process is evaluated for its engineering and economic viability and energy efficiency in terms of raw material availability, type and amount of energy required, by-product demand/disposal, and status of development. The most promising processes are the membrane process (with and without catalytic electrodes), Kel-Chlor, Mobay (direct electrolysis of hydrogen chloride), the Shell process (catalytic oxidation of hydrogen chloride), and oxidation of ammonium chloride. DOE

N80-16132# Montana State Univ., Bozeman. Fisheries Bioassay Lab.
AQUEOUS AMMONIA EQUILIBRIUM - TABULATION OF PERCENT UN-IONIZED AMMONIA Extramural Report, 1 Jan. 1971 - 31 Dec. 1975
Robert V. Thurston, Rosemarie C. Russo, and Kenneth Emerson
Aug. 1979 437 p refs
(Grant EPA-R-800861)
(PB80-103518; EPA-600/3-79-091) Avail: NTIS
HC A19/MF A01 CSCL 07D

The percent of un-ionized ammonia as a function of pH and temperature in aqueous ammonia solutions of zero salinity is presented in tabular form over the following ranges: temperature 0.0 to 40.0 C in increments of 0.2 degree, and pH 5.00 to 12.00 in increments of 0.01 pH unit. GRA

N80-16133# Chemical Systems, Inc., Tustin, Calif.
DEVELOPMENT OF DRY PROCESS MICROPOROUS POLYSULFONE SUPPORTS FOR ULTRATHIN FILM COMPOSITES Final Report
R. E. Kesting 1979 35 p refs
(Contract DI-14-34-0001-8537)
(PB-300498/4; W79-09839) Avail: NTIS HC A03/MF A01
CSCL 07D

A dry process microporous support of polybutylene terphthalate (P13T) was developed. It appears to be superior to wet process polysulfone because its membranes are: (1) more solvent resistant; (2) wet-dry reversible due to traces of polyvinylalcohol (PVA); (3) solvent cast onto polyethlene terphthalate (PET) and forms an integral bond and cannot be removed inadvertently during handling or operation; and (4) made of an optimum high density of 0.1 millimicron pores. The best results were obtained with PET (® PRO Eastman) 5g, polyvinyl alcohol (Gelvatol 20-30 Monsanto) 5g, HFIP 90g. GRA

N80-16134# Permutit Co., Inc., Princeton, N. J.
PRETREATMENT OF SEAWATER FOR REVERSE OSMOSIS PROCESSES, 1976
Arthur C. Epstein 1979 160 p refs
(Contract DI-14-30-3242)
(PB-300509/7; W79-09831; OWRT-3242(1)) Avail: NTIS
HC A08/MF A01 CSCL 07D

Sea water pretreatment systems which precede reverse osmosis systems were studied. The systems studied include: (1) a baseline system which consisted of sand filtration followed by cartridge filtration and a carbon filter for chlorine removal ahead of the hollow fiber polyamide membrane; (2) a coagulation pretreatment system which consisted of an upflow sludge blanket precipitator followed by a polishing filter and cartridge filter, and a carbon filter for removal of chlorine ahead of the hollow fiber polyamide membrane; and (3) an in-line coagulation performed ahead of the base-line pretreatment system. The feed to all three systems was chlorinated/microscreened sea water. The pretreated effluent from systems one and two was used as feed to either a spiral wound thin film composite membrane or a hollow fiber polyamide membrane. System two and three provided water with acceptable plugging factors for feeding reverse osmosis systems. The economics of the three pretreatment systems were determined for a flow rate of four million gallons per day. GRA

N80-16135# National Bureau of Standards, Washington, D.C.
STANDARD REFERENCE MATERIALS: MICRO-HOMOGENEITY STUDIES OF NBS STANDARD REFERENCE MATERIALS, NBS RESEARCH MATERIALS, AND OTHER RELATED SAMPLES Final Report
R. B. Marinenko, K. F. J. Heinrich, and F. C. Ruegg Sep. 1979
88 p refs
(PB-300461/1; NBS-SP-260-65; LC-79-600121) Avail: NTIS
HC A05/MF A01 CSCL 14B

A simple routine technique for studying homogeneity in the micrometer range with the electron microprobe is described. For graphic display, a digital periodic integrator is used. In conjunction with scalers and a stepping motor on the sample stage, traces similar to industrial control charts based on a comparison of the experiment with the expected (Poisson) counting statistics are quickly obtained. A computer program developed to numerically evaluate sample homogeneity is used to test several standard reference materials (SRMs). These include the iron and steels (SRMs 661-664, 461, and 463), the gold-copper and gold-silver alloys (SRMs 481 and 482), the tungsten-20 percent molybdenum alloy (SRM 480), cartridge brass (SRM 478), and the iron-chromium-nickel alloy (SRM 479a). GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-16136 Illinois Univ. at Chicago Circle, Chicago.
MAGNETIC PROPERTIES OF SELECTED TRANSITION METAL COMPOUNDS Ph.D. Thesis
Kyong Ok Joung 1979 126 p
Avail: Univ. Microfilms Order No. 7925991

Ac magnetic susceptibilities as a function of temperature at zero field or as a function of external magnetic field at constant temperature were measured by the mutual inductance methods for the following compounds: (1) [Co(C5H5NO)6](NO3)2; (2) [Ni(C5H5NO)6](NO3)2; (3) [Ni2(en)4C12]C12; and (4) Co(H2O)Cl2(2 urea), where urea is (NH2)2CO. Dissert. Abstr.

N80-16137 North Texas State Univ., Denton.
FORMATION OF SUPERSATURATED ALLOYS BY ION IMPLANTATION AND PULSED-LASER ANNEALING Ph.D. Thesis
Syd Robert Wilson 1979 174 p
Avail: Univ. Microfilms Order No. 8000814

Supersaturated substitutional alloys formed by ion implantation and rapid liquid-phase epitaxial regrowth induced by pulsed-laser annealing were studied using Rutherford backscattering and ion channeling analysis. A series of impurities (As, Sb, Bi, Ga, In, Fe, Zn, Cu) were implanted into single-crystal (001) orientation silicon at does ranging from 1 x 10 to the 15th power/ sq cm to 1 x 10 to the 17th power sq cm. The

samples were subsequently annealed with a Q-switched ruby laser. Ion channeling analysis shows that laser annealing incorporates the Group 3 (Ga, In) and Group V (As, Sb, Bi) impurities into substitutional lattice sites at concentrations far in excess of the equilibrium solid solubility. Channeling measurements indicate the silicon crystal is essentially defect free after laser annealing. Dissert. Abstr.

N80-16138 State Univ. of New York at Stony Brook.
CORROSION BEHAVIOR OF Ni IMPLANTED STEEL Ph.D. Thesis
Shashi Bhushan Agarwal 1979 306 p
Avail: Univ. Microfilms Order No. 8000248

The compositional, structural, and electrochemical properties of Ni-implanted 430 stainless steel were analyzed. The compositional analysis revealed a larger concentration of Ni on the surface than predicted by LSS theory. Also, an extensive radiation damage was observed in the implanted material in the form of entangled dislocation network. The extent of damage was found to increase with Ni concentration. Ion implantation was found to be accompanied by sputtering of the surface. A considerable roughening of the surface occurs which is highlighted by impurities and defects in the substrate. The electrochemical behavior of 430 stainless steel was considerably modified by Ni implantation. These modifications include changes in anodic behavior of 430 stainless steel and in passivation parameters of 430 stainless steel. Dissert. Abstr.

N80-16139 Cincinnati Univ., Ohio.
THE EFFECTS OF INTERSTITIAL IMPURITIES RADIATION TEMPERATURE ON VOIDS SWELLING AND IRRADIATION HARDENING IN THE NEUTRON IRRADIATED MOLYBDENUM Ph.D. Thesis
Shaiw-Rong Scott Liu 1979 282 p
Avail: Univ. Microfilms Order No. 7922607

Molybdenum specimens of three different impurity levels (residual resistivity ratios of 60, 650 and 6320, respectively), irradiated in the Oak Ridge Research Reactor to a fast neutron fluence of 1 x 10 to the 21st power n/sq cm (E > 0.1 MeV) at ten different temperatures ranging from 220 to 900 C were studied using transmission electron microscopy (TEM), small-angle X-ray scattering (SAXS) and knoop microhardness measurements. The TEM results showed that the microstructure consisted of voids, black spots and loops, rafts and dislocation segments. All were present at the lower irradiation temperatures, while only voids and dislocation segments were present at the higher temperatures. SAXS experiments also indicated that voids formed in the specimens irradiated at temperatures ranging from 220 to 900 C. The TEM and SAXS results suggest that the possible threshold temperature of void formation is possibly as low as 150 C (0.15 T sub m) in molybdenum. Dissert. Abstr.

N80-16140 Iowa Univ., Iowa City.
THE EFFECTS OF STRAIN RATE AND STRAIN HISTORY ON THE DYNAMIC BEHAVIOR OF METALLIC MATERIALS Ph.D. Thesis
Ming-Chuen Yip 1979 112 p
Avail: Univ. Microfilms Order No. 7928634

The constitutive equations for strain hardening (FCC metals and alloys) and strain softening-hardening metallic materials (BCC metals and alloys) were developed within the framework of the endochronic theory of viscoplasticity. The constitutive equation is applied to describe the cyclic hardening behavior of materials at a prescribed constant strain rate. The theoretical stress-strain relation for each cycle under total strain control is presented, and the peak stress of each cycle under different controlled total strain is obtained. Wave propagation of strain hardening materials with both prestraining and strain rate history effects was investigated. The strain-time profiles were obtained and are presented for comparison with experimental data. The difference between the constant total strain rate and the constant plastic strain rate is discussed. Dissert. Abstr.

N80-16141*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SCANNING-ELECTRON-MICROSCOPE STUDY OF NORMAL-IMPINGEMENT EROSION OF DUCTILE METALS
William A. Brainard and Joshua Salik Jan. 1980 11 p refs
(NASA-TP-1609; E-085) Avail: NTIS HC A02/MF A01 CSCL 11F

Scanning electron microscopy was used to characterize the erosion of annealed copper and aluminum surfaces produced by both single- and multiple-particle impacts. Macroscopic 3.2 mm diameter steel balls and microscopic, brittle erodant particles were projected by a gas gun system so as to impact at normal incidence at speeds up to 140 m/sec. During the impacts by the brittle erodant particles, at lower speeds the erosion behavior was similar to that observed for the larger steel balls. At higher velocities, particle fragmentation and the subsequent cutting by the radial wash of debris created a marked change in the erosion mechanism. Author

N80-16142*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STRESS CORROSION CRACKING EVALUATION OF MARTENSITIC PRECIPITATION HARDENING STAINLESS STEELS
T. S. Humphries and E. E. Nelson Jan. 1980 34 p refs
(NASA-TM-78257) Avail: NTIS HC A03/MF A01 CSCL 11F

The resistance of the martensitic precipitation hardening stainless steels PH13-8Mo, 15-5PH, and 17-4PH to stress corrosion cracking was investigated. Round tensile and c-ring type specimens taken from several heats of the three alloys were stressed up to 100 percent of their yield strengths and exposed to alternate immersion in salt water, to salt spray, and to a seacoast environment. The results indicate that 15-5PH is highly resistant to stress corrosion cracking in conditions H1000 and H1050 and is moderately resistant in condition H900. The stress corrosion cracking resistance of PH13-8Mo and 17-4PH stainless steels in conditions H1000 and H1050 was sensitive to mill heats and ranged from low to high among the several heats included in the tests. Based on a comparison with data from seacoast environmental tests, it is apparent that alternate immersion in 3.5 percent salt water is not a suitable medium for accelerated stress corrosion testing of these pH stainless steels. A.R.H.

N80-16143*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME CONSIDERATIONS OF THE PERFORMANCE OF TWO HONEYCOMB GAS PATH SEAL MATERIAL SYSTEMS
Robert C. Bill and Lawrence T. Shiembob 1980 29 p refs
To be presented at the Ann. Meeting of the Am. Soc. of Lubrication Engr., Anaheim, Calif., 5-8 May 1980 Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, and Pratt and Whitney Aircraft Group, East Hartford, Conn.
(NASA-TM-81398; AVRACOM-TR-79-33; E-032) Avail: NTIS HC A03/MF A01 CSCL 11F

A standard Hastelloy-X honeycomb material and a pack aluminide coated honeycomb material were evaluated as to their performance as labyrinth seal materials for aircraft gas turbine engines. Consideration from published literature was given to the fluid sealing characteristics of two honeycomb materials in labyrinth seal applications, and their rub characteristics, erosion resistance, and oxidation resistance were evaluated. The increased temperature potential of the coated honeycomb material compared to the uncoated standard could be achieved without compromising the honeycomb material's rub tolerance, although there was some penalty in terms of reduced erosion resistance. Author

N80-16144# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.
ELASTIC AND PLASTIC STRAINS AND THE STRESS CORROSION CRACKING OF AUSTENITIC STAINLESS STEELS Final Report
F. P. Vaccaro, R. F. Hehemann, and A. R. Troiano Aug. 1979 133 p refs
(Contract EY-76-S-02-2576)
(COO-2576-9) Avail: NTIS HC A07/MF A01

The influence of elastic (stress) and plastic (cold work) strains on the stress corrosion cracking (SSC) of a transformable austenitic stainless steel was studied in several aqueous chloride environments. Initial polarization behavior was active for all deformation

conditions as well as for the annealed state. The development of a pseudo-passive (flawed) film leading to localized corrosion, occluded cells and SCC was indicated. The latter did not initiate during active corrosion regardless of the state of strain unless severe low temperature deformation produced a high percentage of martensite. Both elastic and plastic deformation increased the sensitivity to SCC when examined on the basis of percent yield strength. The corrosion potential, the critical cracking potential, and the potential at which the current changes from anodic to cathodic were essentially unaffected by deformation. Apparently the basic electrochemical parameters are independent of the bulk properties of the alloy and totally controlled by surface phenomena. DOE

N80-16145# Los Alamos Scientific Lab., N. Mex.
IRRADIATION DAMAGE IN METALS PRODUCED BY 800-MeV PROTONS
R. D. Brown, W. F. Sommer, and W. V. Green Jul. 1979 14 p
(Contract W-7405-eng-36)
(LA-7939-MS) Avail: NTIS HC A02/MF A01

To allow irradiation of samples on a routine basis, a proton irradiation port (PIP) was constructed in beam line A at LAMPF. This port allowed a high damage-rate irradiation of metal foils several mils thick. Irradiations were completed on foils of aluminum, niobium, molybdenum, and vanadium to damage levels between 0.05 dpa and several dpa, the damage occurring at homologous temperatures above 0.5 T/sub m/. Disks were punched from the irradiated foils and thinned for TEM examination. No voids were observed in irradiated aluminum samples. Molybdenum samples showed a low density of cavities which were believed to be gas filled at these high temperatures. Vanadium samples showed a high density of irradiation-produced defects resulting from irradiation-injected impurities. Such defects have been reported previously in ion-irradiated vanadium. The nature of the damage produced is compared to that found at lower temperatures following neutron or ion bombardment. DOE

N80-16146# Argonne National Lab., Ill.
BIAXIAL CREEP-FATIGUE BEHAVIOR OF TYPE 316H STAINLESS STEEL TUBE
S. Majumdar Apr. 1979 31 p refs
(Contract W-31-109-eng-48)
(ANL-79-33) Avail: NTIS HC A03/MF A01

Biaxial creep-fatigue test data for Type 316 stainless steel tubes at 1100 F for use in high-temperature components in solar central receivers are presented. The specimens were subjected to constant internal pressure and fluctuating axial strain with and without hold times in tension as well as compression. The results show that internal pressure significantly affects diametral ratchetting and axial stress range. Axial tensile hold is found to be more damaging than axial compressive hold even under a biaxial state of stress. DOE

N80-16147# Argonne National Lab., Ill.
DEFORMATION HARDENING OF TYPE 304 STAINLESS STEEL AT ELEVATED TEMPERATURE
A. P. L. Turner 1979 9 p refs Presented at 5th Intern. Conf. on the Strength of Metals and Alloys, Aachen, West Germany, Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790801-4) Avail: NTIS HC A02/MF A01

Samples of Type 304 stainless steel were hardened by various deformation paths. The mechanical behavior of these predeformed samples was characterized by their behavior in tensile tests. Dislocation structure was examined by microscope. Behavior during the prior deformation hardening path was analyzed for indications that the state of the material was changing. Results supported the conclusion that more than one state parameter is required to characterize the material. DOE

N80-16148# Oak Ridge National Lab., Tenn.
DISLOCATION MODEL FOR TWINNING AND FRACTURE AND ITS APPLICATION TO HCP METALS
M. H. Yoo 1979 6 p refs Presented at 5th Intern. Conf. on the Strength of Metals and Alloys, Aachen, Aug. 1979
(Contract W-7405-eng-26)
(CONF-790801-3) Avail: NTIS HC A02/MF A01

A dislocation model for deformation twinning and cleavage fracture was developed based on the dislocation theory of fracture and the anisotropic elasticity theory of dislocations. The extension of a Mode-I crack and a deformation twin was treated in a unified manner in terms of the surface energy, the twin boundary energy, and the applied stress state. A criterion was established for predicting twin nucleation or crack initiation and was applied to sixteen hexagonal metals. DOE

N80-16149# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
LOCALIZED CORROSION AND STRESS CORROSION CRACKING BEHAVIOR OF AUSTENITIC STAINLESS STEEL WELDMENTS CONTAINING RETAINED FERRITE Annual Progress Report, 1 Jun. 1978 - 31 Mar. 1979
W. F. Savage and D. J. Duquette Mar. 1979 9 p refs
(Contract EY-76-C-02-2462)
(COO-2462-5) Avail: NTIS HC A02/MF A01

The results of the pitting experiments performed on the austenitic stainless steel weldments show that the pressure of delta ferrite decreases localized corrosion resistance with pits initiating preferentially at delta ferrite-gamma austenite interphase boundaries. This increased susceptibility is reversible with elevated temperature heat treatments which revert the metastable ferrite phase to the equilibrium austenite phase. DOE

N80-16150# Knolls Atomic Power Lab., Schenectady, N. Y.
LONG-LIFE FATIGUE TEST RESULTS FOR TWO NICKEL-BASE STRUCTURAL ALLOYS
D. F. Mowbray, E. V. Giaquinto, and F. J. Mehringer Nov. 1978 31 p refs Presented at the Am. Soc. of Mech. Engr.-Mater. Eng. Conf., Washington, D.C., 8 May 1979
(Contract EY-76-C-12-0052)
(KAPL-4105; CONF-790575-1) Avail: NTIS HC A03/MF A01

The results are reported of fatigue tests on two nickel-base alloys, hot-cold-worked and stress-relieved nickel-chrome-iron Alloy 600 and mill-annealed nickel-chrome-moly-iron Alloy 625 in which S-N data were obtained in the life range of 10 to the sixth power to - 10 to the tenth power cycles. The tests were conducted in air at 600 F, in thd reversed membrane loading mode, at a frequency of approximately 1850 Hz. An electromagnetic, closed loop servo-controlled machine, built to perform the tests, is described. DOE

N80-16151# Hanford Engineering Development Lab., Richland, Wash.
EFFECT OF HEAT TREATMENT ON THE ELEVATED TEMPERATURE TENSILE AND FRACTURE TOUGHNESS RESPONSE OF ALLOY 718
W. J. Mills Jun. 1979 55 p refs
(Contract EY-76-C-14-2170)
(HEDL-TME-78-98) Avail: NTIS HC A04/MF A01

The tensile and J/sub Ic/ fracture toughness behavior of Alloy 718 was characterized at room temperature, 427 C (800 F) and 538 C (1000 F). Two different heat treatments were used: the conventional (ASTM A637) treatment, and a modified heat treatment designed to improve the toughness of Alloy 718 base metal and weldments. The strength of the conventionally heat treated Alloy 718 was found to be slightly greater than that of the modified Alloy 718. The elastic-plastic J/sub Ic/ fracture toughness response of the modified Alloy 718 was found to be superior to the J/sub Ic/ behavior exhibited by the conventional material over the entire test temperature range. Metallographic and fractographic examinations of Alloy 718 fracture surfaces revealed that this increase in fracture resistance was related to the dissolution of Widmanstaetten precipitates during the high temperature solution anneal employed in the modified treatment. DOE

N80-16152# Metal Properties Council, Inc., New York.
DEVELOPMENT OF A STANDARD METHODOLOGY FOR THE CORRELATION AND EXTRAPOLATION OF ELEVATED TEMPERATURE CREEP AND RUPTURE DATA. VOLUME 2: A STATE-OF-THE-ART REVIEW Final Report
R. M. Goldhoff Apr. 1979 381 p refs Sponsored by Elec. Power Res. Inst.
(EPRI Proj. 638-1)

(EPRI-FP-1062-Vol-2) Avail: NTIS HC A17/MF A01

Contents: (1) The evaluation of elevated temperature creep and rupture strength data: an historical perspective; (2) pre-analysis assessment of creep-rupture data; (3) a comprehensive method of rupture data analysis with simplified models; (4) status of the minimum-commitment method for creep-rupture applications; and (5) regression analysis of creep-rupture data-a practical approach. A.R.H.

N80-16153# Manlabs, Inc., Cambridge, Mass.

ILLUSTRATION OF TERNARY DIAGRAM SYNTHESIS-Mn-Ti-Fe AND Al-Ti-Fe

Larry Kaufman and D. Dew-Hughes 1979 27 p refs Presented at the Symp. on Calculation of Phase Diagrams and Thermocham., Milwaukee, 17 Sep. 1979 Prepared jointly with Brookhaven Natl. Lab., Upton, N.Y.

(Contract EY-76-C-02-0016)

(BNL-26392; CONF-790910-1) Avail: NTIS HC A03/MF A01

Alloys based on the CsCl compound phase TiFe exhibit unusual hydrogen storage capacity. Improvements of these properties were pursued by alloying in which the CsCl structure is retained. The conditions under which that can be accomplished can only be predicted if the ternary phase diagram X-Ti-Fe is known. The present paper illustrates iterative computation of the Al-Ti-Fe and Mn-Ti-Fe ternary systems synthesized from the component edge binaries which were previously characterized by the CALPHAD group. The first computations were checked experimentally and it was found that the Mn-Ti-Fe exhibited good predictability while Al-Ti-Fe did not. Thus a second computation of Al-Ti-Fe was carried out. The initial success of the Mn-Ti-Fe computation and failure of the Al-Ti-Fe calculation depended upon prediction of the trajectory of stable propagation of the TiFe-CsCl phase into the TiFe-X ternary system. DOE

N80-16154# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.

EROSION-CORROSION

B. Vyas 1978 81 p refs

(Contract EY-76-C-02-0016)

(BNL-24884) Avail: NTIS HC A05/MF A01

Various interactions between the chemical and mechanical agents leading to accelerated degradation of materials are presented in order to arrive at a better understanding of the process involved in the accelerated rate of material loss under erosion-corrosion conditions. DOE

N80-16155# Rockwell International Corp., Golden, Colo. Rocky Flats Plant.

EVALUATION OF METHODS FOR CLEANING LOW CARBON URANIUM METAL AND ALLOY SAMPLES

K. Kirchner and M. Dixon 5 Jul. 1979 5 p refs

(Contract EY-76-C-04-3533)

(RFP-2793) Avail: NTIS HC A02/MF A01

Several methods for cleaning uranium samples prior to carbon analysis, using a carbon analyzer, were evaluated. Use of a concentrated aqueous detergent followed by water and acetone rinse was found to be the best overall technique. DOE

N80-16156# Hanford Engineering Development Lab., Richland, Wash.

INFLUENCE OF HEAT TREATMENT ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF ALLOY 718 BASE METAL AND WELDMENTS

W. J. Mills Jun. 1979 121 p refs

(Contract EY-76-C-14-2170)

(HEDL-TME-78-54) Avail: NTIS HC A06/MF A01

Light microscopy, thin foil, and surface replica electron microscopy revealed that the microstructure of this superalloy was sensitive to heat treatment and heat-to-heat variations. Use of a modified aging treatment resulted in a larger grain size and a more homogeneous microstructure than the conventional treatments. The morphology of the primary strengthening gamma phase was found to be finer and more closely spaced in the conventionally treated condition. Room and elevated temperature tensile testing revealed that the strength of the conventionally treated alloy was generally superior to that of the modified material. The modified aging treatment reduced the amount of Laves phase present in the weld zone. Room and elevated temperature tensile properties of the precipitation hardened weldments were relatively insensitive to heat treatment, suggesting that reduction in Laves phase from the weld zone had essentially no effect on tensile properties. As-welded GTA weldments exhibited lower strength levels and higher ductility values than heat-treated welds. DOE

N80-16157# California Univ., Berkeley. Lawrence Berkeley Lab.

COMPUTER SIMULATION OF THE MARTENSITE TRANSFORMATION IN A MODEL TWO-DIMENSIONAL BODY

S. Chen, A. G. Khachaturyan, and J. W. Morris, Jr. May 1979 7 p refs Presented at Intern. Conf. on Martensitic Transformation, Boston, 24 Jun. 1979

(Contract W-7405-eng-48)

(LBL-9346; CONF-7906103-1) Avail: NTIS HC A02/MF A01

An analytical model of a martensitic transformation in an idealized body is constructed and used to carry out a computer simulation of the transformation in a pseudo-two-dimensional crystal. The reaction is assumed to proceed through the sequential transformation of elementary volumes (elementary martensitic particles, EMP) via the Bain strain. The elastic interaction between these volumes is computed and the transformation path chosen so as to minimize the total free energy. The model transformation shows interesting qualitative correspondencies with the known features of martensitic transformations in typical solids. DOE

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-16158* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CRYSTALLINE POLYIMIDES Patent

Terry L. St.Clair and Anne K. St.Clair, inventors (to NASA) Issued 25 Dec. 1979 4 p Filed 15 May 1978 Supersedes N78-24360 (16 - 15, p 1975)

(NASA-Case-LAR-12099-1; US-Patent-4,180,648; US-Patent-Appl-SN-906299; US-Patent-Class-528-207; US-Patent-Class-528-208) Avail: US Patent and Trademark Office CSCL 07C

Aromatic crystalline polyimides are disclosed that are synthesized from polyamide-acid and when heated to 200 C to 300 C become cyclized to afford an opaque polymer. X-ray diffraction of the unoriented film exhibited 47 percent crystallinity. Differential scanning calorimetry reveals a melt at 425 C with no glass transition in these crystalline polyimides.

Official Gazette of the U.S. Patent and Trademark Office

N80-16159 American Univ., Washington, D. C.

A STUDY OF THE PHOTODEGRADATION OF POLY (METHYL METHACRYLATE) Ph.D. Thesis

Mohamed Abouelezz 1979 105 p

Avail: Univ. Microfilms Order No. 8000749

A study was performed in order to examine the effects on the polymer of radiation from the ultraviolet, the visible, and the infrared regions of the spectrum and to identify the mechanism(s) of degradation induced by the radiation. It was concluded that a different or more complex mechanism is operative in the photodegradation of poly (methyl methacrylate) at increasing wavelengths of incident radiation than that proposed for irradiation with a 253.7 nm source. A combination of mechanism (e.g., combination unzipping superimposed on random scission) is probably operating at the higher wavelengths. Dissert. Abstr.

N80-16160 Case Western Reserve Univ., Cleveland, Ohio.

TRANSPORT PROPERTIES OF CHLOROSULFONATED BLOCK COPOLYMERS Ph.D. Thesis

Hoo Young Chung 1979 170 p

Avail: Univ. Microfilms Order No. 8001453

The sorption and diffusion behavior of water and dynamic mechanical properties under various humidities were determined

using solution chlorosulfonated ABA block copolymers (A = polystyrene; B = poly(ethylene-butene-1), a specially prepared sample of poly(ethylene-butene-1) comparable to the B midblock, and their subsequently ionized forms. The extent of chlorosulfonation, analyzed by X-ray fluorescence, ranged from zero to eight percent sulfur. The results are interpreted in terms of a model involving formation of dipole-dipole aggregates within the non polar hydrocarbon matrix. The formation of glassy polystyrene domains, which competes with polar aggregates, was found to have a profound effect on water sorption as well as dynamic mechanical properties. Dissert. Abstr.

N80-16161 American Univ., Washington, D. C.
AN OPTICAL INVESTIGATION OF THE CORRELATION BETWEEN MASS TRANSPORT AND MECHANICAL PROPERTIES OF STRAINED POLYMER FILMS Ph.D. Thesis
Joseph Cornelius Phillips 1979 165 p
Avail: Univ. Microfilms Order No. 8000762

The transport and mechanical relaxation behavior of low density polyethylene and polyvinylidene fluoride (PVF2) in ethyl acetate vapor were extensively investigated at 30 C for a range of strain levels and vapor pressures. Polyethylene in ethyl acetate vapor was found to exhibit conventional diffusion while PVF2 above its glass transition temperat rre of -38 C was found to exhibit Type II diffusion above a transition pressure, p, and conventional diffusion below p. These results tend to show that morphology, elastic and plastic deformations, and mechanical relaxation influence both conventional and nonconventional transport properties and that Type II diffusion may occur for polymer/vapor systems above the glass transition temperature. Dissert. Abstr.

N80-16162 Detroit Univ., Mich.
THERMAL STABILITY OF ISOCYANATE BASED POLYMERS Ph.D. Thesis
Panagiotis I. Kordomenos 1978 226 p
Avail: Univ. Microfilms Order No. 7922254

The thermal behavior of model compounds, as well as model polymers were examined. The kinetics of the initial stage of the decomposition of the model compounds (cleavage of urethane group, oxazolidone and isocyanurate rings) was measured by using an IR-ampoule technique that was developed for this purpose. The decomposition products of model oxazolidone and model isocyanurate compounds were analyzed. The thermal degradation of the model polymers was investigated by means of dynamic and isothermal TGA. It was found that comparative studies of the kinetics of decomposition of model compounds (where the kinetics of the selective cleavage of key groups is monitored) with the isothermal TGA measurements of the model polymer represent a new methodology suitable for the estimation of the thermal limits (weakest points) of the complex polymer molecules. Dissert. Abstr.

N80-16163*# National Aeronautics and Space Administration. Pasadena Office, Calif.
STRONG THIN MEMBRANE STRUCTURE Patent Application
Robert E. Frazer, inventor (to NASA) (JPL) Filed 21 Dec. 1979 24 p
(Contract NAS7-100)
(NASA-Case-NPO-14021-2; US-Patent-Appl-SN-106188) Avail: NTIS HC A02/MF A01 CSCL 11D

A continuous process is described for producing strong lightweight structures for use as solar sails for spacecraft propulsion by radiation pressure. A thin reflective coating, such as aluminum, is applied to a rotating cylinder. A nylon mesh, applied over the aluminum coating, is then coated with a polymerizing material such as a para-xylylene monomer gas to polymerize as a film bound to the mesh and the aluminum. An emissivity increasing material such as chromium or silicon monoxide is applied to the polymer film to disperse such material colloidally into the growing polymer film, or to the final polymer film. The resulting membrane structure is then removed from the cylinder. Alternately, the membrane structure can be formed by etching a substrate in the form of an organic film such as a polymide, or a metal foil, to remove material from the substrate and reduce its thickness. A thin reflective coating (aluminum) is applied on one side of the substrate, and an emissivity increasing coating is applied on the reverse side of the substrate. NASA

N80-16164*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ALUMINUM ION-CONTAINING POLYIMIDE ADHESIVES Patent Application
Anne K. St.Clair (Old Dominion Univ., Norfolk, Va.), Terry L. St.Clair (Old Dominion Univ., Norfolk, Va.), and Larry T. Taylor, inventors (to NASA) (Old Dominion Univ., Norfolk, Va.) Filed 7 Nov. 1979 14 p Sponsored by NASA
(NASA-Case-LAR-12640-1; US-Patent-Appl-SN-092142) Avail: NTIS HC A02/MF A01 CSCL 11I

A method is described for preparing an aluminum ion-filled polyimide adhesive. A meta-oriented aromatic diamine is reacted with an aromatic dianhydride and an aluminum compound in the presence of a water or lower alkanol miscible ether solvent to produce an intermediate polyamic acid. The polyamic acid is converted to the thermally stable, metal ion-filled polyimide by heating in the temperature range of 300 C to produce a flexible, high temperature adhesive. NASA

N80-16165*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANISMS OF LUBRICATION AND WEAR OF A BONDED SOLID LUBRICANT FILM
Robert L. Fusaro 1980 40 p refs Proposed for presentation at 35th Ann. Meeting of the Am. Soc. of Lubrication Engr., Anaheim, Calif., 5-8 May 1980
(NASA-TM-81396; E-296) Avail: NTIS HC A03/MF A01 CSCL 11H

To obtain a better understanding of how bonded solid lubricant films lubricate and wear (in general), the tribological properties of polyimide-bonded graphite fluoride films were studied (in specific). A pin-on-disk type of testing apparatus was used; but in addition to sliding a hemispherically tipped rider, a rider with a 0.95 mm diameter flat area was slid against the film. This was done so that a lower, less variable contact stress could be achieved. Two stages of lubrication occurred. In the first, the film supported the load. The lubricating mechanism consisted of the shear of a thin surface layer (of the film) between the rider and the bulk of the film. The second occurred after the bonded film had worn to the substrate, and consisted of the shear of very thin lubricant films between the rider and flat plateaus generated on the metallic substrate asperities. The film wear mechanism was strongly dependent on contact stress. M.M.M.

N80-16166*# Idaho Univ., Moscow. Dept. of Chemical Engineering.
PERFLUROETHER TRIAZINE ELASTOMERS Final Report, 1 Mar. 1979 - 29 Feb. 1980
Roger A. Korus 1980 25 p refs
(Grant NsG-2367)
(NASA-CR-162748) Avail: NTIS HC A02/MF A01 CSCL 06C

In order to obtain high performance elastomers with the high thermal stability and chemical inertness of perfluoroalkylene triazine and a low glass transition temperature, perfluoroether triazine elastomers were synthesized. The procedure for elastomer synthesis is described as well as general experimental methods. Results are presented and discussed. The screening of catalysts for the dehydration of perfluoroether diamide is also considered. A.R.H.

N80-16167# Firestone Tire and Rubber Co., Akron, Ohio. Central Research Labs.
PHOSPHONITRILIC FLUOROELASTOMER COATED FABRICS FOR COLLAPSIBLE FUEL STORAGE TANKS Final Report, 1 Feb. 1978 - 30 Mar. 1979
Richard W. Sicka and George B. Mitchell Jul. 1979 78 p refs
(Contract DAAG46-78-C-0006; DA Proj. 1L1-63102-D-071)
(AD-A074824; AMMRC-TR-79-44) Avail: NTIS HC A04/MF A01 CSCL 13/4

This report describes the preparation of fuel resistant coated fabric materials that are serviceable at temperatures as low as -70 F. The coated fabric materials were made from a phosphonitrilic fluoroelastomer compound coated on nylon fabric. Efforts

were directed toward attainment of calenderable compounds and test evaluations of the coated fabric. High filler loaded materials proved to be better processable materials. These showed good diffusion rates with test fluids (TT-S-735, Type II and Fuel S). Even better diffusion rates were seen with Arctic diesel fuel. The low temperature flexibility of the vulcanizates and coated fabric was promising for PNF-200 compounds. The seam adhesion strength and the fabric-to-rubber adhesion need to be improved before utilization of this material in tank constructions. GRA

N80-16168# Stanford Univ., Calif. Div. of Applied Mechanics.
ON HARMONIC MOTION OF SANDWICH PLATES Interim Report
G. Herrmann and G. S. Beaupre Jun. 1979 21 p refs
(Contract N00014-76-C-0054)
(AD-A074637; SUDAM-79-2) Avail: NTIS HC A02/MF A01 CSCL 13/11

Horizontally polarized shear motion in symmetric sandwich plates is considered. It is shown that certain Floquet-type solutions describing such motion in an infinite, periodically layered, elastic composite describe the same motion. GRA

N80-16169# Bendix Corp., Kansas City, Kans. Communications Services.
TESTING THE INTERLAMINATE ADHESION OF MULTI-LAYER PRINTED WIRING BOARDS
J. W. Lula Sep. 1978 15 p ref
(Contract EY-76-C-04-0613)
(BDX-613-2011) Avail: NTIS HC A02/MF A01

Thermochemical analysis (TMA) was used to evaluate lamination cure cycles, inner layer surface preparation, prepreg conditioning techniques, and other process variables affecting the interlaminate adhesion of multilayer printed wiring boards. Because of its simplicity, TMA was also used as a production quality control test. DOE

N80-16170# Bendix Corp., Kansas City, Kans. Communication Services.
POLYURETHANE FOAM, 0.05 g/cm3 DENSITY Final Report
J. R. Fender Oct. 1978 17 p refs
(Contract EY-76-C-04-0613)
(BDX-613-1964-Rev) Avail: NTIS HC A02/MF A01

A process developed to meter and mix Rigifoam 6003-2 material on an automatic mixing machine gave a substantially improved yield over the batch-mixing process used in initial development work. It was shown that this process meets the necessary requirements for a high production yield. Previous evaluation of the Bendix Rigifoam 6003-2 foam system is discussed, as well as continued dimensional studies, long-term aging of material, and machine metering and mixing. DOE

N80-16171# California Univ., Livermore. Lawrence Livermore Lab.
CHARACTERIZATION OF HALTHANE POLYURETHANE ADHESIVES. 1: DYNAMIC MECHANICAL AND THERMAL PROPERTIES
D. Mark Hoffman Jun. 1979 26 p refs Presented at DOE Weapons Complex Ann. Adhesives Conf., Amarillo, Tex., 5 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82694; CONF-790668-2) Avail: NTIS HC A03/MF A01

The polyurethanes presented contain polyether-isocyanate soft segments that exhibit a low temperature secondary relaxation at 150 C. The lower molecular weight polyether isocyanate soft segments of 73 series adhesives have higher glass transition temperatures (-50 C) than the higher molecular weight polyether-isocyanate soft segments of 87 and 88 series adhesives (-70 C). The 73 series polyurethanes also show a weak peak in the loss modulus at about 100 C. The relaxation strength of the soft segment glass transition depends on the molecular structure of the hard segments. Chemically different hard segments produce adhesives with different shear storage modulus over the temperature range (5 x 10 to the 8th power Pa for 88 and 87 series adhesives and about 1 x 10 to the 6th power Pa for 73 series adhesives). DOE

N80-16172# Case Western Reserve Univ., Cleveland, Ohio.
POLYMER MATERIALS BASIC RESEARCH NEEDS FOR ENERGY APPLICATIONS. PROCEEDINGS OF A WORKSHOP RECOMMENDING FUTURE DIRECTIONS IN ENERGY-RELATED POLYMER RESEARCH
W. J. Macknight, E. Baer, and R. D. Nelson Aug. 1979 205 p refs Workshop held at Cleveland, 27-29 Jun. 1978 Sponsored by DOE and Massachusetts Univ.
(CONF-780643) Avail: NTIS HC A10/MF A01

The larger field covered in the workshop consists of (1) synthesis and characterization, (2) physical chemistry, (3) physics, and (4) engineering. The basic research needs in polymer materials related to energy are reported. The development of sophisticated instrumentation makes the task of molecular characterization possible on a level hitherto unattainable. Many of these instruments because of their size and complexity must of necessity be located at the DOE National Laboratories. The importance of personnel trained in the polymer field located at these facilities is emphasized. In the past there has been relatively little concerted polymer research within the energy community. This report attempts to describe the present situation and point out some needs and future research directions. DOE

N80-16173# California Univ., Berkeley. Lawrence Berkeley Lab.
LIGHT SCATTERING STUDIES OF SOLIDS AND ATOMIC VAPORS Ph.D. Thesis
T. C. Chiang Sep. 1978 132 p refs
(Contract W-7405-eng-48)
(LBL-8222) Avail: NTIS HC A07/MF A01

Topics covered include: (1) multi-phonon resonant Raman scattering up to four phonons in GaSe and one- and two-phonon resonant Raman scattering in the mixed GaS/sub x/Se/sub 1-x/ crystals with x < or = 0.23; (2) one-phonon resonant Raman scattering in HfS2; (3) excitonic transition in antiferromagnetic MnF2; (4) two-magnon resonant Raman scattering in MnF2 around the magnon sideband; (5) a theory of exciton-exciton interaction in MnF2; (6) independent elastic constants of the layered compound GaSe; and (7) two-photon parametric scattering in sodium vapor. DOE

N80-16174# Steel Structures Painting Council, Pittsburgh, Pa.
PERFORMANCE OF ALTERNATE COATINGS IN THE ENVIRONMENT (PACE) Final Report
Joseph A. Bruno, John Keane, and Raymond E. F. Weaver 30 May 1979 245 p refs Sponsored in part by DOE Pennsylvania Dept. of Transportation, Harrisburg; American Iron and Steel Inst.; Federation of Societies for Coating Technology; Steel Plate Fabricators Association; and Naval Civil Engineering Labs.
(PB-300868/7; FHWA/PA-79/05) Avail: NTIS HC A11/MF A01 CSCL 11C

Anti-corrosion coatings and methods developed to meet environmental needs were selected by a consensus committee evaluated in five environments in comparison with a range of standard materials whose long-term performance had been established. Periodic evaluations show that none of the alternative pigmentations were superior to the red lead or chromate controls in conventional oil or alkyd vehicles, although several were promising. In various vinyl vehicles, however, these alternative pigments, including some inerts, are at least equal to red lead, probably due to an encapsulating effect. GRA

N80-16221*# Cambridge Acoustical Associates, Inc., Mass.
THE EFFECTS OF FREQUENCY, AMPLITUDE, AND LOAD ON THE DYNAMIC PROPERTIES OF ELASTOMERS
John E. Cole, III *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 105-117 refs
(For primary document see N80-16211 07-31)
(Contract N00014-69-C-0056)
Avail: NTIS HC A10/MF A01 CSCL 11G

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-16175 Stanford Univ., Calif.
AUTOHYDROLYSIS FOR IMPROVING METHANE YIELD FROM FERMENTATION OF LIGNOCELLULOSE Ph.D. Thesis
William Frederick Owen 1979 209 p
Avail: Univ. Microfilms Order No. 8001985

Aqueous heat treatment without chemical addition (autohydrolysis) was investigated as a pretreatment method for physically separating lignocellulose constituents from the matrix, in order to improve bioconversion efficiency to methane in anaerobic fermentation systems. Oxidative and nonoxidative autohydrolysis treatments ranging from 150 to 250 C were evaluated for relative effect on representative complex lignocellulosics (white fir, corn stover, and bagasse) and individual components of lignocellulose (cellulose, hemicellulose, and lignin). Preliminary studies using peat and newsprint indicated that bioconversion efficiency could be improved by autohydrolysis pretreatment, but autohydrolysis decreased the bioconversion efficiency of agricultural residues which were relatively biodegradable before treatment. It is proposed that autohydrolysis treatment be limited to nonbiodegradable lignocellulosics such as woody residues or previously digested materials. Dissert. Abstr.

N80-16176 Brigham Young Univ., Provo, Utah.
THEORETICAL MODELING OF COAL AND GAS FIRED TURBULENT COMBUSTION AND GASIFICATION PROCESSES Ph.D. Thesis
Philip John Smith 1979 511 p
Avail: Univ. Microfilms Order No. 8000091

A one-dimensional computer code was developed for the analysis of pulverized coal combustors and entrained flow gasifiers. Emphasis was placed on the description of the coal reaction processes and the gas-particle interactions. An Adams-Moulton, predictor-corrector solution technique was successfully implemented in solving the differential equations involved in the system. A number of predictions have been made for different combustors and gasifiers operating under a variety of conditions. An axi-symmetric two dimensional computer code was developed for the analysis of turbulent gaseous fired diffusion flames and as a basis for coal fired systems. The combustion model uses local instantaneous complex chemical equilibrium. A probability density function approach is used to obtain mean gas phase properties. A number of predictions were made for both nonreacting and reacting flow systems. Dissert. Abstr.

N80-16177# National Academy of Sciences - National Research Council, Washington, D. C. Energy Engineering Board.
HYDROGEN AS A FUEL
1979 86 p refs
(Contract EY-76-C-02-2708)
Avail: NTIS HC A05/MF A01

A panel of the Committee on Advanced Energy Storage Systems of the Assembly of Engineering examined the status and problems of hydrogen manufacturing methods, hydrogen transmission and distribution networks, and hydrogen storage systems. Suitable criteria for establishing the pace, timing, and technical content of appropriate federally sponsored hydrogen R&D programs was considered. It was concluded the increasing urgency to develop new sources and forms of fuel and energy may well impact on the scale and timing of potential future hydrogen uses. M.M.M.

N80-16178# California Univ., Berkeley. Lawrence Berkeley Lab.
AGGREGATED VECTORIAL MODEL OF PETROLEUM FLOW IN THE UNITED STATES
V. V. Krishnan and D. F. Cahn Mar. 1979 90 p refs
(Contract W-7405-eng-48)
(LBL-8874) Avail: NTIS HC A05/MF A01

An aggregated material-flow model is proposed for crude oil and its derivative products. Stages in petroleum flow where material conservation is expected are isolated from those where volumetric or identity changes can occur, and generic properties of petroleum and petroleum products that would assist in effective data validation are identified. The model provides a structural framework for organization and consolidation of the various data bases related to petroleum, and serves as a guide for analysis and enumeration of explicit semantic data interrelationships. The model is amenable to expansion into both transactional and more disaggregated representations. The material-flow model is intended as a preliminary step toward a coherent and comprehensive data structure to support monitoring, forecasting, and regulatory efforts in the energy field. The model is developed in the abstract; no attempt is made to test it using explicit data. DOE

N80-16179# Brookhaven National Lab., Upton, N. Y.
PRELIMINARY ASSESSMENT OF THE PROSPECTS FOR USE OF REFUSE-DERIVED FUEL IN MARYLAND
W. C. Metz and J. Shyer Feb. 1979 82 p refs
(Contract EY-76-C-02-0016)
(BNL-51065) Avail: NTIS HC A05/MF A01

The deployment problems of refuse derived fuel (RDF) production in Maryland are examined. Problems experienced by the pyrolysis plant in Baltimore City and the resource recovery plant in Baltimore County are cited. Maryland's municipal solid waste problems are discussed with emphasis on the major components of the municipal solid waste stream, e.g., volume, composition, and location; collection methods used; present and long-range disposal methods; and regulations and ordinances. The generic social and legal constraints to RDF production are described. The problems of RDF technology deployment in Maryland, i.e., county and state RDF energy potential, institutional barriers to RDF production and use, remitting requirements for new RDF production and use facilities, water quality issues of RDF production and use, air quality issues of RDF production and use, and recommendations for initiating RDF production and use are discussed. DOE

N80-16180# California Univ., Livermore. Lawrence Livermore Lab.
CHEMICAL KINETICS IN LNG DETONATIONS
C. K. Westbrook and L. C. Haselman 14 Sep. 1979 27 p refs Presented at 7th Intern. Colloq. on Gas-Dynamics of Explosions and Reactive Systems, Gottingen, West Germany, 20 Aug. 1979 Revised
(Contract W-7405-eng-48)
(UCRL-82293-Rev-1; CONF-790828-1-Rev-1) Avail: NTIS HC A03/MF A01

The problem of detonability of vaporized mixtures of liquified natural gas and air is addressed, using a characteristic time analysis. Separate numerical models are used to treat the evolution of the blast wave produced by a charge of high explosive and the chemical ignition delay of the fuel-air mixture. These models are combined with experimental data to predict the amount of high explosive required to initiate a detonation of a stoichiometric mixture of methane and air, giving an estimate of 50 to 100 kg of high explosive in spherical geometry. The effects of minor constituents such as ethane and propane on methane-air detonability are examined, and the mechanism by which these minor constituents kinetically sensitize the fuel is discussed. DOE

N80-16181# Department of Energy, Morgantown, W. Va. Energy Technology Center.
UNCONVENTIONAL GAS RECOVERY PROGRAM Semiannual Report, 31 Mar. 1979
R. L. Wise, ed. Aug. 1979 375 p
(METC/SP-79/8) Avail: NTIS HC A16/MF A01

Progress of projects directed at gas recovery from unconventional sources is reported. Methane recovery from coalbeds, eastern gas shales, western gas sand, and geopressured aquifers are among the topics covered. DOE

N80-16182# Badger Plants, Inc., Cambridge, Mass.
CONCEPTUAL DESIGN OF A COAL-TO-METHANOL-TO-GASOLINE COMMERCIAL PLANT: EXECUTIVE SUMMARY Interim Final Report, 31 Aug. 1977 - 31 Mar. 1979
Mar. 1979 53 p

(Contract EX-76-C-02-2416)
(FE-2416-43; IFR-2) Avail: NTIS HC A04/MF A01

An engineering and economic assessment of a conceptual design for a commercial facility to convert coal-to-methanol-to-gasoline is presented. This design is conceptual and, therefore, is considered to be a prediction of the development of the technology in question and thus appropriate for comparative economic evaluation purposes. DOE

N80-16183# Department of Energy, Washington, D. C. Div. of Coal Conversion.
COAL LIQUEFACTION Quarterly Report, Jul. - Sep. 1978
May 1979 65 p
(Contract EX-76-C-01-2297)
(DOE/ET-0068/3) Avail: NTIS HC A04/MF A01

Several conversion processes that are currently in the pilot plant stage are described briefly and information is given as to contractor, contract, funding, site, and current progress. Several support projects are also described. DOE

N80-16184# Department of Energy, Washington, D. C. Div. of Coal Conversion.
COAL GASIFICATION Quarterly Report, Jul. - Sep. 1978
May 1979 77 p
(Contract EY-76-C-01-2297)
(DOE/ET-0067/3) Avail: NTIS HC A05/MF A01

A number of processes for making high Btu gas and for making low Btu gas are described with the contractor identification, contract, site, funding, and current progress. Projects on mathematical modeling and preparation of a coal conversion systems technical data book are also described. DOE

N80-16185# Brookhaven National Lab., Upton, N. Y.
FLASH HYDROPYROLYSIS OF COAL Progress Report, 1 Jul. - 31 Dec. 1978
M. Steinberg and P. Fallon Feb. 1979 156 p
(Contract EY-76-C-02-0016)
(BNL-51010; PR-7) Avail: NTIS HC A08/MF A01

The data generated by the parametric study of lignite was correlated and activation energies for a first approximation of the reaction scheme are presented. These range from 88 Kcal/mol for the formation of ethane and 62 Kcal/mol for the formation of benzene to 29 Kcal/mol for the formation of methane, all from the feed coal. The mechanism appears to be largely chemical reaction rate controlled as opposed to diffusion controlled. DOE

N80-16186# Los Alamos Scientific Lab., N. Mex.
ASSESSMENT OF ENVIRONMENTAL AND SAFETY PROBLEMS IN HYDROGEN ENERGY SYSTEMS
F. J. Edeskuty, J. R. Bartlit, and R. V. Carlson 1979 5 p refs
Presented at the Intern. Congress on Refrigeration, Venice, 23 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-583; CONF-790901-3) Avail: NTIS HC A02/MF A01

Safety problems associated with the use of hydrogen as a portable or transportable fuel are discussed along with mechanisms to ensure the proper design of equipment and techniques for its storage, shipment, and use. The most likely methods of shipment are gas transmission by pipeline and bulk transportation of hydrogen as a cryogenic liquid. While these are well developed, safety and technological problems still exist and include such issues as dispersion of hydrogen releases, behavior of hydrogen on combustion, and hydrogen embrittlement. Safe transportation and handling of hydrogen can be enhanced by uniformity of codes and regulations. Hydrogen use as a fuel is not totally benign from an environmental standpoint; however, the combination of production and end use is generally more acceptable for hydrogen than for alternative fuels. DOE

N80-16187# Gruy Federal, Inc., Arlington, Va.
OIL AND GAS REPLACEMENT COST: DEVELOPMENT AND PRODUCTION. VOLUME 1: DISCUSSION OF METHODOLOGY, EXHIBITS, AND PROJECTIONS Final Report
5 Aug. 1977 112 p Sponsored by DOE
(DOE/TIC-10078) Avail: NTIS HC A06/MF A01

Oil and Gas Development and production costs are projected by region and depth interval for the benchmark years 1980, 1985 and 1990. Twenty-four geographical regions were specified and six depth classes defined under historical development costs. Direct operating costs are also covered. DOE

N80-16188# Los Alamos Scientific Lab., N. Mex.
ESTIMATION OF THE DENSITY OF ORGANIC EXPLOSIVES FROM THEIR STRUCTURAL FORMULAS
H. H. Cady Aug. 1979 23 p refs
(Contract W-7405-eng-36)
(LA-7760-MS) Avail: NTIS HC A02/MF A01

A technique for predicting the density of an organic (C-H-N-O-Cl-F) compound given its proposed structural formula is presented. DOE

N80-16189# Gorham International, Inc., Maine.
ASSESSMENT OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF CONVERTING WOOD RESIDUES TO LIQUID AND GASEOUS FUEL PRODUCTS USING STATE-OF-THE-ART AND ADVANCED COAL CONVERSION TECHNOLOGY Quarterly Report, 1 Dec. 1978 - 28 Feb. 1979
May 1979 15 p refs
(Contract ET-78-C-02-4862)
(COO-4862-3; QR-3) Avail: NTIS HC A02/MF A01

The approach to be used in evaluating coal gasification technologies for gasification of wood is outlined. The coal gasification technologies to be evaluated and their status are tabulated. The parameters critical to the development of wood gasification (technical risk, economics, institutional factors, and environmental impacts) are briefly discussed. DOE

N80-16190# Mobil Research and Development Corp., Paulsboro, N. J.
DEVELOPMENT STUDIES ON SELECTED CONVERSION OF SYNTHESIS GAS FROM COAL TO HIGH OCTANE GASOLINE Final Report
J. A. Brennan Oct. 1978 383 p refs
(Contract EX-76-C-01-2276)
(FE-2276-27) Avail: NTIS HC A17/MF A01

An exploratory, experimental process study was conducted on the direct conversion of coal derived synthesis gas to gasoline. Novel, proprietary catalysts were used; (these unique catalysts do not yield oxygenates and the hydrocarbons formed are limited in size to about C sub 11.) This new technology was compared with conventional Fischer-Tropsch. The experiments were conducted in micro reactor (10 cc catalyst capacity) and in bench-scale units (150 cc catalyst capacity). The bench-scale unit was used in both a fixed and fluid bed mode. The studies included effects of temperature, pressure and space velocity on catalyst performance, and catalyst activation, aging and regeneration. DOE

N80-16191# Los Alamos Scientific Lab., N. Mex.
FIBER-REINFORCED PLASTIC-BONDED EXPLOSIVES
A. P. Torres and A. S. Vigil Oct. 1978 42 p refs
(Contract W-7405-eng-36)
(LA-7522-MS) Avail: NTIS HC A03/MF A01

Fiber reinforcement in plastic-bonded explosives was studied to determine the ability of fiber reinforcement to reduce munition main charge cracking under a severe thermal cycle. Two fiber reinforced plastic-bonded explosives, X-0308 (95 wt% RDX, 4.5 wt% Estane, 0.5 wt% polyethylene fibers) and X-0312 (95 wt% RDX, 3.5 wt% Estane, 1.5 wt% polyethylene fibers), were evaluated and compared against their nonfiber-reinforced homolog, X-0280 (95 wt% RDX, 5 wt% Estane). A thermal stress analysis was performed using TSAAS, a two-dimensional, finite element thermal and stress analysis code. Predictions corresponded closely with experimental results. The study demonstrated that fiber incorporation above 0.5 wt% did not improve resistance to cracking. DOE

N80-16192# Battelle Columbus Labs., Ohio.
PROCEEDINGS: SYMPOSIUM ON COAL CLEANING TO ACHIEVE ENERGY AND ENVIRONMENTAL GOALS HELD AT HOLLYWOOD, FLORIDA ON SEPTEMBER 1978, VOLUME 1 Final Report, Apr. 1977 - Mar. 1979
S. E. Rogers, ed. and A. W. Lemmon, Jr., ed. Apr. 1979 647 p refs

(Contract EPA-68-02-2163)
(PB-299383/0; EPA-600/7-79-098A) Avail: NTIS
HC A99/MF A01 CSCL 07A

The physical and chemical coal cleaning programs of EPA, DOE, the Electric Power Research Institute, and numerous industrial organizations; European and Soviet plans for the future; and problems of ongoing operations are discussed. Topics are presented: coal characteristics, coal cleaning overview, and physical coal cleaning technology. GRA

N80-16193# Battelle Columbus Labs., Ohio.
PROCEEDINGS: SYMPOSIUM ON COAL CLEANING TO ACHIEVE ENERGY AND ENVIRONMENTAL GOALS HELD AT HOLLYWOOD, FLORIDA ON SEPTEMBER 1978, VOLUME 2 Final Report, Apr. 1977 - Mar. 1979
S. E. Rogers and A. W. Lemmon, Jr. Apr. 1979 595 p refs
(Contract EPA-68-02-2163)
(PB-299384/8; EPA-600/7-79-098B) Avail: NTIS
HC A25/MF A01 CSCL 07A

A review and discussion is reported on: the physical and chemical coal cleaning programs of EPA, DOE, the Electric Power Research Institute, and numerous industrial organizations; European and Soviet plans for the future; and problems of ongoing operations. The following included are: environmental assessment and pollution control technology, and chemical coal cleaning technology. GRA

N80-16194# Office of Technology Assessment, Washington, D. C.
GASOHOL: A TECHNICAL MEMORANDUM
Sep. 1979 89 p refs
(PB80-105885; OTA/TM/E-1) Avail: NTIS HC A05/MF A01
CSCL 21D

The technical and non technical issues surrounding the development of gasohol are discussed including the resource base, production technologies, and economics of gasohol, and its use as a transportation fuel. The environmental problems and benefits of producing and using gasohol, and the social and institutional issues about using agricultural products for energy are covered. Policy options about gasohol as well as other bioenergy technologies such as wood and methanol production are considered. GRA

N80-16195# National Technical Information Service, Springfield, Va.
ALCOHOL FUELS. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1973 - Jul. 1979
Diane M. Cavagnaro Sep. 1979 194 p
(NTIS/PS-79/0911/2) Avail: NTIS HC $28.00/MF $28.00
CSCL 21D

Research on alcohol fuels are cited. The citations cover synthesis, chemical analysis, performance testing, processing, pollution, economics, environmental effects, and feasibility. (Contains 178 abstracts). GRA

N80-16228*# Sandia Labs., Albuquerque, N. Mex.
A COMPUTATIONAL MODEL DESCRIBING THE INITIATION OF SILVER ACETYLIDE-SILVER NITRATE EXPLOSIVE BY AN INTENSE LIGHT SOURCE
Floyd H. Mathews *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 177-191 refs
Sponsored by DOE (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 19A

N80-16229*# Sandia Labs., Albuquerque, N. Mex.
TERMINAL VELOCITY AND ROTATION RATE OF A FLYER PLATE PROPELLED BY A TUBE-CONFINED EXPLOSIVE CHARGE
R. A. Benham *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 193-201 refs
(For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 19A

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-16196 California Univ., Berkeley.
VARIABLE MODULUS MODEL FOR INELASTIC FINITE ELEMENT ANALYSIS Ph.D. Thesis
Taha Daud Al-Shawaf 1979 141 p
Avail: Univ. Microfilms Order No. 8000269

A variable modulus modeling procedure for nonlinear analysis of soils is presented. The procedure accounts for stiffening behavior under volumetric strain, strain softening behavior under distortional strain, the influence of hydrostatic stress on shear strength, and the shear dilation effect. A numerical modeling process based on piecewise linear behavior (piecewise constant moduli) is used, without the use of analytical expressions for material properties. The modulus values are determined from the results of hydrostatic and triaxial tests. The theoretical basis of the method is presented, and the procedure for calculating the tangent moduli is described. Computational techniques for the state-determination problem and the linearization phase are developed and implemented in a general purpose computer program. Dissert. Abstr.

N80-16197# Naval Construction Battalion Center, Port Hueneme, Calif. Civil Engineering Lab.
SHRINKAGE-COMPENSATING CEMENT FOR AIRPORT PAVEMENT, PHASE 2
John R. Keeton Sep. 1979 42 p refs
(Contract DOT-FA75WAI-530)
(AD-A075739; FAA-RD-79-11; TN-1561) Avail: NTIS
HC A03/MF A01 CSCL 11/2

Details of a research study on shrinkage-compensating concrete for airport pavements are presented. A total of 53 slab-type prisms 1 foot square and 8, 12, 16, or 20 inches thick were subjected to shrinkage, cooling, and heating. Concrete compressive stresses induced by expansion were calculated, as well as residual compressive stresses after losses due to shrinkage and cooling. The residual concrete compressive stresses, coupled with results from previous field applications of shrinkage-compensating concrete, are used as a basis for recommendation of transverse joint spacings up to 200 feet. Author

N80-16198*# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 1: INVITED PAPERS, VIBRATIONS AND ACOUSTICS, BLAST AND SHOCK
Sep. 1979 191 p refs Presented at the 49th Symp. on Shock and Vibration, Washington, D.C., 17-19 Oct. 1978
Sponsored by NASA, Goddard Space Flight Center 3 Vol.
(NASA-CR-162471; AD-A074699; Bull-49-Pt-1) Avail: NTIS
HC A09/MF A01 CSCL 20K

Development in the modeling and simulation of shock and vibration phenomena are considered. Predicting the noise exposure of payloads in the space shuttle, prediction for step-stress fatigue, pyrotechnique shock simulation using metal-to-metal impact, and prediction of fragment velocities and trajectories are among the topics covered. For individual titles, see N80-16199 through N80-16210.

N80-16199*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
THE DEVELOPMENT OF A METHOD FOR PREDICTING THE NOISE EXPOSURE OF PAYLOADS IN THE SPACE SHUTTLE ORBITER VEHICLE c16
John F. Wilby and Larry D. Pope *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 5-30 refs Sponsored by NASA, Washington and SAMSO (For primary document see N80-16198 07-31)
(Contracts NAS5-22832; NAS9-15231)
Avail: NTIS HC A09/MF A01 CSCL 20A

The development of an analytical model for the prediction of sound levels in the payload bay of the space shuttle orbiter vehicle is outlined. Formulation of the analytical model and its validation by means of model scale and full scale tests are included. It is shown that the approach used in the development

effort has resulted in a prediction procedure which can be expected to give reliable estimates of payload bay sound levels, even when a payload is present. Furthermore, the analytical model has the capability of being readily modified to include other excitations such as turbulent boundary layers and propeller near-field pressures, and to other aerospace vehicles. J.M.S.

N80-16200*# General Electric Co., Utica, N. Y. Aircraft Equipment Div.

PROBABILITY OF FAILURE PREDICTION FOR STEP-STRESS FATIGUE UNDER SINE OR RANDOM STRESS **c39**

Ronald G. Lambert *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 31-41 refs (For primary document see N80-16198 07-31)

Avail: NTIS HC A09/MF A01 CSCL 20L

A previously proposed cumulative fatigue damage law is extended to predict the probability of failure or fatigue life for structural materials with S-N fatigue curves represented as a scatterband of failure points. The proposed law applies to structures subjected to sinusoidal or random stresses and includes the effect of initial crack (i.e., flaw) sizes. The corrected cycle ratio damage function is shown to have physical significance. Author

N80-16201*# Martin Marietta Corp., Denver, Colo.

ON THE USE OF COHERENCE FUNCTIONS TO EVALUATE SOURCES OF DYNAMIC EXCITATION **c39**

Stanley Barrett *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 43-58 refs (For primary document see N80-16198 07-31)

(Contract NAS1-14370)

Avail: NTIS HC A09/MF A01 CSCL 20K

The use of coherence functions for identifying the relative contributions of multiple dynamic inputs to the measured vibration response of spacecraft components on a practical, complex structure was investigated. Data were generated by applying simultaneous vibratory and acoustic excitation to a test model (a modified Titan instrumentation truss). Up to three inputs were used. In some cases mutually coherent inputs were generated. A digital computer program was written to analyze the test data, using an approach based on iterative computational algorithms. The results showed that the coherence function technique was effective in identifying and evaluating sources of excitation, for both independent and coherent in futs. The effect of varying the number of data samples used in the necessary averaging process was briefly investigated. J.M.S.

N80-16202*# Rockwell International Corp., El Segundo, Calif.

STATUS OF CAVITY NOISE PHENOMENA MEASUREMENT AND SUPPRESSION ON THE B-1 AIRCRAFT **c05**

A. G. Tipton and C. H. Hodson *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt 1 Sep. 1979 p 59-66 refs (For primary document see N80-16198 07-16)

Avail: NTIS HC A09/MF A01 CSCL 20A

During the B-1 aircraft development, an extensive program of weapons bay cavity noise measurement and suppression studies was performed using wind tunnel models, flight test measurements, and aircraft design modifications. Substantial cavity noise reduction was demonstrated during flight test operations. The unsuppressed cavity noise level of 170 dB was reduced to values less than 150 dB with external retractable spoilers upstream of the cavity opening. J.M.S.

N80-16203*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE SHUTTLE SOLID ROCKET BOOSTER AFT SKIRT REENTRY NOISE INDUCED BY AN AERODYNAMIC CAVITY-FLOW INTERACTION **c16**

L. A. Schutzenhofer, P. W. Howard, W. W. Clever, and S. H. Guest *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 67-82 refs (For primary document see N80-16198 07-31)

Avail: NTIS HC A09/MF A01 CSCL 20A

High amplitude discrete frequency cavity induced noise was observed during wind tunnel testing of the reentry flight phase conditions of the solid rocket booster (SRB) of the space shuttle vehicle system. These wind tunnel tests were designed to acquire aerodynamic noise data for the development of vibroacoustic design and qualification test criteria for the SRB. The reentry trajectory characteristics of the SRB are random with the angle of attack varying from approximately 96 deg to 180 deg and with the dynamic pressure varying from approximately 360 to 1,020 lb/sq ft for a 95 percentile envelope for a Mach number of 3.5. The SRB model was a 2.8 percent scale model with all the external protuberances. It was tested with internal motor volumes of 5, 50, and 100 percent of the burnt-out SRB motor volume. Results of tests are given for two cavity volumes, i.e., 5 and 100 percent. Author

N80-16204*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SNAPS IN STRUCTURES **c39**

Michail Zak *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 83-87 refs (For primary document see N80-16198 07-31)

(Contract NAS7-100)

Avail: NTIS HC A09/MF A01 CSCL 20K

Snaps as a type of shock phenomena which arise in structures employing films, or strings are studied. The sources and the variety of such snaps are defined and a new mathematical model for their investigation is presented. Author

N80-16205*# SRI International Corp., Menlo Park, Calif.

A SIMPLIFIED METHOD OF EVALUATING THE STRESS WAVE ENVIRONMENT OF INTERNAL EQUIPMENT **c39**

J. D. Colton and T. P. Desmond *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 89-96 refs (For primary document see N80-16198 07-31)

Avail: NTIS HC A09/MF A01 CSCL 20K

A simplified method called the transfer function technique (TFT) was devised for evaluating the stress wave environment in a structure containing internal equipment. The TFT consists of following the initial in-plane stress wave that propagates through a structure subjected to a dynamic load and characterizing how the wave is altered as it is transmitted through intersections of structural members. As a basis for evaluating the TFT, impact experiments and detailed stress wave analyses were performed for structures with two or three, or more members. Transfer functions that relate the wave transmitted through an intersection to the incident wave were deduced from the predicted wave response. By sequentially applying these transfer functions to a structure with several intersections, it was found that the environment produced by the initial stress wave propagating through the structure can be approximated well. The TFT can be used as a design tool or as an analytical tool to determine whether a more detailed wave analysis is warranted. R.E.S.

N80-16206*# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.

HIGH G PYROTECHNIC SHOCK SIMULATION USING METAL-TO-METAL IMPACT **c39**

Monty Bai and Wesley Thatcher *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 97-100 (For primary document see N80-16198 07-31)

Avail: NTIS HC A09/MF A01 CSCL 20K

A technique for simulating high g level pyrotechnic shocks is described and the results of applying the technique to obtain the MIL-STD-1540A shock spectrum with a maximum acceleration of 18,000g at 2,000 Hz are presented. Designing the resonant beam and plate on which the test unit is mounted, and generating a proper impulsive load on them, were the essentials of the technique. One dimensional stress wave and Euler equations were employed in the design. A metal pendulum hammer was used to generate the impulsive load. R.E.S.

N80-16207*# Army Missile Research and Development Command, Redstone Arsenal, Ala.

AN EXPERIMENTAL DESIGN FOR TOTAL CONTAINER IMPACT RESPONSE MODELING AT EXTREME TEMPERATURES **c37**

Virginia P. Kobler, Richard M. Wyskida, and James D. Johannes *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 101-107 refs Prepared in cooperation with Alabama Univ. in Huntsville (For primary document see N80-16198 07-31)

Avail: NTIS HC A09/MF A01 CSCL 20K

An experimental design (a drop test) was developed to test the effects of confinement upon cushions. The drop test produced consistent corner void cushion data from which mathematical models were developed. A mathematical relationship between temperature and drop height was found. R.E.S.

N80-16208*# Southwest Research Inst., San Antonio, Tex.
BLAST FROM BURSTING FRANGIBLE PRESSURE SPHERES c39
E. D. Esparza and W. E. Baker. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 1, Sep. 1979, p. 127-139, refs (For primary document see N80-16198 07-31)
(Grant NsG-3008)
Avail: NTIS HC A09/MF A01 CSCL 20K

Laboratory experiments conducted to obtain incident overpressure data from frangible spheres pressurized with two different gases and a vapor are described. Glass spheres under internal pressure were purposely burst to obtain time histories of overpressure using side-on pressure transducers. A scaling law for pressure spheres bursting in free-air is derived and presented. This law is simplified and used to obtain a functional relationship for the non-dimensional blast parameters. Peak overpressure, arrival and duration times, and impulse data are presented for different initial conditions and blast source energies. These dimensionless data are also compared, wherever possible, with results of theoretical calculations and compiled data for Pentolite high-explosive. The scaled data are quite repeatable and show significant differences from blast waves generated by condensed high-explosives. R.E.S.

N80-16209*# Southwest Research Inst., San Antonio, Tex.
TEST EVALUATION OF SHOCK BUFFERING CONCEPT FOR HYDRODYNAMIC RAM INDUCED BY YAWING PROJECTILE IMPACTING A SIMULATED INTEGRAL FUEL TANK c37
Patrick H. Zabel. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 1, Sep. 1979, p. 141-170, refs (For primary document see N80-16198 07-31)
Avail: NTIS HC A09/MF A01 CSCL 20D

A concept for containing the shock inputs due to hydrodynamic ram caused by an impacting projectile within a fuel cell is discussed. This is to provide a buffering layer of foam, flexible, rigid or a combination thereof, which is sealed from the liquid. A program is described in which this buffering concept was tested. The effectiveness of a novel muzzle-mounted, 'tumble', test device is shown. Author

N80-16210*# Southwest Research Inst., San Antonio, Tex.
PREDICTION OF FRAGMENT VELOCITIES AND TRAJECTORIES c37
J. J. Kulesz, L. M. Vargas, and P. K. Moseley. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 1, Sep. 1979, p. 171-187, refs (For primary document see N80-16198 07-31)
(Contract NAS3-20497)
Avail: NTIS HC A09/MF A01 CSCL 20K

Analytical techniques are described which predict: (1) the velocities of two unequal fragments from bursting cylindrical pressure vessels; (2) the velocity and range of portions of vessels containing a fluid which, when the vessel ruptures, causes the fragment to accelerate as the fluid changes from the liquid to the gaseous phase; and (3) the ranges of fragments subjected to drag and lift forces during flight. Numerous computer runs were made with various initial conditions in an effort to generalize the results for maximum range in plots of dimensionless range versus dimensionless velocity. R.E.S.

N80-16211*# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 2: MODAL AND IMPEDANCE ANALYSIS, HUMAN RESPONSE TO VIBRATION AND SHOCK, ISOLATION AND DAMPING, DYNAMIC ANALYSIS
Sep. 1979, 215 p. refs. Presented at the 49th Symp. on Shock and Vibration, Washington, D.C., 17-19 Oct. 1978. Sponsored by NASA, Goddard Space Flight Center. 3 Vol.
(NASA-CR-162472; AD-A074700; Bull-49-Pt-2) Avail: NTIS HC A10/MF A01 CSCL 20K

The topics discussed include human perception of vibration, isolation and damping in airborne electro-optical systems, turbine blades, and elastomers; dynamic analysis applied to shock pulses and silver acetylide-silver nitrate explosives; and determination of dominant vibration modes using dynamic transfer functions. For individual titles, see N80-16212 through N80-16231.

N80-16212*# Martin Marietta Corp., Denver, Colo.
AN IMPEDANCE TECHNIQUE FOR DETERMINING LOW FREQUENCY PAYLOAD ENVIRONMENTS c39
Kenneth R. Payne. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2, Sep. 1979, p. 1-14, refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 22B

An approximation method for determining low frequency payload environments is developed and compared to state of the art coupling/response routines. Problems in signal conditioning techniques and frequency domain analysis are discussed. Results from analytical simulations with a spring mass system and a mathematical model of the Space Transportation System and Long Duration Facility are presented. K.L.

N80-16213*# Martin Marietta Corp., Denver, Colo.
A STATISTICAL LOOK AT MODAL DISPLACEMENT RESPONSE TO SEQUENTIAL EXCITATIONS c39
William J. Karena. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2, Sep. 1979, p. 15-18, refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

The residual displacement response to a sequence of simple excitations separated by nearly equal time intervals is evaluated on a statistical basis. Mean plus three sigma responses are plotted as a function of the number of sequential excitations for a range of damping values. The curves are derived for parametric evaluation of the vibratory pointing error for a maneuvering spacecraft, but they can be applied to other sequential excitation problems where the residual displacement in a key mode is the response parameter of interest. K.L.

N80-16214*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
ON DETERMINING THE NUMBER OF DOMINANT MODES IN SINUSOIDAL STRUCTURAL RESPONSE c39
W. L. Hallauer, Jr. and A. Franck. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2, Sep. 1979, p. 19-34, refs (For primary document see N80-16211 07-31)
(Grant NsG-1276)
Avail: NTIS HC A10/MF A01 CSCL 20K

The problem of using structural dynamic transfer function data to determine the number of vibration modes dominant in response at a given frequency is addressed. If two or more modes are closely spaced or if response is influenced strongly by distant modes, then the number of dominant modes may not be evident from examination of transfer function plots, and quantitative methods may be required. Two relatively simple methods are reviewed, and a more effective vector-fit method is described in detail. Applications of these methods are given with the use of numerically simulated transfer function data. K.L.

N80-16215*# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
LATERAL AND TILT WHIRL MODES OF FLEXIBLY MOUNTED FLYWHEEL SYSTEMS c44
C. W. Bert and T. L. C. Chen. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2, Sep. 1979, p. 35-46, refs. Sponsored by DOE (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 10B

An axisymmetric energy storage flywheel system with four degrees of freedom, two associated with lateral translation and two with tilting, was driven by an air turbine which added two more degrees of freedom. A six degree-of-freedom analysis was performed and applied to two versions of a specific design. K.L.

N80-16216*# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.
WHOLE-BODY VIBRATION OF HEAVY EQUIPMENT OPERATORS c54

D. E. Wasserman, W. C. Asburry, and T. E. Doyle *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 47-68 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 05H

A vibration field study was made of workers operating track-type tractors, scrapers, motor graders, loaders, backhoes, compactors, skidders, and dump trucks. Vibration data were obtained from the vehicle floor and manseat interface, as well as from the operator's knee, shoulder, and head. The vibration spectrum analysis indicates that for the different types of machines little difference could be attributed to the experience or body mass of the operator and that most of the higher level vibration occurred below the 4 to 8 Hz human body resonance band, much of it at less than 1 Hz. K.L.

N80-16217*# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
RESEARCH RELATED TO THE EXPANSION AND IMPROVEMENT OF HUMAN VIBRATION EXPOSURE CRITERIA **c54**
Richard W. Shoenberger *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 69-79 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 05H

A psychophysical matching technique was used to investigate the perceived intensity of various types of vibration environments. Comparisons of sinusoidal and nonsinusoidal vibrations as well as comparisons of translational and angular vibrations were conducted. Results discriminate between alternate methods for evaluating the severity of nonsinusoidal vibrations and indicate relationships between translational and angular vibrations needed for the expansion of vibration criteria to include angular motions. K.L.

N80-16218*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
COMPUTER AIDED DESIGN OF PASSIVE VIBRATION ISOLATORS FOR AIRBORNE ELECTRO-OPTICAL SYSTEMS **c39**
P. W. Whaley and Jerome Pearson (AFFDL) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 81-86 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

The concept of nodalization for jet-powered, winged aircraft was examined at the Flight Dynamics Laboratory using a simply supported beam loaded with a lumped mass at each end and supported by two passive isolators located arbitrarily along the beam. The Fibonacci numerical search routine was used to minimize the sum of the mean squared angular vibration responses of the two ends. For symmetric loading (end masses identical), the optimum attachment locations were the nodes of the free-free beam. The vibration reduction was several orders of magnitude compared to isolators at the ends. M.M.M.

N80-16219*# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
DESIGN OF TURBINE BLADES FOR EFFECTIVE SLIP DAMPING AT HIGH ROTATIONAL SPEEDS **c07**
David I. G. Jones and Agnieszka Muszynska (Polish Acad. Sci.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 87-96 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 21E

The dynamic behavior of a blade having a root geometry compatible with low frictional forces at high rotational speeds, somewhat like a 'Christmas Tree' root, but with a gap introduced which closes up only at high speed is examined. Approximate nonlinear equations of motion are derived and solved using a method of harmonic balance. Numerical examples are discussed. M.M.M.

N80-16220*# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
A SIMPLE LOW-COST TECHNIQUE FOR MEASURING MATERIAL DAMPING BEHAVIOR **c39**
David I. G. Jones *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 97-103 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

A simple test procedure in which a cylindrical specimen of damping material supporting an added mass is impacted by a small 'hammer' is described. The force transmitted through the specimen is measured by a force gage and the acceleration experienced by the hammer is measured by an accelerometer. The transient signals so generated are displayed on a storage oscilloscope, and the modulus and loss factor of the material are derived from comparisons with a simple transient analysis of a single degree-of-freedom system having a complex stiffness for the spring element. Examples and test data are discussed and comparisons are made with results of other methods of measurement. M.M.M.

N80-16221*# Cambridge Acoustical Associates, Inc., Mass.
THE EFFECTS OF FREQUENCY, AMPLITUDE, AND LOAD ON THE DYNAMIC PROPERTIES OF ELASTOMERS **c27**
John E. Cole, III *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 105-117 refs (For primary document see N80-16211 07-31)
(Contract N00014-69-C-0056)
Avail: NTIS HC A10/MF A01 CSCL 11G

The behavior of the mechanical properties of elastomers under conditions of dynamic loading are considered as a criteria in the design of anti-vibration mounts. M.M.M.

N80-16222*# Army Construction Engineering Research Lab., Champaign, Ill.
LIQUID SPRING SHOCK ISOLATOR MODELING BY SYSTEM IDENTIFICATION **c39**
P. N. Sonnenburg, B. H. Wendler, and W. E. Fisher *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 119-134 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20D

A feasibility study was undertaken to determine if a reasonably accurate model of an off-the-shelf liquid-spring isolator could be found, using data from a few simple and inexpensive tests. A liquid spring was selected for its design versatility and potential use in high performance shock isolation systems. General acceptance of a system identification approach ultimately depends on the simplicity and cost of testing and the ability to represent installed operating conditions by the mathematical formulation. M.M.M.

N80-16223*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A GENERALIZED DERIVATIVE MODEL FOR AN ELASTOMER DAMPER **c39**
Ronald L. Bagley and Peter J. Torvik *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 135-143 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

A generalized derivative (fractional order) is used to construct a dynamic stress-strain constitutive relation for the elastomer 3M-467. The desirable features of this constitutive relation are demonstrated and the constitutive relation is used to determine vibration time histories of a single degree-of-freedom oscillator having an elastomer damper. Author

N80-16224*# Michigan State Univ., East Lansing. School of Packaging.
SHOCK RESPONSE OF NON-LINEAR SYSTEMS **c39**
Kalman Peleg *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 145-157 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

A model consisting of a mass between two preloaded nonlinear (cubic elasticity) springs and restrained by a Coulomb and viscous damper is proposed. An approximate quasi-harmonic solution of the nonlinear differential equation of motion of the model whereby both amplitude and phase are time dependent, enables a study of the motion during the first half cycle (pulse) after collision. Formulae are developed for calculating peak acceleration, rise time, pulse duration and maximum deflection.

These are compared with corresponding formulae of special cases for which exact solutions are known. Acceleration versus time pulses are classified in accordance to pulse shape, e.g., saw-tooth, halfsine and trapezoidal, as a function of system damping. Although the model is intended mainly for quantitative design in packaging engineering problems, it is suitable for studying general shock isolation problems as well. M.M.M.

N80-16225*# Brookhaven National Lab., Upton, N. Y.
STABILITY ANALYSIS AND RESPONSE CHARACTERISTICS OF TWO-DEGREE OF FREEDOM NONLINEAR SYSTEMS **c39**
M. Subudhi and J. R. Curreri *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 159-163 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

The stability of a nonlinear two degree-of-freedom spring-mass system subjected to a sinusoidal exciting force is examined. The solution is perturbed to arrive at a set of coupled variational linear differential equations with periodic coefficients. Floquet theory is used to obtain a characteristic equation. The Routh-Hurwitz stability criterion is adopted to study the stable and unstable regions of the response curves. A computer program is developed to carry out the entire analysis. Extensive information regarding stable zones of the system response is described by means of nondimensional frequency-amplitude diagrams. The results are examined in terms of inferring dynamic response characteristics for sine sweep tests. Author

N80-16226*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
APPLICATION OF RANDOM TIME DOMAIN ANALYSIS TO DYNAMIC FLIGHT MEASUREMENTS **c05**
S. R. Ibrahim *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 165-170 refs (For primary document see N80-16211 07-31)
(Grant NsG-1459)
Avail: NTIS HC A10/MF A01 CSCL 01C

An approach is presented for modal identification of aerospace structures from flight measurements. This approach is the result of combining the time domain modal identification technique and the multiple channel random decrement technique. A technique is also presented to determine relative levels of excitation for identified modes. These techniques are applied to flight data taken from the B-1 bomber. Results are extremely encouraging. Author

N80-16227*# California Univ., Berkeley. Structural Engineering and Structural Mechanics Div.
SHOCK SPECTRA DESIGN METHODS FOR EQUIPMENT-STRUCTURE SYSTEMS **c39**
James M. Kelly and Jerome L. Sackman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 171-176 refs (For primary document see N80-16211 07-31)
(Contract DNA001-C-0233; Grant NSF ENG-77-05197)
Avail: NTIS HC A10/MF A01 CSCL 20K

An analytical method is developed whereby a simple estimate can be obtained of the maximum dynamic response of light equipment attached to a structure subjected to ground motion. The natural frequency of the equipment, modeled as an undamped single degree-of-freedom system, is considered to be close or equal to one of the natural frequencies of the undamped N degree-of-freedom structure. This estimate provides a convenient, rational basis for the structural design of the equipment and its installation. The approach is based on the transient analysis of tuned or slightly detuned equipment-structure systems in which the mass of the equipment is much smaller than that of the structure. The results obtained are simple estimates of the maximum acceleration and displacement of the equipment. A.R.H.

N80-16228*# Sandia Labs., Albuquerque, N. Mex.
A COMPUTATIONAL MODEL DESCRIBING THE INITIATION OF SILVER ACETYLIDE-SILVER NITRATE EXPLOSIVE BY AN INTENSE LIGHT SOURCE **c28**
Floyd H. Mathews *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 177-191 refs Sponsored by DOE (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 19A

The surface initiation of silver acetylide-silver nitrate explosive occurs when the explosive is exposed to irradiation produced by an electrical discharge through an array of tungsten wires, each surrounded by an air-filled Pyrex tube. The initiation process is modeled by first calculating the wire heating and subsequent arc breakdown. Then the arc energy is allowed to reradiate toward the explosive surface using a characteristic relaxation time. Finally, the thermal initiation of the explosive surface is modeled as the conductive transfer of heat through a surface layer of inert explosive which had previously been darkened by exposure to the sun. Initiation occurs when active explosive reaches a critical temperature. A number of unknown parameters are accommodated by normalizing the calculation to agree with the time delay before firing which was measured during a single experiment. A.R.H.

N80-16229*# Sandia Labs., Albuquerque, N. Mex.
TERMINAL VELOCITY AND ROTATION RATE OF A FLYER PLATE PROPELLED BY A TUBE-CONFINED EXPLOSIVE CHARGE **c28**
R. A. Benham *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 193-201 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 19A

A method for predicting the terminal velocity and rotation rate of a flyer plate propelled by an open-ended, tube-contained explosive charge was developed. A procedure for calculating the fraction of the explosive that is effective in accelerating the plate leads to a very simple set of equations for predicting the performance of the explosive system. Calculations using this theory are compared with results from numerous experiments. Measured values of flyer velocity are predicted within plus or minus 5 percent and rotation rates with plus or minus 10 percent. Author

N80-16230*# Naval Surface Weapons Center, White Oak, Md.
A STABILITY THEOREM FOR A DYNAMICALLY LOADED LINEAR VISCOELASTIC STRUCTURE **c39**
D. W. Nicholson *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 203-208 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

The response of a linear viscoelastic structure to a dynamic load is considered. For the finite element equation of dynamic equilibrium a representation of the solution is derived using the exponential matrix function, and this representation permits application of the highly efficient method of Gaussian quadrature. Positive definiteness and other properties of the system mass, damping and stiffness matrices are shown to entail satisfaction of an inequality ensuring a physical and a numerical type of stability. Author

N80-16231*# Michigan State Univ., East Lansing. School of Packaging.
ANALOG DOUBLE INTEGRATION OF SHOCK PULSES **c39**
Kalman Peleg and Richard A. Lund (MTS Systems Corp., Minneapolis, Minn.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 209-217 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

Conventional monitoring and evaluation in shock testing is based mainly on acceleration pulse recordings from a shock machine and a tested product. For product fragility boundary establishment, shock machine velocity change is either computed from drop height, measured by an optical velocity meter or single integration of the acceleration time pulse. An approach to acceleration transient analysis is described whereby a real-time double integrator circuit provides analog readout of velocity and displacement as well as acceleration. Absolute and relative velocity changes and displacements are obtained by means of consecutive integration of signals from acceleration transducers. Although an analog double integration circuit is featured, the applications also apply to digital double integration. Author

N80-16232*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
HOMOGENEOUS ALIGNMENT OF NEMATIC LIQUID

CRYSTALS BY ION BEAM ETCHED SURFACES
E. G. Wintucky, R. Mahmood, and D. L. Johnson 19 Oct. 1979 19 p refs Presented at 156th Meeting of the Electrochem. Soc., Los Angeles, 15-19 Oct. 1979
(NASA-TM-81378; E-283) Avail: NTIS HC A02/MF A01 CSCL 20L

A wide range of ion beam etch parameters capable of producing uniform homogeneous alignment of nematic liquid crystals on SiO2 films are discussed. The alignment surfaces were generated by obliquely incident (angles of 5 to 25 deg) argon ions with energies in the range of 0.5 to 2.0 KeV, ion current densities of 0.1 to 0.6 mA sq cm and etch times of 1 to 9 min. A smaller range of ion beam parameters (2.0 KeV, 0.2 mA sq cm, 5 to 10 deg and 1 to 5 min.) were also investigated with ZrO2 films and found suitable for homogeneous alignment. Extinction ratios were very high (1000), twist angles were small (< or = 3 deg) and tilt-bias angles very small (< or = 1 deg). Preliminary scanning electron microscopy results indicate a parallel oriented surface structure on the ion beam etched surfaces which may determine alignment. Author

N80-16233# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
ACCURACY OF HYDROFOIL LOADING PREDICTIONS OBTAINED FROM A LIFTING-SURFACE COMPUTER PROGRAM Final Report
Peter K. Besch and Edwin P. Rood, Jr. Sep. 1979 203 p refs
(ZF4342101)
(AD-A074702; DTNSRDC-79/039) Avail: NTIS HC A10/MF A01 CSCL 13/10

To provide guidance for hydrofoil designers, an extensive operational evaluation was made of a computer-based lifting-surface theory for calculating hydrodynamic loading on hydrofoils in steady and unsteady motion in inviscid, subcavitating flow at finite depth. Both the numerical stability and the accuracy in comparison with model data were estimated. By use of an empirical correction, lift predictions can be made with an accuracy of about 15 to 20 percent, while pitching moment predictions are substantially less accurate. Determination of the accuracy was hindered by insufficient or imprecise data. Documentation for the computer program is given. Author (GRA)

N80-16234# Aerojet Liquid Rocket Co., Sacramento, Calif.
JEFF(A) MIXED-FLOW MODEL FAN PERFORMANCE OPTIMIZATION Final Report
S. A. Lorenc Jun. 1979 120 p refs
(Contract N00014-78-C-0441)
(AD-A074571; ALRC-FD9630-001) Avail: NTIS HC A06/MF A01 CSCL 13/10

This model test program was conducted in order to improve the performance of the JEFF(A) Mixed-Flow Fan. Both rotor and housing changes were made to the existing model fan and tests were conducted in the ALRC Physics Laboratory. Rotor modifications consisted of varying blade length and narrowing the rotor width at the exit. Housing size was varied by changing axial and radial dimensions. The sensitivity of fan performance to IGV positioning was also determined for both flat and twisted vanes. Finally, full size fan performance was predicted for the best combination of housing and rotor. Recommendations are also made for further improvement of the Mixed-Flow Fan concept. GRA

N80-16235# Oak Ridge National Lab., Tenn.
HEAVY-SECTION STEEL TECHNOLOGY PROGRAM Quarterly Progress Report, Jan. - Mar. 1979
G. B. Whitman and R. H. Bryan Aug. 1979 122 p refs
(Contract W-7405-eng-26)
(NUREG-CR-0818; ORNL/NUREG/TM-324) Avail: NTIS HC A06/MF A01

Research related to all areas of the technology of the materials fabricated into thick-section primary-coolant containment systems of light-water-cooled nuclear power reactors is presented. The behavior and structural integrity of steel pressure vessels containing cracklike laws are considered. Current work is organized into six tasks: (1) program administration and procurement; (2) fracture mechanics analyses and investigations; (3) effect of high-temperature primary reactor water on the subcritical crack growth of reactor vessel steels; (4) investigations of irradiated materials; (5) pressure vessel investigations; and (6) thermal shock investigations. A user-oriented finite-element computer program for calculating mixed-mode stress-intensity factors (SIF's) for nozzle corner flaws of arbitrary shape is being developed. A method for estimating stable crack growth in fracture toughness specimens was developed and applied to the analysis of several sets of data. DOE

N80-16236# Los Alamos Scientific Lab., N. Mex. Cryogenics Group.
SAFETY OF LIQUID HYDROGEN IN AIR TRANSPORTATION
F. J. Edeskuty 1979 18 p refs Presented at the Hydrogen in Air Transportation Conf., Stuttgart, 10 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1418; CONF-790942-1) Avail: NTIS HC A02/MF A01

The safety factors and problems associated with the use of liquid hydrogen as an aircraft fuel are discussed. The properties of liquid hydrogen are reviewed and their effect upon airline operations is reported. The effects include safety requirements for storage and refueling systems and safety devices for aircraft hangars and buildings in the close vicinity. Safety problems which need further research are addressed. These include the consequences of a hydrogen spill and dispersion, hydrogen combustion, and hydrogen disposal.

N80-16237# Argonne National Lab., Ill.
ENERGY AND MATERIALS FLOWS IN THE FABRICATION OF ALUMINUM PRODUCTS
R. M. Arons and A. M. Wolsky Aug. 1978 69 p refs
(Contract W-31-109-eng-38)
(ANL/CNSV-3) Avail: NTIS HC A04/MF A01

The aluminum fabrication process is described and energy use and efficiency for each process step is cited. It is concluded that the most effective approaches to energy conservation is the use of methods for waste heat reduction and recovery, reduction of scrap generation during processing, use of induction heating for both melting and heat treating, and use of alternative processing techniques that eliminate energy intensive intermediate steps. DOE

N80-16238# Bureau of Mines, Tuscaloosa, Ala. Tuscaloosa Metallurgy Research Center.
APPLICATION OF A DIFFUSION MODEL TO OXIDE SINTERING
C. D. Messelt, D. A. Stanley, and E. K. Landis, Jr. 1979 16 p refs
(PB-300399/3; BM-RI-8369) Avail: NTIS HC A02/MF A01 CSCL 11B

The application of a diffusion model to sintering rate data developed for lithium titanium ferrite was investigated. The data were obtained by sintering pressed pellets under identical conditions for various times up to 11 hours. Stereological measurements were made on polished sections, and sintering rates were calculated. A model for intermediate stage sintering was fitted to the stereological data. This procedure produces a method by which these type data are used to study the relative importance of volume and grain boundary diffusion under a variety of sintering conditions. GRA

N80-16239# Colorado School of Mines, Golden. Excavation Engineering and Earth Mechanics Inst.
MECHANICAL TUNNEL BORING PREDICTION AND MACHINE DESIGN Final Report
Levent Ozdemir and Fun-Den Wang Feb. 1979 225 p refs
(Grant NSF APR-77-04183)
(PB80-101660; EMI-427; NSF/RA-790161) Avail: NTIS HC A10/MF A01 CSCL 13B

Research efforts are described to obtain accurate data to verify previously developed equations for mechanical tunnel boring. Procedures pertinent to machine design and performance were also investigated. A laboratory indentation test procedure was designed to predict field boring performance. Extensive indentation tests were conducted in samples of three rock types, results of which confirmed the applicability of indentation tests as a reliable tool to predict disc cutting forces. Field boring data from

an active tunneling site indicate that indentation tests can be used as a means of accurately estimating field boring performance. GRA

N80-16240# Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research.
EFFECT OF SUBBASE TYPE AND SUBSURFACE DRAINAGE ON BEHAVIOR OF CRC PAVEMENTS Interim Report, May 1971 - Dec. 1977
Jagat S. Dhamrait and Donald R. Schwartz May 1979 41 p refs
(PB80-101165; Physical Research-83; FHWA/IL/PR-083) Avail: NTIS HC A03/MF A01 CSCL 13B

As part of an extensive study conducted to determine the significant relationship between the behavior of CRC pavement and various design features, an evaluation was made of four types of subbase and three types of subsurface drainage systems. Deformation of the subbase due to loading and/or subbase erosion under severe climate and moisture conditions can cause severe pavement distress. The subsurface drainage system with longitudinal underdrains placed at the edge of the stabilized subbase was the most efficient in removing free water from beneath the pavement structure. GRA

N80-16241# Ryland Research, Inc., Santa Barbara, Calif.
A STUDY OF INDIRECT FIRE LOSSES FROM FIRES IN NON-RESIDENTIAL PROPERTIES. VOLUME 1: RESEARCH REPORT Final Report
Harold L. Hicks and Richard R. Liebermann 1 Mar. 1979 136 p refs Prepared in cooperation with Tecolote Research, Inc., Santa Barbara, Calif.
(Contract C-7-35539)
(PB-299126/3) Avail: NTIS HC A07/MF A01 CSCL 13M

Several models were developed for estimating indirect losses in commercial occupancies at the local and national levels, and for mercantile, nonmanufacturing, manufacturing, and warehousing occupancies. Appendices containing an annotated bibliography of reference literature; a description of the mathematical tool -- regression analysis -- used to develop a statistical relationship between direct and indirect losses; six case studies; and a description of the computer program used to develop estimates of indirect fire loss are included. GRA

N80-16242# Ryland Research, Inc., Santa Barbara, Calif.
A STUDY OF INDIRECT FIRE LOSSES FROM FIRES IN NON-RESIDENTIAL PROPERTIES. VOLUME 3: INDIRECT RESIDENTIAL FIRE LOSS - A CASE STUDY Final Report
Harvey G. Ryland 1 Mar. 1979 52 p
(Contract C-7-35539)
(PB-299127/1) Avail: NTIS HC A04/MF A01 CSCL 13M

The results of an analysis of indirect losses and related experiences associated with a specific residential fire are presented. Actual components of indirect losses and gains (for both owner/occupant and the general community), estimates of these losses and gains, the total amount of indirect losses for the incident, and recommendations concerning the types of information which should be made available to citizens on how to prepare for and cope with residential fire losses are provided. GRA

N80-16243# South Carolina Univ., Columbia. College of Engineering.
A STUDY OF HIGHWAY EMBANKMENT CONSTRUCTION IN SOUTH CAROLINA MARSHLANDS Final Report
W. K. Humphries 31 May 1979 74 p refs Sponsored in part by South Carolina Dept. of Highways and Public Transportation and FHWA
(PB-300816/6; FHWA/SC-79/002) Avail: NTIS HC A04/MF A01 CSCL 13C

A site in Charleston, South Carolina was studied to determine practical alternatives to bridging over soft foundation soils. Many states with similar soil conditions to those evaluated at this site were contacted concerning their alternative solutions to bridging. A comparative cost study was made for the particular site in Charleston for several possible alternative solutions, and ecological effects of each were considered. It was found that the use of sand drains in combination with surcharging and geotechnical fabrics offer an alternative which is cost effective and sound engineering-wise. GRA

N80-16244# Michigan Dept. of State Highways and Transportation, Lansing. Testing and Research Div.
EFFECTIVENESS OF NEOPRENE SEALS IN PREVENTING CONCRETE PAVEMENT CONTRACTION JOINT DETERIORATION Final Report, 1973 - 1977
F. J. Bashore and A. W. Price Jul. 1979 32 p
(PB-300594/9; R-1122; FHWA/MI-79/2) Avail: NTIS HC A03/MF A01 CSCL 13B

Over 200 cores were taken from contraction joints sealed with compressible seals on 17 construction projects over a period of four years in order to determine the amount and rate of deterioration of the concrete at the bottom of the joint. Seal performance was rated, chloride content of concrete was determined, and drainability of base material was rated. Results indicate that the neoprene seals are performing well in preventing the entry of incompressibles but permit the entry of liquids into virtually all joints. The data indicate that most of the deterioration occurred during the first five years and shows little significant changes for the following years. Several modifications in design, construction, and maintenance of concrete contraction joints are suggested. GRA

N80-16245# West Virginia Univ., Morgantown. Dept. of Civil Engineering.
DETERMINATION OF THE IN SITU PERMEABILITY OF BASE AND SUBBASE COURSES Final Report, 25 May 1976 - 31 May 1979
Lyle K. Moulton and Roger K. Seals May 1979 161 p refs
(Contract DOT-FH-11-9060)
(PB-300908/1; FHWA/RD-79/88; CES-4003) Avail: NTIS HC A08/MF A01 CSCL 13B

The development of a prototype in situ test device, designated the field permeability testing device for determination of the permeability of highway base and subbase courses is described and discussed. The feasibility of in situ permeability measurement techniques was investigted which led to the selection of the velocity method of in situ permeability determination for further development. A prototype field permeability test device was constructed and an extensive program of laboratory and field evaluations of this equipment was performed. It was concluded that the prototype field permeability test device developed satisfies project objectives and provides a convenient means for the determination of the in situ coefficient of permeability of highway bases and subbases with reasonable accuracy and reproducibility. GRA

N80-16246# Virginia Highway and Transportation Research Council, Charlottesville.
EVALUATION OF EXPERIMENTAL FLEXIBLE PAVEMENTS Final Report, Nov. 1971 - Jun. 1979
K. H. McGhee Jul. 1979 57 p refs
(PB-310251/5; VHTRC-80-R5; FHWA/VA-80/05) Avail: NTIS HC A04/MF A01 CSCL 13B

The performance of seven Virginia pavements was evaluated. Among the major findings of the study are: (1) pavements having equivalent design thickness indices are not necessarily equivalent in cost or early structural strength; (2) full-depth asphaltic concrete pavements can give excellent performance in very poor soil areas, especially when the subgrade is modified with cement stabilization; (3) transverse shrinkage cracks reflect from a cement treated stone subbase through 3 in. of bituminous concrete in as little as 18 months and through 7 in. of bituminous concrete in less than 5 years; and (4) sandwich-layer systems can have a detrimental effect on pavement performance. GRA

N80-16247# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
AN EVALUATION OF METHODOLOGY FOR PREDICTION AND MINIMIZATION OF DETRIMENTAL VOLUME CHANGE OF EXPANSIVE SOILS IN HIGHWAY SUBGRADES. VOLUME 1: RESEARCH REPORT Final Report
Donald R. Snethen Mar. 1979 203 p refs
(PB-301254/9; FHWA/RD-79/49) Avail: NTIS HC A10/MF A01 CSCL 13B

The methodology for prediction and minimization of detrimen-

tal volume change of expansive soils in highway subgrades is evaluated. The occurrence and distribution of expansive soils is reported and the roles of the microscale mechanisms that cause volume change are defined. Appropriate treatment alternatives for new and existing highways are assessed and procedures for the design and construction of new pavements and maintenance of existing pavements are recommended. A.W.H.

N80-16248# North Carolina State Univ. at Raleigh. Highway Research Program.

EVALUATION OF THE EFFECTIVENESS OF FABRIC REINFORCEMENT IN EXTENDING THE IN-SERVICE LIFE OF BITUMINOUS CONCRETE OVERLAYS Final Report

W. G. Mullen and Robert J. Hader Jul. 1979 82 p Prepared in cooperation with North Carolina State Dept. of Transportation, Raleigh

(PB-301305/9; ERSD-110-71-5; FHWA/NC-79/001) Avail: NTIS HC A05/MF A01 CSCL 13B

Tests of fabric and non-fabric treated overlays of a jointed unreinforced portland cement concrete pavement on US 70 in Orange County, North Carolina are described. Four continuous fabric and four strip fabric treatments were used in addition to four non-fabric treatments, one of which was the regular two inch 1-2 overlay used for control. The fabrics were three woven or non-woven polymeric materials and one woven fiberglass. The four non-fabric treatments consisted of a surface treatment type mat course, a plant mixed mat coat, an opengraded mix course laid directly on the old pavement and covered with the 1-2 mix, and the 1-2 mix used for control. GRA

N80-16249# Massachusetts Inst. of Tech., Cambridge. Constructed Facilities Div.

ASEISMIC DESIGN PROCEDURES FOR REINFORCED CONCRETE FRAMES. SEISMIC BEHAVIOR AND DESIGN OF BUILDINGS

John M. Biggs, Wai K. Lau, and Drew Persinko Jul. 1979 90 p refs

(Grant NSF ENV-77-14714)

(PB80-104128; NSF/RA-790205; Rept-1) Avail: NTIS HC A05/MF A01 CSCL 13M

Twelve reinforced concrete frames are designed for earthquake and gravity loads using three different procedures for determining the seismic design loads. The procedures are: (1) UBC static load approach; (2) modal analysis using inelastic response spectra; and (3) substitute structure method. The frames are of 4, 8 and 10 stories. The validity of each design procedure is evaluated by time-history analysis of each frame to determine maximum local ductility demands due to both real and artificial ground motion. None of the three methods is found to be completely satisfactory because the ductility demands are not the same as intended in the design and are not evenly distributed over the frame. GRA

N80-16250# Washington Univ., St. Louis, Mo. Dept. of Civil Engineering.

ANALYTICAL METHOD FOR DETERMINING SEISMIC RESPONSE OF COOLING TOWERS ON FOOTING FOUNDATIONS Interim Report

O. M. El-Shafee and P. L. Gould Sep. 1979 228 p refs

(Grant NSF PFR-79-00012)

(PB-301398/3; RR-55; NSF/RA-790165; IR-1) Avail: NTIS HC A11/MF A01 CSCL 13M

A finite element model was developed to analyze shells of revolution under dynamic loading with soil-structure interaction effects. The model consists of high-precision rotational shell finite elements, representing the axisymmetric shell, supported on an equivalent boundary system, representing the soil medium. The substructure method is used to model the shell and soil components. In addition to the seismic analysis capability of the proposed model, it is also applicable to other dynamic loads such as wind. The dynamic behavior of a hyperboloidal cooling tower is studied using the proposed model. Dynamic properties are studied and stress analysis is carried out for a variety of soil conditions. GRA

N80-16251# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

PROBABILISTIC ANALYSIS OF TEMPERATURE LOADS FOR STRUCTURES, STRUCTURAL LOADS ANALYSIS AND SPECIFICATIONS PROJECT

Paul Millman, Robert Kilcup, and C. Allin Cornell Mar. 1979 211 p refs

(Grant NSF ENV-73-00345)

(PB-301415/6; R79-10; NSF/RA-790179) Avail: NTIS HC A10/MF A01 CSCL 13M

Three methods for the probabilistic analysis of temperature effects in building elements are applied to a simple one-dimensional temperature model which could represent a building wall element. The first method is a finite difference solution of the governing differential equation with an actual temperature record as input. In the second method, the temperature record is characterized in the frequency domain by a power spectral density function. The third method uses a simplified approach in which it is observed that the average strain and curvature in a wall are similar in effect to a time averaging filter applied to the temperature record. GRA

N80-16252# Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

EXPERIMENTAL STUDY OF FRAME-WALL INTERACTION IN REINFORCED CONCRETE STRUCTURES SUBJECTED TO STRONG EARTHQUAKE MOTIONS

Daniel P. Abrams and Mete A. Sozen May 1979 400 p refs

(Grant NSF PFR-78-16318)

(PB-301091/5; Structural-Research-Ser-460; UILU-ENG-79-2002; NSF/RA-790132) Avail: NTIS HC A17/MF A01 CSCL 13M

The response of frame-wall structures to strong earthquake motions was studied. Each small-scale structure consisted of two three-bay frames and one wall resisting lateral loads in parallel. Measurements included accelerations, displacements, and forces resisted by the interior wall. The response of the test structures was examined in terms of apparent modal properties to evaluate the correctness of using a linear modal analysis with arbitrarily softened member stiffnesses to estimate response of the nonlinearly behaving structures. Internal force measurements were also examined to investigate frame-wall interaction in the nonlinear range of response and to check the reliability of the proposed design method for proportioning individual elements. GRA

N80-16253# California Univ., Richmond. Earthquake Engineering Research Center.

INVESTIGATION OF THE NONLINEAR CHARACTERISTICS OF A THREE STORY STEEL FRAME USING SYSTEM

Izak Kaya and Hugh D. McNiven Dec. 1978 97 p refs

(Grant NSF ENV-76-04262)

(PB-301363/8; UBC/EERC-78/25; NSF/RA-780681) Avail: NTIS HC A05/MF A01 CSCL 13M

Two mathematical models were constructed of a three-story steel frame that are meant to predict its responses to seismic disturbances. The models constructed are meant to predict nonlinear response. This extension consists of accounting both for changes in the damping coefficients when the amplitudes of motion are large, and for yielding by including the hysteretic behavior of the ends of the members. The hysteretic relationship between the bending moments and rotations at the ends of the members are modeled. With the introduction of hysteretic material behavior, three parameters are added to the eight which are a carry-over from the linear model, so that the new nonlinear models contain eleven parameters. GRA

N80-16254# California Univ., Richmond. Earthquake Engineering Research Center.

SEISMIC BEHAVIOR OF REINFORCED CONCRETE INTERIOR BEAM-COLUMN SUBASSEMBLAGES

Suthipoul Viwathanatepa, Egor P. Popov, and Vitelmo Y. Bertero Jun. 1979 201 p refs

(Grants NSF AEN-73-07734; NSF ENV-76-04263)

(PB-301326/5; UCB/EERC-79/14; NSF/RA-790186) Avail: NTIS HC A10/MF A01 CSCL 13M

Details of experiments to test the seismic behavior of reinforced concrete subassemblages carried out on beam-column subassemblages are presented as well as an evaluation of the significance of the analytical and experimental results obtained. Two virgin concrete subassemblages and one repaired subassem-

blage were tested. A horizontal force was applied to one subassemblage to generate a large single hysteretic loop, the initial part of which provided information on monotonic loading. Once the loading sequence was completed, this specimen was repaired by epoxy injection processes and an incremental cyclic load was applied until failure occurred. The second specimen was tested to failure by applying a similar loading sequence. GRA

N80-16255# California Univ., Richmond. Earthquake Engineering Research Center.
STATIC TILT TEST OF A TAIL CYLINDRICAL LIQUID STORAGE TANK
Ray W. Clough and Akira Niwa Feb. 1979 118 p refs Sponsored by Chevron Oil Field Res. Co.
(PB-301167/3; UCB/EERC-79/06) Avail: NTIS HC A06/MF A01 CSCL 13M
Results of a static tilt test investigation of a 7 3/4 x 15 ft cylindrical liquid storage tank are presented. The test is performed by mounting the tank on a rigid platform, filling it with water, and tilting the platform by lifting one edge with a laboratory crane. Principal test parameters include water depth, tilt angle top condition (open or with roof), and base fixity condition. Test measurements include tank deformations and membrane stresses. The observed behavior is also compared with results to typical design calculations. The unanchored tank tilts more and develops much greater axial stresses than are indicated by typical design procedures. GRA

N80-16256*# National Bureau of Standards, Boulder, Colo. Thermophysical Properties Div.
PRODUCING SLUSH OXYGEN WITH AN AUGER AND MEASURING THE STORAGE CHARACTERISTICS OF SLUSH HYDROGEN
Roland Voth and Paul R. Ludtke Mar. 1979 42 p refs
(NASA Order CC-6253-QA)
(NASA-CR-158412; PB-298555/4; NBSIR-79-1607) Avail: NTIS HC A03/MF A01 CSCL 07D
An auger rotating inside a brass tube refrigerated with liquid helium was used to produce liquid-solid (slush) mixtures of oxygen. The auger produced small particles of solid oxygen so that the resulting mixture could be transferred and stored. The auger could produce slush continuously in an appropriate system, and it could produce slush at pressures higher than the triple point pressure of the oxygen. Three long term storage tests were conducted on an Apollo hydrogen vessel. Filling with slush instead of liquid hydrogen increased the storage time before venting by 1.08 to 1.17 times and increased the mass loaded by 1.11 to 1.13 times. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-16257 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ELECTRIC AND MAGNETIC FIELDS OF AN INTENSE PULSE OF RELATIVISTIC ELECTRONS PROPAGATING THROUGH AIR Ph.D. Thesis
Kenneth Allen Dreyer 1979 206 p
Avail: Univ. Microfilms Order No. 7923337
The theoretical models developed for the electromagnetic fields associated with an electron beam propagating in air are described. One and two dimensional models of the fields, and a model for the electron avalanche of the air are discussed. The ionization process over a pressure range of from five Torr to 760 Torr is described and the net current which saturates near 15 kiloamps at sealevel pressure, and saturates at lower values at lower air pressures is examined. Dissert. Abstr.

N80-16258 Stanford Univ., Calif.
SPECTRAL PEAK AMPLITUDE CODING FOR VOICE DATA COMPRESSION Ph.D. Thesis
George Heavener Smith 1979 101 p
Avail: Univ. Microfilms Order No. 8002017
A speech coding technique which exploits the quasiperiodic nature of voiced speech without relying on pitch estimation is explored. The technique relies on the fact that the bulk of the energy is a short term Fourier transform of voiced speech resides in about a dozen relatively narrowband spectral peaks. The technique was applied to speech whitened by an LPC inverse filter. Spectral peak coding was also applied to the original speech waveform without inverse filtering and experiments are described which explore the issues of the number of peaks required, the peak widths required, the amplitude and phase quantization, and efficient coding for marking the peak frequencies. An intelligibility experiment is described which demonstrates that the technique can robustly code speech at about 8 to 9 kbps. Dissert. Abstr.

N80-16259# Rome Air Development Center, Griffiss AFB, N.Y.
FAA LIGHTNING PROTECTION STUDY: REPORT OF INVESTIGATIONS RELATIVE TO PROVIDING LIGHTNING PROTECTION FOR THE REMOTE CENTER AIR-TO-GROUND (RCAG)
Richard M. Cosel May 1979 13 p refs
(Contract DOT-FA72WAI-356)
(AD-A076943; FAA-RD-79-102) Avail: NTIS HC A02/MF A01 CSCL 17/2
The susceptibility of FAA electronic systems to induced electromagnetic pulse effects due to lightning is considered. Protective devices adequate for low voltage solid state systems are proposed. The Remote Center Air to Ground system is presented. While the RCAG does contain solid state circuitry with potentially susceptible components, they are sufficiently isolated from transients so that effects are apparently negligible. Two separate reviews of four RCAG's in Florida failed to surface any outages directly attributable to lightning induced transients on control lines. M.M.M.

N80-16260*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TECHNIQUE TO DETERMINE LOCATION OF RADIO SOURCES FROM MEASUREMENTS TAKEN ON SPINNING SPACECRAFT
J. Fainberg Nov. 1979 57 p refs Submitted for publication
(NASA-TM-80598) Avail: NTIS HC A04/MF A01 CSCL 20N
The procedure developed to extract average source direction and average source size from spin-modulated radio astronomy data measured on the IMP-6 spacecraft is described. Because all measurements are used, rather than just finding maxima or minima in the data, the method is very sensitive, even in the presence of large amounts of noise. The technique is applicable to all experiments with directivity characteristics. It is suitable for onboard processing on satellites to reduce the data flow to Earth. The application to spin-modulated nonpolarized radio astronomy data is made and includes the effects of noise, background, and second source interference. The analysis was tested with computer simulated data and the results agree with analytic predictions. Applications of this method with IMP-6 radio data have led to: (1) determination of source positions of traveling solar radio bursts at large distances from the Sun; (2) mapping of magnetospheric radio emissions by radio triangulation; and (3) detection of low frequency radio emissions from Jupiter and Saturn. M.M.M.

N80-16261*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ANTENNA FEED SYSTEM FOR RECEIVING CIRCULAR POLARIZATION AND TRANSMITTING LINEAR POLARIZATION Patent Application
Boris L. Seidel (JPL) and Dan A. Bathker, inventors (to NASA) (JPL) Filed 30 Oct. 1979 13 p
(Contract NAS7-100)
(NASA-Case-NPO-14362-1; US-Patent-Appl-SN-106118) Avail: NTIS HC A02/MF A01 CSCL 20N
An invention is described which provides for receiving a circularly polarized signal from an antenna feed connected to orthogonally spaced antenna elements. It also provides for transmitting a linearly polarized signal through the same feed

without switches, and without suffering a 3 dB polarization mismatch loss, using an arrangement of hybrid junctions. The arrangement is comprised of two dividing hybrid junctions, each connected to a different pair of antenna elements and a summing hybrid junction. In one version, a receiver is connected to the summing hybrid junction directly. A diplexer is used to connect a transmitter to only one pair of antenna elements. In another version, designated left and right circularly polarized (LCP and RCP) transmitters are connected to the summing hybrid junction by separate diplexers, and separate LCP and RCP sensitive receivers are connected to the diplexers in order to transmit linearly polarized signals using all four antenna elements while receiving circularly polarized signals as before. An orthomode junction and horn antenna may replace the two dividing hybrid junctions and antenna feed. NASA

N80-16262# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Space Dept.
COMPARISON OF RADAR DERIVED RAIN ATTENUATION WITH THE COMSTAR BEACON AT 28.56 GHz FOR SUMMER AND WINTER PERIODS
Julius Goldhirsh Jul. 1979 38 p refs
(Contract N00024-78-C-5384)
(APL/JHU/SIR-79U-016) Avail: NTIS HC A03/MF A01

Results are given pertaining to an experiment whose aims are to test and improve the accuracy of radar derived slant path rain attenuation methods. These estimated results are compared with measured rain fade levels of the COMSTAR beacon signal at 28.56 GHz at Wallops Island, Virginia. The data base corresponds to five rain days flanking the winter of 1978-79 during which 715 minutes of simultaneous radar and disdrometer data were obtained. Agreement between estimated and measured individual rain fade events was found to be generally good. Agreement between corresponding conditional cumulative fade distributions was excellent. The Marshall-Palmer distribution was injected into the radar program and gave similarly good results. The application of the Marshall-Palmer distribution for stratiform type rains as is generally the rain type for winter periods is consistent with the results obtained. M.M.M.

N80-16263*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
WEIGHTING IN DIGITAL SYNTHETIC APERTURE RADAR PROCESSING
Alan DiCenzo 15 Nov. 1979 25 p refs
(Contract NAS7-100)
(NASA-CR-162684; JPL-PUB-79-94) Avail: NTIS HC A02/MF A01 CSCL 17I

Weighting is employed in synthetic aperture radar (SAR) processing to reduce the sidelobe response at the expense of peak center response height and mainlobe resolution. The weighting effectiveness in digital processing depends not only on the choice of weighting function, but on the fineness of sampling and quantization, on the time bandwidth product, on the quadratic phase error, and on the azimuth antenna pattern. The results of simulations conducted to uncover the effect of these parameters on azimuth weighting effectiveness are presented. In particular, it is shown that multilook capabilities of future SAR systems may obviate the need for consideration of the antenna pattern, and that azimuth time-bandwidth products of over 200 are probably required before the digital results begin to approach the ideal results. J.M.S.

N80-16264*# Computer Sciences Corp., Silver Spring, Md. Systems Sciences Div.
A SURVEY OF AIRBORNE RADAR SYSTEMS FOR DEPLOYMENT ON A HIGH ALTITUDE POWERED PLATFORM (HAPP) Final Report
B. J. Choudhury and K. C. Leung Oct. 1979 39 p refs
(Contract NAS6-6569)
(NASA-CR-156860; CSC/TM-79/6294) Avail: NTIS HC A03/MF A01 CSCL 17I

A survey was conducted to find out the system characteristics of commercially available and unclassified military radars suitable for deployment on a stationary platform. A total of ten domestic and eight foreign manufacturers of the radar systems were identified. Questionnaires were sent to manufacturers requesting information concerning the system characteristics: frequency, power used, weight, volume, power radiated, antenna pattern, resolution, display capabilities, pulse repetition frequency, and sensitivity. A literature search was also made to gather the system characteristics information. Results of the survey are documented and comparisons are made among available radar systems. M.M.M.

N80-16265# Massachusetts Inst. of Tech., Cambridge. Information and Decision Sciences Lab.
ON THE EFFECT OF REDUNDANCY ON THE MULTIPLE ACCESS BROADCAST CHANNEL M.S. Thesis
Oliver Chukwudi Ibe Aug. 1979 78 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A073579; LIDS-TH-924) Avail: NTIS HC A05/MF A01 CSCL 17/2

We consider strategies for transmitting packets over a multiple access broadcast channel. In the strategies considered, a message is formatted into K packets and N-K redundant packets are added to these K packets to form what we call a superpacket. We propose a simple coding scheme that sets these N packets of a superpacket into a special temporal pattern. With a superpacket constructed in this manner, it is possible to reconstruct packets which are lost through collision on the channel with the packets of other superpackets. We compare the throughput of our scheme with that of the slotted Aloha scheme. We use as our retransmission strategy the conflict resolving tree algorithm of Capetanakis. GRA

N80-16266# California Univ., Los Angeles.
SOME FUNDAMENTAL CONSIDERATIONS OF THE EQUATION OF RADIATIVE TRANSFER
J. G. Kuriyan and E. C. G. Sudarshan Oct. 1978 24 p refs
(Contract EY-76-S-05-3992)
(ORO-3992-345) Avail: NTIS HC A02/MF A01

The vector transfer equation of the direct beam (Beer's law) is derived from first principles. It is shown that the analysis of this equation provides a satisfactory resolution of two problems underlying the radiative transfer of the vector electromagnetic field. The results also show that the Beer's law will have to be modified to make a matrix law to accomodate systems that are not spherically symmetric. R.C.T.

N80-16267# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
PROBABILITY OF INTERMODULATION INTERFERENCE IN AN EXPANDED CB SERVICE Final Report
Leslie A. Berry Jul. 1979 26 p refs
(Contract FCC-RA-0056-9)
(PB-300296/1; NTIA/TM-79/15; FCC/PRB/PD-79/01) Avail: NTIS HC A03/MF A01 CSCL 17B

In 1976, the Federal Communications Commission expanded the Citizens Radio Service from 23 to 40 channels. If the band had been expanded more, some channels would have been separated by at least 450 KHz. The intermediate frequency (IF) on many CB receivers is 455 KHz, so separations this large could result in intermodulation product interference. The probability of second order intermodulation interference in an expanded CB service is calculated. The results are presented in the form of decreases in the average operational range of CB stations in the presence of radio noise, co-channel interference, and intermodulation interferences. It is concluded that if 40 single-sideband only channels are added to the present Citizens Radio Service, second-order intermodulation interference will decrease the median operation range by less than 10 percent, while allowing a large increase in the numbers of users. GRA

N80-16268# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
A COMPATIBILITY ANALYSIS OF SPREAD-SPECTRUM AND FM LAND MOBILE RADIO SYSTEMS
John R. Juroshek Aug. 1979 77 p refs
(PB-300651/7; NTIA/REPT-79/23) Avail: NTIS HC A05/MF A01 CSCL 17B

The possibility of overlaying a spread-spectrum system into frequency bands containing conventional FM land-mobile systems is examined. Overlaying is interpreted as meaning the unrestricted operation of spread-spectrum and FM mobiles throughout the same service area and on the same frequency. Conventional

spread-spectrum and FM systems are assumed where a single base serves a large urban area. A theoretical compatibility study is described that concludes that significant interference would result to existing FM systems. This conclusion assumes spread-spectrum transmitter powers comparable to existing FM systems. Landmobile operating frequencies of 150 and 900 MHz are considered. Also examined is the reverse problem of interference from FM to spread spectrum. Curves are prepared showing separation requirement for various channel multipath conditions. A computer simulation program is also described that simulates the operation of a spread-spectrum system in a multiple FM interferer environment. The conclusions are that an overlayed spread-spectrum system also would receive significant interference. A frequency hopping, spread-spectrum system is described that is programmed to miss those FM channels in use at a given locality. The advantages obtained with this technique are briefly discussed. GRA

N80-16269# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
INVESTIGATION OF DIGITAL MICROWAVE COMMUNICATIONS IN A STRONG METEOROLOGICAL DUCTING ENVIRONMENT
R. W. Hubbard Aug. 1979 96 p refs Sponsored in part by Pacific Missile Test Center, Point Mugu, Calif.
(Contract MIPR-N-63126-78MP-31106)
(PB-301212/7; NTIA/REPT-79/24) Avail: NTIS
HC A05/MF A01 CSCL 17B

An experiment conducted over a LOS microwave link off the coast of southern California is described. The objective was to determine the effect of known anomalous propagating conditions, caused by persistent temperature inversions in the atmosphere on a wideband digital communications system. A channel probe was used to measure the effective impulse response of the transmission channel, and bit-error-rate measurements were made on the same probe test signal. In addition, a dual receiver was used to investigate the application of angle diversity on the reception of signals in this propagation environment. The results of the experiment indicate that the test link should, if properly configured, support digital transmission at a mission rate on the order of 50 Mb/s. Recommendations for implementing a digital system for the specific link are given. GRA

N80-16270# Federal Communications Commission, Washington, D. C. Office of Plans and Policy.
COMPARABILITY FOR UHF TELEVISION: A PRELIMINARY ANALYSIS Staff Report, Oct. 1978 - Sep. 1979
Steven R. Brenner, Philip B. Gieseler, Virginia D. Armstrong, and Alex D. Felker Sep. 1979 259 p refs
(PB-301267/1; FCC/OPP-79/02) Avail: NTIS
HC A12/MF A01 CSCL 17B

The evolution of television channel selectors on television receivers and their relevance to vidwing habits are examined. Channel selectors currently in use and their costs and technological capabilities are discussed, as well as current Commission regulations concerning acceptable types of channel selectors. The UHF picture quality handicap is analyzed. Signal behavior from the transmission system to the receiving system is examined. Poor picture quality occurring as a result of the interrelationships between television transmitters, receivers, and antenna systems is also discussed as well as the potential for improvements as a result of changes to one/or a combination of those components. GRA

N80-16271# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
RADAR ABSORBER MEASUREMENT TECHNIQUES AT FREQUENCIES ABOVE 20 GHz Final Report
N. S. Nahman, C. M. Allred, J. R. Andrews, C. A. Hoer, and R. A. Lawton Aug. 1979 71 p refs Sponsored in part by AFAL, Wright-Patterson AFB, Ohio
(PB-299576/9; NBSIR-79-1613) Avail: NTIS
HC A04/MF A01

Methods for implementing automatic permittivity/permeability measurements of radar absorber materials for applications primarily above 20 GHz and into the millimeter wave region to about 100 GHz are discussed. A review of the state of the art of dielectric and magnetic material measurements is given. Automated time domain and frequency domain methods are considered including time domain automatic network analyzers, correlation measurement systems using noise signal sources, and six port network analyzers. GRA

N80-16272# Trans-Communications Corp., Greenwich, Conn.
THE INITIAL GROWTH AND EXPANDING OPPORTUNITIES OF US DOMESTIC SATELLITE SERVICE
H. J. Schlafly, R. E. Button, and B. L. Wormington Feb. 1979 160 p Sponsored by Dept. of Commerce
(PB-300438/9; NTIA/CR-79/3) Avail: NTIS
HC A08/MF A01 CSCL 17B

The growth is charted of U.S. Domestic Satellite Communications during the first years of earth terminal proliferation with emphasis on the compatibility of satellite and cable as a total communication system. The geostationary relay is shown to provide anywhere to everywhere communication for video distribution and for non-video services. The effects of favorable regulation and of continued improvement in terminal equipment are shown to have stimulated satellite usage. Recent growth is illustrated by an earth station index listed by state. Technical characteristics of satellite communications are reviewed, together with procedures for establishing earth terminal sites. The complexity of traffic scheduling is acknowledged as a stimulus for improvement of techniques and development of additional capacity. Opportunities for common carrier, private and shared use are examined. Current or proposed means for accomodating non-video services are described. Elements of digital transmission are examined. The need for interconnection with local distribution systems is described, with particular attention to broadband terrestrial systems. Cable television, private microwave systems and improved common carrier facilities are examined as possible means of supplying this need. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-16273 Colorado State Univ., Fort Collins.
THEORETICAL AND EXPERIMENTAL SQUARE WAVE VOLTAMMETRY Ph.D. Thesis
John Joseph Odea 1979 129 p
Avail: Univ. Microfilms Order No. 7928537

The theory of square wave voltammetry was extended to include electron transfer kinetics, and first order preceding, following and catalytic reactions. The effects of these complications upon experimentally measurable peak positions, heights and widths were predicted by the numerical solution of the integral equations describing the systems. A fast scan square wave technique useful at frequencies up to 1250 Hz and scan rates of 6.25 volts per second was developed to test the theoretical predictions experimentally. A laboratory minicomputer interfaced to a static mercury drop electrode was used for data acquisition and real time control of the experiment. The quasireversible reduction of zinc, the dissociation of cadmium EDTA preceding electron transfer, the rearrangement of hydrazobenzene following electron transfer, and the catalytic reduction of titanium were chosen as model systems. Dissert. Abstr.

N80-16274 Yashiva Univ., New York, N. Y.
PINCHED RELATIVISTIC ELECTRON BEAMS AND COLLECTIVE ACCELERATION OF IONS Ph.D. Thesis
Victor Serlin 1979 129 p
Avail: Univ. Microfilms Order No. 8001271

The collective acceleration of ions by a pinched relativistic electron beam is discussed. Two areas of relativistic electron beam research were investigated, electron beam pinch in the diode and the ion acceleration in an evacuated drift chamber. A 550 keV electron beam with peak current of 55 kA and of 50 nanoseconds duration, was produced in a high voltage diode.

designed specifically for a tight pinching of the electron beam. The characteristics of the electron beam pinch were investigated by means of X-ray pin hole photography, scintillator photography, current and energy measurements in the focal spot of the anode, and damage patterns on witness anode plates. The ion acceleration was studied by means of time analyzed current measurements, ion time of flight analysis, and calorimetry. Results are reported. Dissert. Abstr.

N80-16275 Yeshiva Univ., New York, N. Y.
DIELECTRIC AND PYROELECTRIC PROPERTIES OF FERROELECTRICS Ph.D. Thesis
Yuan-Huai Tsuo 1978 181 p
Avail: Univ. Microfilms Order No. 8001275

The dielectric and pyroelectric properties of ferroelectrics were studied by measuring the temperature and electric field dependence of their dielectric constants and pyroelectric coefficients. Three types of ferroelectrics, classified according to the nature of the order parameters describing their phase transitions, are included: (1) proper ferroelectrics in which the order parameter is the electrical polarization; (2) improper ferroelectrics, in which the order parameter is not the polarization, and the spontaneous polarization arises from a nonlinear coupling of the polarization to the order parameter; and (3) pseudoproper ferroelectrics, in which the order parameter is also not the polarization, but the coupling with the polarization is linear. It is shown that the small dielectric anomalies of improper and pseudoproper ferroelectrics yield an important advantage in infrared detection and pyroelectric energy conversion. But the large Curie constants of proper ferroelectrics are advantageous in thermodielectric energy conversion. Dissert. Abstr.

N80-16276 British Broadcasting Corp., Kingswood (England). Research Dept.
A STATISTICAL ANALYSIS FOR DIGITAL FIELD STRENGTH DATA
A. P. Robinson Nov. 1979 12 p refs
(BBC-RD-1979/24) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Digital equipment using a microprocessor is described which carries out a statistical analysis of field strength data as the measurements are made. The results are obtained immediately and are printed. The analyser is intended primarily for use with a measuring receiver in a vehicle but the report also discusses the scope for other applications. The equipment obtains results which used to be obtained by manual chart analysis, thus an increase in accuracy and speed, and a saving of effort, have been achieved. Author

N80-16277 California Univ., Berkeley.
ELECTROMAGNETIC SCATTERING BY TWO BODIES OF REVOLUTION Ph.D. Thesis
John Frank Hunka 1979 115 p
Avail: Univ. Microfilms Order No. 8000387

A systematic procedure for solving the two body of revolution scattering problem by interfacing with a unimoment program is presented. Spherical vector wave function expansions and addition theorems were investigated. A scatter-independent, modal incident field formulation was developed as a means of interfacing the multiple scattering and unimoment programs. Also, an experimental scattering measurement system was used for the verification of the multiple scattering computations. The verification of the multiple scattering program both numerically and experimentally is discussed in depth. Selected case studies of two body configurations are presented to demonstrate the utility of the program and to lay a foundation for future study and analysis. Dissert. Abstr.

N80-16278# Office of Naval Research, Arlington, Va. Metallurgy and Ceramics Program.
CARBON FIBER ELECTRICAL RESISTANCE MODIFICATION, ITS RELATIONSHIP TO ELECTRICAL EQUIPMENT MALFUNCTION Final Report
1 Sep. 1978 18 p ref Supplement to GIDEP-E134-1524.
(AD-A074656; GIDEP-E134-1623) Avail: NTIS
HC A02/MF A01 CSCL 09/1

This study relates to hazards in the operation of electrical equipment by carbon fibers which come in contact with critical electrical circuits when accidentally dispersed into the air by a variety of means. A carbon Fiber Study Group was convened to consider: (1) the magnitude of resistance changes required to minimize electrical malfunction, (2) whether or not carbon fibers can be modified to meet these requirements, (3) the ease of hardening confined spaces, and (4) the disposal of carbon fibers and composites after use. Conclusions, recommendations, and background information are presented. GRA

N80-16279# Office of Naval Research, Arlington, Va.
CARBON FIBER ELECTRICAL RESISTANCE MODIFICATION, ITS RELATIONSHIP TO ELECTRICAL EQUIPMENT MALFUNCTION Final Report
1 Sep. 1978 64 p refs Supplement to GIDEP-E134-1623
(AD-A074655; GIDEP-E134-152421) Avail: NTIS
HC A04/MF A01 CSCL 09/1

The problem of carbon fibers which come in contact with critical electrical circuits when accidentally dispersed into the air is examined. A Carbon Fiber Study Group was convened to consider whether or not the electrical resistance of carbon fibers could be increased to acceptable levels without altering other desirable characteristics. The group considered: (1) the magnitude of resistance changes required to minimize electrical equipment malfunction; (2) whether or not carbon fibers can be modified to meet these requirements; (3) the ease of hardening confined spaces; and (4) the disposal of carbon fibers and composites after use. GRA

N80-16280# Westinghouse Research Labs., Pittsburgh, Pa. Electrotechnology Dept.
AN EVALUATION OF DIRECT CURRENT ELECTROMAGNETIC PROPULSION IN SEAWATER Final Report, Jan. - May 1979
George T. Hummert Aug. 1979 83 p refs
(Contract N00014-78-C-0667; RF32391801)
(AD-A074830; Rept-79-9B2-EMSUB-R1; ONR-CR-168-007-1)
Avail: NTIS HC A05/MF A01 CSCL 13/10

Electromagnetic seawater thrusters may be classified in one of three general categories: internal duct dc, external field dc, and peristalic ac. Internal duct dc thruster offers the advantages of low magnetic field leakage, simple construction, and potentially high reliability. The most efficient internal duct configuration consists of a converging inlet nozzle and a straight discharge duct. Ideal efficiency calculations based on the one-dimensional Bernoulli equation show that thrusters should be designed with large cross-sectional areas and operate at low discharge velocities. In practice, this may be accomplished by using multiple thruster ducts. Conductivity enhancement, high magnetic fields, and long electrodes also improve efficiency. While the magnetic field-volume requirements for a thruster capable of propelling full-size (2000 ton displacement) submarines appear beyond the present technology, it may be feasible to use superconducting magnets to build high efficiency, internal duct thrusters capable of maneuvering small (approx. 10 ton displacement) submersibles. GRA

N80-16281# Argonne National Lab., Ill.
SUPERCONDUCTING NOTCH FILTER
C. S. Pang, C. M. Falco, R. T. Kampwirth, I. K. Schuller, J. J. Hudak, and T. A. Anastasio 1979 17 p refs Presented at the Cryog. Eng. Conf., Madison, Wis., 21 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790815-23) Avail: NTIS HC A02/MF A01

Results of a preliminary investigation of a superconducting notch filter for possible application in the 2 to 30 MHz high frequency (HF) communication band are presented. The circuit was successfully implemented using planar geometry so that closed cycle refrigeration could be used to cool circuits fabricated from high T sub c/Nb3Sn or Nb3Ge thin films. In the present design, circuit Q's of about 2000 were obtained with 50-ohm source and output impedance (TFD). DOE

N80-16282# Brookhaven National Lab., Upton, N. Y.
ALTERATION OF THE SUPERCONDUCTING PROPERTIES OF A15 COMPOUNDS AND ELEMENTARY COMPOSITE SUPERCONDUCTORS BY NON-HYDROSTATIC ELASTIC STRAIN
D. O. Welch 1979 35 p refs Presented at the Cryogenic

Eng. Conf., Madison, Wis., 21 Aug. 1979
(Contract EY-76-C-02-0016)
(BNL-26400; CONF-790815-10) Avail: NTIS
HC A03/MF A01

The effects of elastic strains on the critical temperatures, magnetic fields, and current densities of superconducting A15 compounds are considered including nonhydrostatic strain states. The experimental evidence, obtained by a variety of techniques, concerning the strain dependence of the critical properties of a number of A15 compounds is reviewed. Theoretical models for describing such effects are discussed. DOE

N80-16283# California Univ., Livermore. Lawrence Livermore Lab.
ELECTROSTATIC FILTERS GENERATED BY ELECTRIC FIELDS
W. Bergman, H. Hebard, R. Taylor, and B. Lum 23 Jul. 1979 31 p refs Presented at the World Filtration Congr., London, 18 Sep. 1979
(Contract W-7405-eng-48)
(UCRL-81926; CONF-790907-1) Avail: NTIS
HC A03/MF A01

The theoretical and experimental findings on fibrous filters converted to electrostatic operation by a nonionizing electric field are presented. Compared to a conventional fibrous filter, the electrostatic filter has a much higher efficiency and significantly lower pressure drop at the same level of particle loading. Two theoretical models of filter clogging are presented. The dendrite model simulates filter clogging of conventional fibrous filter without an electric field and the increasing fiber model simulates filter clogging with an applied electric field. DOE

N80-16284# United Technologies Corp., South Windsor, Conn. Power Systems Div.
AN ac/dc POWER CONVERTER FOR BATTERIES AND FUEL CELLS Annual Report
Ramon W. Rosati, ed. Aug. 1978 98 p refs Sponsored by Elec. Power Res. Inst.
(EPRI-EM-662) Avail: NTIS HC A05/MF A01

The overall objective of the EPRI program is the design of an advanced power converter for use in both battery energy storage and fuel cell generation systems. This will be accomplished by expansion of the existing FCG-1 fuel cell power conditioning inverter into a high-efficiency inverter-rectifier system employing improved commutation circuits and advanced semiconductor devices capable of operating over wider dc voltage ranges. A separate but concurrent program for the U. S. Department of Energy (DOE) is examining augmentation of the present FCG-1 inverter for operation as an inverter-rectifier with battery systems; feasibility and operating characteristics were demonstrated. Activities ahp accomplishments in the EPRI program include revision of the preliminary specification for ac/dc conversion equipment, survey of seven semiconductor manufacturers to project characteristics of thyristors, screening of fifteen commutation concepts and selection of the two most promising options for experimental evaluation, and modifications of existing experimental power pole hardware to evaluate the selected advanced commutation circuits. DOE

N80-16285# General Electric Co., St. Petersburg, Fla.
IMPROVING THE VOLTAGE HOLDOFF PERFORMANCE OF ALUMINA INSULATORS IN VACUUM THROUGH QUASI-METALLIZING
H. Craig Miller 6 Aug. 1979 24 p refs
(Contract EY-76-C-04-0656)
(GEPP-TIS-441) Avail: NTIS HC A02/MF A01

Treatment of the surface of an alumina insulator with coatings incorporating varying amounts of Cr, Mn, and Ti was examined for increasing the vacuum voltage holdoff capability of the insulator. During processing (quasimetallizing) the coating penetrates into the alumina, so it is insensitive to mechanical damage. The quasimetallizing treatment and the effectiveness of each metal and the metal mixes toward improving the voltage holdoff capability of alumina are reported. Quasimetallizing with appropriate formulations were shown to change the surface characteristics of alumina in two ways: it decreases the surface resistivity of the alumina, and it decreases the secondary electron emission yield of the alumina. DOE

N80-16286# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
SHAFT TORSIONAL OSCILLATIONS OF HYDROGENERATORS
L. E. Eilts and Eugene Campbell Aug. 1979 30 p
(PB80-102155; REC-ERC-79-6) Avail: NTIS
HC A03/MF A01 CSCL 10B

The efforts to ahalyze, model, and instrument the shaft torsional oscillations of electric generators are described. The mechanics of the shaft torsional modes are presented through the defining analytical equations from which block diagram and analog computer representation of shaft torsional systems were developed. Results of an analog study of the torsional mode of a hydrogenerator as well as calculated data are presented. An instrumenation system which employs shaft-mounted strain gages to provide a torsional signal was developed for direct field measurement of the torsional behavior of hydrogenerator shafts. The design and circuit configuration of that instrumentation system are presented. GRA

N80-16287# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: NONDESTRUCTIVE TESTS USED TO INSURE THE INTEGRITY OF SEMICONDUCTOR DEVICES, WITH EMPHASIS ON ACOUSTIC EMISSION TECHNIQUES Final Report
George G. Harman Sep. 1979 76 p refs
(ARPA Order 2397)
(PB80-101801; NBS-SP-400-59; LC-79-600131) Avail: NTIS
HC A05/MF A01 CSCL 09A

Device assembly techniques and problems are discussed followed by a review of six important nondestructive tests used during and after device packaging to insure the mechanical integrity of completed electronic devices. The economic and other factors that result in the choice of one screen over another and to production line statistical sampling (LTPD) appropriate to special high reliability device lots such as those used for space flight are included. The status of theory of acoustic emission as it can be applied to microelectronics is discussed. Passive AE techniques are applied to establishing the mechanical bond integrity of beam lead, flip chip, and tape-bonded integrated circuits as well as components in hybrid microcircuits. GRA

N80-17017# Joint Publications Research Service, Arlington, Va.
DEVICES FOR MANUFACTURE OF MICROSTRUCTURES, CHIPS DESCRIBED
K.-W. Gommel *In its* E. Europe Rept.: Sci. Affairs, No. 659 (JPRS-74911) 11 Jan. 1980 p 58-74 Transl. into ENGLISH from Feingeraetetech. (E. Berlin), v. 28, no. 10, 1979 p 446-450
(For primary document see N80-17015 07-99)
Avail: NTIS HC A07/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-16288 Engineering Sciences Data Unit, London (England).
LOSSES CAUSED BY FRICTION IN STRAIGHT PIPES WITH SYSTEMATIC ROUGHNESS ELEMENTS
1979 44 p
(ESDU-79014; ISBN-0-85679-258-6) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

Data for calculating the pressure drop due to friction for the flow of fluids in straight pipes containing systematic roughness elements is provided. The data is applicable to the calculation of pressure drop in pipes containing roughness elements, such as welds at pipe joints, or artificially introduced elements to increase heat transfer to or from the fluid. The developed calculations may be applied for both heating and cooling of

gases and liquids in pipes of circular section containing transverse ribs, helical threads, longitudinal fins, or three dimensional roughness arrays, and also to pipes of rectangular or annular section containing a more limited range of roughness element types. ESDU (GRA)

N80-16289 Brigham Young Univ., Provo, Utah.
TRANSITIONAL FLOW IN AN ANNULUS Ph.D. Thesis
James Max Peterson 1979 165 p
Avail: Univ. Microfilms Order No. 8000087

Fully developed laminar, transitional and turbulent flow of a Newtonian fluid in an annulus of diameter ratio 0.0415 was investigated. Measurements were made of the axial pressure gradient, turbulence intensity, velocities, location of the point of maximum velocity. A range of Reynolds numbers (based on the diameter difference and mass flow rate) from 750 to 130,000 was covered. It was shown that the mean velocity profiles were not rectilinear laminar, were fully developed axially, and varied with the angular position around the annulus indicating a complex laminar flow. Composite pipe measurements show that when a fully developed Poiseuille pipe flow is subjected to several types of disturbance, the transition behavior of the stream depends upon whether the stream impinging upon the disturbance source is itself laminar or turbulent. Dissert. Abstr.

N80-16290 Iowa State Univ. of Science and Technology, Ames.
STABILITY ANALYSIS OF INTERFACIAL CIRCULATION ON A STATIC LIQUID DROP WITH FORCED INTERNAL CIRCULATION Ph.D. Thesis
Soo Bong Joo 1979 181 p
Avail: Univ. Microfilms Order No. 8000142

A hemispherical constant volume drop with forced internal circulation was considered as a model approximating a real drop at a similar stage of formation. It was proposed that the ordered flow patterns of interfacial circulation observed experimentally on the surface of such a drop are a manifestation of hydrodynamic instability, which was affected by internal flow conditions within the drop and by the properties of the interface. A simplified mathematical model was analyzed in order to detail the mechanism for the onset of interfacial circulation from a non-circulatory basic state. Dissert. Abstr.

N80-16291 Stanford Univ., Calif.
NATURAL CONVECTION IN A VERTICAL CHANNEL WITH HEAT AND MASS TRANSFER AND FLOW REVERSAL Ph.D. Thesis
Tsong-Sheng Lee 1979 175 p
Avail: Univ. Microfilms Order No. 8001957

The time-dependent, variable-property governing equations together with the assumed boundary conditions at the channel entrance and exit are solved by using an implicit finite-difference method. Steady-state solutions are obtained for Grashof numbers, GT, up to 700, and channel height-to-width ratios, 10 and 16, over a range of injected mass fluxes of CO_2. Particular attention is given to the effects of the reverse flow on the heat and mass transfer, and graphical results are presented. Mach-Zehnder interferometer and a traversing thermocouple probe were used simultaneously to determine the profiles of temperature and mass concentration in the channel. Results of the measurements are presented and assessed. Experimental results were also obtained for the stability characteristics of the reverse flow, and are presented graphically. Dissert. Abstr.

N80-16292 Stanford Univ., Calif.
AN EXPERIMENTAL STUDY OF MULTIPLE JET MIXING Ph.D. Thesis
Anjaneyulu Krothapalli 1979 166 p
Avail: Univ. Microfilms Order No. 8001955

Results of hot-wire measurements in an incompressible jet issuing from an array of rectangular lobes, equally spaced with their small dimensions in a line, both as a free jet, and as a confined jet, are presented. The quantities measured include mean velocity and the Reynolds stress in the two central planes of the jet at various stations downstream of the nozzle exit. In the case of a single rectangular free jet, the flow field of the jet is found to be characterized by the presence of three distinct regions in the axial mean velocity decay. In the case of a multiple free jet, the flow field for downstream distance X greater than 60D (D = width of a lobe) resembles that of a jet exiting from a two dimensional nozzle with its short dimension being the long dimension of the lobe. In case of a confined multiple jet the flow field is observed to be nearly homogeneous and isotropic for X greater than 60D. Dissert. Abstr.

N80-16293 Utah Univ., Salt Lake City.
THE EFFECT OF SUPERHEATING ON THE PERFORMANCE OF FLOATING DROPLET DIRECT CONTACT HEAT EXCHANGERS Ph.D. Thesis
Calvin Albert Kodres, Jr. 1979 174 p
Avail: Univ. Microfilms Order No. 8000972

A mathematical model of a single evaporating, superheated droplet is formulated and studied numerically to determine instantaneous and average heat transfer rates to the droplet at various stages of evaporation. An explicit procedure for analyzing the entire heat exchanger is then developed based upon the application of a dimensional analysis derivation of a relationship for the heat flux from the single evaporating droplet. The results of the numerical model are used to define the parameters and determine the required constants. Two operating geothermal heat exchangers are designed using this procedure. The two sites both have a moderate temperature brine and both systems utilize pentane as the working fluid. The heat exchanger vessel pressures are varied, providing a range of superheats from 19 to 52 C. The average difference between the calculated and measured total heat flux is about 16%. Dissert. Abstr.

N80-16294*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
EFFECT OF STREAMWISE VORTICES ON TOLLMIEN-SCHLICHTING WAVES
Ali H. Nayfeh Mar. 1979 20 p refs
(Grant NsG-1255; Contract N00014-75-C-0381)
(NASA-CR-162654; VPI-E-79.12) Avail: NTIS HC A02/MF A01 CSCL 20D

The method of multiple scales is used to determine a first order uniform expansion for the effect of counter rotating steady streamwise vortices in growing boundary layers on Tollmien-Schlichting waves. The results show that such vortices have a strong tendency to amplify three dimensional Tollmien-Schlichting waves having a spanwise wavelength that is twice the wavelength of the vortices. An analytical expression is derived for the growth rates of these waves. These growth rates increase linearly with increasing amplitudes of the vortices. Author

N80-16295# Argonne National Lab., Ill. Engineering and Mechanics Section.
EVALUATION OF LAGRANGIAN, EULERIAN, ARBITARY LAGRANGIAN-EULERIAN METHODS FOR FLUID-STRUCTURE INTERACTION PROBLEMS IN HCDA ANALYSIS
Y. W. Chang, H. Y. Chu, and C. Y. Wang 1979 16 p refs
Presented at 5th SMIRT Conf., Berlin, 13-17 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790802-55) Avail: NTIS HC A02/MF A01

The analysis of fluid-structure interaction involved the calculation of both fluid transient and structure dynamics. In the structural analysis, Lagrangian meshes were used exclusively, whereas for the fluid transient, Lagrangian, Eulerian, and arbitrary Lagrangian-Eulerian meshes were used. An evaluation on these three types of meshes is presented with emphasis on the applicability of the method in analyzing fluid-structure interaction problems in hypothetical core disruptive accident analysis. DOE

N80-16296*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
NONPARALLEL STABILITY OF THREE-DIMENSIONAL COMPRESSIBLE BOUNDARY LAYERS. PART 1: STABILITY ANALYSIS Final Report
Nabil M. El-Hady Feb. 1980 38 p refs
(Grant NsG-1645)
(NASA-CR-3245) Avail: NTIS HC A03/MF A01 CSCL 20D

A compressible linear stability theory is presented for nonparallel three-dimensional boundary-layer flows, taking into account the normal velocity component as well as the streamwise and spanwise variations of the basic flow. The method of multiple scales is used to account for the nonparallelism of the basic

flow, and equations are derived for the spatial evolution of the disturbance amplitude and wavenumber. The numerical procedure for obtaining the solution of the nonparallel problem is outlined. Author

N80-16297*# Systems and Applied Sciences Corp., Riverdale, Md.
ANALYTICAL AND DESIGN TECHNIQUES FOR DRAG REDUCTION STUDIES ON WAVY SURFACES Final Report
R. Balasubramanian Jan. 1980 22 p refs
(Contract NAS1-15278)
(NASA-CR-3225) Avail: NTIS HC A02/MF A01 CSCL 20D

Numerical models for two dimensional turbulent boundary layers over wavy surfaces were investigated. Computations for wavy wall boundary layers indicate possibilities of overall drag reduction in a parameter range of the geometry of the wall. The correction technique using integral methods for analyzing arbitrary surfaces was found to be unsuitable for some cases of interest in drag reduction; a Navier-Stokes solver for wavy walls was built to test these problems. Test results of the Navier-Stokes solver indicate that the solution techniques are accurate enough to handle complex geometries and steep variations in fluid properties. Author

N80-16298*# Stanford Univ., Calif.
EVOLUTION OF WEAK DISTURBANCES IN INERT BINARY MIXTURES
M. L. Rasmussen Aug. 1977 32 p refs Sponsored in part by NASA
(NASA-TM-80925; SU-JIAA-TR-6) Avail: NTIS HC A03/MF A01 CSCL 20D

The evolution of weak disturbances in inert binary mixtures is determined for the one-dimensional piston problem. The interaction of the dissipative and nonlinear mechanisms is described by Burgers' equation. The binary mixture diffusion mechanisms enter as an additive term in an effective diffusivity. Results for the impulsive motion of a piston moving into an ambient medium and the sinusoidally oscillating piston are used to illustrate the results and elucidate the incorrect behavior pertaining to the associated linear theory. Author

N80-16299*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HOMOGENEOUS VORTEX MODEL FOR LIQUID SLOSH IN SPINNING SPHERICAL TANKS
Michael El-Raheb and Paul Wagner 15 Nov. 1979 46 p refs
(Contract NAS7-100)
(NASA-CR-162725; JPL-Pub-79-99) Avail: NTIS HC A03/MF A01 CSCL 20D

The problem of forced fluid sloshing in a partially filled spinning spherical tank is solved numerically using the finite element method. The governing equations include Coriolis acceleration, empirical fluid damping and spatially homogeneous vorticity first introduced by Pfeiffer. An exponential instability similar to flutter is detected in the present simulation for fill ratios below 50 percent. This instability appears in the model as a result of the homogeneous vortex assumption since the free slosh equations are neutrally stable in the Liapunov sense. Author

N80-16300*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TURBULENCE MEASUREMENTS IN THE BOUNDARY LAYER OF A LOW-SPEED WIND TUNNEL USING LASER VELOCIMETRY
Edward T. Schairer Feb. 1980 25 p refs
(NASA-TM-81165; A-8058) Avail: NTIS HC A02/MF A01 CSCL 20D

Laser velocimeter measurements in an incompressible, turbulent boundary layer along the wall of a low-speed wind tunnel are presented. The laser data are compared with existing hot-wire anemometer measurements of a flat plate, incompressible, turbulent, boundary layer with zero pressure gradient. An argument is presented to explain why previous laser velocimeter measurements in zero pressure gradient, turbulent boundary layers have shown an unexpected decrease in turbulent shear stresses near the wall. M.M.M.

N80-16301# Stanford Univ., Calif. Dept. of Mechanical Engineering.
INSTRUMENTATION FOR THE MEASUREMENT OF TURBULENCE COMPONENTS IN A THREE-DIMENSIONAL FLOW FIELD Final Report, 1 May - 30 Nov. 1978
M. Frota and R. J. Moffat Aug. 1979 76 p refs
(Grant AF-AFOSR-3597-78; AF Proj. 2307)
(AD-A073954; AFOSR-79-0957TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

A three-coordinate hot-wire anemometer system for turbulence measurements has been implemented for use in three-dimensional flows. High-speed analog processing produces the turbulence data in real time, including all double correlations. A 2 mm diameter miniature probe has been developed. The system has been tested in reference flows and used in a curved boundary layer. GRA

N80-16302# Minnesota Univ., Minneapolis. Hydraulic Lab.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF DRAG REDUCING POLYMER ADDITIVES ON SURFACE PRESSURE FLUCTATIONS ON BODIES OF REVOLUTION WITH ROUGH SURFACES MOVING THROUGH WATER Final Report, 1 May 1977 - 30 Apr. 1978
Edward Silberman May 1978 40 p refs
(Contract N00014-77-C-0356; SR-230101)
(AD-A073836; Rept-172) Avail: NTIS HC A03/MF A01 CSCL 20/4

A sound detector in the surface of a moving body receives not only sound signals radiated from a distant source but also detects pressure fluctuations originating in the turbulent boundary layer of the fluid surrounding the body. The purpose of the present work was to assess the magnitude of the surface pressure fluctuations on a body moving in water and in water with polymer additive under nearly zero pressure gradient conditions. Measurements were made using a single transducer in the surface of an axi-symmetric body. Both smooth and grit-roughened surfaces were used. Mean square pressure fluctuation amplitudes were measured as a function of frequency, non-dimensionalized, plotted, and compared with some results obtained by others in both water and air. It was concluded that the addition of roughness to a smooth surface increases the amplitude at the peak of the spectrum and at all lower frequencies. Polymer additive in the water has just the opposite effect on a rough-surfaced body, decreasing the amplitude at the peak and at all lower frequencies, the reduction increasing monotonically with drag reduction. There was little or no effect at high frequencies attributable to either roughness or polymer additive, but it must be noted that the transducer used was too large to obtain a true measure of amplitude at the highest frequencies. The peak of the spectrum in water appears to have a somewhat higher amplitude than it does in air. GRA

N80-16303# Argonne National Lab., Ill.
VAPOR LOCKING AND HEAT TRANSFER UNDER TRANSIENT AND STEADY STATE CONDITIONS
C. J. Chen, S. T. Wang, and J. W. Dawson 1979 18 p refs Presented at the Cryogenic Eng. Conf., Madison, Wis., 21 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790815-19) Avail: NTIS HC A02/MF A01

The vapor locking in the cooling channels of a cryostable superconducting magnet is studied. The heat transfer characteristics under steady state and transient conditions, and the effects of vapor accumulation of the multiple coil layers are investigated. The critical steady state heat flux for the transition from nucleate boiling to film boiling is reported along with the critical transient energy density for the boiling transition. DOE

N80-16304# Knolls Atomic Power Lab., Schenectady, N. Y.
BOUNDARY CONDITIONS FOR FLOW COMPUTATION WITH NONORTHOGONAL CURVILINEAR COORDINATES
P. F. Muro and E. L. Wachspress Jul. 1979 14 p refs Presented at the Am. Soc. of Mech. Engr. Winter Ann. Meeting, New York, 2 Dec. 1979
(Contract EY-76-C-12-0052)
(KAPL-4123; CONF-791205-4) Avail: NTIS HC A02/MF A01

The manner in which boundary conditions are handled at

walls and at channel inlet and outlet was incorporated in the equations derived to determine the flow with nonorthogonal curvilinear coordinates. DOE

N80-16305# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
SCALING OF SOME FLOWFIELDS WITH FLAMES
F. V. Bracco 1978 49 p refs Presented at the Intern. Symp. on Combustion Modeling in Reciprocating Engines, Warren, Mich., 6 Nov. 1978
(Contract EC-77-S-02-4191)
(CONF-7811102-2) Avail: NTIS HC A03/MF A01

A mathematical model for flow fields with flames is developed and applied to the combustion kinetics of internal combustion engines. DOE

N80-16306# Argonne National Lab., Ill. Engineering Mechanics Section.
QUASI-EULERIAN FORMULATION FOR FLUID-STRUCTURE INTERACTION
J. M. Kennedy, T. Belytschko, and D. F. Schoeberle 1979 20 p refs Presented at the Intern. Conf. on Structural Mechanics in Reactor Technology, Berlin, 13 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790802-66) Avail: NTIS HC A02/MF A01

A quasi-Eulerian finite element formulation used for the treatment of the fluid in fluid-structure interaction problems is described. The present formulation is applicable both to plane two dimensional and axisymmetric three dimensional problems. The application of the method is illustrated in two problems: a two dimensional model of a cross section of a subassembly configuration, where the quasi-Eulerian formulation is used to model the fluid adjacent to the structures and in the channel between the subassemblies; and pressure transients in a straight pipe, where the axisymmetric formulation is used to model the fluid in the pipe. DOE

N80-16307# California Univ., Livermore. Lawrence Livermore Lab.
TURBULENT DUSTY GAS MOTIONS WITH WEAK STATISTICAL COUPLING
Alfred C. Buckingham 17 May 1979 22 p refs Presented at the AIAA Fluid and Plasma Dyn. Conf., Williamsburg, Va., 24 Jul. 1979
(Contract W-7405-eng-48)
(UCRL-82131; CONF-790704-1) Avail: NTIS HC A02/MF A01

Computer simulations were used to describe the random motions and resulting dispersal of gas borne particulates in turbulent internal ballistics flow. Force, energy and motion coupling between particles and gas was assumed weak, with negligible back influence from particles to gas flow structure. Individual particle to gas relative velocities were obtained at incremental time steps by randomization subject to the constraint that their ensemble averaged motions were consistent with the locally computed turbulent intensity. Influence of the particles on turbulent transport and wall erosion is discussed. DOE

N80-16308# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
APPLICATION OF THE FINITE ELEMENT METHOD TO THE NONLINEAR INVERSE HEAT CONDUCTION PROBLEM USING BECK'S SECOND METHOD
B. R. Bass 1978 44 p refs Presented to the ASME Meeting, San Francisco, Calif., 10 Dec. 1978
(Contract W-7405-eng-26)
(K/CSD/INF-78/20; CONF-781202-16) Avail: NTIS HC A03/MF A01

The application is presented of a solution technique for the inverse problem that utilizes a finite element heat conduction model and Beck's nonlinear estimation procedure. The technique is applicable to the one-dimensional nonlinear model with temperature-dependent thermophysical properties. The formulation is applied first to a numerical example with a known solution. The example treated is that of a periodic heat flux imposed on the surface of a rod. The computed surface heat flux is compared with the imposed heat flux to evaluate the performance of the technique in solving the inverse problem. Finally, the technique is applied to an experimentally determined temperature transient taken from an interior point of an electrically-heated composite rod. The results are compared with those obtained by applying a finite difference inverse technique to the same data. DOE

N80-16309# Los Alamos Scientific Lab., N. Mex.
CATALOG OF TWO-DIMENSIONAL VORTEX PATTERNS
L. J. Campbell and R. Ziff Oct. 1978 42 p refs
(Contract W-7405-eng-36)
(LA-7384-MS) Avail: NTIS HC A03/MF A01

The two dimensional patterns that correspond to minima in the free energy of identical parallel vortices inside a rotating cylinder of liquid such as superfluid He-4 are listed. All known stable patterns are listed for N = 1,2,..., 30, 37, 50, where N is the number of vortices. The two lowest energy patterns are shown for all triangular numbers, $N = 1 + 6(1+2+3+..)$, through N = 216. For each value of N the different patterns are ordered according to their relative free energy. DOE

N80-16310# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
NUMERICAL SOLUTION OF THREE-DIMENSIONAL NATURAL CONVECTION BY THE STRONGLY IMPLICIT PROCEDURE
D. W. Pepper and S. D. Harris 1978 13 p refs Presented at the ASME Meeting, San Francisco, 10 Dec. 1978
(Contract EY-76-C-09-0001)
(DP-MS-78-14; CONF-781202-3) Avail: NTIS HC A02/MF A01

A numerical model was developed to solve three-dimensional laminar flow in enclosures. The model is based on a three-dimensional strongly implicit procedure. In simple cases of natural convection due to differential side heating, numerical results at low and moderate Rayleigh numbers agree with results appearing in the literature. Although the model requires a moderate amount of computer storage, computation times are relatively fast. The simple case of heating a cubical room by a uniform floor or ceiling heat system with a vertical wall exposed to a uniformly cooled surface is also investigated. DOE

N80-16311# Iowa State Univ. of Science and Technology, Ames. Heat Transfer Lab.
PREDICTION OF LAMINAR AND TURBULENT FLOW HEAT TRANSFER IN ANNULAR PASSAGES
M. R. Malik and R. H. Pletcher Mar. 1979 285 p refs
(Grant NSF ENG-74-22193)
(PB-299867/2; ISU-ERI-AMES-79099) Avail: NTIS HC A13/MF A01 CSCL 20D

A finite difference numerical procedure for treating variable property laminar and turbulent convective heat transfer in straight annular passages is presented. The calculation scheme is evaluated for both laminar and turbulent flow including laminar upward forced flow with buoyancy. Models using an ordinary differential equation for the transport of mixing length scale in the outer part of the flow and employing a transport equation for turbulence kinetic energy are considered. Predictions are compared to experimental data. The experimentally observed nonmonotonic development of centerline velocity and other flow parameters in a plane duct are well predicted by the model using the transport equation for length scale. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-16312 British Broadcasting Corp., Kingswood (England).
DIGITAL RECORDING USING HOLOGRAM ARRAYS: SOME INITIAL EXPERIMENTS IN 100 M bit/s RECORDING

K. Hacking and J. L. Riley Nov. 1979 20 p refs
(BBC-RD-1979/23) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The construction of an experimental holographic recorder has advanced sufficiently to carry out some initial experiments and to obtain some sample recordings of hologram tracks written on continuously moving photographic film. The hologram exposures and data transfer rates were commensurate with those values required for digital television recording. Careful analysis of the reconstructed hologram images from the test recordings has revealed some problems associated with the film and its processing for this application. The results have also directed attention to several critical areas of the proposed system and underlined the deficiencies still remaining in the principal transducers such as the page-composer and the digital light-deflector. Author

N80-16313*# National Aeronautics and Space Administration. Pasadena Office, Calif.
FARADAY ROTATION MEASUREMENT METHOD AND APPARATUS Patent Application
Milton H. Brockman, inventor (to NASA) (JPL) Filed 21 Dec. 1979 19 p
(Contract NAS7-100)
(NASA-Case-NPO-14839-1; US-Patent-Appl-SN-106119) Avail: NTIS HC A02/MF A01 CSCL 14B

A Faraday measuring apparatus utilized in conjunction with the specific receiver array provides a means for comparing the phase of a reference signal in the receiver array to the phase of a tracking loop signal related to the incoming signal, and comparing the phase of the reference signal to the phase of the tracking signal shifted in phase by 90 degrees. NASA

N80-16314# Brookhaven National Lab., Upton, N. Y.
THERMOLUMINESCENCE DATING APPARATUS EFFICIENCY MEASUREMENT USING A STANDARD LIGHT SOURCE
G. W. Carriveau (Metropolitan Museum of Art, New York) 1978 11 p
(Contract EY-76-C-02-0016)
(BNL-24525) Avail: NTIS HC A02/MF A01

The thermoluminescence apparatus, designed to improve upon light collection and transmission properties in relation to current dating systems, is evaluated. Two methods of light collection, one employing atmospheric reflectors and the other using a reflector and lens system are described. In order to compare the relative effectiveness of these two systems, and to compare their performance against theoretical predictions or future improvements, a standard lamp and housing were developed and calibrated. Two types of miniature lamps were evaluated for this purpose. Their characteristics are presented. DOE

N80-16315# Mitre Corp., McLean, Va. Metrek Div.
PRELIMINARY EVALUATION OF COMMERCIAL CONTINUOUS INSTRUMENTATION FOR THE MEASUREMENT OF VISCOSITY AND COAL CONCENTRATION OF COAL-OIL MIXTURES (COM)
A. J. Sabadell Oct. 1978 59 p refs
(Contract EX-76-C-01-2453)
(HCP/T2463-03) Avail: NTIS HC A04/MF A01

Several alternative commercial instruments for continuous monitoring of viscosity and suspended solids concentration are evaluated in terms of their applicability to the needs of the ongoing Coal-Oil Mixture (COM) Program. For viscosity measurements the rotational type instrument is preferred. For coal concentration measurements the gamma radiation and the sonic types are essentially equal in terms of capability. The results obtained with the latter are promising. Nevertheless, the most promising instruments as well as the others discussed should be tested more extensively before final selection is made. DOE

N80-16316# National Bureau of Standards, Washington, D.C.
NBS INTERAGENCY TRANSDUCER PROJECT: AN OVERVIEW, 1951 - 1979 Final Report
Paul S. Lederer Aug. 1979 50 p refs
(PB-300369/6; NBS-TN-1110) Avail: NTIS HC A03/MF A01 CSCL 14B

The performance of sensory transducers primarily those used in telemetry was studied. The background and history of the project, its objectives, the techniques and specialized facilities developed and used, and of some of the publications that were issued from the project are described. GRA

N80-16317# Arizona Dept. of Transportation, Phoenix.
OPTICAL SIEVE COMPARATOR DEVELOPMENT PROJECT Final Report, Jun. 1978 - Jun. 1979
Gene Poluianov and Frank P. Mancini Jun. 1979 84 p
(PB-300472/8; FHWA/AZ-78/14) Avail: NTIS HC A05/MF A01 CSCL 14B

The development of an optical sieve comparator for the measurement and certification of sieve conformance to specifications is described. The comparator features: (1) measurement of a wide range of mesh sizes (3/8 in. to no. 400); (2) GO/NO GO sampling for spotcheck statistical certification; (3) absolute measurement; (4) simple calibration procedures; (5) variable optical path distance for wide range magnification; (6) folded optical path; (7) visual resolution and repeatability to 1.5 microns; (8) individual precision viewing reticles for each sieve mesh size; (9) rapid and convenient operation. GRA

N80-16318# National Technical Information Service, Springfield, Va.
HOT FILM ANEMOMETRY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Guy E. Habercom, Jr. Sep. 1979 63 p Supersedes NTIS/PS-78/0879; NTIS/PS-77/0783; NTIS/PS-76/0731; NTIS/PS-75/664
(NTIS/PS-79/0909/6; NTIS/PS-78/0879; NTIS/PS-77/0783; NTIS/PS-76/0731; NTIS/PS-75/664) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

The principles of hot film anemometer operation are summarized. Wind tunnel and laboratory tests are described. Flow field dynamics are discussed involving turbulence, boundary layers, separation, shock waves, and stresses. Mathematical models and analysis are presented along with computer techniques and a number of applications. GRA

N80-16319# National Technical Information Service, Springfield, Va.
HOT WIRE ANEMOMETRY, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1971 - Aug. 1979
Guy E. Habercom, Jr. Sep. 1979 229 p Supersedes NTIS/PS-78/0882; NTIS/PS-77/0782; NTIS/PS-76/0732; NTIS/PS-75/663
(NTIS/PS-79/0957/5; NTIS/PS-78/0882; NTIS/PS-77/0782; NTIS/PS-76/0732; NTIS/PS-75/663) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

Abstracts covering the area of hot wire anemometry are presented. Citations include: principles; calibrating; circuit diagrams; flow measurement; hypersonic, supersonic, transonic, and subsonic characteristics; boundary layer studies; turbulence; jet, pipe, and tunnel flow; mathematical models; wind tunnel model tests, airport structure simulation; mass transfer and flow stability; probe modifications; flow about geometric forms; flow patterns; and related topics. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-16320 Stanford Univ., Calif.
CW LASER ANNEALING OF ION IMPLANTED SINGLE CRYSTAL SILICON Ph.D. Thesis
Arnon Gat 1979 130 p
Avail: Univ. Microfilms Order No. 8001921

Experiments were performed on ion implanted arsenic and boron into single crystal silicon. Even though the two ions are different the same basic, unique properties to the cw laser anneal are found. These are: (1) high level of impurity activation as long as the concentration is below solid solubility, (2) crystalline perfection down to 10A resolution, and (3) lack of dopants redistribution from their as-implanted profile. It was shown that when the implanted layer is too deep, as in the case of high energy arsenic or silicon implants, the recrystallization is not

complete and the resultant structure is polysilicon. The thermal model presented suggests that the cw laser annealing process is performed under thermal equilibrium. Dissert. Abstr.

N80-16321* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LASER DOPPLER VELOCITY SIMULATOR Patent
John M. Franke, inventor (to NASA). Issued 4 Dec. 1979. 7 p. Filed 28 Jul. 1978. Supersedes N78-29435 (16 - 20, p 2671)
(NASA-Case-LAR-12176-1; US-Patent-4,176,950; US-Patent-Appl-SN-929083; US-Patent-Class-356-28; US-Patent-Class-332-751; US-Patent-Class-350-359; US-Patent-Class-356-243) Avail: US Patent and Trademark Office CSCL 20E

A method and apparatus for inducing a Doppler frequency shift in a reference beam laser velocimeter light beam to simulate target velocity are described. The light beam is passed through a rotating refractive transparent block positioned between two reference points along the beam which results in a continuous change in the light beam optical path length between the reference points according to a known function. The velocity indicated by the laser velocimeter is compared to the known simulated velocity function for velocimeter testing and calibration.
Official Gazette of the U.S. Patent and Trademark Office

N80-16322*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONCEPTUAL DEVELOPMENT OF THE LASER BEAM MANIFOLD (LBM)
Warren Campbell and Robert B. Owen. Oct. 1979. 16 p.
(NASA-TM-78248) Avail: NTIS HC A02/MF A01 CSCL 20E

The laser beam manifold, a device for transforming a single, narrow, collimated beam of light into several beams of desired intensity ratios is described. The device consists of a single optical substrate with a metallic coating on both optical surfaces. By changing the entry point, the number of outgoing beams can be varied. M.G.

N80-16323# ARO, Inc., Arnold Air Force Station, Tenn.
NONORTHOGONAL MEASUREMENT AXES IN LASER DOPPLER VELOCIMETRY Final Report, Oct. 1977 - Sep. 1978
F. L. Crosswy. Arnold AFS AEDC. Aug. 1979. 28 p. refs.
(AD-A073700; AEDC-TR-79-35) Avail: NTIS HC A03/MF A01 CSCL 20/5

The measurement axes of virtually all multiaxis laser Doppler velocimeter (LDV) systems are nonorthogonal to some degree and are, in general, rotated with respect to orthogonal, Cartesian reference axes. Systematic errors are introduced into the LDV data if axis nonorthogonality and spatial orientation parameters are not properly taken into account by the data reduction equations. This report develops the general 3-space expressions for velocity vector magnitude and spatial orientation in terms of rotated, oblique LDV measurement axis parameters and the velocity vector projections measured by each of these axes. GRA

N80-16324# Los Alamos Scientific Lab., N. Mex.
USE OF LASERS FOR ACCELERATOR DIAGNOSTICS. 1: ELEMENTARY CONCEPTS
J. P. Aldridge and T. D. Hayward. 1979. 28 p. refs. Presented at 8th Symp. on Engr. Problems of Fusion Res., San Francisco, Calif., 13 Nov. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2329; CONF-791102-1) Avail: NTIS HC A03/MF A01

The use of high current linear accelerators for H(-) ions in diagnostic instrumentation that will permit accurate determination of the occupied phase space is examined. A laser photo detachment method is proposed to provide this capability. The fundamental processes that are operative are explored and limitations to the accuracy of measurements using this diagnostic are considered. The arrangement required to reconstruct the detailed beam profile from the measurements at several angles is analyzed. DOE

N80-16325# California Univ., Livermore. Lawrence Livermore Lab.
STATISTICAL ANALYSIS OF ABSORPTIVE LASER DAMAGE IN DIELECTRIC THIN FILMS
A. B. Budgor and Karen F. Luria-Budgor. 11 Sep. 1978. 31 p. Presented at Symp. on Optical Mater. for High Power Lasers, Boulder, 11 Sep. 1978. Submitted for publication.
(Contract W-7405-eng-48)
(UCRL-81670; CONF-780977-1) Avail: NTIS HC A03/MF A01

The Weibull distribution arises as an example of the theory of extreme events. It is commonly used to fit statistical data arising in the failure analysis of electrical components and in DC breakdown of materials. This distribution is employed to analyze time-to-damage and intensity-to-damage statistics obtained when irradiating thin film coated samples of SiO2, ZrO2, and Al2O3 with tightly focused laser beams. The data used is furnished by Milam. The fit to the data is excellent; and least squared correlation coefficients greater than 0.9 are often obtained. DOE

N80-16326# Los Alamos Scientific Lab., N. Mex.
HIGH-ENERGY, SHORT-PULSE, CARBON-DIOXIDE LASERS
Charles A. Fenstermacher. 1979. 26 p. refs. Presented at the Ultra Short Laser Pulses Meeting, London, 23 May 1979
(Contract W-7405-eng-36)
(LA-UR-79-1203; CONF-790558-1) Avail: NTIS HC A03/MF A01

The technological development of carbon dioxide lasers systems is discussed in terms of fusion requirements. Pumping mechanisms, optical gain, and energy storage are considered. Short pulse generation and amplification are described with emphasis on system efficiency. R.C.T.

N80-16327# General Atomic Co., San Diego, Calif.
STEP-BY-STEP APPROACH TO CONVECTIVE COOLING OF LASER DISC AMPLIFIERS
Robert F. Bourque. Apr. 1979. 37 p. refs.
(Contract W-7405-eng-48; GA Proj. 3072)
(UCRL-15047) Avail: NTIS HC A03/MF A01

A step by step approach is presented to the problem of gas cooling of laser glass amplifiers. The basic equations are given for glass conduction, thermal stress, gas convection, and heat exchanger and blower design. An example calculation is then carried out for helium gas at one atmosphere with the gas flow in the direction orthogonal to the optical path. It is found that pumping powers and temperatures are acceptable for this case. Results are also presented for helium in the slant direction and for nitrogen in both directions. The effects on pumping power of gas temperature rise, gas pressure, flashtube rep rate, and flow channel width are also included. It is found that, based on temperature rise and pumping power, nitrogen is as viable a coolant as helium. DOE

N80-16328# Los Alamos Scientific Lab., N. Mex.
ANTARES LASER POWER AMPLIFIER
R. D. Stine, G. F. Ross, and C. J. Silvernail. 1979. 8 p. refs. Presented at the Pulsed Power Conf., Lubbock, Tex., 12-14 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1525; CONF-790622-15) Avail: NTIS HC A02/MF A01

The design of the Antares laser power amplifier is discussed. The power amplifier is the last stage of amplification in the 100 kJ Antares laser. A single, cylindrical, grid control, cold cathode electron gun, surrounded by 12 large aperture CO2 electron beam sustained laser discharge sectors is described. A large scale interaction between optical, mechanical, and electrical disciplines required to meet the design objectives is discussed. Significant component advances required by the power amplifier design are reported. DOE

N80-16329# Sandia Labs., Albuquerque, N. Mex.
EVALUATION OF THE EFFECT OF PREPULSES ON HF LASER-TARGET INTERACTIONS
M. Keith Matzen. Jun. 1979. 25 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-0353) Avail: NTIS HC A02/MF A01

The effect of multinanosecond, low-power-density prepulses on the interaction of multinanosecond, 10 to the 14th power

W/sq cm. HF lasers pulses with slab targets were assessed. The emphasis is on analyzing absorption and X-ray conversion efficiency. A survey of previous experiments gives no evidence that these prepulses will affect the total absorption. However, prepulses have been observed to cause qualitative changes in both the X-ray spectrum and conversion efficiency. Numerical simulations indicate that the laser target interaction is effectively insensitive to low-power-density prepulses. These studies imply that basic laser target experiments with multiplexed, HF laser pulses will provide an important characterization of the interaction of long pulse, multiline, approximately 3 microns radiation with targets. Future wavelength comparison experiments will require prepulse suppression or target isolation. DOE

N80-16330# California Univ., Livermore. Lawrence Livermore Lab.
ANALYSIS OF THE Z DEPENDENCE OF LASER GENERATED SUPRATHERMAL ELECTRON TEMPERATURE
M. D. Rosen and K. G. Estabrook. 17 Apr. 1979. 20 p. refs. Presented at the 9th Ann. Conf. on Anomalous Absorption of Electromagnetic Waves, Rochester, N.Y., 15-18 May 1979. Submitted for publication.
(Contract W-7405-eng-48)
(UCRL-82280; CONF-790564-1) Avail: NTIS HC A02/MF A01

The systematic rise of temperature with Z is theoretically analyzed. It is believed that material albedoes (electron reflectivity) which increase with Z can account for this behavior, since electrons can make multiple passes through the region of resonant electric fields and are thus reheated. A quantitative treatment of this effect yields reasonable agreement with experiment. The effects of magnetic fields and filamentation are also examined. DOE

N80-16331# California Univ., Livermore. Lawrence Livermore Lab.
MASS SPECTROMETER DETERMINATION OF ARGON CONTENTS IN LASER FUSION TARGET PELLETS
C. M. Ward and L. E. Bergquist. 16 Apr. 1979. 14 p. refs. Presented at the 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29-31 Jan. 1979. Prepared in cooperation with Martin Marietta Corp., Denver, Colo.
(Contract W-7405-eng-48)
(UCRL-81416-Rev-1; CONF-790125-78) Avail: NTIS HC A02/MF A01

A system for measuring argon contents in individual laser fusion targets using a getter pumped closed volume quadrupole mass spectrometer is developed. Accuracy of 10 percent can be obtained, limited by the calibration standard and electron multiplier drift. Measurements are simple, unambiguous and can be performed at up to one per hour with a sensitivity equivalent to 1,000 Pa (.01 atm) argon in a 140 micrometers internal diameter sphere. DOE

N80-16332# Los Alamos Scientific Lab., N. Mex.
ANTARES POWER AMPLIFIEH OPTICAL SYSTEM
C. J. Silvernail and K. C. Jones. 1979. 8 p. refs. Presented at Conf. on Optics, Los Alamos, N. Mex., 23 May 1979.
(Contract W-7405-eng-36)
(LA-UR-79-2270; CONF-790529-11) Avail: NTIS HC A02/MF A01

The optical systems of the six Antares laser power amplifiers are described. These assemblies are preceded by the front end optits and followed by the target system. Each power amplifier receives an annular input beam and divides it into 12 beams which are then directed to double pass them through 12 gain regions surrounding a central electron gun. Provisions are made for spatially filtering each beam and for the possibility of adding saturable absorbers. Two keys to the successful completion of the power amplifier are: the avoidance of unwanted lasing modes and hot spots in the wavefronts, and the maintenance of alignment throughout the entire laser system, including the internal alignment of the Power Amplifier. DOE

N80-16333# National Technical Information Service, Springfield, Va.
CARBON DIOXIDE LASERS, VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - Aug. 1979
Diane M. Cavagnaro. Oct. 1979. 151 p. Supersedes NTIS/PS-78/0896; NTIS/PS-77/0710; NTIS/PS-76/0589; NTIS/PS-75/474.
(NTIS/PS-79/1068/0; NTIS/PS-78/0896; NTIS/PS-77/0710; NTIS/PS-76/0589; NTIS/PS-75/474) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

Citations on theory, design, operation, output and diagnostics of CO_2 lasers are presented. Studies relating to excitation, frequency conversion, modulation, laser pumping, reaction kinetics, gas dynamics, and plasmas are included. The development and efficiency of optical components such as mirrors, resonators, tuning devices, infrared optical materials, amplifiers, and gratings are also discussed. GRA

N80-16334# National Technical Information Service, Springfield, Va.
CARBON DIOXIDE LASERS, VOLUME 3: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976-77
Diane M. Cavagnaro. Oct. 1979. 178 p.
(NTIS/PS-79/1067/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

This bibliography cites reports on the theory, design, operation, output and diagnostics of carbon dioxide lasers. The studies relate to excitation, frequency conversion, modulation, laser pumping, reaction kinetics, gas dynamics, and plasmas. The development and efficiency of optical components such as mirrors, resonators, tuning devices, infrared optical materials, amplifiers, and gratings are also covered. This updated bibliography contains 171 abstracts, none of which is new to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-16335 Engineering Sciences Data Unit, London (England).
DESIGN OF DISC CAMS WITH TRANSLATING ROLLER FOLLOWERS: CALCULATION METHODS
1979. 33 p.
(ESDU-79007; ISBN-0-85679-252-7; ISSN-0141-4046) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

A systematic approach to the calculation of kinematic data for external disc cams with translating roller followers is provided. The calculations may be applied to machine tool and automobile engineering, mining equipment, printing, packaging, textile, and special purpose machinery. The results are applicable to all external disc cams with translating roller followers. ESDU (GRA)

N80-16336 Virginia Univ., Charlottesville.
ACTIVE OPTIMAL CONTROL FOR SUPPRESSION OF WHIRL OF A FLEXIBLE CENTRIFUGE Ph.D. Thesis
Marvin Taylor. 1979. 187 p.
Avail: Univ. Microfilms Order No. 8002501

A nonlinear dynamic model of a flexibly supported centrifuge rotor is formulated and studied parametrically for whirl, equilibrium and stability. Experimental data from a test rotor are compared to analytic results for a passive suspension system. The system equations are linearized for application of active linear regulator control and the use of Kalman sequential estimation to suppress whirl. The primary analysis considers a balanced rotor containing a loose small ball. Three additional cases are also studied: (1) unbalance in the rotor containing the small ball; (2) inclusion of the rotor shaft modes due to distributed mass and stiffness of the shaft; and (3) test rotor containing liquid rather than a ball. Computer simulations are performed demonstrating practical, effective feedback control for all of the above cases. Dissert. Abstr.

N80-16337*# Northwestern Univ., Evanston, Ill.
THERMAL ELASTOHYDRODYNAMIC LUBRICATION OF SPUR GEARS Final Report
K. L. Wang and H. S. Cheng. Washington. Feb. 1980. 137 p. refs.

(Grant NGR-14-007-084)
(NASA-CR-3241) Avail: NTIS HC A07/MF A01 CSCL 13I

An analysis and computer program called TELSGE were developed to predict the variations of dynamic load, surface temperature, and lubricant film thickness along the contacting path during the engagement of a pair of involute spur gears. The analysis of dynamic load includes the effect of gear inertia, the effect of load sharing of adjacent teeth, and the effect of variable tooth stiffness which are obtained by a finite-element method. Results obtained from TELSGE for the dynamic load distributions along the contacting path for various speeds of a pair of test gears show patterns similar to that observed experimentally. Effects of damping ratio, contact ratio, tip relief, and tooth error on the dynamic load were examined. In addition, two dimensionless charts are included for predicting the maximum equilibrium surface temperature, which can be used to estimate directly the lubricant film thickness based on well established EHD analysis. Author

N80-16338*# General Electric Co., Cincinnati, Ohio. Materials and Process Technology Labs.
PROGRAM TO DEVELOP SPRAYED, PLASTICALLY DEFORMABLE COMPRESSOR SHROUD SEAL MATERIALS Interim Technical Progress Report, 29 Jun. 1978 - 28 Feb. 1979
R. C. Schwab. Nov. 1979. 78 p. refs
(Contract NAS3-20054)
(NASA-CR-159741; ITPR-1) Avail: NTIS HC A05/MF A01 CSCL 11A

A study of fundamental rub behavior for ten dense sprayed materials and eight current compressor clearance materials has been conducted. A literature survey of a wide variety of metallurgical and thermophysical properties was conducted and correlated to rub behavior. Based on these results, the most promising dense rub material was Cu-9Al. Additional studies on the effects of porosity, incursion rate, blade solidity and ambient temperature were carried out on aluminum bronze (Cu-9Al-1Fe) with and without a 515B Feltmetal underlayer. Author

N80-16339*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONTINUOUS SELF-LOCKING SPIRAL WOUND SEAL Patent Application
Stephen C. Irick, inventor (to NASA). Filed 20 Nov. 1979. 13 p.
(NASA-Case-LAR-12315-1; US-Patent-Appl-SN-096257) Avail: NTIS HC A02/MF A01 CSCL 11A

A spiral wound seal for effecting a seal between two surfaces is described. The seal consists of a strip of gasket material wound into a groove machined into one of the surfaces. The gasket strip is wider than the groove is deep such that a portion of the gasket material protrudes from the groove. The seal is effected by clamping the second surface onto the first surface and thereby compressing the protruding gasket material. NASA

N80-16340*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRIBOLOGICAL PROPERTIES OF SILICON CARBIDE IN METAL REMOVAL PROCESS
Kazuhisa Miyoshi and Donald H. Buckley. 1980. 18 p. refs
To be presented at Intern. Symp. on Metal Working Lubrication, San Francisco, 18-19 Aug. 1980; sponsored by ASME
(NASA-TM-79238) Avail: NTIS HC A02/MF A01 CSCL 13H

Material properties are considered as they relate to adhesion, friction, and wear of single crystal silicon carbide in contact with metals and alloys that are likely to be involved in a metal removal process such as grinding. Metal removal from adhesion between sliding surfaces in contact and metal removal as a result of the silicon carbide sliding against a metal, indenting into it, and plowing a series of grooves or furrows are discussed. Fracture and deformation characteristics of the silicon carbide surface are also covered. The adhesion, friction, and metal transfer to silicon carbide is related to the relative chemical activity of the metals. The more active the metal, the higher the adhesion and friction, and the greater the metal transfer to silicon carbipe. Atomic size and content of alloying elements play a dominant role in controlling adhesion, friction, and abrasive wear properties of alloys. The friction and abrasive wear (metal removal) decrease linearly as the shear strength of the bulk metal increases. They decrease as the solute to solvent atomic radius ratio increases or decreases linearly from unity, and with an increase of solute content. The surface fracture of silicon carbide is due to cleavages of 0001, 10(-1)0, and/or 11(-2)0 planes. J.M.S.

N80-16341*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF WEAR-DEBRIS FROM FULL-SCALE BEARING FATIGUE TESTS USING THE FERROGRAPH
William R. Jones and Stuart H. Loewenthal. 1980. 22 p. refs
Prepared for presentation at the Ann. Meeting of the Am. Soc. of Lubrication Engr., Anaheim, Calif., 5-8 May 1980
(NASA-TM-81403; E-9827) Avail: NTIS HC A02/MF A01 CSCL 13H

The ferrograph was used to determine the types and quantities of wear particles generated during full-scale bearing fatigue tests. Deep-groove ball bearings made from AISI 52100 steel were used. A MIL-L-23699 tetraester lubricant was used in a recirculating lubrication system containing a 49 mm absolute filter. Test conditions included a maximum Hertz stress of 2.4 GPa, a shaft speed of 15,000 rpm, and a lubricant supply temperature of 74 C (165 F). Four fatigue failures were detected by accelerometers in this test set. In general, the ferrograph was more sensitive (up to 23 hr) in detecting spall initiation than either accelerometers or the normal spectrographic oil analysis. Four particle types were observed: normal rubbing wear particles, spheres, nonferrous particles, and severe wear (spall) fragments. Author

N80-16342*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF COMPUTER-OPTIMIZED TAPERED-ROLLER BEARINGS TO 2.4 MILLION DN
R. J. Parker, S. I. Pinel (Industrial Tectonics, Inc., Compton, Calif.), and H. R. Signer (Industrial Tectonics, Inc., Compton, Calif.). 1980. 29 p. refs. Proposed for presentation at the Intern. Lubrication Conf., San Francisco, 18-21 Aug. 1980; sponsored by ASME and the Am. Soc. of Lubrication Engr.
(NASA-TM-81414; E-332) Avail: NTIS HC A03/MF A01 CSCL 13I

The performance of 120.65 mm bore high speed design tapered roller bearings was investigated at shaft speeds to 20,000 rpm under combined thrust and radial load. The test bearing design was computer optimized for high speed operation. Temperature distribution and bearing heat generation were determined as a function of shaft speed, radial and thrust loads, lubricant flow rates, and lubricant inlet temperature. The roller bearing operated successfully at shaft speeds up to 20,000 rpm under heavy thrust and radial loads. Cup cooling was effective in decreasing the high cup temperatures to levels equal to the cone temperature. K.L.

N80-16343# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
FUNDAMENTALS OF PLASMA ARC WELDING Final Report, 1 Apr. 1975 - 30 Sep. 1978
C. B. Shaw, Jr. Aug. 1979. 102 p. refs
(Contract N00014-75-C-0789)
(AD-A074340; SC5031.8-F) Avail: NTIS HC A06/MF A01 CSCL 13/8

A three-year study was made of physical phenomena underlying operation of the plasma-arc welding (PAW) process. Experimental methods were developed to measure plasma spectral intensities during welding, a mathematical method was perfected to compute plasma temperature distributions from the spectral data, and statistical methods were used to extract maximum information from the data and to infer improved values for four ARII transition probabilities. Welds in mild and stainless steels and in Ti-6Al-4V up to 12.7 mm thick were evaluated by metallography and/or by cyclic fatigue studies. At low stress concentration levels, PAW was found to reduce cyclic crack growth rates in the weld metal compared to the parent metal. There appears to be evidence that plasma spectroscopy can aid in selection and control of welding parameters. The plasma temperature measurements clarify the mechanism whereby use of auxiliary ports in the PAW torch orifice cup reduces the width

of a weld nugget. Simple plasmadynamic models were used to relate orifice geometry to plasma temperature and electrical resistance, and to weld quality, thus accounting for the observation that a convergent orifice enhances weld penetration, reduces weld width, and improves weld nugget geometry without causing double-arcing, while a divergent orifice (which simulates an eroded orifice cup) has the opposite, deleterious effects. Nine documents are cited in which these results were reported and complete preprints of four journal articles not yet published are included as appendices. GRA

N80-16344# Shaker Research Corp., Ballston Lake, N. Y.
ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GUIDE. PART 3: TAPERED ROLLER BEARINGS Interim Report, Apr. 1977 - Nov. 1978
A. B. Jones and J. M. McGrew, Jr. Wright-Patterson AFB, Ohio AFAPL Feb. 1979 92 p refs
(Contract F33615-76-C-2038; AF Proj. 3048)
(AD-A074827; SRC-78-TR-33-Pt-3; AFAPL-TR-78-6-Pt-3) Avail: NTIS HC A05/MF A01 CSCL 13/9

This report is an update of the original Part 4 of the Rotor-Bearing Dynamics Design Technology Series, AFAPL-TR-65-45 (Parts 1 through 10). A computer program is given for preparation of tapered roller bearing stiffness data input for rotordynamic response programs. The complete stiffness matrix is calculated including centrifugal effects. Considerativns such as elastohydrodynamic and cage effects are not included since they have little influence on the calculation of tapered roller bearing stiffness. The resulting program is reasonably small and easy to use. GRA

N80-16345# SKF Industries, Inc., King of Prussia, Pa.
M-50 STEEL BEARING MATERIAL FACTORS FOR ROLLING ELEMENT LIFE CALCULATIONS Final Report, 18 Dec. 1977 - 1 Apr. 1979
Frank R. Morrison, John I. McCool, and Nicholas J. Ninos 1 Apr. 1979 113 p refs
(Contract DAAK50-77-C-0009)
(AD-A074217; SKFAL79T013; USAAVRADCOM-TR-79-35) Avail: NTIS HC A06/MF A01 CSCL 13/9

This report presents the results of a survey accumulating life results achieved from bearings manufactured from M-50 tool steel. Life data have been analyzed according to an existing computer program, TABACY. Material and lubrication factors have been determined using this data base, enabling a more accurate calculation of the potential life of a bearing. In addition, this report includes experimental endurance life data obtained on three groups of rolling element bearings manufactured of Vacuum Induction Melted Vacuum Arc Remelted (VIMVAR) M-50 steel. The three bearing designs, all of which have a 45 mm internal diameter, consist of a deep groove ball, an angular contact ball, and a cylindrical roller configuration. These types have been run under several operational conditions using circulating Mobil Jet II synthetic lubricating fluid MIL-L-23699. GRA

N80-16346# Princeton Univ., N. J.
COMBUSTION OPTIMIZATION STUDIES FOR STRATIFIED CHARGE AND DIESEL ENGINES Progress Report, 1 Oct. 1978 - 30 Sep. 1979
R. L. Steinberger and F. V. Bracco Aug. 1979 9 p
(Contract EC-77-S-02-4191)
(COO-4191-2) Avail: NTIS HC A02/MF A01

The transparent-piston, transparent-head engine is in routine use for visualization experiments. The gaseous fuel injector is routinely used with gaseous propane as a fuel injected into the motored engine. High speed filming and short duration pulsed light single exposure techniques are being used to obtain shadow and schlieren records of gaseous and liquid jets. An LDV system for measuring in-cylinder velocities was implemented and data are presently being taken and analyzed. Engine cylinder pressure data can now be taken and reduced with the minicomputer; and an infrared emission absorption technique is used to measure engine cylinder temperature. An alternative approach to the modeling of gaseous jets yielded a characteristic time for steadying of the jet, which in the long run should allow a more efficient computational procedure. Work on the definition of appropriate equations for thick sprays continues. Visual data on engine cyclic variations were obtained with the pulsed illumination television system. DOE

N80-16347# Sandia Labs., Livermore, Calif. Combustion Applications Div.
ENGINE COMBUSTION TECHNOLOGY OVERVIEW
C. W. Robinson and S. C. Keeton Oct. 1978 6 p Presented at the Highway Vehicle Systems Contractors Meeting, Dearborn, Mich., 17 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-8801; CONF-781050-1) Avail: NTIS HC A02/MF A01

A five-year program to develop technology for increasing the efficiency of automotive, truck, and stationary engines and for switching to modified or alternate fuels is discussed. The plan calls for a coordinated program involving DOE/Fossil Fuel Utilization, universities, DOE laboratories, private research organizations, and the engine manufacturing industry. The program plan is complementary to existing programs in the DOE/TEC, DOD, and DOT, and is coordinated with those efforts. DOE

N80-16348# Babcock and Wilcox Co., Alliance, Ohio. Research and Development Div.
DEVELOPMENT OF AUTOMATED WELDING PROCESSES FOR FIELD FABRICATION OF THICK-WALLED PRESSURE VESSEL: ELECTRON BEAM METHOD Quarterly Report 1 Apr. - 30 Jun. 1978
Charles M. Weber 1978 37 p
(Contract EF-77-C-01-2606)
(DOE/ET-2606/3; QR-3) Avail: NTIS HC A03/MF A01

An electron beam welding procedure was developed for welding 8 in. thick SA 387 Grade 22 Class 2 (2 1/4 Cr-1 Mo) steel. A total of 95 welds were made in the horizontal position. DOE

N80-16349# General Electric Co., Sunnyvale, Calif. Advanced Reactor Systems Dept.
METHOD OF ASSESSING THE IMPACT OF METALLURGICAL NOISE AND ITS REDUCTION IN ULTRASONIC TESTING OF AUSTENITIC WELDS
R. A. Day Aug. 1979 24 p refs Presented at the 1979 IEEE Ultrasonics Symp., New Orleans, Sep. 1979
(Contract EY-76-C-03-0893)
(GEFR-SP-164; CONF-790868-1) Avail: NTIS HC A02/MF A01

A method of reducing the ultrasonic noise, or spurious echos, often present in austenitic metals was developed. The method was used on specimens of Type 316 stainless steel, Alloy 800, 16-8-2 weld metal, and Inco-82 type weld metal, and was applied to shear wave tests. It is applicable to longitudinal wave tests. Noise in these materials was subsequently reduced relative to saw cut notches in welded samples. Signal-to-noise improvements of 8Db have been achieved in 16-8-2 weld metal, and order of magnitude improvements is obtained in the probability of large noise signals per inspection. Experiments with 1 and 1/2 megahertz inspection indicate that the improvement attributed to longitudinal wave inspection may be due to the difference in wavelength rather than wave mode. DOE

N80-16350# Science Applications, Inc., Los Angeles, Calif.
LONG LIFE HYDRAULIC BRAKE SYSTEM, SUMMARY Final Report, Oct. 1977 - Mar. 1979
R. Ziskind, I. Osofsky, Y. Mansoor, F. Oldham, and D. Couts May 1979 37 p refs
(Contract DOT-HS-7-01776)
(PB80-104730; SAI-068/80/516; DOT-HS-805-068) Avail: NTIS HC A03/MF A01 CSCL 13F

A long life brake system for passenger vehicles which would have a doubled period between required servicing in comparison to conventional systems was designed. Service life was found initially to be defined by friction pair maintenance in the 30,000 - 40,000 mile range. Subsequent servicing requirements were necessitated by a number of mechanisms derived in large part by fluid degradation, metal corrosion, and rubber deterioration. A long life design approach was specified satisfying a doubled friction pair lifetime and a 100,000 mile balance of system service-free life. Component-by-component design

approach alternatives were given and three test procedures described with which to evaluate compliance with the postulated standard. GRA

N80-16351# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
ASSEMBLY OF INTERFERENCE FITS BY IMPACT AND CONSTANT FORCE METHODS M.S. Thesis
Craig C. Selvage Jun. 1979 54 p refs
(Grant NSF APR-74-18173)
(PB-301289/5; T-693; NSF/RA-790135) Avail: NTIS HC A04/MF A01 CSCL 13H

It is shown that the Poisson effect becomes an important consideration in the assembly of interference fits when the product of Poisson's ratio, coefficient of friction, and the contact length to interference diameter ratio exceeds 0.1. The residual axial stresses resulting from assembly forces are analyzed in detail, and the minimum energy which must be supplied to begin insertion is calculated. An approximate energy analysis of the insertion of an interference fit by an impact load is presented. This analysis takes into account the presence of an axial preload force which might be applied as the impact takes place. Two experiments show a good correlation between the theory and data for impact by hammer blows. GRA

N80-16352# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
INFORMATION APPROACH TO PARTS MATING
Sergio N. Simunovic Apr. 1979 197 p refs
(Grant NSF APR-74-18173)
(PB-300519/6; NSF/RA-790134; T-690) Avail: NTIS HC A09/MF A01 CSCL 13H

The interaction of mechanical parts during the assembly process, the nature of the information available during this interaction, and the form and use of this information in aiding parts mating is examined. The development programmable industry assembly is discussed and how to determine the performance characteristics necessary for a positioning device designed for assembly is addressed. Topics discussed include: the assembly process as a positioning problem and the study of parts mating as a means of solving for this positioning problem; the transition from transporting the parts to positioning the parts for starting the assembly; the actual parts assembly or mating; and the implications of the parts mating study on the configuration of an assembly system. A description of the kinematics of rigid solids in space, a two dimensional analysis of a peg in hole insertion, theoretical performance evaluations, geometric information, experimental design, and position estimation implementation are presented. GRA

N80-16353# National Technical Information Service, Springfield, Va.
INERT GAS WELDING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Aug. 1979
William E. Reed Oct. 1979 237 p Supersedes NTIS/PS-78/0903, NTIS/PS-77/0766, NTIS/PS-76/0724 and NTIS/PS-75/764
(NTIS/PS-79/0995/5; NTIS/PS-78/0903; NTIS/PS-77/0766; NTIS/PS-76/0724; NTIS/PS-75/764) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Research reports on the development of techniques and procedures for inert gas welding and with the characteristics of the resulting welds are presented. Process control, automation, nondestructive testing, and health hazards are also investigated. Metals welded include steel, titanium, aluminum, uranium, and refractory metals. This updated bibliography contains 229 abstracts, 26 of which are new entries to the previous edition. GRA

N80-16354# National Technical Information Service, Springfield, Va.
INERT GAS WELDING, VOLUME 3: CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Aug. 1979
William E. Reed Oct. 1979 125 p Supersedes NTIS/PS-78/-905, NTIS/PS-77/0767 and NTIS/PS-76/0726
(NTIS/PS-79/0996/3; NTIS/PS-78/0905; NTIS/PS-77/0767; NTIS/PS-76/0726) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Reports from worldwide research are cited which deal with the development of techniques and procedures for inert gas welding and with the characteristics of the resulting welds. Process control, automation, and applications are also investigated. Metals welded include steel, titanium, aluminum, copper, and cast iron. This updated bibliography contains 119 abstracts, 27 of which are new entries to the previous edition. GRA

N80-16207*# Army Missile Research and Development Command, Redstone Arsenal, Ala.
AN EXPERIMENTAL DESIGN FOR TOTAL CONTAINER IMPACT RESPONSE MODELING AT EXTREME TEMPERATURES
Virginia P. Kobler, Richard M. Wyskida, and James D. Johannes *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 101-107 refs Prepared in cooperation with Alabama Univ. in Huntsville (For primary document see N80-16198 07-31)
Avail: NTIS HC A09/MF A01 CSCL 20K

N80-16209*# Southwest Research Inst., San Antonio, Tex.
TEST EVALUATION OF SHOCK BUFFERING CONCEPT FOR HYDRODYNAMIC RAM INDUCED BY YAWING PROJECTILE IMPACTING A SIMULATED INTEGRAL FUEL TANK
Patrick H. Zabel *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 141-170 refs (For primary document see N80-16198 07-31)
Avail: NTIS HC A09/MF A01 CSCL 20D

N80-16210*# Southwest Research Inst., San Antonio, Tex.
PREDICTION OF FRAGMENT VELOCITIES AND TRAJECTORIES
J. J. Kulesz, L. M. Vargas, and P. K. Moseley *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 171-187 refs (For primary document see N80-16198 07-31)
(Contract NAS3-20497)
Avail: NTIS HC A09/MF A01 CSCL 20K

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-16355# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Metal Behavior Branch
THE DEVELOPMENT OF QUANTITATIVE NDI FOR RETIREMENT-FOR-CAUSE Final Report, Sep. 1975 - Jun. 1976
J. M. Hyzak, W. H. Reiman, and J. E. Allison Feb. 1979 33 p refs
(AF Proj. 2307)
(AD-A068403; AFML-TR-78-198) Avail: NTIS HC A03/MF A01 CSCL 14/4

To investigate the viability of quantifying NDI signals, relationships between eddy current signals and flaw dimensions were examined. The prime emphasis of this report is exploring these relationships and the difficulties encountered in establishing them. A fracture mechanics/NDI-based disk rejection criteria, retirement-for-cause, which required quantitative NDI, is also described. The case of radially cracked bolt holes in a turbine disk inspected by a semiautomatic eddy current technique is used to illustrate the procedures. Monotonically increasing relationships, primarily logrithmic in nature, were observed between signal characteristics and the dimensions of EDM notches which were used to model actual cracks. Sensitivity level and eddy current system choice were observed to significantly affect the eddy current/flaw dimension relationships. Author

N80-16356*# M&S Computing, Inc., Huntsville, Ala.
DIGITAL ULTRASONIC SIGNAL PROCESSING: PRIMARY ULTRASONICS TASK AND TRANSDUCER CHARACTERIZATION USE AND DETAILED DESCRIPTION Final Report
P. L. Hammond 1 Nov. 1979 560 p
(Contract NAS8-33100)

(NASA-CR-161370; Rept-79-070) Avail: NTIS HC A24/MF A01 CSCL 14D

This manual describes the use of the primary ultrasonics task (PUT) and the transducer characterization system (XC) for the collection, processing, and recording of data received from a pulse-echo ultrasonic system. Both PUT and XC include five primary functions common to many real-time data acquisition systems. Some of these functions are implemented using the same code in both systems. The solicitation and acceptance of operator control input is emphasized. Those operations not under user control are explained. A.R.H.

N80-16357# Akron Univ., Ohio. Dept. of Mathematical Sciences.

A GENERAL APPROACH TO ORDERING OF PARAMETERS WITH APPLICATION IN RELIABILITY Final Report

John C. Conlon Aug. 1979 8 p

(Grant AF-AFOSR-3670-78; AF Proj. 2304)

(AD-A074246; AFOSR-79-0962TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The reports dealt with the applications of the theory of G-ordered functions in reliability; the applications of the theory of G-monotone functions in reliability; ahp some majorization results for a system of flow. The monograph deals with the topics of partial orderings on N-dimensional space and their use in probability and statistics. GRA

N80-16358# Missouri Univ. - Columbia. Dept. of Statistics.

A MAXIMUM LIKELIHOOD ESTIMATOR FOR AN EXPONENTIAL PARAMETER FROM A LIFE TEST WITH BOTH TYPE 1 AND TYPE 2 CENSORING

Kenneth B. Fairbanks Aug. 1979 36 p refs

(Contract N00014-76-C-0789)

(AD-A073895; TR-86) Avail: NTIS HC A03/MF A01 CSCL 12/1

A hybrid life test on items assumed to have an exponential lifetime combines type 1 and type 2 censoring. In type 1 censoring, n items are placed on test and observed for a fixed time t^*, while in type 2 censoring the test terminates with the rth sub 0 failure, where r sub 0 is a preassigned integer. If t sub r sub 0 is the time of the rth sub 0 failure, a hybrid life test terminates at min(t sub r sub 0, t^*). In some situations it may be of interest to estimate the average lifetime theta, following the test decision. In this report, we find the maximum likelihood estimator, theta-cap, when the sample is subject to hybrid censoring. An expression for E(theta-cap) is derived. Because this expression is complex, computer simulations are used to examine the bias of theta-cap. GRA

N80-16359# Missouri Univ. - Columbia. Dept. of Statistics.

CONFIDENCE INTERVALS FOR AN EXPONENTIAL PARAMETER FROM A TWO STAGE LIFE TEST

Kenneth B. Fairbanks Aug. 1979 34 p refs

(Contract N00014-76-C-0789)

(AD-A073896; TR-87) Avail: NTIS HC A03/MF A01 CSCL 12/1

The two stage life test of Bulgren and Hewett (1973) for the mean lifetime, theta, of an exponentially distributed lifetime is essentially a two stage version of type 2 censoring. Since the test decision only determines whether theta is above or below theta sub 0, it may be of interest to estimate theta following the decision using the test data. Epstein (1960a) found confidence intervals for under type 2 censoring. This report shows that Epstein's intervals may be modified slightly and used to provide confidence intervals for theta following the two stage test. The resulting confidence intervals are shown to be conservative.GRA

N80-16360# Missouri Univ. - Columbia. Dept. of Statistics.

APPROXIMATE CONFIDENCE INTERVALS FOR AN EXPONENTIAL PARAMETER FROM A SEQUENTIAL LIFE TEST

Kenneth B. Fairbanks Aug. 1979 37 p refs

(Contract N00014-76-C-0789)

(AD-A073897; TR-88) Avail: NTIS HC A03/MF A01 CSCL 12/1

A sequential life test for the exponential location parameter was given by Epstein and Sobel (1955). This sequential test may be modified by truncating the test at r sub 0 failures and/or at total test time t'. There may be a need or a desire to also estimate the parameter after the test decision, using the test data. Bryant and Schmee (1979) have given confidence intervals for the mean lifetime, theta, from a truncated sequential test scheme, using methods which depend heavily on numerical techniques using a computer. A more flexible approach is considered using a martingale inequality which was also given by Wald (1947) in another context. Interval estimates are found which are functions of a positive constant d which must be chosen less than an upper bound which is itself a function of the number of failures observed. It is suggested that d be chosen as a function of the sample path (i.e., after the test is complete). The validity of the confidence coefficient comes into question if this posterior selection of d is employed. Simulation studies indicate that the resulting intervals are usually conservative. Author (GRA)

N80-16361# Allied Chemical Corp., Idaho Falls, Idaho.

COMPUTERIZED QUALITY CONTROL TECHNIQUES

G. D. Halverson, A. R. Camarata, R. L. Hand, F. W. Spraktes, and J. M. Baldwin 1979 49 p refs Presented at the 20th Ann. Meeting of the Inst. of Nucl. Mater. Management, Albuquerque, N. Mex., 16 Jul. 1979

(Contract EY-76-C-14-2170)

(CONF-790707-11) Avail: NTIS HC A03/MF A01

An examination of historical semicontrolled data for providing a quality control tool by yielding information for such items as: (1) mathematical correction of unidentified systematic deviations; (2) estimation of confidence in lab results; and (3) detection of correctable trends is presented. A computerized quality control system is described and related topics including: (1) data flow and control; (2) use of statistics and graphics in data examination; (3) aspects of human interaction with a computerized system; and (4) the advantages and possible disadvantages of using the described system are discussed. DOE

N80-16362# Oak Ridge National Lab., Tenn. Computer Sciences Div.

EFFICIENT PROCEDURE FOR SELECTING AMONG FIVE RELIABILITY MODELS Ph.D. Thesis

J. E. A. Kent (Nucl. Regulatory Comm.) Oct. 1979 228 p refs

(Contract W-7405-eng-26)

(ORNL/CSD-43) Avail: NTIS HC A11/MF A01

Several parametric families of probability distributions used to model reliability and life testing data are considered. An efficient technique for selecting the best fitting family of distributions is derived. This technique uses scale-invariant statistics that minimize the probabilities of misclassification, and is extended beyond pairwise selections to selecting from a class of families of competing distributions. These statistics are not used in the hypothesis testing framework, but rather as measures of likelihood that the observed data have a distribution from a farticular family of probability distributions. The class of families considered are the Uniform, Exponential, Gamma, Weibull, and Lognormal distributions, for the cases of shape parameters both known and unknown. Results of computer simulations are given for pairwise and multiple family selection procedures, showing the misclassification error rates achieved for selected sample sizes. Illustrations based on actual data are presented, along with a user program for convenient implementation of this procedure. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-16363 Engineering Sciences Data Unit, London (England).

INELASTIC SHEAR STRESSES AND STRAINS IN THE ADHESIVES BONDING LAP JOINTS LOADED IN TENSION OR SHEAR (COMPUTER PROGRAM)

1979 41 p

(ESDU-79016; ISBN-0-85679-261-6) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161 $770.50

A computer program for the ahalysis of the distribution of the shear stresses and strains in the adhesives which bond lap joints of multistep configuration loaded in tension or shear is presented. The program allows for the nonlinear shear stress-strain properties of the adhesive and assumes that the adherend material behavior is elastic. Program lists are provided in the two languages of FORTRAN IV and BASIC. ESDU

N80-16364 Michigan State Univ., East Lansing.
SOME APPROXIMATIONS IN VIBRATIONS AND WAVE MOTION OF ELASTIC MEDIA Ph.D. Thesis
Michael Yvon Rondeau 1979 98 p
Avail: Univ. Microfilms Order No. 8001583

A study of wave propagation phenomena in a linear, elastic, isotropic, homogeneous layer is presented. The motion is described by the integral method of Kirchhoff derived through Hamilton's principle, which serves as the starting point for various approximations to be developed. A series expansion procedure coupled with a new truncation concept is used to construct two dimensional partial differential equations for motions in the layer. Frequency spectra associated with traveling waves in a traction free layer are studied and compared with the spectra preductions of Medick, Nikodem and that of the three-dimensional theory. Impact boundary conditions are applied at the top of the plate and free stresses are applied at the bottom of the plate. The Differential-Difference equations are reduced to Difference equation. Dissert. Abstr.

N80-16365 Stanford Univ., Calif.
A DIFFERENTIAL GEOMETRIC APPROACH TO MATERIAL DEFORMATION Ph.D. Thesis
Edward Marinus Olsen 1979 188 p
Avail: Univ. Microfilms Order No. 8001981

An appropriate language to discuss nonlinear material deformation is differential geometry, as the analysis can establish kinematical quantities in a coordinate-free description. The material kinematical description proceeds first with a metric free or affine analysis. The configuration space of material deformation is expressed in terms of the geometric quantities of torsion and curvature. The introduction of a mentric goes beyond the usual definitions in Riemannian geometry and allows Ricci's lemma to be violated. A nonmetric quantity is introduced which describes the failure of length to be invariant to parallel transport. The configuration space is then described as a nonmetric nonRiemannian space. The understanding of local material yielding and fracture using a global analysis is mathematically developed using path independent integrals of the appropriate field quantities. Material deformation is the movement of a point on a hypersurface having variables to describe yielding, fracture and unloading. Dissert. Abstr.

N80-16366 Notre Dame Univ., Ind.
DYNAMIC YIELDING OF POLYCRYSTALLINE MATERIALS UNDER BIAXIAL LOADING Ph.D. Thesis
Daniel Hon-Ying Ng 1979 285 p
Avail: Univ. Microfilms Order No. 8002619

The dynamic responses as well as static initial and subsequent yield surfaces of a number of specimens made of 6061-T6 aluminum alloy are presented. The stress path obtained in a dynamic biaxial test are reproduced statically. Thd corresponding stress-strain curves are compared and found significantly different. It is found that the dynamic initial yielding occurs at a higher state of biaxial stress depending on the loading rate than that of static yielding. The experimental results are used to verify a set of plastic strain rate equations formulated by analyzing dislocation dynamics through a statistical approach. The theoretical axial and hoop plastic strain rates obtained by the rate equations are found to be in reasonable agreement with the experimental results. Dissert. Abstr.

N80-16367 Stanford Univ., Calif.
ACOUSTOELASTIC ANALYSIS OF CENTER-CRACKED PANELS Ph.D. Thesis
John Bradley Croom Hunter 1979 89 p
Avail: Univ. Microfilms Order No. 8001940

Mechanical and electronic systems were developed for accurate measurement of sound speed variation for longitudinal acoustic waves in uniaxial tensile specimens and stressed panels. Pulse superposition techniques were used in measuring acoustic velocity changes with applied load. These measurements were used for characterization of acoustoelastic response for aluminum and steel alloys. For elastic loading, the velocity changes proportionally with the sum of the inplane principal stresses. This is in agreement with theoretical prediction and is a key result that permits acoustoelastic stress measurement. Stress field measurements were made using the acoustic technique and the uniaxial results for calibration. Loaded panel specimens containing cracks, notches and a central hole were examined and the results compared with theoretical elastic solutions. A technique for extracting the stress intensity factors from acoustoelastic stress measurements around a crack in a loaded panel is described. Dissert. Abstr.

N80-16368 Washington Univ., Seattle.
DYNAMIC ANALYSIS OF SHELLS OF REVOLUTION-SOIL SYSTEMS Ph.D. Thesis
Osama Moustafa El-Shafee 1979 228 p
Avail: Univ. Microfilms Order No. 8001220

A finite element model was developed to analyze shells of revolution under dynamic loading with soil-structure interaction effects. The model consists of high-precision rotational shell finite elements, representing the axisymmetric shell, supported on an equivalent boundary system, representing the soil medium. The substructure method is used to model the shell and soil components. In addition to the seismic analysis capability of the proposed model, it is also applicable to other dynamic loads such as wind. The dynamic behaviour of a hyperboloidal cooling tower shell on discrete supports with a ring footing is studied. Dynamic properties are studied and stress analysis is carried out for a variety of soil conditions. Dissert. Abstr.

N80-16369 Case Western Reserve Univ., Cleveland, Ohio.
STEADY STATE RESPONSE OF A CIRCULAR FOUNDATION ON A TRANSVERSELY ISOTOPIC MEDIUM Ph.D. Thesis
David John Kirkner 1979 233 p
Avail: Univ. Microfilms Order No. 8001463

Dimensionless parameters which are functions of the elastic constants are utilized to define the degree of anisotropy when the foundation investigated is undergoing vertical, rocking or translational vibrations. Impedance and compliance coefficients are presented in tables and curves for a wide range of a dimensionless frequency parameter. Approximate impedance and compliance coefficients are also obtained for a viscoelastic soil. For massive foundations undergoing harmonic vibrations, the dimensionless part of the isotropic impedance function may be used with the expression for the anisotropic static stiffness to obtain the amplitude of vibration. A dimensionless parameter determines the Poisson's ratio of the equivalent isotropic soil. The result is important for the design of machine foundations since it allows for an approximate analysis by using the available isotropic solutions. Dissert. Abstr.

N80-16370 Virginia Univ., Charlottesville.
STRESS SINGULARITIES AT THE CORNERS OF A SEMI-INFINITE STRIP Ph.D. Thesis
William Richard Stout 1979 42 p
Avail: Univ. Microfilms Order No. 8002522

The problem delta delta W(x,y) = 0 in the semi-infinite strip 0 < x < 1 and 0 < y, subject to the boundary conditions: W(0,y) = W sub x (0,y) = 0 W(1,y) = W sub x (1,y) = 0 W(x,0) = 0 W sub y (x,0) = h(x) is considered. The problem is decomposed into its even and add parts about x = 1/2, and the analysis is carried out for the even part. A relation is derived connecting W(x,y) and the solution u(x,y) of a related harmonic problem delta u(x,y) with boundary conditions derived from those for W(x,y). An integral containing the singular part of u(x,y) is obtained. A harmonic boundary value problem is then derived for the singular part of u. Dissert. Abstr.

N80-16371 Stanford Univ., Calif.
THE USE OF STRESS CHANGE EXPERIMENTS TO STUDY THE MECHANISMS OF ELEVATED TEMPERATURE DEFORMATION Ph.D. Thesis

Jeffrey Clarke Gibeling 1979 377 p
Avail: Univ. Microfilms Order No. 8001923

The interpretation of stress change experiments in terms of dislocation creep mechanisms is studied. The development of techniques for high precision and conventional resolution strain transient measurements is described. These methods are applied to the study of polycrystalline aluminum, copper and lead as well as single crystals of aluminum and lead. Evidence of instantaneous dislocation motion and measurements of the time dependent strains are discussed along with the nature of apparent delay times and creep anelasticity. Conclusions are presented.
Dissert. Abstr.

N80-16372 Engineering Sciences Data Unit, London (England).
ELASTIC STRESS CONCENTRATION FACTORS: RECTANGULAR NOTCH IN THE EDGE OF A WIDE FLAT PLATE IN TENSION
Jul. 1979 2 p
(ESDU-79008; ISBN-0-85679-253-5) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161 HC $50.50

Data is provided on the maximum stress at rectangular notches in the side of plates subjected to tensile loading. Typical applications are plates or bars in machinery or structures. The range of applicability is for rectangular notches having a width to depth ratio in the range 0.4 to 10.0 and a corner radius to depth ratio in the range 0.2 to 1.0.
ESDU

N80-16373# National Aerospace Lab., Tokyo (Japan).
THE FREE VIBRATION EQUATIONS, NATURAL FREQUENCIES AND MODAL CHARACTERISTICS OF CLOSED CIRCULAR CYLINDRICAL SHELLS
Tatsuzo Koga and Keiji Komatsu Apr. 1979 45 p refs
(NAL-TR-569T) Avail: NTIS HC A03/MF A01

The relative accuracies of the representative classical theories of thin shells are examined. The order of magnitude comparison of terms involved in the governing equations for the free vibrations of a circular cylindrical shell is the method utilized. The boundary conditions for the shells are taken into account and it is shown that the classical theories yield valid solutions accurate enough when taking into consideration the errors inherent in the Kirchhoff-Love hypothesis. A first approximation, consistent with the order of magnitude estimate, leads to a system of free vibration and boundary constraining equations. The approximation enabled a qualitative estimate of the forms of the characteristic solutions. The accuracy of the Donnell type approximation is investigated and a detailed account of the historical developments of the subject is provided.
A.W.H.

N80-16374# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
INITIAL IMPERFECTION MEASUREMENTS OF INTEGRALLY STRINGER-STIFFENED CYLINDRICAL SHELLS
J. Singer, H. Abramovich, and R. Yaffe Dec. 1978 124 p refs
(TAE-330) Avail: NTIS HC A06/MF A01

The initial geometric imperfections of integrally stringer stiffened cylindrical shells were measured in a special scanning system, on laboratory scale. The system consists essentially of a probe, travelling along a helical path inside the shell, whose output is recorded digitally on a minicomputer. The imperfection measurements of 19 shells, employed in different test programs, are presented both in graphical form and as coefficients of Fourier series - a proposed standard representation for imperfection data.
Author

N80-16375# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
A PENALTY PLATE-BENDING ELEMENT FOR THE ANALYSIS OF LAMINATED ANISOTROPIC COMPOSITE PLATES
J. N. Reddy Aug. 1979 36 p refs
(Contract N00014-78-C-0647)
(AD-A074236; OU-AMNE-79-14; TR-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

A C degrees (penalty) finite element is developed for the equations governing the heterogeneous laminated plate theory of Yang, Norris and Stavsky. The YNS theory is a generalization of Mindlin's theory for homogeneous, isotropic plates to arbitrarily laminated anisotropic plates and includes shear deformation and rotary inertia effects. The present element can also be used in the analysis of thin plates by appropriately specifying the penalty parameter. A variety of problems are solved, including those for which solutions are not available in the literature, to show the material effects and the parametric effects of plate aspect ratio, length-to-thickness ratio, lamination scheme, number of layers and lamination angle on the deflections, stresses, and vibration frequencies. Despite its simplicity, the present element gives very accurate results.
GRA

N80-16376# Oklahoma Univ., Norman. School of Aerospace Mechanical and Nuclear Engineering.
FINITE-ELEMENT ANALYSIS OF LAMINATED BIOMODULUS COMPOSITE-MATERIAL PLATES
J. N. Reddy and W. C. Chao Aug. 1979 26 p refs
(Contract N00014-78-C-0647)
(AD-A074184; OU-AMNE-79-18; TR-7) Avail: NTIS HC A03/MF A01 CSCL 12/1

Finite-element analysis of the equations governing the small-deflection elastic behavior of thin plates laminated of anisotropic bimodulus materials (which have different elastic stiffnesses depending upon the sign of the fiber-direction strain) is presented. Single-layer and two-layer cross-ply, simply-supported rectangular plates subjected to sinusoidally distributed normal pressure and uniformly distributed normal pressure are analyzed. For the sinusoidally loaded case, the finite-element solutions are gratifyingly close to the exact closed-form solutions.
GRA

N80-16377# Virginia Military Inst. Research Labs., Lexington.
INVESTIGATION OF THE SUITABILITY OF THE BAZANT ENDOCHRONIC MATERIAL MODEL FOR MODELLING THE CONCRETE IN A SAMSON ANALYSIS OF A REINFORCED CONCRETE BEAM Final Report, Jan. - May 1979
James W. Jeter, Jr. Jul. 1979 20 p refs
(Grant AF-AFOSR-0066-79; AF Proj. 2307)
(AD-A074202) Avail: NTIS HC A02/MF A01 CSCL 13/3

This investigation involved evaluating the potential of the Bazant endochronic plain concrete model as a possible avenue to an accurate model of the behavior of dynamically loaded reinforced concrete structures. A previous attempt to apply this model to the problem of a dynamically loaded beam was unsuccessful, due to an instability in the computer formulation of the model. In this study it was found that interaction between the tensile cracking model and the SAMSON nonlinear dynamic finite element structural analysis program used for the beam analysis problem resulted in inconsistent definition of the strain behavior experienced by the material, thereby producing instability. A procedure was developed and demonstrated, which successfully eliminated the instability.
GRA

N80-16378# General Dynamics Corp. Fort Worth, Tex.
FASTENER HOLE QUALITY, VOLUME 2 Final Technical Report, Jun. 1976 - Oct. 1978
P. J. Noronha, S. P. Henslee, D. E. Gordon, Z. R. Wolanski, and B. G. W. Yee Wright-Patterson AFB, Ohio AFFDL Dec. 1978 405 p
(Contract F33615-76-C-3113; AF Proj. 486U)
(AD-A074730; FZM-6809-Vol-2; AFFDL-TR-78-206-Vol-2)
Avail: NTIS HC A18/MF A01 CSCL 13/5

This report describes the development of the EIFS (Equivalent Initial Flaw Size) concept as a potential design tool and the generation of EIFS data as a function of several manufacturing and design variables. Several factors or mechanisms that strongly affected the fatigue behavior of fastener holes have been identified and corrected to achieve a 100% improvement in fatigue life. Some of these improvements are being implemented in the F-16 production program and the improved drilling will be implemented in the C5A-H Mod Program.
GRA

N80-16379# Naval Ship Research and Development Center, Bethesda, Md.
DESIGN EQUATION FOR TRIPPING OF STIFFENERS UNDER IN PLANE AND LATERAL LOADS Final Report
John C. Adamchak Jan. 1979 98 p refs
(SF43422593)
(AD-A074752; DTNSRDC-79/064) Avail: NTIS

HC A05/MF A01 CSCL 13/13

A series of design oriented equations to predict the tripping (lateral-torsional instability) of stiffeners under inplane and lateral loads has been developed which will allow this mode of failure to be more comprehensively addressed in the early stages of structural design. This type of failure is characterized by a twisting of the stiffener about its line of attachment to the plating and has been demonstrated by some recent British grillage tests to have serious potential as a primary mode of failure. The solutions developed take into account the effects of the rotational resistance provided by the plating to which the stiffener is attached, non-linear material and structural behavior by means of a tangent modulus type approach, and stiffener web deformations (for inplane loading). The equations are suitable for manual calculations but particularly powerful applications are possible when they are teamed up with a desk-top type mini-computer. GRA

N80-16380# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.

STRUCTURE INELASTICITY 24. EXAMPLES OF NON-UNIQUENESS IN CONTAINED PLASTIC DEFORMATION

Philip G. Hodge, Jr. and David L. White Jul. 1979 21 p

(Contract N00014-75-C-0177)

(AD-A074727; AEM-H1-24) Avail: NTIS HC A02/MF A01 CSCL 20/11

It is well known that in a well-defined boundary-value problem for an elastic/perfectly-plastic structure the displacements are unique if the structure is everywhere elastic, and they are not unique at the yield-point load. The present paper is concerned with the range of contained plastic deformation between these two extremes. Several examples are given in which more than one displacement field exists for loads less than the yield-point load. The significance of this phenomenon is commented on from a physical, mathematical, and computational point of view. GRA

N80-16381# Utah Univ., Salt Lake City. Dept. of Chemistry.

ENERGY DISPERSION AND RELAXATION IN PROPYNAL USING LASER IR/VISIBLE DOUBLE RESONANCE

M. L. Lesiecki, G. R. Smith, J. A. Stewart, and W. A. Guillory 1979 17 p refs Presented at the 14th European Congr. on Molecular Spectry., Frankfort, 3 Sep. 1979

(Contract ER-78-S-02-4695)

(COO-4695-2; CONF-790919-1) Avail: NTIS HC A02/MF A01

The dynamics of energy dispersion in propynal were studied over the pressure range of 5 to 500 mtorr following excitation by a TEA CO2 laser below the dissociation threshold. Wavelength resolved spectra, using the dye laser-induced fluorescence technique, are used to characterize the vibrational levels that are involved in the various energy transfer processes, while time-resolved spectra are used to determine the corresponding rates. The rate constants are extrapolated to zero pressure to obtain the regime of collisionless intramolecular relaxation time. Mechanisms of energy dispersion involving each of the probed vibrational levels are discussed. DOE

N80-16382# California Univ., Livermore. Lawrence Livermore Lab.

ACOUSTIC EMISSION GENERATED IN UNFLAWED 7075-T651 ALUMINUM UNDER UNIFORM BIAXIAL LOADING

M. A. Hamstad, R. G. Patterson, and A. K. Mukherjee 29 Dec. 1978 15 p refs Presented at the 9th World Conf. on Nondestructive Testing, Melbourne, 18-23 Nov. 1979

(Contract W-7405-eng-48)

(UCRL-81030; CONF-791101-3) Avail: NTIS HC A02/MF A01

A tubular specimen for acoustic emission testing of unflawed metals under uniaxial or biaxial loading was designed. The test technique and specimen design using 7075-T651 aluminum were evaluated. Biaxial results differed significantly from uniaxial results. DOE

N80-16383# California Univ., Livermore. Lawrence Livermore Lab.

IDENTIFICATION, DETECTION AND VALIDATION OF VIBRATING STRUCTURES: A SIGNAL PROCESSING APPROACH

J. V. Candy and D. L. Lager 18 Sep. 1979 58 p refs

(Contract W-7405-eng-48)

(UCID-18270) Avail: NTIS HC A04/MF A01

The application of modern signal processing techniques to characterize parameters governing the vibrational response of a structure is presented. Simulated response data is used to explore the feasibility of applying these techniques to various structural problems. On-line estimator/indentifiers are used to estimate structural parameters, validate designed structures, and detect structural failure when used with a detector. DOE

N80-16384# Argonne National Lab., Ill.

EFFECTS OF CRACKS ON THE RESPONSE OF SHELL STRUCTURES

H. J. Petroski 1979 10 p refs Presented at Intern. Conf. on Structural Mech. in Reactor Technol., Berlin, 13 Aug. 1979

(Contract W-31-109-eng-38)

(CONF-790802-57) Avail: NTIS HC A02/MF A01

A simple model that predicts the effects of axial cracks on the elastic deformation of thin cylindrical shells is developed. The model employs Fourier series representations for the deformation components of the shell and represents a crack by pairs of concentrated couples at the crack location. These couples induce bending modes of deformation, with the lower order bending modes dominating the response. Hence excellent results can be obtained with only about 25 bending models superimposed on the axisymmetric breathing mode, which alone characterizes the response of an uncracked shell to an axisymmetric pressure load. The model can be calibrated from a single static finite element analysis of the shell of interest. The calibrated model then accurately predicts the effects of different numbers, sizes, and locations of cracks under both static and dynamic loading of the shell. DOE

N80-16385# General Atomic Co., San Diego, Calif.

INFLUENCES OF THE COUPLE-STRESSES ON THE PURE-BENDING OF A CIRCULAR CYLINDER

B. G. Kao, F. K. Tzung, and F. H. Ho Jul. 1979 46 p refs

(Contract EY-76-C-03-0167)

(GA-A-15141) Avail: NTIS HC A03/MF A01

The solution to the pure-bending of a circular cylinder with the couple-stress theory of linear elasticity is presented. A linear bending moment-curvature relation is derived parallel to the classical beam theory. The section modulus (or the proportional coefficient) associated with the couple-stress theory is always greater than that predicted by the classical theory, and the ratio of the former to the latter increases as the radius of the beam decreases. These aspects clearly agree with the observed behavior of nuclear-grade graphite. Based on the solution, it is further estimated that the characteristic length of the couple-stress theory for H-451 graphite ranges from 0.62 to 1.54 mm. This range concurs with the magnitude of the grain size (maximum is 1.57 mm for H-451 graphite) and agrees with an aspect of the couple-stress theory. DOE

N80-16386# Sandia Labs., Albuquerque, N. Mex. Telemetry Components and Transducers Div.

LIMITATIONS AND CORRECTIONS IN MEASURING DYNAMIC CHARACTERISTICS OF STRUCTURAL SYSTEMS

P. L. Walter Oct. 1978 250 p refs

(Contract EY-76-C-04-0789)

(SAND-78-1015) Avail: NTIS HC A11/MF A01

Limitations encountered in measuring the dynamic characteristics of structural systems are discussed. Structural loading and response were measured by transducers possessing multiple resonant frequencies in their transfer function. In transient environments, the resultant signals from these transducers are shown to be analytically unpredictable in amplitude level and frequency content. Data recorded during nuclear effects simulation testing on structures were analyzed. Results of analysis can be generalized to any structure which encounters dynamic loading. Methods to improve the recorded data are described which can be implemented on a frequency selective basis during the measurement process. These improvements minimize data distortion attributable to the transfer characteristics of the measuring transducers. DOE

N80-16387# Babcock and Wilcox Co., Alliance, Ohio. Research and Development Div.
CONSISTENT CREEP AND RUPTURE PROPERTIES FOR CREEP-FATIGUE EVALUATION
C. C. Schultz 1978 80 p refs Presented at the ASME Meeting, San Francisco, 10 Dec. 1978
(Contract EY-76-C-15-0003)
(CONF-781202-21) Avail: NTIS HC A05/MF A01

The currently accepted practice of using inconsistent representations of creep and rupture behaviors in the prediction of creep-fatigue life is shown to introduce a factor of safety beyond that specified in current ASME Code design rules for 304 stainless steel Class 1 nuclear components. Accurate predictions of creep-fatigue life for uniaxial tests on a given heat of material were obtained by using creep and rupture properties for that same heat of material. The use of a consistent representation of creep and rupture properties for a minimum strength heat is also shown to provide adequate predictions. The viability of using consistent properties (either actual or those of a minimum heat) to predict creep fatigue life thus identifies significant design uses for the results of characterization tests and improved creep and rupture correlations. DOE

N80-16388# Brown Univ., Providence, R. I. Div. of Engineering.
TENSILE CRACKS IN CREEPING SOLIDS
H. Riedel (Max-Planck-Institut feur Eisenforschung, Dusseldorf) and J. R. Rice Feb. 1979 34 p refs
(Contract EY-76-S-02-3084)
(COO-3084-64) Avail: NTIS HC A03/MF A01

The loading parameter determining the stress and strain fields near a crack tip, and thereby the growth of the crack, under creep conditions is discussed. Relevant loading parameters considered are the stress intensity factor K/sub I/, the path-independent integral C*, and the net section stress sigma/sub net/. The material behavior is modelled as elastic-nonlinear viscous where the nonlinear term describes power law creep. At the time t = 0 load is applied to the cracked specimen, and in the first instant the stress distribution is elastic. Subsequently, creep deformation relaxes the initial stress concentration at the crack tip, and creep strains develop rapidly near the crack tip. Besides several methods of estimating the creep zone size, a convenient expression for a characteristic time is derived, which characterizes the transition from small scale yielding to extensive creep of the whole specimen. DOE

N80-16200*# General Electric Co., Utica, N. Y. Aircraft Equipment Div.
PROBABILITY OF FAILURE PREDICTION FOR STEP-STRESS FATIGUE UNDER SINE OR RANDOM STRESS
Ronald G. Lambert *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 31-41 refs (For primary document see N80-16198 07-31)
Avail: NTIS HC A09/MF A01 CSCL 20L

N80-16201*# Martin Marietta Corp., Denver, Colo.
ON THE USE OF COHERENCE FUNCTIONS TO EVALUATE SOURCES OF DYNAMIC EXCITATION
Stanley Barrett *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 43-58 refs (For primary document see N80-16198 07-31)
(Contract NAS1-14370)
Avail: NTIS HC A09/MF A01 CSCL 20K

N80-16204*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SNAPS IN STRUCTURES
Michail Zak *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 83-87 refs (For primary document see N80-16198 07-31)
(Contract NAS7-100)
Avail: NTIS HC A09/MF A01 CSCL 20K

N80-16205*# SRI International Corp., Menlo Park, Calif.
A SIMPLIFIED METHOD OF EVALUATING THE STRESS WAVE ENVIRONMENT OF INTERNAL EQUIPMENT
J. D. Colton and T. P. Desmond *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 89-96 refs (For primary document see N80-16198 07-31)
Avail: NTIS HC A09/MF A01 CSCL 20K

N80-16206*# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
HIGH G PYROTECHNIC SHOCK SIMULATION USING METAL-TO-METAL IMPACT
Monty Bai and Wesley Thatcher *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 97-100 (For primary document see N80-16198 07-31)
Avail: NTIS HC A09/MF A01 CSCL 20K

N80-16208*# Southwest Research Inst., San Antonio, Tex.
BLAST FROM BURSTING FRANGIBLE PRESSURE SPHERES
E. D. Esparza and W. E. Baker *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1979 p 127-139 refs (For primary document see N80-16198 07-31)
(Grant NsG-3008)
Avail: NTIS HC A09/MF A01 CSCL 20K

N80-16212*# Martin Marietta Corp., Denver, Colo.
AN IMPEDANCE TECHNIQUE FOR DETERMINING LOW FREQUENCY PAYLOAD ENVIRONMENTS
Kenneth R. Payne *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 1-14 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 22B

N80-16213*# Martin Marietta Corp., Denver, Colo.
A STATISTICAL LOOK AT MODAL DISPLACEMENT RESPONSE TO SEQUENTIAL EXCITATIONS
William J. Karena *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 15-18 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

N80-16214*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
ON DETERMINING THE NUMBER OF DOMINANT MODES IN SINUSOIDAL STRUCTURAL RESPONSE
W. L. Hallauer, Jr. and A. Franck *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 19-34 refs (For primary document see N80-16211 07-31)
(Grant NsG-1276)
Avail: NTIS HC A10/MF A01 CSCL 20K

N80-16218*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
COMPUTER AIDED DESIGN OF PASSIVE VIBRATION ISOLATORS FOR AIRBORNE ELECTRO-OPTICAL SYSTEMS
P. W. Whaley and Jerome Pearson (AFFDL) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 81-86 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

N80-16220*# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
A SIMPLE LOW-COST TECHNIQUE FOR MEASURING MATERIAL DAMPING BEHAVIOR
David I. G. Jones *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 97-103 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

N80-16222*# Army Construction Engineering Research Lab., Champaign, Ill.
LIQUID SPRING SHOCK ISOLATOR MODELING BY SYSTEM IDENTIFICATION
P. N. Sonnenburg, B. H. Wendler, and W. E. Fisher *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 119-134 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20D

N80-16223*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A GENERALIZED DERIVATIVE MODEL FOR AN ELASTOMER DAMPER
Ronald L. Bagley and Peter J. Torvik *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 135-143 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

N80-16224*# Michigan State Univ., East Lansing. School of Packaging.
SHOCK RESPONSE OF NON-LINEAR SYSTEMS
Kalman Peleg *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 145-157 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

N80-16225*# Brookhaven National Lab., Upton, N. Y.
STABILITY ANALYSIS AND RESPONSE CHARACTERISTICS OF TWO-DEGREE OF FREEDOM NONLINEAR SYSTEMS
M. Subudhi and J. R. Curreri *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 159-163 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

N80-16227*# California Univ., Berkeley. Structural Engineering and Structural Mechanics Div.
SHOCK SPECTRA DESIGN METHODS FOR EQUIPMENT-STRUCTURE SYSTEMS
James M. Kelly and Jerome L. Sackman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 171-176 refs (For primary document see N80-16211 07-31)
(Contract DNA001-C-0233; Grant NSF ENG-77-05197)
Avail: NTIS HC A10/MF A01 CSCL 20K

N80-16230*# Naval Surface Weapons Center, White Oak, Md.
A STABILITY THEOREM FOR A DYNAMICALLY LOADED LINEAR VISCOELASTIC STRUCTURE
D. W. Nicholson *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 203-208 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

N80-16231*# Michigan State Univ., East Lansing. School of Packaging.
ANALOG DOUBLE INTEGRATION OF SHOCK PULSES
Kalman Peleg and Richard A. Lund (MTS Systems Corp., Minneapolis, Minn.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 209-217 refs (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-16389 Stanford Univ., Calif.
OPTIMIZATION TECHNIQUES AND NUMERICAL METHODS FOR AQUIFER MANAGEMENT Ph.D. Thesis
Eduardo A. Aguado 1979 189 p
Avail: Univ. Microfilms Order No. 8002308

Integrated, self-contained models in which the physical behavior and functioning of the groundwater system is truly part of the optimization management model were developed. The partial differential equations describing groundwater flow are approximated by finite differences and the resulting linear algebraic simultaneous equations are imbedded as constraints in a linear programming formulation which can include economical, political, or social, quantifiable decision variables and constraints. The optimal plan for dewatering a construction site is determined and the method is applied to a conceptual, medium-sized sea-water intrusion problem. The optimal strategy for preventing encroachment of sea water in a coastal aquifer while maintaining fresh-water extraction at prescribed levels, is also determined.

Dissert. Abstr.

N80-16390 Wisconsin Univ. - Madison.
MEASUREMENT OF EDDY DIFFUSIVITY AND SOLUTE TRANSPORT THROUGH THE NEAR-SEDIMENT BOUNDARY LAYER OF ICE-COVERED LAKES, USING RADON-222 Ph.D. Thesis
John Ammiel Colman 1979 222 p
Avail: Univ. Microfilms Order No. 7927166

A technique for calculating vertical solute transport through the benthic boundary layer using a mathematical comparison of solute and Rn-222 profiles was investigated. The profile comparison was based on relating the vertical eddy diffusivities calculated from the Rn-222 profiles to the depth gradient of a solute's concentration. The relationship between vertical solute transport and solute flux through the sediment-water interface was also investigated. The sediment contribution during the winter to the net change in solute standing crop was computed from water column solute budgets and compared to changes predicted from vertical solute transport calculations. The comparison indicates some solutes released from the sediments during the winter period are not conservative in the water column.

Dissert. Abstr.

N80-16391*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES Annual Report, 16 Dec. 1978 - 15 Jan. 1979
R. M. Hoffer, M. D. Fleming, L. A. Bartolucci, S. M. Davis, and R. F. Nelson, Principal Investigators 15 Jan. 1979 169 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15508)
(E80-10041; NASA-CR-160379; LARS-TR-011579) Avail: NTIS HC A08/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-16392*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF REGISTRATION, COMPRESSION, AND CLASSIFICATION ALGORITHMS. VOLUME 2: DOCUMENTATION
R. Jayroe, Principal Investigator, R. Atkinson, L. Callas, J. Hodges, B. Gaggini, and J. Peterson Feb. 1979 331 p refs ERTS
(E80-10042; NASA-TM-78227) Avail: NTIS HC A15/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-16393*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
COMPUTER-AIDED PROCESSING OF LANDSAT MSS DATA FOR CLASSIFICATION OF FORESTLANDS
Ross F. Nelson and Roger M. Hoffer, Principal Investigators Oct. 1979 103 p refs ERTS
(Contract NAS9-15508)
(E80-10043; NASA-CR-160381; LARS-TR-102679) Avail: NTIS HC A06/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-16394*# Lockheed Electronics Co., Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). THE BOUNDARY PIXEL STUDY IN KANSAS AND NORTH DAKOTA
D. T. Register, Principal Investigator and A. L. Ona Sep. 1979 34 p refs Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10044; NASA-CR-160365; JSC-14563; LEC-12826)
Avail: NTIS HC A03/MF A01 CSCL 08B

The author has identified the following significant results. The statistical mapping approach to handling boundary pixels can be used as a standard for objectively comparing the cluster based technique, the maximum likelihood estimate based technique, and multicategory labeling.

N80-16395*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION OF SOFTWARE FOR CLUSTER-BASED PROPORTION ESTIMATION
Nim-yau Chu, Principal Investigator Oct. 1979 174 p ERTS
(Contract NAS9-15800)
(E80-10045; NASA-CR-160366; LEC-13934; JSC-16239)
Avail: NTIS HC A08/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-16396*# Maryland Univ., College Park. Dept. of Civil Engineering.
RELATIONSHIP OF PHYSIOGRAPHY AND SNOW AREA TO STREAM DISCHARGE Final Report, 1 Nov. 1976 - 31 May 1979
Richard H. McCuen, Principal Investigator Oct. 1979 146 p refs ERTS
(Grant NGR-21-002-399)
(E80-10046; NASA-CR-162506) Avail: NTIS HC A07/MF A01 CSCL 08L

The author has identified the following significant results. A comparison of snowmelt runoff models shows that the accuracy of the Tangborn model and regression models is greater if the test data falls within the range of calibration than if the test data lies outside the range of calibration data. The regression models are significantly more accurate for forecasts of 60 days or more than for shorter prediction periods. The Tangborn model is more accurate for forecasts of 90 days or more than for shorter prediction periods. The Martinec model is more accurate for forecasts of one or two days than for periods of 3,5,10, or 15 days. Accuracy of the long-term models seems to be independent of forecast data. The sufficiency of the calibration data base is a function not only of the number of years of record but also of the accuracy with which the calibration years represent the total population of data years. Twelve years appears to be a sufficient length of record for each of the models considered, as long as the twelve years are representative of the population.

N80-16397*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, Oct. - Dec. 1979
James C. Barnes, Principal Investigator 7 Jan. 1980 7 p Sponsored by NASA ERTS
(E80-10049; NASA-CR-162521; QPR-9) Avail: NTIS HC A02/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-16398*# Geological Survey, Denver, Colo.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, Sep. - Nov. 1979
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Nov. 1979 20 p Sponsored by NASA ERTS
(E80-10050; NASA-CR-162522) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-16399*# Lockheed Electronics Co., Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). DETAILED DESCRIPTION OF THE WHEAT ACREAGE ESTIMATION PROCEDURE USED IN THE LARGE AREA CROP INVENTORY EXPERIMENT
Willa W. Austin, Principal Investigator Feb. 1978 43 p refs Sponsored by NASA, NOAA, and USDA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15200)
(E80-10051; NASA-CR-160405; LEC-11497) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-16400*# Lockheed Electronics Co., Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PROFILE SIMILARITY FEASIBILITY STUDY
Charles V. Nazare, Principal Investigator Oct. 1979 44 p refs Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10052; NASA-CR-160406; JSC-16246; LEC-14010)
Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-16401*# National Conference of State Legislatures, Denver, Colo.
NCSL REMOTE SENSING PROJECT Final Report, 16 Jul. 1978 - 20 Sep. 1979
Paul A. Tessar, Principal Investigator 20 Sep. 1979 88 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NASw-3230)
(E80-10053; NASA-CR-162523) Avail: NTIS HC A05/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-16402*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SPECTRAL FILTER FOR ESMR'S SIDELOBE ERRORS
Dennis Chesters Sep. 1979 26 p refs
(NASA-TM-80555) Avail: NTIS HC A03/MF A01 CSCL 08B

Fourier analysis was used to remove periodic errors from a series of NIMBUS-5 electronically scanned microwave radiometer brightness temperatures. The observations were all taken from the midnight orbits over fixed sites in the Australian grasslands. The angular dependence of the data indicates calibration errors consisted of broad sidelobes and some miscalibration as a function of beam position. Even though an angular recalibration curve cannot be derived from the available data, the systematic errors can be removed with a spectral filter. The 7 day cycle in the drift of the orbit of NIMBUS-5, coupled to the look-angle biases, produces an error pattern with peaks in its power spectrum at the weekly harmonics. About plus or minus 4 K of error is removed by simply blocking the variations near two- and three-cycles-per-week. R.E.S.

N80-16403*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DIELECTRIC PROPERTIES OF SOIL-WATER MIXTURES AT MICROWAVE FREQUENCIES
J. R. Wang Dec. 1979 24 p refs Submitted for publication
(NASA-TM-80597) Avail: NTIS HC A02/MF A01 CSCL 08M

Recent measurements on the dielectric constants of soil-water mixtures show the existence of two frequency regions in which the dielectric behavior of these mixtures was quite different. At the frequencies of 1.4 GHz to 5 GHz, there were strong evidences that the variations of the dielectric (epsilon) with water content (W) depended on soil type. While the real part of epsilon for sandy soils rose rapidly with the increase in W, epsilon for the high-clay content soils rose only slowly with W. As a consequence, epsilon was generally higher for the sandy soils than for the high-clay content soils at a given W. On the other hand,

most of the measurements at frequencies < 1 GHz indicated the increase of epsilon with W independent of soil types. At a given W, epsilon' (sandy soil) approximately equals epsilon (high-clay content soil) within the precision of the measurements. These observational features can be satisfactorily interpreted in terms of a simple dielectric relaxation model, with an appropriate choice of the mean relaxation frequency f(m) and the range of the activation energy (beta). It was found that smaller f(m) and larger beta were required for the high-clay content soils than the sandy soils in order to be consistent with the measured data. Author

N80-16404*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
L-BAND RADAR SENSING OF SOIL MOISTURE
A. T. C. Chang, S. Atwater (California Univ., Santa Barbara), V. V. Salomonson, J. E. Estes (California Univ., Santa Barbara), D. S. Simonett (California Univ., Santa Barbara), and M. L. Bryan (JPL) Jan. 1980 32 p refs Submitted for publication
(NASA-TM-80628) Avail: NTIS HC A03/MF A01 CSCL 08M

The performance of an L-band, 25 cm wavelength imaging synthetic aperture radar was assessed for soil moisture determination, and the temporal variability of radar returns from a number of agricultural fields was studied. A series of three overflights was accomplished over an agriculutural test site in Kern County, California. Soil moisture samples were collected from bare fields at nine sites at depths of 0-2, 2-5, 5-15, and 15-30 cm. These gravimetric measurements were converted to percent of field capacity for correlation to the radar return signal. The initial signal film was optically correlated and scanned to produce image data numbers. These numbers were then converted to relative return power by linear interpolation of the noise power wedge which was introduced in 5 dB steps into the original signal film before and after each data run. Results of correlations between the relative return power and percent of field capacity (FC) demonstrate that the relative return power from this imaging radar system is responsive to the amount of soil moisture in bare fields. The signal returned from dry (15% FC) and wet (130% FC) fields where furrowing is parallel to the radar beam differs by about 10 dB. A.R.H.

N80-16405*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
SYNTHETIC APERTURE RADAR/LANDSAT MSS IMAGE REGISTRATION
H. E. Maurer, ed., J. D. Oberholtzer, ed., and P. E. Anuta, ed. (Purdue Univ.) Jun. 1979 233 p Sponsored in part by Goodyear Aerospace Corp. Original contains color illustrations
(Contracts NAS6-2816; NAS6-2827)
(NASA-RP-1039) Avail: NTIS HC A11/MF A01 CSCL 17I

Algorithms and procedures necessary to merge aircraft synthetic aperture radar (SAR) and LANDSAT multispectral scanner (MSS) imagery were determined. The design of a SAR/LANDSAT data merging system was developed. Aircraft SAR images were registered to the corresponding LANDSAT MSS scenes and were the subject of experimental investigations. Results indicate that the registration of SAR imagery with LANDSAT MSS imagery is feasible from a technical viewpoint, and useful from an information-content viewpoint. J.M.S.

N80-16406*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
RADIATIVE TRANSFER MODELING APPLIED TO SEA WATER CONSTITUENT DETERMINATION
Kenneth H. Faller Dec. 1979 171 p
(NASA-TM-72736) Avail: NTIS HC A08/MF A01 CSCL 08J

Optical radiation from the sea is influenced by pigments dissolved in the water and contained in discrete organisms suspended in the sea, and by pigmented and unpigmented inorganic and organic particles. The problem of extracting the information concerning these pigments and particulates from the optical properties of the sea is addressed and the properties which determine characteristics of the radiation that a remote sensor will detect and measure are considered. The results of the application of the volume scattering function model to the data collected in the Gulf of Mexico and its environs indicate that the size distribution of the concentrations of particles found in the sea can be predicted from measurements of the volume scattering function. Furthermore, with the volume scattering function model and knowledge of the absorption spectra of dissolved pigments, the radiative transfer model can compute a distribution of particle sizes and indices of refraction and concentration of dissolved pigments that give an upwelling light spectrum that closely matches measurements of that spectrum at sea. A.R.H.

N80-16407*# City Univ. of New York, N. Y. Inst. of Marine and Atmospheric Sciences.
VERIFICATION PROCEDURES FOR THE SEASAT MEASUREMENTS OF THE VECTOR WIND WITH THE SASS
Willard J. Pierson Jan. 1978 39 p refs Sponsored by NASA Prepared for JPL
(Contracts JPL-954411; N00014-77-C-0206)
(NASA-CR-162469; AD-A073644) Avail: NTIS HC A03/MF A01

Various relationships between the friction velocity and the roughness length in boundary layer models are studied in terms of the verification of the SASS on SEASAT. It is shown that verification against a measured wind at a known anemometer height is preferable to verification against a theoretical value of the friction velocity. The effect of the different models is small when they are used to refer all measured winds to one elevation. A model is proposed that has the features of two quite different models and the height of the anemometer for verification purposes is recommended to be 19.5 meters. GRA

N80-16408# California Univ., Livermore. Lawrence Livermore Lab.
REMOTE SENSING FOR DIAGNOSING VAPOR DISPERSION IN SPILLS OF LIQUID ENERGY FUELS
L. G. Multhauf, A. M. Frank, and R. O. Koopman 23 Aug. 1979 53 p
(Contract W-7405-eng-48)
(UCID-18237) Avail: NTIS HC A04/MF A01

The measurement of gas concentrations in Liquid Energy Fuel (LEF) dispersion clouds by remote LIDAR sensing is an attractive alternative to the use of in situ instruments in regions where the gas concentration level is low. A comparison of Raman and DIAL LIDAR shows that Raman LIDAR is best suited to measure the concentration levels of interest in the LEF program. The LIDAR systems are limited primarily by the opaque fog produced by the evaporation of a cryogenic liquid fuel. The limitation is most severe for methane, for which LIDAR is not useful for concentrations above the flammability range. However, it is this low concentration region that the spatial extent of the cloud is large and not easily covered with an array. A fence of in situ instruments proposed for 40 cu m spills at China Lake (a row of 10 in situ instrument stations) and a Raman LIDAR system of similar cost designed to cover the same area of the cloud were compared. LIDAR offers substantially higher spatial resolution and coverage that better allows for wind variations. DOE

N80-16409# Juniata Coll., Huntingdon, Pa.
STUDY OF HYDROCARBON-SHALE INTERACTION
Progress Report, 1 Apr. - 30 Jun. 1979
P. D. Schettler, Jr. and D. L. Wampler 1979 50 p refs
(Contract EY-76-S-05-5197)
(ORO-5197-14; PR-14) Avail: NTIS HC A03/MF A01

Construction of an apparatus for degasibility/isotherm measurements up to 1000 psi is complete. Results of chromatographic analysis of off-gassing from wells KY No. 4-, PA No. 1-, PA No. 2-, OH No. 3-, and IL No. 4-EGSP are tabulated. Temperature coefficients of degasibility and isotherm parameters in Devonian shales were determined. A summary of degasibility/isotherm data is presented. A computer simulation of a matrix diffusion/fracture flow model in the radial case is discussed. A small infrared/X-ray diffraction study is proceeding on selected samples. DOE

N80-16410# Department of Energy, Morgantown, W. Va. Energy Technology Center.
GAS PRODUCTION OF DEVONIAN SHALE WELLS RELATIVE TO PHOTO LINEAMENT LOCATIONS: A STATISTICAL ANALYSIS

J. F. Howard (Howard and Associates, Owensboro, Ky.), S. J. Lahoda (West Virginia Univ., Morgantown), W. E. Zirk (West Virginia Univ., Morgantown), and C. A. Komar Apr. 1979 19 p refs
(METC/CR-79/28) Avail: NTIS HC A02/MF A01

A pilot study was made to relate Devonian shale gas well production to distance from photo lineaments that were mapped at two different scales, namely low altitude (1:24,000) and intermediate altitude (1:62,500). Cumulative production after 5 years for 41 wells located in the Vicco quadrangle of Perry Co., Kentucky, was used in the study. A statistical two-way analysis of variance design was used to group the data into four classes depending on whether the producing wells were within or beyond 300 feet of a photo lineament derived from both scales. Results indicate that cumulative 5 year production is higher for wells sited within 300 feet of a low-altitude photo lineament. The correlations indicate a narrow zone of influence or effect for the geologic feature represented by the photo lineament. Moreover, the most consistently effective features are derived from low-altitude (1:24,000) scale photography, well below the detail commonly utilized in studies to date. DOE

N80-16411# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: UNDERGROUND COAL GASIFICATION
Sep. 1979 76 p Sponsored by DOE, Washington, D.C.
(DOE/EDP-0047) Avail: NTIS HC A05/MF A01

Early tests indicate that some of the groundwater pollution due to underground coal gasification (UCG) is confined to an area adjacent to the gasified zone and the cleansing properties of the surrounding coal may serve as a natural contaminant control system. Ground subsidence is another major concern. Subsidence could cause disruption of aquifers, surface disturbance, and loss of product gas through cracks to the surface. Degradation of air quality is also a significant concern particularly with respect to emissions through cracks and fissures resulting from anticipated subsidence. Potential hazards to the worker exist, including the inadvertent release of gas through cracks in the ground surface and worker safety associated with the sudden collapse through subsidence. Environmental regulations which will most directly affect the UCG program include the Federal Water Pollution Control Act, the Safe Drinking Water Act, and the Clean Air Act. These regulations will impact upon pollution control requirements, and potential siting of facilities. DOE

N80-16412# Battelle Pacific Northwest Labs., Richland, Wash.
COLLECTION AND ANALYSIS OF VEGETATIVE COVER DATA
R. H. Sauer and S. L. Owzarski Jul. 1979 24 p refs
(Contract EY-76-C-06-1830)
(PNL-3068) Avail: NTIS HC A03/MF A01

The rationale, methods, and analytic tools that are commonly used to study changes in vegetation on the Hanford Site are discussed. The method of vegetation analysis that has been successful in the Columbia Basin in Washington State is Daubenmire's (1959) canopy cover approach. Six classes are recognized in use. The percentage cover of each species present is estimated and placed in one of the six classes. The advantage of placing the cover of a species into broad classes instead of making more accurate estimates is that it allows faster data collection. The error is reduced with many samples (usually 50) because the actual value in some samples will be less than the midpoint, and others, greater than the midpoint. The midpoint value is used to calculate the statistics of canopy cover. A FORTRAN listing of the program cover and sample output, consisting of a data listing, frequency, cover statistics, and species diversity for each line is given in the appendix. DOE

N80-16413# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
BACKSCATTER RESPONSE OF SNOW COVERED ROADS AND ROADSIDE SURFACES
F. T. Ulaby and W. H. Stiles Aug. 1979 67 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7046; RSL-TR-377-2) Avail: NTIS HC A04/MF A01

The angular response of the backscatter coefficient for snow covered targets was measured with a microwave action spectrometer. Snow under varying conditions on compacted dirt, short grass, asphalt and concrete surfaces was observed. The measurements were made for three linear polarizations (HH, HV, and VV) and at three frequencies (8.6, 17.0 and 35.6 GHz). The data was compared with measurements in the absence of snow. The general effect of wet or dry snow was observed to be a decrease in the total response dynamic range and therefore an increased difficulty in target discrimination. DOE

N80-16414# Geological Survey, Harrisburg, Pa. Water Resources Div.
FLOW ROUTING IN THE SUSQUEHANNA RIVER BASIN. PART 2: LOW-FLOW FREQUENCY CHARACTERISTICS OF THE SUSQUEHANNA RIVER BETWEEN WAVERLY, NEW YORK AND SUNBURY, PENNSYLVANIA
Donald L. Bringham Jun. 1979 38 p refs Prepared in cooperation with Susquehanna River Basin Commission, Harrisburg, Pa.
(PB-301392/7; USGS/WRI-79/52; USGS/WRD/WRI-79/067)
Avail: NTIS HC A03/MF A01 CSCL 08H

Six flow-routing models were developed, calibrated, and verified for the Susquehanna river between Waverly, New York, and Sunbury, Pennyslvania. The models were used to simulate a 32 year record of daily flows at two ungaged sites. Low flow frequency curves for simulated flows were used to estimate 7 day low flows at the 10 year recurrence interval. The mopel errors, differences between model results and observed streamflow at gaged sites, are considered to be within reasonable limits and overall quality of simulated streamflow and low flow frquency curves is considered good. GRA

N80-16415# Geological Survey, Harrisburg, Pa. Water Resources Div.
FLOW ROUTING IN THE SUSQUEHANNA RIVER BASIN. PART 3: ROUTING RESERVOIR RELEASES IN THE TIOGA AND CHEMUNG RIVERS SYSTEM, PENNSYLVANIA AND NEW YORK Final Report
Jeffrey T. Armbruster Jul. 1979 42 p refs Prepared jointly with Susquehanna River Basin Commission, Harrisburg, Pa.
(PB-301393/5; USGS/WRI-79/85; USGS/WRD/WRI-79/068)
Avail: NTIS HC A03/MF A01 CSCL 08H

Channel-routing models were used to route hypothetical releases from reservoirs in the upper Tioga River basin, Pennsylvania. The models used to route the flows of Cohocton and Chemung Rivers accounted for bank-storage discharge and streamflow depletion by well pumpage. Three hypothetical reservoirs releases were made from the reservoirs and routed to Wilkes-Barre, Pennsylvania. The first hypothetical release investigated was a constant 100 cubic feet per second, and the second release was a constant 70 cubic feet per second. The third scheme was a hypothetical release of 100 cubic feet per second for three days followed by a constant 70 cubic feet per second for the duration of the period considered. The third release scheme was generally the most efficient of the three schemes tested. GRA

N80-16416# Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
IRRIGATION PRACTICES AND RETURN FLOW SALINITY IN GRAND VALLEY Final Report
Gaylord V. Skogerboe, David McWhorter, and James E. Ayars Aug. 1979 220 p refs
(Grant EPA-S-800687)
(PB80-103609; EPA-600/2-79-148) Avail: NTIS HC A10/MF A01 CSCL 02C

The relationships between leachate volume and chemical quality were evaluated. A numerical model of soil moisture and salt transport was used. Field data were collected on 63 research plots located in the Grand Valley, Colorado. From the calibration of the moisture flow model using infiltration data, water content profiles and storage change data, it was concluded that soil moisture flow could be adequately modeled for the Grand Valley. From comparisons of field and simulated data used in evaluating the soil chemistry model, it was concluded that total dissolved solids (TDS) concentrations were adequately modeled but that individual ionic species concentrations were not. The TDS profile calculated at the beginning and end of the growing season show

the salt concentration in the profile below the root zone to be relatively constant. GRA

N80-16417# Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
TOWARD CLASSIFICATION AND RATIONALE FOR WATERSHED MANAGEMENT AND STREAM PROTECTION Final Report
Charles E. Warren. Jun. 1979. 148 p. refs.
(Grant EPA-R-805423)
(PB80-103153; EPA-600/3-79-059) Avail: NTIS HC A07/MF A01 CSCL 08H

A rationale for developing a classification system for watershed management is given. A hierarchical classification is developed that is based on the potentials and environments of systems, especially on the capacities of watersheds and streams to remain in desirable states over relatively long times and to return to desirable states over relatively short times. The suggested approach is to classify headwater streams by using extant knowledge of biogeoclimatic regions, watershed environments, stream order, and the morphological capacities of stream beds. GRA

N80-16418# Geological Survey, Anchorage, Alaska. Water Resources Div.
WATER RESOURCES DATA OF THE SEWARD AREA, ALASKA Final Report
L. L. Dearborn, G. S. Anderson, and Chester Zenone. Dec. 1978. 52 p. refs. Prepared in cooperation with Alaska Dept. of Natural Resources, Anchorage.
(PB80-101298; USGS/WRI-79/11; USGS/WRD/WRI-79/077) Avail: NTIS HC A04/MF A01 CSCL 13B

Water resources data collected in the Seward, Alaska area at various times since 1941 are presented. The present development and use of Seward's water resources are reviewed and alternative sources and methods for further development of the water supplies are discussed. The hydrological setting of Seward is examined and the water availability and water quality are discussed. A.W.H.

N80-16419# Environmental Monitoring and Support Lab., Las Vegas, Nev.
PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN US LAKES. PART 1: METHODS, RATIONALE AND DATA LIMITATIONS
W. D. Taylor, L. R. Williams, S. C. Hern, V. W. Lambou, F. A. Morris (Nevada Univ., Las Vegas), and M. K. Morris (Nevada Univ., Las Vegas). Mar. 1979. 81 p. refs.
(PB-298439/1; EPA-600/3-79-021-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 13B

The physical, chemical, and morphometric conditions of 250 lakes are described. The mechanics and logic of interfacing physical and chemical data (total phosphorus; orthophosphorus; nitrite-nitrate-, ammonia-, and total Kjeldahl-nitrogen; nitrogen/phosphorus ratio; Secchi disk transparency; chlorophyll a; turbidity; pH; total alkalinity; dissolved oxygen; and temperature) with biological data to establish the environmental requirements and the relative importance of phytoplankton are described. GRA

N80-16420# Environmental Monitoring and Support Lab., Las Vegas, Nev.
PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN US LAKES. PART 2: GENERA ACANTHOSPHAERA THROUGH CYSTODINIUM COLLECTED FROM EASTERN AND SOUTHEASTERN LAKES
L. R. Williams, S. C. Hern, V. W. Lambou, F. A. Morris (Nevada Univ., Las Vegas), M. K. Morris (Nevada Univ., Las Vegas), and W. D. Taylor. Mar. 1979. 130 p. refs.
(PB-298440/9; EPA-600/3-79-022-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 13B

Water quality relationships for about 180 genera and 700 species and varieties of phytoplankton were determined from data collected in 17 eastern and southeastern States during 1973. This report presents environmental requirements and relative abundance of 54 phytoplankton genera: Acanthosphaera through Cystodinium. GRA

N80-16421# Environmental Monitoring and Support Lab., Las Vegas, Nev.
PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN US LAKES. PART 3: GENERA DACTYLOCOCCOPSIS THROUGH GYROSIGMA COLLECTED FROM EASTERN AND SOUTHEASTERN LAKES
S. C. Hern, V. M. Lambou, F. A. Morris (Nevada Univ., Las Vegas), M. K. Morris (Nevada Univ., Las Vegas), W. D. Taylor, and L. R. Williams. Mar. 1979. 95 p. refs.
(PB-298441/7; EPA-600/3-79-023-Pt-3) Avail: NTIS HC A05/MF A01 CSCL 13B

Water quality relationships for about 180 genera and 700 species and varieties of phytoplankton were determined from data collected in 17 eastern and southeastern States during 1973. Environmental requirements and relative abundance are presented for 34 phytoplankton genera: Dactylococcopsis through Gyrosigma. GRA

N80-16422# Environmental Monitoring and Support Lab., Las Vegas, Nev.
PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN US LAKES. PART 4: GENERA HANTZCHIA THROUGH PTEROMONAS COLLECTED FROM EASTERN AND SOUTHEASTERN LAKES
V. W. Lambou, F. A. Morris (Nevada Univ., Las Vegas), M. K. Morris (Nevada Univ., Las Vegas), W. D. Taylor, L. R. Williams, and S. C. Hern. Mar. 1979. 115 p. refs.
(PB-298442/5; EPA-600/3-79-024-Pt-4) Avail: NTIS HC A06/MF A01 CSCL 13B

Water quality relationships for about 180 genera and 700 species and varieties of phytoplankton were determined from data collected in 17 eastern and southeastern States during 1973. Environmental requirements and relative abundance are presented for 47 phytoplankton genera: Hantzschia through Pteromonas. GRA

N80-16423# Environmental Monitoring and Support Lab., Las Vegas, Nev.
PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN US LAKES. PART 5: GENERA QUADRIGULA THROUGH ZYGNEMA COLLECTED FROM EASTERN AND SOUTHEASTERN LAKES
M. K. Morris (Nevada Univ., Las Vegas), W. D. Taylor, L. R. Williams, S. C. Hern, V. W. Lambou, and F. A. Morris (Nevada Univ., Las Vegas). Mar. 1979. 108 p. refs.
(PB-298443/3; EPA-600/3-79-025-Pt-5) Avail: NTIS HC A06/MF A01 CSCL 13B

Water quality relationships for about 180 genera and 700 species and varieties of phytoplankton were determined from data collected in 17 eastern and southeastern States during 1973. This report presents environmental requirements and relative abundance of 45 phytoplankton genera: Quadrigula through Zygnema. GRA

N80-16424*# Illinois Inst. of Natural Resources, Springfield.
ILLINOIS LANDSAT FEASIBILITY STUDY
John A. Bishop. Apr. 1979. 94 p. refs. Sponsored by NASA.
(NASA-CR-162760; PB-300409/0; ILLDOE-79/13) Avail: NTIS HC A05/MF A01 CSCL 22A

Satellite remote sensing technology and its application to natural resources planning and management is discussed as well as the satellite's advantages and limitations for data gathering. Recommendations for its use in Illinois are suggested. GRA

N80-16425# Geological Survey, Albuquerque, N. Mex. Water Resources Div.
HYDROLOGIC DATA ON CHANNEL ADJUSTMENTS, 1970 TO 1975, ON THE RIO GRANDE DOWNSTREAM FROM COCHITI DAM, NEW MEXICO, BEFORE AND AFTER CLOSURE Final Report
J. D. Dewey, F. E. Roybal, and D. E. Funderburg. May 1979. 542 p. refs.
(PB-301134/3; USGS/WRD/WRI-79/065; USGS/WRI-79/70) Avail: NTIS HC A23/MF A01 CSCL 13B

Cross section channel profiles sediment transport, and hydrologic data were observed and computed for a series of pre-dam post-dam investigations from 1970 to 1975 at 37 cross sections established along a 59 mile (95 kilometer) study reach

from Cochiti Dam to Isleta Diversion Dam, New Mexico. Cochiti Dam began impounding water in November 1973. Because the dam will trap virtually all of the sediment load originating upstream and water discharge will be controlled, it is expected that equilibrium values of channel width, depth, slope and sediment-transport capability in the existing main stem of the Rio Grande will change. Changes in cross sections with time and space and changes in size distribution of sediments are documented. GRA

N80-16426# Bureau of Mines, Amarillo, Tex. Helium Operations.
HELIUM RESOURCES OF THE UNITED STATES, 1977
B. J. Moore 1979 31 p refs
(PB80-101744; BM-IC-8803) Avail: NTIS HC A03/MF A01 CSCL 08F

Helium resources of the U.S. as of January 1977 are estimated at 710 billion cubic feet. These resources are broken down into four classifications, as follows: helium in measured natural gas resources and in storage, 201 billion cubic feet; helium in indicated natural gas resources, 150 billion cubic feet; helium in hypothetical natural gas resources, 175 billion cubic feet; and helium in speculative natural gas resources, 184 billion cubic feet. Most of the helium in natural gas is presently dissipated as natural gas is consumed as fuel and for other purposes. GRA

N80-16427# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Analysis and Prediction Div.
EDDYLESS CHANNEL FLOWS AND THEIR STABILITY
Stephen Jackson and James C. McWilliams Jul. 1979 61 p refs
(Grant NSF ATM-77-23757)
(PB80-104649; NCAR/TN-142) Avail: NTIS HC A04/MF A01 CSCL 20D

Numerical solutions are presented for steady flow in a zonal channel subjected to a meridionally varying zonal wind stress at the upper surface. The model used is adiabatic, hydrostatic, quasigeostrophic, and baroclinic with quadratic drag force at the lower boundary, vertical momentum diffusion in the interior, and a weak scale-selective horizontal momentum diffusion law. The solution technique is that of quasilinearization for the resulting nonlinear, two point boundary value problem. The steady solutions are also analyzed for their linearized stability to perturbations; they are found to be unstable for sufficiently strong wind stress and weak vertical momentum diffusion. GRA

N80-16428# Texas Dept. of Water Resources, Austin.
OCCURRENCE AVAILABILITY AND CHEMICAL QUALITY OF GROUND WATER IN THE EDWARDS PLATEAU REGION OF TEXAS
Lloyd E. Walker Jul. 1979 334 p refs
(PB-299790/6; TDWR/R-235) Avail: NTIS HC A15/MF A01 CSCL 08H

The principal aquifers, or water-bearing units, in order of importance and development are the Edwards-Trinity (Plateau), composed of the Antlers Formation and the Edwards and associated limestones; the alluvium; the lower Cretaceous, composed of the Hosston, Sligo, Pearsall, and Glen Rose Formations; the Hickory; and the Ellenburger-San Saba. Other units that yield fresh to slightly saline water in limited areas on or near the Edwards Plateau are the Ogallala aquifer and rocks of Pennsylvania, Permian, and Triassic age. The total amount of fresh to slightly saline ground water available from all aquifers on the Edwards Plateau is more than 450,000 acre-feet per year. Of the amount, approximately 308,000 acre-feet is available annually from the Edwards-Trinity (Plateau) and the alluvium aquifers. GRA

N80-16429# Geological Survey, Reston, Va.
U.S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: YELLOWSTONE NATIONAL PARK
Janet Bonner 1979 117 p refs
(PB-301333/1) Avail: NTIS HC A06/MF A01 CSCL 08B

Computer listings of material available in photographic form showing scenes filmed by Skylab, LANDSAT, NASA aircraft, or on USGS mapping missions are presented. In the case of LANDSAT imagery, computer-compatible magnetic tapes are also available. A.R.H.

N80-16430# Geological Survey, Reston, Va.
U.S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: ROCKY MOUNTAIN NATIONAL PARK
Janet Bonner, comp. 1979 74 p
(PB-301334/9) Avail: NTIS HC A04/MF A01 CSCL 08B

Photographs and images of biosphere reserves taken from spacecraft and aircraft provide a significant data base showing broad views and details of the landscape and are invaluable in searching for chantes and trends in forest cover, water area, and other diagnostic landscape features. Each data report in this series lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

N80-16431# Geological Survey, Harrisburg, Pa. Water Resources Div.
REGIONAL STOCHASTIC GENERATION OF STREAMFLOWS USING AN ARIMA (1,0,1) PROCESS AND DISAGGREGATION Final Report
Jeffrey T. Armbruster May 1979 63 p refs Prepared in cooperation with Susquehanna River Basin Commission, Harrisburg, Pa.
(PB-300945/3; USGS/WRD/WRI-79/058; USGS/WRI-79/3) Avail: NTIS HC A04/MF A01 CSCL 08H

An ARIMA (1,0,1) model was calibrated and used to generate long annual flow sequences at three sites in the Juniata River basin, Pennsylvania. The model preserves the mean, variance, and cross correlations of the observed station data. In addition, it has a desirable blend of both high and low frequency characteristics and therefore is capable of preserving the Hurst coefficient, h. The generated annual flows are disaggregated into monthly sequences using a modification of the Valencia-Schaake model. One hundred year sequences were generated and analyzed for their low flow characteristics. A method is proposed for synthesizing flows at ungaged sites. GRA

N80-16432# National Geodetic Survey, Rockville, Md.
HOACOS: A PROGRAM FOR ADJUSTING HORIZONTAL NETWORKS IN THREE DIMENSIONS
T. Vincenty Jul. 1979 18 p refs
(PB-301351/3; NOAA-TM-NOS-NGS-19; NOAA-79090405) Avail: NTIS HC A02/MF A01 CSCL 08G

Horizontal networks were adjusted in the simplest way in the height controlled spatial system without reducing observations to the ellipsoid. The mathematical model of the adjustment is based on the known principles of three dimensional geodesy. A computer program based on this method is described. GRA

N80-16433# Connecticut Univ., Storrs. Inst. of Water Resources.
DETERMINATION OF HYDROLOGIC PARAMETERS FOR GLACIAL TILLS IN CONNECTICUT M.S. Thesis
Lynn Joseph Torak 1979 172 p refs
(Contract DI-14-34-0001-9007)
(PB-300313/4; W79-09677; OWRT-A-077-CONN(1)) Avail: NTIS HC A08/MF A01 CSCL 08H

Glacial tills located in the upland areas of the Shetucket and Quinebaug River basins, Connecticut, were evaluated for horizontal permeability using field and laboratory techniques. Laboratory determined vertical permeabilities were compared to horizontal permeabilities derived from both laboratory and dugwell tests. Results indicate that the till exhibits anisotrophic flow characteristics similar to most stratified sediments. Horizontal components of permeability of at least an order of magnitude greater than vertical components are shown to exist for the glacial tills in this area. The hydrologic implications that arise from considering the anisotropy of the tills in this study area may have regional applications to similar tills located throughout New England. GRA

N80-16434# Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.

A MATHEMATICAL MODEL OF STRATIFIED, BIDIRECTIONAL FLOW IN SHORT CULVERTS M.S. Thesis
Delbert G. Martin 1979 89 p refs
(Contract DI-14-34-0001-7191)
(PB-300494/2; W79-09835; OWRT-B-139-UTAH(5)) Avail: NTIS HC A05/MF A01 CSCL 08H

A two dimensional computer model, simulating bidirectional, density-stratified gravity flow in the vertical plane was developed. The finite element method was applied to the governing equations, i.e., the equations of motion, continuity and convection-diffusion, to obtain a well-posed boundary value problem. Bidirectional flow is known to exist in the culverts located in the railroad causeway of the Great Salt Lake. The discharges, densities, temperatures, interface location, and head differences across the causeway were measured on a monthly basis, from October 1968 to September 1972. This data was used to verify the mathematical model. GRA

N80-16435/ Purdue Univ., Lafayette, Ind. Water Resources Research Center
HEURISTIC DECISION RULES FOR WATER RESOURCES PLANNING
V. Akileswaran, Thomas L. Morin, and Wilbur L. Meier, Jr. Aug. 1979 274 p refs
(Contract DI-14-34-0001-7118)
(PB-300578/2; TR-119; W79-09962; OWRT-B-086-Indi(1)) Avail: NTIS HC A12/MF A01 CSCL 08H

Many of the analytical techniques proposed for water resources planning are simply too sophisticated to be of practical use. Thus, there exists a huge gap between the 'seat-of-the-pants' or ad hoc procedures which are currently in use and the more sophisticated techniques which are not. This situation is a result of a number of factors which are addressed. It is shown how this gap can be successfully filled in many situations through the use of heuristic solution procedures. The heuristics are so simple to apply that they have been successfully implemented on programmable hand-held calculators. GRA

N80-16436/ Utah Water Research Lab., Logan.
A MATHEMATICAL HYDRODYNAMIC CIRCULATION MODEL OF GREAT SALT LAKE FOR RESOURCE MANAGEMENT Final Report
Gary Z. Watters and Charles T. Kincaid Jun. 1979 82 p refs
(Contract DI-14-34-0001-7191)
(PB-299013/3; W79-09054; OWRT-B-139-Utah(6)) Avail: NTIS HC A05/MF A01 CSCL 08H

A hydrodynamic circulation model for Great Salt Lake was developed along with several supporting mathematical models required to provide information on boundary conditions and mixing processes. Two of the supporting models were developed to describe bidirectional seepage flow and culvert flow through the railroad causeway which divides the lake into a north and south arm. A third model utilizes the velocity field computed by the circulation model and provides information on convective and dispersive processes in the lake. A laboratory study was directed toward establishing the diffuse transfer of material from the lower layer of the south arm to the upper layer. GRA

N80-16437/ Geological Survey, Tallahassee, Fla. Water Resources Div.
EVALUATION OF A DIGITAL MODEL FOR ESTUARINE WATER QUALITY SIMULATION IN WASTE ALLOCATION STUDIES
G. E. Seaburn, M. E. Jennings, and M. L. Merritt Apr. 1979 57 p refs Prepared in cooperation with Fla. State Dept. of Environmental Regulation, Tallahassee
(PB-298820/2; USGS/WRD/WRI-79/028) Avail: NTIS HC A04/MF A01 CSCL 08H

Four estuaries along the west coast of peninsular Florida were chosen to make an evaluation of an estuarine model application. Constituents simulated were dissolved oxygen, carbonaceous biochemical oxygen demand, total Kjeldahl nitrogen, and chloride. Current and predicted waste loading of the four estuaries is also described. The model was developed for well-mixed, steady-state, intertidal conditions. Thus, simulated concentrations of substances are computed as average values over a tide cycle. The general equations for the model are based on the law of conservation of mass. GRA

N80-16438/ Geological Survey, Champaign, Ill. Water Resources Div.
EFFECTS OF URBANIZATION ON THE MAGNITUDE AND FREQUENCY OF FLOODS IN NORTHEASTERN ILLINOIS Final Water-Data Report
Howard E. Allen, Jr. and Richard M. Bejcek May 1979 58 p refs Prepared in cooperation with Illinois State Dept. of Transportation, Chicago
(PB-299065/3; USGS/WRD/WRI-79/031) Avail: NTIS HC A04/MF A01 CSCL 08H

Changes in land use associated with urbanization increased flood-peak discharges in northeastern Illinois by factors ranging up to 3.2. Techniques are presented for estimating the magnitude and frequency of floods in that area and for estimating probable changes in flood characteristics that may be expected to accompany progressive urbanization. Three variables, drainage area, channel slope, and percent imperviousness (an urbanization factor), are used to estimate flood magnitudes for frequencies ranging from 2 to 500 years. Multiple-regression analyses were used to relate flood-discharge data to the above watershed characteristics for 103 gaged watersheds. These watersheds ranged in drainage area from 0.07 to 630 square miles, in channel slope from 1.1 to 115 feet per mile, and in imperviousness from 1 to 39 percent. GRA

N80-16439/ Arizona Univ., Tucson. Dept. of Hydrology and Water Resources
AQUIFER MODELING BY NUMERICAL METHODS APPLIED TO AN ARIZONA GROUNDWATER BASIN
Graham E. Fogg, Eugene S. Simpson, and Shlomo P. Neuman Jun. 1979 152 p refs
(Contract DI-14-34-0001-6235)
(PB-298962/2; TR-32; W79-09052; OWRT-C-7517(6235)(1)) Avail: NTIS HC A08/MF A01 CSCL 08H

A mixed explicit-implicit finite element program, called FLUMP was calibrated against a data base obtained from a portion of the Tucson Basin aquifer, Arizona. Previous models for the same region were constructed (an electric analog and a finite difference model) in which calibration was based on prescribed flux boundary conditions along stream courses and mountain fronts. These fluxes are not directly measured and estimates are subject to large uncertainties. In contrast, boundary conditions used in the calibration of FLUMP were prescribed hydraulic heads obtained from direct measurement. GRA

N80-16440/ National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Environmental Research Lab.
SOLAR ALTITUDE EFFECTS ON ICE ALBEDO
S. J. Bolsenga Jun. 1979 52 p refs
(PB-301252/3; NOAA-TM-ERL-GLERL-25; GLERL-Contrib-149; NOAA-79081605) Avail: NTIS HC A04/MF A01 CSCL 08L

The albedos of many natural surfaces, such as soils and crops, are known to be affected by solar altitude, but similar processes have not been well documented for ice surfaces. A limited set of ice albedo data shows that the effects of solar altitude are not nearly as pronounced as those attributed to many other natural surfaces. Surface geometry, direct-diffuse radiation balance, and spectral balance all contribute to these differences. GRA

N80-16441/ Montana Bureau of Mines and Geology, Butte
STRIP COAL MINING AND MINED-LAND RECLAMATION IN THE HYDROLOGIC SYSTEM, SOUTHEASTERN MONTANA
Wayne A. VanVoast, Robert B. Hedges, and John J. McDermott Dec. 1978 129 p refs Prepared in cooperation with Montana Coll. of Mineral Science and Technology, Butte
(Contract OWRC-10570165)
(PB-301253/1; OWRC-70) Avail: NTIS HC A07/MF A01 CSCL 08I

Coal beds which are locally important aquifers for southeastern Montana's agricultural economy are being removed as mining development occurs. Overburden rock materials (spoils) replace the coal beds as aquifers. As mine pits are backfilled, ground waters readily reenter the spoils. The chemistry of spoils waters is diverse, reflecting the lithologic and geochemical variability of overburden materials. At Decker, predominent ions in spoils water

are sodium and bicarbonate; at Colstrip, they are magnesium, calcium, and sulfate. Statistically, spoils waters in both areas are more highly mineralized than nearby stock and domestic waters. Column backing experiments conducted with spoils produced leachates that were chemically similar to waters found in the field. First pore volumes of the leachate were also chemically similar to saturated-paste extracts. The relationships between saturated-paste-extracts quality and spoils-water quality were utilized to develop generalized nomographs for predicting spoils-water cation concentrations from pre-mining paste-extract chemistry. Similar attempts toward predictive nomographs utilizing specific conductance were unsuccessful. GRA

N80-16442# American Univ., Washington, D. C.
APPLICATION OF PLATE TECTONICS TO THE LOCATION OF NEW MINERAL TARGETS IN THE APPALACHIANS Progress Report
Jan Kutina 20 Apr 1979 68 p refs
(Grant NSF AER-76-81807)
(PB-300512/1; NSF/RA-790143; PR-3) Avail: NTIS HC A04/MF A01 CSCL 08I

Analyses which suggest that the basement of the Central and Eastern U.S. consists of large crustal blocks separated by major zones of tectonic weakness are reviewed. The regularities in the distribution of ore deposits in the Appalachians are discussed. Comments on the segmentation of the Appalachian orogeny by transverse lineaments are presented. The report contains seventeen maps of the eastern half of the U.S. showing specific mineral deposits in relation to geologic formations. GRA

N80-16443# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
SIDEBOARD DEVICE FOR IMPROVED FACE VENTILATION IN COAL MINES Technical Progress Report, period ending Aug. 1979
Edward F. Drivers, John C. LaScola, and Fred N. Kissel Aug. 1979 15 p
(PB-300365/4; BM-TPR-108) Avail: NTIS HC A02/MF A01 CSCL 08I

A sideboard device designed to act as an extension of conventional brattice, thus improving face ventilation of developing room and pillar type coal mining was tested. In these laboratory tests, an 8 foot long rigid sideboard was mounted vertically along the left fender of a full scale model ripper-type continuous mining machine, rising to the mine roof to provide an air seal. It extended from the auger support frame pivot point outby along the fender. A novel water spray manifold was used to form an air seal between the sideboard and brattice. Tests showed improvement in face ventilation with the prototype device, and also demonstrated that water sprays can form an effective air seal over a fairly wide pressure range. GRA

N80-16444# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
RADIANT HEATING OF MINE BULKHEADS
John C. Edwards 1979 22 p refs
(PB-300363/9; BM-RI-8356) Avail: NTIS HC A02/MF A01 CSCL 08I

A time dependent mathematical model of radiative heating of bulkheads in mines was developed. The model includes both reradiation from the duct (cylindrical) walls and direct radiation from the fire zone. Thermal loss into the wall of the duct and into the bulkhead is included. Both brick and wood bulkheads are considered. It was found that the heating rate of the system scales as the duct length-to-diameter ratio and the flame temperature. In particular, the time required for the irradiated surface of the bulkhead to reach a specified temperature decreases with increasing flame temperature for a fixed length-to-diameter ratio and increases with increasing length-to-diameter ratio for a specified flame temperature. GRA

N80-16445# GCA Corp., Bedford, Mass. Technology Div.
IMPROVED LIGHT SCATTERING DUST MONITOR Final Report, 3 Aug. 1977 - 31 May 1978
Pedro Liberfeld 28 Feb. 1979 48 p refs
(Contract DI-BM-HO-377092)
(PB-299938/1; BM-OFR-90-79) Avail: NTIS HC A03/MF A01 CSCL 08I

The development, design, fabrication, and testing of a portable, battery-operated, light scattering monitor for the rapid measurement of the concentration of respirable dust in mining environments are described. This instrument incorporates state-of-the-art design characteristics and makes use of advanced solid-state components both for light emission as well as for its detection. The use of a pulsed light source combined with synchronous signal detection minimizes drift problems and optimizes the sensitivity of the measurement. Equivalent mass concentration measurements as low as 10 micrograms per cubic meter can be routinely performed with time constants of about 2 seconds. GRA

N80-16446# Geological Survey, Raleigh, N. C. Water Resources Div.
A TECHNIQUE FOR ESTIMATING HEIGHTS REACHED BY THE 100-YEAR FLOOD ON UNREGULATED, NONTIDAL STREAMS IN NORTH CAROLINA Final Report, 1978 - 1979
R. W. Coble Jul. 1979 21 p refs
(PB-301372/9; USGS/WRI-79/69) Avail: NTIS HC A02/MF A01 CSCL 08H

A method for estimating heights reached by floods having a recurrence interval of 100 years is defined for nontidal streams with unregulated flows in North Carolina. The flood heights are the vertical distance between stream stage at median discharge (50 percent duration) and the 100-year flood stage and are defined for streams draining areas between 1 and 10,000 square miles. A flood height drainage area relation was determined by regression analysis for each of the three physiographic areas of the State-mountains, piedmont, and coastal plain. An illustrated example of how the method can be used in conjunction with topographic maps to estimate flood heights and delineate inundated areas by interpolation is given. GRA

N80-16447# Geological Survey, Tallahassee, Fla. Water Resources Div.
HYDROLOGIC DATA FROM URBAN WATERSHEDS IN THE TAMPA BAY REGION
M. A. Lopez and D. M. Michaelis Aug. 1979 60 p
(PB-301204/4; USGS/WRI-78/125;
USGS/WRD/WRI-79/066) Avail: NTIS HC A04/MF A01 CSCL 08H

Hydrologic data were collected in 10 urbanized watersheds located in the Tampa Bay area, Florida. The gaged watersheds have impervious areas that range from 19 percent for a residential watershed in north Tampa to nearly 100 percent for a downtown Tampa watershed. Land use type, including roads, residential, commercial, industrial, institutional, recreational, and open space, were determined for each watershed. Rainfall and storm runoff data collected were processed. These data were recorded at 5 minute intervals. Chemical and biological analyses of storm runoff for six sites, base flow for seven sites, and analyses of bottom material for seven sites were also stored in the WATSTORE water quality file. GRA

N80-16448# Geological Survey, Menlo Park, Calif. Water Resources Div.
APPLICATION OF TRANSIENT-FLOW TO THE SACRAMENTO RIVER AT SACRAMENTO, CALIFORNIA Final Report
Richard N. Oltmann Feb. 1979 29 p refs Prepared in cooperation with California State Dept. of Water Resources, Sacramento
(PB-301103/8; USGS/WRD/WRI-79/063;
USGS/WRI-78/119) Avail: NTIS HC A03/MF A01 CSCL 08H

The transient-flow simulation model was applied to the Sacramento River at Sacramento, California. An alternative is needed to the empirical stage-fall-discharge computational method, which provides only daily mean discharges and required frequent measurement over a 25- to 26-hour period of the tide-affected flow. Measurement of tide-affect flow involves use of a cable suspended across the river; this presents a hazardous navigational condition. Use of the model does not eliminate the hazardous navigational problem, but it significantly reduces the time that this condition exists. The model demonstrates that it can provide reliable daily mean as well as instantaneous discharge

data. The model also has the capability of providing discharge data for locations farther downstream in the tidal zone from the Sacramento stream gage; this is not possible with the stage-fall-discharge computational method. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-16449* National Aeronautics and Space Administration, Washington, D. C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 23
Oct. 1979 882 p
(NASA-SP-7043(23)) Avail: NTIS HC E07 CSCL 10B

This bibliography lists 1786 reports, articles, and other documents introduced into the NASA scientific and technical information system from July 1, 1979 through September 30, 1979. Author

N80-16450# General Electric Co., Philadelphia, Pa. Applied Sciences Lab.
SIMULATION OF MHD AND STEAM CYCLE FACILITY
Daniel Stern 7 Feb. 1980 90 p
(Doc-80SDS006) Avail: General Electric Company, Space and Research Division, P.O. Box 8555, Philadelphia, Pa. HC $25.00

An existing nonlinear simulation of magnetohydrodynamic (MHD) facility was modified and installed on a PDP 11/34 computer. Time response plots were generated from the nonlinear simulation. A linearized MHD simulation was generated from the nonlinear simulation. A comparison was made between root locus plots and time response plots. The report includes FORTRAN listings of the linear and nonlinear simulations. R.E.S.

N80-16451 Rutgers - The State Univ., New Brunswick, N. J.
THE INTERFACE STATE EFFECTS AND CHARACTERIZATION OF MIS SOLAR CELLS Ph.D. Thesis
Jimm Koo Kim 1979 201 p
Avail: Univ. Microfilms Order No. 7928412

Sets of samples were prepared and experiments were performed on MIS diodes to investigate the interface state density distributions across the semiconductor band gap, using various substrates and metals. The current flow mechanisms in tunneling MIS solar cells were studied. A computer algorithm, generated to simulate the photovoltaic action of MIS solar cells based on the theory developed is described. Experimental data such as the interface state density spectra, time constants, absorption cross sections, and oxide capacitance used in generating I-V plots in dark and under light conditions are discussed. The boundary value problem solved by the computer iterative method using Shickley's assumption of constant quasi Fermi level throughout the depletion region, is described. Dissert. Abstr.

N80-16452* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
ALUMINIUM OR COPPER SUBSTRATE PANEL FOR SELECTIVE ABSORPTION OF SOLAR ENERGY Patent
Marion L. Roberts, Max H. Sharpe, and Albert C. Krupnick, inventors (to NASA) Issued 4 Dec. 1979 6 p Filed 30 May 1978 Supersedes N78-25557 (16 - 16, p 2137) Division of US Patent Appl. SN-829390, Filed 31 Aug. 1977, US Patent 4,104,134
(NASA-Case-MFS-23518-3; US-Patent-4,177,325; US-Patent-Appl-SN-910793; US-Patent-Class-428-629; US-Patent-Class-428-650; US-Patent-Class-428-658; US-Patent-Class-428-675; US-Patent-Class-428-680; US-Patent-Class-126-417; US-Patent-Class-126-901; US-Patent-Appl-SN-829390; US-Patent-4,104,134) Avail: US Patent and Trademark Office CSCL 10A

A method for making panels which selectively absorb solar energy is disclosed. The panels are comprised of an aluminum substrate, a layer of zinc thereon, a layer of nickel over the zinc layer and an outer layer of solar energy absorbing nickel oxide or a copper substrate with a layer of nickel thereon and a layer of solar energy absorbing nickel oxide distal from the copper substrate.

Official Gazette of the U.S. Patent and Trademark Office

N80-16453*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
LARGE WIND TURBINE DESIGN CHARACTERISTICS AND R AND D REQUIREMENTS
Seymour Lieblein, ed. (Technical Report Services, Rocky River, Ohio) Dec. 1979 459 p refs Conf. held at Cleveland, 24-26 Apr. 1979; sponsored in part by DOE
(NASA-CP-2106; CONF-7904111) Avail: NTIS HC A20/MF A01 CSCL 10B

Detailed technical presentations on large wind turbine research and development activities sponsored by public and private organizations are presented. Both horizontal and vertical axis machines are considered with emphasis on their structural design. For individual titles, see N80-16454 through N80-16482.

N80-16454*# Department of Energy, Washington, D. C.
OVERVIEW OF FEDERAL WIND ENERGY PROGRAM
Daniel F. Ancona *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 1-24 ref (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

The objectives and strategies of the Federal wind energy program are described. Changes in the program structure and some of the additions to the program are included. Upcoming organizational changes and some budget items are discussed, with particular emphasis on recent significant events regarding new approvals. R.E.S.

N80-16455*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
DESIGN EVOLUTION OF LARGE WIND TURBINE GENERATORS
David A. Spera *In its* Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 25-33 ref (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

During the past five years, the goals of economy and reliability have led to a significant evolution in the basic design--both external and internal--of large wind turbine systems. To show the scope and nature of recent changes in wind turbine designs, development of three types are described: (1) system configuration developments; (2) computer code developments; and (3) blade technology developments. R.E.S.

N80-16456*# General Electric Co., Philadelphia, Pa. Space Div.
THE GENERAL ELECTRIC MOD-1 WIND TURBINE GENERATOR PROGRAM
Richard H. Poor and R. B. Hobbs *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 35-59 (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

The design, fabrication, installation and checkout of MOD-1, a megawatt class wind turbine generator which generates utility grade electrical power, is described. A MOD-1/MOD-1A tradeoff study is discussed. R.E.S.

N80-16457*# Boeing Engineering and Construction, Seattle, Wash.
THE BOEING MOD-2 WIND TUNNEL SYSTEM RATED AT 2.5 MW
Richard R. Douglas *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 61-78 (For primary document see N80-16453 07-44)

Avail: NTIS HC A20/MF A01 CSCL 10B

A summary description of MOD-2 development and the resulting system hardware is presented. R.E.S.

N80-16458*# WTG Energy Systems, Inc., Buffalo, N.Y.
WTG ENERGY SYSTEMS' MP1-200 200 KILOWATT WIND TURBINE GENERATOR
Allen P. Spaulding, Jr. *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 79-88 (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

The preliminary design criteria of the MP1-200 wind turbine are given along with a brief description of the wind turbine generator. Performance and operational experience and cost factors are included. Recommendations for additional research are listed. J.M.S.

N80-16459*# National Swedish Board for Energy Source Development, Spanga.
SPECIFICATION, SITING AND SELECTION OF LARGE WECS PROTOTYPES
Sven Hugossor *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 89-102 (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

The development of large-scale windpowered systems is outlined. Topics discussed include: prototype specifications development, site selection process, and selection of prototype contractor. J.M.S.

N80-16460*# Technical Univ. of Denmark, Lyngby.
THE DANISH LARGE WIND TURBINE PROGRAM
B. Maribo Pederson *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 103-120 (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

A brief description of the Danish wind energy program and its present status is given. Results and experiences from tests on the Gedser windmill (200 kW) are presented. The key results are presented from the preliminary design study and detailed design of two new WECS (630 kW each) is described. J.M.S.

N80-16461*# Maschinenfabrik Augsburg-Nuernberg A.G., Augsburg (West Germany).
LARGE WIND ENERGY CONVERTER: GROWIAN 3 MW
F. Koerber and Hans A. Thiele *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 121-132 (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

The main features of the Growian wind energy converter are presented. Energy yield, environmental impact, and construction of the energy converter are discussed. Reliability of the windpowered system is assessed. J.M.S.

N80-16462*# Sandia Labs., Albuquerque, N. Mex.
CHARACTERISTICS OF FUTURE VERTICAL AXIS WIND TURBINES (VAWTs)
Emil G. Kadlec *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 133-141 refs (For primary document see N80-16453 07-44)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A20/MF A01 CSCL 10B

The developing Darrieus VAWT technology whose ultimate objective is economically feasible, industry-produced, commercially marketed wind energy systems is reviewed. First-level aerodynamic, structural, and system analyses capabilities which support and evaluate the system designs are discussed. The characteristics of current technology designs are presented and their cost effectiveness is assessed. Potential improvements identified are also presented along with their cost benefits. J.M.S.

N80-16463*# National Research Council of Canada, Ottawa (Ontario).
DESIGN CHARACTERISTICS OF THE 224 kW MAGDALEN ISLANDS VAWT
R. J. Templin *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 143-154 refs (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10A

The evolution of the main design features of the Magdalen Islands vertical axis wind turbine (VAWT) is described. The turbine has a rotor height of 120 ft (36.58 m) and diameter 80 ft (24.38 m). It was operated as a joint project between NRC and Hydro-Quebec in grid-coupled mode from July 1977 to July 1978 when the rotor was destroyed in an accident. The accident, although unfortunate, tested the basic integrity of the design in a gross overspeed condition, and the rotor is being rebuilt with minor modifications. Some directions for future VAWT research are suggested. M.M.M.

N80-16464*# Aluminum Co. of America, Alcoa Center, Pa.
ALCOA WIND TURBINES
Daniel K. Ai *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 155-171 refs (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10A

An overview of Alcoa's wind energy program is given with emphasis on the the development of a low cost, reliable Darrieus Vertical Axis Wind Turbine System. The design layouts and drawings for fabrication are now complete, while fabrication and installation to utilize the design are expected to begin shortly. M.M.M.

N80-16465*# Sandia Labs., Albuquerque, N. Mex.
TEST RESULTS OF THE DOE/SANDIA 17 METER VAWT
Robert O. Nellums and M. H. Worstell *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 173-184 refs (For primary document see N80-16453 07-44)
(Contract DE-AC04-76-DP00789)
Avail: NTIS HC A20/MF A01 CSCL 10B

A review is given of the test program of a 17 meter Vertical Axis Wind Turbine VAWT. Performance test results are discussed including difficulties encountered during the VAWT operation along with ways of solving these problems. M.M.M.

N80-16466*# Sandia Labs., Albuquerque, N. Mex.
OVERVIEW OF VERTICAL AXIS WIND TURBINE (VAWT)
William N. Sullivan *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics R and D Requirements Dec. 1979 p 185-192 refs (For primary document see N80-16453 07-44)
(Contract DE-AC04-76-DP00789)
Avail: NTIS HC A20/MF A01 CSCL 10B

A survey is presented of the practices which were applied for designing VAWT blades. An attempt is made to discuss strengths and weaknesses of the existing procedures. Discussion is provided on planned or suggested future work in developing improved design tools. M.M.M.

N80-16467*# Aluminum Co. of America, Alcoa Center, Pa. Technical Marketing Div.
FABRICATION OF EXTRUDED VERTICAL AXIS TURBINE BLADES
Arthur G. Craig, Jr. *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 193-204 refs (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

Important characteristics of the extruded aluminum blade for the Vertical Axis Wind Turbine are presented. Their weight, structural strength, shape, and maintainability are pointed out. M.M.M.

N80-16468*# Sandia Labs., Albuquerque, N. Mex.
OPERATIONAL EXPERIENCE WITH VAWT BLADES
William N. Sullivan *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 205-210 ref (For primary document see N80-16453 07-44)
(Contract DE-AC04-76-DP00789)
Avail: NTIS HC A20/MF A01 CSCL 10B

The structural performance of 17 meter diameter wind turbine rotors is discussed. Test results for typical steady and vibratory

stress measurements are summarized along with predicted values of stress based on a quasi-static finite element model. K.L.

N80-16469*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRUCTURAL ANALYSIS CONSIDERATIONS FOR WIND TURBINE BLADES
David A. Spera. *In its* Large Wind Turbine Design Characteristics and R and D Requirements. Dec. 1979. p 211-224. refs (For primary document see N80-16453 07-44)
Avail: NTIS. HC A20/MF A01. CSCL 10B

Approaches to the structural analysis of wind turbine blade designs are reviewed. Specifications and materials data are discussed along with the analysis of vibrations, loads, stresses, and failure modes. K.L.

N80-16470*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BLADE DESIGN AND OPERATING EXPERIENCE ON THE MOD-OA 200 kW WIND TURBINE AT CLAYTON, NEW MEXICO
Bradford S. Linscott and Richard K. Shaltens. *In its* Large Wind Turbine Design Characteristics and R and D Requirements. Dec. 1979. p 225-238. refs (For primary document see N80-16453 07-44)
Avail: NTIS. HC A20/MF A01. CSCL 10B

Two 60 foot long aluminum wind turbine blades were operated for over 3000 hours on the MOD-OA wind turbine. The first signs of blade structural damage were observed after 400 hours of operation. Details of the blade design, loads, cost, structural damage, and repair are discussed. K.L.

N80-16471*# Lockheed Aircraft Service, Inc., Ontario, Calif.
EVALUATION OF AN OPERATING MOD-OA 200 kW WIND TURBINE BLADE
Robert E. Donham. *In* NASA. Lewis Res. Center. Large Wind Turbine Design Characteristics and R and D Requirements. Dec. 1979. p 239-265. refs (For primary document see N80-16453 07-44)
Avail: NTIS. HC A20/MF A01. CSCL 10B

Operating loads and structural damage were monitored during operation of the MOD-OA electric generating system. The turbine was damaged locally between stations 48 and 125 after 2.8 million rotations. Loads due to degraded yaw stiffness and fretting at rib station 48 were identified as primary to this distress. The repaired blades operated an additional 4.8 million rotations without problems. K.L.

N80-16472*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN, FABRICATION, AND TEST OF A STEEL SPAR WIND TURBINE BLADE
Timothy L. Sullivan, Paul J. Sirocky, Jr., and Larry A. Viterna. *In its* Large Wind Turbine Design Characteristics and R and D Requirements. Dec. 1979. p 267-284. refs (For primary document see N80-16453 07-44)
Avail: NTIS. HC A20/MF A01. CSCL 10B

The design and fabrication of wind turbine blades based on 60 foot steel spars are discussed. Performance and blade load information is given and compared to analytical prediction. In addition, performance is compared to that of the original MOD-O aluminum blades. Costs for building the two blades are given, and a projection is made for the cost in mass production. Design improvements to reduce weight and improve fatigue life are suggested. K.L.

N80-16473*# WTG Energy Systems, Inc., Buffalo, N.Y.
WTG ENERGY SYSTEMS' ROTOR: STEEL AT 80 FEET
Robert E. Barrows. *In* NASA. Lewis Res. Center. Large Wind Turbine Design Characteristics and R and D Requirements. Dec. 1979. p 285-292 (For primary document see N80-16453 07-44)
Avail: NTIS. HC A20/MF A01. CSCL 10B

The design, specifications, and performance of the 80 foot diameter fixed pitch rotor operating on the MP1-200 wind turbine generator installed as part of the Island of Cuttyhunk's electric power utility grid system are described. This synchronous generating system rated 200 kilowatts at 28 mph wind velocity, and produces constant 60 Hz, 480 VAC current at +/- 1 percent accuracy throughout the machine's operating range. Future R & D requirements and suggestions are included with cost data. A.R.H.

N80-16474*# Gougeon Bros., Inc., Bay City, Mich.
THE USE OF WOOD FOR WIND TURBINE BLADE CONSTRUCTION
Meade Gougeon and Mike Zuteck. *In* NASA. Lewis Res. Center. Large Wind Turbine Design Characteristics and R and D Requirements. Dec. 1979. p 293-308 (For primary document see N80-16453 07-44)
Avail: NTIS. HC A20/MF A01. CSCL 10B

The interrelationships between moisture and wood, conditions for dry rot spore activity, the protection of wood fibers from moisture, wood resin composites, wood laminating, quality control, and the mechanical properties of wood are discussed. The laminated veneer and the bonded sawn stock fabrication techniques, used in the construction of a turbine blade with a monocoque 'D' section forming the leading edge and a built up trailing edge section, are described. A 20 foot root end sample complete with 24 bonded-in studs was successfully subjected to large onetime loads in both the flatwise and edgewise directions, and to fatigue tests. Results indicate that wood is both a viable and advantageous material for use in wind turbine blades. The basic material is reasonably priced, domestically available, ecologically sound, and easily fabricated with low energy consumption. A.R.H.

N80-16475*# Kaman Aerospace Corp., Bloomfield, Conn.
LARGE, LOW COST COMPOSITE WIND TURBINE BLADES
Herbert W. Gewehr. *In* NASA. Lewis Res. Center. Large Wind Turbine Design Characteristics and R and D Requirements. Dec. 1979. p 309-324. refs (For primary document see N80-16453 07-44)
Avail: NTIS. HC A20/MF A01. CSCL 10B

A woven roving E-glass tape, having all of its structural fibers oriented across the tape width was used in the manufacture of the spar for a wind turbine blade. Tests of a 150 ft composite blade show that the transverse filament tape is capable of meeting structural design requirements for wind turbine blades. Composite blades can be designed for interchangeability with steel blades in the MOD-1 wind generator system. The design, analysis, fabrication, and testing of the 150 ft blade are discussed. A.R.H.

N80-16476*# Boeing Engineering and Construction, Seattle, Wash.
THE MOD-1 STEEL BLADE
John VanBronkhorst. *In* NASA. Lewis Res. Center. Large Wind Turbine Design Characteristics and R and D Requirements. Dec. 1979. p 325-342 (For primary document see N80-16453 07-44)
Avail: NTIS. HC A20/MF A01. CSCL 10B

The design, development, fabrication, testing, and transport of two 100 foot metal blades for the MOD-1 WTS are summarized. Because the metal blade design was started late in the MOD-1 system development, many of the design requirements (allocations) were restrictive for the metal blade concept, particularly the maximum weight requirement. The design solutions required to achieve the weight goal resulted in a labor intensive (expensive) fabrication, particularly for a quantity of only two blades manufactured using minimal tooling. A.R.H.

N80-16477*# Boeing Engineering and Construction, Seattle, Wash.
THE BOEING MOD-2 WIND TURBINE SYSTEM ROTOR
Gordon N. Davison. *In* NASA. Lewis Res. Center. Large Wind Turbine Design Characteristics and R and D Requirements. Dec. 1979. p 343-354 (For primary document see N80-16453 07-44)
Avail: NTIS. HC A20/MF A01. CSCL 10B

External configuration, environmental, and internal design requirements for the 300 foot diameter MOD-2 rotor are discussed, with emphasis on design details, significance of fatigue strength, design development test results, and conclusions of the preliminary design efforts. A.R.H.

N80-16478*# Southern California Edison Co., Rosemead.
STATUS OF THE SOUTHERN CALIFORNIA EDISON COMPANY 3 MW WIND TURBINE GENERATOR (WTG)

DEMONSTRATION PROJECT
Robert L. Scheffler *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 355-362 (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

To demonstrate the concept of utility scale electricity production from a high wind energy resource, a program was initiated to construct and test a 3 megawatt (3,000 kW) Schachle wind turbine generator near Palm Springs, California. The background and current status of this program are presented along with a summary of future planned program activities. A.R.H.

N80-16479*# Institut de Recherche de l'Hydro-Quebec, Varennes (Canada).
RESULTS OF A UTILITY SURVEY OF THE STATUS OF LARGE WIND TURBINE DEVELOPMENT
A. Watts, S. Quraeshi (Shawinigan Eng. Co. Ltd., Montreal), and L. P. Rowley (Canadair Ltd., Montreal) *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 363-374 (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

Wind energy conversion systems were surveyed from a utility viewpoint to establish the state of the art with regard to: (1) availability of the type of machines; (2) quality of power generation; (3) suitability for electrical grid; (4) reliability; and (5) economics. Of the 23 designs discussed, 7 have vertical axis wind turbines, 9 have upwind horizontal axis turbines, and 7 have downwind horizontal axis turbines. A.R.H.

N80-16480*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULATION STUDIES OF MULTIPLE LARGE WIND TURBINE GENERATORS ON A UTILITY NETWORK
Leonard J. Gilbert and David M. Triezenberg (Purdue Univ.) *In its* Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 375-384 refs (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

The potential electrical problems that may be inherent in the inertia of clusters of wind turbine generators and an electric utility network were investigated. Preliminary and limited results of an analog simulation of two MOD-2 wind generators tied to an infinite bus indicate little interaction between the generators and between the generators and the bus. The system demonstrated transient stability for the conditions considered. A.R.H.

N80-16481*# Hamilton Standard, Windsor Locks, Conn.
SYSTEM CONFIGURATION IMPROVEMENT
Glidden S. Doman *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 385-396 (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

Factors involved in the choice of the system configuration for the wind turbine generator are listed. It was found that choices among the many configuration options can be based strictly upon the resulting cost of energy results. Choices made on that basis also lead to reduced analytical complexity, less hardware complexity and reduced program risk. It was also found that many seemingly minor details turn out to have important impacts that are seen only after design, performance and cost-finding were thoroughly probed. M.M.M.

N80-16482*# Hamilton Standard, Windsor Locks, Conn.
COST OF ENERGY EVALUATION
Thad M. Hasbrouck *In* NASA. Lewis Res. Center Large Wind Turbine Design Characteristics and R and D Requirements Dec. 1979 p 397-402 (For primary document see N80-16453 07-44)
Avail: NTIS HC A20/MF A01 CSCL 10B

The estimated cost per kilowatt hour, the wind resources in the utilities service area, and the reliability of the units are considered in computing the cost of energy of the wind turbine generator system. M.M.M.

N80-16483*# Energy Technology, Inc., Cleveland, Ohio.
STUDY OF ADVANCED RADIAL OUTFLOW TURBINE FOR SOLAR STEAM RANKINE ENGINES
Cecil Martin and Terry Kolenc Dec. 1979 74 p refs
(Contract DEN3-86)
(NASA-CR-159695; DOE/NASA/0086-79/1; ETI-1279) Avail: NTIS HC A04/MF A01 CSCL 10B

The performance characteristics of various steam Rankine engine configurations for solar electric power generation were investigated. A radial outflow steam turbine was investigated to determine: (1) a method for predicting performance from experimental data; (2) the flexibility of a single design with regard to power output and pressure ratio; and (3) the effect of varying the number of turbine stages. All turbine designs were restricted to be compatible with commercially available gearboxes and generators. A study of several operating methods and control schemes for the steam Rankine engine shows that from an efficiency and control simplicity standpoint, the best approach is to hold turbine inlet temperature constant, vary turbine inlet pressure to match load, and allow condenser temperature to float maintaining constant heat rejection load. A.R.H.

N80-16484*# National Aeronautics and Space Administration, Washington, D. C.
SATELLITE POWER SYSTEM (SPS)
Henry G. Edler Oct. 1978 20 p refs
(Contract EG-77-C-02-4042)
(NASA-TM-80943; TID-29094) Avail: NTIS HC A02/MF A01 CSCL 10A

Potential organizational options for a solar power satellite system (SPS) were investigated. Selection and evaluation criteria were determined to include timeliness, reliability, and adequacy to contribute meaningfully to the U.S. supply; political feasibility (both national and international); and cost effectiveness (including environmental and other external costs). Based on these criteria, four organizational alternatives appeared to offer reasonable promise as potential options for SPS. A large number of key issues emerged as being factors which would influence the final selection process. Among these issues were a variety having to do with international law, international institutions, environmental controls, economics, operational flexibility, congressional policies, commercial-vs-governmental ownership, national dedication, and national and operational stategic issues. R.E.S.

N80-16485*# General Electric Co., Philadelphia, Pa. Space Div.
PROTOTYPE SOLAR HEATING AND COMBINED HEATING COOLING SYSTEMS
DOE 2 Oct. 1978 44 p Sponsored in part by DOE
(Contract NAS8-32092)
(NASA-CR-161340; QR-9) Avail: NTIS HC A03/MF A01 CSCL 10A

The design and development of eight prototype solar heating and combined heating and cooling systems is discussed. The program management and systems engineering are reported, and operational test sites are identified. A.W.H.

N80-16486*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 11: ELECTRICAL CHARACTERISTICS OF 2 ohm-cm, 228 MICRON WRAPAROUND SOLAR CELLS AS A FUNCTION OF INTENSITY, TEMPERATURE, AND IRRADIATION
B. E. Anspaugh, D. M. Beckert, R. G. Downing, and R. S. Weiss 15 Jan. 1980 45 p
(Contract NAS7-100)
(NASA-CR-162686; JPL-Pub-78-15-Vol-11) Avail: NTIS HC A03/MF A01 CSCL 10A

Parametric characterization data on Spectrolab 2 by 4 cm, 2 ohm/cm, 228 micron thick wraparound cell, a candidate for the Solar Electric Propulsion Mission, are presented. These data consist of the electrical characteristics of the solar cell under a wide range of temperature and illumination intensity combinations of the type encountered in space applications. J.M.S.

N80-16487*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EVALUATION OF CONCENTRATED SPACE SOLAR ARRAYS USING COMPUTER MODELING
D. E. Rockey 1 Nov. 1979 54 p refs

(Contract NAS7-100)
(NASA-CR-162681; JPL-PUB-79-87) Avail: NTIS HC A04/MF A01 CSCL 10A

A general approach is developed for predicting the power output of a concentrator enhanced photovoltaic space array. A ray trace routine determines the concentrator intensity arriving at each solar cell. An iterative calculation determines the cell's operating temperature since cell temperature and cell efficiency are functions of one another. The end result of the iterative calculation is that the individual cell's power output is determined as a function of temperature and intensity. Circuit output is predicted by combining the individual cell outputs using the single diode model of a solar cell. Concentrated array characteristics such as uniformity of intensity and operating temperature at various points across the array are examined using computer modeling techniques. An illustrative example is given showing how the output of an array can be enhanced using solar concentration techniques. Author

N80-16488*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MANUFACTURING METHODS OF A COMPOSITE CELL CASE FOR A Ni-Cd BATTERY
J. L. Bauer 15 Dec. 1979 59 p refs
(Contract NAS7-100)
(NASA-CR-162724; JPL-PUB-79-101) Avail: NTIS HC A04/MF A01 CSCL 10A

Basic manufacturing method refinements for using graphite epoxy material for a nickel cadmium battery cell case were performed to demonstrate production feasibility. The various facets of production scale-up, i.e., process and tooling development, together with material and process control, were integrated into a comprehensive manufacturing process that assures production reproducibility and product uniformity. Test results substantiate that a battery cell case produced from graphite epoxy pre-impregnated material, utilizing the internal pressure bag fabrication method, is feasible. R.E.S.

N80-16489*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DIFFUSION LENGTH MEASUREMENTS OF THIN GaAs SOLAR CELLS BY MEANS OF ENERGETIC ELECTRONS
Oldwig vonRoss 1 Feb. 1980 17 p refs
(Contract NAS7-100)
(NASA-CR-162692; JPL-PUB-79-121) Avail: NTIS HC A02/MF A01 CSCL 10A

A calculation of the short circuit current density (j sub sc) of a thin GaAs solar cell induced by fast electrons is presented. It is shown that in spite of the disparity in thickness between the N-type portion of the junction and the P-type portion of the junction, the measurement of the bulk diffusion length L sub p of the N-type part of the junction is seriously hampered due to the presence of a sizable contribution to the j sub sc from the P-type region of the junction. Corrections of up to 50% had to be made in order to interpret the data correctly. Since these corrections were not amenable to direct measurements it is concluded that the electron beam method for the determination of the bulk minority carrier diffusion length, which works so well for Si solar cells, is a poor method when applied to thin GaAs cells. R.E.S.

N80-16490*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POTENTIAL PERFORMANCE IMPROVEMENT USING A REACTING GAS (NITROGIN TETROXIDE) AS THE WORKING FLUID IN A CLOSED BRAYTON CYCLE Final Report
Robert J. Stochl Dec. 1979 23 p refs
(Contract EX-76-A-29-1060)
(NASA-TM-79322; DOE/NASA/1060-79/3) Avail: NTIS HC A02/MF A01 CSCL 10B

The results of an analysis to estimate the performance that could be obtained by using a chemically reacting gas (nitrogen tetroxide) as the working fluid in a closed Brayton cycle are presented. Compared with data for helium as the working fluid, these results indicate efficiency improvements from 4 to 90 percent, depending on turbine inlet temperature, pressures, and gas residence time in heat transfer equipment. Author

N80-16491*# Foster-Miller Associates, Inc., Waltham, Mass.
A 15kWe (NOMINAL) SOLAR THERMAL ELECTRIC POWER CONVERSION CONCEPT DEFINITION STUDY: STEAM RANKINE REHEAT RECIPROCATOR SYSTEM Final Report
H. Fuller, R. Demler, E. Poulin, and P. Dantowitz Jun. 1979 63 p refs
(Contracts DEN3-62; EX-76-A-29-1060)
(NASA-CR-159590; DOE/NASA/0062-79/1; NAS-7845) Avail: NTIS HC A04/MF A01 CSCL 10B

An evaluation was made of the potential of a steam Rankine reheat reciprocator engine to operate at high efficiency in a point-focusing distributed receiver solar thermal-electric power system. The scope of the study included the engine system and electric generator; not included was the solar collector/mirror or the steam generator/receiver. A parametric analysis of steam conditions was completed leading to the selection of 973 K 12.1 MPa as the steam temperature/pressure for a conceptual design. A conceptual design was completed for a two cylinder/opposed engine operating at 1800 rpm directly coupled to a commercially available induction generator. A unique part of the expander design is the use of carbon/graphite piston rings to eliminate the need for using oil as an upper cylinder lubricant. The evaluation included a system weight estimate of 230 kg at the mirror focal point with the condenser mounted separately on the ground. The estimated cost of the overall system is $1932 or $90/kW for the maximum 26 kW output. R.E.S.

N80-16492*# Wyle Labs., Inc., Huntsville, Ala.
OUTDOOR TEST FOR THERMAL PERFORMANCE EVALUATION OF THE OWENS-ILLINOIS SUNPACK SEC-601 (AIR) SOLAR COLLECTOR
Dec. 1979 28 p Sponsored in part by DOE Prepared for IBM Federal Systems Div., Huntsville, Ala.
(Contract NAS8-32036)
(NASA-CR-161339; WYLE-TR-531-37R) Avail: NTIS HC A03/MF A01 CSCL 10A

The test procedures used and the test results obtained during the performance of an evaluation test program on the Owens-Illinois Sunpak, model SEC-601, air solar collector under natural outdoor weather conditions are presented. All testing activities were performed on a single module. The test was performed and the data evaluated as applicable to outdoor testing of solar collectors. J.M.S.

N80-16493*# Sundstrand Corp., Rockford, Ill.
THE 15 kW SUB e (NOMINAL) SOLAR THERMAL ELECTRIC POWER CONVERSION CONCEPT DEFINITION STUDY: STEAM RANKINE TURBINE SYSTEM Final Report
Timothy J. Bland Oct. 1979 63 p refs
(Contracts DEN3-61; EX-76-A-29-1060)
(NASA-CR-159589; AER-1713; DOE/NASA/0061-79/1) Avail: NTIS HC A04/MF A01 CSCL 10A

A study to define the performance and cost characteristics of a solar powered, steam Rankine turbine system located at the focal point of a solar concentrator is presented. A two stage re-entry turbine with reheat between stages, which has an efficiency of 27% at a turbine inlet temperature of 732 C was used. System efficiency was defined as 60 Hertz electrical output divided by absorbed thermal input in the working fluid. Mass production costs were found to be approximately 364 dollars/KW. R.E.S.

N80-16494*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY ANALYSIS OF PERFORMANCE AND LOADS DATA FROM THE 2-MEGAWATT MOD-1 WIND TURBINE GENERATOR
D. A. Spera, L. A. Viterna, T. R. Richards, and H. E. Neustadter 1979 16 p refs Presented at 4th Biennial Conf. and Workshop on Wind Energy Conversion Systems, Washington, D.C., 29-31 Oct. 1979; sponsored by DOE
(Contract EX-77-A-29-1010)
(NASA-TM-81408; DOE/NASA/1010-79/5; E-322) Avail: NTIS HC A02/MF A01 CSCL 10A

Preliminary test data on output power versus wind speed, rotor blade loads, system dynamic behavior, and start-stop characteristics on the Mod-1 wind turbine generator are presented.

These data were analyzed statistically and are compared with design predictions of system performance and loads. To date, the Mod-1 wind turbine generator has produced up to 1.5 MW of power, with a measured power versus wind speed curve which agrees closely with design. Blade loads were measured at wind speeds up to 14 m/s and also during rapid shutdowns. Peak transient loads during the most severe shutdowns are less than the design limit loads. On the inboard blade sections, fatigue loads are approximately equal to the design cyclic loads. On the outboard blade sections, however, measured cyclic loads are significantly larger than design values, but they do not appear to exceed fatigue allowable loads as yet. R.E.S.

N80-16495*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Semiconductor Group.
SEMICONDUCTOR GRADE, SOLAR SILICON PURIFICATION PROJECT Final Report
W. M. Ingle, R. R. Rosler, S. W. Thompson, and R. E. Chaney 10 Dec. 1979 173 p
(Contract JPL-954442)
(NASA-CR-162746; DOE/JPL-954442-78/12; Motorola-2257/12) Avail: NTIS HC A08/MF A01 CSCL 10A

Experimental apparatus and procedures used in the development of a 3-step SiF2(x) polymer transport purification process are described. Both S.S.M.S. and E.S. analysis demonstrated that major purification had occured and some samples were indistinguishable from semiconductor grade silicon (except possibly for phosphorus). Recent electrical analysis via crystal growth reveals that the product contains compensated phosphorus and boron. The low projected product cost and short energy payback time suggest that the economics of this process will result in a cost less than the goal of $10/Kg(1975 dollars). The process appears to be readily scalable to a major silicon purification facility. A.R.H.

N80-16496# Mobil Tyco Solar Energy Corp., Waltham, Mass.
AMORPHOUS SILICON THIN FILM HETEROJUNCTION SOLAR CELLS Quarterly Progress Report, 1 Apr. - 30 Jun. 1979
Aug. 1979 27 p refs
(Contract ET-78-C-03-1846)
(SAN-1846-T3; MT-79-3Q; QPR-3) Avail: NTIS HC A03/MF A01

Experiments on the substitution of carbon for silicon and the substitution of germanium for silicon in hydrogenated a-silicon films grown by capacitive glow discharge techniques are described. Measured optical and electrical properties of the various films are reported. An appendix on the calculation of optical constants (near the absorption edge) in amorphous films is included. DOE

N80-16497# University of Southeastern Massachusetts, North Dartmouth.
ECONOMICS OF GEOTHERMAL POWER
R. DiPippo Feb. 1979 13 p Transl. into ENGLISH from Nucl. Elec. Power Generation (Japan), v. 26, no. 9, Sep. 1975 p 1039-1043
(Contract EY-76-S-02-4051)
(COO-4051-43) Avail: NTIS HC A02/MF A01

Geothermal, steam, nuclear, and hydraulic construction costs, power generating costs, and utilization rate are compared. The risk factor in exploratory geothermal wells is discussed. DOE

N80-16498# Los Alamos Scientific Lab., N. Mex.
CHARACTERIZATION OF CRUSHED GLASS AS A TRANSPIRED AIR HEATING SOLAR COLLECTOR MATERIAL
R. K. Collier 1979 6 p refs Presented at the Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract W-7405-eng-36)
(LA-UR-79-1336; CONF-790541-7) Avail: NTIS HC A02/MF A01

The use of crushed glass matrices as the heat absorbing media in air heating solar collectors was investigated. The most likely candidate glass types and sizes were characterized by measuring pressure drops, optical extinction coefficients, and volumetric heat transfer coefficients. Bed efficiencies were also measured and found to be similar to those expected for screen matrices unless critical amounts of clear glass were used as a top layer, which results in lower efficiency. DOE

N80-16499# Technical Translation Service, Albuquerque, N. Mex.
USE OF SOLAR ENERGY FOR THE PRODUCTION OF ELECTRICITY IN THE ALPS
Jan. 1979 48 p Transl. into ENGLISH from Serie de Publications de la Commission Federale de la Conception Globale de l'Energie (Geneva), etude no. 7 Oct. 1976 48 p Prepared in cooperation with Battelle Memorial Inst., Geneva, Switzerland
(SAND-79-6000) Avail: NTIS HC A03/MF A01

Means of converting solar energy into electricity are reviewed. Applications of solar energy technology to meet the increasing demand for electricity in Switzerland are considered. A description and discussion of central tower and heliostat field systems is presented. Details concerning steam cycles and solar boilers, turboalternator units and heat exhaust systems, daily and seasonal power variations of a solar plant, and effects on energy output due to cloudiness are considered. Meteorological data for the evaluation of possible solar generating sites is discussed and the solar potential of the Alps is analyzed. Integration of solar plants into the existing power grid is discussed. The economic and environmental impacts of solar power plants are considered in detail and a development program is suggested. DOE

N80-16500# Department of Energy, Washington, D. C. Energy Information Administration.
SOLAR COLLECTOR MANUFACTURING ACTIVITY Energy Data Report, Jul. - Dec. 1978
Sep. 1979 45 p
(DOE/EIA-0174/78) Avail: NTIS HC A03/MF A01

Results from a survey of solar collector manufacturing and importing activity are presented. Manufacturers of medium temperature liquid collectors, used primarily for hot water and space heating, low temperature nonmetallic collectors used for pool heating, and special collectors (evacuated tube collector or a concentrating collector), used for pool heating and for air conditioning and specialized industrial processes are included. J.M.S.

N80-16501# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FLYWHEEL ENERGY STORAGE AND CONVERSION SYSTEM FOR PHOTOVOLTAIC APPLICATIONS
A. R. Millner 1979 7 p refs Presented at the Mech. and Magnetic Energy Storage Conductor Ann. Rev., Washington, D.C., 19-22 Aug. 1979
(Contract EY-76-C-02-4094)
(COO-4094-57; CONF-790854-3) Avail: NTIS HC A02/MF A01

A project to develop a flywheel energy storage unit for use with photovoltiacs in residential or load center applications is described. The unit employs a high efficiency permanent-magnet motor-generator and cycloconverter electronics to convert dc input to regulated ac output. The fabrication of a scale model unit, scaling laws for residential and intermediate load center sizes, and worth and cost estimation are discussed. DOE

N80-16502# Brookhaven National Lab., Upton, N. Y.
DECENTRALIZED ENERGY: TECHNOLOGY ASSESSMENT AND SYSTEMS DESCRIPTION
M. K. Reckard Jun. 1979 206 p refs
(Contract EY-76-C-02-0016)
(BNL-50987) Avail: NTIS HC A10/MF A01

Decentralized energy systems and their characteristic features are examined. These systems are divided into six groups for the purpose of analysis: solar, wind, hydro, biomass, geothermal, and coproduction (total energy). The technical and economic potential for the implementation of these systems is discussed for the years 2000 and 2025. The results of a comparison of base-case and decentralized scenarios for the year 2000, using a computer systems model, are presented. Social and institutional factors are also addressed, both as motivations for and results of energy system decentralization. Appendices are included with more detailed technical information on each of the systems groups. DOE

N80-16503# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: SOLAR THERMAL POWER SYSTEMS
Aug. 1979 45 p refs
(DOE/EDP-0035) Avail: NTIS HC A03/MF A01

The goals of the program and potential environmental, health, safety, and socioeconomic impacts relevant to solar thermal power systems (STPS), particularly those sited in the Southwest are discussed. These impacts are screened for key issues, i.e., those issues considered to be the most serious in nature, that have near-term importance to the program, and for which current knowledge of effects and control is inadequate. A management plan is then presented for conducting and coordinating environmental research in concert with the technology development effort to ensure that identified environmental issues are resolved prior to significant public deployment of the technology. Key environmental concerns associated with the development and deployment of STPS were identified in the following subject areas: (1) site selection (including the question of water availability); (2) ecological and microclimatic effects; (3) working fluid handling and release modes; and (4) misdirected solar radiation. DOE

N80-16504# National Climatic Center, Asheville, N. C.
INPUT DATA FOR SOLAR SYSTEMS
V. Cinquemani, J. R. Owenby, Jr., and R. G. Baldwin Aug. 1979 203 p refs
(Contract EX-76-A-29-1041)
(DOE/TIC-10193-Rev-1) Avail: NTIS HC A10/MF A01

Normals (30-year mean values) of maximum, minimum, and average temperatures for a month or year, and of heating and cooling degree days are provided for 248 U.S. stations. Average daily values of total hemispheric (global) solar radiation on a horizontal surface were based on corrected hourly measurements for 25 stations, derived values from corrected measurements for 25 stations, and derived values from the corrected measurements for the remaining 222 stations. DOE

N80-16505# Sandia Labs., Albuquerque, N. Mex.
WORKSHOP ON POWER CONDITIONING FOR ALTERNATIVE ENERGY TECHNOLOGIES, EXECUTIVE SUMMARY
D. R. Smith 1979 139 p Workshop held at Denver, 9-11 May 1979
(Contracts EY-76-C-04-0789; EG-77-C-01-4042)
(SERI-TP-35-217-Pt-2) Avail: NTIS HC A07/MF A01

The development of power conditioners for alternative energy technologies is presented. Topics discussed include: (1) assessments of current technology; (2) identification of operational requirements with a comparison of requirements for each source technology; (3) the identification of future technology trends; (4) the determination of mass production and marketing requirements; and (5) recommendations for program direction. DOE

N80-16506# Oak Ridge National Lab., Tenn.
FOSSIL ENERGY PROGRAM Quarterly Progress Report, period ending 30 Sep. 1978
L. E. McNeese Jan. 1979 287 p refs
(Contract W-7405-eng-26)
(ORNL-5487) Avail: NTIS HC A13/MF A01

Research and development projects that are carried out in support of the increased utilization of coal and other fossil fuel alternatives to oil and gas as sources of clean energy are reviewed. These projects include: coal conversion techniques, coal gasification processess, fossil energy environmental studies, materials technology development for coal conversion, and a life sciences synthetic fuel program for biological research of health hazards in coal conversion. DOE

N80-16507# Brookhaven National Lab., Upton, N. Y.
COMPUTER SIMULATION OF GROUND COUPLED STORAGE IN A SERIES SOLAR ASSISTED HEAT PUMP SYSTEM
J. W. Andrews and Philip D. Metz 1979 5 p refs Presented at the 1979 Intern. Solar Energy Soc. Congr., Atlanta, 28 May - 1 Jun. 1979
(Contract EY-76-C-02-0016)
(BNL-26216; CONF-790541-25) Avail: NTIS HC A02/MF A01

The effect of thermal coupling between the ground and the heat storage element of a series solar assisted heat pump system is studied quantitatively. The transient simulation computer program TRNSYS is used to simulate the solar portion of this system. A program to simulate the thermal interaction of the storage element with the ground is incorporated into TRNSYS as a subroutine. This program calculates heat flow through the ground in discrete steps over space and time. Boundary conditions are established. The ground coupled storage is driven by thermal inputs from the solar portion of the system and from the changing ambient and ground temperatures. DOE

N80-16508# General Atomic Co., San Diego, Calif.
FIXED MIRROR SOLAR CONCENTRATOR FOR APPLICATION TO A 100 MW(e) ELECTRIC GENERATING PLANT
J. R. Schuster, J. M. Neill, and J. Bass May 1979 6 p refs Presented at the 14th Intersoc. Energy Conf., Boston, 5-10 Aug. 1979
(Contract ET-78-C-03-2240)
(GA-A-15340; CONF-790803-10) Avail: NTIS HC A02/MF A01

A design study was performed of a 100 MW(e) power plant that uses a fixed mirror solar concentrator (FMSC) to supply energy for steam generation. Various heat transport fluids were considered and draw salt was selected over Therminol 88 and sodium. The complete plant was modeled in a cost performance optimization code which automatically performed tradeoffs such as reduced blocking vs increased piping costs, field piping heat loss vs pumping power, and fluid outlet temperature vs overall system efficiency. Various collector and receiver designs were studied and evaluated for their cost effectiveness. Operational requirements impacting the component designs were identified. DOE

N80-16509# Brookhaven National Lab., Upton, N. Y.
EXPERIMENTAL RESULTS FROM THE SOLAR GROUND COUPLING RESEARCH FACILITY AT BROOKHAVEN NATIONAL LABORATORY
P. D. Metz 1979 5 p refs Presented at the Intern. Solar Energy Soc. Meeting, Atlanta, 28 May - 1 Jun. 1979
(Contract EY-76-C-02-0016)
(BNL-26219; CONF-790541-27) Avail: NTIS HC A02/MF A01

The results of the first half year of operation of the solar ground coupling research facility are presented. The data from the eight original experiments are analyzed. A computer model of the heat transfer between first generation ground coupled heat transfer and storage devices for a solar source heat pump system and the Earth is discussed. DOE

N80-16510# Massachusetts Inst. of Tech., Cambridge.
INDEPENDENT ASSESSMENT OF ENERGY POLICY MODELS Final Report
E. Kuh and D. O. Wood May 1979 273 p refs Sponsored by EPRI
(EPRI Proj. 1015-1)
(EPRI-EA-1071) Avail: NTIS HC A12/MF A01

Energy policy models are reviewed and analyzed. Two energy system models, the Baughman-Joskow regionalized electricity model and the Wharton annual energy model are assessed and the organizational and procedural issues in the model assessment process are identified. DOE

N80-16511# Midwest Research Inst., Golden, Colo.
SOIL FERTILITY AND SOIL LOSS CONSTRAINTS ON CROP RESIDUE REMOVAL FOR ENERGY PRODUCTION
S. Flaim Jul. 1979 38 p refs
(Contract EG-77-C-01-4042)
(SERI/RR-52-324) Avail: NTIS HC A03/MF A01

A summary of the methodologies used to estimate the soil fertility and soil loss constraints on crop residue removal for energy production is presented. Estimates of excess residue are developed for wheat in north central Oklahoma and for corn and soybeans in central Iowa. The sample farming situations are analyzed. DOE

N80-16512# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLAR PHOTOVOLTAIC FIELD TESTS AND APPLICATIONS PROJECT Quarterly Technical Report, 1 Apr. - 30 Jun. 1978
1978 58 p refs
(Contract EY-76-C-02-4094)
(COO-4094-26) Avail: NTIS HC A04/MF A01

Field tests for a variety of both large and small experimental photovoltaic systems are summarized. Support activities in the areas of power conditioning, control, and storage; materials, processes, testing, and data acquisition are reviewed. DOE

N80-16513# Midwest Research Inst., Golden, Colo.
OBJECTIVES AND STRATEGIES OF THE INTERNATIONAL PHOTOVOLTAIC PROGRAM PLAN
D. Costello, D. Posner, R. Koontz, P. Heiferling, P. Carpenter (JPL), and L. Perelman (JPL) Jul. 1979 45 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-52-250) Avail: NTIS HC A03/MF A01

The objective of the International Photovoltaic Program Plan, the strategies that will be used in the plan, and the approach that is being taken to prepare the plan are described. Background on photovoltaic technology and markets and the DOE domestic photovoltaic effort is also presented. DOE

N80-16514# Midwest Research Inst., Golden, Colo.
PROCEEDINGS: PHOTOVOLTAICS USER REVIEW PANEL
S. Carroll Aug. 1979 26 p refs Proc. held at Golden, Colo., 6-7 Mar. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-69-276) Avail: NTIS HC A03/MF A01

The discussions, recommendations, and conclusions of the photovoltaics user review panel are presented. The purpose of the panel discussion was to determine the technical information dissemination (TID) needs for target audiences, to reach agreement on what informational products could fill these needs and who should produce the materials, and to establish priorities for the need for the TID products. Technological areas discussed include photovoltaics, solar thermal power, biomass, wind energy conversion, and ocean thermal energy conversion. DOE

N80-16515# Kaiser Aluminum and Chemical Corp., Pleasanton, Calif.
ENERGY SAVINGS THROUGH USE OF AN IMPROVED REDUCTION CELL CATHODE
W. H. Goodnow 1979 19 p refs
(Contract EC-76-C-03-1257)
(SAN-1257-T2) Avail: NTIS HC A02/MF A01

Material characterization for a wettable and rained Hall cell cathode was expanded to include inspection of TiB2 components for the 15KA cell restart. The cell was restarted and went through a shakedown and performance monitoring period. An engineering and economic study of TiB2 retrofit into existing cells was carried to the point where a sensitivity type cost analysis was done. DOE

N80-16516# Sandia Labs., Albuquerque, N. Mex. Thermal and Fluid Sciences Dept.
COMPARATIVE ANALYSIS OF SOLAR ENERGY STORAGE CYCLES
C. E. Hackett 1979 25 p refs Presented at the Intern. Conf. on Solar Energy, Milan, 23 Sep. 1979
(SAND-79-1803C; CONF-790954-1) Avail: NTIS HC A02/MF A01

A thermodynamic technique is presented which will enable the assessment of the overall performance of various storage options on an absolute basis so that cost effective designs can be developed to obtain the full thermodynamic and system advantages of energy storage. First the underlying thermodynamic principles of entropy production analysis are examined. The various energy storage schemes are classified. Detailed analyses were developed to cover the various generic types of energy storage which are appropriate for solar power systems. DOE

N80-16517# Sandia Labs., Albuquerque, N. Mex.
PREPARATION OF THIN FILMS FOR SOLAR ENERGY UTILIZATION
D. M. Mattox 1979 17 p refs Presented at the National Vacuum Symp., New York, N.Y., 2 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1754C; CONF-791013-2) Avail: NTIS HC A02/MF A01

A technology assessment of thin film deposition techniques is presented. Commercial applications of thin films include photothermal selective absorbers formed by electroplating, chemical conversion and vacuum processing; solar reflectors formed by vacuum processes; heat reflectors formed by vacuum processes and spray pyrolysis; antireflection coatings formed by vacuum processes and chemical leaching and the metallization of photovoltaic cells. CdS/Cu2S photovoltaics formed by vacuum processes and spray pyrolysis are also close to commercial utilization. Principle concerns in thin films applications include economics of fabrication and environmental stability of the thin film materials. One of the major problems with thin film evaluation is the lack of acceptable testing procedures particularly as related to lifetime. The status of thin films in solar energy utilization is reviewed. DOE

N80-16518# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
EXPERIMENTAL TEST FACILITY FOR SELECTIVE RADIATIVE COOLING SURFACES
F. Sakkal, M. Martin, and P. Berdahl Aug. 1979 6 p refs Presented at the Nat. Passive Solar Energy Conf., Kansas City, Kansas, 3 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9697; CONF-791022-92) Avail: NTIS HC A02/MF A01

The newly constructed radiator test facility at Lawrence Berkeley Laboratory is described and preliminary results are presented for cooling rates from two radiating surfaces. DOE

N80-16519# Ames Lab., Iowa.
PRELIMINARY EXPERIMENTAL RESULTS ON THE OPTICAL PROPERTIES OF MODEL DIRECT SOLAR GAIN INTERIORS
J. F. McClelland, R. Fuchs, R. N. Kniseley, D. A. Block, and L. Hodges 1979 5 p refs Presented at the Nat. Passive Solar Energy Conf., Kansas City, Kansas, 3 Oct. 1979 Prepared jointly with Iowa St. Univ. of Science and Technology, Ames
(Contract W-7405-eng-82)
(ISM-233) Avail: NTIS HC A02/MF A01

An assessment is presented of conditions necessary for quantitative characterizations of direct solar gain optical properties using photoacoustic measurements. Means of satisfying the experimental requirements are discussed in detail. DOE

N80-16520# Idaho National Engineering Lab., Idaho Falls.
COMMERCIAL PROTOTYPE DESIGN OF A SOLAR HEATING/COOLING SYSTEM FOR A MANUFACTURED HOME
M. P. Scofield (EG&G Idaho, Inc., Idaho Falls), A. S. Lau (EG&G Idaho, Inc., Idaho Falls), K. H. Liebelt (EG&G Idaho, Inc., Idaho Falls), N. R. Shinn (Boise Cascade Corp., Idaho), and T. L. Schafer (Boise Cascade Corp., Idaho) Sep. 1979 140 p refs Prepared jointly with Boise Cascade Corp., Idaho
(Contract EY-76-C-07-1570)
(TREE-1384) Avail: NTIS HC A07/MF A01

A prototype design is presented for a solar heating and cooling system for a manufactured modular home. The objective was to develop an active solar system for space heating that would be competitive with conventional energy sources; that is, the increase in the mortgage payment would be completely and simultaneously recovered from energy savings. The heating and cooling system features air collectors that are structurally part of the south facing rear wall, rock storage that is in the basement, and a heat exchanger that preheats domestic hot water. Summer cooling is achieved by cooling rock storage at night and circulating house air through the storage during the day as required. Two nearly identical homes were designed and built incorporating the prototype system. Both in Idaho, one house is located in Boise, the other in Idaho Falls, placing the homes in distinctly different climates. Both homes are being monitored for a two-year period to obtain dynamics and long-term performance data. The results of the monitoring will be the subjects of further reports. DOE

N80-16521# Solar Environmental Engineering Co., Inc., Fort Collins, Colo.
CONTINUING REGIONAL SOLAR ENERGY INFORMATION MINI-CENTER ACTIVITIES AND UPDATING THE SOLCOST PROGRAM Quarterly Report
L. J. Lantz Jul. 1979 69 p
(Contract EG-77-C-02-4643)
(COO-4643-T2) Avail: NTIS HC A04/MF A01

Progress in the various tasks in the program to develop SOLCOST is reviewed. Several SOLCOST examples are included. DOE

N80-16522# Institute of Gas Technology, Chicago, Ill.
SOLAR-MEC DEVELOPMENT PROGRAM, PROJECT 9103 Semiannual Progress Report, 1 Sep. 1977 - 28 Feb. 1978
J. Wurm, S. A. Weil, and L. R. Wright Jan. 1979 44 p
(Contract EG-77-C-02-4495)
(COO-4495-7) Avail: NTIS HC A03/MF A01

The dynamic performance of a supported molecular-sieve, regenerative, heat and mass exchanger is reported, under input conditions typical of the operation of a solar-power open desiccant cooling system. The experimental data are compared with a computer model describing the dynamic processes of air drying and desiccant regeneration of the Solar-MEC desiccant cooling system. The test setup, the experimental program, and the results of diagnostic steps to evaluate and minimize air leakage rates within the Solar-MEC system are described. The test design and experimental approach to verify the performance of the rotary regenerative (sensible) heat exchanger are reported. DOE

N80-16523# Argonne National Lab., Ill. Components Technology Div.
OTEC PERFORMANCE TESTS OF THE UNION CARBIDE ENHANCED-TUBE CONDENSER
David T. Yung, David L. Hillis, James J. Lorenz, and Norman F. Sather May 1979 33 p refs
(Contract W-31-109-eng-38)
(ANL/OTEC-PS-2) Avail: NTIS HC A03/MF A01

Results of performance tests conducted on a Union Carbide enhanced-tube condenser with wire wrapping on the ammonia side and internal axial fins on the water side are reported. This unit performed satisfactorily and was free of operational difficulties. At design operating conditions (a heat duty of 3.2 million Btu/h, an inlet water temperature of 40 F, and a water flow rate of 3200 gpm) the steady-state value of the overall heat transfer coefficient was found to be 818 Btu/h sq + ft F, and the ammonia-side and water-side heat transfer coefficients were 5180 and 1130 Btu/h.sq ft F, respectively. The water-side pressure drop was 1.8 psi. Varying the heat duty from 2.4 million to 4.0 million Btu/h had a negligible effect on thermal performance. The value obtained for the ammonia-side-heat transfer coefficient at nominal conditions is about two times that predicted by the Nusselt expression for condensation on a smooth tube. The water-side coefficient is within 3% of the value predicted by the Noranda correlation for finned tubes. DOE

N80-16524# Sandia Labs., Albuquerque, N. Mex.
SOLAR CENTRAL TEST FACILITY
G. E. Brandvold and John T. Holmes 1979 18 p Presented at the Frontiers of Power Generation Conf., Stillwater, Okla., 24 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1730C; CONF-790924-1) Avail: NTIS HC A02/MF A01

The central receiver test facility capable of delivering 5 million watts of thermal power to experimental equipment is described. The primary CRTF testing programs which involve prototype components (receivers and heliostats) for central receiver solar electric power plants are discussed and the high solar flux and high temperature research and development work is reported. DOE

N80-16525# Department of Energy, Washington, D. C.
FEDERAL PHOTOVOLTAICS UTILIZATION PROGRAM
Jun. 1979 40 p refs
(DOE/EA-0087) Avail: NTIS HC A03/MF A01

The potential environmental effects of silicon cell technology are analyzed. It is noted that any potential environmental impacts of this technology occur in connection with manufacturing of silicon cells and proposed applications of photovoltaic systems. However, it was found that there are no known adverse environmental effects associated with the federal photovoltaics utilization program which cannot be mitigated or avoided. DOE

N80-16526# Massachusetts Inst. of Tech., Cambridge.
PHOTOCHEMICAL ENERGY STORAGE, STUDIES OF INORGANIC PHOTOASSISTANCE AGENTS Progress Report, 1 Apr. 1978 - 31 Mar. 1979
Mark S. Wrighton Dec. 1978 17 p refs
(Contract EY-76-S-02-4178)
(COO-4178-2) Avail: NTIS HC A02/MF A01

Photosensitive surfaces derivatized with redox active ferrocene-centered molecules were investigated. Surfaces studied include Au, Pt, Ge, Si, and GaAs using three different derivatizing reagents. In all cases, persistently-attached, electroactive material can be bound to the surface and characterized by cyclic voltammetry. It is shown that derivatized n-type Si can be used as a photoanode in aqueous electrolytes under conditions where the naked surface is passivated by photoinduced oxide growth (Si yields SiO/sub x/) too fast to allow any useful measurements. DOE

N80-16527# Boston Univ., Mass. Dept. of Chemistry.
ORGANIC PHOTOCHEMICAL STORAGE OF SOLAR ENERGY Progress Report, 1 Mar. 1978 - 31 Jan. 1979
G. Jones, II Feb. 1979 24 p refs
(Contract EG-77-S-02-4380)
(COO-4380-2) Avail: NTIS HC A02/MF A01

Photosensitization mechanisms for driving energy storing reactions of readily available organic compounds were studied. Aromatic sensitizers were used as complexing agents for a series of non-conjugated dienes which are capable of valence isomerization. Diene exciplexes, shown to be stabilized by electron donor-acceptor interaction, led to photoisomers with chemical and quantum efficiency in two of the cases studied. With triplet photosensitizers visible light (to 520 nm) was used to bring about an energy storing valence isomerization of a diester derivative of norbornadiene. High quantum yields (0.6) were measured at the longest wavelengths yet utilized for this type of isomerization. The quantum efficiency for isomerization using a very low energy triplet sensitizer was significantly enhanced at slightly elevated temperatures, suggesting that thermal energy (in amounts present in solar collector media) can be an aid in driving energy storing photo-reactions. DOE

N80-16528# Sandia Labs., Albuquerque, N. Mex.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY EXPERIMENT MANUAL AND TEST PLAN
Aug. 1979 52 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0379) Avail: NTIS HC A04/MF A01

The midtemperature solar systems test facility is described and the procedures for selecting items to be evaluated there are outlined. The prerequisites for installing such items are defined, the typical tests performed are described, and the reports generated and disseminated from the facility are discussed. DOE

N80-16529# Midwest Research Inst., Golden, Colo.
PERFORMANCE CHARACTERISTICS OF A COMMERCIALLY AVAILABLE POINT-FOCUS SOLAR POWER
M. Bohn Apr. 1979 12 p refs Presented at the ASME/AICHE Natl. Heat Transfer Conf., San Diego, Calif., Aug. 1979
(Contract EG-76-C-01-4042)
(SERI/TP-34-169; CONF-790808-17) Avail: NTIS HC A02/MF A01

The performance of a commercially available solar electric power system is described in terms of instantaneous electrical power output for a given insolation and electrical energy production per day. Receiver thermal loss coefficient and concentrator optical efficiency are measured and system performance is given using steam cycle efficiency and electrical generator efficiency as parameters. DOE

N80-16530# Sandia Labs., Albuquerque, N. Mex.
MODELING THE BEAM CHARACTERIZATION SYSTEM
F. Biggs, C. N. Vittitoe, and D. L. King 1979 20 p refs

Presented at ISA Natl. Conf., Chicago, 22 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1295C; CONF-791005-4) Avail: NTIS
HC A02/MF A01

A theoretical model of the beam characterization system (BCS) to interpret results is presented. This model serves as an aid to define specifications, analyze measurements, calculate performance, and answer other questions about the heliostat. A statistical method is used to handle stochastic variables such as sun-tracking errors and surface-slope errors. A cone-optics technique is used to incorporate the statistics into a consistent model of the optical behavior of a heliostat. Use of the model to unfold slope-error distributions and sun-tracking statistics is described for measurements both in and out of the focal plane. The importance of auxiliary input information such as the sunshape (angular distribution of sun rays) to the analysis of BCS measurements is discussed. The role of the BCS in validating heliostats against acceptance criteria is summarized. DOE

N80-16531# Sandia Labs., Albuquerque, N. Mex.
HELIOSTAT BEAM CHARACTERIZATION SYSTEM-CALIBRATION TECHNIQUE
G. S. Phipps. 1979. 23 p. refs. Presented at the ISA Natl. Conf., Chicago, 22 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1532C; CONF-791005-2) Avail: NTIS
HC A02/MF A01

The beam characterization system which digitizes the output signal from a standard 525 line video camera to obtain raw data for measurements of solar heliostat images is described. Absolute irradiance values are obtained from a calibrated pyrheliometer included on the target screen. A video camera measures the relative irradiance values of areas of identical spectral composition. Measurements are made over a two dimensional spatial array of N screen locations. Calibration corrections are applied to the data from the N locations to obtain a single calibrated irradiance data matrix. Methods of obtaining these corrections are discussed and measured results are presented to support the various assumptions. DOE

N80-16532# Argonne National Lab., Ill. Energy and Environmental Systems Div.
SOLAR AVAILABILITY FOR WINTER SPACE HEATING: AN ANALYSIS OF THE CALENDAR PERIOD 1953-1975
J. G. Asbury, C. Maslowski, and R. O. Mueller. Apr. 1979. 20 p. refs.
(Contract W-31-109-eng-38)
(ANL/SPG-14) Avail: NTIS HC A02/MF A01

Data tapes for eight US sites containing hourly readings of insolation and ambient temperature for the period 1953-1975 were analyzed. Scatter-diagrams of insolation versus heating degree-days, compiled on a daily basis, indicate a wide variation in insolation levels, even during periods of coldest weather. For seven of the eight sites, the peak-day backup energy required by a solar space heating system exceeded 85 percent of the peak-day energy requirement of a conventional (nonsolar) heating system. The cities considered are Albuquerque (NM), Bismark (ND), Boston (MA), Caribou (ME), Columbia (MO), Madison (WI), Seattle (WA), and Sterling (VA). DOE

N80-16533# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
EMERGING MATERIAL SYSTEMS FOR SOLAR CELL APPLICATIONS
W. J. Biter and J. R. Szedon. 8 Aug. 1979. 23 p.
(Contract DE-AC04-79ET-23003)
(DOE/ET-23003/1) Avail: NTIS HC A02/MF A01

Modifications and additions to the vacuum system in order to produce films of InP by the plasma-induced deposition process are described. DOE

N80-16534# Delaware Univ., Newark.
CARRIER TRANSPORT THROUGH HETEROJUNCTION SOLAR CELLS
K. W. Boeer. 1979. 7 p. refs. Presented at the Photovoltaic Solar Energy Conf., West Berlin, 23 Apr. 1979. Prepared jointly with SES, Inc., Newark, Del.
(Contract EX-76-C-23-1030)
(DOE/ET/23103-5; CONF-790457-8) Avail: NTIS
HC A02/MF A01

Carrier transport through heterojunctions was analyzed and found to be influenced by the interconnection between the bands of the two semiconductors, by space charge effects near this interconnection, and by interface recombination. Estimation of the discontinuity of the conduction bands using the difference in electron affinities was found insufficient. The space charge double layer caused by charged dangling bonds along the dislocation network and its compensation via charged defects is discussed. Band profile for CdS/Cu2S and Cd/sub x/Zn/sub 1-x/S/Cu2S heterojunctions were evaluated quantitatively and agree within the experimental error with the observation, that, with decreasing lattice mismatch, the open circuit voltge increases, while the short circuit current decreases. DOE

N80-16535# Delaware Univ., Newark.
PHOTOVOLTAIC EFFECT, ITS PRESENT UNDERSTANDING AND REMAINING MYSTERIES
K. W. Boeer. 1979. 5 p. refs. Presented at the Intern. Solar Energy Society Meeting, Atlanta, 28 May 1979. Prepared jointly by SES, Inc., Newark, Del.
(Contract EX-76-C-23-1030)
(DOE/ET/23103-6; CONF-790541-44) Avail: NTIS
HC A02/MF A01

The present phenomenological understanding of the photovoltaic effect and solar cells is discussed. Unexplained questions and problems with the effects of various device parameters on the current-voltage characteristics are discussed, and the need for more sophisticated theoretical analyses of photovoltaic cells is stressed. DOE

N80-16536# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
COMPUTER MODELLING OF AMORPHOUS MATERIALS FOR PHOTOVOLTAIC CONVERSION. Quarterly Progress Report
16 Apr. 1979. 11 p. refs.
(Contract W-31-109-eng-38)
(DOE/TIC-10165, QPR-2) Avail: NTIS HC A02/MF A01

Various aspects of electron localization in models of amorphous silicon are reported. Observed fluctuations in charge neutrality as large as 0.5e have implications for the electrical conductivity of a-Si as well as its vibration frequencies and infrared absorption coefficient. Also, when defects in a-Si are introduced, it is found that the localization parameter reaches remarkably high values for a few states at the Fermi level. DOE

N80-16537# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.
LOW-COST STRUCTURES FOR PHOTOVOLTAIC ARRAYS. Final Report
P. Masser. Aug. 1979. 204 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-7006) Avail: NTIS HC A10/MF A01

Designs of photovoltaic array support structures, which encourage life cycle cost reduction through mass production techniques, material cost reduction, and simplified installation methods, are presented. Nontracking collectors with a low concentration ratio (one to about two sums) are considered primarily for commercial and utility applications. The results are applicable to both thermal and photovoltaic flat plate collectors. A value analysis approach was used, starting with a survey of the current state-of-the-art which found an absence of pertinent references on array support structures. Also, realistic load criteria were not found, and this was determined to be a key area for future cost reduction. Heights above the ground, array geometry, and wind direction all have important effects on loads. Foundation design was also found to be a key area for future cost reduction. A generic concept study was conducted, aimed at life cycle cost reduction, and representative examples were chosen. DOE

N80-16538# Midwest Research Inst., Golden, Colo.
PHOTOVOLTAIC MATERIALS AND DEVICE MEASUREMENTS WORKSHOP: FOCUS ON POLYCRYSTALLINE THIN FILM CELLS
1979. 190 p. refs. Workshop, held at Arlington, Va., 11 Jun. 1979

(Contract EG-77-C-01-4042)
(SERI/TP-49-185; CONF-790601) Avail: NTIS HC A09/MF A01

Papers on the development of thin film solar cells by improving the versatility and reliability of material and device measurement techniques are presented. Structural/chemical aspects, electro-optics, and charge transport techniques are emphasized. DOE

N80-16539# Sandia Labs., Albuquerque, N. Mex.
ECONOMIC ANALYSIS OF DARRIEUS VERTICAL AXIS WIND TURBINE SYSTEMS FOR THE GENERATION OF UTILITY GRID ELECTRICAL POWER. VOLUME 1: EXECUTIVE SUMMARY
W. N. Sullivan. Aug. 1979. 28 p. 4 Vol.
(Contract EY-76-C-04-0789)
(SAND-78-0962-Vol-1) Avail: NTIS HC A03/MF A01

The economic analysis of the Darrieus vertical axis wind turbine is discussed. A description of the technical approach used, key results, and major conclusions is presented along with a summary of the study. DOE

N80-16540# Sandia Labs., Albuquerque, N. Mex.
ECONOMIC ANALYSIS OF DARRIEUS VERTICAL AXIS WIND TURBINE SYSTEMS FOR THE GENERATION OF UTILITY GRID ELECTRICAL POWER. VOLUME 2: ECONOMIC OPTIMIZATION MODEL
W. N. Sullivan. Aug. 1979. 100 p. refs. 4 Vol.
(Contract EY-76-C-04-0789)
(SAND-78-0962-Vol-2) Avail: NTIS HC A05/MF A01

An economic study of the Darrieus vertical axis wind turbine (VAWT) economics is reported. A computer model of VAWT cost and performance factors useful for system design and optimization is presented. The content and limitations of the model are outlined. Output data are presented to demonstrate selection of optima and to indicate sensitivity of energy cost to design parameter variations. Optimized specifications generated by this model for six point designs are summarized. An appendix is included with a FORTRAN IV listing of the model and a description of the input/output characteristics. DOE

N80-16541# Sandia Labs., Albuquerque, N. Mex.
ECONOMIC ANALYSIS OF DARRIEUS VERTICAL AXIS WIND TURBINE SYSTEMS FOR THE GENERATION OF UTILITY GRID ELECTRICAL POWER. VOLUME 3: POINT DESIGNS
R. D. Grover and E. G. Kadlec. Aug. 1979. 99 p. refs. 4 Vol.
(Contract EY-76-C-04-0789)
(SAND-78-0962-Vol-3) Avail: NTIS HC A05/MF A01

Features of the Darrieus vertical axis wind turbine design including the blades, the speed increaser, guy cables and cable anchors, transmission, clutch, brakes, and the electrical system are discussed. System weight characteristics are tabulated. The operation and maintenance costs, and requirements reported and detailed descriptions of point designs for 120, 200, 500, and 1600 kW Darrieus vertical axis wind energy system are examined. DOE

N80-16542# Sandia Labs., Albuquerque, N. Mex.
ECONOMIC ANALYSIS OF DARRIEUS AXIS WIND TURBINE SYSTEMS FOR THE GENERATION OF UTILITY GRID ELECTRICAL POWER. VOLUME 4: SUMMARY AND ANALYSIS OF THE A. T. KEARNEY AND ALCOA LABORATORIES POINT DESIGN ECONOMIC STUDIES
W. N. Sullivan. Aug. 1979. 250 p. refs. 4 Vol.
(Contract EY-76-C-04-0789)
(SAND-78-0962-Vol-4) Avail: NTIS HC A11/MF A01

Two independent economic studies to assess the installed costs of a series six Darrieus vertical axis wind turbine designs are summarized. The designs cover a range of sizes with peak outputs from 10 to 1600 kW. And are designed produce utility grid electrical power. A comparison and analysis of the studies is presented. DOE

N80-16543# Illinois Univ., Urbana. Fusion Studies Lab.
DIRECT ENERGY CONVERSION SYSTEMS
G. H. Miley. 1978. 11 p. refs. Presented at the Meeting on the Technology of Controlled Thermonuclear Fusion, Santa Fe, N. Mex., 9 May 1978.
(Contract EY-76-S-02-2218)
(COO-2218-117; CONF-780508-73) Avail: NTIS HC A02/MF A01

The potential importance of direct energy conversion to the long-term development of fusion power is discussed with stress on the possibility of alleviating waste heat problems. Two approaches to direct conversion, i.e., direct collection and magnetic expansion are reviewed. DOE

N80-16544# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
SPIN TEST OF THE UNIVERSITY OF CALIFORNIA, LAWRENCE LIVERMORE LABORATORY COMPOSITE FLYWHEEL AT THE APPLIED PHYSICS LABORATORY, THE JOHNS HOPKINS UNIVERSITY, ON 18 JULY 1978. Final Report
D. W. Rabenhorst and T. R. Small. 15 Sep. 1978. 15 p. ref.
(Contract W-7405-eng-48)
(UCRL-13910) Avail: NTIS HC A02/MF A01

The Livermore flywheel is a composite structure of laminated, unidirectional, carbon fiber epoxy layers arranged in a quasi-isotropic structural pattern. The flywheel was built up of 160 layers of this unidirectional material with each layer oriented so that the axis of the fibers was 45 degrees from the fibers in the preceding layers. This 45 degree progressive lay-up was arranged so that the flywheel would have mid-plane symmetry. Final cross-section shape of the flywheel was machined with carbide tools to a modified tapered form. The intent was to provide uniform stress throughout the flywheel in the spinning condition. The flywheel specifications, test facility, and spin test results are briefly discussed. DOE

N80-16545# Department of Energy, Washington, D. C. Div. of Technology Assessment.
HYDROTHERMAL ELECTRIC AND DIRECT HEAT. COMMERCIALIZATION PHASE 3 PLANNING
R. C. Clusen. Sep. 1978. 38 p.
(DOE/ERD-0005) Avail: NTIS HC A03/MF A01

A technology program for the development of hydrothermal electric and direct heat energy is discussed. Environmental concerns identified over the commercialization of hydrothermal energy are examined. They include: airborne effluents, waterborne effluents, noise, subsidence, enhanced seismicity, water use conflicts, land use, socioeconomic impacts, and system safety and occupational health. A.W.H.

N80-16546# Delta Research Corp., Arlington, Va.
WORLDWIDE TRANSPORTATION/ENERGY DEMAND FORECAST, 1975 - 2000
R. U. Ayres. Oct. 1978. 103 p. refs.
(Contract W-7405-eng-26)
(ORNL/SUB-78/13536/1) Avail: NTIS HC A06/MF A01

Worldwide transportation energy demand for both commodities and passengers are forecast for 1975 - 2000. The long-range forecast methodology is described. Regional aggregation and economic/demographic projects are discussed. Transportation projections and transportation energy projections are presented. DOE

N80-16547# Department of Energy, Washington, D. C.
ADVANCED ELECTRIC GENERATION. COMMERCIALIZATION IN PHASE 3 PLANNING
Sep. 1978. 46 p.
(DOE/ERD-0014) Avail: NTIS HC A03/MF A01

Two basic technologies are under consideration for advanced electrical generation: fluidized-bed combustion (FBC) and phosphoric acid fuel cells. FBC consists of two major subtypes: atmospheric and pressurized fluidized-bed combustion. The fuel-cell power plant produces electricity by electrochemical conversion. The commercial readiness of these technologies with respect to environmental issues was investigated. Characteristics of the technologies and status information on the technical and environmental R and D programs are discussed. A milestone chart representing a relationship between a considered commercialization schedule and relevant environmental R and D is presented. Environmental concerns significant to the technologies were reviewed. The likelihood and consequences of adverse

findings, the problems and uncertainties stemming from current or anticipated environmental regulation, and potential costs of environmental control are examined. DOE

N80-16548# Sandia Labs., Albuquerque, N. Mex.
AERODYNAMIC HEATING OF HIGH-SPEED FLYWHEELS IN LOW-DENSITY ENVIRONMENTS
M. R. Baer. Oct. 1978. 46 p. refs.
(Contract EY-76-C-04-0789)
(SAND-78-0957). Avail: NTIS. HC A03/MF A01.

A computer code that interfaces with CINDA to predict the effects of aeroheating of high speed flywheels is presented. Slip flow aeroheating is examined for axisymmetric geometries for a steady state or transient calculation. The free molecular aeroheating on a flywheel is discussed. DOE

N80-16549# Argonne National Lab., Ill.
PEAK-LOAD PROBLEM WITH STORAGE TECHNOLOGY
J. G. Asbury and R. O. Mueller. Aug. 1978. 23 p. refs.
(Contract W-31-109-eng-38)
(ANL/SPG-8). Avail: NTIS. HC A02/MF A01.

The pricing and welfare implications of storage in a utility supply is examined. The method of analysis, which separates the load into storage and non-storable components, is described. DOE

N80-16550# Research Triangle Inst., Research Triangle Park, N. C.
APPLICATION ANALYSIS AND PHOTOVOLTAIC SYSTEM CONCEPTUAL DESIGN FOR SERVICE/COMMERCIAL/INSTITUTIONAL AND INDUSTRIAL SECTORS. TASK 1 REPORT
R. A. Whisnant, R. D. Alberts, R. M. Burger, R. P. Gardner, C. B. Morrison, and N. G. Staffa. Jul. 1978. 155 p. refs.
(Contract EY-76-C-04-0789)
(SAND-78-7032). Avail: NTIS. HC A08/MF A01.

The approach used to identify applications in the defined sectors for photovoltaic conversion are: (1) The Standard Industrial Classification Codes and to describe the applications that must be considered and data on the attributes of these applications germane to solar photovoltaic systems application. (2) The expected profitability of photovoltaic applications was determined from the discounted future costs of conventional energy sources, capital costs, and projected operating and maintenance costs over the life of the system. This was combined with the energy consumption of the application to obtain an estimate of the energy market potential. (3) The application ranking and subjective evaluations of market size, diversity, and public exposure were used to select five applications and their locations for design of a suitable photovoltaic system. (4) For each of the selected applications, the various relevant characteristics were identified, potential photovoltaic system configurations were defined, and performance and economic models were used to design a representative system. The design of the selected system is described. DOE

N80-16551# Oak Ridge National Lab., Tenn.
PERFORMANCE EVALUATION OF A LOW-FIRST-COST, THREE-TON, AIR-TO-AIR HEAT PUMP IN THE HEATING MODE
A. A. Domingorena. Oct. 1978. 88 p. ref.
(Contract W-7405-eng-26)
(ORNL/CON-18). Avail: NTIS. HC A05/MF A01.

A low cost, air to air, split system residential heat pump of nominal 3 ton capacity was instrumented and tested in the heating mode under laboratory conditions. The system was tested under both steady state and frosting defrosting conditions. From the steady state tests, the heating capacity and coefficient of performance were determined and evaluations of fan performance, heat exchanger and capillary tube performance, compressor performance, and system heat losses were made. The frosting defrosting tests provided information for evaluating both system and component performance under dynamic conditions. Tests were also conducted to determine the effect of the amount of refrigerant charge on system performance. DOE

N80-16552# Battelle Pacific Northwest Labs., Richland, Wash.
FACTORS AFFECTING POTENTIAL MARKET PENETRATION OF LASER FUSION POWER PLANTS
D. E. Deonigi and D. W. Fraley. Aug. 1979. 43 p. refs.
(Contract EY-76-C-06-1830)
(PNL-2803). Avail: NTIS. HC A03/MF A01.

A mini model constructed to estimate the optimal size of laser fusion power plants and to estimate the allowable cost of the first such plant in relation to the next best alternative is described. The mini model incorporates such factors as market penetration, learning, economies of scale, system size, transmission costs, reserve requirements, development and licensing costs and site costs. The results of the mini model simulations are discussed. DOE

N80-16553# New Mexico Energy Inst., Las Cruces.
PERFORMANCE EVALUATION OF THE NEW MEXICO STATE UNIVERSITY SOLAR HOUSE. Final Report, 1 Jan. 1977 - 1 Jul. 1979
Thomas R. Mancini, Philip R. Smith, and John L. Peterson. May 1979. 34 p. refs.
(PB-301225/9; NMEI-17). Avail: NTIS. HC A03/MF A01. CSCL 13A.

The conversion efficiency of the solar heated and cooled New Mexico State University house is evaluated. The design of the solar house which incorporates energy efficient elements of passive solar systems to minimize both the heating and cooling loads, is described. The liquid type solar system which employs flat plate collectors is examined. The performance evaluation consisted of sampling thirty six data points at ten minute intervals, monitoring the heating system and electrical power consumption of the solar equipment, and collecting environmental data such as solar radiation perpendicular to the plane of the collectors, wind speed, ambient temperature and relative humidity, and measuring the temperature and flowrate through the system. The data collection method is discussed and the instrumentation and accuracy of the measurements is reported. A.W.H.

N80-16554# Resources for the Future, Inc., Washington, D. C.
CONTRIBUTIONS TO THE FOUNDATIONS OF SUPPLY FOR ENERGY AND TRANSPORTATION: CONCEPTS, ECONOMICS, AND TECHNOLOGIES
James W. Sawyer, Jr. Mar. 1979. 224 p. refs.
(Grant NSF AER-75-16163)
(PB-300541/0; NSF/RA-790116). Avail: NTIS. HC A10/MF A01.

The energy problem and its possible effects on transportation, interaction between energy issues and policies, and transportation issues and policies is emphasized. The development of the energy crisis is reviewed and the transition to new energy sources is discussed. Following sections include: discussions of energy resource reserves; the characterization of likely future pricing of energy resources; engineering and economic descriptions of actual and potential synfuel processes; energy as a transportation fuel and as a commodity to be transported; descriptions of the energy and transportation models used; descriptions of the model runs and projections; impacts; emerging issues; and brief discussions of some of the policy options open in both transportation and energy areas. GRA

N80-16555# General Accounting Office, Washington, D. C. Energy and Minerals Div.
FEDERAL DEMONSTRATIONS OF SOLAR HEATING AND COOLING ON PRIVATE RESIDENCES: ONLY LIMITED SUCCESS. Report to the Congress
9 Oct. 1979. 65 p. refs.
(PB-301123/6; EMD-79-55). Avail: NTIS. HC A04/MF A01. CSCL 10A.

The residential solar heating and cooling demonstration program implemented by the Department of Housing and Urban Development for the Department of Energy is analyzed. A perspective on the program, an evaluation of its success in demonstrating solar heating systems, and a discussion of the prospects for demonstrating solar cooling technologies are included. GRA

N80-16556# Berg (Charles A.), Buckfield, Maine.
ENERGY CONSERVATION IN INDUSTRY: THE PRESENT APPROACH, THE FUTURE OPPORTUNITIES. Final Report
Charles A. Berg. May 1979. 96 p. refs.
(Contract EQ7AD505)

(PB-301244/0) Avail: NTIS HC A05/MF A01 CSCL 10A

Possible opportunities for industry to conserve energy through the introduction of new technology are considered. It is indicated that these technology options offer far greater savings of energy and of all other resources required in production than modifying the operation of existing plants, toward which present energy conservation efforts are directed. GRA

N80-16557# National Technical Information Service, Springfield, Va.

SOLAR ENERGY CONCENTRATOR DESIGN AND OPERATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Jul. 1979

Audrey S. Hundemann Sep. 1979 183 p Supersedes NTIS/PS-78/0838 Updates NTIS/PS-77/0458 2 Vol.
(NTIS/PS-79/0926/0; NTIS/PS-78/0838) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

Government-funded research on the design and operation of various types of solar energy concentrators is discussed. Abstracts cover the efficiency and optimization of Fresnel lenses, V-trough concentrators, flat plate and parabolic reflectors, compound parabolic concentrators used in solar photovoltaic conversion, and heliostat systems. A few abstracts deal with heat loss and cost studies. (This updated bibliography contains 177 abstracts, 80 of which are new entries to the previous edition.) GRA

N80-16558# National Technical Information Service, Springfield, Va.

SOLAR ENERGY CONCENTRATOR DESIGN AND OPERATIONS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1979

Audrey S. Hundemann Sep. 1979 225 p Supersedes NTIS/PS-78/0839 Updates NTIS/PS-77/0459 2 Vol.
(NTIS/PS-79/0927/8; NTIS/PS-78/0839) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

Worldwide research on the design and operation of various types of solar energy concentrators is discussed. Topic areas cover thermal and optical performance of Fresnel lenses, compound parabolic concentrators, fixed mirror concentrators, and planar reflector enhancement of flat plat collector systems. A few abstracts deal with V-trough concentrators and methods to calculate performance of concentrators. A separate Published Search on heliostat systems is available. This updated bibliography contains 220 abstracts, 53 of which are new entries to the previous edition. GRA

N80-16559# Michigan Univ., Ann Arbor Highway Safety Research Inst.

COPING WITH ENERGY LIMITATIONS IN TRANSPORTATION: PROPOSALS FOR MICHIGAN

Robert Kaufman and Herman Koenig Apr. 1979 49 p refs Sponsored by Michigan Dept. of Transportation
(PB-299737/7; UM-HSRI-79-13) Avail: NTIS HC A03/MF A01 CSCL 10B

The transportation energy dependence of Michigan's economy and major industries is discussed and quantified. Alternative energy forms and automotive propulsion systems are surveyed and assessed. Probable economic impacts on Michigan are discussed and the dual pressures of rising transport energy costs and federal regulations on the auto industry are outlined. State action for managing the economic transition which Michigan faces is recommended, and a mechanism for managing change is proposed. GRA

N80-16560# National Bureau of Standards, Washington, D.C. National Engineering Lab.

AN INVESTIGATION OF PREFERENCES FOR VARIOUS TYPES OF ENERGY COST FEEDBACK Final Report

Ann Ramsey-Smith and Jennifer L. Gagnon Aug. 1979 73 p refs Sponsored by DOE
(PB-300314/2; NBSIR-79-1771) Avail: NTIS HC A04/MF A01 CSCL 10B

The issue of consumer preferences for various types of energy cost feedback for individual consumers is addressed. Recommendations related to the performance characteristics of energy cost feedback devices for use in testing energy cost feedback meters are examined. GRA

N80-16561# Old West Regional Commission, Billings, Mont.

ENERGY RESEARCH INFORMATION SYSTEM (ERIS) PROJECTS REPORT, VOLUME 4, NUMBER 1 Progress Report, Dec. 1978 - Jun. 1979

Catherine A. Boyd, comp. and Janet Jelinek, comp. Jun. 1979 88 p Prepared in cooperation with Geological Survey, Reston, Va. and Argonne National Lab., Ill.
(PB-300338/1; OWRC/ERIS-7906) Avail: NTIS HC A05/MF A01 CSCL 10B

An inventory of the energy related programs and research activities from 1974 to the present in the states of Montana, Nebraska, North Dakota, South Dakota, and Wyoming is presented. Areas of research include: coal, petroleum, oil shales, fission fuels, synthetic fuels, hydro-energy, renewable energy, resources, energy policy, reclamation, socioeconomic impacts, environmental impacts, and land use. Each project description lists title, investigator(s), research institution, sponsor, funding, time frame, location, a descriptive abstract of the research, and the titles of reports and/or publications generated by the research. GRA

N80-16562# New Mexico Energy Inst., Las Cruces.

ADDITION OF AN AIR-COOLED COLLECTOR TEST CAPABILITY TO THE SOLAR COLLECTOR TEST FACILITY Final Report, 1 Jan. 1977 - 30 Jun. 1978

H. L. Connell Jun. 1979 41 p refs Sponsored in part by the New Mexico Energy and Minerals Dept.
(Contract ERB-76-259)
(PB-300482/7; NMEI-43) Avail: NTIS HC A03/MF A01 CSCL 10A

The design and fabrication of test stands with adjustable-tilt collector mounting frames is discussed. The air flow and conditioning circuits, and the integration of the required temperature and pressure instrumentation are also discussed. GRA

N80-16563# National Technical Information Service, Springfield, Va.

ENERGY POLICY AND RESEARCH PLANNING, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Oct. 1977 - Sep. 1979

Andrey S. Hundemann Sep. 1979 184 p Supersedes NTIS/PS-78/0962, NTIS/PS-77/0839, NTIS/PS-76/0710
(NTIS/PS-79/1069/8; NTIS/PS-78/0962; NTIS/PS-77/0839; NTIS/PS-76/0710) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

Citations relative to planning for future U.S. energy needs on both national and state government levels are presented. The history and development of national and state legislation and regulations, Project Independence studies, and assessment of the effects of deregulation are included. Technical, economic, and environmental considerations in energy planning are also covered. GRA

N80-16564# SRI International Corp., Menlo Park, Calif.

COMPARATIVE ASSESSMENT OF RESIDENTIAL ENERGY SUPPLY SYSTEMS THAT USE FUEL CELLS: EXECUTIVE SUMMARY Final Report, Sep. 1976 - Jan. 1979

R. V. Steele, D. C. Bomberger, K. M. Clark, R. F. Goldstein, R. L. Hays, M. E. Gray, and G. Ciprios Apr. 1979 15 p
(Contract EPA-68-02-2180)
(PB-299207/1; EPA-600/7-79-105A) Avail: NTIS HC A02/MF A01 CSCL 10B

A comparison of residential energy supply systems using fuel cells is presented. All systems used coal as the primary energy source, and all residences were assumed to have identical heating and cooling demands. Five systems were analyzed in detail and the entire energy cycle, from coal mine to end use, was examined for costs, efficiency, environmental impact, and applicability. The five energy systems are: (1) a coal fired power plant supplying electricity and a coal gasification plant supplying SNG; (2) a 26 MW fuel cell power plant fueled by coal derived SNG supplying electricity; (3) a 26 MW fuel cell power plant fueled by coal derived naphtha supplying electricity; (4) a combined cycle power plant fueled by coal derived fuel oil supplying electricity; and (5) a 100 kW fuel cell power plant fueled by coal derived SNG. GRA

N80-16565# SRI International Corp., Menlo Park, Calif.

COMPARATIVE ASSESSMENT OF RESIDENTIAL ENERGY

SUPPLY SYSTEMS THAT USE FUEL CELLS Final Report, Sep. 1976 - Jan. 1979
R. V. Steele, D. C. Bomberger, K. M. Clark, R. F. Goldstein, R. L. Hays, M. E. Gray, and G. Ciprios Apr. 1979 505 p refs (Contract EPA-68-02-2180)
(PB-299208/9; EPA-600/7-79-105B) Avail: NTIS HC A22/MF A01 CSCL 10B

A comparison of residential energy supply systems using fuel cells is presented. Twelve energy systems, able to provide residential heating and cooling using technologies projected to be available toward the end of this century, were designed conceptually. Five systems were analyzed in detail. The entire energy cycle, from coal mine to end use, was examined for costs, efficiency, environmental impact, and applicability. The five energy systems were: (1) a coal fired power plant supplying electricity and a coal gasification plant supplying SNG; (2) a 26 MW fuel cell power plant fueled by coal derived SNG supplying electricity; (3) a 26 MW fuel cell power plant fueled by coal derived naphtha supplying electricity; (4) a combined cycle power plant fueled by coal derived fuel oil supplying electricity; and (5) a 100 kW fuel cell power plant fueled by coal derived SNG, sited in a housing complex, supplying electricity to heat pumps, with heat recovered from the fuel cell supplying supplemental space heating and hot water. GRA

N80-16566# National Technical Information Service, Springfield, Va.
FLAT PLATE SOLAR COLLECTOR DESIGN AND PERFORMANCE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Jul. 1979
Audrey S. Hundemann Sep. 1979 168 p Supersedes NTIS/PS-78/0840
(NTIS/PS-79/0928/6; NTIS/PS-78/0840) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

Federally-funded research on the design and thermal efficiency of air- and liquid-type flat plate collectors is discussed. Topic areas cover convection characteristics, methods to reduce heat loss, optical coatings, and corrosion control. Emphasis of the bibliography is on basic research studies. (This updated bibliography contains 160 abstracts, 63 of which are new entries to the previous edition.) GRA

N80-16567# National Technical Information Service, Springfield, Va.
FLAT PLATE SOLAR COLLECTOR DESIGN AND PERFORMANCE. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1979
Audrey S. Hundemann Sep. 1979 180 p Supersedes NTIS/PS-78/0841
(NTIS/PS-79/0929/4; NTIS/PS-78/0841) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

Citations from worldwide literature on the design, thermal performance, and optimization of air- and liquid-type flat plate collectors are covered. Topic areas include heat loss and heat transfer, effect of orientation, corrosion protection, optical coatings, enhancement of performance through the use of planar reflectors, and the effect of honeycomb layers on collector performance. A few studies pertain to grooved, corrugated, or V-trough collectors. Abstracts dealing with methods of measuring the performance of flat plate collectors and computer optimization studies are included. This bibliography contains 174 abstracts, 30 of which are new entries to the previous edition. GRA

N80-16568# Economics, Statistics and Cooperatives Service, Washington, D. C. National Economics Div.
SOLAR ENERGY FOR AGRICULTURE: REVIEW OF RESEARCH Final Report
W. K. Trotter, W. C. Reid, Jr., and R. G. McElroy Aug. 1979 29 p refs
(PB-298688/3; ESCS-67) Avail: NTIS HC A03/MF A01 CSCL 02B

Solar energy use in various agricultural applications is summarized. Grain drying, heating and cooling of greenhouses and rural residences, heating livestock shelters, drying crops other than grain, food processing, and irrigation are discussed. An exploratory economic assessment of solar energy technologies is given. GRA

N80-16569# New Mexico Energy Inst., Las Cruces.
FEASIBILITY STUDY OF GEOTHERMAL ENERGY FOR HEATING GREENHOUSES Final Report, 1 Jan. - 31 Aug. 1977
Leo J. LaFrance Jun. 1979 24 p refs Sponsored in part by New Mexico Energy and Minerals Dept.
(PB-299517/3; NMEI-41) Avail: NTIS HC A02/MF A01 CSCL 02C

The technical feasibility of heating greenhouses with low temperature, 212 F (100 C) and below, geothermal sources is established. The economic feasibility of using geothermal energy to heat greenhouses is summarized. Candidate greenhouse facilities in New Mexico were determined for conversion to geothermal energy as well as sites favorable for new greenhouse construction. GRA

N80-16570# New Mexico Energy Inst., Las Cruces.
SOLAR POWERED AGRICULTURAL IRRIGATION PUMPING Final Report, 1 Jun. 1976 - 28 Feb. 1979
G. H. Abernathy and T. R. Mancini 15 Feb. 1979 31 p refs
(PB-299294/9; NMEI-31) Avail: NTIS HC A03/MF A01 CSCL 02C

A solar-powered irrigation pumping system was designed and installed at Willard, New Mexico. The system incorporated an east-west oriented field of parabolic trough solar collectors to heat oil. The hot oil in turn heated freon which drove a high speed turbine connected to the irrigation pump. In conjunction with the solar pump, agricultural experiments were conducted. These included drip irrigation of typical food crops that could be grown in the area. GRA

N80-16571# National Technical Information Service, Springfield, Va.
HELIOSTAT SYSTEM DESIGN AND OPERATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1979
Audrey S. Hundemann Sep. 1979 61 p Supersedes NTIS/PS-78/0842
(NTIS/PS-79/0930/2; NTIS/PS-78/0842) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

The design and use of heliostats in solar central receiver thermal power systems are discussed in abstracts from worldwide literature. Topic areas include heliostat systems performance, efficiency, and optimization. Emphasis of the bibliography is on basic research. (This updated bibliography contains 55 abstracts, 17 of which are new entries to the previous edition.) GRA

N80-16572# National Bureau of Standards, Washington, D.C. National Engineering Lab.
PERFORMANCE OF A PACKAGED SOLAR SPACE-HEATING SYSTEM USED WITH A MOBILE HOME
Dennis E. Jones and James A. Hill Aug. 1979 45 p refs Sponsored in part by HUD, Washington, D.C. Div. of Energy, Building Technol. and Standards
(PB-300890/1; NBSIR-79-1799) Avail: NTIS HC A03/MF A01 CSCL 13A

A mobile home was equipped with a packaged solar space-heating system using air heating collectors and pebble bed shortage. The system was fully instrumented and data were collected. The performance of the system was determined and various methods of correlating performance were explored. GRA

N80-16215*# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering
LATERAL AND TILT WHIRL MODES OF FLEXIBLY MOUNTED FLYWHEEL SYSTEMS
C. W. Bert and T. L. C. Chen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 35-46 refs Sponsored by DOE (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 10B

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-16573 Rutgers - The State Univ., New Brunswick, N. J.
AN ANALYSIS OF THE FACTORS AFFECTING THE

DISTRIBUTION OF HEAVY METALS IN A TIDAL ESTUARY Ph.D. Thesis
Santo Vincent Grasso 1979 288 p
Avail: Univ. Microfilms Order No. 7928404

An analysis of the factors affecting the distribution of CD, Cu, Mn, Ni, Pb and Zn in the waters and sediments of the Hackensack River between River Mile 12 and 20.9 was conducted. The two major sources of metals to the area were found to be discharges from the Bergen County Sewerage Authority and contributions from runoff. For the year 1975, the Bergen County Sewerage Authority accounted for 100, 65, 99, 89, 57, and 80% respectively of the Cd, Cu, Mn, Ni, Pb, and Zn discharged into the area. Runoff accounted for most of the remaining portion. Soluble nickel and zinc levels in the river water were similar to the levels contained in the EPA STORET data. The levels of the remaining metals showed marked deviations from the EPA data. Suspended metals were found to exhibit positive correlation with the percentage of fixed suspended matter. Dissert. Abstr.

N80-16574 California Univ., Los Angeles.
THE ENVIRONMENTAL PROTECTION AGENCY'S ROLE IN THE PROTECTION OF WETLANDS: EXAMINATION OF EPA'S PARTICIPATION IN THE SECTION 404 REGULATORY PROGRAM Ph.D. Thesis
Jacalyn Mae Spiszman 1979 193 p
Avail: Univ. Microfilms Order No. 8001407

The legislative history of Section 404 is examined along with the goals and objectives of the EPA's 1978 program plan. Issues which may adversely affect EPA's ability to meet 404 program goals are identified. Material for the analysis of issues is derived from interviews with key agency people, members of the technical community and members of public interest groups with expressed concern of protection of wetland resources. The issues are examined in detail and options for their resolution are considered. A case study is presented in order to illustrate more fully how such issues affect EPA's ability to implement its responsibilities under Section 404. Dissert. Abstr.

N80-16575*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF AIRCRAFT RESULTS FOR 1978 SOUTHEASTERN VIRGINIA URBAN PLUME MEASUREMENT STUDY OF OZONE, NITROGEN OXIDES, AND METHANE
Gerald L. Gregory, Dewey E. Wornom, Joe J. Mathis, Jr., and Daniel I. Sebacher Washington Feb 1980 222 p refs
(NASA-TM-80146; L-12981) Avail: NTIS HC A10/MF A01 CSCL 13B

Ozone production was determined from aircraft and surface in situ measurements, as well as from an airborne laser absorption spectrometer. Three aircraft and approximately 10 surface stations provided air-quality data. Extensive meteorological, mixing-layer-height, and ozone-precursor data were also measured. Approximately 50 hrs (9 flight days) of data from the aircraft equipped to monitor ozone, nitrogen oxides, dewpoint temperature, and temperature are presented. In addition, each experiment conducted is discussed. A.R.H.

N80-16576*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COOLING TOWER WATER CONDITIONING STUDY
M. F. Humphrey and K. R. French 15 Dec 1979 44 p refs (Contract NAS7-100)
(NASA-CR-162691; JPL-PUB-79-104) Avail: NTIS HC A03/MF A01 CSCL 13B

Successful elimination of cooling tower treatment chemicals was demonstrated. Three towers functioned for long periods of time with ozone as the only treatment for the water. The water in the systems was reused as much as 30 times (cycles of concentration) without deleterious effects to the heat exchangers. Actual system blow-down was eliminated and the only makeup water added was that required to replace the evaporation and mist entrainment losses. Minimum water savings alone are approximately 75.1 l/kg/year. Cost estimates indicate that a savings of 55 percent was obtained on the systems using ozone. A major problem experienced in the use of ozone for cooling tower applications was the difficulty of accurate concentration measurements. The ability to control the operational characteristics relies on easily and accurately determined concentration levels. Present methods of detection are subject to inaccuracies because of interfering materials and the rapid destruction of the ozone. J.M.S.

N80-16577*# Columbia Univ., New York.
RESEARCH PLAN FOR ESTABLISHING THE EFFECTS OF TIME VARYING NOISE EXPOSURES ON COMMUNITY ANNOYANCE AND ACCEPTABILITY
Paul N. Borsky Jan. 1980 99 p refs
(Grant NsG-1616)
(NASA-CR-159197) Avail: NTIS HC A05/MF A01 CSCL 13B

The design of a community noise survey to determine the effects of time varying noise exposures in residential communities is presented. Complex physical and human variables involved in the health and welfare effects of environmental noise and the number-level tradeoffs and time of day penalties are among the factors considered. Emphasis is placed on community reactions where noise exposures are equal in day or evening but differ in the night time, and the effects of ambient noise on more intense aircraft noise exposures. Thirteen different times of day and types of operation situations with exposed populations up to 8-10 miles from the airport are identified. A detailed personal interview questionnaire as well as specific instructions to interviewers are included. J.M.S.

N80-16578*# Research Triangle Inst., Research Triangle Park, N. C.
ALTITUDE CHARACTERISTICS OF SELECTED AIR QUALITY ANALYZERS Final Report
J. H. White, R. Strong, and J. B. Tommerdahl Nov. 1979 32 p
(NASA Order L-96783-A; RTI Proj. 43U-1833)
(NASA-CR-159165; RTI/1833/00-03F) Avail: NTIS HC A03/MF A01 CSCL 13B

The effects of altitude (pressure) on the operation and sensitivity of various air quality analyzers frequently flown on aircraft were analyzed. Two ozone analyzers were studied at altitudes from 600 to 7500 m and a nitrogen oxides chemiluminescence detector and a sulfur dioxide flame photometric detector were studied at altitudes from 600 to 3000 m. Calibration curves for altitude corrections to the sensitivuty of the instruments are presented along with discussion of observed instrument behavior. K.L.

N80-16579# George Washington Univ., Washington, D. C. Program in Logistics.
OPTIMAL TREATMENT LEVELS OF A STREAM POLLUTION ABATEMENT SYSTEM UNDER THREE ENVIRONMENTAL CONTROL POLICIES. PART 2: PRELIMINARY SENSITIVITY ANALYSIS OF A CONVEX EQUIVALENT OF THE FIXED DISSOLVED OXYGEN REQUIREMENT POLICY GP MODEL USING SENSUMT
Anthony V. Fiacco and Abolfazl Ghaemi 29 Jun. 1979 45 p refs
(Contract N00014-75-C-0729)
(AD-A074216; SERIAL-T-405-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 13/2

The sensitivity is analyzed of the optimal waste treatment cost of a water pollution control model, with respect to the parameters involved in the formulation of the model. This analysis is conducted for the policy mandating a fixed dissolved oxygen requirement, using an upper Hudson River data base. Details concerning the formulation and solution of this problem were reported in another paper. It is shown here that the maximum allowable dissolved oxygen deficit is unequivocally the parameter to which the optimal waste treatment cost is most sensitive. All of the many parameters involved in the model are analyzed and, relative to stipulated assumptions, are shown to have from significant to negligible impact on the waste treatment cost. GRA

N80-16580# Brookhaven National Lab., Upton, N. Y. Atmospheric Sciences Div.
STATUS OF POLLUTANT REMOVAL TECHNOLOGY FOR COAL FIRED PLANTS IN THE NORTHEASTERN U.S.

E. N. Ziegler (Polytechnic Inst. of N.Y., Brooklyn) and Ronald E. Meyers. Feb. 1979. 44 p. refs.
(Contract EY-76-C-02-0016)
(BNL-51004) Avail: NTIS HC A03/MF A01

The status of air pollution control technology for coal fired industrial and power plant boilers is surveyed. Lime and limestone based scrubbers, the Wellman-Lord, thiosorbic, and citrate processes, electrostatic precipitators, fabric filtration, and modification of the combustion system to reduce nitrogen oxide concentrations are among the technology items covered. Various process capital and annualized costs are reported for SO2 and particulate removal systems. The status of fluidized bed combustion, fuel desulfurization, coversion of coal to gaseous and liquid fuels, and flue gas denitrification is also discussed. DOE

N80-16581# Department of Energy, Washington, D. C.
PETROLEUM PRODUCTION AT MAXIMUM EFFICIENT RATE, NAVAL PETROLEUM RESERVE NO. 1 (ELK HILLS), KERN COUNTY, CALIFORNIA. Final Environmental Impact Statement
Aug. 1979. 525 p. refs.
(DOE/EIS-0012) Avail: NTIS HC A22/MF A01

The Naval Petroleum Reserves were opened up for production at maximum efficient rates consistent with sound engineering practices, for a period of 6 years. Production for Naval Petroleum Reserve No. 1 is expected to peak at between 205,000 and 240,000 bbl/d of crude oil in 1982. Positive impacts of the project are increased employment, use of vacant housing, increased local spending on goods and services, and the potential for increased domestic petroleum production with a commensurate decrease in the US balance of payment deficit. Adverse effects of the project include increased air pollution emissions, increased noise levels, reduction in vegetation, loss of the Petroleum Reserve for use in emergency situations, increased traffic levels, and decreased visual quality. DOE

N80-16582# New York Univ., N. Y. Inst. of Environmental Medicine.
TRACE ORGANIC COMPOUNDS IN THE NEW YORK CITY ATMOSPHERE. PART 1: PRELIMINARY STUDIES. Interim Report
J. M. Daisey, ed. 1979. 105 p. refs.
(EPRI-EA-1121) Avail: NTIS HC A06/MF A01

The kinds and concentrations of organic compounds present in New York City air, with particular emphasis on those classes which are biologically active (and which may pose a health hazard) were investigated. The results indicate the presence of alkylating agents, N-nitrosamines and peroxides as well as polycyclic aromatic hydrocarbons. Direct acting mutagens are also present in two polar and one nonpolar organic fractions of particulate matter. Very little seasonal variation was observed in the mutagenic activity (per microgram) of the organic fractions. Airborne concentrations of extractable organic matter in total suspended particulate matter (TSP) do not appear to have changed significantly from the levels of 9 to 12 micrograms/cu. m. although TSP has declined by more than 50 percent. DOE

N80-16583# Radian Corp., Austin, Tex.
HAOS QUALITY ASSURANCE FINAL REPORT: CRITERIA POLLUTANTS, VOLUME 1. Final Report
Dec. 1978. 119 p. refs.
(PB-299639/5; RAD-79-201-177-04-Vol-1; HAOS-13) Avail: NTIS HC A06/MF A01 CSCL 13B

A comprehensive quality assurance program was conducted to determine the validity and comparability of the data obtained during the monitoring phase. Audits were conducted for the following parameters: ozone, NOx, SO2, total hydrocarbons and methane, CO, and total suspended particulates. The results of the audits were generally good and demonstrated the validity and comparability of the data taken by the diverse monitoring groups. Although the SO2 and CO audit data were generally low and variable, good agreement was obtained for ozone, oxides of nitrogen, THC, CH4, and TSP. GRA

N80-16584# Radian Corp., Austin, Tex.
HAOS QUALITY ASSURANCE: NON-CRITERIA POLLUTANTS, VOLUME 2. Final Report
Mar. 1979. 132 p. refs.
(PB-299640/3; RAD-79-201-177-03-Vol-2; HAOS-14) Avail: NTIS HC A07/MF A01 CSCL 13B

Independent sensor audits or audit observations were conducted on the following perimeters: detailed hydrocarbons, PAN, total oxidants, human visibility, light scattering, visibility using telephotometry respirable particle sampling and analysis, aeroallergens, UV radiation, upper air meteorological measurements, and aldehydes. There were no known standards for some measurements and no approved standard reference methods to calibrate and audit others. Thus, accuracy determinations were difficult, if not impossible. Consequently, it was judged that it was more important to look for trends in the audit data which might explain any anomalies in the monitoring data, or which might identify problems in particular agency procedures. GRA

N80-16585# Environmental Research and Technology, Inc., Westlake Village, Calif. Environmental Analysis Div.
A LAGRANGIAN PHOTOCHEMICAL AIR QUALITY SIMULATION MODEL: ADAPTATION TO THE ST. LOUIS RAPS DATA BASE. VOLUME 1: MODEL FORMULATION. Final Report
Fred Lurman, Daniel Godden, Alan C. Lloyd, and Richard A. Nordsieck. Jun. 1979. 152 p. refs.
(Contract EPA-68-02-2765)
(PB-300470/2; EPA-600/8-79-015A-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 04A

A Lagrangian photochemical air quality simulation model was adapted to the St. Louis, Missouri/Illinois metropolitan region and the Regional Air Pollution Study aerometric and emissions data base. This adaptation was performed to provide a means for EPA to independently assess the validity of a state-of-the-art Lagrangian photochemical model. Chemical kinetic oxidation mechanisms involving hydrocarbons, nitrogen oxides and sulfur oxides and a vertical diffusion formulation for modeling reactive pollutants in the troposphere are described. Methods for determining model input parameters are discussed and model results for ozone, nitrogen dioxide, carbon dioxide, sulfur dioxide, and sulfate are presented. GRA

N80-16586# Environmental Research and Technology, Inc., Westlake Village, Calif. Environmental Analysis Div.
A LAGRANGIAN PHOTOCHEMICAL AIR QUALITY SIMULATION MODEL: ADAPTATION TO THE ST. LOUIS RAPS DATA BASE. VOLUME 2: USER'S MANUAL. Final Report
Fred Lurman, Daniel Godden, Alan C. Lloyd, and Richard A. Nordsieck. Jun. 1979. 448 p.
(Contract EPA-68-02-2765)
(PB-300471/9; EPA-600/8-79-015B-Vol-2) Avail: NTIS HC A19/MF A01 CSCL 04A

A set of instructions was compiled for use of a Lagrangian photochemical air quality simulation model adapted to the St. Louis, Missouri/Illinois metropolitan region and the Regional Air Pollution Study (RAPS) data base. The computer model consists of a set of computer programs for the simulation of atmospheric transport, turbulent diffusion, and chemical kinetics of photochemical pollutants. The computational procedures for using the model and a listing of the computer code are investigated. GRA

N80-16587# California Univ., Riverside.
NITRATE IN EFFLUENTS FROM IRRIGATED LANDS. Final Report
P. F. Pratt, J. W. Biggar, F. R. Broadbent, D. D. Focht, John Letey, L. J. Lund, A. D. McLaren, D. R. Nielsen, L. H. Stolzy, P. R. Stout et al. May 1979. 813 p. refs.
(Grants NSF GI-34733X, NSF GI-43664, NSF AEN-74-11136, NSF ENV-76-10283, NSF PFR-76-10283)
(PB-300582/4; NSF/RA-790107) Avail: NTIS HC A99/MF A01 CSCL 13B

Capabilities were developed to predict the concentrations of NO3(-) in drainage waters that move through the root zone of irrigated croplands and become effluents in tile drains or that move by unsaturated flow to the saturated zone. The kinetics of nitrogen transformations were studied by measuring N transformations from urea through the oxidative process to NO3(-) and

then back to gaseous forms by denitrification and testing kinetic models of these processes. An attempt was made to determine the influence of soil morphology and soil profile characteristics on NO3(-) leaching from the soil-root zone in bench-mark soils. An N balance was approximated for the Santa Maria Valley based on N inputs, crop removals, leaching losses, and losses by denitrification. GRA

N80-16588# Midwest Research Inst., Kansas City, Mo.
FINE PARTICLE EMISSIONS INFORMATION SYSTEM Annual Report, Jan. - Dec. 1978
M. P. Schrag, J. P. Reider, and F. N. Young. May 1979. 54 p. refs.
(Contract EPA-68-02-2641)
(PB80-100449; EPA-600/7-79-128) Avail: NTIS HC A04/MF A01 CSCL 05B

A computerized data base on primary fine particle emissions from stationary sources is described. Changes made in 1978, including the expanded reporting of chemical analysis data, the entering of confidential or proprietary data, the entering of confidential or proprietary data, and the development of computer software to aid users in interpreting the Fine Particle Emissions Information System (FPEIS) data are summarized. Data added to the FPEIS in 1978 and objectives for 1979, including the addition of biological and radiological analysis results and the implementation of a new source categorization protocol are included. The FPEIS provides a centralized inventory of fine particle measurement information for researchers engaged in fine particle control technology development and in the environmental assessment of energy and industrial processes. GRA

N80-16589# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Plant Pathology and Physiology.
OXIDANT AIR POLLUTION IMPACT TO THE FORESTS OF EASTERN UNITED STATES: A LITERATURE REVIEW
John M. Skelly and J. William Johnson. Apr. 1979. 39 p. refs.
(Contract EPA-CC71142-J)
(PB80-103500; EPA-600/3-79-045) Avail: NTIS HC A03/MF A01 CSCL 06F

A review of past studies that have attempted to delineate measurable and/or possible impacts of photochemical oxidants on the forests of eastern United States is presented. Sources of oxidant precursors and subsequent long distance transport phenomena are reviewed and documented. Potential threats to eastern forest tree species are reviewed through a comparison of various fumigation studies in laboratory and field situations. The concept of hidden injury is discussed as being a possible major impact problem facing analysis of real losses. Evidence is presented that suggests that many forest tree species indigenous to the eastern United States may already be detrimentally impacted by previous high oxidant episodes. GRA

N80-16590# Midwest Research Inst., Kansas City, Mo.
ANALYSIS OF AIRBORNE VIABLE BACTERIA AT SOLID WASTE PROCESSING FACILITIES
M. W. Fletcher and D. E. Fiscus. Aug. 1979. 92 p. refs.
(Contract EPA-68-02-1871; MRI Proj. 4033-L)
(PB80-102338; EPA-600/2-79-131) Avail: NTIS HC A05/MF A01 CSCL 06F

Aerobiological testing methodologies used to determine relative levels of airborne bacteria and virus aerosols within and around waste handling facilities are described. Microbiological air sampling, field sample handling, and laboratory analysis methodologies are included. GRA

N80-16591# Geological Survey, Tallahassee, Fla. Water Resources Div.
SALTWATER-BARRIER LINE IN FLORIDA: CONCEPTS, CONSIDERATIONS, AND SITE EXAMPLES
Jerry L. Hughes. Jun. 1979. 38 p. refs. Prepared in cooperation with Florida Dept. of Environmental Regulations, Tallahasssee
(PB80-101306; USGS/WRI-79/75;
USGS/WRD/WRI-79/073) Avail: NTIS HC A03/MF A01 CSCL 13B

The hydrologic concepts and fundamentals of saltwater intrusion in surface water channels and associated ground water systems are discussed in relation to a saltwater barrier line in Florida. The hydrological principles controlling saltwater intrusion along canals and streams and their significance in establishing a saltwater barrier line are discussed. The history of existing salinity barrier structures and their effectiveness in controlling saltwater intrusion are examined. The maintaining of a saltwater barrier line in the areas where such a line was established is described. A.W.H.

N80-16592# State Univ. of New York at Stony Brook. Marine Sciences Research Center.
TEXTURAL PROPERTIES OF SURFICIAL SEDIMENTS OF LOWER BAY OF NEW YORK HARBOR
Clifford R. Jones, Charles T. Fray, and J. R. Schubel. Mar. 1979. 121 p. refs.
(PB80-106479; SR-21; REF-79-4; NOAA-79091302) Avail: NTIS HC A06/MF A01 CSCL 08I

The textural properties of the surficial sedments of the Lower Bay of New York Harbor are described. The grain size distributions are summarized in tabular form. The spatial distributions of selected statistical parameters such as median diameter, mean diameter, standard deviation, skewness, and kurtosis are summarized. Twenty five areas in the Lower Bay of New York Harbor are delimited on the basis of sediment texture. The textural properties of samples within each of these 25 areas are summarized. GRA

N80-16593# Hydronautics, Inc., Laurel, Md.
DESIGN, FABRICATION AND TESTING OF THE AIR-JET OIL BOOM Final Report
Steven H. Cohen and William T. Lindenmuth. Jun. 1979. 140 p. refs.
(Contract EPA-68-03-2497)
(PB80-102635; EPA-600/7-79-143) Avail: NTIS HC A07/MF A01 CSCL 13B

The boom presented has the capability to divert oil slicks under wave and current conditions that normally preclude the development of conventional booms. This boom can divert oil slicks at 3 knots with 85 percent efficiency when at 30 deg to the flow. The key operational feature is a continuous, horizontally oriented air jet ejected from along the boom at the water's surface. Overall, each boom module is about 33 feet long and 2 feet in diameter. Major components include two inflatable sections (ducts) to support the continuous air-jet nozzle and a center support float/jet pump. Some unique features of the structural design are low draft (1 inch) and excellent compliance to waves. Furthermore, the sections are both lightweight and highly compactible for storage. GRA

N80-16594# New York Sea Grant Inst., Albany.
THE LOWER BAY COMPLEX
Ivar W. Duedall, Harold B. OConnors, Robert E. Wilson, and Jeffrey H. Parker. May 1979. 51 p. refs.
(PB80-106990; NYSSGP-AM-79-002; NOAA-79091301)
Copyright. Avail: NTIS HC A04/MF A01 CSCL 13B

The Lower Bay of New York Harbor is studied. The large, seasonally variable inflow of fresh water originating mainly from the Hudson River is examined. The effects of sewage effluent, also a significant source of fresh water is discussed. The distribution of water properties (salinity, nutrients, chlorophyll and the tides and tidal currents in the bay complex are studied. GRA

N80-16595# Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
ADSORPTION OF ENERGY-RELATED ORGANIC POLLUTANTS: A LITERATURE REVIEW Final Report, Jul. 1977 - Apr. 1978
K. A. Reinbold, J. J. Hassett, J. C. Means, and W. L. Banwat. Aug. 1979. 181 p. refs.
(Contract EPA-68-03-2555)
(PB80-105117; EPA-600/3-79-086) Avail: NTIS HC A02/MF A01 CSCL 07D

A literature review on sorption properties of sediments and energy-related organic pollutants is presented. Adsorption of organic compounds in general is discussed, and analytical methodology in soil thin layer chromatography and chemical analysis as applicable to measurement of sorption properties is summarized. The literature on the adsorption of energy-related organic pollutants is reviewed. Reported constants for the adsorption of organic compounds on several adsorbents are

tabulated, and factors that influence adsorption are discussed. GRA

N80-16596# Resources for the Future, Inc., Washington, D. C.
ENVIRONMENTAL SYSTEM STUDY ON THE DEVELOPMENT OF FOSSIL FUEL RESOURCES IN THE SOUTHWEST
James W. Sawyer May 1979 18 p refs
(Grant NSF AER-75-16163)
(PB-300526/1; NSF/RA-790117) Avail: NTIS
HC A02/MF A01 CSCL 13B

Various outcomes of a project designed to study energy and synfuels technologies appropriate to the Southwest are described. The topics investigated include air pollution control for electric power plants in the Southwest, use of coal for electricity generation in California, and energy/transportation concepts, economics, and technologies. Navajo resource problems and economic considerations for the continued care of uranium mill sites are also discussed. GRA

N80-16597# National Center for Resource Recovery, Washington, D. C.
REFRACTORY PARTICLES IN CULLET RECOVERED FROM MUNICIPAL REFUSE
E. J. Duckett Mar. 1979 46 p refs
(Grant NSF APR-75-13864)
(PB-300523/8; NSF/RA-790144) Avail: NTIS
HC A03/MF A01 CSCL 13B

The problem of refractory contamination as a potential barrier to the increased use of glass recovered from municipal solid waste is addressed. The causes of stones in container glass are reviewed along with the nature of the refractory particles found in cullet recovered from municipal solid waste, the behavior of refractory particles in the glass furnace, and some approaches available for either removing refractory particles from the recovered cullet or minimizing the effects of the refractory contaminants. GRA

N80-16598# Urban Inst., Washington, D.C.
BALANCING THE OBJECTIVES OF CLEAN AIR AND ECONOMIC GROWTH: REGULATED MARKETS IN EMISSION REDUCTIONS Interim Report
William A. Foskett, David M. Klaus, and John Haberle Jun. 1979 106 p refs
(Contract NBS-7-35822)
(PB-300835/6; NBS-GCR-ETIP-7962) Avail: NTIS
HC A06/MF A01 CSCL 13B

Work in progress toward the evaluation of implementation and effects of market mechanisms for regulation of major stationary sources of air pollution is reported. Topics covered include the context in which market mechanisms are being introduced, the underlying logic of various market mechanisms and an operating prototype of a market mechanism, potential effects of market mechanisms on air pollution regulation, expectations associated with EPA's introduction of a prototype market mechanism offset policy, and the general direction of continuing work on this particular project. GRA

N80-16599# Environmental Monitoring and Support Lab., Research Triangle Park, N. C.
AIR QUALITY DATA FOR NONMETALLIC INORGANIC IONS: NH4+, NO3-, SO4= FROM THE NATIONAL AIR SUREVEILLANCE NETWORKS, 1976 Final Report
Donald H. Fair, Raymond C. Rhodes, E. Gardener Evans, John C. Puzak, and Frank E. Butler Jun. 1979 78 p
(PB-300458/7; EPA-600/4-79-041) Avail: NTIS
HC A05/MF A01 CSCL 13B

The annual urban and nonurban concentrations of three nonmetallic inorganic ions, ammonium, nitrate, and sulfate - in suspended particulate matter are summarized. Concentration data are presented as cumulative frequency distributions. The arithmetic and geometric means and standard deviations are also reported. GRA

N80-16600# Tennessee Valley Authority, Chattanooga. Office of Natural Resources.
REMOTE SENSING OF SULFUR DIOXIDE EFFECTS ON VEGETATION - PHOTOMETRIC ANALYSIS OF AERIAL PHOTOGRAPHS
C. Daniel Sapp Jun. 1979 42 p refs
(PB-300460/3; TVA/ONR-79/01; EPA-600/7-79-138) Avail: NTIS HC A03/MF A01 CSCL 13B

Spectral reflectances were measured by tri band densitometry of aerial color infrared photographs of soybean Glycine mass fields that had been affected by sulfur dioxide (SO2) emissions from large, coal fired power plants in northwestern Alabama and western Tennessee. The photographs were photometrically calibrated. Results indicate that, at very light levels of foliar injury, the infrared to red reflectance ration decreased with increasing injury. This behavior was in accordance with theory. At moderate and severe levels of injury, the ratio increased with injury. The best indicator of crop yield was green band reflectance, but the red and infrared bands were nearly as good. The yield variable actually increased with the level of injury, apparently because of field to field variations in canopy density. GRA

N80-16601# Acurex Corp., Mountain View, Calif. Aerotherm Div.
ENVIRONMENTAL ASSESSMENT OF STATIONARY SOURCE NOx CONTROL TECHNOLOGIES Annual Report, Jun. 1977 - Jun. 1978
L. R. Waterland, K. J. Lim, K. G. Salvesen, R. M. Evans, E. G. Higginbotham, and H. B. Mason Jun. 1979 203 p refs
(Contract EPA-68-02-2160)
(PB-300469/4; EPA-600/7-79-147; AR-2) Avail: NTIS
HC A10/MF A01 CSCL 13B

Program results are summarized for: (1) developing fuel consumption and NOx emission inventories; (2) field testing selected stationary combustion sources; (3) performing process engineering and environmental assessment studies of NOx controls applied to utility and industrial boilers and gas turbines; and (4) developing reactive air quality and source analysis models. Preliminary NOx control technology analysis for utility boilers indicates that off-stoichiometric combustion and low NOx burners (LNB) are the preferred techniques for both retrofit and new applications. For coal firing, overfire air operation and LNB are both cost effective; LNB is preferred for new wall-fired boilers. For oil and gas firing, staged combustion with burners out of service is recommended. GRA

N80-16602# Mitre Corp., McLean, Va.
A REVIEW OF STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES: PETROLEUM REFINERIES
Kris Barrett and Alan Goldfarb Jan. 1979 93 p refs
(Contract EPA-68-02-2526)
(PB-300480/1; EPA-450/3-79-008; MTR-7825) Avail: NTIS
HC A05/MF A01 CSCL 13B

The current standards of performance for petroleum refineries are presented. The status of current applicable control technology is reviewed and the ability of refineries to meet the current standards is discussed. Compliance test results are analyzed and recommendations are made for possible modifications and additions to the standard, including future studies needed for unresolved issues. GRA

N80-16603# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
EVALUATION OF THE ULTRAVIOLET-OZONE AND ULTRAVIOLET-OXIDANT TREATMENT OF PINK WATER Final Report, 6 Jun. 1976 - 30 Dec. 1977
Milton Roth and Joseph M. Murphy, Jr. Jul. 1979 41 p refs
(PB-300763/0; EPA-600/2-79-129) Avail: NTIS
HC A03/MF A01 CSCL 13B

Pink water, a solution of trinitrotoluene (TNT) and other nitrobodies, is a major pollutant at ammunition plants engaged either in the manufacture of TNT or in the loading, assembly, and packing of bombs and shells. As an alternative to carbon adsorption for the treatment of pink water, two new methods are presented and evaluated. The first involves the use of ultraviolet (uv)-ozone and the second uses a uv-oxidant combination. Commercially available uv water purification units in conjunction with an oxidant such as hydrogen peroxide or Oxone, (a blend of potassium persulfate oxidants), were evaluated for their efficiency in treating pink water. Variables such as film depth, dilution, uv wavelength, and operation of the units in series rather than in parallel were examined. GRA

N80-16604# Resources for the Future, Inc., Washington, D. C.
ENVIRONMENTAL IMPACT AND ECONOMIC EVALUATION RESEARCH NEEDS FOR COASTAL AND MARINE RESOURCE MANAGEMENT Final Report
Elizabeth A. Wilman and John V. Krutilla May 1979 130 p refs
(PB-301208/5; NOAA-79083003) Avail: NTIS HC A07/MF A01 CSCL 13B

Analysis techniques required for the analysis of the benefits and costs of alternative coastal and marine resource use patterns are discussed in terms of adequately managing these resources. Quantitative modelling of natural production systems, toward increased precision in the estimation of the economic value of changes, including attention to the role of secondary economic influences on these values, and toward integrating all of this information into a decision making process which accommodates both the uncertainties involved and the decision maker's attitudes toward the risks involved is considered. GRA

N80-16605# Transportation Research Board, Washington, D.C.
IMPACT OF AIR QUALITY CONTROL MEASURES
Richard J. Zabinski, Gerald S. Cohen, David T. Hartgen, Michael R. Hoyles, George J. Scheuernstuhl et al 1979 37 p refs
(PB-301234/1; TRB/TRR-714; ISBN-0-309-02961-9; LC-79-607813) Avail: NTIS HC A03/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418, HC $3.00 CSCL 13B

Contents: New York State response to the mandates of the clean air act; simplified method for evaluation of control strategies for revision of state implementation plans; analysis of air quality sensitivity to development pattern changes and growth levels; travel and emissions impacts of transportation control measures; and traffic-relations derived from urban driving schedule data. GRA

N80-16606# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeronutronic Div.
DEVELOPMENT OF AN SO2 MONITOR FOR MOBILE SOURCES Final Report, Oct. 1976 - Jan. 1978
Darrell E. Burch, Pamela S. Marrs Davila, Francis J. Gates, and John D. Pembrook Jul. 1979 52 p refs
(Contract EPA-68-02-2448)
(PB80-100472; EPA-600/2-79-121; U-6392) Avail: NTIS HC A04/MF A01 CSCL 14B

An instrument designed to monitor the concentration of SO2 in the exhaust of mobile sources is discussed. A pump and manifold assembly permit operation over a wide range of sample flow rates. The sample cell contains a multiple-pass optical system adjusted to 12 passes, giving a sample path length greater than 5 m. The rms noise level corresponds to approximately 0.05 ppm of SO2 when the electronic time constant is 1 sec. GRA

N80-16607# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeroneutronic Div.
DEVELOPMENT OF A MONITOR FOR HCN IN MOBILE SOURCE EMISSIONS Final Report, Apr. 1977 - Oct. 1978
Darrell E. Burch, Pamela S. Marrs Davila, Francis J. Gates, and John D. Pembrook Jun. 1979 44 p refs
(Contract EPA-68-02-2716)
(PB80-100514; U-6470; EPA-600/2-79-113) Avail: NTIS HC A03/MF A01 CSCL 13B

Three real-time monitors for measurement of HCN concentrations in mobile source emissions were designed, built, tested, and delivered to the Environmental Protection Agency. The important design parameters for these identical instruments were determined with a versatile gas-filter correlation spectrometer. The instruments employ a gas-filter cell to provide sensitivity to HCN while discriminating against other infrared active gases such as H2O, CO2, NH3 and many hydrocarbons that occur in mobile source emissions. The combined error after accounting for H2O interference for most dilute samples is less than 0.1 ppm HCN. GRA

N80-16608# Mathtech, Inc., Princeton, N. J.
AN ANALYSIS OF ALTERNATIVE POLICIES FOR ATTAINING AND MAINTAINING A SHORT-TERM NO2 STANDARD
Robert J. Anderson, Robert O. Reid, and Eugene D. Seskin 17 Sep. 1979 385 p refs Sponsored in part by Council on Environmental Quality, Washington, D.C., and Council on Economic Advisors, Washington, D.C.
(PB80-100530; EPA-230/3-79-011) Avail: NTIS HC A17/MF A01 CSCL 13B

The results of an analysis of alternative policies for implementing short term NO2 standards like those currently under consideration by EPA are summarized. Policy alternatives considered include an extension of current regulatory approaches to provide for control of stationary source emissions in state implementation plans, adoption of an emissions charge as a substitute for emissions limitation regulations, and adoption of a marketable permit program as a substitute for emissions limitation regulations. GRA

N80-16609# Environmental Monitoring and Support Lab., Research Triangle Park, N. C.
THE MAXIMUM LIKELIHOOD APPROACH TO PROBABILISTIC MODELING OF AIR QUALITY DATA Final Report
Terence Fitz-Simons and David M. Holland Jul. 1979 43 p refs
(PB80-104110; EPA-600/4-79-044) Avail: NTIS HC A03/MF A01 CSCL 12A

Software using maximum likelihood estimation to fit six probabilistic models is discussed. The program fits data to the normal distribution, the 3-parameter lognormal distribution, the 3-parameter Weibull distribution, the 3-parameter gamma distribution, the Johnson S(B) distribution, and the 4-parameter beta distribution. Six goodness-of-fit criteria are supplied and ranked by the program to aid in the selection of the most appropriate choice among the six models. The results of applying the program to several subsets of the Los Angeles Catalyst Study data base are presented. GRA

N80-16610# SRI International Corp., Menlo Park, Calif.
ATMOSPHERIC REACTION PRODUCTS OF ORGANIC COMPOUNDS Final Report
Dale G. Hendry and Richard A. Kenley Jun. 1979 90 p refs
(Contract EPA-68-01-5123)
(PB-301384/4; EPA-560/12-79-001) Avail: NTIS HC A05/MF A01 CSCL 04A

A procedure that predicts the products from reaction of compounds in the atmosphere was developed for use in unreasonable-risk evaluations that include assessing new chemicals for persistence and exposure in the environment in this procedure, the relative importance of the three dominant reaction pathways photolysis, reaction with OH radical, and reaction with ozone are first determined for each compound. Then the products from each pathway that play a major role for that compound are estimated using the techniques outlined in the methods. GRA

N80-16611# California Univ., Riverside. Statewide Air Pollution Research Center.
DETAILED CHARACTERIZATION OF GASEOUS AND SIZE RESOLVED PARTICULATE POLLUTANTS AT A SOUTH COAST AIR BASIN SMOG RECEPTOR SITE: LEVELS AND MODES OF FORMATION OF SULFATE, NITRATE AND ORGANIC PARTICULATES AND THEIR IMPLICATIONS FOR CONTROL STRATEGIES Final Report, Nov. 1975 - Jun. 1978
James N. Pitts, Jr. and Daniel Grosjean Jul. 1979 466 p refs
(PB-301294/5; ARB-R-5-384-79-100) Avail: NTIS HC A20/MF A01 CSCL 04A

A two-year research program was conducted to characterize gas phase pollutants, aerometric variables, visibility, aerosol elemental composition, and ambient levels and size distribution of particulate sulfate, nitrate, and ammonium at Riverside, a smog receptor site located at the eastern end of the California South Coast Air Basin. The data base generated was employed: (1) to establish diurnal and seasonal profiles for gaseous and particulate pollutants; (2) to calculate sulfur and nitrogen gas-particle distribution factors; (3) to correlate sulfate and nitrate levels with indicators of photochemical and aqueous aerosol formation mechanisms; and (4) to develop relationships between visibility impairment, aerosol concentration, and aerosol chemical composition. GRA

N80-16612# Technology Service Corp., Santa Monica, Calif.
WEEKEND/WEEKDAY DIFFERENCES IN OXIDANTS AND THEIR PRECURSORS Final Report
Yuji Horie, Joseph Cassmassi, Larry Lai, and Louis Gurtowski Mar. 1979 152 p refs
(Contract EPA-68-02-2595)
(PB-300479/3; EPA-450/4-79-013) Avail: NTIS HC A08/MF A01 CSCL 04A

Differences between weekend and weekday oxidant and oxidant precursor concentrations in the Northeastern United States are examined. Statistical tests were employed to assess whether any differences in daily maximum oxidant concentrations are significant. The analyses revealed that oxidant concentrations downwind of major urban areas tend to be lower on weekends. However, the reductions are not as large as those observed in precursor concentrations within the major urban areas. Reductions in weekend oxidant concentrations at locations within the major urban areas are not as great as those at downwind locations. GRA

N80-16613# Engineering-Science, Inc., McLean, Va.
INVENTORY OF SOURCES WITH EMISSIONS OF 25 TO 100 TONS PER YEAR SUBJECT TO ORGANIC MATERIAL REGULATIONS IN METROPOLITAN BOSTON AQCR Final Report
Jul. 1979 57 p
(Contract EPA-68-01-4146)
(PB-301242/4; EPA-901/9-79-009) Avail: NTIS HC A04/MF A01 CSCL 13B

An inventory of volatile organic compound emissions was conducted for sources in the Metropolitan Boston. Potential sources were identified and questionnaires were mailed to selected sources. The returned questionnaires were reviewed, and emissions were estimated. The results were quantified in an inventory of sources with the potential to emit between 25 and 100 tons/year. GRA

N80-16614# UTE Research Labs., Fort Duchesne, Utah.
THE ENVIRONMENTAL PROTECTION AGENCY FOUR CORNERS AMBIENT AIR MONITORING NETWORK
Jun. 1979 99 p refs
(Contract EPA-68-03-2345)
(PB80-103559; EPA-600/7-79-135) Avail: NTIS HC A05/MF A01 CSCL 13B

An air quality base line for the Four Corners area of Arizona, Colorado, New Mexico, and Utah was established. The base line was used in assessing the impact of the development of coal deposits and the operation of large, coal fired, electrical generating plants in the Four Corners area. A network of 29 monitoring stations was established to obtain data concerning the air quality in a predominantly rural area covering a multistate region. Results were evaluated in terms of the total suspended particulates present in the ambient air at each of the 29 monitoring stations on a seasonal basis. Results also were evaluated in terms of the validity of the sampling and analytical procedures. GRA

N80-16615# Northrop Services, Inc., Research Triangle Park, N. C.
CONTINUOUS AIR POLLUTION SOURCE MONITORING SYSTEMS
James A. Jahnke and G. J. Aldina Jun. 1979 253 p refs
(Contract EPA-68-03-2561)
(PB-300930/5; EPA-625/6-79-005) Avail: NTIS HC A12/MF A01 CSCL 14B

The detailed information necessary to develop a continuous emissions monitoring program at a stationary source facility is provided. Design and performance specifications, and monitoring and date reporting requirements are included. Extractive sampling techniques and in-situ methods are presented along with explanations of the analytical techniques used in marketed instrumentation. Methods for monitoring opacity, pollutant gases, and combustion gases, such as oxygen and carbon dioxide, are described. A detailed explanation of the EPA performance specification test is given along with an explanation of the statistical procedures used to evaluate newly installed systems. GRA

N80-16616# Little (Arthur D.), Inc., Cambridge, Mass.
EVALUATION OF STATIONARY SOURCE PARTICULATE MEASUREMENT METHODS. VOLUME 3: GAS TEMPERATURE CONTROL DURING METHOD 5 SAMPLING Interim Report, Oct. 1973 - Feb. 1977
Edward T. Peters and Jeffrey W. Adams Jun. 1979 32 p refs
(Contract EPA-68-02-0632)
(PB-300336/5; EPA-600/2-79-115-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 14B

Changes in gas temperature were measured along the length of a Method 5 sampling train due to variations in stack gas temperature, sampling rate, filter box temperature and method for controlling the probe heating element. For each run condition, temperatures were measured in the stack, at ambient and at four internal and external positions along the sampling train at one minute intervals. Measurements were continued until the system was observed to reach a state of thermal equilibrium. The results demonstrate that gas temperatures cannot be predicted or controlled on the basis of externally measured temperatures. GRA

N80-16617# Tennessee Valley Authority, Muscle Shoals, Ala.
POTENTIAL PRODUCTION AND MARKETING OF FGD BYPRODUCT SULFUR AND SULFURIC ACID IN THE US (1983 PROJECTION) Final Report, Jun. 1976 - Dec. 1978
W. E. OBrien and W. L. Anders Apr. 1979 59 p refs
(PB-299205/5; ECDP-B-1; EPA-600/7-79-106) Avail: NTIS HC A04/MF A01 CSCL 13B

Least costs of compliance were calculated using comparisons of clean fuel with 50 cents and 70 cents/million Btu premiums, limestone scrubbing, and scrubbing systems with byproduct sulfur and H2SO4 production. Market potential of sales of sulfur burning H2SO4 plants was also determined. At the 50 cent premium, H2SO4 production was the least cost method at five plants, four of which had combined sales of 800,000 tons/yr. At the 70 cent premium, H2SO4 production was the least cost method at 26 plants, 7 of which had sales totalling 1.2 million tons. Other significant observations and results are reported. GRA

N80-16618# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
GUIDANCE FOR SELECTING TSP EPISODE MONITORING METHODS
George Manire 12 Feb. 1979 35 p refs
(PB-298459/9; EPA-450/4-79-007; OAQPS-1.2-114) Avail: NTIS HC A03/MF A01 CSCL 13B

The principles of operation are given for the two episode particulate monitoring methods which are modifications of the reference method. The procedures for establishing a site and season-specific relationship between the high volume method and particulate methods other than the modified reference methods are given. GRA

N80-16619# Industrial Environmental Research Lab., Research Triangle Park, N. C.
A STANDARD PROCEDURE FOR COST ANALYSIS OF POLLUTION CONTROL OPERATIONS. VOLUME 1: USER GUIDE Report, Oct. 1977 - May 1979
Vincent W. Uhl Jun. 1979 65 p refs 2 Vol.
(PB80-108038; EPA-600/8-79-018A-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 13B

A user guide for a standard procedure for the engineering cost analysis of pollution abatement operations and processes is presented. The procedure applies to projects in various economic sectors: private, regulated, and public. The models are consistent with cost evaluation practices in engineering economy and financial analysis. A recommended format is given that should not exceed eight pages when executed. The guidelines facilitate the choice of procedures open to the estimator and the establishment of factors to be used in the evaluation. GRA

N80-16620# Industrial Environmental Research Lab., Research Triangle Park, N. C.
A STANDARD PROCEDURE FOR COST ANALYSIS OF POLLUTION CONTROL OPERATIONS. VOLUME 2: APPENDICES Report, Oct. 1977 - May 1979

Vincent W. Uhl Jun. 1979 154 p refs 2 Vol.
(PB80-108046; EPA-600/8-79-018B-Vol-2) Avail: NTIS
HC A08/MF A01 CSCL 13B

The costs of pollution abatement operations and processes are analyzed for a flue gas desulfurization retrofit facility and a chlorolysis plant. Background information is provided on capital investment and annual expense estimation, discrete and continuous interest factors, measures of merit, cost indices and inflation factors, rates of interest and return, and methods of reliability assessment. K.L.

N80-16621# Mathtech, Inc., Princeton, N. J.
EVALUATION OF THE ENVIRONMENTAL EFFECTS OF WESTERN SURFACE COAL MINING. VOLUME 2: MINE INVENTORY Final Report
William Kelly Feb. 1979 207 p
(Contract EPA-68-03-2226)
(PB-301249/9; EPA-600/7-79-034) Avail: NTIS
HC A10/MF A01 CSCL 08I

A tabular summary of general information is presented for 37 surface coal mines active in the western United States during 1975 and for seven additional mines that were under development in that year. In total, 44 mines in the following states are included: Arizona, Colorado, Montana, New Mexico, North Dakota, and Wyoming. Types of information presented include production information; mine life, employment, and disturbed acreage; coal seam characteristics; reclamation practices; overburden characteristics, and stripping equipment types and capacities. GRA

N80-16622# Skelly and Loy, Harrisburg, Pa.
ENVIRONMENTAL ASSESSMENT OF SURFACE MINING METHODS: HEAD-OF-HOLLOW FILL AND MOUNTAINTOP REMOVAL Interim Report, Nov. 1975 - Jan. 1977
John D. Robins and John C. Hutchins Jul. 1979 223 p refs
(Contract EPA-68-03-2356)
(PB-300540/2; EPA-600/7-79-062) Avail: NTIS
HC A10/MF A01 CSCL 08I

The environmental impact of the mining and reclamation techniques employed in West Virginia and Kentucky mountaintop removal and head-of-hollow fill sites was investigated. GRA

N80-16623# General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
GROUNDWATER QUALITY MONITORING OF WESTERN OIL SHALE DEVELOPMENT. IDENTIFICATION AND PRIORITY RANKING OF POTENTIAL POLLUTION SOURCES
Guenton C. Slawson, Jr. Jan. 1979 241 p refs
(Contract EPA-68-03-2449)
(PB-300536/0; GE77TMP-51; EPA-600/7-79-023) Avail: NTIS HC A11/MF A01 CSCL 08I

Oil shale operations such as those proposed for eastern Utah are assessed as potential pollution sources. A priority ranking of pollutants is presented based on the magnitude of the source and the toxicity, persistence, and mobility of the pollutants. K.L.

N80-16624# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
ICHTHYOPLANKTON ABUNDANCE AND DIVERSITY IN THE EASTERN GULF OF MEXICO Final Report
Edward D. Houde, James C. Leak, Catharina E. Dowd, Steven A. Berkeley, and William J. Richards Jun. 1979 581 p refs
Prepared in cooperation with National Marine Fisheries Service, Miami, Fla.
(Contract DI-AA550-CT7-28)
(PB-299839/1; BLM/YM/ES-79/10) Avail: NTIS
HC A25/MF A01 CSCL 13B

An ichthyoplankton survey in the eastern Gulf of Mexico was carried out to determine the kinds and abundances of larval fishes, their distribution and diversity, and the relationship of their occurrence to environmental factors. Important baseline data on the early life stages of fishes in the Gulf of Mexico are presented. Effects of environmental factors on ichthyoplankton abundances are not clearly demonstrated but the modes and ranges of surface temperature, surface salinities and station depths where common species occurred are clearly defined. Positive affinities of some species with water of Loop Current origin, when it intruded into coastal areas, are demonstrated for several species. GRA

N80-16625# Mitre Corp., McLean, Va. METREK Div.
OUTER CONTINENTAL SHELF ENVIRONMENT MONITORING CONCERNS Final Report
J. Slaughter Jul. 1979 78 p refs
(Contract EQ8AC020)
(PB-299861/5; MTR-79W00192) Avail: NTIS
HC A05/MF A01 CSCL 13B

Information is presented on existing and proposed Federal environmental monitoring programs applicable to oil and gas exploration, development, and production on the outer continental shelves (OCS). An analysis of the relevance of these programs to the needs of state and local governments affected by OCS activities is given. Discussion of significant unmet monitoring needs is included. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-16626 Princeton Univ., N. J.
GEOLOGY OF PRECAMBRIAN METAMORPHIC ROCKS OF THE TRUCHAS PEAKS AREA, NORTH-CENTRAL NEW MEXICO Ph.D. Thesis
Jeffrey Arthur Grambling 1979 269 p
Avail: Univ. Microfilms Order No. 7928471

Detailed mapping in the Trucha Peaks region of north-central New Mexico delineates a deformed and metamorphosed Proterozoic terrane which contains an apparent equilibrium occurrence of the Al2SiO5 triple point. Various dehydration equilibria define the pressure and temperature of crystallization of assemblages which include coexisting kyanite, andalusite, and sillimanite. Geologic evidence, consisting of corresponding lithologies, fold axes, and isograds, suggests that rocks of the Truchas and Picuris Ranges were once adjacent, forming part of an extensive quartzite terrane which has been split apart by 37 km of right lateral motion along the Picuris-Pecos fault. The quartzitic Truchas Group forms part of a Proterozoic greenstone-quartzite association. Minor amounts of metavolcanic materials, which probably originated in the greenstone belt and lapped onto the quartzite platform, are interstratified with massive quartzite near Truchas Peak. These relationships indicate that the greenstone belt and quartzite platform existed side by side. Dissert. Abstr.

N80-16627 Stanford Univ., Calif.
EVOLUTION OF THE LATE PENNSYLVANIAN-EARLY PERMIAN WESTERN OQUIRRH BASIN, UTAH Ph.D. Thesis
Teresa Eileen Jordan 1979 287 p
Avail: Univ. Microfilms Order No. 8001948

The topographic and structural nature of the Oquirrh basin and the depositional mechanisms responsible for the strata are discussed. The sedimentary and structural history of the basin in the Late Pennsylvanian and Early Permian is emphasized. Field study of the western upper Oquirrh Group focused upon measurement, description, and sampling of six detailed sections and reconnaissance study of adjacent areas. The fourteen lithofacies present are dominated by subarkosic arenite and clastic limestone. The distributions of trace fossils and body fossils and paleoecologic interpretations reveal a gradient of water depths spatially and through time. Fusulinid biostratigraphy permits construction of an accurate time framework in which to examine lithologic and paleoecologic trends. Dissert. Abstr.

N80-16628 West Virginia Univ., Morgantown.
SUBSURFACE STRATIGRAPHY OF THE MIDDLE AND UPPER DEVONIAN CLASTIC SEQUENCE IN SOUTHERN WEST VIRGINIA AND ITS RELATION TO GAS PRODUCTION Ph.D. Thesis
Donald Wade Neal 1979 305 p

Avail: Univ. Microfilms Order No. 8000226

A stratigraphic framework for the Middle and Upper Devonian clastic sequence in the subsurface of southern West Virginia was established using gamma-ray logs, drillers' logs, and sample descriptions. The Devonian shale within the study area is submature with respect to hydrocarbon generation yet produces a high quality gas. An interconnected fracture system is postulated to be the reservoir in which gas accumulates where there is the complimentary presence of both thick intervals of black shale and broad flexures which produce fractures. New areas of potential shale gas exploration for both the Huron Member of the Ohio Shale and the Rhinestreet Shale-Marcellus Shale interval are located east of the Warfield Anticline in Boone, Logan, Mingo, McDowell, Wyoming, and Raleigh Counties, West Virginia.

Dissert. Abstr.

N80-16629 Pennsylvania State Univ., University Park.
STRATIGRAPHY AND SEDIMENTOLOGY OF THE UPPER DEVONIAN CATSKILL AND UPPERMOST TRIMMERS ROCK FORMATIONS IN CENTRAL PENNSYLVANIA Ph.D. Thesis
Victor David Kh. Rahmanian 1979 396 p
Avail: Univ. Microfilms Order No. 7922333

Stratigraphy and the depositional history of formations in central and southcentral Pennsylvania are investigated. The uppermost parts of the Trimmers Rock formation and the Catskill formation are described. Paleoenvironmental synthesis of the facies relationships indicates that the Upper Devonian sedimentary units in the area are the products of deposition in a complex prograding deltaic-intradeltaic coast and its associated higher alluvial-coastal plain. The main sediment input area, located in central Pennsylvania, was characterized by an active river system in the alluvial plain which graded down slope into a tidally dominated delta along the shoreline. The intradeltaic regions to the north and south were characterized by broad tidal flats which developed both along the nonconfined coast and the ice side or behind barrier island systems. The results of the petrographic analysis of the sandstone samples are discussed.

Dissert. Abstr.

N80-16630 Princeton Univ., N. J.
GEOLOGY OF THE ACARIGUA AREA, VENEZUELA Ph.D. Thesis
Grant Michael Skerlec 1979 301 p
Avail: Univ. Microfilms Order No. 7928488

In the Acarigua area the Caribbean Mountains consist of three tectonic belts that are continuations of similar belts found farther to the east. The western Caribbean Mountains contain a series of low-angle thrust faults that place the metasediments of the Cordillera de la Costa Belt over the lower grade metasediments of the Central Belt, which is thrust in turn over the Rio Guache Formation. The offset of these basal thrust faults by a complex series of high-angle faults suggests that the maximum possible amount of right-lateral strike-slip displacement along the Bocono fault is 50 kilometers and that no strike-slip displacement at all need have occurred. Isopach data for Cretaceous platform sediments suggest that the western limit of thrust faulting was caused by a thinning of decollement horizons along a pronounced northsouth jog in the Venezuelan continental margin.

Dissert. Abstr.

N80-16631 Stanford Univ., Calif.
QUATERNARY STREAM TERRACES IN THE NORTHWESTERN SACRAMENTO VALLEY, GLENN, TEHAMA, AND SHASTA COUNTIES, CALIFORNIA Ph.D. Thesis
William Clinton Steele 1979 270 p
Avail: Univ. Microfilms Order No. 8002018

Stream terraces in Glenn, Tehama, and Shasta Counties, in the northwestern Sacramento Valley, California, were mapped and analyzed quantitatively. The morphology and pedology of the terraces were delineated in order to develop quantitiative methods for identification of the different terrace levels and to determine their possible origin and age relationships.

Dissert. Abstr.

N80-16632 Colorado State Univ., Fort Collins.
THE YALLAHS FAN DELTA, SOUTHEASTERN JAMAICA: A DEPOSITIONAL MODEL FOR ACTIVE TECTONIC COASTLINES Ph.D. Thesis
William Albert Wescott 1979 189 p
Avail: Univ. Microfilms Order No. 7928557

The vertical and lateral succession of specific subaerial, transitional, and submarine evironments associated with the Yallahs fan delta system provides the data for the development of a stratigraphic model for truncated, coarse-grained, humid region fans that build directly onto relatively steep submarine slopes. This model should prove useful in the recognition of fan delta deposits in the rock record and for the paleogeographic reconstruction of ancient, tectonically active continental and island-arc plate margins. It may also serve as a valuable tool in the search for economic deposits and fossil fuels.

Dissert. Abstr.

N80-16633 Iowa Univ., Iowa City.
PRELIMINARY GEOLOGIC APPRAISAL AND ECONOMIC ASPECTS OF THE PRECAMBRIAN BASEMENT OF IOWA Ph.D. Thesis
Abdolmajid Yaghubpur 1979 397 p
Avail: Univ. Microfilms Order No. 7928633

Precambrian samples from 85 wells, 10 isotopic age determinations, local and regional geophysical data, plus information from surrounding states permit identification of 14 rock units assigned to the Penokean, Eastern Iowa, and Keweenawan Precambrian Provinces. In the Penokean Province, a taconite body, located about 3 miles west of Matlock, Sioux County, is flanked by serpentinite that contains traces of chromite and nickel sulfide. Also, layered-type orthomagmatic titaniferous magnetite deposits are located at Osborne, Clayton County, and Spencer, Clay County. Associated with the Spencer deposit are minor amounts of pyrrhotite and traces of chalcopyrite, whereas vanadium in titanomagnetite is common to both. Several other mineral resource occurrences may exist, particularly stratiform copper deposits in Keweenawan Terrane and uncomformity-type uranium deposits related to the basal Sioux Quartzite contact.

Dissert. Abstr.

N80-16634 Stanford Univ., Calif.
GEOLOGY AND SKARN ORE MINERALIZATION OF THE YEONHWA-ULCHIN ZINC-LEAD MINING DISTRICT, SOUTHEASTERN TAEBAEGSAN REGION, KOREA Ph.D. Thesis
Suckew Yun 1979 409 p
Avail: Univ. Microfilms Order No. 8002041

The zinc-lead skarn deposits of the Yeonhwa-Ulchin mining district were investigated. The structural pattern of the district, the development patterns of ore bodies at each of the mines, including ore minerals in all deposits were examined along with the mineralogical properties of ore and gangue minerals. Results are presented.

Dissert. Abstr.

N80-16635 Stanford Univ., Calif.
PLATE MOTIONS RELATIVE TO THE PALEOMAGNETIC AXIS AND THE LOWER MANTLE Ph.D. Thesis
Richard Garth Gordon 1979 151 p
Avail: Univ. Microfilms Order No. 8001927

The estimation of absolute plate motions is extended to the geologic past and used to test models of absolute motions and plate driving forces. A method for estimating the absolute plate velocity of an individual plate from its ridge and trench boundary is proposed along with a technique for the estimation of the minimum rms velocities relative to the paleomagnetic axis of three major continents since the Devonian. A method is developed using nonlinear least squares and miximum likelihood statistics and applied to the Campanian paleomagnetic data available from the Pacific plate. Paleomagnetic data from India and Australia, the apparent polar wander path of the Pacific plate, and the seafloor spreading histories of the Indian Ocean and southwest Pacific Ocean are used to demonstrate that there was large tertiary relative motion between east and west Antarctica.

Dissert. Abstr.

N80-16636 California Inst. of Tech., Pasadena.
PHYSICS OF MANTLE AND CORE MINERALS Ph.D. Thesis
Raymond Jeanloz 1980 412 p
Avail: Univ. Microfilms Order No. 8002588

Shock wave equation of state data are used to evaluate theoretically calculated properties of the earth's core. Hugoniot

data for MgO and SiO2 suggest that the core is a major heat source for the mantle and that a barrier to convection occurs in the lower mantle. This inference is consistent with shock wave data for CaO which show that calcium could be substantially enriched in the lower mantle. Data for bronzite, olivines, and pyroxenes are consistent with static high pressure results, but suggest the occurrence of post-perovskite phases and also provide evidence for nonequilibrium effects. Although the bulk properties measured under shock are consistent with the attainment of thermodynamic equilibrium, these properties apparently represent highly transient and nonequilibrium states. Dissert. Abstr.

N80-16637 California Univ., Berkeley.
INVESTIGATION OF SEISMIC SOURCES BY THE LINEAR INVERSION OF SEISMOGRAMS Ph.D. Thesis
Brian William Stump 1979 279 p
Avail: Univ. Microfilms Order No. 8000528

A method was developed allowing the direct inversion of seismograms to obtain an estimate of the seismic point source, as characterized by its equivalent first degree force moment tensor. The problem was shown to be linear in both the frequency and time domains and least squares methods were used to estimate the source mechanism. In the synthetic tests that were run, several possible uses of the method were investigated. With a satisfactory station distribution, the source mechanism was recovered using complete seismograms from three component stations or several P arrivals on vertical components. The method was useful in distinguishing multiple events including explosions. The errors of the fits were determined and yield information such as the bandwidth of useful data in the frequency domain and error estimates for fault plane solutions in the time domain fits. Dissert. Abstr.

N80-16638 Stanford Univ., Calif.
PETROLOGY AND STRATIGRAPHY OF PALEOGENE NONMARINE SANDSTONES, CASCADE RANGE, WASHINGTON Ph.D. Thesis
Virgil Allen Frizzell, Jr. 1979 169 p
Avail: Univ. Microfilms Order No. 8001919

A compositional and stratigraphic analysis of the Cascade range north of 47 deg latitude is presented. Results show a range composition of probable Paleozoic and Mesozoic metamorphic rocks and Mesozoic and Tertiary plutonic rocks. Several Paleogene nonmarine arkosic sandstone units fringe and in part occur within the complex crystalline core. The various formations are all composed predominantly of fine- to medium-grained sandstones with lesser amounts of interbedded shale, conglomerate, and coal. Compositionally, the units are predominantly either feldspathic or litho-feldspathic subquartzose sandstones. Modal analysis is performed on samples from the various sedimentary units to establish petrologic compositions and to provide data with which to compare the different units and discuss clast provenance and tectonic regimen. Dissert. Abstr.

N80-16639 Stanford Univ., Calif.
GEOPHYSICS OF THE GEYSERS GEOTHERMAL FIELD NORTHERN CALIFORNIA Ph.D. Thesis
Roger Patrick Denlinger 1979 96 p
Avail: Univ. Microfilms Order No. 8001901

An analysis of detailed gravity, seismic and geodetic information was combined with reservoir engineering studies to place severe constraints on the Geysers vapor dominated geothermal system. An extension of the Mt. Hannah gravity low was found to underlie The Geysers steam system. The negative gravity anomaly associated with the steam system was modeled. A deep low density body underlying the steam system was used to represent part of the heat source and deep seismic reflections observed from NE dipping horizons between 4 and 5 km were used to represent the major tectonic boundaries in the Franciscan formation. Dissert. Abstr.

N80-16640 Stanford Univ., Calif.
THE EFFECTS OF PORE FLUIDS AND FRICTIONAL SLIDING ON SEISMIC ATTENUATION Ph.D. Thesis
Kenneth William Winkler 1979 195 p
Avail: Univ. Microfilms Order No. 8002039

An experimental approach using bar resonance technique was adopted. One meter long bars of rock were vibrated in torsional and extensional modes at frequencies between about 500 and 1700 hertz. Confining pressure, pore pressure, degree of saturation and strain amplitude were all varied. Results indicate that pore fluids dominate seismic attenuation under the conditions of the experiments, conditions which are in many ways representative of the Earth's upper crust. In dry sandstone both P waves and shear waves show relatively small amounts of attenuation. Partial saturation (to about 95 percent) caused attenuation to increase by a factor of two to four and results in P waves being attenuated more strongly than shear waves. The transition to total saturation resulted in maximum shear wave attenuation, but caused a significant reduction in P wave attenuation. In fully saturated rock, shear waves were attenuated more strongly than P waves. Dissert. Abstr.

N80-16641 California Univ., Los Angeles.
STABILITY OF A TURBULENT LAYER CLOUD WITHIN THE PLANETARY BOUNDARY LAYER Ph.D. Thesis
Chin-Hoh Moeng 1979 161 p
Avail: Univ. Microfilms Order No. 8001387

A model for numerical simulations of a stratus cloud layer is constructed by combining a second-order closure turbulent transfer model with a thermal radiative transfer model. The turbulence-radiation combined model is applied to a horizontally uniform one dimensional case and a horizontally nonuniform two dimensional case. In the latter the dynamics of mesoscale circulations have also been incorporated. The two dimensional simulation reproduces the layer cloud instability where the sea surface temperature is high and the large-scale subsidence is weak. The simulated instability process has been analyzed in view of Randall's instability criterion, the eddy kinetic energy budget, and evaporative cooling near the cloud top. The growth rates of the instability are obtained using the linearized perturbation equations. Dissert. Abstr.

N80-16642 Wisconsin Univ. - Madison.
A CASE STUDY OF HEIGHT AND TEMPERATURE ANALYSES DERIVED FROM NIMBUS-6 SATELLITE SOUNDINGS ON A FINE MESH MODEL GRID Ph.D. Thesis
Thomas Lee Koehler 1979 204 p
Avail: Univ. Microfilms Order No. 7927181

Two sets of temperature profiles derived from the same set of Nimbus-6 radiance measurements were evaluated. The first set had an average horizontal spacing of about 300 km and was employed extensively in other impact studies. The second had a finer resolution, roughly a 150 km spacing. Several means of comparison are presented, including visual and statistical comparisons of the temperature and height fields, and comparisons of dynamic and energetic parameters derived from them. The results indicate that Nimbus-6 soundings were able to correctly position the major trough and ridge positions, but underestimate gradients in the analyses. The soundings exhibited a consistent warm bias, with maximum root mean squared errors of more than 3 C near the surface and tropopause. No advantage was found in using the satellite soundings with the finer resolution, mainly because of their higher noise level. Manual screening of the normal resolution soundings provided only minor improvements. Dissert. Abstr.

N80-16643 Maryland Univ., College Park.
METRIC-CONNECTION THEORIES OF GRAVITY Ph.D. Thesis
Phillip Barry Yasskin 1979 317 p
Avail: Univ. Microfilms Order No. 8002074

Using a method similar to that used by Papapetrou and Dixon in the context of metric theories, propagation equations for a body's momentum and and angular momentum are derived. These show that elementary particle spins feel the torsion but orbital angular momentum does not. Results indicate that in a metric theory, spin and orbital angular momentum propagate in the same way. A two tangent space formalism which gives geometrical insight into the presence of two connections was developed. The Christoffel connection acted on one of the tangent spaces (called the external tangent space) while the full connection acted on the other tangent space (called the internal tangent space). The isomorphism between the two tangent spaces (called the soldering isomorphism) corresponded to the orthonormal frame in the usual one tangent space formalism. Its covariant derivative

was the defect tensor which was the difference between the full connection and the Christoffel connection. Dissert. Abstr.

N80-16644 Iowa Univ., Iowa City.
ON THE GENERATION OF AURORAL KILOMETRIC RADIATION Ph.D. Thesis
James Lauer Green 1979 157 p
Avail: Univ. Microfilms Order No. 7928581

Simultaneous observations between the Hawkeye spacecraft in the AKR emission cone and the low altitude polar orbiting spacecraft Triad and AE-D reveal that auroral kilometric radiation (AKR) is correlated with a variety of auroral particle precipitation in the evening to midnight local time sector. It is found that as the AKR intensity increases so does the integrated current sheet intensity of auroral zone field aligned currents observed by Triad increase from a survey of 257 simultaneous observations. Statistically, the linear correlation coefficient between the log of the AKR power flux and the log of the current sheet intensity is 0.57. The results presented indicate that kilometric radiation is generated by inverted-V electron distribution functions in a direct coupling mechanism between particle energy and R-X mode electromagnetic waves. Dissert. Abstr.

N80-16645# Finnish Meteorological Inst., Helsinki.
MAGNETIC RESULTS FROM NURMIJAERVI GEOPHYSICAL OBSERVATORY, 1978
1979 35 p
(ISBN-951-697-125-3; ISSN-0071-5212) Avail: NTIS HC A03/MF A01

Observed magnetic results for 1978 are presented in tabular form. The data include declination, horizontal intensity, vertical intensity, diurnal variation, monthly means, and K-indices. R.E.S.

N80-16646# Institute for Defense Analyses, Arlington, Va.
A CATALOG OF PERTURBING INFLUENCES ON STRATOSPHERIC OZONE, 1955-1975 Final Report, 15 Apr. - 15 Oct. 1978
E. Bauer Sep. 1978 200 p refs
(Contract DOT-FA77WA-3965)
(AD-A063650; P-1340; FAA-EQ-78-20) Avail: NTIS HC A09/MF A01 CSCL 04A

A list of all major time varying perturbations over a 20 year time frame is presented. Detailed consideration is given to the following: atmospheric nuclear explosions; galactic cosmic rays; solar proton events; relativistic (or energetic) electron precipitation, major volcanic eruptions; halocarbons (fluoro-, chloro-, and bromocarbons); fertilizer manufacture; and other industrial nitrogen fixation. For sources injected directly into the stratosphere, the time, altitude, and latitude dependent source strengths are listed, while for the ground based sources the time and latitude dependent production and atmospheric emission rates are given. Time variations of solar ultraviolet and of stratospheric temperature, and possible variations in stratospheric dynamics are also discussed. R.C.T.

N80-16647# Ionospheric Prediction Service, Darlinghurst (Australia).
IONOSPHERIC STORM EFFECTS ON MAXIMUM USABLE FREQUENCIES ON CIRCUITS AROUND AUSTRALIA
L. F. McNamara Apr. 1977 99 p
(IPS-R-35) Avail: NTIS HC A05/MF A01

The effects of ionospheric storms on the maximum usable frequency (MUF) for circuits around Australia were investigated. The results are discussed in terms of the ionospheric parameter foF2, which is directly related to the MUF. Tables are given which list the probability of a storm effect as a function of latitude, season, and local time. R.E.S.

N80-16648# Ionospheric Prediction Service, Darlinghurst (Australia).
ANALYSIS OF NUMERICAL IONOGRAMS. 3: THE VALLEY PROGRAM
A. K. Paul, T. L. Gulyaeva, L. F. McNamara, J. E. Titheridge, and J. W. Wright Oct. 1978 24 p refs
(IPS-X8) Avail: NTIS HC A02/MF A01

Accurate numerical ionograms corresponding to daytime electron density profiles containing an E-F valley have been analyzed by four different methods. It is found that the methods of analysis due to Paul and Titheridge can determine the height of the F layer just above the valley to within a few km. The method used by Wright, on the other hand, leads to underestimates of this height by about 10-20 km. For most profiles, Gulyaeva's method yields errors of 5-10 km, but in some cases overestimates of up to 30 km can occur. Author

N80-16649*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
THE INFLUENCE OF VARIATIONS IN OZONE CONCENTRATION ON THE TEMPERATURE REGIME OF THE ATMOSPHERE
L. R. Rakipova Jun. 1979 6 p refs Transl. into ENGLISH from Transactions (USSR), Leningrad, 1974 p 359-361 Presented at the 1st All-Union Conf., Moscow, 30 Oct. - 1 Nov. 1972 Original language document previously announced as A74-37733 Transl. by SCITRAN, box 5456, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75350) Avail: NTIS HC A02/MF A01 CSCL 04A

The results of a study of the effects provided by changes in the concentration of atmospheric ozone on the mean temperatures of the troposphere and lower stratosphere are presented. It was found that ozone must be considered no less important in producing climatic changes than is CO_2. R.E.S.

N80-16650*# Earthquake Engineering Systems, Inc., San Francisco, Calif.
POTENTIAL UTILIZATION OF THE NASA/GEORGE C. MARSHALL SPACE FLIGHT CENTER IN EARTHQUAKE ENGINEERING RESEARCH
Roger E. Scholl, ed. Dec. 1979 234 p refs Sponsored in part by NSF
(Contract NAS8-33220)
(NASA-CR-161371) Avail: NTIS HC A11/MF A01 CSCL 08K

Earthquake engineering research capabilities of the National Aeronautics and Space Administration (NASA) facilities at George C. Marshall Space Flight Center (MSFC), Alabama, were evaluated. The results indicate that the NASA/MSFC facilities and supporting capabilities offer unique opportunities for conducting earthquake engineering research. Specific features that are particularly attractive for large scale static and dynamic testing of natural and man-made structures include the following: large physical dimensions of buildings and test bays; high loading capacity; wide range and large number of test equipment and instrumentation devices; multichannel data acquisition and processing systems; technical expertise for conducting large-scale static and dynamic testing; sophisticated techniques for systems dynamics analysis, simulation, and control; and capability for managing large-size and technologically complex programs. Potential uses of the facilities for near and long term test programs to supplement current earthquake research activities are suggested. DOE

N80-16651*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROCESSING OF MULTISPECTRAL THERMAL IR DATA FOR GEOLOGIC APPLICATIONS
Anne B. Kahle, Daryl P. Madura, and James M. Soha 15 Nov. 1979 43 p refs Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-162682; JPL-PUB-79-89) Avail: NTIS HC A03/MF A01 CSCL 08G

Multispectral thermal IR data were acquired with a 24-channel scanner flown in an aircraft over the E. Tintic Utah mining district. These digital image data required extensive computer processing in order to put the information into a format useful for a geologic photointerpreter. Simple enhancement procedures were not sufficient to reveal the total information content because the data were highly correlated in all channels. The data were shown to be dominated by temperature variations across the scene, while the much more subtle spectral variations between the different rock types were of interest. The image processing techniques employed to analyze these data are described. J.M.S.

N80-16652# California Univ., Berkeley. Earth Sciences Div.
VERTICAL MOVEMENT ALONG THE CERRO PRIETO TRANSFORM FAULT, BAJA CALIFORNIA, MEXICO - A

MECHANISM FOR GEOTHERMAL ENERGY RENEWAL
S. VonderHaar, J. E. Noble, and I. Puente Cruz. Mar. 1979. 8 p. refs. Prepared jointly by Comision Federal de Electricidad, Mexico City.
(Contract W-7405-eng-48)
(LBL-8905) Avail: NTIS HC A02/MF A01

Data from 53 geothermal wells to depths of 1 to 3 km on either side of the right-lateral Cerro Prieto fault, as well as geophysical data, indicate vertical displacements of this fault of 400 to 600 m. This episodic vertical movement has offset deltaic sandstone reservoirs that are primarily at 1200 m and 1800 m depth and contain 250 to 345 C water. A major fracture system for convective fluid movement has been thus maintained, with production at 150 MW. DOE

N80-16653# Brookhaven National Lab., Upton, N. Y.
NORMAL INCIDENT SOLAR RADIATION MEASUREMENTS AT UPTON, NEW YORK
J. G. Cottingham. 24 Oct. 1978. 15 p.
(Contract EY-76-C-02-0016)
(BNL-50939) Avail: NTIS HC A02/MF A01

Normal incident solar energy measurements made at Upton, L.I., New York are reported and analyzed relative to the total energy received on a horizontal surface. A method for computing normal incident solar radiation is developed and used to study long term variations in this energy source at Upton and to estimate average values for other east coast locations. DOE

N80-16654# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
CHEMICAL COMPACTION AIDS FOR FINE-GRAINED SOILS, VOLUME 1. Final Report
Jack M. Hoover and Richard L. Handy. Jun. 1979. 162 p. refs.
(Contract DOT-FH-11-8135)
(PB-301115/2; FHWA/RD-79/63-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 08M

An extensive review of appropriate subject literature and a pilot laboratory moisture-density-strength study of twenty chemicals with eight soils of varying origin and mineralogy are presented. Also included are a theoretical discussion of possible mechanisms of chemical compaction aids, properties of the twenty-six soils used in the total investigation (Phase I and Phase II), and data from supplemental tests designed to improve understanding of the influences of the chemicals on fine-grained soils. GRA

N80-16655# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Civil Engineering.
PROBABILISTIC SEISMIC STABILITY ANALYSIS: A CASE STUDY
D. A-Grivas and G. Nadeau. Jul. 1979. 42 p. refs.
(Grant NSF ENV-77-16185)
(PB-301291/1; NSF/RA-790131; CE-79-1) Avail: NTIS HC A03/MF A01 CSCL 08K

An application of a probabilistic seismic stability analysis to a natural slope located near Slingerlands, New York, is given. The safety of the slope is measured in terms of its probability of failure rather than the customary factor of safety. Three types of earthquake sources are investigated, namely, a point, a line and an area source, and the dependence on significant seismic parameters of the probability of failure of the slope is examined. On the basis of the results obtained, it is concluded that the present model is useful in assessing the reliability of soil slopes under both static and seismic conditions and the probability of failure of a soil is greatly affected by the type of the earthquake source involved and by the values of seismic parameters that are associated with it. GRA

N80-16656# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Civil Engineering.
A PROBABILISTIC MODEL FOR SEISMIC SLOPE STABILITY ANALYSIS
D. A-Grivas, J. Howland, and P. Tolcser. Jun. 1979. 98 p. refs.
(Grant NSF ENV-77-16185)
(PB-301369/5; NSF/RA-790130; CE-78-5) Avail: NTIS HC A05/MF A01 CSCL 08K

A model for probabilistic stability analysis of earth slopes under earthquake loading is presented. Significant uncertainties associated with conventional pseudo-static methods of seismic stability analysis are recognized and probabilistic tools are introduced for their description and amelioration. The proposed method of analysis accounts for: the variability of material strength parameters; the uncertainty in the exact location of potential failure surfaces; and the uncertainty in the value of the maximum slope acceleration during an earthquake. GRA

N80-16657# National Oceanic and Atmospheric Administration, Boulder, Colo. World Data Center A for Solar-Terrestrial Physics.
AURORAL ELECTROJET MAGNETIC ACTIVITY INDICES AE (11-12) FOR JANUARY - JUNE 1975
J. H. Allen, C. C. Abston, J. E. Salazar, and J. A. McKinnon. Aug. 1979. 115 p. refs.
(PB80-106974; UAG-73; NOAA-79092406) Avail: NTIS HC A06/MF A01 CSCL 04A

The Auroral Electrojet index (AE) is discussed and a brief description is given of the derivation of 11-12 station 1.0 min AE indexes for January - June 1975. Tables are given of hourly averager indexes for each day, of the stations making the main contribution to the hourly indexes, and of the average monthly quiet-time level of horizontal fields (H) at each magnetic observatory. Graphs of the index variations are included for each day of the first half of 1975 and for the frequency and amplitude of extreme variations at each site. GRA

N80-16658# California Univ., Richmond. Earthquake Engineering Research Center.
SOIL STRUCTURE INTERACTION IN DIFFERENT SEISMIC ENVIRONMENTS
Alberto Gomez-Masso (Woodward-Clyde Consultants, San Francisco), John Lysmer (Calif. Univ., Berkeley), Jian-Chu Chen (Calif. Univ., Lawrence Livermore Lab., Livermore), and H. Bolton Seed (Calif. Univ., Berkeley). Aug. 1979. 58 p. refs.
(Contract NSF ENV-76-23277)
(PB80-101520; UCB/EERC-79/18; NSF/RA-790240) Avail: NTIS HC A04/MF A01 CSCL 18E

A plane-strain method for soil structure interaction analysis consisting of the superposition of the free field motions and the interaction motions, in a generalized seismic environment is presented. The free field is modeled as a horizontally layered viscoelastic medium and the seismic environment may consist of a combination of S, P and Rayleigh waves. The soil structure system is modeled with viscoelastic finite elements, transmitting boundaries, viscous boundaries, and a 3 dimensional simulation. Comparative analyses of the same structure are conducted for an input of R waves and for vertically propagating S and P waves in a rock site and sand site. GRA

N80-16659# Massachusetts Inst. of Tech., Cambridge. School of Engineering.
BASELINE CORRECTION OF EARTHQUAKE RECORDS IN THE FREQUENCY DOMAIN
E. Kausel and R. Ushijima. Jul. 1979. 84 p.
(Grant NSF ENV-77-18339)
(PB80-102056; MIT-CE-R79-34; NSF/RA-790180) Avail: NTIS HC A05/MF A01 CSCL 08K

Various integration schemes for discrete functions in the frequency domain were examined and procedures to perform a parabolic baseline correction to earthquake records in this domain were developed. Only for acceleration records having zero mean value over the interval of definition did the simplest integration scheme analyzed (the pseudo-continuous method) coincide with the well known integration procedure of dividing the Fourier Transform of the record by i omega. Records with non-zero mean, on the other hand, required additional terms to achieve consistency with time domain procedures such as the trapezoidal rule. The formulae developed were applied to the Golden Gate Earthquake of March 22, 1957, and compared against each other. GRA

N80-16660# National Oceanic and Atmospheric Administration, Boulder, Colo.
THE INTERNAL REFRACTIVE INDEX SPECTRA OF CLOUDS FROM FORWARD SCATTER RADAR OBSERVATIONS

best copy available

Earl E. Gossard and Richard G. Strauch. Jun. 1979. 39 p. refs.
(PB80-107238; NOAA-TR-ERL-WPL-44) Avail: NTIS
HC A03/MF A01 CSCL 04A

There are occasions when radar return from a volume of cloud is unexpectedly large if it is presumed to be caused by the classical mechanism of incoherent scatter from individual cloud droplets. Such a mechanism predicts the scattered power to be proportional to the inverse 4th power of the wavelength. The observed weaker wavelength dependence could result from Bragg-coherent scatter from the ensemble of droplets or it could result from an enhancement by the cloud of inhomogeneities in the dielectric constant of the gaseous medium within the cloud. Both mechanisms are discussed and compared with data acquired in a forward scatter mode by the WPL 3 cm radar system. Observed differences between the in-cloud and out-of-cloud refraction index spectra are discussed. GRA

N80-16661# National Oceanic and Atmospheric Administration, Boulder, Colo.

EARTHQUAKE HISTORY OF THE UNITED STATES, 1971 - 1976 SUPPLEMENT

Jerry L. Coffman. 1979. 49 p. refs. Sponsored in part by Geological Survey.
(PB80-108434; NOAA-EDIS-PUB-41/1; NOAA-79092103)
Avail: NTIS HC A03/MF A01 CSCL 08K

Descriptions of earthquakes of Modified Mercelli (MM) intensity five and above (intensity six and above in California) for the years 1971 through 1976 are presented. For each region there is a brief resume of the general seismicity along with data on qualifying earthquakes. The earthquakes are grouped into major and intermediate and minor categories. GRA

N80-16662# Princeton Univ., N. J. Dept. of Civil Engineering.

EARTHQUAKE WAVES IN A RANDOM MEDIUM

L. Chu, A. Askar, and A. S. Cakmak. 30 Jun. 1979. 47 p. refs.
(Grant NSF 76-20027)
(PB80-104862; NSF/RA-790127; Rept-79/SM/3) Avail: NTIS HC A03/MF A01 CSCL 08K

Mathematical models are presented for the dynamics of seismic wave propagation through an elastic medium. The energy distribution and energy decay of the waves are examined and a discussion of the relation of the damping coefficient measured in situ and in the laboratory is presented. Sample calculations are presented for single and multilayer systems to obtain response spectra in the laboratory and to Gaussian and actual earthquake input motions. A.W.H.

N80-16663# Geological Survey, Albuquerque, N. Mex. Water Resources Div.

BIBLIOGRAPHY OF GEOLOGY AND HYDROLOGY, EASTERN NEW MEXICO. Final Water Resources Investigation

Ann Finley Wright. Mar. 1979. 175 p.
(PB-300832/3; USGS/WRI-79/76; USGS/WRD/WRI-79/060)
Avail: NTIS HC A08/MF A01 CSCL 08G

The high plains of the eastern New Mexico region and its natural resources are examined. The bibliography contains 1,900 references concerned with the geology, hydrology, chemistry, and geography of the region. GRA

N80-16664# National Geodetic Survey, Rockville, Md.

DETERMINATION OF ASTRONOMIC POSITIONS FOR CALIFORNIA-NEVADA BOUNDARY MONUMENTS NEAR LAKE TAHOE

James E. Pettey. Mar. 1979. 22 p. refs.
(PB-301264/8; NOAA-TM-NOS-NGS-18; NGS-18;
NOAA-79090404) Avail: NTIS HC A02/MF A01 CSCL 08G

Astronomic observations at three California-Nevada boundary monuments near Lake Tahoe were conducted. The reported position of the 120th meridian, as given in U.S. Coast and Geodetic Survey Report for 1900 is reported. GRA

N80-16665# Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.

REPORT ON THE PROGRESS OF REGULATIONS TO PROTECT STRATOSPHERIC OZONE. Annual Report, 1978 - 1979

Ferial S. Bishop. Aug. 1979. 57 p. refs.
(PB-301368/7; EPA-560/12-79-003) Avail: NTIS
HC A04/MF A01 CSCL 13B

The progress made in regulating ozone depleting substances is reported. Nonaerosol and miscellaneous chlorofluorocarbons (CFC) uses, including use as refrigerants, foam blowing agents, cleaning agents in the electronic and metal industries, and as solvents are investigated. Regulatory strategies to reduce CFC emissions including: (1) direct regulation, (2) economic incentives and (3) a conservation program are discussed. GRA

N80-16666# National Oceanic and Atmospheric Administration, Boulder, Colo. World Data Center A for Solid Earth Geophysics.

HOMOGENEOUS MAGNITUDE SYSTEM OF THE EURASIAN CONTINENT: P WAVES

Ludmill Christoskov (Bulgarian Acad. Sci.), Nadja V. Kondorskaya (USSR Acad. Sci.), and Jiri Vanek (Czechoslovak Acad. Sci.). Aug. 1979. 66 p. refs.
(PB-301282/0; NOAA-79090403) Avail: NTIS
HC A04/MF A01 CSCL 08K

A new procedure for determining the magnitude of an earthquake was developed. This procedure is called the homogeneous magnitude system (HMS). A summary of the steps used to establish an HMS of the Eurasian Continent for P waves is presented. GRA

N80-16667# California Univ., Richmond. Earthquake Engineering Research Center.

ARMA MODELS FOR EARTHQUAKE GROUND MOTIONS

M. K. Chang, J. W. Kwiatkowski, R. F. Nau, R. M. Oliver, and K. S. Pister. Jul. 1979. 99 p. refs.
(PB-301166/5; UCB/EERC-79/19) Avail: NTIS
HC A05/MF A01 CSCL 08K

An analysis of four major California earthquake records using a class of discrete linear time-domain processes commonly referred to as auto-regressive/moving-average models is presented. Connections, similarities, and differences between traditional continuous models (with parameter estimates based on spectral analyses) and the discrete models with parameters estimated by various maximum likelihood techniques applied to digitized acceleration data in the time domain are discussed. GRA

N80-16668# Washington Univ., Seattle.

PROCEEDINGS OF THE SECOND INTERNATIONAL CONFERENCE ON MICROZONATION FOR SAFER CONSTRUCTION: RESEARCH AND APPLICATION, VOLUME 2

Dec. 1978. 515 p. refs. Conf. held at San Francisco, 26 Nov. - 1 Dec. 1978. Sponsored in part by UNESCO, ASCE, Earthquake Eng. Res. Inst., Seismological Soc. of America, Univ. Council for Earthquake Eng. Res.
(Grant NSF PFR-77-23228)
(PB-301144/2; NSF/RA-780618) Avail: NTIS
HC A15/MF A01 CSCL 08K

Seismic investigations of various regions in the world are presented together with earthquake prediction studies. Considerable attention is devoted to such theoretical aspects as peak horizontal and vertical accelerations, the relevancy of one dimensional shear models in predicting surface acceleration, and the theory of connectivity. Studies of shear deformation in sandy soils, byacoustic emission response and seismic shear strain induced in soil deposits are reported. Recent earthquake resistant design methods for different types of foundations in Japan are described. GRA

N80-16669# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

TIME-LAPSE SKY PHOTOGRAPHY USING LOW COST CAMERA SYSTEMS

Gordon Larfald and Hans Ericson. Apr. 1979. 17 p. ref.
(PB-300406/6; NOAA-TR-ERL-WPL-43; NOAA-79080903)
Avail: NTIS HC A02/MF A01 CSCL 04A

Time lapse photography systems are described that were developed to provide a record of general sky and atmospheric conditions during field studies of atmospheric parameters. The design emphases were keeping equipment and operation costs

low and operating the systems as automatically as possible. Commercially available components were used where possible. Super-8 movie cameras with electronic shutters were found to be the most satisfactory cameras about which to design the systems. The systems are described in sufficient detail that they can be duplicated. GRA

N80-16076# Joint Publications Research Service, Arlington, Va.
INTERNATIONAL INVESTIGATION OF THE MAGNETOSPHERE
V. V. Migulin and B. I. Silkin. *In its* USSR Rept.: Space, No. 1 (JPRS-74805) 20 Dec. 1979 p 3-14 refs Transl. into ENGLISH from Priroda (USSR) no. 6, 1979 p 2-8 (For primary document see N80-16075 07-12)
Avail: NTIS HC A04/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-16670 Georgia Inst. of Tech., Atlanta.
MONTH AND YEAR AHEAD FORECASTING OF MONTHLY PRECIPITATION FOR THE SOUTHEASTERN UNITED STATES Ph.D. Thesis
William John March 1979 245 p
Avail: Univ. Microfilms Order No. 8002151

Four different statistical techniques were used to develop six models for forecasting monthly precipitation for the southeastern United States. The six models are a Box-Jenkins autoregressive integrated moving-average (ARIMA) model (BJALL), two non-integer harmonic models (NIALL and NIMO), a multiple linear regression model (REGALL) and two models resulting from the combination of forecasts from BJALL and NIALL (COMB2) and from BJALL, NIALL and REGALL (COMBALL). All models were poor predictors of the absolute quantity of precipitation, but they showed some success in forecasting categorical quantity. Overall, REGALL showed better results in forecasting the 1970-1977 years than the other models. Dissert. Abstr.

N80-16671 Colorado State Univ., Fort Collins.
DYNAMICS OF EQUATORIAL MASS-FLOW ADJUSTMENT Ph.D. Thesis
Pedro Leite SilvaDias 1979 217 p
Avail: Univ. Microfilms Order No. 7928547

The problem of the adjustment of the mass and wind fields in a divergent barotropic model was solved on the equatorial beta plane. Contrary to the traditional f plane analysis, the motion does not tend to a perfect geostrophic balance on a short time scale. The beta plane approximation allows for the presence of Rossby waves and since these waves are quasigeostrophic, they may be regarded as the adjusted state. It is also shown that the concept of an adjusted state on the beta plane is dependent on the dispersive properties and energetics of Rossby and gravity waves. Other results are reported. Dissert. Abstr.

N80-16672 Colorado State Univ., Fort Collins.
LINEAR SPECTRAL MODEL OF TROPICAL MESOSCALE SYSTEMS Ph.D. Thesis
Maria Assuncao Faus SilvaDias 1979 232 p
Avail: Univ. Microfilms Order No. 7928546

The sensitivity of mesoscale features with respect to large scale tropical profiles of wind and temperature and to small scale parameterizations was investigated through a linear, spectral, nonhydrostatic model. The cumulus heating parameterization was the so called Wave-CISK parameterization, defined by an idealized moisture budget. It is found that the growth rates of different scales of motion are very sensitive to small scale parameters, such as top of moist layer, mean mixing ratio in moist layer, and level of maximum heating rate. The speed of propagation and the mode of maximum growth rate are not very sensitive to small scale parameterization. Other significant results are reported. Dissert. Abstr.

N80-16673 California Univ., Los Angeles.
NUMERICAL SIMULATION OF THE FORMATION AND DISSIPATION OF STRATUS CLOUD UNDER AN INVERSION Ph.D. Thesis
Fanthune John Moeng 1979 234 p
Avail: Univ. Microfilms Order No. 8001388

Steady-state and transient processes involved in stratus cloud under a sub tropical inversion are examined. A numerical model is developed permitting extensive sensitivity and parameter variation studies. The model includes the following properties: (1) one dimensional, transient; (2) first order closure in turbulent transfer terms; (3) solar radiative transfer; (4) thermal radiation transfer in cloud; (5) soil and sea surface temperature. Field data are simulated by the model and it is determined what input parameterizations (advection and divergence) produce optimal results. Finally, through systematic parameter variation the model shows stratus formation and dissipation to be sensitive to all input parameters within their normal ranges of values. Dissert. Abstr.

N80-16674 Stanford Univ., Calif.
RAPID-SCANNING MEASUREMENTS OF WIND-PRODUCED DOPPLER ON AN ASYMMETRICAL MICROWAVE TRANSHORIZON PROPAGATION PATH Ph.D. Thesis
Ronald Douglas Fleming 1979 131 p
Avail: Univ. Microfilms Order No. 8001917

A rapid data-gathering system is used to remotely probe the wind-field velocity structure in the common volume region of a 164-km transhorizon propagation path. Wind-produced Doppler shifts resulting from average transverse velocities up to about 5 m/s were measured and found consistent both in magnitude and direction with the prevailing winds observed in the lower strata of the common volume region. On numerous occasions Doppler measurement results reflected much higher average velocities (up to 40 m/s) than could be attributed to normal low altitude winds. Time-spatial analyses of these anomalous spectra are indicative of aircraft induced atmospheric disturbances. The spectral signatures of these disturbances may provide additional insight into the generation and decay of aircraft trailing vortices. Dissert. Abstr.

N80-16675*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
THUNDERSTORM-ENVIRONMENT INTERACTIONS DETERMINED WITH THREE-DIMENSIONAL TRAJECTORIES
Gregory Sims Wilson Washington Jan. 1980 163 p refs
(NASA-RP-1054) Avail: NTIS HC A08/MF A01 CSCL 04B

Diagnostically determined three dimensional trajectories were used to reveal some of the scale interaction processes that occur between convective storms and their environment. Data from NASA's fourth Atmospheric Variability Experiment are analyzed. Two intense squall lines and numerous reports of severe weather occurred during the period. Convective storm systems with good temporal and spatial continuity are shown to be related to the development and movement of short wave circulation systems aloft that propagate eastward within a zonal mid tropospheric wind pattern. These short wave systems are found to produce the potential instability and dynamic triggering needed for thunderstorm formation. The environmental flow patterns, relative to convective storm systems, are shown to produce large upward air parcel movements in excess of 50 mb/3h in the immediate vicinity of the storms. The air undergoing strong lifting originates as potentially unstable low level air traveling into the storm environment from southern and southwestern directions. The thermo and hydrodynamical processes that lead to changes in atmospheric structure before, during, and after convective storm formation are described using total time derivatives of pressure or net vertical displacement, potential temperature, and vector wind calculated by following air parcels. R.C.T.

N80-16676*# National Aeronautics and Space Administration, Wallops Station, Wallops Island, Va.
THE ROLE OF SATELLITE ALTIMETRY IN CLIMATE STUDIES
C. L. Parsons Washington Jan. 1980 32 p refs
(NASA-TP-1570) Avail: NTIS HC A03/MF A01 CSCL 04B

The results of three generations of satellite-borne radar

altimetry experiments are summarized. The diverse measurements possible from this instrument are shown to be directly applicable to studies of the importance of the oceans in climate. The radar altimeter has unique value for investigations seeking knowledge of the interconnections between ocean dynamics, heat and momentum transfer across the air-sea interface, sea ice extent, and polar ice sheet thickness. Author

N80-16677# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
A THUNDERSTORM GUST FRONT DETECTION SYSTEM. PART 1: SYSTEM OPERATION AND SIGNIFICANT CASE STUDIES. PART 2: STATISTICAL RESULTS. Summary Report, Oct. 1976 - Apr. 1979
A. J. Bedard, Jr., F. H. Merrem, D. Simms, and M. M. Cairns. Aug. 1979. 146 p. refs.
(Contract DOT-FA76-WAI-622)
(AD-A075922; FAA-RD-79-55-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 01/5

The data presented demonstrate the importance of stable surface layers in determining how well surface temperature and wind measurements represent flow at higher levels and explain underestimates of system severity. The wind and pressure sensors combine to provide a total system offering good reliability for detection of thunderstorm outflows. An array configuration (composed of wind and pressure pump sensors) are recommended for use in airport warning systems. This configuration extending about 10 km from the airport provides a warning for thunderstorm gust-fronts. The data set offers wide possibilities for further exploitation including case study comparisons with numerical models, case study comparisons with weather radar data, and summaries of shear data and Doppler sounder profiles for use by those computing aircraft response and those designing remote sensing systems. M.M.M.

N80-16678*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF GLAS SAT AND NMC HIGH RESOLUTION NOSAT FORECASTS FROM 19 AND 11 FEBRUARY 1976
Robert Atlas. Nov. 1979. 19 p. refs.
(NASA-TM-80591) Avail: NTIS HC A02/MF A01 CSCL 04B

A subjective comparison of the Goddard Laboratory for Atmospheric Sciences (GLAS) and the National Meteorological Center (NMC) high resolution model forecasts is presented. Two cases where NMC's operational model in 1976 had serious difficulties in forecasting for the United States were examined. For each of the cases, the GLAS model forecasts from initial conditions which included satellite sounding data were compared directly to the NMC higher resolution model forecasts, from initial conditions which excluded the satellite data. The comparison showed that the GLAS satellite forecasts significantly improved upon the current NMC operational model's predictions in both cases. R.E.S.

N80-16679# Institut Royal Meteorologique de Belgique, Brussels.
THE WEATHER IN 1978 [LE TEMPS EN 1978]
R. Sneyers. 1979. 53 p. In FRENCH
Avail: NTIS HC A04/MF A01

The general atmospheric situation in Belgium was marked by the predominance of a depression regime from the middle of winter until the middle of summer. This predominance was followed by an anticyclonic regime which lasted until the end of the year. The persistent return of the anticyclonic regime from the middle of summer and the resulting rain deficit, the winter hygrometric deficit, and the mediocre thermal conditions from the middle of summer until the beginning of autumn are considered the most salient facts about Belgian weather in 1978. Variations in wind, air temperature, humidity, and precipitations are discussed for each month. Transl. by A.R.H.

N80-16680# Institut Royal Meteorologique de Belgique, Brussels.
RECENT RAIN MEASUREMENT MAPS OF BELGIUM [LES NOUVELLES CARTES PLUVIOMETRIQUES DE LA BELGIQUE. DE NIEUWE PLUVIOMETRISCHE KAARTEN VAN BELGIE]
G. L. Dupriez and R. Sneyers. 1979. 20 p. In FRENCH and FLEMISH. This accession also covers all 1979 issues received to date.
Avail: NTIS HC A02/MF A01

Meteorological charts of the normal rainfall in Belgium are presented. The charts are presented for each month of the year and show the average rainfall by altitude. Transl. by A.W.H.

N80-16681# National Oceanographic Data Center, Washington, D.C. Environmental Data and Information Service.
MARINERS WEATHER LOG, VOLUME 23, NUMBER 4.
Elwyn E. Wilson, ed. Jul. 1979. 76 p.
(PB-300277/1; NOAA-79080201) Avail: NTIS HC A05/MF A01 CSCL 04B

Articles contained in this issue include a report on the tropical storm Agnes and a discussion of ice navigation through the Great Lakes. A review of marine meteorology for the North Atlantic and Pacific Oceans is presented. A.W.H.

N80-16682*# National Aeronautics and Space Administration, Wallops Station, Wallops Island, Va.
RESULTS OF THE AUGUST 1977 SOVIET AND AMERICAN METEROLOGICAL ROCKETSONDE INTERCOMPARISON HELD AT WALLOPS ISLAND, VIRGINIA
Francis J. Schmidlin, Joseph R. Duke, Andre I. Ivanovsky, and Y. M. Chernyshenko. Feb. 1980. 193 p. refs. Prepared in cooperation with the Hydrometeorological Service of the USSR.
(NASA-RP-1053) Avail: NTIS HC A09/MF A01 CSCL 04B

A coordinated program of rocketsonde investigations along about 60 deg E and 70 deg W between the United States and U.S.S.R. is discussed. The rocketsonde instruments used by the U.S. and U.S.S.R. were compared and the results are presented. The U.S. Super Loki Datasonde and the U.S.S.R. M100B rocketsonde are discussed. Results indicate that the U.S/U.S.S.R. rocketsonde measurement agreement improved since the 1973 intercomparisons. It was learned that the mean of the differences of the temperatures compare to within 6 C at about 60 km and to within 2 C near 50 km. Wind measurements were also found to agree. A.W.H.

N80-16683*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala. Space Sciences Lab.
AVE-SESAME 1: 25-MB SOUNDING DATA
Myron L. Gerhard (Texas A and M Univ., College Station), Henry E. Fuelberg (St. Louis Univ., Missouri), Steven F. Williams (Texas A and M Univ., College Station), and Robert E. Turner. Dec. 1979. 365 p.
(NASA-TM-78256) Avail: NTIS HC A16/MF A01 CSCL 04B

Seven atmospheric variability experiments (AVE), two atmospheric variability and severe storms experiments (AVSSE), and six atmospheric variability experiment-severe environmental storm and mesoscale experiments (AVE-SESAME) conducted by NASA are discussed. The dates, observation times, and data reports for each of the experiments for which data was processed are listed. The AVE experiments were conducted primarily to study atmospheric variability with emphasis on spatial and temporal in atmospheric structure that can be detected from soundings taken at 3 hr intervals but not seen in soundings taken at 12 hr intervals. The AVSSE experiments were conducted to study atmospheric structure and variability associated with severe storms combining both rawinsonde and aircraft data to provide information on near storm environments. The method of processing is discussed, estimates of the rms errors in the data are presented, an example of contact data is given, and soundings are listed which exhibited abnormal characteristics. A.W.H.

N80-16684# Committee on Commerce, Science, and Transportation (U. S. Senate).
WEATHER MODIFICATION
Washington. GPO. 1979. 231 p. refs. Hearings on S. 829 and S. 1644 before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 24 and 26 Oct. 1979.
(GPO-55-607) Avail: Subcomm. on Commerce, Sci., and Transportation

Testimony was given and arguments were heard to declare a comprehensive and coordinated national weather resources

management policy, to provide for the development of standards and guidelines for weather resources management, and to establish a national program of research and development in the weather resources management field; and to declare a national weather modification policy, to establish a national program of research and development in weather modification, to provide for the promulgation of regulations related to weather modification, and for other purposes. M.M.M.

N80-16685# Naval Weather Service Environmental Detachment, Asheville, N. C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS (SSMO): SELECTED SOUTH PACIFIC ISLAND MARINE AREAS, VOLUME 3. AREA 17, TAHITI ISLAND AND MOOREA ISLAND; AREA 18, TUAMOTU ARCHIPELAGO; AREA 19, PITCAIRN ISLAND; AREA 20, EASTER ISLAND; AREA 21, ISLA SAN AMBROSIO AND ISLA SAN FELIX; AREA 22, ISLAS JUAN FERNANDEZ; AREA 23, NORFOLK ISLAND; AREA 24, CHATHAM ISLAND
Sep. 1979 643 p.
(AD-A073874) Avail: NTIS HC A99/MF A01 CSCL 04/2
This report presents marine climatological data for coastal areas 17 - 24 in 21 different tables including weather occurrence, wind direction and speed, cloud amount, ceiling height, visibility, precipitation, dry bulb, relative humidity, air-sea temperature difference, sea height and period, sea surface temperature and sea level pressure. GRA

N80-16686# Naval Weather Service Environmental Detachment, Asheville, N. C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS (SSMO): SELECTED SOUTH PACIFIC ISLAND MARINE AREAS, NEW ZEALAND, VOLUME 4. AREA 25, AUCKLAND WEST; AREA 26, AUCKLAND EAST; AREA 27, COOK STRAIT NW; AREA 28, COOK STRAIT; AREA 29, HAWKE BAY; AREA 30, SOUTH ISLAND NW; AREA 31, FOVEAUX STRAIT; AREA 32, CHRISTCHURCH
Sep. 1979 643 p.
(AD-A073875) Avail: NTIS HC A99/MF A01 CSCL 04/2
This report presents marine climatological data for specific coastal areas 25 - 32 in 21 different tables including weather occurrence, wind direction and speed, cloud amount, ceiling height, visibility, precipitation, dry bulb, relative humidity, air-sea temperature difference, sea height and period, sea surface temperature and sea level pressure. GRA

N80-16687# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19304DT GSRS, MISSILE NUMBER 1030, ROUND NUMBER V-55, 12 JULY 1979
Jul. 1979 24 p.
(DA Proj. 1T6-65702-D-126)
(AD-A074962; ERADCOM/ASL-DR-10444) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19304DT GSRS, Missile Number 1030, Round Number V-55, are presented in tabular form. GRA

N80-16688# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19304DT GSRS MISSILE NUMBER 1066, ROUND NUMBER V-56
Jul. 1979 19 p.
(DA Proj. 1T6-65702-D-126)
(AD-A074965; ERADCOM/ASL-DR-1045) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19304DT GSRS, Missile Number 1066, Round Number V-56, are presented in tabular form. GRA

N80-16689# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
THE 19304DT GSRS MISSILE NUMBER 1035, ROUND NUMBER V-57
26 Jul. 1979 21 p.
(DA Proj. 1T6-65702-D-126)
(AD-A074980; ERADCOM/ASL-DR-1046) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19304DT GSRS, Missile Number 1035, Round Number V-57, are presented in tabular form. GRA

N80-16690# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 1930 GSRS, MISSILE NUMBERS 1115, 1116, 1117, ROUND NUMBERS V-58, V-59, V-60, 30 JULY 1979 Meteorological Data Report
Jul. 1979 22 p.
(DA Proj. 1T6-65702-D-126)
(AD-A074981; ERADCOM/ASL-DR-1047) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19304 GSRS, Missile numbers 1115 thru 1117, Round Numbers V-58 through V-60, are presented in tabular form. GRA

N80-16691# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19702A GSRS, MISSILE NUMBER 340, ROUND NUMBER B-27, 6 AUGUST 1979 Meteorological Data Report
Aug. 1979 25 p.
(DA Proj. 1T6-65702-D-126)
(AD-A074982; ERADCOM/ASL-DR-1048) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19702A GSRS, Missile Number 340, Round Number B-27, are presented in tabular form. GRA

N80-16692# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBER 303, ROUND NUMBER B-28, 6 AUGUST 1979 Meteorological Data Report
Aug. 1979 24 p.
(DA Proj. 1T6-65702-D-125)
(AD-A074983; ERADCOM/ASL-DR-1049) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19702A GSRS, Missile Number 303, Round Number B-28, are presented in tabular form. GRA

N80-16693# Oak Ridge National Lab., Tenn.
METEOROLOGICAL EFFECTS OF THERMAL ENERGY RELEASES (METER) PROGRAM Annual Progress Report, Oct. 1977 - Sep. 1978
A. A. N. Patrinos, comp. and H. W. Hoffman, comp. Jun. 1979 131 p. refs.
(Contract W-7405-eng-26)
(ORNL/TM-6867) Avail: NTIS HC A07/MF A01
The meteorological effects of thermal effluents from power plants are discussed. Information from six separate studies on the subject is presented. The studies involved: rainfall measurements; drift from mechanical draft cooling towers; environmental impact of evaporative plumes; temperature measurements of downwind plumes for plants having 3 or 4 mechanical draft cooling towers in flat terrain; the prediction of local effects of cooling ponds; and self precipitation of snow from cooling towers. DOE

N80-16694# California Univ., Livermore. Lawrence Livermore Lab.
PROSPECTS FOR MONTHLY FORECASTS WITH 3-D GLOBAL WEATHER MODELS
W. J. Quirk. 21 Jun. 1979 9 p. refs. Presented at the 4th Conf. on Numerical Weather Prediction, Silver Spring, Md., 29 Oct. - 1 Nov. 1979
(Contract W-7405-eng-48)
(UCRL-82548; CONF-791038-1) Avail: NTIS HC A02/MF A01
The need for improved methods of forecasting climate variations is considered. The stochastic dynamic forecast method is proposed as one way of improving forecast skill. It is shown that model forecasts of space-time averaged quantities have much smaller errors than forecasts of quantities at a particular time

and place. These errors are small enough that use of stochastic techniques can reduce forecast errors still further. DOE

N80-16695# California Univ., Berkeley. Lawrence Berkeley Lab.
SIMPLIFIED PROCEDURE FOR CALCULATING THE EFFECTS OF DAYLIGHT FROM CLEAR SKIES
H. J. Bryan. Sep. 1979. 33 p. refs. Presented at the Ann. Illuminating Eng. Soc. Tech. Conf., Atlantic City, N.J., 16-20 Sep. 1979.
(Contract W-7405-eng-48)
(LBL-9048; CONF-790916-2; EEB-W-79-08) Avail: NTIS HC A03/MF A01

A simplified procedure for calculating daylight illumination at any point within a room under clear sky conditions is described which is consistent with the CIE recommended daylight factor method. The calculation procedure used here separates the light reaching the point being considered into three components: light directly from the sky and light after reflection from external and internal surfaces. Graphs and tables are developed for these components in order to evolve a calculation procedure which is simple to apply rather than lengthy direct computation from first principles. A validation case study is presented in order to demonstrate the accuracy of the proposed calculation procedure. DOE

N80-16696# North American Weather Consultants, Goleta, Calif.
PROJECT SKYWATER. SKYWATER CONFERENCE 10, JUNE 1978: THE SIERRA COOPERATIVE PILOT PROJECT DESIGN
Dept. of the Interior. Jun. 1979. 362 p. Conf. held at South Lake Tahoe, 22-23 Jun. 1978.
(Contract DI-7-07-83-V0008)
(PB-298529/9) Avail: NTIS HC A16/MF A01 CSCL 04B

The proposed design for a winter weather modification project is considered. Task force workshops conducted in three areas: extended areas of effect, tracers, and contamination, and hypotheses are summarized. The environmental impact statement status, environmental monitoring work, and results from preliminary field studies are covered. GRA

N80-16697# Texas A&M Univ., College Station. Dept. of Meteorology.
MESOSCALE CHARACTERISTICS OF THE TEXAS HIPLEX AREA DURING SUMMER 1977. Final Report, Sep. 1977 - Aug. 1979
James R. Scoggins, Gregory S. Wilson, and Steven F. Williams. Austin, Tex. Texas Dept. of Water Resources. May 1979. 453 p. refs.
(Contract DI-14-06-D-7587)
(PB-298963/0; TDWR/LP-99) Avail: NTIS HC A20/MF A01 CSCL 04B

Mesoscale meteorological data are analyzed and results presented for each day separately. In addition, composite analyses of selected surface variables and atmospheric energetics, mixing ratio, velocity divergence, vertical motion, vertical flux of moisture, moisture divergence, equivalent potential temperature, vorticity, sea level pressure, and pressure change are presented. Charts of analyzed fields determined from data placed on a 15 km grid are compared with radar data coded on a similar grid. Variables considered in the upper air analysis include mass divergence, vertical motion, moisture divergence, and budgets of latent heat energy, kinetic energy, and water vapor. Composite analyses are presented for the surface and upper air variables as a function of convective activity. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-16698 Miami Univ., Fla.
A STEADY THERMOHALINE CONVECTION MODEL (DRIVEN BY TURBULENT BUOYANT PLUMES FROM MULTIPLE ISOLATED SOURCES IN A LARGE NONTURBULENT FINITE REGION, WITH APPLICATIONS TO THE OCEANIC THERMOHALINE CIRCULATION) Ph.D. Thesis
William Horatio Peterson. 1979. 180 p.
Avail: Univ. Microfilms. Order No. 8001679

A two dimensional steady convection model driven by an isolated turbulent buoyant plume in a finite region is developed and extended to include multiple plumes. When the plumes are taken to be inclined wall plumes, the added effects of wall drag and slope are investigated and shown not to effect the qualitative behavior of the model. The model developed suggests behavior qualitatively different from that of previous thermohaline circulation models. The two most important results are: (1) that the interior vertical velocity is small in the thermohaline and increases with depth; and (2) the inclusion of multiple deep water sources and the phenomenon of plume termination with the attendant implications of the terminating plume becoming a mid-depth source. Dissert. Abstr.

N80-16699 South Carolina Univ., Columbia.
A SIMULATION MODEL OF ESTUARINE SUBSYSTEM COUPLING AND CARBON EXCHANGE WITH THE SEA Ph.D. Thesis
James Kevin Summers. 1979. 341 p.
Avail: Univ. Microfilms. Order No. 8002279

A CSMP-III systems model was constructed describing the interactions of the salt marsh, oyster reef, water column, and subtidal benthos subsystems and their relationship to the environmental forcing functions of insolation, water temperature, tidal remixing, sea level, the areal contribution of each subsystem, and offshore concentrations of particulate organic matter (POM) and dissolved organic matter (DOM). Initial simulations indicate that the model output is stable and reproduces some of the major trends of a salt marsh ecosystem. The results of experimental studies suggest that annual variations in sea level resulting in variable tidal coverage of the salt marsh, offshore concentrations of POM and DOM, and the ratio of the surface areas of the marsh and water column subsystems all play important roles in the control of the exchange processes. In addition, the role of tidal remixing is particularly important in the control of annual DOM exchange between the estuary and the sea. Dissert. Abstr.

N80-16700*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ENHANCED NODAL EQUILIBRIUM OCEAN TIDE AND POLAR MOTION
Braulio V. Sanchez. Nov. 1979. 23 p. refs. Submitted for publication.
(NASA-TM-80592) Avail: NTIS HC A02/MF A01 CSCL 08C

The tidal response of the ocean to long period forcing functions was investigated. The results indicate the possibility of excitation of a wobble component with the amplitude and frequency indicated by the data. An enhancement function for the equilibrium tide was postulated in the form of an expansion in zonal harmonics and the coefficients of such an expansion were estimated so as to obtain polar motion components of the required magnitude. R.E.S.

N80-16701# Geological Survey, Woods Hole, Mass. Office of Marine Geology.
SOUTH ATLANTIC OUTER CONTINENTAL SHELF GEOLOGICAL STUDIES, FY 1976. Final Report, 1 Oct. 1976 - 30 Sep. 1977
Aug. 1979. 46 p. refs.
(Contract DI-AA550-MU6-56)
(PB-300822/4; BLM/YM/ES-79/12) Avail: NTIS HC A03/MF A01 CSCL 08G

A geological survey to study to southeastern U.S. Atlantic Continental Margin to assess conditions and hazards that might cause or distribute oil spills or other pollutants, or constrain petroleum exploration or development of the area is discussed. The rate of sediment mobility over the sea bed was measured and the resultant changes in bottom morphology and texture was monitored. The vertical distribution of trace metals in the near surface sediment was determined and the concentration, distribution, and flux of suspended particulate matter in the water column was examined. The results are discussed including the findings on the distribution of reefs and hardgrounds in the Georgia Bight, Vibracore studies of the Georgia Embayment Shelf,

and the Geology of the Florida-Hatteras Slope and Inner Blake Plateau. A map of the South Atlantic Outer Continental Shelf hazards is presented. A.W.H.

N80-16702# Geological Survey, Woods Hole, Mass. Office of Marine Geology.
SOUTH ATLANTIC OUTER CONTINENTAL SHELF GEOLOGICAL STUDIES, FY 1978. Final Report, 1 Oct. 1976 - 30 Sep. 1977
Aug. 1979. 574 p.
(Contract DI-AA550-MU6-56)
(PB-300820/8; BLM/YM/ES-79/11) Avail: NTIS HC A24/MF A01 CSCL 08G

A geological survey to: (1) measure the rate of sediment mobility over the sea bed and monitor resultant changes in bottom morphology and texture; (2) determine the concentration, distribution, and flux of suspended particulate matter in the water column; (3) determine the vertical distribution of trace metals in the near surface sediment at selected locations; (4) evaluate potential geological hazards to oil and gas development due to surficial and intermediate depth structure and mass sediment transport events; (5) identify and determine significance of outcrop and reef structures; and (6) support the activities of the chemical/biological benchmark contractor by obtaining supportive sediment texture, composition, and physical oceanographic information is discussed. GRA

N80-16703# State Univ. of New York at Stony Brook. Marine Sciences Research Center.
AN ASSESSMENT OF THE EFFECTS OF BATHYMETRIC CHANGES ASSOCIATED WITH SAND AND GRAVEL MINING ON TIDAL CIRCULATION IN THE LOWER BAY OF NEW YORK HARBOR
Kuo-Chuin Wong and R. E. Wilson. Jan. 1979. 31 p. refs.
(PB80-106487; SR-18; REF-79-1; NOAA-79091303) Avail: NTIS HC A03/MF A01 CSCL 08C

Tidal circulation patterns and tidal elevations in the lower bay of the New York harbor were numerically simulated for a number of altered bathymetries corresponding to hypothetical mining operations. Results suggest that tidal currents will decelerate over the mined region and accelerate outside of them, and that the tidal stream will be deflected towards the region. It is also clear that the mining near the mouth of the bay could increase tidal range along Staten Island substantially. GRA

N80-16704# Woods Hole Oceanographic Institution, Mass.
ON THE PROPAGATION OF FREE TOPOGRAPHIC ROSSBY WAVES NEAR CONTINENTAL MARGINS. Ph.D. Thesis
Hsien Wang Ou. Aug. 1979. 137 p. refs.
(Grants NSF OCE-76-01813; NSF OCE-78-19513)
(PB-299949/8; WHOI-79-67) Avail: NTIS HC A07/MF A01 CSCL 08C

An analytical model constructed to study the propagation of free topographic Rossby waves in an infinite wedge filled with a uniformly stratified fluid is presented. The problem is found after some coordinate transformations to be identical to the corresponding surface gravity wave problem in a homogeneous fluid but with the roles of the surface and bottom boundaries interchanged. Analytical solutions are discussed for both progressive and trapped waves and their properties are examined. The model predictions are compared with the data taken from NESS76, a New England shelf/slope experiment. GRA

N80-16705# Woods Hole Oceanographic Institution, Mass.
THE INFLUENCE OF DIFFERENTIAL PRODUCTION AND DISSOLUTION OF THE STABLE ISOTOPE COMPOSITION OF PLANKTONIC FORAMINIFERA. Ph.D. Thesis
Jonathan Erez. Jun. 1979. 149 p. refs.
(Grant NSF OSD-77-07732)
(PB-299724/5; WHOI-79-54) Avail: NTIS HC A07/MF A01 CSCL 08A

Planktonic foraminifera from plankton tows, sediment traps and sediments from the central North Atlantic were studied. The oxygen and carbon isotope compositions, possibly caused by symbiotic algae that photosynthetically enhance incorporation of metabolic CO_2 in the skeleton are discussed. The effect of dissolution on the glacial-interglacial amplitude of the Pleistocene isotopic record in the Atlantic and Pacific Oceans is investigated. GRA

N80-16706# Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, Maine.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS: RESPIRATION AND RESPIRATORY ELECTRON TRANSPORT ACTIVITY IN PLANKTON FROM THE NORTHWEST AFRICAN UPWELLING AREA
T. T. Packard. Jan. 1979. 79 p. refs.
(PB-301029/5; NSF/IDOE-79/55; NSF/IDOE/CUEA-TR-47)
Avail: NTIS HC A05/MF A01 CSCL 08C

Microplankton and zooplankton respiration were calculated from ETS activity measurements in the upwelled waters off Cape Blanc, Mauritania. Respiration-photosynthesis ratios were calculated from two different assessments of gross productivity. Correlations support the assumption that phytoplankton metabolism. The role of the zooplankton in the regeneration of ammonium in the euphotic zone was investigated by calculating an ammonium excretion rate from zooplankton respiration and comparing this to phytoplankton NH_4 uptake rates. The hypothesis that the large difference in productivity between the Peru Current and the N.W. African upwelling systems is explained by the differences in the ratio of the compensation depth to the mixed layer depth was tested. GRA

N80-16707# Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, Maine.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. NITRATE REDUCTASE ACTIVITY IN THE NORTH WEST AFRICAN UPWELLING AREA
T. T. Packard, V. Jones, and D. Blasco. Jan. 1979. 104 p. refs.
(Grants NSF OCE-77-18688; NSF OCE-78-00610; Grant NSF OCE-75-23718)
(PB-301030/3; Contrib-78035; NSF/IDOE-79/56; NSF/IDOE/CUEA/TR-50) Avail: NTIS HC A06/MF A01 CSCL 08C

The transfer rates of nitrogen between trophic levels in a food web are discussed in relation to the dynamics of an upwelling ecosystem. The biochemical and environmental regulatory processes of nitrate reduction in the phytoplankton from the N.W. African upwelling system are examined. The importance of time series stations, drogue stations, and cross shelf profiles is discussed. GRA

N80-16708# Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, Maine.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. INTERACTIONS OF PRIMARY NUTRIENT AND CARBON UPTAKE IN THE PERU CURRENT: A REVIEW AND SYNTHESIS OF LABORATORY AND FIELD RESULTS
R. C. Dugdale, B. H. Jones, Jr., J. J. MacIsaac, and J. J. Goering. Feb. 1979. 60 p. refs. Prepared in cooperation with Alaska Univ., College.
(Grant NSF OCE-77-27006)
(PB-301031/1; NSF/IDOE-79/54; NSF/IDOE/CUEA/TR-51) Avail: NTIS HC A04/MF A01 CSCL 08C

The elaboration of a model linking nutrient-limited uptake of primary nutrient and photosynthetic processes is presented. The model of nutrient-limited growth described by Dugdale (1977) was expanded to include multiple-nutrient uptake. The resulting model expands the theoretical basis for the planning and interpretation of observations of primary production and nutrient processes in eutrophic regions of the sea such as the Peruvian upwelling system. GRA

N80-16709# National Marine Fisheries Service, Bay Saint Louis, Miss. National Fisheries Engineering Lab.
OBSERVATIONS OF TEMPERATURE, CURRENT, AND WIND VARIATIONS OFF THE CENTRAL EASTERN COAST OF FLORIDA DURING 1970 AND 1971
Thomas D. Leming. Aug. 1979. 189 p. refs.
(PB-301280/4; NOAA-TM-NMFS-SEFC-6; NMFS/SEFC-6; NOAA-79083001) Avail: NTIS HC A09/MF A01 CSCL 08C

Results of an approximately monthly series of XBT transects during 1971 near Cape Canaveral revealed a pronounced seasonal difference in thermal structure over the continental shelf. The

coastal waters were strongly vertically in winter. This was interpreted as due to increased strength and onshore movement of the Florida Current during the summer months, which was accompanied by intrusion of cold water along the bottom onto the shelf. Following offshore retreat of the Florida Current, cold water lenses 80 km long, 10 km wide, and 5 m thick remained over the bottom in the mid-shelf zone. GRA

N80-16710# East Carolina Univ., Greenville, N.C. Dept. of Biology.
THE DISTRIBUTION AND SEASONALITY OF THE BENTHIC AQUATIC MACROPHYTES OF THE PAMLICO RIVER ESTUARY, NORTH CAROLINA M.S. Thesis
Steven E. Reed Jan. 1979 67 p refs
(Contract DI-14-31-0001-5033)
(PB-300496/7; W79-09834; OWRT-A-077-NC(11)) Avail: NTIS HC A04/MF A01 CSCL 08A

The distribution and seasonal dynamics of the submersed vascular plants and macroscopic algae of the Pamlico River estuary, North Carolina, were studied. Plants were restricted mainly to the sandy shallow margins in the upper two thirds of the estuary with most of the biomass around 1 m depth. The estuary was divided into oligo-, meso- and polyhaline zones based on a rather unstable salinity gradient. In the oligohaline zone macrophyte communities consisted of Vallisneria americana, Potamogeton perfoliatus, Najas guadalupensis, and the muskgrasses Chara sp. and Nitella sp.; the mesohaline zone included V. americana, P. perfoliatus and Ruppia maritima. Line transects were used to sample biomass and community species composition during the seasonal studies. GRA

N80-16711# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
A NUMERICAL INVESTIGATION OF THE BERING SEA CIRCULATION USING A LINEAR HOMOGENEOUS MODEL
Y. J. Han (Oregon State Univ.) and J. A. Galt Jun. 1979 40 p refs
(PB-299884/7; NOAA-TM-ERL-PMEL-15; NOAA-79080902) Avail: NTIS HC A03/MF A01 CSCL 08C

A linear diagnostic model constructed to simulate the Bering Sea circulation is presented. Monthly mean wind stresses along with lateral water mass exchanges were used as model forcing functions. The numerical solutions obtained for the case of annual mean wind stress are presented. GRA

N80-16712# Woods Hole Oceanographic Institution, Mass.
POLEWARD HEAT FLUX AND CONVERSION OF AVAILABLE POTENTIAL ENERGY IN DRAKE PASSAGE
Harry L. Bryden 1979 24 p refs Repr. from J. Marine Res., v. 37, no. 1 p 1-22
(Grant NSF OCE-77-22887)
(PB-301311/7; WHOI-CONTRIB-4099; NSF/IDOE-79/76) Avail: NTIS HC A02/MF A01 CSCL 08J

Energetic fluctuations that transport heat poleward in the Drake Passage are studied. The rate of conversion is found to be approximately equal to the rate at which wind puts energy into the water column. Comparison is made with the baroclinic instability model which predicts conversion of available potential energy. The vertical phase function proved difficult to observe. The signature of the instability process is that temperature and poleward velocity are nearly in phase. A 90 degree phase difference between poleward and eastward velocity components and a dominance of energy in the counterclockwise half of the rotary spectrum are associated with this signature. GRA

N80-16713# Oregon State Univ., Corvallis. School of Oceanography.
TEMPERATURE SECTIONS ALONG THE C-LINE OVER THE SHELF OF CABO NAZCA, PERU FROM MOORED CURRENT METERS, 18 MARCH-10 MAY 1977 AND CTD OBSERVATIONS, 5 MARCH-15 MAY 1977
K. H. Brink, W. E. Gilbert, and A. Huyer Jan. 1979 67 p refs
(Grants NSF OCE-78-03380; NSF OCE-78-03381)
(PB-301101/2; REF-79-2; NSF/IDOE/CUEA/TR-49; NSF/IDOE-79/58) Avail: NTIS HC A04/MF A01 CSCL 08J

Over the continental shelf at 15 degress off Peru, sigma-t is a well-defined function of temperature and hence temperature alone may be used to monitor the changes in stratification, to test the thermal wind equation, and to monitor the hydrographic response to wind events. Vertical-offshore distributions of temperature over the continental shelf and upper slope along a single line as measured by repeated hydrographic sections and a moored current meter array are presented. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-16714* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD AND APPARATUS FOR ELIMINATING LUMINOL INTERFERENCE MATERIAL Patent
Eldon L. Jeffers (Boeing Aerospace Co., Houston, Tex.) and Richard R. Thomas, inventors (to NASA) (Boeing Aerospace Co., Houston, Tex.) Issued 27 Nov. 1979 10 p Filed 9 Feb. 1978 Supersedes N78-18674 (16 - 09, p 1197) Sponsored by NASA
(NASA-Case-MSC-16260-1; US-Patent-4,176,007; US-Patent-Appl-SN-876440; US-Patent-Class-435-34; US-Patent-Class-422-52; US-Patent-Class-23-927) Avail: US Patent and Trademark Office CSCL 06A

A method and apparatus for removing porphyrins from a fluid sample which are unrelated to the number of bacteria present in the sample and prior to combining the sample with luminol reagent to produce a light reaction is disclosed. The method involves a pre-incubation of the sample with a dilute concentration of hydrogen peroxide which inactivates the interfering soluble porphyrins. Further, by delaying taking a light measurement for a predetermined time period after combining the hydrogen peroxide-treated water sample with a luminol reagent, the luminescence produced by the reaction of the luminol reagent with ions present in the solution, being short lived, will have died out so that only porphyrins within the bacteria which have been released by rupturing the cells with the sodium hydroxide in the luminol reagent, will be measured. The measurement thus obtained can then be related to the concentration of live and dead bacteria in the fluid sample.

Official Gazette of the U.S. Patent and Trademark Office

N80-16715* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD FOR SEPARATING BIOLOGICAL CELLS Patent
Donald E. Brooks, inventor (to NASA) (Oregon Univ., Portland) Issued 1 Jan. 1980 5 p Filed 6 Mar. 1979 Supersedes N79-21743 (17 - 12 p 1616) Sponsored by NASA
(NASA-Case-MFS-23883-1; US-Patent-4,181,589; US-Patent-Appl-SN-017888; US-Patent-Class-204-180R; US-Patent-Class-204-299R; US-Patent-Class-424-12) Avail: US Patent and Trademark Office CSCL 06A

A method for separating biological cells by suspending a mixed cell population in a two-phase polymer system is described. The polymer system consists of droplet phases with different surface potentials for which the cell populations exhibit different affinities. The system is subjected to an electrostatic field of sufficient intensity to cause migration of the droplets with an attendant separation of cells.

Official Gazette of the U.S. Patent and Trademark Office

N80-16716 Michigan State Univ., East Lansing.
FACTORS INFLUENCING SPECIFIC GROWTH RATES AND SEASONAL ABUNDANCE OF EUTROPHIC LAKE PHYTOPLANKTON Ph.D. Thesis
Gary Frank Marx 1979 94 p
Avail: Univ. Microfilms Order No. 8001561

The seasonal succession of dominant phytoplankton populations and the daily concentrations of major nutrients in a central Michigan waste treatment basin were monitored over the 1977 growing season in order to study the factors controlling the growth of the various species. Carbon and light attenuation due to large algal standing crops, as well as the availability of dissolved organic substances, seemed to be the major factors controlling annual algal productivity. While a simple, kinetics based model was not be able to accurately predict the weekly specific growth

rates of the various species, predictions of approximate periods of growth were quite accurate, making such a model of considerable value for practical use. Dissert. Abstr.

N80-16717 California Univ., Berkeley.
THEORETICAL STUDIES OF THE LIGHT REACTIONS IN PHOTOSYNTHESIS Ph.D. Thesis
Richard Adam Friesner 1979 193 p
Avail: Univ. Microfilms Order No. 8000347

Using magnetic resonance formalism and theoretical formulations to interpret electron paramagnetic resonance (EPR) spectra the light reactions of photosynthesis were studied. A general method of determining the orientational distribution function of a partially ordered ensemble of paramagnetic systems from its EPR lineshape is presented. A radical pair theory of spin polarization for systems of membrane bound radicals with anisotropic g tensors is developed, and used to explain the orientation dependence of the lineshape of the polarized signal. The electron transport cofactors involved in the photosynthetic light reactions in both green plants and photosynthetic bacteria are identified. Dissert. Abstr.

N80-16718*# National Aeronautics and Space Administration, Washington, D. C.
GLUCOSE METABOLISM IN DIFFERENT REGIONS OF THE RAT BRAIN UNDER HYPOKINETIC STRESS INFLUENCE
K. Konitzer (Acad. of Sci. of the Ger. Democratic Republic) and S. Voigt (Acad. of Sci. of the Ger. Democratic Republic) Jan. 1980 15 p refs Transl. into ENGLISH from Acta Biol. Med. Ger. (East Germany), v. 35, 1976 p 853-866 Transl. by Kanner (Leo) Associates, Redwood City, California
(NASA-TM-75949) Avail: NTIS HC A02/MF A01 CSCL 06C

Glucose metabolism in rats kept under long term hypokinetic stress was studied in 7 brain regions. Determination was made of the regional levels of glucose, lactate, glutamate, glutamine, aspartate, gamma-aminobutyrate and the incorporation of C-14 from plasma glucose into these metabolites, in glycogen and protein. From the content and activity data the regional glucose flux was approximated quantitatively. Under normal conditions the activity gradient cortex and frontal pole cerebellum, thalamus and mesencephalon, hypothalamus and pons and medulla is identical with that of the regional blood supply (measured with I131 serum albumin as the blood marker). Within the first days of immobilization a functional hypoxia occurred in all brain regions and the utilization of cycle amino acids for protein synthesis was strongly diminished. After the first week of stress the capillary volumes of all regions increased, aerobic glucose metabolism was enhanced (factors 1.3 - 2.0) and the incorporation of glucose C-14 via cycle amino acids into protein was considerably potentiated. The metabolic parameters normalized between the 7th and 11th week of stress. Blood supply and metabolic rate increased most in the hypothalamus. R.C.T.

N80-16719*# National Aeronautics and Space Administration, Washington, D. C.
MORPHOLOGICAL AND FUNCTIONAL MANIFESTATIONS OF RAT ADRENAL-CORTEX RESPONSE TO SODIUM BROMIDE ADMINISTRATION UNDER HYPODYNAMIC STRESS
L. T. Kirichek (Kharkov Med. Inst.) and V. I. Zholudeva (Kharkov Med. Inst.) Nov. 1979 12 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 38, no. 6, Nov. - Dec. 1975 p 703-706 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-7593) Avail: NTIS HC A02/MF A01 CSCL 05C

Functional and morphological manifestations of adrenal cortex response to hypodynamia (2-hr immobilization on an operating table) under the influence of bromine preparations were studied. The sodium bromide was administered intraperitoneally in 100, 250, and 500 mg/kg doses once and repeatedly during ten days. The adrenal gland was evaluated functionally by ascorbic acid and cholesterol content and morphologically by coloring it with hematoxylin-eosin and Sudans for lipid revealing at freezing. Results are displayed in two tables and microphotographs. They are summarized as follows: the bromine weakens the functional state of the adrenal cortex in intact rats, causing changes similar to those under stress. During immobilization combined with preliminary bromine administration, a less pronounced stress reaction is noticeable. R.C.T.

N80-16720*# National Aeronautics and Space Administration, Washington, D. C.
CATECHOLAMINES AND MYOCARDIAL CONTRACTILE FUNCTION DURING HYPODYNAMIA AND WITH AN ALTERED THYROID HORMONE BALANCE
G. M. Pruss, V. I. Kuznetsov, and A. A. Zhilinskaya Jan. 1980 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biolhk. (USSR), no. 2, 1975, p 187-195 Original language document previously announced as A75-32600 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Vitebsk State Medical Inst. (USSR)
(Contract NASw-3199)
(NASA-TM-76000) Avail: NTIS HC A02/MF A01 CSCL 06C

The dynamics of catecholamine content and myocardial contractile function during hypodynamia were studied in 109 white rats whose motor activity was severely restricted for up to 30 days. During the first five days myocardial catecholamine content, contractile function, and physical load tolerance decreased. Small doses of thyroidin counteracted this tendency. After 15 days, noradrenalin content and other indices approached normal levels and, after 30 days, were the same as control levels, although cardiac functional reserve was decreased. Thyroidin administration after 15 days had no noticeable effect. A detailed table shows changes in 17 indices of myocardial contractile function during hypodynamia. K.L.

N80-16721# Louisiana State Univ. and A&M Coll., Baton Rouge. Dept. of Chemistry.
PHYSIO-CHEMICAL INVESTIGATION OF SOME AREAS OF FUNDAMENTAL SIGNIFICANCE TO BIOPHYSICS Annual Report, 1978 - 1979
S. P. McGlynn 7 Aug. 1979 151 p refs
(Contract EY-76-S-05-3018)
(ORO-3018-T1) Avail: NTIS HC A08/MF A01

Biographic titles and descriptions of graduate and postgraduate research efforts for the period 1978-1979 are presented. Work in progress includes analyzing the lowest-energy Rydberg transitions of the alkyl halides; decomposition of a spectroscopic signal S into a system of bands; luminescence of aqueous systems; a study of the effects of small molecules on hydrogen bonding via glass transitions in ethanol; Rydberg/intravalence mixing in the S2 state of azulene; ultraviolet photoelectron spectroscopy of carbonyls; and multi-photon processes. R.E.S.

N80-16722# Rochester Univ., N. Y. Dept. of Radiation Biology and Biophysics.
INFLUENCE OF X IRRADIATION AND DIET ON PITUITARY/THYROID FUNCTION IN THE RAT M.S. Thesis
I. G. Qassar 1979 59 p refs
(Contract EY-76-C-02-3490)
(UR-3490-1674) Avail: NTIS HC A04/MF A01

Rats were maintained on low iodine diet or treated with T sub 4. A significant increase in thyroid weight was observed in rats on low iodine diet whereas among rats on normal diet with thyroxine injections, the thyroid was lower in weight than thyroids of control animals. Pituitary weight increased significantly in rats on low iodine diet or T sub 4 treatment. Where PTU was administered to rats pretreated with either normal diet, normal diet plus T sub 4, or maintained on low iodine diet and then exposed to radiation (100 to 400R) to the neck, it was not possible to distinguish the effect of such local radiation on body growth. Contrary to low iodine treatment, administration of PTU did not result in any increase in pituitary weight in rats maintained on normal diet prior to radiation or in rats maintained on low iodine diet prior to radiation. There was, however, a significant increase in pituitary weight in rats injected with thyroxine prior to radiation (250R or 400R). DOE

N80-16723# Iowa Univ., Iowa City.
ANAEROBIC BIOLOGICAL TREATMENT OF LIQUID WASTES FROM PYROLYSIS PROCESSES Progress Report, 1 Apr. 1977 - 31 Mar. 1979
R. R. Dague 15 May 1979 61 p

(Contract EC-77-S-02-4455)
(COO-4455-2) Avail: NTIS HC A04/MF A01

Experimental work has shown that gas scrubber wastes from the pyrolysis process are high in organics that are toxic to anaerobic biological treatment systems. Carbon was evaluated as a method of pretreatment, co-treatment, or separate treatment for application to the pyrolysis wastes. Experiments with carbon adsorption indicates that wastes can be adsorbed to a high degree. Isotherms indicate an adsorptive capacity of between 0.60 and 0.86 grams of COD per gram of carbon. Suspended growth systems are also discussed. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-16724* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES SUPPLEMENT 201
Jan. 1980 66 p.
(NASA-SP-7011(201)) Avail: NTIS HC E03 CSCL 06E

This bibliography lists 191 reports, articles, and other documents introduced into the NASA scientific and technical information system in December 1979. Author

N80-16725* National Aeronautics and Space Administration, Pasadena Office, Calif.
APPARATUS FOR ENDOSCOPIC EXAMINATION Patent
Robert E. Frazer, inventor (to NASA). Issued 4 Dec. 1979 10 p. Filed 17 Jun. 1977. Supersedes N79-19678 (17 - 10, p. 1328)
(NASA-Case-NPO-14092-1; US-Patent-4,176,662; US-Patent-Appl-SN-807597; US-Patent-Class-128-6; US-Patent-Class-128-348; US-Patent-Class-128-DIG9; US-Patent-Class-138-33; US-Patent-Class-138-103; US-Patent-Class-138-133; US-Patent-Class-219-201; US-Patent-Class-219-522) Avail: US Patent and Trademark Office CSCL 06B

An endoscope is having a propulsion mechanism and at least one transmitter at the distal end transmitting bursts of energy waves (radio frequency or ultrasonic) for tracking the position of the distal end through the use of two or more transducers on the anterior or lateral surfaces of a patient is described. The propulsion mechanism which consists of two radially expandable bladders separated by an axially expandable bellows with only the forward bladder attached to the distal end is discussed. Alternate mechanisms are reported. A sheath on the endoscope which includes material having a sharp melting point slightly above body temperature so that the sheath is made flexible at selected sections by applying current to separate heating wires in the sections of the sheath is described.
Official Gazette of the U.S. Patent and Trademark Office

N80-16726*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF GRAVITATION STRESS AND HYPOKINESIA ON BLOOD VESSELS OF THE TESTICLE
E. F. Palazhchenko (I. P. Pavlov First Leningrad Med. Inst.). Nov. 1979 14 p. refs. Transl. into ENGLISH from Arkh. Anat. Gistol. Embriol. (USSR), v. 64, no. 5, 1973 p. 57-63. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75942) Avail: NTIS HC A02/MF A01 CSCL 06S

Rabbits were exposed to single maximum endurable stresses of cranio-caudal direction, hypokinesia for periods of one to eight weeks, and hypokinesia followed by gravitation stresses. The stresses caused dilatation of vessels, greater sinuosity, and occasional ruptures of the walls and extravasation. The greater part of the capillaries were dilated; the greatest part constricted. In hypokinesia there was an increasing atrophy of the testes. Significant results are reported. R.C.T.

N80-16727*# National Aeronautics and Space Administration, Washington, D. C.
THE SIGNIFICANCE OF ACTH FOR THE PROCESS OF FORMATION OF COMPLEX HEPARIN COMPOUNDS IN THE BLOOD DURING IMMOBILIZATION STRESS
B. A. Kudryashov (Moscow State Univ.), F. B. Shapiro (Moscow State Univ.), F. B. Lomovskaya (Moscow State Univ.), and L. A. Lyapina (Moscow State Univ.). Nov. 1979 14 p. refs. Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 61, no. 2, 1975 p. 244-250. Original language document was announced as A75-31019. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75946) Avail: NTIS HC A02/MF A01 CSCL 06S

Adrenocorticotropin (ACTH) was administered to rats at different times following adrenalectomy. Adrenocorticotropin caused a significant increase in the formation of heparin complexes even in the absence of stress factor. When ACTH secretion is blocked, immobilization stress is not accompanied by an increase in the process of complex formation. The effect of ACTH on the formation of heparin complexes was mediated through its stimulation of the adrenal cortex. R.C.T.

N80-16728*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF INGESTION OF COLD AND HOT WATER ON THE COURSE OF THERMAL CHANGES IN THE STOMACH AND INTESTINE
Ye. L. Batinkov. Sep. 1979 12 p. refs. Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 27, no. 1, 1939 p. 108-114. Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. Prep. by First Med. Clinic, Crimean Med. Inst. Imenistalin (USSR)
(NASw-3199)
(NASA-TM-75515) Avail: NTIS HC A02/MF A01 CSCL 06P

With the use of a thermocouple and mirror galvanometer, calibrated before the experiment and after each test, it was found that the normal temperature in the esophagus is 0.1-0.4 C higher than in the oral cavity, the temperature in the duodenum is somewhat less than in the stomach, but higher with cholecystitis, duodenitis or gastritis, the temperature in the normal stomach equals or is somewhat higher than in the esophagus, and that the temperature of distended stomachs frequently is lower than in the esophagus. It was found that hot water is retained in the stomach longer than cold water, and that both hot and cold water are allowed to pass into the duodenum when the water temperature becomes approximately equal to that of the surrounding organs. Author

N80-16729# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mathematics and Statistics.
EMPIRICAL BAYES ESTIMATION OF CRITICAL DOSAGES HAVING SMALLEST PREDICTIVE RISK
Ora Bialik and S. Zacks. 15 Aug. 1979 20 p. refs. Prepared in cooperation with Pennsylvania Univ.
(Contract N00014-75-C-0529; NR Proj. 042-276)
(AD-A074376; TR-38) Avail: NTIS HC A02/MF A01 CSCL 12/1

An empirical Bayes procedure is developed for the estimation of critical dosages in the linear regression case. The empirical Bayes procedure provides consistant estimators of the prior parameters when a large number of independent repetitions of the experiment is available. The methodology is developed to analyze a large set of photodynamic bioassays, for the determination of critical air concentrations of benzo-soluble organic extracts. R.E.S.

N80-16730# IIT Research Inst., Chicago, Ill.
BIOLOGICAL EFFECTS OF HIGH-VOLTAGE ELECTRIC FIELDS. VOLUME 1: AN UPDATE Final Report
Jul. 1979 224 p. refs.
(EPRI Proj. 857-1)
(EPRI-EA-1123) Avail: NTIS HC A10/MF A01

Literature which has become available since mid-1974 on the subject of biological effects of power frequency electric fields was reviewed. Some 2000 new entries of both publications and research programs in progress were identified through a computer-aided literature search. Approximately 50 of these

entries are discussed. The general findings of this update confirm the conclusion that it is highly improbable that electric fields from transmission lines have any significant biological effects on healthy individuals who encounter such fields in a normal way under ordinary conditions. However, further research is still needed in order to understand the nature and extent of any effects that could be harmful. DOE

N80-16731# Sinai Hospital, Detroit, Mich.
DEVELOPMENT OF PERCUTANEOUS ENERGY TRANSMISSION SYSTEMS. Annual Report, 15 Aug. 1978 - 14 Aug. 1979
A. Kantrowitz, P. S. Freed, A. A. Ciarkowski, F. L. Vaughan (Michigan Univ.), J. I. VeShancey (Michigan Univ.), R. Gray (Michigan Univ.), R. Brabec (Michigan Univ.), and I. Bernstein (Michigan Univ.). 16 Apr. 1979. 70 p. refs. Sponsored in part by National Heart and Lung Inst., Bethesda.
(Contract N01-HV-8-2921)
(PB-299739/3; NIH-N01-HV-8-2921-1) Avail: NTIS HC A04/MF A01 CSCL 06B

The initial development of a percutaneous access device is presented. Selected materials were tested for their ability to support cell growth and nutrients were examined for optimizing cell growth and collagen production. To protect the tissue-implant seal from mechanical stresses, alternative surgical techniques were employed to implant a subcutaneous flange. After implanting a flange in a Yucatan miniature pig, forces were applied to the tissue-implant composite. Strain data indicate (1) good fibrotic bonding occurs between the tissue and the implant, and (2) stabilization of the flange with respect to the adjacent dermis. GRA

N80-16732# Saint Elizabeth's Hospital, Brighton, Mass.
DEVELOPMENT OF PRECUTANEOUS ENERGY TRANSMISSION. Annual Progress Report, Aug. 1978 - Mar. 1979
Benedict D. T. Daly, Michael Szycher, Michael Worthington, Fred W. Quimby, and Roger G. Warren. Apr. 1979. 195 p. refs.
(Contract N01-HV-8-2919)
(PB-300518/8; NIH-N01-HV-8-2919-1) Avail: NTIS HC A09/MF A01 CSCL 06B

A composite percutaneous energy transmission system designed to transmit energy to intracorporeal blood pumps were developed. The system contains five basic components. A carbon coated titanium flange at the level of the skin to provide a non-reactive surface to promote superficial sinus development. Below this level is a porous polytetrafluoroethylene (PTFE) surface bonded to a polyurethane tube. This PTFE extends onto a radially rigid, vertically flexible polyurethane skirt. Below the skirt is a polyurethane tube with a preformed bend. The remainder of the skirt and tube are coated with Dacron fibrils. The PTFE is designed to promote collagen ingrowth to inhibit epithelial downgrowth. The Dacron velour promotes bonding in depper tissues. GRA

N80-16733# Joint Center for Graduate Study, Richland, Wash.
IMPLANTED ENERGY CONVERSION SYSTEM. Annual Report, 1 May 1978 - 1 Mar. 1979
R. P. Johnston, A. Bennett, S. G. Emigh, D. H. Gray, J. R. Noble et al. Aug. 1979. 491 p. refs.
(Contract N01-HV-4-2901)
(PB80-101116; JCGS-7908/217; NIH-N01-HV-4-2901-6) Avail: NTIS HC A21/MF A01 CSCL 06L

The JCGS thermal energy converter program objective is to develop clinically useful permanently implantable Stirling/hydraulic power sources to operate heart-assist or full-heart replacement blood pumps. The energy source is heat from an electric heater or from a radioisotope which could provide complete system implantability. Development has progressed through seven system configurations. Stirling Engine 5 has accumulated 6.3 years of operating time and has demonstrated 4.1 years of maintenance-free operation before failure. The short-stroke pump actuator/controller on accelerated life test has demonstrated 6.6 equivalent years of maintenance-free life without failure and accumulated a total of 16.5 equivalent years of operation. System 5 in-vivo test demonstrated circulation of all systemic blood flow throughout 175-hour test. System 6 complete power source demonstrated 15.5 percent efficiency, 1.2 liter volume, and 2.4 kg weight. System 7 engine module has demonstrated 20.1 percent efficiency with 0.2 liter volume and 0.7 kg weight. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-16734# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
MODELING PILOT RESPONSE DELAYS TO BEACON COLLISION AVOIDANCE SYSTEM COMMANDS. Final Report, Jul. - Sep. 1977
B. Billmann, T. Morgan, and J. Windle. Oct. 1979. 34 p. refs.
(FAA Proj. 052-241-310)
(AD-A075946; FAA-RD-79-74; FAA-NA-79-19) Avail: NTIS HC A03/MF A01 CSCL 05/10

Pilot response delays to collision avoidance commands displayed in the cockpit of a General Aviation Trainer simulator were analyzed. For fixed geometries, velocities, and aircraft response rates, the separation at the point of closest approach between aircraft responsing to collision avoidance system (CAS) commands, is inversely related to the length of pilot delay in responding to the CAS command. The Gamma distribution was the best distribution for approximating the empirical data in terms of minimum error mean square, lack of bias, and uniformity of fit. K.L.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-16735 Texas Univ., Galveston.
A STUDY OF OCCUPATIONAL HEAT STRESS BY ANALYSIS OF ENVIRONMENTAL AND HUMAN FACTORS. Ph.D. Thesis
David Jefferson Calley. 1979. 289 p.
Avail: Univ. Microfilms Order No. 7927487

The environmental and physiological aspects related to workmen in a hot production process in the warm and humid Gulf Coast region of the United States are described. Heat stress and strain was investigated in terms of three heat stress indices, the heat stress index, the wet bulb globe temperature, and the wet globe temperature. Correlation coefficients between these indices are discussed. In addition, medical data and clinical chemistry of blood and urine among workmen with heat illness was investigated. Recommendations were made for prevention of heat illness and for the use of heat stress indices. Precautions were stated related to the work-rest ratios and the estimation and measurement of metabolism and allowable exposure times. Dissert. Abstr.

N80-16736 Ohio State Univ., Columbus.
PLANAR BIPED DYNAMICS AND CONTROL. Ph.D. Thesis
Andrew Zbigniew Ceranowicz. 1979. 196 p.
Avail: Univ. Microfilms Order No. 8001704

Linear feedback was used to control the motion of a mathematical biped model composed of five rigid links connected by ideal torque actuators at pin joints and constrained to move only in the sagittal plane. The equations of motion for the biped model and support equations, which describe the contact between the supporting surface and the feet of the biped, are presented. These equations can be solved simultaneously for the biped's accelerations and ground reaction forces once the dynamic state and control torques are known. For point feet and a hard flat horizontal support surface, there are nine possible sets of support equations, i.e., support phases. Finding the correct support phase for any control torques and dynamic state is discussed. These ideas were implemented in the simulation of walking which required the transition between three support phases. Dissert. Abstr.

N80-16737*# Ohio State Univ., Columbus. Human Performance Center and Aviation Psychology Lab.

MULTI-MODAL INFORMATION PROCESSING FOR VISUAL WORKLOAD RELIEF
Michael W. Burke, Richard D. Gilson, and Richard J. Jagacinski. 1980. 28 p. refs.
(Grant NsG-2179)
(NASA-CR-162720) Avail: NTIS HC A03/MF A01 CSCL 05H

The simultaneous performance of two single-dimensional compensatory tracking tasks, one with the left hand and one with the right hand, is discussed. The tracking performed with the left hand was considered the primary task and was performed with a visual display or a quickened kinesthetic-tactual (KT) display. The right-handed tracking was considered the secondary task and was carried out only with a visual display. Although the two primary task displays had afforded equivalent performance in a critical tracking task performed alone, in the dual-task situation the quickened KT primary display resulted in superior secondary visual task performance. Comparisons of various combinations of primary and secondary visual displays in integrated or separated formats indicate that the superiority of the quickened KT display is not simply due to the elimination of visual scanning. Additional testing indicated that quickening per se also is not the immediate cause of the observed KT superiority. R.E.S.

N80-16738*# General Technical Services, Inc., Upper Darby, Pa.
THERMODYNAMIC CONSIDERATIONS IN THE SUPPORT OF LIFE FOR LONG SPACE VOYAGES Final Report
A. S. Iberall and S. Z. Cardon. Nov. 1979. 89 p. refs.
(Contract NASw-3240)
(NASA-CR-162755) Avail: NTIS HC A05/MF A01 CSCL 06K

The essential requirements for the maintenance of life, particularly human life, on isolated space missions of long duration were investigated through the study of extended irreversible thermodynamics. The characterization of a four trophic level system was developed. Questions of stability are discussed. R.E.S.

N80-16739*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Structures and Propulsion Lab.
PROSTHETIC DEVICE FOR CORRECTION OF URINARY INCONTINENCE
Ray Helms. Dec. 1979. 22 p. refs.
(NASA-TM-78255) Avail: NTIS HC A02/MF A01 CSCL 06B

The development and current status of a prosthetic device for the correction of urinary incontinence is presented.

N80-16740# Monsanto Research Corp., Dayton, Ohio.
PHYSICAL TESTING OF POLYMERS FOR USE IN CIRCULATORY ASSIST DEVICES Annual Report, 1 Jun. 1978 - 31 May 1979
Carl R. McMillin, David L. Sheppard, and Thomas A. Orofino. Jul. 1979. 48 p. refs.
(Contract N01-HV-7-2918)
(PB80-101546; MRC-DA-892; AR-1) Avail: NTIS HC A03/MF A01 CSCL 06L

Fatigue life comparisons of candidate elastomers for use in the artificial heart were made under various conditions. These include: (1) cyclical, progressively increasing, uniaxial strain in air, saline, and in-vitro blood media; (2) progressive uniaxial strain in the same media, with prior cut-growth initiation of samples; and (3) cyclical, biaxial strain in an air environment, accelerated by introduction of various stress concentrators in the samples. Materials evaluated were NBS butyl rubber, Upjohn Pellethane, Goodyear Hexsyn, and Thoratec Biomer. The order of ranking of fatigue lifetime was not the same for the tests cited, and the mode of failure differed for filled (butyl rubber, Hexsyn) and unfilled elastomers. GRA

N80-16741# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
EVALUATION OF COMMERCIALLY AVAILABLE LASER PROTECTIVE EYEWEAR Final Report
Kenneth R. Envall and Ross Murray, Jr. (Laser Effects Branch, USAF School of Aerospace Medicine). May 1979. 102 p. refs. Prepared in cooperation with USAF School of Aerospace Medicine, Brooks AFB, Tex.
(PB80-103039; DHEW/PUB/FDA-79/8086; FDA/BRH-79/110) Avail: NTIS HC A06/MF A01 CSCL 06Q

Forty commercially available laser protective eyewear materials and ten representative frames were evaluated under non-stress and stress conditions. Parameters such as optical density, spectral transmission, luminous transmittance, refractive and prismatic effects haze, and impact resistance were determined and, where possible, compared to recommended criteria for occupational eye and face protection. In addition, all materials were subjected to shelf-life, environmental, and laser-induced damage tests to determine damage limits and characteristics. GRA

N80-16216*# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.
WHOLE-BODY VIBRATION OF HEAVY EQUIPMENT OPERATORS
D. E. Wasserman, W. C. Asburry, and T. E. Doyle. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1979. p. 47-68. refs. (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 05H

N80-16217*# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
RESEARCH RELATED TO THE EXPANSION AND IMPROVEMENT OF HUMAN VIBRATION EXPOSURE CRITERIA
Richard W. Shoenberger. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1979. p. 69-79. refs. (For primary document see N80-16211 07-31)
Avail: NTIS HC A10/MF A01 CSCL 05H

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-16742*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFORM: AN INTERACTIVE DATA COLLECTION AND DISPLAY PROGRAM WITH DEBUGGING CAPABILITY
David S. Cwynar. Jan. 1980. 169 p. refs.
(NASA-TP-1424; E-9810) Avail: NTIS HC A08/MF A01 CSCL 09B

A computer program was developed to aid ASSEMBLY language programmers of mini and micro computers in solving the man machine communications problems that exist when scaled integers are involved. In addition to producing displays of

quasi-steady state values. INFORM provides an interactive mode for debugging programs, making program patches, and modifying the displays. Auxiliary routines SAMPLE and DATAO add dynamic data acquisition and high speed dynamic display capability to the program. Programming information and flow charts to aid in implementing INFORM on various machines together with descriptions of all supportive software are provided. Program modifications to satisfy the individual user's needs are considered. R.C.T.

N80-16743*# National Aeronautics and Space Administration, Washington, D. C.
LINKING OF THE MINI-COMPUTER ELECTRONIK-100I AND NR-9821A
B. V. Zubkov (Acad. of Sci., Moscow) and V. N. Khromov (Acad. of Sci., Moscow) Nov. 1979 35 p refs Transl. into ENGLISH of "Soprazheniye Mini-EVM Electronika 100I i NR-9821A", Rept. Pr-312 Acad. of Sci. (USSR), Inst. of Space Res., Moscow, 1976 p 1-33 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75670; Pr-312) Avail: NTIS HC A03/MF A01 CSCL 09B

The means of transmitting digital information from the computer E-100I to the desk top calculator NR-9821A with the help of an intermediate carrier of information (perforated tape) is described. The means of removal of information from the computer E-100I in a form which is understandable for the NR-9821A are given. Instructions for the use and programming of the transcription of information onto magnetic tape from the perforated tape and from the keyboard of the calculator are included. R.C.T.

N80-16744# Air Force Systems Command, Brooks AFB, Tex.
WIZARD: A STRING-ORIENTED MICROPROCESSOR OPERATING SYSTEM Final Report, Oct. 1976 - Sep. 1978
Shelburne D. Wilson, M. Edward Womble, and Michael L. Tworek Aug. 1979 15 p refs
(AD-A074704; SAM-TR-79-14) Avail: NTIS HC A02/MF A01 CSCL 09/2

A string-oriented operating system for Intel-8080-based microcomputers is described. The system consists of a hierarchy of virtual machines. The lowest level virtual machines extend the instruction set of the 8080 to include additional 16-bit arithmetic and logical instructions, new data types, and operators. The data types include strings and string operators derived from the SNOBOL programming language. A table data type is constructed from strings, and table-manipulation operators are provided. A bit-map data type and associated operators are also included. An Input/Output Control System (IOCS) support device-independent IO to multiple devices and diskette files. File name aliases permit many logical IO streams to be dynamically mapped onto a restricted set of physical IO units. Pseudo device handlers expand the capabilities of IO devices and are transparent to application programs. Distributed command decoders interpret IO command strings. Once communication is established with a logical device, a low-overhead IO Vector mechanism may be used for further access. A keyboard monitor provides interactive debugging facilities to application programmers. System resource allocation is implementation dependent and is not embedded in the system nucleus. Multiple implementations over a range of system sizes have demonstrated the utility and adaptability of WIZARD. GRA

N80-16745# School of Aerospace Medicine, Brooks AFB, Tex.
WIZARD PROGRAMMER MANUAL Final Report, Oct. 1976 - Sep. 1978
Shelburne D. Wilson and M. Edward Womble Sep. 1979 41 p
(AF Proj. 7755)
(AD-A074528; SAM-TR-79-15) Avail: NTIS HC A03/MF A01 CSCL 09/2

A string-oriented operating system for the Intel 8080 is described. The system consists of a hierarchy of virtual machines. The lowest virtual machines extend the instruction set of the 8080 to include additional 16-bit arithmetic and logical instructions, new data types, and operators. The data types include strings and string operators derived from the SNOBOL programming language. A table data type is constructed from strings, and table-manipulation operators are provided. A bit-map data type and associated operators are also included. An Input/Output Control System (IOCS) supports device-independent IO to multiple devices and diskette files. File-name aliases permit many logical IO streams to be dynamically mapped onto a restricted set of physical IO units. Pseudo device handlers expand the capabilities of IO devices and are transparent to application programs. Distributed command decoders interpret IO command strings. Once communication is established with a logical device, a low-overhead IO Vector mechanism may be used for further access. A keyboard monitor provides interactive debugging facilities to application programmers. System resource allocation is implementation dependent and is not embedded in the system nucleus. Multiple implementations over a range of system sizes have demonstrated the utility and adaptability of WIZARD. GRA

N80-16746# California Univ., Davis. Dept. of Computing Science.
PERFORMANCE PREDICTION OF COMPUTER ARCHITECTURES OPERATING ON LINEAR MATHEMATICAL MODELS Ph.D. Thesis
L. A. Cox, Jr. 28 Sep. 1978 218 p refs
(Contract W-7405-eng-48)
(UCRL-52582) Avail: NTIS HC A10/MF A01

A limited theory of concurrent computations is developed for concurrent systems based on a requestor/server concept. By use of the Petri-Net concurrent control system model, it is shown that this theory is easily implemented and is capable of predicting the performance of scientific programs running on complex concurrent computer systems. The performance of this type of model is discussed in the light of the requirements for a computer architectural design tool. A number of examples are given to demonstrate the inherent correctness or accuracy. A large-scale computer system design example is presented where this model is used to predict performance. The questions of ease of use, efficiency, and accuracy are discussed, and the problems in the use of this type of approach for predicting performance of software-hardware ensembles are examined. DOE

N80-16747# General Services Administration, Washington, D.C.
INTERNATIONAL BUSINESS MACHINES CORPORATION SYSTEM 34
31 Aug. 1979 56 p
(PB-299650/2; CCVS74-VSR440) Avail: NTIS HC A04/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the IBM System 34 COBOL Compiler Release 4 (SS2 Release 4) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated at the Low Intermediate level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N80-16748# General Services Administration, Washington, D.C.
DATAPOINT 6600 COBOL 2.3
30 Aug. 1979 42 p
(PB-299651/0; CCVS74-VSR445) Avail: NTIS HC A03/MF A01 CSCL 09B

The results obtained from the validation of the subject compiler against the 1974 COBOL Standard are summarized. All categories of discrepancies are listed by level/module within X3.23-1974 and related to each of the Federal levels of the language. A detailed listing of discrepancies is presented together with the tests which were failed. GRA

N80-16749# General Services Administration, Crystal City, Va.
HONEYWELL INFORMATION SYSTEMS COBOLA 0100
31 Aug. 1979 62 p
(PB-299652/8; CCVS74-VSR450) Avail: NTIS HC A04/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the Honeywell

Level 6 COBOL Computer Version 03/08 (GCOS Version 0400 & 0600) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated at the Low Intermediate level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N80-16750# General Services Administration, Washington, D.C. Automated Data and Telecommunications Service.
DIGITAL EQUIPMENT CORPORATION, PDP 11/70, PDP 11 COBOL VERSION 4.0
31 Aug. 1979 54 p
(PB-299653/6; CCVS74-VSR425) Avail: NTIS HC A04/MF A01 CSCL 09B

The results obtained from the validation of the subject compiler against the 1974 COBOL Standard are summarized. The compiler was validated at the low intermediate level of FIPS PUB 21-1. An overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974 along with a section relating the categories of discrepancies to each of the Federal levels of the language, and a detailed listing of discrepancies together with the tests which were failed. GRA

N80-16751# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
TECHNOLOGY ASSESSMENT: ADP INSTALLATION PERFORMANCE MEASUREMENT AND REPORTING Final Report
Carol B. Wilson Sep. 1979 43 p refs
(PB80-101322; NBS-SP-500-53; LC-79-600154) Avail: NTIS HC A03/MF A01 CSCL 09B

The status of ADP installation performance measurement and reporting in the Federal ADP community is compared with the best practices as found in the Federal and private sectors and described in the literature. The comparison reveals that more effort could be expended by Federal sites in the area of computer performance management. The principal obstacles to more and better performance programs are perceived to be the lack of needed measures on many systems and the magnitude of the effort involved in accessing and analyzing the measures which are available. Recommendations whch could partially relieve the situation include: (1) development of standard performance measures; (2) development of a Government-wide data base for normative performance ranges; and (3) development of statistical computer performance evaluation techniques. GRA

N80-16752# General Services Administration, Washington, D.C. Automated Data and Telecommunications Service.
NCR CORPORATION, IMOS COBOL: INDEXED I-O BASED X3.23-1974
9 Jan. 1979 12 p
(PB80-101868; FCTC/TR-79/02) Avail: NTIS HC A02/MF A01 CSCL 09B

A description of the evaluation environment and a summary of Indexed I-O language elements together with any errors/deviations found as a result of the evaluation are provided. GRA

N80-16753# Joint Publications Research Service, Arlington, Va.
EAST EUROPE REPORT: SCIENTIFIC AFFAIRS, NO. 658
28 Dec. 1979 59 p Transl. into ENGLISH from various East European journals
(JPRS-74833) Avail: NTIS HC A04/MF A01

Press and radio coverage of computer, nuclear, communication, and military technologies are presented. Specific topics covered include nuclear plants, reliability indicators for computer systems, and the automation of technological processes. For individual titles, see N80-16754 through N80-16755.

N80-16754# Joint Publications Research Service, Arlington, Va.
PROCESS COMPUTER TECHNOLOGY DEVELOPMENT REVIEWED
H. Willem *In its* E. Europe Rept.: Scien. Affairs, no. 658 (JPRS-74833) 28 Dec. 1979 p 1-14 Transl. into ENGLISH from Mes. Steuern, Regeln (E. Germany) E. Berlin, v. 22, no. 10, 1979 p 550-554 (For primary document see N80-16753 07-60)
Avail: NTIS HC A04/MF A01

The use of process computer technology within the German economy is reviewed. Applications of the Robotron 4000 family to production control, laboratory and test automation, technical calculations, and information processing systems are described. System reliability and development trends are also considered. K.L.

N80-16755# Joint Publications Research Service, Arlington, Va.
RELIABILITY RATE OF COMPUTER SYSTEMS DESCRIBED
Wit Drewniak *In its* E. Europe Rept.: Scien. Affairs, no. 658 (JPRS-74833) 28 Dec. 1979 p 37-43 Transl. into ENGLISH from Informatyka (Poland), no. 7, 1979 p 5-8 (For primary document see N80-16753 07-60)
Avail: NTIS HC A04/MF A01

The reliability of the ODRA 1305, R-32, ICL 1905, and ICL 1903A computers is discussed. The mean time between two successive system failures is calculated for various periods of operation and compared to reliability standards. K.L.

N80-17019# Joint Publications Research Service, Arlington, Va.
INTERFACE ASSEMBLY FOR USE IN K 1520 SYSTEM DESCRIBED
Siegfried Wildner and Rainer Bauch *In its* E. Europe Rept.: Sci. Affairs, No. 659 (JPRS-74911) 11 Jan. 1980 p 100-109 Transl. into ENGLISH from Radio Fernsehen Elek. (E. Berlin), v. 28, no. 9, 1979 p 558-560 (For primary document see N80-17015 07-99)
Avail: NTIS HC A07/MF A01

N80-17020# Joint Publications Research Service, Arlington, Va.
MICROCOMPUTER SYSTEM K 1520 EXAMINED
Bernhard Bader *In its* E. Europe Rept.: Sci. Affairs, No. 659 (JPRS-74911) 11 Jan. 1980 p 110-128 Transl. into ENGLISH from Radio Fernsehen Elek. (E. Berlin), v. 28, no. 10, 1979 p 616-620 (For primary document see N80-17015 07-99)
Avail: NTIS HC A07/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-16756 Wisconsin Univ. - Madison.
FAST ALGORITHMS FOR NP-HARD PROBLEMS WHICH ARE OPTIMAL OR NEAR-OPTIMAL WITH PROBABILITY ONE Ph.D. Thesis
Routo Terada 1979 134 p
Avail: Univ. Microfilms Order No. 7924194

Fast algorithms for six NP-hard problems are present. Thesis algorithms are shown to be optimal or near optimal with probability one. An algorithm for the Euclidean traveling salesman problem in any k-dimensional Levesque set E of zero volume boundary was designed. FOr n points independently, uniformly distributed in E, it is shown that, in probability, the time taken by the algorithm is of order less than n delta (n), as n approaches infinity for any choice of an increasing function delta (however slow its rate of increase). The resulting solution will, with probability one, be asymptotic, as n approaches infinity, to the optimal solution. Dissert. Abstr.

N80-16757 California Univ., Berkeley.
AN APPROACH TO THE REQUIREMENTS ANALYSIS AND SPECIFICATION OF LARGE-SCALE SOFTWARE SYSTEMS Ph.D. Thesis
Hon Hing So 1979 294 p

Avail: Univ. Microfilms Order No. 8000520

A framework for systematic design and development of large-scale software systems is developed with a focus on the early phases of the process. A major hypothesis made is that in order to understand the design of large-scale software, it is necessary first to identify the major transitions in its development. A total software system model should contain submodels that are built upon concepts relevant to the corresponding levels. The coherence in the submodels is ascertained by a rigorous definition of the mapping involved in the transitions. For every element of the system model, consideration is given to the suitable analysis techniques for detecting anomalies and guiding further system development. Techniques investigated include the development of a system attribute hierarchy along with the functional decomposition. The techniques developed are applied to a case study. Dissert. Abstr.

N80-16758 Stanford Univ., Calif.
FORMALIZING THE ANALYSIS OF ALGORITHMS Ph.D. Thesis
Lyle Harold Ramshaw 1979 122 p
Avail: Univ. Microfilms Order No. 8001994

Using partial correctness techniques to allow assertions that describe the probabilistic state of the executing process to be written and manipulated, program verification was extended. A formal system (called the frequency system) is presented in which the arguments can be reduced to symbol manipulation. The use of the frequency system is discussed in several average case analyses. In the examples, symbol manipulation in the frequency system leads directly to the recurrence relation that describes the distribution of the chosen performance parameter. Dissert. Abstr.

N80-16759 California Univ., Los Angeles.
CONSTRUCTIVE EXTENSION AND IMPLEMENTATION OF ABSTRACT DATA TYPES AND ALGORITHMS Ph.D. Thesis
Farshid Nourani 1979 196 p
Avail: Univ. Microfilms Order No. 8001391

The questions of specification, extension, and implementation of abstract data types and algorithms are investigated. Some algebraic techniques for proving correctness of implementations are developed in which injective morphisms of algebras play an important role. Sufficient conditions are given for such morphisms to be injective. The techniques are based on a notion of constructor signature for canonical algebras. The approach is extended to implementations of abstractly specified algorithms through a new method which first does a recursive enrichment of the concrete specification and then imposes the structure of the abstract specification onto the initial algebra for the presentation of the concrete domain. Dissert. Abstr.

N80-16760 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE REPRESENTATION OF FAMILIES OF SOFTWARE SYSTEMS Ph.D. Thesis
Lee Wendell Cooprider 1978 202 p
Avail: Univ. Microfilms Order No. 7925012

A notation is developed for describing the subsystem interconnections of entire systems, the differences between versions of those systems, and the mechanisms by which the systems are constructed. This representation is the basis for the design of a software construction data base. The data base manager automatically performs system construction steps, propagates modifications to system components, and maintains construction histories. The data base user establishes invariates in the data base by attaching policies to each data base object; the policies supply a set of actions to be performed when events in the data base affect the object. An extended sample is presented to demonstrate the applicability of the representation to a real system. Several types of system construction problems are discussed, and directions for improvements to the notation outlined. Dissert. Abstr.

N80-16761 Texas Univ. at Arlington.
COMPUTATIONAL METHODS OF SYSTEM IDENTIFICATION AND PARAMETER ESTIMATION Ph.D. Thesis
Wen-Hsiu Cheng 1979 186 p
Avail: Univ. Microfilms Order No. 8001658

A computational procedure is given and numerical examples are presented using both computer simulated data and experimental data to illustrate the performance of the Direct Computational Method as well as the general method of moments. Comparison of some identification methods is provided. Application to fluorescence decay analysis and, as a case study, modeling identification of an inner gimbal assembly telescope on an airborne pointing and tracking system are discussed in detail. Dissert. Abstr.

N80-16762 Iowa State Univ. of Science and Technology, Ames.
FACTORS AFFECTING COMPUTER PROGRAM COMPREHENSION Ph.D. Thesis
John Peter Boysen 1979 125 p
Avail: Univ. Microfilms Order No. 8000118

Factors affecting the comprehension of computer programs were studied. A pilot study was conducted in which subjects were asked to hand simulate expressions and small programs presented on a computer terminal. The reaction time to indicate the hand simulation results was used as a measure of the comprehensibility of the programs and expressions. The results of the pilot study indicated that, while the reaction time methodology was acceptable for studying simple expression, a different methodology was needed to study the comprehensibility of programs. Several refinement to the methodology were also suggested. Dissert. Abstr.

N80-16763 California Univ., Los Angeles.
ADAPTATION OF SET-DEFINING NOTATION TO THE SPECIFICATION OF FORMAL LANGUAGES Ph.D. Thesis
Arie Berman 1979 201 p
Avail: Univ. Microfilms Order No. 8001363

An adaptation of set-defining notation to the specification of recursively enumerable sets of strings is defined in order to bridge the gap between the nonprocedural set-defining capability of set-defining notation and the limitations of procedural computations. Equivalent interpretations of the system are given using a familiar version of Tarski's fixed point theorem and Ginsburg and Rice's definable sets, and their equivalence is proved. The involvement of string equations is formally described, and an equivalence between arbitrary string equations and a form of set expressions is shown. Restricted interpretations and syntactic restrictions of the proposed formal system are introduced and shown to assure the involvement of only unambiguous or proper string equations. The structural relation of the proposed system to post production systems is established, and any Turing machine computation is shown to be simulated by a search through its definition in the proposed system. Dissert. Abstr.

N80-16764 Ohio State Univ., Columbus.
SOFTWARE SCIENCE AND PROGRAM COMPLEXITY MEASURES Ph.D. Thesis
Albert Louis Baker 1979 276 p
Avail: Univ. Microfilms Order No. 8001686

A program complexity measure software effort is evaluated using the analytical methodology which relies on well defined program transformations. One type of transformation used embodies principles of program modularity. The behavior of E under modularizing tranformations is in agreement with accepted principles pertaining to such program changes. When E is evaluated in light of transformations related to program control flow, its utility as a general measure of program complexity is questioned. This deficiency of E in quantifying control flow complexity motivates the analytical evaluation of other measures which purport to capture this factor. The program knots measure, K, and the normal number of a program, NN, are shown to be inadequate in certain significant respects. The graph theoretic measure cyclomatic complexity, C, is shown to be applicable to program flow graphs, and C bears up well under analytical evaluation. Dissert. Abstr.

N80-16765# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
A VARIABLE METRIC ALGORITHM FOR THE SOLUTION OF THE SINGULAR THREE-DIMENSIONAL MISSILE AVOIDANCE
D. Blank and J. Shinar Jan. 1979 31 p refs
(Grant AF-AFOSR-3458-77)

(TAE-353) Avail: NTIS HC A03/MF A01

A variable metric algorithm is applied to the calculation of singular optimal control. A numerical example is solved to illustrate the feasibility and efficiency of the method. The results obtained show that the variable metric algorithm solves the problem in a relatively small number of iterations and short computer time. M.G.

N80-16766*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

VICAR IMAGE PROCESSING SYSTEM GUIDE TO SYSTEM USE

J. B. Seidman and A. Y. Smith. 1 Dec. 1979. 77 p. revised. (Contract NAS7-100)

(NASA-CR-162693; JPL-PUB-77-37-Rev-1) Avail: NTIS HC A05/MF A01 CSCL 09B

The functional characteristics and operating requirements of the Video Image Communication and Retrieval System are detailed. M.G.

N80-16767*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

COMPUTING REGION MOMENTS FROM BOUNDARY REPRESENTATIONS

J. M. Wilf and R. T. Cunningham. 1 Nov. 1979. 36 p. refs. (Contract NAS7-100)

(NASA-CR-162685; JPL-PUB-79-49) Avail: NTIS HC A03/MF A01 CSCL 09B

The class of all possible formulas for computing arbitrary moments of a region from the region's boundary is derived. The selection of a particular formula depends on the choice of an independent parameter. Several choices of this parameter are explored for region boundaries approximated by polygons. The parameter choice that minimizes computation time for boundaries represented by chain code is derived. Algorithms are presented for computing arbitrary moments for a region from a polygonal approximation of its boundary and for computing low order moments from chain encoded boundaries. K.L.

N80-16768*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SYMBOLIC-NUMERIC INTERFACE: A REVIEW

Edward W. Ng. 1 Jan. 1980. 21 p. refs. (Contract NAS7-100)

(NASA-CR-162690; JPL-PUB-79-106) Avail: NTIS HC A02/MF A01 CSCL 09B

A survey of the use of a combination of symbolic and numerical calculations is presented. Symbolic calculations primarily refer to the computer processing of procedures from classical algebra, analysis, and calculus. Numerical calculations refer to both numerical mathematics research and scientific computation. This survey is intended to point out a large number of problem areas where a cooperation of symbolic and numerical methods is likely to bear many fruits. These areas include such classical operations as differentiation and integration, such diverse activities as function approximations and qualitative analysis, and such contemporary topics as finite element calculations and computation complexity. It is contended that other less obvious topics such as the fast Fourier transform, linear algebra, nonlinear analysis and error analysis would also benefit from a synergistic approach. J.M.S.

N80-16769# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.

SYMBOLIC FACTORABLE SUMT: WHAT IS IT, HOW IS IT USED

Abolfazl Ghaemi and Garth P. McCormick. 25 May 1979. 113 p. refs. (Contract N00014-75-C-0611)

(AD-A074903; Serial-T-408) Avail: NTIS HC A06/MF A01 CSCL 12/1

This report is intended to serve as a guide for coding, solving, and conducting sensitivity and elasticity analysis on a solution vector of general parametric nonlinear programming problems using the latest version of the computer programming model of Symbolic Factorable SUMT. The motivation for development of this model, which uses symbolic factorable input, and the process of its evolution is briefly reviewed. The relative merits and advantages of this model over its earlier versions, as well as over the SUMT-Version 4 model 1 is elaborated. The procedure for putting problems into symbolic factorable language that is digestible by the model, and the related model outputs, are fully explored. For illustrative purposes three increasingly difficult sample problems are coded, solved, and discussed in sufficient detail. For completeness, the theory of symbolic factorable sensitivity analysis that was developed in 4 is included as an appendix. GRA

N80-16770# Technology Service Corp., Santa Monica, Calif.

COMPUTER IMAGE GENERATION TEXTURE STUDY. Final Report

Tony Stenger, William Dungan, and Richard Reynolds. Aug. 1979. 73 p. refs. (Contract F33615-77-C-0063; AF Proj. 6114)

(AD-A074019; AFHRL-TR-79-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

This development project resulted from the need to enhance visual flight simulators (based on computer image generation (CIG) techniques) with textured surfaces. Pilots viewing homogeneous surfaces experience an inadequate perception of motion above these surfaces as well as an ambiguity in the orientation of the surface. Therefore, it was felt that by using textured surfaces within the scene, both depth and motion cues would be made available. This report describes the approaches and techniques used to develop texture material and introduce it into a complex CIG scene. The approach is to create texture tile arrays of trees and grass from digitized photographs of natural texture. These arrays are then replicated over the surface in the fashion of tiles. Preprocessing techniques are described which eliminate the periodic effect due to the tile boundary and macropatterns within the tile itself. Level-of-detail texture tile arrays are created that match the resolution of the texture to the appropriate observer-scene viewing geometry. The level-of-detail arrays and other descriptive parameters are merged into the existing CIG software to produce textured images. Scenes depicting a landing sequence, a divebomb, and a low-altitude flight were then generated. These images show the effect of the varying levels of detail, fields of viewing geometries, and scene deriving distance and motion cues from the additional information contained in the textured images. GRA

N80-16771# Maryland Univ., College Park.

A COMPARISON OF SOME SIMPLE METHODS FOR EXTRACTING TEXTURE PRIMITIVES AND THEIR EFFECTIVENESS IN TEXTURE DISCRIMINATION

Shyuan Wang, Flavio R. D. Velasco (Inst. de Perquisas Espaciais, Sao Paulo, Brazil), and Azriel Rosenfeld. Apr. 1979. 34 p. refs. (Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A073956; TR-759; AFOSR-79-0966TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Three simple methods of extracting texture primitives are compared. It appears that the simplest of these, thresholding at a fixed percentile, yields primitives that are quite effective in texture discrimination. GRA

N80-16772# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.

SOME N BY DN LINEAR COMPLEMENTARITY PROBLEMS SOLVABLE BY A PRINCIPAL PIVOTING ALGORITHM WITH APPLICATIONS

Ikuyo Kaneko and Jong-Shi Pang. Apr. 1979. 40 p. refs. Prepared in cooperation with Wisconsin Univ., Madison. (Contract N00014-75-C-0621; Grant NSF ENG-77-11136; RR0140701)

(AD-A073929; MSRR-435; WP-59-78-79) Avail: NTIS HC A03/MF A01 CSCL 12/1

The purpose of this paper is to study some recent applications of the n by dn LCP solvable by a parametric principal pivoting algorithm (PPP algorithm). First, it is shown that by analyzing the n by dn LCP we could study the problem of solving a system of equations and the (nonlinear) complementarity problem when the function involved is separable. Next, we examine conditions under which the PPP algorithm is applicable to a general LCP, and then present examples of LCP's arising from various applications satisfying the conditions, included among them is the n by dn LCP with a certain P-property. Finally we study a special class of n by dn LCP's which do not possess

the P-property but to which the PPP algorithm is still applicable, a major application of this class of problems is a certain economic spatial equilibrium model with piecewise linear prices. GRA

N80-16773# California Univ., Livermore. Lawrence Livermore Lab. Dept. of Hazards Control.
BIOSAY: A COMPUTER PROGRAM TO STORE AND REPORT BIOASSAY DATA
G. E. Williams and J. R. Parlagreco. Dec. 1978. 16 p.
(Contract W-7405-eng-48)
(UCID-17989) Avail: NTIS. HC A02/MF A01

A computer program designed to manipulate bioassay data is presented. The program contains a data sorting option which allows all the results for particular individuals, or groups of individuals with common attributes, to be separated from the data base. The computer code is written in a conversational tone with aids which make it usable by even casual users of the computer system. DOE

N80-16774# SRI International Corp., Menlo Park, Calif.
ON-LINE PROGRAMMER'S MANAGEMENT SYSTEM. Final Technical Report, Sep. 1977 - Mar. 1979
Bruce L. Parsley, Harvey G. Lehtman, and Susan Kahn. Aug. 1979. 72 p. refs.
(Contract F30602-77-C-0185; AF Proj. 5581)
(AD-A074468; RADC-TR-79-205) Avail: NTIS. HC A04/MF A01. CSCL 09/2

This report is composed of studies that have been conducted to develop the NLS system as an on-line programming environment and to provide an on-line JOVIAL interactive debugger with the capabilities to debug JOVIAL language programs. The final report contains several design additions to the NLS system to create an on-line programming environment. A JOVIAL User's Guide prepared in Addendum Technical Report I provides an extensive set of commands for using the JDAD Debugger. Adendum Technical Report II provides a generalized approach to debugging and describes the NLS/NSW Do-All Debugger (DAD). GRA

N80-16775# Augmentation Resources Center, Cupertino, Calif.
ON-LINE PROGRAMMER'S MANAGEMENT SYSTEM. ADDENDUM 1: USER'S GUIDE TO THE JOVIAL DEBUGGER. Final Technical Report, Sep. 1977 - Mar. 1979
Bruce L. Parsley, Harvey G. Lehtman, and Susan Kahn. Griffiss AFB, N.Y. RADC. Aug. 1979. 96 p.
(Contract F30602-77-C-0185; AF Proj. 5581)
(AD-A074495; RADC-TR-79-205-Add-1) Avail: NTIS. HC A05/MF A01. CSCL 09/2

This report is composed of studies that have been conducted to develop the NLS system as an on-line programming environment and to provide an on-line JOVIAL interactive debugger with the capabilities to debug JOVIAL language programs. The final report contains several design additions to the NLS system to create an on-line programming environment. A JOVIAL User's Guide prepared in Addendum Technical Report I provides and extensive set of commands for using the JDAD Debugger. GRA

N80-16776# SRI International Corp., Menlo Park, Calif.
ON-LINE PROGRAMMER'S MANAGEMENT SYSTEM. ADDENDUM 2: PROGRAMMER'S GUIDE TO THE DEBUGGER. Final Report, Sep. 1977 - Mar. 1979
Bruce L. Parsley, Harvey G. Lehtman, and Susan Kahn. Aug. 1979. 215 p.
(Contract F30602-77-C-0185; AF Proj. 5581)
(AD-A074496; RADC-TR-79-205-Add-2) Avail: NTIS. HC A10/MF A01. CSCL 09/2

A generalized approach to debugging is given. The NLS/NSW Do-All debugger (DAD) is described. GRA

N80-16777# Oak Ridge National Lab., Tenn.
FORTRAN SUBROUTINES FOR BICUBIC SPLINE INTERPOLATION
P. W. Gaffney. Jul. 1979. 33 p. refs.
(Contract W-7405-eng-26)
(ORNL/CSD/TM-67) Avail: NTIS. HC A03/MF A01

FORTRAN subroutines for computing a bicubic spline function which interpolates values of a function u on a rectangular grid are presented. DOE

N80-16778# Argonne National Lab., Ill.
ITERATIVE SOLUTION OF LINEAR PROGRAMS
O. L. Mangasarian. Jul. 1979. 26 p. refs.
(Contract W-31-109-eng-38)
(ANL-79-75) Avail: NTIS. HC A03/MF A01

By perturbing a linear program to a quadratic program, it is possible to solve the latter in its dual variable space by iterative techniques such as successive over-relaxation methods. This solution provides a solution to the original linear program. DOE

N80-16779# Los Alamos Scientific Lab., N. Mex.
MINICOMPUTER-BASE INTERACTIVE IMAGE PROCESSING
J. R. Breedlove, Jr. and S. T. Alexander. 1979. 8 p. refs. Presented at the 1st Intern. Micro and Mini Computer Conf. and Exposition, Houston, Tex., 14 Nov. 1979.
(Contract W-7405-eng-36)
(LA-UR-79-1912; CONF-791104-2) Avail: NTIS. HC A02/MF A01

A mini-computer-based system for interactive image processing and interactive reduction of data from photographs, radiographs, and other image-like information is presented. This system, Digital Image Analysis and Display System (DIADS), represents an efficient alternative to existing supercomputer-based image processing for most problems. DIADS consists of two linked minicomputers with conventional computer peripherals, special tricolor image processing hardware, and extensive supporting software for handling large arrays of data. DIADS is described, and examples of image processing and image analysis results are shown. DOE

N80-16780# Argonne National Lab., Ill.
THE DEVELOPMENT AND APPLICATION OF ENVIRONMENTAL MAPPED DATA DIGITIZATION, ENCODING, ANALYSIS, AND DISPLAY SOFTWARE FOR THE ALICE SYSTEM. VOLUME 1. Interim Report
L. W. Amiot, R. J. Lima, S. D. Scholbrock, C. B. Shelman, and R. H. Wehman. Jun. 1979. 60 p. refs.
(Contract W-31-109-eng-38)
(ANL-79-71-Vol-1) Avail: NTIS. HC A04/MF A01

The ALICE system is described along with the software developed for the processing of mapped environmental information used in city and regional planning, environmental analysis, energy assessment, and resource management. DOE

N80-16781# Oak Ridge National Lab., Tenn.
PIE: A FORTRAN SUBROUTINE FOR PLOTTING CIRCLES, CONCENTRIC CIRCLES, PIE CHARTS, AND SHADED PIE CHARTS
C. A. Dillard. Oct. 1979. 18 p.
(Contract W-7405-eng-26)
(ORNL/CSD/TM-82) Avail: NTIS. HC A02/MF A01

A set of FORTRAN subroutines designed to draw circles, concentric circles, pie charts, and shaded pie charts is described. These subroutines run on IBM/360 computers and the PDP-10. Subroutine PLOT is the only plotting routine used; thus, drawings can be made on Versatec, Calcomp, or Tektronix plotters. DOE

N80-16782# California Univ., Livermore. Lawrence Livermore Lab.
EXPALS: FORTRAN CODE FOR EXPONENTIAL APPROXIMATION BY LEAST SQUARES
C. D. Gardner. 1 Aug. 1978. 47 p.
(Contract W-7405-eng-48)
(UCRL-14541-Rev-2) Avail: NTIS. HC A03/MF A01

A FORTRAN program for obtaining a weighted least squares fit of a sum of exponentials to be run on CDC 6600 or CDC 7600 computers is described. This routine fits a linear combination of real exponential decay functions by the Prony-Householder iteration method. The mathematics and programming involved in EXPALS are presented. Also included are output of examples to test the program. DOE

N80-16783# California Univ., Livermore. Lawrence Livermore Lab.
DATA FLOW COMPUTING: SOFTWARE DEVELOPMENT
R. McGraw. 23 Jul. 1979. 11 p. refs. Presented at the Distributed Computing Systems Conf., Huntsville, Ala., 1-4 Oct. 1979.

(Contract W-7405-eng-48)
(UCRL-83026; CONF-791012-1) Avail: NTIS HC A02/MF A01

The problem of language design for a data flow environment is presented. Several alternatives are surveyed for a data flow language and then one specific effort is considered: MIT VAL. This language stresses implicit concurrency. Both programmer and translator can easily identify and exploit concurrency because VAL disallows all forms of side-effects and aliasing. An analysis of the language and areas of continued research is given. While substantial progress is made, much remains to be done in the areas of language design, translation, and use. DOE

N80-16784# Sandia Labs., Albuquerque, N. Mex.
COMPARISON OF NONLINEAR LEAST SQUARES SOFTWARE
K. L. Hiebert. Aug. 1979. 45 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-0483) Avail: NTIS HC A03/MF A01

The comparison of twelve readily available FORTRAN codes (E04GAF, E04FAF, LMDER, LMDIF, ISQFDN, LSQFDQ, LSQNDN, NL2SOL, NSO3A, SNWT, TJMAR1, ZXSSQ) which solve unconstrained nonlinear least-squares problems is presented. A set of 36 problems reported in the literature was used. To the extent possible, the parameters for the copes were set so as to have the codes solve equivalent problems. However, no code changes were made to achieve this goal. To test the robustness of the codes the initial starting value of the variables and the scaling of both the functions and the variables were varied. While measurements of efficiency such as the number of function evaluations and/or Jacobian evaluations and relative time were recorded, conclusions were based on the reliability of the codes. DOE

62 COMPUTER SYSTEMS

Includes computer networks.

N80-16785 Wisconsin Univ., Madison.
THE DESIGN AND IMPLEMENTATION OF USER ORIENTED SYSTEMS. Ph.D. Thesis
Nathan Relles. 1979. 195 p.
Avail: Univ. Microfilms Order No. 7924190

A taxonomy of user-oriented features of computer systems is developed, consisting of on-line aids, alternative modes of communication, defaults, language extensibility, and effective language design. A set of operating system capabilities is proposed to simplify and encourage the provision of user aids. A set of primitives realigning these capabilities was implemented in the form of a user interface that enables any system to provide user aids consistently, efficiently, and in an unobtrusive manner. An experiment was conducted to investigate the relationships among on-line aids, user performance, and ease of use. The user interface served both as an instrument and object of evaluation. In the first sense, the interface was used to implement the different forms of assistance under study and to monitor their use. At the same time, properties of the interface were evaluated with respect to their effect on ease of use and the effort required to incorporate on-line aids into a program. Dissert. Abstr.

N80-16786# California Univ., Livermore. Lawrence Livermore Lab.
CORRECTING THE PLOTTING SYMBOL POSITIONING ERROR IN TEKTRONIX'S GRAPH PLOT 50 SOFTWARE (4050A07 SERIES B)
L. B. Owen. 6 Aug. 1979. 11 p.
(Contract W-7405-eng-48)
(UCID-18234) Avail: NTIS HC A02/MF A01

A simple modification to the Graph Plot 50 software, devised for eliminating the symbol positioning error, is described. The eight most frequently used plotting symbols are automatically compensated to insure proper positioning when output is created on either the series 4050 screen display or the 4662 plotter. Other keyboard characters can be used as plotting symbols, if desired, but automatic positioning compensation is not provided. DOE

N80-16787# National Bureau of Standards, Washington, D.C. Inst. of Computer Sciences and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: A KEY NOTARIZATION SYSTEM FOR COMPUTER NETWORKS. Final Report
Miles E. Smid. Oct. 1979. 39 p. refs.
(PB80-104698; NBS-SP-500-54; LC-79-600160) Avail: NTIS HC A03/MF A01 CSCL 09B

A cryptographic key notarization system is proposed for computer networks to protect personal (nonshared) files, to communicate securely both on and off-line with local and remote users, to protect against key substitution, to authenticate system users, to authenticate data, and to provide a digital signature capability using a nonpublic key encryption algorithm. The system is implemented by the addition of key notarization facilities which give users the capability of exercising a set of commands for key management as well as for data encryption functions. Key notarization facilities perform notarization which, upon encryption, seals a key or password with the identities of the transmitter and intended receiver. GRA

N80-16788# University Coll., London (England). Dept. of Statistics and Computer Science.
INVESTIGATION OF REQUIREMENTS AND IMPLEMENTATION OF FACILITIES FOR CONNECTING UK HOSTS TO EURONET. Final Report
P. L. Higginson and P. T. Kirstein. Jul. 1979. 29 p. refs.
(BLL-BLRDR-5508) Avail: British Library Lending Div., Boston Spa, Engl.

Topics covered include (1) the LSI-2 test host hardware; (2) design of the X25 software and its interface; (3) protocol design; (4) support facilities and testing aids; (5) development and testing of the test host software; (6) black box problems; and (7) advisory and related activities. A.R.H.

N80-16789# University Coll., London (England). Dept. of Statistics and Computer Science.
FACSIMILE TECHNIQUES FOR ON-LINE COMPUTER NETWORKS. Final Report
Peter T. Kirstein. Feb. 1979. 14 p. refs.
(BLL-BLRDR-5506; INDRA-TR-79-54) Avail: British Library Lending Div., Boston Spa, Engl.

A facsimile communication technique called 'store and inform' is proposed and demonstrated to be feasible over a real packet switched data network. A method for building a replicable system to run over the commercial packet switched data networks is given. An economic analysis of the system shows it to be reasonably attractive. K.L.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-17018# Joint Publications Research Service, Arlington, Va.
MICROCOMPUTER-BASED CNC 600 NUMERICAL CONTROL SYSTEM DESCRIBED
Guenter Wollenberg. *In its* E. Europe Rept.: Sci. Affairs, No. 659 (JPRS-74911) 11 Jan. 1980. p. 77-99. refs. Transl. into ENGLISH from Radio Fernsehen Elek. (E. Berlin), v. 28, no. 11 1979. p. 694-700 (For primary document see N80-17015 07-99)
Avail: NTIS HC A07/MF A01

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-16790 Washington Univ., Seattle.
CLASSES OF NON-COMMUTATIVE RINGS WITH DEDE-

KIND DOMAIN-LIKE PROPERTIES AND MODULE OVER NON-COMMUTATIVE VALUATION RINGS Ph.D. Thesis
Bo-Yuan Chiu 1979 75 p
Avail: Univ. Microfilms Order No. 8002440

A notion of 'radial' of an ideal is introduced for right Noetherian polynomial identity rings and it is shown that in Noetherian dedekind orders, every primary ideal is a power of its radical, and that primary decompositions exist in Noetherian prime PI-rings. Classes of prime polynomial identity rings related to the dedekind rings and the relation of these classes, one to another, are investigated. These include ZPI-rings, multiplication rings, and weak multiplication rings. A weak cancellation property of ideal arithmetic is introduced, under which it is shown that for Noetherian rings the weak multiplication property implies the ZPI property, and that the classes of multiplication rings and weak multiplication rings are identical. Modules over some of the classes of rings are studied, and several generalizations of classical results about modules over the commutative specializations are discovered to hold. Dissert. Abstr.

N80-16791 Texas Univ. at Austin.
SMOOTH GROUP ACTIONS OF PRIME ORDER AND FIXED POINT SETS Ph.D. Thesis
Gary Alan Krause 1979 69 p
Avail: Univ. Microfilms Order No. 7928315

Given an odd prime action on a manifold, there are many different ways to orient the fixed set systematically which depend only on the prime and the ambient manifold. For certain actions, the signatures of the manifold and of the fixed set must be congruent modulo four for at least one of these orientation systems. An approach (using the structure of bordism rings of orientation preserving actions on closed smooth manifolds) to generalizing this congruence to all such orientation systems is indicated. It is shown that the generalization is true for generators of these rings. Dissert. Abstr.

N80-16792 Stanford Univ., Calif.
THE DIRICHLET PROBLEM FOR QUASILINEAR ELLIPTIC EQUATIONS WITH LOWER REGULARITY AT THE BOUNDARY Ph.D. Thesis
Gary Mitchell Lieberman 1979 111 p
Avail: Univ. Microfilms Order No. 8001959

Solutions to the Dirichlet problem for quasi-linear elliptic, second order partial differential equations, i.e., classical solutions of these equations in a bounded n-dimensional domain with prescribed values on the boundary of the domain are considered. Results indicate that under appropriate hypotheses on the equation and the domain, the boundary gradient estimate holds for arbitrary boundary values which are continuously differentiable with Holder continuous first derivatives. Dissert. Abstr.

N80-16793 California Univ., Berkeley.
TRANSFORMATIONAL STRUCTURE OF ALGEBRAIC LOGICS Ph.D. Thesis
Richard Joseph Thompson 1979 345 p
Avail: Univ. Microfilms Order No. 8000540

A general approach to algebraic logic (in the restricted sense of algebraic theories adequate for investigating predicate logic-such as cylindric algebras and polyadic algebras) is presented. Given a variety of algebras, the members of which have Boolean algebras as reducts, the problem arises of showing that all nontrivial members of the variety (or all members of a subclass with a simple algebraic formulation) are subdirect products of certain concrete Boolean set algebras, to which other concrete operations have been adjoined. Dissert. Abstr.

N80-16794 Stanford Univ., Calif.
INFLUENCE FUNCTIONS FOR CENSORED DATA Ph.D. Thesis
Nancy Margaret Reid 1979 41 p
Avail: Univ. Microfilms Order No. 8001996

Influence curves of censored data estimators are considered. The influence curve is a function used in the theory of robust estimation both as a qualitative description of the robustness of an estimator and as a tool for calculating its asymptotic variance. The influence curve of the Kaplan-Meier estimate was calculated. It is shown that the influence curve provides an alternative derivation of the asymptotic variance of this estimate. The regularity conditions required to make this derivation rigorous were verified in the appendix. A chain rule for influence curves was established and was used to calculate the influence curves of censored data estimators that were functions of the Kaplan-Meier estimate. The robustness properties and asymptotic variances of these estimates follow directly. Some examples of this unified approach to calculating variances are given. Dissert. Abstr.

N80-16795 California Univ., Berkeley.
AN EXTENSION OF STRASSEN'S LAW AND SOME PROBABILISTIC RESULTS IN COMPLEX ANALYSIS Ph.D. Thesis
Carl Eric Mueller 1979 63 p
Avail: Univ. Microfilms Order No. 8000452

Several problems concerning Brownian motion and diffusion processes were investigated. A general theorem which contains two of the leading results about Brownian motion are Strassen's version of the law of the iterated logarithm and Levy's modulus of continuity for Brownian paths is proved. For both the law of the iterated logarithm and Levy's modulus, tests for upper and lower functions are known. These results are also shown to be corollaries of a single theorem. The BMO and BMO sub Rho spaces are characterized in terms of the stopping times of Brownian motion. This result resolves a conjecture of Sarason by characterizing BMO sub Rho in terms of Carleson measures. A probabilistic proof of a criterion for BMO due to Hayman and Pommerenke is given. Dissert. Abstr.

N80-16796 Iowa State Univ. of Science and Technology, Ames.
VARIANCE APPROXIMATIONS FOR ESTIMATORS OF FIXED AND RANDOM EFFECTS IN MIXED LINEAR MODELS Ph.D. Thesis
Raghu Nath Kackar 1979 171 p
Avail: Univ. Microfilms Order No. 8000143

The approximate variance formula involved the variances and the covariances of the variance component estimators. Approximate variances and covariances for the Maximum Likelihood and Restricted Maximum Likelihood estimators of the variance components are derived. The computation of these approximate variances and covariances involved evaluating central product moments of quadratic forms of normally distributed random vectors up to the fourth order. Alternative estimation procedures are derived by applying Bayesian concepts. Approximate procedures for interval estimation are also considered. The performance of the approximate variance formula was investigated numerically in the context of estimation of treatment contrasts in balanced incomplete block designs. Dissert. Abstr.

N80-16797 Stanford Univ., Calif.
CONSISTENT NONPARAMETRIC ESTIMATION OF BEST LINEAR CLASSIFICATION RULES/SOLVING INCONSISTENT SYSTEMS OF LINEAR INEQUALITIES Ph.D. Thesis
Richard Lee Greer 1979 294 p
Avail: Univ. Microfilms Order No. 8001930

A nonenumerative algorithm called the tree algorithm is presented which consistently estimates from training sample data those decision rules which are best in a fixed class of linear decision rules for classifying an observation vector into one of two multivariate distributions. The loss function used to define what is meant by a best classification rule is essentially any reasonable statistical measure of loss or in more precise terms, it is a function of the rule only through its misclassification probabilities and it is a nondecreasing function of those. The Bayes, Minimax, and Neyman-Pearson loss functions are included as well as new or relatively unnoticed loss functions derived from norms of the vector of misclassification probabilities. Dissert. Abstr.

N80-16798# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
OUTPUT ENSEMBLE AVERAGE OF PERIODICALLY EXCITED LINEAR TIME-VARYING SYSTEMS
E. Besner and J. Shinar May 1979 22 p refs

(TAE-372) Avail: NTIS HC A02/MF A01

Calculation of the mean square ensemble average of the nonstationary output of a linear time-varying system excited by a periodical random input is carried out by a direct method. Results can be obtained by a closed form solution or in a single computer run. The applicability of the method is illustrated using a missile intercept problem. Author

N80-16799*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.

ANALYSIS AND TESTING OF NUMERICAL FORMULAS FOR THE INITIAL VALUE PROBLEM

R. Leonard Brown, Kurt R. Kovach, and Jeffrey L. Popyack. Jan. 1980. 95 p. refs.

(Grant NsG-1335)

(NASA-CR-162655; UVA-528149-AMCS80-101) Avail: NTIS HC A05/MF A01 CSCL 12A

Three computer programs for evaluating and testing numerical integration formulas used with fixed stepsize programs to solve initial value systems of ordinary differential equations are described. A program written in PASCAL SERIES, takes as input the differential equations and produces a FORTRAN subroutine for the derivatives of the system and for computing the actual solution through recursive power series techniques. Both of these are used by STAN, a FORTRAN program that interactively displays a discrete analog of the Liapunov stability region of any two dimensional subspace of the system. The derivatives may be used by CLMP, a FORTRAN program, to test the fixed stepsize formula against a good numerical result and interactively display the solutions. K.L.

N80-16800# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mathematics and Statistics.

CONFIDENCE INTERVALS FOR THE COMMON VARIANCE OF EQUICORRELATED NORMAL RANDOM VARIABLES

P. F. Ramig and S. Zacks. 1 Aug. 1979. 33 p. refs.

(Contract N00014-75-C-0529; NR Proj. 042-276)

(AD-A074339; TR-37) Avail: NTIS HC A02/MF A01 CSCL 12/1

Confidence intervals for the common variance of equicorrelated normal random variable are investigated. When the correlation coefficient is unknown no uniformly most accurate invariant confidence interval for the common variance exists. We develop interval estimators which are based on the asymptotically most efficient ones by employing the best asymptotic normality of the maximum likelihood estimators. In addition to their comparison with possible competitors, their small sample efficiency is studied. A method for determining exact coverage probabilities and expected length is developed. As a result of these investigations we concluded that interval estimators based on maximum likelihood estimators are to be recommended. GRA

N80-16801# Naval Underwater Systems Center, New London, Conn.

GENERALIZED ADAMS METHODS

Ding Lee. 6 Jul. 1979. 51 p. refs.

(ZR0000101)

(AD-A074548; NUSC-TR-6011) Avail: NTIS HC A04/MF A01 CSCL 12/1

It is most desirable to use an accurate numerical method that allows the use of a large step size to solve stiff initial value problems. A family of generalized Adams-Bashforth and generalized Adams-Moulton methods, which we call GAB-GAM, are shown to be derived from nonlinear multistep (NLMS) methods. GAB-GAM methods are found to have advantages in solving (1) stiff equations; and (2) a class of underwater acoustic wave propagation problems. An application of these methods is included in this report. Also, an ANSI FORTRAN program, together with a set of numerical test examples, is included. GRA

N80-16802# Naval Postgraduate School, Monterey, Calif.

NUMERICAL INVERSION OF LAPLACE TRANSFORMS M.S. Thesis

John Hollis Duncan. Jun. 1979. 192 p. refs.

(AD-A074438) Avail: NTIS HC A09/MF A01 CSCL 12/1

Inversion of Laplace transforms has been accomplished by a numerical integration along appropriate paths in the complex plane. Two general procedures have been used. The simpler and more economical employs a simple path, such as a parabola, which bends to the left. Accuracy is maintained by monitoring the oscillation of the integrand. A second method employs a steepest descent contour. GRA

N80-16803# Stanford Univ., Calif. Dept. of Operations Research.

ON Q-MATRICES, CENTROIDS AND SIMPLOTOPES

Richard W. Cottle and Rabe VonRandow. Jun. 1979. 38 p. refs.

(Contracts N00014-75-C-0267; Grant NSF MCS-76-81259)

(AD-A074959; SU-TR-79-10) Avail: NTIS HC A03/MF A01 CSCL 12/1

A necessary condition for a set of spherical (n-1)-simplicies to cover the sphere S(n-1) in R(n) is established. It is shown that the condition is also sufficient when $n = 2$ but is not so when $n > 2$. The result is viewed as a property of Q-matrices, which arise in connection with the linear complementarity problem. A partitioning theorem for a particular type of convex body known as a simplotope (the cartesian product of two simplices) is proved along with a theorem which states that the centroid of a suitable defined spherical sector has a positive inner product with each nonzero element of the sector. J.M.S.

N80-16804# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.

OPTIMAL INFORMATION ACQUISITION FOR RANDOMLY OCCURRING DECISIONS

Alimohammad Sharifnia. Sep. 1979. 154 p. refs.

(Contract N00014-79-C-0036)

(AD-A074956; SU-EES-DA-79-1) Avail: NTIS HC A08/MF A01 CSCL 12/1

This research investigates the information acquisition policies for randomly occurring decisions. A randomly occurring decision is a decision that must be made upon the occurrence of a precipitating event that occurs randomly with time. Due to the urgency often associated with this type of decision, it is difficult to obtain fresh information at the time of the decision. Therefore, the available information will be limited to the unfresh (old) information from the past. Since the information becomes outdated and obsolete in time, regular updating of the information is often desirable in order to be prepared for the decision. GRA

N80-16805# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.

ASYMPTOTIC NORMALITY OF A VARIANCE ESTIMATOR OF A LINEAR COMBINATION OF A FUNCTION OF ORDER STATISTICS

Joseph C. Gardiner and Parab Kumar Sen. Jul. 1979. 25 p. refs. Revised. Prepared in cooperation with North Carolina Univ.

(Contract N00014-79-C-0522)

(AD-A074846; RM-389-Rev) Avail: NTIS HC A02/MF A01 CSCL 12/1

An estimator of the asymptotic variance of (a randomly stopped) linear combination of a function of order statistics is considered and its asymptotic normality is studied under appropriate regularity conditions. A comparative study of the regularity conditions pertaining to the asymptotic normality and strong convergence of linear combinations of functions or order statistics and their estimated asymptotic variances is also made. GRA

N80-16806# Stanford Univ., Calif. Dept. of Computer Science.

FAST ALGORITHMS FOR SOLVING PATH PROBLEMS

Robert Endre Tarjan. Apr. 1979. 50 p. refs.

(Contracts N00014-76-C-0688; NSF MCS-75-22870)

(AD-A074079; SU-STAN-CS-79-734) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let G = (V,e) be a directed graph with a distinguished source vertex. The single source path expression problem is to find, for each vertex v, a regular expression P(s,v) which represents the set of all paths in G, from s to v. A solution to this problem can be used to solve shortest path problems, solve sparse systems of linear equations, and carry out global flow analysis. A method which computes path expressions by dividing G into components, computing path expressions on the components by Gaussian

elimination, and combining the solutions is described. This method requires O(m alpha(m,n)) time on a reducible flow graph, where n is the number of vertices in G, m is the number of edges in G, and alpha is a functional inverse of Ackermann's function. The method makes use of an algorithm for evaluation functions defined on paths in trees. A simplified version of the algorithm, which runs in O(m log n) time on reducible flow graphs, is quite easy to implement and efficient in practice. J.M.S.

N80-16807# Rutgers - The State Univ., New Brunswick, N. J.
QUALITATIVE STUDY OF NONLINEAR PROBLEMS IN ANALYSIS. Final Technical Report, 1 Jan. 1966 - 30 Jun. 1979
Jane Cronin Scanlon. 30 Aug. 1979. 12 p. refs.
(Contract DAHC04-75-C-0148; Grants DA-ARO(D)-31-124-G784; DA-ARO(D)-31-124-G1098; DA-ARO(D)-31-124-72-G69)
(AD-A074017; ARO-6131.25-M; ARO-12981.2-M; FTR-1) Avail: NTIS. HC A02/MF A01. CSCL 12/1

The objective of the work was to use qualitative methods, especially fixed point theorems and topological degree, to study nonlinear problems in analysis. Existence of solutions of wide classes of abstract nonlinear functional equations are established and the existence of recurrent and period solutions of nonlinear ordinary differential equations are obtained. Upper bounds for the number of such solutions are also obtained. (Such upper bounds for the number of periodic solutions of nonlinear ordinary differential equations have become significant in mathematical studies of chemical reactions.) Several results in the stability of periodic solutions of nonlinear ordinary differential equations were also established. Several mathematical problems which arise in physiology were studied. The most specific conclusion obtained is a clinical recommendation for the treatment of patients suffering from a rupture of an aneurysm of the circle of Willis. Finally, two books have been written: a textbook on qualitative theory of ordinary differential equations and a set of lecture notes on the mathematics of cell electrophysiology. GRA

N80-16808# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.
VECTORIZED SPARSE EXAMINATION. Interim Report.
D. A. Calahan. Aug. 1979. 13 p. refs. Presented at the Sci. Computer Inform. Exchange Meeting, Livermore, Calif., 12-13 Sep. 1979.
(Grant AF-AFOSR-2812-75; AF Proj. 2304)
(AD-A074091; AFOSR-79-0980TR) Avail: NTIS. HC A02/MF A01. CSCL 12/1

Vectorizable sparse equation solution algorithms are classified by the matrix structure which they favor. The state-of-the-art for solution of relatively dense systems is then reviewed. A hybrid vector construct is defined for the increasingly common structure of both moderate local matrix density and global matrix regularity. Estimates are made of CRAY-1 speedup achievable with this construct. A finite difference matrix is studied as an example. GRA

N80-16809# Sandia Labs., Albuquerque, N. Mex. Safeguards Evaluation Div.
USING SETS TO FIND MINIMAL CUT SETS IN LARGE FAULT TREES
R. B. Worrell and D. W. Stack. 1978. 22 p. Presented at the CUBE Symp., Los Alamos, N. Mex., 4 Oct. 1978.
(Contract EY-76-C-04-0789)
(SAND-78-1943C; CONF-781024-3) Avail: NTIS. HC A02/MF A01.

An efficient algebraic algorithm for finding the minimal cut sets for a large fault tree was defined and a new procedure which implements the algorithm was added to the Set Equation Transformation System. The algorithm includes the identification and separate processing of independent subtrees, the coalescing of consecutive gates of the same kind, the creation of additional independent subtrees, and the derivation of the fault tree stem equation in stages. The computer time required to determine the minimal cut sets using these techniques is substantially less than the computer time required to determine the minimal cut sets when these techniques are not employed. It is shown for a given example that the execution time required to determine the minimal cut sets can be reduced from 7,686 seconds to 7 seconds when all of these techniques are employed. DOE

N80-16810# Illinois Univ., Urbana. Dept. of Computer Science.
THE 1979 SIGNUM MEETING ON NUMERICAL ORDINARY DIFFERENTIAL EQUATIONS
R. D. Skeel. Apr. 1979. 137 p. refs. Meeting held at Urbana, Ill., 3 Apr. 1979.
(Contract EY-76-S-02-2383; Grant NSF MCS-78-20007)
(COO-2383-0058; UIUCDCS-R-79-963; UILU-ENG-79-1710; CONF-790403) Avail: NTIS. HC A07/MF A01.

Theory, algorithms, software, and applications related to ordinary differential equations are discussed. Specific topics addressed include stiff differential systems, the method of lines, the stability properties of linear multistep and time discretization methods, and the initial value problem. K.L.

N80-16811# Stanford Univ., Calif. Dept. of Statistics.
ESTIMATION OF RANDOM FIELDS FROM NETWORK OBSERVATIONS
A. F. Cabannes. Sep. 1979. 128 p. refs.
(Contract EY-76-S-02-2874)
(COO-2874-54; SU-TR-26) Avail: NTIS. HC A07/MF A01.

The problem of estimating a random field at points where there are no observations is considered. The study of methods of estimation and the problem of network design are addressed. DOE

N80-16812# Massachusetts Inst. of Tech., Cambridge. Constructed Facilities Div.
COMPUTATION OF HANKEL TRANSFORMS USING THE FAST-FOURIER TRANSFORM ALGORITHMS
E. Kausel and G. Bouckovalas. Aug. 1979. 49 p. refs.
(Grant NSF ENV-77-18339)
(PB80-104045; R79-12; NSF/RA-790206) Avail: NTIS. HC A03/MF A01. CSCL 12A.

An efficient numerical procedure is presented for the computation of Hankel transforms. The algorithm is based on the expression of the Hankel transform in terms of a two dimensional Fourier transform, which is then reduced to only one dimension. The latter is then evaluated with the fast Fourier transform algorithm. Examples are presented, and a listing of the computer program included. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-16813 Georgia Univ., Athens.
LINEAR AND NONLINEAR STOCHASTIC OPERATORS. Ph.D. Thesis.
Kourken Malakian. 1979. 153 p.
Avail: Univ. Microfilms. Order No. 8001019

The error due to closure approximation in hierarchy equations is computed and interpreted through convenient matrix representations developed for both the inverse method and the closure approximations in hierarchy equations. Using the inverse method, improved solutions are developed which accelerate the rate of convergence of the iterative series to different orders. A physical interpretation is given to the improved solutions which gives a better insight into the relationships between the theory of approximations, mathematical modeling and physical systems. Through a description of the analytic foundations of the theory, generalized statistical measures are defined for stochastic processes and are used to compute the statistical measures of the different classes of stochastic systems. Dissert. Abstr.

N80-16814 California Univ., Berkeley.
SPECTRAL ESTIMATION FOR A RANDOMLY SAMPLED TIME-SERIES. Ph.D. Thesis.
Anthony Douglas Thrall. 1979. 171 p.
Avail: Univ. Microfilms. Order No. 8000544

An entomological study of population cycles in which the data was frequently recorded on an irregular daily basis is

described. Spectral time series analysis that would have been readily available had the data been recorded each day of the experiment are provided. The problem is initially considered in a broader framework of time series problems which depart from the assumption that observations were recorded at discrete equispaced times. A model, specific to the above experimental situation, was then developed using a zero-one variable Y(t), which indicates the days on which observations were made. The variable was assumed to be a sequence of independent Bernoulli variables having periodic probabilities. The model was chosen to reflect the tendency of the researcher to observe the experiment more often during the week than on weekends.

Dissert. Abstr.

N80-16815 Indiana Univ., Bloomington.
A BAYESIAN APPROACH TO THE SELECTION OF VARIABLES IN MULTIPLE REGRESSION Ph.D. Thesis
Ramona Bowers Swaine 1979 122 p
Avail: Univ. Microfilms Order No. 8000951

A Bayesian approach to the selection of predictor variables for linear univariate multiple regression analysis is considered. Comparison of regression equations is made via the variance of the predictive distribution of the dependent variable. The predictor variables may be fixed and known, or they may be stochastic and unknown at the time the variable selection decision is made. These cases are considered separately. Prior distributions which allow for relationships among regression parameters of different equations are used. It is demonstrated that the predictive distribution variance permits exclusion of possible predictors in some cases. Empirical analysis shows the effects of changing the prior information used in making the decision and reveals that the predictive variance criterion gives results comparable to other popular variable selection criteria. Dissert. Abstr.

N80-16816 California Univ., Berkeley.
TESTS FOR NORMALITY AND SYMMETRY Ph.D. Thesis
Seongil Park 1979 54 p
Avail: Univ. Microfilms Order No. 8000473

Tests for normality, more generally symmetry, based on sample spacings are considered. Conditions are given under which the tests are unbiased and have isotopic power properties under convex orderings, when the weight function and scale estimator satisfies certain conditions. Asymptotic normality of the tests were obtained under mild conditions on the weight function and the underlying distribution function. Consistency of the tests are shown for certain alternatives. Asymptotically, optimal procedures were investigated and an efficient procedure was found. Pitman efficiencies of known tests were obtained and a new test which improves these tests was proposed.

Dissert. Abstr.

N80-16817 Princeton Univ., N. J.
ROBUST CONFIDENCE INTERVALS FOR THE ONE- AND TWO-SAMPLE PROBLEMS Ph.D. Thesis
Karen Kafadar 1979 259 p
Avail: Univ. Microfilms Order No. 7928475

A robust confidence interval for location in the one-sample problem and for the difference in locations for the two-sample problem is evaluated for its efficiency in stretched-tailed situations. The confidence interval uses an M-estimate called the biweight and its estimated variance, and the critical point from a standard Student's-t distribution. Using Monte Carlo simulation techniques, the biweight confidence intervals are shown to be highly efficient, even for extremely small error rates, on samples of sizes 5, 10, and 20. For common underlying distributions, a biweight-confidence interval using pooled scales is to be recommended, and the distribution of biweight-'t' can be approximated by a Student's-t on nine-tenths of the nominal degrees of freedom. When the underlying distributions are suspected to be different, an unpooled scale estimate should be used, and the distribution of 't' approximated by Student's-t on three-fourths of the degrees of freedom. Dissert. Abstr.

N80-16818# Florida State Univ., Tallahassee. Dept. of Statistics.
DISTRIBUTIONAL RESULTS FOR RANDOM FUNCTIONALS OF A DIRICHLET PROCESS
Robert C. Hannum, Myles Hollander, and Naftali A. Langberg
Aug. 1979 13 p refs
(Contract DAAG29-79-C-0158; Grant AF-AFOSR-3678-78)
(AD-A074698; FSU-Statistics-M520; ARO-16713.1-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

An expression is obtained for the distribution function of the random variable the definite integral of ZdP where P is a random distribution function chosen by Ferguson's (1973) Dirichlet process on (R, B) (R is the real line and B is the o-field of Borel sets) with parameter alpha, and Z is a real-valued measurable function defined on (R, B) satisfying the definite integral of the absolute value of Z to the derivative of alpha - infinity. As a consequence, we show that when alpha is symmetric about O and Z is an odd function, then the distribution of the definite integral of ZdP is symmetric about zero. GRA

N80-16819# Massachusetts Univ., Amherst. Dept. of Mathematics and Statistics.
ON THE UNIFORMLY MINIMUM VARIANCE UNBIASED ESTIMATORS OF THE VARIANCE AND ITS RECIPROCAL OF AN INVERSE GAUSSIAN DISTRIBUTION Interim Report
Ramesh M. Korwar Jul. 1979 10 p refs
(Contract F49620-79-C-0105; AF Proj. 2304)
(AD-A074090; AFOSR-79-0979TR; TR-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

The two-parameter Inverse Gaussian distribution is found to have useful applications in a wide variety of fields. The uniformly minimum variance estimator of its mean is known and is the simple mean. However, no such estimator of the variance is reported in literature. Here the uniformly minimum variance unbiased estimators of the variance and its reciprocal are derived. GRA

N80-16820# Kansas Univ., Lawrence. Dept. of Mathematics.
STOCHASTIC FILTERING AND CONTROL Interim Report, 16 May 1978 - 15 May 1979
Tyrone E. Duncan May 1979 11 p refs
(Grant AF-AFOSR-3177-77; AF Proj. 2304)
(AD-A074258; AFOSR-79-0981TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The topology of the space of minimal transfer functions has been studied with particular emphasis on symmetric transfer functions and a number of important new results have been obtained. Understanding the topology of the space of transfer functions is important in the development of identification algorithms and symmetric transfer functions arise in the description of many physical systems. The problem of state space realization of transfer functions for systems with delays has also been studied and useful results have been obtained. The problems of deterministic control, stochastic filtering and stochastic control have been studied for linear pure delay time systems. A geometric approach has been used which has simplified previous results and has obtained new results. In addition, preliminary investigations of some other related research areas has commenced.

GRA

N80-16821# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
PROBABILITY AND STATISTICS AND APPLICATIONS Final Scientific Report, 1 Jun. 1977 - 31 May 1979
Leon Jay Gleser and David S. Moore Jul. 1979 10 p refs
(Grant AF-AFOSR-3291-77; AF Proj. 2304)
(AD-A074257; AFOSR-79-0961TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This final report reviews the following work: minimax estimation of the mean vectors of multivariate normal distributions and of the slopes of multivariate linear regression models when the error covariance matrix is unknown; minimax properties of generalized ridge regression estimators of regression coefficients in the classical linear model; improvements on inadmissible simultaneous estimators for the parameters of k discrete populations; Bayes multiple comparison procedures in two factor ANOVA designs; calculations of and properties of point and interval estimators of slope parameters in multivariate errors in variables regression models (linear functional equations); asymptotic pointwise optimal and asymptotically optimal sequential Bayes regional estimators for functions of a vector parameter; chi-square goodness-of-fit tests for censored data and for multivariate

normality, and the general theory and application of chi-square tests. A bibliography of publications, reports, and dissertations supported by the grant is provided. GRA

N80-16822# Oak Ridge National Lab., Tenn.
STATISTICAL ANALYSIS OF THE INTERRUPTED TIME-SERIES EXPERIMENT: SOME PROBLEMS AND A RECOMMENDED SOLUTION
T. C. Mawhinney (Indiana Univ.) and D. J. Pack (Ohio State Univ.) 1979 50 p refs Presented at the TIMS/ORSA Natl. Meeting, Milwaukee, 15 Oct. 1979
(Contract W-7405-eng-26)
(CONF-791043-1; CONF-790872-1) Avail: NTIS HC A03/MF A01

The practical implications of modeling observation dependencies using an ARIMA model with differences in before-after N's and O's as compared to the standard t-test and Behrens-Fisher test are evaluated by use of simulated data variations. Results of both the simulation study and statistical theory support the conclusion that ARIMA models should be employed to evaluate before-after (interrupted) time series data in order to avoid the potential of biased conclusions concerning true intervention effects. DOE

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-16823 Stanford Univ., Calif.
INTERACTIVE SOLUTION OF MULTICRITERION ZERO-ONE VARIABLE PROBLEMS WITH UNCERTAIN INFORMATION Ph.D. Thesis
Priyadarshi Ramprasad Shukla 1979 253 p
Avail: Univ. Microfilms Order No. 8002012

Algorithms for solving multicriterion zero-one variable problems with uncertain information are developed. Two cases of uncertainty for the trade off values are explored. The first case considers a range for the trade off value instead of a certain unique value. The second case assumes that the basic information structure is probabilistic and that the unique tradeoff value being obtained is generated from this probabilistic structure. Computational experience with the interactive algorithm obtained by solving nine different problems with two or three criteria and up to 35 zero-one variables shows that the performance of the algorithm is acceptable for practical application. The algorithm performs acceptably well even when the tradeoffs are assessed with considerable uncertainty. Dissert. Abstr.

N80-16824*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN AVERAGING BATTERY MODEL FOR A LEAD-ACID BATTERY OPERATING IN AN ELECTRIC CAR Final Report
John M. Bozek Dec. 1979 19 p refs
(Contract EC-77-A-31-1044)
(NASA-TM-79321; DOE/NASA/1044-79/5; E-277) Avail: NTIS HC A02/MF A01 CSCL 12B

A battery model is developed based on time averaging the current or power, and is shown to be an effective means of predicting the performance of a lead acid battery. The effectiveness of this battery model was tested on battery discharge profiles expected during the operation of an electric vehicle following the various SAE J227a driving schedules. The averaging model predicts the performance of a battery that is periodically charged (regenerated) if the regeneration energy is assumed to be converted to retrievable electrochemical energy on a one-to-one basis. Author

N80-16825# Illinois Univ. at Chicago Circle, Chicago. Dept. of Mathematics.
CIRCULAR BALANCED REPEATED MEASUREMENTS DESIGN Interim Report
Constantin Magda Jul. 1979 25 p refs
(Grant AF-AFOSR-3050-76; AF Proj. 2304)
(AD-A074234; AFOSR-79-0973TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The concept of a circular design is defined and when proper balance for various effects is assumed, its universal optimality is proved over the class of all designs with the same parameters. Such designs are shown to minimize the variance of the best linear unbiased estimators of contrasts of residual and direct effects over the class of equireplicated designs. All models assume first order residual effects and are of circular nature. GRA

N80-16826# National Technical Information Service, Springfield, Va.
NETWORK FLOWS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Sep. 1979
Brian Carrigan Oct. 1979 76 p Supersedes NTIS/PS-78/1032; NTIS/PS-77/0891; NTIS/PS-76/0788; NTIS/PS-75/694; NTIS/PS-75/065
(NTIS/PS-79/1078/9; NTIS/PS-78/1032; NTIS/PS-77/0891; NTIS/PS-76/0788; NTIS/PS-75/694; NTIS/PS-75/065) Avail: NTIS HC $28.00/MF $28.00 CSCL 12B

The bibliography cites research reports concerning applications of network flows to problem solving. Studies on job sequencing, transportation models, water resources, communication systems, data processing, waste disposal, and circuit analysis are included. This updated bibliography contains 69 abstracts, 42 of which are new entries to the previous edition. GRA

N80-16827# National Technical Information Service, Springfield, Va.
NETWORK FLOWS, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Report, 1970 - 1977
Brian Carrigan Oct. 1979 296 p
(NTIS/PS-79/1077/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 12B

Research reports concerning applications of network flows to problem solving are presented. Studies on job sequencing, transportation models, water resources, communication systems, data processing, waste disposal, and circuit analysis are included. (This updated bibliography contains 289 abstracts, none of which are new entries to the previous edition.) GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-16828 Washington Univ., Seattle.
WEAK BASES FOR TOPOLOGICAL SPACES Ph.D. Thesis
Leslie Owen Foged 1979 78 p
Avail: Univ. Microfilms Order No. 8002448

Weak bases are studied with emphasis on sequential spaces. Several characterizations of the sequential order of a topological space are presented and the existance of countable regular spaces of arbitrary finite sequential order is proven. Countable Hausdorff spaces of arbitrary sequential order are constructed. A g-metrizable space which is is not g-developable is constructed and it is proven that a regular space is g-metrizable if and only if it is weakly first countable and admits a sigma-locally finite k-network. It is demonstrated that a g-metrizable space is stratifiable if it has finite sequential order or if it admits a sigma-locally finite covering by compact sets. Dissert. Abstr.

N80-16829# Brown Univ., Providence, R. I. Center for Dynamical Systems.
APPLICATIONS OF CENTRE MANIFOLD THEORY
Jack Carr Jun. 1979 138 p refs
(Grant DAAG29-76-G-0294)
(AD-A074052; ARO-13915-17-M) Avail: NTIS HC A07/MF A01 CSCL 12/1

The purpose of the lectures was to give an introduction to the applications of centre manifold theory to differential equations. Most of the material is presented in an informal fashion, by means of worked examples in the hope that this clarifies the use of centre manifold theory. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-16830# Oak Ridge National Lab., Tenn.
DRAG FORCE ON A CONDUCTIVE SPHERICAL DROP IN A NONUNIFORM MAGNETIC FIELD
J. Walker and W. M. Wells Sep. 1979 30 p ref
(Contract W-7405-eng-26)
(ORNL/TM-6976) Avail: NTIS HC A03/MF A01

The forces associated with the motion of a high velocity lithium droplet cloud traversing the magnetic field of a fusion reactor are derived. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-16831 British Broadcasting Corp., Kingswood (England).
SPHERICAL HARMONIC ANALYSIS AND SOME APPLICATIONS TO SURROUND SOUND
P. S. Gaskell Nov. 1979 19 p refs
(BBC-RD-1979/25) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Spherical harmonic analysis in three dimensions and azimuthal harmonic analysis in two dimensions are used in studying the problems associated with transmitting surround sound. Some of the fundamental factors and limitations of surround sound transmission are highlighted. A number of specific examples are presented. M.M.M.

N80-16832 Texas Univ. at Austin.
AN EXAMINATION OF COUPLED MODE THEORY AS APPLIED TO UNDERWATER SOUND PROPAGATION Ph.D. Thesis
Steven Ross Rutherford 1979 217 p
Avail: Univ. Microfilms Order No. 7928353

The mathematical formalism of coupled mode theory as applied to underwater sound propagation in a range dependent, ocean environment was investigated theoretically. The range dependence of an acoustic medium may be characterized by two types, range variability of the geoacoustic parameters such as sound speed and range variability of the boundary conditions. Both types of range variation are considered and coupled mode theory and its various approximations with respect to the range variability of the ocean bottom are examined. Numerical calculations for the field in a wedge-shaped waveguide are presented to illustrate the effects of the boundary condition approximation and to show how the modifications to the theory produce the desired results. The mathematical formalism is presented in a form amenable to numerical calculations. Also, numerical methods for implementing the theory are described and discussed. Dissert. Abstr.

N80-16833 Stanford Univ., Calif.
THE DESIGN OF EFFICIENT, BROADBAND ULTRASONIC TRANSDUCERS Ph.D. Thesis
John Douglas Fraser 1979 189 p
Avail: Univ. Microfilms Order No. 8001918

A new perturbation theory for wedge transducers was developed. In each case, the fundamentals of the operation of the transducers are discussed, and design techniques are given. Supporting technology was also developed, including the fabrication of composite acoustic materials, formation of acoustically thin bonds, and electrical matching transformers. Characterization techniques are given, and results are compared with theory and with the prior state of the art. Octave bandwidth bulk wave transducers operating in water with less than 4 dB total round trip insertion loss and good impulse responses were produced, as well as practical wedge transducers with conversion efficiencies as high as 44%. These transducers offer improved resolution in imaging applications and greater time-bandwidth products in signal processing applications as well as improved signal-to-noise ratio in both applications. Dissert. Abstr.

N80-16834 Stanford Univ., Calif.
A STOCHASTIC APPROACH TO ULTRASONIC TISSUE CHARACTERIZATION Ph.D. Thesis
Linda Fellingham Joynt 1979 122 p
Avail: Univ. Microfilms Order No. 8001949

Successive echo trains returned from insonified tissue were considered to be sample functions from a random process. Radio frequency echoes returned from the body during ultrasound examination by a clinical B-mode instrument were recorded in real time and subsequently analyzed off-line. Various studies of the heart were made in an attempt to develop a tissue signature characterizing diseased heart muscle as distinct from normal heart muscle. Models for normal and damaged myocardium were developed that led to a successful differentiation based on the statistics of the amplitude distributions of the returned echoes. Rician probability density functions were shown to provide a good fit to data from 'in vivo' hearts. Studies of other tissues were performed applying frequency domain. Frequency spectra were developed and used to yield information about the average spatial structure that was not discernible on the usual ultrasonic scanner display. Dissert. Abstr.

N80-16835 Engineering Sciences Data Unit, London (England).
ESTIMATION OF NOISE SHIELDING BY BARRIERS
1979 41 p
(ESDU-79011; ISBN-0-85679-255-1) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

When a barrier is placed between a sound source and an observer, sound reaches the observer by diffraction over the top of the barrier, or round the barrier edges, and by direct transmission through the barrier. In many practical cases the barrier is designed such that the transmission path is so highly attenuated that it may be neglected. Hence this item is only concerned with the sound reaching the observer via the edge of the barrier. A method is provided for estimating the shielding effect of a barrier in terms of the difference in sound level received at a given location on the side of the barrier remote from the noise source and the sound level received at the same location without the barrier. The sound attenuation due to a barrier is therefore dependent on the redistribution of sound energy by diffraction over the top, and round the edges, of the barrier and the increased propagation losses which result from the change in the length and direction of the sound propagation path due to the presence of the barrier. In the procedure used in this item for estimating the loss due to diffraction it is assumed that the noise is emitted by a point source and that both the source and observer are at large distances from the diffracting edge relative to the wavelengths of the sound considered. Also it is assumed that barriers are rigid, wedge-shaped (as described below) and have hard surfaces and sharp edges. ESDU

N80-16836 Engineering Sciences Data Unit, London (England).
EVALUATION OF THE ATTENUATION OF BROAD-BAND SOUND BY A NON-UNIFORM STILL ATMOSPHERE
1978 65 p Supersedes ESDU-78003
(ESDU-78003-A; ESDU-78003; ISBN-0-85679-228-4) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $578.50

This item provides a means of estimating the attenuation of sound across a frequency band, referred to as band attenuation, by the atmosphere in which the temperature and relative humidity vary along the propagation path. The band attenuation rate is estimated by integrating the discrete frequency attenuation over the appropriate frequency range. Values of discrete frequency attenuation are found. Allowance is made for spectrum shape, and guidance is given on the use of a layering technique for the estimation of attenuation when atmospheric properties vary with altitude. The atmospheric layering technique should be used only when the variation of the atmospheric parameters with altitude is known with sufficient confidence to enable the division of the atmosphere into layers within which temperature and relative humidity vary linearly with altitude. When considering

horizontal propagation of sound where the temperature and relative humidity vary along the propagation path, the suggested layering technique can be used by substituting linear distance for altitude. In this case any change in pressure between the layers due to variations in temperature is extremely small and should be neglected. A numerical method for the estimation of the band atmospheric attenuation rate, assuming an ideal filter shape, is given as the recommended prediction procedure. Listings of the programmed method in both BASIC and FORTRAN are provided. To enable a rapid estimate of the one-third octave band atmospheric attenuation rate to be made, an alternative graphical procedure is provided. A typical application is the correction of aircraft noise measurements to standard atmospheric conditions. ESDU

N80-16837*# California Inst. of Tech., Pasadena.
SECOND SOUND SHOCK WAVES AND CRITICAL VELOCITIES IN LIQUID HELIUM 2 Ph.D. Thesis
Timothy Neal Turner 1979 231 p refs
(Grant NsG-7508)
(NASA-CR-162687) Avail: NTIS HC A11/MF A01 CSCL 20A

Large amplitude second-sound shock waves were generated and the experimental results compared to the theory of nonlinear second-sound. The structure and thickness of second-sound shock fronts are calculated and compared to experimental data. Theoretically it is shown that at T = 1.88 K, where the nonlinear wave steepening vanishes, the thickness of a very weak shock must diverge. In a region near this temperature, a finite-amplitude shock pulse evolves into an unusual double-shock configuration consisting of a front steepened, temperature raising shock followed by a temperature lowering shock. Double-shocks are experimentally verified. It is experimentally shown that very large second-sound shock waves initiate a breakdown in the superfluidity of helium 2, which is dramatically displayed as a limit to the maximum attainable shock strength. The value of the maximum shock-induced relative velocity represents a significant lower bound to the intrinsic critical velocity of helium 2. M.G.

N80-16838*# Massachusetts Inst. of Tech., Cambridge.
STRESS WAVE ATTENUATION IN THIN STRUCTURES BY ULTRASONIC THROUGH-TRANSMISSION Final Report
Samson S. Lee and James H. Williams, Jr. Washington NASA Jan. 1980 32 p refs
(Grant NsG-3210)
(NASA-CR-3203) Avail: NTIS HC A03/MF A01 CSCL 20A

The steady state amplitude of the output of an ultrasonic through transmission measurement is analyzed and the result is given in closed form. Provided that the product of the input and output transduction ratios; the specimen-transducer reflection coefficient; the specimen-transducer phase shift parameter; and the material phase velocity are known, this analysis gives a means for determining the through-thickness attenuation of an individual thin sample. Multiple stress wave reflections are taken into account and so signal echoes do not represent a difficulty. An example is presented for a graphite fiber epoxy composite (Hercules AS/3501-6). A direct method for continuous or intermittent monitoring of through thickness attenuation of plate structures which may be subject to service structural degradation is provided. M.M.M.

N80-16839*# Systems Research Labs., Inc., Newport News, Va. RADA Div.
EXPERIMENTAL EVALUATION OF ACTIVE AND PASSIVE MEANS OF ALLEVIATING ROTOR IMPULSIVE NOISE IN DESCENT FLIGHT
D. S. Janakiram Nov. 1979 86 p refs
(Contract NAS1-15337)
(NASA-CR-159188; RASA/SRL-14-79-04) Avail: NTIS HC A05/MF A01 CSCL 20A

A controlled wind tunnel test program was conducted on a model 2.14 m (7 ft) diameter teetering rotor to determine the effectiveness of blade tips such as the Ogee tip and the TAMI (Tip Air Mass Injection) tip in reducing the impulsive noise due to blade-vortex interaction in descent flight. In addition, a full rectangular tip which has the same span as the Ogee tip and an effective rectangular tip which has the same lifting area as the Ogee tip were also considered. The tests were conducted at two advance ratios (0.125 and 0.14) with various descent rates ranging from steady level flight to about 6 m/sec (20 ft/sec). A comparison of the performance of different rotors showed that for the same tip Mach number and thrust, the Ogee tip rotor absorbed more power than the full rectangular tip rotor, while the TAMI tip rotor absorbed more power than the effective tip rotor. M.M.M.

N80-16840# Mississippi Univ., University. Physical Acoustics Research Group.
PROPAGATION OF SOUND THROUGH THE ATMOSPHERE: EFFECTS OF GROUND COVER 2 Final Report, 1976 - 1979
H. E. Bass and L. N. Bolen 30 Jun. 1979 55 p refs
(Grant DAAG29-76-G-0258)
(AD-A073262; PARGUM-79-01; ARO-14002.2-EX) Avail: NTIS HC A04/MF A01 CSCL 20/1

Measurements of sound amplitude in the vicinity of a ground plane have been made as a function of frequency of the sound source (50 Hz - 2000 Hz), distance of propagation (5m - 300m), and surface conditions. By treating the impedance as an adjustable parameter, the surface impedance as a function of frequency was determined from the measured amplitudes using a theoretical treatment of a spherical wave in the vicinity of a locally reacting surface. The impedance measurements covered the frequency range 50 Hz to 1000 Hz. In this frequency range, the results for three distinctly different surfaces suggest that the impedance can be computed from the specific flow resistance and that grass has little effect on the surface impedance except for decreasing the flow resistance due to the root structure. Experimental studies of surface impedance should include measurements of soil parameters such as density, specific flow resistance, and moisture content so that comparisons can be made between the results from different laboratories and so that a data base for additional theoretical development can be established. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-16841 Utah Univ., Salt Lake City.
THEORETICAL STUDIES OF EXCESS ELECTRON MOBILITIES AND CHANGE-TRANSFER SPECTRA Ph.D. Thesis
Jeanne Louise McHale 1979 112 p
Avail: Univ. Microfilms Order No. 8000968

A theoretical formalism describing the dynamics of an excess electron in equilibrium with a molecular fluid is developed. The Hamiltonian for the solvent molecules plus the extra electron was partitioned to allow the effects of the external medium to be treated in an average manner. The mean square distance traveled by the electron as a function of time was found by averaging the second moment of the electron density over the solvent molecules' positions and momenta. The influence of solvent structure and solvent dynamics on the migration of the electron is discussed. The model was applied to a one dimensional system with nearest neighbor interaction. The equations are discussed in terms of the influence of solvent molecules' fluctuations on the type of motion observed. Applications to two component systems are also treated. Dissert. Abstr.

N80-16842 Pennsylvania Univ., Philadelphia.
LOW ENERGY ELECTRON VIBRATIONAL EXCITATION OF MOLECULES ADSORBED ON SURFACES: EXPERIMENT AND THEORY Ph.D. Thesis
Wilson Ho 1979 292 p
Avail: Univ. Microfilms Order No. 7928141

A specified amount of the desired molecules are let into the vacuum system and allowed to adsorb on the surface. A beam of low energy electrons is incident on the surface and the scattered electrons are energy analyzed. Some of the electrons scatter inelastically, typically 1 part in a thousand, due to vibrational excitation of the adsorbed molecules. The character-

istic discrete energy losses reflect the particular chemical bonds of the adsorbed species on the surface. As in conventional infrared absorption and Raman scattering spectroscopies, chemical identification and molecular structural determination are possible by analyzing the vibrational frequencies and intensities. The sensitivity for detecting the adsorbed species is approximately 0.01 of the fractional coverage of the surface. Dissert. Abstr.

N80-16843 California Univ., Berkeley.
SELECTED TOPICS ON THE ELECTRONIC STRUCTURE OF SMALL MOLECULES Ph.D. Thesis
William Clarence Swope 1979 75 p
Avail: Univ. Microfilms Order No. 8000533

A systematic procedure is presented for constructing symmetrized functions of the coordinates of N fermion particles which may be used as trial wavefunctions in a quantum mechanical description of an N electron molecular system. The functions are symmetrized with respect to the mathematical point of operators which commute with the system's electronic Born-Oppenheimer Hamiltonian, as well as the permutation group. The coupling procedure is applied to the study of the electronic structure of several states of the diatomic molecule sulfur oxide. A model is presented which provides insight into some of the electric anp magnetic properties of small molecules. Dissert. Abstr.

N80-16844 Stanford Univ., Calif.
STUDIES OF ATOMS AND MOLECULES USING MULTIPHOTON ABSORPTION OF ULTRAVIOLET LASER RADIATION Ph.D. Thesis
Daniel Jacob Kigler 1979 160 p
Avail: Univ. Microfilms Order No. 8001954

Properties of excited atoms and molecules are studied using multiphoton absorption rare-gas-halide laser radiation. The basic technique involves observation of fluorescent emission from gas samples irradiated by an ArF (193 nm) or KrF (248 nm) laser. Following a review of the properties of RGH lasers and their application to nonlinear excitation, three sets of experiments are described. First, collisional and photoabsorption properties of electronically excited H2 are studied by means of selective excitation of the H2 E, F 1 Sigma g + double minimum state. Two-photon excitation of Xe (5p5 6p) at 248 nm and of Xe(+) and Kr (4p5 6p) at 193 nm forms the basis for another group of experiments. Finally, studies of photolytic production of S(1S) atoms by two-photon dissociation of OCS at 193 nm are reported. Dissert. Abstr.

N80-16845 California Univ., Berkeley.
PHOTODISSOCIATION PROCESSES IN MOLECULAR BEAMS Ph.D. Thesis
Lee Richard Carlson 1979 144 p
Avail: Univ. Microfilms Order No. 8000298

The photodissociation dynamics of molecules in a molecular beam was studied. Photofragmentation translational spectroscopy was utilized to observe the photodissociation dynamics of ozone. Using a supersonic molecular beam and a 10 nanosecond pulsed laser, the velocities of the fragment products were measured by the method of time of flight. Dissert. Abstr.

N80-16846 Rutgers - The State Univ., New Brunswick, N. J.
THE TEMPERATURE AND DENSITY DEPENDENCE OF THE NUCLEAR SPIN-SPIN INTERACTION IN HD GAS AND FLUID Ph.D. Thesis
James Richard Beckett 1979 286 p
Avail: Univ. Microfilms Order No. 7928383

Precise measurements were made of the temperature and density dependence of the indirect electron coupled nuclear spin spin interaction (J sub HD) in HD gas and liquid. These precise measurements were possible because of the double resonance spin echo technique. The use of this spin echo technique in principle allowed the frequency resolution of the measurements to be determined by the transverse decay time T sub 2, rather than by the magnetic field inhomogeneity determined decay time T sub 2. Measurements of J sub HD in liquid HD were made to precision of + or - .002 Hz. Dissert. Abstr.

N80-16847 Stanford Univ., Calif.
THE PRODUCTION OF NEUTRINOS AND NEUTRINO-LIKE PARTICLES IN PROTON-NUCLEUS INTERACTIONS Ph.D. Thesis
John Patrick Dishaw 1979 162 p
Avail: Univ. Microfilms Order No. 8001904

An experimental search was performed to look for the direct production of neutrinos or neutrino like particles. Possible sources of such particles include the semileptonic decay of new heavy particles such as charm, and the direct production of a light neutral Higgs particle such as the axion. The production of these particles was inferred by energy nonconservation in the collision of a proton with an iron nucleus. The total visible energy of the interaction was measured using a sampling ionization calorimeter. The calorimeter was calibrated with muons. Energy nonconservation in the data is manifest as a nonGaussian distribution on the low side of the calorimeter measured energy. Model calculations yielded the fraction of events expected in the nonGaussian behavior for the various sources of neutrinos or neutrino like particles. Dissert. Abstr.

N80-16848 Stanford Univ., Calif.
HIGH RESOLUTION SPECTROSCOPY OF THE HYDROGEN BALMER-ALPHA LINE Ph.D. Thesis
John Elmore Mitchel Goldsmith 1979 105 p
Avail: Univ. Microfilms Order No. 8001926

The wavelength of the hydrogen 2S sub 1/2 - 3P sub 1/2 transition, observed by using polarization spectroscopy to probe metastable hydrogen atoms produced in a dc discharge, was measured relative to a nearby molecular iodine transition. A measurement of the wavelength of the iodine transition then yielded the value R sub infinite = 109737.31476(32) cm for the Rydberg constant, with a precision more than three times greater than obtained previously. An improved measurement of the iodine wavelength could immediately yield an additional nearly three-fold improvement in the Rydberg constant, without requiring any further study of hydrogen transitions. Dissert. Abstr.

N80-16849 State Univ. of New York at Binghamton.
ON THE MANY-BODY THEORY FOR SYSTEMS CONSISTING OF COMPOSITE PARTICLES Ph.D. Thesis
Sadhu Mahendra Singh 1979 137 p
Avail: Univ. Microfilms Order No. 7923430

The many body theory for a system composed of two species, each consisting of spin 1/2 elementary constituents, was formulated in terms of four constituent composites from the first principle. The identical constituent pair language and nonidentical constituent pair language are derived from the four constituent composite language. Using a simple separable potential, for Bose like condensation of the fermion pairs into the lowest energy state, the critical density for the pair condensation in the lowest energy state as a function of the interaction strength, the momentum distribution function in the condensed mode, the pair binding energy in the low density limit as a function of the interaction strength and the ground state energy per pair as a function of the density are computed within the composite Hartree-Fock approximation. Dissert. Abstr.

N80-16850 Washington Univ., St. Louis, Mo.
THE SIMPLE ATOMIC HOPPING PROBLEM. PARTICLE CORRELATION FUNCTIONS WITH APPLICATION TO DIPOLAR INDUCED SPIN LATTICE RELAXATION Ph.D. Thesis
Otto Francis Sankey 1979 160 p
Avail: Univ. Microfilms Order No. 8002462

A model of atomic hopping is developed which takes into account the correlated motion of distinguishable particles in a lattice. These correlations are included by prohibiting multiple occupancy of a lattice site or particles to pass through each other. The method is used to derive expressions for the correlation functions which describe the motion of a single specific particle or a pair of distinguishable particles. These correlation functions are indirectly measured in NMR relaxation time studies where the relaxation is caused by magnetic dipolar interactions. Particular attention is given to spin lattice relaxation time of hydrogen in disordered phases of various metal hydrides. Dissert. Abstr.

N80-16851*# Hawaii Univ., Honolulu. Inst. for Astronomy.
NON-MAXWELLIAN VELOCITY DISTRIBUTION FUNCTIONS ASSOCIATED WITH STEEP TEMPERATURE

GRADIENTS IN THE SOLAR TRANSITION REGION. PAPER 1: ESTIMATE OF THE ELECTRON VELOCITY DISTRIBUTION FUNCTIONS
Robert Roussel-Dupre [1979] 49 p refs
(Contract NAS5-22409; Grants NsG-7536; NSF ATM-78-22202; NSF GA-31477)
(NASA-CR-162696) Avail: NTIS HC A03/MF A01 CSCL 20H

It was shown that, in the presence of the steep temperature gradients characteristic of EUV models of the solar transition region, the electron and proton velocity distribution functions are non-Maxwellian and are characterized by high energy tails. The magnitude of these tails are estimated for a model of the transition region and the heat flux is calculated at a maximum of 30 percent greater than predicted by collision-dominated theory. M.M.M.

N80-16852*# Hawaii Univ., Honolulu. Inst. of Astronomy.
NON-MAXWELLIAN VELOCITY DISTRIBUTION FUNCTIONS ASSOCIATED WITH STEEP TEMPERATURE GRADIENTS IN THE SOLAR TRANSITION REGION. PAPER 2: THE EFFECT OF NON-MAXWELLIAN ELECTRON DISTRIBUTION FUNCTIONS ON IONIZATION EQUILIBRIUM CALCULATIONS FOR CARBON, NITROGEN AND OXYGEN
Robert Roussel-Dupre [1979] 21 p refs
(Contract NAS5-22409; Grants NsG-7536; NSF ATM-78-22202; NSF GA-31477)
(NASA-CR-162695) Avail: NTIS HC A02/MF A01 CSCL 20H

Non-Maxwellian electron velocity distribution functions, previously computed for Dupree's model of the solar transition region are used to calculate ionization rates for ions of carbon, nitrogen, and oxygen. Ionization equilibrium populations for these ions are then computed and compared with similar calculations assuming Maxwellian distribution functions for the electrons. The results show that the ion populations change (compared to the values computed with a Maxwellian) in some cases by several orders of magnitude depending on the ion and its temperature of formation. A.R.H.

N80-16853# Houston Univ., Tex. Dept. of Chemistry.
INTERACTIONS OF MOLECULAR AND ION BEAMS WITH SURFACES Final Report, 1 Jan. 1977 - 31 May 1979
J. Wayne Rabalais 21 Jun. 1979 27 p refs
(Grant DAAG29-77-G-0054)
(AD-A073278; ARO-14361.24-C; FR-1) Avail: NTIS HC A03/MF A01 CSCL 20/8

Low kinetic energy active ion bombardment of transition metals, Si, Ge, Sn, Pb, graphite, and diamond have shown that chemical reactions can be induced between ion beams and surfaces. These reactions are specific and selective with respect to the ion-target combination and the thickness of the reacted layer can be controlled by varying the ion energy. The techniques of X-ray and UV photoelectron spectroscopy, auger spectroscopy, secondary ion mass spectrometry (SIMS) and thermal desorption spectrometry (TDS) under ultra-high vacuum conditions are used to characterize the products of the beam-surface reactions. The reaction of 30-3000 eV nitrogen beams with the first-row transition metals results in the formation of metal nitrides. The amount of nitrogen reacting with the metal can be correlated to the enthalpy of formation of the metal nitride. Reactions of nitrogen with M, MO, and MO2 (M = Si, Ge, Sn, Pb) produces nitrides with no evidence for nitrate, nitrite, or nitroso formation in the oxides. A mechanism is proposed for the reaction which involves charge exchange neutralization and dissociation of the ion at the surface followed by penetration into the lattice, thermalization, and finally chemical reaction. GRA

N80-16854# Oak Ridge National Lab., Tenn.
CENTRAL COLLISIONS IN INTERMEDIATE ENERGY HEAVY-ION REACTION
C. Y. Wong 1979 36 p refs Presented at the Symp. on Heavy Ion Phys. from 10-200 MeV/A, Upton, N.Y., 16 Jul. 1979
(Contract W-7405-eng-26)
(CONF-790743-5) Avail: NTIS HC A03/MF A01

To understand the underlying physics, the effect of the mean field and the effect of particle collisions are studied separately. It is found that the sudden increase in the density of the overlapping region can cause the volcano effect, leading to the complete disintegration of one of the nuclei. The self-consistent mean field also gives rise to the bunching instability when the two Fermi spheres of the colliding nucleons separate. The collision between nucleons, on the other hand, leads to irreversible dissipation, thermalization, and the possibility of a hydrodynamical description of the dynamics. The dynamics of central collisions were studied using the hydrodynamical description for many combinations of targets and projectiles at different energies. The formation of shock waves, sidesplash, and the complete disintegration of the whole nucleus are examined. Nuclear viscosity is found to affect the angular distribution of the reaction products and also the maximum compression ratio achieved during the collision. DOE

N80-16855# Brookhaven National Lab., Upton, N. Y.
NEW DIRECTIONS IN ELEMENTARY PARTICLE PHYSICS: P ANTI P FROM VERY LOW TO VERY HIGH ENERGIES
M. Jacob (CERN, Geneva) 1979 60 p refs Presented at LAMPF Workshop, Los Alamos, N. Mex., 20-31 Aug. 1979
(Contract EY-76-C-02-0016)
(BNL-26515) Avail: NTIS HC A04/MF A01

Low energy anti pp physics are reviewed including annihilation processes, the spectroscopy of baryonium states, quasinuclear states and their relation to baryonium, the spectroscopy of protonium, and access to the whole charmonium family. High energy anti pp physics is reviewed covering total cross section rise, the common shape of cross sections, real part of forward amplitude, particle production, quantum number excitation, high transverse momentum, and high mass lepton pair. The search for the weak bosons, hadron physics at collider energies, and the anti pp collider program are discussed. DOE

N80-16856# Brandeis Univ., Waltham, Mass. Dept. of Physics.
RESEARCH IN ELEMENTARY PARTICLE PHYSICS Technical Progress Report, 1 May 1978 - 29 May 1979
L. E. Kirsch and H. J. Schnitzer 1979 15 p refs
(Contract EY-76-S-02-3230)
(COO-3230-2) Avail: NTIS HC A02/MF A01

The research performed on both the theoretical and experimental properties of elementary particles is described. Experiments with the multiparticle spectrometer for kaon production, muon production, and baryonium/hadronic charm search are discussed. A.W.H.

N80-16857# City Univ. of New York, N. Y. Dept. of Chemistry.
APPROXIMATION METHODS FOR THE PARTITION FUNCTIONS OF ANHARMONIC SYSTEMS Ph.D. Thesis
P. Lew Jul. 1979 132 p refs
(Contract EY-76-S-02-3127)
(COO-3127-30-T1) Avail: NTIS HC A07/MF A01

The analytical approximations for the classical, quantum mechanical, and reduced partition functions of the diatomic molecule oscillating internally under the influence of the Morse potential were derived and their convergences were tested numerically. The analytical method is described for use in the treatment of anharmonic systems. DOE

N80-16858# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
DOUBLE RESONANCE SPECTROSCOPY OF MULTIPLE-PHOTON EXCITED MOLECULES
J. I. Steinfeld, C. C. Jensen (Joint Inst. for Lab. Astrophysics), T. G. Anderson, and C. Reiser 1979 10 p refs Presented at the 4th Intern. Congr. Laser 79 Opto-Electron., Munich, 2 Jul. 1979
(Contract EY-76-S-02-2793)
(COO-2793-15; CONF-790720-3) Avail: NTIS HC A02/MF A01

A diode infrared laser double resonance investigation was conducted of the initial photon absorption step in SF6. A variety of double resonance effects were observed: two level, three level, and four level. The utilization of the diode infrared laser double resonance to study multiple photon excitation in polyatomic

molecules and vibrational levels above the first excited state onto the quasi continuum is discussed. DOE

N80-16859# Oak Ridge National Lab., Tenn.
RADIATION FROM Ag AND K FILM BOMBARDED BY LOW ENERGY ELECTRONS Ph.D. Thesis
M. S. Chung, T. A. Callcott, and E. T. Arakawa Nov. 1978 95 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6527) Avail: NTIS HC A05/MF A01

Photon spectra from metallic films irradiated by low energy electrons (10-1500 eV) were investigated. Both radiative and nonradiative plasmon modes were studied. For silver films, two peaks were resolved when the films were very smooth. The intensity of the surface plasmon radiation was measured as a function of the incident electron energy for energies between 100 eV and 1200 eV and found to have a linear dependence. DOE

N80-16860# Oak Ridge National Lab., Tenn.
COHERENCE EFFECTS IN HEAVY ION-ATOM COLLISIONS
C. Bottcher 1978 16 p refs Presented at Workshop on Coherence and Correlation in Atomic Collisions, London, 18 Sep. 1978
(Contract W-7405-eng-26)
(CONF-780936-1) Avail: NTIS HC A02/MF A01

An approach to charge capture and ionization by highly stripped projectiles is described and shown to explain cross section systematics through the periodic table. Oscillations in cross section with respect to charge state observed around atomic number 70 are explained as an f-wave resonance in the target electron-projectile scattering. The ratio of H2 to H cross sections for both light and heavy projectiles is shown to fit a two center coherent scattering model; independent scattering by the two centers is not a good assumption for velocities below 4 A.U. Similar coherence effects are predicted in stripping by molecular gases even in multielectron processes wodre the independent atom model might be thought valid. Recent experiments on the forward peak of electrons ejected from the projectile show interesting structure which can be partly explained without invoking interference effects. DOE

N80-16861# Brown Univ., Providence, R. I.
INTERACTIONS OF MOLECULES WITH SURFACES Progress Report, 1 Aug. 1978 - 30 Apr. 1979
E. F. Greene Apr. 1979 13 p refs
(Contract ER-78-S-02-4974)
(COO-4974-1) Avail: NTIS HC A02/MF A01

The elastic scattering of a velocity selected beam of Kr atoms from the surface of a graphite crystal is examined. The angular distribution and energy dependence of the scattering was compared with the predictions of a model. The yields of positive ions produced when beams of neutral alkali atoms hit hot surfaces of silicon or alumina were measured for various temperatures of the surfaces. A quasi equilibrium model for the ionization was developed. DOE

N80-16862# Rensselaer Polytechnic Inst., Troy, N. Y.
THEORY OF HEAVY ION COLLISIONS Annual Progress Report
D. Sperber Aug. 1978 14 p refs
(Contract EY-76-S-02-3463)
(COO-3463-51) Avail: NTIS HC A02/MF A01

Theoretical studies of heavy ion collisions for the period 1977 to 1978 are described. Complete damping, dynamical and random aspects, the role of deformation and transfer and nonequilibrium aspects in strong damping, a thermodynamic model of strongly damped collisions with one body dissipation, fusion excitation functions, and a hydrodynamical model for the disintegration of a hot zone in heavy ion collisions are considered. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-16863 California Univ., Berkeley.
INDEPENDENT PARTICLE ASPECTS OF NUCLEAR DYNAMICS Ph.D. Thesis
Michael Cornelius Robel 1979 283 p
Avail: Univ. Microfilms Order No. 8000492

A generalization of the independent particle model from nuclear statics to nuclear dynamics is discussed. Attention is centered on the average behavior of nuclear dynamics, as opposed to detailed behavior, such as the characteristic of shell effects in nuclear statics. A one body model is applied to nuclear vibrations. The wall formula which supplies the dissipation is appended to the standard, hydrodynamical theory of vibrations. The combination of internal, Fermi motion, and relative nuclear motion with refraction at the host's surface is calculated to produce well focused emission patterns in velocity space, which are called Fermi jets. Dissert. Abstr.

N80-16864 Notre Dame Univ., Ind.
RESONANCES IN NUCLEAR PHYSICS Ph.D. Thesis
Mosleh-Uddin Ahmed 1980 92 p
Avail: Univ. Microfilms Order No. 8002604

Resonance phenomena in nuclear physics are examined in the light of the analytic properties of the S matrix. A resonant state is considered to correspond to a suitably located pole in the S matrix or the scattering amplitude. A procedure is described for extracting the pole position of a resonant amplitude from a knowledge of the phase shift versus energy. Effective range expansion of the scattering amplitude is invoked to obtain the energy dependence. Pole positions are determined for the four p-wave resonances in the nucleon-alpha system with high precision. The use of pole position to define the mass of unstable nuclear states is discussed and the model independence of the pole position is emphasized. Dissert. Abstr.

N80-16865# Columbia Univ., New York. Dept. of Physics.
THEORETICAL HIGH ENERGY PHYSICS Progress Report, 1 May 1978 - 30 Apr. 1979
T. D. Lee Jun. 1979 22 p
(Contract EY-76-C-02-2271)
(COO-2271-102) Avail: NTIS HC A02/MF A01

The research in high energy physics is summarized. Publications are listed. DOE

N80-16866# California Univ., Livermore. Lawrence Livermore Lab.
FUSION: THE POWER SOURCES OF THE FUTURE INERTIAL CONFINEMENT OPTION
V. Rupert 13 Jun. 1979 19 p Presented at the Soc. of Women Engr. Natl. Student Conf., San Francisco, 27 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82768; CONF-790698) Avail: NTIS HC A02/MF A01

The advantageous features and the methods being pursued toward achieving power generation from inertial confinement fusion are discussed. The concept of nuclear fusion is reviewed which includes a discussion of fusion reactions using deuterium and tritium. Research progress in inertial confinement fusion is reported and the application of lasers, electron beams, and ion beams to drive the compression and heating of the fusion fuels is surveyed. A.W.H.

N80-16867# Oak Ridge National Lab., Tenn. Fusion Energy Div.
PULSE PILEUP EFFECTS OF PLASMA ELECTRON TEMPERATURE MEASUREMENTS BY SOFT X-RAY ENERGY ANALYSIS
G. R. Dyer, G. H. Neilson, and G. G. Kelley Oct. 1978 26 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6541) Avail: NTIS HC A03/MF A01

The electron temperature of hot plasmas was derived from

bremsstrahlung spectra obtained by pulse height analysis using a lithium compensated silicon detector. Time resolved temperature measurements required high counting rates, with ultimate rate limted by pulse pileup. To evaluate this limit, spectral distortion due to pileup and consequent effects on temperature determination were investigated. Expressions for distorted spectra were derived as functions of Maxwellian temperature and pileup fraction for both square and triangular pulse shapes. A comparison of temperatures obtained from distorted spectra with actual values indicates that measurements with less than 10 percent error can be made in the absence of line radiation, even from spectra containing 40 percent pileup. DOE

N80-16868# Oak Ridge National Lab., Tenn. Computer Sciences Div.
QUARTZ: A NUMERICAL SIMULATION OF AN ASYMMETRIC ELECTROSTATIC ACCELERATOR
J. H. Wooten, L. J. Drooks, D. H. McCollough, R. W. McGaffey, and J. H. Whealton. 1979. 25 p. refs. Presented at the 3rd IMACS Intern. Symp. on Computer Methods for Partial Differential Equation, Bethlehem, Pa., 20 Jun. 1979.
(Contract W-7405-eng-26)
(CONF-790619-2) Avail: NTIS HC A02/MF A01
The physics and numerical aspects of the development of the computer code QUARTZ are given. This code includes the (1) use of a finite element code to obtain solutions of Poisson's equation in an asymmetric, three dimensional volume, (2) inclusion of space charge neutralization by electrons, and (3) inclusion of ion space charge through an iterative procedure. DOE

N80-16869# Brown Univ., Providence, R. I. Dept. of Physics.
RESEARCH PROGRAM IN THEORETICAL HIGH-ENERGY PHYSICS Progress Report
D. Feldman. 1 Oct. 1978. 12 p. refs.
(Contract EY-76-C-02-3130)
(COO-3130TA; Brown-HET-377) Avail: NTIS HC A02/MF A01
The theoretical physics studies of high energy phenomena, the properties and interactions of elementary particles, and quantum field theory are reported. The applications of field theoretic methods to the general theory of relativity, gravitation, cosmology, and bound state mean field theory are considered. A.W.H.

N80-16870# Notre Dame Univ., Ind.
MULTIQUARK MESONS REVISITED
S. K. Bose and E. C. G. Sudarsham. Aug. 1978. 20 p. refs.
(Contract EY-76-S-05-3992)
(ORO-3992-344) Avail: NTIS HC A02/MF A01
A model of meson states which speculated on the existance of mesons that might constitute multiplets larger than the familiar nonets, denoted multiquarks, is reviewed. The structure of the meson tensor is presented and results in meson-baryon coupling are discussed. A.W.H.

N80-16871# Office of Radiation Programs, Washington, D.C. Technology Assessment Div.
SEDIMENT CHARACTERISTICS OF THE 2800 METER ATLANTIC NUCLEAR WASTE DISPOSAL SITE: RADIONUCLIDE RETENTION POTENTIAL
James Neiheisel. Sep. 1979. 38 p. refs. Prepared in cooperation with Corps of Engineers, Washington, D.C.
(PB-301255/6; ORD/TAD-79/10) Avail: NTIS HC A03/MF A01 CSCL 18G
The sediments of the abandoned 2800 meter Atlantic nuclear waste dumpsite were analyzed for texture mineral composition, physical properties, cation exchange capacity, and factors effecting sediment deposition. Ocean disposal was evaluated as an alternative nuclear waste disposal method. The sediments physical and chemical properties were evaluated in the light of the geologic setting for their potential role in retarding radionuclide leachate migration from the waste drums to the water column. GRA

N80-16872# Nuclear Utility Services, Inc., Palo Alto, Calif.
LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT. VOLUME 5: POLICY RECOMMENDATIONS, CONCLUSIONS AND SUMMARY Final Report
Fred Feizollahi, R. Jon Stoovky, John M. Connelly, and Thomas L. Jentz. Aug. 1979. 82 p. refs.
(PB80-105083; NUS-3383; CAEC-44) Avail: NTIS HC A05/MF A01; Also available in set of 5 reports PB80-105034, HC E13 CSCL 18G
Low-level waste management technology for light water reactors is evaluated. The problems that must be solved to allow the development of large-scale management of low-level radioactive wastes generated at nuclear power facilities and by the nuclear power industry in California are identified. A technical, economic, and environmental overview of waste management alternatives is presented. GRA

N80-16873# Nuclear Utility Services, Inc., Palo Alto, Calif.
LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT. VOLUME 2: FORECAST OF LOW-LEVEL RADWASTE MANAGEMENT REQUIREMENTS Final Report
Fred Feizollahi. Nov. 1978. 62 p. refs. Sponsored by California Energy Resources Conservation and Development Commission.
(PB80-105059; NUS-3158-Vol-2; CAEC-010-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 18G
Low level waste management technology for light water reactors are evaluated and the problems that must be solved within the next few years to allow for the orderly development of large scale management of low level radioactive wastes generated at nuclear power facilities and by the nuclear power industry in California are identified. The future requirements for power reactor low level waste management are discussed and quantities of low level radioactive wastes that will be generated in commerical light water-reactor plants are forecasted. GRA

N80-16874# Nuclear Utility Services, Inc., Palo Alto, Calif.
LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT. VOLUME 3: FEASIBILITY OF VOLUME-REDUCTION PROCESSES Final Report
Fred Feizollahi, J. Wynn Phillips, and William H. Bell. Nov. 1978. 100 p. refs. Sponsored by California Energy Resources Conservation and Development Commission.
(PB80-105067; NUS-3183-Vol-3; CAEC-42-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 18G
Low level waste management technology for light reactors is investigated. Volume reduction technology is highlighted and evaluated for application to low level radioactive waste from light reactor plants. A number of volume reduction systems are examined including fluidized bed dryers, bitumen systems, dry waste compactors, and evaporative crystallization. A.W.H.

74 OPTICS

Includes light phenomena.

N80-16875 Stanford Univ., Calif.
TIME INTEGRATING OPTICAL SIGNAL PROCESSING Ph.D. Thesis
Peter Kellman. 1979. 149 p.
Avail: Univ. Microfilms Order No. 8001952
Optical techniques for linear signal processing applied to large time bandwidth product operations are examined. A comprehensive treatment of time integrating acousto-optic signal processing is given. The extension of one dimensional time integrating optical correlation to two dimensional processing, the concept of interferometric detection with electronic reference, and the generalization of these signal processing techniques to complex computation are discussed. One and two dimensional complex signal processing algorithms are developed for noncoherent optical realizations and the class of achievable signal processing operations is derived. Analysis of time integrating algorithms for complex spectral analysis and ambiguity function processing is presented. Correlation and power spectral estimates are defined and signal to noise ratios are derived. Dissert. Abstr.

N80-16876# Bendix Corp., Kansas City, Mo.
X-RAY POLE FIGURE ANALYSIS Final Report
D. M. Jarboe and D. E. Lacey. Sep. 1978. 54 p. refs.
(Contract EY-76-C-04-0613)

(BDX-613-1829-Rev) Avail: NTIS HC A04/MF A01

The data used to produce pole figures are obtained by X-ray diffraction techniques. The techniques are complicated and can be simplified using computerized data acquistion, reduction, and CRT display techniques. Pole figures of cold-rolled cartridge brass (70Cu-30Zn) taken from published literature were found to closely compare with results achieved at Bendix Kansas City. DOE

N80-16877# National Bureau of Standards, Boulder, Colo. National Engineering Lab.
DESIGN OF A REFLECTION ON APPARATUS FOR LASER BEAM PROFILE MEASUREMENTS
Eric G. Johnson, Jr. Jul. 1979 128 p refs Sponsored in part by DOD, Calibration Coordination Group
(Contract CCG-78-109)
(PB80-101256; NBS-TN-1015) Avail: NTIS HC A07/MF A01 CSCL 20F

Topics covered include: (1) the use of Fourier optics concepts with off-axis reflections and rough surfaces to provide the basis for accurate computer simulation of laser beams; (2) the program, BEAM, which generates the expected behavior of the apparatus under variation of laser wavelength, physical dimensions for curvatures, hologram structure, and changes in positions of the various components; (3) the simulation results which demonstrate the expected characteristics for the apparatus; and (4) the key element in the apparatus, namely the reflection hologram, which requires discussion of the design, construction, and testing of this element. The Hartman plate method is described briefly so that a comparison between it and the holographic method can be made. The comparison shows why the holographic method is best for a standard for irradiance and phase-front measurements. GRA

N80-17016# Joint Publications Research Service, Arlington, Va.
CARL ZEISS JENA PRODUCTION OF OPTICAL PRECISION INSTRUMENTS DESCRIBED
K. Muetze. *In its* E. Europe Rept.: Sci. Affairs, No. 659 (JPRS-74911) 11 Jan. 1980 p 23-54 Transl. into ENGLISH from Feingeraetetechnik (E. Berlin), v. 28, no. 10, 1979 p 437-445 (For primary document see N80-17015 07-99)
Avail: NTIS HC A07/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-16878 Princeton Univ., N. J.
TWO-DIMENSIONAL EIGENMODE ANALYSIS OF THE TRAPPED-ION INSTABILITY Ph.D. Thesis
Richard Marchand 1979 197 p
Avail: Univ. Microfilms Order No. 7928481

A fully two dimensional eigenmode analysis of trapped ion instability in an axisymmetric toroidal geometry is discussed. The calculation takes into account the basic dynamics associated with other low frequency modes such as the trapped electron instability and the ion-temperature-gradient instability. The formalism is also applicable to the familiar radially local and one dimensional radiation radial approximations. Results obtained in these limits are represented. The radially local limit is also used to investigate the possible presence of low frequency microinstabilities in the recent neutral-beam heated PLT discharges. In this case, the ion temperature gradients are found to have a strong destabilizing influence, and an ion temperature threshold is computed. For higher shear plasmas, the radial structure of the trapped-ion mode is found to differ considerably from the one-dimensinal approximation. Dissert. Abstr.

N80-16879 California Univ., Berkeley
THE ANNIHILATION MODEL OF THE TORMAC SHEATH Ph.D. Thesis
James Henry Hammer 1979 144 p
Avail: Univ. Microfilms Order No. 8000366

A one dimensional, steady state fluid model is developed to describe the boundary layer between plasma and magnetic field that occurs in the Tormac sheath. The model includes transport across the magnetic field as well as mirror losses along the field, the latter being represented as annihilation terms in the one dimensional equations. The model equations are derived from the two dimensional, time dependent hierarchy of equations generated by taking velocity moments of the kinetic equation including collisions. With the approximations a set of nonlinear ordinary differential equations is generated with independent variable x, the distance across the sheath. The annihilation equations are integrated numerically for a variety of situations: poloidal field reversed and nonreversed sheaths; classical and anomalous collisionality; including or excluding electron wall interactions. The integration yields profiles for density, pressure, flow velocity, magnetic and electric fields as well as the eating in rate of the sheath and the floating electrostatic potential. Dissert. Abstr.

N80-16880# Nagoya Univ. (Japan) Inst. of Plasma Physics
STABILITY OF A TOROIDAL PLASMA BY HOT ELECTRON ANNULUS IN A BUMPY TORUS
H. Sanuki and M. Fujiwara Dec. 1979 18 p refs
(IPPJ-426) Avail: NTIS HC A02/MF A01

The ballooning instability is analyzed in a bumpy configuration using a relatively simple fluid model of an inhomogeneous slab plasma with grativational field simulating the bad curvature effect and the grad-B effect due to hot electron annulus. Mathieu type equation is derived to investigate a linear analysis. Stability boundary giving the maximum stable Beta sub p (beta value of bulk plasma) as a function of Beta sub h and the threshold for Beta sub h (beta value of hot electron annulus) are studied for Nagoya bumpy torus parameters. The relevance of our theoretical analysis is discussed in a comparison with the previous results. J.M.S.

N80-16881# Nagoya Univ. (Japan)
FINITE TEMPERATURE EFFECT OF RAY TRACING NEAR THE ELECTRON CYCLOTRON RESONANCE
M. Tanaka, M. Fujiwara, and H. Ikegami Nov. 1979 26 p refs
(IPPJ-427) Avail: NTIS HC A03/MF A01

Ray trajectories and power absorption of electromagnetic wave propagating in an inhomogeneous plasma are investigated in the frequency region near the electron cyclotron resonance. Plasmas are assumed to be cylindrical with the toroidal effect on magnetic field taken into consideration. Finite temperature effect on ray tracing is studied in detail by applying the geometrical optics to a warm plasma, and it is found that the geometrical optics cannot be applied in the region of the electron cyclotron resonance, where the group velocity does not coincide with the velocity of energy flow. Author

N80-16882# Nagoya Univ. (Japan) Inst. of Plasma Physics
A TWIN OPTICALLY-PUMPED FAR-INFRARED CH3OH LASER FOR PLASMA DIAGNOSTICS
M. Yamanaka, Y. Takeda, S. Tanigawa, A. Nishizawa, N. Noda, M. Shimobayashi, Y. Hayashi, T. Koizumi, K. Nagasaka, S. Okajima et al. Nov. 1979 35 p refs
(IPPJ-428) Avail: NTIS HC A03/MF A01

A twin optically-pumped FIR CH3OH laser composed of two identical waveguide resonators was constructed for the modulated interferometer system to be applied to the JIPP T-2 Tokamak machine. The anti-symmetric doublet due to the Raman-type resonant two-photon transition is reproducibly observed at 118.8 micron m. With the 118.8-micron m line, the frequency separation of the anti-symmetric doublet indicates that the CH3OH absorption line center is 16 - or - 1 MHz higher than the pump 9.7-micron P(36) CO2 laser line center. It is shown that the Raman-type resonant two-photon transition is useful in getting several-MHz phase modulations for the far-infrared laser interferometer. Some preliminary performances of this twin laser for the modulated interferometer are described. A.R.H.

N80-16883# Nagoya Univ. (Japan) Inst. of Plasma Physics
WHISTLER WAVE TRAPPING IN A DENSITY CREST
H. Sugai, H. Niki, M. Inutake, and S. Takeda Nov. 1979 32 p refs

(IPPJ-429) Avail: NTIS HC A03/MF A01

The linear trapping process of whistler waves in a field aligned density crest is investigated theoretically and experimentally below omega = omega sub c/2. The conditions of the crest trapping are derived in terms of the frequency omega/omega sub c, the incident wave normal angle theta sub i, and the density ration n sub i/n sub o. The oscillation length of the trapped ray path for a parabolic density profile is calculated. The phase and amplitude profile of the whistler wave measured along and across the crest is discussed. The experiment on antenna excited whistler wave performed in a large magnetized plasma with the density crest is described. the theory of the crest trapping is presented, bearing the antenna excitation experiments in mind, and the experimental apparatus and method are reported. A.W.H.

N80-16884# Vanderbilt Univ., Nashville, Tenn. Dept. of Physics and Astronomy.

PRODUCTION AND DIAGNOSTICS OF DENSE NUCLEAR PLASMAS. Final Report, 1 Sep. - 31 Aug. 1979

Ja H. Lee. Aug. 1979. 81 p. refs.

(Grant NsG-1235)

(NASA-CR-162656) Avail: NTIS HC A05/MF A01 CSCL 20I

Dense nuclear plasmas were produced in devices with three different geometries, namely a Mather-type dense plasma focus (DPF), a hypocycloidal pinch (HGP), and a staged plasma focus (SPF). The basic mechanism common to all three geometries was a strong zeta pinch of the current sheets which was launched from the insulator surface by an inverse zeta pinch. The HCP and the SPF are geometrical variances of the Mather-type plasma focus and have significant advantages over the Mather-type device. R.C.T.

N80-16885*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMMENTS ON TEC TRENDS

James F. Morris. 1979. 28 p. refs. Presented at Intern. Conf. on Plasma Sci., Montreal, 4-6 Jun. 1979; sponsored by IEEE.

(NASA-TM-79317; E-273) Avail: NTIS HC A03/MF A01 CSCL 20I

A technology assessment of thermionic energy conversion research and technology is presented. R.E.S.

N80-16886*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTS ON H2-O2MHD POWER GENERATION

J. Marlin Smith. 1980. 18 p. refs. Proposed for presentation at the 3d World Hydrogen Energy Conf., Tokyo, 23 - 26 Jun. 1980.

(NASA-TM-81424) Avail: NTIS HC A02/MF A01 CSCL 20I

Magnetohydrodynamic power generation experiments utilizing a cesium-seeded H2-O2 working fluid were carried out using a diverging area Hall duct having an entrance Mach number of 2. The experiments were conducted in a high-field strength cryomagnet facility at field strengths up to 5 tesla. The effects of power takeoff location, axial duct location within the magnetic field, generator loading, B-field strength, and electrode breakdown voltage were investigated. For the operating conditions of these experiments, it is found that the power output increases with the square of the B-field and can be limited by choking of the channel or interelectrode voltage breakdown which occurs at Hall fields greater than 50 volts/insulator. Peak power densities of greater than 100 MW/cu M were achieved. A.R.H.

N80-16887# Addis Translations International, Portola Valley, Calif.

HYDRODYNAMIC EQUILIBRIUM OF PLASMA IN AN AMBIPOLAR TRAP

G. V. Stupakov. Jun. 1979. 25 p. refs. Transl. into ENGLISH of report IYAF-78-93 from Academy of Sciences (USSR), Novosibirsk, 1978. p 1-21. Sponsored by DOE. Prepared for California Univ., Lawrence Livermore Lab.

(UCRL-Trans-11493; IYAF-78-93) Avail: NTIS HC A02/MF A01

Hydrodynamically equilibrium plasma configurations in an ambipolar trap are investigated. It is shown that with allowance for the finite value of beta the constant pressure surfaces on the long part of the center mirror cell are distorted and in general are not circular cylinders. The effects of the distortion of the surfaces in relation to the selection of the mirror field are described. DOE

N80-16888# Addis Translations International, Portola Valley, Calif.

PLASMA PHYSICS AND PROBLEMS OF CONTROLLED THERMONUCLEAR REACTIONS

V. T. Tolok, ed. Jun. 1979. 166 p. refs. Transl. into ENGLISH of Kharkov Fiziko-Tekhnicheskiy Inst. (USSR), v. 77, no. 39, 1977. 164 p.

(UCRL-Trans-11487) Avail: NTIS HC A08/MF A01

Contents: (1) integral model of a pulsed coaxial plasma gun; (2) investigation of the operation of a pulsed coaxial plasma gun in the MHD approximation; (3) investigation and optimization of high power electrodynamic plasma accelerators; (4) turbulent processes in a pulsed coaxial plasma gun; (5) investigation of neutron and X-ray radiation on the MK-200 device; (6) measurement of neutron yield from the plasma of a coaxial gun; (7) formation of shock waves in high density plasma bunches on impact from a magnetic barrier; (8) investigation of high energy plasma burst formation in a complex plasma injector system; and (9) peculiarities of beam formation from a moving dense plasma for spectral analysis of the ion component. A.R.H.

N80-16889# Illinois Univ., Urbana.

STABILITY OF THE FIELD-REVERSED MIRROR. Ph.D. Thesis

E. C. Morse. 1979. 109 p. refs.

(Contract EY-76-S-02-2218)

(COO-2218-136) Avail: NTIS HC A06/MF A01

The stability of a field reversed mirror plasma configuration is studied with an energy principle derived from the Vlasov equation. The stability properties of a field reversed mirror are compared with the stability properties of similar magnetohydrodynamic equilibria. The Vlasov energy principle developed is applied to a computer simulation of an axisymmetric field reversed mirror state. Techniques for suppressing instabilities are outlined, and the applicability of the Vlasov energy principle to more complicated equilibrium models is shown. DOE

N80-16890# California Univ., Livermore. Lawrence Livermore Lab.

REVIEW OF ELECTRON-BEAM HEATING OF MAGNETIC MIRROR CONFINED PLASMAS, WITH APPLICATION TO THE TANDEN MIRROR EXPERIMENT

M. Seidl. 10 Apr. 1979. 42 p. refs.

(Contract W-7405-eng-48)

(UCRL-52759) Avail: NTIS HC A03/MF A01

Results from early electron-beam heating experiments and more recent basic beam-plasma physics experiments are presented. Present theoretical understanding is examined. It is concluded that rather simple electron-beams could be employed on the tandem mirror experiment (TMX) to carry out electron heating experiments. DOE

N80-16891# Oak Ridge National Lab., Tenn.

HIGH BETA TOKAMAKS

R. A. Dory, D. P. Berger, L. A. Charlton, J. T. Hogan, J. K. Munro, D. B. Nelson, Y. K. M. Peng, D. J. Sigmar, and D. J. Strickler. 1978. 18 p. refs. Presented at the Conf. on Plasma Phys. and Control., Innsbruck, 23 Aug. 1978.

(Contract W-7405-eng-26)

(CONF-780811-23) Avail: NTIS HC A02/MF A01

MHD equilibrium, stability, and transport calculations are made to examine the accessibility and behavior of high beta Tokamak plasmas in the range beta approximately 5 to 15 percent. Results from flux conserving Tokamak models, classical models, and models with spatially resolved transport which include effects from sawtooth oscillations and magnetic islands are discussed. A.W.H.

N80-16892# Oak Ridge National Lab., Tenn. Fusion Energy Div.

HYDROGEN PELLET FUELING EXPERIMENT ON THE ISX-A TOKAMAK

S. L. Milora, C. A. Foster, P. H. Edmonds, and G. L. Schmidt

(Princeton Univ.) Oct. 1978 14 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6498) Avail: NTIS HC A02/MF A01

Experiments on the ISX-A Tokamak which demonstrate the technique of plasma fueling by solid hydrogen pellet injection are reported. The effects on plasma stability, confinement, and plasma density are discussed. DOE

N80-16893# General Dynamics/Convair, San Diego, Calif.
CONFIRMATORY ANALYSIS AND DETAIL DESIGN OF THE MAGNET SYSTEM FOR MIRROR FUSION TEST FACILITY (MFTF)
R. E. Tatro and R. W. Baldi Oct. 1978 62 p
(Contract W-7405-eng-48)
(UCRL-13923; CASD-LLL-78-007) Avail: NTIS
HC A04/MF A01

A confirmatory analysis of the mirror fusion test facility (MFTF) magnet system conceptual design is presented. A thermal analysis of magnet cooldown and warmup is discussed and design analysis of the magnet thermal shield systems and structural supports is reported. A cryostability analysis of the MFTF magnet conductor is presented and the structural integrity of the MFTF magnet case, jacket, and shield system is examined. A.W.H.

N80-16894# Los Alamos Scientific Lab., N. Mex.
MIRROR POSITION DISPLAY EQUIPMENT FOR THE TARGET CHAMBER MIRROR MOUNTS OF THE LASL HELIOS LASER FUSION FACILITY
F. D. Wells and D. A. Remington 1979 6 p Presented at the IEEE Region Six Conf., Sacramento, Calif., 25 Apr. 1979
(Contract W-7405-eng-36)
(LA-UR-79-589; CONF-790427-1) Avail: NTIS
HC A02/MF A01

Equipment was fabricated which records the absolute positions of sixteen mirror mounts used to direct and focus eight high-energy laser beams for research in laser induced fusion. Each mirror mount is driven by three stepping motors, controlled to produce the motions of focus, tilt, and rotate relative to the target. Stepping of the motors is sensed by incremental optical encoders coupled to the motor drive shafts. Outputs from the encoder tracks are multiplexed to a microprocessor which transmits motor step information via a fiber optical data link to a mirror position display chassis. This unit accumulates the steps, stores the motor positions, displays mirror positon data to the operator, and provides the equipment control functions. Standby battery power is included to retain the motor step data in the event of power failure. DOE

N80-16895# Science Applications, Inc., Boulder, Colo. Lab. for Applied Plasma Studies.
AXIS ENCIRCLING ION GYRO-RADIUS
P. J. Catto, R. E. Aamodt, M. N. Rosenbluth (Princeton Univ.), J. A. Byers, and L. D. Pearlstein Jun. 1979 27 p refs Prepared jointly with Lawrence Livermore Lab., Calif.
(Contracts EY-76-C-03-1018; W-7405-eng-48)
(SAI-79-023-766-LJ; LAPS-188) Avail: NTIS
HC A03/MF A01

An idealized plasma model in which all the ion guiding centers lie along the magnetic axis of a cylindrically symmetric plasma was investigated. The radial eigenvalue equation was derived and solved for this strongly unstable limit. Many of the physical features predicted by simple analytic limits of the WKB phase integral condition were verified by a comparison with the results of a particle simulation. DOE

N80-16896# Oak Ridge National Lab., Tenn.
NCMART: ALGORITHMS AND COMPUTER CODES FOR A MODIFIED ALGEBRAIC SPATIAL RECONSTRUCTION OF SPECTROSCOPIC EMISSIVITIES FOR ELMO BUMPY TORUS
R. H. Carpenter and N. H. Lazar Nov. 1978 66 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6500) Avail: NTIS HC A04/MF A01

A modification of the algebraic reconstruction technique first used in tomography is applied to two dimensional spatial resolution of spectroscopic data from the ELMO Bumpy Torus (EBT) taken in two fan views from ports at the top and side of the midplane of a mirror section. The reconstruction algorithms are derived and a description is given of the code implementing them for the EBT data on a PDP-10 computer. Test problem results show that reliable information on impurity distributions in the cross section viewed may be obtained by this method. Instructions for use of the computer codes are included, along with source program listings and sample output from a run using experimental data. DOE

N80-16897# Aerospace Corp., Los Angeles, Calif. Aerophysics Lab.
FUSION LASER STUDIES Final Rport, 21 May - 21 Nov. 1978
J. S. Whittier, J. J. T. Hough, R. L. Wilkins, R. W. F. Gross, R. Hofland, Jr., J. F. Bott, N. Cohen, and C. P. Wang Dec. 1978 77 p refs
(Contract ED-78-C-08-1559)
(NVO-1559-1) Avail: NTIS HC A05/MF A01

Computer modeling of short pulse HF chemical lasers is discussed. Disagreements between laser code predictions and short pulse laser experiments are examined. The introduction of treatments for initiation and energy loss mechanisms, and the consideration of initiation nonuniformities are evaluated for reducing uncertainties between code predictions and experimental observations. Areas of work required to reduce the remaining modeling uncertainties are identified. DOE

N80-16898# Sandia Labs., Albuquerque, N. Mex.
PARTICLE BEAM INTERACTIONS WITH PLASMAS AND THEIR APPLICATION TO INERTIAL FUSION
M. J. Clauser, E. J. T. Burns, and J. Chang 1979 8 p refs Presented at the Conf. Intern. sur les Phenomenes D'ionisation dans les Gaz, Grenoble, France, 9 Jul. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1411C; CONF-790708-4) Avail: NTIS
HC A02/MF A01

The basic principles of fusion target implosions and the particle beam characteristics required to ignite the targets are summarized. The interaction of light ion beams and electron beams with fusion target plasmas is discussed. An historical review of the pulse power approach to inertial fusion is given. DOE

N80-16899# Los Alamos Scientific Lab., N. Mex.
SYSTEMS-DESIGN AND ENERGY-BALANCE CONSIDERATIONS FOR IMPACT FUSION
R. A. Krakowski and R. L. Miller 1979 27 p refs Presented at the DOE Impact Fusion Workshop, Los Alamos, N. Mex., 10 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1969; CONF-790741-4) Avail: NTIS
HC A03/MF A01

Areas of concern and potential problems for impact fusion are considered. A parametric and qualitative description of the general energy balance and systems considerations for an Impact Fusion Reactor (IFR) design are reported. Reactor systems design considerations for an IFR are presented. The IFR viability is assessed based on projectile target energy balances and thermonuclear burn models. DOE

N80-16900# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.
ASPECTS OF TOKAMAK TOROIDAL MAGNET PROTECTION
R. W. Green and M. S. Kazimi Jul. 1979 198 p refs
(Contract EY-76-S-02-2431)
(COO-2431-6; PFC/TR-79-6) Avail: NTIS HC A09/MF A01

Geometric models were used to estimate the potential for damage to a Tokamak reactor inner wall and blanket due to a toroidal magnet field collapse. The only potential hazard found to exist was due to the MHD pressure rise in a lithium blanket. A survey of proposed protection methods for superconducting toroidal magnets was conducted. Computer programs were developed which allowed the toroidal magnet set to be modeled as a set of circular filaments. A thermal model of the conductor was used which allowed heat transfer to the magnet structure and which included the effect of temperature dependent properties. A protection system design procedure was developed. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-16901 Stanford Univ., Calif.
PICOSECOND DYNAMICS OF ENERGY TRANSFER IN PURE AND MIXED ORGANIC CRYSTALS Ph.D. Thesis
Dana Donald Dlott 1979 137 p
Avail: Univ. Microfilms Order No. 8001906

Intermolecular interactions in molecular crystals which give rise to electronic excitation transport are studied. Experimental investigations of the wide variety of radiative and radiationless transitions which occur in molecular crystals are discussed. The application of the techniques of picosecond time resolved spectroscopy to the study of radiationless processes including excimer formation, phonon effects, and excited state energy transport is reported. Several observables which depend on excited state mobility are discussed and in particular it is shown that the picosecond transient grating technique permits direct determination of excited state mobility by introducing a well defined distance scale directly in the sample. Dissert. Abstr.

N80-16902 California Univ., Berkeley.
LOW ENERGY ELECTRON DIFFRACTION AND AUGER ELECTRON SPECTROSCOPY STUDIES OF THE STRUCTURE AND CHEMISTRY OF IRON SINGLE CRYSTAL SURFACES Ph.D. Thesis
Clifford Alan Megerle 1979 346 p
Avail: Univ. Microfilms Order No. 8000441

The techniques of low energy electron diffraction and Auger electron spectroscopy were used to study the structure, the Debye temperature and the adsorption behavior of several iron and vanadium single crystal surfaces. Clean Fe(110), Fe(111) and Fe(100) surfaces were obtained after the removal of sulfur impurities by a two step process involving (1) the heating of the sample to a temperature of 850 C in a flowing stream of hydrogen at a pressure of one atmosphere and for a period of approximately four weeks, follwed by (2)several ion bombardment-anneal cycles. Dissert. Abstr.

N80-16903 California Univ., Berkeley.
STUDIES OF ELECTRON CORRELATION IN THE PHOTOIONIZATION PROCESS Ph.D. Thesis
Richard Allen Rosenberg 1979 200 p
Avail: Univ. Microfilms Order No. 8000493

Electron correlation, the interaction of two or more electrons confined in a region of space, was treated under the formalism of configuration interaction (CI). The types of CI involved in the photoionization process was divided into three categories: initial state configuraton interaction, final ionic state configuration interaction, and continuum state configuration interaction. The experimental studies which reveal how the various types of CI may become manifested in photoionization are examined. The experimented methods utilized in the work were photoelectron spectroscopy (PES), electron impact spectroscopy (EIS), and time resolved fluorescence spectroscopy. Dissert. Abstr.

N80-16904 California Inst. of Tech., Pasadena.
THEORETICAL STUDIES OF BOUND EXCITON DECAY AND OF TRANSPORT ACROSS SEMICONDUCTOR INTERFACES Ph.D. Thesis
Gordon Cecil Osbourn 1979 164 p
Avail: Univ. Microfilms Order No. 7920345

Calculations of the phononless Auger and radiative transition rates for excitons bound to the four common shallow acceptors (B, Al, Ga and In) in Si and Ge are presented. The calculation of radiative transition rates is compared to estimates obtained from absorption experiments. Calculations for the Auger and radiative recombination rates for acceptor bound excitons in the Hg-CdTe alloy system and in GaAs are discussed. Calculations of reflection and transmission coefficients for electrons and holes at abrupt and graded (100) interfaces for the GaAs-Ga sub 1-x Al sub x As system are presented. The calculations are performed using the empirical tight binding approximation. The dependence of the transport coefficients on the alloy composition was investigated. The effect of the distance over which the interface is graded on the transport coefficients was examined. A theoretical study of impact ionization in heterojunction systems is reported. Dissert. Abstr.

N80-16905 North Texas State Univ., Denton.
CO2-LASER INDUCED HOT ELECTRON MAGNETO-TRANSPORT EFFECTS IN n-InSb Ph.D. Thesis
Bradley Thomas Moore, Jr. 1979 204 p
Avail: Univ. Microfilms Order No. 800795

The effects of optical heating via infrared free carrier absorption on the electron magneto-transport properties of n-InSb at helium temperatures was studied. A CO2 laser was used as the optical source. The photoexcited electrons generated by the free carrier absorption were found to relax their excess energy by emitting a maximum number of optical phonons before electron-electron scattering distributed the remaining energy to the bulk conduction band electron gas. The Shubnikov-de Haas (SdH) oscillations in the magnetoresistance were used to monitor the electron temperature. The application of the SdH effect to the study of optical heating is discussed. Dissert. Abstr.

N80-16906 Cincinnati Univ., Ohio.
MOSSBAUER MEASUREMENTS ON LOW TEMPERATURE DEUTERON IMPLANTED Al(Co57) Ph.D. Thesis
Tami Louis Marcuso 1979 149 p
Avail: Univ. Microfilms Order No. 8002123

In situ Mossbauer measurements were performed on the dilute alloy Al(Co(57)) following low temperature deuteron implantations obtained from the 2.5 MeV Van de Graaff accelerator. The irradiations produced a satellite absorption resonance in the Mossbauer spectra which was defined as a Lorentzian doublet. The results were compared to other Mossbauer investigations of the same system after low temperature neutron and electron irradiations. A description of the experimental equipment and associated low temperature irradiation performance is presented. The procedure used to make the dilute, substitutional Al(Co(57)) alloy is discussed, and, based on this procedure, a substitutional cosolubility limit was estimated. Mossbauer results concerning coprecipitation from solid solution are presented: the incomplete recovery of the spectra following irradiation is tentatively associated with coprecipitation thermally activated by thermal spike mechanisms. Dissert. Abstr.

N80-16907 Wisconsin Univ. - Madison.
CALCULATION OF LOCAL FIELDS IN CUBIC LATTICES OF POLARIZABLE ATOMS Ph.D. Thesis
Alfred Paul Lehnen 1979 273 p
Avail: Univ. Microfilms Order No. 7927184

The response of cubic lattices of polarizable atoms to static electric fields is treated. A series solution in powers of the polarizability is obtained for the self-consistent dipole-field equations. Two cases are considered in detail, a uniform field and the field of a point charge. For the uniform field, an exact calculation is made for the maximum value of the polarizability for which there exists a solution to the dipole field equations. For the simple cubic lattice, results are obtained which are smaller than the Clausius-Mosotti limit. It is shown that the deviation of the atomic dipole from the continuum result drops exponentially with distance from the crystal surface. A normal mode analysis of an infinite lattice of Drude-model atoms is done to identify the limiting polarizability for more general nonuniform fields. Dissert. Abstr.

N80-16908 Nebraska Univ. - Lincoln.
TESTS OF NEW THEORIES FOR CRYSTAL ANHARMONICITY Ph.D. Thesis
Bruce W. Jones 1979 191 p
Avail: Univ. Microfilms Order No. 8000897

Two theories of crystal anharmonicity were tested. The uncorrelated-pairs approximation (UPA) is used to determine the equilibrium thermodynamic properties of systems with different model potentials. A generalization of the self-consistent phonon (SCP) approximation is developed to treat the problem of a displacive phase transition. Quantum-mechanical corrections and three-body forces were included in the harmonic approximation only, and very good agreement with Monte Carlo results was obtained. The UPA is simple to apply and is more accurate at

high temperatures than the so-called improved self-consistent phonon approximation. Dissert. Abstr.

N80-16909 Texas Univ. at Austin.
DYNAMICS NEAR THE PHASE TRANSITIONS IN LIQUID CRYSTALS Ph.D. Thesis
Khurshid Akhter Hossain 1979 111 p
Avail: Univ. Microfilms Order No. 7928303

A general formalism is developed to study the dynamics near the nematic to smectic phase transitions in liquid crystals. This formalism is cast in such a form that the very successful dynamic renormalization group method can be applied. The contributions to the viscosities which enter the stress tensor in the nematic state of a liquid crystal and the twist viscosity gamma sub 1, for the order parameter fluctuations near the nematic-smectic A, nematic-smectic C transitions and the Lifshitz point are calculated. The parameter which describes the reversible coupling between the shear and the director is also obtained. The calculational scheme involves a mode-coupling method. These results are compared with those of Jahnig and Brochard near the nematic-smectic-A transition. The dynamics of the NA transition is also investigated by the renormalization group method. Dissert. Abstr.

N80-16910 Arizona State Univ., Tempe.
AN INVESTIGATION OF CRYSTAL SURFACE STRUCTURE BY REFLECTION ELECTRON DIFFRACTION Ph.D. Thesis
Gary George Hembree 1979 136 p
Avail: Univ. Microfilms Order No. 8000942

Enhancement of the crystallographic contrast present in scanning electron micrographs formed by the secondary electron output from specimens of pyrolytic graphite was observed at glancing incident beam angles. A program of experimental observations of the angular dependence of the secondary electron image contrast and reflection electron diffusion (RED) patterns was carried out utilizing an instrumental system which combines scanning electron microscopy (SEM) and RED in an ultra high vacuum environment. The experimental results were interpreted with the help of computed RED intensities and Bloch wave extinction depths. These were obtained from a program based on an n beam dynamical electron diffraction formulation. The results of this comparison showed that the enhanced crystallographic contrast originated from variations in the penetration depth of the incident electron beam caused by different azimuthal incidence angles with respect to the crystal lattice. Dissert. Abstr.

N80-16911 Princeton Univ., N. J.
COMPARATIVE LOW ENERGY ELECTRON DIFFRACTION STUDIES OF InSb(110) AND GaAs(110) SURFACES Ph.D. Thesis
Jwu-Lin Yeh 1979 123 p
Avail: Univ. Microfilms Order No. 7928496

The structural search using kinematical calculations of the intensities of normally incident low energy electrons diffracted from InSb(110) and the structural refinement afterwards using dynamical calculations is discussed. A surface structure model revealing InSb(110) top three layer atomic reconstructions through a comparison with the measured intensities is presented. The findings from ELEED analysis on InSb(110) surface are compared with the results of the previous studies of GaAs(110) from different directions such as the characteristics of normal-incidence and CMTA data, the scattering factors of the constituent atoms, the procedure of structure determination, the finally proposed structural parameters, and some other physical properties of these two III-V covalently bonded compound semiconductors. The introduction of an appropriate Debye-Waller factor for a diatomic material and the usefulness of the low temperature LEED intensity data are reported. Dissert. Abstr.

N80-16912 Maryland Univ., College Park.
GINZBURG-LANDAU THEORY AND THE SUPERCONDUCTING TRANSITION IN THIN, AMORPHOUS BISMUTH FILMS Ph.D. Thesis
Deborah VanVechten 1979 243 p
Avail: Univ. Microfilms Order No. 8002078

The calculation of the effect of (b/2)((the absolute value of psi) squared) squared on the fluctuation conductivity in three different approximations is presented. The predictions are compared to data on thin amorphous bismuth films. The first approximation calculates the contribution to the fluctuations' self energy of the tadpole diagrams. The values of the theoretical equation's fitting parameters were determined by a least squares method and turn out to depend on film thickness in the manner predicted by the theory. Dissert. Abstr.

N80-16913 Rutgers - The State Univ., New Brunswick, N. J.
SURFACE DEFECTS IN WEAKLY DEFORMED SINGLE CRYSTAL SILICON AND THEIR EFFECT ON INTERFACE PROPERTIES OF MOS CAPACITORS Ph.D. Thesis
Krishna Murty 1979 218 p
Avail: Univ. Microfilms Order No. 7928428

A quantitative correlation is established between the induced stresses and the electronic properties of the MOS capacitor and MOSFET device. X-ray topographic evidence showed that sputtered Ta films induce strain resulting in microplastic defects at the surface of Si wafer as shown on the X-ray section topographs. These defects are most likely caused by incorporation of Ta atoms in Si lattice. Auger electron spectroscopy has shown that implanted Ta atoms diffuse through SiO2 and reach Si surface. Dislocation etching followed by SEM examination verified X-ray topographic evidence of the location of defects on Si surface. Dissert. Abstr.

N80-16914*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PLANAR MULTIJUNCTION HIGH VOLTAGE SOLAR CELLS
John C. Evans, Jr., An-Ti Chai, and Chandra Goradia (Cleveland State Univ., Ohio) 1980 10 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81389; E-299) Avail: NTIS HC A02/MF A01 CSCL 20L

Technical considerations, preliminary results, and fabrication details are discussed for a family of high-voltage planar multijunction (PMJ) solar cells which combine the attractive features of planar cells with conventional or interdigitated back contacts and the vertical multijunction (VMJ) solar cell. The PMJ solar cell is internally divided into many voltage-generating regions, called unit cells, which are internally connected in series. The key to obtaining reasonable performance from this device was the separation of top surface field regions over each active unit cell. Using existing solar cell fabricating methods, output voltages in excess of 20 volts per linear centimeter are possible. Analysis of the new device is complex, and numerous geometries are being studied which should provide substantial benefits in both normal sunlight usage as well as with concentrators. A.R.H.

N80-16915# Army Military Personnel Center, Alexandria, Va.
STRUCTURAL PROPERTIES OF Nb3Sn DIFFUSION LAYERS FABRICATED ON SINGLE CRYSTAL Nb SUBSTRATES M.S. Thesis. Final Report
James Frederick DeBroux 4 Sep. 1979 146 p refs
(AD-A074738) Avail: NTIS HC A07/MF A01 CSCL 13/13

The structural properties of Nb3Sn diffusion layers fabricated on oriented single crystal Nb substrates exhibit systematic behaviors based on substrate orientation which result from interactions between the substrates and A15 overlayers. Preferred orientation of the diffusion layers is confirmed by X-ray and electron diffraction measurements. Within the bulk of a specific Nb(hkl) substrate layer, the preferred orientation appears to be a function of layer thickness for the range of thicknesses studied (or 1 to 17 micrometers). It is believed to develop over distance due to a competition between the growth region orientation at the advancing interface (required by lattice registry of the bcc and A15 lattices) and the tendency of Nb3Sn layers toward a natural growth direction, A15(100); this competition is moderated by in situ annealing of the Nb3Sn as growth advances. Consistent with this model is the fact that surface preferred orientation of a diffusion layer on a given Nb(hkl) substrate, both for as-grown surfaces and for internal surfaces exposed by etching, appears to be a function of net layer thickness. GRA

N80-16916# Ames Lab., Iowa.
MAGNETIC CRITICAL TEMPERATURE GAP IN Gd-Y ALLOYS

S. Legvold, P. Burgardt, and B. J. Beaudry. 1979. 11 p. refs. Presented at the Intern. Conf. on Magnetism, Munich, Sep. 1979. Prepared jointly with Iowa State Univ. of Science and Technology, Ames.
(Contract W-7405-eng-82)
(ISM-228; CONF-790909-8) Avail: NTIS HC A02/MF A01

In a search for Lifshitz points, a very interesting and complex region in the magnetic phase diagram of Gd-Y alloys near 30 atomic percent Y was found. An Apparent jump (gap) in the highest ordering temperature and perplexing magnetic behavior for samples near this expected Lifshitz point concentration was observed. DOE

N80-16917# Brookhaven National Lab., Upton, N. Y.
PHONON SCATTERING IN METALLIC GLASSES
J. L. Black. 1979. 9 p. refs. Presented at the 3d Intern. Conf. on Phonon Scattering, Providence, 28 Aug. 1979.
(Contract EY-76-C-02-0016)
(BNL-26610; CONF-790862-3) Avail: NTIS HC A02/MF A01

Theoretical and experimental developments in the study of metallic glasses at temperatures near or below 1K are presented. In this temperature regime, it appears that practically all glasses, whether metallic or insulating, behave in a similar fashion. The fact that such similarities occur, despite substantial structural differences between metallic and insulating glasses, constitutes a major theoretical challenge. The evidence for universal behavior and the theory which is necessary to understand this evidence are emphasized. Most of this evidence involves a comparison of phonon scattering in metallic glasses with its counterpart in insulating glasses. DOE

N80-16918# Ames Lab., Iowa.
ALLS, A GENERALIZED CRYSTALLOGRAPHIC LEAST SQUARES PROGRAM
R. L. Lapp and R. A. Jacobson. Aug. 1979. 72 p. refs.
(Contract W-7405-eng-82)
(IS-4708) Avail: NTIS HC A04/MF A01

A program was written in FORTRAN for the least squares refinement of single crystal X-ray diffraction data. The program uses the same methods to handle symmetry, calculate derivatives, and invert the matrix as ORFLS, but includes options for block diagonal matrix refinement, secondary extinction refinement, reuse of the matrix on successive cycles, and several input/output options to improve the program's efficiency and utility. A complete listing of the program and detailed instructions for its use are included. DOE

N80-16919# Sandia Labs., Albuquerque, N. Mex.
RADIATION-HARDENED BULK CMOS TECHNOLOGY
W. R. Dawes, Jr. and D. H. Habing. 1979. 7 p. refs. Presented at the Computers in Aerospace Conf., Los Angeles, 22 Oct. 1979.
(Contract EY-76-C-04-0789)
(SAND-79-0714C; CONF-791040-1) Avail: NTIS HC A02/MF A01

The evolutionary development of a radiation-hardened bulk CMOS technology is reviewed. The metal gate hardened CMOS status is summarized, including both radiation and reliability data. The development of a radiation-hardened bulk silicon gate process, which was successfully implemented to a commercial microprocessor family and applied to a new, radiaton-hardened, LSI standard cell family, is also discussed. The cell family is reviewed and preliminary charcterization data is presented. Various radiation-hardened technologies are compared with regard to performance, reliability, and availability is made. DOE

N80-16920# Oak Ridge National Lab., Tenn.
EQUILIBRIUM PROPERTIES OF THE FLUXOID LATTICE IN SINGLE-CRYSTAL NIOBIUM
H. R. Kerchner, D. K. Christen, S. T. Sekula, and P. Thorel. Jun. 1979. 12 p. refs. Presented at Superconductivity in d- and f-Band Metals, San Diego, Calif., 21 Jun. 1979. Submitted for publication.
(Contract W-7405-eng-26)
(CONF-790653-2) Avail: NTIS HC A02/MF A01

The dimensions and symmetry of the fluxoid lattice in a single-crystal sphere of niobium were measured by using a double-perfect-crystal small-angle neutron-scattering technique (DCSANS). The bulk magnetization of the same sample was measured by a field-sweep technique. In addition, the misalignment between the fluxoids and the applied magnetic field was observed by DCSANS. The findings are reported, and the measurements are compared with realistic microscopic theory where it is available. DOE

N80-16921# California Univ., Livermore. Lawrence Livermore Lab.
SURFACE SELF-DIFFUSION OF GERMANIUM AND SILICON
D. M. Makowiecki and J. B. Holt. 11 Jun. 1979. 12 p. refs. Presented at the 5th Intern. Conf. on Sintering and Related Phenomena, Notre Dame, Ind., 18 Jun. 1979.
(Contract W-7405-eng-48)
(UCRL-82865; CONF-790682-4) Avail: NTIS HC A02/MF A01

Surface self-diffusion was investigated by measuring the smoothing of surface profiles on germanium and silicon single crystals. The profiles generally would not change when the crystals were annealed in vacuum. However, removal of oxide films by a reducing atmosphere or flash heating yielded samples that changed their profiles considerably upon annealing. This evidence indicates that surface oxide films are stopping surface diffusion on these crystals. Preliminary data yield values for the surface-diffusion coefficients that are not particularly low when compared with those of metals. However, the data indicate low volume-diffusion coefficients for silicon and germanium, which may contribute to the nonsinterability of these materials. DOE

N80-16922# Bendix Corp., Kansas City, Mo.
SHELF-LIFE DETERMINATION OF EPOXY PREPREGS AND FILM ADHESIVES
B. G. Parker and C. H. Smith. 1978. 17 p. refs.
(Contract EY-76-C-04-0613)
(BDX-613-2110) Avail: NTIS HC A02/MF A01

Epoxy prepregs and film adhesives composed of partially cured epoxy resins and, in the case of the prepregs, a fiber matrix, are examined. Differential scanning calorimetry (DSC), a method for performing thermochemical analysis, is discussed and its application to epoxy prepregs for acceptance testing and observing the kinetics of the curing reaction is described. DOE

N80-16923# Argonne National Lab., Ill.
COMPTON SCATTER IN GERMANIUM AND ITS EFFECT OF IMAGING WITH GAMMA-RAY POSITION-SENSITIVE DETECTORS
I. S. Sherman, M. G. Strauss, and R. Brenner. 19 Oct. 1978. 12 p. refs. Presented at IEEE Nucl. Sci. Symp., San Francisco, 19 Oct. 1978.
(Contract W-31-109-eng-38)
(CONF-781028-1) Avail: NTIS HC A02/MF A01

The spatial spread due to Compton scatter in Ge was measured to study the reduction in image contrast and signal to noise ratio (S/N) resulting from erroneous readout in Ge position sensitive detectors. The step response revealing this spread was obtained by scanning with a 122 keV gamma ray beam across a boundary of two sectors of a slotted coaxial Ge(Li) detector that is 40 mm in diameter by 22 mm long. DOE

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics, and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-16924 California Univ., Berkeley.
STATISTICAL MECHANICS AND FIELD THEORY Ph.D. Thesis
Stuart Alan Samuel. 1979. 339 p.
Avail: Univ. Microfilms Order No. 8000504

The application of field theory methods to statistical mechanics is discussed. In particular, statistical systems are related to fermionic like field theories through a path integral representation. The basic definitions, ideas, and uses of anticommuting variables are presented. The Ising model, the free fermion model, and close packed dimer problems on various lattices are considered. Graphical calculation techniques are developed. The application of statistical mechanics intuition to field theories is also discussed. Certain relativistic field theories are shown to be equivalent to classical interacting gases. The problem of quark confinement is addressed. Dissert. Abstr.

N80-16925 California Inst. of Tech., Pasadena.
MATHEMATICAL MODELING AND EXPERIMENTAL STUDIES OF THERMAL REACTIONS OF COAL
Ph.D. Thesis
Ravi Jain 1980 312 p
Avail: Univ. Microfilms Order No. 8000958

A mathematical model based on coal's chemical structure and its reactions is developed for computer simulation pyrolysis. For the purpose of mathematical modeling, coal is considered to be a population of randomly distributed functional groups on a matrix. A scheme based on statistical transformations is devised to compute concentrations of reacting configurations before and during pyrolysis. The rates of reactions are expressed in terms of these concentrations. Differential equations governing the rate of change of state variables with pyrolysis time are formulated and numerically integrated on the computer. The dependence of the yield and composition of volatiles on (1) transport parameters like particle size and pressure, and (2) kinetic parameters like time, temperature and time-temperature history, is investigated. Gaseous products are analyzed using chromatography, while tar is characterized by GPC, NMR, and elemental analysis. Dissert. Abstr.

N80-16926 California Univ., Berkeley.
MOLECULAR THERMODYNAMICS OF DEW-POINT CALCULATIONS IN COAL GASIFICATION PROCESSES
Ph.D. Thesis
Abdalla Ibrahim El-Twaty 1979 205 p
Avail: Univ. Microfilms Order No. 8000333

A flow apparatus for dew point measurements suitable for highly asymmetric mixtures at high temperatures is described. The apparatus was used to measure the vapor pressure of anthracene in the temperature range 145-165 C and the solubility of n-hexadecane in methane at 125 C near 600 psig. A molecular thermodynamic model was developed to predict condensation conditions for coal gases. Fugacity coefficients are calculated from the viral equation for the gas-phase. The model is implemented in the form of a computer program which requires as input: the total pressure, weight fractions of all components of the feed and, for each tar cut, one vapor pressure datum, fraction aromaticity, and hydrogen-to-carbon ratio. The program calculates the initial dew point as well as the mole and weight percent of tar and/or water condensed as the temperature falls along the heat exchanger. Dissert. Abstr.

N80-16927# Argonne National Lab., Ill.
HIGH-TEMPERATURE THERMODYNAMIC PROPERTIES OF THE THORIUM-OXYGEN SYSTEM
R. J. Ackermann and M. Tetenbaum 1979 25 p refs Presented at the Intern. Colloq. on Mater. for High-Temperature Energy, Toronto, 16 Jul. 1979 and Intern. Symp. on Thermodyn. of Nucl. Mater., Jeulich, West Germany, 29 Jan. - 2 Feb. 1979
(Contract W-31-109-eng-38)
(CONF-790761-1) Avail: NTIS HC A02/MF A01

Thermodynamic properties of the Th-O system at high temperatures were investigated by means of mass effusion, mass spectrometric, and transpiration techniques over compositions ranging from the congruently vaporizing composition to the lower phase boundary composition. A very sharp decrease in O potential occurs when stoichiometric thoria is reduced but slightly from the stoichiometric composition. The small extent of reduction over a wide range of O potentials measured in the temperature range 2400 to 2655 K is a clear illustration of the higher stability of the ThO sub 2-x phase compared with actinide oxides such as UO sub 2-x, PuO sub 2-x, as well as other metal oxide systems. Estimates of delta H-bar sub O27, delta S-bar sub O2, and the standard free energy of formation of bivariant ThO sub 2-x compositions were made. A substantial increase in the total pressure of Th-bearing species occurs when stoichiometric thoria is reduced toward the lower phase boundary. DOE

N80-16928# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
SOLITON MASSES IN SUPERSYMMETRIC THEORIES
J. F. Schonfeld 1979 32 p refs
(Contract EY-76-C-02-1764)
(COO-1764-363) Avail: NTIS HC A03/MF A01

A systematic mass-calculation procedure derived from the supersymmetry algebra is presented. This method is applied to a large class of two dimensional models, and finds that in O(Dirac constant) the quantum-mechanical mass of a kink differs from its classical mass by a universal expression that has no dependence on the details of the interaction. The difference contains an ultraviolet divergence that exactly cancels the divergence in the classical mass. This contradicts recent claims that the difference must be zero. This result can also be checked using a number of other techniques, but it is argued that in space-times of dimension greater than two only the procedure derived from the supersymmetry algebra is likely to have any practical value. In two dimensions the difference between the quantum and classical masses can be related to properties of the amplitudes with which elementary bosons and fermions are scattered by a kink-antikink pair. These amplitudes satisfy a supersymmetry Ward identity. DOE

N80-16929# Idaho National Engineering Lab., Idaho Falls.
THERPP: A THERMODYNAMIC PROPERTIES PROGRAM
R. S. Deeds Aug. 1979 112 p refs
(Contract EY-76-C-07-1570)
(TREE-1081-Rev) Avail: NTIS HC A06/MF A01

The computer program THERPP, a program that calculates the thermodynamic properties of light hydrocarbons and mixtures of light hydrocarbons, is documented. A specific pressure-temperature or pressure-enthalpy grid is input to obtain properties in the desired region. THERPP is a modification of the program HSGC. Thermodynamic properties are calculated using Starling's modification to the Benedict-Webb-Rubin equation of state. DOE

N80-16930# Texas Univ., Austin. Center for Particle Theory.
INTERACTION BETWEEN CLASSICAL AND QUANTUM SYSTEMS: A NEW APPROACH TO QUANTUM MEASUREMENT. 2: THEORETICAL CONSIDERATIONS
T. N. Sherry and E. C. G. Sudarshan 1978 27 p refs
(Contract EY-76-S-05-3992)
(ORO-3992-342) Avail: NTIS HC A03/MF A01

An approach to the quantum measurement process is developed. In this approach, the apparatus is treated as a classical system; however, the classical apparatus is directly coupled to the quantum system. A principle of integrity, which requires that the observables of the classical apparatus retain their classical integrity, is introduced. The constraints that this principle places upon the coupling between the apparatus and the quantum system are examined. A model loosely based on the Stern-Gerlach experiment is used to illustrate the approach. A coupling which satisfies the principle of integrity is exhibited for this model. DOE

N80-16931# Texas Univ., Austin. Center for Particle Theory.
INTERACTION BETWEEN CLASSICAL AND QUANTUM SYSTEMS: A NEW APPROACH TO QUANTUM MEASUREMENT. 3: ILLUSTRATION
S. R. Gautam, T. N. Sherry, and E. C. G. Sudarshan 1978 28 p refs
(Contract EY-76-S-05-3992)
(ORO-3992-343) Avail: NTIS HC A03/MF A01

In accordance with the approach to quantum measurement in which the apparatus is treated as a purely classical instrument to be described by the laws of classical mechanics, some simple experiments are examined for the purpose of illustration. The Stern-Gerlach experiment is examined in detail: it is seen explicitly how the relevant information is transferred to the apparatus variables. A magnetic interferometer arrangement and a crossed field arrangement are also examined. Consideration of these experiments leads to the inclusion of an extra procedural step

in the approach. This extra step is necessary so that an observer may measure the classical apparatus variables at will after the interaction is completed. DOE

N80-16932# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
THERMAL, MECHANICAL, AND PHYSICAL PROPERTIES OF SELECTED BITUMINOUS COALS AND COKES
J. M. Singer and R. P. Tye 1979 44 p refs
(PB-300398/5; BM-RI-8364) Avail: NTIS HC A03/MF A01 CSCL 08I

Thermal, mechanical, and physical properties, of virgin and heat-treated seam coal were determined. Measured properties include thermal conductivity, specific heat, thermal expansion, density, compressive and tensile strength, porosity, and permeability, interdependence among all properties is discussed. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-16933# Pittsburgh Univ., Pa. Dept. of Industrial Engineering.
SCIENTIFIC MANAGEMENT OF THE REPAIRABLE ITEM INVENTORY SYSTEM Final Report
Steven Nahmias 28 Aug. 1979 5 p
(Grant AF-AFOSR-3494-78; AF Proj. 2304)
(AD-A074259; AFOSR-79-0982TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The purpose of this research was to examine a number of existing mathematical models of repairable inventory systems in order to discover possible improvements and/or generalization of existing work in this area of research. The research resulted in two research reports. One deals with a deterministic model for a repairable item inventory system with a finite repair rate. The second report deals with managing repairable item inventory systems. The second paper presents a relatively comprehensive review of the mathematical models which have appeared in the literature for managing inventory systems where items were subject to repair. It deals with both the continuous review models - METRIC and its extensions and periodic review models which are based on dynamic programming formulations. GRA

N80-16934# New York State Assembly Scientific Staff, Albany.
LINKING SCIENCE AND TECHNOLOGY TO PUBLIC POLICY: THE ROLE OF UNIVERSITIES
Abdo I. Baaklini, ed. 1979 156 p Prepared in cooperation with State Univ. New York, Albany
(Grant NSF ISP-75-18374)
(PB80-108202; ISBN-0-915194-03-1; LC-78-22608) Avail: NTIS HC A08/MF A01 CSCL 05A

The nature of the relationship between universities and state governments is addressed from both historical and contemporary perspectives. Benefits to be derived by universities and state governments through mutual cooperation and sources of problems that can arise from close relationships between the two are discussed in edited conference papers. The consensus is that increased cooperation between universities and state governments, particularly in the areas of S & T, will prove highly beneficial to both, provided that the arrangements through which this cooperation is achieved are sufficiently flexible to recognize autonomy of the universities. GRA

N80-16935# British Library, London (England).
REVIEW OF MANAGEMENT INFORMATION FROM COMPUTER-BASED CIRCULATION SYSTEMS IN ACADEMIC LIBRARIES
C. Mary Overton Jun. 1979 36 p
(BLL-BLRDR-5471; ISBN-0-905984-32-3; ISSN-0308-2385) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.: £3.50

The production and use of management information from computer-based circulation libraries in the United Kingdom are reviewed. Statistical, operational, and analytical information categories are described and the potential usefulness of each type is illustrated. Particular attention is paid to archive files. The management information used in fund allocation loan regulation, book buying, and stock management is briefly described. Factors which detract from the value of management information from automated circulation systems are discussed. K.L.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-16936 Nebraska Univ. - Lincoln.
CONTINGENCY FACTORS AFFECTING THE USER INVOLVEMENT ROLE IN THE DESIGN OF SUCCESSFUL INFORMATION SYSTEMS Ph.D. Thesis
Charles Russel Franz 1979 215 p
Avail: Univ. Microfilms Order No. 8001065

A field survey was conducted to test various contingency hypotheses. Different types of user involvement in designing and implementing information systems were examined along with the resultant success of the information systems to the user. User involvement was studied under various organizational and user conditions to determine the effect which these various conditions has upon user involvement as well as the subsequent user-perceived usefulness of the information system. It was concluded that user involvement is an important variable in producing successful information systems. It was emphasized that more attention should be devoted to developing other measures of user involvement and system's success. Dissert. Abstr.

N80-16937# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.
EXPERIENCE IN USING THE LIBRARIAN AS AN AID IN MANAGING LARGE-SCALE DATA BASES
J. L. Sexton 1978 15 p Presented at the 2nd Librarian User Group Meeting, Atlanta, 6-7 Mar. 1978
(Contract W-7405-eng-26)
(K/CSD/INF-78/4; CONF-780370-1) Avail: NTIS HC A02/MF A01

The storage, maintenance, and retrieval of many data bases varying widely in size (up to 50,000 records) and associated with each other in a variety of subtly implied ways was studied. A system was devised whereby the data are stored on a librarian master file in a highly atomized form and are retrieved and configured at job submission time on the basis of criteria such as work-package structuring, Engineering Department organizational lines, etc. The simplicity and ease-of-use of Librarian enabled implementation of an on-line data base management system and led to higher benchmarks of responsiveness and reliability than were previously possible. DOE

N80-16938# British Library, London (England). Research and Development Dept.
DESIGNING INFORMATION: SOME APPROACHES, SOME PROBLEMS AND SOME SUGGESTIONS
Patricia Wright 1979 55 p refs
(BLL-BLRDR-5509) Avail: British Library Lending Div., Boston Spa, Engl.

The problems of characterizing the domain of information design are considered. A range of taxonomic classifications that deal with four aspects of communication are provided; the medium (e.g., print/microform), the text itself (e.g., journal article/catalog card), the readers' interaction with the text (e.g., browsing/studying) and researchers' perspectives on information design (e.g., data collection/theory building). Emphasis is given to the value of studying information users and the category of user is broadened to include both the providers as well as the recipients of messages. Suggestions are made concerning areas where further research effort could be usefully directed. M.M.M.

N80-16939# Cambridge Univ. (England).
STATISTICAL BASES OF RELEVANCE ASSESSMENT FOR THE IDEAL INFORMATION RETRIEVAL TEST COLLECTION
H. Gilbert and K. Sparck Jones May 1979 99 p refs Sponsored in part by British Library
(BLL-BLRDR-5481)

The statistical basis of relevance assessment for information retrieval experiments is addressed with special reference to the proposed 'ideal' information retrieval test collection. Statistical arguments, or methods, for establishing what assessment information is required in given circumstances, from which actual procedures for obtaining this information may be derived are considered. The idea and specification of the 'ideal' collection is introduced along with some illustrative data on the relevance properties of various actual test collections. Some of the constraints on any proposed assessment methods and procedures are discussed. Two methods of determining assessment requirements, the 'pool' method and the 'squares' method, are developed in detail. The implications of the methods discussed are considered in terms of procedures for obtaining assessments when building the 'ideal' collection, and in relation to the use of the collection for future experiments. J.M.S.

N80-16940# British Library, London (England). Research and Development Dept.
DISSEMINATION OF NEW IDEAS IN LIBRARIANSHIP AND INFORMATION WORK
Apr. 1979 32 p Seminar held at British Library, London, 16 Oct. 1978
(BLL-BLRDR-5482; ISBN-0-905984-39-0; ISSN-0307-2385) Avail: British Library Lending Div., Boston Spa, Engl.

The dissemination of advanced developments in the field of libraries and information systems is discussed. Problems of dissemination, techniques of dissemination, and the role of national organizations are among the factors covered. Matching the technique to the target group is included. J.M.S.

N80-16941# British Library, London (England).
CAB/CAIN EVALUATION PROJECT: A COMPARATIVE STUDY ON THE PERFORMANCE OF TWO AGRICULTURAL DATABASES IN A COMPUTERIZED CURRENT AWARENESS SERVICE
Susan Harvey 1979 93 p refs
(BLL-BLRDR-5483; ISBN-90-220-0) Avail: British Library Lending Div., Boston Spa, Engl.

The selective dissemination of information performance of the Commonwealth Agricultural Bureau and the cataloging and indexing tapes of the US National Agricultural Library is compared with emphasis on the needs of a representative population of users of agricultural information. Factors which affect the overall performance of the system are identified along with the way in which they interact. These factors include the data base, search software, users-system interface, and the user. J.M.S.

N80-16942# British Library, London (England). Research and Development Dept.
SOME STATISTICAL INDICATORS OF UK ABSTRACTING AND INDEXING SERVICES
H. East Jul. 1979 34 p
(BL-BLLRDR-5488; ISBN-0-905984-40-4) Avail: British Library Lending Div., Boston Spa, Engl.

Statistical indicators relating to the size, longevity, ownership and subject scope of British abstracting and indexing services, are presented. Of the 2.9 million references published annually, 715 are in machine readable form and 629 carry abstracts. Commercial producers are currently predominant in terms of annual volumes of publication; the greatest growth is in the life sciences area. Two out of three services producers operate within a 50 mile radius of central London. M.M.M.

N80-16943# Leicester Univ. (England). Primary Communications Research Centre.
THE PRESENTATION OF SCIENCE BY THE MEDIA
Greta Jones, Ian Connell, and Jack Meadows 1979 83 p refs
(BLL-BLRDR-5494; ISBN-0-906083-04-4; ISSN-0141-0261) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The construction of media interpretations of science is studied. The sources of information available to media specialists, the use of these sources, and the way in which source material is transmuted in the course of its transmission to the general public are investigated. It is concluded that methods of approach to science are generally comparable across the media, although the nature of the medium concerned necessarily imposes its own conventions on the final mode of presentation. K.L.

N80-16944# Sheffield Univ. (England).
FORMAL DESCRIPTION, CODING AND COMPUTER HANDLING OF GENERIC FORMULAE IN CHEMICAL PATENTS
E. V. Krishnamurthy and M. F. Lynch Mar. 1979 37 p refs
(BLL-BLRDR-5490) Avail: British Library Lending Div., Boston Spa, Engl.

Some aspects of a formal linguistic approach to the automatic coding and analysis of chemical patents are discussed. Close analogy exists between the two problems of patent classification and pattern analysis. A method is outlined for developing parsing algorithms for the purpose of checking the inclusion of a specific structure or a partially defined structure as a member of the set of structures defined by a generic chemical formula occurring in chemical patents. A.R.H.

N80-16945# British Library, London (England).
AN EXPERIMENT IN SYNOPSIS PUBLISHING IN THE FIELD OF MECHANICAL ENGINEERING
R. J. Millson Sep. 1979 127 p refs
(BLL-BLRDR-5498; ISBN-0-905984-41-2; ISSN-0308-2385) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.: £10.00

In order to evaluate the concept of synopsis publishing, a subscription journal, Engineering Synopses, was published containing synopses derived from papers accepted for publication in the Proceedings of the IMechE. A regular subscription distribution of some 160 copies of the journal was achieved, augmented by about a further 150 copies distributed to questionnaire recipients, IMechE Committee members, etc. Correspondence with and visits to organizations in academia, industry and elsewhere were undertaken to augment the views of respondents to the questions and to increase the scope of the research by extending it beyond the confines of the disciplines covered by mechanical engineering. Notes are included on the cost effectiveness of the synopsis journal package compared with the traditional journal it might supplant, carrying the same number of titles; copyright implications and the launching of a synopsis journal. Reference is made to the possible future role of synopsis publishing in developing information macro-policies. Particular emphasis is placed on the needs of professional engineers in industry and a role for synopsis publishing in attempting to meet these needs. The prospects of integrating the synopsis journal with centralized on-demand services for full text provision are discussed. M.M.M.

N80-16946# Polytechnic of North London (England). School of Librarianship.
THE USE OF FORM DESIGNS FOR CATALOGUE INPUT: A PROJECT INVOLVING THE HP2645A DISPLAY STATION
S. Datta, E. J. Gredley, and P. J. Sallis Mar. 1979 67 p
(BLL-BLRDR-5501) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Research was performed to: (1) investigate the possibilities of teaching MARC cataloging to participants in the project;

(2) familiarize participants with the HP2645A terminal, exploring some of its editing facilities as a stand-alone device; and (3) investigate the value and usefulness of various form overlay designs for the input of MARC cataloging data. M.M.M.

N80-16947# British Library, London (England). Research and Development Dept.
PERSONAL CURRENT AWARENESS SERVICE: A HANDBOOK OF TECHNIQUES FOR MANUAL SDI
T. Whitehall Sep. 1979 124 p refs
(BLRDR-5502; ISBN-0-905984-43-9; ISSN-0306-2385) Avail: British Library Lending Div., Boston Spa, Engl.: £7.00; 16 BLL overseas, 15 European or 40 UK BLL photocopy coupons

Current awareness service to individuals based on scanning material collected by libraries is reported. Methods were taken from the literature and from interviews carried out in academic, special and public libraries. A wide variety of approaches to manual SDI was discovered, with librarians, subject specialists and project workers acting as scanners. Its place alongside other current awareness techniques, including computerised SDI, is discussed. There is a detailed treatment of profiling, scanning and notification techniques. A quality control system is described which is based on criteria identified by clients as being relevant to the value of an SDI service. Organization, promotion and management of SDI are also covered, and an analysis of production techniques produces four basic approaches. M.M.M.

N80-16948# British Library, London (England). Research and Development Dept.
INFORMATION SYSTEMS IN UK AGRICULTURE Final Report
G. M. Craig May 1979 85 p
(BLL-BLRDR-5469; ISBN-0-9505984-33-1; ISSN-0308-2385) Avail: British Library Lending Div. Boston Spa, Engl.: £5.00-10.00; 16 BLL overseas, 15 European or 40 UK BLL photocopy coupons

The complexity of the system(s) which exist in the UK is pointed out in order to convey the findings and applications of agricultural research to agriculturists working in different areas. Increased production and the use of certain forms of information such as review articles, seems potentially important, and new information storage and retrieval systems, utilizing modern technology, offer opportunities for improving the organization and accessibility of existing agricultural literature and data. More user education is necessary to ensure the efficient use of existing information. M.M.M.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-16949# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, AND CERTAIN INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1980, PART 1
Washington GPO 1979 1179 p refs Hearings on H.R. 4394 before a subcomm. of the Comm. on Appropriations, 96th Congr., 1st Sess., 21 Feb. 1979
(GPO-41-318) Avail: Comm. on Appropriations

Highlights of NASA's 1979 accomplishments are reviewed as a backdrop to testimony covering a space shuttle supplementary request of $185 million dollars, and a proposed 1980 budget totaling $47 billion dollars. Special emphasis is given to cost growth for space shuttle and operating plans for SEASAT, the space telescope, and the Galileo and Voyager projects. Other areas discussed include the space transportation system, space sciences, space and terrestrial applications, aeronautics and space technology, space tracking and data systems, construction of facilities, and program management. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-16950* Denver Univ., Colo. Industrial Economics Div.
SPACE BENEFITS: THE SECONDARY APPLICATION OF AEROSPACE TECHNOLOGY IN OTHER SECTORS OF THE ECONOMY
Jan. 1980 236 p
(Contract NASw-3113)
(NASA-CR-162697) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 05A

Over 580 examples of the beneficial use of NASA aerospace technology by public and private organizations are described to demonstrate the effects of mission-oriented programs on technological progress in the United States. General observations regarding technology transfer activitiy are presented. Benefit cases are listed in 20 categories along with pertinent information such as communication link with NASA; the DRI transfer example file number and individual case numbers associated with the technology and examples used; and the date of the latest contract with user organizations. Subject, organization, geographic, and field center indexes are included. A.R.H.

N80-16951# Rutgers - The State Univ., New Brunswick, N. J. Bureau of Engineering Research.
ULTRAFILTRATION OF RAW SEWAGE USING AN IMMOBILIZED ENZYME MEMBRANE
Shaw S. Wang, Burton Davidson, and C. Y. Jeng Jul. 1979 32 p refs
(Contract N00014-77-C-0566)
(AD-A074804) Avail: NTIS HC A03/MF A01 CSCL 13/2

Ultrafiltration of raw sewage was performed using multiple-enzymes immobilized on non-cellulosic, ultrafiltration membranes. An increase of 12% in the permeate flux rate at quasi-steady state was observed due to the action of the immobilized enzymes. Enzymes were immobilized by physical sorption to minimize the loss of ultrafiltration capability of the membrane, due to immobilization process. A mathematical model based on diffusive transport and enzymatic action was presented. A standard Marquardt algorithm and a fourth-order Runge-Kutta integration routine were used for estimation of the non-linear parameters in the model. Comparing data presented here to the data reported earlier on the ultrafiltration on NFDM (non-fat, dry milk), it was found that the enzyme-membrane has a longer half-life for the NFDM case than for the raw sewage case. Furthermore, the first-order enzyme decay rate is much faster in the multiple enzyme system used in raw sewage filtration than the single enzyme system used in the ultrafiltration of NFDM. GRA

N80-16952# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN: THE PUBLIC INSTITUTIONS MODEL TECHNICAL DOCUMENTATION
Avis C. Vidal and H. James Brown Mar. 1979 48 p refs
(Grant NSF ENV-72-03372)
(PB-301112/9; NSF/RA-780424) Avail: NTIS HC A03/MF A01 CSCL 13B

A model formalizing the decision processes that plan the

size and location of public institutional facilities is presented. The model is worked out in detail for the planning of public elementary and secondary schools. Demand for school facilities is estimated using the sixty household types allocated by the housing model. At the town level, this estimate of demand is used to determine whether new facilities will be built; within towns, the distribution of households is used as a guide in locating new schools. When new facilities are constructed, the associated capital expenditures are used by the fiscal model in determining each town's capital budget and tax rate. These linkages allow the modeling of school construction to be responsive to population changes. GRA

N80-16953# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN. THE HOUSING MODEL TECHNICAL DOCUMENTATION
Hugh Wilkins, H. James Brown, John Kirlin, Mingche Li, and Kerry Vandell. May 1979. 130 p. refs.
(Grant NSF ENV-72-03372)
(PB-301111/1; NSF/RA-780418) Avail: NTIS
HC A07/MF A01 CSCL 13B

A housing model to determine the future development pattern of residential land use is presented. The model determines the amounts and types of new residential development and locates the various housing types on particular sites on the basis of developer's profit. The model distinguishes a total of seven single-family and five multiple-family structure types for new construction. The socio-economic characteristics of households in each enumeration district are updated based on the location of new construction and housing choices made by households moving into the area. GRA

N80-16954# Otis Elevator Co., Denver, Colo. Transportation Technology Div.
VEHICLE LONGITUDINAL CONTROL AND RELIABILITY PROJECT. A REVIEW OF AGT PROPULSION, POWER CONDITIONING, BRAKING AND POWER DISTRIBUTION TECHNOLOGY, VOLUME 2, PART C Final Report
P. Schumacher, ed. Jun. 1979. 78 p.
(Contract DOT-UT-70048)
(PB-300373/8; OTIS/TTD/VLCR-064;
UMTA-IT-06-0148-79-2) Avail: NTIS HC A05/MF A01 CSCL 13B

The state of the art of each technology is assessed to provide top level information for system design, specification writing and regional planning. The topics discussed are: propulsion motor technology including both dc and ac motors, power conditioning options for converting guideway power to a suitable form for the motor being used, electrical and mechanical braking, and power distribution and collection considerations. GRA

N80-16955# Otis Elevator Co., Denver, Colo. Transportation Technology Div.
VEHICLE LONGITUDINAL CONTROL AND RELIABILITY PROJECT. A REVIEW OF ENTRAINMENT TECHNOLOGY Final Report
P. Schumacher, ed. Feb. 1979. 92 p. refs.
(Contract DOT-UT-70048)
(PB-300372/0; OTIS/TTD/VLCR-059;
UMTA-IT-06-0148-79-1) Avail: NTIS HC A05/MF A01 CSCL 13B

The results of a survey of entrainment technology conducted for the VLCR project are presented. The technology review was conducted to evaluate the state-of-the-art in train formation and to identify those areas requiring special attention for Automated Guideway Transit (AGT) systems. The information which is summarized was derived through: (1) a literature search and review; (2) discussions with coupler manufacturers; (3) a questionnaire to rapid transit operators; and (4) a study of transit authority coupler specifications. GRA

N80-16956# National Technical Information Service, Springfield, Va.
A DIRECTORY OF COMPUTER SOFTWARE APPLICATIONS: SPACE TECHNOLOGY Progress Report, 1970 - Jun. 1979
Jun. 1979. 142 p.
(PB-296039/1; NTIS/SA-79/08) Avail: NTIS
HC $28.00/MF $28.00 CSCL 22A

Approximately 2600 space technology reports that list computer programs and/or their documentation are cited. These software applications pertain to topics such as manned spacecraft, space probes, scientific satellites, and communications satellites. Satellite and spacecraft trajectories are determined and launch vehicle performance is evaluated. The directory contains complete bibliographic data for each report as well as a subject and a corporate author index. GRA

N80-16957# Oklahoma State Dept. of Health, Oklahoma City.
MUNICIPLE WASTEWATER TREATMENT BY THE OVERLAND FLOW METHOD OF LAND APPLICATION Final Report, Jun. 1974 - Mar. 1979
Dempsey H. Hall, Joel E. Shelton, Charles H. Lawrence, Ernest D. King, and Raymond A. Mill. Aug. 1979. 141 p. refs. Prepared in cooperation with Oklahoma Univ. Health Sciences Center, Oklahoma City.
(Grant EPA-R-803218)
(PB80-102908; EPA-600/2-79-178) Avail: NTIS
HC A07/MF A01 CSCL 02C

The capabilities of treating raw municipal waste water and secondarily treated waste water were assessed on a seasonal basis by applying the waste waters to experimental overland flow treatment modules. Application techniques employed in the raw treatment phase include rotating spray booms with fan nozzles. Fixed riser and trough methods were used for the secondary treatment phase. The performance of the raw waste water overland flow system and the performance of the waste water stabilization pond receiving the same waste water were compared. Tests were conducted to determine removal efficiencies for the two treatment systems and the soil composition. GRA

N80-16958# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
DESIGN AND CONSTRUCTION OF COVERS FOR SOLID WASTE LANDFILLS Progress Report, Mar. 1977 - Dec. 1978
R. J. Lutton, G. L. Regan, and L. W. Jones. Aug. 1979. 277 p. refs.
(Contract EPA-IAG-D7-01097)
(PB80-100381; EPA-600/2-79-165) Avail: NTIS
HC A13/MF A01 CSCL 13B

Guidelines are provided in selection, design, and construction of cover for management of municipal, industrial, and hazardous solid wastes (with the exception of radioactive waste). Natural soils as cover are the prinicipal subject; however, synthetic membranes, chemicals, and waste products are also discussed in detail since their relative importance should grow in the future. Each of the important functions of cover is considered in the context of selecting and designing cover but with cognizance of the effects of conflicts that may arise, e.g., between water infiltration and gas venting. A scheme is proposed for establishing functional priorities and in turn for weighting the importance of soil characteristics to allow for most effective selection. Allowance is made for functional conflicts through design features. Procedures are presented for designing soil cover systems to meet the requirements based on principles of soil mechanics and the state of the art in soil construction. Accordingly, this report is not so much a review of current methods as it is a guide to potentially the best practice. GRA

N80-16959# Celanese Chemical Co., Inc., Corpus Christi, Tex. Technical Center.
BIOLOGICAL TREATMENT OF HIGH STRENGTH PETROCHEMICAL WASTEWATER Final Report, 20 Feb. 1976 - 23 Sep. 1979
William J. Humphrey and Enrique R. Witt. Aug. 1979. 114 p.
(Grant EPA-12020-EPH)
(PB80-100456; EPA-600/2-79-172) Avail: NTIS
HC A06/MF A01 CSCL 13B

The biological treatment of a complex petrochemical wastewater containing high concentrations of organic chlorides, nitrates, and amines was studied using a sequence of anaerobic methanogenesis and oxygen activated sludge. Only partial removal of chemical oxygen demand (COD) was achieved during anaerobic

denitrification because of the relatively low nitrate/COD ratio. Anerobic methanogenic treatment also was unsuccessful in reducing the COD concentration to any great extent, even after pretreatment by anaerobic denitrification. The activated sludge system was effective in removing the biodegradable portion expressed as biochemical oxygen demand of the pretreated combined wastewater stream; but the yellow color of the effluent was unacceptably dark. GRA

N80-16960# Wyle Labs., Inc., Colorado Springs, Colo. Scientific Services and Systems Group.
TRUCK DESIGN OPTIMIZATION PROJECT. PHASE 2: ANALYTICAL TOOL ASSESSMENT REPORT
L. Johnson, A. Gilchrist, M. Healy, C. Bush, and G. Sheldon Aug. 1979 58 p refs
(Contract DOT-FR-742-4277)
(PB80-104888; TDOP/TR-06; FRA/ORD-79/36) Avail: NTIS HC A04/MF A01 CSCL 13F

The performance of Type 2 freight car truck designs versus the standard, three-piece Type 1 truck was evaluated. The analytical tools, consisting primarily of freight car truck simulation models and their supporting computer programs, used to extend and interpret the field test results are described. GRA

N80-16961# Woods Hole Oceanographic Institution, Mass.
WASTEWATER RENOVATION AND RETRIEVAL ON CAPE COD
R. F. Vaccaro, P. E. Kallio, B. H. Ketchum, W. B. Kerfoot, and A. Mann Aug. 1979 193 p refs Prepared in cooperation with Massachusetts Div. of Water Pollution Control, Westborough
(Grant EPA-S-802037)
(PB80-100423; EPA-600/2-79-176) Avail: NTIS HC A09/MF A01 CSCL 02C

Alternative wastewater disposal techniques which promise to maintain high groundwater quality and promote its conservation are considered. An assessment of agricultural spray-irrigation as a potential means of lessening groundwater contamination and depletion is given. Experimental emphasis is placed on variations in the rates and methods of wastewater application and in the types of renovation agricultural crops placed under wastewater irrigation. Results from these studies are promising and suggest that under ideal circumstances, the coupling of secondary domestic effluent to animal forage crops can bring about a degree of wastewater renovation which exceeds direct disposal to sand filter beds and approaches the goals of tertiary treatments. GRA

N80-16962# Michigan State Univ., East Lansing. Inst. of Water Research.
UTILIZATION OF NATURAL ECOSYSTEMS FOR WASTEWATER RENOVATION
Thomas M. Burton, Darrell L. King, Robert C. Ball, and Thomas G. Bahr Apr. 1979 170 p refs
(Grant EPA-Y-005065)
(PB80-100431; EPA-905/3-79-003) Avail: NTIS HC A08/MF A01 CSCL 13B

A facility for the experimental treatment, recycle, and reuse of municipal sewage plant effluents is described. The facility provides for the diversion of secondary effluent from an activated sludge treatment plant. This waste flow is directed away from the receiving stream to an intensely managed aquatic and terrestrial nutrient system. Nutrients are stripped from the waste flow as it proceeds through the system incorporating nutrients into harvestable biomass. Biological activity in the aquatic system has a major impact on water quality as evidenced by significantly reduced water concentrations of phorphorus, nitrogen, and inorganic carbon. GRA

N80-16963# Kerr (Robert S.) Environmental Research Lab., Ada, Okla. Industrial Sources Section.
ACTIVATED CARBON TREATMENT OF INDUSTRIAL WASTEWATERS: SELECTED TECHNICAL PAPERS
Aug. 1979 308 p refs
(PB80-100522; EPA-600/2-79-177) Avail: NTIS HC A14/MF A01 CSCL 13B

Papers from petroleum refining/petrochemical industry symposia are presented. The topics covered are: (1) state-of-the-art; (2) organic compound removal; (3) granular pilot-scale studies; (4) powdered activated carbon pilot-scale studies; (5) full-scale granular activated carbon treatment; (6) full-scale powdered activated carbon treatment; and (7) activated carbon regeneration. The economics of activated carbon treatment are also considered. GRA

N80-16964# DeLeuw, Cather and Co., Chicago, Ill.
CHARACTERISTICS OF URBAN TRANSPORTATION SYSTEMS: A HANDBOOK FOR TRANSPORTATION PLANNERS Final Report
D. B. Sanders and T. A. Reynen Jun. 1979 196 p refs Prepared in cooperation with Urban Inst. Sponsored in part by FHWA
(Contract DOT-UT-20019)
(PB-301319/0; UMTA-IT-06-004) Avail: NTIS HC A09/MF A01 CSCL 13B

A handbook to be used by transportation planners and urban specialists for estimating system parameters for conventional transportation technology is presented. Three modes are evaluated: rail transit, local bus and bus rapid transit, and highway systems. Each mode contains an assessment of the following seven selected supply parameters: speed, capacity, operating cost, energy consumption, pollutant emissions, capital costs, and accident frequency. GRA

N80-16965# California State Div. of Mass Transportation, Sacramento.
HUMAN SERVICE AGENCY TRANSPORTATION COORDINATION Final Report
James P. Hunter Jun. 1979 101 p refs
(PB-300891/9; DMT-047; Rept-64-120-631060; UMTA-CA-09-8001-79-4) Avail: NTIS HC A06/MF A01 CSCL 13B

The costs of independent special purpose transportation services were compared with the costs of combined transportation services. The feasibility of coordinating existing transit to satisfy the transportation needs of human service agencies in various sized communities was considered. The California Department of Transportation's (Caltrans) study of the feasibility of coordinating human service agency transportation in three areas of California is presented. Cost and ridership data were collected from these agencies by means of inventories, interviews, and questionnaires. The cost data indicated that combined transportation costs are approximately equal to the average of the costs of independent special purpose transportation. GRA

N80-16966# General Accounting Office, Washington, D. C. Community and Economic Development Div.
STRONGER FEDERAL DIRECTION NEEDED TO PROMOTE BETTER USE OF PRESENT URBAN TRANSPORTATION SYSTEMS
4 Oct. 1979 71 p
(PB-300974/3; CED-79/126) Avail: NTIS HC A04/MF A01 CSCL 13B

The Federal Highway Administration and Urban Mass Transportation Administration regulations requiring urban areas to develop short-range transportation plans to make better use of present urban transportation systems are discussed. The regulations have not been as effective as they could have been because the two Federal agencies have not administered the regulations consistently, urban areas have not been able to institute planning processes that result in unified plans, and projects that have the most potential for improving the efficiency of existing transportation systems have not been widely adopted. The Secretary of Transportation needs to strengthen Federal administration of the regulations. GRA

N80-16967# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND QUALITY IN ENVIRONMENTAL PLANNING AND DESIGN: THE TRANSPORTATION MODEL TECHNICAL DOCUMENTATION
Michael Tyler and Steve Cummings May 1979 61 p refs
(Grant NSF ENV-72-03372)
(PB-300981/8; NSF/RA-780430) Avail: NTIS HC A04/MF A01 CSCL 13B

The projection of travel demand on transportation facilities is made to provide data for the evaluation of the transportation network and are linked to other models such as fiscal, air and noise. The model is composed of a travel demand and a supply or volume/performance component. The demand submodel projects travel demand between internal zones in the study area and between internal and external zones. The supply model is implemented by adding each projected origin destination pair into the network incrementally and recalculating the network equilibrium after each increment using the least time rule. In this manner, travel demand is allocated over alternative routes as a function of the level of demand. GRA

N80-16968# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN: THE LAND VALUE MODEL TECHNICAL DOCUMENTATION
Howard S. Bloom and H. James Brown Mar. 1979 17 p refs Color illustrations reproduced in black and white
(Grant NSF ENV-72-03372)
(PB-301047/7; NSF/RA-780434) Avail: NTIS
HC A02/MF A01 CSCL 13B

A land value model to update vacant land values by hectare to account for the impact of new development is presented. These updated values provide impact both to land use models for allocations in future time periods and to the public fiscal model to provide estimates of assessed value. GRA

N80-16969# Seattle Office of Management and Budget, Wash.
OVERALL CITY TECHNOLOGY PROCESS Final Report
Arun G. Jhaveri and Casey Jones Apr. 1979 31 p
(Grant NSF ISP-78-11664)
(PB-301109/5; NSF/RA-790079) Avail: NTIS
HC A03/MF A01 CSCL 13B

State-of-the-art science and technology are applied to city problems and to integrate the technology transfer process into the city's regular decision-making process. The integration of the technology assessment and application process into the city's annual budget process and the involvement of significant city staff in technology assessment, priority setting, and application activities is described. Municipal energy conservation and program performance measurement are emphasized. GRA

N80-16970# Transportation Research Board, Washington, D.C.
LOCAL AND REGIONAL DEVELOPMENT AND TRANSPORTATION NEEDS
Edward C. Muse, Robert E. Taggart, Jr., Jon E. Burkhardt, Annette M. Gaegler, and William C. Hartwig 1979 50 p refs
(PB-301207/7; TRB/TRR-716) Avail: NTIS HC A03/MF A01; HC also available from Transportation Research Board, Washington, D. C. 20418 HC $3.00 CSCL 13B

Contents: Environmental planning and design for rapid transit facilities; Estimating socioeconomic impacts of transportation systems; Residential dislocation costs and consequences; Dynamic social and economic effects of the Connecticut Turnpike; Rural road-closure planning program to preserve agricultural land; New location patterns and U.S. transportation policy; Development of truck trip-generation rates by generalized land-use categories. GRA

N80-16971# Hensley-Schmidt, Inc., Jackson, Miss.
TRANSPORTATION NEEDS FOR THE ELDERLY, HANDICAPPED AND LOW INCOME OF MISSISSIPPI
Kay Van Sickel and Kenneth W. Heathington 1979 33 p Sponsored in part by Mississippi State Highway Dept., Jackson., and Mississippi Council on Aging
(PB-301273/9) Avail: NTIS HC A03/MF A01 CSCL 13B

The present role of public transportation in Mississippi and future alternative directions are outlined. An inventory of special transportation services and analysis of transportation demands and vehicle needs along with alternatives for coordination of these services are included. A manual of Federal programs that provide funds for transportation services, both rural and urban, was compiled to aid transportation agencies and communities in Mississippi in developing comprehensive, balanced transportation programs. GRA

N80-16972# Young (Arthur) and Co., Washington, D. C.
INFORMATION TRANSFER IN THE OFFICE OF RESEARCH AND DEVELOPMENT Final Report
Steven Stryker, Hugo Becker, and Angela Griffiths Aug. 1979 46 p
(PB80-101371; EPA-600/9-79-030) Avail: NTIS
HC A03/MF A01 CSCL 05B

The results of a study conducted to determine the effectiveness of the Office of Research and Development's (ORD) information transfer activities are presented. The type and volume of activity is reported as well as costs, intended and actual audiences, and the method used for determining each activity's public demand. Activities include journal articles, speeches, conferences and seminars, technical reports, and newsletters. GRA

N80-16973# Colorado Univ. at Boulder.
TREATMENT OF SECONDARY EFFLUENT BY INFILTRATION-PERCOLATION Final Report, Aug. 1975 - Sep. 1978
D. G. Smith, K. D. Linstedt, and E. R. Bennett Aug. 1979 118 p refs Prepared in cooperation with City of Blouder, Colo.
(Grant EPA-R-803931)
(PB80-103658; EPA-600/2-79-174) Avail: NTIS
HC A06/MF A01 CSCL 13B

The treatment performance of three rapid infiltration basins receiving secondary treated municipal waste water is evaluated at the City of Boulder Sewage Treatment Plant. The pretreatment, the hydraulic load to the soil, the duration wetting and drying cycles, and climatic influences on system performance are evaluated. Two of the basins have unscarified beds while one has a bed surface constructed in a ridge and furrow arrangement. Year-round operation allowed evaluation of applied effluent and infiltrated water collected from underdrains during extreme climatic conditions. GRA

N80-16974# DeLeuw, Cather and Co., Chicago, Ill.
AGT GUIDEWAY AND STATION TECHNOLOGY. VOLUME 8: WEATHER PROTECTION CONCEPTS Final Report
R. D. Stevens, T. J. Nicario, T. J. McGean, S. M. Easley, and T. L. Easley Aug. 1979 249 p refs Prepared jointly with ABAM Engineers Inc.
(Contract DOT-UT-70066)
(PB-299746/8; UMTA-IT-06-0152-79-7) Avail: NTIS
HC A11/MF A01 CSCL 13F

Guideway, station, and weather protection concepts which will reduce the cost and implementation time associated with AGT systems as well as to improve performance are considered. Weather protection concepts are presented for guideways associated with AGT systems, with emphasis on minimizing costs and energy consumption while maximizing system operability/reliability during winter weather. The concepts include a comparison of embedded pipe and electric heating systems with varied heated widths, heating densities, and amount of utilization. GRA

N80-16975# Comsis Corp., Wheaton, Md.
TRANSIT CORRIDOR ANALYSIS: A MANUAL SKETCH PLANNING TECHNIQUE Final Report
M. M. Carter, R. H. Watkins, J. D. ODoherty, M. Iwabuchi, and G. W. Schultz Apr. 1979 207 p Prepared for Urban Mass Transportation Admin. Prepared in cooperation with DeLeuw, Cather and Co., Washington, D.C., Voorhees (Alan M.) and Assoc., Inc., McLean, Va., and Pratt (R. H.) Assoc., Inc., Washington, D.C.
(PB-301378/6; UMTA-MD-06-0046-79-1) Avail: NTIS
HC A10/MF A01 CSCL 13B

A sketch planning technique for quick first evaluations of urban transportation planning proposals is described. General parameters and assumptions are discussed and those situations in which the technique can be applied are identified. The method and computation procedures are presented along with examples of each step of the procedures as applied to a sample problem. GRA

N80-16976# National Technical Information Service, Springfield, Va.
ELECTRIC AUTOMOBILES. CITATIONS FROM THE NTIS

DATA BASE Progress Report, 1964 - Aug. 1979
Audrey S. Hundemann Sep. 1979 276 p Supersedes NTIS/PS-78/0880, NTIS/PS-77/0635, NTIS/PS-76/0560 and NTIS/PS-75/490
(NTIS/PS-79/0990/6; NTIS/PS-78/0880; NTIS/PS-77/0635; NTIS/PS-76/0560; NTIS/PS-75/490) Avail: NTIS HC $28.00/MF $28.00 CSCL 13F

The research pertaining to battery systems, costs, and evaluations of electric vehicles are presented. Nickel zinc and lead acid batteries are studied and various types of lithium cells and hybrid heat engine/electric systems are reported. This bibliography contains 271 abstracts, 58 of which are new entries to the previous edition. GRA

N80-16977# National Technical Information Service, Springfield, Va.
ELECTRIC AUTOMOBILES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Aug. 1979
Audrey S. Hundemann Sep. 1979 285 p Supersedes NTIS/PS-78/0881; NTIS/PS-77/0637; and NTIS/PS-76/0561
(NTIS/PS-79/0991/4; NTIS/PS-78/0881; NTIS/PS-77/0637; NTIS/PS-76/0561) Avail: NTIS HC $28.00/MF $28.00 CSCL 13F

Citations from worldwide research cover the design of electric automobiles, vans, buses, and hybrid vehicles. Studies are included on lead-acid, zinc-air, lithium-sulfur, and nickel-cadmium batteries; fuel cells; drive trains; and chassis construction. This updated bibliography contains 279 abstracts, 75 of which are new entries to the previous edition. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-16978 Texas Univ. at Austin.
INTERIOR REISSNER-NORDSTROM BLACK HOLES Ph.D. Thesis
Nelson Arturo ZamoranoHole 1979 130 p
Avail: Univ. Microfilms Order No. 7928372

A scalar wave packet localized at the event horizon, and considered as a small disturbance is able to send waves that after a double scattering sneak into the Cauchy horizon producing unbounded energy densities there. This is a direct consequence of the analytic structure of the reflection and transmission coefficients. It is concluded that the inner horizon is generally unstable in nature. In the Reissner-Nordstrom case, the inclusion of the observed universal microwave radiation is sufficient to produce a great change of the R-N topology at the Cauchy horizon. In dealing with the dynamics of the massless scalar waves in this geometry the radial part of the equations arising by perturbations of a family of black holes (Schwarzschild, Reissner-Nordstrom and Kerr) is a form of the spin-weighted spheroidal wave equation. In other words, the angular part and the radial part of scalar perturbations of the black holes mentioned above obey the same equation. Dissert. Abstr.

N80-16979 Tufts Univ., Medford, Mass.
RADIO ASTRONOMICAL OBSERVATIONS OF REGIONS OF STAR FORMATION Ph.D. Thesis
Robert Frederick Willson 1979 292 p
Avail: Univ. Microfilms Order No. 7920529

The observations of radio wavelength atomic and molecular transitions towards regions of star formation are presented. Radio wavelength measurements and upper limits for CH emission from diffuse interstellar clouds in the direction of nearby bright stars whose optical wavelength spectra exhibit the absorption lines of CH are reported. Line emission from OH and NH3 was detected in the direction of small groups of T Tauri stars and the space between them. Impact broadening was detected in the radio frequency recombination lines emitted by the emission nebular W51 (G49.5 + 0.0) and W49A (G49.2 + 0.0). The search for OH maser emission in the direction of more than eighty infrared stars is discussed along with the detection of twelve new sources of emission. Dissert. Abstr.

N80-16980 California Univ., Los Angeles.
SPECTROPHOTOMETRY OF RING NEBULAE AROUND WOLF-RAYET STARS Ph.D. Thesis
Karen Beth Kwitter 1979 179 p
Avail: Univ. Microfilms Order No. 8001381

Spectrophotometric observations of four ring nebulae surrounding population I Wolf-Rayet stars and four additional filamentary nebulae are analyzed in order to determine the physical conditions and chemical abundances in these objects. It is concluded that the ring nebuale are enriched in nitrogen and helium as a result of contamination of the ambient interstellar medium by the helium- and nitrogen-rich wind from the central Wolf-Rayet star. Two of the additional nebulae are found to be Peimbert Type I planetary nebulae, overabundant in nitrogen and helium due to mixing of CNO processed material into the parent envelope prior to ejection. Two of the remaining objects, a shell around an Oef star and a small H II region around an early Be star, exhibit normal abundances. For two of the ring nebulae, the fraction of nebular mass contributed by the central star from published stellar abundances is estimated. It is found that in these cases, the stellar wind has provided less than 10% of the observed nebular mass. Dissert. Abstr.

N80-16981 California Univ., Berkeley.
LONG TERM VARIATION OF ASTEROID NUTATION Ph.D. Thesis
Richard Paul Henke 1979 115 p
Avail: Univ. Microfilms Order No. 8000375

Asteroids are irregular bodies that are shown to be rotating by the variation in the reflected solar illumination as they rotate. Since they are irregular, the character of their rotational motion is described by specifying the time dependence of the components of their angular velocities along the eigenvectors of their nondegenerate inertia tensors. The results presented are the computation of (1) the time scale for the decay of the residual energy, (2) the rate of the residual energy excitation, and (3) the equilibrium value of the residual energy as function of the asteroid's physical and dynamic parameters and an adopted field asteroid mass and velocity distribution. The amount of nutation is interpreted in terms of its impact on the light curves of the asteroids, which are assumed to be triaxial ellipsoids. Dissert. Abstr.

N80-16982 California Univ., Berkeley.
EUV OBSERVATIONS OF THE LOCAL ISM Ph.D. Thesis
Jay Reynolds Freeman 1979 174 p
Avail: Univ. Microfilms Order No. 8000346

The design, calibration, operation, and data analysis of two spaceborne extreme-ultraviolet photometers, sensitive at the 584 A spectral line of neutral helium, are described. Analysis of data from the first instrument indicates that to two standard deviations, the bulk speed of the local interstellar medium with respect to the Sun exceeds 15 km/s. Data from the second instrument provides a measurement of the number density of neutral helium in the nearby interstellar medium which is smaller than values derived by cruder measurements by a factor of almost three. When this value of the helium number density is interpreted in the context of theoretical models of the interstellar medium, it is concluded that the temperature of the local interstellar radiation field is less than or about equal to 7000 K and that the solar system may lie within the outskirts of an interstellar gas cloud. Dissert. Abstr.

N80-16983 Texas Univ. at Austin.
AN INVESTIGATION OF THE PROPERTIES OF CLOSE MULTIPLE STARS Ph.D. Thesis

Francis Charles Fekel, Jr. 1979 265 p
Avail: Univ. Microfilms Order No. 7928284

Over 350 high dispersion coude plates and coude Reticon observations of 15 close mulitple systems were obtained and measured for radial velocities to determine spectroscopic orbital elements. Multiplicity was discovered or confirmed for six of these systems and nine others were reinvestigated. Use of the solid state Reticon detector produced observations with very high signal-to-noise. As a result, seven spectroscopic components not previously seen with conventional detectors were discovered in these systems. The properties of these 15 systems and 22 others from the literature were compared with the results of numerical studies of the formation of close multiple stars by both fission and fragmentation. The ages of solar type close multiple systems were estimated from lithium abundances of the individual components. The determination of the masses of late type giants is discussed. The masses of two more late type giants were determined using spectroscopic, occultation, speckle, and visual observations. Dissert. Abstr.

N80-16984 Virginia Univ., Charlottesville.
A RADIO SURVEY OF BRIGHT GALAXIES Ph.D. Thesis
Linda Lou Dressel 1979 223 p
Avail: Univ. Microfilms Order No. 8002517

A radio continuum survey of a large apparent magnitude limited sample of galaxies to determine which galactic properties and environments are associated with the occurrence of radio sources is reported. The 2380 MHz system was used to observe all 2095 galaxies in the Uppsala General Catalog of Galaxies brighter than m sub p = 14.5. Twenty two percent of the sources were above the detection limit of 15 mJy. A three element interferometer was used to find flux densities, spectral indices, and positions of dominant compact components in sources stronger than 35 mJy. Dissert. Abstr.

N80-16985 California Inst. of Tech., Pasadena.
A STUDY OF HYDROXYL MASERS IN THE CIRCUMSTELLAR ENVELOPES OF LONG PERIOD VARIABLE STARS Ph.D. Thesis
Menachem Cimerman 1980 91 p
Avail: Univ. Microfilms Order No. 8000956

The problem of the OH mainline masers is investigated by radio observations of two LPV sources with unique OH properties, and by a theoretical analysis. Observations of the OH maser in W Hya are presented, which suggest an explanation of their unique polarization characteristics. The maser lines may be formed at a distance of approximately 1 x 10 to the 14th cm from the stellar surface in the presence of a magnetic field of approximately 1 x 10 to the 9th milligauss. The pumping of OH masers in late type variables by direct stellar radiation of 2.8 microns is studied. Two pumping schemes are suggested based on line coincidences between OH V=0-1 transitions and strong H2O upsilon 3 transitions. The water molecules perturb the stellar radiation by absorption, and thus cool the coinciding OH transition. It is demonstrated that this cooling is capable of producing strong OH masers in the circumstellar envelopes of late type variables. Dissert. Abstr.

N80-16986*# Northwestern Univ., Evanston, Ill. Dept. of Physics and Astronomy.
HELIUM RUNAWAYS IN WHITE DWARFS
Ronald E. Taam 8 Aug 1979 22 p refs
(NASA-CR-162694) Avail: NTIS HC A02/MF A01 CSCL 03A

The long term evolution of an accreting carbon white dwarf was studied from the onset of accretion to the ignition of helium. The variations in the details of the helium shell flash examined with respect to variations in mass accretion rate. For intermediate rates the helium flash is potentially explosive whereas for high rates the shell flash is relatively weak. The results are discussed in the context of the long term evolution of novae. A.R.H.

N80-16987*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
CHARACTERISTICS OF THE TELESCOPE FOR HIGH ENERGY GAMMA-RAY ASTRONOMY SELECTED FOR DEFINITION STUDIES ON THE GAMMA RAY OBSERVATORY
E. B. Hughes (Stanford Univ., Calif.), R. Hofstadter (Stanford Univ., Calif.), A. Johansson (Stanford Univ., Calif.), J. Roth (Stanford Univ., Calif.), D. L. Bertsch, W. J. Cruickshank, C. H. Ehrmann, C. E. Fichtel, R. C. Hartman, D. A. Kniffen et al. Oct. 1979 26 p refs Presented at IEEE 1979 Sci. Symp., San Francisco, 17-19 Oct. 1979 Submitted for publication
(Contract NAS5-25544; Grant NGR-05-020-452)
(NASA-TM-80590) Avail: NTIS HC A03/MF A01 CSCL 03A

The high energy gamma-ray selected for definition studies on the Gamma Ray Observatory provides a substantial improvement in observational capability over earlier instruments. It will have about 20 times more sensitivity, cover a much broader energy range, have considerably better energy resolution and provide a significantly improved angular resolution. The design and performance are described. Author

N80-16988*# National Aeronautics and Space Administration, Washington, D. C.
UBVR OBSERVATION OF V1357 CYG - CYG X-1. SEARCH OF THE OPTICAL RADIATION OF THE ACCRETION DISK
V. S. Shevchenko Nov. 1979 20 p refs Transl. into ENGLISH of "UBVR Nablyudeniya V 1387 Cyg - Cyg X-1. Poisk Opticheskogo Izlucheniya akkretsionnogo Diska," Rept. Pr-408 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-22 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75677; Pr-408) Avail: NTIS HC A02/MF A01 CSCL 03A

Data from 30 nights of V 1357 Cyg observations in July, August, and September of 1977 are presented. The contribution of the disk to the optic brightness of the system is computed with regard for the heating of its surface by ultraviolet radiation from V 1357 Cyg and X-ray radiation from Cyg X-1. The disk radiation explains the irregular variability in the system brightness. The possibility of the eclipse of the star by the disk and the disk by the star is discussed. K.L.

N80-16989*# Harvard Coll. Observatory, Cambridge, Mass.
X-RAY OBSERVATIONS OF A COMPACT BINARY SOURCE Final Report, 1 Jul. - 31 Dec. 1979
A. K. Dupree 1979 6 p refs
(Grant NsG-5312)
(NASA-CR-162750) Avail: NTIS HC A02/MF A01 CSCL 03A

Simultaneous X-ray and ultraviolet measurements of selected binary X-ray sources can provide a unique probe of the wind structure and mass loss phenomena in an extended stellar atmosphere. Measurements of the X-ray flux from Vela X-1 (HC8 77581) and 4U1700-37 (HD153919) obtained by OAO 3 and IUE are discussed. A.R.H.

N80-16990# National Technical Information Service, Springfield, Va.
A DIRECTORY OF COMPUTER SOFTWARE APPLICATIONS: ASTRONOMY AND ASTROPHYSICS Progress Report, 1970 - May 1979
May 1979 36 p
(PB-294832/1; NTIS/SA-79/07) Avail: NTIS HC $25.00/MF $25.00 CSCL 03B

Approximately 430 astronomy and astrophysics reports that list computer programs and/or their documentation are cited. These software applications pertain to topics such as solar activity, atmospheric radiative transfer, stellar and galactic structure, lunar and planetary studies, and astrophysical data reduction. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-16991 California Univ., Berkeley.
RELATIVE ISOTOPIC ABUNDANCES OF ZIRCONIUM IN S-TYPE STARS Ph.D. Thesis
Alma Claire Zook 1978 82 p
Avail: Univ. Microfilms Order No. 8000589

The relative abundances of the six stable or nearly stable isotopes of zirconium were measured for three S stars, R Cyg, V Cnc, and R Gem. The method of analysis is described with the abundances determined by comparing the observed stellar profile of intensity vs wavelength with synthetic spectra calculated by the Minnaert interpolation scheme for a single slab LTE stellar atmosphere. The presence of the long lived unstable isotope Zr-93 supports the hypothesis that nucleo-synthesis is taking place in the S stars, while the absence of the r-process isotope Zr-96 supports the hypothesis that the s process is the mechanism responsible for this nucleosynthesis. Dissert. Abstr.

N80-16992 California Univ., Berkeley.
HETERODYNE SPATIAL INTERFEROMETRY OF CIRCUMSTELLAR DUST SHELLS AT A WAVELENGTH OF 11 MICRONS Ph.D. Thesis
Edmund Charles Sutton 1979 179 p
Avail: Univ. Microfilms Order No. 8000532

The spatial distribution of the 11 micron thermal emission from circumstellar dust envelopes was studied using an infrared heterodyne interferometer. The spatial distribution of silicate grain emission was measured to probe the temperatures and densities of the circumstellar material and thereby to gain an understanding of the structures of circumstellar envelopes. The interferometer used consists of two separate telescopes, each of which is associated with a heterodyne receiver. Among the sources which were observed with this interferometer are alpha Orionis, o Ceti, VY Canis Majoris, and IRC +10216. The 11 micron brightness distributions of these objects all have spatially extended dust emission components. Other significant observations and results are reported. Dissert. Abstr.

N80-16993 Maryland Univ., College Park.
KINEMATICS OF H1 NEAR THE GALACTIC CENTER Ph.D. Thesis
Rameshwar Prasad Sinha 1979 162 p
Avail: Univ. Microfilms Order No. 8002062

The results of a survey of 21 cm line emission in Milky Way Galaxy from 360 deg to 11 deg longitude and from -2 deg to +2 deg latitude are presented. These data along with other published data are used in the derivation of a rotation curve for the Galaxy inside the solar circle (radius 10 kpc). The rotation curve is used to derive a mass model consisting of three components, viz., a nuclear spheroid, a spherical bulge, and a general galactic disk. The symmetry properties of the distribution of H1 in the region around the galactic center are explored. Inside a radius of 1 kpc the H1 appears to be distributed in the shape of an elongated noncircular slowly rotating disk which is inclined to the galactic equator. The velocity dispersion of the H1 distribution in the central elongated disk is examined. Dissert. Abstr.

N80-16994 California Univ., Santa Cruz.
MASS LOSS FROM CATACLYSMIC VARIABLE SECONDARIES Ph.D. Thesis
Ronald Lynn Gilliland 1979 72 p
Avail: Univ. Microfilms Order No. 8002209

Computer simulations of mass loss from cataclysmic variable star secondaries are discussed. The calculations involve solution of the nonlinear hydrodynamical equations of stellar structure under varying degrees of approximation in an attempt to determine stability of the mass loss process. Evolutionary sequences treating only the region near the Lagrangian point were constructed in a manner consistent with the assumption of Roche geometry. The effects of mass flow nonorthogonal to the Roche equipotential surfaces were examined. Dissert. Abstr.

N80-16995 California Univ., Santa Cruz.
H 2 REGION-LIKE GALAXIES Ph.D. Thesis
Howard Bradley French 1979 77 p
Avail: Univ. Microfilms Order No. 8002208

Line fluxes in the region 3700 - 7100A are presented for 14 galaxies with strong, sharp, H 2 region like emission lines. Ratios of the line fluxes are used to derive electron temperatures and densities, and the abundances of helium, oxygen, nitrogen, neon and sulfur relative to hydrogen. The galaxies are found to be photoionized by hot main sequence stars. The velocity dispersion was measured for one object; the mass of stars derived for it was several times smaller than the mass of neutral hydrogen which was previously found in an extened halo around this object. Galactic chemical evolution was investigated through a comparison of the relative abundances in these galaxies with their normal values. Dissert. Abstr.

N80-16996 Iowa State Univ. of Science and Technology, Ames.
TREATMENT OF MOLECULAR ABSORPTION BY USE OF TRANSMISSION AVERAGE OPACITIES IN COOL STELLAR ATMOSPHERE MODELS Ph.D. Thesis
Frederick Bender 1979 298 p
Avail: Univ. Microfilms Order No. 8000114

Computation of cool stellar atmosphere models by means of transmission averages was examined. Models were computed using the transmission average to represent the opacity of the CO molecule. The use of the models in conjunction with a synthetic spectrum generator is discussed. Dissert. Abstr.

N80-16997*# Harvard Coll. Observatory, Cambridge, Mass.
STUDIES OF THE LOCAL INTERSTELLAR MEDIUM Final Report, 1 May - 30 Sep. 1979
A. K. Dupree 1979 13 p refs
(Grant NsG-5293)
(NASA-CR-162749) Avail: NTIS HC A02/MF A01 CSCL 03B

The existing ultraviolet and optical data concerning late-type stars are discussed along with the acquisition and reduction of additional ultraviolet and simultaneous ground-based observation. The stars Alpha Centauri A, and Lamdba Andromedae are discussed in terms of stellar chromospheres, or the instellar medium. F.O.S.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology, and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-16998* National Aeronautics and Space Administration, Washington, D. C.
ATLAS OF MARS: THE 1:5000000 MAP SERIES
R. M. Batson, P. M. Bridges, and J. L. Inge 1979 154 p refs Prepared in cooperation with Geol. Surv., Flagstaff, Ariz.
(NASA Order W-13709; NASA Order WO-8122; NASA Order W-13687; NASA Order L-55232)
(NASA-SP-438; LC-79-600164) Avail: SOD HC $7.00 as NAS1.21:438 CSCL 03B

Small-scale maps and photomosaics covering the entire surface of the planet Mars are presented. The cartographic contents are reduced-scale versions of the 1:5,000,000 topographic series of 30 quadrangles compiled by the U.S. Geological Survey in cooperation with NASA. Most of the quadrangles were compiled with data from the Mariner 9 spacecraft, gathered in 1972. A few sheets, however, incorporated information derived from the two Viking Orbiter spacecraft from 1976 through 1978. Several versions of each quadrangle are shown. These versions include the controlled photomosaics from which final map products were derived, airbrushed shaded relief maps based on the photomosaics and on a variety of special computer enhancements of pictures not included in the mosaics, shaded relief maps with overprints of albedo markings derived by special enhancements of selected Mariner 9 images and contour maps derived from a wide variety of nonimage data ranging from Earth-based radar to remote sensing instruments on the Mariner 9 spacecraft. Discussions of mapping procedures and a gazeteer of feature nomenclature on Mars are included in appendices. A.R.H.

N80-16999 California Univ., Los Angeles.
LUNAR MAGNETISM AND PLASMA INTERACTIONS Ph.D. Thesis
Howard Weiss 1979 103 p

Avail: Univ. Microfilms Order No. 8001419

The nature and origin of distinct magnetic signatures observed from lunar orbit are examined. A comparison of the dayside lunar magnetic measurements of the Apollo subsatellites with simultaneous interplanetary measurements reveals an enhancement of the lunar compressional fluctuations when the lunar measurements were taken below 100 km altitude. The most probable source of these low altitude fluctuations appears to be the interaction of the solar wind with anomalous magnetic fields on the moon's surface. The possibility of cratering of the lunar surface as the source of both the anomalous magnetic fields and weak dipole field of the moon is explored. It is found that the present upper limit of a lunar dipole moment can be approximated by the cratered shell model if the 17 largest lunar craters and a reasonable level of magnetization of the crust are used. Nevertheless, it appears that the anomalous magnetic fields presently observed on the lunar surface are not directly a consequence of cratering of an internally magnetized crust.

Dissert. Abstr.

N80-17000 California Univ., Berkeley

NOBLE-GAS-RICH SEPARATES FROM ORDINARY CHONDRITES Ph.D. Thesis

Robert Keith Moniot 1979 75 p

Avail: Univ. Microfilms Order No. 8000447

Acid resistant residues were prepared by HCl-HF demineralization of three H-type ordinary chondrites. These residues were found to contain a large proportion of the planetary type trapped Ar, Kr, and Xe of the meteorites. The similarity of these acid residues to those from carbonaceous chondrites and LL type ordinary chondrites suggests that the same phase carries the trapped noble gases in all these diverse meteorite types. Because the H group represents a large fraction of all meteorites, this result indicates that the gas rich carrier phase is as universal as the trapped noble-gas component itself.

Dissert. Abstr.

N80-17001*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NARROW-BAND JOVIAN KILOMETRIC RADIATION: A NEW RADIO COMPONENT

Michael L. Kaiser and M. D. Desch Jan. 1980 16 p refs Submitted for publication

(NASA-TM-80626) Avail: NTIS HC A02/MF A01 CSCL 03B

A new component of Jupiter's radio spectrum is investigated. The component emits in a very narrow bandwidth (less than or equal to 40 kHz) near 100 kHz. Its waveform is a very smooth and gradual rise and subsequent fall in intensity, usually over two hours. The emission is polarized with left hand polarization associated with the Jovian northern magnetic hemisphere and right hand with the south. The emissions deviation from a strict system 3 rotation period repetition rate is examined. The emission source of the narrow band component which rotates 3 to 5 percent slower than all other forms of Jovian radio emission is determined from propagation considerations, coupled with the observed lack of corotation, to a source region near the equatorial plane at the outer edge of the Io plasma torus. The narrow band KOM (nKOM) form is examined using observations from the PRA instrument. The spectrum and occurrence statistics are described and contrasted with the tapered or broadband KOM (bKOM) characteristics.

A.W.H.

N80-17002*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE OCCURENCE RATE, POLARIZATION CHARACTER AND INTENSITY OF BROADBAND JOVIAN KILOMETRIC RADIATION

M. D. Desch and M. L. Kaiser Jan. 1980 26 p refs Submitted for publication

(NASA-TM-80627) Avail: NTIS HC A03/MF A01 CSCL 03B

The major observational features of one new component of Jupiter's radio emission spectrum, the broadband kilometer-wavelenth radiation or bKOM are described. The Voyager planetary radio astronomy experiments reveal that the overall occurrence morphology, total power, and polarization character of bKOM are strong functions of the latitude and/or local time geometry of the observations. The post-encounter data show a decline in the mean occurrence rates and power level of bKOM and, in particular, a depletion in the occurrence rate at those same longitudes where the detection rate is a maximum before encounter. Additionally, the polarization sense undergoes a permanent reversal in sign after encounter, whereas the time-averaged wave axial ratio and degrees of polarization remain relatively unchanged. No evidence of any control by Io is found. The strong dependence of the morphology on local time suggests a source whose beam is nearly fixed relative to the Jupiter-sun line.

A.R.H.

N80-17003*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

VOYAGER 1: ENCOUNTER WITH JUPITER

Mar. 1979 44 p Original contains color illustrations

(NASA-CR-162721; JPL-400-11) Avail: NTIS HC A03/MF A01 CSCL 03B

An overview of the Voyager is presented along with samples of the nearly 19,000 photographs returned by Voyager 1 spacecraft at the midpoint of its 38-month mission to Jupiter and Saturn. Particular emphasis is given to color photographs of the Great Red Spot, and the surface features of the Gallilean satellites.

A.R.H.

N80-17004*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE STRATIGRAPHIC SEQUENCE OF VOLCANIC AND SEDIMENTARY UNITS IN THE NORTH POLAR REGION OF MARS

Michael E. Botts Jan. 1980 69 p refs

(NASA-TM-78254) Avail: NTIS HC A04/MF A01 CSCL 03B

Based on photogeologic mapping of Viking orbiter images of Mars, four distinct informal stratigraphic units are defined for the region north of 70 degrees N latitude. They are: (a) bulbous plains, (b) mantled plains, (c) dune deposits, and (d) layered deposits/perennial ice. Background information on the Martian polar caps is provided from telescopic observation, Mariner mission results, and Viking mission results (August 1976-November 1978). A description, and an interpretation and distribution of the stratigraphic units are presented. Surface winds, which were determined from dune orientations, and discussed and implications for the source of circumpolar dune materials are delineated. A list of the Viking Orbiter imagery used in the research, the computer programs for crater size frequency distributions, and the crater size frequency data are presented.

A.W.H.

N80-17005*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.

ANALYSIS OF EROSION AND TRANSPORTATION FEATURES FROM LUNAR ORBITER AND APOLLO PHOTOGRAPHY Final Technical Report, 15 Jun. 1977 - 31 Jul. 1978

Thomas Gold 1980 11 p

(Grant NsG-7348)

(NASA-CR-162703) Avail: NTIS HC A02/MF A01 CSCL 03B

Certain classes of surface features in Lunar Orbiter and Apollo Panoramic Photographs are identifed and possible correlations between the occurrence of these features and their geographical location on the Moon are studied. Whether evidence of erosion and transport processes not encountered on Earth exists is investigated using the lunar photographs. The variety and intensity of transport processes on the Moon resulting from exposure to plasmas is discussed.

A.W.H.

N80-17006*# National Aeronautics and Space Administration, Washington, D. C.

THE STRUCTURE AND MICROPHYSICAL PROPERTIES OF THE CLOUDS OF VENUS

M. Ya. Marov Aug. 1979 64 p refs Transl. into ENGLISH of "Struktura i Mikrofizicheskiye Svoistva Oblakov Venery", Preprint-144 Acad. of Sci. USSR, Inst. of Applied Mathematics, Moscow, 1978 p 1-69 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(NASw-3199)

(NASA-TM-75725; Preprint-144) Avail: NTIS HC A04/MF A01 CSCL 03B

Results are presented from the processing and interpreta-

tion of measurement data in the descent capsules of the automatic stations Venera-9 and Venera-10 for the characteristics of light scattering in the atmosphere of Venus by means of onboard nephelometers. A model for the aerosol component in the planet's atmosphere in the altitude range 62-14 km is proposed. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-17007*# National Aeronautics and Space Administration, Washington, D. C.
THE MECHANISM OF TEMPERATURE AND PRESSURE CHANGES IN THE EARTH'S ATMOSPHERE DURING SOLAR FLARES
V. D. Reshetov Jun. 1979 11 p refs Transl. into ENGLISH of conf. paper "O Mekhanizme Izmenenia Temperatury i Davlenia v Atmosfere Zemli pri solnechnykh Vspyshkakh", 1974 p 288-296 Presented at 1st All-Union Conf. on Sun Atmosphere Relations in Climate Theory and Weather Forecasts, Moscow, 30 Oct. - 1 Nov. 1972 p 288-296 Original language document was announced as A74-37725 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75349) Avail: NTIS HC A02/MF A01 CSCL 03B

The effect of solar flares on the weather on Earth is examined. It is concluded that the processes which arise in the atmosphere are so intricate that a single calculation of solar activity is insufficient for long-range forecasting. However, combined consideration of processes dependent upon the dynamic instability of the atmosphere and the effect of solar activity will contribute to the improvement of long-range forecasts. A.R.H.

N80-17008# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
ANALYSIS OF SOLAR WIND DATA FROM THE SOLRAD 11A AND 11B SPACECRAFT Final Report, 1 Feb. 1975 - 31 May 1978
Alan J. Lazarus Hanscom AFB, Mass. AFGL Feb. 1979 88 p refs
(Contract F19628-75-C-0131; AF Proj. 2311)
(AD-A070945; AFGL-TR-79-0056) Avail: NTIS HC A05/MF A01 CSCL 03/2

The data reduction, analysis, and interpretation of solar wind data obtained from the experiment on the SOLRAD spacecraft are described. This experiment which involved plasma detectors that measure current within differential energy channels for positive ions and electrons is reviewed. The positive ion distribution functions determined from the SOLRAD data are analyzed. A.W.H.

N80-17009# Tufts Univ., Medford, Mass. Dept. of Physics.
VERY LARGE ARRAY (VLA) OBSERVATIONS OF SOLAR ACTIVE REGIONS
Kenneth R. Lang 1 Feb. 1979 19 p refs
(Contract F19628-79-C-0010)
(AD-A066780; AFGL-TR-79-0037; SR-1) Avail: NTIS HC A02/MF A01 CSCL 03/2

Synthesis maps of solar active regions obtained using twelve 25 m paraboloids (65 interferometer pairs) of the very large array (V.L.A.) are presented and described. A synthesized beam of 1 in by 3 in is obtained at a wavelength of 6 cm. The present and future observational capabilities of the V.L.A. are described and the basic techniques of using the V.L.A. to observe the Sun are described. A.W.H.

N80-17010# National Oceanic and Atmospheric Administration, Boulder, Colo.
ENERGY RELEASE IN SOLAR FLARES. PROCEEDINGS OF THE WORKSHOP ON ENERGY RELEASE IN FLARES
David M. Rust and A. Gordon Emslie Jul. 1979 73 p refs Workshop held at Cambridge, Mass. 26 Feb. - Mar. 1979 Prepared in cooperation with Am. Sci. Eng., Inc., Cambridge, Mass. and Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
(PB-300905/7; UAG-72; NOAA-79081307) Avail: NTIS HC A04/MF A01 CSCL 03B

Parallel meetings of three small teams were held where theories of thermalization, particle acceleration, and mass motion in flares were discussed. An overview of the major scientific issues identified for the study of energy release in flares is given. More specific discussions of the three program areas are included. The concepts of Joint Observing Sequences and Collaborative Observing Sequences (COSs) developed by NASA's Solar Maximum Mission investigators are explained. Specific observations needed for each COS are listed. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-17011*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGY SPECTRA OF COSMIC RAY NUCLEI TO ABOVE 100 GeV/NUCLEON
M. Simon (Max Planck Inst. fuer Extraterrestriche Physik, West Germany), H. Spiegelhauer (Max Planck Inst. fuer Extraterrestriche Physik, West Germany), W. K. H. Schmidt (Max Planck Inst. fuer Extraterrestriche Physik, West Germany), F. Siohan, J. F. Ormes, V. K. Balasubrahmanyan, and J. F. Arens Oct. 1979 43 p refs Submitted for publication
(NASA-TM-80587) Avail: NTIS HC A03/MF A01 CSCL 03B

The chemical composition cosmic rays as a function of energy in the range of a few GeV/nucleon to some hundreds of GeV/nucleon for boron through iron are presented. The experiment combined an ionization spectrometer and a gas Cherenkov counter, which was flown on a balloon, to perform two different and independent energy measurements. The experimental apparatus is described in detail. The energy dependence of the cosmic ray escape length for boron and iron is reported and predicted changes in the energy dependence of the ratios of primary nuclei O/C and iron/C - O are discussed. A.W.H.

N80-17012*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. High Energy Astrophysics Lab.
THE UNIQUE COSMIC EVENT OF 1979 MARCH 5
Thomas L. Cline Dec. 1979 17 p refs Submitted for publication
(NASA-TM-80630) Avail: NTIS HC A02/MF A01 CSCL 03B

A transient that appears to be neither a typical gamma ray burst nor an X-ray burster was found to possess a variety of unusual properties that would seem to be mutually inconsistent. The observed parameters include a 200 microsecond onset time, a subsequent temporal intensity oscillation with an 0 second period, a spectral feature consistent with a moderately red shifted positron annihilation line, a maximum photon flux greater than any known gamma ray or x ray transient, and a very accurate source location measurement consistent with that of the N49 supernova remnant associated with the large Magellanic Cloud at 55 kpc distance. A.W.H.

N80-17013# California Univ., Livermore. Lawrence Livermore Lab.
STUDY OF ENERGETIC ELECTRONS IN THE OUTER RADIATION-BELT REGIONS USING DATA OBTAINED BY THE LLL SPECTROMETER ON OGO-5 IN 1968
H. I. West, Jr., R. M. Buck, and G. Davidson (Lockheed Missiles and Space Co., Palo Alto, Calif.) 26 Jul. 1979 84 p refs
(Contract W-7405-eng-48)
(UCRL-52807) Avail: NTIS HC A05/MF A01

An account is given of measurements of electrons made by the LLL magnetic electron spectrometer (60 to 3000 keV in seven differential energy channels) on the Ogo-5 satellite in the

earth's outer-belt regions during 1968 and early 1969. The data were analyzed specifically to determine pitch-angle diffusion lifetimes as a function of energy in the L-range 2 to 5. As a part of this effort, the general dynamics of these regions were studied in terms of the time dependent energy spectra, and pitch-angle distrubtion for the seven energy groups were obtained as a function of L wtih representative values presented for L = 2.5 to 6. The pitch-angle-diffusion results were used to analyze the dyanmics of the electrons injected following the intense storms on October 31 and November 1, 1968, in terms of radial diffusion. The derived diffusion coefficients provide a quite reasonable picture of electron transport in the radiation belts. Both the radial-and pitch-angle-diffusion results are compared with earlier results.
DOE

99 GENERAL

N80-17014*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FISCAL YEAR 1979 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS AND PRESENTATIONS
O. L. White, comp. Oct. 1979 62 p
(NASA-TM-78250) Avail: NTIS HC A04/MF A01 CSCL 05B

This bibliography lists approximately 590 formal NASA technical reports, papers published in technical journals, presentations by MSFC personnel, and reports of MSFC contractors introduced into the NASA scientific and technical information system in 1979.
J.M.S.

N80-17015# Joint Publications Research Service, Arlington, Va.
EAST EUROPE REPORT: SCIENTIFIC AFFAIRS, NO. 659
11 Jan. 1980 146 p Transl. into ENGLISH from various East European journals
(JPRS-74911) Avail: NTIS HC A07/MF A01

Developments in the various theoretical and applied scientific disciplines and technical fields are presented. The administration, structure, personnel, and research plans of leading East European scientific organizations and institutions are described. Applications of microelectronics to optical instrumentation and computers are emphasized. For individual titles, see N80-17016 through N80-17020.

N80-17016# Joint Publications Research Service, Arlington, Va.
CARL ZEISS JENA PRODUCTION OF OPTICAL PRECISION INSTRUMENTS DESCRIBED **c74**
K. Muetze *In its* E. Europe Rept.: Sci. Affairs, No. 659 (JPRS-74911) 11 Jan. 1980 p 23-54 Transl. into ENGLISH from Feingeraetetechnik (E. Berlin), v. 28, no. 10, 1979 p 437-445 (For primary document see N80-17015 07-99)
Avail: NTIS HC A07/MF A01

Optical precision instrument construction is presented. Developmental tendencies in instrument construction, the role of automation, and instrument performance and reliability are discussed.
R.E.S.

N80-17017# Joint Publications Research Service, Arlington, Va.
DEVICES FOR MANUFACTURE OF MICROSTRUCTURES, CHIPS DESCRIBED **c33**
K.-W. Gommel *In its* E. Europe Rept.: Sci. Affairs, No. 659 (JPRS-74911) 11 Jan. 1980 p 58-74 Transl. into ENGLISH from Feingeraetetech. (E. Berlin), v. 28, no. 10, 1979 p 446-450 (For primary document see N80-17015 07-99)
Avail: NTIS HC A07/MF A01

The process of microstructuring in semiconductor engineering is discussed. Problems and trends in microstructure production are described.
R.E.S.

N80-17018# Joint Publications Research Service, Arlington, Va.
MICROCOMPUTER-BASED CNC 600 NUMERICAL CONTROL SYSTEM DESCRIBED **c63**
Guenter Wollenberg *In its* E. Europe Rept.: Sci. Affairs, No. 659 (JPRS-74911) 11 Jan. 1980 p 77-99 refs Transl. into ENGLISH from Radio Fernsehen Elek. (E. Berlin), v. 28, no. 11 1979 p 694-700 (For primary document see N80-17015 07-99)
Avail: NTIS HC A07/MF A01

The numerical control system CNC 600, which is based on microprocessors, is presented.
R.E.S.

N80-17019# Joint Publications Research Service, Arlington, Va.
INTERFACE ASSEMBLY FOR USE IN K 1520 SYSTEM DESCRIBED **c60**
Siegfried Wildner and Rainer Bauch *In its* E. Europe Rept.: Sci. Affairs, No. 659 (JPRS-74911) 11 Jan. 1980 p 100-109 Transl. into ENGLISH from Radio Fernsehen Elek. (E. Berlin), v. 28, no. 9, 1979 p 558-560 (For primary document see N80-17015 07-99)
Avail: NTIS HC A07/MF A01

An interface module for operating a display screen unit was developed. This module fits smoothly into the K 1520 microcomputer system. It is particularly suited to control the ANA 440 S display screen unit of the VEB Combine Robotron, but it can also be used to control other display screen units. Through a supplementary high frequency adapter, it is also possible to connect the connection control to the antenna input of an arbitrary television receiver meeting European television standards. Two types of display can be programmed.
R.E.S.

N80-17020# Joint Publications Research Service, Arlington, Va.
MICROCOMPUTER SYSTEM K 1520 EXAMINED **c60**
Bernhard Bader *In its* E. Europe Rept.: Sci. Affairs, No. 659 (JPRS-74911) 11 Jan. 1980 p 110-128 Transl. into ENGLISH from Radio Fernsehen Elek. (E. Berlin), v. 28, no. 10, 1979 p 616-620 (For primary document see N80-17015 07-99)
Avail: NTIS HC A07/MF A01

The application of microcomputer technology in the national economy of East Germany is discussed. The application of the Robotron K 1520 microcomputer system is described in detail. The system design of the K 1520 system is presented and it's advantages are described.
R.E.S.

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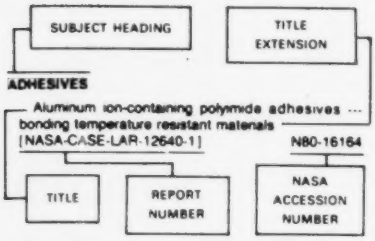

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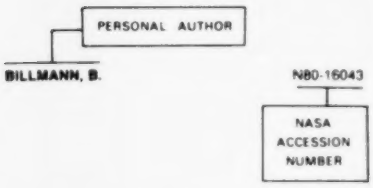

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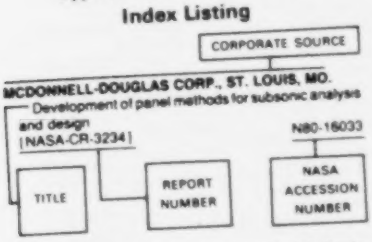

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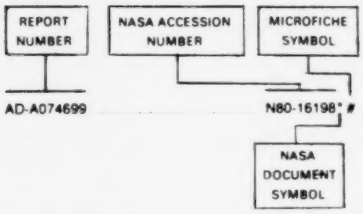

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NTIS/PS-76/0682 ..... N80-16053 #
NTIS/PS-76/0710 ..... N80-16563 #
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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 949

02 AERODYNAMICS 949

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 951

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 952

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 954

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION N.A.

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 956

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 958

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 959

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 960

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13 ASTRODYNAMICS 963

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 963

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

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16 SPACE TRANSPORTATION 965

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For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 965

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION N.A.
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20 SPACECRAFT PROPULSION AND POWER 966
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For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

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24 COMPOSITE MATERIALS 968
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25 INORGANIC AND PHYSICAL CHEMISTRY 970
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For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 973
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27 NONMETALLIC MATERIALS 979
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28 PROPELLANTS AND FUELS 982
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ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 983
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 991
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34 FLUID MECHANICS AND HEAT TRANSFER 1001
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35 INSTRUMENTATION AND PHOTOGRAPHY 1005
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For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 1008
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 1011
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38 QUALITY ASSURANCE AND RELIABILITY 1015
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39 STRUCTURAL MECHANICS 1016
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For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) N.A.

43 EARTH RESOURCES 1021
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For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 1023
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 1030
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 1032
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space-Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 1035
Includes weather forecasting and modification.

48 OCEANOGRAPHY 1038
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 1039
Includes genetics.

52 AEROSPACE MEDICINE 1044
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 1045
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54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 1046
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

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61 COMPUTER PROGRAMMING AND SOFTWARE 1049
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 1052
Includes computer networks.

63 CYBERNETICS 1052
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 1054
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 1058
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 1060
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 1060
Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering*.

70 PHYSICS (GENERAL) 1060
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72 ATOMIC AND MOLECULAR PHYSICS 1062
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73 NUCLEAR AND HIGH-ENERGY PHYSICS 1064
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For space radiation see *93 Space Radiation*.

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76 SOLID-STATE PHYSICS 1067
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For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1070
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1071
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1072
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 1073
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1073
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1074
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1076
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1077
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1077
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1078
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1082
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For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

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REPORT NUMBER

N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey 3 Sep 1979 409 p refs
(Contract NAS1-15624)
(NASA-CR-159149) Avail NTIS HC A18/MF A01
CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects — not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, G-SEAT OPTIMIZATION
D.C. McGuire, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223950)

To investigate optimization of g-seat configurations, use of improved components, and software optimization.

A bench test set-up will be used to investigate hardware configurations, components, and adjustments. The configuration will include compressor, conoflow valve, booster valve, a g-seat bellow with instrumentation (potentiometer and accelerometer) and strip chart recorder. Software analysis will consist of organization and optimization by reducing unnecessary arrays, maximizing linear flow and eliminating unnecessary branching. The results will be applied to the g-seat systems of ASPT to improve their performance such as in lowered time constants, rise times, transport lags, and software execution time. Improved performance will make feasible emulation and evaluation on ASPT of new system design such as the A-10 simulator seat under development by Reflectone.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

1.0002, SUPERSONIC CRUISE/TRANSONIC MANEUVER WING SECTION DEVELOPMENT
C.D. Wiler, Rockwell International Corp., *International Airport, Los Angeles, California* (DF139870; F33615-77-C-3066)

Current advanced tactical aircraft missions include requirements for efficient supersonic cruise configurations capable of effective transonic maneuver. This effort is directed toward the application of advanced aerodynamic technologies in achieving such performance and represents a significant step toward the achievement of an improved force capability pending favorable results.

A wing design, which will include specification of thickness, camber, taper, and twist, will be evolved using analytical, design, and/or experimental techniques consistent with the current state of the art. Appropriate revolutionary configurations and approaches which represent advanced aerodynamic technologies will be incorporated into the design in order to overcome the aerodynamic configuration incompatabilities of the supersonic cruise and transonic maneuver flight regimes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, STUDIES IN ROTOR AERODYNAMICS AND NOISE
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0004, FUNDAMENTAL STUDIES OF UNSTEADY TURBULENT BOUNDARY LAYERS
W.C. Reynolds, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - DEVELOPMENT OF HIGH-ANGLE-OF-ATTACK SYSTEM IDENTIFICATION TECHNOLOGY
W.E. Hall, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DN875586; N00014-78-C-0641)

System identification technology for use in flight testing aircraft has been developed in order to reduce flight test time and costs, and to improve the accuracy of flight test estimated aircraft characteristics. Initial applications have been limited to analysis of linear aircraft response at low angles of attack. During combat maneuvers, aircraft operate at high angles of attack where aerodynamic characteristics become highly nonlinear. The objective of this project is to develop the capability to quantify nonlinear stall/departure characteristics of high performance jet aircraft from flight test data using an advanced integrated approach to system identification.

Data are being obtained from a flight test program to expand the high-angle-of-attack envelope of F-4S aircraft. The program is being conducted in two phases. The first phase has been completed. The final phase will consist of high-angle-of-attack flight tests based on input design results, nonlinear model structure determination and verification, parameter identification to estimate nonlinear aerodynamic coefficients, development of an aerodynamic data base, and estimates of the F-4S airplane high-angle-of-attack departure boundaries.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0006, AERONAUTICAL TECHNOLOGY, TECH AREA M - AVIATION HUMAN ENGINEERING
I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0D5001)

Improve Army air mobility systems by providing improved knowledge, criteria and technology for man-machine integration and by providing better engineering methods for performing the AVSCOM man-machine integration functions.

Systematic exploratory R&D in human performance technology, flight simulation methods and requirements, control and display technology, and man-machine dynamics. The approach emphasizes analytical and experimental studies using laboratory, simulation, mathematical modeling and flight test facilities. These activities have been coordinated with and will complement and support the handling qualities R&D of Tech Area A and the flight simulator development of Tech Area K. Objectives will be achieved largely through joint participation with NASA, making maximum use of the facilities and expertise available within NASA for man-machine systems research.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0007, AERONAUTICAL TECHNOLOGY, TECH AREA K - FLIGHT SIMULATION
I.C. Statler, U.S. National Aeronautics & Space Admin., Ames Research Center, *Moffett Field, California* 94035 (DA0D5004)

Perform analyses and design studies to determine the requirements of a rotary-wing R&D flight simulator capable of simulating NOE flight operations. This effort complements the hardware development being conducted under 6.3, Project DB34.

In joint participation with NASA, perform the studies with the expectation of providing modifications and additions to an available NASA simulator to meet the Army's mission requirements.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0008, COOPERATIVE GRADUATE PROGRAM IN THE FLIGHT SCIENCES
H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0009, A NEW NUMERICAL APPROACH FOR COMPRESSIBLE VISCOUS FLOWS
J.C. Wu, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (NSG 3307)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0010, WING/NACELLE INTERFERENCE FLOW INVESTIGATION
J. Nogel, Iowa State University of Science & Technology, Graduate School, *Beardshear Hall, Ames, Iowa* 50010 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

1.0011, DEVELOPMENT OF FINITE DIFFERENTIAL METHOD FOR INTERNAL COMPUTATIONAL FLUID MECHANICS
C.J. Chen, University of Iowa, School of Engineering, Dept. of Mechanical Engineering, *Jessup Hall, Iowa City, Iowa* 52240 (NSG 3305)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0012, AIR CUSHION SYSTEM TRUNK FLUTTER MODEL DEVELOPMENT
A.B. Boghani, Foster Miller Associates Inc., *135 2nd Ave., Waltham, Massachusetts* 02154 (DF141860; F33615-78-C-3412)

This effort supports the development of air cushion systems (ACS) for Air Force aircraft takeoff and landing. Under some ACS-equipped aircraft ground operating conditions, ACS trunks experience a flutter phenomenon which causes the aircraft to become dynamically unstable, introducing ground operation problems. The objective of this research study is to establish a better understanding of ACS trunk flutter and to develop an analytical technique for the evaluation of the flutter characteristics for ACS trunk designs. This technique will be applied for optimization and evaluation of ACS trunk designs to eliminate/minimize trunk flutter and to significantly improve ACS-equipped military aircraft ground operation.

Existing studies and test data will be analyzed to establish the principal variables and conditions causing ACS trunk flutter. Then, an analytical technique will be developed for evaluation of the flutter characteristics for ACS trunk designs. Next, the technique will be verified by its use to evaluate the flutter characteristics of the XC-8A aircraft's ACS trunk under various conditions. The results will be compared with flight test data. Initial ACS trunk design criteria will be developed for elimination of flutter and a final report prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, DEVELOPMENT OF A METHODOLOGY FOR HORIZONTAL AXIS WIND TURBINE DYNAMIC ANALYSIS
R.H. Miller, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 3303)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0014, APPLICATION OF ADAPTIVE FINITE ELEMENT ANALYSIS OF INTEGRATED DESIGN AND ANALYSIS OF AIRCRAFT STRUCTURES
B.A. Szabo, Washington University, School of Engineering & Applied Science, Dept. of Civil Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (NSG 1640)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0015, UNSTEADY TRANSONIC AERODYNAMICS OF CASCADES
E.H. Dowell, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Sciences, *Box 430, Princeton, New Jersey* 08540 (NSG 3292)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0016, THE INFLUENCE OF AUDITORY INPUTS ON SIMULATED FLIGHT OPERATIONS
E. Galanter, Columbia University, School of Arts & Sciences, Dept. of Psychology, *Broadway & W. 116th St., New York, New York* 10027 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0017, DEVELOPMENT OF ADVANCED FLIGHT CONTROL ACTUATION SYSTEM CONCEPTS FOR NAVY AIRCRAFT
J. Leonard, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN981062; N62269-78-C-0218)

The general objective of this task is to examine the broad spectrum of new flight control actuation concepts with respect to potential advantages and interrelationships with other aircraft systems. The resultant effect of these new concepts will be evaluated against projected aircraft mission and maintenance requirements. Recent advancements in on-board computers, electrical power equipment and solid-state processing components may offer advantages to new aircraft, especially with growing emphasis on combat survivability and simplified squadron maintenance. This contract supports work unit ZA601, Agency Accession No. DN 681080.

An investigation will be conducted to determine the feasibility of integrating an all-electric rotary actuator in a proposed aircraft. The investigation will determine potential benefits and design concepts for mechanization of such a system. A follow-on program may include development of hardware, testing and eventual flight demonstration.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0018, TRANSONIC WIND TUNNEL EXPERIMENTS ON OSCILLATING AIRFOILS
S.L. Petrie, Ohio State University Research Foundation, *1314 Kinnear Rd., Columbus, Ohio* 43212 (DF138650; AFOSR-76-3021)

This work unit supports the aeroelastic evaluation of high-speed aircraft. It will contribute to the development of im-

proved unsteady aerodynamic methods to predict aircraft aeroelastic stability and structural dynamic response. The goal is to develop a low-cost research facility to conduct unsteady aerodynamic tests on oscillating models in transonic wind tunnels, resulting in ultimate savings in the costs to design new aircraft. The presence of a national capability to make these measurments will allow the orderly development of necessary analytical methods to optimize aircraft structures for minimum weight and cost.

A contractor will be selected to survey the ambient interference in a small transonic wind tunnel without a model present. An oscillating model will then be inserted into the tunnel and studies performed to determine Mach number, Reynolds number and wall interference effects on unsteady pressure measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, STRAIN GAGE ATTACHMENT TO COMPOSITES

J.L. Mullineaux, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141470)

This work unit supports the structural testing of aircraft components made from composites containing epoxy matrix material. The strength of the composite matrix is affected by a combination of elevated temperature and high humidity environments. Strain gage transducers can be used to determine the effects if the transducers are themselves impervious to the environment. This work unit will investigate techniques to obtain reliable data from strain gages installed on composite parts which are exposed to elevated temperature and humidity. The data from such transducers will greatly contribute to the flight safety of military aircraft.

This program will investigate non-epoxy adhesives as bonding agents and RTV silicon materials as coatings for strain gage installations on composites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, A STUDY OF INTERACTIVE AEROELASTIC AND AERODYNAMIC PROBLEMS RELATING TO GENERAL AVIATION PROPELLERS

B.W. McCormick, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Aerospace Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NSG 3304)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0021, STRUCTURAL DEGRADATION AND HAZARDS FROM HELICOPTER STRUCTURE EXPOSED TO FIRE AND/OR EXPLOSIONS (ABBREV)

R. Schiltz, Bell Helicopter Textron, *Hwy. 183, P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3859; DAAK51 79 C 0009)

To investigate the effects of fire/explosion on the structural integrity of composite materials and the personnel hazards (toxicity, smoke, etc.) resulting from same.

Following a literature and organizational survey to establish design guidelines and requirements, composite specimens will be fabricated and laboratory tested to ascertain the structural degradation and resulting hazards (smoke, toxicity, etc.) to personnel when burning/explosion occurs. Based on the test findings, design guidelines will be developed to minimize the structural and personnel harmful effects due to composites exposed to post-crash, in-flight or explosive-induced fire. A computer program simulating the result of a helicopter composite structures fire will be demonstrated at ATL, Ft. Eustis, VA, upon completion of the technical effort.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0022, FORWARD SWEPT WING ANALYSIS

S.K. Hadley, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF140910; F33615-77-C-3133)

There are several planned approaches to improved performance of high-speed fighter aircraft in transonic maneuvering. Current deficiencies in this area indicate the need for major innovation to achieve large advantages in air combat maneuvering. One such innovation utilizes forward swept wings to overcome many present aerodynamic deficiencies. Until recently this concept suffered from loss of static stability due to wing tip deflection departure. The recent breakthroughs in aeroelastic tailoring at wing structure may lead to resolution of this tip departure problem and realization of substantial performance improvement. A detailed analysis is required to examine the full potential of forward swept wings for advanced fighter aircraft.

An investigation of the aerodynamic and aeroelastic implication of forward swept wings will be carried out using current analysis methods. Studies will be cast in a framework of planned mission requirements using advanced aft-swept baselines.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, WIND TUNNEL STUDIES OF ADVANCED CARGO AIRCRAFT CONCEPTS

G.L. Goglia, Old Dominion University, School of Engineering, Dept. of Mechanical Engineering & Mechanics, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, AEROTHERMODYNAMIC HEAT SHIELD ENVIRONMENTS

D. Bershader, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

2.0002, EFFECTS OF PAYLOAD HANDLING CONSIDERATIONS ON SPACE SHUTTLE TRAJECTORIES DURING PROXIMITY OPERATIONS

W.T. Fowler, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Research, *200 W. 21st, Austin, Texas* 78712

Research is being conducted into the proximity operations, or rendezvous, phase of space shuttle missions involving payload recovery. One and two impulse trajectories from station-keeping locations within 1000 feet of the target body payload are being considered. A one impulse trajectory is defined to have a final relative velocity less than or equal to 0.2 ft./sec. This value is the maximum allowable rate (at maximum payload mass of 3200 lb.) for RMS capture. All successful rendezvous trajectories must meet rigid constraints on plume impingement, crew visibility, total fuel consumption, total coast time (time from first impulse to final approach), and safety.

SUPPORTED BY University of Texas

2.0003, NUMERICAL METHODS IN OPTIMAL CONTROL

D.G. Hull, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Current research in this area is being directed toward optimal control using parameter optimization with numerical derivatives. One problem being investigated concerns system identification applied to the reduction of flight test

data for atmospheric reentry vehicles. Another problem concerns the development of a method for computing numerical derivatives accurately.

SUPPORTED BY University of Texas

2.0004, ORBITAL MECHANICS OF LARGE SPACE STRUCTURES

B.E. Schutz, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Various applications using large structures in space have been proposed including solar power stations and space colonies. Some of the proposals utilize orbits which are resonant with the moon, the sun, the earth's gravitational field, etc. As a consequence, large amplitude oscillations occur in some cases which could significantly influence the selection of particular orbits for large space structures. Current analysis is concentrating on 1) general characteristics of orbital motion in these resonant cases; 2) ascertaining the existence of small amplitude motions; and 3) the general characteristics of the rotational motion of a large structure.

SUPPORTED BY University of Texas

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, HYDROGEN UPON AND WITHIN MATERIALS USING NUCLEAR MAGNETIC RESONANCE

R.W. Vaughan, California Inst. of Technology, School of Engineering, Dept. of Chemistry & Chemical Engin, *1201 E. California Blvd., Pasadena, California* 91109 (DMR7721394A02)

This grant permits purchase of a super-conducting magnet to complete construction of a state-of-the-art, high-field, high-resolution nuclear magnetic resonance (NMR) spectrometer for the study of solids and solid surfaces. NMR spectroscopy of liquid solutions has become an extremely important technique in chemistry. Application of NMR to solids, however, has been limited because of solid-state interactions. The purpose of the new spectrometer system is two-fold. The first is to significantly enlarge the scope of Professor Vaughan's work in the development of high-resolution, solid-state NMR. Specifically, techniques are being developed for the study of non-integral spin systems. These include nuclei of interest for solid-state chemical research such as lithium-7, boron-11, and sodium-23. The second purpose is to extend the range and rapidity of research, carried out by workers from the California Institute of Technology and from other institutions, on surface species on oxide catalysts and dispersed metal catalysts, and inorganic hydrides, metal cluster complexes, and metallic systems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0002, CORROSION INHIBITION OF BEARING ALLOYS

J.W. Butler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980145)

The objective of this work unit is a process for treating the high-quality bearing and transmission alloy AISi-52100 so that it will not corrode in normal usage.

The approach is to apply ion implantation techniques to produce a graded alloy near the surface, with the alloy at the surface being corrosion-resistant and with a smooth transition from this new surface alloy to the basic AISi-52100 substrate alloy. Specific alloying elements to be implanted and tested will be chromium, molybdenum, tantalum, and titanium.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0003, INITIATION OF CRACKS IN LCF OF TI ALLOYS

G.R. Yoder, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980076)

Determine the relationship between low-cycle fatigue crack initiation resistance and fatigue crack propagation resistance for select microstructural modifications, so that a fundamental basis for metallurgical optimization of total fatigue life can be established. Establish rational micromechanistic interpretation of results.

Systematically determine the low-cycle fatigue crack initiation resistance of Ti-6Al-4V for microstructural modifications which are already well characterized in terms of fatigue crack propagation resistance, mechanical properties and quantitative metallographic parameters. The different microstructures, as affected by changes in heat treatment and interstitial oxgen content, are to be examined for crack initiation resistance under conditions of constant stress amplitude.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0004, HIGH-TEMPERATURE MOLECULES AND MOLECULAR ENERGY STORAGE

W. Weltner, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Chemistry, *208 Tigert Hall, Gainesville, Florida* 32601 (DF042010; AFOSR-76-2906)

AF function - rocket propulsion, electromagnetic weaponry. Deficiency - structural and spectroscopic information on molecular species found in high-temperature systems such as wakes, plumes, nozzles, lasers and combustors is required for improved design features of Air Force systems. Objective - research includes optical and electron spin resonance (ESR) spectroscopy of molecular species and the spin-alignment of radicals at high magnetic fields and low temperatures. How work contributes - the optical and ESR spectra of high-temperature species provide information on vibrational, electronic and magnetic energy levels which is useful in plume identification and suppression and in the development of advanced lasers. Spin-aligned radicals provide a potentially important source of advanced, high-energy propellants.

Species are vaporized and trapped in solid argon matrices at 4-10 degrees K for the study of their optical and ESR spectra. Species to be examined include carbon molecules (C5, C6), silicon species (SiC, SiN, SiO2), the oxides, hydrides, fluorides and nitrides of the transition metals Mn, V, Fe, Cr, Ni and Yb, and HI2 and HCl2. A molecular energy storage apparatus has been constructed to allow spin alignment of radicals at high magnetic fields and low temperatures and will be tested.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - RESIDUAL STRESS ANALYSIS IN METALS AND ALLOYS

J.B. Cohen, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science, *633 Clark St., Evanston, Illinois* 60201 (DN923045; N00014-78-M-0079)

The service life of critical naval components such as gears, bearings, and helicopter blades depends on the fatigue resistance developed by heat treatment and surface processing. This program will invesitgate the nature and effect of residual stresses on the fatigue behavior of these materials.

The plastic zone in front of a fatigue crack will be examined in Al-Cu and Al-Zn alloys using a small X-ray beam to determine the nature of the fatigue damage. This will be related to the fatigue hardening and fatigue softening observed in these alloys. Residual stress analysis will be explored to find out why the X-ray measured stress depends on the particular X-ray diffraction peaks used in the determination. Technical coverage of an important meeting will be provided in the form of written review.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0006, MECHANISMS OF HYDROGEN EMBRITTLEMENT IN METALS AND ALLOYS USED IN NAVAL STRUCTURES

H.K. Birnbaum, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mining Engineering & Metallurgy, *207 Engineering Hall, Urbana, Illinois* 61801 (DN123376; N00014-75-C-1012)

This research undertakes to clarify the mechanisms by which hydrogen can embrittle metals and alloys, such as those used for naval aircraft and ship structures.

Crack initiation and propagation mechanisms in metal--hydrogen alloys are being investigated over a range of hydrogen contents, temperatures and stress conditions. Standard metallurgical techniques are being used.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0007, A THEORETICAL INVESTIGATION OF SPECTRAL LINE SHAPE

K.M. Sando, University of Iowa, School of Liberal Arts, Dept. of Chemistry, *Jessup Hall, Iowa City, Iowa* 52240 (CHE79-12456)

This grant supports research under the Quantum Chemistry Program to develop mathematical models for the shapes of spectral lines in gases. These models provide fundamental information about interatomic interaction energies, which is important for understanding how atoms exchange energy with one another and with electromagnetic radiation during collisions. The models can be used to interpret and predict the results of experiments which are now possible with modern laser technology.

Professor Sando will extend his theoretical investigations to include satellite bands that are observed in the resonance broadening of cesium. The concept of pairwise additivity of interatomic potentials will be incorporated in atomic line shape theory. New computational methods will be developed to fit the potential to a full line shape and to include coupling among atomic states in a computer simulation code. Several commonly used approximations in line shape theory will be tested numerically. An objective of the research is to invert line shapes to recover the interatomic potential.

This is a renewal of research currently supported by NSF grant CHE-7611968 at The University of Iowa.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, ELECTRONIC STRUCTURES AND CHEMICAL BONDING OF SMALL METAL AND ALLOY AGGREGATES

K.H. Johnson, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgy & Materials Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR7818800)

Research previously supported by DMR7415224.

Theoretical studies of the electronic structure of solids will be carried out, including the completion of work on transition-metal impurities in copper and the extension of cluster molecular-orbital calculations to transition-metal impurities in aluminum. The calculation of residual resistivities, spin densities, electric and magnetic hyperfine parameters on the basis of the cluster spin-orbitals is planned, along with the further investigation of Jahn-Teller effects and spin-orbit coupling. A reformulation of the Anderson model Hamiltonian, particularly the 'U parameter,' to account for the large bonding-antibonding interaction and much reduced exchange splitting of the impurity orbitals will be attempted, along with a parameterization of a model spin Hamiltonian on the basis of the cluster electronic structures. Possible relationships between the concept of 'cluster renormalization' and the renormalization-group method of attacking the Kondo problem will be explored, including a computational procedure analogous to that of the renormalization-group method for determining the effects of successive surrounding shells of atoms on the impurity. The cluster molecular-orbital method will also be applied to Fe impurities in palladium as a basis for explaining the occurrence of 'giant magnetic moments' in such a dilute alloy system. Extensions of the cluster method to nondilute transition-metal alloys, including impurity-impurity interaction, solid-solution alloys, and intermetallic compounds are also part of our long-range research objectives. Finally, concurrent continuing theoretical studies of metallic and bimetallic clusters of catalytic importance will be done. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0009, HIGH-TEMPERATURE PROPERTIES OF EUTECTICS, DIRECTIONALLY SOLIDIFIED ALLOYS AND MONOCRYSTALS FOR POTENTIAL ARMY AIRCRAFT ENGINE

P.J. Ahearn, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0C4808)

Properly chosen eutectics, directionally solidified alloys or monocrystals may provide the optimum method for making turbine blades and vanes.

Mechanical properties of eutectics and other alloys are influenced by the solidification parameters. Currently properties are optimized by rapid cooling, directional solidification, solidification as a monocrystal, etc. These methods have limitations and thus experimets are being conducted to improve upon the techniques and also to devise new methods of solidification. Current interest is centered upon experiments involving controlled liquid flows artificially introduced at the liquid-solid interface during solidification.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0010, RESEARCH ON CORROSION AND CORROSION-RESISTANT STRUCTURAL AND PROPULSION SYSTEMS MATERIALS

S.J. Ketcham, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN833088)

Since the overall structural integrity of naval aircraft has a critical dependence on the elimination of catastrophic failures due to corrosion and/or embrittlement, work in this unit involves research on the interactions of environment and stress on high-strength alloys and composite materials as they relate to corrosion susceptibility and propensity to environmental cracking, and on ways to measure and mitigate these factors.

Research is being pursued on the mechanisms and detection of microstructural corrosion and environmental cracking of high-strength steels and aluminum alloys by advanced state-of-the-art metallurgical and electrochemical techniques; on the corrosion response of advanced systems, e.g., sintered and composite materials; and on new laboratory accelerated corrosion tests and corrosion/embrittlement detection systems for fleet use.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0011, INVESTIGATION OF REINFORCED THERMOPLASTIC COMPOSITES

J.T. Hoggatt, Boeing Co., Boeingaerospace, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN890171; N00019-79-C-0203)

To evaluate fiber-reinforced thermoplastics for aircraft and missile structures.

To develop methods for impregnation and fabrication of high-temperature thermoplastic materials. Evaluate significant mechanical and physical properties of laminates. Initiate synthesis and reformulation efforts to develop improved polymer systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality

Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, TURBULENT SHEAR FIELDS
B.Z. Jenkins, U.S. Dept. of Defense, Army, Missile Research & Development Command, Technology Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1107)

The objective is to analytically and experimentally characterize the FAR field rocket exhaust as a source of operational and flight interference. In particular, the evaluation of large remanent turbulence eddies in proximity to the launch structure and the ground are to be studied in view of their tendency to produce a persistent disturbed aerodynamic and uv/ir/optical propagation environment.

Rocket sled facilities will be used to better define the properties of the exhaust plume at great distances from the exit. Computer codes for predicting the effects of these flow fields on obscuration due to smoke and/or dust entrainment and on objects immersed in them will be acquired or developed.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

4.0002, TO PROVIDE ENGINEERING SERVICES TO IMPLEMENT SOFTWARE, ON NAVAJO COMMUNITY COLLEGE PDP11-70 COMPUTER
S.F. Isher, Navajo Community College, Undergraduate School, *Tsaile, Arizona* 86556 (NSG 737)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

4.0003, ROLE OF MICROSTRUCTURE IN EPITAXIAL REGROWTH IN METAL-SEMICONDUCTOR INTERFACES 15999-MS
R.A. Armistead, Advanced Research & Applications Corp., *1223 E. Arques Ave., Sunnyvale, California* 94086 (DA0G8993; DAAG29-79-C-0014)

To study the mechanism of solid-phase epitaxial regrowth in metal-semiconductor systems. Relevance - the research is relevant to processing of silicon for integrated circuits which are used in a multitude of Army electronics components for communications, signal processing, computers, etc. It is also relevant to the understanding of the behavior of integrated circuits subjected to radiation environments.

The program will include (1) growth of Al/Si structures. (2) ion implantation of Al and protons in Al film; protons, Si, B, As, In and Si film; Si, B, As, In and Si film to create amorphous Si. (3) characterization of specimens using TEM/TED/SEM, AES. (4) measurement of I-V and C-V characteristics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0004, RESEARCH ON TURBULENT MIXING
A. Roshko, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (DN975341; N00014-79-C-0365)

The objective of this study is to develop a better understanding of the mechanics of turbulent structure and mixing, including large-scale entrainment processes, smaller scale molecular mixing processes, and the interaction between them. This information is needed for improved prediction of both reactive and non-reactive mixing processes within various components of turbojet and ramjet engines and to provide a basis for better control of such mixing. Ultimately it should lead to improved propulsion systems for naval weaponry applications.

A mixing region will be formed between two adjacent nonidentical liquid or gaseous streams. The dependence of the mixing process on various relevant parameters will be investigated through a combination of coupled flow visualization studies and quantitative measurements. Flow visualization will be accomplished in the liquids by means of conventional and fluorescent dye tracers and infinite rate chemical indicators, and in the gases with shadowgraph or schlieren photographs of gaseous tracers of different density than the mixing gases. Quantitative measurements will be made using laser velocimetry for the liquids and species concentration sampling probes in the gases.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, CALCULATIONS FOR TURBULENT FLOWS IN DUCTS
T. Cebeci, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DN890141; N00019-78-C-0613)

Development of methods for the calculation of turbulent flows in ducts. Analytical study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0006, ACQUISITION OF A SYSTEMATIC DATA BASE FOR WING-ALONE CHARACTERISTICS AT HIGH ANGLES OF ATTACK 16030-E
J.N. Nielsen, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DA0G9031; DAAG29-79-C-0020)

To obtain, experimentally, systematic wing-alone data base measurements which are as free as possible of support interference effects and which extend to higher aspect ratios. Relevance - the research is directly relevant to the prediction of aerodynamics and hence performance of tactical air defense missiles.

A variety of pressure and force wing models with varied aspect ratio, taper and airfoil sections will be tested for subsonic and low supersonic speeds in the Ames 6-by-6 foot supersonic wind tunnel and for moderate to high supersonic speeds in the Langley unitary 4-by-4 foot wind tunnel.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0007, SURVEILLANCE - EFFICIENT EXCIMER DISCHARGE LASER
D.E. Rothe, Northrop Corp., Research & Technology Center, *1 Research Park, Palos Verdes Peninsula, California* 90274 (DN875654; N00014-78-C-0831)

The objective of this work unit is to contribute to the development of a satellite-mounted blue-green laser that is suitable for Navy communication and surveillance applications.

To accomplish the proposed objective, an experimental and theoretical program will be pursued to optimize power coupling into the rapidly changing load characteristics typically encountered with high-pressure self-sustained gas discharges. A novel high-pressure gas laser device that employs high-voltage transverse electrical preionization and high-impedance longitudinal electrical excitation will be designed, built, and characterized using KrF, XeCl, and N2 gas mixtures. A computer model will be developed that is capable of describing the time-dependent electrical and power coupling characteristics of both this device and a contractor-owned uv preionized transverse excited device. Model predictions will be compared with experimental results and optimum drive circuits for both laser devices and will be designed, fabricated, and tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, MILLIMETER WAVE COMMUNICATIONS TECHNOLOGY
W.H. Watson, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Electronics Engineering & Sciences Dept., *San Diego, California* 92152 (DN988682)

Develop millimeter wave components for a Q-band transmitter chain in support of satellite communication systems.

Develop components for the transmitter system to include an S- to Q-band power-up converter, a 10 watt solid-state amplifier and a 250 watt traveling wave tube (TWT) amplifier. Supporting contractual work reported under DN987685.

SUPPORTED BY U.S. Dept. of Defense, Naval Electronic Systems Command, Electronic Technology Div.

4.0009, SOLAR FLARE PREDICTION (PART OF BLOCK PROGRAM FOR EM/EO)

J.H. Richter, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Environmental Sciences Dept., *San Diego, California* 92152 (DN888505)

Determination of solar flare precursor and development of forewarning criteria for the purpose of improved naval communication by minimizing the effects of communications blackouts and disturbances caused by solar flares.

High-resolution solar radiation temperature contour maps will be analyzed by examining the temporal and spatial characteristics of active regions at 3.3mm, 8.6mm, 2.0cm, 3.2cm and 9.1cm wavelengths. By comparing active-region parameters obtained from the analysis, a description will be developed to be used in solar flare modeling and to determine solar flare precursor criteria. Correlations to solar emissions at other wavelengths will be made.

SUPPORTED BY U.S. Dept. of Defense, Naval Material Command, Support Technology Div.

4.0010, SAW READOUT

J.P. Rahn, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN782271)

To carry out a program which will lead to the development of an infrared imaging system that is readout by means of surface acoustic waves. Such a system could operate in either the 3-5 micron or 8-14 micron bands and would have many desirable features that are nonexistent in present systems, e.g., low cost, compact, rugged, no moving parts and room temperature performance may be possible.

The electric field of a surface acoustic wave propagating on a piezoelectric material (such as lithium niobate) penetrates into an adjacent semiconductor and experiences attenuation and phase shift due to the presence of free charge carriers in the latter. This effect will be utilized to sense spatial variations in infrared intensity on either a narrow band-gap semiconductor or a pyroelectric material. Measurements will be made that will result in a definitive statement of the applicability of surface acoustic wave scanning of infrared imagery to the needs of the Navy. It is anticipated that industry involvement in this program will begin during FY78.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0011, LASER-PLASMA INTERACTIONS

F.F. Chen, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Electrical Sci & Engin, *405 Hilgard Ave., Los Angeles, California* 90024 (EY-76-S-03-0034 PA #236)

In inertial confinement fusion, an important problem is the coupling of driver energy to the target pellet in the region of the corona plasma that is produced on the surface of the target. The object of this program is to study the interaction of CO2 laser light and high-power microwaves with independently produced plasmas, so as to verify theoretical predictions on the various non-linear processes that can occur. Among these phenomena are parametric reflection via stimulated Brillouin and Raman scattering; nonlinear refraction and filamentation; nonclassical absorption via parametric decay, oscillating two-stream, and two-plasmon decay instabilities; resonance absorption; generation of fast ions and electrons and of spontaneous magnetic fields; and reduced heat transport. The first phenomena on this list are currently under investigation.

RESULTS: In the CO2 program, the first detection of stimulated Brillouin scattering in a thermal plasma was achieved. The apparatus has been upgraded to give higher intensity, shorter pulses, and a more reproducible plasma target. In the microwave program, the effect of finite pump bandwidth has been investigated on the parametric decay threshold, fast electron generation, density profile modification, and spontaneous magnetic fields.

SUPPORTED BY U.S. Dept. of Energy, Div. of Laser Fusion

4.0012, A GALERKIN-FINITE ELEMENT TECHNIQUE FOR SMALL-SCALE ATMOSPHERIC FLOWS AND TRANSPORT OVER GENERAL TERRAIN 15810-GS

R.L. Sani, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Aerospace Engineering Sciences, *1200 University Ave., Boulder, Colorado* 80302 (DA0G8967; DAAG29-79-G-0045)

To develop and assess a primitive, variable, Galerkin-finite element (GFE) technique which can accomodate general topography and which leads to a discretized system involving only velocity model unknowns. Relevance - many battlefield problems involve understanding of air flows in complex terrain. This is basic research which has long-range relevance to better modeling of air flows based on observations at a few sites.

The approach involves exploring theoretically and numerically the possiblities that GFE techniques are appropriate for application to small-scale flows where irregular terrain is a problem.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0013, REUSABILITY OF FILAMENT-WOUND LAUNCH TUBES

C.M. Minke, Hercules Inc., *910 Market St., Wilmington, Delaware* 19806 (DA0G1081; DAAK40 78 C 0101)

Find cost-effective techniques and methods of reducing to acceptable limits the ablation of the bore of fiber-reinforced composite launch tubes by the exhaust from rockets using aluminized propellant.

The task involves: A. Assessing the interior environment of the launch tube. Three diameter ranges are being considered - 2.5-6.0 inches, 6-10 inches, and 10-16 inches. B. Selecting possible composite candidates that will withstand the environments. C. Qualitatively assessing the suitability using primarily a blown flame source.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Ground Equipment & Missile Structures Directorate

4.0014, ELECTRONIC DEVICES & CIRCUITS FOR USE IN RADIATION ENVIRONMENTS

H.L. Hughes, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN020143)

The objective is to improve the reliability of transistors, integrated circuits, and other semiconductor devices required to operate in nuclear radiation environments (nuclear-weapon and space environments). Such circuits and devices are required in naval missile, satellite, and ship systems (e.g., Trident, GPS, DMSP, MEECN, MX).

The approach is to develop a complete family of radiation-hardened CMOS/SOS bulk silicon and NMOS LSI circuits. The most radiation-susceptible region of CMOS devices is the insulator-semiconductor interface. Techniques to reduce the radiation sensitivity of this interface are being pursued. Silicon dioxide films with highly controlled electrical properties are being grown and deposited on silicon device substrates. The reduction of radiation-induced surface effects in bipolar devices and circuits is also being investigated. LSI/VLSI fabrication techniques such as E-beam and X-ray lithography are being investigated in terms of hardness.

SUPPORTED BY U.S. Dept. of Defense, Defense Nuclear Agency

4.0015, TRAINING EFFECTIVENESS EVALUATION IN FLIGHT TRAINING

J.A. Puig, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Human Factors Lab., *Orlando, Florida* 32813 (DN994029)

The objective of this task is to develop a training effectiveness evaluation technology that can be applied to current and future training programs. This effort will prove useful in estab-

lishing guidelines for evaluating training programs and their training devices.

This effort will involve the following tasks: (a) develop a training effectiveness evaluation (TEE) technology with the intent of refining techniques to provide more efficient and sensitive instruments for evaluation, (b) develop guidelines and publish a 'handbook' or guide to training evaluation, (c) apply and validate the methods described in the guide, and (d) develop a TEE specification and data item descriptions (DIDs).

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

4.0016, DYNAMICS OF COMPOSITE MATERIALS AND ELASTIC STRUCTURAL ELEMENTS WITH VARIABLE DIMENSIONS 15872-E

S. Nemat Nasser, Northwestern University, Evanston Campus, Technological Inst., Dept. of Civil Engineering, *633 Clark St., Evanston, Illinois* 60201 (DA0F9277; DAAG29-78-G-0149)

The development and exploitation of a new methodology for an effective and accurate response of elastic composites and the vibration of elastic structural components which have relatively large variations in their stiffness, mass distribution and/or dimensions. Relevance - the dynamic response of optimized lighter weight missile and aircraft structures constructed of composite materials requires critical analysis. The use of composites with meaningful dynamic analysis will result in improved helicopter components.

Appropriate mixed variational principles will be used in connection with either a Ritz-type approximation (for composites and structures with regular geometries) or with a finite element approach (for irregular geometries).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0017, DYNAMIC RESPONSE OF ROTOR/BEARING SYSTEMS

C. Cusano, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical & Industrial Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

The purpose of this analytical investigation is to study the dynamics of rotors supported in fluid-film bearings. The areas which are being investigated include: (a) The transmissibility and stability of gas-lubricated, externally pressurized porous journal bearings supporting a rigid rotor. (b) The transmissibility characteristics of flexibly-mounted rolling-element bearings and fluid-film bearings in porous bearing squeeze-film dampers. Results obtained from relatively simple rotor-bearing models have demonstrated that porous bearings, under certain operating conditions, can be more effective dampers than solid bearings operating under the same conditions.

SUPPORTED BY University of Illinois

4.0018, A GRAPHICAL INTERPRETATION OF VARIABLES IN LAMBERT'S PROBLEM

J.E. Prussing, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

In orbital mechanics Lambert's problem is the classical boundary value problem of determining the two-body orbit which connects two given position vectors in a specified flight time. It is used in modern-day spacecraft targeting problems. In the classical formulation for the time-of-flight equation, due to Lagrange, two variables appear which are functions of the geometry of the terminal radii and the energy of the transfer orbit. A simple geometrical interpretation of these variables as angles has been obtained. Applications of this interpretation to the solutions of the boundary value problem are being investigated.

SUPPORTED BY University of Illinois

4.0019, A QUANTITATIVE APPLICATIONS-ORIENTED EVALUATION OF THEMATIC MAPPER DESIGN SPECIFICATIONS

P.H. Swain, Purdue University, Graduate School, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 5414)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0020, NON-SATELLITE COMMUNICATIONS RELAYS

A. Durling, Booz Allen & Hamilton Inc., Applied Research Division, *4330 East West Hwy., Bethesda, Maryland* 20014 (DN981088; N62269-78-C-0437)

The technical objective of this task is to examine specific relay modes as part of the feasibility assessmet of expendable relays. This work supports work unit ZE 103, Agency Accession DN 681003.

The approach is to utilize the data base and analysis provided under NADC contract N62269 74 C 0231 and apply the concepts generated under the contract to the assessment of the expendable relays.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0021, INVESTIGATION OF AUTOMATIC PICTURE TRANSMISSION RELATIVE TO SPACE SCIENCES

C.H. Kirksey, Bowie State College, Graduate School, *Bowie, Maryland* 20715 (NSG 5416)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0022, NAVY VEHICLE DESIGN AND CONSTRUCTION - DESIGN TECHNIQUES FOR MULTIVARIABLE DIGITAL CONTROL SYSTEMS WITH MULTIPLE SAMPLE RATES

S.W. Gully, Analytic Sciences Corp., *6 Jacob Way, Reading, Massachusetts* 01867 (DN975440; N00014-79-C-0431)

During the design of a digital flight control system, it can be advantageous to have different feedback loops sampled at separate rates in order to save on computer requirements. For example, the response characteristics of an inner stability loop and an outer guidance loop are usually an order of magnitude apart and, therefore, the sample rates of each loop can also differ by the same amount. No modern control theoretical technique exists for designing multivariable digital control systems with multiple sample rates. The purpose of this project is to develop practical synthesis and analysis methods for multirate digital control systems.

The optimal multirate control problem will be formulated by starting with the optimal multirate estimation procedure which has been developed by the contractor. The general optimal multirate estimation and control problem will then be solved. The algorithms which are developed will be exercised on a realistic aircraft with multirate sensors and actuators. Optimal multirate control law and state estimation will be constructed and compared with single rate designs to illustrate the advantages and differences in complexity between them. An algorithm which will automatically guarantee a stabilizing initial starting property will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0023, ENERGY CONVERSION COMPRESSOR BLADE FLUTTER MEASUREMENT USING RETROREFLECTORS

J.L. Kerrebrock, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN875763; N00014-78-C-0536)

The objective of this project is to assess the viability of compressor blade flutter measurements utilizing a retroreflector technique developed at Aerodyne Research, Inc. The effort is experimental in nature and is aimed at direct measurements of aerodynamic damping coefficients in terms of interblade phase

angle, tip Mach number, and pressure ratio. This research will contribute to an increased understanding of the effects on performance of one of the limiting factors in the design of fan and compressor blades (blade flutter), and hopefully result in increased performance of gas turbine engines needed for naval aircraft propulsion, but useful as well to marine power plants and fixed installations.

An instrument designed, built, and calibrated by Aerodyne Research, Inc., has been procured by the M.I.T. gas turbine laboratory. It will be utilized in an M.I.T. blowdown compressor to conduct blade flutter measurements for correlation with conventional on-going flutter research. Capability of the sensor will be extended to include two channels and to detection of the direction as well as the amplitude of the motion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0024, GENERATION OF FREE RADICALS AND IONS FOR SPACECRAFT PROPULSION

J. Asmussen, Michigan State University, School of Engineering, Dept. of Electrical Engineering, *Engineering Bldg., East Lansing, Michigan* 48824 (NSG 3299)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0025, CURVATURE EFFECTS ON EFFECTIVENESS AND HEAT TRANSFER IN THREE-DIMENSIONAL FILM COOLINGS 16595-E

E.R. Eckert, University of Minnesota, St. Paul Campus, Graduate School, *St. Paul, Minnesota* 55101 (DA0G9098; DAAG29-79-C-0117)

To conduct an experimental and analytical fundamental study to determine the influence of curvature for the design of film cooling arrangement of turbine blades. The curvature of the turbine blades will affect the heat transfer coefficient and will be used to predict the blade temperatures and, consequently, the ensuing blade thermal stresses. Relevance - this work is applicable to Army helicopter engines where the current trend is to higher temperature, highly cooled gas turbines.

The heat transfer of flow around a circular cylinder, with coolant injection through a row of holes, will be measured in a low-speed wind tunnel. The pressure variation along the cylinder surface, as well as the boundary layer development without and with film cooling, will be obtained. The mass transfer analogy will be used to determine the film cooling effectiveness. Foreign gas will be ejected through the holes and the condensation of this gas along the cylinder surface downstream of the holes will be measured using a gas chromatograph. A second cylinder covered by a thin layer of naphthalene will likewise be tested.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0026, INCOMPRESSIBLE AXISYMMETRIC WAKES

F.R. Hama, Princeton University, School of Engineering & Applied Sciences, Dept. of Mechanical & Aerospace Engineering, *Box 430, Princeton, New Jersey* 08540 (ENG78-24177)

This is a continuation of research previously supported under NSF Grant ENG 77-28247 dealing with the instability, vortex formation or shedding, and transition behind an axisymmetric body. The central focus is on the mechanisms within nonlinear stability theory leading to transition to turbulence in axisymmetric flows. During earlier grant periods an elaborate suspension system was constructed to accommodate the necessary critical alignment of the test model. A misalignment of one minute of angle could result in asymmetry of the mean velocity distribution which in turn promotes flow instability. Experiments conducted show features not found in other experiments such as appearance of higher harmonics in the spectra and appears to be associated with a two-dimensional-like travelling wave instead of the helical mode assumed in the current theory. This grant will provide support to complete the stability experiments.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0027, HOLOGRAPHIC FABRICATION OF GRATINGS IN METAL SUBSTRATES

J.M. Ballantyne, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (NSG 1651)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0028, DAMAGE REPAIR PROCEDURE

F. Drum, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890156; N00019-79-C-0106)

To obtain a repair methodology that is cost-effective, compatible with the material requirements of the full-size hardware and permits the rapid restoration of the damaged stabilizers to original levels of structural integrity and environmental durability.

The repair approach will be the application of an adhesive-bonded boron/epoxy patch co-cured in an autoclave. The repair site will be stepped to accommodate the flush portion of the patch. The external doubler portion of the repair will be covered with a ply of fiberglass/epoxy.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0029, RAYS AND MODES ON CONCAVE SURFACES 15972-EL

L.B. Felsen, Polytechnic Inst. of New York, Brooklyn Campus, Graduate School, Dept. of Electrical Engineering & Electrophysics, *333 Jay St., Brooklyn, New York* 11201 (DA0G8978; DAAG29-79-C-0005)

To provide fundamental understanding of electromagnetic wave propagation on and scatter by concave surfaces and surfaces with variable curvature including effects on polarization. Relevance -results of this study will be directly relevant to ground wave propagation over uneven terrain, scatter from concave surfaces such as jet engine intake cavities, large reflector antennas and dome phase array antennas.

To proceed by studying selected cononical problems which can be solved exactly and thus provide rigorously based asymptotic results. The solutions will be cast in terms of a mixture of ray-optical and whispering gallery modes chosen in correct proportion to obtain accurate results.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0030, NAVIER-STOKES NUMERICAL STUDIES OF THE SUPERSONIC LAMINAR FLOW ABOUT CONES AT ANGLES OF ATTACK

Unknown, Polytechnic Inst. of New York, Long Island Center, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Farmingdale, New York* 11735 (DN875484; N00014-78-C-0597)

The development of accurate methods to compute the flow fields about bodies for complex flow situations is essential for the aerodynamic design and optimization of aircraft and missiles. In the proposed investigation, the laminar flow over a yawed cone will be studied within the the framework of the Navier-Stokes equations. Particular attention will be devoted to the formation of vortices near the leeward symmetry plane; the formation of cross-flow imbedded shocks; and the strong viscous-inviscid interactions for both the axial and the secondary flows.

A new solution procedure, for the Navier-Stokes equations in primitive variables, which utilizes the fact that the flow has a dominant (axially) direction will be used. The difference equations will employ a filtering technique, which in model problems has drastically reduced oscillations associated with cap-

tured shocks. The filtering procedure is equivalent to a weighted-average of conservation and non-conservation differencing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0031, RESEARCH ON MICROWAVE JUNCTION-GATE FIELD EFFECT TRANSISTORS 13586-EL
S.K. Ghandhi, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Electrical Engin, *110 8th St., Troy, New York* 12181 (DA0E9120; DAAG29 76 G0172)

To investigate and improve junction field effect transistors in III-V compounds. Relevance - electronic III-V compound devices permit operation into tens of gigahertz; junction gate field effect transistors are expected to be more reliable than presently used Schottky gate field effect transistors. Vital relevance to communication/navigation satellites, tactical communication links, missile guidance, ew equipment.

To study basic problems associated with the growth and characterization of the channel layer, and with obtaining an improved understanding of diffusion and masking problems associated with the junction gate.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0032, IMPROVED CONTAMINATION CONTROL OF CIRCULATING ENGINE LUBRICATING OIL
J.A. Tichy, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Mechanical Engineering, *110 8th St., Troy, New York* 12181 (DN975183; N00014-79-C-0100)

The objective is to upgrade the technology for separation of contaminants from circulating lubricating oil. Recent studies of maintenance procedures in naval diesel-powered ships and aircraft engines have clearly indicated that the contamination of circulating lubricating oil is a major source of increased wear and friction, premature failure of machine elements, and high maintenance costs.

The approach will be to conduct an investigation study of new available technology which can be used to solve current ship and aircraft circulating oil problems. The study will be performed in four phases: (a) determine particulate content of used oils, correlate with measured rheological behavior. (b) develop a lubrication filtration theory. (c) conduct controlled filtration experiments to test the filtration theory. (d) perform centrifugal filtration studies and wear tests.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0033, IMPROVEMENT OF NONLINEAR TRANSIENT ANALYSIS EFFICIENCY
R.J. Melosh, Duke University, School of Engineering, Dept. of Civil Engineering, *Durham, North Carolina* 27706 (NSG 1647)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0034, THE APPLICATION OF OPTICAL COMPUTING TECHNIQUES TO JET ENGINE CONTROLS
S.A. Collins, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NSG 3302)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0035, AN INVESTIGATION OF AIR SOLUBILITY IN JET FUEL AT HIGH PRESSURE
G.M. Faeth, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Mechanical Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NSG 3306)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0036, PICOSECOND OPTICS
M.F. Becker, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: This research program is aimed at measuring fast optical phenomena on a previously unavailable time scale. We have constructed an optical delay line apparatus which can resolve fast phenomena on the 10 picosecond to 10 nanosecond time scale using mode-locked laser pulses. As a candidate for our first experiments, we have chosen the semiconducting-metallic phase transition in vanadium dioxide (VO2) at 68 degrees C. As this material is of interest as a potential optical data storage medium, the writing time and energy requirements as well as the mechanisms of the transition are of interest. Measurements of the dynamic behavior of this transition have been made by initiating the transition with a short, energetic light pulse and probing its state at some later time with a portion of the same pulse which has been optically delayed. As the delay time is changed and the transition reexcited, its response can be traced for all times of interest. Preliminary experiments show exceedingly fast (less than 10 psec.) optical excitation of a nonequilibrium state followed by an exceptionally long decay period. From this time-resolved reflection and transmission data, we can attempt to understand the dynamic behavior of the phase transition. The project is in its fourth year and expected to continue fairly indefinitely.

SUPPORTED BY University of Texas

4.0037, UNIVERSAL WIDE-BAND RECORDER
J. Rayburn, Isomet Corp., *5263 Port Royal Rd., Springfield, Virginia* 22151 (DN581147; N62269-75-C-0404)

To develop a universal wide-band recorder for airborne electro-optical sensor imagery with new real-time playback capability. This work supports work unit ZT701, Accession No. DN 781263.

The wide-band recorder developed under contract and tested at NavAirDevCen will be used as test apparatus in a study contract (CPFF) to obtain performance data on dry process films relating to image and playback quality of this recorder.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

4.0038, DYNAMIC IDENTIFICATION FOR CONTROL OF LARGE SPACE STRUCTURES
S.R. Ibrahim, Old Dominion University, School of Engineering, Dept. of Mechanical Engineering & Mechanics, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NSG 1649)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0039, AIRBORNE ANTENNA PATTERN CALCULATIONS
R.R. Mielke, Old Dominion University, School of Engineering, Dept. of Electrical Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NSG 1655)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0040, NUMERICAL SOLUTIONS OF THE TIME-DEPENDENT COMPRESSIBLE NAVIER-STOKES EQUATIONS
S. Abarbanel, Tel Aviv University, *155 Herzl St., Tel Aviv, Israel* (DF052850; AFOSR-78-3651)

AF function - aerospace vehicles. Opportunity - the design of future Air Force weapons systems will require fast and accurate solutions to complex compressible flow problems in such areas as aircraft-external weapons carriage effects, reentry flow dynamics, and flight at high angle of attack. Theoretical methods now available for analyzing such flow fields are either inadequate or excessively costly for engineering applications. Objective - to develop a variety of numerical-mathematical tools for solving the partial differential systems governing compressible (inviscid and viscous) flow and to apply them to problems of

interest in aerodynamics. How work contributes - the research effort will develop numerical methods suitable for analysis of inviscid and viscous compressible flow fields, including the presence of shock waves. Effort will be directed toward increasing the accuracy, reducing computational time, and increasing the generality of application of the methods developed relative to those currently available.

A finite difference method developed previously for solving inviscid, compressible flow problems will be extended to calculate the viscous flow field for slender, blunted bodies at angle of attack. Also, a study of the stability of initial boundary value problems for the case of dissipative finite difference schemes suitable for application to aerodynamics problems and a study of the effect of boundary treatment on the stability of the overall scheme will be made. In addition, spectral methods based on Chebyshev polynomials will be used to investigate the problem of the interaction of a shock wave with a boundary layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, GLACIOLOGY STUDIES

L.R. Mayo, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *213 E St., Anchorage, Alaska* 99501 (AK 66-049)

1. Determine the relationship between climate and snow and ice storage, runoff and ice motion in glacierized basins in Alaska. 2. Answer specific questions concerning glacier activity, potentials and hazards as construction projects and populations encounter glacier-affected streams, lakes and basin areas.

Collect long term, high quality climatic, snow balance, ice balance, ice motion and streamflow measurements and analyze these data to detect significant changes as they occur. Advise of specific hazards and benefits due to the presence of glacier activities as they arise. Maintain an up-to-date aerial photographic library from which interpretations can be made.

Key instrumentation at two glacier basins studied during the International Hydrological Decade, 1965-1974, will be maintained. These two Index Glacier Basins serve as the bases for analysis of snow cover and glacier activity monitored by aerial photographic reconnaissance throughout Alaska. Field trips to basins with specific questions are used to further refine the reconnaissance interpretation. Collect data on the regime of a glacier-dammed lake to analyze its complete cycle.

Fully integrated methods for field surveying of glacier dynamics and field/office calculating of all major results completed. These new techniques allow field verification that all items of glacier dynamics are measured adequately. Ice radar capability achieved. Dynamic response of even large glaciers to climatic changes is much more rapid than previously suspected.

Fully develop and field test a method for obtaining annual maximum and minimum balance in glaciers of any size with only one field trip a year of only a few days. This will allow development of program to monitor climatic variations of very large glaciers.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0002, DEVELOPMENT OF MARTIAN TERRACED-EJECTA DEPOSITS

M. Sheridan, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NSG 7642)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0003, VOYAGER

L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Astrogeologic Studies Branch, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (9580-01031)

On March 5, 1979, the Voyager 1 spacecraft will fly past Jupiter and its array of satellites, making close approaches to three of the satellites. Io, Ganymede, and Callisto will be imaged over a wide range of phase angles in both color and black and white at resolutions between one and three kilometers. Additionally, the satellites Europa and Amalphea will be imaged at FAR encounter at a resolution of about ten kilometers. The Galilean satellites are large planetary bodies, two of them are larger than our Moon and two of them are larger than the planet Mercury. The imaging data will be used for visual interpretation of the surface histories as well as to prepare color or spectral albedo maps to characterize the distribution materials on their surfaces. On July 9, 1979, Voyager 2 will make a similar pass through the Jovian system, again passing close to three of the satellites. The hemispheres of Callisto and Ganymede, which were not imaged on Voyager 1, will be imaged on Voyager 2, providing coverage of approximately 80% of those bodies at resolutions between 1 and 3 kilometers. Additionally, Europa, slightly larger than our Moon, will be imaged at a resolution of about 5 kilometers. The Jovian system is exciting from the point of view of planetary research because the satellites which revolve about Jupiter in regular circular orbits mimick the planets around the sun. The satellites exhibit regular trends such as decreasing density and increasing mass in volume with increasing distance from Jupiter. Because they have suffered identical bombardment histories, it should be possible to compare the evolutionary histories of a collection of bodies, which range from rocky satellites to large ice balls.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0004, PIONEER VENUS RADAR

H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-01535)

The Pioneer Venus orbiter spacecraft was launched successfully in May and will be inserted into Venus orbit December 4, 1978. Low resolution radar images and altimetry data will be acquired of the entire planet between 75 degrees N and 50 degrees S latitudes along subspacecraft tracks spaced 150 km apart at the equator. During the extended mission the ground tracks obtain coverage at a spacing of 75km at the equator. The coarse radar images and altimetry traces combined with high and low resolution Earth-based telescopic images will allow the construction of mosaics and topographic maps. These maps, combined with gravity and magnetic data obtained by the orbiting spacecraft, will increase our knowledge of the surface expression of geologic features which will provide clues to possible volcanic, tectonic and eolian processes that have operated on the planet, and eventually to a deeper understanding of Earth, the twin planet, as well as Venus.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, EOLIAN PROCESSES

J.F. McCauley, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02353)

STATES TO WHICH PROJECT PERTAINS: Arizona, New Mexico.

Plans include wind tunnel experiments, field observations and electron microscopy studies to determine the response of rocks of various lithologies to wind erosion, and to define the relative role of deflation as opposed to abrasion in the evolution of planetary surfaces. Systematic measurements of wind and other climatic data in various types of desert regions will be obtained in connection with another project, by emplacement of remote sensing platforms that transmit to the GOES-1 satellite, for relay to the USGS Computer Center at Flagstaff. Geologic field studies will be conducted to provide ground data on topography, vegetation, surface sediments and rock types in each area. Analysis of the data is expected to result in mathematical models of eolian processes for application to the interpretation of data from planetary missions such as Viking and Voyager.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, NAVY ENVIRONMENT - FOG ANALYSIS
H. Loos, Laguna Research Lab., *21421 Stans Ln., Laguna Beach, California* 92651 (DN675223; N00014-76-C-0436)

The objective of this research is to analyse and select from the electrical mechanisms operative in the coalescence of fog drops that one which is theoretically optimum as the basis for field trials of fog modification experiments. Better environmental support of naval operations constitutes the relevance of this research.

Details of the analysis will include size of charged drops in relation to fall speed and dwell time in the fog, extent of charge, relative numbers of seed drops in relation to fog density, means of production of charged drops, avoidance of corona and discharge limits for amount of charge placed in cloud, etc.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0007, CLOUD COVER MEASUREMENT SYSTEM
T.W. Metcalf, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Surface & Aerospace Surveillance Dept., *San Diego, California* 92152 (DN987533)

(1) To determine the relative opacity of clouds in the visible and ir spectrum. (2) To determine the percentage of time if a difference in opacity in the visible and ir spectrum exists. This information is essential in order to select an optimum EO sensor to be used on an earth surveillance satellite.

The relative opacity of clouds will be determined by comparing the energy in the visible and ir spectra radiated from the sun through the clouds. The visible radiation from the sun will be detected by a TV camera and the ir radiation by a pyroelectric Vidicon camera. The sensors will be mounted on an equatorial clock-driven mount that tracks the sun as it moves across the sky. The output of the two sensors will be monitored and analyzed by a video processor unit designed around a microcomputer. If either of the two video signals meet a predetermined criteria, the microcomputer will turn a video recorder on. The images from both sensors will be recorded for a more detailed analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

5.0008, LABORATORY EXPERIMENTS ON THE ELECTRON ACCELERATION UNDER CONDITIONS SIMILAR TO THE AURORAL MAGNETOSPHERE
H. Boehmer, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (ATM79-15159)

This grant will support a laboratory experiment that should shed light on the phenomena leading to electron acceleration in the polar magnetosphere above auroral arcs. The experimental conditions will be chosen to simulate the plasma state found by the S3-3 satellite to exist in the magnetosphere: a fully ionized, magnetized and collisionless plasma with a magnetic field-aligned electron drift in a current channel whose radial extent is of the order of the hot ion Larmor radius. In this plasma, which contains strong electrostatic ion cyclotron wave turbulence, phenomena have been observed that are interpreted as the generation of suprathermal electrons. By measuring the temporally and spatially resolved electron energy distribution and plasma potential, the mechanism of the electron acceleration will be investigated and compared with various models like anomalous resistivity, trapping and electrostatic shocks or double layers.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0009, SEARCH AT SOUTH POLE FOR THE PENDULUM MODE OF THE EARTH'S INNER CORE
L.S. Knopoff, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DPP77-27903 A01)

The University of California at Los Angeles will continue to observe changes in the gravity at the South Pole in order to derive earth tides and earth's free vibrations. This research has been underway since 1967, most recently under grants DPP76-17234 and DPP77-27903, using two Lecoste-Romberg earth-tide gravimeters to measure vertical gravitational changes. The project will make modifications to the instruments and use a newly developed pendulum gravimeter in order to improve the sensitivity of the observations by a factor of approximately 100. The increased sensitivity will be used to search for the earth's inner-core pendulum mode. The data from the South Pole are unique because of the geographical relationship to the solar and lunar gravitational forces and because of the extreme stability and seismic quietness of the polar ice cap. The project is yielding significant data and conclusions on the inner structure and composition of the earth. During the winter of 1980, two relatively automatic, matched gravimeters will be operated by UCLA at South Pole.

One UCLA scientist is at South Pole during 1979. Another UCLA scientist will be at the South Pole during 1980. An additional UCLA scientist will be at the South Pole during the 1979-80 summer to assist in the installation and adjustment of the equipment. One additional UCLA scientist will be in training under this grant at UCLA during 1980 for possible duty at the South Pole during 1981.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0010, SEASAT PROGRAM - AN OCEAN MESOSCALE EDDY INVESTIGATION UTILIZING SEASAT-A SMMR DATA
R.L. Bernstein, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (K7-972; MO-A01-78-00-4329)

OBJECTIVE: To create from SMMR data, oceanographically useful sea surface temperature maps with an effective grid resolution between 50 and 100 km spatially, and five days temporally. These maps will be used to study the development of strong mesoscale (200 - 600 km) meanders and eddies in the Kuroshio - Oyashio extension region (30 degrees - 45 degrees N, 140 degrees - 170 degrees W), which have detectable sea surface temperature expressions in all seasons except summer.

APPROACH: Sea surface temperature data obtained by the SEASAT-A SMMR will be assembled for the western North Pacific, and mapped in five-day blocks. The maps will be examined for internal consistency and compared with conventional XBT data obtained by ships-of-opportunity, to establish a confidence level.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0011, NAVY ENVIRONMENT - MERGING SATELLITE AND CONVENTIONAL OCEANOGRAPHIC DATA
R.L. Bernstein, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (DN975254; N00014-75-C-0152)

A series of academic and tactical studies are to take place in the Pacific Ocean in waters contiguous to the west coast of the United States. A number of these investigations will be directly or indirectly in support of Pacific Fleet activities. Those activities, particularly ASW operations, need current and forecast knowledge of surface and subsurface thermal conditions, ocean waves, surface winds, and other ocean features over broad ocean areas of their operations. These mesoscale areas can be scanned in real-time with subsequent detailed interpretation of DMSP and NOAA satellite imagery. Near simultaneous measurements of physical oceanographic parameters are essential in the validation of ground-truth interpretations of the imagery.

Remotely sensed sea surface data from satellites and aircraft will be analyzed in conjunction with in-situ ocean thermal information. These field experiments will support the basis of design criteria for satellite input to oceanographic research and subsequent fleet ocean forecasts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0012, TROPOSPHERIC MEASUREMENTS OF PARTICULATES AND TRACE GASES

B.J. Huebert, Colorado College, Graduate School, *Colorado Springs, Colorado* 80903 (ATM79-06146)

Project GAMETAG (Global Atmospheric Measurement Experiments on Tropospheric Aerosols and Gases) provided significant, new data on tropospheric HNO3 and HCl vapors and particulate NO3-, Cl-, SO4--, and NH3 ion. Although important information has been obtained about global budgets for trace species, gas/particle interactions, and the photochemistry of the troposphere, large gaps remain in our knowledge. This grant funds the development and demonstration of high volume sampling techniques for use in very clean areas of the troposphere which will (1) provide size versus chemical composition information on aerosols, (2) make more specific collections of HCl and HNO3, in the presence of other acidic chlorides and nitrates, (3) collect NH3 vapor, (4) permit several metal analyses to be performed on particulates from remote areas, and (5) allow a measurement of the total aerosol acidity. These techniques will facilitate the identification of sources of trace atmospheric species and the study of reaction mechanisms not possible with present instrumentation. The techniques will be demonstrated as an auxiliary experiment on aircraft already scheduled to be deployed during the MONEX project during the summer of 1979.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0013, RADIATIVE EFFECT OF FINITE CLOUDS IN FIELDS OF CLOUDS

T.B. McKee, Colorado State University, School of Engineering, Dept. of Atmospheric Sciences, *Fort Collins, Colorado* 80523 (ATD78-27556)

The objective of this research program is to provide an increased understanding of the interaction of solar radiation in fields of clouds. Cloud geometry has been shown to have a pronounced effect on the radiances and irradiances of individual clouds. However, clouds occur in such a wide array of microphysical properties, geometric shapes, and time scales that the effect of geometry (or in broader terms, horizontal inhomogeneities) upon the energy exchange in terms of reflection (albedo), absorption, and transmission is not obvious. Theoretical treatment of radiative transfer in clouds has been extensive for semi-infinite plane parallel clouds. This research treats clouds as finite bodies. The theoretical work on finite clouds has shown that they can be very different from a piece of semi-infinite cloud and can also be very similar depending on the physical properties, solar-viewer geometry, and optical thickness. The effects of the finiteness or geometric shape upon cloud fields in the earth's atmosphere have not been investigated in detail. This project will compare finite cloud model computations with observed atmospheric data.

This research used cloud physics and radiation data collected during the 1974 field phase of the Global Atmospheric Research Program (GARP) Atlantic Tropical Experiment (GATE) objective of improving understanding of the interactions between radiation and tropical circulations.

This grant is a natural continuation of a previous GATE grant to Professor McKee.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0014, GLOBAL MAGNETISM - GM

J.C. Cain, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9780-01754)

Definitive computation of geomagnetic field. This will include analysis of Russian and U.S. Satellite magnetic data, incorporation of surface magnetic survey data and definition of transient variations due to external causes. Numerical analysis is to be done on both a global scale and local functions to define the surface field to a scale down to 2 km.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0015, GEOLOGIC APPLICATIONS OF THERMAL-INERTIA MAPPING FROM SATELLITE-HCMM

T.W. Offield, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046 MS939, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-02189)

To evaluate the effects of scale and resolution changes from both HCMM satellite and aircraft data, to assess the need for topographic correlation at different scales and resolutions, and to develop an automatic topographic correction technique. Also to compare thermal-inertia data from aircraft and HCMM satellite with maps of geology, soil type, soil moisture, land use, energy resources, and vegetation to correlate thermal inertia with the target geologic materials.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0016, PICEANCE BASIN SPRING HYDRAULICS RESEARCH

G.J. Saulnier, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Bldg. 53 Denver Federal Ctr., Mail Stop 415 Box 25046, Lakewood, Colorado* 80225 (CO 75-060)

Aquifer dewatering resulting from oil-shale mining will reduce groundwater discharge to streams and springs. Many springs in the Piceance Basin are used as water supplies for livestock and domestic use. The source of these springs and the potential effects of aquifer dewatering on these springs need to be determined before actual mine dewatering begins.

Locate and determine the source of major springs in the Piceance Basin, determine their flow characteristics, and predict the effects of dewatering resulting from oil-shale mining on spring flow. Collect, compile, and maintain records of spring discharge and water quality so that changes resulting from development can be determined.

Infrared color aerial photography and thermal imagery will be used to inventory springs. Samples will be collected from springs for water quality analysis. The concentrations of fluoride and chloride and water temperature will provide information to help determine if the source of spring flow is from the Uinta or Green River formation. This information is essential to improve the conceptual model of the hydrologic system. Discharge records will be collected from flumes installed at about 70 springs to provide pre-development data on springflow.

Infrared color aerial photography and thermal imagery were used to identify springs in the Piceance Basin. Flumes have been installed and discharge records are being collected at 70 springs by grant to the Colorado Department of Natural Resources, Division of Water Resources. Water-quality samples collected by the grantee from 48 springs were analyzed by the U.S. Geological Survey. Spring schedules and geologic data were compiled for 70 springs.

Analyze the discharge, water chemistry, and geologic data to determine the geologic source of selected springs. Prepare a report on the data collected and plan for continued collection of discharge and water-quality data which will provide a basis for evaluating the effects of proposed oil-shale development on springs.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0017, ASSESSMENT OF HIGHWAY ENVIRONMENTAL IMPACT IN CONNECTICUT USING REMOTE SENSING PROCEDURES

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Objectives are to: 1) evaluate the potential impacts on freshwater inland wetlands caused by proposed CT 275 in the Mansfield-Coventry area, using remote sensing techniques and field studies, previously tested, evaluated, and refined; 2) contrast the results of biological field studies conducted along pro-

posed CT 195 in the winter with those conducted in the summer to evaluate relative accuracy and efficiency; 3) identify and outline those surface phenomena detectable by remote sensing techniques that might play a role in an environmental impact prediction strategy; and 4) conduct a cost-effectiveness analysis contrasting the use of color infrared and panchromatic black-and-white aerial photographs in highway corridor planning. Recent low-level CIR aerial photographs were interpreted for inland wetland delineation and classification in the corridor study area. These photographs are currently being analyzed to determine land use/cover type in the study area. Repeated wetland field studies have been conducted and these data are being analyzed statistically. Cost data for the alternate modes of aerial imagery are being collected. At the same time, measures of effectiveness are being defined and quantified.

SUPPORTED BY Connecticut State Government

5.0018, NUMERICAL STUDY OF BAROCLINIC INSTABILITY

J.E. Geisler, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (NAS 8-33558)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0019, NITROGEN FIXATION AS AN ADJUNCT TO WASTEWATER PURIFICATION SYSTEMS USING WATER HYACINTHS

A.C. Rogerson, Fort Valley State College, Graduate School, *Fort Valley, Georgia* 31030 (NSG 735)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0020, ATMOSPHERIC POLLUTION SCAVENGING

R.G. Semonin, State Water Survey, *Box 232, Urbana, Illinois* 61801 (6440; EY-76-S-02-1199)

The objectives of this project are to determine the time and space variability of precipitation quality and deposition over a microscale region and to operate one of the eight MAP3S precipitation chemistry network sites. A network encompassing 150 square-km with event samples spaced 1 mile apart was established in central Illinois. Event and subevent precipitation and aerosol sampling for major ions and pH are being conducted. Precipitation chemistry and aerosol composition data will be interpreted to improve the parameterization of precipitation scavenging in MAP3S regional transport models and to better quantify the roles of in-cloud and below-cloud scavenging processes.

BIBLIOGRAPHIC REFERENCES: Changnon, S.A. Jr., and R.G. Semonin (eds.), Special Edition for Metromex, J. Appl. Met. 17(5), May 1978.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0021, AIRLIFT SUPPORT OF PROJECT ASHCAN

Unknown, U.S. Dept. of Defense, Air Force, Military Airlift Command, *Scott Air Force Base, Belleville, Illinois* 62225 (6544; EX-76-A-28-2935)

The purpose of this effort is for the Air Force to provide aerial recovery capability in support of Project Ashcan in Panama and Alaska.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0022, INTERPRETATION OF METEOROLOGICAL SATELLITE DATA

T. Fujita, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (8-011; 04-4-158-1 MOD. #9)

OBJECTIVES: To use satellite data in conjunction with other meteorological data for the purpose of learning and understanding the behavior and dynamics of mesometeorological systems, particularly thunderstorm complexes producing tornadoes and other severe weather such as heavy rains, wind, and hail. To develop means of applying satellite data to the problem of very short range forecasts, i.e., 'nowcasting'. To develop techniques and procedures for getting the satellite data into useful form for the meteorologist.

APPROACH: Emphasis in the coming 12 months will be directed toward the first and second objectives with particular attention on those severe weather systems which present special hazards to the public, such as tornadoes, high winds, and heavy rain. Fujita will continue to collect special and conventional ground truth data during and after certain tornado events for the purpose of establishing relationships between the behavior and appearance of cloud tops in satellite imagery to occurrence, intensity and persistence of tornadoes. Conduct research on the data collected during the highly successful Project NIMROD in order to relate satellite-viewed cloudtops with precipitation and windstorms beneath.

PROGRESS: Produced a 'Manual of Downburst Identification' which is intended to aid the operational meteorologist in distinguishing downburst damage from tornado damage, in identifying situations of downburst potential using radar and satellite data, and in understanding, generally, the behavior and characteristics of downbursts. From several detailed studies of SMS/GOES IR data he has observed a tendency for rapid anvil growth just prior to the downburst with a cessation of anvil growth as the downburst begins and cloud top warming near and during downburst occurrence. Fujita anticipates that once forecasters and observers distinguish between tornadoes and downbursts that tornado reports will decline markedly. Operated and directed Project NIMROD in the Chicago area and collected a wide variety of data. Many convective systems moved through the network allowing the collection of a great volume of data from RHI and Doppler radars, 315 rain gauges, special serial radiosondes, and both rapid and normal scan pictures from GOES.

SUPPORTED BY U.S. Dept. of Commerce, National Environmental Satellite Service, Meteorological Satellite Lab.

5.0023, AN ATLAS OF PALEOGEOGRAPHIC MAPS

A.M. Ziegler, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (EAR79-15133)

This action provides continuing support for the completion and publication of a series of paleogeographic reconstructions for thirty time intervals ranging from the late Precambrian to the Recent. The maps will show continental orientations, reconstructed biogeography, climatology, tectonic regime and the economic deposits for each time interval. The location of the continents is based on paleomagnetic measurements and checked by reference to available biogeographic data and plate tectonic considerations. The atlas is a summary and synthesis of present understanding of plate tectonics during Phanerozoic time and will provide a forum for reinterpreting the wealth of data in the geologic literature and will help focus future research.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0024, MICROWAVE SEA SURFACE TEMPERATURE DETERMINATION

P. Gloersen, U.S. National Aeronautics & Space Admin., Office of Space Science, Goddard Space Flight Center, *Greenbelt, Maryland* 20771 (7-141; NA79AA-G-00739)

OBJECTIVE: The objective of this research project is to obtain data sets of microwave measurements of sea surface temperature. These measurements will be made from the NASA CV-990.

APPROACH AND CURRENT PLANS: The CV-990 will be flown during satellite passage (SEASAT-1 and Nimbus-G) and over data buoys and oceanographic ships. This combination of satellite, aircraft, and surface data will enable NOAA to

make an assessment of the capability of microwave radiometers to measure sea surface temperature.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0025, NUTRIENT DYNAMICS IN AMAZON LAKES

T.R. Fisher, University of Maryland, College Park Campus, Chesapeake Bay Center for Environmental & Estuarine Studies, *Box 775, Cambridge, Maryland* 21613 (DEB78-23642)

Complete descriptions of rates of supply and loss of nutrients are not generally available for tropical lakes, although dynamics of these nutrients, such as nitrogen and phosphorus, have been identified as the most important processes influencing primary production in these ecosystems. This work involves a 2-year investigation of nutrient cycling in Lake Janauaca, a tropical lake in the central Amazon Basin of Brazil. The most distinctive feature of the lake is that each year it is, to a large extent, drained and flooded by a 10-meter annual water level fluctuation of the nearby Amazon River to which the lake connects by a solitary narrow channel. Three hypotheses are being tested: (1) during the 10-meter rise in water level, the Amazon contributes 75% of the lake volume, direct rainfall contributes 8%, and 17% remains from the previous year; (2) during rising water levels, riverborne nitrate and phosphate are the most important sources of new N and P which involve several hypolimnion-epilimnion exchanges in the lake; (3) by sampling other lakes using satellite remote sensing, it will be shown that data obtained from Lake Janauaca are representative of widespread phenomena throughout the Amazon Basin that significantly influence the biological character of lakes bordering the Amazon River, as well as the geochemistry of the river itself.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Environmental Biology

5.0026, FIELD-ALIGNED PARTICLE FLUXES AND PARALLEL ELECTRIC POTENTIAL

C.S. Lin, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NSG 5404)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0027, STUDY OF NATURALLY OCCURRING AND ARTIFICIALLY CREATED F-REGION IRREGULARITIES NEAR ARECIBO

S. Basu, Emmanuel College, Graduate School, Dept. of Physics, *400 the Fenway, Boston, Massachusetts* 02115 (ATM78-25264)

In recent years, the study of nighttime F-region irregularities at midlatitudes has engaged the attention of both theoreticians and experimentalists. The theoretical efforts have mostly concerned studies of plasma instabilities in the midlatitude ionosphere and computer simulations of the same. Various experimental techniques have also been used to study these irregularities.

This grant funds a program of research focusing on correlated measurements needed to identify the plasma that operate in generating small-scale irregularities in the midlatitude ionosphere. The studies are of both natural and artificial irregularities at Arecibo (where the necessary collection of diagnostic tools can be found).

Continuous measurements of Faraday rotation and amplitude fluctuations at 137 MHz with geostationary satellites will monitor total electron content for wave-like perturbations and scintillations near Arecibo. These observations will be conducted in conjunction with several periods of correlated incoherent scatter measurements of F-region density and transport. Later, when the High Frequency Ionospheric Modification Facility at Arecibo becomes operative in June, 1979, similar data will be obtained within the ionospheric volume heated by the intense modifying radio waves. The formation and decay of these artificial irregularities and, in particular, the power spectrum of irregularities in the scale length range of 0.1 - 1 km and any associated larger scale (approximately 10km) variations will provide insight into the generation of km-scale irregularities.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0028, DESIGN, CONSTRUCTION AND TESTING OF LORAN-C TELEMETRY FROM A DRIFTING BUOY

R.G. Walden, Woods Hole Oceanographic Institution, Dept. of Ocean Engineering, *Main St., Woods Hole, Massachusetts* 02543 (R/E-2)

OBJECTIVES: The measurement of near-surface current transport utilizing Lagrangian techniques provides useful information for use in pollution, fisheries and oceanographic research. We propose to evaluate through experiment the feasibility of tracking a surface drifting buoy equipped with an automatic tracking Loran-C receiver and telemetry transmitter. Present methods use vessels or aircraft requiring frequent sitings. A system using satellites (Nimbus) is currently in use which provides a position accuracy of plus or minus 2 km and requires third party data processing with attendant delays. The proposed system will provide high resolution buoy position data which is immediately available to the user with a position accuracy of better than 500 m. The approach appears feasible at this time because of new developments in automatic Loran-C receivers which will automatically search and lock-on to the signals with no human participation. The receiver selected has a digital output which is compatible to directly modulate an hf transmitter.

ANTICIPATED BENEFITS: The successful development of this system will provide a Lagrangian method of tracking ocean currents within a 200 mile radius of a vessel or shore station. The system is dedicated to the user requiring no third party processing costs or delays in obtaining position information. It is not dependent upon satellite operation but upon a permanent Loran-C system which can provide accurate position fixes (greater than 500 m) any time of day.

Scientists at the Woods Hole Oceanographic Institution (Beardsley) have expressed interest in using such a system south of Bermuda, the Gulf Stream and the Gulf of Maine. The system would likewise be useful to BLM studies of George's Bank and the Georgia Embayment. The NOAA National Marine Fisheries Service PATCH study on Georges' Bank is also a potential user.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0029, SEASAT PROGRAM - DETECTION OF OCEANIC CURRENTS USING SEASAT-A SAR SIGNAL DATA

R.A. Schuchman, Environmental Research Inst. of Michigan, Radar & Optics Division, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (7-926; MO-AO1-78-00-4322)

OBJECTIVE: Investigate techniques for detection of oceanic current motion by measurement of the SAR azimuth Doppler frequency shift by separation from wave orbital and phase velocity effects. Results will be development of algorithms for current measurements using SAR, measurement accuracy estimates, and current velocity maps for the test area.

APPROACH: Experimental sites will be chosen for maximum tidal currents in excess of 3 knots and in some cases greater than 9 knots. The corresponding difference between ebb and flood will be roughly double these values. Stationary land targets, located near the ocean test sites, will be measured to obtain a reference for the Doppler shift data. Doppler information from over-the-ocean test sites will be examined and measured for both SEASAT and aircraft cases. A correction algorithm that accounts for spacecraft yaw, pitch and roll will then be developed and applied to the SEASAT Doppler frequency scans and aircraft data. The land and sea Doppler frequency scans from SEASAT and aircraft will be examined for detection and measurement of a Doppler shift. The velocities obtained from aircraft X- and L-band wavelengths will be compared to SEASAT L-band velocity measurements. Finally, the radar cur-

rent values will be compared to sea truths surface current maps of the site areas.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0030, MEASUREMENTS OF DIFFERENTIAL CROSS-SECTION OF SECONDARY ELECTRONS EJECTED FROM ATMOSPHERIC GASES BY ELECTRON IMPACT

T.W. Shyn, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Oceanic Sciences, *Ann Arbor, Michigan* 48104 (ATM79-01618)

An important process in the upper atmospheres of planets is the interaction of electrons with neutral atoms and molecules. The interaction consists of elastic and inelastic scattering processes including ionization of the particles by electron impact. Electrons, particularly those produced as a result of ionization of atmospheric gases, lose their energy principally in inelastic collisions and elastic collisions, and eventually become a part of the thermal electron population at the end of the cascade energy loss process. The understanding of the energy deposition (energy lost) by energetic electrons in a particular gas or mixture of gases requires a comprehensive and consistent set of cross-sections describing the primary and subsequent (secondary) events taking place in the bombarded gas.

Reliable comprehensive experimental data on the angular and energy distributions of secondary electrons are required to understand the energy transfer processes in the upper atmosphere and to calculate the overall energy budget in the atmosphere. The long-term goal of the studies funded here is to develop complete and accurate sets of scattering cross-sections for electron impact on gases characteristic of planetary atmospheres. These cross-sections are necessary to understand the energy budget in these atmospheres. This grant funds this task for the gases N2, O2, NO, CO, CO2, H2, He, CH4, using a crossed-beam technique.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0031, IMPLEMENTING REMOTE SENSING CAPABILITIES IN MANAGEMENT OF WATER AND WETLAND RESOURCES

C.E. Olson, University of Michigan, Ann Arbor Campus, School of Natural Resources, *Ann Arbor, Michigan* 48104 (R/CZ-11)

OBJECTIVES: First Year: 1) Compare the U.S. Fish and Wildlife Service Wetland classification standards with the Michigan Land Cover/use Classification System to determine the degree to which the Michigan system is adaptable to the newer standards. 2. Determine and document the utility of LANDSAT data as a data source for water and wetland inventory and monitoring in Michigan, based on needs of state-level managerial personnel.

Second Year: 1. Assess the utility of LANDSAT-C thermal data in detecting upwelling and current patterns in large lakes. Use of such data in verifying existing circulation models for large lakes would be included.

ANTICIPATED BENEFITS: Two primary results are expected. First, a clear understanding of the differences between the new U.S. Fish and Wildlife Service wetland classifications and the Michigan Land Cover/use Classification System will be obtained. Second, the utility of LANDSAT data as a data source for wetland inventory in support of wetland managers will be more completely defined.

The data and experimental results, as well as the procedural steps involved in implementing a wetlands monitoring system, will be useful as input for: a) Coastal and inland wetland management programs, including the National Wetlands Inventory. b) Determinations of the impact of wetland removal by construction, agriculture or dredging activities.

IDENTIFIED BENEFITS TO DATE: Our on-going review and correlation of available information on remote sensing of water and wetland resources have shown several areas in which specific work is needed under Great Lakes conditions. Those affecting the design of a water and wetland information system responsive to the needs of water and wetland managers are considered most important. Efforts have been directed towards elucidating timely and cost-effective remote sensing methods of assessing wetland quality, shore erosion, and lake circulation patterns. A compilation of this information is in draft form, and it is anticipated that a substantial managerial community will make use of this document upon publication. We have prepared an audio-visual presentation that will be used to convey the results of the above review to decision-makers, and plan to deliver that presentation to state and local authorities starting in February.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0032, EARTH RESOURCES SYNTHETIC APERTURE RADAR APPLICATIONS DEVELOPMENT WORKING GROUP

J.W. Rouse, University of Missouri, Columbia Campus, Graduate School, *205 Jesse Hall, Columbia, Missouri* 65201 (NAS 9-15896)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0033, ANALYTICAL, EXPERIMENTAL, AND MODELLING STUDIES OF LUNAR ROCKS AND THEIR ORIGINS

L.A. Haskin, Washington University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *4559 Scott Ave., St. Louis, Missouri* 63130 (EAR79-08762)

This is a continuation of work previously supported by NASA which has been transferred to NSF.

This work is concerned mainly with chemical aspects of evolution of lunar and planetary crusts and regoliths and trace element behavior during igneous differentiation of planetary bodies.

We will analyze mineral and lithic fragments from lunar and terrestrial rocks to help determine the trace-elements compositions of the parent rocks and their sources. We will analyze suites of terrestrial basalts as part of the LSI Basaltic Vulcanism project; these samples will be studied by a variety of techniques by other investigators. We will continue measurements of distribution coefficients and EPR and electrochemical measurements of behavior of trace elements in silicates.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0034, AERIAL REMOTE SENSOR DATA COLLECTION, PROCESSING, AND ANALYSIS FOR ENVIRONMENTAL MONITORING

J.R. Donaldson, Lockheed Electronics Co. Inc., *P.O. Box 15027, Las Vegas, Nevada* 89114 (68-03-2636; J833C-080)

OBJECTIVE: Provide continuing on-site, nonpersonnel services support to the remote sensing program operational and research/development at the EPA Environmental Monitoring and Support Laboratory-Las Vegas.

APPROACH: Remote sensor data acquisition, reduction and processing image analysis, and preparation of output products. Work in electronic data processing concerns technique development and the operation and maintenance of the digital image analysis system. Support is provided in the development of active type airborne monitoring systems.

PROGRESS: The contractor is presently completing the project's fifth year of support.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0035, TROPHIC CLASSIFICATION OF LAKES UTILIZING CONTACT AND LANDSAT DATA

D.H. Boland, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Sys-

tems Lab., Water & Land Quality Branch, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J613A-023)

OBJECTIVES/APPROACH: Determine the feasibility of assessing the trophic condition of lakes using a combination of LANDSAT multispectral scanner data and contact-sensed data. Specific objectives include: 1) development and evaluation of models to predict lacustrine trophic state, 2) development and evaluation of models to estimate specific trophic indicators, 3) evaluation of LANDSAT's capability for estimating lake surface area, and 4) generation and evaluation of thematic photo maps which depict specific trophic indicators and trophic state. Water quality data were collected from ten Colorado lakes concurrently or near-concurrently with overflights of LANDSAT and NASA aircraft. Aircraft-borne instrumentation included a modular multispectral scanner and metric cameras loaded with color and false color infrared film. LANDSAT MSS and M2S digital data were computer-processed at the Jet Propulsion Laboratory. A trophic state index was developed using the contact-sensed water quality data. Regression models were developed, using MSS and M2S data, to estimate trophic state and selected trophic state indicators. LANDSAT lake surface estimates were compared to those derived from the aerial photography. Thematic photo maps were computer-generated using water truth-scanner data relationships.

FINAL OUTPUT: A report describing the project results will be used by state and federal monitoring agencies.

PROGRESS: Trophic ranking of Colorado lakes using LANDSAT and NASA Overflight data compared favorably to rankings obtained using contact-sensed data. Several problem areas were defined for further investigation. Publication of the project report is projected for June 1979.

Project report, 'Trophic Classification of Selected Colorado Lakes: Lake Classification through the Amalgamation of Contact-Sensed Data and Digitally Processed Multispectral Scanner Data Acquired by Satellite and Aircraft' was jointly published with NASA, Office of Space and Terrestrial Applications, Environmental Observations Division, Washington, D.C.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0036, CLIMATIC AND PHONOLOGICAL MODELS FOR RESOURCE PLANNING AND MANAGEMENT

R.O. Gifford, University of Nevada, Reno Campus, School of Agriculture, Dept. of Plant Soil & Water Science, *Reno, Nevada* 89507 (177774 (HRB NO.))

The following tasks will be accomplished: 1. Develop techniques for extending data from limited station locations to areal coverage. 2. Develop techniques to forecast long-term series of events from short-term records. 3. Describe interrelationships between climatic variables. APPROACH: The statistical descriptions of climatic data made under project W-48 will be reexamined for their application to locations other than those for which the data was originally analyzed. Patterns of precipitation at three or more locations will be compared using statistical comparison techniques. Where the patterns are not significantly different they will be used to interpolate the precipitation pattern for locations between them. The minimum amount of local information needed to describe the precipitation pattern using surrounding patterns will be sought using trial and error methods. Similar analyses will be made for temperature patterns. Using the same data base, the length of record required to establish the time pattern of climatic data will be explored by comparing short- and long-term records at a variety of locations. The combined occurrence of climatic elements examined by statistical studies of the precipitation, temperature, solar radiation, and possibly other parameters. The combined occurrences will also be summarized and analyzed in models for potential evapotranspiration and water balance.

SUPPORTED BY University of Nevada

5.0037, USE OF AIRCRAFT SPECTRORADIOMETRY TO DETERMINE WATER QUALITY

H.L. McKim, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (31583)

OBJECTIVE: To quantitatively assess water quality parameters in fresh and salt water regimes utilizing aircraft spectroradiometer data and to conduct laboratory tests to determine spectral bands of interest for quantitative and qualitative measurement of water quality data to meet Corps of Engineers requirements.

APPROACH: A prototype 500-channel aircraft spectroradiometer instrument with a 10 Angstrom units spectral resolution will be used in the study to assess water quality parameters in fresh and salt water systems. The instrument provides a digital tape read-out for 500 channels ranging from the visible (0.42 microns) to the near infrared wavelengths (1.0 micron) for a minimal 60 by 60 ft. area. Laboratory testing to determine spectral bands of interest will be conducted with the airborne spectroradiometer instrument. The results will be compared to field tests in FY 78 run. Aircraft spectroradiometer flights over selected test site areas will be accomplished in conjunction with ground truth data acquisition. Analysis of the high resolution multispectral data will be used to qualitatively and quantitatively assess water quality parameters, especially turbidity, based on correlation to field measurements.

In addition, the GISS theoretical model will be run with data taken in 1978. Spectral response curves will be generated based on varying the size, optical properties and density of particulate matter. Results from the 1978 aircraft flight analyses and laboratory experiments will be compared to conventional techniques. A cost-effective comparison between conventional techniques and aircraft spectroradiometry to assess quality parameters in fresh and salt water will be made. Procedures to assess water quality will be made for use by Corps of Engineers Division.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0038, NUMERICAL SIMULATION OF THE NEW YORK BIGHT COASTAL WATERS

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OBJECTIVES: The objective is to construct an advanced, three-dimensional hydro-numerical model which will accurately predict the dynamic and thermodynamic properties of Atlantic coastal waters in response to tidal, surface wind, heat and salinity forcing.

ANTICIPATED BENEFITS: The model will be verified by comparing predictions with N.Y. Bight oceanographic data collected under the NOAA MESA Program. Thereafter, the model can be applied to the prediction of pollutant dispersion and bottom sediment transport; it should then be extended to include ecosystem models.

IDENTIFIED BENEFITS TO DATE: 1.) A published report entitled, 'The Middle Atlantic Bight: A Climatological Atlas of Oceanographic Properties'. 2.) Analysis and simulation of tides. 3.) Simulation of a climatological year for the Middle Atlantic Bight.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0039, FLOW BEHAVIOR OF EXTRATERRESTRIAL MATERIALS

L.C. Klein, Rutgers the State University of New Jersey, Busch Campus, Graduate School, *Piscataway, New Jersey* (EAR79-06771)

This task was originally funded by NASA but has been transferred to NSF for continued support. This study focusses on the viscous flow behavior of extraterrestrial materials - both lunar and meteoritic materials. This study includes an experimental investigation of the effects of oxygen fugacity on flow behavior in lunar materials, such as glassy soils, and in meteoritic materials, such as breccia fragments in howardites, as well as in the Fe-Si-O system. The flow behavior is observed over a wide range of temperatures and oxygen fugacities in order to identify structural aspects of iron-containing silicates, and to evaluate effects of solute redistribution on crystal growth. Experimental measurements are extended to include the intermedi-

ate temperature region in glasses that do not crystallize readily. A semi-empirical model is being formulated to describe flow in the high viscosity region. It is expected that this study will lead to a better understanding of the flow process in iron-containing silicate materials in a variety of environments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0040, PREPARATION FOR 1979 SOLAR ECLIPSE
A.A. Gilcrease, New Mexico State University, Las Cruces Campus, Physical Science Lab., *P.O. Box 548, Las Cruces, New Mexico* 88070 (DA0F2141; DAAD07-78-C-0058)

The technical objective is to prepare sets of rocket-borne experiment packages and take care of all logistical considerations necessary for the conduct of the 1979 Solar Eclipse Field Measurements Program.

A detailed experimental plan involving many coordinated experiments is organized for the total solar eclipse on 26 February 1979. The experiments will focus on the measurements of atmospheric response in the 60-90 km altitude region.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0041, AEROBIC BIOLOGICAL WASTE TREATMENT FOR CLOSED ECOLOGICAL LIFE SUPPORT SYSTEMS
M.L. Shuler, Cornell University, Ithaca Campus, School of Engineering, Chemical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (NSG 2408)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0042, THE METEOROLOGICAL VARIATION OF ANTARCTIC AEROSOLS
A.W. Hogan, State University of New York, Albany Campus, Atmospheric Sciences Research Center, *41 State St., Albany, New York* 12203 (DPP7820662)

During the austral summer of 1979-80 and 1980-81, measurements will be made at South Pole Station in Antarctica of the concentrations of aerosols, ozone, carbon dioxide, and other trace chemical constituents at the surface of the ice cap and up to the katabatic return flow above the inversion. In addition, during the austral summer of 1980-81, airborne measurements of aerosols, ozone, and meteorological parameters will be made over Antarctica using a science configured LC-130 logistics aircraft.

These measurements will be used to obtain an improved understanding of (1) the physical properties of and precipitation mechanisms for atmospheric aerosols over the antarctic plateau, and (2) the meteorological processes which transport aerosols to the plateau.

Logistics support is required for two scientists in austral summers of 1979-80 and 1980-81.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0043, NON-NUCLEAR POLLUTANTS IN STRATOSPHERIC AIR
E.P. Hardy, U.S. Dept. of Energy, Office of Health & Environmental Research, Environmental Measurements Lab., *376 Hudson St., New York, New York* 10014 (1783)

The objectives are to document the concentrations of selected stable tracers (particulate and gases) in the stratosphere as a function of latitude, altitude and season; to inventory the stratospheric burdens of these materials; to examine vertical transport in the troposphere; to develop and test stratospheric transport models; and to supply basic data for other scientific programs in studying the ultimate deposition of tracers in the environment. Particulate and gas sampling is conducted by both aircraft (Project Airstream) and balloons (Project Ashcan) in the stratosphere on a seasonally repetitive basis in the northern hemisphere. Aircraft sampling extends from 75 degrees N to the equator at four altitudes up to 63K ft. and balloons are launched in Alaska, Panama and New Mexico to 70, 80, and 90K ft. Data and interpretive analysis are routinely published and distributed to all member nations through the United Nations.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0044, OCEAN REMOTE SENSING
G.S. Brown, Applied Science Associates Inc., *Apex, North Carolina* 27502 (DN975312; N00014-79-C-0198)

Precision radar altimeters carried by satellite offer the possibility of measuring and monitoring low amplitude variations in sea level which are indicators of ocean frontal boundaries, geostrophic currents, and subsurface eddy positions. This program will analyze the feasibility of extracting these oceanographic signals from the much larger signal caused by variations in geoid heights, and test the calculations against observed ocean data.

Theory will be developed for relating ocean wave-wave-interaction to the modulation of short capillaries which are responsible for the altimeter signal return. An empirical study of change in backscatter as the satellite passes over frontal boundaries measured in-situ will also be conducted.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0045, UTILIZATION OF RANGE DIFFERENCE OBSERVATIONS IN GEODYNAMICS
I.I. Mueller, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Geodetic Science, *164 W. 17th Ave., Columbus, Ohio* 43210 (NAS 5-25888)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0046, EXAMINATION OF REQUIREMENTS AND METHODS FOR REPORTING ATMOSPHERIC INFORMATION
J.K. Leurs, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (NAS 8-33369)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0047, REMOTE SENSING APPLICATIONS TO OKLAHOMA RESOURCES AND ENVIRONMENTAL PROBLEMS
S. Walsh, Oklahoma State University, Graduate School, *211-215 Whitehurst Hall, Stillwater, Oklahoma* 74075 (NSG 7640)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0048, FEASIBILITY OF GOES DATA RELAY SYSTEM IN THE U.S. GEOLOGICAL SURVEY'S WATER DATA COLLECTION PROGRAM
G.L. Gallino, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Portland, Oregon* (OR 76-079)

Real-time water data are needed in the Pacific Northwest to manage, plan, and develop its water resources in support of hydroelectric-power development, flood control, pollution control, irrigation, and wildlife management. Indivdual agencies are installing their own systems at gaging stations operated by the U.S. Geological Survey. However, use of so many different 'real-time' systems reduces operation efficiency. There is need for an efficient system for use by all. The Geostationary Operational Environmental Satellite (GOES) could provide such a system.

Use the GOES system as a telemetry supplement to existing data-collection facilities to improve the real-time data-collection system. Evaluate the impact of such a real-time system on the WRD program and determine costs and benefits. Develop computerized data-verification programs and appraise the effective-

ness. Compare the accuracy of GOES-acquired data to data acquired by conventional methods.

Use the Bull Run and Sandy River Basins as a test area for the system. The 107-square-mile area is the watershed for the Portland Municipal water supply. Instruments will be installed at one site for stream-stage turbidity and precipitation, three sites for stage and turbidity, four sites for stage alone, and two sites for precipitation and air temperature alone. GOES platforms will be installed at each site. The Portland District will manage the system and the Northwest Water Resources Data Center will check verification methods.

The 10 GOES satellite platforms operated reasonably well during the past year. A letter summarizing progress made toward the objectives: (1) to evaluate the impact of the system on District operations, (2) to determine cost benefits, (3) to develop a computerized verification system and to compare the accuracy of GOES-acquired data with conventionally acquired data, was sent to the Instrumentation Group. The project has been terminated.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0049, SYNTHESIS OF REGIONAL CRUST AND UPPER MANTLE STRUCTURE FROM SEISMIC AND GRAVITY DATA

S.S. Alexander, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Geosciences, *116 Deike Bldg., University Park, Pennsylvania* 16802 (NCC 5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0050, BLM COOPERATIVE PROJECTS

W.G. Rohde, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Data Center, Applications Branch, *Sioux Falls, South Dakota* 57198

STATE TO WHICH PROJECT PERTAINS: Arizona.

The overall objective is to evaluate the usefulness of LANDSAT film products, computer-compatible tapes, and aerial photographs at several scales for mapping and inventorying wildland vegetation in Northern Arizona.

Standard and enhanced LANDSAT imagery will be manually interpreted to illustrate the extent to which such techniques can be used to map and inventory the area of vegetation communities.

Digital LANDSAT data will be classified to stratify the project area into broad vegetation categories. This stratification will be used to allocate sample units to be photographed with 1:6000 normal color film. Sample units will be allocated proportionately to the area within each stratum. Each aerial photograph will be interpreted and a number of photo plots will be selected, using proportional allocation, and visited on the ground. The photo and ground observations will be used to describe the resource cover types associated with each stratum and to estimate the area of each vegetation cover type.

Digital terrain data will be registered to the LANDSAT data. The terrain data, (i.e., elevation, slope aspect) and the photo data will be used to develop post-classification stratification models to improve the capability of mapping vegetation resources.

SUPPORTED BY U.S. Dept. of the Interior, Land Information & Analysis Office, EROS Data Center

5.0051, APPLICATION OF SATELLITE AND AIRCRAFT IMAGERY TO HYDROGEOLOGY

G.K. Moore, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Sioux Falls, South Dakota* (CR 73-196)

Remote sensing has considerable potential for hydrologic studies, particularly in the visible, infrared, and microwave parts of the spectrum. It offers new information and new tools to the hydrologist and can reduce the field work necessary in conventional studies. Research, testing, and development are needed to obtain operational procedures, however.

(1) Conduct research on the applications of remote sensing to ground-water occurrence, surface drainage characteristics, and water color and turbidity. Develop application examples. (2) Develop enhancement and interpretation procedures for remote sensing imagery and digital data, using both manual and computer processing. (3) Train and consult with other hydrologists on feasibility tests and operational uses of remote sensing. (4) Originate, plan, and coordinate programs and projects in remote sensing.

(1) Analyze existing data for hydrologic information; develop procedures for information extraction. Evaluate effects of atmosphere and soil and vegetation cover. (2) Evaluate existing procedures for manual and digital processing. Determine need and utility of new procedures. (3) Conduct training courses and briefings. (4) Work with WRD, EROS, and NASA personnel to originate and coordinate remote sensing applications to hydrologic problems.

Talks, briefings, and training lectures were given at EROS Data Center, Natl. Space Technology Labs, SD State Univ., Murray State Univ., and one WRD District. A formal paper was presented at the World Water Conference in Mar del Plata, Argentina. Work on the Yampa Basin and Johnstown flood was completed and underway, respectively. Research on water color and turbidity was completed. Personnel from five districts were given training in digital processing of LANDSAT data.

Conduct training courses in hydrologic remote sensing. Begin research on relationship of source areas to stream flows. Continue work on Johnstown flood. Prepare formal paper on water turbidity. Continue training in digital processing. Prepare lecture notes for training courses.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0052, SOLAR-WIND AND MAGNETOSPHERIC ELECTRIC FIELDS AND PLASMAS

J.L. Burch, University of Texas, San Antonio Campus, School of Science & Mathematics, Dept. of Earth & Physical Sciences, *San Antonio, Texas* 78285 (NSG 5418)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0053, IMPACT OF GASEOUS SULFUR AND AEROSOLS PRODUCED BY POWER PLANTS ON THE CCN BUDGET

V.K. Saxena, Utah Higher Education System, University of Utah, School of Science, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (7963)

A comprehensive program to study the regional transport and dispersion of sulfur and chlorine particles is proposed. The study is aimed at determining the variability of CCN upwind and downwind of the power plants, investigating the growth and formation of CCN in the plane plume, and determining whether the gaseous sulfur-to-sulfate conversion processes give rise to a secondary maximum in the CCN concentration downwind of the plume. Our newly developed CCN spectrometer will be used. It is capable of producing real-time measurement and display of the entire CCN spectrum within as short a time interval as 15 seconds. Airborne measurements abroad a DC3 aircraft will be made. One of the most fascinating aspects of the proposed study is the utilization of the CCN activity spectrum as a natural tracer of the air mass history. The proposed study will help MAP3S in four respects. First, the submicron cycle and therefore a study of their transport is needed. Second, they represent the fingerprints of a pollution plume in terms of their activity spectrum and are the best tracers of air originating from urban-industrial areas. Third, they have been shown to be derived from the gaseous sulfur-to-sulfate conversion processes and are involved in the acid rain. Fourth, larger sulfate particles directly emitted from power plants may form haze at ambient relative humidities thereby degrading the visibility.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0054, SEASAT-A COORDINATION AND APPLICATION

D.E. Lichy, U.S. Dept. of Defense, Army, Corps of Engineers, Coastal Engineering Research Center, *Kingman Bldg., Fort Belvoir, Virginia* 22060 (31582)

OBJECTIVE: To coordinate the Corps needs with NASA activities with the SEASAT satellite for the development of remote applications. An overall Corps need exists to develop remote sensing techniques for coastal terrestrial and ice engineering problems and application of these techniques to field problems.

APPROACH: Evaluation and coordination of SEASAT-A application to the Corps needs by research, correspondence, attendance at meetings, participation in seminars and working groups and consulting with SEASAT groups of NASA, other sponsors, Corps Division and District offices, CRREL, WES, ETL, IWR, and Division laboratories. This effort will match the potential capabilities of SEASAT-A with Corps problems and needs.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Coastal Engineering Research Center

5.0055, PETROLOGIC STUDY OF RETURNED LUNAR SAMPLES

E. Roedder, U.S. Dept. of the Interior, Geological Survey, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (EAR79-06760)

This study is a continuation of work previously funded by NASA which has now been transferred to NSF for support. This study is aimed at understanding planetary processes and history through the study of inclusions in selected geological samples. Investigations will be made in the area of understanding the phenomena of trapped melt inclusions in crystallized silicate materials. These studies will assist in interpreting the complex differentiation trends evident in the gross compositions of the host materials as well as those of silicate melt immiscibility. The study has wide application to the area of terrestrial mineralogy and petrology as well as planetary geoscience.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0056, EXTRA-TERRESTRIAL OXYGEN FUGACITIES

M. Sato, U.S. Dept. of the Interior, Geological Survey, National Center, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9710-01150)

The project is primarily responsible for determining oxygen fugacity values of lunar rocks, meteorites, and other planetary matter to provide basic data on the oxygen fugacities of rocks and minerals in the Solar System. On the basis of these data and other available information such as the behavior of volatile matters, we evaluate the causes and mechanisms of redox reactions that occurred during the formation of planetary bodies and magmatic activities.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0057, REMOTE SENSING/WASTE DISPOSAL

L.C. Rowan, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9790-02015)

STATES TO WHICH PROJECT PERTAINS: New York, Pennsylvania, Utah, Maine, South Dakota.

The objectives are to delineate landforms using satellite and aircraft images that may reflect subsurface and surface geologic structures. During this year, emphasis will be placed on statistical analysis of identified lineaments to determine regional trends and on detailed field and aircraft image studies of selected lineaments to characterize these features. In both cases, geophysical data, including aeromagnetic maps, seismic profiles, and gravity maps and subsurface stratigraphic data will be used to relate the lineaments to subsurface structures. Ultimately, this approach should permit characterization of large regions where detailed mapping of geophysical and subsurface stratigraphic data are only locally available.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0058, REMOTE SENSING/CUSMAP

L.C. Rowan, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9790-02074)

STATES TO WHICH PROJECT PERTAINS: Utah, Nevada, Arizona, Missouri.

Emphasis will be placed on compilation of digital image processing of LANDSAT images for mapping lineaments and other landforms and limonitic hydrothermally altered rocks. Analysis of these data involves both photointerpretative and statistical methods to identify the most significant features for localization of ore deposits. High-altitude aircraft photographs and other images will be used to supplement the LANDSAT data. Results will include maps showing the distribution of lineaments and limonitic altered rocks which later will be integrated with other geophysical, geochemical, and geologic field mapping data. Another important aspect of these investigations is the acquisition, processing, and analysis of multispectral aircraft data for overcoming some of the limitations imposed by the spectral bands used in the LANDSAT scanner.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0059, OXYGEN FUGACITIES OF EXTRATERRESTRIAL MATERIALS AND REDOX REACTIONS

M. Sato, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Experimental Geochemistry & Mineralogy Branch, *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (EAR79-08578)

This work is a continuation of studies previously funded by NASA but which have been transferred to NSF. The project is primarily responsible for determining oxygen fugacity values of lunar rocks, meteorites, and other planetary matter to provide basic data on the oxygen fugacities of rocks and minerals in the Solar System. On the basis of these data and other available information such as the behavior of volatile matters, we evaluate the causes and mechanisms of redox reactions that occurred during the formation of planetary bodies and magmatic activities.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0060, LAND USE CHANGE DETECTION AND MAP UPDATE

V.A. Milazzo, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092 (G-25)

Conduct actual test and demonstration studies in select area(s) using approaches and techniques of change detection and map update previously recommended. Investigate the interpretive and cartographic aspects in identifying and mapping land use changes and in selectively updating land use maps. Establish standard procedures and techniques to be used by compilers in updating land use and land cover maps.

Refine criteria and procedures for selecting areas for land use update. Begin preliminary development of a workable set of standard and routine guidelines for update selection that can be used in an operational map update program.

Begin evaluation of likely candidate areas for map update in a first-round update program. Consider use of LANDSAT for targeting areas for possible update. Conduct search of available remote sensing sources and explore opportunities for new photo source acquisition under proposed Federal High-Altitude Photography Program as well as improved techniques in the use of LANDSAT digital data for change detection and map update. Establish preliminary areas for map update.

Continue to work with Topographic Division, state and regional cooperators and NASA in the areas of land use change

detection and map update already developed and pursue areas of further cooperation.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0061, RESEARCH AIRCRAFT OPERATIONS
C.L. Simpson, U.S. Dept. of Energy, Battelle Pacific Northwest Lab., *P.O. Box 999, Richland, Washington* 99352 (000556; EY-76-C-06-1830)

The purpose of this program is the provision of technical support for DOE-DBER Atmospheric Research programs, in the form of airborne laboratories and tracer-release facilities. Aircraft support is required especially for the following Atmospheric Sciences programs: Precipitation Scavenging, Atmospheric Boundary Layer Studies, Particle Resuspension and Translocation, Cooling Tower and Cooling Pond-Atmospheric Impact, Aerosol and Trace Gas Transformation, and Urban Pollution and Tracer Studies. Two aircraft, a Cessna-411 and a Douglas DC-3, have been equipped with tracer release facilities as well as the necessary instrumentation for highly sophisticated measurements of cloud physics, aerosols, pollutant-gases, atmospheric tracers, and turbulence.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0062, POLAR ICE REMOTE SENSING
W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 70-064)

One of the fastest varying large-scale features on the earth's surface is sea ice. Theoretical studies show the ice canopy in polar regions to be of major importance in (1) determining the global heat balance, and (2) determining the vapor flux of water into temperate regions. In order to test the developing numerical models of polar regions it is necessary to acquire sequential large-scale synoptic data over polar regions. Remote sensing, especially in frequencies in the microwave range, appears to offer the best chance of obtaining these data.

As investigators for Sea Ice for NASA and the Spacecraft Oceanography Center-NOAA, we will design polar remote sensing experiments using NASA and other agency remote sensing aircraft and satellites. Aircraft and satellite experiments will be coordinated with necessary ground truth networks for the remote sensing systems. The basic premise for these plans will be to develop the correct remote sensing means to acquire data that will be useful in testing numerical models of sea ice and glacier ice.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, MORPHOMETRICS OF CELLULAR DAMAGE IN MICE RECEIVING WHOLE BODY IRRADIATION
W.J. Sapp, Tuskegee Inst., School of Arts & Sciences, Dept. of Biology, *Tuskegee Institute, Alabama* 36088 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0002, OXYGEN EFFECTS AND EARLY BIOCHEMICAL EVOLUTION - ACETYL-COA SYNTHETASES IN YEAST
J.A. Neptune, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, INVESTIGATION ON PROCHLORON - A PROKARYOTIC GREEN ALGA
E.C. Weaver, California State University & Colleges, San Jose State University, School of Science, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCA 2-675910)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, CARDIOVASCULAR DECONDITIONING AND EXERCISE PERFORMANCE
R.F. Debusk, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NCA 2-745911)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, MATCHING CROP VARIETIES TO EFFICIENT USE OF NITRATES, AMMONIUM AND UREA FOR THE CONTROLLED ECOLOGY LIFE SUPPORT SYSTEM (CELSS)
R.C. Huffaker, University of California, Davis Campus, School of Agriculture & Environmental Sciences, Dept. of Agronomy & Range Science, *Davis, California* 95616 (NSG 2406)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0006, SYSTEM FOR ASSESSMENT OF 24-HOUR BIORHYTHM DESYNCHRONOSIS AND ITS EFFECTS ON PERFORMANCE AND PSYCHOLOGICAL STATE (ABBREV)
L.F. Chapman, University of California, Davis Campus, School of Veterinary Medicine, Dept. of Behavioral Biology, *Davis, California* 95616 (NCA 2-180905)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, HEAT RESISTANCE OF MICROORGANISMS
J.E. Campbell, U.S. Dept. of Health Education & Welfare, Public Health Service, Food & Drug Admin., Bureau of Foods, *200 C St. S.W., Washington, District of Columbia* 20204 (04068)

STATEMENT OF OBJECTIVES: a. Provide technical support and advice on the efficacy of sterilization cycles and the expected microbiological loading on spacecraft components to the Chief, Planetary Biology Program; and b. conduct research on the mechanism of thermal inactivation of microorganisms and investigate ways and means of improving the effectiveness of sterilization cycles.

DESCRIPTION OF WORK: 1. Determine the heat resistance of B. megaterium, B. cereus, Cl sporogenes and an unknown soil anaerobe in the closed can system. An attempt will be made to develop predictive models based on time, temperature and humidity. 2. Examine the possibility that a measure of the internal osmotic pressure of the spore can be related to thermal resistance. 3. Determine the thermal resistance of S. typhimurium, S. senftenberg 775W in the can system and specifically constructed oven at one or more temperatures. At least 8 relative humidities will be examined.

SUPPORTED BY U.S. Dept. of Health Education & Welfare, Food & Drug Admin., Bureau of Foods

6.0008, ENVIRONMENTAL INTERACTIONS WITH THE AGING PROCESS
G.A. Sacher, U.S. Dept. of Energy, Div. of Biological & Medical Research, *9700 S. Cass Ave., Argonne, Illinois* 60439 (001541; W-31-109-ENG-38)

This program is concerned with the effects of environmental pollutants on the daily (diel) cycles of energy metabolism, motor activity, and body temperature in small rodents. These processes can be measured accurately and continuously on unrestrained animals. The hypothesis is that they are sensitive indicators of the health status of the animal, including expectation of disease morbidity and survival. We have gone a considerable way toward validating this hypothesis, and are beginning to in-

vestigate the effects of specific pollutants. The purpose is, first, to characterize the effects of each pollutant, and second, to determine whether these effects predict the subsequent health history of the animal. Energy-related pollutants currently under examination are ionizing radiations, ingested lead, and high-voltage electric fields. Diel cycles of metabolism, activity, and temperature can be logged continuously and automatically for several individual mice simultaneously for periods up to 2 weeks. The search for indicator variables has thus far been limited to the energy expenditure variable, and has revealed 3 variables that predict the length of life, i.e., resting metabolic rate (negative correlation), ratio of average to resting metabolic rate (positive correlation), and change of metabolic rate from youth to old age (negative correlation). The search must now be extended to the activity and temperature variables, which have become functional only recently. The initial phase of work with pollutants will be focused on radiation variables both ionizing and non-ionizing. The non-ionizing radiations to be examined are 60 Hz electric fields and 2450 MHz microwaves, as produced by the proposed Solar Power Satellite system.

BIBLIOGRAPHIC REFERENCES: Sacher, G.A., P.H. Duffy and E. Stafeldt, Genetic Relation of Life-Span to Metabolic Rate for Five Mouse Strains and Their Hybrids, Fed. Proc. 37: 716(1978). Sacher, G.A., Longevity, Aging, and Death: an Evolutionary Perspective, The Gerontologist 18: 112-119(1978).

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

6.0009, PLANT DIVERSITY TO SUPPORT HUMANS IN A CONTROLLED ECOLOGY LIFE SUPPORT SYSTEM GROUND-BASED DEMONSTRATOR
J.E. Hoff, Purdue University, School of Agriculture, Dept. of Horticulture, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NSG 2401)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, HIGHER PLANT SPECIES SELECTION CRITERIA FOR A CLOSED ECOLOGICAL LIFE SUPPORT SYSTEM - PHOTOSYNTHETIC AND NUTRITIONAL ASPECTS
C.A. Mitchell, Purdue University, School of Agriculture, Dept. of Horticulture, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NSG 2404)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

6.0011, DEVELOPMENT OF A PROTOTYPE EXPERIMENT FOR TREATING CELSS AND PCELSS WASTES TO NUTRIENTS FOR PLANT GROWTH
M. Modell, Massachusetts Inst. of Technology, School of Engineering, Dept. of Chemical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 2403)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0012, PLANT CHARACTERISTICS FOR CONTROLLED ECOLOGY LIFE SUPPORT SYSTEM AND STUDY OF PHYSIOLOGICAL INJURIES TO PLANTS (ABBREV)
T.W. Tibbitts, University of Wisconsin, Madison Campus, School of Agriculture & Life Sciences, Dept. of Horticulture, *Agriculture Hall, Madison, Wisconsin* 53706 (NSG 2405)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general), Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, COMPUTERIZED SAFETY INFORMATION SYSTEM FOR GSFC'S HEALTH AND SAFETY ENGINEERING OFFICE
H.D. Cabassa, University of Puerto Rico, Mayaguez Campus, Graduate School, *Mayaguez, Puerto Rico* 00708 (NAS 5-25844)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0002, NRL-1 STRATOSPHERIC GLOBAL PREDICTION MODEL
M.R. Schoeberl, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880271)

To provide the Navy with a numerical model of the middle atmosphere which is computationally efficient and capable of being coupled with the Navy's tropospheric prediction model to generate suitable upper boundary conditions and predict stratosphere-troposphere interactions.

A quasigeostropic model developed by Schoeberl (1976) is being used to investigate stratospheric large-scale dynamics and troposphere-stratosphere coupling. The NRL version of the Canadian spectral primitive equation model developed originaly by Daley et al. (1976) will be used to investigate nongeostropic coupling.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

7.0003, APPLICATIONS OF BIFURCATION THEORY
J.F. Auchmuty, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Mathematics, *Memorial Hall, Bloomington, Indiana* 47401 (MCS78-00952 A01)

This continues research previously supported by NSF MCS78-00952.

Professor Auchmuty will study the analysis and modelling of certain nonlinear phenomena in astronomy, biology, chemistry and chemical engineering. The problems include various aspects of the theory of reaction-diffusion and interaction-diffusion equations, especially the theory of bifurcating waves. Also he will continue his work on bifurcation problems in astronomy and celestial mechanics and related mathematics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0004, ELECTROMAGNETIC SCIENCES COMPUTATIONS AND MATHEMATICAL ANALYSIS
Schneeberger, R D P Inc., *Waltham, Massachusetts* (DF903230; F19628-77-C-0242)

1. The objective of this effort is the support of in-house research programs in the fields of electromagnetic sciences including tropospheric scattering radar and antenna techniques, microwave acoustic devices, and ionospheric physics problems. 2. The product of this contract will be mathematical, numerical and/or graphic solutions as well as graphic representations to data furnished. Completed art work must be of sufficiently high quality to be used for publication in technical journals.

Data reduction and/or mathematical analysis related to electromagnetic sciences problems, curve plotting, drafting and artistic creative illustrations from experimental and theoretical scientific data, or tracing of machine-produced curves, as well as free-style artistic illustrations of concepts, apparatus or devices. Some of the work will be block and circuit diagrams, lettering and 3-dimensional pictorial representations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

7.0005, MATHEMATICAL SCIENCES POSTDOCTORAL RESEARCH FELLOWSHIP
G.B. McFadden, (No Performing Organization Reported), *New York* (MCS79-19143)

The research will involve the area of applied mathematics, particularly the computer design of 3-dimensional swept wing configurations with low wave drag.

The Fellowship Institution will be the Courant Institute.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0006, TWO-DIMENSIONAL RECURSIVE DIGITAL FILTERS FOR NEW REAL-TIME IMAGE PROCESSING
W.E. Alexander, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Electrical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 5406)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0007, COMPUTER SCIENCE AND COMPUTER ENGINEERING RESEARCH EQUIPMENT
R.W. Ehrich, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Computer Science, *Blacksburg, Virginia* 24061 (MCS7907032)

A computer system will be acquired to form an interdisciplinary laboratory for remote sensing and image processing. Research will be undertaken on the following topics: Structural-statistical Approaches to the Analysis of Macrotextures. A Facet Model for Low-level Image Processing. Shape Recognition. Spatial Data Structures. Homomorphisms - Exact and Inexact Matching.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, RESEARCH IN THEORETICAL ELEMENTARY PHYSICS
L. Susskind, Stanford University, Graduate School, *Stanford, California* 94305 (PHY78-26847)

Research will be done in theoretical physics to further our understanding of elementary particles, quantum field theory, and related areas of solid-state physics, statistical mechanics, astrophysics and cosmology. Topics include: 1) Quantum chromodynamics, focussing on questions related to quark confinement, 2) Quantum field theory in environments of extreme temperature, density, or pressure, 3) Elementary particle physics of the very early universe, and 4) Dynamical mechanisms for symmetry breaking-in theories of the electro-weak force.

This is the first year of a four-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0002, ELECTROMAGNETIC PROPERTIES OF LAYERED SUPERCONDUCTING STRUCTURES
M.R. Beasley, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (DMR79-11117)

Research supported under NSF Grant DMR75-04368 will be continued and extended. This research involves a comprehensive experimental effort to fabricate, characterize and study the superconducting properties of layered and quasi-two-dimensional superconductors. Materials of interest include the naturally occurring layered compounds, artifically layered composites and very thin films. The relationship between the layered and/or two-dimensional nature of such superconductors and their electromagnetic properties will be investigated. Particular emphasis will be placed on detailed studies of the critical magnetic fields and critical current densities of such systems, the effect of layering on the superconducting transition temperature, and the onset of resistance in two-dimensional superconductors.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0003, MATERIAL SUPPORT TECHNOLOGY - TUNNELLING INVESTIGATION OF QUASI-ONE-DIMENSIONAL MATERIALS
P.M. Chaikin, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DN675684; N00014-76-C-1078)

The Navy has need for new electronic materials that offer improved performance in operational systems. This program will provide needed information on the electronic properties of a class of materials that holds promise for such increased capabilities in communications and surveillance.

The investigator will use electron tunnelling to investigate a series of quasi-one-dimensional materials of considerable current interest. These materials fall into the categories of polysulfur nitride, the charge transfer salts based on tetracyano-quinodimenthane (TCNQ), and metallo-organic salts based upon platinum cyanide (KCP). All have unusually anisotropic electronic and vibrational properties and undergo phase transitions at low temperatures that are associated with Peierl's distortions. Studies in polysulfur nitride will focus on the temperature dependence of the superconducting energy gap while those in the TCNQ salts will initially focus on the phase transition.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0004, EXPERIMENTAL STUDIES OF CRITICAL SYSTEMS
D.S. Cannell, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DMR79-10030)

Accurate light-scattering measurements of the static and dynamic properties of a model critical fluid, xenon, at temperatures very near its critical point, will be performed in order to observe slight corrections to asymptotic scaling. Sound velocity studies on the same model system, together with the correlation-range data obtained from the first experiments, will be used to compare sound speed and attenuation with theory. A light-scattering study of spinodal decomposition will also be performed in a binary fluid mixture chosen to minimize multiple scattering; very rapid quenches will be achieved by using pressure changes. Finally, studies of the kinetics of carbon monoxide adsorption on nickel films will be completed and extended to other substrates, and epitaxial films for such studies will be grown.

Research previously supported under DMR 7618962 A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, THEORETICAL STUDIES OF THE INTERFACE ELECTRONIC PROPERTIES OF TETRAHEDRALLY COORDINATED SEMICONDUCTORS
A. Madhukar, University of Southern California, Electronic Sciences Lab., *3551 University Ave., Los Angeles, California* 90007 (DN775385; N00014-77-C-0397)

As solid-state devices such as field-effect transistors, which are found in naval electronic systems, become more compact and more surface-oriented in their electrical transport behavior, they begin to be dominated by surface- and interface-related effects. This program will seek to find better understanding of the electronic properties of interfaces formed between tetrahedrally coordinated semiconductors and of transport properties of inversion layers formed at a semiconductor-insulator interface.

Green's function techniques are applied to problem areas. In one case theoretical studies are made of the properties of solid-solid interfaces, the Schottky barrier and heterojunction problems. Tight binding Hamiltonians are used to calculate interface states and charge redistribution at interfaces, including the effects of short-range electron-electron interactions. These techniques are now being extended to the case of superlattice

structures in various binary III-V compound semiconductor systems. The other area of study is that of the electronic and transport properties of surface inversion layers. The major thrust is to consider both electron-electron and electron-phonon interactions in describing the experimental results of mass enhancement in Shubnikovdehaas and cyclotron resonance measurements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0006, THEORETICAL STUDY OF SOLITON PHENOMENA IN CONDENSED MATTER

S.E. Trullinger, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR79-08920)

Research previously supported by DMR7708445.

The importance of localized soliton solutions of nonlinear wave equations in condensed matter physics has grown tremendously in the last few years, and soliton phenomena in condensed matter now forms a major and very exciting area of materials research.

Research in the areas of soliton statistical mechanics and response to perturbations will be continued in three exciting new areas as well. These include: (1) a study of the quantum-mechanical behavior of electrically charged solitons (called phi-particles) in charge-density-wave systems, in order to determine whether the phi-particle gas exhibits any instabilities, one possiblity being a superconductive instability, (2) a study of the nonlinear behavior of charge-density-waves in the linear chain conductor niobium-triselenide with emphasis on the role of soliton-like 'discommensurations' in the non-Ohmic conductivity process which has been recently observed and, (3) a study of the phenomenon of self-induced transparency in dense matter in order to establish the conditions for the appearance of new propagating modes (multi-solitons). This phenomenon may provide the basis for an ultrashort-light-pulse generator having importance for laser-induced fusion. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, LOWER BOUNDS TO EIGENVALUES IN ATOMIC PHYSICS

R.N. Hill, University of Delaware, School of Arts & Sciences, Dept. of Physics, *Newark, Delaware* 19711 (PHY79-06936)

This research focuses on methods of computing lower bounds to discrete eigenvalues in atomic physics. The primary objectives are (1) proofs of nonexistence for bound states (of negative ions) which do not exist, and (2) computation of tight lower bounds, comparable in accuracy with Rayleigh-Ritz upper bounds, for bound states which do exist. The results, which are expected to include both rigorous proofs and accurate numbers, should be of interest to mathematical physicists who work on the rigorous theory of the Schrodinger equation with coulomb interactions, to atomic physicists and quantum chemists, and to applied mathematicians who work on the general problem of eigenvalue estimation.

A knowledge of the exact number of bound states of specific negative ions is important for scattering theory, and for theories of absorption. For example, the principal process responsible for the opacity of the solar photosphere is the continuous absorption by the H-ion; the predicted absorption coefficient would be modified if H- had an additional bound state below the continuum. Highly accurate calculations of bound state energies of atoms are important when relativistic corrections are being explored, and/or when experimental determination of these energies is difficult or impossible. Moreover, the accuracy of an approximation can only be assessed with certainty if both upper and lower bounds are available. The upper bounds are easily obtained from Rayleigh-Ritz. The lower bounds have, at least in the past, been more difficult to obtain. This project represents an attempt to provide the latter.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0008, ANALYSIS OF TRACE IMPURITIES IN SEMICONDUCTOR MATERIALS

S. Mayo, U.S. Dept. of Commerce, National Bureau of Standards, Electronic Technology Div., *14th & Constitution Ave. N.W., Washington, District of Columbia* 20234 (DN975471; N00014-79-F-0051)

Improvement in electron devices for Navy systems and development of new devices in the future depends on better understanding and control of impurities in semiconductor materials. New, precise techniques to analyze semiconductors for trace impurities, which influence the electronic and optical properties of materials, must be developed to improve material growth and doping programs.

Laser radiation will be used to resonantly excite and ionize atoms in a special ionization chamber in which the electron-ion pairs produced can be detected. This resonance ionization spectroscopic (RIS) technique will be developed and applied to a variety of impurities found in silicon, gallium arsenide, and other semiconductors. High energy laser radiation will impinge on solid samples creating a spallation of atoms from the surface. These atoms will then be subjected to the RIS technique. Parameters must be investigated in order to obtain absolute quantitative measurements of trace impurity concentrations. Subsequently, these methods will be used to profile the impurity concentration as a function of depth into the sample.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0009, PLASMA THEORY

T. Coffey, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980032)

The Linus program at NRL is attempting to apply imploding liner flux compression techniques and advanced plasma source techniques to the generation and confinement of high-energy density plasmas. Such techniques have application to high-pulsed power generation, nuclear fusion and nuclear weapons effects simulation. NRL has developed techniques for stabilized liner implosions in which the liner motion is contractible and reversible. This is in contrast to the more conventional explosively-driven liners. The objective of the present program is to provide the theoretical support needed for the interpretation of experimental results and their extrapolation to larger systems.

This project will utilize advanced techniques in plasma physics and fluid mechanics for modeling the dynamics of imploding liners, liner magnetic field interface and the properties of liner compressed plasmas. The program will be significantly integrated with on-going experimental activities at NRL.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0010, GENERATION AND DETECTION OF MICROWAVE PHONONS

H.N. Spector, Illinois Inst. of Technology, Lewis College of Sciences & Letters, Dept. of Physics, *3300 S. Federal St., Chicago, Illinois* 60616 (DMR76-24466 A02)

Investigation of the generation and detection of microwave phonons in semiconductors, previously supported by NSF Grant DMR 7624466, will be continued. The work involves the theoretical investigation of such as the enhancement of the generation of phonon echoes in semiconductors in the presence of d.c. electric and magnetic fields, the enhancement of up-conversion effects in the microwave frequency region, and the detection of microwave phonons by the mixing of two phonon beams to generate a microwave electric field. In addition, the acoustoelectric interactions due to both deformation potential and piezoelectric coupling, in a frequency range which has not been readily accessible, will be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, SHALLOW DONOR IMPURITIES IN HIGH PURITY SEMICONDUCTORS
G.E. Stillman, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (DN880264; TBD)

Microwave and millimeter wave devices and systems are needed for Navy and DOD applications. The active semiconductor materials used or contemplated being used in many of these devices include the III-V semiconductors, gallium arsenide and indium phosphide. In order to fully understand these materials the amount and type of native impurities must be determined.

The total donor and acceptor levels in gallium arsenide shall be determined by conventional means such as Hall measurements and photoluminescence. High resolution for infrared Fourier transform spectroscopy will be used for determination of shallow donor spectra. Comparison of various crystal growth and epitaxial techniques will be made to determine residual donor levels and their dependence on processing techniques and parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0012, VIBRATIONAL RELAXATION OF EXCITED SPECIES OF INTEREST TO CHEMICAL LASERS
L.H. Sentman, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

A classical model for the interaction of two rotating, dissimilar diatomic molecules under the action of a Morse potential has been developed. Relaxation times for V-R, T and V-V, R energy transfer have been calculated and compared with experimental data over the temperature range 250-5000 degrees K. Good agreement between experiment and theory is obtained for the V-R, T self-relaxation of H(D)F, H(D)Cl, HBr and H(D)I and for the V-V, R relaxation of HF-N2. It is shown that the attractive forces are important only in the self-relaxation of H(D)F, and that the dominant energy transfer mechanism in the self-relaxation of H(D)Cl, HBr and H(D)I, inter-molecular energy transfer is the dominant mechanism.

SUPPORTED BY University of Illinois

8.0013, RESONANCE IONIZATION SPECTROSCOPY OF ATOMS
M.H. Mayfeh, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (PHY78-25247)

This project in atomic physics will exploit the recently developed techniques of resonance ionization spectroscopy, in which a particular species of atom is selectively ionized by absorption of several photons of light of well-defined frequency from a laser. Only a small number of atoms is necessary for successful detection. Particular experiments will include the study of optical and radiative collisions and photoionization cross-sections of short-lived excited states.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0014, KINETICS OF PHASE TRANSITIONS
H. Sato, Purdue University, School of Materials Engineering, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DMR79-03932)

Research previously supported by DMR7621497.

Theoretical research of irreversible phenomena in crystalline solids, aimed at elucidating nonlinear processes which occur in states far from equilibrium, will be carried out. The method to be used is the Path Probability method of irreversible statistical mechanics, and the phenomena to be studied are those of specific interest in materials science such as the kinetics of order-disorder transformations, the nature of glass transitions and fast ionic transport in solid electrolytes. Through the study of the above problems, the foundations of kinetic processes will be reexamined. Based on the progress made concerning the general description of kinetic processes which occur in systems undergoing phase transitions of second order, basic processes involved in the phase transitions of first order, such as nucleation processes, crystal growth and the necessary theoretical tools for these processes, will be examined.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, VARIATIONAL PRINCIPLES FOR SOME PROBLEMS IN ATOMIC PHYSICS
A.R. Rau, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Physics, *University Station, Baton Rouge, Louisiana* 70803 (PHY76-05721 A01)

Research on atomic theory initiated under NSF grant PHY76-05721 will be continued and expanded. Amongst the topics to be considered will be: (A) Variational Principles for Mathematical-Physics Problems, 1) General construction of variational principles, 2) Variational principles for electron degradation in a medium, 3) Variational principles for hierarchical equations (BBG KY and Born-Green-Yvon) arising in statistical physics; (B) Effects of External Fields on Rydberg States, 1) WKB calculations of helium-layer system, 2)Atoms in external fields.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0016, BAND THEORY OF FERROMAGNETIC METALS
J. Callaway, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (DMR78-17806)

Research previously supported by DMR7619850. Theoretical research on the electronic structure of itinerant ferromagnets will be carried out. In particular, the recently developed methods of energy band theory will be applied to understand various magnetic and transport properties of metals such as nickel and cobalt. Of primary interest will be the calculation of the spin wave excitation spectrum and the dynamic magnetic susceptibility in these materials. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, NEUTRON SCATTERING IN MAGNETIC MATERIALS
J.W. Lynn, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DMR79-00908)

Neutron scattering experiments will be carried out to examine phase transitions in a number of magnetic materials. Special attention will be given to materials which exhibit the coexistence of magnetism and superconductivity, to the spin-flop transition and bicritical point in uniaxial antiferromagnets and to the spin-fluctuation spectra of isotropic ferromagnets just below the Curie temperature. This is a renewal of DMR 7681185. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, STRUCTURE OF GRAIN BOUNDARIES
R.W. Balluffi, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR7812804)

This is a basic investigation of the detailed atomic structure of grain boundaries. The atomic configuration in bi-crystals of gold will be modelled by computer simulation. The experimen-

tal work will be done by S. Sass of Cornell University. The research to be undertaken will include: (1) determination of the grain boundary core structure: the atomic structure of the core of a range of boundaries of different angles will be calculated by computer simulation; the x-ray structure factors will then be calculated and compared with measurements of the diffraction from boundaries of these same types performed by Sass at Cornell; (2) determination of the core structure of grain boundary dislocations (GBDs) of different angles: the structure of the core of GBDs in a range of boundaries will be calculated; the electron diffraction contrast produced by the GBDs will be calculated and compared with the experimentally observed contrast from GBDs of the same type; and (3) determination of the anisotropy of the boundary energy and the occurrence of faceting: systematic observations of the faceting of a series of predetermined boundaries will be made; computer calculations of the corresponding boundary structures and energies will then be made, and predictions of faceting will be made and compared with experiment. The initial calculation can be extended to grain boundaries in other materials, both pure elements and alloys. It is expected that the results of this research will enhance significantly our understanding of the nature of grain boundaries. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, MONOLAYER FILMS ADSORBED ON HIGHLY UNIFORM, WELL-ALIGNED GRAPHITE SUBSTRATES

M. Bretz, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (DMR79-03614)

This research is a continuation and extension of work supported under Grant No. DMR-7620369. Monolayer helium and hydrogen films adsorbed on highly uniform and well-aligned graphite substrates will be studied with emphasis on two-dimensional superfluid onset phenomena. A newly perfected ac calorimetric technique will be used to measure the heat capacity of sub-monolayer films of helium and hydrogen adsorbed on different substrates. The increased sensitivity of this technique will permit the obtaining of definitive data for layers as thin as 0.25 monolayers. Present facilities are being upgraded to include a pulsed NMR system for the study of ultra-thin films of helium-4.

This is first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, MAGNETIC INVESTIGATION OF SOME NEW QUASI TWO-DIMENSIONAL MAGNETIC SYSTEMS

J.E. Drumheller, Montana State University, School of Letters & Sciences, Dept. of Physics, *Bozeman, Montana* 59715 (DMR79-05588)

Lower-dimensional magnetic systems will be studied using a variety of physical techniques such as paramagnetic resonance, optical and infrared spectroscopy, and electric conductivity. Two important but often neglected features of these systems will be investigated--structural phase transitions and the role of antisymmetric exchange in the magnetic properties. Experiments using Raman scattering and high resolution magnetic susceptibility will be carried out to examine the complete exchange interaction including the antisymmetric term. New lower-dimensional magnetic systems will be studied in which mixing of two magnetic ions can occur.

This research was previously supported under DMR 7682089.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, REGIONAL INSTRUMENTATION FACILITY FOR A SURFACE SCIENCE AND SUBMICRON ANALYSIS LABORATORY

G.J. Lapeyre, Montana State University, School of Letters & Sciences, Dept. of Physics, *Bozeman, Montana* 59715 (CHE79-16134)

A regional instrumentation facility for surface science and submicron analysis will be established at Montana State University. It will include capabilities for x-ray and ultraviolet photoelectron spectroscopy and scanning Auger microprobe and many ancillary measurements. This facility will serve the instrumentation needs in a diverse number of disciplines including materials science, earth sciences, microbiology, mineralogy, engineering, and physics. Research to be conducted at the facility includes: 1) Angular resolved photoemission studies of clean and chemisorbed surfaces; 2) Surface density of states for normal photoemission; 3) Corrosion effects in molten carbonate systems; 4) Segregation of trace impurity elements in grain boundaries; 5) Characterization of insulating and semiconducting thin films. It will bring an important resource to a diverse group of academic, industrial, and governmental laboratories. This facility will serve the northwestern region of the United States. Independent and collaborative research will be an important thrust of the facility in addition to providing a state-of-the-art measurement capability for concerned scientists.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0022, NMR STUDIES OF PHASE TRANSITIONS IN RARE GAS SUBMONOLAYERS

H.Y. Carr, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR7823956)

Nuclear magnetic resonance (NMR) experiments will be carried out to observe density and temperature-dependent local magnetic fields in the gas-like and solid-like phases of rare gas sub-monolayers. In particular, the 2-dimensional 'liquid-vapor' and 'liquid-solid' phase transitions will be studied in these systems by observing the local-field discontinuities between phases. The rare gas will be adsorbed on graphite substrates. Other substrates will be investigated.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0023, APPROXIMATION METHODS FOR ORBIT CALCULATIONS OF SLOWLY MOVING SYSTEMS IN GENERAL RELATIVITY WITH APPLICATION TO BINARY PULSAR PSR 1913 PLUS 16

J.L. Anderson, Stevens Inst. of Technology, School of Engineering, Dept. of Physics & Engineering Physics, *Castle Point Station, Hoboken, New Jersey* 07030 (PHY79-11664)

Research in theoretical gravitational physics initiated under NSF grant PHY77-11687A01 will be continued. Research will concentrate on the application of modern singular mathematical perturbation methods to derive the equations of motion for gravitationally bound radiating systems, such as the binary pulsar. Appropriate boundary conditions for the system will also be developed.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0024, ULTRAFAST ELECTRONIC RELAXATION OF HIGHLY PHOTO-EXCITED MATERIALS

H. Mahr, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR78-16751)

Ultrafast relaxation of excess electron and hole populations will be studied in direct gap semiconductors and other materials. The evolution of electron and hole relaxation will be monitored on a picosecond time scale by measuring time-resolved spectra of luminescence emitted by the sample, using a unique picose-

cond time-resolution luminescence spectrometer based on c.w. mode-locked, tunable dye lasers. In particular, the following will be studied: (1) the properties and time-history of an electrode-hole-droplet phase in CdSe/CdS crystals at helium temperatures, (2) the relaxation of an electron-hole plasma and its transition in time to an insulating excitonic phase (Mott transition) in CdSe and CdSe/CdS crystals at higher temperatures than helium, and (3) other electron-hole-droplet phases of unusually high critical temperatures and in materials quite different from the typical II-VI semiconductors CdS and CdSe.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, A THEORETICAL INVESTIGATION OF ATOMIC SCATTERING PROCESSES

L. Spruch, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (PHY79-10413)

Research in theoretical atomic physics initiated under NSF grant PHY77-10131 will be continued. Among the topics to be investigated are: 1. Effect of target ionization on electron-atom scattering in a radiation field; 2. Electron-ion scattering in a radiation field; 3. Generalization of the low-frequency approximation for scattering in a laser field; 4. Variational principle for the scattering length for target ground state wave function imprecisely known; 5. Analytic form for the generalized oscillator strength; 6. Lamb shift for an electron image bound by a conducting wall; 7. Charge transfer at high but not asymptotically high impact velocities; 8. Variational principle for charge transfer for target ground state wave function imprecisely known; 9. Extreme principle estimation of transition rates for the emission of photons by low Z excited atoms in intense magnetic fields; 10. Electric dipole polarizability of the neutron.

This is the first year of a four-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0026, PHYSICAL PROPERTIES OF NARROW SUPERCONDUCTING FILMS AND ARRAYS

Y. Kao, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (DMR77-04511 A02)

This research is a continuation of work begun under NSF grant No. DMR73-07494. The properties of superconducting microbridges, Josephson junctions and arrays of Josephson junctions will be studied in order to develop sensitive radiation detectors. Computer-controlled electron-beam lithography will be used to fabricate superconducting microbridges which range in size from a few thousand angstroms to a few microns. The physical properties of individual bridges will be studied and a special emphasis will be placed on the coupling between adjacent bridges. Measurements will be made to study non-equilibrium effects and the dynamics of superconducting pairs in arrays of Josephson junctions. A primary goal of the research is to understand the coherent properties of arrays of weakly coupled superconductors.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, COHERENCE EFFECTS IN QUANTUM OPTICS

L. Mandel, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (PHY79-06349)

This is a proposal for support of research on various interactions between light and atomic systems, in which coherence and cooperative effects play a significant role. These interactions may involve both multiphoton and multiatom processes, and they have become especially accessible to investigation with the development of tunable lasers.

Research will continue on coherence effects in quantum optics. This includes: resonance fluorescence, in which the photon statistics of atomic emission will be investigated; resonant radiation pressure effects on atoms; and laser phase transitions, particularly those in which a first order phase transition of the electromagnetic field can be achieved.

This research is a continuation of that previously supported under NSF grant PHY77-07108A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0028, SINGLE ATOM INTERACTIONS AND SURFACE SEGREGATION OF DILUTE ALLOYS USING ATOM-PROBE AND FIELD ION MICROSCOPY

T.T. Tsong, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR79-04862)

The unique atomic resolution of the field ion microscope (FIM) will be used to investigate systematically the interaction between two atoms, both adatom-adatom and adatom-substitutional atom interactions, on group VIII and IB surfaces. The atomic interaction will be correlated with the electronic structures of adatoms and substrate surfaces, and the directional walk of single atoms under a controllable driving force will also be investigated. This information is not only of fundamental interest, but is also related to the surface reactivity. Since the unique catalytic activity of a surface arises partly from surface segregation of minority species in the alloy, the absolute composition depth profiles of near surface layers of dilute alloys will also be measured using the single atomic layer spatial resolution of the Time-of-Flight Atom-Probe FIM. The dependence of the composition of near surface layers on the bulk concentration of minority species, the sample temperature, and the crystal planes will be investigated, as well as the kinetics of reaching thermodynamic equilibrium. The alloys chosen for this study are nickel-copper, platinum-gold and platinum-copper since they are accessible to FIM study and they also offer various tests of the existing theories.

This research was previously supported by DMR 7815925.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0029, THEORETICAL STUDIES OF RESONANT SCATTERING IN ATOMIC PHYSICS

J.N. Bardsley, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY79-00957)

Research in theoretical atomic physics initiated under NSF grant PHY76-21456 will be continued. The major emphasis of this research will be on the study of dissociative recombination of electrons with molecular ions. Further calculations on electron scattering by neutral molecules and theoretical analysis of the complex coordinate method are proposed.

This is a new year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0030, ATOMIC PROCESSES IN STRONG ELECTROMAGNETIC FIELDS

J.E. Bayfield, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY79-09031)

The physics of atoms and molecules in strong electromagnetic fields is to be broadly investigated using new, sensitive and flexible techniques based upon highly excited atom and negative ion beams in microwave and infrared laser fields. Particular experiments will include: studies of non-resonant multiphoton transitions to a continuum; studies of resonant multiphoton dissociation of high vibrational states of small molecules; studies of resonant multiphoton ionization of highly excited atoms; and merged atoms-beams experiments on strong-field radiative proton-hydrogen collisions.

This is the first year of a three-year continuing grant.

This research is a continuation of that previously supported under NSF grant PHY76-84186A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0031, THEORY OF QUANTUM ELECTRODYNAMIC PROCESSES IN THE FIELD OF AN ATOM

R.H. Pratt, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY78-26491)

Research in theoretical atomic physics initiated under NSF grant PHY7403531A04 will continue. Investigations will emphasize the study of quantum electrodynamic processes in the field of atoms and atomic ions. This includes both the study of specific radiative processes, or processes which combine quantum electrodynamic interactions with nuclear or weak interactions, and general techniques of calculation. Work will continue on bremsstrahlung and pair production (particularly how to compactly characterize data), atomic photo-effect (behavior of dominant radial matrix elements), Rayleigh and Compton scattering, internal conversion and other nuclear transformations. Other studies include atomic environments, an analytic perturbation theory for screened potentials and approximate high-energy wave functions.

1st year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0032, ELECTRONIC PROPERTIES OF LIQUIDS

L.R. Painter, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Physics, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (006484)

Techniques have been developed for measuring the electronic structure of condensed materials. This technique consists of measuring the reflectances from the surfaces of solids in the visible and ultraviolet spectral region as a function of the angle of incidence of the light. Such data are analyzed to yield the real and imaginary parts of the dielectric constants, epsilon(1) and epsilon(2), and the energy loss function, -im(1/epsilon). The possibility of utilizing such a technique in the study of the electronic properties of liquids was examined first by the contractor during the years 1966 to 1968 wherein she was able to determine the dielectric response of pure water in the region from 2000 to 1050 Angstroms. Under the present contract a new open-dish windowless reflectometer with movable monochromator was constructed in order to extend the studies on liquid water to shorter wavelength (high energy). Reflectance measurements on water with the new cell have been taken in the spectral region from 1350 to 500 Angstroms and the data analyzed to yield the optical and dielectric constants of the liquid. Similar techniques have been used in the study of two silicon diffusion pump oils, Dow Corning 704 and 705 (tetramethylhetraphenytrisiloxane and trimethylpentaphenytrisiloxane, respectively), two linear hydrocarbons, tetradecane and heptadecane, on glycerol, bovine albumin, and DNA. Similar studies have been made on solutions of fucose, cholesterol and the phospholipid lecithin.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

8.0033, IONOSPHERIC MODIFICATION EXPERIMENTS AT ARECIBO

W.E. Gordon, Rice University, School of Engineering, Dept. of Electrical Engineering, *6100 Main St., Houston, Texas* 77001 (ATM79-09088)

The ionospheric modification experiments performed at Arecibo have led to significant developments in aeronomy, ionospheric physics and plasma physics. The variety of unexpected phenomena associated with the modification process has stimulated a great deal of theoretical work, especially in the field of nonlinear plasma physics. Of particular importance have been the so-called parametric instabilities which have applications to laser fusion research, and the thermal coupling processes which lead to a striated ionospheric plasma.

Using support provided here Dr. Gordon will mount one major and two follow-up ionospheric modification experiments per year using the current facilities at Arecibo Observatory along with the auxiliary HF facility now under construction and a portable 50 MHz radar positioned on the island of Guadeloupe.

The problems of interest reflect the widening scope of the experimental capabilities at Arecibo. The following areas of research will be studied: 1. Parametric instabilities in the F region, their excitation and suppression. 2. The generation of meter scale field-aligned plasma striations and their relation to plasma instabilities. 3. The interaction of the HF wave with blanketing sporadic E and the implications of these observations on the nature of sporadic E.

The overall aim is to stimulate the ionosphere in order to further our understanding of plasma instabilities.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0034, CHEMIIONIZATION IN COLLISIONS INVOLVING EXCITED RARE GAS ATOMS

R.F. Stebbings, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy/Physics, *6100 Main, Houston, Texas* 77001 (C-552)

Absolute rate constants for the ionization of highly excited xenon atoms Xe(nf), with 25 less than or equal to n less than or equal to 41, in collisions with CH3I, C7F14, C6F6 and CH3Br have been measured and the major charged reaction products have been identified for all but CH3Br. Theoretical models view such collisions as being dominated by the interaction between the target molecules and the 'essentially free' Rydberg electrons, and in the case of CH3I, C7F14 and C6F6 the resulting negative ions are indeed similar to those resulting from the attachment of free thermal electrons.

In collisions with NH3 molecules it is observed that the xenon Rydberg atoms are selectively excited to discrete, more highly excited states. These states are identified by the technique of field ionization and are found to be displaced in energy from the initial Rydberg states by amounts equal to the rotational spacings of the NH3 molecule.

The collisions may thus be represented by Xe(nf) plus NH3(J) yields Xe(n'f) plus N3H(J-1) and demonstrate, for the first time, the conversion of rotational to electronic excitation energy in collisions.

SUPPORTED BY Robert A. Welch Foundation

8.0035, SPACETIME PHYSICS

J.A. Wheeler, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (PHY78-26592)

A program of theoretical research in gravitational physics will be initiated. Topics to be investigated include: (1) Quantum gravity; (2) Early universe cosmology; (3) Gravitational collapse; (4) Quantum field theory in curved spacetime.

This is the 1st year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0036, THEORETICAL STUDIES IN MANY-BODY PHYSICS

B. Sutherland, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR77-08474 A01)

Research previously supported by DMR7708474.

Theoretical research in many-body physics will be carried out. This will concentrate on non-perturbative techniques on model systems which are relevant to the understanding of quantum fluids, phase transitions, non-linear fields and non-equilibrium phenomena. Three areas of theory will be explored: a) soli-

ton physics; b) energy band theory and c) two-dimensional magnetic systems, described by a Heisenberg Hamiltonian.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, THERMODYNAMICS AND THERMOELECTRICITY IN RUTILE AND RELATED SYSTEMS
O.W. Johnson, Utah Higher Education System, University of Utah, School of Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR79-07802)

The transition metal oxides and related compounds are important due to their high melting temperatures and thermodynamic stability. Quantitative understanding of the properties and behavior of these materials, unfortunately, has lagged far behind that of other materials such as covalent semiconductors or metals. The rutile phase of titanium dioxide is probably the best understood of the transition metal oxides, although much of what has been learned is still rather qualitative. Rutile is, thus, a logical choice as a model system in which to study the characteristic properties of this class of materials. There are also potential technological applications for rutile.

This project is concerned with the thermodynamic parameters necessary to characterize completely lattice defects (oxygen vacancies and titanium interstitials, hydrogen interstitials, and substitutional impurities) in the rutile form of titanium dioxide. This is done by measuring conduction electron concentration at high temperatures in a known ambient controlled by a zirconi electrolytic cell. Thermoelectricity in rutile and similar systems also is investigated with the goals, first, of using the thermoelectric behavior as a probe of other transport properties and, second, of improving the figure of merit of thermoelectric devices. Previous work on this project has contributed, in part, to the development of an electrically conducting rutile ceramic of improved chemical stability.

First year of a two-year continuing grant; renewal of work supported by DMR76-82077.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0038, IONOSPHERIC WAVE-PARTICLE EFFECTS
D. Strickland, Science Applications Inc., *8400 Westpark Dr., McLean, Virginia* 22101 (DN980217; N00014-79-C-0197)

To investigate the effects of ionospheric plasma wave-particle interactions on the transport of non-thermal electrons.

Develop plasma physics modules which treat wave-particle interactions and incorporate these modules into NRL's existing numerical code of electron transport and deposition in the ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0039, ROLE OF DISLOCATIONS IN DYNAMIC FAILURE OF LIF UNDER SHOCK CONDITIONS
G.E. Duvall, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DMR79-06122)

The mechanisms of precursor decay in doped and undoped LiF will be studied by propagation of shocks in 100 directions wherein primary (110) slip systems are stressed. In the 100 experiments Mg will be diffused into undoped LiF and the resulting layer hardened by suitable annealing. For 28 kilobar impact, precursor amplitudes will be measured as a function of distance from the boundary between Mg-hardened and undoped LiF. The results will suggest whether or not dislocations are being driven at supersonic velocities in pure LiF and whether or not dislocation break-up is occurring at the high velocities produced by the shock wave.

This research was previously supported under DMR 7708656.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0040, OPTICAL DETECTION OF ELECTRON SPIN RESONANCE IN COMPOUND SEMICONDUCTORS
B. Henderson, University of Dublin Trinity College, Physical Lab., *Dublin, Ireland* (DA0E9302; DAERO 79 G0028)

Develop techniques and study luminescense and recombination of free and bound electrons, holes, and excitons in III-V and II-VI semiconductor compounds and alloys.

Optical detection of magnetic resonance and spin-dependent photoconductivity of semiconducting solids will be investigated. Both techniques make use of spin-dependent effects for observation of photo-excited phenomena in semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Research & Standardization Group

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, INTERSTELLAR MEDIUM STUDIES
B.L. Lutz, Lowell Observatory, *P.O. Box 1269, Flagstaff, Arizona* 86001 (AST7820131)

High-resolution studies of the visible and near-infrared spectra of moderately to heavily reddened early-type stars are proposed as a continuation and extension of a study of interstellar diatomic carbon (C2). The interstellar line spectrum of stars in the dense Cygnus OB2 (VI Cyg) association will be studied as an optical map of the spatial distribution of the consistent atomic and molecular species within the cloud. The studies will be combined with spatial mapping in carbon monoxide 12CO and 13CO radio lines. This cloud, which allows the combination of optical and radio observations, is thought to be a transition between the classical tenuous and dark clouds and represents a rare opportunity to study the interstellar chemistry of a dense optical cloud. Cloud models for this region will be investigated.

Additional observations of Ophiuchi are proposed to determine the kinetic temperature of the cloud through the observation of interstellar C2. Specifically, the 2-O R (O) line will be sought using the PEPSIOS for combination with the Q(2) line observed last season. A similar search for interstellar C2 in the zeta Persei spectrum is also proposed. Both sets of observations are seen as tests of current cosmochemical models of tenuous cloud regions.

Other stars such as HD183143 and BD-plus 66 degrees 1675 are included in the interstellar medium study, and new possible molecules detectable in the infrared are added to the program search list.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0002, EVALUATION OF MULTIPLE-MIRROR TELESCOPE ACTIVE OPTICS ALIGNMENT CONTROL SYSTEM
W.F. Hoffmann, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST76-20822 A02)

A multiple-mirror telescope on Mount Hopkins, a 8,650 foot mountain south of Tucson, Arizona, is in the final stages of construction. It has been funded by the University of Arizona and the Smithsonian Astrophysical Observatory. It is equivalent to a conventional telescope 4.5 meters in diameter but uses six 1.8 meter diameter mirrors working together. The crucial element is the active optics control system which combines the beams from all six mirrors, continually adjusting each one to maintain optimum alignment.

A three-year program of testing and evaluation of the active optics system will be carried out at the University of Arizona. The performance of the optical system will be critically evaluated. The system will be improved wherever possible. The limiting factors in the telescope mechanics and in the earth's atmosphere will be identified. The results will be analyzed with respect to the application of the multi-mirror approach for the construction of new very large aperture optical and infrared telescopes.

This is a continuation of research previously funded under NSF Grant AST 76-20822.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0003, MODERN AND HISTORICAL ANALYSES OF THE SOLAR CONSTANT

R.J. Angione, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Astronomy, *5402 College Ave., San Diego, California* 92115 (ATM77-07987 A01)

This grant will support the continuation of a long-term program of analysis of data on variations in atmospheric constituents and the solar spectral energy output during the period 1902 to 1960, combined with modern ground-based observations.

Half of the effort will be devoted to accurate determination of the solar constant and spectral energy distribution using modern techniques of analysis on published results and archival data from the Smithsonian Institution's Solar Constant Observing Program. This program was operated for more than 50 years under the direction of Dr. C. G. Abbot, and is unparalleled among photometric programs in terms of accuracy and time-length of baseline. Analysis of these data represents a way of recovering accurate, quantitative information on variations in the solar energy output over long-term scales.

The second half of the effort will be devoted to the establishment and operation of a state-of-the-art solar constant observing station at Mt. Laguna Observatory in Southern California. This station will incorporate all of the methods proven useful in over fifty years of Smithsonian observations, as well as modern technical advances to provide highly accurate contemporary benchmark values for variations in atmospheric constituents and the solar constant. Experience gathered in the operation of this station will be used in interpretation of the Smithsonian data. Long-term operation of the station is planned in a manner that will keep the need for long-term support at an absolute minimum.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0004, RESEARCH WITH PHOTON-COUNTING SPECTROMETER SYSTEMS AT THE HALE OBSERVATORIES

S.A. Shectman, Hale Observatories, *813 Santa Barbara ST., Pasadena, California* 91101 (AST79-11332)

The Cassegrian spectrograph of the Las Campanas Observatory 2.5-meter duPont telescope has been equipped with a photon-counting, intensifier diode array detector system. A similar system, developed as a prototype, is in use at the Mt. Wilson 2.5-meter telescope and the Palomar 5-meter telescope. These instruments are being used for a wide variety of observational projects.

This grant will provide for technical support of these instruments. There will be development of improved facilities for data reduction. The resolution and dynamic range of this detector will be improved.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0005, THEORETICAL STUDIES OF PLANETARY ATMOSPHERES

G.E. Thomas, University of Colorado, Boulder Campus, Lab. for Atmospheric & Space Physics, *1200 University Ave., Boulder, Colorado* 80302 (ATM76-23812 A02)

This grant funds a study of the radiative processes which determine the thermal structure of the middle atmospheres of the planets, particularly the stratosphere and mesosphere of Earth. The initial emphasis will be on developing general theoretical methods for calculating the time-dependent properties of temperature and density, as they are affected by changing solar ultraviolet heating, or by impulsive or harmonic disturbances due to dynamical processes. Specific applications will be made to the diurnal temperature variation of the middle atmosphere, to the coupling of photochemistry to radiation, and to the effects of non-LTE on the thermal emission. In addition, this grant funds a study of the structure of the outer hydrogen exosphere of Earth and the planets. This will be achieved both by analysis of satellite measurements and through a dynamical theory of the interaction of the exosphere with solar radiation. It is planned to conduct a detailed study of the behavior of atomic hydrogen in the upper thermosphere during a geomagnetic storm, from an analysis of Lyman alpha airglow data and from a dynamical theory of a time-dependent exosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0006, HOT STARS WITH EXPANDING ATMOSPHERES

D.G. Hummer, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (AST77-23183)

Support is for studies concerned with the outer atmospheres and stellar winds of very hot and luminous stars, such as those of type Of, nuclei of planetary nebulae and Wolf-Rayet stars. Individual areas of research include stellar wind and line formation theory arising from stellar rotation, stellar wind models for absolute instability to investigate possible heating mechanisms for the wind, and the current discrepancies between theoretical and observational results on the temperature and ionization state of the wind. In the course of these investigations, excitation equilibrium calculations for He II, N III, C III-IV, and O VI will be carried out using a powerful multi-level, spherical geometry, expanding-atmosphere code that has been developed at the University of Colorado.

Prior support was by NSF Grant AST 76-22032.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, SPECTROSCOPIC STUDIES RELATING TO PROBLEMS IN STELLAR EVOLUTION THEORY AND EARLY CHEMICAL EVOLUTION

D. Butler, Yale University, Graduate School, Dept. of Astronomy, *206 Elm, New Haven, Connecticut* 06520 (AST79-10009)

This research will be concerned with the study of a class of very old intrinsic variables known as BL Herculis stars. The stars vary on time scales of one to three days, and exist in globular clusters of the galaxy, in dwarf spheroidal galaxies and in the Small Magellanic Cloud. Very little is known, however, about the BL Herculis stars in the general galactic field. Such stars will be studied via the techniques of intermediate-band photoelectric photometry. Stellar atmospheric parameters such as surface gravity, temperature and chemical composition will be determined for these stars.

There will be studies of the chemical abundances of RR Lyrae stars in the Magellanic Clouds, and there will be a low-resolution spectroscopic study of giant and subgiant stars in the globular clusters NGC6397.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0008, FUNDAMENTAL AND ANALYTICAL INVESTIGATIONS OF MECHANISMS AND PHENOMENA RELATED TO SPACECRAFT ELECTROCHEMICAL DEVICES

W.C. Nottingham, University of the District of Columbia, Graduate School, Dept. of Chemistry, *1025 Vermont Ave. N.W., Mt. Vernon Sq. Campus, Washington, District of Columbia* 20005 (NGR 09-050-003)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0009, NATURE OF SHORT-PERIOD BINARY STARS FROM AN OBSERVATIONAL VIEWPOINT

R.E. Wilson, State University System of Florida, University of South Florida, School of Natural Sciences, Dept. of Astronomy, *4202 Fowler Ave., Tampa, Florida* 33620 (AST77-09188)

Fundamental data will be extracted from existing light curves of contact and other short-period binary stars as a test of theories of the structure and evolution of these binaries and a stimulus to new theoretical ideas. Large numbers of such systems need analysis to permit meaningful statistical studies of their properties. The work will include W UMa-type and other contact binaries, also 'short-period Algol', and 'short-period Beta Lyrae' type systems, so far almost completely neglected except for gathering of observations. This basic ground-work should lead to a better understanding of the nature of these latter type systems from an evolutionary point of view. The light curve and differential corrections programs developed by the investigators will be further improved, and the latest versions made available to workers in the field.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, OBSERVATIONS OF INTERSTELLAR LINES IN STARS TOWARD THE NORTH POLAR SPUR

P.C. Frisch, University of Chicago, Graduate School, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (NSG 5405)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0011, RESEARCH IN RADIO ASTRONOMY

G.W. Swenson, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (AST79-01690)

Research using the method of Very Long Baseline Interferometry (VLBI) to observe radio astronomical sources, including fully-automated VLBI station operation, will be carried out. The participation of the Vermillion River Observatory (VRO) in the VLBI network will continue providing a badly-needed midwestern station to the interim network of existing telescopes. It is intended to equip the 120-foot telescope for operation at six centimeters wavelength.

The 18 cm continuum flux monitoring program, which has been under way since 1973, will be continued for about 30 sources which show significant variations at this wavelength plus a score or so more which might be expected to show variations. In addition a systematic monitoring program will be instituted for the 18 cm fluxes ascribable to the small-diameter components of a large number of sources, using VLBI between the VRO telescope and the National Radio Astronomy Observatory 300-foot telescope.

The principal funding is from the University of Illinois, which supports the VRO and most of the salaries of the Principal Investigator and his doctoral-level colleagues. This is a continuation of AST-7700440AO1.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0012, RADIO OBSERVATIONS OF INTERSTELLAR CLOUDS, CIRCUMSTELLAR SHELLS, AND COMETS

L.E. Snyder, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST79-07830)

The research in this project is concerned with molecules in astronomical objects. Maser emission from silicon oxide (SiO) and hydroxyl radical (OH) molecules originating in shells of material surrounding stars will be studied to learn more about the physics of the maser pumping processes and to measure the sizes of these circumstellar shells. The SiO maser in the Orion region remains enigmatic and this research should cast light on its nature.

Observational searches for certain large molecules, including glycine, will be carried out in various regions of the interstellar medium. The positive detection of glycine, the simplest of the amino acids, will have strong implications for theories of the origins of life on the Earth and elsewhere in the universe. Observations of molecules containing deuterium, the isotope of hydrogen of mass 2, will enhance understanding of interstellar abundance ratios, chemical fractionation, and partial ionization. The observations will also enhance understanding of the fundamental molecular constants. Radio observations of molecules in comets will be made in order to advance the currently limited understanding of cometary chemistry. The ultimate goal of this research is to understand galactic chemical evolution and its role in the various stages of star formation. The observations will be made with three different radio telescopes, the 36 foot and 140 foot of the National Radio Astronomy Observation and the University of Illinois' Vermillion River Observatory's 120 foot dish.

This is a continuation of AST-7701345AO1.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0013, STUDY OF BOW SHOCK IONS, PARTICLE ACCELERATIONS AND PLASMA INSTABILITIES

C.S. Wu, University of Maryland, College Park Campus, Inst. for Fluid Dynamics & Applied Mathematics, *College Park, Maryland* 20742 (NSG 5408)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0014, OBSERVATIONS OF DISTANT CLUSTERS AND CENTRAL REGION OF OUR GALAXY

K.A. Janes, Boston University, School of Arts & Sciences, Dept. of Astronomy, *881 Commonwealth Ave., Boston, Massachusetts* 02215 (AST78-25535)

It has not been possible until recently to say, even approximately, how our galaxy was formed or how it has evolved. However, in the past two or three years some rather detailed theoretical descriptions of the formation and evolution of the galaxy have been published, making specific comparisons with observation possible. The dynamics of the galaxy and the general distribution of stars and gas are reasonably well understood and can be compared directly with theory. However, some of the theory makes predictions about the chemical evolution of the galaxy, that is to say the relationship between the chemical compositions of stars and their ages and distribution in the galaxy. We know little about the compositions of stars as a function of age even in the vicinity of the sun and almost nothing about the chemical makeup of stars in distant parts of the Galaxy. The aim of this research project is to study some distant clusters of the galactic disk and to analyze low-resolution spectra of stars in the central region of the galaxy. From these observations it will be possible to learn something about the nature of the stellar population in these distant regions and how the stars there may differ from those in the vicinity of the sun.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0015, STUDY OF THE PROPAGATION OF GEOMAGNETIC PULSATION SIGNALS

W.J. Hughes, Boston University, School of Liberal Arts, Dept. of Astronomy, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (NSG 5407)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0016, FLUID MOTION IN THE EARTH'S CORE AND MANTLE

W.V. Malkus, Massachusetts Inst. of Technology, School of Science, Dept. of Mathematics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EAR77-12889 A01)

This is a project to explore the consequences of a newly discovered analytical path towards the determination of the non-linear macrodynamics of planetary and solar dynamos. Those general features of dynamo magnetic fields and the concommitant global flows are sought which are insensitive to the details of the energy-supplying small-scale motions. Preferential selection of steady or periodic dipole parity, westward drift of the earth's core fluid, and 'equatorial acceleration' on the sun are all macrodynamic features now accessible to investigation without dependence upon numerical experiment. The new formulation of the macrodynamical dynamos problem is based upon a determination of the Taylor-like constraints on Lorentz forces in the stably-stratified fluid adjacent to the actively generating region. The flows produced in the stably-stratified fluid can be both the finite amplitude signature of the dynamo process and the principal feature determining parity and polarity. Equally important, the axisymmetric form of the initial nonlinear problem so formulated is separable and solvable for many different small-scale forcing functions.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

10.0017, MARS ORBITER AND COMET MISSION

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SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space Science

10.0018, MICROWAVE SPECTROSCOPY

H.E. Radford, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31R-4R50-01)

Laboratory measurements of microwave and far-infrared spectral lines of interstellar molecules are done by resonance absorption methods.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0019, OPTICAL SPECTROSCOPY OF THE INTERSTELLAR MEDIUM

W.A. Traub, Smithsonian Institution, Astrophysical Observatory, Optical & Infrared Div, *60 Garden St., Cambridge, Massachusetts* 02138 (310-4050-12)

A spectroscopic search was made for a deuterium emission line in the Orion nebula in order to determine the isotope ratio of deuterium to hydrogen, which is a crucial parameter in cosmological models of the formation of the universe. From our observations, we are able to set an upper limit D/H less than 1.3 times 10 to the minus 4th power; from our earlier detection of deuterium on Jupiter, we expect that a factor of 10 further improvement will be needed for a measurement in Orion. The presence of a previously undetected high-velocity cloud with an H alpha emission feature which partially overlaps the expected D alpha position is the only impediment to a more accurate determination.

Analysis of our earlier observations of the CN absorption band 3874 A was completed, resulting in a determination of the cosmic background radiation temperature (at 1.32 mm) of about 2.9 degrees K.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0020, THEORETICAL ASTROPHYSICS - THE PHYSICS OF DENSE STELLAR SYSTEMS

J.G. Hills, Michigan State University, School of Natural Sciences, Dept. of Astronomy & Astrophysics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (AST78-21454)

A research program primarily concerned with the dynamics of dense stellar systems (galactic nuclei and the cores of globular clusters) will be carried out. In particular, a quasi-stellar object (OSO or quasar) model in which the tremendous energy produced is provided by the tidal breakup of stars and the subsequent capture of their debris by large black holes in the galactic nuclei will be investigated. There is recent observational evidence that there is a large black hole in one of the large well-known galaxies. Research in the physics of other dense physical systems will also be done.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0021, STUDY OF THE FLUCTUATIONS IN THE COSMIC X-RAY BACKGROUND

E.L. Turner, Princeton University, Graduate School, Dept. of Astrophysical Sciences, *205 Nassau Hall, Princeton, New Jersey* 08540 (NSG 5415)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0022, MULTIFREQUENCY OBSERVATIONS OF SELECTED GALAXIES AND EXTRAGALACTIC SOURCES

P.J. Huggins, New York University, Graduate School, *100 Washington Sq. E., New York, New York* 10003 (NSG 5411)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0023, OBSERVATIONS OF EMISSION-LINE GALAXIES AND QUASARS

D.W. Weedman, Pennsylvania State University, University Park Campus, School of Science, Dept. of Astronomy, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (AST79-01067)

Large numbers of emission-line galaxies have been discovered in surveys during the past decade, primarily by Markarian with the Byurakan (USSR) Schmidt telescope and by various observers with the Tololo (Chile) Schmidt. These galaxies need further study because the source of radiation energizing the gas which produces the emission lines is not understood. In many cases, this source seems related to that in the quasars. Consequently, extensive studies of both emission-line galaxies and quasars are proposed to investigate the energy source. For quasars much study will also be directed toward determining their distribution in the universe. The optical observations will be done with telescopes at the Black Moshannon Observatory of the Pennsylvania State University as well as the national observatories. Quasars will also be studied with the Very Large Array radio telescope.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0024, THE CONSTRUCTION OF NEW ASTROMETRIC INSTRUMENTATIONS FOR THE DETECTION OF EXTRASOLAR PLANETARY SYSTEMS

G.D. Gatewood, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (AST79-09181)

Astrometric instrumentation combining photon counting techniques with those of precision interferometric spacing and minicomputer technology has been designed and built at the Allegheny Observatory. Tests with the Allegheny 76-cm Thaw photographic refractor indicate that the new detector may be expanded into a system capable of rivaling the astrometric precision projected for the Space Telescope and the European Space Agency's HIPPARCOS satellite. Precision is tripled and stars

ten times fainter can be reached. These tests show that most of the existing long focus astrometric telescopes could, with careful modeling, obtain precisions of 2 or 3 mas (1 mas equals 1 milliarcsec equals 0.001 arcsec) per object per night. This precision combined with the ability to routinely measure 15th-magnitude and fainter reference stars would give astrometrists the ability to determine precise parallaxes at stellar distances greater than 100 parsecs and to survey nearly 100 neighboring stars for evidence of Jupiter-like planets. The Multichannel Astrometric Photometer (MAP) will be improved and parallax observations will be undertaken.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0025, OBSERVATION OF LUNAR OCCULTATIONS AND OTHER MUTUAL PHENOMENA

D.S. Evans, University of Texas, Austin Campus, School of Arts & Sciences, Dept. of Astronomy, *200 W. 21st, Austin, Texas* 78712 (AST77-12216 A02)

Several telescopes of the McDonald Observatory in west Texas will be used with photoelectric photometers for recording observations of lunar occultations-eclipses of stars by the moon. The fast response time of the photometer as the moon moves past the star has the effect of producing an angular resolution even smaller than the diffraction limit of the telescope ued for direct observation. The position of the moon's edge is determined very accurately for orbital correction, double stars are frequently discovered, whose angular separations are too small for direct observation. In favorable cases stellar diameters can be determined. In the rare events when a star is occulted by a planet or asteroid, information about the planet's atmosphere and size, or the position and size of the asteroid are obtained. For occultations by these solar system objects portable equipment will be taken to the site where the event is predicted to occur. Observations in various wavelength ranges of the spectrum with more than one telescope will increase the astrophysical value of the information obtained.

Prior support was by NSF grant AST 77-12216.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0026, RAPID OPTICAL VARIATIONS FROM COMPACT STARS

R.E. Nather, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST79-06340)

This grant will provide support for observational studies of rapid optical variations of compact stars: white dwarf stars, neutron stars, and black holes. The work will concentrate primarily on the rapid variations associated with white dwarf stars, both the single white dwarfs and those in cataclysmic variables (the novae and related stars). The single white dwarf stars show variations in their luminosity because they are pulsating stars. Studies of these stars will include searching for new variable stars and measuring accurate periods and period changes of the pulsations. There will be studies of the rapid coherent oscillations of the white dwarf stars in the cataclysmic variables. There will be studies of the rapid flickering and quasi-periodic oscillations from the disk of material (accretion disk) surrounding the white dwarf. There will be measurements of the orbital radial velocity curves of these close binary systems, and there will be measurements of the profiles and changes in the profiles of the spectral emission lines coming from the accretion disk.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0027, IRREGULAR SATELLITES AND CERTAIN UNUSUAL NON-TROJAN ASTEROIDS

R.W. Shorthill, Utah Higher Education System, University of Utah, School of Science, Geospace Sciences Laboratory, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (AST78-24847)

The planned research will help determine the surface mineralogy of the faint irregular satellites of Jupiter and Saturn and selected asteroids, and distinguish among proposed theories of their origin. Progress on both mineralogy and origin is presently hampered by an extreme lack of observational data. The outer Jovian satellites form two groups at different Joviocentric distance parameters. Questions of origin also apply to the irregular Saturnian satellites Hyperion and Phoebe. The measurement of the visible and near-infrared reflectance spectra of solid planetary surfaces is the most useful means of remotely determining their mineralogy and petrology. To determine the mineralogy and petrology of the satellite surface, one needs the maximum spectral coverage and resolution permitted by the available flux. Measurement of asteroidal spectral reflectances at 1.25, 1.6, and 2.2 mu will more than double the spectral range over which asteroids may be compared with laboratory measurements of meteorite samples. Broadband photometry is suitable for the determination of near-infrared asteroid spectral reflectances. Standard broad-band astronomical filters and standard stars will be used, employing large reflecting telescopes. These observations will be made of the irregular satellites and main belt asteroids of unusual color and non-main belt asteroids of unusual orbits.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0028, THE EVOLUTION OF STRUCTURE IN THE UNIVERSE

P.E. Boynton, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (INT78-08774)

This award supports basic research in observational studies of the evolution of the structure of the Universe. The project is conducted by the Department of Astronomy, University of Washington; and the Research Institute for Electromagnetic Waves of the Department of Physics, University of Rome; and takes place under the Cooperative Science Programs jointly sponsored by the National Science Foundation and the Italian National Council for Research.

The project's objective is to test a ground-based program of FAR infrared observations to detect and measure the mass-density fluctuations in the early Universe (Z approximately equal to 1000). The investigators will examine small angular scales (one to three minutes of arc) in the relict radiation by a technique based on state-of-the-art technology. The data are expected to clarify our knowledge about the inhomogeneity of the mass present in the primordial Universe, and thereby elucidate the question of the so-called 'missing mass', the difference between the observable mass in the present Universe and the mass that would have had to be present at the primordial explosion that created the structure of the Universe. The measurements in question would provide a fundamental test for a whole class of theories concerning the evolution of the Universe. Also, the detection of very distant clusters of galaxies may result from the observational program, as well as a better understanding of the characteristics of the earth's atmosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological
& Internat. Affairs, Div. of International
Programs

10.0029, STUDIES OF DISCRETE ELECTROMAGNETIC EMISSIONS IN THE MAGNETOSPHERE

C.S. Lin, University of Washington, School of Arts & Sciences, Dept. of Geophysics, *Seattle, Washington* 98105 (NSG 5410)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

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For information on obtaining these films, contact:
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VOLUME 18 NUMBER 8/APRIL 23, 1980

Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-17021* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 117
Jan. 1980 100 p
(NASA-SP-7037(117)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 307 reports, articles, and other documents introduced into the NASA scientific and technical information system in December 1979. Author

N80-17022# Naval Air Engineering Center, Lakehurst, N.J. Engineering Dept.
COMPILATION OF DATA COVERING AIRCRAFT SERVICING FACILITIES ABOARD AVIATION AND AMPHIBIOUS AVIATION SHIPS
Michael A. Strano 17 Oct. 1979 279 p
(AD-A076443; NAEC-ENG-6703-Rev-15) Avail: NTIS HC A13/MF A01 CSCL 01/3

This report is a compilation of data covering aircraft servicing facilities aboard aviation and amphibious aviation ships. Data is furnished on aircraft servicing facilities relating to fueling and defueling, electrical starting and servicing, oxygen and nitrogen, aircraft inertial alignment, compressed air, and cooling and starting air. GRA

N80-17023# Air Force Academy, Colo.
AIR FORCE ACADEMY AERONAUTICS DIGEST, SPRING 1979 Final Report
E. J. Jumper and M. M. Tower Jul. 1979 167 p
(AD-A075419; USAFA-TR-79-7) Avail: NTIS HC A08/MF A01 CSCL 20/4

This digest covers unclassified research in aeronautics performed at the United States Air Force Academy during the six months ending 1 July 1979. This report includes individual technical papers in the specific areas of aerodynamics, fluid mechanics, experimental instrumentation, engineering education and thermodynamics and heat transfer. GRA

N80-17024# Accademia Nazionale dei Lincei, Rome (Italy).
COLLECTED WORKS OF A. G. CROCCO. VOLUME 1: 1904 TO 1925 [A. G. CROCCO. OPERE. PUBBLICATE A CURA DELL'ACCADEMIA NAZIONALE DEI LINCEI]
Arturo Gaetano Crocco 1978 592 p refs In ITALIAN
Avail: NTIS HC A25/MF A01

A collection of 80 papers published by A. G. Crocco up to 1925 is presented. The subjects refer to the general field of aeronautics and aerodynamics, including papers on dirigibles, helicopters, aircraft construction materials, navigation, aerodynamics, aircraft artillery, the use of helium in airships, economic factors, and flight stability. Author (ESA)

N80-17025# Accademia Nazionale dei Lincei, Rome (Italy).
COLLECTED WORKS OF A. G. CROCCO. VOLUME 2: 1926-1940 [A. G. CROCCO. OPERE. PUBBLICATE A CURA DELL'ACCADEMIA NAZIONALE DEI LINCEI]
Arturo Gaetano Crocco 1978 591 p refs In ITALIAN
Avail: NTIS HC A25/MF A01

A collection of 57 papers published by A. G. Crocco from 1926 to 1940 is presented. The subjects refer to the general fields of aeronautics and aerodynamics, including papers on military aviation, aerodynamic stability, aerodynamic characteristics, stratospheric flight, flight conditions, aircraft instruments, and economic and political issues. Author (ESA)

N80-17026# Accademia Nazionale dei Lincei, Rome (Italy).
COLLECTED WORKS OF A. G. CROCCO. VOLUME 3: 1941 TO 1962 [A. G. CROCCO. OPERE. PUBBLICATE A CURA DELL'ACCADEMIA NAZIONALE DEI LINCEI]
Arturo Gaetano Crocco 1978 526 p refs In ITALIAN
Avail: NTIS HC A23/MF A01

A collection of 46 papers published by A. G. Crocco from 1941 to 1962 is presented. The subjects refer to the general fields of aeronautics and aerodynamics, including papers on military aviation, aerodynamic stability, aerodynamic characteristics, interplanetary navigation, atomic propulsion, missiles, and astronautics. Author (ESA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-17027 Stanford Univ., Calif.
VISCOUS-INVISCID INTERACTIONS IN LAMINAR FLOWS NEAR SEPARATION REGIONS AND CORNERS Ph.D. Thesis
Jose Carlos Albano do Amarante 1979 142 p
Avail: Univ. Microfilms Order No. 8001872

The implications of the viscous inviscid interactions close to a separated region resulting in regular integration of the two dimensional boundary layer equations are discussed. An inverse boundary layer method is developed where the interactions are represented by prescribing a displacement thickness profile. It is based on a vorticity-stream function formulation with similarity variables which are very convenient since the required transition from a standard approach to an inverse approach is made smoothly and without difficulties. The method is then applied to study an axially symmetric three dimensional separation. Dissert. Abstr.

N80-17028*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
A SUPERSONIC THREE-DIMENSIONAL CODE FOR FLOW OVER BLUNT BODIES: PROGRAM DOCUMENTATION AND TEST CASES Progress Report, 1 Mar. 1978 - 30 Apr. 1979
D. S. Chaussee and O. J. McMillan Feb. 1980 205 p

(Contract NAS1-15305)
(NASA-CR-3224; NEAR-TR-194) Avail: NTIS
HC A10/MF A01 CSCL 01A

The use of a computer code for the calculation of steady, supersonic, three dimensional, inviscid flow over blunt bodies is illustrated. Input and output are given and explained for two cases: a pointed code of 20 deg half angle at 15 deg angle of attack in a free stream with M sub infinite = 7, and a cone-ogive-cylinder at 10 deg angle of attack with M sub infinite = 2.86. A source listing of the computer code is provided. Author

N80-17029*# Neilsen Engineering and Research, Inc., Mountain View, Calif.
CALCULATION OF TWO-DIMENSIONAL INLET FLOW FIELDS IN A SUPERSONIC FREE STREAM: PROGRAM DOCUMENTATION AND TEST CASES Final Report, 1 Mar. 1978 - 30 Apr. 1979
S. H. Biringen and O. J. McMillan Mar. 1980 165 p refs
(Contract NAS1-15305)
(NASA-CR-3221; NEAR-TR-195) Avail: NTIS
HC A08/MF A01 CSCL 01A

The use of a computer code for the calculation of two dimensional inlet flow fields in a supersonic free stream and a nonorthogonal mesh-generation code are illustrated by specific examples. Input, output, and program operation and use are given and explained for the case of supercritical inlet operation at a subdesign Mach number (M Mach free stream = 2.09) for an isentropic-compression, drooped-cowl inlet. Source listings of the computer codes are also provided. Author

N80-17030*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PREDICTION METHOD FOR TWO-DIMENSIONAL AERODYNAMIC LOSSES OF COOLED VANES USING INTEGRAL BOUNDARY-LAYER PARAMETERS
Louis J. Goldman and Raymond E. Augler Feb. 1980 43 p refs
(NASA-TP-1623; E-076) Avail: NTIS HC A03/MF A01 CSCL 01A

A generalized analysis to predict the two-dimensional aerodynamic losses of film-cooled vanes by using integral boundary-layer parameters is presented. Heat-transfer and trailing-edge injection effects are included in the method. An approximate solution of the generalized equations is also included to show more clearly the effect of the different boundary-layer and cooling parameters on the losses. The analytical predictions agree well with the experimental results, indicating that available boundary-layer calculations for cooled vanes are of sufficient accuracy to use in the prediction method. Author

N80-17031# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Dept. of Aerospace and Ocean Engineering.
APPROXIMATE ANALYSIS OF AXISYMMETRIC BASE FLOWS WITH INJECTION IN SUPERSONIC FLOW
J. A. Schetz, F. S. Billig, and S. Favin Blacksburg, Va. Virginia Polytech. Inst. and State Univ. 30 Oct. 1979 28 p refs
Backup document for AIAA synoptic, "Approximate analysis of axisymmetric supersonic base flows with injection", scheduled for publication in AIAA Journal, Jul. or Aug. 1980 sponsored by Naval Ordinance Systems Command
(VPI-Aero-099) Avail: NTIS HC A03/MF A01

The flow processes in the wake of a projectile moving in at supersonic speeds with mass addition to the base region were analyzed in order to accurately predict the pressure on the base so that base drag and its reduction due to injection could be estimated. The major assumptions are involved with the development of an approximate pressure-angle relation, modelling of turbulent transport processes and the use of one-dimensional or pseudo-one-dimensional flow equations in various regions of the flow. Comparisons with experiment at M(1) = 2.0 and 3.0 show that good predictions of base pressure can be achieved with a minimum of complexity. A.R.H.

N80-17032# ARO, Inc., Arnold Air Force Station, Tenn.
SEPARATED AND NONSEPARATED TURBULENT FLOWS ABOUT AXISYMMETRIC NOZZLE AFTERBODIES. PART 1: DETAILED SURFACE MEASUREMENTS Final Report, 1 Oct. 1976 - 30 Sep. 1977
J. A. Benek AEDC Oct. 1979 51 p refs
(AD-A077144; AEDC-TR-78-49-PT-1) Avail: NTIS
HC A04/MF A01 CSCL 20/4

Extensive static pressure data were obtained on a model consisting of a cone-ogive-cylinder forebody, two interchangeable circular arc afterbody boattails having length-to-forebody diameter ratios of 0.80 and 1.77, and two interchangeable solid exhaust plume simulators of cylindrical and contoured geometry. Boundary-layer pitot data and photographic records of model tufts and schlieren data were also obtained. Data were collected over a Mach number range of 0.60 to 1.30 and a unit Reynolds number range of 3.2 to 13.12 million per m (1 to 4 million per ft) at zero angle of attack and sideslip for the purpose of obtaining experimental data suitable for comparison with theoretical predictions. Data are presented for two model configurations with cylindrical solid plume simulators at three flow conditions: (1) length-to-diameter ratio = 1.77 boattail at Mach number number 0.80 and Reynolds number 8.2 million per m for high subsonic, unseparated flow; (2) length-to-diameter ratio = 0.80 boattail at Mach number 0.60 and unit Reynolds number 8.2 million per m for subsonic, separated flow; and (3) length-to-diameter ratio = 0.80 boattail at Mach number 0.95 and unit Reynolds number 8.2 million per m for transonic, separated flow with boundary-layer-shock interaction. GRA

N80-17033# McDonnell-Douglas Research Labs., St. Louis, Mo.
UNSTEADY TRANSONIC FLOWS IN A TWO-DIMENSIONAL DIFFUSER Annual Technical Report, 1 Apr. 1978 - 31 Mar. 1979
M. Sajben and J. C. Kroutil 31 May 1979 27 p refs
(Contract F49620-77-C-0082; AF Proj. 2307)
(AD-A075261; AFOSR-79-0990TR) Avail: NTIS
HC A03/MF A01 CSCL 20/4

The second and third years of the contract comprise its second phase, aimed at exploring the effects of periodic, downstream excitation on the transonic flow in a two-dimensional diffuser model. The present report covers the second year of the contract. The pulse generator was incorporated in the diffuser model, and its controls were synchronized with the optical instrumentation. The boundary-layer control system was turned for best two-dimensionality of the flow. The flowfield instrumentation was selected, and an appropriate actuator was constructed. Perturbation of the flow by the actuator was determined to be acceptably small. Boundary-layer profiles were determined on all four walls, and the Mach number distribution was mapped in detail over the diffuser exit cross-section. Surface pressure distributions were measured, and spark schlieren photos were taken for the available pressure ratio range. GRA

N80-17034# Boeing Military Airplane Development, Seattle, Wash. Military Airplane Development Organization.
FORMULATION OF THE THREE DIMENSIONAL TRANSONIC UNSTEADY AERODYNAMIC PROBLEM Interim Report, 15 May 1978 - 15 Feb. 1979
H. Yoshihara Feb. 1979 87 p refs
(Contract F33615-78-C-3201; AF Proj. 2401)
(AD-A075403; AFFDL-TR-79-3030) Avail: NTIS
HC A05/MF A01 CSCL 20/4

Unsteady transonic flow for a swept wing of moderate sweep is formulated in the small disturbance limit. Boundary conditions at the wing, the trailing vortex sheet, and the outer computational boundaries are given including the ventilated wall conditions. Shortcomings of the small disturbance hypothesis is reviewed, suggesting means to compensate for them. Viscous interactions are described together with procedures to incorporate their effects. GRA

N80-17035# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
SYNTHESIS OF UNSTEADY AERODYNAMIC PROBLEMS CONCERNING HELICOPTERS [SYNTHESE DES PROBLEMES D'AERODYNAMIQUE INSTATIONNAIRE DE L'HELICOPTERE]
J. Gallot Paris Assoc. Aeron. et Astronautique de France 1979 22 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-19; ISBN-2-7170-0546-3) Avail: NTIS

HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

The impact of unsteady phenomena on the performance of a rotary wing as well as on overall helicopter performance is discussed with emphasis on the ways in which manufacturers try to take these effects into consideration at the design stage. Criteria taken into consideration include operating conditions for different profiles, problems associated with unsteady operation, and the impact of these problems on flight performance. The validity of mathematical models which predict unsteady aerodynamic phenomena, such as flow separation and compressibility is discussed and found to be good at the industrial design level.

Author (ESA)

N80-17036# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

EXPERIMENTAL STUDY OF THE AERODYNAMICS OF A HELICOPTER ROTOR BLADE MODEL IN AN UNSTEADY FLOW REGIME DURING WIND TUNNEL TESTS

P. Philippe, P. Lafon, and J. C. Bohl 1979 13 p refs In FRENCH; ENGLISH summary Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978

(AAAF-NT-79-21; ISBN-2-7170-0548-X) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

Test tools and facilities were developed to understand and analyze flows encountered on helicopter rotor blades. The measurements performed on straight or 30 deg swept blade tips reveal unsteady and tridimensional effects on absolute pressure distributions. The experimental data are also compared with calculations, thus summing up the state of art of available prediction methods.

Author (ESA)

N80-17037# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft u. Raumfahrt.

INVESTIGATION OF THE FLIGHT MECHANICS AND AERODYNAMICS OF THE GROUND EFFECT PRINCIPLE [FLUGMECHANISCHE UND AERODYNAMISCHE UNTERSUCHUNGEN ZUM STAUFLUEGELPRINZID]

M. Haake, G. Kleineidam, and R. Staufenbiel Bonn Dokzentbw Feb. 1979 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(Contract T/RF-41/RF-410/51109)

(BMVg-FBWT-79-4) Avail: NTIS HC A06/MF A01; Dokzentbw, DM 40

The relationship between aerodynamic configurations and ground effect flight characteristics are reported. Static longitudinal stability with particular reference to height stability is discussed. Longitudinal motion which shows three stable modes with sufficient damping by a suitable selection of the aerodynamic configuration is examined. Variation of thrust is found to be best suited for controlling the height. A wind tunnel measurement technique is presented which allows direct evaluation of the height stability. Pressure distributions and aerodynamic coefficients are determined theoretically and experimentally. A plate with boundary layer suction used to simulate the ground is described. Thin and moderately cambered airfoils are examined and the influence of the deformation of the wake is reported.

Author (ESA)

N80-17038# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

THE ANALYSIS OF MEASURED SURFACE LOADS AS A BASIS FOR THE DERIVATION OF ACCEPTABLE LOAD LIMITS FOR MILITARY AIRCRAFT COMPONENTS [DIE ANALYSE VON GEMESSENEN BETRIEBSBEANSPRUCHUNGEN ALS GRUNDLAGE FUER DIE ABLEITUNG VON LASTANNAHMEN FUER MILITAERISCHES FLUGGERAET]

J. M. Azschel and V. Ladda Bonn Dokzentbw May 1979 76 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(Contract T/RF-43/RF-430/51038)

(BMVG-FBWT-79-9) Avail NTIS HC A05/MF A01; Dokzentbw, DM 30

Recent investigations into gust loads on airplanes are reviewed using the theory of turbulence and its application to problems associated with flight in turbulence. The statistical description of turbulence and the dynamic response of the structure due to gusts are considered. In most cases, the results are presented in terms of cumulative frequency distributions and power spectra for independent gust components. The statistical dependence of the components is omitted in this case even though it must be considered for example in the design of T-tails. More information is needed regarding the gust gradients which must be known when assuming a single gust model for the design of aircraft components. Models which were developed and verified by means of measured load-time histories during service are presented to aid in solving the problems addressed.

Author (ESA)

N80-17039# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

VORTEX SHEDDING FROM SHARP EDGES

J. M. R. Graham Nov. 1977 28 p refs

(IC-Aero-77-06; ISSN-0308-7247) Avail: NTIS HC A03/MF A01

Numerical methods of shedding point vortices in inviscid two-dimensional flow past a sharp edge and the subsequent roll up of the shed vortex sheet are discussed. The results of some numerical calculations are presented.

Author (ESA)

N80-17040# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

DESCRIPTION AND REPORT ON THE CALIBRATION OF AN UNSTEADY FLOW WIND TUNNEL, PART 1. THE UNSTEADY LIFT GENERATED ON AN AIRFOIL AT MODERATE INCIDENCE TO A FLOW CONTAINING STREAMING OSCILLATIONS, PART 2

J. M. R. Graham May 1979 24 p refs

(IC-Aero-79-04-Pt-1/2; ISSN-0308-7247) Avail: NTIS HC A02/MF A01

A first set of velocity and pressure measurements made in an unsteady flow wind tunnel are presented. The wind tunnel provides a low speed mean flow superimposed streamwise oscillations of variable amplitude generated by rotating vanes at the downstream end. The fluctuating lift on an unstalled airfoil at incidence in an unsteady streamwise flow was measured and compared with predictions of unsteady thin airfoil theory.

Author (ESA)

N80-17041# Royal Aircraft Establishment, Farnborough (England).

HOLOGRAPHIC INTERFEROMETRY OF CARBON FIBER REINFORCED PLASTIC WINGTIPS

M. Marchant London HMSO Aug. 1978 63 p refs

(RAE-TR-78105; BR68663) Avail: NTIS HC A04/MF A01

Seven experimental Harrier ferry-tips were examined by holographic interferometry primarily for defects in core to skin bonding. With increasing experience, the quality of the holograms recorded improved and although the interference patterns formed when the structure is warmed are often complicated, discontinuities are readily observed. A number of suspected defects were found which are virtually undetectable using standard radiographic techniques. The most prominent of these are the long straight anomalies visible on all but the first sample examined. It is thought that they may be due to overlapping sheets of film adhesive, but this was not established with certainty. An ultrasonic scan of one sample also failed to detect it. Small circular patterns, possibly indicating debonds, were found in a number of place. A group of large anomalies observed on one sample were confirmed by radiography.

Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations, and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-17042# Lockheed-California Co., Burbank.

GENERAL AVIATION AIRPLANE STRUCTURAL CRASHWORTHINESS USER'S MANUAL VOLUME 2: INPUT-

OUTPUT, TECHNIQUES AND APPLICATIONS Final Report, Jun. 1976 - Feb. 1978
Max A. Gamon, Gil Wittlin, and William L. LaBarge Sep. 1979 253 p
(Contract DOT-FA75WA-3707)
(AD-A075949; LR-28307-Vol-2-Rev; FAA-RD-77-189-Vol-2-Rev) Avail: NTIS HC A12/MF A01 CSCL 01/3

A comprehensive description of program KRASH is provided. The following are included: user's guide; math model development; KRASH data requirements; and typical model arrangements. R.C.T.

N80-17043# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ACCIDENT DATA SYSTEMS STUDY REQUIREMENTS ANALYSIS FOR A FAA ACCIDENT DATA SYSTEM Final Report, Oct. 1977 - Jul. 1979
Ellis V. Couch, Ron M. Hill, T. Kolankiewicz, and Gerald Skelton Aug. 1979 167 p refs
(FAA Proj. 014-100-100)
(AD-A075611; FAA-NA-79-172) Avail: NTIS HC A08/MF A01 CSCL 01/2

The Federal Aviation Administration is investigating possible improvements in its accident data system to enhance aviation safety because the present data system is limited in scope, difficult to use, and of little benefit to aviation safety analysts. The immediate needs which can be met in the near term as well as improvements which will necessitate extensive changes in data collection forms, procedures, and methodologies are analyzed. Other similar data systems are examined, previous related studies are reviewed, and recommendations from users of accident data systems are surveyed. The FAA Flight Standards Service incorporated additional data elements, improved software for better data access, and other near term improvements in the General Aviation Accident Data System now under development. These improvements are evolutionary steps toward the fulfillment of the long range requirements. A.R.H.

N80-17044# Air Force Academy, Colo. Research Lab.
CARGO GENERATION FORECASTING MODELS
John S. Brush Oct. 1979 11 p refs
(AF Proj. 2304)
(AD-A076136; FJSRL-TR-79-0010) Avail: NTIS HC A02/MF A01 CSCL 15/5

Time series models of daily cargo generated for two MAC channels are developed. The strong weekly cyclical fluctuation is exploited in developing forecasting models using both past cargo generation and past cargo arrivals as inputs. GRA

N80-17045# Dayton Univ., Ohio.
THE SCALING OF BIRD IMPACT LOADS Final Report, 16 Jan. 1978 - 16 Feb. 1979
Antonios Challita and John P. Barber Jun. 1979 67 p refs
(Contract F33615-78-C-3402; AF Proj. 2402)
(AD-A075215; UDR-TR-79-23; AFFDL-TR-79-3042) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report describes an experimental study which was conducted to investigate the loads produced by the impact of 1800 g and 3600 g birds. Both real birds and bird simulants were tested. Impact pressures were measured and compared with smaller bird impact results obtained on previous testing programs. The magnitude of the impact pressures was found to be independent of bird size. The temporal and spatial distribution of impact pressures scaled linearly with bird dimensions. The impact behavior of large birds was consistent with flow models developed to describe small bird impacts. It was concluded that large and small birds display the same fundamental impact loading processes and that these processes are adequately described by the previously developed flow model. GRA

N80-17048# Douglas Aircraft Co., Inc., Long Beach, Calif.
ADVANCED DESIGN AIRCREW PROTECTIVE RESTRAINT SYSTEMS Final Report
A. Blair McDonald Aug. 1979 59 p refs
(Contract F33615-78-C-0509)
(AD-A076061; AMRL-TR-79-45) Avail: NTIS HC A04/MF A01 CSCL 01/3

This study is the initial phase of a program aimed at the development of advanced design aircrew systems for the next generation of Air Force combat aircraft. For these new aircraft, it is anticipated that combat operations will involve high multiaxial acceleration maneuvers and that new aircrew systems will be required for restraint, protection and escape under these combat conditions. GRA

N80-17268 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
BIRD IMPACT LOADING
J. S. Wilbeck and J. P. Barber (Dayton Univ. Research Inst., Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 115-122 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-17047# Federal Aviation Administration, Washington, D. C. Flight Transportation Lab.
REVIEW AND EVALUATION OF NATIONAL AIRSPACE SYSTEM MODELS Final Report, Jan. - Dec. 1978
A. R. Odoni and R. W. Simpson Oct. 1979 357 p refs
(Contract DOT-TSC-1491)
(AD-A078050; FAA-EM-79-12; DOT-TSC-FAA-79-8) Avail: NTIS HC A16/MF A01 CSCL 17/7

A guide to the availability and capability of state of the art analytical and simulation models of the national airspace system (NAS) is presented. A listing of 230 reports containing technical descriptions of models developed during the last decade are reviewed with 50 distinct models described. The reports are classified into primary categories based on applicability of the model to various aspects of the NAS. Capacity/delay models are classified as capacity oriented runway, delay oriented runway, complete airport, terminal airspace, air route traffic (including communications), controller workload and performance, and models of major segments of the NAS. Reports describing models primarily concerned with safety related measures and noise related measures are categorized separately. Information contained in each model review includes report ID, abstract, input/output parameters, computer related characteristics, assumptions, quality of documentation, extent of validation, and an evaluation of the model's usefulness and limitations. The reports also contain a comparative evaluation of models in the same primary category. These evaluations present an overview of the models contained in each category, summarize the main features of the best models, and document the conclusions and recommendations regarding the model best suited for specific applications. A.W.H.

N80-17048# National Aviation Facilities Experimental Center, Atlantic City, N. J.
SUMMARY OF TRANSPONDER DATA Interim Report, Jun. 1977 - Aug. 1978
Max Greenberg Aug. 1979 53 p refs
(FAA Proj. 031-241-830)
(AD-A075486; FAA-RD-79-56; FAA-NA-79-23) Avail: NTIS HC A04/MF A01 CSCL 17/7

The performance characteristics of transponders and digitized encoded altimeters were determined in the operational environment of general aviation aircraft. A transponder performance analyzer (TPA), developed to measure performance parameters of transponders installed in aircraft is described. The TPA installed in a bus for mobility, simulates an air traffic control beacon interrogator to facilitate measurement of 15 transponder parameters in 30 seconds. A standard gain horn is utilized to

couple the signals between the TPA bus and the aircraft. Transponder data were collected at four different geographic locations resulting in more than 950 samples of general aviation transponders. Results presented in tabular form, show that 36 percent of the transponders met all measured parameters. The TPA operation and procedures are reported and the data collection and sampling techniques are discussed. A.W.H.

N80-17049# National Aviation Facilities Experimental Center, Atlantic City, N. J.
COMPUTER STUDY OF TULSA INTERNATIONAL AIRPORT RUNWAY 17R GLIDE SLOPE SITES Final Report, Feb. - Nov. 1978
Thomas J. Laginja Sep. 1979 44 p refs
(FAA Proj. 071-713-800)
(AD-A075521; FAA-RD-79-27; FAA-NA-79-8) Avail: NTIS HC A03/MF A01 CSCL 17/7

The effect of the terrain at the approach end of Tulsa International Airport runway 17R on guidance signals radiated from an instrument landing system glide slope antenna system is examined. The performances of capture effect, sideband reference, and null reference systems were compared using a mathematical simulation model in order to select the antenna system that will result in the least perturbation of signal. The model, the modeling technique, and the application of the model are described along the input data. A.W.H.

N80-17050# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
REPORT ON THE FAA TASK FORCE ON AIRCRAFT SEPARATION ASSURANCE. VOLUME 2: CONCEPT DESCRIPTION
N. A. Blake Jan. 1979 69 p refs
(AD-A077807; FAA-EM-78-19-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 17/7

The development of the integrated aircraft separation assurance (ASA) system for the National Airspace System is discussed with emphasis on system errors, mid-airs, and near mid-airs, and altitude deviations. The system element requirements are defined to provide two levels of backup to the ATC system: a separation violation warning and a final fail safe collision advisory and resolution function. The current FAA ASA development programs are discussed as well as the changes required to transition to an integrated ASA system. A.R.H.

N80-17051# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DEFORMOGRAPHICS: HIGH-RESOLUTION PROJECTION DISPLAY DEVELOPMENT FOR AIR TRAFFIC CONTROL PURPOSES Report, Jan. 1973 - Dec. 1978
Gerard Spanier Oct. 1979 224 p refs
(FAA Proj. 975-200-00A)
(AD-A078023; FAA-NA-79-24) Avail: NTIS HC A10/MF A01 CSCL 17/7

A display device and technology called deformographics is described and its practical value for the presentation of large quantities (e.g., 30,000 characters) of air traffic control data was investigated. The engineering, development, human factors, and test and evaluation phases are included and the technical performance data and applications concepts are provided. The project determined the viability of the technology, established the basis for further operational concept studies, and assessed the reproducibility of devices and performance based on the technology. The results indicate a wide use of the technology for air traffic control data and information presentation, as well as other similar applications, and indicate a significant superiority of performance over other conventional and emerging display technologies. R.C.T.

N80-17052# Analysis and Technology, Inc., North Stonington, Conn.
TARGET TRACKING WITH MULTIPLE DATA SOURCES Final Report
H. F. Jarvis and N. B. Nill 15 Aug. 1979 137 p refs
(Contract N00014-78-C-0707)
(AD-A076559; P-515-1-79) Avail: NTIS HC A07/MF A01 CSCL 17/7

This report presents the results of a study on the impact of a priori estimates of range and/or target speed on the bearings-only TMA problem. The method selected for this evaluation was a computer simulation of Maximum A posteriori Probability (MAP) estimate which incorporates the a priori statistical information in an asymptotically optimum manner. The a priori range information represents environmental predictions of likely range bands based on alternate propagation paths (direct, 1st CZ, 2nd CZ, etc.). An additional phase of the study evaluated the use of Depression/Elevation (D/E) estimates from environmental predictions for resolving horizontal bearing from conical angle measurements. The results of the study indicate that the benefits achieved from the use of a priori range information are algorithm dependent and primarily aid numerical convergence rather than solution accuracy. The use of a priori range together with estimated D/E does provide solution improvement for conical angle measurements from line arrays. The use of speed estimates improves both numerical convergence and solution quality during the initial TMA legs. GRA

N80-17053# Armament Development and Test Center, Eglin AFB, Fla.
PROCEEDINGS OF THE BIENNIAL GUIDANCE TEST SYMPOSIUM, 9TH, VOLUME 1
Oct. 1979 393 p refs Symp. held at Holloman Air Force Base, New Mexico, 10-12 Oct. 1979
(AD-A076567; ADTC-TR-79-11-Vol-1) Avail: NTIS HC A17/MF A01 CSCL 17/7

These proceedings contain papers included in the Ninth Biennial Guidance Test Symposium. This symposium, hosted by the Central Inertial Guidance Test Facility, is directed toward the exchange of information, stimulation of new ideas, and discussion of recent developments in the field of guidance testing. The papers presented include such topics as the Global Positioning System, the Space Shuttle, Aircraft Inertial Navigators, Component Evaluation, Advanced Guidance Methodology, Missile Guidance Systems and Analysis Techniques. GRA

N80-17054# Analytical Systems Corp., Burlington, Mass.
LORAN-C SYSTEM DYNAMIC MODEL: TEMPORAL PROPAGATION VARIATION STUDY Final Report, 1 Oct. 1978 - 30 Apr. 1979
L. W. Campbell, R. H. Doherty, and J. R. Johler Jul. 1979 63 p refs Prepared in cooperation with Colorado Research and Prediction Lab., Boulder
(Contract DOT-CG-829358-A)
(AD-A076214; ASECR-79-107; USCG-D57-79) Avail: NTIS HC A04/MF A01 CSCL 20/14

The results of a theoretical study to determine the expected extent of temporal variations in the Loran-C System are presented. Graphs of secondary phase correction vs distance, parametric in vertical lapse factor, for six values of ground impedance and parametric in ground impedance, for three values of vertical lapse factor are included. Although the secondary phase correction is most sensitive to ground impedance, it is relatively time stable and the most important parameter of concern in temporal variations is the vertical lapse factor. The effect of the surface refractive index on the secondary phase correction is negligible except in so far as it is correlated with the vertical lapse factor. A flow diagram and description of a program suitable for use on a desk calculator to calculate the secondary phase correction is included. GRA

N80-17055# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
SIZE EFFECT ON NAVIGATION USING A STRAPDOWN IMU
J. C. Hung, J. S. Hunter, W. W. Stripling, and H. V. White 27 Jun. 1979 29 p
(AD-A075434; DRSMI-T-79-73) Avail: NTIS HC A03/MF A01 CSCL 17/7

Size effects in a strapdown IMU (Inertial Measurement Unit) are not always ignorable. They should be considered in the error budget for high accuracy inertial navigation. This report presents results of a study on size effects. It is found that while each individual accelerometer has only one type of size effect, an IMU has two in general, the 'mounting offset size effect' and the cluster size effect. General formulas for determining IMU size effect errors are developed in the report. Numerical examples,

laboratory test results, and flight simulation results are given to demonstrate the size effects and to reveal their effect on navigation error. It is discussed that an optimum orientation for the accelerometer cluster can be chosen to minimize the navigation errors caused by size effects. It is also shown that, in principle, size effect of an IMU can be compensated using the angular rate information available from gyros. A size effect compensation concept is proposed with the associated computation algorithm given. GRA

N80-17056# Defence Research Establishment Valcartier (Quebec).
AREA CORRELATION TRACKING WITH AUTOMATIC COMPENSATION FOR MAGNIFICATION AND ROTATION
C. Munteanu. Jul. 1979. 72 p. refs.
(AD-A073011; DREV-R-4140/79) Avail: NTIS HC A04/MF A01 CSCL 17/8

Target tracking by area correlation involves matching a stored reference image of the target to live search scenery. The performance of the area correlator can be severely degraded by target magnification and three-axis rotation. This report presents 2 algorithms that estimate magnification and rotation angles, and allow the tracker to take compensating action via zoom lens and roll gimbal. The first algorithm, applicable to fixed targets, estimates rotation about the line of sight only (roll angle). The second algorithm estimates rotation in 3 axes, as required for maneuvering targets. The presentation of both algorithms is supported by simulation using photographs and artificial images. GRA

N80-17057# Champlain Technology Industries, Palo Alto, Calif.
AIRBORNE EVALUATION OF THE PRODUCTION AN/ARN-133 LORAN-C NAVIGATOR. Final Report
Richard J. Adams and John B. McKinley. Jul. 1979. 260 p. refs.
(Contract DOT-FA75WA-3662)
(AD-A075484; USCG-D-32-79) Avail: NTIS HC A12/MF A01 CSCL 17/7

This report presents the results of a comprehensive flight test evaluation of a production airborne Loran-C navigator. The test was performed on a FAA approved helicopter route in the Northeast Corridor, at NAFEC in Atlantic City, New Jersey and in the Gulf of Mexico. The test aircraft used were United States Coast Guard HH52 and HH53 helicopters. The test period was from June 1978 to January 1979. The test plan and test objectives were developed jointly by the United States Coast Guard and the Federal Aviation Administration and Systems Control, Inc. (Vt), Champlain Technology Industries Division. The flight test profiles and procedures were developed for the following reasons: (1) to assess the acceptability of Loran-C navigation in the operational ATC environment of the Northeast Corridor; (2) to determine the system use accuracy for Loran-C for enroute, terminal and non-precision approach flight; (3) to evaluate the Loran-C navigator performance in several offshore missions. The primary conclusions of this flight test evaluation were: the navigator was acceptable in the operational environment of the Northeast Corridor for both enroute and point-in-space approaches; the navigator satisfied AC 90-45A crosstrack accuracy requirements for enroute, terminal area and non-precision approaches; the production navigator satisfied a longtrack AC 90-45A accuracy requirements for enroute and terminal area, but not for non-precision approaches; the navigator performed acceptably during all phases of offshore testing. GRA

N80-17058# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
THE MODELING ERROR COMPENSATION OF DIGITAL FILTERS FOR THE ALIGNMENT OF INERTIAL PLATFORMS
Srinivasan Vathsal. 1979. 41 p. refs.
(DFVLR-FB-79-19) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8.80

The modeling error compensation of digital filters for the alignment of inertial platforms is considered. A feedback compensator was derived using singular control concepts by minimizing the actual estimation error without increasing computer loading. Numerical results are presented for two specific cases. A minimax design to consider worst cases of the platform and measurement noise disturbances in the real world model is given. Author (ESA)

N80-17059# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
COLORED MEASUREMENT NOISE DIGITAL PREFILTERING BY REGRESSION LINES
Rainer Froriep. May 1979. 58 p. refs.
(DFVLR-Mitt-79-05) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, West Germany DM 10.80

The fast initial fine alignment of an inertial platform with a Kalman filter, accelerated by a digital prefilter, is shown. The digital prefilter has the task to estimate certain state variables by constructing linear mean square regression lines from each batch of measurements with colored noise. The developed prefilter is characterized by a brief computation time and small storage requirements, which makes a very high data rate possible. The choice of filter structure and parameters is discussed referring to simulation results. The filter algorithm is illustrated step by step, both on-line and off-line. It is compared to prefiltering averaging and is shown to perform well. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-17060*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
COMPARISON OF ANALYTICAL AND FLIGHT TEST IDENTIFIED AERODYNAMIC DERIVATIVES FOR A TANDEM-ROTOR TRANSPORT HELICOPTER
Ward F. Hodge. Feb. 1980. 56 p. refs.
(NASA-TP-1581; L-13228) Avail: NTIS HC A04/MF A01 CSCL 01C

Flight tests for verifying an analytical aerodynamic derivative model of a CH-47 helicopter were conducted for low cruise speeds and transition to hover portions of curved, decelerating landing approach trajectories. All testing was performed on a closed loop basis with the stability augmentation system of the helicopter operating, and response data were obtained using both manual and computer generated input maneuvers. The results indicate some differences between the measured response time histories and those predicted by both analytical and flight test identified derivatives. With some exceptions the discrepancies are not severe, and the overall agreement between the measured and computed time histories is reasonably good. No adverse effects attributable to closed loop testing were noted, and the use of computer generated inputs proved to be superior to manual ones. Author

N80-17061*# Missouri Univ.-Rolla. Dept. of Mechanical and Aerospace Engineering.
AERODYNAMIC-STRUCTURAL ANALYSIS OF DUAL BLADED HELICOPTER SYSTEMS. Final Technical Report
Bruce P. Selberg, Donald L. Cronin, Kamran Rokhsaz, John R. Dykman, and Carla J. Yager. Feb. 1980. 46 p. refs.
(Grant NsG-2375)
(NASA-CR-162754) Avail: NTIS HC A03/MF A01 CSCL 01C

The aerodynamic and structural feasibility of the birotor blade concept is assessed. The inviscid flow field about the dual bladed rotor was investigated to determine the aerodynamic characteristics for various dual rotor blade placement combinations with respect to blade stagger, gap, and angle of attack between the two blades. The boundary layer separation on the rotors was studied and three dimensional induced drag calculations for the dual rotor system are presented. The thrust and power requirements of the rotor system were predicted. NASTRAN, employed as the primary modeling tool, was used to obtain a model for predicting in plane bending, out of plane bending, and the torsional

behavior of the birotors. Local hub loads, blade loads, and the natural frequencies for the birotor configuration are discussed. A.W.H.

N80-17062*# Arde, Inc., Mahwah, N.J.
DESIGN STUDY OF PRESTRESSED ROTOR SPAR CONCEPT Final Report, Mar. 1975 - Jun. 1976
David Gleich Jan. 1980 101 p refs Sponsored in part by the Army Aviation Res. and Develop. Command
(Contract NAS1-13816)
(NASA-CR-159086, ARDE-J/N-41005) Avail: NTIS HC A06/MF A01 CSCL 01C

Studies on the Bell Helicopter 540 Rotor System of the AH-1G helicopter were performed. The stiffness, mass and geometric configurations of the Bell blade were matched to give a dynamically similar prestressed composite blade. A multi-tube, prestressed composite spar blade configuration was designed for superior ballistic survivability at low life cycle cost. The composite spar prestresses, imparted during fabrication, are chosen to maintain compression in the high strength cryogenically stretchformed 304-L stainless steel liner and tension in the overwrapped HTS graphite fibers under operating loads. This prestressing results in greatly improved crack propagation and fatigue resistance as well as enhanced fiber stiffness properties. Advantages projected for the prestressed composite rotor spar concept include increased operational life and improved ballistic survivability at low life cycle cost. M.M.M.

N80-17063# Lockheed-Georgia Co., Marietta
AERODYNAMIC INVESTIGATION OF C-141 LEADING EDGE MODIFICATION FOR CRUISE DRAG REDUCTION, VOLUME 1. Final Technical Report, Jun. 1977 - Sep. 1978
W. T. Blackerby and P. R. Smith Wright-Patterson AFB, Ohio AFFDL Jun. 1979 172 p refs
(Contract F09603-77-A-0204, AF Proj. 2404)
(AD-A076610, LG78ER0233-Vol-1, AFFDL-TR-79-3059-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 01/3

A study was made of the aerodynamic design and high speed wing tunnel investigation of wing leading edge modifications for cruise drag reduction on the C-141 aircraft. Also investigated were the effects of a wing swept tip extension and trailing edge anti-drag bodies. These modifications were tested in the AEDC 16-Foot Transonic Facility, using a 0.044 scale C-141B model, to determine the effects on C-141 cruise aerodynamic characteristics and wing chordwise pressure distributions. Design of the leading edge modifications was based on the use of transonic wing theory, transonic airfoil theory and experience previously gained with a two-dimensional airfoil leading edge modification program. Force data results were analyzed to determine the effects on C-141 cruise drag, drag rise characteristics and cruise performance. Correlations were made with transonic theory using the measured chordwise pressure distributions. A fuel and cost savings evaluation was made of the selected leading edge configuration based on measured and predicted cruise performance improved. GRA

N80-17064# McDonnell Automation Co., St. Louis, Mo.
EFFECT OF SERVICE ENVIRONMENT ON F-15 BORON/EPOXY STABILATOR Final Report, Aug. 1977 - Jun. 1979
T. V. Hinkle Jun. 1979 137 p refs
(Contract F33615-77-C-3124, AF Proj. 2401)
(AD-A076493, AFFDL-TR-79-3072) Avail: NTIS HC A07/MF A01 CSCL 11/4

The objective of this program was to conduct a series of tests for evaluating the effects of service environment on the strength of the boron/epoxy skins which are an integral part of the F-15 horizontal stabilator. Full scale static tests were conducted on two stabilators, and test results were compared with the capability of the F-15 stabilator demonstrated in previous testing. Moisture contents at various locations in the composite skins were predicted by evaluating the environmental histories of both test articles. Predicted contents were corroborated by moisture contents measured at conclusion of the static tests. F-15 deployments were projected for a 25 year service life, and moisture contents of stabilator composite skins were calculated for each projected deployment. Structural element tests were conducted under the maximum temperature and absorbed moisture conditions expected in service. Physical and chemical characteristics of the test article skins were evaluated relative to baseline boron/epoxy characteristics. GRA

N80-17065# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
THE A-10 AND DESIGN-TO-COST: HOW WELL DID IT WORK?
Roger E. Carleton May 1979 52 p refs
(AD-A075437) Avail: NTIS HC A04/MF A01 CSCL 05/1

This document covers systems procurement in a design-to-cost atmosphere. Deficiencies in this program are identified and recommendations are offered to improve this lack of responsiveness. GRA

N80-17066# Center for Naval Analyses, Alexandria, Va. Operations Evaluation Group.
THE ACCELEROMETER METHODS OF OBTAINING AIRCRAFT PERFORMANCE FROM FLIGHT TEST DATA DYNAMIC PERFORMANCE TESTING
William R. Simpson Jun. 1979 402 p refs
(AD-A075226, CNA-PP-245) Avail: NTIS HC A18/MF A01 CSCL 01/3

There are, in general, two basic methods of obtaining aircraft performance from flight test data. The first of these methods, the Direct method, is to fly a particular maneuver of interest and mathematically correct this maneuver to a given set of standard conditions. Several similar maneuvers at different flight conditions are then combined in a composite map representing one aspect of the aircraft performance. The Indirect method is more subtle and has its basis deeper in theory. By this method, a group of aerodynamic and propulsion parameters are developed which in themselves are only numbers and do not represent performance. These parameters are not tied to a specific maneuver or maneuver type, but in general relate the physical forces required to achieve a certain flight condition. Such parameters for an aircraft would be the drag coefficient, lift coefficient, thrust available, fuel flow requirements, etc. However, these parameters can be combined with known facts about the airframe and propulsion system in such a fashion as to compute airplane performance. With the advent of highly accurate accelerometers, the dynamic maneuvers have become attractive for development of aerodynamic data when obtaining aircraft performance using the Indirect Method. GRA

N80-17067# Textron Bell Helicopter, Fort Worth, Tex.
INVESTIGATION OF THE CRASH-IMPACT CHARACTERISTICS OF ADVANCED AIRFRAME STRUCTURES Final Report
James D. Cronkhite, Thomas J. Haas, Victor L. Berry, and Robert Winter Sep. 1979 222 p refs
(Contract DAAJ02-77-C-0062, DA Proj. 1L2-62209-AH-76)
(AD-A075163, USARTL-TR-79-11) Avail: NTIS HC A10/MF A01 CSCL 01/3

The purpose of this program was to investigate the crash-impact characteristics of advanced troop transport helicopter airframe structures constructed of composite materials. Currently available information was surveyed on the crash-impact behavior of composite materials, analytical tools for design of crashworthy airframe structures, and airframe structure crashworthiness design criteria. Information on the crash-impact behavior of composite materials was found to be limited. Automotive studies showed that by innovative design, composite materials could function efficiently as energy absorbers to reduce crash-impact loads. Other pertinent studies were found that are currently in progress at Bell Helicopter Textron, the NASA Langley Research Center and the U.S. Army's Research and Technology Laboratories and are summarized. Finally, effects of composite materials on the compliance of airframe structures with current Army crashworthiness requirements are discussed. GRA

N80-17068# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE APPLICATION OF A PARAMETERIC METHOD OF FATIGUE LOAD MEASUREMENT TO WINGS BASED ON FLIGHT MEASUREMENTS ON A LIGHTNING MK T5
Anne Burns, J. P. Thompson, and G. E. King HMSO Nov. 1977 59 p refs Supersedes RAE-TR-77178 and ARC-37708
Original contains color illustration

best copy available

(ARC-R/M-3836; BR69023; ISBN-0-11-471169-0; RAE-TR-77178; ARC-37708) Avail: NTIS HC A04/MF A01; HMSO £10.00; PHI

The application of a parametric method for deriving fatigue loads for fighter aircraft wings is studied. The load is deduced from a statistical correlation with an appropriate combination of aircraft motion variables and control surface angles. The combined effect of symmetric and asymmetric loading is considered. Flights measurement are centered on Lightning fighter aircraft, but the scope is limited by the lack of ground load calibrations for the wing strain gages. This necessitated the development of parametric formulas for local rather than overall loads. Author (ESA)

N80-17069# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.

SESAME: A SYSTEM OF EQUATIONS FOR THE SIMULATION OF AIRCRAFT IN A MODULAR ENVIRONMENT

B. N. Tomlinson. London: HMSO, Jan. 1979. 151 p. refs.
(RAE-TR-79008; BR68659) Avail: NTIS HC A08/MF A01

A system of equations was developed for the simulation of aircraft motion in real time using a digital computer. Those parts of the mathematical model common to all aircraft were created as a set of FORTRAN subroutines, leaving the user to create only a small group of routines specifically to describe a particular aircraft. The equations employed are defined and the computer implementation described. The data presented can be used as a handbook and user guide. Because the routines described are not specific to real time simulation, they can also be used as a basis for a general mathematical model of an aircraft for use on any computer which handles FORTRAN. Author (ESA)

N80-17278 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

CALCULATION OF NATURAL FREQUENCIES AND MODE SHAPES OF MASS LOADED AIRCRAFT STRUCTURES

P. Wayne Whaley. *In* Shock and Vibration Inform. Center: The Shock and Vibration Bull., Pt. 3, Sep. 1978, p. 13-20. (For primary document see N80-17275, 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17299*# Rockwell International Corp., Los Angeles, Calif.

SELECTED TOPICS FROM THE STRUCTURAL ACOUSTICS PROGRAM FOR THE B-1 AIRCRAFT

Peter M. Belcher. *In* Shock and Vibration Inform. Center: The Shock and Vibration Bull., Pt. 3, Sep. 1979, p. 55-68. refs.
(For primary document see N80-17293, 08-31)
Avail: NTIS HC A05/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors, and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-17070# National Aviation Facilities Experimental Center, Atlantic City, N. J.

EXHAUST EMISSIONS CHARACTERISTICS FOR A GENERAL AVIATION LIGHT-AIRCRAFT AVCO LYCOMING TIO-540-J2BD PISTON ENGINE: Final Report

Eric E. Becker. Sep. 1979. 101 p. refs.
(FAA Proj. 201-521-100)
(AD-A075355; FAA-RD-79-68; FAA-RD-79-36) Avail: NTIS HC A06/MF A01 CSCL 21/7

The TIO-540-J2BD engine (S/N890-X) was tested at the National Aviation Facilities Experimental Center to develop a steady state exhaust emissions data base. This data base consists of current production baseline emissions characteristics, lean-out emissions data, effects of leaning-out the fuel schedule on cylinder head temperatures, and data showing ambient effects on exhaust emissions and cylinder head temperatures. The engine operating with its current full-rich production fuel schedule could not meet the proposed Environmental Protection Agency standard for carbon monoxide and unburned hydrocarbons (HC) under sea level standard-day conditions. The engine did, however, meet the proposed EPA standards for oxides of nitrogen under the same sea level conditions. The results show a trend toward higher levels of emissions output for CO and HC when the ambient conditions approximated hot day sea level conditions while producing slightly lower levels of nitrogen oxides. Author

N80-17071*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

AERODYNAMIC PERFORMANCES OF THREE FAN STATOR DESIGNS OPERATING WITH ROTOR HAVING TIP SPEED OF 337 METERS PER SECOND AND PRESSURE RATIO OF 1.54. 1: EXPERIMENTAL PERFORMANCE

Thomas F. Gelder. Feb. 1980. 108 p. refs.
(NASA-TP-1610; E-136) Avail: NTIS HC A06/MF A01 CSCL 21E

The aerodynamic performances of four stator-blade rows are presented and evaluated. The aerodynamic designs of two of these stators were compromised to reduce noise; a third design was not. On a calculated operating line passing through the design point pressure ratio, the best stator had overall pressure-ratio and efficiency decrements of 0.031 and 0.044, respectively, providing a stage pressure ratio of 1.483 and efficiency of 0.865. The other stators showed some correctable deficiencies due partly to the design compromises for noise. In the end-wall regions blade-element losses were significantly less for the shortest chord studied. Author

N80-17072# Volvo Flygmotor A.B., Trollhaettan (Sweden).

EFFECTS OF DESIGN PARAMETERS ON COOLING AIR REQUIREMENT IN A GAS TURBINE COMBUSTOR

Bjorn G. A. Sjoblom. 22 Aug. 1979. 34 p. refs. Backup document for AIAA synoptic scheduled for publication in Journal of Aircraft on May 1980.
(Log-C3797) Avail: NTIS HC A02/MF A01

A computer program for the preliminary design of aircraft gas turbine combustors was used for a parametric study. The program is based on established methods for wall temperature calculations and it determines the main dimensions, the air flow distribution and the film cooling air requirement. Effects of design parameters on the cooling air flow in an aircraft gas turbine combuster were studied. Variation of the overall pressure ratio gave a similar trend as data for existing combustors. It was also found that the percentage of cooling air for a typical design is roughly proportional to the overall pressure ratio to the 0.85 power multiplied by the turbine inlet temperature to the 2.4 power. TIT 2.4, which provides a simple extrapolation formula for existing combustors. Author

N80-17073*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.

DISTRIBUTION ANALYSIS FOR F100(3) ENGINE: Final Report

W. A. Walter and M. Shaw. Jan. 1980. 66 p. refs.
(Contract NAS3-20835)
(NASA-CR-159754; FR-12087) Avail: NTIS HC A04/MF A01 CSCL 21E

The F100(3) compression system response to inlet circumferential distortion was investigated using an analytical compressor flow model. Compression system response to several types of distortion, including pressure, temperature, and combined pressure/temperature distortions, was investigated. The predicted response trends were used in planning future F100(3) distortion

tests. Results show that compression system response to combined temperature and pressure distortions depends upon the relative orientation, as well as the individual amplitudes and circumferential extents of the distortions. Also the usefulness of the analytical predictions in planning engine distortion tests is indicated. J.M.S.

N80-17074*# Pratt and Whitney Aircraft, East Hartford, Conn.
EXPERIMENTAL EVALUATION OF A LOW EMISSIONS HIGH PERFORMANCE DUCT BURNER FOR VARIABLE CYCLE ENGINES (VCE) Final Report
R. P. Lohmann and R. J. Madon. Oct. 1979. 118 p. refs.
(Contract NAS3-20602)
(NASA-CR-159694; PWA-5513-32A) Avail: NTIS HC A06/MF A01 CSCL 21A

An evaluation was conducted with a three stage Vorbix duct burner to determine the performance and emissions characteristics of the concept and to refine the configuration to provide acceptable durability and operational characteristics for its use in the variable cycle engine (VCE) testbed program. The tests were conducted at representative takeoff, transonic climb, and supersonic cruise inlet conditions for the VSCE-502B study engine. The test stand, the emissions sampling and analysis equipment, and the supporting flow visualization rigs are described. The performance parameters including the fuel-air ratio, the combustion efficiency/exit temperature, thrust efficiency, and gaseous emissions calculations are defined. The test procedures are reviewed and the results are discussed. A.W.H.

N80-17075# Massachusetts Inst. of Tech., Cambridge. Gas Turbine and Plasma Dynamics Lab.
BOUNDARY LAYER AND WAKE MODIFICATIONS TO COMPRESSOR DESIGN SYSTEMS: THE EFFECT OF BLADE-TO-BLADE FLOW VARIATIONS ON THE MEAN FLOW FIELD OF A TRANSONIC ROTOR Final Report, 1 Sep. 1976 - 31 Aug. 1978
Arun K. Sehra. Wright-Patterson AFB, Ohio AFAPL, Mar. 1979. 218 p. refs.
(Contract F33615-76-C-2118; AF Proj. 2307)
(AD-A076204; GT/PDL-144; AFAPL-TR-79-2010) Avail: NTIS HC A10/MF A01 CSCL 21/5

The effect of blade-to-blade flow variations on the mean flow field of a highly loaded transonic axial flow compressor was investigated. The theoretical approach centered around modeling of three important phenomena associated with blade-to-blade flow fluctuations, which control the mean momentum and energy transfer processes. Apparent stresses were introduced into the mean flow momentum equations by pitchwise averaging. Loss concept of mean relative total pressure, due to conversion of mean flow kinetic energy to the energy of fluctuations, was introduced. Based on this concept, mean rothalpy and the production of apparent entropy were defined. An expression for mean rothalpy variation along the streamline was derived by pitchwise averaging of the energy equation. Mean flow equations suitable for the streamline curvature computational scheme were developed which include these three effects. Apparent stresses, mean rothalpy and apparent entropy variations were calculated from measured velocity fluctuations. The revised streamline curvature procedure was then used to predict the axisymmetric (peripheral mean) flow. The agreement of rotor outlet tangential velocity is excellent, reproducing an unusual peak which is not explainable by usual techniques. The results showed that 3-D inviscid effects do not significantly modify the mean flow, and that the direct effect of apparent stresses on the mean flow is also small. GRA

N80-17076# Dayton Univ., Ohio.
PROBE EFFECTS IN GAS TURBINE COMBUSTOR EMISSION MEASUREMENTS Final Report, 1 Mar. - 1 Oct. 1978
J. A. Clark, J. E. Peters, and A. M. Mellor. Jun. 1979. 62 p. refs. Prepared in cooperation with Purdue Univ., Lafayette, Ind., Combustion Lab.
(Contract F33615-77-C-2069; AF Proj. 2308)
(AD-A076257; AFAPL-TR-79-2041; PUDU-CL-78-05) Avail: NTIS HC A04/MF A01 CSCL 21/5

Four geometrically distinct, stainless steel probes are used to study the concentrations of CO, HC, NO, and NOX at several different radial and two different axial positions within a simplified gas turbine combustor. The probes are all water cooled but do not employ an aerodynamic quench. They are designed to assess the effect of tip shape, tip to body proximity, and probe entry point on measured pollutant concentrations. Though probe entry point and tip to body proximity are shown to imperceptibly affect the pollutant concentrations, probe tip geometry has a marked impact on the measured pollutant levels. Specifically, the aerodynamic, tapered-tip probe yields depressed CO and HC, and elevated NO concentrations compared to other three blunt-tipped probes. Regarding reproducibility, the pollutant concentrations measured with one of the blunt-tipped probes in this study are compared to pollutant levels measured with the same probe three years ago (Tuttle, et al. 1975). CO and HC are shown to be the most reproducible species, while NO and NOx acceptably but less accurately agree with past studies. GRA

N80-17077# Aeronautical Research Council, London (England).
VORTEX SHEDDING MECHANISMS IN RELATION TO TIP CLEARANCE FLOWS AND LOSSES IN AXIAL FANS
R. I. Lewis (Newcastle Univ. Engl.) and E. C. H. Yeung (Newcastle Univ. Engl.). London HMSO, May 1977. 37 p. refs. Supersedes ARC-37359
(ARC-R/M-3829; ISBN-0-11-471162-3; ARC-37359) Avail: NTIS HC A03/MF A01; HMSO £4.00; PHI

The importance of tip leakage flows in axial fans as a source of loss is evaluated. The dimensionless loss is related to a range of dimensionless parameters by application of a jet loss theory. Vortex shedding models are presented. Theoretical predictions of lift coefficient reduction are compared with published experimental data for isolated rectangular plates, with experimental tests for a single airfoil adjacent to a wall with an oncoming boundary layer, and with correlations of the percentage reduction in total lift versus gap chord ratio. Author (ESA)

N80-17078# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Stabsabt. Programmvorbereitung.
TURBINE ENGINE RESEARCH AND TECHNOLOGY IN THE FEDERAL REPUBLIC OF GERMANY, VOLUME 1
Alf Loeffler. Dec. 1978. 188 p. refs. In GERMAN; ENGLISH summary. 2 Vol.
(DFVLR-Mitt-78-04) Avail: NTIS HC A09/MF A01; DFVLR, cologne DM 54.20

The economic importance of the technology of gas turbines, steam turbines, turbosuperchargers, and turbocompressors is cited relative to German industry and its share of the world market. The priorities for research and development are derived from the mission requirements of these engines. An extensive inquiry by questionaire and discussions with experts provided the foundation for a description of the current technological status and expected trends in this field. In addition, they served as a basis for the evaluation of a possible technological transfer. Conclusions are drawn with respect to the importance of technological progress for national economy, development of transportaion technology, defense technology, and energy economy. Author (ESA)

N80-17079# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Stabsabt. Programmvorbereitung.
TURBINE ENGINE RESEARCH AND TECHNOLOGY IN THE FEDERAL REPUBLIC OF GERMANY, VOLUME 2
Alf Loeffler. Dec. 1978. 167 p. refs. In GERMAN; ENGLISH summary. 2 Vol.
(DFVLR-Mitt-78-05) Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 51.40

The economic importance of the technology of gas turbines, steam turbines, turbosuperchargers, and turbocompressors is cited relative to German industry and its share of the world market. The priorities for research and development are derived from the mission requirements of those engines. An extensive inquiry by questionnaire and discussions with experts provided the foundation for a description of the current technological status and expected trends in this field. In addition they served as a basis for the evaluation of a possible technological transfer. Conclusions are drawn with respect to the importance of technological progress for national economy development of

transportation technology, defense technology, and energy economy. Author (ESA)

N80-17263 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
VIBRATIONS OF A COMPRESSOR BLADE WITH SLIP AT THE ROOT
David I. G. Jones and Agnieszka Muszynska (Polish Academy of Sciences, Warsaw) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 53-61 (For primary document see N80-17258 08-31)
Avail: NRL Tech. Inform. Div., Washington D.C.

N80-17265 Sikorsky Aircraft, Stratford, Conn.
DAMPING OF AN ENGINE EXHAUST STACK
John J. DeFelice and Ahid D. Nashif (Anatrol Corp., Cincinnati, Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 75-84 (For primary document see N80-17258 08-31)
Avail: NRL Tech. Inform. Div., Washington D.C.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-17080# SRI International Corp., Menlo Park, Calif.
PILOTED FLIGHT SIMULATION STUDY OF LOW-LEVEL WIND SHEAR, PHASE 4. ALL-WEATHER LANDING SYSTEMS, ENGINEERING SERVICES SUPPORT PROJECT, TASK 2 Interim Report, Apr. 1978 - Mar. 1979
W. H. Foy and W. B. Gartner Mar. 1979 148 p refs
(Contract DOT-FA75WA-3650; SRI Proj. 4364)
(AD-A077164; FAA-RD-79-84) Avail: NTIS HC A07/MF A01 CSCL 01/2

The fourth in a series of piloted DC10 flight simulation exercises concerned with the development and test of airborne techniques designed to aid the pilot in detecting and coping with low level wind shear are described. The exercise included validation tests of systems developed from the techniques that had shown the most promise in previous tests. Approach and landing situations were simulated, using manual control assisted by flight director. Takeoff trials were run against 5 wind profiles by the 3 project pilots. No good airborne means of coping with wind shear were found. R.C.T.

N80-17081*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
FLIGHT TESTS OF THE TOTAL AUTOMATIC FLIGHT CONTROL SYSTEM (TAFCOS) CONCEPT ON A DHC-6 TWIN OTTER AIRCRAFT
William R. Wehrend, Jr. and George Meyer Feb. 1980 73 p refs
(NASA-TP-1513; A-7901) Avail: NTIS HC A04/MF A01 CSCL 01C

Flight control systems capable of handling the complex operational requirements of the STOL and VTOL aircraft designs as well as designs using active control concepts are considered. Emphasis is placed on the total automatic flight control system (TACOS) (TAFCOS). Flight test results which verified the performance of the system concept are presented. J.M.S.

N80-17082# Honeywell Systems and Research Center, Minneapolis, Minn.
DIGITAL FLIGHT CONTROL SOFTWARE VALIDATION STUDY Final Report, Apr. 1978 - Apr. 1979
Edward R. Rang, Michael J. Gutmann, Dennis B. Mulcare, and William G. Ness Wright-Patterson AFB AFFDL Jun. 1979 257 p refs
(Contract F33615-78-C-3605)
(AD-A076021; HONEYWELL-79SRC18; AFFDL-TR-79-3076) Avail: NTIS HC A12/MF A01 CSCL 01/3

The problems of designing, verifying, and validating software for digital flight control systems are reviewed to study how the new software engineering tools and techniques may be incorporated into the development process. This shows how automated methodologies will provide error-free flight control software at lower costs. The need for expensive, lengthy test programs is reduced by analytical methods. The quality of the software is demonstrated with higher confidence when designs are structured to facilitate the subsequent verification steps. The military standards relating to flight control systems are reviewed, and modifications to include provisions for software verification are recommended. GRA

N80-17083# National Aeronautical Establishment, Ottawa (Ontario).
THEORETICAL ANALYSIS OF THE TRANSIENT RESPONSE OF A WING TO NON-STATIONARY BUFFET LOADS
B. H. K. Lee Apr. 1979 86 p refs
(AD-A073702; NAE-LR-597; NRC-17465) Avail: NTIS HC A05/MF A01 CSCL 20/4

A method for predicting the response of a wing to non-stationary buffet loads is presented. The wing is treated as a cantilever beam with known mass distribution. Using generalized co-ordinates, the vibration of the wing is governed by the second order mass-spring-damper oscillator equation. The buffet load on the wing is expressed as an integral of the sectional force, which is a function of the spanwise location and time. The non-stationary load is represented by the product of a deterministic time function and a statistically stationary random function. The time history of the applied load is segmented into a number of time intervals. Analytical expressions for the mean square response of the wing displacement are derived using a power spectral density for the random part of the applied load, similar to that used in the theory of isotropic turbulence. The effects of damping, ratio of the undamped natural frequency of the system to the half power frequency of the power spectral density, length of time segment, and duration of applied load on the response of the wing have been investigated for three examples of the load versus time histories. (GRA)

N80-17084# Universite des Sciences et Techniques de Lille (France).
INITIAL STUDY OF THE RESPONSE OF AN AIRCRAFT TO LATERAL GUSTS [RESPONSE DE L'AVION AUX RAFALES LATERALES. ETUDES EXPLORATOIRE]
J. L. Cocquerez and R. A. Verbrugge Paris Assoc. Aeron. et Astronautique de France 1979 37 p In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-03) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

The study of aircraft performance in turbulence, especially the response to lateral gusts, is required in order to optimize the use of automatic flight control systems. Those flight conditions emphasized include low altitude approach, landing with wind composed of transversal gusts, and stability at steep angles of attack at low speeds. The preponderant effects of gust loads vis-a-vis degrees of freedom, the roles of the various control surfaces of the aircraft, and the responses of different aircraft planforms are shown, leading to the modelization of these phenomena. Author (ESA)

N80-17085# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE IDENTIFICATION OF THE FLUTTER MECHANISM FROM A LARGE-ORDER FLUTTER CALCULATION
J. C. A. Baldock London HMSO Feb. 1978 48 p refs Supersedes RAE-TR-78017 and ARC-37871
(ARC-R/M-3832; ISBN-0-11-47116-8; RAE-TR-78017; ARC-37871) Avail: NTIS HC A03/MF A01; HMSO £5.00; PHI

The phase differences between degrees of freedom in a flutter calculation are discussed. From the study of phase variation with airspeed in binary systems, a technique is evolved for identifying the essential degrees of freedom in a large-order flutter calculation. This technique can be combined with a general flutter analysis in order to represent the flutter condition in a large-order flutter calculation with an equivalent two degree of freedom system. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-17086# Illinois Univ., Urbana. Dept. of Civil Engineering.
LONGITUDINAL JOINT SYSTEMS IN SLIP-FORMED RIGID PAVEMENTS. VOLUME 2: ANALYSIS OF LOAD TRANSFER SYSTEMS FOR CONCRETE PAVEMENTS Interim Report
R. M. Tabatabaie, E. J. Barenberg, and R. E. Smith. Nov. 1979. 192 p. refs.
(Contract DOT-FH-11-8474)
(AD-A078836; FAA-RD-79-4-2) Avail: NTIS HC A09/MF A01 CSCL 13/2

The theoretical evaluation of alternate joint systems are discussed. The findings and conclusions plus recommendations for implementation are given. Models are presented which form the basis for significantly improved design procedures for rigid pavements. These models and analysis techniques provide the tools for the design and analysis for various pavement systems with both longitudinal and transverse joint systems. R.C.T.

N80-17087# Vehicle Systems Development Corp., Upland, Calif.
DETAILED DESIGN AND FABRICATION OF A HELICOPTER GROUND MOBILITY SYSTEM (HGMS) Final Technical Report, Oct. 1977 - May 1979
Robert W. Forsyth, John P. Forsyth, Nathan N. Shiovitz, and Laurence E. Reinhart. Sep. 1979. 47 p. refs.
(Contract DAAJ02-77-C-0077)
(AD-A076932; VSDC-579/43; USARTL-TR-79-24) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report presents the results of a program for the design, fabrication, test, and demonstration of two identical engineering models of the Helicopter Ground Mobility System (HGMS). Task 1 resulted in a complete, detailed and documented design for the HGMS prime mover, skid-equipped helicopter adapter, and flotation track assemblies. In Task 2, the design was converted into hardware which, along with a device simulating the wheel-equipped UH-60A (Black Hawk) and YAH-64 (AAH) helicopters, was tested in Task 3 to demonstrate compliance with the requirement and specification for the HGMS. Minor changes, the need for which emerged from the test activity, were incorporated in the engineering models and design data during Task 3. In Task 4, the contractor prepared assessments of HGMS reliability and maintainability as well as estimates of requirements for logistics support. The total program described in this final report produced systems which clearly indicate that Army helicopters, both wheeled and skid-equipped, can be successfully transported between a forward area landing zone and a concealed larger area with no surface preparation and with a minimum of equipment and personnel. Moreover, the program demonstrated that a lightweight and helicopter-transportable HGMS answers the Army's long-standing need for helicopter ground mobility. GRA

N80-17088# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTS FOR THE REDUCTION OF WIND TUNNEL WALL INTERFERENCE BY ADAPTIVE-WALL TECHNOLOGY Final Report, Oct. 1977 - Sep. 1978
E. M. Kraft and R. L. Parker, Jr. AEDC, Arnold AFS, Tenn. Oct. 1979. 43 p. refs.
(AD-A076555; AEDC-TR-79-51) Avail: NTIS HC A03/MF A01 CSCL 20/4

Experiments were conducted in the AEDC Aerodynamic Wind Tunnel (1T) to evaluate the applicability of adaptive-wall technology to reduce wall interference in a transonic wind tunnel. Data were obtained on a six-percent-blockage, two-dimensional, NACA 0012 airfoil section with two different, adaptable porous wall configurations. One configuration featured variable longitudinal control of the local hole angle and the other featured global porosity control. The experiments demonstrated that adaptive-wall techniques could be used to significantly reduce wall interference effects. Although neither wall configuration could be adjusted to duplicate the pressure distributions (calculated at the tunnel boundary control surface with adaptive-wall technology) to produce interference-free conditions, matching the pressure level upstream of the model and minimum pressure in the vicinity of the model adequately reduced the wall interference. One of the most effective means for matching these global parameters was plenum pressure adjustment; thus, some refinement may be obtained through segmented plena control. GRA

N80-17089# Civil Aeronautics Board, Washington, D.C.
AIRPORT ACTIVITY STATISTICS OF CERTIFICATED ROUTE AIR CARRIERS Semiannual Report
31 Dec. 1978. 315 p. Prepared in cooperation with FAA, Washington, D.C.
(AD-A076194) Avail: NTIS HC A14/MF A01 CSCL 01/2

This report furnishes airport activity of the Certificated Route Air Carriers. Included in the data contained in table 6 are passenger enplanements, tons of enplaned freight, express, and mail. Both scheduled and non-scheduled service, and domestic and international operations are included. These data are shown by airport and carrier. Table 7 includes departures by airport, carrier and type of operation, and type of aircraft. GRA

N80-17090# Boeing Co., Wichita, Kans.
JET ENGINE DEMOUNTABLE TEST CELL EXHAUST SYSTEM PHASE: COANDA/REFRACTION NOISE SUPPRESSION CONCEPT, ADVANCED DEVELOPMENT
R. E. Ballard, W. F. Byers, and D. L. Armstrong. Apr. 1979. 91 p. refs.
(Contract N00014-76-C-1229)
(AD-A076253; D3-11527-1; NAEC-92-112) Avail: NTIS HC A05/MF A01 CSCL 01/5

The successfully demonstrated Coanda/refraction air-cooled exhaust noise suppressor system is applied to the Navy requirement for effective exhaust noise suppression in jet engine demountable test cells. The technical approach consists of analytical studies and one-sixth scale model tests using simulated afterburning engine exhaust. Revisions are made to the previously developed system to improve noise suppression capability while reducing the system overall size and initial cost. Revisions include moving secondary air inlets to reduce enclosure size and improve cooling, shortening the Coanda surface to provide more acoustically treated exhaust stack and providing variations in exhaust stack configuration such as single and dual acoustic splitters and acoustic wedges up the back wall. Extensive data were recorded and analyzed to identify the aerothermodynamic and acoustic trends related to these configuration changes. Results present recommendations for an air-cooled Coanda/refraction exhaust system for application to demountable test cells. GRA

N80-17091# Boeing Co., Wichita, Kans.
JET ENGINE CLASS C TEST CELL EXHAUST SYSTEM PHASE. COANDA/REFRACTION NOISE SUPPRESSION CONCEPT-ADVANCED DEVELOPMENT Technical Report, Oct. 1976 - Jan. 1977
R. E. Ballard and D. L. Armstrong. Lakehurst, N.J. Naval Air Engineering Center. May 1979. 89 p. refs.
(Contract N00140-76-C-1229)
(AD-A075277; D3-11500-1; NAEC-92-113) Avail: NTIS HC A05/MF A01 CSCL 20/1

The successfully demonstrated Coanda/refraction air-cooled exhaust noise suppressor system is applied to the Navy requirement for an effective air-cooled retrofit configuration for the class 'C' test cells (concrete enclosure). The technical approach consists of analytically sizing retrofit components to meet both acoustic and aerothermodynamic requirements and then testing at one-sixth scale using simulated afterburning engine exhaust to verify the design configuration. Model variations included exhaust stack height, exhaust stack inner flow passage configurations (straight walls and diffuser) and removal of a concrete internal partition wall. Extensive data were recorded and analyzed to identify the aerothermodynamic trends related to these configuration changes. Results present recommendations for an air-cooled Coanda exhaust noise suppression system for retrofit of Navy class 'C' test cells. GRA

N80-17092# National Aeronautical Establishment, Ottawa (Ontario)
A PERTURBATION THEORY OF TWO-DIMENSIONAL TRANSONIC WIND TUNNEL WALL INTERFERENCE
Y. Y. Chan. Apr. 1979. 27 p. refs.
(AD-A071167; NAE-LR-598; NRC-17476) Avail: NTIS HC A03/MF A01 CSCL 20/4

The wind tunnel wall interference in transonic speed is formulated as perturbation to the basic flow around the airfoil in free air. The perturbation equation is derived from the transonic small disturbance equation and is linear but with variable coefficients containing the non-linear solution of the basic flow. The equation is solved numerically by a direct matrix method using the classical boundary condition for a porous wall. The solution in terms of lift versus angle of attack agrees well with that calculated directly from the small disturbance equation.
GRA

N80-17093# Royal Aircraft Establishment, Bedford (England). Structures Dept.
THE REDUCTION OF DYNAMIC INTERFERENCE BY SOUND-ABSORBING WALLS IN THE RAE 3 FOOT WIND TUNNEL
D. G. Mabey. London: AMSO, Aug. 1977. 40 p. refs. Supersedes RAE-TR-77120 and ARC 37618
(ARC-R/M-3837; BR69024; ISBN-0-11-471170-4; RAE-TR-77120; ARC-37618) Avail: NTIS HC A03/MF A01; HMSO £ 5.00; PHI

A preliminary investigation made with temporatory test liners in a 3-ft by 3-ft tunnel confirms that there are significant advantages in using working sections with sound-absorbing walls for aeroelastic tests at subsonic and transonic speeds. In particular, tunnel resonances and flow unsteadiness can be reduced just as effectively in a large wind tunnel as in the small tunnel (4-in by 4-in) used for previous pilot tests. The reduction in flow unsteadiness obtained with sound-absorbing walls significantly improved wind buffeting measurements on an ordinary wind tunnel model.
Author (ESA)

N80-17094# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
THE INFLUENCE OF SIMULATOR MOTION WASH-OUT FILTERS ON THE PERFORMANCE OF PILOTS WHEN STABILIZING AIRCRAFT ATTITUDE IN TURBULENCE
M. F. C. VanGool. 1 Feb. 1978. 52 p. refs.
(NLR-TR-78022-U) Avail: NTIS HC A04/MF A01

The influence of simulator motion on the performance of four pilots when stabilizing an aircraft disturbed by turbulence in the pitch and roll axes was investigated. Pilot describing functions, remnant spectra, and a number of associated performance measures were determined for this compensatory tracking task. The results lead to the conclusion that for the task under consideration, no significant differences can be observed when the second-order high-pass wash-out filter break frequency in the pitch and roll degree of freedom is varied from 0.1 rad/sec to 0.5 rad/sec. However, performance in either condition is considerably better than results obtained fixed-based. This is also reflected in the pilot comments and effort ratings, stating that the task is easier with motion.
Author (ESA)

N80-17095# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
WIND TUNNELS AND TEST RIGS
P. Braushaw. Jul. 1979. 6 p. Supersedes IC-Aero-70-01
(IC-Aero-79-05; ISSN-0308-7247; IC-Aero-70-01) Avail: NTIS HC A02/MF A01

Dimensions and details are given for 14 test rigs, ranging from a water channel to a Mach 25 nitrogen tunnel. Data, in tabular form, is divided into three sections: low speed tunnels, high speed tunnels, and water test rigs. Summaries of operating conditions as well as remarks on special applications are included.
Author (ESA)

N80-17096# Royal Aircraft Establishment, Bedford (England). Structures Dept.
THE USE OF SOUND ABSORBING WALLS TO REDUCE DYNAMIC INTERFERENCE IN WIND TUNNELS
D. G. Mabey. London: HMSO, Nov. 1976. 74 p. refs. Supersedes RAE-TR-76157 and ARC-37438
(ARC-R/M-3831; ISBN-0-114-71164; RAE-TR-7615; ARC-37436) Avail: NTIS HC A04/MF A01; HMSO £ 7.00; PHI

A scheme for reducing dynamic interference in wind tunnel at subsonic and transonic speeds was tested in a pilot 4in x 4in tunnel. Two types of dynamic interference were considered: excitation of unwanted acoustic resonances within the working section and flow unsteadiness. The models used to establish the resonances in the working sections with hard walls were small circular cylinders operating in a subcritical Reynolds number range and thus generating discrete pressure fluctuations at the vortex shedding frequency. When the resonances were suppressed by the wall materials the pressure fluctuations agreed well with previous measurements made in a much larger, low speed wind tunnel and with predictions. The tests show that both types of interferences could be substantially reduced by replacing the conventional hard walls of a closed or a slotted working section by appropriate sound absorbing walls.
Author (ESA)

N80-17271 SRI International Corp., Menlo Park, Calif.
FINITE ELEMENT ANALYSIS OF MULTICOMPONENT STRUCTURES IN RIGID BARRIER IMPACTS
J. K. Gran, L. E. Schwer, J. D. Colton, and H. E. Lindberg. *In* The Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1978. p. 153-160. refs. (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-17097 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE 1979 JANNAF PROPULSION MEETING, VOLUME 1
Karen L. Strange, ed. Mar. 1979. 643 p. Meeting held at Anaheim, Calif., 6-8 Mar. 1979.
(Contract N00024-78-C-5384)
(AD-A075262; CPIA Pub-300-Vol-1) Avail: Issuing Activity CSCL 22/1

A collection of papers dealing with various aspects of ballistics missile propulsion is presented. Topics discussed include research, development, test, and engineering advancements in solid, liquid, ramjet, and gun propulsion systems. For individual titles, see N80-17098 through N80-17119.

N80-17098 Thiokol Corp., Elkton, Md.
MX CANISTER EJECT GAS GENERATOR **c20**
Donald R. Reed, E. Lynn Thomas, Joseph E. Reardon, and Winthrop L. Cummings. (Westinghouse Elec. Corp., Sunnyvale). *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p. 1-24 (For primary document see N80-17097 08-12)
(Contract F04704-75-C-0010)
Avail: Issuing Activity

Hot gas generator eject system studies and tests were conducted in support of the overall MX canister program. A hot gas generator was designed to pressurize the canister breech and eject the missile with specific axial dynamics. The resulting MX launch eject gas generator design was fabricated and statically tested to evaluate its high mass flow, high progressivity, and short burn characteristics. The same basic generator design and many components were then adapted to produce MX peashooter eject gas generators. MX peashooter launch tests successfully demonstrated the launch technique and produced energy loss information useful for more accurate prediction of eject system performance.
R.E.S.

N80-17099 Martin Marietta Corp., Denver, Colo.
MX BREAKOUT AND ERECTION SYSTEM DEVELOPMENT **c15**
Lorman T. Park. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p. 25-62 (For primary document see N80-17097 08-12)
(Contract F04704-77-C-0008)

Avail: Issuing Activity

The analysis, design and development effort leading to the full scale demonstration testing of the MX missile breakout and erection system is presented with emphasis on the actuators and gas generators. R.E.S.

N80-17100 Vought Corp., Dallas, Tex.
ALVRJ FLIGHT TEST PROGRAM SUMMARY **c15**
L. E. Pearson. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 63-82 (For primary document see N80-17097 08-12)
Avail: Issuing Activity

An advanced development flight test program of the Navy's air launched low volume ramjet (ALVRJ) was completed in 1976. The program resulted in five highly successful flight tests of an integral rocket ramjet (IRR) missile configuration through various simulated tactical flight profiles. The program successfully demonstrated IRR technology, established the performance capability of the ALVRJ configuration and provided environmental data operating in this high temperature, high dynamic pressure sustained flight regime. The flight test program is discussed including preparations and conduct of the tests, flight characteristics of the vehicle, performance math model simulation used for flight predictions, and data analysis techniques and routines used to define the performance capability of the subsystems as well as the total vehicle system. R.E.S.

N80-17101 Aerojet Solid Propulsion Co., Sacramento, Calif.
THE EFFECT OF PROPELLANT FORMULATION VARIABLES ON COMBUSTION STABILITY **c28**
G. A. Zimmerman and M. J. Ditore. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 83-99. refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity

The combustion stability results obtained during reduced smoke propellant development are reviewed and the effects of propellant formulation variables on pressure coupled combustion response, as obtained from T-burner tests, are presented. The data relate the effect of AP particle size, stability additive type, concentration, and particle size on combustion response. For some of the variables, the effects of frequency and pressure are shown. The laboratory burner tests correlated well with motor test firings. Author

N80-17102 Thiokol Corp., Huntsville, Ala. Huntsville Div.
EFFECTS OF FORMULATION VARIABLES ON THE COMBUSTION STABILITY CHARACTERISTICS OF SOME REDUCED SMOKE PROPELLANT **c28**
R. B. Kruse and D. W. Booth. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 99-118. ref (For primary document see N80-17097 08-12)
Avail: Issuing Activity

Three groups of reduced-smoke propellants were tested to evaluate the effects of formulation variables upon processing characteristics, tensile properties, burning rate, burning rate exponent, and nonsteady combustion behavior. The combustion stability characteristics of the propellants were considered along with a greatly simplified T-burner test procedure employed as a screening tool to rank a large number of propellants in at least a semi-quantitative fashion. The effects of such variables as oxidizer particle size distribution and incorporation of additives intended to enhance burning rate or stability characteristics upon the combustion response of the propellant are discussed. M.M.M.

N80-17103 Aerojet Solid Propulsion Co., Sacramento, Calif.
EQUILIBRIUM MODEL FOR SECONDARY SMOKE PREDICTION **c28**
James P. Coughlin. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 119-133. refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity

Correlation of equilibrium model predictions with measured secondary smoke in flight tests conducted at Eglin Air Force Base indicated an 87.5% prediction accuracy for both a double base minimum smoke propellant and a composite AP reduced smoke propellant. Also included in the correlation was an earlier series of ground launched flight tests with a rocket containing another composite AP propellant. Required input for the analysis and predictions includes chemical composition of the propellant, altitude, temperature and relative humidity of the ambient air, motor chamber pressure and nozzle dimensions, and missile velocity. M.M.M.

N80-17104 Army Missile Research and Development Command, Redstone Arsenal, Ala.
COMPARISON OF FLUORINE AND CHLORINE CONTAINING COMPOUNDS ON SECONDARY SMOKE FORMATION **c28**
M. T. Cucksee and H. C. Allen. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 135-143 (For primary document see N80-17097 08-12)
Avail: Issuing Activity

A series of propellants was designed to determine and compare effects of chlorine and fluorine, with and without heavy metals, on secondary smoke formation. It was concluded that secondary smoke formation by fluorine containing compounds does not appear to be a serious obstacle to their use in minimum smoke propellants. M.M.M.

N80-17105 Brunswick Corp., Lincoln, Nebr.
DEVELOPMENT OF A COMPOSITE MOTOR CASE FOR THE VIPER ANTITANK WEAPON SYSTEM **c20**
A. R. Cederberg. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 145-157 (For primary document see N80-17097 08-12)
(Contract DAAH01-76-C-0658)
Avail: Issuing Activity

A filament wound fiberglass/epoxy composite motor case was successfully developed for the VIPER tactical weapon system. This motor case can be mass produced at low cost while maintaining high reliability. Significant advances in the state of the art of filament winding and the design of filament wound components are provided along with the development of an improved structural joint technology for composite materials utilizing mechanical fasteners. Implementation of these concepts was accomplished through development of high speed numerically controled winding equipment and supporting computer software. M.M.M.

N80-17106 Boeing Aerospace Co., Huntsville, Ala. Army Systems Div.
ROCKET MOTOR PEAK NOISE REDUCTION PROGRAM **c20**
Charles R. Carter. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 159-185. refs (For primary document see N80-17097 08-12)
(Contract DAAK40-78-C-0038)
Avail: Issuing Activity

The design, test and analysis of two techniques being developed for reducing the peak noise produced by a shoulder-fired rocket weapon system are described. Tests verified that the peak noise produced by the M-72 rocket motor can be reduced at the gunner's position by 10 db with a baffled cylinder suppressor and by 1.3 db by aerodynamically shaping the nozzle closure. Analysis of the unsuppressed and suppressed peak noise generated by the M-72 rocket motor indicate that the peak noise in the near field is produced by the energy associated with a strong pressure wave that can be correlated with spherically symmetric point explosion data. The hardware test data base and analysis techniques developed provided a basis for the design of prototype field weight suppressor systems for protecting the gunner and crew from the intense peak noise produced by both man-portable and shoulder-fired rocket weapon systems. M.M.M.

N80-17107 Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnet Lab.
ELECTROMAGNETIC GUNS, LAUNCHERS AND REACTION ENGINES **c14**
Henry H. Kolm. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 329-346. refs (For primary document see N80-17097 08-12)
(Grant DAAG29-78-G-0147)
Avail: Issuing Activity

Electromagnetic acceleration is studied as an alternative to chemical propulsion. Systems considered include the dc rail gun

driven by energy stored inertially in a homopolar generator and transmitted through a switching inductor, and the synchronous mass driver energized by a high voltage alternator through an oscillating coil-capacitor circuit. A momentum transformer that transfers momentum from a massive, chemically propelled armature sabot to a much lighter, higher velocity projectile by magnetic flux compression is described. Among the potential applications are the acceleration of gram-size particles, terminal ballistic and impact fusion research, low powered STOL aircraft, and the launching of small space vehicles at high repetition rates. K.L.

N80-17108 Army Armament Research and Development Command, Dover, N. J.
CONTROLLING STOCKPILED PROPELLANT **c20**
Gayton Silvestro. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p. 347-358. refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity.
A program for evaluating the safety and performance of propellants stored in packs, building structures, and under various conditions of temperature and humidity is described. Laboratory tests include stabilizer content, heat stability, total volatiles, and closed bomb. Ballistic tests include charge establishment and uniformity. K.L.

N80-17109* Thiokol Corp., Brigham City, Utah. Wasatch Div.
SPACE SHUTTLE SRM DEVELOPMENT **c16**
I. C. Adams and F. W. Call. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p. 405-436. (For primary document see N80-17097 08-12)
(Contract NAS8-30490)
Avail: Issuing Activity. CSCL 22B.
The successful static testing of the fourth Space Shuttle Solid Rocket Motor (SRM) is described. Transportation and support equipment concepts and component reusability are demonstrated. The evolution of the SRM transportation support equipment and special test equipment designs are reviewed, and development activities are discussed. Handling and processing aspects of large, heavy components are reviewed briefly. K.L.

N80-17110* Rockwell International Corp., Downey, Calif. Space Systems Group.
IMPROVING PERFORMANCE OF THE SPACE SHUTTLE **c16**
D. L. Gerhardt and N. A. Bremberg. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p. 437-445. (For primary document see N80-17097 08-12)
(Contract NAS9-1400)
Avail: Issuing Activity. CSCL 22B.
The use of strap-on solids on either the solid rocket boosters or the external tank was studied. Relative feasibilities were defined and long range growth potentials were determined. K.L.

N80-17111 ARO, Inc., Arnold Air Force Station, Tenn. AEDC Div.
FACILITY REQUIREMENTS FOR IUS SOLID-PROPELLANT ROCKET MOTOR TESTING **c20**
F. D. Cantrell and C. H. Kunz. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p. 447-457. refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity. CSCL 21H.
The test facility requirements for the development and qualification testing of the Inertial Upper Stage (IUS) solid propellant rocket motors at simulated altitude conditions are reviewed. These requirements are: (1) maintain an environmental pressure such that nozzles with large area ratios will flow full throughout motor burn; (2) capture the exhaust gases from fixed nozzles and nozzles equipped with extendible exit cones gimbaling at large angles; (3) provide simulated altitude environment for motors ranging in thrust levels from 10,000 to 60,000 lbf with burn times up to 160 sec; (4) accurately determine ballistic performance; (5) temperature condition and test motors between 23 and 102 F; (6) temperature condition nozzle exit cones to -150 F before motor ignition; and (7) spin test motors with gross weights of 8,000 lbm and 25,000 lbf thrust at spin rates of 70 rpm. K.L.

N80-17112*# Vought Corp., Dallas, Tex.
AGING PROBLEMS IN GRAPHITE PHENOLIC NOZZLE LINERS **c20**
G. S. McCorkle. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p. 461-472. ref (For primary document see N80-17097 08-12)
(Contract NAS1-15100)
Avail: Issuing Activity. CSCL 21H.
Age related cracks in the graphite phenolic linear and/or ATJ insert in several nine year old Altair IIA solid rocket nozzles were investigated and determined to be limited to a single lot of nozzles. Test results and photomicrographs of fracture surfaces are presented which establish that in the discrepant nozzles the bond between the graphite fibers and the phenolic resin was tenacious, resulting in a nearly homogenous behavior. These materials are shown to have a relatively weak resin - fiber bond and behave more like a released fiber composite. Lot qualification fiber directional tensile strength and the chemical composition of the two materials were comparable, indicating that standard acceptance testing could not have differentiated between the desirable and undesirable material. Review of processing records failed to reveal any cause for the difference in the aging characteristics. K.L.

N80-17113* Vought Corp., Dallas, Tex.
SMALL ORBITAL TRANSFER VEHICLE FOR SHUTTLE OPERATIONS **c16**
Alfred I. Sibila. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p. 473-488. (For primary document see N80-17097 08-12)
(Contract NAS8-32710)
Avail: Issuing Activity. CSCL 22B.
Small orbital transfer vehicles to place payloads in orbits with altitudes above those of the standard Shuttle operation are studied. Low energy earth orbits below those of the planned spinning solid upper stages are addressed. Tandem and clustered solids are considered along with controlled solids, monopropellant and bipropellant liquids, and staged solid/liquid combinations. The performance, airborne support equipment, and program costs for the selected candidate concepts are presented. The results show that the most economical way to deliver the low energy payloads is with a modular liquid bipropellant stage system for the large majority of the payloads. The remainder of the payloads would use the Shuttle with integral OMS and Scout from WTR for a few specialized payloads until the Shuttle is operational at WTR. K.L.

N80-17114 Martin Marietta Corp., Denver, Colo.
PROPULSION CONCEPTS FOR SPACE TRANSFER OF LARGE SPACE STRUCTURES **c20**
W. E. Pipes. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p. 489-511. refs (For primary document see N80-17097 08-12)
(Contract F04701-77-C-0180)
Avail: Issuing Activity. CSCL 21H.
Large space structures that will carry solar cell arrays, highpowered communications relay antennas and large aperture sensor systems are considered and evaluated. The propulsion requirements are discussed and the propulsion systems that are compatible with deployable large space structures are defined. The propulsion concept, propellant, configuration, performance capabilities, and state of development are described. R.C.T.

N80-17115* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STATUS OF FLUORINE/HYDRAZINE PROPULSION SYSTEMS TECHNOLOGY FOR PLANETARY MISSIONS **c20**
D. L. Bond and G. W. Kruger. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p. 513-527. refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity. CSCL 21H.
The technology readiness of a high performance, liquid, space storable propulsion system is discussed. Both the design and analysis of a typical flight system and a demonstration system are described. The demonstration system was fabricated and tested to establish the credibility of the systems design. All

identified safety concerns were addressed, and a positive endorsement was obtained for the system. The effort was very successful in that the system design appears feasible and was not radically different from previously flown spacecraft. No significant technical system problems were identified, and this fluorine/hydrazine system was included in premission studies for upcoming missions. R.C.T.

N80-17116* Jet Propulsion Lab., California Inst. of Tech., Pasadena. Applied Mechanics Div.
A SUMMARY AND UPDATE OF THE CONFIGURATION AND TEMPERATURE CONTROL STUDIES FOR A FLUORINE-HYDRAZINE PROPULSION SYSTEM **c20**
J. W. Stultz and R. A. Grippi. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 529-556. ref (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity. CSCL 21H
An integral tank design which combines the fluorine and helium pressurant tanks and two structural support concepts which significantly reduces the conductive thermal load are presented. Results of recent shield development testing which show that a hybrid shadow shield configuration reduces the radiation load to an acceptable value are discussed. Examples of spacecraft configuration changes necessary for a space storable propellant, as compared to an earth storable propellant, are given. Some general space storable spacecraft configuration guidelines are recommended for future mission planning. R.C.T.

N80-17117* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROGRESS ON A LIQUID FLUORINE-HYDRAZINE ROCKET ENGINE THRUST CHAMBER ASSEMBLY **c20**
M. A. Appel. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 557-582. refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity. CSCL 21H
The status of the 3560-N (800 lbf) rocket engine thrust chamber assembly for the space storable systems technology program is discussed. Specific items covered include sea level test results, analytical methods, carbon-carbon composite chambers and the problems encountered. R.C.T.

N80-17118* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MATERIALS COMPATIBILITY WITH FLUORINE **c28**
L. R. Toth, J. C. Lewis, and C. M. Moran. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 583-606. refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity. CSCL 21I
Materials compatibility information and results with liquid fluorine propellant are presented. Titanium alloy, 6A1-4V, was investigated for application on a fluorine-hydrazine propulsion system. The data show that the alloy is satisfactory for this application. R.C.T.

N80-17119* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONTROL COMPONENT DEVELOPMENT FOR A FLUORINE-HYDRAZINE PROPULSION SYSTEM **c20**
R. S. Weiner, C. A. Solis, and R. Hagler, Jr. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 607-633. refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity. CSCL 21H
The development of control components for fluorine systems is discussed. The pyrotechnic valve for propellant isolation during a spacecraft's cruise mode is emphasized. The survivability of the valve with fluorine is described when either squib reaction products or sheared particulates become exposed to the propellant. The valves (normally closed and normally open) feature 1.27 cm ports and are sized for a 3560-N thrust engine. The results obtained from tests of these valves with helium gas, liquid nitrogen, and fluorine are presented. R.C.T.

N80-17120*# National Aeronautics and Space Administration, Washington, D. C.
RESEARCH PROJECT MAURETANIA: SATELLITES AS DEVELOPMENT AIDS
Rupert Haydn, Helmut Bonarius, and Manfred Schramm. Feb. 1980. 18 p. Transl. into ENGLISH from Bild Wiss. (West Germany), no. 11, 1979. p 151-161. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76064) Avail: NTIS. HC A02/MF A01. CSCL 22A
A general discussion is presented of how satellite images and ground surveys are used to define land use. Specifically it deals with the Tagant region in Mauretania, West Africa. R.C.T.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories, and orbit and launching dynamics.

N80-17121*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A GENERAL TIME ELEMENT USING CARTESIAN COORDINATES: ECCENTRIC ORBIT INTEGRATION
Guy Janin. Jan. 1980. 18 p. refs
(NASA-TM-80942; JSC-16313) Avail: NTIS. HC A02/MF A01. CSCL 22A
A general time element, valid with any arbitrary independent variables, and used with Cartesian coordinates for the integration of the elliptic motion in orbits, is examined. The derivation of the time element from a set of canonical elements of the Delaunay type, developed in the extended phase space, is presented. The application of the method using an example of a transfer orbit for a geosynchronous mission is presented. The eccentric and elliptic anomaly are utilized as the independent variable. The reduction of the in track error resulting from using Cartesian coordinates with the time element is reported. A.W.H.

N80-17122*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. Mission Planning and Analysis Div.
HP-9825A HFRMP TRAJECTORY PROCESSOR (#TRAJ). DETAILED DESCRIPTION
S. M. Kindall. Jan. 1980. 277 p.
(NASA-TM-80941; JSC-6397; Rept-80-FM-9) Avail: NTIS. HC A13/MF A01. CSCL 22A
The computer code for the trajectory processor (#TRAJ) of the high fidelity relative motion program is described. The #TRAJ processor is a 12-degrees-of-freedom trajectory integrator (6 degrees of freedom for each of two vehicles) which can be used to generate digital and graphical data describing the relative motion of the Space Shuttle Orbiter and a free-flying cylindrical payload. A listing of the code, coding standards and conventions, detailed flow charts, and discussions of the computational logic are included. A.R.H.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters, and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-17107 Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnet Lab.
ELECTROMAGNETIC GUNS, LAUNCHERS AND REACTION ENGINES
Henry H. Kolm. *In* APL. The 1979 JANNAF Propulsion Meeting, Vol. 1. Mar. 1979. p 329-346. refs (For primary document see N80-17097 08-12)
(Grant DAAG29-78-G-0147)
Avail: Issuing Activity

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles, and space stations.

N80-17123*# LinCom Corp., Pasadena, Calif.
A GROUND BASED PHASE CONTROL SYSTEM FOR THE SOLAR POWER SATELLITE, VOLUME 4 Final Report
C. M. Chie. Jan. 1980. 66 p. refs.
(Contract NAS9-15782)
(NASA-CR-160458; TR-0180-0779) Avail: NTIS HC A04/MF A01 CSCL 22B

A ground phase control system is studied as an alternative approach to the current reference retrodirective phase control system in order to simplify the spaceborne hardware requirement. Based on waveform selections, functional subsystems to implement the ground-based phase control concept are identified and functionally represented. It was concluded that the feasibility of the concept becomes unclear if the conditions of the ionosphere and satellite motion are not met. M.M.M.

N80-17124# Research Inst. of National Defence, Linkoeping (Sweden).
CURRENT SOVIET SPACE PROGRAMS [NAAGRA UPPGIFTER OM AKTUELLA SOVJETISKA SATELLITERS VERKSAMHET]
Astrid Rundkwist. Feb. 1979. 40 p. refs. In SWEDISH
(FOA-C-30160-F4) Avail: NTIS HC A03/MF A01

A discussion of the Soviet space program is presented. The utility of satellites for the study of meteorological phenomena, and in the manufacturing of optical materials and metal alloys under zero gravity conditions is shown. Author (ESA)

N80-17125# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
GEOS 3. VOLUME 1: EXECUTIVE SUMMARY Final Report
T. Kilvington, P. D. Matthews, P. Vangasse, P. Braund, T. Morley, E. Crellin, J. Pope, F. G. Harding, L. Virdee, and A. P. Vickery. Mar. 1979. 181 p. refs. 3 Vol.
(Contract ESA-3811/78-NL-MS)
(ESS/SS-922-Vol-1; ESA-CR(P)-1226-Vol-1) Avail: NTIS HC A09/MF A01

The technical aspects of the GEOS 3 which is to be launched on Ariane in tandem with another spacecraft by 1983 are discussed. Four distinct mission options are investigated and the feasibility of each option is discussed. The options are: a near polar lunar orbiter; a lunar orbiter with a transfer trajectory similar to that of option one; an operational orbit with the apogee lying about a lunar distance in the opposite direction to the sun; and the exploration of the far reaches of the magnetotail by orbiting the L2 point of the Earth-Sun system. Proposed configurations are described, as well as the sensor options for all missions. The rate of scientific return and other parameters used to compare mission effectiveness are discussed. Author (ESA)

N80-17126# Research Inst. of National Defence, Linkoeping (Sweden).
DIMENSIONING OF LV-RB TYPE 3 MISSILE AND PARAMETER STUDY OF RB BEHAVIOR BY SIMULATING WITH A COMPUTER [DIMENSIONERING AV LVRB TYP 3 SAMT PARAMETERSTUDIER AV RB-UPPFOERANDE GENOM SIMULERING I CSMP]
Kurt Andersson, John Sundelin, and Erik Aastroem. Jul. 1979. 38 p. refs. In SWEDISH
(FOA-C-20309-E3) Avail: NTIS HC A03/MF A01

An approximate dimensioning of body and components of LV-RB missiles is discussed. A computer simulation with the continuous system modelling program (CSMP) was run, obtaining the performance characteristics for each case. Three types of missiles were considered, dependent upon target velocity and position. A set of charts and tables showing the estimated flight performance of the missiles is presented. Author (ESA)

N80-17127# Research Inst. of National Defence, Linkoeping (Sweden).
COMPUTER PROGRAM FOR ANALYSIS OF SPEED AND RANGE FOR A GIVEN MISSILE WITH A KNOWN THRUST TIME DIAGRAM [CSMP-PROGRAM FOER ANALYS AV HASTIGHET OCH RAECKVIDD FOER GIVEN ROBOT MED GIVEN DRAGKRAFTPROGRAM]
Erik Aastroem. Jul. 1979. 23 p. refs. In SWEDISH
(FOA-C-20310-E3) Avail: NTIS HC A02/MF A01

The continuous system modeling program (CSMP) is described. The use of the program to simulate missile parameters such as velocity and range is discussed. Acceleration diagrams and lateral distance covering are discussed. The program is derived from the basic equations, from which a block diagram is developed. Each block represents a mathematical operation. Examples in the form of tables and diagrams are presented. Author (ESA)

N80-17128# Research Inst. of National Defence, Linkoeping (Sweden).
COLLIMATION CONTROL LIMITS FOR LVRB TYPE 3 MISSILES KOLLIMATIONSSTRYNINGSBEGRAENSINGAR, LVRB TYP 3]
Goesta Hall, Goeran Lyman, and Inga Nordstroem. Jul. 1979. 44 p. refs. In SWEDISH
(FOA-C-20311-E3) Avail: NTIS HC A03/MF A01

The limits of acceleration, velocity in the proximity of the target, and sight angle for collimation controlled LV missiles were studied to examine the influence of the target and missile parameters on the surface covering of collimation controlled missiles. Results in the form of charts and tables are presented for four different types of missiles. Author (ESA)

N80-17129# Research Inst. of National Defence, Linkoeping (Sweden).
COLLIMATION CONTROL KINEMATICS [KOLLIMATIONS-STYRNINGSKINEMATIK]
Jonas Agerberg. Jul. 1979. 16 p. refs. In SWEDISH
(FOA-C-20312-E3) Avail: NTIS HC A03/MF A01

A computer program which determines the tangential acceleration and sight angle of a collimation controlled missile approaching a target is described. Limiting values of the variables associated with this type of missile control are examined. Radial and tangential accelerations, and the coordinates of missile and target, entered at the computer terminal as initial data are discussed. The results are presented in tabular form using the horizontal distance as an independant parameter. Author (ESA)

N80-17130# Research Inst. of National Defence, Linkoeping (Sweden).
KINEMATIC MODEL FOR COLLIMATION CONTROLLED AIR DEFENSE MISSILE (KINK) [KINEMATISK MODELL FOER KOLLIMATIONSSTYRD LUFTVAERNSROBOT (KINK)]
Goeran Lyman and Inga Nordstroem. Jul. 1979. 48 p. refs. In SWEDISH
(FOA-C-20313-E3) Avail: NTIS HC A03/MF A01

A mathematical model which describe the trajectory of a collimation controlled air defense missile is presented. The mode is three dimensional and assumes that the missile is assumed to be kinematic and always in line of sight of the target. The description of the trajectory is integrated from the thrust diagram and air resistance, taking into account the variation derived from altitude and velocity. Two simulation programs, differing in language, integration ability, and information produced are discussed. Author (ESA)

N80-17131# Research Inst. of National Defence, Linkoeping (Sweden).
SIDE-LOOKING TARGET SEEKING MISSILE GUIDANCE SYSTEMS [INVERKAN PAA ETT SYFTBAERINGSMAALSOEKANDE ROBOTSYSTEMS TAEKNINGSOMRAADE AV MAALSOEKARENS SNGDTITTNINGSFOERMAAGA]
Aake Assarsson. Jul. 1979. 19 p. refs. In SWEDISH
(FOA-C-20314-E3) Avail: NTIS HC A02/MF A01

The influence of the side looking feature of a missile guidance system on its field of vision at both constant and changing velocities is described. Examples of limitations are given for a missile with a given speed curve using a kinematic model of a target seeking missile. Rules for calculating the limits of

the fluid of vision for a variable velocity missile are presented. For the above cases the target is moving on a straight trajectory at a constant speed. In the case of a maneuvering target, calculations become difficult and limit determinations must be made by simulation rather than modeling. Author (ESA)

N80-17132# Research Inst. of National Defence, Linkoeping (Sweden).
ALTERNATIVE STEERING PRINCIPLES FOR LVRR MISSILES [NAAGRA ALTERNATIVA STYRPRINCIPIER FOER LVR]
Magnus Herolf Jul. 1979 23 p refs In SWEDISH
(FOA-C-20319-E3) Avail: NTIS HC A02/MF A01

A preliminary study of some aspects of missile steering is presented. The estimation of target trajectory and target recognition were investigated using regression analysis and adaptive Kalman filters. Application of nonlinear prediction is discussed. Some steering techniques are analyzed, including the control of the tangent acceleration and steering towards the predicted collision point. Author (ESA)

N80-17099 Martin Marietta Corp., Denver, Colo.
MX BREAKOUT AND ERECTION SYSTEM DEVELOPMENT
Loman T. Park *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 25-62 (For primary document see N80-17097 08-12)
(Contract F04704-77-C-0008)
Avail: Issuing Activity

N80-17100 Vought Corp., Dallas, Tex.
ALVRJ FLIGHT TEST PROGRAM SUMMARY
L. E. Pearson *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 63-82 (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17302*# Raytheon Co., Bedford, Mass. Missile Systems Div.
SHOCK ISOLATION PLATFORM FOR SEASPARROW LAUNCHER
Paul V. Roberts *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 85-95 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 16A

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-17133*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE SOLID ROCKET BOOSTER COST-PER-FLIGHT ANALYSIS TECHNIQUE
J. Alan Forney Dec. 1979 172 p
(NASA-TM-78259) Avail: NTIS HC A08/MF A01 CSCL 20H

A cost per flight computer model is described which considers: traffic model, component attrition, hardware useful life, turnaround time for refurbishment, manufacturing rates, learning curves on the time to perform tasks, cost improvement curves on quantity hardware buys, inflation, spares philosophy, long lead, hardware funding requirements, and other logistics and scheduling constraints. Additional uses of the model include assessing the cost per flight impact of changing major space shuttle program parameters and searching for opportunities to make cost effective management decisions. R.C.T.

N80-17109* Thiokol Corp., Brigham City, Utah. Wasatch Div.
SPACE SHUTTLE SRM DEVELOPMENT
I. C. Adams and F. W. Call *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 405-436 (For primary document see N80-17097 08-12)
(Contract NAS8-30490)
Avail: Issuing Activity CSCL 22B

N80-17110* Rockwell International Corp., Downey, Calif. Space Systems Group.
IMPROVING PERFORMANCE OF THE SPACE SHUTTLE
D. L. Gerhardt and N. A. Bremberg *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 437-445 (For primary document see N80-17097 08-12)
(Contract NAS9-1400)
Avail: Issuing Activity CSCL 22B

N80-17113* Vought Corp., Dallas, Tex.
SMALL ORBITAL TRANSFER VEHICLE FOR SHUTTLE OPERATIONS
Alfred I. Sibila *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 473-488 (For primary document see N80-17097 08-12)
(Contract NAS8-32710)
Avail: Issuing Activity CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-17134*# National Aeronautics and Space Administration, Washington, D. C.
SPACECRAFT FOR FLIGHT IN THE ATMOSPHERE OF VENUS
G. M. Moskalenko Feb. 1980 13 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 4, Jul. - Aug. 1979 p 21-26 Transl. by JPRS, Arlington, Va.
(NASA-TM-75932) Avail: NTIS HC A02/MF A01 CSCL 22B

Possible configurations of space vehicles which would be delivered to Venus by rocket system in order to autonomously carry out flights in an automatic (and possibly piloted) mode are considered with respect to mission and flight altitude. Base (high altitude) vehicles, operating at pressure, sendity, and temperature corresponding to those on Earth at sea level, will have little maneuverability, will serve as carriers for equipment, scientific devices, and other cargo, and will study the gas composition of the Venus atmosphere from above. Low altitude vehicles will explore the planet from flight altitude in the vicinity of the planet's surface, as well as land on it. Analogous to deep submergence vehicles such as the bathyscaphe and the bathyplane, they will have a certain amount of maneuverability and will study the atmospheric boundary layer from below. The advantages of aerostats in this environment are discussed. Drawings of the aerostatic base station, the variable-length aerostatic sing vehicle, and the hybrid aerostatic vehicle with attached wings are included. A.R.H.

N80-17135*# Kollmorgen Corp., Radford, Va. Research and Development Center.
LABORATORY SIMULATION OF IRRADIATION-INDUCED DIELECTRIC BREAKDOWN IN SPACECRAFT CHARGING
Final Report, 1 Apr. 1977 - 30 Nov. 1979
Edward J. Yadlowsky, Russell J. Churchill, and Robert C. Hazelton
13 Feb. 1980 53 p refs
(Grant NsG-3145)
(NASA-CR-162762) Avail: NTIS HC A04/MF A01 CSCL 22B

The discharging of dielectric samples irradiated by a beam of monoenergetic electrons is investigated. The development of a model, or models, which describe the discharge phenomena occuring on the irradiated dielectric targets is discussed. The electrical discharge characteristics of irradiated dielectric samples are discussed and the electrical discharge paths along dielectric surfaces and within the dielectric material are determined. The origin and destination of the surface emitted particles is examined and the charge and energy balance in the system is evaluated. A.W.H.

N80-17254 Hughes Aircraft Co., El Segundo, Calif.
TRANSFER FUNCTION APPLICATIONS TO SPACECRAFT STRUCTURAL DYNAMICS
J. R. Fowler and E. Dancy (Hewlett-Packard Co., Los Angeles) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 93-101 refs (For primary document see N80-17247 08-31)
(Contract IS-774)
Avail: NRL Tech. Inform. Div., Washington, D.C.

N80-17281 Martin Marietta Corp., Denver, Colo.
USE OF A SHOCK SPECTRA TO EVALUATE JITTER OF A FLEXIBLE MANEUVERING SPACECRAFT
William J. Kacena *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 39-47 refs (For primary document see N80-17275 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-17136*# National Aeronautics and Space Administration, Washington, D. C.
GLOSSARY OF TERMS AND TABLE OF CONVERSION FACTORS USED IN DESIGN OF CHEMICAL PROPULSION SYSTEMS
Russell B. Keller, Jr., comp. Oct. 1979 89 p
(NASA-SP-8126) Avail: NTIS HC A05/MF A01 CSCL 21H

The glossary presented is based entirely on terms used in the monographs on Chemical Propulsion. Significant terms relating to material properties and to material fabrication are presented. The terms are arranged in alphabetical order, with multiple word terms appearing in the normal sequence of usage; for example, ablative cooling appears as such, not as cooling, ablative, and lip seal appears as such, not as seal, lip. Conversion Factors for converting U.S. customary units to the International System of Units are presented in alphabetical order of the physical quantity (e.g., density, heat flux, specific impulse) involved. M.M.M.

N80-17137*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
PHYSICAL PHENOMENA IN MERCURY ION THRUSTERS
Annual Report, 1 Dec. 1978 - 1 Dec. 1979
Paul J. Wilbur Dec. 1979 146 p refs
(Grant NGR-06-002-112)
(NASA-CR-159784) Avail: NTIS HC A07/MF A01 CSCL 21C

Experimental tests results demonstrating that reductions in screen grid thickness enhance the performance of ion thruster grids are presented. Shaping of the screen hole cross section is shown on the other hand not to affect performance substantially. The effect of the magnetic field in the vicinity of the hollow cathode on cathode performance is studied and test results are presented that show reductions in keeper voltages of a few volts can be realized by judicious applications of fields on the order of 100 gauss. The plasma downstream of a SERT 2 thruster operating without high voltage is studied. A model describing electron escape from the thruster under these conditions is discussed. A model defining the performance of the baffle aperture of an ion thruster is refined and experimental verification of the model is undertaken. Author

N80-17138*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ANALYTICAL INVESTIGATION OF TWO HYDROGEN OXYGEN ROCKET ENGINE SYSTEMS FOR LOW-THRUST APPLICATION
Dean D. Scheer 1980 17 p refs Presented at JANNAF Propulsion Meeting, Monterey, Calif., 11-13 Mar. 1980
(NASA-TM-81420; E-343) Avail: NTIS HC A02/MF A01 CSCL 21H

Two hydrogen oxygen rocket engine system concepts were analyzed parametrically over a thrust range from 100 to 1000 pounds and a chamber pressure range from 175 to 1000 psia. Both concepts were regeneratively cooled with hydrogen and were pump fed by electric motor driven positive displacement pumps. Electric power was provided by either a turboalternator (turboalternator concept) or some means external to the engine system (auxiliary power concept). The turboalternator concept is discussed. The computer program used to conduct the analyses along with the design characteristics of the major engine system components is described. The feasible design range of the systems over the parametric range of thrust is discussed in terms of allowable chamber pressure. Engine system estimated performance, mass, and dimensional envelope parametric data within the feasible design range are presented. A.W.H.

N80-17139*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SOLID ROCKET BOOSTER THRUST VECTOR CONTROL SUBSYSTEM VERIFICATION TEST (V-2) REPORT
Boris Pagan Dec. 1979 174 p
(NASA-TM-78258) Avail: NTIS HC A08/MF A01 CSCL 21H

The results of the verification testing sequence V-2 performed on the space shuttle solid rocket booster thrust vector control subsystem are presented. A detailed history of the hot firings plus additional discussion of the auxiliary power unit and the hydraulic component performance is presented. The test objectives, data, and conclusions are included. R.C.T.

N80-17140*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
FINITE ELEMENT MODELS OF THE SPACE SHUTTLE MAIN ENGINE
G. R. Muller Jan. 1980 70 p refs
(NASA-TM-78260) Avail: NTIS HC A04/MF A01 CSCL 21H

Finite element models were developed as input to dynamic simulations of the high pressure fuel turbopump (HPFTP), the high pressure oxidizer turbopump (HPOTP), and the space shuttle main engine (SSME). Descriptions are provided for the five basic finite element models: HPFTP rotor, HPFTP case, HPOTP rotor,

HPOTP case, and SSME (excluding turbopumps). Modal results are presented for the HPFTP rotor, HPFTP case, HPOTP rotor, coupled HPFTP rotor and case, HPOTP case, coupled HPOTP rotor and case, SSME (excluding turbopumps), and SSME (including turbopumps). Results for the SSME (including turbopumps) model are compared to data from a SSME HPOTP modal survey. R.C.T.

N80-17141*# Rocketdyne, Canoga Park, Calif.
ADVANCED COOLING TECHNIQUES FOR HIGH-PRESSURE HYDROCARBON-FUELED ENGINES Final Report, Aug. 1978 - Oct. 1979
R. T. Cook Oct. 1979 230 p refs
(Contract NAS3-21381)
(NASA-CR-159790; RI/RD79-310) Avail: NTIS HC A11/MF A01 CSCL 21H

The regenerative cooling limits (maximum chamber pressure) for O2/hydrocarbon gas generator and staged combustion cycle rocket engines over a thrust range of 89,000 N (20,000 lbf) to 2,669,000 N (600,000 lbf) for a reusable life of 250 missions were defined. Maximum chamber pressure limits were first determined for the three propellant combinations (O2/CH4, O2/C3H8, and O2/RP-1 without a carbon layer (unenhanced designs). Chamber pressure cooling enhancement limits were then established for seven thermal barriers. The thermal barriers evaluated for these designs were: carbon layer, ceramic coating, graphite liner, film cooling, transpiration cooling, zoned combustion, and a combination of two of the above. All fluid barriers were assessed a 3 percent performance loss. Sensitivity studies were then conducted to determine the influence of cycle life and RP-1 decomposition temperature on chamber pressure limits. Chamber and nozzle design parameters are presented for the unenahanced and enhanced designs. The maximum regenerative cooled chamber pressure limits were attained with the O2/CH4 propellant combination. The O2/RP-1 designs relied on a carbon layer and liquid gas injection chamber contours, short chamber, to be competitive with the other two propellant combinations. This was attributed to the low decomposition temperature of RP-1. R.C.T.

N80-17142*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLUME CHARACTERIZATION OF A ONE-MILLIPOUND SOLID TEFLON PULSED PLASMA THRUSTER, PHASE 2 Final Report, 1 Mar. 1978 - 30 Apr. 1979
L. K. Rudolph, K. G. Harstad, L. C. Pless, and R. M. Jones Sep. 1979 150 p refs Sponsored by NASA
(Contracts F04611-78-X-0034; F04611-79-X-0026)
(NASA-CR-162786; JPL-Pub-79-105; AFRPL-TR-79-60) Avail: NTIS HC A07/MF A01 CSCL 21H

Measurements of the pulsed plasma thruster (PPT) plume upstream mass flux were made in the Molecular Sink (MOLSINK) vacuum facility in order to minimize the plume-tank wall reflected mass flux. Using specially designed collimators on 4 rows of Quartz Crystal Microbalanced (QCMs) mounted on a support extending radially away from the plume axis, measurements were made of the mass flux originating in a thin slice of the PPT primary plume at an arbitrary dip angle with respect to the thruster axis. The measured and analytically corrected mass flux from particles reflected from the MOLSINK walls was substracted from the collimated QCM measurements to improve their accuracy. These data were then analytically summed over dip angle to estimate the total plume backflow upstream of the thruster nozzle. The results indicate that the PPT backflow is of order 10 to the minus 10th power g/square cm/pulse in the region from 38 to 86 cm from the PPT axis in the nozzle exit plane. This flux drops with the square of the radial distance from the PPT axis and is comparable to the backflow of an 8 cm ion thruster, which has performance characteristics similar to those of the PPT. R.C.T.

N80-17098 Thiokol Corp., Elkton, Md.
MX CANISTER EJECT GAS GENERATOR
Donald R. Reed, E. Lynn Thomas, Joseph E. Reardon, and Winthrop L. Cummings (Westinghouse Elec. Corp., Sunnyvale) *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 1-24 (For primary document see N80-17097 08-12)
(Contract F04704-75-C-0010)
Avail: Issuing Activity

N80-17105 Brunswick Corp., Lincoln, Nebr.
DEVELOPMENT OF A COMPOSITE MOTOR CASE FOR THE VIPER ANTITANK WEAPON SYSTEM
A. R. Cederberg *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 145-157 (For primary document see N80-17097 08-12)
(Contract DAAH01-76-C-0658)
Avail: Issuing Activity

N80-17106 Boeing Aerospace Co., Huntsville, Ala. Army Systems Div.
ROCKET MOTOR PEAK NOISE REDUCTION PROGRAM
Charles R. Carter *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 159-185 refs (For primary document see N80-17097 08-12)
(Contract DAAK40-78-C-0038)
Avail: Issuing Activity

N80-17108 Army Armament Research and Development Command, Dover, N. J.
CONTROLLING STOCKPILED PROPELLANT
Gayton Silvestro *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 347-358 refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17111 ARO, Inc., Arnold Air Force Station, Tenn. AEDC Div.
FACILITY REQUIREMENTS FOR IUS SOLID-PROPELLANT ROCKET MOTOR TESTING
F. D. Cantrell and C. H. Kunz *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 447-457 refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity CSCL 21H

N80-17112*# Vought Corp., Dallas, Tex.
AGING PROBLEMS IN GRAPHITE PHENOLIC NOZZLE LINERS
G. S. McCorkle *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 461-472 ref (For primary document see N80-17097 08-12)
(Contract NAS1-15100)
Avail: Issuing Activity CSCL 21H

N80-17114 Martin Marietta Corp., Denver, Colo.
PROPULSION CONCEPTS FOR SPACE TRANSFER OF LARGE SPACE STRUCTURES
W. E. Pipes *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 489-511 refs (For primary document see N80-17097 08-12)
(Contract F04701-77-C-0180)
Avail: Issuing Activity CSCL 21H

N80-17115* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STATUS OF FLUORINE/HYDRAZINE PROPULSION SYSTEMS TECHNOLOGY FOR PLANETARY MISSIONS
D. L. Bond and G. W. Kruger *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 513-527 refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

N80-17116* Jet Propulsion Lab., California Inst. of Tech., Pasadena. Applied Mechanics Div.
A SUMMARY AND UPDATE OF THE CONFIGURATION AND TEMPERATURE CONTROL STUDIES FOR A FLUORINE-HYDRAZINE PROPULSION SYSTEM
J. W. Stultz and R. A. Grippi *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 529-556 ref (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

N80-17117* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROGRESS ON A LIQUID FLUORINE-HYDRAZINE ROCKET ENGINE THRUST CHAMBER ASSEMBLY
M. A. Appel. *In* APL. The 1979 JANNAF Propulsion Meeting. Vol. 1. Mar. 1979. p. 557-582. refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity. CSCL 21H

N80-17119* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONTROL COMPONENT DEVELOPMENT FOR A FLUORINE-HYDRAZINE PROPULSION SYSTEM
R. S. Weiner, C. A. Solis, and R. Hagler, Jr. *In* APL. The 1979 JANNAF Propulsion Meeting. Vol. 1. Mar. 1979. p. 607-633. refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity. CSCL 21H

N80-17279 Ballistic Research Labs., Aberdeen Proving Ground, Md.
ROCKET MOTOR RESPONSE TO TRANSVERSE BLAST LOADING
Norris J. Huffington, Jr. and Henry L. Wisniewski. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 3. Sep. 1978. p. 21-32. refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-17143# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
MATERIALS AND STRUCTURES RESEARCH SCIENTIFIC REPORT, 1978. Progress Report [FORSCHUNGSBEREICH WERKSTOFFE UND BAUWEISEN: WISSENSCHAFTLICHER BERICHT STAND 1978]
1978. 101 p. refs. In GERMAN. Original contains color illustrations.
Avail: NTIS. HC A06/MF A01.
Research in structural engineering, aerodynamics, the mechanical properties of light alloys and refractory materials, the applications of powder metallurgy, the space environment, energy, health problems, and weightlessness are discussed.
Author (ESA)

24 COMPOSITE MATERIALS

Includes laminates.

N80-17144 Rutgers - The State Univ., New Brunswick, N. J.
MECHANICAL BEHAVIOR OF COMPOSITE MATERIALS IN MULTIAXIAL STRESS FIELDS. Ph.D. Thesis
Joo Won Kim. 1979. 191 p.
Avail: Univ. Microfilms. Order No. 7928413
The stress-strain behavior of glass fiber reinforced Nylon-6 and polycarbonate in tension, compression and shear superimposed on hydrostatic pressures of various intensities was investigated. The experimental results on Nylon-6 composites showed that the tensile and shear moduli increased linearly and the strength, defined as the maximum stress in tension and the stress at 2 percent offset strain in compression and shear, increased nonlinearly with pressure. For polycarbonate composites, the modulus and the strength both increased with pressure but the increases were rather modest. The effects of adding glass fibers to form composite materials were shown to be much less for polycarbonate composites than for Nylon-6 composites in tension, compression and shear. A three dimensional model based on a plane stress model was developed to predict the maximum strengths of the composites.
Dissert. Abstr.

N80-17145 California Univ., Berkeley.
PROPERTIES, MICROSTRUCTURES AND RADIATION RESISTANCE OF STAINLESS STEEL-GLASS COMPOSITE MATERIALS. Ph.D. Thesis
Robert Allan Clark. 1979. 128 p.
Avail: Univ. Microfilms. Order No. 8000308
A composite material consisting of glass platelets in a 316L stainless steel matrix was developed by standard techniques using glass and metal powders. Mechanical properties were determined as a function of type and amount of glass in the composite and processing history. These results were correlated with composite microstructures. The best mechanical properties were achieved from specimens machined out of larger powder compacts that had been: (1) steel die compacted at 70 ksi for two minutes; (2) hydrogen sintered at 1300 C for one hour; (3) hot rolled to a single pass 30 percent reduction at 950 C in a protective atmosphere; and (4) annealed one hour at 1000 C. The irridation experiment showed that a fine grained powder metallurgy product did not improve nor degrade resistance to blistering under He+ ion bombardment relative to values obtained for similar wrought materials. No benefit in terms of reduced void formation and swelling would be derived from use of this material in a reactor environment.
Dissert. Abstr.

N80-17146 Iowa State Univ. of Science and Technology, Ames.
FRACTURE MECHANICS OF UNIDIRECTIONAL COMPOSITE MATERIALS. Ph.D. Thesis
Shahrokh Parhizgar. 1979. 82 p.
Avail: Univ. Microfilms. Order No. 8000164
The available mathematical theories and principles needed for the full investigation of fracture in orthotropic plates are documented. The fracture phenomena in orthotropic composite plates are examined and compared with the fracture in isotropic plates. The extent to which the principles of linear fracture mechanics are applicable to orthotropic plates is studied. It is shown that fracture toughness of unidirectional composites is independent of crack length but dependent on crack-fiber orientation. For experimental verification of the above principles, unidirectional glass epoxy material (Scotchply 1002) was used. The fracture toughness of Scotchply 1002 for different crack-fiber orientations is obtained by utilizing Solid Sap finite element program and compact tension specimens. An empirical formula relating the fracture toughness of the material for different crack-fiber orientations is found.
Dissert. Abstr.

N80-17147*# Boeing Commercial Airplane Co., Seattle, Wash.
THE 737 GRAPHITE COMPOSITE FLIGHT SPOILER FLIGHT SERVICE EVALUATION. Annual Report, May 1978 - Apr. 1979
Daniel J. Hoffman and Robert L. Stoecklin. Jan. 1980. 56 p. refs.
(Contract NAS1-11668)
(NASA-CR-159094; AR-5) Avail: NTIS. HC A04/MF A01. CSCL 11D
The flight service experience of 111 graphite-epoxy spoilers on 737 transport aircraft and related ground based enviromental exposure of graphite-epoxy material specimens is reported. Spoilers were installed on 28 aircraft representing seven major airlines operating throughout the world. Over 1,188,367 spoiler flight hours and 1,786,837 spoiler landings were accumulated by this fleet. Tests of removed spoilers and ground-based exposure specimens after the fifth year of service indicate modest changes in composite strength properties. Two incidents of trailing edge delamination with subsequent core corrosion were observed. Based on visual, ultrasonic, and destructive testing, there has been no evidence of moisture migration into the honeycomb core and no core corrosion.
K.L.

N80-17148*# Boeing Commercial Airplane Co., Seattle, Wash.
PRELIMINARY DESIGN OF GRAPHITE COMPOSITE WING PANELS FOR COMMERCIAL TRANSPORT AIRCRAFT
B. A. Byers and Robert L. Stoecklin. Feb. 1980. 68 p. refs.
(Contract NAS1-15107)
(NASA-CR-159150) Avail: NTIS. HC A04/MF A01. CSCL 11D

Subjectively assessed practical and producible graphite/epoxy designs were subjected to a multilevel screening procedure which considered structural functions, efficiency, manufacturing and producibility, costs, maintainability, and inspectability. As each progressive screening level was reviewed, more definitive information on the structural efficiency (weight), manufacturing, and inspection procedures was established to support the design selection. The configuration features that enhance producibility of the final selected design can be used as a generic base for application to other wing panel designs. The selected panel design showed a weight saving of 25 percent over a conventional aluminum design meeting the same design requirements. The estimated cost reduction in manufacturing was 20 percent, based on 200 aircraft and projected 1985 automated composites manufacturing capability. The panel design background information developed will be used in the follow-on tasks to ensure that future panel development represents practical and producible design approaches to graphite/epoxy wing surface panels. A.R.H.

N80-17149# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
BASIC CONCEPTS OF STATISTICS AND THEIR APPLICATIONS IN COMPOSITE MATERIALS Final Report, 1 Dec. 1978 - 31 Jan. 1979
Won J. Park. Jun. 1979. 70 p. refs.
(AD-A076198; AFML-TR-79-4070) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report is intended to present, in a simple and concise way, basic concepts of statistics and their applications in composite material engineering. The subjects are selected from the standpoint of key concepts and applications rather than theory and elegance. It is envisioned that this report is suitable for a short course (or refresher course) for composite material engineers, who have been working with data but have not done any formal course work in statistics. GRA

N80-17150# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
NONDESTRUCTIVE EVALUATION OF DAMAGE IN METAL MATRIX COMPOSITES Interim Report
Edmund G. Henneke, II, Kenneth L. Reifsnider, Wayne W. Stinchcomb, and John E. Duke. 30 Jan. 1979. 53 p. refs.
(Contract N00014-78-C-0153)
(AD-A075284) Avail: NTIS HC A04/MF A01 CSCL 14/2

The basic objectives of this work were: to apply nondestructive evaluation techniques to metal matrix composites; to obtain base line data as to the ability of these techniques to locate, identify and quantify defects in these materials; to determine the effect of these defects on strength and stiffness; and to modify the techniques as required for application to specimens having geometries other than the flat tensile coupon. Several different nondestructive testing techniques have been considered for possible application to metal matrix composites. A description of these is given in the following pages. Some of these methods have been applied during the past year to Al/Fp fiber composites while others have been investigated in a preliminary fashion in order to determine potential problem areas that will need to be solved for proper application in the coming year. GRA

N80-17151# Virginia Polytechnic Inst. and State Univ., Blacksburg.
DEFECT-PROPERTY RELATIONSHIPS IN COMPOSITE MATERIALS, PART 4 Final Report, 7 Feb. 1977 - 8 Feb. 1979
Kenneth L. Reifsnider, Edmund G. Henneke, II, and Wayne W. Stinchcomb. Wright-Patterson AFB, Ohio. AFML. Jun. 1979. 146 p. refs.
(Contract F33615-77-C-5044; AF Proj. 2419)
(AD-A076497; AFML-TR-76-81-Pt-4) Avail: NTIS HC A07/MF A01 CSCL 11/4

This report describes the results of an investigation of the nature of damage in two graphite-epoxy laminates under various loading histories, with special attention to the changes in mechanical properties caused by specific damage mechanisms. The results include several new findings, the development of unique investigative methods and some substantial deviations from common model predictions. The discovery of a 'characteristic damage state' is reported. GRA

N80-17152# General Dynamics/Convair, San Diego, Calif.
COMPOSITE MATERIAL APPLICATION TO THE MK12A RV MIDBAY SUBSTRUCTURE Final Report, Oct. 1976 - Jul. 1978
W. Garcia, J. Hertz, J. Prunty, and H. McCutchen. Sep. 1979. 162 p. refs.
(Contract DAAG46-76-C-0073; DA Proj. 1W1-62113-A-661)
(AD-A076485; CASD/ASC-76-001A; AMMRC-TR-79-51) Avail: NTIS HC A08/MF A01 CSCL 22/2

The work reported herein represents a feasibility study to reduce weight of the MK12A reentry vehicle midbay structure by replacing the aluminum structure with graphite composite materials. Following conceptual design of the MK12A midbay structure utilizing advanced composite materials, the effort was redirected to the Advanced Ballistic Reentry Vehicle (ABRV). Specimens and subcomponent elements representative of the ABRV configuration were provided for nuclear vulnerability and hardness testing of the Air Force Weapons Laboratory. GRA

N80-17153# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
POOLED ESTIMATIONS OF THE PARAMETERS ON WEIBULL DISTRIBUTIONS Final Report, 15 Jan. - 30 Jun. 1979
Won J. Park. Aug. 1979. 48 p. refs.
(AF Proj. 2303)
(AD-A076513; AFML-TR-79-4112) Avail: NTIS HC A03/MF A01 CSCL 11/4

In composite materials fatigue life testing under different levels of stress, the underlying distributions are assumed to be the Weibull distribution with the common shape parameter. The problems of estimations and testing hypotheses regarding the common shape parameter and scale parameters in the Weibull distributions are considered. The results are: three methods of pooled estimation of the shape parameter, exact confidence intervals and testing hypotheses for the shape parameter, comparison of the bias factor of three pooled estimators of the shape parameter and exact confidence intervals and testing hypotheses for the scale parameters. Examples are given for composite material applications. GRA

N80-17154# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
TRIBOLOGICAL BEHAVIOR OF METAL MATRIX COMPOSITES Interim Report
M. F. Amateau, R. F. Flowers, and E. Eliezer. 14 Sep. 1979. 32 p. refs.
(Contract F04701-78-C-0079)
(AD-A075764; TR-0079-(4762-03)-1; SAMSO-TR-79-56) Avail: NTIS HC A03/MF A01 CSCL 11/4

The wear and friction behavior of continuous graphite-fiber-reinforced metal matrix composites was investigated. Composite materials were tested against 4620 steel at 54 m/sec at room temperature in air without lubricant. The graphite fibers studied included rayon-based, pitch-based, and polyacrilonitrile (PAN)-based fibers. Both high-modulus and high-strength PAN-based fibers were examined. The fibers were incorporated into Cu- and Ag- based alloys by means of a liquid metal infiltration technique. The results of this study indicate that the type of graphite fiber in the composite is the most significant factor in the wear and friction behavior of metal matrix composites. In some high-modulus fiber Sn-bronze composites fiber fraction influences wear rate, but not coefficient of friction. Neither the matrix alloy nor the composite tensile strength per se correlates with the friction and wear properties; however, there are specific trends for the various matrix alloys. GRA

N80-17155# Textron Bell Helicopter, Fort Worth, Tex.
FILAMENT WINDING PRECISION RESIN IMPREGNATION SYSTEM Final Report, Aug. 1977 - Mar. 1979
Richard R. Zeits. Mar. 1979. 100 p. refs.
(Contract DAAJ01-77-C-0777)
(AD-A075279; USAAVRDCOM-TR-79-15) Avail: NTIS HC A05/MF A01 CSCL 13/13

This report presents the results of a program to develop and evaluate a precision resin impregnation system. The program objective was to develop a resin impregnator capable of consistently wetting S-glass, Kevlar and graphite roving with

resin controlled within plus or minus 2% by weight. The tests conducted demonstrate the ability of the developed equipment to meet resin content control objectives. The effect of the process variables of fiber temperature, resin temperature and winding speed on impregnation quality were evaluated. Short beam shear tests and microstructure analysis were the primary evaluation tests conducted. GRA

N80-17156# Research Inst. of National Defence, Linkoeping (Sweden)
SOME MECHANICAL AND CHEMICAL PROPERTIES OF BORON CARBIDES [INVERKAN AV BORKARBIDENS SAMMANSAATTNING PAA DGSS MEKANISKA EGENSKAPER]
Lars Ekbom and Gunnar Magnusson. Apr. 1979. 19 p. refs. In SWEDISH
(FOA-C-20301-F9). Avail: NTIS. HC A02/MF A01

The chemical composition of boron carbides was studied in reference to the effects of the concentration of boron, silicon, and aluminum on its mechanical properties for use in light-weight armor. An increase in the concentration of boron improves sintering and reduces sintering temperatures as compared with conventional boron carbide. Small additions of silicon and aluminum reduce density and increase static resistance. Author (ESA)

N80-17157# Research Inst. of National Defence, Linkoeping (Sweden)
INVESTIGATION OF SHAPES, SIZES, AND ELECTRICAL RESISTANCE OF FRAGMENTS OF CARBON FIBER COMPOSITES [UNDERSOEKNING AV FORM, STORLEK OCH ELEKTRISKT MOTSTAAND PAA FRAGMENT FRAAN KOLFIBERKOMPOSITER]
Tom Karlsson. 1979. 14 p. refs. In SWEDISH
(FOA-C-20304-F9). Avail: NTIS. HC A02/MF A01

The carbon fiber composites Hercules 3501 and Fiberdux were tested. After filing, sawing, drilling, and grinding tests, the composite wastes were examined. The shape, size and electric resistance were studied. The size of particles varied from several millimeters to a few micro according to the test used. The shapes, which were classified into four categories, were found in various quantities in the wastes. The carbon particles are good electric conductors if a good contact is reached with sufficient pressure. Author (ESA)

N80-17158# Fulmer Research Inst. Ltd., Stoke Poges (England)
THE SIGNIFICANCE OF DEFECTS IN CRFP BONDED HONEYCOMB STRUCTURES AND NON-DESTRUCTIVE TEST METHODS FOR THEIR DETECTION. Final Report
R. L. Crocker and W. H. Bowyer. May 1979. 114 p. refs.
(Contract ESTEC-2922/76-NL-PP(SC))
(FRI-R736/4; ESA-CR(P)-1229). Avail: NTIS. HC A06/MF A01

The identification of defects which occur in carbon fiber reinforced plastics skinned aluminum honeycomb sandwich materials was undertaken, along with an assessment of their significance in terms of mechanical properties. A range of defects was examined and all were shown to have significant effects on laminate strength. Available non-destructive test methods were reviewed and evaluated using specimens containing deliberately introduced defects. The optimum available nondestructive test procedure involves a combination of visual examination, roller probe coupled ultrasonics and X-radiography. The performance of other techniques including holographic interferometry, laser speckle pattern interferometry and thermography is discussed. Author (ESA)

N80-17280 Naval Underwater Systems Center, Newport, R. I.
EXPERIMENTAL AND THEORETICAL DYNAMIC ANALYSIS OF CARBON-GRAPHITE COMPOSITE SHELLS
A. Harari and B. E. Sandman. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 3, Sep. 1978, p. 33-37. refs. (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography, combustion theory, electrochemistry, and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-17159 Cincinnati Univ., Ohio
ADSORPTION OF POLAR MACROMOLECULES ONTO METALLIC SURFACES. Ph.D. Thesis
Sun-Lin Chen. 1979. 112 p.
Avail: Univ. Microfilms. Order No. 8002426

Reflection-absorption infrared spectroscopy and ellipsometry were used to determine the structure of thin films, formed by adsorption of organic compounds onto iron and copper mirrors from solution. Results of the investigations suggest that: (1) the adsorption of 1-octadecanol may be due to the formation of hydrogen bonds to the surface; (2) the adsorption of dodecanoic acid may be due to the coordination of a carboxylate ion to a pair of metal atoms; and (3) the adsorption of dodecylamine and octadecanamide may be due to the coordination of -NH2 groups to metal atoms or the formation of hydrogen bonds to the surface. The adsorption of Epon 828 was also studied. Films about 15 A in thickness were formed on the metallic surface with a vertical conformation. The adsorption of higher molecular weight epoxies, Epon 1001 and Epon 1007, was also considered under the influence of solvents. Dissert. Abstr.

N80-17160 California Univ., Berkeley
COMBUSTION AND STABILITY CHARACTERISTICS OF A PREMIXED VORTEX DOMINATED TWO DIMENSIONAL FLOW. Ph.D. Thesis
Ahmad Reza Ganji. 1979. 305 p.
Avail: Univ. Microfilms. Order No. 8000350

A two dimensional combustion tunnel was constructed. A lean premixed turbulent propane/air flame was stabilized behind a rearward facing step. The following were studied: the existence and importance of large coherent structures in turbulent reacting and nonreacting free shear layers behind the step; the effect of inlet temperature and reference velocity on efficiency; CO, NO2 and NO sub x production in the flame; and the blowout and upstream propagation of the flame in this system. Dissert. Abstr.

N80-17161*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry
CATALYSTS FOR ELECTROCHEMICAL GENERATION OF OXYGEN. Final Report
P. Hagans and E. Yeager. 31 Dec. 1979. 168 p. refs.
(Grant NGR-36-027-050)
(NASA-CR-162757). Avail: NTIS. HC A08/MF A01. CSCL 07D

Several aspects of the electrolytic evolution of oxygen for use in life support systems are analyzed including kinetic studies of various metal and nonmetal electrode materials, the formation of underpotential films on electrodes, and electrode surface morphology and the use of single crystal metals. In order to investigate the role of surface morphology to electrochemical reactions, a low energy electron diffraction and an Auger electron spectrometer are combined with an electrochemical thin layer cell allowing initial characterization of the surface, reaction run, and then a comparative surface analysis. M.G.

N80-17162*# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology
THE INVESTIGATION OF TIME DEPENDENT FLAME STRUCTURE BY IONIZATION PROBES
J. M. P. Ventura, T. Suzuki, A. J. Yule, S. Ralph, and N. A. Chigier. [1980]. 23 p. refs. Sponsored in part by AFOSR, ONR and US Army
(Grant NsG-7517)
(NASA-CR-162766). Avail: NTIS. HC A02/MF A01. CSCL 21B

Ionization probes were used to measure mean ionization current and frequency spectra, auto-correlations and cross-correlations in jet flames with variation in the initial Reynolds

numbers and equivalence ratios. Special attention was paid to the transitional region between the burner exit plane and the plane of onset of turbulence. M.M.M.

N80-17163*# National Aeronautics and Space Administration, Washington, D. C.
CONCERNING A NEW CLASSIFICATION OF TRICYANIDES
F. Krafft and A. vonHansen. Nov. 1979. 13 p. Transl. into ENGLISH from Ber. Deut. Chem. Ges. (West Germany), v. 22, 1889 p 803-811. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75504) Avail: NTIS HC A02/MF A01 CSCL 07D

A new classification series of tricyanides is presented. Several tricyanides are synthesized by a simple method from aluminum chloride, benzonitrile, and a respective alkyl or phenyl chloride, purified by recrystallization and distillation, and then analyzed. Structural formulae are suggested, and molecular weights, melting points, and boiling points are determined for each. Author

N80-17164# Virginia Univ., Charlottesville. Dept. of Chemistry.
TWO-DIMENSIONAL CORRELATED NUCLEAR MAGNETIC RESONANCE OF SPIN-COUPLED 11 B-1
David C. Finster, William C. Hutton, and Russell N. Grimes. Oct. 1979. 15 p. refs.
(Contract N00014-75-C-0305)
(AD-A076505; TR-32) Avail: NTIS HC A02/MF A01 CSCL 07/4

Two-dimensional (2D) Fourier transform nuclear magnetic resonance spectroscopy has been applied for the first time to a B11-H1 spin system. A heteronuclear experiment is performed on the closo-carborane, 2,4-C2B5H7, to give a 2D correlated spectrum in which chemical shift data of B11 and H1 are simultaneously displayed on a three-dimensional map. It is shown that the technique has the potential to resolve broad, overlapped B11 signals via the chemical shift of the protons to which they are scalar-coupled. GRA

N80-17165# Dayton Univ. Research Inst., Ohio.
COMBUSTION DIAGNOSTICS USING LASER SPONTANEOUS-RAMAN SCATTERING. Final Report, 1 Jul. 1976 - 31 Oct. 1978
Perry Pappas Yaney. Wright-Patterson AFB, Ohio. AFAPL. Apr. 1979. 139 p. refs.
(Contract F33615-76-C-2078; AF Proj. 3048)
(AD-A076514; UDR-TR-79-46; AFAPL-TR-79-2035) Avail: NTIS HC A07/MF A01 CSCL 21/2

An existing computer-controlled Raman spectroscopy system, using a pulsed nitrogen laser and a double spectrometer, was upgraded and used to measure the temperatures in the combustion plume of an afterburning J85-5 turbojet engine. The computer-fitted temperatures had standard deviations between one and three percent. The agreement with simultaneous and sequential gas-sampling probe measurements and with sequential thermocouple measurements was within five percent. Upon completion of these studies, the system was extensively modified for use with a 10-inch diameter combustion tunnel. Forty-eight sets of Raman data were taken over a wide range of operating conditions of the tunnel. The temperatures ranged from 1000 to over 2000 K using methane fuel. The turbulent diffusion flame was characterized by an unsteady appearance and was orange-yellow in color. Poisson standard deviations for 21 of the measurements averaged four percent. Measurements and spectra of the laser-induced and non-laser-induced backgrounds were also obtained and analyzed. GRA

N80-17166# Naval Surface Weapons Center, White Oak, Md.
ION BEAM ANALYSIS OF Li-B ALLOYS. Final Report
Donald G. Simons, David J. Land, Matt D. Brown, and James G. Brennan. 1 Mar. 1979. 20 p. refs.
(AD-A076137; NSWC/TR-79-95) Avail: NTIS HC A02/MF A01 CSCL 07/4

Proton backscatter analysis has been used to study lithium-boron residues which have been produced by a chemical process designed to extract the free lithium phase from lithium-boron alloys. On the two samples studied there is no evidence of the presence of Li on those surfaces which were in direct contact with the extraction chemicals. This depletion appears to be at least 3.5 microns deep. Measurements on the inside surfaces show that Li is present in a concentration which is in excess of the bound Li content of the samples. GRA

N80-17167# Sussex Univ., Brighton (England). School of Engineering and Applied Sciences.
DIRECT MEASUREMENT BY SECONDARY-ION MASS SPECTROMETRY OF SELF-DIFFUSION OF BORON IN Fe40Ni40B20 GLASS
R. W. Cahn, J. E. Evetts, J. Patterson, R. E. Samekh, and C. Kenway Jackson. 1 Oct. 1979. 20 p. refs.
(Grant N00014-78-G-0048)
(AD-A075782; TR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

The available methods for measuring diffusion rates of various metalloids in metallic glasses are critically reviewed, and the advantages of studying boron diffusion by secondary-ion mass-spectrometry (SIMS) set out. A surface coating of chemical composition similar to that of the glass but enriched in 10(B) was deposited on the polished glass by sputtering in an ultraclean environment. The samples were diffusion-annealed and profiled by SIMS. Subsequent tests showed that some samples had partly crystallized and these had anomalously low diffusion rates. GRA

N80-17168# Illinois Univ. at Urbana-Champaign.
REACTION OF CALCIUM SILICATES WITH CARBON DIOXIDE AND WATER. Final Report, Jan. 1976 - Jan. 1979
R. L. Berger and J. Francis Young. 26 Sep. 1979. 38 p. refs.
(Grants DAAG29-76-G-0116; DAAG29-78-G-0049)
(AD-A075762; ARO-13031.3-MS) Avail: NTIS HC A03/MF A01 CSCL 07/4

The reaction of five calcium silicates with CO2 water was investigated. The calcium silicates differed in Ca/Si ratio or polymorphic type. Reaction kinetics were dependent on the Ca/Si ratio of the initial calcium silicates. Activation energy for the carbonation reaction ranged from 9.8 kcal/mole for Ca3SiO5 to 22.9 kcal/mole for CaSiO3. The reaction products were calcium carbonate (CaCO3) and a calcium silicate hydrate of variable stoichiometry. The Ca and H2O content of the calcium silicate hydrate product decreases with degree of reaction. This results in the final stable reaction products consisting of calcium carbonate and a highly polymerized hydrous silica gel which is insoluble in HCl. Calcite forms during the carbonation of Ca3SiO5, beta-Ca2SiO4, and gamma-Ca2SiO4 if free water is present. Aragonite forms in the absence of free H2O and in the carbonation of CaSiO3. The carbonation reaction decreases rapidly at CO2 pressures -0.12. At pressures from 0.12 to 54 atm the carbonation reaction increases, but at a slow rate. Temperature and relative humidity have significant influences on the rate of carbonation. GRA

N80-17169# ARO, Inc., Arnold Air Force Station, Tenn.
INTERAGENCY NITRIC OXIDE MEASUREMENT INVESTIGATION: AEDC RESULTS FOR PHASE 1. CALIBRATION TECHNIQUE FOR OPTICAL MEASUREMENT SYSTEM. Final Report, Oct. 1977 - Aug. 1979
J. D. Few, H. S. Lowry, III, W. K. McGregor, and D. R. Keefer. AEDC. Oct. 1979. 40 p. refs.
(AD-A077145; AEDC-TR-79-65) Avail: NTIS HC A03/MF A01 CSCL 07/2

As part of the continuing investigation to determine the cause of the differences that were formerly found to exist between nitric oxide (NO) concentrations measured with conventional sample extraction-gas analyzer techniques and with an ultraviolet (UV) spectroscopic technique, an experimental program was undertaken. The purpose of phase 1 of this program was to measure NO concentrations in several sources with known amounts of NO and over the range of temperatures from 300 to 2,000 K. Spectroscopic and probe measurements were obtained and compared over the test envelope. During this period, a discrepancy in the NO computer model used for reducing the data was identified and has since been corrected. Included in

this report are the results of the optical measurements, a comparison of these results with the known concentrations, and a description of the new computer model. GRA

N80-17170# Michigan State Univ., East Lansing. Dept. of Chemistry.
TRIPLE QUADRUPOLE MASS SPECTROMETRY FOR DIRECT MIXTURE ANALYSIS AND STRUCTURE ELUCIDATION Interim Report
R. A. Yost (Florida Univ., Gainesville) and C. G. Enke. Oct. 1979. 30 p. refs.
(Contract N00014-76-C-1092)
(AD-A075254; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

The triple quadrupole mass spectrometer is shown to be a simple and highly efficient system for the observation of the fragmentation pattern of selected ions. The instrument consists of, in series, a CI/EI ion source, a quadrupole mass filter, an RF-only quadrupole collision chamber, a second mass filter, and an electron multiplier. The high sensitivity of the MS/MS technique with quadrupoles depends particularly on the highly efficient low energy collision-induced dissociation process in the strong focusing RF quadrupole field. Detection limits for methane and nitrobenzene of 10 to the minus 15 mole are shown. Analysis of a mixture of six components, including two isomers and an isobaric compound is presented. Chemical noise is virtually eliminated by the selection of both parent and fragment ion. An application of the system for structure elucidation is also described. GRA

N80-17171# Michigan State Univ., East Lansing. Dept. of Chemistry.
THE FRAGMENTATION OF THE IONS OF NONAN-4-ONE: A STUDY BY TRIPLE QUADRUPOLE MASS SPECTROMETRY Interim Report
R. A. Yost (Florida Univ., Gainesville) and C. G. Enke. 3 Oct. 1979. 21 p. refs. Submitted for publication.
(Contract N00014-76-C-1092)
(AD-A075255; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

The fragmentation of the ions of the compound nonan-4-one were studied in detail with low-energy collision-induced dissociation (CID) in a triple quadrupole mass spectrometer. Ions of the sample molecule created in an EI source are mass selected by a quadrupole mass filter, dissociated by low-energy collision with neutral molecules in a quadrupole collision chamber, and the dissociation products are mass-selected by a second quadrupole mass analyzer. The normal EI mass spectrum of nonan-4-one shows 47 fragment ions. A fragmentation spectrum is obtained for each of the ions from the EI source. The result is the positive identification of over 400 parent-daughter pairs. This compares with a total of 47 observed pairs (37 confirmed) from all previous metastable ion studies. Normal alkanone fragmentations are observed: Alpha-cleavage, loss of CO or C2H4 from Alpha-cleavage ions, and McLafferty rearrangement in the long chain. The relative abundances of the short chain and long chain Alpha-cleavage fragments are demonstrated to depend on the fragmentation energy available with the long chain fragment predominating at lower energies. The fragmentations observed are grouped for discussion. A number of parent-daughter structures and fragmentation mechanisms are confirmed and some new ones are proposed. New graphical representations of the fragmentation patterns have been devised to accommodate the large amount of information produced in this study. GRA

N80-17172# Pennsylvania State Univ., University Park. Dept. of Chemistry.
SYNTHESIS OF TETRANUCLEAR MIXED-METAL CLUSTERS VIA THE REACTION OF CO(CO4) WITH CLOSED METAL CARBONYL TRIMERS. CRYSTAL AND MOLECULAR STRUCTURE OF (PH3P)2N CORU3(CO13) Interim Report
Paul C. Steinhardt, Wayne L. Gladfelter, A. Dale Harley, Joseph R. Fox, and Gregory L. Geoffroy. 3 Oct. 1979. 40 p. refs. Submitted for publication.
(Contract N00014-77-C-0417; NR Proj. 053-645)
(AD-A075264; TR-79-2) Avail: NTIS HC A03/MF A01 CSCL 07/2

The clusters HCoRu3(CO)13, HCoRu2Os(CO)13, HCoRuOs2(CO)13, and HCoOs3(CO)13 were synthesized by allowing K(CO(CO)X4) to react with Ru3(CO)12, Ru2Os(CO)12, RuOs2(CO)12 and Os3(CO)12, respectively, followed by protonation. Reaction of K(Co(CO)4) with Fe3(CO)12, Fe2Ru(CO)12, and FeRu2(CO)12 followed by acidification did not lead to the desired hybrido mixed metal clusters but instead to various other products. Reaction of (PPN)(Co(CO)4) (PPN = (Ph3P)2N) with Fe3(CO)12 and Ru3(CO)12 without subsequent acidification gave the salts (PPN) (CoFe3(CO)13) and (PPN)(CoRu3(CO)13). The latter was structurally characterized by single crystal X-ray diffraction. It crystallizes in the space group Pi with Z = 2 and unit cell dimensions a = 9.783(5) angstroms, b = 14.768(5) angstroms c = 18.675(5), alpha = 110.39(3) degrees, beta = 99.02(4) degrees, gamma = 91.44(4) degrees, and V = 2489(4) angstroms cubed. Other significant observations are reported. R.C.T.

N80-17173# SRI International Corp., Menlo Park, Calif.
NITROUS ACID AS AN OXIDANT IN ACIDIC MEDIA Final Report, 15 Jul. 1976 - 31 May 1979
David S. Ross and Georgina P. Hum. 25 Sep. 1979. 21 p. refs.
(Contract DAAG29-76-C-0060)
(AD-A075263; ARO-13754.2-CX) Avail: NTIS HC A02/MF A01 CSCL 07/2

It has been found that benzyl and aliphatic alcohols are rapidly oxidized by nitrous acid to the corresponding carbonyl compound at 25 degrees C in 50-70% sulfuric acid. The oxidations are very rapid, complete within minutes for most substrates; the process appears to be quantitative, at least in runs with alcohol concentrations in the 10 to the -14 M range. For the benzyl alcohols, an electron withdrawing para-substituent, such as nitro, retards the rate, while an electron donating group, such as methyl, increases the rate. Thus, some cationic character must be present in the process. The rate increases with increasing acidity, peaking at 60% sulfuric acid, and declining thereafter. Surprisingly, ethers are oxidized as well, with the most unlikely case, the methyl ether of 2-phenyl-2-propanol, cleanly and rapidly yielding acetophenone. For primary and secondary alcohols and their ethers, the proposed mechanism for oxidation includes initial electrophilic attack by NO- on oxygen, followed by elimination of HNO. In these cases, the nitrous acid is regenerated, probably through HNO oxidation by dissolved oxygen. Thus, an equivalent of nitrous acid oxidizes more than one equivalent of alcohol. For the tertiary alcohol case, we suggest elimination of alkyl nitrite; however, the mechanistic details remain to be fully established. GRA

N80-17174# Materials Research Labs., Ascot Vale (Australia).
LOW INTENSITY, LONG DURATION CHEMILUMINESCENT SYSTEMS. PART 2: CHEMILUMINESCENCE FROM BIS2, 4-DICHLORO-6-CARBOALKOXYPHENYL OXALATES
Christopher D. Dowd and D. Brenton Paul. Jan. 1979. 35 p. refs.
(AD-A073142; MRL-R-737-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 07/4

Various oxalate esters have been synthesised and their chemiluminescent emission examined in an attempt to produce an improved low intensity, disposable lighting device suitable for 10 hours operation. Derivatives of the bis(2-carboalkoxy-4,6-dinitrophenyl)oxalate series were shown to possess unsuitable stability while the chemiluminescence of the bis(6-carboalkoxy-2,4,5-trichlorophenyl)oxalates was too intense to modify suitably. A number of bis(6-carboalkoxy-2,4-dichlorophenyl)oxalates were prepared and by treatment with various combinations of catalyst and inhibitor satisfactory low intensity light emission could be achieved after a 5 minute induction period. Optimum conditions were: oxalate ester, 2 x 10(-2)M; H2O2, 2 x 10(-2)M; potassium salicylates, 5 x 10(-4M); oxalic acid, 10(-4M). The storage stabilities and solubilities of the dichloro series of oxalates were superior to those of 2,4,6-TCPO. Aspects of the synthesis of the substituted salicylic acid precursors to the oxalates are discussed. The merits of chemiluminescent systems relative to beta lights are considered for the particular case of low level illumination. GRA

N80-17175# Sandia Labs., Livermore, Calif. Materials Development Div.
PLATING ON TITANIUM FOR ELECTROCHEMICAL JOIN-

ING APPLICATIONS
J. W. Dini and H. R. Johnson Sep. 1979 21 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8038) Avail: NTIS HC A02/MF A01

Ring shear tests were used to evaluate the adhesion of electroplated nickel on titanium. Different plating processes were investigated. Shear strengths as high as 299 MN/sq m (43,300 psi) were obtained. By utilizing the best processes as indicated from these tests, some titanium parts with machined tapers were then successfully joined to one another and to a uranium alloy (mulberry) with thick nickel plating. DOE

N80-17176# Los Alamos Scientific Lab., N. Mex.
ELUCIDATION OF GEOMATRICES BY LASER PYROLYSIS/GAS CHROMATOGRAPHY AND PYROLYSIS/MASS SPECTROMETRY
C. E. R. Jones and N. E. Vanderborgh 1979 22 p refs
Presented at the Intern. Symp. on Advances in Chromatography, Lausanne, Switzerland, 24 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1147; CONF-790931-1) Avail: NTIS HC A02/MF A01

Presented methods for the examination of organics entrained in geological matrices are tedious even if not fallible. Thermal degradative techniques combined with the separatory power of a gas chromatographic column or a quadrupole mass spectrometer operating low-voltage electron impact model afford rapid access to detailed profiles of such materials. The virtue of these parallel approaches are compared and contrasted in application to the elucidation of Devonian Shale and other geological material. DOE

N80-17177# Ames Lab., Iowa. Dept. of Chemistry.
NEUTRON-CAPTURE GAMMA-RAY ANALYSIS OF COAL FOR SULFUR, IRON, SILICON AND MOISTURE Ph.D. Thesis
D. A. Fay May 1979 135 p refs
(Contract W-7405-eng-82)
(IS-T-847) Avail: NTIS HC A07/MF A01

Samples of coal weighing approximately 200 grams placed in a collimated beam of neutrons from the thermal column of the Ames Laboratory Research Reactor produced capture gamma-rays which could be used for the simultaneous determination of sulfur and iron. Spectra from NaI(Tl) and Ge(Li) detectors were used and interferences were located by examining spectra of the major elemental components of coal. In determining sulfur, iron is a potential source of interference when gamma-ray spectra are collected with a NaI(Tl) detector. Corrections for iron interference were made by use of a higher energy iron peak. The possibility of determining silicon in coal was investigated but this element determination was unsuccessful since capture gamma-ray spectrometry lacked the necessary sensitivity for silicon. A linear relation was found between the area of the hydrogen capture peak at 2.23 MeV and the amount of water added to coal. DOE

N80-17178# Centre Technique des Industries Mecaniques, Senlis (France).
THE ELECTRODEPOSITION OF CHROME ON STEEL ALLOYS. DEVELOPMENT OF AN ELECTROCHEMICAL METHOD FOR CHARACTERIZING TREATED SURFACES BEFORE PLATING Final Report [DEPOT DU CHROME DUR SUR LES ACIERS ALLIES MISE - AU POINT D'UNE METHODE ELECTROCHEMIQUE DE CARACTERISATION DES PREPARATIONS DE SURFACE AVANT CHROMAGE]
Mortier and Fuvelle 30 Jan. 1979 32 p refs In FRENCH
(CETIM-1-2F-08-0) Avail: NTIS HC A04/MF A01

Surface treatment in preparation for chromium electroplating is discussed. The plating of 16 NC 6 cementite, a stainless steel, and two carbon steels, XC 38 and XC 100, is examined. An electrochemical method for determining the suitability of a metallic surface to electrodeposition is demonstrated. Fatigue tests on the plated surfaces are discussed. The surface treatment is examined in relation to the reduction of current density during electroplating. Author (ESA)

N80-17179# National Physical Lab., Teddington (England). Div. of Chemical Standards.
PHYSICAL CONSTANTS OF SOME CONSTITUENTS OF COAL TAR
E. F. G. Herington Jun. 1979 10 p refs
(NPL-Chem-102) Avail: NTIS HC A02/MF A01

A table of physiochemical properties of coal tar is given. The numerical values, which are expressed in the International System of Units, were extracted from up-to-date sources and include the results of precise measurements made in the Division of Chemical Standards, of the National Physics Laboratory. Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-17180 Wisconsin Univ. - Madison.
NON-METALLIC INCLUSIONS IN MAGNESIUM-TREATED IRONS Ph.D. Thesis
Charles Ching-en Wang 1979 288 p
Avail: Univ. Microfilms Order No. 7924197

Effects of magnesium treatment and post-inoculation on non-metallic inclusions in hypereutectic ductile irons were studied by investigating: (1) chemical changes in the melt; (2) generation of non-metallic inclusions after the two treatments; (3) microstructural changes; (4) the phenomenon of magnesium and inoculation fade; and (5) the role of inclusions as heterogeneous nucleating particles in the process of spheroidal graphite nucleation. All tests were carried out on magnesium-treated melts held at 2550 F to 2600 F for 40 to 90 minutes and then post-inoculated. Holding took place under an atmosphere of natural gas with the reaction products left in contact with the melt. It is concluded that any kinds of inclusions may serve as nuclei for spheroidal graphite and the efficiency of nodule formation is controlled by both inclusions and melt conditions. Dissert. Abstr.

N80-17181 Stevens Inst. of Tech., Hoboken, N. J.
STRUCTURE AND STRESS OF EPITAXIAL GOLD ELECTRODEPOSITS ON COPPER AND SILVER SUBSTRATES Ph.D. Thesis
Srinivas T. Rao 1979 140 p
Avail: Univ. Microfilms Order No. 7925056

The effect of a substrate and an additive on the surface and internal stress of thin epitaxially electrodeposited gold was studied. The substrates were rolled recrystallized copper and silver sheets with a texture such that planes were predominantly parallel to the surface. The internal stresses were determined from the force exerted by an electrobalance to offset the bending of the substrate plated on only one side. Additional experiments were performed in which the deposition was interrupted after a gold layer had covered the substrate. To determine the cause of an initial force application by the electrobalance prior to gold deposition, experiments in an electrolyte in which sodium ions were substituted for gold were performed. The internal stress was also measured after a deliberate replacement reaction between replacement reaction between copper and gold had been permitted to occur. Dissert. Abstr.

N80-17182 Rutgers - The State Univ., New Brunswick, N. J.
SURFACE LAYER AND BULK PLASTICITY OF TENSILE DEFORMED AND FATIGUE CYCLED METALS AND PREDICTION OF FATIGUE LIFE BY X-RAY DIFFRACTION Ph.D. Thesis
Robert Northrup Pangborn 1979 250 p
Avail: Univ. Microfilms Order No. 7928435

X-ray double crystal diffractometry and reflection topography were employed to examine the deformation response of single crystals and Al 2024 alloys specimens. A propensity for preferential work hardening of the surface layers compared to the bulk material was demonstrated for both tensile deformed and fatigue cycled metals. The cyclically induced defect distribution with depth from the specimen surface was also investigated as a function of the fraction of fatigue life. The excess dislocation density of grains located up to 300 micron in depth was examined using molybdenum radiation, and found to vary linearly with the fatigue life. This steep linear dependence, in conjunction with the early

life saturation behavior of surface grain densities measured with copper radiation, provided a new criterion for predicting accurately the fatigue life and failure. Dissert. Abstr.

N80-17183 Ohio State Univ., Columbus.
ELECTROCHEMICAL STUDIES OF Ni, Cr, Fe AND STRESS CORROSION CRACKING OF Ni-Cr-Fe ALLOYS BY FAST STRAIN RATE TEST IN CONCENTRATED Na OH AT ELEVATED TEMPERATURES Ph.D. Thesis
Uh-Chul Kim 1978 320 p.
Avail: Univ. Microfilms. Order No. 7922509

A reaction mechanism as well as short term and relatively long term corrosion rates were found for the corrosion of nickel at controlled potentials. Some data for Cr and Fe were also compared with the data for Ni. Crack propagation rates were measured for Nickel 200 and for AISI 304L stainless steel. Annealed AISI 304L, sensitized AISI 304L and annealed AISI 304L with inhibitor were studied. These data were compared with the data for Incoloy 800 and for Inconel 600 after other workers. Results are discussed and conclusions drawn. Dissert. Abstr.

N80-17184 Ohio State Univ., Columbus.
CORROSION OF METALS BY LIQUID SODIUM-CARBONATE Ph.D. Thesis
Randy Carl John 1979 213 p.
Avail: Univ. Microfilms. Order No. 8001756

The corrosion of metals by liquid Na2CO3 was studied using electrochemical probes for O2 and Na to correlate the solubilities of NiCO3, Na2NiO2, and NaAlO2 to the salt basicity. These solubilities were correlated to TGA-measured kinetics of metallic coupons coated with thin films of Na2CO3. The solubility and kinetic measurements were then compared to free corrosion measurements of alloys covered with thin salt films in which the chemistries of the oxide/melt and melt/gas interfaces were monitored electrochemically with increasing time. The conclusions of this study are that Na2CO3 coatings can increase or decrease the corrosion rates of alloys, as compared to oxidation. Alloys covered with films which are very soluble in the salt (e.g., Cr2O3 and SiO2) experience accelerated attack in the presence of Na2CO3. On the other hand, alloys covered with films insoluble in the salt (e.g., Al2O3 and NiO) undergo reduced attack when coated with the salt. Dissert. Abstr.

N80-17185 Case Western Reserve Univ., Cleveland, Ohio.
THE DESIGN OF AN ACIDIFIED NaCl ENVIRONMENT FOR THE STUDY OF THE EFFECT OF DEFORMATION ON THE STRESS CORROSION CRACKING OF A 301 AUSTENITIC STAINLESS STEEL Ph.D. Thesis
Frederick Paul Vaccaro 1979 222 p.
Avail: Univ. Microfilms. Order No. 8001481

A solution, composed of 4.9 M NaCl, 15 M Na2SO4 was acidified at a pH approximately 7 with 3.0 ml HCl/1t. Although lower concentration NaCl solutions often display active passive behavior, even under acidified conditions, stress corrosion cracking (SCC) did not occur in short times (less than 100 hours). Acidification initially activates the alloy and a thick film composed of insoluble corrosion products develops. These products were shown to be primarily Cr enriched, Fe and Ni depleted, and contained Cl and S. At either a critical thickness, structure, or composition, a uniquely rapid transformation occurs resulting in a pseudo passive film which is highly susceptible to localized corrosion and SCC. All deformation conditions increase sensitivity to SCC when the criterion for comparison is the percent yield strength. Dissert. Abstr.

N80-17186 California Univ., Berkeley.
THE MICROSTRUCTURE, MECHANICAL PROPERTIES, AND TWO-BODY ABRASIVE WEAR RESISTANCE OF MODIFIED SECONDARY HARDENING STEELS Ph.D. Thesis
Thomas A. Lechtenberg 1979 135 p.
Avail: Univ. Microfilms. Order No. 8000415

A study of the alloy system presented led to the development of a new composition (Fe-0.4C-4Cr-2Mo-1W-0.5V) which had, at the same hardness as the base steel, a much higher impact toughness (55Rc, 40 ft-lbs). A microstructural analysis showed that there are two types of carbides which precipitate upon tempering and are responsible for the secondary hardening. These were identified as an M2C carbide at 500 C and an MC carbide at 575 C. Two-body abrasive wear rates were measured and it was found that the commercial steel composition with large undissolved M23C6 carbides exhibited the lowest wear rates. The modified steels had wear rates about 10-15% higher at similar hardness levels. At similar yield strengths, the lowest wear rates were obtained in the presence of cubic MC carbides in the microstructure. Dissert. Abstr.

N80-17187 California Univ., Berkeley.
FUNDAMENTAL INVESTIGATION OF CONTINUOUS PRECIPITATION IN AN Fe-Nb CREEP RESISTANT ALLOY Ph.D. Thesis
John Arthur Wert 1979 145 p.
Avail: Univ. Microfilms. Order No. 8000561

An extensive study was made of the precipitation behavior of an Fe-1.7 at.% Nb alloy quenched from the delta phase field. The first step in the decomposition reaction is thought to occur by clustering of Nb atoms in the ferrite matrix, similar to the clustering of Mo atoms which is known to occur during aging of Fe-Mo alloys. The precipitate-free zones were formed by solute depletion in the vicinity of the grain boundary and the subsequent difficulty of nucleation of the Fe2Nb precipitates in the regions of lowered solute concentration. Using two-step aging treatments, an initial low temperature step to develop the Nb atom clusters followed by a higher temperature step to cause Fe2Nb precipitation, the precipitate-free zones were eliminated. The origin of this effect is though to be nucleation of Fe2Nb precipitates on the clusters developed during the initial aging step. Dissert. Abstr.

N80-17188 Case Western Reserve Univ., Cleveland, Ohio.
MECHANISMS OF PINHOLE FORMATION IN GRAY IRON Ph.D. Thesis
Baltasar Hernandez-Reyes 1979 66 p.
Avail: Univ. Microfilms. Order No. 8001458

The influence of selected additions on the surface tension of molten iron for gray iron castings was determined and the effect that this surface tension exerted on the pinhole susceptibility of the gray iron cast into green sand molds was determined. The surface tension was measured by determining the pressure developed by a high purity argon gas bubble from a ceramic capillary tube immersed in the molten iron. The additions to the molten iron studied were aluminum, sulfur, titanium, tellurium, iron oxide pellets, rare earths, selenium and phosphorus. The pinhole susceptibility was significantly affected by the surface tension. High surface tensions above a specific line drawn through a surface tension temperature plot did not exhibit pinholes in green sand molds. The surface tension of molten iron was lowered significantly by the temperature and any measurements have to normalize this temperature effect in evaluating susceptibility to pinholing. Dissert. Abstr.

N80-17189 Ohio State Univ., Columbus.
SPECIFIC ENERGIES FOR FRACTURE ON ALPHA-BETA PHASE INTERFACES IN TITANIUM-MOLYBDENUM SYSTEM Ph.D. Thesis
James Arthur Hall 1979 158 p.
Avail: Univ. Microfilms. Order No. 8001740

Energy per unit fracture surface area, consumed in the fracture of titanium-molybdenum alloys along alpha-beta interfaces, was studied in order to improve the understanding of fracture behavior of two phase titanium alloys which are known often to favor the phase interface as crack initiation sites or fracture paths. The nature of the composition profile in the immediate vicinity of the phase interface which included the composition gradient, g, and the beta phase composition at the interface, N sub alpha/Beta were studied. Both equilibrium and nonequilibrium profiles obtained by equilibration anneals as modified by subsequent up-quench or down-quench treatment were studied. Dissert. Abstr.

N80-17190 Michigan Technological Univ., Houghton.
THE EFFECTS OF BISMUTH SEGREGATION ON THE GRAIN BOUNDARY DIFFUSION OF NICKEL IN COPPER Ph.D. Thesis
Stephen P. Clough 1977 98 p.

Avail: Univ. Microfilms Order No. 8001316
The grain boundary diffusion of nickel at 530 C in dilute copper - bismuth alloys was studied. Grain boundary chemistry was monitored by Auger electron spectroscopic analysis of intergranular fracture surfaces. The prior segregation of bismuth to the copper grain boundaries was found to lower the grain boundary diffusivity of nickel by over an order of magnitude at 530 C. Equal concentrations of nickel and bismuth were found on the fracture surfaces. A classical thermodynamic argument, developed to explain temper embrittlement in low alloy steels, was used to predict the formation of a two dimensional grain boundary compound of nickel and bismuth. The theory developed attributes the decrease in the grain boundary diffusivity of nickel to the formation of the compound. Possible applications of the theory are discussed. Dissert. Abstr.

N80-17191 California Univ., Berkeley.
PRECIPITATION HARDENING IN Fe-Ni BASE AUSTENITIC ALLOYS Ph.D. Thesis
Keh-Minn Chang 1979 105 p
Avail: Univ. Microfilms Order No. 8000305
The precipitation of metastable Ni3X phases in the austenitic Fe-Ni-base alloys is investigated by using various combinations of hardening elements, including Ti, Ta, Al, and Nb. The theoretical background on the formation of the L1 sub 2 type and DO sub 22 type transition precipitates is summarized, and a model for their appearance is proposed from an analysis of static concentration waves ordering the fcc lattice. The aging behavior of these alloys is studied over the temperature range of 500 C to 900 C. Typical hardness curves show a substantial hardening effect due to precipitation. An excellent combination of strength and fracture toughness can be developed by employing double aging techniques. It is also shown that the addition of Cr retards the aging kinetics of the precipitation reactions and suppresses intergranular embrittlement. Dissert. Abstr.

N80-17192 Michigan Technological Univ., Houghton.
THERMODYNAMICS AND KINETICS OF THE PROEUTECTOID FERRITE TRANSFORMATION IN Fe-C AND Fe-C-X ALLOYS Ph.D. Thesis
John Robert Bradley 1977 126 p
Avail: Univ. Microfilms Order No. 8001315
Three models of the statistical thermodynamics of interstitial solid solutions are used to reevaluate the thermodynamics of the proeutectoid ferrite reaction. Thickening and lengthening kinetics of proeutectoid ferrite allotriomorphs are measured as a function of isothermal transformation temperature in several Fe-C-X alloys where X = Si, Ni, Mn and Cr. Resulting parabolic growth rate constants are compared to values calculated on the basis of three models: local equilibrium at alpha:gamma boundaries with partition of X, local equilibrium with 'pile-up' of X rather than bulk partition, and paraequilibrium. Values calculated from the paraequilibrium model are in best agreement with the experimental values. Dissert. Abstr.

N80-17193 Cincinnati Univ., Ohio.
CORRELATION OF SUBSTRUCTURE AND CRACK BEHAVIOR WITH CREEP-FATIGUE PROPERTIES OF 304 STAINLESS STEEL Ph.D. Thesis
August Martin Ermi 1979 233 p
Avail: Univ. Microfilms Order No. 8002106
Transmission and scanning electron microscopy were employed to study the substructure and cracking behavior of AISI 304 stainless steel tested at elevated temperatures in low-cycle fatigue with various hold times. Parameters such as cell size, misorientation angle, precipitates, the number of cycles to initiate a crack, and crack growth rate were evaluated and discussed in terms of fatigue properties and creep and environment effects. A 304 SS reference heat showed that the cell size was inversely related to the relaxed tensile saturation stress, but at the lower strain rate, substructures tended to resemble that of pure creep. A second heat of 304 SS, which displayed significant resistance to fatigue damage for tension holds, was compared to the standard heat. The improved fatigue life was attributed to differences in grain size and grain boundary precipitate morphology. Dissert. Abstr.

N80-17194 California Univ., Berkeley.
MICROSTRUCTURES AND PHASE TRANSFORMATIONS IN INTERSTITIAL ALLOYS OF TANTALUM Ph.D. Thesis
Ulrich Dahmen 1979 134 p
Avail: Univ. Microfilms Order No. 8000320
Electron microscopy and ultrahigh vacuum technology were used to examine the microstructures and phase transformations in dilute interstitial tantalum carbon alloys. Through a number of control experiments, the role and sources of interstitial contamination in the alloy preparation (and under operating conditions) are revealed. It is demonstrated that all previously published work on the dilute interstitially ordered phase Ta64C can be explained consistently in terms of ordering of the interstitial contaminants oxygen and hydrogen, leading to the formation of the phases Ta12O and Ta2H. Dissert. Abstr.

N80-17195 Michigan Technological Univ., Houghton.
INTERFACIAL REACTIVITY AND STRESS CORROSION CRACKING OF SOME COPPER ALLOYS IN ACIDIC ENVIRONMENTS Ph.D. Thesis
Timothy R. Pinchback 1977 163 p
Avail: Univ. Microfilms Order No. 8001317
The roles of bulk electrolyte composition and alloy solute segregation in controlling localized corrosion and SCC susceptibility were determined. The materials studied included a tin bearing commercial admiralty brass and high purity binary alloys of Cu-Sn, Cu-Sb, and Cu-Bi. SCC mechanisms are proposed based on determinations of crack kinetics, crack morphology, fracture surface chemistry, solution analysis and alloy polarization characteristics. The variables that determine localized corrosion tendency and crack initiation are alloy solute content, segregation and stress. The relative effects of these parameters are discussed. A mechanism for crack propagation based on strain enhanced dissolution at segregated grain boundaries is presented. Dissert. Abstr.

N80-17196 Michigan Technological Univ., Houghton.
CHARACTERIZATION OF GAS BUBBLES INJECTED INTO LIQUID METALS AND THE KINETICS OF GASEOUS DEOXIDATION OF LIQUID COPPER Ph.D. Thesis
Rockne James Andreini 1976 196 p
Avail: Univ. Microfilms Order No. 8001312
Liquid metals under laminar flow at the orifice were studied as argon or carbon monoxide bubbles were injected into the surface. An experimental approach, which utilized the noises generated by bubbles, was used to collect the necessary data. Tin, lead, and copper melts were investigated. Gas bubble formation frequencies (and hence bubble size) were determined, and it was found that the bubble size generated for a particular orifice diameter was dependent upon the magnitudes of the orifice Froude and Weber numbers. Drag coefficients of the rising bubbles were found to agree well with data previously generated in aqueous solution systems. Bubble size and velocities were determined in akinetic study of gaseous deoxidation of liquid copper with carbon monoxide and reformed natural gas as the reducing gases. The deoxidation kinetics utilizing carbon monoxide are determined primarily by the mass transport of oxygen in liquid copper. Dissert. Abstr.

N80-17197 Stanford Univ., Calif.
TWO THEORETICAL STUDIES OF FRACTURE AND DEFORMATION OF METALS Ph.D. Thesis
George Mathews Pharr, IV 1979 176 p
Avail: Univ. Microfilms Order No. 8001991
The growth of grain boundary cavities is examined using a mechanism in which atoms are driven by gradients in curvature along the surface of the cavity to the grain boundary. Particular attention is given to following the time dependent shape evolution of an initially lenticular cavity. Taking this approach allows for the determination of the effects of capillarity and transients on the growth process. The cavity evolution is examined using a finite difference numerical scheme in which the displacements of discrete points on the cavity surface are followed in time. An array of cavities is studied to determine the effects of cavity interaction on the growth process and to define a criterion for fracture. Low temperature plastic deformation is also examined and a dislocation dynamical model for low temperature plastic

flow is developed from the Taylor-Orowan equation.
Dissert. Abstr.

N80-17198 Yeshiva Univ., New York, N. Y.
COMPUTER SIMULATION STUDIES OF BINARY ALLOYS
Ph.D. Thesis
Mohan Kumar Phani 1979 163 p
Avail: Univ. Microfilms Order No. 8001276

A Monte Carlo simulation of a binary alloy on a simple cubic and plane square lattices is presented. The system with 27,000 sites and equal number of A and B atoms is quenched from an infinite temperature to a temperature T = 0.6T sub c and the time evaluation of the long range and short range order parameters and structure functions are studied. The antiphase domains are seen to play an important role in the kinetics. The binary alloy on a fcc lattice with nearest and next nearest neighbor interactions is treated by Monte Carlo. The energy, sublattice magnetization and specific heat (energy fluctuation) are calculated. The phase diagram in the T-alpha plane is calculated for the equicomposition alloy. For the alpha as it approaches infinity point the extrapolated value is approximately 1 percent higher than the known series expansion result. Dissert. Abstr.

N80-17199*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL PROCESSES INVOLVED IN THE INITIATION OF HOT CORROSION OF B-1900 AND NASA-TRW VIA
George C. Fryburg, Fred J. Kohl, and Carl A. Stearns 1979 49 p refs Presented at 165th Meeting of the Electrochem. Soc., Los Angeles, 14-19 Oct. 1979
(NASA-TM-81399; E-308) Avail: NTIS HC A03/MF A01 CSCL 11F

Sodium sulfate induced hot corrosion of B-1900 and NASA-TRW VIA at 900 C was studied with special emphasis on the chemical reactions occurring during and immediately after the induction period. Thermogravimetric tests were run for set periods of time after which the samples were washed with water and water soluable metal salts and/or residual sulfates were analyzed chemically. Element distributions within the oxide layer were obtained from electron microprobe X-ray micrographs. A third set of samples were subjected to surface analysis by X-ray photoelectron spectroscopy. Evolution of SO2 was monitored throughout many of the hot corrosion tests. Results are interpreted in terms of acid-base fluxing mechanisms. K.L.

N80-17200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANISOTROPY OF NICKEL-BASE SUPERALLOY SINGLE CRYSTALS
Rebecca A. MacKay (Case Western Reserve Univ., Cleveland), Robert L. Dreshfield, and Ralph D. Maier (Case Western Reserve Univ., Cleveland) 1980 17 p refs Prepared for Presentation at 4th Intern. Symp. on Superalloys, Champion, Pa., 21-25 Sep. 1980
(NASA-TM-81437; E-327) Avail: NTIS HC A02/MF A01 CSCL 11F

The influence of orientation on the tensile and stress rupture behavior of 52 Mar-M247 single crystals was studied. Tensile tests were performed at temperatures between 23 and 1093 C; stress rupture behavior was examined between 760 and 1038 C. The mechanical behavior of the single crystals was rationalized on the basis of the Schmid factor contours for the operative slip systems and the lattice rotations which the crystals underwent during deformation. The tensile properties correlated well with the appropriate Schmid factor contours. The stress rupture lives at lower testing temperatures were greatly influenced by the lattice rotations required to produce cross slip. A unified analysis was attained for the stress rupture life data generated for the Mar-M247 single crystals at 760 and 774 C under a stress of 724 MPa and the data reported for Mar-M200 single crystals tested at 760 C under a stress of 689 MPa. Based on this analysis, the stereographic triangle was divided into several regions which were rank ordered according to stress rupture life for this temperature regime. Author

N80-17201*# National Aeronautics and Space Administration, Washington, D. C.
MICROSTRUCTURE AND MECHANICAL PROPERTIES OF HIP-CONSOLIDATED RENE 95 POWDERS
Y. Shimanuki, Y. Nishino, M. Masui, and H. Doi Feb. 1980 15 p refs Transl. into ENGLISH from J. Jap. Soc. Powder Met. (Japan), v. 25, no. 8, Dec. 1978, p 262-267 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75759) Avail: NTIS HC A02/MF A01 CSCL 11F

The effects of heat-treatments on the microstructure of P/M Rene 95 (a nickel-based powder metal), consolidated by the hot-isostatic pressing (HIP), were examined. The microstructure of as-HIP'd specimen was characterized by highly serrated grain boundaries. Mechanical tests and microstructural observations reveal that the serrated grain boundaries improved ductility at both room and elevated temperatures by retarding crack propagation along grain boundaries. Author

N80-17202# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
PHASE TRANSFORMATIONS AND TENSILE PROPERTIES OF Ti-10V-2Fe-3Al
T. W. Duerig, G. T. Terlinde, and J. C. Williams Aug. 1979 39 p refs
(Contract N00014-76-C-0409)
(AD-A074093; JWTR-5) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effect of heat treatment on the microstructure of the metastable beta alloy Ti-10V-2Fe-3Al has been studied using light and electron metallography, analytical electron microscopy, and X-ray diffraction. A limited survey of the effect of microstructure on tensile properties of the alloy also has been conducted. It has been found that the alloy contains inclusions which are rich in Ti, S, Si, and P. The alloy has been shown to form the omega phase both athermally and isothermally. The isothermal omega can have either an ellipsoidal or a cuboidal morphology. The reasons for this are enumerated. The formation of the equilibrium alpha phase has been studied, and three distinct modes of formation are described. A stress induced othorhombic martensite also has been observed. The effect of this stress induced product on tensile behavior is discussed. The relative roles of inclusions and alpha phase precipitates on tensile fracture also have been examined. GRA

N80-17203# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
PHOTOACTIVATION OF COBALT CARBONYL CATALYST: GENERATION OF REACTIVE MONONUCLEAR FRAGMENTS FROM DINUCLEAR, METAL-METAL BONDED COMPLEXES
Carol L. Reichel and Mark S. Wrighton 12 Sep. 1979 16 p refs
(Contract N00014-75-C-0880)
(AD-A074182; TR-18-ONR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The metal-metal bonded complexes (CO2(CO)6L2) (l = p(n-Bu)3, P(OPh)3) and Fe(n5-C5H5) (CO)2CO)(CO)3(P(OPh)3)) all undergo efficient (theta greater than 0.1 at 355 nm) photochemical metal-metal bond cleavage to produce reactive 17-valence electron (CO(CO)3L) fragments. In the presence of 1-pentene no alkene isomerization is found for L = P(n-Bu)3; low, but significant, photocatalytic activity is found for L = P(OPh)3 or when the P(n-Bu)3 complex is irradiated in the presence of P(OMe)3. The Co(CO)3L) precursors are strikingly more active when irradiation is carried out in the presence of HSiEt3, a hydride source. Both alkene isomerization and n-pentane formation are observed, along with small quantities of Si-containing products. The Fe(n to the fifth power-C5H5)(CO)2) radical photogenerated independently from (Fe2(n to the fifth power-C5H5)2(CO)4 is not active under any conditions used thus far. The activity of 17-valence electron radicals in this application is Co(CO)3(P(OPh)3)) = Co(CO)3(P(n-Bu)3)) = Fe(n to the fifth power-C5H5)(CO)2). These species are not themselves effective catalysts but do seem to react with HSiEt3 to form catalytically active, mononuclear Co-hydride complexes. GRA

N80-17204# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
US/AUSTRALIA COLLABORATIVE RESEARCH PROJECT

ON CORROSION FATIGUE IN D6AC STEEL JOINTS Final Report, Jan. 1974 - Aug. 1978
C. L. Harmsworth, D. S. Kemsley, and J. M. Finney Dec. 1978 112 p refs Prepared in cooperation with Aeronautical Research Labs., Melbourne
(AF Proj. 2418)
(AD-A076197; AFML-TR-78-150; ARL/Struc-370/MAT-108) Avail: NTIS HC A06/MF A01 CSCL 11/6

A U.S./Australian program has been conducted to determine the effect of manufacturing-induced and environmental corrosion on D6AC steel Taper-Lok bolted joints as used in the F-111 aircraft. Under constant amplitude, traces of distilled water or concentrated hydrochloric acid in the bolt holes did not reduce fatigue life. Under spectrum loading, traces of water did not affect fatigue life but traces of hydrochloric acid reduced the mean fatigue life of the joint by a factor of 110. The results of further constant amplitude tests and a limited series of spectrum tests confirmed previous findings that the life of those original joints in the F-111 which were manufactured using a six-flute hand reamer could be appreciably extended by rework with an 18-flute tapered reamer as used in later F-111 production. Other rework procedures involving cold working of the hole by a mandrel or specially designed fasteners showed little improvement when used in this relatively high-strength steel joint material. The effects of improved sealants and the capability of ultrasonic and magnetic NDI techniques for inspection of cracks at fastener holes were also investigated. It is concluded that the life of uncontaminated, properly fabricated and sealed D6AC steel joints as used in the F-111 wing carry through should not be a source of fatigue failure during a normal aircraft lifetime. GRA

N80-17205# Army Armament Research and Development Command, Dover, N. J. Fire Control and Small Caliber Weapon Systems Lab.
SINTERING CYCLE INFLUENCE ON P/M STEEL FORGINGS' DYNAMIC PROPERTIES Final Report
Andrew Crowson Aug. 1979 37 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A075244; AD-E400342; ARSCD-TR-79008) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effects of sintering environments and their respective parameters on the dynamic properties of P/M steel forgings have been determined. Compacted preforms were sintered from 10 to 90 minutes over a range of temperatures (1100-1370 C) in inert, vacuum, and reducing atmospheres. The final oxide content was found to vary exponentially with sintering time, sintering temperature, and gas flow-rate regardless of the type of atmosphere used. Reduction of the metal oxides was basically controlled by two factors: (1) carbon, and (2) elevated temperature. Two levels of oxide reduction were evident. The initial level involved a reduction of the majority of the metal oxides (iron, molybdenum, and nickel oxides), whereas the secondary level resulted in a slow reduction of the more thermodynamically stable oxides of manganese and chromium. Elongation, reduction in area, and impact energy values showed a corresponding increase with decreasing oxide content. GRA

N80-17206# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
NEW SAMARIUM-2 COBALT-17-BASED COMPOUNDS FOR PERMANENT MAGNET APPLICATIONS
F. Rothwarf, H. A. Leupold, A. Tauber, J. T. Breslin, and R. L. Bergner Sep. 1979 15 p refs
(DA Proj. 1L1-61102-AH-47)
(AD-A075424; DELET-TR-79-20) Avail: NTIS HC A02/MF A01 CSCL 09/1

The magnetic properties of several samarium-2 cobalt-17-based alloy systems potentially useful for microwave/millimeter-wave applications are reviewed. Two types of materials are discussed. One contains heavy rare earth substituents for some samarium in an attempt to achieve intrinsically temperature stabilized magnets. The other contains manganese or chromium substituents for some cobalt in the samarium-2(cobalt, iron, copper, zirconium)-17 type compound in an effort to enhance the coercivity and to attain a more linear demagnetization curve for this material, which already has an energy product of 30 megagauss oersteds. GRA

N80-17207# Kentucky Univ., Lexington. Dept. of Metallurgical Engineering and Materials Science.
A STUDY OF THE ELECTROPLASTIC EFFECT IN METALS Final Technical Report, 1 Jan. 1977 - 31 May 1979
Hans Conrad and Kenji Okazaki 31 Jul. 1979 44 p refs
(Grant AF-AFOSR-3203-77; AF Proj. 2307)
(AD-A075267; AFOSR-79-0988TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effects of high density, direct current pulses (100 to 1000 A/sq. mm for periods of 55-120 microsecs) on the flow stress determined in an Instron tensile testing machine were studied in a number of polycrystalline metals representing various crystal structures (Pb, Sn, Fe and Ti), with most attention being focused on Ti. The current pulses produced a decrease in the flow stress delta (o sub p) in all four metals. The work on Ti indicated that delta (o sub p) contains a contribution in addition to heating and pinch effects. This contribution (the electroplastic effect) increased significantly with current density, interstitial content and temperature (77-300K), to a lesser degree with strain, but no change was detected for a 25 fold increase in strain rate. Computer calculations of the dynamic stress changes associated with the approximately sinusoidal current-time pulses employed here yielded a contribution due to the electron-dislocation interaction (for a current density of 5000 A/sq mm at 300K) which was 32% of delta (o sub p). A model is proposed for the electroplastic effect which is based on theoretical considerations that the current flow exerts a force on the dislocations which adds to the applied force pushing a dislocation against obstacles. Complementary studies were performed on: (a) the decremental unloading method for determining the internal stress in metals, (b) the effects of temperature, gain size and interstitial content on the flow stress of Ti and (c) plastic instability in Ti sheet. GRA

N80-17208# Illinois Univ. at Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.
PHASE CHANGES IN THE NIOBIUM-HYDROGEN SYSTEM. 1: ACCOMMODATION EFFECTS DURING HYDRIDE PRECIPITATION
B. J. Makenas and H. K. Birnbaum 1 Jul. 1979 36 p refs
(Contract N00014-75-C-1012)
(AD-A075518) Avail: NTIS HC A03/MF A01 CSCL 11/6

The accommodation effects which accompany hydride precipitation were studied in the Nb-H system using T.E.M. Elastic accommodation and punching of prismatic dislocation loops in the solid solution matrix were observed on precipitation. The reversibility of the plastic accommodation processes was studied. Dislocation generation and motion in the hydride was observed during reversion. These observations were related to the volume changes due to hydride formation and to the thermodynamics of the phase change. Direct evidence for the inhibition of hydride precipitation due to trapping at O and N interstitials is presented. GRA

N80-17209# Hughes Research Labs., Malibu, Calif.
GaAs SURFACE PASSIVATION FOR DEVICE APPLICATIONS Interim Report, 15 Jun. - 15 Dec. 1978
C. L. Anderson, M. D. Clark, and J. W. Peters Wright-Patterson AFB, Ohio AFAL Mar. 1979 21 p
(Contract F33615-78-C-1444; AF Proj. 2305)
(AD-A075479; AFAL-TR-79-1057; IR-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

This report describes the initial stages of a program to develop deposited dielectrics for GaAs device applications. Three applications of the dielectrics are being investigated: (1) isolation of control electrodes, (2) passivation of the GaAs surface, and (3) encapsulation of completed circuits. The dielectrics being studied include silicon oxynitride; mixtures of silicon nitrode and germanium nitride; and mixtures of silicon dioxide, gallium oxide, and aluminum oxide. Deposition techniques being employed are pyrolytic chemical vapor deposition, plasma-enhanced deposition, and photochemical deposition. This report describes the apparatus being used for this program and the chemical analysis of preliminary films deposited. No interface state measurements are reported. GRA

N80-17210# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.

GaAs SURFACE EFFECTS Interim Report, 1 Jul. - 31 Dec. 1978
Gordon J. Kuhlmann Wright-Patterson AFB AFAL Jun. 1979 64 p refs
(Contract F33615-78-C-1591; AF Proj. 2305)
(AD-A075478; C78-851/501) Avail: NTIS HC A04/MF A01 CSCL 11/6

This report presents the results of the first six months of a program to investigate the passivation of GaAs surfaces using a native insulator. Ion implantation of phosphorus and subsequent oxidation of the surface was used to form the insulator. Post-implant annealing indicates that Chemical Vapor Deposition SiO2 has somewhat better encapsulating properties than sputtered Si3N4. It was found that high-dose phosphorus implantation significantly reduces decomposition of the semiconductor surface under the SiO2 encapsulant during high-temperature annealing. GRA

N80-17211# Argonne National Lab., Ill.
ION BOMBARDMENT-INDUCED CHANGES IN THE SURFACE COMPOSITION OF BINARY ALLOYS
N. Q. Lam, H. Wiedersich, and P. R. Okamoto 1979 8 p refs Presented at the Conf. on Irradiation Behavior of Metallic Mater. for Fast Reactor Core Components, Corsica, France, 5 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-790657-5) Avail: NTIS HC A02/MF A01

Redistribution of alloy components during heavy-ion bombardment was investigated using a kinetic model that includes the effects of radiation-induced segregation and preferential sputtering. Theoretical predictions are qualitatively compared with recent experimental measurements. DOE

N80-17212# Argonne National Lab., Ill.
MARTENSITIC PHASE TRANSFORMATION IN SHAPE-MEMORY ALLOYS
A. A. Golestaneh 1979 15 p refs Presented at the Intern. Conf. on Martensitic Transformation, Boston, 24 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-7906103-3) Avail: NTIS HC A02/MF A01

Isothermal studies are described of the shape-recovery phenomenon, stress-strain behavior, electrical resistivity and thermoelectric power associated with the martensite-parent phase reaction in the Ni-Ti shape-memory alloys. The energy-balance equation that links the reaction kinetics with the strain energy change during the cooling-deforming and heating cycle is analyzed. The strain range in which the Clausius-Clapeyron equation satisfactorily describes this reaction is determined. A large change in the Young's modulus of the specimen is found to be associated with the M yields P reaction. A hysteresis loop in the resistivity-temperature plot is found and related to the anomaly in the athermal resistivity changes during cyclic M yields P yields M transformation. An explanation for the resistivity anomaly is offered. The M structure is found to be electrically negative relative to the P structure. A thermal emf of > or = 0.12 mV is found at the M-P interface. DOE

N80-17213# Centre Technique des Industries Mecaniques, Senlis (France).
ON THE IMPROVEMENT OF CHROME PLATING IN A CIRCULATING ELECTROLYTE [AMELIORATION DES DEPOTS DE CHROME PAR DEPOSITION DANS UN ELECTROLYTE EN CIRCULATION]
F. Mortier and J.-J. Sabatier Feb. 1979 47 p refs In FRENCH
(CETIM-12-F-20-0) Avail: NTIS HC A03/MF A01

The literature concerning chrome electrodeposition is surveyed. Industrial electroplating processes and improvements in these processes are discussed. Problem areas in chrome electrodeposition including the toxicity of the baths, a relatively slow deposition rate often leading to hydrogen embrittlement, and the emission of poisonous gases during electroplating, are examined. Possible solutions to these problems including the use of chrome baths containing trivalent salts, the use of ultrasonics, exploiting the influence of forced electrolyte circulation, and varying the current of electrolysis, are studied. Special attention is paid to controlling the pH factor during the process. Author (ESA)

N80-17214# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
SCIENTIFIC AND TECHNICAL RESEARCH IN THE METAL WORKING INDUSTRY Annual Report [RAPPORT ANNUEL ON COMITE PERMANENT AU CONCEIL GENERAL]
6 Jun. 1979 40 p refs In FRENCH
Avail: NTIS HC A03/MF A01

The research and development efforts reported include foundry techniques, metal forming, machining and assembling metal parts, the development of metallurgy in electronics, and the use of automation and data processing in the metal working industry. Emphasis is placed on the growing role of electronics, especially microprocessors, in these applications. Author (ESA)

N80-17215# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ORDERING EFFECTS IN TRANSITION METAL ALLOYS IN RELATION TO THEIR ELECTRONIC STRUCTURES [EFFECTS D'ORDRE DANS LES ALLIAGES DE MATAUX DE TRANSITION EN RELATION AVEC LEUR STRUCTURE ELECTRONIQUE]
Guy Treglia 1978 74 p refs In FRENCH; ENGLISH summary
(ONERA-NT-1978-9) Avail: NTIS HC A04/MF A01

The ordering energy in transition metal alloys, contrary to the cohesive energy, can be written as the sum of effective pair interactions. These interactions are defined in terms of quantities calculated from the electronic structure of these metals. Two methods are used. First, for an annealed alloy, the susceptibility is calculated by means of a molecular field method using an extremization of the free energy. Then, the interactions by analogy with the Ising model are identified. The best thermodynamic one-site approximation is shown to be the coherent potential approximation (CPA). Using the second method for a 'frozen' alloy, the ordering energy is given by a generalized perturbation expression taking as a reference state the completely, disordered state treated within the usual CPA. Results show that both methods give the same concentration dependent effective pair interactions. This is true even if the charge transfers are taken into account. A detailed numerical discussion shows the validity range of this model to be the same as the CPA one. Author (ESA)

N80-17216# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE PHYSICOCHEMICAL PROPERTIES OF SLAGS. PART 4: SURVEY OF DATA ON INTERFACIAL PROPERTIES BETWEEN MOLTEN METALS AND MOLTEN SLAGS CONTAINING CaF2
B. J. Keene Jun. 1979 55 p refs
(NPL-Chem-99-Pt-4) Avail: NTIS HC A04/MF A01

Data from the literature on the interfacial properties between molten metals and molten slags containing CaF2 were surveyed. Assessment of the data was not possible, since most of the studies have been conducted on complex systems, in which relatively small differences in surface-active components could have had a significant effect on the surface properties. Author (ESA)

N80-17217# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE PHYSIOCHEMICAL PROPERTIES OF SLAGS. PART 5: REVIEW OF THE PHASE DIAGRAMS FOR CaF2-BASED SLAGS
K. C. Mills Jul. 1979 89 p refs
(NPL-Chem-100-Pt-5) Avail: NTIS HC A05/MF A01

The extant information on phase diagrams for CaF2 based slags was collated and evaluated. The data for gaseous species given off by various molten slags were also reviewed as the reactions producing these species also affect the phase equilibria. Recommended phase diagrams for the various systems are reported. Author (ESA)

N80-17218# Centre Technique des Industries Mecaniques, Senlis (France).
THE INFLUENCE OF CEMENTATION CONDITIONS ON THE PRESSENCE OF RESIDUAL AUSTENITE AFTER TEMPERING. THE ROLE OF AUSTENITE IN CHARACTERIZING

THE IN-SERVICE MECHANICAL PROPERTIES OF PARTS Final Report [INFLUENCE DES CONDITIONS DE CEMENTATION SUR LA PRESENCE D'AUSTENITE RESIDUELLE APRES TREMPE. ROLE DE CETTE AUSTENITE SUR LE COMPORTEMENT EN SERVICE DES PIECES MECHANIQUES]
C. Tournier, A. Brucelle, and F. Lecroiscey 17 Apr. 1979 208 p refs In FRENCH
(CETIM-12-G-08-0) Avail: NTIS HC A10/MF A01

The relation between steels and the resulting structure during cementation were studied. Measurements by X-ray analysis and layer characterization show that the quantity of residual austenite in the cemented layers can be accurately predicted. Micrographic analysis which shows that the profile of other constituents (martenite, bainite, perlite) is closely linked to the level of austenite present, is discussed. The surface mechanical (fatigue) properties of the materials were studied. It was shown that when the level of austenite falls below 30 percent it is difficult to predict fatigue behavior. Author (ESA)

N80-17219# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Sect. Construction Metallique.
RESIDUAL DUCTIVITY IN WELDED JOINTS [RESERVE DE DUCTILITE DANS LES JOINTS SOUDES]
R. Baus (Belgium Univ., Liege), W. Chapeau (Belgium Univ., Liege), and M. Piron (Belgium Univ., Liege) Mar. 1979 71 p refs In FRENCH
(CRIF-MT-139) Avail: NTIS HC A04/MF A01

The measurement of residual ductility and its interpretation for welded joints in a wide range of steels is discussed. Results permit the quantitative evaluation of fracture risk for a welded joint undergoing tensile stress and containing a fault of a given dimension. Variables taken into consideration include the types of base and feeder metals used, type of heat treatment, mechanical characterisitcs, and the welding technique employed. Arc welding with laboratory control of the amount of hydrogen diffused into the weld is emphasized. The method of interpretation is based on methods used for notch tests on full scale specimens and involves a finite element analysis through a computer program. Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-17220*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICATION AND WEAR MECHANISMS OF POLYIMIDE-BONDED GRAPHITE FLUORIDE FILMS SUBJECTED TO LOW CONTACT STRESS
Robert L. Fusaro Jan. 1980 27 p refs
(NASA-TP-1584; E-9990) Avail: NTIS HC A03/MF A01 CSCL 11H

The tribological properties of polyimide-bonded graphite fluoride films were studied with a pin-on-disk friction apparatus. A 440 C HT stainless steel rider with a 0.95 millimeter diameter flat area was slid against the film in order to achieve a light, closely controlled contact stress. A 1 kilogram load was applied to this flat to give a projected contact stress of 14 megapascals. Two stages of lubrication were operating. In the first stage, the film supported the load and the lubricating mechanism appeared to be the shear of a thin surface layer of the film between the rider and the bulk of the film. The second stage began after the original film was worn away, and the lubricating mechanism appeared to be the shear of very thin lubricant layers between the flat area on the rider and flat plateaus generated on the sandblasted asperities of the metallic substrate. The major difference between the lubricating mechanisms of the hemispherical and flat riders was that the flat wore through the film much more slowly than did the hemisphere. K.L.

N80-17221*# Aerotherm Acurex Corp., Mountain View, Calif. Aerospace Systems Div.
SYNTHESIS OF IMPROVED PHENOLIC RESINS Final Report
C. B. Delano and A. H. McLeod 4 Sep. 1979 115 p refs
(Contract NAS3-21368)
(NASA-CR-159724; FR-79-25/AS) Avail: NTIS HC A06/MF A01 CSCL 11G

Twenty seven addition cured phenolic resin compositions were prepared and tested for their ability to give char residues comparable to state-of-the-art phenolic resins. Cyanate, epoxy, allyl, acrylate, methacrylate and ethynyl derivatized phenolic oligomers were investigated. The novolac-cyanate and propargyl-novolac resins provided anaerobic char yields at 800 C of 58 percent. A 59 percent char yield was obtained from modified epoxy novolacs. A phosphonitrilic derivative was found to be effective as an additive for increasing char yields. The novolac-cyanate, epoxy-novolac and methacrylate-epoxy-novolac systems were investigated as composite matrices with Thornel 300 graphite fiber. All three resins showed good potential as composite matrices. The free radical cured methacrylate-epoxy-novolac graphite composite provided short beam shear strengths at room temperature of 93.3 MPa (13.5 ksi). The novolac-cyanate graphite composite produced a short beam shear strength of 74 MPa (10.7 ksi) and flexural strength of 1302 MPa (189 ksi) at 177 C. Air heat aging of the novolac-cyanate and epoxy novolac based composites for 12 weeks at 204 C showed good property retention. Author

N80-17222# Army Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF RAPIDLY DEPLOYABLE PLASTIC FOAM SYSTEMS. VOLUME 1: SYSTEM DEVELOPMENT Final Report
Alvin Smith Oct. 1979 41 p refs 2 Vol.
(MIPR-FY1456-78-00006; MIPR-FY1456-79-00002)
(AD-A076332; CERL-TR-M-272-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

Volume 1 of this report (1) presents the findings of a study conducted to develop a low-density polyurethane foam system that is deployable within 5 seconds; and (2) documents a study of foam/fabric deployable shapes. An especially fast-reacting foam formulation was devised, hardware for delivery and mixing of foam chemicals was designed and evaluated, various geometric shapes of constant volume that the foam could be formed into were investigated, and the impact loading characteristics of the foam at various times soon after generation were studied. Fabrication of fabric foam cylinders was also studied. Volume 2 documents a study of fabric-skinned, foam-filled cylindrical beams and an analytical/experimental study of their bending properties. Results of the studies show that a low-density polyurethane foam system that will deploy within 5 seconds is practical to generate and to form into geometrically shaped lightweight fabric bags. The foam exhibits good impact absorption properties very quickly after formation; these properties can be used to attenuate rapidly applied loads of low to intermediate velocities. Finally, the fabric/foam composite beams possess interesting structural qualities commensurate with the fabric and foam used in making them. The analytical and experimental results compare very well. The analysis identified several factors of the mechanics involved that must be included in calculations to predict the loading response of such composites. GRA

N80-17223# Army Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF RAPIDLY DEPLOYABLE PLASTIC FOAM SYSTEMS. VOLUME 2: NONLINEAR DEFORMATION AND LOCAL BUCKLING OF KEVLAR FABRIC/POLYURETHANE FOAM COMPOSITES Final Report
Alvin Smith, S. S. Wang, and A. Y. Kuo Oct. 1979 49 p refs 2 Vol.
(MIPR-FY1456-78-00006; MIPR-FY1456-79-00002)
(AD-A076310; CERL-TR-M-272-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 11/9

The binding properties of fabric skigned, foam filled cylindrical beams were investigated. Results show that a low density polyurethane foam system that will deploy within 5 seconds is practical to generate and to form good impact absorption properties very quickly after formation. These properties are used

to attenuate rapidly applied loads of low to intermediate velocities. R.C.T.

N80-17224# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
MICROENCAPSULATED FLUORESCENT DYE PENETRANT Final Report, Oct. 1977 - Jan. 1979
S. Allinikov Jul. 1979 35 p ref
(AF Proj. 2421)
(AD-A076183; AFML-TR-79-4027) Avail: NTIS HC A03/MF A01 CSCL 11/3

Microencapsulated fluorescent dye penetrant materials were evaluated for feasibility as a technique to detect cracks on metal surfaces when applied as a free flowing dry powder. Various fluorescent dye solutions in addition to a commercial penetrant (Zyglo ZL-30) were microencapsulated and tested on nondestructive inspection crack standards. The material could be applied dry with standard spray apparatus, and removed by blowing air, vacuum or with a detergent water mixture. Indications of cracks 0.5 microns in width or larger could be visually observed in the tests conducted to date. GRA

N80-17225# Army Materials and Mechanics Research Center, Watertown, Mass.
CORROSION/EROSION BEHAVIOR OF SILICON NITRIDE AND SILICON CARBIDE CERAMICS: GAS TURBINE EXPERIENCE Final Report
R. Nathan Katz Apr. 1979 26 p refs Presented at the 23d Natl. SAMPE Symp., Anaheim, Calif., 3 May 1978
(ARPA Order 1849)
(AD-A076382; AMMRC-MS-79-2) Avail: NTIS HC A03/MF A01 CSCL 11/2

Ceramic materials, silicon nitride and silicon carbide in particular, are under intensive engineering development for gas turbine applications. One of the factors which has encouraged this line of development is the excellent corrosion/erosion behavior of these ceramics. This paper will briefly review some of the fundamental mechanisms and critical materials properties thought to govern the corrosion/erosion behavior of ceramics and point out where these differ from those of metals. A review of available erosion, corrosion, and combined corrosion/erosion testing of silicon nitrides and silicon carbides will be presented. While the results of these tests are quite encouraging, it is evident that there is a lack of data at high temperatures, in atmospheres containing multiple contaminates, and there is virtually no long-duration testing information. The author will suggest areas of research required to further our understanding of corrosion/erosion behavior and phenomena, and provide a more extensive data base for future engineering applications. GRA

N80-17226# Rockwell International Science Center, Thousand Oaks, Calif.
MICROSTRUCTURALLY DEVELOPED TOUGHENING MECHANISMS IN CERAMICS. STRESS-INDUCED PHASE TRANSFORMATIONS: THEORY OF PHASE RETENTION AND FRACTURE TOUGHNESS
F. F. Lange Oct. 1979 28 p refs
(Contract N00014-77-C-0441)
(AD-A076532; SC5117.6TR, TR-6) Avail: NTIS HC A03/MF A01 CSCL 11/2

The thermodynamics of a constrained transformation has been examined with regard to the conditions for phase retention during fabrication and the effect of a stress-induced transformation on the fracture toughness. Constraint of the shape change associated with the transformation by an elastic matrix will lower the transformation temperature. Retention also requires that a critical grain size (or particle size) cannot be exceeded during fabrication. Two binding solutions for the critical stress intensity factor (Kc) were obtained: one for the case where the transformation suffers no stress hysteresis effect and the other for a large stress hysteresis effect. Both indicate that Kc will depend on the transformation's shape change, the elastic properties of the constraining matrix, the volume fraction of the retained, metastable phase and temperature. Kc is predicted to decrease with increasing temperature. GRA

N80-17227# Monsanto Research Corp., Dayton, Ohio.
ASSESSMENT OF THE FLAMMABILITY OF AIRCRAFT HYDRAULIC FLUIDS Final Report, 15 Dec. 1975 - 30 Sep. 1978
Leo Parts Wright-Patterson AFB, Ohio AFAPL Jul. 1979 85 p refs
(Contract F33615-76-C-2015; AF Proj. 3048)
(AD-A076512; MRC-DA-860; AFAPL-TR-79-2055) Avail: NTIS HC A05/MF A01 CSCL 11/8

The main thrust of the program was directed toward two objectives: (1) development of apparatus for the measurement of ignitability characteristics of fluids at high temperatures (up to 930 C); and (2) the use of that and other apparatus for the determination of ignitability, flame propagation properties, and heats of combustion of a number of aircraft fluids. These included currently used hydraulic fluids, candidate nonflammable hydraulic fluids, and other aircraft fluids such as lubricants, fuels, and heat transfer fluids. The studies were successful in the identification of candidate nonflammable hydraulic fluids. These fluids were identified as Halocarbon AO-8, Freon E6.5, and Brayco 814Z. A semiautomatic ignition test apparatus was built that can be used for measurements at temperatures up to 1000 C. The operation range of a hot manifold ignition test apparatus was extended up to 930 C. GRA

N80-17228# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
EFFECT OF WORKPIECE PROPERTIES ON GRINDING FORCES IN POLYCRYSTALLINE CERAMICS
B. G. Koepke and R. J. Stokes Jun. 1979 41 p refs
(Contract N00014-69-C-0123)
(AD-A075388; HONEYWELL-47502; TR-7) Avail: NTIS HC A03/MF A01 CSCL 20/2

Grinding forces have been measured on a number of polycrystalline ceramics and correlations between the forces and workpiece properties have been attempted in an effort to gain insight into mechanisms of chip formation. The closest correlations were with a parameter related to the indentation fracture characteristics of each workpiece. This suggests that a major mechanism of chip formation during multipoint abrasive machining of ceramics is fracture resulting from the plastic indentation of the workpiece by the abrasive grains. Grinding forces during up and down grinding were different but both correlated with the indentation fracture parameter when the comminution characteristics of the chips during down grinding were accounted for. GRA

N80-17229# Office of Naval Research, London (England).
HOW PLASTICS FAIL: THE CHURCHILL CONFERENCE
Willard D. Bascom Aug. 1979 16 p Presented at the 5th Intern. Conf. on Deformation, Yield and Fracture of Polymers, Cambridge, England, 2-5 Apr. 1979
(AD-A075433; ONRL-C-4-79) Avail: NTIS HC A02/MF A01 CSCL 11/9

This report reviews the presentations and discussion at the 5th International Conference on Deformation, Yield and Fracture of Polymers held at the University of Cambridge on 2-5 April, 1979. The work presented at the Conference gives some insight into the state-of-the-art of research on how polymeric materials fail. No breakthroughs were revealed, but the tone of the Conference suggested a coming to grips with nonlinear processes. GRA

N80-17230# Naval Surface Weapons Center, White Oak, Md.
MOISTURE SORPTION AND DIFFUSION IN HERCULES 3501-6 EPOXY RESIN Progress Report, Oct. 1977 - Oct. 1978
Joseph M. Augl 30 Mar. 1979 42 p refs
(AD-A076008; NSWC/TR-79-39) Avail: NTIS HC A03/MF A01 CSCL 11/9

The objective of this work was to obtain the moisture sorption equilibria of Hercules 3501-6 epoxy resin and its concentration dependent moisture diffusion coefficient. These data are necessary for predicting changes in aircraft structural composites properties where this resin is used as a matrix material. The data were obtained by sorption measurements with a Cahn electrobalance. It was found that the diffusion coefficient is strongly concentration-dependent at low moisture concentration, however, it is fairly flat at moisture concentrations corresponding to equilibrium concentration between 30 to 80 percent relative humidity. GRA

N80-17231# Akron Univ., Ohio. Inst. of Polymer Science
BONDING ELASTOMER LAYERS TOGETHER BY A SURFACE OXIDATION REACTION
R. J. Chang, A. N. Gent, C. C. Hsu, and K. C. Sehgal Oct. 1979 34 p refs
(Contract N00014-76-C-0408)
(AD-A076265; TR-5) Avail: NTIS HC A03/MF A01 CSCL 07/3

An experimental study has been carried out of the self-adhesion of thin layers of three crosslinked elastomers: cis-polyisoprene (natural rubber) and two polybutadienes. For the polybutadiene materials, the strength of self-adhesion was found to be strongly dependent upon the time of exposure of the two surfaces to air before they were brought into contact. The strength rose dramatically during the first hour or so of exposure so that in some instances the layers could not later be forcibly separated. When the surfaces were exposed to air for longer periods before joining them, the strength of self-adhesion, caused by prior exposure to air for short periods, did not take place on exposure to nitrogen or for samples of cis-polyisoprene, and it was reduced or delayed in samples containing antioxidant. It is therefore attributed to surface oxidation reactions that can lead to the formation of interfacial covalent bonds with polybutadiene but not with polyisoprene. Some possible reaction schemes are discussed. GRA

N80-17232# State Univ. of New York at Stony Brook. Dept. of Chemistry.
POLYMER CONFORMATION BY LIGHT SCATTERING Final Report, 1 Sep. 1968 - 31 May 1979
Benjamin Chu Sep. 1979 6 p refs
(Grants DA-ARO(D)-31-124-73-G30; DA-ARO(D)-31-124-70-G19; DAAG29-76-G-0005; DAAG29-76-G-1030)
(AD-A076296; ARO-8014.30-C; ARO-13245.13-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

In this project, we tried to study the conformation and dynamics of supramolecular solutions by developing the technique of laser light scattering and by examining the fluid behavior near the critical mixing point. We improved the technique of photon correlation spectroscopy and the method of data analysis so that we succeeded in establishing a new technique for measuring particle size distributions. By relating the tricritical point of fluid mixtures to the theta point in polymer solutions, we could now study polymer solution behavior in the semidilute and gel regions. GRA

N80-17233# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INVESTIGATION OF A DEPLOYABLE POLYURETHANE FOAM GROUND IMPACT ATTENUATION SYSTEM FOR AEROSPACE VEHICLES. VOLUME 2: FIAS TEST NUMBERS 49 THROUGH 91 Final Report, Nov. 1976 - May 1978
Stephen R. Mehaffie Jul. 1979 229 p refs
(AF Proj. 1964)
(AD-A075658; AFFDL-TR-78-145-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 22/2

An investigation was conducted to determine the feasibility of an advanced deployable impact attenuation system for use with aerospace vehicles. Performance of the system with a boilerplate AQM-34V RPV was quantified through a series of full-scale impact tests. A prototype design and costing analysis is presented. The conclusion was that the Foam Impact Attenuation System (FIAS) could provide the optimum system for the ground recovery of RPV's. GRA

N80-17234# Argonne National Lab., Ill.
NONDESTRUCTIVE EVALUATION TECHNIQUES FOR HIGH-TEMPERATURE CERAMIC COMPONENTS Quarterly Report, Apr. - Jun. 1979
Jul. 1979 25 p refs
(Contract W-31-109-eng-38)
(ANL/MSD-79-5; QR-7) Avail: NTIS HC A02/MF A01

Silicon carbide samples with various microstructures were examined by through-transmission acoustic microscopy. The microstructures were ranked with respect to ease of inspection. Some preliminary results were presented on the use of a transducer and acoustic mirror for bore-side ultrasonic inspections of SiC heat exchanger tubing. The technique of photoacoustic microscopy is discussed. A simple test was run to illustrate the principles involved in this technique. DOE

N80-17235# Toulouse Univ. (France).
SELF EXTINCTION OF PARTIAL DISCHARGES IN INSULATING POLYMERIC MATERIALS INDUCED BY METALLIC CHELATES
Bui Ai, C. Huraux, and O. Issa 1978 6 p refs Sponsored by Delegation Gen. a la Rech. Sci. et Tech.
(Publ-350) Avail: NTIS HC A02/MF A01

Measuring apparatus for determining threshold voltage of partial discharge apparition in samples during their aging under alternative voltage is described. This apparatus made it possible to compare different types of additives as healing agents for insulator defects. Author (ESA)

N80-17236# Toulouse Univ. (France). Lab. de Genie Electrique.
HIGH FREQUENCY DIELECTRIC LOSSES IN POLYETHYLENE UNDER VERY HIGH HYDROSTATIC PRESSURE [LES PERTES DIELECTRIQUES EN HAUTE FREQUENCE DU POLYETHYLENE SOUMIS A DE TRES FORTES PRESSIONS HYDROSTATIONES]
Bui Ai, Hoang The Giam, D. Lebarbier, and S. C. Bapt 1978 5 p refs In FRENCH
(Publ-352) Avail: NTIS HC A02/MF A01

In order to study the effect of hydrostatic pressure on the insulating quality of polyethylene used in submarine telephone cables, laboratory experiments were carried out. The apparatus, including a high pressure chamber (1500 bar maximum working pressure), a General Radio 1690 A signal generator, and a Hewlet-Packard 4342 Q-meter, is described. Results indicate that the experimental setup can measure fine dielectric losses over a wide frequency range (0.1 to 15 MHz) and in a temperature range of from -10 C to 50 C. Author (ESA)

N80-17237# Toulouse Univ. (France). Lab. de Genie Electrique.
THIN POLYMER FILMS SYNTHESIZED BY LOW FREQUENCY GLOW DISCHARGE WITH APPLICATIONS TO ELECTRONICS AND MICROELECTRONICS [COUCHES MINCES DE POLYMERES OBTENUES PAR DECHARGE LUMINESCENTE ET LEURS APPLICATIONS EN ELECTRONIQUE ET MICROELECTRONIQUE]
Bui Ai, Y. Segui, D. Brosset, and M. Valentin 1978 20 p refs In FRENCH Presented at Journees d'Etudes sur les Plastiques dans l'Electron. et la Microelectron., Paris, 23-26 Apr. 1978
(Publ-353) Avail: NTIS HC A02/MF A01

The manufacturing procedure for polymer thin films and its application to thin film condensors and to semiconductor passivation are described. The experimental device consists of two aluminum electrodes creating a uniform electrostatic field in a chamber subjected to high vacuum. The glow discharge acts upon a continuous gaseous stream of styrene monomer. The influence of several parameters of the polymer film characteristics is discussed. An experimental capacitor of 160 sq. mm is described, consisting of 160 five layers of succesive polymer and aluminum films on a glass substrate. Limiting the number of free radicals formed during the polymerization process allowed for the reduction of high frequency losses by a factor of five. The reported results for passivation application are also very promising. Author (ESA)

N80-17238*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
FACTORS AFFECTING THE FRACTURE ENERGY OF A STRUCTURAL ADHESIVE Interim Report
D. G. OConnor and H. F. Brinson Sep. 1979 104 p refs
(Grant NGR-47-004-090)
(NASA-CR-162475; PB-300473/6; VPI-E-79-31) Avail: NTIS HC A06/MF A01 CSCL 11A

Various adhesive fracture strength and energy tests and the mechanisms of mechanical and chemical adhesion are discussed. The sensitivity of the strain energy release rate to specimen preparation is considered. The rate and time dependence of the adhesive are then investigated using the TDCB specimen. The

fractured surfaces are also studied using scanning electron microscopy to determine the mechanisms of failure. GRA

N80-17239# National Technical Information Service, Springfield, Va.
THE SYNTHESIS AND PROPERTIES OF POLYURETHANE RESINS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1973 - Oct. 1979
Diane M. Cavagnaro. Nov. 1979. 299 p. Supersedes NTIS/PS-78/1092; NTIS/PS-77/0981; NTIS/PS-76/0922; NTIS/PS-75/745
(PB80-800477; NTIS/PS-78/1092; NTIS/PS-77/0981; NTIS/PS-76/0922; NTIS/PS-75/745) Avail: NTIS HC $30.00/MF $30.00 CSCL 11I
Topics covered include the synthesis, polymeriztion, casting, chemical properties, physical properties, and mechanical properties of urethane resins used in such applications as adhesives, solid propellants, coatings, biomaterials, structural members, and sealers. This updated bibliography contains 293 abstracts, 29 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-17240 California Univ., Berkeley.
A STUDY OF VAPOR EXPLOSION PHENOMENA Ph.D. Thesis
Chih-Ping Tso. 1979. 145 p.
Avail: Univ. Microfilms Order No. 8000550
A multi-mechanism physical model is proposed to explain vapor explosion. In particular, the model predicts the existence of an upper limit for the colder liquid above which no interaction is expected, regardless of the hot liquid temperature. Based on the model, interaction zones are presented for the tin-water, lead-water, aluminum-water, gallium-water, copper-water, uranium dioxide-water, uranium dioxide-sodium, and the glass-water systems. An experimental investigation was conducted whereby interaction zones were found for three small scale systems by melting 3 to 10 gm of pure metal in a crucible and dropping the metal into a water tank. The data for these three systems agree well with the proposed model. Dissert. Abstr.

N80-17241# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
A COUPLED INTERIOR BALLISTICS FINITE ELEMENT COMBUSTION INSTABILITY ANALYSIS PROCEDURE, PART 2
Robert M. Hackett. 26 Jun. 1979. 40 p.
(AD-A075110; DRDMI-T-79-68-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 19/4
A computer code is formulated which provides the solid propellant grain designer with the capability of performing an interior ballistics analysis while, with a minimum amount of additional effort, at the same time performing a combustion instability prediction analysis at any designated point in time during the entire period of performance. The program, in effect, couples the output of an existing solid propellant grain design evaluation code, which predicts the acoustic chamber geometry during surface regression, with the input to the existing three-dimensional finite element combustion instability prediction code, FLAP3. The three-dimensional finite element mesh and boundary conditions are generated from the grain surface regression data for the progressive burn times. The entire finite element mesh and boundary condition generation by FLESH3, the companion to FLAP3, is executed with the input of seven geometry parameters, which are obtained from the ballistics code output, and the corresponding burn depth parameter. The use of the developed program is demonstrated for three different values of burn depth for the case of a typical star design. GRA

N80-17242# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
THERMAL OXIDATIVE STABILITY TEST METHODS FOR JPTS JET FUEL Final Report, Jan. 1976 - Dec. 1978
Royce P. Bradley and Charles R. Martel. Aug. 1979. 53 p. refs
(AF Proj. 3048)
(AD-A076374; AFAPL-TR-79-2079) Avail: NTIS HC A04/MF A01 CSCL 21/4
Various samples of Thermally Stable Jet Fuel (JPTS) produced in accordance with military specification MIL-T-25524, were tested for thermal oxidative stability using the Jet Fuel Thermal Oxidation Tester (JFTOT). Two of the fuel samples had marginal thermal stability and provided data needed for the proposed substitution of the JFTOT for the ASTM-CRC Fuel Coker. Over 130 samples of JPTS fuel, submitted for fuel specification compliance test, were tested for thermal oxidative stability using the JFTOT in lieu of the Fuel Coker. The JFTOT, in conjunction with the Alcor Mark 8A Tube Deposit rater, was found to be suitable for the use with JPTS fuels. GRA

N80-17243# Sandia Labs., Albuquerque, N. Mex. Process Research Div.
APPLICATION OF RADIOGRAPHY TO COAL LIQUEFACTION
D. G. Sample and M. G. Thomas. 1979. 16 p. refs. Presented at the ASNT Fall Conf., St. Louis
(Contract EY-76-C-04-0789)
(SAND-79-1226C; CONF-791008-2) Avail: NTIS HC A02/MF A01
The application of X-radiographic techniques to the investigation of coal and coal liquefaction systems is discussed. The analysis of catalysts used in coal liquefaction by wavelength and energy dispersive analyses, identification and isolation of tagged catalysts using film radiography, and measuring mineral matter in coal with a radiation gage are among the topics covered. DOE

N80-17244# Los Alamos Scientific Lab., N. Mex.
PRODUCTION OF SYNTHETIC GAS FROM NUCLEAR ENERGY SOURCES
C. A. Anderson, J. C. Biery, and L. A. Booth. Apr. 1979. 235 p. refs
(Contract EW-78-Y-04-4183)
(LA-7592-MS) Avail: NTIS HC A11/MF A01
A survey of nuclear energy sources and their potential application to the production of synthetic gas is documented. The state-of-the-art in commercial nuclear fission reactors and on-going research and development in advanced reactors is described. The status of fusion energy research and estimated timing of commercial availability are reported. Surveys of high temperature electrolysis and thermochemical cycles as means for producing synthetic gas from process heat are given. Synthetic gas production from radiolysis is discussed. A description of the nuclear fuel cycle and uranium reserve and resource estimates are presented. DOE

N80-17245# Research Inst. of National Defence, Linkoeping (Sweden).
BURNING TESTS FOR FUEL RICH HTPB (HYDROXYL TERMINATED POLYBUTADIENE) POWDER WITH AMMONIUM PERCHLORATE AS AN OXIDIZER [FOEBRAWNNINGSEGENSKAPER FOER BRAENSLERIKS HTPB-KRUT MED AMMONIUMPERKLORAT (AP) SOM OXIDATOR]
Torsten Liljegren and Bert Anderson. Mar. 1979. 22 p. refs. In SWEDISH
(FOA-C-20299-D1) Avail: NTIS HC A02/MF A01
Fuel rich, terminated polybutadien designed for a hybrid motor has been tested for combustion characteristics in a rocket engine. Using a combustion catalyst and finely divided perchlorate, the perchlorate content can be reduced 30% while maintaining combustion stability. Burning time of mixtures containing from 30% to 60% ammonium perchlorate are given. The effects of temperature on burn time is more pronounced in powders containing 40% ammonium perchlorate than on normal powders. Author (ESA)

N80-17246# Institut Francais du Petrole, Rueil-Malmaison. Lab Recherches Chemiques de Base.

STORING HYDROGEN IN THE FORM OF LIGHT ALLOY HYDRIDES Final Report [STOCKAGE DE L'HYDROGENE SOUS FORME D'HYDRURES D'ALLIAGES DE METAUX LEGERS]
Edouard Freund and Christine Guillerm Jul. 1978 58 p refs In FRENCH
(IFP-26-209) Avail: NTIS HC A04/MF A01

Different hydrides are investigated to find a system with a sufficiently high storage density (> or = 3 percent). The formation of hydrides with light alloys is examined. Reaction kinetics for hydride formation were defined and applied to the systems Mg-Al-H, Mg-Al-Cu-H, Ti-Al-Hi, Ti-Al-Cu-H, and Ti-Al-Ni-H. Results indicate that the addition of Al destabilizes MgH2 and TiH2 hydrides while having only a limited effect on the storage density. Author (ESA)

N80-17101 Aerojet Solid Propulsion Co., Sacramento, Calif.
THE EFFECT OF PROPELLANT FORMULATION VARIABLES ON COMBUSTION STABILITY
G. A. Zimmerman and M. J. Ditore *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 83-99 refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17102 Thiokol Corp., Huntsville, Ala. Huntsville Div.
EFFECTS OF FORMULATION VARIABLES ON THE COMBUSTION STABILITY CHARACTERISTICS OF SOME REDUCED SMOKE PROPELLANT
R. B. Kruse and D. W. Booth *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 99-118 ref (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17103 Aerojet Solid Propulsion Co., Sacramento, Calif.
EQUILIBRIUM MODEL FOR SECONDARY SMOKE PREDICTION
James P. Coughlin *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 119-133 refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17104 Army Missile Research and Development Command, Redstone Arsenal, Ala.
COMPARISON OF FLUORINE AND CHLORINE CONTAINING COMPOUNDS ON SECONDARY SMOKE FORMATION
M. T. Cucksee and H. C. Allen *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 135-143 (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17118* Jet Propulsion Lab., California Inst. of Tech., Pasadena
MATERIALS COMPATIBILITY WITH FLUORINE
L. R. Toth, J. C. Lewis, and C. M. Moran *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 583-606 refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21I

N80-17273 Southwest Research Inst., San Antonio, Tex.
PREDICTION OF CONSTRAINED SECONDARY FRAGMENT VELOCITIES
Peter S. Westine and John H. Kineke, Jr. (Ballistic Research Labs., Aberdeen, Md.) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 183-192 refs (For primary document see N80-17258 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-17247 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 1: KEYNOTE ADDRESS, INVITED PAPERS, PANEL SESSIONS, MODAL TEST AND ANALYSIS
Sep. 1978 149 p Symp. held at Huntsville, Ala., 18-20 Oct. 1977; sponsored by Army Missile Res. and Develop. Command 4 Vol.
(Bull-48-Pt-1) Avail: NRL Tech. Inform. Div., Washington, D.C.

The theory and application of modal vibration testing is discussed. Topics include the distribution of shaker forces in multiple shaker modal testing, modal confidence factor in vibration testing, transfer function applications to spacecraft structural dynamics, the characterization of torpedo structural modes and resonant frequencies, and Laguerre function representation of transients. For individual titles, see N80-17248 through N80-17257.

N80-17248 Army Engineer Waterways Experiment Station, Vicksburg, Miss.
TECHNICAL INFORMATION RESOURCES FOR THE SHOCK AND VIBRATION COMMUNITY c82
Edward J. Kolb *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 11-18 (For primary document see N80-17247 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

An overall assessment of the growth and future of information storage techniques is presented. A review of the growth patterns for the communication industry, specifically the increasing use of computers is presented. The management and storage of shock and vibration information is examined through the above concepts. A.W.H.

N80-17249 Geological Survey, Washington, D. C.
EARTHQUAKES: THEIR CAUSES AND EFFECTS c46
Robert M. Hamilton *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 19-21 (For primary document see N80-17247 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

The causes of earthquakes and the topic of earthquake prediction are discussed. The ability to control earthquakes is reported through an experiment at the Rangely oil field in Colorado. A.W.H.

N80-17250 Martin Marietta Corp., Denver, Colo.
FORCE APPORTIONING FOR MODAL VIBRATION TESTING USING INCOMPLETE EXCITATION c39
G. Morosow and R. S. Ayre (Colorado Univ., Boulder) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 39-48 (For primary document see N80-17247 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

A technique is presented for determining the shaker forces necessary to isolate a mode during a modal vibration test. The method is based on the multiple exciter, tuned dwell approach. Several assumptions are made in the approach including: the modal is linear and, therefore, the superposition of modal responses holds; only proportional damping is considered; all shaker forces are phase coherent; and the approach is derived for a discrete system, and therefore, by inference the method is applicable to continuous systems. Two examples are presented to demonstrate the technique. A.W.H.

N80-17251 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ON THE DISTRIBUTION OF SHAKER FORCES IN MULTIPLE-SHAKER MODAL TESTING c39
W. L. Hallauer, Jr. and J. F. Stafford *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 49-63 (For primary document see N80-17247 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

A method for structural dynamic modal testing by multiple shaker sinusoidal excitation is reviewed, and its theory and application are discussed. Numerical results from simulated modal testing on mathematical structural models are presented to illustrate the strengths and weaknesses of the method. The characteristics of these modals include damping which couples the normal modes and closely spaced modes. Numerical techniques required for implementation of the method are described. A procedure is suggested for replacing actual

mechanical tuning with calculations employing transfer function data. A.W.H.

N80-17252* Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
MODAL CONFIDENCE FACTOR IN VIBRATION TESTING **c39**
Sam R. Ibrahim. *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 65-75 (For primary document see N80-17247 08-31)
(Grant NsG-1459)
Avail: NRL Tech. Inform. Div., Washington, D.C. CSCL 20K
The theory and applications of a time domain modal test technique are presented. The method uses free decay of random responses from a structure under test to identify its modal characteristics namely, natural frequencies, damping factors, and mode shapes. The method can identify multimodal (highly coupled) systems and modes that have very small contribution in the responses. A method is presented to decrease the effects of high levels of noise in the data and thus improve the accuracy of identified parameters. This is accomplished using an oversized mathematical model. The concept of modal confidence factor (MCF) is developed. The MCF is a number calculated for every identified mode for a structure under test. The MCF varies from 0.000 for a distorted, nonlinear, or noise mode to 100.0 for a pure structural mode. The theory of the MCF is based on the correlation that exits between the modal deflection at a certain station and the modal deflection at the same station delayed in time. The theory and application of the MCF is illustrated by two experiments. The first experiment deals with simulated responses from a two degree of freedom system with 20 percent, 40 percent, and 100 percent noise added. The second experiment was run on a generalized payload model. The free decay response from the payload model contained about 22 percent noise. A.W.H.

N80-17253 Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
A BUILDING BLOCK APPROACH TO THE DYNAMIC BEHAVIOR OF COMPLEX STRUCTURES USING EXPERIMENTAL AND ANALYTICAL MODAL MODELING TECHNIQUES **c39**
J. C. Cromer, M. Lalanne, D. Bonnecase, and L. Gaudriot. *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 77-91 refs (For primary document see N80-17247 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.
An approach that takes into account constrained or unconstrained substructures is used to connect components whose properties are determined by experiments to those modeled by finite element techniques. Using a transfer function analyzer system, the constrained and unconstrained modal methods are applied to a beam in bending. The methods are then applied to a complex practical structure and agreement between experimental and theoretical results is shown to be good. K.L.

N80-17254 Hughes Aircraft Co., El Segundo, Calif.
TRANSFER FUNCTION APPLICATIONS TO SPACECRAFT STRUCTURAL DYNAMICS **c18**
J. R. Fowler and E. Dancy (Hewlett-Packard Co., Los Angeles) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 93-101 refs (For primary document see N80-17247 08-31)
(Contract IS-774)
Avail: NRL Tech. Inform. Div., Washington, D.C.
Fast Fourier transform computed transfer functions are used for several spacecraft applications. An Intelsat 4A spacecraft is tested using several excitations and the resulting transfer functions are compared using modal frequencies and damping. Examples are given of mass and stiffness computations from transfer functions and the use of alternative reference points for the transfer functions. The use of slight changes in transfer functions to detect failures is also demonstrated. K.L.

N80-17255 Martin Marietta Corp., Denver, Colo.
LOAD TRANSFORMATION DEVELOPMENT CONSISTENT WITH MODAL SYNTHESIS TECHNIQUES **c39**
R. F. Hruda and P. J. Jones. *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 103-109 (For primary document see N80-17247 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.
A method is presented for the development of component internal load transformations consistent with modal synthesis procedures. The resulting load transformations account for component interactions across statistically indeterminate interfaces. An economical method of obtaining these transformations is used along with a modified modal coupling procedure. K.L.

N80-17256 Westinghouse Research and Development Center, Pittsburgh, Pa.
REDUCED SYSTEM MODELS USING MODAL OSCILLATORS FOR SUBSYSTEMS (RATIONALLY NORMALIZED MODES) **c39**
F. H. Wolff and A. J. Molnar. *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. Sep. 1978 p 111-118 refs (For primary document see N80-17247 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.
A method of using modal oscillators to represent complex structural subcomponents is developed which can be applied to unidirectional models. It is shown that the oscillator mass must be the effective mass to guarantee the correct total system characteristics. When the modes are normalized in a specific way the effective mass and generalized or modal mass are identified. K.L.

N80-17257 Wright State Univ., Dayton, Ohio.
LAGUERRE FUNCTION REPRESENTATIONS OF TRANSIENTS **c64**
G. R. Spalding. *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 137-141 refs (For primary document see N80-17247 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.
The use of Laguerre functions in modeling the dynamic response of highly damped systems is discussed. Laguerre functions of varying time constant are generated from the Laguerre polynomials. By sampling at the axis crossings of the nth order Laguerre polynomial, system response can be represented by a finite set of orthonormal vectors. These vectors provide both a representation that is exact at the measurement points and interpolation functions that can be suited to the application. K.L.

N80-17258 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN. PART 2: ISOLATION AND DAMPING, IMPACT, BLAST
Sep. 1978 234 p refs Presented at the 48th Symp. on Shock and Vibration, Huntsville, Ala., 18-20 Oct. 1977; sponsored by Army Missile Res. and Develop. Command 4 Vol.
(Bull-48-Pt-2) Avail: NRL Tech. Inform. Div., Washington D.C.
Damping materials tests and impact load tests highlight an analysis on vibration isolators and structural response to impact loads and blasts. Topics include bird impact loading, testing piping constraint energy absorbers for reactor containment applications, structural damping techniques for vibration control, and a determination of specifications for damping materials characteristics and performance. For individual titles, see N80-17259 through N80-17274.

N80-17259 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
SPECIFICATION OF DAMPING MATERIAL PERFORMANCE **c39**
David I. G. Jones and J. P. Henderson. *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 1-11 refs (For primary document see N80-17258 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.
The development of a specification for controlling damping material performance is studied. An approach to the problem is discussed which involves (1) the establishment of an appropriate and adequate method for measuring the data needed, namely a particular form of the resonant beam technique, and (2) the specification of the required material properties in terms of a complex modulus reduced temperature nomogram with allowable limits superimposed. Details of the utilization of the resonant beam technique, particularly with a sandwich configuration, is presented for soft viscoelastic materials. Recommended spec-

men geometries and testing procedures are described. The use of the resonant beam test technique as a possible standard method for measuring complex dynamic moduli of damping materials is evaluated. A.W.H.

N80-17260 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
A REDUCED-TEMPERATURE NOMOGRAM FOR CHARACTERIZATION OF DAMPING MATERIAL BEHAVIOR c39
David I. G. Jones. *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 13-22 refs (For primary document see N80-17258 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

A reduced temperature nomogram was developed which simplifies the task of collapsing test data into the form of universal reduced frequency master curves. The master curves allow the materials properties to be read directly off the graph as a function of both frequency and temperature. The steps necessary, after a reduced frequency plot is drawn, to create a reduced temperature plot are described. The plot is achieved by superimposed oblique coordinates on the master curve to represent the temperature variations. Examples are provided illustrating the development and application of typical nomographs. A.W.H.

N80-17261 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
COMPUTERIZED PROCESSING AND EMPIRICAL REPRESENTATION OF VISCOELASTIC MATERIAL PROPERTY DATA AND PRELIMINARY CONSTRAINED LAYER DAMPING TREATMENT DESIGN c39
Lynn C. Rogers and Ahid D. Nashif (Anatrol Corp., Cincinnati, Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 23-37 refs (For primary document see N80-17258 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

Technology advancements in the state of the art of processing and representing modulus and loss factor data as a function of temperature and frequency are presented. The application of the characterized properties of materials to study the performance of various damping treatments is discussed. A method for performing preliminary constrained layer damping treatment design covering the complete range of practical engineering parameters is outlined. The curve fitted analytical expressions of the modulus and loss factor, used to predict the amount of damping achieved when a constrained layer treatment is applied to a vibrating structure, are discussed. The predicted results were compared with measured results over a wide temperature and frequency range. A.W.H.

N80-17262 Lord Kinematics, Erie, Pa.
NEW STRUCTURAL DAMPING TECHNIQUE FOR VIBRATION CONTROL c39
B. M. Patel, G. E. Warnaka, and D. J. Mead (Southampton Univ., England) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 39-52 (For primary document see N80-17258 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

A structural damping configuration is presented which makes efficient use of damping materials by subjecting them to both shear and extensional deformations. The configuration consists, in one form, of a series of rows of vertically oriented platelets with damping material sandwiched between them. Adjacent rows of platelets may overlap each other to enhance the deformation of the damping material. A theoretical analysis of the configuration is reported and compared with experimental results for a variety of varying configurations. The structural damping configuration is shown to apply to very rigid structures where it can control flexural vibrations and sound radiation with low added weight. A mathematical model of the structural damping design optimization is described. A.W.H.

N80-17263 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
VIBRATIONS OF A COMPRESSOR BLADE WITH SLIP AT THE ROOT c07
David I. G. Jones and Agnieszka Muszynska (Polish Academy of Sciences, Warsaw) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 53-61 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

An analytical model, developed to represent the vibrational behavior of a jet engine compressor blade in its fundamental mode, and which allows for slip at the blade disc interface, is described. The model is applied to a particular blade geometry and the results are compared. The implications of using the model for the design of compressor and turbine blades in order to optimize slip damping levels are discussed. A.W.H.

N80-17264 Army Engineer Waterways Experiment Station, Vicksburg, Miss.
RESPONSE OF A HELICAL SPRING CONSIDERING HYSTERETIC AND VISCOUS DAMPING c39
P. F. Mlakar and R. E. Walker. *In* the Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 63-74 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington DC.

An analytical model of a helical spring is developed which includes distributed mass, viscous damping, and hysteretic damping. The limiting effects of both types of damping on the resonant response are discussed. The model is compared with experimental data and it was found that viscous damping limits the resonant response of a helical spring. The effect of hysteretic damping is discussed and a correlation between the system loss factor due to combined viscous and hysteretic damping and the system loss factors for each type of damping alone is reported. A.W.H.

N80-17265 Sikorsky Aircraft, Stratford, Conn.
DAMPING OF AN ENGINE EXHAUST STACK c07
John J. DeFelice and Ahid D. Nashif (Anatrol Corp., Cincinnati, Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 75-84 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

A program whose objective was to introduce high damping into the helicopter engine exhaust extension in order to decrease its vibrational amplitude at resonance and thereby increase its fatigue life is described. A specialized high temperature damping material, in the form of vitreous enamel, reported to work effectively over the operational temperature range of the exhaust extension is examined. The application of the high temperature damping materials to the engine exhaust extension and the effect upon the vibrational amplitudes at resonance and component service life are discussed. A.W.H.

N80-17266 Arya Mehr Univ. of Technology, Teheran (Iran) Dept. of Mechanical Engineering.
MULTI-VARIABLE OPTIMIZATION FOR VIBRATION ISOLATION OF ROAD VEHICLES c37
Ebrahim Esmailzadeh. *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 85-96 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

The transmission of road-generated vibrations into a vehicle body is treated as a source-path-receiver problem. The suspension system acts as the path, and improved isolation can be achieved by having a single compliant bushing at the connecting point of the shock absorber to the body with none at the other end. A mathematical model is derived for such a system and an expression for the absolute displacement transmissibility of the body and that of the wheel is derived. An optimization procedure is applied in order to evalute the optimum values of the non-dimensional variables involved. This minimizes the maximum motion transmitted to the body from the road surface over a broad frequency range. Author

N80-17267* Lord Kinematics, Erie, Pa.
ISOLATION MOUNTS FOR THE HEAO-B X-RAY TELESCOPE c37
H. L. Hain and R. Miller (American Science and Engineering, Inc., Cambridge, Mass.) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 97-113 refs (For primary document see N80-17258 08-31)
(Contract NAS8-30750)
Avail: NRL, Tech. Inform. Div., Washington D.C. CSCL 13I

The orbiting HEAO-B X-ray telescope experiment package

is described as well as the isolation mounts which will be used to support and protect it. The design and testing phases of the isolation development program are discussed and data are presented. A.R.H.

N80-17268 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
BIRD IMPACT LOADING **c03**
J. S. Wilbeck and J. P. Barber (Dayton Univ. Research Inst., Ohio) *In* The Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1978. p. 115-122. refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

An extensive experimental program to investigate the mechanics of bird impact and to define the loads which birds exert at impact, is described. Bird impact pressures were measured by impacting birds against a heavy steel plate in which piezoelectric transducers were flush mounted. Data was collected for bird masses ranging from 60g to 4kg and velocities ranging from 50 to 300 m/s. Results are presented and compared with the predictions of a fluidynamic theory. A.R.H.

N80-17269 New Mexico State Univ., Las Cruces. Physical Science Lab.
FREQUENCY RESPONSE AND DIFFERENTIATION REQUIREMENTS FOR IMPACT MEASUREMENTS **c39**
Anthony S. Hu and Iian-Tau Chen. *In* The Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1978. p. 123-130. refs (For primary document see N80-17258 08-31) (Contract DOT-HS-6-01400)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Impact response data are often subjected to integration and differentiation procedures. These procedures are low- and high-pass filtering processes. The measurement frequency response requirements are discussed using harmonic analysis and the requirements are related to three differentiation procedures. Results indicate that for operations in the frequency domain, the bandwidth used for differentiation must be higher than that used to reconstruct the function itself. For operations in the time domain, the sampling rate must be sufficiently high to avoid frequency cutoff. A.R.H.

N80-17270 SRI International Corp., Menlo Park, Calif.
STRUCTURAL RESPONSE OF EARTH PENETRATORS IN ANGLE-OF-ATTACK IMPACTS **c39**
J. D. Colton. *In* The Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1978. p. 131-141. refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

An analysis based on a one-dimensional beam-mass model was developed to predict the early-time response of penetrator structures in angle-of-attack impacts. It was found that the peak compressive strain, which determines whether or not the penetrator casing fails, depends on the magnitude of the lateral load produced by impacts at an angle of attack, the load rise time (which is inversely proportional to impact velocity), and the relative mass of the nose and aft sections. By relating the loading to the impact conditions through empirical data, a procedure was devised to characterize the strength of penetrator structures in terms of impact velocity and angle of attack. The resulting critical impact curves can be used to make tradeoffs among structural dimensions (e.g., length and wall thickness), to select the best structure for a particular application, and to provide a framework for planning and interpreting experiments and more detailed calculations. Author

N80-17271 SRI International Corp., Menlo Park, Calif.
FINITE ELEMENT ANALYSIS OF MULTICOMPONENT STRUCTURES IN RIGID BARRIER IMPACTS **c09**
J. K. Gran, L. E. Schwer, J. D. Colton, and H. E. Lindberg. *In* The Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1978. p. 153-160. refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Techniques are presented for the transient analysis of multicomponent structures impacting rigid barriers using the finite element method. The analysis considers distortion and failure of joints, multiple impacts, and elastic-plastic material behavior. The models for each component of an example structure are developed separately, guided by the results of impact experiments. A comparison of the predictions of these finite element models with the results of the experiments demonstrates the applicability and accuracy of the models. The complete structure is then analyzed by combining the component models. The net result is good correlation of experiment and analytical prediction for the acceleration of a mass on a rather complex structure. Author

N80-17272 Franklin Inst. Research Labs., Philadelphia, Pa.
TESTING PIPING CONSTRAINT ENERGY ABSORBERS FOR REACTOR CONTAINMENT APPLICATIONS **c39**
R. C. Yaeger and R. C. Chou. *In* The Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1978. p. 161-181. ref (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A drop testing machine was developed and used to provide experimental data for use in the application of a design concept for durable low cost energy absorbers to a real reactor installation. The instrumentation, data acquisition, and data processing systems are described and the test program is discussed, including some of the problems encountered and their solutions. Typical analog records are shown as well as digital plots of the same data. A.R.H.

N80-17273 Southwest Research Inst., San Antonio, Tex.
PREDICTION OF CONSTRAINED SECONDARY FRAGMENT VELOCITIES **c28**
Peter S. Westine and John H. Kineke, Jr. (Ballistic Research Labs., Aberdeen, Md.) *In* The Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1978. p. 183-192. refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The applied specific impulse solution from the detonation of line sources is obtained by performing a model analysis, and curve fitting the resulting π terms to experimental test data. Forty-eight tests on a variety of spheres and cylinders with different orientations, various amounts of explosive, and numerous standoff distances were subjected to blast waves from line sources and had the impulse imparted to the object determined by measuring velocities. Fragment velocities for objects which had originally been constrained as cantilever or clamped-clamped beams were obtained by modifying the impulse-momentum relationship used in velocity predictions for unconstrained fragments. Use of approximate analytical energy solutions for various modes of failure in brittle as well as ductile materials indicate that the impulse term could be reduced by the square root of a structural strain energy related to toughness (area under the true stress-strain curve) and fragment volume. Sixty observed velocities on 1020 steel, 1095 steel, and 2024-T3 aluminum beams of different sizes and with various applied specific impulses were used to complete this second solution and demonstrate its validity. A.R.H.

N80-17274 Agbabian Associates, El Segundo, Calif.
IMPEDANCE TECHNIQUES FOR SCALING AND FOR PREDICTING STRUCTURE RESPONSE TO AIR BLAST **c39**
F. B. Safford, R. E. Walker (Army Waterways Experiment Station, Vicksburg, Miss.), and T. E. Kennedy (Defense Nuclear Agency, Washington, D.C.) *In* The Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 2. Sep. 1978. p. 193-214. refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Transfer impedances were measured on a 1/12-scale model and on its prototype structure. The structure was the Perimeter Acquistion Radar Building (PARB) of the SAFEGUARD ABM System, which mesures 125 ft (38 m) in height, 194 ft (59 m) on its front, and 210 ft (64 m) on its side, with exterior walls 2 to 6 ft (0.9 to 1.8 m) thick. The impedance measurements for both structures were then used with air-blast loads to predict internal acceleration responses. Predictions for the model were compared to test acceleration records taken when the model was excited by an air blast generated from a 500-ton (453,550 kg) TNT explosion. The data were scaled for comparison with prototype responses. Author

N80-17275 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 3: STRUCTURAL ANALYSIS, FATIGUE
Sep. 1978 118 p refs Presented at the 48th Symp. on Shock and Vibration, Huntsville, Ala., 18-20 Oct. 1977; sponsored by Army Missile Res. and Develop. Command
(Bull-48-Pt-3) Avail: NRL, Tech. Inform. Div., Washington, D.C.

Structural analysis techniques applicable to the evaluation of vibration and its effects are discussed. Fatigue damage under the conditions of random vibration is also considered. For individual titles, see N80-17276 through N80-17288.

N80-17276 Washington Univ., St. Louis, Mo. Dept. of Civil Engineering.
A SOURCE OF LARGE ERRORS IN CALCULATING SYSTEM FREQUENCIES **c39**
Robert M. Mains *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 1-4 (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Errors in system frequency calculations resulting from the use of nondiagonal mass matrices with eigenvalue routines that replace the mass matrix with its eigenvalues before proceeding to the calculation of system frequencies are discussed. The errors are illustrated in several solutions of an 18 degree of freedom system. Ways to avoid these errors are considered. J.M.S.

N80-17277 Paris Univ. (France). Lab. de Mecanique Appliquee.
RESEARCH METHOD OF THE EIGENMODES AND GENERALIZED ELEMENTS OF A LINEAR MECHANICAL STRUCTURE **c39**
R. Fillod and J. Diranda *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 5-12 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A method which determined the eigenfrequencies, eigenmodes and generalized elements of a structure is described. Of all the methods tested, those based on the appropriation of modes seem to give the most accurate results. The method presented is based on the appropriation method and determines the eigenvectors and generalized elements directly by calculus from the forced response to a given frequency. J.M.S.

N80-17278 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
CALCULATION OF NATURAL FREQUENCIES AND MODE SHAPES OF MASS LOADED AIRCRAFT STRUCTURES **c05**
P. Wayne Whaley *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 13-20 (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The problem of loaded random vibration response estimation using Galerkin's method, a direct method, and a generalized coordinates approach is examined. Results indicate that both the direct method and the generalized coordinates solution give very good estimates of the first four modes of a mass loaded simply supported beam, with the generalized coordinates solution giving better accuracy than the direct method. Galerkin's method gives unacceptable results. In addition, a matrix iteration scheme for computing loaded modes, given unloaded modes, is presented. Results show that over 50% reduction in execution time is possible in computing the first four modes, with good accuracy maintained. J.M.S.

N80-17279 Ballistic Research Labs., Aberdeen Proving Ground, Md.
ROCKET MOTOR RESPONSE TO TRANSVERSE BLAST LOADING **c20**
Norris J. Huffington, Jr. and Henry L. Wisniewski *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 21-32 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The effects of propellant inertia and of internal pressurization on the structural response of solid propellant rocket motors subjected to transverse air blast loading were investigated, both analytically and numerically. The numerical predictions were accomplished using the PETROS 3.5 computer program, which employs the finite difference method to solve the equations governing finite amplitude elastoplastic response of thin shells. The response of a typical rocket motor configuration was calculated for the limiting situations of the bare motor case and of the motor case containing the complete propellant grain, each with no internal pressurization and with the pressurization resulting from propellant combustion. These calculations showed that the unpressurized motors experience a much larger deformation than the pressurized motors for the same blast loading. The most significant result is the quantification of the greater vulnerability of rocket motors prior to their ignition, whether on the launcher or as upper stages of in-flight missiles. J.M.S.

N80-17280 Naval Underwater Systems Center, Newport, R. I.
EXPERIMENTAL AND THEORETICAL DYNAMIC ANALYSIS OF CARBON-GRAPHITE COMPOSITE SHELLS **c24**
A. Harari and B. E. Sandman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 33-37 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A comparison between experimental and theoretical models of a carbon-graphite/honeycomb composite shell vibrating in air and submerged in water is presented. Mode shapes and resonant frequencies are identified according to theory and experiment both for in-air and in-water vibration. Excellent agreement is exemplified. Author

N80-17281 Martin Marietta Corp., Denver, Colo.
USE OF A SHOCK SPECTRA TO EVALUATE JITTER OF A FLEXIBLE MANEUVERING SPACECRAFT **c18**
William J. Kacena *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 39-47 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The effects of vibration on the operation of displacement sensitive spacecraft instruments are examined. The example presented is an optical pointing instrument that is vibrating because an orbital maneuver has just been performed. It is shown that a residual displacement shock spectrum of the rotational acceleration time history defines the vibration modes and the maneuvers which are critical to pointing accuracy. In addition, several realistic maneuvers are discussed and their effects on vibration are compared. J.M.S.

N80-17282 Waterloo Univ. (Ontario). Dept. of Civil Engineering.
BUCKLING OF EULER'S ROD IN THE PRESENCE OF ERGODIC RANDOM DAMPING **c39**
H. H. E. Leipholz *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 49-52 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

For a small mean value of viscous damping, superposed by an ergodic random damping fluctuation, it is shown that for a sufficiently small expected value of the fluctuation's magnitude, almost certain asymptotic stability of the Euler rod can be guaranteed. Moreover, if the expected value does not exceed a certain fraction of the damping's mean value, the critical value of the load for deterministic damping remains the stability limit despite of the randomly superposed damping fluctuation. M.M.M.

N80-17283 Naval Underwater Systems Center, Newport, R. I.
WAVE PROPAGATION IN A CYLINDRICAL SHELL WITH JOINT DISCONTINUITY **c32**
A. Harari *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 53-61 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The frequency ranges where energy is transmitted or attenuated are analyzed for a cylindrical shell as well as the effects of the joints on the propagation of the wave. M.M.M.

N80-17284 Shock and Vibration Information Center (Defense), Washington, D. C.

RESPONSE TO MOVING LOADS OVER A CRYSTALLINE HALF-SPACE **c39**

Sasadhar De (Old Engineering Office, West Bengal, India) *In its* The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 63-70 refs (For primary document see N80-17275 08-31)

Avail: NRL Tech. Inform. Div., Washington, D.C.

The mathematical analysis to study the steady-state response to a line load moving with a constant speed over a crystalline half-space is considered. The half-space is composed of monoclinic, orthorhombic and cubic crystals. The solutions for the cases of supersonic, subsonic and transonic are investigated. The importance of the problem in crystal physics is pointed out as well as an application to study the motion of the ground composed of crystalline rocks under pressure waves generated by nuclear explosions. M.M.M.

N80-17285 Paris Univ. (France). Lab. de Mecanique Appliquee.

ADJUSTMENT OF A CONSERVATIVE NON GYROSCOPIC MATHEMATICAL MODEL FROM MEASUREMENT **c35**

L. Bugeat, R. Fillod, G. Lallement, and J. Piranda *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 71-81 refs (For primary document see N80-17275 08-31)

Avail: NRL Tech. Inform. Div., Washington, D.C.

A method is presented for calculating the modifications of a discrete, conservative model, which enables to reduce the distance between its dynamic behavior and the one identified on the physical structure. An initial approximate model is known and results from a discretization a priori, for example, by finite element method are obtained. The comparisons of the partial eigensolutions of this model, together with the corresponding eigensolutions identified on the physical structure, were used to locate the spatial area (or groups of degrees of freedom) where the initial model reveals dominant errors. The exploitation of the perturbation method was utilized to calculate the variations of the physical construction parameters, such that the modified model becomes, on a certain frequential field, dynamically similar to the physical structure. The results of a numerical similation are presented. M.M.M.

N80-17286 Kobe Univ. (Japan).

FIRST-PASSAGE FAILURE PROBABILITY IN RANDOM VIBRATION OF STRUCTURES WITH RANDOM PROPERTIES **c39**

N. Nakagawa, R. Kawai, and K. Funahashi *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 83-92 refs Prepared in cooperation with Kawasaki Heavy Industries Ltd., Japan (For primary document see N80-17275 08-31)

Avail: NRL Tech. Inform. Div., Washington, D.C.

Nonstationary responses are generally analyzed for random vibration of structures which have random properties. Using the derivative method, statistical values of responses (mean function and autocovariance function) are obtained. The first passage failure probability is considered. It is assumed that a structure with random properties is subjected to a weakly stationary random excitation. Applying the average technique, the Fokker-Plank and the Kolmogorov backward equations are derived. Then, the first-passage failure probability is obtained. From numerical examples, it is found that it is necessary to consider the influence of the structural random properties, since it increases the first-passage failure probability. M.M.M.

N80-17287 General Electric Co., Utica, N. Y. Aircraft Equipment Div.

FRACTURE MECHANICS APPLIED TO STEP-STRESS FATIGUE UNDER SINE/RANDOM VIBRATION **c39**

Ronald G. Lambert *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 93-101 refs (For primary document see N80-17275 08-31)

Avail: NRL Tech. Inform. Div., Washington, D.C.

A proposed cumulative fatigue damage law is derived which uses fracture mechanics theory as its basis in order to predict the fatigue life of structures subjected to several levels of sequentially applied stress. The proposed law applies to all initial crack (i.e., flaw) sizes in the structure. The proper boundary condition to be imposed at the interface of the two stress regions is analyzed. Author

N80-17288 Concordia Univ., Montreal (Quebec).

RANDOM FATIGUE DAMAGE APPROACH TO MACHINERY MAINTENANCE **c37**

T. Seshadri Sankar, G. D. Xistris, and G. L. Ostiguy *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 103-114 refs Prepared jointly with Ecole Polytechnique, Montreal (Quebec) (For primary document see N80-17275 08-31)

Avail: NRL Tech. Inform. Div., Washington, D.C.

The amount of fatigue damage incurred as a result of stresses that occurred during operating conditions is computed using a linear damage accumulation law and expressions are developed for the expected value of the damage sustained over a specific time period. The behavior of these statistical parameters with operating time and with various system fatigue properties is discussed. The calculated damage provides a reliable indication of the remaining trouble free life and can be employed in the maintenance field to monitor the performance of industrial machinery. M.M.M.

N80-17289 California Univ., Berkeley.

CONSIDERATIONS FOR MAINTENANCE STRATEGIES FOR PORTLAND CEMENT CONCRETE PAVEMENTS Ph.D. Thesis

Donaldson Ross Macleod 1979 438 p

Avail: Univ. Microfilms Order No. 8000430

The requirements of a pavement management system for plain jointed Portland cement concrete pavements are studied. Ride deterioration caused by slab faulting (step-off) at the transverse joints, and slab breakup due to cracking are identified as the major distress mechanisms on California's plain jointed Portland cement concrete pavements. Four hundred lane miles of pavement were analyzed to establish a relationship between faulting index and ride quality. Guidelines for predicting faulting distress are presented. A mechanistic model is developed using finite element techniques in an analysis that considered variations in strength parameters and environmental conditions. Finally, a pavement management system is developed based on the findings of faulting and cracking performance. Excess user costs caused by faulting are compared to remedial costs of improving the ride. Dissert. Abstr.

N80-17290 Stanford Univ., Calif.

LIFELINE RESPONSE ANALYSIS UNDER NONSTATIONARY TRAVELING SEISMIC WAVE LOADING Ph.D. Thesis

Shayan Pazargadi 1979 213 p

Avail: Univ. Microfilms Order No. 8001990

A random vibration model of an above-the-ground lifeline system under nonstationary Gaussian traveling surface wave loading is presented as well as the wave passage effects on the response behavior of the system. The lifeline structure is modelled as a multi-input, multi-output linear time invariant filter with a set of stochastic inputs that represent the motions induced at the supports as a result of the wave passage across the lifeline. It was shown that the response values are very sensitive to the values of the surface wave velocity and therefore the phase difference between the support motions. In addition, the response values obtained for the stationary assumption of the input loading are in general larger than those of the nonstationary cases. Dissert. Abstr.

N80-17291 Stanford Univ., Calif.

MODEL TESTS ON EARTHQUAKE SIMULATORS: DEVELOPMENT AND IMPLEMENTATION OF EXPERIMENTAL PROCEDURES Ph.D. Thesis

Russell Scott Mills 1979 280 p

Avail: Univ. Microfilms Order No. 8001975

A comprehensive test study, encompassing material, subassembly and earthquake simulator tests, was performed to enable an accurate comparison of model and prototype response. Earthquake simulator tests utilized the El Centro 1940 North-South component and an artificial earthquake composed of discrete spectral components to excite the structure both elastically and inelastically. Accurate simulation of the prototype structure in terms of global and local response parameters was achieved.

The nature of prototype inelastic response was duplicated by the small scale model as characterized by yielding of the joint panel zones in shear and by comparison of the ductility demand and energy distribution of the respective structures. Observed minor discrepancies in model-prototype correlation can be explained by the larger weld sizes of the model and by the influence of earthquake simulator reproduction capabilities on test structure response. Dissert. Abstr.

N80-17292*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PRECISION HEAT FORMING OF TETRAFLUOROETHYLENE TUBING Patent
W. V. Ruiz (Rockwell International Corp., Downey, Calif.) and C. S. Thatcher, inventors (to NASA) (Rockwell International Corp., Downey, Calif.) Issued 18 Jan. 1980 11 p Sponsored by NASA
(NASA-Case-MSC-18430-1; US-Patent-Appl-SN-113015) Avail: NTIS HC A02/MF A01 CSCL 13H

A method is provided for altering the size of tetrafluoroethylene tubing which is only available in limited combination of wall thicknesses and diameter. The tetrafluoroethylene tubing is slid onto an aluminum mandrel to which the ends of the tubing are clamped. The tubing and mandrel are placed in a supporting coil which is then positioned in an insulated steel pipe. The steel pipe is normally covered with a fiber glass insulator to smooth out temperature distribution therein. The entire structure is then placed in an oven which heats the tetrafluoroethylene tubing and shrinks it to the outer dimension of the aluminum mandrel. After cooling, the aluminum mandrel is removed from the newly sized tetrafluoroethylene tubing by a conventional chemical milling process. NASA

N80-17293*# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 3: STRUCTURE MEDIUM INTERACTION, CASE STUDIES IN DYNAMICS
Sep. 1979 97 p refs Presented at the 49th Symp. on Shock and Vibration, Washington, D.C., 17-19 Oct. 1978 Sponsored by NASA. Goddard Space Flight Center 3 Vol.
(NASA-CR-162473; AD-A074701; Bull-49-Pt-3) Avail: NTIS HC A05/MF A01 CSCL 20K

Structure and medium interactions topics are addressed. Topics include: a failure analysis of underground concrete structures subjected to blast loadings, an optimization design procedure for concrete slabs, and a discussion of the transient response of a cylindrical shell submerged in a fluid. Case studies in dynamics are presented which include an examination of a shock isolation platform for a seasparrow launcher, a discussion of hydrofoil fatigue load environments, and an investigation of the dynamic characteristics of turbine generators and low tuned foundations. For individual titles, see N80-17294 through N80-17302.

N80-17294*# Florida Univ., Eglin AFB.
FAILURE OF UNDERGROUND CONCRETE STRUCTURES SUBJECTED TO BLAST LOADINGS
C. A. Ross, P. T. Nash, and G. R. Griner *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 1-9 refs Prepared in cooperation with Air Force Armament Lab., Eglin AFB, Fla. (For primary document see N80-17293 08-31)
(Grant AF-AFOSR-3592-78)
Avail: NTIS HC A05/MF A01 CSCL 13M

The response and failure of two edges of free reinforced concrete slabs subjected to intermediate blast loadings are examined. The failure of the reinforced concrete structures is defined as a condition where actual separation or fracture of the reinforcing elements has occurred. Approximate theoretical methods using stationary and moving plastic hinge mechanisms with linearly varying and time dependent loadings are developed. Equations developed to predict deflection and failure of reinforced concrete beams are presented and compared with the experimental results. A.W.H.

N80-17295*# Naval Civil Engineering Lab., Port Hueneme, Calif.
OPTIMIZATION OF REINFORCED CONCRETE SLABS
J. M. Ferritto *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 11-22 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 13M

Reinforced concrete cells composed of concrete slabs and used to limit the effects of accidental explosions during hazardous explosives operations are analyzed. An automated design procedure which considers the dynamic nonlinear behavior of the reinforced concrete of arbitrary geometrical and structural configuration subjected to dynamic pressure loading is discussed. The optimum design of the slab is examined using an interior penalty function. The optimization procedure is presented and the results are discussed and compared with finite element analysis. A.W.H.

N80-17296*# Naval Surface Weapons Center, White Oak, Md.
A NUMERICAL COMPARISON WITH AN EXACT SOLUTION FOR THE TRANSIENT RESPONSE OF A CYLINDER IMMERSED IN A FLUID c34
M. E. Giltrud and D. S. Lucas *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 23-28 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 20D

The transient response of an elastic cylindrical shell immersed in an acoustic media that is engulfed by a plane wave is determined numerically. The method applies to the USA-STAGS code which utilizes the finite element method for the structural analysis and the doubly asymptotic approximation for the fluid-structure interaction. The calculations are compared to an exact analysis for two separate loading cases: a plane step wave and an exponentially decaying plane wave. A.W.H.

N80-17297*# Boeing Co., Renton, Wash. Marine Systems.
FOIL SYSTEM FATIGUE LOAD ENVIRONMENTS FOR COMMERCIAL HYDROFOIL OPERATION
D. L. Graves *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 29-40 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 20K

The hydrofoil fatigue loads environment in the open sea is examined. The random nature of wave orbital velocities, periods and heights plus boat heading, speed and control system design are considered in the assessment of structural fatigue requirements. Major nonlinear load events such as hull slamming and foil unwetting are included in the fatigue environment. Full scale rough water load tests, field experience plus analytical loads work on the model 929 Jetfoil commercial hydrofoil are discussed. The problem of developing an overall sea environment for design is defined. State of the art analytical approaches are examined. A.W.H.

N80-17298*# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
EVALUATION OF ROTOR-BEARING SYSTEM DYNAMIC RESPONSE TO UNBALANCE c37
Roger E. Thaller and David W. Ozimek *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 41-53 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 13I

The vibration environment within air conditioner rotating machinery referred to as an air cycle machine (ACM) was investigated to effectively increase ACM reliability. To assist in the selection of design changes which would result in improved ACM performance, various design modifications were incorporated into a baseline ACM configuration. For each design change, testing was conducted with the best balance achieveable (baseline) and with various degrees of unbalance. Relationships between unbalance (within the context of design changes) and the parameters associated with design goals were established. The results of rotor dynamics tests used to establish these relationships are presented. R.C.T.

N80-17299*# Rockwell International Corp., Los Angeles, Calif.
SELECTED TOPICS FROM THE STRUCTURAL ACOUSTICS PROGRAM FOR THE B-1 AIRCRAFT c05
Peter M. Belcher *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 55-68 refs (For primary document see N80-17293 08-31)

Avail: NTIS HC A05/MF A01 CSCL 01C

The major elements of the structural acoustics program for the B-1 aircraft are considered. Acoustic pressures measured at 280 sites on the surface of the vehicle were used to develop pressure models for a resizing of airframe components for aircraft No. 4 (A/C4). Acoustical fatigue design data for two dynamically complex structural configurations were acquired in laboratory programs, the conceptions for and executions of which detailed significant departures from the conventional. Design requirements for mechanical fasteners for configurations other than these two made use of analytical extensions of regrettably limited available information. R.C.T.

N80-17300*# Gilbert/Commonwealth, Jackson, Mich.
EXPERIMENTAL INVESTIGATION OF DYNAMIC CHARACTERISTICS OF TURBINE GENERATORS AND LOW-TUNED FOUNDATIONS c37
S. P. Ying, M. E. Forman, and R. R. Drumm *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 69-77 refs Prepared in cooperation with Pennsylvania Power and Light Co., Allentown (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 21E

Turbine generator (T-G) units with low tuned concrete foundations were investigated experimentally during both startup and normal operating conditions. The dynamic response of the turbine generators and their foundation systems were characterized by resonance curves obtained during the startup transient and by vibration mode shapes at the normal operating condition. No severe resonance at the fundamental frequencies of the system was observed. The deflection or displacement of the foundation pedestal does not lead to unacceptable T-G vibration. The experimental results are compared and discussed with some previous theoretical studies. R.C.T.

N80-17301*# McDonnell Aircraft Co., St. Louis, Mo.
COMBINED VIBRATION/TEMPERATURE/SIDELOAD ENVIRONMENTAL TESTING OF UHF BLADE ANTENNAS c39
Ronald Volker *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 79-84 (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 20K

Service problems encountered on the F-4 aircraft showed that the environmental qualification requirements for the UHF blade antenna were not adequate. Although the individual environmental levels were stringent enough, only combined environmental testing could duplicate the conditions in which service problems occurred. Techniques for applying static side load simultaneously with vibration and temperature were developed. The combined environment testing was instrumental in the rapid assessment of antenna modifications and resulted in a final configuration which proved satisfactory in service. A need to include combined environmental testing for qualification of blade antennas was established. Author

N80-17302*# Raytheon Co., Bedford, Mass. Missile Systems Div.
SHOCK ISOLATION PLATFORM FOR SEASPARROW LAUNCHER c15
Paul V. Roberts *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 85-95 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 16A

A unique low frequency shock isolation platform is used to mount the NATO SEASPARROW Launcher aboard U.S. shock hardened ships. The platform attenuates shock response to less than structural design loads which were used to minimize weight on smaller NATO ships and for compatibility with airborne missiles. Author

N80-17303# Naval Postgraduate School, Monterey, Calif.
THE CONSISTENT SECOND-ORDER THEORY OF WAVE/STRUCTURE INTERACTION Final Report
C. J. Garrison Sep. 1979 45 p refs
(Grant NSF ENG-73-04019)
(AD-A076550; NPS-69-79-010) Avail: NTIS HC A03/MF A01 CSCL 13/13

The consistent second-order theory of the interaction of regular gravity waves with a fixed object in water of finite depth is developed. The theory is carried out for the most general case of a body of arbitrary shape which may extend through the free-surface or be completely immersed. The incident wave evolves in the development as a second-order Stokes' wave. Boundary-value problems are established for both the first- and second-order velocity potentials and a numerical method based on the Green's function is outlined. The determination of forces exerted by gravity waves on large structures immersed in the sea has become of great practical interest in recent years. For example, in the design of bottom-mounted oil storage facilities or large ocean caissons, the wave-induced horizontal and up-lift forces and overturning moments are factors of primary importance. The effect of large amplitude waves in particular is of importance in the determination of the permanence of an ocean structure and, therefore, a higher-order theory appears to have significant practical value. For example, Apelt and Macknight (1976) found measured forces on an ocean caisson model in fairly large-amplitude shallow-water waves to be considerably in excess of calculations based on linear diffraction theory. GRA

N80-17304# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
MASS FORCE AND WEIGHT
B. Swindells Mar. 1979 18 p refs
(NPL-MOM-38) Avail: NTIS HC A02/MF A01

The relationships among mass, force, and 'weight' are discussed and obsolescent units of force are reviewed. The procedure for finding the weight of a body using a spring balance or strain gage load cell is discussed. Author (ESA)

N80-17305# Centre Technique des Industries Mecaniques, Senlis (France).
ON THE SIMULATION OF FORMING PROCESSES Final Report [SIMULATION DES PROCEDES DE MISE EN FORME]
J. L. Montagut 19 Apr. 1979 64 p refs In FRENCH
(CETIM-1-3K-21-0) Avail: NTIS HC A04/MF A01

The laboratory simulation of forming processes using model materials is discussed. The choice of a simulation materials, its preparation, and the design of a machine to simulate the process under investigation is emphasized. Problems, such as the influence of friction on the similarity relationship and the use lubricants, are taken into consideration. A mathematical model of the simulation concept is presented, then used to analyze results obtained with a forging simulation setup. Theoretical results concerning other simulation exercise, notably viscoplasticity tests, are also compared with results from tests reported in the literature. Author (ESA)

N80-17306# Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
STRENGTHENING OF REINFORCED CONCRETE COLUMNS FOR EARTHQUAKE RESISTANCE Final Report
Lawrence F. Kahn Jun. 1979 97 p refs
(Grant NSF ENG-77-06478)
(PB-300982/6; NSF/RA-790133) Avail: NTIS HC A05/MF A01 CSCL 13C

Several methods of strengthening reinforced concrete columns to improve their seismic resistance are described. Based on the test results and the ease of construction, it was concluded that U-clamp and banding techniques showed great promise in providing low cost, easy-to-construct methods for greatly improving the ductibility and earthquake resistance of existing reinforced concrete columns. Photographs showing column construction, reinforcement techniques, and results of testing are presented. GRA

N80-17307# Florida State Dept. of Transportation, Gainesville. Office of Materials and Research.
FLEXIBLE PAVEMENT DESIGN - (CHIEFLAND, CRESTVIEW, LAKE WALES, PALM BEACH, MARIANNA) REPORTS FOR STUDY P-1-63 Final Summary Data Reports, 1962 - 1978
R. L. McNamara Jun. 1979 50 p
(PB-301424/8; RR-196-A; FHWA/RD-79-S0896) Avail: NTIS HC A03/MF A01 CSCL 13B

A condensed version of the performance data generated and

collected from five flexible pavement projects is presented. These five projects are considered to have fulfilled the requirements, but it is planned to continue the surveillance and evaluation of the completed projects to determine the long term behavior of Florida base course materials. GRA

N80-17308# California Univ., Richmond. Earthquake Engineering Research Center.
MECHANICAL BEHAVIOR OF LIGHTWEIGHT CONCRETE CONFINED BY DIFFERENT TYPES OF LATERAL REINFORCEMENT
Miguel A. Manrique (California Univ., Berkeley), Vitelmo V. Bertero (California Univ., Berkeley), and Egor P. Popov (California Univ., Berkeley) May 1979 123 p refs
(Grant NSF ENV-76-04263)
(PB-301114/5; UCB/EERC-79/05; NSF/RA-790183) Avail: NTIS HC A06/MF A01 CSCL 13C

Results are given of an experimental study to evaluate the different aspects of the behavior of lightweight concrete. The behavior of confined lightweight concrete when subjected to axial, monotonic loading was emphasized. The effects on confined concrete of the following parameters were considered: (1) concrete cover; (2) longitudinal reinforcement; and (3) lateral reinforcement arrangement. A total of 30 confined and unconfined specimens were tested. The effect of the mentioned parameters are evaluated; subsequently, the experimental results are compared with the results of a similar investigation carried out on normal weight concrete. An analytical stress-strain relationship for longitudinally reinforced confined lightweight concrete is presented. Practical design implications are presented. GRA

N80-17309# American Association for the Advancement of Science, Washington, D.C. Office of Public Sector Programs.
FIRE SAFETY AND DISASTER PREPAREDNESS
Mar. 1979 284 p refs Presented at the Workshop Considering Problems Identified by the Intergovernmental Sci. and Tech. Panel, Washington, D.C., 14-16 Mar. 1979
(Grant NSF OPA-78-24464)
(PB-300467/8; AAAS/Pub-79/R/3; NSF/RA-790096) Avail: NTIS HC A13/MF A01 CSCL 13L

Problems areas and their relationship to science and technology were discussed and analyzed. The problem areas considered were: (1) evaluation of fire prevention and suppression management; (2) causes and prevention of injury and disability among firefighters; (3) public awareness of fire hazards; and (4) disaster preparation planning. GRA

N80-17310# National Bureau of Standards, Washington, D.C. Center for Building Technology.
FIRE EFFECTS ON REINFORCED CONCRETE MEMBERS Final Report
Bruce Ellingwood and James Shaver Aug. 1979 44 p refs
(PB-299904/3; NBS/TN-985) Avail: NTIS HC A03/MF A01 CSCL 13M

Thermal and structural analyses for reinforced concrete members were validated using experimental data. Temperature distributions computed in reinforced concrete members for several realistic fire exposures were examined and compared to the distributions measured in a standard test. Parameter studies show the effect of typical variations in thermal diffusivity, emissivity and conductivity. Structural responses for the different fire exposures were also briefly compared. GRA

N80-17311# JACA Corp., Fort Washington, Pa.
EVALUATION OF THE ECONOMIC AND ENVIRONMENTAL FEASIBILITY OF USING FUSED AND UNFUSED INCINERATOR RESIDUE IN HIGHWAY CONSTRUCTION Final Report, 1978 - 1979
Uday M. Patankar, Emilio Palermo, Gary D. Gindlesperger, and Michael R. Taylor Apr. 1979 141 p refs
(Contract DOT-FH-11-9427)
(PB-300893/5; FHWA/RD-79/83) Avail: NTIS HC A07/MF A01 CSCL 13C

The use of residue in highway construction is discussed. The residue was evaluated for use as subbase material, in bituminous base and, in a fused state, as wearing course. Similar analysis was performed for disinterred residue from an existing landfill site. The results show that incinerator residue would prove competitive with virgin aggregate in highway construction in three of the five metropolitan areas studied. If the landfill savings gained by the municipality in using the incinerator residue are figured in, the use of the residue becomes economically attractive in all the SMSA's studied. GRA

N80-17312# Hawaii Univ. at Manoa, Honolulu. Dept. of Civil Engineering.
SYSTEM IDENTIFICATION OF TALL VIBRATING STRUCTURES Final Report
George T. Taoka Jul. 1979 124 p refs
(Grant NSF ENV-75-16926)
(PB-301064/2; NSF/RA-790173) Avail: NTIS HC A06/MF A01 CSCL 13M

Ambient vibration responses under natural wind conditions of five tall structures in Tokyo and Yokohama were recorded. The ambient data obtained were analyzed by four system identification methods: filtered correlation, spectral moments, spectral density, and two-stage least square. Factors that greatly affect the values of parameters estimates obtained from the ambient vibration record are record length, signal-noise ratio in the record, filter shape, and filter cutoff bandwidth. GRA

N80-17313# National Technical Information Service, Springfield, Va.
CORROSION OF REINFORCED CONCRETE, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1977
William E. Reed Nov. 1979 248 p
(PB80-800790) Avail: NTIS HC $30.00/MF $30.00 CSCL 13C

Citations from worldwide journal reports on concrete deterioration by corrosion are presented. Studies on bridge decks, offshore structures, buildings, and industrial plants are covered. Inhibition and prevention of this process by coatings, additives, impregnation, and steel thermomechanical treatment are also included, as are the testing and performance of concrete under corrosive conditions. This updated bibliography contains 285 abstracts, none of which are new entries to the previous edition. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-17314 Maryland Univ., College Park.
A NEW CLASS OF MULTI-ACCESS PROTOCOLS FOR PACKET COMMUNICATION OVER A SATELLITE CHANNEL: THE INTERLEAVED FRAME FLUSH-OUT PROTOCOLS Ph.D. Thesis
Jeffrey Ernest Wiesethier 1979 252 p
Avail: Univ. Microfilms Order No. 8002073

A class of protocols, known as the Interleaved Frame Flush-Out (IFFO) protocols are introduced. These protocols combine random access and reservation techniques, and use a slotted variable length frame structure which adapts to instantaneous system traffic. Numerical and simulated results were obtained for the IFFO protocols. It is demonstrated that the delay-through-put performance of both F-IFFO and CR*IFFO is better than that of previously proposed schemes over a wide range of applications, and that stability is guaranteed as long as the input rate is less than one packet per slot. Dissert. Abstr.

N80-17315 Princeton Univ., N. J.
SOME NEW TECHNIQUES AND PERFORMANCE ANALYSES IN DIGITAL SIGNAL PROCESSING Ph.D. Thesis
David Clair Munson 1979 190 p
Avail: Univ. Microfilms Order No. 7928483

Structures with greatly reduced arithmetic roundoff error are implemented using multiplierless ROM-accumulator (ROM/ACC) arithmetic. The N/S ratios are derived for these realizations using a ROM/ACC error analysis and are shown to be small. In addition,

an example demonstrates that the ROM/ACC realizations may require as little as one half the ROM worldlength and operate at up to twice the word rate of direct form ROM/ACC realizations that achieve the same S/N. Error spectrum shaping, a technique which utilizes quantizer feedback to reduce the effect of roundoff error, is shown to reduce limit cycle amplitudes in digital filters. Assuming ROM/ACC arithmetic, an expression for the MSE in an ESS filter is also derived, including the effect of finite wordlength ROM. The problem of generating a random sequence with a specified marginal distribution and autocovariance is also investigated. Dissert. Abstr.

N80-17316 California Univ., Berkeley.
PENETRATION AND SCATTERING OF ELECTROMAGNETIC FIELDS BY ADVANCED COMPOSITE BODIES OF REVOLUTION Ph.D. Thesis
Hugh Kao 1979 106 p
Avail: Univ. Microfilms Order No. 8000396

A numerical algorithm based on the unimoment method is developed for the computation of electromagnetic (EM) response of advanced composites. The unimoment approach is characterized by the mathematical division of space into an interior and exterior region. With the advanced composites modeled by a permittivity tensor, the Maxwell's equations in the interior region are specialized to a coupled partial differential equation valid for inhomogeneous, anisotropic, axial-symmetric media. The finite element method is used to obtain the interior solutions corresponding to a set of linearly independent boundary trial functions. Such a procedure has the effect of generating the inverse differential operator that governs the interior solution. In the exterior region, the scattered fields are analytically represented by a series expansion having unknown coefficients. With appropriate enforcement of continuity conditions, the solution to the EM field penetration and scattering problem is obtained. Dissert. Abstr.

N80-17317 Ohio State Univ., Columbus.
A COMPUTATIONAL MODEL FOR SUBSURFACES PROPAGATION AND SCATTERING FOR ANTENNAS IN THE PRESENCE OF A CONDUCTING HALF SPACE Ph.D. Thesis
Curtis Woodward Davis 1979 280 p
Avail: Univ. Microfilms Order No. 8001716

Techniques are presented which can be used to model a wide variety of underground radar probing methods and scatterer types. Antenna properties and medium propagation effects are modeled using a thin wire computational procedure which are modified to allow the impedance altering effects of the conducting interface to be accounted for. The resulting modified antenna currents are treated as radiating in a homogeneous conducting medium. Target scattering behavior is modeled by scattering attenuation functions (SAF) which are computed separately from the aforementioned antenna model. The SAFs are presented which represent the scattering from doubly curved surfaces and long cylinders. The modification of underground electromagnetic fields incident upon the interface is accounted for by the development of interface correction functions. Dissert. Abstr.

N80-17318 Ohio State Univ., Columbus.
RADIATION BY SOURCES ON PERFECTLY CONDUCTING CONVEX CYLINDERS WITH AN IMPEDANCE SURFACE PATH Ph.D. Thesis
Levent Ersoy 1979 133 p
Avail: Univ. Microfilms Order No. 8001726

An asymptotic high frequency analysis of the radiation patterns of a magnetic line source, or a magnetic line dipole, located on a uniform impedance surface patch which partly covers an electrically large perfectly conducting convex cylinder is presented. Radiation pattern calculations based on this analysis compare quite well with a numerical moment method type solution, a previous GTD solution for those impedances which support an Elliot mode, and also with some experimental results. A moderately large increase in the radiation intensity is obtained in the vicinity of the horizon for cylinders loaded by an impedance surface which support Elliot type modes. This work is relevant to the analysis of fuselage mounted airborne antennas for satellite communication purposes. Dissert. Abstr.

N80-17319 Stanford Univ., Calif.
MONOLITHIC POWER-SPECTRUM CENTROID DETECTOR Ph.D. Thesis
Levy Gerzberg 1979 225 p
Avail: Univ. Microfilms Order No. 8001922

Systems and integrated circuit technologies related to the applications, theory, and realization of a monolithic power spectrum centroid detection was investigated. Optimal system configurations and new monolithic devices was developed to enable detector realization in integrated circuit form. Detection schemes for the operation of single sideband detectors for directional velocity and flow estimation were introduced. The square root of f centroid detector was selected for implementation and use based on theoretical estimation errors derived for the correlation and the square root of f centroid detectors, plus the need for versatility and integrated circuit realization. This detector verifies its versatility, accuracy, and good agreement with theoretical performance. Dissert. Abstr.

N80-17320# RAND Corp., Santa Monica, Calif.
LIMITATIONS ON TOA ACCURACY
T. Finley Burke Sep. 1979 14 p
(Contract F49620-77-C-0023)
(P-6386) Avail: NTIS HC A02/MF A01

A directional antenna is a filter whose response varies with direction. A modulated signal transmitted from such an antenna produces different far-field waveforms in all directions (except for possible symmetry). The response of a receiver to the transmission will vary with position in the antenna pattern of the emitter. The system performance of a rudimentary time of arrival (TOA) system consisting of three identical receivers was examined. The analysis indicates that in a simple idealized TOA system that would otherwise be entirely free from error, the waveform effect arising from a directional emitter can lead to errors of several dozen meters in the computed location. R.E.S.

N80-17321*# Mitre Corp., Houston, Tex.
TMS COMMUNICATIONS HARDWARE. VOLUME 1: COMPUTER INTERFACES
J. S. Brown and S. S. Weinrich Feb. 1979 37 p refs
(NASA Order T-5295-F)
(NASA-CR-160449; MTR-H721-Vol-1; JSC-14682) Avail: NTIS HC A03/MF A01 CSCL 17B

A prototpye coaxial cable bus communications system was designed to be used in the Trend Monitoring System (TMS) to connect intelligent graphics terminals (based around a Data General NOVA/3 computer) to a MODCOMP IV host minicomputer. The direct memory access (DMA) interfaces which were utilized for each of these compters are identified. It is shown that for the MODCOMP, an off-the-shell board was suitable, while for the NOVAs, custon interface circuitry was designed and implemented. J.M.S.

N80-17322*# Mitre Corp., Houston, Tex.
TMS COMMUNICATIONS HARDWARE. VOLUME 2: BUS INTERFACE UNIT
J. S. Brown and G. T. Hopkins Mar. 1979 36 p refs
(NASA Order T-5295-F)
(NASA-CR-160450; MTR-4721-Vol-2; JSC-14723) Avail: NTIS HC A03/MF A01 CSCL 17B

A prototype coaxial cable bus communication system used in the Trend Monitoring System to interconnect intelligent graphics terminals to a host minicomputer is described. The terminals and host are connected to the bus through a microprocessor-based RF modem termed a Bus Interface Unit (BIU). The BIU hardware and the Carrier Sense Multiple Access Listen-While-Talk protocol used on the network are described. J.M.S.

N80-17323*# Mitre Corp., Houston, Tex.
TMS COMMUNICATIONS SOFTWARE. VOLUME 1: COMPUTER INTERFACES
J. S. Brown and M. D. Lenker Apr. 1979 81 p refs
(NASA Order T-5295-F)
(NASA-CR-160451; MTR-4723-Vol-1; JSC-14792) Avail: NTIS HC A05/MF A01 CSCL 17B

A prototype bus communications system, which is being used to support the Trend Monitoring System (TMS) as well as for evaluation of the bus concept is considered. Hardware and

software interfaces to the MODCOMP and NOVA minicomputers are included. The system software required to drive the interfaces in each TMS computer is described. Documentation of other software for bus statistics monitoring and for transferring files across the bus is also included. J.M.S.

N80-17324*# Mitre Corp., Houston, Tex.
TMS COMMUNICATIONS SOFTWARE. VOLUME 2: BUS INTERFACE UNIT
Paul J. Gregor Apr. 1979 110 p refs
(NASA Order T-5295-F)
(NASA-CR-160452; MTR-4723-Vol-2; JSC-14793) Avail: NTIS HC A06/MF A01 CSCL 17B

A data bus communication system to support the space shuttle's Trend Monitoring System (TMS) and to provide a basis for evaluation of the bus concept is described. Installation of the system included developing both hardware and software interfaces between the bus and the specific TMS computers and terminals. The software written for the microprocessor-based bus interface units is described. The software implements both the general bus communications protocol and also the specific interface protocols for the TMS computers and terminals. J.M.S.

N80-17325*# Mitre Corp., Houston, Tex.
DIAGNOSTIC PROCEDURES FOR TREND MONITORING SYSTEM (TMS) COMMUNICATIONS
J. S. Brown and M. D. Lenker Mar. 1979 37 p refs
(NASA Order T-5295-F; Contract F19628-79-C-0001)
(NASA-CR-160453; MTR-4724; JSC-14794) Avail: NTIS HC A03/MF A01 CSCL 17B

A prototype coaxial cable bus communications sytem was developed to support the trend monitoring system (TMS). Troubleshooting procedures are described at the system level. The procedures can be used by repair personnel to isolate a fault in the TMS and to restore the system to operation by swapping out failed components. R.E.S.

N80-17326*# Mitre Corp., Houston, Tex.
TREND MONITORING SYSTEM (TMS) GRAPHICS SOFTWARE
J. S. Brown Apr. 1979 93 p
(NASA Order T-5295-F)
(NASA-CR-160454; MTR-4725; JSC-14795) Avail: NTIS HC A05/MF A01 CSCL 17B

A prototype bus communications systems, which is being used to support the Trend Monitoring System (TMS) and to evaluate the bus concept is considered. A set of FORTRAN-callable graphics subroutines for the host MODCOMP comuter, and an approach to splitting graphics work between the host and the system's intelligent graphics terminals are described. The graphics software in the MODCOMP and the operating software package written for the graphics terminals are included. J.M.S.

N80-17327*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALTERNATIVE BEAM EFFICIENCY CALCULATIONS FOR A LARGE-APERTURE MULTIPLE-FREQUENCY MICROWAVE RADIOMETER (LAMMR)
R. F. Schmidt Dec. 1979 33 p refs Submitted for publication
(NASA-TM-80603) Avail: NTIS HC A03/MF A01 CSCL 20N

The fundamental definition of beam efficiency, given in terms of a far field radiation pattern, was used to develop alternative definitions which improve accuracy, reduce the amount of calculation required, and isolate the separate factors composing beam efficiency. Well-known definitions of aperture efficiency were introduced successively to simplify the denominator of the fundamental definition. The superposition of complex vector spillover and backscattered fields was examined, and beam efficiency analysis in terms of power patterns was carried out. An extension from single to dual reflector geometries was included. It is noted that the alternative definitions are advantageous in the mathematical simulation of a radiometer system, and are not intended for the measurements discipline where fields have merged and therefore lost their identity. R.C.T.

N80-17328*# LinCom Corp., Pasadena, Calif.
SHUTTLE/TDRSS COMMUNICATIONS SYSTEM PERFORMANCE ANALYSIS Final Report, 20 Apr. 1979 - 24 Jan. 1980
W. R. Braun 24 Jan. 1980 126 p refs
(Contract NAS9-15799)
(NASA-CR-160467; TR-0180-1179) Avail: NTIS HC A07/MF A01 CSCL 17B

The results of the performance analysis performed on the Shuttle/Tracking and Data Relay Satellite System (TDRSS) communications system are presented. The existing Shuttle/TDRSS link simulation program were modified and refined to model the post-radio frequency interference TDRS hardware and to evaluate the performance degradation due to RFI effects. The refined link models were then used to determine, evaluate and assess expected S-band and Ku-band link performance. Parameterization results are presented for the ground station carrier and timing recovery circuits R.E.S.

N80-17329# Naval Ocean Systems Center, San Diego, Calif.
TADIXS OCEAN NETWORK PLAIN. A PROPOSAL FOR THE FCC-TO-TFCC SATELLITE LINKAGE VIA TADIXS FOR EACH FCC AREA OF OPERATIONS Final Report, 1 Apr. - 1 Jun. 1979
J. L. Dodd, C. T. Ogata, and W. J. Pomper 1 Jun. 1979 20 p
(AD-A076560; NOSC/TR-440) Avail: NTIS HC A02/MF A01 CSCL 17/2

The objective of this study was to develop an ocean network plan to show (1) the Tactical Data Information Exchange System (TADIXS) ocean coverage assigned to each Fleet Command Center (FCC) and (2) the communications concepts required to assure FCC-to-TFCC linkage throughout the ocean area responsibility of each FCC. A network plan was developed that allows FCC-TFCC communication for all locations within the area of responsibility of each FCC. System backup for the loss of a uhf satellite is discussed; uhf and narrowband shf backups are considered and effects analyzed. GRA

N80-17330# Naval Ocean Systems Center, San Diego, Calif.
DESIGN OF SHIPBOARD HF ANTENNAS FOR BROADBAND CHARACTERISTICS
R. L. Goodbody 1 Sep. 1979 18 p refs
(AD-A076539; NOSC/TD-286) Avail: NTIS HC A02/MF A01 CSCL 09/1

Typical US Navy ships have 5 to 19 hf transmitters and 6 to 24 or more hf receivers which must all be capable of operating simultaneously without mutual interference. Achieving this capability is made difficult by rf currents induced on all the complex conducting shapes on the structure when electromagnetic energy is radiated or received. The topside in effect acts as a complex antenna. The topside has some highly undesirable shapes from the point of view of the antenna designer. Prominent ship features such as corners, masts, and yard-arms have a strong effect on hf antenna characteristics. The antenna designer must therefore be sophisticated in the use of rf filters and in the placement and control of hf antennas and rf conductors in the ship's topside. This document provides guidance in design of broadband hf antennas on ships. It will be useful to engineers not familiar with Navy shipboard hf antenna systems. It will also be useful to shipyard engineers in the determination of antenna construction techniques. GRA

N80-17331# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
SATCOM EHF AIRBORNE TERMINAL AVAILABILITY TO COST ANALYSIS DEMONSTRATION Technical Report, Jul. 1978 - Apr. 1979
Herbert M. Bartman Jul. 1979 150 p refs
(AD-A076163; AFAL-TR-79-1105) Avail: NTIS HC A07/MF A01 CSCL 17/2

A practical approach (TASA/DEPEND Program) for analyzing system 'ilities' was demonstrated based on results reported in Technical Reports AFAL-TR-78-45 and AFAL-TR-78-135. This approach provides an analysis tool for studying the impact of changes in mission use on reliability, availability and dependability so that mission plans can be optimized with respect to achieving design objectives as related to cost. An important feature of

this analysis approach is that the impact of malfunctions and failures on system availability and cost are separately assessed. This makes it possible to directly relate the contributions of hardware module reliability and maintainability to functional block performance. Such studies provide a means for concentrating reliability and maintainability resources in areas that will provide the maximum system improvement at the minimum cost. Also, a relational basis for trade-offs between reliability and maintainability requirements is obtained in relationship to cost. GRA

N80-17332# Defense Communications Engineering Center, Reston, Va.
DELAY ANALYSIS OF TASI WITH RANDOM FLUCTUATIONS IN THE NUMBER OF VOICE CALLS
M. J. Fischer Sep. 1979 34 p refs
(AD-A076172; AD-E100296; DCEC-TN-15-79) Avail: NTIS HC A03/MF A01 CSCL 17/2

In this technical note we consider the performance of a voice communications system where the talkspurts of a conversation are buffered and multiplexed over the transmission channels. A mathematical model is given for the behavior of a talkspurt in the system when the voice calls are allowed to statistically come and go. A numerical analysis is conducted to determine the sensitivity of various system measures of performance to the presence of voice calls and to relate various measures of performance. GRA

N80-17333# Electronics Research Lab., Adelaide (Australia).
THE EFFECT OF SCINTILLATIONS OF TRANSIONOSPHERIC COMMUNICATIONS
D. G. Singleton Apr. 1979 42 p refs
(AD-A076182; ERL-0074-TR) Avail: NTIS HC A03/MF A01 CSCL 20/14

Consideration is given to the bearing ionospheric scintillation on the design and on the evaluation of the performance of satellite communication links. Emphasis is placed on establishing a design parameter of universal application. The cumulative amplitude distribution function (cdf), which was found application in this regard, is shown experimentally to be well represented by the Nakagami m-distribution at all scintillation levels. However, the cdf is demonstrated to be strictly valid only for amplitude modulated signals of short duration. Autocorrelation, power spectra and level crossing techniques are investigated in an effort to establish a design parameter more universally applicable than the cdf. A quantity message reliability is defined which removes the short duration restriction inherent in the cdf. A formula for message reliability is developed which allows it to be evaluated for any fade margin and message length, given the scintillation index and the half width of the autocorrelogram of the scintillating channel. A design chart, embodying this information, is also illustrated. GRA

N80-17334# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MINIMUM DIRECTIVE GAIN OF HOPPED-BEAM ANTENNAS
Andre R. Dion 11 Jun. 1979 30 p refs
(Contract F19628-78-C-0002; AF Proj. 2029)
(AD-A076495; TN-1979-33; ESD-TR-79-158) Avail: NTIS HC A03/MF A01 CSCL 09/5

The optimum parameters of an antenna whose beam is hopped to uniformly spaced directions within a circular coverage are derived for a phased array and for a multifeed lens antenna. The minimum directive gain, GMIN, within the coverage is the parameter optimized. The analysis shows that, for small bandwidth-diameter products, the two antenna configurations exhibit about the same GMIN, but the optimum aperture diameter is about 30 percent smaller with the phased array. However, as the bandwidth-diameter product increases, the GMIN of the lens antenna becomes progressively greater than that of the phased array. GRA

N80-17335# New Jersey Inst. of Technology, Newark.
RADIATION FROM INTEGRATED DIELECTRIC MILLIMETER-WAVE SLAB-WEDGE STRUCTURES Final Technical Report, 29 Jan. 1976 - 31 May 1979
G. M. Whitman, S. J. Maurer, and A. R. Noerpel (Bell Telephone Labs., Holmdel, N.J.) Oct. 1979 80 p refs
(Grants DAAG29-76-G-0131; DAAG29-77-G-0094)
(AD-A076504; ARO-13677.2-ELX) Avail: NTIS HC A05/MF A01 CSCL 20/14

A method of analysis of an integrated dielectric slab waveguide and wedge radiator is presented. Plane wave constituents in the slab are assumed to excite the dielectric wedge. The solution in the wedge is postulated to be a finite, continuous spectrum of plane waves. Reflections of these waves from the wedge boundaries are taken into account by introducing angularly dependent Fresnel reflection coefficients into the integrands of the planewave integral representations. These integrals reduce asymptotically to the dielectric slab fields in the limit of small wedge apex angle at the interface between the slab and the wedge. Using numerical techniques, the TE surface fields and the far field radiation patterns are determined for different dielectric materials, wedge lengths and slab widths. It is observed that by decreasing either the relative permittivity of the dielectric or the slab width or by increasing the wedge length a more directive antenna pattern results. GRA

N80-17336# E-Systems, Inc., St. Petersburg, Fla. ECI Div.
ELECTRONICALLY TUNED UHF RECEIVER PRESELECTOR Final Technical Report, 27 Oct. 1977 - 30 Oct. 1978
Thomas Swanson Griffiss AFB, N.Y. RADC Aug. 1979 106 p refs
(Contract F30602-77-C-0200; AF Proj. 2338)
(AD-A075286; RADC-TR-79-210) Avail: NTIS HC A06/MF A01 CSCL 17/2

This report describes design and construction of a prototype improved electronically tunable UHF receiver preselector for interference reduction in Air Force communication systems. This research work was directed toward developing the technology for frequency agile preselectors to protect solid state receivers from high level signals originating from colocated UHF transmitters. The design approach consists of tuning a modified comb-line filter structure with high Q UHF capacitors and pin diode switches. Equations and design considerations are given for construction of tuning networks which have Cx2 to the Nth power binary capacitance steps. A computer program was used to predict the filters' performance based on the values of stray capacitance and inductance of the tuning networks. The tuning networks were then optimized which ensured that spurious resonances fell well outside of the tuning range of the filters. The filters were built based on these computer modeled results. Test data showed input VSWR variation versus the tuning frequency of the filters. These changes were found to be caused by variation in current loading at the tap point of the resonator resulting from the different values of capacitance selected in the tuning network. Improved filter performance was obtained by grounding the input transformers in the vicinity of the tuning network tap point. GRA

N80-17337# Rome Air Development Center, Griffiss AFB, N.Y.
SPREAD-SPECTRUM DATA LINK TEST FACILITY
Oscar H. McKee Aug. 1979 53 p refs
(AD-A075098; RADC-TR-79-244) Avail: NTIS HC A04/MF A01 CSCL 09/5

This technical report describes the development of an in-house capability for evaluating wide bandwidth spread spectrum modems. The major portion of the report concerns the development and fabrication of the microwave transmitting and receiving equipment used during the flight testing of a direct sequence spread spectrum modem developed to RADC specifications. The microwave equipment developed for the test facility operated at an IF of 300 MHz, with four distinct RF frequencies of 4500 MHz, 4900 MHz, 7350 MHz and 7900 MHz. The output power for all stations was set at 200 watts CW, however, additional power is available at the three ground stations. Section 2 of the report presents the theoretical calculations used to predict the maximum range expected from each of four data links incorporated in a five station test scenario. The maximum theoretical range was calculated to be 414.3 miles, however, the ranges achieved during actual flight testing were approximately 9 dB below theoreteical expectations. GRA

N80-17338# Raytheon Co., Goleta, Calif. Electromagnetic Systems Div.
FEED LENS PORTION OF 3-D DOME ANTENNA STUDY Final Report, 1 Oct. 1973 - 3 Apr. 1979

David T. Thomas and S. Douglas Bixler Oct. 1979 104 p refs
(Contract N00014-77-C-0760)
(AD-A076298) Avail: NTIS HC A06/MF A01 CSCL 09/5

A 3-D Dome/Rotman Lens Antenna system is described which offers the capability for greater than hemisphere scan coverage from a single feed array, greater than octave bandwidth, and multiple simultaneous beams. The history and selected results of related programs are included. Results of the analysis performed show peak phase errors of 15 degrees for scanning in the major axis planes. This error level would produce about 28 dB peak sidelobe levels for low sidelobe distributions. Complete descriptions of the analysis, computer programs and results are included.
GRA

N80-17339# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
RADAR BACKSCATTER FROM A VEGETATED TERRAIN: A DISCRETE SCATTERING APPROACH
Roger H. Lang and Spiro P. Sokolakis Jun. 1979 65 p refs
(Contract DAAK70-77-C-0142; DA Proj. 4A1-61102-B-52C)
(AD-A076249; ETL-0159) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report studies radar backscattering from a vegetated terrain. The vegetation is modelled by spherical water droplets which can be treated as discrete scatterers. The vegetation is assumed sufficiently lossy so that the underlying ground is not noticeable. The method of Foldy is used to evaluate the mean field in the vegetation when the wavelength of the incident radiation is large compared to the droplet size. Once an equivalent dielectric constant for the vegetation is obtained by the Foldy technique, single scattering is employed to evaluate the backscattering cross section. The resulting expression is found to compare favorably with experimental data. In addition to the three dimensional work, a one dimensional problem is analyzed. This analysis is compared with the Foldy approximation in the high density limit.
GRA

N80-17340# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TURBULENCE EFFECTS ON THE RECEIVER OPERATING CHARACTERISTICS OF A HETERODYNE-RECEPTION OPTICAL RADAR
Barbara A. Capron, Jeffrey H. Shapiro, and Robert C. Harney Jul. 1979 97 p refs
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A076535; TST-33; ESD-TR-79-189) Avail: NTIS HC A05/MF A01 CSCL 17/9

The theory of atmospheric turbulence effects on the receiver operating characteristics of coherent optical radars is reviewed and the theoretical results for the target detection probability are numerically evaluated. Graphs and tables are presented of the glint target and speckle target detection probabilities as a function of the carrier-to-noise ratio at various false alarm probabilities for different turbulence log-amplitude variances. Experimental turbulence strength measurements are reviewed and used to determine typical log-amplitude variances. These results are combined with the detection probability calculations to predict the performance of a realistic infrared radar under a variety of turbulent propagation conditions.
GRA

N80-17341# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
MILLIMETER RADAR SEA RETURN STUDY Final Technical Report, Feb. - Oct. 1978
Robert N. Trebits Apr. 1979 48 p refs
(Contract N60921-77-C-A168)
(AD-A075516; GIT-EES-A-2013-FTR) Avail: NTIS HC A03/MF A01 CSCL 17/9

A site selection process was performed for a planned field exercise to measure radar sea clutter reflectivity at low grazing angles using several radar frequencies between 9.5 and 95 GHz. A detailed test plan was developed to collect calibrated radar cross section data over a variety of geometric and environmental conditions. The data collection and calibration processes have been described using radar systems and ancillary electronic equipment.
GRA

N80-17342# Air Force Weapons Lab., Kirtland AFB, N. Mex.
ELECTROMAGNETIC PULSE INTERACTION NOTES--EMP 3-38 Final Report
Carl E. Baum Kirtland AFB, N.M. AFWL May 1979 488 p refs
(AF Proj. 9996)
(AD-A073770; AD-E200329; AFWL-TR-79-401) Avail: NTIS HC A21/MF A01 CSCL 20/14

This is a series of five notes on electromagnetic pulse interaction. Subjects covered in this volume are: electromagnetic shielding by advanced composite materials; fields in a rectangular cavity excited by a plane wave on an elliptical aperture; transient electromagnetic characterization of arbitrary conducting bodies through an aperture-perforated conducting screen; a comparison of stick model skin current predictions with scale model measurements for the E-4 and EC-135 aircraft; aperture excitation of a wire in a rectangular cavity.
GRA

N80-17343# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF PADE APPROXIMANTS TO ELASTIC WAVE SCATTERING
J. E. Gubernatis 1979 7 p refs Presented at ARPA/AF Review of Progress in Quantitative NDE, La Jolla, Calif., 8 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1902; CONF-790757-1) Avail: NTIS HC A02/MF A01

Several Pade methods were used to try to accelerate the convergence of partial wave sums for scattering amplitudes. A specific test problem of longitudinal-to-longitudinal scattering from a spherical void was studied in detail. Results for this test case and the behavior of partial wave amplitudes for general cases are presented and discussed.
DOE

N80-17344# Electrical Research Association, Leatherhead (England). RF Technology Centre
DEFINITION OF AN ANTENNA CONFIGURATION FOR TVBS COVERAGE OF SMALL COUNTRIES Final Report
N. Adatia and B. Claydon Mar. 1979 29 p refs
(Contract ESTEC-3687/78-NL-PP)
(RFTC-821078; ESA-CR(P)-1231) HC A03/MF A01

Radiation characteristics and mechanical design criteria are presented for a carbon fiber reflector representative of non-furlable satellite antennas. The solid reflector was designed to fit within the Ariane shroud in the single launch mode and to provide a .8 deg and .6 deg beam for coverage of small countries in the 11.7 to 12.5 GHz band. Reflector designs were based on the use of a rectangular corrugated horn as a primary feed.
Author (ESA)

N80-17345# Universite Catholique de Louvain (Belgium). Lab. de Telecommunications et d'Hyperfrequences.
STUDY OF PROPAGATION EFFECTS CAUSING DEGRADATION TO SYNTHETIC APERTURE RADAR PERFORMANCE
A. Guissard and M. Rognoni Jun. 1979 119 p refs
(Contract ESTEC-3688/78-NL-AK(SC))
(ESA-CR(P)-1236) Avail: NTIS HC A06/MF A01

An analysis of the influence of tropospheric turbulence in clear air on phase fluctuations and resolution of an SAR system is presented. The solution of the plane wave equation in a homogeneous medium is reviewed and the results extended to a spherical wave in a locally homogeneous medium. The limits of validity imposed by the approximations are discussed. A survey of the structure constant models and records is presented, and two profiles, depicting alleged worst case conditions, are used to estimate the phase structure function on the synthetic aperture. The possible effects of precipitation, clouds, ducts, and the bright band are considered.
Author (ESA)

N80-17346# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ON THE SELF CONFINEMENT OF ELECTROMAGNETIC RADIATION
B. Lehnert Jul. 1979 23 p refs
(TRITA-EPP-79-13) Avail: NTIS HC A02/MF A01

A theoretical approach which examines the rest mass of particles as eigenmodes of self confined electromagnetic

radiation is discussed. An extended interpretation of Maxwell's equations is used. A case in which the particle interior contains a unipolar like electric field having a nonvanishing divergence and coupled to a poloidal dipole like magnetic field with a non-vanishing curl is examined. Numerical order of magnitude estimations based on this model are compared with experimentation data for the electron and the proton. Author (ESA)

N80-17347# Admiralty Experiment Works, Haslar (England).
IDENTIFYING THE MARINE VEHICLE FROM THE PULSE RESPONSE
T. B. Booth. London HMSO 1975 14 p refs Presented at 4th Ship Control System Symp., The Hague, Oct. 1975
(BR69339) Avail: NTIS HC A02/MF A01

The application of systems identification techniques for establishing the stability and control characteristics of marine vehicles using a record of their response to a pulse maneuver is examined. Equations of disturbed motion for lateral motion and vertical motion (in the case of submersibles) as well as the effects of fluid memory on hydrodynamic force increments are considered. Results show that the motion is represented by a linear transfer operator. The application of the analysis to artificial records is reported. Author (ESA)

N80-17348# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
MEASUREMENT OF RADIATION PATTERNS OF AIRCRAFT ANTENNAS IN NON-STEADY FLIGHT
D. C. Schering and H. Tellegen. 10 Feb. 1979 28 p refs
(NLR-TR-78018-U) Avail: NTIS HC A03/MF A01

Methods for measuring radiation patterns of aircraft antennas are described. During pitch and roll maneuvers radiation in the symmetry respective lateral plane of the aircraft is recorded. Diagrams of the horizontal plane are obtained by a semi-stationary method; a circular track with wings level is flown at a relatively large distance from the ground station. During the time that the maneuvers are being carried out only small parts of the ground antenna diagram are needed and the effect of the shape of this pattern is reduced to a scalc factor; the brief time involved also minimizes the influence of a varying distance, changes in environment conditions, and of equipment characteristics. The effect of reflection from the Earth's surface is reduced by the use of an artificial ground plane and by optimization of the configuration of the receiving antennas. The methods were applied to a Fokker F-27 transport aircraft in a version containing nine different aerials. A fair reduction in flying time is obtained over the well-known standard method of 'flying along'. Author (ESA)

N80-17349# National Technical Information Service, Springfield, Va.
MODEMS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE. Progress Report, 1974 - 1977
William E. Reed. Nov. 1979 221 p
(PB80-800568) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Reports are cited on the design, operating principles, and applications of modems, with applications to data transmission, digital voice communication, and satellite communications. The bibliography contains 258 abstracts. GRA

N80-17283 Naval Underwater Systems Center, Newport, R. I.
WAVE PROPAGATION IN A CYLINDRICAL SHELL WITH JOINT DISCONTINUITY
A. Haran. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 53-61 refs (For primary document see N80-17275 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-17350 Stanford Univ., Calif.
PARAMETERS CONTROLLING THE PHOTOVOLTAIC PROPERTIES OF THE COPPER SULFIDE/CADMIUM SULFIDE HETEROJUNCTION. Ph.D. Thesis
William George Haines. 1979 139 p
Avail: Univ. Microfilms Order No. 8001933

The parameters controlling the photovoltaic properties of the Cu2S/CdS heterojunction were investigated. Results indicate that the behavior of the short circuit current and the open circuit voltage are describable in terms of a deep, donor-like level in the CdS region adjacent to the metallurgical interface. The relative probability of tunneling from this level to the Cu2S is derived, as is the probability of tunneling from the level to the CdS conduction band. Dissert. Abstr.

N80-17351 Cincinnati Univ., Ohio.
INFRARED EXTRINSIC MOSFET DETECTOR WITH AND WITHOUT MEMORY, BASED UPON EPITAXIAL SILICON/GERMANIUM ALLOY. Ph.D. Thesis
Chih-Sieh Teng. 1979 198 p
Avail: Univ. Microfilms Order No. 8002144

The terminal characteristics of the photodetector and the basic characteristics of the gold impurity centers were analyzed and demonstrated. It is found that the photoresponse is negative or positive and depends on the operational modes (with and without preset), relative doping concentrations and the bias-applied conditions. The experimental results match the theoretical predictions. An attempt to examine the effects of infrared radiation on gold impurity centers in a p-channel MOSFET fabricated on Si/Ge alloy is reported. A shift in the gold energy level was obtained. The possibility for arbitrary selection of wavelength for maximal response through the control of permittivity, by the use of epitaxial alloys is pointed out. Dissert. Abstr.

N80-17352 California Univ., Berkeley.
TRANSPORT THEORY OF HIGH-FREQUENCY RECTIFICATION IN SCHOTTKY BARRIERS. Ph.D. Thesis
Dah Wen Tsang. 1979 172 p
Avail: Univ. Microfilms Order No. 8000549

A theory based on the Boltzmann equation is used to study rectification by Schottky barriers at frequencies as high as infrared. Taking short range particle collision and long range Coulombic interaction into consideration and employing a second-order perturbation analysis, charge densities, fields, and currents are calculated as a function of frequency. Typically, it is found that rectification is nearly constant from zero frequency to the plasma frequency of the bulk semiconductor, then drops. A reversal of the sign of the rectification current is predicted near omega sub p. The small signal impedance of the junction is calculated as a function of frequency. The theory is extended to mixing of two weak signals and mixer output is calculated as a function of heat frequency. It is found that this output can be much larger than the value one would estimate from the ideal diode equation due to a parametric or varactor effect. Dissert. Abstr.

N80-17353 Stanford Univ., Calif.
APPLICATION OF POLYVINYLIDENE FLUORIDE TO MONOLITHIC SILICON/PVF2 TRANSDUCER ARRAYS. Ph.D. Thesis
Robert Gerald Swartz. 1979 218 p
Avail: Univ. Microfilms Order No. 8002021

The construction of one-and two-dimensional arrays for medical ultrasonic imaging is described, including the design and fabrication of front-matching layers and two-component backings which are efficient attenuators of reverberation. Impedance matching is improved by polyvinylidene fluoride (PVF2). A POSFET receiving transducer employs this material as the piezoelectric sensing element. The performance of this device is analyzed

theoretically, and the broadband consequences of the lambda/4 resonant mode of operation are demonstrated. A large clinical-prototype POSFET array was constructed. This array achieves a 72 dB dynamic range, + or - 22 deg acceptance angle, 200 kHz to 6 MHz spectral operating range, and an impulse response unmatched by any other array technology. The multiple-layer technique is investigated as a means of generating a large acoustic output, and current-source electrical drive is proposed for a PVF2 transmitter. Dissert. Abstr.

N80-17354 California Univ., Berkeley.
APPLICATIONS OF INFORMATION THEORY TO IMAGE ENCODING Ph.D. Thesis
Dimitris Anastassiou 1979 139 p
Avail: Univ. Microfilms Order No. 8000271

Various descriptions of random fields defined on a discretized raster are considered. A finite number (usually equal to 2) of possible tones is assumed, thus permitting the determination of random curves at the boundaries between regions of lattice sites with different intensity levels. These models are extensions of one dimensional Markov chains. Theorems pertaining to the entropy rate of such random fields are presented and typical sample fields with appearance which reasonably approximate the shape of random curves defined by the edges of objects in an image are generated. Near-optimum encoding strategies applied to these models are devised. A way to describe a single random curve together with expressions of interesting quantities pertaining to the description is presented. Dissert. Abstr.

N80-17355 California Univ., Berkeley.
REMOTE SENSING OF DIELECTRIC MEDIUM Ph.D. Thesis
Shimon Coen 1979 130 p
Avail: Univ. Microfilms Order No. 8000309

A remote sensing technique for the estimation of the dielectric and conductivity profile of an inaccessible stratified half space is presented. The data was the reflected power from the inaccessible region, due to normally incident plane waves at various discrete frequencies. The problem was posed as a nonlinear Fredholm integral equation of the first kind, where the dielectric and conductivity profile of the inaccessible half space was sought. The equation was solved approximately by developing a Quasi Newton method in functional space. The Backus and Gilbert resolving power theory was used to estimate the resolution and certainty of the results. Results are given for the reconstruction of various dielectric and conductivity profiles from an artificial data, together with resolving kernels and local averages estimates. Dissert. Abstr.

N80-17356 Rutgers - The State Univ., New Brunswick, N. J.
ELECTRON-BEAM EVAPORATED SILICON FILMS FOR MIS PHOTOVOLTAICS: PROPERTIES OF FILMS AND DEVICES Ph.D. Thesis
Alan Edward Delahoy 1979 193 p
Avail: Univ. Microfilms Order No. 7928393

The feasibility of extending MIS (metal insulator semiconductor) photovoltaic technology to vacuum deposited, thin film polycrystalline silicon is demonstrated. Rectifying MIS junctions, exhibiting strong photovoltaic response, are formed on high purity, boron doped silicon films produced by electron beam evaporation. The physical and electrical properties of the films are investigated, and device properties analyzed. The dissolution of Si by the Al layer, and the subsequent formation of Si growth centers at the surface of the Al layer, is extensively documented by scanning electron microscopy studies. A model is proposed relating the surface density of growth centers to the initial Si incidence rate. The relation of the growth centers to the observed columnar growth is discussed. Dissert. Abstr.

N80-17357# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
FIELD IMPACT EVALUATION REPORT ON THE ELECTRONIC TABULAR DISPLAY SUBSYSTEM (ETABS) Final Report, Dec. 1978 - Jul. 1979
Oct. 1979 52 p
(AD-A078848; FAA-RD-79-101) Avail: NTIS HC A04/MF A01 CSCL 14/2

A team of field personnel from air traffic and airways facilities conducted an impact assessment of the projected implementation of the electronic tabular display subsystem (ETABS) at air route control center. Alternatives were developed which could be expected to reduce or eliminate the negative consequences identified which could result from ETABS implementation. Six impact areas are addressed. These are: impact on the workforce, technological considerations, implementation, operations, training, and logistics support. Conclusions and recommendations as to the most desirable alternative solutions from a field viewpoint are presented. A.R.H.

N80-17358*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE PERFORMANCE OF THE MARTIN DIGITAL FILTER FOR HIGH-AND LOW-PASS APPLICATIONS
Charles R. McClain Oct. 1979 30 p refs Submitted for publication
(NASA-TM-80593) Avail: NTIS HC A03/MF A01 CSCL 09A

A nonrecursive numerical filter is described in which the weighting sequence is optimized by minimizing the excursion from the ideal rectangular filter in a least squares sense over the entire domain of normalized frequency. Additional corrections to the weights in order to reduce overshoot oscillations (Gibbs phenomenon) and to insure unity gain at zero frequency for the low pass filter are incorporated. The filter is characterized by a zero phase shift for all frequencies (due to a symmetric weighting sequence), a finite memory and stability, and it may readily be transformed to a high pass filter. Equations for the filter weights and the frequency response function are presented, and applications to high and low pass filtering are examined. A discussion of optimization of high pass filter parameters for a rather stringent response requirement is given in an application to the removal of aircraft low frequency oscillations superimposed on remotely sensed ocean surface profiles. Several frequency response functions are displayed, both in normalized frequency space and in period space. A comparison of the performance of the Martin filter with some other commonly used low pass digital filters is provided in an application to oceanographic data. M.G.

N80-17359*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MAGNETIC FIELD CONTROL Patent Application
Walter Haeussermann, inventor (to NASA) Filed 11 Jan. 1980 12 p
(NASA-Case-MFS-23828-1; US-Patent-Appl-SN-111436) Avail: NTIS HC A02/MF A01 CSCL 09C

A torque control an electromechanical torquing device of a type where a variable clearance occurs between a rotor and field is presented. A Hall effect device senses the field present, which would vary as a function of spacing between field and rotor, and the output of the Hall effect device controls the power applied to the field so as to provide a well-defined field and thus a controlled torque to the rotor which is well defined. NASA

N80-17360# California Univ., Berkeley. Dept. of Physics.
SIS QUASIPARTICLE JUNCTIONS AS MICROWAVE PHOTON DETECTORS
P. L. Richards, T. M. Shen, R. E. Harris (NBS, Boulder, Colo.), and F. L. Lloyd (NBS, Boulder, Colo.) Dec. 1979 12 p refs Submitted for publication
(Contract N00014-75-C-0496)
(AD-A076590) Avail: NTIS HC A02/MF A01 CSCL 20/10

The strong nonlinearity of the quasiparticle tunneling current in superconductor-insulator-superconductor junctions near the full gap voltage 2 Delta/e can be used for direct detection of microwave signals. Measurements at 36 GHz yielded a current responsivity of 3.5000 A/W, which is within a factor of 2 of the quantum limited value e/h-bar omega. The measured NEP of 2.6 - or - 0.8 x 10 to the -16th power W/sq-rt. Hz is the lowest value reported to date and can probably be improved significantly. The experimental results are compared with both the standard classical analysis and photon assisted tunneling theory. GRA

N80-17361# Army Electronics Research and Development Command, Fort Belvoir, Va. Night Vision and Electro-Optics Labs.

OVERVIEW OF PULSE-HEIGHT ANALYSIS OF IMAGE INTENSIFIER TUBES Final Report, Nov. 1977 - Sep. 1978
Byong H. Ayn Jun. 1979 64 p refs
(AD-A076155; DELNV-TR-0006) Avail: NTIS
HC A04/MF A01 CSCL 09/5

Pulse-height analysis (PHA) of image intensifier tubes (I2 tube) is described using a multiple-channel analyzer (MCA). The experimental setup, schematics of I2 tubes, statistics and mathematics for the analysis, and methods for data acquisition and reduction are included in the report. PHA complements another experimental technique which measures the noise figure (N(f)) of an I2 tube by explaining causes for good or bad performance of the tube. Technical developments of I2 tubes over the years were retraced to point out the improvements or the distinctions of a later generation I2 tube over an earlier one. Some of the tube characteristics are described in detail when they affect the N(f) or the gain noise figure. Background mathematics and statistics are illustrated, and some useful oscilloscope traces are given. GRA

N80-17362# Bogue Electric Mfg. Co., Patterson, N.J.
DC TEST RIG PROPULSION MOTOR Final Report
Sylvain Garnett May 1979 58 p refs
(Contract DAAK70-78-C-0044)
(AD-A074960) Avail: NTIS HC A04/MF A01 CSCL 09/3

This project's mission was to design, construct and evaluate two high speed dc propulsion motors with a nominal rating of 10Hp at 6000 rpm and an intermittent rating of 20Hp at 3000 rpm at a motor weight of 95lbs/unit. The motors are designed for use in conjunction with either a conventional dc chopper motor controller, or as dual motor drive in conjunction with a two phase, sequentially switched dc chopper motor controller. The auxiliary shunt field is used to synchronize speed between the two motors and to assist the series field during the regenerative brake mode. GRA

N80-17363# GenRad, Inc., Concord, Mass.
AUTOMATIC MICROCIRCUIT BRIDGE AND AUTO-BALANCING UNIT Final Report, Jun. 1976 - May 1977
William F. Byers, Robert J. Hanson, and William J. Riley May 1979 74 p refs
(Contract DAAB07-76-C-1380; DA Proj 1S7-62705-AH-94)
(AD-A075921; DELET-TR-76-1380-F) Avail: NTIS
HC A04/MF A01 CSCL 09/1

This report summarizes the design and test of a Microcircuit Bridge and Balancing Unit to be used in a precision measurement of quartz crystal resonators. Design goals for the Bridge and Balancing Unit were to measure resistance with a 5% accuracy and capacitance with a + or - 0.1 pF accuracy from 8 to 220 MHz and at temperatures from -50 C to +105 C. The autobalance Unit will perform initial balance, final balance, and plus/minus susceptance offset on command. Based on the measured data, it will be possible to calculate the Q of the crystal resonator being tested. GRA

N80-17364# Hughes Aircraft Co., Fullerton, Calif.
SEMI-ADDITIVE PROCESSES FOR FABRICATION OF PRINTED WIRING BOARDS Final Report, 1 Jul. 1976 - 31 Dec. 1978
Jack Quintana Jun. 1979 141 p refs
(Contract DAAK01-76-C-1100)
(AD-A075975; FR-79-12-190) Avail: NTIS HC A07/MF A01
CSCL 09/1

Printed wiring boards fabricated by semi-additive processes from four laminate types have met the requirements of MIL-P-13949, MIL-P-5110, and selected tests of MIL-P-55640. Laminate types consisted of ultra-thin copper with peelable carrier, ultra-thin copper with etchable carrier, sacrificial foil, and adhesively-coated nonclad. GRA

N80-17365# Fulmer Research Inst. Ltd., Stoke Poges (England)
FIELD EMISSION COLD CATHODE DEVICES BASED ON EUTECTIC SYSTEMS Interim Report, 1 May 1977 - 30 Apr. 1978
Duncan Stewart, Paul D. Wilson, and Vivian G. Rivlin Griffiss AFB, N.Y. RADC Jul 1979 40 p refs
(Grant AF-AFOSR-3292-77; AF Proj 4600)
(AD-A075066; R744/2; RADC-TR-79-170) Avail: NTIS
HC A03/MF A01 CSCL 09/1

A survey has been made of the performance as field emission cold cathodes of selected refractory materials fabricated as needle arrays by unidirectional solidification. Specially designed apparatus was used to observe the operating lifetimes and Fowler-Nordheim functions of needle arrays of niobium carbide, tantalum carbide in a nichrome matrix and of a gamma/gamma primed - alpha eutectic in the Ni Mo Ta Al system. The results are co-related with SEM observations. Thermodynamic stabilities under the operating conditions are discussed. GRA

N80-17366# Thermal Technology Labs., Buffalo, N.Y.
DEVELOPMENT OF LIGHTWEIGHT TRANSFORMERS FOR AIRBORNE HIGH POWER SUPPLIES Final Report, Jul. 1976 - Mar. 1979
James P. Welsh Jun. 1979 69 p refs
(Contract F33615-75-C-2014; AF Proj 3145)
(AD-A076215; AFAPL-TR-79-2049) Avail: NTIS
HC A04/MF A01 CSCL 09/5

Emphasis on this program was on the development of high voltage, high power, high frequency, low specific weight, inverter transformers. A primary intent was the reduction of specific weight without sacrifice of either electrical performance or reliability. Research was conducted into the characteristics of magnetic and dielectric materials, improved magnetic circuit modeling, and application of advanced heat transfer techniques. Computer-aided design methods were utilized and specialized programs were developed to permit extensive manipulation of multiple design parameters. GRA

N80-17367# Texas Univ. at Austin Dept. of Chemistry
SEMICONDUCTOR ELECTRODES. 26: SPECTRAL SENSITIZATION OF SEMICONDUCTORS WITH PHTHALOCYANINE
Calvin D. Jaeger, Fu-Ren F. Fan, and Allen J. Bard Oct. 1979 31 p refs Submitted for publication
(Contract N00014-78-C-0592)
(AD-A076149; TR-4) Avail: NTIS HC A03/MF A01 CSCL 20/12

Spectral sensitization by metal-free phthalocyanine (H2Pc) films was observed on various semiconductor electrodes (single crystal n-TiO2, n-SrTiO3, n-WO3, n-ZnO, n-CdS, n-CdSe, n0Si, and n-GaP, SnO2 conducting glass). The spectral response of the sensitized photocurrent was generally the same as the absorption spectrum of the phthalocyanine. The rather thick (400 A to 1 micron H2Pc films showed both anodic and cathodic photocurrents depending upon the applied potential. The anodic photocurrents represented the usual sensitization of the n-type semiconductor, while the cathodic photocurrents were attributed to p-type behavior of the phthalocyanine itself. The current-potential curves of the semiconductor electrodes depended on the nature of the H2Pc film, the presence of a redox couple (i.e., p-hydroquinone/p-benzoquinone) in solution and the wavelength of the irradiating light. The magnitude of the steady state sensitized photocurrent was linear with light intensity and was strongly affected by the addition of the supersensitizer. GRA

N80-17368# Georgia Inst. of Tech., Atlanta Engineering Experiment Station
TRANSIENT-THERMAL BEHAVIOR OF PULSED HIGH POWER IMPATT AND TRAPATT DIODES Final Technical Report, 12 Apr. 1976 - 11 Apr. 1979
John W. Amoss 12 Jun. 1979 106 p refs
(Grant DAAG29-76-G-0202)
(AD-A073578; ARO-13775.2-ELX) Avail: NTIS
HC A06/MF A01 CSCL 20/12

Results of an analytical investigation of transient and steady state temperature and current profiles within the active region of a variety of IMPATT structures are presented. The analyses are based on thermal models which assume power dissipation distributions with an axial dependence proportional to the electric field intensity E(z) and a radial dependence proportional to the local current density j(r). Examples are presented in which the local current density is assumed to decrease with the local temperature. The temperature gradients within the active region depend strongly on the doping profile. These analyses show that the maximum temperature at the edge of the active region can

be as much as 25% higher than at the center of the avalanche region, especially for high efficiency, high power structures where the ionization is highly localized and the electric field intensity in the drift region is sufficiently high to prevent unsaturated drift velocities and depletion-layer modulation. Breakdown calculations using temperature dependent ionization coefficients and axial temperature profiles suggest that actual temperatures within a device can be significantly higher than those measured experimentally by using a predetermined breakdown voltage vs temperature calibration curves. GRA

N80-17369# Naval Research Lab., Washington, D. C.
DESIGN MANUAL FOR A CONSTANT BEAMWIDTH TRANSDUCER Interim Report
A. L. VanBuren 11 Oct. 1979 34 p refs
(RR0110842)
(AD-A076971; AD-E000330; NRL-8329) Avail: NTIS HC A03/MF A01 CSCL 17/1

The theory of a broadband constant beamwidth transducer (CBT) which is based on Legendre function amplitude shading of a spherical cap was described in a previous report, J. Acoust. Soc. Am. 64 38-43 (1978). Theoretical calculations showed the CBT to have uniform acoustic loading, extremely low side-lobes, virtually no nearfield, an essentially constant beam pattern for all frequencies above a certain cutoff frequency, and a flat transmitting current response over a broad band for piezoelectric drive. In this report formulas suitable for the design of a CBT which is to be used as a transmitter and/or receiver are developed. The formulas involve simple algebraic and trigonometric expressions and can be readily evaluated using a pocket calculator. Formulas are developed for the required velocity distribution, limiting beam patterns, directivity index, equivalent two-way beam widths for volume and surface reverberation, shading coefficients for a stepwise implementation of the velocity distribution, size, ceramic mass, bandwidth, source level, transmitting voltage and current responses, and receiving voltage sensitivity. The report concludes with an example illustrating the procedure used to design a CBT with a specified - 3 dB half-angle beam pattern, source level, and receiving voltage sensitivity. GRA

N80-17370# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART A: TECHNOLOGY OF OPTOELECTRONIC EMITTERS Final Report
Diethard Huber Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 58 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 3 Vol.
(BMFT-FB-T-78-42) Avail: NTIS HC A04/MF A01; Fachinformationzentrum, Karlsruhe, DM 11.35

A survey of electro-optical devices is presented. Technology and fabrication advances are reported. The developments of various LEDs and IREDs are described. IR diodes (lambda = 930 nm), fast IR diodes (100 MHz), IR diodes made of GaAlAs, red emitting diodes (GaAsP, lambda = 660 nm), and yellow and green emitting diodes (GaP, lambda = 560 nm; GaAsP, lambda = 590 nm) are highlighted. Performance tests and manufacturing techniques are described. Author (ESA)

N80-17371# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART B: TECHNOLOGY OF OPTOELECTRONIC RECEIVERS Final Report
Klaus Berchtold Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 79 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 3 Vol.
(BMFT-FB-T-78-43) Avail: NTIS HC A05/MF A01; Fachinformationzentrum, Karlsruhe, DM 16.40

A survey of electro-optical devices is presented. Advances in technology and fabrication are reported. The development of special detectors based on silicon for the wavelength range 0.4 microns to 1 micron is presented. The packaging and measuring techniques tailored to electro-optical requirements are discussed. Methods and possibilities of dectector integration are examined. Emphasis is placed on photo pin diodes and photo avalanche diodes with extremely high gain bandwidth products (260 GHz), sensor cells, photo transistors, photo darlingtons, and monolithic integrated detector devices. The manufacturing techniques of the electro-optical components are reported. Author (ESA)

N80-17372# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART C: TECHNOLOGY OF OPTOCOUPLERS Final Report
Werner Schoeberl Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 62 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 3 Vol.
(BMFT-FB-T-78-44-Pt-C) Avail: NTIS HC A04/MF A01; Fachinformationzentrum, Karlsruhe, DM 12.60

A survey of electro-optics is presented. Recent advances in technology and fabrication are reported. The development of various electro-optic couplers is described with emphasis on couplers with very high coupling ratios (600 percent), couplers with high frequency limits (1 to 2 MHz), couplers with high isolation capability (10 kV), and combinations for signal coupling over distances using fiber optics or diffuse radiation (IR remote control). Extensive performance tests results as well as a discussion of manufacturing techniques elaborated during the development of these electro-optical components are given. Author (ESA)

N80-17373# Toulouse Univ. (France). Lab. de Genie Electrique.
ON THE MECHANISM OF DISCHARGE PROPAGATION AT THE SURFACE OF AN ELECTROLYTE
A. M. Rahal, J. C. Labadie, and C. Huraux 1978 15 p refs Presented at 1978 Conf. on Elec. Insulation and Dielec. Phenomena, Pocono Manor, Pa., 1978
(Publ-360) Avail: NTIS HC A02/MF A01

A graphical interpretation of critical flashover conditions and a detailed experimental study of the phenomenon are presented. A mechanism governing flashover, a force acting on the dicharge column, is proposed. Experiments show the existence of this force and responsibility for flashover. Author (ESA)

N80-17374# Toulouse Univ. (France). Lab. de Genie Electrique.
STUDY OF THE EVOLUTION OF ELECTRICAL TREEING BY OBSERVATION OF LUMINOUS PHENOMENA AND DISCHARGE DETECTION
C. Laurent and C. Mayoux 1978 6 p refs Presented at 1978 Conf. on Elec. Insulation and Dielec. Phenomena, Pocono Manor, Pa.
(Publ-361) Avail: NTIS HC A02/MF A01

Results obtained from the observation of discharge characteristics for different treeing types as well as the time dependent evolution of accompanying light phenomena were studied. The experimental apparatus, consisting of a microscope (400 X) and a camera, are described and the experimental procedure outlined. Results demonstrate the occurance of light emission due to the existence of discharge under the studied voltage conditions. The evolution of the light in the electrode gap was revealed through the use of an image intensifier. The same aging conditions as those reported in the literature for an air filled gap were also observed. Author (ESA)

N80-17375# Toulouse Univ. (France). Lab. de Genie Electrique.
BEHAVIOR OF COMPOSITE INSULATION UNDER THE ACTION OF SUPERFICIAL ARCS. APPLICATION TO LINE INSULATORS Final Report [TENUE DES ISOLANTS COMPOSITES A L'ACTION DES ARCS SUPERFICIELS - APPLICATION AUX ISOLATEURS DE LIGNE]
Bui Ai, C. Huraux, and A. M. Rahal Dec. 1978 21 p refs In FRENCH
(Publ-378) Avail: NTIS HC A02/MF A01

Laboratory measurements were made in order to define the flashover mechanism observed on high voltage line insulators. Surface discharge propagation is considered to be due to the build-up of pollutants on the insulator surface. The laboratory apparatus, consisting of an open channel filled with an electrolyte, is described. This device represents a linear model of the electric equation under study. Variables are arc length, extent of polluted surface, and type as well as resistance of the electrolyte. Results determine experimentally the lowest voltage at which an arc sufficient to short-circuit the electrolyte develops. Some possible applications of this data to the improvement of insulators are then discussed. Author (ESA)

N80-17376# Research Inst. of National Defence, Linkoeping (Sweden).
X-BAND FET AMPLIFIERS FOR APPLICATIONS IN PHASE ARRAYS. VOLUME 1: TEXT [X-BANDS FET-EFFEKTFOERSTAARKARE FOER TILLAAMPNING I GRUPP-ANTENNER. DEL 1]
Herbert Steyskal Jun. 1979 57 p refs In SWEDISH; ENGLISH summary 2 Vol.
(FOA-C-30156-E1-Vol-1) Avail: NTIS HC A04/MF A01

Characteristics of X-band GaAs-FET power amplifiers, based on measurements of actual devices, are reported. Two types of amplifiers are discussed: (1) a commercial amplifier with 100 mW CW output; and (2) breadboard model with 1 W CW output. Data of relevance to applications in phased arrays were measured in CW and ICW operation. Emphasis was on the dependence of phase on operating voltage, signal power, and temperature. Measurement techniques are described. The tests demonstrate suitable characteristics for applications in active modules for phased arrays. The amplifiers are shown to be superior to equivalent diode amplifiers in regards to efficiency and phase data. Author (ESA)

N80-17377# Research Inst. of National Defence, Linkoeping (Sweden).
X-BAND FET AMPLIFIERS FOR APPLICATIONS IN PHASED ARRAYS. VOLUME 2: TABLES AND GRAPHS [X-BANDS FET-EFFEKTFOERSTAARKARE FOER TILLA AMPNING I GRUPPANTENNER. DEL 2: FIGURE OCH TABELLER]
Herbert Steyskal Jun. 1979 37 p In SWEDISH; ENGLISH summary 2 Vol.
(FOA-C-30156-E1-Vol-2) Avail: NTIS HC A03/MF A01

Characteristics of X-band GaAs-FET power amplifiers, based on measurements of actual devices, are reported. Two types of amplifiers are discussed. One is a commercial amplifier with 100 mW cw output and the other is a breadboard model with 1 W cw output. Data of relevance to application in phased arrays were measured in cw and icw operation. Emphasis was on the dependence of phase on operating voltage, signal power, and temperature. Measurement techniques are described. The tests demonstrate suitable characteristics for applications in active modules for phased arrays. The amplifiers are shown to be superior to equivalent diode amplifiers in regards to efficiency and phase data. Author (ESA)

N80-17378# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART C: LIGHT EMITTING DIODES (Ga CRYSTALS) Final Report
Gunter Raab Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 77 p refs In GERMANY; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 5 Vol.
(BMFT-FB-T-78-36) Avail: NTIS HC A05/MF A01; Fachinformationzentrum Karlsruhe, DM 15.95

In preparation for eventual production on an industrial scale, the synthesis of GaP and the growth of single crystals was developed to allow larger charges than were previously possible. The pressure vessel developed for the synthesis of charges up to 1 kg proved, in practice, to be satisfactory for initial loads yielding up to 1.5 kg of polycrstaline materials. The liquid encapsulated growth of the monocrystals was achieved in a high pressure crystal pulling apparatus. This allowed the production of monocrystals with a weight up to 0.7 kg and up to 2 inches in diameter which were not only reproducible, but could also be treated further. Author (ESA)

N80-17379# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART D: OPTOELECTRONIC EMITTER AND DETECTOR ARRAYS Final Report
Heinz Haemmerling Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 87 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 5 Vol.
(BMFT-FB-T-78-45) Avail: NTIS HC A05/MF A01; Fachinformationzentrum, Karlsruhe DM 18.10

Techniques for integration of optoelectronic devices and displays are described. The integration of emitters was carried out in three steps. These were the hybrid integration of chips for seven segment displays (red, green, yellow), hybrid integration in the form of functional displays with up to 1250 picture points, and monolithic integration in a matrix. Arrays of phototransistors incorporating duodiodes were also developed for decoding purposes. Author (ESA)

N80-17380# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART E: FABRICATION OF 3-5 COMPOUNDS FOR OPTOELECTRONIC DEVICES Final Report
Wolfgang Gramann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 108 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 5 Vol.
(BMFT-FB-T-78-46) Avail: NTIS HC A06/MF A01; Fachinformationzentrum, Karlsruhe, DM 22.30

Gallium phosphide crystal growth, either by a liquid encapsulated Czochralski method or by a synthesis solute diffusion method, is discussed. Principles of liquid phase epitaxy and gas phase epitaxy are then compared. The necessary reactors and apparatus for this work are extensively described, starting with their design and including in service adjustments. Emphasis is on the differences between vapor phase epitaxial techniques for the fabrication of red, green, and yellow LED's and liquid phase epitaxy used in the production of materials for GaP green LED's and for IR emitting diodes (GaAs, Si, and GaAlAs).Author (ESA)

N80-17381# Compagnie Generale d'Electricite, Marcoussis (France). Div. Energie.
EFFECT OF A ROTATION MAGNETIC FIELD AROUND A BUNDLE OF NIOBIUM-TITANIUM FILAMENTS Final Report [EFFET D'UN CHAMP MAGNETIQUE TURNANT SUR DES BRINS COMPOSITES A BASE DE FILAMENTS DE NIOBIUM TITANE]
Alain Fevrier Sep. 1978 32 p In FRENCH
(Contract DGRST-77-7-1384)
Avail: NTIS HC A03/MF A01

Superconductor losses due to a rotating magnetic field were studied. An experiment was set up to verify a formula derived to predict these losses by analog with the losses produced by a variation in the induction amplitude. A previously developed computer program was extended to calculate these losses as a time series function of a variable amplitude magnetic field. Comparison of measured results with calculated predictions shows that losses from hysteresis in a rotating field can be determined to within 10% while induction current losses at relatively low rotational speeds are given to within 20%. Author (ESA)

N80-17382# Compagnie Generale d'Electricite, Marcoussis (France). Div. Energie.
DEVELOPMENT OF A LINE SUPERCONDUCTOR MADE OF NIOBIUM CARBONITRIDE FILAMENTS Final Report [BRIN SUPRACONDUCTEUR A BASE DE FILAMENTS DE CARBONITRURE DE NIOBIUM]
B. Letellier, F. Gaillet, and Jr. Trottier Sep. 1978 31 p In FRENCH
(Contracts DGRST-76-7-1761; DGRST-76-7-1762)
Avail: NTIS HC A03/MF A01

A technique for the vapor deposition of niobium carbonitride on an inert substrate in the form of a filament (dia. 7 microns) was developed. The bundling of these filaments and their impregnation with an antidiffusion copper barrier was then studied. The superconducting and mechanical characteristics of these filament bundles were determined. Results show that the method is practicable. A bundle of 3000 carbon filaments was prepared, then coated in niobium carbonitride. However, over any significant length of the obtained line the superconducting characteristics were not constant. The adhesion of the superconducting coating to the filament bundle was also unsatisfactory. Author (ESA)

N80-17383# Thomson-CSF, Boulogne-Billancourt (France). Direc. Tubes Electroniques et Disposities a Image.
NUMERICAL TO ANALOG CONVERSION. A HIGH FREQUENCY CONVERTER TUBE Final Report [CONVERSION ANALOGIQUE NUMERIQUE TUBE CONVERTIS SEUR HAUTE FREQUENCE]
Courtan, Deschamps, and Cuchet May 1978 18 p In FRENCH
(TDI/1.032/78) Avail: NTIS HC A02/MF A01

A breadboard model of a high frequency converter tube having opposed electron guns sweeping a silicon diode mosaic target is presented. An input beam energy of 8 keV which allows

signals to be registered at a frequency of 150 MHz with a resolution of 400 television lines at the target diameter is examined. The output signal is video and is monitored on a television display. Results indicate that after optimizing the tube/target/tube design it is possible to measure signals at a frequency of 1 GHz. Author (ESA)

N80-17384# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
IMPROVING THE PERFORMANCE OF GaAs INTEGRATED LOGIC CIRCUITS IN ANTICIPATION OF LARGE SCALE INTEGRATION Final Report [AMELIORATION DES PERFORMANCES DES CIRCUITS INTEGRES LOGIQUES AU GaAs EN VUE DE L'INTEGRATION A GRANDE ECHELLE]
Jean Caron, Gilles Durand, and Marc Rocchi May 1979 55 p refs In FRENCH
(Contract DGRST-77-7-0984)
(LEP-79/509.SME-646-h) Avail: NTIS HC A04/MF A01

A computerized simulation of performance and structural parameters for field effect transistors in logic circuits was performed in order to optimize power consumption for diode transistor logic designs. Based on reports from the literature, logic circuits on GaAs generally show an energy dissipation of approximately 20 mW/gate for a limit of 10 gates per integrated circuit. An extensive description of the models used in these simulations is given and, after optimization, best results give a power consumption of 0.05 mW/gate for integrated circuits of from 100 to 1000 gates. Author (ESA)

N80-17385# National Technical Information Service, Springfield, Va.
SQUID DEVICES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Nov. 1979
George W. Reimherr Nov. 1979 125 p Supersedes NTIS/PS-78/1169; NTIS/PS-77/1046; NTIS/PS-76/0872; NTIS/PS-75/687
(PB80-801087; NTIS/PS-78/1169; NTIS/PS-77/1046; NTIS/PS-76/0872; NTIS/PS-75/687) Avail: NTIS HC $30.00/MF $30.00 CSCL 20L

The cited reports of Federally funded research discuss the theory, performance, preparation, and applications of SQUID devices (also called Superconducting Quantum Interference Devices). This updated bibliography contains 119 abstracts, 21 of which are new entries to the previous edition. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-17386 Texas Univ. at Arlington.
PREDICTED LARGE EDDIES IN THE FLAT PLATE BOUNDARY LAYER Ph.D. Thesis
Aspi Rustom Wadia 1979 265 p
Avail: Univ. Microfilms Order No. 8001660

An energy extremum principle is used to predict the eigenmodes which correpond to the large eddy structure of the flat plate, fully developed turbulent boundary layer. The results of the theoretical study agree qualitatively with all of Lemmerman's results for small wave numbers and his results are speculated to involve the large scale structure modified by the instabilities of this investigation. The preliminary study of the perturbation velocities indicate that the spanwise fluctuations are extremely large near the wall. The presence of burst and sweep phenomena was identified at the mid section of the boundary layer and it is observed that during the bursting phenomena of boundary layer blow off, the fluid is pushing mostly in the z-direction near the wall to replace the exported fluid. Dissert. Abstr.

N80-17387 George Washington Univ., Washington, D. C.
THERMAL PERFORMANCE OF METAL AND PLASTIC PIPES AS EARTH STORAGE HEAT EXCHANGERS Ph.D. Thesis
Mahmut Nazli 1979 147 p
Avail: Univ. Microfilms Order No. 8001357

Three coil configurations were tested: (1) copper coil in length L, (2) plastic coil of length L, and (3) plastic coil of length 2L. All coils had the same inside and loop diameters. Dry and wet sand were used as storage materials. The storage material was heated by circulating hot water through the coils. In a similar manner, heat was extracted using cold water. The thermal performance of the copper coil of length L and plastic coil of length 2L were very comparable for charging either the dry sand or wet sand storage. In the case of extraction the thermal performance of the copper coil of length L and plastic coil length L were very comparable for the dry sand storage. When the sand was 100 percent saturated with water, the thermal performance of the plastic coil of length 2L and the copper coil of length L were almost the same. Dissert. Abstr.

N80-17388 Cincinnati Univ., Ohio.
CHARACTERISTICS OF THREE-DIMENSIONAL TURBULENT JETS: A NUMERICAL STUDY Ph.D. Thesis
Choudary Ramakrishna Bobba 1979 139 p
Avail: Univ. Microfilms Order No. 8002091

The three-dimensional jet issuing from a rectangular nozzle into a quiescent fluid or a coflowing free stream has been carefully analyzed. The problem is mathematically described by the time-averaged three-dimensional parabolised Navier-Stokes equations in a rectangular coordinate system. The detailed quantitative results obtained for compressible free-shear flows provide further understanding of the structure of the turbulent flows. The discrepancies in the turbulent flow results are attributed to the lack of information on the initial conditions and to the use of a turbulence model based on the assumptions of isotropy and an effective turbulent viscosity. A modified turbulence model which accounts for anisotropy is recommended for similar studies. Dissert. Abstr.

N80-17389 California Univ., Berkeley.
ANALYSIS OF TURBULENT GENERATION BETWEEN HORIZONTAL PLATES Ph.D. Thesis
Massoud Kaviany-Nejad 1979 153 p
Avail: Univ. Microfilms Order No. 8000399

One dimensional analysis of steady state turbulent thermal convection for the case of a fluid layer confined between two horizontal plates is considered. A two-layer model, namely a conduction sublayer and a turbulent-core is adopted. The results for a two-equation model are in fair agreement with the experimental results for turbulent kinetic energy (t.k.e.) production rate of t.k.e. and dissipation-rate of t.k.e. However the numerical results for eddy diffusivities are lower than the experimental results. The results for a one-equation model are also in fair agreement with the experimental results except for eddy diffusivities which are lower than the experimental results. An experiment for transient turbulent thermal convection in a pool of water cooled from above is considered. Dissert. Abstr.

N80-17390 Michigan State Univ., East Lansing.
ARIMA STATISTICAL MODELS OF TRANSIENT HEAT CONDUCTION ERRORS FOR AITKEN'S CONFIDENCE REGION Ph.D. Thesis
Irwin Perry Schisler 1979 201 p
Avail: Univ. Microfilms Order No. 8001587

An iterative Aitken's least squares estimator was implemented within an existing standard least squares computer program for the heat conduction problem. The accuracy of this modified computer code was verified in a simulation study. It was found that the effects of correlated errors for the available dynamic measurements and associated models can be treated without great difficulty. The parameter estimates using standard least squares tend to be very close to the values computed by the more powerful Aitken's least squares method. Hence the parameters required in the covariance matrix, V, can be estimated accurately and easily from the standard least squares residuals. The covariance matrix for the thermal parameters can be evaluated by a simple recursive difference scheme rather than using the covariance matrix V directly in the matrix product. Dissert. Abstr.

N80-17391 California Univ., Berkeley.
DISPERSED FLOW FILM BOILING DURING REFLOODING

Ph.D. Thesis
William Thomas Peake 1979 217 p
Avail: Univ. Microfilms Order No. 8000477

A droplet model was used for the analysis of the fluid flow and heat transfer in the dispersed flow film boiling regime during reflooding of a tubular channel. Comparisons were made of the predicted wall heat fluxes, vapor temperatures, qualities, and droplet diameters and the experimental data. The heat transfer predictions are in agreement with the data at locations away from the quench front for certain values of the initial droplet diameter and velocity. It was observed that the initial droplet diameter, and to lesser extent the initial droplet velocity, had a large effect upon the predicted wall heat flux. Calculations were made for initial droplet sizes varying between 0.5 and 2.0 mm.
Dissert. Abstr.

N80-17392 Rutgers - The State Univ., New Brunswick, N. J.
DOUBLE-DIFFUSIVE CONVECTIVE INSTABILITY OF AN INCLINED FLUID LAYER Ph.D. Thesis
Ramesh Chandra Paliwal 1979 132 p
Avail: Univ. Microfilms Order No. 7928434

A total of 21 experimental runs - at least two at each inclination of the fluid layer from the vertical - is reported. A finite difference scheme as well as the Galerkin method are developed to solve the stability equations. In view of the computational efficiency and economy, final computations are made using the Galerkin technique with 12 terms in the truncated expansion series. For -75 deg < theta < 75 deg, critical instability is found to be of stationary type. Theoretically calculated results of the critical thermal Rayleigh numbers and the critical wave numbers at various inclinations are in very good agreement with the experimental data.
Dissert. Abstr.

N80-17393 California Univ., Berkeley.
EXPERIMENTAL AND NUMERICAL INVESTIGATION OF NATURAL CONVECTION IN CYLINDRICAL ENCLOSURES Ph.D. Thesis
Cecil Fernando HessSilva 1979 171 p
Avail: Univ. Microfilms Order No. 8000377

Axisymmetric natural convection flows in an enclosure are studied experimentally and analytically. Two boundary conditions were studied experimentally: (1) a constant heat flux (CHF) on the side walls; and (2) a constant temperature source (CTS) on the top of the side walls. It was observed in the CHF experiments that a quasi-steady regime was achieved after extended periods of time. Expressions for the velocity and temperature profiles are presented for various boundary conditions. Correlations of the Nusselt number for various Rayleigh numbers and wall materials are presented for the CTS boundary condition. Results computed with this method are in good agreement with the numerical solution and experimental data.
Dissert. Abstr.

N80-17394 Ohio State Univ., Columbus.
FULLY IMPLICIT SOLUTION OF THE NAVIER-STOKES EQUATIONS AND ITS APPLICATION TO NON-RECTANGULAR GEOMETRY BY THE USE OF ORTHOGONAL MESH GENERATION Ph.D. Thesis
Robert Gerald Govenar 1979 290 p
Avail: Univ. Microfilms Order No. 8001735

A numerical method of solution for the Navier-Stokes equations is developed for non-rectangular geometries. A fully implicit technique is developed making use of a fast direct solution method. A technique for generating an orthogonal curvilinear mesh is developed by utilizing a non-orthogonal curvilinear mesh and solution of two Laplace equations, followed by interpolation. The results of these studies are combined and applied to a non-rectangular geometry.
Dissert. Abstr.

N80-17395 California Univ., Berkeley.
EXPERIMENTAL STUDY OF UNSTEADY ENTRANCE FLOW IN A CURVED PIPE Ph.D. Thesis
Karl Ow Gong 1979 157 p
Avail: Univ. Microfilms Order No. 8000356

The effect of pulsatility of the entry flow within a curved pipe was investigated experimentally. The curved pipes used in the experiments were of circular cross section and 180 deg bend. The pulsatile flows in the experiments conformed to the flow rate equation Q = Q sub DC + Q sub AC(cos)(omega)(t)-psi. A laser Doppler anemometer system with a rotating diffraction grating used as a frequency shifting device was used to obtain the axial and secondary velocities. The three parameters describing unsteady flows in a curved pipe were the mean alternative Dean number, the frequency parameter, and the amplitude ratio. The first experiment was performed on the curved pipe with a curvature to radius ratio L/a = 20, and with parametric values kappa = 120, alpha = 8.0 and gamma = .34. Significant observations and results of all three experiments are given.
Dissert. Abstr.

N80-17396*# Cambridge Hydrodynamics, Inc., Mass.
ADVANCED STABILITY THEORY ANALYSES FOR LAMINAR FLOW CONTROL Final Report
Steven A. Orszag Feb. 1980 50 p refs
(Contract NAS1-15372)
(NASA-CR-3233) Avail: NTIS HC A03/MF A01 CSCL 20D

Recent developments of the SALLY computer code for stability analysis of laminar flow control wings are summarized. Extensions of SALLY to study three dimensional compressible flows, nonparallel and nonlinear effects are discussed.
Author

N80-17397*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF A CERAMIC COATING ON METAL TEMPERATURES OF AN AIR-COOLED TURBINE VANE
Herbert J. Gladden and Curt H. Liebert Feb. 1980 29 p refs
(NASA-TP-1598; E-167) Avail: NTIS HC A03/MF A01 CSCL 20D

The metal temperatures of air cooled turbine vanes both uncoated and coated with the NASA thermal barrier system were studied experimentally. Current and advanced gas turbine engine conditions were simulated at reduced temperatures and pressures. Airfoil metal temperatures were significantly reduced, both locally and on the average, by use of the the coating. However, at low gas Reynolds number, the ceramic coating tripped a laminar boundary layer on the suction surface, and the resulting higher heat flux increased the metal temperatures. Simulated coating loss was also investigated and shown to increase local metal temperatures. However, the metal temperatures in the leading edge region remained below those of the uncoated vane tested at similar conditions. Metal temperatures in the trailing edge region exceeded those of the uncoated vane.
K.L.

N80-17398*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VOLUME-ENERGY PARAMETERS AND TURBULENT-FLOW DENSITY FLUCTUATIONS
Robert C. Hendricks Jan. 1980 28 p refs
(NASA-TP-1585; E-127) Avail: NTIS HC A03/MF A01 CSCL 20D

Volume-energy relations determined from an equation of state were used to group many sets of heat transfer data for liquids and gases, including the near-critical region. The volume - Gibbs energy parameter grouped these data better than did such other parameters as enthalpy, temperature, or internal energy.
K.L.

N80-17399*# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
A LASER TOMOGRAPHIC INVESTIGATION OF LIQUID FUEL SPRAYS
A. J. Yule, C. AhSeng, P. Felton, A. Ungut, and N. A. Chigier [1980] 25 p refs Sponsored in part by AFOSR, U.S. Navy and U.S. Army
(Grant NsG-7517)
(NASA-CR-162765) Avail: NTIS HC A02/MF A01 CSCL 20D

A light scattering technique is combined with a tomographic transformation to convert line of sight integrated data, measured in sprays, to measurements of droplet size and concentration in volume elements within the spray. The technique is developed and assessed by systematic experiments in axisymmetric sprays generated by twin-fluid atomisers. The good agreement found shows that, provided certain conditions are satisfied by the local spray structure, the technique provides information on spray structure, similar in detail and extent to that derived by photography, but with reduced experimental time. The technique

is applied to an investigation of a kerosene spray vaporizing in a hot gas stream. M.M.M.

N80-17400*# National Aeronautics and Space Administration, Washington, D. C.
FIRST RESULTS OF A STUDY ON TURBULENT BOUNDARY LAYERS IN OSCILLATING FLOW WITH A MEAN ADVERSE PRESSURE GRADIENT
R. Houdeville and J. Cousteix Nov. 1979 37 p refs Transl. into English of conf. paper 'Premiers Resultants d'une Etude sur les Couches Limites Turbulents en Ecoulement Pulse avec Gradient de Pression Moyen Defavorable" p 1-16 Presented at the 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978 Original language document announced as A79-35110 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-75799) Avail: NTIS HC A03/MF A01 CSCL 20D

The development of a turbulent unsteady boundary layer with a mean pressure gradient strong enough to induce separation, in order to complete the extend results obtained for the flat plate configuration is presented. The longitudinal component of the velocity is measured using constant temperature hot wire anemometer. The region where negative velocities exist is investigated with a laser Doppler velocimeter system with BRAGG cells. The boundary layer responds by forced pulsation to the perturbation of potential flow. The unsteady effects observed are very important. The average location of the zero skin friction point moves periodically at the perturbation frequency. Average velocity profiles from different instants in the cycle are compared. The existence of a logarithmic region enables a simple calculation of the maximum phase shift of the velocity in the boundary layer. An attempt of calculation by an integral method of boundary layer development is presented, up to the point where reverse flow starts appearing. M.M.M.

N80-17401# Naval Postgraduate School, Monterey, Calif.
MEASUREMENTS OF JET DISPERSIONS SIMULATED IN AN AERONAUTICAL WIND TUNNEL M.S. Thesis
J. V. Brendmoen Sep. 1979 94 p refs
(AD-A076578) Avail: NTIS HC A05/MF A01 CSCL 13/2

A neutrally stable atmospheric surface layer was suitably simulated in a low speed wind tunnel by tripping the boundary layer with a fence and letting the turbulent flow develop over a length of roughness elements. Jet exhaust dispersion characteristics, simulated by a burner/nozzle system, were investigated by measuring the horizontal and vertical temperature profiles at axial stations downwind from the nozzle exit. Dispersion sensitivity to different nozzle exit conditions, angles of incidence to the wind, the nozzle surface blockage were investigated. The results were compared to disperison methods used in the Air Quality Assessment Model (AQAM). It was found that the experimental jet penetration length was much shorter than that assumed in AQAM, and that a plume rise existed, which is not included in the current AQAM model. Required inputs of the initial dispersion coefficients were determined as a function of wind direction. GRA

N80-17402# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
NUMERICAL FLOW FIELD PROGRAM FOR AERODYNAMIC HEATING ANALYSIS Interim Technical Report, Jun. 1977 - Dec. 1978
H. J. Fivel Wright-Patterson AFB, Ohio AFFDL Apr. 1979 157 p refs
(Contract F33615-77-C-3003; AF Proj. 2404)
(AD-A076442; AFFDL-TR-79-3025) Avail: NTIS HC A08/MF A01 CSCL 20/4

This report documents the first phase of a study to modify an existing computer program which provides an economical and easy to use analytic tool for aerodynamic heating to a wide variety of 3-dimensional vehicle configurations. This report also serves as a preliminary version of a user's manual for the computer program plus two auxiliary programs written to analyze vehicle geometry, and presents program capabilities, input/output characteristics, and example problems. Core requirements have been minimized by the use of overlays. User oriented features of the program include minimized input requirements and various options for application flexibility. GRA

N80-17403# National Technical Information Service, Springfield, Va.
SHEAR FLOW. PART 2: BASES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Oct. 1979
Guy E. Habercom, Jr. Nov. 1979 311 p Supersedes NTIS/PS-78/1161; NTIS/PS-77/1038; NTIS/PS-76/0936; NTIS/PS-75/821
(PB80-800394; NTIS/PS-78/1161; NTIS/PS-77/1038; NTIS/PS-76/0936; NTIS/PS-75/821) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

In this bibliography, reports on shear flow in gases including air, exhausts, lasers, and plasmas are cited. Characteristics are discussed involving boundary layer dynamics, shock waves, turbulent flow and mixing; stratification, wake, wind tunnel testing, subsonic, transonic, supersonic, and hypersonic flow, geometric configurations, magnus force, turbine blades, airfoils, and airframes, and magnetohydrodynamics. Some reference is made to flow separation and reattachment, the subjects also of other bibliographies. Model tests, jets channel flow, and additional topics are discussed. This updated bibliography contains 303 abstracts, 32 of which are new entries to the previous edition. GRA

N80-17404# National Technical Information Service, Springfield, Va.
SHEAR FLOW. PART 3: GENERAL STUDIES. A BIBLIOGRAPHY WITH ABSTRACTS
Guy E. Habercom, Jr. Nov. 1979 293 p
(PB80-800402; NTIS/PS-78/1162) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

General aspects of fluid shear in laminar and turbulent flow are discussed. The discussions cover boundary layer dynamics, layers, stratified flow, stresses, ducts, pipes, channels, mixing, bursts, magnetohydrodynamics, viscosity, and oscillation. References are made to separation and reattachment. Wind tunnel modeling and flat plate characteristics are described, including mathematical models, computerized simulation, theory, equations of motion, anemometry, numerical analysis, and stability. Data are given on wall flow, wake, heat transfer, and pressure gradients. Wind shear is excluded. This updated bibliography contains 285 abstracts, 20 of which are new entries to the previous edition. GRA

N80-17405# ARO, Inc., Arnold Air Force Station, Tenn.
SEPARATED AND NONSEPARATED TURBULENT FLOWS ABOUT AXISYMMETRIC NOZZLE AFTERBODIES. PART 2: DETAILED FLOW MEASUREMENTS Final Report, 1 Oct. 1977 - 1 Dec. 1978
John A. Benek AEDC Oct. 1979 215 p refs Sponsored by the Air Force
(AD-A076458; AEDC-TR-79-22) Avail: NTIS HC A10/MF A01 CSCL 20/4

Measurements of mean velocity, specific turbulent kinetic energy, and specific Reynolds shear were obtained at M to the base infinity = 0.64 and ReD = 288,600 in a symmetry plane of two axisymmetric, circular-arc, boattail geometries each of which had a solid plume simulator. The geometries were selected such that an attached- and a separated flow boundary layer would be obtained. Ancillary measurements, consisting of model surface and tunnel wall, axial, static pressure distributions, and velocity vectors near the tunnel wall provide a well-defined domain with which to validate numerical flow simulations. Tabulations of the data and coefficients of least-squares dubic spline fits to the data are presented. GRA

N80-17406# Binary Systems, Inc., Silver Spring, Md.
WAVENUMBER SPECTRAL MEASUREMENT OF TURBULENT BOUNDARY LAYER WALL PRESSURE BY MAXIMUM LIKELIHOOD METHODS Final Report
P. S. Tong Apr. 1979 44 p refs
(Contract N00014-72-C-0318)
(AD-A076499; WBR-79-2) Avail: NTIS HC A03/MF A01 CSCL 20/4

A combined procedure based on conventional and maximum likelihood spectral estimation techniques is proposed for the measurement of turbulent boundary layer pressure fluctuation wavenumber spectrum. It is shown that the mixed procedure is

more tolerant to sensor inaccuracies in amplitude, phase or phase center alignment. GRA

N80-17407# Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.

A NEW THEORY OF TURBULENT FLOW IN A PIPE

Robert R. Long Sep. 1979 58 p refs Sponsored in part by the NSF, Washington, D.C.

(Contract N00014-75-C-0805; Grant NSF OCE-76-18887; Grant NSF ATM-76-22284)

(AD-A076598; TR-16-SER-C) Avail: NTIS HC A04/MF A01 CSCL 20/4

A new theory of turbulent shear flow is based on the discovery of a second boundary layer, which we call the viscous mesolayer. The existence of this layer between the core and the sublayer makes it impossible to match the outer (core) expressions for mean quantities with the inner expressions based on Prandtl's 'law of the wall', as in classical theory. Indeed, the supposed region of applicability of the classical theory, namely the layer in which both inner and outer behaviors are imposed, is precisely in the mesolayer where either behavior may be imposed. The mesolayer concept is used to develop a new theory of the distribution of mean quantities in pipe flow. Solutions are obtained for the mean quantities in an inertial sub-range and in a viscous subrange on either side of the mesolayer. Major alterations in the classical theory results. GRA

N80-17408# Wisconsin Univ. - Madison. Mathematics Research Center.

THE INITIAL VALUE PROBLEM FOR THE EQUATIONS OF MOTION OF COMPRESSIBLE VISCOUS AND HEAT-CONDUCTIVE FLUIDS

Akitaka Matsumura and Takaaki Nishida Sep. 1979 14 p ref (Contract DAAG29-75-C-0024)

(AD-A077136; MRC-TSR-1991) Avail: NTIS HC A02/MF A01 CSCL 20/4

The initial value problem associated with the equations of motion for isotropic Newtonian fluids is investigated. The fluids are compressible, viscous and heat-conductive. It is proved that there exists a unique global solution in time, for the small initial data, and the solution has the decay rate of (1 - t) to 3/4 power as t approaches positive infinity. The motions of compressible, viscous and heat-conductive fluids are described by a system of partial differential equations which is of hyperbolic-parabolic type and highly nonlinear. One of the first mathematical problems associated with this system is the initial value problem. We obtain the existence of a unique smooth global solution in time for the initial value problem and also the decay rate of the solution as time tends to infinity. GRA

N80-17409# Wisconsin Univ. - Madison. Mathematics Research Center.

ON THE SWIRLING FLOW BETWEEN ROTATING COAXIAL DISKS, ASYMPTOTIC BEHAVIOR 2

Heinz Otto Kreiss (California Inst. of Tech., Pasadena) and Seymour V. Parter Jul. 1979 44 p refs

(Contracts DAAG29-75-C-0024; N00014-76-C-0341)

(AD-A077126; MRC-TSR-1981) Avail: NTIS HC A03/MF A01 CSCL 20/4

Solutions of the von Karman equations for the swirling flow between two rotation coaxial disks are discussed. The shapes and asymptotic behavior are considered along with the types of permissible limit functions. The cell structure is studied in detail for the case when the limit function oscillates about zero. F.O.S.

N80-17410# Argonne National Lab., Ill. Reactor Analysis and Safety Div.

FINITE ELEMENT FORMATION FOR FLUID-STRUCTURE INTERACTION IN THREE-DIMENSIONAL SPACE

R. F. Kulak 1979 32 p refs Presented at the 3d US Natl. Congr. on Pressure Vessels and Piping, San Francisco, 25 Jun. 1979

(Contract W-31-109-eng-38)

(CONF-790615-26) Avail: NTIS HC A03/MF A01

A development is presented for a three-dimension hexahedral hydrodynamic finite-element. Using trilinear shape functions and assuming a constant pressure field in each element, simple relations were obtained for internal nodal forces. Because the formulation was based upon a rate approach it was applicable to problems involving large displacements. This element was incoporated into an existing plate-shell finite element code. Diagonal mass matrices were used and the resulting discrete equations of motion were solved using explicit temporal integrator. Results for several problems are presented which compare numerical predictions to closed form analytical solutions. In addition, the fluid-structure interaction problem of a fluid-filled, cylindrical vessel containing internal cylinders was studied. DOE

N80-17411# Universite des Sciences et Techniques de Lille (France).

AN APPLICATION OF THE NUMERICAL SOLUTION OF NONLINEAR PROBLEMS IN FLUID MECHANICS USING LEAST SQUARES AND FINITE ELEMENT METHODS, TO UNSTEADY NAVIER-STOKES EQUATIONS [UNE APPLICATION DE LA SOLUTION NUMERIQUE DE PROBLEMS NONLINEARES EN MECHANIQUE DES FLUIDES]

B. Mantel, J. Periaux, and P. Perrier Paris Assoc. Aeron. et Astronautique de France 1979 35 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978

(AAAF-NT-79-06; ISBN-2-7170-0539-0) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

A calculation method for viscous fluid flow at mid-range Reynolds numbers is presented. Application to the formulation of a computer program for the numerical simulation of separated turbulent flow at large Reynolds numbers, adding to the Navier-Stokes equations either a classic turbulence model or a homogenized random turbulence expression, is shown. The use of optimal control theory with a distributed parameter system to adjust the parameters so as to assure convergence of the algorithm and to permit the use of smaller computers is also proposed. As for the treatment of nonlinearities, gradient conjugates which have been conditioned to be unconditionally stable in time are suggested. Author (ESA)

N80-17412# Institut de Mecanique des Fluides de Marseille (France).

TRANSITION OF AN OSCILLATING INCOMPRESSIBLE FLOW IN A PIPE OR IN A BOUNDARY LAYER [TRANSITION D'UN ECOULEMENT OSCILLATOIRE INCOMPRESSIBLE DANS UNE CONDUITE OU DANS UNE COUCHE LIMITE]

J. Fauchas and C. Clarion Paris Assoc. Aeron. et Astronautique de France 1979 20 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978

(AAAF-NT-79-09; ISBN-2-7170-0536-6) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

A mathematical description of a parallel, or quasi-parallel, incompressible unsteady flow is given as the starting point for a prediction of the transistion from laminar to turbulent flow using an energy method. A critical value is determined for the analytic expression of the velocity field as a function of space-time coordinates. Similitude parameters are considered. Calculations are shown to be in good agreement with reported experimental results where it has been observed the beginning of the transition corresponds with the development of point instabilities in the laminar flow regime of a pulsating sinusoidal flow in a cylindrical horizontal tube. Author (ESA)

N80-17413# Aix-Marseilles Univ. (France). Inst. de Mecanique Statistique de la Turbulence.

VISUALIZATION OF UNSTEADY STRUCTURES IN A TURBULENT FLOW DOWNSTREAM FROM ONE AND FROM TWO PARALLEL BARS [VISUALISATION DES STRUCTURES INSTATIONNAIRES DANS UN ECOULEMENT TURBULENT, EN AVAL D'UN ET DE DEUX BARREAUX PARALLELES]

C. Domptail, P. Bonmarin, and R. Dumas Paris Assoc. Aeron. et Astronautique de France 1979 22 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseilles, 7-9 Nov. 1978

(AAAF-NT-79-14; ISBN-2-7170-0541-2) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 12 (France and EEC) FF 21 (others)

The design of a hydrodynamic tunnel with a vertical axis for flow visualization, using a lasar Doppler velocimeter, is

presented. This apparatus was used to study the turbulent flow downstream from a single cylindrical bar, then to study the wake downstream from two parallel bars of equal diameter, and finally of two parallel bars of different diameters. Flow visualization results are given which show, notably, the development of counter gradient diffusion phenomena in the wake of the two bars of different diameters. An interpretation is given based on the hypothesis which links this phenomenon to an asymmetry in the rotation of large pseudo-coherent vortices. Author (ESA)

N80-17414# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft u. Raumfahrt.

DETERMINATION OF THE PRESSURE FIELD AROUND A SLENDER BODY ACCELERATING AT A SMALL ANGLE OF ATTACK, USING A MOVING SINGULARITIES METHOD [BESTIMMUNG DER DRUCKPUNKTLAGE BEI SWACH ANGESTELLTEN, BESCHLEUNIGTEN DREHKOERPERN MIT HILFE DER METHODE DER BEWEGTEN SINGULARITAETEN]

W. Arrenbrecht, A. Beyer, and J. Ballman Bonn Dokzentbw Apr. 1979 69 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF-41/70040/71439)
(BMVG-FBWT-79-8) Avail: NTIS HC A04/MF A01; Dokzentbw, DM 30

A singularity method for the calculation of the potential flow around a slender body of revolution accelerating in a compressible fluid at small angle of attack is presented. Two different types of moving singularities are used and their derivation is shown. The time dependence of the solutions is characterized either by the dirac delta function (solitary disturbance) or by a heavyside function (continuous disturbance starting at time tau). Author (ESA)

N80-17415# Admiralty Marine Technology Establishment, Teddington (England).

THE EFFECT OF A PROPULSOR ON THE HULL BOUNDARY LAYER OF A BODY OF REVOLUTION

D. J. Atkins London HMSO May 1979 18 p refs
(AMTE-N-TM79101; BR68408) HC A02/MF A01

An axisymmetric boundary layer prediction method modified to include an approximate representation of a lightly loaded propulsor is discussed. The method is capable of predicting the effect of single and contra-rotating propellers on the boundary layer flow in the vicinity of the propulsor. Author (ESA)

N80-17416# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

BOUNDARY LAYERS IN AN OSCILLATING FLOW

Jean Cousteix 1979 35 p refs In FRENCH; ENGLISH summary
(ONERA-NT-1979-1) Avail: NTIS HC A03/MF A01

Unsteady flows which are periodic on the average with the external velocity oscillating around a zero or nonzero mean time value are considered. A review of related theoretical and experimental work is presented with emphasis on the boundary layers associated with this type of flow. Numerical methods for calculating these boundary layers are outlined and compared. Their validity relative to recent experimental results is evaluated. Author (ESA)

N80-17417# National Technical Information Service, Springfield, Va.

BOUNDARY LAYER CONTROL, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Oct. 1979

Guy E. Habercom, Jr. Nov. 1979 273 p Supersedes NTIS/PS-78/1150; NTIS/PS-77/0989; NTIS/PS-76/0928; NTIS/PS-75/824
(PB80-800337; NTIS/PS-78/1150; NTIS/PS-77/0989; NTIS/PS-76/0928; NTIS/PS-75/824) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Citations of applications to aerodynamics, hydrodynamics, turbomachinery and liquid flow are presented. Discussions refer to components and configurations. Flow fields include subsonic, transonic, supersonic, and hypersonic. Analyses involve computerized simulations, mathematical models and methods, and numerical solutions. Additional topics are temperature effects, mechanical responses, unsteady dynamics, and heat and mass transfer. This updated bibliography contains 265 abstracts, 51 of which are new entries to the previous edition. GRA

N80-17418# National Technical Information Service, Springfield, Va.

FLOW REATTACHMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979

Guy E. Habercom, Jr. Nov. 1979 128 p Supersedes NTIS/PS-78/1158; NTIS/PS-77/0988; NTIS/PS-76/0925
(PB80-800345; NTIS/PS-78/1158; NTIS/PS-77/0988; NTIS/PS-76/0925) Avail: NTIS HC $30.00/MF $30.00

Studies are reported on certain fluid flow conditions where, after boundary layer or flow separation has occurred, the flow attaches again to a surface. The materials cover both laminar and turbulent boundary layers in gases and liquids, principally the former. Aerodynamic and gas flow research relates to subsonic, transonic, supersonic, and hypersonic speeds involving plane, curved, and cavity surfaces for various types of flow. Applications are to such forms as geometric shapes, ramps, wings, airfoils, and other bodies. Wind tunnel testing is described. Hydrodynamic and liquid flow data refer to jets and fluidic devices. Mathematical models and analyses are included. This updated bibliography contains 123 abstracts, 3 of which are new entries to the previous edition. GRA

N80-17419# National Technical Information Service, Springfield, Va.

SHEAR FLOW, PART 1: LIQUIDS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979

Guy E. Habercom, Jr. Nov. 1979 218 p Supersedes NTIS/PS-78/1160; NTIS/PS-77/1037; NTIS/PS-76/0935; NTIS/PS-75/819
(PB80-800386; NTIS/PS-78/1160; NTIS/PS-77/1037; NTIS/PS-76/0935; NTIS/PS-75/819) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Shear flow and stresses are studied for a number of liquid forms such as water, lubricants, polymers, liquified gases, and liquid metals. The studies relate to hydrodynamics, elastohydrodynamics, magnetohydrodynamics, fluerics, rheology, acoustics, and oceanology. Some of the subjects include cavitation, jets, mixing, stratification, ultrasonics, capillary flow, blood circulation, sedimentation, wake, injection, liquid-gas interactions, and pipe and channel flow. Other topics cover drops, surface flow, nonnewtonian fluids, liquid crystals, hydraulic fluids, and layers. Theoretical aspects, mathematical models, equations of motion, computer programs, measurement technology, and empirical relationships are included. This updated bibliography contains 210 abstracts, 8 of which are new entries to the previous edition. GRA

N80-17296*# Naval Surface Weapons Center, White Oak, Md.

A NUMERICAL COMPARISON WITH AN EXACT SOLUTION FOR THE TRANSIENT RESPONSE OF A CYLINDER IMMERSED IN A FLUID

M. E. Giltrud and D. S. Lucas *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 23-28 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-17420# National Research Council of Canada, Ottawa (Ontario).

VELOCITY MEASUREMENT BY THE CORRELATION METHOD; ACCURATE, CONTACTLESS, NO MOVING PARTS

Ingvar Andermo, Goran Moerkoch, and Anders Sjoelund 1980 15 p
(NRC/CNR-TT-1958; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

Velocity measurements by the correlation method were assessed and found to be accurate measures. The wide range of applications of the correlation method are discussed. R.E.S.

N80-17421*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTI-CHANNEL TEMPERATURE MEASUREMENT AMPLIFICATION SYSTEM Patent Application
James R. Currie, inventor (to NASA) Filed 29 Nov. 1979 19 p
(NASA-Case-MFS-23775-1; US-Patent-Appl-SN-098569) Avail: NTIS HC A02/MF A01 CSCL 14B

A multichannel temperature amplification system for solar energy applications is presented. Differential thermocouple outputs are sequentially amplified by a common amplifier and compared with a reference temperature signal in an offset correction amplifier. A poled output signal is provided when a differential output is of a discrete level. NASA

N80-17422*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FATIGUE STRENGTH TESTING EMPLOYED FOR EVALUATION AND ACCEPTANCE OF JET-ENGINE INSTRUMENTATION PROBES
Everett C. Armentrout 1980 25 p refs Presented at 25th Ann. Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by ASME
(NASA-TM-81402; E-313) Avail: NTIS HC A02/MF A01 CSCL 14B

The fatigue type testing performed on instrumentation rakes and probes intended for use in the air flow passages of jet engines during full scale engine tests is outlined. A discussion of each type of test performed, the results that may be derived and means of inspection is included. R.E.S.

N80-17423*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTICAL SENSORS FOR AERONAUTICS AND SPACE
R. J. Baumbick, J. Alexander (NASA. Johnson Space Center), R. Katz (Naval Avionics Center, Indianapolis, Ind.), and J. Terry (Army Applied Technology Labs., Ft. Eustis, Va.) Jan. 1980 16 p
(NASA-TM-81407; E-321) Avail: NTIS HC A02/MF A01 CSCL 14B

A review of some NASA and DOD programs to develop optical sensors with fiberoptics for instrumentation and control is presented. Fiberoptic systems offer some distinct advantages. Noise immunity is one important asset. Fiberoptic systems do not conduct electricity and therefore can be used in and near areas that contain explosive or flammable materials. One objective of these programs is to produce more reliable sensors and to improve the safety and operating economy of future aircraft and space vehicles. Author

N80-17424*# Oklahoma Univ., Norman.
MINIATURE PIEZORESISTIVE SOLID STATE INTEGRATED PRESSURE SENSORS Final Report
Seun K. Kahng Feb. 1980 32 p refs
(Grant NsG-1481)
(NASA-CR-162752) Avail: NTIS HC A03/MF A01 CSCL 14B

The characteristics of silicon pressure sensors with an ultra-small diaphragm are described. The pressure sensors utilize rectangular diaphragm as small as 0.0127 x 0.0254 cm and a p-type Wheatstone bridge consisting of diffused piezoresistive elements, 0.000254 cm by 0.00254 cm. These sensors exhibit as high as 0.5 MHz natural frequency and 1 mV/V/psi pressure sensitivity. Fabrication techniques and high frequency results from shock tube testing and low frequency comparison with microphones are presented. Author

N80-17425*# Pratt and Whitney Aircraft, East Hartford, Conn.
THIN FILM TEMPERATURE SENSOR
H. P. Grant and J. S. Przybyszewski 15 Feb. 1980 61 p refs
(Contract NAS3-20768)
(NASA-CR-159782; PWA-5526-31) Avail: NTIS HC A04/MF A01 CSCL 14B

Thin film surface temperature sensors were developed. The sensors were made of platinum-platinum/10 percent rhodium thermocouples with associated thin film-to-lead wire connections and sputtered on aluminum oxide coated simulated turbine blades for testing. Tests included exposure to vibration, low velocity hydrocarbon hot gas flow to 1250 K, and furnace calibrations. Thermal electromotive force was typically two percent below standard type S thermocouples. Mean time to failure was 42 hours at a hot gas flow temperature of 1250 K and an average of 15 cycles to room temperature. Failures were mainly due to separation of the platinum thin film from the aluminum oxide surface. Several techniques to improve the adhesion of the platinum are discussed. R.E.S.

N80-17426# Texas Technological Univ., Lubbock. Optical Systems Lab.
MULTIPLEX HOLOGRAPHY FOR SPACE-VARIANT OPTICAL PROCESSING, PARTS 1 AND 2
Mike I. Jones and E. Lee Kral 1 Sep. 1979 320 p refs
(Grant AF-AFOSR-2855-75)
(AD-A074987; AFOSR-79-0991TR) Avail: NTIS HC A14/MF A01 CSCL 20/6

A major goal of the research effort has been the implementation of two-dimensional representations of space-variant optical systems. In a sampling theorem-based approach this requires sampling the system's input plane and multiplexing the system's transfer functions for the various input plane samples. Our technique utilizes diffusers in the individual reference beams to encode the sequentially-recorded holograms so as to minimize hologram-to-hologram crosstalk on playback. Part 1 of this report presents the results of a detailed examination of the use of ground glass diffusers with up to 100 holograms being multiplexed. Experimental results include the representation of a strongly space-variant magnifier, and a demonstration that indeed the individually multiplexed holograms are adding coherently on playback. Part 2 contains properties of various models of pure phase, pure amplitude, and combined amplitude, and combined amplitude and phase diffusers. A spatial random telegraph wave description is employed for the diffusers, with either evenly spaced transition points or Poisson distributed transitions assumed. GRA

N80-17427# Army Engineer Topographic Labs., Fort Belvoir, Va.
MATERIALS RESEARCH FOR HOLOGRAPHIC RECORDING. NUMBER 3: HARDENED GELATIN HOLOGRAPHIC RECORDING MATERIALS
James W. Gladden and John W. Eastes Sep. 1979 69 p refs
(DA Proj. 4A1-61102-B-52C)
(AD-A076203; ETL-0197; Rept-3) Avail: NTIS HC A04/MF A01 CSCL 14/5

The results of a study of four different hardened gelatin holographic recording materials are reported. These are the dichromated, diazo, diazo resin, and silver halide (sensitized) gelatins. The report concludes that of the four photosensitive processes studied, the silver halide (sensitized) gelatin process offers the most promising process characteristics. The silver halide gelatin process is a new holographic recording process that can be used to prepare phase volume holograms in hardened gelatin. The process uses a reversal bleach that dissolves the developed silver metal image while further crosslinking the gelatin in the vicinity of the silver image. Upon fixing and with dehydration of the resulting gelatin hologram, one obtains recordings similar to those produced by the dichromated gelatin process. This is accomplished with exposures on the order of 200 to 500 micron J/sq cm at 514.5 nm in a silver halide emulsion that has a panchromatic response. Furthermore, because the hologram has no silver halide present, the hologram does not exhibit the printout phenomena characteristic of bleached holograms. GRA

N80-17428# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
RESPONSE OF SLIGHTLY DAMPED GYROSCOPIC SYSTEMS

L. Meirovitch and G. Ryland, II 1979 41 p refs
(Contract N00014-78-C-0194)
(AD-A075283) Avail: NTIS HC A03/MF A01 CSCL 17/7

A second-order perturbation theory is developed for the response of slightly damped gyroscopic systems. The solution is based on the Eigensolution for undamped gyroscopic systems and is expressed in terms of real quantities alone. GRA

N80-17429# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
HIGH-G GIMBAL TECHNOLOGY STUDIES
A. Rodgers Jul. 1979 25 p refs
(AD-A076488; DRSMI-T-79-75) Avail: NTIS HC A02/MF A01 CSCL 17/7

The objective of this task is to study the gimbal technology and predict feasible concepts worthy of demonstrating a two-axes wide angle stabilized gimbal system. Acceleration environments for the high velocity projectiles are of such intensities that special bearing protection design technology is required to develop a cannon type launchable gimbal system. GRA

N80-17430# Army Engineer Topographic Labs., Fort Belvoir, Va.
FOURIER TRANSFORM AUTOCORRELATION
Michael M. McDonnell Apr. 1979 37 p
(DA Proj. 4A1-61101-A-91D)
(AD-A076109; ETL-0184) Avail: NTIS HC A03/MF A01 CSCL 14/5

This report describes a device which can take a complete Fourier transform of the intensity transmittance of a photographic transparency. The transform is taken by purely optical means. A complete system analysis is presented, and some results of experiments with the device are described. GRA

N80-17431# Pennsylvania State Univ., University Park. Applied Research Lab.
THE DESIGN OF PIEZOELECTRIC TRANSDUCERS USING GOAL PROGRAMMING M.S. Thesis
Diana F. McCammon 11 Jun. 1979 97 p refs
(Contract N00024-79-C-6043)
(AD-A075282; ARL/PSU/TM-79-140) Avail: NTIS HC A05/MF A01 CSCL 09/5

The design of piezoelectric transducers often involves the satisfaction of multiple, conflicting design specifications. The use of conventional mathematical programming techniques in this endeavor has been inhibited by their inability to consider these multiple objectives within their design formulations. Goal programming is an effective alternative methodology. Transducer design analysis through goal programming provides the optimal solution to the multiple criteria of various types of transducers. The solutions to five design specifications for a reasonably complex transducer are presented. The details of the formulation and analysis of results provide an indication of the ability of this approach to resolve even more complex transducer design problems. GRA

N80-17432# Abcor, Inc., Wilmington, Mass. Walden Div.
RESEARCH ON PERSONAL DOSIMETERS TO MEASURE HYDRAZINE FUELS IN AIR Final Report, Aug. 1977 - Dec. 1978
Rosemary Ellersick Oct. 1979 61 p
(Contract F33615-77-C-0618; AF Proj. 7930)
(AD-A077034; SAM-TR-79-22) Avail: NTIS HC A04/MF A01 CSCL 06/18

The wide use of toxic and highly reactive hydrazine and unsymmetrical dimethylhydrazine (UDMH) as rocket motor fuels created a need to monitor their vapors in air at concentrations as low as 0.1 ppm. The objective of this research effort was to develop, test, and deliver prototype models of a hydrazine fuels dosimeter capable of filling the personal-exposure monitoring part of this need. This report describes the building and testing of a hydrazine dosimeter. Significant analytical difficulties were encountered. The most precise hydrazine measurements were made using the para-dimethylaminobenzaldehyde (PDAB) colorimetric analysis; isothermal furaldehyde GC analysis was satisfactory but less precise. UDMH analysis was much more difficult. A tedious adaptation of the TPF colorimetric analysis gave reasonable results, but the temperature-programmed furaldehyde GC analysis was not satisfactory. UDMH analysis/collection was not fully evaluated because of program duration and budget considerations; hydrazine evaluation was extensive. Laboratory test exposures to low ppm concentrations of hydrazine and UDMH were done with the linearity of the dosimeter's response to 0.1-10-ppm time-weighted average concentrations of hydrazine statistically demonstrated. UDMH analytical problems prevented demonstration of UDMH linearity of response. GRA

N80-17433# Clemson Univ., S.C.
ON LINE COMPUTER RECALIBRATION OF INSTRUMENTS Final Report, 1 Oct. 1978 - 30 Sep. 1979
R. W. Gilchrist and W. J. Barnett Jul. 1979 134 p
(Contract EY-77-S-09-1011)
(DOE/ET-01011/8) Avail: NTIS HC A07/MF A01

A system for on-line computer recalibration of instruments was developed. The system consists of two computer programs; an off-line data analysis program and an on-line error reduction program. The off-line program accepts extensive calibration data, analyzes it and prepares it for use in the on-line program. The on-line program accepts the instrument observations and corrects for errors according to the current system state. The on-line program is appropriate for use with a microprocessor. Corrections are made for such deterministic errors as bias, linearity, and hysteresis and errors due to system state parameters such as temperature and humidity. DOE

N80-17434# Royal Aircraft Establishment, Farnborough (England). Radio and Navigation Dept.
PRACTICAL ACCELEROMETER TESTING
C. M. Philip London HMSO Dec. 1978 26 p refs
(RAE-TR-78149; BR66986) Avail: NTIS HC A03/MF A01

In calibrating modern inertial quality accelerometers which are accurate to a few parts in a million, extreme care must be exercised in measurement technique and interpretation of the results. Some of the tests which are performed currently with accelerometers are analyzed and the effects of errors in the test equipment are discussed. A mathematical modeling approach is used to explore calibrating methods. Results show that while the conventional four point test remains an important means of monitoring instrument performance, multiposition tests are considered superior when measurements of the highest accuracy are required. Author (ESA)

N80-17435# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
UNCERTAINTIES IN THE MEASUREMENT OF GAGE BLOCKS BY INTERFEROMETRY
K. G. Birch May 1979 30 p refs
(NPL-MOM-29) Avail: NTIS HC A03/MF A01

Potential sources of uncertainty in the measurement of gage blocks by interferometry are examined in order to evaluate the total uncertainty in the measured length of a block. The sources of uncertainty evaluated include fringe fraction estimation, gage block temperature measurement, temperature difference between gage block and platen, coefficient of linear expansion of gage material, refractivity of air, phase change on reflection, wringing film thickness, and interferometer parameters. The uncertainties are identified as random or systematic and the summed uncertainty of each type is stated as a two sided confidence interval corresponding to a confidence level of 0.99. A total uncertainty, obtained by combining the random and systematic uncertainties is also derived. Author (ESA)

N80-17436# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
A SURVEY OF SECONDARY STANDARD GAGES FOR ACCURATE PRESSURE MEASUREMENT UP TO ABOUT 1 GPa
G. N. Peggs Jan. 1979 22 p refs
(NPL-MOM-37) Avail: NTIS HC A02/MF A01

Secondary standard gages suitable for accurate pressure measurement up to about 1 GPa are reviewed. Several recently developed types of practical gages are discussed and their performance assessed. Results show that there are several constraints on the choice of a suitable secondary standard gage for a particular application, e.g., the number and quality of the leadthroughs required to operate the gage. Author (ESA)

N80-17437# Centre Technique des Industries Mecaniques, Senlis (France).
A THREE DIMENSIONAL ROUGHNESS METER FOR IMPROVED EVALUATION OF SURFACE MICROCONTOURS Final Report [LE RUGOSIMETRE TRIDIMENSIONNEL POUR UNE MEILLEURE EVALUATION DES ETATS DE SURFACE]
Grandadam, Prebe, and Riout 20 Jul. 1979 22 p In FRENCH
(CETIM-1-DD-04-0) Avail: NTIS HC A02/MF A01

A critique of conventional profilometry is given after which a three-dimsiional approach to surface roughness characterization is offered. Emphasis is on the misleading nature of two-dimensional cutaway representations of surface contours. As an alternative, a contour following sensor is proposed which provides measurments in three dimensions as it is moved across the surface under investigation. The laboratory apparatus, including the pickup arm, its peripherals, a programmable calculator, and a graphic display, are described. As an example, a milled surface is studied, then compared with standard profilometric data. Results shown that the three-dimensional method does better at analyzing the homogeneity of a surface and that it is more efficient in revealing point defects. Author (ESA)

N80-17438# Environmental Monitoring and Support Lab., Cincinnati, Ohio. Quality Assurance Branch.
ANGULAR FLOW INSENSITIVE PITOT TUBE SUITABLE FOR USE WITH STANDARD STACK TESTING EQUIPMENT Final Report
W. J. Mitchell, B. E. Blagun, D. E. Johnson, and M. R. Midgett Jun. 1979 89 p refs
(PB80-102007; EPA-600/4-79-042) Avail: NTIS HC A05/MF A01 CSCL 13B

Five pitot tube designs were tested under various gas flow conditions for accuracy in measuring static and total pressure. The static and impact pressure measuring tubes least affected by angular flow were combined and then evaluated in the presence of standard particulate sampling nozzles. Tests were performed on 'S', 'L', Kiel and cylinder pitot tubes and a shielded static pressure pitot tube. The percent error for each pitot tube was determined as a function of yaw, pitch, orifice size, orifice location, pitot tube size, and velocity. A pitot tube was developed that is accurate within 5% when yawed and pitched + or - 30 degrees even while attached to a standard EPA Method 5 sampling assembly. This pitot tube was field tested at a sewage sludge incinerator, a clay crushing plant and a power plant. GRA

N80-17285 Paris Univ. (France). Lab. de Mecanique Appliquee.
ADJUSTMENT OF A CONSERVATIVE NON GYROSCOPIC MATHEMATICAL MODEL FROM MEASUREMENT
L. Bugeat, R. Fillod, G. Lallement, and J. Piranda *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 71-81 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-17439 Stanford Univ., Calif.
LASER INDUCED COLLISIONS Ph.D. Thesis
Jonathan C. White 1979 153 p
Avail: Univ. Microfilms Order No. 8002036

A collisional process which permits the rapid and controllable transfer of energy among interacting atomic or molecular species is described. This process, termed a laser induced inelastic collision, results from the long range, dipole-dipole interaction between two species in which a photon is used to satisfy an energy defect. Coupled equations describing the effect are developed and numerically integrated for the transition probability and collision cross section. The numerical results are compared with approximate formula for the cross section at line center and in the wing. Applications for laser induced infrared upconversion, so called radiative collision lasers, and new pair absorption studies are proposed. Dissert. Abstr.

N80-17440 Stanford Univ., Calif.
THEORY OF THE ISOCHRONOUS STORAGE RING LASER Ph.D. Thesis
David Anthony George Deacon 1979 227 p
Avail: Univ. Microfilms Order No. 8006375

The use of an isochronous storage ring as the electron source for a high power, high efficiency free electron laser is proposed. The conditions for the existence of such traps are defined and the dependence of their size and shape on the laser parameters and the deviations from isochronicity in the arc of the storage ring are characterized. The optimization of the laser parameters are discussed and numerical example of its performance is given assuming a design which can be realized in practice. The tolerances on the field strengths and the laser cavity length are derived and it is shown how they can be satisfied in a real facility. Dissert. Abstr.

N80-17441 California Inst. of Tech., Pasadena.
DESIGN, CONTROL, AND CHARACTERIZATION OF THE PASSIVELY MODE LOCKED CW DYE LASER, 1. PHOTOCONDUCTIVE IMPULSE RESPONSE AND EXCESS CARRIER LIFETIME OF Cr-DOPED GaAs, 2 Ph.D. Thesis
Pinchas Agmon 1980 204 p
Avail: Univ. Microfilms Order No. 8000954

Following a description of the laser's elements, the mode stability of its multi-mirror resonator is studied. The monitoring of the laser operational state by pulsewidth and bandwidth measurements is described. A transient photoconductive experiment is conducted. The semi-insulating Cr:GaAs material is irradiated with a continuous train of picosecond light pulses with photon energy above the band-gap energy, generated by the passively mode locked CW dye laser. A photoconductive decay time of 67 psec is deduced from the observations and interpreted as the result of both bulk and surface recombination. It is shown that it agrees well with longer carrier life-time in Cr:GaAs measured under steady state conditions with longer illumination wavelengths. Dissert. Abstr.

N80-17442 California Univ., Berkeley.
DOUBLE MODE-LOCKING OF THE CW DYE LASER Ph.D. Thesis
Etan Bourkoff 1979 219 p
Avail: Univ. Microfilms Order No. 8000291

Double mode-locking of the CW dye laser is investigated. Using cross-correlation techniques, a direct display of the system jitter distribution is experimentally obtained, in addition to displays of the shapes of the primary and secondary double mode-locked pulses, all on a picosecond time scale. It is determined that the primary mode-locked pulse is closely approximated by a single-sided exponential shape, whereas the secondary pulse is, in general, adequately described by a double-sided exponential shape, whose trailing edge contains a slowly-decaying tail. Detailed information on the relative synchronism between the two pulse trains, and on their relative time of generation within the common laser cavity, is also given. An empirical study of some of the important system parameters of double mode-locking is made and a versatile configuration which allows a wide range of independent tunability is demonstrated. Dissert. Abstr.

N80-17443*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
PERFORMANCE ANALYSIS OF THE SPACEBORNE LASER RANGING SYSTEM
W. D. Kahn, F. O. Vonbun, D. E. Smith (Business and Technol. Systems, Inc.), T. S. Englar (Business and Technol. Systems, Inc.), and B. P. Gibbs Oct. 1979 26 p refs Submitted for publication
(NASA-TM-80330) Avail: NTIS HC A03/MF A01 CSCL 20E

The 'spaceborne laser ranging system' is a proposed short pulse laser on board an orbiting spacecraft. It measures the distances between the spacecraft and many laser retroreflectors (targets) deployed on the earth's surface. The precision of these range measurements was assumed to be about plus or minus 2 cm. These measurements were then used together with the

orbital dynamics of the spacecraft to derive the intersite vector between the laser ground targets. The errors associated with this vector were on the order of 1 to 2 cm. The baseline distances determined range from 25 km to 1200 km. By repeating the measurements of the intersite vector, strain and strain rate errors were estimated. The realizable precision for intersite distance determination was estimated to be on the order of 0.5 cm at 300 km and about 1.5 cm at 1200 km. The corresponding inaccuracies for the intersite distances were larger, than is 1 cm and 3.5 cm respectively. The corresponding precision in the vertical direction was 1 cm and 3 cm. R.E.S.

N80-17444# New York Univ., N. Y. Dept. of Physics.
PHOTON ECHOES IN STANDING WAVE FIELDS: TIME SEPARATION OF SPATIAL HARMONICS
J. L. Legouet and P. R. Berman Sep. 1979 18 p refs
(Contract N00014-77-C-0553)
(AD-A076103) Avail: NTIS HC A02/MF A01 CSCL 20/5

A calculation is presented to describe the response of an atomic system subjected to two strong standing wave field pulses separated in time. One finds a sequence of output pulses following the input ones, reminiscent of classical photon echoes. A physical picture of the processes involved in echo formation is presented and connection is made with the classical picture of photon echoes. The application of these techniques to collision studies is emphasized. It is shown that studies of echoes produced by standing wave fields can prove advantageous for exploring the effects of small angle scattering on both level populations and atomic coherences. GRA

N80-17445# Naval Weapons Center, China Lake, Calif.
LASER DYE PURITY AS DETERMINED BY THIN LAYER CHROMATOGRAPHY Research Report, Nov. 1978 - Aug. 1979
Aaron N. Fletcher and May L. Chan Oct. 1979 27 p
(ZG54581001)
(AD-A076562; NWC-TP-6132) Avail: NTIS HC A03/MF A01 CSCL 20/5

A total of 66 laser dyes have been examined by thin layer chromatography for the presence of impurities using three different solvent systems. Very few dyes were found that could be considered as pure. The specific effect, if any, of the impurities upon the lasing characteristics of the dyes is not known. Further work is needed to determine whether a purer dye would yield better lasing characteristics. A few dyes were shown to degrade while being tested. GRA

N80-17446# IBM Research Lab., Yorktown Heights, N. Y.
STUDY OF LASERS Final Report, 15 Jul. 1976 - 14 Jul. 1979
Peter P. Sorokin 15 Oct. 1979 10 p refs
(Contract DAAG29-76-C-0062)
(AD-A076507; ARO-14016.9-P) Avail: NTIS HC A02/MF A01 CSCL 20/5

Results achieved in four separate laser studies are summarized. Topics covered are (1) time-resolved infrared spectral photography; (2) laser-included thermal explosions; (3) parahydrogen 16 micron tunable source; and (4) a study of the c (triplet) pi (u) state of H2 in discharges. GRA

N80-17447# Defense Intelligence Agency, Washington, D.C.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NO. 38, NOVEMBER - DECEMBER 1978
Sep. 1979 118 p
(AD-A075784; DIA-DST-1740Z-006-79) Avail: NTIS HC A06/MF A01 CSCL 20/5

Coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; beam propagation; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser measurement applications; laser-excited optical effects; beam-target interaction; and plasma generation and diagnostics. GRA

N80-17448# Naval Postgraduate School, Monterey, Calif.
FREQUENCY CONTROL OF A CO2 LASER USING STARK CELL STABILIZATION M.S. Thesis
Daniel Morris Brown Jun. 1979 122 p refs
(AD-A075210) Avail: NTIS HC A06/MF A01 CSCL 20/5

Preliminary studies have been carried out for the frequency and intensity stabilization of the output of a carbon dioxide laser, by feedback control of resonator length. Fluctuations due to discharge current and temperature and flow rate of coolant were studied. Current regulation of the power supply was found to be necessary for intensity stability. Cavity length tuning allowed vibration-rotation line selection, with a strong hysteresis effect. A computer analysis of error signal production for a pyroelectric detector and for a HgCdTe detector indicated that phase sensitive detection of the first harmonic signal component gave the typical frequency discriminant. Operation of a servo loop integrator for the feedback loop has been considered. A suitable Stark Effect absorption cell for feedback signal generation has been constructed, but has not been applied to the laser. GRA

N80-17449# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
AUTOMATED LASER SPECKLE INTERFEROMETRY DISPLACEMENT CONTOUR ANALYZER
John A. Schaeffel, Jr. 2 Jul. 1979 43 p refs
(AD-A075109; DRSMI-T-79-1) Avail: NTIS HC A03/MF A01 CSCL 17/8

This work presents a new technique and experimental equipment to analyze Young's Fringe speckle interferograms. A new method using an off-axis optical photodetector was developed for generating displacement contour maps of bodies when deformed under load. Laser speckle interferograms are made of the deformed body and analyzed with a special displacement contouring computer analyzer. Interferograms of a flawed composite tube were analyzed by the system and are presented in the work. Currently operating at about 20% of its maximum rated speed, the system can analyze 5000 data points in less than four minutes. This report presents both the theory and hardware which may be utilized to generate displacement contour maps of deformed bodies. GRA

N80-17450# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
INVESTIGATION OF MILLIMETER WAVE AND FAR INFRARED MULTIWAVELENGTH SYSTEMS Final Report, 1 Jul. 1977 - 31 Mar. 1979
R. G. Shackelford, J. J. Gallagher, R. W. McMillan, G. R. Loefer, and W. M. Penn 17 Sep. 1979 69 p refs
(Contract DAAG29-77-C-0026)
(AD-A075265; GIT/EES-A-1985; ARO-15277.2-A-P) Avail: NTIS HC A04/MF A01 CSCL 17/5

This report summarizes the results of three related tasks performed under the subject contract: Hybrid Millimeter Wave/CO2 Laser Target Acquisition System; Millimeter Wave Propagation Through Battlefield Dust; and Report of NMMW System Subpanel. A full final report has been published on each subtask, and is available through the cognizant Army Organizations. (A GRA

N80-17451# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
ACTIVE LASER SEEKER CONCEPTS EVALUATION
Khalil Seyrafi and Thomas H. James Jun. 1979 44 p
(AD-A075979; DRSMI-T-CR-79-22) Avail: NTIS HC A03/MF A01 CSCL 17/7

This final report covers the subject of active search and acquisition by a 10.6 micrometer missile seeker. The primary issue is the discrimination capabilities of an active system. Included in this report are performance evaluations in coherent and incoherent modes, compared to passive seekers, evaluations of the viability of several target discriminants, considerations regarding acquisition scan techniques, and economic considerations of such active seeker designs. GRA

N80-17452# Illinois Univ. at Chicago Circle, Chicago. Dept. of Physics.
LASER EXCITATION OF INNER-SHELL ATOMIC STATES BY MULTIQUANTUM PROCESSES Annual Summary Report, 1 Aug. 1978 - 31 Jul. 1979
Charles K. Rhodes and R. Thomas Hawkins 31 Oct. 1979

127 p refs
(Contract N00014-78-C-0625)
(AD-A076069) Avail: NTIS HC A07/MF A01 CSCL 07/4

Multiquantum ultraviolet processes utilizing the available ultrahigh spectral brightness rare gas halogen technology can be used to generate inversion densities 10 to the 15th power/cu cm in the 10-20 eV range. On the basis of current experimental findings we conclude that these nonlinear methods of excitation can be successfully extrapolated to excitations in the 20-50 eV range, the region of excited atomic inner-shell configurations. GRA

N80-17453# Army Electronics Research and Development Command, Fort Monmouth, N. J. Night Vision and Electro-Optics Labs.
DESIGN APPROACH FOR THE VISIOCEILOMETER AN/GMQ-( ) (XE-1) Final Report
Henry Saphow, Frederick Kobylarz, Gunther Kainz, and Earl Griggs Sep 1979 39 p refs
(DA Proj 1L1-62111-AH-71)
(AD-A076011; DELNV-TR-79-4) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report details the in-house efforts to design, fabricate and test a combination visiometer/ceilometer based upon Laser Rangefinding and CCD technologies. The effort described demonstrated concept feasibility and offers recommendations for implementing future generation equipment. GRA

N80-17454# Hughes Aircraft Co., Culver City, Calif. Laser Systems Div.
PULSED RF WAVEGUIDE STUDIES PROGRAM Research and Development Report, Jul. 1978 - Apr. 1979
L. V. Sutter Aug 1979 53 p refs
(Contract DAAB07-78-C-2450)
(AD-A073298; HAC-FR79-93-885; DELNV-TR-78-2450-1) Avail: NTIS HC A04/MF A01 CSCL 20/5

The operation of a pulsed RF Waveguide CO2 laser was successfully demonstrated. The efficient passive matching of the RF power supply to the laser head was achieved. Peak powers of up to 400 watts with 150 nanoseconds pulsewidth were obtained at repetition rates of up to 20 kilohertz. Peak small signal gains of up to 2.7 percent/cm were achieved. The pulsed laser was also run CW and thus mixed mode operation is feasible. GRA

N80-17455# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
VIBRATIONAL ENERGY TRANSFER AND KINETICS OF HIGH ENERGY MOLECULAR LASERS Final Report, 1 Jun. 1976 - 31 May 1979
T. A. Cool 17 Aug 1979 9 p refs
(Grant DAAG29-76-G-0252)
(AD-A073592; ARO-13880.1-P) Avail: NTIS HC A02/MF A01 CSCL 20/5

Vibrational energy transfer probabilities were measured for the H2-D2, H2-HCl, HF-HCN, DF-HCN, and H2-HCN systems from 220-450 K. Two-photon photodissociation of HgCl, HgBr, and HgI was observed to produce highly electronically excited (Hg2) atoms. Franck-Condon factors and r-centroids were calculated for the sum of B SQ-sum of X sq systems of HgCl, HgBr, and HgI. GRA

N80-17456# Auburn Univ., Ala. Dept. of Physics.
NUCLEAR PUMPED LASERS
J. R. Williams, M. J. Monahan, and Q. C. Murphree Jul 1979 56 p refs
(Grant DASG60-77-C-0165)
(AD-A073385) Avail: NTIS HC A04/MF A01 CSCL 20/5

A 3.5 MeV Dynamitron accelerator has been used to investigate low pressure mixtures of Kr-NF3, Xe-NF3, Kr-NF3-UF6, and Xe-NF3-UF6. The accelerator provides low intensity, guassian shaped, pulsed proton beams with FWHM pulse widths of 3 ns and repetition rates of 1 microsec to 32 ms. Emissions from the gas scintillation cell are observed with a single proton counting system. Under existing experimental conditions, the metastable reaction channel dominates the system kinetics, and analysis of experimental results gives formation rate constants, K(1), of 1.7 x 10 to the -10th power cc/sec and 5.5 x 10 to the -11th power cc/sec for the reactions Kr* - NF3 to KrF* - NF2 and Xe* - NF3 to XeF* - NF2, respectively. The results of absolute conversion efficiency measurements show the Xe-NF3 system to be approximately an order of magnitude more efficient than the Kr-NF3 system. The addition of approximately 0.75 torr of UF6 to a 40/2 torr mixture of Kr/NF3 reduces the 2487 A emission by approximately 50%. A 50% reduction in the 3525 A emission from a 40/4 torr mixture of Xe/NF3 is observed when 2 torr of UF6 are added. GRA

N80-17457# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENT EVALUATION OF LASER ATTENUATION BY WATER DROPS Final Report, 2 Jan. - 30 Sep. 1978
J. T. Miller AEDC, Arnold AFS, Tenn. Aug 1979 30 p refs
(AD-A073430; AEDC-TR-79-18) Avail: NTIS HC A03/MF A01 CSCL 20/6

A test program was conducted to measure the transmission of both CO2 and HeNe laser beams through an attenuation region occupied by water drops. Analysis of the measurements shows that there is reasonable agreement between experiment and diffraction theory and that the major source of uncertainty arises from the characterization of the attenuating particle field. GRA

N80-17458# Stanford Linear Accelerator Center, Calif.
VARIABLE PARAMETER FREE ELECTRON LASER
P. L. Morton Aug 1979 7 p refs Presented at the ONR Workshop on Electron Generators of Coherent Radiation, Telluride, Colo., 13 Aug 1979
(Contract EY-76-C-03-0515)
(SLAC-Pub-2371; CONF-790853-1) Avail: NTIS HC A02/MF A01

The use of the free electron laser (FEL) to treat the acceleration of charged particles with radio frequency accelerating systems is described with emphasis on the design of the wiggler magnet used for the FEL. The derivation of the equations are presented in a physically intuitive fashion rather than in a strictly rigorous manner thus showing in a rather graphic way how the variation of the magnetic wiggler field and wave length affects the coupling of the electron energy to the optical laser beam. By proper variation of the wiggler parameters, it is possible to obtain a tremendous improvement in the performance of a variable parameter wiggler over the constant parameter wiggler. DOE

N80-17459# Naval Research Lab., Washington, D. C.
SHORT WAVELENGTH LASERS FOR FUSION Final Report, 1 Apr. 1978 - 31 Mar. 1979
N. Djeu and B. Wexler 1979 37 p refs
(Contract ES-77-A-01-6021)
(DOE/TIC-10163) Avail: NTIS HC A03/MF A01

Two approaches to laser fusion drivers are examined: (1) an optically pumped Hg (63Po-3 yields 6 S-1) energy storage system; (2) metal vapor Raman compression. The feasibility of the first method was investigated by measuring the Hg stimulated emission cross section, which implied a saturation photon fluence in excess of the damage limit on existing window materials. The possibility of obtaining peak power magnification through stimulated Raman scattering was investigated by studying metal vapors as the appropariate Raman medium. The experiments indicate that a XeCl laser in conjunction with Pb vapor constitutes the most promising pump-compressor combination. Compression in excess of 6.7, with photon efficiencies of 42%, has been observed. DOE

N80-17460# Plessey Co. Ltd., Towcester (England). Allen Clark Research Centre.
COMPARATIVE STUDY OF 1.06 MICRON DETECTORS FOR Nd-YAG LASER APPLICATIONS Final Report
R. W. Bicknell and H. Blackburn Jun 1979 287 p refs
(Contract ESTEC-3501/78-NL-AK(SC))
(CD-6500650/G; ESA-CR(P)-1234) Avail: NTIS HC A13/MF A01

A literature survey is presented, making a comparative study of the state of the art in detectors, detector concepts, and detector technology. The theory and practical considerations of detectors for 1.06 micron laser radiation are discussed and it is shown that only photon detectors which are capable of operating at 400 Mbps at less than 100 nW received power to achieve

bit error rates less than 10 to the -6 power. The possibility of improved detector-amplifier combination performance using GaAs FET amplifiers is pointed out. A feasibility study of the growth of compound semiconductor epitaxial layers and manufacturing procedures for producing 1 to 1.6 micron detectors, is presented. Author (ESA)

N80-17461# Atomic Weapons Research Establishment, Aldermaston (England).
THE CONSTRUCTION AND PERFORMANCE OF A TRANSVERSELY EXCITED ATMOSPHERIC PRESSURE LASER (TEAL)
P. L. Eggins, R. J. Prosser, and A. C. Simmons London HMSO Jun. 1979 35 p refs
(AWRE-O-9/79; BR69056; ISBN-0-85518129-X) Avail: NTIS HC A03/MF A01; HMSO £ 1.50; PHI

The construction of a transversely excited atmospheric pressure laser is described with reference to the required specification for single pulse thermal blooming experiments. The performance parameters such as energy, temporal profile, spectrum, and stability are described. Measurements of the spatial profile are compared with theoretical predictions. The results of the pulse stretching experiments, in which the pulse is lengthened from 3 to 14 microsec, are described. Author (ESA)

N80-17462# Compagnie Generale d'Electricite, Marcoussis (France).
A SATURABLE ABSORBER FOR IODINE LASERS Final Report [ABSORBANT SATURABLE POUR LE LASER A IODE]
J. C. Farcy Dec. 1977 55 p refs In FRENCH
(Contract DGRST-76-7-1437)
Avail: NTIS HC A04/MF A01

A saturable absorber for use in a high power pulsed laser system (iodine laser at 1.315 microns) was identified. This absorber (4-diethylamino dithiobenzil nickel diluted with tetral hydrothiophen) was characterized for transmissivity (output power in function of input power; pulse duration reduction) and its relaxation time was deduced based on a model. A passive mode blocking oscillator using this absorber was built and used to generate 500 psec pulses. Author (ESA)

N80-17463# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
A PRACTICAL APPROACH TO THE DESIGN AND CONSTRUCTION OF IODINE STABILIZED LASERS
Andrew J. Wallard Mar. 1979 84 p refs
(NPL-QU-51) Avail: NTIS HC A05/MF A01

The construction and operation of an iodine stabilized helium-neon laser is described. A moderate acquaintance with the physical details of frequency stabilized lasers and the principles of the saturated absorption effect is assumed. A complete set of circuit diagrams for the laser control system is included and the adjustment and operating conditions of the laser are discussed in detail. The performance of the lasers, their limitations, and possibilities for improvement are discussed. A brief description of applications is given. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power), machine elements and processes, and mechanical equipment.

N80-17464 California Univ., Berkeley.
STUDY OF JET IGNITION FOR LEAN MIXTURES Ph.D. Thesis
Kevin Yale Teichman 1979 132 p
Avail: Univ. Microfilms Order No. 8000538

The use of jets of active radicals as igniters for lean methane-air mixtures is investigated. The effectiveness of a plasma jet igniter and a combustion jet igniter is examined experimentally and compared to that of a conventional spark. This involved studying each system's fluid dynamic characteristics and ability to extend the flammability limit of lean mixtures. In support of the experimental program, a theoretical study of the effect of radicals on ignition is also carried out. Schlieren flash photographs showed that the gas dynamic properties of the jets are primarily governed by their initial velocity, while the particular process by which they were formed plays a secondary role. The most interesting properties of jet ignition are: (1) a controllable depth of penetration; (2) zonal preturbulization; and (3) a wide dispersion of ignition sources resulting in multipoint ignition. Dissert. Abstr.

N80-17465 Stanford Univ., Calif.
MONOTONICITY ANALYSIS IN ENGINEERING DESIGN OPTIMIZATION Ph.D. Thesis
Panayiotis Yerasimos Papalambros 1979 114 p
Avail: Univ. Microfilms Order No. 8001988

Monontonicity analysis in engineering design problems having many constraints containing functions with extensive monotonic properties is examined. When applicable, it can determine which constraints are active at the optimum. Examination of the possible combinations of active constraints leads to the global optimum. Rules and practices are suggested here for initial modeling of a problem into suitable form for monotonicity analysis. A rigorous step-by-step method is developed to detect monotonic properties and use them to find the global optimum. Qualitative detection of monotonicity directly from differential equations is described. Maximum principles are used to determine the behavior of the solution. A qualitative formulation of the constraints is deduced directly from the boundary conditions. Two design examples are given, one dealing with a reflected-core nuclear reactor and another with an explosive activated cylinder. Dissert. Abstr.

N80-17466*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPUR-GEAR-SYSTEM EFFICIENCY AT PART AND FULL LOAD
Neil E. Anderson and Stuart H. Loewenthal Feb. 1980 42 p refs Prepared in cooperation with Army Aviation Res. and Develop. Command, Cleveland
(NASA-TP-1622; AVRADCOM-TR-79-46; E-061) Avail: NTIS HC A03/MF A01 CSCL 13I

A simple method for predicting the part- and full-load power loss of a steel spur gearset of arbitrary geometry supported by ball bearings is described. The analysis algebraically accounts for losses due to gear sliding, rolling traction, and windage in addition to support-ball-bearing losses. The analysis compares favorably with test data. A theoretical comparison of the component losses indicates that losses due to gear rolling traction, windage, and support bearings are significant and should be included along with gear sliding loss in a calculation of gear-system power loss. M.G.

N80-17467*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE SENSITIVITY ANALYSIS OF DEPARTMENT OF ENERGY-CHRYSLER UPGRADED AUTOMOTIVE GAS TURBINE ENGINE, S/N 5-4 Final Report
Roy L. Johnsen Dec. 1979 37 p refs
(Contract EC-77-A-31-1040)
(NASA-TM-79242; DOE/NASA/1040-79/9; E-147) Avail: NTIS HC A03/MF A01 CSCL 21A

The performance sensitivity of a two-shaft automotive gas turbine engine to changes in component performance and cycle operating parameters was examined. Sensitivities were determined for changes in turbomachinery efficiency, compressor inlet temperature, power turbine discharge temperature, regenerator effectiveness, regenerator pressure drop, and several gas flow and heat leaks. Compressor efficiency was found to have the greatest effect on system performance. K.L.

N80-17468*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRECISION RECIPROCATING FILAMENT CHOPPER Patent Application
Austin D. McHatton, Arthur L. Newcomb, Jr., and Gregory Schluge, inventors (to NASA) (Bionetics Corp., Hampton, Va.) Filed 29 Nov. 1979 11 p
(NASA-Case-LAR-12564-1; US-Patent-Appl-SN-098567) Avail: NTIS HC A02/MF A01 CSCL 13I

A chopper for cutting multifilament line is described in which the pull-pull motion of a double edged sliding blade

driven by dual solenoids, provides a chop on each motion. The line is fed by a pair of rollers one of which is driven. The chopped line length and chop rate are independently controlled. A jet airstream is provided to dispense chopped lengths of line.
NASA

N80-17469*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
SIMPLIFIED FATIGUE LIFE ANALYSIS FOR TRACTION DRIVE CONTACTS
Douglas A. Rohn, Stuart H. Loewenthal, and John J. Coy. 1980. 30 p. refs. Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, 18-22 Aug. 1980; sponsored by ASME. Prepared in cooperation with Army Aviation Res. and Develop. Command, Cleveland.
(NASA-TM-79199; AVRADCOM-TR-80-C-4; E-355) Avail: NTIS. HC A03/MF A01. CSCL 13I
A simplified fatigue life analysis for traction drive contacts of arbitrary geometry is presented. The analysis is based on the Lundberg-Palmgren theory used for rolling-element bearings. The effects of torque, element size, speed, contact ellipse ratio, and the influence of traction coefficient are shown. The analysis shows that within the limits of the available traction coefficient, traction contacts exhibit longest life at high speeds. Multiple, load-sharing roller arrangements have an advantageous effect on system life, torque capacity, power-to-weight ratio and size. Author

N80-17470*# Chrysler Corp., Detroit, Mich.
MATERIALS REVIEW FOR IMPROVED AUTOMOTIVE GAS TURBINE ENGINE. Final Report
C. Belleau, W. L. Ehlers, and F. A. Hagen. Apr. 1978. 101 p. refs. Sponsored by NASA.
(Contract EY-76-C-02-2749.A011)
(NASA-CR-159673; DOE/NASA/2749-79/4-Vol-4) Avail: NTIS. HC A06/MF A01. CSCL 21A
The potential role of superalloys, refractory alloys, and ceramics in the hottest sections of engines operating with turbine inlet temperatures as high as 1370 C is examined. The convential superalloys, directionally solidified eutectics, oxide dispersion strenghened alloys, and tungsten fiber reinforced superalloys are reviewed and compared on the basis of maximum turbine blade temperature capability. Improved high temperature protective coatings and special fabrication techniques for these advanced alloys are discussed. Chromium, columbium, molybdenum, tantalum, and tungsten alloys are also reviewed. Molbdenum alloys are found to be the most suitable for mass produced turbine wheels. Various forms and fabrication processes for silicon nitride, silicon carbide, and SIALON's are investigated for use in highstress and medium stress high temperature environments.
K.L.

N80-17471# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
APPLICATION OF ELECTRON BEAM WELDING TO HEAVY COMPONENTS
V. Colangelo. Jun. 1979. 31 p. refs.
(AD-A076173; ARLCB-MR-79014) Avail: NTIS. HC A03/MF A01. CSCL 13/8
The current investigation evaluates the mechanical properties and weld soundness of an electron beam welded casting which was substituted for a complex forging. The mechanical properties obtained were adequate, however, radiographic studies indicated considerable porosity in the welds, which was not tolerable. This porosity was the result of the agglomeration of porosity on forged specimens of the same alloy and configuration. The study showed that weldments made from forged sub-sections could meet the mechanical property and soundness requirements. GRA

N80-17472# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF WELDING THEAMAL STRAINS IN HIGH STRENGTH QUENCHED AND TEMPERED STEEL. M.S. Thesis
Mark D. Lipsey. Jun. 1978. 132 p. refs.
(AD-A075251) Avail: NTIS. HC A07/MF A01. CSCL 11/6
Previous studies of transient thermal strains during welding of high strength quenched and tempered steels are discussed. Data on the transient strain and temperature response during welding experiments on HY-130 and low carbon steel are presented. The experiments consisted of unrestrained, multipass, butt welds in one inch thick plates. The experimental results are compared to analytical predictions by the MIT computer program for the one dimensional analysis of thermal stresses and metal movement during welding. Results indicate that the program accurately predicts the temperature distribution present during welding. However, the program fails to accurately predict the transient strain response except far from the weld line where transverse strains are insignificant. Therefore, the one-dimensional program has limited usefulness for predicting response in thick sections. Recommendations are made which include a comparison of results with a two-dimensional computer analysis and a metallurgical characterization of both the weld metal and the base metal near the weld. GRA

N80-17473# Centre Technique des Industries Mecaniques, Senlis (France).
A REVIEW OF FINISHING PROCEDURES INVOLVING TURNING AND MILLING. Final Report. [ETUDE BIBLIOGRAPHIQUE. OPERATION DE FINITION EN TOURNAGE ET FRAISAGE]
M. Girard. 1 Sep. 1977. 70 p. refs. In FRENCH.
(CETIM-1-21-60-0) Avail: NTIS. HC A04/MF A01
The machining and finishing of parts, specifically when turning and/or milling operations are involved, are discussed. The literature is reviewed and a state-of-the-art assessment is made. It is concluded that improvement is possible for the cost effectiveness of these operations as well as in reducing lost material and scraps. In support of these findings work parameters affecting the quality of finished surfaces are examined and their influence on the efficiency of machining is verified experimentally. Practical suggestions as to the choice of tool specifications and operating mode to improve finished surface quality are made.
Author (ESA)

N80-17474# Centre Technique des Industries Mecaniques, Senlis (France).
REPORT ON WORK AT CETIM IN THE FIELD OF PRECISION GRINDING. PART 1: RECTIFYING PARAMETERS. [ACTION DU CETIM DANS LE DOMAINE DE LA RECTIFICATION. LES PARAMETRES DE RECTIFICATION]
J. C. Tanguy. 4 Oct. 1978. 34 p. refs. In FRENCH.
(CETIM-1-3D-25-0) Avail: NTIS. HC A03/MF A01
The different mechanical parameters which must be considered when rectifying a part with a grinding wheel are discussed. The grinding operation is defined in general terms. The grinding wheel itself is studied in terms of the work surface width and surface length to be rectified. A mathematical model is derived which gives a prediction of the expected result, depending on the job (length and width of cut), the desired precision, and on the geometry of the work surface as well as of the grinding wheel face. Results allow for the adjustment of the grinding machine used; notably feed speed and wheel rpm, as well as providing data useful in designing even more precise grinding wheels.
Author (ESA)

N80-17475# Centre Technique des Industries Mecaniques, Senlis (France).
ON THE DIMENSIONING OF BONDED SURFACES. Final Report. [CALCUL DES DIMENSIONS DES JOINTS COLLES]
J. L. Joubert, D. Benazet, and H. Ancenay. Apr. 1979. 150 p. refs. In FRENCH.
(CETIM-1-3N-05-0) Avail: NTIS. HC A07/MF A01
A method for calculating the surface areas needed to bond two flat plates so that they will not come apart under a predetermined shear load is presented. Rectangular surfaces are considered both theoretically and experimentally. Results show the importance of the glue layer thickness. A linearization of the apparent shear strength of the adhesive is used to give a minimum bonding surface prediction. Theoretical results are compared with measured shear values from destructive traction tests on bonded surfaces. Agreement is satisfactory for structural design purposes.
Author (ESA)

N80-17476# Centre Technique des Industries Mecaniques, Senlis (France).

CRITERIA FOR DETERMINING THE SPECIFICATIONS OF ACCORDION TYPE BELLOWS IN REGARDS TO FRENCH STANDARDS FOR PRESSURE APPARATUS Final Report [REGLES DE CALCUL DES COMPENSATEURS DE DILATATION A ONDES EN 'U' POUR LE CODE FRANCAIS DES APPAREILS A PRESSION]
F. Osweiller May 1979 29 p refs In FRENCH
(CETIM-14-B-08-0) Avail: NTIS HC A03/MF A01

Calculation criteria for determining the minimum thickness of expandable joint walls, the number of axial displacement cycles, and the pressure variations which the equipment can withstand are presented. The standards apply to compensators with monolayer dilatation and sides formed of a series of one or more identical U shaped bulges. Each bulge is described as two symmetrical halfwaves with the line portion of the halfwave having a maximum deviation from the vertical of 8 deg. The possible effects of vibration on the structure are not considered.
Author (ESA)

N80-17477# Centre Technique des Industries Mecaniques, Senlis (France).
REPORT ON WORK AT CETIM ON PRECISION GRINDING, PART 4 [ACTION DU CETIM DANS LE DOMAINE DE LA RECTIFICATION]
M. Tanguy 14 Jun. 1979 58 p In FRENCH
(CETIM-1-3D-25-0) Avail: NTIS HC A04/MF A01

Data relative to the choice of a grinding wheel for a given job are discussed. In service tests on different grades of grinding wheels were carried out and their wear was measured. Results show that the grade of a grinding wheel has an important influence on the work needed to make a cut as well as on the energy consumed during the operation. However, it has little effect on the condition of the finished surface. Surface quality depends on such factors as abrasive grain size, feed speed, wheel rpm, etc. By quantitatively following the wear of a grinding wheel as a function of material it is shown how the choice of grade can increase grinding efficiency and reduce the need for frequent wheel truing.
Author (ESA)

N80-17478# Centre Technique des Industries Mecaniques, Senlis (France).
DESIGN SPECIFICATIONS FOR STAMPING TOOLS Final Report [CONTRAINTES DANS LES OUTILLAGES D'ESTAMPAGE]
J. L. Montagut 5 May 1979 109 p refs In FRENCH
(CETIM-1-3K-16-0) Avail: NTIS HC A06/MF A01

A finite element method is presented as a support for the computer assisted design of forming tools used in metal working. Emphasis is on the calculation of the pressing force distribution across the tool surface during forming. Semi-complex part shapes, generally flat or symmetrical, are considered. Numerous applications are cited for calculating tool mechanical load limits leading to a reduction in tool damage due to crack initiation at tool contours. It is also shown that changes in the exterior geometry of the tool have little effect on its service life. The generalized application of this design analysis method to precision forging is discussed.
Author (ESA)

N80-17479# Centre Technique des Industries Mecaniques, Senlis (France).
CONCEPT AND CONSTRUCTION OF TORQUES BOLTED ASSEMBLIES Final Report [CONCEPTION OET MONTAGE DES ASSEMBLAGES BOULONNES PRECONTRAINTS]
C. Sayettat Jun. 1979 113 p refs In FRENCH Supsersedes CETIM-1-1G-05-0
(CETIM-1-3N-06-0; CETIM-1-1G-05-0) Avail: NTIS HC A06/MF A01

Theoretical models are developed for optimizing bolted structure geometries, torqued to a specific value. An attempt is made to rationalize the use of bolts while reducing materials costs, but maintaining a specified level of reliability. It is emphasized that these models have not been proven experimentally and suggestions are made for possible tests. Author (ESA)

N80-17480# Centre Technique des Industries Mecaniques, Senlis (France).
A REVIEW OF WORK CONCERNING REDUCTION GEAR TRAINS [ETUDE EXPLORATOIRE DES EFFORTS DANS LES REDUCTEURS PLANETAIRES]
A. Ayel and J. Chalier Apr. 1979 38 p refs In FRENCH
(CETIM-1-4H-30-0) Avail: NTIS HC A03/MF A01

After a review of the literature, theory, and calculation methods regarding the positioning of contact points in multiple gear reduction configurations are discussed. The application of these formulas is demonstrated by analyzing the differences in power transmission, based on the number of contact points during meshing, for different gear train sizes. Finally, examples of various gear teeth ratio dependent reduction designs are shown, being limited to those configurations which could possibly be built.
Author (ESA)

N80-17481# Centre Technique des Industries Mecaniques, Senlis (France).
REPORT ON WORK AT CETIM IN THE FIELD OF PRECISION GRINDING, PART 3 [ACTION DU CETIM DANS LE DOMAINE DE LA RECTIFICATION]
M. Tanguy 12 Apr. 1979 51 p In FRENCH
(CETIM-13-D-25-0-Pt-3) HC A04/MF A01

Tests designed to show the influence of the diamond point on grinding wheel performance and on the characteristics of the finished surfaces are presented. Variables include the type of diamond point (cut stone, recut point, or raw diamond) and the amount of material removed at each adjustment. Steel (100C6) parts were used as work pieces. A first set of experiments involved adjustments to the grinding surface of from 0.05 to 0.8 mn/rev. A second set of experiments, using 35NCD16 steel parts, was based on facing adjustments of 0.1 to 0.4 mm/rev. Combined results show that increasing the diamond facing cut increases the roughness of the finished surface. Changing the diamond type also effects finished surface quality. Author (ESA)

N80-17482# Centre Technique des Industries Mecaniques, Senlis (France).
PREDICTION OF DYNAMIC PROPERTIES OF A ROTOR SUPPORTED BY HYDRODYNAMIC BEARINGS USING THE FINITE ELEMENT METHOD Final Report
J. Peigney 19 Sep. 1979 30 p refs Presented at Intern. Conf. on Eng. Appl. of the Finite Element Method, Oslo, May 1979
(CETIM-1-4A-29-0) Avail: NTIS HC A03/MF A01

General programs for rotor bearing analysis using the finite element method are presented. A consistent representation of both mass and stiffness is used for the rotor shaft while hydrodynamic bearings are calculated by solving a Reynolds equation. Dynamic characteristics of these bearings are then obtained with a perturbation method. These programs are compared with both numerical and experimental results from the literature and agreement is shown to be good. The influence of bearing characteristics on the stability threshold and the unsteady response of a rotor are also studied. Author (ESA)

N80-17483# Centre Technique des Industries Mecaniques, Senlis (France).
CRITERIA FOR DETERMINING THE SPECIFICATIONS OF ACCORDION TYPE BELLOWS BASED ON FRENCH STANDARDS FOR PRESSURE APPARATUS Final Report [REGLES DE CALCUL DES COMPENSATEURS DE DILATATION A ONDES EN U POUR LE CODE FRANCAIS DES APPARGILS A PRESSION]
F. Osweiller 11 Jun. 1979 29 p refs In FRENCH
(CETIM-1-4B-08-0) Avail: NTIS HC A03/MF A01

Calculation criteria for determining the minimum thicknesses of expandable joint walls as well as the number of axial displacement cycles and the pressure variations which these structures can withstand are given. These standards only apply to pressure compensators designed for monolayer dilatation and having sides formed into a series of one or more identical T-shaped bulges. Each bulge is described as two symmetrical half waves. A half wave is formed by a line with curves at each end and having the same arc and arc length. The line portion of the half wave can have a maximum deviation from the vertical of 8 deg. These design criteria do not take into consideration the possible effects of vibration on the structure. Author (ESA)

N80-17484# Transportation Systems Center, Cambridge, Mass.
COMPARISON OF FUEL ECONOMY AND EMISSIONS FOR

DIESEL AND GASOLINE POWERED TAXICABS Final Report, Jun. 1976 - Apr. 1979
K. M. Hergenrother Washington Jul. 1979 30 p
(PB-298609/9; DOT-TSC-UMTA-79-30; UMTA-MA-06-0066-79-1) Avail: NTIS HC A03/MF A01 CSCL 21D

Potential improvements in fuel economy and exhaust emissions by dieselization of the taxi fleet in a large urban area was assessed. Sixty-six diesel powered taxicabs and an equal number of gasoline powered cabs were operated for 120,000 miles each in three taxicab fleets in New York City. Identical cabs were powered with either 198 CID diesel engines or 225 CID gasoline engines. Test results from all cabs were used to determine fuel economy and exhaust emissions. On the road, the diesel cabs had 50 percent better fuel economy than the gasoline cabs; the diesel exhaust emissions (HC, CO, NOx) were lower than the gasoline exhaust emissions over the life of the test. Emission from the diesels did not appreciably degrade with vehicle age; emission from the gasoline cabs increased appreciably. GRA

N80-17485# National Bureau of Standards, Washington, D.C. Fracture and Deformation Div.
ANALYSIS OF THE PNEUMATIC BURST OF A LARGE SEAMLESS STEEL PRESSURE VESSEL IN NATURAL GAS SERVICE
Bruce W. Christ Mar. 1979 121 p
(Contract DOT-AS-40034)
(PB-300579/0; NBSIR-78-1589) Avail: NTIS HC A06/MF A01 CSCL 13D

A metallurgical evaluation and fracture analysis was made of a pneumatically-burst seamless steel compressed gas cylinder which was used for over-the-highway transport of natural gas. The cylinder ruptured due to environmentally-assisted cracking. The fracture originated at a part-through crack in a region of high tensile strength. Four other part-through cracks were found in the vicinity of the fracture origin. Up to 500 ppm by volume of hydrogen sulfide was detected in gas samples taken from the natural gas wells after the incident. Evidence of sulfur was found on the fracture origin and on the inside wall. It was concluded that the rupture was due to the internal gas pressure acting on the region of the fracture origin. GRA

N80-17486# Massachusetts Univ., Amherst. Dept. of Mechanical Engineering.
DESIGN FOR MANUFACTURABILITY: NONPRODUCTIVE TIME IN CONVENTIONAL METAL CUTTING (DESIGN FOR MANUFACTURABILITY)
L. Fridriksson and T. Cullinane Feb. 1979 158 p
(Grant NSF APR-77-10197)
(PB-300511/3; NSF/RA-790092; Rept-3) Avail: NTIS HC A08/MF A01 CSCL 13H

Procedures are determined for estimating the cost of the nonproductive time which occurs during conventional metal cutting. This includes both the cost of material handling between machines, and the nonproductive time required to handle individual parts during machining operations. These times and costs are determined as a function of each part's design. By determining the Optiz code number for a particular part and its mass, it is possible to estimate, through the application of the procedure developed, the nonproductive time and the material handling cost associated with the part's manufacture. GRA

N80-17487# National Technical Information Service, Springfield, Va.
HIGH TEMPERATURE BEARINGS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979
William E. Reed Nov. 1979 174 p Supersedes NTIS/PS-78/1060; NTIS/PS-77/0911; NTIS/PS-76/0784; NTIS/PS-75/716
(PB80-800485; NTIS/PS-78/1060; NTIS/PS-77/0911; NTIS/PS-76/0784; NTIS/PS-75/716) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

The bibliography covers the design, development, applications, and material studies with applications to bearings, gas turbines, nuclear reactors, and space applications. Research on gas bearings, high speed bearings, and lubrication are included. This updated bibliography contains 168 abstracts, 10 of which are new entries to the previous edition. GRA

N80-17488# National Technical Information Service, Springfield, Va.
ROLLER BEARINGS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Oct. 1979
Guy E. Habercom, Jr. Nov. 1979 206 p Supersedes NTIS/PS-78/1110; NTIS/PS-77/0986; NTIS/PS-76/0886; NTIS/PS-75/803
(PB80-800857; NTIS/PS-78/1110; NTIS/PS-77/0986; NTIS/PS-76/0886; NTIS/PS-75/803) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Design and performance of roller bearings are investigated in these Government-sponsored research reports. Rolling contact bearing surfaces, hardening methods, mechanical properties, and lubricating techniques are among the areas reviewed. This updated bibliography contains 200 abstracts, 17 of which are new entries to the previous edition. GRA

N80-17489# National Technical Information Service, Springfield, Va.
BALL BEARINGS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Oct. 1979
Guy E. Habercom, Jr. Nov. 1979 247 p Supersedes NTIS/PS-78/1119; NTIS/PS-77/0996; NTIS/PS-76/0885
(PB80-800840; NTIS/PS-78/1119; NTIS/PS-77/0996; NTIS/PS-76/0885) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Design and performance of ball bearings are investigated in these reports gathered in a worldwide literature survey. Wear resistance, lubrication means and effectiveness, and physical properties are among the parameters reviewed. This updated bibliography contains 242 abstracts, 36 of which are new entries to the previous edition. GRA

N80-17490# National Technical Information Service, Springfield, Va.
BALL BEARINGS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Sep. 1979
Guy E. Habercom, Jr. Nov. 1979 237 p Supersedes NTIS/PS-78/1118; NTIS/PS-75/806
(PB80-800832; NTIS/PS-78/1118; NTIS/PS-77/0995; NTIS/PS-76/0884; NTIS/PS-75/806) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Design and performance of ball bearings are investigated in these Government-sponsored research reports. Wear resistance, lubrication means and effectiveness, and physical properties are among the parameters reviewed. This updated bibliography contains 227 abstracts, 13 of which are new entries to the previous edition. GRA

N80-17491# National Technical Information Service, Springfield, Va.
ROLLER BEARINGS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Oct. 1979
Guy E. Habercom, Jr. Nov. 1979 236 p Supersedes NTIS/PS-78/1111; NTIS/PS-77/0987; NTIS/PS-76/0887
(PB80-800865; NTIS/PS-78/1111; NTIS/PS-77/0987; NTIS/PS-76/0887) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Design and performance of roller bearings are investigated in these reports gathered in a worldwide literature survey. Rolling contact bearing surfaces, hardening methods, mechanical properties, and lubricating techniques are among the areas reviewed. This updated bibliography contains 244 abstracts, 30 of which are new entries to the previous edition. GRA

N80-17266 Arya Mehr Univ. of Technology, Teheran (Iran). Dept. of Mechanical Engineering.
MULTI-VARIABLE OPTIMIZATION FOR VIBRATION ISOLATION OF ROAD VEHICLES
Ebrahim Esmailzadeh *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 85-96 refs
(For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

N80-17267* Lord Kinematics, Erie, Pa.
ISOLATION MOUNTS FOR THE HEAO-B X-RAY TELESCOPE
H. L. Hain and R. Miller (American Science and Engineering, Inc., Cambridge, Mass.) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 97-113 refs (For primary document see N80-17258 08-31)
(Contract NAS8-30750)
Avail: NRL, Tech. Inform. Div., Washington D.C. CSCL 13I

N80-17288 Concordia Univ., Montreal (Quebec).
RANDOM FATIGUE DAMAGE APPROACH TO MACHINERY MAINTENANCE
T. Seshadri Sankar, G. D. Xistrix, and G. L. Ostiguy *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 103-114 refs Prepared jointly with Ecole Polytechnique, Montreal (Quebec) (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17298*# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
EVALUATION OF ROTOR-BEARING SYSTEM DYNAMIC RESPONSE TO UNBALANCE
Roger E. Thaller and David W. Ozimek *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 41-53 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 13I

N80-17300*# Gilbert/Commonwealth, Jackson, Mich.
EXPERIMENTAL INVESTIGATION OF DYNAMIC CHARACTERISTICS OF TURBINE GENERATORS AND LOW-TUNED FOUNDATIONS
S. P. Ying, M. E. Forman, and R. R. Drumm *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 69-77 refs Prepared in cooperation with Pennsylvania Power and Light Co., Allentown (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 21E

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques, and quality control.

N80-17492 California Univ., Berkeley.
RELIABILITY SYSTEMS WITH EXPONENTIAL DISTRIBUTED COMPONENT LEVELS Ph.D. Thesis
Yu-Song Yen 1979 86 p
Avail: Univ. Microfilms Order No. 8000584

Two problems are studied; the allocation of resources and the concept of the reliability importance of each component. The most important component of the system is determined by using Schur convex/concave properties of system reliability functions. Dissert. Abstr.

N80-17493 Centre Technique des Industries Mecaniques, Senlis (France).
A REVIEW OF THE DETECTION OF THE NATURE AND GEOMETRY OF INTERNAL FLAWS AND PITS. PART 2: FOCUSING ULTRASONIC BEAMS Final Report [CONNAISSANCE DE LA LOCALISATION DE LA NATURE ET DE LA FORME DANS L'ESPACE DES DEFAUTS INTERNES ET DEBOUCHANTS]
C. Flambard, A. Lambert, J. Rivenez, and Y. Pralus 28 Aug. 1979 16 p refs In FRENCH 4 Vol.
(CETIM-1-5H-05-0-Pt-2A) Avail: NTIS HC A02

The literature on the focusing of ultrasonic beams is reviewed. Abstracts of the documents cited are given and pertinent conclusions are summarized. These include a function for the variation of the echo intensity as a point of reference and the possibility of rotating the target to decrease the intensity of a given echo. Emphasis is on the dimensioning of flaw geometries. Approximately 80 bibliographies are included. Author (ESA)

N80-17494 Centre Technique des Industries Mecaniques, Senlis (France).
THE DEFINITION AND ADAPTATION OF ACOUSTIC BEAMS FOR ULTRASONIC INSPECTION. PART 4: BIBLIOGRAPHY Final Report [LA DEFINITION ET L'ADAPTATION DU FAISCEAU ACOUSTIQUE EN CONTROLE PAR ULTRASONS]
A. Lambert and Y. Pralus 18 May 1979 10 p refs In FRENCH 4 Vol.
(CETIM-1-5H-10-0-Pt-4) Avail: NTIS HC A02

The use of focused ultrasonic acoustic beams for nondestructive parts inspection is considered. The structures of acoustic fields around transducers are analyzed theoretically. A traditional definition of the acoustic field of a phase transducer is presented. The influence of a focusing lens is then examined. Results show that two models for representing these beams are possible. One is based on a focal point concept, the other on the beam width. Agreement between the practical characterization of these beams and the theoretical models developed is good, provided that the analysis of the beam is carried out under precisely controlled conditions. How these models can be used to characterize transducers for ultrasonic inspection is shown. Author (ESA)

N80-17495# Villanova Univ., Pa. Dept. of Mechanical Engineering.
AEROSTRUCTURE NONDESTRUCTIVE EVALUATION BY THERMAL FIELD TECHNIQUES Final Report, 17 Mar. 1978 - 17 Jan. 1979
P. V. McLaughlin, Jr., E. V. McAssey, Jr., and R. C. Deitrich 1 Nov. 1979 40 p refs
(Contract N68335-78-M-5337)
(AD-A076541; NAEC-92-131) Avail: NTIS HC A03/MF A01 CSCL 14/2

Certain types of flaws and damage in composite materials are not readily observable by visual examination. Examples of these are delaminations, blindside impact damage, and sub-surface laminar cracks. Programs are currently underway to develop methods of detecting such flaws by many techniques, among which are X-ray, neutron radiography, ultrasonic transmission and reflectance, eddy current, and thermography. This report describes results of an experimental and analytical research investigation to evaluate infrared thermography as an NDE tool to locate structural damages which are not easily located by visual examination. Also discussed are possible applications to aluminum structures. GRA

N80-17496# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
THE RELATIONSHIPS BETWEEN FAILURE RATES AND ELECTRICAL PARAMETERS OF ELECTRONIC COMPONENTS [RELATIONS ENTRE LES TAUX D'AVARIE ET LES PARAMETERS ELECTRIQUES DES COMPOSANTS ELECTRONIQUES]
Vinod Kumar and Louis-Francois Pau Dec. 1978 25 p refs In FRENCH; ENGLISH summary
(ENST-D-78017) Avail: NTIS HC A02/MF A01

An attempt to relate the electrical parameters of electronic components to their failure rates is described. Problems concerning the availability and use of data regarding the failure rate and electrical parameters of components are discussed with emphasis on the variety of test methods and the data sources for the components. Explicit relations between the failure rates of the discrete components (active and passive) and their electrical parameters are calculated and tabulated, the failure rate and parameter data are included. The failure mechanisms of integrated circuits (SSI, MSI, and LSI) are discussed as an aid to finding the informative parameters of such components. Author (ESA)

N80-17497# Centre Technique des Industries Mecaniques, Senlis (France).
A REVIEW OF THE DETECTION OF THE NATURE AND GEOMETRY OF INTERNAL FLAWS AND PITS. PART 1: ULTRASONICS Final Report [CONNAISSANCE DE LA LOCALISATION DE LA NATURE ET DE LA FORME DANS L'ESPACE DES DEFAUTS INTERNES ET DEBOUCHANTS]
C. Flambard, A. Lambert, J. Rivenez, and Y. Pralus 28 Aug. 1979 17 p refs In FRENCH 4 Vol.
(CETIM-1-5H-05-0-Pt-1) Avail: NTIS HC A02/MF A01

Various techniques of ultrasonic flaw detection are reviewed. Methods covered include the Pohlmann cell, the ultrasonic camera, echogram generators, and holography. The reflected echos method is cited as being generally the most reliable to date. However, none of the methods examined satisfactorily detects dimensional characteristics of flaws. Holography was considered the most promising approach to this problem, yet with the advent of focused transducers, interest has somewhat shifted away from this technique.
Author (ESA)

N80-17498# Centre Technique des Industries Mecaniques, Senlis (France).
A REVIEW OF THE DETECTION OF THE NATURE AND GEOMETRY OF INTERNAL FLAWS AND PITS. PART 2B: SPECTRAL ANALYSIS OF ULTRASONIC ECHOES Final Report [CONNAISSANCE DE LA LOCALISATION DE LA NATURE ET DE LA FORME DANS L'ESPACE DES DEFAUTS INTERNES ET DEBOUCHANTS]
C. Flambard, A. Lambert, J. Rivenez, and Y. Pralus 28 Aug. 1979 37 p refs In FRENCH 4 Vol.
(CETIM-1-5H-05-0-Pt-2B) Avail: NTIS HC A03/MF A01

The literature on the spectrum analysis of ultrasonic echoes is reviewed and abstracts of the most significant documents cited are given/ Main topics considered include dual-frequency ultrasonic echo testing, the determination of defect geometry through frequency analysis, broadband ultrasonic techniques, the characterization of flaws by ultrasonic spectroscopy in amplitude and in phase, and ultrasonic beam diffraction by artificial flaws. Emphasis is on possible industrial applications of ultrasonics for quality control.
Author (ESA)

N80-17499# Centre Technique des Industries Mecaniques, Senlis (France).
A REVIEW OF THE DETECTION OF THE NATURE AND GEOMETRY OF INTERNAL FLAWS AND PITS. PART 4: ULTRASONIC SPECTRAL ANALYSIS EXPERIMENTATION Final Report [CONNAISSANCE DE LA LOCALISATION DE LA NATURE ET DE LA FORME DANS L'ESPACE DES DEFAUTS INTERNES ET DEBOUCHANTS]
C. Flambard, A. Lambert, J. Rivenez, and Y. Pralus 30 Aug. 1979 39 p In FRENCH 4 Vol.
(CETIM-1-5H-05-0-Pt-4) Avail: NTIS HC A03/MF A01

The design and construction of laboratory equipment for the study of echoes diffracted by defects in otherwise homogeneous mediums are described. A rig for controlling the orientation of the sonde as well as the measurement instrumentation are covered. Preliminary tests results along with the data acquisition system are shown and the theory of spectral analysis for acoustic emission lines, both of echo intensity and pulse beam deflection, is given. Results indicate the validity of ultrasonic spectroscopy for determining the dimensions of defects in solid or liquid mediums.
Author (ESA)

N80-17500# Centre Technique des Industries Mecaniques, Senlis (France).
THE DEFINITION AND ADAPTATION OF ACOUSTIC BEAMS FOR ULTRASONIC INSPECTION. PART 2: ULTRASONIC TRANSDUCERS FOR FOCUSED BEAMS Final Report [LA DEFINITION ET L'ADAPTATION DU FAISCEAU ACOUSTIQUE EN CONTROLE PAR ULTRASONS]
A. Lambert and Y. Pralus 13 Jun. 1979 43 p In FRENCH 4 Vol.
(CETIM-15-H-10-0-Pt-2) Avail: NTIS HC A03/MF A01

The use of focused ultrasonic acoustic beams for nondestructive parts inspection is considered. The structures of acoustic fields around transducers are analyzed theoretically and a traditional definition of the acoustic field of a plane transducer is presented. The influence of a focusing lens is then examined. Results show that two models representing these beams are possible. One is based on a focal point concept, the other on the beam width. Agreement between the practical characterization of these beams and the theoretical models is good, provided that the analysis of the beam is carried out under precisely controlled conditions. The use of these models to characterize transducers for ultrasonic inspection is demonstrated.
Author (ESA)

N80-17501# Centre Technique des Industries Mecaniques, Senlis (France).
INTEGRATED INSPECTION OF LARGE, DROP FORGED PARTS: RESULTS TO DATE USING ULTRASONIC FLAW DETECTION [CONTROL INTEGRE DES PIECES DE GROSSE FORGE: RESULTATS ACTUELS]
J. Rivenez and B. Bossuat 9 Apr. 1979 34 p In FRENCH (CETIM-1-5H-19-0) Avail: NTIS HC A03/MF A01

Different ultrasonic inspection techniques were tested. In most cases parts coming from a drop forge procedure, with large dimensions, and not yet having undergone finishing procedures, were inspected. Problems, such as detection of defects in the presence of parasite echoes and the rapid and accurate handling of the acquired data, are considered. Results are not conclusive. Practical application of this technique was not achieved, mainly due to difficulties in eliminating background noise effects. Several possible solutions are suggested. It is also noted that the test conditions were not as severe as one might expect in many industrial applications.
Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-17502 California Univ., Berkeley.
THE ELASTOSTATIC AXISYMMETRIC PROBLEM OF CRACKED SPHERE EMBEDDED IN A DISSIMILAR MATRIX Ph.D. Thesis
Rishi Kant 1979 79 p
Avail: Univ. Microfilms Order No. 8000395

The elastostatic axisymmetric problem of a sphere, containing a centrally located penny shaped crack, embedded in a dissimilar matric subject to far field loads was solved by using Boussinesq stress functions. There were two coordinate systems - oblate spheroidal for representing the crack surface and spherical polars for the spherical surface - used to satisfy boundary conditions. Integral representations and transformations of harmonic functions were used to relate stress functions in the two coordinate systems. This procedure led to a system of algebraic equations which were solved, for axisymmetric tractions on both the surfaces. This solution was then used to obtain the solution of the original problem. A representation of the solution for the axisymmetric problem of a crack in an infinite medium is also presented.
Dissert. Abstr.

N80-17503 Stanford Univ., Calif.
ACOUSTOELASTICITY: STRESS MEASUREMENTS USING ULTRASONICS Ph.D. Thesis
George Carver Johnson 1979 136 p
Avail: Univ. Microfilms Order No. 8001945

The nondestructive testing technique acoustoelasticity is presented as a method for the evaluation of stress within a specimen. This method makes use of changes in acoustic wave speed as the stress within the body changes. Velocity changes of plane waves as functions of stress and strain are developed in general form using the theory of elasticity. The equations for the velocities are shown to be linear in stress and strain when the material strain energy function is assumed to include terms through third order in strain. The theoretical basis for making the measurements in terms of frequency changes is presented.
Dissert. Abstr.

N80-17504 Stanford Univ., Calif.
INFLUENCE OF FINE PARTICLES ON MECHANICAL BEHAVIOR OF POLYCRYSTALLINE SOLIDS Ph.D. Thesis
Jer-hong Lin 1979 205 p
Avail: Univ. Microfilms Order No. 8001961

A phenomenological equation was proposed to described the creep behavior of oxide dispersion strengthened materials with emphasis on TD-Nichrome. Thermal-mechanical processing treatments were developed for attainment of fine microstructures in the 52100 bearing steel. Three mechanical properties were

assessed for a 52100 bearing steel with an ultrafine structure. A unique transformation product, called the divorced eutectoid, was observed in the processed ultrafine microstructure 52100 bearing steel. Another high carbon speciality steel, 01 cold work steel, was made superplastic by the methods developed from previous studies on the 52100 bearing steel.Dissert. Abstr.

N80-17505 Iowa State Univ. of Science and Technology, Ames.
STUDIES ON THE YIELD BEHAVIOR OF PHOTOPLASTIC MATERIALS Ph.D. Thesis
Jose Luiz deFranca Freire 1979 100 p
Avail: Univ. Microfilms Order No. 8000134

The influences of strain rate and temperature on the yield strength of several polyester materials and polycarbonate were studied. The initial yield locus for both materials is well represented in the tension-compression quadrant by a pressure modified von Mises criterion. The photoplastic method of analzying unloaded models after using slicing techniques is discussed and applied to a plane strain compression example and to the axisymmetric compression of cylinders. A nonlinear finite element program, NONSAP, was employed to obtain solutions, based on von Mises and Drucker-Prager criteria, for the plane strain example in order to compare results. It is shown that photoplastic methods and finite element techniques can be combined to obtain solutions which would be difficult to verify if either method were used independently. Dissert. Abstr.

N80-17506# Aeronautical Research Labs., Wright-Patterson AFB, Ohio.
THE FRACTURE OF A PARACHUTE HOOK: A CASE STUDY OF THE ROLE OF MATERIALS PARAMETERS IN RELIABILITY ANALYSIS
L. R. F. Rose and B. J. Wicks 1979 28 p refs
(ARL-MAT-Note-125; AR-001-591) Avail: NTIS
HC A03/MF A01

A detailed analysis of the risk of failure for the particular case of a parachute hook is used to illustrate what information is required for that purpose, how much of it is readily available, and in what areas further research is needed. The analysis relies on the use of a full scale test to identify the mode of failure and hence the relevant strength parameter. It is concluded that an important role of materials research is to provide an understanding of the factors which can affect mechanical properties, so that the characteristics of the relevant population of structures or components may be more precisely defined, and the variability in strength which can be expected in service may be estimated. A number of topics for further research are discussed, but the practical value of this research will depend on the precision of the results obtained and this cannot be determined beforehand. Author

N80-17507# Aeronautical Research Labs., Melbourne (Australia).
THREE DIMENSIONAL VIBRATIONS IN A RECTANGULAR BAR
T. G. Ryall Oct. 1978 19 p refs
(ARL/Struc-Rept-373; AR-001-306) Avail: NTIS
HC A01/MF A01

An analysis of the free vibrations of a rectangular bar which is semi-infinite in all directions is presented. It is shown that there are six possible types of vibration which allow three adjacent surfaces to be free from normal stress. Three of these vibrations correspond to a corner rotating and the remaining three correspond to a corner translating. The vibration of a rubber block, which as a Poisson's ratio of 0/5, is discussed, and the results illustrate how these fundamental solutions combine to give a free vibration. M.G.

N80-17508# National Aerospace Lab., Amsterdam (Netherlands).
ADDITIONAL INFORMATION ABOUT FALSTAFF
J. B. DeJonge 6 Dec. 1979 13 p refs
(NLR-TR-79056-U; ICAF-1133) Avail: NTIS
HC A02/MF A01

The defining properties are described for a standard load sequence considered representative of the load time history in the lower wing skin near the wing root of a fighter aircraft. The complete FALSTAFF sequence of numbers, ranging from 1 to 32, represents 200 'flights', and consists of 35966 numbers equally distributed over peaks and troughs. The program does not define the way, both with regard to shape and time, in which the load varies between a trough and a peak. The complete Markov-matrix plus tabulations and level crossings pertaining to the FALSTAFF-sequence are presented. A.R.H.

N80-17509# Boeing Co., Wichita, Kans.
EVALUATION OF THE CRACK GAGE CONCEPT FOR MONITORING AICRAFT FLAW GROWTH POTENTIAL, VOLUME 2 Final Report, 1 Jul. 1977 - 1 Dec. 1978
Gary G. Cassatt Jun. 1979 262 p
(Contract F33615-77-C-5023)
(AD-A076320; AFML-TR-79-4037-Vol-2) Avail: NTIS
HC A12/MF A01 CSCL 01/3

The results of a test program to evaluate the ability of a bonded-on precracked coupon to monitor the growth of flaws in the basic structure are included. All testing utilized 7075-T651 aluminum from a single plate. Both constant thickness and stepped crack gages were evaluated. Evaluation of a wide range of sensitivity in crack gage crack growth response was made. Structure flaws of (1) corner flaw at a hole, (2) through flaw at a hole, and (3) center notch flaw were evaluated. The cyclic test loading included constant amplitude of two R ratios and three representative aircraft usage flight profiles. Strain gage instrumentation was used to measure structure stresses and load transferred into the crack gages. GRA

N80-17510# Boeing Co., Wichita, Kans.
EVALUATION OF THE CRACK GAGE CONCEPT FOR MONITORING AIRCRAFT FLAW GROWTH POTENTIAL VOLUME 1. TECHNICAL DISCUSSION Final Report, 1 Jul. 1977 - 1 Dec. 1978
Gary G. Cassatt Jun. 1979 112 p refs
(Contract F33615-77-C-5073)
(AD-A076421; AFML-TR-4037 Vol-1) Avail: NTIS
HC A06/MF A01 CSCL 01/3

The results of a test program to evaluate the ability of a bonded on precracked coupon to monitor the growth of flaws in the basic structure are included. All testing utilized 7075-T651 aluminum from a single plate. Both constant thickness and stepped crack gages were evaluated. Evaluation of a wide range of sensitivity in crack gage crack growth response was made. Structure flaws of, (1) corner flaw at a hole, (2) through flaws at a hole and (3) center notch flaw were evaluated. The cyclic test loading included constant amplitude of two R ratios and three representative aircraft usage flight profiles. Strain gage instrumentation was used to measure structure stresses and load transferred into the crack gages. GRA

N80-17511# Pennsylvania State Univ., University Park. Applied Research Lab.
VIBRATION OF PLATES OF VARIOUS GEOMETRIES Ph.D. Thesis
Earl G. Williams 17 Jun. 1979 158 p refs
(Contract N00024-79-C-6043)
(AD-A076185; ARL/PSU/TM-79-130) Avail: NTIS
HC A08/MF A01 CSCL 11/6

Point driven, flat, thin aluminum plates of various geometries with free boundaries are studied in this thesis. We have applied a theory which allows the mean of the driving point admittance to be predicted over a wide frequency range at any point on these plates. This prediction is compared to the experimentally determined admittance. Also, the expected minimum and maximum variations about this mean are predicted and compared to the experimental data over a broad frequency range. Measured loss factors for these free plates were used in the theoretical models. The actual admittance versus frequency for a center driven rectangular plate was predicted using a mode sum technique and compared to measured data. A simple algebraic formula was used to predict the resonance frequencies of the rectangular and square plates with free boundaries. The transfer admittance of these point driven plates was also measured experimentally and compared to a theory which predicts the mean admittance versus frequency. The dependence of this mean on plate size and also on plate damping was demonstrated. GRA

N80-17512# State Univ. of New York at Buffalo. Dept. of Engineering Science.
CREEP DAMAGE UNDER ONE-DIMENSIONAL VARIABLE

TENSILE STRESS Summary Report
F. A. Cozzarelli and G. Bernasconi Sep. 1979 33 p refs
(Contract N00014-75-C-0302)
(AD-A075780; REPT-114) Avail: NTIS HC A03/MF A01 CSCL 20/11

A nonlinear damage relation, containing the axial strain history and a time integral over the stress history, is proposed for the case of one-dimensional time dependent tensile stress. Nonlinear steady and transient creep terms are included in the axial strain relation, and elastic and creep Poisson's ratios are introduced into the lateral strain relation. Using these relations, complete damage solutions are obtained for the constant stress rate, step stress, relaxation and constant load tests. Observations are made concerning the associated rupture times. GRA

N80-17513# Southwest Research Inst., San Antonio, Tex.
FATIGUE-MICROCRACK BEHAVIOR UNDER THE INFLUENCE OF SURFACE RESIDUAL STRESSES Interim Report, 1 Aug. 1978 - 31 Jul. 1979
J. E. Hack and G. R. Leverant 1 Oct. 1979 42 p refs
(Contract N00014-78-C-0674)
(AD-A075285) Avail: NTIS HC A03/MF A01 CSCL 20/11

Direct observations of the surface crack opening displacement (SCOD) of surface microcracks have been performed on samples of Ti-6Al-4V under both cyclic and static loading conditions. The observations were conducted in a specially-designed loading stage in-situ in a scanning electron microscope. SCOD's of cracks as small as 7 microns in surface length have been studied with this technique. Preliminary results have indicated that crack opening is purely elastic for the strain range studied although a significant residual opening is apparent when no load is applied. Concurrent with the experimental efforts, an analytical approach has been developed to predict SCOD for both elastic and plastic loading conditions based on crack geometry. The correlation between predicted SCOD values and independent data for microcracks is excellent. The approach will be modified to account for the influence of an imposed residual stress field and compared to experimental results on microcrack behavior. GRA

N80-17514# Naval Postgraduate School, Monterey, Calif.
VIBRATION OF A CANTILEVER BEAM THAT SLIDES AXIALLY IN A RIGID FRICTIONLESS HOLE
Arthur P. Boresi and David Salinas Sep. 1979 24 p refs
(AD-A075944; NPS-69-79-009) Avail: NTIS HC A02/MF A01 CSCL 13/13

This paper considers a cantilever beam which can move in and out of a rigid frictionless hole. Hamilton's principle is used for the development of two governing equations, and boundary conditions defined over a moving boundary. A transformation of coordinates is used to transform the problem into a system of two nonlinear p.d.e. defined over a fixed region. A discussion of some mathematical and physical considerations is presented. Finally, a finite element formulation of the problem is presented. GRA

N80-17515# Catholic Univ. of America, Washington, D. C. Dept. of Physics.
RESONANT SCATTERING OF ELASTIC WAVES FROM SPHERICAL SOLID INCLUSIONS Technical Report, 1 Feb. 1979 - 30 Jun. 1980
Lawrence Flax and Herbert Neberall Sep. 1979 44 p refs
(Contract N00014-76-C-0430; RR0110801)
(AD-A075659) Avail: NTIS HC A03/MF A01 CSCL 20/11

Previous investigations concerning the scattering of elastic waves from solid spherical inclusions have furnished expressions for the scattering cross sections which, upon numerical evaluation, exhibited resonance-like features as a function of frequency. In the present work, we study these resonances in a fashion suggested by the resonance theory of acoustic scattering. The resonances of the solid inclusions, exemplified by iron or lucite spheres imbedded in an aluminum matrix, are found numerically in the individual normal-mode scattering amplitudes, and are interpreted in terms of phase-matched circumferential waves. Dispersion curves for the phase velocities of the latter are obtained, exhibiting two families of waves of different type. Finally, the connection of these waves with the Stoneley waves on the boundary between two flat half-spaces is noted in the high-frequency limit. GRA

N80-17516# Centre Technique des Industries Mecaniques, Senlis (France).
ON RESIDUAL CHARACTERISTICS IN MATERIALS: THEIR ORIGIN, INFLUENCE, AND MEASUREMENT Final Report [OUVRAGE CONTRAINTES RESIDUELLES. ORIGINE, INFLUENCE, MESURE]
Chabenat, Flavenot, and Niku-Lari 7 Feb. 1979 325 p refs
In FRENCH
(CETIM-1-1D-05-0) Avail: NTIS HC A14/MF A01

The stress-strain mechanisms governing the formation of residual plastic deformations in anisotropic materials experiencing various thermal and/or mechanical stresses during manufacturing are investigated. The influence of this residual stress 'memory' on the measurable characteristics of materials is shown. Different measurement methods, destructive tests, and nondestructive tests are then described and compared. Results show that the accuracy of these tests procedures are no longer in question. However, the application of residual stress measurement on an industrial basis is still beyond corporate means, mainly due to complexity in making measurements and to the prohibitive cost of measurement equipment and its associated data analysis. Author (ESA)

N80-17517# Centre Technique des Industries Mecaniques, Senlis (France). Dept. of Statique et Dynamique des Structures.
STUDY OF THE ELASTIC FLARING OF SHELLS HAVING ANY GEOMETRY Final Report [ETUDE DU FLAMBEMENT ELASTIQUE DES COQUES DE GEOMETRIE QUELCONQUE]
F. Boyer, F. Nasarre, S. Nor, and G. Verchery 9 Mar. 1979 154 p In FRENCH; ENGLISH summary Prepared in cooperation with Univ. de Technol. de Compiegne
(Contracts DGRST-75-7-1413; DGRST-75-7-1414)
(CETIM-11-A-07-0) Avail: NTIS HC A08/MF A01

The structural instability of general elastic shells was studied for the case of bifurcation as well as for softening. Finite element computer programs were developed with two types of elements. A three dimensional degenerated isoparametric element was used for equilibrium bifurcation and an Ahmad type isoparametric shell element with variable shape and number of nodes was employed for large displacement. Results show that the behavior of the three-dimensional element is satisfactory provided that some modification is introduced. The Ahmad shell element is effective, but somewhat cumbersome in the nonlinear case. Author (ESA)

N80-17518# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft u. Raumfahrt.
COLLECTION AND ANALYSIS OF IN SERVICE FLIGHT HISTORIES OF THE INITIATION OF FATIGUE DAMAGE [SAMMLUNG UND ANALYSE VON IM BETRIEB VON LUFTFAFR ZEUGEN AUFGETRETENEN ERMUEDUNGSSCHAEDEN]
H. Huth and D. Schuetz Bonn Dokzewtbw Apr. 1979 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF43/RF-430/51038)
(BMVG-FBWT-79-10) Avail: NTIS HC A03/MF A01; Dokzentbw, DM 30

In-service aircraft failure histories are evaluated in order to show weak points of design and causes of early fatigue inititation. The distribution and frequency of fatigue cracks in the different structural components show that the main problem is in the joints. The crack lengths of service and test failures at the time of detection are also evaluated. The principal causes of damage are found to be excessive load transfer, double stress concentration, design stress, induced deflections, secondary bending, sharp edge, open hole, and production defects. These causes are explained using examples taken from the collection of cracks. Author (ESA)

N80-17519# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
ON THE FATIGUE LIFE EVALUATION OF JOINTED SPECIMENS UNDERGOING LOAD TRANSFER WITH REGARD TO STRESS CONCENTRATION [ZUR LEBENSDAUERABSCHAETZUNG VON FUEGUNGEN MIT SCHUBBEANSPRUCHTEN BEFESTIGUNGSELEMENTEN UNTER BERUECKSICHTIGUNG DER LASTUEBERTRAGUNG]

J. Franz and D. Schuetz Bonn Dokzentbw Apr. 1979 96 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF-43/RF-430/51038)
(BMVG-FBWT-79-11) Avail: NTIS HC A05/MF A01; Dokzentbw, DM 30

The methods of fatigue life evaluation for jointed parts in aircraft structures show great uncertainties, a fact which is indicated by the numerous and in many cases early occurences of fatigue failures in such components. These uncertainties are caused by the insufficient consideration of important parameters, which influence fatigue life decisively, during the design phase. The influence of two parameters, load transfer, and secondary bending stresses, on the fatigue life of jointed specimens were investigated. Results show that for the performance of a reliable fatigue life evaluation, it is important to determine the load transfer and the secondary bending stresses either theoretically or experimentally (as in the case of an already existing construction). If load transfer, and secondary bending stresses are known, more detailed methods are applicable for fatigue life evaluation which enables a more optimal design of joints to be made in consideration of fatigue. Author (ESA)

N80-17520# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
FATIGUE BEHAVIOR OF BS 2L65 ALUMINUM ALLOY PIN-LOADED LUGS WITH INTERFERENCE-FIT BUSHES
J. E. Moon London HMSO Nov. 1977 78 p refs Supersedes RAE-TR-77177 and ARC-37872
(ARC-R/M-3835; BR69022; ISBN-011-471168-2; RAE-TR-77177; ARC-37872) Avail: NTIS HC A05/MF A01; HMSO £7.00; PHI

Cumulative fatigue damage in lugs with and without interference fit bushes is studied. Fatigue tests carried out under constant and variable amplitude loading conditions with local stress measurements made using the companion specimen method are described. The local stress measurements are discussed in relation to the large increase in life under constant amplitude associated with fitting an interference fit bush in a pin jointed lug and to the reduction in life following prestress. The application of stress measurements in sequences representing narrow band random loading for life estimations is examined. Author (ESA)

N80-17521# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
ON INTERFACING STRUCTURAL INFORMATION AND LOADING DATA IN AEROELASTIC ANALYSIS
Dorothy Holford and J. C. Copley London HMSO May 1977 86 p refs Supersedes RAE-TR-77-074; ARC-37619
(ARC-R/M-3833; ISBN-0-11-471166-6; BR68824; RAE-TR-77-074; ARC-37619) Avail: NTIS HC A05/MF A01; HSMO £8.00; PHI

A systematic means of interfacing structural and loading information in aeroelastic analyses is developed and a computer implementation, with particular application to plate-like structures, is described. Various numerical examples of the use of the method are given, and the overall accuracy of the procedure advocated is critically examined. The proposed FORTRAN subroutine produces a flexibility matrix which purports to relate either displacement or a spatial derivative of displacement at a set of points to loads at a second set of points. Results show that so long as the displacements, as calculated from the derived matrix, do not resemble those of an eigenvector of that matrix which is associated with a relatively low flexibility (viewed in relation to the number and distribution of points in the two sets) then they are likely to be of an acceptable accuracy. Author (ESA)

N80-17522# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
FATIGUE BEHAVIOR OF PIN-LOADED LUGS IN BS 2L65 ALUMINUM ALLOY
J. E. Moon and P. R. Edwards London HMSO Nov. 1977 56 p refs Supersedes RAE-TR-77-167; ARC-37840
(ARC-R/M-3834; ISBN-0-11-471167-4; BR68825; RAE-TR-77-167; ARC-37840) Avail: NTIS HC A04/MF A01; HMSO £6.00; PHI

Fatigue tests were carried out on lugs of BS 2L65 aluminum alloy loaded by steel pins under constant amplitude (CA) and narrow band random (NBR) loading over a range of mean stresses and for different values of prestress. Life estimations for the NBR tests were made using Miner's rule. The relative fatigue performance under CA and NBR loading as expressed by the Miner summation was consistent with the fatigue damage accumulation being markedly affected by observed changes in residual stress at the point of crack initiation due to local yielding under the higher load levels. Author (ESA)

N80-17523# National Physical Lab., Teddington (England). Div. of Materials Applications.
INFLUENCE OF MONITORING CONDITIONS ON THE STRESS WAVE EMISSION DATA RECORDED DURING TENSILE TESTING OF A GRP
G. D. Sims and D. G. Gladman Jun. 1979 33 p refs
(NPL-DMA(R)5) Avail: NTIS HC A03/MF A01

A stress wave/acoustic emission monitoring technique was assessed for its potential in detecting failures in reinforced plastics. Repeat tensile tests were conducted using a standardized procedure for a glass fiber/epoxy laminate of low variability for several monitoring parameters such as system gain, transducer type, transducer to failure site separation distance, specimen dimensions, ringdown versus event, and total count versus count rate. Under most conditions a similar trend of emission data with increased applied stress was obtained. In some cases only the final failure was detected and in all cases there was a considerable variation in the absolute count levels recorded. It was found in several cases that simple empirical relationships could be obtained which allowed for these changes in the monitoring condition. However, the potential dangers in accepting data without undertaking calibration-type experiments and without directly relating the emission data to actual failures were clearly apparent. In particular, there is a need to establish that an absence of emissions is in reality an absence of failures. Author (ESA)

N80-17524# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Sect. Construction Metallique.
EXTERNAL LOADINGS ON NOZZLES IN CYLINDRICAL SHELLS Progress Report
Joris Decock Jun. 1979 52 p refs
(CRIF-MT-132; PR-3) Avail: NTIS HC A04/MF A01

The influence of the parameters t/T and D/T on the stresses in the cylindrical shell and the nozzle was examined using elastic stress measurements performed on four test models. The maximum stress in the nozzle was estimated for three different types of external loads. Fatigue tests were performed under external fully reversed longitudinal moments and the results were compared to predicted fatigue life. Author (ESA)

N80-17250 Martin Marietta Corp., Denver, Colo.
FORCE APPORTIONING FOR MODAL VIBRATION TESTING USING INCOMPLETE EXCITATION
G. Morosow and R. S. Ayre (Colorado Univ., Boulder) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 39-48 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17251 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ON THE DISTRIBUTION OF SHAKER FORCES IN MULTIPLE-SHAKER MODAL TESTING
W. L. Hallauer, Jr. and J. F. Stafford *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 49-63 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17252* Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
MODAL CONFIDENCE FACTOR IN VIBRATION TESTING
Sam R. Ibrahim *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 65-75 (For primary document see N80-17247 08-31)
(Grant NsG-1459)
Avail: NRL, Tech. Inform. Div., Washington, D.C. CSCL 20K

N80-17253 Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
A BUILDING BLOCK APPROACH TO THE DYNAMIC BEHAVIOR OF COMPLEX STRUCTURES USING EXPERIMENTAL AND ANALYTICAL MODAL MODELING TECHNIQUES
J. C. Cromer, M. Lalanne, D. Bonnecase, and L. Gaudriot *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 77-91 refs (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17255 Martin Marietta Corp., Denver, Colo.
LOAD TRANSFORMATION DEVELOPMENT CONSISTENT WITH MODAL SYNTHESIS TECHNIQUES
R. F. Hruda and P. J. Jones *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 103-109 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17256 Westinghouse Research and Development Center, Pittsburgh, Pa.
REDUCED SYSTEM MODELS USING MODAL OSCILLATORS FOR SUBSYSTEMS (RATIONALLY NORMALIZED MODES)
F. H. Wolff and A. J. Molnar *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 111-118 refs (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17259 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
SPECIFICATION OF DAMPING MATERIAL PERFORMANCE
David I. G. Jones and J. P. Henderson *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 1-11 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17260 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
A REDUCED-TEMPERATURE NOMOGRAM FOR CHARACTERIZATION OF DAMPING MATERIAL BEHAVIOR
David I. G. Jones *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 13-22 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17261 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
COMPUTERIZED PROCESSING AND EMPIRICAL REPRESENTATION OF VISCOELASTIC MATERIAL PROPERTY DATA AND PRELIMINARY CONSTRAINED LAYER DAMPING TREATMENT DESIGN
Lynn C. Rogers and Ahid D. Nashif (Anatrol Corp., Cincinnati, Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 23-37 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17262 Lord Kinematics, Erie, Pa.
NEW STRUCTURAL DAMPING TECHNIQUE FOR VIBRATION CONTROL
B. M. Patel, G. E. Warnaka, and D. J. Mead (Southampton Univ., England) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 39-52 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17264 Army Engineer Waterways Experiment Station, Vicksburg, Miss.
RESPONSE OF A HELICAL SPRING CONSIDERING HYSTERETIC AND VISCOUS DAMPING
P. F. Mlakar and R. E. Walker *In* the Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 63-74 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington DC.

N80-17269 New Mexico State Univ., Las Cruces. Physical Science Lab.
FREQUENCY RESPONSE AND DIFFERENTIATION REQUIREMENTS FOR IMPACT MEASUREMENTS
Anthony S. Hu and Iian-Tau Chen *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 123-130 refs (For primary document see N80-17258 08-31) (Contract DOT-HS-6-01400)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17270 SRI International Corp., Menlo Park, Calif.
STRUCTURAL RESPONSE OF EARTH PENETRATORS IN ANGLE-OF-ATTACK IMPACTS
J. D. Colton *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 131-141 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17272 Franklin Inst. Research Labs., Philadelphia, Pa.
TESTING PIPING CONSTRAINT ENERGY ABSORBERS FOR REACTOR CONTAINMENT APPLICATIONS
R. C. Yaeger and R. C. Chou *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 161-181 ref (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17274 Agbabian Associates, El Segundo, Calif.
IMPEDANCE TECHNIQUES FOR SCALING AND FOR PREDICTING STRUCTURE RESPONSE TO AIR BLAST
F. B. Safford, R. E. Walker (Army Waterways Experiment Station, Vicksburg, Miss.), and T. E. Kennedy (Defense Nuclear Agency, Washington, D.C.) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 193-214 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

N80-17276 Washington Univ., St. Louis, Mo. Dept. of Civil Engineering.
A SOURCE OF LARGE ERRORS IN CALCULATING SYSTEM FREQUENCIES
Robert M. Mains *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 1-4 (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17277 Paris Univ. (France). Lab. de Mecanique Appliquee.
RESEARCH METHOD OF THE EIGENMODES AND GENERALIZED ELEMENTS OF A LINEAR MECHANICAL STRUCTURE
R. Fillod and J. Diranda *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 5-12 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17282 Waterloo Univ. (Ontario). Dept. of Civil Engineering.
BUCKLING OF EULER'S ROD IN THE PRESENCE OF ERGODIC RANDOM DAMPING
H. H. E. Leipholz *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 49-52 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17284 Shock and Vibration Information Center (Defense), Washington, D. C.
RESPONSE TO MOVING LOADS OVER A CRYSTALLINE HALF-SPACE
Sasadhar De (Old Engineering Office, West Bengal, India) *In its* The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 63-70 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17286 Kobe Univ. (Japan).
FIRST-PASSAGE FAILURE PROBABILITY IN RANDOM VIBRATION OF STRUCTURES WITH RANDOM PROPERTIES
N. Nakagawa, R. Kawai, and K. Funahashi *In* Shock and Vibration

Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 83-92 refs Prepared in cooperation with Kawasaki Heavy Industries, Ltd., Japan (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17287 General Electric Co., Utica, N. Y. Aircraft Equipment Div.
FRACTURE MECHANICS APPLIED TO STEP-STRESS FATIGUE UNDER SINE/RANDOM VIBRATION
Ronald G. Lambert *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 93-101 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17301*# McDonnell Aircraft Co., St. Louis, Mo.
COMBINED VIBRATION/TEMPERATURE/SIDELOAD ENVIRONMENTAL TESTING OF UHF BLADE ANTENNAS
Ronald Volker *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 79-84 (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N80-17525 Colorado State Univ., Fort Collins.
ASPECTS OF DEGRADATION OF ALLUVIAL STREAMS IN RESPONSE TO BASE-LEVEL LOWERING Ph.D. Thesis
Zeev Binyamin Begin 1979 257 p
Avail: Univ. Microfilms Order No. 7928505

In homogenous alluvial sediments, not subject to armouring, the ultimate result of base level lowering by a certain amount is degradation all along the channel by the same amount. The main impact of erosion is felt in early stages after initiation of the process, and mainly near the mouth. The rate of degradation at any station along the channel reaches a peak and then slowly decreases with time, and the peak rate is attenuated with distance from the outlet. Sediment discharge at the outlet decreases rapidly with time, with a decay close to an exponential one with an exponent of about -0.5. Headward migration of knickpoints is a function of the ability of the channel to transport sediments downstream of the receding knickpoint. The exact migration pattern depends upon the shape of the knickpoint - a vertical one being described by an equation of motion different from a non-vertical, flattening knickpoint. Dissert. Abstr.

N80-17526 Colorado State Univ., Fort Collins.
ANALYTICAL/NUMERICAL METHODS FOR GROUNDWATER FLOW AND QUALITY PROBLEMS Ph.D. Thesis
Charles Joseph Daly 1979 178 p
Avail: Univ. Microfilms Order No. 7928512

The movement of dissolved substances through non homogeneous porous media is calculated by first obtaining an analytical solution to the equation of groundwater flow. This solution is then incorporated in a numerical algorithm for determining mass transport. The solution of several steady and unsteady groundwater flow problems demonstrate that the technique has the potential for high accuracy and computational efficiency. Application of the method of characteristics to the mass transport problem yields a set of differential equations whose solution is a set of characteristic lines. A fourth-order Runge-Kutta algorithm followed by a predictor-corrector scheme of the same order are used to numerically determine these lines. The aggregate of the characteristic lines defines the change of mass concentration and the path of fluid particles in the flow field. Solutions for mass transport in steady and unsteady flow fields are presented. Dissert. Abstr.

N80-17527*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF MAGNETIC ANOMALIES OF LITHOSPHERIC ORIGIN MEASURED BY SATELLITE AND AIRBORNE MAGNETOMETERS OVER WESTERN CANADA
R. A. Langel, R. L. Coles (Dept. of Energy, Mines and Resources, Ottawa), and M. A. Mayhew (Business and Technological Systems, Inc., Seabrook, Md.) Sep. 1979 39 p refs
(NASA-TM-80568) Avail: NTIS HC A03/MF A01 CSCL 08G

Crustal magnetic anomaly data from the OGO 2, 4 and 6 (Pogo) satellites are compared with upward-continued aeromagnetic data between 50 deg -85 deg N latitude and 220 deg - 260 deg E longitude. Agreement is good both in anomaly location and in amplitude, giving confidence that it is possible to proceed with the derivation and interpretation of satellite anomaly maps in all parts of the globe. The data contain a magnetic high over the Alpha ridge suggesting continental composition and a magnetic low over the southern Canada basin and northern Canadian Arctic islands (Sverdrup basin). The low in the Sverdrup basin corresponds to a region of high heat flow, suggesting a shallow Curie isotherm. A ridge of high field, with two distinct peaks in amplitude, is found over the northern portion of the platform deposits and a relative high is located in the central portion of the Churchill province. No features are present to indicate a magnetic boundary between Slave and Bear provinces, but a trend change is evident between Slave and Churchill provinces. South of 60 deg latitude a broad magnetic low is located over very thick (40-50 km) crust, interpreted to be a region of low magnetization. Author

N80-17528*# Purdue Univ., Lafayette, Ind.
ATLAS OF SOIL REFLECTANCE PROPERTIES
E. R. Stoner, M. F. Baumgardner, L. L. Biehl, and B. F. Robinson 15 Nov. 1979 89 p refs
(Contract NAS9-15466)
(NASA-CR-160446; LARS-TR-111579) Avail: NTIS HC A05/MF A01 CSCL 08M

A compendium of soil spectral reflectance curves together with soil test results and site information is presented in an abbreviated manner listing those soil properties most important in influencing soil reflectance. Results are presented for 251 soils from 39 states and Brazil. A narrative key describes relationships between soil parameters and reflectance curves. All soils are classified according to the U.S. soil taxonomy and soil series name for ease of identification. Author

N80-17529# Recognition Systems, Inc., Van Nuys, Calif.
FEASIBILITY OF USING OPTICAL POWER SPECTRUM ANALYSIS TECHNIQUES FOR AUTOMATIC FEATURE CLASSIFICATION FROM HIGH RESOLUTION THERMAL, RADAR, AND PANCHROMATIC IMAGERY
Harvey L. Kasdan 1 Jun. 1979 195 p refs
(Contract DAAK70-78-C-0019)
(AD-A076566; KS-77-370; MS-79-404; ETL-0186) Avail: NTIS HC A09/MF A01 CSCL 05/8

The objective of this study was to determine experimentally the feasibility of using optical power spectrum analysis techniques for automatic topographic feature classification from high resolution radar, panchromatic and thermal imagery. A data base of radar, panchromatic and thermal imagery was assembled. Radar and panchromatic imagery were available over the same geographical area with the same scale and perspective. An optical power spectrum data base of 6,216 individual aperture samples from the three types of imagery was collected. Feature analysis and decision software required in addition to standard FACEL routines was developed. Using this software, features and a decision rule were developed for radar imagery that achieved 90% correct classification of four classes of terrain. A quantitative statistical analysis was performed to determine the effects of

aperture and sensor type on the optical power spectrum based features. In addition, a qualitative analysis was performed in order to present examples that illustrate signature differences between radar and panchromatic imagery. No single sensor performs best for all classes. The results lead to the following choices for the detection of particular terrain types: Urban-panchromatic, Water radar or panchromatic, Agriculture - radar, and Forest -thermal or radar. GRA

N80-17530# Durham Univ. (England). Dept. of Geography.
STATISTICAL CHARACTERIZATION OF ALTITUDE MATRICES BY COMPUTER. REPORT 6: AN INTEGRATED SYSTEM OF TERRAIN ANALYSIS AND SLOPE MAPPING Final Report
Ian S. Evans. 1979. 199 p. refs.
(Contract DA-ERO-591-73-G0040)
(AD-A076558) Avail: NTIS. HC A05/MF A01. CSCL 08/2

A system is described which: (a) replaces existing sets of diverse terrain indices with a group of statistics for point-characteristics; (b) calculates all of these statistics in a single computer run from a single data set; and (c) utilizes available altitude matrix data. The procedures are applicable to Altitude matrix data at any grid mesh. From altitudes in each 3 x 3 submatrix, a quadratic surface is fitted and solved for its first and second horizontal and vertical derivatives at the central point. This yields the slope gradient, slope aspect, profile convexity, and plan convexity at every point in the original matrix, except for the peripheral rows and columns. These 'point' descriptors are presented as: (1) line-printer shaded maps; (2) histograms; (3) scatter plots of each pair; (4) matrix of pair-wise correlations, plus circular regressions on aspect, and several multiple regressions, and (5) summary (moment-based) statistics. In general, the five basic descriptors have little relation to each-other, except that gradient is usually a quadratic function of altitude. A comparison is made with other approaches, such as spectral analysis and fractional modelling. The long-distance persistence properties of terrain mean that considerable extra variance at long wavelengths is usually incorporated when the study area is extended. Hence the auto correlation function varies with the length of series or size of area. Variance of derivatives are also affected, but means, skews, and kurtoses are not. GRA

N80-17531# Bayerische Akademie der Wissenschaften, Munich (West Germany). Bayerischen Kommission fuer die Internationale Erdmessung.
THE WESTERN EUROPEAN SATELLITE PROGRAM Final Report
Walter Ehrnsperger. 1978. 175 p. refs. In ENGLISH; GERMAN summary.
(Astron-Geodaet-Arb-37; ISBN-3-7696-9780-4;
ISSN-0340-7691) Avail: NTIS. HC A08/MF A01

The organization and results of the 'Western European Satellite Triangulation' program are presented. The 40 participating stations and the cameras used are described. Cooperation between the prediction center is reported. The two principle models, the method of simultaneous points and the method of spatial smoothing of the orbit, are introduced and their respective formulas are derived and explained. It is shown that the calculation of simultaneous points has the advantage of being easy to carry out. For both models adequate methods were found for handling the large amount of data, eliminating erroneous measurements, and estimating individual weights for the stations. The data as submitted to the computing center did not contain the correlations between the satellite stations, and, consequently, they were not available for the calculations. The three dimensional coordinates of 30 Western European Satellite stations are computed and compared based on various model variations. Author (ESA)

N80-17532# Royal Netherlands Meteorological Inst., De Bilt.
A STOMATAL VAPOR TRANSPORT RESISTANCE METER FOR ESTIMATING BULK CROP EVAPOTRANSPIRATION [EEN STOMATAIRE WEERSTANDSMETER]
W. Kohsiek. 1979. 61 p. refs. In DUTCH; ENGLISH summary.
(KNMI-WR-79-10) Avail: NTIS. HC A04/MF A01

A method for measuring the bulk stomatal resistance of a surface covered with short grass is described. The principal of operation is that of a chamber method, which is a frequently used device for measuring the gas transfer across the crop atmosphere interface. An estimate for the resistance to water vapor transport between the stomatal chambers in the leaves as well as the atmosphere of the measuring device was obtained. This resistance is seen as the sum of the bulk stomatal resistance of the crop under the chamber and the resistance for the transport from the surface of the leaves to the chamber atmosphere. Results for an open and closed chamber method were compared with each other and with the bulk stomatal resistance derived from field measurements of the evaporation with Bowen's ratio, together with a model for transport resistances in the natural atmosphere. Author (ESA)

N80-17533# Royal Netherlands Meteorological Inst., De Bilt.
THE COMPUTATION OF THE VERTICAL GROUND WATER VELOCITY FROM THE GROUND TEMPERATURE PROFILE [BEREKENEN VAN DE VERTICALE GRONDWATERSNELHEID UIT GROUNDTEMPERATUURPROFIELMETINGEN]
T. DeCrook. 1979. 37 p. refs. In DUTCH; ENGLISH summary.
(KNMI-WR-79-11) Avail: NTIS. HC A03/MF A01

A method is described for measuring the vertical ground water velocity indirectly from the Earth's temperature profiles. If there is no ground water velocity, the ground temperature is determined by a vertical upward thermal flow, that comes from deeper bottom layers, and a thermal flow streaming up or down in the upper bottom layers which is driven by the radiation of the sun. These two heat flows determine the normal temperature profile. If the ground water streams upward, with a certain velocity, the normal temperature profile is modified. Extra heat is transported upward and the temperature increases. The rate of temperature rise depends on the velocity of water. This problem is stated as a linear partial differential equation of the second order which determines the relationship between the ground water velocity and the temperature of the bottom layers. A computer program for these calculations, written for the Burroughs B6700 in extended ALGOL language, is described. Author (ESA)

N80-17534# Geological Survey, Reston, Va.
STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS
E. T. Baker, Jr. Jul. 1979. 52 p. refs. Prepared for Texas Water Development Board, Austin.
(PB-299916/7; TDWR/R-236) Avail: NTIS
HC A04/MF A01. CSCL 08G

The subsurface delineation of hydrogeologic units of Miocene and younger age and stratigraphic units of Paleocene to Holocene age establishes an interrelationship of these units statewide across much of the coastal plain of Texas. The 11 dip sections and strike section, which extend from the land surface to 7,600 feet (2,316 meters) below sea level, provide continuity of correlation from the outcrop to the relatively deep subsurface. Sand containing water with less than 3,000 milligrams per liter of dissolved solids, which is shown on the sections, serves an index of water availability of this quality. GRA

N80-17535*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SEASAT GULF OF ALASKA WORKSHOP REPORT. VOLUME 1: PANEL REPORTS
Apr. 1979. 374 p. refs. Workshop held at Pasadena, Calif., 22 Sep. 1979; sponsored in part by NASA. Sponsored by NASA.
(NASA-CR-162759; PB-300413/2; NOAA-79073114;
Rept-622-101) Avail: NTIS. HC A16/MF A01. CSCL 08E

The comparison of surface observations with satellite sensor data as well as the intercomparison of data from sensors measuring common geophysical parameters were covered. There is clear evidence that a real time oceanic monitoring system, patterned after the Seasat sensors, yield extremely important data for meteorology, climatology, ocean circulation, navigation, and numerous other oceanographic and geodetic applications. The salient conclusions are given, on a sensor by sensor basis. GRA

N80-17536# Continental Shelf Associates, Tequesta, Fla.
SOUTH ATLANTIC HARD BOTTOM STUDY Final Report
Jun. 1979. 375 p. refs. Original contains color illustrations.
(Contract DI-AA551-CT8-25)
(PB-300821/6; BLM/YM/ES-79-13) Avail: NTIS

HC A16/MF A01 CSCL 13B

Oil and gas lease blocks in the Georgia Embayment were surveyed with a precision depth recorder, side scan sonar, and sub-bottom profiler for the purpose of identifying and mapping areas of hard bottom. The efficacy with which standard geophysical equipment and techniques could identify and map hard bottom stress was determined. In addition, the hard bottom substrate and associated fauna were identified and described from dredge samples and color photographs. J.M.S.

N80-17537# Manhattan Coll., New York.
VERIFICATION ANALYSIS OF LAKE ONTARIO AND ROCHESTER EMBAYMENT THREE DIMENSIONAL EUTROPHICATION MODELS Final Report
Robert V. Thomann Aug. 1979 153 p refs
(Grant EPA-R-803680030)
(PB80-103625; EPA-600/3-79-094) Avail: NTIS
HC A08/MF A01 CSCL 13B

A three dimensional time variable model of the phytoplankton and nutrients of Lake Ontario and the Rochester Embayment is examined. The data from the International Field Year on the Great Lakes (IFYGL) are used as the primary data base. The data are summarized and statistically analyzed on a three dimensional grid and segment averages using a 67 segment representation of the lake and a 72 segment representation of Rochester Embayment, are calculated. In addition, averages for eight regions of the lake and lakewise averages for two depth layers are computed. GRA

N80-17538# Texas Water Development Board, Austin.
SUSPENDED-SEDIMENT LOAD OF TEXAS STREAMS Progress Report, Oct. 1971 - Sep. 1975
John P. Dougherty May 1979 91 p
(PB80-101850; TDWR/R-233) Avail: NTIS
HC A05/MF A01 CSCL 08H

Sediment data obtained for the 1972 through 1975 water years are presented. Maximum, minimum, and average annual suspended-sediment loads are summarized in table form for each gage point. Sediment outflow measurements for four reservoirs in Texas are also presented. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-17539 Miami Univ., Coral Gables, Fla.
INFORMATION THEORY APPLIED TO SOLAR RADIATION CONCENTRATORS Ph.D. Thesis
Russell Paul Patera 1979 179 p
Avail: Univ. Microfilms Order No. 8001674

A solar collector is treated as a communication channel with the input being the directional distribution of radiation at the aperture and the output being the spatial distribution of the radiation at the absorber. The channel structure and information measure are found. The information measure is used to obtain a general figure of merit which is useful for collector comparisons over wide ranges of operating conditions. The findings of the theory indicate that for an isotropic distribution of radiation at the input, a single absorber segment is sufficient for optimum collector performance. For a nonisotropic distribution, many thermally separated absorber segments are necessary for optimum performance. The heat transfer fluid is first passed through the warm segments, and then passed sequentially through the progressively hotter segments. Three practical examples are given. Dissert. Abstr.

N80-17540 Ohio State Univ., Columbus.
INFLUENCE OF OXYGEN ON THE ELECTROCHEMICAL BEHAVIOR OF THE CaF2 SOLID ELECTROLYTE Ph.D. Thesis
Schiao-Feng Chou 1979 256 p
Avail: Univ. Microfilms Order No. 8001708

The open-circuit electromotive force (EMF) values of this cell were the same as those measured by traditional oxygen concentration cell using calcia-stabilized ZrO2 as the electrolyte. Alternating current analysis technique was used to differentiate the electrochemical behavior of CaF2 in argon and oxygen atmospheres. The equivalent circuits of cell Pt/CaF2/Pt in argon and oxygen atmospheres at different temperatures were identified. The interface conductivity measuring the rate of the electrode reaction increases when the oxygen activity in the electrode increases. The electrode reaction involves oxygen. The electrode reaction of the CaF2 cell in an oxygen environment involves oxygen. Oxygen ions are mobile in the CaF2 electrolyte. A theory is given to interpret the observed EMF of this type of oxygen concentration cell. Dissert. Abstr.

N80-17541 Georgia Inst. of Tech., Atlanta.
OPTICAL AND THERMAL EFFECTS IN LINEAR SOLAR CONCENTRATING COLLECTORS Ph.D. Thesis
Sheldon Moseley Jeter 1979 430 p
Avail: Univ. Microfilms Order No. 8000828

Procedures for the analysis and evaluation of optical and thermal effects in concentrating solar collectors employing reflector optical systems are presented. Particular emphasis is placed on the consideration of cylindrical, single-axis suntracking concentrators and collectors. The optical analysis is based on fundamental concepts of geometrical optics augmented by limited simplifications generally applicable to solar energy utilization and leading to representations of the source as a finite disc emitter and of the concentrating surface as an array of differential reflective elements. The optical characteristics of several ideal concentrators are evaluated and detailed. Coupling the results of the optical analysis with standard heat transfer and hydraulic analysis yields a model for the thermal collector suitable for performance projections and dynamic simulations. Elementary examples of the application of the model are presented. Dissert. Abstr.

N80-17542 California Univ., Berkeley.
HEAT AND MASS TRANSFER ANALYSIS OF SOLAR-HEATED HYDROPONIC GREENHOUSES Ph.D. Thesis
John Charles Glaub 1979 110 p
Avail: Univ. Microfilms Order No. 8000355

An alternative greenhouse heating system was investigated in response to excessively high fuel costs currently facing greenhouse growers. A solar-heated hydroponic system was proposed and analyzed. This system utilizes the hydroponic gravel beds and nutrient solution as the thermal storage medium. Simulation results indicated a significant advantage in using double polyethylene wall construction in comparison to a single glass wall. An existing glass house can be improved by adding a single layer of plastic with an enclosed air space between. Results show a preference for placing the plastic on the inside of the house as opposed to the outside. Collector areas can be held down by increasing the thermal storage capacity of the system. A full-floor bed design offers the advantages of increased thermal storage and improved heating performance at a relatively small additional cost. Dissert. Abstr.

N80-17543*# Electro-Mechanical Research, Inc., Sarasota, Fla.
DOE/NASA WIND TURBINE DATA ACQUISITION. PART 1: EQUIPMENT
O. J. Strock Jan 1980 56 p
(Contract DEN3-98)
(NASA-CR-159779; EMR-827053) Avail: NTIS
HC A04/MF A01 CSCL 10B

Large quantities of data were collected, stored, and analyzed in connection with research and development programs on wind turbines. The hardware configuration of the wind energy remote data acquisition system is described along with its use on the NASA/DOE Wind Energy Program. R.C.T.

N80-17544*# National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala.

SOLAR ENERGY CONTROL SYSTEM Patent Application
James R. Currie, inventor (to NASA) Filed 29 Nov. 1979 18 p
(NASA-Case-MFS-25287-1; US-Patent-Appl-SN-098570) Avail: NTIS HC A02/MF A01 CSCL 10A

A solar energy control system for a hot air type solar energy heating system wherein thermocouples are arranged to sense the temperature of a solar collector, a space to be heated, and a top and bottom of a heat storage unit is described. Pertinent thermocouples are differentially connected togther, and these are employed to effect the operation of dampers, a fan, and an auxiliary heat source. In accomplishing this, the differential outputs from the thermocouples are amplified by a single amplifier by multiplexing techniques. Additionally, the amplifier is corrected as to offset by including as one multiplex channel a common reference signal. NASA

N80-17545*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
ENERGY FROM AQUATIC PLANT WASTEWATER TREATMENT SYSTEMS
B. C. Wolverton and Rebecca C. McDonald Sep. 1979 18 p refs
(NASA-TM-X-72733) Avail: NTIS HC A02/MF A01 CSCL 10A

Water hyacinth (Eichhornia crassipes), duckweed (Spirodela sp. and Lemma sp.), water pennywort (Hydrocotyle ranunculoides), and kudzu (Pueraria lobata) were anaerobically fermented using an anaerobic filter technique that reduced the total digestion time from 90 days to an average of 23 days and produced 0.14-0.28 cu m CH4/kg (dry weight) (2.3-4.5 cu ft/lb) from mature filters. The anaerobic filter provided a large surface area for the anaerobic bacteria to establish and maintain an optimum balance of facultative, acid-forming, and methane-producing bacteria. Consequently the efficiency of the process was greatly improved over prior batch fermentations. Author

N80-17546*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
PEP SOLAR ARRAY DEFINITION STUDY Final Technical Report
31 Dec. 1979 138 p refs
(Contract NAS9-15870)
(NASA-CR-160457; TRW-35515-6001-RU-00) Avail: NTIS HC A07/MF A01 CSCL 10A

The conceptual design of a large, flexible, lightweight solar array is presented focusing on a solar array overview assessment, solar array blanket definition, structural-mechanical systems definition, and launch/reentry blanket protection features. The overview assessment includes a requirements and constraints review, the thermal environment assessment on the design selection, an evaluation of blanket integration sequence, a conceptual blanket/harness design, and a hot spot analysis considering the effects of shadowing and cell failures on overall array reliability. The solar array blanket definition includes the substrate design, hinge designs and blanket/harness flexibility assessment. The structural/mechanical systems definition includes an overall loads and deflection assessment, a frequency analysis of the deployed assembly, a components weights estimate, design of the blanket housing and tensioning mechanism. The launch/reentry blanket protection task includes assessment of solar cell/cover glass cushioning concepts during ascent and reentry flight condition. M.G.

N80-17547*# Institute of Gas Technology, Chicago, Ill.
HIGH-TEMPERATURE MOLTEN SALT THERMAL ENERGY STORAGE SYSTEMS Final Report, 14 Sep. 1977 - 14 Dec. 1978
Randy J. Petri, Terry D. Claar, Ray R. Tison, and Leonard G. Marianowski Feb. 1980 175 p refs
(Contract NAS3-20806)
(NASA-CR-159663; DOE/NASA/0806-79/1) Avail: NTIS HC A08/MF A01 CSCL 10A

The results of comparative screening studies of candidate molten carbonate salts as phase change materials (PCM) for advanced solar thermal energy storage applications at 540 to 870 C (1004 to 1600 F) and steam Rankine electric generation at 400 to 540 C (752 to 1004 F) are presented. Alkali carbonates are attractive as latent heat storage materials because of their relatively high storage capacity and thermal conductivity, low corrosivity, moderate cost, and safe and simple handling requirements. Salts were tested in 0.1 kWhr lab scale modules and evaluated on the basis of discharge heat flux, solidification temperature range, thermal cycling stability, and compatibility with containment materials. The feasibility of using a distributed network of high conductivity material to increase the heat flux through the layer of solidified salt was evaluated. The thermal performance of an 8 kWhr thermal energy storage (TES) module containing LiKCO3 remained very stable throughout 5650 hours and 130 charge/discharge cycles at 480 to 535 C (896 to 995 F). A TES utilization concept of an electrical generation peaking subsystem composed of a multistage condensing steam turbine and a TES subsystem with a separate power conversion loop was defined. Conceptual designs for a 100 MW sub e TES peaking system providing steam at 316 C, 427 C, and 454 C (600 F, 800 F, and 850 F) at 3.79 million Pa (550 psia) were developed and evaluated. Areas requiring further investigation have also been identified. Author

N80-17548*# Kaman Aerospace Corp., Bloomfield, Conn.
DESIGN, FABRICATION, TEST, AND EVALUATION OF A PROTOTYPE 150-FOOT LONG COMPOSITE WIND TURBINE BLADE Final Report
Herbert W. Gewehr Sep. 1979 135 p refs
(Contracts NAS3-20600; EX-76-I-01-1028)
(NASA-CR-159775; DOE/NASA/0600-79/1; R-1575) Avail: NTIS HC A07/MF A01 CSCL 10B

The design, fabrication, testing, and evaluation of a prototype 150 foot long composite wind turbine blade is described. The design approach and material selection, compatible with low cost fabrication methods and objectives, are highlighted. The operating characteristics of the blade during rotating and nonrotating conditions are presented. The tensile, compression, and shear properties of the blade are reported. The blade fabrication, tooling, and quality assurance are discussed. A.W.H.

N80-17549*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROCEEDINGS OF THE 13TH PROJECT INTEGRATION MEETING Progress Report, Apr. 1979 - Aug. 1979
R. R. McDonald Aug. 1979 465 p Presented at 13th Project Integration Meeting, 22-23 1979
(Contract NAS7-100)
(NASA-CR-162787; JPL-Pub-79-88; DOE/JPL-1012-29; PR-13) Avail: NTIS HC A20/MF A01 CSCL 10A

Progress made by the Low Cost Solar Array Project during the period April through August 1979 is presented. Reports are given on project analysis and integration; technology development in silicon material, large area sheet silicon, and encapsulation; production process and equipment development; engineering and operations, and a discussion of the steps taken to integrate these efforts. A report on, and copies of viewgraphs presented at the Project Integration Meeting held August 22-23, 1979 are presented. M.M.M.

N80-17550*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 12: ELECTRICAL CHARACTERISTICS OF SOLAREX BSF, 2-OHM-CM, 50-MICRON SOLAR CELLS (1978 PILOT LINE) AS A FUNCTION OF INTENSITY, TEMPERATURE, AND IRRADIATION
B. E. Anspaugh, D. M. Beckert, R. G. Downing, T. F. Miyahira, and R. S. Weiss 1 Mar. 1980 44 p refs
(Contract NAS7-100)
(NASA-CR-162789; JPL-Pub-78-15-Vol-12) Avail: NTIS HC A03/MF A01 CSCL 10A

Electrical characteristics of Solarex back-surface-field, 2-ohm-cm, 50-micron N/P silicon solar cells are presented in graphical and tabular format as a function of solar illumination intensity, temperature, and irradiation. Author

N80-17551*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CHARACTERIZATION OF DELIBERATELY NICKEL-DOPED SILICON WAFERS AND SOLAR CELLS

A. M. Salama. 1 Nov. 1980. 24 p. refs.
(Contract NAS7-100)
(NASA-CR-162790; JPL-Pub-79-116; DOE/JPL-1012-34)
Avail: NTIS HC A02/MF A01 CSCL 10A

Microstructural and electrical evaluation tests were performed on nickel-doped p-type silicon wafers before and after solar cell fabrication. The concentration levels of nickel in silicon were 5 x 10 to the 14th power, 4 x 10 to the 15th power, and 8 x 10 to the 15th power atoms/cu cm. It was found that nickel precipitated out during the growth process in all three ingots. Clumps of precipitates, some of which exhibited star shape, were present at different depths. If the clumps are distributed at depths approximately 20 micron apart and if they are larger than 10 micron in diameter, degradation occurs in solar cell electrical properties and cell conversion efficiency. The larger the size of the precipitate clump, the greater the degradation in solar cell efficiency. A large grain boundary around the cell effective area acted as a gettering center for the precipitates and impurities and caused improvement in solar cell efficiency. Details of the evaluation test results are given. Author

N80-17552*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EVALUATION OF HIGH-ENERGY LITHIUM THIONYL CHLORIDE PRIMARY CELLS
H. A. Frank. 1 Feb. 1980. 99 p. refs.
(Contract NAS7-100)
(NASA-CR-162791; JPL-Pub-80-6) Avail: NTIS HC A05/MF A01 CSCL 10A

An advanced commercial primary lithium cell (LiSoCl2) was evaluated in order to establish baseline data for improved lithium batteries for aerospace applications. The cell tested had nominal capacity of 6 Ah. Maximum energy density at low rates (less than C/30, where C is the cell capacity in amp-hrs and 30 corresponds to a 30 hr discharge time) was found to be near 300 Wh/kg. An equation which predicts the operating voltage of these cells as a function of current and state of charge is presented. Heat generation rates of these cells were determined as a function of current in a calorimeter. It was found that heat rates could be theoretically predicted with some degree of accuracy at currents less than 1 amp or the C/6 rate. No explosions were observed in the cells during the condition of overdischarge or reversal nor during high rate discharge. It was found, however, that the cells can vent when overdischarge currents are greater than C/30 and when discharge rates are greater than 1.5C. A.R.H.

N80-17553# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
REGENERATIVE BURNER SYSTEM FOR THERMOELECTRIC POWER SOURCES
G. Guazzoni, J. Angello, and A. Herchakowski. Jul. 1979. 9 p. refs.
(DA Proj. 1L1-62705-AH-94)
(AD-A075955; DELET-TR-79-16) Avail: NTIS HC A02/MF A01 CSCL 10/2

A thermoelectric power source is being developed to provide a multifuel, silent, maintenance free tactical power generator for forward area and unattended-operation applications. An experimental study of a regenerative burner system for the 500-Watt Thermoelectric Power Source has resulted in significant reduction in fuel consumption and infrared signature of the power source. GRA

N80-17554# KDI Score, Inc., Cockeysville, Md.
IMPROVED THERMAL BATTERY. Final Report, Jun. 1976 - Dec. 1978
Praful V. Dand and Khushrow K. Press. Apr. 1979. 38 p.
(Contract F33615-76-C-2144; AF Proj. 3145)
(AD-A075835; AFAPL-TR-79-2027) Avail: NTIS HC A03/MF A01 CSCL 10/3

Under U.S.A.F. Contract F33615-76-C-2144, KDI SCORE undertook a study to advance state-of-the-art technology of thermal batteries for military applications, so that they might meet the requirements of some systems now using more complicated and expensive reserve batteries. An exhaustive study of the calcium/calcium chromate system and investigation of many new electrochemical systems showed lithium/iron disulfide to be a superior system got thermal batteries, with longer life at high current densities, and greater energy density. Based on battery tests, it was concluded that calcium/calcium chrome thermal batteries could not achieve the goal of 30 minutes life at 30 volts and 30 amperes, and that the lithium-aluminum/iron disulfide system, which achieved approximately 80% of the goal, could, with further development reach and possibly surpass this goal. Author (GRA)

N80-17555# Brookhaven National Lab., Upton, N. Y.
THERMAL MATS FOR SPACE HEATING AND COOLING
P. P. Szydlik and A. L. Berlad. Mar. 1979. 19 p. refs.
(Contract EY-76-C-02-0016)
(BNL-51019) Avail: NTIS HC A02/MF A01

A single solar-powered device to accomplish both direct-gain heating and space cooling or water heating was studied. In the former operating mode, heating load reductions of 10 to 30 percent were achieved for small structures under cold, sunny midwinter weather conditions. With water flowing, cooling load reductions of 25 percent were obtained with the mats attached to only one large surface of similar structures. The mats also posses significant water heating capability which is a function of flow rate and solar flux. When operated simultaneously as space cooling devices, they serve as efficient water preheaters. For lower flow rates, temperature rises are sufficiently high for direct coupling to domestic hot water supplies. DOE

N80-17556# Franklin Research Center, Philadelphia, Pa.
FIRST PASSIVE SOLAR HOME AWARDS
Jan. 1979. 229 p. refs.
(Contract EX-76-A-29-1020)
(DSE-1020-T17) Avail: NTIS HC A11/MF A01

One hundred and sixty two solar home projects are listed and described. The projects are divided into three general categories: direct solar gain, indirect solar gain, and solarium. Discussions on selecting the best type of solar project for a given area, issues involved in marketing passive solar homes, and calculating the solar gain from passive systems are included. A.W.H.

N80-17557# Bechtel National, Inc., San Francisco, Calif.
COMBINED CYCLE FOR SOLAR-FOSSIL HYBRID POWER GENERATION
E. Y. Lam and J. H. Westsik. 1979. 5 p. refs. Presented at 14th Intersoc. Energy Conversion Conf., Boston, Mass., 5 Aug. 1979.
(Contract ET-78-C-03-2051)
(CONF-790803-43) Avail: NTIS HC A02/MF A01

Parametric studies were conducted on a near term and an advanced version of a nominal 100 MWe commercial power system. The combined cycle hybrid system consists of an air operated open Brayton cycle with a steam Rankine bottoming cycle utilizing the gas turbine waste heat. Solar energy is used to preheat the air in the gas turbine cycle with the air cooled receiver located upstream from the combustor in a series arrangement. Cycle efficiencies of 43.5 and 47.7 percent and average annual solar fractions of .312 and .408 were predicted for the near term and advanced versions respectively. DOE

N80-17558# Idaho National Engineering Lab., Idaho Falls.
TODAY'S GEOTHERMAL POWER ECONOMICS AND RISKS
T. W. Lawford. 1979. 6 p. refs. Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979.
(Contract EY-76-C-07-1570)
(CONF-790803-44) Avail: NTIS HC A02/MF A01

Capital and power generation costs are developed as a parameterized composite of a number of ongoing geothermal power projects. Several of the most commonly accepted risks of geothermal power are evaluated in terms of cost penalties to a basic cost of power. The status of geothermal power in the U.S. is reviewed. DOE

N80-17559# California Univ., Berkeley. Lawrence Berkeley Lab.
SIMULATION OF THE DEPLETION OF TWO-PHASE GEOTHERMAL RESERVOIRS
K. Pruess, G. Bodvarsson, R. C. Schroeder, P. A. Witherspoon,

R. Marconcini (Ente Nazionale per l'Energia Elettrica, Florence, Italy), G. Neri (Ente Vazionale per l'Energia Electtrica, Florence, Italy), and C. Ruffilli (Ente Nazionale per l'Energia Elettrica, Florence, Italy). Aug. 1979. 18 p. refs. Presented at 54th Ann. Tech. Conf. and Exhibition, Las Vegas, Nev., 23 Sep. 1979.
(Contract W-7405-eng-48)
(LBL-9606; CONF-790913-8) Avail: NTIS HC A02/MF A01

The simulator SHAFT79 was used to study the depletion of different types of geothermal reservoirs. Investigations of idealized systems include effects of gravity and fluid injection. Pressure decline is analyzed as a function of cumulative production. The main conclusions are: (1) the well-known p/Z-method for estimating fluid reserves is not applicable to two-phase geothermal reservoirs; (2) there is a strong tendency towards spatially uniform boiling which causes a pressure decline and allows in many cases, estimates of the total reservoir volume and of the total heat content of the reservoir rock; (3) propagation of a boiling front through a deep water tables, as a consequence of fluid production, gives rise to a peculiar pattern of pressure decline and may allow prediction of the distance of the water table from the producing wells and of the vertical thickness of the water zone, thereby giving important clues to estimating fluid reserves; (4) the pressure effects of injection of colder fluid depend strongly on (one- or two-) phase conditions in the reservoir, upon injection rate, and upon absolute permeability. Average pressure may actually decline in two-phase reservoirs rather than increase due to injection. DOE

N80-17560# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
METAL FOILS FOR DIRECT APPLICATION OF ABSORBER COATINGS ON SOLAR COLLECTORS
C. M. Lampert. Aug. 1979. 18 p. refs. Presented at the Am. Electroplaters Soc. Symp. on Coatings for Solar Collectors, St. Louis, 16-17 Oct. 1979.
(Contract W-7405-eng-48)
(LBL-9324; CONF-791021-1) Avail: NTIS HC A02/MF A01

The basic materials and processing associated with the production of coated metal foils for solar collector absorber surfaces are discussed. Also covered are details of heavier metal strips for direct fabrication of solar collectors. Techniques including bonding methods and the use of adhesives are surveyed. Commercial solar foil manufacturers are covered, along with the new research efforts in this area. In conclusion, advantages and disadvantages are outlined, with specific recommendations. DOE

N80-17561# Arizona Univ., Tucson. Dept. of Electrical Engineering.
SEGMENTED DISH CONCENTRATOR DESIGN PROJECT
R. L. Call. Jul. 1979. 89 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-7024) Avail: NTIS HC A05/MF A01

A description of the segmented dish concentrator is presented in two parts: (1) the design and fabrication of the optical module concentrator with heat sink and solar cell receiver; and (2) the design and procedure of mounting the solar cells. The optical module consists of tiers of conical reflecting surfaces accumulating light on a central hexagonal shaped cylindrical receiver. The solar cells are mounted on the faces of the hexagon. Complete units were assembled and tested. Various reflecting materials were tested. An overall maximum of 7.6 percent was obtained for the module using a silver reflector. R.E.S.

N80-17562# Midwest Research Inst., Golden, Colo.
STATE-OF-THE-ART OF SOLAR CONTROL SYSTEMS IN INDUSTRIAL PROCESS HEAT APPLICATIONS
W. S. Su and J. N. Castle. Jul. 1979. 26 p. refs. Presented at the ISA Natl. Conf., Chicago, 22-25 Oct. 1979.
(Contract EG-77-C-01-4042)
(SERI/TP-39-240; CONF-791005-5) Avail: NTIS HC A02/MF A01

Solar system configurations currently being used or proposed are presented. Parameters and functions deemed essential in solar system controls are identified. Operating deficiencies and possible future improvements are discussed. DOE

N80-17563# Sandia Labs., Albuquerque, N. Mex.
SUNTECH SOLAR LINEAR ARRAY THERMAL SYSTEM (SLATS) TEST RESULTS. Summary Report
H. J. Gerwin. Aug. 1979. 58 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-0658) Avail: NTIS HC A04/MF A01

A fixed-receiver, movable-reflector solar collector system was tested. The collector included 260 sq. m of reflector area. Thermal energy was transferred from the linear receiver to a heat exchanger by water and from the heat exchanger to the thermal storage tanks by Therminol 66. The collector system start-up and operation over a period of 16 months is described. Several data tables and many graphical displays show the performance characteristics under various operating parameters. DOE

N80-17564# Sandia Labs., Albuquerque, N. Mex.
RECEIVER ASSEMBLY DESIGN STUDIES FOR 2-m 90 DEG PARABOLIC CYLINDRICAL SOLAR COLLECTORS
A. C. Ratzel. Sep. 1979. 87 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-1026) Avail: NTIS HC A05/MF A01

A computer simulation was developed to provide cumulative all day performance results or instantaneous solar noon results for three annular solar receiver assemblies: 2.223, 2.54, and 3.175 cm o.d. tubes with concentric glass jackets. Representative clear spring, summer, and winter conditions for Albuquerque, N.M. were modeled. Design problems considered in the analysis included misalignment of the receiver assembly from the focal line, reflector trough tracking bias, variation in receiver tube operating temperature, and variation in the reflector trough one-dimensional slope errors and two-dimensional mirror errors. Summarized performance results for all studies are provided graphically. For operating receiver-tube temperatures < 475 K, the 3.175 cm receiver tube provides the best overall collector performance results. For higher operating temperatures where detrimental receiver heat losses become more significant, the smaller 2.54 cm tube is more effective for solar energy collection. DOE

N80-17565# Sandia Labs., Albuquerque, N. Mex.
PERFORMANCE OF LINEAR SOLAR CONCENTRATING COLLECTORS
R. P. Stromberg. 1979. 21 p. refs. Presented at the First Intern. Symp. on Non-conventional Energy, Trieste, Italy, 27 Aug. - 7 Sep. 1979.
(Contract EY-76-C-04-0789)
(SAND-79-1378C; CONF-790850-1) Avail: NTIS HC A02/MF A01

Performance equations and performance as a function of intensity are discussed. Progress over the past five years and current linear concentrating collector performance are reviewed. The design and development of a low technology linear concentrator are described. DOE

N80-17566# Sandia Labs., Albuquerque, N. Mex.
PERFORMANCE OF SOLAR PASSIVE BUILDINGS
R. P. Stromberg. 1979. 20 p. refs. Presented at the First Intern. Symp. on Non-conventional Energy, Trieste, Italy, 27 Aug. - 7 Sep. 1979.
(Contract EY-76-C-04-0789)
(SAND-79-1574C; CONF-790850-2) Avail: NTIS HC A02/MF A01

Test data are presented for five different homes during the same winter days. Trombe wall, waterwall, greenhouse, and direct gain features of the buildings display their differing responses to the same climate conditions. DOE

N80-17567# Battelle Pacific Northwest Labs., Richland, Wash.
GUST-RISE EXCEEDANCE STATISTICS FOR WIND TURBINE DESIGN
C. H. Huang and G. H. Fichtl. Jul. 1979. 31 p. refs.
(Contract EY-76-C-06-1830)
(PNL-2530) Avail: NTIS HC A03/MF A01

A method of obtaining the velocity change for the design life of a wind energy conversion system is presented. The turbulence spectra, variation of the length scale, turbulence intensity, and surface roughness that are needed to compute the total number of gust rises from the formula are also described. K.L.

N80-17568# Sandia Labs., Albuquerque, N. Mex.
MAGMA ENERGY RESEARCH, 79-1. Semiannual Report, Oct. 1 - 31 Mar. 1979
R. K. Traeger, ed., J. L. Colp, ed., and R. R. Neel, ed. Jul. 1979. 59 p. refs
(Contract EY-76-C-04-0789)
(SAND-79-1344) Avail: NTIS HC A04/MF A01

The Kilauea Iki lava lake was evaluated. Mathematical models of the cooling of the lake and the state of solidification of the liquid lens were verified by thermal profile and permeability measurements. Jet augmented drilling concepts successfully penetrated the viscous, multiphase molten rock region in some locations where conventional drilling failed. Heat transfer studies in the lake suggest that injection of fluids to enhance convection may be useful to extract energy from magma chamber margins. An 800 cc simulation facility for evaluating simulated magma properties at temperatures to 1500 C and pressures to 4 kbar was completed and tested. Thermodynamic stability diagrams were developed for 15 pure metals in basaltic magma systems and compatibility tests were completed. Results are to be used to define simple alloy systems which may be compatible with magmas and to identify other superalloy material candidates. DOE

N80-17569# Midwest Research Inst., Golden, Colo.
OVERVIEW OF DEVELOPING PROGRAMS IN SOLAR DESICCANT COOLING FOR RESIDENTIAL BUILDINGS
1979. 18 p. Presented at the ASHRAE Soc. Meeting, Detroit, 24 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-34-187; CONF-790678-3) Avail: NTIS HC A02/MF A01

Open cycle adsorption and absorption systems are examined. The different dehumidifier bed configurations are the distinguishing features of these systems. The basic operating principles of each dehumidifier concept are explained along with some discussion of their comparative features. Performance predictions developed by SERI for a solar desiccant solar system employing an axial flow desiccant wheel dehumidifier are presented. In terms of life cycle cost and displaced fossil fuel energy, the results indicate that it should be beneficial to use solar desiccant coolers in residential applications. DOE

N80-17570# Battelle Pacific Northwest Labs., Richland, Wash.
SOME POTENTIAL MATERIAL SUPPLY CONSTRAINTS IN SOLAR SYSTEMS FOR HEATING AND COOLING OF BUILDINGS AND PROCESS HEAT. A PRELIMINARY SCREENING TO IDENTIFY CRITICAL MATERIALS
R. L. Watts, W. E. Gurwell, T. A. Nelson, and S. A. Smith. Jun. 1979. 137 p. refs
(Contract EY-76-C-06-1830)
(PNL-2972) Avail: NTIS HC A07/MF A01

Nine solar heating and cooling of buildings designs and three agricultural and industrial process heat designs were studied to identify potential future material constraints to their large scale installation and use. The systems were screened and found to be free of serious future material constraints. The screening was carried out for each individual system design assuming 500 million sq m of collector area installed by the year 2000. Also, two mixed designed scenarios, containing equal portions of each system design, were screened. Three materials were identified that could possibly restrain the deployment of solar systems in the specific scenarios investigated. They are iron and steel, soda lime glass and polyvinyl fluoride. All three of these materials are bulk materials. No raw material supply constraints were found. DOE

N80-17571# Solar Environmental Engineering Co., Inc., Fort Collins, Colo.
CONTINUING REGIONAL SOLAR ENERGY INFORMATION MINI-CENTER ACTIVITIES AND UPDATING THE SOLCOST PROGRAM. Quarterly Report, Nov. 1978 - Jan. 1979
L. J. Lantz. Jan. 1979. 31 p.
(Contract EG-77-C-02-4643)
(COO-4643-T1) Avail: NTIS HC A03/MF A01

Contents: interactive SOLCOST interface; energy conversion - solar system optimization; detailed duct sizing; extension of the SOLCOST data base; portable FORTRAN version; automatic collector parameter subroutine; the SOLAR INDEX; and the operation of the SOLCOST Mini-Center. DOE

N80-17572# Research Triangle Inst., Research Triangle Park, N. C.
DEVELOPMENT OF HIGH EFFICIENCY, LOW COST ZnSiAs2 SOLAR CELLS. Quarterly Progress Report, 9 Apr. - 30 Jun. 1979
J. E. Andrews. 1979. 7 p.
(Contract DE-AC04-79ET-23001)
(DOE/ET-23001-T1; QPR-1) Avail: NTIS HC A02/MF A01

Three critical goals are identified that must be achieved before ZnSiAs2 can be realistically assessed: (1) hole concentrations must be reduced the 1018 to 1019/cu cm range to the 1016 to 1017/cu cm range (2) n-type ZnSiAs2 must be demonstrated; and (3) ZnSiAs2 pn junctions must be demonstrated. The approach taken and the progress made toward achieving these goals are described. DOE

N80-17573# Midwest Research Inst., Golden, Colo.
AEROSOLS AND SOLAR ENERGY
R. E. Bird and R. L. Hulstrom. 1979. 11 p. refs. Presented at the Workshop on Artificial Aerosols, Vail, Colo., 19 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-36-309; CONF-7906108-1) Avail: NTIS HC A02/MF A01

A brief description is presented of the involvement of the Solar Energy Research Institute (SERI) in atmospheric research, including aerosol characterization and modeling. The use of both rigorous and simple models for radiation transport is described. Modeled broadband solar irradiance data are shown to illustrate the important influence that aerosols have on the enrgy available to solar systems and the economics of solar systems design. Standard aerosol measurement methods for solar applications are discussed along with the need for improved instrumentation and methods. DOE

N80-17574# Battelle Pacific Northwest Labs., Richland, Wash.
ENERGY MATERIAL TRANSPORT, NOW THROUGH 2000, SYSTEM CHARACTERISTICS AND POTENTIAL PROBLEMS. TASK 3: PETROLEUM TRANSPORTATION. Final Report
J. G. DeSteese. Mar. 1979. 291 p.
(Contract EY-76-C-06-1830)
(PNL-2421) Avail: NTIS HC A13/MF A01

A summary characterization of the petroleum transportation system and an assessment of some potential problems that may impact petroleum transportation in the United States during the balance of the century are presented. The system characterization includes a review of petroleum product movements, modal operations and comparisons, and transportation regulations and safety. A median scenario based on published projections shows that the US will probably rely on foreign oil to supply between 40 and 50 percent of domestic petroleum needs throughout the balance of the century. DOE

N80-17575*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ASSESSMENT OF LOW-COST MANUFACTURING PROCESS SEQUENCES
Robert G. Chamberlain. 1979. 11 p. refs. Presented at the European Congr. on Operations Res., Amsterdam, 9 Apr. 1979
(Contract EY-76-A-29-1012)
(NASA-CR-162745; CONF-790451-1) Avail: NTIS HC A02/MF A01 CSCL 10A

An extensive research and development activity to reduce the cost of manufacturing photovoltaic solar arrays by a factor of approximately one hundred is discussed. Proposed and actual manufacturing process descriptions were compared to manufacturing costs. An overview of this methodology is presented. DOE

N80-17576# Dow Chemical Co., Midland, Mich. Hydrocarbons and Energy Research Dept.
ENERGY FROM THE SITU PROCESSING OF ANTRIM OIL SHALE. Quarterly Technical Progress Report, Jan. - Mar. 1979
L. J. Washington, Jr. 20 Mar. 1979. 45 p. refs
(Contract EX-76-C-01-2346)
(FE-2346-44) Avail: NTIS HC A03/MF A01

The 100 series wells, which had been hydraulically and then explosively fractured, are shown to have much greater permeability than had been present in the wells on the existing site during the 1978 extraction trials. Well 301, which is the central well in the explosive underreaming series, was cleaned out. Two wells were drilled and cored nearby. Extensive fracturing due to the use of explosives in Well 301 was evident in the well located 15 feet from the site of the explosive treatment. Communication between these wells is also evident. A downhole methane burner of Tejas Petroleum Engineers was successfully tested under realistic operating conditions in an existing well. DOE

N80-17577# Wizard Research and Development Group, Inc., Washington, D.C.
CRITERIA FOR AN IDEAL SOLAR PHOTOVOLTAIC POWERED INDUSTRY
Jun. 1979 74 p refs
(Contract ET-78-X-01-5433)
(HCP/T5433-01) Avail: NTIS HC A04/MF A01

The application of solar photovoltaic energy and the use of energy in the Primary Metals Industries were surveyed in literature and used to outline criteria for an ideal solar photovoltaic powered industry. Some of the major findings include: (1) the most important requirements of an ideal solar photovoltaic powered industry are the ability to use dc electrical power, ability to be located in Southern California or the Southwestern US and ability to do without power for extended periods of time, (2) the costs of varying from the ideal are most severe with respect to the loss of power element of the criteria, (3) although most of the industries in the Primary Metals group use tremendous amounts of electrical energy, the general requirements of an uninterruptible power source makes them less than ideal users of photovoltaic energy, (4) it appears to be both technologically and economically feasible to develop processes which would make at least four of the seven members of the Primary Metals Industries ideal solar photovoltaic powered industries. DOE

N80-17578# Brookhaven National Lab., Upton, N. Y.
REGIONAL ENVIRONMENT-ENERGY DATA BOOK: NORTHEAST REGION
Dec. 1978 714 p refs
(Contract EY-76-C-02-0016)
(DOE/TIC-10114/3, BNL-24867) Avail: NTIS HC A99/MF A01

A compilation of regional data relating to the energy, environmental, socioeconomic, and institutional characteristics of the Northeast is presented. The document discusses: current and historic data on energy supply, demand, and production; sector fuel demands, fuel consumption, transmission, and transportation; location of energy production and conversion; water quality and quantity; air quality and air quality control areas; natural and induced climatic conditions; waste disposal; land and coast conditions, use, and management; managed and endangered species; demographic and socioeconomic conditions; and health and mortality data. DOE

N80-17579# Rasor Associates, Inc., Sunnyvale, Calif.
THERMIONIC CONVERTERS AND LOW-TEMPERATURE PLASMA
F. G. Baksht, G. A. Dyvzhev, A. M. Martsinovskiy, B. Ya. Moyzhes, G. Ye. Dikus, E. B. Sonin, and V. G. Yuryev 1978 489 p refs Transl. into ENGLISH of Termoemissionnye prebrazovateli i nizkotemperaturnaia plazma (USSR), 1973 490 p
(DOE-TR-1) Avail: NTIS HC A21/MF A01

The fundamental physical processes in plasma diodes (the phenomena of plasmas and electrodes surfaces), the methods for investigating the low-temperature plasma of thermionic converters, and the investigation of physical processes in thermionic converter (TIC) plasmas and pre-electrode sheaths that occur in the various operating modes are outlined. Topics covered include: (1) thermionic converters and low-temperature plasma, (2) emission and adsorption processes (TIC electrodes), (3) elementary processes in a plasma, (4) kinetic phenomena in the plasma, (5) ionization and recombination in a low-temperature plasma, (6) pre-electrode phenomena in a TIC plasma, (7) experimental methods for investigating low-temperature plasmas, (8) the diffusion mode of thermionic converters, (9) the low-voltage arc in a TIC, (10) the direct-flight (Knudsen) mode of TIC operation; and (11) some engineering problems of TIC's. DOE

N80-17580# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
THE EFFECT OF TEMPERATURE ON SILICON SOLAR CELL PERFORMANCE Final Report [EFFET DE LA TEMPERATURE SUR LE FONCTIONNEMENT DES CELLULES SOLAIRES AU SILICIUM]
S. Makram-Ebeid Feb. 1979 33 p refs In FRENCH; ENGLISH summary
(Contract DGRST-77-7-2024)
(LEP-79/202 SME-680-C) Avail: NTIS HC A03/MF A01

The effect of temperature on silicon solar cells was investigated for monocrystalline cells with P-N and MIS structures and for polycrystalline cells having N+/P structures. The I-V characteristics under AM1 conditions were measured at different temperatures. The dark current was measured and interpreted by means of known theories. A numerical model is developed to calculate the spectral response and the AM1 photocurrent. The theory is compared with experiments and it is shown that for monocrystalline cells the temperature change of photocurrent is mainly due to changes in the optical absorption coefficients. In polycrystalline cells, the increase in the lifetime of photocarriers with increasing temperature contributes significantly to change in the photocurrent. Author (ESA)

N80-17581# Institut fuer Kernenergetik, Stuttgart (West Germany). Energy Conversion and Heat Transfer Div.
TECHNICAL ASSISTANCE IN CONNECTION WITH THE ADAPTATION OF THE HEAT PIPE DIODE Final Report
M. Groll, W. D. Muenzel, and W. Supper May 1979 48 p ref
(Contract ESTEC-2943/76-NL-PP(SC))
(ESA-CR(P)-1232) Avail: NTIS HC A03/MF A01

The shutdown behavior of an all aluminum axially grooved heat pipe diode was examined. A flexible stainless steel artery heat pipe was investigated using ammonia as the working fluid. The liquid trap technique was used for the axially grooved pipe, heating the condenser, and attaching a thermal mass to both evaporator and trap. Shutdown energy of the diode was about 1.5 Wh. The flexible pipe showed a maximum performance of more than 300 W for both the straight and bent pipe. Author (ESA)

N80-17582# Badische Anilin- und Soda-Fabrik A. G., Ludwigshafen am Rhein (West Germany).
DEVELOPMENT OF ELECTROCHEMICAL STORAGE BATTERIES WITH IMPROVED ENERGY DENSITY Final Report
Fritz Beck and Wolfram Treptow Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 209 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-77-88) Avail: NTIS HC A10/MF A01; Fachinformationzentrum, Karlsruhe, DM 43.45

The development of secondary batteries containing metals and metal oxides as nonporous electrodes was investigated. Of the systems examined Zn/MnO2 has the most favorable theoretical stored energy density (up to 360 Whr/kg). Acid corrosion of active masses and the poor load capacity of MnO2 impeded practical applications. The Pb/PbO2 system did not have these problems with an energy yield of 35 to 40 Whr for a theoretical stored energy density of 107 Whr/kg. The limiting value was about 50 Wh/kg. These values were valid for HBF4 as an electrolyte, which was found to be optimal. Power density was high as well. Results indicate that polypropylene filled with natural graphite is feasible as material for base electrodes. It leads to an essentially metal free bipolar battery design and an improved manufacturing technique. Data on cycle life as well as suggestions for the transformation of these results into improved battery design are also presented. Author (ESA)

N80-17583# Royal Aircraft Establishment, Farnborough (England). Space Dept.
PHOTOVOLTAIC CONVERSION RESEARCH AND DEVELOPMENT IN THE UNITED KINGDOM
F. C. Treble London HMSO 9 Mar 1977 14 p refs Presented at 1st Solar Energy R and D Workshop, Bldg. Res. Estab., 24 Mar. 1977

(RAE-TM-SPACE-247; BR57075) Avail: NTIS HC A02/MF A01

Research and development, aimed at reducing the cost and increasing the efficiency of photovoltaic solar cells and modules for terrestrial applications in the United Kingdom is discussed. The cell types involved include crystalline and amorphous silicon, thin film and ceramic cadmium sulfide, cadmium sulfide/indium phosphide, gallium arsenide, and Schottky barrier. These activities are reviewed, with some background information on the general topic of photovoltaic conversion and the merits of the various approaches. Recommendations for future action are made.

Author (ESA)

N80-17584# National Technical Information Service, Springfield, Va.

THERMAL ENERGY STORAGE, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Jul. 1979

Diane M. Cavagnaro Sep 1979 117 p

(NTIS/PS-79/0952/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

The cited reports of Federally funded research concern thermal energy storage. The 112 citations cover the design of equipment, performance evaluation, theory, materials used, and experimental design. GRA

N80-17585# National Technical Information Service, Springfield, Va.

THERMAL ENERGY STORAGE, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1977

Diane M. Cavagnaro Sep 1979 203 p

(NTIS/PS-79/0951/8) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

Studies on thermal energy storage are cited. The 197 citations discuss the materials used, design, theory, performance evaluation, experimental design and applications. GRA

N80-17586# National Technical Information Service, Springfield, Va.

THERMAL ENERGY STORAGE, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1977

Diane M. Cavagnaro Sep 1977 211 p

(NTIS/PS-79/0953/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

Research from worldwide journal literature on thermal energy storage is cited in the bibliography. The 205 citations cover the materials used, equipment design, theory, industries, performance evaluation, and the problems faced. GRA

N80-17587# National Technical Information Service, Springfield, Va.

THERMAL ENERGY STORAGE, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Jul. 1979

Diane M. Cavagnaro Sep 1979 116 p

(NTIS/PS-79/0954/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

Reports from worldwide research are cited covering thermal energy storage. The 110 citations cover many aspects such as the materials used, theory, applications, performance evaluation, design, and problems and advantages. GRA

N80-17588# National Technical Information Service, Springfield, Va.

SILICON SOLAR CELLS, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Nov. 1978 - Oct. 1979

Brian Carrigan Nov 1979 176 p Supersedes NTIS/PS-1116, NTIS/PS-77/0958, NTIS/PS-76/0801

(PB80-800717, NTIS/PS-78/1116, NTIS/PS-77/0958, NTIS/PS-76/0801) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Worldwide research on the development of solar energy conversion devices using silicon ribbons, sheets, films, crystals, and wafers is cited. The preparation, purity, crystal defects, and efficiency of these cells are covered. The economics of solar cell development is discussed. The effects of radiation and weathering on performance are included. This updated bibliography contains 171 abstracts, all of which are new entries to the previous edition. GRA

N80-17589# National Technical Information Service, Springfield, Va.

SILICON SOLAR CELLS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Dec. 1977 - Oct. 1979

Brian Carrigan Nov 1979 290 p Supersedes NTIS/PS-1115, NTIS/PS-77/0956, NTIS/PS-76/0800, NTIS/PS-75/628

(PB80-800691, NTIS/PS-78/1115, NTIS/PS-77/0956, NTIS/PS-76/0800, NTIS/PS-75/628) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Citations of Government sponsored research reports on silicon solar cell growth and fabrication are presented. Processes covered include chemical vapor deposition, the Czochralski method, dendritic growth, ribbon growth, epitaxial growth, and silicon sheet fabrication on substrates. Silicon compound synthesis, purification, and reduction are discussed. Casting, cutting, and shaping of silicon solar cells are included. Solar energy conversion efficiency and performance are described. Abstracts on costs and production of these cells are covered. This updated bibliography contains 209 abstracts, 75 of which are new entries to the previous edition. GRA

N80-17590# National Technical Information Service, Springfield, Va.

SILICON SOLAR CELLS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1976 - Oct. 1978

Brian Carrigan Nov 1979 201 p

(PB80-800709) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Worldwide research pertaining to solar energy conversion devices using silicon ribbons, sheets, films, crystals, and wafers is cited. The preparation, purity, crystal defects, and efficiency of these cells are covered. Solar cell development costs are discussed. The effects of radiation and weathering on performance are described. This updated bibliography contains 196 abstracts, none of which are new entries to the previous edition. GRA

N80-17591# National Technical Information Service, Springfield, Va.

DESIGN AND APPLICATIONS OF FLYWHEELS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Aug. 1978

Guy E. Habercom, Jr. Oct 1979 264 p

(PB80-800303) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

The design and varied applications of flywheels and reaction wheels are investigated in these Government-sponsored research reports. Such diversified applications as satellite stabilization, surface vehicle propulsion, energy transfer devices, and inertia or friction welding are reviewed. This updated bibliography contains 258 abstracts, none of which is new to the previous edition. GRA

N80-17592# National Technical Information Service, Springfield, Va.

DESIGN AND APPLICATIONS OF FLYWHEELS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Sep. 1978 - Sep. 1979

Guy E. Habercom, Jr. Oct 1979 99 p Supersedes NTIS/PS-78/0997, NTIS/PS-77/0882, NTIS/PS-76/0767, NTIS/PS-75/743, NTIS/PS-75/070

(PB80-800311, NTIS/PS-78/0997, NTIS/PS-77/0882, NTIS/PS-76/0767, NTIS/PS-75/743, NTIS/PS-75/070) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Federally funded resarch in the design and use of flywheels and reaction vehicles is cited in 93 abstracts, all of which are new to the previous edition. Applications considered incude energy storage for surface vehicle propulsion, inertia or friction welding, and satellite attitude control. A.R.H.

N80-17593/ National Technical Information Service, Springfield, Va.
DESIGN AND APPLICATIONS OF FLYWHEELS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Oct. 1979
Guy E. Habercom, Jr. Oct. 1979 271 p Supersedes NTIS/PS-78/0998, NTIS/PS-77/0883, NTIS/PS-76/0768
(PB0-800329, NTIS/PS-78/0998, NTIS/PS-77/0883, NTIS/PS-76/0768) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

This bibliography cites 266 reports from world literature relating to the design and use of flywheels and reaction wheels for such applications as satellite attitude control, surface vehicle propulsion, energy transfer devices, and inertia or friction welding. Of the entries, 44 are new to the previous edition. A.R.H.

N80-17594/ National Technical Information Service, Springfield, Va.
COMBINED CYCLE POWER GENERATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Oct. 1979
Audrey S. Hundemann Nov. 1979 158 p Supersedes NTIS/PS-78/1156, NTIS/PS-77/0991
(PB80-800915, NTIS/PS-78/1156, NTIS/PS-77/0991) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Federally-funded research pertaining to design, efficiency, cost, resource requirements, and environmental aspects of combined cycle power plants is discussed. Abstracts primarily deal with use of coal gasification in conjunction with combined gas and steam turbine generation, including subsystems development studies. This updated bibliography contain 151 abstracts, 45 of which are new entries to the previous edition. GRA

N80-17595/ National Technical Information Service, Springfield, Va.
COMBINED CYCLE POWER GENERATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Oct. 1979
Audrey S. Hundemann Nov. 1979 195 p Supersedes NTIS/PS-78/1157, NTIS/PS-77/0992
(PB0-800923, NTIS/PS-78/1157, NTIS/PS-77/0992) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Design, performance, efficiency, economics, and environmental aspects of combined cycle power plants are discussed. Abstracts of worldwide research cover the use of waste heat from gas turbines to drive steam turbines and the thermal efficiency of integrated gasification combined cycle plants using low or intermediate Btu gas. A few abstracts pertain to control and instrumentation used in the plants. This updated bibliography contains 189 abstracts, 36 of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-17596 Michigan Technological Univ., Houghton.
SIMULATION AND MEASUREMENT OF DISPERSING GASEOUS EXHAUST EMISSIONS FROM DIESEL ENGINES IN A MINE ENVIRONMENT Ph.D. Thesis
Harold Joseph Schock, Jr. 1979 236 p
Avail: Univ. Microfilms Order No. 8001318

The production and transport of pollutants in an underground mine were analyzed for the case of an operator working in a dead-ended drift. Experiments were conducted to determine the relative merits of induction ventilation at the entrance to the drift, ventilation of the drift with positive displacement tubing, and no auxiliary ventilation. It was found that ventilation with positive displacement tubing provided the best removal of diesel generated pollutants. Using a mathematical model, the effects of exhaust pipe location and time spent out of the drift were determined and the relationship between CO2 and NO levels was investigated. The exhaust pipe location was shown to have a significant impact on operator exposure to exhaust gases. It was also shown that NO concentration varied directly with CO2 levels. Author

N80-17597/ California Univ., Berkeley. Lawrence Berkeley Lab.
REGIONAL ENVIRONMENT-ENERGY DATA BOOK: WESTERN REGION
Dec. 1978 435 p refs
(Contract W-7405-eng-48)
(DOE/TIC-10114/2; LBL-7921) Avail: NTIS HC A19/MF A01

This document provides a compilation of regional data relating to the energy, environmental, socioeconomic, and institutional characteristics of the West. The document is divided into four chapters. Chapter one includes current and historic data on energy supply, demand, and production; sector fuel demands, fuel consumption, transmission, and transportation; location of energy production and conversion; and energy prices by sector and state. Chapter two shows a variety of natural and preternatural characteristics including water quality and quantity; air quality and air quality control areas; natural and induced climatic conditions; waste disposal; land and coast conditions, use, and management; managed and endangered species; demographic and socioeconomic conditions; and health and mortality data. Included in Chapter three are a variety of organizational, legislative, and regulatory data. Chapter four provides energy equivalents, metric conversions, an index, and a glossary. DOE

N80-17598/ California Univ., Berkeley. Lawrence Berkeley Lab.
REGIONAL ENVIRONMENT-ENERGY DATA BOOK: SOUTHERN REGION
Dec. 1978 832 p refs
(Contract W-7405-eng-26)
(DOE/TIC-10114/4; ORNL-5443) Avail: NTIS HC A99/MF A01

Regional data relating to the energy, environmental, socioeconomic, and institutional characteristics of the South is compiled. Chapter one includes current and historic data on energy supply, demand, and production; sector fuel demands, fuel consumption, transmission, and transportation; location of energy production and conversion; and energy prices by sector and state. Chapter two shows a variety of natural and preternatural characteristics including water quality and quantity; air quality and air quality control areas; natural and induced climatic conditions; waste disposal; land and coast conditions, use, and management; managed and endangered species; demographic and socioeconomic conditions; and health and mortality data. Included in Chapter three are a variety of organizational, legislative, and regulatory data. Chapter four provides energy equivalents, metric conversions, an index, and a glossary. DOE

N80-17599/ Battelle Pacific Northwest Labs., Richland, Wash.
REGIONAL ENVIRONMENT-ENERGY DATA BOOK: NORTHWEST REGION
Dec. 1978 864 p refs
(Contract W-7405-eng-36)
(DOE/TIC-10114/5; PNL-RAP-28) Avail: NTIS HC A99/MF A01

A compilation of regional data relating to the energy, environmental, socioeconomic, and institutional characteristics of the Northwest is presented. The document is divided into four chapters and includes data on the following: energy supply, demand, and production; environmental quality; natural and induced climatic conditions; waste disposal; land and cost conditions, use, and management; managed and endangered species; demographic and socioeconomic conditions; and health and mortality. DOE

N80-17600/ Geological Survey, Champaign, Ill. Water Resources Div.
CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77. VOLUME 1: DES PLAINES RIVER BASIN AND LAKE MICHIGAN
David Grason and R. W. Healy Apr. 1979 224 p refs Prepared in cooperation with Ill. State Environmental Protection Agency
(PB-299912/6; USGS/WRD/WRI-79/041) Avail: NTIS HC A10/MF A01 CSCL 13B

Samples of surface water were collected and analyzed. The results from water years 1975 to 1977 are presented in tabular form, and the history of sampling and analytical methods during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. GRA

N80-17601# Geological Survey, Champaign, Ill. Water Resources Div.
CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77. VOLUME 2: ILLINOIS RIVER BASIN AND MISSISSIPPI RIVER TRIBUTARIES NORTH OF ILLINOIS RIVER BASIN
David Grason and R. W. Healy Apr. 1979 287 p refs Prepared in cooperation with Ill. State Environmental Protection Agency
(PB-299913/4; USGS/WRD/WRI-79/042; USGS/WRI-79/24) Avail: NTIS HC A13/MF A01 CSCL 13B

Samples of surface water collected at 590 sites were analyzed and the results are presented in tabular form. Stream discharge data from records of the U.S. Geological Survey are included if the sampling site was at or near a gaging station. K.L.

N80-17602# Geological Survey, Champaign, Ill. Water Resources Div.
CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77. VOLUME 3: OHIO RIVER TRIBUTARIES AND MISSISSIPPI RIVER TRIBUTARIES SOUTH OF ILLINOIS RIVER BASIN
David Grason and R. W. Healy Apr. 1979 246 p refs Prepared in cooperation with Ill. Environmental Protection Agency
(PB-299914/2; USGS/WRD/WRI-79/043; USGS/WRI-79/25) Avail: NTIS HC A11/MF A01 CSCL 13B

Results from the analysis of surface water samples are presented in tabular form, and the history of sampling and analytical methods during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. GRA

N80-17603# PEDCo-Environmental, Inc., Cincinnati, Ohio.
ASSESSMENT OF ENVIRONMENTAL IMPACT OF THE MINERAL MINING INDUSTRY Final Report
J. S. Greber, V. D. Patel, E. A. Pfetzing, R. S. Amick, and R. O. Toftner Jul. 1979 289 p
(Contract EPA-68-03-2479)
(PB80-103492; EPA-600/2-79-107) Avail: NTIS HC A13/MF A01 CSCL 13B

A multimedia (air, liquid and solid wastes) environmental assessment of the domestic mineral mining industry is presented. Major pollution problems associated with the industry are identified. Research and development needs for adequate control of air pollutants and liquid and solid wastes connected with mineral mining are defined. GRA

N80-17604# National Water Well Association, Worthington, Ohio.
PROCEEDINGS OF THE NATIONAL GROUND WATER QUALITY SYMPOSIUM (4TH). Final Report, 6 Feb. 1978 - 5 Feb. 1979
Aug. 1979 181 p refs Repr. from Ground Water, v. 17, no. 1, Jan.-Feb. 1979 and v. 17, Mar.-Apr. 1979 Conf. held at Minneapolis, 20-22 sep. 1978 Sponsored in part by National Water Well Assoc.
(Grant EPA-R-805747)
(PB80-103476; EPA-600/9-79-029) Avail: NTIS HC A09/MF A01 CSCL 13B

Thirty-four papers are presented in debate format addressing various aspects of ground water quality. Water pollution, land use, and pollution control were the major subject areas. R.E.S.

N80-17605# Environmental Monitoring and Support Lab., Las Vegas, Nev.
DISTRIBUTION OF PHYTOPLANKTON IN TEXAS LAKES Progress Report, 15 Mar. - 20 Nov. 1974
M. K. Morris, W. D. Taylor, L. R. Williams, S. C. Hern, and V. W. Lambou Jun. 1979 122 p refs Prepared in cooperation with Nevada Univ., Las Vegas
(PB80-103401; EPA-600/3-79-070) Avail: NTIS HC A06/MF A01 CSCL 13B

Species and abundance of phytoplankton in the 38 lakes in Texas are reported. Results from the calculation of several water quality indices also include (Nygaard's Trophic State Index, Palmer's Organic Pollution Index, and species diversity and abundance indices). GRA

N80-17606# Geological Survey, University, Ala. Div. of Water Resources.
GROUND-WATER MANAGEMENT TECHNIQUES FOR THE CONTROL OF SALT-WATER ENCROACHMENT IN GULF-COAST AQUIFERS Summary Report
Gary R. Walter, Robert E. Kidd, and George M. Lamb 1979 95 p refs Prepared jointly with OWRT, Washington, D.C.
(PB80-102965; W80-00490; OWRT-B-073-ALA-1) Avail: NTIS HC A05/MF A01 CSCL 13B

The fresh ground-water resources of the Gulf Shores area of Alabama occur in four principal aquifiers. In order of increasing depth, these are designated the Beach Sand aquifer, the Gulf Shores aquifer, the 350-Foot aquifer, and the 500-Foot aquifer. Only in the Beach Sand aquifer can the cases of salt-water contamination be unequivocably attributed to seawater encroachment. Based on the results of numerical modeling and interpretation of the water chemistry, the cases of contamination in the Gulf Shores aquifer may be due to leakage of saline water around well bores, leakage from confining beds and movement of pockets of relic salt water within the aquifer rather than lateral seawater encroachment. GRA

N80-17607# Connecticut Univ., Storrs. Inst. of Water Resources.
POTENTIAL GROUND WATER POLLUTION FROM SEWAGE SLUDGE APPLICATION ON AGRICULTURAL LAND Technical Completion Report, Jul. 1976 - Sep. 1979
R. William Wengel and Gary F. Griffin Sep. 1979 20 p refs Prepared for OWRT, Washington, D.C.
(Contract DI-14-31-0001-6007)
(PB80-102957; W80-00489; OWRT-A-074-CONN-1) Avail: NTIS HC A02/MF A01 CSCL 13B

Corn for silage was grown for three years on land treated with either annual applications or a single application of limed, dewatered sewage sludge at six rates of application. Yields of silage, heavy metal uptake, soil heavy metals, soil nitrates, and soil pH were measured. Soil pH increased under all sludge applications in proportion to rate and total amount of sludge applied. High soil pH reduced extractability of soil metals and also crop uptake of zinc. Soil Cd, Cu, Ni, Pb, and Zn increased with sludge application rate only in the plow layer. No leaching of these metals occurred. Soil nitrates increased with sludge application rate. Leaching and accumulation of nitrates at depths of 244 cm were shown at high application rates. GRA

N80-17608# Southwest Research Inst., San Antonio, Tex.
ENVIRONMENTAL MONITORING OF A WASTEWATER TREATMENT PLANT Final Report, Oct. 1977 - Mar. 1978
D. E. Johnson, D. E. Camann, H. J. Harding, and C. A. Sorber Aug. 1979 137 p refs
(Grant EPA-R-805533)
(PB80-103211; EPA-600/1-79-027) Avail: NTIS HC A07/MF A01 CSCL 06F

A wastewater aerosol monitoring program was conducted at an advanced wastewater treatment facility using the activated sludge process. Wastewater aerosols containing pathogenic organisms are generated by the aeration basin and by an aerated surge basin. From a preliminary microbial screen of the wastewater, predominant indicator and pathogenic microorganisms were selected for routine wastewater and aerosol monitoring. The geometric mean aerosol concentrations at 30 to 50 meters downwind of the aeration basin were 5.8 cfu/cum of total coliforms, 2.0 cfu/cum of fecal streptococci, 9.1 cfu/cum of mycobacteria, 7 cfu/cum of pseudomonas, and 0.7 pfu/cum of coliphage. GRA

N80-17609# Benham-Blair and Affiliates, Inc., Oklahoma City, Okla.
LONG-TERM EFFECTS OF LAND APPLICATION OF

DOMESTIC WASTEWATER: DICKINSON, NORTH DAKOTA, SLOW RATE IRRIGATION SITE
Aug. 1979 180 p refs Prepared in cooperation with Engineering Enterprises, Inc., Norman, Okla.
(Contract EPA-68-02-2363)
(PB80-102643; EPA-600/2-79-144) Avail: NTIS
HC A09/MF A01 CSCL 02C

The long term effects of applying treated domestic wastewater to farmland at Dickinson, North Dakota are reported. Slow rate irrigation, using the border-strip method, has been practiced since 1959. Water soil, and crop samples from this test site were compared with similar samples from a nearby control site irrigated with well water. Samples were also taken to detect coliform bacteria. Thirteen parameters were found to be present at significantly greater concentrations in the effluent used to irrigate the test site than in the river water used to irrigate the control site. GRA

N80-17610# Teknekron, Inc., McLean, Va.
A STUDY OF RADIOACTIVE AIRBORNE EFFLUENTS FROM PARTICLE ACCELERATORS Final Report
Joel L. Cehn Aug. 1979 117 p refs
(Contract EPA-68-01-4997)
(PB80-101314; ORP/TAD-79/12) Avail: NTIS
HC A06/MF A01 CSCL 18H

Radioactive gas production and release around non-Federally owned particle accelerators is discussed. The estimated 1200 non-Federally owned accelerators in the United States are categorized by type and energy, and the potential for radiogas production is discussed for various types. The results of field monitoring around two machines (a cyclotron and a Van de Graaff) are also presented. Estimates of annual radiogas releases from generic accelerator facilities are made. The isotopes of interest are tritium from a generic Van de Graaff; nitrogen-13, oxygen-15, and carbon-11 from a generic cyclotron; and argon-41 from a generic linac. Control technologies to reduce airborne releases of these isotopes are discussed. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-17611 Miami Univ., Coral Gables, Fla.
AN APPLICATION OF AMINO ACID RACEMIZATION THE DETERMINATION OF PALEOHEAT FLOW Ph.D. Thesis
Barry Jay Katz 1979 251 p
Avail: Univ. Microfilms Order No. 8001662

A kinetic model for the racemization of isoleucine in foraminifera was developed from pre-existing data. The differing thermal histories of the samples whether due to variations in bottom water temperatures or the effects of deep burial and the subsequent effects of the natural geothermal gradient were considered. Material obtained from the Deep Sea Drilling Project was evaluated in light of this kinetic model. Calculated reaction temperatures (CRTs) were commonly above those expected for thermal equilibrium with both past and present bottom water temperatures. The calculated reaction temperatures increased with increasing depth and related to the effects of the geothermal gradient through time. This effect quantified through the substitution of a function of heat flow into an Arrhenius equation. The time averaged heat flows calculated through this process were commonly in agreement with available geologic and geophysical information. Dissert. Abstr.

N80-17612 Northwestern Univ., Evanston, Ill.
GLOBAL CYCLING BEHAVIOR OF TRACE METALS Ph.D. Thesis
Ronald Joseph Lantzy 1979 180 p
Avail: Univ. Microfilms Order No. 7927392

Global atmospheric input data for 20 trace metals are presented and the relative importance of natural and anthropogenic surfaces are assessed. A mathematical model was derived and used to calculate enrichment Factors (EFs) based on natural and anthropogenic influxes, effluxes, and interhemispheric transfer rates. The calculated EFs agree with observed EFs at mid and high latitude for lithophile metals, but only at mid latitude for atmophile metals. At high latitude calculated EFs for atmophile metals were lower than observed EFs. To explain these observations and calculations, several additional sources of atmospheric trace metals are discussed. Model calculations show that cessation of anthropogenic trace metal emissions would result in a return of enrichment factors to preindustrial values in less than one year. Other significant observations and results are given. Dissert. Abstr.

N80-17613 Case Western Reserve Univ., Cleveland, Ohio.
DISTRIBUTION PATTERNS OF HOLOCENE AND REWORKED PALEOZOIC PALYNOMORPHS IN SEDIMENTS FROM SOUTHEASTERN LAKE MICHIGAN Ph.D. Thesis
Martha R. Fletcher 1979 331 p
Avail: Univ. Microfilms Order No. 8001478

The distribution and origin of Holocene and reworked Paleozoic palynomorphs extracted from sediments from rivers tributary to Lake Michigan, from soil and bedrock of the river drainage basins, and from gravity-core tops and subsurface sediments from south-western Lake Michigan is examined. Relative pollen frequencies (percentages) and pollen concentration data are supplemented by preservation-quality data for all identifiable grains. Important controls of ultimate pollen distribution in the lake are location and vegetation of the source area, differential transport depending on grain density, differential resistance to decay, lake circulation patterns, and flowering season. A post-glacial spruce zone is reported for the first time in Lake Michigan, and the changing pattern of abundances of reworked and long-transported pollen and Paleozoic spores in the lower parts of one core support other evidence for the abrupt end of a Lake Michigan-Lake Superior connection in the lower Holocene. Dissert. Abstr.

N80-17614 California Inst. of Tech., Pasadena.
REGIONAL VARIATIONS IN THE LEAD ISOTOPIC CHARACTERISTICS OF LATE CENOZOIC BASALTS FROM THE SOUTHWESTERN UNITED STATES Ph.D. Thesis
Joel Earl Everson 1979 464 p
Avail: Univ. Microfilms Order No. 7920352

The lead isotopic systematics of volcanic rocks in the southwestern United States can be divided into three broad regional groups: one characteristic of Colorado Plateau volcanic fields, a second found in many areas of the Basin and Range province, and in neighboring areas along the Pacific coast, and a third peculiar to an area in southern Nevada. Colorado Plateau volcanic rocks have generally unradiogenic leads, locally exhibit large variations in isotopic ratio. Basin and Range type samples are characterized by relatively radiogenic leads and, comparatively, a uniformity of isotopic composition in local areas. Southern Nevada leads are somewhat unradiogenic, appear to display a local uniformity in isotopic composition, and lie off the Colorado Plateau secondary isochrons. Dissert. Abstr.

N80-17615 California Univ., Los Angeles.
MAGNETIC FLUCTUATIONS IN THE FREQUENCY RANGE 0.1 TO 1 HERTZ OBSERVED UPSTREAM FROM THE EARTH'S BOW SHOCK Ph.D. Thesis
Donald Duane Childers 1979 177 p
Avail: Univ. Microfilms Order No. 7921387

Variations in the magnetic field as observed upstream from the Earth's bow shock are investigated. Power spectra of upstream fields undisturbed by bow shock associated effects are presented for the frequency range .01 < or = f approx. < 1 Hz. Magnetic fields disturbed by bow-shock-related effects measured in the upstream region on both sides of the sun-earth direction are found to have similar power spectra over the range .01 < or = f approx. < 1 Hz. The salient spectral characteristic of these fields is a strong peak in the range 0.01 - 0.05 Hz, marked by significant coherences among the vector components at the peak frequency. The spatial distribution of the upstream field fluctuations in the range 0.07 < or = f approx. < 1 Hz is presented and evidence of a bow shock process as the dominant factor behind the subject turbulence in this region is given. In addition, a large number of the high frequency, highly coherent discrete

wave packets often observed in the upstream region are investigated. Dissert. Abstr.

N80-17616 Institut d'Aeronomie Spatiale de Belgique, Brussels.
TERRESTRIAL SPACE: BIBLIOGRAPHY, FASCICLE 16A
1978 158 p refs
Avail: Issuing Activity

A bibliography of scientific works relative to the Earth's space environment is presented. Subject headings include meteorology, geomagnetism, auroras, and airglow. Also covered are studies of the ionosphere. Subheadings deal with the D region, E region, and F region. The topside region, whistlers, and general problems are treated as well. Author (ESA)

N80-17617 Institut d'Aeronomie Spatiale de Belgique, Brussels.
TERRESTRIAL SPACE: BIBLIOGRAPHY, FASCICLE 16B
1978 140 p refs
Avail: Issuing Activity

International in scope, this bibliography cites 760 documents relating to the earth's space environment. Topics cover solar radiation; cosmic rays; the structure of the upper atmosphere; and satellite orbits with emphasis on potential. Atmospherics are considered from the point of view of homosphere, aeronomical chemistry, the heterosphere, interaction between neutral and ionized atmosphere, the exosphere, and the magnetosphere. Author (ESA)

N80-17618*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A PROPOSED CONCEPT FOR A CRUSTAL DYNAMICS INFORMATION MANAGEMENT NETWORK
Guy M. Lohman and J. Thomas Renfrow 15 Jan. 1980 116 p refs
(Contract NAS7-100)
(NASA-CR-162785; JPL-Pub-79-111) Avail: NTIS HC A06/MF A01 CSCL 08E

The findings of a requirements and feasibility analysis of the present and potential producers, users, and repositories of space-derived geodetic information are summarized. A proposed concept is presented for a crustal dynamics information management network that would apply state of the art concepts of information management technology to meet the expanding needs of the producers, users, and archivists of this geodetic information. J.M.S.

N80-17619# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
A SURVEY OF CURRENTLY IMPORTANT EMPIRICAL THERMOSPHERIC MODELS Interim Report
David R. Hickman, Barbara K. Ching, Carl J. Rice, Lawrence R. Sharp, and Joe M. Straus 14 Sep. 1979 188 p refs
(Contract F04701-78-C-0079)
(AD-A075748; TR-0079-4960-04-2; SAMSO-TR-79-57) Avail: NTIS HC A09/MF A01 CSCL 04/1

A description of currently important empirical thermospheric models is given, and the relative advantages of each are discussed. In addition, a comprehensive set of contour plots of total density is presented to allow more detailed examination of quantitative aspects of the models. GRA

N80-17620# Dayton Univ., Ohio.
THE 1977 ROBIN PROGRAM, USER'S MANUAL
John F. Myers and James K. Luers Jul. 1979 42 p refs
(Contract DAAD07-78-C-0020)
(AD-A075443; ERADCOM/ASL-CR-79-0020-1) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Robin 77 or revised High Altitude Robin Program is specifically designed for computer reduction of Robin flights which attain an apogee of approximately 125 km, and are tracked by an FPS/16 radar. The program also provides accurate reduction for Robin flights attaining other apogees between 65 and 150 km. If a passive sphere other than the 1-m Robin approximately 115 g is used, reduction with this program is still possible. There may be times, however, when drag coefficients are not available and thus density, temperature, and pressure cannot be computed. The time of fall test used to determine spheres collapse is not used for sphere with dimensions that differ from the Robin. At each second of flight, the program calculates altitude, wind components and direction, density, temperature, and pressure, the RMS noise error winds, density, temperature and pressure, and other balloon dynamics. Author (GRA)

N80-17621# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
CORRELATED OBSERVATIONS OF AURORAL ARCS, ELECTRONS, AND X-RAYS FROM A DMSP SATELLITE Interim Report
Paul F. Mizera, Janet G. Luhmann, Wojciech A. Kolasinski, and J. Bernard Blake 28 Sep. 1979 22 p refs
(Contract F04701-78-C-0079)
(AD-A075207; TR-0079(4960-05)-2; SAMSO-TR-79-53) Avail: NTIS HC A02/MF A01 CSCL 04/1

The first simultaneous observations, made from a single DMSP satellite, of visible auroral arcs, precipitating primary electrons, and atmospheric bremsstrahlung X-rays are presented for a moderately disturbed auroral event. Measured electron fluxes were used to compute absolute X-ray distributions expected at the satellite altitude. The agreement between the calculated and measured X-ray spectra is sufficiently good to suggest that global auroral energy input can be monitored by an orbiting X-ray spectrometer. GRA

N80-17622# Webb Associates, Yellow Springs, Ohio.
THE PRECIPITATING ELECTRON DETECTORS (SSJ/3) FOR THE BLOCK 5D/FLIGHTS 2-5 DMSP SATELLITES: CALIBRATION AND DATA PRESENTATION Final Report, 1 Jan. 1977 - 30 Sep. 1978
M. S. Gussenhoven, D. A. Hardy, and A. Huber Aug. 1979 64 p refs
(Contract F49620-77-C-0050)
(AD-A075114; AFOSR-79-1060TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

The work under this contract had as its goal the time-dependent phenomenological modeling of the polar cap regions. The vehicle for modeling the caps has been to analyze the following collection of data DMSP images showing polar cap auroras DMSP electron measurements hourly averages of the interplanetary magnetic field ground magnetometer data from Thule and magnetic indices. DMSP images from the winters of 1972-1973 and 1974-1975 provided consistently good records of the northern polar cap regions and were used as the primaary basis of the study. The DMSP images for these periods were traced and gridded in corrected geomagnetic coordinates and local geomagnetic time. The subset of cases for which auroras occur at above 80 degrees corrected geomagnetic latitude was identified and further categorized by local time interval of occurrence morning, midnight, evening sectors. The occurrence of extremely high latitude aurora in each category was correlated with magnetic indices, magnetometer response at Thule, and solar wind parameters. The correlation of cap size as determined by poleward auroral boundaries, and the time variation of these with the above parameters was also made. GRA

N80-17623# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
AN EFFECTIVE STRESS MODEL FOR GROUND MOTION CALCULATIONS Final Report, Oct. 1977 - Jun. 1979
George Y. Baladi Sep. 1979 118 p refs
(AD-A076537; WES-TR-SL-79-7) Avail: NTIS HC A06/MF A01 CSCL 14/2

This report documents the development of a three-dimensional, elastic-plastic, work-hardening constitutive model based on the theory of effective (intergranular) stress for the purpose of simulating the response of isotropic three-phase (partially saturated) earth materials. This model can be used to perform effective stress ground shock analyses. The model is actually a marriage of two single-phase elastic-plastic models which simulate, respectively, the drained and undrained stress-strain behavior of earth media, and whose coefficients can all be determined experimentally using conventional laboratory testing techniques. Fitting the model, therefore, requires an extra set of laboratory tests (the drained tests) over that required to fit a contemporary (total stress) ground shock model. The feasibility of using the new model for effective stress ground shock analyses is demonstrated numerically by solving a simplified two-dimensional airslap problem for a saturated sand halfspace using

an effective stress version of the LAYER code. The real power of this computational tool has yet to be investigated by applications against actual field experiments. Appendix A reviews the fundamentals of elastic-plastic models. GRA

N80-17624# Sperry Rand Corp., Great Neck, N. Y. Sperry Systems Management.
SEISMIC PROFILING SYSTEMS Final Report
Apr. 1979 18 p
(Contract N00014-78-C-0208)
(AD-A076262; Rept-2542.1579) Avail: NTIS
HC A02/MF A01 CSCL 08/11

A Seismic Profiling System was delivered on 30 January 1978 for temporary installation and operation aboard the NR-1. In order to have the equipment installed and tested in time for a planned mission, it was necessary to substitute an Edo Model 550A recorder in lieu of the final Model 615-2 recorder. The model 615-2 recorder was still in production at this time, but was subsequently delivered to the NR-1 and the Model 550A recorder was returned to the vendor. It has been reported that the seismic profiling equipment performed satisfactorily during the entire mission. The Model 615-2 recorder which has replaced the Model 550A recorder is more compact and mounts in the 2300 equipment rack, a considerable advantage over the unwieldy size of the latter recorder. The final equipment was delivered in accordance with the contract requirements. GRA

N80-17625# Ohio State Univ., Columbus. Electroscience Lab.
TROPOSPERIC WATER VAPOR ABSORPTION IN THE INFRARED WINDOW REGIONS Ph.D. Thesis
Michael E. Thomas. Aug. 1979 251 p refs
(Contract DAAG29-77-C-0010)
(AD-A076267; ESL-784701-5; ARO-14702.4-GS) Avail: NTIS
HC A12/MF A01 CSCL 04/1

Attenuation of infrared radiation in the troposphere is dominated by water vapor absorption. Most past work on the spectroscopy of water vapor has been on the analysis of the rotational and vibrational bands. As a result a thorough listing of line positions, line strengths and halfwidths exists today. Because of the weak 'continuum' absorption in the water vapor windows centered at 10 and 4 microns, efforts to measure and model the continuum have not been as successful as efforts in the analysis of the bands. Yet a precise understanding of continuum absorption is important for long path energy transmission. The purpose of this study is to demonstrate the importance of far wing phenomena in characterizing H2O continuum absorption. A total line shape for water vapor-nitrogen interactions valid under tropospheric conditions is derived. The model is tested using a set of experimental room temperature H2O continuum measurements of high quality. Using this data base parameters of the far wing component of the total line shape are determined. GRA

N80-17626# Electronics Research Lab., Adelaide (Australia).
PRELIMINARY ASSESSMENT OF INFRA-RED TRANSMISSION DATA MEASURED OVER OCEAN-TYPE WATERS IN A TEMPERATE ENVIRONMENT
D. R. Cutten. Mar. 1979 44 p refs
(AD-A073417; ERL-0063-TM) Avail: NTIS HC A03/MF A01
CSCL 04/1

Measurements have been made of the near sea infra-red transmission of the atmosphere over paths of 5 and 9 km in a temperature environment. Seven broadband spectral regions have been used and variations with absolute humidity, temperature and visibility are investigated. The data are compared with the predictions of the AFGL computer model LOWTRAN3B. A discrepancy has appeared between the measured and calculated data for the 4.4 to 5.4 micrometers region due, possibly, to either no water continuum absorption being included in the model or an under-estimation of the N2 continuum absorption. Indications are that the dependence of water vapour continuum transmission on precipitable water and temperature in the 8.2 to 11.8 micrometers region may not be accurately described by the LOWTRAN3B model. GRA

N80-17627# Science Applications, Inc., La Jolla, Calif.
SATELLITE MEASUREMENTS OF TROPOSPHERIC AEROSOLS
M. Griggs. 30 Aug. 1979 17 p refs Presented at the 23rd Ann. Intern. Symp. of the Soc. of Photo-Opt. Instr. Engr., San Diego, Calif., 29 Aug. 1979
(Contract N00014-77-C-0489)
(AD-A075579; SAI-011-79-1004-LJ) Avail: NTIS
HC A02/MF A01 CSCL 04/1

This report develops a number of upper and lower bounds for the reliability of multistate systems, that is, systems for which each component may exist in one of a finite number of states. These bounds are based on notions of multistate minimal paths and minimal cuts. The bounds are far more easily computed than the exact system reliability. In order to further reduce the computations required and obtain sharper bounds, a modular-decomposition-based bound is developed for multistate systems. GRA

N80-17628# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
THE MICROPHYSICS OF ICE CLOUDS - A SURVEY Interim Report
Rosemary M. Dyer and Arnold A. Barnes, Jr. 8 May 1979 39 p refs
(AF Proj. 2310)
(AD-A077020; AFGL-TR-79-0103) Avail: NTIS
HC A03/MF A01 CSCL 04/1

Published results of observations of crystal habits, particle sizes and numbers of ice particles in clouds are summarized and discussed. There are systematic variations with cloud type, and in some instances, with cloud age and location within a cloud system. However, the body of data available is insufficient to formulate a climatology of ice cloud microphysics. The several measurement techniques in current use are evaluated, as are some of the techniques now under consideration for future use. The particle enhancement observed on some occasions is discussed, and the various theories accounting for it presented. Finally, recommendations are made concerning future field programs and theoretical studies required before accurate predictions of the ice cloud microphysical environment can be made. GRA

N80-17629# California Univ., Berkeley. Lawrence Berkeley Lab.
FAULT INTERSECTIONS AND HYBRID TRANSFORM FAULTS IN THE SOUTHERN SALTON TROUGH GEOTHERMAL AREA, BAJA CALIFORNIA, MEXICO
S. VonderHaar and I. PuenteCruz (Comision Federal de Electricidad, Mexico City). Jul. 1979 5 p refs Presented at Geothermal Resources Council Ann. Meeting, Reno, Nev., 24 Sep. 1979
(Contract W-7405-eng-48)
(LBL-9458; CONF-790906-28) Avail: NTIS
HC A02/MF A01

Analysis of 55 wells drilled at the Cerro Prieto Geothermal Field and a suite of geological and geophysical studies throughout the southern Salton Trough from the Mexican-United States border to the Gulf of California clarify two concepts important to geothermal development: increased natural convective fluid flow and better permeability should occur at intersecting faults both regionally and within a producing field, and the Cerro Prieto and Imperial faults are best conceived of as hybrid types having features of both San Andreas style wrench faults and oceanic transform faults. DOE

N80-17630# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
POTENTIAL AND INDUCTIVE ELECTRIC FIELDS IN THE MAGNETOSPHERE DURING AURORAS
W. J. Heikkila (Texas Univ., Dallas), R. J. Pellinen (Finn. Meteorol. Inst.), C. G. Faalthamaar, and L. P. Block. Mar. 1979 21 p refs Submitted for publication
(TRITA-EPP-79-02) Avail: NTIS HC A02/MF A01

Magnetospheric processes responsible for auroral activity are discussed. Results show that during quiescent auroras the large scale electric field in essentially irrotational. The volume formed by the plasma sheet and its extension into the auroral oval is connected to an external energy source by electric currents which enter and leave the volume at different electric potentials as well as supplying sufficient energy to support the auroral

activity. The location of the actual acceleration of particles depends on the internal distribution of electric fields and currents. One important feature is the energization of the carriers of the cross-tail current and another is the acceleration of electrons precipitated through relatively low altitude, magnetic field aligned, potential drops. Substorm auroras depend on rapid and (especially initially) localized release of energy that can only be supplied by tapping stored magnetic energy. Author (ESA)

N80-17631# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
AN EMPIRICAL DETERMINATION OF THE PRODUCTION EFFICIENCY FOR AURORAL 6300 A EMISSION BY ENERGETIC ELECTRONS
G. G. Shepherd, J. D. Winningham (Texas Univ., Dallas), F. E. Bunn (York Univ., Toronto), and F. W. Thirkettle (York Univ., Toronto). Jun. 1979. 21 p. refs.
(TRITA-EPP-79-10). Avail: NTIS. HC A02/MF A01.

Auroral data from the Soft Particle Spectrometer and the Red Line Photometer on the ISIS-2 spacecraft were selected to form an electron energy flux and optical auroral emission data base. The energy fluxes are stored as integrated fluxes over four energy bands and the corresponding stored optical emission rates are corrected for airglow and for albedo. Because of the variety of electron energy spectra represented in the data base it was possible to perform a regression analysis that yielded the production efficiency for the production of emission for each of the four bands. The significance of this approach is that it permits a multiparameter description of an electron energy spectrum, and its relationship to a specific optical emission, by purely empirical means. Author (ESA)

N80-17632# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
FIELD LINE PROJECTIONS OF 6300 A AURORAL EMISSIONS INTO THE OUTER ATMOSPHERE
Marian M. Shepherd (York Univ., Toronto, Canada). Jul. 1979. 10 p. refs.
(TRITA-EPP-79-11). Avail: NTIS. HC A02/MF A01.

An empirical magnetospheric model was employed to project auroral intensity boundaries into the magnetosphere. The auroral data are in the form of instantaneous maps of 6300 A emission, acquired with the ISIS-2 spacecraft, and correspond to fluxes of low energy electrons. These are specific to a particular universal time and date. The purely empirical magnetospheric model used includes the dipole tilt as a variable and permits selection from four different disturbance levels. In a general way, the auroral projections agree with what is expected, giving some confidence in this application of the model. However, a number of features appear that were not predicted and which should permit new insights into the relationship of specific auroral boundaries to the structure of the magnetosphere. Author (ESA)

N80-17633# Royal Netherlands Meteorological Inst., De Bilt.
SEISMOLOGICAL BULLETIN OF THE SEISMOGRAPH STATIONS IN THE NETHERLANDS, VOLUME 60, 1972
1979. 111 p.
(KNMI-108-60). Avail: NTIS. HC A06/MF A01.

The geographic coordinates of the Dutch seismograph stations are given and the instruments used at each station are described. Data analysis, including interpretation of microseismic activity, is discussed. Results are presented in tabular form. Author (ESA)

N80-17249 Geological Survey, Washington, D. C.
EARTHQUAKES: THEIR CAUSES AND EFFECTS
Robert M. Hamilton. *In* The Shock and Vibration Inform. Center, The Shock and Vibration Bull., Pt. 1. Sep. 1978. p. 19-21. (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-17634 Deutscher Wetterdienst, Offenbach am Main (West Germany).
EQUIPMENT AND METHODS FOR MEASURING LOCAL AND OVERALL PRECIPITATION [NEUE GERAETE UND METHODEN ZUR MESSUNG DES PUNKT- UND FLAECHENNIEDERSCHLAGES]
Walter Attmannspacher. 1978. 17 p. refs. In GERMAN; ENGLISH summary.
(ISBN-3-88148-163-X; ISSN-0072-4130). Avail: NTIS. HC A02.

The ombrometer HP with its three sensors for measuring duration and amount of precipitation is described. Basic problems associated with fog/precipitation measurement by a single ombrometer are discussed. Examples of this measurement using A-band and C-band radar are given. Results from C-band radar measurement are compared with a statistical study of synchronous radar rain gage measurement. The studied rain gage network is described. A fully automatic radar precipitation measurement system is considered. Author (ESA)

N80-17635 Deutscher Wetterdienst, Offenbach am Main (West Germany).
WIND FORCE ANALYSIS FOR THE FEDERAL REPUBLIC OF GERMANY TO DETERMINE THE USEFULNESS OF WIND POWER [DIE WINDVERHAELTNISSE IN DER BUNDESREPUBLIK DEUTSCHLAND IM HINBLICK AUF DIE NUTZUNG DER WINDKRAFT]
W. Benesch, G. Duensing, G. Jurksch, and R. Zoellner. 1978. 145 p. refs. In GERMAN; ENGLISH summary. Original contains color illustrations.
(ISBN-3-88148-164-8). Avail: NTIS. HC A07.

The utilization of wind force in inland areas is investigated on the basis of data sets from 74 stations from the period 1969 to 1974. The dependence of the annual means and average annual cumulative frequencies of wind velocity on elevation is evaluated. Analyses on the duration of threshold values of wind velocity are also made. A number of sites suitable for wind power utilization are identified. Author (ESA)

N80-17636 Direction de la Meteorologie Nationale, Paris (France).
CYCLOGENESIS IN THE WESTERN MEDITERRANEAN BASIN [CYCLOGENESIS DU BASSIN MEDITERRANEEN OCCIDENTAL]
Claude Fons. Jan. 1979. 62 p. refs. In FRENCH.
(MN-Mono-109). Avail: NTIS. HC A04.

Several case histories of cyclogenesis in the western Mediterranean basin are presented. Preponderant effects on the evolution of low pressure zones in this area are orographic. Analysis shows that fronts moving down the Rhone Delta coincide with the development of numerous depressions over the Mediterranean sea and with the occurence of high winds (30 knots and over). A considerable drop in high altitude pressure is also noted. Maximum variations in geopotential are seen at 300 mbars. A specific technique for long range forecasting in this region is proposed. Author (ESA)

N80-17637# Federal Aviation Administration, Atlantic City, N.J.
MANUAL VOICE INPUT SUBSYSTEM OF THE NAFEC MASS WEATHER DISSEMINATION SYSTEM. Interim Report
Paul Quirk and Louis Delemarre. Nov. 1979. 29 p.
(FAA Proj. 131-401-800).
(AD-A077074; FAA-RD-79-12; FAA-NA-79-21). Avail: NTIS. HC A03/MF A01. CSCL 04/2.

The development, test, evaluation, and application of digital technology to the mass dissemination of meteorological and aeronautical information is investigated. The prototype model is a fully automated system designed to transfer a significant amount of workload from the FSS specialist to system hardware and to provide better service to the flying public. M.M.M.

N80-17638*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION OF THE FOURTH ORDER BAND MODEL
Eugenia Kalnay-Rivas and David Hoitsma (Sigma Data Services Corp.). Dec. 1979. 117 p. refs. Submitted for publication.

(NASA-TM-80608) Avail: NTIS HC A06/MF A01 CSCL 04B

A general circulation model is presented which uses quadratically conservative, fourth order horizontal space differences on an unstaggered grid and second order vertical space differences with a forward-backward or a smooth leap frog time scheme to solve the primitive equations of motion. The dynamic equations for motion, finite difference equations, a discussion of the structure and flow chart of the program code, a program listing, and three relevent papers are given. M.G.

N80-17639*# Cornell Univ., Ithaca, N. Y.
DEVELOPMENT OF A SEVERE LOCAL STORM PREDICTION SYSTEM: A 60-DAY TEST OF A MESOSCALE PRIMITIVE EQUATION MODEL Final Report, 1 Dec. 1976 - 30 Sep. 1978
Douglas A. Paine, John W. Zack, and Michael L. Kaplan (General Electric Management and Technical Service Co., Hampton, Va.) 1979 147 p refs
(Grant NsG-1365)
(NASA-CR-162756) Avail: NTIS HC A07/MF A01 CSCL 04B

The progress and problems associated with the dynamical forecast system which was developed to predict severe storms are examined. The meteorological problem of severe convective storm forecasting is reviewed. The cascade hypothesis which forms the theoretical core of the nested grid dynamical numerical modelling system is described. The dynamical and numerical structure of the model used during the 1978 test period is presented and a preliminary description of a proposed multigrid system for future experiments and tests is provided. Six cases from the spring of 1978 are discussed to illustrate the model's performance and its problems. Potential solutions to the problems are examined. A.W.H.

N80-17640*# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
PROGRAM OF RESEARCH IN SEVERE STORMS Final Report
31 Oct. 1979 24 p refs
(Grant NsG-1251)
(NASA-CR-162764) Avail: NTIS HC A02/MF A01 CSCL 04B

Two modeling areas, the development of a mesoscale chemistry-meteorology interaction model, and the development of a combined urban chemical kinetics-transport model are examined. The problems associated with developing a three dimensional combined meteorological-chemical kinetics computer program package are defined. A similar three dimensional hydrostatic real time model which solves the fundamental Navier-Stokes equations for nonviscous flow is described. An urban air quality simulation model, developed to predict the temporal and spatial distribution of reactive and nonreactive gases in and around an urban area and to support a remote sensor evaluation program is reported. A.W.H.

N80-17641*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GUIDELINES FOR THE AIR-SEA INTERACTION SPECIAL STUDY: AN ELEMENT OF THE NASA CLIMATE RESEARCH PROGRAM, JPL/SIO WORKSHOP REPORT
15 Feb. 1980 53 p refs
(Contract NAS7-100)
(NASA-CR-162792; JPL-Pub-80-8) Avail: NTIS HC A04/MF A01 CSCL 04B

A program in the area of air sea interactions is introduced. A space capability is discussed for global observations of climate parameters which will contribute to the understanding of the processes which influence climate and its predictability. The following recommendations are some of the suggestions made for air sea interaction studies: (1) a major effort needs to be devoted to the preparation of space based climatic data sets; (2) NASA should create a group or center for climatic data analysis due to the substantial long term effort that is needed in research and development; (3) funding for the analyses of existing data sets should be augmented and continued beyond the termination of present programs; (4) NASA should fund studies in universities, research institutions and governments' centers; and (5) the planning for an air sea interaction mission should be an early task. F.C.T.

N80-17642# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
PROBABILITY WEATHER FORECASTS FOR THE ARMY Final Report. M.S. Thesis
Arthur C. Kyle 8 Jun. 1979 116 p refs
(AD-A076190) Avail: NTIS HC A06/MF A01 CSCL 04/2

The United States Army presently receives weather forecasts expressed in categorical terms. However, this forecast form limits the useful information that can be communicated to the decision maker. This study investigates the utility of replacing categorical forecasts with probability forecasts in order to enhance decision making by Army commanders. To this end, the advantages and limitations of probability forecasts are reviewed. The principal conclusion of this study is that Army commanders would benefit from receiving probability weather forecasts. Finally, several recommendations for smoothing the conversion are given and a briefing that a Staff Weather Officer can use a basis for showing an Army commander the utility of probability forecasts is provided. GRA

N80-17643# Florida State Univ., Tallahassee. Dept. of Statistics.
A MULTIVARIATE METHODOLOGY FOR THE ANALYSIS OF WEATHER MODIFICATION EXPERIMENTS
Elton Scott Aug 1979 73 p refs
(Contract N00014-76-C-0394)
(AD-A076164; FSU-Statistics-M514; TR-147-ONR) Avail: NTIS HC A04/MF A01 CSCL 04/2

This paper develops applications of multivariate statistical models, particularly principal component analysis, to the analysis of data from weather modification experiments. The efficacy of these multivariate applications is examined by applying the proposed models to data from Phase 1 of the Santa Barbara Convective Band Seeding Program conducted for the Navy by North American Weather Consultants. Multivariate summary measures of precipitation are developed and multivariate methods are given to analyze the effects of cloud-seeding on precipitation. Results from these models, based on the above-mentioned data set, are reported along with conclusions and suggestions for further work. An appendix provides detailed summary statistics for the analyses. Author (GRA)

N80-17644# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
ELMENDORF AFB, ANCHORAGE, ALASKA: REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
17 Sep. 1979 477 p
(AD-A076085; USAFETAC/DS-79-071) Avail: NTIS HC A21/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Elmendorf AFB, Anchorage, Alaska. It contains the following parts (1) Weather Conditions; Atmospheric Phenomena; (2) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface Winds; (4) Ceiling Versus Visibility; Sky Cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurence or cumulative percentage frequency of occurrence tables. GRA

N80-17645# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
FORT SILL AAF, LAWTON, OKLAHOMA: REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSO), PARTS A-F Final Report
19 Sep. 1979 672 p
(AD-A076080; USAFETAC/DS-78/086) Avail: NTIS HC A99/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather

observations for Fort Sill AAF, Lawton, Oklahoma. It contains the following parts: (1) Weather Conditions; Atmospheric Phenomena; (2) Precipitation Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface Winds; (4) Ceiling Versus Visibility; Sky Cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables.
GRA

N80-17646# Air Force Environmental Technical Applications Center, Scott AFB, Ill. Data Processing Div.
GRAY AAF, FORT LEWIS, LACEY, WASHINGTON: REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
Asheville, N.C. 23 Feb. 1979 445 p
(AD-A076079; USAFETAC/DS-79-085) Avail: NTIS
HC A19/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Fort Lewis, Lacey, Washington. It contains the following parts: (1) Weather Conditions Atmospheric Phenomena (2) Precipitation Snowfall and Snow Depth (daily amounts and extreme values (3) Surface Winds, (4) Ceiling Versus Visibility Sky Cover, (5) Psychrometric Summaries (daily maximum and minimum temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables.
GRA

N80-17647# Naval Postgraduate School, Monterey, Calif.
DETERMINATION OF VERTICAL WIND SHEAR FROM LINEAR COMBINATIONS OF SATELLITE RADIANCE GRADIENTS: A THEORETICAL STUDY Technical Report, 1 Oct. 1978 - 22 Sep. 1979
Sep. 1979 44 p refs
(AD-A075213; NPS63-79-004) Avail: NTIS
HC A03/MF A01 CSCL 04/2

By applying the thermal wind equation to the radiative transfer equation, one can derive the vertical wind shear from horizontal gradients of radiances measured by satellite. The vertical resolution of the wind shear can be optimized by using linear combinations of radiance gradients. A theoretical study was conducted to determine the optimal pressure intervals over which wind shears could be resolved when using weighting functions associated with the SSH sounder of the Defense Meteorological Satellite Program, and those associated with the TOVS instrument package on the TIROS-N/NOAA series of operational satellites. Two distinct computational approaches are presented and their respective results are summarized.
GRA

N80-17648# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
LANGLEY AFB, NEWPORT NEWS, VIRGINIA: REVISED UNIFORM SUMMARY OF SURFACE WEATHER Final Report
1 Jun. 1979 478 p
(AD-A076083; USAFETAC/DS-79/069) Avail: NTIS
HC A21/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Langley AFB, Newport News, Virginia. It contains the following parts: (1) Weather Conditions; Atmospheric Phenomena; (2) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface Winds; (4) Ceiling Versus Visibility; Sky Cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables.
GRA

N80-17649# New Mexico State Univ., Las Cruces. Physical Science Lab.
HELICOPTER REMOTE WIND SENSOR (HRWS) GROUND TEST
J. E. Ottesen and David H. Dickson Oct. 1979 21 p refs
(Contract DAAD07-79-C-0008)
(AD-A077142; ERADCOM/ASL-CR-79-0008-2) Avail: NTIS
HC A02/MF A01 CSCL 04/2

Ground tests of the Helicopter Remote Wind Sensor (HRWS) were run at Biggs Optical Range (BOR) to determine the suitability of the HRWS for measuring low-level cross winds for surface launched weapons ballistics. The HRWS accurately measured winds under a variety of atmospheric turbulence conditions. Average absolute differences (with respect to the BOR) were 0.6 m/s for point measurement, 0.8 m/s for the near field, and 1.3 m/s for a 500-m path.
GRA

N80-17650# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
FORT HUACHUCA, HUACHUCA CITY, ARIZONA: REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
20 Aug. 1979 509 p refs
(AD-A076070; USAFETAC/DS-79/068) Avail: NTIS
HC A22/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Fort Huachuca, Huachuca City, Arizona. It contains the following parts: (1) Weather Conditions; Atmospheric Phenomena; (2) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface Winds; (4) Ceiling Versus Visibility; Sky Cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables.
GRA

N80-17651# Deutscher Wetterdienst, Hohenpeissenberg (West Germany).
RESULTS OF AEROLOGICAL AND SURFACE OZONE MEASUREMENTS [SONDERBEOBACHTUNGEN DES METEOROLOGISCHEN OBSERVATORIUMS HOHENPEISSENBERG. NR. 37. ERGEBNISSE DER AEROLOGISCHEN UND BODENNAHEN OZONMESSUNGEN IM 1. HALBJAHR 1978]
1978 193 p In GERMAN; ENGLISH summary
(ISSN-0581-1287; ISSN-0343-7426) Avail: NTIS
HC A09/MF A01

Ozone measurements made during the first half of 1978 at Hohenpeissenberg, Germany, are reported. Surface ozone was measured near the ground while total ozone was measured using a Dobson spectrophotometer. Results are presented in tabular form.
Author (ESA)

N80-17652# Deutscher Wetterdienst, Hohenpeissenberg (West Germany).
DETAILED AEROLOGICAL TABLES FROM THE INTERNATIONAL OZONE SURVEY [SONDERBEOBACHTUNGEN DES METEOROLOGISCHEN OBSERVATORIUMS HOHENPEISSENBERG. NR. 38. AUSFUGHRLICHE AEROLOGISCHE TABELLEN DES INTERNATIONALEN OZONSONDENVERGLEICHS 3.4.-21.4. 1978]
1978 104 p In GERMAN
(ISSN-0581-1287; ISSN-0343-7426) Avail: NTIS
HC A06/MF A01

Ozone measurements from five countries (USA, Japan, India,

West Germany, and East Germany) are reported and compared. Four different sondes were used, the results of which are given in tabular form. Author (ESA)

N80-17653# Deutscher Wetterdienst, Hohenpeissenberg (West Germany).
RESULTS OF AEROLOGICAL AND SURFACE OZONE MEASUREMENTS IN THE SECOND HALF OF 1978 [SONDERBEOBACHTUNGEN DES METEOROLOGISCHEM OBSERVATORIUMS HOHENPEISSENBERG. NR. 39. ERGEBNISSE DER AEROLOGISCHEN UND BODENNAHEN OZONMESSUNGEN IM 2. HALBJAHR 1978]
1979 174 p In GERMAN; ENGLISH summary
HC A08/MF A01

Ozone measurements, made twice a week at Hohenpeissenberg, Germany are reported. Surface ozone was measured conventionally near the ground while total ozone was determined using a Dobson spectrophotometer. Results are given in tabular form. Author (ESA)

N80-17654# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
METHODS OF STEREOSCOPIC CLOUD ANALYSIS FROM SPACE
Dieter Lorenz and Erich Schmidt May 1979 42 p refs Original contains color illustrations
(DLR-Mitt-79-04) Avail NTIS HC A03/MF A01; DFVLR, Cologne DM 10.60

Stereoscopic cloud imaging from weather satellites to facilitate cloud analysis and improve cloud height determination is discussed. Cloud imaging is performed from a geostationary as well as from a polar orbit. A system for a nearly polar operational weather satellite to meet special European requirements is proposed. The system consists of an optomechanical stereoscopic line scanner with two inclined scan planes and with visible and thermal infrared channels for day and night imaging. The integration of an additional laser altimeter for height measurements of reference points makes it possible to correct the influence of wind on cloud height determination (caused by nonsynchronous imaging) as well as to detect winds from cloud motion. Both optical and electronic methods can be used for image display and processing. Author (ESA)

N80-17655# Royal Netherlands Meteorological Inst., De Bilt.
METEOROLOGY AND THE FORECASTING OF AIR POLLUTION. THE USE OF DAILY AIR QUALITY CRITERIA IN FUEL CHOICE FOR ELECTRIC POWER STATIONS [EEN STUDIE VAN DE TOEPASSING VAN METEOROLOGISCHE EN LUCHTVERONTREIGINGSCRITERIA BIJHET VOEREN VAN EEN BRANDSTOFKEUZEBELEID VOOR ELECTRICTEITSCENTRALES]
H. VanDop, N. D. VanEgmond (RIV, Bilthoven, Netherlands), and J. F. DenTonkelaar 1979 30 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-8) Avail NTIS HC A03/MF A01

An air pollution forecast based on meteorological parameters was tested. The meteorological parameters included in the forecast are the daily average wind speed, the strength of the nocturnal inversion, and the daily maximum mixing height. The observed and 24 hour forecast values were compared over a period of five years. The correlation between the forecast indexes for one, two, and three days in advance and the observed values are 0.64, 0.48, and 0.34, respectively. The forecast was investigated as a possible decision parameter for fuel choice in big electric power plants in the Netherlands. The underlying strategy is to use fuel with a high sulfur content (oil) during days with a low air pollution potential. It is shown that a fuel choice strategy based on the forecast results in better air quality than was observed without any strategy under the same conditions. Author (ESA)

N80-17656# Royal Netherlands Meteorological Inst., De Bilt.
THE EFFECTS OF WEATHER SHIPS ON NUMERICAL ANALYSIS AND PREDICTION
H. Timmerman 1979 16 p refs
(KNMI-WR-79-9) Avail NTIS HC A02/MF A01

The results of a numerical experiment are described. The intention of this experiment was to obtain sustaining arguments for the use of weatherships. The test consisted of two series analysis and forecasts on an octagonal grid, almost covering the Northern Hemisphere. The only difference between the two series is a difference in the observational data: one set with, the other without weatherships. The effect of the observations of weatherships was studied by comparing the measured heights of 500 mbar with values analyzed with and without weatherships. Results show that omission of the weatherships leads to an average increase in the rms of 2.8 dam to 4.8 dam. Author (ESA)

N80-17657# Royal Netherlands Meteorological Inst., De Bilt.
A BAROCLINIC FOUR LEVEL MODEL WITH FILTERED EQUATIONS [EEN BAROKLIEN VIERLAGEN-MODEL MET GEFILTERDE VERGELIJKINGEN]
A. W. DenExterBlokland 1979 52 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-12) Avail NTIS HC A04/MF A01

The design of a simple four level baroclinic quasi-geostrophic model with filtered equations is described. The basic vorticity, thermodynamic, continuity, hydrostatic, and state equations are presented. The dry model is constructed by setting the humidity term equal to zero. The horizontal divergences on the mbar levels and the vertical velocity are eliminated using the integrated continuity equation with the vertical velocity equal to zero at the boundaries. Four prognostic equations, with the four tendencies of the stream functions as unknowns, are derived. The variations of the coriolis parameter over the globe is taken into account. Author (ESA)

N80-17658# Royal Netherlands Meteorological Inst., De Bilt.
THERMAL WIND ESTIMATES FROM SYNOPTIC AIR TEMPERATURE OBSERVATIONS
G. J. Cats Jun. 1979 13 p refs
(KNMI-V-324) Avail NTIS HC A02/MF A01

The variance, correlation, and climatology parameterizations required in the optimum interpolation analysis of 1.5 m air temperature are given. Application of the optimum interpolation method leads to horizontal temperature gradient estimates that correlate significantly with the difference between observed 1500 m wind and the surface geostrophic wind. From surface observations of pressure and air temperature a reliable estimate of upper winds (around heights of 1500 m) can be formed. Author (ESA)

N80-17659# Royal Netherlands Meteorological Inst., De Bilt.
WIND PROFILE ESTIMATES UP TO 200 m FROM SYNOPTIC OBSERVATIONS
G. J. Cats 1979 21 p refs
(KNMI-V-326) Avail NTIS HC A02/MF A01

A scheme for estimating the friction velocity (u) and the Obukhov length (L) from synoptic observations is described. Businger's flux-profile relationships are used. The estimated values of (u) are in very good agreement with values obtained from fitting Businger's profiles to observations of wind speed and temperature profiles up to 20 m. The estimated values of (L) show less agreement, especially during the night. The estimated (u) and (L) lead to good wind speed estimates up to a height of 200 m in near neutral conditions. Under very unstable conditions the correlation coefficient between estimated and observed wind speeds is small, but, because of the low average wind speed, the root-mean-square error of estimate is also small (1.7 m/sec at 200 m). Under very stable conditions the estimation scheme leads to completely erroneous results (at 200 m, e.g., the rms error of estimate is 4 m/sec), because the Businger relations are applied far beyond their application range. Author (ESA)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography, and marine resources.

N80-17660 Florida State Univ., Tallahassee.
SURFACE LITHOFACIES, BIOFACIES, AND DIATOM DIVERSITY PATTERNS AS MODELS FOR DELINEATION

OF CLIMATIC CHANGE IN THE SOUTHEAST ATLANTIC OCEAN Ph.D. Thesis
David Richard Defelice 1979 240 p
Avail: Univ. Microfilms Order No. 8001091

The distribution of diatom species in surface sediments of the southeast Atlantic Ocean is studied. Low diversity stress flora along the Polar Front, Antarctic slope, and the northern boundary of winter sea ice reflect unstable, unpredictable environments. Downcore analysis of cores lying adjacent to the Polar Front and the diatom ooze-pelagic clay boundary show evidence for past climatic variations. The low trophic level occupied by diatoms and the subsequent sensitivity of these organisms to abiotic environmental parameters such as light quality, make relative diatom abundance a useful tool for monitoring fluctuations of winter sea ice and the temperature changes responsible for these fluctuations. The position of the Polar Front migrated at least three times within the last 0.015 my BP. Within the last 0.3 my BP warm maxima have occurred at approximately 0.0, 0.015, 0.125 and 0.3 my BP. Dissert. Abstr.

N80-17661# Meteorology International, Inc., Monterey, Calif.
THE EXPANDED OCEAN THERMAL-STRUCTURE ANALYSIS SYSTEM: A DEVELOPMENT BASED ON THE FIELDS BY INFORMATION BLENDING METHODOLOGY Final Report
Manfred M. Holl, Michael J. Cuming, and Bruce R. Mendenhall. Jul. 1979 222 p refs
(Contract N00014-79-C-0236)
(AD-A076534; MII-M-241) Avail: NTIS HC A10/MF A01 CSCL 08/10

The Expanded Ocean Thermal-Structure (EOTS) analysis system, an application of the general-purpose Fields by Information Blending (FIB) methodology, is an advanced, comprehensive and flexible system for four-dimensional analysis of thermal structure from the ocean surface to the bottom. Using surface (ships, buoys, satellites) and sounding observations and information carried and accrued along the time axis from previous analyses and climatologies, analyses may be performed for any region and for any grid resolution in space and time. Significant variabilities in the vertical profile are represented by a set of thermal-structure parameters--absolute values, gradients and curvatures. Special provision is made for fine resolution of thermal structure in the vicinity of the Primary Layer Depth and for restricting flow of information across land barriers. EOTS may be used for real-time synoptic analyses and, using available data bases, for production of historical sequences and climatologies. A wide variety of optional outputs includes horizontal and vertical sections of temperature and sound speed. This report provides a comprehensive account of the FIB information-processing concepts and formulations upon which EOTS is based. Samples of EOTS-generated output are included. A user's manual for the EOTS analysis system is also available. GRA

N80-17662# Naval Postgraduate School, Monterey, Calif.
ONE-DIMENSIONAL MODEL PREDICTIONS OF OCEAN TEMPERATURE ANOMALIES DURING FALL, 1976 Technical Report, Dec. 1978 - Aug. 1979
Russell L. Elsberry, Patrick C. Gallacher, and Roland W. Garwood, Jr. Aug. 1979 30 p refs
(AD-A075212; NPS63-79-003) Avail: NTIS HC A03/MF A01 CSCL 08/10

The hypothesis that upper Ocean temperature anomalies that developed over the North Pacific Ocean during the fall-winter of 1976-77 were primarily generated by vertical mixing processes was tested using the Garwood (1977) mixed layer model. A series of points along 175 deg W and along 38 deg N were chosen for use in this preliminary study. Atmospheric forcing for the one-dimensional ocean model was derived from the surface heat budget calculations in the Fleet Numerical Weather Central (FNWC) atmospheric prediction model. The suitability of the FNWC heat flux calculations was evaluated through comparison with the upper ocean heat content changes derived from the TRANSPAC analyses. The comparisons showed better agreement along 175 deg W than along 38 deg N. A series of ocean thermal structure predictions from 15 September to 31 December 1976 were made using the time series of the atmospheric forcing and the initial profile from the September TRANSPAC analysis. In the central region near 38 deg N, 165 deg W the predicted thermal structure agreed very well with the TRANSPAC analysis for December 1976. Near the southern and western ends of the domain, the temperature predictions were systematically lower than the analyzed values between the surface and 200 m. GRA

N80-17663# Delaware Univ., Newark. Coll. of Marine Studies.
WAVELIKE BAROCLINIC DISTURBANCES ON SHALLOW UPPER OCEAN DENSITY FRONTS
Richard A. Fornato. Mar. 1979 226 p refs Prepared in cooperation with Connecticut Univ., Stores
(Contracts N00014-78-C-0071; N00014-75-C-0714)
(AD-A076248; CMS-C-1-79) Avail: NTIS HC A11/MF A01 CSCL 08/10

A theoretical development of small amplitude wave disturbances on oceanic fronts is presented. The prototype front is the inshore boundary of the Gulf Stream, although the model encompasses a wider range of applicability. This work is an extension of recent research by Garvine which showed the importance of dissipation near the surface front, and earlier work by Duxbury on large scale time varying inviscid flow regimes. A two-layer model is considered in which the lower layer is much deeper than the upper, lighter layer. The upper layer, including the frontal zone, is then dynamically uncoupled from the lower layer. The frontal zone that forms the horizontal boundary of the upper layer is divided into two regions, a smaller, inner region in which the flow is dissipative and depends upon interfacial mass entrainment and turbulent friction, and a larger, outer region in which the motion is inviscid. The boundary between these two regions is placed where the internal Froude number is of order one. GRA

N80-17664# Royal Netherlands Meteorological Inst., De Bilt.
SEA SURFACE TEMPERATURE AND MIXED LAYER DEPTH DURING THE JASIN 78 EXPERIMENT
P. Kruseman and G. J. Prangsma. 1979 14 p
(KNMI-V-325) Avail: NTIS HC A02/MF A01

The general interest data set from the JASIN-78 experiment is presented. Eight sea surface temperature charts and a plot of mixed layer depth versus time are presented to give a rough estimate of the conditions during the experiment. Author (ESA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-17665 Michigan State Univ., East Lansing.
INTERACTION OF ELECTROMAGNETIC FIELDS WITH HETEROGENEOUS BIOLOGICAL SYSTEMS Ph.D. Thesis
Sutus Rukspollmuang. 1979 207 p
Avail: Univ. Microfilms Order No. 8001585

The theoretical and experimental results of the induced electric field inside a biological system when it is irradiated by a non-ionized electromagnetic (EM) radiation are presented. A numerical method based on a tensor integral equation is outlined for estimating the induced EM heating. A phantom model of man which was constructed with thin plexiglass filled with phantom material, was irradiated by 500 to 3000 MHz EM waves in a microwave anechoic chamber. The distribution of the measured electric field was compared with the distribution of theoretical results obtained numerically from the tensor integral equation method. A quantitative agreement was obtained between experiment and theory. A study was also conducted to investigate effective methods of inducing hyperthermia in the tumors embedded in animal and human bodies by utilizing EM fields. Dissert. Abstr.

N80-17666*# National Aeronautics and Space Administration, Washington, D. C.
NEW STUDIES OF VENUS
L. V. Ksanfomaliti. Feb. 1980 18 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 4, Jul.-Aug. 1979 p 5-14 Transl. by JPRS, Arlington, Va.
(NASA Order W-13183)
(NASA-TM-75931) Avail: NTIS HC A02/MF A01 CSCL 03B

The American and Russian 1978 Venus explorations are reported. Highlights of their accomplishments and subjects of study are discussed. Included are investigations of the surface pressure, temperature, composition, and mass of the Venusian atmosphere, along with cloud layer structure, greenhouse effect, and diurnal variations. M.M.M.

N80-17667*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF GRAVITATIONAL OVERLOADS, HYPOKINESIA AND HYPODYNAMIA ON THE VESSELS OF THE PULMONARY BLOOD CIRCUIT
A. A. Kasimtsev. Feb. 1980. 13 p. refs. Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (USSR), no. 2, 1973, p. 82-90. Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by 1st Leningrad I. M. Pavlov Medical Inst.
(Contract NASw-3199)
(NASA-TM-75963) Avail: NTIS HC A02/MF A01 CSCL 06C

Vessels of the pulmonary circuit are studied under normal conditions, in exposure to single stress or continuous threshold endurable chestspine gravitational stresses, and one to eight weak hypokinesia and hypodynamic effects followed by stress. Examination methods include rentgenography and microrentgenography, clearing, and histology. In exposure to gravitational stress the distal portions of the arterial vessels of the 3 and 4 orders constrict, while all veins dilate. Sinuosity of all vessels is noted. The volume of the capillary bed increases and signs of perivascular edema occur. Due to hypokinesia and hypodynamia the arteries constricted and the arterial bed becomes poor. The veins of all orders dilate and the volume of the capillary bed increases. The changes grew greater the longer the terms of hypodyamic effects. Successive combination of hypokinesia and hypodynamia and gravitational stresses cause more pronounced changes than separate effects of these two factors and result in great deformity of the vascular walls, including their rupture and penetration of formed elements beyond the limits of the vascular bed. M.G.

N80-17668*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF GRAVITATIONAL ACCELERATION, HYPOKINESIA AND HYPODYNAMIA ON THE STRUCTURE OF THE INTESTINAL VASCULAR BED
M. V. Nikitin. Feb. 1980. 12 p. refs. Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (USSR), no. 3, Mar. 1974, p. 54-61. Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by 1st Leningrad I. P. Pavlov Medical Inst.
(Contract NASw-3199)
(NASA-TM-75972) Avail: NTIS HC A02/MF A01 CSCL 06C

A series of experiments comparing single and combined effects of hypokinesia and gravitational acceleration on morphology of intestinal blood vessels are discussed. Results indicate that hypokinesia has a whole body nonspecific effect reflected even in an organ whose activity shows little or no change due to hypokinesia. In early hypokinetic stages blood redistribution caused anorexia, intestinal atonia, and secretory disruption. Destructive changes from further exposure include aneurisms, varicoses, extravascular movement of blood elements, and vascular wall muscle fiber degeneration. The effect of acceleration is greatest in the ventrodorsal direction. Changes due to acceleration then hypokinesia are like those due to hypokinesia alone; changes due to acceleration before and after hypokinesia are like those due to acceleration. Adaptation raises acceleration tolerance but the effects do not survive four week hypokinesia. M.G.

N80-17669*# National Aeronautics and Space Administration, Washington, D. C.
INFLUENCE OF MOBILITY RESTRICTION ON HABITUATION OF THE VESTIBULAR APPARATUS
G. I. Gorgiladze and G. S. Kazanskaya. Feb. 1980. 8 p. refs. Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 211, no. 4, 1 Aug. 1973, p. 1005-1008. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75995) Avail: NTIS HC A02/MF A01 CSCL 06C

Test results presented indicate that 30-day hypokinesia did not affect the intensity of nystagmus, velocity of slow phase, total number of jerks, and duration of the reaction in animals were the same as before mobility restriction and did not differ from those of the control group. However, hypokinesia resulted in the disappearance of habituation of the vestibulary system to repeated angular accelerations. The known hypokinetic changes in the endocrine system were studied. It was concluded that reduction in adrenergic function may be the cause of disappearance of vestibular apparatus habituation during hypokinesia. M.M.M.

N80-17670*# National Aeronautics and Space Administration, Washington, D. C.
RNA CONTENT IN MOTOR AND SENSORY NEURONS AND SURROUNDING NEUROGLIA OF MOUSE SPINAL CORD UNDER CONDITIONS OF HYPODYNAMIA AND FOLLOWING NORMALIZATION
V. A. Brumberg and L. A. Peyemer. Feb. 1980. 15 p. refs.
(Contract NASw-3198)
(NASA-TM-76032) Avail: NTIS HC A02/MF A01 CSCL 06C

The differences in the dynamics of reparative processes in RNA metabolism within the neuron-neuroglia unit after the cessation of hyper- and hypodynamia is dicussed. The role of neuroglia is stressed in compensatory, reparative and trophic processes in the nervous system as well as the possibility in an adaptation at the cellular level. M.M.M.

N80-17671*# National Aeronautics and Space Administration, Washington, D. C.
DIFFERENTIATION AND RADIOSENSITIVITY OF HEMOPOIETIC STEM CELLS OF MICE DURING HYPOKINESIA
V. N. Shvets. 1980. 10 p. refs. Transl. into ENGLISH from Radiobiol. (USSR), v. 19, no. 2, 1979, p. 199-203. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76066) Avail: NTIS HC A02/MF A01 CSCL 06C

The potential for differentiation and radiosensitivity of the stem hemopoietic cells (KOE) under conditions of initial and later hypokinesia is examined. It is established that in the initial period of hypokinesia (3 days) when a stress reaction prevails, changes occur in the erythroid differentiation and radiosensitivity of KOE. This effect is associated with redistribution of T-lymphocytes that increase in number in the bone marrow of mice during hypokinesia. At later periods of hypokinesia (30 days) when changes in the organism are related to hypokinesia proper, differentiation and radiosensitivity of KOE were normalized. M.G.

N80-17672*# National Aeronautics and Space Administration, Washington, D. C.
DYNAMICS OF CHANGE IN RAT ARTERIAL PRESSURE UNDER CONDITIONS OF IMMOBILIZATION
Ye. A. Yumatov, Yu. G. Skotselyas, and L. I. Ivanova. Feb. 1980. 9 p. refs. Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 3, 1979, p. 22-26. Transl. by Scientific Translation Service, Santa Barbara, Calif. Original Doc. prepared by USSR Academy of Medical Sciences, Moscow.
(Contract NASw-3198)
(NASA-TM-76045) Avail: NTIS HC A02/MF A01 CSCL 06C

Emotional stress developed in immobilized rats was shown to be accompanied by changes in the regulation of arterial pressure and the frequency of cardiac contractions. A group of adapting rats displayed definite resistance to emotional stress, while a group of rats incapable of adapting to acute emotional stress died with characteristics of cardiovascular insufficiency. The mechanisms providing resistance to emotional stress in numerous conflict situations were analyzed. K.L.

N80-17673# Rhode Island Univ., Kingston. Graduate School of Oceanography.
BIOCHEMICAL CORRELATES OF SEASONAL CHANGE IN MARINE COMMUNITIES
N. Perry Jeffries. May 1979. 19 p. refs. Repr. from Am. Nat., v. 113, no. 5, May 1979, p. 643-658.
(Grant NOAA-04-80-M01-147)

(PB-301380/2; Marine-Reprint-119; NOAA-79082402) Copyright. Avail: NTIS HC A02/MF A01 CSCL 06B

Changes in the fatty acid distributions of plankton and benthos in response to seasonal change are analyzed. It is found that as a temperate community matures and becomes more complex, so does its fatty acid composition. Chemical progression is most rapid during succession from winter-spring to summer-fall species groups, a period of reorganization among characteristic fatty acid sets. Increasing amounts of saturated acids seem to disclose a change in community structure, whereas an important polyunsaturate forms a focus around which these progressions take place.
GRA

N80-17674# Joint Publications Research Service, Arlington, Va.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 14, NO. 6, 1979

O. G. Gazenko, ed. 31 Jan. 1980 114 p. refs. Transl. into ENGLISH of Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 90 p. (JPRS-75041) Avail: NTIS HC A06/MF A01

The biological and physiological effects of manned space flight are addressed. Specifically, the selection and training of cosmonauts, the evaluation and analysis of data to facilitate the transition from orbital to interplanetary flights, and research aimed at guaranteeing safety on long flights and reliability of the human component of the man spaceship system are considered. Space psychology and physiology, environmental problems and control, and telemetry are included. For individual titles, see N80-17675 through N80-17694.

N80-17675# Joint Publications Research Service, Arlington, Va.

SOME PHILOSOPHICAL ASPECTS OF THE PROBLEM OF MAN, THE BIOSPHERE AND SPACE c52

N. A. Agadzhanyan. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 1-8 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 1-9 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

Man environment interactions are considered in terms of the laws governing evolution and further development of the Universe. The emergence of a human society is seen as a qualitatively new stage in the evolution of organic matter. Progress in science and engineering is discussed in relation to the effect on the natural environment and on living beings. Space exploration is seen as an opportunity to evaluate man's role, position, and responsibility in the infinite Universe.
J.M.S.

N80-17676# Joint Publications Research Service, Arlington, Va.

COMPOSITION OF INTESTINAL MICROFLORA OF COSMONAUTS BEFORE AND AFTER SPACE FLIGHTS c52

N. N. Lutke, V. M. Shidov, G. D. Synykh, and V. I. Legenkov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 9-20 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 9-13 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The composition of the intestinal microflora of 12 cosmonauts was studied before and after space missions of varying duration. Changes in the intestinal microbial coenosis were found prelaunch. The pattern of changes did not vary with an increase in space flight duration. The use of special prophylactic measures exerted a positive effect on intestinal microecology. Bifidobacteria and lactobacilli showed the greatest changes inflight. Therefore, it seems important to arrange preflight sanation of the intestinal microflora as a prophylactic method.
Author

N80-17677# Joint Publications Research Service, Arlington, Va.

OBJECTIVES AND CONDITIONS OF PHYSIOLOGICAL EXPERIMENTS ON RATS CONDUCTED ABOARD THE COSMOS-936 BIOSATELLITE

Ye. A. Gin, V. I. Korolkov, A. R. Kotovskaya, A. D. Noskin, V. A. Kondratyeva, A. A. Shipov, and I. I. Britvan. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 21-26 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 18-22 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

Results of physiological studies of rats flown onboard the biosatellite Cosmos 936 are summarized. The satellite-borne experiments investigated the mechanisms of the physiological effects of weightlessness, and considered artificial gravity as an effective means of preventing the adverse effects of weightlessness. The feasibility of a control group that would be exposed to all space flight factors, with the exception of weightlessness, in order to differentiate between in the influence of weightlessness on physiological systems and the effects of other space flight factors was assessed.
J.M.S.

N80-17678# Joint Publications Research Service, Arlington, Va.

SOME NEUROCHEMICAL CHARACTERISTICS OF RATS DURING FLIGHT ABOARD THE COSMOS-782 ARTIFICIAL SATELLITE AND AFTER RETURN TO EARTH

O. G. Gazenko, N. N. Demin, A. N. Panov, D. A. Rashevskaya, N. L. Rubinskaya, and R. A. Tigranyan. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 27-32 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 22-26 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The brains of rats flown onboard the biosatellite Cosmos 782 were sampled immediately postflight and taken under neurochemical study. It was shown cytospectrophotometrically that the absolute content of RNA decreased by 20 percent in the cytoplasm of cerebellar Purkinje cells and remained unaltered in glial cells-satellites, and that the protein content did not change. In the frontal cortex (homogenates) the concentration of sulfhydryl groups decreased by 26 percent, activity of nonspecific cholinesterase by 30 percent and acetyl cholinesterase by 33 percent. The activity of the latter in the cerebellum also diminished.
Author

N80-17679# Joint Publications Research Service, Arlington, Va.

EFFECTS OF MINIMAL GRAVITATIONAL LOADS ON FLUID-ELECTROLYTE METABOLISM AND RENAL FUNCTION OF MAN DURING PROLONGED IMMERSION c52

A. I. Grigoryev and Ye. B. Shulzhenko. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 33-39 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 27-31 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

It was demonstrated that renal excretion of fluid, osmotically active substances and electrolytes could be reduced, using low gravitational exposures (+Gz). The degree and duration of water and electrolyte retention were different with respect to the experimental time. The major physiological mechanisms of the changes in fluid-electrolyte metabolism were: a decrease in the glomerular filtration rate and a change in water and ion transport in renal tubules.
Author

N80-17680# Joint Publications Research Service, Arlington, Va.

CREATINURIA IN MAN DURING PROLONGED HYPOKINESIA c52

S. A. Kamfonina. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p40-44 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 32-35 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

A prolonged bed rest experiment of 94 days caused an increase in renal excretion of creatine during the first two months and a return to the pretest level during the third month. The bed rested test subjects who performed exercise showed a lower and delayed (by the 3rd month) increase in creatine excretion.
Author

N80-17681# Joint Publications Research Service, Arlington, Va.

CHANGES IN THE NEUROMOTOR SYSTEM DURING 45 DAYS OF HYPOKINESIA **c52**

Ye. A. Shaposhnikov, P. I. Sidorov, and A. I. Kolomenskiy. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 45-51 refs Transl. into ENGLISH from Kosmich. Biol. Aviatkomich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 35-39 (For primary document see N80-17674 08-51)

Avail: NTIS HC A06/MF A01

Neurological and electromyographic examinations of 12 test subjects during a 45 day bed rest study were carried out. Symptoms indicating changes in the suprasegmentary innervation were noted. Shortening of the duration of potentials was shown by needle electromyography. A decline in the threshold of H-reflex and a change in the frequency parameters of EMG were seen. These data suggest a change in the functional state of the central and peripheral motor neuron during prolonged hypokinesia. Prophylactic efficiency of muscle electrostimulation is discussed.

Author

N80-17682# Joint Publications Research Service, Arlington, Va.

ELECTROSTIMULATION OF MUSCLES FOR THE PREVENTION OF NEUROMUSCULAR DISORDERS DURING 45-DAY ANTIORTHOSTATIC HYPOKINESIA **c52**

V. S. Georgiyevskiy, Ye. A. Ilinskaya, V. I. Matveyev, V. M. Mikhaylov, and V. I. Pervushin. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 52-57 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 40-44 (For primary document see N80-17674 08-51)

Avail: NTIS HC A06/MF A01

Healthy test subjects exposed to a 45 day head down tilting (-6.5 deg) showed a decline of the tone and strength of certain muscle groups, a decrease of leg circumference, a deterioration of the walking pattern, and a reduction of exercise tolerance (provocative tests with bicycle ergometry pedalling at a moderate and maximum rate). Electrostimulation of muscles applied by the Tonus-2 equipment for 30 min twice a day, 6 days a week helped to reduce the level of hypokinesia induced disorders.

Author

N80-17683# Joint Publications Research Service, Arlington, Va.

EFFECT OF VESTIBULAR STIMULI ON VISUAL TRACKING IN A LIMITED TRACKING AREA **c52**

V. I. Babiyak, Yu. N. Kholodov, and Yu. K. Yanov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 58-63 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 49-48 (For primary document see N80-17674 08-51)

Avail: NTIS HC A06/MF A01

The results of studying visual tracking of targets which moved with a constant amplitude of angular displacement are presented. The tracking was carried out during an interaction of vestibular and optic sensors. The tracking stability was related to the coincidence of the direction of vestibular and optic stimuli.

J.M.S.

N80-17684# Joint Publications Research Service, Arlington, Va.

ROLE OF INTEROCEPTIVE AFFERENTATION IN FUNCTION OF THE CORTEX OF THE VISUAL ANALYZER **c52**

N. I. Pityk. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 64-71 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 48-53 (For primary document see N80-17674 08-51)

Avail: NTIS HC A06/MF A01

The experiments on diplacin-immobilized rats showed that stimulation of gastric and rectal mechanoreceptors caused noticeable changes in the control and light-induced impulse activity of neurons of the optic cortex. The predominant pattern of cell reactions were tonic changes of impulsation. They included both stimulatory and inhibitory effects. The latter occurred mostly as a result of stimulation of gastric mechanoreceptors. Changes in the evoked activity of those neurons involved most frequently enhancement or inhibition of responses, contrasting and stabilization of short-latent responses, and then masking with neuronal noise. The functional importance of the changes in the control and evoked activities of neurons of the optic cortex during interoceptive effects as well as possible central pathways of their realization in the optic cortex is discussed.

R.E.S.

N80-17685# Joint Publications Research Service, Arlington, Va.

EFFECT OF ACUTE HYPOXIA ON SPECIFIC AND NONSPECIFIC SYSTEMS OF THE RABBIT BRAIN

N. S. Akopyan and O. G. Baklavadzhyan. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 72-78 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 53-57 (For primary document see N80-17674 08-51)

Avail: NTIS HC A06/MF A01

Electrical activity of the brain under hypoxic activity was studied with the use of the EEG. At a simulated altitude of 8500-9000 m, an increase in the amplitude of the early positive and negative phase of the thalamic-cortical evoked potentials, and a slight prolongation of the latent period were seen. Changes in the reticulo-cortical and hypothalamo-cortical evoked potentials included a pronounced inhibition of their negative phase. In the EEG slow delta-waves increased gradually, becoming the major rhythm. The presence of EEG signs of the development of inhibitory processes in the cortex suggested that the changes in evoked potentials were also a result of inhibition of cortical neurons. Hypoxia-adapted rabbits tolerated acute hypoxia much better. They exhibited less pronounced changes in the electric manifestations of the function of specific and nonspecific projection systems of the brain.

R.E.S.

N80-17686# Joint Publications Research Service, Arlington, Va.

STUDY OF BIOELECTRIC ACTIVITY OF NEURO-MUSCULAR AND SYMPATHETIC SYSTEMS DURING EXPOSURE TO A STEADY MAGNETIC FIELD **c52**

L. D. Klimovskaya and S. B. Krotova. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 79-84 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 58-61 (For primary document see N80-17674 08-51)

Avail: NTIS HC A06/MF A01

The experiments on an isolated frog neuromuscular preparation showed that an exposure to stable magnetic fields of 1000-4000 Oe did not influence the time parameters, amplitude and pattern of the action potentials of the gastrocnemius muscle induced by ischiatic nerve simulation with single impulses. Similar results were obtained from an analysis of electric responses of the upper cervical sympathetic node to the stimulation of preganglionar fibers in in situ experiments on urethane anesthesized rabbits subjected to a total exposure of a stable magnetic field (500-3000 Oe). In addition, an exposure to a stable magnetic field of 4000 Oe brought about a decrease of the level of depression of the action potential of muscles after conditioning tetanus.

R.E.S.

N80-17687# Joint Publications Research Service, Arlington, Va.

EFFECTS OF STRONG INFRALOW-FREQUENCY MAGNETIC FIELDS ON BONE MARROW CELL DIVISION **c52**

A. D. Strzhizhovskiy, C. V. Galaktionova, and P. A. Cheremnykh. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 85-88 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 61-63 (For primary document see N80-17674 08-51)

Avail: NTIS HC A06/MF A01

The effect of an infralow frequency field of 3-127 kOe applied for 1 hr on mitotic activity, frequency of chromosomal aberrations and number of bone marrow cells of mice was studied. The exposure of mice to fields of 3 and 8 kOe stimulated and to fields of 54 and 127 kOe inhibited mitotic activity. No increase in the frequency of aberrant mitoses in bone marrow cells was

noted. The changes in the cell number were small (no more than 20 percent) and readily reversible. Author

N80-17688# Joint Publications Research Service, Arlington, Va.

PROGRAMMED CONTROL OF THE AUTOTROPHIC COMPONENT OF AN ECOLOGICAL SYSTEM THAT IS CLOSED WITH REGARD TO EXCHANGE OF GASES c52

A. S. Nasonov and V. S. Toroptsov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 89-95 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 63-68 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The ecological system with closed gas exchange consisting of autotrophic and heterotrophic components located in different rooms was studied. The conditions of O2 and CO2 steady state with a periodically working autotrophic component were found. The stability of the steady-state was analyzed. Author

N80-17689# Joint Publications Research Service, Arlington, Va.

EFFECT OF CARBON MONOXIDE ON ANIMALS ADAPTED TO HYPOXIC HYPOXIA

V. V. Kustov and V. G. Litau. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 98-102 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 69-72 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

Experiments were conducted on 80 white male mice to investigate the development of carbon monoxide poisoning in animals adapted to hypoxic hypoxia. The following parameters were studied: body weight, hemoglobin and erythrocyte content of peripheral blood, blood catalase activity, blood peroxidase activity, and increment of carboxyhemoglobin. The results show that carbon monoxide in a concentration of 500 mg/cu m induces substantial changes in mice referable to several integral (body weight), hematological, and enzymatic parameters which are inherent in chronic carbon monoxide poisoning. R.E.S.

N80-17690# Joint Publications Research Service, Arlington, Va.

EFFECT OF STEADY MAGNETIC FIELD ON SOME ASPECTS OF ENERGY AND NITROGEN METABOLISM IN THE RAT CEREBRAL HEMISPHERES

Ye. A. Nosova and L. M. Kurkina. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 103-105 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 72-74 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The effects of high intensity steady magnetic fields (SMF) on ammonia, glutamine, glutamic, aspratic and gamma-aminobutyric [GABA] acids were studied, as well as concentration levels of adenisine triphosphonic acid (ATP), phosphocreatine and lactic acid in the cerebral hemispheres of rats. Exposure of animals to SMF of 3000 Oe for 3 hours did not lead to reliable changes in levels of components of the glutamine-glutamic acid system, or in aspartic acid and GABA. The ATP content of brain tissue of rats exposed to SMF was reliably, though not markedly, decreased; phosphocreatine was unchanged, while lactic acid content was significantly increased. The decrease demonstrated in ATP content of the cerebral hemispheres to the bottom range of normal and increase in lactic acid to the top range of normal are indicative of greater activity of metabolic processes in the central nervous system of rats exposed to SMF, as compared to control animals. R.E.S.

N80-17691# Joint Publications Research Service, Arlington, Va.

EFFECT OF RHEOPOLYGLUCIN ON BLOOD CLOTTING FACTORS OF THE AORTA, MYOCARDIUM AND VENAE CAVAE DURING HYPOKINESIA c52

V. I. Inchina. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 106-110 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 74-76 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The influence of low molecular dextrans on blood clotting and fibrinolytic peoperties of blood vessels and the myocardium under hypokinetic conditions was studied. The low molecular dextran used was rheopolyglucin. Constriction of the arteriolar lumen, dilatation of venules, appearance of recessed sacculations and increased capillary permeability were found in the myocardium of hypokinetic rabbits. These changes in the vascular wall, combined with demonstrated changes in the tissular system of hemostasis, lead to impairment of microcirculatory hemostasis. Rheopolyglucin, which normalizes the rheological properties of blood and diminishes aggregation of formed elements, improved microcirculation. However, complete restoration of circulation only occurred when capillaries were free of fibrin. R.E.S.

N80-17692# Joint Publications Research Service, Arlington, Va.

EFFECTS OF ACCELERATIONS ON THE EARLY STAGE OF RADIATION LESION IN ANIMALS

V. V. Antipov, D. N. Gavrilyuk, B. L. Razgovorov, and B. I. Davydov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 111-114 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), Vol. 14, No. 6, Nov./Dec. 1979 p 76-77 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The influence of accelerations on the course of the body's primary reaction to the combined effect of accelerations and ionizing radiation was studied. The results of experiments on rats and dogs show that exposure to accelerations prior to radiation attenuates the primary reaction of both rats and dogs. Exposure to accelerations of irradiated animals induced effects in different directions: attenuation of gastro-intestinal tract disturbances at the early stage of radiation lesion in rats, and intensification of some manifestations of the primary reaction in dogs. R.E.S.

N80-17693# Joint Publications Research Service, Arlington, Va.

TEST IRRADIATION OF CHRONICALLY IRRADIATED DOGS FOR EVALUATION OF HEMOPOIETIC SYSTEM FUNCTION

T. Ye. Burkovskaya and B. A. Markelov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 115-119 refs. Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 78-80 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

In order to determine the severity of lesion and state of compensatory mechanisms of the hemopoietic system, acute irradiation was used as a used functional load. Male mongrel dogs were kept in a Co gamma field for 6 years. The results show functional deficiency of myeloid hemopoiesis in dogs submitted to long term chronic radiation; this deficiency was not demonstratable in ordinary morphological examinations of blood and bone marrow. The obtained results are indicative of a reduction in the bone marrow reserve of mature granulocytes, and this is more marked in dogs preirradiated in a dose of 1130 rad, as well as disturbances in the system of postradiation renewal of granulocyctes. Repair and compensatory-adaptive capabilities remain at a rather high level in the erythroid system. R.E.S.

N80-17694# Joint Publications Research Service, Arlington, Va.

INSOLUBLE COLLAGEN CONTENT OF DOG TISSUES AFTER EXPOSURE TO LOW DOSES OF CHRONIC GAMMA RADIATION

Z. A. Vinogradova. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 120-122 Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 80-82 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The effect of chronic irradiation on metabolism of collagen proteins was studied by assaying the insoluble collagen content

of animal tissues at different stages of a chronic experiment. The results show a decrease in insoluble collagen content of organs and tissues (lungs, aorta, liver, tendon, cartilage and skin) of irradiated dogs as the accreted dosage increased. The results also show age-related changes with respect to collagen content. R.E.S.

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N80-17695*# North Carolina State Univ., Raleigh. Neuropsychology Lab.
AROUSAL FROM SLEEP: THE UNIQUENESS OF AN INDIVIDUAL'S RESPONSE AND THE PROBLEM OF NOISE CONTROL Final Report
T. E. LeVere. 1979. 48 p. refs.
(Grant NGL-34-002-095)
(NASA-CR-162747) Avail: NTIS HC A03/MF A01 CSCL 06P

The dynamic nature of sleep is reviewed. Research is then presented concerning two fundamental issues: (1) does an individual react differently to auditory sounds when asleep as compared to when the individual is awake and (2) does sleep disruption necessarily involve behavioral awakening? R.E.S.

N80-17696*# General Electric Co., Hudson Falls, N.Y. Space Division.
BIOMEDICAL SYSTEMS ANALYSIS PROGRAM Final Report
31 Dec. 1979. 72 p. refs.
(Contract NAS9-15487)
(NASA-CR-160456, TIR-741-LSP-9025) Avail: NTIS HC A04/MF A01 CSCL 06B

Biomedical monitoring programs which were developed to provide a system analysis context for a unified hypothesis for adaptation to space flight are presented and discussed. A real-time system of data analysis and decision making to assure the greatest possible crew safety and mission success is described. Information about man's abilities, limitations, and characteristic reactions to weightless space flight was analyzed and simulation models were developed. The predictive capabilities of simulation models for fluid-electrolyte regulation, erythropoiesis regulation, and calcium regulation are discussed. R.E.S.

N80-17697*# National Aeronautics and Space Administration, Washington, D. C.
SPACE FLIGHT RESEARCH RELEVANT TO HEALTH, PHYSICAL EDUCATION, AND RECREATION: WITH PARTICULAR REFERENCE TO SKYLAB'S LIFE SCIENCE EXPERIMENTS Final Report
Wayne D. VanHuss (Michigan State Univ., East Lansing) and William W. Heusner (Michigan State Univ., East Lansing). Jun. 1979. 56 p. refs.
(NASA-EP-148) Avail: NTIS MF A01; SOD HC EP1.19:148 CSCL 06P

Data collected in the Skylab program relating to physiological stresses is presented. Included are routine blood measures used in clinical medicine as research type endocrine analyses to investigate the metabolic/endocrine responses to weightlessness. The daily routine of physical exercise, coupled with appropriate dietary intake, sleep, work, and recreation periods were considered essential in maintaining the crew's health and well being. M.M.M.

N80-17698# Research Inst. of National Defence, Linkoeping (Sweden).
IMPROVED PILOT TRAINING THROUGH MODIFICATION OF SELECTION AND TRAINING PROCEDURES
Leif Carlstedt. Mar. 1979. 15 p. refs. In SWEDISH; ENGLISH summary.
(FOA C-55029-H7) Avail: NTIS HC A02/MF A01

Modifications in selection procedures and training environment for military basic flight students have improved the ratio of selected to passed from 40 to 80 during the past decade. Applicants are screened in six stages. Test and assessment data are examined using the conjunctive multiple cutoff method. The selection process is a synthesis of characterological and compositional models. Changes in the training environment may cause loss of validity in some tests results. Author (ESA)

N80-17699# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
PROPOSED NATIONAL EXPOSURE LIMITS FOR MICROWAVE AND RADIOFREQUENCY RADIATION
G. Campos Venuti, M. Grandolfo, and G. Mariutti. 31 Jan. 1979. 100 p. refs. In ITALIAN; ENGLISH summary. Presented at the Conv. Naz. dell' Assoc. Ital. di Fis. Sanitaria e Protezione Contro le Radiazioni, Rome, 30-31 Oct. 1978.
(ISS-P-79/2) Avail: NTIS HC A05/MF A01

At present in Italy no statutory requirements or recommendations are enforced with respect to maximum permissible levels of microwave and radio frequency radiation to which either the general public or workers may be exposed. After a brief survey of current scientific data, a rationale for adopting permissible levels in the frequency range 100 kHz to 300 gHz is presented. Comparisons with other national and international standards are made. Author (ESA)

N80-17700# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
INTERCOMPARISON OF ISS AND BIPM PRIMARY EXPOSURE STANDARDS FOR MEDIUM ENERGY X-RAYS
E. Casnati (Inst. di Fis. dell' Univ., Ferrara, Italy), L. Pugliani, and P. Selvadori. 26 Feb. 1979. 58 p. refs.
(ISS-R-79/3) Avail: NTIS HC A04/MF A01

The primary exposure standards of the Istituto Superiore di Sanita and the Bureau International des Poids et Measures in the medium energy X-ray range were compared. After a description of the X-ray qualities on which the comparison was based, how the quantities appearing in the exposure definition were evaluated is explained and the aspects typical of the phenomenological realization of the exposure unit are listed. The properties of the X-ray beam, the correction factors applied to the free-air chamber measurements for obtaining the unit of exposure, the peculiarities and response of the transfer cavity chamber, and the calibration of the latter are discussed. The final results of the comparison are shown then compared with results reported by other laboratories. Author (ESA)

N80-17701# National Technical Information Service, Springfield, Va.
THE TOXICOLOGY OF OZONE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Nov. 1979
Elizabeth A. Harrison. Nov. 1979. 132 p. Supersedes NTIS/PS-78/1120.
(PB80-800881, NTIS/PS-78/1120) Avail: NTIS HC $30.00/MF $30.00 CSCL 06T

The studies cited cover the toxic effects of ozone on humans, animals, and plants. Although many reports cite the effects of ozone generated as a photochemical oxidant from air pollution, others simply look at the basic biological effects of ozone without discussing its source. The topics described include ozone's effects on forests and agricultural crops, industrial exposure, maximum exposure levels, effects on microorganisms, and physiological effects. This updated bibliography contains 126 abstracts, 41 of which are new entries to the previous edition. GRA

N80-17702# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE SURVIVAL AND PROTECTION OF EQUIPMENT IN THE EVENT OF ACCIDENTAL IMMERSION IN COLD WATER
C. Boutelier. Jan. 1979. 125 p. refs. In FRENCH.
(AGARD-AG-211-FR) Avail: NTIS HC A06/MF A01

The physiological reactions of the human body to thermal aggression and eventual pathological incidences and their treatment are described for airmen and designers of equipment designed for protecting pilots against cold water following accidental immersion. Topics covered include: (1) heat transfer from the human body in ambient cold by conduction, convection, evaporation, and radiation; (2) the physiological response to immersion - tolerance and acclimatization; (3) diagnosis and

treatment of local and general effects of cold, including hypothermia; (4) the theoretical basis for protective clothing; (5) methods for evaluating protective clothing; and (6) the design and construction of anti-immersion equipment: wet suits, dry suits, life vests, and lifeboats. Transl. by A.R.H.

N80-17675# Joint Publications Research Service, Arlington, Va.
SOME PHILOSOPHICAL ASPECTS OF THE PROBLEM OF MAN, THE BIOSPHERE AND SPACE
N. A. Agadzhanyan. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 1-8 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 1-9 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17676# Joint Publications Research Service, Arlington, Va.
COMPOSITION OF INTESTINAL MICROFLORA OF COSMONAUTS BEFORE AND AFTER SPACE FLIGHTS
N. N. Lizko, V. M. Shilov, G. D. Syrykh, and V. I. Legenkov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 9-20 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 9-13 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17679# Joint Publications Research Service, Arlington, Va.
EFFECTS OF MINIMAL GRAVITATIONAL LOADS ON FLUID-ELECTROLYTE METABOLISM AND RENAL FUNCTION OF MAN DURING PROLONGED IMMERSION
A. I. Grigoryev and Ye. B. Shulzhenko. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 33-39 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 27-31 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17680# Joint Publications Research Service, Arlington, Va.
CREATINURIA IN MAN DURING PROLONGED HYPOKINESIA
S. A. Kamforina. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p40-44 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 32-35 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17681# Joint Publications Research Service, Arlington, Va.
CHANGES IN THE NEUROMOTOR SYSTEM DURING 45 DAYS OF HYPOKINESIA
Ye. A. Shaposhnikov, P. I. Sidorov, and A. I. Kolomenskiy. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 45-51 refs Transl. into ENGLISH from Kosmich. Biol. Aviatkomich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 35-39 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17682# Joint Publications Research Service, Arlington, Va.
ELECTROSTIMULATION OF MUSCLES FOR THE PREVENTION OF NEUROMUSCULAR DISORDERS DURING 45-DAY ANTIORTHOSTATIC HYPOKINESIA
V. S. Georgiyevskiy, Ye. A. Ilinskaya, V. I. Matveyev, V. M. Mikhaylov, and V. I. Pervushin. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 52-57 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 40-44 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17683# Joint Publications Research Service, Arlington, Va.
EFFECT OF VESTIBULAR STIMULI ON VISUAL TRACKING IN A LIMITED TRACKING AREA
V. I. Babiyak, Yu. N. Kholodov, and Yu. K. Yanov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 58-63 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 49-48 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17684# Joint Publications Research Service, Arlington, Va.
ROLE OF INTEROCEPTIVE AFFERENTATION IN FUNCTION OF THE CORTEX OF THE VISUAL ANALYZER
N. I. Pityk. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 64-71 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 48-53 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17686# Joint Publications Research Service, Arlington, Va.
STUDY OF BIOELECTRIC ACTIVITY OF NEURO-MUSCULAR AND SYMPATHETIC SYSTEMS DURING EXPOSURE TO A STEADY MAGNETIC FIELD
L. D. Klimovskaya and S. B. Krotova. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 79-84 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 58-61 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17687# Joint Publications Research Service, Arlington, Va.
EFFECTS OF STRONG INFRALOW-FREQUENCY MAGNETIC FIELDS ON BONE MARROW CELL DIVISION
A. D. Strzhizhovskiy, G. V. Galaktionova, and P. A. Cheremnykh. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 85-88 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 61-63 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17688# Joint Publications Research Service, Arlington, Va.
PROGRAMMED CONTROL OF THE AUTOTROPHIC COMPONENT OF AN ECOLOGICAL SYSTEM THAT IS CLOSED WITH REGARD TO EXCHANGE OF GASES
A. S. Nasonov and V. S. Toroptsov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 89-95 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 63-68 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17691# Joint Publications Research Service, Arlington, Va.
EFFECT OF RHEOPOLYGLUCIN ON BLOOD CLOTTING FACTORS OF THE AORTA, MYOCARDIUM AND VENAE CAVAE DURING HYPOKINESIA
V. I. Inchina. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 106-110 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 74-76 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors, individual and group behavior, crew training and evaluation, and psychiatric research.

N80-17703# Research Inst. of National Defence, Linkoeping (Sweden)

COMPENSATORY AND CONJUNCTIVE PROCESSING OF TEST INFORMATION FOR PREDICTION OF RESULTS OF MILITARY FLIGHT TRAINING [KOMPENSATORISK OCH KONJUNKTIV BEHANDLING AV TESTINFORMATION FOER PREDIKTION AV RESULTAT PAA MILITAAR FLYGUTBILDNING]
Leif Carlstedt Mar. 1979 28 p refs In SWEDISH
(FOA-C-55025-H7) Avail: NTIS HC A03/MF A01

Data collected during aircraft pilot selection tests were analyzed by two different methods to determine the predictive ability of each to military flight training. The comparison was made using data from four groups using a compensatory and a conjunctive method. The conjunctive or cross validation method gave better predictions in three of the four groups, but the compensatory or regression analysis method gave better results in the fourth group. Author (ESA)

N80-17704# Research Inst. of National Defence, Linkoeping (Sweden).
STEPWISE PILOT SELECTION: PROCEDURE AND VALIDITY [STEGVIST URVAL AV FLYGFOERARE: PROCEDUR OCH VALIDITET]
Leif Carlstedt Mar. 1979 18 p refs In SWEDISH
(FOA-C-55026-H7) Avail: NTIS HC A02/MF A01

A graduated selection method used since 1970 to select Swedish military pilots is described and compared with previous practice. Formerly, all test data were weighted equally at all stages of the selection process, but now the data are quantified by an expectancy hypothesis at the beginning of the selection process. Also, the personality test defense mechanism test has been introduced as a selection instrument. Using the graduated or stepwise method has improved the selection rate from 45 to 56 men trained per 20 selected, to 41 men trained per 20 selected. Author (ESA)

N80-17705# Research Inst. of National Defence, Linkoeping (Sweden).
THE INFLUENCE OF THE CHANGE OF FLIGHT INSTRUCTION AND HIS ABILITY UPON THE PUPIL'S ADAPTATION TO FLYING [INVERKAN AV FLYGLAERARBYTGN OCH FLYGLAERARENS KVALITET PAA ELEVENS ANPASSNING TILL FLYGNING]
Leif Carlstedt Mar. 1979 20 p refs In SWEDISH
(FOA-C-55027-H8) Avail: NTIS HC A02/MF A01

The importance of the frequency of the changes of flight teacher and of his quality on the pupil's adaptation to flying is studied. It is shown that students having fewer than five flying tests with the same teacher during the 20 first flying hours are expected to fail more often than those who have more than five with the same teacher. The pupil's adaptation to flying (measured by a questionaire) is related to the improvements made at the beginning of the training period. In most cases students adapting well have had teachers rated as good in the flying school. Author (ESA)

N80-17706# Research Inst. of National Defence, Linkoeping (Sweden).
IMPROVED FLIGHT TRAINING METHODS [OPERATION KVALITETSHOEJNING AV FLYGFOERARPRODUKTIONEN]
Leif Carlstedt and F. Paul Johansson Mar. 1979 49 p refs In SWEDISH
(FOA-C-55028-H8) Avail: NTIS HC A03/MF A01

The evolution of methods used in military pilot training is presented along with a discussion and evaluation of Swedish practices. An experiment is described in which the trainee group is given a distinctive name and exposed to a training cadre which was highly motivated at all levels of command. The long term project showed increases in pilot selection success ratio. Author (ESA)

N80-17707# National Technical Information Service, Springfield, Va.
INFORMATION PROCESSING IN HUMANS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Nov. 1977 - Nov. 1979
Elizabeth A. Harrison Nov. 1979 123 p supersedes NTIS/PS-78/1154; NTIS/PS-77/1042; NTIS/PS-76/0947; NTIS/PS-75/858; NTIS/PS-75/087
(PB80-800931; NTIS/PS-78/1154; NTIS/PS-77/1042; NTIS/PS-76/0947; NTIS/PS-75/858; NTIS/PS-75/087) Avail: NTIS HC $30.00/MF $30.00 CSCL 05J

Psychophysiology, memory, visual evoked responses, psychoacoustics, neuroses, decision making and learning, as related to information processing in humans, are topics covered by the selected abstracts of research reports. This updated bibliography contains 118 abstracts, 64 of which are new entries to the previous edition. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-17708*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED REMOTE WORK STATION DEVELOPMENT ARTICLE, EXECUTIVE SUMMARY Final Report
1 Mar. 1979 69 p
(Contract NAS9-15507)
(NASA-CR-160462; NSS-MR-RP008) Avail: NTIS HC A04/MF A01 CSCL 05H

The mission requirements for the manned remote work station (MRWS) flight article and the manned remote work station open cherry picker development test article is defined. Considerations are given for the near, mid, and far term use of the MRWS with emphasis on its ultimate application: constructing the Solar Power Satellite. R.C.T.

N80-17709*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED REMOTE WORK STATION DEVELOPMENT ARTICLE. VOLUME 1, BOOK 1: FLIGHT ARTICLE REQUIREMENTS. APPENDIX A: MISSION REQUIREMENTS Final Report
1 Mar. 1979 317 p
(Contract NAS9-15507)
(NASA-CR-160463; NSS-MR-RP008-Vol-1-Book-1) Avail: NTIS HC A14/MF A01 CSCL 05H

The requirements for several configurations of flight articles are presented. These requirements provide the basis to design manned remote work station development test articles and establish tests and simulation objectives for the resolution of development issues. Mission system and subsystem requirements for four MRWS configurations included: open cherry picker; closed cherry picker; crane turret; and free flyer. R.C.T.

N80-17710*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED REMOTE WORK STATION DEVELOPMENT ARTICLE. VOLUME 1, BOOK 2, APPENDIX B: TRADE AND DESIGN DEFINITION STUDIES Final Report
1 Mar. 1979 201 p
(Contract NAS9-15507)
(NASA-CR-160464; NSS-MR-RP008-Vol-1-Book-2) Avail: NTIS HC A10/MF A01 CSCL 05H

System trades, evaluations, and selection were organized under the appropriate manned remote work station roles and subsystems. Those trades/evaluations that have an impact on simulator fidelity were given emphasis in terms of identifying alternate concepts, making a selection, and defining the system approach. Those trades that do not impact simulator fidelity have the issues delineated and future study requirements identified. R.C.T.

N80-17711*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED REMOTE WORK STATION DEVELOPMENT ARTICLE. VOLUME 2: SIMULATION REQUIREMENTS. APPENDIX A: OPEN CHERRY PICKER DEVELOPMENT TEST ARTICLES SPECIFICATION Final Report
1 Mar. 1979 132 p
(Contract NAS9-15507)
(NASA-CR-160465; NSS-MR-RP008-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 05H

A manned remote work station (MRWS) mission scenario, broken down into the three time phases was selected as the basis for analysis of the MRWS flight article requirements and concepts. The mission roles for the three time phases, supporting tradeoff and evaluation studies, was used to identify key issues requiring simulation. The MRWS is discussed in terms of its capability to perform such operations as support of Spacelab experiments, servicing and repair of satellites, and construction. Future considerations for the use of the MRWS are also given. R.C.T.

N80-17712*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED REMOTE WORK STATION DEVELOPMENT ARTICLE. VOLUME 3: DEVELOPMENT TEST PLAN. APPENDIX A: MANUFACTURING REQUIREMENTS/SCHEDULE Final Report
1 Mar. 1979 180 p
(Contract NAS9-15507)
(NASA-CR-160466; NSS-MR-RP008-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 05H

The tests and procedures for the manned remote work station (MRWS) open cherry picker (OCP) development test article (DTA) are described to validate systems requirements and performance specifications. A development test program is outlined to evaluate key design issues and man/machine interfaces when the MRWS OCP is used in a shuttle support role of satellite servicing and in orbit construction of large structures. R.C.T.

N80-17713# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
REFERENCE TREE NETWORKS: VIRTUAL MACHINE AND IMPLEMENTATION Ph.D. Thesis
Robert Hunter Halstead, Jr. 2 Jul. 1979 250 p refs
(Contract N00014-75-C-0661)
(AD-A076570; MIT/LCS/TR-222) Avail: NTIS HC A11/MF A01 CSCL 05/8

A current-technology computing machine may be roughly decomposed into a processor, a memory, and a data path connecting them. The interposition of this data path between processing and storage elements creates a bottleneck which inhibits progress at the high-performance end of the technological spectrum. Additionally, the monolithic nature of present-day processors resists incremental addition or removal of processing power. The research described here attacks the problem of constructing more powerful and more flexible computer systems along three fronts: the definition of a virtual machine providing for parallel computation using objects and object references, the development of a distributed implementation mechanism ('reference trees') supporting object management functions including garbage collection, and the investigation of scheduling algorithms and collection of performance results. A reference tree network using these concepts is composed of a multiple of independent small processors, yet operates as a coherent programming system. Programs and data spread automatically and transparently through the network to occupy underused resources. The modular structure of the network provides many parallel data paths as well as allowing for easy addition or removal of modules, thus addressing some of the problems discussed here. A prototype reference tree network, the Mu Ner, is currently in operation. GRA

N80-17714# Human Resources Research Organization, Alexandria, Va.
EFFECTS OF FATIGUE FROM WEARING THE AN/PVS-5 NIGHT VISION GOGGLES ON SKILLS INVOLVED IN HELICOPTER OPERATIONS Technical Report, 13 May - 29 Dec. 1978
Garvin D. Chastain and Albert L. Kubala Jul. 1979 51 p refs
(Contract MDA907-78-C-2017; DA Proj 2Q7-63743-A-775)
(AD-A075426; HUMRRO-FR-WD-TX-78-18; ARI-RR-1217)
Avail: NTIS HC A04/MF A01 CSCL 06/17

Reviews of the literature on rotary wing flight and interviews with aviators were conducted to determine which helicopter tasks and maneuvers are performed most frequently and/or are the most critical. Those operations found to be most critical were analyzed into perceptual and psychomotor components, and a battery of perceptual and psychomotor tests was selected to measure these factors. Aviators were tested both before and after flying with the AN/PVS-5 goggles. Eye-hand coordination was marginally affected following flight, and reaction time to lights was significantly affected. GRA

N80-17715# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
THE VISUAL SCENE PERCEPTION PROCESS INVOLVED IN MANUAL APPROACH LANDING
P. H. Wewerinke 13 Oct. 1978 87 p refs
(Contract NIVR-1857)
(NLR-TR-78130-U) Avail: NTIS HC A05/MF A01

The outside scene is often an important source of information for manual control tasks. In the context of aircraft control the most importance example is the visual approach scene. Modeling the visual scene perception process on the basis of linear perspective geometry and relative motion cues is dealt with. Its impact on aircraft approach performance is investigated. Model predictions utilizing visual threshold data from baseline experiments and psychophysical literature of a variety of visual approach tasks are compared with the results of an experimental program. The results confirm that the visual scene may be assumed to provide a variety of cues among which the human operator has to divide his attention. Both the performance and workload results illustrate that the model provides a meaningful description of the outside world perception process with a useful predictive capability. Additional research, however, is warranted in order to be able to deal with the realistic, complex, time varying manual approach and landing situation. Author (ESA)

N80-17716# Massachusetts Inst. of Tech., Cambridge.
SUPERMAN: A SYSTEM FOR SUPERVISORY MANIPULATION AND THE STUDY OF HUMAN/COMPUTER INTERACTIONS M.S. Thesis
Thurston L. Brooks and Thomas B. Sheridan Jul. 1979 286 p refs
(Contract N00014-77-C-0256; Grant NOAA-04-7-158-44079)
(PB-301290/3; MITSG-79/20; NOAA-79082405) Avail: NTIS HC A13/MF A01 CSCL 13J

The need for supervisory control of remote teleoperator vehicles in the ocean environment is considered and it is shown that computer controlled systems can increase the effectiveness of remote manipulation. A distinction is made between absolute tasks--tasks which have a known spatial relationship to the manipulator base prior to execution--and relative tasks-tasks which cannot be spatially defined prior to execution. Based on the mathematical and theoretical foundations described, a supervisory system was developed and demonstrated. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N80-17717*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ASSESSMENT OF FUTURE COMPUTER SYSTEM NEEDS FOR LARGE-SCALE COMPUTATION
Peter Lykos and John White Feb. 1980 57 p Prepared in cooperation with Illinois Inst. of Tech., Chicago
(NASA-TM-78613; A-7929) Avail: NTIS HC A04/MF A01 CSCL 09B

Data ranging from specific computer capability requirements to opinions about the desirability of a national computer facility

are summarized. It is concluded that considerable attention should be given to improving the user-machine interface. Otherwise, increased computer power may not improve the overall effectiveness of the machine user. Significant improvement in throughput requires highly concurrent systems plus the willingness of the user community to develop problem solutions for that kind of architecture. An unanticipated result was the expression of need for an on-going cross-disciplinary users group/forum in order to share experiences and to more effectively communicate needs to the manufacturers. K.L.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-17718 California Univ., Berkeley.
THE EFFECTS OF CONCURRENCY CONTROL OF THE PERFORMANCE OF DATABASE MANAGEMENT SYSTEMS Ph.D. Thesis
Daniel Roland Ries 1979 218 p
Avail: Univ. Microfilms Order No. 8000487

The performance tradeoffs between parallelism and increased concurrency control overhead during simultaneous user updates of a database are studied using simulation models. The results indicate that in many cases coarse granularity such as file, relation, or record type locking is preferable. However, if all of the updates are small and randomly access the database, finer granularity, such as page or record locking becomes necessary. If the sizes and access patterns of updates vary considerably, a lock hierarchy with different sized locks is beneficial. The simulation results also indicate that with a high speed network and mostly local database activities, either primary site control or decentralized control algorithms are acceptable. As the network becomes slower, the decentralized control algorithms are preferable. If most of the database activities are distributed, however, the primary site approach can take advantage of its global knowledge to better schedule the processing of transactions and thus provide better performance than the decentralized algorithms. Dissert. Abstr.

N80-17719 Texas Univ. at Austin.
HARDWARE SUPPORT FOR MODERN SOFTWARE CONCEPTS Ph.D. Thesis
Charles George Hoch 1978 153 p
Avail: Univ. Microfilms Order No. 7928374

A realizable machine architecture which straightforwardly supports program modularity, typing and abstract data objects, concurrency, recursion, and program recovery/restart is described and defined. The proposed architecture is obtained through a unifying synthesis and formalization of existing hardware concepts. The key conceptual elements of the design are the integration of the concepts of typing, capabilities, word tagging, and memory virtualization, and the uniform treatment of hardware instructions, software functions, and device actions. The practicality of the architecture is demonstrated by using a software realization of it as an intermediate target language for the implementation of GYPSY, a language which includes all of the concepts of modern software mentioned above. Dissert. Abstr.

N80-17720 Texas Univ. at Austin.
LOCKING MECHANISMS FOR CONCURRENCY CONTROL AND CONSISTENCY IN DATA BASE SYSTEMS Ph.D. Thesis
Sukho Lee 1979 166 p
Avail: Univ. Microfilms Order No. 7928321

Locking mechanisms, structural locking and semantic locking, are developed to control concurrency and maintain data base consistency. The structural locking mechanism allows precise specification of the locked data objects and thus can afford maximal concurrency via the realization of minimal locking. The set-oriented conflict test associated with the mechanism is simple and effective. Furthermore, when associative memories are in common use in data base machines, structural locking has unique characteristics to take advantage of this architecture. Semantic locking provides a mechanism for maintaining consistency between semantically dependent data objects in concurrency environment. The mechanism allows a system to enforce the appropriate consistency constraints when constraining data are updated. Dissert. Abstr.

N80-17721 Ohio State Univ., Columbus.
A MINICOMPUTER-MULTIPLE MICROPROCESSOR SYSTEM FOR GAIT ANALYSIS USING TELEVISION AND FORCE PLATE DATA Ph.D. Thesis
Hoover J. Chen 1979 407 p
Avail: Univ. Microfilms Order No. 8001707

A minicomputer multiple microprocessor system which is capable of processing the video information from three television cameras placed at different locations was developed. The system detects the positions of lights attached to various human joints. Spatial coordinate information from the television is acquired simultaneously without the loss of data through the parallel microprocessor architecture. The multiple microprocessor interface module functioning as the front-end device for the master PDP-11/34 computer allows each camera to be handled by its own dedicated microprocessor. Interactive software programs for data sorting, smoothing, and processing are written in such a way thay they can be executed by nontechnical personnel. Dissert. Abstr.

N80-17722* Systems Technology, Inc., Mountain View, Calif.
THE ANALYSIS OF DELAYS IN SIMULATOR DIGITAL COMPUTING SYSTEMS. VOLUME 1: FORMULATION OF AN ANALYSIS APPROACH USING A CENTRAL EXAMPLE SIMULATOR MODEL Final Report
Robert K. Heffley, Wayne F. Jewell, Richard F. Whitbeck, and Ted M. Schulman Feb. 1980 101 p refs
(Contract NAS2-10106)
(NASA-CR-152340; STI-TR-1140-1-Vol-1) Avail: NASA Ames Res. Center, Moffett Field, Calif. 94035 CSCL 09B

The effects of spurious delays in real time digital computing systems are examined. Various sources of spurious delays are defined and analyzed using an extant simulator system as an example. A specific analysis procedure is set forth and four cases are viewed in terms of their time and frequency domain characteristics. Numerical solutions are obtained for three single rate one- and two-computer examples, and the analysis problem is formulated for a two-rate, two-computer example. K.L.

N80-17723*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SMOOTHING FILTER FOR DIGITAL TO ANALOG CONVERSION Patent
Charles A. Wagner, inventor (to NASA) Issued 25 Jan. 1980 16 p
(NASA-Case-FRC-11025-1; US-Patent-Appl-SN-115536) Avail: NTIS HC A02/MF A01 CSCL 09B

An electronic filter comprised of three active filter sections (A, B, C) is provided to smooth the stepped signal from a digital to analog converter. The first section has a noninverting low pass filter transfer function, and the second has an inverting transfer function designed to pass a narrow frequency band centered at the step frequency of the stepped output signal with sharp cutoff on either side of that narrow band. The third section adds the noninverted output of the first section to the inverted output of the second section. This third section has a lead lag transfer function designed to reduce the phase angle between the signal at its output terminal and the stepped signal at the input of the first section. NASA

N80-17724# General Research Corp., McLean, Va. Operations Analysis Group.
ANALYSIS TO DETERMINE FUNCTIONAL AND SYSTEMS REQUIREMENTS FOR AN ON-LINE AND COMPOSITION SYSTEM (SACS). REPORT OF TASK G NEAR- AND LONG-TERM IMPROVEMENTS Final Report, period ending Aug. 1979
Francis O. Deppner, John J. Anderson, and Whitney C. Scully Sep. 1979 123 p
(Contract MDA903-78-C-0445)
(AD-A076019; GRC-1070-06-79-CR) Avail: NTIS

HC A07/MF A01 CSCL 09/2

This report identifies specific improvement actions required to bring an improved on-line SACS to fruition. The actions have been further broken into subtasks, dependency relationships have been established, and tasks have been identified as being either near-term (1-12 months) or long-term (up to 32 months). The report also contains a network schematic which portrays the sequence in which the SACS improvement work should be accomplished during the full 32 months of effort. GRA

N80-17725# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
RESULTS OF GEOTECHNICAL COMPUTER USAGE SURVEY Final Report
David P. Hammer and Robert D. Bennett Aug. 1979 47 p refs
(AD-A073826; WES-MP-GL-79-19) Avail: NTIS HC A03/MF A01 CSCL 09/2

Recognizing a need for improving automatic data processing (ADP) capabilities in the geotechnical field, the Office, Chief of Engineers, requested the U.S. Army Engineer Waterways Experiment Station to conduct a study to determine if geotechnical elements in the Corps of Engineers (CE) thought an upgrading of their ADP capabilities was needed and, if so, exactly what type of effort would be most beneficial. The first phase of this study consisted of a survey of various representative CE District and Division offices to investigate the state of the art in computer usage among CE geotechnical elements and compile what they considered to be their greatest needs. This report presents the results of that study. Based on the results of this survey, an upgrading in the area of geotechnical computer applications is apparently needed and desired by the majority of CE District and Division offices. Efforts toward accomplishing this should be directed toward increasing capabilities in the areas of (1) data-base management; (2) interactive graphics and plotting; and (3) technology transfer. GRA

N80-17726# General Accounting Office, Washington, D. C.
SPERRY UNIVAC EXEC-8 OPERATING SYSTEM
Oct. 1979 92 p
(PB80-101702; CCVS74-VSR430) Avail: NTIS HC A05/MF A01 CSCL 09B

The results obtained from the the validation of the Sperry Univac 1100 series COBOL Compiler Version 4R2A (EXEC-8 Version 36R10C) against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1) are summarized. The compiler was validated at the HIGH level of FIPS PUB 21-1. An overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974 and a section relating the categories of discrepancies to each of the Federal levels of the language are presented together with a detailed listing of discrepancies and the tests which were failed. GRA

N80-17727# General Accounting Office, Washington, D. C.
NCR CORPORATION, IMOS COBOL VERSION 04.03.04
16 Oct. 1979 68 p
(PB80-102361; CCVS74-VSR460) Avail: NTIS HC A04/MF A01 CSCL 09B

A consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1) is presented. The compiler was validated at the LOW INTERMEDIATE level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language and a detailed listing of discrepancies together with the tests which were failed. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-17728 Stanford Univ., Calif.
PERFORMANCE OF UPDATE ALGORITHMS FOR REPLICATED DATA IN A DISTRIBUTED DATABASE Ph.D. Thesis
Hector Garcia-Molina 1979 319 p
Avail: Univ. Microfilms Order No. 8001920

Studies are presented on the performance of update algorithms for replicated data in a distributed database. In doing so, several other related issues are investigated. A simple model of a distributed database which is suitable for studying updates and concurrency control are presented. A performance model and a set of parameters which represent the most importance performance features of a distributed database are developed. Dissert. Abstr.

N80-17729 California Univ., Berkeley.
ON DESIGN AND VERIFICATION OF PROGRAM MODULES FOR RESOURCE SHARING Ph.D. Thesis
Wu-Hon Francis Leung 1979 189 p
Avail: Univ. Microfilms Order No. 8000417

Methods for the specification, design, and verification of program modules which allow more than one process to execute their procedures at the same time are presented. For the purpose of specifying these program modules, a method to construct their state space is given. The procedures of a program module are organized according to a design protocol so that when a process executes the program module, it follows the steps specified by the protocol. For program modules so designed, sufficient conditions to avoid interfering situations are established. A mechanism called a synchronization queue is proposed to be used in a program module to satisfy these conditions. Techniques to verify the partial correctness of these program modules are developed and methods to reduce the effort in verification are given. Conditions to show the absence of infinite loops, total blocking, permanent blocking, and starvation of an individual process in a program module are also derived. Dissert. Abstr.

N80-17730# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
DIGITIZING FOR COMPUTER-AIDED FINITE ELEMENT MODEL GENERATION
H. A. Kamel and Z. Navabi 10 Oct. 1979 35 p
(Contract N00014-75-C-0837)
(AD-A076573; TR-5) HC A03/MF A01 CSCL 13/13

For the purpose of this paper, computer aided design is acknowledged as being a complex process involving many disciplines. This paper describes an approach to a specific discipline, that of structural analysis, which has evolved with the design process in mind. The vehicle for the implementation of this approach is a collection of programs developed over the last eight years at the University of Arizona, and called the GIFTS system. This paper briefly describes the latest version of the system, GIFTS-5, and demonstrates its suitability in a design environment by simple examples. The programs constituting the GIFTS system were used as a tool for research in many areas, including mesh generation, finite element data base design, interactive analysis, numerical analysis, as well as digitization. The last sections describe a newly developed digitizing program aimed at facilitating the preparation of input describing complex two-dimensional models for the GIFTS mesh generator. Modern analysis methods, of which the finite element is a prime example, permit the engineer to analyze most types of structures under a variety of loads. Although this is valid in principle, many practical considerations are involved which may influence the desirability and practicality of a computer analysis. GRA

N80-17731# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
MUTATION ANALYSIS Final Report
Allen T. Acree, Timothy A. Budd (Yale Univ., New Haven, Conn.), Richard A. DeMillo, Richard J. Lipton (Calif. Univ., Berkeley), and Frederick G. Sayward (Yale Univ., New Haven, Conn.) Sep. 1979 90 p refs
(Contract N00014-79-C-0231; Grant DAAG29-78-G-0121)
(AD-A076575; GIT-ICS-79/08; ARO-15950.4-A-EL) Avail: NTIS HC A05/MF A01 CSCL 09/2

A new type of software test, called mutation analysis, is

introduced. A method of applying mutation analysis is described, and the design of several existing automated systems for applying mutation analysis to FORTRAN and COBOL programs is sketched. These systems have been the means for preliminary studies of the efficiency of mutation analysis and of the relationship between mutation and other systematic testing techniques. The results of several experiments to determine the effectiveness of mutation analysis are described, and examples are presented to illustrate the way in which the technique can be used to detect a wide class of errors, including many previously defined and studied in the literature. Finally, a number of empirical studies are suggested, the results of which may add confidence to the outcome of the mutation analysis of a program. GRA

N80-17732# Stanford Univ., Calif. Dept. of Computer Science.

A SYMMETRIC CHAIN DECOMPOSITION OF L(4,N)

Douglas B. West Aug. 1979 18 p refs

(Contract N00014-76-C-0688; Grant MCS-77-23738)

(AD-A076876; SU-STAN-CS-79-763) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let L(m,n) be the set of integer m-tuples (a sub i, ..., a sub m), with 0 < or = a sub i < or = n, ordered by a < or = b when a sub i < or = b sub i for all i. It is shown that L(m,n) is a symmetric chain order for all (m,n) by construction for m = 4. K.L.

N80-17733# George Washington Univ., Washington, D. C. Inst. for Management Science and Engineering.

BASIC RESULTS IN THE DEVELOPMENT OF SENSITIVITY AND STABILITY ANALYSIS IN CONSTRAINED MATHEMATICAL PROGRAMMING

Anthony V. Fiacco and William P. Hutzler 7 Aug. 1979 51 p refs

(Contract DAAG29-79-C-0062)

(AD-A076486; SERIAL-T-407; ARO-16229.1-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

For large classes of mathematical programming problems, a detailed technical survey is given of key developments in sensitivity and stability analysis results, i.e., results characterizing the relationship between the optimal value function or a solution set and problem perturbations. The emphasis is on finite dimensional nonlinear problems with deterministic parametric perturbations. Precise assumptions and conclusions of key results are given in the more than 30 theorems that are stated. Some effort has been made to unify the notation and terminology and to place the results in perspective. Directions of future research and applications are indicated. Finally, an extensive bibliography is included. The paper is motivated by a desire to unify into one body of theory the many penetrating results that are now known in this crucially important area. GRA

N80-17734# SRI International Corp., Menlo Park, Calif.

A JOVIAL VERIFIER Interim Report, 14 Nov. 1977 - 31 Dec. 1978

B. Elspas, M. W. Green, M. S. Moriconi, and R. E. Shostak Jul. 1979 78 p refs

(Contract F30602-78-C-0031; AF Proj. 2532)

(AD-A075108; SRI-6977-1; RADC-TR-79-195) Avail: NTIS HC A05/MF A01 CSCL 09/2

This Interim Report describes progress during the first year of research and development on a program verification system supporting the design, development, and formal verification of programs written in JOVIAL-J73-I. The work reported here represents an outgrowth and continuation of earlier efforts concerned with JOVIAL-J3 (JOCIT version). Detailed descriptions are presented of progress and future plans in the following areas: (a) Analysis of the JOVIAL-J73/I language with respect to verifiability, leading to formal definitions of its syntax and semantics, and to the enhancement of the language by assertion constructs for the purposes of specification, and verification (b) The organization, technical development, and implementation of portions of the JOVIAL Verifier - in particular, of a verification condition generator and deductive subsystems; (c) The selection, analysis, and verification of two real software systems of significant size and complexity, critical parts of which will be implemented in J73/I and which is hoped to be verified by means of the JOVIAL Verifier. GRA

N80-17735# Honeywell Information Systems, Inc., Minneapolis, Minn.

RATIONALE FOR THE DESIGN OF THE GREEN PROGRAMMING LANGUAGE, A LANGUAGE DESIGNED IN ACCORDANCE WITH THE STEELMAN REQUIREMENTS

15 Mar. 1979 266 p refs Prepared in cooperation with CII Honeywell Bull, Louveciennes, France

(Contract MDA903-77-C-0331; ARPA Order 3341)

(AD-A073662) Avail: NTIS HC A12/MF A01 CSCL 09/2

This document, the rationale for the design of the GREEN programming language, and the companion Reference Manual, are the two defining documents for the GREEN language. They serve different purposes. The Reference Manual contains a complete and concise definition of the language. Following Wirth we believe in the virtue of having a rather short reference manual. This has the advantage of providing the information in a form that can easily be consulted, read and reread several times, as the basis for developing a good familiarity with the language. GRA

N80-17736# Honeywell Information Systems, Inc., Minneapolis, Minn.

THE GREEN LANGUAGE: A FORMAL DEFINITION

Apr. 1979 113 p Prepared in cooperation with CII Honeywell Bull, Louveciennes, France

(Contract MDA73-77-C-0331)

(AD-A073714) Avail: NTIS HC A06/MF A01 CSCL 09/2

This document is a Preliminary Draft of the Formal Definition of the GREEN Programming Language. As such, it indicates the structure and style of the final document. At this stage, the Static Semantics is well advanced but not complete, and large parts of the Dynamic Semantics are missing. Some sections (such as Chapter 4 - 6) have been worked on in detail to give a better idea of the final shape of the Formal Definition. GRA

N80-17737# Argonne National Lab., Ill.

FIC: A FINITE ELEMENT CODE FOR CALCULATING ADDED MASS AND DAMPING COEFFICIENTS: USER'S MANUAL

S. M. Batill Jul. 1979 59 p refs

(Contract W-31-109-eng-38)

(ANL-CT-79-46) Avail: NTIS HC A02/MF A01

A user manual is presented for a code capable of calculating the hydrodynamic reactions on multiple interacting bodies undergoing simple harmonic motion. Input requirements are documented and the program output is described. A sample data set and program listing are also included. It should be noted that the program is not prepared for production applications but is intended for use as a research tool. DOE

N80-17738# Research Inst. of National Defence, Linkoeping (Sweden).

DIALOG WITH A COMPUTER FOR TEXT EDITING AND DATA BASE HANDLING [DIALOG MED EN DATOR FOER TEXTREDIGERING OCH DATABASHANTERING]

Per Thernquist Feb. 1979 84 p In SWEDISH

(FOA-C-20291-X7/H9) Avail: NTIS HC A05/MF A01

Material taken from a course in basic computer techniques is presented with reference to IBM 370 and DEC 10 systems. Use of an interactive terminal is discussed with examples of a text editing system called SOS and a data base management system 1022, written for the DEC 10. Practical exercises are given. Author (ESA)

N80-17739# Centre Technique des Industries Mecaniques, Senlis (France).

ON THE SOLVING OF INTEGRAL EQUATIONS ON A HYBRID COMPUTER Final Report [RESOLUTIONS EQUATIONS INTEGRALES CALCULATEUR HYBRIDE]

Lenclos Feb. 1979 68 p In FRENCH

(CETIM-11-L-05-0) Avail: NTIS HC A04/MF A01

The solving of classical field problems by integral equations using a hybrid computer is examined. The test problem involved describing torsion for a cylindrical bar. After considering the solution of this problem by a Laplace equation, its formation as an integral equation for the contour of the cross section of the bar is presented. The transformations, carried out to condition the data for input on a hybrid computer, are discussed. The

organization of the programs for solving the problem are presented and results are shown in print out form. Author (ESA)

N80-17740# Marconi Co. Ltd., Chelmsford (England).
PERFORMANCE ANALYSIS OF VITERBI DECODING OF CONVOLUTIONAL CODED DATA TRANSMITTED OVER A NONLINEAR CHANNEL USING MODSIM
J. K. Potts, S. Shepherd, and C. R. Telfer. Dec. 1977. 16 p. refs. 3 Vol.
(Contract ESTEC-2327/74-HP)
(ESA-CR(P)-881-Vol-3) Avail: NTIS HC A02/MF A01

The calculating method described is validated by: a comparison of calculated error probabilities with decoder simulations, and in the case of uncorrelated data, with published results; and a comparison of calculated and extrapolated path preference probabilities with results obtained by the method of statistics of extreme values. The path enumeration importance sampling process which provides an upper bound to the error probability is described. Author (ESA)

N80-17741# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
EVALUATION OF A SIMULATION FRAME PROGRAM FOR THE EAI PACER 600
Hans-Heinz Lange. Dec. 1978. 31 p. refs.
(DLR-Mitt-79-01) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Ger. DM 7.70

An example of a simulation program is presented. The computer used was a hybrid system with one analog console and two digital processors (EAI Pacer 600 type). The operating features are described and discussed in relation to the options included. Author (ESA)

N80-17742# Loughborough Univ. of Technology (England). Dept. of Mathematics.
THE IMPLEMENTATION OF SOME ANALYTICAL TECHNIQUES ON A COMPUTER
G. A. Evans and J. Hyslop. Sep. 1978. 16 p. refs.
(Maths-Res-129) Avail: NTIS HC A02/MF A01

Computing techniques and their associated programs are briefly discussed. Two areas of application are cited: the programming of arithmetic and logical expressions so as to code scientific formulas and numerical methods; and the direct manipulation of algebraic expressions by machines. A hybrid method making use of these two extremes is then presented and its use is demonstrated by examples which form a study of the numerical integration of highly oscillatory integrands. Series reversion involving Bessel functions and the use of Leibnitz theorem are included. The recognition of suitable simple recursions as the main tool in setting up algorithms of this sort is emphasized. Results show a savings in computation time over other analytical techniques. Author (ESA)

N80-17743# Montpellier Univ. (France). Dept. Physique Mathematique.
A PACKAGE OF ROUTINES FOR LINEAR INVERSE PROBLEMS. VOLUME 1: REFINED DATA COMPUTATION
Michel Cuer and Roger Bayer. Jan. 1979. 30 p. refs. 4 Vol.
(PM/79/2) Avail: NTIS HC A03/MF A01

A package of FORTRAN routines based on linear programming technique is described. For demonstration purposes the inverse gravity problem, posed by the analysis of data from the measurement of the Earth's gravitational field to obtain information on subsurface mass distribution, is treated. Following a theoretical review of the algebra used in these analyses, the routines for transforming the data into a 'refined form' and subroutines which perform elementary analytic operations are presented. The results from the processing of a three-dimensional artificial case drawn from gravimetric data are shown. Author (ESA)

N80-17744# Montpellier Univ. (France). Dept. Physique Mathematique.
A PACKAGE OF ROUTINES FOR LINEAR INVERSE PROBLEMS. VOLUME 2: ELEMENTARY LINEAR PROGRAMMING ALGORITHMS
Michel Cuer and Roger Bayer. Jan. 1979. 26 p. refs. 4 Vol.
(PM/79/3) Avail: NTIS HC A03/MF A01

Algorithms for solving two problems in linear algebra are given. A matrix analysis of gravimetric data is used as an example. For the unknown vector X, the problems are (1) compute a basic feasible solution of AX = b where zero CH-76 or = X CH-76 or = Xmax or show that the problem has no solution, and (2) if the problem has solutions and c sup T is an n-components row vector compute a solution of Ax = b where zero CH-76 or = X CH-76 or = Xmax which minimizes the number (c sup T)X. As an approach to these problems the simplex algorithm is used. Results on the identification of gravity anomalies are shown. Author (ESA)

N80-17745# Montpellier Univ. (France). Dept. Physique Mathematique.
A PACKAGE OF ROUTINES FOR LINEAR INVERSE PROBLEMS. VOLUME 3. PARAMETRIC LINEAR PROGRAMMING ALGORITHM
Michel Cuer and Roger Bayer. Jan. 1979. 30 p. refs. 4 Vol.
(PM/79/4) Avail: NTIS HC A03/MF A01

Given two vectors, an algorithm which generates functions to draw curves representative of the bounds on the center of mass of a body which creates an anomaly is presented. Independent variables represent the total mass and the first moment of the mass distribution. Results from the application of this subroutine to artificial gravimetric data are shown. Author (ESA)

N80-17746# Montpellier Univ. (France). Dept. Physique Mathematique.
A PACKAGE OF ROUTINES FOR LINEAR INVERSE PROBLEMS. VOLUME 4. FITTING PROCEDURES IN NORM L INFINITY
Michel Cuer and Roger Bayer. Jan. 1979. 66 p. refs. 4 Vol.
(PM/79/5) Avail: NTIS HC A04/MF A01

Given a vector and an index set, an optimization algorithm is presented. The numerical solution generated by the first algorithm is used to solve a second vector value problem and the associated algorithm is also described. Adjustments to previously presented algorithms to solve these two problems are analyzed. The results are used in the computation of an artificial model from the feasible solutions generated by the elementary linear programming algorithms and supported by verified boundary conditions. Results on the density contrast of equivalent layers of the artificial model are shown. Author (ESA)

N80-17747# Research Inst. of National Defence, Linkoeping (Sweden).
SIMPLIFIED PLANE MODEL FOR THE DETERMINATION OF POSSIBLE TARGET POSITION MEASURING PRECISION [FOERENKLAND PLAN MODELL FOER BESTAEMNING AV MOEJLIG MAALINMAETNINGSNOGGRANNHET]
Boerge Lindstroem. Jul. 1979. 15 p. refs. In SWEDISH.
(FOA-C-20316-E3) Avail: NTIS HC A02/MF A01

The model designed to determine the position of the target, including distance and angle calculation is described. Most of the uncertainties are assumed to be related to the acceleration, while other uncertainties are modeled as uncorrelated stochastic processes. A Kalman type filter is used to determine the target position. Due to geometric factors the calculation is only approximate. Author (ESA)

N80-17748# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
REPORTS ON THE USE OF THE PASCAL P-SYSTEM [ARBEITSBERICHTE ZUM PASCAL P-SYSTEM MIT BEITRAEGEN VON]
Burkhard Austermuehl, George Hechler, and Hans-Jurgen Hoffmann. Nov. 1977. 41 p. refs. In GERMAN; ENGLISH summary. Submitted for publication.
(PU1R3/77) Avail: NTIS HC A03/MF A01

Three reports on the development of the PASCAL P-system for computer programming are presented. Implementation on a SIEMENS BS 2000 computer is described. The interpretive design of the stack computer program, the macroassembling of the stack computer codes, and compilation in assembly language are discussed. The possibility of extending PASCAL through two main features of EL1 language is examined. These are the introduction of generic routines and the treatment of data types

as values. The extension of PASCAL through the use of an abstract data type is reported. Author (ESA)

N80-17749# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
A REVIEW OF INTERACTIVE SYSTEMS, EMPHASIZING PROGRAMMING PROCEDURES, THEORETICAL CONCEPTS AND IMPLEMENTATION CONSIDERATIONS [ARBEITEN MIT INTERAKTIVEN SYSTEMEN ERLAEUTERT AM VORGANG DES PROGRAMMIERENS. THEORETISCHE KONZEPTE UND GESICHTSPUNKTE DER REALISIERUNG]
Hans-Jurgen Hoffmann and I. Kupka. Oct. 1978. 52 p. refs. In GERMAN; ENGLISH summary.
(PU1R6/78; IFI-HH-8-53/78) Avail: NTIS. HC A04/MF A01.
Models of man machine information exchanges which contribute to a deeper understanding of design, implementation, and usage of systems for interactive programming are reviewed. Emphasis is on the automata theory underlying man machine interaction and the problems posed in structuring the dialogue. Results present various schemes for the structuring of arguments as hierarchies of instructions. Author (ESA)

N80-17750# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
AN INTERACTIVE SYSTEM WHICH ALLOWS USER INPUT OF NONFORMALIZED SPECIFIC CATCHWORDS
Gerhard Knorz. Dec. 1978. 42 p. refs. In GERMAN; ENGLISH summary.
(PU1R7/78) Avail: NTIS. HC A03/MF A01.
An interactive system which is able to interpret application oriented in a professional terminology of catchwords, covering a suitably restricted miniworld, is described. The main components of the system, which is controlled by a metasystem, are reported and the approach for handling nonformalized input is described. Development of the system and implementation of its most essential parts is described relative to the syntactical problems encountered when defining terms in natural language for the system. Author (ESA)

N80-17751# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
MODEL OF A MULTILEVEL DIALOG [MODELLE MEHRSCHICHTIGER DIALOGE]
Hans-Jurgen Hoffmann. Jan. 1979. 25 p. refs. In GERMAN; ENGLISH summary.
(PU1R1/79) Avail: NTIS. HC A02/MF A01.
The concept of 'levels' is introduced in the modeling of man machine dialogs. An interactive system is defined, consisting of addressable units with which a user can communicate at a given time and with which he exchanges messages. Machine responses can be retained, in which case the user may address another unit later retrieving the stored information, or disregarded, in which case the data is erased. Sequences of dialog steps are classified into forms, such as question answer dialog, command dialog, mixed dialog, parallel dialog, and competitive dialog. Structuring principles for retained responses, including hierarchical structuring of stored subprograms, quasi-simultaneous structuring of stored coroutines, and cooperating processes without explicit structuring are examined. Results are given as a level oriented model of these structuring parameters. Author (ESA)

N80-17752# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
METASYSTEM FOR A DIALOG CONTROL SYSTEM WHICH ACCEPTS INPUT FROM THE USER OF NONFORMALIZED SPECIFIC CATCHWORDS [METASYSTEM FUER EIN SYSTEM ZUR DIALOGFUEHRUNG, DAS ANWENDUNGSBEZOGENE EINGABEN IN EINER STICHWORTARTIGEN FACHSPRACHE AKZEPTIERT]
Gerhard Knorz. Jan. 1979. 22 p. refs. In GERMAN; ENGLISH summary.
(PU1R3/79) Avail: NTIS. HC A02/MF A01.
The concept of a man machine interactive system is discussed which allows the use of nonformalized professional terminology in a dialog with the user. The architecture consists of a dialog control system governing the dialog phase of address and a metasystem which handles the concept definitions phase. The dialog control system is discussed only in so far as is necessary to understand the operation of the metasystem. The dialog structure is specified through the metasystem in some descriptive sublanguage the processing of which is explained. The language level in which dialog specifications are given is demonstrated by examples from range profile analysis and descriptive statistics. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N80-17753# Naval Postgraduate School, Monterey, Calif.
DISTRIBUTED SHORTEST PATH ALGORITHMS FOR COMPUTER NETWORKS
Jin Y. Yan. Aug. 1979. 38 p. refs.
(RR0000101)
(AD-A075415; NPS55-79-017) Avail: NTIS.
HC A03/MF A01. CSCL 12/1.
This paper presents two distributed algorithms for finding shortest paths from a source node to all other nodes in an N-node network. These algorithms are executed at individual nodes using only local information. Algorithm 1 works in networks where there are no topological changes such as link failures, link recoveries or changes of link lengths. Algorithm 2 is a modification of Algorithm 1 for networks where there are topological changes. Algorithm 1 determines the optimal shortest paths in at most N3/4 steps, which is only one-half of the computational upper bounds of Abram and Rhodes and Segall, Merlin and Gallager's algorithms. After the last topological change, Algorithm 2 determines the optimal shortest paths in the same number of steps as Algorithm 1. There are many situations where the present algorithms will work up to N/2 times faster than the algorithms proposed by these authors. GRA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

N80-17754 Ohio State Univ., Columbus.
REAL-TIME MULTIPROCESSOR CONTROL OF A HEXAPOD VEHICLE. Ph.D. Thesis
Ching-Shu Chao. 1979. 188 p.
Avail: Univ. Microfilms. Order No. 8001705.
A real time multiprocessor control system which includes an effective servo control scheme as well as a limb coordination algorithm to achieve interactive operation of a hexapod vehicle over level ground under human operator control is developed. The entire control system is separated into two parts, motion planning and motion execution, which run concurrently in a PDP-11/03 and a PDP-11/45 computer. The motion planning block interprets the operator's commands, updates body state variables, implements a wave gait, and computes foot trajectories. The motion execution block provides a servo system which includes two feedback loops: the inner joint-rate servo loop is in leg joint coordinates, and the outer foot-position servo loop is in rectangular body coordinates. Alternative real time software techniques are applied in order to reduce system response time as far as possible utilizing available hardware facilities. Dissert. Abstr.

N80-17755# Massachusetts Univ., Amherst. Dept. of Computer and Information Science.
STUDIES IN IMAGE SEGMENTATION ALGORITHMS BASED ON HISTOGRAM CLUSTERING AND RELAXATION. Ph.D. Thesis
P. A. Nagin. Sep. 1979. 183 p. refs.
(Contract N00014-75-C-0459)
(AD-A076576; COINS-TR-79-15) Avail: NTIS.
HC A09/MF A01. CSCL 09/2.

best copy available

The research in this thesis has focussed upon the algorithms and structures that are sufficient to generate an accurate description of the information contained in a relatively complex class of digitized images. This aspect of machine vision is often referred to as 'low-level' vision or segmentation, and usually includes those processes which function close to the sensory data. The bulk of this thesis devotes itself to the exploration of some of the problems typically encountered in segmentation. In addition, a new and robust algorithm is presented that avoids most of these problems. The analysis is carried out through the use of a series of computer-generated tests images with known characteristics. Segmentation algorithms of varying degrees of complexity are applied to each image and their performance is carefully evaluated. It will be shown that even the most sophisticated algorithms that are currently in use often perform poorly when confronted with certain apparently simple images. In particular, it is shown that techniques which rely on histogram clustering often generate gross segmentation errors due to overlap in the distributions of the individual objects in a scene. Moreover, the relaxation processes used to correct these errors are themselves prone to errors, but of a different kind. Both techniques, clustering and relaxation, fail because they are based on information which is too global to be effective in complex scenes. GRA

N80-17756# Maryland Univ., College Park. Computer Science Center.

SOME NEW IMAGE SMOOTHING TECHNIQUES

Ann Scher, Flavio R. D. Velasco, and Azriel Rosenfeld. Mar. 1979. 30 p. refs.

(Contract DAAG53-76-C-0138; DARPA Order 3206)

(AD-A076351; CSC-TR-733) Avail: NTIS. HC A03/MF A01. CSCL 09/4

This report documents a collection of new techniques for image smoothing, and gives examples of their performance. The techniques involve averaging over half-neighborhoods, weighted averaging, and averaging based on local property probabilities. GRA

N80-17757# Stanford Univ., Calif. Dept. of Operations Research.

SIMULATION METHODS FOR RESPONSE TIMES IN NETWORKS OF QUEUES

Donald L. Iglehart and Gerald S. Shedler. Aug. 1979. 24 p. refs.

(Contract N00014-76-C-0578; Grant NSF MCS-79-09139)

(AD-A075173; SU-TR-49) Avail: NTIS. HC A02/MF A01. CSCL 12/1

Theoretically sound and computationally efficient estimation methods for 'passage times' in certain closed networks of queues is described. Informally, a passage time is the time for a job to traverse a portion of the network. Such quantities are important in computer and communication system models where they represent job response times, and in this context, quantities other than mean values are of interest. From a single simulation run, the methods described here provide both point estimates and confidence intervals for general characteristics of response times. GRA

N80-17758# Stanford Univ., Calif. Dept. of Operations Research.

REGENERATIVE SIMULATION OF RESPONSE TIMES IN NETWORKS OF QUEUES: STATISTICAL EFFICIENCY

Donald L. Iglehart and Gerald S. Shedler. Sep. 1979. 47 p. refs.

(Contract N00014-76-C-0578; Grant NSF MCS-75-23607)

(AD-A075174; TR-51) Avail: NTIS. HC A03/MF A01. CSCL 12/1

In this report the calculation of variance constants entering into central limit theorems used to obtain confidence intervals from passage time simulations is considered. Using results of Hordijk, Iglehart, and Schassberger for the calculation of moments in discrete time and continuous time Markov chains, we calculate variance constants pertinent to mean passage times. This is done first for the 'marked job method' for passsage time simulation which is based on the tracking of a distinguished job, and then for the 'decomposition method' in which observed passage times for all of the jobs enter into the construction of point and interval estimates. The results of this paper provide a means of comparing the statistical efficiency of the two estimation methods. GRA

N80-17759# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.

TWO-TIME SCALE DISCRETE SYSTEMS. M.S. Thesis

R. G. Phillips. Feb. 1979. 116 p. refs.

(Contracts DAAB07-72-C-0259; DAAG29-78-C-0016; Contract EX-76-C-01-2088)

(AD-A077146; DC-22; UILU-ENG-78-2232) Avail: NTIS. HC A06/MF A01. CSCL 12/1

The approach taken in this thesis is to decouple a two-time-scale discrete system into slow and fast subsystems. The phenomena of a boundary layer, possible order reduction, and independent slow and fast subsystems are analyzed. The analogy with continuous singularly perturbed systems is discussed throughout the text. A real time algorithm is presented which enables separate design and update of slow and fast control laws. GRA

N80-17760# Centre Technique des Industries Mecaniques, Senlis (France).

ON THE IMPROVEMENT OF AUTOMATIC CONTROL BY USING DATA PROCESSING. THE INTEGRATION OF ULTRASONIC INSPECTION WITH THE MANUFACTURING OF FINE TOLERANCE PARTS [AMELIORATION DU CONTROLE AUTOMATIQUE PAR L'EMPLOI D'UN TRAITEMENT INFORMATIQUE. CASDU CONTROLE PAR ULTRASONS INTEGRE A LA FABRICATION DES PIECES DE VALEUR]

J. Rivenez. 5 Dec. 1978. 23 p. In FRENCH.

(CETIM-15-H-19-0) Avail: NTIS. HC A02/MF A01

Ultrasonic inspection as used in industry is reviewed. The data processing of ultrasonic echos is considered. The combination of ultrasonic inspection with data reduction and processing for verifying the tolerances on large forged parts is analyzed. Results are used to show the feasibility of a similar integration of ultrasonics and EDP for inspecting fine tolerances on precision parts. Author (ESA)

N80-17761# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

A PROPERTY OF AN AUTONOMOUS MINIMAX OPTIMAL CONTROL PROBLEM

Kjell Holmaaker. 1979. 8 p. refs.

(CTH-Math-1979-21) Avail: NTIS. HC A02/MF A01

A control system, scalar product of X - f(x,u), with cost functional ess sup T sub zero - or - 1 - or - T sub 1, G (x(-t), u(t)) is considered. For an optimal pair (X bar (scalar product), u bar (scalar product)) there is a maximum principle of the form eta (t) f(x bar (t), u bar (t)) = Max, where u is an element of Omega (t), eta (t)f(x bar (t), u). By means of this fact it is shown that eta (t)f(x bar (t), u bar (t)) is equal to a constant almost everywhere. Author (ESA)

N80-17762# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.

ON FINITE ELEMENT METHODS FOR OPTIMAL CONTROL PROBLEMS, PART 1

Claes Johnson. 1979. 59 p. refs. 2 Vol.

(CTH-79.03-R) Avail: NTIS. HC A04/MF A01

The use of finite element methods in the solution of optimal control problems on Hilbert spaces with linear and continuous dynamics as well as closed and convex state control constraints is discussed. Discretized versions of the problem are considered in order to find approximate solutions. The problem of estimating the error between the exact solution and the approximate solution is also considered. Various algorithms for finding a numerical solution are shown together with results of some numerical experiments. Author (ESA)

N80-17763# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.

ON FINITE ELEMENT METHODS FOR OPTIMAL CONTROL PROBLEM. PART 2: ILL POSED PROBLEMS

Claes Johnson. 1979. 23 p. refs. 2 Vol.

(CTH-79.04-R) Avail: NTIS. HC A02/MF A01

The use of finite element methods in the solution of

optimal control problems on Hilbert spaces with linear and continuous dynamics as well as closed and convex state-control constraints is discussed. Problems with nonlinear state equations or constraints on the state are considered along with problems in which the solution, u, does not depend continuously on the right hand side of Au = z sub d. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-17764 Notre Dame Univ., Ind.
MULTIVARIABLE FEEDBACK LOOP CLOSURES: AN APPROACH BY EXTERIOR ALGEBRA. Ph.D. Thesis
V. Seshadri. 1980. 133 p.
Avail: Univ. Microfilms. Order No. 8002624.

A structure called the exterior algebra, which is especially well-suited for addressing problems that involve determinants and inverses is described wherein the notions of quotients and tensor products are introduced from algebraic viewpoint and then these ideas are used to construct the desired exterior algebra. The exterior algebraic structure is viewed in action by using it to formulate the problem of feedback loop closures, the loops being closed one by one. It is shown that this problem of feedback loop closures is intimately related to certain exterior algebraic structures called induced exterior morphisms, this provides insight into the nature of zeros of multivariable systems. Individual closed-loop zeros, of a system with output feedback, are considered. A method for pole- and zero-placement under rank-one feedback is obtained, and it is illustrated with both handworked and machine-worked examples; the computer program used to solve the latter is also listed. Dissert. Abstr.

N80-17765*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
APPLYING INTEGRALS OF MOTION TO THE NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS
Donald J. Jezewski. Dec. 1979. 28 p. refs.
(NASA-TM-80945; JSC-16302; Rept.-79-FM-47) Avail: NTIS. HC A03/MF A01. CSCL 12A.

A method is developed for using the integrals of systems of nonlinear, ordinary differential equations in a numerical integration process to control the local errors in these integrals and reduce the global errors of the solution. The method is general and can be applied to either scalar or vector integrals. A number of example problems, with accompanying numerical results, are used to verify the analysis and support the conjecture of global error reduction. K.L.

N80-17766*# National Aeronautics and Space Administration, Washington, D. C.
COMMENTS ON NUMERICAL SOLUTION OF BOUNDARY VALUE PROBLEMS OF THE LAPLACE EQUATION AND CALCULATION OF EIGENVALUES BY THE GRID METHOD
L. A. Lyusternik. Jan. 1980. 25 p. Transl. into ENGLISH from Tr. Mat. Inst. imeni V. A. Steklov (USSR), v. 20, 1947, p. 49-64. Transl. by Scientific Translation Services, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-75770) Avail: NTIS. HC A02/MF A01. CSCL 12A.

The mathematics involved in numerically solving for the plane boundary value of the Laplace equation by the grid method is developed. The approximate solution of a boundary value problem for the domain of the Laplace equation by the grid method consists of finding u at the grid corner which satisfies the equation at the internal corners (u = Du) and certain boundary value conditions at the boundary corners. A.R.H.

N80-17767# California Univ., Berkeley. Operations Research Center.
SOLUTIONS OF SPHERICAL INEQUALITIES
David Gale. Sep. 1979. 10 p. refs.
(Contract N00014-76-C-0314; Grant NSF SOC-78-05196)
(AD-A076597; ORC 79-10) Avail: NTIS. HC A02/MF A01. CSCL 12/1.

It is shown that the problem of finding a point in the intersection of a finite number of balls in n-space is equivalent to solving a very simple (one constraint) quadratic program. GRA

N80-17768# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
A NUMERICAL COMPARISON BETWEEN TWO UNCONSTRAINED VARIATIONAL FORMULATIONS
J. J. Wu and T. E. Simkins. Sep. 1979. 36 p. refs.
(AD-A076178; AD-E440050; ARLCB-TR-79024) Avail: NTIS. HC A03/MF A01. CSCL 12/1.

In an effort to relieve the often cumbersome burden of meeting the requirements on the end conditions and to unify the solution formulation for boundary- and initial-value problems, unconstrained variational statements have been introduced in conjunction with some approximate methods. In the case of a boundary value problem, it is shown in this paper that two different variational statements can be established: one is arrived at by the use of the LaGrange multipliers, the other by energy considerations. The numerical convergence of the solutions associated with finite element schemes using one of these two different variational statements is compared with that of the other. In the case of an initial value problem, both formulations can again be established when the adjoint field variable and the adjoint variational statement are introduced. The numerical data presented here indicate that while both methods generate excellent convergent results for the boundary value problem, the method of stiff springs yields results which show much better convergence for the initial value problem than those achieved by LaGrange multipliers. GRA

N80-17769# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
ZEROS OF MULTIVARIABLE SYSTEMS: DEFINITIONS AND ALGORITHMS. M.S. Thesis
D. K. Lindner. May 1979. 192 p. refs.
(Contracts DAAG29-78-C-0016; EX-76-C-01-2088; Grants NSF ENG-74-20091; AF-AFOSR-3633-78)
(AD-A077147; DC-23; UILU-eng-78-2234) Avail: NTIS. HC A09/MF A01. CSCL 12/1.

A number of definitions of zeros of linear time-invariant multivariable systems have appeared recently. This work surveys selected literature on these zeros. Two questions are addressed here: First, how are zeros defined and how are these definitions interrelated; Second, how can they be calculated. The definitions of zeros are considered for three system representations: (1) the transfer function matrix, (2) the state space representation in the frequency domain; and (3) the state space representation in the time domain. The definitions of zeros for transfer function matrices are shown to be (mostly) equivalent. However, several different sets of zeros are defined for state space representations. The interrelationships between all of these definitions is discussed in detail. It turns out that the calculation of zeros directly from the definitions is not always tractable. The properties of zeros, however, provide several algorithms for calculating zeros. Finally, a new algorithm for the calculation of invariant zeros is introduced. It is based on the geometrical properties of linear time invariant systems. This algorithm is applicable to the most general class of systems (A,B,C,D). GRA

N80-17770# North Carolina State Univ. at Raleigh. Dept. of Mathematics.
RESEARCH ON NONLINEAR DIFFERENTIAL EQUATIONS. Final Report, 24 Sep. 1978 - 23 Sep. 1979
Robert H. Jr. Martin. 12 Oct. 1979. 12 p. refs.
(Grant DAAG29-76-G-0332)
(AD-A076500; ARO-14020.2-M) Avail: NTIS. HC A02/MF A01. CSCL 12/1.

The research deals with the application of abstract techniques in the study of the behavior and (asymptotic) stability of solutions to differential equations of reaction-diffusion type. These equations include models in a cellular control process with positive feed-back and a model in gas-liquid reactions. Most of the results are based on techniques that involve the determination of invariant sets for solutions and the preservation of inequalities between solutions. GRA

N80-17771# California Univ., Berkeley. Electronics Research Lab.
SOLVER: AN ANALYTIC FUNCTION ROOT SOLVING AND PLOTTING PACKAGE
H. Stephen Au-Yeung and Alex Friedman. 31 Aug. 1979. 72 p.
(Contracts N00014-77-C-0578; DE-AS03-76SF-00034)
(AD-A075803; UCB/ERL-M79/55) Avail: NTIS
HC A04/MF A01 CSCL 09/2

SOLVER is a root solver that provides automatic compilation, loading, and execution. It uses a simple version of Muller's method. SOLVER is intended for the occasional user who needs roots but balks at learning to use sophisticated but complicated solvers, which usually also require considerable additional programming. The user need only supply the function to be set to zero and the number of solutions desired. SOLVER is available on the CRAY-1 computer. GRA

N80-17772# Maryland Univ., College Park. Computer Science Center.
REGION REPRESENTATION BOUNDARY CODES FROM QUADTREES
Charles R. Dyer, Azriel Rosenfeld, and Hanan Samet. Feb. 1979. 29 p. refs.
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A076352; OSC-TR-732) Avail: NTIS HC A03/MF A01 CSCL 09/4

There has been recent interest in the use of quadtrees to represent regions in an image. It thus becomes desirable to develop efficient methods of conversion between quadtrees and other types of region representations. This paper presents an algorithm for converting from quadtrees to a simple class of boundary codes. GRA

N80-17773# Wisconsin Univ., Madison. Mathematics Research Center.
GLOBAL STABILITY OF STATIONARY SOLUTIONS OF REACTION-DIFFUSION SYSTEM
R. A. Gardner. Sep. 1979. 16 p. refs.
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A077138; MRC-TSR-1993) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A condition is given which implies that the trivial solution, U is identically equal to 0, of a class of reaction-diffusion systems with homogenous Dirichlet boundary conditions, is a global attractor for all non-negative solutions. In certain cases, this condition, which relates the diffusion matrix and the domain to a parameter which depends on the nonlinear term, significantly improves similar conditions which can be obtained from energy estimates. Applications are given to equations arising in mathematical ecology. GRA

N80-17774# Stanford Univ., Calif. Dept. of Computer Science.
PERFORMANCE OF UPDATE ALGORITHMS FOR REPLICATED DATA IN A DISTRIBUTED DATABASE Ph.D. Thesis
Hector Garcia-Molina. Jun. 1979. 164 p. refs.
(Contract MDA903-77-C-0322)
(AD-A075268; SU-STAN-CS-79-744; SU-STAN-CSL-TR-172)
Avail: NTIS HC A08/MF A01 CSCL 12/1

In this thesis we study the performance of update algorithms for replicated data in a distributed database. In doing so, we also investigate several other related issues. We start by presenting a simple model of a distributed database which is suitable for studying updates and concurrency control. We also develop a performance model and a set of parameters which represent the most important performance features of a distributed database. The distributed database models are used to study the performance of update algorithms for replicated data. This is done in two steps. First the algorithms are analyzed in the case of completely replicated databases in a no failure, update only environment. Then, the restrictions that we made are eliminated one at a time, and the impact on the system performance of doing this is evaluated. For the first step, we develop a new technique for analyzing the performance of update algorithms. This iterative technique is based on queueing theory. Several well known update algorithms are analyzed using this technique. The performance results are verified through detailed simulations of the algorithms. The results show that centralized control algorithms nearly always perform better than the more popular distributed control algorithm. GRA

N80-17775# Lockheed Missiles and Space Co., Palo Alto, Calif. Palo Alto Research Lab.
PARTITIONED TRANSIENT ANALYSIS PROCEDURES FOR COUPLED-FIELD PROBLEMS: ACCURACY ANALYSIS
K. C. Park and C. A. Felippa. Jul. 1979. 34 p. refs.
(Contract N00014-74-C-0355)
(AD-A075685; LMSC-D678072) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Partitioned solution procedures for direct time integration of second-order coupled-field systems are studied from the standpoint of accuracy. Such procedures are derived by three formulation steps: implicit integration of coupled governing equations, algebraic partitioning, and extrapolation to advance the solution. It is shown that the combined effect of partition, extrapolation and computational paths, dictates the choice of stable extrapolators and the preservation of rigid-body motions. Stable extrapolators for various computational paths are derived and implementation-extrapolator combinations which preserve rigid-body motions are identified. A spectral analysis shows that the partition itself, when stable, affects primarily frequency distortion. Finally, the advantages and shortcomings of five partitioned procedures are discussed as a guide to practical applications. GRA

N80-17776# Wisconsin Univ. - Madison. Mathematics Research Center.
NONLINEAR SCHROEDINGER EVOLUTION EQUATIONS
H. Brezis and T. Gallouet. Sep. 1979. 12 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077137; MRC-TSR-1992) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The nonlinear Schroedinger equation occurs in the study of some problems in nonlinear optics (propagation of laser beams through the atmosphere or in a plasma). The main novelty of the present result is that it applies to the propagation of beams in channels (instead of the whole space). The proof relies on a new Sobolev-Orlicz embedding inequality which could be useful in other situations. GRA

N80-17777# Wisconsin Univ. - Madison. Mathematics Research Center.
NUMERICAL STABILITY IN AN INVERSE SCATTERING PROBLEM
W. W. Symes. Aug. 1979. 49 p.
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A077135; MRC-TSR-1990) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The main result of this paper is a stability theorem for a certain class of difference algorithms designed to give approximate solutions of a model inverse scattering problem in one dimension. This stability result guarantees the convergence of the approximate solutions to the exact solution of the problem as the grid of the difference scheme is refined. The results of numerical experiments are presented based on one of these schemes, in which second-order convergence is observed. Furthermore, the cost (that is, the dependence on N of the number of arithmetic operations required to compute the solution at N grid points) of the algorithms discussed below is essentially optimal. GRA

N80-17778# Wisconsin Univ. - Madison. Mathematics Research Center.
LOCAL FIXED POINT INDEX THEORY FOR NONSIMPLY CONNECTED MANIFOLDS
Edward Fadell and Sufian Husseini. Aug. 1979. 43 p. refs.
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-01451)
(AD-A077133; MRC-TSR-1988) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Given a compactly fixed map f:U yields M, where U is an open subset of a manifold M, it is a classical result that one can assign an integer-valued index I(f,U) to this situation with the property that I(f,U) is not equal to 0 implies f (and any compactly fixed perturbation of f) has fixed points in U, i.e., solutions to the equations f(x) = x. However, it can still happen

that I(f,U) = 0 and f has essential fixed points in U. The objective of this paper is to provide a finer invariant o(f,U), called the local obstruction index, which has the property that o(f,U) is not = to 0 if, and only if, every compactly fixed perturbation of f has fixed points in U. The main objective is to assign to this data a new index, o(f,U), which is not necessarily an integer, which removes this fundamental defect so that now the equation has essential solutions in U. A general formula for computing the value of o(f,U) is also given. GRA

N80-17779# Wisconsin Univ. - Madison. Mathematics Research Center.

A PHASE PLANE DISCUSSION OF CONVERGENCE TO TRAVELING FRONTS FOR NONLINEAR DIFFUSION

P. C. Fife and J. B. McLeod. Jul. 1979. 49 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077131; MRC-TSR-1986) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The asymptotic behavior as it approaches infinity was studied of solutions u(x,t) of the equation u sub t-u sub xx -f(u) = 0, x an element from minus infinity to infinity, in the case f(0) = f(1) = 0, with f(u) nonpositive for u(< 0) sufficiently close to 1. This guarentees the uniqueness (but not the existence) of a traveling front solution u = U(x-ct), U(minus infinity) = 0, U(infinity) = 1, and it is shown in essence that solutions with monotonic initial data converge to a translate of this traveling front if it exists, and to a stacked combination of traveling fronts if it does not. The approach is to use the monotonicity to take u and t as independent variables and p = u sub x as the dependent variable, and apply ideas of sub and supersolutions to the diffusion equation for p. R.C.T.

N80-17780# Wisconsin Univ. - Madison. Mathematics Research Center.

A SIMPLE RELIABLE NUMERICAL ALGORITHM FOR FOLLOWING HOMOTOPY PATHS

Tien-Yien Li and James A. Yorke. Jul. 1979. 22 p. refs.
(Contract DAAG29-75-C-0024; Grants NSF MCS-76-24432; NSF MCS-78-02420; NSF MCS-78-09525)
(AD-A077129; MRC-TSR-1984) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The purpose of this paper is to develop simple algorithms and flow charts for the homotopy continuation methods so that scientists may easily program reliable curve followers. The emphasis is on simplicity and reliability at the expense of the speed. GRA

N80-17781# Wisconsin Univ. - Madison. Mathematics Research Center.

ON A PATH FOLLOWING METHOD FOR SYSTEMS OF EQUATIONS

C. B. Garcia and T. Y. Li. Jul. 1979. 17 p. refs.
(Contract DAAG29-75-C-0024; Grant DAAG29-78-G-0160)
(AD-A077128; MRC-TSR-1983) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The problem of finding one or all solutions to systems of equations, equilibrium, fixed points, or to dynamical systems is considered. In the last few years, a new method has emerged for solving this problem. The idea is to start at a given solution of a simpler problem and to follow a path of solutions as the path parameter (and hence, the problem) is gradually changed. This path is proved to exist via topological approaches and is shown to lead to the 'right' place. In this paper, a general predictor-corrector method is described for following the curve. It is a globalization of the classical Davidenko approach. It is shown that the method can follow the path to any desired degree of accuracy and is convergent. GRA

N80-17782# Wisconsin Univ. - Madison. Mathematics Research Center.

EFFICIENT MULTISTEP PROCEDURES FOR NONLINEAR PARABOLIC PROBLEMS WITH NONLINEAR NEUMANN BOUNDARY CONDITIONS

R. E. Ewing. Jul. 1979. 24 p. refs.
(Contract DAAG29-75-C-0024; Grant DAAG29-78-G-0161; Grant NSF MCS-78-09525)
(AD-A077127; MRC-TSR-1982) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Efficient multistep procedures for time stepping Galerkin methods for nonlinear parabolic partial differential equations with nonlinear Neumann boundary conditions are presented and analyzed. The procedures involve using a preconditioned iterative method for approximately solving the different linear equations arising at each time step in a discrete time Galerkin method. Optimal order convergence rates are obtained for the iterative methods. Work estimates of almost optimal order are obtained. R.C.T.

N80-17783# Wisconsin Univ. - Madison. Mathematics Research Center.

ON ABSTRACT VOLTERRA EQUATIONS WITH KERNELS HAVING A POSITIVE RESOLVENT

P. H. Clement. Jul. 1979. 13 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077124; MRC-TSR-1979) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The nonlinear abstract Volterra equation of convolution type is considered. Boundedness and asymptotic properties of the solutions are established under the assumption that the kernel satisfies certain natural positivity conditions. An important property of linear and nonlinear diffusion equations is that the solutions of such equations obey a 'maximum principle'. In particular, if the initial data and the forcing terms are nonnegative, then the solution is nonnegative. The Volterra equation (V) is an abstraction of a mathematical model for nonlinear heat flow in a material with 'memory'. The kernel b in (V) can be expressed in terms of the physically meaningful heat flux and internal energy relaxation functions. In this paper equation (V) for a class of kernels b is considered which insure the positivity of the solution operator. GRA

N80-17784# Wisconsin Univ. - Madison. Mathematics Research Center.

BOUNDS FOR EIGENVALUES OF HERMITIAN TRENCH MATRICES. Technical Summary Report, 1977 - Jul. 1979

T. N. E. Greville. Jul. 1979. 21 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077122; MRC-TSR-1977) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A necessary condition for a strictly banded matrix to have to have a Toeplitz inverse is that it have a certain special structure fully characterized by two polynomials, A(x) of degree r and B(x) of degree s. This special structure is a Toeplitz matrix. A Trench matrix is nonsingular if and only if A(x) and B(x) have no common zero, and a strictly banded matrix has a Toeplitz inverse if and only if it is a nonsingular Trench matrix. Bounds are established for eigenvalues of Hermitian Trench matrices that depend on only the polynomials A(x) and B(x) and not on the order of the matrix. GRA

N80-17785# Wisconsin Univ. - Madison. Mathematics Research Center.

ON THE EXISTENCE OF HERMITE-BIRKHOFF QUADRATURE FORMULAS OF GAUSSIAN TYPE. Technical Summary Report, 1978 - Jul. 1979

Nira Dyn. Jul. 1979. 16 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077123; MRC-TSR-1978) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Existence of Gaussian quadrature type formulas related to Hermite-Birkhoff interpolation is proved for a class of incidence matrices satisfying the conditions of the Atkinson-Sharma Theorem. For the subclass of Hermite matrices this analysis furnishes yet another proof of the existence of Gaussian quadrature formulas with multiple nodes. GRA

N80-17786# Wisconsin Univ. - Madison. Mathematics Research Center.

A PRIORI ESTIMATES AND EXISTENCE RESULTS FOR SOME SEMILINEAR ELLIPTIC PROBLEMS

P. L. Lions. Jul. 1979. 10 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077106; MRC-TSR-1975) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Problems arising in, for example, physics, biology and chemical reactors lead to boundary value problems for semilinear elliptic

equations. The question of identifying for which nonlinearities these semilinear problems have solutions is by no means settled. Roughly speaking, nonlinearities which grow too rapidly yield unsolvable problems while under other conditions on the growth, existence can be proved. Some conditions are improved which were previously known to guarantee the existence of positive solutions of such problems. GRA

N80-17787# Wisconsin Univ., Madison. Mathematics Research Center.
THE GROWTH OF POWERS OF A NON-NEGATIVE MATRIX
Shmuel Friedland and Hans Schneider. Jun. 1979. 28 p. refs.
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-01087)
(AD-A077094; MRC-TSR-1963) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let A be a non-negative nxn matrix. In this paper the growth of the powers, A to the M power, m = 1,2,3,... is studied. These powers occur naturally in an iteration process which is important in applications and numerical techniques. Roughly speaking, the asymptotic behavior of each entry of A to the m power is analyzed. The main result is applied to determine necessary and sufficient conditions for the convergence to the spectral radius of A of certain ratios naturally associated with the iteration presented. GRA

N80-17788# Centre Technique des Industries Mecaniques, Senlis (France).
ALGORITHMS FOR DECOUPLING VIBRATORY MODES Final Report [ALGORITHMES DE DECOUPLAGE MODES VIBRATOIRES]
Garcin. Feb. 1979. 81 p. In FRENCH. Prepared in cooperation with Besancon Univ., France.
(CETIM-1-1E-24-0) Avail: NTIS HC A05/MF A01

An algorithmic study of the decoupling of vibratory modes on a SAVIEM test rig is presented. Inconclusive results from the study are examined including a lack of accuracy in frequency measurement at the experimental stage, an insufficient number of measurement points, a highly nonlinear response to amplitude variations at the test rig, and the lack of an acceptable data smoothing procedure. Author (ESA)

N80-17789# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
MEASURABLE SET-VALUED FUNCTIONS
Kjell Holmaaker. 1979. 51 p. refs.
(CTH-Math-1979) Avail: NTIS HC A04/MF A01

The theory of measurable set-valued functions is introduced. The considered functions are defined on a measureable subset of R and have values that are nonempty subsets of R sup N. Several possible definitions of measurability and their relationships are examined. After a section on integrals of set-valued functions, some applications to control theory are shown. Author (ESA)

N80-17790# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
METHODS AND TRADITIONS OF BABYLONIAN MATHEMATICS. PART 2: AN OLD-BABYLONIAN CATALOGUE TEXT WITH EQUATIONS FOR THE SQUARE AND THE CIRCLE
Joeran Friberg. 1979. 17 p. refs.
(CTH-Math-1979-14) Avail: NTIS HC A02/MF A01

The text of the Old Babylonian clay tablet BM 80 209 is analyzed. It is shown to be a catalog of linear and quadratic equations, expressed in geometric quantities such as area, diameter, circumference, etc., of circles or squares. Similarities between the present text and two catalog texts from Susa as well as a mathematical compendium from Tell Harmal and Heron's Geometry written two thousand years later are briefly noted. Author (ESA)

N80-17791# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
INTEGRAL FORMULAS FOR THE (ALPHA ALPHA-BAR) EQUATION AND ZEROS OF BOUNDED HOLOMORPHIC FUNCTIONS IN THE UNIT BALL
Bo Berndtsson. 1979. 23 p. refs.
(Contract SWED-NSRC-F-2989-005)
(CTH-Math-1979-16) Avail: NTIS HC A02/MF A01

Solutions of the alpha alpha-bar equation are constructed using integral formulas. The result is applied to give a sufficient condition for a zero set in the unit ball in domain sup 2 or domain sup 3 to be defined by a bounded holomorphic function. For domain sup 2 this condition says that the zero set has finite area. Author (ESA)

N80-17792# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
PATH DECOMPOSITION AT BACKWARD TIMES IN REGENERATIVE SETS
Olav Kallenberg. 1979. 32 p. refs.
(CTH-Math-1979-17) Avail: NTIS HC A03/MF A01

A backward time is a random time which only depends on the future, in the same sense as a stopping time only depends on the past. It is shown that a backward time taking values in a regenerative set M splits M into conditionally independent subsets and that the conditional distributions on the left are given by the Palm distributions with respect to the local time random measure xi of M. The strongest results hold at points where (P sub t) has a continuous version which occurs essentially where the renewal measure E (xi) has a continuous density p. The continuity set of p is described rather precisely in terms of the growth rate and regularity properties of the Levy measure of M. Author (ESA)

N80-17793# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON SUBGRADIENTS OF A CONVEX FUNCTION IN ABSTRACT WIENER SPACE
Christer Borell. 1979. 9 p. refs.
(CTH-Math-1979-20) Avail: NTIS HC A02/MF A01

An abstract Wiener space (S, beta) is defined such that S is a real, locally convex Hausdorff vector space and beta a fixed centered Gaussian Radon measure on S. The main result shows that any convex function f's tends to R cup braces + infinity braces being bounded above on a set of positive beta measure, has a beta measurable subgradient at each point in the set n sub beta braces f = + infinity braces. Author (ESA)

N80-17794# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ON NUMBERS MISSED BY THE DIVISOR FUNCTION d SUB 3(N)
P. Shiu. Apr. 1978. 9 p. refs.
(Maths-Res-126) Avail: NTIS HC A02/MF A01

The missing value problem is generalized to d sub 3 (n), the number of ways of writing as a product of three factors. It is shown that the range of d sub 3 (n) is the set R sub 3 of numbers which are products of triangular numbers. The least integer in the set M sub 3 (x) is identified. K.L.

N80-17795# Loughborough Univ. of Technology (England). Dept. of Mathematics.
THE DECOMPOSITION PRINCIPLE AND THE SPECTRUM OF THE DIRAC EQUATIONS
B. J. Harris. Apr. 1978. 19 p. refs.
(Maths-Res-127) Avail: NTIS HC A02/MF A01

A decomposition principle for the Dirac equations which gives criteria under which the spectrum of Dirac equations is independent of the behavior of the potential in compact regions is presented. The main result is a decomposition theorem which states, that provided P satisfies certain conditions which restrict its singularities, the essential spectrum of T + P, the self adjoint operator, is independent of the behavior of P on compact regions of Hilbert space. Author (ESA)

N80-17796# Loughborough Univ. of Technology (England). Dept. of Mathematics.
OPTIMIZATION USING RATIONAL FUNCTIONS
C. Storey. Nov. 1978. 9 p. refs. Presented at 3rd Symp. Ueber Operations Res., Mannheim, West Ger., 6-8 Sep. 1978.
(Maths-Res-131) Avail: NTIS HC A02/MF A01

The use of rational functions as approximations to a general function of a single variable in the context of univariate minimization is discussed. An algorithm for the application of the technique was devised and used on a number of test functions.

Some comparison of this rational function algorithm with other methods is given. In approximation theory it is well known that rational functions have certain advantages over polynomials and it was hoped that they would offset the extra computation required in fitting the rationals. Numerical evidence accrued shows that the use of rational function approximations is valid in optimization. Results for univariate minimization and as a line search technique are good. The use of rational function approximations for optimization of many variable problems, however, still presents a number of problems. Author (ESA)

N80-17797# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ON SQUARE-FULL INTEGERS
P. Shiu. Nov. 1978. 15 p. refs.
(Maths-Res-134). Avail: NTIS. HC A02/MF A01

A positive integer q is called square-full if p squared divides q whenever p is a prime divisor of q. The nth square-full integer is denoted by q sub N. Each q sub N is written uniquely as (a squared)(b cubed) where b is a square-free integer. Let X > or = 1 and denote by Q(X) the number of integers q sub N < or = X. It is proved that as X tends to infinity, Q(X) = Ax to the 1/2 power + Bx to the 1/3 power + O(X to the 1/6 power), where A = zeta(c/2)/zeta(3) and B = zeta(2/3)/zeta(2). Two gap problems associated with the square-full integers are then considered. Finally, two inequalities are studied and shown to hold relative to the gaps between square-free integers. Author (ESA)

N80-17798# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ON DIRAC FIELDS IN A CURVED SPACE-TIME
J. B. Griffiths. Dec. 1978. 18 p. refs.
(Maths-Res-135). Avail: NTIS. HC A02/MF A01

It is shown that spin 1/2 particles with non-zero rest mass have certain anomalous properties in a curved space-time. For example, the sign of their energy density may be observer dependent. In addition, the complete energy-momentum tensor may vanish in some space-times. The anomalies associated with neutrino fields in general relativity are also shown to occur with Dirac fields. Such fields may be energy nondefinite and ghost solutions may occur. Thus, spin 1/2 particles tend not to satisfy the energy condition that is required for the singularity theorems in general relativity. For weak gravitational fields the anomalies considered may never occur. However, in a situation of gravitational collapse, Dirac particles do not satify the usual energy conditions. Author (ESA)

N80-17799# Loughborough Univ. of Technology (England). Dept. of Mathematical Sciences.
FURTHER REMARKS ON THE CONTROLLABILITY OF LINEAR CONSTANT DELAY-DIFFERENTIAL SYSTEMS
M. G. Frost (Trent Polytech., Nottingham, Engl.) and C. Storey. Feb. 1979. 15 p. refs.
(Maths-Res-136). Avail: NTIS. HC A02/MF A01

Function space null controllability is considered for certain delay differential systems. The implications of the input decoupling factors and input decoupling zeros of the corresponding system matrices are examined. Results demonstrate that a transformation of system similarity over the defined function space between the discussed system matrices will preserve the function space null controllability. It does not follow that system matrices which correspond to function space null controllable systems (and have no output decoupling factor) are system similar over the defined function space if they correspond to the same transfer function matrix. Author (ESA)

N80-17800# Loughborough Univ. of Technology (England). Dept. of Mathematical Sciences.
TRANSFORMATIONS OF STRICT SYSTEM EQUIVALENCE BETWEEN POLYNOMIAL SYSTEM MATRICES OVER STATE-SPACE (s, z)
M. G. Frost (Trent Polytech., Nottingham, Engl.) and C. Storey. Feb. 1979. 17 p. refs.
(Maths-Res-137). Avail: NTIS. HC A02/MF A01

Conditions are established under which polynomial system matrices over state space s, z are strictly system equivalent over state space s, z. The conditions under which polynomial system matrices are strictly system equivalent over state space s, z rather than state-space (z)s are discussed. Conditions under which the zeros of the two matrices are presented by a transformation of strict system equivalence of the state-space system matrices exists if and only if they correspond to the same transfer function matrix. Author (ESA)

N80-17801# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
TEMPLATE OVERLAPS IN TREE MANIPULATION SYSTEMS
Hans H. Kron. Jun. 1978. 32 p. refs. Presented at the Workshop WG 78 Graphentheoretische Konzepte in der Informatik, Feuerstein, West Ger., 15-17 Jun. 1978.
(PU1R1/78). Avail: NTIS. HC A03/MF A01

The use of tree templates as the basis for a variety of parametric pattern manipulating systems is analyzed. Parameters are matched against a tree to select a node of application, relevant subtrees, and a manipulation rule. The possibility of ambiguity arising since a given set of templates might match the tree at a given node is discussed and a rule determining the most specific of the templates is given. The concepts of linear templates tree of multiple occurrences of parameters and of template meeting are developed. The representation of linear template overlaps as meet semilattices is examined. Author (ESA)

N80-17257 Wright State Univ., Dayton, Ohio.
LAGUERRE FUNCTION REPRESENTATIONS OF TRANSIENTS
G. R. Spalding. *In* The Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 1. Sep. 1978. p. 137-141. refs.
(For primary document see N80-17247 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing, Monte Carlo method; and stochastic processes.

N80-17802 California Univ., Berkeley.
EXPLORATORY LONGITUDINAL FACTOR ANALYSIS Ph.D. Thesis
Stephen Lance Beber. 1979. 158 p.
Avail: Univ. Microfilms. Order No. 8000288

Several longitudinal factor models are reviewed in a unified notational system. This is followed by the presentation of the stationarity model (stationarity indicating the manifestation of cross occasion stability in the variables resulting in a constant or stationary factor pattern over time). Confirmatory and explorational concepts are compared as a means for applied research. An explorational technique is developed that estimates the parameters of the stationarity model. In a two part procedure, a stepwise algorithm is depicted that provides prerequisite values for a means of direct estimation. Four data sets, representing a variety of psychological measures collected over periods of up to 40 years, are used to test the technique. The explorational estimation procedure is found to be successful in classifying the factors from an initial image analysis, and is shown to be internally consistent. Dissert. Abstr.

N80-17803# Naval Postgraduate School, Monterey, Calif.
THE USE OF THE EMPIRICAL PROBABILITY GENERATING FUNCTION TO ESTIMATE THE NEYMAN TYPE A DISTRIBUTION PARAMETERS M.S. Thesis
Harold R. Bishop. Sep. 1979. 86 p. refs.
(AD-A076577). Avail: NTIS. HC A05/MF A01. CSCL 12/1

The Maximum Likelihood estimators for the Neyman Type A distribution parameters are very difficult to compute. In this thesis, the Empirical Probability Generating Function is used to provide estimators that are easier to compute and have asymptotic efficiency at least as high as 97% of that for the Maximum Likelihood estimators over most of the parameter space considered. The estimators found by this method are consistently better than the Method of Moments and the Method of Zero Frequency estimators with respect to asymptotic efficiency.

The considerations of preference in using one method over another are discussed. GRA

N80-17804# Iowa Univ., Iowa City. Div. of Educational Psychology.
LOCAL AND REGIONAL COHERENCE UTILITY ASSESSMENT PROCEDURES
Melvin R. Novick, David T. Chuang, and Dennis F. Dekeyrel. Jul. 1979. 34 p. refs.
(Contract N00014-77-C-0428)
(AD-A076531; TR-79-7) Avail: NTIS HC A03/MF A01 CSCL 12/1

Novick and Lindley (1978, 1979) have dealt with the use of utility functions for applications in education and have advocated the use of the standard gamble (von Neumann and Morgenstern, 1953) elicitation procedure with the addition of coherence checking using overspecification and a least squares fit. In this procedure utilities are inferred from probability judgements offered by the assessor. This paper describes local and regional coherence procedures which seek utility coherence in successive restricted domains of the parameter space as preludes to overall coherence checking. These procedures and some others are viewed as possible ways of avoiding anchoring and certainty effect biases found in earlier fixed probability methods, and presumably present in current fixed state procedures. GRA

N80-17805# California Univ., Berkeley. Operations Research Center.
OPTIMAL LIST ORDER UNDER PARTIAL MEMORY CONSTRAINTS
Y. C. Kan and Shelton M. Ross. Mar. 1979. 27 p. refs.
(Contract N00014-77-C-0299; Grant AF-AFOSR-3213-77)
(AD-A077139; ORC-79-4) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem of interest is to determine the optimal ordering so as to minimize the long run average cost. Clearly if the P sub i were known, the optimal ordering would simply be to order the elements in decreasing order of the P sub i's. In fact even if the P sub i's were unknown we could do as well asymptotically by ordering the elements at each unit of time in decreasing order of the number of previous requests for them. In this paper we first consider the case in which the only memory allowed at any time is the ordering of the elements at that time; in other words, the only type of reordering rules we allow are ones in which the reordered permutation of elements at any time is only allowed to depend on the present ordering and the position of the element requested. We also consider the above problem under the premise that additional memory is allowed. In particular we allow the decision-maker to utilize such rules as 'only make a change (according to some preassigned rule) if the same element has been requested k times in a row.' We show that as k approaches infinity we can do as well as if we knew the values of the P sub i, and in addition we show that the convergence is monotone. GRA

N80-17806# Iowa Univ., Iowa City. Div. of Educational Psychology.
AN IMPROVED MODEL AND COMPUTER PROGRAM FOR BAYESIAN M-GROUP REGRESSION. Research Report, Oct. 1978 - Mar. 1979
Ivo W. Molenaar and Charles Lewis. Mar. 1979. 62 p. refs.
(Contract N00014-77-C-0428; RR0420401)
(AD-A075393; TR-79-5) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper presents a modified model and computer algorithm for the estimation of regressions in m-groups. The major features of the new approach are: (1) The use of parameters with constant values for slopes across groups whenever the prior or the data indicate that this is desirable, (2) the use of a residual variance constant across groups, (3) independent priors for regression parameters, (4) scales of the predictors at the grand mean rather than at the so-called 'ideal scaling points', (5) transformation of all variables including the criterion to mean zero and variance one at the start of the calculations, (6) an improved search procedure for finding the mode of the posterior distribution. This new solution provides a greatly speeded-up algorithm which defines the posterior mode precisely. GRA

N80-17807# Wisconsin Univ. - Madison. Mathematics Research Center.
SAMPLING AND BAYES INFERENCE IN THE ADVANCEMENT OF LEARNING
George E. P. Box. Jun. 1979. 33 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077100; MRC-TSR-1969) Avail: NTIS HC A03/MF A01 CSCL 12/1

Sampling theory inference (e.g., inference based on sampling distributions of statistics and in particular on significance tests) and Bayesian inference are usually thought of as rivals and much effort has been spent in propounding their relative merits. In this paper it is argued that both kinds of inference are needed in the scientific iteration whereby knowledge is acquired. This iteration employs a directed alternation between induction and deduction which uses model criticism on the one hand and parameter estimation on the other. An analysis of Bayes' formula reveals model criticism as a sampling theory concept and parameter estimation as a Bayesian concept. The implications of these ideas for robust estimation are discussed. GRA

N80-17808# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON THE STRUCTURE OF STATIONARY FLAT PROCESSES 2
Olav Kallenberg. 1979. 32 p. refs.
(CTH-Math-1979-18) Avail: NTIS HC A03/MF A01

An attempt is made to prove, under weakest possible assumptions, that a stationary random measure eta or a simple point process Xi on the space of k-flats in R sup d is a.s. invariant or a Cox process, respectively. The problems for Xi and eta are related by the fact that Xi is Cox whenever the Papangelou conditional intensity measure zeta of a thinning of Xi is a.s. invariant. In particular, eta is shown to be a.s. invariant whenever it is absolutely continuous with respect to some fixed measure eta and has no outer degenerates. When k = d - z > or = z no absolute continuity is needed, provided that the first moments exist and that eta has no inner degeneracies either. It is further shown that, under a certain regularity condition on Xi, Xi, and zeta simultaneously nondegenerate in either sense. Author (ESA)

N80-17809# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A SIMPLE CUSUM TYPE STATISTIC FOR THE CHANGE-POINT PROBLEM WITH ZERO-ONE OBSERVATIONS
A. N. Pettitt. Jul. 1978. 18 p. refs.
(Maths-Res-128) Avail: NTIS HC A02/MF A01

A simple cumulative sum (CUSUM) type statistic for the change point with zero-one observations is introduced. A conditional test of no change against change is derived and compared with a likelihood ratio test. The simple test statistic performs well in a small sample simulation. Also, the estimation of the change point is considered using the simple statistic and shown to be asymptotically equivalent to the maximum likelihood estimator in certain circumstances and almost equivalent in others. Simulation experiments investigating the small sample behavior, show the simple CUSUM type estimator to be generally superior to the maximum likelihood estimator. Author (ESA)

N80-17810# Loughborough Univ. of Technology (England). Dept. of Mathematics.
SOME RESULTS ON ESTIMATING A CHANGE-POINT USING NON-PARAMETRIC STATISTICS
A. N. Pettitt. Nov. 1979. 26 p. refs.
(Maths-Res-132) Avail: NTIS HC A03/MF A01

A general class of statistics, derived from a Mann-Whitney-Wilcoxon two sample statistic, for estimating the change point in a sequence of random variables is considered. These statistics should perform well when the underlying populations are not normal but are long-tailed. Some asymptotic results are discussed and comparisons of a simple non-change point are made. Some Monte Carlo results are also reported to give some indication of small sample behavior. The nonparametric statistic performs well under the assumption of long-tailed distributions. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-17811# Army Inventory Research Office, Philadelphia, Pa.
SYSTEM AVAILABILITY WITH REDUNDANCY AND SPARES
Alan J. Kaplan Jul. 1979 37 p refs
(AD-A073743; IRO-TR-79-4) Avail: NTIS HC A03/MF A01 CSCL 15/5

This report discusses evaluation of expected steady state system availability when there is parallel redundancy and a pool of spares. The pool may support more than one system. Exact results are obtained for both warm standby and cold standby cases, assuming component installation time is 0. Approximations are suggested for treating non-zero installation time. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-17812# Stanford Univ., Calif. Dept. of Psychology.
PREFERENCE TREES Technical Report, 1 Dec. 1978 - 1 Oct. 1979
Amos Tversky and Shmuel Sattath 1 Oct. 1979 91 p refs (Contract N00014-79-C-0077)
(AD-A076024; TR-1) Avail: NTIS HC A05/MF A01 CSCL 12/1

This paper develops a probabilistic choice model, called Preference Tree or Pretree, which describes choice as a covert hierarchical elimination process. Each alternative is represented as a measurable collection of aspects and the entire ensemble of aspects is assumed to have a tree structure. At each stage one selects an aspect (i.e., a branch of the tree) with probability that is proportional to its measure and eliminates all the alternatives that do not belong to the selected branch. The process continues until only a single alternative remains. Pretree is considerably more parsimonious than the more general model of Elimination-by-Aspects (EBA) because it has at most 2n rather than 2 to the nth power parameters, where n is the number of choice alternatives. At the same time, Pretree is much less restrictive than models (e.g., Luce, 1959) which assume that the strength of preference of x over y is independent of other alternatives. It is shown that the proposed model, which is based on random selection of aspects, is also compatible with a different decision strategy in which the aspects are considered in a fixed sequential order. Finally, Pretree is applied to the analysis of choice that is constrained by a partition imposed on the offered set (e.g., an agenda). It is shown that choice probabilities are unaffected by constraints if and only if the constraints are compatible with the structure of the tree. The effect of an agenda on individual choice is investigated experimentally, and its implications to committee decision making and consumer behavior are discussed. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*

N80-17813 Stanford Univ., Calif.
INSTANTANEOUS KINEMATIC PROPERTIES OF POINT AND LINE TRAJECTORIES Ph.D. Thesis
Jon Michael McCarthy 1979 139 p
Avail: Univ. Microfilms Order No. 8001968

The instantaneous kinematics of moving rigid bodies is discussed. The differential geometry of curves and surfaces is used to derive functions describing the shape of point and line trajectories in the vicinity of a reference position. These functions are then used to tie the geometric characteristics of point and line trajectories directly to the representation of a motion in terms of the set of numbers known as the instantaneous invariants of the motion. A description of the shape of point trajectories, to the third order, is obtained for planar and spherical motion. For spatial motion, in addition to the study of point trajectories, the third order properties of trajectories generated by lines in the moving body are examined. Dissert. Abstr.

N80-17814# North Carolina Univ. at Chapel Hill. Dept. of Chemistry.
MAGNETISM OF MIXED VALENCE COMPOUNDS
William E. Hatfield 1 Oct. 1979 53 p refs
(Contract N00014-76-C-0816; NR Proj 053-617)
(AD-A075804; TR-8) Avail: NTIS HC A04/MF A01 CSCL 20/3

Results of representative studies of magnetic properties of mixed valence compounds are described in terms of Heisenberg-Van Vleck-Direc exchange theory, which is developed. Systems of discrete clusters, chains, sheets, and three dimensinal polymeric materials are discussed. Several important problems requiring additional research are identified. GRA

N80-17815# Montpellier Univ. (France). Dept. of Physique Mathematique.
ON EXTREMAL SOLUTIONS OF STURM-LIOUVILLE INVERSE PROBLEMS
Pierre C. Sabatier Jan. 1979 10 p refs
(PM/79/6) Avail: NTIS HC A02/MF A01

The problem of reconstructing the density p(x) of a vibrating string given the N first eigenfrequencies of two vibrating configurations admits solutions that minimize certain weighted averages of the density. The expansions of functions on the squares of eigenfunctions gives a simple set of necessary conditions on these weights. In particular, it is shown that the only weight functions f(x) that are consistent in all cases with the existence of an extremal density, made up of a finite number of point masses, are polynomials of degree two. Author (ESA)

N80-17816# Research Inst. of National Defence, Linkoeping (Sweden).
STABILITY AND DISPERSION MEASUREMENTS OF PROJECTILES WITH DIFFERING WHEELBASES [STABILTETSMAATNING OCH SPRIDNINGSSKJUTNING AV PROJEKTILER MED OLIKER LAANG CYLINDRISK DGL]
Sven Nordstroem and Nils-Bertil Nilsson Mar. 1979 107 p refs In SWEDISH; ENGLISH summary
(FOA-C-20298-D2) Avail: NTIS HC A06/MF A01

Artillery projectiles of five different wheelbases were tested on a firing range for stability and dispersion at four velocities at long and short ranges. Drag measurements were made which shows that changing the wheelbase does not measureably alter the drag coefficient. The static stability factor S sub 0 depends strongly upon the wheelbase with measured values from 3.1 for the short projectile to 1.2 for the longest. In most cases the data were within the limits of static dynamic stability. During long range firings no statistically different dispersions were found. There was a weak correlation between S sub 0 and range dispersion. Author (ESA)

N80-17817# Montpellier Univ. (France). Dept. de Physique Mathematique.
AROUND THE CLASSICAL STRING PROBLEM
Pierre C. Sabatier Jun. 1979 18 p refs Presented at Intern. Meeting on Nonlinear Evolution Equations and Dynamical Systems, Lecce, Italy, 20-23 Jun. 1979
(PM/79/14) Avail: NTIS HC A02/MF A01

The problem of reconstructing the density rho(x) of a vibrating string given the N first eigenfrequencies of two vibrating configurations admits solutions that minimize certain weighted averages of the density. There exists a simple set of necessary conditions of these weights. In particular, it is shown that the only weight functions f(x) that can be consistent in all cases with the existence of an extremal density which is made up of a finite number of point masses are polynomials of degree two. It is shown that the weighted averages can be calculated exactly. Explicit formulas are given which in certain cases depend only on the spectrum of one vibrating configuration. The results strongly suggest applications to the Earth inverse problem. They are also extended to other problems which suggest applications

to nonlinear questions. In particular, a nonlinear evolution equation is studied and conservation laws are discussed. Author (ESA)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-17818 Stanford Univ., Calif.
HIGH PERFORMANCE ELECTRONICS FOR ULTRASOUND IMAGING Ph.D. Thesis
Michael David Eaton 1979 151 p
Avail: Univ. Microfilms Order No. 8001908

The development of a computer controlled preprocessor based on a cascade charge coupled device (C3D) electronic lens is discussed. Motivation is presented for use of the system beam pattern (impulse response) as a quantitative performance measure. It is shown that spurious responses (sidelobes/grating lobes) are the primary limitation in diagnostic imaging. Asynchronous charge transfer within the C3D is modeled and analyzed, producing simple design formulas for applying the device to real scanners. Aperture apodization experiments which reveal substantial improvements in sidelobe/background levels are described.
Dissert. Abstr.

N80-17819 Pennsylvania Univ., Philadelphia.
THE COHERENCE OF ACOUSTIC SIGNALS IN THE OCEAN AND APPLICATION TO THE DESIGN OF VERY LARGE ARRAYS Ph.D. Thesis
William John Graham 1979 179 p
Avail: Univ. Microfilms Order No. 7928134

A solution to the coherence between underwater acoustic signals in multipath channels which have uncorrelated random fluctuations is presented. The multipath coherence function (MCF) is applied to the design of a very large array (VLA) composed of widely spaced subarrays. The solution is developed in terms of ensemble averages of the random channel transfer functions. The oceanographic fluctuations considered in the MCF are internal waves, internal tides, spatial phase variations due to multipath interference, and frequency selective multipath interference. The relative effects of these fluctuations are compared. The theory predicts VLA signal to noise gain, resolution ability, and scanning ability for specified system configuration, multipath characteristics, and parameters of environmental fluctuations. A VLA system design approach is proposed and considerations in system implementation are analyzed.
Dissert. Abstr.

N80-17820 Stanford Univ., Calif.
ACOUSTIC MICROSCOPY AT OPTICAL WAVELENGTHS Ph.D. Thesis
Victor Burr Jipson 1979 204 p
Avail: Univ. Microfilms Order No. 8001944

A scanning reflection acoustic microscope that utilizes acoustic waves with optical wavelengths is evaluated. The design of the instrument is discussed with particular attention paid to the acoustic lens element. The design and fabrication of efficient high frequency acoustic transducers and matching layers are described. An optical technique that allows the lens to be properly illuminated is discussed and the problem of acoustic diffraction and beam steering in the anisotropic lens element is considered. The RF electronics necessary for this instrument are described and signal to noise considerations evaluated. A technique is described for studying contrast changes in acoustic images as a function of lens object spacing. The use of the acoustic microscope to image interior planes within a solid is considered. In particular, the use of liquid metals as a replacement for water as the acoustic coupling media is examined. Dissert. Abstr.

N80-17821# National Research Council of Canada, Ottawa (Ontario).
EFFECTS OF WIND SPEED DISTRIBUTION ON THE PROPAGATION OF SOUND
Nobuhara Aoshima 1980 21 p refs Transl. into ENGLISH from Nihon Onkyogakkaishi Japan, v. 34, no. 5, 1978 p 308-315
(NRC/CNR-TT-1959; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

While sound attenuates when traveling against the wind, a rise is observed in the sound pressure level if the wind is behind. The fluctuation in these instances sometimes amounts to as much as several bels. An approach to calculating the sound field is described which takes into consideration the wave character of sound and accounts for the frequency characteristics of the attenuation that occurs. The method is essentially based on Fresnel's theory in optics, but introduces to this theory the concept that wind produces a phase shift in sound waves. A.R.H.

N80-17822# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
AN ANALYSIS OF TRANSVERSE MODES IN ACOUSTIC SURFACE WAVE RESONATORS
B. K. Sinha and H. F. Tiersten Sep. 1979 54 p refs
(Contract N00014-76-C-0368)
(AD-A077067; RPI-TR-29) Avail: NTIS HC A04/MF A01 CSCL 20/1

A system of approximate surface wave equations employed in an earlier treatment of the reflection of straight-crested surface waves by arrays of reflecting strips is extended to the case of variable-crested surface waves. Although the basic straight-crested surface wave velocities are determined as in the previous treatment, in the present case a reduction in straight-crested surface wave velocity in the unplated region due to the adjacent plated regions, which is essential for the existence of the guided transverse modes, is determined by means of a perturbation procedure. The attendant depth dependence for each region is employed in the variational principle as in the earlier treatment, but now the variable cresting relation for the isotropic substrate is incorporated in the description. The resulting equations are applied in the determination of both the transverse modes in each region and the transmission line representation of each mode. The transverse wave numbers in a given mode are taken to be the same in the plated and unplated regions in order that the interior edge conditions be satisfied pointwise. The system of parallel transmission lines is applied in the analysis of the reflection of variable-crested surface waves by uniformly spaced arrays. The response to a rectangular input of a particular reflecting array consisting of aluminum reflecting strips on ST-cut quartz is calculated and compared with measurements. GRA

N80-17823# Naval Underwater Systems Center, New London, Conn.
EFFECTS OF RANDOM SHADING, PHASING ERRORS, AND ELEMENT FAILURES ON THE BEAM PATTERNS OF LINE AND PLANAR ARRAYS
Azizul H. Quazi, H. Azizul, and Albert H. Nuttall 17 Sep. 1979 14 p refs
(AD-A076494; NUSC-TD-6103) Avail: NTIS HC A02/MF A01

The effects of random shading, phasing errors, and element failures on the beam patterns of line and planar arrays are investigated. The results indicate that the effects of element failures and random phasing errors on the beam pattern are more pronounced than the effect of shading errors. The deep side lobe level, in both line and planar arrays, is critically affected by random errors that include shading, phasing, and element failures. The combined effect of random shading, phase, and element failures on the beam pattern of a line array is more dramatic than it is on the beam pattern of a planar array. GRA

N80-17824# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
RESEARCH ON HELICOPTER ROTOR NOISE Final Report, 1 Jun. 1976 - 30 Sep. 1979
H. Liebowitz and F. Farassat Oct. 1979 13 p refs
(Grants DAAG29-78-G-0152; DAAG29-76-G-0259)
(AD-A075259; ARO-13517.3-EX) Avail: NTIS HC A02/MF A01 CSCL 20/1

This report summarizes the results of studies in the following areas: (1) applications of generalized functions to aeroacoustics and aerodynamic problems, (2) bounds on thickness and loading noise of rotating blades and the effects of blade sweep on reduction

of the noise of rotating blades, (3) study of nonlinear effects relevant to the rotor noise problem and (4) computational aspects of high speed rotor noise. GRA

N80-17825# Texas Univ. at Austin. Applied Research Labs.
LABORATORY AND FIELD STUDIES OF SEDIMENT ACOUSTICS Annual Report, 1 Jan. - 31 Dec. 1978
Donald J. Shirley, David W. Bell, and Jens M. Hovem Jun. 1979 137 p refs
(Contract N00014-76-C-0117)
(AD-A075833; ARL-TR-79-26) Avail: NTIS HC A07/MF A01 CSCL 20/1

Work under Contract consisted of three parts 1 redesign and updating of the ARL UT profilometer system used to measure in situ sound velocities of ocean bottom sediments, 2 development of transducers to measure shear wave and acoustic impedance parameters of sediments, and 3 laboratory measurements to develop and confirm theoretical models for acoustic propagation in sediments. Data obtained for the three parts of the program are reported. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-17826# New York Univ., N. Y. Dept. of Physics.
THEORY OF COLLISIONALLY AIDED RADIATIVE EXCITATION IN THREE-LEVEL SYSTEMS: A NEW INTERFERENCE EFFECT
S. Yeh and P. R. Berman 23 May 1979 8 p refs
(Contract N00014-77-C-0553)
(AD-A076101) Avail: NTIS HC A02/MF A01 CSCL 07/4

Collisionally Aided Radiative Excitation in a three-level atomic system is investigated using a stationary phase method for the case of large atom-field detunings and weak incident fields. It is found that collision-induced coherent phase interference effects can give rise to oscillatory structure in the total absorption cross section as a function of relative speed (energy). An example is given for a specific interatomic potential, indicating that experimental observation of such an effect is feasible. GRA

N80-17827# New York Univ., N. Y. Dept. of Physics.
THE EFFECTS OF VELOCITY-CHANGING COLLISIONS ON TWO-PHOTONS AND STEPWISE ABSORPTION SPECTROSCOPIC LINESHAPES
P. R. Berman, P. F. Liao, and J. E. Bjorkholm Sep. 1979 23 p refs
(Contract N00014-77-C-0553)
(AD-A076100) Avail: NTIS HC A02/MF A01 CSCL 07/4

We report the results of an experimental study of the effects of velocity-changing collisions on two-photon and stepwise absorption lineshapes. Excitation spectra for the 3S(1/2) yields 3P(1/2) yields 4D(3/2) transitions of sodium atoms undergoing collisions with foreign gas perturbers are obtained. These spectra are obtained with two cw dye lasers. One laser, the pump laser, is tuned 1.6 GHz below the 3S(1/2) yields 3P(1/2) transition frequency and excites a nonthermal longitudinal velocity distribution of excited 3P(1/2) atoms in vapor. Absorption of the second (probe) laser is used to monitor the steady state excited state distribution which is a result of collisions with rare gas atoms. The spectra are obtained for various pressures of He, Ne, and Kr gases and are fit to a theoretical model which utilizes either the phenomenological Keilson-Stoerer or the classical hard sphere collision kernel. The theoretical model includes the effects of collisionally aided excitation of the 3P(1/2) state as well as effects due to fine-structure state-changing collisions. Although both kernels are found to predict lineshapes which are in reasonable agreement with the experimental results, the hard sphere kernel is found superior as it gives a better description of the effects of large angle scattering for heavy perturbers. Neither kernel provides a fully adequate description over the entire line profile. The experimental data is used to extract effective hard-sphere collision cross sections for collisions between sodium 3P(1/2) atoms and helium, neon and krypton perturbers. GRA

N80-17828# New York Univ., N. Y. Dept. of Physics.
STUDY OF COLLISIONAL REDISTRIBUTION USING TWO-PHOTON ABSORPTION WITH A NEARLY RESONANT INTERMEDIATE STATE
P. R. Berman, P. F. Liao, and J. E. Bjorkholm Sep. 1979 14 p refs
(Contract N00014-77-C-0553)
(AD-A076099) Avail: NTIS HC A02/MF A01 CSCL 07/4

We report studies of collision-induced features of the 3S(1/2) yields 3P(1/2) yields 4D(3/2) two-photon absorption in atomic sodium vapor undergoing collisions with several rare gas perturbers. The results yield the collisional redistribution function which describes the nonresonant excitation of the 3P(1/2) intermediate state. Good agreement with theory is obtained only if effects of 3P(1/2) in equilibrium with 3P(3/2) state-changing collisions are included in the calculations. Results are used to obtain a value for a pressure broadening coefficient in the Na-Kr system. GRA

N80-17829# Naval Research Lab., Washington, D. C.
GENERATION OF HIGH ENERGY-HIGH CURRENT ION PULSES BY MAGNETIC COMPRESSION OF ION RINGS Interim Report
C. A. Kapetanakos 24 Oct. 1979 34 p refs
(AD-A076200; AD-E000333; NRL-MR-4093) Avail: NTIS HC A03/MF A01 CSCL 20/7

A scheme is proposed for the generation of intense, high energy ion pulses by magnetic compression of ion rings. After compression the ring is extracted through a half magnetic cusp that transforms an appreciable fraction of the ring's rotational energy to translational energy. The existence of equilibrium of a hollow, rotating beam in the absence of an external magnetic field and a conducting guide tube was shown using the Vlasov-Maxwell approach. Therefore, the proposed scheme appears to be in particular useful for those applications that require a large separation between the accelerator and the target. GRA

N80-17830# IRT Corp., San Diego, Calif.
MOLECULAR BEAM STUDIES OF LOW ENERGY REACTIONS Annual Report
R. H. Neynaber and S. Y. Tang 15 Oct. 1979 5 p refs
(Contract N00014-74-C-0011)
(AD-A075394; IRT-8103-009) Avail: NTIS HC A02/MF A01 CSCL 20/7

The annual summary of the research performed under ONR Contract No. N00014-74-C-0011 is given. The report describes merging and crossed-beam studies of chemi-ionization and/or ion-molecule reactions. Included are investigations of the He(*) - D, Ne(*) - Xe, Ar(*) - Kr(*), Ne(*) - Ar(*), He(+) - Ne(*), and Kr(+) - Cs systems. A description is also given of how this research helps resolve unknown aspects of the areas investigated. GRA

N80-17831# SRI International Corp., Menlo Park, Calif.
METASTABLE RARE GAS COLLISIONS WITH MOLECULES Summary Questionnaire, Oct. 1978 - Oct. 1979
Keith T. Gillen 15 Oct. 1979 6 p refs
(Contract N00014-76-C-0734)
(AD-A076022) Avail: NTIS HC A02/MF A01 CSCL 07/2

This report summarizes recent progress in an experimental investigation of reactive and inelastic scattering of fast metastable rare gas atoms by various target molecules. Detailed investigations have been made of reactons between He *(2 to the first power s), He*(2 to the 3rd power s), and Ar* projectiles and O2 target molecules. Collisional ion-pair formation differential cross sections and electronically and vibrationally inelastic cross sections have been emphasized. Classical trajectory calculations on diabatic potential surfaces have been used to model and interpret the experimental results. GRA

N80-17832# Hebrew Univ., Jerusalem (Israel). Dept. of Chemistry.
ELECTRONIC EXCITATION IN MOLECULAR COLLISIONS: STRUCTURAL, DYNAMIC AND KINETIC CONSIDERA-

TIONS Annual Summary Report, Sep. 1978 - Aug. 1979
R. D. Levine Sep. 1979 9 p
(Grant N00014-78-G-0036)
(AD-A074955) Avail: NTIS HC A02/MF A01 CSCL 20/10

The factors governing chemical reactivity with special reference to the role of electronic energy is promoting the reaction and to the production of electronically excited species are examined. The problem is studied both in general terms (i.e., the development of the required theoretical framework) and in application to specific systems. GRA

N80-17833# Sandia Labs., Albuquerque, N. Mex. Applied Physics Div.
SNEER: A DIGITAL COMPUTER PROGRAM FOR THE SIMULATION OF CHARGED PARTICLE BEAMS AND ELECTROSTATIC LENSES
J. E. Boers Jul. 1979 35 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0597) Avail: NTIS HC A03/MF A01

The SNEER program is found to be powerful tool for the analysis of charged particle beams and trajectories. Inclusion of relativistic trajectory computations and the ability to include dielectrics in the potential relaxation enables the program to handle virtually any type of beam configuration not including a source - such as a cathode. Examples shown have produced results within a few percent of exact theoretical and experimental results. A sample input data set is presented for still another application of the program. Trapped electron orbits are traced in electric and magnetic fields in an ion gauge configuration. DOE

N80-17834# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
THE REACTION OF O(1D) WITH WATER [UNTERSUCHUNG DER REAKTION VON O(1D)-ATOMEN MIT H2O]
K. Kaufmann Dec. 1978 6 p refs In GERMAN
(MPIS 27/1978; ISSN-0436-1199) Avail: NTIS HC A02/MF A01; Fachinformationszentrum Karlsruhe, West Germany DM 3.60

The reaction of activated oxygen atoms (O-1D) with molecules was studied in the laboratory by means of a quadrupole mass spectrometer. This reaction, producing HZ and OZ molecules, contributes to reducing the concentration of activated oxygen atoms in the ionosphere produced by the ozone absorption of ultraviolet radiation. It is concluded that the contribution of this reaction to the deactivation of (O-1D) is less than 1.6% (+ or - 1%). Author (ESA)

N80-17835# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
MOLECULAR BEAM MEASUREMENTS OF INELASTIC CROSS SECTIONS FOR TRANSITIONS BETWEEN DEFINED ROTATIONAL STATES (jm) OF CsF IN COLLISIONS WITH He, Ne, Ar, Kr, AND Xe, CH4, SF6, C2H6, N2, CO, CO2, N2O, CH3Cl, CH3Br, CF3H, AND CF3Br
U. Borkenhagen, H. Malthan (IABG, Munich), and J. Peter Toennies Jan. 1979 86 p refs
(MPIS-5/1979; ISSN-0436-1199) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Karlsruhe, West Germany DM 15.60

Absolute inelastic cross sections for rotational quantum state to state transitions were measured. Small angle grazing collisions of CsF molecules colliding with rare gas collision partners as well as with other scattering partners were studied. In the collision region the quantization axis of the CsF molecules is defined by a weak electric field (300 V/cm) directed perpendicular to the direction of the velocity selected CsF and the target nozzle beam. The apparatus, which uses electrostatic quadrupole fields to state select and state analyze the CsF molecules prior to and after scattering, is described. The formulas used to derive the various types of cross sections from the pressure dependences are derived. A transmission function for each rare gas and transition was calculated using a Monte Carlo method. Theoretical predicted differential cross sections were compared with the reported values. The cross sections were correlated with the predictions of a Born approximation theory for the various predominant potential terms. Author (ESA)

N80-17836# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A PROBLEM WITH CLASSICAL NEUTRINO FIELDS IN GENERAL RELATIVITY
J. B. Griffiths Nov. 1978 17 p refs
(Maths-Res-133) Avail: NTIS HC A02/MF A01

Weak gravitational interactions with neutrinos are discussed. A general relativistic theory of neutrino fields is sought. The idealized neutrino which has zero rest mass, zero charge, and spin 1/2 is considered. There are two advantages to considering this idealized case. The neutrino is regarded as a semiclassical null field analogous to that for a photon and it simplifies the mathematics. The implications of this anomaly and its associated properties on the theory are emphasized. Author (ESA)

N80-17837# Montpellier Univ. (France). Dept. de Physique Mathematique.
BEHAVIOR OF SIGMA (POSITRON-ELECTRON YIELDS OMEGA MESON-ANTI-OMEGA-MESON) NEAR THE THRESHOLD INCLUDING FINITE WIDTH EFFECTS
J. Layssac May 1979 6 p refs
(PM/79/13) Avail: NTIS HC A02/MF A01

In high energy electron-positron collisions the production of omega-mesons and anti-omega-mesons is a very crucial test of unified theories of weak and electromagnetic interactions. After a brief consideration of the computed cross section of omega-meson and anti-omega-meson production according to the Weinberg-Salam model, the effects on boson production due to omega prime width are studied. Results are used to compute the cross section sigma (positron-electron yields omega-meson-anti-omega-meson) before the threshold. It is shown that 10 GeV before the opening of the channel omega-meson and anti-omega-meson the cross section is about 10 percent of its maximum value (0.18 x 10 to the -8 power mb). Author (ESA)

N80-17838# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
RADIATION PROTECTION PROBLEMS RELATED TO PARTICLE ACCELERATORS WITH SPECIAL EMPHASIS ON THE START UP AUTHORIZATION PROCEDURE REQUIRED BY ITALIAN LAW
A. Baroncelli (INFN Sez. Sanita), M. Belli, S. Benassi (Direzione Centrale Sicurezza Nucl. e Protezione Sanitaria), C. Bosio (INFN Sez. Sanita), M. Paganini-Fioratti (Direzione Centrale Sicurezza Nucl. e Protezione Sanitaria), and M. Pelliccioni (Lab. Nazl. di Frascati, Italy) 1 Dec. 1978 72 p refs In ITALIAN; ENGLISH summary
(ISS-T-78/15) Avail: NTIS HC A04/MF A01

A guideline based on practices in Italy and aimed at ensuring radiation protection around particle accelerators is given. Radiation hazards to living organisms are examined. An evaluation of the hazards is presented. Pertinent laws and regulations stemming from the evaluation of risk are reviewed. Particle accelerator characteristics are listed and the types and intensity of radiation likely to be encountered using the equipment are shown. Author (ESA)

N80-17839# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France)
APPLICATION OF THE MOLECULAR BEAM TECHNIQUE TO THE GROWTH OF ALKALI METAL ANTIMONIDE PHOTOCATHODES: STUDY OF THE GROWTH KINETICS Final Report [APPLICATION DE LA TECHNIQUE DES JETS MOLECULAIRES A L'ETUDE DE LA CINETIQUE DE CROISSANCE DES PHOTOCATHODES D'ANTIMONIURES ALCALINS]
G. Marie 1 Mar. 1977 45 p refs In FRENCH
(Contract DGRST-77-7-0084)
(LEP-79/510.SME-619-B) Avail: NTIS HC A03/MF A01

Alkali metal source generators, developed to use with a molecular beam technique for the fabrication of photocathodes (Sb, Na, K, Cs) are discussed. The simultaneous use of the different sources makes it possible to obtain homogeneous, pure layers whose stoichiometry is controlled by regulating the sources. As the chemical reactions between the elements only occur on the substrate, the technique provides a simple means of controlling crystal layer growth. Results obtained in the growth of trialkali photocathodes are shown to be reproducible while characterization

of the fabricated materials indicates the value of the technique for the development of photocathodes with high photoelectric sensitivity. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-17840 California Inst. of Tech., Pasadena.
SINGLE-AND MULTIPLE-SCATTERING MECHANISMS IN HIGH-ENERGY NUCLEAR COLLISIONS Ph.D. Thesis
Robert Lee Hatch 1980 126 p
Avail: Univ. Microfilms Order No. 8002587

The production of energetic protons from relativistic nuclear collisions was studied using two approaches, the hard scattering model and an intranuclear cascade model. The hard scattering model combines the simplified kinematics of single scatterings and the effects of the momentum distribution for nucleons in the nucleus to provide a parameter free description of a nucleus-nucleus collision. Free nucleon-nucleon cross sections were used to describe the individual NN interactions. The model is also applied to explain the observed two proton azimuthal correlations from these systems and, with simple assumptions, to estimate the single scattering component of the inclusive proton spectra. Calculations of the one and two particle inclusive spectra are presented using forms for the momentum distribution obtained both from the analysis of proton-nucleus backscattering data and from theory. A simple cascade model was used to calculate the inclusive proton spectra at 180 degrees from 600 MeV proton-nucleus collisions. Dissert. Abstr.

N80-17841*# United Technologies Research Center, East Hartford, Conn.
SPECTRAL PROPERTIES OF GASEOUS URANIUM HEXAFLUORIDE AT HIGH TEMPERATURE
N. L. Krascella Washington NASA Feb. 1980 29 p refs
(Contract NAS1-14329)
(NASA-CR-3244; R79-912869-1) Avail: NTIS HC A03/MF A01 CSCL 20I

A study to determine relative spectral emission and spectral absorption data for UF6-argon mixtures at elevated temperatures is discussed. These spectral data are required to assist in the theoretical analysis of radiation transport in the nuclear fuel-buffer gas region of a plasma core reactor. Relative emission measurements were made for UF6-argon mixtures over a range of temperatures from 650 to 1900 K and in the wavelength range from 600 to 5000 nanometers. All emission results were determined for a total pressure of 1.0 atm. Uranium hexafluoride partial pressures varied from about 3.5 to 12.7 mm Hg. Absorption measurements were attempted at 600, 625, 650 and 675 nanometers for a temperature of 1000 K. The uranium partial pressure for these determinations was 25 mm Hg. The results exhibit appreciable emission for hot UF6-argon mixtures at wavelengths between 600 and 1800 nanometers and no measurable absorption. The equipment used to evaluate the spectral properties of the UF6-argon mixtures included a plasma torch-optical plenum assembly, the monochromator, and the UF6 transfer system. Each is described. A.W.H.

N80-17842# Battelle Pacific Northwest Labs., Richland, Wash.
NUCLEAR WASTE MANAGEMENT STATUS AND RECENT ACCOMPLISHMENTS Final Report
J. L. McElroy and R. E. Burns May 1979 85 p refs Sponsored by Elec. Power Res. Inst.
(Contract EY-76-C-06-1830)
(EPRI-NP-1087) Avail: NTIS HC A05/MF A01

The status and technical progress of nuclear waste disposal is reviewed with emphasis on technical and programmatic progress in high level nuclear waste disposal technology during the 1976 to 1978 time period. Process steps in the waste solidification and geologic disposal system are described emphasizing processes and systems that are more advanced in terms of readiness for full scale demonstration. Technical accomplishments in support of the reference waste vitrification and geologic disposal approach are highlighted. DOE

N80-17843# National Technical Information Service, Springfield, Va.
LASER FUSION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Oct. 1977 - Sep. 1979
Brian Carrigan Oct. 1979 231 p Supersedes NTIS/PS-78/1062; NTIS/PS-77/0865; NTIS/PS-76/0856; NTIS/PS-75/0783
(PB80-800246; NTIS/PS-78/1062; NTIS/PS-77/0865; NTIS/PS-76/0856; NTIS/PS-75/0783) Avail: NTIS HC $30.00/MF $30.00 CSCL 18A

The bibliography cites research on target fabrication, laser implosion instability, and laser produced plasma studies. The bibliography contains 225 abstracts, 107 of which are new entries to the previous edition. GRA

74 OPTICS

Includes light phenomena.

N80-17844 Dartmouth Coll., Hanover, N.H.
OPTICAL PROPERTIES AND STRUCTURE OF VANADIUM, NIOBIUM, TANTALUM, CHROMIUM, MOLYBDENUM, AND TUNGSTEN FILMS Ph.D. Thesis
James Ernest Nestell, Jr. 1979 233 p
Avail: Univ. Microfilms Order No. 8001173

The optical properties, dc resistivity, and microstructure are determined for V, Nb, Ta, Cr, Mo, and W evaporated thin films deposited onto elevated temperature (700-1000 C), room temperature, and cooled (77K) substrates. The film structures are investigated with X-ray and transmission electron diffraction and transmission electron microscopy probes. It is found that well-crystallized films are produced at the elevated temperatures, with grain sizes significantly greater than those of room-temperature depositions. The optical reflectance of opaque, well-crystallized Ta, Cr, Mo and W films is larger than for films deposited at room temperature. Dissert. Abstr.

N80-17845 Stanford Univ., Calif.
TUNABLE INFRARED GENERATION USING PARAMETRIC AND RAMAN PROCESSES Ph.D. Thesis
Stephen John Brosnan 1979 185 p
Avail: Univ. Microfilms Order No. 8001879

Methods of generating widely tunable infrared light using parametric and Raman processes are described. Detailed measurements are presented which establish the usefulness of an infrared source composed of a parametric oscillator and a Raman mixing frequency downconverter. The design of the LiNbO3 angle tuned parametric oscillator was optimized, and the measured performance characteristics were compared with theoretical models. Dissert. Abstr.

N80-17846 California Univ., Berkeley.
DIAGRAMMATIC AND FLOW GRAPH ANALYSIS OF THE DENSITY MATRIX FOR NONLINEAR OPTICAL CALCULATIONS Ph.D. Thesis
Ting Kwong Yee 1979 128 p
Avail: Univ. Microfilms Order No. 8000582

Two kinds of diagrammatic analyses of the density operator for the evaluation of nonlinear optical quantities are considered. The time evolution of both the wave function and its complex conjugate are treated by diagrammatic analysis. Examples involving the third-order susceptibility are discussed for both monochromatic and pulse excitation. The diagrams provide a convenient means by which nonlinear optical processes can be precisely defined and the susceptibility readily evaluated. Flow graphs are used to deduce Feenberg perturbation expansions for radiative interactions. Relevance to laser induced multiphoton excitation and energy level shift calculations in the presence of a strong field are also discussed. The flow graph technique is generalized to calculate density matrix elements. Examples involving the saturation phenomena of the first-order polarization and the TPRTHG are discussed. Dissert. Abstr.

N80-17847 California Univ., Berkeley.
INVESTIGATION OF SOME THIN-FILM SCHEMES FOR ELECTRO-OPTICS MODULATION AND DETECTION IN INTEGRATED OPTICS Ph.D. Thesis
Tirumala Ramakrishna Ranganath 1979 162 p
Avail: Univ. Microfilms Order No. 8000485

The operation of a symmetric fork waveguide structure was analyzed using simple symmetry arguments. It was found that an embedded ridge fork waveguide structure behaved as a mode order converter and not as a simple beam splitter. As a consequence, an interferometric modulator incorporating symmetric fork waveguides should function as a true amplitude modulator only if the individual arms of the structure were single mode waveguides. Such a structure was realized experimentally using Ti-diffused LiNbO3 embedded ridge waveguides. Measurements indicated that the device's operation does depend on the mode order converting behavior of single mode symmetric fork waveguides. Light detection in dielectric waveguides through direct evanescent coupling to an etched mesa photodiode was examined. A mesa diode was used in conjunction with a simple branched waveguide modulator (fabricated using Ti-diffused LiNbO3 waveguide structures) to demonstrate the scheme. Experimentally determined quantum efficiency of the photo diode was compared to the theoretically determined value. An experimental structure consisting of a 300 angstrom buffer layer of air between the LiNbO3 waveguide and the silicon mesa diode ia discussed.
Dissert. Abstr.

N80-17848*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
FIBER-OPTIC INSTRUMENTATION: CRYOGENIC SENSOR MODEL DESCRIPTION Final Report
M. M. Sharma 25 Nov. 1979 20 p
(Contract NAS9-15454)
(NASA-CR-160448; TR-A001) Avail: NTIS HC A02/MF A01 CSCL 20F

An assessment and determination of technology requirements for developing a demonstration model to evaluate feasibility of practical cryogenic liquid level, pressure, and temperature sensors is presented. The construction of a demonstration model to measure characteristics of the selected sensor and to develop test procedures are discussed as well as the development of an appropriate electronic subsystem to operate the sensors. M.M.M.

N80-17849# New York Univ., N. Y. Dept. of Physics.
SOLVABLE MODEL FOR OPTICAL AND RADIATIVE COLLISIONS
E. J. Robinson Sep. 1979 7 p refs
(Contract N00014-77-C-0553)
(AD-A076102) Avail: NTIS HC A02/MF A01 CSCL 07/4

The related problems of optical and radiative collisions are examined theoretically. The actual R to the nth power potentials found in nature are simulated by powers of the hyperbolic secant, which enables one to obtain closed form solutions for the transition probabilities in the weak field regime. GRA

N80-17850# Photon Research Associates, Inc., La Jolla, Calif.
DEVELOPMENT AND VALIDATION OF STANDARDIZED INFRARED RADIATION MODEL (SIRRM). GAS/PARTICLE RADIATIVE TRANSFER MODEL Computer Code Development Report, 8 Sep. 1978 - 30 Jun. 1979
G. N. Freeman, C. B. Ludwig, W. Malkmus, and R. Reed Edwards AFB, Calif. AFRPL 30 Oct. 1979 173 p refs Prepared in cooperation with Grumman Aerospace Corp., Bethpage, N.Y.
(Contract F04611-78-C-0081; AF Proj. 3058)
(AD-A076199; AFRPL-TR-79-55) Avail: NTIS HC A08/MF A01 CSCL 20/6

Analytical models have been developed to treat the coupled gas/particle radiative transfer in exhaust plumes, monochromatically and in a band model approach. In addition, the availability of the particle optical parameters has been investigated. The requirements for the plume scattering model in SIRRM are: Coupled emission, absorption and scattering treatment; Multiple scattering with cylindrical geometry; Three-dimensional, non-uniform, axisymmetric medium; Arbitrary particle mixtures and size distribution; Line-by-line and band-model treatments; and Alternate levels of engineering approximation. These requirements are met by developing two basic approaches, a 6-flux and an N-flux approach. This distinction refers to the associated subdivision in angular space, six-orthogonal coordinates versus N nonorthogonal coordinates in azimuth and elevation, thus providing the alternatives of computational simplicity of the 6-flux model with generality of the N-flux model. Numerous parametric calculations were performed to study the effect of optical depth, scattering albedo, phase function and medium geometry on the target signature and computational requirements. GRA

N80-17851# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ACCURACY REQUIREMENTS FOR GEODSS PHOTOMETRY
John M. Sorvari 26 Jul. 1979 44 p refs
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A076496; ETS-47; ESD-TR-79-188) Avail: NTIS HC A03/MF A01 CSCL 20/6

Requirements on the accuracy of GEODSS photometry were derived based on the stated goals of GEODSS photometry. Fulfilling these requirements will ensure that the data are of sufficient quality for their intended purpose. Calculations based on the properties of the proposed system show that the requirements can be met if care is taken in the detailed design and data processing techniques. GRA

N80-17852# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
GENERALIZED RAY OPTICAL ANALYSIS OF REFLECTION FROM A SMOOTH CONVEX CONDUCTING SURFACE
R. Mittra and A. M. Rushdi Oct. 1979 47 p refs
(Contract N00014-75-C-0293; Grant AF-AFOSR-3375-77)
(AD-A075278; UIEM-79-12; UILU-ENG-79-2556) Avail: NTIS HC A03/MF A01 CSCL 20/3

In certain applications involving reflection from smooth convex surfaces, the conventional geometrical optics method (GO) is not sufficiently accurate. In this paper a generalization of the conventional GO formulas is presented and closed-form expressions are derived. The derivation of the generalized geometrical optics (GGO) forumulas is based on the Fresnel transformation between two planes, one of which contains the spectral point, while the other passes through the observation point. The method developed herein improves the accuracy of GO with paying the high numerical cost of the physical optics integration. It is important, in particular, for computing the reflection characteristics of numerically specified surfaces. GRA

N80-17853# Thomson-CSF, Orsay (France). Lab. Centrale de Recherches.
STUDY OF THE APPLICATION OF THERMAL EFFECTS ON LIQUID CRYSTALS TO DEVICES FOR THE PROJECTION OF INFORMATION ON A SCREEN Final Report [ETUDE DE L'APPLICATION DES EFFETS THERMIQUES DANS LES CRISTEAUX LIQUIDES AUX DISPOSITIFS DE PROJECTION D'INFORMATION SUR ECRAN]
Serge LeBerre and Michel Hareng Dec. 1977 57 p refs In FRENCH Original contains color illustrations
Avail: NTIS HC A04/MF A01

The electro-optical and thermo-optical properties of liquid crystals were studied in order to develop a system for storing and displaying information. The system is based on an optical 'valve' and contains data as an array of points whose diffusivity to visible light can be changed. Light projected through the 'valve' is interpreted using Schlieren optics making possible a black and white display. Diffusion characteristics of the 'valve' can be completely, or locally, changed using a YAG laser. The data rate obtained with this device is 20,000 points/sec (200 characters/sec) with a contrast of 20:1. Author (ESA)

N80-17854# Officine Galileo S.p.A., Florence (Italy).
OPTICAL RATE SENSOR CONCEPT: EVALUATION STUDY Final Report
A. Buccheri Dec. 1978 183 p
(Contract ESTEC-3306/77-NL-AK(SC))
(Rept-401-DT-4; ESA-CR(P)-1238) Avail: NTIS HC A09/MF A01

The possibility of deriving angular rate information from randomly distributed celestial sources by methods involving spatial frequency filtering is analyzed. Measuring angular rates by imaging a star field on a detector and by using a spatial filter to

transform image motion into a modulation of the detector output is discussed. The application of a reticle system, placed in the image plane of an objective lense looking at the star field from a spacecraft, is analyzed. A preliminary design of a system with no moving parts, three independent optical heads, and a single electronics box is described. Author (ESA)

N80-17855# Eurosat S.A., Geneva (Switzerland).
STUDY FOR THE DETERMINATION OF GEOMETRIC AND SPECTRAL RESOLUTION REQUIREMENTS OF OPTICAL IMAGING INSTRUMENTS FOR EARTH RESOURCES SATELLITES, VOLUME 1 Final Report
C. L. P. Miller. May 1979. 55 p.
(Contract ESA-3529/78-F-HS(SC))
(CM/PR/3384-Vol-1; ESA-CR(P)-1239-Vol-1) Avail: NTIS HC A04/MF A01

A study aimed at establishing optimum values of sensor related parameters is reviewed. The history is traced from the original call for ideas to the final statements of objectives and proposed methodology. Recommendations for the activation of the study are made selecting three alternatives with various levels of constraint. Author (ESA)

N80-17856# Compagnie Generale d'Electricite, Marcoussis (France). Div. Materiaux.
DEVELOPMENT OF LOW ATTENUATION GLASSES FOR OPTICAL TRANSMISSION APPLICATIONS Final Report [ELABORATION DE VERRES A FAIBLE ATTENUATION POUR LIASONS OPTIQUES]
C. LeSergent, J. Grosbois, and J. Portier. Jun. 1978. 24 p. In FRENCH
(Contracts DGRST-76-7-07850; DGRST-76-7-0786; DGRST-76-7-0787)
Avail: NTIS HC A02/MF A01

Raw materials (silicon; sodium carbonate; calcium carbonate; boric acid) were refined and their applicability to the drawing of optical fibers was investigated. Glass fibers several kilometers in length, having an attenuation of 30 dB/km at 830 or 1060 nm, were drawn from the glasses SiOZ-Na2O-CaO and SiO2-B2O3-Na2O-B2O3. Following a study of the influence of diffusion on transmissivity and an improvement in fusion techniques, fibers were drawn from smaller sample batches having an attenuation of 10 plus or minus 1 dB/km for the same wavelengths. Fluoride glasses were studied, but results in fiber drawing were negative. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-17857 California Univ., Berkeley.
VARIATIONAL METHOD FOR ELECTROMAGNETIC WAVES IN A MAGNETO-PLASMA Ph.D. Thesis
Rene Rafael Dominguez. 1979. 129 p.
Avail: Univ. Microfilms Order No. 8003326

A variational method is presented to derive the electromagnetic response for waves, of an arbitrary beta model plasma, in a magnetic field whose curvature is simulated by an external gravitational field. The variational method, applied in the present work to slab and cylindrical plasma models, obtains the Maxwell integral equations in Fourier space. The limitations of the frequently employed local approximation are established from the approximate differential equations and a symmetric set of local Maxwell equations are obtained which, neglecting Landau resonances, are manifestly Hermitian for real eigenfrequencies. The local Maxwell equations are used to perform a detailed stability analysis of the low frequency drift Alfven mode and the hot electron flute interchange mode. Dissert. Abstr.

N80-17858# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
NONLINEAR PERTURBATIONS OF COLD MAGNETIZED PLASMA GENERATED BY RADIATION PRESSURE FORCES
R. Klima. Oct. 1978. 16 p. refs.
(IPPCZ-225) Avail: NTIS HC A02/MF A01

The nonlinear perturbations of plasma density and velocity are derived for the case of a quasi monochromatic wave packet propagating perpendicularly to a magnetostatic field. Radiation pressure forces arising from the time dependence of the wave amplitude are included. Thermal pressure and collisional effects are neglected. The basic equations and assumptions are formulated and the time averaged electric current density is established. The plasma motion in the direction of wave propagation is studied for two particular cases and the results obtained are discussed. A.W.H.

N80-17859# Institute of Plasma Physics, Prague (Czechoslovakia).
THE DISSIPATIVE INSTABILITY OF A RELATIVISTIC ELECTRON BEAM
P. Krocek. Sep. 1978. 15 p. refs.
(IPPCZ-224) Avail: NTIS HC A02/MF A01

The theory of the wall instabilities of surface waves excited by an electron beam is developed. Their classification, linear, quasilinear and nonlinear theory is given. It is shown that dissipative instabilities convert practically all the energy lost by the beam into the heating of the lossy walls confining the beam. Author

N80-17860# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
CORPUSCULAR DIAGNOSTICS OF A HOLLOW CATHODE DISCHARGE
J. Rybnicek. Sep. 1978. 56 p. refs.
(IPPCZ-223) Avail: NTIS HC A04/MF A01

The intrinsic feasibility of measuring the positive ion mass spectrum of an external magnetic field-free double cathode discharge at pressures up to 130 Pa is demonstrated. A corpuscular diagnostic method for a hollow cathode discharge is described and the experimental results are presented. At the discharge pressure of 10 Pa of argon gas, the energy spectrum of the ions being extracted through a capillary opening shows a marked anisotropy. The mass spectral measurements yield results differing by two orders of magnitude from the expected ones. The concept of limit angle of inelastic scattering is introduced and discussed in terms of classical mechanics. The limit angle is derived on the basis of the energy and momentum conservation laws, holding the inelastic scattering for the limit case of the centra-field motion. The term collision of two absolutely rigid spheres is defined. A.R.H.

N80-17861# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
AN INTEGRAL APPROACH OF SUCCESSIVE COLLISIONS TO LINEAR CHARGED-PARTICLE TRANSPORT THROUGH A FINITE SLAB
S. Kuhn. 1979. 30 p. refs. Presented at the Meeting on Math. Methods in Plasma Phys., Oberwolfach, West Ger., 16-21 Sep. 1979. Submitted for publication, sponsored by Fonszue Foerderung der Wissenschaft lichen Forschung, Austria
Avail: NTIS HC A03/MF A01

The steady-state velocity distribution functions of test particles passing through a one-dimensional slab filled with a background gas were calculated. The test particles are injected at a constant rate and accelerated by an applied electric field, at the same time undergoing binary collisions with the background particles. With the assumption of a finite-range (or cut-off) interaction potential, the test particles are classified according to their scattering order, i.e., the number of collisions they have suffered since entering the slab. The related partial distribution functions can be obtained successively by integration of linear, first-order ordinary differential equations along the characteristics. Their sum is the distribution function looked for, which satisfies the linear Boltzmann equation. The Method can quite naturally handle both boundary conditions and strongly non-equilibrium situations, and is amenable to various generalizations. As an example of application, the thermalization of a beam undergoing symmetic charges transfer is given, and the complete analytical solution obtained covers a previous result as a special case. A.R.H.

N80-17862# Avco-Everett Research Lab., Mass.
INVESTIGATION OF THE PRODUCTION OF HIGH DENSITY UNIFORM PLASMAS Final Report, 2 Apr. 1978 - 2 Apr. 1979
D. H. Douglas-Hamilton and P. Rostler. May 1979. 47 p. refs. (Contract F33615-78-C-2013; AF Proj. 2308)
(AD-A076492; AFAPL-TR-79-2059-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 20/9

The discharge streamer instability, which leads to arcing in nonself-sustaining discharges is investigated experimentally and theoretically. Framing camera studies of streamer growth from the cathode of an e-beam sustained discharge in various gases under various discharge conditions are described, analyzed, and compared with theoretical predictions. A previously developed model of the streamer is extended to include a more detailed description of the density, temperature, and input power distributions around the streamer tip. Stable high-density plasma discharges have many applications in plasma physics. An especially significant example is the use of these discharges in high-power gas lasers. The work described here concerns investigation of the external ionization e-beam sustainer method of producing a high-density discharge, together with the advantages and instabilities peculiar to that system. GRA

N80-17863# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.
DESIGN STUDY OF A FUSION-DRIVEN TOKAMAK HYBRID REACTOR FOR FISSILE FUEL PRODUCTION, VOLUME 1 Final Report
R. P. Rose. May 1979. 284 p. refs.
(EPRI-ER-1083-Vol-1) Avail: NTIS HC A13/MF A01

Conceptual approaches for a Tokamak fusion driven fuel producing reactor were evaluated. The conceptual design of the hybrid reactor was based on using projected state of the art technology for the late 1980s. The conceptual definitions of two alternatives for the fusion driver were assessed. A two component Tokamak (TCT) concept, based on the TFTR plasma physics parameters, was compared to a beam driven thermonuclear (BDTN) concept, based on the USSR T-20 plasma physics parameters. DOE

N80-17864# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.
DESIGN STUDY OF A FUSION-DRIVEN TOKAMAK HYBRID REACTOR FOR FISSILE FUEL PRODUCTION, VOLUME 2 Final Report
R. P. Rose. May 1979. 268 p. refs.
(EPRI-NP-1083-Vol-2) Avail: NTIS HC A12/MF A01

Conceptual approaches for a Tokamak fusion driven fuel producing reactor are discussed. The conceptual design of the hybrid reactor was based on using projected state of the art technology for the late 1980s. Considerations such as reactor materials and safety are included. The conceptual definitions of two alternatives for the fusion driver were evaluated. A two component Tokamak (TCT) concept, based on the TFTR plasma physics parameters, was compared to a beam driven thermonuclear (BDTN) concept, based on the USSR T-20 plasma physics parameters. DOE

N80-17865# Toulouse Univ. (France). Lab. de Genie Electrique.
PHYSICAL ASPECTS OF POLYMER SURFACE TREATMENT [ASPECTS PHYSIQUES DU TRAITEMENT DES SURFACES POLYMERIQUES]
C. Mayoux. 22 Feb. 1978. 47 p. refs. In FRENCH. Presented at ADERP Seminar sur la Chem. des Plasmas et des Appl. Ind., 22 Feb. 1978.
(Publ-358) Avail: NTIS HC A03/MF A01

The transformation of polymer surfaces by electric discharges is examined. Industrial processes, laboratory techniques, and measuring procedures are reviewed. An experimental device for polymer treatment in a uniform electric field and two measuring systems for electrical characterization are described. The rates of chemical change on the polymer surface produced by ionized gases and electrons are discussed. The application of plasma treatment to manufacturing light reflectors and electrets as well as textile fiber modifications are analyzed. It is concluded that the existent analytic methods, such as infrared spectrometry, are not yet sufficiently accurate to measure surface modifications and that the reaction mechanisms vary with the polymer constitution. Author (ESA)

N80-17866# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
PLASMA IN LABORATORY AND SPACE
Hannes Alfven. Jul. 1979. 54 p. refs. Presented at 14th Intern. Conf. on Phenomena in Ionized Gases, Grenoble, France, 9-13 Jul. 1979. Submitted for publication.
(TRITA-EPP-79-12) Avail: NTIS HC A04/MF A01

The use of scaling laws in the transfer of knowledge concerning laboratory, magnetospheric, and astrophysical plasma phenomena is discussed. The impact of in situ magnetospheric plasma measurements on plasma physics is reviewed. Two kinds of plasma are defined: passive plasma regions described by classical hydrodynamic theory, and active plasma regions, whose structure is considered in terms of boundary conditions and circuit theory. An astrophysical description of the formation of the solar system is presented. Author (ESA)

N80-17867# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
LONGITUDINAL INVARIANT SURFACES IN RING-CURRENT CONFIGURATIONS Research and Training Program On Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
J. Scheffel. Apr. 1979. 24 p. refs.
(TRITA-PFU-79-07) Avail: NTIS HC A02/MF A01

The influence of magnetically shielded supports on particle motion in ring current fusion devices was investigated. For this purpose the longitudinal adiabatic invariant was studied. The obtained results confirm earlier approximate deductions of the surfaces generated by the particle drift motion across the magnetic field. It is shown that the disturbances of these surfaces by the support field can be kept small by a proper choice of the system parameters. Author (ESA)

N80-17868# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ON PLASMA STABILIZATION IN PRESENCE OF AN INHOMOGENEOUS MAGNETIC VACUUM FIELD Research and Training Program on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
Bo Lehnert. Jul. 1979. 29 p. refs.
(TRITA-PFU-79-08) Avail: NTIS HC A03/MF A01

The problem of plasma stability in the presence of an immersed inhomogeneous magnetic vacuum field is examined in terms of the energy principle of magnetohydrodynamic disturbances. Physically relevant boundary conditions are discussed including those which exclude electric surface currents and take realistic current and pressure profiles into account. Two types of configurations are discussed in connection with electromagnetic mode stabilization by means of an inhomogeneous vacuum field. The low beta case of closed vacuum field geometry, and the high beta case of open vacuum field geometry (such as in Extrap configurations with a pinch being immersed in a strongly inhomogeneous transverse vacuum field), are examined. The latter condition replaces that of the Kruskal-Shafranov limit and predicts that stabilization is possible for long wave length kinks in Extrap geometry. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-17869 Wisconsin Univ. - Madison.
LOW-FREQUENCY DYNAMICS IN COOPERATIVE JAHN-TELLER SYSTEMS Ph.D. Thesis
Kok Ming Leung. 1979. 108 p.
Avail: Univ. Microfilms Order No. 7927186

Jahn-Teller crystals, the coupled phonon-pseudospin model of the ferroelectric KDP, one dimensional conductor, and the Dicke model of superradiance which are all characterized by

linear couplings between bosons and other dynamic variables are explored. A number of exact results are derived. With the help of these exact results, the low frequency dynamics in strain-induced Jahn-Teller systems are determined. The approach makes use of the general formalism developed recently for the low frequency dynamics of rare earth magnets with degenerate crystal field levels. Detailed studies of the dynamics in the slow and fast relaxation regime are made. As an application of the theory, the ultrasonic attenuation and electrical resistivity of TmZn are examined. Finally, the ultrasonic data in the alpha-phase of the superionic conductor, RbAg4I5, where a Jahn-Teller-like interaction has been proposed, are presented.
Dissert. Abstr.

N80-17870 Case Western Reserve Univ., Cleveland, Ohio
SECONDARY ELECTRON EMISSION FROM ALUMINUM ALLOY SURFACES. Ph.D. Thesis
Richard Ernest Chase. 1979. 98 p.
Avail: Univ. Microfilms. Order No. 8001452.

Secondary electron emission characteristics were determined for three aluminum alloys with two different surface compositions (natural oxide and chromate conversion layer). Except for a Rutherford backscattering study of one sample, all measurements were made in an ultrahigh vacuum system designed for Auger electron spectroscopy (AES) and equipped with a retarding grid, double pass cylindrical mirror analyzer (CMA). Modifications to the commercial AES electronics package and redesign of the sample carousel allowed three types of measurements to be made with the sample in front of the CMA: (1) Secondary electron energy distribution, (2) secondary electron emission coefficent, and (3) surface composition by AES.
Dissert. Abstr.

N80-17871 California Univ., Berkeley
INFRARED ABSORPTION SPECTROSCOPY OF CARBON MONOXIDE ON NICKEL FILMS: A LOW TEMPERATURE THERMAL DETECTION TECHNIQUE. Ph.D. Thesis
Robert Brian Bailey. 1979. 134 p.
Avail: Univ. Microfilms. Order No. 8000276.

Sensitive vibrational spectra of carbon monoxide molecules adsorbed on evaporated nickel films were measured by attaching a thermometer to the sample, cooling the assembly to liquid helium temperatures, and recording the temperature changes which occur when infrared radiation is absorbed. The measurements are made in an ultrahigh vacuum chamber in which the sample surface is cleaned, heated, exposed to gas molecules, and cooled to 1.6 K. The spectra of chemisorbed CO molecules are interpreted in terms of the linear and bridge absorption sites on the nickel surface. The spectra also shows how the distribution of molecules among these sites changes when the CO coverage increases and intermolecular forces become important. The spectra of physically adsorbed molecules in both monolayer and multilayer films are reported.
Dissert. Abstr.

N80-17872 Stanford Univ., Calif.
PART 1: ENERGY BARRIER FOR ELECTRON PENETRATION INTO NOBLE LIQUIDS. PART 2: DIELECTRIC PROPERTIES OF SUPERFLUID HELIUM-THREE. Ph.D. Thesis
Lawrence Lane Tankersley. 1979. 145 p.
Avail: Univ. Microfilms. Order No. 8002023.

The Galitskii approach is used to calculate the self energies in order to find the energy barrier opposing the penetration of electrons into liquid helium, neon, and argon. The energy is computed to second order in the s wave scattering length using the liquid structure factor to describe the actual two body correlations in the host liquid. Dielectric screening corrections to the electron-atom interaction are included for the cases of neon and argon. The predictions for the dielectric behavior of superfluid helium three A are reviewed. A molecular model is proposed to improve the description of the interaction between two polarized helium atoms.
Dissert. Abstr.

N80-17873 Brandeis Univ., Waltham, Mass.
BRILLOUIN AND RAMAN SCATTERING STUDIES OF SrTiO3 NEAR THE PHASE TRANSITION TEMPERATURE. Ph.D. Thesis
Chin-Bing Su. 1979. 139 p.
Avail: Univ. Microfilms. Order No. 7925729.

A single mode argon ion laser was used to study the Brillouin modes and the soft optic Raman modes near the 107 K structural phase transition in a stressed single domain crystal of SrTiO3. The direction acoustic phonon wave vector q was examined. All three Brillouin modes were studied under the same cool down run with reproducible results, and the Brillouin spectra were analyzed with a triple pass plane Fabry-Perot interferometer. The soft Raman spectra were analyzed with a grating spectrometer.
Dissert. Abstr.

N80-17874# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
GIANT MAGNETISM IN PRESSURE QUENCHED CADMIUM SULFIDE
R. K. MacCrone and C. G. Homan. Sep. 1979. 17 p. refs.
(DA Proj. 1L1-161102-H-60)
(AD-A076171; AD-E440049; ARLCB-TR-79023). Avail: NTIS. HC A02/MF A01. CSCL 20/3.

Large positive magnetism (paramagnetism) is reported in poly-crystalline CdS samples pressure quenched from above the semiconducting-conducting phase transition. This positive magnetism reaches a maximum magnetization approaching four gauss at fields between five and twelve KOe.
GRA

N80-17875# Pennsylvania State Univ., University Park. Materials Research Lab.
MAGNETOFERROELECTRICS, DIVERTABLE FERROELECTRICS AND PYROELECTRIC GLASS CERAMICS. Final Report, 22 Mar. 1976 - 21 Jun. 1979
R. E. Newnham, L. E. Cross, W. A. Schulze, and A. S. Bhalla. 21 Jun. 1979. 66 p. refs.
(Contract DAAG29-76-G-0145; DA Proj. 1T1-61102-BH-57)
(AD-A076202; ARO-13731.4-P). Avail: NTIS. HC A04/MF A01. CSCL 20/3.

The highlight of the past three years was the discovery of magnetoferroelectricity, a new type of ferroelectricity caused by the ordering of magnetic spins in a low symmetry arrangement. A magnetoferroelectric develops a reversible spontaneous electric polarization on passing through a magnetic phase transition. The effect was demonstrated on Cr2BeO4 which undergoes a phase transformation from a centric paramagnetic state to a complex antiferromagnetic state at 28K. Ceramic specimens can be poled electrically below the transition temperature to a remnant polarization about five orders of magnitude smaller than BaTiO3. Additional magnetoferroelectric studies have been carried out on single crystals of CrBeO4 and on certain mixed crystals in the Fe2O3-Cr2O3 system. Second harmonic signals were observed from PbZrO3 ceramics, verifying the acentric nature of this important end member of the PZT system. Divertable ferroelectrics are an interesting group of materials in which the spontaneous polarization can be reoriented, but not reversed. The results of some experiments on nickel iodine boracite, and on barium titanium germanate are described. A new class of pyroelectric materials is reported. Carefully crystallized lithium silicate glass-ceramics are found to be pyroelectric.
GRA

N80-17876# Missouri Univ.-Kansas City. Dept. of Physics.
MOLECULAR AND CRYSTALLINE ELECTROMAGNETIC PROPERTIES OF SELECTED CONDENSED MATERIALS IN THE INFRARED. Final Report, 1 Apr. 1978 - 30 Jun. 1979
Marvin R. Querry. 30 Aug. 1979. 266 p. refs.
(Contract DAAG29-76-G-0185; DA Proj. 1T1-61102-BH-57)
(AD-A076502; ARO-13739.9-GS). Avail: NTIS. HC A12/MF A01. CSCL 20/8.

By using water as a reflectance standard, relative specular reflectance spectra in the infrared were measured for 38 materials including aqueous solutions of zinc chloride, phosphoric acid, and nitric acid; and for diesel fuel, fog oil, tetramethyl-tetraphenyl-trisiloxane, 1-hexadecanol, 1-octadecanol, 1-eicosanol, rutile, lucite, limestone, and natural waters. Spectral values of the complex refractive indices, suitable for Mie scattering computations, were computed and tabulated by use of Kramers-Kronig analysis. The spectra were further analyzed in terms of fundamental intra and inter-molecular vibrational modes. Transmittance spectra of powders pressed in a KBr matrix were also measured. Powders were montmorillonite, colemanite, Kernite, Kaolin, Lampblack, activated charcoal, and wood charcoal. Analysis of the transmit-

fance spectra was not completed but is still underway during continuation of this research. Tabulations of all complex refractive indices were supplied to the Aerosol/Obscuration Science Group at the Aberdeen Proving Ground, Md. GRA

N80-17877# Aerospace Corp., El Segundo, Calif.
FABRICATION AND ELECTRICAL PROPERTIES OF EPITAXIAL PbTe METAL-INSULATOR-SEMICONDUCTOR STRUCTURES Interim Report
P. H. Zimmermann, M. E. Mathews, and D. C. Joslin 30 Aug. 1979 24 p refs
(Contract F04701-78-C-0079)
(AD-A075778; TR-0079-4970-20-1; SAMSO-TR-79-92) Avail: NTIS HC A02/MF A01 CSCL 09/1

Methods for the fabrication of metal insulator semiconductor structures with the use of epitaxial PbTe films are described. These methods obviate the need for treating the semiconductor surface. They involve epitaxial film growth in a vacuum environment by hot-wall epitaxy followed by (1) deposition of ZrO2 without breaking vacuum and (2) deposition of pyrolytic SiO2. Capacitance-voltage characteristics in both cases closely correspond to theoretical values. Depletion layer generation is shown to be the dominant contribution to the inversion conductance. GRA

N80-17878# Aerospace Corp., El Segundo, Calif. Electronic Research Lab.
JOSEPHSON JUNCTION CHARACTERIZATION FROM IMPEDANCE MEASUREMENTS Interim Report
Helmut Kanter 14 Sep. 1979 27 p Supersedes ATM-78(3727)-1
(Contract F04701-78-C-0079)
(AD-A075216; TR-0079(4727)-1; ATM-78(3727)-1; SAMSO-TR-79-54) Avail: NTIS HC A03/MF A01 CSCL 20/12

Voltage biased junctions in SQUID type configurations show a characteristic response in their MW impedance, which as indicated by a small signal analysis appears primarily determined by the junction termination at the low frequency idler. The evaluation of the response affords the measurement of some circuit and junction parameters which cannot otherwise be obtained from I-V measurements and thus could be considerable help in characterizing Josephson junctions in microwave circuits. GRA

N80-17879# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
GaAs MONOLITHIC MICROWAVE SUBSYSTEM TECHNOLOGY BASE
J. Oakes and D. W. Maki Jun. 1979 61 p refs
(Contract N00014-78-C-0268; DARPA Order 3543)
(AD-A075287; Rept-78-0941) Avail: NTIS HC A04/MF A01 CSCL 20/12

In the materials area, effort on this program during the first six months has been devoted to process technology development, and materials study and qualification. Equipment delays and malfunctions have limited progress however, direct implants and implants into both VPE and LPE were investigated with encouraging results. Investigation of self aligned gate FET's have shown high gate resistance and feedback capacitance, and corresponding low gain, resulting in a decision to revert to realized gate FET's. Interdigital capacitors with values up to 2 pf have been fabricated for use as tuning capacitors. A one bit phase shifter has been designed using lumped elements and Schottky barrier chip diodes. Testing was delayed, however, by a mask error which is being corrected. GRA

N80-17880# Honeywell Corporate Technology Center, Bloomington, Minn.
GROWTH OF SINGLE CRYSTAL GALLIUM PHOSPHIDE BY LIQUID PHASE EPITAXY AND SYNTHESIS SOLUTE DIFFUSION Final Technical Report, 1 Apr. 1977 - 30 Sep. 1978
P. E. Petersen, R. G. Schulze, and S. R. Peterson Apr. 1979 121 p refs
(Contract F33615-77-C-5043; AF Proj. 2423)
(AD-A075065; HR-4710B; AFML-TR-79-4049) Avail: NTIS HC A06/MF A01 CSCL 20/2

The objective of this research program was to further develop the synthesis-solute-diffusion (SSD) and liquid-phase epitaxy (LPE) techniques for the growth of high-quality gallium phosphide. This program resulted in the growth of epitaxial layers of GaP which had excellent growth morphology and carrier concentrations approximately 3 over 5 x 10 to the 15 power. The SSD technique was advanced so that low dislocation density bulk GaP could be grown. Carbon was identified as the principal acceptor in this material which limited the carrier concentration to approximately 3 over 2 x 10 the 16 power. An extensive materials evaluation program was conducted as a part of this development. The morphology of the grown material was analyzed by optical and electron-microscopic techniques. Hall and resistivity analysis was used to determine the majority carrier transport properties. The carrier concentration profiles were determined by capacitance-voltage measurements. The deep levels were investigated by photocapacitance spectroscopy, and the minority carrier diffusion lengths were measured by the Schottky-barrier photo current technique. GRA

N80-17881# Stanford Univ., Calif. Center for Materials Research.
PREPARATION AND CHARACTERIZATION OF SINGLE CRYSTALS AND EPITAXIAL LAYERS OF SILICON CARBIDE BY MOLTEN SALT ELECTROLYSIS Annual Report, 15 Jul. 1978 - 14 Jul. 1979
T. H. Geballe, R. S. Feigelson, and D. Elwell Oct. 1979 29 p refs
(Contract N00014-78-C-0489; RR0210203)
(AD-A076281; CMR-243-026-001) Avail: NTIS HC A03/MF A01 CSCL 20/2

The synthesis of silicon carbide by electrolysis of molten salts has been achieved for the first time. Two systems have been investigated, one involving K2SI F6 and LI2 CO3 Dissolved in a KF/LI F eutectic, the other being a combination of NA2 CO3 and Si O2 with Na BO3 and Li F. The latter system has given much more reproducible results. In both cases, electrolysis has proceeded at about 750 C which is very low in comparison with the melting point of silicon carbide. Synthesis of Si C at temperatures below 1000 C does not appear to have been previously reported. Possibly because of the low deposition temperature, it has been found necessary to use deposition potentials which are appreciably highter than the minimum value. This use of relatively high deposition potentials and corresponding current densities leads to irregular growth morphology and to deposition of metastable 2 H and 33 R polytypes rather than the stable 6 H or 15 R. The Si C is co-deposited with an excess of amorphous carbon. Changes in melt composition to reduce the carbonate to silicate ratio are necessary to eliminate this excess. Initial deposits are relatively impure, the major contaminants being constituents of the inconel furnace lining. GRA

N80-17882# Naval Research Lab., Washington, D. C.
BROADBAND GaAs MESFET POWER AMPLIFIER DESIGN ASPECTS Final Report
H. A. Willing and W. H. Ku Oct. 1979 50 p refs
(AD-A075692; NRL-8334) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report presents design aspects of ultra-wideband Ga As MESFET power amplifiers which are directed to ECM and EW system applications. Fundamental gain-bandwidth limitations are derived for state-of-the-art Ga As MESFET power devices. Broadband designs are developed in the 2- to 18- GHz range using analytical and computer-aided optimization techniques. These designs are based upon small-and large-signal device characterization and modeling. Presented are systematic procedures required to arrive at the final designs. Modeling techniques and their utilization as a tool in achieving optimum performance are described. Included in this report is a discussion of the laboratory methods employed to perform small-and large-signal device characterization and analysis. GRA

N80-17883# Edinburgh Univ. (Scotland). Dept. of Physics.
AN INVESTIGATION OF THE DYNAMICAL PROPERTIES OF CRYSTALS BY RAMAN SPECTROSCOPY Final Report, 29 Aug. 1977 - 30 Jun. 1979
W. Taylor Jun. 1979 14 p refs

(Grant DA-ERO-77-G-076)
(AD-A072968) Avail: NTIS HC A02/MF A01 CSCL 20/2

This report describes light scattering measurements from a variety of materials which undergo structural phase transitions. The materials studied include boracites, lead germanate and perovskites and the studies have found new transitions, determined the nature of the soft mode and detailed the changes in the spectra due to the presence or addition of impurities. In addition associated theoretical work has questioned the validity of the usual way of interpreting soft mode results obtained from light scattering techniques. An experiment was also performed to study the light scattering from magnons in a mixed antiferromagnet. GRA

N80-17884# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
ANNEALING OF ION-IMPLANTED SILICON BY AN INCOHERENT LIGHT PULSE
H. A. Bomke, H. L. Berkowitz, M. Harmatz, S. Kronenberg, and R. Lux Jul. 1979 8 p refs Repr. from Appl. Phys. Lett., v. 33, no. 11, 1 Dec. 1978 p 955-957
(DA Proj. 1L1-61101-A-91A)
(AD-A073495; DELET-TR-79-18) Avail: NTIS HC A02/MF A01 CSCL 20/12

Annealing of boron-implanted silicon by a single 15-microsecond pulse from a flash lamp has been observed. The required energy density was 27 joules per square centimeter incident on the silicon. Electrical activity of boron was comparable to that in thermally annealed samples. GRA

N80-17885# Brookhaven National Lab., Upton, N. Y.
INTERACTION BETWEEN ELECTRONS AND TUNNELING LEVELS IN METALLIC GLASSES
J. L. Black and B. L. Gyorffy 1978 5 p refs Presented at 15th Conf. on Low Temperature Phys., Grenoble, France, 23 Aug. 1978
(Contract EY-76-C-02-0016)
(BNL-24235; CONF-780824) Avail: NTIS HC A02/MF A01

A simple model in which the conduction electrons of a metallic glass experience a local time-dependent potential due to two-level tunneling states is considered. The model exhibits interesting divergent behavior which is quite different from that predicted by an earlier s-d Kondo model. DOE

N80-17886# Rochester Univ., N. Y.
GROUND STATE PROPERTIES AND ENERGY PARAMETERS OF THE ANDERSON LATTICE SYSTEM, CeAl2
R. D. Parks, L. C. Kupferberg, M. C. Croft (Rutgers - The State Univ., Piscataway, N. J.), S. M. Shapiro (BNL), and E. Gurewitz (BNL) 1978 7 p refs Presented at Colloq. of Phys. of the Metallic Rare Earths, St. Pierre de Chartreuse, France, 4 Sep. 1978
(Contract EY-76-C-02-0016)
(BNL-24655; CONF-780913-3) Avail: NTIS HC A02/MF A01

Results of magnetostriction and thermal expansion measurements on CeA12 in and near the antiferromagnetic (AF) phase are summarized. Preliminary results of an ongoing neutron scattering study are also included. The AF phase boundary in the H-T plane, the nature of the reorientation of the AF domains in field, and the evolution of the AF order parameter in field are among the topics covered. The nature of the AF fluctuations above T sub N and the magnetic exchange between Ce atoms are also discussed. J.M.S.

N80-17887# National Physical Lab., Teddington (England). Div. of Electrical Science.
PRELIMINARY EXPERIMENTS ON THE FEASIBILITY OF FABRICATING STABLE JOSEPHSON POINT CONTACTS FOR SUBMILLIMETER-WAVELENGTH RECEIVERS
T. G. Blaney and N. R. Cross Apr. 1979 89 p refs
(NPL-SI-89/0414; ESA-CR(P)-1235) Avail: NTIS HC A05/MF A01

The feasibility of constructing point contacts which are mechanically and electrically stable was investigated in the context of conditions of repeated temperature cycles between 300K and liquid He temperature, and quality and geometry compatible with use at submillimetric wavelengths. The experiments were concentrated on one form of device consisting of a contact between two niobium wires (130 micrometers diameter) which is sealed into, and supported by a glass tube encapsulation. The dc characteristics of the devices were monitored at both test temperatures. The laser-sealed devices are sufficiently promising to warrant further development. The best of the tested devices could be repeatedly cycled without change in electrical or mechanical characteristics. The tests show that the remaining quality problems can probably be solved by sealing the devices in vacuum. Author (ESA)

N80-17888# Loughborough Univ. of Technology (England). Dept. of Mathematics.
THE DEVELOPMENT OF A GENERAL SURFACE UNDER ION BOMBARDMENT
R. Smith Sep. 1978 21 p refs
(Maths-Res-130) Avail: NTIS HC A02/MF A01

The numerical calculations used to determine the development of surface topography during ion beam sputtering are presented. The theory is applied both to a three dimensional example and to an example illustrating the effects of a nonuniform ion beam. Results for the surface erosion of an elliptical hummock indicate the development of an edge along the top of the hummock parallel to the major axis of the ellipse which develops into a more pointed structure. The effect of a Gaussian beam, is depicted graphically and shows that for a wide beam, a circle erodes into a wedge like structure. Author (ESA)

N80-17889# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
STUDY OF THE FORMATION PROCESS FOR COMPOUND AGGREGATES: APPLICATION TO IONIZED CLUSTER BEAM DEPOSITION OF GaAs THIN FILMS Final Report [ETUDE DU PROCESSUS DE FORMATION D'AGREGATS DE COMPOSES APPLICATION AU DEPOT EN COUCHES MINCES DE GaAs L'AIDE D'UN FAISCEAU D'AGREGATS CHARGES]
A. Mircea-Roussel Jul. 1979 22 p refs In FRENCH; ENGLISH summary
(Contract DGRST-78-7-0315)
(LEP-79/538.SME-651-B) Avail: NTIS HC A02/MF A01

The ionized cluster beam deposition technique was used in growing layers of the 3-5 compound InAs. Two separate sources for the elements and a mixing chamber were used. Results show that InAs layers are obtained only under very restrictive conditions. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-17890 Stanford Univ., Calif.
RAYLEIGH-BENARD CONVECTION FROM THERMODYNAMIC FLUCTUATIONS Ph.D. Thesis
Bharat S. Jhaveri 1979 76 p
Avail: Univ. Microfilms Order No. 8001943

The evolution of cellular convection from disturbances present in an initially conducting but potentially unstable fluid system is studied. A weakly supercritical transient Rayleigh-Benard problem is considered. The random initial value problem is formulated by deriving the system of Ito-stochastic differential equations for the random Fourier amplitudes of evolving disturbances, and specifying the statics of the random forcing and initial values. An approximate ensemble for the random evolution is constructed by Monte Carlo simulation. The influence of random forcing during different stages of evolution is examined. Time dependent moment properties of interest generated from the approximate ensemble are discussed and the onset time for instability is evaluated. Highly supercritical conditions are investigated. Dissert. Abstr.

N80-17891 California Univ., Berkeley.
A COMPARISON OF SYSTEM PARAMETER IDENTIFICATION METHODS AS APPLIED TO A PARTICULAR THERMAL DYNAMICS PROBLEM Ph.D. Thesis
Peter VanBlarigan 1979 135 p
Avail: Univ. Microfilms Order No. 8000254

A method of cooling the detonators to -54 C in minimum time, with assurance that the temperatures are uniform and accurate is described. A mathematical system model was used to predict minimum cooling time. Due to the complexity of the detonator, the model was predicted using a system identification approach. Five identification methods were tested and evaluated. The five methods were least squares, stochastic approximation, sequential learning, model reference adaptive system, and heuristic identification. The system to be identified was assumed to be an eighth order discrete linear system. A state space configuration was used, and each state variable, or temperature, was measured to obtain the system output for identification. The Stochastic Approximation and Sequential Learning methods were found to work the best. Dissert. Abstr.

N80-17892# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
SUPERCOOLED AND SUPERHEATED WATER
C. A. Angell Oct. 1979 40 p refs
(Contract N00014-78-C-0035)
(AD-A076152) Avail: NTIS HC A03/MF A01

Various thermodynamic, transport and structural features of water in its metastable states, both supercooled and superheated, have been determined in recent years, and highly anomalous behavior has been found near the limiting temperatures in each case. For example, the heat capacities increase exponentially at each extreme. In the high temperature extreme this behavior is predictable from van der Waals theory, but the low temperature anomaly is not. The measurements will be reviewed, with emphasis on the more extensively studied supercooled states at normal and high pressure, and evidence will be given that the low temperature anomalies can be described by expressions containing a singular temperature closely associated with the temperature of homogeneous nucleation of ice I. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-17893 Stanford Univ., Calif.
COMPUTATIONAL ISSUES IN LINEAR LEAST SQUARES ESTIMATION AND CONTROL Ph.D. Thesis
John Anthony Newkirk 1979 250 p
Avail: Univ. Microfilms Order No. 8001980

Various approaches to solving the matrix Riccati equation are examined. Scattering theory is used to provide a pure derivation of several square root algorithms. A set of criteria for choosing among these algorithms is presented and examined with empirical evaluations. Differentiating criteria include sensitivity to repeated closed-loop eigenvalues, the impact of singular model parameters, computational accuracy, and the rate of convergence. Sensitivity to parameter uncertainty in discrete-time systems is considered using a quadratic minimization of a generalized cost function. This same algorithm is used to design arbitrary-order compensation using complete system information. For discrete-time systems, the square root doubling algorithms are found to be comparable to the eigenvector decomposition algorithms in terms of memory requirements, elapsed computation time, and performance. The doubling algorithms are also found to solve a wider class of problems. Dissert. Abstr.

N80-17894 Stanford Univ., Calif.
CRISIS DECISION ANALYSIS Ph.D. Thesis
Burke Edward Robinson 1979 118 p
Avail: Univ. Microfilms Order No. 8001999

A modeling procedure, adapted from standard decision analysis methods, that guides the structuring, assessment, and analysis of crisis decisions. Features of the crisis modeling procedure include: (1) identify and structure all those, and only those, variables that may change the decision; (2) assess probable outcomes quickly and efficiency; and (3) indicate, at any moment, the best decision and the value of further modeling. Concepts and associated techniques for constructing a skeleton model are suggested and described including template, sequence, influence, tree, preference, and inquiry. Outcome assessments are made only after the procedure indicates that a new alternative or event should be added to the model and are assessed as estimates rangine from the worst probable to the best probable outcomes. The procedure is used to model the Mayaguez crisis of 1975 and a proposed corporate crisis concerning the purchase of ore. Dissert. Abstr.

N80-17895 Stanford Univ., Calif.
THE CONCEPT OF INFLUENCE AND ITS USE IN STRUCTURING COMPLEX DECISION PROBLEMS Ph.D. Thesis
Daniel Lee Owen 1979 140 p
Avail: Univ. Microfilms Order No. 8001983

A general mathematical characterization of the influence between random variables in a decision problem is described. The definition of influence can serve the decision analyst by helping him to conceptualize and communicate the relationship of the probability distributions on different variables in a probabilistic decision model. The definition of influence supports a calculus of influences that allows one to compute the total influence of one variable on another even when there are several intermediate variables. Using this influence calculus, the importance of a particular variable to the decision model can be determined. An immediate consequence is a recommendation for which variables to include in the model and whether the uncertainty about a variable is important. The theoretical bases of the influence method and conventional discretization are compared. Dissert. Abstr.

N80-17896 California Univ., Berkeley.
INTERVAL ELIMINATION METHODS FOR INTERACTIVE OPTIMIZATION OF MULTIPLE OBJECTIVES Ph.D. Thesis
Anthony Neal Payne 1979 151 p
Avail: Univ. Microfilms Order No. 8000476

The tradeoff problem arising when multiple, conflicting objectives must be optimized is considered and a man machine interaction methodology by which the decision-maker can efficiently and accurately estimate his preferred objective value from the tradeoff set is developed. A model of a special class of decision-makers for which an inverval representation defines an interval of uncertainty containing the preferred objective value is proposed. A measure of worst-case uncertainty is formulated as a criterion for optimal strategies and the bi-objective tradeoff problem is studied in detail. The worst-case uncertainty is minimized to derive optimal strategies. These stragies are then used to develop a general algorithm. Finally, the general multi-objective tradeoff problem is considered. An efficient strategy for placing experiments is proposed and used to devise a general interval elimination method in algorithmic form. Dissert. Abstr.

N80-17897# RAND Corp., Santa Monica, Calif.
BUNCHED LAUNCH, BUNCHED ACQUISITION, AND WORK-AROUNDS-ELEMENTS OF ALTERNATIVE SPACECRAFT ACQUISITION POLICIES Interim Report
B. W. Augenstein, David Dreyfuss, and Anson G. Parish Oct. 1979 74 p
(Contract F49620-77-C-0023)
(AD-A076490; RAND/R-2166-AF) Avail: NTIS HC A04/MF A01 CSCL 22/2

A review of spacecraft acquisition policy to determine whether, and to what degree, variations in acquisition methods can lower total space system costs without loss of operational capability.

The authors conclude that there is an alternative to the conventional acquisition strategy; it would involve changes both in the conventional procurement process and in the conventional launch process. This alternative decreases system costs while increasing operational capability, and is equally useful with either an expendable booster or a Space Transportation System recoverable booster used for launch. The concept would call for bunched launch (launching the total mission-required spacecraft in as short a time as possible) and bunched procurement (buying the total number of satellites needed at one time) necessitating accommodations to institutional constraints and the present legal and regulatory framework. GRA

N80-17898# Decision Research Corp., Eugene, Oreg.
BEHAVIORAL ASPECTS OF COST-BENEFIT ANALYSIS
Baruch Fischhoff Jan. 1979 38 p refs
(Contract N00014-79-C-0029; ARPA Order 3668)
(AD-A075099; PTR-1077-79-1) Avail: NTIS
HC A03/MF A01 CSCL 05/10

Characteristic limits of cost benefit analysis techniques are surveyed. These include: (1) the unavailability of necessary inputs o to the analysis; (2) the absence of procedures for assessing the validity of an analysis; and (3) the necessary incompleteness of any formal model of a decision situation. The usefulness of cost benefit analysis as a management tool is emphasized. J.M.S.

N80-17899# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Dept. of Systems Management.
INTERACTIVE PROGRAMMING FOR MANAGEMENT AIDS TO DECISION MAKING: QUEUEING THEORY APPLIED M.S. Thesis
Paul Hamilton Sep. 1979 131 p
(AD-A076982; AFIT/GSM/SM/79S-6) Avail: NTIS
HC A07/MF A01 CSCL 05/10

Quantitative models for decision-making are useful only if they are available to those who must make the decisions. QUEUE1, an interactive computer program which incorporates six basic queueing theory models, was developed. QUEUE1 and instructions were designed for use by mid-level managers who do not have an extensive knowledge of computer operations or modeling theory. QUEUE1 was tested on five individuals. Test results lead to the conclusion that interactive programming techniques can present quantitative models to non-technical managers in a useable format. GRA

N80-17900# General Technology Systems Ltd., London (England).
STUDY AND IMPLEMENTATION OF AN ESA COMPUTERIZED PLANNING SYSTEM. VOLUME 1: PLANNING SYSTEM FUNCTIONS AND STRUCTURE Progress Report
R. Brunt, G. E. Hall, and L. W. Steings Jan. 1978 154 p 3 Vol.
(Contract ESA-3172/77-F-WMT)
(GTS-760972-Vol-1; ESA-CR(P)-1222-Vol-1) Avail: NTIS
HC A08/MF A01

The program structure, system functions, user and data requirements are presented for a computerized system used for planning, decision making, and information retrieval within the European Space Agency. The programs, written in FORTRAN 4, permit analysis of cost data, manipulation of price levels, currencies, cost elements, prediction of national space expenditure capabilities, and the margin available for new projects, as well as the selection of projects relative to the margin, and a comparison of manpower requirements with forecast industrial capacity. Author (ESA)

N80-17901# General Technology Systems Ltd., London (England).
STUDY AND IMPLEMENTATION OF AN ESA COMPUTERIZED PLANNING SYSTEM. VOLUME 3: PROGRAM DOCUMENTATION Progress Report
G. E. Hall, N. R. Craddock, W. Spiess, and P. Thermann Oct. 1978 213 p 3 Vol.
(Contract ESA-3172/77-F-WMT)
(GTS-760972-Vol-3; ESA-CR(P)-1222-Vol-3) Avail: NTIS
HC A10/MF A01

The computer implementation aspects of a computerized planning system for ESA are described. Both the configurations of the programs and of the 15 data files, deduced using some basic rules, are described. The derivation of the program structure is discussed along with the data file derivation. Tables of intrinsic data are presented. Author (ESA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-17902 California Univ., Berkeley.
SEARCH MECHANISMS FOR LARGE FILES Ph.D. Thesis
Marie-Anne Kamal Neimat 1979 194 p
Avail: Univ. Microfilms Order No. 8000460

Search methods for files that are sorted and sequentially stored on secondary storage are studied. The method of successive linear interpolation (SLI) is analyzed. It is shown that SLI takes on the order of log log N searches to locate a key in the file of N sorted, uniformly distributed keys. The method of SLI is compared to false position and binary search methods. An algorithm which selects (under certain conditions) the optimum partition of data blocks into clusters for tree structured indexes is presented. This algorithm runs in time M(3), where M is the number of blocks in the file. Also presented are nonoptimal, linear time algorithms, which also yield structures giving file access times significantly less than that of the original full tree. The organization and memory management of the index trees for sequential files are considered. Dissert. Abstr.

N80-17903 Indiana Univ., Bloomington.
A MATHEMATICAL MODEL TO EVALUATE THE EFFECTS ON RETRIEVAL TIMES OF ALTERNATE STRUCTURES FOR LIBRARY DATABASE DESIGN Ph.D. Thesis
Karen Andrea Momenee 1979 273 p
Avail: Univ. Microfilms Order No. 8000709

A model is developed to aid in choosing the most efficient data structures for library databases. The model consists of two parts: an information model which can be totally divorced from the machine implementation and enables the designer to describe the contents of the database and query stream in set theoretic terms; and a retrieval model which simulates the operation of the database and measures retrieval time for various structural configurations and query forms in terms of seeks (or access movements) and rotations of the disk. Assumptions in previous models of a uniform distribution of attribute-values are replaced with bibliometric distributions based on author productivity and the frequency of occurrence of words in natural language. These distributions are used to generate the queries and as a statistical sketch to describe the probable contents of the database. Dissert. Abstr.

N80-17904*# National Aeronautics and Space Administration, Washington, D. C.
THE POTENTIALITIES OF SEVERAL DATA PROCESSING SYSTEMS FOR COMPRESSING INFORMATION
Yu. K. Khodarev Feb. 1971 24 p refs Transl. into ENGLISH of "potentsial'nyye vozmozhnosti szhatiya informatsii nekotorykh sistem obrabotki dannykh", Rept. Pr-24 Acad. of Sci. U.S.S.R., Inst. of Space Res., Moscow, 1970 24 p Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-2035)
(NASA-TT-F-13845; Pr-24) Avail: NTIS HC A02/MF A01
CSCL 05B

The data compression coefficient of systems for gathering and processing data from spacecraft is classified. The extremal probability distributions give the values of the maximal and minimal mean coefficient of frame compression for any values of the mean number of active channels in the frame. It is found that the real coefficients of frame compression are close to the minimally possible ones for the obtained values of the mean number of active channels in the frame. Author

N80-17905*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AOIPS DATA RETRIEVAL SYSTEM (DRS) SUPPORT FOR GARP SEA ICE AND RAIN RATE DATA SETS
K. W. Posey Nov. 1978 38 p
(NASA-TM-79686) Avail: NTIS HC A03/MF A01 CSCL 05B

The functional capabilities which are incorporated into the Goddard Space Flight Center Atmospheric and Oceanographic Information Processing System (AOIPS) Data Retrieval System (DRS) are identified. These capabilities provide access to sea ice concentration and ocean rainfall rate data sets produced from the Nimbus-5 and Nimbus-6 Electrically Scanning Microwave Radiometer brightness temperature measurements for the Global Atmospheric Research Program Project during its Data Systems Tests. This support consists of four basic functions: (1) an inventory capability which provides a description of the contents of each tape resident sea ice and rain rate data set; (2) a selective tape to tape copy capability which allows for the creation of a subset data tape containing only those data sets of interest; (3) a data set selection capability whereby the contents of a specific data set can be displayed or printed or transferred to disk for further processing; and (4) an image display capability which allows for specified data sets to be transformed into a digital image format for subsequent display and analysis on the AOIPS image analysis terminals. J.M.S.

N80-17906# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.
THE INTELLIGENT MEMORY SYSTEM ARCHITECTURE RESEARCH DIRECTIONS
Chat-Yu Lam and Stuart E. Madnick Aug. 1979 46 p refs
(Grant N00039-78-G-0160)
(AD-A073485; CISR-M010-7908-01; CISR-TR-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

Information storage, retrieval, communication, and processing have become increasingly important for modern command and control systems. Conventional computers are primarily designed for computational purposes and are not well-suited for information management. This report introduces the concepts and research directions of the Intelligent Memory System (IMS), which is particularly designed for large-scale information management to support future command and control systems. Author (GRA)

N80-17907# Bundesministerium fuer Wissenschaft und Forschung, Vienna (Austria).
AUTOMATED RETRIEVAL OF SCIENTIFIC INFORMATION IN AUSTRIA [DATEN, DIENSTE, DOKUMENTE 3: AUTOMATISIERTE WISSENSCHAFTS- INFORMATIONS-SYSTEME IN OESTERREICH. BESTANDSAUFNAHME]
1978 107 p Partly in ENGLISH and GERMAN
(ISBN-3-7002-0461-2) Avail: NTIS HC A06/MF A01

The problems caused by the increase in scientific publishing and the efforts to ameliorate the situation through the use of computerized retrieval systems are discussed. The equipment and systems available in Austria are surveyed. Prospects for the development of new systems are examined. Author (ESA)

N80-17908# British Library, London (England). Graphic Information Research Unit.
TWO EXPERIMENTS ON THE LAYOUT OF INFORMATION ON COMPUTER OUTPUT MICROFILM. 1: COLUMN SPACING AND HORIZONTAL CODING IN TABLES AND INDEXES. 2: SINGLE VERSUS DOUBLE COLUMN FORMATS FOR CINE AND COMIC MODE LIBRARY CATALOGUES
Linda Reynolds and Herbert Spencer Jan. 1979 66 p
(BLRDR-5480) Avail: British Library Lending Div., Boston Spa, Engl.

The effects of column spacing and horizontal coding on a subject's ability to read across between two columns of information, and the ease of use of single versus double column formats for cine and comic mode library catalogs were investigated in an effort to improve the readability of information on computer output microfilm. Results show that both column spacing and horizontal coding significantly affect the speed with which the task is performed. The use of a line space or a line space with a rule after every fifth entry, or with leader dots between columns is recommended. Column spacing had no effect on the scores obtained. An interaction was found between the complexity and length of the entries and the chosen format in terms of ease of use of the catalog. This interaction affects the spatial relationship between adjacent entries. A.R.H.

N80-17248 Army Engineer Waterways Experiment Station, Vicksburg, Miss.
TECHNICAL INFORMATION RESOURCES FOR THE SHOCK AND VIBRATION COMMUNITY
Edward J. Kolb *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 11-18 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-17909# Planco, Inc., Dallas, Tex.
SURVEY OF THE RESEARCH INTO ENERGY-ECONOMIC INTERACTIONS. VOLUME 2: ANNOTATED BIBLIOGRAPHY
R. Coates, D. Hanson, S. Tuenger, and J. Kennington Apr. 1979 423 p
(Contract EI-78-C-01-6346)
(DOE/TIC-10134-Vol-2) Avail: NTIS HC A18/MF A01

Abstracts of about 400 articles, books, and reports cited in Planco's 'Survey of the Research into Energy-Economy Interactions: Volume I are reported'. It represents the end result of a search for recent (1960 to present) and ongoing research into energy-economy interactions. Only the research directly related to macroeconomic energy-economy interactions was selected for inclusion in the annotated bibliography. Abstracts are provided. DOE

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-17910# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1981, PART 1
Washington GPO 1980 798 p refs Hearings on S. 2240 before the Comm. on Commerce, Sci., and Transportation, 96th Congr., 2d Sess., 1980
(GPO-57-406) Avail: Comm. on Commerce, Sci., and Transportation

Highlights of NASA programs are presented along with justifications for a proposed budget of $5,736.7 million for research and development, research and program management, and construction of facilities. A supplemental budget for the space shuttle program is included. A.R.H.

N80-17911# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA SUPPLEMENTAL AUTHORIZATION FOR FISCAL YEAR 1979
Washington GPO 1979 10 p Report on H.R. 1787 of the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 10 May 1979
(S-Rept-96-128; GPO-39-010) Avail: U.S. Capitol, Senate Document Room

A bill is presented which authorizes the appropriation of $185 million in additional funds to NASA for FY 1979 to be used for space shuttle orbiter production activities. The funding requirement is not due to any single program element, but to several items including the orbiter, main engines, solid rocket boosters, external tank, and thermal protection system. A.R.H.

N80-17912# Committee on Commerce, Science, and Transportation (U. S. Senate).
PATENT POLICY, PART 1
Washington GPO 1979 461 p refs Hearings on S. 1215 before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 23 and 27 Jul.; 25 Oct. 1979
(GPO-52-476) Avail: Subcomm. on Sci., Technol., and Space

Federal patent policies which were originally designed to protect the public interest by preventing the so-called give away, have operated to discharge contractor bidding thus eliminating incentives to innovate or disclose new ideas, and to delay the commercialization of inventions developed under Federal contract. A bill is presented and discussed, which will establish and maintain a Federally policy for the management and use of the results of government funded science and technology research and development. A.R.H.

N80-17913# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1981, PROGRAM REVIEW, VOLUME 1
Washington GPO 1979 649 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 16-18 Oct. 1979
(GPO-53-814) Avail: Subcomm. on Space Sci. and Applications

The status of NASA programs is reviewed as a preliminary to fiscal 1981 authorization hearings. Problems of cost, performance, and scheduling which can affect the budget program performance are examined. Particular emphasis is given to advanced research and development, technology utilization, and aerospace technology transfer in communications, space processing, energy conversion, electric propulsion systems, life sciences, planetary exploration, astrophysics, solar terrestrial interactions, and Earth resources observation. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-17914 Stanford Univ., Calif.
THE USE OF THE MACROANALYTIC MODELS FOR TRANSIT PLANNING IN SUBURBAN AREAS
Ph.D. Thesis
Wei-Yue Lim 1979 241 p
Avail: Univ. Microfilms Order No. 8001960

The use of macroanalytic models to form the basis for transit planning in suburban areas is discussed. The framework developed for using these models for planning consists basically of three steps: (1) the development of performance charts for fixed route and dial-a-ride service using transit supply relationships; (2) the incorporation of demand models with supply models to form a supply-demand equilibrium model; and (3) the use of macroanalytic models for the partial optimization of transit designs in the presence of multiple conflicting performance criteria.
Dissert. Abstr.

N80-17915# Committee on Commerce, Science, and Transportation (U. S. Senate).
NATIONAL TECHNOLOGY INNOVATION ACT
Washington GPO 1979 432 p refs Hearings on S. 1250 before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 21, 27 Jun. and 21 Nov. 1979
(GPO-50-438) Avail: Subcomm. on Sci., Technol., and Space

The status of industrial innovation in the United States is reviewed, and the provisions of a bill to establish centers for industrial technology where universities and industries can collaborate in the generation of new ideas for technology are discussed. The proposed Office for Industrial Technology within the Department of Commerce, will (1) oversee the relation between technology and the economic and social well being of the country; (2) provide data, analysis, and judgement necessary to enhance the development of technology and innovation; and (3) support the technology broadly applicable to industrial development. A.R.H.

N80-17916*# Garrett Corp., Torrance, Calif.
ADVANCED ELECTRIC PROPULSION SYSTEM CONCEPT FOR ELECTRIC VEHICLES
A. E. Raynard and F. E. Forbes Aug. 1979 157 p refs
(Contracts EC-77-A-31-1044; DEN3-81)
(NASA-CR-159651; DOE/NASA/0081-79/1; AiResearch-79-16182) Avail: NTIS HC A08/MF A01 CSCL 13F

Seventeen propulsion system concepts for electric vehicles were compared to determine the differences in components and battery pack to achieve the basic performance level. Design tradeoffs were made for selected configurations to find the optimum component characteristics required to meet all performance goals. The anticipated performance when using nickel-zinc batteries rather than the standard lead-acid batteries was also evaluated. The two systems selected for the final conceptual design studies included a system with a flywheel energy storage unit and a basic system that did not have a flywheel. The flywheel system meets the range requirement with either lead-acid or nickel-zinc batteries and also the acceleration of zero to 89 km/hr in 15 s. The basic system can also meet the required performance with a fully charged battery, but, when the battery approaches 20 to 30 percent depth of discharge, maximum acceleration capability gradually degrades. The flywheel system has an estimated life-cycle cost of $0.041/km using lead-acid batteries. The basic system has a life-cycle cost of $0.06/km. The basic system, using batteries meeting ISOA goals, would have a life-cycle cost of $0.043/km. A.R.H.

N80-17917*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ROADSIDE TREE/POLE CRASH BARRIER FIELD TESTS
A. H. Wilson 15 Nov. 1979 52 p refs
(Contract NAS7-100)
(NASA-CR-162788; JPL-Pub-79-114) Avail: NTIS HC A04/MF A01 CSCL 13F

A series of tests was carried out to evaluate the performance of a crash barrier designed to protect the occupants of an automobile from serious injury. The JPL barrier design is a configuration of empty aluminum beverage cans contained in a tear-resistant bag which, in turn, is encased in a collapsible container made of plywood and steel. Tests were conducted with a driven vehicle impacting the barrier. The basic requirements of NCHRP Report 153 were followed except that speeds of 30 mph rather than 60 mph were used. Accelerometer readings on the driver's helmet showed that the driver was never subjected to dangerous decelerations, and never experienced more than temporary discomfort. Also, all of the requirements of the cited report were met. An extrapolation of data indicated that the JPL barrier installed in front of a tree or telephone pole along a roadside would also have met the requirements at a speed of 40 mph. A.R.H.

N80-17918# EIC, Inc., Newton, Mass.
SURVEY ON METALLURGICAL RECYCLING PROCESSES
Final Report
J. P. Pemsler Mar. 1979 197 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-79-2) Avail: NTIS HC A09/MF A01

Major opportunities for increasing the extent of recycle of nonferrous scrap metals and thereby increasing the energy savings are discussed. Preliminary flowsheets are presented for the recovery of value metals from batteries considered for use in vehicular propulsion and load leveling applications. A flow sheet was outlined for an integrated hydrometallurgical process to treat low-grade copper scrap. A fully integrated hydrometallurgical process is outlined, and costs and energy consumption are derived for recovering zinc metal from electric furnace flue dusts. Costs and energy are high and the process does not appear to warrant

development at this time. Improvement in the recycle of magnesium is associated primarily with improved recycle in the Al industry where Mg is an important alloy additive. Ni and Ti recycle are associated with improved collection and sorting of stainless steel and specialty alloys. DOE

N80-17919# Booz-Allen and Hamilton, Inc., Bethesda, Md. Transportation Consulting Div.
LOW-FLOOR ARTICULATED BUS DEMONSTRATION Final Report
Sep. 1979 45 p
(Grant UMTA-9073-077)
(PB-300497/5; UMTA-MD-06-0024-79-1; BP-79-001) Avail: NTIS HC A03/MF A01 CSCL 13F

The stability and anti-jackknifing capabilities of a low-floor articulated bus are documented. Data on performance; reactions of drivers, maintenance and management personnel; and public relations demonstrate that the low-floor concept is an improvement over current articulated vehicle designs. The low floor allows faster and easier boarding, thus increasing productivity and offering an advantage to elderly and handicapped persons. GRA

N80-17920# Otis Elevator Co., Denver, Colo. Transportation Technology Div.
VEHICLE LONGITUDINAL CONTROL AND RELIABILITY PROJECT. VOLUME 5: VLCR ENTRAINMENT AND PLATOONING ANALYSIS AND DESIGN, PARTS A AND B Final Report
D. Lorenz Feb. 1979 534 p
(Contract DOT-UT-70048)
(PB-299798/9; OTIS/TTD/VLAC-058;
UMTA-IT-06-0148-79-5) Avail: NTIS HC A23/MF A01 CSCL 13F

Longitudinal control aspects of automatic entrainment and platooning concepts were studied in order to: (1) develop functional and performance specifications for longitudinal control systems for automated guideway transit systems using automatic entrainment or platooning; (2) evaluate an automatic coupling and decoupling system suitable for trained vehicle operation and failed vehicle pulling and pushing; (3) establish design concepts and specifications for automatic coupling systems which meet the requirements in a cost-effective manner; and (4) assess the platooning concept and establish platooned vehicle operation. GRA

N80-17921# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
OPERATION OF AUTOMATED GUIDEWAY TRANSIT VEHICLES IN DYNAMICALLY RECONFIGURED TRAINS AND PLATOONS - EXTENDED SUMMARY Final Report, Sep. 1976 - Dec. 1978
S. Shladover Apr. 1979 112 p refs
(Contracts MA-11-0029)
(PB-300513/9; UMTA-MA-06-0085-79-1) Avail: NTIS HC A06/MF A01 CSCL 13F

A broad-based preliminary evaluation of the potential advantages and disadvantages of an entrained automated guideway transit (AGT) system is presented. It includes an investigation of the applications for which entrained AGT is well suited, and an assessment of how much capacity improvement it can offer. The study shows that passenger capacity of AGT systems may be increased by operating vehicles in dynamically-reconfigured trains or platoons. It is estimated that a minimum lane capacity of 5,000 to 10,000 passengers per hour is needed to make single-party AGT economically competitive with buses and that this capacity requires the use of trains. The capacity advantage of entraining is demonstrated for a single guideway link and for merge junctions, using Monte Carlo simulation. GRA

N80-17922# Transportation Systems Center, Cambridge, Mass.
ANALYSIS OF LIFE-CYCLE COSTS AND MARKET APPLICATIONS OF FLYWHEEL ENERGY-STORAGE TRANSIT VEHICLES Final Report, Fall 1977 - Summer 1978
D. L. Goeddel and G. Ploetz Jul. 1979 191 p
(PB-300289/6; DOT-TSC-UMTA-78-77;
UMTA-MA-06-0044-78-2) Avail: NTIS HC A09/MF A01 CSCL 13F

The operational requirements and conceptual design of flywheel energy storage vehicles for transit service are analyzed along with the economic viability and potential market applications of these proposed concepts within urban transit operations. The design characteristics, system capital costs, and annual recurring operations/maintenance costs associated with the conventional diesel bus, the trolly bus, and the flywheel-powered vehicle systems are defined. The results of the life cycle analysis and the sensitivity of these results due to variations of key assumed input variables are described. GRA

N80-17923# Transportation Systems Center, Cambridge, Mass.
SIMULATION OF AN URBAN BATTERY BUS VEHICLE Final Report, Jun. - Dec. 1978
John J. Stickler Jul. 1979 90 p
(PB-300306/8; DOT-TSC-UMTA-79-15;
UMTA-MA-06-0093-79-1) Avail: NTIS HC A05/MF A01 CSCL 13F

The computer simulation of a battery-powered bus as it traverse an arbitrary mission profile of specified acceleration, roadway grade, and headwind is described. The battery-bus system components comprise a DC shunt motor, solidstate power conditioning unit with regeneration capability, and a battery source consisting of a multiunit lead acid battery. The computer model determines vehicle tractive effort and power consumption and computes actual vehicle speed for a given mission profile. The computer model uses a 'modularization' format which facilitates the simulation of alternate propulsion systems involving the interchange of one system component for another. GRA

N80-17924# Stanford Univ., Calif. Dept. of Civil Engineering.
DEVELOPMENT OF RESEARCH IN THE CONSTRUCTION OF TRANSPORTATION FACILITIES: A STUDY OF NEEDS, OBJECTIVES, RESOURCES, AND MECHANISMS FOR IMPLEMENTATION Final Report
John W. Fondahl and Boyd C. Paulson Aug. 1979 145 p refs
(Contract DOT-OS-60150)
(PB-301389/3; DOT/RSPA/DPB/50-79/12) Avail: NTIS HC A07/MF A01 CSCL 13B

The implementation of research results is discussed along with problems created by planning, design, and organizational decisions. Incentives and obstacles to research implementation are identified and proposals for more rapid and effective application of research results are made. Increased utilization of demonstration projects, bid alternates, turnkey contracts, and follow-up measures are discussed. A special study of measures by the Japanese construction industry to achieve cost reduction through innovation is included. Experience originating in projects such as BART, WMATA, and MARTA is examined to identify problems that have serious impact both on costs and the environment desirable for innovative efforts. GRA

N80-17925# M and I, Inc., Fort Collins, Colo.
EVALUATION OF OPERATION AND MAINTENANCE FACTORS LIMITING MUNICIPAL WASTEWATER TREATMENT PLANT PERFORMANCE Final Report
Bob A. Hegg, Kerwin L. Rakness, and James R. Schultz Jun. 1979 174 p refs
(Contract EPA-68-03-2224)
(PB-300331/6; EPA-600/2-79-034) Avail: NTIS HC A08/MF A01 CSCL 13B

A significant number of wastewater treatment plants constructed with Federal monies have not met design or permit standards. Comprehensive evaluation were conducted at thirty wastewater treatment facilities to identify, quantify and rank the causes of this poor performance. The two highest ranking factors identified were inadequate operator application of concepts and testing to process control and sewage treatment understanding. Many operators were not trained as evidenced by a lack of sewage treatment understanding, but even trained operators did not apply concepts of operation to process control. The third highest ranking factor identified was improper technical guidance from authoritative sources. Six of the ten highest ranking factors were related to improper plant design. GRA

N80-17926# M and I, Inc., Fort Collins, Colo.
A DEMONSTRATION APPROACH FOR IMPROVING PERFORMANCE AND RELIABILITY OF BIOLOGICAL

WASTEWATER TREATMENT PLANTS Final Report
Bob A. Hegg, Kerwin L. Rakness, and James R. Schultz Jun. 1979 64 p refs
(Contract EPA-68-03-2224)
(PB-300476/9; EPA-600/2-79-035) Avail: NTIS
HC A04/MF A01 CSCL 13B

The factors limiting plant performance at thirty treatment facilities were examined and a method, Composite Correction Programs (CCP), of improving plant effluent quality was developed. A CCP was implemented at the Havre, Montana Wastewater Treatment Plant and a significant improvement in plant effluent resulted which allowed permit standards to be met consistently. The potential improvment in plant performance that could be achieved if CCP's were implemented at all thirty facilities evaluated was projected. The mass of BOD5 and TSS discharged to the receiving streams would be reduced by 490 metric tons/year and 470 metric tons/year, respectively. GRA

N80-17927# Wiss, Janney, Elstner and Associates, Inc., Northbrook, Ill.
CONTROL OF VIBRATION AND BLAST NOISE FROM SURFACE COAL MINING, VOLUME 3 Final Report, 1 Jul. 1975 - 28 Feb. 1978
John F. Wiss and Patrick W. Linehan Dec. 1978 626 p refs
(Contract J-0255022)
(PB-299889/6; BM-OFR-103(3)-79) Avail: NTIS
HC A99/MF A01; also available in set of 4 reports HC E16 as PB-299886-SET CSCL 13F

The effects of blast parameters upon the ground and air vibration were studied. Results of a series of controlled experiments conducted at four surface coal mines are presented. Data from preliminary scale-model blasts conducted at a quarry are included. GRA

N80-17928# Boeing Vertol Co., Philadelphia, Pa. Surface Transportation Systems Dept.
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. VOLUME 1: INTRODUCTION Final Report, Jan. - Jun. 1976
Feb. 1979 74 p refs
(Contract DOT-TSC-1062)
(PB-301146/7; DOT-TSC-UMTA-79-27-Vol-1;
UMTA-MA-06-0025-79-3-Vol-1) Avail: NTIS
HC A04/MF A01; also available in set of 4 reports PC E10, PB-301145-SET CSCL 13F

Specifications were developed for an optimum light rail vehicle. The performance, power consumption, ride roughness, noise, and radio frequency interference tests carried out on production pilot cars are described and the results are summarized. K.L.

N80-17929# Boeing Vertol Co., Philadelphia, Pa. Surface Transportation Systems Dept.
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. VOLUME 2: PERFORMANCE AND POWER CONSUMPTION TESTS Final Report, Jan. - Jun. 1976
Feb. 1979 66 p refs
(Contract DOT-TSC-1062)
(PB-301147/5; DOT-TSC-UMTA-79-27-Vol-2;
UMTA-MA-06-0025-79-4-Vol-2) Avail: NTIS
HC A04/MF A01; also available in set of 4 reports PC E10, PB-301145-SET CSCL 13F

The results of acceleration, deceleration, traction resistance, spin/slide control system, and power consumption tests are presented. The tests are described in detail. K.L.

N80-17930# Boeing Vertol Co., Philadelphia, Pa. Surface Transportation Systems Dept.
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. VOLUME 3: RIDE QUALITY, NOISE, AND RADIO FREQUENCY INTERFERENCE TESTS Final Report, Jan. - Jun. 1976
Feb. 1979 178 p refs
(Contract DOT-TSC-1062)
(PB-301148/3; DOT-TSC-UMTA-79-27-Vol-3;
UMTA-MA-06-0025-79-5-Vol-3) Avail: NTIS
HC A09/MF A01; also available in set of 4 reports PC E10, PB-301145-SET CSCL 13F

Detailed descriptions and discussions of the engineering tests performed on samples of the SLRV are presented. GRA

N80-17931# Boeing Vertol Co., Philadelphia, Pa. Surface Transportation Systems Dept.
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. VOLUME 4: DATA LOGS Final Report, Jan. - Jun. 1976
Feb. 1979 67 p refs
(Contract DOT-TSC-1062)
(PB-201149/1; DOT-TSC-UMTA-79-27-Vol-4;
UMTA-MA-06-0025-79-6-Vol-4) Avail: NTIS
HC A04/MF A01; also available in set of 4 reports PC E10, PB-301145-SET CSCL 13F

The SLRV (Standard Light Rail Vehicle) is a 71-foot vehicle, articulated to negotiate curves down to a 32-foot radius and designed to operate at speeds up to 50 mph. Although the basic configuration and performance is standardized, the current operating properties (Massachusetts Bay Transportation Authority and San Francisco Municipal Railway) have specified individual requirements for auxiliary equipment and passenger accomodation. The results of the series of tests conducted to establish a baseline for the SLRV obtained in accordance with the General Vehicle Test Plans and to provide further experience in the use of the Test Plans in testing urban rail vehicles are presented. Performance power consumption, ride roughness, noise, and radio frequency interference are the topics covered. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-17932*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE X-RAY PULSARS 4U1145-61 AND 1E1145.1-6141
N. E. White, S. H. Pravdo, R. H. Becker, E. A. Boldt, S. S. Holt, and P. J. Serlemitsos Jan. 1980 16 p refs Submitted for publication
(NASA-TM-80636) Avail: NTIS HC A02/MF A01 CSCL 03A

Observations of the X-ray sources near 4U1145-61 are presented. The presence of two periodicities at 291 and 297 seconds is confirmed. The location of the shorter period is isolated to within 3 arc minutes of 4U1145-61. The spectrum of 4U1145-61 is a power law out to at least 60 keV with a 500 eV EW iron line at 6.7 keV. The inferred spectrum of the other is absorbed. No evidence is found for a monotonic variation in either pulse period. K.L.

N80-17933*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
GSFC CONTRIBUTIONS TO THE NATO X-RAY ASTRONOMY INSTITUTE, ERICE, JULY 1979
S. S. Holt and R. F. Mushotzky Sep. 1979 47 p refs
(NASA-TM-80559) Avail: NTIS HC A03/MF A01 CSCL 03A

An overview of X-ray astronomical spectroscopy in general is presented and results obtained by HEAO 1 and 2 as well as earlier spacecraft are examined. Particular emphasis is given to the spectra of supernova remnants; galactic binary X-ray sources,

cataclysmic variables, bulges, pulsars, and stars; the active nuclei of Seyfert 1 galaxy, BL Lac, and quasars; the diffuse X-ray background, and galactic clusters. A.R.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-17934 Cincinnati Univ., Ohio.
SOME PROPERTIES OF SPATIALLY HOMOGENEOUS SPACETIMES Ph.D. Thesis
Grant Colin Coomer 1979 133 p
Avail: Univ. Microfilms Order No. 8002428

The gravitational instability theory of galaxy formation is investigated for a viscous fluid and for a charged, conducting fluid with a magnetic field added as a perturbation. It is found that the growth rate of density perturbations in both cases is lower than in the perfect fluid case. The initial value problem for a viscous fluid with heat conductivity is also discussed. Spatially homogeneous but nonisotropic spacetimes are investigated. Two perfect fluid solution of Einstein's field equations are found which have spacelike hypersurfaces with Blanchi type II geometry. An expression for the spectrum of the cosmic microwave background radiation in a spatially homogeneous but nonisotropic universe is found and then used to determine the angular distribution of the intensity of the radiation in the simpler of the two solutions. When accepted values of the matter density and decoupling temperature are inserted into this solution, values for the age of the universe and the time of decoupling are obtained which agree reasonably well with the values of the standard model of the universe. Dissert. Abstr.

N80-17935 Texas Univ. at Austin.
A STUDY OF INTERSTELLAR DARK CLOUDS Ph.D. Thesis
Ronald Lee Snell 1979 287 p
Avail: Univ. Microfilms Order No. 7928359

An investigation of the physical and chemical properties of nine interstellar dark clouds is reported. The observations were compared with theoretical models of the line emission and absorption from the clouds to derive the fundamental physical parameters. The temperatures, densities, masses, and abundances of atomic and molecular species were determined in the nine dark clouds. The kinetic temperatures of the dense regions of the clouds were examined. The extended CO emission in the clouds and the decreasing densities in the outer regions of the clouds are discussed. Dissert. Abstr.

N80-17936 Institut d'Aeronomie Spatiale de Belgique, Brussels.
INTERPLANETARY SPACE: BIBLIOGRAPHY, FASCICLE 15
1978 154 p refs
Avail: Issuing Activity

This bibliography cites 786 reports from international literature concerning interplanetary space in the solar system. Subjects covered include the Moon; Venus; Mars; Jupiter and its satellites; Mercury; Saturn and its satellites; Pluto; Neptune, and Uranus; and meteors; cosmic rays; gravitation; and the structure of interplanetary space. Author (ESA)

N80-17937*# Wisconsin Univ. - Madison. Dept. of Physics.
SPATIAL DISTRIBUTION AND BROAD-BAND SPECTRAL CHARACTERISTICS OF THE DIFFUSE X-RAY BACKGROUND, 0.1 - 1.0 keV
D. McCammon, W. L. Kraushaar, W. T. Sanders, and D. N. Burrows Aug. 1979 11 p refs Presented at 16th Intern. Cosmic Ray Conf., Kyoto, Aug. 1979
(Grant NGL-50-002-044)
(NASA-CR-162763; No-102) Avail: NTIS HC A02/MF A01 CSCL 03B

Preliminary maps covering more than 85 percent of the sky are presented for three energy bands: the B band, the C band, and the M band. The study was undertaken to find evidence that most of the diffuse X-ray background at energies less than 1 keV is local to the galaxy and that it is most probably due to thermal radiation from a low density plasma which fills a substantial fraction of interstellar space. A preliminary analysis of the data is provided including a report that most of the B and C band flux has a common origin, probably in a 10 to the 6th power K region surrounding the Sun, and that most of the M band flux does not originate from the same material. A.W.H.

N80-17938*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PENROSE PHOTOPRODUCTION SCENARIO FOR NGC 4151: A BLACK HOLE GAMMA-RAY EMISSION MECHANISM FOR ACTIVE GALACTIC NUCLEI AND SEYFERT GALAXIES
Darryl Leiter Dec. 1979 33 p refs Submitted for publication
(NASA-TM-80624) Avail: NTIS HC A02/MF A01 CSCL 03B

A consistent theoretical interpretation is given for the suggestion that a steepening of the spectrum between X-ray and gamma ray energies may be a general, gamma-ray characteristic of Seyfert galaxies, if the diffuse gamma ray spectrum is considered to be a superposition of unresolved contributions, from one or more classes of extragalactic objects. In the case of NGC 4151, the dominant process is shown to be Penrose Compton scattering in the ergosphere of a Kerr black hole, assumed to exist in the Seyfert's active galactic nucleus. A.R.H.

N80-17939*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE PHYSICAL ENVIRONMENT IN THE GALACTIC NUCLEI Ph.D. Thesis - Maryland Univ.
James Howard Beall Sep. 1979 190 p refs
(Contract NGL-21-002-033)
(NASA-TM-80569) Avail: NTIS HC A09/MF A01 CSCL 03B

Galactic nuclei and quasars emit radiation over the entire electromagnetic spectrum. This suggests that concurrent observations over a wide frequency range may provide useful information in determining appropriate models for the physical environment in which the radiation is produced. In conjunction with observations by the high energy spectrometer on OSO-8, four sources have been studied in this manner; the nucleus of the elliptical galaxy, Centaurus A (NGG 5128); the quasar, 30273; the Seyfert galaxy, NGC 4151 and the nucleus of the Milky Way (GCX). Concurrent observations are used to construct the composite spectra (from radio to X-ray) for Cen A and NGC 4151 while the composite spectra of 30273 and GCX are derived from the OSO-8 data and from other observers. A skymap technique used to analyze observations of the galactic center region yielded data consistent with a significant, hard X-ray source at the radio and infrared position of the nucleus of the Milky Way. A theoretical analysis of the temporal variability of the Cen A data is undertaken and its implications discussed. Similarities between the composite spectra of the observed sources suggest that radio-bright and radio-quiet quasars may represent the emission from galactic nuclei with elliptical and Seyfert-like morphologies, respectively. A.R.H.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-17940*# National Aeronautics and Space Administration, Washington, D. C.
MARS: THE VIKING DISCOVERIES
Bevan M. French Oct. 1977 37 p Original contains color illustrations
(NASA-EP-146) Avail: NTIS MF A01; SOD HC CSCL 03B

An overview of the Viking Mars probe is presented. The Viking spacecraft is described and a brief history of the earlier

observations and exploration of Mars is provided. A number of the Viking photographs of the Martian surface are presented and a discussion of the experiments Viking performed including a confirmation of the general theory of relativity are reported. Martian surface chemistry is discussed and experiments to study the weather on Mars are reported. A.W.H.

N80-17941*# California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
ANALYSIS OF VIKING INFRARED THERMAL MAPPING DATA OF MARS. THE EFFECTS OF NON-IDEAL SURFACES ON THE DERIVED THERMAL PROPERTIES OF MARS Final Technical Report, 1 Oct. 1978 - 30 Sep. 1979
Duane O. Muhleman and Bruce M. Jakosky Sep. 1979 56 p refs Submitted for publication
(Grant NsG-7565)
(NASA-CR-162782; Contrib-3228) Avail: NTIS HC A04/MF A01 CSCL 03B

The thermal interia of the surface of Mars varies spatially by a factor of eight. This is attributable to changes in the average particle size of the fine material, the surface elevation, the atmospheric opacity due to dust, and the fraction of the surface covered by rocks and fine material. The effects of these non-ideal properties on the surface temperatures and derived thermal inertias are modeled, along with the the effects of slopes, CO2 condensed onto the surface, and layering of fine material upon solid rock. The non-ideal models are capable of producing thermal behavior similar to that observed by the Viking Infrared Thermal Mapper, including a morning delay in the post-dawn temperature rise and an enhanced cooling in the afternoon relative to any ideal, homogeneous model. The enhanced afternoon cooling observed at the Viking-1 landing site is reproduced by the non-ideal models while that atop Arsia Mons volcano is not, but may be attributed to the observing geometry. Author

N80-17942# National Technical Information Service, Springfield, Va.
MARS ENVIRONMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1971 - Sep. 1979
Audrey S. Hundemann Sep. 1979 265 p Supersedes NTIS/PS-78/0940; NTIS/PS-77/0863; NTIS/PS-76/0841; NTIS/PS-75/752; NTIS/PS-75/031
(NTIS/PS-79/0974/0; NTIS/PS-78/0940; NTIS/PS-77/0863; NTIS/PS-76/0841; NTIS/PS-75/752; NTIS/PS-75/031) Avail: NTIS HC $30.00/MF $30.00 CSCL 03B

Research dealing with atmospheric and surface properties of Mars is discussed. A few abstracts pertain to instrumentation used in the space exploration. This updated bibliography contains 257 abstracts, 18 of which are new entries to the previous edition. GRA

N80-17943*# National Center for Atmospheric Research, Boulder, Colo.
CONVECTION IN ROTATING LAYERS WITH THERMAL WINDS AND APPLICATION TO JUPITER
David H. Hathaway 9 May 1979 153 p refs
(Contract NAS8-31958; Grants NGL-06-003-057; NSF ATM-77-23757)
(NASA-CR-162476; PB-301336/4; NCAR-CT-53) Avail: NTIS HC A08/MF A01 CSCL 03B

A linear stabilty analysis is carried out for fluid layers under uniform rotation which possess both vertical and horizontal temperature gradients. In order to represent various latitudes with these plane parallel layers, a rotation vector is used which is generally oblique to gravity. The preferred convective modes are assessed as a function of latitude for both ideal and real fluid. It is found that the diffusive effects of viscosity and thermal conductivity are relatively unimportant in determining the preferred orienation of these conective rolls. It is proposed that the axisymmetric cloud hands observed on the planet Jupiter may be produced by these east-west convective instabilities. A simple radiative-convective model for Jupiter is used to estimate the parameter values relevant in the stability analysis. GRA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-17944*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
STUDY OF THE SOLAR CYCLE FROM SPACE
Feb. 1980 366 p refs Symp. held at Wellesley, Mass., 14-15 Jun. 1979; sponsored in part by Am. Astron. Soc.
(NASA-CP-2098; Rept-7801) Avail: NTIS HC A16/MF A01 CSCL 03B

The objectives of and benefits to be derived from a program of solar cycle research are discussed with emphasis on the role space observations will play in this venture. The strategy to be employed in the coming decade is considered as well as crucial missions, experiments, and the theoretical advances required. For individual titles, see N80-17945 through N80-17968.

N80-17945*# High Altitude Observatory, Boulder, Colo.
DYNAMICS OF THE SOLAR INTERIOR AND THE SOLAR DYNAMO
Peter A. Gilman *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 3-11 (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

The solar convection zone is the origin of most of the variations in solar output observed or suspected to occur. The Sun's magnetic field is rooted there, and solar activity and the solar cycle are generated and maintained there. Changes in the magnetic fields which reach into the solar atmosphere and beyond to interplanetary space are largely determined by the dynamo action of velocity fields in the convection zone. If changes in solar luminosity occur on time scales of months to millenia, such changes probably have their origin in the changing dynamics of the convection zone, either as cause of or in response to long term changes in the level of solar activity. Fluctuations would occur in the rate at which energy is brought to the surface by convection, and the solar diameter would be slightly modified. To describe and ultimately understand the global workings of the solar dynamo requires simultaneous high quality photospheric observations of solar velocities, magnetic fields, intensity patterns, luminosity and various radiative outputs. The observations must be nearly continuous in time and of long duration-most or all of a solar cycle. Such a measurement program should be a major part of the proposed Solar Cycle and Dynamics Mission. A.R.H.

N80-17946*# High Altitude Observatory, Boulder, Colo.
THE CORONA AND HELIOSPHERE
T. Holzer *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 13-25 (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

The eleven-year solar cycle is an especially appropriate period over which to study the solar output and its variation, because during this cycle most of the important types of solar variability (many characterized by periods shorter than eleven years) are manifested. Studies of solar variability over a solar cycle will improve understanding of solar structure and of the generation of the solar wind, and this improved understanding can be useful in the related studies of stellar structure and stellar winds, since stellar observations are necessarily less detailed and sophisticated than are solar observations. A particularly significant benefit that will accrue from a thorough study of the solar atmosphere and its variability over the next solar cycle is a great enhancement in the usefulness of so-called 'proxy' data in studying longer term solar variations and their terrestrial implication. A.R.H.

N80-17947*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
OVERVIEW ON THE STUDY OF THE SOLAR CYCLE FROM SPACE
Robert W. Noyes *In* NASA Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 31-42 (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

Recent insights into the workings of the solar system are reviewed as factors to be considered when formulating key questions to be answered during a large scale program to study the solar cycle. The main objectives of the Solar Cycle and Dynamics Mission are to determine the causes (physical origins and mechanisms) of the solar cycle and the effects of these mechanisms on the heliosphere, the vast region that includes the corona, interplanetary medium, and the terrestrial environment. The mission should be able to obtain synoptic data on solar variability associated with the cycle, and over at least a fraction of a single 11-year cycle. A.R.H.

N80-17948*# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.

A SOLAR ACTIVITY MONITORING PLATFORM FOR SCADM

Kenneth E. Kissell and David D. Ratcliff (Air Force Inst. of Tech.) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 45-54 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

The adaptation of proven space probe technology is proposed as a means of providing a solar activity monitoring platform which could be injected behind the Earth's orbital position to give 3 to 6 days advanced coverage of the solar phenomenon on the backside hemisphere before it rotates into view and affects terrestrial activities. The probe would provide some three dimensional discrimination within the ecliptic latitude. This relatively simple off-Earth probe could provide very high quality data to support the SCADM program, by transmitting both high resolution video data of the solar surface and such measurements of solar activity as particle, X-ray, ultraviolet, and radio emission fluxes. Topics covered include the orbit; constraints on the spacecraft; subsystems and their embodiments; optical imaging sensors and their operation; and the radiation-pressure attitude control system are described. The platform would be capable of mapping active regions on an hourly basis with one arc-second resolution. A.R.H.

N80-17949*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.

PROBLEMS OF INTERIOR STRUCTURE, THE SOLAR DYNAMO AND THE ROLE OF SCADM IN PROVIDING INTERIOR DIAGNOSTICS

Nigel O. Weiss (Cambridge Univ.) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 55-64 (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

What is already known about the structure of the Sun, the motion of its convective zone, and the solar cycle is reviewed. Topics discussed include solar variability, solar 'seismology', velocity patterns, magnetic fields, and the dynamo theory. Observations are needed to determine global properties (solar luminosity and radius), oscillations (p and g models), velocities (variation of rotation with time and depth), and magnetic fields. A.R.H.

N80-17950*# American Science and Engineering, Inc., Cambridge, Mass.

X-RAY BRIGHT POINTS AND THE SOLAR CYCLE DEPENDENCE OF EMERGING MAGNETIC FLUX

John M. Davis *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 65-73 refs (For primary document see N80-17944 08-92)

(Contracts NAS2-8683; NAS5-25496; NAS2-7758)

Avail: NTIS HC A16/MF A01 CSCL 03B

Soft X-ray imaging of the solar corona during the period 1970 to 1978 resulted in significant modifications to the view of the solar cycle with respect to both the properties of the large scale (coronal holes) and small scale (X-ray Bright Points) solar magnetic field. In the latter case, the particular contribution is to the emerging magnetic flux. Sounding rocket observations combined with the Skylab data indicate that the XBP are anticorrelated with sunspot number and are the dominant contributors to the solar cycle. A continuous data set covering a complete cycle would enable the validity of this result which has serious implications for the nature of the solar dynamo, to be confirmed. Author

N80-17951*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.

X-RAY BRIGHT POINTS AND THE SOLAR CYCLE

L. Golub and G. S. Vaiana (Osservatorio Astronomico, Palermo, Italy) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 75-83 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

The shape of the Sun's activity spectrum is such that the majority of all magnetic flux emerging at the surface comes in the form of bright points, i.e., regions living less than two days. Examination of soft X-ray data obtained from 1970 to 1978 shows that the number of bright points appears to be anticorrelated with traditional activity indices, such as sunspot number; the anticorrelation persists after corrections are made for obscuration by active regions. Comparison of X-ray data with KPNO magnetograms shows that to within a factor of two, the average total amount of magnetic flux emerging over the full Sun is constant through the entire period of observation. The Solar cycle therefore appears to be more an oscillation in the wavenumber distribution of emerging flux than of the total quantity of magnetic flux produced. A.R.H.

N80-17952*# Boston Univ., Mass. Dept. of Astronomy.

OBSERVABLE SOLAR FEATURES WHICH PROVIDE CLUES TO THE STATE OF THE SOLAR DYNAMO

Kenneth H. Schatten *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 85-100 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

Space experiments are suggested to better monitor the solar dynamo and solar luminosity variations. Polar and other magnetic fields, sunspots, coronal holes, filaments and other observable solar and solar wind phenomena can provide us with important links to test and discover physical mechanisms which relate solar activity to terrestrial weather, climate, and possibly population variations. Author

N80-17953*# High Altitude Observatory, Boulder, Colo.

THE OPPORTUNITIES OFFERED BY SCADM FOR THE STUDY OF SURFACE PHENOMENA RELATED TO INTERIOR STRUCTURE AND DYNAMICS

Timothy M. Brown *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 101-135 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

The physical processes to be probed by experiments may be grouped as large scale flows, oscillations, and chromospheric/coronal diagnostics. While the fundamental concerns and observational equipments are similar within each class, different investigations may tell different things about the Sun. Observational requirements are listed for experiments to study (1) plasma-magnetic field interactions; (2) interior structure via oscillations; (3) chromospheric and coronal tracers; (4) rotation, meridional flows, and giant cells; (5) the depth dependence of rotation; (6) EUV luminosity; (7) intensity fluctuations and tracers; and (8) diameter oscillations. The effects of noise and timestring on experiment results are assessed. A.R.H.

N80-17954*# Arizona Univ., Tucson. Dept. of Physics.

SECOND GENERATION DETECTOR FOR LOW ORDER GLOBAL SOLAR OSCILLATIONS

F. F. Forbes, R. Bos, and H. A. Hill *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 137-146 refs Sponsored in part by NSF (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

The first observations of long period low order global solar oscillations grew out of diameter measurements made over an extended period of time. As a result of these investigations, a detailed understanding of the surface properties of the oscillations evolved, allowing development of a second generation detector. This new detector, currently under development directly utilizes various surface properties of the oscillations and does not, therefore, directly involve diameter measurements. The specifications of the detector, its supporting telescope and the observing program are reviewed. Author

N80-17955*# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.

THE MEASUREMENT OF GLOBAL SCALE SURFACE DYNAMICS

E. N. Frazier *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1990 p 147-157 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

The SCADM mission implicitly contains a requirement for a fundamentally new type of satellite instrument: a very sensitive (approximately 1 m s/1) imaging velocity detector. This is needed to measure global oscillations and global circulation patterns, but the sensitivity requirement is so severe that it has not yet been met even with ground based instruments. In this presentation, the various possible sources of noise and other errors in such a device are considered, and the more detailed instrumental requirements are developed. This leads to the conceptual design of a velocitygraph that appears to achieve the necessary sensitivity and imaging capability within a resonable weight and volume.

Author

N80-17956*# California Univ. at Los Angeles. Dept. of Astronomy.

OBSERVATIONAL REQUIREMENTS FOR MEASUREMENTS OF SOLAR ROTATION INWARD TO THE BASE OF THE CONVECTION ZONE

Edward J. Rhodes, Jr. *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 159-173 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

Measurements of the rate of rotation at various depths in the solar interior and of temporal changes in the rotation are discussed. A technique to measure the absolute rate of the Sun's rotation (in meters per second) below its visible surface over the outer 3% of its radius using ground based equipment is described. The theory of the technique, developed to the base of the solar convection zone is analyzed. It is stressed that such deeper rotational measurements, extending from 3% inward to 25 to 30% of the Sun's radius can only be obtained from a spaceborne instrument which is not subject to the normal Earth based day-night observing cycle.

A.W.H.

N80-17957*# Stanford Univ., Calif. Inst. for Plasma Research.

A SUNSPOT PERIODICITY AND THE SOLAR ROTATION

J. W. Knight, P. A. Sturrock, and K. H. Schatten (Boston Univ., Mass.) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 175-194 refs (For primary document see N80-17944 08-92)

(Grant NGL-05-020-272; Contract F19628-77-R-0310)

Avail: NTIS HC A16/MF A01 CSCL 03B

A least squares power spectrum analysis of daily sunspot numbers for the last 122 years yielded a statistically significant peak at 12.0715 plus or minus .002 days period. This feature at 11.685 days (sidereal) of the sunspot spectrum is discussed in relation to the peak at 12.22 days (sidereal) which Dicke found in his oblateness data. The data is attributed to the Sun's core if the core rotates at either 12.0715 days or 24.1430 days period (synodic). It is suggested that spacecraft observations combined with correlative analysis of solar surface features between eastern and western hemispheres could further reveal a basic core periodicity. A Dicke type space oblateness experiment is discussed for providing better photospheric observations than a ground instrument to determine the core periodicity.

A.W.H.

N80-17958*# Los Alamos Scientific Lab., N. Mex.

SPATIAL EVOLUTION OF MAGNETIC FIELDS AS SEEN IN CORONAL STREAMERS TO 12 R SUB O DURING THE SOLAR CYCLE

C. F. Keller and W. Matuska *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 201-208 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

Outer coronal photographs made from high altitude aircraft at the solar eclipses of 1966, '70, '72, '73, and '79 which sample various times in the solar cycle are presented. Coronal streamers extending from the solar limb to 12 R sub o are displayed. The evolution of the streamers as they distort magnetic field lines to large distances from the Sun is examined. Results show that the distortion is varied, that the polar plumes can be traced beyond 8 R sub o, diverging apparently along dipole field lines, and that the divergence varies along the solar cycle. Various changes in nonpolar streamers are discussed including the tendency to become radial beyond 3 to 5 R sub o as if controlled by the solar wind.

A.W.H.

N80-17959*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.

THE DEPENDENCE OF CORONAL HOLE SIZE ON LARGE SCALE MAGNETIC FIELD STRENGTH

Steven T. Suess and Richard S. Steinolfson (Alabama Univ., Huntsville) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 209-217 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

The importance of mathematical models of the coronal structure for studies of coronal energetics, to simulate global flows of the solar wind, and to obtain reliable solar terrestrial predictions is discussed. Previous coronal models, including an example of a coronal MHD flow model, are reviewed. The development of a coronal model which is a logical extension of earlier models and which allows a closer relationship to the photospheric magnetic field as it is observed daily is described. The calculations are outlined. The assumptions of the model are: axisymmetric flow with no rotation, resulting in two dimensional flow in a meridional plane; zero viscosity and infinite electrical conductivity; polytropic, single fluid flow; and no momentum addition.

A.W.H.

N80-17960*# Naval Research Lab., Washington, D. C. Center for Space Research.

THE CONTRACTION AND DISAPPEARANCE OF THE POLAR CORONAL HOLES

N. R. Sheeley, Jr. *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 219-231 refs (For primary document see N80-17944 08-92)

(NASA Order W-14429)

Avail: NTIS HC A16/MF A01 CSCL 03B

He I 10830 A spectroheliograms obtained during 1974-1979 were used to study the evolution of the Sun's polar coronal holes. Synoptic polar plots show that the holes have decreased in size to the point that only vestigual holes remain and even these remnants fluctuate with detailed sunspot activity.

A.W.H.

N80-17961*# California Univ. at San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.

SOLAR CYCLE CHANGES IN THE HIGH LATITUDE SOLAR WIND

B. J. Rickett and W. A. Coles *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 233-243 refs Submitted for publication (For primary document see N80-17944 08-92)

(Contract F19628-77-C-0161; Grant NSF ATM-78-06770)

Avail: NTIS HC A16/MF A01 CSCL 03B

Measurements of the solar wind velocity during the period 1971-79 using the technique of interplanetary scintillation are discussed. The average wind speed was faster than 500 km/s at latitudes above 30 deg for most of 1973-77. The fast polar stream, observed to become much narrower in 1978-79 is examined. The narrowing of the polar streams coincided with the emergence of sunspots at midlatitudes, with the start of the new solar cycle, and with a corresponding contraction of the polar coronal holes. The theory that the solar magnetic field controls the large scale structure of the solar wind is discussed in relation to the results.

A.W.H.

N80-17962*# Los Alamos Scientific Lab., N. Mex.

AN IMAGING X-RAY SPECTROMETER TO STUDY SOLAR ACTIVITY IN CONJUNCTION WITH THE SCADM PROGRAM

Richard L. Blake *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 245-258 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

An experiment is proposed to study solar active region dynamics and evolution. The experiment will employ an imaging

X-ray spectrometer to study solar activity in conjunction with the SCADM program. A summary of the experiment is presented which includes the specifications and capabilities of the X-ray spectrometer, the scientific objectives, the method of approach, and a comparison of the experiment with other solar X-ray experiments. The experiment is proposed for use on the space shuttle due to its larger volume and weight capacity. A.W.H.

N80-17963*# American Science and Engineering, Inc., Cambridge, Mass.

APPLICATION OF A MAGNETOGRAPH AND X-RAY TELESCOPE TO THE STUDY OF CORONAL STRUCTURE VARIATIONS

David M. Rust. *In* NASA. Goddard Space Flight Center. Study of the Solar Cycle from Space. Feb. 1980. p 259-263. refs. (For primary document see N80-17944 08-92)
(Contract NAS8-27758)
Avail: NTIS. HC A16/MF A01. CSCL 03B

The application of magnetographs and X-ray imaging techniques to determine the magnitude, structure, origin, and evolution of the solar coronal magnetic field is examined. The spatial and temporal resolution of the X-ray telescope is discussed and a comparison of ground based magnetogram sequences versus a magnetograph in space is presented. Skylab photographs of the evolution of transient coronal holes are provided. A.W.H.

N80-17964*# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.

VARIATIONS OF THE SOLAR WIND AND SOLAR CYCLE IN THE LAST 300 YEARS

J. Feynman and S. Silverman (AFGL). *In* NASA. Goddard Space Flight Center. Study of the Solar Cycle from Space. Feb. 1980. p 265-276. refs. (For primary document see N80-17944 08-92)
(Contract F19628-79-C-0031)
Avail: NTIS. HC A16/MF A01. CSCL 03B

The past history of the solar wind and solar cycle, inferred from records of geomagnetics and aurora, is examined. Records show that the solar wind apparently varied in a systematic manner throughout the period from 1770 to 1857 and that the period around 1810 resembled the 1901 minimum geomagnetic disturbance. Results show that the solar wind and hence the Sun changes on a time scale long compared to a solar cycle and short compared to the Maunder minimum. The inclusion of a study on the solar wind and solar cycle variations for the SCADM mission is discussed. A.W.H.

N80-17965*# New Hampshire Univ., Durham. Dept. of Physics.

CONTRIBUTIONS OF SCADM TO SOLAR-TERRESTRIAL PHYSICS

L. A. Fisk. *In* NASA. Goddard Space Flight Center. Study of the Solar Cycle from Space. Feb. 1980. p 277-289. refs. (For primary document see N80-17944 08-92)
Avail: NTIS. HC A16/MF A01. CSCL 03B

The many different aspects of solar terrestrial physics are summarized. The possible influence of variations in the solar outputs on the terrestrial climate, and the role for SCADM in such studies is emphasized. The use of SCADM to provide detailed information on variations in the solar outputs over a sizeable fraction of the solar cycle, and on the physics of the convection layer of the Sun is discussed. A.W.H.

N80-17966*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.

CONTROL OF THE EARTH'S ELECTRIC FIELD INTENSITY THROUGH SOLAR WIND MODULATION OF GALACTIC COSMIC RADIATION: SUPPORT FOR A PROPOSED ATMOSPHERIC ELECTRICAL SUN-WEATHER MECHANISM

Ralph Markson. *In* NASA. Goddard Space Flight Center. Study of the Solar Cycle from Space. Feb. 1980. p 291-313. refs. (For primary document see N80-17944 08-92)
(Contract N00014-79-C-0399)
Avail: NTIS. HC A16/MF A01. CSCL 03B

The ionospheric potential and galactic cosmic radiation, found to be inversely correlated with the solar wind velocity are examined as being germane to weather modification. Since the ionospheric potential is proportional to the fair weather electric field intensity and cosmic radiation is the dominant source of atmospheric ionization, it is concluded that the Earth's overall electric field varies in phase with atmospheric ionization and that the latter is modulated by the solar wind. A proposed mechanism, in which solar control of ionizing radiation influences atmospheric electrification and thus possibly cloud physical processes is discussed. An experimental approach to critically test the proposed mechanism through comparison of the temporal variation of the Earth's electric field with conditions in the interplanetary medium is outlined. A.W.H.

N80-17967*# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.

CORONAL HOLES, SOLAR DIURNAL ANISOTROPY OF COSMIC RAYS AND OFF-ECLIPTIC INTERPLANETARY MAGNETIC FIELDS

H. S. Ahluwalia. *In* NASA. Goddard Space Flight Center. Study of the Solar Cycle from Space. Feb. 1980. 10 p. refs. (For primary document see N80-17944 08-92)
(Grant NSF ATM-78-10727)
Avail: NTIS. HC A16/MF A01. CSCL 03B

The information regarding the electromagnetic states of the interplanetary medium, derived from the analyses of the cosmic ray intensity variations observed with a global network of cosmic ray detectors such as neutron monitors and muon telescopes, is reviewed. The relation of the temporal characteristics of the cosmic ray solar diurnal anisotropy to the large scale characteristics of the interplanetary magnetic field, far away from the ecliptic plane, is addressed. A model for the phenomenon is described. A.W.H.

N80-17968*# Calgary Univ. (Alberta). Dept. of Physics.

SOLAR CORONAL HOLES AND COSMIC RAY INTENSITY VARIATIONS

D. Venkatesan, S. P. Agrawal (APS Univ., Rewa, India), L. J. Lanzerotti (Bell Telephone Labs., Inc., Murray Hill, N.J.), and R. T. Hansen (High Altitude Observatory). *In* NASA. Goddard Space Flight Center. Study of the Solar Cycle from Space. Feb. 1980. 11 p. refs. (For primary document see N80-17944 08-92)
Avail: NTIS. HC A16/MF A01. CSCL 03B

A relationship between the (North-South) asymmetry in the areas of the solar polar coronal holes and the (North-South) anisotropy in the cosmic ray intensity is examined. The investigation was extended over a period of two years, using ground based observations of coronal brightness obtained by the K-Coronameter. Periods for study of cosmic ray variations were chosen maximizing the asymmetry of the polar coronal holes. The importance of the role played by coronal holes in the solar modulation of galactic cosmic rays is emphasized. A.W.H.

N80-17969# Aerospace Corp., El Segundo, Calif. Lab. Operations.

CRLS-229 SOLAR X-RAY SPECTROMETER/SPECTROHELIOGRAPH EXPERIMENT Interim Report

P. B. Landecker, W. T. Chater, C. K. Howey, D. L. McKenzie, and H. R. Rugge. Oct. 1979. 207 p. refs.
(Contract F04701-79-C-0080)
(AD-A076255; TR-0080(5960-01)-1; SAMSO-TR-79-76) Avail: NTIS. HC A10/MF A01. CSCL 03/2

The CRLS-229 Solar X-ray Spectrometer/Spectroheliograph was launched in the solar pointed section of the United States Air Force Space Test Program P78-1 satellite on 24 February 1979. The SOLEX collimated Bragg crystal spectrometer experiment and the MONEX solar X-ray monitor experiment were built by The Aerospace Corporation, and the Naval Research Laboratory supplied the SOLFLEX uncollimated solar flare crystal spectrometer and the MAGMAP magnesium mapping experiment. The SOLEX A spectrometer has a 20 arc sec multigrid collimator, an ADP or RAP crystal, and proportional counter detector with a 25 micrometers thick beryllium window. The SOLEX B spectrometer has a 60 arc sec collimator, an ADP or RAP crystal, and a channel electron multiplier array detector. The SOLEX crystals and detectors can be driven so that either spectrometer exposes RAP to the collimated solar X-rays while the other exposes ADP. The spacecraft pointing system can raster the SOLEX collimator over the whole sun or a 5 x 5 arc minute region to build up a monochromatic image, or it can point the instrument anywhere on the sun so that spectra in the 3-25 angstroms range are obtained. GRA

N80-17970# Institut fuer Weltraumforschung, Graz (Austria) Inst. fuer Meteorologie und Geophysik.
A STUDY OF HE SUPERPOSITION OF A CURRENT SHEET AND A DIPOLE FIELD [STIDIEN UBER DIE SUPERPOSITION VON STROMSCHICHT UND DIPOLFELDERN]
O. M. Burkard and H. Rucker. Apr. 1978. 39 p. refs. In GERMAN; ENGLISH summary.
Avail: NTIS. HC A03/MF A01.

The interaction between the solar wind plasma and a planetary obstacle, e.g., the Earth's dipole field, is examined. The magnetic field structure of the Earth's dipole is analyzed for the case of an incomplete shielding. The physical quantities which are important in this context are modeled and studied. The principle mechanism of the model is seen as a relative motion between a current sheet and a magnetic dipole initiating a force at the charged particles within the conductive sheet. According to the dipole's position relative to the current sheet which is responsible for a current system and a sheet magnetic field. The superposition of these current sheets and dipole fields leads to magnetic field structures which are expected to be found around the subsolar magnetopause. Author (ESA)

N80-17971# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 420, AUGUST 1979. PART 1: PROMPT REPORTS. Progress Report, Jun. - Jul. 1979
Helen E. Coffey, ed. Aug. 1979. 170 p.
(PB80-107097; SGD-420-Pt-1; NOAA-79092402). Avail: NTIS. HC A08/MF A01. CSCL 03B.

Data for July 1979 is provided on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, coronal holes, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, and Boulder Geomagnetic Substorm Log. Data is reported for June 1979 on: daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N80-17972# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR GEOPHYSICAL DATA NO. 420, AUGUST 1979. PART 2: COMPREHENSIVE REPORTS. Progress Report, Jan. - Feb. 1979
Helen E. Coffey, ed. Aug. 1979. 125 p.
(PB80-107105; SGD-420-Pt-2; NOAA-79092403). Avail: NTIS. HC A06/MF A01. CSCL 03B.

Data for February 1979 is provided on: active regions, synoptic solar maps, solar radio emission, energetic solar particles and plasma, and solar X-ray radiation. Synoptic charts and an abbreviated calendar record for January 1979 are included. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-17973 California Univ., Santa Cruz.
INFRARED STUDIES OF LINE EMISSION IN COMPACT H 2 REGIONS. Ph.D. Thesis
Daniel Fred Lester. 1979. 99 p.
Avail: Univ. Microfilms. Order No. 8002211.

Observations of infrared emission lines are reported for the compact H II regions G29.9-0.0,G45.13 - 0.14A, W49OH2, W51IRS1 and IRS2, G75.84 - 0.4, S106A, W3IRS1 and IRS3, S156, Mon R2IRS1, K3-50A and the H 2 region at the galactic center Sgr A IRS1. Measurements of the fine structure lines of [NeII] 12.81 micron, [SIV] 10.51 micron and [ArIII] 8.99 micron are presented, along with measurements of the Br alpha 4.05 micron recombination line of ionized hydrogen. For several of the least obscured objects, measurements of [SIII] 9532A, R delta 10048A and HeI 10830A are reported. Dissert. Abstr.

N80-17974*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
X-RAY SPECTRUM OF KEPLER'S SNR
R. H. Becker, E. A. Boldt, S. S. Holt, P. J. Serlemitsos, and N. E. White. Jan. 1980. 11 p. refs. Submitted for publication.
(NASA-TM-80637). Avail: NTIS. HC A02/MF A01. CSCL 03B.

Observations made with the solid state spectrometer aboard the Einstein Observatory confirm Kepler's SNR as an X-ray source with an intensity between 1-3 KeV of 7.2 x 10 to the-11th power ergs/sq cm-s. The X-ray spectrum is similar to those of Cas A and Tycho, with strong line emission from the helium-like species of Si, S, and Ar. Direct comparisons to Tycho's SNR suggest a distance of Kepler's SNR of greater than or equal to 5 kpc. Author

N80-17975*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE HIGH ENERGY X-RAY SPECTRUM OF 4U1700-37 OBSERVED FROM OSO-8
J. F. Dolan, M. J. Coe, C. J. Crannell, B. R. Dennis, K. J. Frost, G. S. Maurer, and L. E. Orwig. Oct. 1979. 24 p. refs. Submitted for publication.
(NASA-TM-80583). Avail: NTIS. HC A02/MF A01. CSCL 03B.

The most intense hard X-ray source in the confused region in Scorpius is identified as 4U1700-37. The 3.4-day modulation is seen above 20 keV with the intensity during eclipse being consistent with zero flux. The photon-number spectrum from 20 to 150 keV is well represented by a single power law with a photo-number spectral index of -2.77 + or - 0.35 or by a thermal bremsstrahlung spectrum with kT = 27.98.8-min X-ray modulation previously reported at lower energies. Despite the difficulties in reconciling both the lack of periodic modulation in the emitted X-radiation and the orbital dynamics of the system with theories of the evolution and physical properties of neutron stars, the observed properties of 4U1700-37 are all consistent with the source being a spherically accreting neutron star rather than a black hole. K.L.

N80-17976*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SATELLITE OBSERVATIONS OF RAPIDLY VARYING COSMIC X-RAY SOURCES. Ph.D. Thesis - Catholic Univ.
Gregory Scott Maurer. May 1979. 170 p. refs.
(NASA-TM-80285). Avail: NTIS. HC A08/MF A01. CSCL 03B.

The X-ray source data obtained with the high energy celestial X-ray detector on the Orbiting Solar Observatory -8 are presented. The results from the 1977 Crab observation show nonstatistical fluctuations in the pulsed emission and in the structure of the integrated pulse profile which cannot be attributed to any known systematic effect. The Hercules observations presented here provide information on three different aspects of the pulsed X-ray emission: the variation of pulsed flux as a function of the time from the beginning of the ON-state, the variation of pulsed flux as a function of binary phase, and the energy spectrum of the pulse emission. M.G.

N80-17977# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
DISCRETE GAMMA RAY SOURCES (E = 30 MeV)
V. Schoenfelder. 1979. 16 p. refs.
Avail: NTIS. HC A02/MF A01.

Low and medium energy gamma ray measurements between 0.5 and 30 MeV are reviewed. Results show that significant astrophysical phenomena are observable between X-ray energies and high energy gamma rays. Observations of galactic and extragalactic sources are summarized and future aspects are outlined. The development of extragalactic gamma ray astronomy is discussed for low gamma ray energies. Author (ESA)

99 GENERAL

N80-17978*# National Aeronautics and Space Administration, Washington, D. C.
THIS IS NASA
1979 53 p
(NASA-EP-155) Avail: NTIS MF A01; SOD HC as EP1.19:155 CSCL 05A

Highlights of NASA's first 20 years are described including the accomplishments of the National Advisory Committee for Aeronautics from its creation in 1915 until its absorption into NASA in 1958. Current and future activities are assessed in relation to the Federal R&D research plan for FY 1980 and to U.S. civil space policy. A NASA organization chart accompanies descriptions of the responsibilities of Headquarters, its various offices, and field installations. Directions are given for contacting the agency for business activities or contracting purposes; for obtaining educational publications and other media, and for tours. Manpower statistics are included with a list of career opportunities. Special emphasis is given to manned space flight, space launch vehicles, space shuttle, planetary exploration, and investigations of the stars and the solar system. A.R.H.

N80-17979# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
GENERAL PHYSICS, PLASMA DYNAMICS, AND COMMUNICATION SCIENCES AND ENGINEERING Annual Progress Report, 1 Jan. - 31 Dec. 1978
P. A. Wolff and J. Allen Jan. 1979 196 p refs
(Contract DAAG29-78-C-0020)
(AD-A076568; APR-121) Avail: NTIS HC A09/MF A01 CSCL 09/3

Progress is reported in the areas of general physics, plasma dynamics, and communication sciences and engineering. Topics covered include mic molecular microscopy, photoemission spectroscopy, interfacial chemistry, quantum electronics, radio astronomy, and electrodynamics. Digital signal processing, speech communication, and communications biophysics and neurophysiology are included. J.M.S.

N80-17980# Cambridge Univ. (England). Dept. of Engineering.
ACTIVITIES OF THE DEPARTMENT OF ENGINEERING FOR THE ACADEMIC YEAR 1977/1978 Annual Report
W. A. Mair 1979 27 p refs
Avail: NTIS HC A03/MF A01

Activities reviewed include those related to acoustics; fluid mechanics, applied thermodynamics and turbomachinery; control, management systems, and computer aided design; electrical engineering, material sciences, soil mechanics, and the study of structures and their properties. Author (ESA)

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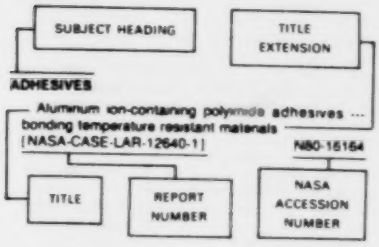

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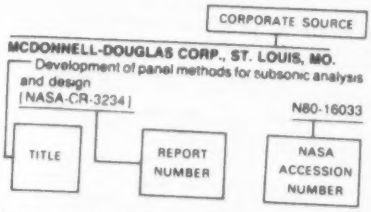

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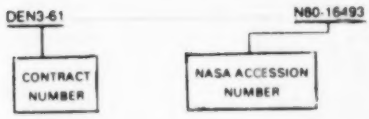

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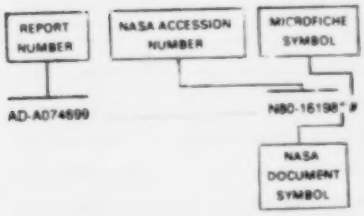

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AEDC-TR-79-18 N80-17457 #
AEDC-TR-79-22 N80-17405 #
AEDC-TR-79-51 N80-17088 #
AEDC-TR-79-65 N80-17169 #

AFAL-TR-79-1057 N80-17209 #
AFAL-TR-79-1105 N80-17331 #

AFAPL-TR-79-2010 N80-17075 #
AFAPL-TR-79-2027 N80-17554 #
AFAPL-TR-79-2035 N80-17165 #
AFAPL-TR-79-2041 N80-17076 #
AFAPL-TR-79-2049 N80-17366 #
AFAPL-TR-79-2055 N80-17227 #
AFAPL-TR-79-2059-VOL-1 N80-17862 #
AFAPL-TR-79-2079 N80-17242 #

AFFDL-TR-78-145-VOL-2 N80-17233 #
AFFDL-TR-79-3025 N80-17402 #
AFFDL-TR-79-3030 N80-17034 #
AFFDL-TR-79-3042 N80-17045 #
AFFDL-TR-79-3059-VOL-1 N80-17083 #
AFFDL-TR-79-3072 N80-17064 #
AFFDL-TR-79-3076 N80-17062 #

AFGL-TR-79-0103 N80-17526 #

AFIT/GSM/SM/79S-6 N80-17849 #

AFML-TR-78-81-PT-4 N80-17131 #
AFML-TR-78-150 N80-17204 #
AFML-TR-79-4027 N80-17224 #
AFML-TR-79-4037-VOL-2 N80-17509 #
AFML-TR-79-4049 N80-17880 #
AFML-TR-79-4070 N80-17149 #
AFML-TR-79-4117 N80-17153 #
AFML-TR-4037 VOL-1 N80-17510 #

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AFOSR-79-0990TR N80-17033 #
AFOSR-79-0991TR N80-17425 #
AFOSR-79-1060TR N80-17622 #

AFRPL-TR-79-55 N80-17890 #
AFRPL-TR-79-60 N80-17142* #

AFWL-TR-79-401 N80-17342 #

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AR-001-306 N80-17507 #
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ARDE-J/N-41065 N80-17062* #

ARI-RR-1217 N80-17714 #

ARL-MAT-NOTE-125 N80-17506 #

ARL-TR-79-26 N80-17825 #

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ARL/PSU/TM-79-140 N80-17431 #

ARL/STRUC-REPT-373 N80-17507 #

ARL/STRUC-370/MAT-106 N80-17204 #

ARLCB-MR-79014 N80-17471 #

ARLCB-TR-79023 N80-17874 #
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ARO-9014.30-C N80-17232 #
ARO-13031.3-MS N80-17188 #
ARO-13245.13-C N80-17232 #
ARO-13517.3-EX N80-17824 #
ARO-13677.2-ELX N80-17335 #
ARO-13731.A-P N80-17875 #
ARO-13739.8-GSX N80-17876 #
ARO-13754.2-CX N80-17173 #
ARO-13775.2-ELX N80-17368 #
ARO-13880.1-P N80-17455 #
ARO-14016.9-P N80-17446 #
ARO-14020.2-M N80-17770 #
ARO-14702.4-GS N80-17825 #
ARO-15277.2-A-P N80-17450 #
ARO-15850.4-A-EL N80-17731 #
ARO-16229.1-M N80-17730 #

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ASTRON-GEODAET-ARB-37 N80-17531 #

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AVRADCOM-TR-80-C-4 N80-17469* #

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BLRDR-5480 N80-17908 #

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BMFT-FB-T-78-36 N80-17378 #
BMFT-FB-T-78-42 N80-17370 #
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BMVG-FBWT-79-4 N80-17037 #
BMVG-FBWT-79-8 N80-17414 #
BMVG-FBWT-79-9 N80-17038 #
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BR57075 N80-17883 #
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BR69024 N80-17083 #
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CERL-TR-M-272-VOL-2 N80-17223 #

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CETIM-1-1D-05-0 N80-17518 #
CETIM-1-1E-24-0 N80-17786 #
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CETIM-1-2F-08-0 N80-17178 #
CETIM-1-3D-25-0 N80-17474 #
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CETIM-1-3K-18-0 ..... N80-17478 #
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CETIM-1-3N-05-0 ..... N80-17475 #
CETIM-1-3N-06-0 ..... N80-17479 #
CETIM-1-4A-29-0 ..... N80-17482 #
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CETIM-1-5H-05-0-PT-2A ..... N80-17493 #
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CETIM-13-D-25-0-PT-3 ..... N80-17481 #
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CMR-243-026-001 ..... N80-17881 #

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1085

02 AERODYNAMICS 1085

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1089

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1090

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1091

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1093

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1093

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1095

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1095

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1096

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS N.A.

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1099

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1100

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING 1100

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1101

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION N.A.

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1101

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 1102

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1102

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1104

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1109

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 1112

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 1117

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1119

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 1124

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 1129

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 1134

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 1139

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

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36 LASERS AND MASERS 1141

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 1144

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 1147

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 1148

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

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43 EARTH RESOURCES 1157

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 1164

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *85 Urban Technology and Transportation*.

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Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 1169

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 1175

Includes weather forecasting and modification.

48 OCEANOGRAPHY 1180

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 1181

Includes genetics.

52 AEROSPACE MEDICINE 1183

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 1187

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 1187

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 1188

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61 COMPUTER PROGRAMMING AND SOFTWARE 1190

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 1193

Includes computer networks.

63 CYBERNETICS 1193

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For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 1197

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 1204

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 1207

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 1207

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

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Includes quantum mechanics; and Bose and Fermi statistics.
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SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

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Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1223
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

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Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

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Includes cosmology; and interstellar and interplanetary gases and dust.

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Includes solar activity, solar flares, solar radiation and sunspots.

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N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey 3 Sep 1979 409 p refs
(Contract NAS1-15624)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01
CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, ROTOR SYSTEM RESEARCH AIRCRAFT - MATHEMATICAL MODELLING, STATE ESTIMATION, AND PARAMETER IDENTIFICATION

J.C. Wang, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCA 2-675902)

Two rotor system research aircrafts (RSRA) have been built to provide the United States Government with the capabilities necessary for the effective and efficient in-flight test and verification of promising new rotor concepts and supporting technology developments. To achieve the RSRA research mission a set of mathematical models will be studied for the design of vehicle flight control laws, estimation of rotor and wing force and moment, and a real-time flight simulation study. The integrated state estimation and parameter identification procedures developed by a NASA contractor will be reviewed and applied to RSRA simulated or real flight test data for estimation of RSRA states, and also for determination of the final structure and parameter values of each mathematical model. The estimated states are to be used for rotor performance analysis and the mathematical models will be used in the design of in-flight control laws. The characteristics of the RSRA instrumentation and recording systems will be analyzed for the RSRA system identification study. Most of the proposed studies will be conducted at NASA-Ames Research Center. A quarterly progress report and a final comprehensive report will be delivered to NASA-Ames.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0002, FLIGHT EVALUATION OF INTEGRATED NAVIGATION TECHNIQUES FOR GENERAL AVIATION

A.K. Choudhury, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 7624)

The feasibility of using a simplified Kalman filter to blend air data with multiple VOR/DME data will be analyzed and simulated on HP 21 MX computer and the results will be compared with the actual flight test data at Langley with on-board computers (micro-processors) to process the data.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

1.0003, MADAIR AIRCRAFT INSTALLATION

R.A. Morrisson, Lockheed California Co., *Burbank, California* 91503 (DN981085; N62269-78-C-0399)

Design and implement aircraft installation for the MADAIR F light test program. This contract supports work unit ZU 701, gency Accession No. DN 681083.

Perform the essential stress analysis, fabrication and preliminary installation effort for the on-board components of the MADAIR system.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

1.0004, GAS GENERATOR FUELS STUDY

L. Schipper, Signal Co. Inc., Airesearch Manufacturing Company, *1010 Wilshire Blvd., Los Angeles, California* 90017 (DF190710; F29601-77-C-0074)

Identification of viable alternative(s) to hydrazine for use in gas generators required to drive high power airborne power units.

Fifteen fuels are to be investigated for possible use in high power APU systems. The contractor will develop a parametric weighting system for selection of candidate fuels. A detailed fuel specification and duty cycle are provided for development of the weighting system. The range of interest is from 3,000 to 20,000 shaft horsepower.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

1.0005, AERONAUTICAL TECHNOLOGY, TECH AREA K - FLIGHT SIMULATION

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0D5000)

Perform analyses and design studies to determine the requirements of a rotary-wing R&D flight simulator capable of simulating NOE flight operations. This effort complements the hardware development being conducted under 6.3 Project DB34.

In joint participation with NASA, perform the studies with the expectation of providing modifications and additions to an available NASA simulator to meet the Army's mission requirements.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0006, HELICOPTER AIRBORNE INSTRUMENTATION SYSTEM

J. Strock, Schlumberger Ltd., EMR Telemetry, *Fruitville Rd., P.O. Box 3041, Sarasota, Florida* 33578 (DA0D4935; DAAK11 79 C 0033)

Current airmobile doctrine necessitates operations in flight regimes which cause high aircrew workload. This instrumentation package is needed to make quantitative assessments of aircrew performance. Data collected will be used to make design recommendation related to improving aircrew interaction with the helicopter. Instrumentation will consist of the installation to appropriate transducers to measure specified helicopter control and helicopter state variable. These signals will be processed for both recording on magnetic tape and relaying telemetry to a ground station. Acquire an airborne instrumentation system to assess aircrew performance over a wide range of operational conditions.

Furnish an airborne instrumentation system to be installed on a UH-1 helicopter by the USAHEL. System to be supplied

shall consist of an airborne data collection system, tape recording system along with ground station hardware and software needed to convert airborne taped data into engineering units for analysis.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Human Engineering Lab.

1.0007, ADVANCED TRANSONIC W/B DESIGN METHODOLOGY

M.E. Lores, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DF141350; F33615-78-C-3014)

The Air Force function for this effort is the design development of both transport and fighter aircraft. Transports, which cruise at transonic speeds, and fighters, which maneuver at transonic conditions, have been designed in the past by use of 2-D transonic and 3-D subcritical methods, although most problems are 3-D and transonic in nature. The objective of this effort is to develop more efficient transport and fighter configurations than possible in the past and at a lesser cost. This work will contribute to more fuel efficient transports and more maneuverable fighters at transonic speeds as well as reducing the cost of designing these aircraft.

Recently developed 3-D transonic methods will be incorporated into a design procedure and applied to the development of a transport and a fighter configuration. The configurations will be tested in a wind tunnel and the results of the tests will be used to verify or improve the computer code.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, TORSION-BENDING FLUTTER OF VISCOELASTIC WINGS

H.H. Hilton, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

An analysis of subsonic and supersonic torsion-bending flutter, including rotary inertia, shear and heating effects, of a time-dependent linear viscoelastic lifting surface consisting of either a Bernoulli-Euler or a Timoshenko beam is formulated using aerodynamic strip theory. Complex moduli models for aluminum are characterized as functions of temperature and frequency by fitting Chebyshev polynomials to actual material experimental data.

The flutter analysis is carried out in the complex plane and a computerized iterative method for the determination of flutter speeds and frequencies is developed. The influence of viscoelastic material properties (storage and loss moduli) temperature, rotary inertia and shear effects is evaluated. The results of the analysis show that in the presence of viscoelastic material damping it is possible to obtain flutter velocities and frequencies which are smaller than undamped elastic ones for the same geometric lifting surface.

The effects of structural damping in combination with viscoelastic damping are also under investigation.

SUPPORTED BY University of Illinois

1.0009, A NEW APPROACH TO FLIGHT CONTROL SYNTHESIS VIA OPTIMAL PILOT MODELING

D.K. Schmidt, Purdue University, School of Aeronautics & Astronautics, Dept. of Aeronautics & Astronautics, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (0294-56-1282)

Given adequate design specifications, or aircraft handling qualities criteria, and a valid system model, design techniques, particularly modern control approaches, are available to system designer for synthesizing even the most complex flight control systems. Unfortunately, however, weaknesses exist in both the design specification and modeling areas for non-conventional aircraft such as V/STOL and control configured vehicles (CCV's). The assertion here is that due to the 'non-conventional' multi-variable nature of the vehicle and the piloting task, and due to the anticipated complexity of the systems involved, a 'non-conventional' approach to the control design problem is worthy of investigation. The program would consist of the development and simulator evaluation of a design approach usable in the absence of quantitative handling qualities specifications, and yet explicitly include design objectives based on pilot rating concepts by means of an analytical pilot model. The proposed procedure involves the unique approach of simultaneously solving for the stability augmentation system (SAS) gains and pilot model via optimal control techniques. The program is just getting under way.

SUPPORTED BY Purdue Research Foundation

1.0010, NAVY VEHICLE DESIGN AND CONSTRUCTION - AIRCRAFT STABILITY AND CONTROL ANALYSIS AT HIGH ANGLES OF ATTACK

R.K. Mehra, Scientific Systems Inc., *1640 Massachusetts Ave., Cambridge, Massachusetts* 02138 (DN675668; N00014-76-C-0780)

At high angles of attack, the flying qualities of most high performance aircraft deteriorate due to undesirable characteristics such as pitch-up, roll coupling, wing rock, and directional divergence. These characteristics significantly reduce tracking capability and maneuverability, and often lead to loss of aircraft control. This program will develop an analytical framework of study for this flight regime, and identify designs of departure preventing control systems. The analysis is based on the bifurcation and catastrophe theory methodology (BACTM).

Utilizing six degree of freedom equations of motion and a fighter aircraft model equilibrium and bifurcation surfaces will be generated for the stall/spin flight regime. Aircraft flight test data will be used to verify the resultant surfaces as functions of aircraft control parameters. The theory will be applied to spin equations of motion to investigate the cause of post stall divergence, and techniques for spin prevention and recovery will be investigated. Simulation tests will be conducted to validate high angle of attack control techniques and test out the spin prevention and recovery techniques which are developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0011, EFFECT OF DESIGN VARIANCES AND MANUFACTURING TOLERANCES ON THE STRENGTH AND LIFE OF MECHANICALLY FASTENED COMPOSITE JOINTS

S.P. Garbo, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF140840; F33615-77-C-3140)

The efficient joining of the various composite materials involves the identification of parameters affecting joint strength and life, establishment of design approaches for military aircraft applications, and compilation of design data. In many cases, the manufacturing tolerances and quality acceptance limits used in the design of anisotropic composite joints are the result of practices developed from homogeneous metal joint test data implemented in aircraft structures for many years. The objective of this effort is to develop a failure criteria specifically for mechanically fastened anisotropic composite material joints. The payoff will be increased usage and lower production costs of composite military aircraft components without compromising reliability of the composite joints.

The approach taken in this effort will be to perform selective experiments to determine the effect of manufacturing (such as hole clearance and location tolerances) and design (such as irregular fastener spacing) tolerances on the static strength and fatigue life of bolted joints in graphite-epoxy composite structure. Failure mechanisms for the joints will be postulated based on prior experience and experimental observations and combined with accurate stress analyses to develop a failure criterion which shall be verified by additional experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0012, TRANSONIC SEPARATED FLOW STUDIES FOR NAVAL AIRCRAFT

T.J. Falk, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DN123228; N00014-76-C-0630)

The performance of aircraft at transonic speeds is severely limited during maneuvering by adverse shock-boundary layer interactions and flow separation on the wing. Though the effects of these phenomena on the aerodynamic characteristics

have been studied in the laboratory, the measurements have inadequately simulated viscous effects - resulting in serious problems when the laboratory data have been applied to the design of full-scale aircraft. The present investigation will study, experimentally, shock boundary layer interaction at transonic speed with full-scale viscous simulation to provide basic data leading to a more complete understanding of these complex flows and to provide for the development of viscous scaling laws.

Accurate aerodynamic data for aircraft and missile design needs require matching the Reynolds number as well as the Mach number in laboratory tests. Because of the extreme expense of conventional laboratory equipment to accomplish this match at transonic speeds, such testing has usually been performed at reduced Reynolds numbers - leading in several instances to serious airplance deficiencies. The present investigation will study shock boundary layer interaction at full-scale Reynolds numbers at transonic speeds in a short duration tube wind tunnel. Though the running time will be short, about 40 milliseconds, sufficient time will be available to develop steady flow, and enable total pressure and static pressure surveys to be made. In the interaction region, the surface shear and wall static pressure will be measured.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0013, ADVANCED CARBON BRAKES FOR FIGHTER AIRCRAFT

B.J. Brookman, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140890)

This effort supports the development of design and performance criteria and test techniques required for the optimum use of advanced carbon brakes on Air Force aircraft. Air Force aircraft incur high operational costs and down times due to maintenance and replacement costs of aircraft brakes. The objective of this program is to evaluate the potential of carbon-carbon composite materials used in aircraft brakes, and to develop standards and specifications for carbon brakes for future USAF aircraft. Potential advantages are lighter weight resulting in increased payload or lower fuel costs, better friction characteristics resulting in more efficient gear structure, and longer wear life resulting in lower acquisition and maintenance costs per landing and less down time.

A series of dynamometer tests will be conducted on three brake sizes (13 inch rim 2 rotor, 16 inch rim 4 rotor, and 18 inch rim 3 rotor) to evaluate the performance characteristics of carbon materials in aircraft brakes. A total of 8 carbon brakes with construction and material variations will be tested, along with two beryllium and one steel brake in order that the carbon performance may be assessed by comparison with more conventional materials. Brake performance will be evaluated as a function of energy level, rate of energy input, brake temperature, and brake wear rate. Additional sizes and carbon material variations shall be included in the test program as they are developed and become candidates for current and future aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, AIRCRAFT PARAMETER EXTRACTION USING UNSTEADY AERODYNAMIC FORCE MODELS

W.R. Wells, Wright State University, School of Science & Engineering, Dept. of Engineering, *Dayton, Ohio* 45431 (DF139660; AFOSR-77-3220)

This work unit supports the AFFDL/FGC basic research plan that is intended to provide experimental methods to validate theoretical unsteady aerodynamics. The identification of these experimental unsteady aerodynamics will provide for safer control of aircraft flight. The specific objective of this unit is to develop a parameter estimation procedure for unsteady aerodynamic terms associated with body fixed axis system motions. Results may be incorporated into flexible aircraft parameter estimation procedure in FY-78 time period. When these experimental data are better estimated and incorporated, the aircraft response to conventional and advanced control systems will be more predictable.

State equations of symmetric motion of an aircraft's body fixed axis system are to be developed from fundamental solutions of partial differential equations of potential flow. The aerodynamic parameter of a, b(t), c in the state equation dx/dt equals ax(t) plus b(t)x(t) plus cu are then estimated for linear and nonlinear equation cases.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, MM&T - APPLICATION OF THERMOPLASTICS TO HELICOPTER SECONDARY STRUCTURES (DA0E3869)

D.J. Hoffstedt, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0G0013; DAAK51-79-C-0019)

This manufacturing methods and technology (MM&T) program is to expand thermoplastic manufacturing technology to fabricate full-scale flightworthy secondary structures with a reduced cost as compared to epoxy composite and metallic counterpart components. Selection of the best overall fabrication technique will be conducted by investigating limitations of various vacuum-forming processes.

Work will consist of detail structural design refinement and configuration and material selection for the engine access door assembly for the CH-47 aircraft through element demonstration; tooling development; and, finally, fabrication of full-scale helicopter components. Tests will be conducted in order to perform comparative analysis (cost, structural integrity, weight, repair/maintenance characteristics) with the metallic and/or thermoset (epoxy) counterpart.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0016, CANOPY INTERNAL GLINT CONTROL

D. Piccioni, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0E3854; DAAK51 78 C 0009)

Develop a kit to eliminate or reduce helicopter (AH-1S) canopy reflections caused by instrument panel lighting.

Research has established that a light control film developed by the 3M company has the potential, if selectively applied, of eliminating or reducing canopy reflections from instrument lighting that cause night flight problems. This effort will use this method in the design and fabrication of an experimental kit for solving this problem for the AH-1S (production) helicopter. The kit will subsequently be tested and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0017, ALL-COMPOSITE GENERAL AVIATION AIRCRAFT

R.O. Stearman, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: In 1977, the first FAA certified all-composite aircraft was donated to the Aerospace Engineering and Engineering Mechanics Department of the University of Texas at Austin. Several flight research programs are being developed with this aircraft. These include an investigation of a mechanism of noise transfer into a composite aircraft cabin environment, an investigation of the influence of winglets on aircraft performance and a study of subcritical flight flutter testing techniques for general aviation aircraft. On-board digital data acquisition and recording systems are being developed for these programs. The study attempts to initiate a general aviation research program within the department.

SUPPORTED BY University of Texas

1.0018, HT 79-14- A REPRESENTATIVE SUMMARY OF THE AH-1G AERODYNAMIC AND STRUCTURAL LOADS SURVEY DATA

D.J. Merkley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3864)

Stimulate interest in and awareness of the quality, comprehensiveness and versatility of the AH-1G operational loads survey (OLS) data bank and the data management and analysis system DATA-MAP (data from aeromechanics' test and analytics - management and analysis package), formerly known as OLS-DMS. The OLS data bank contains simultaneously recorded data from an extensively instrumented AH-1G which includes blade surface pressures, leading edge stagnation data, local blade flow velocities and directions, blade accelerations, bending moments and attendant responses in the control system and airframe. The potential of the OLS data bank with respect to the Army's needs will be realized through increased interest and awareness.

Survey selected aerodynamic and structural data with corresponding flight-test conditions for representative steady-state and transient maneuvers convering the range of the OLS flight envelope. The resulting set of reduced data will be documented in plotted format utilizing DATA-MAP to illustrate the extent of flight conditions and magnitude of the various types of data available.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0019, NEW REMOTELY PILOTED VEHICLE, RPV, LAUNCH AND RECOVERY CONCEPTS DEVELOPMENT

R.F. Yurczyk, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF137610; F33615-78-C-3404)

The advanced remotely piloted vehicle (ARPV) has been assigned a definite role in support of combat operations in conventional warfare. A critical link in this role is a capability for high sortie rates and fast turnaround times, which are largely controlled by the effectiveness of the launch recovery system. The objective of this effort is to study several air cushion launch/recovery systems and an air bag skid landing system in terms of system dynamics, operational capability, and cost. This study will allow a valid evaluation of the effectiveness of these systems to be made.

A dynamic model of two basic RPV airframes combined with several different air cushion systems and an air bag skid system shall be made and their dynamic response studied to determine optimum configurations. preliminary designs incorporating the results of the analysis shall be made. A performance and cost study of the various systems shall be done.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, EVALUATE AND MODIFY VIKING LANDER X-RAY FLUORESCENCE ANALYZER

W. Kelleher, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Langley Research Center, *Hampton, Virginia* 23665 (D7-0053; J884A-029)

OBJECTIVE/APPROACH: The objective of this project is to convert the X-ray fluorescence analyzer developed for the Viking spacecraft for use in water monitoring applications. First a detailed evaluation of problems regarding detection limits, preconcentration, cooling, etc. will be made to determine the potential for adapting the instrument. If adaptation appears economically feasible, identified modifications will be made to the unit and it will be field tested.

FINAL OUTPUTS: 1. A report on the feasibility and anticipated problems of converting the X-ray fluorescence unit for use in water monitoring will be delivered. 2. If approved, a report on modifications made and results of tests will be prepared.

PROGRESS: An existing IAG with NASA-Langley has been modified to permit this work. Conversations with other researchers have identified many potential problem areas which must be addressed. Work at NASA-Langley is presently being initiated.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, A STUDY OF THE REDOX PHOTOCHEMISTRY OF A NUMBER OF IRON COMPLEXES

J.L. Reed, Atlanta University, School of Arts & Sciences, Dept. of Chemistry, *223 Chestnut St. S.W., Atlanta, Georgia* 30314 (NSG 8019)

It has been proposed that ferric and ferrous complexes may be utilized in converting solar energy to more useful forms. However, although a number of reports on the photochemical behavior of iron complexes have appeared in the literature, our understanding of these phenomena is still very incomplete. It is the objective of this investigation to examine a number of iron complexes in an effort to obtain a more complete understanding of their behavior.

Of particular interest in this study is the mechanism(s) operative in oxidation-reduction of iron complexes and related model compounds. To be examined are: the energy state(s) responsible for the effects of solvent and temperature on the process and energy transfer processed.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

3.0002, POLYMER FRACTOGRAPHY - A SCANNING ELECTRON MICROSCOPY ATLAS OF FRACTURES

E.J. Korda, Atlanta University Center Corp., Science Research Institute, *360 Westview Dr. S.W., Atlanta, Georgia* 30310 (KSC 80-1)

The purpose of this investigation is to study the fractured surfaces of polymeric materials (i.e., elastomers, amorphous and crystalline polymers, etc.) using the scanning electron microscope to document representative features to produce an atlas of fractographs that can be utilized in the identification of failure modes. Initially, brittle and ductile polymers fractured by tension and fatigue are being studied.

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

3.0003, CHARACTERIZATION OF THE PHYSICO-CHEMICAL PROPERTIES OF POLYMERIC MATERIALS FOR AEROSPACE FLIGHTS

M. Rock, Bowie State College, Graduate School, Dept. of Chemistry, *Bowie, Maryland* 20715 (NSG 5009)

Materials of interest to Goddard Space Flight Center are routinely tested in a vacuum at 125 degrees C, at Greenbelt, to determine their outgassing properties. This affects their suitability for use in space modules. It is our object to extend the range of these tests to higher and lower temperature ranges than those usually run at Goddard Space Flight Center. Further, we have the capability of testing materials in air or inert atmosphere as well as in vacuum.

We use a Dupont 900 Differential Thermal Analyzer (DTA) and an auxiliary Dupont 950 Thermogravimetric Analyzer (TGA). The TGA enables us to measure outgassing - via weight loss - from 20 degrees to 500 degrees C. The DTA indicates exothermic and endothermic changes over the same range. We are currently running the standard DTA and TGA tests.

We are also doing research for the battery analysis program.

Nickel-cadmium batteries sometimes fail in use. It is useful to analyze similar cells, of the same batch, which have been subjected to the same conditions.

We are developing calibration curves for atomic absorption spectroscopy. The curves involved are for Ni, Cd and Co. Calibrations are also being made for mixtures.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

3.0004, HOMOGENEOUS AND HETEROGENEOUS TERNARY COMPLEXES INVOLVING NUCLEOTIDES, METAL CATIONS AND AMINO ACIDS

J. Orenberg, California State University & Colleges, San Francisco State University, School of Science, Dept. of Chemistry, *1600 Holloway Ave., San Francisco, California* 94132 (NCA 2-660902)

Ternary coordination complexes involving 5'-nucleotides, amino acids, and metal ions play an important role in contemporary biological processes such as replication, transcription, and amino-acylation. Clay surfaces containing metal ions in the matrix can be considered to be close inorganic analogs to ternary systems in biological processes. Clay surfaces are of interest to chemical evolutionists because they have recognized the possibility of specific adsorption and thus concentration of biological or prebiological molecules on these surfaces leading to condensation. It is the intent of this investigation to evaluate stability constants and selectivity for aqueous mixed-ligand, ternary systems involving nucleotides, metal ions and amino acids and compare these results to the analogous ternary systems of homometallic clays, nucleotides, and amino acids. This comparison should allow conclusions to be drawn as to the necessity of clay surfaces in the formation of metal ternary complexes leading to condensation products or biopolymers in chemical evolution. The results should be significant in determining the direction of future endeavors involving polymer absorption and condensation on homometallic clays. A final written report embodying the results of the collaborative research shall be submitted.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0005, SMECTITE CLAYS IN MARS SOIL - EVIDENCE FOR THEIR PRESENCE AND ROLE IN VIKING BIOLOGY EXPERIMENTS

J.B. Orenberg, California State University & Colleges, San Francisco State University, School of Science, Dept. of Chemistry, *1600 Holloway Ave., San Francisco, California* 94132 (NSG 7512)

This investigation is intended to show by experiment the hypothesis that if clays are major components of the fine Martian soil, then most of the results of the Viking biology experiments were caused by and can be explained on the basis of clay surface activity in catalysis and gas adsorption. The first year of this study showed that the Viking Labeled Release (LR) reaction could be simulated with certain clays; labeled carbon was released from the medium solution used in the Viking LR experiment when reacted with clays at rates and quantities similar to those measured by Viking on Mars. The component in solution that decomposed most readily was formate; the decomposition is postulated to be iron catalyzed on the clay surface. The reaction rate was affected by pH, type of exchangeable ion, salt concentration and preheating. It is planned to continue the study of the effects of water content, salt content and salt composition in the clay in LR experiments. Experiments also will be initiated to study the carbon fixation reaction similar to that occuring in the Viking Pyrolytic Release carbon assimilation experiments. The results of these studies will allow a better understanding of the Mars soil chemistry (its effects on the planet's water and volatiles balance) and its geological history.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

3.0006, FIBER RELEASE BY MECHANICAL LOADING & THERMAL EXPOSURE FROM FIBER REINFORCED POYMERIC COMPOSITE MATERIAL AIRCRAFT PARTS (ABBREV)

R.N. Anderson, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Materials Science, *Washington Sq., San Jose, California* 95192 (NSG 2332)

The objectives of the project are: 1. To study the amount and size of carbon fiber released when the composite material panels were subjected to a) impact and fire, b) fire alone and c) fire and impact. 2. To measure the mechanical properties of composite materials in tension and flexure with and without aging the material in different weathering conditions. 3. To measure the thermal properties like thermal conductivity, specific heat and thermal expansion coefficient. 4. To measure the impact resistance and vibration damping and elastic modulus at different temperatures.

The first objective has been completed by designing the required test set-ups and analyzing the test results. The fiber release is correlated with time of fire, velocity of gas flow, structure of the material.

The current emphasis is on measurement and correlation of the mechanical and thermal properties of composite materials. Ten candidate composite materials have been tested using different test equipment. These test results are useful in characterizing the composite materials for strength, modulus, fracture toughness, impact strength under different environmental conditions and temperatures. These data are also applied in processing composite materials to test different curing cycles and resins.

The thermal properties are required to calculate the spalling resistance of composite materials. These tests are also planned to be run.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0007, A STUDY OF FIBER MATERIALS FOR USE IN TEMPERATURE RESISTANT FIBER REINFORCED COMPOSITES

R.N. Anderson, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Materials Science, *Washington Sq., San Jose, California* 95192 (NCC 2-3)

The objective of this project is to evaluate the high temperature characteristics of commercially available and developmental refractory fibers for use in fiber reinforced composites. Specifically, the structure of an aluminoborosilicate fiber has been studied in detail as a function of temperature utilizing x-ray diffraction analyses and scanning electron microscopy to determine its structural limitations and capabilities. In addition, developmental fibers recently synthesized are being studied and modified to improve their properties for use in fiber reinforced composites.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0008, AN INVESTIGATION OF TOXIC HAZARDS FROM BURNING MATERIALS IN CONTROLLED FIRES

R.C. Ballard, California State University & Colleges, San Jose State University, School of Science, *Washington Sq., San Jose, California* 95192 (NCC 2-4)

The goals of this investigation are to examine the egress capacity, exposure toxicity, and subsequent pathology in Sprague-Dawley rats when exposed to manufactured materials that are burned so as to duplicate a fire scenario.

Progress is currently being made in developing and assemblying the necessary materials and equipment for these evaluations.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0009, A STUDY OF PROCESSING PARAMETERS FOR NON-METALLIC COMPOSITES

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2209)

Durable, lightweight, structural materials can be made from polymer containing composites. These materials often have low fire resistance. Improving the fire resistance of the polymer by including halogen often results in undesirable side effects, e.g., toxic fume evolution on burning.

The objective of this grant is to produce fire-resistant polymers without resorting to halogenation. One approach is to increase the char forming tendency by incorporating multiply

bonded aromatic groups in the polymer structure. Materials containing pendant fluorene groups have been synthesized and are being evaluated for their processability and their thermal and flammability characteristics.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0010, CHARACTERIZATION AND DEGRADATION STUDIES ON AROMATIC POLYIMIDES AND POLYESTERS

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2274)

The objective of this study is to characterize a number of polymers for potential use in aerospace applications, and to study their thermal degradation reactions.

The thermal, physical and chemical properties of different polymers are being obtained and compared using thermogravimetric analysis, differential scanning calorimetry, dynamic mechanical analysis and thermal conductance measurements. The char and the volatile materials evolved under thermal degradation of various polymers have been examined using gas chromatography-mass spectrometry, infrared, nuclear magnetic resonance spectroscopy, elemental analysis and other analytical tools and methods. Some model compounds have been synthesized and studied.

Preliminary data on (1) photo/thermal degradation of an aromatic polyimide (Kapton), (2) photo/thermal degradation of polyester (based on bisphenol fluorene or bisphenol A and 50/50 iso-/terephthalic acid), (3) thermal oxidation and degradation of epoxy resins (MY 720-DDS, Epon 828-DDS) and (4) dynamic mechanical analysis of various composite resins (MY 720-DDS, Epon 828-DDS, Narmco 5208, and MXG 6070) are reported.

The research will carry out detailed thermal chemical and physical characterization on advanced composite resins such as polystyrylpyridine, bismaleimide polymer and epoxy resins based on the bisphenol fluorene system.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0011, APPLICATION OF X-RAY FLUORESCENCE SPECTROMETRY TO WATER QUALITY ASSURANCE

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2305)

The objective of these studies was to develop analytical methodologies based on X-ray fluorescence (XRF) spectrometry that will provide fast real-time (less than 20 minutes) simultaneous multi-element determination of inorganic elements as fractional parts-per-billion levels in municipal drinking water and reclaimed waste-water. A second aspect of this project was to develop this package in such a manner that it could be mounted in a mobile 30' trailer along with up to 17 other such analytical modules, thus forming a complete mobile water quality assurance laboratory.

The primary inorganic species of interest are the 8 elements covered by US EPA regulations for drinking water, and experimental work is based on energy dispersive XRF utilizing isotopic excitation (chosen deliberately in view of the space limitations and portability requirements dictated by use in the trailer). In view of parallel development work by the Magnovox Corporation via EPA grants which has concentrated on cationic species, we have directed our attention to the anionic species Cr(VI), As, and Se.

Experimental work has been completed that examines the kinetics of anion exchange on thin membranes, pH and temperature control, potential oxidation state changes by anionic analytes, and interferences from other higher concentration anions. Preliminary work has been conducted to allow development of calibration standards, and absolute trapping efficiencies for the commercially supplied anion exchange membranes have been determined for each element under of variety of conditions.

Experimental work continues on the analytical methods needed for real samples, or the optimum method of preparing and using absolute and relative standards, and on the distribution of inorganic pollutants between bulk water and particulates. Alternate methodologies for pre-concentration techniques will be examined in more detail.

Co-operation with the Santa Clara Valley Water District, and use of their facilities at the Palo Alto, California, wastewater reclamation plant, are gratefully acknowledged.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0012, INORGANIC CRYSTAL CLATHRATES - FIRE CONTROL INVOLVING INORGANIC MICRO-ENCAPSULATION & THERMALLY CONTROLLED RELEASE (ABBREV)

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCA 2-675806)

The major objective of this program was to develop a new or improved fire extinguishant system based on dry chemicals that will not only extinguish fuel fires with a continuous source of fuel (i.e. a broken fuel lead feeding an ignition source such as an electrical fault or adjacent hot surface), but which will prevent the fire from re-igniting after extinguishment even though the supply of fuel is still present and has not been terminated. In particular, we were concerned with fires localized in engine compartments of aircraft. Since fire is a chemical phenomenon it should be controllable by chemical means, and both experimental and theoretical methods have been used to produce, develop, and successfully test a new concept in fire control.

Experimental work has now been completed wherein a group of new chemicals have been characterized, their synthesis by new methods developed and optimized, and shown to possess special properties that satisfy several requirements predicted for fire control. Based on these new chemicals, model systems have been formulated, developed, and successfully tested under a variety of conditions pertinent to aircraft engine nacelle fires. These model systems have proven to be more effective than any commercially available fire extinguishants, and more effective than any other known experimental systems. A theoretical model has been developed and refined that appears to describe fire control mechanisms better than any previous models, and which is supported by a considerable body of experimental data obtained for a variety of conditions.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0013, RADIATION CHEMISTRY STUDIES OF CARBON SUBOXIDE POLYMERS - AN INVESTIGATION OF A PROPOSED PRE-BIOTIC LINK TO THE ORIGINS OF LIFE

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The objective of this program is to examine a self-consistent hypothesis for the formation of life-bearing molecules from a simple inorganic substances such as carbon monoxide and carbon dioxide, and which provides a viable alternate to the currently accepted 'primeval soup' hypothesis. More importantly, this alternate hypothesis could account for the formation of life-bearing molecules on planets that are devoid of water and reduced carbon precursors such as methane, conditions that are difficult to reconcile with the 'primeval soup' hypothesis, and are just the conditions that obtain on Mars and Venus according to data received from the planetary probes sent to these planets.

The experimental work is being carried on under three broad categories, directed by three faculty members: One group is examining the physical-organic aspects of reaction mechanism pathways, directive effects, and product distributions; a second group is concerned with inorganic aspects of the postulated polymeric intermediates, surface induced polymerization effects, and configurational properties of polymer growth; a third group is examining the radiolytic and photolytic effects induced by various energy input and transfer processes (photolytic, radiolytic, tribo-luminescent, and magnetic).

Experimental work continues under these same three broad categories, and will include the study of model compounds such

as substituted alpha-pyrones, circular dichroic measurements of polymeric materials grown under intense local magnetic/electrical fields, stabilization of excitation centers, and specific radical attack phenomena induced by microwave discharges.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0014, ENVIRONMENTAL STABILITY OF COMPOSITE RESIN MATRICES

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2353)

The objective is to study the photooxidative and hydrolytic degradation of baseline and advanced composite resins as part of an assessment of their long-term environmental stability as matrices for fiber-reinforced composites. Baseline matrices consist of epoxy resins based on diglycidyl ether of bisphenol A (e.g., Epon 828) or tetraglycidylmethylene dianiline (e.g. MY 720), while advanced matrices include epoxy resins based on blends of diglycidyl ether of bisphenol A and diglycidyl ether of bisphenol fluorene, phenolic novolacs, bismaleimides and polystyryl pyridine. The mechanisms by which these resins degrade under the influence of ultraviolet radiation, oxygen and moisture are being investigated with the aid of infrared spectroscopy and scanning electron microscopy. This work focused on the effect of degree-of-cure on the photooxidation of Epon 828 and MY 720 resins, both cured with diaminodiphenylsulfone (DDS). The standard-cured MY 720/DDS resin was found to photooxidize at a much slower rate than the corresponding under- or overcured resins. This finding was confirmed by accelerated weathering tests. In contrast, Epon 828/DDS resins, whether standard, under- or overcured, all showed essentially the same rate of photooxidation and the same rate of accelerated weathering.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0015, MODIFICATION OF POLYMERIC SUBSTRATA FOR THE GAS CHROMATOGRAPHIC ANALYSES OF CO, CARBONYLS AND O2 IN ATMOSPHERES

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STATEMENT OF THE PROBLEM: To chromatographically separate and identify the components of planetary gases with emphasis on carbon monoxide, carbonyls and oxygen. In order to analyze light gases successfully, all gaseous constituents must be adequately separated from each other. Examples of generally difficult separations include N2/CO,Ar/CO,. N2/O2 and Ar/O2. Carbonyl (C double bond O) containing molecules are expected to be found along with hydrocarbons, nitrilic species and amines, from which they will have to be separated. With deliberate and controlled retardation of the oxygenated species, the problems of peak coincidence can be resolved. The gases that are being described are those anticipated in the analysis of planetary atmospheres during future unmanned missions.

GENERAL APPROACH TO BE APPLIED: The investigation of physically enclathrated di-oxygen retarding chelate species by di-vinylbenzene polymers will provide the basis for experimentally resolving peak coincidences.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0016, GRAPHITE-EPOXY COMPOSITE PROTECTIVE COATINGS

L.A. Mayer, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2371)

STATEMENT OF THE PROBLEM: To prevent or delay the onset of a form of self-sustained oxidation ('smoldering combustion') of composites subjected to hyperthermal environments; to prevent or delay the irreversible loss of composite properties subjected to hyperthermal environments.

APPROACH TO BE APPLIED: The investigation will be directed toward determining the effectiveness of non-intrusive thin film coatings as it relates to the problem statements. Preliminary evidence suggests the viability of the above approach. Continuing efforts will be directed at determining the feasibility and suitability of inorganic-intumescent/ablative coating systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0017, OXYGEN EFFECTS AND EARLY BIOCHEMICAL EVOLUTION - ACETYL-COA SYNTHETASES OF YEAST

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The unicellular eucaryote, S. cerevisiae can grow with and without the presence of oxygen during growth. The major objective is to study the effects of oxygen on some biochemical processes in this yeast, with special reference to the enzyme acetyl-CoA synthetase. This organism produces two different isozymes depending on the availability of oxygen. The effects of oxygen on the production of these two isozymes will be studied. Attempts are directed towards purification of the enzyme elaborated under anaerobic conditions. Immunology coupled with classical enzymological approach are being used towards this goal.

The technique to obtain monoclonal antibodies without specific immunization is being used, since the non-aerobic isozyme is labile to all purification techniques. Preliminary data with aerobic isozyme has revealed the technique can be adapted to the enzyme of non-aerobic origin.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0018, CHARACTERIZATION AND FORMULATION OF FLUOROCARBON ETHER ELASTOMERS

G.A. Selter, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2186)

The requirements of high-performance aircrafts have led to making use of internal cavities in the wings and other parts of the aircraft for fuel storage. The objective of this proposed research is to synthesize and thoroughly characterize new sealant materials for the interior of aircraft fuel tank. Spectroscopic, chromatographic, kinetic, thermogravimetric, calorimetric, and mechanical methods of analysis are being used to optimize conditions of new elastomer synthesis and limits of their applications. A process for simultaneous chain extension and crosslinking was developed whereby oxadiazole and triazine rings are formed to serve as linkages. Several perfluoroalkylether polymers with different chain length and crosslink density were successfully prepared and characterized. These polymers have excellent low-temperature flexibility, low modulus, and high thermal stability.

Recently a new technique using triazine ring system for both chain extension and crosslinking has been developed which simplifies the curing process and produces much better sealant materials in almost every aspect. However, the properties of perfluoether polymers are determined by the chain length and crosslink density, so optimization of these factors will be investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0019, ANTIREFLECTION COATINGS FOR SOLAR CELLS

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This program is directed at the development of new materials and a new fabrication method for the deposition of antireflection (AR) coatings on existing photovoltaic cells. The new AR coating material to be investigated is nonstoichiometric silicon oxynitride. The new AR coating deposition process to be used is plasma enhanced chemical vapor deposition. These sili-

con oxynitride coatings will be inhomogeneous, i.e., the composition of the coatings will have a spatial gradient in their refractive index.

The current status of this program is: a) Design calculations for optimal refractive index profiles of dielectric coatings have been completed for a variety of coating thicknesses and cell encapsulation materials, and b) The plasma reactor has been constructed and is currently being inspected by the safety department prior to its use.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0020, ANALYSIS AND INVESTIGATION OF AEROSPACE BATTERIES

P.P. McDermott, Coppin State College, Undergraduate School, Dept. of Chemistry & Physical Sciences, *2500 W. North Ave., Baltimore, Maryland* 21216 (NSG 5051)

The object of this research has been to improve the life and reliability of aerospace batteries through the investigation of cell degradation and factors that limit cell life. Under this program, a full-time Research Associate directs the analysis of test cells at the Goddard Space Flight Center's Electrochemical Analysis Laboratory and trains Coppin State College students in techniques of chemical and electrochemical analysis.

The Principal Investigator has studied a number of areas related to cell degradation, including positive plate determination, cadmium migration, electrolyte relocation, and the changes in electrode morphology with aging. Results of these studies have been reported extensively in the Proceedings of the GCFC Battery Workshop, Extended Abstracts of the Electrochemical Society, Procedings of the Power Conference, and the IECEC.

Future work will include examination of the voltage data as a means of assessing the state of the battery deterioration and extension of research into the area of Lithium batteries.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0021, LASER INDUCED PHOTOLUMINESCENCE STUDIES OF PRIMARY PHOTOCHEMICAL PRODUCTION PROCESSES OF COMETARY RADICALS

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The primary quantum state distributions of dark fragments following photodissociation have been measured for H2O, C2N2 and HC2CH, as part of an ongoing program to investigate the dynamics of photodissociation. Such energy distributions are important for understanding cometary spectra. A powerful Nd-YAG pumped dye laser system with frequency mixing and anti-Stokes Raman shifting will be used in this program as a narrow band photolysis source in the near VUV to expand this work.

The photochemical lifetime of OH in comets at 1 AU has been calculated to to be between 7x10 to the 4th power and 2x10 to the 5th power sec, depending on the radial velocity of the comet. The first observations of cometary spectra using IUE were made of Comet Seargent 1978m.

Finally photodissociative excitation using an atomic resonance lamp has shown that NH3 and N2H4 may be qualitatively identified and quantitatively measured at the pressures that may be encountered in a cometary mission. Using f/l optics the sensitivity has been conservatively estimated at 10 to the 10th power molecules/cc for a 100 sec counting period.

BIBLIOGRAPHIC REFERENCES: The Lifetime of the OH Radical in Comets at 1 AU, W.M. Jackson, in press, Icarus (1979). IUE Observations of Comet Seargent 1978, W.M. Jackson. Astronomy and Astrophysics, 73, L-7 (1979).

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

3.0022, AQUATIC PLANTS AS FILTRATION SYSTEMS FOR CHLORINATED HYDROCARBONS

F.L. Shore, Jackson State University, School of Liberal Arts, Dept. of Chemistry, *1365 Lynch St., Jackson, Mississippi* 39217 (NSG 8026)

The purpose of this proposed research is to: (1) investigate the potable water supply of the NSTL Mississippi test facility to identify and estimate the organic compounds present and (2) to evaluate the effectiveness of aquatic plants for removal of identified compounds from the water.

We have shown the water hyacinth Eichhornia crassipes (Mart.) Solms will rapidly remove Toxaphene, Mirex, Kepone, and DDT from water. We have also found evidence of dechlorination of Toxaphene in extracts of the leaves of hyacinths grown in aqueous solutions of this pesticide.

The well water will be passed through XAD resin, desorbed with an organic solvent and analyzed for organic compounds by injection in the gas chromatograph with electron capture, the gas chromatograph-mass spectrometer, and liquid chromatograph.

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

3.0023, THE MATRIX-ISOLATION INFRARED-LASER-RAMAN STUDY OF THE MOLECULAR STRUCTURE OF CHLORINE NITRATE

J.H. Hall, Morehouse College, School of Arts & Sciences, Dept. of Chemistry, *223 Chestnut St. S.W., Atlanta, Georgia* 30314 (NSG 7652)

The possible depletion of the stratospheric ozone layer by chlorofluorocarbons has been a matter of considerable concern and interest in recent years. The chlorofluorocarbons or freons are chemically inert in the troposphere and may diffuse into the stratosphere and undergo photodissociation to form Cl. The Cl atoms may then react with O3 to form ClO and possibly catalytically deplete the ozone layer.

It has been suggested that the chemical models of the stratosphere be modified to incorporate the formation and destruction of chlorine nitrate, ClONO2, ClO plus NO2 plus M yields ClONO2 plus M, ClONO2 plus h nu yields Cl plus NO3 or O plus ClONO.

A reasonable structure for ClONO2 is one of C2v symmetry with a Cl attached to an oxygen on a symmetric NO3; however, it has been recently proposed that ClONO2, produced via reaction (1), possibly exists in four isomeric forms, the C2V structure, as ClOONO, OClONO, and OClONO (C2V).

The purpose of this proposed research is to 1) obtain low temperature (10K) infrared and laser-Raman spectra of laboratory synthesized stable ClONO2; 2) determine whether isometric forms of ClONO2 produced from (1) exist and spectroscopically (infrared and laser-Raman) characterize these molecules; and 3) determine qualitatively the relative stabilities of any isomers.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Jet Propulsion Lab.

3.0024, ELECTRON-IMPACT EXCITATION OF MOLECULAR NITROGEN

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A distorted wave procedure is being used to calculate the total and differential, electron-molecular nitrogen impact cross sections, for the elastic and electronic excitation processes. The distorted wave method is a variationally stable technique based on a generalization of the multichannel Kato identity, and a single-center representation of the target is used. However, the scattering equations, which are solved using a non-iterative integral equation algorithm, include only the spherical part of the interaction potential, while the non-spherical part appears in a matrix element sandwiched between the calculated projectile orbitals. The collision energies of primary interest lie between ten and one hundred electron-volts.

A unique development is the use of the computer to generate formulas based on Slater-type orbitals. This is made possible

by employment of our recently developed c-matrix and our version of 'computer algebra.'

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

3.0025, HIGH VACUUM-HIGH TEMPERATURE EVAPORATION OF SUPERALLOYS

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OBJECTIVE: To study evaporative characteristics of a number of superalloys at temperatures 700 degrees C, 800 degrees C, 900 degrees C and 1000 degrees C and approximately 10 minus to the 6th power torr. Rates of evaporation of alloy ingredients, and preferential evaporation of the same elements are expected to be learned. Results are to be used to determine the best alloying combination for high temperature applications in outer space,

APPROACH: Four high vacuum and high temperature systems, each at one of the 4 temperatures given above, are loaded with 9 specimens and tested for aging periods from 6 hours to 4600 hours. Weight losses are determined during each successive aging period.

CURRENT PROGRESS: Testing of the first superalloy, Hastelloy X, is almost terminated and plans are currently underway to test Hastelloy S.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0026, ESR STUDIES OF VISCOUS LIQUID CRYSTALS

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The transient response of nematic Phase V (EM Laboratories) and nematic butyl-P-(P-ethoxypenoxycarbonyl)phenyl carbonate (BEPC) to a redirected magnetic field has been explored by EPR and a new EPR linewidth phenomenon accompanying this transient response has been discovered. The spin probes employed in this work were vanadyl acetylacetonate and 2-(14 carboxytetradecyl) 2-ethyl-4,4-dimethyl-3-oxazolidinyloxyl. In all cases studied the transient response for reorientation angles 25 degrees or less leads to an EPR line broadening which relaxes exponentially to the equilibrium value. Below 0 degrees C the activation energy for the relaxation process involving phase V is 14.7 kcal/mole; from 0 degrees C to 25 degrees C the activation energy is 10.1 kcal/mole. In the case of BEPC the activation energies are about 13.5 kcal/mole below 58 degrees C and about 9 kcal/mole above 58 degrees C. In both cases the change in activation energy occurs roughly 5 degrees C above the normal nematic-crystalline transition temperature. Present experimental data show no dependence of the measured relaxation parameters on the nature of the spin probe employed.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0027, SYNCHROTRON RADIATION AS A PROBE OF ATOMIC AND MOLECULAR PROCESSES

R.N. Zare, Stanford University, School of Humanities & Sciences, Dept. of Chemistry, *Stanford, California* 94305 (PHY79-08694)

Research will continue on a study of the interaction of ultra-violet light from a synchrotron radiation source with simple atoms and molecules. New equipment will be installed to obviate the need for any windows between the source and the sample and thus make it possible to use photons of a wider range of wave lengths. Two main topics will be investigated: 1) a study of the dynamics of molecular dissociation; 2) a study of atomic photoionization.

Both studies will address such fundamental problems as the symmetry of the repulsive state responsible for the dissociation process and the lifetime of the excited state.

This research is a continuation of that currently supported under NSF grant PHY77-02252.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

3.0028, ANALYSIS AND EVALUATION OF ADVANCED ROCKET NOZZLE MATERIAL US

J.B. Patton, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN782242)

To increase the basic understanding of the thermomechanical behavior of advanced rocket nozzle materials (e.g. carbon-carbons). Results will lead to increased reliability of advanced strategic propulsion systems. Special attention will be paid to material behavior at high temperature, mechanical property characterization methods, nondestructive test and evaluation methods, failure mechanisms, and improved analytical techniques.

Identify current deficiencies and inadequacies in the thermomechanical characterization of carbon-carbon materials. In conjunction with ONR, a research program will be developed and implemented to increase the basic understanding in critical carbon-carbon materials technology areas. This will be accomplished by reviewing all similar and related work, planning new programs, reviewing proposals, monitoring and evaluating progress of pertinent ONR programs and contracts, providing coordination of similar DOD (NRL, NSWC, RPL, AFML, AFOSR) laboratory efforts and ongoing programs, and keeping onr personnel informed about ongoing work and plans.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0029, DAMAGE AND EROSION OF MATERIALS

A.G. Evans, University of California, Berkeley Campus, Graduate School, *2200 University Ave., Berkeley, California* 94720 (DN975217; N00014-79-C-0159)

Carbon-carbon composites (C/C) are prime candidates for use in RV nose cones and launch vehicle rocket nozzles. Ceramics such as Si3N4 are candidate materials for missile engines and domes. The use of these materials in the above applications requires microstructures that are resistant to erosion (material removal). This study has the following three objectives: (1) characterize the deformation processes leading to erosion, (2) determine the microstructural dependence of these deformation processes, (3) develop models of the erosion process.

Carbon-carbon and model (glass fiber-epoxy) materials will be loaded in compression. The deformation processes, such as fiber kink initiation, at defects will be characterized. Displacements at the defects will be analyzed and from these displacements the stresses in the fibers calculated. From these calculations strength/probability models for the fibers will be evaluated. Ceramic materials will be impacted with SiC or quartz particles and indented using standard techniques (Knoop). The resulting material damage will be characterized. the results will be modeled using elastic/plastic stress analysis and fracture mechanics formulations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0030, STUDY OF THE INTERACTION BETWEEN SMALL MOLECULES AND METAL CLUSTERS - A MODEL FOR CATALYSIS

S.E. Novick, Wesleyan University, School of Science in Society, Dept. of Chemistry, *Middleton, Connecticut* 06457 (11260-G5)

It is proposed to investigate structural and dynamical aspects of the metallic surface-hydrocarbon bonding (other compounds will also be tried) so important in heterogeneous catalysis. The experiments that will be carried out in molecular beam high vacuum apparatus consists of producing a weak complex between a small metal cluster and various small molecules via the technique of supersonic expansion. The interactions of various molecules and the surface of the metal cluster serves as the experimental model for the active catalytic site. The techniques to be used to probe these complexes consist of 1) electron excitation and laser excitation to produce fluorescence which will be dispersed and analyzed; 2) mass spectrometric studies; 3)

qualitative polarity studies (as a crude structure probe); 4) laser dissociation experiments; and 5) high resolution radio-frequency and microwave spectroscopy as a sensitive structure probe.

SUPPORTED BY American Chemical Society

3.0031, ENVIRONMENTAL EFFECTS IN STRESS CORROSION CRACKING IN ALUMINUM ALLOYS

R.T. Foley, American University, School of Arts & Sciences, Dept. of Chemistry, *Mass. & Nebraska Aves. N.W., Washington, District of Columbia* 20016 (DN475438; N00014-75-C-0799)

The objective of this task is to clarify the role of environmental factors in stress corrosion cracking of aluminum alloys used in naval aircraft and craft.

An experimental program is to be conducted to study the effect of various anions in pitting initiation in aluminum alloys, a study of local solution chemistry in these alloys, and a testing phase to correlate the first two approaches with susceptibility of the alloys to stress corrosion cracking. Standard electrochemical and fracture mechanics techniques are to be used for this study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0032, CORROSION IN NATURAL ENVIRONMENTS

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PROJECT OBJECTIVES: To develop test methods for measuring corrosion of alloys in soil and marine environments and to use those methods to obtain accurate data for engineers designing systems to be used in those environments for pipelines, power cables, aircraft, communications, and structures.

PROJECT APPROACH: Soil, atmospheric and marine test sites are established. Coated, uncoated specimens fabricated from many alloys with and without stress, crevices, coupled with other metals are exposed to the test environments for varying periods. Periodic inspections and electrochemical measurements are made to determine corrosion rates and conditions. New measurement techniques are evaluated. Corrosion data collected at periodic intervals after specimen removal analyzed and published.

PRIOR YEAR ACCOMPLISHMENTS: Piling corrosion monograph completed, 2 papers published, 5 talks presented, 16 new telephone cable systems and cable housing system installed, symposium on power cable corrosion organized, corrosion conditions determined for power cables.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

3.0033, INITIATION OF CRACKS IN LCF OF TITANIUM ALLOY

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To seek and find basis for interrelating effects of microstructural control on resistance to crack initiations vs propagation due to repeated loading, said basis needed to optimize life of jet engine parts by material selection.

To measure and compare strain-controlled low-cycle-fatigue (LCF) crack initiation with extant data for crack propagation characteristics of the Ti-6Al-4V system. Crack propagation resistance is markedly improved by appropriate microstructural modification but with unknown effect on initiation. The ordinary and cyclic stress-strain curves will be compared to propagation data via TLIM fracture analysis program. The collaboration effort in code 6380 will assess stress-controlled LCF endurance.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0034, LASER-INDUCED CHEMISTRY AND ENERGY TRANSFER STUDIES IN SMALL MOLECULES

E. Weitz, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Chemistry, *633 Clark St., Evanston, Illinois* 60201 (CHE79-08501)

This research is in the area of quantum chemistry. A multifaceted program involving laser induced chemistry and vibrational energy transfer studies is planned. Three areas of laser induced chemistry will be investigated. One area deals with the reaction of atoms with triatomic molecules. Reactions have been carefully selected for ease of detection of products as well as the anticipation of significant vibrational acceleration of reactions. In some systems it will be possible to couple laser chemistry with energy transfer studies to yield state resolved reaction cross-sections. Area two deals with bimolecular reaction of stable species where again the systems have been chosen with the anticipation of significant vibrational acceleration of reaction. The final area deals with novel applications of the multiphoton excitation technique to chemical problems. Applications are planned with respect to the concerted or non-concerted nature of elimination reactions, elucidation of reaction mechanism and with regard toward the dynamics of the isomerization process in hexadienes as well as the possible use of infrared multiphoton excitation in the directed synthesis of these isomers. Energy transfer considerations and techniques play an important part in all of these studies. This research represents a continuation of that supported by Foundation grant CHE7610333.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0035, THEORETICAL STUDIES OF ADSORPTION AND RELATED PHENOMENA ON METAL SURFACES

R. Gomer, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (DMR79-07232)

A microscopic model of single particle surface diffusion will be developed to see if abnormally small pre-exponential factors, found experimentally, can be accounted for. It is further planned to study the dynamics of two-dimesional systems with a view to obtaining correlation functions of density fluctuations under conditions where independent particle models of diffusion break down, and to obtain equations of state of adsorbed layers. It is further planned to investigate the electronic structure of composite metal surfaces, consisting of one or more atomic layers of one metal on a substrate with which it does not alloy. Finally, work on field ionizaton of impurity states in semiconductors will be extended to include temperature assisted tunneling.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0036, SYNTHESIS, STRUCTURE, AND MAGNETIC TRANSITIONS IN TRANSITION METAL COMPOUNDS

R.L. Carlin, University of Illinois, Chicago Circle Campus, School of Liberal Arts & Sciences, Dept. of Chemistry, *601 S. Morgan St., Chicago, Illinois* 60680 (DMR79-06119)

The broad goal of this project is to increase understanding of magnetic ordering in solids. Theorists have provided several constructs for different types of magnetic interactions. As a chemist, Professor Carlin is uniquely qualified to prepare, characterize, and measure the properties of the new compounds which are needed in order to test these constructs. Examples are the two- and three-dimensional X-Y magnetic models.

Specific experiments include: (1) low temperature susceptibility and/or specific heat measurements on: (a) transition metal (cobalt, iron, copper, and manganese) pyridine N-oxide complexes, and (b) several amorphous antiferromagnets, including an attempt to construct a spin glass in a nonmetallic system, and, (2) determination of magnetic phase diagrams below 1K.

First year of a three-year continuing grant. Continuation of work supported under Grant No. DMR76-18963.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0037, APPLICATIONS OF ELECTRON MICROSCOPY IN MATERIALS SCIENCE

H.L. Fraser, University of Illinois, Urbana Champaign Campus, Materials Research Lab., *Urbana, Illinois* 61801

Development and application of analytical and transmission electron microscopy techniques to determine morphology, microstructure, crystal and electronic structure, and microchemistry of metallic alloys is under way. Applications include the omega phase transformation in Zr-Nb alloys, iodine embrittlement in Zr alloys, the alpha-beta interface in Ti-Al-V alloys, and precipitation in Nb-Ti-C alloys. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

3.0038, ULTRASONICALLY STIMULATED ACOUSTIC EMISSION

D.N. Beshers, Columbia University, School of Mines, Dept. of Metallurgy, *Broadway & W. 116th St., New York, New York* 10027 (DMR77-05214 A01)

This is a continuation of studies of dynamic plasticity within solid materials by analysis of the harmonic spectrum generated by ultrasonic stimulation. The information derived from the spectrum analysis is correlated with mechanical property data and metallographic determination of the microstructure. The method, developed studying brass, will be extended to several more complex single-phase and two-phase body-centered cubic and face-centered cubic alloys. The results obtained will be used to develop a quantitative model of dynamic events which occur during the plastic deformation of metallic materials. This is a renewal of NSF grant DMR75-03236.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0039, THEORETICAL STUDIES IN CHEMICAL PHYSICS

D.R. Herrick, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Chemistry, *1472 Kincaid St., Eugene, Oregon* 97401 (CHE79-09500)

This grant supports research under the Quantum Chemistry Program to study symmetry effects of electronic states in atoms and molecules. When the motions of electrons are highly correlated, the usual classification scheme for ground or excited states becomes inadequate, leading to apparent anomalies and difficulty in the interpretation of experimental data. Professor Herrick's research is essentially concerned with clarifying this situation by group theoretical analysis of the interaction between electron pairs. Three related areas involving strong mixing effects and autoionization will be investigated: (1) Multiply-excited states and few-body correlations, and the extent to which near-degeneracy mixings and new energy level clustering effects are governed by Lie algebras, including doubly-excited states, leading to the two-electron photodetachment threshold of negative ions; (2) High-Rydberg states, especially angular momentum transfer mechanisms and strong state-mixing by electron collisons, the Stark effect, and atomic diamagnetism; (3) New computational approaches to complex energy variational methods and resonances, including effects of vibrationally excited diatomic Rydberg states and narrow-width transmission models for quasi-one-dimensional semiconductors. An objective of part of the research is to help provide more efficient design of semiconductor devices.

This is a renewal of research currently supported by NSF grant CHE7610332 to the University of Oregon at Eugene.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0040, ELECTRONIC STRUCTURE OF SUBSTOICHIOMETRIC TRANSITION METAL OXIDES

J.W. Rabalais, University of Houston, School of Natural Sciences & Mathematics, Dept. of Chemistry, *3801 Cullen Blvd., Houston, Texas* 77004 (E-656)

The phenomena of photochromism and electrochromism in amorphous transition metal oxide films of WO3, MoO3, and V2O5 have been investigated by X-ray and UV photoelectron spectroscopy. A sandwich configured electochromic cell is described which allows reversible coloration/bleaching of the films. Results indicate that upon coloration, reduced state species of the metal ions are produced and that electrons occupy empty metal d bands near the Fermi level.

Ion beam studies of the reactions of nitrogen and nitric oxide with surfaces of carbonaceous materials have been investigated by X-ray and UV photoelectron spectroscopy (XPS and UPS), secondary ion mass spectrometry (SIMS), and flash desorption mass spectrometry. Reaction of N and O with graphite produces two products, a cyanide- or oxide-type compound and intersitial N or O atoms between the layers of rings or at defect sites. Reaction of N with diamond or teflon produces only a cyanide-type compound. Reaction of N with Si and Ge and their oxides produces nonstoichiometric nitrides which are similar to Si3N4 and Ge3N4. SIMS experiments on alkali halides have shown the clusters of the type MnXn-1 where M equals Li, Na, K, Cs and X equals F, Cl, Br, I are very stable in the vapor phase.

SUPPORTED BY Robert A. Welch Foundation

3.0041, ELECTRON SPECTROSCOPY OF SEMICONDUCTOR HETEROJUNCTION INTERFACES

M.G. Lagally, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Mineral & Metallurgical Engineering, *Madison, Wisconsin* 53706 (DN775535; N00014-77-C-0474)

The operational properties of solid state electron devices used in Navy electronic systems, are often dominated by the electronic effects occuring at various solid surfaces and solid-solid interfaces. understanding and controlling the surface effects is essential to improving performance and reliability.

Using surface analysis techniques such as Auger spectroscopy, ultraviolet photoemission spectroscopy, x-ray photoemission spectroscopy, and energy loss spectroscopy, the investigator will probe the local electronic properties of surface atoms. These atoms may represent the host material, absorbed impurities, or atoms of an adjacent host material such as occurs in the semiconductor-semiconductor heterojunction. Determination of the local density of states at each atom will permit evaluation of the effects of impurities or surface states on the overall electronic nature of the surface. Of particular interest is the nature of the energy discontinunity which appears at the heterojunction interface and the changes in local density of states as a result of surface disorder and oxidation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, ATMOSPHERIC EFFECTS ON COHERENT LASER SYSTEMS

S.S. Murty, Alabama Agricultural & Mechanical University, School of Technology, Dept. of Engineering Technology, *Normal, Alabama* 35762 (NSG 8037)

The objectives of this work is to investigate the effects of atmosphere on the performance of the CO2 laser Doppler systems and to explore the application of the differential absorption technique of detecting gaseous constituents using NASA-MSFC system. The approach is mainly theoretical. In addition, we will be gathering experimental data on the behavior of structure constant CN of the atmospheric refractive turbulence. The analysis of the finite beam effects on the signal-to-noise ratio has been completed and current effort is on developing a computer program to evaluate the finite beam effects.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0002, PSEUDONOISE TEST TECHNIQUE FOR COMMUNICATIONS CHANNEL EVALUATION

G.D. Weathers, Alabama Agricultural & Mechanical University, School of Technology, Dept. of Electrical & Electronics Engineering Technology, *Normal, Alabama* 35762 (NAS 9-14770)

The effort includes a detailed study of the application of RMS distortion testing using pseudonoise to communications channels where performance is traditionally based to some extent upon subjective factors. These channels include television and voice communications. The results of this study will be applied to the development of communication system testing techniques which will extend the usefulness of a pseudonoise test-set.

The project also includes a design study of alternate methods for non-real-time testing of data handling systems that include a record-playback process, and construction of breadboards to demonstrate the most promising techniques.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0003, THERMAL ANALYSIS OF COAL

P.I. Gold, California State University & Colleges, California State University, Los Angeles Campus, School of Engineering, Dept. of Mechanical Engineering, *Los Angeles, California* 90032 (NSG 7263)

The purpose of this study is to continue the program of experimental thermal analysis of coal to provide quantitative data suitable for the development of thermal design criteria for high-pressure coal-feeding processes.

Differential scanning calorimetry studies demonstrated the occurrence of exothermic transitions in or near the plastic region superimposed upon the major endothermic process associated with the production of volatiles in the range of 300-500 degrees C, when coal is heated in an inert gas.

Thermogravimetric analyses performed under the same conditions indicated a close relationship between the temperature of maximum volatization and the temperature at which the exotherm is observed.

Effort is currently underway to develop kinetic parameters for the weight loss process and quantitatively determine the enthalpy changes during pyrolysis.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0004, DEVELOPMENT OF A DIRECT CONTACT HEAT EXCHANGER FOR APPLICATIONS IN POWER GENERATION SYSTEMS UTILIZING GEOTHERMAL BRINES

R. Manvi, California State University & Colleges, California State University, Los Angeles Campus, School of Engineering, Dept. of Mechanical Engineering, *Los Angeles, California* 90032 (NASW 3257)

The objectives of the study are: Experimental investigation of Direct Contact Heat Transfer mechanism in which a hot water jet collides with a Freon 113 liquid jet. Freon 113 is basically immiscible in water. The liquid jets would impinge at various angles, and with differing momenta. Development of heat transfer correlations, comparison of this study's heat transfer data with other direct contact heat exchanger concepts.

The experimental setup to conduct heat transfer experiments has been assembled and leak tested. Heat Transfer data gathering is underway and during the final period of this study, heat transfer correlations will be developed and assessed.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0005, INVESTIGATION OF AN AUTOMATIC ELECTRONIC CONTROLLER FOR USE IN HUMAN THERMAL REGULATION WITH A LIQUID COOLED GARMENT

J.H. Kurzweil, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Electrical Engineering, *Washington Sq., San Jose, California* 95192 (NCA 2-675904)

The need for automation of human thermoregulation using a liquid cooled garment in the artificial environment of a space suit is shown. The possible control methods are explored and an approach suitable for use in an operational extravehicular protective system is selected. The proposed research will lead to fabrication and refinement of a breadboard, microprocessor based controller that will maintain thermal equilbrium for a wide range of exercise rates and thermal environments.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0006, COMMUNICATIONS SYSTEM ANALYSIS OF ADVANCED MANNED SPACE FLIGHT

D.L. Schilling, City University of New York, City College, School of Engineering, Dept. of Electrical Engineering, *Convent Ave. & 138th St., New York, New York* 10031 (NAS 9-13940)

Hardware considerations frequently dictate the use of 'conventional' analog processing and transmission techniques for communications channels such as television. Analog FM with discriminator detection at the receiving terminal is frequently the choice and has been used exclusively in manned spaceflight systems.

With the advent of communications relay satellites, dramatic increases in communications coverage are possible, but this increased coverage is not without penalty. The receiving terminal for a television signal originated at and transmitted from the manned spacecraft will now be at a much greater distance and will have greatly reduced capabilities. More efficient signal processing and transmission techniques become of interest, therefore, in an attempt to reduce the hardware required at the manned spaceflight terminal to provide acceptable communications.

Digital transmission systems offer several potential advantages over analog transmission systems, including increased link efficiency, lighter weight, higher reliability, reduced prime requirements, and greatly increased ease of multiplexing with other signals in digital form. An efficient source encoding technique, to reduce the transmitted bit rate, used in conjunction with an efficient channel encoding technique, can provide very real and significant performance advantages over analog transmission systems.

Previous efforts in this area have led to the development of a small, low-power, efficient ADM for encoding television signals. However, current ADM design results in periods of operation resulting in steady-state, repetitive ADM encoder outputs of the form--11001100--corresponding to a non-varying input signal. It is the intent of this research to provide for an analysis of the occurrence of the 1100 pattern, determine the possible data rate reduction resulting from the removal of the 1100 pattern, and estimate the equipment necessary to perform such removal.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0007, AN ADAPTIVE LEARNING CONTROL SYSTEM FOR LARGE FLEXIBLE SPACE STRUCTURES

F. Thau, City University of New York, City College, Graduate School, *Convent Ave. & 138th St., New York, New York* 10031 (NAG 1-6)

ABSTRACT. The purpose of the research is to study the application of adaptive/learning control systems for large, flexible space structures. Techniques that have been developed for the control of aircraft despite changing operating characteristics are used to develop a learning control system for a multi-configuration flexible space vehicle. Statistical decision theory is used to design sensor and actuator redundancy management subsystem algorithms and to develop a configuration identification subsystem to be used with a learning algorithm subsystem and a memory and control process subsystem.

An important feature of this learning approach is that adaptive gain adjustments can be achieved without prestoring large blocks of parameter data and without the need for 'dither' signal inputs which will be suppressed during operations for which they are not compatible.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0008, INVESTIGATIONS OF FREESTREAM NOISE IN SUPERSONIC NOZZLES (ABBREV)

M.R. Schopper, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (NAS 1-15877)

It is well known that the noise radiated from turbulent nozzle boundary layers affects boundary layer transition on wind tunnel models. In the current research effort the noise-transition problem is being studied. A theoretical study of one aspect of the noise-laminar layer interaction will be completed and published as a NASA Contractor Report. Some of this work has appeared in AIAA Paper 79-1523. Previous measurements in a Mach 5 rapid-expansion nozzle have shown that the acoustic disturbance levels are low in the leading portion of the test section rhombus. An investigation of boundary layer transition on a slender cone in this Mach 5 nozzle is currently underway to see if transition is delayed as a result of the low noise levels. It is expected that a Mach 3 rapid-expansion nozzle will become operational in early 1980 and that cone transition results will also be obtained in this new facility.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0009, THE INVESTIGATION OF MICROPROCESSORS AS MASS STORAGE CONTROLLERS FOR FLIGHT APPLICATIONS

A.K. Trehan, Hampton Inst., Graduate School, Dept. of Electrical Engineering & Computer Science, *Hampton, Virginia* 23368 (NSG 1294)

One of the major problems in the data systems for inflight applications is the mass storage of data at medium and high speeds. The massive flight data is usually stored on some mass storage device like a tape or a disc with or without pre-processing. With the development of microprocessors, it seems feasible and cost effective to use them as controllers for the acquisition of in-flight data.

Hampton Institute has investigated the use of microprocessors and floppy discs for use as in-flight mass storage devices at medium and high speeds for use with the ongoing experiments of the FID at Langley Research Center.

Due to the significant advances made recently in the monolithic image sensor field, there are sensors available that combine the advantages of charge coupled devices and custom designed photodiode arrays. One such device, a RETICON CCPD-1728 as well as a FAIRCHILD CCD121H has been interfaced with the HP 2100 for complete evaluation.

In conjunction with the interface effort, HI has also investigated the possibility of using recent developments in the bit slice processors so as to handle each pixel of data independent of any other pixel.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0010, THE INVESTIGATION OF MICROPROCESSORS FOR USE AS CONTROLLERS FOR TUNABLE DIODE LASERS

A.K. Trehan, Hampton Inst., Graduate School, Dept. of Electrical Engineering & Computer Science, *Hampton, Virginia* 23368 (NSG 1552)

The Laser Heterodyne Spectrometer (LHS) currently being developed at Langley Research Center will provide the capability to measure atmospheric pollutants with a specificity unrealizable in the past.

To achieve this high degree of accuracy, an exceedingly complex instrumentation is required. The Tunable Diode Laser (TDL), a solid state device is a prime contender for the local oscillator in the LHS. However TDL exhibits a considerable variability and hysterisis in its wavelength stability and control.

Hampton Institute is investigating the design of a microprocessor based controller for a TDL system. The investigation includes a study of using off-the-shelf assemblies in the fabrication process and development of the system software. The initial design of the controller has been accomplished and presently a number of methods are being analyzed and reviewed for the wavelength identification. At present a gas cell using a known gas shows promise.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0011, RADIATIVE TRANSFER MODEL FOR REMOTE SENSING OF LASER-INDUCED FLUORESCENCE OF PHYTOPLANKTON IN NON-HOMOGENEOUS TURBID WATERS

D.D. Venable, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (NCC 1-11)

The purpose of this study is to characterize phytoplankton using remotely sensed optical data from laser induced fluorescence of chlorophyll a. A radiative transfer computer model is being developed to characterize the total flux and angular distribution of photons when laser radiation is incident on turbid water that contains a non-homogeneous suspension of inorganic sediments and phytoplankton. This radiative transfer model is based on the Monte Carlo technique. The computer model assumes that the aquatic medium can be represented by a stratified concentration profile and that appropriate optical parameters can be defined for each layer. The present research efforts include comparison of the predicted results with published data. In addition, efforts are being made to minimize the required computer resources and run time.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0012, THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES I, II, AND III

P.M. Bainum, Howard University, School of Engineering, Dept. of Mechanical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 1414)

Attitude control techniques for the pointing and stabilization of very large, inherently flexible spacecraft systems are being investigated in this research. First the attitude dynamics and control of a long, homogeneous flexible beam whose center of mass is assumed to follow a circular orbit have been treated. In the initial phase, first-order effects of gravity-gradient are included, whereas external perturbations and related orbital station keeping maneuvers are ignored. Three mathematical models describing the system's rotations and deflections within the orbital plan have been developed--one model, which treats the beam as a number of discretized mass particles connected by massless links, and two continuum-type models. The natural (uncontrolled) dynamics of this system have been simulated. The concept of distributed modal control, which provides a means for controlling a particular system mode independently of all other modes, has been examined, along with other types of control laws including an application of optimal control theory. The effect of varying the number of modes in our model as well as the number and location of control devices is being examined, analytically, where possible, and numerically for general cases.

In the latter phases of the study, three dimensional mathematical models of beams, plates, and antenna-like shell structures are being treated, following the approach described above for the two-dimensional beam; control of the continuum model of the plate, and shell models will be treated. In addition, it is planned to consider different ways of selecting actuator control laws and also the effects of sensor noise and model uncertainty.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0013, THEORETICAL EVALUATION OF LINEAR KALMAN FILTERING TECHNIQUES FOR ADVANCED MISSION STATE DETERMINATION

A.K. Choudhury, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 9010)

Theoretical Evaluation of Linear Kalman Filtering Techniques for Advanced Mission State Determination.

Most practical filtering problems involve delay in the state variables due to the time taken in the transmission of signals. The delayed state space equation is of the form: XK plus 1

equals AXK plus B XK-l plus C UK; YK equals D XK plus VK where l greater than or equal to 1 is the delay, UK, VK are white Gaussian noises, and the matrices A,D,C,D are of appropriate dimensions. In case of delayed state space model degeneracy occurs and plays an important role.

The system XK plus 1 equals A XK plus B XK-l; YK equals D XK is said to be degenerate if YK is identical to O, K more than or equal to n, where n is a positive integer. Constructions of degenerate systems, i.e., given D,A, l, to find B such that YK is identical to O, K more than or equal to n is an important problem. Constructions of degenerate problems containing all possible free parameters are being investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0014, PERFORMANCE OF NON-COHERENT CODE TRACKING LOOPS

A.K. Choudhury, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 9010)

Global position satellite system (GPS) is a three-dimensional radionavigation system for estimating the position of moving vehicle very accurately. The GPS receiver consists of two coupled loops, Doppler-tracking (costas loop) loop and delay-tracking loop (code loop). For slow-moving vehicles the Doppler can be assumed to be constant and the loops can be decoupled, and inexpensive receivers can be operated on the above assumption. Here the delay-tracking loop (code loop) is analyzed analytically in the linear region and simulated in HP 21 MX computer in the linear and non-linear regions for different tracking loop filters. Z transform is used in the analysis.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0015, TRACKING OF DELAY/DOPPLER LOOPS OF REFSAT RECEIVER

A.K. Choudhury, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAS5-24251)

Global position satellite system (GPS) is a three-dimensional radionavigation system for estimating position and velocity of vehicles accurately. Here the acquisition and tracking properties of Doppler/delay loops suitable for REFSAT AIDING GPS loops are analyzed and compared with simulated results.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0016, THE 1980 NASA-ASEE SUMMER FACULTY FELLOWSHIPS PROGRAM (AERONAUTICS AND SPACE RESEARCH) AT THE NASA GODDARD SPACE FLIGHT CENTER, GREENBELT, MD

D. Fan, Howard University, School of Engineering, Dept. of Mechanical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NGT 09-011-060)

The objectives of the NASA-ASEE Summer Faculty Fellowships Program (Aeronautics and Space Research) are: (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate an exchange of ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of participants' institutions and to contribute to the research objectives of the NASA centers.

Thirty-two college or university faculty members from major engineering and science disciplines will receive Fellowships to participate in the ten-week program at the NASA Goddard Space Flight Center (GSFC) during the summer of 1980. The program consists of two parts: research (90% of total time) and education (10% of total time). In cooperation with GSFC Colleague, a Faculty Fellow will pursue independent research on a selected topic of mutual interest. The research program thus provides Faculty Fellows with unique opportunities to contribute to ongoing projects at GSFC. The educational program will include a short course and weekly seminars by invited lecturers on topics of general interest. Also tours of NASA facilities will be conducted.

Research opportunities in the areas of communications/computers, engineering, space sciences, earth resources/observations, atmospheric sciences/geophysics are available at GSFC.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0017, CHARACTERIZATION OF LOW INTENSITY X-RAY IMAGING DEVICES (LIXISCOPE)

G.A. Ferguson, Howard University, School of Engineering, Dept. of Mechanical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 5268)

A low intensity x-ray imaging scope (LIXISCOPE), developed by NASA, is being characterized using radiation from an electrically excited source. The optimum energy spectrum recommended for several categories of specimen being analyzed (i.e. medical specimen, industrial specimen, etc.) will be determined. The utility of the LIXISCOPE in medical applications will be investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0018, GRADUATE RESEARCH PROGRAM IN ADVANCED AEROSPACE STRUCTURES

I.W. Jones, Howard University, School of Engineering, Dept. of Civil Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 1320)

The present research effort in this program is a study of various types of foldable elastic tubes for use as structural members or hinges in large space structures.

The in-orbit construction and/or deployment of large space structures (platforms, antennas, solar cell arrays, etc.) will become technically feasible with the advent of the Space Shuttle. One of the basic concepts under consideration for the creation of these structures is to construct sub-assembly structural systems on the ground, packaged to fit within the vehicle, place them in orbit and deploy them without the use of external energy. The underlying problem of developing a lightweight system that can be folded into a small volume, high density mass, and deployed utilizing only the stored strain energy is being studied under this grant.

To date, a series of test specimens of various geometries, and a special purpose testing machine have been designed and constructed. Unfolding tests are being conducted to determine the workability of the specimens and the strain energy released by each.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0019, FEASIBILITY STUDY OF USING FET TO MEASURE ELECTRIC FIELD STRENGTH

Y. Wang, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (KSC 79-11)

The objective of this project is to build an electric field measurement sensor with no moving parts. The electric field to be measured is the quasi static fields from electrified storm clouds.

The approach is to make use of field effect transistors as the sensing device. They are small and use very little electrical power. If mounted about a sphere and raised above ground, the direction as well as the magnitude of the field can be determined.

The first task is to determine the difference in the electric field form factor for a smooth sphere and for a sphere with the transistors mounted on it.

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

4.0020, DYNAMIC CHARACTERISTICS OF LINEAR HYDROSTATIC GAS BEARINGS

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Linear hydrostatic gas bearings have been proposed for use in mechanical coolers for space applications. The purpose of the proposed research is to study the static and dynamic characteristics of such systems. The principal problem to be addressed is the angular forced vibration of a statically loaded, inherently compensated, hydrostatic journal bearing due to oscillating external pressure. The solution to this problem has been identified as critical to the analytical determination of the load-carrying capacity of a bearing in a candidate cooler design. Consideration will also be given to radial forced vibration and to free vibration of this type of bearing.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0021, CALIBRATION OF THE QUARTZ CRYSTAL MICRO-BALANCE CASCADE IMPACTOR USING THE BERGLUND-LIU MONODISPERSE AEROSOL GENERATOR (ABBREV)

N. Matthews, Le Moyne Owen College, Undergraduate School, Dept. of Education, *807 Walker Ave., Memphis, Tennessee* 38126 (NSG 1593)

OBJECTIVE: The objective of this research is to calibrate the Quartz Crystal Microbalance (QCM) and determine its response to particle size and mass concentration.

INSTRUMENT DESCRIPTION: The QCM is the most promising of the instruments capable of giving real-time data of aerosols characteristics from stratospheric and surface sampling. It is a ten stage cascade impactor that collects pollutants aerodynamically according to their size distribution and density. The instrument is flown on the NASA-U-2, which flies up to an altitude of 65,000 feet, the NCAR Saberliner, which flies up to 40,000 feet, and the NASA-P-3, which flies up to 25,000 feet, for sampling atmospheric aerosols.

APPROACH: The Berglund-Liu Aerosol Generator will be used to generate particles of known size and mass density and introduced into the QCM. The instrument will be checked for its response to aerosols of known sizes and mass density. The Laboratory Values will be compared to the Calculated Values that are based on the design parameters of the instrument.

PROGRESS: Particles from 0.312 up to 2.020 microns were generated using the Nebulizer method employing Latex spheres and good results were achieved. Efforts are underway to generate larger aerosols for continued research.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0022, THE CALIBRATION OF PHOTOGRAPHIC AND SPECTROGRAPHIC FILM

E.C. Hammond, Morgan State University, Graduate School, Dept. of Science Education, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NSG 5074)

The purpose of this project is to develop, evaluate, and utilize densitometric techniques and procedures for the determination of the relative and absolute characteristics of standard and special spectroscopic films and plates in the infrared, visible, and ultra-violet spectral-region. IIaO spectroscopic film was irradiated by neutrons from a neutron howitzer, producing 106 neutrons per steradians. The film placed in the metal canister and irradiated with neutrons exhibited higher density readings, than those films placed in the plastic canister. Using a weak gamma-source, the middle density patterns of the film tended to display some separation, compared to the controls. The exposure of IIaO film to a beta-source showed dramatic increases in the densities in the lighter density patterns as well as in the darker densities patterns. We have subjected the IIaO film to various experiments involving soaking and agitating the film, as a function of standard times and temperatures. There are dramatic density changes, depending upon length of time for soaking and the agitation patterns used. Exposing the film to an electric field produced dramatic changes in the densitometric readings of the patterns. Substantial density changes resulted when IIaO films were exposed to liquid nitrogen temperatures. Our initial studies on the aging processes of IIao film attempted to quantify the effects of ambient light and heat, which together produced density increases over a nine month period. Studies have been conducted using a densitometric comparison versus different solvents, including distilled water made at Goddard, tap water from the City of Baltimore and distilled water produced at Morgan. The distilled water processing solutions showed greater stability as a function of time, while the city tap water produced substantial increases in the density readings across the entire range of the photographic patterns on the IIaO.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0023, THE INVESTIGATION, IDENTIFICATION, ANALYSIS, AND INTERPRETATION OF NEW POSSIBILITIES IN TRANSFER TECHNOLOGY AT GODDARD SPACE FLIGHT CENTER

J.H. Taylor, Morgan State University, School of Arts & Sciences, Dept. of Physics, *Baltimore, Maryland* 21212 (J-23558; NAS 5-23558)

The objective of this project is to assist Donald Friedman, Goddard's technology utilization officer, in assessing Goddard's technology, inventions/scientific capability potential for possible transfer to the public sector.

This year with the permission of Dr. Yin, I entered the Lixiscope in the Industrial Research Corporation's program to honor the 100 most significant inventions of the year. We were successful in winning an award. This is the first time Goddard has participated in this program. We anticipate continuing participation.

Currently I am involved in a project with the Hopkins Wilmer Eye Clinic which deals with Goddard's expertise in image enhancement. Preliminary work on this project far exceeds the expectations of the doctors at Hopkins. We feel this will result in an excellent transfer of Goddard's expertise to the medical community.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0024, A LABORATORY STUDY OF THE DIFFUSE REFLECTANCE SPECTRA OF FROSTS AND MINERALS OCCURRING ON ASTRONOMICAL OBJECTS

F.M. Glaser, Pan American University, School of Science & Math., Dept. of Physical Sciences, *Edinburg, Texas* 78539 (NSG 9070)

Measurements of the diffuse reflectance of single-component and polycomponent frosts at a variety of temperatures have been carried out over a wide spectral region. Frosts composed of water, ammonia, carbon dioxide, and hydrogen sulfide have been studied in detail. In some cases, features in the spectra are temperature dependent and can be used as a remote thermometer when the frost is observed on a remote astronomical object, such as a planetary satellite or atmosphereless planet. Spectra of a few mineral powders and frost-covered mineral surfaces have also been obtained. These results simulate the 'dirty snow' seen in the polar regions of Mars and are useful in interpreting the spectrophotometric data of planets, asteroids, and satellites.

The study of the effects of radiation on these materials is continuing. Far ultraviolet photons, electrons, protons, and other charged particles can initiate a variety of chemical and physical reactions in the surface layers of solids. The presence of reaction products can be detected as changes in the reflectance spectrum and perhaps identification of some of the product species can be made from this data alone. In any case, many astronomical objects are subject to ionizing radiation of differing extent. Such measurements are of particular interest in the case of Galilean satellites as they are subjected to the intense radiation trapped in Jupiter's magnetosphere.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0025, EXTENSION OF CANOPY REFLECTANCE TO LANDSAT AND LIGHT INTERCEPTION WITHIN A CANOPY

E.W. Le Master, Pan American University, Graduate School, Dept. of Physical Sciences, *Edinburg, Texas* 78539 (NSG 9033)

So that field reflectance spectra and vegetative canopy reflectance models can be coupled directly to LANDSAT multispectral scanner (MSS) data, a model has been developed for taking light reflected from a vegetative canopy, passing it through a standard atmosphere, and converting it to MSS digital counts. This model will be tested directly for several crops and bare soil using LANDSAT overpass data and field reflectance spectra. The data collected from these sites will also be used to test several theoretical results derived during the last grant period. It was found that the concepts of infinite reflectance could also be applied to LANDSAT data, yielding unique points of infinite green reflectance for cotton, wheat, and grain sorghum. Such points can be used for both crop discrimination and the calculation of leaf area index.

An array of silicon light detectors constructed in the present grant period will be used to measure the visible (400-700 nm) and infrared (700-1100 nm) radiation fluxes inside a vegetative canopy. The results will be used to test the light absorption model developed by the investigators and to further our understanding of the model depth concept.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0026, STATE VECTOR UPDATE FILTER FOR AUTOLAND PORTION OF THE SHUTTLE LANDING

G.S. Grewal, Southern University Agricultural & Mechanical College, Baton Rouge Campus, School of Engineering, Dept. of Electrical Engineering, *Baton Rouge, Louisiana* 70813 (NSG 9030)

The autoland portion of the shuttle landing, which starts at approximately 12,000 to 2,000 feet altitude, requires a high-rate state vector update. The processing of the external navigation aid data at a rate greater than two seconds would require a replacement of the sophisticated Kalman filter with a faster filter like the complementary filter used by Sperry on CV990 autoland project, or a modified suboptimal version of the general Kalman filter.

The state vector of the general Kalman filter, as used in the shuttle, has 12 components; three for the position, three for the velocity, three for the IMU platform alignment errors, and three for the measurement biases. In the land phase the dimension of the state vector is reduced to six; three for the position and three for the velocity of the shuttle. Experience has shown that the switch-over from the Kalman to the complementary filter is not very successful, especially as far as the velocity component of the state vector is concerned. The bounds on the error between the Kalman and the complementary filter have been derived, assuming no IMU misalignment and measure biases, but the errors from the experimental results exceed the analytic bounds. This indicates that the IMU misalignment and the measurement biases cannot be ignored in the complementary filter, i.e., the complementary filter should be expanded from six to twelve states. This would entail extra computation time for the complementary filter, thus diluting its value.

Research has been completed and remaining effort will be concentrated on documentation and evaluation of results.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0027, IN VITRO EXPERIMENTAL VALIDATION OF SOME LEFT VENTRICULAR ANALYTICAL MODELS

G. Ray, Southern University Agricultural & Mechanical College, Baton Rouge Campus, School of Engineering, Dept. of Mechanical Engineering, *Baton Rouge, Louisiana* 70813 (NSG 2041)

A computer assisted methodology has been developed to analyze the sequential motion of the human left ventricular (LV) chamber to determine the (i) regional distribution of the constitutive properties of the passive myocardium during diastole and (ii) the distribution of the blood pressure inside the LV chamber during systole. Both of these parameters provided a new and powerful intrinsic index of the LV contractility and the regional location of the myocardial pathology. Several human and canine angiocardiographic data were exercised and analyzed by this method which we have described as 'Mechanocardiography'.

In order to determine the accuracy of these computer models we have preformed in vitro experiments with LV chambers made of Silastic casts. The pulsating physiological flow was simulated in a mock circulatory device. The wall motion was recorded with a high speed (hy-cam) camera and the continuous variation of the chamber pressure was monitored. These served as input data to the finite element computer model of the LV chamber. Good correlation between the model predicted results and the experimental findings were observed. Currently the results are undergoing further statistical evaluation.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0028, ATOMIC OXYGEN STIMULATED OUTGASSING EXPERIMENT FOR THE LONG DURATION EXPOSURE FACILITY (LDEF) PHASE 1, 2, AND 3 (OPTION)

R.L. Scott, Southern University Agricultural & Mechanical College, Baton Rouge Campus, School of Engineering, Dept. of Mechanical Engineering, *Baton Rouge, Louisiana* 70813 (NAS 1-15335)

Select thermal control surfaces will be exposed to the atomic oxygen in the near orbit. Passive collecting samples wwll collect any induced outgassing resulting from the oxygen impingement. The optical condition of the passive samples will be measured using a ground based integrating sphere reflectometer and a directional reflectometer. This experiment makes it possible to determine if the atomic oxygen was a major factor in observed but unexplained Skylab contamination.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0029, ENVIRONMENTAL AND GROWTH MEASUREMENTS IN WHEAT AND SORGHUM FIELDS AND THEIR CORRELATION WITH INFRA-RED RADIATION TOWARDS PREDICTING YIELDS

E.A. Brams, Texas A & M University, Prairie View A & M University, School of Agriculture, Dept. of Electrical Engineering, *Prairie View, Texas* 77445 (NSG 9006)

The primary objectives of the research are to acquire ground measurements of environmental and growth parameters in a field containing a rotation of winter wheat followed by grain sorghum throughout the growth season in the Texas Coastal Prairie, and to analyze the measurements to find relationships that assess crop vigor from which experienced agronomists could predict yield levels.

An experimental field of level terrain with uniform soil has been planted and harvested since 1975. Environmental and growth measurements continue to be taken during each cropping season. Ten stations will be established in each field, representing ten replications to measure select variables taken daily at 1500 hours. A total of 26 variables will be measured, including infra-red radiation, temperatures, moisture, wind, and plant growth factors. Data groupings and statistical analysis will be performed, with the objective of identifying relationships among the 25 variables considered the independent variable.

It is assumed that air temperatures of the grain canopy, soil moisture at 0-6 cm depths, soil temperatures at 2-6 cm, and solar energy absorption will have a profound and direct influence on crop performance during the growing season. Measurements of the four parameters will be related to infra-red measurements towards developing an assessment of crop vigor that can be related, in turn to a proportionate factor of maximal yield at harvest.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0030, PERMEABILITY OF POLYMERIC MATERIALS TO CONDENSABLE GASES AND ORGANIC LIQUIDS

I.G. Dillon, Tuskegee Inst., School of Engineering, Dept. of Mechanical Engineering, *Tuskegee Institute, Alabama* 36088 (KSC 70 10)

The effects of certain penetrants on barriers of chemical protective clothing are being examined in terms of the permeability of the clothing to these penetrants. Clothing material being evaluated includes Neoprene, Polyurethane, Polyvinyl al-

cohol, and Butyl coated Nomex. Penetrants of interest are Dimethyl Formamide, Hexane, Toluene, and NO2.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0031, INVESTIGATION OF ELECTRICAL BREAKDOWN CHARACTERISTICS AND STABILITY OF INSULATING MATERIALS USED ON SOLAR CELLS

C.V. Doreswamy, Tuskegee Inst., School of Engineering, Dept. of Electrical Engineering, *Tuskegee Institute, Alabama* 36088 (NSG 8038)

The main objective of this investigation is to study and evaluate the extent of degradation of the insulating materials used on Solar cells mounted on the spacecraft. The degradation occurs due to the effect of space plasma and plasma initiated discharges in the presence of high electric fields. Extensive test rigs and measuring equipment have been developed, calibrated and checked to measure the changes in the dielectric properties of the insulating materials. Accurate tests and measurements will be conducted to measure the changes in the dielectric constant, surface resistivity, volume resistivity and the dissipation factor of the insulating materials. These investigations are expected to result in a realistic evaluation of the quality and stability of the insulating materials, thereby contributing to the development of more efficient and reliable solar cell power systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0032, INVESTIGATION OF DEGRADATION PROCESS OF INSULATING MATERIALS

C.V. Doreswamy, Tuskegee Inst., School of Engineering, Dept. of Electrical Engineering, *Tuskegee Institute, Alabama* 36088

The primary objective of the proposed investigation is to study the effect thermal stresses, high electric field and plasma on the electrical insulating materials. Basic research looking into the fundamental processes of insulation degradation and stability will be carried out. The aspects identified for the intensive experimental and theoretical study are the nature of surface discharges, dielectric loss mechanisms and changes in the surface and volume insulating properties due to thermal cycling. It is hoped that the results of this investigation will lead to the development of useful guidelines and evaluation methods for the design of more efficient and reliable electrical systems, and solar cell arrays.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0033, AN IMPROVED COMPUTER MODEL FOR PREDICTION OF AXIAL GAS TURBINE PERFORMANCE LOSSES

R.M. Jenkins, Tuskegee Inst., Graduate School, *Tuskegee Institute, Alabama* 36088 (NSG 3295)

The program objective is to develop a comprehensive, reliable computer model for prediction of aerodynamic performance losses in axial gas turbines, utilizing a minimum of program input variables. Blade profile losses are to be related to approximate blade geometries through use of the Stanitz blade generation technique. Endwall, tip leakage, and secondary flow losses will be accounted for by existing empirical correlations. Particular emphasis is to be placed on boundary layer growth and separation phenomena within a blade row.

Future work will concentrate on refinement of the various program subsystems; it is also intended to eventually extend the analysis to radial turbine configurations.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0034, ANALYTICAL INVESTIGATION OF THE HEAT-PIPE RADIATOR AS A SPACECRAFT HEAT REJECTION SYSTEM

J.P. Sellers, Tuskegee Inst., School of Engineering, Dept. of Mechanical Engineering, *Tuskegee Institute, Alabama* 36088 (NAS 9-13844)

As a result of NASA-sponsored feasibility and prototype heat-pipe radiator testing, valuable experimental data have been accumulated. In this study the analysis, interpretation and documentation of these data will be continued. Computer models, either those written previously for NASA, or new ones when needed, will be used to complete the analysis.

Because of the current interest in the fluid header concept and its demonstrated high performance, particular emphasis is placed upon analysis of data from the JSC prototype panel vacuum tests. All single-panel data obtained to date have been analyzed and the results reported; 3-panel results are being finalized, and a summary report will be prepared.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0035, INVESTIGATION OF ABSORBERS AND RADIATORS FOR SOLAR POWER SYSTEMS

J.P. Sellers, Tuskegee Inst., School of Engineering, Dept. of Mechanical Engineering, *Tuskegee Institute, Alabama* 36088 (NSG 8054)

A high efficiency absorber is essental for the economical operation of thermal solar space power systems. It was established in earlier theoretical studies that the reradiation losses from the absorber can be reduced by utilizing a light-pipe geometry. Under concentrations ranging from 150 to 200 suns, it was also shown experimentally that at absorber temperatures less than 500 degrees F the measured instantaneous absorber efficiency exceeded 95%. In those tests the light-pipe was cylindrical. The experimental study is being continued with emphasis on operation at the absorber. In addition, solar intensity mapping using GaAlAs solar cells will be conducted at the outlet of the light pipe. At least three different light-pipe geometries will be studied: cylindrical, triangular and square. At this time the 6 ft concentrator reflector used with the absorber is made from thin film plastic to minimize costs. A paraboloid shape is achieved by maintaining approximately 0.5 psi differential pressure across the film. This novel approach to a high quality reflector has required evaluating different film materials, film seam integrity and rim-film attachment techniques.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0036, INVESTIGATION OF EFFECTS OF MICROWAVES ON GROWTH OF ASPERGILLUS FLAVUS ON CORN

M. Albano, University of Maryland, Eastern Shore, Undergraduate School, Dept. of Natural Sciences, *Princess Anne, Maryland* 21853 (NSG 6033)

The theory and practice of microwave heating are not new, but their use as control measures for insect infestation and in sterilization are recent and spreading widely. This study is to investigate the effect of microwaves on the growth of Aspergillus flavus on corn in storage. Preliminary studies have shown that drying corn by microwaves does not adversely affect the nutritional value of corn. Seed germination does not seem to be adversely affected either.

Corn samples both freshly harvested and dried were exposed to different doses of microwaves. Microwaves were generated on a commercially available microwave oven. At 420 watts, exposures of 60 & 90 seconds showed inhibitory effect. However, at 180 seconds exposure, no inhibition was observed.

The next phase of the project will investigate the effect of microwaves on aflatoxin, produced by A. flavus. It has been shown that irradiation with gamma rays destroys A. flavus spores but was ineffective in altering the aflatoxin B-1 in regard to chromatographic behavior, chemical structure or toxicity. Should microwaves prove to be effective in altering aflatoxin, it could very well be an important point to consider in the possible use of microwaves for drying corn.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0037, TWO-DIMENSIONAL RECURSIVE DIGITAL FILTERS FOR NEAR REAL-TIME IMAGE PROCESSING

W.E. Alexander, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Electrical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 5406)

The two-dimensional recursive digital filter is particularly suited to image processing applications or other bivariate data processing when there is a premium placed upon computer memory requirements and time for processing. Therefore, it has definite advantages over the Fast Fourier Transform (FFT) algorithm for many image processing applications. This project involves synthesis and implementation of two dimensional digital recursive filters for subjective image processing applications. Emphasis is placed upon finding algorithms that offer advantages for near real-time image processing applications.

Currently algorithms are being developed for the University's DEC10 computer for actual image processing. Image display will be with the Department of Electrical Engineering's HP1000 computer system and Grinnell GMR-27 display system. Additional memory is expected to be added to the HP1000 computer system in the near future. After this is accomplished, the algorithms will be moved over to the HP1000 computer system.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0038, PATTERNS OF RESIDUAL STRESSES WITHIN COMPLEX WELDED STEEL STRUCTURES

B.M. Botros, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Mechanical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 1516)

This study analyzes the effect of vibration on the patterns of residual stresses generated by welding steel structures. The major objective is to develop some general procedure to relax harmful internal stresses due to welding. A36 steel bars of varying sections were used to build box shapes, two for each design.

In the first phase, thin layers were removed off the metallic surfaces with nitric acid and the residual strains were measured using electric strain gauges. Theoretical formulas and suitable computer programs were developed and applied to reveal the patterns of stress distribution. High tensile stresses of about 25,000 psi were found at the weld, dropping sharply through 4 to 5 inch from the weld zone.

In the second phase of the study each second box was hammered, a spectrum received through an accelerometer and recorded off the screen of an oscilloscope. An effective vibration frequency was chosen through computer modeling, not to exceed 100 cps and the frame was vibrated for approximately 15 minutes. A complete stress analysis followed and the results generally showed that vibration was effective on the embedded stresses. The high tensile stresses at the weld disappeared and a general pattern of low stresses was revealed.

Fatigue testing and other complex welded shapes are still under investigation.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0039, DESIGN AND TESTING OF SMALL COMPOSITE SPECIMENS

A.V. Sharma, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Mechanical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 1631)

The effect of low velocity projectile impact on the strength carrying ability of aerospace components fabricated with fiber composites is one of the important factors to be considered in the design. Experimental studies conducted by numerous investigators in this area reveal that the composites exhibit strength degradation when subjected to the low velocity projectile impact. Further, the cost of fabricating the specimens in the experimental studies appears to be high.

OBJECTIVE: In order to reduce the cost of specimens in the experimental studies, it is desirable to find a correlation of properties obtained through the testing of large and small specimens.

APPROACH: Develop different support fixtures to test small laminates in the compression mode subjected to the projectile impact. The buckling strains and strengths at failure would be compared with those obtained from testing larger specimens.

CURRENT PLANS/PROGRESS: The first phase of the experimental program is underway leading to the fabrication of several different support fixtures to stabilize the compression-loaded laminates.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0040, MATERIAL GROWTH AND CHARACTERIZATION OF III-V COMPOUNDS FOR SOLID STATE DEVICES

E.K. Stefanakos, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Electrical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 1390)

Due to excellent performance of optical fibers in the wavelength range 1.0-1.3 microns, there is real interest to develop new alloy systems and a heterojunction technology for emission in this range. Also, recent theoretical studies carried out on ternary and quaternary III-V compounds to determine candidate materials for MOSFET, TED and IMPATT devices suggest that the quaternary compound InGaAsP can have better high frequency performance than GaAs.

The research will concentrate on the growth and characterization of the quaternary compound InxGa1-xAsyP1-y (0.73 less than or equal to x less than or equal to 0.85, 0.35 less than or equal to y less than 0.6) grown by liquid phase epitaxy on InP substrates. The material characterization studies will include: surface morphology and layer uniformity; resistivity and Hall measurements; capacitance-voltage impurity profiling, photoluminescence and carrier velocity-electric field measurements. The quality of the III-V quaternary epi-layers will be investigated by processing and testing Schottky barrier field effect transistor (FET) structures.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0041, INERTIAL REFERENCE TECHNOLOGY RESEARCH EXPERIMENTS

R.B. Jenkins, University of Southern Colorado, School of Applied Science & Engineering Technology, Dept. of Electronics Engineering Technology, *2200 Bonforte Blvd., Pueblo, Colorado* 81001 (NSG 2048)

RESEARCH OBJECTIVE: The primary objective of the research effort is to continue research in inertial sensor fault detection and identification technology in order to provide a sound basis for further integrated navigation and flight control system decision making. This goal is accomplished through research and evaluation of systems having the potential for reliable inertial sensor redundancy management.

RESEARCH APPROACH: Inertial sensing redundancy management algorithms using an orthoskew sensor configuration are being developed and evaluated. The algorithm which has the greatest potential in terms of cost, reliability and performance criteria will be flight tested as well.

Three different levels of experimentation are used: computer simulation, laboratory simulation with ring laser gyro sensors, and flight tests in a VTOL environment. Computer simulation involves algorithm development on a large scale computer using the most applicable high-level language. Laboratory simulation experiments are performed on the three best candidate algorithms. These algorithms, using ring laser gyro sensors are then operated in a VTOL environment to determine their reaction to vibration, temperature change, humidity, power source transients, etc.

The redundancy management concept has been extended to include multiple computer fault tolerance. 'Purging' logic is being developed to enable detection and isolation of a faulted computer. Microprocessors are used as the basis for the candidate multiple computer configurations.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0042, NAVY VEHICLE DESIGN AND CONSTRUCTION - DESIGN OF MAXIMUM LIFT AIRFOILS FOR TRANSONIC MANEUVERABILITY

M. James, Dynamics Technology Inc., *3838 Carson St., Torrance, California* 90503 (DN975465; N00014-79-C-0458)

Increased transonic maneuverability is being imposed on Navy combat aircraft because of mission and survivability requirements. Great progress has been made in recent years in the computational design of efficient transonic cruise aircraft, both military and civilian. The capability is now emerging to design for transonic maneuverability with similar success. However, the criteria and limits which must be specified for transonic maneuvering designs are complex and not well defined. It is the objective of this research to investigate the design of optimum transonic maneuvering airfoils and to establish design limits and criteria to be used in this design process.

An inverse computational design procedure for transonic airfoils will be used to establish optimum maneuvering airfoil designs for which the maneuver parameter MDD2CL is maximized. Criteria for establishing permissible shock srength, shock location, pressure distribution, flow separation limits, etc., will be developed for the design process. Geometry criteria to confine the designs to practical shapes which can be achieved from the basic airfoils through variable geometry and/or variable camber concepts will be establshed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0043, SUPERSONIC FLOW ABOUT YAWED BODIES

J.L. Steger, Flow Simulations Inc., *735 Alice Ave., Mountain View, California* 94041 (DN975536; N00014-79-C-0544)

The development and the utilization of accurate methods to compute the flow fields about bodies at high angles of attack and high speeds is essential for the aerodynamic design and optimization of aircraft and missiles. In the proposed investigation, the laminar flow over a yawed body will be studied within the framework of the Navier-Stokes equations (or a suitable accurate approximation to them). Particular attention will be devoted to the formation of vortices on the leeward side of the body, the formation of cross-flow imbedded shocks, and the strong viscous-inviscid interactions between the boundary layer and external flows.

The approach will be to use both the parabolized Navier-Stokes equations and the more accurate unsteady thin-layer Navier-Stokes equations. The parabolized Navier-Stokes equations will be used to explore the overall flow field in order to establish the particular regions which must be studied in greater detail. The more detailed study will use the parabolized Navier-Stokes equations in a carefully clustered grid. The more accurate unsteady thin layer Navier-Stokes equations will be used to monitor and to supplant the parabolized results when necessary.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0044, RESEARCH IN HIGH-ENERGY PLASMAS

A.J. Lichtenberg, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering & Computer Science, *Berkeley, California* 94720 (ENG78-26372)

This research program involves the theoretical and experimental study of plasma creation, containment, and heating in magnetic mirror plasma device configurations. The research covers the following topics: A. Theoretical and experimental studies relating to adiabatic invariance and its breakdown, with applications to plasma trapping and containment. B. Theoretical and experimental study of axial feedback stabilization of flute modes in a low temperature, multiple mirror plasma. C. Study of cold plasma stabilization of hot-electron plasmas.

This is a continuation of research previously supported under NSF grant ENG-7809424.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0045, RESEARCH ON HETEROGENEOUS TURBULENT FLOWS

P.A. Libby, University of California, San Diego Campus, Graduate School, Dept. of Applied Mechanics & Engineering Science, *P.O. Box 109, La Jolla, California* 92037 (DN975362; N00014-79-C-0355)

The objective of this study is to develop a better understanding of variable density effects on turbulence and mixing in non-reactive flows, and the interaction of those effects with chemistry in reactive flows. This information is needed both for improved prediction of the complex mixing and combustion processes within the combustors of aircraft turbojet engines, and to provide a basis for advanced combustor design. Ultimately it should lead to improved propulsion systems for naval weaponry applications.

A mixing region will be formed by injecting a two-dimensional helium jet, which maybe heated, into a moving airstream. Hot wire anemometry and thermometry will be combined with statistical techniques to study the mixing process. The present jet generator will be modified to obtain improved two-dimensional results close to the point of injection. Further measurements will be made both in this region and downstream under the influence of a streamwise pressure gradient. A coordinated theoretical study of turbulent reacting flows with pre-mixed reactants will be carried out utilizing an improved representation of the turbulent transport. Emphasis will be on the interaction between the turbulent fluctuations and the reactive heat release, with specific application to oblique flames and the effects of acceleration on turbulent flames.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0046, RESEARCH ON WALL TURBULENCE 13681-E

R.F. Blackwelder, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DA0E9203; DAAG29 76 G0297)

To experimentally explore the unsteady eddies that occur naturally in turbulent shear flows. Relevance - new turbulence models are needed for prediction methodology in missile aerodynamics, rotorcraft aerodynamics and interior and exterior ballistics.

Special techniques will be developed to cope with the random phase which occurs whenever detecting and sampling occur at different spatial locations. The relationships between turbulent bursts and the outer flow field will be examined and the downstream evolution of the bursting phenomena will be investigated utilizing these specialized techniques.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0047, MEASUREMENT OF INTERACTION OF MILLIMETER WAVES WITH WATER VAPOR ON EARTH-SPACE PATHS 15957-GS

D.C. Hogg, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., *Boulder, Colorado* 80302 (DA0G9129)

To develop a method for remotely sensing atmospheric water vapor through better understanding of the absorption properties of water vapor at millimeter wavelengths. Relevance - the research has relevance to remote sensing of atmospheric water vapor, satellite-communication signal attenuation, and radiometric approach to the Army millimeter wave program.

Absorption by water vapor will be measured using a radiometric system consisting of channels at 20.6 gHz and 31.6 gHz. Simultaneous humidity measurements will be taken by radiosonde, and absorption calculated from the water vapor profiles observed. The data will be analyzed to establish extrapolation to near millimeter wavelengths and to determine the temperature dependence of the absorption.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0048, WAVEGUIDE COUPLERS

W.K. Burns, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980231)

To assist in the development of improved techniques for coupling laser sources to waveguides and to characterize light propagation into these guides. Techniques will be investigated to improve coupling of diode lasers into waveguides. Butt coupling techniques will be studied initially with later studies to include an assessment of the viability of grating couplers. The propagation characteristics of the coupled light will also be investigated with emphasis on scattered light reduction.

Experimental and analytical studies will address problems associated with coupling diode lasers to waveguides. Output beam patterns will be measured for both waveguides and lasers and coupling efficiencies will be maximized by tailoring these profiles. Coupling via waveguide gratings will be investigated analytically to define problem areas and to project coupling efficiencies. The characteristics of light propagating in the waveguides will be determined and techniques to suppress scattered light will be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0049, MOTION SYSTEM TESTING

W.T. Harris, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Advanced Simulations Concepts Lab., *Orlando, Florida* 32813 (DN994014)

Develop the necessary materials and program to provide the ability to perform (a) acceptance testing, (b) quality assurance and revalidation testing, (c) daily readiness testing and (d) diagnostic testing of synergistic cockpit motion hardware.

Develop the testing plan, award contract for software services, test software and hardware developed, field test the testing program and apparatus.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulations Concepts Lab.

4.0050, A GENERALIZED WAKE-INTEGRAL APPROACH FOR DRAG DETERMINATION IN THREE-DIMENSIONAL FLOWS

J.C. Wu, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (ENG79-00891)

This is joint project between Georgia Institute of Technology and Lockheed-Georgia Company on determination of drag, its nature and its distribution from measurements made in the wakes of finite bodies, including lifting cases.

The theoretical portion will be carried out at Georgia Tech while the wind tunnel experiments will be carried out at Lockheed-Georgia. The primary objective will be to develop a generalized wake-integral approach for drag determination in three-dimensional flows.

Emphasis on energy conservation has sharpened the need to understand the drag producing mechanisms. This project could well lead to new ideas concerning low drag or energy efficient configurations for both future aircraft as well as land based vehicles.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0051, INTERACTION OF VARIOUS MATERIALS WITH HIGH-TEMPERATURE, HIGH DENSITY PLASMAS

K. Kim, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

A hypocycloidal-pinch plasma device has been constructed to investigate the interaction of high temperature (approximately 1KeV), high-density (approximately 10 to the 18th power cc) plasmas with various materials. Subjects of particular interest are: Study of particle-plasma interaction for different probe particles, investigation of soft X-ray emission characteristics from various filling gases, development of a high-power UV source, and study of laser-plasma interaction, which includes plasma heating.

SUPPORTED BY University of Illinois

4.0052, MINIMUM-FUEL ORBIT TRANSFER IN SIMPLE GRAVITATIONAL FIELDS

J.E. Prussing, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

The subject of minimum-fuel impulsive orbit transfer has received a great amount of attention over the past fifteen years. The problem is quite complex and a complete solution for an inverse-square gravitational field is not known. The purpose of the current investigation is to apply primer vector theory to the simplified cases of uniform and field-free cases, describe all the types of minimum field transfers, and gain insights which may lead to new solutions for more complex fields.

SUPPORTED BY University of Illinois

4.0053, STOCHASTIC LANGUAGES AND THEIR APPLICATIONS TO SIGNAL AND IMAGE PROCESSING

K.S. Fu, Purdue University, School of Electrical Engineering, Dept. of Electrical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (DN975495; N00014-79-C-0574)

To improve the Navy's surveillance capabilities by developing improved stochastic languages and associated statistical methods for applications to signal and image processing.

Statistical and probabilistic research will be performed to develop improved methods for target identification and texture discrimination of satellite images. In particular research work will include (1) the investigation of stochastic graphs and stochastic graph grammars for pattern description, (2) the extension of certain inference algorithms to tree grammars and (3) investigation of stochastic error correcting syntax analysis for tree languages.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0054, NUMERICAL STUDIES OF UNSTEADY SUPERSONIC MIXING FLOWS

J.D. Anderson, University of Maryland, College Park Campus, School of Engineering, Dept. of Aerospace Engineering, *College Park, Maryland* 20742 (DN775431; N00014-77-C-0257)

Mixing phenomena play a central role in many fluid dynamic applications ranging from the flow at the trailing edge of a wing to the flow in a chemical laser. The proposed research will examine, numerically, the mixing between two co-flowing jets in which oscillations, representative of controlled input disturbances, will be introduced.

In recent years significant progress has been made in the interpretation of the nature of the mixing of two, steady, planar, co-flowing jets. The planned numerical work will examine the influence of controlled time-dependent disturbances on the diffusion between the two jets. The calculations will use the time-dependent Navier-Stokes equations. Jets of the same composition as well as dissimilar jets will be studied. For turbulent flows, a kinetic energy model will be used.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0055, THERMAL STABILITY OF POWER TRANSISTORS

D.H. Navon, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Electrical Engineering, *Amherst, Massachusetts* 01002 (ENG79-01819)

Characteristics of semiconductor power switching devices are being investigated with the aid of numerical models. Specific problems being considered include: 1. The operation of V-groove MOSFET (metal-oxide-semiconductor field-effect-transistor) structures under high current and high voltage conditions, taking temperature into account. 2. The operation of the V-MOSFET as a high current, high speed switch. 3. The limitations on power handling capability of V-MOSFET and V-groove junction FETs. 4. The power limitations of V-FETs in

an inductive circuit environment. 5. Design criteria for optimum performance of the V-FET as a high frenquency device.

This is a continuation of research previously supported under NSF grant ENG-7509334 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0056, DROPLET MOTION INDUCED BY WEAK SHOCK WAVES

S. Temkin, Rutgers the State University of New Jersey, New Brunswick Campus, School of Engineering, Dept. of Mechanical Aerospace & Industrial Engineering, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (ENG76-105045 A02)

This action provides renewal support for NSF Grant ENG 76-15045. Two year experimental study of the unsteady motion of small liquid droplets responding to the passage of weak compressive wave pulse will be carried out in a shock-tube facility completed under the previous grant. Water droplets with diameters in the range of 50-500 microns will be exposed to the wave with the resulting Reynolds number in the range of 10-100.

The main objective of this investigation is to measure the response of small water droplets to 'N-Waves.' These have both negative and positive fluid velocity regions, so that they may be used to study, under controlled conditions, the effects of acceleration and deceleration on the drag. The information obtained in this investigation is of importance in many situations of practical interest. In particular, it is needed in studies of droplet coalescence in thunderclouds, and in the study of techniques used to coagulate industrial aerosols as a means of reducing particulate air pollution.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0057, TRANSONIC TURBOMACHINERY INLET CONDITIONS

W.J. Rae, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DN890139; N000019-78-C-0603)

To develop methods for treating inlet conditions in transonic turbomachinery flow field calculations.

Theoretical study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0058, CARS INVESTIGATIONS IN TURBULENT, SOOTING FLAMES

M. Lapp, General Electric Co., Research & Development Center, *1 River Rd., Schenectady, New York* 12305 (DN975437; N00014-79-C-0381)

The objective of this research effort is to provide a scientific basis for a non-perturbing, space and time resolved optical probe of gas temperature and constituency in combustion systems, based upon laser Raman scattering. Such optical sensors will be useful initially for providing detailed access to temperature and species concentrations in combustor flows as well as to possibly providing signals for control purposes - all necessary for improved propulsion systems for naval aircraft and missile applications.

Techniques developed during the past several contract years will be utilized to measure flame product gas density from vibrational Raman scattering stokes q-branch signals, and temperature from the corresponding Stokes/anti-Stokes ratio of the nitrogen. Axial velocities will be measured by use of laser velocimetry apparatus. A pulsed dye laser source operating in the mid-visible will be used for the Raman effort, in conjunction with spectrometer/photomultiplier or other advanced forms of detection.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0059, QUASI-OPTIC STUDY OF DIELECTRIC RADOMES AND LENSES 15369-EL

L.B. Felsen, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Aerospace Engineering & Applied Mechanics, *333 Jay St., Brooklyn, New York* 11201 (DA0F9276; DAAG29-78-G-0168)

To provide improved methods for calculating the effects of radomes on missile and aircraft antennas and to determine the limits over which classical geometric optics may be applied to determine radome effects. Relevance - results of this research are directly relevant to Army systems requiring high performance antenna-radome combinations, e.g., missile radomes, and low-sidelobe, high precision radar radomes.

A rigorous solution for the radome will be formulated and evaluated via asymptotic methods. The analysis will contain contributions of leaky modes, whispering gallery modes and surface waves as well as the usual ray optical contributions. The relative importance of each of these terms will be assessed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0060, RADAR BEACON DATA LINK

J. Monson, Syracuse Research Corp., *Merrill Ln., Univ. Heights, Syracuse, New York* 13210 (DN890169)

Establish radar beacon data link capability for Marine Corps forward air controllers (FACS).

Modify PPN-18 FAC radar beacon to allow for manual insertion of range/bearing to target and altitude difference between target and FAC, and to provide automatic encoding of beacon replies to strike aircraft radar interrogations, design decoder/display for A-6E cockpit.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0061, AVIONICS RELIABILITY ASSESSMENT

T. James, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF099740)

Establish a recurrent identification of reliability/maintainability problems by work unit code and/or NSN's of avionics equipment for all systems. Identification should delineate where reliability growth can be effectd by action from the AFAL technical divisions. The reliability parameters of the problem equipment should be evaluated and compared to equipment change effected by the technical divisions.

The equipment with problems identified on the data product (1) are to be evaluated for existing reliability parameters (MTBF, shape, scale of the failure distribution) and statistical tests of reliability improvement in the parameters values conducted on data supplied from AFAL technical division action. To do statistical analysis of the results obtained under the combined environmental reliability test (CERT) to influence reliability testing in the future, evaluation of the total CERT concept as a reliability test program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0062, NON-SATELLITE COMMUNICATIONS RELAY

R. Enderson, Raven Industries Inc., Electronic Systems Division, *205 E. 6th St., Sioux Falls, South Dakota* 57101 (DN981054; N62269-78-C-0452)

The technical objective of this task is to provide sufficient test data and analysis to demonstrate the feasibility of a ballon-borne expendable relay for communications purposes. This work supports work unit ZE103, Agency Accession DN 681003.

The approach is to purchase balloon systems previously developed to provide platforms for test purposes.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0063, CLASSIFICATIONS OF SOLUTIONS OF THE THREE-BODY PROBLEM

R.A. Broucke, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

A classification of periodic orbits in the planar general three-body problem is being made. Approximately twenty new families have been obtained by varying the masses or another parameter such as the rotation angle. A systematic study has been made on the types of solutions of two particular cases of the general problem; the non-rotating rectilinear problem and the planar isosceles triangle problem. Several new forms of equations of motion have been discovered for the three-body problem.

SUPPORTED BY University of Texas

4.0064, NOISE GENERATION IN MECHANICAL SYSTEMS - IMPACT NOISE

N.D. Perreira, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: An analytical and experimental investigation of the acoustic noise produced during and after impacts of mechanical system elements is being examined. The noise sources being examined include the aeroacoustic noise generated by the air ejection from the impact site and the noise due to the system surface motions. These motions are comprised of the gross accelerations of the impacting bodies, local deformation near the impact site, surface and other traveling waves generated at the impact site, and standing waves or vibrations of the two impacted bodies.

We are presently attempting to identify the element and impact characteristics that determine the dominate noise source or sources. Analytical modeling and experimental verification of these models will follow.

SUPPORTED BY University of Texas

4.0065, PROPERTIES OF MERCURY-CADMIUM-TELLURIUM SOLID SOLUTIONS

R.F. Brebrick, Marquette University, School of Engineering, Dept. of Mechanical Engineering, *1515 W. Wisconsin Ave., Milwaukee, Wisconsin* 53233 (DF052440; AFOSR-78-3611)

AF function - secure space communications and covert optical electronics require devices which exploit properties and interactions of materials with far infrared radiation. Opportunity - infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective -this research seeks a reliable interpolation scheme to characterize the pseudobinary solid solution series of mercury, cadmium and tellurium for the growth of mercury-cadmium telluride materials of potential use in infrared detectors and sources. Based on measurements of the partial pressures of both mercury, cadmium-saturated and tellurium-saturated solid solutions, the Gibbs free energy, enthalpy and entropy of formation will be calculated. In addition, the chemical potentials of the solid solution components, HgTe and CdTe will be calculated in a thermodynamically self-consistent fashion. How work contributes-the proposed measurements and calculations will furnish basic phase diagram and thermodynamic information for better defining the conditions for growing (Hg,Cd)Te crystals with controlled optical properties. The key problem is the growth of large, stoichiometric crystals of uniform composition is the partial pressure and the solidus temperature of mercury.

Partial pressures will be determined by measuring the optical density (and transmission in the case of Cd) between 220 and 500 nm of the vapor in equilibrium with the solid solutions. Samples that are metal-saturated at some temperature above 300 degrees c will be prepared by adding a known excess of Hg (the predominant vapor species) to known weights of the solid solution. Because of the high Hg pressures anticipated and the limited size of the sample (1/2 to 5 gm), it will be necessary to establish the temperature-volume profile in the fused silica optical cells so that changes in the composition of the solid solution can be followed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, DEVELOPMENT OF CAPABILITIES FOR COMPUTER PROCESSING OF REMOTELY SENSED DATA AT A MINORITY INSTITUTION

O.L. Montgomery, Alabama Agricultural & Mechanical University, School of Agriculture, Dept. of Natural Resources & Environmental Studies, *Normal, Alabama* 35762 (NSG 8066)

This initial three-year project provides for the development of a computer processing capability in the analysis of remotely sensed data. The 'Remote Sensing Program' at Alabama A&M University, will make the transition from a 'project' to a 'program' oriented remote sensing center.

The objectives are four fold in nature: (1) to further establish and strengthen research efforts currenly underway at Alabama A&M University, (2) to develop and test new and improved methods of analyzing and extracting information from remotely sensed data in a cost-effective manner, (3) to identify and cooperate with potential users of remotely sensed data, (4) to provide for the orderly and efficient transfer of the technological advancements of the sciences.

Program areas have been developed as a means of fulfilling the objectives. The program areas are as follows: (1) research and development, (2) application testing and technology. Through these program areas, the center hopes to develop, test, and transfer the science of remote sensing and its applications to the solution of agricultural, natural resource and land use inventorying, monitoring and assessment problems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0002, THE MOTION OF PARTICLES IN INTERSTELLAR SPACE RELEASED FROM A NUCLEAR WASTE PAYLOAD CONTAINER

A.C. Williams, Alabama Agricultural & Mechanical University, Graduate School, *Normal, Alabama* 35762 (NSG 8068)

This project is a theoretical investigation into one aspect of a feasibility study related to the disposing of nuclear waste in space. The effect of the nuclear waste payload disintegrating into small particles and the resulting long-term earth reentry risk of the particles is looked at. Work in progress has indicated that for certain size particles, significant electric charges can accumulate which gives rise to a resultant electromagnetic interaction with the interplanetary magnetic field. Further work will be done in parameterizing the various interactions of the particles with the interplanetary environment.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0003, MEASUREMENT OF TOTAL ELECTRON CONTENT AND IONOSPHERIC ELECTRON CONTENT VIA FARADAY ROTATION AND GROUP DELAY TECHNIQUES

M.P. Paul, Alcorn State University, Graduate School, Dept. of Industrial Education & Technology, *Lorman, Mississippi* 39096 (NGR 25-012-001)

Total electron content has proved to be a very useful ionospheric parameter. The measurement of this parameter has been greatly simplified by the proliferation in the number of presently orbiting geostationary satellites. A field station was set up on this university campus for the routine measurement of this parameter via Faraday rotation of 173.35 MHz transmissions of ATS-1 and ATS-3. Data obtained so far since July, 1974 have been analyzed to study their temporal variation and are found to be consistent with the data obtained at other midlatitude stations.

Recently this facility has been used for the experimental investigation of horizontal temporal evolution of ionospheric modification created by rocket exhausts via spaced-receiver technique. Data obtained show excellent promise.

Our plans for the simultaneous measurements of ionospheric, total and plasmaspheric electron content during the third phase of ATS-6 via Faraday rotation and group delay techniques were a great success. Our receiving system was on air in December, 1976 and data collection was continued up to shortly before the transmission schedule was permanently terminated. Results obtained are found to be consistent with those obtained by other midlatitude experimenters and reveal a wealth of information on the diurnal variation of ionospheric and plasmaspheric contents, especially during the periods of geomagnetic disturbances.

Our future plans are to continue this type of routine measurement and thereby establish the trend of long-term variation of the parameters.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0004, IONOSPHERIC, TOTAL AND PROTONOSPHERIC ELECTRON CONTENT MEASUREMENTS AT A MIDLATITUDE STATION

M.P. Paul, Alcorn State University, Graduate School, Dept. of Industrial Education & Technology, *Lorman, Mississippi* 39096 (NGR 25-012-001)

Total electron content has proved to be a very useful ionospheric parameter. The measurement of this parameter has been greatly simplified by the proliferation in the number of presently orbiting geostationary satellites. A field station was set up on the Alcorn State University campus (31.5 degrees North latitude, 91.06 degrees West longitude) for the routine measurement of this parameter via Faraday rotation of 137.35 MHz transmission of ATS-1 and ATS-3. Data obtained so far since July, 1974 have been analyzed to study the temporal variation of this parameter and are found to be consistent with the data obtained at other midlatitude stations.

These equipments have also been used recently at different temporary field stations on the east coast of Florida for studying the ionospheric hole, its creation by rocket exhaust and its horizontal and vertical temporal evolution during the rocket launching on September 19, 1979 and measuring the Faraday rotation of satellite SIRIO signal. The data, which seem to be very promising and presently under analysis, will be reported elsewhere.

Our plans for the simultaneous measurements of ionospheric, total electron and plasmaspheric contents during the third phase of radio beacon experiment of ATS-6 via Faraday rotation and group delay techniques were a great success. Our receiving system was on air in the middle of December, 1976 when the satellite was maneuvered to its final longitude location and continued data collection until the conclusion of this transmission program. Results obtained from partial analysis of data are consistent with the results obtained by other select groups of experimenters around the world and reveal a wealth of information on the diurnal variation of ionospheric and plasmaspheric contents, especially during the periods of geomagnetic disturbances.

Our future plans are to continue this type of routine measurement.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0005, PIONEER VENUS PROBE ANOMALIES IN LOWER VENUS ATMOSPHERE

J.K. Goodman, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCA 2-675908)

ABSTRACT. Four Pioneer Venus Probe spacecrafts entered the Venusian atmosphere on December 9, 1978, and descended to the surface while making in situ measurements of chemical composition, structure and radiative balance. In the lower Venusian atmosphere, a number of anomalous events were noted in some of the scientific instruments and probe engineering data at approximately the same altitude. The objectives of this study are to 1) formulate the range of atmospheric states and conditions at the anomaly levels that are consistent with the overall planetary circulation models and U.S./Soviet probe measurements, 2) extrapolate the mesoscale and microphysical conditions at these levels that are capable of generating and maintaining electromagnetic fields of the order necessary to cause the anomalous reading and 3) examine the potential spacecraft induced atmospheric interactions that could generate and/or enhance these conditions.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0006, STUDY OF PLANETARY METEOROLOGY

C.A. Riegel, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2-2)

An investigation into the response of the Martian atmosphere to the growth and decay of the polar caps is proposed through the use of a zonally averaged numerical model based on the complete set of hydrodynamic equations. The efficacy of the model is its ability to isolate the baroclinic and mass exchange processes that characterize the polar regions. The results will be used to assess the dust-raising capability of the polar cap winds and to enhance our understanding of general atmospheric processes. A method for improving the estimates of threshold wind speeds is also proposed.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0007, FURTHER DEVELOPMENT OF THE AMES TWO-DIMENSIONAL MODEL

C.A. Riegel, California State University & Colleges, San Jose State University, Graduate School, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NSG 2130)

The two-dimensional stratospheric model developed by scientists at the NASA-Ames Research Center, in collaboration with Dr. C. A. Riegel of SJSU, has been applied to studies of perturbations of the terrestrial ozone layer (e.g. see Borucki et al., 1976). Since February, 1976, research supported by NASA Grant NSG 2130 has resulted in substantial speed-up of the model with regard to computer time requirements. This speed-up has reduced the costs of running the model by 40% without severely affecting the accuracy of the solution. Additional reductions are anticipated by the contract expiration date of March 31, 1978. Thus it should now be possible to expand the model to enable the study of additional problems. To this end, it is proposed that the model include the following: a) diurnal averaging of aeronomic rate coefficients, b) inclusion of sulfur compound chemistry and aerosol model, and c) a study of the effects of carbon compounds in the stratosphere.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0008, STRATOSPHERIC-MESOSPHERIC DYNAMICS

C.A. Riegel, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCA 2-0R675-809)

Ames and San Jose State University scientists have developed a two-dimensional model that treats the chemistry of minor constituents in the stratosphere and mesosphere and includes bulk flow and eddy transport. This model includes reactions involving nitrogen, hydrogen and chlorine oxides, and is being used to assess the environmental effects of aerospace vehicle operations and of releases of chlorofluoromethanes. Results of the model calculations are in reasonable agreement with observations; but further refinements are desirable.

In addition, Ames scientists have continued work on a submodel of stratospheric-mesospheric dynamics. Professor Riegel of San Jose State University is assisting in the development of this model by advising on necessary meteorological approximations and in comparing model performance with observed atmospheric structure.

Furthermore, Ames scientists conducted an extensive observational program in Panama during July 1977. Large amounts of meteorological data were collected and are being processed. These data must be interpreted and correlated with air samples

taken by aircraft observations for studies of tropospheric-stratospheric exchange in the tropics.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0009, STRATOSPHERIC POLLUTANT TRANSPORTS BY PLANETARY WAVES AND TROPICAL CIRCULATIONS

C.A. Reigel, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2-17)

In the past decade there has been increasing concern about the impact of pollutants on stratospheric ozone, and the resulting effects on the biosphere in the event of significant ozone reductions. Possible pollutants include NOx emissions from high-flying SST's and heavy lift launch vehicles (McConnell and McElroy, 1974), fluorocarbons from aerosol sprays and refrigerants (Turco and Whitten, 1979), and N2O gas from the increased use of fertilizers in agriculture (Crutzen, 1972). The photochemistry of the species is complex; moreover, since they interact strongly with atmospheric motions, a proper assesment of stratospheric pollution requires a three-dimensional dynamical model. The development of such a model entails numerous difficulties, in particular the impossibility of simulating every dynamical phenomenon of the atmosphere. To some extent, then, one must know beforehand what the most important mechanisms for pollutant transport are so the model can be designed to simulate or parametrize them properly. This requires a theoretical understanding of observed atmospheric phenomena, and an ability to understand their implications for pollutant transport.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0010, VERIFICATION OF SEASAT WIND SPEED AND DIRECTION - GLOBAL CAPABILITY FOR EXTRA TROPICAL CYCLONES (ABBREV)

W.J. Pierson, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Oceanography, *Convent Ave. & 138th St., New York, New York* 10031 (NAS 1-15669)

The purpose of this program is to improve upon the results obtained in 1978-79 based on a re-calibration of the sigma nauget measurements made by the SeaSat scatterometer. Improved wind vector algorithms will be computed so as to determine the accuracy with which the SASS has measured the winds over the ocean. Mesoscale turbulence features will be studied in terms of frequency spectra for frequencies corresponding to periods from two minutes to three hours so as to balance the 'error' budget in comparison of conventional measurements with the spacecraft data. Finally, these new results will be used to study selected extra tropical cyclones and tropical cyclones in which high winds and large wind gradients occurred.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0011, ATMOSPHERIC KINETIC INVESTIGATION

J.B. Halpern, Howard University, Graduate School, *2400 6th St. N.W., Washington, District of Columbia* 20001

Based on previous work of the principal investigator, several special cases have been identified in which two photon excitation should be especially strong. In particular it is proposed to detect CO using the TPE of the Hopfield-Birge systems, and to measure the excitation by monitoring the cross-fluorescent decay to the A state. In OH, close accidental coincidences with the strong (5,0) ground state vibrational transition, one of the Meinel bands, should greatly enhance the TPE of the A state, whose fluorescent decay would be a measure of the amount of OH present. This method avoids the problem of OH radical generation from two photon dissociation of water vapor which limits current laser induced fluorescence measurements. Especially for CO and other diatomic molecules, whose first allowed absorption is in the VUV TPE may be a superior method for remote ambient detection.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0012, LANDSAT STUDY RELATING SOIL ZINC CONTENT TO INCIDENCE OF DIABETES

I.G. Molnar, Lincoln University, School of Agriculture, Dept. of Agricultural & Natural Resources, *Jefferson City, Missouri* 65101 (NSG 13-1)

There is a considerable body of research which suggests a relationship exists between diabetes and zinc deficiencies within various animals and man. The objective of this research is to combine information obtained from epidemiological studies of the incidence of diabetes with zinc content of soils as indicated by geochemical maps of Missouri. Efforts will be made to expand and refine existing geochemical maps using Landsat data.

PROGRESS/CURRENT PLANS: Contract awarded in December 1979. Initial work currently underway.

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0013, X-RAY DIFFRACTION STUDIES OF SHOCKED LUNAR ANALOGS

R.E. Hanna, St. Marys University, School of Arts & Sciences, Dept. of Geology, *2700 Cincinnati, San Antonio, Texas* 78228 (NSG 9039)

This project aims -methods for determining the shock pressures experienced by terrestrial lunar analogs involved in cratering processes, and (2) to determine by X-ray diffraction methods the distribution of shock pressures experienced by mineral grains in naturally and artifically shocked samples.

This research utilizes X-ray powder diffractometry (line-broadening studies) and Debye-Scherrer single-grain studies. The samples are lunar analog standards shocked at the Johnson Space Center flat-plate accelerator, nuclear-shocked granodiorite from the Piledriver test in Nevada, and naturally shocked suevite from the Ries Crater in Germany.

Diffractometer standards have been completed for shocked quartz, orthoclase, oligoclase, enstatite, and olivine. A preliminary article on the technique was published in Advances in X-ray Analysis 20, 337-344 (1977). Debye-Scherrer studies of the nuclear-shocked and accelerator-shocked granodiorite are completed, as are about one-half of the naturally shocked Ries samples. Comparison has been made of all three Debye-Scherrer studies. The distribution of shock pressures around a terrestrial impact crater was measured using the application of methods studied. Research is essentially complete, and final reports are in preparation.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0014, SURFACE DRIFT CURRENTS IN THE OCEAN

J.J. Dudiz, University of Maryland, Eastern Shore, Undergraduate School, *Princess Anne, Maryland* 21853 (NSG 6025)

Surface drift currents in the ocean are composed of two types of flow--the classical Ekman flow where Coriolis and viscous forces are balanced and the Stokes drift resulting from irrotational gravity wave motion. The purpose of this project is to model theoretically this interaction of wind stress, viscosity and the earth's rotation, including recognition of the separate modes of motion and understanding the conditions under which they exist.

Initial effort has been spent in considering the drift current induced by a non-rotating, viscously modified surface gravity wave. Boundary layer calculations have rectified the contradictory results, regarding the magnitude of the surface drift velocity in deep-waves, which were obtained by previous investigators using differing analytic approaches.

Present work concerns resolving the still unrealistic surface currents obtained from this model under certain limiting conditions. In the future, the more complex problem which includes

the additional interaction mechanism of the earth's rotation will be considered.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0015, ELECTRON MICROPROBE STUDY OF LUNAR AND PLANETARY ZONED PLAGIOCLASE FELDSPARS

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Compositionally zoned plagioclase feldspars, as members of a continuous reaction series, reflect the external temperature-pressure conditions and bulk composition of a crystallizing silicate melt. Though difficult to interpret, plagioclase zoning is a potentially useful tool for understanding lunar and planetary magmatic processes and recognizing sequences of magmatic events. Because the current understanding of plagioclase zoning is stll unsatisfactory, a detailed investigation of naturally grown and synthetic grown zoned plagioclases was begun in Feburary 1977.

The present study has consisted of (1) a detailed petrography of numerous igneous rock thin sections whose plagioclase feldspars contain oscillatory and other types of zoning; and (2) a detailed electron microprobe study of these samples for compositional data. Three zoned plagioclases were selected for analysis by a new technique for collecting and presenting areal electron microprobe data. This new technique utilizes a computerized real-time data collection system that gathers X-ray photon counts from the microprobe spectrometers as the microprobe electron beam scans the specimen surface. After appropriate data processing the computer draws elemental concentration contour maps from two-dimensional data matrices collected for each element.

Comparisons of the above microprobe data with optical determinations have been made on a portion of the samples, and are being completed on the remaining samples. Preliminary results have been presented to the Geological Society of America. A final report is being prepared for publication.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0016, OCCURRENCE AND MINERAL CHEMISTRY OF HIGH PRESSURE PHASES, POTRILLO BASALT, SOUTH CENTRAL NEW MEXICO

J.M. Hoffer, University of Texas, El Paso Campus, School of Science, Dept. of Geological Sciences, *El Paso, Texas* 79902 (NSG 9062)

A study is underway to investigate the occurrence, distribution, mineralogy, and geochemistry of high pressure megacrysts from cones and lavas in the Potrillo Basalt field of south central New Mexico. This investigation will form the basis for evaluation of current experimental studies in crystal growth of megacrysts in the earth's mantle.

Megacrysts of feldspar, pyroxene, amphibole, and xenoliths of olivene-pyroxene-spinel occur abundantly in the volcanic rocks of the Potrillo Basalt; they are found in isolated crystals within volcanic bombs associated with the older cinder and maar volcanoes, or as inclusions in basalt flows. To date only the olivine-pyroxene-spinel modules and selected feldspar megacrysts have been studied. It has been concluded that the feldspar megacrysts were formed under high pressure and came from great depth. However, to date, very little data is available concerning the distribution, variation, and composition of a megacryst suite from a single volcanic area.

Detailed collection of megacrysts in the Potrillo Basalt has been carried out, and sample areas are being mapped to estimate abundance and distribution of the various megacryst types. Petrographic thin sections of megacrysts are being studied to determine texture and mineralogy, and major element determinations are being made by x-ray fluorescence analysis. The results of these studies should provide basic data on the interior of the earth as an example of how one would analyze similar samples should they be returned from other planetary bodies.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0017, MEASUREMENT OF BI-DIRECTIONAL REFLECTED SPECTRA AND CORRELATION TO AGRONOMIC PARAMETERS

R.A. Watlington, University of the District of Columbia, Undergraduate School, *4100 Connecticut Ave. N.W., Van Ness Campus, Washington, District of Columbia* 20008 (NSG 5290)

The research on this project is intended to establish the reliability of bidirectionally scanned reflectance spectra for accessing various agronomic parameters of specified agricultural subjects.

The research involves using two and three band, hand-held radiometers as well as a truck-mounted, 395 band spectroradiometer to scan the specially prepared fields of corn, soybean, and wheat at the Beltsville Agricultural Research Center. These scans will be cross-referenced to the physical characteristics and growth stages of the crops and will be conducted as a function of look angle primarily. Concurrently, the effects of changing sun angles, cloud conditions and atmospheric state will be recorded and considered to minimize inaccuracies in correlating agronomic measurable to look angle (at specific wavelength) - or to wavelength (at specific look angle.)

The expected products of this project are: 1) a model correlating bidirectional radiometric spectral information to specific crop parameters, such as species or growth stage; 2) an analysis of the feasibility of the bidirectional approach (compared to conventional zenith-look approaches) for earth-surface and satellite studies of agronomic subjects; and 3) an algorithm for considering the effects of sun angles and observer look angles upon detected reflected radiance.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0018, APPLICATION OF REMOTE SENSING TECHNOLOGY TO MANAGEMENT OF AGRICULTURAL AND NATURAL RESOURCES OF ALABAMA

O.L. Montgomery, Alabama Agricultural & Mechanical University, School of Agriculture, Dept. of Natural Resources & Environmental Studies, *Normal, Alabama* 35762 (0077538; ALAX-011-479)

OBJECTIVE: Develop a remote sensing processing capability in Alabama, for rapid inventory, assessment and monitoring of the resources of the state. Determine the feasibility of providing current and accurate soils map from remotely sensed data.

APPROACH: Proposed the acquisition of an intermediate remote sensing terminal which will be connected to the control machine processing center at the Laboratory for Applications of Remote Sensing (LARS), Purdue University via telephone line. Concurrent with the installation of the processing terminal will be the acquisition of remotely sensed data over north Alabama. The computer compatible tapes containing data over the areas of interest will be forwarded to the LARS computer facility where they will be stored in the tape storage area set aside solely for use by persons at this terminal site. The visible and photography, topographic maps and ground observation data will be stored at terminal site.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Alabama

5.0019, VOYAGER MAPPING

H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-01973)

In 1978, the design of the cartographic data reduction scheme was completed. This includes geometric transformation and enhancement of images by digital pressing; establishing geodetic control nets using data provided by Mert Davies, Rand Corporation; generation of controlled mosaics; and production of selected shaded relief bases.

Primary goal of the Voyager Mission is to generate topographic and geologic maps of five satellites of Jupiter based on 1500 images that will be acquired by the cameras of Voyagers 1 and 2 during the period of March through May-June 1979. Data

reduction efforts will begin in March 1979 and continue to FY 82.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0020, PG-HISTORY OF CHRYSE HYDROGRAPHIC BASIN

H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02360)

Most geologists agree that the large channels that descend into the Chryse basin from the south and southwest are fluvial in origin. However, only from the recently obtained high resolution stereoscopic Viking photography can we (1) attempt to date the channeling episodes by crater counts, (2) estimate the volume of water that has traversed the channels and (3) estimate the volume of collapsed terrain that may represent melted subsurface ice that provided the water. One of the most interesting problems defined in the investigation of Mars is the possibility that different climatic conditions may have recurred repeatedly in the past. Questions concerning the evolution of the Martian atmosphere, and the posible presence of life in the past are intimately tied to the channel and volcanic history. The Chryse basin may be the best area on the planet to investigate these questions.

Geologic maps of channel areas, source areas, and debouchment areas will be drawn, using newly available Viking mosaics as a base. Topographic (contour) maps will be prepared of selected areas. Profiles will be drawn in additional areas of high interest from stereophotogrammetric and radar data. Crater counts will be made of all channel areas and the surfaces into which channels are cut. The volume of collapsed terrain will be computed from mosaics, topographic maps and profiles. In this way the most quantitative estimates possible will be made for the processes affecting the hydrographic basin. The geologic relations elucidated by mapping and crater counting will lead to the delineation of a geologic history.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0021, SURFICIAL GEOLOGY OF THE EQUATORIAL REGION OF MARS

L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02354)

The objectives here are: 1. to characterize regional color boundaries and units as they evolve with season on Mars, 2. to establish correlations among terrain morphologies, ages, and colors, 3. using high resolution Viking images to establish the nature of boundaries between and textures within units, 4. to generate maps of the color-terrain-age texture units, and 5. to analyze isolated high resolution color images and important targets, particularly of the Viking landing sites, to establish the regional context of the material units recognized a higher resolution. Based on earlier work from Viking approach color data, it appears that although primary lithologies produced by a variety of processes control regional color, the overriding influence is by eolian transport over timescales from days to perhaps billions of years. Hence, the prime focus in our initial objectives if the apparent eolian units and stratigraphy (Soderblom et al. 1978) that pervades the central and north equatorial region of Mars; hence, this work is classifed as an eolian project.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0022, OPERATIONAL APPLICATIONS OF SATELLITE SNOW COVER OBSERVATIONS AND DCS OPERATIONS IN THE ARIZONA TEST SITE

H.H. Schumann, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Phoenix, Arizona* (AZ 75-041)

The Landsat, NOAA, and SMS/GOES satellite imagery will be the primary source of repetitive remote-sensing data over central Arizona for obtaining snow-covered areas on the Salt and Verde River watersheds. These data will be supplemented by repetitive aerial surveys and supporting ground truth relayed by the ERTS DCS. The ERTS data collection platforms will relay hydrologic and meteorological data from key locations to aid in interpretation of the imagery and to demonstrate the ability of satellite telemetry systems to furnish timely and meaningful hydrologic information for use by water management.

1. To evaluate repetitive satellite imagery together with aerial surveys in an attempt to develop an operational capability in Arizona for using satellite imagery for mapping the distribution of snowcover on the Salt and Verde River watersheds. 2. To develop techniques and procedures for systematic monitoring of snowcover and moisture conditions using remote sensor methods together with the use of the ERTS data collection system to relay ground truth data in near-real time.

The ERTS-1 and NOAA-2 imagery will be the primary source of repetitive remote-sensing data over central Arizona for obtaining snow-covered areas on the Salt and Verde River watersheds. These data will be supplemented by repetitive aerial surveys and supporting ground truth relayed by the ERTS DCS. The ERTS data collection platforms will relay hydrologic and meteorological data from key locations to aid in interpretation of the imagery and to demonstrate the ability of the relay system to furnish timely and meaningful hydrologic information for use by water management.

The feasibility of using satellite telemetry for the relay of hydrologic data in near-real time was demonstrated during the floods of March 1978. The SMS/GOES data-collection system was used to furnish streamflow and hydrometeorological data to the Salt River project in Phoenix near-real time to assist in reservoir operations. The hydrometeorological streamflow-prediction model (HM) was modified and tested for use on the Salt-Verde watershed in central Arizona.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0023, AIRCRAFT MEASUREMENT OF PLUME DISPERSION AND CHEMISTRY

D. Blumenthal, Meteorology Research Inc., *3401 Mendocino Ave., Santa Rosa, California* 95401 (68-02-2713; G603A-AA-107)

OBJECTIVE: To acquire a data base necessary for the development of control strategies for the reduction of ambient air concentrations of sulfates and nitrates.

APPROACH: Large scale, discrete, intensive experimental field studies will be conducted. Aircraft measurements of SO2, O3, bscat, NO and NO2 will be made and integrated samples will be collected for aerosol size distribution and composition.

PROGRESS: Field collection completed. Samples are being analyzed and data reduced.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0024, THERMONIC HEAT EXCHANGER (THX) DEVELOPMENT

N.J. Rasor, Rasor Associates Inc., *420 Persian Dr., Sunnyvale, California* 94086 (HT-01-01; EY-76-C-02-2263.A005)

To do research to determine the feasibility of adopting thermionic conversion technology, developed for use in the space nuclear power program to terrestrial electrical program. Design and test a THX cell. Initiate systems analysis of THX topping of fossil fuel fired electric plants.

SUPPORTED BY U.S. Dept. of Energy, Office of Fossil Energy

5.0025, SEASAT PROGRAM - INTEGRAL INVERSION OF SEASAT - COMPARISON OF DERIVED SWELL AMPLITUDES & RMS WAVEHEIGHT WITH SURFACE TRUTH (ABBREV)

B.J. Lipa, S R I International, Remote Measurements Laboratory, *300 Ravenswood Ave., Menlo Park, California* 94025 (7-923; MO-AO1-78-00-4319)

OBJECTIVE: Develop a integral inversion technique which when applied to Seasat Altimeter data will give the functional form of the ocean surface height probability density.

APPROACH: The derived probability functions will be interpreted in terms of swell amplitude and from waveheight of wind-derived waves. These results will then be compared with surface truth measurements obtained in the Joint Air-Sea interaction (JASIN) experiment and the Gulf of Alaska experiment.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0026, STUDY OF AEROSOL EFFECTS ON SOLAR RADIATION USING LIDAR AND AN INSTRUMENTED TOWER

P.B. Russell, S R I International, Atmospheric Sciences Laboratory, *300 Ravenswood Ave., Menlo Park, California* 94025 (ATM78-02704)

The objectives of this study are to improve our understanding of the role of aerosols in modifying climate. This will be achieved by monitoring the changes in the atmospheric albedo while simultaneously documenting particle concentrations and characteristics. Radiative models will be used to interpret the measurements.

The study includes continuous measurements of upward and downward solar irradiance above the urban-coastal haze layer using a unique tower facility at Sutro Tower, lidar documentation of haze structure, numerous radiometric measurements near the surface.

The plan includes two field programs at the Sutro Tower and adaptation of an advanced radiative transfer code for simulation of measured incidents. It also includes participation in a joint marine field program with the University of Arizona. At the end of the two-year program all measurements and analyses will be unified in terms of aerosol models and parametric radiative effects that will be published in a form readily usable by other climate modelers.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0027, OCEAN SURVEILLANCE USING PASSIVE RADIOMETRY

N.R. Ortwein, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Surface & Aerospace Surveillance Dept., *San Diego, California* 92152 (DN887530)

Examine existing empirical data and literature to determine the uses of passive detection of submerged objects and floor features from above the ocean surface, using solar illumination.

Task 1 - obtain information on the inherent limitations of visible and near IR data gathered by optical instruments over water, as used in the NASA ERTS series of satellites. This shall include a determination of measurement limitations due to instrument calibration, with allowance made for wavelength dependence. Task 2 - subcontract to visibility lab for preparation of all radiometry models developed to date that are relevant to assess detection of underwater objects using solar radiance. Supporting contractual data is reported under DN887546.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

5.0028, REMOTE SENSING OF INTERNAL WAVES

R.R. Buntzen, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Systems Analysis Office, *San Diego, California* 92152 (DN987526)

To measure and correlate ocean internal wave motion with fluctuations in the upwelling light field; to separate and understand the origins of the surface and subsurface components of the light field observed.

A controlled experiment will take place at the NOSC tower during the months of July and August. Instrumentation will consist of three thermistor chains (15-20 beads) to measure the amplitude and direction of internal waves, three 4-band spectroradiometers to measure change in the upwelling and downwelling subsurface light field, and a imaging spectroradiometer to monitor on the surface radiance. Support instrumentation will include a NADC/SIO spectral/transmissometer for determining water clarity versus depth, a profiling fluorometer for chlorophyll and pigment determination and a conductivity-depth-temperature probe (CDT) for measuring density and hence Vaisala-Brunt period and finally internal wave modes present. Data would be recorded on magnetic tape and reduced on the NOSC UNIVAC 1110 computer. Analysis and report preparation would follow.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

5.0029, VIKING - PHYSICAL PROPERTIES

H.J. Moore, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *345 Middlefield Rd., Menlo Park, California* 94025 (9580-00734)

Data on the physical properties of the surface materials collected by the two Viking landers on Mars show that there are four distinct kinds of surface materials. They are, in order of increasing strength: 1. cross-bedded drift material at the Lander 1 site, 2. platy to crusty 'soil' at the Lander 2 site, 3. cloddy to rocky 'soil' at the Lander 1 site, and 4. rocks at both sites. Cohesions, angles of internal friction, and other physical properties are currently being analyzed using surface sampler data and camera pictures obtained during both the Primary and Extended Viking Missions.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0030, MERCURY RESOURCE APPRAISAL

E.H. Bailey, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Western Mineral Resources, *345 Middlefield Rd., Menlo Park, California* 94025 (9320-02008)

Continuing to gather mercury resource data of all kinds in field and in office. Maintain CRIB mercury data file, office file, research collection of specimens from mercury deposits of world.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0031, EVOLUTION OF THE THARSIS REGION OF MARS

M.H. Carr, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02375)

The objective is to understand the nature and history of the Tharsis anomaly on Mars. Tharsis is at the center of a 7 km high bulge in the Martian crust. Fractures associated with the formation of the bulge have affected an entire hemisphere of the planet and the most prominent volcanic region of the planet is at its center. The project aims at determining when the bulge started to form, whether its growth was continuous or episodic, how the growth correlates with the associated volcanic activity and when its vast radial fracture system formed.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0032, FAULTS AND OCCURRENCES OF GEOTHERMAL ANOMALIES

G.C. Brogan, Woodward & Clyde Consultants, *P.O. Box 1149, Orange, California* 92668 (14-08-0001-16310)

STATE TO WHICH PROJECT PERTAINS: California.

The objective of this research is a generic study of faulting in relation to hydrothermal systems. Attributes of faults and hydrothermal systems will be investigated in order to identify differences in the character and genesis of faults that pass through a hydrothermal reservoir, bound a hydrothermal reservoir, influence the heat source, define the geothermal province boundaries and relate the province to large-scale regional features. Differences between faults or fault segments, and diagnostic features of faults in various functional relationships with respect to the reservoir will be determined primarily by cataloging fault characteristics and geothermal data in a special purpose, computer data base that can be used to highlight general associations. Faults will be located for field study by low-sun-angle aerial photography, other remote sensing imagery and informa-

tion on fault distribution in relatively well-studied areas. Field investigations in three to five study areas will include excavation of trenches across fault alignments. It will emphasize evaluation of absolute and relative age of faults, fault characteristics, and mineralogic and chemical concentration gradients.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0033, NATIONAL AEROMAGNETIC SURVEY

R.H. Godson, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9730-00352)

The project will publish updated publication lists by state of aeromagnetic and aeroradioactivity maps and reports. Administration and monitoring of new contracts to private industry for airborne surveys will continue. A computer data base of principal facts of airborne surveys will be established. Work will be started on compiling state wide maps of Alaska and Hawaii in color.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0034, LIGHT AIRCRAFT PHOTOGRAPHY AND MAPPING RESEARCH

R.L. Parker, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9350-00800)

This project seeks to develop techniques of aerial photography using small-format cameras, and of aerial geologic reconnaissance in order to assist geologic mapping and mineral resource investigations. Currently a T-41B is being used to fly 70-mm cameras for both vertical and oblique photography using color and black-and-white films. Projects supported are primarily resource studies in the Rocky Mountain states.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0035, REMOTE SENSING FOR URANIUM EXPLORATION

G.L. Raines, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046 MS939, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-01706)

STATES TO WHICH PROJECT PERTAINS: Wyoming, Utah, New Mexico, and Colorado.

The primary objectives for this year are (1) to extend the types of analyses performed in the southern Powder River Basin to the rest of the basin and, hopefully, to define new areas within the area with uranium potential, (2) to further refine the analysis of the aircraft data as a uranium alteration mapping tool, (3) to complete the analysis of the enhanced images of the southern two-thirds of Utah in preparation for the pattern recognition study, and (4) to start processing Landsat data for an analysis of the San Juan Basin.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0036, PROJECT MAGNET UPGRADE OF SAMPLING RATE SELECTOR

R. Laurentson, U.S. Dept. of Defense, Navy, Naval Oceanographic Office, *Washington, District of Columbia* 20390 (DN881530; N62269-78-WR-00494)

Upgrade airborne project MAGNET instrumentation to facilitate data collection at a higher sampling rate. This work supports work unit ZU701, Accession No DN681083.

Project MAGNET data collection system hardware is being modified so that higher sampling rates can be implemented quickly and efficiently through use of a front panel selection switch. (Previously any change in sampling rate required extensive internal hardware manipulation.)

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

5.0037, MARINE AEROSOLS

L.H. Ruhnke, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880226)

The objective of this research is to improve prediction of vertical distributions of marine aerosol size spectra. Microwave radiometric data from satellites will be used to derive whitecap conditions which are believed to relate well to the aerosol generation rate at the sea surface. In conjunction with satellite-derived wind data and turbulence models, the capability to predict optical and IR propagation properties in the marine boundary layer will be increased.

An initial theoretical model of the vertical distribution of aerosol size spectra will be constructed utilizing current knowledge of white water production, turbulent mixing processes, particulate fall speeds, the cloud physics of salt particles and computer techniques. This model will be field tested in the MARSEN I experiment where surface meteorological and aerosol measurements can be obtained under severe weather conditions from fixed towers in the North Sea.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0038, RESPONSE OF A WESTERN BOUNDARY CURRENT IN THE GULF OF MEXICO TO WIND FORCING

W. Sturges, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Oceanography, *205 Wildwood Dr., Tallahassee, Florida* 32306 (OCE78-20722)

This project is a combined field and analysis study of the response of currents in the western boundary region in the Gulf of Mexico to the seasonally varying wind forcing. The effort is a continuation of a previous study addressing similar questions but involving the analysis of existing data sets. The field effort involves a current meter and temperature sensor array which will be deployed for a nine-month period. In addition satellite data and hydrographic data taken by ships and aircrafts will be used to track eddies from the Loop Current as they enter the western boundary region. The overall experimental design attempts to resolve changes in the boundary current from effects caused by Loop Current eddies.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0039, GEOCHEMISTRY OF LUNAR AND PLANETARY PROCESSES

J.A. Philpotts, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Geology & Geophysics, *2444 Dole St., Honolulu, Hawaii* 96822 (EAR79-06950)

This investigation is a continuation of work previously funded by NASA but transferred to NSF. The goal of this research is to gain understanding of the igneous differentiation of the Moon and planets. Specific objectives are (1) to study kinetic effects on lithophile trace element liquid-solid partitioning in rapidly cooled mare basalts in order to understand the nature and magnitude of these effects and be able to take them into account in estimating equilibrium partition coefficients--isotope dilution analyses on separates and microprobe analyses of thin sections will be performed, (2) to obtain 'corrected' partition coefficients from porphyritic lunar rocks, and from lunar mineral-whole rock values given in the literature, for use in differentiation models, (3) to undertake a review and synthesis of information on the igneous evolution of the Moon. Another set of objectives are (4) to see if ash deposits are as useful as are lavas as signatures for individual volcanoes, (5) to examine changes in lava composition of a volcano with time, (6) to examine temporal and spatial changes in geochemical activity of a hotspot, (7) to investigate the origin of silicic rock in a tholeiitic basalt section. These latter objectives will be met by analyzing Hawaiian

volcanics for lithophile trace element abundances and for major elements by electron microprobe.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0040, DELINEATION OF MINERAL BELTS BY SATELLITE AND GEOPHYSICAL REMOTE SENSORS
D.W. Levandowski, Purdue University, School of Science, Dept. of Geosciences, *Executive Bldg., West Lafayette, Indiana* 47907 (XR0406)

The overall objective of this research is the development of a Landsat-based methodology for aiding the reconnaissance phase of exploration for mineral resources. Specifically, the main objective is to develop and apply methods of combining geological, geophysical and geochemical information together with Landsat data to assist in delineating and mapping mineral belts.

The research will consist of establishing geological and geophysical features of mineral belts and determining the spectral and spatial characteristics of Landsat data that reflect these features. The major portion of the research will consist of examining in detail well established mineral belts (Colorado and Montana-Idaho) and systematically developing the criteria for delineating them. Particular emphasis will be given to using preprocessed Landsat data for the mapping of structural and lithologic features. Manual comparison of these features along with computer-aided statistical studies will be used to establish the correlation between geological and geophysical features with the Landsat derived features.

The procedures and techniques developed will then be applied to a test area to determine if an extension of the Colorado mineral belt exists in Arizona.

SUPPORTED BY Purdue Research Foundation

5.0041, EOMET AND MARINE FOG FIELD INVESTIGATIONS IN THE GULF OF MEXICO
J.B. Russell, U.S. Dept. of Defense, Navy, Naval Avionics Facility, *Indianapolis, Indiana* 46218 (DN797002)

To investigate the atmospheric marine boundary layer in order to provide an understanding of its influence on the propagation of electromagnetic radiation and on the formation, maintenance, and dissipation of marine fog.

Meteorological, micrometeorological and microphysical measurements in the marine boundary layer, as well as oceanographic measurements, will be made. Measurements will be made from fixed platform, ship and aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0042, N.E. REGIONAL OXIDANT STUDY FIELD SUPPORT
C.R. Dickson, U.S. Dept. of Energy, Ames Lab., *Ames, Iowa* 50010 (D9-X0348; G603A-AD-033)

OBJECTIVE: The objective of this effort is to obtain additional upper-air observations; continuous airborne measurements of ozone and meteorological parameters, and to follow an air-parcel using tetroons.

APPROACH: The National Weather Service will make additional radiosonde observations at the existing upper-air stations; a specially instrumented research aircraft will be used to make the airborne observation, and the tetroons will be tracked using a mobile radar system.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Research Information Center

5.0043, LASER HYDROGRAPHY DEVELOPMENT
D.B. Enabnit, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey, Engineering Development Lab., *6001 Executive Blvd., Rockville, Maryland* 20852 (86221700)

OBJECTIVE: Validation of the capability of an airborne laser system to meet the vertical requirements of NOS, and determination of the cost effectiveness and associated optimum prototype system configuration which best meets NOS' requirements.

APPROACH: The first objective will be addressed by field testing the NASA Airborne Oceanographic Lidar (AOL) as an 'engineering model' laser depth sounder. The second objective will be met by doing a conceptual design and performing a cost benefit analysis to determine cost per unit area of airborne hydrography.

PROGRESS: Evaluation of the data collected during the field testing is in progress. Comparisons between laser bathymetry and sonar bathymetry have been made to statistically estimate accuracy of the laser system. Effort is being placed in the quantification of biases produced by laser pulse power loss and pulse stretching in the water. Techniques for correcting laser soundings for surface wave effect and improving measurement precision of aircraft attitude have been developed. There still exists a bias in the AOL data that has not been accounted for but since it is predictable, it can be accounted for in any operational system.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Data Information Service

5.0044, SENSOR DEVELOPMENT FOR BASIC SURFACE OBSERVATIONS - VISIBILITY
D.T. Acheson, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Equipment Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8AA81024)

OBJECTIVE: To develop a visibility sensor to accurately measure the atmospheric extinction coefficient. From this quantity, runway visual range (RVR), runway visibility (RVV) and other closely related measures of visibility are easily computed. The sensor should be capable of measuring visibility over the range of 0.1 to 10 kilometers.

APPROACH: 1. Evaluate the EG&G Forward Scatter Meter. 2. Investigate laser backscatter devices as candidate prevailing visibility sensors.

PROGRESS: Telephotometer is being fabricated. EG&G Forward Scatter Meters borrowed from FAA are being modified by manufacturer. Delivery is expected in January.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0045, SEASAT PROGRAM - 'OCEANOGRAPHIC STUDIES USING SEASAT-A ALTIMETRIC DATA'
C. Wunsch, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (K7-971; MO-A01-78-00-4327)

OBJECTIVE: Seasat-A altimetric data, will be combined with (1) a priori geoids determined by satellite orbit analysis and shipboard gravity measurements, (2) the known spectrum of the sea surface currents, and (3) the known hydrographic field of the ocean, in an inverse solution for an improved geoid and a determination of ocean circulation.

APPROACH: The application of altimetric data from Seasat-A to geophysical and oceanographic problems involve simultaneously dealing with a satellite ephemeris, the geoid, ocean circulation, and associated phenomena.

The primary interest in physical oceanography will be to determine the open-ocean circulation on a global basis, with a long-term goal to obtain the general circulation (the averaging time to be defined) the long-term fluctuations, the large-scale (mesoscale) variability, and, ultimately, the dynamical relationships among these flows.

The geodesy goal is to obtain the ocean geoid and the mean sea-surface topography (i.e., the difference between the precise satellite-to-sea-surface altimeter measurements, surface-

gravity data, and a geopotential model expressed in spherical harmonics derived from satellite perturbation analysis.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0046, SIMULTANEOUS MEASUREMENTS OF HYDROGEN AND OXYGEN EXOSPHERIC TEMPERATURES

S.K. Atreya, University of Michigan, Ann Arbor Campus, Graduate School, Dept. of Atmospheric & Oceanic Science, *Rackham Bldg., Ann Arbor, Michigan* 48104 (ATM79-01064)

Two outstanding problems in our understanding of the planetary exospheres are intimately tied to a knowledge of the (line) profiles of the geocoronal hydrogen emissions: The extent to which particles in 'satellite orbits' are present; and the degree to which a non-thermal component of escaping hydrogen may be present. An accurate spectral line shape measurement of the geocoronal hydrogen emissions addresses these questions. From the doppler line profile, one can also determine the temperature associated with the emitting region. A precise and accurate measurement of the temperature in the exosphere of the earth is important for understanding the planetary escape of light gases and for modeling the atmosphere which lies below the exobase. The escaping gases, primarily hydrogen, are expected to undergo evaporative cooling, and create an exosphere in which each species has a slightly different temperature. As a direct consequence of this cooling, the escape rate of light gases will be reduced resulting in an increase in the thermospheric content of hydrogen (and a reduction of the altitude where the flux limit occurs). A further effect is that the measure of exospheric temperature of hydrogen is not a direct measure of the temperature of the major constituent gas.

This grant funds an attack on these problems by allowing, for the first time, simultaneous measurements of the exospheric hydrogen temperature and the thermospheric temperature of the major gas, oxygen. The program will be carried out at Arecibo, which is unique for this purpose.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0047, NO/NO2 MEASUREMENTS IN SUPPORT OF ACID PRECIPITATION EXPERIMENT (APEX)

D.H. Stedman, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Oceanic Science, *Ann Arbor, Michigan* 48104 (ATM7819250)

The acid precipitation experiment (APEX) is a collaborative effort among NCAR and several universities with the goal of exploring, by aircraft experiments, the air chemistry underlying acid precipitation on a regional scale. This grant supports measurements of NO and NO2 during APEX. These NOx species are precursors of HNO3, an important constituent of acidic precipitation. An NO/NO2 analytical system will be installed aboard the research aircraft, and data will be collected and analyzed to explore the interrelationship among the oxides of nitrogen, HNO3 concentrations, O3 concentrations, and solar flux. In addition to providing new insight into the role of NO and NO2 in the air chemistry of acid rain, the data will be a significant direct addition to knowledge of tropospheric concentrations of nitrogen oxides.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0048, ISOTOPIC AND GEOCHEMICAL STUDIES OF LUNAR SAMPLES AND DIFFERENTIATED METEORITES

V.R. Murthy, University of Minnesota, Minneapolis Campus, School of Earth Sciences, Dept. of Geology & Geophysics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (EAR79-06769)

This study is a continuation of investigations, previously supported by NASA, which have been transferred to NSF. The work deals with three specific projects: (1) the magnetic history of the moon in the period 4.5-4.0 AE ago by studies of non-mare melt rocks, (2) Rb-Sr, Sm-Nd and 40 Ar-39Ar studies of the silicate fractions of differentiated meteorites such as mesosiderites and IAB iron meteorites, and (3) considerations of the lunar initial strontium ratio by studies on Rb-poor, Sr-rich feldspathic highland rocks. The overall objectives are to understand the early planetary evolution of differentiated meteorites and the possible relationships between them.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0049, INSTRUMENTATION DEVELOPMENT FOR HYDROLOGIC DATA COLLECTION

F.C. Koopman, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *NSTL Station, Bay St. Louis, Mississippi* 39520 (SR 54-141)

New developments in equipment and instrumentation suitable for use in water resources investigations, surveys and research need to be evaluated. Advances in electrical, electronic, and mechanical devices and components should be investigated.

Instruments or systems needed for WRD data collection are usually very specialized and so limited in number that industry enthusiasm and accomplishment fails to satisfy these needs. Therefore it is the objective of this project to design devices and systems which satisfy field requirements for new, special or improved instrumentation.

The technology developed for each project or device is open for group and individual review prior to final method selection. After this selection maximum emphasis is directed toward operational reliability with minimum visitation and maintenance. Both method selection and development decisions are governed by practical techniques for accuracy, power conservation, longevity and overall economy.

Fifty-seven water quality monitors (WQM) were tested and distributed. Fifteen units were designed and assembled to interface with a magnetic-flow meter for recording flow on a digital recorder. A mini-servo control unit was designed and proven reliable for production. A current meter digitizer for replacement of earphones and stopwatch was prototyped and ten experimental units furnished to districts. Two systems were built for the Ohio River locks and dams for monitoring flow controls. Calibrations and repairs were made on 300 meters. Maintenance was conducted for the satellite relay program. The Denver Training Center was assisted. The laboratory maintained liaison with agencies and commercial concerns on hydrologic instrumentation.

Design, assemble and install flow-through monitor systems. Investigate, develop, design and improve signal conditioning circuits for interfacing hydrologic sensors to recorders. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0050, IMPROVEMENT OF REMOTE SENSING TECHNOLOGY RESEARCH APPLIED TO LAND RESOURCE ANALYSIS

D.J. Barr, University of Missouri, Rolla Campus, School of Mines & Metallurgy, Dept. of Mining Petroleum & Geological Engineering, *Rolla, Missouri* 65401 (SER77-06848)

The proposed project will provide the instrumentation, graduate student support, and research climate for improving the application of remote sensing technology to the solution of land resource allocation problems. Research into methods of detecting, delineating, and/or monitoring of land use, mineral and energy resources, agricultural, forest and range resources, water resources, reclamation, and environmental quality will be improved and enhanced. Satellite and aircraft image processing equipment will be procured and integrated into the existing remote sensing laboratory. Graduate research opportunities will be provided along with seminars for exchange of research ideas,

problems, and results among researchers from a variety of science and engineering disciplines.

SUPPORTED BY U.S. National Science Foundation, Directorate for Science Education, Div. of Science Education Resources Improvement

5.0051, TROPHIC CLASSIFICATION OF ILLINOIS LAKES

D.H. Boland, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., Water & Land Quality Branch, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J613B-024)

OBJECTIVE/APPROACH: The general objective is to classify Illinois lakes according to trophic state using LANDSAT multispectral scanner data in conjunction with water quality data collected by the National Eutrophication Survey. Specific objectives include: 1) ranking of Illinois lakes as to Secchi depth transparency, 2) ranking of lakes according to chlorphyll A levels, 3) ranking of lakes according to a trophic index, and 4) compilation of lake surface area estimates. Statistical relationships between water quality data from Illinois lakes sampled by the National Eutrophication Survey and LANDSAT multispectral data for the same lakes will be examined. If significant relationships are found, models will be developed to estimate the magnitude of the trophic indicators and the trophic index in the NES lakes. The models will then be used to estimate the parameter values in the remaining Illinois lakes.

FINAL OUTPUT: A report will be published describing the project's results and, including the ranking, will be used by Region V & Illinois water quality managers.

PROGRESS: Comparison of LANDSAT and contact data trophic rankings, Secchi depth, and chlorophyll A were quite successful. Interpolation for lakes not originally contact sensed was good; however, extrapolation to Secchi depth and chlorophyll A values beyond those originally used to establish algorithms was less successful. Clusters of lakes provided by the algorithms appeared to correspond to groups of lakes having many natural properties in common. Project report 'Trophic Classification of Illinois Water Bodies' has passed technical review.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0052, DEVELOP ADVANCED TECHNIQUES FOR TROPHIC CLASSIFICATION OF LAKES AND ASSESSING ESTUARINE AND WETLANDS AREAS

V.W. Lambou, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., Water & Land Quality Branch, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J884A-027)

OBJECTIVE/APPROACH: The objective is to develop a method to assess lacustrine trophic state and land use impact on lakes through a combination of satellite and aircraft multiscanner data and in situ data. The development and verification of such a system is being cooperatively pursued by EMSL-LV and NASA's JPL at Pasadena. Ground truth (in situ) data are being obtained through cooperative efforts with EPA Regional, State, and other Federal agency personnel. Construction of algorithms, overflight data acquisition and computer processing are being conducted by JPL-Pasadena. Data analyses and interpretation is accomplished jointly.

OUTPUTS: A report on the results obtained will be published. A second report describing the methodology, developed software, and other operational details will also be published to provide an operational monitoring tool for assessment of lake water quality by Federal, State, and other interested organizations.

PROGRESS: Collection of contact sensed data by cooperating Agencies personnel is being conducted. LANDSAT scenes for the appropriate data have been ordered, and data processing has begun.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0053, REMOTE SENSING APPLICATIONS FOR THE ANALYSIS AND MANAGEMENT OF RENEWABLE NATURAL RESOURCES

P.T. Tueller, University of Nevada, Reno Campus, School of Agriculture, Dept. of Renewable Natural Resources, *Reno, Nevada* 89507 (177771 (HRB NO.))

To investigate remote sensing techniques for application to natural resources management including range, forestry, wildlife, watershed, outdoor recreation and crop agriculture. Test techniques for vegetation mapping, wetland inventory, range condition and trend, erosion evaluation, and economic value. Assess site biomass and production, land use mapping and classification. Conduct resource inventories and serve as a repository for remote sensing data. APPROACH: Various scales (1:600 to 1:1,000,000) of color and color infrared types along with actual ground data, densitometers, and field averaging spectrographs will be used to identify phenomena relative to subjects being investigated. Accepted and experimental techniques and procedures will be used and evaluated. Computerized imagery from Land Set I and II will be evaluated. In all cases applications will be emphasized.

SUPPORTED BY University of Nevada

5.0054, UPGRADING OF TWO SOLID-SOURCE MASS-SPECTROMETERS TO STATE-OF-THE-ART INSTRUMENTS

R.K. O'Nions, Columbia University, School of Arts & Sciences, Dept. of Geological Sciences, *Broadway & W. 116th St., New York, New York* 10027 (EAR78-25197)

It is proposed to substantially improve the abundance sensitivity of the MM-30 by the addition of a commercially available electrostatic analyzer (energy filter) which is complete with a Faraday and Daly detector and to purchase a high voltage supply and electronics for the Daly scintillation detector. The current Faraday collector and Daly, which will be released from the Micromass 30 when the proposed changes are made, will be used to replace the collector on the Lamont 12" mass-spectrometer and provide the much needed improvement in detector sensitivity required on this instrument.

The instruments will be used in the following studies: 1) Oceanic Basalts and Ultramafic Nodules; 2) Evolution of Archaean Crust; 3) Oceanic Ferro-manganese deposits; and 4) Meteorite Studies.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0055, PETROLOGY OF THE ORDINARY CHONDRITES

R.T. Dodd, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Science, *Stony Brook, New York* 11790 (EAR79-23850)

This is a renewal grant of investigations carried out on the systematic petrology of ordinary chondritic meteorites (EAR7421801). The petrology of the ordinary chondrites will be studied in order to provide information on the pre- and post-accretionary histories of these meteorites. Specific tasks to be undertaken in this study include: 1. chemical and petrographic study of chondrules in type 3 ordinary chondrites to assess the roles of fractional vaporization, reduction, and sampling of precursor rocks in their chemical differentiation; 2. study of the L-group chondrites to investigate the major element variations

within this group of meteorites; and 3. determination of the metamorphic histories of the L-group chondrites.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0056, GOES SATELLITE RESEARCH PROJECT, JUNIATA RIVER BASIN, PENNSYLVANIA

C.D. Kauffman, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *228 Walnut St., Harrisburg, Pennsylvania* 17108 (PA 76-075)

An automated hydrologic data collection-processing system is needed to provide users with processed data which is essentially real time and independent of manually collected data tapes.

To evaluate the Geostationary Operational Environmental Satellite (GOES) system, determine the reliability of the convertible data collection platform (CDCP) and associated hardware, and demonstrate usefulness of data processing through the system. Select 20 sites for upcoming COMSAT general proposed pilot project and brief cooperators and District personnel on the COMSAT system.

To install CDCP's water level sensors at nine of 14 gaging stations currently being operated in the basin and attempt to manage the stations based on data coming through the GOES system. Develop viable analysis and processing techniques using GOES-collected data. Meet with COMSAT personnel and cooperators for exchange of information regarding the COMSAT system operational features, site selection, and data format, needs, and availability.

All CDCP's were returned twice for factory modification and installed in the field. Data was monitored almost daily. Six technicians were trained in CDCP operation. An unpublished report on CDCP Operation for a one-year period was completed and submitted to the Chief, Data Relay project. Data for five COMSAT DCP's was monitored almost daily for an eight-month period after which DCP's and associated hardware were removed. A performance report was prepared by COMSAT General and a performance summary was prepared by the Chief, Data Relay project.

Continue to evaluate the geostationary operational environmental satellite (GOES) system, determine the reliability of the convertible data collection platform (CDCP) and associated hardware, and demonstrate usefulness of data processing through the system. Meet with COMSAT personnel and cooperators to select 20 sites for upcoming proposed COMSAT General pilot project. Perform necessary field reconnaissance at each site.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0057, RESEARCH AIRCRAFT PROGRAM

T.V. Crawford, E.I. du Pont de Nemours & Co. Inc., *P.O. Box A, Aiken, South Carolina* 29801 (976; AT(07-2)-1)

The objectives of this program are to provide research aircraft and data analysis support for the testing of atmospheric dispersion models. The data bases will include: the concentration of pollutants in the atmosphere surrounding SRP measured by the aircraft; pollutant concentration data from ground and tower sampling stations; the release rate of pollutants from the plant stacks; and all relevant meteorological data from the plant towers, the WJBF-TV tower, the National Weather Service, and other sources.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0058, NATIONAL PARK SERVICE COOPERATIVE PROJECTS

D.T. Lauer, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Data Center, *Sioux Falls, South Dakota* 57198

To (a) generate by means of remote sensing resource inventory information useful for the development of a General Management Plan over park areas, (b) evaluate accuracy levels, time and costs associated with obtaining resource information using remote sensing techniques, (c) train NPS personnel to understand the advantages and limitations of remote sensing technology applied to resource inventory, monitoring, and assessment problems, and (d) report on the methodology, results, and applicability of remotely sensed data used for national park planning and management purposes.

SUPPORTED BY U.S. Dept. of the Interior, Land Information & Analysis Office, EROS Data Center

5.0059, EFFECTS OF THE INTERPLANETARY MAGNETIC FIELD ON THE DAYSIDE MAGNETOSPHERE

J.L. Burch, University of Texas, San Antonio Campus, School of Science & Mathematics, Dept. of Earth & Physical Science, *San Antonio, Texas* 78285 (ATM78-26762)

The objective of this research is to investigate the coupling of solar-wind energy and momentum into the magnetosphere by determining the effects of the interplanetary magnetic field (IMF) on dayside plasma convection and particle precipitation. The investigation will contribute to the International Magnetospheric Study since it will utilize simultaneous measurements from Atmosphere Explorer D and either Imp 7 or Imp 8 from the early part of 1976. Variations in the solar-magnetospheric x, y, and z IMF components will be investigated separately to determine their effects on the topology of polar-cusp magnetic field lines, on the patterns of dayside plasma convection, on dayside particle acceleration processes, and on interhemispheric asymmetries of these phenomena. The overall aim is to understand magnetosphere dynamics in response to solar inputs.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0060, CORPS OF ENGINEERS REMOTE SENSING COMMITTEE

K.T. Yoritomo, U.S. Dept. of Defense, Army, Corps of Engineers, Engineer Topographic Lab., *Fort Belvoir, Virginia* 22060 (31642)

OBJECTIVES: The objectives of the Committee are to continually evaluate the state-of-the-art; provide technical assistance; disseminate remote sensing information; coordinate institutional arrangements; determine remote sensing data processing, handling, and storage requirements; and to determine Corps remote sensing user requirements, recommend priorities, and where possible, seek to assure that NASA's and other agencies' developmental systems respond to Corps needs.

APPROACH: The Committee meets twice each year to review remote sensing technology and to discuss its application to Corps of Engineers projects. The Committee recommends priorities for expenditure of remote sensing R&D funds. The Committee also supports training and the dissemination of remote sensing information.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Engineer Topographic Lab.

5.0061, NATIONAL ENVIRONMENTAL OVERVIEW PROGRAM

J.B. Epstein, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9510-01593)

The National Environmental Overview Program summarizes characteristics and geographic distribution of earth materials and nature and extent of geologic processes in the United States. Maps at a scale of the National Atlas (1:7,500,000) will be major products, although larger scale maps have been and will be prepared. The maps and reports will provide a geologic data base useful to the understanding of environmental problems on a national scale and will be useful for generalized decision making on land use, energy and mineral resource development and their environmental impact, and public health. While maps at this scale probably cannot solve specific problems, they will identify the problems and point out critical areas of potential geologic constraints and guide future topical research.

The program includes preparation of the following maps at 1:7,500,000: landslides, surficial materials, volcanic hazards, active faults, surface water availability, karst and its engineering problems, swelling clays, bedrock lithology, nuclear reactor sites and their geologic problems, density of fault, areas of coal strip mines, Quaternary Dating techniques, radioactive waste management sites, engineering geologic map of the United States, impact structures, and carbonate for SO2 scrubbing. A quaternary map of the United States (1:1,000,000 and 1:2,500,000) and various environmental and engineering geology derivative maps will be prepared. A data file, allowing the retrieval of many items shown on published geologic maps is being prepared.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0062, METALLOGENIC STUDIES

P.W. Guild, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9340-00244)

Continue assembling mineral deposit data for North America; plot data on map at 1:5,000,000, together with geologic/tectonic information, for visual analysis of their metallogenic significance, delineation of provinces and epochs, and their possible relationship to other events in earth history (particularly global tectonics). Enter data into computer storage for machine analysis in the future. Stimulate, maintain contacts with similar efforts on other continents.

Simplify, plot the data at 1:10,000,000 for the Circum-Pacific Minerals Map of NE Quadrant; advise on assembly and plotting of minerals data for the remaining quadrants (including Antarctica); codify the data for computer storage, retrieval, and analysis.

Maintain contact with IGCP Project 'Remote Sensing and Mineral Exploration', based on Landsat imagery and mineral deposit data; a principal objective is to evaluate the role of lineaments and circular structures in localizing mineral deposits.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0063, TRACE ELEMENTS IN PLANETARY MATERIAL BY ACTIVATION ANALYSIS

J.W. Morgan, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (EAR79-11120)

This project is a continuation of studies previously supported by NASA but now transferred to the NSF.

Trace element analysis of planetary materials by activation analysis techniques will be carried out on a diverse set of extraterrestrial materials. The characterization, classification, and interpretation of meteoritic metal in lunar breccias and soils will be carried out in order to provide important information on the nature of the projectives which have formed these samples. The nature and distributions of volatile elements (primarily the platinum metals) in materials which have undergone shock by meteorite impact will be studied. The analytical data generated by this study will be used in modelling studies which are attempting to unravel the early and subsequent history of the planetary materials, e.g., meteorites, lunar samples, etc.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0064, SALINAS GEOPHYSICS

J.D. Phillips, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9730-02177)

States to which project pertains: New York, Pennsylvania.

Investigate the relation between surface lineaments seen in satellite imagery and subsurface structure in the Appalachian basin of central New York State and northern Pennsylvania, using aeromagnetic, gravity, seismic reflection, and deep well data.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0065, COAST MARINE ADVISORY SERVICES - GRAYS HARBOR COLLEGE

J.M. Smith, Grays Harbor College, Undergraduate School, *Aberdeen, Washington* 98520 (A/FP-5)

OBJECTIVES: Provide education and information programs responsive to the needs of the marine resource users of the Washington coast region (Grays Harbor and Pacific counties). 1. Offer short courses, workshops, and an annual marine technical conference in response to needs identified by the local marine community. 2. Provide information and announcements to fishermen and coastal citizens through The Harbor Tides newsletter. 3. Assist the NWS in disseminating infrared satellite data to fishermen in Washington off-shore waters. 4. Provide public marine education programs through Coop. Extension, 4-H, and local school districts. 5. In cooperation with County Extension, develop use of shrimp wastes for agricultural fertilizer by working with shrimp processors and farmers.

ANTICIPATED BENEFITS: 1. The short courses and workshops seek to increase the ability of commercial fishermen and charterboaters to be effective harvesters and businessmen. The marine technical conference provides information to improve fishing operations (fishing gear, boat safety, electronics, etc.). 2. Harbor Tides disseminates information useful in addressing the development and improved use of local marine resources. 3. The availability of infrared satellite data will allow fishermen to reach fishing grounds sooner and to consume less fuel in finding and maintaining contact with school of fish. 4. The availability of public marine educational programs can increase the awareness, knowledge, and appreciation of local people for local marine environment. 5. Using shrimp wastes on dairy farmlands can increase farm productivity while reducing farm and shrimp processor costs.

IDENTIFIED BENEFITS TO DATE: 1. Improved relationships between the commercial fishermen and the National Weather Service has provided more useful weather broadcasts for local fishermen and charterboat operators. 2. In 1976-77 conducted 5 workshops attended by 120 people. Assisted BVTI in holding this year's marine technical conference (see A/FP-6). 3. Shrimp processors and dairy farmers in the South Bend area started a cooperative program to utilize 400 tons of shrimp waste per year. 4. Provided assistance to the City of Cosmopolis which established a salmon rearing project in Mill Creek. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0066, ICE DYNAMICS

W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 70-058)

The ice dynamics project is concerned with studying the motion of sea ice, glaciers, and ice caps and the way in which these systems interact with the atmosphere and oceans. Recent numerical modelling of the atmosphere and oceans reveals that the least understood part of the water and heat budget of the earth is that taking place in polar regions. Recent theoretical work also indicates that the arctic ice cover may be a metastable or unstable system. Russian and American development in the arctic necessitates intense study of the region to avoid inadvertent, irreversible changes of the arctic ice pack, glaciers, and oceans.

(1) To create numerical models of the arctic and antarctic ice covers and oceans for a variety of different rheological assumptions concerning the ice pack; (2) to acquire data to test the numerical models of the arctic ocean and ice pack and the antarctic oceans and ice pack by directly participating in remote sensing and surface-truth experiments and from remote sensing polar-orbiting satellites; (3) to construct multi-dimensional, time-dependent models of glacier flow and to test them with observations of glaciers made within the state of Washington by project personnel and glacier data from other investigators in other nations; (4) to construct numerical models of water flow within

glacier and ice cap systems and to test these models with observations acquired from various glacier sites; (5) to study models of snow hydrology of alpine areas such as the North Cascades and Sierras.

The numerical models described above will be done using high-speed digital computers both within the Survey and at the U. of Washington. The field work in the polar regions will be done in direct cooperation with other agencies such as NASA, NOAA and DOE Canada, with whom the Ice Dynamics Project is in direct and intimate contact. This will include aircraft remote sensing using the NASA CV 990 airborne laboratory. Field work on glaciers will be done.

Continued work on an idea to replace the concept of eddy viscosity in fluid dynamics. A system for converting twice-daily Antarctic surface pressure data to air stress data on sea ice has been completed for application to a numerical model to describe Antarctic sea ice. A paper on the approximation of saturation vapor pressure has been completed. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0067, SEASAT PROGRAM - 'ENHANCEMENT OF SEASAT WIND-STRESS MEASUREMENTS USING DATA FROM GOES'

V.E. Suomi, University of Wisconsin, Madison Campus, Space Science & Engineering Center, *Agriculture Hall, Madison, Wisconsin* 53706 (7-974; MO-A01-78-00-4331)

OBJECTIVE: To resolve the ambiguity of the wind and stress measurements from the scatterometer and to improve their quality by using the cloud motion winds from GOES.

APPROACH: The principle involved is that low level cloud motions are highly correlated with surface winds over the ocean. Thus, cloud motion vectors can be transformed into estimates of surface winds with modification for boundary layer effects. These independent data can be used for selecting the correct scatterometer solution and providing quality control checks on the solution. Results expected from this program are improved data sets of sea surface stress or wind measurements. The approach to the problem will be to assume a value for the frictional wind changes below cloud base using tabulated data and any other pertinent literature. A second component of the wind changes will be calculated from the temperature gradients. These two corrections will be used to approximate the surface wind from the cloud motion wind and the closest scatterometer solution can then be selected.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0068, A SATELLITE STUDY OF MONSOON DISTURBANCES IN THE ARABIAN SEA AND THE BAY OF BENGAL DURING SUMMER MONEX

D.N. Sikdar, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Geological Sciences, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (ATM79-01981)

The objective of this grant is to provide support for the participation of the PI in the 1979 summer Monsoon Experiment (MONEX). MONEX is a regional subprogram of the Global Atmospheric Research Program. The summer phase of MONEX will take place from 5 May to 31 July 1979 and it will have two components; the Arabian Sea and the Bay of Bengal.

The PI will assist at the operations centers at Bombay (May and June) and Calcutta (July) primarily in analyses, forecasting and mission guidance activities. His work will support a large and complex U.S. research aircraft program. He will, in addition, be a research and mission scientist aboard the research aircraft.

Finally, a quick-look data set emphasizing dynamic and thermodynamic features of disturbances selected for intensive analysis in a later phase of this project will be prepared and made available to MONEX scientists.

MONEX is a major study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmospheric and ocean in monsoon regions. MONEX is important scientifically and also has significance for global agriculture, economics and politics. The initiative for MONEX is from the Government of India with the U.S.S.R. and U.S.A. playing major roles. In addition to the benefits mentioned above, MONEX offers an excellent opportunity for scientific and technical cooperation between, and of mutual benefit to the U.S., India and the U.S.S.R.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0069, MEASUREMENT OF AIRBORNE RADIOACTIVITY AND ITS METEOROLOGICAL APPLICATION

R. Reiter, Institut fur Atmosphariische Umweltforschung der Fraun. Gesel, *Kreuzeckbahnstrasse 19 Frg, Garmisch Partenkirchen, Federal Republic of Germany* (P-02-78-0157; EY-76-C-02-3425)

The influx of stratospheric air into the biosphere is studied with the objective to obtain information about the frequency distribution of stratospheric intrusions as a function of seasonal and inter-annual variations. Stratospheric intrusions are indicated by high concentrations of the cosmogenic radionuclides Be7, P32, P33, and the ozone, measured at the mountain observatory Zugspitze (300 m a.s.l.). The transport of stratospheric air into the troposphere is determined on the basis of the isentropic trajectory analysis. The forecasting of stratospheric intrusions is performed based on observations of the variation of the relative humidity in the upper troposphere.

The quality of the forecasting technique is subjected to a statistical examination.

Aerosol layers in the stratosphere are measured by means of a lidar system.

RESULTS: It has been possible to prognosticate the fallout of the Chinese nuclear test of 25 September 1976. The forecasts of the influx intensity of stratospheric air into the biosphere came exactly true in 70% of the cases. The height of the stratospheric aerosol layer found changed during the period of observation.

SUPPORTED BY U.S. Dept. of Energy, Div. of Biomedical & Environmental Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, CHARACTERIZATION OF SPACE ENVIRONMENT USING PLANT CELLS AND TISSUES

G.C. Sharma, Alabama Agricultural & Mechanical University, School of Agriculture, Dept. of Plant Science, *Normal, Alabama* 35762 (NSG 8067)

Characterization of space environment using plant cells particularly agronomically important cereals in the long-term objective of this study. Plant cells can be cultured in space with greater ease than animal cells. Earlier space investigations have concentrated more at the organismal level in higher plants than at the cellular level. The approach used in this study is to identify and conduct ground-based experiments with cells using tissue culture techniques. Emphasis is being placed on monocots, thus far primarily wheat, rye, and their hybrid triticale. Both haploid and diploid callus cells are being utilized in single cell regeneration and differentiation of callus from such single cells. Those steps in this sequence that are found to be precocious will be tried in the space environment with parallel ground-based experiments. Future attempts will use protoplast isolation and fusion among agronomically important crop plants. The chromosome giemsa technique and scanning electron microscopy have been utilized to study the chromosomal composition of callus cells and the fine structure during differentiation.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

6.0002, BIO-GAS PRODUCTION FROM ALLIGATOR WEEDS

A. Latif, Alcorn State University, Graduate School, Dept. of Biology, *Lorman, Mississippi* 39096 (NSG 8036 SUP No. 4)

OBJECTIVE: Develop a process to produce bio-gas and methane from the microbial anaerobic decomposition of alligator weeds and water hyacinths. Comparison of anaerobic filter digester with conventional anaerobic digester. Evaluation of various physical, chemical and biological factors on the rate, amount and percent composition of bio-gas produced from the microbial anaerobic decomposition of alligator weeds and water hyacinths by the use of anaerobic filter digester. Evaluation of fermented sludge as a supplemental feed.

APPROACH: Alligator weeds and water hyacinths will be chopped and placed in fermentation units. Starter seed will be used from the rumen content of a cow's stomach. Experiments will be conducted by using anaerobic filter digester as well as conventional anaerobic digester.

PROGRESS: Information obtained from the experiments indicate that the higher incubation temperature, pollution of alligator weeds and water hyacinths with heavy metals, addition of poultry droppings and cattle manure to the fermentation units, have increased the amount of bio-gas produced as well as the percentage of methane in bio-gas. Data also indicate the anaerobic filter digester is more efficient than a conventional anaerobic digester. Chemical analysis of sludge reveals that it is rich in protein and minerals and could be used as feed. For conclusive results further studies are in progress.

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

6.0003, EFFECTS OF HEAT ACCLIMATION AND EXERCISE ON ACCELERATION TOLERANCE

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The purpose of this interchange is to test these hypotheses: a) That acceleration tolerance in subjects riding passively (without compensatory muscular contraction) will decrease following exercise training in a cool environment, and decrease further following exercise training in a hot environment. b) That subjects trained with isometric exercise will have better acceleration tolerance than subjects trained with isotonic exercise. Normotensive men and women and hypertensive men will be trained in hot and cool environments with various combinations of isometric and isotonic exercise regimens. Their tolerance times and other physiological responses will be determined on a human centrifuge.

The results of these studies will be submitted for publication in the scientific literature.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, EFFECTS OF CENTRIFUGATION ON GONADAL AND ADRENOCORTICAL STEROIDS IN RATS

R. Kakihana, California State University & Colleges, San Francisco State University, School of Science, Dept. of Biology, *1600 Holloway Ave., San Francisco, California* 94132 (NSG 2281)

The objective of this research is to study the effects of acute and chronic stress due to the changes in the gravitational force on the pituitary-gonadal and pituitary-adrenocortical systems. Specifically, we attempt to determine the following steroids in the plasma and brain of rats following different duration and intensity of centrifugation stress: testosterone, dihydrotestosterone, estradiol and corticosterone. The gonadal hormones and corticosteroid are assayed by radioimmunoassay and protein-binding assay, respectively, following separation by column partition chromatography.

Preliminary results indicate that the centrifugation stress (2 and 6 hours of 4.1 g centrifugation) caused a significant decrease of plasma and brain (soluble fraction) testosterone, while it increased corticosterone over 10-fold. The plasma corticosterone levels after 16 hours of centrifugation was lower than 2 hour stress, indication some degree of adaptation.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, STUDIES IN OLR AND SETI

C.S. Seeger, California State University & Colleges, San Francisco State University, Graduate School, *1600 Holloway Ave., San Francisco, California* 94132 (NSG 2210)

Continuing studies are proposed in the theory of strategies for the search for extraterrestrial intelligence (SETI) by microwave radio means; and studies in the area of origin of life research (OLR) which are clearly related to SETI. Our research will include the study of signal detection theory and associated techniques, algorithmic and architectural, to improve our ability to recognize an ETI signal; the study and development of a theory for optimum SETI observations using existing radio telescope technology; continuing electromagnetic environmental analysis of observational tests at selected radio astronomy sites; analysis of th problems and possibilities associated with large space antenna systems; and studies to determine the properties of stars for generation of a long-needed stellar catalog. Results of this research will be integrated into the overall plans for the proposed joint ARC-JPL SETI program, and will be embodied in scientific publications, at least one book, several manuscripts for technical journals, and various reports. Further, this research is expected to increase the interest in OLR and SETI and stimulate research in a wide range of related scientific disciplines on the part of scientists not now aware of how their fields of study impinge on research on Life in the Universe concepts and problems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0006, THE UNIFIED SYSTEM FOR THE BIOLOGICAL EXPLORATION OF MARS

R.W. Ballard, California State University & Colleges, San Jose State University, School of Science, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NSG 2213)

Continuing research using the mass spectrometer and computer data analysis equipment of the 'Unified System' has indicated that it is possible to accurately detect and distinguish organic and inorganic carbon compound in coils. This has been performed by controlled heating of the soil samples from room temperature up to 800 degrees centigrade, and measuring the gases which are evolved. By means of such programmed pyrolysis of the carbon components of the soil, one can distinguish organic from inorganic constituents in the soil. The organic carbon content of soils is of interest to scientists since it is indicative of the organic carbon materials which are available to support living systems.

The second major effort under study has been the comparison of the laboratory research equipment with the Viking flight model engineering test units. This is being accomplished by conducting identical experiments in both laboratory and flight equipment, using simulated Mars soils (smectite clays). These experiments involve parametric studies conducted with fertile and sterile smectite clays at various incubation temperatures using labeled formate nutrient. Samples are incubated at various periods of time from three days to three weeks. The absorption of the nutrients into the soil is measured as well as the gases evolved under the various environmental conditions. All gas analysis measurements are made by the mass spectrometer, the core of the 'Unified System'.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, ALTERED GRAVITY AS A RESEARCH TOOL IN THE STUDY OF MAMMALIAN AGING AND LIFE SPAN

R.C. Ballard, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCA 2-675906)

The primary goal of the proposed investigation is to assess the rate of aging of young adult rats exposed to continuous centrifugation at 2G. The explicit hypothesis that will be tested is that the rate of aging of centrifuged rats will be significantly higher than that of control animals maintained at 1G. This hypothesis is based on the finding of a 15-20% increase of O2 consumption in rats at 2.5G by Oyama and co-workers and on the

'rate of living' hypothesis proposed by Pearl, which maintains that the rate of aging is proportional to the specific metabolic rate of an animal. The 'rate of living' hypothesis has been validated in invertebrates by many workers (including Miquel, on fruit flies, and Sohal, on house flies). It seems to us that chronic centrifugation is a unique tool for testing of the rate of living hypothesis in mammals. The emphasis in the proposed research will be in developing the methodology and analytical techniques for assessing the rate of aging centrifuged rats. Dr. Jaime Miquel and his collaborators will be studying the fine structure of four key organs of metabolism and internal homeostasis, namely heart, liver, kidney and adrenal gland, which are expected to show high levels of oxygen consumption during centrifugation. Dr. Ralph Ballard and his collaborators at the Department of Biology of San Jose State University will be concerned with the study of possible mitochondrial changes in liver, by investigating oxygen consumption of isolated mitochondria in vitro. An additional task of Dr. Ballard and his research assistants will be the development of techniques and performance of measurements in order to assess the rate of physiological aging in centrifuged rats. The results of these investigations will be made available in a final report and in one of various publications to be coauthored by Dr. Ballard and Dr. Miquel.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, PERCEPTION AND PERFORMANCE IN FLIGHT SIMULATION

B. Clark, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NSG 2269)

The objective of this grant was to study perceptual problems relevant to flight simulation. The research was conducted at Ames Research Center and was carried out by collaboration between students and faculty at San Jose State University and Research scientists at the Center. Work has been conducted in three general areas: (a) vestibular effects on flight simulation, (b) flight management and man-cockpit interfacing, and (c) visual perception in flight simulation.

Five experiments have been conducted on the effects of vibratory, rotary acceleration on pilot performance. The effects of vibratory, rotary acceleration on: response time to suprathreshold rotary acceleration, tracking performance, and sensitivity to angular acceleration, have been studied.

Work has been carried out in several areas of flight management. The following specific problems have been studied: cockpit display of traffic information, workload, automatic speech recognition, synthetic speech call-outs during the landing phase of flight, perceptual factors in the microwave landing system, automation, and total simulation of flight training.

Work carried out in the area of visual perception has been concerned with reduced visibility problems with emphasis on the use of head-up displays. The final report for this grant is being prepared.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0009, ASSESSMENT OF MOTION SICKNESS IN RATS - AN INVESTIGATION OF PICA AS THE RELEVANT BEHAVIORAL MANIFESTATION

R. Fox, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCA 2-675801)

Three experiments will be conducted which will contribute to the assessment of the rat as a model for motion sickness research. The first experiment is designed to develop behavioral assessment procedures for pica, anorexia, and conditioned taste aversion as they are related to motion sickness in the rat, with the objective of establishing sensitive operant measures that are systematically related to severity of motion sickness induced by rotation. The second experiment uses these measures to study the time course of habituation to rotation. A third experiment is designed to assess the value of these measures of motion sickness under several different motion-sickness evoking stimuli (Coriolis acceleration, linear acceleration, sensory conflict, for example).

The end-item of the interchange will be a report describing the results of the three experiments and detailing the best technique for measuring motion sickness in the rat.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, CENTRAL SYNAPTIC ACTIONS OF ANTIMOTION SICKNESS AGENTS

R. Fox, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCA 2-675808)

A detailed understanding of the effects of antimotion sickness agents on the central nervous system (CNS) is clearly important to aviation and spaceflight. The various drugs which are currently used to combat motion sickness constitute a pharmacologically diverse group with multiple CNS actions. At present, it is not known which of these actions are crucial to preventing motion sickness. The proposed research will serve two purposes. First, the synaptic action of several antimotion sickness drugs will be determined by examining their presynaptic effects on the uptake of several biogenic amines and their postsynaptic effects on histamine and acetylcholine receptors. Second, these effects will then be related to the antiemetic properties of the drugs using an animal behavioral model. The research is important both for determining the causally relevant antiemetic properties of these agents as well as for evaluating possible undesirable side effects of these drugs.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0011, CHANGES IN CORTISOL AND ANTIDIURETIC HORMONE DURING INDUCED MOTION SICKNESS IN SQUIRREL MONKEYS

R.A. Fox, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NSG 2339)

The purpose of this project is to investigate the relationship between hormones and motion sickness in squirrel monkeys. Changes in the circulating blood levels of vasopressin and cortisol will be examined while susceptible and resistant monkeys are subjected to motion sickness-producing stimulation. Vasopressin is known to be related to nausea and motion sickness in humans and this research will investigate the use of vasopressin as a physiological measure of motion sickness in monkeys. Cortisol is a common measure of general stress which will be used to distinguish general stress effects from motion sickness-specific effects hypothesized to be reflected by vasopressin. These investigations will expand the understanding of hormone changes during motion sickness and will contribute to a better understanding of the physiology of motion sickness.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0012, ESTABLISHMENT OF A SAMPLE TREATMENT PROTOCOL FOR VIRUS DETECTION BY LASER FLUORIMETRY

G.A. Funk, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NSG 2398)

Experiments are being conducted in support of a study to determine the applicability of the laser fluorimeter to virus detection and quantitation. In this instrument, an aqueous suspension of fluorescent-stained virus particles is passed through a fine capillary into a flowing sheath of water, creating a distinct core of sample. An argon laser beam is focused on this core and fluorescent-stained particles passing through the laser beam are excited and emit photons which are detected and counted by a photomultiplier and displayed electronically. Environmental water samples contain varying amounts of non-viral particulate matter which may either clog the capillary and disrupt the core/sheath structure, or which may be stained nonspecifically by the fluorescent reagent and create unacceptable high background levels of fluorescence. One aspect of this study is to devise a procedure for treating water to eliminate all particulate

matter and background-contributory substances without removing the virus particles. A second facet of the study is to devise a procedure for attaching a fluorescent reagent to a specific indicator virus, and to evaluate the machine esponse to this labelled preparation.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0013, POPULATION DYNAMICS IN SMALL-SCALE MICROBIAL ECOSYSTEMS

R.D. Haight, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCA 2-675907)

Controlled ecological life support systems designed to support man in space will include microorganisms associated with the plant, animal, and human components of the system. Microorganisms will influence the functioning of each of the other components as a result of their metabolic activities. It may be necessary, therefore, to control the behavior of microbial populations if stability in the entire ecosystem is to be attained. These studies will investigate the behaviors of members of a microbial population which have been derived from soil and confined to a specialized, limited environment. In addition, smaller ecosystems of organisms of varying diversity, isolated from the original population, will be studied to determine the relationship between the diversity and stability of an ecosystem as a function of environmental variability. Environmental and biological perturbations will be imposed on the populations in order to see if such variations can be used to achieve stability of ecosystems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0014, QUANTITATION OF READAPTATION OF SELECTED PHYSIOLOGICAL VARIABLES FOLLOWING ENVIRONMENTAL PERTURBATION

D.C. Holley, California State University & Colleges, San Jose State University, Graduate School, *Washington Sq., San Jose, California* 95192 (NCA 2-675903)

An acute alteration in the normal periodicity of light and darkness, namely placing the subjects into constant light, has recently been shown to negatively effect the ability of monkeys to regulate deep body temperature when temporarily exposed to a cold challenge. We propose to further investigate this novel demonstration of an impairment of homeostasis caused by the removal of normal light-dark cues from the environment. Recently developed mathematical techniques will be used to quantitate the time course of deadaptation and readaptation of certain physiological parameters following photoperiod alterations. Pilot studies will be performed on rats surgically implanted with radiotelemetry devices and blood vascular cannulas. Parameters to be monitored include heart rate, body temperature, locomotor activity, eating and feeding frequency and urinary excretion of sodium, potassium, calcium, and tetrahydrocorticosterone. Following photoperiod alteration, the animals' abilities to regulate or respond to homeostatic challenges will be assessed. Once preliminary experiments have been completed, these studies will be extended to a non-human primate model (monkey). Subsequent findings will be summarized in a final written report.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0015, NITROGEN FIXATION AS AN ADJUNCT TO WASTEWATER PURIFICATION SYSTEM USING WATER HYACINTHS

N.B. Brown, Fort Valley State College, Graduate School, Dept. of Biology, *Fort Valley, Georgia* 31030 (NSG 735)

Recently, the use of aquatic vascular plants as 'polishing agents' to remove residual BOD5 and reduce elemental contamination of nitrogen and phosphorus has gained considerable attention and practical application. However, phosphorus, one of the algae-bloom causing agents, cannot be effectively removed by vascular plants if it exists in an excess of approximately one-third of total Kjeldahl nitrogen.

This project will seek to remedy this problem through these objectives: 1) to employ a model lagoon system consisting of three lagoon tiers using plastic wading pools in a greenhouse (e.g. a solar aqua-cell system), 2) as excess phosphorus promotes algae-blooms, we will exploit the nitrogen-fixing ability of nitrogen-fixing blue-greens to increase the available nitrogen in the model treatment system, 3) to utilize water hyacinth to adequately polish (to EPA standards) the effluent in the presence of the fixed nitrogen.

Initially water hyacinths, Eichhornia crassipes (mart.) solms and blue-green algae, Anabaenopsis circularis (Camb. Univ., strain CU102/3) will be used for investigation and the determination of these parameters.

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

6.0016, ZOOLOGICAL EFFECTS OF VARIATIONS IN ATMOSPHERIC OXYGEN LEVELS

G. Kloek, Kentucky State University, Undergraduate School, Dept. of Biology, *Frankfort, Kentucky* 40601 (NSG 801)

Since 1974 this research has sought to determine certain limits of survivability, normal life functions, and reproductive life cycles on one small animal. The fruit fly, Drosophila melanogaster, has been subjected to multiple, interrelated variations of atmospheric pressure, oxygen partial pressure, and ambient temperature. Clear boundaries of statistically significant population dynamics have been established. A so-called 'optimal' set of circumstances is difficult to declare since it depends on the criterion measured, and some degree of compensation for one adverse environmental condition may be accomplished by reciprocal manipulation of another. One further gain has been derived from following serial generations of fruit flies to assess possible effects beyond those acting directly on the organism.

The investigator has recently broadened his objectives to include potential use of this animal model in controlled ecology life support systems (CELSS).

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

6.0017, INVESTIGATION OF MEDICAL INFORMATION MANAGEMENT SYSTEM APPLICATION IN A COMPLEX HEALTH CARE FACILITY

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OBJECTIVES: To utilize a cost-effective computer-based medical records system in a diversified health care delivery environment, including both in-patient and out-patient facilities.

APPROACH: The system is developed from a modified version of MIMS (Medical Information Management System) which was initially developed at NASA-Houston to monitor the health status of astronauts. One element of the health care service facilities will be used as a test area to evaluate the systems operation; after the introduction of modifications arising from the test results, the system will be extended to cover additional service areas.

CURRENT OPERATIONS: The original set of programs were written exclusively for CDC computers. Modification of the programs is being undertaken by staff on this and related contracts, to allow a wider use of the basic systems approach. This will be achieved by writing the programs in a form which is largely machine independent, with a significant degree of optimization to the data base actually in use. Medical Records data is currently being transcribed to computer files in preparation for system testing.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

6.0018, REGULATION OF THE ADRENAL CORTEX FUNCTION DURING STRESS

K.F. Soliman, State University System of Florida, Florida Agricultural & Mechanical University, School of Pharmacy, Dept. of Pharmacology, *Tallahassee, Florida* 32307 (NSG 2183)

The objective of this proposal is to study peripheral control of the adrenal cortex during stress. Rats will be used as experi-

mental models for this project. Stresses being studied include ether, histamine or endotoxin administration, or cold exposure. In this study the adrenal medullary enzymes (tyrosine hydroxylase, dopamine hydroxylase and PNMT) will be examined in relation to stress. The liver glucocorticoids sulfotransferase and brain tryptophan hydroxylase activities will be related to the availability of the adrenal medullary hormones and to the exposure to stress. The effect of circadian rhythm on these biochemical mediators will be investigated. The brain biogenic amines or different parts of the brain will be studied in relation to stress and circadian rhythm. In another study the synthesis and the release of glucocorticoids will be investigated using isolated adrenal cells. The adrenal cellular response to histamine, endotoxin and ACTH will be evaluated in relation to the availability of epinephrine in the media. Finally, glucocorticoids half life and tissue binding and the glucocorticoids receptors will be evaluated in relation to epinephrine administration or stress exposure.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0019, LIVER CELLS - A MODEL SYSTEM FOR STUDIES ON METABOLISM IN SPACE

M.E. Tolbert, State University System of Florida, Florida Agricultural & Mechanical University, School of Pharmacy, *Tallahassee, Florida* 32307 (NSG 2311)

Presently, and with due justification, there is strong concentration on the function of the liver relative to space travel. Studies on liver metabolism are of great interest in view of the fact that liver function impairment has been implicated in reduced caloric utilization and in weight reduction among mammals in space. The effects of space flight on the mammalian system cannot be correctly evaluated until the factors affecting the underlying biological mechanisms are thoroughly understood.

In view of the need to investigate liver functions and their regulation more thoroughly, the present program of research was developed with objectives as follows: 1) to perfect a technique for the isolation of a large population of intact liver parenchymal cells which will be useful in space laboratories where studies of liver functions are conducted, 2) to isolate a uniform system of intact liver cells to serve as a suitable test system for studies on liver functions in zero gravity, and 3) to document the characteristics of the isolated liver cell system so that it can become a useful base of reference for studies of liver functions under space conditions.

The results of these and other studies may provide man with the information needed to sustain human life on other planets and may also increase man's adaptive capability for prolonged space flights. In general, the isolated hepatic cell system will be projected as a model system for studies involving mechanism of drug action and general liver processes. The system being developed will be projected as one for use in hepatic research laboratories in space.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0020, THE INFLUENCE OF ENDOGENOUS AMINES ON DIURNAL TOXICITY OF CNS STIMULANTS AND DEPRESSANTS

C.A. Walker, State University System of Florida, Florida Agricultural & Mechanical University, School of Pharmacy, *Tallahassee, Florida* 32307 (NSG 2029)

The progress report to date shows that circadian rhythms have been established for all the major neurotransmitters. During the past year our lab established for the first time circadian rhythms in specific brain parts for glycine. High concentrations were noted in the pons. The possibility of glycine receptors in the brain indicate a need for additional studies involving the pons and drugs that affect glycine.

We propose to continue the identification and investigation of drugs (central nervous system stimulants and depressants) in terms of significant circadian variations in toxicity (LD50) and therapeutic effectiveness (ED50). The effects of these drugs on brain amines at different times of the day will be extensively examined including the chronopharmacokinetic. The compounds to be measured will include GABA and cyclic AMP. Attempts will be made to complete a circadian profile simultaneously for epinephrine, norepinephrine, acetylcholine, serotonin, histamine, GABA, glycine and cyclic AMP for cortex, midbrain, caudate nucleus, cerebellum and specific areas of the spinal cord. Alterations in environmental parameters to include reverse cycles, uneven length of light-dark cycles and time periods for light-dark adaptations will be continued in this investigation. Small laboratory animals will be used (mice and rats) initially, followed by larger animals when studying the therapeutic effectiveness of specific drugs. The animals will be adapted in the regular manner in a temperature controlled environmental room equipped for automatic programmed illumination cycles.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0021, MORPHOMETRICS OF CELLULAR DAMAGE IN MICE RECEIVING WHOLE BODY IRRADIATION

W.J. Sapp, Tuskegee Inst., School of Arts & Sciences, Dept. of Biology, *Tuskegee Institute, Alabama* 36088 (NCC 2-12)

This research is designed to investigate the effects of radiation from high energy particles (HZE) on the proliferating germinal epithelium in mice testes. Morphometrics of cellular damage due to radiation can be easily assessed in the seminiferous epithelium of the testis since the spermatogonial cells proliferate rapidly, and in certain stages, are extremely radiosensitive.

Dose is one important variable in radiation studies, and quantitation of dose effects is a necessary step in evaluation of radiation damage. Since various spermatogonial cells can be identified morphologically, the testis provides excellent material for quantitative studies.

This work involves exposure of brown mice to whole-body or testicular irradiation with beams of heavy ion particles such as neon and argon.

After irradiation, the testicular tissue will be processed in the usual manner for electron microscopy. The plastic-embedded tissue can be sectioned for either light or electron microscopy.

In addition to determining the relative biological effectiveness (RBE) of various heavy ion particles, this work will also involve a determination of the nuclear and cytoplasmic volumes in certain tissues, an ultrastructural study of the radiation effects on specific cells, and autoradiography as a means of determining the sensitivity of specific cells and the cell renewal processes.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0022, AQUATIC VASCULAR PLANTS AND ALGAE AS POTENTIAL BIOLOGICAL COMPONENTS OF CLOSED ECOLOGICAL LIFE SUPPORT SYSTEMS

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BACKGROUND: A recent study by NASA Ames Research Center has emphasized the use of biological methods for wastewater treatment (recycling) and food production in Closed Ecological Life Support Systems (CELSS) for Large Space Habitats. Use of aquatic vascular plants and/or algae under terrestrial environment has been very promising in the two areas of waste recycling and food production. Information is not available on the use of aquatic vascular plants and algae under controlled/closed environments.

OBJECTIVE: Objective of this work is to complete a literature review and discuss with experts the potential problem areas in the use of aquatic vascular plants and algae under Controlled/Closed environments.

PROGRESS: Water Hyacinths and duckweed have been selected as the plants for possible use in CELSS for wastewater recycling and food (protein) production. Very little work on CELSS has been done in United States. Russian scientists have utilized algae for CELSS but details of their experimental designs are not available. Current plans are to design an experiment to study the gas exchange (CO_2-O_2) and evapotranspiration on the use of water hyacinths/algae in closed or partially closed ecological life support systems. This work is an integral

part of NASA's ongoing research on Potential Biological Components of CELSS for Large Space Habitats.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

6.0023, STUDIES OF MICROWAVE RADIATION AS A TOOL IN SOIL STERILIZATION AGAINST MAJOR DISEASES AND PESTS OF AGRICULTURAL CROPS

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Soil samples from different soil types and locations were analyzed for soil microorganisms and arthropods before and after exposure to 2450MHz, 6KW fully conveyorized microwave source. The effect of the microwave radiation on the soil organisms was assessed using the classical microbiological method, and the Dry-Funnel method for extraction of small arthropods developed by K.E. Fletcher of the Rothamsted Experiment Station at Harpenden, England. Results so far indicate that all fungi were readily killed by the microwave treatment; all nitrogen-fixing bacteria were inactivated and killed but some spore forming bacteria survived; no nematodes survived the microwave treatment and all isolated arthropods (eggs, larvae and adults) were found killed by the microwave treatment. The effect of the microwave on the soil organisms was non-selective and there did not appear to be any residual effects of the microwave; lower pH values of the microwaved soils and increase in the acidity were detected. The soils showed no changes in their compositions but there was a significant decrease in most of the chemical components of the treated soils; growth of plants (peanut) in the early stages was retarded in treated soils but improved and were better than controls; flowering occurred (early) in the microwave treated soils and not in the untreated controls.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

6.0024, DETERMINATION OF SELECTED TOXIC METALS IN SEDIMENTS AND BENTHIC SPECIES IN RELATION TO NUCLEAR POWER PLANT OPERATIONS

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Trends in copper and zinc concentrations in oysters from the central Chesapeake Bay region are being studied. Oysters were collected in June 1978 and June 1979 from 13 sites in clean and polluted areas, near two power plants, and a seed area. A minimum of 29 oysters from each site were individually analyzed for copper and zinc using nitric acid wet digestion, filtration and flame atomic absorption. Preliminary results indicate: 1) Zinc and copper concentrations were always significantly positively correlated and the copper/zinc ratios were highest in oysters from the two power plant and oyster seed areas. 2) Copper concentrations in oysters were significantly negatively correlated with site salinity in 1978 (-6.2ppm/ppt) and 1979 (-6.7 ppm/ppt). 3) Copper concentrations were significantly negatively correlated with individual oyster wet weights at half the sites. 4) Zinc concentrations in oysters were generally not significantly correlated with either site salinity or individual oyster weights. 5) Oysters from the seed are consistently had the highest copper concentrations and copper/zinc ratio. 6) Copper concentrations increased in oysters from the central bay region and decreased in oysters from the Patuxent and Potomac rivers. 7) Oysters from the Calvert Cliffs Nuclear Power Plant area continued to show increasing concentrations of copper relative to reference areas; however oysters from the Chalk Point Power Plant area which has recently installed cooling towers had significantly decreased copper concentrations. Sampling and analyses are continuing.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

6.0025, GLUCONEOGENESIS AND GLYCOGENOLYSIS - THE 24-HR PATTERN AND CORRELATION OF SEVERAL PHYSIOLOGIC FUNCTIONS

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The purpose of this study is to correlate the 24-hour patterns of several biochemical tissue constituents such as liver glycogen, blood glucose, certain enzymes and the controlling factors involved in rat hepatic gluconeogenesis and glycogenolysis. Rats are maintained in 12 hours of altering light and dark in an isolated room. At the end of the experimental regimen, organ and tissues are harvested at 4-hour intervals throughout a 24-hour period. The tissue constituents are then assayed for possible diurnal variations. Significant diurnal variations have been found for rat hepatic glucose-6-phosphatase (EC. 3.1.3.9), neutral fructose 1,6-diphosphatase (EC. 3.1.3.11, Ashman et al., 1976. Comp. Biochem. Physiol. 53B: 315-318), phosphohexose isomerase (EC. 5.3.1.9), phosphoglucomutase (EC. 2.7.5.1), glutamate-oxaloacetate transaminase (EC 2.6.1.1), liver glycogen, plasma glucose, plasma corticosterone and stomach plus contents weights. Correlations were made between circadian locomotor activities, plasma corticosterone, liver glycogen and the enzymes. Corticosterone levels peak immediately at the onset of the dark period when the rats begin their running. When rats eat during the dark period, liver glycogen is stored until it reaches maximum levels during the light period. As the investigation progresses, additional correlations will be made in the hope of establishing a marker rhythm for the other tissue constituents.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0026, SATURATED HEATED OXYGEN/BLEED AIR NEBULIZER FOR RESUSCITATION OF THERMAL CASUALTIES IN AIR EVACUATION

F.S. Pettyjohn, U.S. Dept. of Defense, Army, Medical Research & Development Command, Aviation Medicine Research Div., *Fort Rucker, Ozark, Alabama* 36360 (DA0B6902)

To develop and test the concept of use of heated saturated oxygen/bleed air in helicopter air evacuation/resuscitation of the hypothermic or pulmonary casualty.

Develop new technology and equipment to use helicopter bleed-air and electrical power 28 VDC or 115 VAC 400 Hz to provide a source of heated, dry or super-saturated oxygen or air to deliver heat to the hypothermic combat casualty. The concept of the lungs as a heat exchanger employing the extremely large surface area available for the passage of blood as a distributor of heat to distal organs represents a unique application in air evacuation and resuscitation. The equipment will be designed for simplicity, low cost, and compatibility with UH-lH aeromedical helicopters. Compatibility with advanced oxygen systems (chlorate candle and Army molecular sieve oxygen generators) will be explored. Concept and prototype evaluation will be conducted using mongrel dogs as subjects. Monitoring of temperature and pulmonary effects of increased inspiratory air/oxygen during simulated and in-flight evacuation missions will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0027, TERRAIN VISUAL CUE REQUIREMENTS FOR FLIGHT SIMULATION

G.H. Buckland, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223200)

1. To investigate the relative utility of different types of terrain visual cues for low altitude visual flight simulation, 2. To evaluate the relative importance of the trade-offs between the limited number of possible visual cues, and 3. To develop the optimum visual scene for ASPT, for use in other research and training which requires low altitude visual flight simulation.

Dual phase experiments will be used. Experienced pilots will participate in either the landing or NOE studies. The general approach will be to vary the types of visual cues available to

the pilots and study the effects of these cues upon their subsequent performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0028, STUDY CONTROL CONCEPTS FOR LOW-COST TRAINING

B. McFadden, McFadden Electronics, *8953 Atlantic Blvd., South Gate, California* 90280 (DN894039; N61339-78-C-0170)

Low-cost electronics are making possible very low-cost, part-task aviation skills trainers. To be effective, low-cost controls with acceptable feel will be required. This study will identify approaches and fabricate examples for evaluation.

Models of control feel will be studied to determine necessary characteristics. Implementation schemes will then be considered and samples fabricated.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0029, CGI TECHNIQUES EVALUATION

D. Cohen, University of Southern California, Information Sciences Inst., *Marina Del Rey, California* 90291 (DN794044; N61339-77-C-0154)

The objective of this task is to conduct a state of the art survey on the application of computer generated imagery (CGI) to flight simulation devices, a technological forecast of advances, and assess the future of this technology and its impact on Navy flight training in the early 80's.

The survey will address the following issues: (a) state of the art, (b) human factor aspects, (c) expected future progress, and (d) probable impact of new technology.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Experimental Computer Simulation Lab.

6.0030, INTERSTIMULUS INTERVAL AS IT AFFECTS TEMPORARY THRESHOLD SHIFT IN SERIAL PRESENTATIONS OF LOUD TONES

J.V. Tobias, U.S. Dept. of Transportation, Federal Aviation Admin., Office of Aviation Medicine, *800 Independence Ave. S.W., Washington, District of Columbia* 20591 (FAA-AM-79-16)

Temporary threshold shifts were measured repeatedly during a session in order to determine effects of interstimulus interval (ISI) on the shift. The fatiguing sound was a 3-minute, 110-dB-SPL, 4,000-Hz tone. Immediately following the 3-minute stimulation, Bekesy-audiometric tracings were made for 3 minutes at 5,656 Hz. Then the subject sat quietly for the ISI that was used during that session. The effect of the subject's rest time or time off was compared at two points on the recovery curve: at 30 seconds and at 2 minutes following the cessation of the fatiguing sound. For susceptible subjects tested with short-duration ISIs, each successive threshold showed a greater shift than the earlier ones for at least four tests. As ISI was increased, improvement seemed not to follow the expected linear form. At some critical value that varies from subject to subject, successive tests no longer differ from each other; each one is similar to a first trial in which no previous exposure to the high-level tone has occurred. For most subjects run under these conditions, the critical ISI value is at least 30 minutes.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Office of Aviation Medicine

6.0031, IMPROVING FLEET EFFECTIVENESS THROUGH IMPROVED NAVY AND MARINE CORPS AIRCREW PERFORMANCE ASSESSMENT

R.E. Doll, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., *Pensacola, Florida* 32512 (DN141808)

Development and implementation of systems for forecasting likelihood of training completion has reduced costly attrition and resulted in improved fleet effectiveness. Among aviators and naval flight officers who complete training, however, substantial costs are still incurred through attrition in replacement training squadrons (RTSs) and a continuing incidence of marginal and unsatisfactory fleet performance, reflecting both individual differences in capability and problems in training and RTS syllabi. Identifying relevant differences in skill and ability and optimizing syllabus responsiveness to operational demands requires valid and reliable performance measurement. the objective of this work unit is to develop improved methods for assessment of aircrew performance and to utilize performance data in recommendations for improved fleet effectiveness.

Standardized performance assessment methods will be developed and evaluated, and elements critical to fleet performance determined. selection and assignment procedures will be developed and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept.

6.0032, PERSONNEL TECHNOLOGY - HUMAN PLANNING AND PROBLEM SOLVING IN ROUTE CONSTRUCTION

A. Stevens, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DN875263; N00014-78-C-0235)

Navy and Marine Corps jobs such as navigation, air traffic control, and fire control require personnel to formulate a plan or sequence of instructions from information which must be extracted from a visual display. This work will construct a theory and particular models of this process in selected route-planning scenarios. The theory will identify and evaluate heuristics used in route planning and determine how these heuristics relate to the observable behavior of individuals engaged in route planning and traversal. A particular goal of the theory is an account of how analytic and symbolic planning processes relate to the spatial and graphic representations of the area being traversed.

Spatial representations will be formalized in the theory through the use of a constraint network which can be used to derive quantitative constraints from symbolic statements about the space. Planning heuristics will be formalized as constraints which can be entered in the network. Taken as a whole the theory will be applied to protocols taken from a simulation system which allows for laboratory observation of route planning and route traversal behavior. Additional experiments on route memory will be used to test the spatial representation used in the theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0033, PERSONNEL TECHNOLOGY - COGNITIVE-FACTORS ANALYSIS OF SKILLED HUMAN PERFORMANCE

S.W. Keele, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Psychology, *1472 Kincaid St., Eugene, Oregon* 97401 (DN775694; N00014-77-C-0643)

This work will explore a cognitive-factors approach to analysis and prediction of skilled performance under high information loads characteristic of those found in piloting, fire control, and other military jobs. The work seeks to establish the construct validity of a number of cognitive abilities, including attentional flexibility, time-sharing, concentration, spatial orientation, and executive functions. Measures of these factors will be derived and empirically evaluated in terms of both concurrent and predictive validity.

Further validation studies will be carried out for previously refined measures of attentional flexibility. The construct validity of the concentration factor will be studies using tasks measuring the ability to disregard target information presented on to-be-ignored channels. Previously discovered factors of time-sharing ability will be construct-validated, and measures calibrated on experienced pilots. At least one new task will be formulated to assess executive function. A four-task assessment battery for spatial abilities will be tried on flight-training students.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, STATISTICAL CLASSIFICATION TECHNIQUES FOR ENGINEERING AND CLIMATIC DATA SAMPLES

E.C. Temple, Alabama Agricultural & Mechanical University, School of Arts & Sciences, Dept. of Mathematics, *Normal, Alabama* 35762 (NSG 8065)

When standard classification roles (or models) are constructed from sample data, it is known that the probability of misclassification is not minimized. Thus, the primary objective of the proposed research was to develop a biased Probability of Misclassification (PMC) model for classifying observations from a multivariate normal population such that the PMC is minimized. The purpose of the PMC model is to develop a tool for the statistical classification of practical engineering problems of interest to NASA for the Space Shuttle Program and the NASA Climatic Program.

A biased sample discriminant model using only principal component procedures has been investigated. Computer simulation experiments have been used to assess the effect of the biased procedures on the probability of misclassification. The performance of the biased model has not indicated acceptable results. Thus, an expanded research focus will be initiated under Grant #NSG-8065 Supplement 1. The focus will be a consideration of more general biasing approach to the problem.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0002, HOLOGRAPHIC GRATINGS FOR SPECTROGRAPHIC APPLICATIONS - STUDY OF ABERRATIONS

M.S. Bhatia, Bowie State College, Graduate School, Dept. of Mathematics, *Bowie, Maryland* 20715 (NGR 21-027-010)

The study of the optimum performance and ruling conditions relative to holographic grating technology is continued. As reported in the documents # X-720-77-79, X-720-77-145, X-722-78-3 and X-722-78-31 we have developed computer programs to determine design parameters to rule holographic aberration corrected diffraction gratings and Rowland Circle spectrographic mounts. We will investigate the design of aberration corrected holographic toroid gratings for Seya Namioka and for Rowland Circle spectrographic mounts. It is also expected that the analysis of the theory of Type III holographic gratings with regard to correction of aberrations will be initiated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0003, RESEARCH IN NUMERICAL INTEGRATION AND ATTITUDE CONTROL LAWS

S. Srivastava, Bowie State College, Graduate School, Dept. of Mathematics & Science, *Bowie, Maryland* 20715 (NGR 21-027-004)

This project investigates the process of updating attitude quaternion without depressing the size of state co-variance matrix, which amounts to a search for a proper filter preserving the positive definiteness.

The kinematic equations can be written in differential form using the quaternion representation of the attitude. This is generally preferred to the Euler angle representation because of its analytical characteristics.

The attitude quaternion, along with the current noise contribution, is propagated to present time. Matrices Q (6x6) and phi (6x6) are formed. P (6x6) is propagated to update time using phi and Q. The Kalman gain matrix K is computed, then finally the attitude quaternion is updated.

This process of updating involves so much of extra computation that it is desirable to (i) propagate without depressing the size of Q; (ii) then to calculate the gain K; (iii) update the attitude quaternion.

In doing so, some inequalities creep in, possibly because of loss of positive definiteness. Square root filter, UDUT, or some modified versions are most likely to work. This is being investigated now.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0004, JOINT DEVELOPMENT OF A DISPLAY SOFTWARE SYSTEM FOR UNSTEADY TRANSONIC FLOW FIELD COMPUTATIONS

J. Mitchem, California State University & Colleges, San Jose State University, School of Science, Dept. of Mathematics, *Washington Sq., San Jose, California* 95192 (NCA 2-675901)

Extensive computer codes are now being developed at NASA-Ames Research Center to study the unsteady transonic aerodynamics of oscillating airfoils and helicopter rotors. A finite difference procedure is used to solve the governing equations of the flow field. The solutions result in a great amount of data representing the unsteady characteristics of the flow field and thus require an efficient display-software system for organizing the data. It is this system that is proposed for development. The task will involve the development of computer programs, the output of which, in the form of graphics displays or movies should show the following features: 1) The time history of the automatic grid-generation to show it being tailored for the computation of oscillating airfoils or helicopter rotors. 2) The variation of the aerodynamic characteristics represented by the pressure distribution along the airfoils, constant Mach number and density contours, velocity vectors, and stream lines. 3) The phase shifts between the aerodynamic forces and the airfoil motions.

The documentation of the system should be user-oriented conceptually, including sample operations.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0005, ALGORITHMS FOR EFFECTIVE USE OF THE CDC STAR-100 COMPUTER IN THE SOLUTION OF OVER-DETERMINED LINEAR SYSTEMS OF LINEAR EQUATIONS

S.N. Shah, Hampton Inst., Graduate School, Dept. of Mathematics, *Hampton, Virginia* 23368 (NCC 1-7)

The objective of the proposed research is to develop a vectorized algorithm to solve over-determined systems of linear equations with real coefficients to make effective use of the CDC-STAR-100 computer, which has capabilities for processing vector quantities and performing vector operations.

APPROACH/PROGRESS/PLANS: The coefficient matrix is stored as vectors, column wise, and the computations are reorganized to take advantage of STAR-100 architecture and capabilities. Initial results show that in the case of 120 linear equations with 100 unknowns, the new algorithm solves the system in less than 12% of the time taken by the non-vectorized algorithm solving the same system. Future plans are to store the coefficient matrix row-wise and perform more numerical experiments by reorganizing computations.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0006, TEST FOR DIURNAL RAINFALL VARIATION

T.L. Gill, Howard University, Graduate School of Arts & Sciences, Dept. of Mathematics, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 5295)

In this Research project, we use a distribution free method known as the Kolmogrov-Smirnov Statistic in conjunction with the Wilcox test in order to analyze rainfall data obtained from the G.A.T.E. Program over the Atlantic Ocean. The objective is to provide answers to a number of important questions associated with rainfall variation over the oceans. In particular we plan to determine those oceanic regions where there is a diurnal rainfall variation and evaluate the level statistical confidence for each region. We also plan to evaluate the sensitivity of our conclusions as a function of the number of rainfall data points and identify any periodic behavior in the daily rainfall rate.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0007, MEDICAL INFORMATION MANAGEMENT SYSTEM

J.W. Frankowsky, Lincoln University, Undergraduate School, Dept. of Mathematics, *Lincoln University, Pennsylvania* 19352 (NAS 5-23800)

The Medical Information Management System ('MIMS') is a NASA-developed computerized system that will allow a hospital, laboratory, clinic or private physician to create and control a medical data base on patients. The system is interactive, has flexible format and provides the user with the ability to create records, recall records, search for specific data and do research with the data base created.

Current modifications continue program conversions that permit the system to operate on mini computers. Extensions of MIMS are being made so as to enhance its use in an ORC mode in conjunction with the requirements for research particularly as applicable to non-invasive vascular research. In addition, effort is being made to combine the MIMS System with INTERNIST (Univ. of Pittsburgh) and MEDAS (Univ. of Southern California) so as to form a physician-user oriented computer aided medical diagnostic tool.

There is close cooperation with selected physicians and medical facilities in order to design and test the programs for useful data formats, decide what data to store and test all parameters of the system.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0008, NUMERICAL DIFFERENTIATION AND INTERPOLATION PROCEDURES WITH ERROR ESTIMATES FOR NON-EXACT DATA

R.E. Bozeman, Morehouse College, School of Arts & Sciences, Dept. of Mathematics, *223 Chestnut St. S.W., Atlanta, Georgia* 30314

Most techniques that are available for differentiating finite data sets make the assumption that the data is precise or exact. Consequently, these procedures do not take into account errors that may be due to observation when data is collected from experiments. There are, however, several techniques that appear to be suitable for differentiating experimental data and in this study an analysis will be made of these procedures. The ultimate goal is to either identify an existing procedure or devise a new one that minimizes the error of estimation of the derivative including truncation errors as well as errors of observation in the original data set. Specifically an integral equation and regularization procedure and a time series technique will be considered.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

7.0009, ASSESSMENT OF THE QUALITY OF 'GATE' AREA RAINFALL DATA FROM A NIMBUS-5 RADIOMETER

N. Knox, Morgan State University, School of Arts & Sciences, Dept. of Mathematics, *Baltimore, Maryland* 21212

The purpose of this study is to evaluate the quality of rain intensity estimates derived from passive microwave measurements by the Nimbus-5 Electrically Scanned Microwave Radiometer during the GARP (Global Atmospheric Research Program) Atlantic Tropical Experiment (GATE). To do this, the following tasks must be completed: 1. Collect and verify computer printouts of ESMR-5 GATE coincident data. 2. Use the ESMR-5 calibration curves to convert ESMR-5 brightness temperatures to rain intensity estimates for a two degree square centered at (23.5 degrees W, 8.5 degrees N). 3. Compare ESMR-5 rain intensity estimates to coincident GATE radar measurements of rain rate.

At this time seventy-one ESMR-5 measurements coincident with GATE radar measurements have been retrieved from computer compatible tapes at Goddard Space Flight Center.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0010, MEDICAL APPLICATION FOR COMPUTER TECHNOLOGY

F.A. Fresh, State University System of Florida, Florida Agricultural & Mechanical University, School of Business & Industry, Management Sciences Division, *Tallahassee, Florida* 32307 (NAS 5-25165)

There exists several parallel attempts to develop a tractable and efficient automated system to assist physicians to make differential diagnoses. The availability of such an operational system would enable the extension of medical care to relatively remote areas (i.e., rural or space) through a greater reliance on the paramedical personnel. Differences among some of the systems currently under investigation include the theoretical basis for the underlying model (i.e., Bayesian and artificial intelligence) and the availability of an adequate medical knowledge base. The objective of this project is to identify a computer-based model which offers the capabilities for differential diagnosis, extensive medical knowledge base, maintainable in a common computer language and transportable to multiple, economical hardware environments. This project is investigating means to integrate the available technology into a system which can be made operational.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0011, A CHRONOLOGY AND RETRIEVAL SYSTEM FOR WALLOPS FLIGHT CENTER ATMOSPHERIC DATA

J.C. Smith, University of Maryland, Eastern Shore, Undergraduate School, *Princess Anne, Maryland* 21853 (NSG 6016)

The University of Maryland, Eastern Shore (MES) is conducting efforts as a part of Research Grant, Office of University Affairs Grant No. NSG 6016, to respond to a need by the NASA, Wallops Flight Center (WFC) to determine and chronologically compile the atmospheric measurement data taken in past years in that geographical area (i.e., within atmosphere sensors). The overall objective is to develop an information-base filing and retrieval system that will provide scientists with ready access to Wallops Flight Center atmospheric data. More specifically, a computerized recovery of information by type of measurements (parameters), instruments, altitude, time of day and other pertinent facts, is visualized as an ultimate goal. Grant efforts have followed the NASA recommendation of a phased approach.

PHASE I: The first phase centered upon enlisting the aid of Wallops Flight Center people and learning of the resources available. Initial interviews and initial results yielded a Verified Basic Listing for Tabulation.

PHASE II: Phase II efforts approached the initial task to create a summary catalog of the primary data base consisting of more than eighty-six hundred (8600) project or experiment cases. Utilization of Phase I results and new development of methods, personnel training, and follow-on needs to handle the varied types of data and sources categorically related to meteorology, aeronomy, and the interdisciplinary atmospheric-geophysical sciences has produced a Preliminary Summary Data Catalog in three (3) volumes.

Case selection, initial entries of NASA experiments are on catalog data sheets A and B for 1977, and 1978 are complete. (Research efforts to identify, locate and list experiment-related science and technical publications for Volume 4 have been initiated utilizing the RECON system at NASA Wallops Flight Center.)

Efforts have also been initiated with NASA WFC Personnel to provide magnetic data tapes that contain most of the meteorological rocket and Jimsphere information suitable for inclusion during software development.

A computerized output and listing of our current total of experiment-related publications has been prepared, and a library collection of assembled WFC experiment or case related publications will soon be displayed in the NASA Technical Library.(Text Abridged)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

7.0012, RESEARCH IN ORBIT DETERMINATION

J.S. Bakshi, University of the District of Columbia, School of Engineering Technologies, Dept. of Mathematics, *4100 Con-*

necticut Ave. N.W., Washington, District of Columbia 20008 (NSG 5122)

The attitude of the spacecraft when expressed in Euler's form can be described by a differential equation using quaternion. An exact solution for this equation can be found by using average angular body rate. In this project, the task is to compare accuracy and ease of computation for the propagation of quaternion, when the average angular rate is not used. Furthermore, an attempt is being made to find a suitable method or a suitable filter to propagate attitude quaternion without depressing the size of state convariance matrix which will preserve positive definiteness and stability. The use of Kalman filter, in this project is compared with Schmidt, Potter and other filters.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0013, METHODS FOR MAKING A NUMBER OF STRUCTURALLY SIMILAR STATISTICAL DECISIONS WITH APPLICATIONS TO THE ANALYSIS OF REMOTE SENSING DATA

S. Vardeman, Purdue University, School of Science, Dept. of Mathematics, *Executive Bldg., West Lafayette, Indiana* 47907 (MCS78-04366 A01)

Professor Vardeman will consider decision theoretic questions arising in situations in which a number of structurally similar but statistically independent decisions are to be made simultaneously or serially. He will study the decision theoretic basis for making large numbers of classification decisions and will apply this theory to the analysis of remote sensing data.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0014, BACKSCATTER RAY TRACE

T.B. Barrett, Parke Mathematical Lab. Inc., *1 River Rd., Carlisle, Massachusetts* 01741 (DF902400; F19628-77-C-0054)

AF function - high frequency radar detection at long range. Deficiency - inadequate mathematical and computer techniques are available to translate ionospheric measurements into short-term predictions on the effects imposed by ionosphere on oth radar. Objective - develop computer automation for ray-tracing synthesis of backscatter-radar ionograms, and for inference of ionospheric electron distributions from observed backscatter ionograms. How research contributes -backscatter ionograms can potentially be computer processed to produce electron distributions in the region of radar surveillance, and thus can be used to update current ionospheric models. Backscatter radar observations on group-path range and apparent azimuth can be converted to ground range and true azimuth when the electron distribution is known.

The approach to this effort will be to develop computer techniques to automate the synthesis of swept-frequency backscatter ionograms, using three-dimensional ray-tracing computations for given electron distributions. Techniques will be developed for categorization, storage and retrieval of major characteristics of the synthesized ionograms. A computerized procedure will be developed for converting an observed ionogram into electron distribution by computing ionograms for trial electron distributions till the computer matches the observed ionogram.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

7.0015, SOLUTION OF REYNOLD'S EQUATIONS

W.E. Simpkin, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN890155; N00019-79-C-0136)

Jet entrainment is dependent on the jet velocity profile and turbulence level which at present are not accounted for in model testing or in mathematical models of jet entrainment and mixing. The ultimate goal of this work is to develop a model that will account for all the major parameters in the mixing process, such that jet entrainment can be modelled.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, SOLUTION GROWTH OF CRYSTALS IN ZERO-GRAVITY

R.B. Lal, Alabama Agricultural & Mechanical University, School of Arts & Sciences, Dept. of Physics & Mathematics, *Normal, Alabama* 35762 (NAS8-32945)

A series of experiments will be performed in which crystals will be grown by the low-temperature solution growth technique in a microgravity environment of the orbital Spacelab. The objectives are: (1) to produce structurally more homogeneous crystals free from inclusions of solution by eliminating convection transients, (2) to obtain data on mass and heat transport in diffusion controlled growth system, and (3) to confirm the advantages of a microgravity environment for solution crystal growth. Triglycine sulfate (TGS) crystals will be grown in the Fluid Experiment System (FES) on Spacelab III by slowly extracting heat at a programmed rate through a seed crystal of TGS suspended on an insulated string in a saturated solution of TGS. Variations in the liquid density, solution concentration, and temperature around the growing crystal will be studied using a holographic technique. Growth in earth gravity will be studied by the same techniques and the resulting crystalline features will be compared and correlated with the growth conditions. In a microgravity environment it should be possible to eliminate convective flows and establish a diffusion controlled transport of the solute to the interface. By extracting heat from the crystal in a controlled manner, it should allow a slow but uniform growth resulting in a high degree of crystal perfection. Also, TGS has practical applications as infrared detectors whose performance might be improved by increased perfection. Experiments for the growth of TGS crystals are in progress. For the first time, crystals of TGS have been grown by cooling the seed crystal.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0002, A STUDY OF OPTIMUM INSULATION CONFIGURATIONS AND MATERIALS

F. Holmstrom, California State University & Colleges, San Jose State University, School of Science, Dept. of Physics, *Washington Sq., San Jose, California* 95192 (NCC 2-26)

The objective of this project is to find ways to passively protect equipment or structures from fires or other heating environments (e.g. by insulating the equipment from the fire), or to prevent propagation of compartmental fires to adjoining compartments. Systematic designs of fire protection systems are being done with mathematical models of fire protection and insulation systems.

The goals are: high level protection per unit weight, high durability, negligible toxic gas and smoke production, and resistance to corrosion from salt and humid atmospheres. The proposed configuration consists of numerous 'thin' insulative layers, with an air gap separating each layer. NASA has developed a mathematical model of this system containing air gaps, and a number of optimum designs have been analytically determined. NASA is also conducting an experimental fire testing program to verify the performance of these systems. This agreement will compare the mathematical and experimental findings for these types of protection systems in an effort to implement practical fire-protection systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0003, THEORY OF STRONG TURBULENCE BY RENORMALIZATION INTO REPEATED-CASCADE

C.M. Tchen, City University of New York, City College, Graduate School, *Convent Ave. & 138th St., New York, New York* 10031 (NSG 1485)

The general problem of turbulence and the particular problem of optical turbulence concern a system of stochastic and

nonlinear partial differential equations in configuration space. The difficulty as introduced by velocity can be minimized by a kinetic approach, transforming the said system to a master equation in phase space. The velocity now being an independent variable ceases to cause nonlinearity. The closure thus simplified is performed by a scaling procedure, involving macro-evolution, micro-transport coefficient, and submicro-relaxation. This kinetic approach reproduces the Kolmogoroff spectrum for incompressible turbulence, and derives other spectra for compressible turbulence and plasma turbulence. It is planned to extend to optical turbulence: scintillation at long path, saturation, and optical remote sensing, without the restriction from familiar hypotheses of frozen turbulence, small scales, and Markoff process.

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0004, MEASUREMENT OF THE VAPOR PHASE COMPOSITION AND PRESSURE FOR LIQUID-VAPOR EQUILIBRIUM IN AQUEOUS SOLUTIONS OF SULFURIC ACID

V.R. Veluri, Clark College, Undergraduate School, Dept. of Physics, *240 Chestnut St. S.W., Atlanta, Georgia* 30314 (NSG 2143)

The thermodynamic parameters needed for modeling the atmospheric aerosol formation are not available. This is particularly true of the sulfuric acid-water system which is important and of contemporary interest.

To meet this, a series of experiments have been initiated which will provide the equilibrium partial pressures of vapor over a sulfuric acid solution for a range of compositions. The technique employs the use of a time of flight mass spectrometer to sample the vapor phase above a sample through a molecular leak inlet. By calculating the response of the system to know pressures of molecular species of interest, the vapor phase partial pressures can be determined. Current work involves the completion of calibrating the system for SO2, SO3, and H2SO4. After calibration is completed, extensive studies of the partial pressures of these substances as a function of liquid phase composition and temperature will be undertaken.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0005, NEUTRINO INTERACTIONS AT COSMIC RAY ENERGIES

R.E. Mickens, Fisk University, School of Liberal Arts, Dept. of Physics, *17th Ave. N. & Meharry Blvd., Nashville, Tennessee* 37203 (NSG 5297)

The objective of this research is to obtain estimates of the neutrino-nucleon total cross section at cosmic-ray energies. In particular, we are concerned with the energy interval 10-10 GeV. Recent studies on deep underwater muon and neutrino detection show that in the near future it may be feasible to perform experiments using such ultra-high energy cosmic-ray neutrinos. The design of these experiments will depend, in part, on the value of the neutrino-nucleon cross section; consequently, it is of some interest to have estimates of the neutrino-nucleon total cross estimates of the neutrino-nucleon total cross section over this energy range.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0006, OPTICAL CHARACTERIZATION OF ZERO-GRAVITY GROWN CRYSTALS

E. Silberman, Fisk University, School of Liberal Arts, Dept. of Physics, *17th Ave. N. & Meharry Blvd., Nashville, Tennessee* 37203 (NSG 8060)

Preliminary experiments performed in the micro-gravitational field of the Skylab and Apollo-Soyuz flights have shown the possibility of growing better crystals, as compared to the best that can be obtained on the Earth's surface. Further research on the potential of this space technology will be carried out in the Spacelab missions. The experiments have shown the need for better methods of measuring the physical constants of the new crystals. This proposal aims at developing a computerized-scanning-laser illuminated-photoelectrical ultramicroscope which could characterize degrees of crystal perfection. Measurements will be performed on the kind of crystals to be grown in the near future in Spacelab flights.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0007, TURBULENCE IN TRANSIENT SOLAR PHENOMENA

M. Cross, Grambling State University, School of Arts & Sciences, Dept. of Physics, *Grambling, Louisiana* 71245

Recent advances have been made in the evolution of a fundamental theory of turbulence based on the physics of microscopic processes. The general use of models based on second moment closure schemes has been shown to be incorrect. In transitional flow, new parameters have been derived from kinetic theory which successfully characterize a variety of fluid and plasma systems with turbulent bursts and turbulence generated by amplified thermodynamic fluctuations. We propose to investigate the implications of these developments for transient solar phenomena. Specifically, we shall begin by extending the modern approaches for the study of unstable fluids to appropriately chosen periodic structures and bursting effects in the solar corona and interplanetary medium. We shall take full advantage of existing data on solar activity and use well established analytical procedures. From this, we expect to gain new insight into the physics of the sun. The cost to NASA for the first year of research would be approximately $30,000.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0008, STUDIES OF NEW MEDIA FOR RADIATION-INDUCED LASERS

K.S. Han, Hampton Inst., Graduate School, Dept. of Physics, *Hampton, Virginia* 23368 (NSG 1595)

The objective of this study is to search the laser material which would be suitable to solar pumped lasing. For a suitable solar pumped laser material, the following conditions are required: (1) good overlapping between solar spectrum and absorption spectrum of the laser medium, (2) broad band laser pumping mechanism, (3) efficient energy handover from energy storage medium to lasing medium, (4) low threshold to match a reasonable solar concentration (since solar radiation intensity has only 1.4 kWatts/sq. cm without any concentration service), (5) high power efficiency. The first laser medium we investigated was the iodine laser lasing at 1.315 microns. The iodine laser (usually lasing an organic compound CF3 I or C3FI) has broadband absorption from 250 microns to 290 microns and when flashed by xenon flashlamp, C3F3I or C3FI is photodissociated and produces an iodine atom in the P excited states.

In our preliminary study, the laser efficiency with respect to iodine pumping band was measured to be 3 percent. The solar radiation has low power density at the iodine laser pumping band. Therefore the buildup time is long. Iodine laser was also showing the laser action at the substantially higher temperature. This is encouraging because solar pumped laser will have to operate at higher than room temperature in order to make the laser medium absorb heat.

The further study of the lasing material will be centered around CF3I, IBr, NOCl laser for their compatibility for solar pumping mentioned earlier.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0009, FEASIBILITY OF USING TEKTITES AND OTHER SPACE RELATED GLASSES FOR THE CONTAINMENT OF NUCLEAR WASTES

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Low temperature magnetic susceptibility measurements, extensive infrared spectra measurements, electron microscopy observations, electron microprobe analysis, Mossbauer spectra, and standard visual techniques will be used to determine if tektites or other space related glasses can be candidates for long term storage of nuclear waste materials.

The effects of radiation damage on the structure of these glasses will be examined by subjecting them to extreme amounts of radiation, and then performing magnetic, Mossbauer and infrared property studies which will determine if the basic glass structure has been affected. Infrared and electron microscopy studies of these glasses will be made before and after severe hydration, which will determine the amount of water contained and the progress of the water through the glasses. Further studies will be made by subjecting these glasses to many different high temperatures for various time periods and measuring the devitrification by use of the above standard solid state techniques. The results of these measurements will be extrapolated to long periods of time at ordinary temperatures.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0010, RESEARCH IN ELECTRON SPECTROSCOPY

T. Tsang, Howard University, School of Liberal Arts, Dept. of Physics & Astronomy, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NGR 09-011-057)

The objective of the research is the basic understanding of surface physics. The radiation damages of transition metal sulfides under ion bombardment have been studied by photoelectron spectroscopy. Under inert gas ion bombardment, decomposition to metal and elemental sulfur was observed. However, there is considerable difference between the dosages required to induce decomposition, differing by a factor of 200 between iron sulfide and copper sulfide. On the other hand, under oxygen ion bombardment, the predominant process appears to be ion-surface chemical reactions. Again, the dosages required for oxidation differ considerably. In particular, we note that the rate of ion-surface chemical reactions is inversely correlated with the rate of impact-induced decomposition. These results suggest systematics for radiation damages under ion bombardment.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0011, OPTICALLY PUMPED SUBMILLIMETER WAVES AND APPLICATIONS

J.M. Dutta, North Carolina Central University, School of Arts & Sciences, Dept. of Physics, *1805 Fayetteville St., Durham, North Carolina* 27707 (NSG 5120)

Recently there has been a greatly increased interest in far infrared spectroscopy of the atmosphere for the study of certain trace gas constituents of the upper atmosphere. Present investigations using conventional interferometric spectrometers have limited ability to separate the weak lines of trace gases from the dominant lines of other gases due to their poor resolving power. The proposed effort is to construct a tunable high resolution spectrometer based on a far infrared laser. A compact, stable FIR laser has been constructed and alternate stabilization schemes such as an optoacoustic technique are being tested. Various Schottky diodes and mixer structures are also being investigated for their suitability in a heterodyne spectrometer. Part of the proposed effort is the continuation of these investigations with the ultimate goal of constructing a high resolution far infrared spectrometer suitable for the study of trace gases present in the upper atmosphere.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0012, CRYSTAL STRUCTURE AND CATALYTIC PROPERTIES OF NOBLE METAL-RARE EARTH ALLOYS

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The catalytic properties of many noble metals can be improved by judicious rare earth additions. It is proposed in this project that the catalytic properties of two kinds of noble metal alloys be studied: (a) Noble metals containing trace amounts of rare earths, and (b) Noble metal-rare earth alloys with intermediate phases. Iridium, ruthenium, rhenium, platinum, etc. noble metals shall be alloyed with cerium, neodymium, etc. light rare earths and their catalytic properties in hydrogenation, etc. reactions studied. The types of crystallizations and phase equilibria in many of the noble metal-rare earth alloy systems are not known. It is also of interest to determine the crystal structures of intermediate phases in binary systems of selected rare earths with iridium, ruthenium, rhenium and platinum. This study is to determine the bonding behavior among transition metals of Group III and Group VIII and to establish the alloy theory for transition metal alloys.

A separate phase of the research program would look into the physical properties of these alloys, especially of those used in the catalyst study. The electrical resistivities of selected alloys shall be studied as a function of temperature in the cryogenic ranges. The effects of rare earth additions on the properties of the noble metals would be analyzed critically.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0013, THERMODYNAMIC PROPERTIES OF SULFURIC ACID AT TEMPERATURES IMPORTANT TO THE ATMOSPHERE

R.A. Morrison, Talladega College, Undergraduate School, Dept. of Physics, *Talladega, Alabama* 35160 (NSG 2217)

Our initial determination of the total pressure in equilibrium with highly concentrated sulfuric acid has now been reported. The values are in reasonable agreement with other recent ones reported by Roedel. Uncertainties in our low-temperature measurements were larger than expected, and an improved design has been completed to solve this problem. The new design will also allow measurements at lower temperatures. Construction of the partial-pressure-measuring device continues.

Our initial theoretical calculations used ideal gas assumptions. The results clearly showed their inadequacy. Theoretical techniques using statistical molecular theory have been designed to use the existing data to determine the pair correlation potential. Once determined, the pair correlation potential should reliably predict the thermodynamic properties of the acid at stratospheric temperatures. Our work, then, will not only focus on the total and partial pressures, it will also predict energies, entropies, and heat capacities (for example).

We will start the study of other sulfur compounds that may have a lower vapor pressure than sulfuric acid at stratospheric temperatures: dithionic, peroxi-di-sulfuric, and peroxi-mono-sulfuric acids.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0014, SIZE EFFECT STUDIES OF THIN METAL FILMS

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Size effect parameters of thin metal polycrystalline films are to be obtained by direct comparison with their epitaxial form. The comparison will be made on a series of films of different thicknesses formed during the same evaporation. A high substrate temperature necessary to form the epitaxial films during evaporation while holding the polycrystalline films at room temperature will be made possible by using a split substrate holder with the two halves held at different temperatures. Attempts will be made to vary the upper film surface roughness as well as obtain experimental values of 'bulk' resistivity and mean free path. These values of resistivity, mean free path, and specularity parameter will then allow the polycrystalline films to be analyzed according to the Mayadas-Shatzkes theory. The split substrate system has been fabricated and temperature from 100K to 600K have been obtained while electrically contacting the films.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0015, EXCITATION CROSS-SECTION MEASUREMENTS OF ATMOSPHERIC INTEREST

H.D. Morgan, University of the District of Columbia, Graduate School, *1025 Vermont Ave. N.W., Mt. Vernon Sq. Campus, Washington, District of Columbia* 20005 (NSG 5192)

Most of our research program consists of extending absolute emission cross section measurements of atomic nitrogen, atomic oxygen and hydrogen into the extreme ultraviolet (500-1100 angstroms), where there are few reported measurements in the literature. Such experiments will furnish useful results for further investigation of the earth's aurora, the day-glow planetary atmospheres and stellar spectra.

The design of the experiment involves the excitation of atoms by electrons in a chamber attached to the entrance slit of a normal incidence monochromator and the detection of photons by pulse counting techniques. An electrostatically focused electron gun is used to bombard the atomic species in the excitation chamber. Photons emitted by the atom pass through the entrance slit and are dispersed by a diffraction grating, then detected by a photomultiplier tube at the exit slit. The resulting pulses are stored in a multichannel analyzer which scans through each channel as the wavelength or voltage to the electron gun is varied with time. Two spectrums can be produced (intensity vs the wavelength or intensity vs electron energy). Cross sections of the excited states, the excitation mechanism and their minimum thresholds can then be determined from the spectra.

At the present the experimental apparatus has been fabricated and constructed. Emission cross sections resulting from electron impact on N2 and O2 have been remeasured and the results are being prepared for publication. Problems remain in determination of the atomic specie density used in calculating cross sections resulting from electron impact on atomic oxygen and nitrogen. Progress is being made in this area, but much remains to be done.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0016, CONTINUATION OF PARTIAL DISCHARGE TESTING/STUDY OF EFFECTS OF SURFACE CHARGING DUE TO GEOMAGNETIC SUBSTORMS

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The phenomena of high-voltage DC partial discharges is being investiated; this involves life testing of various electrical components commonly found on spacecraft. Also being investigated are the effects of DC discharges in vacuum. The effects of low-voltage DC discharges on spacecraft components is studied, using a high-resolution power supply. This will be followed by a study of effects on components of discharges due to voltages consisting of AC superimposed on DC; primary emphasis here will be on the laboratory feasibility of such a study.

A detailed investigation of various kinds of breakdown phenomena in semiconductor devices used on geosynchronous spacecraft is being made, with emphasis on the plasma approach (both solid-state and gaseous state). This involves a theoretical treatment based upon appropriate plasma and other models, coupled with experimental testing of said models, wherever feasible.

The effects of long-term electron bombardment on spacecraft electrical components is being ascertained in an effort to better understand the results of geomagnetic substorms on such components. The type and degree of possible damage to various exposed surfaces such as solar panels is being investigated; progress on testing of the TDRSS solar panel at Lewis Research Center is being monitored. Support will be given the effort to adapt all or part of the NASCAP computer code to the Goddard Space Flight Center computing system, in order to predict the electric potential in a magnetospheric environment and the resulting arcing from electrically active spacecraft.

Undertakings are joint active efforts involving personnel from the Goddard Space Flight Center, Lewis Research Center, and the University of the District of Columbia.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0017, MATERIAL SCIENCE AND SOLID-STATE PHYSICS STUDIES WITH POSITIVE MUON SPIN PRECESSION

C.E. Stronach, Virginia State College, Graduate School, Dept. of Physics, *Petersburg, Virginia* 23806 (NSG 1342)

This project utilizes the precession of polarized positive muons, and their parity-violating decay, to study properties of solids.

By measuring the precession rate of muons the magnetic field at interstitial sites in ferromagnets may be determined and the hyperfine contact field arising from conduction electron polarization may be extracted. Of particular interest is the variation in the hyperfine field with the introduction of various nonmagnetic impurities. Studies of Fe(Al), Fe(Mo), Fe(Nb) and Fe(Ti) suggest systematic variations occur as functions of the impurity type.

The rate of depolarization of the precession signal provides a measure of the diffusion rate of muons. Thus trapping of muons, which produces depolarization, can be observed and used to test for impurities, defects, dislocations, and strains. The depolarization rate of muons in low-temperature high-purity Al, for example, is very sensitive to the amount and type of impurities present.

These studies are continuing at the TRIUMF cyclotron. The next run is scheduled for November 1979.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0018, MEDIUM-ENERGY NUCLEAR PHYSICS STUDIES

C.E. Stronach, Virginia State College, School of Science & Technology, Dept. of Physics, *Petersburg, Virginia* 23806 (NSG 1646)

This project utilizes medium-energy probes to study nuclear structure and reactions.

The primary emphasis is on studies of pion reactions in which coincidence events between outgoing charged particles and nuclear de-excitation gamma rays are observed. These coincidence spectra will enable us to distinguish, for example, between pion absorption and pion survival events. The spectra of charged particles should indicate for absorption events whether the pion's rest mass is shared by the nucleus as a whole, or whether the absorption process occurs with significant frequency upon smaller segments of nuclei. We anticipate performing a series of these experiments at the LAMPF LINAC in March 1980.

Another area of study is (p,d) reactions. Polarized protons and a magnetic spectrometer are used to measure differential cross sections and analyzing powers for deuteron production. The results are strongly dependent upon the j values of the final nuclear states, and suggest that (p,d) analyzing powers may allow reliable j assignments at intermediate energies and provide a valuable tool for identification of deep-hole strengths. We anticipate performing a series of these experiments at the TRIUMF cyclotron in December 1979.

Analogous experiments with photon and heavy-ion probes are under consideration.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0019, CALCULATION OF TOTAL CROSS SECTIONS FOR CHARGE EXCHANGE IN MOLECULAR COLLISIONS

J.W. Ioup, Xavier University of Louisiana, School of Arts & Sciences, Dept. of Physics, *7325 Palmetto St., New Orleans, Louisiana* 70125 (NSG 1361)

Previous research accomplished under this grant included the theoretical investigation of low-energy collisions of nitrogen ions with nitrogen molecules. Theoretical developments and calculations reported in the literature were applied to experimental data obtained by Dr. Al Smith of the Instruments Research Division at NASA Langley Research Center. The application of these techniques to gas-gas/surface and gas-surface charge transfer collisions was also studied.

As part of their investigation of these reactions, experimentalists must select ions for mass and energy before the collision

and analyze the same properties after. In order to increase the understanding of these devices, the 127 degrees cylindrical electrostatic analyzer and the quadrupole mass spectrometer were studied. Analytical expressions have been obtained for the transmission of the 127 degrees cylindrical electrostatic analyzer as a function of energy and two input angles for the entrance slit smaller than, equal to, and larger than the exit slit. Low-current selector and analyzer outputs for assumed energy and angle input distributions as well as broadening curves have been obtained.

A computer model of the quadrupole mass spectrometer has been developed. The path of an ion through the spectrometer may be calculated as well as the fraction of incident particles which are transmitted. The effects of fringing fields and of varying the pole piece separations (tilting the pole pieces) are being investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0020, SOLAR RADIATION MEASUREMENT PROJECT

J.W. Ioup, Xavier University of Louisiana, School of Arts & Sciences, Dept. of Physics, *7325 Palmetto St., New Orleans, Louisiana* 70125 (NSG 8050)

The purpose of this research project is to obtain measurements of the solar radiation incident at New Orleans. These measurements include the direct and the diffuse solar flux, the total amount of incident solar radiation per day with its distribution in time over the daylight hours, and infrared and ultraviolet data. Climatic measurements include temperature, barometric pressure, humidity, rainfall, and cloud cover, and atmospheric particulate measurements will be made of the correlation of these data with the insolation. The reliability and accuracy of instruments such as those using silicon photovoltaic cells will be tested by comparison with standard equipment. Data acquisition, storage, and analysis is performed under microcomputer control. Initial measurements are being made at the Xavier University campus with future data collection at various locations throughout the city and surrounding area.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0021, ADSORBED FILMS, INTERFACES AND PHASE TRANSITIONS IN TWO AND THREE DIMENSIONS

D.L. Goodstein, California Inst. of Technology, Graduate School, Dept. of Physics, *1201 E. California Blvd., Pasadena, California* 91109 (DMR79-00827)

This research is a continuation of work supported under NSF Grant No. DMR77-00036. A comprehensive experimental program encompassing five distinct but interrelated projects concerned with films, interfaces and phase transitions will be undertaken. Nuclear magnetic resonance techniques will be applied to methane films in order to study the transmission and reflection of phonons at the vacuum interface of real crystals. A technique of combined thermodynamic measurement and analysis, previously applied to helium adsorbed on Grafoil, will be applied to new systems in order to investigate problems concerning two-dimensional matter.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, MOLECULAR BEAM CARS SPECTROSCOPY

R.L. Byer, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (CHE79-12673)

Professor Byer is supported by a grant from the Structural Chemistry and Thermodynamics Program and the Atomic, Molecular, and Plasma Physics Program to carry out detailed high resolution spectroscopic measurements. The major emphasis of Byer's work will be the study of pulsed molecular beams in order to enhance spectral and structural details for important molecular systems such as methane and sulfur hexafluoride. Thus, Byer will be combining state-of-the-art high vacuum technology with high powered laser systems to develop further the utility of coherent anti-Stokes Raman spectroscopy (CARS). The extension of high resolution CARS to sub-Doppler linewidths will provide precise absolute frequency measurements and improve considerably the resolution of complex spectra. A second area of study will be the Raman spectra of hydrogen and deuterium. The purpose of studying hydrogen in a molecular beam is to improve significantly the precision of the measured Raman vibrational frequencies and to verify the isotopic shift of the molecular vibration which is a direct test of the validity range for the Born-Oppenheimer approximation.

This research is a continuation of that currently supported by Foundation Grant, CHE-7621987.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0023, GENERAL RELATIVITY AND COSMOLOGY

R.K. Sachs, University of California, Berkeley Campus, School of Letters & Science, Dept. of Mathematics, *Berkeley, California* 94720 (PHY79-13146)

Research in theoretical gravitational physics initiated under NSF grant PHY77-1519A01 will be continued. Among the topics to be investigated are: 1) inhomogeneous cosmologies 2) particle production in cosmological models.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0024, HIGHLY NONLINEAR PHENOMENA AND PHYSICS OF CONFINEMENT

A.Y. Wong, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY79-08480)

A three-year program will systematically study three important topics in plasma physics. The first program involves highly nonlinear phenomena in plasmas, including the investigation of the generation and interaction of Langmuir solutions to verify the predictions of the nonlinear Schrodinger equation. The second program involves the conversion of electrostatic waves to electromagnetic waves. The electrostatic waves will be generated by the beam-plasma instability will also be studied. The third program involves particle transport in an axisymmetric magnetic field configuration with and without magnetic perturbations. In order to extend this study to the high temperature regime, a complementary university/industry collaboration effort will be carried out. Hughes Research Laboratories will develop high perveance neutral beam (2-5 keV, 50 amp) jointly with UCLA. This source is expected to raise the ion temperature in the Dodecapole to several hundred electron volts.

This is the fist year of a three-year continuing grant, a continuation of research begun under PHY7707160 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0025, STUDIES OF GAMMA RAY LINE EMISSION FROM ASTROPHYSICAL SOURCES

R.E. Lingenfelter, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (AST79-11987)

This research will be concerned with theoretical studies of the high energy gamma-ray line emission from astrophysical sources. The following problems will be considered; 1) There will be a calculation of the deexcitation line emission spectra and individual line emissivities resulting from thermonuclear reactions at ion temperatures in excess of one billion degrees Kelvin. 2) There will be an investigation f the cross sections and luminosities of various neutron producing reactions which are important in such high temperature interactions. 3) There will be a calculation of the neutron and positron production rates in thermonuclear reactions at these temperatures. 4) Calculations will be made of the gravitationally and Doppler shifted gamma-ray line emission spectra which might be expected from various models of accretion around a neutron star or a black hole. 5)

There will be a comparison of these emission spectra with the gamma-ray line emission that has been reported from the galactic center and Centaurus A.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

8.0026, SURVEY OF ATOMIC AND MOLECULAR SCIENCE

C.K. Reed, National Academy of Sciences, *2101 Constitution Ave. N.W., Washington, District of Columbia* 20037 (PHY78-25026)

The National Academy of Sciences, through its Committee on Atomic and Molecular Science (CAMS), will conduct a study and prepare a report to characterize the present state of research in atomic and molecular science. Included in the characterization will be information on numbers of research workers and nature of research activities, geographical location, types of research organizations participating, demographic information, training, and levels and sources of support. Universities, national laboratories, and industry will be surveyed. On the basis of such data the Committee will prepare a report on the status, health, and needs of the field.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0027, THEORETICAL STUDIES OF THE INTERACTION OF RADIATION WITH MATTER

S.T. Manson, Georgia State University, School of Arts & Sciences, Dept. of Physics, *33 Gilmer St. S.E., Atlanta, Georgia* 30303 (PHY76-80123)

Research in theoretical atomic physics initiated under NSF Grant PHY72-05156 A01 will be continued. This research will focus on: 1. Investigate within the framework of Born approximation, the energy and angular distribution of electrons ejected by fast charged particle impact ionization of atoms. 2. Calculate, within the same framework, inelastic scattering form factors, generalized oscillator strengths, and energy loss cross sections for fast charged particle impact ionization of the atomic subshells of selected elements, as well as to determine their contributions to the total ionization cross section and stopping power. 3. Study the angular distribution of photoelectrons from open shell atoms, where the effects of anisotropic interactions play an important role, as well as other topics of interest in photoelectron spectroscopy such as satellite lines. 4. Explore the behavior of the cross section for the photoionization of selected excited states of various atoms. The results of the calculations will serve to provide further insight into the basic nature of these fundamental atomic processes which are of importance in plasma physics, atmospheric, solar, and astrophysics, radiation physics and for studies of the transport of energy from the site of thermonuclear reaction.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0028, A PROGRAM OF RESEARCH IN FAST ION SPECTROSCOPY

H.G. Berry, University of Chicago, School of Physical Sciences, Dept. of Physics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (PHY78-27635)

Studies will continue of the interaction of fast atoms with thin foils, and of the processes involved as the atoms pass through the surface into vacuum. In addition, the scattering of atoms from surfaces at oblique angles will be studied. A model will be constructed to describe the collision processes involved.

This work is a continuation of that supported by NSF Grant PHY76-81960A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0029, SYNCHROTRON RADIATION STUDIES OF MATTER

F.C. Brown, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR76-20644)

High-resolution measurements of photoabsorption cross-sections will be extended to the carbon, oxygen, and nitrogen K edges in simple polyatomic gases. The experiments will be carried out using a new ultrahigh vacuum monochromator recently installed at the Stanford Synchrotron Radiation Project. The results will be compared with at threshold calculations of the highly excited states of molecules using ab initio theory. It is expected that the theory of extended absorption fine structures can be applied far above threshold. In addition, extreme ultraviolet photoabsorption experiments will be carried out at the Physical Sciences Laboratory, Stoughton, Wisconsin. These will include studies of the selenium 3d-level absorption threshold in layer type titanium di-chalcogenide crystals with controlled transition metal excess.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0030, HIGH-MAGNETIC-FIELD SUPERCONDUCTIVITY AND MAGNETISM IN TRANSITION METALS AND ALLOYS

R.R. Hake, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DMR77-10545 A02)

Research begun under NSF grant No. DMR7509940 will be continued and extended. A broad experimental program in the study of high magnetic field superconductivity in the transition-metal alloys will be undertaken and a major part of the program will involve the relationship between superconductivity and magnetism. Three areas of study are: 1) fluctuation effects and Type II superconductivity, 2) normal state electronic properties of disordered transition-metal alloys, and 3) spin glasses and Kondo systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0031, APPLICATION OF SOFT MODE ANALYSES TO THE LATTICE DYNAMICS OF DNA AND RNA HELICES

E.W. Prohofsky, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR7820602)

Research previously supported by DMR7414367.

This project is a theoretical study of the dynamics involving mass displacement of the DNA and RNA helices. In particular those atomic motions which involve change in shape of helices will be studied. Such changes in shape are brought about by changes in environment or by interaction with biological molecules. It is believed that these changes in shape are involved in the biological functioning of these macromolecules. The method used is that of soft mode analysis originally used to study displacive phase change in crystalline solids. The method involves calculating the onset of instabilities in the vibrational behavior of a system which leads to changes in shape. A necessary part of this project is the development of accurate models of the vibrational behavior of the helices. Methods will be developed and used on the refinement of the vibrations from observations of the infrared absorption and Raman scattering DNA and RNA. The effect of counterions and water of hydration on the vibrations as well as on the shape is to be investigated. The previous successful theory for the B to A DNA change is to be improved and extended to other DNA systems.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0032, EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF INTERACTION OF INTENSE RADIATION WITH ATOMS

S. Earkiel, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (PHY79-09739)

This research program is concerned with experimental and theoretical investigations of atom-field interaction and related phenomena. This includes the development of an ultra stable cw dye laser which is essential for probing the incredibly narrow features recently uncovered in multi-level interactions, the experimental study of the behavior of 3-level and 4-level system in weak and intense fields, theoretical studies of bistability which may lead to some experimental investigations, and some theoretical calculations of the behavior of multi-level systems in the presence of Doppler and collisional broadening. Finally, some high precision spectroscopy on a dense cold beam of hydrogen is proposed.

This research is a continuation of that previously supported under NSF grant PHY77-07156A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0033, SCATTERING SPECTROSCOPY OF LIQUID CRYSTALS

O.D. Lister, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-23555)

Liquid crystalline materials have phases with varying degrees of order intermediate between the total lack of long-range order in liquids and the nearly complete order of crystalline solids. The rich diversity of phases present in these systems affords an opportunity to elucidate the phenomenon of melting and to provide fundamental understanding of why various condensed phases of matter exist and have the properties they do.

Quasielastic light scattering from the normal modes resulting from long range orientational ordering is combined with ultra high resolution X-ray scattering spectroscopy to examine simultaneously positional ordering and its interaction with the orientational order of the molecules in smectic -A, smectic C, and the well ordered smectic B-like phases of liquid crystals. Picosecond time resolved spectroscopy is used to study molecular motion. Recently developed techniques in submicron technology will be used to study the interaction of liquid crystals with surfaces and to prepare well aligned samples of the various phases. The results are expected to provide valuable information on the properties of liquid crystals as well as insight into the role of symmetry and spatial dimensionality in determining which phases of condensed matter can exist in nature. They should be relevant also to lower dimensional physics. In particular, they should aid in understanding the phenomenon of melting in two dimensions. This is a continuation of work supported by DMR76 18035. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, LIGHT SOURCE PROJECT

W. Parkinson, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31A-4A50-02)

Initiated plans to extend our atomic and molecular spectroscopy program to include quantitative measurements of the basic parameters of highly ionized atoms such as excited-state lifetimes, fluorescence decay branching ratios, wavelengths and collision and absorption cross sections. Initiated this work with a program to develop a new spectroscopic source of multiply ionized atoms that will possess several unusual features that are expected to eliminate many of the uncertainties that are associated with the more conventional sources. The new device will be built around a high-current hot-cathode oscillatory discharge ion source that was developed by G.S. Mavrogenes, W.J. Ramler and C.B. Turner at the Argonne National Laboratory as an adjunct to the design of a high-power heavy-ion cyclotron.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

8.0035, EXPERIMENTAL STUDY OF THE PHYSICAL AND ELECTRONIC PROPERTIES OF LIQUID TRANSITION METALS AND TRANSITION-LIKE METALS AND ALLOYS

J.B. Van Zytveld, Calvin College, Undergraduate School, Dept. of Physics, *1331 Franklin St. S.E., Grand Rapids, Michigan* 49506 (DMR79-09969)

Certain electronic and physical properties of solid and liquid transition metals and transition-like metals will be measured at high temperatures. Experiments include: measurements of resistivity and thermopower of the iron series transition metals from room temperature to above their melting points: measurements of resistivity and thermopower of solid and liquid europium and also the liquid allow strontium-barium; measurements of the density of liquid europium and ytterbium, and also of the liquid alloys magnesium-calcium, magnesium-strontium and magnesium-barium. These measurements will permit tests of recent theoretical work on the electronic and thermodynamic properties of liquid metal systems.

This is the first year of a three-year continuing grant; research was previously supported by DMR 7705213.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, IONOSPHERIC PLASMA PROCESSES

R. Sudan, Cornell University, Ithaca Campus, Lab. of Plasma Studies, *159 Sapsucker Woods Rd., Ithaca, New York* 14850 (DN980183; N00173-77-C-240)

The DOD is becoming increasingly dependent upon satellite systems for communication, surveillance and navigational purposes. It has become increasingly evident over the past few years that turbulent structure developing in the ionosphere can adversely affect the transmission of satellite signals. This affect manifests itself in fluctuations in the phase and amplitude of the transmitted signal. The objective of the current program is to assist in identifying the cause and characterizing the properties of the relevant ionospheric plasma turbulence. This information is needed in order to provide prediction of satellite systems performance.

Modern theories of strong plasma turbulence are employed to characterize turbulence in the ionized component of the E and F regions on the ionosphere. The results of these calculations are compared with numerical studies performed at NRL and with radar data taken in the field.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0037, THERMAL CONDUCTIVITY OF CONFINED HELIUM-4 AT THE SUPERFLUID TRANSITION AND SPECIFIC HEAT OF HELIUM-3 ON THE SURFACE OF HELIUM-4

F.M. Gasparini, State University of New York, Buffalo Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *3435 Main St., Buffalo, New York* 14214 (DMR77-11325 A01)

This is a continuation and extension of research supported under NSF Grant No. DMR-7711325. Thermal conductivity experiments will be performed on liquid helium confined to dimensions of the order of, or less than, 200A. Such data obtained in the region of the lambda transition, will test current ideas with regard to finite-size scaling effects on the thermodynamical properties of this unique quantum fluid. Heat capacity studies of helium-3 films on the surface of helium-4 confined in 2000A nucleopore filters will continue. In this work a helium-4 film (30-50A thick) is initially formed, upon which helium-3 is deposited to produce a film between 0.05 and 1.0 atomic layers. These helium-3 films behave as two-dimensional gases and provide readily available systems for the use of specific heat techniques

to study two-dimensional phase transitions--a topic of high scientific interest.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0038, PHYSICS AND TECHNOLOGY OF MATERIALS

N. Spielberg, Kent State University, School of Arts & Sciences, Dept. of Physics, *Hilltop Dr., Kent, Ohio* 44240 (SER78-00596)

Three new courses will be developed as an integrated introduction to materials science for Technology and other students, as well as for specialists. Prerequisites for these courses are one year of introductory physics and two quarters of calculus. The first course covers the application of selected concepts from modern condensed state physics to the electrical, magnetic and optical properties of solids. The second and third courses will deal with material science and physical metallurgy. The courses will be designed to maximize student comprehension of the ways in which basic physical concepts contribute to understanding and utilization of the technical properties of materials. The project calls for (1) intensive joint development by Physics and Technology faculty, review of applicable pedagogical material, and design of evaluation procedures during the first summer of the program; (2) teaching of the courses with ongoing evaluation and minor revision during the following academic year; (3) major revision as required during the second summer; and (4) a second round of teaching to establish the courses permanently in the curriculum. With the present student body makeup, 40 or 50 students per year will be served. The courses should also be suitable for evening and extension students. The detailed lecture notes and other material developed should be of value for ongoing use in these and other courses.

SUPPORTED BY U.S. National Science Foundation, Directorate for Science Education, Div. of Science Education Resources Improvement

8.0039, THEORY OF CRYSTALLINE ELECTRONS IN MAGNETIC FIELDS

G.H. Wannier, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DMR79-04837)

Research previously supported by DMR7706736.

Theoretical research on the behavior of the electronic structure of solids under the influence of a magnetic field. This theory is well understood in the weak and strong field limits. This research will deal with the problem in the intermediate region, i.e., between 10 Kilogauss and 10 Gigagauss. The theory will be developed with the aim of understanding the extra fine structure superimposed on the simple picture of an electron in a magnetic field. The difficulties of handling the irrational field case will be avoided by concentrating on the calculation of the density of states. Also, the possibility of approaching the problem by means of localized (Wannier) functions will be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0040, PROPERTIES OF THE GENERALIZED SCHOTTKY BARRIER

H.K. Henisch, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (INT77-04433 A01)

This research is concerned with metallic contacts on semiconductors and, in particular, with calculations relating to the properties of Schottky barriers. Traditional work in this area has involved many simplifying assumptions that are customarily introduced in order to make analytic solutions possible. In contrast, the complete transport equations can only be solved numerically by computer. The research in progress under this grant aims at such solutions for semi-infinite contact systems of arbitrary barrier height, barrier mobility ratio, barrier lifetime, and dielectric relaxation time, with special reference to the interaction between the barrier region itself and the bulk region immediately adjoining. Solutions free from these restraints have never been reported. The project also examines the consequences of current-dependent charges in surface states, and the special conditions which prevail at semiconductor-semiconductor contacts. These considerations are relevent to solar cell efficiency and its optimization.

The project represents the continuation of a collaboration between physicists and electrical engineers at Penn State University and the Venezuelan Institute for Scientific Research (previously funded by grant INT 77-04433 and the Venezuelan National Council for Scientific Research).

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0041, PIEZO-OPTIC PROPERTIES OF CERAMIC MATERIALS

K. Vedam, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR76-82074)

This research will be concerned with two aspects of the piezo-optical properties of ceramic materials at high pressure, namely: (1) variation of the refractive index of solids with pressure to 100 kbars, and (2) variation of the optical rotary dispersion and circular dichroism in crystals with pressure. The materials to be studied include paratellurite (TeO2), hexagonal selenium, the gyroelectric material 5P50 3GeO2, and benzil. In all of these crystals, the desired optical absorption occurs at or near the visible spectrum, which should facilitate the experiments on effects of pressure and temperature on the optical properties.

The studies are of theoretical interest and also will be of value from the technological point of view, such as the development of suitable materials for a variety of acousto-optic device applications.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0042, EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE TRANSPORT PROPERTIES OF SEMICONDUCTING SURFACE INVERSION LAYERS

P.J. Stiles, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DN675521; N00014-76-C-0894)

As solid-state devices such as field-effect-transistors that are found in naval electronic systems become more compact and more surface oriented in their electrical transport behavior, they begin to be dominated by surface related effects. This program will seek to find better understanding of the surface related effects on the electrical properties of the compound semiconductor materials that make up the devices.

The investigators will seek a theoretical and experimental understanding of the physics of charge transport in compound semiconductor surface inversion layers. Experimental work will address the formation of good insulators on the surfaces and will characterize the transport in the surface inversion layer through mobility and magnetic transport effects. Theoretical studies will consider effects of exchange correlation, resonant screening, and final state interactions on the subband separation, and the effects of finite magnetic fields on effective mass and effective g value. A new consideration is the idea of surface channel tunneling as it relates to a FET device used to study subband properties.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0043, DYNAMIC MEASUREMENTS IN LIQUID CRYSTALS

S.V. Letcher, University of Rhode Island, School of Arts & Sciences, Dept. of Physics, *Kingston, Rhode Island* 02881 (DMR79-06785)

Knowledge of the properties of liquid crystal phases and of the ion transitions between them has increased dramatically

over the last decade. Many aspects of their dynamical properties, especially near phase transitions, remain unclear. For example, both theoretical and experimental studies have yielded contradictory results for shear viscosities near phase transitions. Further careful experiments on dynamical properties, therefore, are needed.

In the present work are studied the shear properties of oriented liquid crystal phase. Particular attention is given to the dynamics of the smectic A-smectic B phase transition and to the reentrant nematic phase. The former problem has been stimulated by the apparent similarity of the A-B transition to two-dimensional melting and the recent theoretical advances in that field. Shear impedance changes and shear stresses at very low rates are measured. Measurements of the anisotropic viscosity of the reentrant nematic and its relation to those of the high temperature nematic and intermediate smectic phases promise to be a good test of the model for that system.

Renewal of work supported by DMR77-07813.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0044, REACTIVE COLLISION PROCESSES INVOLVING ATOMS, MOLECULES AND SURFACES

N.F. Lane, Rice University, School of Natural Sciences, Dept. of Physics/Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (C-540)

Theoretical calculations have been performed of rates and cross sections for a number of collision processes involving molecules, atoms, and electrons in gases and near metal surfaces. These rates are important in the kinetic modeling of laser media and high- and low-temperature plasmas. The theoretical studies include: vibrational and rotational energy-transfer in electron-CO2 collisions; determination of the effects of plasma screening on inelastic electron-ion scattering in high-temperature, high-density plasmas; extension of charge-transfer studies in He ions collisions with atomic hydrogen to include 'continuum' correlation effects; energy transfer in collisions of excited atoms and molecules with metal surfaces; energy transfer in slow collisions of exited- and ground-state rare-gas atoms; self-consistent LCAO/MO (local exchange) calculation of energies and wave functions for H in a nickel crystal. A new theoretical program has been initiated to study: (1) inner-shell photoionization of large molecules by a hybrid R-Matrix/Multi-Scattering approach, and (2) electronic excitation of molecules (and molecular crystals) by 'Super-thermal' neutron scattering.

SUPPORTED BY Robert A. Welch Foundation

8.0045, ROCKET-BORNE STUDY OF AURORAL ELECTRIC FIELDS AND CURRENTS

E.A. Bering, University of Houston, School of Natural Sciences & Mathematics, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (ATM77-21462 A01)

Data on the electrodynamic structure of the aurora borealis taken during the flight of sounding rocket Terrier-Malemute 29.007 UEX will be analyzed. The data include measurements of the DC electric field, AC electric field, plasma density and plasma temperature. Correlations and comparisons will be made with a variety of data from other instruments on the rocket and from ground based sources. The rocket trajectory carried over an auroral arc and, thus, good data was obtained on an important auroral form. The overall aim of the research is to deduce the particle behavior, current density on electro-magnetic fields associated with the arc.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0046, CONJUGATE MAGNETOSPHERIC ELECTRIC FIELDS, MAGNETOSPHERIC ULF RADIATION, AND MODULATIONS OF ELECTRON PRECIPITATION (ABBREV)

E.A. Bering, University of Houston, School of Natural Sciences & Mathematics, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DPP79-09236)

Five electric field detectors will be constructed and added to the University of Maryland's X-ray balloon payloads planned for flight from Siple Station, Antarctica, in January 1980 to study interactions of very-low-frequency and ultra-low-frequency waves with particles in the magnetosphere.

The data obtained by the electric field detectors on these flights will be used to investigate the interaction between energetic electron precipitation and ultra-low-frequency waves.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

8.0047, THEORETICAL INVESTIGATION OF INVERSION LAYERS IN METAL-OXIDE-SEMICONDUCTOR INTERFACES 15873-P

C.S. Ting, University of Houston, School of Natural Sciences & Mathematics, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DAÓG9030; DAAG29-79-C-0039)

To study the subband energy levels of the metal-oxide-semiconductor interface Auger-type transitions affecting infrared optical absorption involving these levels, their temperature dependence, the consequences of intervalley electron-electron scattering on electron mobility, and the dependence of effective quasi-particle electron mass on the density of sodium ions drifted to the interface as evidenced by cyclotron resonance. Relevance - improved understanding of these interfaces found in field-effect transistors widely used in military and industrial devices has the potential of significantly impacting the future of semiconductor device technology.

The Green's function method of many-body theoretical physics will be used, particularly involving the random phase approximation and the memory-function formalism.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0048, HIGH-PRESSURE PHASES OF COPPER CHLORIDE AND HIGH TRANSITION TEMPERATURE SUPERCONDUCTORS

C. Chu, University of Houston, School of Pharmacy, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DMR79-08486)

This research is a continuation and extension of work supported under NSF grant No. DMR-7723204. A broadly based experimental program involving the use of ultra-high pressures and low temperatures will investigate the electrical, magnetic, thermal, optical and superconducting properties of a variety of alloys and compounds. Initial efforts will concentrate on a detailed study of the high pressure phase of copper chloride. Concomitant with this work, will be a study of the effect of ultra-high pressures on the magnetic properties of metallic elements and compounds as well as on the ternary molybdenum chalcogenides.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0049, ANOMALOUS SOUND PROPAGATION IN METALS

J.D. Gavenda, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR78-25232)

The recently discovered phenomenon of anomalous sound propagation in copper by conduction electrons in extended orbits will be studied by measurements with various geometries of ultrasonic wave vector and polarization. The dependence of

this phenomenon on the properties of the Fermi electrons in different metals will be investigated and a quantitative theoretical model will be developed on the basis of the experimental results. Phases of the project will include: 1. the determination of the validity of pulsed-ultrasonic experimental data in the presence of extended-orbit resonances, 2. a better understanding of the mechanisms involved in direct generation of ultrasound by electromagnetic fields, 3. the reduction of ambiguity in the interpretation of magnetoacoustic data, 4. the possible explanation of anomalous microwave propagation by open-orbit electrons, and 5. the possibility of ultrasonic amplification through coupled extended-orbit resonances. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0050, TOPICS IN THEORETICAL PHYSICS

C.E. Carlson, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (PHY79-08240)

Research will be done in theoretical physics to enhance our understanding of elementary particles and of the nucleon-nucleon interaction in nuclear physics.

The theoretical problems to be investigated concern the hadronic production of charmed particles, extraction of Gen from elastic e-d scattering data, calculation of the long range nucleon-nucleon interaction from quark confinement models, and determination of the sign of the NN interaction at short distances.

This is the first two years of a four-year continuing grant, previously supported under NSF grant PHY77-07409.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0051, THEORETICAL MEDIUM ENERGY NUCLEAR PHYSICS

J.V. Noble, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (PHY79-01672)

This work is in the field of theoretical physics, with particular emphasis on study of nuclear interactions. Specific topics which will be examined include: 1) Implications of wave function orthogonality for improved DWBA calculations. 2) Relativistic effects in medium energy reactions. 3) Characterization of nuclear collective motions in terms of coupled meson and nucleon fields. 4) Relativistic three body dynamics. 5) Measurement of the mesonic component of nuclei.

This is the first year of a three year continuing grant, previously supported under NSF grant PHY76-84374A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0052, U.S.-U.S.S.R. COLLABORATIVE PROJECT IN ATOMIC PHYSICS

R. Geballe, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (PHY76-24196 A01)

Diagnostic equipment for atomic beams studies will be provided. This equipment is necessary for the research program already initiated under this grant, which will study photodetachment of certain negative ions.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, LANDSAT STUDY OF URBAN CHANGE IN JACKSON, MISSISSIPPI

M. Lang, Jackson State University, School of Liberal Studies, Dept. of Social Science & Educational Geography, *1325 Lynch St., Jackson, Mississippi* 39217 (NSG 736)

This project has three components: 1) Applied research utilizing Landsat data for monitoring, assessment and analysis of changing land use patterns along an interstate highway beltway in Jackson, Mississippi. 2) Development of Landsat data analysis capabilities at Jackson State University. 3) Establishment of research ties among geographers at predominantly minority institutions to encourage the use of Landsat data in research and instruction at their respective college or university.

PROGRESS/CURRENT PLANS: Planning and initial efforts are underway in the research phase of this project. Landsat imagery of the study area, collected during 1976 and 1978, has been obtained and analysis has begun. Field studies to be used for verification of the Landsat data have been initiated. Finally, efforts are underway to augment existing central computing facilities at Jackson State University to allow for analysis of digital Landsat data.

During October 1979 a workshop was held at Jackson State University. The purpose of the workshop was to bring together geographers from predominantly minority institutions to discuss ways of improving geography programs at these universities. Participants outlined research topics which could be undertaken jointly. These included: 1) Geographic and social impacts of community development efforts in major urban areas of the South. 2) Economic impact of loss of black owned farmland in the South - using Landsat data. 3) Changing ethnic residential patterns in major cities of the South.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

9.0002, STUDY OF GENERALIST VERSUS SPECIALIST CONCEPT IN PERSONNEL MANAGEMENT

C. Sampson, State University & Community College System of Tennessee, Tennessee State University, School of Arts & Sciences, Dept. of Political Science, *Nashville, Tennessee* 37203 (NAS 9-15862)

Effective personnel administration, i.e., the procurement, development, and utilization of an organization's human resources is the key to successful management. Regardless of what product or service an organization provides and no matter what size, age, or location, it must procure human resources to remain viable. Further, if the organization is to survive, it must design programs to develop human resources to their fullest capacities and maintain ongoing worker commitment.

The practice of personnel administration faces three general demands. First, it must help the organization cope with a changing environment, with constraints and opportunities developed externally, such as those stemming from public law and labor unions. Second, it must cooperate with other line and staff areas to achieve the organization's goals. It must secure the respect, trust, and confidence of the members of these units in order to effectively implement its programs. Third, it is required to respond to certain serious human resource management problems organizations face.

This study will examine all areas considered in a 1968 study of the JSC personnel organization, and will compare JSC with other agencies. It will examine the role of the Personnel Management Specialist in contemporary generalist and specialist operations. These two approaches will be compared and contrasted, and their relevance to JSC will be analyzed. Included in the report will be a discussion of the impact of the revamping of the Civil Service Commission.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

9.0003, SPACE FLIGHT DESIGN AND DEVELOPMENT STUDIES

H.E. Blackwell, Texas Southern University, School of Arts & Sciences, Dept. of Physics, *3201 Wheeler Ave., Houston, Texas* 77004 (NAS 9-16054)

The contract includes work in two areas. Initially, effort will be concentrated on the review, criticism, testing as re-

quired, and preparation of course material for training of flight design paraprofessionals. The course materials will be developed from initial materals prepared at JSC. Periodic reviews will be scheduled for the purpose of discussing progress and problems. The goal is a modular set of instructions incorporating innovative educational techniques which can be used with minimum preparation time by the instructor, and which will insure consistent training for all students.

The second phase will be preliminary development of a remote manipulator arm real-time simulator. TSU will review engineering data and algorithms, devise improved algorithms if required, and implement these algorithms into a university computer facility. Technical exchanges and reviews will be scheduled on a regular basis. The long-range goal is a system which could be used for training and flight design.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

9.0004, AN EVALUATION OF THE LANGLEY LEARNING CENTER

A.E. Boese, Virginia State College, Graduate School, Dept. of Economics, *Petersburg, Virginia* 23806 (NAS 1-16079)

N.A.S.A.-Langley has established a Learning Center as an alternative educational method to supplement its employee training efforts. This method of training offers employees individualized learning in those instances where it appears to be more convenient, meaningful, and cost effective.

The objective of Virginia State University's contract with N.A.S.A. is to evaluate the effectiveness of the training function of the Learning Center. This evaluation will be made possible through four related projects: (1) The development and validation of a means of surveying the job related training needs of the Langley Research Center. (2) The development and validation of a means of evaluating the learning experience of Learning Center participants. (3) The development and validation of a means of surveying employee satisfaction with the Learning Center. (4) The development and validation of a method of evaluating the value of the Learning Center in relation to the total Research Center.

The study is intended to eventually help increase the effectiveness of the Learning Center, and the productivity of the participants and the Research Center.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, USE OF THE CHAPPUIS BAND FOR DETERMINATION OF MODERN AND HISTORICAL STRATOSPHERIC OZONE LEVELS

R.J. Angione, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Astronomy, *5402 College Ave., San Diego, California* 92115 (NSG 1430)

A program is underway to optimize observations and data reduction techniques to use absorption of sunlight by the Chappuis band for the determination of contemporary and historical amounts of ozone in the earth's stratosphere. Observations made by the Smithsonian Institution's Astrophysical Observatory during the period from 1905 to 1955 are being analyzed to produce long-term baselines for Table Mountain, California, and Mount Montezuma, Chile. Shorter length baselines will be determined for seven other sites in North and South America and Africa. Ozone amounts will be reported on an absolute scale that is independent of, but comparable with, results from Dobson spectrophometry. Modern observations in the wavelength range 0.40 to 0.95 microns are being made of the sun during the daytime with a filter wheel radiometer and of bright stars at night with an existing astronomical telescope and photometer.

The filter wheel radiometer was taken to Mauna Loa Observatory and intercompared with the Dobson. The Chappuis band results were systematically lower by 0.17%. To date we have baseline ozone measurements from 1920 to 1950 for Table Mountain, California, and Mount Montezuma, Chile.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

10.0002, THEORETICAL STUDIES OF SOLAR WIND DYNAMICS

T. Kilpatrick, California State University & Colleges, San Francisco State University, School of Science, Dept. of Physics & Astronomy, *1600 Holloway Ave., San Francisco, California* 94132 (NCA 2-660806)

The hot outer atmosphere of the sun expands supersonically into interplanetary space. This hydrodynamic flow, called the solar wind, streams past Earth causing such effects as the northern and southern lights, magnetic storms, and perhaps influencing the weather on the Earth. However, the physical mechanisms which act to heat and accelerate high-speed streams in the wind have not been clearly elucidated. Hydromagnetic waves can transfer momentum to the wind, and large fluxes have been observed in high-speed streams by spacecraft borne instruments. The proposed research will examine the role that hydromagnetic waves play in the acceleration and heating of the solar wind. The results of these investigations will be reported in published papers.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0003, IRRADIATION EFFECTS ON SURFACE OF THE MOON, MERCURY, ASTEROIDS & OTHER AIRLESS SOLAR SYSTEM BODIES DUE TO SOLAR HIGH ENERGY & COSMIC RAYS

M.S. Spergel, City University of New York, York College, Undergraduate School, Dept. of Physics, *150-14 Jamaica Ave., Jamaica, New York* 11432 (NSG 7454)

Under study is both the feasibility of determining planetary composition by remote sensing of galactic cosmic ray induced gamma rays and the prediction of rare earth abundances within the lunar soil. Investigations of secondary neutrons induced in the lunar soil and in planetary and cometary soils have indicated that the energy spectra of the neutrons and their secondary gamma rays are determined principally by the soil composition.

Various production mechanisms for the induced neutrons were considered. The neutron flux is then calculated using a 100 energy group neutron transport code. The calculations are carried out in collaboration with Drs. P.W. Levy and O.W. Lazareth of Brookhaven National Laboratories and utilize recent neutron and gamma ray cross sections. The calculations were performed assuming isotopic and anisotopic neutron scattering.

The gamma ray fluxes were calculated from the neutron flux distributions generated by the galactic cosmic rays primaries. The gamma ray fluxes use a transport code.

It would appear that galactic cosmic ray fluxes will produce a gamma ray flux at the surface that is measurable by 'state of the art' instrumentation. In fact, if values of 10 minus to the 6th power ph/sq. cm Mev sec Str are measurable, it should be possible to measure the induced gamma rays out to 30 lunar radii from a surface.

Soil composition, rather than the characteristics of the secondaries appear to be the dominant factor shaping the gamma energy flux. The prompt gamma ray energy spectrum appears to contain prominent maxima indicative of certain nuclei. Thus, the prompt gamma ray flux measurements may provide a practical technique for determining soil composition in fly-by missions.

The study is continuing to examine the variation of secondary flux for compositional variation.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0004, THEORETICAL PROBLEMS OF SPIRAL GALAXIES

C. Yuan, City University of New York, City College, Graduate School, *Convent Ave. & 138th St., New York, New York* 10031 (NSG 2348)

The density-wave-theory has proven to be the most successful theory of explaining the spiral structure of disc galaxies. One objective of the present research is to further strengthen the theory by solving the eigen-value problem recently formulated by Lin and Lau to find spiral modes of density waves. The short-range goal is to develop a numerical method which is capable of calculating eigen-values and modes for a large class of galactic models. In particular, we are interested in confirming the asymptotic theory put forward by Lin and Lau and obtaining the spiral modes for the Milky Way. The long-range goal of this study is to establish a dynamical classification of spiral galaxies. The problems of discretizing the singular integral equation of the Poisson's type and treating the radiation boundary condition at infinity are resolved. We are in the process of establishing methods to search the eigen-values of a complex algebraic system.

The second objective of the research is to study the evolution of the abundance distribution of the gas in spiral galaxies, especially for galaxies like the Milky Way which has an inner Lindblad resonance. The gas will redistribute itself in the course of time as it is continuously depleted into star formation by the triggering mechanism of the large-scale shock along spiral arms. We shall use the Godunov Method to solve the gas dynamics equations with the mass loss derived from the density-wave theory. The first order numerical scheme which can handle the geometric singularity at the center and the source terms is being developed. Our immediate aim is to obtain the time-dependent axisymmetric solution. However, we intend to extend the problem to two dimensions in the future.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0005, THEORETICAL STUDIES OF AURORAL AND MAGNETOSPHERIC PHENOMENA

D.W. Swift, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-14897 A01)

This grant will support a broad range of theoretical studies directed toward answering fundamental questions about the auroral magnetospheric substorm and the mechanisms of energy flow from the solar wind to the aurora. The work will consist of an interplay of analytical studies and numerical modelling of plasma processes.

Specific projects planned are: 1. an investigation of the mechanism for the development of large localized potential differences across magnetospheric field lines; 2. an investigation of energy transfer processes through the northern and southern boundaries of the magnetospheric tail; 3. an improved V-shock model to calculate perpendicular energization of oxygen ions; and 4. an investigation of wave-particle diffusion processes in auroral electron beams.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0006, PLANETARY GEOSCIENCE CONSORTIUM

L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Branch of Astrogeologic Studies, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (9580-01327)

Although the primary emphasis is shifting away from lunar studies to other planets, two lunar activities will continue. First, Wilhelms will complete his two-year effort to compile a new map of the maria based on all available consortium data and second, phase-angle-color studies by Soderblom will be finished. The prime emphasis will be to collect and reduce a variety of Mercury and Mars data coming available (crater density, color variation, geology, for both; IRTm, MAUD, geomorphic and structural maps, gravity and others for Mars). Additionally, pilot studies will begin late in FY 79 for reduction, portrayal and correlation of Venus Pioneer and Voyager data.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0007, SEARCH FOR LOW MASS COMPANIONS OF SOLAR-TYPE STARS USING A FABRY-PEROT SPECTROMETER

K.M. Serkowski, University of Arizona, Lunar & Planetary Lab., Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (AST78-23107)

Since August 1977 an echelle spectrometer with a Fabry-Perot wavelength calibration has been in operation on the Catalina 154-cm telescope. It has measured stellar radial velocities with accuracy of about plus or minus 30m/sec, considerably higher than conventional instruments. The instrument is used for a search for low-mass (0.001 to 0.1 solar mass) companions around solar-type stars. The purpose of this search is to detect the Jupiter-like planets and to estimate the frequency of single stars among solar-type stars, essential for estimating the frequency of extrasolar planetary systems and for explaining the origin of the solar system.

It is planned to include in the search all those 52 solar-type stars brighter than V equals 5.5 mag. for which Abt and Levy did not find evidence of duplicity or multiplicity. The present Digicon detector will be replaced by a 342 x 42 element intensified CID array, permitting observations of 9 echelle orders simultaneously and therefore increasing the limiting magnitude of the radial velocity meter to V equals 6.0 mag. A laser calibration will be installed which should increase the accuracy of the radial velocities to above plus or minus 15m/sec for a single observation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0008, SPECTROSCOPIC STUDIES OF QUASISTELLAR OBJECTS

P.A. Strittmatter, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST77-23055 A01)

A wide variety of projects have been investigated in order to understand the nature of the line-formation regions in quasistellar objects (QSO's). In the past years discoveries have been made that certain absortion systems with redshifts both greater and much less than the emission redshift must originate at distances so far from QSO's that the absorbing material cannot be directly associated with the quasar. In addition, the results of studies of absorption in low-redshift QSO's are consistent with the redshifts originating in intervening galaxies. Certain Seyfert galaxies and HII regions have been studied and interesting discoveries concerning the nature of the continuum radiation from the nucleus of the galaxy NGC 1068 and the hot star lambda Ori A were made.

The spectroscopic work on low-z QSO's will be continued for the next two years in order to find absorption systems that may arise in intervening galaxies which can be directly photographed in the red region of the spectrum and studied spectroscopically. Absorption systems in high-z quasars will also be observed at high resolution in order to determine element abundances and whether line-splitting is caused by radiation pressure ('line-locking'). Emission-line regions will be modeled theoretically in order to determine whether the line profiles can be accounted for in terms of radiation pressure. Finally, low-dispersion work on the identification of Molonglo sources will be continued, as well as the initiation of a new discovery program of radio-quiet high-redshift QSO's using a converging beam transmission grating. This is a continuation of grant AST 76-22991.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0009, OBSERVATIONAL PROGRAM IN GROUND-BASED INFRARED ASTRONOMY

G. Neugebauer, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST77-20516 A01)

An infrared astronomy program using the telescopes of the Hale Observatories will be carried out. The program emphasizes the unique capabilities of the 200 inch telescope--high spatial

resolution with high signal-to-noise--combined with high-sensitivity photometric equipment developed over the past years. Highest priority will be put on high spatial resolution studies of galactic nuclei and point sources using the 200 inch; this can determine size structure with an uncertainty of approximately 0.1". An increasing emphasis is being placed on high spatial resolution, medium spectral resolution spectroscopy. The telescopes at Las Campanas, Chile, and Mauna Kea, Hawaii, will also be used.

The specific scientific programs which will be emphasized include the continuation of the study of molecular hydrogen with high spatial resolution. The systematic study of the infrared energy distributions of quasars will be continued along with low-resolution spectroscopy to identify atomic lines which are redshifted into the near infrared in comparison with lines which are redshifted into the visible. Several extragalactic and galactic ionized hydrogen (H II) regions will be studied in addition to the observations of regions of star formation within the Galaxy.

This is a continuation of research begun under NSF grant AST 74-18555 A2.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, LABORATORY STUDY OF NEUTRAL POINT SOLAR FLARE PROCESSES

R.S. White, University of California, Riverside Campus, Inst. of Geophysics & Planetary Physics, *Riverside, California* 92502 (ATM76-23463 A02)

The primary objective of this grant is the experimental investigation of the dynamic behavior of plasmas in the neighborhood of an x-type magnetic neutral point, and the process of reconnection of magnetic field lines. The purpose of this effort is to clarify the physical processes that take place in solar flares, substorms of the earth's magnetosphere, and other manifestations of plasma dynamic behavior and field line reconnection in complex magnetic field systems containing x-type magnetic neutral points.

The investigators will study magnetic field line reconnection with a flat plate Double Inverse Pinch Device (Mark IV) and three-dimensional, double-dipole configurations. They measure the fluxes and energy spectra of accelerated ions and electrons, optical, microwave, and X-ray radiations, the magnetic field line configurations, reconnection rates, and energy dissipation rates. A major effort will be made to determine the conditions required to produce the remarkable transitions from ohmic to turbulent conductivity which have been observed. These sudden conduction mode transitions produce many phenomena that correspond to those in solar flares and magnetospheric substorms.

The overall aim of this work is to understand the process of magnetic reconnection and how it relates to realistic models of the solar flare and the magnetosphere substorm.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0011, AN INVESTIGATION OF MAGNETIC FIELDS IN PROMINENCES AND FLARES

J.M. Malville, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (ATM78-25059)

This grant will support an investigation of the role of magnetic fields in solar prominences and flares based largely upon data obtained with the Kitt Peak National Observatory (KPNO) magnetograph. Observational material which has already been obtained includes helium line magnetograms of disk filaments and hydrogen line magnetograms of limb prominences, both with spatial resolution approaching one second of arc. Major themes of the study will be the association between velocity fields and magnetic fields, electric current systems in the low corona, and the development of flare-like current sheets in prominences. New observations are measurements of magnetic fields in limb flares and high time resolution studies of flare-like events in prominences. The overall aim is to understand the magnetic/electric character of solar activity.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0012, INSTRUMENT FOR LONG DURATION OBSERVATIONS OF SOLAR P-MODE OSCILLATIONS

R.F. Howard, Carnegie Inst. of Washington, *1530 P St. N.W., Washington, District of Columbia* 20005 (AST78-20404)

This grant will support the purchase of data reduction and analysis equipment to be used in a program of seismic probing of the structure of the sun. Specifically, the motions of the surface of the sun will be measured on a regular basis in order to derive the variations with time of the rate of rotation of the surface and subsurface layers of the sun. In addition to studying solar rotation these observations will permit an investigation of other aspects of solar velocity fields such as possible acoustic oscillations generated by solar flares, meridional flows and variations in frequency and amplitude of the newly discovered p-mode oscillations. Such observations will improve our knowledge of how solar variations affect our terrestrial environment.

The equipment will be used in conjunction with the 60-foot solar telescope on Mt. Wilson with which the five minute oscillations of the sun were originally discovered. Practically all the observing time available on this instrument will be dedicated to this program. Large blocks of observing time are necessary to the success of the project. The proposed data acquisition and analysis system will have the necessary speed and capability to collect and store large amounts of data and to carry out the required data reduction tasks which are central to this project.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0013, OBSERVATIONAL STUDIES OF THE ATMOSPHERES OF EARLY-TYPE STARS

S.C. Wolff, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Astronomy & Physics, *2444 Dole St., Honolulu, Hawaii* 96822 (AST77-27404 A01)

The analyses of the spectra of early type stars are essential to studies of galactic structure, interstellar matter, stellar nucleosynthesis and evolution. Within the last decade our understanding of atmospheric structure and line formation processes has reached the point where it appears possible to use the observed spectra to obtain reliable diagnostics of the conditions prevailing in the atmospheres of these early stars. This research will be devoted to carrying out an observational program designed to provide photoelectric measurements at high resolution of the spectrum of such stars. A study of the line profiles due to elements such as hydrogen, helium and carbon will be made in order to test the model atmosphere calculations, to provide data which will be used as an input for further improvements in the theoretical models, and to take advantage of the calculations already made to determine atmospheric parameters, rotational velocities, and helium abundances for early type stars.

This is a continuation of work originally supported under NSF grant AST77 27404.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0014, POSITIONAL STUDIES OF MINOR PLANETS

H.J. Wood, Indiana University, Bloomington Campus, Graduate School, *2805 E. 10th, Bloomington, Indiana* 47401 (AST79-08911)

Support is to continue a long-term scientific service project for positional and magnitude measurements of minor planets down to the 17th magnitude. In the program, 6,300 astrographic plates were accumulated using a 25cm astrograph during the period 1948-1966. Presently, positions are being measured on re-

quest for those objects which need orbit improvements to facilitate modern astrophysical observation or for those objects which may become 'critical', in danger of being lost because of poorly-known orbital elements. The Indiana Minor Planet Center responds to requests for astrometric positional measurements from scientists all over the globe. Dr. Brian Marsden at the Smithsonian Astrophysical Observatory, who coordinates the activities of several observatories through the International Minor Planet Center is the major user of astrometric positions of minor planets measured at Indiana. In addition, Dr. Paul Herget has developed a new program at Cincinnati to find newly discovered minor planets on plates where they were missed earlier. Professor Herget's program is a new source of requests for blinking and measurement on the astrographic plates. Indiana has the largest asteroid plate collection in the United States and thus provides a valuable service to groups active in minor planet research.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0015, CONTINUED SURVEYS FOR EMISSION LINE OBJECTS

T.J. Bohuski, Western Kentucky University, School of Science & Technology, Dept. of Physics & Astronomy, *Bowling Green, Kentucky* 42101 (AST78-01375)

The first part of the project will be a survey of emission line galaxies in the Hydra I and Centaurus clusters in an attempt to determine the luminosity function of such objects down to an absolute magnitude of M equals minus 13. Since many emission line galaxies appear to be experiencing a high rate of star formation, such data is useful for studying the time-dependence of the star formation rate within galaxies. The purpose of part two of this project is to examine the question of how the discovery rate of quasars depends on differences in the observers, the equipment used, and the identification criteria. Substantial variations in the discovery rate do appear to exist and understanding of why they do is necessary to a proper interpretation of quasar statistics. An objective prism survey of a region that is being surveyed independently by another group of observers will be carried out to find out how the discovery rate of quasars depends on the equipment used and other factors.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0016, INFRARED STUDIES OF PRE- AND POST-MAIN-SEQUENCE STARS

S.G. Kleinmann, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST78-27639)

This research will be devoted to observational studies of regions of active star formation. These studies will be based upon sources found in the United States Air Force mid-infrared sky survey. In order to provide detailed models of star formation, observations will be made aimed at determining the positions on the Hertzsprung-Russell diagram of objects evolving towards the main sequence and the density, temperature and velocity structure of matter surrounding the protostar. The observations will be made at the Kitt Peak National Observatory.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0017, THE GALACTIC DISTRIBUTION OF INTERSTELLAR ABSORPTION

R.J. Davis, Smithsonian Institution, Astrophysical Observatory, Optical & Infrared Div, *60 Garden St., Cambridge, Massachusetts* 02138 (310-4050-05)

OBJECTIVE: Obtain an improved determination of the galactic distribution of interstellar dust, and of variations in its extinction properties, in the wavelength range 1300 to 6000 angstroms.

SECONDARY OBJECTIVE: To complete the identification of stars having peculiar photometric properties in the above wavelength range, based on UBV, H-beta, and the Celescope ultraviolet photometry.

APPROACH: Obtain UBV and H-beta photometry for all stars in the Celescope catalog not already having UBV photometry, using telescopes and photometric equipment at Kitt Peak National Observatory (Davis) and at Cerro Tololo Inter-American Observatory (Deutschman and Schild). Determine variations in the interstellar extinction as a function of distance and galactic longitude and latitude for all stars in the Celescope catalog.

PROGRESS: Observations, data reduction, and preliminary data analysis are complete. We are preparing a paper for publication, most probably in the Astrophysical Journal Supplement Series.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0018, ACQUISITION OF EQUIPMENT FOR HELIUM LIQUEFIER AND RECOVERY SYSTEM

A.M. Goldman, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (DMR7810902)

A helium liquefier and gas recovery system will be purchased and installed to provide liquid helium for the scientific community at the University of Minnesota as well as for an off-campus institute, the Freshwater Biological Institute. Research requiring the use of liquid helium is carried out in a number of departments of the Institute of Technology and of the College of Biological Sciences. The most active areas of research are condensed matter physics, biochemistry, infrared astronomy, upper atmospheric physics and geomagnetism. Gas recovery will be expanded to include all participating laboratories.

SUPPORTED BY U.S. National Science Foundation, Div. of
Materials Research

10.0019, EQUIPMENT ACQUISITION - FRAPAS

J.A. Lockwood, University System of New Hampshire, University of New Hampshire, School of Liberal Arts, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM79-10543)

This grant will permit the acquisition of a Flight Readiness and Preliminary Analysis Support System (FRAPAS) for the neutron and gamma-ray balloon program at the University of New Hampshire. This system, consisting of such elements as a dual floppy disk, static and dynamic RAMS, terminals, tape transport, and a DEC writer, will enable diagnostic tests to be made on the balloon flight system. Complete system checks and calibrations can be made quickly. Real-time displays of all data can also be made.

A flexible ground support system is needed for the UNH neutron and gamma-ray detector systems because of the extreme complexity of the data acquired. The cosmic-ray isotope and electron measurements of Webber will also use this system. A frame of 18-4 bit words must be processed, two-dimensional matrices analyzed, and extensive checks made to ensure that the system is operating properly. The system will be used primarily with the UNH time-of-flight neutron and gamma-ray detector capable of measuring the fluxes, energy spectra, and angular distributions of neutrons and gamma-rays in the energy intervals from 2 MeV to 60 MeV and 0.5 MeV to 10 MeV respectively. The proposed balloon flights with this detector and the FRAPAS system will attempt to set limits on the diffuse cosmic gamma-ray flux from 0.5 MeV to 3 MeV, and determine the angular distributions and energy spectra of atmospheric neutrons from 3-60 MeV.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0020, CURRICULUM DEVELOPMENT IN ASTRONOMICAL TECHNIQUES

S.L. Sharpless, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (SER7900764)

A course in astronomical techniques is to be developed and implemented in the Department of Physics and Astronomy at the University of Rochester. The course will be designed to improve the capability of the Department and strengthen its offerings at both the undergraduate and graduate levels. The specific objects are two-fold: 1) to provide astronomy majors with a broader base from which to proceed into individual research projects, and 2) to improve the science training of pre-service teachers of science and mathematics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div. of Science Education Resources Improvement

10.0021, PHYSICAL NATURE OF COMETS

A.H. Delsemme, University of Toledo, School of Arts & Sciences, Dept. of Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (AST79-14789)

The program of establishing brightness profiles in the monochromatic light of different molecular, ionic and atomic emissions in comets will be continued. In particular, numerous brightness profiles will be established for Comet West, as a function of its heliocentric distance, from a sequence of spectrograms previously obtained in Toledo. The brightness profiles will be measured in two directions, sunwards and antisunwards. The program will be further developed from spectrograms, obtained either from ground-based observatories (in Toledo or elsewhere) for the major ions (like H, O or CO) and radicals (like CN or C) or to be obtained from space with the international Ultraviolet Explorer, (mainly for H, C and O) should a bright comet appear. This approach has provided the only direct observation known so far for the plasma behavior ahead of a comet, and will yield, therefore, a better understanding of its interaction with the solar wind. It will also coniderably diminish one of the major uncertainties in the measure of the vaporization rate of different gases from the cometary nucleus, and will be therefore an important step towards understanding their mysterious chemisty. Theoretical studies linking hypotheses of cometary origin to their chemical and physical nature will also be undertaken.

Prior support was by NSF grant AST 76-07116A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0022, A LONG-RANGE NEUTRINO DETECTOR

K. Lande, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (AST79-08670)

This project will involve support of an experiment for the detection of neutrino and antineutrino bursts emitted by a star as it becomes a supernova. The creation of the supernova involves very large amounts of energy which must be radiated away from the star and much of this energy can be carried by neutrinos. The detection of neutrinos from a supernova explosion will enable one to determine the physical conditions near the center of the star at the onset of the explosion.

The detector will also be able to detect high energy neutrinos from localized stellar sources. One will be able to determine if neutrino oscillations occur for neutrino transits of the earth. The detector will also measure the characteristics of very high energy muons produced by the interaction of cosmic ray primaries in the upper atmosphere. Limits on the lifetime of nucleons such as the proton will also be determined.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0023, THE ALLEGHENY OBSERVATORY TRIGONOMETRIC PARALLAX PROGRAM

G.D. Gatewood, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (AST75-02641 A03)

Precision measurement of the parallactic shift for the nearby stars as the earth circles about the sun furnishes the important result of the star's distance and hence its true brightness. Continuation of such measures also reveals the star's motion through space. In addition, for binary stars the stellar masses are determined in favorable cases. These parameters are important results for the physics of the stars.

The Pittsburgh group will continue parallax observations for stars of general interest, brighter than magnitude 16 and north of -20 degrees declination, thought to be within 65 light years of the sun, also some stars of greater distance but of special interest, including those of the Hyades cluster, in an international campaign. In addition, a number of visual and astrometric binaries will be continued under long-term observation. The many requests expected from other astronomers will be processed as rapidly as possible. Further study of ways of improving the precision of observation and reduction will be emphasized. Observations will be made with the Thaw refractor at Pittsburgh and with the 88-inch reflector at high altitude at the Mauna Kea Observatory of the University of Hawaii.

Prior support was by NSF grant AST 75-02641 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0024, THE OBSERVATION AND ANALYSIS OF RESULTS FROM THE 16 FEBRUARY 1980 TOTAL SOLAR ECLIPSE - INITIAL PHASE

J.L. Streete, Southwestern at Memphis, Undergraduate School, Dept. of Physcis, *2000 North Pkwy., Memphis, Tennessee* 38112 (ATM79-16235)

Southwestern at Memphis and the High Altitude Observatory (HAO) of the National Center for Atmospheric Research will jointly carry out observations and analysis of the brightness and polarization of the solar corona for the total solar eclipse of 16 February 1980. The results obtained from this program are directed toward a number of specific goals, in addition to their contribution to synoptic studies of the corona: (a) the verification of the in-flight radiance and polarization calibration of the HAO Coronagraph/Polarimeter on the Solar Maximum Mission (SMM); (b) the determination, with high reliability, of the optical parameters of that orbiting instrument; (c) the cross calibration between the SMM instrument and the ground-based HAO Mark III K-Coronameter instrument at Mauna Loa, Hawaii; and (d) the cross calibration with the joint Harvard/HAO Lyman-alpha/White Light Coronagraph Rocket Flight, and other Lyman-alpha rocket coronal observations to be carried out during or near the period of totality.

The main scientific objective is to further our understanding of coronal properties.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0025, JOINT U.S.-FRANCE PROGRAM OF INTERSTELLAR MOLECULAR SPECTROSCOPY

P.A. Vanden Bout, University of Texas, Austin Campus, Graduate School, Dept. of Astronomy, *200 W. 21st, Austin, Texas* 78712 (INT78-21382)

This award provides for the support of research in the field of galactic radio astronomy. The objective of the joint research is to make spectral line observations of star-forming interstellar molecular clouds. These observations are aimed at elucidating the conditions which led to star formation.

The two groups will study the physical properties of galactic molecular clouds. The research will center on the determination of the physical conditions in clouds where star formation has occurred or is occurring now, i.e., the densities, temperatures and velocities of the gas and dust, what factors have trig-

gered the onset of star formation and what is the energy balance. To accomplish that goal radio and infra-red data at several wavelengths will be collected. The mm wavelength radio data will be taken on the Texas antenna. The other radio and infra-red data will be obtained at a combination of U.S., French and other European observatories. In addition, the French will provide the U.S. group with a Carcinotron (alternative local oscillator capable of multiplication to higher frequencies i.e., greater than 150 GHz. This device will be installed at the Texas antenna.

This project is under the auspices of the U.S.-France Cooperative Science Program and provides for cooperation between scientists at the University of Texas at Austin and the Meudon Observatory at Paris, France as well as other groups in German, Holland and the U.K.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

10.0026, ANALYSIS OF DIFFERENCES BETWEEN THE OBSERVED AND THEORETICAL POSITIONS OF MARS

R.L. Duncombe, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

Transit Circle and Astrolabe observations of Mars at all oppostions from 1950 to 1975 show departures in declination from an ephemeris based on the theory of G.M. Clemence. Analysis has shown that the discrepancy arises from an error in the secular change of the inclination of the orbit of Mars. A new geocentric ephemeris incorporating this correction is being prepared.

SUPPORTED BY University of Texas

10.0027, THE EVOLUTION OF STARS IN METAL DEFICIENT SYSTEMS AND RELATED PROBLEMS IN OTHER STARS

R.T. Rood, University of Virginia, School of Arts & Sciences, Dept. of Astronomy, *Garrett Hall, Charlottesville, Virginia* 22903 (AST76-23170 A01)

This research will involve studies of the structure of stars in galactic globular clusters and dwarf spheroidal galaxies. There will be an analysis of the effect of abundance anomalies on the stars of galactic globular clusters and dwarf spheroidal galaxies which are extremely deficient in their heavy element abundances. An attempt will be made to find improved ways of connecting theoretical calculations and observational data in these systems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0028, NOBLE GAS GEOCHRONOLOGY OF METEORITES

F.A. Podosek, Washington State University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *Administration Bldg., Room 101, Pullman, Washington* 99163 (EAR7823853)

This project is focused on study of the chronology of the earth solar system, based on the natural radionuclides 129I, 244Pu and 40K. The experimental work principally involves noble gas mass spectrometric analyses of selected meteorites, but other techniques also play important roles. The chronological information is contained in the relationships between the parent radionuclides and their noble gas decay products (129Xe, fission Xe, 40Ar).

In addition to a study of the chronology of events in the early solar system, this program is also an investigation of more general aspects of solar system isotopic structures and the apparent lack of complete homogenization of the various nucleosynthetic products of which the solar system is made. This results from determination of the isotopic composition of xenon in the material from which meteorites formed and from establishing limits to the possibly heterogeneous distribution of short-lived radionuclides. For the latter the simultaneous study of 129I, 244Pu and absolute chronology by 40Ar-39Ar analysis is an important feature of the proposed program.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

GENERAL

11.0001, SUMMER RESEARCH FELLOWSHIP PROGRAM

G.C. Darden, Hampton Inst., Graduate School, Dept. of Mathematics, *Hampton, Virginia* 23368 (NAS 1-14832)

The main purpose of the Summer Research Fellowship Program is to involve more predominantly black colleges and universities in activities of the National Aeronautics and Space Administration in a way that will strengthen and expand the academic programs of these institutions.

OBJECTIVES OF THE PROGRAM: 1. To promote cooperative ventures between these institutions and the Langley Research Center; 2. To increase the resource base available to the Langley Research Center for application to its research mission; 3. To expand the academic program at participating institutions.

PARTICIPANTS: The program provides ten persons the opportunity to engage in research at the Langley Research Center for ten weeks during the summer. Participants are required to write a report on their respective projects which are chosen from a list developed by the divisions of the Center. Each participant works with a Center scientist during the summer and has full access to equipment necessary to complete the project.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

11.0002, NASA-MORGAN STATE UNIVERSITY SUMMER FACULTY RESEARCH PROGRAM

N.K. Proctor, Morgan State University, Graduate School, Dept. of Biology, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NGT 21-025-006)

The purpose of the Summer Faculty Research program is to (1) benefit the academic process at participating institutions; (2) further cooperation between participating institutions and Goddard Space Flight Center; and (3) increase the resources available to Goddard for application to its research mission. Selected faculty engage in research at Goddard Space Flight Center during a 10-week period and work under the supervision of technical monitors from Goddard. Problems investigated by faculty are in the areas of mathematics, computer science, physics, chemistry, management systems, and engineering. Goddard provides specific problems in the above areas and participants are selected based on prior education and experience.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-17981*# Battelle Columbus Labs., Ohio.
USER DEFINITION AND MISSION REQUIREMENTS FOR UNMANNED AIRBORNE PLATFORMS, REVISED Final Report
M. B. Kuhner and J. R. McDowell Dec. 1979 87 p Revised (Contract NAS6-2938)
(NASA-CR-156861) Avail: NTIS HC A05/MF A01 CSCL 02A

The airborne measurement requirements of the scientific and applications experiment user community were assessed with respect to the suitability of proposed strawman airborne platforms. These platforms provide a spectrum of measurement capabilities supporting associated mission tradeoffs such as payload weight, operating altitude, range, duration, flight profile control, deployment flexibility, quick response, and recoverability. The results of the survey are used to examine whether the development of platforms is warranted and to determine platform system requirements as well as research and technology needs. J.M.S.

N80-17982# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A CONSIDERATION OF GENERAL AVIATION IN THE UNITED KINGDOM
R. E. Caves May 1979 73 p refs
(TT-7902; ISSN-0140-9751) Avail: NTIS HC A04/MF A01

A semistructural analysis of the operational and economic viability on 1978 data, is presented. Models of contemporary fare structures, bloc times, and costs are developed in order to determine break even values for third level scheduled operations. Two potentially attractive routes from a theoretical stand point are examined to demonstrate the marginal nature of third level operations. Some attention is given to airport access, to nonscheduled general aviation, and to the relevance of the results within present U.K. transport planning choices. Author (ESA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-17983 Illinois Inst. of Tech., Chicago.
DYNAMIC STALL ON OSCILLATING AIRFOILS IN OSCILLATING FREE-STREAMS Ph.D. Thesis
Bang-Ji Hsieh 1979 278 p
Avail: Univ. Microfilms Order No. 8003648

The dynamic stall phenomenon on an oscillating airfoil in the presence of the free stream oscillations was studied. The study was conducted on a NACA 0012 profile airfoil which was oscillating in pitch around a mean angle of attack of 15 degrees with an amplitude of 10 degrees. The corresponding range of angles extending from 5 to 25 degrees includes the angle of stall of a stationary airfoil in steady flow which was about 12 degrees under present conditions. Tests were made in both steady and oscillating free streams and at the two reduced frequencies of 0.15 and 0.25. Education, i.e., periodic sampling and averaging was used to remove the nonphase related noise from the pressure signals providing an instantaneous ensemble average which was phase related to the oscillation of the airfoil, of the free stream, or both. The instantaneous distributions of pressure coefficient, normal force coefficient and moment coefficient were computed from the instantaneous educted pressure signals in terms of the instantaneous dynamic pressure of the free stream. Comparisons between tripped and untripped flows and between the flows at the two reduced frequencies are discussed. Dissert. Abstr.

N80-17984*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL INVESTIGATION OF TWO LARGE ANNULAR DIFFUSERS WITH SWIRLING AND DISTORTED INFLOW
William T. Eckert, James P. Johnston (Stanford Univ., Calif.), Tad D. Simons (Stanford Univ., Calif.), Kenneth W. Mort, and V. Robert Page Feb. 1980 106 p refs
(NASA-TP-1628; AVRADCOM-TR-79-40; A-7436) Avail: NTIS HC A06/MF A01 CSCL 01A

Two annular diffusers downstream of a nacelle-mounted fan were tested for aerodynamic performance, measured in terms of two static pressure recovery parameters (one near the diffuser exit plane and one about three diameters downstream in the settling duct) in the presence of several inflow conditions. The two diffusers each had an inlet diameter of 1.84 m, an area ratio of 2.3, and an equivalent cone angle of 11.5, but were distinguished by centerbodies of different lengths. The dependence of diffuser performance on various combinations of swirling, radially distorted, and/or azimuthally distorted inflow was examined. Swirling flow and distortions in the axial velocity profile in the annulus upstream of the diffuser inlet were caused by the intrinsic flow patterns downstream of a fan in a duct and by artificial intensification of the distortions. Azimuthal distortions or defects were generated by the addition of four artificial devices (screens and fences). Pressure recovery data indicated beneficial effects of both radial distortion (for a limited range of distortion levels) and inflow swirl. Small amounts of azimuthal distortion created by the artificial devices produced only small effects on diffuser performance. A large artificial distortion device was required to produce enough azimuthal flow distortion to significantly degrade the diffuser static pressure recovery. Author

N80-17985# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
RESEARCH ON THE STABILITY OF AIR CUSHION SYSTEMS
P. A. Sullivan, M. Hinchey, I. Murra, and G. J. Parrivano Nov. 1979 166 p refs
(UTIAS-238; ISSN-0082-5255) Avail: NTIS

HC A08/MF A01

Certain specified problems encountered in the development of flexible multicell type skirted air cushions for overland use are described. The hysteresis mechanisms in static roll stiffness are included. A preliminary examination of the dynamics of a skirt developed for low speed operation is reported and the progress made on the analysis and prediction of self excited oscillations in heave is summarized. R.C.T.

N80-17986*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

WIND-TUNNEL/FLIGHT CORRELATION STUDY OF AERODYNAMIC CHARACTERISTICS OF A LARGE FLEXIBLE SUPERSONIC CRUISE AIRPLANE (XB-70-1). 3: A COMPARISON BETWEEN CHARACTERISTICS PREDICTED FROM WIND-TUNNEL MEASUREMENTS AND THOSE MEASURED IN FLIGHT

Henry H. Arnaiz, John B. Peterson, Jr. (NASA Langley Research Center), and James C. Daugherty (NASA Ames Research Center). Mar. 1980. 59 p. refs.

(NASA-TP-1516; H-1079) Avail: NTIS HC A04/MF A01 CSCL 01A

A program was undertaken by NASA to evaluate the accuracy of a method for predicting the aerodynamic characteristics of large supersonic cruise airplanes. This program compared predicted and flight-measured lift, drag, angle of attack, and control surface deflection for the XB-70-1 airplane for 14 flight conditions with a Mach number range from 0.76 to 2.56. The predictions were derived from the wind-tunnel test data of a 0.03-scale model of the XB-70-1 airplane fabricated to represent the aeroelastically deformed shape at a 2.5 Mach number cruise condition. Corrections for shape variations at the other Mach numbers were included in the prediction. For most cases, differences between predicted and measured values were within the accuracy of the comparison. However, there were significant differences at transonic Mach numbers. At a Mach number of 1.06 differences were as large as 27 percent in the drag coefficients and 20 deg in the elevator deflections. A brief analysis indicated that a significant part of the difference between drag coefficients was due to the incorrect prediction of the control surface deflection required to trim the airplane. Author

N80-17987*# National Aeronautics and Space Administration, Washington, D. C.

BOUNDARY LAYER CONTROL BY MEANS OF SUCTION

G. Maillart. Jan. 1980. 45 p. refs. Transl. into ENGLISH from Bull. des Services Techniques 106, Apr. 1947. 35 p. Original language document was announced as N79-71086. Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75502) Avail: NTIS HC A03/MF A01 CSCL 01A

The process of boundary layer control by means of suction is described. Its historical development is briefly traced, and its application to airfoils and diffusers is discussed. Author

N80-17988*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

INTERACTION OF A TWO-DIMENSIONAL STRIP BOUNDARY LAYER WITH A THREE-DIMENSIONAL TRANSONIC SWEPT-WING CODE

Perry A. Newman, James E. Carter, and Ruby M. Davis. Mar. 1978. 35 p. refs.

(NASA-TM-78640) Avail: NTIS HC A03/MF A01 CSCL 01A

A 3D inviscid transonic analysis code was combined with a 2D strip integral boundary layer technique to form an approximate interaction procedure for analyzing the flow over a high aspect ratio wing near cruise conditions. Converged results obtained using the procedure for an aspect ratio 10.3 supercritical wing are discussed. Angle of attack adjustments were made during the iterative procedure in order to compensate for the viscous lift loss. A comparison of the calculations with experimental data is presented. A.W.H.

N80-17989*# Lockheed-Georgia Co., Marietta.

THE AERODYNAMIC DESIGN OF AN ADVANCED ROTOR AIRFOIL

James A. Blackwell, Jr. and Bobby L. Hinson. Mar. 1978. 112 p.

(Contract NAS1-14597)

(NASA-CR-2961; LG77ER0208) Avail: NTIS HC A06/MF A01 CSCL 01A

An advanced rotor airfoil, designed utilizing supercritical airfoil technology and advanced design and analysis methodology is described. The airfoil was designed subject to stringent aerodynamic design criteria for improving the performance over the entire rotor operating regime. The design criteria are discussed. The design was accomplished using a physical plane, viscous, transonic inverse design procedure, and a constrained function minimization technique for optimizing the airfoil leading edge shape. The aerodynamic performance objectives of the airfoil are discussed. A.W.H.

N80-17990*# National Aeronautics and Space Administration, Washington, D. C.

SOLUTION OF A FEW NONLINEAR PROBLEMS IN AERODYNAMICS BY THE FINITE ELEMENTS AND FUNCTIONAL LEAST SQUARES METHODS. Ph.D. Thesis - Paris Univ.

Jacques Periaux. Dec. 1979. 278 p. refs. Transl. into ENGLISH of "Resolution de quelques Problems non Lineaires en Aerodynamique par des Methodes d'Elements Finis et de Moindres Carres Fonctionnels" Paris, 19 Jun. 1979. 280 p. Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75732) Avail: NTIS HC A13/MF A01 CSCL 01A

The numerical simulation of the transonic flows of idealized fluids and of incompressible viscous fluids, by the nonlinear least squares methods is presented. The nonlinear equations, the boundary conditions, and the various constraints controlling the two types of flow are described. The standard iterative methods for solving a quasi elliptical nonlinear equation with partial derivatives are reviewed with emphasis placed on two examples: the fixed point method applied to the Gelder functional in the case of compressible subsonic flows and the Newton method used in the technique of decomposition of the lifting potential. The new abstract least squares method is discussed. It consists of substituting the nonlinear equation by a problem of minimization in a H to the minus 1 type Sobolev functional space. A.W.H.

N80-17991*# National Aeronautics and Space Administration, Washington, D. C.

COMPARISON OF AERODYNAMIC COEFFICIENTS OBTAINED FROM THEORETICAL CALCULATIONS WIND TUNNEL TESTS AND FLIGHT TESTS DATA REDUCTION FOR THE ALPHA JET AIRCRAFT

R. Guiot and H. Wunnenberg. Feb. 1980. 31 p. refs. Transl. into ENGLISH of "Comparison des Coefficients Aerodynamiques Issues des Calculs Theoretiques, Essais en Soufflerie et Depouillements d'Essais en vol Effectues sur l'Alpha Jet". Rept. AGARD-CP-187. AGARD. Presented at the 46th Meeting of the Flight Mech. Panel, Valloire, France, 9-13 Jun. 1975. p. 19-1 - 19-15. Original language document was announced as N76-25295. Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original language document prepared by Avions Marcel Dassault-Breguet Aviation, Saint-Cloud, France and Dornier-Werke G.m.b.H., Friedrichshafen, West Germany.

(Contract NASw-3199)

(NASA-TM-75237; AGARD-CP-187) Avail: NTIS HC A03/MF A01 CSCL 01A

The methods by which aerodynamic coefficients are determined and discussed. These include: calculations, wind tunnel experiments and experiments in flight for various prototypes of the Alpha Jet. A comparison of obtained results shows good correlation between expectations and in-flight test results. J.M.S.

N80-17992*# Mississippi State Univ., State College. Dept. of Aerospace Engineering.

FULL SCALE VISUALIZATION OF THE WING TIP VORTICES GENERATED BY A TYPICAL AGRICULTURAL AIRCRAFT. Final Report

Ernest J. Cross, Jr., Phillip D. Bridges, Joe A. Brownlee, W. Wayne Livingston et al. Jan. 1980. 102 p. refs.

(Contract NsG-1511)

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(NASA-CR-162796; MSSU-EIRS-ASE-80-2) Avail: NTIS HC A06/MF A01 CSCL 01A

The trajectories of the wing tip vortices of a typical agricultural aircraft were experimentally determined by flight test. A flow visualization method, similar to the vapor screen method used in wind tunnels, was used to obtain trajectory data for a range of flight speeds, airplane configurations, and wing loadings. Detailed measurements of the spanwise surface pressure distribution were made for all test points. Further, a powered 1/8 scale model of the aircraft was designed, built, and used to obtain tip vortex trajectory data under conditions similar to that of the full scale test. The effects of light wind on the vortices were demonstrated, and the interaction of the flap vortex and the tip vortex was clearly shown in photographs and plotted trajectory data. Author

N80-17993*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

EFFECT OF SWEEP AND ASPECT RATIO ON THE LONGITUDINAL AERODYNAMICS OF A SPANLOADER WING IN- AND OUT-OF-GROUND EFFECT

Scott O. Kjelgaard and John W. Paulson, Jr. Jan. 1980 166 p. refs

(NASA-TM-80199) Avail: NTIS HC A08/MF A01 CSCL 01A

A wind tunnel investigation was conducted to determine the effects of leading edge sweep, aspect ratio, flap deflection, and eleven deflection on the longitudinal aerodynamic characteristics of a span distributed load advanced cargo aircraft (spanloader). Model configurations consisted of leading edge sweeps of 0, 15, 30, and 45 deg and aspect ratios of approximately 2, 4, 6, and 8. Data were obtained for angles of attack of -8 to 18 deg out of ground effect and at angles of attack of -2, 0, and 2 deg in ground effect at Mach number equal 0.14. Flap and elevon deflections ranged from -20 to 20 deg. The data presented in tabulated form are intended for reference purposes and are presented without analysis. A.W.H.

N80-17994*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.

COMPUTER PREDICTION OF THREE-DIMENSIONAL POTENTIAL FLOW FIELDS IN WHICH AIRCRAFT PROPELLERS OPERATE: COMPUTER PROGRAM DESCRIPTION AND USERS MANUAL

Stephen J. Jumper Aug. 1979 258 p. refs

(Grant NsG-1308)

(NASA-CR-162816; PSU-Aero-R-79/80-5) Avail: NTIS HC A12/MF A01 CSCL 01A

A method was developed for predicting the potential flow velocity field at the plane of a propeller operating under the influence of a wing-fuselage-cowl or nacelle combination. A computer program was written which predicts the three dimensional potential flow field. The contents of the program, its input data, and its output results are described. R.E.S.

N80-17995*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

A CALCULATION PROCEDURE FOR VISCOUS FLOW IN TURBOMACHINES, VOLUME 2

J. Khalil and W. Tabakoff Jan. 1980 54 p. refs

(Contract NAS3-21609; DA Proj. 1L1-61102-AH-45)

(NASA-CR-159636) Avail: NTIS HC A04/MF A01 CSCL 21E

Turbulent flow within turbomachines having arbitrary blade geometries is examined. Effects of turbulence are modeled using two equations, one expressing the development of the turbulence kinetic energy and the other its dissipation rate. To account for complicated blade geometries, the flow equations are formulated in terms of a nonorthogonal boundary fitted coordinate system. The analysis is applied to a radial inflow turbine. The solution obtained indicates the severity of the complex interaction mechanism that occurs between the different flow regimes (i.e., boundary layers, recirculating eddies, separation zones, etc.). Comparison with nonviscous flow solutions tend to justify strongly the inadequacy of using the latter with standard boundary layer techniques to obtain viscous flow details within turbomachine rotors. Capabilities and limitations of the present method of analysis are discussed. M.G.

N80-17996# Naval Surface Weapons Center, White Oak, Md.

AN EXPERIMENTAL STUDY OF TWO-DIMENSIONAL SUPERSONIC JET IMPINGEMENT ON A FLAT PLATE

T. F. Zien and R. T. Driftmyer Aug. 1979 95 p. refs

(AD-A076536; NSWC/TR-79-289) Avail: NTIS HC A05/MF A01 CSCL 20/4

An experimental study of the flow field associated with a two-dimensional, supersonic jet impinging normally on a flat plate is reported. Two wedge nozzles manufactured at the design Mach numbers of 1.75 and 2.75, respectively, were used to provide the jet. Extensive pitot surveys of the free jet were first conducted to determine the quality of the free jet. Results indicate that the simple wedge nozzles were adequate in providing the desired two-dimensional jet in the free expansion configuration. Results of surface pressure measurements and schlieren photographs of the impingement flow indicating the shock patterns are then presented and discussed. Although the results are principally reported for the case of the jet at isentropic exit conditions, some results of underexpanded and overexpanded jets are also included. Some discrepancies between the experiment and the simple theory based in the method of integral relations and the inviscid flow model are noted and discussed. An 'effective' jet Mach number is introduced which accounts largely for the discrepancy between experiments and theory, and its determination is based on the measured stagnation point pressure on the plate surface. GRA

N80-17997# Aeronautical Research Labs., Melbourne (Australia).

THE AERODYNAMICS DIVISION AIRBORNE DATA ACQUISITION PACKAGE TEST AND CALIBRATION

P. Ferrarotto Mar. 1979 37 p. refs

(AD-A071365; ARL/Aero-TM-312) Avail: NTIS HC A03/MF A01 CSCL 14/2

The unit described in this memorandum was designed and built in conjunction with the Aerodynamics Division Airborne Data Acquisition Package (ADADAP). It provides a means by which the ADADAP can be checked for correct operation. The output signals of the unit simulate the various analogue signals which would normally be derived from transducers on board an instrumented aircraft. A brief description of the operation of the unit and circuit details are included in this memorandum. GRA

N80-17998# Dayton Univ. Research Inst., Ohio.

NUMERICAL SOLUTION OF A SUPERSONIC NOZZLE AFTERBODY FLOW WITH JET EXHAUST Final Report, Sep. 1976 - Feb. 1978

Ameer G. Mikhail Jun. 1979 69 p. refs

(Contract F33615-76-C-3145; AF Proj. 2307)

(AD-A076116; UDR-TR-79-43; AFFDL-TR-79-3078) Avail: NTIS HC A04/MF A01 CSCL 20/4

Numerical solutions to the compressible turbulent Navier-Stokes equations for supersonic flow at Mach number 1.5, past an axisymmetric nozzle boattail with jet exhaust were obtained using MacCormack's explicit numerical scheme. The AGARD 10 deg-nozzle was considered and a total of five cases were computed showing the effects of boattail geometry, jet-exhaust temperature, boattail wall temperature and the differences with the corresponding two-dimensional case. It was established that the hot boattail surface reduces the pressure drag significantly as does the hot jet exhaust when compared with the cold wall, cold exhaust case. The present approach can be used directly for boattailing nozzles for minimum pressure drag, as well as for a parametric study for aircraft designers. GRA

N80-17999# Weapons Systems Research Lab., Adelaide (Australia).

CALCULATION OF SUBSONIC NORMAL FORCE AND CENTRE OF PRESSURE POSITION OF BODIES OF REVOLUTION USING SLENDER BODY THEORY BOUNDARY LAYER METHOD

K. D. Thomson Apr. 1979 37 p. refs

(AD-A076128; WSRL-0093-TR; AR-001-656) Avail: NTIS HC A03/MF A01 CSCL 20/4

The aim of this report is to present a method of predicting the aerodynamic characteristics of slender bodies of revolution at small incidence, under flow conditions such that the boundary layer is turbulent. Firstly, a panel method based on slender body theory is developed and used to calculate the surface velocity

distribution on the body at zero incidence. Secondly, this velocity distribution is used in conjunction with an existing boundary layer estimation method to calculate the growth of boundary layer displacement thickness which is added to the body to produce the effective aerodynamic profile. Finally, recourse is again made to slender body theory to calculate the normal force curve slope and center of pressure position of the effective aerodynamic profile. Comparisons made between predictions and experiment for a number of slender bodies extending from highly boattailed configurations to ogive-cylinders, and covering a large range of boundary layer growth rates, indicate that the method is useful for missile design purposes. GRA

N80-18000# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.

THEORETICAL ANALYSIS OF THE FLOW FIELD OVER A FAMILY OF OGIVE BODIES, VOLUME 2

R. L. Richardson and B. Z. Jenkins. 20 Aug. 1979. 56 p. refs. (AD-A077397; DRSMI-T-CR-77-5). Avail: NTIS. HC A04/MF A01. CSCL 20/4.

Local normal force distributions are presented for pointed tangent ogive bodies and spherically blunted tangent ogive bodies at free stream Mach numbers of 2 to 4.5 at 2 deg angle-of-attack. Also, total or integrated values of normal force coefficients, pitching moment coefficients, and centers of pressure are given for all body shapes as a function of free stream Mach number for the same angle of attack. These data were obtained using the US Army Missile Command three-dimensional method of characteristics computer code. GRA

N80-18001# Neilsen Engineering and Research, Inc., Mountain View, Calif.

DATA REPORT FOR A TEST PROGRAM TO STUDY TRANSONIC FLOW FIELDS ABOUT WING-BODY/PYLON/STORE COMBINATIONS. VOLUME 1: TUNNEL EMPTY FLOW SURVEY DATA, WING BODY FORCE/MOMENT/SURFACE PRESSURE DATA, AND PRESSURE STORE FORCE/MOMENT/SURFACE PRESSURE DATA. Interim Summary Report, 14-22 Feb. 1978

S. S. Stahara and A. J. Crisalli. May 1978. 256 p.
(Contract F44620-75-C-0047; AF Proj. 2307)
(AD-A077182; AFOSR-79-1070TR; NEAR-TR-163-Vol-1). Avail: NTIS. HC A12/MF A01. CSCL 20/4.

Results are presented for transonic wind tunnel tests conducted in the 4T Wind Tunnel at Arnold Engineering and Development Center for various wing-body/pylon store model combinations. Experimental data were obtained at 0.2, and 5 degrees angle of attack of the model combinations and at Mach numbers of 0.925, 0.950, 1.05, and 1.10 in the transonic range. Pylon and store models were attached to a wing-body combination in two separate, systematic model build-up sequences. At each stage of the first sequence, flow velocities and static pressures were obtained in the vicinity of the store or those regions normally occupied by a store while force, moment, and surface pressure measurements were taken on the wing-body model. Also, flow velocities and static pressure were recorded on a cylindrical control surface far from the tunnel centerline to provide outer flow field conditions. The second model build-up sequence involved a special pressure-instrumented store that was mounted on the captive trajectory system for simulating a separating store. Detailed pressure distributions and loading were obtained on the store. GRA

N80-18002# Neilsen Engineering and Research, Inc., Mountain View, Calif.

DATA REPORT FOR A TEST PROGRAM TO STUDY TRANSONIC FLOW FIELDS ABOUT WING-BODY/PYLON/STORE COMBINATIONS. VOLUME 2: FLOW FIELD SURVEY DATA FOR CONFIGURATIONS 21 AND 22. Interim Report, 14-23 Feb. 1978

S. S. Stahara and A. J. Crisalli. May 1978. 247 p.
(Contract F44620-75-C-0047; AF Proj. 2307)
(AD-A077153; AFOSR-79-1071TR; NEAR-TR-163-Vol-2). Avail: NTIS. HC A11/MF A01. CSCL 20/4.

This volume of the data report presentes the flow-field survey data for configurations 21 and 22 at Mach numbers M1 = 0.925, M2 = 0.950, and M3 = 1.05 and angles of attack alpha = 0, 2, and 5 degrees. The data were obtained in the 4T Wind Tunnel at Arnold Engineering and Development Center. These tests, performed at a nominal Reynolds number per foot of 3.0 x 10 to the 6th power are indexed and outlined. GRA

N80-18003# Institut de Mecanique des Fluides de Marseille (France).

TRANSIENT EFFECTS ON A STALLED AIRFOIL IN A PULSATING FLOW: COMPARISON WITH RESULTS FROM A SIMILAR AIRFOIL UNDERGOING HORIZONTAL SHAKING [EFFETS INSTATIONNAIRES SUR UN PROFIL EN DECROCHAGE DANS UN ECOULEMENT PULSE; COMPARISON AVEC LE MOUVEMENT DE TAMIS]

C. Maresca, D. Favier, and J. Rebont. Paris: Assoc. Aeron. et Astronautique de Paris, 1979. 66 p. refs. In FRENCH; ENGLISH summary. Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978.
(Contract STTA-77/98/313/00/481/75/86)
(AAAF-NT-79-13; ISBN-2-7170-0540-4). Avail: NTIS. HC A04/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others).

The unsteady effects encountered by a symmetrical airfoil NACA 0012 set at fixed indicence (20 deg) in an oscillating flow (delta V/V = 0.74; C sub omega/2V = 0.65; Re = 70,000) were studied. The results were obtained through measurements of aerodynamic components (lift, drag, moment) evidenced by distributions of the static pressure and skin friction along the chord of the airfoil and through visualizations around the airfoil at different phases of the period. The results are discussed and compared with those already obtained on the same airfoil moving forward-backwards in a uniform flow under the same conditions. As far as the mean effects on the lift, drag, pressure distribution, and vortex shedding mechanism on the upper side of the airfoil are concerned, the reciprocity of the two kinds of flow is demonstrated. Author (ESA)

N80-18004# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Aerothermodynamique.

IMPLEMENTATION OF UNSTEADY OSCILLATORY FLOW IN A TRANSONIC WIND TUNNEL [MISE AU POINT D'ECOULEMENTS INSTATIONNAIRES OSCILLATOIRES DANS UNE SOUFFLERIE TRANSSONIQUE]

A. Mignosi, J. L. Gobert, and C. Quemard. Paris: Assoc. Aeron. et Astronautique de France, 1979. 42 p. refs. In FRENCH; ENGLISH summary. Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978.
(AAAF-NT-79-15; ISBN-2-7170-0542-0). Avail: NTIS. HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others).

Oscillatory flow was obtained in an injector driven transonic wind tunnel through periodic variation of the downstream throat area by rotation of a suitable shaped cam. The measurement techniques and the probes developed for the experimental studies are described. The characteristics of the unsteady flow in the test section are compared with the results from computations based on the resolution of the unsteady equations. One dimensional flow is assumed. The possibilities of such a device are illustrated by a preliminary study of a wing profile in a transonic flow. The oscillation of both the shock wave and the wake in answer to flow pulsation is shown. Author (ESA)

N80-18005# Office National d'Etudes et de Recherches Aerospatiales, Modane (France).

UNSTEADY FLOW MEASUREMENTS IN AIR INTAKES [MESURES INSTATIONNAIRES DANS UNE PRISE D'AIR]

M. Grandjacques. Paris: Assoc. Aeron. et Astronautique de France, 1979. 23 p. refs. In FRENCH. Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978.
(AAAF-NT-79-16; ISBN-2-7170-0543-9). Avail: NTIS. HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others).

The means for studying the steady and unsteady flow of air intakes by measuring the pressures at the compressor inlet plane are described. Improved instantaneous differential pressure measurement devices are described which extend the range of utilization from 40 C to 100 C and compensate the zero and sensitivity thermal offsets. The system was assembled for simultaneous measurement in 40 channels at a rate of up to

1700 pressure measurements per second. The results show that the system is adequate for industrial applications, yielding a precision range on the order of 0.5%. Author (ESA)

N80-18006# Institut de Mecanique des Fluides de Marseille (France).
ON THE PULSATION OF A NORMAL SHOCK WAVE CONTAINED IN AN AERODYNAMIC INLET [PULSATION D'UN CHOC DROIT EN AERODYNAMIQUE INTERNE]
A. Agnes, E. Brocher, and H. Miton. Paris: Assoc. Aeron. et Astronautique de France, 1979. 21 p. refs. In FRENCH; ENGLISH summary. Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978. Sponsored by Direc. des Rech. Etudes et Tech. (DRET).
(AAAF-NT-79-17; ISBN-2-7170-0544-7) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others).

The response of a normal shock wave, located in a nozzle to down stream pressure perturbation was determined. The system for generating pulsations is described, which consists basically of a Hartmann Sprenger tube in which oscillations of up to 30 KHz can be produced. Initial results are presented showing the two frequencies at which the shock wave oscillations are particularly intense. The computation method for the shock wave oscillation amplitude is also discussed. Author (ESA)

N80-18007# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
THE GUST AS A COHERENT STRUCTURE IN THE TURBULENT BOUNDARY LAYER
Haakan Gustavsson and Magnus Linde. 1979. 19 p. refs.
(Contract SWED-BESD-5061-012)
(FFA-TN-AU-1499-Pt-5) Avail: NTIS HC A02/MF A01.

Gusts in the atmospheric boundary layer are coherent structures which seem to have very characteristic features. The same kind of structures were found in turbulent boundary layers investigated in the laboratory. The results of such experiments were used to formulate a model for the gust which emphasizes its deterministic features. As a result, the gust structure is scaled on the outer variables of the boundary layer, i.e., the thickness of the boundary layer and the free stream velocity. The gust's longitudinal extent is considerably larger than its lateral one. Its front has a slope in the wind direction. Within the gust, there is first a decrease in the longitudinal velocity followed by a steep rise and a subsequent slow decay to the mean value.
Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-18008# Lockheed-California Co., Burbank.
GENERAL AVIATION AIRPLANE STRUCTURAL CRASHWORTHINESS PROGRAMMER'S MANUAL Final Report, Nov. 1977 - Dec. 1978
W. L. Labarge. Jun. 1979. 210 p. Revised.
(Contract DOT-FA75WA-3707)
(AD-A075737; FAA-RD-78-120-Rev; LR-23683) Avail: NTIS HC A10/MF A01 CSCL 13/12

A programming manual is presented to describe the program KRASH. Included are: systems requirements, input data deck, and demonstration problems. M.M.M.

N80-18009# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
TASK FORCE ON DETERRENCE OF AIR PIRACY Final Report
H. L. Reighard and John T. Dailey. Nov. 1978. 138 p.
(AD-A078457; FAA-AM-78-35) Avail: NTIS HC A07/MF A01 CSCL 01/2

The establishment of a multidisciplinary task force on the deterrence of air piracy and the work of the task force in developing an airline passenger preboarding screening system and other actions to deter hihacking is summarized. The screening system combines a behavioral profile with a metal detecting magnetometer to identify those persons who could be potential hijackers. The value of the epidemiological method is discussed and the multidisciplinary approach to the problems of hijacking is emphasized. A.W.H.

N80-18010*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Apr. - 30 Jun. 1978
Jun. 1979. 54 p. refs. Prepared in cooperation with Battelle Columbus Labs., Mountain View, Calif.
(NASA-TM-78608; A-7904; QR-9) Avail: NTIS HC A04/MF A01 CSCL 01C

The human factors frequency considered a cause of or contributor to hazardous events onboard air carriers are examined with emphasis on distractions. Safety reports that have been analyzed, processed, and entered into the aviation safety reporting system data base are discussed. A sampling of alert bulletins and responses to them is also presented. J.M.S.

N80-18011*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE AERIAL RELAY SYSTEM: AN ENERGY-EFFICIENT SOLUTION TO THE AIRPORT CONGESTION PROBLEM
Albert C. Kyser. Jan. 1980. 24 p. refs. Presented at the AIAA Aircraft Systems and Technol. Meeting, New York, 22 Aug. 1979.
(NASA-TM-80208) Avail: NTIS HC A02/MF A01 CSCL 17B

The ability to transfer airline passengers between aircraft in flight, if adequately developed and integrated into the national air transportation system, could provide significant improvements in transportation-system performance, in terms of airport congestion, fuel consumption, and passenger service. The proposed Aerial Relay System concept, which was developed as a means of exploiting inflight transfer, makes use of large 'cruise liner' aircraft which fly continuously along their routes, docking periodically with short-haul feeder aircraft for exchange of payloads. Preliminary vehicle designs for a representative system are described and the operational feasibility of the concept for the United States in the 1990's is discussed. R.E.S.

N80-18012# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
HUMAN FACTORS IN HIGH SPEED LOW LEVEL ACCIDENTS: A 15 YEAR REVIEW
R. C. Rud and D. F. Leben. Jul. 1979. 13 p. refs.
(AD-A076221; DCIEM-79-R35) Avail: NTIS HC A02/MF A01 CSCL 01/2

The Canadian Forces introduced the gf 104G into Squadron Operation in 1963 and since that time these aircraft have operated in the high-speed, low-level environment in both the strike/reconnaissance and tactical support roles. Fifty-seven accidents involving these aircraft are reviewed with regard to cause factors. Marginal weather appears to be the one most significant factor contribution to low-level, high-speed accidents however, several human factors such as visual contrast problems, fatigue, stress, reaction time, 'mission completion' syndrome, inattention and task overload were identified. Aspects of accidents which typify human factors problems are described. Suggested possible preventive measures are outlined. Author (GRA)

N80-18013# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
FEASIBILITY TESTING OF A BODY INFLATABLE BLADDER (BIB) RESTRAINT DEVICE Phase Report
Marcus Schwartz. Apr. 1979. 46 p.
(WF41400000)
(AD-A078681; NADC-79241-60) Avail: NTIS HC A03/MF A01 CSCL 06/17

A feasibility model of an inflatable type restraint system was designed and developed for use with existing operational restraint hardware to improve crewman safety during ejection. The vest type inflatable system is worn over the flight suit and

under the MA-2 integrated torso harness. Upon inflation, the crewman is forced back into the suit while slack is removed from the harness. Subsequent ejection tower testing has demonstrated significant reductions in horizontal head and torso response during the catapult phase of the ejection. Author (GRA)

N80-18014# Technische Hogeschool, Delft (Netherlands). Afdel. der Luchtvaart- en Ruimtevaarttechniek.
AVIATION SAFETY AND ITS IMPROVEMENT [DE VEILIGHEID IN DE LUCHTVAART EN HAAR BEWAKING]
H. Wittenberg. Jan. 1978. 55 p. refs. In DUTCH. Presented at Symp. Veiligheid van de Vervoerssystemen, Delft, 17 Mar. 1978.
(VTH-LR-260) Avail: NTIS. HC A04/MF A01.
A synopsis of 75 years of air transportation data was compiled in relation to aircraft accidents and aviation safety. Regulations covering aircraft construction, maintenance, aircraft control and navigation, training, and accident investigation are reviewed. Author (ESA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft, air navigation systems (satellite and ground based), and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-18015 Illinois Univ. at Urbana-Champaign.
A NEW APPROACH TO MULTI-SENSOR NAVIGATION SYSTEM DESIGN
Michael Joseph Cannon. 1979. 126 p.
Avail: Univ. Microfilms. Order No. 8004147.
The flexibility and power of digital processors in the design of aviation navigation systems is discussed. Navigation systems which use a variety of input sensors and which use processors to integrate the system components are examined. Methods for counting errors in specific sensor inputs are examined in terms of the characteristics of the sensors. The set of input sensors, when properly chosen, can complement one another in the information they provide and in their operating domains. Overlap in the information provided makes possible cross checking for sensor errors or equipment failure and allows for a variety of degraded or backup mode operations. These areas in navigation systems and their design are emphasized. Dissert. Abstr.

N80-18016 Texas A&M Univ., College Station.
A NAVIGATION ALGORITHM FOR SINGLE CHANNEL LOW-COST GPS RECEIVER. Ph.D. Thesis
Hamed Parsiani. 1979. 133 p.
Avail: Univ. Microfilms. Order No. 8003171.
A sequential navigation algorithm for a navigator using the Global Positioning System satellites was developed and tested for both noise-free and noisy system models. Data from a six-hour flight from California to Hawaii (C5A aircraft) simulated a true user to test the accuracy of the user's position for a sequential navigation system. Dissert. Abstr.

N80-18017# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
REPORT ON THE TASK FORCE ON AIRCRAFT SEPARATION ASSURANCE, APPENDICES
D. J. Bryant, D. G. Hamrick, W. D. Love, A. L. McFarland, A. D. Mundra, H. C. Strunz, and C. F. Swett. Jan. 1979. 334 p. ref.
(AD-A077713; FAA-EM-78-19-Vol-3-App; AEM-2) Avail: NTIS. HC A15/MF A01. CSCL 17/7.
An integrated aircraft separation assurance (ASA) system for the national airspace system is examined. The system element requirements which are defined to provide two levels of backup to the ATC system, a separation violation warning and a final fail safe collision advisory and resolution function, are defined. Current ASA development programs are discussed and the changes required to make the transition to an integrated ASA system are reported. This volume includes appendices for two previous volumes and defines in detail the specific interfaces and designs required for system integration. A.W.H.

N80-18018# Analytic Sciences Corp., Reading, Mass.
DIFFERENTIAL OMEGA IN THE ALASKA/YUKON REGION: AN ANALYTIC ASSESSMENT. Final Report, Oct. 1978 - Jul. 1979
James M. Foltz, Barry E. Griffiths, Richard D. Healy, and Radha R. Gupta. Aug. 1979. 94 p. refs.
(Contract DOT-FA78WA-4236)
(AD-A078517; FAA-RD-79-77; TR-1579-1) Avail: NTIS. HC A05/MF A01. CSCL 17/7.
A differential navigation system for improving the navigation performance of airborne equipment in the vicinity of a fixed site ground station is evaluated. An error model for signal propagation prediction residuals is used to predict performance achievable with ground station and airborne equipment sites. Predictions are made for use of the equipment as a nonprecision approach aid within the differential system coverage area, and for use as an enroute navigation aid between areas serviced by a differential system ground station. System implementation in the Alaska/Yukon region is specifically addressed. M.G.

N80-18019*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RIM INERTIAL MEASURING SYSTEM. Patent Application
Nelson J. Groom, Willard W. Anderson, and William H. Phillips, inventors (to NASA). Filed 7 Dec. 1979. 27 p.
(NASA-Case-LAR-12052-1; US-Patent-Appl-SN-102002) Avail: NTIS. HC A03/MF A01. CSCL 17G.
A strapdown inertial measuring system for measuring angular rate and linear accelerations about a spacecraft is disclosed. The system uses an annular momentum control device (AMCD) as the basic sensor. Features of the device include reliability, zero friction, zero wear, low volume, high momentum to mass ratio, and zero breakout forces. The AMCD is comprised of a rim and several magnetic bearing stations to control the position of the rim in the axial and radial directions. Signals from axial position sensors are used to compute the angular rates about first and second mutually perpendicular axes in the plane or the rim and the linear acceleration along a third axis perpendicular to the first and second axes. Signals from radial position sensors are used to compute the linear accelerations along the first and second axes. J.M.S.

N80-18020*# Research Triangle Inst., Durham, N. C.
CONTINUED STUDY OF NAVSTAR/GPS FOR GENERAL AVIATION. Final Report
R. D. Alberts and W. H. Ruedger. Dec. 1979. 214 p. refs.
(Contract NAS1-14719)
(NASA-CR-159145; RTI-1404-00-01F) Avail: NTIS. HC A10/MF A01. CSCL 17G.
A conceptual approach for examining the full potential of Global Positioning Systems (GPS) for the general aviation community is presented. Aspects of an experimental program to demonstrate these concepts are discussed. The report concludes with the observation that the true potential of GPS can only be exploited by utilization in concert with a data link. The capability afforded by the combination of position location and reporting stimulates the concept of GPS providing the auxiliary functions of collision avoidance, and approach and landing guidance. A series of general recommendations for future NASA and civil community efforts in order to continue to support GPS for general aviation are included. R.E.S.

N80-18021*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT PERFORMANCE OF THE TCV B-737 AIRPLANE AT JORGE NEWBERRY AIRPORT, BUENOS AIRES, ARGENTINA USING TRSB/MLS GUIDANCE
William F. White and Leonard Clark. Jan. 1980. 41 p. refs.
(NASA-TM-80223) Avail: NTIS. HC A03/MF A01. CSCL 17G.
The flight performance of the Terminal Configured Vehicle airplane is summarized. Demonstration automatic approaches and landings utilizing time reference scanning beam microwave landing

system (TRSB/MLS) guidance are presented. The TRSB/MLS was shown to provide the terminal area guidance necessary for flying curved automatic approaches with final legs as short as 2 km. R.E.S.

N80-18022# Texas Instruments, Inc., Dallas. Equipment Group.
GLOBAL POSITIONING SYSTEMS (GPS). MANPACK/VEHICULAR USER EQUIPMENT (MVUE). VOLUME 2: SET DESCRIPTION. Final Report, Jun. 1975 - Aug. 1979
15 Aug. 1979. 283 p.
(Contract F04701-75-C-0181)
(AD-A076483; SAMSO-SD-TR-79-13-Vol-2) Avail: NTIS. HC A13/MF A01. CSCL 17/7
This volume describes the design of the MVUE set as implemented in phase 1 of GPS, to include set description, software overview, and software/hardware subsystem descriptions. GRA

N80-18023# Texas Instruments, Inc., Dallas. Equipment Group.
GLOBAL POSITIONING SYSTEM (GPS). MANPACK/VEHICULAR USER EQUIPMENT (MVUE). VOLUME 3: SET DESCRIPTION. Final Report, Jun. 1975 - Aug. 1979
15 Aug. 1979. 431 p. refs.
(Contract F04701-75-C-0181)
(AD-A076484; SAMSO-SD-TR-79-13-Vol-3) Avail: NTIS. HC A19/MF A01. CSCL 17/7
This volume provides module level descriptions for each of the modules which make up the MVUE software and hardware subsystems. GRA

N80-18024# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
HELICOPTER REMOTE WIND SENSOR SYSTEM DESCRIPTION
D. H. Dickson and Charles M. Sonnenschein. Sep. 1979. 57 p.
(DA Proj. 1L1-62111-AH-71)
(AD-A076153; ERADCOM/ASL-TR-0040) Avail: NTIS. HC A04/MF A01. CSCL 14/2
The helicopter remote wind sensor (HRWS) is an application of a laser Doppler velocimeter. This system description describes the HRWS fabricated by Raytheon Company for the US Army Atmospheric Sciences Laboratory. The HRWS was designed to measure wind fields in an aircraft turbulent environment. The operational emphasis is to augment an attack helicopter's fire control system. This CO2 laser heterodyne system remotely measures three dimensional winds from 1 to 33 meters in front of the sensor. The HRWS was mounted in an external pod compatible with AH-1, AAH and UH-1 wing stores or a fixed wing aircraft equipped with standard wing shackles. The HRWS theory, functions, and subsystem are discussed. Data from flight and ground testing will be presented in a later report. GRA

N80-18025# Intermetrics, Inc., Cambridge, Mass.
GPS AND EAR/GEANS SOFTWARE SUPPORT. Final Report, Dec. 1976 - Jun. 1979
N. A. Carlson, W. S. Widnall, P. K. Sinha, P. A. Grundy, and L. F. Wiederholt. Aug. 1979. 166 p. refs.
(Contract F33615-77-C-1044; AF Proj. 666A)
(AD-A078607; IR-397; AFAL-TR-79-1127) Avail: NTIS. HC A08/MF A01. CSCL 17/7
The Air Force Avionics Laboratory is sponsoring development of both the Generalized Development Model (GDM) of GPS User equipment, and the EAR/GEANS radar/inertial navigator. This report documents results of analysis and software support for both of these programs. GPS-related analysis has been performed in the area of GDM software support, particularly, stability analysis of alternate designs for rate-aiding of non-coherent mode of GPS receiver; vertical channel analysis and simulation; improved GPS/Inertial Simulator model implementation; and integrated GPS/strapdown performance studies. EAR/GEANS-related analysis has been performed in the areas of Error Isolation Filter (EIF) development planning; vertical channel error modeling; error modeling for GEANS space-stable baro-inertial navigator; EAR radar measurement modeling; EAR/GEANS flight test data recording; gravity perturbation modeling; EAR/GEANS Error Isolation Filter synthesis; onboard feedback correction compensation in the EIF; and EIF optimal filter/smoother mechanization equations selection. GRA

N80-18026# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
DISCRETE ANALOG PROCESSING FOR TRACKING AND GUIDANCE CONTROL. Final Report, 1 Aug. 1978 - 31 Aug. 1979
E. S. McVey, E. A. Parrish, R. M. Inigo, and R. J. Schalkoff. 31 Aug. 1979. 179 p. refs.
(Contract N00014-78-C-0695)
(AD-A078809; UVA/525350/EE79/102; ONR-CR-233-092-1) Avail: NTIS. HC A09/MF A01. CSCL 17/7
The search for and development of algorithms for a real-time, automatic system capable of tracking 2-D targets in complex scenes is discussed. The problems and constraints involved in such an undertaking as well as previous efforts are summarized. No algorithms could be found in the literature that will provide satisfactory results for realistic conditions. A mathematical model of scene spatial and temporal evolution is developed for certain classes of targets and target perturbations. It is shown that for small target perturbations the 2-D tracking problem may be approximated as a 1-D time-varying parameter estimation problem. A novel and CCD-implementable solution is developed which is superior to previously developed algorithms, particularly when considering target rotation and dilation and target/background separation. Results of system simulation and suggestions for future research are presented. GRA

N80-18027# Research Inst. of National Defence, Linkoeping (Sweden).
OMEGA MEASUREMENTS IN STOCKHOLM [OMEGAMAETNINGAR I STOCKHOLM]
Bertil Landkvist. Mar. 1979. 84 p. refs. In SWEDISH.
(FOA-C-20296-E3) Avail: NTIS. HC A05/MF A01.
A measurement device registering and evaluating automatically the Omega and Decca navigation system positions in latitude and longitude is presented. This equipment was initially designed for Omega navigation system but can also be used for the Decca navigation system. No special Decca navigation hyperbolic charts are needed when using this device. The results are presented in form of tables and diagrams. The two sigma limits of the position estimation error are reduced from 5-6 nautical miles to 1.5-3 nautical miles. Author (ESA)

N80-18069*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN EVALUATION CRITERIA MODEL FOR THE NAVIGATION NETWORK SYSTEM DESIGN
In its The Deep Space Network. 15 Feb. 1980. p. 68-78. (For primary document see N80-18058 09-12)
Avail: NTIS. HC A07/MF A01.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-18028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TERMINAL CONFIGURED VEHICLE PROGRAM: TEST FACILITIES GUIDE
Washington. 1980. 67 p. refs.
(NASA-SP-435) Avail: NTIS. HC A04/MF A01. CSCL 01C
The terminal configured vehicle (TCV) program was established to conduct research and to develop and evaluate aircraft and flight management system technology concepts that will benefit conventional take off and landing operations in the terminal area. Emphasis is placed on the development of operating methods for the highly automated environment anticipated in the future. The program involves analyses, simulation, and flight experiments. Flight experiments are conducted using a modified Boeing 737 airplane equipped with highly flexible display and control

equipment and an aft flight deck for research purposes. The experimental systems of the Boeing 737 are described including the flight control computer systems, the navigation/guidance system, the control and command panel, and the electronic display system. The ground based facilities used in the program are described including the visual motion simulator, the fixed base simulator, the verification and validation laboratory, and the radio frequency anechoic facility. A.W.H.

N80-18029*# Boeing Vertol Co., Philadelphia, Pa.
SYNTHESIS OF ROTOR TEST DATA FOR REAL-TIME SIMULATION
M. A. McVeigh. Mar. 1979. 232 p. refs.
(Contract NAS2-9015)
(NASA-CR-152311; D210-11505-1) Avail: NTIS
HC A11/MF A01 CSCL 01C

A mathematical model of a hingeless tilting rotor is presented. The model was obtained by a systematic curve fit procedure applied to an extensive set of model scale wind tunnel data. The math model equations were used in a real time flight simulation model of a hingeless tilt rotor XV-15 to assess changes in flying qualities compared to those obtained using a previous rotor model. Extensive plots of the rotor derivatives are given. Discussions of attempts to apply multivariable linear regression techniques to the data and the use of an analytical rotor representation are included. Author

N80-18030*# Boeing Vertol Co., Philadelphia, Pa.
A HINGELESS ROTOR XV-15 DESIGN INTEGRATION FEASIBILITY STUDY. VOLUME 1: ENGINEERING DESIGN STUDIES. Final Report
J. P. Magee and H. R. Alexander. Mar. 1978. 473 p.
(Contract NAS2-9015)
(NASA-CR-152310; D210-11360-1-Vol-1) Avail: NTIS
HC A20/MF A01 CSCL 01C

A design integration feasibility study was carried out to investigate what modifications to the basic XV-15 were necessary to accomplish a flight demonstration of the XV-15 with a Boeing hingeless rotor. Also investigated were additional modifications which would exploit the full capability provided by the combination of the new rotor and the existing T53 engine. An evaluation of the aircraft is presented and the data indicate improved air vehicle performance, acceptable aeroelastic margins, lower noise levels and improved flying qualities compared with the XV-15 aircraft. Inspection of the rotor system data provided shows an essentially unlimited life rotor for the flight spectrum anticipated for the XV-15. R.E.S.

N80-18031*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
CONCEPTS FOR GENERATING OPTIMUM VERTICAL FLIGHT PROFILES
John A. Sorensen. Sep. 1979. 107 p. refs.
(Contract NAS1-15497)
(NASA-CR-159181) Avail: NTIS HC A06/MF A01 CSCL 01C

Algorithms for generating optimum vertical profiles are derived and examined. These algorithms form the basis for the design of onboard flight management concepts. The variations in the optimum vertical profiles (resulting from these concepts) due to variations in wind, takeoff weight, and range-to-destination are presented. Further considerations for mechanizing two different onboard methods of computing near-optimum flight profiles are then outlined. Finally, the results are summarized, and recommendations are made for further work. Technical details of optimum trajectory design, steering requirements for following these trajectories, and off-line computer programs for testing the concepts are included. J.M.S.

N80-18032*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE ESTIMATES OF A BOEING 747-100 TRANSPORT MATED WITH AN OUTSIZE CARGO POD
Lloyd S. Jernell. Feb. 1980. 20 p. refs.
(NASA-TM-80227) Avail: NTIS HC A02/MF A01 CSCL 01C

The design mission performance of a Boeing 747-100 aircraft mated with an outsize cargo pod was studied. The basic design requirement was the rapid deployment of a combat loaded mobile bridge launcher from a United States east coast staging base to Europe. Weight was minimized by stripping the aircraft of unneeded, quick removal items and by utilizing graphite-epoxy composite materials for most pod components. The mission analysis was based on wind tunnel data and full scale carrier aircraft and engine data. The results are presented in tabular and graphic form. A.W.H.

N80-18033# North American Rockwell Corp., El Segundo, Calif.
AIRCRAFT TRANSPARENCY FAILURE AND LOGISTICAL COST ANALYSIS: SUPPLEMENTAL STUDY. Final Report, Feb. - Jun. 1979
S. S. Brown. Wright-Patterson AFB, Ohio AFFDL. Jun. 1979. 250 p. refs.
(Contract F33615-77-C-3060; AF Proj. 2402)
(AD-A075500; NA-79-237; AFFDL-TR-79-3083) Avail: NTIS
HC A11/MF A01 CSCL 01/3

Concern for increasing costs in maintenance of transparency systems has prompted the Air Force Flight Dynamics Laboratory to sponsor this study contract. The object of this study is to identify the high-cost, high maintenance transparency components; identify cause of failures; and recommend corrective programs to reduce cost of ownership to the Air Force Logistics Command. The study involved the review of 20 selected aircraft in current inventory to establish an extensive data base relating transparency maintenance activity and associated logistical support costs. An important adjunct to this study was to research design characteristics, perform a failure analysis, and identify associated logistical support cost for each study aircraft. By using a selective process of correlating the transparency failure modes and maintenance costs with the relative stature of aircraft in current inventory, corrective programs were established and verified by life-cycle cost trades. These corrective programs entailed a comprehensive search for various design improvement that could be innovated to negate the reported failures. The study results contained herein are an extension of objectives of the original program and are directed at supplementing the corrective programs for six additional aircraft. GRA

N80-18034# Naval Air Development Center, Warminster, Pa.
DESIGN AND TEST OF A BORON - ALUMINUM HIGH TEMPERATURE WING. Final Report
R. J. Richey and T. E. Hess. May 1979. 106 p. refs.
(AD-A075814; NADC 79145-60) Avail: NTIS
HC A06/MF A01 CSCL 01/3

The feasibility of utilizing the high buckling stability characteristics of boron - aluminum advanced composite material in a simple, low-cost spar-rib-skin construction for a thin airfoil structure was investigated for high temperature application up to 589 K. The design concept developed consists of boron-aluminum skins, to carry the primary bending and torsion loads, mechanically fastened to a light gage steel sub-structure, which resists transverse shear and stabilizes the skins. The viability of the concept depends on whether this stabilization of the skin material can be accomplished with a practical number and spacing of substructure elements. A weight saving of one third in comparison to the production article is projected in this boron-aluminum version of the BYM-34E wing. A major wing subcomponent was fabricated and static tested to validate the structural adequacy of the overall design. GRA

N80-18035# Boeing Aerospace Co., Seattle, Wash.
NEW REMOTELY PILOTED VEHICLE LAUNCH AND RECOVERY CONCEPTS: COMPUTER PROGRAM LISTINGS. Final Report, Mar. 1978 - Mar. 1979
Steven J. Baumgartner, Roger F. Yurczyk, James G. Brister, and Vinod K. Rajpaul. Jun. 1979. 173 p.
(Contract F33615-78-C-3404; AF Proj. 2402)
(AD-A076611; AFFDL-TR-79-3069-Vol-2) Avail: NTIS
HC A08/MF A01 CSCL 01/3

Dynamic analysis, preliminary design, and performance/cost trade studies of air bag skid and air cushion concepts for launch and recovery of Boeing and Rockwell advanced RPV concepts have been conducted. Dynamic analysis was performed using the six degree-of-freedom computer program EASY. Dynamic simulations included perturbations to steady state flight, landing, and takeoff simulations. Launch and recovery concepts investi-

gated were air bag skid system, air cushion recovery system, integrated air cushion system, and air cushion launch platform. Performance/cost trade study factors investigated were complexity, fuel requirements, adverse weather capability, ground equipment and facility requirements, survivability, reliability and maintainability, and system acquisition and life cycle costs. Results of the study indicated that an air cushion system is a feasible means of recovery of an RPV such as the Boeing and Rockwell ARPV concepts. An air bag skid with an arrestor system is a feasible approach when minimum field length is a major design factor. Integrated air cushion system for launch and recovery are greatly affected by engine characteristics. In each case, the launch and recovery systems are shown to be an integral part of the total vehicle design and strongly influences the airframe design. GRA

N80-18229 McDonnell-Douglas Astronautics Co., St. Louis, Mo.
TURBULENT-BOUNDARY-LAYER EXCITATION AND RESPONSE THERETO FOR A HIGH-PERFORMANCE CONICAL VEHICLE
C. M. Ailman. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 4, Sep. 1978, p. 159-169, refs
(For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-18036* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AIR SPEED AND ATTITUDE PROBE Patent
Gerald J. Baker and Merle A. Economu, inventors (to NASA). Issued 15 Jan. 1980, 6 p. Filed 30 May 1978. Supersedes N78-25088 (16 - 16, p. 2077)
(NASA-Case-FRC-11009-1; US-Patent-4,184,149; US-Patent-Appl-SN-910708; US-Patent-Class-340-177VA; US-Patent-Class-73-188; US-Patent-Class-73-189; US-Patent-Class-73-212) Avail: US Patent and Trademark Office. CSCL 01D

An air speed and attitude probe characterized by a pivot shaft normally projected from a data boom and supported thereby for rotation about an axis of rotation coincident with the longitudinal axis of the shaft is described. The probe is a tubular body supported for angular displacement about the axis of rotation and has a fin mounted on the body for maintaining one end of the body in facing relation with relative wind and has a pair of transducers mounted in the body for providing intelligence indicative of total pressure and static pressure for use in determining air speed. A stack of potentiometers coupled with the shaft to provide intelligence indicative of aircraft attitude, and circuitry connecting the transducers and potentiometers to suitable telemetry circuits are described.

Official Gazette of the U.S. Patent and Trademark Office

N80-18037*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EARLY FLIGHT TEST EXPERIENCE WITH COCKPIT DISPLAYED TRAFFIC INFORMATION (CDTI)
Terence S. Abbott, Gene C. Moen (Army Res. and Technol. Labs., Hampton, Va.), Lee H. Person, Jr., Gerald L. Keyser, Jr., Kenneth R. Yenni, and John F. Garren. Feb. 1980, 31 p. refs
(DA Proj. 1L2-62209-AH-76)
(NASA-TM-80221; AVRADCOM-TR-80-B-2) Avail: NTIS HC A03/MF A01 CSCL 01D

Coded symbology, based on the results of early human factors studies, was displayed on the electronic horizontal situation indicator and flight tested on an advanced research aircraft in order to subject the coded traffic symbology to a realistic flight environment and to assess its value by means of a direct comparison with simple, uncoded traffic symbology. The tests consisted of 28 curved, decelerating approaches, flown by research-pilot flight crews. The traffic scenarios involved both conflict-free and blunder situations. Subjective pilot commentary was obtained through the use of a questionnaire and extensive pilot debriefing sessions. The results of these debriefing sessions group conveniently under either of two categories: display factors or task performance. A major item under the display factor category was the problem of display clutter. The primary contributors to clutter were the use of large map-scale factors, the use of traffic data blocks, and the presentation of more than a few aircraft. In terms of task performance, the cockpit displayed traffic information was found to provide excellent overall situation awareness. R.E.S.

N80-18038*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECT OF VIEWING TIME, TIME TO ENCOUNTER, AND PRACTICE ON PERCEPTION OF AIRCRAFT SEPARATION ON A COCKPIT DISPLAY OF TRAFFIC INFORMATION
Sharon OConnor, Everett Palmer, Daniel Baty, and Sharon Jago. Feb. 1980, 17 p. refs. Prepared in cooperation with San Jose State Univ., Calif.
(Grant NsG-2269)
(NASA-TM-81173; A-8072) Avail: NTIS HC A02/MF A01 CSCL 01D

The concept of a cockpit display of traffic information (CDTI) includes the integration of air traffic, navigation, and other pertinent information in a single electronic display in the cockpit. Two studies were conducted to develop a clear and concise display format for use in later full-mission simulator evaluations of the CDTI concept. Subjects were required to monitor a CDTI for specified periods of time and to make perceptual judgments concerning the future position of a single intruder aircraft in relationship to their own aircraft. Experimental variables included: type of predictor information displayed on the two aircraft symbols; time to encounter point; length of time subjects viewed the display; amount of practice; and type of encounter (straight or turning). Results show that length of viewing time had little or no effect on performance; time to encounter influenced performance with the straight predictor but did not with the curved predictor; and that learning occurred under all conditions. R.E.S.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-18039* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD AND APPARATUS FOR RAPID THRUST INCREASES IN A TURBOFAN ENGINE Patent
Jack E. Cornett (GE, Cincinnati, Ohio), Ralph C. Corley (GE, Cincinnati, Ohio), Thomas O. Fraley (GE, Cincinnati, Ohio), and Andrew A. Saunders, Jr., inventors (to NASA) (GE, Cincinnati, Ohio). Issued 22 Jan. 1980, 9 p. Filed 9 Dec. 1977. Sponsored by NASA
(NASA-Case-LEW-12971-1; US-Patent-4,184,327; US-Patent-Appl-SN-858936; US-Patent-Class-60-240; US-Patent-Class-60-39.03; US-Patent-Class-60-39.27) Avail: US Patent and Trademark Office. CSCL 21E

Upon a landing approach, the normal compressor stator schedule of a fan speed controlled turbofan engine is temporarily varied to substantially close the stators to thereby increase the fuel flow and compressor speed in order to maintain fan speed and thrust. This running of the compressor at an off-design speed substantially reduces the time required to subsequently advance the engine speed to the takeoff thrust level by advancing the throttle and opening the compressor stators.

Official Gazette of the U.S. Patent and Trademark Office

N80-18040*# Little (Arthur D.), Inc., Cambridge, Mass.
STUDY OF RESEARCH AND DEVELOPMENT REQUIREMENTS OF SMALL GAS-TURBINE COMBUSTORS
E. P. Demetri, R. F. Topping, and R. P. Wilson, Jr. Jan. 1980 69 p refs
(Contract NAS3-21980)
(NASA-CR-159796; ADL-83381-2) Avail: NTIS HC A04/MF A01 CSCL 21E

A survey is presented of the major small-engine manufacturers and governmental users. A consensus was undertaken regarding small-combustor requirements. The results presented are based on an evaluation of the information obtained in the course of the study. The current status of small-combustor technology is reviewed. The principal problems lie in liner cooling, fuel injection, part-power performance, and ignition. Projections of future engine requirements and their effect on the combustor are discussed. The major changes anticipated are significant increases in operating pressure and temperature levels and greater capability of using heavier alternative fuels. All aspects of combustor design are affected, but the principal impact is on liner durability. An R&D plan which addresses the critical combustor needs is described. The plan consists of 15 recommended programs for achieving necessary advances in the areas of liner thermal design, primary-zone performance, fuel injection, dilution, analytical modeling, and alternative-fuel utilization. M.M.M.

N80-18041*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
INTERNAL COATING OF AIR COOLED GAS TURBINE BLADES Final Report
P. L. Ahuja Nov. 1979 73 p refs
(Contract NAS3-21038)
(NASA-CR-159701) Avail: NTIS HC A04/MF A01 CSCL 21E

Six coating systems were evaluated for internal coating of decent stage (DS) eutectic high pressure turbine blades. Sequential deposition of electroless Ni by the hydrazine process, slurry Cr, and slurry Al, followed by heat treatment provided the coating composition and thickness for internal coating of DS eutectic turbine blades. Both NiCr and NiCrAl coating compositions were evaluated for strain capability and ductile to brittle transition temperature. R.C.T.

N80-18042*# Vought Corp., Dallas, Tex.
LOW SPEED TEST OF THE AFT INLET DESIGNED FOR A TANDEM FAN V/STOL NACELLE
W. W. Rhoades and A. H. Ybarra Feb. 1980 79 p refs
(Contract NAS3-21468)
(NASA-CR-159752; TR-2-30320/OR-52360) Avail: NTIS HC A05/MF A01 CSCL 21E

An approximately .25 scale model of a Tandem Fan nacelle designed for a Type A V/STOL aircraft configuration was tested in a 10-by-10 foot wind tunnel. A 12 inch, tip driven, turbofan simulator was used to provide the suction source for the aft fan inlet. The front fan inlet was faired over for this test entry. Model variables consisted of a long aft inlet cowl, a short aft inlet cowl, a shaft simulator, blow-in door passages and diffuser vortex generators. Inlet pressure recovery, distortion, inlet angle of attack separation limits were evaluated at tunnel velocities from 0 to 240 knots, angles of attack from -10 to 40 degrees and inlet flow rates representative of throat Mach numbers of 0.1 to 0.6. High inlet performance and stable operation was verified at all design forward speed and angle of attack conditions. The short aft inlet configuration provided exceptionally high pressure recovery except at the highest combination of angle of attack and forward speed. The flow quality at the fan face was somewhat degraded by the addition of blow-in door passages to the long aft inlet configuration due to the pressure disturbances generated by the flow entering the diffuser through the auxiliary air passages. M.M.M.

N80-18043*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION IN YEAR 2000
Richard J. Weber 1980 18 p refs Proposed for presentation at Global Technol. 2000, the 1980 Intern. Meeting of the Am. Inst. of Aeron. and Astronautics, Baltimore, 5-11 May 1980
21A

A sampling of probable future engine types, such as convertible engines for helicopters, turboprops for fuel-conservative airliners, and variable-cycle engines for supersonic transports are presented. Related technology improvements in propellers, materials, noise suppression, etc. are reviewed. R.E.S.

N80-18044# Ohio State Univ. Research Foundation, Columbus.
INVESTIGATION OF THE BOUNDARY LAYER BEHAVIOR ON TURBINE AIRFOILS Final Report, 16 Jun. 1975 - 15 Dec. 1978
Lit S. Han, Wesley R. Cox, and Arnon Chait Aug. 1979 273 p refs
(Contract F33615-75-C-2052; AF Proj. 3066)
(AD-A075501; OSURF/760256/784174; AFAPL-TR-79-2011) Avail: NTIS HC A12/MF A01 CSCL 20/4

Smoke flow visualization, hot-wire anemometer, and pressure distribution studies were conducted to determine some of the wake and pressure surface boundary layer transition region characteristics along an enlarged two-dimensional turbine airfoil model in cascade. Smooth surface as well as rough surface airfoils were used in the study, which utilized a continuous, subsonic, specially built wind-tunnel. The flow provided a range of blade chord Reynolds numbers from 7.9E - 5 1.5E - 6 at turbulence levels of 0.6 to 0.8%. A pressure surface transition region was found to exist from about S/C = 0.43 to the trailing edge for the smooth surface airfoil, and up to S/C = 0.1 for a rough surface airfoil. The transition region for a smooth surface was initiated through the formation of Goertler vortices which were found to break down through the action of traveling Tollmein-Schlichting waves. Other phenomena observed include various trailing edge vortex formations which may be linked to the intermittency of the boundary layer near the trailing edge, and a low frequency traveling wave formed in conjunction with the appearance of traveling waves. An empirical relationship was developed for the traveling wave frequency. Comparison was made with stability theory and empirical methods of predicting transition. Linear stability theory was found to predict the Goertler wavelength, but not that of the traveling waves. GRA

N80-18045# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE 7TH ANN. TRI-SERVICE MEETING FOR AIRCRAFT ENGINE MONITORING AND DIAGNOSTICS Final Report, 5-7 Dec. 1979
James L. Pettigrew and Keith Hamilton Jul. 1979 284 p Meeting held at Arnold Air Force Station, Tenn., 5-7 Dec. 1978
(AD-A076126; ASD-TR-79-5040) Avail: NTIS HC A13/MF A01 CSCL 21/5

These proceedings contain an edited compilation of the presentations of government agencies at the Seventh Tri-Service Diagnostic Conference held at Arnold Engineering Development Center, Arnold Air Force Station Tennessee 5-7 Dec. 1978. The program themes were current experience service needs and technology thrusts in aircraft turbine engine monitoring and diagnostics. Working level representatives from the maintenance organization of operating and support commands gave their views on the requirements for specific diagnostic and maintenance decision information. GRA

N80-18046# ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF F-16 NOZZLE-AFTERBODY FORCES AT TRANSONIC MACH NUMBERS WITH EMPHASIS ON SUPPORT SYSTEM INTERFERENCE Final Report, Jan. - Jul. 1978
Earl A. Price, Jr. AEDC Dec. 1979 207 p refs Sponsored by the Air Force
(AD-A078693; AEDC-TR-79-56; AFAPL-TR-79-2099) Avail: NTIS HC A10/MF A01 CSCL 20/4

A comprehensive experimental program was conducted to provide nozzle-afterbody data with a minimum interference support system on a 1/9-scale F-16 model and to determine the interference induced on the afterbody-nozzle region by a sting, a wingtip, and a strut model support system. The investigation was conducted over the Mach number range from 0.6 to 1.5 and at angles of attack from 0 to 9 deg. Interference was evaluated by comparison of nozzle-afterbody axial and normal forces obtained from integrating pressure data. The results include parametric

studies of the effects of various components of the wingtip support system (i.e., the support blade axial position, wingtip boom diameter, boom spacing, and boom-tip axial location). High-pressure air at ambient temperature was utilized for exhaust plume simulation. The results indicate that a sting support passing through the nozzle with the jet effects simulated by an annular jet appears to offer a minimum interference support system for the type of nozzle-afterbody test described in this report. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-18047*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
V/STOLAND AVIONICS SYSTEM FLIGHT-TEST DATA ON A UH-1H HELICOPTER
Fredric A. Baker, Dean N. Jaynes, Lloyd D. Corliss, Sam Liden (Sperry Rand Corp., Phoenix, Ariz.), Robert B. Merrick, and Daniel C. Dugan. Feb. 1980. 68 p. refs.
(NASA-TM-78591; A-7831) Avail: NTIS HC A04/MF A01 CSCL 01C

The flight-acceptance test results obtained during the acceptance tests of the V/STOLAND (versatile simplex digital avionics system) digital avionics system on a Bell UH-1H helicopter in 1977 at Ames Research Center are presented. The system provides navigation, guidance, control, and display functions for NASA terminal area VTOL research programs and for the Army handling qualities research programs at Ames Research Center. The acceptance test verified system performance and contractual acceptability. The V/STOLAND hardware navigation, guidance, and control laws resident in the digital computers are described. Typical flight-test data are shown and discussed as documentation of the system performance at acceptance from the contractor. M.M.M.

N80-18048*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THRUST AUGMENTED SPIN RECOVERY DEVICE Patent Application
Bobby L. Berrier, inventor (to NASA). Filed 27 Apr. 1979. 15 p.
(NASA-Case-LAR-11970-2; US-Patent-Appl-SN-034104) Avail: NTIS HC A02/MF A01 CSCL 01C

A lightweight and drag-free yaw control system developed for a jet propelled aircraft is described. Emphasis is placed on providing aircraft attitude control at low flight speeds, at high angles of attack, and during spin. The control system is comprised of a vertical tail with a thrust augmented rudder and a thrust rudder tab. The jet exhaust stream is deflected by the thrust vectoring rudder tab in a sideward direction to the aircraft, producing a thrust vectored yawing moment and creating supercirculation about the vertical tail and thrust augmented rudder. Supercirculation, a thrust-induced aerodynamic phenomenon, generates lift without increasing drag, enabling the rudder to provide additional yawing force for attitude control. J.M.S.

N80-18049# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNSTEADY EFFECTS WITH CONTROL SURFACES [EFFETS INSTATIONNAIRES DES GOUVERNES]
Richard Grenon and Andre Desopper. Assoc. Aeron. et Astronautique de France. 1979. 14 p. refs. In FRENCH. Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978.
(AAAF-NT-79-01; ISBN-2-7170-0528-5) Avail: NTIS HC A02/MF A01; CEDOCAR; Paris FF 17 (France and EEC) FF 21 (others)

The unsteady phenomena observable around control surfaces in subsonic and transonic flow is discussed. Results obtained with an airfoil profile equipped with a trailing edge flap moving sinusoidally in a two dimensional subsonic or transonic flow regime are reported. Steady and unsteady pressure measurements made during wind tunnel tests are given. A comparison is made between these measurements and results for the steady and unsteady flow field of a perfect fluid. An attempt is made to take into consideration viscous effects. Results show that theory does not satisfactorily describe coupling phenomena, notably flow separation and the interaction between the shock front and the boundary layer. Author (ESA)

N80-18050# Aerospatiale Usines de Toulouse (France). Helicopters Div.
ROTORS IN FORWARD FLIGHT AND DYNAMIC STALL [PALE RECULANTE ET DECROCHAGE DYNAMIQUE]
J. Renaud. Paris Assoc. Aeron. et Astronique de France. 1979. 26 p. refs. In FRENCH. Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978.
(AAAF-NT-79-20; ISBN-2-7170-0547-1) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

Dynamic stall of rotors in forward flight is studied in terms of the limiting on helicopter performance. Manifestations of the phenomena depend on the characteristics of the rotors and on operating conditions. The lift of the rotor, forward velocity, engine speed, and the interaction of vortices with the blade surface all contribute to the development of stall. Experiments demonstrating the unsteady nature of the phenomena are reported. Simulation of dynamic stall phenomena on an oscillating model shows that the delay in unsteady stalling is associated with the development of a system of vortices along the leading edge. A two dimensional analysis is used in modeling dynamic stall. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-18051# Yang (Nai C.) and Associates, New York, N.Y.
NONDESTRUCTIVE EVALUATION OF AIRPORT PAVEMENTS. VOLUME 1: PROGRAM REFERENCES
Nai C. Yang. Sep. 1979. 173 p.
(Contract DOT-FA77WA-3964)
(AD-A078835; FAA-RD-78-154-1) Avail: NTIS HC A08/MF A01 CSCL 13/2

The concept of nondestructive evaluation and functional pavement design was integrated into a computer program which is described. The program logic and operational procedures used in the computer program are outlined as follows. The nondestructive test (NDT) is used as a substitute for the plate load test without interference to airport operation. The evaluation and design segment evaluates the strength by cumulative stress damage and progressive surface deformation. The final program output is the cost information for ten design alternatives of equal functional performance. The validation program makes the correlations between the NDT data and subgrage geology, regional climate, airport operation, existing pavements, and response of airport bridges. A.W.H.

N80-18052# Permali, Inc., Mount Pleasant, Pa.
DEVELOPMENT AND TEST OF LOW-IMPACT RESISTANT TOWERS Final Report
Eugene T. Rogers, Jonathan A. Ross, and Kenneth M. Snyder. Aug. 1979. 76 p.
(Contract DOT-FA78WA-4152)
(AD-A077160; W79005; FAA-AF-79-1) Avail: NTIS HC A05/MF A01 CSCL 01/5

A break-away fiberglass mast for use in low impact resistant (LIR) structures to support airport approach lighting systems was developed. This design will withstand 100 mph winds (including gusts) without ice and 75 mph winds (including gusts) with a 1/2 inch radial ice load. Yet, when struck by a light airplane wind, it breaks into pieces without catastrophic damage to the wing. It was observed that impact energy needed to

break the mast was in the order of 679 foot-pounds and that peak forces were in the order of 5,656 lbs. J.M.S.

N80-18053# Aeronautical Research Labs., Melbourne (Australia).
COMPUTER SYNTHESIS OF FLIGHT SIMULATION VISUALS
John Sandor Feb 1979 36 p refs
(ARL/SYS-Note-61; AR-001-593) Avail: NTIS HC A03/MF A01

The principles of computer synthesis of external world visuals for faster display are reviewed. The areas of environment description, edge and polygon clipping, hidden surface removal, shading, and image aberrations are discussed. Particular attention is given to hierarchical environment structure, image coherence, shading functions, and area averaging edge smoothing techniques. A.W.H.

N80-18054# Aeronautical Research Labs., Melbourne (Australia).
PROGRAMS FOR THE TRANSONIC WIND TUNNEL DATA PROCESSING INSTALLATION. PART 7: EXTENDED FOCAL
N. Pollock Mar. 1979 44 p refs
(AD-A073414; ARL/Aero-TM-314) Avail: NTIS HC A03/MF A01 CSCL 09/2

Since the transonic wind tunnel data processing installation, which is based on a PDP 8-I computer, was installed in 1968 a considerable library of standard programs have been produced. This program library covers all types of testing commonly carried out in the wind tunnel. However there remains the possibility of unusual tests being required which are not covered by existing programs. This memorandum describes modifications to the Digital Equipment Corporation FOCAL language (FOCAL is a keyboard oriented interpretive language similar to BASIC) which permit the tunnel instrumentation, display and plotter to be operated by FOCAL programs. Using this extended FOCAL language it should be possible to rapidly write and de-bug programs to meet unusual requirements not covered by the standard program library. GRA

N80-18055# Battelle Columbus Labs., Ohio.
METHODOLOGY FOR MAKING A SELF-ABSORPTION CORRECTION TO THE SIMPLE COPPER-LINE-RATIO TECHNIQUE USED FOR ARC-TUNNEL ENTHALPY MEASUREMENTS Final Report, Oct. 1977 - Oct. 1978
Anthony A. Boiarski Oct. 1979 77 p refs
(Contract F33615-76-C-3145; AF Proj. 2404)
(AD-A078686; AFFDL-TR-79-3122) Avail: NTIS HC A05/MF A01 CSCL 20/13

Detailed theory and analytical procedures are presented which provide a method for self-absorption correction of the simple 5106/5153 angstrom copper-line-ratio technique used to measure arc-tunnel stagnation enthalpy. This correction procedure involves simultaneous measurement of the 5106 angstrom line full half-width in order to infer copper number density and gas temperature from the self-absorption broadened line profile shape, and the simple one intensity ratio. Theoretical formulations of other dominant line-broadening contributions (i.e., Doppler, Van der Waals, and Stark effects) are also included in order to accurately determine the degree of line broadening that results from self-absorption alone. Typical data reduction curves are presented to demonstrate the correction process. These curves indicate that large errors in measured enthalpy could result if self-absorption was not properly accounted for in the data analysis procedure. An error estimate is also included to indicate the typical accuracy presently obtainable from this self-absorption correction method. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-18056* National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGY FOR LARGE SPACE SYSTEMS. A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 2
20 Mar. 1980 106 p
(NASA-SP-7046(02)) Avail: NTIS HC A06 CSCL 22A

This bibliography lists 258 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1, 1979 and December 31, 1979. Its purpose is to provide helpful information to the researcher, manager, and designer in technology development and mission design in the area of the Large Space Systems Technology (LSST) Program. Subject matter is grouped according to systems, interactive analysis and design, structural concepts, control systems, electronics, advanced materials, assembly concepts, propulsion, solar power satellite systems, and flight experiments. Author

N80-18057*# RAND Corp., Santa Monica, Calif.
CONTROL NETWORKS FOR THE GALILEAN SATELLITES, NOVEMBER 1979
Merton E. Davies, Thomas A. Hauge, Frank Y. Katayama, and James A. Roth Nov. 1979 70 p refs
(Contracts NASw-3210; JPL-953613)
(NASA-CR-162799; R-2532-JPL/NASA;
ISBN-0-8330-0197-3) Avail: NTIS HC A04/MF A01 CSCL 22A

Pictures of the four Galilean satellites taken as the two Voyager spacecraft approached Jupiter during March and July 1979 are presented. Control nets of the Galilean satellites, computed photogrammetrically, and measurements of the mean radii are presented. The pictures in the control nets are identified, the coordinates of the control points are given, and identifications of some of the control points are shown on figures. The use of star field pictures to compute the focal lengths of the camera is discussed and the geometric relationship between the narrow and wide and angle cameras is reported. A description of the coordinate systems of the Galilean satellites is presented and the status of the control net computations is reported. A.W.H.

N80-18058*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Nov. - Dec. 1979
15 Feb. 1980 131 p refs
(Contract NAS7-100)
(NASA-CR-162795; JPL-PR-42-55) Avail: NTIS HC A07/MF A01 CSCL 14B

The functions and facilities of the Deep Space Network are considered. Progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations is reported. For individual titles, see N80-18059 through N80-18073.

N80-18059*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Feb. 1980 p 1-4 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N80-18060*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING ORBITER COMPLETION MISSION c15
R. L. Gillette *In its* The Deep Space Network 15 Feb. 1980 p 4-5 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 22A

Viking Spacecraft activities from 1 April 1979 through 30 November 1979 are reported. The DSN Viking tracking support for the same periods included. J.M.S.

N80-18061*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER MISSION SUPPORT c14
G. M. Rockwell *In its* The Deep Space Network 15 Feb. 1980 p 7-9 ref (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

The continuing Deep Space Network support of Pioneer

Mission Operations is reported. Information on the cruise phases of Pioneers 6-9, Pioneer 10, post-encounter coverage of Pioneer 11, Pioneer 12 orbital operations, and other mission-related activities is included. J.M.S.

N80-18062*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY **c89**
R. M. Taylor *In its* The Deep Space Network 15 Feb. 1980 p 10-11 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 03A

The activities of the Deep Space Network in support of radio astronomy operations during the period September 1979 to December 1979 are reported. J.M.S.

N80-18063*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRACTICAL LIMITATIONS ON NOISELESS OPTICAL CHANNEL CAPACITY **c74**
S. A. Butman, J. Katz, and J. R. Lesh *In its* The Deep Space Network 15 Feb. 1980 p 12-14 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20F

An optimization scheme under the constraint of a given information rate (in nats/second) and minimum time slot resolution is presented. It is shown that system efficiencies in excess of 10's of nats/photon will be extremely difficult to achieve due to fundamental time resolution limitations. J.M.S.

N80-18064*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ESTIMATING THE ANGULAR POSITION OF A MOVING DEEP SPACE VEHICLE USING TWO ROTATING TRACKING STATIONS **c13**
H. H. Tan *In its* The Deep Space Network 15 Feb. 1980 p 15-29 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 22A

The problem of estimating the angular position of a deep space vehicle moving at a constant velocity using two rotating tracking stations is considered. The optimal attainable estimation performance and associated receiver design are included. Parametric dependence of the optimum attainable estimation performance is also studied. J.M.S.

N80-18065*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VALIDATION OF ROUNDTRIP CHARGED-PARTICLE CALIBRATIONS DERIVED FROM S- AND X-BAND DOPPLER VIA DRVID MEASUREMENTS **c32**
D. W. Green *In its* The Deep Space Network 15 Feb. 1980 p 30-40 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20N

It is shown that roundtrip signal path calibrations for charged particle effects can be computed from S- and X-band Doppler data. The method by which this is done is described, and possible error sources are examined. It is shown that roundtrip calibrations computed from S- and X-band Doppler compare to direct measurements using DRVID to within the DRVID data noise. J.M.S.

N80-18066*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPERATION OF JOULE-THOMPSON REFRIGERATION ABOVE THE CRITICAL PRESSURE OF HELIUM **c31**
D. L. Johnson *In its* The Deep Space Network 15 Feb. 1980 p 41-49 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20L

The refrigeration capacity of an existing refrigeration system was measured as a function of the supply pressure and the return pressure in the Joule-Thomson circuit. The performance of the refrigerator was calculated and compared to the ideal Carnot cycle refrigerator. K.L.

N80-18067*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FEASIBILITY STUDY OF A SPACECRAFT SURVEILLANCE SYSTEM **c14**
C. A. Greenhall *In its* The Deep Space Network 15 Feb. 1980 p 50-62 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

The system for monitoring the health of the proposed International Comet Exploration spacecraft during its solar electric propulsion stage cruise mode is discussed. The system uses a commerical fast Fourier transform spectrum analyzer for noncoherent, synchronous detection of an alternating-tone signal received by a small parabolic antenna (0.8 to 3 m in diameter). Integration times vary from 3.7 to 9.5 min. K.L.

N80-18068*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE PRACTICAL LIMITS OF PHOTON COMMUNICATION **c32**
R. J. McEliece, E. R. Rodemich, and A. L. Rubin *In its* The Deep Space Network 15 Feb. 1980 p 63-67 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 17B

It is shown that for photon communication, the rate R sub o = 1 nat per photon is the rate beyond which an explosive increase is encountered in the required ratio of peak-to-average signal power and in the required bandwidth expansion. On the basis of these results, it is conjectured that no practical photon communication system can be designed to operate above 10 nats per photon. K.L.

N80-18069*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN EVALUATION CRITERIA MODEL FOR THE NAVIGATION NETWORK SYSTEM DESIGN **c04**
In its The Deep Space Network 15 Feb. 1980 p 68-78 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01

The approaches used in developing the basis for a system design evaluation model are described. Two evaluation cases are modeled, leading to a general model that is then detailed for application specifically to the Navigation Network conceptual designs. The identification of the system attributes and their associated perspectives are discussed along with the method of scoring and ranking a candidate design. K.L.

N80-18070*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TROPOSPHERIC PATH LENGTH FLUCTUATION IN TEMPERATE SEMIARID LOCALES: APPLICATION TO THE GRAVITATIONAL WAVE DETECTION EXPERIMENT **c46**
A. L. Berman and S. D. Slobin *In its* The Deep Space Network 15 Feb. 1980 p 79-85 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 04A

Radiosonde data from Edwards Air Force Base and radio metric scintillation data collected over a long, nearly horizontal path in Hawaii investigated. Utilizing a hypothesis that wet tropospheric path length fluctuation is proportional to total wet tropospheric signal delay, the two types of data are shown to be in reasonable agreement for averagings times (tau sub a) of approximately 3000 seconds. The two-way modeled tropospheric fractional frequency fluctuation at tau sub a = 1000 seconds is 1.6 x 10 to the 14th power. K.L.

N80-18071*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GCF-NOCC RECONFIGURATION **c60**
J. P. McClure *In its* The Deep Space Network 15 Feb. 1980 p 86-89 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 09B

Improvements in the operational capability of the equipment and computer programs in the Network Operations Control Center and the Ground Communications Facility Central Communications Terminal at JPL are documented. K.L.

N80-18072*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRELIMINARY TELEMETRY OPERATIONS EXPERIENCE WITH THE REAL-TIME COMBINER, 1 NOVEMBER 1978 TO 1 NOVEMBER 1979 **c17**
N. K. Simon and C. Hoynes *In its* The Deep Space Network 15 Feb

1980 p 90-96 ref (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 09F

A prototype version of a two station, real time signal combiner was installed at Goldstone DSS 14/(12) and used to support the Voyager Mission at Jupiter and the Pioneer 11 Mission at Saturn. Early combined station operating experience with a real Time Combiner in the loop is reported. K.L.

N80-18073*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VITERBI DECODING MODIFIED FOR SOURCES WITH MEMORY **c32**
V. Kopwar *In its* The Deep Space Network 15 Feb. 1980 p 97-110 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 17B

The gain in signal to noise ratio realized using redundancies inherent in TV data to modify the decoding metric of the DSN Viterbi decoders is investigated. This modification takes into account the memory in a TV scan line to change the transition probabilities as originally computed using independent data. The resulting data rate gain or error probability decrease is achieved without requiring any spacecraft modifications or additions. A preliminary examination of this concept on a binary symmetric channel using a simplified Markov source model involving two-level or hard-clipped TV demonstrates that very substantial decreases in error probability may be achieved. K.L.

N80-18074*# National Aeronautics and Space Administration, Washington, D. C.
THE WORLD OF TOMORROW: AEROSPACE ACTIVITIES FOR 8- TO 10-YEAR OLDS. A GUIDE FOR LEADERS OF CHILDREN'S GROUPS AND TEACHERS OF THE LOWER GRADES
1978 70 p Prepared in cooperation with the Boy Scouts of America, Dallas/Fort Worth Airport, Tex.
(NASA-EP-144) Avail: NTIS MF A01; SOD HC CSCL 22A

During January 1977, NASA helped the Cub Scout Division of the Boy Scouts of America in the conduct of its The World of Tomorrow monthly theme. In this period, 249 Cub Scout packs participated in a nationwide aerospace activities project, a pilot project in which den leaders and Cubmasters conducted local programs for their Cub Scouts and Webelos Scouts. The products of these local programs are presented with the written accounts submitted by adult leaders and written compositions, pictures, and photographs of models submitted by the youngsters. A.W.H.

N80-18075*# Brown Engineering Co., Inc., Huntsville, Ala. Space Systems Dept.
STRAWMAN PAYLOAD DATA FOR SCIENCE AND APPLICATIONS SPACE PLATFORMS Final Report
Jan. 1980 214 p
(Contract NAS8-32711)
(NASA-CR-161376; SP80-MSFC-2403) Avail: NTIS HC A10/MF A01 CSCL 22A

The need for a free flying science and applications space platform to host compatible long duration experiment groupings in Earth orbit is discussed. Experiment level information on strawman payload models is presented which serves to identify and quantify the requirements for the space platform system. A description data base on the strawman payload model is presented along with experiment level and group level summaries. Payloads identified in the strawman model include the disciplines of resources observations and environmental observations. A.W.H.

N80-18076*# General Dynamics/Convair, San Diego, Calif.
ORBITAL REFILL OF PROPULSION VEHICLE TANKAGE
F. Merino, J. Risberg, and M. Hill Feb. 1980 256 p
(Contract NAS3-21360)
(NASA-CR-159722; GDC-CRAD-80-001) Avail: NTIS HC A12/MF A01 CSCL 22A

Techniques for orbital refueling of space based vehicles were developed and experimental programs to verify these techniques were identified. Orbital refueling operations were developed for two cryogenic orbital transfer vehicles (OTV's) and an Earth storable low thrust liquid propellant vehicle. Refueling operations were performed assuming an orbiter tanker for near term missions and an orbital depot. Analyses were conducted using liquid hydrogen and N2O4. The influence of a pressurization system and acquisition device on operations was also considered. Analyses showed that vehicle refill operations will be more difficult with a cryogen than with an earth storable. The major elements of a successful refill with cryogens include tank prechill and fill. Propellant quantities expended for tank prechill appear to to insignificant. Techniques were identified to avoid loss of liquid or excessive tank pressures during refill. It was determined that refill operations will be similar whether or not an orbiter tanker or orbital depot is available. Modeling analyses were performed for prechill and fill tests to be conducted assuming the Spacelab as a test bed, and a 1/10 scale model OTV (with LN2 as a test fluid) as an experimental package. R.C.T.

N80-18077# European Space Operations Center, Darmstadt (West Germany). Operations Dept.
GEOS-2: REPORT ON THE FIRST SIX MONTHS OF ROUTINE OPERATIONS
Paris ESA Jun. 1979 69 p refs
Avail: NTIS HC A04/MF A01

The European Space Operations Center operational support and the onboard performance are summarized. Experiments performed daily are discussed and the satellite positions and maneuvers performed are described. Special experiment operations including balloon and rocket campaigns, (Porcupine, Substrom), a lithium release operation, and measurements along geomagnetic field lines are reported. An anomaly which occurred due to a failure in the solar array causing damage to some experiments is discussed. Author (ESA)

N80-18078# Royal Norwegian Council for Scientific and Industrial Research, Blindern. Space Activity Div.
SPACE ACTIVITY IN NORWAY, 1978
Oslo 1979 37 p refs Presented at 22nd COSPAR Plenary Meeting, Bangalore, India, May-June 1979
(SAD-80-T; ISBN-82-7224-026-2) Avail: NTIS HC A03/MF A01

The organization of space oriented activity in Norway over the year is discussed. The test facilities are described and programs for rocket and balloon sounding in conjunction with satellite projects are reported. Research in maritime satellite communication, search and rescue, satellite navigation, and geographical surveys are reviewed. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-18064*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ESTIMATING THE ANGULAR POSITION OF A MOVING DEEP SPACE VEHICLE USING TWO ROTATING TRACKING STATIONS
H. H. Tan *In its* The Deep Space Network 15 Feb. 1980 p 15-29 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 22A

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N80-18059*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Feb. 1980

p 1-4 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

N80-18061*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER MISSION SUPPORT
G. M. Rockwell *In its* The Deep Space Network 15 Feb. 1980 p 7-9 ref (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

N80-18067*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FEASIBILITY STUDY OF A SPACECRAFT SURVEILLANCE SYSTEM
C. A. Greenhall *In its* The Deep Space Network 15 Feb. 1980 p 50-62 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-18079# Naval Surface Weapons Center, White Oak, Md. Strategic Systems Dept.
MODIFLY: A MODULAR MULTI-DEGREE-OF-FREEDOM TRAJECTORY PROGRAM Final Report
John E. Holmes 1 Mar. 1979 127 p
(AD-A073901; NSWC/WOL/TR-78-59) Avail: NTIS HC A07/MF A01 CSCL 16/2

MODIFLY is a modular trajectory simulation computer program which was written so as to be effective, efficient, and easily modified. The program was designed primarily for the simulation of typical autonomous guided missiles in which roughly equal consideration is given to the simulations of the seekers, guidance, autopilot, controls, and aerodynamics. It was written in FORTRAN IV language for use on a CDC 6500 computer and uses overlay files and a library edit routine. GRA

N80-18080# Raytheon Co., Bedford, Mass. Missile Systems Div.
MODULAR DIGITAL MISSILE GUIDANCE Technical Report, 1 Jan. - 31 Dec. 1977
Frank J. Langley, A. J. Mannion, K. D. Laube, J. Demetrick, and D. S. Goldstein 14 Dec. 1979 288 p refs
(Contract N00014-75-C-0549)
(AD-A078808; BR-11344; ONR-CR-233-052-4) Avail: NTIS HC A13/MF A01 CSCL 17/7

A set of macromodular microcomputer specifications has been prepared to meet a wide range of missile guidance and control requirements. These specifications define the function performance and interface requirements of each microcomputer module, i.e., microprocessor, memory and input-output I/O interface for analog and serial digital I/O, such that device technology improvements can continually be accommodated within the bounds of module function performance and interface requirements. To ensure such flexibility in design, other alternative device technologies were reviewed and evaluated for the MIL-STD-4553A serial digital I/O interface and the spectrum analyzer module, viz: fiber-optic data link and charge-coupled device, (CCD), very-large-scale integration (VLSI) analyzer options. In addition, the requirements for universal microcomputer development systems were explored in order to support both medium-speed single-chip microprocessors and high-speed bit-slice emulators to preserve software commonality. Lastly, the compatibility of the Navy AN/UYK-30 microprocessor with the macromodular microcomputer family was investigated on the basis of throughput and electrical interface. In summary, this phase of the program has culminated in the generation of a practical set of microcomputer module specifications for multi-source procurement. GRA

N80-18081# M&S Computing, Inc., Huntsville, Ala.
THE DIGITAL AIR DEFENSE MISSILE SYSTEM SIMULATION TECHNICAL EFFORT Final Report, 14 May - 30 Sep. 1979
D. G. Ellenburg, M. K. Grounds, J. D. McCormick, T. C. Phillips, and E. G. Peters 30 Sep. 1979 13 p
(Contract DAAK40-79-D-0003)
(AD-A078814; REPT-79-057) Avail: NTIS HC A02/MF A01 CSCL 17/7

M and S Computing, Inc., has provided engineering and programming support to develop, modify, and utilize existing Guidance and Control simulation software, and has performed studies to determine system performance in assorted operational modes. This document summarizes the accomplishment of M and S Computing, Inc., for the past five months. The remainder of this document is divided into sections described below. Section 2 describes the digital area correlator model developed by M and S Computing, Inc. Section 3 describes the system analysis support provided by M and S Computing. GRA

N80-18082# Air Force Occupational and Environmental Health Lab., Brooks AFB, Tex.
BASELINE ACOUSTIC AND VIBRATION STUDY OF THE MINUTEMAN 2, INTEGRATED PROGRAM LAUNCH CONTROL CENTER, WS-133B (IP)
Nick A. Farinacci Jan. 1979 59 p refs
(AD-A075509; OEHL-79-10) Avail: NTIS HC A04/MF A01 CSCL 16/4

This report presents baseline acoustic and vibration data acquired in a Minuteman (2) (Integrated Program) Launch Control Center (WS-133B). No hazardous levels for exposures of up to 24 hour duration were found. Recommendations are provided to reduce the levels compatable with an environment suitable for long-duration crew alerts. GRA

N80-18083# Research Inst. of National Defence, Stockholm (Sweden).
KINETIC MODEL FOR A PURPOSE CARRYING TARGET FINDING AIR DEFENSE MISSILE (KINM) [KINEMATISK MODELL FOER SYFTBAERINGSMAALSOEKANDE LUFTVAARNSROBOT (KINM)]
Goeran Lyman and Inga Nordstroem Jul. 1979 45 p refs In SWEDISH
(FOA-C-20315-E3) Avail: NTIS HC A03/MF A01

A mathematical model for the trajectory of a purpose carrying target seeking air defense missile, launched against a moving target is described. The model is three dimensional, but the target can only have one arbitrary direction, with constant load factor. The kinetic trajectory of the missile is integrated from the thrust diagram and air resistance. The variation of air density and speed of sound with height was taken into account. The program was implemented for a DEC-10 computer. Author (ESA)

N80-18084# Research Inst. of National Defence, Stockholm (Sweden).
MISS DISTANCE WITH PURPOSE CARRYING CONTROL THROUGH COMMANDS FROM A GROUND STATION [BOMAVSTAAND VID SYFTBAARINGSSTYRNING MEDELST KOMMANDON FRAAN MARKSTATION]
Aake Assarsson Jul. 1979 25 p refs In SWEDISH
(FOA-C-20317-E3) Avail: NTIS HC A02/MF A01

The miss distance of a LV missile with steering commanded by a ground station was studied by computerized simulation of the last part of the trajectory which was assumed to be under internal control by the missile. Stochastic target and missile error angles were introduced as well as stochastic target maneuvering. It is concluded that further study is necessary to obtain acceptable miss distance results. Author (ESA)

N80-18085# Research Inst. of National Defence, Stockholm (Sweden).
SIMULATION OF LV MISSILE STEERING [SIMULERING AV LV-ROBOTSTYRNING MED UTSKJUTNING FRAAN FASTA LAVETTER]
Karl-Erik Olsson Jul. 1979 35 p refs In SWEDISH
(FOA-C-20318-E3) Avail: NTIS HC A03/MF A01

A computerized simulation of missile kinematic trajectories from fixed launchers was carried out using a continuous system modelling program. The study includes a description of kinematic

analysis of missile steering and steering strategies for moving targets. The results are presented in form of diagrams and tables, showing the applications of the simulation method. Author (ESA)

N80-18060*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING ORBITER COMPLETION MISSION
R. L. Gillette. *In its* The Deep Space Network. 15 Feb. 1980 p 4-5 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 22A

N80-18227 Pacific Missile Test Center, Point Mugu, Calif.
THE VIBRATION RESPONSE OF THE PHOENIX MISSILE IN THE F-14 AIRCRAFT CAPTIVE-FLIGHT ENVIRONMENT
Marsha E. Burke. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 4. Sep. 1978 p 139-150 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18228 Naval Weapons Center, China Lake, Calif.
SOME DYNAMIC RESPONSE ENVIRONMENTAL MEASUREMENTS OF VARIOUS TACTICAL WEAPONS
W. W. Parmenter. *In* Shock and Vibration Inform. Center. The Shock and Vibration Bull., Pt. 4. Sep. 1978 p 151-158 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-18086# Committee on Science and Technology (U. S. House).
SPACE SHUTTLE 1980
Washington GPO 1980 599 p Status Rept. for Comm. on Sci. and Technol., 96th Congr., 2d Sess., Jan. 1980
(GPO-55-916) Avail: SOD HC

The space shuttle program cost, performance, and schedules were reviewed for 1980. As a result of NASA's financial and schedule assessment of the shuttle program for 1980, a need for a supplemental budget request was identified. A brief description of the space shuttle program is provided, and major issues are identified for the FY 1980 supplemental budget request, and the FY budget. F.O.S.

N80-18087*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATION FOR THE DATA NOISING PROGRAM
M. T. Nguyen. Jun. 1979 44 p
(Contract NAS9-15800)
(NASA-CR-160534; JSC-14807; LEC-13266) Avail: NTIS HC A03/MF A01 CSCL 05B

Problems in the Space Shuttle aerodynamic data that are expected to occur in the actual Orbital Flight Test (OFT) flight data are introduced. The user selects from 1 to 100 channels to be operated on by this program. For each selected channel number, the user may introduce up to three problems in the channel data: time skew, data noise in the frequency domain, and data-quantization. The output data is the input data plus the data for each selected channel number with NOISE selected by the program user. M.M.M.

N80-18088*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER SUBSYSTEM HARDWARE/SOFTWARE INTERACTION ANALYSIS. VOLUME 8: FORWARD REACTION CONTROL SYSTEM
Daniel D. Becker. Jan. 1980 119 p refs
(NASA-TM-80959; JSC-14651-Vol-8) Avail: NTIS HC A06/MF A01 CSCL 09B

The results of the orbiter hardware/software interaction analysis for the AFT reaction control system are presented. The interaction between hardware failure modes and software are examined in order to identify associated issues and risks. All orbiter subsystems and interfacing program elements which interact with the orbiter computer flight software are analyzed. The failure modes identified in the subsystem/element failure mode and effects analysis are discussed. A.W.H.

N80-18089*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER SUBSYSTEM HARDWARE/SOFTWARE INTERACTION ANALYSIS. VOLUME 8: AFT REACTION CONTROL SYSTEM, PART 2
Daniel D. Becker. Jan. 1980 136 p refs
(NASA-TM-80960; JSC-14651-Vol-8-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 09B

The orbiter subsystems and interfacing program elements which interact with the orbiter computer flight software are analyzed. The failure modes identified in the subsystem/element failure mode and effects analysis are examined. Potential interaction with the software is examined through an evaluation of the software requirements. The analysis is restricted to flight software requirements and excludes utility/checkout software. The results of the hardware/software interaction analysis for the forward reaction control system are presented. A.W.H.

N80-18090*# Axiomatix, Los Angeles, Calif.
SHUTTLE GLOBAL POSITIONING (GPS) SYSTEM DESIGN STUDY. Final Report
Peter Nilsen and Gaylord Huth. 12 Feb. 1980 109 p refs
(Contract NAS9-15387)
(NASA-CR-160539; R8002-1) Avail: NTIS HC A06/MF A01 CSCL 22A

Investigations of certain aspects and problems of the shuttle global positioning system GPS, are presented. Included are: test philosophy and test outline; development of a phase slope specification for the shuttle GPS antenna; an investigation of the shuttle jamming vulnerability; and an expression for the GPS signal to noise density ratio for the thermal protection system. M.M.M.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-18091# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-range Instrumentation Group.
TEST METHODS FOR TELEMETRY SYSTEMS AND SUBSYSTEMS. VOLUME 3: TEST METHODS FOR RECORDER/REPRODUCER SYSTEMS AND MAGNETIC TAPE
1979 117 p refs Supersedes IRIG-118-73-Rev. 4 Vol.
(AD-A075736; IRIG-118-79-Vol-3; IRIG-118-73-Rev) Avail: NTIS HC A06/MF A01 CSCL 09/6

Contents: Head Tests; Tape Speed Tests; Speed Variation and Timing Error Tests; Direct Record Systems Tests; FM Systems Tests. Appendixes: Application Notes for Magnetic Tape Recorder/Reproducer Testing; Magnetic Tape Test Procedures. GRA

N80-18092# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-range Instrumentation Group.
TEST METHODS FOR TELEMETRY SYSTEMS AND SUBSYSTEMS. VOLUME 4: TEST METHODS FOR DATA MULTIPLEX EQUIPMENT
1979 164 p refs Supersedes IRIG-118-73-Rev. 4 Vol.
(AD-A075789; IRIG-118-79-Vol-4; IRIG-118-73-Rev) Avail: NTIS HC A08/MF A01 CSCL 09/6

Contents: Frequency Division Multiplex (FDM) Test Procedures; Time Division Multiplex (TDM) Systems; Subcarrier Oscillators; Bit Synchronizers; The Spectrum of an NRZ-PN

Sequence; Calculation of Bit Error Measurement Intervals; and Definitions and Suggested Circuits for Bit Synchronizer Testing. GRA

N80-18093# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-range Instrumentation Group.
TEST METHODS FOR TELEMETRY SYSTEMS AND SUB-SYSTEMS. VOLUME 1: END-TO-END TEST METHODS FOR TELEMETRY SYSTEMS
1979 93 p refs Supersedes IRIG-118-73-Rev 4 Vol.
(AD-A075735; IRIG-118-79-Vol-1; IRIG-118-73-Rev) Avail: NTIS HC A05/MF A01 CSCL 09/6

Contents: Solar Calibration; Test Methods for Transducer-Based System Calibrations; Alternate Solar Calibration Test Method; RF System Test Application Notes; Test for Receiver System Linearity. GRA

N80-18094# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-range Instrumentation Group.
TEST METHODS FOR TELEMETRY SYSTEMS AND SUB-SYSTEMS. VOLUME 2: TEST METHODS FOR TELEMETRY RF SUBSYSTEMS
1979 190 p refs Supersedes IRIG-118-73-Rev 4 Vol.
(AD-A075775; IRIG-118-79-Vol-2; IRIG-11873-Rev) Avail: NTIS HC A09/MF A01 CSCL 09/6

Contents: Test Procedures for Telemetry Antenna Systems; Test Procedures for Telemetry RF Preamplifiers; Test Procedures for Telemetry Multicouplers; Test Procedures for Telemetry Receivers; Test Procedures for Diversity Combiners; Appendixes: Intermodulation Products and Intercept Point; and Noise Figure Measurements. GRA

N80-18072*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRELIMINARY TELEMETRY OPERATIONS EXPERIENCE WITH THE REAL-TIME COMBINER, 1 NOVEMBER 1978 TO 1 NOVEMBER 1979
N. K. Simon and C. Hoynes *In its* The Deep Space Network 15 Feb. 1980 p 90-96 ref (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control, and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-18095*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASCAP MODELLING COMPUTATIONS ON LARGE OPTICS SPACECRAFT IN GEOSYNCHRONOUS SUBSTORM ENVIRONMENTS
N. John Stevens and Carolyn K. Purvis 1980 20 p refs Presented at Soc. of Photo-Optical Instrumentation Engineers, Los Angeles Technical Symp., North Hollywood, Calif., 4-7 Feb. 1980
(NASA-TM-81395; E-305) Avail: NTIS HC A02/MF A01 CSCL 22B

The NASA Charging Analyzer Program (NASCAP) is used to evaluate qualitatively the possibility of such enhanced spacecraft contamination on a conceptual version of a large satellite. The evaluation is made by computing surface voltages on the satellite due to encounters with substorm environments and then computing charged particle trajectories in the electric fields around the satellite. Particular attention is paid to the possibility of contaminants reaching a mirror surface inside a dielectric tube because this mirror represents a shielded optical surface in the satellite model used. Deposition of low energy charged particles from other parts of the spacecraft onto the mirror was found to be possible in the assumed moderate substorm environment condition. In the assumed severe substorm environment condition, however, voltage build up on the inside and edges of the dielectric tube in which the mirror is located prevents contaminants from reaching the mirror surface. J.M.S.

N80-18096# TRW, Inc., Redondo Beach, Calif.
PHASE CHANGE/HEAT STORAGE MATERIALS DATA COMPILATION Final Report, Aug. 1978 - Jan. 1979
V. R. Hunter and R. F. Block Jun. 1979 52 p refs Prepared in cooperation with Honeywell, Inc., St. Petersburg, Fla.
(Contract F33615-78-C-5081; AF Proj. 2100)
(AD-A076414; AFML-TR-79-4078) Avail: NTIS HC A04/MF A01 CSCL 20/5

A survey of available phase change heat storage materials for space temperature control applications are surveyed. A list of thirty one low-to-medium temperature (100 to 800 F) phase change storage materials are recommended as prime candidates for limiting component temperature excursions during a laser threat. Appendices are provided that include a data compilation of over 200 phase change heat storage materials, a list of data references, a phase change material bibliography and more descriptive information on the prime heat storage material candidates. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-18097* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PRESSURE LIMITING PROPELLANT ACTUATING SYSTEM Patent
Paul B. Reese (Rockwell International Corp., Downey, Calif.) and David W. Murphy, inventors (to NASA) (Rockwell International Corp., Downey, Calif.) Issued 15 Jan. 1980 4 p Filed 4 Aug. 1978 Supersedes N78-31162 (16 - 22, p 2906)
(NASA-Case-MSC-18179-1; US-Patent-4,183,217; US-Patent-Appl-SN-931218; US-Patent-Class-60-632) Avail: US Patent and Trademark Office CSCL 21H

A pressure limiting propellant activating system for simultaneously limiting the output force while maintaining a constant output pressure from the combustion chamber is described. The propellant actuated system includes an outer barrel, outer housing and a combustion chamber. A main piston is movable in the barrel housing when gas pressure is developed in the combustion chamber. A relief piston is concentrically mounted and fixedly movable with the main piston when gas pressure is exerted from the combustion. A relief piston has a force-activated separation mechanism for limiting the output force while simultaneously maintaining constant output pressure on the main piston from the combustion chamber.

Official Gazette of The U.S. Patent and Trademark Office

N80-18098*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ECONOMIC ANALYSIS OF THE DESIGN AND FABRICATION OF A SPACE QUALIFIED POWER SYSTEM

Gregory Ruselowski Jan. 1980 25 p refs
(NASA-TM-81418; E-339) Avail: NTIS HC A02/MF A01 CSCL 10B

An economic analysis was performed to determine the cost of the design and fabrication of a low Earth orbit, 2 kW photovoltaic/battery, space qualified power system. A commercially available computer program called PRICE (programmed review of information for costing and evaluation) was used to conduct the analysis. The sensitivity of the various cost factors to the assumptions used is discussed. Total cost of the power system was found to be $2.46 million with the solar array accounting for 70.5%. Using the assumption that the prototype becomes the flight system, 77.3% of the total cost is associated with manufacturing. Results will be used to establish whether the cost of space qualified hardware can be reduced by the incorporation of commercial design, fabrication, and quality assurance methods. J.M.S.

N80-18099# Naval Surface Weapons Center, Dahlgren, Va.
COMPARISON OF ABLATIVE MATERIALS IN A SOLID ROCKET MOTOR FLOW FIELD
J. B. Henderson, L. P. Anderson, and G. R. Moore Aug. 1979 39 p Sponsored in part by Naval Sea Systems Command
(AD-A075507; NSWC/TR-79-218) Avail: NTIS HC A03/MF A01 CSCL 11/7

Seven different ablative materials have been tested behind Thiokol TOMAHAWK rocket motors. The maximum erosion, erosion patterns, and the mass loss of the samples have been determined from these tests. In addition, time-dependent temperature profiles were measured in four of the test samples during firing. From these data, local ablation rates for the materials were determined. GRA

N80-18230 Hercules, Inc., Magna, Utah.
CALCULATION OF ATTACH POINT LOADS DUE TO POSSIBLE COMBUSTION INSTABILITY IN THE SPACE SHUTTLE SOLID ROCKET BOOSTERS
F. R. Jensen and D. T. Wang *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 171-174 (For primary document see N80-19213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-18100# University of Southern California, Los Angeles. Dept. of Chemistry.
ORGANOSILICON CHEMISTRY Final Report, 1 Oct. 1976 - 30 Sep. 1979
William P. Weber Sep. 1979 68 p refs
(Grant AF-AFOSR-3123-77)
(AD-A078293; AFOSR-79-1233TR) Avail: NTIS HC A04/MF A01 CSCL 07/3

The following studies are summarized: (a) several aspects of the chemistry of polysilane-polysulfides (b) the photochemical generation of silicon-oxygen doubly bonded intermediates and the study of the insertion of these intermediates into Si-O single bonds of siloxanes, (c) novel reactions of silylenes, (d) the mass spectral fragmentation patterns of several classes of aryl substituted disiloxanes, (e) generation of dichlorocarbene under phase transfer catalysis conditions, and (f) gas phase vacuum pyrolysis of several five membered heterocyclic-1,2-butadrenes. GRA

N80-18101# National Bureau of Standards, Washington, D.C. Chemical and Biodegradation Processes Group.
APPLICATION OF A GRAPHITE FURNACE ATOMIC ABSORPTION DETECTOR AUTOMATICALLY COUPLED TO HPLC FOR SPECIATION OF METAL-CONTAINING MACROMOLECULES Interim Report
E. J. Parks, F. E. Brinckman, and W. R. Blair May 1979 31 p refs Presented at the Intern. Symp. on Column Liquid Chromatography, Boston, 7-10 May 1979 Submitted for publication
(NR Proj. 356-689)
(AD-A077321) Avail: NTIS HC A03/MF A01 CSCL 07/3

High pressure liquid chormatography (HPLC) coupled with graphite furnace atomic absorption (GFAA) is capable of sensitive, nearly non-destructive, element-specific separation and detection of a wide range of molecular species containing metals or metalloids. Applications of HPLC-GFAA techniques are discussed, including size exclusion chromatography (SEC) for the analysis of experimental organometallic polymers containing chemically bonded biocidal organotin moieties, and reverse bonded phase (RBP) chromatogrphy for analysis of novel organotin silicates. In conjunction with variably sensitive optical RI/UV detection, GFAA demonstrates separation of the polymers into a least two tin-containing fractions of widely different molecular weight (MW). The relative proportions of high and low MW fractions have important implication with respect to performance specifications for these and similar controlled release materials. Tin-specific and silicon-specific analysis of an organotin silicate demonstrates co-elution of species containing each element. Future off/online Si29 and Sn119 FT-NMR will demonstrate whether each element is bonded to the same molecular species. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-18102 Duke Univ., Durham, N. C.
PLASTIC ANALYSIS OF METAL-MATRIX COMPOSITE LAMINATES Ph.D. Thesis
Yehia Ahmed Bahei-El-Din 1979 273 p
Avail: Univ. Microfilms Order No. 8003814

The development of phenomenological materials models for elastic-plastic fibrous composites is described with emphasis on a continuum model which represents the mechanical properties of the constituents and the essential features of their mutual constraints. Such a material model is developed, and constitutive equations describing hardening and flow rules are derived. Evaluation of the model is made in regard to the application of fibrous metal-matrix composites in laminated plates. The capability of the material model and the finite element method in describing the behavior of composite structures was demonstrated in evaluating both the overall response and the plastic yielding of laminated plates with discontinuities, such as holes and notches. Dissert. Abstr.

N80-18103*# Lockheed-California Co., Burbank.
ADVANCED COMPOSITE AILERON FOR L-1011 TRANSPORT AIRCRAFT Quarterly Technical Report, 22 Dec. 1973 - 24 Mar. 1978
14 Apr. 1978 54 p refs
(Contract NAS1-15069)
(NASA-CR-162863; LR-28559; DLR-003; QTR-2) Avail: NTIS HC A04/MF A01 CSCL 11D

Design and evaluation of alternate concepts for the major subcomponents of the advanced composite aileron (ACA) was completed. From this array of subcomponents, aileron assemblies were formulated and evaluated. Based on these analyses a multirib assembly with graphite tape/syntactic core covers, a graphite tape front spar, and a graphite fabric rib was selected for development. A weight savings of 29.1 percent (40.8 pounds per aileron) is predicted. Engineering cost analyses indicate that the production cost of the ACA will be 7.3 percent less than the current aluminum aileron. Fabrication, machining, and testing of the material evaluation specimens for the resin screening program was completed. The test results lead to the selection of Narmco 5208 resin for the ACA. Other activities completed include: the detailed design of the ACA, construction of a three dimensional finite element model for structural analysis, and formulation of detail plans for material verification and process development. R.E.S.

N80-18104*# Lockheed-California Co., Burbank.
ADVANCED MANUFACTURING DEVELOPMENT OF A COMPOSITE EMPENNAGE COMPONENT FOR L-1011 AIRCRAFT Quarterly Technical Report, 1 Jan. 1978 - 31 Mar. 1978

14 Apr. 1978 130 p
(Contract NAS1-14000)
(NASA-CR-162862; LR-28573; DLR-003; QTR-9) Avail: NTIS HC A07/MF A01 CSCL 11D

Tooling concepts were developed which would permit co-couring of the hat stiffeners to the skin to form the cover assembly in a single autoclave cycle. These tooling concepts include the use of solid rubber mandrels, foam mandrels, and formed elastometric bladders. A simplification of the root end design of the cover hat stiffeners was accomplished in order to facilitate fabrication. The conversion of the 3D NASTRAN model from level 15 to level 16 was completed and a successful check run accomplished. A detailed analysis of the thermal load requirement for the environmental chambers was carried out. Based on the thermal analysis, best function requirements, load inputs and ease of access, a system involving four chambers, two for the covers containing 6 and 4 specimens, respectively, and two for the spares containing 6 and 4 specimens, respectively, evolved. R.E.S.

N80-18106*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SMALL-SCALE TEST FOR FIBER RELEASE FROM CARBON COMPOSITES
W. J. Gilwee, Jr. and R. H. Fish Feb. 1980 9 p refs Presented at Conf. on Advanced Composites, Special Topics, El Segundo, Calif., 4-6 Dec. 1979
(NASA-TM-81179; A-7962) Avail: NTIS HC A02/MF A01 CSCL 11D

A test method was developed to determine relative fiber loss from pyrolyzed composites with different resins and fiber construction. Eleven composites consisting of woven and unwoven carbon fiber reinforcement and different resins were subjected to the burn and impact test device. The composites made with undirectional tape had higher fiber loss than those with woven fabric. Also, the fiber loss was inversely proportional to the char yield of the resin. K.L.

N80-18108*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF COMPOSITE MATERIALS TO TURBOFAN ENGINE FAN EXIT GUIDE VANES
G. T. Smith 1980 19 p refs Presented at 35th Ann. Conf. of the Reinforced Plastics/Composite Inst., New Orleans, 4-8 Feb. 1980; sponsored by Soc. of Plastics Industries
(NASA-TM-81432; E-356) Avail: NTIS HC A02/MF A01 CSCL 11D

A program was conducted by NASA with the JT9D engine manufacturer to develop a lightweight, cost effective, composite material fan exit guide vane design having satisfactory structural durability for commerical engine use. Based on the results of a previous company supported program, eight graphite/epoxy and graphite-glass/epoxy guide vane designs were evaluated and four were selected for fabrication and testing. Two commercial fabricators each fabricated 13 vanes. Fatigue tests were used to qualify the selected design configurations under nominally dry, 38 C (100 F) and fully wet and 60 C (140 F) environmental conditions. Cost estimates for a production rate of 1000 vanes per month ranged from 1.7 to 2.6 times the cost of an all aluminum vane. This cost is 50 to 80 percent less than the initial program target cost ratio which was 3 times the cost of an aluminum vane. Application to the JT9D commercial engine is projected to provide a weight savings of 236 N (53 lb) per engine. Author

N80-18107*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIRE TEST METHOD FOR GRAPHITE FIBER REINFORCED PLASTICS
Kenneth J. Bowles 1980 13 p refs Presented at 5th Intern. Conf. on Fire Safety, Millbrae, Calif., 14-18 Jan. 1980
(NASA-TM-81438; E-360) Avail: NTIS HC A02/MF A01 CSCL 11D

A potential problem in the use of graphite fiber reinforced resin matrix composites is the dispersal of graphite fibers during accidental fires. Airborne electrically conductive fibers originating from the burning composites could enter and cause shorting in electrical equipment located in surrounding areas. A test method for assessing the burning characteristics of graphite fiber reinforced composites and the effectiveness of the composites in retaining the graphite fibers has been developed. The method utilizes a modified rate of heat release apparatus. The equipment and the testing procedure are described. The application of the test method to the assessment of composite materials is illustrated for two resin matrix/graphite composite systems. A.R.H.

N80-18108*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE POTENTIAL FOR DAMAGE FROM THE ACCIDENTAL RELEASE OF CONDUCTIVE CARBON FIBERS FROM BURNING COMPOSITES
Vernon L. Bell Apr. 1980 23 p refs Proposed for presentation at the AGARD Structures and Materials Panel Specialist's Meeting of Effect of Service Environment on Composite Materials, Athens, Greece, 16 Apr. 1980
(NASA-TM-80213) Avail: NTIS HC A02/MF A01 CSCL 11D

The potential damage to electrical equipment caused by the release of carbon fibers from burning commercial airliners is assessed in terms of annual expected costs and maximum losses at low probabilities of occurrence. A materials research program to provide alternate or modified composite materials for aircraft structures is reviewed. K.L.

N80-18109*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPOSITE COMPONENTS ON COMMERCIAL AIRCRAFT
H. Benson Dexter Mar. 1980 24 p refs To be presented at the AGARD Specialist Meeting on Effect of Service Environ. on Composite Mater., Athens, 13-18 Apr. 1980
(NASA-TM-80231) Avail: NTIS HC A02/MF A01 CSCL 11D

Commercial aircraft manufacturers are making production commitments to composite structure for future aircraft and modifications to current production aircraft. Flight service programs with advanced composites sponsored by NASA during the past 10 years are described. Approximately 2.5 million total composite component flight hours have been accumulated since 1970 on both commercial transports and helicopters. Design concepts with significant mass savings were developed, appropriate inspection and maintenance procedures were established, and satisfactory service was achieved for the various composite components. A major NASA/U.S. industry technology program to reduce fuel consumption of commercial transport aircraft through the use of advanced composites was undertaken. Ground and flight environmental effects on the composite materials used in the flight service programs supplement the flight service evaluation. A.R.H.

N80-18110# Wyoming Univ., Laramie. Dept. of Mechanical Engineering.
HYGROTHERMAL RESPONSE OF POLYMER MATRIX COMPOSITE MATERIALS Final Report, 9 Feb. 1976 - 8 Feb. 1979
Donald F. Adams and David E. Walrath Sep. 1979 35 p refs
(Grant DAAG29-76-G-0163; DAAG29-78-G-0053)
(AD-A076623; UWME-DR-901-102-1; ARO-13323.6-MSX)
Avail: NTIS HC A03/MF A01 CSCL 11/4

A two-dimensional, generalized plane strain, finite element analysis of the stress states in the individual fibers and surrounding matrix of a unidirectionally reinforced composite material was developed. The fibers are modeled as elastic but anisotropic; the matrix is modeled as isotropic, but elastoplastic. Thermal and moisture absorption histories as well as temperature - and moisture-dependent material properties are included. A complete finite element computer program, an associated plot package, and extensive numerical results are available. Experimental work was conducted using unreinforced (neat resin), castings of Hercules 3501-6 epoxy matrix, as well as AS/3501-6 graphite/epoxy matrix, and S2/3501-6 glass/epoxy unidirectional composites. Axial and transverse tensile tests as well as torsional shear tests were performed, under various temperatures and moisture conditions. Experimental results and comparisons with micromechanics predictions are summarized, with references given to

various conference and journal publications for detailed information. GRA

N80-18111# Connecticut Univ., Storrs. Dept. of Mechanical Engineering.
WEAR OF HOMOGENEOUS AND COMPOSITE MATERIALS UNDER CONDITIONS OF REPEATED NORMAL AND SLIDING IMPACT Final Report, 30 Jun. 1976 - 31 Aug. 1979
Stephen Rice and Roman Solecki 1979 36 p refs
(Grant AF-AFOSR-3087-76; AF Proj. 2307)
(AD-A078429; AFOSR-79-1241TR) Avail: NTIS
HC A03/MF A01 CSCL 20/11

This report describes experimental and analytical investigations in the area of wear of materials under repetitive compound impact. A reciprocating apparatus which provides controlled, repeatable, measureable impulsive loads between specimen and counterface has been employed in wear testing. Specimen materials in previous experimentation include polymers, composites, and several alloys. That reported herein focuses upon titanium alloys, metallic composites, and copper-chromium alloys. The formation of subsurface zones occurring in impact wear appears to be significant. Correlations between subsurface strain gradients and wear have been demonstrated. These subsurface plastic deformations are dependent upon macroscopic 'solid contact' conditions imposed during impact. Temperatures occasioned at and near the wear interface are shown locally to each level of 800C for test conditions explored. Void and crack formation in the substrate is occasionally observed, but not nearly to the extent reported for materials under conditions of sliding wear. Analytical investigations are directed toward determination of the states of stress in material specimens undergoing controlled repetitive impact. Results are derived from the equations of the linear theory of elasticity applied to a finite cylinder impacting a rough, rigid surface. GRA

N80-18112# Daedalean Associates, Inc., Woodbine, Md.
ENGINEERING FEASIBILITY OF INTERNAL FRICTION DAMPING AS A NONDESTRUCTIVE EVALUATION TECHNIQUE FOR SYNTHETIC ROPES Final Report
David C. Fresch, Larry L. Yeager, and A. P. Thiruvengadam 28 Feb. 1979 229 p refs
(Contract DOT-CG-828271-A)
(AD-A078461; USCG-D-51-79) Avail: NTIS
HC A11/MF A01 CSCL 11/5

This report discusses the technical feasibility of applying an internal friction damping, nondestructive evaluation technique for synthetic ropes. Applications for synthetic ropes include mooring lines, towing hawsers and lines for single point moorings (SPM) in deep water ports (DWP). The theory of internal friction damping is presented as it has been historically applied to metallic materials. The report then discusses the methodology for application of the internal friction damping technique to synthetic rope material and construction. The experimental apparatus and specific laboratory technique as applied to six inch and eight inch circumference rope is next discussed in detail. The report then discusses the experimental results and relates the test results to feasibility of employing the test technique as a guideline device for rope deterioration/performance. The report also relates this discussion to characteristics of the ropes tested under both wet and dry conditions. The experimental results section concludes with a comparison of the effect of the internal friction damping for various synthetic rope failure mechanisms. GRA

N80-18113# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
FINAL EVALUATION OF RAIN EROSION ON SLED TEST RESULTS AT MACH 3.7 TO 5.0 FOR SLIP-CAST FUSED SILICA RADOME STRUCTURES
K. N. Letson and William G. Burleson 6 Mar. 1979 63 p refs
(AD-A077348; DRSMI-T-79-42) Avail: NTIS
HC A04/MF A01 CSCL 11/2

This report contains a summary of rain erosion results obtained for high-purity slip-cast fused silica (SCFS) models on sleds at Holloman Air Force Base, New Mexico. This effort, which was initiated to evaluate the rain erosion behavior of SCFS as a function of velocity and angle of incidence was completed with good correlation of results. The tests were performed in artificial rain at average velocities between 1270 and 1740 m/sec (Mach 3.7 and 5.0). Right circular cone models having semivertex angles of 15, 19, 22.5, 25, 27.5, and 30 degrees were tested. A special test vehicle and sample design were utilized to avoid sled vibration-induced failures that are common to small samples of brittle ceramics at velocities near Mach 5. A unique feature of the sled test vehicle is its capability of testing seven cone frusta, thereby simulating actual radome forebody shapes. The sample design and special mounting technique resulted in obtaining correlatable erosion data which were free of spurious mass losses caused by sample fracture and edge effects. Because SCFS has low fracture toughness and relatively poor rain erosion resistance under severe conditions, other candidate ceramic and plastic radome materials were tested concurrently in the interest of finding a tougher structure. However only those results for SCFS are presented in this report. GRA

N80-18114# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Centrale.
INFLUENCE OF THE ORIENTATION AND THE CROSSING OF FIBERS ON THE RUPTURING OF NOTCHED CARBON FIBER/EPOXY COMPOSITE MATERIALS Final Report [INFLUENCE DE L'ORIENTATION ET DU CROISEMENT DES FIBRES SUR LA RUPTURE DES COMPOSITES FIBRES DE CARBONE-EPOXYDE ENTAILLES]
C. Bathias 29 Aug. 1978 43 p refs In FRENCH
(Contract DGRST-76-7-1017)
(PV-38.022) Avail: NTIS HC A03/MF A01

Notched specimens as well as specimens containing holes were subjected to traction loads to rupture in order to determine the influence of fiber orientation and notch or hole sensitivity on fracture strength. The mathematical tools used in the analysis along with a radiographic technique for characterizing notch damage are discussed. Results demonstrate that the presence of notches or holes equally weaken this type of composite. Crossing the reinforcing fibers at 45 deg gives better results than at 30 deg. A study of the fracture mechanisms, based on a finite element layer analysis of the damaged zone, indicates that the 'R curve' can be used to predict the fracture strength of composite plates. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-18115 Indiana Univ., Bloomington.
HIGH-PRECISION MASS SPECTROMETRIC HYDROGEN ISOTOPE RATIO MEASUREMENTS Ph.D. Thesis
David William Peterson 1979 236 p
Avail: Univ. Microfilms Order No. 8000717

The analytical capabilities of mass spectrometric ion-current measurement systems are described on both a theoretical and a practical basis. From the theoretical standpoint, a signal-to-noise ratio (S/N) model that evaluated the fundamental sources of noise present in ion-current measurement systems was developed. Use of this model accurately predicted the performance (precision) for ion-current ratio measurements made by two isotope ratio mass spectrometers, one designed for carbon isotopic measurements, and the other designed for hydrogen isotopic measurements. For the hydrogen isotope ratio mass spectrometer, the precision of a differential ratio measurement was calculated by use of the S/N model (0.26 0/00) and shown to be in good agreement with the measured precision (0.24 0/00). Dissert. Abstr.

N80-18116 Virginia Univ., Charlottesville.
INELASTIC ELECTRON TUNNELING SPECTROSCOPY OF UV IRRADIATED MOLECULES Ph.D. Thesis
James Michael Clark 1979 191 p

Avail: Univ. Microfilms Order No. 8002512

Tunneling spectroscopy was applied to the study of molecular radiation damage. Purine and pyrimidine nucleotides, small peptides and substituted benzene ring compounds in monolayer coverage were irradiated with ultraviolet radiation under ultrahigh vacuum conditions. Damage to the molecules is manifested by a loss of intensity in the vibrational structure due to bond weakening or bond rupture and by an enhancement in intensity as new radiation products are formed. In a comprehensive study of nucleic acid constituents, IETS was capable of detecting subtle structural variations among compounds containing the same purine or pyrimidine base as well as distinguishing among compounds containing different bases. Spectra which can differentiate among derivatives of the purine base adenine were produced by carefully measuring the spectral region below 600 1/cm for each derivative. Dissert. Abstr.

N80-18117 Massachusetts Univ., Amherst.
FUNCTIONAL GROUP SELECTIVE HIGH PERFORMANCE LIQUID CHROMATOGRAPHIC STATIONARY PHASES Ph.D. Thesis
Thomas Henry Mourey 1979 224 p
Avail: Univ. Microfilms Order No. 8004967

Functional group selectivity has been incorporated into high performance liquid chromatographic stationary phases by taking advantage of the chemistry, electronic character, and physical-chemical properties of individual functional groups present in the solute molecules. These phases were manufactured by synthesizing novel orgarohalosilanes which possess reactive functionalities. Dissert. Abstr.

N80-18118 Illinois Univ. at Urbana-Champaign.
ELECTRON PARAMAGNETIC RESONANCE STUDIES OF LOW SYMMETRY NICKEL(I) AND MOLYBDENUM (V) COMPLEXES. PART 1: COMPUTER SIMULATION OF ELECTRON PARAMAGNETIC RESONANCE SPECTRA. PART 2: ELECTRON PARAMAGNETIC RESONANCE STUDIES OF NICKEL(I) TRIPHENYLPHOSPHINE COMPLEXES. PART 3: ELECTRON PARAMAGNETIC RESONANCE STUDIES OF A MOLYBDENUM(V) THIOCYANATE COMPLEX Ph.D. Thesis
Mark Joseph Nilges 1979 201 p
Avail: Univ. Microfilms Order No. 8004241

Part 1 describes computer programs that are used to simulate single crystal and polycrystalline electronic paramagnetic resonance (EPR) spectra for S=1/2 systems with nuclear hyperfine and quadrupole interactions. The programs are applicable to low symmetry complexes and allow for the noncoincidence of different EPR tensors. Part 2 describes the successful preparation and EPR spectra of single crystals of Ni. The unusual spectral features in the EPR spectra of the complexes are explained in terms of a halogen nuclear quadrupole interaction which is competitive with the halogen superhyperfine interaction. Part 3 describes the EPR spectra of Mo-95 and Mo-97 doped single crystals of TPA2NbO(SCN)5. Dissert. Abstr.

N80-18119 Cornell Univ., Ithaca, N. Y.
THREE STUDIES IN THE ELECTRONIC AND VIBRATIONAL STRUCTURE OF POLYATOMIC MOLECULES. 1: THE THERMAL LENSING SPECTROMETER AND THE LOCAL MODE MODEL OF VIBRATIONAL OVERTONE SPECTRA. 2: CALCULATIONS OF SECOND ORDER HYPERPOLARIZABILITIES. 3: THE MOLECULAR STRUCTURE OF THE BENZYL RADICAL AND ITS IONS AND A PROGRAM FOR NORMAL MODE ANALYSIS Ph.D. Thesis
James Albert Morrell 1979 251 p
Avail: Univ. Microfilms Order No. 8003957

The thermal lensing absorption spectrometer was used to characteristize the C-H stretching overtones in several aromatic and aliphatic molecules. The spectra derived from different types of C-H bonds are clearly resolved, and spectral shifts are seen which arise from intermolecular perturbations of the force constants of the C-H oscillators. This absorption spectrometer was used to develop and verify the local mode model of overtone absorption spectra. In addition, the hyperpolarizability of several substituted organic systems was computed. It was found that only one charge transfer state accounts for the bulk of the nonlinearity of p-nitroaniline. A structural determination of the benzyl radical and ions revealed that the radical and the anion are planar, while the cation has C sub 3 symmetry with the CH2 group slightly out of plane. A program for the calculation of the normal modes of vibrations and harmonic vibrational energies of small molecular systems is given. Dissert. Abstr.

N80-18120 Wisconsin Univ. - Madison.
A MASS POINT LOCALIZED KINETIC THEORY OF FLUIDS Ph.D. Thesis
Richard Lee Hansen 1979 149 p
Avail: Univ. Microfilms Order No. 8001142

A kinetic theory of molecules with internal degrees of freedom was developed which recognizes the size and structure of the molecules involved. This was accomplished by localizing the kinetic quantities for a given mass point at the position of that mass point. The kinetic theory represents a generalization of an earlier theory to include more general potentials of intermolecular and intramolecular interaction. It is shown for the mass point localized kinetic theory that a symmetric pressure tensor results. It is also shown that an antisymmetric part to the pressure tensor is not necessary for the rotational relaxation of a rotationally excited system. A model calculation is carried out for a polymeric solution in which hydrodynamic interaction forces are included. The system considered for the model calculation is composed of a single species of polymer, modeled as an asymmetric dumbbell in a single structureless solvent. Dissert. Abstr.

N80-18121 Illinois Univ. at Urbana-Champaign.
CHEMICAL AND PHYSICAL CHARACTERIZATION OF ENVIRONMENTAL POLLUTANTS Ph.D. Thesis
Mary Myers Tucker 1979 156 p
Avail: Univ. Microfilms Order No. 8004290

A single method for the speciation of inorganic and organic mercury in natural water samples was developed. The technique specifically reduces inorganic mercury, Hg(2+), to elemental mercury by simple alkaline sodium borohydride reduction, followed by cold vapor atomic absorption detection. Total mercury, Hg(2+) and RHgX, is similarly determined following decomposition of the organic mercury by ultraviolet light. A simple particle leaching technique was developed to obtain information about physical characteristics and speciation of particle surfaces. Analysis of cumulatively collected leachate provides integral leaching curves; whereas, analysis of incrementally collected leachate provides differential leaching curves. These curves yield complementary information about the physical availability of the elements to the environment via the leaching process. Dissert. Abstr.

N80-18122 Massachusetts Univ., Amherst.
APPLICATIONS OF OPEN TUBULAR COLUMNS TO THE GAS CHROMATOGRAPHY OF VOLATILE METAL COMPLEXES Ph.D. Thesis
Therese Phyllis Tetu 1979 289 p
Avail: Univ. Microfilms Order No. 8004995

The chromatographic behavior of volatile metal complexes on a variety of open tubular columns was investigated. Primary interest was focussed on the tetradentate beta-ketoamine complexes of Cu(II) and Ni(II). Extensions of this work included an investigation of the behavior of several chromium (III) beta-diketonates and organometallics on these columns. Initial investigations were performed using stainless steel porous layer open tubular (PLOT) columns. The viability of glass PLOT columns for metal complex GC was also investigated. The principle column for these investigations was a non-polar OV101 PLOT column. The use of a deactivated substrate in ths case allowed the successful elution of Cu(II) and Ni(II) tetradentate beta-ketoamines possessed of various degrees thermal and chromatographic stability. Dissert. Abstr.

N80-18123 Pittsburgh Univ., Pa.
SEVERAL APPLICATIONS OF NONDISPERSIVE CONTINUUM SOURCE ATOMIC FLUORESCENCE SPECTROMETRY Ph.D. Thesis
Frank Lipari 1979 155 p
Avail: Univ. Microfilms Order No. 8004867

A wavelength modulated spectrometer and a continuum source atomic fluorescence system for the simultaneous multielement determination of elements that form volatile metal hydrides are discussed. Spectral selectivity, in both cases, is achieved by

the use of bandpass interference filters. The wavelength modulated spectrometer has comparable sensitivity to atomic absorption spectrometry (AAS) and was applied with good results in trace metal determinations in pooled blood serum. The atomic fluorescence system also has sensitivity comparable to AAS and was utilized in The simultaneous multielement mode for As, Sb, and Ge determinations in NBS Low Allow Steel samples. The main advantages of these instruments are that they are low cost, simple, easy to operate, free of spectral interference, and applicable to analyses in a wide variety of matrices.
Dissert. Abstr.

N80-18124 Massachusetts Univ., Amherst.
THE ANALYSIS AND CHARACTERIZATION OF THE URETHANE FUNCTIONAL GROUP VIA FUSION REACTION GAS CHROMATOGRAPHY Ph.D. Thesis
David George Gibian 1979 120 p
Avail: Univ. Microfilms Order No. 8004927

Fusion reaction gas chromatography was applied to the analysis and characterization of urethanes and polurethanes. It was found to be a rapid and accurate means of assaying and characterizing compounds containing the urethane functional group. The advantages of fusion reaction gas chromatography are that a one piece apparatus may be used, ensuring identical conditions for all samples. Reactions are made to go to completion. Only milligram amounts of sample are required, and the sample need not be volatile. Each component of a mixture containing the same functional group can be determined, in contrast to standard functional group methods which only give total functional group present. Matrix effects are removed and undesirable side reactions eliminated.
Dissert. Abstr.

N80-18125 Massachusetts Univ., Amherst.
THE APPLICATION OF CHROMATOGRAPHY AND ANCILLARY TECHNIQUES TO THE CHARACTERIZATION OF SHALE OIL/OIL SHALE COMPOUND CLASSES AND OF ORGANOMETALLICS Ph.D. Thesis
Frank Patrick DiSanzo 1979 203 p
Avail: Univ. Microfilms Order No. 8004916

Chromatography and Ancillary techniques (specific detectors and mass spectrometry) were applied to the characterization of shale oil and oil shale compound classes and of organometallics. An inexpensive and simple preparative low pressure high performance liquid chromatographic scheme was developed for shale oil hydrocarbon analysis. Activated silica and silver nitrate impregnated 32-63 micron silica was employed for the isolation of alkanes, alkenes, and aromatics. Evidence for the presence of prist-1-ene in the alkene fraction is presented. Application of on-line reactors to aid in the discrimination between various classes of hydrocarbons is also described.
Dissert. Abstr.

N80-18126 North Carolina Univ. at Chapel Hill.
SOME APPLICATIONS OF NEGATIVE ION MASS SPECTROMETRY Ph.D. Thesis
Kenneth Louis Busch 1979 255 p
Avail: Univ. Microfilms Order No. 8005018

Methane or a mixture of methane and oxygen were used as moderator gases at 1 to 2 torr in a chemical ionization mass spectrometer to produce gas enhanced negative ion mass spectra. Negative ion mass spectra were compared with electron impact and methane positive chemical ionization mass spectra for organophosphorus pesticides. Polychlorinated aromatic hydrocarbons, nitriles, and organometallic compounds were also investigated. Methane enhanced negative ion mass spectrometry proved to be useful by virtue of abundant ions reflecting molecular weight, reduced fragmentations, and for those molecules with several electrophores, a sensitivity much greater than the positive ion methods.
Dissert. Abstr.

N80-18127 Princeton Univ., N. J.
APPLICATIONS OF COHERENT ANTI-STOKES RAMAN SPECTROSCOPY (CARS) Ph.D. Thesis
Gabriel Laufer 1978 148 p
Avail: Univ. Microfilms Order No. 8003791

New Coherent Anti-Stokes Raman Spectroscopy (CARS) techniques and their application to gas diagnostics and surface spectroscopy are presented. In the first experiment, hollow waveguides are shown to enhance CARS by two orders of magnitude for low pressure gases. Theoretical and experimental comparisons of signals generated by tight focusing in a cell with those generated in a hollow waveguide are presented. These arguments show that for low pressures, enhancements are on the order of the square of the waveguide length to the confocal beam parmeter ratio. In the second experiment, a new crossed beam CARS configuration is studied. This crossed beam configuration produces an angularly separated CARS spectrum, eliminating the need for a spectrometer.
Dissert. Abstr.

N80-18128*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
COMBUSTION STABILITY WITH BAFFLES, ABSORBERS AND VELOCITY SENSITIVE COMBUSTION Final Report, Dec. 1969 - Feb. 1980
C. E. Mitchell Feb. 1980 9 p refs
(Grant NGR-06-002-095)
(NASA-CR-162803) Avail: NTIS HC A02/MF A01 CSCL 21B

Analytical and computational techniques were developed to predict the stability behavior of liquid propellant rocket combustors using damping devices such as acoustic liners, slot absorbers, and injector face baffles. Models were developed to determine the frequency and decay rate of combustor oscillations, the spatial and temporal pressure waveforms, and the stability limits in terms of combustion response model parameters.
K.L.

N80-18129# Naval Research Lab., Washington, D. C.
CATALYSTS FOR THE OXIDATION OF CARBON MONOXIDE AT LOW TEMPERATURES Interim Report
J. K. Musick and F. W. Williams Nov. 1979 28 p refs
(S0205034)
(AD-A077323; NRL-8353) Avail: NTIS HC A03/MF A01 CSCL 07/4

Four catalysts (hopcalite, Whetlerite, a supported palladium, and a supported platinum) were tested for efficiency in promoting the oxidation of carbon monoxide (CO). At room temperature and 50% RH, hopcalite has no catalytic capability and platinum has practically none. At room temperature and 15% RH, hopcalite is superior to platinum in catalyzing the oxidation of CO. Hopcalite is more efficient than either of the other three catalysts in the 52 to 66 C (125 to 150 F) temperature range at both humidities. Platinum and palladium are superior to both hopcalite and Whetlerite at both humidities in the 113 to 135 C (235 to 275 F) temperature range. Higher humidity decreases the co-oxidizing capabilities of hopcalite and Whetlerite but does not do so for platinum and palladium. Whetlerite is in the lower-performing group of catalysts under all except one of the different conditions used in the tests. For the hopcalite, palladium, and platinum catalysts there is a temperature below 135 C (275 F) and above 68 C (155 F) at which CO can be oxidized efficiently.
GRA

N80-18130# Massachusetts Univ., Amherst. Astronomy Research Facility.
INFRARED EMISSION SPECTROSCOPY OF LOW PRESSURE GASEOUS DISCHARGES, II Interim Report
Peter Hansen and Hajime Sakai Jul. 1979 49 p refs
(Contract F19628-76-C-0087; AF Proj. 2310)
(AD-A078796; UMASS-ARF-79-305; AFGL-TR-79-0150; SCIENTIFIC-2) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report summarizes a survey study aimed at improving our understanding of the physical processes which control the infrared radiation in the upper atmosphere. The experiment is conducted to generate various infrared bands of the atmospheric species in our large discharge chamber. Interpretations are given for the observed data by identifying the species involved and determining their parameters in terms of the atomic or molecular transitions.
GRA

N80-18131# Indiana Univ., Bloomington. Dept. of Chemistry.
AN ACCURATE MODEL FOR SAMPLE DROPLET ACCELERATION IN ANALYTICAL FLAMES Interim Report
Richard E. Russo and Gary M. Hieftje Dec. 1979 21 p refs
Submitted for publication
(Contract N00014-76-C-0838; NR Proj. 051-622)
(AD-A078655; TR-24) Avail: NTIS HC A02/MF A01 CSCL 07/4

The experimentally observed velocity of an aerosol droplet in an air-acetylene flame is compared to the velocity calculated through a new mathematical model. The experimental droplet velocity is measured by means of stroboscopic photography of a stream of individual droplets sent into a flame at a known frequency and traveling very reproducible trajectories. Because the temporal spacing between these droplets is known, a measure of the instantaneous droplet location enables their velocity to be calculated. The droplet acceleration model was modified by incorporating into it a spatially changing flame rise velocity, which was assumed constant in earlier treatments. Excellent agreement has been found between calculated and measured droplet acceleration in the flame. GRA

N80-18132# Texas Univ. at Austin. Dept. of Chemistry.
AUGER SPECTRA OF AMMONIA ON ALUMINUM AND OXIDIZED ALUMINUM Progress Report, 1 Jan. - 31 Dec. 1979
Charles T. Campbell, J. W. Rogers, Jr., R. L. Hance, and J. M. White Nov. 1979 10 p refs Submitted for publication
(Contract N00014-75-C-0922; NR Proj. 056-578)
(AD-A078524; TR-10) Avail: NTIS HC A02/MF A01 CSCL 07/4

X-ray excited N(KVV) Auger spectra are reported for submonolayer amounts of ammonia adsorbed at 128K on clean and oxidized polycrystalline aluminum. The spectra were deconvoluted using an instrument function derived from the measured losses associated with the N(1s) photoionization region. The resulting spectra are compared with gas phase and condensed NH3 spectra. GRA

N80-18133# Vermont Univ., Burlington. Dept. of Chemistry.
SYNTHETIC APPROACHES TO MIXED-VALENCE CHEMISTRY
David B. Brown and James T. Wrobleski Nov. 1979 28 p refs
(Contract N00014-75-C-0756)
(AD-A078513; TR-18) Avail: NTIS HC A03/MF A01 CSCL 07/4

Several preparative routes to mixed-valence materials have been examined and the effect of the synthetic variables discussed. It has been shown that solubility is a dominant factor in the successful isolation of many such materials. Soluble metal cluster complexes are susceptible to sequential oxidation/reduction reactions which lead to mixed-valence clusters, and the importance and utility of electrochemical measurements in the preparation and understanding of these clusters is discussed. The preparation of mixed-valence polymers by solid-state reactions and by polymer growth techniques has been examined, and the types of behavior exhibited are shown to be explicable using arguments derived from the thermodynamics of solutions. GRA

N80-18134# SRI International Corp., Menlo Park, Calif.
CONTRIBUTION OF SURFACE CATALYSIS AND GAS PHASE REACTION TO CATALYTIC COMBUSTOR PERFORMANCE Final Report, 15 Aug. 1977 - 15 Aug. 1979
C. M. Ablow, S. Schechter, H. Wise, and B. J. Wood Oct. 1979 81 p refs
(Contract F49620-77-C-0123; AF Proj. 2308)
(AD-A078465; AFOSR-79-1146TR) Avail: NTIS HC A05/MF A01 CSCL 07/4

Engineering studies with catalytic combustors in the main burner and afterburner of aircraft propulsion systems have been concerned with the attainment of high combustion efficiency and flame stabilization of fuel-air mixtures outside the conventional flammability limits. The development of such devices that will perform at optimum efficiency over a broad range of operating conditions requires a detailed understanding of the flow of a reactive gas through ducts with catalytic walls, in which both hetorogeneous (wall) and homogeneous (gas) chemical reaction kinetics can occur. Of special interest to our study is the evaluation of the relative contributions of surface-catalyzed and gas-phase reactions to the total heat release rate in a catalytic combustor over a range of operating variables that include gas flow velocity, catalyst temperature, surface reactivity, and fuel-air ratio. Two catalytic combustor systems were employed. One involved stagnation point boundary layer flow with a catalytically active flat surface, the other duct flow in a multichannel catalytic monolith. The experimental studies were supplemented by theoretical calculations of heat release rates and temperature profiles based on models appropriate to the geometry and fluid dynamics of each catalytic combustion system. The result of our studies with dilute propane-air gas mixture and platinum coated surfaces have demonstrated that in both combustor configurations the gas phase combustion can be initiated by the wall-catalyzed reaction. GRA

N80-18135# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
ON THE SYNTHESIS OF METASTABLE A-15 Nb3Si BY ION IMPLANTATION AND ON ITS SUPERCONDUCTING TRANSITION TEMPERATURE
M. T. Clapp (Mass. Univ., Amherst) and Robert M. Rose Nov. 1979 26 p refs
(Contract N00014-76-C-0297)
(AD-A077396; TR-2) Avail: NTIS HC A03/MF A01 CSCL 07/2

The authors have found a new technique for the synthesis of metastable compounds of well defined composition; namely, ion implantation of a selected element into the desired crystal structure. Starting with a substrate material of A-15 Nb3Al0.9Si0.1, two basic approaches were tried towards the formation of A-15 Nb3Si by Si implantation: (1) direct replacement of the Al by Si, and (2) implantation into a surface layer depleted of Al. This later approach proved to be the most successful. It consisted of removing the Al by a diffusion anneal and replacing the Al deficiency by sequential Si implatation. Upon subsequent heat treatment, a surface layer of A-15 Nb3Al0.2Si0.8 was produced. Details of the experimental procedure and a discussion of the superconducting transistion temperature measurements of the implanted surfaces are presented. GRA

N80-18136# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
THE PHYSICAL STRUCTURE OF TURBULENT FLAMES
N. A. Chigier and A. J. Yule Jan. 1979 11 p refs Presented at the Aerospace Sci. Meeting, New Orleans, 15-17 Jan. 1979
(Grant AF-AFOSR-3414-77; AF Proj. 2308)
(AD-A070008; AFOSR-79-0656TR; PAPER-79-0217) Avail: NTIS HC A02/MF A01 CSCL 21/2

This paper reports on measurements made in the mixing region of an axisymmetric turbulent propane/air jet issuing from a round nozzle into a low-velocity, low-turbulence intensity, unconfined co-flowing airstream. The exit velocity of the jet fluid and its turbulence intensity are sufficiently low to allow the formation of ring vortices within the mixing layer, bounded, on the inside, by the potential core of the jet and, on the outside, by the secondary airstream. High speed cine films show evidence of formation of vortices and flamelets at the interfaces. The changes in shape, movement and coalescence downstream of the nozzle are examined. Measurements of fluctuating velocity are made by a single particle-counting forwardscatter laser anemometer. Fluctuating temperature is measured with microthermocouples with 'in situ' measurement of time constant and direct compensation by digital signal recording and analysis. Variation in location and amplitude of peaks of velocity and temperature traces are directly associated with flame structures recorded by film. Signals from all probes are acquired and processed by PDP-8 and PDP-1103 Digital Equipment Corporation computers. GRA

N80-18137# State Univ. of New York at Buffalo. Dept. of Chemistry.
PREPARATION AND PROPERTIES OF ((TRIMETHYL SILYL)METHYL)-GALLIUM 3 COMPOUNDS
O. T. Beachley, Jr. and R. G. Simmons Nov. 1979 29 p refs Submitted for publication
(Contract N00014-78-C-0562)
(AD-A076123; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/2

A series of neutral organogallium(3) compounds which incorporate the (trimethyl silyl)methyl ligand, have been prepared and fully characterized by elemental analyses, NMR and infrared spectroscopy, molecular weight data, solubility properties and Lewis acid-base chemistry. The parent compound Ga(CH2SiMe3)3 prepared from GaC13 by a standard Grignard

reaction in diethylether. The halogen derivatives were prepared from Ga(CH2SiMe3)3 by elimination reactions with HCl or HBr and exchange reactions with GaCl3 or GaBr3. GRA

N80-18138# Exxon Research and Engineering Co., Linden, N.J. Corporate Research Labs.
RADIATION AUGMENTED COMBUSTION Interim Report, 1 Jun. 1978 - 31 May 1979
Anthony E. Cerkanowicz Jul. 1979 33 p refs
(Contract F49620-77-C-0085; AF Proj. 2308)
(AD-A077563; EXXON/GRUS.2BFB-79; AFOSR-79-1096TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

Radiative initiation and enhancement of combustion in unsensitized fuel-air mixtures via the photodissociation of oxygen molecules and combustion intermediary species are being investigated. Pulsed VUV (vacuum ultraviolet) light sources and continuous UV (ultraviolet) light sources are being used for this purpose. Experimental efforts are directed at elucidation of light source conversion efficiency and spectral characteristics, and reactant mixture-photon interactions. A complementary effort involves the development of analytical capability required for modeling photochemical initiation and enhancement of combustion. GRA

N80-18139# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.
SPECTROELECTROCHEMICAL MONITORING OF ELECTRODE REACTIONS BY MULTIPLE SPECULAR REFLECTANCE SPECTROSCOPY Technical Report, 15 Jun. 1978 - 1 Jul. 1979
Charles E. Baumgartner, Gary T. Marks, David A. Aikens, and Herbert H. Richtol Oct. 1979 24 p refs Submitted for publication
(Contract N00014-78-C-0494)
(AD-A076951; TR-1) Avail: NTIS HC A02/MF A01 CSCL 09/1

Multiple specular reflection is the basis of a new thin layer spectro-electrochemical cell which does not use optically transparent electrodes, the optical sensitivity of which exceeds that of cells using transparent electrodes by a factor of several hundred. As a result, the ability to detect short-lived intermediates and weakly absorbing species in spectroelectrochemical studies is much improved. Absorbance changes less than 5 x 10 to the minus 5 absorbance units per electrode reflection are readily observed. A cell 4cm long with a 120 micrometers spacing, operated to give approximately 330 reflections, was used to monitor optically the reduction of methylene blue and the reoxidation of the leuco form at concentrations as low as 5 x 10 to the minus 7M. For both reactions, the absorbance is linear with square root of t from 10 ms to ca 3 s, and the magnitude agrees well with values calculated from the geometry of the optical path. Among the advantages of the new technique are greatly increased optical sensitivity and the ability to use electrode materials which are not transparent. GRA

N80-18140# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
IGNITION AND FLAME PROPAGATION IN SPRAYS Final Report, 1 Jun. 1976 - 30 Aug. 1979
William A. Sirignano and Suresh K. Aggarwal 1 Dec. 1979 47 p refs
(Grants DAAG29-76-G-0266; DAAG29-77-G-0145; DA Proj. 1L1-61102-BH-57)
(AD-A078889; MAE-1459; ARO-14052.2-E) Avail: NTIS HC A03/MF A01 CSCL 21/2

Flame initiation and propagation through an air-fuel vapor-fuel drop system is numerically modeled in a cylindrical one-dimensional combustor. Using an unsteady formulation and allowing unsteady mass, momentum and heat transfer between the two phases, results have been obtained to observe the effects of activation energy, preexponential factor, intitial droplet size, initial temperature, stoichiometric ratio and diffusivity on the flame propagation. It is observed that the process is essentially unsteady. Also, unlike pre-mixed case, heterogeneous combustion gives rise to large variation in fuel-air ratio, which could produce a secondary diffusion flame in the wake of a propagating flame. GRA

N80-18141# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ISOMERIZATION AND DECOMPOSITION OF 1.2 EPOXY PROPANE BY INTENSE CO2 LASER RADIATION [ISOMERISIERUNG UND ZERFALL VON 1.2-EPOXIPROPAN BEI BESTRAHLUNG MIT INTENSIVEN CO2 - LASERLICHT]
M. Kneba and H. G. Wagner Nov. 1978 23 p refs In GERMAN
(MPIS-18/1978; ISSN-0436-1199) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Goettingen, West Germany DM 6,30

The competing reactions of isomerization and photolysis of 1,2-epoxy propane under intense infrared radiation from a CO2 laser were studied quantitatively in order to clarify some mechanisms of hydrocarbon oxidation. The experimental work was done at different pressures using a CO2 laser pulse energy of 0.1 and 1.5 joules. Direct heating by infrared quanta absorption and energy transfer from SF6 molecules were used. Results are presented in charts showing the concentration of the different reaction products such as aldehyde, acetone, and vinylic ether as a function of 1,2-epoxy propane partial pressure, of the laser pulse intensity, and of the dilutant partial pressure. Author (ESA)

N80-18142# National Technical Information Service, Springfield, Va.
CARBON AND GRAPHITE. PART 3. GRAPHITE--PHYSICAL, MECHANICAL, AND STRUCTURAL STUDIES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Oct. 1979
Mona F. Smith Dec. 1979 105 p Supersedes NTIS/PS-78/1052; NTIS/PS-77/0846; NTIS/PS-76/0687; NTIS/PS-75/615; NTIS/PS-75/181
(PB80-802390; NTIS/PS-78/1052; NTIS/PS-77/0846; NTIS/PS-76/0687; NTIS/PS-75/615; NTIS/PS-75/181) Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

The physical, mechanical, and structural properties of graphite are examined. Graphite composites and fibers studies are excluded along with graphite chemistry. The use of graphite as a reactor material is reported. This updated bibliography contains 102 abstracts, 29 of which are new entries to the previous edition. GRA

N80-18143# National Technical Information Service, Springfield, Va.
CARBON AND GRAPHITE. PART 3. GRAPHITE--PHYSICAL, MECHANICAL, AND STRUCTURAL STUDIES, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1976
William E. Reed Dec. 1979 232 p
(PB80-802382) Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

The physical, mechanical, and structural properties of graphite are discussed. Studies of graphite composites and fibers are excluded along with graphite chemistry. The majority of the studies deal with the use of graphite as a reactor material. This updated bibliography contain 226 abstracts, none of which are new entries to the previous edition. GRA

N80-18144# National Technical Information Service, Springfield, Va.
CARBON AND GRAPHITE. PART 2. CARBON AND GRAPHITE COMPOSITES - EXCLUDING CARBON FIBER COMPOSITES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979
William E. Reed Dec. 1979 262 p Supersedes NTIS/PS-78/1051; NTIS/PS-77/0845; NTIS/PS-76/0686; NTIS/PS-75/614; COM-74-11527
(PB80-802374; NTIS/PS-78/1051; NTIS/PS-77/0845; NTIS/PS-76/0686; NTIS/PS-75/614; COM-74-11527) Avail: NTIS HC $30.00/MF $30.00 CSCL 11B

Carbon and graphite composites are studied. Topics include nonfiber carbon reinforcement, carbon or graphite matrix composites, applications, properties, fabrication, and structural analysis. The majority of research concerns aircraft components and ablative materials for rockets. This updated bibliography contains 262 abstracts, 48 of which are new entries to the previous edition. GRA

N80-18145# National Technical Information Service, Springfield, Va.
CARBON AND GRAPHITE. PART 1: CARBON AND GRAPHITE FIBERS AND FIBER COMPOSITES, VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Sep. 1977 - Oct. 1979
William E. Reed Dec. 1979 249 p Supersedes NTIS/PS-78/1050; NTIS/PS-77/0844; NTIS/PS-76/0685; NTIS/PS-75/613; COM-74-11527
(PB80-802366; NTIS/PS-78/1050; NTIS/PS-77/0844; NTIS/PS-76/0685; NTIS/PS-75/613; COM-74-11527) Avail: NTIS HC $30.00/MF $30.00 CSCL 11B

Citations cover reinforcement of numerous polymers and metals by carbon and graphite fibers. Topics include processing, design, properties, stress analysis, and performance of the composite structures or parts. Composites from polyimide, epoxy, and aluminum matrices are among the types cited. Fabrication and testing of materials for rocket nozzles, reentry vehicles, aircraft components, automobiles, and ships are included. This updated bibliography contains 241 abstracts, 100 of which are new entries to the previous edition. GRA

N80-18146# National Technical Information Service, Springfield, Va.
CARBON AND GRAPHITE. PART 4. GRAPHITE--CHEMICAL PROPERTIES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979
Diane M. Cavagnaro Dec. 1979 249 p Supersedes NTIS/PS-78/1053; NTIS/PS-77/0847; NTIS/PS-76/0688; NTIS/PS-75/616
(PB80-802408; NTIS/PS-78/1053) Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

Citations on the chemistry of graphite are presented. Topics include vaporization, thermodynamics, surface chemistry, intercalation compounds, chemisorption, and oxidation. This updated bibliography contains 228 abstracts, 32 of which are new entries to the previous edition. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-18147 Missouri Univ. - Columbia.
ENVIRONMENTAL EFFECTS ON THE MECHANISM OF FRETTING FATIGUE IN 7075-T6 ALUMINUM Ph.D. Thesis
Cheung Jarm Poon 1979 116 p
Avail: Univ. Microfilms Order No. 8002392

A cyclic type of loading with a sinusoidal waveform at a frequency of 10 Hz was applied to the specimen, which was under a normal contact pressure of 6000 psi with a fretting pad at the same time, until failure occurred. Statistical analysis of the data led to the conclusion, with at least 95 percent confidence, that the chemical corrosion process in fretting fatigue plays the dominant role in reducing fatigue life. Fractographic analysis on failed specimens indicates that different mechanisms of fretting fatigue resulted from different environments. In laboratory air environment, the generation of pits due to fretting is considered to be the cause of crack initiation which led to subsequent early failure of the specimen. In vacuum environment, the fretting damage was less severe, and crack initiation is considered to result from the action of tangential surface stress on welded metallic junctions between two contacting surfaces. Dissert. Abstr.

N80-18148 Missouri Univ. - Columbia.
CHARACTERIZATION OF METAL DAMAGE THROUGH INFRARED TECHNOLOGY Ph.D. Thesis
Sharon Lynn Langenbeck 1979 275 p
Avail: Univ. Microfilms Order No. 8002376

Five different materials, 410 Stainless Steel, Waspaloy (y.s. 120), 17-4 PH Stainless Steel, Ti-6A1-2Sn-4Zr-2Mo, and Waspaloy (y.s. 154), were used to characterize the thermal profile of a fatigue crack. Both the 410 Stainless Steel and Waspaloy (120) were tested under the new and used (wear) conditions. During stable crack growth the change in temperature at the crack tip was quite small and steadily increased as the stress intensity increased. The last few cycles before failure showed a sharp increase in the thermal gradient with no cooling below ambient at the crack tip. From the ambient temperature both an increase and a decrease in temperature was observed during stable crack growth. The cooling at maximum load is response from elastic loading while the heating is due to a plasticity effect. At lower stress levels the decrease in temperature correlated quite well with the theoretical data. However, as the stress increased the experimental data had a larger change in temperature than predicted. Dissert. Abstr.

N80-18149 Ohio State Univ., Columbus.
MECHANISMS OF RECOVERING LOW CYCLE FATIGUE DAMAGE IN INCOLOY 901 Ph.D. Thesis
Robert Edward Schafrik 1979 259 p
Avail: Univ. Microfilms Order No. 8001823

The effect of thermal treatment and hot isostatic pressing (HIP) on eliminating low cycle fatigue (LCF) damage was investigated during tests done in air at 500 F at a total strain range of 0.75%. The mechanisms of crack initiation and crack propagation in baseline specimens were determined and used as the basis of comparison for the rejuvenated specimens. A pre-rejuvenation damage level of 800 cycles (60% of crack initiation) was selected. Some specimens to be HIP processed were ceramic coated; the rest were left uncoated. Post-HIP testing revealed that LCF properties were adversely affected by surface microstructural damage caused by the HIP processing. Thermal rejuvenation, consisting of a standard solution treatment and double aging, was partially successful in recovering fatigue properties. Initiation life was extended by 400 cycles and cycles to failure was extended by 600 cycles. This behavior is explained in terms of microstructural damage. Dissert. Abstr.

N80-18150 Ohio State Univ., Columbus.
ELECTROCHEMICAL INVESTIGATION OF HOT CORROSION Ph.D. Thesis
George William Watt 1979 198 p
Avail: Univ. Microfilms Order No. 8001854

Four different electrodes were investigated in molten sodium sulfate: (1) a Pt foil immersed in the melt; (2) a silver wire in a mixture of 10 m/o Ag_2SO_4 in Na_2SO_4, enclosed in a mullite tube; (3) a Pt-wire immersed in Na_2SO_4 over which an equilibrated mixture of $SO_3/SO_2/O_2$ is passed, the system enclosed in a mullite tube; and (4) a Pt-wire in oxygen inside a calcia-stabilized zirconia tube. These electrodes were then employed to study the corrosion of pure Ni, pure Cr, and the compound NiAl covered with thin molten sodium sulfate films and various gaseous atmospheres over the salt film. Open circuit potential measurements with Ag/Ag_2SO_4, SO_2/O_2 gas, and fully or partially stabilized ZrO_2 reference electrodes were made. Galvanic current measurements with the corroding metal coupled to a Pt electrode as well as potentiostatic polarizations were also accomplished. The results are interpreted in terms of a scale fluxing model and a scale growth and dissolution model analogous to scale growth and evaporation in metal/gas reactions. Dissert. Abstr.

N80-18151 Illinois Univ. at Urbana-Champaign.
ANELASTIC STUDIES OF INTERSTITIALLY TRAPPED HYDROGEN IN NIOBIUM Ph.D. Thesis
Philip Emerson Zapp 1979 140 p
Avail: Univ. Microfilms Order No. 8004311

The local motion of hydrogen trapped by oxygen and nitrogen solutes was studied using anelastic relaxation methods. Internal friction peaks due to the reorientation of O-H pairs were measured in the < 100 >, < 110 > and < 111 > directions of niobium single crystals. Reorientation occurs by hydrogen jumping around the fixed O interstitial trap, the frequency of which was found to be higher in The < 111 > direction than in the < 110 > direction. The activation enthalpy of motion was 0.12 eV in The former direction and 0.18 eV in the latter. Two probable models for the O-H defect are (1) a single O-H pair with < 100 > monoclinic point symmetry, and (2) two types of pairs, one with < 100 > orthorhombic symmetry and the other with < 100 > monoclinic symmetry. The jump frequency of nitrogen-trapped hydrogen in the temperature range of about 40 to 80K was

studied with strain relaxation and low frequency internal friction techniques. The jump frequency at a given temperature was found to be lower than that of oxygen-trapped hydrogen, and it is in good agreement with the Flynn-Stoneham theory of phonon-assisted quantum tunneling. Dissert. Abstr.

N80-18152 Illinois Univ. at Urbana-Champaign.
THE CHARACTERIZATION OF THE THERMODYNAMICS OF SPECIFIC AND NONSPECIFIC INTERACTIONS IN LIQUID METAL MIXTURES Ph.D. Thesis
Kenneth Richard Cox 1979 186 p
Avail: Univ. Microfilms Order No. 8004152

The application of three different solution models to liquid metal mixtures was investigated. A Dolezalek type chemical model was used to represent activity coefficient and phase equilibria behavior for liquid metal systems which are expected to form strong complexes. A general linear least squares technique for calculating chemical theory parameter values was proposed and a physical model which includes the electron contributions to the total energy was applied to liquid metal systems for which no strong complexes were expected to form. A combination chemical physical model was proposed to deal with specific interactions. The model uses a single physical parameter to represent each binary pair. One chemical parameter is used for each complex formed in the liquid metal. The model is applied to represent both activity coefficient and solid liquid phase boundary data. A comparison is made between predicted and experimental results. The experimental activities were obtained using a multiple Knudsen cell-mass spectrometer technique. The results were compared with the predictions of the single parameter physical model. Dissert. Abstr.

N80-18153# National Research Council of Canada, Ottawa (Ontario).
UTILIZATION OF SUPERPLASTICITY IN INDUSTRIAL METAL FORMING
G. H. Gessinger 1980 15 p refs Transl. into ENGLISH from Radex-Rundsch. (Austria), v. 2, 1977 p 124-130
(NRC/CNR-TT-1946; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The advantages and limitations of superplastic sheet metal forming are discussed. The typical alloy groups such as nickel superalloys, carbon steels, and zinc alloys are described in relation to their sheet metal forming, isothermal solid blank forming, and the semifinished products. M.M.M.

N80-18154# Materials Research Labs., Melbourne (Australia).
FRACTURE TOUGHNESS OF FATIGUE-DAMAGED STEEL SPECIMENS
Graham Clark Jun. 1979 20 p refs
(MRL-R-749; AR-001-827) Avail: NTIS HC A02/MF A01

The fracture toughness of high quality gun steel is examined. Conditions under which the fatigue precracking levels specified for K sub Ic tests may produce unreasonably high values of K sub Ic leading to an increased possibility of in-service fracture of components designed using these values, are described. M.G.

N80-18155*# United Technologies Research Center, East Hartford, Conn.
STUDY OF THE EFFECTS OF GASEOUS ENVIRONMENTS ON THE HOT CORROSION OF SUPERALLOY MATERIALS Final Report
John G. Smeggil and N. S. Bornstein 5 Feb. 1980 93 p
(Contract NAS3-21376)
(NASA-CR-159747; R79-914387-4) Avail: NTIS HC A05/MF A01 CSCL 11F

The effect of the gaseous corrodent NaCl on the high temperature oxidation and sodium sulfate induced hot corrosion behavior of alumina formers, chromia formers, and the superalloy B-1900 was examined. Isothermal experiments were conducted at 900 C and 1050 C in air in the presence and absence of NaCl vapors. Microstructural changes in oxide morphology and increased rates of oxidation were observed when NaCl(g) was present. It is hypothesized that the accelerated rates of oxidation are the result of removal of aluminum from the scale substrate interface and the weakening of the scale substrate bonds. The aluminum removed was redeposited on the surfaces in the form of alumina whiskers. For the superalloy B-1900, alumina whiskers are also formed, and the alloy oxidizes at catastrophic rates. In the case of Ni-25Cr alloy, NaCl vapors interact with the scale depleting it of chromium. R.C.T.

N80-18156*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF A SOLAR SELECTIVE COATING SYSTEM USING BLACK COBALT OXIDE FOR HIGH TEMPERATURE SOLAR COLLECTORS
G. McDonald 1980 16 p refs Proposed for presentation at Intern. Conf. on Metal Coatings, San Diego, Calif., 21-25 Apr. 1980; Sponsored by Am. Vacuum Soc.
(NASA-TM-81385; E-293) Avail: NTIS HC A02/MF A01 CSCL 10A

Black cobalt oxide coatings (high solar absorptance layer) were deposited on thin layers of silver or gold (low emittance layer) which had been previously deposited on oxidized (diffusion barrier layer) stainless steel substrates. The reflectance properties of these coatings were measured at various thicknesses of cobalt for integrated values of the solar and infrared spectrum. The values of absorptance and emittance were calculated from the measured reflectance values, before and after exposure in air at 650 C for approximately 1000 hours. Absorptance and emittance were interdependent functions of the weight of cobalt oxide. Also, these cobalt oxide/noble metal/oxide diffusion barrier coatings have absorptances greater than 0.90 and emittances of approximately 0.20 even after about 1000 hours at 650 C. Author

N80-18157*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF IMPURITIES IN COAL-DERIVED LIQUIDS ON ACCELERATED HOT CORROSION OF SUPERALLOYS Final Report
Daniel L. Deadmore and Carl E. Lowell Mar. 1980 30 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-81384; DOE/NASA/2593-79/13; E-292) Avail: NTIS HC A03/MF A01 CSCL 11F

A Mach 0.3 burner rig was used to determine the effects of potential coal derived liquid fuel impurity combustion of products on hot corrosion in IN-100, IN-792, IN-738, U-700, Mar M-509, and 304 stainless steel. The impurities, added as aqueous solutions to the combustor, were salts of sodium, potassium, vanadium, molybdenum, tungsten, phosphorus, and lead. Extent of attack was determined by metal consumption and compared to the effects of sodium alone. Vanadium, molybdenum, tungsten, phosphorous, and lead in combination with sodium all resulted in increased attack as compared with sodium alone at some temperatures, apparently due in large part to the extension of the formation of liquid deposits. Varying the sodium-potassium ratio had little effect for ratios less than 1:3 for which reduced, but measurable, attack was observed. K.L.

N80-18158# Rock Island Arsenal, Ill. Engineering Directorate.
AN EVALUATION OF PROCESSES FOR THE BLACKENING OF PRECIPITATION-HARDENED STAINLESS STEELS
J. T. Menke Jun. 1979 32 p
(AD-A075134; SARRI-EN-TR-79-01) Avail: NTIS HC A03/MF A01 CSCL 11/6

Precipitation-hardened stainless steels (corrosion-resistant materials with excellent mechanical properties) require dark, nonreflective finishes to be useful for most military applications. Work involving such finishes was conducted to determine which of the various blackening processes could be used for these materials without decreasing their inherent corrosion resistance. Corrosion tests were conducted on coated and uncoated 17-4, 17-7, 14-8Mo, and AM350 alloys in the annealed and precipitation-hardened condition. The blackening processes evaluated included black chromium plating, zinc phosphating, molten sodium dichromate, and alkaline-oxidizing treatments. Activated and passivated specimens were used as controls in the corrosion tests. Potentiostatic, potentiodynamic, and 5% salt spray (astm-b117) tests were used to evaluate the various specimens. Salt-spray tests showed that maximum corrosion protection was provided by black chromium and zinc phosphate coatings. All corrosion tests showed that black coatings produced by the alkaline-oxidizing process provided varying degrees of corrosion

resistance, dependent upon the alloy or thermal treatment used, and that coatings produced by the molten sodium dichromate treatment provided poor corrosion protection. Black coatings on the 14-8Mo and AM350 alloys exhibited the best corrosion resistance. GRA

N80-18159# Naval Research Lab., Washington, D. C.
FATIGUE CRACK GROWTH OF A508 STEEL IN HIGH-TEMPERATURE, PRESSURIZED REACTOR-GRADE WATER
W. H. Cullen, Jr., V. Provenzano, K. J. Torronen, H. E. Watson, and F. J. Loss 28 Sep. 1979 58 p refs
(AD-A075506; NRL-MR-4063; NRL/NUREG-CR-0969) Avail: NTIS HC A04/MF A01 CSCL 11/6

Fatigue crack growth tests of A508-2 pressure vessel steel have been conducted at two test temperatures (93 C and 288 C) using a variety of constant amplitude waveforms. The load ratios were either 0.1 or 0.125, and the water chemistry was carefully monitored and controlled so as to simulate the nominal pressurized water reactor chemistry. The test procedures are described, and an examination of all the data indicates that the results fall into one of two rather clearly defined categories. One band of data, termed 'low', lies close to or essentially on, the ASME Section XI Code air environment default line. The other band of data, termed 'high', resides approximately midway between the ASME Sec. XI air and water environment default lines. The two bands of data are the result of certain combinations of the waveform and temperature variables listed above, and are determined by the following rules: (1) a ramp time in excess of one second is needed to obtain the high crack growth rate; and (2) the application of a hold time, together with a high temperature, serves to depress a normally high crack growth rate test (i.e., one with a long ramp time) and force it into the low category. A hydrogen embrittlement model is used as a basis for the explanation of this behavior. During the longer ramp times (approximately one second) hydrogen formed by aqueous hydrolysis diffuses into the plastic zone resulting in local embrittlement. GRA

N80-18160# Illinois Univ. at Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.
HYDROGEN-EMBRITTLEMENT-HYDRIDE FRACTURE
S. Gahr, B. J. Makenas, and H. K. Birbaum Sep. 1979 20 p refs
(Contract N00014-75-C-1012)
(AD-A076912) Avail: NTIS HC A02/MF A01 CSCL 20/11

Consideration is given to causes for the extreme brittleness observed for most hydrides. Surface energies for cleavage of the beta NbH0.82 f.c. orthorhombic hydride along the (1,00) and (110) are obtained using fracture mechanics methods. The values are shown to be about equal to those of b.c.c. niobium. The relative surface energies of niobium and NbH are consistent with measurements of phonon frequencies and elastic constants. None of the data indicates any decrease of atomic bonding due to the incorporation of hydrogen in the metal lattice. Dislocation mobility is considered on the basis of T.E.M observations and the crystal structure. It is shown that half of the /110/ <111> slip systems cause hydrogen disordering and therefore experience a high lattice frictional stress. Domain boundaries also are shown to be dislocation barriers. Hydride brittleness is considered to result from the decrease in dislocation mobility and in the slip systems available to cause plastic blunting at elastic discontinuities. GRA

N80-18161# Lockheed Missiles and Space Co., Palo Alto, Calif.
ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWERS Research and Development Status Report, 5 Mar. - 4 Jun. 1979
R. E. Lewis Jun. 1979 23 p refs
(Contract F33615-78-C-5203; DARPA Order 3575)
(AD-A077197; LMSC-D677934) Avail: NTIS HC A02/MF A01 CSCL 11/6

Advanced aluminum alloys are to be developed that will provide major payoffs for important new aircraft, spacecraft, and missile systems in the next decade. Payoffs will result from weight savings of structural components which, in turn, lead to increased range, payload, service life, and decreased life-cycle cost. Recently conducted feasibility and design tradeoff studies provide a basis for selecting certain property goals for improved aluminum alloys that will result in significant weight savings. GRA

N80-18162# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DEVELOPMENT OF ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWDERS FOR AEROSPACE STRUCTURAL APPLICATIONS Interim Technical Report, 5 Mar. - 4 Sep. 1979
R. E. Lewis Sep. 1979 137 p refs
(Contract F33615-78-C-5203; ARPA Order 3575)
(AD-A077800; LMSC-D678772) Avail: NTIS HC A07/MF A01 CSCL 11/6

Advanced aluminum alloys are being developed that will provide major payoffs in terms of weight savings for new aerospace structures. The two property goals are: (1) a 30-percent increase in modulus of elasticity-to-density ratio, and (2) a 20-percent increase in modulus of elasticity-to-density ratio plus a 20-percent increase in strength-to-density ratio, when compared to Al 7075-T76 and without a significant loss in other properties important for structural applications. The program is organized into three phases: (1) a fundamental alloy and process development study; (2) scale-up of two best alloys and evaluation of mill product forms; (3) design evaluation involving selected redesign of aerospace components, analysis of payoffs, and recommendations for manufacturing technology development. Phase 1 activity, to be completed in the first two years, is organized into four Tasks: (1) development of advanced aluminum alloys containing lithium; (2) development of advanced aluminum alloys that do not contain lithium; (3) quantitative microstructural analyses and mechanical property correlations; (4) study of aerospace structural applications for advanced aluminum alloys including development and application of a method for predicting weight savings. Phase 1 activity is described below; Phases 2 and 3 have not been initiated. GRA

N80-18163# Warwick Univ. Coventry (England). Dept. of Physics.
COMPTON SCATTERING STUDIES OF METALS AND HYDRIDES WITH 412 KeV GAMMA RADIATION Final Report, Oct. 1977 - Sep. 1979
Malcolm J. Cooper Sep. 1979 35 p refs
(Grant DA-ERO-77-G-099; DA Proj. 1T1-61102-BH-57)
(AD-A078801) Avail: NTIS HC A03/MF A01 CSCL 20/6

A 412 KeV Compton spectrometer has been designed at Warwick, and commissioned at the SRC Rutherford Laboratory. The performance of the system was highly satisfactory, but routine operation of the equipment has been hampered by deterioration in the resolution of the detector, and delays have occurred as a result of faults in the computerised data acquisition system. The Compton profile of vanadium has been measured, and is found to be in disagreement with theory, the anisotropies being smaller than predicted. In related investigations evidence for the failure of the impulse approximation has been found, and the viability of obtaining cohesive energies from Compton profiles has been assessed. GRA

N80-18164# Birmingham Univ. (England). Dept. of Physical Metallurgy and Science of Materials.
SOME ASPECTS OF FATIGUE CRACK CLOSURE IN TITANIUM ALLOYS Final Scientific Report, 1 Jan. - 30 Jun. 1979
C. J. Beevers 31 Aug. 1979 42 p refs Prepared for AF Office of Sci. Res., Washington, D.C. and European Office of Aerospace Res. and Develop., London
(Grant AF-AFOSR-0045-79; AF Proj. 2301)
(AD-A076948; EOARD-TR-80-2) Avail: NTIS HC A03/MF A01 CSCL 11/6

Fatigue crack growth at intermediate rates and R 0.1 has been measured in compact tension specimens of the alloys Ti-6Al-4V and Ti-6Al-5Zr-0.5Mo-0.25Si. Crack length was determined from the output of a crack mouth displacement gauge and by using a d.c. potential drop technique. The incidence of crack closure was examined during fatigue by using both of the above methods; COD was found to be more reliable for closure measurement than potential drop. In contrast to the fine microstructured Ti-6Al-4V, the coarse Ti-6Al-5Zr-0.5Mo-0.25Si showed substantial load transfer across the crack faces during

fatigue and this was attributed to a 'non-closure' mechanism. Low crack growth rates in the latter alloy were rationalized in terms of an effective delta K. Marked reductions in growth rate produced by variable amplitude loading at Ti-6Al-4V could not be explained by crack closure. GRA

N80-18165# National Bureau of Standards, Washington, D.C. Metal Science and Standards Div.
APPLICATION OF SOLIDIFICATION THEORY TO RAPID SOLIDIFICATION PROCESSING Semiannual Report, 1 Apr. - 30 Sep. 1979
W. J. Boettinger, J. W. Cahn, S. R. Coriell, and J. R. Manning Oct. 1979 19 p refs
(ARPA Order 3751)
(AD-A076947) Avail: NTIS HC A02/MF A01 CSCL 13/8

Work is reported on the following areas of rapid solidification processing: (1) Microsegregation and Stability at the Solidification Interface, (2) Glass Formation by Rapid Cooling of Eutectic Systems, (3) Compositional Limits Imposed by Thermodynamics during Rapid Solidification and Relative Stability of Heterogeneous Microstructures. The theory of rapid solidification was investigated to determine whether major aspects of rapid solidification processes can be explained by conventional solidification theory and to examine non-equilibrium effects which can arise. In particular, segregation effects, glass-forming tendencies, and rules governing the formation of equilibrium and non-equilibrium phases, including alloy composition limits, reaction sequences and metastable phase formation, will be investigated. GRA

N80-18166# Technion - Israel Inst. of Tech., Haifa. Solid State Inst.
TRANSPORT AND RECOMBINATION PROPERTIES OF LEAD TIN TELLURIDE ALLOYS Final Report, 1 Jan. 1978 - 30 Sep. 1979
Kurt Weiser 1979 13 p
(Grant AF-AFOSR-3509-78; AF Proj. 2306)
(AD-A078687; AFOSR-79-1260TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

Doping effects and photoconductivity were studied for single crystal films of lead tin telluride (Pb(0.8)Sn(0.2)Te) grown by vapor phase epitaxy. Growth of films was carried out by an evaporation condensation process in which the alloy was evaporated from a polycrystalline source and the vapor was condensed on a barium fluoride substrate. Interesting doping effects were obtained with indium which produces a deep level in the gap with unusual properties. Extensive galvanomagnetic measurements suggest that indium enters as a self-compensating impurity and pins the Fermi level near midgap, in contrast to other Group III elements such as gallium and thallium which dope the material n-type and p-type, respectively. An investigation of the kinetics of photoconductivity revealed that around the 'device temperature' of 77 K, the recombination of excess carriers is thermally activated, but becomes approximately temperature independent below 50 K. These results and the magnitude of the photoconductive life-time lead to the surprising conclusion that contrary to prevailing opinion, Auger recombination is not the dominant recombination mechanism for samples with carrier concentration in the 1-10/10 to the 16th power cc range. GRA

N80-18167# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France). Lab. de la Direction Technique.
STUDY OF THE RELATIONSHIP OF MICROPOROSITY IN NICKEL-BASED ALLOYS TO STRUCTURAL HARDENING WITH TITANIUM AND ALUMINUM DURING PRECISION CASTING European Concerted Action - COST 50. Materials for Gas Turbines, Project F5/1 Final Report [ETUDE DE LA SENSIBILITE A LA MICROPOROSITE D'ALLIAGES BASE NICKEL A DURISSEMENT STRUCTURAL PAR LE TITANE ET L'ALUMINIUM POUR FONDERIE DE PRECISION]
Philippe Julien, Jean-Claude Lecomte, Francoise Lavaud, Gerard Lesoult, Francine Wets, and Eric Bachelet 16 Nov. 1978 59 p refs In FRENCH Prepared in cooperation with Ecole des Mines de Paris
(Contracts DGRST-74-7-0152; DGRST-74-7-0153; DGRST-74-7-0154; DGRST-76-7-0608; DGRST-76-7-0609) Avail: NTIS HC A04/MF A01

The correlations between chemical composition, the solidification process, and the tendency towards microporosity were studied in controlled casting and cooling conditions, using eight types of INCONCEL 738 alloy and eight types of C263 alloy. A negative correlation was found between the microporosity index of the C263 alloy and the fraction of eutectic gamma-carbide. The microporosity generation mechanisms are discussed pointing out that the alloys rich in carbon and carbide forming elements, such as Ti, Zr, Hf, show higher porosity independent of the eutectic quantity formed at the end of the solidification period, suggesting an alternative type of porosity forming mechanism. Author (ESA)

N80-18168# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
VARIATION IN THE MECHANICAL PROPERTIES AND IN THE FRACTURE STRENGTH OF AN ALUMINUM 7075 T651 PLATE, MEASURED IN THE DIRECTION OF THICKNESS
H. F. deJong Jul. 1978 43 p refs In DUTCH; ENGLISH summary
(VTH-LR-271) Avail: NTIS HC A03/MF A01

The variation in mechanical properties and fracture toughness in the direction of thickness of an aluminum plate (7075 T651 alloy) with a thickness of 25.4 mm was investigated using a constant strain test technique. The results show there is a distinct inhomogeneity in this direction for both the mechanical properties and fracture toughness as well as for hardness. Possible explanations for this behavior related to the microstructure are discussed. Author (ESA)

N80-18169# New Mexico Univ., Albuquerque. Technology Application Center.
CORROSION CHARACTERISTICS OF ALUMINUM ALLOYS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Nov. 1979
Gerald F. Zollars Nov. 1979 41 p Sponsored in part by NTIS
(PB80-801137) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

This bibliography contains 162 citations concerning the corrosion characteristics of aluminum alloys. Included are articles dealing with corrosion resistance, stress corrosion cracking, intergranular corrosion, electrochemical corrosion, corrosion prevention, and corrosion, and fatigue tests of aluminum alloys. GRA

N80-18170# New Mexico Univ., Albuquerque. Technology Application Center.
CORROSION CHARACTERISTICS OF TITANIUM ALLOYS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Nov. 1979
Gerald F. Zollars Dec. 1979 33 p Sponsored by NTIS
(PB80-801467) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Citations from international literature concerning the corrosion characteristics of titanium alloys are presented. Included are articles dealing with corrosion resistance, electrochemical corrosion, stress corrosion cracking, and corrosion tests of titanium alloys. This bibliography contains 126 citations. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-18171 Case Western Reserve Univ., Cleveland, Ohio.
CRYSTALLINITY, MORPHOLOGY, AND RHEOLOGY OF PVC-PLASTICIZER SYSTEMS Ph.D. Thesis
Pravin Laxminarayan Soni 1979 156 p
Avail: Univ. Microfilms Order No. 8002052

Gels of atactic PVC in certain solvents were found to yield higher than normal levels of crystallinity. The crystallites were found to have a broad range of melting points indicating the

presence of a range of size and/or perfection. Upon orientation, gels from dimethyl phthalate were found to exhibit an anomalous meridional reflection in the wide angle X-ray diffraction fiber pattern. Plasticized PVC was found to consist of a heterogeneous distribution of plasticizer. The 100-200 A microdomains, which are essentially unplasticized, do not fuse at temperatures up to 165 C. However, at 180 C they begin to fuse, resulting in a more homogeneous distribution of the plasticizer. Increasing the size distribution of particles in PVC plastisols was found to decrease the shear thickening effect at the high shear rates. Addition of coarse particles was found to result in a reduction in the low shear viscosity. Dissert. Abstr.

N80-18172 Massachusetts Univ., Amherst.
CALORIMETRIC STUDIES OF POLYMER BLEND SYSTEMS Ph.D. Thesis
Charles Luce Ryan, Jr. 1979 222 p
Avail: Univ. Microfilms Order No. 8004983

Several polymer blend systems were studied utilizing Tian-Calvet microcalorimetry and differential scanning calorimetry. The model system was polystyrene/poly(2,6-dimethyl-1,4-phenylene oxide). Different substituents were added to the polystyrene chain and noted for the effect on the compatibility with PPO. Substituents included fluorine, chlorine, bromine and methyl in both the 2 and 4 position on the polystyrene phenyl group. The thermodynamics of mixing was observed utilizing Hess's law to measure the polymer-polymer heat of mixing. Equilibrium states below T sub g were explored using Tian-Calvet microcalorimetry coupled with Hess's law. This method allows the location of both the binodal and spinodal phase boundaries in the glassy state and the establishment of an UCST. The contours of the free energy-composition diagram are discussed.
Dissert. Abstr.

N80-18173 Akron Univ., Ohio.
THE EFFECT OF PARTICLE SHAPE OF MODEL FILLER ON THE REINFORCEMENT OF ELASTOMERIC VULCANIZATES Ph.D. Thesis
Chuk Ling Leung 1980 139 p
Avail: Univ. Microfilms Order No. 8003394

The interaction between SBR vulcanizates and a model polymeric filler, polystyrene, was studied together with the effect of particle shape on the properties of such filled vulcanizates. It was found that for peroxide cured vulcanizates with polymeric filler, the degree of filler-polymer interaction decreased as the cure time was decreased from the optimum. Electron micrographs showed that after hot milling, the spherical polystyrene particles were distorted to ellipsoidal particles and aligned in the direction of milling. Physical properties of these vulcanizates, except the Young's modulus, were found to be anisotropic. Physical properties measured in the direction of filler alignment were found to be better than those measured transverse to filler alignment. The degree of anisotropy was also found to increase as the length of the ellipsoidal particles increased. Young's modulus was found to be independent of filler size, shape or orientation.
Dissert. Abstr.

N80-18174 Akron Univ., Ohio.
STYRENE-BUTADIENE COPOLYMERIZATION IN ORGANOLITHIUM SYSTEMS Ph.D. Thesis
Ling-Kun Huang 1979 179 p
Avail: Univ. Microfilms Order No. 8003393

The organolithium-initiated copolymerization of styrene and butadiene was studied in detail using sec-butyl lithium as polymerization initiator in various solvents and solvent-mixtures. The composition of the copolymers and the chain microstructure were determined by NMR analysis. In bulk or in hydrocarbon solvents, the reactivity ratio of butadiene was much higher than that of styrene, in spite of the much higher reactivity of styrene in homopolymerization. Small additions of polar solvent had a significant effect on the reactivity ratios of styrene and butadiene, and also on the microstructure of polybutadiene. Arrhenius functions were plotted for the relationship between temperature and reactivity ratios. Within experimental error, the reactivity ratios of the styrene-butadiene pair were unaffected by changes in initiator concentration in the range from .001 to .01M. Dissert. Abstr.

N80-18175 Massachusetts Univ., Amherst.
THE PHYSICS OF POLY(ETHYLENE OXIDE)/POLY (METHYL METHACRYLATE) BLENDS Ph.D. Thesis
Dennis Mark Hoffman 1979 215 p
Avail: Univ. Microfilms Order No. 8004938

The PEO/PMMA blend is shown to be compatible at all compositions above the melting point of the PEO based on the behavior of the glass transition, the spherulite growth rate, and morphological evidence. The temperature dependence of spherulite growth follows the Fischer-Turnbull expression if a WLF modification of the diffusion term is used. If the glass transition temperature varies according to a Fox type equation, the depression of the spherulite growth rate follows from the hypothesis of compatibility in the melt. Further evidence supporting the contention of melt compatibility is found from the shift in the dynamic mechanical tan delta maxima and DSC transition phenomena. At intermediate compositions, these types of measurements are difficult to interpret because recrystallization and melting phemonena occur near T sub g. Morphological and crystallization behaviors are used to show that these compositions are also compatible. Dissert. Abstr.

N80-18176 Syracuse Univ., N. Y.
SPECIFIC SOLVENT INTERACTIONS AND STRESS INDUCED CRYSTALLINITY IN POLYMERS Ph.D. Thesis
Edward Balizer 1979 253 p
Avail: Univ. Microfilms Order No. 8004486

Stress induced crystallization was investigated in networks of trans polychloroprene and cis polyisoprene crosslinked by dicumyl peroxide. Theories of stress induced crystallization were used to analyze the experimental results. In addition, the equilibrium of intra- and intermolecular hydrogen bonds was investigated for syndiotactic and isotactic polyvinyl alcohol in aqueous solution. The partition function was calculated along with the chain second moment and its temperature coefficient. It was found that both tacticities, isotactic and syndiotactic, have negative temperature coefficients. The isotactic chain populates the transconformer with increasing intramolecular bond strength. However, the syndiotactic chain shifts from the trans to the lefthanded helical conformation with increasing bond strength. These results are in accord with negative temperature coefficients and the majority of experimental results. Author

N80-18177# Osaka City Univ. (Japan). Dept. of Mechanical Engineering.
ACOUSTIC FATIGUE STRENGTH OF FRP PANELS
T. Fujii, T. Fukuda, S. Iida, and M. Sano 1979 5 p refs
Repr. from Organic Coatings and Plastic Chem., vol. 40, 1979 p 682-687 Presented at the Am. Chem. Soc./Chem. Soc. of Japan Chem. Congr., Honolulu, 1-6 Apr. 1979 Sponsored by Am. Chem. Soc. Prepared in cooperation with Natl. Aerospace Lab., Tokyo
Copyright. Avail: NTIS HC A02/MF A01

Acoustic fatigue in four kinds of fiber reinforced panels (FRP) with three layers consisting of roving glass cloth and/or glass-fiber mat reinforced unsaturated polyester resin is examined. It is observed that the glass-fiber mat reinforced test panel may be more isotropic in the failure pattern than the roving glass cloth reinforced test panels. The experimental results indicate that the acoustic fatigue strength of FRP test panels is considerably lower than the fatigue strength of FRP materials tested under constant stress. Under several assumptions, the acoustic fatigue life of test panels is predicted by the experimental data of fatigue strength of FRP obtained from the constant stress testing. Good agreement with the experimental data is shown. Furthermore, the increase of acoustic fatigue strength of such test panels is experimentally investigated by bonding carbon FRP on the middle part of a panel or laminating carbon fiber woven tapes simultaneously in the molding process of panels. As a result, it is found that the latter stiffening method is more effective. M.G.

N80-18178*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WEAR PARTICLES OF SINGLE-CRYSTAL SILICON CARBIDE IN VACUUM
Kazuhisa Miyoshi and Donald H. Buckley Feb. 1980 24 p refs Submitted for publication
(NASA-TP-1624; E-077) Avail: NTIS HC A02/MF A01 CSCL 20B

Sliding friction experiments, conducted in vacuum with silicon carbide /000/ surface in contact with iron based binary alloys are described. Multiangular and spherical wear particles of silicon carbide are observed as a result of multipass sliding. The multiangular particles are produced by primary and secondary cracking of cleavage planes /000/, /10(-1)0/, and /11(-2)0/ under the Hertzian stress field or local inelastic deformation zone. The spherical particles may be produced by two mechanisms: (1) a penny shaped fracture along the circular stress trajectories under the local inelastic deformation zone, and (2) attrition of wear particles. M.G.

N80-18179*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TACKIFIER FOR ADDITION POLYIMIDES Patent Application
Terry L. StClair and John M. Butler, inventors (to NASA) (Virginia Polytechnic Inst. and State Univ., Blacksburg) Filed 7 Nov. 1979 18 p
(NASA-Case-LAR-12642-1; US-Patent-Appl-SN-092141) Avail: NTIS HC A02/MF A01 CSCL 11G

An improvement of addition polyimides wherein an essentially solventless, high viscosity laminating resin is synthesized from low-cost liquid monomers is presented. The improved process takes advantage of a reactive, liquid plasticizer such as monoethylphthalate which is used in lieu of an alcohol solvent, and helps solve a major problem of maintaining good prepreg tack and drape, or the ability of the prepreg to adhere to adjacent plies and conform to a desired shape during the layup process. This improvement results in both longer life of the polymer prepreg and the processing of low-void laminates and appears to be applicable to all addition polyimide systems. NASA

N80-18180*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCESS FOR THE PREPARATION OF NEW ELASTOMERIC POLYTRIAZINES Patent Application
Robert W. Rosser and Roger A. Korus, inventors (to NASA) (San Jose State Univ., Calif.) Filed 25 Jul. 1980 15 p
(NASA-Case-ARC-11248-2; US-Patent-Appl-SN-060434) Avail: NTIS HC A02/MF A01 CSCL 11G

New crosslinked elastomeric polytriazines were prepared by a four step procedure which consists of: (1) forming a poly (imidoylamidine) by the reaction under reflux conditions of anhydrous ammonia with certain perfluorinated alkyl or alkyl-ether dinitriles; (2) forming a linear polytriazine by cyclizing the imidoylamidine linkages by reaction with certain perfluorinated alkyl or alkylether acid anhydrides or halides; (3) extending the linear polytriazine chain by further refluxing in anhydrous ammonia; and (4) heating to cyclize the new imidoylamidine linkages and thereby crosslink the polymer. NASA

N80-18181*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REACTION BONDED SILICON NITRIDE PREPARED FROM WET ATTRITION-MILLED SILICON
Thomas P. Herbell, Thomas K. Glasgow, and Nancy J. Shaw 1980 20 p refs Presented at the 4th Ann. Conf. on Composites and Advan. Mater., Cocoa Beach, Fla., 20-24 Jan. 1980; sponsored by the Am. Ceram. Soc.
(NASA-TM-81428; E-329) Avail: NTIS HC A02/MF A01 CSCL 11G

Silicon powder wet milled in heptane was dried, compacted into test bar shape, helium-sintered, and then reaction bonded in nitrogen-4 volume percent hydrogen. As-nitrided bend strengths averaged approximately 290 MPa at both room temperature and 1400 C. Fracture initiation appeared to be associated with subsurface flaws in high strength specimens and both subsurface and surface flaws in low strength specimens. Author

N80-18182*# University of Southern Colorado, Pueblo.
ENVIRONMENTAL STRESS CRACKING OF POLYMERS Final Report
Kent I. Mahan 1980 99 p refs
(Grant NsG-806)
(NASA-CR-162825) Avail: NTIS HC A05/MF A01 CSCL 07/4

A two point bending method for use in studying the environmental stress cracking and crazing phenomena is described and demonstrated for a variety of polymer/solvent systems. Critical strain values obtained from these curves are reported for various polymer/solvent systems including a considerable number of systems for which critical strain values have not been previously reported. Polymers studied using this technique include polycarbonate (PC), ABS, high impact styrene (HIS), polyphenylene oxide (PPO), and polymethyl methacrylate (PMMA). Critical strain values obtained using this method compared favorably with available existing data. The major advantage of the technique is the ability to obtain time vs. strain curves over a short period of time. The data obtained suggests that over a short period of time the transition in most of the polymer solvent systems is more gradual than previously believed. Author

N80-18183*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF THE WEIGHT LOSS AND ADHERENCE OF NINE DIFFERENT POLYIMIDE FILMS THERMALLY AGED AT 315 C AND 350 C IN AIR
Robert L. Fusaro Mar. 1980 34 p refs
(NASA-TM-81381; E-286) Avail: NTIS HC A03/MF A01 CSCL 07D

Thermal exposure experiments at 315 and 350 C were performed in air on nine different types of polyimides applied to thin 304 stainless steel foils. The tests were conducted to determine which polyimide was the most thermally stable and adherent when subjected to long exposure times at elevated temperatures. One polyimide designated PIC-7 was found to be more thermally stable than the others; however, it did not possess the adherent properties of PIC-2 and PIC-5. It was concluded that as far as thermal stability and adherence are concerned, five of the polyimides are more suitable for high temperature applications than the other four. K.L.

N80-18184# Defence Research Establishment, Ottawa. (Ontario). Environment Protection Section.
FLUOROALKYL SILOXANES AS LIQUID-REPELLENT FABRIC FINISHES. PART 1: A STATE-OF-THE-ART REVIEW AND SYNTHESIS OF THE MONOMERS
John W. Bovenkamp Jun. 1979 36 p refs
(AD-A073149; DREO-R-803-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 11/3

This project concerns the evaluation of fluoroalkyl-substituted siloxane polymers as liquid-repellent finishes. First, a brief literature review is given on the current state-of-the-art of these finishes. Second, syntheses and properties for a family of ten fluoroalkyl silanes are reported. These monomers include the best of those utilized in the literature as well as several new ones chosen to elucidate the effect of structure on liquid repellent properties. A second report will describe the method of polymerization, the liquid repellency values obtained with the homopolymers, and the results of copolymerizations with the much cheaper non-fluorinated silanes. GRA

N80-18185# Defence Research Establishment, Ottawa. (Ontario). Environment Protection Section.
FLUOROALKYL SILOXANES AS LIQUID-REPELLENT FABRIC FINISHES. PART 2: THE HOMOPOLYMERS AND THEIR COPOLYMERS WITH ALKYL SILANES
J. W. Bovenkamp Jun. 1979 37 p refs
(AD-A073150; DREO-R-804-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 11/3

In this report the liquid-repellant properties of the homopolymers and selected copolymers of ten fluoroalkyl substituted silane monomers of varying structures are evaluated. The homopolymers of the silanes are synthesized, applied to nylon/cotton (50:50 weight percent) and cotton as finishes, and the oil and water repellency imparted to these fabrics ascertained by standard tests. In this manner it is possible to compare the effects of (1) length and degree of branching of the fluorinated alkyl chains, (2) the use of network (three replaceable silane substituents in the monomer) versus linear (two replaceable substituents) siloxane polymers, and (3) the use of either an amide or an ether function to bond the fluoroalkyl group to the polymer backbone. Due to the expense of these fluorinated materials, a study was conducted of the copolymerization of the best fluoroalkyl substituted silanes

with much cheaper non-fluorinated alkyl silanes. Among the latter were those with varying alkyl chain lengths and number and orientation of the replaceable silane substituents. The oil and water repellencies obtained with both the homopolymers and copolymers ranged from outstanding to essentially none. Explanations are advanced for the values obtained and literature comparisons are made. GRA

N80-18186# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
SYNTHESIS CHARACTERIZATION AND MORPHOLOGY OF A CIS 1, 4 POLYISOPRENE/POLY N-BUTYLMETHACRYLATE DIBLOCK COPOLYMER
Robert E. Cohen and Frank S. Bates Dec. 1979 27 p refs
(Contract N00014-77-C-0311; NR Proj. 356-646)
(AD-A078731; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/3

Homogeneous anionic polymerization methods were employed to synthesize a diblock copolymer of the form (A)(n)-b-(B)(m) in which repeat unit A is isoprene, B is n-butylmethacrylate and b is a single unit of 1,1 diphenylethylene. Various physical-chemical characterization methods were employed to determine that the molecular weights of the A and B blocks are 80,000 and 160,000 g/mole respectively. NMR spectra indicated that the poly n-butylmethacrylate moiety is composed predominantly of syndiotactic triads. Thermal analysis and dynamic mechanical testing were used to determine the polyisoprene and poly n-butylmethacrylate glass transition temperatures, which were around -70 and 20 C respectively; the poly n-butylmethacrylate transition observed in the viscoelastic experiments was unusually broad, covering more than 75 C from onset to completion. Thin films of the diblock copolymer prepared by solvent evaporation casting methods, using a variety of solvents and a wide range of solvent evaporation rates, showed a variety of morphologies in transmission electron micrographs. Most notable among these was a structure obtained in rapid-evaporation castings which contained relatively large regions of homogeneous diblock copolymer embedded in the microphase-separated material. While these homogenized regions remain unchanged indefinitely in the bulk material at room temperature, they tend to decompose to the stable microphase-separated material upon heating or upon addition of solvent. GRA

N80-18187# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.
LONG-TERM THERMAL STABILITY OF SOLITHANE, A CANDIDATE TWT ENCAPSULANT Final Report, 1 Feb. - 30 Sep. 1978
Camille A. Gaulin, Vester L. Knight, and Manfred Buechler Sep. 1979 17 p ref
(Contract F04701-78-C-0079)
(AD-A078832; TR-0079(4402)-1; SAMSO-79-038) Avail: NTIS HC A02/MF A01 CSCL 09/1

In support of traveling-wave tube amplifier tube encapsulant evaluations, a cured sample of Solithane 113 (a polyurethane potting compound supplied by Watkins-Johnson) was exposed to a vacuum-thermal (120 C) environment for 300 hours to determine if channel degradation occurs on such exposure. Degradation was determined qualitatively by sampling into a quadrupole mass spectrometer the gases and vapors produced from the sample and analyzing the spectra of the gases. The resultant spectra indicated significant thermochemical degradation of the polymer under the conditions of the exposure. These results should be factored into deliberations on the choice of encapsulants for TWTA components. Degradation of this kind may markedly affect physical-chemical properties of the material over the long term and should be treated as a potential source of tube failure due to corona discharge. GRA

N80-18188# Oklahoma Univ., Norman. Dept. of Chemistry.
VARIABLE TEMPERATURE 119M SN MOESSBAUER STUDY OF ORGANOTIN - SUBSTITUTED STYRENE MONOMERS AND POLYMERS
K. C. Molloy, J. J. Zuckerman, H. Schumann (Technical Univ. of Berlin), and G. Rodewald (Technical Univ. of Berlin) Oct. 1979 8 p refs Submitted for publication
(Contract N00014-77-C-0432; NR Proj. 053-636)
(AD-A075958; TR-13) Avail: NTIS HC A02/MF A01 CSCL 11/9

Variable temperature 119m Sn Moessbauer spectroscopy can detect the enhanced binding of the tin atom in organotin 1V substituted styrenes on polymerization. GRA

N80-18189# Naval Research Lab., Washington, D. C.
THE NATURE OF STRENGTH CONTROLLING MACHINING FLAWS IN CERAMICS Interim Report
R. W. Rice and J. J. Mecholsky, Jr. 25 Sep. 1979 33 p refs
(AD-A075491; NRL-MR-4077) Avail: NTIS HC A03/MF A01 CSCL 12/2

The nature of machining flaws introduced in a variety of glass, single crystal, and especially poly-crystal bodies are reported, based on fractographic determination of such flaws as the source of mechanical failure. Particular attention is given to grinding where the anisotropy of strength due to the direction of grinding relative to the tensile axis is shown to be due primarily to a dual population of flaws of differing shapes. One set of flaws form approximately perpendicular and another parallel to the grinding direction. The latter flaws are typically substantially more elongated and often larger than the former and thus give lower strengths for stressing perpendicular to the direction of grinding. Sawing, sanding, and polishing are also shown to result in similar dual flaw populations. The character of flaws are examined as a function of the type of material and machining, as well as specimen size and shape. The latter suggests a limited strength-size effect due to machining flaws. However, the key findings are that machining flaws do not vary greatly with typical variations of machining or material parameters, e.g., composition, grain size, or hardness. GRA

N80-18190# Army Materials Research Agency, Watertown, Mass.
CARBON IMPURITY EFFECT ON THE THERMAL DEGRADATION OF A Si3N4-Y2O3 CERAMIC Final Report
H. Knoch and George E. Gazza May 1979 14 p refs
(DA Proj. 1L1-62105-AH-84)
(AD-A075138; AMMRC-TR-79-27) Avail: NTIS HC A02/MF A01 CSCL 11/2

The oxidation behavior of hot-pressed Si3N4-Y2O3 compounds (principally Si3 Y2O3N4, N-melilite) was studied in air between 700 C and 1440 C. It is shown that carbon impurity strongly influences the thermal degradation of these compounds. Oxidation of carbon-containing materials in air at 1000 C leads to high weight gains, severe cracking, and complete destruction of the samples. Nominally carbon-free materials show good oxidation resistance without cracking. GRA

N80-18191# TRW, Inc., Cleveland, Ohio.
ULTRASONIC DETECTION OF SURFACE FLAWS IN GAS TURBINE CERAMICS Final Report, 13 Sep. 1977 - 12 Dec. 1978
Thomas Derkacs and Istvan M. Matay Aug. 1979 137 p refs
(Contract N62269-77-C-0136)
(AD-A076023; TRW-ER-7980-F; NADC-76369-30) Avail: NTIS HC A07/MF A01 CSCL 11/2

A 45 MHz ultrasonic surface wave technique was developed and evaluated for detection of small surface flaws of - 100 microns (0.004 inches) in gas turbine quality ceramics. The surface wave technique, which employs conventional immersion C-scan recording, was evaluated on hot pressed silicon nitride and silicon carbide of two sources each, and also on reaction bonded silicon nitride and sintered silicon carbide. These evaluations included tests on specimens run in a burner rig to simulate the effects on NDE of a gas turbine operating environment. Conventional mechanical tests were also run to verify defect sizes and types and to correlate flexural strength with ultrasonic inspection results. The technique was found to be quite sensitive to surface conditions such as grinding damage, as well as to defects. Flexural strength was correlated qualitatively with the extent of ultrasonic response from machining damage. The sensitivity to defects was found to be limited by the depth of machining damage and the focal spot size of the ultrasonic beam. For the 580 microns (0.023 inch) diameter focal spot size used, the smallest defect verified metallurgically was equivalent to a 30 microns (0.0012 inch) deep semi-circular crack. Specimens

run in the burner rig were found to become uninspectable because of fused silica on the surface. Author (GRA)

N80-18192# Rockwell International Science Center, Thousand Oaks, Calif.
MICROSTRUCTURALLY DEVELOPED TOUGHENING MECHANISMS IN CERAMICS: TRANSFORMATION TOUGHENING IN THE Al2O3/ZrO2 COMPOSITE SYSTEM Progress Report, 1 Jun. 1978 - 31 May 1979
F. F. Lange Oct. 1979 29 p refs
(Contract N00014-77-C-0441)
(AD-A076439; SC5117.7TR; TR-7) Avail: NTIS HC A03/MF A01 CSCL 11/2

Three Al2O3/ZrO2 composites series, containing 0, 2, and 7.5 mole percent Y2O3, respectively, were fabricated. For the Al2O3/ZrO2(-2M/oY2O3) series, tetragonal ZrO2 was retained from one end-member to the other. Significant increases in fracture toughness and strength were observed for materials in this system. Strengths decreased with increasing temperature. These results are consistent with previous theoretical predictions. GRA

N80-18193# De Soto, Inc., Des Plaines, Ill.
HIGH SOLIDS COATING SYSTEMS Final Report, 15 Aug. 1977 - 15 Jan. 1979
Gretchen McKay Apr. 1979 95 p
(Contract F33615-77-C-5101; AF Proj. 2422)
(AD-A07' 433; DFR-79-2; AFML-TR-79-4041) Avail: NTIS HC A05/MF A01 CSCL 11/3

The goal of this program is the development of a 65% volume solids, sprayable (airless electrostatic method), polyurethane exterior aircraft coating meeting MIL-C-83286 performance specifications. A high solids coating can significantly reduce solvent emissions and help the Air Force meet EPA/OSHA requirements for reduced environmental pollution and increased work safety. One formulation consisting of a combination of Acryloid AU-568 (oxazolidine), NIAX PCP-0300 (polyol), and Desmodur N-100 (polyisocyanate) exhibited performance properties close to MIL-C-83286. Additional effort is required to simultaneously maximize coating flexibility and solvent (aircraft fluid) resistance. The pot life of the mixed two-package system and the final spray viscosity also must be improved. Potential polyol and polyisocyanate candidates can be successfully screened using concentration-viscosity diagrams. The effects of solvent on solution rheology were greater than expected. GRA

N80-18194# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
SPACE RADIATION EFFECTS ON TEFLON FILMS Interim Report
Henry S. Judeikis Sep. 1979 40 p refs
(Contract F04701-78-C-0079)
(AD-A076613; TR-0079(4872-01)-02; SAMSO-TR-79-070) Avail: NTIS HC A03/MF A01 CSCL 06/18

Degradation of macroscopic physical properties resulting from chemical changes in fluorocarbon polymers exposed to ionizing radiation is reviewed. The effects of temperature, ultraviolet/visible radiation, and dose rate are considered. Of particular interest are property changes that occur on exposure of these materials to simulated space radiation environments. Results from recent space simulation exposure tests are considered in light of these phenomena. General recommendations are made for the application of existing data to spacecraft problems, as well as for the conduct of future space simulation exposure tests. GRA

N80-18195# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
EFFECT OF SURFACE EXPOSURE TIME (SET) ON STRENGTH OF ADHESIVE BONDS TO ALUMINUM
Marie C. Ross, Natalia Petrianyk, Elizabeth A. Garnis, Raymond F. Wegman, and David W. Levi Aug. 1979 15 p refs
(AD-A077107; AD-E400356; ARLCD-TR-79009) Avail: NTIS HC A02/MF A01 CSCL 13/8

Surface exposure times (SET) at 23 C and 50% RH for 2024-T3 aluminum subsequently bonded with EC-2214 adhesive did not affect the bond strength for SET up to 30 days. SET at 54 C and 95 + or - 5% RH gave much lower bond strengths that did not further change with increasing SET. The difference in strength is believed to be due to the formation of a hydrated aluminum oxide on the aluminum surface at 54 C and 95 + or - 5% RH. This hydrated oxide functions as a weak boundary layer. GRA

N80-18196# Dayton Univ. Research Inst., Ohio.
ENVIRONMENTAL DURABILITY TESTING OF STRUCTURAL ADHESIVES. PART 3: RELIABOND 500/RELIABOND 398 Interim Technical Report, Jun. - Dec. 1978
D. Robert Askins Wright-Patterson AFB, Ohio AFML Nov. 1979 31 p ref
(Contract F33615-78-C-5002; AF Proj. 7381)
(AD-A078953; UDR-TR-79-24; AFML-TR-78-35-Pt-3) Avail: NTIS HC A03/MF A01 CSCL 11/1

A program has been conducted to investigate the durability of a 350 F (121 C) curing modified epoxy structural adhesive in an elevated temperature, high humidity environment while under stress. Durability was assessed with three different types of environmental exposure. Unstressed lap shear specimens were exposed to both a 140 F (60 C)/95-100% R.H. environment and a 140 F (60 C) water soak and residual strength tests were conducted after various aging intervals. Stressed lap shear specimens were exposed to a 140 F (60 C)/95-100% R.H. environment and time-to-failure recorded. The unstressed agings produced a progressive loss of residual strength and a progressive increase in the amount of adhesive (interfacial) failure with increased aging time. The stressed agings produced times-to-failure at least as long as those previously obtained (AFML-TR-78-35, Part I) for the PL-729-3/PL-728 and AF-143-2/EC-3917 adhesive/primer systems on the same substrates and surface preparations. Had exposure times been extended beyond 2400 hours, the R398/R500 system may have proven more durable than the two previously tested systems. GRA

N80-18197# California Univ., Berkeley. Dept. of Materials Science and Engineering.
ELASTIC/PLASTIC INDENTATION DAMAGE IN CERAMICS. PART 1: THE MEDIAN/RADIAL CRACK SYSTEM. PART 2: A STUDY OF KINK BAND FORMATION IN COMPOSITES Progress Report, 1 Jan. - 1 Dec. 1979
B. R. Lawn, A. G. Evans, D. B. Marshall, and C. H. Hsueh 1 Dec. 1979 63 p refs
(Contract N00014-79-C-0159)
(AD-A078839) Avail: NTIS HC A04/MF A01 CSCL 11/2

A theory for describing the evolution of the median/radial crack system in the far field of sharp-indenter contacts is developed. Analysis is based on a model in which the complex elastic/plastic field beneath the indenter is resolved into elastic and residual components. The elastic component, being reversible, assumes a secondary role in the fracture process: although it does enhance downward (median) extension during the loading half-cycle, it suppresses surface (radial) extension to the extent that significant growth continues during unloading. The residual component accordingly provides the primary driving force for the crack configuration in the final stages of evolution, where the crack tends to near-half-penny geometry. On the hypothesis that the origin of the irreversible field lies in the accommodation of an expanding plastic hardness impression by the surrounding elastic matrix, the ensuing fracture mechanics relations for equilibrium crack growth are found to involve the ratio hardness-to-modulus as well as toughness. Observations of crack evolution in soda-lime glass provide a suitable calibration of indentation coefficients in these relations. GRA

N80-18198# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
APPLICATIONS OF SURFACE ANALYSIS TECHNIQUES TO STUDIES OF ADHESION Final Report, Mar. - Jul. 1979
William L. Baun Sep. 1979 38 p refs
(AF Proj. 2419)
(AD-A077520; AFML-TR-79-4126) Avail: NTIS HC A03/MF A01 CSCL 11/1

The question is often asked, 'which is the best surface chemistry tool for research on adhesive bonding?' This question is difficult to answer because it depends on the aspects of adhesion which is being studied. Often a combination of instruments must be used to take advantage of the strong points of each. In metal-to-metal bonding there are many facets of adhesive/

adherend interaction. Elemental characterization of adherends, especially when composition with depth is desired, is often best accomplished with Auger Electron Spectroscopy (AES). When information of chemical bonding is required, X-Ray Photoelectron Spectroscopy (XPS) is the choice of most workers. Extremely thin layers of material (when first layer surface sensitivity is needed) requires Ion Scattering Spectrometry (ISS). The high sensitivity of Secondary Ion Mass Spectrometry (SIMS) to many elements important in adhesive bonding makes this technique useful, especially coupled with other methods, such as ISS and AES. Modern surface analysis along with Scanning Electron Microscopy (SEM) provides information on failure surfaces to allow unequivocal determination of the mode of failure. Problems such as charging and decomposition under the probing beam are encountered when characterizing the part of the failure surfaces containing the adhesive. GRA

N80-18199# Northrop Corp., Hawthorne, Calif. Aircraft Group.
ENVIRONMENTAL DURABILITY OF THE WELDBOND, FPL AND PABST JOINING SYSTEMS Final Report, 1 Dec. 1977 - 31 May 1979
R. G. Hocker Wright-Patterson AFB, Ohio AFML Jul. 1979 79 p refs
(Contract F33615-76-C-5412)
(AD-A076608; NOR-79-41; AFML-TR-79-4081) Avail: NTIS HC A05/MF A01 CSCL 13/8

This program was conducted as an addendum to Contract No. F33615-76-C-5412, 'Advanced Weldbonding Process Establishment for Aluminum'. Under controlled stress and environmental conditions, a direct comparison of durability and surface corrosion behavior was made for three surface preparation/adhesive systems. These systems included the PABST adhesive bonding system, the FPL adhesive bonding system, and the Northrop weldbond system. The three types of tests used were the wedge test, the constant load-salt water immersion test, and the surface scratch test. Four different environmental exposures were used: (1) 95 to 100 percent relative humidity at 120 F, (2) 5 percent salt fog at 95 F, (3) 3.5 percent salt water and (4) the sea coast beach site at El Segundo, California. Four material combinations were evaluated for this program: 2024-T3 alclad bonded to 7075-T6 bare, 2024-T3 bare bonded to 7075-T6 bare, 2024-T3 bare bonded to 2024-T3 bare, and 7075-T6 bare bonded to 7075-T6 bare. The objective of this program was to rank the three bonding systems and four material combinations in terms of durability and corrosion behavior. GRA

N80-18200# Ecole Nationale Superieure de Techniques Avancees, Paris (France).
STUDY AND TORSION TESTING OF COMPOSITE MATERIALS IN THE FORM OF BARS HAVING RECTANGULAR CROSS-SECTIONS [ETUDE DU TEST DE TORSION DE BARREAUX COMPOSITES A SECTION RECTANGULAIRE]
Chetha Phang and Tat Sinh Vong Dec. 1977 34 p refs In FRENCH
(Contract DGRST-74-7-0747)
(RR-094) Avail: NTIS HC A03/MF A01

The modulus of shear and the elastic limit at shear were evaluated for an orthotropic prismatic bar of composite structure using extensometric measurements of deformation of shear. A tensor analysis of average deformation at shear is presented as a theoretical introduction to the determination of the shear characteristics of a material through strain gage measurement of surface deformation during torsional stress. The experimental setup is described and the processes used in the fabrication of specimens are outlined. Results show good agreement between predicted linear elastic behavior of the bars and measured deformations at failure. Author (ESA)

N80-18201# National Technical Information Service, Springfield, Va.
ADHESIVES: PROPERTIES, PREPARATION, AND APPLICATIONS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Nov. 1979
Diane M. Cavagnaro Dec. 1979 304 p Supersedes NTIS/PS-78/1180; NTIS/PS-77/1060; NTIS/PS-76/0892; NTIS/PS-75/704; NTIS/PS-75/040
(PB80-801855; NTIS/PS-78/1180; NTIS/PS-77/1060; NTIS/PS-76/0892; NTIS/PS-75/704; NTIS/PS-75/040) Avail: NTIS HC $30.00/MF $30.00 CSCL 11A

Studies on polymer chemistry, curing, crosslinking, and synthesis for use as adhesives are cited. The heat resistance, fracture, aging, shear strength, and other physical and mechanical properties of adhesives and sealants are covered, as is the use of adhesives in aircraft, laminates, wood bonding, electronics, and spacecraft. This updated bibliography contains 296 abstracts, 95 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-18202 Oklahoma State Univ., Stillwater.
PHOTOCHEMICAL CONVERSION OF COAL TO GASOLINE IN AN ENTRAINED BED REACTOR Ph.D. Thesis
Muthu Subramanian Sundaram 1979 246 p
Avail: Univ. Microfilms Order No. 8003606

The interaction of photochemically produced hydrogen atoms with a variety of coal dusts under various reaction conditions was investigated. The existence of correlations between coal types and their relative hydrogen atom reactivities as a function of temperature, extent of conversion, particle size, and hydrogen atom concentration was explored. Dissert. Abstr.

N80-18203# Department of the Treasury, Washington, D.C. Bureau of Alcohol, Tobacco and Firearms.
EXPERIMENTAL ALCOHOL FUEL PLANTS
Dec. 1979 27 p
(ATF-P-5000-2) Avail: NTIS HC A03/MF A01

Information on experimental alcohol fuel plants for personal fuel use is presented. Pertinent laws and regulations for the prospective alcohol producers and users are described. R.E.S.

N80-18204# Department of the Treasury, Washington, D.C. Bureau of Alcohol, Tobacco and Firearms.
ALCOHOL FUELS INFORMATION DIRECTORY
Feb. 1980 8 p
(ATF-P-5000-3) Avail: NTIS HC A02/MF A01

Information on renewable energy sources, particularly alcohol fuels, is presented. Permit information is discussed. R.E.S.

N80-18205*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INITIAL CHARACTERIZATION OF AN EXPERIMENTAL REFEREE BROADENED-SPECIFICATION (ERBS) AVIATION TURBINE FUEL
George M. Prok and Gary T. Seng Jan. 1980 10 p refs
(NASA-TM-81440; E-206) Avail: NTIS HC A02/MF A01 CSCL 21D

Characterization data and a hydrocarbon compositional analysis are presented for a research test fuel designated as an experimental referee broadened-specification aviation turbine fuel. This research fuel, which is a special blend of kerosene and hydrotreated catalytic gas oil, is a hypothetical representation of a future fuel should it become necessary to broaden current kerojet specifications. It is used as a reference fuel in research investigations into the effects of fuel property variations on the performance and durability of jet aircraft components, including combustors and fuel systems. J.M.S.

N80-18206# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Labs.
EVALUATION OF JP-5 TURBINE FUEL IN THE SINGLE CYLINDER CUE 1790 DIESEL ENGINE Final Report, Jun. - Nov. 1979
Richard B. Moon Nov. 1979 42 p refs
(Contract DAAK70-79-C-0060)
(AD-A078666; AFLRL-119) Avail: NTIS HC A03/MF A01 CSCL 21/4

The performance test compared fuel consumption and

horsepower of the CUE 1970 when operating on JP-5 turbine fuel in place of diesel fuel while the endurance test compared engine wear and deposits when operating the CUE 1790 on JP-5 instead of diesel fuel. The performance test indicated no change in power and a 3 + or - 1 percent increase in fuel consumption. The endurance test indicated no change to slightly less wear, less deposits, no change in the oil consumption rate, and nothing unusual or excessive in the used oil analyses. Analysis of the JP-5 indicated a cetane number within diesel fuel specifications. Although further tests are necessary to define the effect of random variables on the test results, from this test it can be concluded that the use of JP-5 in the CUE 1790 resulted in no appreciable loss in performance or service life. As a result, JP-5 is considered to be a satisfactory alternative fuel for use in the AVDS 1790-2C diesel engine. GRA

N80-18207# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab Section.

PROPELLANT SURVEILLANCE REPORT LGM-30, A, B, F, G, STAGE 1, TP-H1043 AFT CLOSURE PROPELLANT Semiannual Report

John A. Thompson Nov. 1979 33 p

(AD-A078778; MANCP-424(79)) Avail: NTIS HC A03/MF A01 CSCL 21/9

This report contains propellant test results from cartons of TP-H1043 propellant representing selected batches used in the aft closure of First Stage Minuteman Motors. Data from TP-H1043 propellant obtained from the aft closures of the LGM-30 A, B, F and G Motors are reported in regression analyses for the fifth time and the fourth time using the G085 computer system. Testing was accomplished in accordance with MMWRM Project M82934C. An analysis of all parameters indicate that no significant degradation is anticipated for at least two years past the oldest data point. Each point on the regression plot represents all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot. The data range at any age can be found by suitable inquiry of the G085 system. GRA

N80-18208# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.

PROPELLANT SURVEILLANCE REPORT LGM-30 F & G STAGE 1, PHASE E, SERIES 8, TP-H1011 Semiannual Report

John A. Thompson Oct. 1979 140 p

(AD-A078777; MANCP-423(79)) Avail: NTIS HC A07/MF A01 CSCL 21/9

This report contains propellent test results from cartons of TP-H1011 bulk propellant representing LGM-30 F and G First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMWRM Project M82934C - WNL 17514. The data from this test period are combined with data from previous testing and entered into the G085 computer for storage, analysis and regression analysis. From the statistical analysis of all data tested to date thirteen and one-half years for F and G, significant degradation of the propellant does not appear likely for at least two years past the oldest data point. Each point on the regression plot represents the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot or group of regression plots. The data range at any age can be found by suitable inquiry of the G085 system. GRA

N80-18209# Georgia Inst. of Tech., Atlanta.

THE FIRE ENVIRONMENT OF A SOLID ROCKET PROPELLANT BURNING IN AIR Final Report

E. W. Price, W. L. Meyer, W. C. Strahle, S. S. Samant, E. A. Powell, and J. C. Handley Mar. 1979 249 p refs

(Contract F29601-76-C-0119)

(AD-A076941; AD-E200321; AFWL-TR-78-34) Avail: NTIS HC A11/MF A01 CSCL 21/9

A study was made of the fire environment of UTP 3001 propellant burning at atmospheric pressure in air, with particular emphasis on the conditions likely to affect objects immersed in the fire. The studies involved measurements of conditions using propellant samples with planar burning surfaces from 2 to 120 sq cm. Early tests indicated that deposition of condensed materials was a critical factor in heat-up of immersed objects. Several methods of observation were used to determine temperatures, flow variables, nature of condensed material and spatial distributions of these variables. Analyses were made of chemical equilibrium conditions, burning of aluminum droplets, and of size distribution of condensed materials versus location in the flow. GRA

N80-18210# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.

AN INVESTIGATION OF PARTICLE SIZE DISTRIBUTION USING LASER HOLOGRAPHY OF BURNING SOLID PROPELLANT Final Report, Nov. 1977 - 30 Sep. 1978

Michael J. Adams and T. W. Owens Sep. 1979 43 p refs

(AF proj. 2308)

(AD-A078904; AFRPL-TR-79-48) Avail: NTIS HC A03/MF A01 CSCL 21/2

A test area was modified to allow holographic recordings to be made of burning solid propellant samples as contained in a pressurized window bomb. A holographic reconstruction area was also established. An attempt was made to develop a semi-automated holographic data retrieval (HDR) system using existing AFRPL hardware. The purpose of the HDR system was to retrieve particle size and positions information in a timely manner from holographic reconstructions of the propellant combustion. Experiments with the HDR system revealed serious deficiencies in the areas of resolution and particle recognition. Since a primary goal of the program was to establish particle distribution correlations from holographically derived particle information, the present program has been inactivated pending the development and acquisition of an improved HDR system. GRA

N80-18211# Defence Research Information Centre, Orpington (England).

TESTING FOR HOMOGENEITY OF CHEMICAL COMPOSITION OF SOLID PROPELLANTS BY MEANS OF HPLC

M. Fariwar-Mosheni (Esfahan Univ., West Germany), E. Ripper (Bundesinst. fuer Chem. -Tech. Untersuchungen), J. Zierath (Bundesinst. fuer Chem. -Tech. Untersuchungen) et al Jul. 1979 7 p refs Transl. into ENGLISH from Git Fachzeitschrift fuer das Laboratorium, (West Germany), v. 22, no. 9, 1978 p 781-782

(DRIC-Trans-5685; BR69143) Avail: NTIS HC A02/MF A01

A quantitative analytical method based on high pressure liquid chromatography is described for determining the chemical composition of propellant extracts. The standard deviation and reproducibility of the mean values of the contents were found to be so favorable that the method is suitable for determining inhomogeneities in solid propellants. It also has the advantage of requiring considerably less time than the polarographic methods used for routine purposes in the field of propellant analysis. Author (ESA)

N80-18212# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

HYDROGEN AS A FUEL

L. W. Richards Jul. 1979 35 p refs

(TT-7903; ISSN-0140-9751) Avail: NTIS HC A03/MF A01

Research on the storage of hydrogen in automobiles is reviewed. Metal hydride storage, encapsulation of hydrogen in molecular sieve zeolites, and the reaction of saline hydrides with water are considered in detail. After a brief comparison of hydrogen energy yield with gasoline energy yield per weight, hydrogen fuel storage in motor vehicles is considered. Safety factors of different storage schemes (high pressure gas, cryogenic tanks, metal hydrides) are emphasized along with volume and weight considerations. Results show two basic systems as feasible, namely that of a saline hydride reacting with water inside the vehicle, or a system involving a combination of calcium - mischmetal and magnesium, with nickel to act as a catalyst. Author (ESA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-18213 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 4: VIBRATION TESTING, INSTRUMENTATION, LOADS AND ENVIRONMENTS, TRACKED VEHICLES
Sep. 1978 174 p refs Presented at the 48th Symp. on Shock and Vibration, Huntsville, Ala., 18-20 Oct. 1977; sponsored by Army Missile Res. and Develop. Command 4 Vol.
(Bull-48-Pt-4) Avail: NRL, Tech. Inform. Div., Washington, D.C.

Topics are presented on vibration measurement techniques and their reliability in establishing acceptance levels for the structural integrity of missiles, aircraft structure, and solid rocket boosters. For individual titles, see N80-18214 through N80-18230.

N80-18214 Pacific Missile Test Center, Point Mugu, Calif.
A MATHEMATICAL METHOD FOR DETERMINING A LABORATORY SIMULATION OF THE CAPTIVE-FLIGHT VIBRATIONAL ENVIRONMENT **c39**
Sharon Ogden *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 1-4 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A method for selecting a small number of discrete dynamic pressure (q) levels and associated test time at each level which represents the given captive-flight conditions is described for the PHOENIX missile. M.M.M.

N80-18215 Pacific Missile Test Center, Point Mugu, Calif.
ACOUSTICS OR SHAKERS FOR SIMULATION OF CAPTIVE FLIGHT VIBRATION **c39**
A. M. Spandrio and M. E. Burke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 5-14 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Two methods currently being used to simulate the captive flight vibration loads the PHOENIX missile experiences on the F-14 aircraft are compared. In these programs the PHOENIX T-201 Environmental Measurements Missile was used. This same missile was subjected to captive flight simulation using the dual shaker vibration and acoustical vibration. PHOENIX T-201 was assembled in the same instrumentation configuration during both simulations as it was in the captive flight programs. The excitation of the missile by acoustics more nearly resembled that seen in captive flight than the excitation provided by the dual shakers. Since the acoustic excitation allows the missile to vibrate in three axes simultaneously, the simulation technique becomes far superior when the single axis constraint of shakers is considered. In addition, several test specimens may be placed in the acoustic chamber simultaneously. It was concluded that the use of acoustics for simulation of captive flight vibration demonstrated itself to be an accurate and cost effective test method. M.M.M.

N80-18216 Pacific Missile Test Center, Point Mugu, Calif.
AUTOMATIC ENVIRONMENTAL CONTROL SYSTEM FOR MISSION PROFILE TESTING **c35**
Robert Schilken *In* Shock and Vibration Inform. Centsr The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 15-23 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A simple and inexpensive Automatic Environmental Control System was developed for controlling realistic mission profile environmental tests. Hardwired logic and reprogrammable electronic storage were used in the general purpose control system. Coding techniques and a random number generator for simulating temperature day variations in the mission are presented. The entire thermoacoustic environmental generation facility used for missile captive flight simulation is described including a newly developed high efficiency noise modulator driver. Author

N80-18217 Harris Corp., Melbourne, Fla. Electronic Systems Div.
BROAD-BAND MECHANICAL VIBRATION AMPLIFIER **c35**
R. T. Fendrich *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 25-31 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The mechanical system described amplifies vibration inputs at frequencies above the system isolation frequency (80 Hertz). It effectively amplified input vibration levels by a factor of 3 g's/g over an input frequency range of 100 to 2000 Hz, allowing testing at 150 g's while driving the shaker at only 60 g's, thereby saving energy and high level wear and tear on the shaker system and extending the upper limit of feasible test levels. M.M.M.

N80-18218 Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
STABILITY AND FREQUENCY RESPONSE OF HYDRO-MECHANICAL SHAKERS IN VIBRATION RIGS **c35**
T. Seshadri Sankar *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 33-47 refs Sponsored by the Natl. Res. Council of Canada and the Formation de Chercheurs et d'Action Contertee (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

An analytical study on the stability and frequency response of hydromechanical shakers used for generating vibrational signals to drive a vibration rig is presented. The analytical expressions for stability are derived based on linearized flow characteristic equations and taking into account the effect of fluid inertance and resistance in the connecting pipes. It was shown that the size of the connecting pipes and their elasticity influence the stability of the shaker. Simple expressions are derived for the amplitude ratio and phase angle against frequency for both open and closed loop frequency response of the hydromechanical shaker based on Duffing's linearization scheme. The analytical expressions derived for stability and frequency response can be directly used for selecting and/or specifying the hydromechanical shaker which best meets a given set of requirements. M.M.M.

N80-18219 Harris Corp., Melbourne, Fla. Electronic Systems Div.
MIL-STD-781C RANDOM RELIABILITY TESTING PERFORMED BY USING ACOUSTIC COUPLING **c35**
S. M. Landre *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 49-56 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

An approach for performing random vibration during reliability testing by using an acoustic coupled shaker system is described. It employs a speaker, a flat plate fixture, a hi-fi amplifier, and a hi-fi tape recorder capable of playing a tape loop. Laboratory experiments on the model to evaluate its performance and potential are presented. M.M.M.

N80-18220 Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.
CONSERVATISM IN RANDOM VIBRATION ANALYSIS AND TESTING **c39**
Thomas L. Paez *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 57-70 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Some measures of confidence in specified test levels are proposed. A technique is described for finding the probability that a test is more severe than the field environment from which it was derived. A mean square structural response criterion is used. It was shown that a laboratory random vibration test is most likely to fail when the structure being tested has lightly damped, low frequency modes, and when the test duration is short. M.M.M.

N80-18221 Boeing Aerospace Co., Seattle, Wash.
INCANDESCENT LAMP LIFE UNDER RANDOM VIBRATION **c33**
Clark J. Beck, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 71-81 refs

(For primary document see N80-18213 09-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

Several sets of incandescent lamps were subjected to random vibration in order to generate a curve of lamp life versus vibration level. The vibration levels were varied from 0.02 G sq/Hz to 1.6 G sq/Hz. Each set of lamps was vibrated until all lamps failed or for a maximum time of 2-1/2 hours. The tests were conducted with lamps energized and not energized. The test results show that average operational life of a lamp under random vibration differs significantly from lamp rated life. M.M.M.

N80-18222 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ANGULAR VIBRATION MEASUREMENT TECHNIQUES **c35**
P. Wayne Whaley and Michael W. Obal *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 83-93 refs (For primary document see N80-18213 09-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

Six angular vibration sensors are evaluated in light of the requirements for measuring angular vibrations of aircraft structures in order to describe optical package disturbances. In addition, experience with differential angular vibration measurement using conventional accelerometers is presented and evaluated. These results indicate a strong need to develop a good, reliable, miniature angular vibration sensor for airborne measurements. K.L.

N80-18223 Monash Univ., Clayton (Australia).
HIGH FREQUENCY GROUND VIBRATION MEASUREMENT **c39**
H. Nolle *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 95-103 refs (For primary document see N80-18213 09-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

The basic requirements for vibration transducer-to-ground coupling to ensure linear measuring system response are reviewed. Results are presented from field tests of different designs for ground attachments, and recommendations are made for procedures of ground attachment installation in different soil types and rock formations. The techniques are demonstrated with reference to some of the results of vibration surveys of three different railway track installations. K.L.

N80-18224 Bouche Labs., Sun Valley, Calif.
THE RECIPROCITY CALIBRATION OF VIBRATION STANDARDS OVER AN EXTENDED FREQUENCY RANGE **c39**
R. R. Bouche *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 105-111 refs (For primary document see N80-18213 09-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

Reciprocity calibrations are performed at various frequencies up to 10,000 Hz using an air-breathing shaker with a built-in primary standard accelerometer. The shaker is used for sensitivity and frequency response calibrations on other accelerometers and velocity pickups in the range of 10 Hz to 10,000 Hz and up to 50,000 Hz for resonance frequency calibrations. Author

N80-18225 Sandia Labs., Albuquerque, N. Mex.
A NON-CONTRACTING BETA BACKSCATTER GAGE FOR EXPLOSIVE QUANTITY MEASUREMENT **c35**
P. B. Higgins, F. H. Mathews, and R. A. Benham *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 113-126 refs (For primary document see N80-18213 09-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

A noncontracting method of measuring the quantity of light initiable explosive previously applied to a surface is described. Design parameters, calibration procedures, and field results are given for a beta backscatter gage which measures the areal density of a layer of the primary explosive, silver acetylide-silver nitrate (SASN), on a carbon or aluminum subsurface. The radiation patterns produced by the gage using three different beta source geometries are determined and their relative merits are discussed. K.L.

N80-18226 Air Force Weapons Lab., Kirtland AFB, N. Mex. Civil Engineering Research Div.
DATA ACQUISITION FOR THE IMMEDIATE FUTURE **c35**
Josef F. Schneider *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 127-137 refs (For primary document see N80-18213 09-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

The problem of acquiring transient data in an extremely hostile environment is addressed. An analog multiplex system that transmits data in real time and requires analog type recording is considered along with a system that multiplexes on the digital side. The data is stored digitally and plotted for quick-look analysis without the need for precomputer data reduction. Application guides and formulae are given for each system, and a comparison is presented which lists respective system merit parameters for similar data handling requirements. K.L.

N80-18227 Pacific Missile Test Center, Point Mugu, Calif.
THE VIBRATION RESPONSE OF THE PHOENIX MISSILE IN THE F-14 AIRCRAFT CAPTIVE-FLIGHT ENVIRONMENT **c15**
Marsha E. Burke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 139-150 refs (For primary document see N80-18213 09-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

The vibration response characteristics of the PHOENIX missile on the F-14 aircraft in the captive high environment is investigated. Variations in vibration response with flight condition, mounting configuration, direction, and location along the length of the missile are examined. The conclusions are: (1) vibration response in externally carried stores is directly proportional to dynamic pressure except in the transonic region where an increase in vibration occurs; (2) vibration response varies with platform configuration with an increase occurring with additional externally carried stores in the flow fields; and (3) vibration response is most severe in the after section and in the vertical and lateral direction of the externally carried stores. K.L.

N80-18228 Naval Weapons Center, China Lake, Calif.
SOME DYNAMIC RESPONSE ENVIRONMENTAL MEASUREMENTS OF VARIOUS TACTICAL WEAPONS **c15**
W. W. Parmenter *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 151-158 refs (For primary document see N80-18213 09-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

Pertinent results of several environmental dynamic measurement programs for widely diverse types of tactical weapons are reported. Spectra are included for the SLUFAE weapon mounted on a tracked vehicle, the ASROC missile mounted within launcher cells and magazines of various classes of ships, the FAE-II and GATOR free-fall weapons captive-flown on A-7 and AV-8 aircraft, the Condor weapon captive-flown on an A-6 aircraft, and the MAD-FAE weapon dispenser system suspended beneath a CH-53 helicopter. The character of the dynamic environments during weapon deployment is briefly discussed. K.L.

N80-18229 McDonnell-Douglas Astronautics Co., St. Louis, Mo.
TURBULENT-BOUNDARY-LAYER EXCITATION AND RESPONSE THERETO FOR A HIGH-PERFORMANCE CONICAL VEHICLE **c05**
C. M. Ailman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 159-169 refs (For primary document see N80-18213 09-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

A compiled data bank for describing the fluctuating pressures that force the shell of a non-maneuvering reentry vehicle to vibrate during reentry is presented, the use of local aerodynamic parameter values for the cone when predicting these pressures is discussed, and the characteristics of shell-mode vibration peculiar to a conical structure with a multilayered skin are described. Flight data are reported for such a structure maneuvering as a result of flow disturbance at the aft end. The data suggest some angle of attack dependencies not previously detected, and indicate low frequency response of the vehicle as a beam. The beam response is analytically examined as to its probable cause. K.L.

N80-18230 Hercules, Inc., Magna, Utah.
CALCULATION OF ATTACH POINT LOADS DUE TO POSSIBLE COMBUSTION INSTABILITY IN THE SPACE

SHUTTLE SOLID ROCKET BOOSTERS c20
F. R. Jensen and D. T. Wang *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 171-174 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The structural response of the Space Shuttle vehicle to possible acoustic combustion instability in the solid rocket boosters was analyzed. The response of the vehicle to pressure oscillations in the solid rocket boosters (SRB's) was calculated in terms of forces and displacements at the attach points between the SRB's and the External Tank (ET), and between the ET and the orbiter. The NASTRAN computer program was used to analyze various finite element shuttle models. A detailed finite element model of the solid rocket motor was constructed for use with the cyclic symmetry option in NASTRAN. The models were analyzed separately and results were combined to represent the total structure by using a mechanical impedance type approach. K.L.

N80-18231* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF PRODUCING SILICON Patent
Charles B. Wolf (Westinghouse Electric Corp., Trafford, Pa.) and Thomas N. Meyer, inventors (to NASA) (Westinghouse Electric Corp., Trafford, Pa.) Issued 12 Feb. 1980 6 p Filed 29 Mar. 1978 Supersedes N78-22186 (16 - 13, p 1678) Sponsored by NASA
(NASA-Case-NPO-14382-1; US-Patent-4,188,368; US-Patent-Appl-SN-891373; US-Patent-Class-423-350; US-Patent-Class-261-118; US-Patent-Class-422-224) Avail: US Patent and Trademark Office CSCL 13H

A liquid reactant injector assembly suited for the injection of liquid reactant into a high temperature metal reductant vapor and carrier gas stream for the production of metal is presented. The assembly is especially adapted for the continuous production of high purity silicon by the reduction of SiCl4 with sodium. The assembly includes a refractory-lined, hollow metal shell having ten equally-spaced, concentric, radially directed ports provided in the shell and wall. A hydraulic, atomizing type spray nozzle is mounted in each of the ports recessed from the inner wall surface. Official Gazette of the U.S. Patent Office

N80-18232 Texas A&M Univ., College Station.
STRUCTURAL EVALUATION OF RECYCLED PAVEMENT MATERIALS, VOLUMES 1 AND 2 Ph.D. Thesis
Dallas Neville Little, Jr. 1979 713 p
Avail: Univ. Microfilms Order No. 8003161

The principles of rational pavement analysis were used together with in situ nondestructive testing to evaluate the structural performance of recycled pavement materials under load. The recycled layers were compared to the conventional pavement layers of the AASHTO Road Test by means of The AASHTO structural layer coefficient. These coefficients describe the relative structural contribution of an asphalt concrete surface, a crushed stone base, and a gravel subbase to the pavement system. A rational technique utilizing nonlinear layered elastic theory and characterization of recycled asphalt bound materials in terms of resilient modulus as a function of temperature was used to develop structural coefficients for the recycled materials. The response of the recycled layer was compared to a reference layer of conventional construction at the same location using the stiffness equivalency factor concept. The results proved the recycled surfaces and bases to be generally stiffer and superior in terms of their ability to favorably distribute harmful stresses and strains than the conventional materials. Dissert. Abstr.

N80-18233 Pittsburgh Univ., Pa.
PREDICTION AND STATISTICAL ANALYSIS OF SETTLEMENTS OF SHALLOW FOUNDATIONS ON SAND Ph.D. Thesis
Michel Ragi R. Elias 1979 151 p
Avail: Univ. Microfilms Order No. 8004848

A proposed settlement formulation based on the theory of elasticity and the equivalent corrected blow counts is used to calculate the ratio, r, of measured settlements to calculated settlements of 67 shallow foundations on sand. The error in predicting settlement as estimated by the variance indicates that the proposed method results in an improvement over two recognized methods. The proposed method is considered to be consistent, and more reliable in the sense that the variance and uncertainty in the predicted settlements are known and can be accounted for. A hypothetical project involving the design of foundations on sand, from the standpoint of settlement considerations, is presented to illustrate a procedure of optimizing the total expected settlement related cost of the project, C sub T, which is expressed as a function of the number of test borings. In the optimization process, the optimum number of test borings that would minimize C sub T is determined. Dissert. Abstr.

N80-18234 Illinois Univ. at Urbana-Champaign.
RESILIENT BASED FLEXIBLE PAVEMENT DESIGN PROCEDURE FOR SECONDARY ROADS Ph.D. Thesis
Jose Ludwig Figueroa 1979 334 p
Avail: Univ. Microfilms Order No. 8004168

Easy to use and reliable algorithms to predict the resilient response of flexible pavements in terms of material properties and layer thicknesses are developed based on the data generated from a modified finite element program and an elastic layer stress-dependent program. Other research objectives are: (1) to establish the significance of subgrade resilient properties in determining pavement response to load; (2) to establish the significance of the damage caused to the pavement by loads applied during periods of critical subgrade support; (3) to study the influence on pavement response of using different types of granular base materials and to examine the possibility of developing thickness equivalence factors; and (4) to study the influences of base material shear strength on the development of failure zones within the pavement cross-section and on the pavement response to load. Dissert. Abstr.

N80-18235 Illinois Univ. at Urbana-Champaign.
RESISTANCE OF REINFORCED CONCRETE STRUCTURES UNDER HIGH INTENSITY LOADS Ph.D. Thesis
Theodor Krauthammer 1979 230 p
Avail: Univ. Microfilms Order No. 8004210

The resistance of reinforced concrete structural members subjected to high intensity loads such as that arising from a nuclear detonation, is studied for cases in which an equivalent static design approach can be employed as a basis for the proportioning of the structural components. A modified procedure for analyzing and designing reinforced concrete beams is developed. The method provides a basis for assessing the influence of the shearing reinforcement on the ultimate moment capacity of the beams. The procedure is employed to analyze simply supported reinforced concrete slender and deep beams and the results are compared to the experimental data. Dissert. Abstr.

N80-18236 Illinois Univ. at Urbana-Champaign.
A STUDY OF LOCAL MINIMA IN STRUCTURAL DESIGN Ph.D. Thesis
Bernardo Horowitz 1979 197 p
Avail: Univ. Microfilms Order No. 8004191

Structural design optimization problems are addressed. Design problems involving simple structural configurations amenable to graphical representation are discussed. The results obtained for those examples suggest that each local minimum corresponds to a specific way in which the structure may carry the applied loads. This motivates the concept of load carrying mechanisms. In order to be able to handle larger problems, an algorithm is developed which seeks to ensure convergence to a possible local minimum corresponding to the intended mode of behavior. For the case of single loads and stress constraints only, it is shown that the Lagrange multipliers represent the gradient vector of the functional that expresses the objective function in terms of the maximum member stresses. The method is applied to symmetric plane frames made up of prismatic members where the objective function is the total volume of material. Examples of structures subjected to single loading conditions and stress constraints only are studied to verify the generality of the concept of load carrying mechanisms. Dissert. Abstr.

N80-18237 Texas A&M Univ., College Station.
BEARING CAPACITY OF DRIVEN PILES IN SAND Ph.D. Thesis
Reno Reine Castello 1979 151 p
Avail: Univ. Microfilms Order No. 8003113

The unit point and side resistances obtained from thirty-four field pile load tests were used to determine which of the pile geometry and soil parameters are most significant. Bearing capacity factors are calculated and correlated with the most significant pile-soil system parameters. Three types of load test data are used: compression test data adjusted for residual stresses, unadjusted compression test data and compression/tension test data. The best and simplest correlations are developed by plotting the bearing capacity factors versus the relative depth, i.e., the depth of penetration to diameter ratio. An error analysis of these correlations provides the basis for the conclusion that both unadjusted compression and compression/tension test correlations yield fairly accurate predictions (usually within ±20%) for total bearing capacity. However, the compression/tension test correlations give the best predictions for point and side bearing capacity. Dissert. Abstr.

N80-18238 Massachusetts Univ., Amherst.
A STUDY OF THE STRUCTURE OF LIQUID HELIUM BY X-RAY SCATTERING Ph.D. Thesis
Howard Neil Robkoff 1979 263 p
Avail: Univ. Microfilms Order No. 8004980

The static structure factor of liquid He-4 was systematically measured over a wide range of temperature, pressure and momentum transfer, using a high intensity precision cryogenic X-ray diffractometer. The data at small momentum transfer extrapolate smoothly to the thermodynamic value for the k intercept. Generally, the effect of increasing the density at constant temperature is to heighten and sharpen the structure factor peak and displace it to slightly larger values of k. Agreement with the previous neutron measurements at elevated pressure by Mozer et al is excellent. A comparison with recent theoretical calculations for elevated pressure at OK reveals a sharper status structure factor peak in the experimental results. The effect of lowering the temperature at constant density is found to be an increase in the structure factor peak height up to the lambda transition. Further cooling is observed to result in a small but distinct decrement in structure. This decrease in structure persists to the lowest temperature studied. Dissert. Abstr.

N80-18239 Illinois Univ. at Urbana-Champaign.
EXPERIMENTAL STUDY OF FRAME-WALL INTERACTION IN REINFORCED CONCRETE STRUCTURES SUBJECTED TO STRONG EARTHQUAKE MOTIONS Ph.D. Thesis
Daniel Paul Abrams 1979 400 p
Avail: Univ. Microfilms Order No. 8004118

The response of reinforced concrete structures subjected to earthquake motions was studied. Reinforced concrete model structures were subjected to simulated earthquake motions. Each ten-story structure comprised two frames resisting lateral inertial loads in parallel with one slender structural wall. Geometry of each structure was the same, however, reinforcement was varied according to different concepts of intended behavior. Measurements at each level included accelerations, displacements, and forces resisted by wall. Strength of members was established according to a design method that recognized energy dissipation capabilities of reinforced concrete structures in the nonlinear range of response. A linear analytical model with arbitrarily softened members was used to estimate maximum response. Dissert. Abstr.

N80-18240 Illinois Univ. at Urbana-Champaign.
RESPONSE OF TEN STORY, REINFORCED CONCRETE MODEL FRAMES TO SIMULATED EARTHQUAKES Ph.D. Thesis
Haluk Cecen 1979 353 p
Avail: Univ. Microfilms Order No. 8004149

The elastic and inelastic response of reinforced concrete structures subjected to strong earthquake excitations was investigated for two identical test structures which were subjected to different numbers and intensities of base motions (principal variables of these tests). All the base motions were patterned after the El Centro-NS, 1940 earthquake. The original earthquake time scale was compressed by a factor, k = 2.5, in order to excite the test models in a way that would be compatible with the excitation of actual structures by real earthquakes. Several analytical methods and structural idealizations were evaluated by comparing the response calculated by them with the observed response of the test structures. A special formulation of a general method was used in an attempt to determine apparent member stiffness distributions at selected instants of a given response history. Dissert. Abstr.

N80-18241 Lehigh Univ., Bethlehem, Pa.
ANALYSIS AND DESIGN OF STEEL BEAM-TO-COLUMN WEB CONNECTIONS Ph.D. Thesis
Glenn Paul Bentschler 1979 390 p
Avail: Univ. Microfilms Order No. 8003068

Web connections were studied relative to their elastic behavior with regard to stiffness, stress distribution, and stress concentrations. The primary analytical tool used was the finite element method. Also included were experimental tests involving web connection details as well as web connection beam and column assemblages. Two types of connections were studied: (1) a connection where the beam flange is attached to the column via a flange connection plate which is welded or bolted to the beam flange and welded to the column flanges; and (2) a connection in which the beam flange is welded directly to the column web. Procedures are outlined for predicting the elastic stiffness of such connections. Dissert. Abstr.

N80-18242 Oklahoma State Univ., Stillwater.
A STUDY OF FLEXIBLE PAVEMENT CRACK DYNAMICS AND SEALANTS Ph.D. Thesis
Ismail Mouhamed Bash 1979 162 p
Avail: Univ. Microfilms Order No. 8003556

Laboratory test procedures for predicting field performance of flexible pavement crack sealing materials were evaluated. In addition, a field study of crack movements and behavior under varying load and temperature conditions was conducted in order to establish criteria for sealant performance based on average conditions on Oklahoma pavements. The bond-ductility test was found to offer the basic evaluative procedure for crack sealing materials. The rubberized asphalt was superior to the other tested sealants. The asphalt cements and the emulsions were found to be too stiff to withstand crack simulated straining actions. The geological formation underlying the pavement had an effect on subsequent cracking of the pavement and cracking behavior. The relative vertical displacement of the crack sides, which indicates the sealant shear strain, was approximately 10 percent of the horizontal crack movement. Dissert. Abstr.

N80-18243# Illinois Univ., Urbana. Dept. of Civil Engineering.
LONGITUDINAL JOINT SYSTEMS IN SLIP-FORMED RIGID PAVEMENTS. VOLUME 3: USER'S MANUAL Interim Report
Amir M. Tabatabaie and Ernest J. Barenberg Nov. 1979 76 p
(Contract DOT-FH-11-874)
(AD-A078850; FAA-RD-79-4-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 13/2

The computer program described, can be used for the analysis of a number of problems which can be summarized as follows: (1) concrete pavements with load transfer systems at the joints; (2) jointed reinforced concrete pavements with cracks having reinforcement steel at the cracks; (3) continuously reinforced concrete pavements; (4) concrete shoulders with or without the bars; (5) concrete pavements with a stabilized base or an overlay and assuming either a perfect bond or no bond between two layers; and (6) concrete slabs of varying thicknesses and modulus of elasticities, and subgrades with varying modulus of supports. A.R.H.

N80-18244*# National Aeronautics and Space Administration, Washington, D. C.
DEBURRING DIE-CASTINGS BY WET VIBRATORY PLANT
Hans-Martin Loeschbart Feb. 1980 11 p ref Transl. into ENGLISH from Geisserei (West Germany), v. 58, no. 1, 14 Jan. 1971, p 6-9 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75755) Avail: NTIS HC A02/MF A01 CSCL 13H

A wet vibratory procedure for the removal of burrs from die castings is described. In this process synthetic abrasive chips and detergent solutions are agitated with the work in such a

way as to produce a spiral circulatory movement. Details of various forms of vibrator basin and shapes of abrasive are illustrated. The automation of deburring is illustrated through the application of vibrators of spiral design in combination with transport and drying devices. M.G.

N80-18245*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ROLE OF THE MICRO ENVIRONMENT ON THE TRIBOLOGICAL BEHAVIOR OF MATERIALS
Donald H. Buckley 1980 13 p refs Proposed for presentation at Ann. Meeting of the Inst. of Environ. Sci., Philadelphia, 11-14 May 1980
(NASA-TM-81434; E-358) Avail: NTIS HC A02/MF A01 CSCL 20K

The properties of the environment which exert an influence upon adhesion, friction, wear, and lubrication of materials in solid state contact are discussed. The effect of the environment upon lubricants and lubricant properties is considered in relation to the interaction of the lubricant with the material surfaces in solid state contact and the ability of lubricants to provide protective surface films. J.M.S.

N80-18246# Centre Technique des Industries Mecaniques, Senlis (France).
THE INFLUENCE ON SPARK MACHINING EFFICIENCY OF THE TECHNIQUE FOR INDUCING DIELECTRIC CIRCULATION BETWEEN THE WORK MATERIAL AND THE ELECTRODE Final Report [INFLUENCE DU MODE DE CIRCULATION DU DIELECTRIQUE ENTRE LA PIECE ET L'ELECTRODE SUR LE RENDEMENT DE L'USINAGE PAR ELECTRO EROSION]
Dixmier 30 Nov. 1979 106 p In FRENCH
(CETIM-13-G-03-0) Avail: NTIS HC A06/MF A01

Dielectric circulation techniques in electro-erosion machining are reviewed. Several alternatives are discussed and practical rules of the selection of the optimum dielectric circulation technique for each case are given. The discussion includes the case of passing-through cavities, the influence of electrode shape and material, optimization of flow, and aspiration flow systems. It is shown that there are low and high limits to the acceptable dielectric flow and practical rules for the maximum length of dielectric circulation in the electrode gap are derived. Author (ESA)

N80-18247# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
COST MINIMIZATION CALCULATIONS FOR PLANE AND THREE DIMENSIONAL FRAME STRUCTURES [RECHNERGESTUETZTER ENTWURF ZUR KOSTENMINIMIERUNG EBENER UND RAEUMLICHER FACHWERKE]
Ulrich Breitling 1978 99 p refs In GERMAN
(ILR-39; ISBN-3-7983-0655-9; ISSN-0341-0587) Avail: NTIS HC A05/MF A01

The concept of nonlinear concave goal functions are applied to cost optimizing structural calculations. Difficulties arise in employing the functions due to the lack of means simplifying and quantifying economic factors and technical details concerning fabrication. Applications of the method are shown for such three dimensional structures as bridges and roofs. Author (ESA)

N80-18248# Texas Transportation Inst., College Station.
METHODOLOGY FOR PREDICTING THE REFLECTION CRACKING LIFE OF ASPHALT CONCRETE OVERLAYS Interim Report, Sep. 1974 - Mar. 1979
Frederick P. Germann and Robert L. Lytton Mar. 1979 151 p refs Sponsored in part by Texas State Dept. of Highways and Public Transportation, Austin
(PB80-101710; TTI-2-8-75-207-5; FHWA/TX-79-09-207-5) Avail: NTIS HC A08/MF A01 CSCL 13B

An experimental testing procedure was established, for quantitative analysis of overlays designed to reduce reflection cracking. From this testing procedure the overlay scheme that shows the most resistance to cracking can be chosen. The procedure uses crack propagation tests on overlay samples which are conducted on a machine called the overlay tester. This machine was specifically built to stimulate the displacements resulting from temperature changes in the cracked or jointed pavement or base materials that are beneath an overlay. Various types of overlay samples were investigated on the overlay tester. These include samples with fabric, such as 'Petromat', and samples composed of different grades of asphalt. GRA

N80-18249# Transportation Research Board, Washington, D.C.
PAVEMENT DISTRESS, EVALUATION, AND PERFORMANCE
Michael I. Darter, Scott A. LaCoursiere, Scott A. Smiley, J. Brent Rauhut, Freddy L. Roberts et al 1979 83 p refs
(PB80-101991; TRB/TRR-715; ISBN-0-3090-2962-7; LC-79-607814) Avail: NTIS HC A05/MF A01 CSCL 13B

The topics presented deal with the following areas: (1) structural distress mechanisms in continuously reinforced concrete pavement; (2) response and distress models for pavement studies; (3) distresses and related material properties for premium pavements; (4) evaluation of permanent deformation in asphalt concrete pavements; (5) subjective and mechanical estimations of pavement serviceability for rural-urban road networks; (6) quantifying pavement serviceability as it is judged by highway users; (7) measuring pavement performance by using statistical sampling techniques; (8) laboratory testing of a full-scale pavement: the Danish road-testing machine; (9) utility decision model for pavement recycling; and (10) seasonal and short-term variations in skid resistance. GRA

N80-18250# Louisiana Dept. of Transportation and Development, Baton Rouge. Research and Development Section.
TEXTURING OF CONCRETE PAVEMENTS Final Report, Jun. 1973 - Aug. 1979
Sheldon M. Law and Masood Rasoulian Aug. 1979 54 p refs
(PB80-106032; RR-134; FHWA/LA-79-134) Avail: NTIS HC A04/MF A01 CSCL 13B

Research was conducted to document and evaluate the Category 2 Experimental Concrete Texturing project. Several texturing techniques, were tried and compared in order to determine which concrete pavement texture would perform best in regard to skid resistance, durability non hydroplaning properties, noise levels and uniformity. Initially transverse metal tines produced the highest skid number and the best speed gradient. It was recommended that the texturing technique of a longitudinal burlap drag followed by metal tines applied transversely to the centerline of the concrete pavement, be continued as standard on all new concrete pavements and bridge decks. GRA

N80-18251# National Technical Information Service, Springfield, Va.
CRYOGENIC REFRIGERATION, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Nov. 1977 - Nov. 1979
William E. Reed Dec. 1979 133 p Supersedes NTIS/PS-78/1262; NTIS/PS-77/1158; NTIS/PS-76/0871; NTIS/PS-75/826
(PB80-802051; NTIS/PS-78/1262; NTIS/PS-77/1158; NTIS/PS-76/0871; NTIS/PS-75/826) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Topics in the cited reports include cryogenic cooling of electronic equipment, infrared equipment, cryogenic storage vessels, magnetohydrodynamic generators, and superconducting magnets, coils, rotating machinery, and transmission lines. Marine refrigeration of liquefied natural gas, cryogenic heat pipes, cryogenic heat transfer, and space applications are studied. Methods investigated include adiabatic demagnetization, electrocaloric effect, Joule-Thomson effect, thermoelectric cooling, and Crayton, Claude, Gifford-McMahon, Sterling, and Vuilleumier cycles. This updated bibliography contains 125 abstracts, 48 of which are new entries to the previous edition. GRA

N80-18066*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPERATION OF JOULE-THOMPSON REFRIGERATION ABOVE THE CRITICAL PRESSURE OF HELIUM
D. L. Johnson *In its* The Deep Space Network 15 Feb. 1980 p 41-49 refs (For primary document see N80-18058 09-12) Avail: NTIS HC A07/MF A01 CSCL 20L

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-18252* National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH-SPEED DATA LINK FOR MODERATE DISTANCES AND NOISY ENVIRONMENTS Patent
Michael W. Sievers, inventor (to NASA) (JPL) Issued 5 Feb. 1980 10 p Filed 25 Apr. 1978 Supersedes N79-24212 (17 - 15, p 1968) Sponsored by NASA
(NASA-Case-NPO-14152-1; US-Patent-4,187,394; US-Patent-Appl-SN-899828; US-Patent-Class-178-58R; US-Patent-Class-179-15BA) Avail: U.S. Patent and Trademark Office CSCL 17B

A full duplex, high speed data link is described which comprises identical modules at each site for communication over coaxial cables. Each module having a digital frequency modulation (DFM) transmitter with an first-in-first-out (FIFO) data buffer for data from a digital system to be transmitted over a cable and a receiver with an FIFO data buffer for data received for a digital system at the other end of the cable. Data words are preceded by a sync word which enables the receiver. Every word transmitted, including the sync word is stored in the FIFO data buffer. This arrangement using FIFO buffers allows for asynchronous transmission of data with receipt of the data beginning with the very first bit of the sync word.

Official Gazette of the U.S. Patent and Trademark Office

N80-18253* National Aeronautics and Space Administration. Pasadena Office, Calif.
RADIO FREQUENCY ARRAYING METHOD FOR RECEIVERS Patent
Milton H. Brockman (JPL) and Mahlon F. Easterling, inventors (to NASA) (JPL) Issued 29 Jan. 1980 15 p Filed 31 Oct. 1978 Supersedes N79-14272 (17 - 05, p 0585) Sponsored by NASA
(NASA-Case-NPO-14328-1; NASA-Case-NPO-14579-1; NASA-Case-NPO-14590-1; US-Patent-4,186,347; US-Patent-Appl-SN-956160; US-Patent-Class-325-305; US-Patent-Class-325-307; US-Patent-Class-325-419) Avail: US Patent and Trademark Office CSCL 17B

A method and apparatus for increasing the signal to noise ratio of a receiving facility for coherent frequency reception by arraying receiving systems using separate antennas for each, or one antenna for all systems are presented. One system is operated with a carrier tracking loop to provide a first local oscillator frequency for the first and all other systems arrayed, with individual tracking loops in all other systems operated at IF for tracking out any phase differences due to separate group delays using an adjustable phase shifter for a second reference to compensate for different group delays in the antenna and low noise amplifier of each of the other systems. The second IF output of all systems is summed into the first system. This technique may also be used when two systems are arrayed to an antenna designed for circular or linear polarization diversity reception to effectively provide the same signal to noise ratio for both polarized signal transmission channels that would result from matched polarization. An arrangement adapted to high rate telemetry reception is disclosed. With additional components, the same arrangement is adapted to provide low rate telemetry reception as well.

Official Gazette of the U.S. Patent and Trademark Office

N80-18254 Illinois Univ. at Urbana-Champaign.
ANALYSIS OF ARBITRARILY SHAPED WIRE ANTENNAS RADIATING OVER A LOSSY HALF-SPACE Ph.D. Thesis
Parviz Parhami 1979 136 p
Avail: Univ. Microfilms Order No. 8004249

The problem of an arbitrarily oriented current element over a lossy half space is analyzed. Various numerical approaches are developed and discussed for evaluating the infinite Sommerfeld integrals appearing in the vector potential expressions. In particular, a technique based on the steepest descent path integration is introduced for exact evaluation of these integrals, and, as an efficient alternative, an additional technique is developed based on approximating the well behaved Fourier transform expressions of the Sommerfeld integrals. The latter technique has the merit of not requiring any time consuming infinite integrations and, at the same time, is shown to yield accurate results for a wide range of parameters of practical interest. Finally, the thin wire antenna problem over a lossy half space is analyzed via the method of moments and the current element solution techniques discussed earlier. Dissert. Abstr.

N80-18255 California Univ., Santa Barbara.
EVALUATION AND IMPROVEMENTS TO THE QUALITY AND INTELLIGIBILITY OF LINEAR PREDICTION VOICE CODING Ph.D. Thesis
David Yee-Yan Wong 1979 281 p
Avail: Univ. Microfilms Order No. 8003040

Linear prediction (LP) voice coding is discussed. The causes of the loss in speech quality are studied and techniques for improvements are explored. Low bit rate speech coding is attained with LP voice coding because of the explicit use of a linear speech model. The validity of the linear model and the accuracy with which its parameters are estimated by the LP algorithms are examined. From this examination, a number of problem areas which lead to quality degradation are defined. An evaluation is conducted to correlate the problem areas with the perceived quality defects in the vocoded speech. The evaluation consists of careful listening and analysis of speech samples produced by two different LP vocoder programs followed by a series of short experiments. Based on the preliminary evaluation, a study on the application of a more realistic excitation pulse for synthesizing voiced speech is conducted. A least squares technique for extracting the glottal volume velocity waveform from the speech waveform is developed and applied to several speech samples.

Dissert. Abstr.

N80-18256 Syracuse Univ., N. Y.
ELECTROMAGNETIC TRANSMISSION THROUGH A FILLED SLIT OF ARBITRARY CROSS SECTION IN A CONDUCTING PLANE OF FINITE THICKNESS Ph.D. Thesis
David Thomas Auckland 1979 137 p
Avail: Univ. Microfilms Order No. 8004485

Electromagnetic transmission through a filled slit in a conducting plane of finite thickness was investigated when the slit cross sections was an arbitrary shape. A non-modal formulation was developed whereby the original problem was broken up, via the equivalence principle, into three isolated situations. An integral equation was written for each of these situations involving equivalent electric and magnetic currents as unknowns on the closed contour defining the slit cross section. These three integral equations were solved simultaneously and it is shown that they have a unique solution at all frequencies. A modal solution was also developed for the case when the slit cross section can be viewed as a sequence of two dimensional rectangular cavities, each coupled to the other by an aperture. Results obtained from these two solutions are compared. Dissert. Abstr.

N80-18257 Kansas Univ., Lawrence.
RADAR IMAGE SIMULATION: A PROJECT TO DEVELOP A MODEL, DEFINE ITS OPERATIONAL CONSTRAINTS, VALIDATE ITS ACCURACY, AND TO PRODUCE SAMPLE RESULTS, VOLUME 1 AND 2 Ph.D. Thesis
Verne Henry Kaupp 1979 552 p
Avail: Univ. Microfilms Order No. 8002808

A radar image simulation project was conducted to develop a model, to define its operational constraints, to validate its accuracy, and to produce sample results. Two different approaches to simulation of radar imagery were evaluated and resulted in two distinct models. The first of these models, the point scattering method (PSM), is applicable to simulation of area extensive, distributed targets. The second, the area spatial filtering (ASF) method, is applicable to simulation of specular reflection, cultural targets. Theoretical developments for both models are summarized, implementations are discussed, and sample results are presented. In addition, several ancillary studies performed in support of simulation are presented. Dissert. Abstr.

N80-18258# Northeastern Univ., Boston, Mass. Electronics Research Lab.
FM TRANSMISSION OF TELEVISION FROM ROCKETS AND BALLOONS Interim Report
Willard F. Thorn 11 Jul. 1979 58 p refs
(Contracts F19628-76-C-0111; F19628-76-C-0152; AF Proj. 7659)
(AD-A075489; SCIENTIFIC-3; AFGL-TR-79-0160) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report deals with the use of preemphasis filtering in FM transmission of television. The television cameras and transmitter are to be located on rocket or balloon instrumentation payloads. The large RF bandwidth necessary for television transmission requires a large transmitted power for the distances of interest. The use of preemphasis will reduce the required transmitted power considerably below that required for a picture of similar quality without preemphasis. This thesis shows how preemphasis filtering can provide an improvement and what the limits of these improvements are. GRA

N80-18259# Institute for Telecommunication Sciences, Boulder, Colo.
COMPARISON OF MEASURED DATA WITH IF-77 PROPAGATION MODEL PREDICTIONS Final Report
M. E. Johnson and G. D. Gierhart Aug. 1979 443 p refs
(Contracts DOT-FA78WAI-840; DOT-FA68WAI-145)
(AD-A076508; FAA-RD-79-9) Avail: NTIS HC A19/MF A01 CSCL 20/14

Measured propagation data were compared with predictions made by the IF-77 (ITS-FAA-77) and other propagation models. Although IF-77 was developed for aeronautical applications, it can be used for some point-to-point propagation paths, and the measured data selected for comparison includes point-to-point as well as aeronautical paths. Approximately 870,000 hours of data are associated with the 242 paths used. Predictions made with IF-77 were always best or second best and were substantially better than those made for free space conditions. The IF-77 model has a wide range of application and provides predictions compatible with the more specialized models tested. The aeronautical propagation data pool from which the data were selected is an appendix. A.R.H.

N80-18260# Communications Research Centre, Ottawa (Ontario). Technology and Systems Branch.
PICTURE DESCRIPTION INSTRUCTIONS (PDI) FOR THE TELIDON VIDEOTEX SYSTEM
H. G. Bown, C. D. OBrien, W. Sawchuk, and J. R. Storey Nov. 1979 74 p
(CRC-TN-699-E) Avail: NTIS HC A04/MF A01

The Telidon Videotex system is a method by which information is accessed from central data bases by the general public. By the use of a domestic home television receiver augmented by a microcomputer controlled interface device a user can access pages of graphical and textual information over a public common carrier communications facility such as the telephone network, a cable television line, or in a broadcast television signal. A coding scheme which encodes a picture into the geometric drawing elements which compose it is described. The picture description instructions are an alpha geometric coding model and are based on the primitives of POINT, LINE, ARC, RECTANGLE, POLYGON, point by point BIT encoded images, and TEXT encoded as ASCII characters. A detailed specification of the code as well as a description of the principles which make it independent of communications channel and display hardware is provided. A.W.H.

N80-18261*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A FLUORESCENT RADIATION CONVERTER Patent Application
Walter Viehmann, inventor (to NASA) Filed 11 Jan. 1980 19 p
(NASA-Case-GSC-12528-1; US-Patent-Appl-SN-111439) Avail: NTIS HC A02/MF A01 CSCL 20N

A fluorescent radiation converter having a substantially undoped optically transparent substrate and a waveshifter coating deposited on at least one portion of substrate for absorption of radiation and conversion thereof to fluorescent radiation is described. The coating is formed of substantially 1000 g/liter of a solvent, 70 to 200 g/liter of an organic polymer, and .2 to 25 g/liter of at least one organic fluorescent dye. The incoming incident radiation impinges on the coating and enters therein. Radiation is absorbed by the fluorescent dye and is reemitted as a longer wavelength radiation. Advantages of the fluorescent radiation converter in the areas of liquid crystal displays, scintillation counters, and in photovoltaic conversion techniques are discussed. NASA

N80-18262*# International Telephone and Telegraph Corp., New York.
THE 30/20 GHz FIXED COMMUNICATIONS SYSTEMS SERVICE DEMAND ASSESSMENT. VOLUME 1: EXECUTIVE SUMMARY
R. B. Gamble, H. R. Seltzer, K. M. Speter, and M. Westheimer Aug. 1979 50 p 3 Vol.
(Contract NAS3-21366)
(NASA-CR-159619) Avail: NTIS HC A03/MF A01 CSCL 17B

Demand for telecommunications services is forecasted for the period 1980-2000, with particular reference to that portion of the demand associated with satellite communications. Overall demand for telecommunications is predicted to increase by a factor of five over the period studied and the satellite portion of demand will increase even more rapidly. Traffic demand is separately estimated for voice, video, and data services and is also described as a function of distance traveled and city size. The satellite component of projected demand is compared with the capacity available in the C and Ku satellite bands and it is projected that new satellite technology and the implementation of Ka band transmission will be needed in the decade of the 1990's. Author

N80-18263*# International Telephone and Telegraph Corp., New York.
THE 30/20 GHz FIXED COMMUNICATIONS SYSTEMS SERVICE DEMAND ASSESSMENT. VOLUME 2: MAIN REPORT
R. B. Gamble, H. R. Seltzer, K. M. Speter, and M. Westheimer Aug. 1979 309 p refs 3 Vol.
(Contract NAS3-21366)
(NASA-CR-159620) Avail: NTIS HC A14/MF A01 CSCL 17B

A forecast of demand for telecommunications services through the year 2000 is presented with particular reference to demand for satellite communications. Estimates of demand are provided for voice, video, and data services and for various subcategories of these services. The results are converted to a common digital measure in terms of terabits per year and aggregated to obtain total demand projections. J.M.S.

N80-18264*# International Telephone and Telegraph Corp., New York.
THE 30/20 GHz FIXED COMMUNICATIONS SYSTEMS SERVICE DEMAND ASSESSMENT. VOLUME 3: ANNEX
R. B. Gamble, H. R. Seltzer, K. M. Speter, and M. Westheimer Aug. 1979 63 p 3 Vol.
(Contract NAS3-21366)
(NASA-CR-159621) Avail: NTIS HC A04/MF A01 CSCL 17B

A review of studies forecasting the communication market in the United States is given. The applicability of these forecasts to assessment of demand for the 30/20 GHz fixed communications system is analyzed. Costs for the 30/20 satellite trunking systems are presented and compared with the cost of terrestrial communications. J.M.S.

N80-18265# Communications Research Centre, Ottawa (Ontario).
SYSTEM-DESIGN CONSIDERATION FOR AN OPTICAL CORRELATOR FOR THE SEASAT-A SYNTHETIC-APERTURE RADAR
E. B. Felstead Apr. 1979 81 p refs
(AD-A071358; CRC-1321) Avail: NTIS HC A05/MF A01 CSCL 17/9

System-design considerations are presented for an optical correlator that processes signals recorded on film from the

synthetic-aperture radar of the SEASAT-A satellite. A strip-map image of the Earth's surface is to be produced with a resolution down to 6.5 m along track (azimuth) and 25 m across track (range). The input film and the two-dimensional Fourier transform are described mathematically and their parameters given. Processing problems introduced by range curvature, antenna pitch and yaw, earth rotation, low PRF, etc., are handled by simple modifications to a standard tilted-plane correlator. Recommended system configurations, output parameters and system limitations are given. GRA

N80-18266# Arcon Corp., Waltham, Mass.
MATHEMATICAL ANALYSIS AND PROGRAMMING AS APPLIED TO ELECTROMAGNETIC PROPAGATION AND ANTENNA DESIGN Final Report, 28 Sep. 1976 - 30 Jun. 1978
John OBrien, Ilya Koltunov, Peter Wintersteiner, and Benzion Guz Jun. 1979 122 p
(Contract F19628-76-C-0310; AF Proj. 9993)
(AD-A076150; RADC-TR-79-146) Avail: NTIS
HC A06/MF A01 CSCL 20/14

In this report, the analysis and programming for various problems in the field of Electromagnetic propagation and antenna design are considered. The scope of our work extended into a variety of technical areas. Among the technical areas are: Magneto-acoustic surface waves, Signal analysis, Polar VLF propagation, Ionospheric pulse reflections, Detection and tracking of targets, and Antenna Design. GRA

N80-18267# Naval Research Lab., Washington, D. C.
RADAR SURVEILLANCE/RADAR TRACKING VARIANT TO SPEARS
Mar. 1979 75 p Revised
(AD-A076147; NRL-7958-Rev) Avail: NTIS
HC A04/MF A01 CSCL 17/9

The AAW performance simulation designated SPEARS (System Performance Evaluation and Requirements Simulation) now exists in a version which contains extensive revisions in the areas of radar surveillance and radar tracking. To upgrade the capability of the SPEARS simulation of shipboard radar surveillance, a detailed radar-surveillance model designated SURSEM (Surveillance Radar Systems Evaluation Model) has been modified and incorporated into SPEARS. In addition, a simple tracking algorithm has also been added to replace the implicit assumption that a target track is established instantaneously upon initial detection and then carried automatically until the target either leaves the radar's coverage volume or terminates its flight. Due to time and financial constraints, this version of SPEARS has undergone only limited testing at present. GRA

N80-18268# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE USE OF LINEAR PREDICTION FOR THE INTERPOLATION AND EXTRAPOLATION OF MISSING DATA AND DATA GAPS PRIOR TO SPECTRAL ANALYSIS
Stephen B. Bowling and Shu T. Lai 18 Jun. 1979 23 p refs
(Contract F19628-78-C-0002)
(AD-A075515; TN-1979-46; ESD-TR-79-160) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The spectral analysis of a series of equally spaced samples of a time-stationary process becomes difficult when samples are missing or sizable data gaps occur within the interval of interest. A linear prediction algorithm can be used to fill in the missing data with estimates that are spectrally consistent with the data that are observed. Simulated and practical radar examples demonstrate an improvement in resolution and a reduction of sidelobe interference levels. Computer programs are provided which accomplish the extrapolation and interpolation for complex data. GRA

N80-18269# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
STIMULATED - EMISSION - OF - ENERGETIC - PARTICLES (SEEP) EXPERIMENT Final Report
Sep. 1979 28 p refs
(Contract N00014-78-C-0755)
(AD-A075503; LMSC-D678462) Avail: NTIS
HC A03/MF A01 CSCL 20/14

The immediate scientific objective of this stimulated-emission-of-energetic-particles (SEEP) program is to experimentally establish the detailed relationship between ground-based VLF transmitter activity (i.e., operating frequency, signal strength, pulse duration and duty cycle) and the characteristics of the resulting particle precipitation (intensity, energy and pitch angle distribution). Once these relationships are established an assessment can be made of the feasibility of using controlled wave-particle interactions as a selective method of precipitating electrons from the radiation belts onto critical communication links in the ionosphere. With this knowledge corrective actions to mitigate the effects of such activity against existing and planned U.S. Navy communication systems can be pursued. GRA

N80-18270# Stanford Univ., Calif. Electronics Labs.
ELF SFERIC OCCURRENCES IN THE ANTARCTIC DURING A SOLAR PROTON EVENT CASE STUDY OF OCCURENCES AT BYRD STATION DURING THE EVENT 9 JUNE 1968 Final Report, 1 Dec. 1977 - 30 Nov. 1978
A. C. Fraser-Smith and R. A. Helliwell 19 Sep. 1979 45 p refs
(Contract DNA001-78-C-0017)
(AD-A078923; AD-E300634; SU-SEL-79-005; DNA-4911F)
Avail: NTIS HC A03/MF A01 CSCL 04/1

Electromagnetic waves with frequencies above the extremely-low-frequency range (ELF; frequencies in the range 5 Hz-3) are susceptible to a variety of solar proton event (SPE) effects when propagating through a polar region in the earth-ionosphere waveguide. These effects appear to become less severe as the frequency of the waves becomes smaller and approaches the ELF range. Although measurements have been lacking, it would be expected that ELF wave propagation through the polar regions would be comparatively stable. To investigate polar ELF wave propagation during an SPE, we have carried out a series of measurements of the properties of ELF sferics (75 Hz) at a polar location (Byrd Station, Antarctica) during a moderately-large SPE. These measurements suggest that an SPE can significantly alter the characteristics of ELF signals propagating through the polar regions: during the first 24 hours of the SPE there was a reduction of about 50% in the median amplitudes of the sferics, compared with their amplitudes before the SPE, and there were substantial changes in their rates of occurrence. GRA

N80-18271# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
MILLIMETER WAVE HARDENED ANTENNA WINDOW MATERIALS DEVELOPMENT Final Report, Jul. 1978 - Apr. 1979
James P. Brazel, Richard Fenton, John A. Roetling, and Richard A. Tanzilli Aug. 1979 275 p refs
(Contract DAAG46-79-C-0047; DA Proj. 8X3-63304-D-215)
(AD-A076769; AMMRC-TR-79-45) Avail: NTIS
HC A12/MF A01 CSCL 17/5

A materials development and characterization program has been conducted with the goal of developing hardened antenna window materials for application to millimeter wave and infrared sensors for ballistic missile defense interceptor (BMDI) applications. Three distinct classes of materials were studied. The ADL-4D6 multidirectionally reinforced silica-silica composite developed in previous BMD work was tested for particle erosion resistance and dielectric properties in the mm wavelength region. A comprehensive study was also performed on the effects of constituent properties and weaving and composite densification variations on the mechanical properties of this material. A second class of refractory dielectrics, ultrahigh purity nitrides of silicon and aluminum, were also examined for their ultimate potential in the BMDI environment. Specimens were prepared by chemical vapor deposition and hot pressing of powders. These were variously tested for mechanical and thermal properties, chemical purity and dielectric properties in X and millimeter wavelength bands. The CVD Si3N4 material in particular showed a decade lower loss tangent than previously reported versions of this ceramic. A third material, 'Raytran' zinc selenide, an infrared window material candidate, was characterized for its thermophysical and mechanical properties from -150 C to 1000 C. GRA

N80-18272# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
STUDIES OF EQUATORIAL SCINTILLATION PROBLEMS Final Report, 21 Jun. 1976 - 30 Sep. 1979
K. C. Yeh and C. H. Liu Sep. 1979 235 p refs
(Grants DAAG29-76-G-0286; DAAG29-78-G-0101)
(AD-A076622; UILU-eng-79-2559; TR-65; ARO-14260-8-ELX)
Avail: NTIS HC A11/MF A01 CSCL 20/14

This report describes the experimental set-up, observations and results of satellite radio signals received at an equatorial station. The effects of dispersion and scattering of a pulse propagating through the ionosphere are also investigated theoretically. GRA

N80-18273# Harry Diamond Labs., Adelphi, Md.
THE EMP RESPONSE OF A SYSTEM OF UNCOUPLED, INTERCONNECTED CABLES
Robert F. Gray Oct. 1979 21 p
(DA Proj. 1L1-62120-AH-25)
(AD-A077659; HDL-TR-1903) Avail: NTIS HC A02/MF A01 CSCL 20/14

An approximate analytical technique is developed for the electromagnetic pulse (EMP) response of a complex system of cables deployed over a real earth. The technique involves an existing transmission-line solution for the EMP response of a cable which is extended to a system of interconnected but uncoupled cables by the principle of superposition. The complete response of one particular cable is found by replacing all the other cables connected to it with equivalent Thevenin sources. The response of the cable due to the EMP and the equivalent sources are then summed. The equivalent Thevenin sources are developed from the existing transmission-line solution for the EMP response of a single cable. Experimental verification of the applicability of the superposition principle to transmission lines is also given. GRA

N80-18274# Ohio State Univ. Research Foundation, Columbus. Dept. of Engineering Mechanics.
RECENT DEVELOPMENTS IN CLASSICAL WAVE SCATTERING - FOCUS ON THE T-MATRIX APPROACH Final Report, 1 Dec. 1978 - 30 Sep. 1979
Vijay K. Varadan, ed., Vasundara V. Varadan, ed. et al Aug. 1979 570 p refs Presented at the Intern. Symp., Columbus, Ohio, 25-27 Jun. 1979
(Contract N00014-79-C-0111)
(AD-A077579; OSURF-761454/711671) Avail: NTIS HC A24/MF A01 CSCL 20/11

Contents: T-Matrix Approach--Single Scattering; T-Matrix Approach--Multiple Scattering; Computational Aspects of T-Matrix, Comparison with other Methods; Moment Methods; Geometrical Theory of Diffraction; Resonances and Singularity Expansions; Finite Element Method; Multiple Scattering Theories; Experimental Methods and Inverse Scattering Analyses; and Special Topics. GRA

N80-18275# Ohio State Univ. Research Foundation, Columbus. Dept. of Engineering Mechanics.
MULTIPLE SCATTERING OF ACOUSTIC, ELECTROMAGNETIC AND ELASTIC WAVES
Vijay K. Varadan Sep. 1979 33 p refs
(Contract N00014-78-C-0559; Grant NOAA-04-78-B01-21)
(AD-A077577; OSURF-761261/711400; OSURF-761251/711374) Avail: NTIS HC A03/MF A01 CSCL 20/11

In this article we present a multiple scattering analysis of the coherent wave propagation through an inhomogeneous medium consisting of either random or periodic distribution of scatterers of arbitrary shape. Both specific and random orientations of the scatterers are considered. The mathematical unity inherently present in the T-matrix formalism for the three wave fields, namely acoustic, electromagnetic and elastic, is employed in conjunction with suitable averaging procedures to formulate a self-consistent multiple scattering theory. For a random distribution of scatterers we use a configurational averaging procedure, while for a periodic distribution, we use a suitable lattice sum based on crystallographic theory. The information about the orientation of the scatterers has been incorporated into the T-matrix of the scatterer itself thus making formalism a convenient computational scheme to study the anisotropic effects in an inhomogeneous medium. The statistically averaged equations obtained by the analysis are then solved by using Lax's quasicrystalline approximation to obtain the bulk or effective properties of the medium. Numerical results are presented for propagation speeds, attenuation and frequency dependent elastic properties for a range of frequencies to demonstrate the broad applicability of the T-matrix method. GRA

N80-18276# American Electronic Labs., Inc., Farmingdale, N.J.
ELECTROMAGNETIC RADIATION SYSTEM (EMRS) FOR SUSCEPTIBILITY TESTING Quarterly Report, 1 Jan. - 31 Mar. 1979
Margaretta V. Stone Aug. 1979 11 p
(Contract DAAB07-76-C-0332; DA Proj. 1L7-62701-AH-92)
(AD-A076953; CORADCOM-76-0332-10) Avail: NTIS HC A02/MF A01 CSCL 14/2

The function of the Electromagnetic Radiation System (EMRS) is to generate electromagnetic energy to produce a constant field strength that can be automatically scanned as a function of frequency. The design objective is to cover the frequency range of 30 Hz to 40 GHz with field intensities up to 200 volts per meter. This report describes system equipment status and results of performance tests in the demonstration frequency ranges of 30-60 MHz, 1.0-2.1 GHz, 2.1-4.0 GHz and 12.4-18.0 GHz. GRA

N80-18277# Science Applications, Inc., El Segundo, Calif.
HARDENED RADAR COMPONENT MATERIALS DEVELOPMENT STUDY Final Report, 28 May 1978 - 30 Jan. 1979
Irving Osofsky and Robert Semelsberger May 1979 255 p refs
(Contract DAAG46-78-C-0052; DA Proj. 8X3-63304-D-215)
(AD-A077805; AMMRC-TR-79-34) Avail: NTIS HC A12/MF A01 CSCL 17/9

A combined analytical and experimental study was conducted to identify and evaluate materials for protecting Ballistic Missile Defense system ground radar components from nuclear thermal radiation damage. This program included thermal testing using the French Solar Furnace and the SAI Thermal Radiation Simulator, electrical property tests at the Georgia Institute of Technology, Engineering Experiment Station, and planning of mechanical property tests to be conducted in the BMD Materials Test facility at AMMRC. Materials included bulk ceramics, ceramic coatings and bulk ablators. The results indicated promise for the use of a silicone rubber ablator and uninfiltrated porous ceramic coatings for radar component thermal hardening. Further tests and analyses are recommended for these classes of materials in order to evaluate the effect on radar performance. GRA

N80-18278# ITT Gilfillan, Inc., Van Nuys, Calif.
SIGNAL PROCESSING FOR UNATTENDED RADAR Final Technical Report, Sep. 1978 - Feb. 1979
John M. Milan, Robert H. Fletcher, Jr., Charles D. Lucas, Jr., and Jack W. Goodwin Griffiss AFB, N.Y. RADC Oct. 1979 174 p ref
(Contract F30602-78-C-0288; AF Proj. 4506)
(AD-A078478; RADC-TR-79-243) Avail: NTIS HC A08/MF A01 CSCL 17/9

This final report documents the results of a six-month study conducted during phase 1 of a contract to examine Signal Processing for Unattended Radars. Based on a general set of system and processor requirements for a representative unattended radar, various signal processing operations, architectures, and technologies are evaluated. A recommended signal processor is identified, and the selection rationale is presented. The principle selection criteria are those of reliability, performance, cost, maintainability, risk and power consumption. The major risk areas in the selected processor have been identified and a validation plan proposed for phase 2 of the SPUR effort. This plan consists of recommended approaches, including a formal test plan, for reducing these risks. GRA

N80-18279# Mission Research Corp., Santa Barbara, Calif.
THE SENSITIVITY OF SATELLITE COMMUNICATIONS TO THE UNCERTAINTIES IN SELECTED CHEMICAL REACTION RATE COEFFICIENTS Final Report, Apr. 1977 - Feb. 1979

Murray Scheibe 31 May 1979 55 p refs
(Contract DNA001-77-C-0224)
(AD-A078924; AD-E300633; MRC-R-458; DNA-4971F) Avail: NTIS HC A04/MF A01 CSCL 20/14

The relative importance of various reaction rates are examined using the results of a recent MELT code calculation for a megaton range burst at 250 km altitude. New rate coefficients are developed for the critical reactions involved in the ion decay and the uncertainties in these rate coefficients are examined. With the use of a number of assumptions, some of them rather crude, these rate coefficient uncertainties are translated into uncertainties in communications degradation effects for HF and higher frequencies and some of these are significant. Areas in which improvement is needed, with regard to both reaction rate data and the chemistry treatment in MELT, are noted. GRA

N80-18280# Research Inst. of National Defence, Linkoeping (Sweden).
AN X-BAND ARRAY ANTENNA MODULE WITH Si-IMPATT DIODE AMPLIFIER. VOLUME 1: TEXT
Herbert Steyskal Mar. 1979 77 p refs In SWEDISH; ENGLISH summary 2 Vol.
(FOA-C-30154-E1-Vol-1) HC A04/MF A01

The construction of a MIC transceiver module is reported. Test methods for transmitter and receiver branches are described and test results are reported with emphasis on phase stability as a function of temperature, voltage, and time. Test results for icw drift of single IMPATT diode amplifier stages are given, e.g., intrapulse phase shift. Author (ESA)

N80-18281# Research Inst. of National Defence, Stockholm (Sweden).
AN X-BAND ARRAY ANTENNA MODULE WITH Si-IMPATT DIODE AMPLIFIER. VOLUME 2: FIGURES AND TABLES [X-BANDS GRUPPANTENNMODUL MED Si-IMPATT DIODFOERSTAERKARE. DEL 2: FIGURER OCH TABELLER]
Herbert Steyskal Mar. 1979 52 p In SWEDISH 2 Vol.
(FOA-C-30154-E1-Vol-2) Avail: NTIS HC A04/MF A01

Figures and tables are presented for the test results of the transmitter and receiver branches of a MIC tranceiver module. Phase stability is emphasized in terms of temperature, voltage, and time. Graphic data is also given for the icw drift of a single IMPATT diode amplifier. Author (ESA)

N80-18282# Research Inst. of National Defence, Stockholm (Sweden).
AN X-BAND ARRAY ANTENNA MODULE WITH GaAs IMPATT DIODE AMPLIFIER. VOLUME 1: TEXT
Herbert Steyskal Apr. 1979 76 p refs In SWEDISH; ENGLISH summary 2 Vol.
(FOA-C-30155-E1-Vol-1) Avail: NTIS HC A05/MF A01

The construction of a MIC twin transceiver module is described. It contains three stage GaAs IMPATT diode amplifiers with 1 W cw output and 20 dB gain at 9 GHz, analog ferrite phase shifters, PIN-diode switches, and balanced mixers. Test methods for transmitter and receiver branches are described and test results broken down into transmitter, receiver, and control elements characteristics are reported. Emphasis is on phase data as functions of temperature, voltage, and time. Phase and amplitude tracking at constant voltage or constant current were measured for a changing ambient temperature. The ICW operation of the transmitter branches on low duty cycle was tested and results concerning amplification and intrapulse phases shift are discussed. Author (ESA)

N80-18283# Research Inst. of National Defence, Stockholm (Sweden).
AN X-BAND ARRAY ANTENNA MODULE WITH GaAs IMPATT DIODE AMPLIFIER. VOLUME 2: FIGURES AND TABLES [X-BANDS GRUPPANTENNMODUL MED GaAs IMPATT DIODFOERSTAERKARE. DEL 2: FIGURER OCH TABELLER]
Herbert Steyskal Apr. 1979 48 p In SWEDISH 2 Vol.
(FOA-C-30155-E1-Vol-2) Avail: NTIS HC A03/MF A01

Table and figures are presented for the test results of the transmitter and receiver branches of a MIC twin module. Author (ESA)

N80-18284# Polytechnical Univ. of Madrid (Spain). Escuela Tecnica Superior de Ingenieros Telecomunicacion.
CONTRIBUTIONS OF OPTIMAL RECEIVER THEORY TO DIGITAL EQUALIZATION [APORTACION DE LA TEORIA DEL RECEPTOR OPTIMO A LA IGUALACION DIGITAL]
Jesus Rivero Laguna 1979 58 p refs In SPANISH
(ETSI-04-176) Avail: NTIS HC A04/MF A01

Data transmission through telephonic channels was analyzed with emphasis on optimal receiver theory. An optimized analog filter structure was studied and its influence on the received signal was determined. The modifications derived from the insertion of a digital filter were surveyed and optimal detection algorithms were examined. It is concluded that the equalization of the telephonic channel for data transmission can be reduced to the design of a digital filter, leaving out the nonlinear optimal detectors if the intersymbol interference is not too strong. Author (ESA)

N80-18065*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VALIDATION OF ROUNDTRIP CHARGED-PARTICLE CALIBRATIONS DERIVED FROM S- AND X-BAND DOPPLER VIA DRVID MEASUREMENTS
D. W. Green *In its* The Deep Space Network 15 Feb. 1980 p 30-40 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20N

N80-18068*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE PRACTICAL LIMITS OF PHOTON COMMUNICATION
R. J. McEliece, E. R. Rodemich, and A. L. Rubin *In its* The Deep Space Network 15 Feb. 1980 p 63-67 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 17B

N80-18073*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VITERBI DECODING MODIFIED FOR SOURCES WITH MEMORY
V. Kopwar *In its* The Deep Space Network 15 Feb. 1980 p 97-110 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 17B

N80-18464*# Centre National d'Etudes des Telecommunications, Lannion (France). Dept. Mesures Ionospheriques et Radioelectriques.
THE FRENCH SHORT TERM RADIOPROPAGATION PREDICTIONS IN THE DECAMETER BAND
P. Lassudrie-Duchesne, A. M. Bourdila, and H. Sizun *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 12-24 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18465*# Forschungsinstitut der Deutschen Bundespost, Darmstadt (West Germany).
PROPAGATION PREDICTIONS FOR THE HF-RANGE BY THE RESEARCH INSTITUTE OF THE DEUTSCHE BUNDESPOST
Th. Damboldt *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 25-43 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18468*# Polish Academy of Sciences, Warsaw. Space Research Centre.
ESTIMATION OF SOLAR FLAME INFLUENCE ON RADIO CIRCUIT TRANSMISSION LOSS
Z. Klos and K. Stasiewicz *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 67-71 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18472*# National Physical Lab., New Delhi (India). Radio Science Div.
LONG TERM SOLAR ACTIVITY AND IONOSPHERIC PREDICTION SERVICES RENDERED BY THE NATIONAL PHYSICAL LABORATORY, NEW DELHI

B. M. Reddy, S. Aggarwal, D. R. Lakshmi, S. Shastri, and A. P. Mitra *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 118-133 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18478*# Radio Research Labs., Nakaminato (Japan).
FORECASTS OF GEOMAGNETIC ACTIVITIES AND HF RADIO PROPAGATION CONDITIONS MADE AT HIRAISO/JAPAN
K. Marubashi, Y. Miyamoto, T. Kidokoro, and T. Ishii *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 182-204 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18480*# Radio Research Labs., Tokyo (Japan).
RADIO PROPAGATION PREDICTION SERVICES IN JAPAN
Rikio Maeda *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 212-222 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18481*# Radio Research Labs., Tokyo (Japan).
RADIO DISTURBANCE WARNING ISSUANCE SYSTEM
Rikio Maeda and Hisao Inuki *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 223-228 (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18488*# Naval Ocean Systems Center, San Diego, Calif.
PROPHET: AN APPLICATON OF PROPAGATION FORECASTING PRINCIPLES
Paul E. Argo and Ilan J. Rothmuller *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 312-321 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-18285* National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH POWER RF COAXIAL SWITCH Patent
Edward R. Caro, inventor (to NASA) (JPL) Issued 5 Feb. 1980 6 p Filed 10 Oct. 1978 Continuation of abandoned U.S. Patent Appl. SN-835419, filed 21 Sep. 1977 Sponsored by NASA
(NASA-Case-NPO-14229-1; US-Patent-4,187,416;
US-Patent-Appl-SN-949886; US-Patent-Class-200-153S;
US-Patent-Class-200-304; US-Patent-Class-333-262;
US-Patent-Appl-SN-835419) Avail: US Patent and Trademark Office CSCL 09A

A coaxial switch capable of operating in a vacuum with high RF power in the 1.2 GHz range without multipactor breakdown, and without relying on pressurization with an inert gas is described. The RF carrying conductors of the switch are surrounded with a high grade solid dielectric, thus eliminating any gaps in which electrons can accelerate.

Official Gazette of the U.S. Patent and Trademark Office

N80-18286* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOLTAGE FEED THROUGH APPARATUS HAVING REDUCED PARTIAL DISCHARGE Patent
Stephen R. Peck (GE, Philadelphia) and Jeffrey W. Benham, inventors (to NASA) (GE, Philadelphia) Issued 22 Jan. 1980 5 p Filed 10 Jan. 1978 Supersedes N78-17297 (16 - 8, p 1013) Sponsored by NASA
(NASA-Case-GSC-12347-1; US-Patent-4,185,164;
US-Patent-Appl-SN-868249; US-Patent-Class-174-142;
US-Patent-Class-174-73R) Avail: US Patent and Trademark Office CSCL 09A

A voltage feed-through apparatus, having reduced partial discharge, has an electrical conductor and an electrical terminal connected thereto. A semiconductor sleeve surrounds the conductor for reducing the electric field concentration at the metallic conductor surface and consequently reducing the partial discharge occurrences. An insulator sleeve encircles the semiconductor sleeve. A metallic sleeve surrounds a portion of the terminal. Another insulator is connected to the metallic sleeve and surrounds a portion of the insulator sleeve forming a space therebetween. Another metallic sleeve spaced from the first metallic sleeve surrounds a portion of the other insulator.

Official Gazette of the U.S. Patent and Trademark Office

N80-18287* National Aeronautics and Space Administration. Pasadena Office, Calif.
MICROWAVE POWER TRANSMISSION BEAM SAFETY SYSTEM Patent
Richard M. Dickinson, inventor (to NASA) (JPL) Issued 5 Feb. 1980 8 p Filed 16 Oct. 1978 Supersedes N79-10271 (17 - 01, p 0036) Sponsored by NASA
(NASA-Case-NPO-14224-1; US-Patent-4,187,506;
US-Patent-Appl-SN-951829; US-Patent-Class-343-100R;
US-Patent-Class-310-306; US-Patent-Class-343-100ST) Avail: US Patent and Trademark Office CSCL 09C

A system in which the characteristics of a microwave power transmission beam are controlled in accordance with power distribution profiles altered due to the detected presence or entrance of an object into the beam which causes changes that are perceived in various received, reflected and scattered power distribution profiles resulting over various receiving elements of the system is presented. The system comprises a microwave power beam radiator array, a microwave power beam receiving antenna array, the radiator array in one embodiment being located on an orbiting spacecraft and the receiving array being located at a ground station. Another embodiment provides a ground based transmitting array and a receiving array aboard an aircraft or airship.

Official Gazette of the U.S. Patent and Trademark Office

N80-18288 Illinois Univ. at Urbana-Champaign.
DETECTION, ESTIMATION, AND ORDER REDUCTION IN MULTIPARAMETER SINGULARLY PERTURBED SYSTEMS Ph.D. Thesis
Dean Altshuler 1979 105 p
Avail: Univ. Microfilms Order No. 8004123

The problem of state estimation for the slow modes of a hierarchial singularly perturbed system is considered. A detection estimation approach is derived which obtains near optimal estimates in the presence of multiple perturbation parameter uncertainties. The scheme is of most value when the estimation problem is one of a steady state nature. However, small sample performance is analytically derived. Since the algorithm always contains a near optimal filter corresponding to the unknown perturbation parameters, questions of convergence need not be considered. A second problem that is addressed is that of obtaining a steady state slow mode estimate when the perturbation parameter is not small. It is shown that in many cases, a near optimal solution exists that is easily implementable. Its performance, in general, is superior to the reduced filter, yet its complexity is comparable. Dissert. Abstr.

N80-18289 Illinois Univ. at Urbana-Champaign.
THE DYNAMIC STABILITY OF PERMANENT-MAGNET STEP MOTORS Ph.D. Thesis
Steven Howard Pollack 1979 281 p
Avail: Univ. Microfilms Order No. 8004255

The dynamic stability of open loop, constant voltage, permanent magnet step motor systems is examined. The mid frequency resonance region is highlighted. Analytical stability expressions are experimentally verified. A fourth order nonlinear model of a permanent magnet step motor is used. The model is linearized around a constant speed nominal trajectory. The resulting perturbed system is time varying. Techniques are presented for solving the perturbed system. Dissert. Abstr.

N80-18290 Clemson Univ., S.C.
A METHOD FOR THE TRANSIENT STABILITY ENHANCEMENT OF A POWER SYSTEM USING FEEDBACK CONTROL OF A SYNCHRONOUS GENERATOR Ph.D. Thesis
Haren Almaula 1979 97 p
Avail: Univ. Microfilms Order No. 8003339

A control strategy for augmenting the transient stability of a power system is developed using a direct phase model of a synchronous generator. The strategy uses prime-mover power and the excitation voltage of the synchronous generator as the controller variable. The control problem is formulated as a sequence of linear optimal control problems, where the control law is obtained from the backward solution of a Riccati type, matrix differential equation. Two different conditions of transient instability of a power system are considered. In each case the control strategy counters the instability resulting from a three phase-to-ground fault near the synchronous generator. The control strategy is applied only after the fault is removed. A gain of one cycle in the transient stability limit is observed in each case. Dissert. Abstr.

N80-18291 Rensselaer Polytechnic Inst., Troy, N. Y.
ELECTRON AND HOLE PHOTOCURRENT EFFECTS ON IMPATT OSCILLATORS Ph.D. Thesis
Hanuman Prasad Vyas 1979 155 p
Avail: Univ. Microfilms Order No. 8004770

The effect of the magnitude and composition of leakage current on IMPATT oscillator performance is experimentally and theoretically evaluated. The principal effect of leakage current is to cause a reduction in the diode RF power output and an increase in the frequency of oscillations. The electron dominated leakage currents are more effective in reducing the RF power output and increasing the frequency of oscillations of an Impatt oscillator compared to leakage current dominated by holes. For experimental demonstration of leakage current effects flat profile, single drift region Impatt diodes were fabricated. A He-Ne laser was used as an optical source and the composition of leakage current with this source is changed by fabricating two types of devices. One with junction side down or flip chip to generate hole dominated leakage current and other with junction side up or top mounted to generate electron dominated leakage current. Dissert. Abstr.

N80-18292 New Jersey Inst. of Technology, Newark.
THEORY AND DESIGN OF CYCLOTRON-WAVE TRAVELING-WAVE AMPLIFIERS Ph.D. Thesis
Arthur Herman Gottfried 1979 277 p
Avail: Univ. Microfilms Order No. 8002664

The energy exchange mechanism and the axial beam velocity spread induced by RF interactions are examined. Analysis of the energy spread in a realistic model of the beam with nonzero size and nonzero space-charge density shows that higher maximum efficiencies at higher power is attainable (with collector depression) in cyclotron-wave amplifiers than in synchronous-wave amplifiers. A one-watt, and a ten-watt cyclotron-wave amplifier at 3 GHz, utilizing bifilar helix circuits, scaled from a 2 kW, 5 GHz design, were constructed. A computer was used to design a pitch taper for the circuit of the ten-watt tube to maintain synchronism between beam and circuit waves so as to enable the extraction of more energy from the beam. Test results indicate the possibility of attaining efficiencies of the order of 70% in a 2 kW, 5 GHz cyclotron-wave amplifier. Because of the relatively low interaction impedance available for transverse-wave interactions, it is estimated that gains of the order of 1 dB/inch are possible. Dissert. Abstr.

N80-18293 Missouri Univ. - Columbia.
PARALLEL DIGITAL SIMULATION OF POWER SYSTEMS Ph.D. Thesis
Alvin Lawrence Day 1979 223 p
Avail: Univ. Microfilms Order No. 8002351

A quadrature differential equation simulation technique suitable for parallel digital processors is developed. Parallel digital architectures are suggested which provide modular construction to allow expansion, modification, and easier maintenance of the simulator. The solution speed of the proposed fully programmable power system simulator is independent of the size of the simulated system. Detailed model equations are developed for several basic power system components using the quadrature differential equation technique. This technique of simulation is shown to be valid by comparisons with a conventional sequential digital program and a hybrid simulator. Faster than real time simulation with the TMS 9900 is shown to be possible by the substitution of a TMS 9900 steam turbine model into an analog simulation system scaled at twenty times faster than real time. Present microprocessors are feasible for simulation of only the slower solution rate models of a power system. The faster components may be simulated by either analog electronics or discrete digital hardware. Dissert. Abstr.

N80-18294 California Univ., Davis.
THE EFFECT OF NONUNIFORM CHANNEL DOPING ON HIGH FREQUENCY JFET AND MESFET DEVICES Ph.D. Thesis
Giovonnae Francesca Anderson 1979 155 p
Avail: Univ. Microfilms Order No. 8003495

A new load device for use in high speed switching circuits is presented. The device, a non-uniformly doped junction field effect transistor (NUDJFET), has a doping gradient along the length of the channel, that is, the doping at the source end of the channel is higher than the doping at the drain end of the channel. A model for this device was developed and used in computer simulations which compared gallium arsenide high speed switching circuits which used NUDJFETs as a load device with circuits employing conventional load devices. According to simulations, circuits using GaAs NUDJFETs should show a reduction in the speed power product ranging from 42% to 12% depending on the circuit configuration. Dissert. Abstr.

N80-18295 Alabama Univ., University.
DEVELOPMENT OF EQUIVALENTS FOR ELECTRIC POWER SYSTEM TRANSIENT STABILITY ANALYSIS Ph.D. Thesis
Nallicheri J. Balu 1979 208 p
Avail: Univ. Microfilms Order No. 8004528

The simplified representation of an external system was constructed in two stages: (1) a dynamic equivalent for reducing the number of generator terminal buses in the external system, and (2) a network equivalent for eliminating the unwanted nongenerator buses in the external system. The dynamic equivalents was developed based on the principle of coherency of generating units. A novel analytical technique, based on the study of trajectories of a power system in a state space was developed for the recognition of coherent machine groups during system disturbances. Two coherency-based techniques for the construction of dynamic equivalents of external systems are discussed, and computer programs were developed for the implementation of these techniques. The practical applicability and the accuracy of each of these two techniques is demonstrated. Dissert. Abstr.

N80-18296 Illinois Univ. at Urbana-Champaign.
STATE ESTIMATION OF LINEAR SYSTEMS DRIVEN SIMULTANEOUSLY BY WIENER AND POISSON PROCESSES Ph.D. Thesis
Samuel Horshing Poriza Au 1979 116 p
Avail: Univ. Microfilms Order No. 8004127

The case where the incident intensities of the Poisson processes are low and the system is observed in an additive white Gaussian noise is considered. The minimum mean-squared-error (MMSE) optimal filter is derived via the Doleans-Dade and Meyer differentiation rule for discontinuous semimartingales and its corresponding basic filtering theorem for white Gaussian observations noise. The nonclosedness property and performance of the filter are investigated. The results together with the performance of the linear optimal filtering schemes lead to the conclusion that causal filters and noncausal linear filters are inherently unsuitable for the state estimation for such class of systems. A noncausal nonlinear suboptimal scheme is developed for the estimation problem based on a combined estimation and detection strategy. A first order approximation scheme is included in the scheme to eliminate the error propagation effects that result from the sequential structure of the approach. Dissert. Abstr.

N80-18297 Toledo Univ., Ohio.
ANALYTICAL CORE LOSS CALCULATIONS FOR MAGNETIC

MATERIALS USED IN HIGH FREQUENCY HIGH POWER CONVERTER APPLICATIONS Ph.D. Thesis
James Edward Triner 1979 101 p
Avail: Univ. Microfilms Order No. 8002826

The basic magnetic properties under various operating conditions encountered in the state-of-the-art dc-ac/dc converters were examined. Using a novel core excitation circuit, the basic B-H and loss characteristics of various core materials were observed as a function of circuit configuration, frequency of operation, input voltage, and pulse-width modulation conditions. From this empirical data, a mathematical loss characteristics equation was developed to analytically predict the specific core loss of several magnetic materials under various waveform excitation conditions. Core excitations involving symmetric and asymmetric conditions for both sinusoidal and square wave waveforms were investigated analytically using three specific core loss calculation methods. The predicted and measured specific core losses were within 10 percent of each other for all conditions analyzed. Dissert. Abstr.

N80-18298# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
FIELD IMPACT EVALUATION PROCESS ON ELECTRONIC TABULAR DISPLAY SUBSYSTEM (ETABS) Final Report, Dec. 1978 - Jul. 1979
Oct. 1979 32 p
(AD-A078848; FAA-RD-79-100) Avail: NTIS HC A03/MF A01 CSCL 14/2

The process used in conducting a field impact evaluation of the electronic tabular display subsystem is described. Various group structural and process techniques are described. These include a diagonal slice approach to team formulation and several different methods of team building, process control, and conflict management. M.G.

N80-18299*# Texas Instruments, Inc., Dallas. Central Research Labs.
LOW POWER, COMPACT CHARGE COUPLED DEVICE SIGNAL PROCESSING SYSTEM Final Report, Apr. 1976 - Aug. 1978
P. W. Boeehart, D. D. Buss, W. L. Eversole, C. R. Hewes, and D. J. Mayer Feb. 1980 194 p refs
(Contract NAS1-14290)
(NASA-CR-3218; Rept-08-78-49) Avail: NTIS HC A09/MF A01 CSCL 09A

A variety of charged coupled devices (CCDs) for performing programmable correlation for preprocessing environmental sensor data preparatory to its transmission to the ground were developed. A total of two separate ICs were developed and a third was evaluated. The first IC was a CCD chirp z transform IC capable of performing a 32 point DFT at frequencies to 1 MHz. All on chip circuitry operated as designed with the exception of the limited dynamic range caused by a fixed pattern noise due to interactions between the digital and analog circuits. The second IC developed was a 64 stage CCD analog/analog correlator for performing time domain correlation. Multiplier errors were found to be less than 1 percent at designed signal levels and less than 0.3 percent at the measured smaller levels. A prototype IC for performing time domain correlation was also evaluated. R.C.T.

N80-18300*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID METAL SLIP RING Patent Application
Frank D. Berkopec, Robert R. Lovell, and David H. Culp, inventors (to NASA) Filed 21 Dec. 1979 11 p
(NASA-Case-LEW-12277-3; US-Patent-Appl-SN-106190) Avail: NTIS HC A02/MF A01 CSCL 09A

The liquid metal slip ring described comprises a rotor in the form of a range about an axis and a stator, the rotor being rotatable relative to the stator. The rotor has a channel in which the liquid metal is retained during operation by surface tension. The stator comprises a brush or probe which is partially immersed in the metal in the channel and is bidirectionally symmetrical so that whichever direction the rotor turns the probe presents the same physical resistance and affords the same electrical conductivity as a connection between the probe and the rotor. Author

N80-18301*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY DESIGN OF LARGE REFLECTORS WITH FLAT FACETS
Pradeep K. Agrawal, Melvin S. Anderson, and Michael F. Card Jan. 1980 35 p refs
(NASA-TM-80164) Avail: NTIS HC A03/MF A01 CSCL 09C

A concept for approximating curved antenna surfaces using flat facets is discussed. A preliminary design technique for determining the size of the reflector surface facets necessary to meet antenna surface accuracy requirements is presented. A proposed large Microwave Radiometer Satellite is selected as an application, and the far field electromagnetic response of a faceted reflector surface is compared with that from a spherical reflector surface. Author

N80-18302*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMIONIC CATHODE LIFE TEST STUDIES
Ralph Forman and Paul Elmer (Watkins-Johnson, Palo Alto, Calif.) 1980 11 p refs Proposed for presentation at the Tri-Services Cathode Workshop, New York, 15-17 Apr. 1980; sponsored by Dept. of the Air Force
(NASA-TM-81441; E-317) Avail: NTIS HC A02/MF A01 CSCL 09A

An update on the life testing of commerical, high current density impregnated tungsten cathodes is presented. The B-type cathodes, operated at a current density of 2 A/cm2 and a cathode temperature of 1100 C have now been run satisfactorily for more than four years. The M-cathode, at the same current density but at an operating temperature of only 1010 C, have been tested for more than three years. The M-cathodes show no degradation in current over their present operating life whereas the current from the B-cathodes degrade about 6 percent after four years of operation. R.E.S.

N80-18303# Fairchild Camera and Instrument Corp., Palo Alto, Calif. Research and Development Lab.
PROCESS VARIABLE DEPENDENCE AND INTER-RELATIONSHIP BETWEEN AVALANCHE INJECTED AND RADIATION INDUCED CARRIER TRAPPING IN THERMAL OXIDES Progress Report, 1 Jul. - 30 Sep. 1979
Oct. 1979 15 p refs
(Contract N00014-79-C-0297)
(AD-A078362; PR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

Progress to data includes the completion of the automated avalanche carrier injection and trapping system, the preparation of samples to study hole and electron trapping in dry as well as wet oxides, and the measurements of the effects of various process parameters on the trapping characteristics of thermal silicon dioxide. GRA

N80-18304# Watkins-Johnson Co., Scotts Valley, Calif.
HIGH CONTRAST CRT Interim Report, 1 Oct. 1978 - 28 Feb. 1979
Glenn A. Holmquist Aug. 1979 31 p
(Contract DAAB07-77-C-2639; DA Proj. 1L1-62705-AH-94)
(AD-A076235; DELET-TR-77-2639-5; IR-5) Avail: NTIS HC A03/MF A01 CSCL 09/5

Sixteen faceplates were completed and characteristic optical data was recorded. The difficulties in production result from the properties of the faceplate glass limiting the maximum temperature of the La2O2S heat treatment. The optimum fabrication techniques, with this limitation, produced quality faceplates.GRA

N80-18305# Raytheon Co., Waltham, Mass. Research Div.
LOSSLESS BROADBAND MICROWAVE SWITCHES Interim Report, 1 Sep. 1978 - 31 Aug. 1979
James Vorhaus Sep. 1979 58 p
(Contract N00014-78-C-0623; RF54581001)
(AD-A076379; S-2609) Avail: NTIS HC A04/MF A01 CSCL 09/1

The GaAs dual-gate MESFET is a very powerful microwave device offering more gain and a wider range of functional capabilities than a conventional single-gate FET. It has also been demonstrated that the dual-gate FET can be switched from full off to full on in less than 50 psec. Combining the high gain

and fast switching speed of this device with its inherently high isolation makes it an attractive candidate for microwave switching applications. This report describes the progress made during the first year of an effort to demonstrate the feasibility of using dual-gate FET's as high speed, broadband, lossless microwave switches. In this period, we have designed and fabricated two different dual-gate FET structures which functionally operate as multipole, multithrow switches with gain. We have achieved gains of 18 dB at 10 GHz from a more conventional dual-gate structure. This result is comparable to the best reported in the literature. We have also measured on-off ratios in excess of 30 dB and channel-to-channel isolation in excess of 25 dB in a multiport structure. Due to the many difficulties in handling multiport structures such as these, we have not yet been able to demonstrate signal switching. However, near the end of this report period we developed a new measurement technique which has the potential of eliminating many of the existing difficulties. GRA

N80-18306# Electronics Research Lab., Adelaide (Australia).
AN ANALYTIC ANALYSIS OF A KALMAN FILTER AND SMOOTHER
B. Billard Jul. 1979 26 p refs
(AD-A076140; ERL-0087-TR) Avail: NTIS HC A03/MF A01 CSCL 09/3

A Kalman filter and smoother which uses data from position measuring instrumentation to estimate changes in position, velocity, and acceleration is derived in detailed analytic form. The filtering and smoothing characteristics are shown to be completely determined by a single nondimensional parameter, which itself is a simple function of the input parameters to the filter. The concept of the bandwidth of the filter and the smoother is examined, and analytic expressions are derived for the bandwidth of the smoother, and of the filter with respect to position. The analysis highlights situations in which the smoother is clearly superior to the filter. GRA

N80-18307# Naval Postgraduate School, Monterey, Calif.
PERFORMANCE ANALYSIS OF A TYPE OF ELECTROHYDRODYNAMIC POWER GENERATOR
T. H. Gawain and Oscar Biblarz Apr. 1979 91 p
(AFOSR MIPR 78-0002)
(AD-A076115; NPS67-79-006) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report develops a detailed analysis of a type of electrohydrodynamic power generator which employs an ejector and a so-called 'fluid flywheel' as essential components. The medium is steam containing electrically charged water droplets. The analysis takes into account the experimentally established facts that the maximum strength of the electrical field that can be sustained at incipient breakdown at the most critical location is proportional to the fluid density at that location. It is shown that as a consequence of this fact, the electrical output can be maximized by designing the primary jet for an exit Mach number of 0.71. Estimates are made of the pump work required, of mixing losses in the ejector and of friction and secondary flow losses. The mathematical analysis is reduced to a fully nondimensional form and the key dimensionless parameters that govern performance are clearly identified. A preliminary estimate is made of the numerical values of these parameters and the overall performance of the system is estimated on this basis. GRA

N80-18308# Naval Ship Research and Development Center, Bethesda, Md.
NO-LOAD TESTING OF THE SHAPED FIELD SUPERCONDUCTIVE MOTOR Final Report
H. N. Robey, M. J. Cannell, and L. T. Dunnington Oct. 1979 60 p refs
(AD-A076125; DTNSRDC-79/076) Avail: NTIS HC A04/MF A01 CSCL 09/5

A laboratory-model superconductive d.c. motor, designed and constructed at the David W. Taylor Naval Ship Research and Development Center for peak power output in the 400 to 1000 hp range, has been undergoing no-load testing since January 1973. Results, reported herein, substantially validate the loss estimates (6.5 kW total power loss at 1800 rpm, 120 amp field current, open circuit) predicted in a prior analysis, and indicate that no major problems should be encountered in future planned load tests, with the possible exception of the collector electromagnetic stability, which cannot be evaluated satisfactorily at no-load conditions. Background information on machine development and discussions of the liquid metal and cryogenic helium handling procedures are also included. GRA

N80-18309# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
BONDED GRID DEVELOPMENT Final Technical Report, 1 Feb. 1978 - 31 Jan. 1979
Richard Dawson Griffiss AFB, N.Y. RADC Oct. 1979 83 p refs
(Contract F30602-78-C-0101; AF Proj. 4506)
(AD-A078631; RADC-TR-79-249) Avail: NTIS HC A05/MF A01 CSCL 09/1

This report details the results of efforts expended towards the development of a cathode and control grid assembly having the control grid solidly bonded to the cathode surface by means of a layer of insulating material. A device capable of emission and modulation was fabricated and tested. This effort demonstrated the feasibility of a control grid for microwave tubes fabricated with lithographic techniques directly on the cathode surface. When perfected this technique has two primary payoffs: (1) It will permit the use of high gain control grids at higher frequencies than possible with present shadow grid construction techniques, (2) It will also improve tube reliability, yield and construction cost. This technique will be applicable to microwave tubes used in tactical and ground based radars as well as ground based and satellite communications systems. GRA

N80-18310# Hughes Aircraft Co., Malibu, Calif.
OPTICAL-MICROWAVE INTERACTIONS IN SEMICONDUCTOR DEVICES Quarterly Report, 1 Jul. - 30 Sep. 1979
L. Figueroa, C. Slayman, and H. W. Yen Oct. 1979 29 p refs
(Contract N00173-78-C-0192)
(AD-A078538; QR-5) Avail: NTIS HC A03/MF A01 CSCL 09/1

GaAs FETs and Gunn diodes with built-in optical waveguides are being developed. The purpose is to allow optical signals to be coupled into the active region of the devices efficiently. These FETs will be useful for optical mixing, optical injection locking, and optical detection purposes. The Gunn diodes will be used for high-speed pulsed nodulation of injection lasers. GRA

N80-18311# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
PERMANENT MAGNET AND SUPERCONDUCTING GENERATORS IN AIRBORNE, HIGH POWER SYSTEMS Interim Report, 1 Feb. 1978 - 31 Mar. 1979
Hugh L. Southall and Frederick C. Brockhurst Aug. 1979 99 p refs
(AF Proj. 3145)
(AD-A078424; AFAPL-TR-79-2073) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report presents results of a study performed to compare airborne, high power supplies at power levels of 10 and 20 MW utilizing permanent magnet and superconducting generators. Algorithms for the weight and volume of these electrical generators are presented and algorithms for the other power supply components are used to predict total system weights for seven point designs at the two power levels. GRA

N80-18312# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE 1ST AFAPL GENERATOR AND MOTORS SEMINAR Interim Report, 1 Oct. - 1 Jul. 1979
Hugh L. Southall, J. L. McCabria, Sam Noodleman, M. S. Issaacson, W. F. Weldon et al Aug. 1979 210 p refs Conf. held at Wright-Patterson AFB, Ohio, Oct. 1977
(AF Proj. 3145)
(AD-A078341; AFAPL-TR-79-2090) Avail: NTIS HC A10/MF A01 CSCL 10/2

A seminar was held at Wright-Patterson AFB in October 1977 to provide for government, industry, and university presentations on the latest developments in generator and motor technology. In addition, the mathematical modeling of generator and motors was the subject of other presentations at the meeting.

This technical report organizes and publishes presentations made at the seminar. GRA

N80-18313# IIT Research Inst., Rome, N.Y.
MICROCIRCUIT DEVICE RELIABILITY DIGITAL FAILURE RATE DATA, SUMMER 1979
David B. Nicholls 1979 419 p refs
(Contract F30602-78-C-0281)
(AD-A077199; RAC-MDR-12) Avail: NTIS HC A18/MF A01 CSCL 09/5

This compendium of microcircuit device reliability is divided into two parts: Digital Failure Rate Summarized Data and Digital Device Data-Detailed Listings. The summaries pertain to warranty experience, and generic field, reliability demonstration, equipment checkout and life test data. The detailed listings consist of field, reliability demonstration, and equipment checkout experience as well as life test results arranged by operational type, manufacturer, and part number. MIL-HDBK-217B parameters have been incorporated into the entries to permit comparisons with predicted values. GRA

N80-18314# Widener Univ., Chester, Pa. Center of Engineering.
EFFICIENT FAULT ANALYSIS IN LINEAR ANALOG CIRCUITS Final Report, 28 May - 28 Jul. 1979
Alfred T. Johnson, Jr. Oct. 1979 81 p refs
(Grant AF-AFOSR-0106-79; AF Proj. 2305)
(AD-A078604; TR-79-03; AFOSR-79-1270TR) Avail: NTIS HC A05/MF A01 CSCL 09/3

This report addresses the problem of high-resolution fault diagnosis in linear, analog electrical circuits in which a limited number of terminals are accessible for measurement. An efficient algorithm is described for computing network responses after a single parameter is changed. The computational complexity of this algorithm has been found to be very superior to that of a conventional algorithm. In addition, the problem of choosing a set of measurements for fault analysis has been studied. We have found necessary conditions for resolving the fault to the component level. The problems of measurement error and numerical conditioning have also been studied. GRA

N80-18315# Northrop Research and Technology Center, Palos Verdes Peninsula, Calif.
INVESTIGATION OF THE BASIC MECHANISMS OF RADIATION EFFECTS ON SEMICONDUCTOR DEVICES USED IN ELECTRO-OPTICAL SENSOR APPLICATIONS Final Report, Jan. 1978 - Jan. 1979
Joseph R. Srour, Siegfried Othmer, Susan C. Chen, and Robert A. Hartmann 31 Aug. 1979 147 p refs
(Contract DNA001-78-C-0028)
(AD-A076940; AD-E300617; NRTC-79-9R; DNA-4881F) Avail: NTIS HC A07/MF A01 CSCL 09/1

This report describes results of an investigation of radiation effects on semiconductor devices used in electro-optical sensor applications. Emphasis is placed on determining the basic mechanisms of the interaction of radiation with such devices with a view toward gaining understanding of benefit to developers of radiation-tolerant devices. A study of ionizing radiation effects on silicon MOS devices was performed at temperatures ranging from 4 to 77 degrees K. Charge buildup in the SiO2 layer was observed to be identical at 4 and 77 degrees K after a steady-state exposure to ionizing radiation, which indicates that electron trapping is not important at 4 degrees K. Results at both temperatures can be accounted for quite well in terms of hole trapping and hole transport. An investigation of the basic mechanisms of radiation effects on extrinsic silicon detector material was initiated. Carrier removal produced by neutron bombardment of such material was studied and it was found that the introduction rate of compensating defects depends strongly on the depth within the forbidden gap of the intentional dopant level. A detailed study of radiation effects on charge-coupled devices was performed, with emphasis placed on examining changes in dark current density produced by bombardment with neutrons and with ionizing radiation. The rate of increase in dark current density was found to be very similar for neutron-irradiated buried-channel CCDs obtained from two sources. Results of short-term annealing measurements on CCDs following pulsed neutron bombardment are also presented. A damage coefficient appropriate for describing the introduction of damage in silicon depletion regions was experimentally determined. GRA

N80-18316# North Carolina State Univ., Raleigh. Solid State Electronics Lab.
A THEORETICAL SEARCH FOR SUPER-VELOCITY SEMICONDUCTORS Annual Report, 1 Jan. - 31 Dec. 1979
M. A. Littlejohn Dec. 1979 79 p refs
(Contract N00014-76-C-0480; RR0210203)
(AD-A078719) Avail: NTIS HC A05/MF A01 CSCL 20/12

This report presents the results of research on carrier transport in III-V semiconducting compounds and alloys and the performance of microwave devices fabricated from those compounds and alloys. GRA

N80-18317# Naval Academy, Annapolis, Md.
THE ELECTRICAL SWITCHING PROPERTIES OF AMORPHOUS BISMUTH TRIOXIDE THIN FILM DEVICES Final Report, 1978 - 1979
R. Stephen Weis 9 May 1979 58 p refs
(AD-A077662; USNA-TSPR-101) Avail: NTIS HC A04/MF A01 CSCL 20/12

Many gold-amorphous bismuth trioxide-gold layered devices, known as Bi-O-Trons were fabricated and their switching properties were investigated. The Bi-O-Trons were made by direct vacuum deposition. A unique microprocessor controlled measurement method was developed. This report also contains evidence that filaments can be formed by exclusively thermal effects. Also, evidence that suggests an electrothermal model of threshold switching is presented and discussed. Finally a conclusion about the possibility of the immediate application of Bi-O-Trons as memory cells is presented. GRA

N80-18318# Texas Technological Univ., Lubbock. Laser Lab.
STUDIES OF TRANSIENT DISCHARGES Annual Report, 15 Jun. 1978 - 14 Jun. 1979
P. F. William and M. A. Gundersen 1 Oct. 1979 29 p refs
(Contract F49620-79-C-0118; AF Proj. 2301)
(AD-A078894; AFOSR-79-1304TR; AR-2) Avail: NTIS HC A03/MF A01 CSCL 20/9

Progress during the time period June 15, 1978 through June 14, 1979 in our program to study the basic physical processes responsible for laser-induced breakdown of spark gaps is reported. Major accomplishments during the period include: (1) the measurement of temporarily and spatially resolved electron densities during and after the arc phase; (2) the study of the initial buildup of charge and current in these gaps; and (3) improvements in the data acquisition equipment used in the work. Evidence of a shock front seen in the electron density data was obtained. GRA

N80-18319# Naval Research Lab., Washington, D. C.
THE INSTABILITY BOUNDARY AND GROWTH RATE CONTOURS OF THE GYROTRON AMPLIFIER WITH SPREADS IN ENERGY AND MOMENTA
Joon Y. Choe and Saeyoung Ahn 14 Nov. 1979 13 p refs
(AD-A077450; NRL-MR-4106) Avail: NTIS HC A02/MF A01 CSCL 09/5

The combined effects of the spreads in energy and axial momentum of annular beam electrons in a gyrotron amplifier are spectrally investigated. A conveniently normalized dispersion relation is found for TE modes, and analyzed to obtain the instability boundary and growth rate contours. The spread effects prove to reduce the growth rate near the beam-waveguide synchronous mode, and enhance it for the mode out of synchronization. In particular the growth rate at the synchronous mode tends to peak when the electron distribution is thermally isotropic. GRA

N80-18320# California Univ., Berkeley. Electronics Research Lab.
ON-CHIP PERIPHERAL CIRCUITS FOR CCD SIGNAL PROCESSORS Final Report, 15 Jun. 1976 - 14 Jun. 1979
R. W. Brodersen and D. A. Hodges Jun. 1979 7 p refs
(Grant DAAG29-76-G-0244)
(AD-A076603; ARO-13962.4-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

Research has been carried out on real-time signal processing

using techniques amenable to realization in large-scale integrated circuit technology. Specific system elements studied include precision frequency filters, multiplying digital-analog converters and correlators. GRA

N80-18321# Toulouse Univ. (France). Lab. de Genie Electrique.
THIN FILM DEPOSIT AND TREATMENT OF SURFACES BY ELECTRIC DISCHARGES [DEPOT DE COUCHES MINCES ET TRAITMENT DE SURFACES SOUS DECHARGE]
R. Lacoste 1978 19 p refs In FRENCH Presented at Assoc. pour le Develop. de l'Enseignement et de la Rech. de la Region Parisienne (ADERP) Seminar sur la Chimie des Plasmas, Paris, 20-24 Feb. 1978
(Publ-349) Avail: NTIS HC A02/MF A01

Industrial utilization of plasma is reviewed, focusing on semiconductor manufacturing, passive components manufacturing, and metallic surface treatments. The deposit of organic insulating thin films in semiconductor manufacturing is discussed. Metallic surface treatments including nitruration of iron and titanium alloys are reported. Author (ESA)

N80-18322# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Rechner- und Programmstrukturen.
METHODS FOR DIAGNOSIS OF FAULTS IN SWITCHING NETWORKS [METHODEN DER FEHLERDIAGNOSE IN SCHALTNETZEN]
Monika Rustemeier 1978 190 p refs In GERMAN
(GMD-Mitt-43) Avail: NTIS HC A09/MF A01

The existing processes for fault diagnosis in digital circuits are surveyed and discussed on a theoretical basis. Possible improvements are suggested for the most generally used. All the tests are, in principle usable, but in practice many have prohibitive computation requirements. Author (ESA)

N80-18323# National Technical Information Service, Springfield, Va.
FREQUENCY SYNTHESIZERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979
William E. Reed Dec. 1979 204 p Supersedes NTIS/PS-78/1254; NTIS/PS-77/1102; NTIS/PS-76/0829; NTIS/PS-75/790 2 Vol.
(PB80-801905; NTIS/PS-78/1254; NTIS/PS-77/1102; NTIS/PS-76/0829; NTIS/PS-75/790) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Spread spectrum and single sideband communications, navigation, and frequency control are applications included in these Federally-sponsored research reports on frequency synthesizers. Methods and devices used include surface acoustic waves, digital control, number representation schemes, phase shift, cesium beam tubes, and phased locked systems. This updated bibliography contains 196 abstracts, 16 of which are new entries to the previous edition. GRA

N80-18324# National Technical Information Service, Springfield, Va.
FREQUENCY SYNTHESIZERS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979
William E. Reed Dec. 1979 222 p Supersedes NTIS/PS-78/1255; NTIS/PS-77/1103 2 Vol.
(PB80-801913; NTIS/PS-78/1255; NTIS/PS-77/1103) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Communications, radar, music synthesizers, frequency control, biomedical and test equipment, and microwave systems are applications of frequency synthesizers included in these research reports from worldwide literature. Methods and devices used include surface acoustic waves, phased locked systems, digital control, number representation schemes, and voltage controlled systems. This updated bibliography contains 214 abstracts, 31 of which are new entries to the previous edition. GRA

N80-18221 Boeing Aerospace Co., Seattle, Wash.
INCANDESCENT LAMP LIFE UNDER RANDOM VIBRATION
Clark J. Beck, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 71-81 refs
(For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-18325 State Univ. of New York at Stony Brook.
A FUNCTIONAL APPROACH TO THE STATISTICAL MECHANICS OF FLUID PARTICLES IN TURBULENCE Ph.D. Thesis
Taylan Alankus 1979 95 p
Avail: Univ. Microfilms Order No. 8004403

A turbulence formalism based on the generating functional for the probability density functions of a turbulent Eulerian velocity field is presented. For incompressible fluids it is shown that the generating functional coincides with the characteristic functional of a random scalar field which can be considered as the microscopic density for fluid particles. The dynamical equations for the microscopic density and the generating functional are derived, and it is demonstrated at the functional level that the whole formalism is mathematically indistinguishable from the statistical dynamics of a closed system of (many) identical particles interacting with velocity dependent and dissipative forces. The dynamical equation for the generating functional is formally solved by using functional integration technqiues, and the integral representations of the probability density functions are given. Some fluid dynamical model equations for which the integral representations can be evaluated explicitly are considered. Dissert. Abstr.

N80-18326 Kansas Univ., Lawrence.
A NUMERICAL INVESTIGATION OF THE TWO STREAM INSTABILITY AND RESONANT HEATING OF AN INHOMOGENEOUS, AXISYMMETRIC, PLASMA COLUMN Ph.D. Thesis
Mohammad Taghi Ahmadian 1979 185 p
Avail: Univ. Microfilms Order No. 8002745

An inhomogeneous, cylindrically axisymmetric electron plasma confined electrostatically by immobile ions and with an external boundary surface is considered. A two stream instability excited by axial counter-streaming is followed through limiting amplitude for one or two unstable wavenumbers. The results show that the limiting amplitude is largest for the wavenumber with largest growth rate, consistent with the one-dimensional result. In the case of multiple unstable waves, the first wave to reach limiting amplitude modifies the distribution function and 'turns off' the instability before the other waves reach the limiting amplitudes they would attain as isolated waves. An electric field is applied on the boundary of the plasma along the axis of the cylinder. Power amplification through a thermonuclear fusion reaction is achieved by using the wave to speed up particles on the tail of the distribution function. The maximum power amplication occurs at a frequency omega = 1.3 omega(p). Dissert. Abstr.

N80-18327 Illinois Inst. of Tech., Chicago.
HEAT, MASS AND MOMENTUM TRANSFER THROUGH SPRAYS Ph.D. Thesis
Mohan L. Jain 1979 293 p
Avail: Univ. Microfilms Order No. 8003649

An experimental facility consisting of a subsonic wind tunnel, a spray generation system and instrumentation was designed and constructed. A numerical-photographic procedure was developed for analyzing drop trajectories to imply drop drag coefficients. Experiments were conducted over a Reynolds number range of 1000-3500, and it was found that the drops in the sprays of the present type experience up to 18% higher drag than single drops. Thermal experiments to determine average heat and mass transfer through sprays were conducted over a Reynolds number range of 1000-2500 for three different spray

configurations involving two volume fractions. It is shown that the widely used Ranz-Marshall correlations for single drops give too high a prediction for heat and mass transfer in the present system. Only 36-67% of the calculated transport actually occurred over the Reynolds number range studied. Dissert. Abstr.

N80-18328 Florida Univ., Gainesville.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF THE EFFECT OF DYES ON SOLAR DISTILLATION Ph.D. Thesis
Anil Kumar Rajvanshi 1979 203 p
Avail: Univ. Microfilms Order No. 8002890

A model was developed which treated the transient heat transfer inside the dye-water system as one dimensional. Coupled with this was the energy exchange from the surface of water to the glass cover by convection, radiation and evaporation of water. A finite difference technique was used in solving the nonlinear partial differential equations. The results from the model were compared with those from an experimental investigation using two identical solar stills (4 ft. x 4 ft. x 1 ft.). The control still contained water only while the other had dye-water solution. The dyes used were Black Napthylamine, Red Carmoisine and Dark Green, with various concentrations. An increase in distillate output resulted with increasing dye concentration, but became independent of concentration after 500 ppm. The change of increase of output with concentration of the dye was different for different dyes (among those tested) with Black having the maximum rate and Red having the lowest. For the spring conditions at Gainesville, Florida, the optimum concentrations for Black, Green and Red dyes were 218 ppm, 377 ppm and 408 ppm, respectively. Dissert. Abstr.

N80-18329 Old Dominion Univ., Norfolk, Va.
EFFECT OF PRECURSOR HEATING ON RADIATING AND CHEMICALLY REACTING VISCOUS FLOW AROUND A JOVIAN ENTRY BODY Ph.D. Thesis
Kuo-Yen Szema 1979 185 p
Avail: Univ. Microfilms Order No. 7927104

The influence of changes in the precursor region flow properties (resulting from absorption of the radiation from the shock layer) on the entire shock layer flow phenomena around a Jovian entry body was investigated. Realistic thermo-physical and radiation models are used and results are obtained by employing the implicit finite difference technique in the shock layer and an iterative procedure for the entire shock layer-precursor zone. Results obtained for a 45 deg hyperboloid blunt body entering the Jupiter's atmosphere at zero angle of attack indicate that pre-heating of the gas significantly increases the static pressure and temperature ahead of the shock for entry velocities exceeding 36 km/sec. The nonequilibrium radiative heating rate to the body is found to be significantly higher than the corresponding equilibrium heating. The precursor heating, in general, increases the radiative and convective heating to the body, and this increase is slightly higher for the nonequilibrium conditions. Dissert. Abstr.

N80-18330 Oklahoma State Univ., Stillwater.
LAMINAR FREE CONVECTIVE HEAT TRANSFER IN THE SUPERCRITICAL REGION WITH VARIABLE FLUID PROPERTIES Ph.D. Thesis
Afshin Jahanshahi Ghajar 1979 207 p
Avail: Univ. Microfilms Order No. 8003574

A technique was developed which allowed predictions of heat transfer to fluids in the supercritical region. This technique proved to be more general, less complicated, easier to use, and more accurate in comparison to the existing prediction schemes. The heat transfer predictions are in good agreement with the existing variable property experimental data. Analytical methods for predicting thermodynamic and transport properties in the supercritical region were developed from the available experimental data. A shorthand method (reference temperature) was developed by which heat transfer to fluids in the supercritical region under variable property conditions can be evaluated. The heat transfer results obtained with the reference temperature scheme showed good agreement with the existing variable property theoretical and experimental results. Dissert. Abstr.

N80-18331 California Univ., Davis.
HEAT TRANSFER TO AIR FROM A YAWED ISOTHERMAL CYLINDER Ph.D. Thesis
John Stanford Kraabel 1979 222 p
Avail: Univ. Microfilms Order No. 8003518

Local and mean heat transfer coefficients were determined experimentally at two subscritical Reynolds numbers for forced convective heat transfer from an isothermal circular cylinder to air. The stagnation point and laminar boundary layer heat transfer was found to be dependent only on the Reynolds number based on the velocity component normal to the cylinder. The local heat transfer from the rear of the cylinder, for moderate yaw (up to 40%), was also independent of the spanwise component of flow. At higher angles (50 deg, 60 deg), the heat transfer from the rear of the cylinder is dependent on both yaw and Reynolds number. The region of minimum heat transfer, which occurs in the vicinity of flow separation, was found to be dependent on the yaw. A numerical solution of the stagnation point and laminar boundary layer equations is presented. The numerical heat transfer results compare favorably with the experimental data. Dissert. Abstr.

N80-18332 Lehigh Univ., Bethlehem, Pa.
AN EXPERIMENTAL AND THEORETICAL STUDY OF THE CONFINED VORTEX WITH HIGH FLOW RATE Ph.D. Thesis
Walter Jeffrey Shakesphere 1979 156 p
Avail: Univ. Microfilms Order No. 8003070

The behavior of the flow field in the vortex chamber when the radial and tangential velocities are of equal order of magnitude at the cylindrical distributor and the Reynolds number based on chamber radius and radial velocity is of order 10,000 was investigated. A model was developed by piecing together the analyses for three regions, including the main part of the flow field, the portion near the end walls and the viscous core close to the axis of symmetry. It is shown that although the end wall secondary flow patterns persist, the end wall boundary layers may be uncoupled from the flow in the main region. An explanation for the variation in the size of the viscous core region with changes in operating parameters is presented and compared with a previous theory now used extensively in vortex modelling. A parametric analysis of the radial velocity profiles with changes in geometry was also done. Dissert. Abstr.

N80-18333 Princeton Univ., N. J.
MACROSCOPIC DESCRIPTION OF MULTI-PHASE SYSTEMS: A THERMODYNAMIC THEORY OF FLOW IN POROUS MEDIA Ph.D. Thesis
Majid Hassanizadeh 1980 289 p
Avail: Univ. Microfilms Order No. 8005288

A systematic averaging technique was developed and used to derive multi-phase equations of mass, momentum, angular momentum, energy and entropy from the balance laws for a single continuum. The technique was systematized by requiring a single set of criteria to govern the averaging of all quantities and all equations. Next, a constitutive theory for solid-fluid systems was developed. Finally, the general form of constitutive assumptions for porous media was reduced using the Coleman and Noll method of exploitation of entropy inequality. The constitutive equations were then linearized and a set of field equations were obtained which provided nine equations to be solved for fluid density, porosity, fluid velocity vector, solid displacement vector and the medium temperature. Certain fluid flow cases were reviewed and appropriate equations of varying degrees of approximation were obtained. Dissert. Abstr.

N80-18334 Cornell Univ., Ithaca, N. Y.
TURBULENCE MODELING IN HOMOGENEOUS FLOWS: DETERMINATION OF THE RAPID TERMS Ph.D. Thesis
Yasuo Bikane 1979 114 p
Avail: Univ. Microfilms Order No. 8003970

A method to determine the rapid terms in homogeneous turbulence was studied. The invariant functions in the dissipation equation were determined by data matching. The unknown invariant functions in the rapid terms were determined theoretically by using optimum variables and the independency hypothesis. In order to predict the existing data, one of the invariant functions was modified. The dissipation equation was also modelled by

the invariant technique. Because the form of the invariant functions in the equation is unknown, the form was assumed with two unknown constants which were optimized by data matching. The set of the modeling equations was tested for four experiments. The results agree reasonably with the experimental data. Dissert. Abstr.

N80-18335 Texas A&M Univ., College Station.
THE EFFECTS OF SPRAY ENTRAINMENT ON THE MEAN WIND PROFILE AND THE OVERALL LOAD ON MARINE STRUCTURES Ph.D. Thesis
John Michael Macha 1979 101 p
Avail: Univ. Microfilms Order No. 8003163

A model for the mean wind profile was developed. The log law for turbulent flow past a solid rough boundary was modified and applied to the relative wind speed over a wavy water surface. The waves were treated as individual roughness elements and the transfer of wind momentum to entrained spray drops was accounted for by an additional additive term. Experimental measurements in a high speed wind/wave channel showed that an equivalent 10-meter wind speed of 57 m/sec, the drag on entrained spray drops accounted for over 30 percent of the total momentum transfer from the wind. The spray content of the air at high wind speeds, was investigated from the standpoint of additional loading on marine structures due to spray impact. A maximum limiting spray concentration of .001 grams/cucm was determined based on the available turbulent mechanical energy in the wind shear layer. In addition, extensive measurements of spray concentration and impact force were conducted in the wind/wave channel. Dissert. Abstr.

N80-18336 Princeton Univ., N. J.
DEFORMATION AND HYDRODYNAMIC INTERACTION OF TWO PARTICLES IN A SUSPENSION Ph.D. Thesis
Mark Menachem Friedman 1979 167 p
Avail: Univ. Microfilms Order No. 8003782

The interactions between two particles immersed in a Newtonian fluid are studied under conditions such that inertial effects are negligible and no external forces or couples act on the particles. The flow field used is that produced by the Maxwell orthogonal rheometer. This flow field displays a nonzero vorticity and rate of deformation. Theories pertaining to the deformation of a single drop and the interaction of two solid spheres are combined and applied to the orthogonal rheometer flow field. Particle trajectories are obtained for two solid spheres, two fluid spheres, and two deformable drops in the linear, uniform shear flow field. Agreement between the theory and experiments performed in an orthogonal rheometer is obtained for only a few special cases. The lack of agreement is attributed to secondary flows induced by wall effects. These effects were shown to be produced by the bottom plate container wall and were related to the geometrical asymmetry of the orthogonal rheometer. Suggestions are offered as to how such problems may be overcome in the future. Dissert. Abstr.

N80-18337*# Little (Arthur D.), Inc., Cambridge, Mass.
EXPERIMENTAL STUDY OF THE STABILITY AND FLOW CHARACTERISTICS OF FLOATING LIQUID COLUMNS CONFINED BETWEEN ROTATING DISKS Final Report
A. A. Fowle, L. Soto, P. F. Strong, and C. A. Wang Feb. 1980 129 p
(Contract NASw-3186)
(NASA-CR-162800) Avail: NTIS HC A06/MF A01 CSCL 20D

A low Bond number simulation technique was used to establish the stability limits of cylindrical and conical floating liquid columns under conditions of isorotation, equal counter rotation, rotation of one end only, and parallel axis offset. The conditions for resonance in cylindrical liquid columns perturbed by axial, sinusoidal vibration of one end face are also reported. All tests were carried out under isothermal conditions with water and silicone fluids of various viscosities. A technique for the quantitative measurement of stream velocity within a floating, isothermal, liquid column confined between rotatable disks was developed. In the measurement, small, light scattering particles were used as streamline markers in common arrangement, but the capability of the measurement was extended by use of stereopair photography system to provide quantitative data. Results of velocity measurements made under a few selected conditions, which established the precision and accuracy of the technique, are given. The general qualitative features of the isothermal flow patterns under various conditions of end face rotation resulting from both still photography and motion pictures are presented. R.C.T.

N80-18338*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATIC THERMAL SWITCH Patent Application
Lawrence D. Wing and Joseph W. Cunningham, inventors (to NASA) Filed 30 May 1979 23 p
(NASA-Case-GSC-12415-1; US-Patent-Appl-SN-043943) Avail: NTIS HC A02/MF A01 CSCL 20D

An automatic heat flow control switch consisting of a thermal transfer plate pivotally mounted between two thermally conductive plates is described. A phase change power unit which includes a plunger is in contact with one of the conductive plates. When the unit is actuated by an increase in heat transmission, the plunger extends and pivots the transfer plate to vary the thermal conduction. An element connected to the transfer plate biases the transfer plate in a predetermined position with respect to the conductive plates. The biasing element, transfer plate, and piston can be arranged to provide either a closed or open thermally conductive path. The switch is to be used to control the temperature of electronic instruments in the Space Shuttle equipment bays. NASA

N80-18339*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF NUMERICAL SOLUTIONS TO NON-LINEAR PROBLEMS OF FLUID MECHANICS OBTAINED BY THE METHOD OF LEAST SQUARES AND THE FINITE ELEMENT METHOD TO UNSTEADY NAVIER-STOKES EQUATIONS
B. Mantel, J. Periaux, and P. Perrier Dec. 1979 32 p refs
Transl. into ENGLISH of conf. paper "Une Application de la Solution Numerique de Problemes Non-lineaires en Mecanique des Fluides, par les Methodes de Moindres-Carres abstraits et d'elements Einis, aux Equations de Navier-Stokes Instantionnaires" Assoc. Aeron. et Astron. autique (France), 1978 33 p Presented at the Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978. Original language document announced as A79-32281 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75727) Avail: NTIS HC A03/MF A01 CSCL 20D

A method of calculating viscous fluid flows having an average Reynolds number is presented. J.M.S.

N80-18340*# Old Dominion Univ. Research Foundation, Norfolk, Va.
EXPERIMENTAL STUDY OF FLOW DUE TO AN ISOLATED SUCTION HOLE AND A PARTIALLY PLUGGED SUCTION SLOT Final Report, 1 Feb. 1978 - 31 Jan. 1980
G. L. Goglia and Stephen P. Wilkinson Feb. 1980 36 p refs
(Grant NsG-1491)
(NASA-CR-162808) Avail: NTIS HC A03/MF A01 CSCL 20D

Details for construction of a model of a partially plugged, laminar flow control, suction slot and an isolated hole are presented. The experimental wind tunnel facility and instrumentation is described. Preliminary boundary layer velocity profiles (without suction mode) are presented and shown to be in good agreement with the Blasius laminar profile. Recommendations for the completion of the study are made. An experimental program for study of transition on a rotating disk is described along with preliminary disturbance amplification rate data. M.G.

N80-18341*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
RESONANT DOPPLER VELOCIMETER Ph.D. Thesis. Final Report, 1 Jul. 1974 - 31 Oct. 1979
Micha Zimmermann Mar. 1980 247 p refs
(Grant NsG-1070)
(NASA-CR-162815; MAE-T-1465) Avail: NTIS HC A11/MF A01 CSCL 20D

A technique is presented for visualizing and quantitatively

measuring velocity, temperature, and pressure by shining a single frequency laser beam into a gaseous flow which is seeded with an atomic species. The laser is tuned through the absorption frequencies of the seeded species and the absorption profile is detected by observing fluorescence as the atoms relax back to the ground state. The flow velocity is determined by observing the Doppler shift in the absorption frequency. Spectroscopic absorption line broadening mechanisms furnish information regarding the static temperature and pressure of the moving gas. Results of experiments conducted in the free stream and in the bow shock of a conical model mounted in a hypersonic wind tunnel indicate that the experimental uncertainties in the measurement of average values for the velocity, temperature and pressure of the flow are 0.1, 5 and 10 percent respectively. K.L.

N80-18342# Defence Research Establishment Suffield, Ralston (Alberta).

A SEMI-EMPIRICAL EQUATION FOR THE VISCOSITY OF AIR

James J. Gottlieb and David V. Ritzel Jul. 1979 23 p refs
(AD-A072053; DRES-TN-454) Avail: NTIS HC A02/MF A01 CSCL 20/4

Sutherland's theoretical expression for the absolute or dynamic viscosity of a gas has been modified to represent experimental viscosity data for air. The resulting semi-empirical equation accurately describes measured viscosities of air for temperatures ranging from the boiling point at 78 K to molecular dissociating conditions at 2500 K. Discrepancies between measured values and semi-empirical results rarely exceed 2%. Other more limited expressions for the viscosity of air are also compared to measured viscosity data and discussed. GRA

N80-18343# McDonnell-Douglas Research Labs., St. Louis, Mo.

VISCOUS FLOWFIELDS INDUCED BY TWO- AND THREE-DIMENSIONAL LIFT JETS IN GROUND EFFECT Final Technical Report, 1 Feb. 1976 - 28 Feb. 1979

W. W. Bower, R. K. Agarwal, G. R. Peters, and D. R. Kotansky 1 Mar. 1979 38 p refs
(Contract N00014-76-C-0494; NR Proj. 215-246; RR0141184)
(AD-A078782; ONR-CR-215-246-3F) Avail: NTIS HC A03/MF A01 CSCL 20/4

An important consideration for VTOL aircraft design is the aerodynamic interaction between airframe undersurfaces and the ground. In an effort to predict this phenomenon, a second-order-accurate, finite-difference scheme for solution of the two- and three-dimensional conservation equations of fluid mechanics, in combination with a turbulence model, is described. The solution technique is applied to a planar lift jet in ground effect for both incompressible and compressible flow and to two interacting incompressible jets with fountain formation. Fluid properties that characterize the jet impingement flowfields are given for a range of Reynolds numbers, and comparisons with measured data are presented. GRA

N80-18344# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

STUDY OF THREE-DIMENSIONAL INTERNAL FLOW PROBLEMS RELATED TO TURBOMACHINERY FLOWS Annual Report, 1 Jan. - 31 Dec. 1978

Kirti N. Ghia and Urmila Ghia Feb. 1979 68 p refs
(Contract F49620-78-C-0041; AF Proj. 2307)
(AD-A078376; AFL-79-2-46; AFOSR-79-1264TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

The primary objective of this two-year research project is to develop a finite-difference numerical technique for the solution of the parabolized Navier-Stokes equations using a system of surface-oriented coordinates suitable for ducts of arbitrary geometry. An additional objective to be fulfilled by this research consists of developing an analysis for laminar duct flow with stream wise separation using mathematical models simpler than the full Navier-Stokes equations. In order to achieve the above objectives, the following three problems have been studied during the first year of the two-year contract period: (1) Laminar Flow through Joukowski ducts, (2) Laminar flow through curved polar ducts, and (3) Analysis of laminar streamwise flow separation via a semi-elliptic mathematical model. In each phase of the research attention is given to the accuracy of the numerical solutions as well as the efficiency with which they can be determined. For this purpose, the following two additonal areas have been studied: (4) Higher accuracy of numerical solutions, and (5) Efficient numerical algorithms. Suitable model problems have been selected wherever required, in this research, with the overall goal of contributing to further the understanding of internal flows in turbomachinery. Each of the above research areas is described in this report. GRA

N80-18345# Brussels Univ. (Belgium). Inst. de Mecanique Appliquee.

THEORETICAL STUDY OF THERMAL LOSSES: THE USE OF HYBRID AND COMBINED DRY COOLANTS [ETUDE DE BASE DES REJETS THERMIQUES: UTILISATION DE REFRIGERANTS SECS, HYBRIDES ET COMBINES]

Andre L. Jaumotte, Pierre Decock, Bernard Leduc, and Philippe Nagel 1978 67 p refs In FRENCH Sponsored by Groupement Ecologique Belge (GEBEG)
(NT-44-1978) Avail: NTIS HC A04/MF A01

After a brief review of techniques used in the disposal of waste heat from electrical power plants, dry coolant systems are cited as a promising solution. Emphasis is placed on the size reduction of cooling towers, on further limiting heat exchanger surfaces by using special cooling fin profiles, and on the introduction of an intermediary cold cycle between the condenser and the coolant (ammonia cycle). Results show that a combined wet tower/dry tower system has short term advantages, especially from a cost effectiveness point of view (reduced ecological impact). Three regions in Belgium are taken as examples of areas that might benefit from this scheme. As a long term solution the use of a condensable fluid (ammonia) with a cold cycle for recuperating thermal energy is suggested. Author (ESA)

N80-18346# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany). Lehrstuhl fuer Angelwandte Mechanik und Stroemungsphysik.

MORPHOLOGICAL AND PHENOMENOLOGICAL STUDY OF THE TRANSFORMATION OF A RING VORTEX COLLIDING WITH AN OBJECT [MORPHOLOGISCH-PHAENOMENOLOGISCHE UNTERSUCHUNG DER UMBILDUNG VON RINGWIRBELN, DIE KOERPER ANSTROEMEN]

Peter E. M. Schneider Apr. 1978 209 p refs In GERMAN
(MPIS-14/1978; ISSN-0436-1199) Avail: NTIS HC A10/MF A01; Max-Planck Inst. fuer Stroemungsforsch., Goettingen, West Germany DM 62.70

Photographic methods were used to study the formation of turbulence caused when one fluid was introduced into another. The experimental conditions and apparatus are described including the geometry of the vortex generator. The influence of the form of the target upon the vortex is shown in the case of spheres, cylinders, screens, and flat plates. Analogies are made between these phenomena and optical reflection. Author (ESA)

N80-18347# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

FORMATIONS AND TRANSFORMATIONS OF A LIQUID STREAM FLOWING IN AIR FROM POLYGONALLY SHAPED NOZZLES [BILDUNG UND UMBILDUNG VON FLUESSIGKEITSSTRAHLEN, DIE DURCH POLYGONFOERMIGE OEFFNUNGEN IN LUFT AUSSTROEMEN]

Georg E. H. Schrader Dec. 1978 175 p refs In GERMAN
(MPIS-28/1978) Avail: NTIS HC A08/MF A01; Max-Planck Inst. fuer Storemungsforsch., Goettingen, West Germany DM 53.90

The formation, persistance, and onset of turbulence and the disappearance of regular stream shapes was studied empirically with photographic techniques. Descriptions of the experimental apparatus are given. Orifice shapes included many geometric forms, symmetric and nonsymmetric as well as slits. Author (ESA)

N80-18348# Association Aeronautique et Astronautique de France, Paris.

THE INFLUENCE OF A HIGH PRESSURE GRADIENT ON UNSTEADY VELOCITY PERTURBATIONS IN THE CASE OF A TURBULENT SUPERSONIC FLOW [INFLUENCE D'UN

FORT GRADIENT DE PRESSION SUR DES PERTURBATIONS INSTATIONNAIRES DE VITESSE CAS D'UN ECOULEMENT TURBULENT SUPERSONIQUE]
J. J. Dussauge and J. F. Debieve Jul. 1979 28 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-10; ISBN-2-7170-0537-4) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

The amplification or reduction of unsteady velocity perturbations under the influence of strong flow acceleration or deceleration is studied. Supersonic flows with large velocity and pressure gradients are examined and the conditions in which the velocity fluctuations depend on the action of the average gradients of pressure and velocity, rather than turbulence, are described. Experimental results obtained on a cylinder positioned parallel to the flow are analyzed statistically and interpreted as a 'return to laminar' process. It is shown that this 'return to laminar' implies negative values in the turbulence production terms for kinetic energy. A simple geometrical representation of the Reynolds stress production is given. It is also shown that in the experimental case the influence of viscous energy dissipation cannot be neglected. Author (ESA)

N80-18349# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
A TURBULENT LAYERS DESCRIPTION OF UNSTEADY TWO DIMENSIONAL FLOW [MODELISATION D'ECOULEMENTS BIDIMENSIONNELS INSTATIONNAIRES PAR DES NAPPES TOURBILLIONNAIRES]
C. Berger Paris Assoc. Aeron. et Astronautique de France 1979 32 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-18; ISBN-2-7170-0545-5) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

The modeling of free layers is examined. It is shown that for computations based on point vortices, models do not adequately describe continuous media flow. Taking into account the continuity of the layer by means of fluid segments allows the elimination of those irregularities and makes it possible to calculate its deformation to a very advanced degree. Examples of Kelvin-Helmholtz instability are presented and compared with the linear theory. This model is then applied to an alternative vortices regime in a flow around a cylinder. The evolution of the pressure distribution on the cylinder is represented adequately by this model. Author (ESA)

N80-18350# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ON THE EVOLUTION, PERSISTANCE, INSTABILITY, REGENERATION AND DISAPPERANCE OF VORTEX RINGS [WERDEN, BESTEHEN, INSTABILITAET, REGENERATION, VERGEHEN EINES RINGWIRBELS]
Peter E. M. Schneider Aug. 1978 178 p refs In GERMAN
(MPIS-17/1978; ISSN-0436-1199) Avail: NTIS HC A09/MF A01

A detailed description was made of the successive phases occuring during the evolution of vortex rings in a fluid. Theoretical conditions of stability and instability are studied in connection with variations in energy. An analogy is made with acoustical and luminous phenomena. Author (ESA)

N80-18351# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
SPONTANEOUS LIQUEFACTION IN RETROGRADE FLUIDS UNDER CONDENSATION SHOCK WAVES [SPONTANE KONDENSATION RETROGRADER GASE DURCH VERDICHTUNGSSTOESSE]
Hans-Dieter Speckmann Oct. 1978 91 p refs In GERMAN
(MPIS-21/1978; ISSN-0436-1199) Avail: NTIS HC A05/MF A01

A theoretical review of the conditions for partial and total liquefaction of a saturated vapor under the effect of an isentropic compression is presented, and a shock tube was examined with several gases to develop observational techniques. These involved the use of the phenomenon of extinction of laser light in place of photographic techniques. Author (ESA)

N80-18352# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ENVIRONMENTAL STUDY OF THE INTERACTION OF TWO VORTEX RINGS HAVING THE SAME AXIS OF SYMMETRY [EXPERIMENTELLE UNTERSUCHUNG DER WECHSELWIRKUNG ZWEIER RINGWIRBEL MIT GEMEINSAMER SYMMETRIEACHSE]
Hans-Heinrich Claus Nov. 1979 88 p refs In GERMAN
(MPIS-26/1978) Avail: NTIS HC A05/MF A01

Observations were made of two vortex rings produced by the same orifice, in the case where one overtakes the other. The relationship between the initial speeds (in a fluid) determines whether the rings coalesce or whether one passes the other. The resulting energy exchange is studied, and comparisons are made with theoretical calculations. Author (ESA)

N80-18353# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.
COMPARISON OF SEVERAL FINITE DIFFERENCE SCHEMES FOR TIME MARCHING METHODS AS APPLIED TO ONE DIMENSIONAL NOZZLE FLOW
W. vanHove and A. Arts Jun. 1979 51 p refs
(VKI-TN-132) Avail: NTIS HC A04/MF A01

One dimensional, inviscid, transonic flow with shock through a convergent divergent nozzle was used as a test case to compare several explicit finite difference schemes for time marching methods. The comparison was carried out both theoretically and numerically, and accounted for stability conditions and convergence speed. Additional means to improve the convergence of time marching methods are also discussed. Author (ESA)

N80-18354# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
PERTURBATION SOLUTIONS FOR BLAST WAVES IN A LOW DENSITY GAS
S. Srinivasan Aug. 1978 46 p refs
(VTH-LR-263) Avail: NTIS HC A03/MF A01

A solution for the propagation of blast waves in a low density gas, in which a virial power expansion in terms of the parameter lambda representing the product of the internal volume of the molecules which is assumed to be constant and the initial gas density is used in the equation of state, is presented. Analytical expressions are obtained by means of a perturbation technique showing the dependence of pressure, density, and gas velocity on the distance from the origin of the explosion and the distance of the shock front. The influence of the parameter lambda on the flow field and temperature distributions is studied at different stages of the explosion process. Shock velocity variations with the shock propagation distance and shock trajectories are also determined. A comparison is made with ideal gas solutions. It is found in a significant temperature drop near the origin. Author (ESA)

N80-18355# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
NON-UNIFORM PROPAGATION OF CYLINDRICAL SHOCKS AND DETONATIONS
S. Srinivasan Aug. 1978 39 p refs
(VTH-LR-264) Avail: NTIS HC A03/MF A01

Nonuniform propagation of diverging cylindrical shocks and detonations are considered. The nonsimilar effects due to counter pressure are accounted for in the case of shocks. For overdriven detonations, the nonsimilar effect due to heat release at the wave front is taken into account. Detailed flow patterns and characteristic properties are presented for these two situations. Author (ESA)

N80-18356# Research Inst. of National Defence, Stockholm (Sweden).
MODEL FOR THE FRONT PROPAGATION IN A DETONATING GAS
Sven Wahlborn and Hjoerdis Celander Sep. 1978 30 p refs
(FOA-C-20323-D6(D8)) Avail: NTIS HC A03/MF A01

The general laws for the propagation of an explosion wave in a perfect gas are presented and reformulated in a pair of characteristic equations. The solutions of these equations are discussed for nonsteady detonation processes where the front speed (U) is allowed to vary in a regular fashion with front

location (R). In a simplified model, governed essentially by the Hugoniot conditions and overall energy conservation, an explicit relation between U and R is derived for a strong detonation (spherical case). This model is applied to unconfined divergent detonation and to laser driven detonation. Conclusions are drawn about the qualitative validity of the model and the initiation criteria for the processes considered. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-18357* National Aeronautics and Space Administration. Pasadena Office, Calif.
VISCOSITY MEASURING INSTRUMENT Patent
Samuel P. Feinstein, inventor (to NASA) (JPL) Issued 29 Jan. 1980 6 p Filed 23 Jun. 1978 Supersedes N78-27385 (16 - 18, p 2390) Sponsored by NASA
(NASA-Case-NPO-14501-1; US-Patent-4,185,493; US-Patent-Appl-SN-918535; US-Patent-Class-73-56; US-Patent-Class-73-343R; US-Patent-Class-264-40.4) Avail: US Patent and Trademark Office CSCL 14B

A method and apparatus are provided for enabling the measurement of the viscosity of substances, especially those containing volatiles at elevated temperatures, with greater accuracy and at less cost than before. The apparatus includes a cylinder with a narrow exit opening at one end and a piston which closely slides within the cylinder to apply force against a sample in the cylinder to force the sample through the exit opening. In order to more rapidly heat a sample the ends of the cylinder and piston are tapered and the sample is correspondingly tapered, to provide a large surface to volume ratio. A corresponding coal sample is formed by compressing particles of coal under high pressure in a mold of appropriate shape.
Official Gazette of the U.S. Patent and Trademark Office

N80-18358* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC PRESSURE ORIFICE SYSTEM TESTING METHOD AND APPARATUS Patent
Randolph F. Culotta and Donald L. Posey, inventors (to NASA) Issued 8 Jan. 1980 7 p Filed 17 Aug. 1978 Supersedes N78-33123 (16 - 24, 3179)
(NASA-Case-LAR-12269-1; US-Patent-4,182,158; US-Patent-Appl-SN-934576; US-Patent-Class-73-40; US-Patent-Class-73-4R) Avail: U.S. Patent and Trademark Office CSCL 14B

A method and apparatus are presented for pressure testing the static pressure orifices and associated connections used in wind tunnels. A cylindrical module, having in one end an open hemispherical calibration pressure chamber separated from and surrounded by an annular vacuum chamber is placed over the orifice of the system to be tested. O-rings ensure seating and a vacuum seal between the chambered end of the module and the surface around the orifice: one O-ring separates the outer chamber from the outside environment. Ports lead from each of the chambers out the other end of the module to tubes connected to a control box consisting of calibration pressure and vacuum supply lines, bleeder valves, and gauges.
Official Gazette of the U.S. Patent and Trademark Office

N80-18359* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISTRIBUTED-SWITCH DICKE RADIOMETERS Patent
Curt A. Levis, inventor (to NASA) (Ohio State Univ., Columbus) Issued 11 Dec. 1979 7 p Filed 29 Mar. 1978 Supersedes N78-22436 (16 - 13, p 1714) Sponsored by NASA
(NASA-Case-GSC-12219-1; US-Patent-4,178,100; US-Patent-Appl-SN-891356; US-Patent-Class-356-216; US-Patent-Class-325-363; US-Patent-Class-343-100ME; US-Patent-Class-73-355R) Avail: U.S. Patent and Trademark Office CSCL 14B

A radiometer on an orbiting spacecraft is described which derives high spatial resolution information from terrestrial and atmospheric regions. The N elements or subapertures on the spacecraft transduce electromagnetic energy into electric signals. Many or all of the elements are simultaneously illuminated by electromagnetic energy radiated from the same region. Identical, parallel processing channels are responsive to the N elements. Each of the channels includes a variable gain amplifier responsive to the signal transduced by its corresponding array elements. The gain of each amplifier is controlled as a function of the output difference when the channel is connected periodically to each of a pair of Dicke noise sources, such as resistors maintained at predetermined temperatures.
Official Gazette of the U.S. Patent and Trademark Office

N80-18360*# University of Southern Mississippi, Hattiesburg.
DECONVOLUTION OF GAS CHROMATOGRAPHIC DATA Final Report
Samuel Howard and Grayson H. Rayborn Feb. 1980 79 p refs
(Contract NsG-1380)
(NASA-CR-3229) Avail: NTIS HC A05/MF A01 CSCL 07D

The use of deconvolution methods on gas chromatographic data to obtain an accurate determination of the relative amounts of each material present by mathematically separating the merged peaks is discussed. Data were obtained on a gas chromatograph with a flame ionization detector. Chromatograms of five xylenes with differing degrees of separation were generated by varying the column temperature at selected rates. The merged peaks were then successfully separated by deconvolution. The concept of function continuation in the frequency domain was introduced in striving to reach the theoretical limit of accuracy, but proved to be only partially successful. R.C.T.

N80-18361*# Santa Barbara Research Center, Goleta, Calif.
InSb CHARGE COUPLED INFRARED IMAGING DEVICE: THE 20 ELEMENT LINEAR IMAGER Final Report
R. D. Thom, T. L. Koch, W. J. Parrish, J. D. Langan, and S. C. Chase Feb. 1980 140 p refs
(NASA-CR-3235) Avail. NTIS HC A07/MF A01 CSCL 14B

The design and fabrication of the 8585 InSb charge coupled infrared imaging device (CCIRID) chip are reported. The InSb material characteristics are described along with mask and process modifications. Test results for the 2- and 20-element CCIRID's are discussed, including gate oxide characteristics, charge transfer efficiency, optical mode of operation, and development of the surface potential diagram. K.L.

N80-18362*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF AND MEANS FOR RETARDING DYE FADING DURING ARCHIVAL STORAGE OF DEVELOPED COLOR PHOTOGRAPHIC FILM Patent Application
Richard B. Hoover and Charles M. Rhodes, inventors (to NASA) Filed 7 Feb. 1980 8 p
(NASA-Case-MFS-23250-1; US-Patent-Appl-SN-119340) Avail: NTIS HC A02/MF A01 CSCL 14E

A method for retarding dye fading of developed color photographic film is described. Fading is accomplished by placing the film in a sealed, opaque vault; introducing a dry, pressurized inert gas into the vault while the latter is vented; and sealing the vault after the air within the vault has been purged and replaced by the inert gas. Preferably, the gas is nitrogen; and the vault is stored at a temperature below room temperature to preserve the color photographic emulsions on the film contained within the vault. For short term storage, sodium thiocyanate pads charged with water are placed within the vault. For long term storage, the interior of the vault is kept at a low relative humidity. NASA

N80-18363*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIQUID-IMMERSIBLE ELECTROSTATIC ULTRASONIC TRANSDUCER Patent Application
John H. Cantrell, Jr., Joseph S. Heyman, William T. Yost

(Tennessee Univ.), Michael A. Torbett (Tennessee Univ.), and Mark A. Breazeale, inventors (to NASA) (Tennessee Univ.) Filed 21 Dec. 1979 12 p
(NASA-Case-LAR-12465-1; US-Patent-Appl-SN-106136) Avail: NTIS HC A02/MF A01 CSCL 14B

A broadband megahertz range electrostatic acoustic transducer for use in a liquid environment is described. A liquid-tight enclosure which includes a metallic conducting membrane as part of its outside surface has a means inside the liquid-tight enclosure for applying a tension to the membrane and for mounting an electrode with the flat end approximately parallel to the membrane. A structure for ensuring that the membrane and the flat end of the electrode are exactly parallel and a fixed predetermined distance from each other is included. NASA

N80-18364*# National Aeronautics and Space Administration. Pasadena Office, Calif.
FREQUENCY-SCANNING PARTICLE SIZE SPECTROMETER Patent Application
Alain L. Fymat, inventor (to NASA) (JPL) Filed 10 Aug. 1979 21 p
(Contract NAS7-100)
(NASA-Case-NPO-13606-2; US-Patent-Appl-SN-065676) Avail: NTIS HC A02/MF A01 CSCL 14B

A particle size spectrometer having a fixed field of view within the forward light scattering cone at an angle theta sub s between approximately 100 and 200 minutes of arc (preferably at 150 minutes), a spectral range extending approximately from 0.2 to 4.0 inverse micrometers, and a spectral resolution between about 0.1 and 0.2 inverse micrometers (preferably toward the lower end of this range of spectral resolution), is employed to determine the distribution of particle sizes, independently of the chemical composition of the particles, from measurements of incident light, at each frequency, sigma (= 1/lambda), and scattered light, I(sigma). NASA

N80-18365*# M&S Computing, Inc., Huntsville, Ala.
THE IDENTIFICATION AND CORRECTION OF CHANNEL-TO-CHANNEL PHASE DIFFERENCES WITHIN A DATA PROCESSING SYSTEM Final Report
Hubert M. Horton 2 Jan. 1980 34 p refs
(Contract NAS8-31004)
(Rept-79-077; NASA-CR-161377) Avail: NTIS HC A03/MF A01 CSCL 14C

Data processing hardware was tested in order to determine the sources of channel time delay differences and mathematically characterize the differences. A procedure developed to detect and correct these delay differences was subjected to test data in order to verify its capability. Test results are presented. K.L.

N80-18366*# Energetics Science, Inc., Elmsford, N. Y.
TOXIC LEVEL HYPERGOLIC VAPOR DETECTION SENDOR DEVELOPMENT Final Report
Joseph R. Stetter, Ying-Kit Lau, and Raymond B. Cromer 28 Nov. 1979 116 p
(Contract NAS10-9492)
(NASA-CR-154633; KSC-TR-28-1) Avail: NTIS HC A06/MF A01 CSCL 14B

Development of an electrochemical sensor technology capable of PPB level hypergolic vapor sensing is reported. A portable instrument capable of meeting the design goals is described. J.M.S.

N80-18367*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INFRARED SCANNER CONCEPT VERIFICATION TEST REPORT
F. D. Bachtel Jan. 1980 66 p
(NASA-TM-78264) Avail: NTIS HC A04/MF A01 CSCL 14B

The test results from a concept verification test conducted to assess the use of an infrared scanner as a remote temperature sensing device for the space shuttle program are presented. The temperature and geometric resolution limits, atmospheric attenuation effects including conditions with fog and rain, and the problem of surface emissivity variations are included. It is concluded that the basic concept of using an infrared scanner to determine near freezing surface temperatures is feasible. The major problem identified is concerned with infrared reflections which result in significant errors if not controlled. Action taken to manage these errors result in design and operational constraints to control the viewing angle and surface emissivity. R.C.T.

N80-18368*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIBER OPTIC SENSORS FOR MEASURING ANGULAR POSITION AND ROTATIONAL SPEED
Robert J. Baumbick Mar. 1980 13 p
(NASA-TM-81454; E-381) Avail: NTIS HC A02/MF A01 CSCL 20F

Two optical sensors, a 360 deg rotary encoder and a tachometer, were built for operation with the light source and detectors located remotely from the sensors. The source and detectors were coupled to the passive sensing heads through 3.65 meter fiber optic cables. The rotary encoder and tachometer were subjected to limited environmental testing. They were installed on an air breathing engine during recent altitude tests. Over 100 hours of engine operation were accumulated without any failure of either device. K.L.

N80-18369# Aeronautical Research Labs., Melbourne (Australia).
SPECIFICATION FOR THE INSTALLATION OF ELECTRICAL RESISTANCE STRAIN GAUGES ON STRAIN PAIRS COUNTER AIRCRAFT
S. W. Gee Mar. 1979 13 p
(AD-A071363; ARL/Struc-TM-301) Avail: NTIS HC A02/MF A01 CSCL 14/2

A number of RAAF aircraft are to be strain gauged as part of a program designed to monitor the in-flight fatigue damage accumulated by service aircraft during normal squadron usage. Flight strains are to be measured by gauges, strategically placed on the structure and monitored by strain pairs counters. The materials and methods of application recommended in this memo, have been successfully used for flight trials over several years and have proved very reliable. Any deviations from the suggested methods should be thoroughly checked before use on the aircraft. GRA

N80-18370# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
GIMBAL PICKOFF TECHNOLOGICAL STUDIES
Aubrey Rodgers Aug. 1979 22 p refs
(AD-A076372; DRSMI-T-79-81) Avail: NTIS HC A02/MF A01 CSCL 17/7

The purpose of this study and analysis is to employ more sophisticated gyro gimbal pickoff component technology to replace existing pickoff designs. The existing wide gyro pickoffs experience gimbal wiring and slipring torques, potentiometer wiper lift off during flight environment, noise, increased friction, and assembly cost. The goals of this study are to gain a better understanding of the pickoff error mechanism and to utilize the major advances in component development, materials, and manufacturing techniques as applicability to the design of inertial instruments. GRA

N80-18371# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
CONSTRUCTION OF A HIGH RESOLUTION HETERODYNE SPECTROMETER FOR MEASUREMENTS OF IN LINE PROFILES MEDIUM INFRARED [AUFBAU EINES HOCHAUFLOESENDEN HETERODYN-SPEKTROMETERS ZUR MESSUNG VON LINIENPROFILEN IM MITTLEREN INFRA-ROT-BEREICH]
Klaus-Uwe Dettmar May 1979 89 p refs In GERMAN
(MPI-PAE/Extraterr-156; ISSN-0340-8922) Avail: NTIS HC A05/MF A01

The instrument uses a CO2 laser and electric filters to provide a resolution up to 10 to the minus 7th power, and higher sensitivity. The apparatus contains a frequency mixer and employs the laser light like a local oscillator. Measurements taken with acetylene indicate that the instrument will provide useful spectra for work with planetary atmospheres. Author (ESA)

N80-18216 Pacific Missile Test Center, Point Mugu, Calif.
AUTOMATIC ENVIRONMENTAL CONTROL SYSTEM FOR MISSION PROFILE TESTING

Robert Schilken *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 15-23 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18217 Harris Corp., Melbourne, Fla. Electronic Systems Div.
BROAD-BAND MECHANICAL VIBRATION AMPLIFIER
R. T. Fandrich *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 25-31 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18218 Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
STABILITY AND FREQUENCY RESPONSE OF HYDRO-MECHANICAL SHAKERS IN VIBRATION RIGS
T. Seshadri Sankar *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 33-47 refs Sponsored by the Natl. Res. Council of Canada and the Formation de Chercheurs et d'Action Contertee (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18219 Harris Corp., Melbourne, Fla. Electronic Systems Div.
MIL-STD-781C RANDOM RELIABILITY TESTING PERFORMED BY USING ACOUSTIC COUPLING
S. M. Landre *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 49-56 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18222 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ANGULAR VIBRATION MEASUREMENT TECHNIQUES
P. Wayne Whaley and Michael W. Obal *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 83-93 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18225 Sandia Labs., Albuquerque, N. Mex.
A NON-CONTRACTING BETA BACKSCATTER GAGE FOR EXPLOSIVE QUANTITY MEASUREMENT
P. B. Higgins, F. H. Mathews, and R. A. Benham *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 113-126 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18226 Air Force Weapons Lab., Kirtland AFB, N. Mex. Civil Engineering Research Div.
DATA ACQUISITION FOR THE IMMEDIATE FUTURE
Josef F. Schneider *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 127-137 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-18372* National Aeronautics and Space Administration. Pasadena Office, Calif.
DIELECTRIC-LOADED WAVEGUIDE CIRCULATOR FOR CRYOGENICALLY COOLED AND CASCADED MASER WAVEGUIDE STRUCTURES Patent
Robert C. Clauss (JPL) and Rex B. Quinn, inventors (to NASA) (JPL) Issued 5 Feb. 1980 6 p Filed 9 Feb. 1978 Supersedes N78-22359 (16 - 13, p 1703) Sponsored by NASA
(NASA-Case-NPO-14254-1; US-Patent-4,187,470;
US-Patent-Appl-SN-876432; US-Patent-Class-330-4;
US-Patent-Class-331-94; US-Patent-Class-333-24R) Avail: US Patent and Trademark Office CSCL 20E

A dielectrically loaded four port waveguide circulator is used with a reflected wave maser connected to a second port between first and third ports to form one of a plurality of cascaded maser waveguide structures. The fourth port is connected to a waveguide loaded with microwave energy absorbing material. The third (output signal) port of one maser waveguide structure is connected by a waveguide loaded with dielectric material to the first (input) port of an adjacent maser waveguide structure, and the second port is connected to a reflected wave maser by a matching transformer which passes the signal to be amplified into and out of the reflected wavemaser and blocks pumping energy in the reflected wave maser from entering the circulator. A number of cascaded maser waveguide structures are thus housed in a relatively small volume of conductive material placed within a cryogenically cooled magnet assembly.
Official Gazette of the U.S. Patent and Trademark Office

N80-18373 California Univ., San Diego.
NECESSARY CONDITIONS FOR THE HOMOGENEOUS FORMATION OF A VOLUME AVALANCHE DISCHARGE WITH SPECIFIC APPLICATIONS TO RARE GAS-HALIDE EXCIMER LASER DISCHARGES Ph.D. Thesis
Jeffrey Ian Levatter 1979 153 p
Avail: Univ. Microfilms Order No. 8002939

The phenomena involved in high E/n (electric field to gas number density ratio) breakdown and its relationship to the formation of spatially homogeneous discharges is considered. Assuming uniform field electrodes with no edge effects, the minimum preionization density required for homogeneous discharge initiation is found to depend on the voltage rise time across the electrodes as well as on the total gas pressure and various electrochemical properties of the gas mixture. A large volume avalanche dicharge laser was constructed which employs an 1 X-ray preionization scheme to obtain the required spatially uniform volume preionization. Using X-rays as an ionizing agent, spatially homogeneous pulsed avalanche discharges of several liter volume at several atmosphere pressure for up to 100-nesec duration were successfully generated. In concurrent laser generation experiments, high-optical-quality pulsed UV laser output up to 2.5 J/liter from such discharges in rare gas/halogen mixtures, and ir laser output of up to 12.5 J/liter from a He/N2/CO2 mixture were observed. Dissert. Abstr.

N80-18374 Texas A&M Univ., College Station.
EXCITED STATES OF RUBIDIUM POPULATED BY STEP-WISE EXCITATION USING A RUBIDIUM LAMP AND/OR A TUNABLE DYE LASER: IMPORTANCE OF REDISTRIBUTION COLLISIONS Ph.D. Thesis
Ralph Henry Hill, Jr. 1979 133 p
Avail: Univ. Microfilms Order No. 8003147

Excited states of rubidium were populated by using a stepwise excitation scheme. The first step is either a transition to an atomic intermediate state using a rubidium resonance lamp, or a transition to a molecular intermediate state using a laser as the excitation source. The second step in both cases is accomplished using a laser to populate high states in the rubidium atom. Two different commercial lasers were used and the results were compared. One laser is a single mode laser whereas the other is a multimode laser. Once the excited states are populated, the importance of collisions with ground state rubidium atoms is investigated. Angular momentum changing collision cross sections are investigated. Dissert. Abstr.

N80-18375 Illinois Univ. at Urbana-Champaign.
LASER MELTING AND SUBSEQUENT SOLIDIFICATION OF A SURFACE LAYER Ph.D. Thesis
Shin-Chen Hsu 1979 224 p
Avail: Univ. Microfilms Order No. 8004193

The effect of stationary and moving high intensity heat fluxes, achieved by laser or electron beam radiation, on the surface melting and subsequent solidification variables of metallic substrates was investigated. The problems considered are the rapid melting and solidification of the surface layer of a semi-infinite solid subjected to: (1) step function stationary uniform heat flux over a circular region on its bounding surface when heat flow conditions are almost unidirectional; (2) step function stationary uniform and Gaussian heat flux distributions over a circular region on its bounding surface when heat flow is two-dimensional; and (3) uniform and Gaussian heat flux distributions over a circular region on its bounding surface moving

with a constant velocity, U, in the y-direction. Microstructural observations made on an Al-4.5% Cu alloy substrate are described and the findings are compared with the general trends established in the quasisteady state moving flux calculations. Dissert. Abstr.

N80-18376 State Univ. of New York at Stony Brook.
STUDIES IN ONE BEAM LASER SPECKLE INTERFEROMETRY Ph.D. Thesis
Gopal Krishan Jaisingh 1979 215 p
Avail: Univ. Microfilms Order No. 8004408

Topics covered include: (1) the motion of subjective speckles; (2) the upper bound of the one beam method; (3) the effects of an axial movement of the filtering aperture from its usual Fourier plane position on the wholefield filtering method; (4) a technique to determine surface contours of three dimensional objects; (5) a method to determine in-plane and out of plane displacement of a surface simultaneously by combining the one beam speckle method with projection moire; (6) determining displacements at the interior of three dimensional transparent objects using speckles produced by the scattered laser light; (7) fringe sharpening and (8) extension of the two beam method to three beams. Dissert. Abstr.

N80-18377 Illinois Univ. at Urbana-Champaign.
MULTIPHOTON CONTRIBUTIONS TO FAR INFRARED GENERATION IN OPTICALLY PUMPED DEUTERIUM OXIDE Ph.D. Thesis
Samuel Judah Petuchowski 1979 172 p
Avail: Univ. Microfilms Order No. 8004253

Far infrared (FIR) emission at 66 and 50 microns in D2O vapor, optically pumped with a CO2 TEA laser, is shown to constitute a stimulated Raman process associated with each wave within a system of four molecular vibrational-rotational levels. A propagation model, based on a semiclassical, quasistatic density matrix analysis, is constructed and applied to the system. The model is generalized to include one-, two-, and three-wave interactions among three near-resonant waves of arbitrary intensity in a variety of four-level system configurations. Agreement between the model calculations and empirical data is shown with respect both to FIR temporal behavior and to 66 micron pulse energy vs. D2O pressure and pump intensity. Explicit account is taken of inhomogeneous broadening of the pump transition at lower D2O pressures. Various hypotheses are considered to explain the singular failure of the model to account for the observed 50 micron intensity. Dissert. Abstr.

N80-18378# Illinois Univ., Urbana. Aeronomy Lab.
A MICROCOMPUTER CONTROL SYSTEM FOR THE URBANA SODIUM LIDAR
K. Teitelbaum and C. F. Secorist, Jr. 1 Jun. 1979 131 p
(Grant NSF ATM-78-12308)
(UILU-ENG-79-2507; ISSN-0508-0581; Aeronomy-88) Avail: NTIS HC A07/MF A01

The design, fabrication, and testing of a microcomputer control system for the Urbana lidar is described. Calibration of the lidar system against Rayleigh scattering returns is considered, and altitude profile of the mesospheric sodium concentration is presented. R.C.T.

N80-18379# Materials Research Labs., Melbourne (Australia).
A 30-kW CO2 MIXING LASER
Ross C. McLeary, Russell E. Whitcher, and Peter J. Beckwith Jun. 1979 22 p refs
(MRL-R-751; AR-001-830) Avail: NTIS HC A03/MF A01

A convectively cooled, continuous wave mixing laser is described which is simple, robust, and reliable, and can be manufactured in a workshop with standard machining facilities. High pressure discharges are stabilized by pre-ionizing the gas flow by passing it through an array of subsidiary arc discharges. Flowing nitrogen, at a pressure of 120 kPa is electrically excited before passing through a restriction into a region of high pressure (20 kPa), where it is mixed with CO2. A small quantity of helium is added to depopulate the lower laser level and the optical power is extracted by means of a resonator situated downstream of the mixing system. The laser is operated in a blow down mode in which the gases are initially stored in pressure vessels and subsequently flow through the laser into a vacuum task. The plasma injection technique produced a laser with an output power of 30 kW at an efficiency rate of 9 percent. A.R.H.

N80-18380*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LASER MEASURING SYSTEM FOR INCREMENTAL ASSEMBLIES Patent Application
James A. Munford and John G. Etzel, inventors (to NASA) Filed 7 Dec. 1979 14 p
(NASA-Case-GSC-12321-1; US-Patent-Appl-SN-102001) Avail: NTIS HC A02/MF A01 CSCL 20E

Incremental assemblies such as wire-wrapped frame assemblies used in spark chambers and the like are precisely measured using a system which includes a laser, an interferometer, and a retroreflector. A light source and a photodetector are located adjacent to the incremental assembly and mounted on a movable carriage. The interferometer is also mounted on the movable carriage, while the laser and retroreflector are positioned at either end of the carriage track. The carriage is moved along one edge of the incremental assembly between the retroreflector and the laser, and as the carriage is moved, the light from the light source to the photodetector is interrupted. This produces a trigger command to a control unit which in turn causes a distance measurement to be made. A printout is provided for each sampling trigger command to list such items as ideal position, actual position and amount of error. NASA

N80-18381*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH POWER METALLIC HALIDE LASER Patent Application
Thomas J. Pivirotto, inventor (to NASA) (JPL) Filed 7 Feb. 1980 19 p
(Contract NAS7-100)
(NASA-Case-NPO-14782-1; US-Patent-Appl-SN-119339) Avail: NTIS HC A02/MF A01 CSCL 20E

A high power metallic halide (CU3C13) laser capable of providing 300 watts of output power is disclosed. More specifically it is a laser amplification system and a heat exchanger in a closed loop system. In addition, a molecular dissociation apparatus is provided at the input to the laser amplifier for dissociating the copper chloride into copper atoms and ions and chlorine atoms and ions. The dissociation apparatus includes a hollow cathode tube and an annular ring spaced apart from the tube end. A voltage differential is applied between the annular ring and the hollow cathode tube so that as the copper chloride flows therethrough, it is dissociated into copper and chlorine ions and atoms. NASA

N80-18382*# Airborne Instruments Lab., Melville, N. Y.
APPLICATION OF TUNABLE DIODE LASERS AS LOCAL OSCILLATORS IN AN INFRARED HETERODYNE RADIOMETER (IHR) Final Report
M. G. Savage, R. C. Augeri, and B. J. Peyton Dec. 1979 95 p refs
(Contract NAS1-14362)
(NASA-CR-159121) Avail: NTIS HC A05/MF A01 CSCL 20E

The utility of diode lasers as local oscillators (LOs) in a heterodyne receiver application was investigated. The CW power, spectral tunability, spectral stability, and spatial intensity distribution of the TDL outputs were measured. A tunable diode laser LO was incorporated into a laboratory Dicke-switched infrared heterodyne setup and used to measure radiometer sensitivity as well as spectroscopic characteristics of selected absorption lines of ammonia. The test results on one of the two tunable diode lasers are emphasized in an attempt to provide a comprehensive data package which may be useful for future planning purposes. The second tunable diode laser exhibits characteristics similar to the fully tested TDL with the exception that some changes in its performance characteristics as it was temperature cycled between room temperature and the operating temperature of approximately 50K occurred. A.R.H.

N80-18383*# Old Dominion Univ., Norfolk, Va. Dept. of Physics.
TUNABLE DIODE LASER HETERODYNE RADIOMETER MEASUREMENT OF ATMOSPHERIC ABSORPTION OF

SOLAR RADIATION Final Report, 15 Oct. 1977 - 14 Dec. 1979
Charles N. Harward and Gary E. Copeland Mar. 1980 55 p refs
(Grant NsG-1466)
(NASA-CR-162827; PTR-80-3) Avail: NTIS HC A04/MF A01 CSCL 20E

A tunable infrared heterodyne radiometer (TIHR) which uses a diode laser as the local oscillator is described as well as methods for the evaluation of the excess noise characteristics of the tunable diode laser. Preliminary atmospheric absorption data taken with the TIHR are presented and show the capability of the TIHR for making the highest resolution atmospheric measurements to date. A.R.H.

N80-18384# JAYCOR, Alexandria, Va.
THE NON-LINEAR THEORY OF FREE ELECTRON LASERS AND EFFICIENCY ENHANCEMENT
P. Sprangle, Cha-Mfi Tang, and W. M. Manheimer Washington, D.C. Wave Research Lab. 28 Sep. 1979 54 p refs
(DARPA Order 3817; RR011941)
(AD-A075063; NRL-MR-4034) Avail: NTIS HC A04/MF A01 CSCL 20/5

The development of lasers in which the active medium is a relativistic stream of free electrons has recently evoked much interest. The potential advantages of such free electron lasers include, among other things, continuous frequency tunability, very high power of operations and high efficiency. The free electron laser is characterized by a pump field: for example, a spatially periodic magnetic field, which scatters from a relativistic electron beam. The scattered radiation has a wavelength much smaller than the pump wavelength depending on the electron beam energy. We present a general self-consistent non-linear theory of the free electron laser process. The non-linear formulation of the temporal steady state free electron laser problem results in a set of coupled differential equations governing the spatial evolution of the amplitudes and wavelength of the radiation and space charge fields. These equations are readily solved numerically since the amplitude and wavelength vary on a spatial scale which is comparable to a growth length of the output radiation. A number of numerical/analytical illustrations are presented ranging from the optical to the submillimeter wavelength regime. Our non-linear formulation in the linear regime is compared with linear theory and agreement is found to be excellent. Analytical expressions for the saturated efficiency and radiation amplitude are also shown to be in very good agreement without non-linear numerical solutions. Efficiency curves are obtained for both the optical and submillimeter FEL examples with fixed magnetic pump parameters. We show that these intrinsic efficiencies can be greatly enhanced by appropriately contouring the magnetic pump period. GRA

N80-18385# Defence Research Establishment Valcartier (Quebec).
PERFORMANCE AND DIAGNOSTICS OF LASERS INITIATED BY THE REACTION OF NO WITH ClO2
S. J. Arnold, K. D. Foster, and D. R. Snelling Sep. 1979 25 p refs
(AD-A076010; DREV-R-4144/79) Avail: NTIS HC A02/MF A01 CSCL 20/5

A purely chemical HCl laser employing transverse flow was operated with a maximum multiline output power of 13 W, which represents a chemical efficiency of 8.6% based on the total exothermicity of the pumping reaction. The required nonequilibrium concentration on Cl atoms was generated by the branched-chain reaction of NO with ClO2. Mass spectrometric and absorption spectroscopic measurements of species concentrations in the NO/ClO2 reaction system showed that the effectiveness of production of the branched chain decreased with increasing total pressure. GRA

N80-18386# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
CHEMICAL LASER SYSTEMS: AN ENGINEERING APPROACH. VOLUME 1: CHEMICAL LASER ANALYSIS PROGRAM
Clark D. Mikkelsen and Billy J. Walker 31 Jan. 1979 321 p
(DA Proj. 1L1-61102-AH-49)
(AD-A075476; DRSMI-T-79-24-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 20/5

The Chemical Laser Analysis Program presented in this report is a computer program for the rapid, parametric evaluation of high energy, chemical laser systems, including the combustion chemistry, laser devices gas dynamics, various diffuser-ejector pressure recovery subsystems, and system volume/mass estimates. The program does not calculate specific laser power but relies on experimental data for scaling information. The FORTRAN EXTENDED computer program listing, as well as detailed information on program development, organization, and operating procedure are given along with a complete program nomenclature and two sample cases. GRA

N80-18387# Naval Research Lab., Washington, D. C. Plasma Physics Div.
METHODS OF EFFICIENCY ENHANCEMENT AND SCALING FOR THE GYROTRON OSCILLATOR Interim Report
K. R. Chu, M. E. Read, and A. K. Ganguly Sep. 1979 29 p refs
(Contract DE-AC01-79ET-52053)
(AD-A075133; NRL-MR-4051) Avail: NTIS HC A03/MF A01 CSCL 20/5

It is shown that a gyrotron oscillator operating in a slightly tapered magnetic field can attain an efficiency of about 78%, approximately 1.7 times higher than that obtainable in a constant magnetic field. Extensive numerical data have been tabulated and a convenient parameter is introduced to generate numerical efficiency scaling relations through which optimum operating conditions are clearly exhibited. Conditions for reaching the high efficiency operating regime have also been studied and are numerically illustrated. GRA

N80-18388# Avco-Everett Research Lab., Mass.
FLAMEOUT AND ACOUSTIC DAMPING IN PULSED CHEMICAL LASERS Final Report
R. Limpaecher Jun. 1979 143 p refs
(Contract N00173-76-C-0162; DARPA Order 3016)
(AD-A076124) Avail: NTIS HC A07/MF A01 CSCL 20/5

The objective of this program was to address the acoustic damping issue of a repetitively-pulsed atmospheric pressure pulsed chemical laser. For this purpose a device, one meter in size parallel to the optical axis, was designed and constructed. To achieve flameout 80 fluidic devices were used to control the hydrogen flow. A new mixer was fabricated to obtain the required medium quality using a photochemical machining technique. For the acoustic quieting a heat exchanger was used to reduce the acoustic reflection of the hot-cold gas interfaces, and a muffler type acoustic absorber was constructed for acoustic energy attenuation. The results of a limited test period have been described. GRA

N80-18389# Michigan Univ., Ann Arbor. College of Engineering.
THEORETICAL STUDIES OF LASER LIGHT INTERACTION AND OPTICAL AND X-RAY EMISSION FROM DENSE METALLIC PLASMAS Final Report, 1 Aug. 1975 - 1 Oct. 1979
J. J. Duderstadt and R. S. B. Ong Nov. 1979 55 p refs
(Grant AF-AFOSR-2904-76; AF Proj. 2301)
(AD-A078664; AFOSR-79-1303TR) Avail: NTIS HC A04/MF A01

The interaction of a high power CO2 laser with a dense plasma is investigated. Stimulated Brillouin scattering and thermal self-focusing of the incident beam is studied. The dynamics of a strongly turbulent plasma generated by laser-plasma interaction, and the behavior of nonlinear waves (solitons) in the plasma is analyzed. Advanced MHD plasma simulation models are employed to study the complex dynamics of nonequilibrium plasmas interacting with laser radiation. MHD computer codes capable of simulating exploding wire or pinch dynamics subjected to intense laser irradiation are developed. Radiation transport effects, such as X-ray line emission and re-absorption in optically thick regions of the plasma, are incorporated in the MHD computer code. GRA

N80-18390# Avco-Everett Research Lab., Mass.
INVESTIGATION OF OPTIMUM LASER PUMPING Final

Report, 15 Aug. 1974 - 31 Jul. 1979
J. H. Jacob, R. Brochu, A. Hawryluk, J. Hsia, and M. Rokni
Nov. 1979 95 p refs
(Contract N00014-75-C-0062; DARPA Order 3500)
(AD-A078974) Avail: NTIS HC A05/MF A01 CSCL 20/5

The objective of this program is to characterize the performance of various laser candidate systems so that reliable projections of their usefulness for long-range DARPA missions can be properly assessed. This final report highlights the accomplishments attained under this contract and summarizes those results obtained in the interim period since the last semiannual technical report. These include: (1) an attachment rate constant determination for the reaction e plus Cl2, (2) kinetic quenching measurements and role of the B- and C- states in XeF*, (3) some preliminary results on active medium absorption in XeF* laser mixtures, (4) the effect of the ground state population on the XeF laser performance; and (5) a detailed model of e-beam pumped KrF* laser. GRA

N80-18391# Southern Methodist Univ., Dallas, Tex.
DESIGN OF INJECTION LASERS FOR IMPROVED RADIATION PERFORMANCE Final Report, 23 Feb. 1976 - 22 Feb. 1979
Jerome K. Butler 14 Nov. 1979 111 p refs
(Grant DAAG29-76-G-0146; DA Proj. 1T1-61102-BH-57)
(AD-A078519; ARO-13568.9-EL) Avail: NTIS HC A06/MF A01 CSCL 20/9

This research was concerned with (1) the electromagnetic modes and (2) the radiation pattern characteristics of contemporary injection laser structures. The objective was to investigate laser structures which can produce stable-beam radiation patterns. The control of lateral fields in lasers has been accomplished with many novel devices such as the channeled-substrate-planar, buried heterostructure and strip-loaded waveguide. The drawback to the stripe laser is that it is laterally unstable. Much of our work has been aimed at rigorously modeling the electromagnetic modes of stripe lasers. We have also applied our analysis to other lasers such as the channeled-substrate-planar device. GRA

N80-18392# Defence Research Information Centre, Orpington (England).
THE THEORY OF OPTICAL RESONATORS
L. Ronchi (CNR, Florence) Jun. 1979 24 p refs Transl. into ENGLISH from Alta Frequenza (Italy), v. 47, no. 6, 1978 p 468-474
(DRIC-Trans-5616; BR68834) Avail: NTIS HC A02/MF A01

The operating principles of optical resonators are examined, focusing on unstable resonators used in the field of high power lasers. The main characteristic discussed is that every mode occupies the whole volume at its disposal and in particular, the volume of the active material. This is related to the control of lateral modes. Theory predicts that the connection with external space can be exploited by using the radiation spillover which generally corresponds with a fairly regular near field. It is noted that reported experimental results on unstable resonators agree well with the presented theoretical analysis regarding field distributions and connection with outside space. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-18393* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CRYOGENIC CONTAINER COMPOUND SUSPENSION STRAP Patent
John W. Vorreiter, inventor (to NASA) Issued 22 Jan. 1980 5 p Filed 22 Aug. 1978 Supersedes N79-18087 (17 - 09, p 1109)
(NASA-Case-ARC-11157-1; US-Patent-4,184,609; US-Patent-Appl-SN-935827; US-Patent-Class-220-445; US-Patent-Class-220-423; US-Patent-Class-220-901) Avail: US Patent and Trademark Office CSCL 13I

A support strap for use in a cryogenic storage vessel for supporting the inner shell from the outer shell with a minimum heat leak is presented. The compound suspension strap is made from a unidirectional fiberglass epoxy composite material with an ultimate tensile strength and fatigue strength which are approximately doubled when the material is cooled to a cryogenic temperature.
Official Gazette of the U.S. Patent and Trademark Office

N80-18394 Illinois Univ. at Urbana-Champaign.
COMBUSTION SIMULATION OF A DUAL CHAMBER STRATIFIED CHARGE SPARK IGNITION ENGINE Ph.D. Thesis
Samuel Shangchi Pan 1979 210 p
Avail: Univ. Microfilms Order No. 8004247

A one-dimensional mathematical model was developed which includes the submodels of ignition, mixing; chemical kinetics, heat transfer, turbulent diffusivity, and NO formation. Studies are made on the basic parameters, such as the turbulence level, the preexponential constant, the heat transfer, the mixing percentage, the total air fuel ratio, the prechamber intake air fuel ratio, the prechamber intake mass flow ratio, the volumetric efficiency, the throat diameter, and the spark location and timing. The calculated results correlate well with the experimental data. All the predicted trends agree with the experimental trends over the range of the engine conditions investigated. Dissert. Abstr.

N80-18395 Tennessee Technological Univ., Cookeville.
IDENTIFICATION OF NOISE SOURCES IN FC CENTRIFUGAL FAN ROTORS Ph.D. Thesis
David Raj 1978 263 p
Avail: Univ. Microfilms Order No. 8004108

The sources of broad band noise in forward curved centrifugal fan rotors were studied using a 10.6 inch diameter fan. The flow field inside the fan was observed using flow visualization techniques. The velocity and velocity fluctuations of the rotor exit flows were measured using a hot-wire anemometer. The blade-to-blade variation of the absolute velocity, both magnitude and direction, and the high level of velocity fluctuations made it necessary to develop a special sampling system for the velocity measurements. This system was successfully used to measure the rotor exit velocity levels. The separated flow over the blade suction surface was the major broad band noise source. The presence of circumferential and axial gradients in the mean flow also contributed to the problem. The rotor blades must be redesigned to eliminate the flow separation over the suction surfaces. Dissert. Abstr.

N80-18396*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLARED TUBE ATTACH SYSTEM Patent Application
Innis D. Alkire (Rockwell International Corp., Houston, Tex.) and Julian P. King, Jr., inventors (to NASA) (Rockwell International, Houston, Tex.) Filed 18 Jan. 1980 16 p Sponsored by NASA
(NASA-Case-MSC-18416-1; US-Patent-Appl-SN-113017) Avail: NTIS HC A02/MF A01 CSCL 13I

A flared tube connection is described. It can be disassembled and assembled in a nondestructive manner without wasting, discarding, or damaging any of its parts or any portion of the associated tubing and parts to which it is joined, and features a split ferrule which may be installed or removed in situ and used to couple fluid lines without the necessity of a permanently installed coupling nut. NASA

N80-18397*# National Aeronautics and Space Administration. Pasadena Office, Calif.
INTERNAL COMBUSTION ENGINE WITH ELECTROSTATIC DISCHARGING FUELS Patent Application
James B. Stephens (JPL) and Charles G. Miller, inventors (to NASA) (JPL) Filed 18 Sep. 1979 16 p Sponsored by NASA
(NASA-Case-NPO-13798-2; US-Patent-Appl-SN-076635) Avail: NTIS HC A02/MF A01 CSCL 21A

An internal combustion engine system is disclosed in which a mixture of air and fuel droplets which are electrostatically charged to a selected polarity, e.g., negative, is fed to the engine's chambers. The fuel droplets are of uniform size in the micron range, and tend to be uniformly distributed in each chamber. Each chamber includes an electrode which, at a particular point in the engine's cycle of operation, is electrically connected to a

potential of a polarity opposite the polarity of the fuel droplets' charge to initiate electrostatic discharging of the droplets. The discharging produces sparks which initiate the combustion of the fuel droplets. Due to electrically insulating matter in the chambers' walls the charged droplets prior to combustion are repelled away from the walls to minimize combustion quenching. NASA

N80-18398*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THERMAL BARRIER SEAL Patent Application
Milo Surbat (Rockwell International Corp., Downey, Calif.) and John O. Kane, inventors (to NASA) (Rockwell International Corp., Downey, Calif.) Filed 10 Mar. 1980 16 p Sponsored by NASA
(NASA-Case-MSC-18390-1; US-Patent-Appl-SN-092170) Avail: NTIS HC A02/MF A01 CSCL 11A

A thermal barrier for providing thermal sealing in an elongated space of varying width between adjacent surfaces of first and second members mounted for at least limited movement relative to each other is disclosed. The barrier may include an elongated envelope formed by an elongated sheet of fibrous material centrally and longitudinally folded to provide trailing and leading edges of the barrier. An elongated rigid support plate, the contour of which conforms to the contour of the adjacent surface of one of the members, may be enclosed in the envelope. An elongated core may be confined within the envelope near its leading edge between the rigid support plate and the inner surface of the other side of the envelope. The core is deformable to accommodate the varying width of the elongated space while still maintaining thermal sealing contact between the barrier and the adjacent surfaces of the first and second members. NASA

N80-18399*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOVING BODY VELOCITY ARRESTING LINE Patent Application
Reid A. Hull, inventor (to NASA) Filed 28 Dec. 1979 11 p
(NASA-Case-LAR-12372-1; US-Patent-Appl-SN-108107) Avail: NTIS HC A02/MF A01 CSCL 13H

A method for arresting a moving body using steel cables that elongate to absorb kinetic energy is presented. A sleeve surrounding the cables protects them from chafing and provides an energy absorbing system should the cables fail. NASA

N80-18400*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS PATH SEAL Patent Application
Robert C. Bill and Robert D. Johnson, inventors (to NASA) Filed 20 Nov. 1979 8 p
(NASA-Case-NPO-12131-3; US-Patent-Appl-SN-096255) Avail: NTIS HC A02/MF A01 CSCL 20A

A gas path seal suitable for use with a turbine engine or compressor is described. A shroud wearable or abradable by the abrasion of the rotor blades of the turbine or compressor shrouds the rotor bades. A compliant backing surrounds the shroud. The backing is a yieldingly deformable porous material covered with a thin ductile layer. A mounting fixture surrounds the backing. NASA

N80-18401*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CIRCUMFERENTIAL SHAFT SEAL Patent Application
L. P. Ludwig, inventor (to NASA) Filed 7 Dec. 1979 8 p
(NASA-Case-LEW-12119-2; US-Patent-Appl-SN-102004) Avail: NTIS HC A02/MF A01 CSCL 20A

A circumferential shaft seal in which the seal elements are capable of adequate response to shaft motion is described. The seal is comprised of two sealing rings held to a rotating shaft by means of a surrounding elastomeric band. The rings are segmented and have an inner diameter dimensioned so that the segments can slidably and sealably engage the shaft. Alternative embodiments of the seal concept are described and suggestions for component materials are given. M.G.

N80-18402*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IMPROVED TIRE/WHEEL CONCEPT Patent Application
Philip M. Harper, Sr., inventor (to NASA) (Boeing Commercial Airplane Co., Seattle, Wash.) Filed 12 Dec. 1979 12 p Sponsored by NASA
(NASA-Case-LAR-11695-2; US-Patent-Appl-SN-103836) Avail: NTIS HC A02/MF A01 CSCL 01C

A tire and wheel assembly is described which consists of a low profile pneumatic tire with sidewalls that deflect inwardly under a load and a wheel having a narrow central channel and extended rim flanges. The extended rim flanges support the tire sidewalls under static and dynamic loading conditions to produce a combination particularly suited to aircraft applications. NASA

N80-18403*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL AND EXPERIMENTAL SPUR GEAR TOOTH TEMPERATURE AS AFFECTED BY OPERATING VARIABLES
Dennis P. Townsend and Lee S. Akin (Western Gear Corp., Industry, Calif.) 1980 29 p refs Presented at 3d Intern. Power Transmission and Gearing Conf., San Francisco, Calif., 18-22 Aug. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81419; E-342) Avail: NTIS HC A03/MF A01 CSCL 13I

A gear tooth temperature analysis was performed using a finite element method combined with a calculated heat input, calculated oil jet impingement depth, and estimated heat transfer coefficients. Experimental measurements of gear tooth average surface temperatures and instanteous surface temperatures were made with a fast response infrared radiometric microscope. Increased oil jet pressure had a significant effect on both average and peak surface temperatures at both high load and speeds. Increasing the speed at constant load and increasing the load at constant speed causes a significant rise in average and peak surface temperatures of gear teeth. The oil jet pressure required for adequate cooling at high speed and load conditions must be high enough to get full depth penetration of the teeth. Calculated and experimental results were in good agreement with high oil jet penetration but showed poor agreement with low oil jet penetration depth. Author

N80-18404*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF A HIGH PERFORMANCE FIXED-RATIO TRACTION DRIVE
Stuart H. Loewenthal, Neil E. Anderson, and Douglas A. Rohn 1980 32 p refs Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, Calif., 18-22 Aug. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81425; E-349) Avail: NTIS HC A03/MF A01 CSCL 13I

The results of a test program to evaluate a compact, high performance, fixed ratio traction drive are presented. This transmission, the Nasvytis Multiroller Traction Drive, is a fixed ratio, single stage planetary with two rows of stepped planet rollers. Two versions of the drive were parametrically tested back-to-back at speeds to 73,000 rpm and power levels to 180 kW (240 hp). Parametric tests were also conducted with the Nasvytis drive retrofitted to an automotive gas turbine engine. The drives exhibited good performance, with a nominal peak efficiency of 94 to 96 percent and a maximum speed loss due to creep of approximately 3.5 percent. Author

N80-18405*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENDURANCE AND FAILURE CHARACTERISTICS OF MODIFIED VASCO X-2, CBS 600 AND AISI 9310 SPUR GEARS
Dennis P. Townsend and E. V. Zaretsky 1980 28 p refs Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, Calif., 18-22 Aug. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81421; E-344) Avail: NTIS HC A03/MF A01 CSCL 13I

Gear endurance tests and rolling-element fatigue tests were conducted to compare the performance of spur gears made from AISI 9310, CBS 600 and modified Vasco X-2 and to compare the pitting fatigue lives of these three materials. Gears manufactured from CBS 600 exhibited lives longer than those manufac-

tured from AISI 9310. However, rolling-element fatigue tests resulted in statisitcally equivalent lives. Modified Vasco X-2 exhibited statistically equivalent lives to AISI 9310. CBS 600 and modified Vasco X-2 gears exhibited the potential of tooth fracture occurring at a tooth surface fatigue pit. Case carburization of all gear surfaces for the modified Vasco X-2 gears results in fracture at the tips of the gears. Author

N80-18406*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF GEOMETRY AND OPERATING CONDITIONS ON SPUR GEAR SYSTEM POWER LOSS
Neil E. Anderson and Stuart H. Loewenthal 1980 31 p refs Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, Calif., 18-22 Aug. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81426; E-350; AVRADCOM-TR-80-C-2) Avail: NTIS HC A03/MF A01 CSCL 20I

The results of an analysis of the effects of spur gear size, pitch, width, and ratio on total mesh power loss for a wide range of speeds, torques, and oil viscosities are presented. The analysis uses simple algebraic expressions to determine gear sliding, rolling, and windage losses and also incorporates an approximate ball bearing power loss expression. The analysis shows good agreement with published data. Large diameter and fine pitched gears had higher peak efficiencies but low part load efficiency. Gear efficiencies were generally greater than 98 percent except at very low torque levels. Tare (no-load) losses are generally a significant percentage of the full load loss except at low speeds. Author

N80-18407*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONSTRAINED FATIGUE LIFE OPTIMIZATION OF A NASVYTIS MULTIROLLER TRACTION DRIVE
John J. Coy, Douglas A. Rohn, and Stuart H. Loewenthal 1980 20 p refs Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, Calif., 18-22 Aug. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81447; AVRADCOM-TR-80-C-6; E-214) Avail: NTIS HC A02/MF A01 CSCL 13I

A contact fatigue life analysis method for multiroller traction drives is presented. The method is based on the Lundberg-Palmgren analysis method for rolling element bearing life prediction, and also uses life adjustment factors for materials, processing, lubrication, and effect of traction. The analysis method is applied in an optimization study to the multiroller traction drive, consisting of a single-stage planetary configuration with two rows of stepped planet rollers of five rollers per row. The drive was approximately 25 centimeters in diameter by 11 centimeters long, having a nominal ratio of 15:1. The theoretically predicted drive life was 2510 hours at a nominal continuous power and speed of 74.6 kW (100 hp) and 7500 rpm. Author

N80-18408*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS AND DESIGN OF A UNIFORM-CLEARANCE, PUMPING-RING ROD SEAL FOR THE STIRLING ENGINE
I. Etsion Mar. 1980 30 p refs
(NASA-TM-81463; E-080) Avail: NTIS HC A03/MF A01 CSCL 11A

A uniform clearance pumping ring, as opposed to the conventional taper clearance one, is described. The uniform clearance concept eliminates complex elastohydrodynamic problems and enables a simple analytical treatment to be made. An analytical expression is derived for the pumping rate showing the effect of various design parameters on the pumping ring's performance. An optimum clearance is found by which the pumping rate is maximized and a numerical example is presented to demonstrate the potential of the uniform clearance design. Author

N80-18409*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME LIMITATIONS IN APPLYING CLASSICAL EHD FILM-THICKNESS FORMULAE TO A HIGH-SPEED BEARING
John J. Coy and Erwin V. Zaretsky 1980 32 p refs Proposed for presentation at Intern. Lubrication Conf., San Francisco, 18-21 Aug. 1980; sponsored by Am. Soc. of Mech. Engr. and Am. Soc. of Lubrication Engr.
(NASA-TM-81431; AVRADCOM-TR-80-C-3; E-198) Avail: NTIS HC A03/MF A01 CSCL 13I

Elastohydrodynamic film thickness was measured for a 20 mm ball bearing using the capacitance technique. The bearing was thrust loaded to 90, 448, and 778 N. The corresponding maximum stresses on the inner race were 1.28, 2.09, and 2.45 GPa. Test speeds ranged from 400 to 14,000 rpm. Film thickness measurements were taken with four different lubricants: (1) synthetic paraffinic; (2) synthetic paraffinic with additives; (3) neopentylpolyol (tetra) ester; and (4) synthetic cycloaliphatic hydrocarbon traction fluid. The test bearing was mist lubricated. Test temperatures were 300, 338, and 393 K. The measured results were compared to theoretical predictions and are presented. A.W.H.

N80-18410# Pennsylvania State Univ., University Park. Applied Research Lab.
HANDBOOK OF VIBRATION AND NOISE CONTROL Final Report
J. C. Snowdon 27 Apr. 1979 204 p refs
(Contract N00024-79-C-6043)
(AD-A071485; ARL/PSU-TM-79-75) Avail: NTIS HC A10/MF A01 CSCL 20/11

The static and dynamic properties of rubberlike materials are reviewed initially, followed by discussion of the simple and compound mounting systems. Reference is also made to the dynamic vibration absorber and to the measurement of mount transmissibility. Three sections then describe the natural frequencies, the mechanical impedances, and the transmissibility of structural members. Finally, four-pole parameter analyses are reviewed and the relative transmissibility of various mounting systems supported by a variety of non-rigid foundations is discussed. GRA

N80-18411# Engineering Development Establishment, Maribyrnong (Australia).
LABORATORY INVESTIGATION OF THE PERFORMANCE OF A HOLDEN ENGINE OPERATING ON LIQUIFIED PETROLEUM GAS
N. Webb Aug. 1979 49 p
(AD-A076145; EDE-28/79) Avail: NTIS HC A03/MF A01 CSCL 14/2

A laboratory investigation into the relative performances of an engine when operated on both liquified petroleum gas (LPG) and petrol showed that the engine operated at higher terminal efficiency on LPG and also that it would operate satisfactorily at leaner air-fuel mixtures on this fuel. Engine performance was less affected by retarded ignition for LPG than for petrol. Furthermore, a large increase in dwell angle from the recommended setting had no significant effect on LPG performance. The LPG carburettor when installed in its normal configuration maintained an essentially constant mixture strength with no part throttle leaning of mixtures to give better efficiency nor corresponding full throttle enrichment to give best engine torque. GRA

N80-18412# General Electric Co., Syracuse, N.Y.
ALTERNATIVE METHOD FOR THE EVALUATION OF FUSED GLASS-TO-METAL SEALS Final Technical Report, 19 Jan. 1978 - 19 Feb. 1979
G. F. Trojanowski and L. Zakraysek Griffiss AFB, N.Y. RADC May 1979 52 p refs
(Contract F30602-78-C-0086; AF Proj. 2338)
(AD-A077514; PM-13-79; RADC-TR-79-98) Avail: NTIS HC A04/MF A01 CSCL 11/1

Glass-to-metal seals on electronic component packages make it possible to obtain electrical feed-thru while maintaining hermeticity throughout severe environmental exposure. As a result of this study, it was determined that sealed sub-assemblies will generally pass the least severe thermal shock requirement of MIL-STD-883, but that the same (previously accepted) lots will exhibit a 6%, or higher, failure rate as a result of manufacturing stresses imposed by cover welding, delidding, and thermal bakes or soaks. During this study, the use of tighter controls on the

more critical glass sealing processes was shown to reduce the reject rate to less than 1%. Success in matched glass-seal making depends on the use of three thermal treatments for Kovar: de-carburizing, pre-oxidation and sealing. This report deals specifically with pre-oxidation and sealing. An oxide film on Kovar, prior to sealing, promotes glass wetting and provides for the development of a chemical-mechanical bond at the glass-metal interface. A determination for residual intergranular oxide is useful for judging the quality of a matched glass-to-metal seal where pre-oxidation is a requisite for sealing. Residual oxides can be detected by metallographic techniques, and the range of 2.0 - 6.5 micrometers is appropriate for high quality glass seals. Other effects are also detectable by the evaluation of metallographic cross-sections of sealed packages. These include volume fraction of bubble formation, bubble size, bubble distribution, glass-metal separation and other interface criteria. GRA

N80-18413# National Swedish Road and Traffic Research Inst., Linkoeping.
EXPERIMENTAL USE OF ELECTRONIC DIRECTION FINDING INDICATORS IN SNOW REMOVAL
Roland Oestergren 1977 41 p In SWEDISH; ENGLISH summary
(VTI-130) Avail: NTIS HC A03/MF A01

Equipment for detecting the lateral position of snow removal vehicles was tested under realistic winter conditions. A magnetic steering cable is buried in each traffic lane of the roadway, with detectors mounted in the vehicle giving visual position indications. Drivers had difficulty following the cables because of the need to scan the instruments as well as the road directly ahead of the thrower. Author (ESA)

N80-18414# National Swedish Road and Traffic Research Inst., Linkoeping.
THE INFLUENCE OF ROAD ROUGHNESS ON THE BRAKING AND STEERING PERFORMANCE OF CARS
Georg Magnusson and Peter W. Arnberg 1977 46 p refs In SWEDISH; ENGLISH summary
(VTI-134) Avail: NTIS HC A03/MF A01

Information was compiled concerning the influence of road roughness on automobile braking and steering characteristics, and on driver performance. Evidence found indicates that road roughness has a degrading effect on wheel load and therefore steering ability, but contradictory findings exist for its effects on braking performance. Drivers' visual, auditory, and kinesthetic information acquisition as well as steering ability are influenced by vibration, but it is not clear that it is important to traffic safety. Author (ESA)

N80-18415# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FLUTTER ANALYSIS OF SMALL WINDTURBINE, DESIGNED FOR MANUFACTURE AND USE IN DEVELOPING COUNTRIES
P. C. Hensing Aug. 1978 29 p refs
(UTH-LR-272) Avail: NTIS HC A03/MF A01

The flutter behavior of a wind turborotor designed for manufacture and use in developing countries was investigated. Possible improvements are discussed. The effect of scaling is considered. Results show that the addition of small tip-masses has a curative influence on flutter sensitive rotor designs. Author (ESA)

N80-18416# Technische Hogeschool, Delft (Netherlands). Lab. of Fine Mechanics.
A STUDY OF SOME ASPECTS OF THE MECHANICAL BEHAVIOR OF CROSS-SPRING PIVOTS AND PLATE SPRING MECHANISMS WITH NEGATIVE STIFFNESS
J. F. Dijksman May 1979 121 p refs
(WTHD-116) Avail: NTIS HC A06/MF A01

Several aspects of mechanical and kinematical behavior involving a guiding composed of a cross-spring pivot are investigated. Formulas are given for determining the radial flexibility of a cross-spring pivot as a function of the angle of rotation. The mechanical properties of mechanisms composed of flat thin plate springs are also calculated. These mechanisms are suitable for reducing positive stiffness of an elastic guiding for translation. Author (ESA)

N80-18417# National Technical Information Service, Springfield, Va.
SEALS AND GASKETS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Nov. 1976 - Nov. 1979
William E. Reed Dec. 1979 125 p Supersedes NTIS/PS-78/1251; NTIS/PS-77/1093; NTIS/PS-76/0938; NTIS/PS-75/838; NTIS/PS-75/140
(PB80-802010; NTIS/PS-78/1251; NTIS/PS-77/1093; NTIS/PS-76/0938; NTIS/PS-75/838; NTIS/PS-75/140) Avail: NTIS HC $30.00/MF $30.00 CSCL 11A

Both gas and liquid seals are considered. Areas studied include polymers, physical properties, glass metal seals, configurations, test methods, and design. Applications involve such areas as gas turbines, water pumps, shaft seals, spacecraft seals, and other specialized seals and gaskets. Highway joint seals are excluded. This updated bibliography contains 213 abstracts, 74 of which are new entries to the previous edition. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-18418# Aeronautical Research Labs., Melbourne (Australia).
RELIABILITY ANALYSIS FOR OPTIMUM DESIGN
A. O. Payne and A. D. Graham 14 Sep. 1978 18 p refs Repr. from Eng. Fracture Mech., Great Britain, v. 12, 1979 p 329-346
(ICAF-1132) Avail: NTIS HC A02/MF A01

An approach is presented which offers a means of enabling the influence of significant design parameters to be studied and the design to be optimized. It is illustrated by two applications-assessment of ultimate load design procedures for an offshore drilling unit and the derivation of a reliability based inspection procedure for a crop-dusting aircraft. The approach requires extensive data not normally available in design and is still in the development stage, but it is seen as an approach to achieving an optimum design. R.E.S.

N80-18419# Arinc Research Corp., Annapolis, Md.
THE APPLICATION OF RELIABILITY IMPROVEMENT WARRANTY TO DYNAMIC SYSTEMS Final Report, 28 Sep. 1978 - 4 Sep. 1979
A. A. Bilodeau, F. B. Crum, W. A. Dunphy, and R. A. Kowalski 4 Sep. 1979 162 p
(Contract DAAK70-78-C-0200)
(AD-A075520; Rept-1736-01-1-2025; MERADCOM-TQ-1) Avail: NTIS HC A08/MF A01 CSCL 14/4

The Reliability Improvement Warranty (RIW) is currently used within the Department of Defense to provide an incentive to contractors to design and produce equipment that will have a low failure rate, as well as low costs of repair following failure in field or operational use. Current applications of RIW have generally been restricted to initial production procurements of relatively small, transportable avionics equipment. The RIW concept has potential applications for dynamic systems (e.g., transmissions, gearboxes, engines, etc.) procured by the U.S. Army Mobility Equipment Research and Development Command (MERADCOM). However, dynamic systems may differ from avionics in design and maintenance concepts, transportability features, and deployment and utilization philosophy. Therefore, current criteria for using RIW and current guidelines for developing RIW terms and conditions should be reviewed and adapted for this new class of systems. This effort identified several differences between the characteristics of dynamic systems and those of RIW avionics equipment that are not emphasized in current RIW guidelines. RIW application criteria for dynamic systems were also developed. An existing life-cycle cost (LCC) model was modified to address quantitative features of dynamic systems that should be considered in an economic analysis of RIW versus organic maintenance. Case studies were developed to demonstrate the use of the RIW selection criteria and the LCC model. GRA

N80-18420# Illinois Univ. at Urbana-Champaign. Engineering-Psychology Research Lab.
THE PROCESSING RESOURCE DEMANDS OF FAILURE DETECTION IN DYNAMIC SYSTEMS
Christopher D. Wickens and Colin Kessel Jan. 1979 27 p refs
(Grant AF-AFOSR-3380-77)
(AD-A078329; EPL-79-1/AFOSR-79-1; AFOSR-79-0684TR)
Avail: NTIS HC A03/MF A01 CSCL 05/8

A conception of human attentional resources is presented that describes these resources, not as an undifferentiated pool of capacity, but as partitioned into separate structure-specific reservoirs related to the processes of encoding, central processing and responding. An experiment is then described in which subjects detected dynamic system failures, either while actually tracking the control dynamics (manual mode), or while passively observing an autopilot controlling the dynamics (automatic mode). Failure detection, the primary task was performed alone, and with each of two structurally different loading tasks: mental arithmetic and a critical instability tracking task. Manual detection and primary task tracking were affected by the critical tracking task but not by mental arithmetic. The opposite pattern of interference was found for automatic detection. Assuming that manual and automatic detection depend upon different information sources, these results are shown to be compatible with the concept of structure-specific resources. GRA

N80-18421# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE TESTING: X-RAY PHOTOGRAPHY AND RADIOGRAPHY, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Report, Aug. 1976 - Sep. 1979
William E. Reed Dec. 1979 283 p Supersedes NTIS/PS-78/1059; NTIS/PS-77/0910; NTIS/PS-76/0781
(PB80-802200; NTIS/PS-78/1059; NTIS/PS-77/0910; NTIS/PS-76/0781) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Techniques, equipment, and applications for nondestructive testing are discussed. Applications include flaw detection, fatigue determination, inspection of joints, quality control, and measurement of mechanical and physical properties. This updated bibliography contains 277 abstracts, 94 of which are new entries to the previous edition. GRA

N80-18422# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE TESTING: X-RAY PHOTOGRAPHY AND RADIOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Report, 1964 - Sep. 1979
William E. Reed Dec. 1979 286 p Supersedes NTIS/PS-78/1058; NTIS/PS-77/0908; NTIS/PS-76/0780; NTIS/PS-75/656
(PB80-802192; NTIS/PS-78/1058; NTIS/PS-77/0908; NTIS/PS-76/0780; NTIS/PS-75/656) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Techniques, equipment, and applications for nondestructive testing are discussed. Applications include flaw detection, fatigue determination, inspection of joints, and measurement of mechanical and physical properties. This updated bibliography contains 278 abstracts, 30 of which are new entries to the previous edition. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-18423 Illinois Univ. at Urbana-Champaign.
MIXED-MODE FRACTURE ANALYSIS USING A CONSERVATION INTEGRAL Ph.D. Thesis
Jen-fu Yau 1979 116 p
Avail: Univ. Microfilms Order No. 8004309

An efficient and convenient method of analysis for determining stress intensity factors for two-dimensional mixed mode fracture problems with complicated geometry and loading conditions (static or dynamic) is presented. The method is applicable to a wide variety of material properties including linear elastic isotropic, anisotropic, as well as isotropic bimaterials and linear viscoelastic behavior. One of the salient features of the present analysis is that it can directly determine mixed mode stress intensity solutions from the conservation integral without the need of solving the corresponding complex boundary value problem. This method is demonstrated to be superior in its numerical simplicity to other approaches, since the conservation integral can be conveniently evaluated along a path removed from the crack tip region. Solutions of complicated and practical engineering problems such as cracks emanating from a circular hole and a crack branching from an edge crack in a fibrous composite are presented. Dissert. Abstr.

N80-18424 Clemson Univ., S.C.
COLLAPSE LOAD ANALYSIS FOR PLATES AND PANELS Ph.D. Thesis
Kailasam Satyamurthy 1979 101 p
Avail: Univ. Microfilms Order No. 8003339

A FORTRAN, large capacity computer program was developed to determine collapse loads and bifurcation loads for fiber reinforced, laminated, circular cylindrical panels with rectangular plan form and rectangular plates under general loading systems and boundary conditions. The program is based on the principle of total potential energy and uses finite difference in the discretization process. Whole station spacing was used to calculate the strain energy associated with an area element and an orthogonal finite difference grid that provides for variable spacings in perpendicular directions is incorporated. Numerical results for isotropic panels are presented that compare favorably with results obtained via the general computer program STAGS. Other numerical results for fiber reinforced, laminated panels are also presented that illustrate the types of boundary conditions, applied loads, cut-outs, and initial geometric imperfections that can be handled by the present program. Dissert. Abstr.

N80-18425 Illinois Univ. at Urbana-Champaign.
BOUNDARY INTEGRAL EQUATION SOLUTION OF PLANE ELASTICITY PROBLEMS WITH HIGH STRESS CONCENTRATIONS Ph.D. Thesis
Hassan Nikooyeh 1979 133 p
Avail: Univ. Microfilms Order No. 8004240

A numerical method for determination of stresses in two-dimensional elastic bodies with high stress concentration is presented. Major emphasis is placed on bodies with a notch having a fillet of small radius and bodies with a crack of small width. These static boundary value problems are formulated in terms of boundary integral equations of a type used previously for sharp notches and cracks. The results for the fillet problem are used to develop analytical solutions for the intermediate region adjacent to the fillet region. In this way the details of the boundary configuration of the fillet are reflected in a set of generalized displacements which characterize the intermediate field. For the solution of the whole body including the loaded boundary, kernels are used to pick out the generalized displacements of the intermediate region. The solution of the wide crack problem is similar except that a perturbation scheme is required to ensure homogeneous boundary conditions at the actual edges of the crack. Dissert. Abstr.

N80-18426 Colorado Univ. at Boulder.
RESPONSE OF A CIRCULAR CYLINDRICAL SHELL TO DISTURBANCES IN A HALF-SPACE Ph.D. Thesis
Nabil Mohamed El-Akily 1979 206 p
Avail: Univ. Microfilms Order No. 8002971

The problem of determining the steady state dynamic response of a circular cylindrical shell to disturbances in a half-space is discussed. Both the shell and the surrounding medium are assumed to be linearly elastic, isotropic, and homogeneous and the shell is assumed to be in welded contact with the surrounding medium. Approximate solutions for the response of the shell and as a limiting case of the shell, the solutions for the cavity are presented. The solutions in both cases are obtained by two different methods. First, the method of matched asymptotic expansions

is used. The second method of solution (the method of successive reflections) is based on assuming two infinite series representing the scattered field. The usefulness and the range of applicability of each method is established for the cases studied.

Dissert. Abstr.

N80-18427*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRESS ANALYSIS AND BUCKLING OF J-STIFFENED GRAPHITE-EPOXY PANEL
Randall C. Davis Washington Feb. 1980 23 p refs
(NASA-TP-1607; L-13256) Avail: NTIS HC A02/MF A01 CSCL 20K

A graphite epoxy shear panel with bonded on J stiffeners was investigated. The panel, loaded to buckling in a picture frame shear test is described. Two finite element models, each of which included the doubler material bonded to the panel skin under the stiffeners and at the panel edges, were used to make a stress analysis of the panel. The shear load distributions in the panel from two commonly used boundary conditions, applied shear load and applied displacement, were compared with the results from one of the finite element models that included the picture frame test fixture. A.W.H.

N80-18428*# Lehigh Univ., Bethlehem, Pa.
STRESS INTENSITY FACTORS IN TWO BONDED ELASTIC LAYERS CONTAINING CRACKS PERPENDICULAR TO AND ON THE INTERFACE. PART 1: ANALYSIS
Ming-Che Lu and F. Erdogan Jan. 1980 31 p refs 2 Vol. (Grants NGR-39-007-011; NSF ENG-78-09737)
(NASA-CR-159218) Avail: NTIS HC A03/MF A01 CSCL 20K

The basic crack problem which is essential for the study of subcritical crack propagation and fracture of layered structural materials is considered. Because of the apparent analytical difficulties, the problem is idealized as one of plane strain or plane stress. An additional simplifying assumption is made by restricting the formulation of the problem to crack geometries and loading conditions which have a plane of symmetry perpendicular to the interface. The general problem is formulated in terms of a coupled system of four integral equations. For each relevant crack configuration of practical interest, the singular behavior of the solution near and at the ends and points of intersection of the cracks is investigated and the related characteristic equations are obtained. The edge crack terminating at and crossing the interface, the T-shaped crack consisting of a broken layer and a delamination crack, the cross-shaped crack which consists of a delamination crack intersecting a crack which is perpendicular to the interface, and a delamination crack initiating from a stress-free boundary of the bonded layers are some of the practical crack geometries considered. A.R.H.

N80-18429*# Lehigh Univ., Bethlehem, Pa.
STRESS INTENSITY FACTORS IN TWO BONDED ELASTIC LAYERS CONTAINING CRACKS PERPENDICULAR TO AND ON THE INTERFACE. PART 2: SOLUTION AND RESULTS
Ming-Che Lu and F. Erdogan Jan. 1980 53 p refs 2 Vol. (Grants NGR-39-007-011; NSF ENG-78-09737)
(NASA-CR-159219) Avail: NTIS HC A04/MF A01 CSCL 20K

The numerical method is given for solving the plane problem for two, bonded infinite dissimilar elastic strips which contain cracks of various configurations. The problem is intended to approximate a composite beam or a plate having cracks perpendicular to and on the interface of the two layers. A.R.H.

N80-18430# Tokyo Univ. (Japan).
FRACTURE MECHANICS IN JAPAN
Takeo Yokobori 1978 20 p refs Repr. from Fracture Mech., Proc. Intern. Symp. on Fracture Mech., 1978 p 91-109 Presented at Intern. Symp. on Fracture Mech., Washington, D.C., 1978
(ICAF-1123) Avail: NTIS HC A02/MF A01

A brief survey of fracture mechanics studies in Japan is given. Combined micro and macrofracture mechanics including both crack and crystal dislocation as stress concentrators, rate process theory and nucleation theory of fracture, including both thermal fluctuation and macroscopic stress concentration such as crack are among the topics examined. Comparative fracture studies, on cracked specimens and uncracked specimens, on brittle fracture and fatigue, crack arrest for fracture design, and high temperature strength and fracture are included. J.M.S.

N80-18431# Kawasaki Heavy Industries, Ltd., Akashi (Japan). Technical Inst.
STUDY ON CRACK PROPAGATION UNDER QUASI-RANDOM LOADING
Toshiyasu Tsunenari and Hideo Ono 1978 14 p refs
(Doc-XIII-876-78; ICAF-1124) Avail: NTIS HC A02/MF A01

A crack propagation model incorporating retardation effects is proposed in order to more precisely determine crack propagation in hulls under random wave loads. Simulation results show good agreement with results of crack propagation tests under quasi-random loads. K.L.

N80-18432# Osaka Univ. (Japan).
ESTIMATION OF THE FATIGUE STRENGTH OF WELDED JOINTS BASED ON NON-DESTRUCTIVE TEST RESULTS
Kunihiko Satoh and Kenji Seo Mar. 1979 17 p refs Repr. from Proc. 1st Conf. on N.D.T., R.O.C. (Japan), Mar. 1979 17p
(ICAF-1125) Avail: NTIS HC A02/MF A01

The relationship between the fatigue strength of welded joints and the results of nondestructive test was investigated experimentally. Furthermore, statistical data of stress concentration factor caused by porosities were obtained by finite element method. It was found that the fatigue strength of welded joints with porosites could be estimated theoretically by using these statistical data and the fatigue strength reduction factor. Author

N80-18433# Kyoto Univ. (Japan). Dept. of Engineering Science.
LOCAL RESIDUAL STRESS NEAR FATIGUE CRACK TIP
Shuji Taira and Keisuke Tanaka 1978 9 p refs Repr. from Trans. Iron Steel Inst. Jap. (Japan), v. 19, 1979 p 411-418
(ICAF-1129) Avail: NTIS HC A02/MF A01

The distribution of residual stress near the tip of a fatigue crack propagating under constant amplitude stress cycling accompanied by several cycles of overloads was measured using an X-ray microbeam diffraction technique. The residual stress measured in the close vicinity of the crack tip was compressive and gradually changed to tensile at a certain distance from the crack tip. The compressive residual stress became higher as the number of overload cycles increased. The high compressive residual stress may be responsible for a large amount of growth retardation of a fatigue crack due to increasing numbers of overload cycles. A theoretical method to predict the growth rate of a fatigue crack from information on the local residual distribution near the tips of fatigue cracks is presented. K.L.

N80-18434# Kyoto Univ. (Japan).
STATISTICAL EVALUATION OF FATIGUE LIVES AT AND NEAR FATIGUE LIMIT FOR NOTCHED SPECIMENS OF STEEL AND THEIR LIFE DISTRIBUTIONS
Toshiro Yamada, Susumu Sogami, and Daisuke Kawamura 1979 7 p refs Repr. from Proc. of the 22nd Japan Congr. on Mater. Res. (Japan), 1979 p 169-174
(ICAF-1131) Avail: NTIS HC A02/MF A01

The initiation and the propagation of the fatigue cracks as well as the shape of distribution of cracks near the fatigue limit are studied for a CR-MO steel. Fatigue cracks are observed using an electronmagnescope. The relations between the distribution of fatigue lives and the propagation and distribution of fatigue cracks are investigated. A statistical distribution function lives at and near the fatigue limit is proposed. J.M.S.

N80-18435# French Air Force, Vanves (France).
ACTION OF PLASTIC DEFORMATIONS IN THE MECHANICAL DAMAGE SUFFERED BY THE SURFACE OF STRUCTURES
William Barrois 1979 19 p refs In FRENCH; ENGLISH summary
(ICAF-1114) Avail: NTIS HC A02/MF A01

After reviewing the essential features of the fatigue behavior of metal structures in service, it is shown that the elementary phenomena of plastic deformation and fatigue crack propagation,

which explain the fatigue behavior of notched parts, also play an important role in other modes of damage of machinery parts. This is the case for mechanical surface damage under repeated bearing pressure in the absence of any apparent lateral sliding, for fretting fatigue in which there is alternating lateral displacements of very low amplitude, and for false-brinelling marks in ball or roller bearings. It is also the case for unidirectional friction wear and for rolling damage, either with friction in gears or with very low friction in ball or roller bearings. R.E.S.

N80-18436# French Air Force, Vanves (France).
REPEATED PLASTIC DEFORMATION AS A CAUSE OF MECHANICAL SURFACE DAMAGE IN FATIGUE, WEAR, FRETTING-FATIGUE, AND ROLLING FATIGUE: A REVIEW
William Barrois 1979 24 p refs
(ICAF-1116) Copyright. Avail: NTIS HC A02/MF A01

Statements bringing together essential features of the fatigue behavior of metal structures in service are reviewed. It is shown that the elementary phenomena of plastic deformation and fatigue crack propagation, which explain the fatigue behaviour of notched parts, also play an important role in other modes of damage of machinery parts. This is the case for mechanical surface damage under repeated bearing pressures in the absence of any apparent lateral sliding, for fretting-fatigue in which there alternating lateral displacement of very low amplitude, and for false-brinelling marks in ball or roller bearings. It is also the case for unidirectional friction wear and for rolling damage, either with friction in gears or with very low friction in ball or roller bearings. R.E.S.

N80-18437# Doshisha Univ., Kyoto (Japan).
A RELIABILITY ANALYSIS APPROACH TO FATIGUE LIFE DISPERSION OF LAMINATED GLASS FIBER COMPOSITE MATERIALS
T. Tanimoto, S. Amijima, H. Ishikawa (Kagawa Univ., Japan), K. J. Miller, ed. (Sheffield Univ., England), and R. F. Smith, ed. (Welding Inst., Cambridge, England) Oxford, England Pergamon Press 1979 11 p refs Repr. from ICM, England Presented at the 3d Intern. Conf. on Mech. Behavior of Mater. Cambridge, England, 20-24 Aug. 1979
(ICAF-1127) Avail: NTIS HC A02/MF A01

The statistical nature of the fatigue life of laminated glass fiber composite materials (FRP) is studied. Four different FRP laminates (satin woven FRP, plain woven FRP, roving woven FRP, and SMC laminated FRP) were used in the experiments. Unidirectional carbon fiber reinforced plastic was used for comparison. P-S-N diagrams for each laminate are presented. A statistical approach based on the Weibull distribution was applied to the test data to evaluate the dispersion in the fatigue life of the material. The effect of varying applied stress levels, specimen size, and glass fiber content on the fatigue life and its dispersion of the laminates is discussed. A.W.H.

N80-18438# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
MINITWIST: A SHORTENED VERSION OF TWIST
H. Lowak, J. B. DeJonge, J. Franz, and D. Schuetz 1979 25 p refs In GREEK
(LBF-TB-146) Avail: NTIS HC A02/MF A01

A description of the shortened version of the transport wing standard load program (TWIST), called MINITWIST, is presented. In all cases where testing time is a prohibitive factor to use TWIST, it is proposed to use this shortened program. The user of this shortened program should be aware though that in most cases the load cycles with high frequency and low amplitude omitted in MINITWIST would contribute to damage; thus the results will overestimate the fatigue life. R.E.S.

N80-18439# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
LITERATURE REVIEW ON THE MECHANICAL BEHAVIOR OF FIBER COMPOSITE MATERIALS. ANALYSIS OF THE STATE-OF-THE-ART, VOLUME 1 [SCHRIFTTUMSRECHERCHE ZUM FESTIGKEITSVERHALTEN VON FASERVERBUNDWERKSTOFFEN ANALYSE DES STANDES DER TECHNIK - BAND 1]
J. J. Gerharz and D. Schuetz 1979 436 p refs In GERMAN
(LBF-TB-145-Vol-1) Avail: NTIS HC A19/MF A01

Literature concerning the mechanical behavior of fiber reinforced plastic materials is surveyed. The topics evaluated include results of damage observations, mechanisms and influences of moisture absorption, and inspection and testing methods. Calculation procedures and models for the prediction of the mechanical behavior of composites are also analyzed. Examples of structural applications are presented and development efforts in fiber composite technology are indicated. K.L.

N80-18440# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
LITERATURE REVIEW ON THE MECHANICAL BEHAVIOR OF FIBER COMPOSITE MATERIALS. ANALYSIS OF THE STATE-OF-THE-ART, VOLUME 2: APPENDIX [SCHRIFTTUMSRECHERCHE ZUM FESTIGKEITSVERHALTEN VON FASTERVERBUNDWERKSTOFFEN ANALYSE DES STANDES DER TECHNIK - BAND 2: ANHANG]
J. J. Gerharz 1979 519 p refs In GERMAN
(LBF-TB-145-Vol-2-App) Avail: NTIS HC A22/MF A01

The literature concerning the mechanical behavior of fiber reinforced plastic materials is catalogued by essential test parameters. The results of damage observations, the mechanism and influence of moisture absorption, and inspection and testing methods are included along with calculation procedures and models for predicting mechanical behavior. Structural applications and development efforts in fiber composite technology are indicated. K.L.

N80-18441# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
FATIGUE BEHAVIOUR OF HIGH-PRESSURE VESSELS [FESTIGKEIT VON HOCHDRUCKBEHAELTERN FUER NEUARTIGE FERTIGUNGSVERFAHREN]
V. Grubisic and C. M. Sonsino 1979 250 p refs In GERMAN
(LBF-FB-148) Avail: NTIS HC A11/MF A01

Fatigue experiments on plain and cylindrical specimens with high strain concentration prove that low cycle material properties determined on unnotched specimens can be applied for the dimensioning of these vessels to a defined initial crack. Dimensioning including the stage of crack-propagation is not recommended because of very high strain-intensities and resulting small critical crack-depths, as several damage cases show. R.E.S.

N80-18442# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
FATIGUE BEHAVIOR OF NODULAR IRON UNDER COMBINED STATIC AND DYNAMIC MULTIAXIAL STRESSES [FESTIGKEITSVERHALTEN VON SPHAEROGUB BEI KOMBINIERTER STATISCHER UND DYNAMISHCER MEHRACHSIGER BEANSPRUCHUNG]
V. Grubisic and J. Neugebauer 1979 59 p refs In GERMAN
(LBF-FB-149) Avail: NTIS HC A04/MF A01

Specimens of GGG 60 were tested under combined axial load and torsion acting in phase and out of phase. Under combined out of phase stresses, an increase in fatigue life that was dependent on the mean stresses occurred. A computer program used to determine the magnitude and direction of the equivalent stress is described. K.L.

N80-18443# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
FATIGUE MEASURING GAUGES (FMG): A NEW SYSTEM FOR MONITORING FATIGUE LOADS
W. Ludwig, K. F. Sahm, and E. Steinheil 1979 23 p Presented at Tenth ICAF Symp., 17 May 1979, Brussels
Avail: NTIS HC A02/MF A01

An optical fatigue measuring gage (FMG), which provides monitoring of ingegral fatigue loads of individual structural units up to any given state in operational life, is described and evaluated. It is based on specially prepared, polished, and annealed metal foils which are cemented to the sites of structural units to be controlled, and which have the property of storing dynamic loads via well defined changes in surface properties due to plastic deformation. The measuring apparatus is made up of an optical measuring head and a display unit. The measuring head contains an illumination system with lenses producing a parallel beam as well as electron optical receivers. The FMG reveal information

on load history of structural units for the time the foils have been attached. The various possibilities for monitoring fatigue loads are described and FMG data are correlated with fatigue failure data of materials and structural units. M.G.

N80-18444# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
SEPARATION OF PRESTRESSED-TIME FUNCTIONS AFTER THEIR BEGINNING [TRENNUNG VON BEANSPRUCHUNGS-ZEITTUNKTIONEN NACH IHREM UPSPRUNG]
O. Buxbaum and J. M. Zaschel 1979 8 p refs Repr. from Sonderdruck aus Konstrwktion, West Germany, v. 31, no. 9, 1979 p 345-351 In GERMAN
Avail: NTIS HC A02/MF A01

Random stress-time histories as measured at structures in service consist usually of two parts, i.e., stresses caused by environment and by the so-called working process inherent in the usage of the structure. In order to obtain a reliable fatigue life assessment, these two parts must be separated before analysis is performed. Criteria are defined which can be used to identify either of the two parts. Based upon these criteria, methods for a separation were developed. It was demonstrated on a number of examples that for a wide range of stress-time histories two methods can be applied, i.e., frequency filtering and a separation of single stress variations characterized by shape and period. R.E.S.

N80-18445*# National Aeronautics and Space Administration, Washington, D. C.
A CONTRIBUTION TO NONLINEAR ROD THEORY
D. Petersen Nov. 1979 7 p refs Transl. into ENGLISH from Z. Angew. Math. Mech. (West Germany), v. 59, May 1979 p T205 - T206 Original language document was announced as A79-43975 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75734) Avail: NTIS HC A02/MF A01 CSCL 20K

The application of rod theories of higher order for the analysis of rotor blades is considered. It is demonstrated that the introduction of higher order terms must be consonant with the hypotheses of the rod theory, and linear theory premises cannot be used heedless of the consequences. M.G.

N80-18446*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
AEROELASTIC EQUATIONS OF MOTION OF A DARRIEUS VERTICAL-AXIS WIND-TURBINE BLADE
Krishna Rao V. Kaza (Toledo Univ.) and Raymond G. Kvaternik Dec. 1979 57 p refs
(Contract E(49-26)-1028)
(NASA-TM-79295; DOE/NASA/1028-79/25; E-238) Avail: NTIS HC A04/MF A01 CSCL 20K

The second-degree nonlinear aeroelastic equations of motion for a slender, flexible, nonuniform, Darrieus vertical-axis wind turbine blade which is undergoing combined flatwise bending, edgewise bending, torsion, and extension are developed using Hamilton's principle. The blade aerodynamic loading is obtained from strip theory based on a quasi-steady approximation of two-dimensional incompressible unsteady airfoil theory. The derivation of the equations has its basis in the geometric nonlinear theory of elasticity and the resulting equations are consistent with the small deformation approximation in which the elongations and shears are negligible compared to unity. These equations are suitable for studying vibrations, static and dynamic aeroelastic instabilities, and dynamic response. Several possible methods of solution of the equations, which have periodic coefficients, are discussed. K.L.

N80-18447# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
DYNAMIC STABILITY OF COLUMNS SUBJECTED TO NONCONSERVATIVE FORCES
J. J. Wu and J. D. Vasilakis Oct. 1979 23 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A078920; AD-E440053; ARLCB-TR-79030) Avail: NTIS HC A02/MF A01 CSCL 12/1

The numerical results of a class of problems of linear elastic stability problems subjected to nonconservative forces and under various support conditions are presented. A single solution formulation by which these results have been obtained is described. Accuracy of these results compared with those reported in the literature is discussed. GRA

N80-18448# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ANTI-PLANE SHEAR FIELDS WITH DISCONTINUOUS DEFORMATION GRADIENTS NEAR THE TIP OF A CRACK IN FINITE ELASTOSTATICS
J. K. Knowles and Eli Sternberg Sep. 1979 73 p refs
(Contract N00014-75-C-0196)
(AD-A076027) Avail: NTIS HC A04/MF A01 CSCL 20/11

This paper reconsiders the problem of determining the elastostatic field near the tip of a crack in an all-around infinite body deformed by a 'Mode 3' loading at infinity to a state of anti-plane shear. The problem is treated for a class of incompressible, homogeneous, isotropic elastic materials whose constitutive laws permit a loss of ellipticity in the governing displacement equation of equilibrium at sufficiently severe shearing strains. The analysis represents a generalization of that reported in an earlier study and, as before, is carried out for the 'small-scale nonlinear crack problem', in which a crack of finite length is replaced by a semi-infinite one, and the nonlinear field far from the crack-tip is matched to the near field predicted by the linearized theory. The methods employed in the present paper are necessarily largely qualitative, since they apply to all materials in the class considered. The principal feature of the resulting elastic field is the presence of two symmetrically located curves issuing from the crack-tip and bearing discontinuities in displacement gradient and stress. GRA

N80-18449# Aeronautical Research Labs., Melbourne (Australia).
A REVIEW OF AUSTRALIAN INVESTIGATIONS ON AERONAUTICAL FATIGUE DURING THE PERIOD APRIL 1977 TO MARCH 1979
G. S. Jost Apr. 1979 68 p refs
(AD-A071641; ARL/Struc-TM-303) Avail: NTIS HC A04/MF A01 CSCL 01/3

A summary is presented of the aircraft fatigue research and associated activities which form part of the programs of the Aeronautical Research Laboratories, Commonwealth Aircraft Corporation Pty. Ltd., Department of Transport (Airworthiness Branch), Royal Australian Air Force and the Government Aircraft Factories. The major topics discussed include the fatigue of both civil and military aircraft structures, fatigue of materials and components and fatigue life monitoring and assessment. GRA

N80-18450# Army Research and Technology Labs., Fort Eustis, Va.
HLH ROTOR BOX BEAM FATIGUE TEST
M. Hanson Sep. 1979 21 p refs
(DA Proj. 1L1-62209-AH-76)
(AD-A076931; USARTL-TN-35) Avail: NTIS HC A02/MF A01 CSCL 20/11

The purpose of this program was to evaluate the fatigue properties of a fiberglass/epoxy box beam specimen which was similar in design to the Heavy Lift Helicopters (HLH) rotor blade spar. The fiberglass/epoxy box beam was designed and fabricated by Boeing Vertol using a ply layup scheme similar to the rotor HLH blade spar but with a different preimpregnated fiberglass tape. The box beam was tested at a fatigue load level sufficient to cause failure within a reasonable number of fatigue cycles (5 x 1000,000) to determine fatigue strength and observe failure modes and rates. Premature fatigue failure occurred in the box beam as the result of chordwise wrinkles occurring during fabrication. The Integral Spar Inspection System (ISIS), which depends on a pressure differential between the sealed spar and outside ambient pressure to detect leaks resulting from cracks or flaws, indicated that a leakage had occurred at approximately the same time the failure was observed. It was concluded that the ISIS appeared to be a viable technique for signaling a structural failure of fiberglass spars. The presence of the wrinkles in the spar which resulted in premature failure, however, precluded any

conclusions with regard to the fatigue strength of the preimpregnated fiberglass tape used. GRA

N80-18451# Army Natick Research and Development Command, Mass.
FINITE ELEMENT ANALYSIS OF A STATICALLY LOADED ISO TACTICAL SHELTER
Arthur R. Johnson and Vitty P. Ciras Jan. 1979 156 p refs
(DA Proj. 1L1-62723-A-427)
(AD-A075807; NATICK/TR-79/023) Avail: NTIS
HC A08/MF A01 CSCL 13/3

A finite element analysis of a 2.4 m x 2.4 m x 6.1 m (8 ft x 8 ft x 20 ft) 3-for-1 expandable Army Shelter has been made for static loads designated in the specifications for Army ISO (International Standard Organization) Tactical Shelters. The report includes a description of the load paths, an investigation of the load-carrying capability of the structure both with and without wall panels as structural members, recommendations for improving the design for static load response, a buckling analysis for the ISO stacking test, and a comparison of calculated and measured data for a series of tests performed on the prototype shelter analyzed in this report. GRA

N80-18452# Naval Research Lab., Washington, D. C. Metals Performance Branch.
PROCEDURES FOR PRECISION MEASUREMENT OF FATIGUE-CRACK-GROWTH-RATE USING CRACK-OPENING-DISPLACEMENT TECHNIQUES Final Report
G. R. Yoder, L. A. Cooley, and T. W. Crooker 19 Nov. 1979 25 p refs
(SF54591506)
(AD-A077670; NRL-MR-4120) Avail: NTIS
HC A02/MF A01 CSCL 20/11

This paper describes experimental and analytical procedures whereby the conventional commercial fracture mechanics clip-gage can be used for precision measurement of fatigue-crack-growth-rate in compact tension specimens. Potential sources of error in measuring crack length via COD techniques are delineated. Comparisons are made among crack length data obtained via specimen surface observations and crack-opening-displacement (COD) techniques. Comparisons are also made among data analyzed by the secant and 7-point incremental polynomial methods. It is emphasized that COD techniques can enhance the accuracy of the secant method of data reduction. Step-loading procedures using COD techniques are described. Proposed amendments to ASTM E647-78T regarding incrementing of crack-length measurements via COD techniques are discussed. GRA

N80-18453# Pittsburgh Univ., Pa. School of Engineering.
SCIENCE OF FRACTURE Annual Report, 15 Aug. 1978 - 14 Aug. 1979
Max L. Williams, Jr. and Campbell C. Yates 12 Oct. 1979 126 p refs
(Contract F49620-78-C-0101; AF Proj. 2307)
(AD-A077564; SETEC-SF-79-51; AFOSR-79-1145TR) Avail: NTIS HC A07/MF A01 CSCL 20/11

This research program is intended to explore and develop commonalities in fracture theory as applied to wide classes of differing materials at different scales - from the atomic to the continuum. Primary attention is focused upon analytical and experimental methods needed to analyze underlying and potentially common basic mechanisms controlling the fracture process, e.g., two and three dimensional stress singularities, effect of environment, etc. and to examine structure-property relationships, including the effect of the fabrication process upon the preparation of specimens made from standardized model materials representative of polymers and metals. Secondary emphasis is focused upon numerical analysis methods needed at various scale levels, atomic to continuum, and instrumentation capability peculiarly suited to or needed for fracture studies. In later stages of the program, increasing attention will be devoted to technology transfer and engineering applications of the basic research. Major results during the first year include: (1) the development of a test for measuring Mode 2 fracture toughness, and (2) quantifying the effect of geometry in an embedded fiber or rod and the location of initial interfacial debonding from the matrix upon resulting adhesive fracture under load. GRA

N80-18454# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
A STRESS-STRAIN-TIME MODEL (SST) FOR HIGH-TEMPERATURE, LOW-CYCLE FATIGUE Technical Report, Jan. 1978 - Aug. 1979
Henry L. Bernstein Aug. 1979 32 p refs
(Contract F33615-76-S-5191; AF Proj. 7351)
(AD-A078829; SRL-6909-01; AFML-TR-79-4114) Avail: NTIS
HC A03/MF A01 CSCL 20/11

A Stress-Strain-Time Model (SST) has been developed to predict high-temperature, low-cycle fatigue life. The model states that the life can be predicted by three variables--stress, strain, and time. These three variables are combined in a power-law equation to predict the life. The stress parameter accounts for mean stress effects. The strain parameter accounts for time-independent fatigue damage, and the time parameter accounts for the time dependence of fatigue life. High-temperature, low-cycle fatigue data for several alloy systems are correlated to within a factor of 2.1, and data are predicted to within a factor of 2.6 using the SST Model. GRA

N80-18455# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
A NUMERICAL APPROACH TO ELASTIC-PLASTIC PLAIN-STRAIN PROBLEMS OF THICK-WALLED CYLINDERS
P. C. T. Chen Oct. 1979 22 p refs Proposed for Presentation at the 10th Southeastern Conf. on Theoret. and Appl. Mech., Knoxville, Tenn., 17-18 Apr. 1980
(DA Proj. 1L1-61101-A-91A)
(AD-A078365; ARLCB-TR-79026) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A new finite-difference approach has been developed for solving the elastic-plastic plane-strain problems of thick-walled cylinders subjected to internal or external pressure. The material is assumed to obey the von Mises' yield criterion, the Prandtl-Reuss flow theory and the isotropic hardening rule. The numerical scheme is stable for ideally-plastic as well as straining-hardening materials. The approach is simpler than others, and very accurate solutions can be obtained by reducing the grid sizes and load increments. The results for the stresses and strains in all principal directions have been computed as functions of loading history. GRA

N80-18456# Forest Products Lab., Madison, Wis.
BENDING STRENGTH OF VERTICALLY GLUED LAMINATED BEAMS WITH ONE TO FIVE PLIES
Ronald W. Wolfe and Russell C. Moody 1979 23 p refs Prepared in cooperation with Wisconsin Univ., Madison
(AD-A077173; FSRP-FPL-333) Avail: NTIS
HC A02/MF A01 CSCL 11/12

Properties of vertically laminated beams were studied to determine the effects of number and quality of component laminations on structural performance. Deterministic and probabilistic analyses were both used to show how performance varies with number and quality of laminations and with assumed loading parameters. Increase in allowable stress with number of laminations, currently recognized as a constant adjustment for three or more laminations, was significant for two-lamination beams as well. This increase proved to be inversely related to lumber quality. Results will be helpful to organizations publishing engineering design stresses in establishing a more efficient design of vertically laminated beams. GRA

N80-18457# Royal Inst. of Tech., Stockholm (Sweden). Inst.
BENDING PROPERTIES OF NON-HOMOGENEOUS PLATES OF ISOTROPIC AND ORTHOTROPIC MATERIALS [BOEJSTYVHET HOS EN ICKE-HOMOGEN PLATTA AV ISOTROPT OCH ORTOTROPT MATERIAL]
Pavel Sindelar 1977 24 p refs In SWEDISH
(TRITA-HFL-21) Avail: NTIS HC A02/MF A01

The bending properties of laminated plates composed of several layers of different homogeneous materials was studied. Isotropic and orthotropic materials were considered. A bending theory for thin, uniform, and flat plate was developed. The corresponding equations are presented together with numerical examples. It is shown that while the orthotropy and the width ratio have a noticeable influence on the bending characteristics, the shearing force ratio is of minor importance. Author (ESA)

N80-18458# Royal Inst. of Tech., Stockholm (Sweden).
FRACTURE MECHANICS STUDY OF FRESH WATER ICE [BROTTMEKANISKA STUDIER AV FAERSKVATTENIS]
Holger Droege Dec. 1975 70 p refs In SWEDISH
(TRITA-HFL-0021; Publ-201) Avail: NTIS HC A04/MF A01

Various experiments done on fresh water ice are reported. Some general physical characteristics and data linked to elasticity research are described. The results of fracture elasticity experiments on artificial fresh water ice at -10 C are given. A special hydraulic press was used and displacement, force, and time were registered by two X-Y recorders. Polarized light photographs were taken. Load rates of 100 14, and 1.3 N/s were used. Only for the 100 and 14 N/s was fracture elasticity found in accordance with linear fracture mechanics prediction. The average value of fracture elasticity was 0.16 and 0.26 mega newton per meter to the 3/2 power respectively. The corresponding values for the re-iced test samples are 0.13 and 0.19 MN/m to the 3/2 power respectively. Author (ESA)

N80-18459# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FATIGUE CRACK GROWTH IN LUGS AND THE STRESS INTENSITY FACTOR
J. Schijve and A. H. W. Hoeymakers Jul. 1978 28 p refs
(VTH-LR-273) Avail: NTIS HC A03/MF A01

Crack growth in aluminium alloy lugs was recorded during constant amplitude loading (R = 1/3). Observations were made both for artificial cracks started by a small saw cut and natural cracks started by fretting corrosion between hole and pin. Scatter was low for artificial cracks, whereas considerable scatter was seen at the natural cracks as a result of multiple crack initiation at different times and locations. The fastest crack growth was observed for artificial cracks which appear to be a worst case as compared to natural cracks. The K-values derived from crack growth results were in good agreement with K-values reported in the literature. Author (ESA)

N80-18460# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
UTILIZATION OF 'STAGS' TO DETERMINE KNOCKDOWN FACTORS FROM MEASURED INITIAL IMPERFECTIONS
Johann Arbocz and C. D. Babcock Nov. 1978 88 p refs
(VTH-LR-275) Avail: NTIS HC A05/MF A01

Various methods for predicting the buckling load of axially compressed stringer stiffened shells in the presence of initial imperfections were evaluated. Both simplified analytical methods and refined computer codes based on finite difference energy formulation (STAGS) were used. The analytical predictions were validated by comparison with the experimentally determined buckling load. A method is proposed which makes it possible to take into account both the effect of initial imperfections and the effect of the appropriate boundary conditions. Author (ESA)

N80-18461# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A MODEL OF AN ELASTIC EARTH BY A FINITE ELEMENT METHOD APPLIED TO SPHERICAL SHELLS Thesis - Tech. Univ., Berlin [MODELL EINER ELASTISCHEN ERDE AUF DER GRUNDLAGE FINITER KUGELSCHALEN-ELEMENTE]
Heinz-Juergen Szameitat 1979 133 p refs In GERMAN
(Ser-C/Diss-249-Mitt-149) Avail: NTIS HC A07/MF A01

In the model, the Earth is represented by a series of concentric spheres of constant density, each of which is given an analytical function. A computer program analyzes the elastic deformation and produces potentials and variations in the gravity field. Author (ESA)

N80-18214 Pacific Missile Test Center, Point Mugu, Calif.
A MATHEMATICAL METHOD FOR DETERMINING A LABORATORY SIMULATION OF THE CAPTIVE-FLIGHT VIBRATIONAL ENVIRONMENT
Sharon Ogden *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 1-4 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18215 Pacific Missile Test Center, Point Mugu, Calif.
ACOUSTICS OR SHAKERS FOR SIMULATION OF CAPTIVE FLIGHT VIBRATION
A. M. Spandrio and M. E. Burke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 5-14 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18220 Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.
CONSERVATISM IN RANDOM VIBRATION ANALYSIS AND TESTING
Thomas L. Paez *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 57-70 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18223 Monash Univ., Clayton (Australia).
HIGH FREQUENCY GROUND VIBRATION MEASUREMENT
H. Nolle *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 95-103 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18224 Bouche Labs., Sun Valley, Calif.
THE RECIPROCITY CALIBRATION OF VIBRATION STANDARDS OVER AN EXTENDED FREQUENCY RANGE
R. R. Bouche *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 105-111 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

42 GEOSCIENCES (GENERAL)

N80-18462*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SOLAR-TERRESTRIAL PREDICTIONS PROCEEDINGS. VOLUME 1: PREDICTION GROUP REPORTS
Richard F. Donnelly, ed. Aug. 1979 433 p refs Workshop held in Boulder, Colo., 23-27 Apr. 1979 Sponsored by NASA, AFGL, AFOSR, DOE and NSF
(NASA-CR-162794) Avail: NTIS MF A01; SOD HC CSCL 04A

The current practice in solar terrestrial predictions is reviewed with emphasis of prediction, warning, and monitoring services. Topics covered include: ionosphere-reflected HF radio propagation; radiation hazards for manned space flights and high altitude and high latitude aircraft flights; and geomagnetic activity. For individual titles, see N80-18463 through N80-18495.

N80-18463*# Observatoire de Meudon (France).
THE FORECASTING CENTER OF MEUDON, FRANCE c47
Paul Simon *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 1-11 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04B

Main features of solar activity are described in relation to solar and geophysical forecasting. Spectroheliograms, radio and X-ray data, white light coronal observations, particles data, photospheric images, and photospheric magnetic fields are among the types of data used to identify the active centers and flares of the Sun. Forecasting and identification of geomagnetic activity is also discussed. The forecasting technique is described along with the types of users. J.M.S.

N80-18464*# Centre National d'Etudes des Telecommunications, Lannion (France). Dept. Mesures Ionospheriques et Radioelectriques.
THE FRENCH SHORT TERM RADIOPROPAGATION PREDICTIONS IN THE DECAMETER BAND c32
P. Lassudrie-Duchesne, A. M. Bourdila, and H. Sizun *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 12-24 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

Weekly and daily predictions of the ionospheric characteristics

relevant to radio propagation are considered. A description of the techniques involved is given as well as examples showing how the prediction messages are prepared. The short term predictions are confined to restricted geographical areas and are relevant to radio circuits whose terminators are both located inside the same zone. They can be used with a reasonable approximation for circuits less than 3000 km of length whose reflection point lies within a given zone. J.M.S.

N80-18465*# Forschungsinstitut der Deutschen Bundespost, Darmstadt (West Germany).
PROPAGATION PREDICTIONS FOR THE HF-RANGE BY THE RESEARCH INSTITUTE OF THE DEUTSCHE BUNDESPOST c32
Th. Damboldt *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 25-43 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

Long term and short term HF propagation prediction service is described. The long term prediction method is computer based. The short term prediction method is still a manual method which relies mainly on a number of continuous field strength recordings and on the forecaster's ability to interpret the recordings and to combine this information with all available solar-geophysical data. Examples of the predictions are given and are compared with actually observed HF propagation conditions. J.M.S.

N80-18466*# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.
A METHOD OF PREDICTIONS GEOMAGNETIC ACTIVITY BASED ON A CORONAL MODEL OF RELATIONS BETWEEN SOLAR AND GEOMAGNETIC ACTIVITIES c46
Jaroslav Halenka *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 44-60 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

A method developed to predict both disturbed and quiet geomagnetic periods is described. The method uses solar situations along the CM with the key role of filaments, giving indirect evidence of types of directly unobservable coronal structures above them. The time lag, not to be interpreted in terms of propagation speed, between the CM activity and the commencement of the geomagnetic response is about one to two days. Solar phenomena serve as indicators within approximately 10 deg of the CM and up to the zone of high latitude filaments. J.M.S.

N80-18467*# Polish Academy of Sciences, Warsaw. Space Research Centre.
KAZIA: A COMPUTER SYSTEM FOR SOLAR-TERRESTRIAL DATA PROCESSING AND OBJECTIVE PREDICTION c46
K. Stasiewicz, M. Maksymienko, and M. Jakimiec (Wroclaw Univ.) *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 61-66 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

A computer system for solar terrestrial data processing is described. The data base consists mainly of information contained in Ursigrams exchanged between the IUWDS Regional Warning Centers. The system structure and its functions are presented. Solar flare forecasting is described, as one of the prediction techniques incorporated in the system. J.M.S.

N80-18468*# Polish Academy of Sciences, Warsaw. Space Research Centre.
ESTIMATION OF SOLAR FLAME INFLUENCE ON RADIO CIRCUIT TRANSMISSION LOSS c32
Z. Klos and K. Stasiewicz *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 67-71 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

A provisional method for determining the hours and frequencies at which solar flares cause major radiopath absorption increase is presented. This technique is incorporated in a computer program for monthly radio propagation prediction. J.M.S.

N80-18469*# Crimean Astrophysical Observatory (USSR).
SOVIET SHORT-TERM FORECASTS OF ACTIVE REGION EVOLUTION AND FLARE ACTIVITY c92
A. B. Severny, N. N. Stepanyan, and N. V. Steshenko *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 72-88 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

The structure and strength of the magnetic fields of the Sun's active regions were studied to obtain information for short term forecasting. Intensity forecasts were then made using the information obtained on the gradients of the magnetic fields between sunspots of opposite polarity. A comparison of flare forecasting methods is presented. R.E.S.

N80-18470*# Institute of Applied Geophysics, Moscow (USSR).
FORECASTING OF SOLAR ENERGETIC RADIATION AT THE FORECAST CENTER OF THE INSTITUTE OF APPLIED GEOPHYSICS c92
S. I. Avdyushin, N. K. Pereyaslova, F. L. Dlikman, and Yu. M. Kulagin *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 89-103 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

Solar energetic radiation forecasting techniques are described. The factors that are used as the basis for the forecasts are discussed. R.E.S.

N80-18471*# Institute of Applied Geophysics, Moscow (USSR).
FORECASTING IONOSPHERIC AND GEOMAGNETIC CONDITIONS AT THE IAG FORECASTING CENTER c46
S. I. Avdyushin, A. D. Danilov, A. B. Malyshev, G. N. Novikova, and P. M. Svidsky *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 104-117 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

A description of the Moscow Regional Warning Center activity in the field of geomagnetic and ionospheric forecasting is presented. R.E.S.

N80-18472*# National Physical Lab., New Delhi (India). Radio Science Div.
LONG TERM SOLAR ACTIVITY AND IONOSPHERIC PREDICTION SERVICES RENDERED BY THE NATIONAL PHYSICAL LABORATORY, NEW DELHI c32
B. M. Reddy, S. Aggarwal, D. R. Lakshmi, S. Shastri, and A. P. Mitra *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 118-133 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

The data base used in solar and ionospheric prediction services is described. Present prediction techniques are discussed and compared with actual observations. Future prediction techniques using computers are also discussed. R.E.S.

N80-18473*# National Physical Lab., New Delhi (India).
A SIMPLIFIED INDEXING OF F-REGION GEOPHYSICAL NOISE AT LOW LATITUDES c46
S. Aggarwal, D. R. Lakshmi, and B. M. Reddy *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 134-139 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

A simple method of deriving an F-region index that can warn the prediction users at low latitudes as to the specific months when they have to be more careful in using the long term predictions is described. R.E.S.

N80-18474*# Academia Sinica, Kunming (China). Yunnan Observatory.
SPIRAL SUNSPOTS AND SOLAR ACTIVITY FORECASTS c92
Ding You-ji and Zhang Bai-rong *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 140-153 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

The definition of a spiral sunspot is given. Three examples are described which illustrate the processes of the occurrence of spiral sunspots and the roles played by them in prominence and flare activities. A method for solar activity forecasts is then proposed making use of parameters such as spiral sunspots, prominences and neutral lines. R.E.S.

N80-18475*# Academy of Sciences, Peking (China). Solar Activity Prediction Group.
SOLAR ACTIVITY PREDICTIONS AT PEKING OBSERVATORY **c92**
In NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 154-162 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

Solar activity prediction procedures used at the Peking Observatory are briefly reviewed. Methods for short term prediction of solar proton events and the results for proton events of importance greater than 1 during the period 1974-1977 are given in detail. The characteristic values of solar cycle 21 are predicted. Author

N80-18476*# Academia Sinica, Nanking (China). Purple Mountain Observatory.
LONG-TERM FORECASTING OF SOLAR ACTIVITY **c92**
Xu Zhen-Tao, Zhao Ai-Di, Mei Yan-Lin, and Guo Quan-Shi *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 163-175 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

Corrections to the forecast of the basic parameters of the 21st cycle are described. Estimates about the level of solar activity in the 22nd cycle are presented. R.E.S.

N80-18477*# Academia Sinica, Nanking (China). Solar Activity Prediction Group.
SHORT-TERM SOLAR ACTIVITY FORECASTING **c92**
Chen Xie-Zhen and Zhao Ai-Di *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 176-181 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

A method of forecasting the level of activity of every active region on the surface of the Sun within one to three days is proposed in order to estimate the possibility of the occurrence of ionospheric disturbances and proton events. The forecasting method is a probability process based on statistics. In many of the cases, the accuracy in predicting the short term solar activity was in the range of 70%, although there were many false alarms. M.M.M.

N80-18478*# Radio Research Labs., Nakaminato (Japan).
FORECASTS OF GEOMAGNETIC ACTIVITIES AND HF RADIO PROPAGATION CONDITIONS MADE AT HIRAISO/JAPAN **c32**
K. Marubashi, Y. Miyamoto, T. Kidokoro, and T. Ishii *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 182-204 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

The Hiraiso Branch of RRL prediction techniques are summarized separately for the 27 day recurrent storm and the flare-associated storm. The storm predictions are compared with the actual geomagnetic activities in two ways. The first one is the comparison on a day to day basis. In the second comparison, the accuracy of the storm predictions during 1965-1976 are evaluated. In addition to the storm prediction, short-term predictions of HF radio propagation conditions are conducted at Hiraiso. The HF propagation predictions are briefly described as an example of the applications of the magnetic storm prediction. M.M.M.

N80-18479*# Nagoya Univ., Toyokawa (Japan). Research Inst. of Atmospherics.
A REVIEW OF SHORT-TERM FLARE FORECASTING ACTIVITIES AT TOYOKAWA **c92**
Shinzo Enome *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 205-211 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

Short-term forecasting of solar activity conducted at Toyokawa is briefly reviewed. The forecasts are based on microwave observations of the slowly varying component of solar radiation associated with active regions. It was found that for proton flares which take place in intense active regions, it is possible to predict their occurrence with certain accuracy, but for a certain class of proton flares which occur in a small active region or which are associated with an active region, which evolves very rapidly, or for whose which occur behind the limb, it is almost impossible to forecast their occurrence. M.M.M.

N80-18480*# Radio Research Labs., Tokyo (Japan).
RADIO PROPAGATION PREDICTION SERVICES IN JAPAN **c32**
Rikio Maeda *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 212-222 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

Japanese prediction services for HF radio communications are outlined in relation to prediction method, performance and evaluation. The current prediction is based on the CCIR interim method with some modifications matching to a computer system. The principal service is the monthly median prediction issued regularly three months in advance for various communication circuits. A daily prediction for short distance circuits is being prepared by using real time ionospheric sounding data. An evaluation theory and practice is expected to be introduced in the future prediction service. M.M.M.

N80-18481*# Radio Research Labs., Tokyo (Japan).
RADIO DISTURBANCE WARNING ISSUANCE SYSTEM **c32**
Rikio Maeda and Hisao Inuki *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 223-228 (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

A radio disturbance warning issuance system was introduced in the Hiraiso Branch of the Radio Research Laboratories in 1972 to reconstruct the current radio disturbance warning service as a social information service. A description of the new ideas which were experimentally systematized by means of an electronic computer is presented. M.M.M.

N80-18482*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
A REVIEW OF THE OPERATION OF THE IUWDS REGIONAL WARNING CENTRE AT THE IONOSPHERIC PREDICTION SERVICE, SYDNEY **c46**
F. E. Cook and P. Davies *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 229-238 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

The operation of the Sydney Regional Warning Centre is reviewed. Routine data reports are issued daily, while disturbance warnings (short-term forecasts) are issued as necessary. An outline of the methods used in forecasting solar activity and geomagnetic disturbances is given. Author

N80-18483*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
A DISTURBANCE FORECASTER'S VIEW OF THE SEPTEMBER 1977 EVENTS **c46**
F. E. Cook *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 239-248 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

The solar-geophysical events of 1977 September 7-26 are presented. A variety of disturbance forecasting problems, viz. disc transit of a center of activity with high microwave flux but relatively low meter-wave flux, flares in this region near east limb, central meridian, and west limb with major radio events, and the presence of two coronal holes, were observed. The Sydney daily GEOSYD message and IPS Disturbance Warnings issued during this period are related to the solar geophysical data available, at the time, about these events. M.M.M.

N80-18484*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
THE USE OF IONOSPHERIC INDICES TO MAKE REAL- AND NEAR-REAL-TIME FORECASTS OF foF2 AROUND AUSTRALIA **c46**
L. F. McNamara *In* NOAA Solar-Terrest. Prediction Proc., Vol. 1 Aug. 1979 p 249-258 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

Two computer programs are used to forecast foF2 at points

around Australia from daily and hourly ionospheric indices. It is found that for forecasts one day ahead, the most accurate results are obtained using the past variations of foF2 at several stations to determine a latitudinal-average daily ionospheric index. Forecasts made with lead times of zero to three hours do not offer significant improvements over those made one day ahead. K.L.

N80-18485*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
PREDICTION LIMITS FOR foF2 **c46**
P. J. Wilkinson. *In* NOAA. Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p 259-278. refs (For primary document see N80-18462 09-42)
Avail: NTIS. MF A01; SOD HC. CSCL 04A

Some of the factors limiting the prediction of foF2 are investigated using median and hourly foF2 values recorded at stations in the Australian ionosonde network. Different time and spatial scales together with different levels of solar and geomagnetic activity are considered. All data used in the analysis are displayed in a series of scatter diagrams which provide an overall view of the accuracy limits for foF2 predictions. K.L.

N80-18486*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
A WEEKLY IONOSPHERIC INDEX **c46**
J. F. Turner and P. J. Wilkinson. *In* NOAA. Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p 279-287. refs (For primary document see N80-18462 09-42)
Avail: NTIS. MF A01; SOD HC. CSCL 04A

The monthly and weekly T indices are discussed. Some possibilities for improving the reliability of the weekly T index are considered, including extending its applicability to daily variations of the global ionosphere. K.L.

N80-18487*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
CORONAL HOLES INFERRED FROM THE FLEURS EAST-WEST SOLAR SCANS **c92**
Brian G. Ferguson. *In* NOAA. Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p 288-311. refs (For primary document see N80-18462 09-42)
Avail: NTIS. MF A01; SOD HC. CSCL 03B

East-West solar scans produced daily on 692 and 1415 MHz are analyzed for the period 1968 to 1973. The analysis confirms that coronal holes are stable features displaying significantly reduced electromagnetic emission which can persist for many solar rotations. The coronal hole observations are summarized in a series of tables. K.L.

N80-18488*# Naval Ocean Systems Center, San Diego, Calif.
PROPHET: AN APPLICATON OF PROPAGATION FORECASTING PRINCIPLES **c32**
Paul E. Argo and Ilan J. Rothmuller. *In* NOAA. Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p 312-321. refs (For primary document see N80-18462 09-42)
Avail: NTIS. MF A01; SOD HC. CSCL 20N

A propagation assessment and forecasting terminal, PROPHET, is described. The terminal is a key element of the environmental prediction and assessment system which uses real time solar/geophysical data to provide real time knowledge of propagation conditions. The terminal uses models to translate data from satellite and ground based sources into performance predictions for specific systems. K.L.

N80-18489*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
PREDICTIONS OF THE SPACE ENVIRONMENT SERVICES CENTER **c46**
G. R. Heckman. *In its* Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p 322-349. refs (For primary document see N80-18462 09-42)
Avail: NTIS. MF A01; SOD HC. CSCL 04A

The types of users of the Space Environment Services Center are identified. All the data collected by the Center are listed and a short description of each primary index or activity summary is given. Each type of regularly produced forecast is described, along with the methods used to produce each prediction. K.L.

N80-18490*# Air Force Global Weather Central, Offutt AFB, Nebraska.
GEOPHYSICAL FORECASTING AT AFGWC **c46**
Richard L. Thompson and James A. Secan. *In* NOAA. Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p 350-366. refs (For primary document see N80-18462 09-42)
Avail: NTIS. MF A01; SOD HC. CSCL 04A

Methods for forecasting the state of the space environment, Sun, interplanetary field, magnetosphere, and ionosphere are discussed. Areas requiring scientific advancements to support the increasing operational requirements of systems that use or are affected by the environment above 50 km are identified. K.L.

N80-18491*# Air Force Global Weather Central, Offutt AFB, Nebraska.
IONOSPHERIC MODELING AT AIR FORCE GLOBAL WEATHER CENTRAL **c46**
Thomas F. Tascione, Thomas W. Flattery, Vernon G. Patterson, James A. Secan, and James W. Taylor, Jr. *In* NOAA. Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p 367-377. refs (For primary document see N80-18462 09-42)
Avail: NTIS. MF A01; SOD HC. CSCL 04A

The four Dimensional Ionospheric Model (4-D) is described. The 4-D integrates a wide variety of ionospheric data types into a consistent ionospheric specification. At each observing location, the 4-D reduces an entire electron density profile to four weighting coefficients. These weighting coefficients are interconnected in time and space by spectral analysis techniques. The resultant field of spectral coefficients can be used to reconstruct an electron density profile at any latitude, longitude and time. R.C.T.

N80-18492*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
MSFC SOLAR ACTIVITY PREDICTIONS FOR SATELLITE ORBITAL LIFETIME ESTIMATION **c92**
H. C. Fuler, C. A. Lundquist, and W. W. Vaughan. *In* NOAA. Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p 378-384. refs (For primary document see N80-18462 09-42)
Avail: NTIS. MF A01; SOD HC. CSCL 03B

The procedure to predict solar activity indexes for use in upper atmosphere density models is given together with an example of the performance. The prediction procedure employs a least square linear regression model to generate the predicted smoothed vinculum R sub 13 and geomagnetic vinculum A sub p(13) values. Linear regression equations are then employed to compute corresponding vinculum F sub 10.7(13) solar flux values from the predicted vinculum R sub 13 values. The output is issued principally for satellite orbital lifetime estimations. R.C.T.

N80-18493*# Michigan Univ., Pontiac. McMath-Hulbert Observatory.
EXAMPLES OF PROBLEM FLARES OR SITUATIONS IN PAST SOLAR-TERRESTRIAL OBSERVATIONS **c92**
H. W. Dodson, E. R. Hedeman, and O. C. Mohler. *In* NOAA. Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p 385-397. refs. Sponsored in part by APL/JHU (For primary document see N80-18462 09-42)
(Grants NGL-23-005-275; NOAA-03-4-022-94)
Avail: NTIS. MF A01; SOD HC. CSCL 03B

Instances of solar activity are disscused in terms of their relative interference with making solar terrestrial observations. Unexpected flares of significance are reported and the geophysical effects of these flares are noted. R.C.T.

N80-18494*# Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
FORECASTS OF GEOMAGNETIC ACTIVITY BY OTTAWA MAGNETIC OBSERVATORY: THEIR RELIABILTY AND APPLICATION **c46**
J. Hruska. *In* NOAA. Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p 398-405. refs. Sponsored in part by NOAA (For primary document see N80-18462 09-42)
Avail: NTIS. MF A01; SOD HC. CSCL 04A

A 27 day forecast of geomagnetic activity based on the forecasts from two locations is presented. To evaluate the reliability of the forecasts, the predicted activity was compared with the actual geomagnetic activity at five geomagnetic observatories located in different magnetic zones: Ottawa (57.0N, 351.5E);

Meanook (61.8N, 301.0E); Fort Churchill (68.8N, 322.5E); Cambridge Bay (76.7N, 294.0E); and Resolute Bay (83.1N, 287.7E). Results indicate that the percentage of correct predictions varies with the geomagnetic latitude of the observatory used for comparison. The percentage is on the average highest for lower latitude stations and lowest for the northern stations. The number of incorrect predictions ranges from 4.7% for Ottawa to 8.4% for Churchill. R.C.T.

N80-18495*# Air Force Geophysics Lab., Hanscom AFB, Mass.
PPS76: A COMPUTERIZED EVENT MODE SOLAR PROTON FORECASTING TECHNIQUE **c92**
D. F. Smart and M. A. Shea *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 406-427 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

A procedure was developed to generate a computerized time intensity profile of the solar proton intensity expected at the Earth after the occurrence of a significant solar flares on the Sun. A combination of many pieces of independent research and theoretical results are included. A construction of selected experimental and theoretical results from the entire domain of solar terrestrial physics is given. R.C.T.

N80-18496# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LAND USE AND CLIMATOLOGICAL PARAMETERS IN HUMID TROPICS [O CLIMA E O USO DA TERRA NOS TROPICOS UMIDOS]
Luiz Carlos Baldicero Molion and Juan Jose Verdesio Bentancurt Nov. 1979 28 p refs In PORTUGUESE; ENGLISH summary Presented at the 2d Simp. Nacl. de Ecol., Belem, Portugal, 19-24 Nov. 1979
(INPE-1630-RPE/092) Avail: NTIS HC A03/MF A01

The interaction of climatological parameters with different land use systems in the humid tropics is discussed. The climate of humid tropical regions is characterized as a function of large scale parameters and the differences of the energy and water balances terms over different ground cover types are discussed. It is shown that humid forests have a higher net radiation flux when compared to different cover types and, therefore, have more energy available to vaporize water. Consequently, the changeover from forest to other land uses modifies the regional climate. An attempt is made to identify techniques which would attenuate the land use effects on the climate of tropical regions. M.G.

N80-18497*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL CALCULATION OF STEADY INVISCID FULL POTENTIAL COMPRESSIBLE FLOW ABOUT WIND TURBINE BLADES
Djordje S. Dulikravich 1980 11 p refs Presented at the Wind Energy Conf., Boulder, Colo., 9-11 Apr. 1980; sponsored by AIAA and Midwest Energy Research Inst.
(NASA-TM-81438; E-361; AIAA-Paper-80-0607) Avail: NTIS HC A02/MF A01 CSCL 10B

An exact nonlinear mathematical model that accounts for three-dimensional cascade effects about the inner portions of the rotor blades and compressibility effects about the tip regions of the blades was derived. An artificially time dependent version was iteratively solved by a finite volume technique involving an artificial viscosity and a three-level consecutive mesh refinement. The exact boundary conditions were applied by generating a boundary conforming periodic computation mesh. K.L.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-18498* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RADAR TARGET FOR REMOTELY SENSING HYDROLOGICAL PHENOMENA Patent
Willford E. Sivertson, Jr., inventor (to NASA) Issued 15 Jan. 1980 6 p Filed 22 Sep. 1978 Supersedes N78-33511 (16 - 24, p 3231)
(NASA-Case-LAR-12344-1; US-Patent-4,184,155; US-Patent-Appl-SN-945041; US-Patent-Class-343-5CM; US-Patent-Class-343-5W; US-Patent-Class-343-18B; US-Patent-Class-343-18D) Avail: U.S. Patent and Trademark Office CSCL 08H

An apparatus for remotely measuring and accessing water status relative to snow and glacial melt, surface runoff, rainfall, evaporation, flow rate, and soil moisture is described. A radar target located at a selected location on the surface of the Earth is designed to collect water and render its cross sectional area variable as a function of the height of the water level within the target. The target is remotely monitored by an orbiting or airborne synthetic aperature radar. The target appears as a bright spot embedded within the radar image. The target brightness is indicative of the height of the water level within the ground located target.

Official Gazette of the U.S. Patent and Trademark Office

N80-18499 Kansas Univ., Lawrence.
AN EVALUATION OF MAP DESIGN AND MAP READING USING EYE MOVEMENT RECORDINGS Ph.D. Thesis
Theodore R. Steinke 1979 335 p
Avail: Univ. Microfilms Order No. 8002766

The eye movements of 60 subjects looking at a map were recorded using a corneal reflection technique in order to determine the parts of the map being observed, the time spent looking at the various parts, and the scanning sequence. One of three maps (having the same basic map body but with varying amounts of surrounding information) was shown to each group of 20 subjects to ascertain the effect of map design on map reading ability. All subjects reconstructed the map from memory shortly after eye movement recording. Analysis of the film shows attention was directed to the map body, title, and legend. The average time spent looking at the map was about 22 seconds, but ranged from 12.6 to 40.3 seconds. Reading was begun in the central and upper part of the map body or on the title. After this the gaze moved in very diverse directions with little unaminity in the location of the part last observed. There were relatively few differences in the way the maps transmitted geographic information to the readers as revealed by map reconstruction; however, maps with little or no surrounding information seem to function more efficiently. Dissert. Abstr.

N80-18500* Oregon State Univ., Corvallis.
AN INVESTIGATION OF THE UTILITY OF LANDSAT 2 MSS DATA TO THE FIRE-DANGER RATING AREA, AND FOREST FUEL ANALYSIS WITHIN CRATER LAKE NATIONAL PARK, OREGON Ph.D. Thesis
Hassan Alizadeh Rabii 1979 434 p
Avail: Univ. Microfilms Order No. 8002679

Downed forest fuel tonnage/acre within Crater Lake National Park was inventoried and mapped using LANDSAT multispectral data in conjunction with National Cartographic Information Center (NCIC) digital topographic Information. Interactive classification capability of a Nova 840 computer system and its video color display provided identification and mapping criteria for classification of various surface and cover types within the park. Ground truth information was utilized to correlate the MSS/topographic data set to color IR aerial photographic data. Dissert. Abstr.

N80-18501 Colorado Univ. at Boulder.
MASS BALANCE AND ASPECTS OF THE GLACIER ENVIRONMENT, FRONT RANGE, COLORADO, 1969-1973 Ph.D. Thesis
James Benjamin Johnson 1979 308 p
Avail: Univ. Microfilms Order No. 8002987

Study of the topoclimate of the Arapaho Glacier and the Arikaree Glacier established solar radiation as a predominant factor in controlling the mass balance of glaciers in the Indian Peaks region of the Colorado Front Range. Due to avalanching from the cirque walls and the wind drift into the basins, snow accumulates to average depths of 5.5 m exceeding the regional accumulation. Ablation removes most of the snow pack each year. Albedos vary from around 0.8 in the early ablation season

down to 0.4 at the end of the summer. The change occurs primarily due to the accumulation of dust and debris at the surface of the snow pack and the amount of this contamination is the major control on the melt rates. The fact that this controlling factor exists suggests that melting of the glaciers can be augmented artificially be adding darkening materials to the early summer snow cover if desired. Accelerated melting would then leave a deeper topographic catchment for the next winter accumulation and potentially increase the water supply available from the alpine areas. Dissert. Abstr.

N80-18502 Florida Univ., Gainesville.
ANALYSIS OF FRESHWATER LENS FORMATION IN SALINE AQUIFERS Ph.D. Thesis
John Patrick Glass 1979 189 p
Avail: Univ. Microfilms Order No. 8002880

Results of laboratory tests using vertical Hele-Shaw models to determine the shape and rate of movement of the initially vertical interface between two fluids of different density show that, for relatively thick aquifers, it is not correct to neglect the vertical components of flow as has formerly been done. An analytical method is presented for the location of the boundary of a steady freshwater lens in a coastal aquifer. A pair of coupled ordinary differential equations is derived which describe the steady flow of freshwater injected into a leaky saline aquifer under the Dupuit assumption. A three dimensional finite element model is developed which can be used to locate the boundaries of a steady freshwater lens under a wide variety of conditions. A finite difference model developed for the U.S. Geological Survey is used to analyze the axisymmetric flow in transient freshwater lenses. Dissert. Abstr.

N80-18503 Utah State Univ., Logan.
WATERSHED CONSTITUENT LOADING ANALYSIS UTILIZING EMPIRICAL HYDROCHEMICAL MODELING TECHNIQUES Ph.D. Thesis
Jerald Stevens Fifield 1980 208 p
Avail: Univ. Microfilms Order No. 8005104

A simple modification to a hydrologic model in order to create a hydrochemical model is discussed and verified. Two basins along the Colorado River (the Grand Valley, Colorado, and Palo Verde, California) as well as along the Arkansas River in Colorado and Yakima River in Washington were used to acquire stream quality and quantity data. The modified deterministic model was calibrated on 80,200 acres of the Grand Valley, Colorado. Subsequent management runs indicate that only a not minimal reduction of salt loading to the Colorado River will be realized by lining canals, laterals and ditches whereas substantial reduction will result upon increased farm efficiency and/or reduction of spills. When optimal management conditions are met, sulfate will decrease the most and potassium the least. Dissert. Abstr.

N80-18504 California Univ., Davis.
TURBULENT MIXING PROCESSES IN A PARTIALLY MIXED ESTUARY Ph.D. Thesis
Robert Carl MacArthur 1979 341 p
Avail: Univ. Microfilms Order No. 8003523

A method of estimating the nature and magnitude of the parameters which describes the flow, in the region near the bed, located below the maximum density gradient in partially mixed estuaries is developed and validated. Accurate determination of these parameters allows the calculation of the vertical profiles of velocity and an estimation of the vertical turbulent mixing coefficients within this region. Calculated values of the local bed shear stress obtained from numerically integrating a form of the two dimensional momentum equation were found to be accurate when compared to the measured sediment bed shear strengths for various orders of aggregation throughout a mean tide. Orderly flows occur during specific periods of time during a tidal cycle and only within certain vertical regions of the flow within the Savannah estuary. Criteria are developed to be able to identify these periods of fully developed flow. Dissert. Abstr.

N80-18505 Utah State Univ., Logan.
FEATURE SELECTION AND CLASSIFIER DESIGN WITH APPLICATIONS TO REMOTE SENSING OF MULE DEER Ph.D. Thesis
Manmohan M. Trivedi 1980 134 p
Avail: Univ. Microfilms Order No. 8005119

The deer detection problem where the classification is performed in a multidimensional feature space. A generalized scene, of which the winter range may be considered typical is used in the classification. It includes the deer, evergreen trees, sagebrush, and dry brush against a snow background. A general interclass feature selection procedure, based upon clustering technique, was formulated and used to select best feature sets for the analysis. The classification performance was estimated by considering the a priori probabilities of 'not-deer' objects sufficiently high to eliminate the misclassification of not-deer objects into deer class. The three or four feature classifier was shown to be capable of providing useful deer census data in an operational system when combined with appropriate spatial classification techniques. Dissert. Abstr.

N80-18506*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
DEVELOPMENT OF LANDSAT-BASED TECHNOLOGY FOR CROP INVENTORIES Final Report, 15 Nov. 1978 - 14 Nov. 1979
Q. A. Holmes, R. Horvath, R. C. Cicone, R. J. Kauth, and W. A. Malila, Principal Investigators Dec. 1979 217 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10054; NASA-CR-160421; ERIM-132400-29-1F; SR-E9-00404) Avail: NTIS HC A10/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18507*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
DEVELOPMENT OF LANDSAT-BASED TECHNOLOGY FOR CROP INVENTORIES: APPENDICES Final Report, 15 Nov. 1978 - 14 Nov. 1979
Q. A. Holmes, R. Horvath, R. C. Cicone, R. J. Kauth, and W. A. Malila, Principal Investigators Dec. 1979 303 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10055; NASA-CR-160422; ERIM-132400-29-2F; SR-E9-00404) Avail: NTIS HC A14/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18508*# Houston Univ., Tex. Dept. of Mathematics.
DEVELOPMENT OF MATHEMATICAL TECHNIQUES FOR THE ANALYSIS OF REMOTE SENSING DATA Final Report, 1 Dec. 1978 - 31 Dec. 1979
H. P. Jr. Decell, B. C. Peters, W. A. Coberly, F. Kempe, and T. Nguyen, Principal Investigators 31 Dec. 1979 31 p refs ERTS
(Contract NAS9-15543)
(E80-10056; NASA-CR-160445) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-18509*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EVALUATION OF THREE-CATEGORY CLASSIFICATION
K. A. Havens and K. M. Abotteen, Principal Investigators Aug. 1979 45 p refs Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10058; NASA-CR-160436; JSC-16012; LEC-13498) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following signficant results. Examination of both machine estimates and stratified areal estimates produced by clustering and classification reveal no significant differences between the proportion estimates and ground truth estimates. When testing the variances of the machine estimates, a significant reduction in the variances was found when the number of starting dots was increased from 30 to 45. The variances were again reduced, although not significantly,

when the number of starting dots was increased from 45 to 60. From these results, 60 starting dots are recommended for a three-category classifier. When examining the variances of the estimates for the four estimation procedures (using 60 dots), no significant differences were found between procedures. Thus, only the machine clustering may be used to produce an estimate, and the stratified areal estimate computations and maximum likelihood classification can be deleted.

N80-18510*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). LACIE TRANSITION YEAR PLAN FOR THE DIRECT ESTIMATION OF WHEAT FROM LANDSAT IMAGERY
R. K. Lennington, N. E. Marquina, D. T. Register, and M. C. Kinsler, Principal Investigators Mar. 1979 51 p Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10059; NASA-CR-160426; JSC-14553; LEC-11861) Avail: NTIS HC A04/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-18511*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
IMPLEMENTATION OF BADHWAR CLASSIFICATION OF CORN/SOYBEAN SEGMENTS
Willie W. Austin, Principal Investigator Oct. 1979 32 p refs ERTS
(Contract NAS9-15800)
(E80-10060; NASA-CR-160425; JSC-16274; LEC-14064) Avail: NTIS HC A03/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-18512*# Department of Industry, London (England).
SATELLITE MONITORING OF SEA SURFACE POLLUTION Progress Report, 1 Sep. - 31 Dec. 1979
Gilbert Fielder and Duncan John Telfer, Principal Investigators 31 Dec. 1979 27 p Sponsored by NASA Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10062; NASA-CR-162584; PR-2-14/P6; PR-2) Avail: NTIS HC A03/MF A01 CSCL 13B
The author has identified the following significant results. Image processing techniques developed are well adapted to the exploration and isolation of local areas which exhibit small temperature differences between themselves and their surroundings. In the worst case of imagery of small areal extent of sea surface having no coastal boundary in the area, there is yet no method of distinguishing unambiguously an oil spill from fog, cloud, the effect produced by shallow sediments, or the effects of naturally occuring thermal fronts. In the case of uniform slicks of liquid North Sea oil in still air, laboratory simulation experiments show that, for oil thicknesses in excess of 1 or 2 mm, there is, under equilibrium conditions, little dependence of oil surface temperature on the thickness of the oil layer. The surface temperature of oil is consistently higher than that of water, the difference being about 1 K at low values of relative humidity, but tending to increase as the relative humidity increases.

N80-18513*# Texas A&M Univ., College Station. Remote Sensing Center.
CORRELATION OF SPACECRAFT PASSIVE MICROWAVE SYSTEM DATA WITH SOIL MOISTURE INDICES (API) Progress Report, Feb. - Aug. 1979
Bruce J. Blanchard, Principal Investigator Aug. 1979 66 p refs ERTS
(Grant NsG-5193)
(E80-10063; NASA-CR-162585; RSC-3622-2) Avail: NTIS HC A04/MF A01 CSCL 08M
There are no author-identified significant results in this report.

N80-18514*# Texas A&M Univ., College Station. Remote Sensing Center.
MEASUREMENT OF SOIL MOISTURE TRENDS WITH AIRBORNE SCATTEROMETERS Progress Report, 1 Jun. 1979 - 1 Jan. 1980
Bruce J. Blanchard, Principal Investigator 1 Jan. 1980 71 p ERTS
(Grant NsG-5134)
(E80-10064; NASA-CR-162586; RSC-3458-4) Avail: NTIS HC A04/MF A01 CSCL 08M
The author has identified the following significant results. Cursory examination of the data indicates that the listed row tillage practices at 90 deg to the radar beam are approximately 12.5db higher than other comparable agricultural land. The Seasat radar data show evidence that the high return occurs only at a narrow range in look direction near the 90 deg. Such a high increase in return compared to a 15db range in film response would indicate that rows seen crosswise would saturate optically processed data. This response to row direction will have an adverse effect on monitoring agricultural lands with L band radar systems. Preliminary examination indicates that there is no sensitivity to soil moisture at the 5 deg look angle when using a like-polarized L band system. Some sensitivity was evident at a look angle of 20 deg and only a weak sensitivity was indicated at 40 deg look angle. At both 20 deg and 40 deg there is a significant response to soil moisture and none to row direction. Steep angles or the 5 deg look angle using cross polarized (HB) L band system appear insensitive to row direction and soil moisture.

N80-18515*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM Quarterly Report, 1 Jul. - 30 Sep. 1979
R. P. Mroczynski, Principal Investigator 30 Sep. 1979 56 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15325)
(E80-10065; NASA-CR-160435; LARS-093079) Avail: NTIS HC A04/MF A01 CSCL 02F
There are no author-identified significant results in this report.

N80-18516*# Stanford Univ., Calif. Dept. of Geology.
HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA
Ernest I. Rich, Principal Investigator 21 Jan. 1980 2 p HCMM
(Contract NAS5-24479)
(E80-10067; NASA-CR-162588) Avail: NTIS HC A02/MF A01 CSCL 08M
The author has identified the following significant results. Detailed examination of Nite-IR images of intermontane basins in arid and/or semiarid areas of California discloses a ring or halo of relatively lighter greytone around the edges of each basin. Intermontane basins in the Northern Coast Range, however, do not show this thermal haloing. The topographic elevation of the haloes in arid basins shows seasonal variation, but it is present on nearly all images. A similar halo encircles many of the volcanoes on the Modoc Plateau and Southern Cascade Range. Although the halo around the arid intermontane basins can possibly be explained in relation to the location of alluvial fans (and perhaps water content of the rocks), a similar explanation cannot be made for the haloes around volcanoes or for the lack of haloes around basins in the Coast Range. Atmospheric thermal layering may be an alternative explanation; however, this explanation is also riddled with inconsistencies.

N80-18517*# National Oceanic and Atmospheric Administration, Washington, D. C.
APPLICATION OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 18 Jan. 1980 4 p Sponsored by NASA HCMM
(E80-10068; NASA-CR-162639) Avail: NTIS HC A02/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-18518*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE EVALUATION AND OUTLOOK PANEL TRANSCRIPT: THE LACIE SYMPOSIUM
1978 22 p refs Symp. held at Houston, Tex., 23 Oct. 1978 Sponsored by NASA, NOAA, and USDA ERTS
(E80-10069; NASA-CR-162641; JSC-13769) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-18519*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). BIBLIOGRAPHIC ADDENDA, TECHNICAL REPORTS, PAPERS, AND MEMORANDUMS PUBLISHED UNDER SUPPORTING RESEARCH AND TECHNOLOGY AND OTHER RESEARCH, TEST, AND EVALUATION CONTRACTS FOR THE EARTH OBSERVATIONS DIVISION
J. B. Aumann, Principal Investigator May 1978 37 p ERTS
(Contract NAS9-15200)
(E80-10070; NASA-CR-160423; JSC-14278; LEC-11651) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-18520*# Calspan Advanced Technology Center, Buffalo, N.Y.
APPLICATIONS OF HCMM SATELLITE DATA Quarterly Report, 23 Aug. - 23 Nov. 1979
23 Nov. 1979 4 p HCMM
(Contract NAS5-24263)
(E80-10071; NASA-CR-162642; QR-9) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-18521*# Department of Agriculture, Weslaco, Tex. Science and Education Administration.
PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Sep. - 1 Dec. 1979
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Dec. 1979 8 p HCMM
(NASA Order S-4019-88)
(E80-10072; NASA-CR-162643) Avail: NTIS HC A02/MF A01 CSCL 08M
The author has identified the following significant results. Procedures to edit cloud-contaminated pixels from those pixels representing Earth surface features were investigated. Because clouds are more reflective than Earth features and are colder than Earth surface features most of the year at 26 N latitude, either a raw digital count ratio or a ratio of reflectance percentage for the VIS band to the temperature works well. For this procedure, the two bands of data need to be registered to the ground scene.

N80-18522*# Texas A&M Univ., College Station. Remote Sensing Center.
CONTINUATION OF MEASUREMENT OF HYDROLOGIC SOIL-COVER COMPLEX WITH AIRBORNE SCATTEROMETERS Final Report
Bruce J. Blanchard, John L. Nieber, and Andrew J. Blanchard, Principal Investigators [1979] 48 p refs ERTS
(Grant NsG-5156)
(E80-10073; NASA-CR-162644; FR-3496) Avail: NTIS HC A03/MF A01 CSCL 08M
The author has identified the following significant results. Analysis of radar scatterometry data obtained over five flight lines in Texas by NASA C-130 aircraft demonstrated that multivariant radar data can be used to distinguish difference in land use, and hence be an indicator of surface runoff characteristics. The capability of using microwave sensors to detect flood inundation of timbered land was also determined.

N80-18523*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITONS AS SEEN BY HCMM Progress Report, Jul. - Oct. 1979
W. D. Rosenthal, J. C. Harlan, and Bruce J. Blanchard, Principal Investigators Oct. 1979 13 p HCMM
(Contract NAS5-24383)
(E80-10074; NASA-CR-162645; PR-3712-7) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-18524*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Oct. - Dec. 1979
Donald G. Moore, Principal Investigator and J. L. Heilman Dec. 1979 59 p refs Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, MD 20771. Domestic users send orders to 'Attn: National Space Science Data Center', non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(Contract NAS5-24206)
(E80-10075; NASA-CR-162646; SDSU-RSI-80-01) Avail: NTIS HC A04/MF A01 CSCL 13B
The author has identified the following significant results. Evidence of a heat sink produced by perched water tables was detected with HCMM night thermal data. The region of shallow water was not visible on HCMM visible or day IR imagery. The results are consistant with previous aircraft investigations.

N80-18525*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). COMPOSITION AND ASSEMBLY OF A SPECTRAL-MET DATA BASE FOR SPRING AND WINTER WHEAT, VOLUME 2
M. H. Trenchard, M. L. Sestak, M. C. Kinsler, and D. E. Phinney, Principal Investigators Jun. 1979 194 p Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10076; NASA-CR-160437; JSC-14901-Vol-2; LEC-13393-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-18526*# Texas A&M Univ., College Station. Dept. of Mathematics.
AGRISTARS: A JOINT PROGRAM FOR AGRICULTURE AND RESOURCES INVENTORY SURVEYS THROUGH AEROSPACE REMOTE SENSING. DEVELOPMENT AND EVALUATION OF CLUSTERING PROCEDURES Final Report
L. F. Guseman, Jr., Principal Investigator Nov. 1979 110 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-14689)
(E80-10079; NASA-CR-160427; SR-T9-00402) Avail: NTIS HC A06/MF A01 CSCL 02C
There are no author-identified significant results in this report. For individual titles, see N80-18527 through N80-18529.

N80-18527*# Texas A&M Univ., College Station. Dept. of Mathematics.
DISTANCE PRESERVING LINEAR FEATURE SELECTION Final Report
L. F. Guseman, Jr., Principal Investigator and Jack Bryant *In its* AgRISTARS: A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing Nov. 1979 22 p refs ERTS (For primary document see N80-18526 09-43)
(Rept-19) Avail: NTIS HC A06/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-18528*# Texas A&M Univ., College Station. Dept. of Mathematics.
THE EASY REMOTE SENSING PROBLEM Final Report
L. F. Guseman, Jr., Principal Investigator and Jack Bryant *In its* AgRISTARS: A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing Nov. 1979 52 p refs ERTS (For primary document see N80-18526 09-43)
(Rept-20) Avail: NTIS HC A06/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-18529*# Texas A&M Univ., College Station. Dept. of Mathematics.
THE CRAMER-RAO LOWER BOUND AS A CRITERIA FOR EVALUATING A LARGE DATA REDUCTION SYSTEM SUCH AS LACIE Final Report
L. F. Guseman, Jr., Principal Investigator and Patrick L. Odell (Texas Univ. at Dallas) *In its* AgRISTARS: A Joint Program for Agriculture and Resource Inventory Surveys Through Aerospace Remote Sensing Nov. 1979 24 p refs ERTS (For primary document see N80-18526 09-43)
(Rept-21) Avail: NTIS HC A06/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-18530*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECT OF SOIL TEXTURE ON THE MICROWAVE EMISSION FROM SOILS
Thomas Schmugge Jan. 1980 32 p refs
(NASA-TM-80632) Avail: NTIS HC A03/MF A01 CSCL 08M
The intensity brightness temperature of the microwave emission from the soil is determined primarily by its dielectric properties. The large difference between the dielectric constant of water and that of dry soil produces a strong dependence of the soil's dielectric constant on its moisture content. This dependence is effected by the texture of the soil because the water molecules close to the particla surface are tightly bound and do not contribute significantly to the dielectric properties. Since this surface area is a function of the particle size distribution (soil texture), being larger for clay soils with small particles, and smaller for sandy soils with larger particles; the dielectric properties will depend on soil texture. Laboratory measurements of the dielectric constant for soils are summarized. The dependence of the microwave emission on texture is demonstrated by measurements of brightness temperature from an aircraft platform for a wide range of soil textures. It is concluded that the effect of soil texture differences on the observed values can be normalized by expressing the soil moisture values as a percent field capacity for the soil. A.R.H.

N80-18531# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
APPLICATION OF STATISTICAL CORRELATION IN THE STUDY OF AVAILABLE WATER IN LAYERS OF CERRADO SOIL [APLICACAO DE MODELOS DE ANALISE ESTATISTICA COM ESTRUTURA CORRELACAO EM ESTUDOS DE DISPONIBILIDADE DE AGUA EM SOLO DOS CERRADOS]
Joal Neves Barreto Oct. 1979 206 p refs In PORTUGUESE; ENGLISH summary
(INPE-1607-TDL/014) Avail: NTIS HC A10/MF A01
The use and extension of the method of time series analysis, as illustrated by the application to studies of the influence of density of planting on the availability of water in different layers of 'Cerrado' soil, is proposed. Three models are elaborated, that take into account, isolated or jointly, the experimental errors correlated both serial and contemporaneously. It is concluded that, for the data analyzed, the averages of the densities, layers and interactions, differ in behavior when analyzed together. The use of this method of analysis, by the adoption of models with correlated errors, is an answer, in specific instances, to the convenience of developing alternate methods of analysis which take into consideration a more adequate correlation structure. M.M.M.

N80-18532# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SIGNIFICANT RESULTS FROM A PROJECT ON AGRICULTURAL STATISTICS, 1975 - 1978 [RESULTADOS SIGNIFICANTES DO PROJETO ESTATISTICAS AGRICOLAS: 1975 - 1978]
Francisco Jose Mendonca, David Chung Liang Lee, Antonio Tebaldi Tardin, Sherry Chou Chen, Rene Antonio Novaes, and Yosio Edemir Shimabukuro Oct. 1979 29 p refs In PORTUGUESE; ENGLISH summary
(INPE-1609-NTE/155) Avail: NTIS HC A03/MF A01
Results acquired by the staff of the Agricultural Statistics Project between 1975 and 1978 are presented. During this period color infrared images and LANDSAT data were interpreted in order to obtain crop identification and area estimates. M.M.M.

N80-18533# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE UTILIZATION OF RADAR IMAGES IN THE GEOLOGICAL MAPPING OF PRE-CAMBRIAN REGION: A PROPOSED MODEL [A UTILIZCAO DE IMAGENS DE RADAR NO MAPEAMENTO DE AREAS PRE-CAMBRIANS: UMA PROPOSICAO DE METOPOLOGIA]
Paulo Roberto Meneses, Chan Chiang Liu, and Waldir Renato Paradella Sep. 1979 14 p In PORTUGUESE Presented at 2nd Regional Symp. of Simposio Regional de Geology Rio Claro, Brazil, 15-18 Nov. 1978 Revised
(INPE-1578-RPE/075) Avail: NTIS HC A02/MF A01
A method for geological mapping in the Pre-Cambrian regions of polycyclic and polyphasic evolution, when radar imagery (scale: 1:250,000) is used as the main data source is proposed. A multistage procedure is adopted in this study. First, a standard geological cross section is selected by data is then used as the basis of the next researching stage, photointerpretation of the radar imagery. It is shown that for a regional geological study, a prior field mapping of standard profils affords greater facility than the conventional procedure in which photointerpretation is made first. M.G.

N80-18534*# Massachusetts Inst. of Tech., Cambridge.
ESTIMATION OF EFFECTIVE HYDROLOGIC PROPERTIES OF SOILS FROM OBSERVATIONS OF VEGETATION DENSITY M.S. Thesis
Tobin Eugene Tellers 1980 125 p refs
(Grant NsG-5306)
(NASA-CR-162797) Avail: NTIS HC A06/MF A01 CSCL 08M
An existing one-dimensional model of the annual water balance is reviewed. Slight improvements are made in the method of calculating the bare soil component of evaporation, and in the way surface retention is handled. A natural selection hypothesis, which specifies the equilibrium vegetation density for a given, water limited, climate-soil system, is verified through comparisons with observed data and is employed in the annual water balance of watersheds in Clinton, Ma., and Santa Paula, Ca., to estimate effective areal average soil properties. Comparison of CDF's of annual basin yield derived using these soil properties with observed CDF's provides excellent verification of the soil-selection procedure. This method of parameterization of the land surface should be useful with present global circulation models, enabling them to account for both the non-linearity in the relationship between soil moisture flux and soil moisture concentration, and the variability of soil properties from place to place over the Earth's surface. Author

N80-18535# Naval Postgraduate School, Monterey, Calif.
STATISTICAL METHODS OF PROBABLE USE FOR UNDERSTANDING REMOTE SENSING DATA
Donald P. Gaver Oct. 1979 40 p refs
(AD-A076906; NPS55-79-020) Avail: NTIS HC A03/MF A01 CSCL 12/1
This report outlines several new statistical approaches to data problems likely to be encountered when remote sensing methods are used. The methods described are robust regression analysis, smoothing, and modeling and estimation of ice pressure ridge characteristics. GRA

N80-18536# Army Engineer Topographic Labs., Fort Belvoir, Va.
SIGNAL SIGNATURES OF TOPOGRAPHIC FEATURES USING ANALOG TECHNOLOGY
Pi-Fuay Chen and William W. Seemuller May 1979 37 p refs
(AD-A076110; ETL-0185) Avail: NTIS HC A03/MF A01 CSCL 09/2

Signal signatures and signatures of various spectral decompositions of selected topographic features, such as line roads, road intersections, and rectangular buildings, were developed by using analog signal processing techniques. The signal signatures were constructed in the spatial domain, and the corresponding signatures of various spectral components were obtained in the Walsh transform domain. An electronic system for generating two-dimensional Walsh functions for decomposition of topographic features was designed and built. A scheme for detecting the decomposed spectral components using an analog processor was presented. GRA

N80-18537# Army Engineer Topographic Labs., Fort Belvoir, Va.
AN EVALUATION OF CONVENTIONAL CORRELATION METHODS WHEN MATCHING INFRARED IMAGERY TO PANCHROMATIC IMAGERY
Michael A. Crombie Aug. 1979 37 p refs
(AD-A076111; ETL-0195) Avail: NTIS HC A03/MF A01 CSCL 09/4

In this report, a practical method of determining parallax by matching an infrared image to a corresponding panchromatic image using conventional correlation methods is evaluated using digitized serial images. However, from the results of the study, the method was found to be unsatisfactory. GRA

N80-18538# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
RADAR IMAGE SIMULATION OF SEASONALLY DEPENDENT REFERENCE SCENES Contract Report, 27 Mar. - Sep. 1978
J. C. Holtzman, J. E. Bare, V. H. Kaupp, E. E. Komp, and J. A. Stiles Apr. 1979 238 p refs
(Contract DAAK70-78-C-0062)
(AD-A076119; RSL-TR-370-2; ETL-0188) Avail: NTIS HC A11/MF A01 CSCL 17/9

The results are reported from applying radar image simulation to produce simulated reference scenes of winter conditions for a missile guidance usage. A data base was constructed of the Watertown, New York, test site and simulated radar images were generated. The data base was prepared from historical data for an 'average' winter at the test site. Simulated radar images were produced via the point scattering model and an empirical model was used for predicting the electromagnetic reflectance from the ground, its cover, and overlying snow. Copies of the simulated radar images are included. The results reported were obtained for four (4) simulations corresponding to four specific altitudes in the terminal phases of the trajectory of a guided missile, each successively lower. The simulated images have been produced for testing against actual radar data of the same site via the Correlatron. These tests have not been performed as the actual radar data have not yet been obtained. GRA

N80-18539# Science Applications, Inc., Arlington, Va.
PROCEEDINGS OF THE IMAGE UNDERSTANDING WORKSHOP Semiannual Report, Apr. - Nov. 1979
Lee S. Baumann, ed. et al Nov. 1979 187 p refs Conf. held at Los Angeles, 7-8 Nov. 1979
(Contract MDA903-78-C-0095; DARPA Order 3454)
(AD-A077568; SAI-80-974-WA) Avail: NTIS HC A09/MF A01 CSCL 05/8

This document contains the technical papers and outlines of semiannual progress reports presented by the research activities in Image Understanding sponsored by the Information Processing Techniques Office, Defense Advanced Research Projects Agency. The papers were presented at a workshop conducted on 7-8 November 1979 in Los Angeles, California. GRA

N80-18540# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
CHARGED DISLOCATION IN ICE. 1: EXISTENCE AND CHARGE DENSITY MEASUREMENT BY X-RAY TOPOGRAPHY
Kazuhiko Itagaki Nov. 1979 19 p refs
(DA Proj. 4A1-61102-AT-24)
(AD-A078775; CRREL-79-25) Avail: NTIS HC A02/MF A01 CSCL 08/12

The motion of dislocations in single crystal ice under an electric field was observed by using X-ray topographic methods. Electric charge density on these dislocations was deduced from the amplitude and length of the dislocation segment under the known ac electrical field. The most likely linear charge density was about -5 x 10 to the minus 11th power c/m, although considerable variation is possible depending on the effective field acting on the dislocation lines. GRA

N80-18541# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
CRYSTAL ALIGNMENTS IN THE FAST ICE OF ARCTIC ALASKA
W. F. Weeks and A. J. Gow Oct. 1979 29 p refs
(Grant NSF DPP-77-27479; NOAA-01-5-022-1651)
(AD-A077188; CRREL-79-22) Avail: NTIS HC A03/MF A01 CSCL 08/12

Field observations at 60 sites located in the fast or near-fast ice along a 1200-km stretch of the north coast of Alaska between Bering Strait and Barter Island have shown that the great majority of the ice samples (95%) exhibit striking c-axis alignments within the horizontal plane. Such alignments were usually well developed by the time the ice was 50 cm thick and in some cases when the ice was 20 cm thick. In all cases the degree of preferred orientation increased with depth in the ice. Representative standard deviations around a mean direction in the horizontal plane are commonly less than + or - 10 deg. for samples collected near the bottom of the ice. The general patterns of the alignments support a correlation between the preferred c-axis direction and the current direction at the ice/water interface. A comparison between c-axis alignments and spot current measurements made at 42 locations shows that the most frequent current direction coincides with the mean c-axis direction. Such alignments are believed to be the result of geometric selection with the most favored orientation being that in which the current flows normal to the (0001) plates of ice that compose the dendritic sea ice/sea after interface. GRA

N80-18542# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
BACKSCATTER MEASUREMENTS OF SEA ICE WITH A HELICOPTER-BORNE SCATTEROMETER
J. S. Patel, R. G. Onstott, C. V. Delker, and R. K. Moore Jul. 1979 132 p refs
(Contract N00014-76-C-1105)
(AD-A077814; RSL-TR-331-13) Avail: NTIS HC A07/MF A01 CSCL 08/12

The purpose of this paper is to describe the design and development of the University of Kansas helicopter-borne scatterometer system, HELOSCAT. The experiments performed to measure the radar backscatter from sea ice with this system along with the results are also described. Backscatter measurements were made at 1-2 GHz and 8-18 GHz frequencies, HH-polarization, and three incidence angles (20, 40, and 60 deg). Different types of ice ranging from thin ice to multiyear ice were observed; however, most data were collected from thick first-year and multiyear ice. A comparison of 1-2 GHz results for thick first-year and multiyear ice shows that the scattering coefficient values for multiyear ice at 60 deg are slightly lower than the value for thick first-year ice. The 8-18 GHz results show that the backscatter from multiyear ice at these frequencies is higher than the backscatter return from thick first-year ice by at least 3-4 dB. The frequency response of backscatter return is an upward sloping straight line on a dB-vs-frequency plot. For the multiyear ice, only the 60 deg data was found usable; the data at 20 deg and 40 deg were determined to be erroneous because of a malfunctioning frequency counter. GRA

N80-18543# Wisconsin Univ. - Madison.
REMOTE MEASUREMENTS OF BOUNDARY LAYER VELOCITY PARAMETERS BY MONOSTATIC LIDAR

Jeffery Thomas Sroga Oct. 1979 132 p refs
(Contract DAAG29-76-C-0136; DA Proj. 1T1-61102-GH-37)
(AD-A078678; ERADCOM/ASL-CR-79-0136-1) Avail: NTIS
HC A07/MF A01 CSCL 17/8

Wind velocity parameters in the planetary boundary layer are measured using spatial inhomogeneities in the natural aerosol content as tracers. Lidar measurements of these spatial inhomogeneities are correlated in time and space to remotely estimate the mean speed, direction and the rms speed variance of the wind velocity. Aerosol inhomogeneities with horizontal dimensions of 60m-0.1km were found to be efficient tracers of the wind. The coherence between spatially and temporally separated lidar profiles of these spatial aerosol inhomogeneities is used to determine the perpendicular components along and across the beam pattern of the horizontal wind velocity. Comparisons between lidar horizontal wind measurements with tower anemometers and pilot balloons show that lidar can remotely sense the boundary layer flow. GRA

N80-18544# Stanford Univ., Calif. Electronic Labs.
REMOTE SENSING OF OCEAN SURFACE CURRENT AND CURRENT SHEAR BY HF BACKSCATTER RADAR
Eng-Chong Ha Aug. 1978 141 p refs
(Contract N00014-75-C-0356)
(AD-A078834; SU-SEL-79-022; SU-TR-D415-1) Avail: NTIS
HC A07/MF A01 CSCL 17/9

The Doppler spectrum of radar return from the sea at HF contains two narrow lines displaced upward and downward from the carrier frequency, resulting from backscatter off ocean surface waves moving toward and away from the radar, respectively. These Bragg lines indicate resonant backscatter which occurs for the ocean waves of length one-half the radio wavelength. The phase velocity of these gravity waves consists of two components; the first is determined by the wavelength and the second by the current component in the direction of wave propagation averaged over depth with an exponential weighting function that has a characteristic scale proportional to the wavelength. The Doppler shift of the radar carrier is determined by the wave phase velocity. Its variation with carrier frequency is thus related to the vertical profile of the current component in the radar direction by a Laplace transform; therein lies the principle of radio measurement of ocean current and its vertical shear. Radio backscatter experiments to verify the feasibility of such measurements were conducted using the radar operating at four frequencies covering the range from 3 to 30 MHz. The depth-averaged radial current deduced from the centroid of the Doppler-shifted sea echo experiments at 6.8, 13.3, 21.7, and 29.8 MHz showed fluctuations on the order of 1 cm/sec superimposed on temporal trends that reached maximum values of about 40 cm/sec. It is concluded that multifrequency backscatter ground-wave radar at HF constitutes a powerful technique for mapping current and its vertical profile in the top few meters of the ocean. GRA

N80-18545# Consiglio Nazionale delle Ricerche, Padua (Italy).
USE OF SATELLITE IMAGERY FOR THE DERIVATION OF THE HYDROGEOLOGIC CHARACTERISTICS OF A TEST AREA IN SEMIARID CLIMATES
Carlo Vaccari (Italeco SpA) and Bruno Marcolongo 29 May 1979 12 p Presented at COSPAR Water Resources Symp., Bangalore, India, 30 May - 1 Jun. 1979
Avail: NTIS HC A02/MF A01

The ability to identify locations of underwater storage is especially important in semiarid areas. To this effect, the application of remote sensing by LANDSAT can lead to the identification of potential sites suitable for further ground exploration, thus curtailing the time, labor, and expense of alternative prospecting procedures. The method described utilizes the radiometric information supplied by LANDSAT, together with existing and readily available ground information, to reconstruct the major hydrogeologic features of a semiarid area and to assess in semiquantitative fashion its potential subsurface water content. Author (ESA)

N80-18546# Science Applications, Inc., La Jolla, Calif.
A PRELIMINARY STUDY OF THE CONSEQUENCES OF DEEP OCEAN MINING TECHNOLOGY TRANSFER Research Report, Oct. - Dec. 1978
P. B. Grote and W. A. Coleman 18 Dec. 1978 105 p
(PB-300723/4; BM-OFR-124-79) Avail: NTIS
HC A06/MF A01 CSCL 08I

The possible transfer of U.S. and other developed country deep ocean mining (DOM) technologies to developing countries is one of several major issues in current United Nations Law of the Seas negotiations. A critique of the various terms and conditions pertaining to technology transfer in recent negotiating tests is presented. The relevant DOM technology, sources of innovation, and methods of proprietary protection are described. Functional requirements for viable technology transfer are developed and used as a basis for the definition of alternative levels of programs and implementation approaches, including required changes in the negotiating text. The consequences of these technology transfer options on the various parties are investigated. GRA

N80-18547# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
GEOTHERMAL ENERGY DEVELOPMENT IN THE EASTERN UNITED STATES. EVALUATION OF POTENTIAL GEOTHERMAL RESOURCE AREAS
Franklin O. Mitchell Jul. 1979 53 p refs
(Contracts EX-76-A-36-1008; DE-A101-79ET-27025)
(PB-299925/8; APL/JHU-QM-79-163-GT) Avail: NTIS
HC A04/MF A01 CSCL 08I

A method for the comparative evaluation of geothermal prospects in the eastern United States in proposed and illustrated. Comparisons are based on quantified data from geologic, engineering, and socio-economic sources including temperature gradient, depth to basement, drilling costs, population, and distribution by town size, as well as energy use in residential, commercial, and industrial applications. GRA

N80-18548# Wiss, Janney, Elstner and Associates, Inc., Northbrook, Ill.
CONTROL OF VIBRATION AND BLAST NOISE FROM SURFACE COAL MINING, VOLUME 4: EXECUTIVE REPORT Final Report, 1 Jul. 1975 - 28 Feb. 1978
John F. Wiss and Patrick W. Linehan Dec. 1978 50 p refs
(Contract DI-BM-J0255022)
(PB-299890/4; BM-OFR-103(4)-79) Avail: NTIS
HC A03/MF A01; also available in set of 4 reports HC E16, PB-199886-SET CSCL 13F

A series of controlled experiments was conducted at four surface coal mines to study the effects of certain blast parameters upon the ground and air vibration. Preliminary scale model blasts were conducted at a quarry to provide basic data. An analysis of the data obtained from the field tests is presented. Where possible, expressions were developed that can be helpful in establishing guidelines for the design of blasting to minimize adverse results with respect to noise and ground vibration. GRA

N80-18549*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SEASAT GULF OF ALASKA WORKSHOP REPORT
George H. Born (NOAA), John C. Wilkerson (NOAA), John W. Sherman, III, and David B. Lame May 1979 42 p Prepared in cooperation with DOD, Washington, D.C.
(NASA-CR-162463; PB-301417/2; JPL-662-101;
NOAA-79090406) Avail: NTIS HC A03/MF A01 CSCL 08J

Results are presented of an initial evaluation of part of the 105-day Seasat mission, focusing on data obtained from a 30 day experiment conducted in the Gulf of Alaska during August-September 1978. The Gulf of Alaska Seasat Experiment (GOASEX) was the only dedicated surface observation program conducted to validate the satellite data. Initial quantitative Seasat results produced during a Workshop held on January 22-26, 1979 are reported. Based on an early evaluation of these results, it is concluded that some of the original objectives of sensor performance were met. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-18550* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF FABRICATING A PHOTOVOLTAIC MODULE OF A SUBSTANTIALLY TRANSPARENT CONSTRUCTION Patent
Paul A. Dillard (Lockheed Missile and Space Co., Sunnyvale, Calif.), Walter M. Fritz (Lockheed Missile and Space Co., Sunnyvale, Calif.), and Dan R. Lott, inventors (to NASA) (Lockheed Missile and Space Co., Sunnyvale, Calif.) Issued 22 Jan. 1980 7 p Filed 26 Jul. 1978 Supersedes N78-28626 (16 - 19, p 2558) Sponsored by NASA
(NASA-Case-NPO-14303-1; NASA-Case-NPO-14305-1; US-Patent-4,184,903; US-Patent-Appl-SN-928133; US-Patent-Class-156-104; US-Patent-Class-156-278; US-Patent-Class-156-285; US-Patent-Class-156-303; US-Patent-Class-156-312) Avail: U.S. Patent and Trademark Office CSCL 10A

A method characterized by the steps of positioning a plurality of uniformly dimensioned photovoltaic cells in registered relation with a plurality of openings formed in a planar tool is disclosed. The method allows acess to the P contact surface of each of the cells. The steps of the method are: (1) connecting the N contact surface of alternate cells to the P contact surface of the cells interposed therebetween, (2) removing therefrom residue of solder flux, (3) applying to the N contact surfaces of the cells a transparent adhesive, (4) placing a common transparent cover plate in engaged relation with the adhesive, (5) placing a film over the circular openings for hermetically sealing the openings, and (6) establishing a vacuum between the film and the cover plate.

Official Gazette of the U.S. Patent and Trademark Office

N80-18551* National Aeronautics and Space Administration. Pasadena Office, Calif.
DRIVER FOR SOLAR CELL I-V CHARACTERISTIC PLOTS Patent
Gary B. Turner, inventor (to NASA) (JPL) Issued 15 Jan. 1980 6 p Filed 26 Jul. 1978 Supersedes N78-28625 (16 - 19, p 2557) Sponsored by NASA
(NASA-Case-NPO-14096-1; US-Patent-4,184,111; US-Patent-Appl-SN-928128; US-Patent-Class-324-404; US-Patent-Class-324-158D) Avail: U.S. Patent and Trademark Office CSCL 10A

A bipolar voltage ramp generator which applies a linear voltage through a resistor to a solar cell for plotting its current versus voltage (I-V) characteristic between short circuit and open circuit conditions is disclosed. The generator has automatic stops at the end points. The resistor serves the multiple purpose of providing a current sensing resistor, setting the full-scale current value, and providing a load line with a slope approximately equal to one, such that it will pass through the origin and the approximate center of the I-V curve with about equal distance from that center to each of the end points.

Official Gazette of the U.S. Patent and Trademark Office

N80-18552* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLAR CELL ANGULAR POSITION TRANSDUCER Patent
Maynard C. Sandford and David L. Gray, inventors (to NASA) Issued 15 Jan. 1980 8 p Filed 9 Feb. 1978 Supersedes N78-18394 (16 - 09, p 1160)
(NASA-Case-LAR-11999-1; US-Patent-4,184,072; US-Patent-Appl-SN-876299; US-Patent-Class-250-231SE; US-Patent-Class-250-211K) Avail: U.S. Patent and Trademark Office CSCL 10A

An angular position transducer utilizing photocells and a light source is disclosed. The device uses a fully rotatable baffle which is connected via an actuator shaft to the body whose rotational displacement is to be measured. The baffle blocks the light path between the light source and the photocells so that a constant semicircular beam of light reaches the photocells. The current produced by the photocells is fed through a resistor, a differential amplifier measures the voltage drop across the resistor which indicates the angular position of the actuator shaft and hence of the object.

Official Gazette of the U.S. Patent and Trademark Office

N80-18553 Oklahoma Univ., Norman.
ANALYSIS OF THE GEOTHERMAL BINARY CYCLE USING PARAFFIN HYDROCARBONS AS WORKING FLUIDS Ph.D. Thesis
Khan Zafar Iqbal 1979 301 p
Avail: Univ. Microfilms Order No. 8004390

It is demonstrated that the analysis of the geothermal binary cycles is simplified through the use of basic thermodynamic relations. The complex interrelationships of thermodynamic, equipment, unit operational, and cost parameters are presented. It is shown that mixtures provide a significantly greater amount of work compared to pure fluids. Furthermore, mixture composition and behavior can be changed over the plant lifetime to match the changes in the geothermal resource. For fixed brine flow rate conditions, a decrease in the resource temperature results in a decrease in the net plant power. For the 300 F georesource temperature, the resource utilization and cost optima nearly coincide. Dissert. Abstr

N80-18554*# Spectrolab, Inc., Sylmar, Calif.
DEVELOPMENT OF IMPROVED WRAPAROUND CONTACTS FOR SILICON Final Report
Jay W. Thornhill Dec. 1979 41 p
(Contract NAS3-20065)
(NASA-CR-159748) Avail: NTIS HC A03/MF A01 CSCL 10A

A developmental process for fabricating 2 X 4 cm back surface field silicon solar cells featuring wraparound contacts and screen printed dielectric isolation is described. The process was then used to fabricate a number of cells for evaluation and study, as well as to establish the validity of the process sequence. While a number of cells exhibiting relatively good conversion efficiencies were produced, nearly all had low I-V curve factors for the level of efficiencies attained. Cells with conversion efficiencies of more than 15 percent (air mass zero and 25 C) had fill factors of only 0.76. Evidence as to the cause of this has not been conclusive, but is most probably linked to isolation failure in the wraparound dielectric and associated shunting problems. Author

N80-18555*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLEXIBLE FORMULATED PLASTIC SEPARATORS FOR ALKALINE BATTERIES Patent Application
D. W. Scheibley, J. M. Bozek, and D. G. Soltis, inventors (to NASA) Filed 28 Sep. 1979 10 p
(NASA-Case-LEW-12363-4; US-Patent-Appl-SN-079914) Avail: NTIS HC A02/MF A01 CSCL 10C

A flexible separator for alkaline batteries is disclosed. The separator is comprised of a coating which is applied to a nonwoven porous substrate such as sheets or mats of asbestos or other materials which are inert with respect to the alkaline electrolyte of the battery. The coating material comprises a polyphenylene oxide polymer, an organic additive and inorganic and organic fillers which comprise 55% by volume or less of the coating material. Preferably, at least one inorganic filler material which is reactive with the electrolyte is included to produce desirable pores in the coating. The organic additive is a polymeric polyester material which is hydrolyzed by the alkaline electrolyte to improve conductivity of the coating. NASA

N80-18556*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLEXIBLE FORMULATED PLASTIC SEPARATORS FOR ALKALINE BATTERIES Patent Application
D. W. Scheibley, J. M. Bozek, and D. G. Soltis, inventors (to

NASA) Filed 19 Jul. 1979 10 p
(NASA-Case-LEW-12363-3; US-Patent-Appl-SN-058658) Avail: NTIS HC A02/MF A01 CSCL 10C

A flexible separator for alkaline batteries is disclosed. The separator is comprised of a coating which is applied to a nonwoven porous substrate such as sheets or mats of asbestos or other materials which are inert with respect to the alkaline electrolyte of the battery. The coating material is comprised of a polyphenylene oxide polymer, an organic additive and inorganic, and organic fillers which comprise 55% by volume or less of the coating material. Preferably, at least one inorganic filler material which is reactive with the electrolyte is included to produce desirable pores in the coating. The organic additive is a polymeric polyester material which is hydrolyzed by the alkaline electrolyte to improve conductivity of the coating. NASA

N80-18557*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CATALYST SURFACES FOR THE CHROMOUS/CHROMIC REDOX COUPLE Patent Application
Jose D. Giner (Giner, Inc.) and Kathleen J. Cahill, inventors (to NASA) (Giner, Inc.) Filed 27 Jul. 1979 15 p Sponsored by NASA
(NASA-Case-Lew-13148-2; US-Patent-Appl-SN-061555) Avail: NTIS HC A02/MF A01 CSCL 10A

An electricity producing cell of the reduction-oxidation type is disclosed. The cell is divided into two compartments by a membrane and each compartment contains a solid inert electrode. A ferrous/ferric couple in a chloride solution serves as a cathode fluid which is circulated through one of the compartments to produce a positive electric potential disposed therein. A chromic/chromous couple in a chloride solution serves as an anode fluid which is circulated through the second compartment to produce a negative potential on an electrode disposed therein. The electrode is an electrically conductive, inert material plated with copper, silver or gold. A thin layer of lead plates onto the copper, silver or gold layer when the cell is being charged, the lead ions being available from lead chloride which has been added to the anode fluid. If the REDOX cell is then discharged, the current flows between the electrodes causing the lead to deplate from the negative electrode and the metal coating on the electrode will act as a catalyst to cause increased current density. NASA

N80-18558*# National Aeronautics and Space Administration, Washington, D. C.
CONTROL STRATEGY FOR A VARIABLE-SPEED WIND ENERGY CONVERSION SYSTEM
A. Jacob, D. Veillette, and V. Rajagopalan Nov. 1979 10 p refs Transl. into ENGLISH from Proc. of New York Inst. of Elec. Engineers Inc., 1978 p 528-531 In FRENCH Presented at Can. Commun. and Power Conf., Montreal, 18-20 Oct. 1978 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75512) Avail: NTIS HC A02/MF A01 CSCL 10A

A control concept for a variable-speed wind energy conversion system is proposed, for which a self-exited asynchronous cage generator is used along with a system of thyristor converters. The control loops are the following: (1) regulation of the entrainment speed as function of available mechanical energy by acting on the resistance couple of the asynchronous generator; (2) control of electric power delivered to the asynchronous machine, functioning as a motor, for start-up of the vertical axis wind converter; and (3) limitation of the slip value, and by consequence, of the induction currents in the presence of sudden variations of input parameters. Author

N80-18559*# Avco Corp., Wilmington, Mass.
PARAMETRIC STUDY OF POTENTIAL EARLY COMMERCIAL MHD POWER PLANTS Final Report
Finn A. Hals Dec. 1979 246 p refs
(Contracts DEN3-51; EF-77-A-01-2674)
(NASA-CR-159633; DOE/NASA/0051-79/1) Avail: NTIS HC A11/MF A01 CSCL 10B

Three different reference power plant configurations were considered with parametric variations of the various design parameters for each plant. Two of the reference plant designs were based on the use of high temperature regenerative air preheaters separately fired by a low Btu gas produced from a coal gasifier which was integrated with the power plant. The third reference plant design was based on the use of oxygen enriched combustion air preheated to a more moderate temperature in a tubular type metallic recuperative heat exchanger which is part of the bottoming plant heat recovery system. Comparative information was developed on plant performance and economics. The highest net plant efficiency of about 45 percent was attained by the reference plant design with the use of a high temperature air preheater separately fired with the advanced entrained bed gasifier. The use of oxygen enrichment of the combustion air yielded the lowest cost of generating electricity at a slightly lower plant efficiency. Both of these two reference plant designs are identified as potentially attractive for early MHD power plant applications. R.E.S.

N80-18560*# LinCom Corp., Pasadena, Calif.
A GROUND BASED PHASE CONTROL SYSTEM FOR THE SOLAR POWER SATELLITE. EXECUTIVE SUMMARY, VOLUME 1, PHASE 3 Final Report
C. M. Chie Jan. 1980 51 p refs
(Contract NAS9-15782)
(NASA-CR-160536; TR-0180-0779-Vol-1-Phase-3) Avail: NTIS HC A04/MF A01 CSCL 10B

The Solar Power Satellite (SPS) concept and the reference phase control system investigated in earlier efforts are reviewed. A summary overview of the analysis and selection of the pilot signal and power transponder design is presented along with the SOLARSIM program development and the simulated SPS phase control performance. Evaluations of the ground based phase control system as an alternate phase control concept are summarized. R.E.S.

N80-18561*# LinCom Corp., Pasadena, Calif.
SPS PILOT SIGNAL DESIGN AND POWER TRANSPONDER ANALYSIS, VOLUME 2, PHASE 3 Final Report
W. C. Lindsey, R. A. Scholtz, and C. M. Chie Jan. 1980 108 p refs
(Contract NAS9-15782)
(NASA-CR-160537; TR-0180-0779-Vol-2-Phase-3) Avail: NTIS HC A06/MF A01 CSCL 10B

The problem of pilot signal parameter optimization and the related problem of power transponder performance analysis for the Solar Power Satellite reference phase control system are addressed. Signal and interference models were established to enable specifications of the front end filters including both the notch filter and the antenna frequency response. A simulation program package was developed to be included in SOLARSIM to perform tradeoffs of system parameters based on minimizing the phase error for the pilot phase extraction. An analytical model that characterizes the overall power transponder operation was developed. From this model, the effects of different phase noise disturbance sources that contribute to phase variations at the output of the power transponders were studied and quantified. Results indicate that it is feasible to hold the antenna array phase error to less than one degree per power module for the type of disturbances modeled. R.E.S.

N80-18562*# Grumman Aerospace Corp., Bethpage, N.Y.
ACTIVE HEAT EXCHANGE SYSTEM DEVELOPMENT FOR LATENT HEAT THERMAL ENERGY STORAGE Topical Report, Jun. 1978 - Feb. 1979
Joseph Alario, Robert Kosson, and Robert Haslett Jan. 1980 73 p refs
(Contracts DEN3-39; EC-77-A-31-1034)
(NASA-CR-159726; DOE/NASA/0039-79/1;
GAC-TR-1681-09) Avail: NTIS HC A04/MF A01 CSCL 10A

Various active heat exchange concepts were identified from among three generic categories: scrapers, agitators/vibrators and slurries. The more practical ones were given a more detailed technical evaluation and an economic comparison with a passive tube-shell design for a reference application (300 MW sub t storage for 6 hours). Two concepts were selected for hardware development: (1) a direct contact heat exchanger in which molten salt droplets are injected into a cooler counterflowing stream of liquid metal carrier fluid, and (2) a rotating drum scraper in which molten salt is sprayed onto the circumference of a rotating drum, which contains the fluid salt is sprayed onto

the circumference of a rotating drum, which contains the fluid heat sink in an internal annulus near the surface. A fixed scraper blade removes the solidified salt from the surface which was nickel plated to decrease adhesion forces. In addition to improving performance by providing a nearly constant transfer rate during discharge, these active heat exchanger concepts were estimated to cost at least 25% less than the passive tube-shell design. R.E.S.

N80-18563*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENGINEERING EVALUATION OF A SODIUM HYDROXIDE THERMAL ENERGY STORAGE MODULE Final Report
Donald G. Perdue and Larry H. Gordon Feb. 1980 22 p refs
(Contract EC-77-A-31-1034)
(NASA-TM-81417; DOE/NASA/1034-80/7; E-338) Avail: NTIS HC A02/MF A01 CSCL 10A

An engineering evaluation of thermal energy storage prototypes was performed in order to assess the development status of latent heat storage media. The testing and the evaluation of a prototype sodium hydroxide module is described. This module stored off-peak electrical energy as heat for later conversion to domestic hot water needs. R.E.S.

N80-18564*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OVERVIEW OF A STIRLING ENGINE TEST PROJECT
Jack G. Slaby 1980 27 p refs Proposed for presentation at 5th Intern. Automotive Propulsion Systems Symp., Dearborn, Mich., 14-18 Apr. 1980
(Contract EC-77-A-31-1040)
(NASA-TM-81442; DOE/NASA/1040-80/12; E-362) Avail: NTIS HC A03/MF A01 CSCL 10B

Tests were conducted on three Stirling engines ranging in size from 1.33 to 53 horsepower (1 to 40 kW). The tests were directed toward developing alternative, backup component concepts to improve engine efficiency and performance or to reduce costs. Some of the activities included investigating attractive concepts and materials for cooler-regenerator units, installing a jet impingement device on a Stirling engine to determine its potential for improved engine performance, and presenting performance maps for initial characterization of Stirling engines. The experiment results of the tests are presented along with predictions of results of future tests to be conducted on the Stirling engines. R.E.S.

N80-18565*# General Electric Co., Philadelphia, Pa. Space Div.
APPENDIX: MOD-1 WIND TURBINE GENERATOR ANALYSIS AND DESIGN REPORT, VOLUME 2 Final Report
May 1979 425 p
(Contracts NAS3-20058; EX-77-A-29-1010)
(NASA-CR-159496; DOE/NASA/0058-79/2-Vol-2-App) Avail: NTIS HC A18/MF A01 CSCL 10B

The MOD-1 detail design is appended. The supporting analyses presented include a parametric system trade study, a verification of the computer codes used for rotor loads analysis, a metal blade study, and a definition of the design loads at each principal wind turbine generator interface for critical loading conditions. Shipping and assembly requirements, composite blade development, and electrical stability are also discussed. K.L.

N80-18566*# LinCom Corp., Pasadena, Calif.
ANALYTICAL SIMULATION OF SPS SYSTEM PERFORMANCE, VOLUME 3, PHASE 3 Final Report
A. V. Kantak and W. C. Lindsey Jan. 1980 91 p refs
(Contract NAS9-15782)
(NASA-CR-160538; TR-0180-0779-Vol-3-Phase-3) Avail: NTIS HC A05/MF A01 CSCL 10B

The simulation model for the Solar Power Satellite spaceantenna and the associated system imperfections are described. Overall power transfer efficiency, the key performance issue, is discussed as a function of the system imperfections. Other system performance measures discussed include average power pattern, mean beam gain reduction, and pointing error. R.E.S.

N80-18567# Naval Postgraduate School, Monterey, Calif.
SOLAR ENERGY DESIGN IMPROVEMENT: A METHODOLOGY FOR HYDRONIC FLATPLATE COLLECTOR SYSTEMS M.S. Thesis
Lawrence William Kozoyed Sep. 1979 236 p refs
(AD-A076836) Avail: NTIS HC A11/MF A01 CSCL 03/2

A methodology for solar energy system design improvement has been developed and coupled with a constrained function optimization code resulting in an automated solar energy system design procedure. The scope of the methodology is limited to systems using flat plate collectors and water as the working fluid. Eight parameters have been included as independent design variables. The design variables included collector area, collector tile angle, collector and storage fluid stream velocities, and collector to storage heat exchanger dimensions. The procedure includes an accounting for economic parameters as an intimate part of the design process. The resulting methodology has been used for the design of solar energy systems which would use shelf item collectors for the purpose of determining the optimum design variable vector for a given situation. The methodology could also be used on a limited basis for collector design optimization by exploring the effects of changing selected collector parmeters on system performance. The methodolgoy is coded in the FORTRAN computer language under the name SOLOAD-1 (Solar Energy Optimization Analysis or Design). GRA

N80-18568# SRI International Corp., Menlo Park, Calif.
A FEASIBILITY STUDY OF WINDPOWER FOR THE NEW ENGLAND AREA Final Report, 4 Jun. - 31 Oct. 1979
Patrick Martin, Michael Balma, Gwen Crooks, Roy Endlich, and Christopher Maxwell Oct. 1979 238 p refs
(Contract N00014-79-C-0539; SRI Proj. 8569)
(AD-A076614) Avail: NTIS HC A11/MF A01 CSCL 05/3

SRI International examined the applicability of large-scale windpower electricity generating systems (WEGS) as an alternative source of energy for the New England States in general and for the U.S. Navy Portsmouth Shipyard at Kittery, Maine, in particular. The Boeing Mod 2 wind machine was selected as representative of current technology in the appropriate size range of 2.5 megawatts (MW) rated capacity. Parametric economic analyses led to the conclusion that WEGS electricity can be at economic parity with the incremental electricity from conventional generators using oil or gas without any allowance for a capacity credit, provided that the annual utilization factor for the WEGS is at least 50%. Such utilization appears to be achievable at elevations between 620 and 1,240 m (2,000 and 3,000 ft). About one-eight of the 35,500 sq kilometers of air space reviewed in New Hampshire is at such elevations. Nonutility financing and capitalization can halve the costs of WEGS electricity. Nonutility ownership of WEGS is encouraged by recent state and federal legislation. The primary potential WEGS environmental impact, interference with television reception, can be mitigated by installation of cable TV service. GRA

N80-18569# Honeywell Power Sources Center, Horsham, Pa.
SAFETY STUDIES OF LITHIUM-SULFUR DIOXIDE CELLS Final Report, 25 Apr. - 27 Oct. 1978
L. J. Blagdon and B. Randall Ft. Monmonth, N.J. ERADCOM Nov. 1979 117 p refs
(Contract DAAB07-78-C-0530; DA Proj. 1F2-63702-DG-10)
(AD-A078961; DELET-TR-78-0530-F) Avail: NTIS HC A06/MF A01 CSCL 09/1

Hermetically sealed sulfur dioxide 'D' cells were fabricated and tested to improve safety during use/abuse conditions. Cathodes and anodes were optimized to yield efficient and safe operation at -20 F. Explosions were eliminated and venting was minimized when the cells were discharged at 2A constant current to 200% of the theoretical SO2 content between -20 F and +130 F. Discharge currents at 3.5A and above resulted in frequent but safe venting. GRA

N80-18570# American Univ., Washington, D. C.
THE PREPARATION OF SOME NOVEL ELECTROLYTES: SYNTHESIS OF PARTIALLY FLUORINATED ALKANESULFONIC ACIDS AS POTENTIAL FUEL CELL ELECTROLYTES Final Report
C. Bunyagidj, H. Pietrowska, and M. H. Aldridge Sep. 1979 77 p refs

(Contract DAAK70-77-C-0047; DA Proj. 1L1-61102-AH-51) (AD-A078473) Avail: NTIS HC A05/MF A01 CSCL 10/2

The objective of this research was to prepare some strong acids for evaluation by Fort Belvoir as potential fuel cell electrolytes. The major acid, other than phosphoric, H3PO4, currently under investigation by Fort Belvoir as a fuel cell electrolyte is TFMSA, CF3SO3H.H2O, trifluoromethanesulfonic acid monohydrate aqueous solutions and sodium salt mixtures. TFMSA has been found to be superior to H3PO4 from the standpoint of electrode kinetics, but certain undesirable characteristics (volatility; wetting of Teflon) led to this research for a better fuel cell electrolyte. GRA

N80-18571# Naval Surface Weapons Center, White Oak, Md.
AROMATIC IONS AS ANODE MATERIALS FOR RECHARGEABLE, AMBIENT-TEMPERATURE BATTERIES Final Report
Stanley D. James Mar. 1979 28 p refs
(ZR0130101)
(AD-A078697; NSWC/TR-79-295) Avail: NTIS HC A03/MF A01 CSCL 10/3

The use of aromatic radical ions is proposed as anode material for high energy density, ambient-temperature and secondary batteries. Preliminary data are promising, showing that the naphthalenide anion can provide high current-densities at practical current-collectors like steel and nickel. However, the present test-electrode design did not confine naphthalene long enough to demonstrate rechargeability over a number of cycles. Two approaches are recommended to containing the aromatics close to a current-collector for extended periods of charge-discharge cycling. GRA

N80-18572# Eagle-Picher Industries, Inc., Colorado Springs, Colo.
HIGH RATE STABLE NICKEL-CADMIUM BATTERIES Final Report, Jun. 1975 - May 1979
James M. Hill Aug. 1979 69 p refs
(Contract DAAB07-75-C-1770)
(AD-A078714; DELET-TR-75-1770-F) Avail: NTIS HC A04/MF A01 CSCL 10/3

The report describes work for the design, construction, and testing of advanced state-of-the-art high rate stable vented nickel-cadmium batteries, with a special emphasis on the improvement of the separator wrap. Eagle-Picher Industries, Inc. designed and tested three to five cell units (BB-600 cells) of the BB-433 aircraft battery during phase I of this contract for the purpose of determining and selecting an optimum design. Phase II, the second half of the contract, included the design, fabrication and testing of 24 volt, 35 ampere-hour batteries of the BB-433 configuration, utilizing the optimum design features of Phase I. The batteries and the three to five cell units were tested in accordance with the updated Technical Guidelines for High Rate Stable Nickel-Cadmium Batteries. GRA

N80-18573# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
SAFETY STUDIES OF LITHIUM-SULFUR DIOXIDE CELLS Final Report, 11 May - 10 Dec. 1978
A. N. Dey and P. Witalis Nov. 1979 66 p refs
(Contract DAAB07-78-C-0535; DA Proj. 1F2-63702-D-610)
(AD-A077277; DELET-TR-78-0535-F) Avail: NTIS HC A04/MF A01 CSCL 10/3

The objective of this program was to study the relationship between the various design parameters of Li/SO2 cells and their abuse resistance for the purpose of developing approaches to the design of cells with an increased abuse resistance. The investigations were focussed on hermetically sealed D cells. Three factors were found to affect the abuse resistance of the cells significantly: (1) the Li/SO2 ratio, (2) the anode/cathode capacity ratio, and (3) the intrinsic rate capability of the cathode. Cells incorporating the most favorable combination of these factors were found to have a significantly greater abuse resistance than the standard production cells as determined by the behavior of the cells under constant current cell reversal at various discharge rates. The experimental work showed that for any particular cell design abusive conditions can be found that render the cells unsafe. It also showed that the abuse resistance of the cells can be even further increased by the development of truly high rate cathode structures and electrode configurations, so much so that in all probability the cells may be rendered safe under all conditions encountered in field use and storage. GRA

N80-18574# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
ANALYSIS OF PRESSURE PRODUCING REACTIONS IN LITHIUM-SULFUR DIOXIDE CELLS Final Report, 15 Sep. 1977 - 31 Jul. 1979
A. N. Dey and R. W. Holmes Nov. 1979 139 p refs
(Contract DAAB07-77-C-0472; DA Proj. 1L1-62705-AH-94)
(AD-A077379; DELET-TR-77-0472-F) Avail: NTIS HC A07/MF A01 CSCL 10/3

Although the State-of-the-Art hermetically sealed high-rate D cells made by P. R. Mallory Co. Inc. are sufficiently abuse resistant for many applications, this program was initiated to explore the feasibility of improving the intrinsic abuse resistance of the system even further by chemical and/or mechanical means, so that the product may be rendered safe under all user conditions. The approach that was pursued involved: (1) the identification of the chemical reactions responsible for the pressure buildup and/or thermal runaway; (2) the determination of the sensitivity of these reactions to the various use and abuse variables; and (3) the development of methods to desensitize these reactions. GRA

N80-18575# Mallory (P. R.) and Co., Inc., Burlington, Mass.
LITHIUM-THIONYL CHLORIDE BATTERY Quarterly Report, 1 Apr. - 31 Jul. 1979
A. N. Dey, N. Hamilton, W. Bowden, and P. Witalis Nov. 1979 61 p refs
(Contract DAAB07-78-C-0563; DA Proj. 1L1-62705-AH-94)
(AD-A077162; DELET-TR-78-0563-3; QR-3) Avail: NTIS HC A04/MF A01 CSCL 10/3

The Li/SOCl2 inorganic electrolyte system is the highest energy density system known to date. It consists of a Li anode, a carbon cathode and SOCl2 which acts both as a solvent and as a cathode active material. The electrolyte salt that has been used most extensively is LiAlCl4, but salts such as Li2B10Cl10 and Li2O(AlCl3)2 have also been used successfully in this system for improving the shelf life characteristics. The main objective of this program is to develop high rate Li/SOCl2 cells and batteries for portable applications of the U.S. Army. The cells and batteries must deliver more high energy densities than are presently available and must be safe to handle under U.S. Army field conditions. GRA

N80-18576# Eagle-Picher Industries, Inc., Joplin, Mo. Electronics Div.
CALCIUM INORGANIC ELECTROLYTE BATTERY DEVELOPMENT Interim Report, Aug. 1977 - Jan. 1979
R. L. Higgins and L. Elliott Jun. 1979 82 p
(Contract F33615-77-C-2020; AF Proj. 3145)
(AD-A077685; AFAPL-TR-79-2044) Avail: NTIS HC A05/MF A01 CSCL 10/3

The objectives of this program are based on the desire to develop a calcium/oxyhalide system comparable to the lithium/oxyhalide system with respect to energy density and rate capabilities, while overcoming the problems of voltage delay and safety hazards. This project is directed toward assessing basic performance, safety, storage, and voltage delay of the calcium/oxyhalide system for use in Air Force applications. Early small cell development is designed for use in life support, rescue equipment, and spacecraft power, while Phase II development of large cells up to 10,000 Ampere hours is anticipated for use in missile standby and emergency ground power systems. Specific factors of concern in these applications are low volume, performance over a temperature range -40 F to 165 F, safety, and long shelf life. GRA

N80-18577# Air Force Academy, Colo.
OPTIMIZATION OF LiAl/NaAl-Cl SUB 4/CuCl SUB 2 THERMAL CELLS Technical Report, 2 Feb. - 21 Sep. 1979
Robert L. Vaughn Nov. 1979 24 p refs
(AF Proj. 2303)
(AD-A076945; FJSRL-TR-79-0011) Avail: NTIS HC A02/MF A01 CSCL 10/3

The optimization of LiAl/NaAlCl4/CuCl2 single thermal cells

is presented. Energy densities were obtained over the temperature range 175-275 degrees C and current density range 15-150 mA/square centimeters. The results were compared to similar data for LiAl/NaAlCl4/MoCl5 and LiAl/NaAlCl4/FeCl3 cells. Although the CuCl2 type cell had a lower voltage than the other types, its energy density was higher due to the extended lifetimes of these cells. GRA

N80-18578# Bundesministerium fuer Wissenschaft und Forschung, Vienna (Austria). Sektion Forschung.
THE STORAGE OF ELECTROCHEMICAL ENERGY [ELEKTROCHEMISCHE ENERGIESPEICHERUNG: BESTANDSAUFNAHME NATIONALER UND INTERNATIONALER FORSCHUNGEN UND ENTWICKLUNGEN VON ELEKTROCHEMISCHEN ENERGIESPEICHERN]
Jan. 1976 77 p refs In GERMAN
Avail: NTIS HC A05/MF A01

A brief survey of national and international research is compiled. Progress is noted in electrochemical batteries, chemical electrolytes electric production, and fuel cells. Author (ESA)

N80-18579# Open Univ., Milton (England). Energy Research Group.
REPORT ON THE GAS SUPPLY INDUSTRY
G. Alexander, R. Armson, M. Barrett, D. Casper, P. Chapman, D. Crabbe, G. Gravelle, D. Hemming, D. Herd, S. Johnson et al
Mar. 1979 212 p refs
(ERG-027) Avail: NTIS HC A10/MF A01; Secretary, Energy Res. Group, Milton Keynes, England

The evolution of the natural gas industry in the UK is reviewed, then an assessment of its operations in the foreseeable future is made. Its rapidly growing significance in the formulation of UK energy policy is emphasized, especially in regard to decisions in the development of nuclear energy. The impact on the UK coal industry is also shown and the relevance to planning for substitute natural gas production is pointed out. Pricing issues are covered as well. Supporting data presented include gas industry statistics on supply and demand, fuel price statistics, gas appliance statistics, and a load curve analysis used to foresee the possibility of a gas supply shortfall. Author (ESA)

N80-18580# National Technical Information Service, Springfield, Va.
SILVER CELLS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1976
Diane M. Cavagnaro Dec. 1979 215 p
(PB80-802309) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Federally-funded research reports on silver cell primary and storage batteries with respect to electrochemistry, separators, hermetic seals, electrolytes, electrodes, charging, reliability, and applications are presented. The citations pertain mainly to silver zinc cells and to silver cadmium cells. This updated bibliography contains 207 abstracts, none of which are new entries to the previous edition. GRA

N80-18581# National Technical Information Service, Springfield, Va.
SILVER CELLS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979
Diane M. Cavagnaro Dec. 1979 101 p Supersedes NTIS/PS-78/1191; NTIS/PS-77/1026; NTIS/PS-76/0879; NTIS/PS-75/649
(PB80-802317; NTIS/PS-78/1191; NTIS/PS-77/1026; NTIS/PS-76/0879; NTIS/PS-75/649) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

The cited reports from Federally-funded research relate to silver cell primary and storage batteries with respect to electrochemistry, separators, hermetic seals, electrolytes, electrodes, charging, reliability, and applications. Studies concerning silver zinc cells and silver cadmium cells are discussed in the majority of the abstracts. This updated bibliography contains 95 abstracts, 19 of which are new entries to the previous edition. GRA

N80-18582# National Technical Information Service, Springfield, Va.
SILVER CELLS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979
Diane M. Cavagnaro Dec. 1979 130 p Supersedes NTIS/PS-78/1192; NTIS/PS-77/1027; NTIS/PS-76/0860
(PB80-802325; NTIS/PS-78/1192; NTIS/PS-77/1027; NTIS/PS-76/0880) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Citations from worldwide research on silver cell primary, storage, and solid state batteries are presented. Studies on electrochemistry, electrodes, electrolytes, separators, reliability, charging, and performance are covered. The use of these batteries in spacecraft, electric automobiles, and submersibles is discussed. This updated bibliography contains 124 abstracts, 20 of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-18583 North Carolina Univ. at Chapel Hill.
EVALUATION OF A PHOTOCHEMICAL SYSTEM FOR NITROGEN OXIDES CONTROL Ph.D. Thesis
John Randolph Richards 1979 199 p
Avail: Univ. Microfilms Order No. 8005069

The technical feasibility of a photochemical pretreatment system for NOx control at coal fired boilers was evaluated. This approach utilizes reaction mechanisms similar to those responsible for photochemical oxidant incidents. The reactions are initiated under controlled conditions while the pollutants are at high concentration and while the reaction products can be removed. Results indicate that under time limited and light limited conditions, it is possible to quench the photochemical reactions at the NO2 peak and prior to the formation of ozone, aerosols, and other secondary products. However, the photochemical system will not be commercially competitive unless serious operational problems limit the alternative techniques or unless the photochemical system can be refined to reduce cost. Dissert. Abstr.

N80-18584 Wisconsin Univ. - Madison.
ENSEMBLE TRAJECTORY ANALYSIS OF SUMMERTIME SULFATE AEROSOL CONCENTRATIONS IN THE NORTHEASTERN UNITED STATES Ph.D. Thesis
Perry James Samson 1979 164 p
Avail: Univ. Microfilms Order No. 7928667

A technique for quantifying the relationships between observed concentrations of atmospheric sulfate aerosol and their corresponding upstream history of sulfur dioxide emissions, wind speed, and mixing height is presented. Using reported sulfate concentrations from several sampling sites, 72 h upstream trajectories are computed for the mixed-layer of the atmosphere over the duration of their respective sampling periods. It is found that the sulfate concentrations were insensitive to upstream mixing height, highly correlated with the inverse of wind speed occurring at times greater than 24 h upstream of the sampling point, and totally in response to the spatial configuration of sources around the sampling point. The resultant sulfate concentrations were not always correlated with the total upstream emissions burdens of sulfur dioxide. The implications of these results to possible emission control strategies for sulfur dioxide to reduce the regional episodes of high sulfate concentrations are discussed and future work using this technique is outlined. Dissert. Abstr.

N80-18585 Commission of the European Communities, Luxembourg. Applied Mechanics Div.
ON THE FUTURE AVERAGE MERCURY CONTENT OF AIR, SOIL AND RIVER SEDIMENTS IN THE EUROPEAN ECONOMIC COMMUNITY AND IN THE WORLD'S OCEANS
R. H. vanEnk 1978 56 p refs
(EUR-6023; ISBN-92-825-0529-4; CD-NO-78-013-EN-C) Copyright. Avail: Issuing Activity

A computerized simulation of the pathways of mercury through the environment was used to estimate the average mercury concentration levels in the atmosphere, soil, and river sediments in the EEC as a function of time. In an extended model the impact of the total mercury released throughout the world on

the average mercury content of ocean water as a function of time was investigated. It was shown that the tendency of the average mercury content levels to increase rapidly in the EEC is arrested. No significant increase of average mercury content of ocean water is expected. Author (ESA)

N80-18586*# ORI, Inc., Silver Spring, Md.
AERIAL APPLICATIONS DISPERSAL SYSTEMS CONTROL REQUIREMENTS STUDY Final Report
J. S. Bauchspies, W. L. Cleary, W. F. Rogers, W. Simpson, and G. S. Sanders 15 Feb. 1980 84 p refs
(Contract NAS3-21714)
(NASA-CR-159781; ORI-TR-1686) Avail: NTIS HC A05/MF A01 CSCL 13B

Performance deficiencies in aerial liquid and dry dispersal systems are identified. Five control system concepts are explored: (1) end of field on/off control; (2) manual control of particle size and application rate from the aircraft; (3) manual control of deposit rate on the field; (4) automatic alarm and shut-off control; and (5) fully automatic control. Operational aspects of the concepts and specifications for improved control configurations are discussed in detail. A research plan to provide the technology needed to develop the proposed improvements is presented along with a flight program to verify the benefits achieved. K.L.

N80-18587# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.
CONTROL OF PARTICULATE EMISSIONS FROM TURBINE ENGINE TEST CELLS BY COOLING WATER INJECTION Final Report, Feb. - May 1979
Michael G. MacNaughton, James J. Tarquinio, and Joseph A. Martone Jul. 1979 77 p
(AF Proj. 1900)
(AD-A075947; AFESC/ESL/TR-79-19) Avail: NTIS HC A05/MF A01 CSCL 13/2

The operation of DOD turbine engine test cells in California has been criticized by the State environmental regulatory agencies because smoke generated by some engines results in excessive opacity (visibility) of the test cell exhaust plume. Since the plume exceeds visibility standards for only a relatively small proportion of engines tested a low cost control technique which brings the test cell into compliance with opacity standards is required. This study was initiated to verify that, in addition to forming a steam plume, water used to cool the test cell walls also removes engine generated particulates and substantiates this procedure as a legitimate pollution control technique. It can be concluded from this study that water injection as practiced at McClellan AFB test cell results in significant (approx. 50% by weight) control of turbine engine particulate emissions. It is postulated that the process could be made more efficient by the use of better designed spray nozzles which would increase water droplet particle contact and inclusion of a demister to increase water removal from the exhaust. GRA

N80-18588# National Technical Information Service, Springfield, Va.
AIR POLLUTION EFFECTS ON MATERIALS. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Report, 1971 - Sep. 1979
William E. Reed Dec. 1979 84 p
(PB80-801871) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

The bibliography contains selected research reports from worldwide literature on corrosion and damage by air pollution and includes studies on the effects upon steel, textiles, and building materials. Many studies cover a specific pollutant and its corrosive or damaging properties. This updated bibliography contains 78 abstracts, 9 of which are new entries to the previous edition. GRA

N80-18589# National Technical Information Service, Springfield, Va.
AIR POLLUTION EFFECTS ON MATERIALS. CITATIONS FROM THE NTIS DATA BASE Report,
William E. Reed Dec. 1979 159 p Supersedes NTIS/PS-78/1073; NTIS/PS-77/0912; NTIS/PS-76/0854; NTIS/PS-75/760; NTIS/PS-74/113
(PB80-801863; NTIS/PS-78/1073; NTIS/PS-77/0912; NTIS/PS-76/0854; NTIS/PS-75/760; NTIS/PS-74/113) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

The bibliography contains selected research reports on corrosion and damage by air pollution and includes studies on the effects upon steel, textiles, and building materials. Many studies cover a specific pollutant and its corrosive or damaging properties. This updated bibliography contains 151 abstracts, 27 of which are new entries to the previous edition. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-18590 Illinois Univ. at Urbana-Champaign.
RELATIONSHIP OF ACOUSTIC EMISSION AND ULTRASONIC VELOCITY TO DEFORMATION MECHANISMS AND DILATANCY DURING THE DUCTILE DEFORMATION OF MARBLE Ph.D. Thesis
Theodore Allen Koelsch 1979 128 p
Avail: Univ. Microfilms Order No. 8004208

The effects of confining pressure and grain size on both the macroscopic and microscopic deformational behavior of triaxially deformed marble were investigated by the simultaneous measurement of acoustic emissions, sample dilatancy and ultrasonic velocity changes. Numerical spectral analysis was carried out by digitizing individual events with a transient recorder. The axial compressional velocity changes were determined to within 0.01 percent from the transit time of 1 MHz signals. The analysis of the acoustic signals revealed two major types of signals distinguishable by their main frequency and waveform. The important microscopic processes identified were: (1) intracrystalline twinning, (2) grain boundary rotation and sliding, (3) microfracture nucleation, and (4) microfracture propagation. The importance of twinning as an effective mechanism for microfracture nucleation was demonstrated. Dissert. Abstr.

N80-18591 Colorado Univ. at Boulder.
THE NORTH PACIFIC OSCILLATION AND EIGENVECTORS OF NORTHERN HEMISPHERE ATMOSPHERIC CIRCULATION DURING WINTER Ph.D. Thesis
Jeffrey Charles Rogers 1979 186 p
Avail: Univ. Microfilms Order No. 8003010

A climatological study of the North Pacific Oscillation between 1906 and 1973, and a related analysis of the eigenvectors of Northern Hemisphere sea level pressure and 500 mb height departures for the winters 1946-47 through 1976-77 were performed. Two types of eigenvector analysis were carried out: the first was for mean winter pressure and height anomalies for the 31 winters and the second was for daily pressure and height departures during each individual winter. Eigenvector patterns based on daily data were compared between winters and also with the seasonal mean anomaly eigenvector patterns. Eigenvector patterns based upon unnormalized data appear to show real spatial variability in atmospheric anomaly fields whereas eigenvectors from normalized data are less useful. The associations between the time coefficients of the pressure and height eigenvector patterns are discussed. Dissert. Abstr.

N80-18592 New Mexico State Univ., University Park.
CONVECTION IN THE EARTH'S MANTLE DUE TO VISCOUS SHEAR AT THE CORE-MANTLE INTERFACE AND DUE TO LARGE SCALE BUOYANCY Ph.D. Thesis
Richard Guy Hills 1979 437 p
Avail: Univ. Microfilms Order No. 8002697

A three dimensional constant viscosity model for the mantle motions which are caused by viscous shear at the core mantle interface and by large scale buoyant forces is developed. The model utilizes geomagnetic data and magnetohydrodynamic theory to define an outermost core free stream velocity distribution. The resulting free stream velocity field is used in conjunction with the viscous boundary layer equations to find the corresponding stress field that the core exerts on the mantle. The resulting stress field acting on the inner mantle along with various passive

outer boundary conditions are used to find the corresponding three dimensional velocity field of the mantle. To account for large scale buoyant forces, the model uses a currently available three dimensional seismic velocity anomaly distribution for the mantle along with simple linear models relating seismic velocity anomaly to density perturbation. Dissert. Abstr.

N80-18593 Texas Technological Univ., Lubbock.
COMPUTATION OF SYNTHETIC SEISMOGRAMS BY THE METHOD OF CHARACTERISTICS Ph.D. Thesis
Louis Reyes Castro 1979 65 p
Avail: Univ. Microfilms Order No. 8003211

The method of characteristics is applied to one-dimensional stress wave propagation problems of exploration interest. Several seismograms computed from dry, elastic, and viscoelastic near surface models are compared to data recorded by various types of receivers. The characteristics method is also used to obtain a solution to Biot's equations for wave propagation in saturated media. Synthetic seismograms are computed from various core and reservoir models saturated with different types of fluids. The computed seismograms are used to study the effect of variable reservoir conditions on a seismic wavelet. Dissert. Abstr.

N80-18594 Ohio State Univ., Columbus.
TROPOSPHERIC WATER VAPOR ABSORPTION IN THE INFRARED WINDOW REGIONS Ph.D. Thesis
Michael Eugene Thomas 1979 252 p
Avail: Univ. Microfilms Order No. 8001842

Attenuation of infrared radiation in the troposphere is dominated by water vapor absorption. Most past work on the spectroscopy of water vapor was on the analysis of the rotational and vibrational bands. As a result, a thorough listing of line positions, line strengths and halfwidths exists today. Because of the weak continuum absorption in the water vapor windows centered at 10 and 4 microns efforts to measure and model the continuum were as successful as efforts in the analysis of the bands. Yet a precise understanding of continuum absorption is important for long path energy transmission. The purpose of this study is to demonstrate the importance of far wing phenomena in characterizing H2O continuum absorption. A total line shape for water vapor-nitrogen interactions valid under tropospheric conditions is derived. The model is tested using a set of experimental room temperature H2O continuum measurements of high quality. Using this data base parameters of the far wing component of the total line shape are determined from near band experimental data. Dissert. Abstr.

N80-18595 Colorado Univ. at Boulder.
POSITIONS AND MOVEMENT OF VHF LIGHTNING SOURCES DETERMINED WITH MICROSECOND RESOLUTION BY INTERFEROMETRY Ph.D. Thesis
Craig Owen Hayenga 1979 222 p
Avail: Univ. Microfilms Order No. 8002981

The first positions and movement in azimuth and elevation of VHF lightning sources obtained with a 34 MHz swept lobe interferometer are presented. The positions are correlated in time with electric field measurements which provide identification of the various processes occurring during a lightning discharge. Data from several flashes are presented. The early or breakdown phase consists primarily of quasicontinuous VHF emission from a large number of linear sources moving rapidly approx. 10 to the 7th power m/s) over distances of approx. 100-1500 meters. The relative positions of these sources drift with a velocity approximately > 100,000 m/s. The temporal and spatial patterns of the observed 34 MHz radiation indicate that different processes generate VHF radiation than those that generate lower frequency lightning radio emission. The source of VHF lightning radiation is attributed to the acceleration of electrons in the small high field region at the tip of an advancing breakdown streamer. Dissert. Abstr.

N80-18596 Missouri Univ. - Columbia.
SPECTRAL ANALYSIS OF SYNOPTIC SCALE DISTURBANCES OVER THE MARSHALL ISLANDS REGION Ph.D. Thesis
Geoffrey Arthur Gordon 1979 121 p
Avail: Univ. Microfilms Order No. 8002364

A comprehensive spectral analysis of the Marshall Islands upper air data is presented. Upper air observations interpolated to a synoptic scale grid network are used in the analysis to examine the spatial variability of the spectral statistics. Variance spectra of geopotential height, virtual temperature, and specific volume are found to be dominated either by a diurnal component and/or by long period fluctuations. The average structure of the synoptic scale disturbances is determined from cross spectra between grid points and between levels in the vertical. The interstation coherences for the vertical motion are generally small. Cross spectra between the vertical and specific volume are used to estimate the eddy conversion of available potential energy to eddy kinetic energy. The low frequency components, periods greater than about 10 days, are largely responsible for the long term eddy conversion process. Dissert. Abstr.

N80-18597 Cornell Univ., Ithaca, N. Y.
ELECTRIC FIELDS IN THE LOW LATITUDE IONOSPHERE AND THEIR RELATIONSHIP TO MAGNETOSPHERIC AND INTERPLANETARY PHENOMENA Ph.D. Thesis
Gonzales Butron 1979 162 p
Avail: Univ. Microfilms Order No. 8003934

The low latitude extension of magnetospheric fields during magnetically disturbed periods was investigated through case studies of particular events. Simultaneous auroral and equatorial electric field data are used along with magnetic field data to study anomalous electric field patterns. During some substorms, accompanied by ring current activity, the worldwide equatorial zonal electric field component reversed from the normal pattern. In several cases the zonal equatorial electric field component was nearly identical in form to the zonal auroral component, indicating the close electrical coupling between these regions. Less certain, but equally intriguing, is the evidence presented for a close relationship between the zonal equatorial electric field and the time derivative of the ring current induced magnetic field. Dissert. Abstr.

N80-18598 Texas A&M Univ., College Station.
A STUDY OF THE VARIABILITY OF THUNDERSTORM ELECTRICAL EVENTS BASED ON VERY-LOW-FREQUENCY ELECTROMAGNETIC DATA Ph.D. Thesis
William Burns Freeman, Jr. 1979 181 p
Avail: Univ. Microfilms Order No. 8003129

The incidence of lightning discharge was estimated including areal and global statistics and monthly values over a regularly spaced grid that includes much of the Eastern Hemisphere. It is shown that the Southern Hemisphere tropics were higher in average incidence of discharge than the Northern Hemisphere tropics. The relationship between flash density and thunderstorm days were studied for the months of January, April, August, and November with a curvilinear regression analysis. The relationship varied by season. The large-scale causes of the variability of cloud-to-ground discharges (dependent variable) were also studied. Multiple linear regression was used with and without a logarithmic transformation of the dependent variable. The variability of cloud-to-ground discharges when significant lightning had occurred was emphasized. Dissert. Abstr.

N80-18599# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOMAGNETIC MEASUREMENTS AT SAO JOSE DOS CAMPOS Progress Report, Dec. 1971 - Jan. 1975
J. M. daCosta, I. S. Batista, E. G. de Souza, and N. B. Trivedi Dec. 1979 190 p refs Revised
(INPE-1643-RPE/099-Rev) Avail: NTIS HC A09/MF A01

The total geomagnetic field intensity measurements are provided. Hourly mean values are given in the form of tables, computerized plots show the daily variations. Analysis of some important geomagnetic storms are also presented. The instrument used was an optical pumping rubidium vapor magnetometer. A brief explanation on the principle of operation of the magnetometer is also given. M.M.M.

N80-18600# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AIRGLOW STUDIES ON THE IONOSPHERE DYNAMICS OVER LOW LATITUDE IN BRAZIL
J. H. A. Sobral, M. A. Abdu, and I. S. Batista Dec. 1979 20 p refs Revised

(INPE-1644-RPE/100-Rev) Avail: NTIS HC A02/MF A01

Certain features are presented of the ionosphere dynamics over Cachoeira Paulista, Brazil, based on recent photometric observations of OI 6300 A emission, and ionosonde data, both taken at that site. The photometer scanned the geomagnetic meridional plane in a zenith angle range of 75 S to 75 N. Remarkable wavelike structures in the airglow intensity were observed in the premidnight period, which propagate from north to south (poleward) at an average speed of about 240 (+ or -) 70 m/s, assuming the emitting layer to be at an altitude of 250 km. These disturbances had wavelength of a few hundred kilometers and were associated with spread F echoes in the ionograms. A discussion is made on the possible source of the poleward propagating airglow disturbances. It is argued that these are possible manifestations of the vertical propagation of plasma bubbles over the magnetic equator. M.M.M.

N80-18601# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

IMPLICATION OF Z VARIATIONS DURING A NEAR-MOON EQUATORIAL COUNTERELECTROJET ON 6 MARCH 1967, IN THE INDIAN ZONE

R. P. Kane Nov. 1979 19 p refs Revised

(INPE-1613-RPE/087-Rev) Avail: NTIS HC A02/MF A01

The daily variations of geomagnetic H, D, Z were studied for the average of five internationally quiet days of March 1967, as also for a particular day (March 6, 1967), when a spectacular near-noon counterelectrojet occurred, at Trivandrum (about 30 km south of the dip equator) and Kodaikanal and Annamalainagar (about 170 km and 290 km north of dip equator) in the Indian zone. For the average quiet days, the electrojet seemed to be centered near dip equator in the morning, but shifted steadily southward over Trivandrum and beyond by evening. For the near-noon counterelectrojet day, single current systems flowing more than hundred kilometers to the north of the dip equator and/or double current systems, one normal near the dip equator and another reverse, about hundred kilometers or more to the north were indicated. Author

N80-18602# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ANALYSES OF THE MIDDLE LATITUDE INSTABILITIES USING A QUASI-GEOSTROPHIC MODEL [ANALISE DA INSTABILIDADE DOS DISTURBIOS DE ESCALA MEDIA, USANDO UM MODELO QUASE GEOSTROFICO]

Nelson de Jesus Ferreira and V. B. Rao Oct. 1979 38 p refs In PORTUGUESE; ENGLISH summary Presented at the 31st Reuniao Anual da SBPC

(INPE-1592-RPE/079) Avail: NTIS HC A03/MF A01

Effects of latent heat of condensation on middle latitude disturbances are discussed, using a two layer quasi-geostrophic model. The main characteristics of instabilities, vertical structure and energy transformations of unstable disturbances are analyzed, using the classical method of eigen values. Results showed that the inclusion of latent heat does not change significantly the conventional baroclinic instability, but generate another class of disturbances, the so-called medium-scale disturbances. These disturbances have a characteristic wave length of approximately 1000 km. Author

N80-18603# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A STUDY OF THE INFLUENCE OF OROGRAPHY AND DIFFERENTIAL ALBEDO ON THE ATMOSPHERIC CIRCULATION: AN APPLICATION TO THE BRAZILIAN NORTHEAST [UM ESTUDO SOBRE A INFLUENCIA DO ALBEDO DIFERENCIAL DA OROGRAFIA NA CIRCULACAO ATMOSFERICA: UMA APLICACAO PARA O NORDESTE BRASILEIRO]

Manoel Francisco Gomes Filho Nov. 1979 93 p refs In PORTUGUESE; ENGLISH summary

(INPE-1640-TDL/015) Avail: NTIS HC A05/MF A01

The influence of orography and differential albedo on the mean vertical motion in the atmosphere over Northeast Brazil was investigated. The vertical velocity is calculated at the top of the planetary boundary layer, using a vertically integrated atmospheric model, in which the zonal flow is laterally limited by rigid walls in the north and south, and vertically limited by a fixed lid. The mathematical model is similar to that of Berkofsky except that the equations are in the sigma coordinate system. The linearized equations are numerically resolved using a grid in which the variables are staggered in space and an Euler-backward time integration scheme. Considering the orography alone, sinking motions are induced over the region where the mean annual precipitation is a minimum. The same distribution of vertical motion results when the albedo alone is considered, which is in accord with the hypothesis of Charney. When both the orography and the albedo are incorporated in the model, the descending motion is found to be a greater intensity. As a result, it appears that the orography and the albedo together contribute to the low rainfall and arid conditions over Northeast Brazil. Author

N80-18604# Illinois Univ., Urbana. Aeronomy Lab.

WIND AND WAVE OBSERVATIONS IN THE MESOSPHERE USING COHERENT-SCATTER RADAR

I. D. Countryman and S. A. Bowhill 1 Oct. 1979 148 p

(Grant NSF ATM-77-06787)

(UILU-ENG-79-2508; ISSN-0568-0581; Aeronomy-89) Avail: NTIS HC A07/MF A01

Measurements of backscattered signals from the mesosphere using the coherent scatter technique were reviewed. The observations periods were four 48 hour intervals covering 1977. The multiheight, multidirectional wind measurements indicate that short period (1 minute to 1 hour) vertical velocity oscillations are usually evanescent vertically although propagating, reflected (trapped) modes are observed. Short period horizontal velocity oscillations were not consistently strong enough to be measurable for the pointing directions used. Tidal period horizontal winds were variable in amplitude and do not match theoretical predictions regarding uniform growth with height. R.C.T.

N80-18605*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

STUDY OF THE STORM TIME FLUXES OF HEAVY IONS Final Report

[1978] 42 p refs

(Contract NASw-3112)

(NASA-CR-162826; LMSC-D673774) Avail: NTIS HC A03/MF A01 CSCL 04A

The characteristics of the storm time ring current ions in the energy range of 0.5 to 16 keV were investigated. Data were processed and analyzed from the energetic ion mass spectrometer aboard the S3-3 satellite. Results are used for planning and operating the ion mass spectrometer experiment on the ISEE spacecraft, for selecting and processing the ISEE ion data, and for planning and conducting coordinated satellite experiments in support of the International Magnetospheric Study (IMS). It is established from the S3-3 ion data that relatively large fluxes of energetic (keV) O(+) and H(+) ions are frequently flowing upward from the ionosphere along magnetic field lines in the polar auroral regions. Also, from investigations with the same instrument during the main phase of three moderate (D sub ST approximately 100) magnetic storms, it is found that the number density of O(+) ions in the ring current was comparable to H(+) ion density the range 0.5 to 15 keV. J.M.S.

N80-18606*# Rockwell International Science Center, Thousand Oaks, Calif.

INTERNAL FRICTION AND MODULUS IN ROCKS AT DEPTH Annual Report, 1 Jan. - 31 Dec. 1979

B. R. Tittmann, V. A. Clark, and L. Ahlberg Jan. 1980 5 p

(Contract NAS9-13846)

(NASA-CR-160476; SC577.86AR; AR-6) Avail: NTIS HC A02/MF A01 CSCL 08K

Experimental results relevant to the seismic wave attenuation observed for the lunar crust are presented along with some results bearing on the mechanism by which the presence of volatiles increases the attenuation. K.L.

N80-18607*# City Coll. of the City Univ. of New York. Dept. of Earth and Planetary Sciences.

SPHERICAL HARMONIC ANALYSIS OF A SYNOPTIC CLIMATOLOGY GENERATED WITH A GLOBAL GENERAL CIRCULATION MODEL

Zaphiris D. Christidis and J. Spar Feb. 1980 50 p refs

(Grant NGR-33-016-086)

(NASA-CR-162804) Avail: NTIS HC A03/MF A01 CSCL 04A

Spherical harmonic analysis was used to analyze the observed climatological (C) fields of temperature at 850 mb, geopotential height at 500 mb, and sea level pressure. The spherical harmonic method was also applied to the corresponding 'model climatological' fields (M) generated by a general circulation model, the 'GISS climate model.' The climate model was initialized with observed data for the first of December 1976 at 00 GMT and allowed to generate five years of meteorological history. Monthly means of the above fields for the five years were computed and subjected to spherical harmonic analysis. It was found from the comparison of the spectral components of both sets, M and C, that the climate model generated reasonable 500 mb geopotential heights. The model temperature field at 850 mb exhibited a generally correct structure. However, the meridional temperature gradient was overestimated and overheating of the continents was observed in summer. Author

N80-18608*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

NIGHTTIME/DAYTIME OPTICAL SURVEY OF LIGHTNING AND CONVECTIVE PHENOMENA EXPERIMENT (NOSL)

Bernard Vonnegut (State Univ. of New York at Albany), Otha H. Vaughan, Jr., and Marx Brook (New Mexico Inst. of Mining and Technology) Feb. 1980 27 p refs

(NASA-TM-78261) Avail: NTIS HC A03/MF A01 CSCL 04A

The Nighttime/Daytime Optical Survey of Lightning experiment was selected for flight on Orbital Flight Test 2 of the Space Shuttle. The background and rationale for the experiment are presented and the experiment hardware, the operating procedures, and the data analysis technique are discussed. Some preliminary results from the prototype hardware development are also presented. R.E.S.

N80-18609# Pennsylvania State Univ., University Park.

A HIGH SPEED DIGITAL AUTOCORRELATOR AND ITS APPLICATION TO MESOSPHERIC WATER VAPOR DETECTION

P. T. Petruno and John J. Olivero Jul. 1979 125 p refs

(Grant DAAG29-78-G-0083; DA Proj. 1L1-61102-B5-3A)

(AD-A076018; ERADCOM/ASL-CR-79-0083-1) Avail: NTIS HC A06/MF A01 CSCL 04/1

The emission and absorption spectrum of stratospheric and mesospheric water vapor are to be detected and analyzed. In both cases the method of detection requires a 22 GHz radiometer, and the data analysis requires a high speed, high resolution spectral analyzer. The basic radiometer fundamentals are discussed here, then the various techniques of spectral analysis are considered, which include both digital and analog versions of filter banks and autocorrelators. A prototype 2 x 1 bit digital autocorrelator was then designed and constructed. The system was designed to operate at a sampling rate of up to 100 MHz, with a resolution dependent on the number of autocorrelation points used. The system was then interfaced to a Nova 1200 minicomputer for data accumulation and transfer of data to nine track magnetic tape for standard processing. An IBM 370 computer system was available for final data reduction and analysis. The final system was a 16 point autocorrelator, two points of which were constructed. Future goals include completing the 16 points and using the system for a ground based measurement of upper atmosphere water vapor. GRA

N80-18610# Defence Research Establishment Valcartier (Quebec).

THE EFFECTS OF RELATIVE HUMIDITY ON ATMOSPHERIC AEROSOL EXTINCTION IN THE 3-5 MICROMETERS AND 8-15 MICROMETERS SPECTRAL REGIONS

W. G. Tam and C. Boily May 1979 26 p refs

(AD-A070159; DREV-R-4121/79) Avail: NTIS HC A03/MF A01 CSCL 04/1

The variation of the infrared aerosol extinction coefficient as a function of relative humidity is studied. This is based on a two component particle distribution model. The aerosol extinction coefficient increases by a factor of more than 10 throughout the 3-5 and 8-15 micrometers spectral regions as the relative humidity increases from 0.5 to 0.99. For high relative humidities, a region of lower extinction around 10-11 micrometers is noticed. GRA

N80-18611*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

A CORRELATION BETWEEN AURORAL KILOMETRIC RADIATION AND FIELD-ALIGNED CURRENTS Progress Report

James Lauor Green, Nicolaos A. Saflekos, Donald A. Gurnett, and Thomas A. Potemra May 1979 34 p refs Prepared in cooperation with APL, Johns Hopkins Univ., Laurel, Md.

(Contract NAS1-13129; Grant NGL-16-001-043; Contracts N00014-76-C-0016; N00017-72-C-4401)

(NASA-CR-162842; AD-A076413; Rept.-79-38) Avail: NTIS HC A03/MF A01 CSCL 04/1

Simultaneous observations of field-aligned currents (FAC) and auroral kilometric radiation (AKR) are compared from the polar orbiting satellites Triad and Hawkeye. The Triad observations were restricted to the evening-to-midnight local time sector (19 to 01 hours magnetic local time) in the northern hemisphere. This is the region where it is believed the most intense storms of AKR originate. The Hawkeye observations were restricted to when the satellite was in the AKR 'emission cone' in the Northern Hemisphere and at radial distances > or = 7 R(E) (Earth radii) to avoid local propagation cutoff effects. A (R/7 R(E))2 normalization to the power flux measurements of the kilometric radiation from Hawkeye is used to take into account the radial dependence of this radiation and to scale all intensity measurements such that they are independent of Hawkeye's position in the emission cone. Integrated field-aligned current intensities from Triad are determined from the observed transverse magnetic field disturbances. Statistically, there is a good correlation between the AKR intensity and the integrated current sheet intensity of field-aligned currents. It is found that as the intensity of auroral kilometric radiation increases so does the integrated auroral zone current sheet intensity increase. GRA

N80-18612# Naval Research Lab., Washington, D. C.

THE NRL CHMAIR CODE: A DISTURBED SEA LEVEL AIR CHEMISTRY CODE Interim Report

R. F. Fernsler, A. W. Ali, J. R. Greig, and I. M. Vitkovitsky 15 Nov. 1979 41 p refs

(AD-A077687; NRL-MR-4110) Avail: NTIS HC A03/MF A01 CSCL 04/1

An Air Chemistry Code which describes the evolution and the relaxation of disturbed air at the sea level is described. Pertinent reactions and their coefficients are presented. The Code can be utilized with various forms of energy inputs, i.e., high power lasers, microwave radiation, electric discharge and high energy electron and proton beams. GRA

N80-18613# Naval Research Lab., Washington, D. C.

COMPUTER SIMULATION OF GRADIENT DRIFT INSTABILITY PROCESSES IN OPERATION AVEFRIA

B. E. McDonald, M. J. Keskinen, S. L. Ossakow, and S. T. Zalesak 15 Nov. 1979 39 p refs

(AD-A077688; NRL-MR-4112) Avail: NTIS HC A03/MF A01 CSCL 04/1

Numerically equations of motion are solved for the evolution of a one level, two dimensional F region ionospheric plasma cloud with five different ratios of cloud to background integrated Pedersen conductivity. The simulations show that (1) physically small clouds striate due to the gradient drift instability more rapidly than large clouds, and (2) there exists a minimum striation onset time as a function of the Pedersen conductivity ratio. Observation (1) is in agreement with the rapid striation development exhibited by the physically small Avefria barium cloud releases, relative to the large Secede or STRESS type releases. Author (GRA)

N80-18614# Colorado Univ., Boulder.

CHARGED ATMOSPHERIC CONGLOMERATES: ROLE OF NEGATIVE IONS IN HETEROMOLECULAR NUCLEATION: THE PROPERTIES OF SMALL CLUSTERS AND ATMOSPHERIC IONS Final Report, 10 Jun. 1978 - 1 Jul. 1979

A. W. Castleman, Jr. 1 Jul. 1979 34 p refs

(Grant DAAG29-76-G-0276)

(AD-A078962; ARO-14191.8-CH) Avail: NTIS

HC A03/MF A01 CSCL 04/1

There has been an enormous growth of interest in the properties of small particles and in the mechanisms by which they are formed. The research program undertaken in our laboratory was directed to a study of the fundamentals of nucleation about negative ions, with particular attention to an elucidation of the structure of small clusters, and the role of chemical bonding in establishing their stability. Using a new high pressure mass spectrometric technique, a systematic investigation of the bond energies and entropies of numerous ligand-negative ion complexes were determined. Concurrent theoretical work on the bonding of small complexes and ion-induced nucleation was also undertaken. The results have led to a more complete understanding of nucleation phenomena, and especially of the importance of cluster structure in the development of surfaces and in effecting phase transformations. In addition, the work has led to a clarification of some recent atmospheric observations reported in the literature.
Author (GRA)

N80-18618# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ALTAIR OBSERVATIONS OF IONOSPHERIC IRREGULARITIES AND BACKGROUND DENSITIES
David M. Towle 19 Sep. 1979 68 p refs
(Contract F19628-78-C-0002)
(AD-A078599; TN-1979-41; ESD-TR-79-223) Avail: NTIS
HC A04/MF A01 CSCL 04/1

A series of measurements of the properties of equatorial ionospheric irregularities were made at Kwajalein, M.I. in August 1977 and July-August 1978. These measurements, involved coordinated ground based and in-situ sensors. The ARPA Long-range Tracking and Instrumentation Radar (ALTAIR), obtained backscatter and transmission data during five nights in August 1977 and eight nights in July-August 1978. This report describes the ALTAIR data from the night of 11 August 1978 which yield direct quantitative measurements of 1 m and 3/8 m irregularities and of plasma depleted regions. These plasma depleted regions, previously predicted on the basis of theoretical speculation and in-situ data, appear to be associated with the decay phase and not the generative phase of the field aligned irregularities.
GRA

N80-18619# Utah State Univ., Logan. Space Measurement Lab.
ROCKETBORNE IONOSPHERIC STUDIES Final Report, 28 May 1976 - 30 Sep. 1979
D. A. Burt and G. D. Allred 6 Aug. 1979 144 p refs
(Contract F19628-76-C-0261)
(AD-A078799; AFGL-TR-79-0179) Avail: NTIS
HC A07/MF A01 CSCL 04/1

Eight instrumented sounding rockets were flown to investigate ionospheric parameters and to further the development of new instruments and measurements techniques for investigating such parameters. Particular emphasis has been placed upon development of instrumentation for electron dosing via large electron accelerators aboard the payloads and assessment of the effects of such dosing as manifested by ultraviolet, visible, and particularly, infrared emissions. Launches have been accomplished under a variety of ionospheric conditions ranging from the quiescent, undisturbed ionosphere through intense auroral conditions. This report describes the program of launches and instrumentation used to accomplish the measurements.
GRA

N80-18617# Southwest Research Inst., San Antonio, Tex.
LIGHTNING TRACKING SYSTEM EVALUATION Progress Report, 1 May - 13 Jul. 1979
R. L. Johnson 22 Aug. 1979 6 p
(Contract N00014-79-C-0223)
(AD-A078722) Avail: NTIS HC A02/MF A01 CSCL 04/1

This is a progress report summarizing technical progress on (1) verification of performance of the lightning position and tracking system (LPATS) developed by Atlantic Science Corporation, and (2) a side-by-side performance comparison of the LPATS device with the lightning location system developed by Lightning Location and Protection Incorporated (LLP).
GRA

N80-18618# Naval Research Lab., Washington, D. C.
PRELIMINARY NUMERICAL STUDY OF THE OUTER SCALE SIZE OF IONOSPHERIC PLASMA CLOUD STRIATIONS
M. J. Keskinen, B. E. McDonald, and S. L. Ossakow 3 Dec. 1979 27 p refs
(AD-A078492; NRL-MR-4124) Avail: NTIS
HC A03/MF A01 CSCL 04/1

The one level, two-dimensional fluid equations modelling striation development in large F region ionospheric plasma clouds have been numerically solved, using an initial one-dimensional cloud geometry, for three different initial Pedersen conductivity gradient scale lengths L = 3, 6, 10 km. In the nonlinear regime evidence is presented for an outer scale size of well developed striations in a direction (y) perpendicular to the ExB drift (x) of the plasma cloud whose initial Pedersen conductivity varies only along the drift direction.
GRA

N80-18619# Naval Research Lab., Washington, D. C.
A COHERENT NONLINEAR THEORY OF AURORAL KILOMETRIC RADIATION
Crockett L. Grabbe, P. Palmadesso, and K. Papadopoulos Oct. 1979 37 p refs
(RR0330242)
(AD-A078918; AD-E000342; NRL-MR-4087) Avail: NTIS
HC A03/MF A01 CSCL 04/1

A theory of auroral kilometric radiation due to the nonlinear interaction between negative energy electromagnetic waves and coherent EIC waves is developed. The theory predicts that such radiation produced must have X-mode polarization and must have a frequency just slightly below the Doppler-shifted beam cyclotron frequencies. The basic requirement for free space accessibility is the presence of high-energy beams and a density cavity of the type observed by Isis I measurements. It is predicted that a harmonic band structure in the kilometric radiation may be observable.
GRA

N80-18620# Air Force Geophysics Lab., Hanscom AFB, Mass.
SATELLITE ATMOSPHERIC RADIANCE MEASUREMENTS IN THE VACUUM ULTRAVIOLET
R. F. Huffman, F. J. LeBlanc, J. C. Larrabee, and D. E. Paulsen Jul. 1979 44 p refs
(AF Proj. 6690)
(AD-A078628; AFGL-TR-79-0151; AFGL-ERP-665) Avail: NTIS HC A03/MF A01 CSCL 04/1

A satellite experiment has obtained nadir-viewing atmospheric radiance measurements in the 1100 to 2900 angstrom wavelength region from the polar orbiting satellite S3-4. This report describes the instrumentation, measurement techniques, and initial results. The observed emission is from airglow, solar scatter, and auroral regions. Spectral and spatial measurements previously unavailable have been made for the nitrogen Lyman-Birge-Hopfield emission, vacuum ultraviolet aurora, hydrogen geocorona, tropical ultraviolet airglow, twilight fluorescence nitric oxide spectrum, and night oxygen Herzberg band emission. Low values of the day and night background radiance values have been found; these values can be applied to improved missile detection techniques. Spatial resolution down to about one kilometer will enable possible variability to be sought. Observations were made in the period March to September 1978. Correlations with other geophysical factors such as solar flux, magnetic index, and seasonal variations will be made after the data base from the experiment is completed.
GRA

N80-18621# Air Force Geophysics Lab., Hanscom AFB, Mass.
ABSORPTION DATA ANALYSIS FOR EUVS EXPERIMENT OF THE SATELLITES AE-C, D AND E
Les M. Chaikin and Katsura Fukui Aug. 1979 48 p refs
(AF Proj. 6690)
(AD-A078663; AFGL-TR-79-0191; AFGL-ERP-672) Avail: NTIS HC A03/MF A01 CSCL 04/1

One of the two tasks that the Extreme Ultraviolet Spectrophotometers (EUVS) onboard the Atmosphere Explorer Satellites perform is absorption analysis of the thermosphere. The optical depth is derived from observations during parts of orbits including conditions of nearly negligible attenuation as reference. Details of two different approaches are described. The first one, used by the program LMC80, deals with certain standard optical depths only; the second one, used by the program LMC85, deals with time-ordered records of optical depths for input-controlled fixed steps in time.
GRA

N80-18622# Science Applications, Inc., La Jolla, Calif.
H2O-N2 TRANSITION RATES AND LINE SHIFTS OF WATER VAPOR Final Report
J. Nagel and D. Rogovin Kirtland AFB, New Mexico AFWL Jul. 1979 131 p refs
(Contract F29601-77-C-0039; AF Proj. 317J)
(AD-A078394; AD-E200395; AFWL-TR-79-3) Avail: NTIS HC A07/MF A01 CSCL 04/1

The VV deactivation rate of N2 by H2O is calculated using a hard core repulsive potential. The process is found to be dominated by near resonant VR processes with large changes in rotational motion, and the rate is critically dependent on the classical path chosen. In part 2, a nonperturbative model of H2O is used to calculate the effects of centrifugal distortion on absorption line intensities. The errors are less than 10 percent for weak as well as strong lines. The effects of collision broadening by N2 and O2 are presented using Anderson theory together with dipole transitions by the multimode model. GRA

N80-18623# Smithsonian Astrophysical Observatory, Cambridge, Mass.
GLOBAL FREQUENCY DISTRIBUTION OF EXOSPHERIC TEMPERATURE
Jack W. Slowey Jul. 1979 25 p refs
(Contract F19628-78-C-0126; AF Proj. 6690)
(AD-A077293; AFGL-TR-79-0143; SCIENTIFIC-1) Avail: NTIS HC A02/MF A01 CSCL 04/1

The distribution of exospheric temperature under all conditions of solar and geomagnetic activity and of spatial location was determined for two different models of the Earth's thermosphere and exosphere. The two models were the 1971 Jacchia model and the U.S. Standard Atmosphere Supplements, 1966. Data from the past 12 solar cycles were used to determine the contribution of solar activity to the distributions. The contribution of geomagnetic activity was based on the distribution of geomagnetic activity for solar cycle 20. The spatial contribution was determined by analysis of the diurnal variation in exospheric temperature as given by the particular model. The resulting distributions indicate a mean exospheric temperature of approximately 900 K for either model. GRA

N80-18624# Photometrics, Inc., Lexington, Mass.
AIRCRAFT PROGRAM FOR TARGET BACKGROUND, AND SKY RADIANCE MEASUREMENTS
Randall B. Sluder, W. Scott Andrus, and Irving L. Kofsky 15 Jun. 1979 28 p refs
(Contract F19629-77-C-0168; ARPA Order 2656)
(AD-A076959; PHM-01-79; SCIENTIFIC-2; AFGL-TR-79-0139) Avail: NTIS HC A03/MF A01 CSCL 17/8

A review of PhotoMetrics' field and data reduction work for the Air Force Geophysics Laboratory in the DNA-sponsored nuclear effects simulations program and the ARPA-sponsored targets and backgrounds measurements program during the period April 1978-April 1979 is presented. Data flights of USAF NKC-135 53120 on which PhotoMetrics operated radiometric instruments, the design, fabrication and application of an optical co-aligner for very narrow-angle aircraft instruments are documented, and modifications to an ISIT vidicon camera for auroral imaging are reviewed. GRA

N80-18625# Royal Netherlands Meteorological Inst., De Bilt.
TIDE FORECASTING ACCURACY [VERGELIJKING VAN VERWACHTE EN OPGETREDEN WATERSTANDEN]
J. J. Hoogstrate 1979 15 p ref In DUTCH
(KNMI-V-320) Avail: NTIS HC A02/MF A01

Forecast data on high tide prepared for the Dutch coast were compared with real data to determine the effect length of forecast period on accuracy. Data for high tides were analyzed at Hoek van Holland and Flushing, for 0800 and 1500 hours covering a two year period. Charts are presented showing the deviations from predicted heights. Author (ESA)

N80-18626# Stockholm Univ. (Sweden). Dept. of Meteorology.
CALIBRATION OF AN ULTRAVIOLET POLYCHROMATOR FOR ROCKETBORNE STUDIES OF AURORA
Margareta Malmort 8 Jan. 1979 53 p refs In SWEDISH; ENGLISH summary Prepared in Cooperation with International Meteorological Inst., Stockholm
(AP-19) Avail: NTIS HC A04/MF A01

A multichannel fixed wavelength spectrometer, i.e., polychromator, for the spectral interval 200 to 400 nm, was designed, constructed, and calibrated. The instrument is for the study of nitric oxide chemistry in an auroral arc illuminated by the Sun. The instrument is part of the rocket payload S-27 TWILIGHT. Emission features are observed on two channels, one fitted with a quartz cell containing NO, the other with an argon filled reference cell. The purpose is to obtain specifically high spectral selection for NO emissions. All channels have a bandwidth of roughly 4 nm and a sensitivity of about 10 counts/Rayleigh. The calibration procedure is presented together with the purpose of the experiment and a brief physical description of some relevant processes involved in auroral NO chemistry. Author (ESA)

N80-18070*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TROPOSPHERIC PATH LENGTH FLUCTUATION IN TEMPERATE SEMIARID LOCALES: APPLICATION TO THE GRAVITATIONAL WAVE DETECTION EXPERIMENT
A. L. Berman and S. D. Slobin *In its* The Deep Space Network 15 Feb. 1980 p 79-85 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 04A

N80-18466*# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.
A METHOD OF PREDICTIONS GEOMAGNETIC ACTIVITY BASED ON A CORONAL MODEL OF RELATIONS BETWEEN SOLAR AND GEOMAGNETIC ACTIVITIES
Jaroslav Halenka *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 44-60 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18467*# Polish Academy of Sciences, Warsaw. Space Research Centre.
KAZIA: A COMPUTER SYSTEM FOR SOLAR-TERRESTRIAL DATA PROCESSING AND OBJECTIVE PREDICTION
K. Stasiewicz, M. Maksymienko, and M. Jakimiec (Wroclaw Univ.) *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 61-66 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18471*# Institute of Applied Geophysics, Moscow (USSR).
FORECASTING IONOSPHERIC AND GEOMAGNETIC CONDITIONS AT THE IAG FORECASTING CENTER
S. I. Avdyushin, A. D. Danilov, A. B. Malyshev, G. N. Novikova, and P. M. Svidsky *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 104-117 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18473*# National Physical Lab., New Delhi (India).
A SIMPLIFIED INDEXING OF F-REGION GEOPHYSICAL NOISE AT LOW LATITUDES
S. Aggarwal, D. R. Lakshmi, and B. M. Reddy *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 134-139 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18482*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
A REVIEW OF THE OPERATION OF THE IUWDS REGIONAL WARNING CENTRE AT THE IONOSPHERIC PREDICTION SERVICE, SYDNEY
F. E. Cook and P. Davies *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 229-238 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18483*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
A DISTURBANCE FORECASTER'S VIEW OF THE SEPTEMBER 1977 EVENTS

F. E. Cook *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 239-248 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18484*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
THE USE OF IONOSPHERIC INDICES TO MAKE REAL- AND NEAR-REAL-TIME FORECASTS OF foF2 AROUND AUSTRALIA
L. F. McNamara *In* NOAA Solar-Terrest. Prediction Proc., Vol. 1 Aug. 1979 p 249-258 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18485*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
PREDICTION LIMITS FOR foF2
P. J. Wilkinson *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 259-278 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18486*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
A WEEKLY IONOSPHERIC INDEX
J. F. Turner and P. J. Wilkinson *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 279-287 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18489*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
PREDICTIONS OF THE SPACE ENVIRONMENT SERVICES CENTER
G. R. Heckman *In its* Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 322-349 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18490*# Air Force Global Weather Central, Offutt AFB, Nebraska.
GEOPHYSICAL FORECASTING AT AFGWC
Richard L. Thompson and James A. Secan *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 350-366 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18491*# Air Force Global Weather Central, Offutt AFB, Nebraska.
IONOSPHERIC MODELING AT AIR FORCE GLOBAL WEATHER CENTRAL
Thomas F. Tascione, Thomas W. Flattery, Vernon G. Patterson, James A. Secan, and James W. Taylor, Jr. *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 367-377 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18494*# Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
FORECASTS OF GEOMAGNETIC ACTIVITY BY OTTAWA MAGNETIC OBSERVATORY: THEIR RELIABILTY AND APPLICATION
J. Hruska *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 398-405 refs Sponsored in part by NOAA (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-18627 Oklahoma Univ., Norman.
THE ENERGY BUDGETS OF A DEVELOPING CYCLONE OVER THE EAST CHINA SEA DURING THE 1975 AIR MASS TRANSFORMATION EXPERIMENT Ph.D. Thesis
Ming-Ying Wei 1979 148 p
Avail: Univ. Microfilms Order No. 8003805

The available potential and kinetic energy budgets are evaluated for a developing cyclone over the East China Sea during the 1975 air mass transformation experiment. The computations are made in a quasi Lagrangian frame. The relationship between the cyclone development and the amount of energy supplied from the ocean during air mass modification is examined. Three components of the diabatic processes are considered. Both the stable and convective latent heat release are estimated; the latter is accomplished using Kuo's cumulus parameterization scheme. The sensible heat transferred from the ocean is computed by employing the bulk aerodynamic method. The radiational heating is estimated considering modeled cloud distributions. Dissert. Abstr.

N80-18628 Colorado Univ. at Boulder.
TEMPERATURE AND CIRCULATION ANOMALIES IN THE EASTERN CANADIAN ARCTIC, SUMMER 1946 - 1976 Ph.D. Thesis
Richard Alan Keen 1979 170 p
Avail: Univ. Microfilms Order No. 8002991

Baffin Island and nearby regions of the eastern Canadian Arctic have been the focus of many recent and ongoing paleoclimatic and glaciological studies. The region is very suitable for these studies because of the sensitivity of regional ice and snow conditions to small changes in summer temperature (which average a few degrees above freezing). Baffin Island's location beneath one of the major features of the general atmospheric circulation, a trough in the upper westerlies, raises the possibility that regional climate variations may be closely linked to changes in the global-scale climate and circulation. The existence of such a link would greatly enhance the importance of Baffin Island paleoclimatic and glaciological studies. The thirty summers (1946-76) of surface temperature and pressure, and upper air data for the Baffin region, the Arctic, and the extratropical Northern Hemisphere, are analyzed to establish the nature and significance of the regional global summer climate and circulation links. Dissert. Abstr.

N80-18629 Cornell Univ., Ithaca, N. Y.
NUMERICAL MODELING OF HIGH LATITUDE WINDS IN THE UPPER ATMOSPHERE Ph.D. Thesis
Antonio Eduardo Pereira 1979 98 p
Avail: Univ. Microfilms Order No. 8003974

The upper atmospheric electrically driven wind system was modeled to reproduce the characteristics of rocket measurements made in the afternoon auroral over Fairbanks. The plasma density and electric field in a geostationary frame of reference were obtained from the incoherent scatter radar station at Chatanika, Alaska. The model consists of the meteorological equations to which viscosity and forcing terms of electrical origin were added. The equations can be solved numerically by treating the advection terms with the Lax-Wendroff method and the viscous terms by a fully implicit method. The continuity equation does not need to be solved simultaneously with the momentum and energy equations. The dispersion associated with the Lax-Wendroff method can be controlled by using a grid spacing small in relation to the length scale for large changes in the electric field, plasma density, and other parameters. Dissert. Abstr.

N80-18630 Texas A&M Univ., College Station.
THUNDERSTORM-ENVIRONMENT INTERACTIONS DETERMINED WITH THREE-DIMENSIONAL TRAJECTORIES Ph.D. Thesis
Gregory Sims Wilson 1979 166 p
Avail: Univ. Microfilms Order No. 8003197

Diagnostically determined three dimensional trajectories were used to reveal some of the scale interaction processes that occur between convective storms and their environment. Convective storm systems with good temporal and spatial continuity are shown to be related to the development and movement of short wave circulation systems aloft that propagate eastward within a zonal mid tropospheric wind pattern. These short wave systems are found to produce the potential instability and dynamic triggering needed for thunderstorm formation. The environmental flow patterns, relative to convective storm systems, are shown to produce large upward air parcel movements in excess of

50 mb/3h in the immediate vicinity of the storms. The thermo- and hydrodynamical processes that lead to changes in atmospheric structure before, during, and after convective storm formation are successfully described using total time derivatives of pressure or net vertical displacement (NVD), potential temperature, and vector wind calculated by following air parcels. The high degree of scale interaction between synoptic and convective scale systems is demonstrated statistically, using multiple linear regression, by combining NVD's and static stability measurements to successfully locate convective activity of various intensities over the AVE IV network. Dissert. Abstr.

N80-18631 World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: GLOBAL OBSERVING SYSTEM - SATELLITE SUB-SYSTEM. INFORMATION ON THE APPLICATION OF METEOROLOGICAL SATELLITE DATA IN ROUTINE OPERATIONS AND RESEARCH: ABSTRACTS, ANNUAL SUMMARIES AND BIBLIOGRAPHIES
1978 198 p refs
(WMO-475-Suppl-2) Avail: NTIS HC A09

Contributions from countries participating in the World Weather Watch program are listed. Emphasis is on the Global Observing System: Satellite sub-system. Bibliographic information and an abstract of each contribution are provided. Author (ESA)

N80-18632# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
HIGH-INTENSITY RAINFALL STATISTICS FOR CANADA
B. Segal Nov. 1979 130 p refs
(CRC-1329-E) Avail: NTIS HC A07/MF A01

Rainfall data for Canada are presented, and the potentially detrimental influence of the rainfall on microwave transmission is studied. The rainfall statistics across the entire country are examined and discussed in relation to the design and operation of radio and radar systems. The precipitation data base is reviewed including rain gauge calibration, rain gauge errors, and rain chart misalignment. The rainfall inhomogeneity and the temporal variability are discussed and precipitation modifying influences such as terrain effects and anthropogenic effects are reported. A.W.H.

N80-18633# Instituto de Pesquisas Especiais, Sao Jose dos Campos (Brazil).
THE RELATIONSHIP BETWEEN TOTAL PRECIPITABLE WATER AND SURFACE DEW POINT
Y. Viswanadham Oct. 1979 17 p refs Revised Submitted for publication
(INPE-1604-RPE/084-Rev) Avail: NTIS HC A02/MF A01

Mean monthly and annual values of total precipitable water are compared with mean monthly and annual values of surface dewpoint for each 5 deg latitude belt from equator to 85 deg S. The degree of relationship is good. However, the correlation coefficients are lower for latitudes 00 deg - 20 deg S than for latitudes 25 deg - 85 deg S. The computed regression equations give excellent estimates of precipitable water from surface dew-point for middle and higher latitudes in cooler seasons. Zonally averaged values of the moisture profile power index lambda for the Southern Hemisphere are presented. This power index is highly variable (-9.26(- or +) 4.57) even for mean monthly moisture profiles. The results obtained are useful for the zonally averaged climatic models. M.M.M.

N80-18634# Instituto de Pesquisas Especiais, Sao Jose dos Campos (Brazil).
STABILITY PROPERTIES OF MEDIUM-SCALE DISTURBANCES IN A BALANCE MODEL
V. Brahmananda Rao and Nelson J. Ferreira Oct. 1979 32 p refs Revised Submitted for publication
(INPR-1591-RPE/078-Rev) Avail: NTIS HC A03/MF A01

Stability properties of medium scale disturbances, their structure and energetics are studied using a two layer balance model. Under normal static stability two modes of unstable disturbances are generated: conventional baroclinic wave and a medium scale disturbance. The vertical structure of the latter mode shows that it is shallow agreeing with the observations of Nitta and Yamamoto (1974). When the static stability is low, a deep medium scale disturbance is generated. This agrees with the observations of Reed (1979). Thus the shallow or deep nature of medium scale disturbance depends on the stability of the atmosphere. Author

N80-18635# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INFRARED IMAGE ENHANCEMENT OBTAINED FROM METEOROLOGICAL SATELLITES [REALCE DE DADOS IN FRAVERMELHO TRANSMITIDOS POR SATELITES METEOROLOGICOS]
Nelson Jesus Ferreira and Vernon Edgar Kousky Oct. 1979 29 p refs In PORTUGUESE
(INPE-1596-RPE/081) Avail: NTIS HC A03/MF A01

A series of curves utilized to enhance the infrared data obtained from meteorological satellites is shown. The high resolution of the images depicted the thermal characteristics of the continental surface as well as those of the ocean surface. It was noted that the areas showing greater convective activity and a probability of precipitation are easily identified. Transl. by M.M.M.

N80-18636*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PRELIMINARY LOOK AT AVE-SESAME 1 CONDUCTED ON 10-11 APRIL 1979
Steven F. Williams (Texas A and M Univ., College Station), James R. Scoggins (Texas A and M Univ., College Station), Nicholas Horvath (Texas A and M Univ., College Station), and Kelly Hill Feb. 1980 62 p refs
(NASA-TM-78262) Avail: NTIS HC A04/MF A01 CSCL 04B

Preliminary information on the general weather conditions during the AVE-SESAME 1 period is presented together with a summary of severe weather reports. K.L.

N80-18637# Air Weather Service, Scott AFB, Ill.
ELECTRO-OPTICAL HANDBOOK. VOLUME 1: WEATHER SUPPORT FOR PRECISION GUIDED MUNITIONS
Kit G. Cottrell, Paul D. Try, Donald B. Hodges, and Ronald F. Wachtmann May 1979 107 p refs
(AD-A075168; AWS-TR-79-002) Avail: NTIS HC A06/MF A01 CSCL 04/1

A foundation for weather support to Precision Guided Munitions operating at visual through microwave wavelengths is established for use by Air Weather Service base weather station forecasters and staff weather officers. Chapter 1 describes the effects of the atmosphere and the Earth's surface on electromagnetic energy. Precision Guided Munitions (PGMs) and their sensitivities to the environment are discussed in Chapter 2. The next two chapters discuss weather support concepts and techniques to support PGMs. A glossary of terms, supplemental radiative transfer theory, and example worksheets illustrating support techniques to TV, infrared, and laser designator systems are included in the appendixes. GRA

N80-18638# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
PERFORMANCE EVALUATION OF THE OPTICAL CROSSWIND PROFILER
Ruben Rodriguez and William J. Vechione Aug. 1979 82 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A075145; ERADCOM/ASL-TR-0038) Avail: NTIS HC A05/MF A01 CSCL 04/2

Field measurements of integrated path crosswinds were made at Biggs Optical Range, Biggs Army Airfield, Fort Bliss, Texas, during the period of 31 January to 8 March 1978. The measurements were made with the Optical Crosswind Profiler (OCP), a bistatic system that measures crosswinds at six locations along its path by detecting and analyzing the movement of atmospheric scintillations. This report describes the performance evaluation test, test support equipment, and data collection methodology. Data collected with this sensor were compared to integrated path wind averages measured by the calibrated anemometer array. This report presents X-Y scatter plots, derived weighting functions, and wind measurement comparison plots. Results of this test showed that the alignment procedure is

lengthy and tedious. Furthermore, simultaneous alignment of the six OCP sensors is very difficult to attain. However, once a sensor is aligned at 500 m, wind velocity values measured with it fall within 8 percent of the values obtained from the calibrated anemometer array. Operation at 2000 m is not reliable due to difficulties in obtaining and retaining alignment. GRA

N80-18639# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
PRECIPITATION ESTIMATION USING SATELLITE DATA
Bruce T. Miers Sep. 1979 44 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A075978; ERADCOM/ASL-TR-0039) Avail: NTIS HC A03/MF A01 CSCL 04/2

This report attempts to show that, by fitting particular nonlinear auto-covariance and cross-covariance functions to space-time covariance values calculated from satellite data, convective complex characteristics such as size, ellipticity, motion, growth, and decay of a storm can be determined. These modeled features then can be related to convective storm characteristics found by Scofield and Oliver. In turn, these characteristics are related to actual rainfall amounts. The results of this study are a first step in removing the subjectivity from current rainfall estimation techniques. Results from the 20 May 1977 storm over Texas and Oklahoma are presented. GRA

N80-18640# Ballistic Research Labs., Aberdeen Proving Ground, Md.
METEOROLOGICAL MEASUREMENTS PROGRAM DURING UNIFIED NAVY FIELD TEST PROGRAM Final Report
John M. Evans, John W. Kinch, and John H. McNeilly Aug. 1979 852 p refs
(DA Proj. 1X2-63314-D-093)
(AD-A075459; AD-E430309; ARBRL-MR-02942) Avail: NTIS HC A99/MF A01 CSCL 04/2

The Ballistic Research Laboratory participated with the Unified Navy Field Test Program conducted at the TRW Capistrano Test Site near San Clemente, CA from the fall of 1976-May 1978. Part of the BRL's responsibility in this program was to provide the meteorological measurements and analysis. These measurements provided the data required to determine optimum high energy laser propagation windows, and to predict propagation results. Meteorological parameters included in these measurements are the horizontal wind velocity normal to the propagation path, barometric pressure, wind speed and direction at several fixed points, strength of atmospheric optical turbulence, net and total solar radiation, temperature, dew point, and relative humidity. This report describes the measurement and recording techniques of the meteorological parameters, and presents the data obtained. GRA

N80-18641# Naval Environmental Prediction Research Facility, Monterey, Calif.
SUMMARY OF AN EASTPAC REFRACTIVE STRUCTURE CLIMATOLOGY Final Report
Wayne Sweet Jul. 1979 33 p
(AD-A075456; NEPRF-TR-79-02) Avail: NTIS HC A03/MF A01 CSCL 04/2

This report summarizes the most pertinent data and information contained in an earlier, in-depth refractive structure climatology, NEPRF TR 2-77 (MII), 'Development of a Synoptic Climatology of Tropospheric Refractive Conditions for the Eastern Pacific Ocean off the West Coast of the United States - Tasks One and Two.' Refractive structure data for five latitude zones of EASTPAC are given. Paragraph summaries discuss each of the selected statistics. GRA

N80-18642# Royal Netherlands Meteorological Inst., De Bilt.
WEATHER FORECASTING FOR THE CONSTRUCTION AND BUILDING INDUSTRY DURING THE WINTER 1976 - 1977 [RAPPORT BETREFFENDE DE WEERBERICHTGEVING VOOR DE BOUWNIJVERHEID IN DE WINTER 1976 - 1977]
J. J. Allan, A. P. A. Kleintjes, and D. M. vanderWoude 1977 25 p In DUTCH
(KNMI-V-296) Avail: NTIS HC A02/MF A01

The technical and organizational aspects of issuing forecasts for the construction industry are described, including the equipment required, forecast accuracy, and user acceptance. During the period under consideration, an average of 1900 telephone calls were received daily by the automatic answering service. Weather data for the period are presented. Author (ESA)

N80-18643# Royal Netherlands Meteorological Inst., De Bilt.
THE RELATION BETWEEN THE QUALITY OF THE WEEK LONG FORECAST AND THE QUALITY OF THE CURRENTLY USED GWL FORECAST [OVER HET VERBAND TUSSEN ENERZIJDS DE KWALITEIT VAN DE WEEKVERWACHTING EN ANDERZIJDS DE KWALITEIT VAN DE DAARBIJ GEBRUIKTE GWL-VOORSPELLING, ANOLOGIE EN 72-UUR PROG]
W. H. vandeGeer 1978 7 p In DUTCH
(KNMI-V-297) Avail: NTIS HC A02/MF A01

The production of one week weather forecasts using the long term analogous case method is presented. A computer program was used to compare cases from the previous month with those of the same month from a historical file dating from 1881. The most likely cases selected were used by experienced meteorologists to prepare the weekly forecast. Data elements considered include hours of sunshine, number of dry days, and maximum and minimum temperatures. Author (ESA)

N80-18644# Royal Netherlands Meteorological Inst., De Bilt.
VERIFICATION OF FIGURE EXPECTATIONS [VERIFICATIE VAN CIJFERVERWACHTINGEN]
H. Daan 1978 25 p In DUTCH
(KNMI-V-298) Avail: NTIS HC A02/MF A01

A quantity, called the reference value, was defined and used as a tool to aid in weather forecasting. For nine weather elements, including maximum and minimum temperature, sunshine duration, and wind speed, a probability was expressed as this reference value. This number proved useful as a guide in weather discussions where meteorologists develop one day forecasts. Forecast verifications for the period 1971 to 1977 are presented. Author (ESA)

N80-18645# Royal Netherlands Meteorological Inst., De Bilt.
VERIFICATION OF OBJECTIVE FORECASTS BASED ON ANALOGIES [VERIFIKATIE VAN OBJECTIEVE OP ANALOGEN GEBASEERDE VERWACHTINGEN]
H. A. F. M. Otten 1978 18 p In DUTCH
(KNMI-V-300) Avail: NTIS HC A02/MF A01

A comparison between standard methods of making one and two day forecasts and an analogous case method are presented. Analogies for thirty past situations (the 500 mb level only) are examined. The weather which materialized at these situations being considered as a forecast is shown. Data are presented which indicate that the method can produce accurate forecasts. Author (ESA)

N80-18646# Royal Netherlands Meteorological Inst., De Bilt.
RESULTS FROM ESTABLISHING SHORT TERM WEATHER FORECASTS BASED ON METHOD OF ANALOGIES [RESULTATEN VAN HET MAKEN VAN WEERSVERWACHTINGEN VOOR DE KORTE TERMIJN M.B.V. ANALOGEN-METHODEN]
J. H. A. Bernard, E. Hoftstee, and J. Jerphanion 1978 14 p refs In DUTCH
(KNMI-V-301) Avail: NTIS HC A02/MF A01

Examples of an analogous case method which examine the stream patterns to produce forecasts are described. Results did not match the accuracy of the operational 24 hour forecasts. Author (ESA)

N80-18647# Royal Netherlands Meteorological Inst., De Bilt.
RESULTS FROM A STUDY OF WEEK LONG FORECASTS FOR 1975 - 1978 [RESULTATEN VAN ONDERZOEK AAN DE WEEKVERWACHTING OVER DE PERIODE 1975 - 1978]
J. Reiff and J. L. Nap 1978 9 p In DUTCH
(KNMI-V-302) Avail: NTIS HC A02/MF A01

Intercomparisons of several methods for producing one week weather forecasts are presented for 150 cases. Predictions are issued for maximum and minimum temperature, the number of dry days and circulation type (according to the GWL system).

The best analogous case method is compared with a presistency forecast starting with the forecast for day three. Author (ESA)

N80-18648# Royal Netherlands Meteorological Inst., De Bilt.
COMPUTER SYSTEM OPERATING MANUAL FOR THE METEOROLOGICAL MAST AT CABAUW [HANDLEIDING COMPUTERSYSTEEM MEETMAST CABAUW]
P. A. T. Nieuwendijk and J. C. vanVuure 1978 33 p In DUTCH
(KNMI-V-303) Avail: NTIS HC A03/MF A01

A minicomputer data gathering and reduction system was developed for a 200 m instruments meteorological tower. Data was taken with rapid response sensors for determination of energy balance and for turbulence measurements. The programs were written for a HP21MX in FORTRAN 4. The system permits data sampling as well as archiving on a disk drive. Author (ESA)

N80-18649# Royal Netherlands Meteorological Inst., De Bilt.
SOFTWARE PACKAGE DESCRIPTION FOR INSTRUMENT READINGS AT CABAUW [BESCHRIJVING VAN HET PROGRAMMAPAKKET T.B.V. DE ROUTINEREGISTRATIE TE CABAUW]
P. A. T. Nieuwendijk and J. G. vanderVliet 1978 43 p refs In DUTCH
(KNMI-V-306) Avail: NTIS HC A03/MF A01

A set of computer programs written in ALGOL was developed for processing and archiving meteorological data taken at the 213 m tower. The sample interval is 30 seconds. The program set permits the testing of raw data tapes, generation of temperature and wind profiles at half hour intervals, and the generation of permanent tape files. Instructions for the use of the system are presented. Author (ESA)

N80-18650# Royal Netherlands Meteorological Inst., De Bilt.
FREQUENCY DISTRIBUTIONS OF THE WIND VELOCITY AND THE WIND ENERGY OF THE LIGHTSHIPS TERSCHELLINGERBANK, TEXEL, GOEREE AND NOORDHINDER [FREKWENTIEVERDELINGEN VAN DE WINDSNELHEID EN DE WINDENERGIE VAN DE LICHTSCHEPEN TERSCHELLINGERBANK, TEXEL, GOEREE EN NOORDHINDER]
G. J. Yperlaan 1979 92 p ref In DUTCH
(KNMI-V-309) Avail: NTIS HC A05/MF A01

Tables of wind velocity and wind energy are presented, prepared from data taken at four coastal lightships off the coast of the Netherlands for use in studying the feasibility of wind power. Data was also taken at shore stations, but differences in collection methods make it difficult to compare the two data sets. Author (ESA)

N80-18651# Royal Netherlands Meteorological Inst., De Bilt.
THE INFLUENCE OF THE NUMBER OF PARTICIPANTS UPON THE WORKING MULTIDAY FORECASTS [DE INVLOED VAN HET AANTEL DEELNEMERS AAN HET OVERLAG BIJ DE OPSTELLING VAN MEERDAAGSE VERWACHTINGEN]
R. deBruijn 1979 13 p refs In DUTCH
(KNMI-V-310) Avail: NTIS HC A02/MF A01

The differences in quality of weather forecasts prepared by two person teams or three person teams were compared. In all cases, performance on Sundays was less adequate than on weekdays. The working of multi-day forecasts edited on Sundays by one or two meteorologists is less accurate than weekday forecasts edited by three meteorologists. The differences are not thought to be noticeable by the public. Author (ESA)

N80-18652# Royal Netherlands Meteorological Inst., De Bilt.
AN AUTOMATED SYSTEM FOR NUMERICAL FORECASTS OF TIDAL HEIGHTS, WIND-DRIVEN SEAS, FRONTAL WAVES AND SWELLS [EEN GEAUTOMATISEERD SYSTEEM VOOR NUMERIEKE VERWACHTINGEN VAN WATEROPZETTEN, ZEEGANG EN DEINING]
J. W. Sanders 1979 22 p refs In DUTCH
(KNMI-V-311) Avail: NTIS HC A02/MF A01

The operational program for producing short range forecasts of sea conditions in the shipping channel off the Netherlands is described. Because of the large draft of modern tankers, the water level and energy in the wave spectrum for periods longer than 10 sec must be known for the duration of the ships passage. A description of the numerical forecasting model which incorporates both meteorological and oceanographics parameters is presented. Author (ESA)

N80-18653# Royal Netherlands Meteorological Inst., De Bilt.
CORRECTIONS FOR FORWARDLY DISPERSED LIGHT WITH TRANSMISSOMETER (KNMI SHORT RANGE) [CORRECTIES VOOR VOORWAARTS VERSTROOID LICHT BIJ TRANSMISSOMETERS (KNMI KORTE BASIS)]
H. R. A. Wessels 1979 17 p refs In DUTCH
(KNMI-V-312) Avail: NTIS HC A02/MF A01

Measurements of the runway visual range (RVR) values taken with range transmissometers are compiled. It was found that the instruments contain a too large field of view, causing a 15 percent over evaluation of the RVR. Tables are presented for correcting the error bringing the remaining deviations to less than 6 percent. Author (ESA)

N80-18654# Royal Netherlands Meteorological Inst., De Bilt.
WIND MEASUREMENTS AT THE TV TOWER AT MARKELO [WINDMETING OP DE TV-TOREN TE MARKELO]
J. A. Mellink and C. A. Velds 1979 25 p refs In DUTCH
(KNMI-V-313) Avail: NTIS HC A02/MF A01

Wind speed and direction data taken for six weeks at a 170 m mast are compared with data from the 200 m instrumented tower at Cabuaw, as part of a feasibility study for a boundary layer meteorological network in the Netherlands utilizing television masts. Author (ESA)

N80-18655# Royal Netherlands Meteorological Inst., De Bilt.
ARE SEVERE WINTERS PRECEDED BY AN ABNORMAL CIRCULATION PATTERN IN THE FALL? [WORDEN STRENGE WINTERS VOORAFGEGAAN DOOR EEN ABNORMAL CIRKULATIEPATROON IN DE HERFST?]
J. vanRaalten 1979 8 p refs In DUTCH
(KNMI-V-315) Avail: NTIS HC A02/MF A01

Atmospheric circulation during the autumns preceding severe winters occurring between 1881-1975 was studied for evidence of abnormal circulation patterns. Data indicate that severe winters are preceded by an autumn in which northern circulation types are more frequent than usual. A forecasting rule is offered: that a necessary, but not sufficient condition for severe winters is that the preceding autumn is characterized by a sufficient number of northern circulation episodes. Author (ESA)

N80-18656# Royal Netherlands Meteorological Inst., De Bilt.
VARIATION OF METEOROLOGICAL PARAMETERS AT SELECTED SITES IN THE NETHERLANDS [VARIATIE NAAR TIJD EN PLAATS VAN EEN AANTAL WEERSELEMENTEN IN NEDERLAND]
J. M. Terpstra 1979 17 p refs In DUTCH
(KNMI-V-314) Avail: NTIS HC A02/MF A01

The hypothesis that the inclusion of place and time information in radio broadcast weather forecasts may diminish the utility of the forecast to the public was examined using actual data. For temperature, in 25 percent to 35 percent of the cases, the omission of place indication would have resulted in a less useful forecast because of large area variations. For wind velocity, 85 percent of the time, the difference between morning and noon wind is not more than one beaufort. In the cases where this difference exceeds one beaufort, indications of time and place may be important. Author (ESA)

N80-18657# Royal Netherlands Meteorological Inst., De Bilt.
ANALYSIS METHODS AND FRONT STRUCTURE [ANALYSEMETHODEN EN FRONTENSTRUCTUUR]
L. M. Hafkenscheid, J. H. A. Bernard, H. R. A. Wessels, J. Reiff, and M. J. M. Saraber 1979 59 p refs In DUTCH
Presented at Synoptisch Symp., De Bilt, Netherlands, 15-29 Nov. 1978
(KNMI-WR-79-2) Avail: NTIS HC A04/MF A01

New analytical methods and tools of interest to operational weather forecasters are presented, including the use of potential wet bulb temperature in frontal analysis and real time cross sections produced in the field. The distribution of precipitation is discussed in the context of warm and cold fronts. A recent trajectory model which uses windfield prognoses is described, which includes the vertical wind component. Author (ESA)

N80-18658# Royal Netherlands Meteorological Inst., De Bilt.
LONG RANGE WEATHER FORECASTING [MAAND- EN SEIZOENSVERWACHTINGEN. ACHTERGRONDEN VAN HET ONDERZOEK IN DE WG AC]
H. M. vandenDool, J. D. Opsteegh, J. Reiff, and J. Oerlemans
1979 11 p refs In DUTCH
(KNMI-V-317) Avail: NTIS HC A02/MF A01

Research in the Netherlands medium-to-long on range weather forecasting (one to four months) is discussed. Statistical dynamical models are thought to offer the best possibility for ever achieving workable forecasts. Author (ESA)

N80-18659# Royal Netherlands Meteorological Inst., De Bilt.
SYSTEMATIC WIND ERROR AND THE STANDARD PLUVIOMETRIC [EEN ONDERZOEK NAAR DE GROOTTE VAN DE SYSTEMATISCHE WINDFOUT VAN DE STANDAARD REGENMETER]
C. G. Dekker 1979 20 p refs In DUTCH
(KNMI-V-317) Avail: NTIS HC A02/MF A01

A comparison made between the reference ground pluviometer and the currently used national, pluviometer to determine the systematic error caused by wind effect is described. Comparison data taken at Eibergen, Noorosleen, Zandvoort, and DeBilt, Netherlands over a four year period are presented, showing the relationship between wind speed and systematic error by season. Author (ESA)

N80-18660# Royal Netherlands Meteorological Inst., De Bilt.
A QUASI-OBJECTIVE METHOD FOR PRECIPITATION PREDICTION [EEN KWASI-OBJEKTIEVE METHODE VOOR KWANTITATIEVE BENADERING VAN NEERSLAGHOEVEELHEDEN]
C. J. vanderGoot 1979 27 p refs In DUTCH
(KNMI-V-318) Avail: NTIS HC A03/MF A01

A computer model was developed for predicting quantitatively the amount of precipitation expected over a given area. The quantitative approximation was made quasi objectively using the flow at 500 Mb and the mean vertical speed, calculated twice daily. Results compare well with real data and the model may be applied as a first guess method in operational situations. Author (ESA)

N80-18661# Royal Netherlands Meteorological Inst., De Bilt.
A SUBJECTIVE WEATHER TYPOLOGY [NAAR EEN SUBJECTIEVE WEER-TYPOLOGIE]
H. Daan 1979 43 p refs In DUTCH
(KNMI-V-319) Avail: NTIS HC A03/MF A01

A classification scheme was developed in which synoptic weather data are analyzed graphically to produce a subjective description of weather by type. Temperature, precipitation, and sunshine data were input elements, but the classification was extended to include such special phenomena as thunderstorms, hail, snow, and fog as well as extreme conditions such as frost, very high or low temperature, and severe storms. The classification scheme encompasses 36 types of weather. Frequency of occurance and an evaluation of the system using real data are presented. Some data elements become irrelevant in defining extreme weather conditions. Author (ESA)

N80-18662# Royal Netherlands Meteorological Inst., De Bilt.
PRECIPITATION, OPEN WATER EVAPORATION AND POTENTIAL PRECIPITATION SURPLUS IN THE NETHERLANDS: FREQUENCY DISTRIBUTIONS IN THE GROWING SEASON , [NEERSLAG, OPENWATERVERDAMPING EN POTENTIEEL NEERSLAGOVERSCHOT IN NEDERLAND. FREQUENTI EVERDELINGEN IN HET GROEISEIZOEN]
H. A. R. deBruin 1979 99 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-4) Avail: NTIS HC A05/MF A01

An objective parameter for defining a wet or a dry growing season is defined as precipitation (RR), open water evaporation (EO) and the potential precipitation surplus (RR-Epot) where Epot is the potential evaporation. Frequency distributions for these quantities are given for April to October for selected stations. The theoretical background of the three quantities is discussed. Measurement techniques at the sites are presented with statistical analyses of the time series for the quantities. Author (ESA)

N80-18663# Stockholm Univ. (Sweden). Dept. of Meteorology.
NUMERICAL STUDY OF PARTICLE GROWTH AND WATER VAPOR CONCENTRATION IN NOCTILUCENT CLOUDS
Ingemar Kinnmark Jan. 1979 61 p refs Prepared jointly with Intern. Meteorol. Inst.
(AP-18) Avail: NTIS HC A04/MF A01

An existing model was adapted to yield the distribution function of noctilucent cloud particles according to radius and altitude and the various assumptions regarding the temperature profile, water vapor mixing ratio, turbulent diffusion, and updraft. The specific numerical procedure known as the method of characteristics was employed. The theoretical background of this technique and the preliminary results obtained for an atmosphere with no vertical wind are presented. It is established that under the peculiar physical conditions near the mesopause the particle distribution has a well-defined peak whose position varies with the assumed water concentration and that this maximum is followed by a very sharp cut-off towards larger radii. Assuming that turbulent transport is described by the classical eddy diffusion concept, only limited changes in the mixing-ratio profile are found. Author (ESA)

N80-18664# Royal Netherlands Meteorological Inst., De Bilt.
CORRELATIONS BETWEEN THE 500 mb CIRCULATION AND THE WEATHER IN THE NETHERLANDS [CORRELATIES TUSSEN DE 500 mbar-STROMING EN HET WEER IN NEDERLAND]
H. Daan 1979 15 p refs In DUTCH
(KNMI-V-321) Avail: NTIS HC A02/MF A01

A method of presenting numerical weather data for eastern visualization from the synoptic point of view were developed. Correlations between the height of the 500 mb surface and percentage of sunshine, maximum and minimum temperatures, and wind data were computed for the years 1949 to 1972 and are shown in charts. Methods for interpreting the charts are given. Author (ESA)

N80-18665# Royal Netherlands Meteorological Inst., De Bilt.
DESCRIPTION OF A GRADIENT VERIFICATION PROGRAM AND A COMPARISON BETWEEN OBJECTIVELY AND SUBJECTIVELY PERFORMED VERIFICATION OF THE PREDICTED CURRENTS FROM BK4 [BESCHRIJVING VAN EEN GRADIENT-VERIFICATIE VE MET DOOR METEOROLOGEN VERRICHTE SUBJECTIEVE VERIFICATIE VAN HET VOORSPELD STROMINGSPATROON VAN BK4]
L. C. Heijboer 1979 36 p refs In DUTCH
(KNMI-V-322) Avail: NTIS HC A03/MF A01

An intercomparison of forecasts of wind driven sea heights procured by several different computer models with subjective forecasts was performed. Judgements of the accuracy of forecasts produced by earlier versions of the models T3 and T4 were inconclusive, but forecasts from version T5 compared favorably with Bracknell version BK4 which is based upon the 500 mb and 1000 mb hemisphere analysis from Bracknell. Author (ESA)

N80-18666# Royal Netherlands Meteorological Inst., De Bilt.
FAST CONVERGENT ITERATION PROCEDURE FOR CALCULATING THE ISOBARIC WET BULB TEMPERATURE [SNEL CONVERGERENDE ITERATIEPROCEDURE VOOR HET BERSKENEN VAN DE (ISOBARISCHE) NATTEBOLTEMPERATUR]
L. M. Hafkenscheid 1979 7 p In DUTCH
(KNMI-V-327) Avail: NTIS HC A02/MF A01

The calculation of the wet bulb temperature with a given pressure, atmospheric pressure, and temperature with the psychrometer formula has been described. In linear approximation the equation is not solvable analytically. An approximation formula is used to produce a numerical solution, which is shown. Author (ESA)

N80-18463*# Observatoire de Meudon (France).
THE FORECASTING CENTER OF MEUDON, FRANCE
Paul Simon *in* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 1-11 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-18667* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OCEANIC WAVE MEASUREMENT SYSTEM Patent
John F. Holmes (Computer Sciences Corp., Falls Church, Va.) and Ronald T. Miles, inventors (to NASA) (Computer Sciences Corp., Falls Church, Va.) Issued 22 Jan. 1980 6 p Filed 16 Oct. 1978 Supersedes N79-10689 (17 - 01, p 0091) Sponsored by NASA
(NASA-Case-MFS-23862-1; US-Patent-4,184,368; US-Patent-Appl-SN-951423; US-Patent-Class-73-170A) Avail: US Patent and Trademark Office CSCL 08C

An oceanic wave measured system is disclosed wherein wave height is sensed by a barometer mounted on a buoy. The distance between the trough and crest of a wave is monitored by sequentially detecting positive and negative peaks of the output of the barometer and by combining (adding) each set of two successive half cycle peaks. The timing of this measurement is achieved by detecting the period of a half cycle of wave motion. Official Gazette of the U.S. Patent and Trademark Office

N80-18668 California Univ., San Diego.
MICROSCALE MEASUREMENTS OF TEMPERATURE IN THE UPPER OCEAN FROM A TOWED BODY Ph.D. Thesis
John Carl Schedvin 1979 459 p
Avail: Univ. Microfilms Order No. 8002945

Measurements of small scale fluctuations of temperature in the upper ocean were obtained using a towed instrumentation system. Vertical profiling of the tow body, due to ship motion, showed a complex structure of pancake shaped regions. The mean vertical temperature gradient and microstructure spectral properties were homogeneous within each region, implying a common hydrodynamic origin. Towed body motions and vibrations were measured, and their effects on the temperature signals were examined. Vibrational contamination was significant, and is identified as coming from variations in the resistance of a connector in series with the low impedance, platinum film temperature sensor. It was found that comparison of the effective rate of strain to the Brunt-Vaisala frequency is a criterion for discrimination between active and fossil turbulence. Fossil turbulence regions were observed at most depths, but because the active turbulence required to produce them was not observed, it was concluded that the mixing and diffusive processes at these depths were undersampled. Dissert. Abstr.

N80-18669 Connecticut Univ., Storrs.
WAVELIKE BAROCLINIC DISTURBANCES ON SHALLOW UPPER OCEAN DENSITY FRONTS Ph.D. Thesis
Richard Anthony Formato 1979 224 p
Avail: Univ. Microfilms Order No. 8003745

A theoretical development of small amplitude wave disturbances on oceanic fronts is presented. The prototype front is the inshore boundary of the Gulf Stream. A two layer model is considered in which the lower layer is much deeper than the upper, lighter layer. The frontal zone that forms the horizontal boundary of the upper layer is divided into two regions, a smaller, inner region in which the flow is dissipative and depends upon interfacial mass entrainment and turbulent friction, and a larger, outer region in which the motion is inviscid. The boundary between these two regions is placed where the internal Froude number is of order one. Both geostrophic and ageostrophic basic state (nontime varying) flows are considered under the f plane approximation. Dissert. Abstr.

N80-18670 Connecticut Univ., Storrs.
EARLY DIAGENESIS OF TRACE METALS IN NEARSHORE LONG ISLAND SOUND SEDIMENTS Ph.D. Thesis
William Berry Lyons 1979 274 p
Avail: Univ. Microfilms Order No. 8003752

Sedimentary pore waters were obtained seasonally from two nearshore areas in Long Island Sound, Branford Harbor, Ct. and Mystic River Estuary, Ct. The pore waters were collected, separated from the sediments and analyzed utilizing inert atmospheric and ultraclean laboratory techniques in order to minimize any artificats due to improper sampling and contamination. The pore fluids and the sediments were analyzed for a variety of major and minor components as well as the trace metals, Fe, Mn, Zn, Cu, Pb, Cd and Ag. Sediments from these two areas were anoxic and bacterially mediated sulfate reduction was the major biogeochemical process taking place. As this process proceeded, SO4(2-) was consumed, sedimentary organic matter was oxidized and HS(-), PO4(3-), NH4(+), titration alkalinity and dissolved organic carbon was produced. Other significant observations as well as the results are reported. Dissert. Abstr.

N80-18671# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COASTAL WATER TEMPERATURES IN THE SOUTHEASTERN PORTION OF BRAZIL FROM OCEANOGRAPHIC DATA AND NOAA SATELLITE OBSERVATIONS, VOLUME 1 [TEMPERATURAS DAS AGUAS DA COSTA SUDESTE DO BRASIL, OBTIDAS ATRAVES DE DADOS OCEANOGRAFICOS E DE DADOS DE SATELITES DA SERIE NOAA, VOLUME 1]
Hector Manuel Inostroza Villagra and Jose Luiz Stech Sep. 1979 101 p refs In PORTUGUESE; ENGLISH abstract
(INPE-1569-RPE/070) Avail: NTIS HC A06/MF A01

Sub surface temperature charts in the southeastern coast of Brazil, utilizing oceanographic data and thermal sensor data of NOAA's satellites are presented. A detailed analysis of 350 oceanographic stations resulted in the finding of a marked seasonal tendency in the vertical temperature structure of the waters. A correlation was established between the surface and vertical thermal structure. The analysis was done on a weekly time basis with the year 1970 as the reference year. Temperature charts at the depth of 50 m were done for the four seasons of the year, as an example of the applicability of the model, with results considered as satisfactory in a first approach. M.M.M.

N80-18672*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MISSION AND SENSOR CONCEPTS FOR COASTAL AND OCEAN MONITORING USING SPACECRAFT AND AIRCRAFT
W. L. Darnell Jan. 1980 48 p refs
(NASA-TM-80103) Avail: NTIS HC A03/MF A01 CSCL 08C

A concept developed for a 1990 oceanic mission which places strong emphasis on coastal monitoring needs is described and analysed. The concept assumes that use of one active spacecraft in orbit and one on standby plus airplanes and data collection platforms which provide continuing complementary coverage and surface truth. The coastal measurement requirements and goals, the prospective oceanic and coastal sensors, the spacecraft and aircraft data platforms, and the prospective orbit designs are discussed. A.W.H.

N80-18673# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDY OF OCEANIC LITHOSPHERE USING GEOS-3 RADAR ALTIMETER DATA Final Report, 1 Oct. 1977 - 30 Sep. 1979
M. C. Roufosse Jul. 1979 29 p refs
(Contract F19628-78-C-0003; AF Proj. 2309)
(AD-A077344; AFGL-TR-79-0181) Avail: NTIS HC A03/MF A01 CSCL 08/7

The aim of this work is to study the mechanical properties and time evolution of the lithosphere. For that purpose, geoid heights derived from the Geos 3 radar altimeter were used. The study of the correlation existing between bathymetry and free-air anomalies or geoid heights gives information on the mechanical properties of the lithosphere and its thickness. The lithospheric thickness is related to the age of the lithospheric plate, and by probing several locations spanning varied temporal situations, one is able to retrace the time evolution of the lithospheric plates. Toward that aim, several seamount chains, islands, and ridges have been investigated in the Pacific, Atlantic, and Indian Oceans. In the regions studied so far, the age of the lithosphere at the time of loading is the primary parameter. In this work, the author attempts a systematic study of all the parameters

influencing the observed mechanical properties of the lithosphere. GRA

N80-18674# National Academy of Sciences - National Research Council, Washington, D. C. Ship Research Committee.
A SUMMARY OF WAVE DATA NEEDS AND AVAILABILITY Final Report
M. D. Burkhart, E. S. Dillon, and O. H. Oakley Aug. 1979 30 p
(Contract DOT-CG-80356-A)
(AD-A076067) Avail: NTIS HC A03/MF A01 CSCL 08/3

The paper consists of three parts. First is a summary of the wave data needs of three classes of maritime interests: (a) designers of ships and floating and fixed offshore platforms, (b) regulatory bodies and classification societies primarily interested in safety and environmental protection, and (c) operators concerned with ship routing and offshore activities such as oil and mineral recovery and energy production. The second part is a summary of the status of wave data, and the third part is a set of conclusions. The present wave data base to meet the developing needs of designers of ship and offshore structures, regulatory bodies, and operators is incomplete. To complete it using only in situ measurement methods such as buoys appears impractical. However, these do have important use in the collection of data for special areas of interest, particularly where severe seas are known to occur, and for verification and calibration of hindcast and satellite measurement techniques. The two most promising means of developing the required wave climatology appear to be: (a) by hindcasting techniques and (b) by satellite observations. Hindcasting techniques, which can produce broadband directional spectra, are well advanced but require additional verification. Satellite techniques and hardware will not be available for some years. Visual observations by mariners continue; although these observations cannot provide quantitative (spectral) data, they are valuable for estimating long-term wave-height distribution. GRA

N80-18675# Bertram Associates, Merrimack, N.H.
REMOTE IDENTIFICATION OF A SALT WATER WEDGE THROUGH DISSIPATIVE MEDIA WITH A MONOCYCLE RADAR
C. L. Bertram and R. A. Shore Oct. 1979 125 p refs
(Contract N00014-79-C-0160)
(AD-A076621) Avail: NTIS HC A06/MF A01 CSCL 08/3

One purpose of this study is to show theoretically the potential of a monocycle technique to detect and identify salt water wedges under dissipative fresh water. Also, the potential use for bathymetry is discussed, in particular for bodies of water of extremely low salinities as may be expected in some parts of the Baltic Sea, in Fjords and in large estuaries. The importance of bathymetry for military operations in shallow water is well known. It happens to be that some bodies of water with very low salinity are in areas of particular military sensitivity. Salt water wedges are of military importance for small submarines, swimmers and swimmer delivery vehicles and mine and counter mine warfare. GRA

N80-18676# American Inst. of Biological Sciences, Arlington, Va.
SYMPOSIUM ON DISSERTATIONS ON CHEMICAL OCEANOGRAPHY
1979 77 p refs Symp. held at Arlington, Va., 8-12 Oct. 1979
(Contract N00014-78-C-0140)
(AD-A078526) Avail. NTIS HC A05/MF A01 CSCL 08/10

Contents: Ion Association and Activity Coefficients in Electrolyte Solutions; Activity Effects in Seawater and Other Saline Mixtures; Volatile Organic Compounds in Seawater; The Interactions between Copper and Organic Matter in Coastal Seawater; Vertical Transportation of Organic Materials in Oceanic Environments; An Investigation of Vertical Mixing Rates in Fjords Using Naturally Occurring Radon-222 and Salinity as Tracers; The Geochemistry of Radium-226 and Radium-228 in Marine Deposits; The Dissolution Kinetics of Biogenic Calcium Carbonate; Sedimentary Geochemistry of Hydrocarbons from Narragansett Bay, Rhode Island; Early Diagenesis of Trace Metals in Nearshore Long Island Sound Sediments; Rates of Sediment Accumulation and Their Bearing on Metallogenesis on the Nazca Plate, Southeast Pacific; Discrete Suspended Particles of Barite and the Barium Cycle in the Open Ocean; Trace Metal-Organic Matter Interactions in Anoxic Marine Sediments during Early Diagenesis; Factors Influencing the Phase Partitioning of Iron and Associated Elements during Early Diagenesis in Shallow Marine Sediments; The Chemistry of Salt Marsh Sediments; Benthic Nutrient Regeneration and Sediment-Water Exchange in an Organic-Rich Coastal Sediment Cape Lookout Bight, North Carolina; The Role of Zooplankton Fecal Material in the Cycling and Deposition of Particulate Matter in an Estuarine and Deep-Oceanic Region of the North Eastern Pacific Ocean. GRA

N80-18677# Naval Research Lab., Washington, D. C. Applied Ocean Acoustics Branch.
SOME BASIC ASPECTS OF OCEANIC INTERNAL WAVES AND THE SOUND-SPEED FLUCTUATIONS THEY GENERATE Interim Report
David R. Palmer (Univ. of Miami, Fla.) 26 Oct. 1979 16 p refs
(ZF52552003)
(AD-A077537; AD-E000337; NRL-MR-4098) Avail: NTIS HC A02/MF A01 CSCL 20/1

This report is a selective summary of some recent work concerned with mathematically characterizing those fluctuations in the speed of sound which are the result of oceanic internal waves. GRA

N80-18678# Research Inst. of National Defence, Stockholm (Sweden).
TESTS OF LASER INDUCED FLUORESCENCE FROM ALGAE AT SEA [LASERINDUCERAD FLUORESCENS FRAAN ALGER. RESULTAT FRAAN FTT BAATBURET FAELTFOERSOEK]
Brit Hartmann, Ove Steinvall, and Anders Widen Jul. 1979 52 p refs In SWEDISH
(FOA-C-30171-E1) Avail: NTIS HC A04/MF A01

Fluorescence from algae illuminated by a boat mounted laser was measured to see if the technique is feasible for airborne ocean surveillance of algae concentrations and oil or chemical spills. Good agreement was found between the laser data and manually gathered data, but uncertainty about chlorophyll concentrations requires that the airborne system be complemented with a ground truth calculation method in some parts of the area surveyed. Author (ESA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-18679*# California Univ., Berkeley. Environmental Physiology Lab.
METHODOLOGY FOR ESTIMATION OF TOTAL BODY COMPOSITION IN LABORATORY MAMMALS
Nello Pace, Donald F. Rahlmann, and Arthur H. Smith 14 Dec. 1979 44 p refs
(Grant NsG-7336)
(NASA-CR-162806; EPL-79-1) Avail: NTIS HC A03/MF A01 CSCL 06C

A standardized dissection and chemical analysis procedure was developed for individual animals of several species in the size range mouse to monkey (15 g to 15 kg). The standardized procedure permits rigorous comparisons to be made both interspecifically and intraspecifically of organ weights and gross chemical composition in mammalian species series, and was applied successfully to laboratory mice, hamsters, rats, guinea pigs, and rabbits, as well as to macaque monkeys. The procedure is described in detail. R.E.S.

N80-18680*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE CARBON ISOTOPE BIOGEOCHEMISTRY OF THE INDIVIDUAL HYDROCARBONS IN BAT GUANO AND THE ECOLOGY OF INSECTIVOROUS BATS IN THE REGION OF CARLSBAD, NEW MEXICO
David J. DesMarais, J. M. Mitchell (Indiana Univ., Bloomington), W. G. Meinschein (Indiana Univ., Bloomington), and J. M. Hayes

Feb. 1980 46 p refs
(NASA-TM-81164; A-8056) Avail: NTIS HC A03/MF A01 CSCL 06C

The structures and C-13 contents of individual alkanes extracted from bat guano found in the Carlsbad region of New Mexico can be related to both the photosynthetic pathways of the local plants and the feeding habits of the insects that support the bats. Carbon isotopic analyses of the 62 most important plant species in the Pecos River Valley, the most significant feeding area for the Carlsbad bats, reveal the presence of 29 species with C3 photosynthesis and 33 species, mostly grasses, with C4 photosynthesis. Although the abundances of nonagricultural C3 and C4 plants are similar, alfalfa and cotton, both C3 plants, constitute over 95 per cent of the crop biomass. The molecular composition of the bat guano hydrocarbons is fully consistent with an insect origin. Two isotopically distinct groups of insect branched alkanes were discerned. These two groups of alkanes derived from two chemotaxonomically distinct populations of insects possessing distinctly different feeding habits. It is likely that one population grazes predominantly on crops whereas the other population prefers native vegetation. This and other isotopic evidence supports the notion that crop pests constitute a major percentage of the bats' diet. Author

N80-18681*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF THE ENZYMATIC INHIBITOR OF KUNITZ ON THE GASTRIC LESIONS FROM RESERPINE, FROM PHENYLBUTAZONE, FROM PYLORIC LIGATION AND BY RESTRAINT IN THE RAT
F. Guerrin, A. Demaille, P. Merveille, and C. Bel Feb. 1980 9 p refs Transl. into ENGLISH from Comp. Rend. Soc. Biol. (Paris), v. 159, no. 5, 1965 p 1172-1174 In ENGLISH and FRENCH Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76027) Avail: NTIS HC A02/MF A01 CSCL 06C

The protective effects of certain polypeptides on gastric ulcerations caused from reserpine and phenylbutazone in the rate were studied. It was found that the Kunitz enzymatic inhibitor exerts a protective action in regard to gastric lesions. However, the inhibitor did not change the development of Shay ulcers and stress ulcers from restraint. R.E.S.

N80-18682*# National Aeronautics and Space Administration, Washington, D. C.
MULTIPURPOSE ROTATING MACHINE FOR IMMOBILIZATION AND CONDUCTING STUDIES ON SMALL LABORATORY ANIMALS
N. F. Kornelishin 9 Feb. 1980 7 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 5, Sep. - Oct. 1979, p 80-82 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76049) Avail: NTIS HC A02/MF A01 CSCL 14B

A new device assisting the researcher in conducting laboratory experiments on small animals is described. Its advantages over extant machines are discussed. R.E.S.

N80-18683*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF RESTRICTED MOTION IN HIGH TEMPERATURE ON ENZYMATIC ACTIVITY OF THE PANCREAS
A. Abdusattarov and G. I. Smirnova Feb. 1980 6 p refs Transl. into ENGLISH from Uzbeksk. Biol. Zh. (USSR), no. 1, 1979 p 35-37 Transl. by Sci. Transl. Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76063) Avail: NTIS HC A02/MF A01 CSCL 06C

Effects of 30 day hypodynamia coupled with high temperature (35-36 C) on enzymatic activity of the pancreas of male adult rats were studied. The test animals were divided into four groups. Group one served as controls (freedom of movement and a temperature of 25-26 C, considered optimal). The remaining animals were divided into three additional groups: Group two freedom of movement but high temperature (35-36 C); group three hypodynamia but an optimal temperature; group four hypodynamia and 35-36 C. Considerable change in the enzymatic activity in the pancreas of the four groups is observed in three experimental groups (two, three, and four) as compared to the control (group one). The results indicate that adaption of the organism to the thermal factor and restricted movement is accompanied by a change in the enzymatic spectrum of the pancreas. With the combined effect of these two stresses under conditions of the adaption of the organism especially sharp shifts occur in the enzymatic activity. R.E.S.

N80-18684*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF CONSECUTIVE COOLING AND IMMOBILIZATION ON CATECHOLAMINE METABOLISM IN RAT TISSUES
E. Sh. Matlina, S. M. Waysman, I. G. Zaydner, B. M. Kogan, and L. V. Nozdracheva Nov. 1979 19 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 60, no. 4, Apr. 1974 p 540-547 Trans. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75962) Avail: NTIS HC A02/MF A01 CSCL 06C

The combined effect of two stressor stimuli--cooling and immobilization--acting successively on the sympathetic-adrenaline system was studied experimentally in rats that were cooled for 8 hours at 7 C on the first day and immobilized for 6 hours on the next day. The biochemical and histochemical methods used and the experimental technique involved are described in detail. The following conclusions were formulated: (1) the successive action of cooling and immobilization results in a stronger decrease in the adrenaline and noradrenaline content in the adrenal gland than that which could be due to a simple summation of the cooling and immobilization effects; (2) successive cooling and immobilization are followed by activation of catecholamine synthesis in the adrenal gland; and (3) 1-DOPA administration (45 mg/kg 3 times in 2 days) intraabdominally activated catecholamine synthesis in the adrenal glands in both the control and test animals. R.E.S.

N80-18685*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECTS OF ADRENALECTOMY AND CORTICSTEROID INJECTION ON THE FIBRINOLYTIC ACTIVITY OF COMPLEX HEPARIN COMPOUNDS IN THE BLOOD DURING IMMOBILIZATION
B. A. Kudryashov, E. G. Lomovskaya, F. B. Shapiro, and L. Ya. Lyapina Feb. 1980 11 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 59, no. 7, 1973 p 1108-1113 Original language document announced as A75-31019 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Moscow State Univ., USSR
(Contract NASw-3199)
(NASA-TM-75985) Avail: NTIS HC A02/MF A01 CSCL 06C

Total non-enzymatic fibrinolytic activity in the blood of rats increased three times in response to stress caused by 30 minute immobilization, and the activity of epinephrine-heparin complex increased nine times. In adrenalectomized animals, which showed a weak response to the same stress, intraperitoneal injection of hydrocortisone 30 minutes prior to immobilization normalized the response. Obtained results indicate that adrenalectomy leads to sharp reduction of heparin complexing with thromogenic proteins and epinephrine, while substitution therapy with hydrocortisone restores anticoagulation system function. Author

N80-18686*# National Aeronautics and Space Administration, Washington, D. C.
INFLUENCE OF AMBIENT TEMPERATURES ON THE PRODUCTION OF RESTRAINT ULCERS IN THE RAT
L. Buchel and D. Gallaire Feb. 1980 7 p refs Transl. into ENGLISH from Soc. Biol. C. R. Seances, (France), v. 160, no. 10, 1966 p 1817-1820 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-76028) Avail: NTIS HC A02/MF A01 CSCL 06C

A study of the influence of ambient temperature on the production of restraint ulcers in the rat is described. It concludes that the production of restrain ulcers, is favored by the reduction of the environmental temperature, whether the rat has been subjected to a fast or not. R.E.S.

N80-18687*# National Aeronautics and Space Administration, Washington, D. C.
FEATURES OF CHOLINERGIC CARDIA REGULATION UNDER CONDITIONS OF HYPOKINESIA
Ye. A. Markova, Yu. I. Bondarenko, V. A. Bolyarskaya, V. V. Fayfura, A. P. Rosolovskiy, and L. N. Babinskaya Feb. 1980 10 p refs Transl. into ENGLISH from Patologhk. Fiziol. Eksp. Terapiya (USSR), no. 3, 1979 p 13-16 Transl. by Kanner (Leo) Associates Redwood City, Calif.
(Contract NASw-3198)
(NASA-TM-76044) Avail: NTIS HC A02/MF A01 CSCL 06C

The features of cholinergic processes in the heart on the 4th, 8th, 16th and 30th days of hypokinesia were studied in experiments on 382 albino rats. It was shown that hypokinesia is attended by increased acetylcholine content in the atria, reduced choline acetyltransferase activity in the atria and ventricles and by increased activity of acetylcholinesterase in the ventricles and of pseudocholinesterase in both parts of the heart. The sensitivity of the heart to exogenic acetylcholine and to stimulation of the vagus nerve increases. Author

N80-18688*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECTS OF STIMULATION OF THE ANTERIOR CINGULATE GYRUS IN CATS WITH FREEDOM OF MOVEMENT
G. Dapres, J. Cadilhac, and P. Passouant Feb. 1980 8 p refs Transl. into ENGLISH from Compt. Rend. Soc. Fr. Gynecol. (France), v. 161, no. 3, 1967 p 657-660 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76055) Avail: NTIS HC A02/MF A01 CSCL 06C

Stimuli of varying strength, frequency and duration were applied to the anterior cingulate gyrus in unanesthetized cats with freedom of movement. The motor, vegetative and electrical effects of these stimuli, although inconstant, lead to a consideration of the role of this structure in the extrapyramidal control of motricity. Author

N80-18689*# National Aeronautics and Space Administration, Washington, D. C.
TOPOCHEMICAL DIFFERENCES IN THE AMOUNT OF RNA IN THE MOTONEURONS OF THE SPINAL CHORD IN HYPOXIA AND HYPOKINESIA
V. A. Brumberg, O. G. Gazenko, N. N. Demin, V. B. Malkin, and L. Z. Pevzner Feb. 1980 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), vol. 205, no. 6, 1972 p 1490-1493 Original language document was announced as A73-12558 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75994) Avail: NTIS HC A02/MF A01 CSCL 06C

Reactions to hypoxia and hypoknesia were compared by measuring charges in the amount of ribonucleic acid (RNA) in the cytoplasm of neurons of the intumescentia cervicalis and lumbalis. Animals were subjected to hypoxia, hypokinesia and both combined and a control group to neither. A total of two groups of motoneurons were compared, one innervating the respiratory musculature, the other the musculature of the lower extremities, so that hypoxic hypoxia would probably affect the first group primarily and hypokinesia the second. Results indicate that neither affect the amount of RNA in the neurons of the first group but a significant increase is noted in neurons of the second group. Other significant results are reported. R.C.T.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-18690* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTRA-OCULAR PRESSURE NORMALIZATION TECHNIQUE AND EQUIPMENT Patent
William J. McGannon, inventor (to NASA) Issued 22 Jan. 1980 5 p Filed 31 Aug. 1977 Supersedes N77-30727 (15 - 21, p 2839)
(NASA-Case-LEW-12723-1; US-Patent-4,184,491; US-Patent-Appl-SN-829317; US-Patent-Class-128-276; US-Patent-Class-128-760) Avail: US Patent and Trademark Office CSCL 06B

A method and apparatus for safely reducing abnormally high intraocular pressure in an eye during a predetermined time interval is presented. This allows maintenance of normal intraocular pressure during glaucoma surgery. According to the invention, a pressure regulator of the spring biased diaphragm type is provided with additional bias by a column of liquid. The height of the column of liquid is selected such that the pressure at a hypodermic needle connected to the output of the pressure regulator is equal to the measured pressure of the eye. The hypodermic needle can then be safely inserted into the anterior chamber of the eye. Liquid is then bled out of the column to reduce the bias on the diaphragm of the pressure regulator and, consequently, the output pressure of the regulator. This lowering pressure of the regulator also occurs in the eye by means of a small second bleed path provided between the pressure regulator and the hypodermic needle. Alternately, a second hypodermic needle may be inserted into the eye to provide a controlled leak off path for excessive pressure and clouded fluid from the anterior chamber.
Official Gazette of the U.S. Patent and Trademark Office

N80-18691* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INDUCTION POWERED BIOLOGICAL RADIOSONDE Patent
Thomas B. Fryer, inventor (to NASA) Issued 5 Feb. 1980 12 p Filed 12 May 1977 Supersedes N77-23743 (16 - 14, p 1894)
(NASA-Case-ARC-11120-1; US-Patent-4,186,749; US-Patent-Appl-SN-796256; US-Patent-Class-128-748; US-Patent-Class-128-903; US-Patent-Class-73-724) Avail: US Patent and Trademark Office CSCL 06B

An induction powered implanted monitor for epidurally measuring intracranial pressure and telemetering the pressure information to a remote readout is disclosed. The monitor utilizes an inductance-capacitance (L-C) oscillator in which the C comprises a variable capacitance transducer, one electrode of which is a small stiff pressure responsive diaphragm. The oscillator is isolated from a transmitting tank circuit by a buffer circuit and all electric components in the implanted unit except an input and an output coil are shielded by a metal housing.
Official Gazette of the U.S. Patent and Trademark Office

N80-18692 Kent State Univ., Ohio.
THE EFFECTS OF SPECTRAL DENSITY AND STIMULUS INTENSITY ON THE ELICITATION OF THE ACOUSTIC REFLEX Ph.D. Thesis
Colleen Ann Mcaleer 1979 159 p
Avail: Univ. Microfilms Order No. 8003475

The acoustic reflex (AR) responses of normal hearing and hearing-impaired subjects elicited by moderate and high tensity stimuli when the stimulus energy was contained within an AR critical band were compared. The effects of minimum and maximum spectral density of the elicitation and growth of the AR were also investigated. The results show that ARTs were higher in dB sound pressure level for all four stimulus conditions for the hearing-impared than for the normal hearing subjects. Additionally, stimulus spectral density within a critical band had a differential effect on the elicitation of the AR for normal hearing and hearing-impaired subjects. The differences between the AR responses of normal hearing and hearing-impaired subjects could

be attributed to the anatomical and physiological changes that accompany a noise-induced hearing loss. Dissert. Abstr.

N80-18693 Florida Univ., Gainesville.
FATIGUE IN SKELETAL MUSCLE Ph.D. Thesis
Brian Robert Macintosh 1979 118 p
Avail: Univ. Microfilms Order No. 8002876

Skeletal muscle fatigue is examined utilizing an in situ dog gastrocnemius-plantaris muscle preparation. Skeletal muscle fatigue (reduced force output for a given stimulus) results from a thirty minute period of isometric contractions at 2.5 to 20/sec. This fatigue is not a result of failure of motor nerve propagation or transmitter release. The ratio of oxygen uptake to developed tension is unaltered during or following fatiguing contractions. Energy sources are available and with maximal activation the contractile mechanism is capable of the same force output it had before the fatiguing contractions. Further, there is no reduction in twitch developed tension associated with intracellular acidosis. It appears that twitch fatigue results from a reduced activation of the myofilaments during a twitch contraction. This may be due to either a reduced sarcoplasmic Ca2(+) concentration during contraction or a reduced response of the myofilaments at a given CA2(+) concentration. Dissert. Abstr.

N80-18694 Virginia Univ., Charlottesville.
MICROVASCULAR DETERMINANTS OF OXYGEN SUPPLY IN RESTING AND CONTRACTING STRIATED MUSCLE Ph.D. Thesis
Bruce Maurice Klitzman 1979 138 p
Avail: Univ. Microfilms Order No. 8002544

The alteration of striated muscle oxygen supply in response to increases in oxygen demand induced by twitch contraction was examined. The approach taken was to measure the four most important microvascular determinants of tissue oxygen supply: arteriolar diameter, capillary density, tissue PO2, and hematocrit. Using the results of this study obtained at the microvascular level, muscle oxygen consumption was estimated to increase 9.8 fold with 1 Hz twitch contraction. Perfused muscle studies have found an increase of 8 fold with 1 Hz contraction. These results from microvascular and whole organ studies are remarkably close, indicating that the parameters chosen in this study as determinants of oxygen supply do in fact accurately reflect oxygen supply when considered collectively. Dissert. Abstr.

N80-18695 Missouri Univ. - Columbia.
CIRCADIAN RHYTHMICITY IN VENTRICULAR MYOCARDIAL AND DIAPHRAGMATIC METABOLISM Ph.D. Thesis
Susan Marie Garthwaite 1979 121 p
Avail: Univ. Microfilms Order No. 8002361

Circadian rhythm studies were utilized to elucidate metabolic mechanisms operative in ventricle and diaphragm of unstressed animals. Male Wistar rats were sampled after two weeks of entrainment to a 12L:12D light cycle in which the lights came on at 0600 hours and went off at 1800 hours. Food and water were available ad lib. Ventricular and diaphragmatic samples were obtained from each rat at 4 hour intervals during the 24 hour cycle. Weight of the stomach contents of the same rats was also determined as an index of food consumption. A circadian rhythm in ventricular glycogen was found with a peak at 0600 hours and a nadir at 1800 hours. Ventricular free fatty acid and triglyceride levels also showed a circadian rhythm, but 180 deg out of phase with the glycogen rhythm. A circadian rhythm of diaphragmatic glycogen was found with a peak value preceding the ventricular glycogen peak by about 4 hours. Other significant results are reported. Dissert. Abstr.

N80-18696 Arizona Univ., Tucson.
MUSCULAR FORCE-VELOCITY ALTERATIONS CONSEQUENT TO SLOW AND FAST VELOCITY POWER TRAINING Ph.D. Thesis
Edward Francis Coyle 1979 77 p
Avail: Univ. Microfilms Order No. 8003049

Muscular force-velocity alterations were compared to slow and fast velocity power training. Active males trained the knee extensors of both legs simultaneously for six weeks, three times per week, by attempting to generate maximal peak torque (MPT) with each repetition at velocities of 60 deg/sec (MPT/60), 300 deg/sec (MPT/300), or both. Fast training significantly improved MPT uniformly (16-21%) at the training velocity as well as at slower velocities. Only the MPT/180 and MPT/300 improvements contained a significant physiological component of adaptation. High tension producing contractions appear necessary to improve MPT/slow while fast training velocities must be employed to improve MPT/fast. Fast training improves MPT in the mid-velocities more effectively than does slow training. Dissert. Abstr.

N80-18697 Arizona Univ., Tucson.
MODELS OF HUMAN VISION IN DIGITAL IMAGE BANDWIDTH COMPRESSION Ph.D. Thesis
Douglas James Granrath 1979 181 p
Avail: Univ. Microfilms Order No. 8003051

The study of human vision is applied to the problem of reducing the amount of information necessary to represent an image. Relevant vision research is reviewed, including eye and retina anatomy, membrane potential recordings, and psychophysical studies. Current engineering models of human vision are discussed in terms of their structural similarities to the eye. A two-channel model of spatial interaction in the retina is then developed based on retinal cell structure and related experimental results. Analysis of this model shows that one of the channels carries mainly image contrast information while the other carries edge detail. Computer simulation results demonstrate a bandwidth reduction potential from 8 bits per pixel down to 2 bits per pixel for the model. Suggestions for further research include use of the two-channel model to predict image quality. Dissert. Abstr.

N80-18698 Lehigh Univ., Bethlehem, Pa.
MATHEMATICAL ANALYSIS OF CARBON DIOXIDE TRANSPORT BY BLOOD Ph.D. Thesis
Ramon Fayad 1979 191 p
Avail: Univ. Microfilms Order No. 8003061

A theoretical analysis of acid-base balance at the microcirculatory level is presented. A mathematical model that includes the physiological and biochemical processes important to carbon dioxide transport by blood is constructed. Using perturbation and time scale techniques to study the steady-state problem, analytic solutions are obtained for the cases when no change in saturation of hemoglobin occurs and when a linear decrease in oxygenation of blood from the arterial to the venous end of the capillary occurs. The extent to which the various processes contribute to carbon dioxide transport by blood is determined, and it is found that while the dependence of CO2 exchange on O2 (Haldane effect) accounts for 40% of carbon dioxide transport, the magnitude of the Bohr effect is rather small. Dissert. Abstr.

N80-18699 George Washington Univ., Washington, D. C.
CONTINUOUS REAL-TIME AUDITORY EVOKED POTENTIALS USING A SLIDING WINDOW OF AVERAGES Ph.D. Thesis
Nicholas Antrony Diakides 1979 195 p
Avail: Univ. Microfilms Order No. 8003453

Procedures and computer instrumentation which would advance the state of the art in auditory evoked response (AER) measurement, especially to alleviate the need for prolonged testing periods required by the traditional method of AER measurement were developed. The key to an improved method lay in the use of high rates of presentation of auditory stimuli, i.e., 20-50 Hz, and a means of continuously averaging and updating the output data (sliding window of averages). The high stimulus rates would allow more responses to be obtained and evaluated in a very short time, i.e., a few seconds. A clearly observable enhancement of AER amplitude was found at and around 45 Hz with correspondingly high signal-to-noise ratios (SNRs) when referenced to ongoing EEG background activity levels. Having demonstrated the fundamental phenomenon of AER and SNR enhancement at high stimulus frequencies, a low cost microcomputer system and operational algorithm were developed and successfully tested. Dissert. Abstr.

N80-18700 Wisconsin Univ. - Madison.
MASS TRANSFER STUDIES OF PULMONARY FUNCTION Ph.D. Thesis

Simon Hallifax Hobbs 1979 282 p
Avail: Univ. Microfilms Order No. 7928647

A comprehensive lung model was developed which takes into account both diffusion and ventilation distribution effects. Particlar emphasis was placed on the simulation of the pulmonary transport of insoluble inert gases, especially nitrogen, helium, and sulfur hexafluoride, which are commonly used in respiratory diagnostic testing. An expression was developed to describe individual lung unit alveolar gas concentrations, in terms of the most important lung parameters. The ventilation distribution found throughout the lung was the critical factor controlling gas concentration since it severely limited transport of gas into poorly ventilated lung regions. Dissert. Abstr.

N80-18701 Commission of the European Communities, Luxembourg.
THE RADIATION PROTECTION PROGRAM. Annual Report, 1977
1978 798 p refs Partly in ENGLISH, FRENCH and GERMAN
(EUR-5972; ISBN-92-825-0184-1) Copyright Avail: Issuing Activity

Five hundred seventy-four papers published as a result of research are presented under six headings. These are dosimetry, radioactive contamination of the environment, hereditary effects of ionizing radiation, somatic short-term effects of ionizing radiation, somatic long-term effects of ionizing radiation, and evaluation of radiation risks. Much research was undertaken into the damaging effects of radiation on chromosomes and other genetic material. Somatic effects of radiation in the induction of leukemia and carcinogenesis as well as the controlled use of radiation in the treatment of diseases were studied. The environmental impact of radiation on the water cycle and food chain are also covered. Author (ESA)

N80-18702# Royal Aircraft Establishment, Farnborough (England).
THE HUMAN BODY TEMPERATURE REGULATION SYSTEM
J. Werner Sep. 1979 24 p refs Transl. into ENGLISH from Biol. Cybernetics (West Germany), v. 17, 1975, p 53-63
(RAE-Lib-Trans-2019; BR71910) Avail: NTIS HC A02/MF A01

The control loop of human body temperature is treated as a distributed parameter system. The equations of heat balance are formulated, admitting discontinuities of parameters. Using two successive integral transformations and an expansion with eigenfunctions, an analytical solution is found for the closed control loop. Regarding the stationary as well as the dynamic behavior, the mathematical results are on the whole compatible with experimental results. K.L.

N80-18703# Materials Research Labs., Melbourne (Australia).
SIZE AND LUMINANCE DISCRIMINATION IN THE PERIPHERAL VISUAL FIELD
Stephen E. Jenkins Oct. 1979 28 p refs
(MRL-R-760; AR-001-843) Avail: NTIS HC A03/MF A01

The discrimination of length differences between two bars as well as size and luminance differences between two discs was measured as a function of the angle of eccentricity between the fixation point and the stimulus. The experiments provided basic data necessary for the interpretation of experiments involving the detection of discs embedded in a complex background which in turn elucidate the determinants of camouflage. It was found that: (1) discs are discriminated in size by virtue of their difference in diameter rather than their difference in area; (2) the 50% and 90% levels of detection probability of size and luminance contrast between two discs are linear functions of eccentricity at least to 14 deg eccentricity; (3) the visual system is better at discriminating size contrast at all eccentricities tested than it is at discriminating luminance contrast; and (4) there is a fundamental difference between the mechanisms which mediate size and luminance discrimination. K.L.

N80-18704*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL INVESTIGATION OF THE ROLE OF THYROCALCITONIN IN THE PROPHYLAXIS OF DISTURBANCES IN THE WATER-SALT AND MINERAL METABOLISM DURING A 30-DAY HYPOKINESIA
V. S. Shashkov, B. B. Yegorov, B. S. Dmitriyev, A. N. Volozhin, and B. P. Krotov Nov. 1979 10 p refs Transl. into ENGLISH from Fiz. Zh. SSSR (Moscow), v. 60, no. 2, 1974 p 290-294
Original language document was announced as A74-26557
Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75938) Avail: NTIS HC A02/MF A01 CSCL 06S

The effect of thyrocalcitonin (TCT) injections on the metabolism of water and electrolytes in free-moving and immobilized chinchilla hares is described. Calcium excretion from immobilized animals was elevated, but normalized in those also receiving TCT injections. TCT also normalized water content and excretion rates. Author

N80-18705*# National Aeronautics and Space Administration, Washington, D. C.
RESTRAINT ULCERS IN THE RAT. 1: INFLUENCE ON ULCER FREQUENCY OF FASTING AND OF ENVIRONMENTAL TEMPERATURE ASSOCIATED WITH IMMOBILIZATION OF VARYING DURATIONS
L. Buchel and D. Gallaire Feb. 1980 16 p refs Transl. into ENGLISH from Arch. Sci. Physiol. (France), v. 21, 1967 p 527-536 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76031) Avail: NTIS HC A02/MF A01 CSCL 06S

The results of the production of experimental ulcers in rats are described. Two experimental conditions were found to regularly provoke the appearance of gastric ulcers in a high percentage of rats: (1) two-and-a-half hour restraint, proceeded by a 24 hour fast; and (2) one-and-a-half hour restraint with lowering of the environmental temperature while fasting. R.E.S.

N80-18706*# National Aeronautics and Space Administration, Washington, D. C.
HORMONE SUPPLY OF THE ORGANISM IN PROLONGED EMOTIONAL STRESS
M. G. Amiragova, B. V. Stulnikov, and R. I. Svirskaya Feb. 1980 15 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR I. M. Sechenova (USSR), v. 65, no. 7, 1979 p 945-952 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3198)
(NASA-TM-76046) Avail: NTIS HC A02/MF A01 CSCL 06S

The effect of prolonged emotional stress of varying genesis on the hormonal function of the pancreas, thyroid gland, and adrenal cortex was studied. The amount of the hormonal secretion was found to depend on the type of adaptation activity and its duration. High secretion of the hormones observed outside the adaptation activity was examined as an index of the phase transition of defense reactions to the phase of overstress. R.E.S.

N80-18707*# National Aeronautics and Space Administration, Washington, D. C.
PHYSIOLOGIC REACTIONS DURING FIVE WEEKS OF CONTINUOUS RESIDENCE IN AN ARTIFICIAL HUMID AND HOT CLIMATE
Ulrich Laaser Oct. 1979 24 p refs Transl. into ENGLISH from Int. Z. Angew. Physiol. (West Germany), v. 25, 1968 p 279-302 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Tuebingen Univ., West Germany
(Contract NASw-3199)
(NASA-TM-75356) Avail: NTIS HC A02/MF A01 CSCL 06S

During 5 weeks in a climatic room, total sweat during work almost doubled. Initial hour differences increasingly equalized. There was a displacement of sweat secretion from trunk to extremities till the end of week 3, occurring earlier and more clearly for the arm than for the leg. Work temperatures dropped rapidly and evenly to a constant level by day 11. Circulation behavior matched that of temperature. Pulse rate during work dropped like rectal temperature and pulse rate during rest was phasically like the pattern of corresponding temperatures. Except

best copy available

for the first days urine output was adequate and even, Na decreasing in the urine until week 3, then returning to initial values. Na and K in sweat declined but with opposite patterns for hours 1-4. Total salt elimination decreased. The conclusive phenomena of redistribution occurred within the first 3 weeks. A few functions changed later also. Relatively trivial changes in an otherwise uniform reaction pattern indicated that after 3 or even 5 weeks of acclimatization the process is not over or at least not completely so. The tempo of the process appears to be a function of the degree of loading. Author

N80-18708*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF HYPOKINESIA ON CONTRACTILE FUNCTION OF CARDIAC MUSCLE

F. Z. Meyerson, V. I. Kapelko, A. M. Trikhpoyeva, and M. S. Gorina. Feb. 1980. 12 p. refs. Transl. into ENGLISH from Kardiologiya (USSR), no. 2, Feb. 1979, p. 71-76. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76061) Avail: NTIS HC A02/MF A01 CSCL 06S

Rats were subjected to hypokinesia for two months and the contractile function of isolated papillary muscle was studied. Hypokinesia reduced significantly the isotonic contraction rate which depended on the ATPase activity of the myofibrils; it also reduced the rate and index of relaxation which depended on the functional capacity of the Ca(++) pump of the sarcoplasmic reticulum. The maximum force of isometric contraction determined by the quantity of actomyosin bridges in the myofibrils did not change after hypokinesia. This complex of changes is contrary to that observed in adaptation to exercise when the rate of isotonic contraction and relaxation increases while the force of isometric contraction does not change. The possible mechanism of this stability of the contractile force during adaptation and readaptation of the heart is discussed. Author

N80-18709*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

OBJECTIVE MEASUREMENT OF HUMAN TOLERANCE TO +G SUB Z ACCELERATION STRESS. Ph.D. Thesis - Univ. of N. Indiana

Salvadore A. Rositano. Washington, Feb. 1980. 100 p. refs. (NASA-TM-81166; A-8059) Avail: NTIS HC A05/MF A01 CSCL 06S

The efficacy of a new objective technique using a transcutaneous Doppler flowmeter to monitor superficial temporal artery blood flow velocity during acceleration was investigated. The results were correlated with current objective and subjective G tolerance end points. In over 1300 centrifuge runs, retrograde eye level blood flow leading to total flow cessation was consistently recorded and preceded visual field deterioration leading to blackout by 3 to 23 seconds. The new method was successfully applied as an objective indication of tolerance in a variety of test situations including evaluation of g-suits, straining maneuvers, and 13 deg, 45 deg and 65 deg set back angles. R.E.S.

N80-18710*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

COSMOS 81 US/USSR CARDIOVASCULAR STUDY: EXPERIMENT IMPLEMENTATION PLAN

John W. Hines. Feb. 1980. 14 p.
(NASA-TM-81178) Avail: NTIS HC A02/MF A01 CSCL 06B

The experimental activities to be undertaken in the accomplishment of the Cosmos 81 Primate Study are discussed. A detailed description of the specific tasks to be performed, approaches, options, and tradeoffs to be considered, and personnel assigned is presented. The main project is to chronically instrument the carotid artery (flow, pressure) using Rhesus monkeys and interpret the results. R.E.S.

N80-18711*# National Aeronautics and Space Administration, Washington, D. C.

EFFECTS OF GRAVITATIONAL STRESS, HYPOKINESIA AND HYPODYNAMIA ON THE STRUCTURE OF THE VASCULAR BED OF THE SPLEEN

N. T. Nesterenko. Feb. 1980. 12 p. refs. Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (USSR), v. 64, no. 5, 1973, p. 44-51. Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by 1st Leningrad I. P. Pavlov, Medical Inst.
(Contract NASw-3199)
(NASA-TM-75934) Avail: NTIS HC A02/MF A01 CSCL 06S

The effects of two extreme factors, hypokinesia and hypodynamia, on spleen vascular beds were studied on 180 male and female albino rats. Vessels were studied by roentgenography, microroentgenography, clearing of sections and histology. Gravity stress yielded constriction of all links of arterial bed and of order 5-7 veins. Large intraorganic vein diameters changed significantly but erratically. Hypokinesia in early phases produced pronounced spleen size reduction. Veins and arteries constricted along entire length. Later hypokinetic stages showed arteries still constricted, veins began to dilate from week 4 of hypokinesia. Sinuosity, uneven contours and varicose dilations of walls in large arteries and veins occurred. Abrupt changes in parenchyma, e.g., atrophy of folliculi, narrowing of lumen of central arteries from thickening of muscular wall. After exposure to hypokinesia followed by gravitational stress, pronounced lesions such as deformation of vascular wall, including rupture, in all vessels of the spleen vascular bed. R.E.S.

N80-18712# Interuniversitair Reactor Instituut, Delft (Netherlands).

[ACTIVITIES REPORT ON REACTOR PHYSICS, 1977 TO 1978] Annual Report [JAARVERSLAG 1977-1978: AKADEMISCH JAAR]

1979. 107 p. refs. In DUTCH
Avail: NTIS HC A06/MF A01

The structure, staffing, budget, space allocation, and publications of the institute are described. The scientific activities include radiation and reactor physics, radiochemistry, dosimetry, and radiation hygiene. Author (ESA)

N80-18713# Southampton Univ. (England). Inst. of Sound and Vibration Research.

VIBRATION INJURIES OF THE HAND AND ARM: THEIR OCCURENCE AND THE EVOLUTION OF STANDARDS AND LIMITS

M. J. Griffin. Jul. 1979. 85 p. refs.
(Contract HSE-1653/45.09)
(ISVR-TR-101) Avail: NTIS HC A05/MF A01

Alternative methods of rating the serverity of vibration exposures for the hand and arm are compared. The difficulties associated with the formulation of useful vibration standards and limits are discussed and deficiencies in present standards are outlined. Specific recommendations concerning the formulation of standards and limits are offered. Desirable objectives for surveys of worker health, tool vibration characteristics, and working methods are defined. The need for reducing and isolating tool vibration is identified along with the importance of tool gripping methods. It is suggested that an improved understanding of the nature of vibration injuries and their symptoms is required. Author (ESA)

N80-18714# Technische Hogeschool Twente, Enschede (Netherlands). Afdel. Elektrotechniek.

APPLICATION OF MUTUAL AMOUNT OF INFORMATION FOR TIME DELAY ESTIMATION. Ph.D. Thesis

G. W. vanArragon. 6 Aug. 1979. 80 p. refs. Partly in ENGLISH and DUTCH
(THT-210) Avail: NTIS HC A05/MF A01

An estimate for the average mutual amount of information (AMAI) as a function of time delay between two time series was developed. This estimate is intended for analyzing the spread of an epileptic seizure through the cortical layers of the brain of an epileptic patient based on an ictal EEG recording. The theory of mutual amount of information is reviewed. It depends on the marginal and joint probability densities of two time series. An estimator for the joint (bi-variate) density is proposed and compared with estimators described in the literature. Results show that the proposed estimator is the best for practical AMAI estimation. A computer algorithm for AMAI estimation was derived and its behavior studied using test data. Promising results lead to its inclusion in an interactive FORTRAN program which is

available as part of an EEG analysis library for special purposes.
Author (ESA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-18715 California School of Professional Psychology, Los Angeles
THE POWER PROCESS: A SYNTHESIS THEORY OF POWER Ph.D. Thesis
Steven Howard Graubard 1979 418 p
Avail: Univ. Microfilms Order No. 8003230

A series of studies designed to test the process approach to power is offered. In order to describe the power process adequately, a blend of phenomenological and empirical methods is suggested. Phenomenological techniques are expected to yield subjects' descriptions, thoughts and feelings associated with power related experiences. This data is analyzed for thematic content as it relates to each of the four power process components and compared with data obtained from empirical measures. Experimental situations, including small group interactions, individual tasks, experimental descriptions, and specific psychological tests, are suggested. Implications for future research are discussed.
Dissert. Abstr.

N80-18716# Research Inst. of National Defence, Linkoeping (Sweden)
PILOT SELECTION USING PSYCHOLOGICAL METHODS [URVAL AV FLYGFOERARE MGD PSYKOLDGISKA METODER]
Leif Carlstedt Mar. 1979 62 p refs In SWEDISH
(FOA-C-55024-H7) Avail: NTIS HC A04/MF A01

The use of psychological methods in military aircraft pilot selection is surveyed, covering the period from World War 1 to 1979. The methods of analysis used have different starting points, stressing either the man or the function characteristics. A multiple regression statistical evaluation model is most frequently used resulting in some compensation of psychological characteristics. No examples of normative evaluation models were found in recent pilot selection methods.
Author (ESA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-18717 Arizona State Univ., Tempe
MODELING REQUIREMENTS FOR NETWORK SIMULATION OF HUMAN-MACHINE SYSTEMS Ph.D. Thesis
Gayle Lynn Berry 1979 335 p
Avail: Univ. Microfilms Order No. 8003862

A critical review of eight task taxonomies was performed. Each taxonomy was ranked against a set of criteria which were developed to select for usefulness in modeling human machine systems. The standard task analysis procedure was revised so that all information required for a network computer simulation of a human machine system would be produced. The two highest ranking task taxonomies were used in the task analysis procedure to model a test case human machine system. A SAINT computer simulation was performed for each of the two resulting models. For each simulation model, both Normal and Weibull distributions were used in four different combinations to represent human task performance time. In order to make it possible to use the Weibull distribution when no sample data were available, a method was developed to derive the Weibull parameters for shape and scale from an estimated mean and standard deviation.
Dissert. Abstr.

N80-18718*# Rockwell International Corp., Canoga Park, Calif.
STS MISSION DURATION ENHANCEMENT STUDY: (ORBITER HABITABILITY) Final Report
A. D. Carlson Dec. 1979 145 p
(Contract NAS9-15903)
(NASA-CR-160535; SOD-79-0321) Avail: NTIS HC A07/MF A01

Habitability improvements for early flights that could be implemented with minimum impact were investigated. These included: (1) launching the water dispenser in the on-orbit position instead of in a locker; (2) the sleep pallet concept; and (3) suction cup foot restraints. Past studies that used volumetric terms and requirements for crew size versus mission duration were reviewed and common definitions of key habitability terms were established. An accurately dimensioned drawing of the orbiter mid-deck, locating all of the known major elements was developed. Finally, it was established that orbiter duration and crew size can be increased with minimum modificattion and impact to the crew module. Preliminary concepts of the aft med-deck, external versions of expanded tunnel adapters (ETA), and interior concepts of ETA-3 were developed and comparison charts showing the various factors of volume, weight, duration, size, impact to orbiter, and number of sleep stations were generated.
R.E.S.

N80-18719# School of Aerospace Medicine, Brooks AFB, Tex.
A NEW ANTI-G VALUE FOR HIGH-PERFORMANCE AIRCRAFT Final Report, 1 Jan. 1977 - 1 Jan. 1979
Russell R. Burton, Robert M. Shaffstall, Jamy L. Jaggars, Kent K. Gillingham, and Kenneth W. Stevens Nov. 1979 25 p
(AF Proj. 7930)
(AD-A076904; SAM-TR-79-27) Avail: NTIS HC A02/MF A01 CSCL 22/1

The USAF School of Aerospace Medicine (USAFSAM) Crew Technology Division has developed an advanced anti-G valve for pressurizing the anti-G suit during exposures to acceleration. The anti-G valve presently in fighter aircraft has been determined to operate too slowly for rapid onset of G, potentially causing pilots of high-performance aircraft to black out, lose consciousness, and/or become fatigued. The time relationship to G-suit pressurization using the conventional anti-G valve was found to be sigmoidal, having two relatively slow pressurization phases--one early, and the other late--in the suit-inflation schedule. Elimination of these two slow phases were accomplished by: (1) preinflating the anti-G suit to 0.2 psi prior to an increase in G (called 'Ready Pressure'), and (2) increasing the capacity of air flow through the anti-G valve (called 'Hi-Flow'). The development of the Hi-Flow Ready Pressure (HFRP) anti-G valve by USAFSAM increased in the rate of G-suit pressurization threefold. This HFRP anti-G valve was tested on eight F-15 pilots, using the centrifuge at the Naval Air Development Center, Warminster, Pa. A comparison of this experimental valve with the conventional anti-G valve (presently operational in the F-15 aircraft) resulted in a high degree of pilot acceptance, because the HFRP valve had better valve response, reduced valve error scores, and allowed the pilots to tolerate high-G exposures with less effort.
GRA

N80-18720# Research Inst. of National Defence, Stockholm (Sweden)
PROTOTYPE: PRELIMINARY STUDY ON EMERGENCY BREATHING APPARATUS [FRISKLUFTHJAELM 1 PROTOTYP. FOERSTUDIUM]
Tage Berglund Jun. 1979 17 p In SWEDISH
(FOA-C-40103-C2) Avail: NTIS HC A02/MF A01

Some developmental alternatives for the protection helmet M-51 are discussed in terms of military aircraft application. A helmet prototype is described, including four complete mask alternatives. It is concluded that all four designs and the helmet prototype are acceptable, but improvements are necessary in all cases.
Author (ESA)

N80-18721# Research Inst. of National Defence, Stockholm (Sweden)
SUGGESTIONS FOR THE CONTENTS OF THE AVIATION BOARD SURVIVAL KIT [FOERSLAG TILL INNEHAALL I FV NOEDUTRUSTNINGSPACKE]
Ove Wilson, Christer Spaangberg, and Bo Ekberger Aug. 1979 56 p refs In SWEDISH
(FOA-A-59004-H3(H9)) Avail: NTIS HC A04/MF A01

Survival equipment for aircrews operating over land and sea in arctic climates is described. Survival techniques are discussed in relation the contents of a proposed survival kit, including the requirements for protection from the elements, food and water, signaling, first aid, and weapons. The various kit materials are either attached to the life jacket, the flight suit, the life raft, or are found in a separate container. Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-18722* Systems Technology, Inc., Mountain View, Calif.
THE ANALYSIS OF DELAYS IN SIMULATOR DIGITAL COMPUTING SYSTEMS. VOLUME 2: FORMULATION OF DISCRETE STATE TRANSITION MATRICES, AN ALTERNATIVE PROCEDURE FOR MULTIRATE DIGITAL COMPUTATIONS Final Report
Warren F. Clement and Wayne F. Jewell Feb. 1980 44 p refs
(Contract NAS2-10106)
(NASA-CR-152341; STI-TR-1140-1-Vol-2) Avail: NASA Ames Res. Center, Moffett Field, Calif. 94035 CSCL 09B

The effects of spurious delays in real time digital computing systems are examined for the two-computer, multirate problem. A transition matrix which combines the computational algorithms and multirate effects is formulated. Some examples are provided which demonstrate the analysis approach and suggest applications. K.L.

N80-18723 Syracuse Univ., N. Y.
RELACS, AN ASSOCIATIVE COMPUTER ARCHITECTURE TO SUPPORT A RELATIONAL DATA MODEL Ph.D. Thesis
Ellen Jane Oliver 1979 418 p
Avail: Univ. Microfilms Order No. 8004513

The problem of implementing a relational data model on a computer system designed expressly for that purpose is discussed. A proposed computer architecture for a relational associative computer system, (RELACS), is introduced. It is shown that the proposed system is capable of supporting many functions of a data base management system. Timing equations are developed to describe the operation of RELACS for retrieval, deletion, modification and addition. These equations are utilized to examine the behavior of RELACS when relation cardinality, associative array memory (AAM) size, the number of attributes in the query and the number of relations in the query are varied. Results indicate that the larger the AAM up to a maximum of the relation cardinality, the faster was the processing. The AAM size is affected by the speed and cost requirements of the Data base management system as well as the expected relation cardinality. It was also found that the time to process a query increases as the number of attributes and/or relations is increased. Dissert. Abstr.

N80-18724 University of Southwestern Louisiana, Lafayette.
A MATHEMATICAL MODEL FOR A VIRTUAL MACHINE MONITOR AND ITS SUPPORTIVE STRUCTURE Ph.D. Thesis
Duc Tan Nguyen 1979 174 p
Avail: Univ. Microfilms Order No. 8002711

A functional mathematical model is developed for a virtual machine monitor (VMM) on either uniprocessor or distributed processor support systems. The support systems should have a monostate architecture or should be dynamically microprogrammable so that they can emulate such an organization. Five studies are undertaken in the research: (1) an examination of the capability of existing dataflow languages to describe operating systems, in particular, to model VMM functions, (2) an investigation of a specific VMM and its support architecture to be used as a basis for the research, (3) the construction of an abstract dataflow model for the selected structure, (4) the formalization of the relationship between elements of the VMM and its support architecture using algebraic and functional relations, and (5) a demonstration that the abstract dataflow model exhibits the same behavior as does the base structure. Dissert. Abstr.

N80-18725 Illinois Univ. at Urbana-Champaign.
TEST GENERATION FOR MICROPROCESSORS Ph.D. Thesis
Satish Mukund Thatte 1979 172 p
Avail: Univ. Microfilms Order No. 8004286

Test generation procedures for testing microprocessors in a user environment are developed. A general graph-theoretic model for microprocessors is developed at the register transfer level. Any microprocessor can be easily modeled using information only about the instruction set and the functions performed by it. A fault model is developed on a functional level quite independent of the implementation details. The effects of faults in the fault model are investigated at the level of the graph theoretic model. Test generation procedures are proposed which take the microprocessor organization and the instruction set as parameters and generate tests to detect all the faults in the fault model. The complexity of the test sequences measured in terms of the number of instructions is given. Efforts in generating tests for a real microprocessor and evaluating their fault coverage are described. Dissert. Abstr.

N80-18726 Oklahoma State Univ., Stillwater.
OPTIMAL DISTURBED MICROPROCESSOR ARCHITECTURE USING MULTI-PHASE PROCESSING TO PERFORM A VECTOR, MATRIX MULTIPLICATION Ph.D. Thesis
Larry Gene Stotts 1979 150 p
Avail: Univ. Microfilms Order No. 8003605

The application of optimal design criteria to the implementation of an array processor is explored. The algorithm and the hardware are simultaneously taken into account in the design process in an attempt to combine as many steps as possible in the design sequence. The algorithm of a vector, matrix product is utilized since it forms the operational bases of linear recursive filtering and similar practical engineering computations. The design is minimized to system cost and constrained to time of completion, system power consumption, and system circuit board area. The concept of optimization is used at a modular level and at a circuit design level in an attempt to optimize the system throughout. Dissert. Abstr.

N80-18727 Oklahoma Univ., Norman.
DATA DETECTION IN HIGH DENSITY DIGITAL MAGNETIC RECORDING Ph.D. Thesis
Hossein Mohamad Moghadam 1979 153 p
Avail: Univ. Microfilms Order No. 8003803

A generalized read system which combines several features in order to significantly increase probability of detection is designed. Signal equalization in conjunction with a peak-follower qualifying channel, followed by a phase coherent matched filter are the key elements of the design. The concept of a real time majority decoder, in the block diagram form, is introduced and

discussed. This concept utilizes three differently processed channels resulting in a certain degree of uncorrelation among them. The outcome is determined by a majority decode logic.
Dissert. Abstr.

N80-18728# Synectics Corp., Rome, N. Y.
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE 1. VOLUME 4: CHARTING SUBSYSTEM Final Technical Report, 26 Apr. 1977 - 26 Jul. 1978
J. Late and A. DiPasqua. Sep. 1979. 45 p. refs. 5 Vol.
(Contract F30602-77-C-0065)
(AD-A076107; RADC-TR-79-179-Vol-4) Avail: NTIS
HC A03/MF A01

The requirements, functional design, and operational considerations of the Automated Air Information Production System charting subsystem are presented. The charting subsystem provides capture, revision, and output of graphic data appearing throughtout the Defense Mapping Agency Aerospace Center flight information publications. The data are presented in digital form and techniques are provided to simplify alteration of the data.
J.M.S.

N80-18729# Synectics Corp., Rome, N. Y.
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE 1. VOLUME 5: CARTOGRAPHIC EBR SYSTEM Final Technical Report, 26 Apr. 1977 - 26 Jul. 1978
Sep. 1979. 41 p. refs. 5 Vol.
(Contract F30602-77-C-0065)
(AD-A076108; RADC-TR-79-179-Vol-5) Avail: NTIS
HC A03/MF A01 CSCL 05/2

The design, fabrication, installation and testing an advanced large format, electron beam recorder for the production of computer generated master recordings on film is reported. Flight information products produced include: enroute high altitude charts; enroute low altitude charts; low altitude instrument approach procedure books; high altitude instrument approach procedure books; low altitude instrument departure procedure books; high altitude instrument departure procedure books; IFR supplements; VFR supplements; general planning books; area planning books; and area planning - special use airspace books.
J.M.S.

N80-18730# Synectics Corp., Rome, N. Y.
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE 1. VOLUME 1: EXECUTIVE SUMMARY Final Technical Report, 26 Apr. 1977 - 26 Jul. 1978
N. Bottini and P. Nash. Sep. 1979. 65 p. refs. 5 Vol.
(Contract F30602-77-C-0065)
(AD-A076104; RADC-TR-79-179-Vol-1) Avail: NTIS
HC A04/MF A01 CSCL 05/2

An automated system designed to reduce the manual labor required for the revision and publication of information critical to flight operations and logistical planning is described. Response time between receipt of changes to air navigation/air facilities data and the dissemination of that data to all users is also improved.
J.M.S.

N80-18731# Synectics Corp., Rome, N. Y.
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE 1. VOLUME 2: PUBLISHING SUBSYSTEM Final Technical Report, 26 Apr. 1977 - 26 Jul. 1978
S. Edelblum and S. Bowden. Sep. 1979. 145 p. refs. 5 Vol.
(Contract F30602-77-C-0065)
(AD-A076105; RADC-TR-79-179-Vol-2) Avail: NTIS
HC A07/MF A01 CSCL 05/2

An automated system developed to provide information critical to flight operations and logistical planning is described. The publishing subsystem permits publications to be produced on electronic equipment and extends the power and flexibility of digital manipulation to the updating and reformating of publications.
J.M.S.

N80-18732# Synectics Corp., Rome, N. Y.
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE 1. VOLUME 3: AIR FACILITIES SUBSYSTEM Final Technical Report, 26 Apr. 1977 - 26 Jul. 1978
W. Nehl and P. Moulder. Sep. 1979. 134 p. refs. 5 Vol.
(Contract F30602-77-C-0065)
(AD-A076106; RADC-TR-79-179-Vol-3) Avail: NTIS
HC A07/MF A01 CSCL 05/2

The requirements, functional design, and operational considerations of the Automated Air Facility Information File (AAFIF) are presented. The air facilities subsystem provides maintenance of the AAFIF data bases, selective data base retrieval, special report generation, and generation of formatted tape files for film negative output.
J.M.S.

N80-18733# Aeronautical Research Labs., Melbourne (Australia).
A MICROPROCESSOR CONTROLLED PROM PROGRAMMER
C. W. Sutton. Feb. 1979. 41 p.
(AD-A073154; ARL/Aero-TM-313) Avail: NTIS
HC A03/MF A01 CSCL 09/2

This paper describes a microprocessor controlled PROM programmer with user options to program, list and copy the memory content of MM5204Q devices.
GRA

N80-18734# Electronics Research Lab., Adelaide (Australia).
MANAGEMENT PROCEDURES FOR CONTROLLING DATA STORAGE ON THE IBM SYSTEM 370 COMPUTER AT DRCS
J. C. Gwatking and R. W. Collier. Jan. 1979. 34 p.
(AD-A076139; ERL-0055-TR) Avail: NTIS HC A03/MF A01
CSCL 05/2

This document is one of a series describing various aspects of data management on the DRCS Central Computer. It includes methods for controlling user datasets on both disk and magnetic tape. Where appropriate, the operating procedures and supporting software are also outlined.
GRA

N80-18735# Wisconsin Univ. - Madison. Mathematics Research Center.
THE DESIGN AND IMPLEMENTATION OF A DATABASE MANAGEMENT SYSTEM USING ABSTRACT DATA TYPE
A. James Baroody, Jr. and David J. DeWitt. Jun. 1979. 57 p. refs.
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-01721)
(AD-A077101; MRC-TSR-1970) Avail: NTIS
HC A04/MF A01 CSCL 05/2

The design, implementation, and performance analysis of a database management system implemented using abstract data types are presented. The use of abstract data types as an implementation tool is shown to have several significant advantages over current implementation techniques. First, by using a combination of abstract data types and generic procedures to structure the design of a database system, the resulting software will be more reliable. Also, by employing a programming language which supports specification and verification of abstract data types, we can guarantee data independence. Finally, we demonstrate that the application of abstract data types permits the elimination of run-time interpretation of the schema and subschema such as in IBM's IMS, Univac's DMS110, and INGRES. Instead, the data manipulation routines, which are shown to be examples of generic procedures, are implemented as parameterized calls to the procedures bound to the instances of the three abstract data types used to represent the logical structure of the database.
GRA

N80-18736# National Technical Information Service, Springfield, Va.
COMPUTER PERFORMANCE EVALUATION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Nov. 1979
Brian Carrigan. Dec. 1979. 248 p. Supersedes NTIS/PS-78/1078; NTIS/PS-77/0938; NTIS/PS-76/0830; NTIS/PS-75/753; NTIS/PS-75/063
(PB80-802085; NTIS/PS-78/1078; NTIS/PS-77/0938; NTIS/PS-76/0830; NTIS/PS-75/753; NTIS/PS-75/063) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography cites research on the measurement of computer systems effectiveness. It includes studies on workload determination, computational efficiency, and techniques for performance evaluation of both hardware and software. This updated bibliography contains 268 abstracts, 79 of which are new entries to the previous edition.
GRA

N80-18737# National Technical Information Service, Springfield, Va.
DATA COMPRESSION, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Nov. 1979
Brian Carrigan Dec 1979 96 p Supersedes NTIS/PS-78/1248, NTIS/PS-77/1130, NTIS/PS-76/0996
(PB80-801657, NTIS/PS-78/1248, NTIS/PS-77/1130, NTIS/PS-76/0996) Avail NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide journal literature cites research on techniques and equipment for data compression. Reports on video communications, data management, and computer storage devices are included. This updated bibliography contains 90 abstracts, 58 of which are new entries to the previous edition. GRA

N80-18738# National Technical Information Service, Springfield, Va.
DATA COMPRESSION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979
Brian Carrigan Dec 1979 192 p Supersedes NTIS/PS-78/1247, NTIS/PS-77/1129, NTIS/PS-76/0995, NTIS/PS-75/860, NTIS/PS-75/067
(PB80-801632, NTIS/PS-78/1247, NTIS/PS-77/1129, NTIS/PS-76/0995, NTIS/PS-75/860, NTIS/PS-75/067) Avail NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography cites Government-sponsored research studies on techniques and equipment for data compression. Reports are included on video communications, telemetry, voice communications, data management, and computer storage devices. This updated bibliography contains 234 abstracts, 16 of which are new entries to the previous edition. GRA

N80-18071*# Jet Propulsion Lab., California Inst. of Tech., Pasadena
GCF-NOCC RECONFIGURATION
J. P. McClure *In its* The Deep Space Network 15 Feb. 1980 p 86-89 (For primary document see N80-18058 09-12)
Avail NTIS HC A07/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-18739 Massachusetts Univ., Amherst
FORMAL METHODS AND HUMAN FACTORS IN THE DESIGN OF INTERACTIVE LANGUAGES Ph.D. Thesis
Andrew Jay Singer 1979 202 p
Avail Univ Microfilms Order No. 8004989

An approach to the design of interactive languages is presented which focuses on the problems of human engineering and complete definition for these languages. First, an approach which stresses user concerns and employs a detailed rationale to provide a basis for extracting human factors data is demonstrated in the design of an interactive 'assistant' for PASCAL programmers. Then, a method for completely describing interactive languages is developed in which interactive behavior is described using transition diagrams augmented by a semi-formal notation inspired by production systems. Finally, the framework of a complete semi-formal definition for the assistant is presented. The approach stresses the importance of details in the design process. Dissert. Abstr.

N80-18740 Carnegie-Mellon Univ., Pittsburgh, Pa.
SYMBOLIC EXECUTION OF FORMAL MACHINE DESCRIPTIONS Ph.D. Thesis
John Denniston Oakley 1979 168 p
Avail Univ Microfilms Order No. 7925022

The noteworthy problems of machine symbolic execution were investigated. A rigorous method was developed for symbolically evaluating algebraic-like expressions defined over the domain of variable length bit strings. A mixed integer/bit string representation was devised which permitted the elimination of superfluous bit lengths (by conversion to an integer valued expression); non-superfluous bit lengths were represented explicitly. A formal proof was given of the equivalence of this mixed representation with the original. Appropriate simplification techniques were introduced. Other accomplishments and observations as well as the results are reported. Dissert. Abstr.

N80-18741 Massachusetts Univ., Amherst
STUDIES IN IMAGE SEGMENTATION ALGORITHMS BASED ON HISTOGRAM CLUSTERING AND RELAXATION Ph.D. Thesis
Paul Alexander Nagin 1979 179 p
Avail Univ Microfilms Order No. 8004968

The algorithms and structures that are sufficient to generate an accurate description of the information contained in a relatively complex class of digitized images are discussed. Some of the problems typically encountered in segmentation are explored. An algorithm is presented that avoids most of these problems. A series of computer generated test images with known characteristics are reported. Segmentation algorithms of varying degrees of complexity are applied to each image and their performance is carefully evaluated. It is shown that even the most sophisticated algorithms often perform poorly when confronted with certain apparently simple images. It is also shown that techniques which rely on histogram clustering often generate gross segmentation errors due to overlap in the distributions of the individual objects in a scene. Dissert. Abstr.

N80-18742 Syracuse Univ., N. Y.
LINEAR AND ALMOST-LINEAR METHODS FOR THE UNIFICATION OF FIRST ORDER EXPRESSIONS Ph.D. Thesis
Neil Vincent Murray 1979 137 p
Avail Univ Microfilms Order No. 8004511

Two techniques for rapid construction of stable equivalence relations are discussed. These techniques give rise to two classes of algorithms, having almost-linear and linear complexity. A published linear algorithm is shown to be incorrect and possibly not linear, and a correct linear algorithm is given. It is shown that the almost-linear algorithms can operate on graphs having fewer directed arcs than graphs suitable for linear algorithms. An interesting development arising from the study of equivalence handling is that under certain restrictions the equivalence problem can be done in linear time and space. The two abstract algorithms discussed were implemented in ALGOL W. Brief experiments conducted to compare their running times showed that the almost-linear algorithm runs faster than the linear one throughout the entire range of input sizes generated. Dissert. Abstr.

N80-18743 Syracuse Univ., N. Y.
ANALYSIS OF FUTURE EVENT SET ALGORITHMS FOR DISCRETE EVENT SIMULATION Ph.D. Thesis
William Michael McCormack 1979 271 p
Avail Univ Microfilms Order No. 8004510

The analytical and empirical results for the performance of algorithms proposed to implement the future event set in discrete event simulation are reported. These results provide a clear insight to the factors affecting algorithm performance, permit evaluation of the hold model often used to study future event set algorithms; and determine the best algorithm(s) to use. A number of theorems are given on the effect that scheduling distributions have on performance. A classification of distributions is established for efficient insertion scanning of a linear structure. The most significant results concern the effect of more than one scheduling distribution being present, as is typical of most simulations. Dissert. Abstr.

N80-18744 University of Southwestern Louisiana, Lafayette
METHODS OF COMPACTING MICROPROGRAMS Ph.D. Thesis
Patrick Wayne Mallett 1979 188 p
Avail Univ Microfilms Order No. 8002714

The problem of reducing the number of microinstructions within a given microprogram for a horizontal microprogrammed processor was examined. Several results were obtained which include: specification and successful implementation of a machine independent model of microoperations and microinstructions; specification of metrics which can form a basis for evaluating

various methods of compacting microprograms; successful extension and implementation of three algorithms, proposed in the literature, to accept input of microoperations specified in terms of the machine independent model; the design and implementation of a systems implementation language translation system which generates compacted microcode, equivalent to an input high level source program. Other significant results are reported. Dissert. Abstr.

N80-18745 Florida Univ., Gainesville.
A GENERALIZED SYSTEM FOR APPLICATION PROGRAM CONVERSION TO ACCOUNT FOR DATABASE SEMANTIC CHANGES: DESIGN AND PROTOTYPE IMPLEMENTATION Ph.D. Thesis
Herman Lam. 1979. 201 p.
Avail: Univ. Microfilms. Order No. 8002872.

The effect on the application programs as a result of the database changes in the associated database was studied. A methodology of program analysis and conversion to account for the database changes is presented. Topics covered include: (1) the methodology; (2) a model of application program conversion; (3) an analysis of access patterns in the context of a semantic data model; (4) the possible meaningful semantic changes and their transformation rules for program conversion; (5) prototype implementation of the conversion phase; (6) the major interfaces to the conversion phase; and (7) the problems for future investigation. Dissert. Abstr.

N80-18746 Ohio State Univ., Columbus.
COMPUTATIONAL COMPLEXITY OF REAL FUNCTIONS AND POLYNOMIAL TIME APPROXIMATIONS Ph.D. Thesis
Ker-I Ko. 1979. 181 p.
Avail: Univ. Microfilms. Order No. 8001765.

Recursive analysis, the theory of computation of functions on real numbers, was studied from various aspects. The computational complexity of real functions using the methods of recursive function theory was investigated. Partial recursive real functions were defined and their domains were characterized as the recursively open sets. The time complexity of recursive real continuous functions were defined and it is shown that the time complexity and the modulus of uniform continuity of a function are closely related. The complexity of the roots and the differentiability of polynomial time computable real functions were studied. The concept of nondeterministic computation was used to study the complexity of the integrals and the maximum values of real functions. Dissert. Abstr.

N80-18747 University of Southwestern Louisiana, Lafayette.
A METHODOLOGY FOR FREE FORMAT SYSTEMS DESIGN Ph.D. Thesis
Edwin David Hoover. 1979. 242 p.
Avail: Univ. Microfilms. Order No. 8002713.

A system that implements a free form methodology is presented that provides an analyst with an automated technique designed specifically for the planning and design phase. The system utilizes a top down, structured approach comprised of a feasibility phase, detail design phase, and a task specifications phase. The system insures that the design is consistent with management's established objectives and that the individual tasks mesh to obtain the desired goals. Results indicate that with little or no training any analyst may begin using the system. Dissert. Abstr.

N80-18748 Cornell Univ., Ithaca, N. Y.
TOPICS IN COMPUTATIONAL COMPLEXITY Ph.D. Thesis
Steven Jonathan Fortune. 1979. 130 p.
Avail: Univ. Microfilms. Order No. 8003924.

The problem of determining a homeomorphic embedding of a pattern graph in a target graph is described. The case where both pattern and target graphs are directed is considered. For pattern graphs which are essentially trees of height one, a polynomial time algorithm is given; for all other pattern graphs the problem is NP-complete. The problem of determining the two closest of n points, where the points are given by their coordinates in a k-dimensional Euclidean space is stated and it is shown that there is an obvious O(n2) algorithm for the problem: compare every pair of points. The termination properties for languages with various type structures are evaluated using versions of the gamma-calculus. The independence result for the polymorphic programming language is a consequence of the ability to represent in the polymorphic gamma-calculus all the computable functions which are provably recursive in Peano Arithmetic. Dissert. Abstr.

N80-18749*# National Aeronautics and Space Administration, Washington, D. C.
PROGRAMS FOR HIGH-SPEED FOURIER, MELLIN AND FOURIER-BESSEL TRANSFORMS
D. K. Ikhabisimov, A. S. Debabov, B. I. Kolosov, and D. A. Usikov. Sep. 1979. 19 p. refs. Transl. into ENGLISH of "Programmy Bystrykh Preobrazovaniy Fur'ye Mellina i Fur'ye-Besselya". Rept. Pr-418. Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978. 17 p. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75678; Pr-418) Avail: NTIS. HC A02/MF A01. CSCL 09B.

Several FORTRAN program modules for performing one-dimensional and two-dimensional discrete Fourier transforms, Mellin, and Fourier-Bessel transforms are described along with programs that realize the algebra of high speed Fourier transforms on a computer. The programs can perform numerical harmonic analysis of functions, synthesize complex optical filters on a computer, and model holographic image processing methods. K.L.

N80-18750*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
GRAPHICS AND COMPOSITE MATERIAL COMPUTER PROGRAM ENHANCEMENTS FOR SPAR
Gary L. Farley (Army Research and Technol. Labs., Hampton, Va.) and Donald J. Baker (Army Research and Technol. Labs., Hampton, Va.). Feb. 1980. 51 p. refs.
(NASA-TM-80209) Avail: NTIS. HC A04/MF A01. CSCL 09B.

User documentation is provided for additional computer programs developed for use in conjunction with SPAR. These programs plot digital data, simplify input for composite material section properties, and compute lamina stresses and strains. Sample problems are presented including execution procedures, program input, and graphical output. K.L.

N80-18751*# Texas Univ. at Austin. Inst. for Computing Science and Computer Applications.
DESIGN OF A VERIFIABLE SUBSET FOR HAL/S Final Report
James C. Browne, Donald I. Good, Anand R. Tripathi, and William D. Young. 31 Dec. 1979. 264 p.
(Contract NAS9-13864)
(NASA-CR-162814) Avail: NTIS. HC A12/MF A01. CSCL 09B.

An attempt to evaluate the applicability of program verification techniques to the existing programming language, HAL/S is discussed. HAL/S is a general purpose high level language designed to accommodate the software needs of the NASA Space Shuttle project. A diversity of features for scientific computing, concurrent and real-time programming, and error handling are discussed. The criteria by which features were evaluated for inclusion into the verifiable subset are described. Individual features of HAL/S with respect to these criteria are examined and justification for the omission of various features from the subset is provided. Conclusions drawn from the research are presented along with recommendations made for the use of HAL/S with respect to the area of program verification. A.W.H.

N80-18752# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
PORTABILITY OF LARGE COBOL PROGRAMMERS: THE COBOL PROGRAMMER'S WORKBENCH Final Technical Report, 25 Nov. 1976 - 30 Jun. 1979
P. H. Enslow. Sep. 1979. 286 p. refs.
(Grant DAAG29-77-G-0045)
(AD-A076917; GIT-ICS-79-09; ARO-14752.1-A-EL) Avail: NTIS. HC A13/MF A01. CSCL 09/2.

The COBOL Programmer's Workbench is a fully integrated

collection of automated software tools designed to substantially aid in the design, implementation, test, and maintenance of COBOL data processing systems, especially those that must run on a variety of target host operating environments. The Workbench also assists in the preparation and maintenance of all supporting documentation. One of the most important capabilities of the Workbench is the automatic preparation of a set of equivalent but compiler-unique versions of a baseline program that has been written in Workbench COBOL. The research here included an investigation of the problems of converting a baseline program into compiler-unique versions, an initial study of the use of reuseable modules in-line COBOL code, a limited feasibility demonstration of these capabilities, and a preliminary study for the design of COBOL. GRA

N80-18753# Human Resources Research Organization, Alexandria, Va.
STUDY OF SYMBOLOGY FOR AUTOMATED GRAPHIC DISPLAYS Technical Report, 11 May 1977 - 11 May 1978
Peter W. Hemingway, Albert L. Kubala, and Garvin D. Chastain May 1979 65 p refs
(Contract DAHC19-75-C-0025; DA Proj. 2Q7-63743-A-775)
(AD-A076916; HUMRRO-FR-WD-TX-78; ARI-TR-79-A18) Avail: NTIS HC A04/MF A01 CSCL 05/8

The primary purpose of this report is to describe the current status of symbology development for use in interactive graphic display systems such as the Command and Control Interactive Display Experimentation System (CCIDES). A secondary purpose is to examine user requirements for such systems when employed as a part of a Tactical Operations System (TOS). An extensive literature survey indicated a great variety of available alternative symbology formats. Before a specific format is selected, the necessary information requirements for a particular position must be determined. For Army tactical displays, this information should be gathered in experiments using realistic battle scenarios. As a related effort, alternative symbol formats were evaluated by civilians. Naive subjects generally preferred a pictorial symbol over traditional military alternatives. The report is written for a military audience. GRA

N80-18754# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
A COLUMN GENERATION TECHNIQUE FOR THE COMPUTATION OF STATIONARY POINTS
Jong-Shi Pang Oct. 1979 30 p refs
(Contract N00014-75-C-0621)
(AD-A076415; MSRR-447; WP-29-79-80) Avail: NTIS HC A03/MF A01 CSCL 12/1

In two recent papers, Eaves showed that Lemke's algorithm can be used to compute a stationary point of an affine function over a polyhedral set. This paper proposes an alternative method which is based on parametric principal pivoting. The proposed method involves solving systems of linear equations and parametric linear subprograms over the given polyhedral set. An obvious advantage of the method is that any special structure of the polyhedral set can be exploited profitably in the solution of the subprograms. GRA

N80-18755# Stanford Univ., Calif. Dept. of Operations Research.
DOCUMENTATION OF A COMPUTER PROGRAM FOR THE BOUND-AND-SCAN ALGORITHM FOR INTEGER LINEAR PROGRAMMING
Nancy F. Jacqmin Jul. 1979 90 p refs
(Contract N00014-76-C-0418; Grant NSF MCS-76-81259)
(AD-A075811; TR-87) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report gives documentation for the computer code BDSCAN for solving integer linear programming problems using the bound-and-scan algorithm. A listing of the program with sample input and output is included. GRA

N80-18756# Army Engineer Topographic Labs., Fort Belvoir, Va.
A WEIGHTED LINE-FINDING ALGORITHM
K. Abdoshah and A. Klinger Sep. 1979 25 p refs
(AD-A076112; ETL-0200) Avail: NTIS HC A02/MF A01 CSCL 09/4

This paper introduces two new algorithms to detect a line in a digitized picture. The algorithms are compared with the Hough algorithm, and their computational advantages are shown. We discuss the potential for, and the use of, the algorithms in applications, including the use of imagery in digital cartography. GRA

N80-18757# Yucca International, Inc., Scottsdale, Ariz.
SOFTWARE DEVELOPMENT, ITEM 0005 OF MICROPROCESSOR-BASED POWER CONDITIONER CONTROLLER
Feb. 1979 51 p refs
(Contract DAAK70-78-C-011)
(AD-A076118) Avail: NTIS HC A04/MF A01 CSCL 09/3

This report describes the efforts to develop a microprocessor-based controller for the Delco 15KW power conditioner. Continuing from the hardware development, the previous task, the software necessary to perform voltage regulation of the converter section was developed. The assembled program was executed and debugged using the simulation capability provided. GRA

N80-18758# California Univ., Davis. Signal and Image Processing Lab.
APPLICATIONS OF STOCHASTIC MODELS FOR IMAGE DATA COMPRESSION
Sheng-Huey Wang (Picker Corp., Mayfield Village, Ohio) and Anil K. Jain Sep. 1979 257 p refs
(Grant DAAG29-78-C-0206)
(AD-A078781; ARO-16222.3-EL) Avail: NTIS HC A12/MF A01 CSCL 09/4

Intraframe image data compression systems are analyzed in this thesis using stochastic modeling concepts. The formulations of stochastic image models are obtained from different classes of partial differential equations. Their application to the coding problem shows the connection between predictive, hybrid and transform coding schemes. The resulting coding schemes are evaluated in terms of tangible system terms such as signal to noise ratio, mean square error and rate distortion curve. GRA

N80-18759# Stanford Univ., Calif. Systems Optimization Lab.
CONJUGATE-GRADIENT METHODS FOR LARGE-SCALE NONLINEAR OPTIMIZATION
Phillip E. Gill and Walter Murray Oct. 1979 65 p refs Presented at the 24th Intern. Meeting of the Inst. of Management Sci., Hawaii, Jun. 1979
(Contracts DAAG29-79-C-0110; DE-AS03-76SF-00326; Grants NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A078713; SU-SOL-79-15; ARO-16470.1-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this paper we discuss several recent conjugate-gradient type methods for solving large-scale nonlinear optimization problems. We demonstrate how the performance of these methods can be significantly improved by careful implementation. A method based upon iterative preconditioning will be suggested which performs reasonably efficiently on a wide variety of significant test problems. Our results indicate that nonlinear conjugate-gradient methods behave in a similar way to conjugate-gradient methods for the solution of systems of linear equations. These methods work best on problems whose Hessian matrices have sets of clustered eigenvalues. On more general problems, however, even the best method may require a prohibitively large number of iterations. We present numerical evidence that indicates that the use of theoretical analysis to predict the performance of algorithms on general problems is not straightforward. GRA

N80-18760# Naval Research Lab., Washington, D. C.
GUIDE TO VECTORIZATION ON THE NAVAL RESEARCH LABORATORY'S TEXAS INSTRUMENTS ADVANCED SCIENTIFIC COMPUTER. VOLUME: VECTORIZATION PRIMER
Barbara Brooks, Harvey Brock, and Max Miller (Texas Univ. at Austin) 13 Nov. 1979 26 p refs
(AD-A077365; NRL-MR-4102-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

The Vectorization Primer is for programmers newly using the Texas Instruments Advanced Scientific Computer (ASC) and it is for managers, scientists, and programmers who are contemplating the ASC. The concept of vectorization is introduced

and illuminated. Fundamental principles and basic programming techniques for achieving vectorization are presented. Problems and pitfalls that FORTRAN programmers, new to the ASC, encounter in writing and vectorizing FORTRAN programs are discussed. This information is useful to the potential ASC user for weighing the benefits of vectorization against the costs of vectorization in programming effort. This information assists the new ASC programmer in mastering concepts and techniques for vectorization. It guides him/her around irksome pitfalls. Volume 2 of the Guide to Vectorization on the Naval Research Laboratory's Texas Instruments Advanced Scientific Computer is for experienced ASC programmers. Advanced vectorization techniques, examples, and considerations are presented. GRA

N80-18761# Research Inst. of National Defence, Stockholm (Sweden).
GRAF: AN AUXILIARY PROGRAM FOR PRESENTATION OF FUNCTIONS IN 90 DEGREE COORDINATES WITH TEKTRONIX 4051 [GRAF - ETT HJAALPPROGRAM FOER PRESENTATION AV FUNKTIONER I RAATVINKLIGA KOORDINATER MED TEKTRONIX 4051]
Carl Reuterswaard. Jun. 1979. 36 p. refs. In SWEDISH (FOA-C-54027-H2). Avail: NTIS. HC A03/MF A01

An interactive computer program written in BASIC is described which creates a dialog with the user, requesting the input values needed for drawing curves and their labels. The general purpose program has been used for plotting meteorological data as well as physiological data. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N80-18762 Ohio State Univ., Columbus.
DESIGN AND ANALYSIS OF THE DISTRIBUTED DOUBLE-LOOP COMPUTER NETWORK (DDLCN) Ph.D. Thesis
Jacob John Wolf, III. 1979. 243 p.
Avail: Univ. Microfilms. Order No. 8001859

A dynamically fault-tolerant computer network is presented that operates under totally distributed control. Detection and recovery schemes are presented for both link and interface faults. Analytical and simulation models are developed that predict message flow patterns and expected message transmission times. The simulation model is also used to investigate several dynamic message routing algorithms. Dissert. Abstr.

N80-18763 Princeton Univ., N. J.
THE DESIGN OF DEADLOCK- AND LIVELOCK-FREE PACKET SWITCHING NETWORKS Ph.D. Thesis
Sam Toueg. 1979. 88 p.
Avail: Univ. Microfilms. Order No. 8005282

Several types of deadlock free uniform local flow control procedures (controllers) that prevent store and forward deadlocks in any packet switching network are presented. These local controllers are executed independently by each node in a network, using only local information readily available to these nodes. Several properties of the proposed deadlock-free uniform controllers, as well as their relationship, are given, and a proof of their optimality with respect to deadlock-free uniform controllers using the same local information is presented. A deadlock- and livelock-free local controller is described which guarantees that every packet reaches its destination within a finite amount of time from the moment of its creation. Dissert. Abstr.

N80-18764 Ohio State Univ., Columbus.
INTERPROCESS COMMUNICATION AND SYNCHRONIZATION FOR DISTURBED SYSTEMS Ph.D. Thesis
Roberto Pardo. 1979. 242 p.
Avail: Univ. Microfilms. Order No. 8001800

Strategies for routing multi destination messages, mainly in local architectures are developed. The exchange of multi destination messages deals with the design of several protocols at various levels that ensure different degrees of reliability. The levels considered are: (1) unreliable level, where the protocol implements process addressing and chooses the best multi destination routing algorithm; (2) best effort to deliver level, where the protocol attempts to deliver the message to as many of its destinations as possible, filtering duplicates and out of order messages at each destination; and (3) guarantee to deliver level, where the protocol ensures that every destination will receive the message, regardless of momentary unavailability due to communication or processing system failures. Dissert. Abstr.

N80-18765 Illinois Univ. at Urbana-Champaign.
A COMPREHENSIVE APPROACH TO THE PERFORMANCE MEASUREMENT AND EVALUATION OF LARGE-SCALE COMPUTER SYSTEMS Ph.D. Thesis
Herbert Walker Merrill, Jr. 1979. 66 p.
Avail: Univ. Microfilms. Order No. 8004228

The performance measurement and evaluation of large scale computer systems do not require hardware and software monitors as data collectors, but rather a comprehensive approach is described which uses only the computer system's accounting file as the data source. This data is processed into a performance data base which is the primary tool of this approach, and it is used to establish meaningful and measurable performance objectives. The objectives for service are related to resource consumption by a charging scheme that charges a higher price for better service, and thus capacity measures (for equipment acquisition or release) relate directly to qualitative and quantitative measures of user satisfaction versus supplier's costs. The implementation of the performance data base is described and the development of specific objectives for several systems (batch, interactive) is described. Examples of the capacity measures are shown, and several examples of the simplicity, cost-effectiveness and utility of the approach are described. Dissert. Abstr.

N80-18766 Oregon State Univ., Corvallis.
ANALYSIS OF NEW PROTOCOLS FOR COMPUTER COMMUNICATION NETWORKS Ph.D. Thesis
Clifford John Warner. 1980. 287 p.
Avail: Univ. Microfilms. Order No. 8002630

An advanced forward area tactical radar network, now under conceptual development by the Air Force Electronic Systems Division, can be viewed as a novel form of computer network but with other unique problems resulting from the specialized nature of the application. The proposed network will link together a number o short-range radars, each with associated data processing equipment, so that each radar site has a complete file of tracks for all targets seen by any radar in the network. In addition, the communication network is expected to be used for transmission of a variety of other types of command and control messages. A new class of adaptive routing protocols for computer communication networks has been developed in this thesis, using the radar network as a basis, but applicable to any computer communication network. These new routing protocols utilize new techniques for searching out and using both reciprocal paths (paths over which messages can travel in either direction) and nonreciprocal paths (paths over which messages can travel in only one direction) for directed message routing. The computations required by the new routing protocols are carried out in a distributed manner at each network node. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-18767 Illinois Univ. at Urbana-Champaign.
CONTROLLABILITY AND ACCESSIBILITY IN NONLINEAR CONTROL SYSTEMS Ph.D. Thesis
Kevin Anthony Grasse. 1979. 186 p.
Avail: Univ. Microfilms. Order No. 8004177

The stability of certain properties of nonlinear control systems were investigated. It is shown that the fixed endtime accessibility property is generic (in a strong sense) and that, under certain conditions, fixed endtime controllability to a compact set is preserved under small perturbations. Results are phrased in terms of control vector fields on a differentiable manifold. Dissert. Abstr.

N80-18768*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
THE REDUCED ORDER MODEL PROBLEM IN DISTRIBUTED PARAMETER SYSTEMS ADAPTIVE IDENTIFICATION AND CONTROL. Interim Report
C. Richard Johnson, Jr. Mar. 1980. 76 p. refs.
(Grant NAG-1-7)
(NASA-CR-162807) Avail: NTIS. HC A05/MF A01. CSCL 09B

The research concerning the reduced order model problem in distributed parameter systems is reported. The adaptive control strategy was chosen for investigation in the annular momentum control device. It is noted, that if there is no observation spill over, and no model errors, an indirect adaptive control strategy can be globally stable. Recent publications concerning adaptive control are included. F.O.S.

N80-18769*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ROBUSTNESS RESULTS IN LQG BASED MULTIVARIABLE CONTROL DESIGNS
Norman A. Lehtomaki, Nils R. Sandell, Jr. (Alpha Tech. Inc., Burlington, Mass.), and Michael Athans. Feb. 1980. 77 p. refs.
(Grant NGL-22-009-124; Contracts ET-78-C-01-3395; N00014-79-C-0377)
(LIDS-P-976; NASA-CR-162813) Avail: NTIS. HC A05/MF A01. CSCL 09B

The robustness of control systems with respect to model uncertainty is considered using simple frequency domain criteria. Results are derived under a common framework in which the minimum singular value of the return difference transfer matrix is the key quantity. In particular, the LQ and LQG robustness results are discussed. K.L.

N80-18770# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A TRUTH MAINTENANCE SYSTEM
Jon Doyle. Jun. 1979. 47 p. refs.
(Contract N00014-75-C-0643; Grant NSF MCS-77-04828)
(AD-A078419; AI-M-521) Avail: NTIS. HC A03/MF A01. CSCL 05/8

To choose their actions, reasoning programs must be able to make assumptions and subsequently revise their beliefs when discoveries contradict these assumptions. The Truth Maintenance System (TMS) is a problem solver subsystem for performing these functions by recording and maintaining the reasons for program beliefs. Such recorded reasons are useful in constructing explanations for program actions and in guiding the course of action of a problem solver. This paper describes (1) the representations and structure of the TMS, (2) the mechanisms used to revise the current set of beliefs, (3) how dependency-directed backtracking changes the current set of assumptions, (4) techniques for summarizing explanations of beliefs, (5) how to organize problem solvers into 'dielectically arguing' modules, (6) how to revise models of the belief systems of others, and (7) methods for embedding control structures in patterns of assumptions. We stress the need of problem solvers to choose between alternate systems of beliefs, and outline a mechanism by which a problem solver can employ rules guiding choices of what to believe, what to want, and what to do. GRA

N80-18771# Maryland Univ., College Park. Computer Science Center.
CONNECTED COMPONENT LABELING USING QUADTREES
Hanan Samet. Apr. 1979. 30 p. refs.
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A076130; CSC-TR-756) Avail: NTIS. HC A03/MF A01. CSCL 05/8

An algorithm is presented for labeling the connected components of an image represented by a quadtree. The algorithm proceeds by exploring all possible adjacencies for each node once and only once. Once this is done, any equivalences generated by the adjacency labeling phase are propagated. Analysis of the algorithm reveals that its worst case average execution time is bounded by a quantity proportional to the product of the log of the region's diameter and the number of blocks comprising the area connected by the components. GRA

N80-18772# Maryland Univ., College Park. Computer Vision Lab.
SECOND-ORDER STATISTICS OF TEXTURE PRIMITIVES. Interim Report
Shyuan Wang, Angela Wu, and Azriel Rosenfeld. Jul. 1979. 32 p. refs.
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A077390; TR-779; AFOSR-79-1162TR) Avail: NTIS. HC A03/MF A01. CSCL 05/8

Primitive 'elements' were extracted from a set of textures; a set of attributes was measured for each primitive; and second-order statistics of these attributes were computed for pairs of neighboring primitives, using several definitions of 'neighboring'. In some cases, textures not discriminable used statistics of the second order. GRA

N80-18773# Stanford Univ., Calif. Dept. of Computer Science.
USING PATTERNS AND PLANS TO SOLVE PROBLEMS AND CONTROL SEARCH
David Edward Wilkins. Jul. 1979. 267 p. refs. Sponsored in part by National Science Foundation.
(Contract MDA903-76-C-0206; NSF MCS-78-00524)
(AD-A076872; SU-STAN-CS-79-474; AIM-329) Avail: NTIS. HC A12/MF A01. CSCL 06/4

The type of reasoning done by human chess masters has not been done by computer programs. The purpose of this research is to investigate the extent to which knowledge can replace and support search in selecting a chess move and to delineate the issues involved. This has been carried out by constructing a program, PARADISE (Pattern Recognition Applied to Directing Search), which finds the best move in tactically sharp middle game positions from the games of chess masters. GRA

N80-18774# Burroughs Corp., Paoli, Pa. Federal and Special Systems Group.
SOFTWARE MAINTENANCE MANUAL FOR THE MODULAR SYSTEM CONTROL DEVELOPMENT MODEL (MSCDM), BOOK 1. Final Report, Sep. 1976 - Nov. 1979
Nov. 1979. 393 p.
(Contract DCA100-76-C-0083)
(AD-A078391; AD-E100313; Rept-66157) Avail: NTIS. HC A17/MF A01. CSCL 09/2

The Distributed Master Control Program (DMCP) and the technical control application programs of the Modular System Control Development Model (MSCDM) are described. Program listings of each program and subprogram are presented. Programs are written in FORTRAN and MACRO-11 for Digital Equipment Corporation (DEC) LSI-11 microcomputers. GRA

N80-18775# Burroughs Corp., Paoli, Pa. Federal and Special Systems Group.
SOFTWARE MAINTENANCE MANUAL FOR THE MODULAR SYSTEM CONTROL DEVELOPMENT MODEL (MSCDM), BOOK 2. Final Report, Sep. 1976 - Nov. 1979
Nov. 1979. 296 p.
(Contract DCA100-76-C-0083)
(AD-A078392; AD-E100314; Rept-66158) Avail: NTIS. HC A13/MF A01. CSCL 09/2

Program descriptions and listings of the Modular System Control Development Model utility programs and diagnostics are presented. This includes the Bootstrap Load Facility for the Ring Architecture. GRA

N80-18776# Burroughs Corp., Paoli, Pa. Federal and Special Systems Group.
SOFTWARE MAINTENANCE MANUAL FOR THE MODULAR SYSTEM CONTROL DEVELOPMENT MODEL (MSCDM), BOOK 3. Final Report, Sep. 1976 - Nov. 1979
Nov. 1979. 89 p.
(Contract DCA100-76-C-0083)
(AD-A078393; AD-E100315; Rept-66159) Avail: NTIS. HC A05/MF A01. CSCL 09/2

Program flow charts are presented. Flow charts for all operating systems, applications, diagnostic and utility programs are included in this single volume. GRA

N80-18777# Colorado Univ. at Boulder. Dept. of Electrical Engineering.
FEEDBACK SYSTEM DESIGN Annual Report
Isaac M. Horowitz. 1979. 24 p. refs.
(Grant AF-AFOSR-2946-76; AF Proj. 2304)
(AD-A078486; AFOSR-79-1238TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In Quantitative Feedback Synthesis, bounds on plant uncertainty and on the system performance are specified a priori. The minimum feedback is used which satisfies the latter over the range of plant uncertainty. The principal effort during the past year was in extending Quantitative Feedback Synthesis to two new highly complex, multiple-loop, single input-output plant structural classes. The significant advantage of multiple-loop over single-loop is that, in highly uncertain systems, the same performance specifications can be satisfied, with tremendously smaller sensor noise effects. A technique denoted as 'Design Perspective' was developed, which enables the designer to evaluate the trade-offs without a detailed design. Thus, early in the game and before doing a detailed design, the designer can obtain an excellent idea of which loops (sensors) to use and which to omit and the portion of the 'feedback burden' to assign to each loop. The same design techniques are applicable to highly uncertain nonlinear plants with the same structure. Several complex detailed design examples with very large uncertainty were done. Design perspective results were very close to the final design results. The designs were simulated on the digital computer and in all cases satisfied the a priori assigned performance specifications. GRA

N80-18778# Brown Univ., Providence, R. I. Center for Dynamical Systems.
OPTIMAL DISCOUNTED LINEAR CONTROL OF THE WIENER PROCESS Interim Report
Icannis Karatzas. Sep. 1979. 18 p. refs.
(Grant AF-AFOSR-3063-77; AF Proj. 2304)
(AD-A078487; AFOSR-79-1249TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

We consider the problem of discounted optimal control of the Wiener process, transformed by the action of a nonanticipative control into the state process. The latter satisfies the state equation on an appropriate probability space. There is a cost per unit time for being in the wrong state which is an even, uniformly convex function on the reals whose second derivative is decreasing with distance from the origin. There is also a cost per unit time for using the control. Both costs are discounted in time by a factor and the control action is limited. The controller has to choose a law as a nonanticipative, measurable functional of the state process with values so as to minimize the expected discounted total cost. In the present paper we proceed by formulating the control problem. The Bellman equation of dynamic programming is explicity solved and the candidate for the optimal law is discerned from the properties of the solutions. Optimality of the candidate is proved. GRA

N80-18779# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
SOME PROPERTIES OF THE DUAL ADAPTIVE STOCHASTIC CONTROL ALGORITHM Interim Report
Pierre Dersin, Michael Athans, and David A. Kendrick. Aug. 1979. 31 p. refs.
(Grant AF-AFOSR-3321-77; AF Proj. 2304)
(AD-A078488; LIDS-P-936; AFOSR-79-1254TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The purpose of this paper is to compare analytically the properties of the suboptimal dual adaptive stochastic control algorithm when the plant dynamics contain multiplicative white noise parameters. A simple scalar example is used for this analysis. GRA

N80-18780# Brown Univ., Providence, R. I. Center for Dynamical Systems.
CONTROL OF DYNAMICAL SYSTEMS Interim Report, 1 Sep. 1978 - 30 Aug. 1979
J. K. Hale, H. T. Banks, E. F. Infante, and J. P. LaSalle. Oct. 1979. 33 p. refs.
(Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A078489; AFOSR-79-1251TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Fifteen papers were prepared for publication or published during the ensuing period of research. Topics included identification and control of systems with delays, qualitative theory of functional differential and difference equations, nonlinear oscillations, control of dynamical systems, and stability of infinite-dimensional systems. GRA

N80-18781# California Univ., Los Angeles. Dept. of System Science.
COUNTABLE STATE AVERAGE COST REGENERATIVE STOPPING PROBLEMS
Bruce L. Miller. Apr. 1979. 33 p. refs.
(Contract N00014-76-A-0004; Grant NSF ENG-76-12250)
(AD-A078509; UCLA-WP-288) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Regenerative stopping problems are stopping problems which recommence from the initial state upon stopping. An algorithm is presented which solves a semi-Markov regenerative stopping problem with a finite number of continue actions by solving a sequence of stopping problems. New results for the optimal stopping problem are obtained as well as for the regenerative stopping problem. Two models in the literature are used as detailed examples of the algorithm. GRA

N80-18782# California Univ., Los Angeles. Dept. of System Science.
OPTIMAL INVESTIGATION AS A REGENERATIVE STOPPING PROBLEM
A. Gregory Buckman and Bruce L. Miller. May 1979. 27 p. refs.
(Contract N00014-78-C-0428; Grant NSF ENG-76-12250)
(AD-A078510; UCLA-WP-289) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This report discusses the problem of dynamic optimal investigation of a two-state (in control, out of control) system. The true state can only be inferred from reported costs and the time since the last correction. It is demonstrated that when the parameters satisfy certain conditions, such problems can be efficiently solved as regenerative stopping problems. Some general results for regenerative stopping problems are also obtained. In the last section the problem is generalized to n two-state systems. By combining simulation with the Regenerative Stopping Algorithm, a problem with 20 state variables is solved with a small error term. GRA

N80-18783# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.
NEW METHODS FOR ANALYSIS OF THE PERFORMANCE OF GUIDANCE AND CONTROL SYSTEMS Annual Interim Report, 1 Oct. 1978 - 30 Sep. 1979
Richard S. Bucy. Sep. 1979. 3 p. refs.
(Grant AF-AFOSR-3100-76; AF Proj. 2304)
(AD-A078534; AFOSR-79-1152TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The investigation has continued in the use of information theory and in particular rate distortion theory to derive useable upper and lower bounds on the expected loss for the nonlinear filtering problem. A new design criterion has been derived which leads to effective designs of large systems when the entire state is not available for feedback control. Preliminary results have been obtained on the problem of absolute phase demodulation. New results which evaluate the information loss which results from use of the classical phase lock loop instead of the optimal demodulator, have been obtained and are being investigated. Author (GRA)

N80-18784# Cornell Univ., Ithaca, N. Y. School of Operations Research and Industrial Engineering.
INCOMPLETE BLOCK DESIGNS FOR COMPARING TREATMENTS WITH A CONTROL. 3: OPTIMAL DESIGN FOR p = 4, k = 3 AND p = 5, k = 3
Robert E. Bechhofer and Ajit C. Tamhane (Northwestern Univ.). Oct. 1979. 27 p. refs.
(Contracts DAAG29-77-C-0003; N00014-75-C-0586; Grant NSF ENG-77-06112)
(AD-A078331; TR-436) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper continues the study of balanced treatment incomplete block (BTIB) designs. The definitions of inadmissibility and strong inadmissibility are generalized. The search for optimal designs is restricted to the smaller class of admissible designs obtained using these new definitions. Lists of generator designs, the (conjectured) complete class of generator designs, catalogs of admissible designs, and tables of optimal designs are given for p = 4, k = 3 and p = 5, k = 3. GRA

N80-18785# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering.

OPTIMAL CONTROL OF SYSTEMS WITH UNCERTAINTY Interim Report, Sep. 1978 - Aug. 1979

W. E. Schmitendorf. 1979. 91 p. refs.

(Grant AF-AFOSR-2423-76; AF Proj. 2304)

(AD-A078433; AFOSR-79-1257TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

The first problem considered was that of steering a system without disturbances to the origin when the magnitude of the control is constrained. A technique was developed for determining if a system can be steered to the origin and also a method for obtaining such a control when it exists. Next, the controllability problem was generalized by allowing for targets other than the origin. To reduce computational capability, a method was developed which exploits the affine nature of the target and requires the solution of a smaller dimensional optimization problem. One other area which has been under investigation is that of avoidance control. The controllability problem for systems with disturbances is being investigated. Research is also continuing on controllability of systems without disturbances. Work is also in progress on the avoidance control problem as well as the closely related holding problem. GRA

N80-18786# Cornell Univ., Ithaca, N. Y.

INCOMPLETE BLOCK DESIGNS FOR COMPARING TREATMENTS WITH A CONTROL. 1: GENERAL THEORY

Robert E. Bechhofer and Ajit C. Tamhane. Mar. 1979. 36 p. refs.

(Contracts DAAG29-77-C-0003; N00014-75-C-0586; Grant NSF ENG-77-06112)

(AD-A078330; TR-414) Avail: NTIS HC A03/MF A01 CSCL 12/1

This is the first paper of a series in which we outline a theory of optimal incomplete block designs for comparing several treatments with a control, and give plans of optimal designs to use for this purpose. In the present paper we develop the basic theory of the incomplete block designs which are appropriate for the many-to-one comparisons problem; the optimality considerations for such designs will be addressed in subsequent papers. For this problem we propose a new general class of incomplete block designs which are balanced with respect to test treatments. We shall use the abbreviation BTIB to refer to such designs. We study their structure, and give some methods of construction. A procedure for making exact joint confidence statements for our multiple comparisons problem is described. Using a new concept of admissibility of designs, it is shown how 'inferior' designs can be eliminated from consideration. Some open problems concerning construction of BTIB designs are posed. GRA

N80-18787# Massachusetts Inst. of Tech., Cambridge. Lab. of Information and Decision Systems.

A FUNCTIONAL EXPANSION APPROACH TO THE SOLUTION OF NONLINEAR FEEDBACK PROBLEMS Interim Report

Ram-Nandan P. Singh (Mitre Corp., McLean, Va.) and Timothy L. Johnson. Aug. 1979. 24 p. refs.

(Grant AF-AFOSR-3281-77; AF Proj. 2304)

(AD-A077408; LIDS-P-796-A; AFOSR-79-1189TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The application of a functional expansion technique introduced by Bellman to the determination of nonlinear optimal control laws is described. For a certain class of 'smooth' control problems, it is demonstrated that convergence of the expansion technique may be improved by use of a nonlinear (rather than linear) auxiliary equation which is based on a known cost-to-go function for an associated 'linear-quadratic' optimal control problem. GRA

N80-18788# Brown Univ., Providence, R. I. Div. of Applied Mathematics.

PARTIALLY OBSERVED STOCHASTIC CONTROL SYSTEMS

Wendell H. Fleming and Etienne Pardoux. 1979. 4 p. refs.

(Grants AF-AFOSR-3063-77; NSF MCS-76-07261; AF Proj. 2304)

(AD-A078290; AFOSR-79-1166TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper, the authors are concerned with the existence of optimal controls for problems. The method depends on introducing another stochastic control problem which is called a 'separated' problem. For several years the question of proving a general theorem about existence of optimal controls in the strict sense has been open. The authors do not obtain such a result here. However, they obtain an existence theorem in which a somewhat wider class of control processes is admitted. GRA

N80-18789# Brown Univ., Providence, R. I. Center for Dynamical Systems.

NUMERICAL METHODS AND APPROXIMATION AND MODELLING PROBLEMS IN STOCHASTIC CONTROL THEORY Final Report, 1 Jul. 1978 - 30 Jun. 1979

Wendell H. Fleming and Harold J. Kushner. 15 Aug. 1979. 8 p. refs.

(Grant AF-AFOSR-3063-76; AF Proj. 2304)

(AD-A078288; AFOSR-79-0972TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Many areas of stochastic control were studied in this period. Monte Carlo algorithms of type appearing in adaptive systems were studied and stability, convergence and rate of convergence results obtained. The analytical techniques developed for this purpose have a wide applicability in the study of similar algorithms. Robust computationally oriented approximations to optimal non-linear filters were developed. A deep study of how to find the Markov system that best approximates a given non-linear system with a wide band-width input was undertaken and very good results obtained. The problem is important in control and communication theory because it is usually desired to use the many available methods for analyzing Markov systems. The results obtained seem to be the best available so far and application to control and communication theory are being pursued. Optimal stochastic control problems under the condition of partial information on the system state were studied and a new formulation, similar to that of the non-linear filtering problem, developed. The approach seems promising in providing qualitative information on this difficult class of problems. Part of the technique uses measure-valued processes in a way which has wider applicability to problems involving distributed states or information. GRA

N80-18790# Control Dynamics Co., Huntsville, Ala.

APPLICATION OF DIGITAL TECHNOLOGY TO GUIDANCE AND CONTROL THEORY Technical Report, 1 Aug. - 30 Sep. 1979

S. M. Seltzer. 30 Sep. 1979. 21 p. refs.

(Contract DAAK40-79-C-0213)

(AD-A078815; CDC-79-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

The purpose of the study reported upon herein is to investigate the potential existence of a clustering of system poles and zeros in the z-domain. This potential is shown to exist. A means of separating the clustering is proposed by mapping from the complex z-domain onto the complex w-domain. The reason for so-doing is to ameliorate computational difficulties that can arise as the result of closely clustered roots. GRA

N80-18791# Technical Research Centre of Finland, Espoo. Electrical Engineering Lab.

OPTIMAL CONTROL PROBLEMS WITH DISCRETE TIME, LINEAR DYNAMICS, AND CONVEX STATE-CONTROL CONSTRAINTS Ph.D. Thesis - Helsinki Univ.

Eero Tamminen. 1979. 49 p. refs. Sponsored by Emil Aaltonen Foundation

(VTT-ENT-26; ISBN-951-38-0797-5) Avail: NTIS HC A03/MF A01

The assumptions about the structure and the elements of optimal control problems are defined. The original problem is

converted into an equivalent Lagrangian optimization problem. The functional analytic approach of Dubovitskij and Milyutin is applied to the Lagrangian problem and necessary conditions for optimality are derived for the original problem in the form of a maximum principle. In the time-point-wise Hamiltonian minimization problems, which give the optimal control, explicit state-control constraints are presented. The driving Lagrange multiplier vector in the adjoint state equations is characterized as the solution to the optimization problem which is the dual of the Hamiltonian problem. Owing to the convexity assumptions, the maximum principle is also a sufficient condition for optimality. The possibility of avoiding singular solutions by reformulating state constraints into state-dependent control constraints is treated. The maximum principle leads to a two-point boundary value problem. An iterative scheme for solving this problem is considered. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-18792 University of Southern Illinois at Carbondale.
STABILITY CONSIDERATIONS FOR VOLTERRA INTEGRO-DIFFERENTIAL EQUATIONS Ph.D. Thesis
Leigh Carl Becker 1979 82 p
Avail: Univ. Microfilms Order No. 8004027

The basic stability properties of the equation x prime (t) = A(t)x(t) + the integral from 0 to t of C(t,u)x(u)du + f(t) are considered, where A and C are continuous n by n matrices, f is a continuous n-vector-valued function, and x is an n-vector. A solution is expressed in terms of the solutions of an associated family of homogeneous equations via a variation of parameters formula. Stability results for the associated family when A(t) is identically equal to A, a constant stable matrix, are obtained in terms of a symmetric positive definite matrix. When f(t) is identically equal to 0, necessary and sufficient conditions are obtained for uniform stability, uniform asymptotic stability, and exponential asymptotic stability. These results coupled with the variation of parameters formula yield some perturbation results. Dissert. Abstr.

N80-18793 Massachusetts Univ., Amherst.
COMPLEMENTATION, REGULARITY AND CONVERGENCE OF MEASURES IN BANACH SPACES GENERATED BY QUANTUM LOGICS Ph.D. Thesis
Olga Rozinak Beaver 1979 71 p
Avail: Univ. Microfilms Order No. 8004896

Assuming that a quantum logic, 2, carries a sufficiently large collection of states, the collection is embedded as base for a base-norm space S. Then 2 can be embedded in the order-unit Banach dual S* of S and the base-norm Banach dual S** of S* consists of functions which, restricted to 2, are finitely additive. It is shown that if the collection of states is regular with respect to a particular subset P of 2, then each function in S** can be decomposed into countably additive and purely finitely additive parts. It is further shown that weak compactness of sets of functions in S can be determined by the behavior of the functions either on certain maximal lattice subsets of S*, or on P if the collection of states is P-regular. Finally, criteria are established under which a closed subspace of S* is not topologically complemented in S*. Dissert. Abstr.

N80-18794 Alabama Univ., University.
STABILITY THEORY FOR MATHEMATICAL PROGRAMMING PROBLEMS WITH UNBOUNDED CONVEX FEASIBLE REGIONS: A POINT-TO-SET SUBMAP APPROACH Ph.D. Thesis
Robert Grover Batson 1979 39 p
Avail: Univ. Microfilms Order No. 8004529

The stability is examined of mathematical programming problems when the resource vector associated with the constraints is perturbed. Using classical decomposition theorems. A line-free unbounded closed convex feasible region is written as the sum of the convex hull of its extreme points plus its recession cone. The regularity assumption is that the recession cones of the feasible regions are constant on a neighborhood of the original resource vector b. When the resource vector is varied, the convex hull of extreme points (the basic hull) becomes a submap of the feasible region point-to-set map. It is assumed that the basic hull is compact at b and base our analysis on semicontinuity properties of the basic hull at b. The optimal value is a function of the resource vector used to pose the problem. Stability is defined as the continuity of this optimal value function at b. Such continuity is significant for duality theory and in the practice of operations research. Sufficient conditions for continuity, and also for linear continuity of v at b are the major findings. Dissert. Abstr.

N80-18795 Wisconsin Univ. - Madison.
COALESCING BROWNIAN MOTIONS ON THE LINE Ph.D. Thesis
Richard Alejandro Arratia 1979 134 p
Avail: Univ. Microfilms Order No. 8001124

Coalescing Brownian motions on the real line R are defined and analyzed. This system is the continuous space analog of coalescing random walks on the lattice of integers Z. The system is constructed with arbitrary initial sets of particles. The system has an invariant equilibrium measure, a point process on R called pi sup c. A duality relation for the system of coalescing Brownian motions makes it possible to express the zero function of pi sup c in terms of finite systems of annihilating Brownian motions. Using coalescing Brownian motions, the limiting behavior of some nearest neighbor interaction particle systems on the one dimensional lattice Z, such as coalescing random walks, annihilating random walks, and the basic voter model can be analyzed. Dissert. Abstr.

N80-18796 Brandeis Univ., Waltham, Mass.
PROJECTIVE NORMALIZATION OF SURFACES WITH A FIXED HILBERT POLYNOMIAL Ph.D. Thesis
Carola AndujoRolon 1979 32 p
Avail: Univ. Microfilms Order No. 8002414

Let P(x) be a rational polynomial such that P(m) is an integer for every integer m. Let V be a projective surface defined over an algebraically closed field k and C sub V a generic hyperplane section over k. Let Sigma be the set of pairs (V, Cv) with a fixed Hilbert polynomial P(m) = chi(V, L(mC sub V)). The aim is to prove that there is a constant M sub O depending only on the Hilbert polynomial chi(V, L(mC sub V)) such that for m greater than M sub O the linear system (mC sub V) defines a birational morphism 1/gamma for which gamma(V) is projectively normal. Associate to every pair (V, Cv) a pair (V*, C*), where f:V* - V is the desingularization of V and C* is the pull back f-1(Cv). By Bertini's theorem it is concluded that C* is an absolutely irreducible curve. (C*)(2) (C*)(2) = (C sub V)(2) greater than 0 and I(C*, Y) equal to or greater than 0 for every positive divisor Y on V*. The idea is to use some results which are known for non-singular surfaces to prove the existence of an integer M sub O, independent of the choice of V, that is, depending only on the Hilbert polynomial such that the minimal sum of the linear systems A(C*) and A(mC*) is complete for M equal to or greater than M. Dissert. Abstr.

N80-18797 Montana Univ., Missoula.
THE CLASS NUMBER OF AN ALGEBRAIC NUMBER FIELD: ITS INTERPRETATION AND USE Ph.D. Thesis
Herbert Emil Kasube 1979 96 p
Avail: Univ. Microfilms Order No. 8002330

The history of algebraic number theory is examined. The definitions of ideal numbers and ideals for the algebraic number field K are reviewed. Kummer's theory of ideal numbers for K is used to develop an interpretation of the class number of K and to explain how small class numbers suggest that the integers of the field are close to being uniquely factorable. Background material is presented to interpret the vocabulary needed for the interpretation. The class number is shown to be useful in studying Fermat's last theorem. The application of the computer in studying the class number and connected topics such as Fermat's last theorem is discussed. Dissert. Abstr.

N80-18798 Duke Univ., Durham, N. C.
A HEYTING ALGEBRA BESTIARY, TERTIUM DAMUS Ph.D. Thesis
Samuel Bishop Johnson 1979 176 p

Avail: Univ. Microfilms Order No. 8003627

The concept of a Heyting algebra which is a generalization of the concept of a Boolean algebra is discussed. The definitions and facts of Heyting algebra are reviewed. Results concerning the structure of Heyting algebras, their varieties, and their relation to topoi are established. Four major results are established: (1) the free Heyting algebra on one generator is analyzed; (2) it is shown that the lattice of varieties of Heyting algebras contains a sublattice isomorphic to the lattice of all subsets of the natural numbers; (3) through construction of the appropriate topos it is shown that each Boolean algebra appears as the subobjects of the terminator in some value based topos; (4) the free Heyting algebra on two generators is shown to appear as the subobjects of the terminator in no value based topos. Dissert. Abstr.

N80-18799 Florida Univ., Gainesville.
ON DISCRETE METRICS AND BETWEENNESS RELATIONS Ph.D. Thesis
Edward Richard Howorka 1979 147 p
Avail: Univ. Microfilms Order No. 8002866

Classes of graphs G defined by conditions imposed on the metric or betweenness space associated with G are reported. It is shown that the class of integer valued metric spaces realizable in Husimi trees is characterized by a classical condition used often to describe the tree realizable metric spaces, the so called four point condition. Several other metric conditions satisfied by trees are considered, and the corresponding classes of graphs characterized. Distance hereditary graphs (graphs G whose connected induced subgraphs preserve the distance of G) are described in terms of their cycle and clique structure. Ptolemaic graphs (graphs whose associated metric space is ptolemaic) are shown to be distance hereditary. Several characterizations of ptolemaic graphs are given, and an operation is exhibited which generates finite ptolemaic graphs from complete graphs. Dissert. Abstr.

N80-18800 Houston Univ., Tex.
MANIFOLDS WITH GENERALIZED BOUNDARY AND DIFFERENTIAL SEMIGROUPS Ph.D. Thesis
George Erwin Graham 1979 79 p
Avail: Univ. Microfilms Order No. 8005125

The notion of a Frechet derivative is strengthened to apply to vector valued functions on subsets of Euclidean space with dense interior, and the possibility of extending differentiable functions is examined for certain special cases. The chain rule, inverse function theorem, and several other theorems from advanced calculus are established. The differential geometry is developed with emphasis on differentiable structures, the tangent bundle, products, vector fields, and the Lie bracket operation on vector fields. Differentiable semigroups are discussed. A differentiable semigroup is a semigroup S on an n-manifold with generalized boundary such that the multiplication function is differentiable. It is shown that if S has an identity, then the multiplication satisfies a cancellation law in a neighborhood of the identity. Dissert. Abstr.

N80-18801 Georgetown Univ., Washington, D.C.
K-UNIFORMLY CONVEX BANACH SPACES Ph.D. Thesis
Raymond Sylvester Geremia, Jr. 1979 116 p
Avail: Univ. Microfilms Order No. 8004693

Geometric properties of a Banach space which generalize uniform convexity was studied. These properties make use of notions of volume and area in a Banach space and it is shown that these notions are consistent with one's intuitions about volume and area. Results are shown for Banach spaces that are 2-uniformly convex or locally 2-uniformly convex. For spaces that are locally 2-uniformly convex it is shown that the concepts of norm and weak sequential convergence on the unit sphere are equivalent. It is also shown that the metric projection onto a closed and convex Chebyshev set is continuous in these spaces. Dissert. Abstr.

N80-18802 Arizona Univ., Tucson.
MULTIPHASE AVERAGING OF PERIODIC SOLITON EQUATIONS Ph.D. Thesis
Mark Gregory Forest 1979 293 p
Avail: Univ. Microfilms Order No. 8003057

The multiphase averaging of periodic soliton equations is considered. The periodic sine-Gordon equation and its associated inverse spectral theory are analyzed, including a discussion of the spectral representations of exact, N-phase sine-Gordon solutions. The physical characteristics of the periodic waves are emphasized with a motivation from the well-known whole-line solutions. A canonical Hamiltonian approach for the modulational theory of N-phase waves is prescribed. A concrete illustration of this averaging method is provided with the periodic sine-Gordon equation. For the KdV equation, very general results are given for multiphase averaging of the N-phase waves. Single-phase results are extended to general N phases, and more importantly, an invariant representation in terms of Abelian differentials on a Riemann surface is provided. Several consequences of this invariant representation are deduced, including strong evidence for the Hamiltonian structure of N-phase modulational equations. Dissert. Abstr.

N80-18803 Illinois Univ. at Urbana-Champaign.
SOME OPTIMAL AND NEAR-OPTIMAL LOW RATE ALGEBRAIC CONVOLUTION CODES Ph.D. Thesis
Robert Charles Eaker 1979 107 p
Avail: Univ. Microfilms Order No. 8004161

The algebraic structure of certain classes of convolutional codes and several classes of optimal or near optimal convolutional codes are presented. Classes of Abelian codes which are ideals in a group algebra are discussed. It is shown that these Abelian codes and their weight distribution play a fundamental role in the construction and analysis of convolutional codes. Dissert. Abstr.

N80-18804 Florida Univ., Gainesville.
CONVERGENCE THEOREMS FOR ABSTRACT ASYMPTOTIC MARTINGALES Ph.D. Thesis
Robert Wayne Smith 1979 88 p
Avail: Univ. Microfilms Order No. 8002899

Convergence theorems are derived for asymptotic martingales which take values in a locally convex topological vector space and for scalar valued asymptotic martingales which are integrable with respect to a measure which takes values in such a space. Basic concepts and terminology concerning asymptotic martingales of real valued random variables are established. Several convergence theorems are developed for weakly measurable Pettis integrable asymptotic martingales which take values in a locally convex topological vector space. Conditions which insure a discrete parametered asymptotic martingale converges are obtained almost everywhere in the weak topology as well as Conditions guaranteeing weak convergence in measure of a continuous parametered asymptotic martingale. Dissert. Abstr.

N80-18805 Oklahoma State Univ., Stillwater.
DIVISIBILITY IN 3-MANIFOLD GROUPS Ph.D. Thesis
Stephen Andrew Sedory 1979 69 p
Avail: Univ. Microfilms Order No. 8003600

The scope of study for this research is concerned with answering the following group theoretic question. Given a positive integer n and an element g in a group G, does there exist in G a solution to the equation Xn = g? The question is restricted to those groups which occur as the fundamental group of certain 3-manifolds. It is translated to a topological setting and there becomes the question of whether a given loop in a given manifold is freely homotopic to a power of some other loop. The geometric properties of the class of manifolds considered are exploited to answer this question. The findings and conclusions are that an algorithm is constructed which answers the above question for those groups occurring as the fundamental group of compact, orientable, irreducible, sufficiently large 3-manifolds which contain no essential annuli or tori in their entire hierarchy. The algorithm provides, for a given manifold M and loop l in M, a list of all those positive integers n for which l is freely homotopic to the nth power of some loop sigma sub n. Further, for each such n, the algorithm constructs such a loop sigma sub n. Dissert. Abstr.

N80-18806 Pittsburgh Univ., Pa.
MAXIMUM LIKELIHOOD ESTIMATION IN AUTOREGRESSIVE PROCESSES WITH MISSING OBSERVATION Ph.D. Thesis
Suan-Boon Tan 1979 90 p
Avail: Univ. Microfilms Order No. 8004879

Three methods are proposed for estimation in autoregressive processes when there are missing observations. These methods use a maximum likelihood approach and are based on the EM algorithm, the Newton-Raphson method, and the method of scoring applied to the likelihood equations. The resulting estimation equations are modified by excluding certain asymptotically negligible terms. Under suitable conditions on missing patterns estimates obtained from the Newton-Raphson method and the method of scoring are consistent, asymptotically normal and one-step asymptotically efficient if the initial estimates are consistent. Additionally, estimation in autoregressive moving average processes with missing observations is considered. Finally, extension to vector autoregressive moving average processes with missing observations is also discussed. Dissert. Abstr.

N80-18807 Rensselaer Polytechnic Inst., Troy, N. Y.
A MATHEMATICAL MODEL OF SPATIALLY LOCALIZED NEURAL SYSTEMS Ph.D. Thesis
James Richard Brannan 1979 122 p
Avail: Univ. Microfilms Order No. 8004755

A probabilistic model of a spatially localized, mutually excitatory (inhibitory) population of neurons is formulated. The state variable of a typical neuron within a densely interconnected population of neurons is assumed to be a stochastic process, X(t), representing the difference in electromagnetic potential across the cell membrane at the soma. The stochastic differential equation formulated for X(t) is that of a jump process, but physiological considerations suggest that a diffusion approximation is viable. Sufficient conditions for a diffusion model are derived. The Fokker-Planck diffusion equation is then modified to allow for: (1) a refractory period following absorption of the process at a boundary; and (2) excitatory (inhibitory) feedback from within the population. The resulting nonlinear hybrid system of equations provides a concise description of the activity of the neural populations under consideration. Dissert. Abstr.

N80-18808 Oklahoma State Univ., Stillwater.
THE DEVELOPMENT OF NORMAL FUNCTIONS Ph.D. Thesis
Joan E. Palsmeier Bell 1979 105 p
Avail: Univ. Microfilms Order No. 8003557

The development of normal functions from their origin to the present is discussed. Normal functions are defined in terms of normal families, which had their beginning in 1912. The term normal function first appeared in print in 1957 in an paper by Lehto and Virtanen in which they extended the Lindelof property from analytic and bounded to meromorphic functions. Many results on normal functions have since appeared in the mathematical journals. The analyzation of these theorems resulted in the grouping of the theorems into five major categories, which are presently abbreviated as those related to uniform rho-d continuity, generalizations of several of Lehto and Virtanen's results, cluster sets, the spherical derivative, and miscellaneous results. Among the areas for future study are normal harmonic functions and variations of normality. The study shows that since the paper by Lehto and Virtanen, normal functions have become an important area in the field of complex variables. Dissert. Abstr.

N80-18809# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
APPROXIMATION BY POLYNOMIAL ARCS TO GENERATE SUBOPTICAL NUMERICAL SOLUTIONS IN CONTROL PROBLEMS
Atair Rios Neto Dec. 1979 11 p refs Presented at 5th COBEM Conf., Campinas, Spain, 12 Dec. 1979 Revised
(INPE-1642-RPE/098-Rev) Avail: NTIS HC A02/MF A01

A direct search procedure is proposed for generating suboptimal numerical solutions for dynamical systems optimal control problems. An approximation by polynomial arcs for the control function is taken and a first order gradient type of numerical search is adopted, reducing the problem in each iteration, to one of parameter optimization. R.C.T.

N80-18810# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE BOLTZMANN AND THE FOKKER-PLANCK EQUATIONS
J. A. Bittencourt Oct. 1979 60 p
(INPE-1606-RPE/082-Rev) Avail: NTIS HC A04/MF A01

A derivations are presented of the Boltzmann collision integral, which applies to the case of binary collisions in a dilute gas, and of the Fokker-Planck collision term, which applies to the case of multiple Coulomb interactions in a plasma. The assumptions involved in the derivation of the Boltzmann collision integral, and its irreversible character, are discussed. An anlaysis of Boltzmann's H theorem and a derivation of the equilibrium Maxwell-Boltzmann distribution function, based on a maximum entropy approach, are also presented. An aproximate expression for the Boltzmann collision term, valid for a weakly ionized plasma, is obtained through a spherical harmonic expansion of the distribution function. Next the Fokker-Planck equation is derived, starting from the Boltzmann collision integral. Finally, the Fokker-Planck coefficients are calculated for the Coulomb interaction and applied to the case of electron-ion collisions. Author

N80-18811*# National Aeronautics and Space Administration, Washington, D. C.
NUMERICAL INSTABILITY AND STABILIZATION OF THE KINEMATIC DIFFERENTIAL EQUATION USING QUATERNIONS
W. Geiger Nov. 1979 9 p refs Transl. into ENGLISH from Z. Angew. Math. Mech. (West Germany), v. 59, no. 5, May 1979 p T 118 - T 120 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75731) Avail: NTIS HC A02/MF A01 CSCL 12A

The possibility of using quaternions to describe the position of a gyroscope with a given rotating vector is discussed. K.L.

N80-18812# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
A PROJECTED STOCHASTIC APPROXIMATION METHOD FOR ADAPTIVE FILTERS AND IDENTIFIERS Interim Report
Harold J. Kushner 22 Aug. 1979 15 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-77; NSF ENG-77-12946)
(AD-A078602; AFOSR-79-1250TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report deals with a great variety of stochastic approximation procedures, for constrained and unconstrained systems and for convergence w.p.1. and weak convergence, all for systems with correlated inputs. The techniques are readily usable for many problems that are not explicitly treated there. This will be illustrated here for one particular class of constrained problems which is of great current interest and which arises in identification and in adaptive control theory. In fact, it is just such constrained problems to which more attention should be given, owing to their prevalence. The proofs are contained in various parts and, after the problem is defined, it is shown how to put the bits and pieces together. The problem and method are typical of a large class of adaptive systems which can be treated by similar methods, and is worth singling out. GRA

N80-18813# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
REMARKS ON BIFURCATION THEORY IN DIFFERENTIAL EQUATIONS Interim Report
Jack K. Hale 1979 13 p refs
(Grants AF-AFOSR-3092-76; DAAG27-76-G-0294; NSF MCS-79-05774)
(AD-A078689; AFOSR-79-1247TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper discusses primarily the idea of genericity in bifurcation theory for one and two parameter problems. Recent results on homoclinic points are mentioned as well as a connection between the bifurcation function and dynamic behavior. GRA

N80-18814# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
STABILITY FROM THE BIFURCATION FUNCTION Interim Report
Jack K. Hale 11 Oct. 1979 13 p refs
(Grants AF-AFOSR-3092-76; DAAG27-76-G-0294; NSF

MCS 79-05774; AF Proj. 2304)
(AD-A078688; AFOSR-79-1248TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This paper contains an extension to C superscript k -vector fields of the classical results of Liapunov on the stability of an equilibrium point in the critical case of one zero root. The transformation theory of Liapunov is not applicable to this case. We exploit fundamental relations from bifurcation theory. GRA

N80-18815# California Univ., Berkeley. Electronic Research Lab.
NO PERIOD TWO IMPLIES CONVERGENCE, OR WHY USE TANGENTS WHEN SECANTS WILL DO
W. Kahan. Oct. 1979. 63 p. refs
(Contract N00014-76-C-0013)
(AD-A078479; UCB/ERL-M79/61) Avail: NTIS
HC A04/MF A01 CSCL 12/1

A familiar task is to solve f(x) = 0 given a continuously differentiable real function f. Newton's iteration could be tried; so could the Secant iteration. Except when the derivative f' costs appreciably less to evaluate than does f, the Secant iteration tends in practice to converge ultimately more efficiently than Newton's whenever both iterations converge to the desired root. When will they both converge? We find roughly that wherever Newton's iteration converges from every starting point in an interval I, so must the Secant iteration converge from every pair of starting points in I provided only that f actually reverses sign in I. This is an unexpected way for the Secant iteration to dominate Newton's. GRA

N80-18816# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
MULTIPLE INTEGRAL EXPANSIONS FOR NONLINEAR FILTERING. Interim Report
S. K. Mitter and D. Ocone. Sep. 1979. 8 p. refs
(Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A078490; AFOSR-79-1256TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In their seminal paper, Fujisaki, Kallianpur and Kunita showed how the best least squares estimate of a signal contained in additive white noise can be represented as a stochastic integral with respect to innovation process, the integral being adapted to the observation process. The difficulty with this representation is that in general, this estimate is not useful for computing the estimate since the innovations process depends on the estimate of the signal itself. In this paper we discuss representation of the estimate directly in terms of the observation process. In doing so, we derive new results on multiple integral expansions for square-integrable functionals of the observation process and show the connection of this work to the theory of contraction operators on Fock space. This letter development is due to Nelson and Segal. We also present several applications of these results to determining sub-optimal filters. GRA

N80-18817# Massachusetts Inst. of Tech., Cambridge. Computer Science Lab.
PROBABILISTIC ALGORITHMS IN FINITE FIELDS
Michael O. Rabin. Jan. 1979. 29 p. refs
(Contract N00014-75-C-0661)
(AD-A078416; MIT/LCS/TR-213) Avail: NTIS
HC A03/MF A01 CSCL 12/1

We present probabilistic algorithms for the problems of finding an irreducible polynomial of degree n over a finite field, finding roots of a polynomial, and factoring a polynomial into its irreducible factors over a finite field. All of these problems are of importance in algebraic coding theory, algebraic symbol manipulation, and number theory. These algorithms have a very transparent, easy to program structure. For finite fields of large characteristic p, so that exhaustive search through z sub p is not feasible, or algorithms are of lower order in the degrees of the polynomial and fields in question, than previously published algorithms. GRA

N80-18818# Brown Univ., Providence, R. I. Applied Report
AN EXAMPLE OF BIFURCATION TO HOMOCLINIC ORBITS
Shui-Nee Chow (Michigan State Univ., East Lansing), Jack K. Hale, and John Mallet-Paret. 1 Sep. 1979. 32 p.
(Grants AF-AFOSR-3092-76; NSF MCS-76-06739; NSF MCS-79-05774; DAAG27-76-G-0294; AF Proj. 2304)
(AD-A078432; AFOSR-79-1240TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The purpose of this paper is to determine the curves in lambda-space of bifurcation to strange attractors and to relate this to hyperbolic subharmonic bifurcations. GRA

N80-18819# Florida State Univ., Tallahassee. Dept. of Statistics.
UNIFIED TREATMENT OF SOME INEQUALITIES AMONG RATIOS OF MEANS. Interim Report
Emad El-Neweihi and Frank Proschan. Oct. 1979. 8 p. refs
(Grant AF-AFOSR-3678-78; AF-AFOSR-3050-76; AF Proj. 2304)
(AD-A078464; FSU-Statistics-M524; AFOSR-79-1230TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Using majorization and Schur-functions, Marshall, Olkin, and Proschan obtained a result concerning monotonicity of the ratio of means. This note shows that a slight extension of their result provides a unified method for obtaining and extending inequalities between means due to Chan, Goldberg, and Gonek, as well as deriving additional inequalities of the same type. GRA

N80-18820# Maryland Univ., College Park. Computer Vision Lab.
IMAGE MODELS. Interim Report
Narendra Ahuja and Azriel Rosenfeld. Jul. 1979. 38 p. refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A078468; TR-781; AFOSR-79-1158TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This paper reviews pixel-based and region-based ('structural') image models. The former include both one-dimensional time series and random field models, with the properties of the field specified either locally or globally. GRA

N80-18821# Maryland Univ. Baltimore County, Baltimore. Dept. of Mathematics.
DETECTION, ESTIMATION, AND CONTROL ON GROUP MANIFOLDS. Final Report, 1 Jun. 1974 - 31 May 1979
James T. Lo. 31 May 1979. 22 p.
(Grant AF-AFOSR-2671-74; AF Proj. 2304)
(AD-A077707; AFOSR-79-1093TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The results covered by this final report can be put in two categories - continuous-time systems and discrete-time systems. The continuous-time systems considered are bilinear in form. The bilinear systems have been extensively studied in recent years for three primary reasons. First, it has been shown that bilinear systems are feasible mathematical models for large classes of problems of practical importance. Second, bilinear systems provide higher order approximations to nonlinear systems than do linear systems. Third, bilinear systems have rich geometric and algebraic structures which promise a fruitful field of research. GRA

N80-18822# Florida State Univ., Tallahassee. Dept. of Statistics.
EXTREME POINTS OF CERTAIN CONVEX SUBSETS OF LOG-CONVEX FUNCTIONS
Naftali A. Langberg, Ramon V. Leon, James Lynch, and Frank Proschan. Aug. 1979. 18 p. refs. Sponsored in part by NSF, Washington, D.C.
(Contract DAAG29-79-C-0158; Grant AF-AFOSR-3678-78)
(AD-A077549; FSU-Statistics-M519; TR-D-34-ARO; AFOSR-78-14TR; ARO-16713.2-M) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The identification of the extreme points of a convex set is an important problem in mathematics. One reason for identifying the extreme points is that they are, in many instances, the basic building blocks for the convex set. For instance, when the convex set is a compact subset of a locally convex space it is the closed convex hull of its extreme points (Krein-Milman Theorem) and if in addition the set is metrizable, any point in it has an integral representation in terms of the extreme points (Choquet's Theorem). Recently the extreme points for certain types of convex compact sets of probability distributions which occur in reliability theory have been identified. The extreme points for the set of discrete decreasing failure rate distributions are identified

without appealing to Choquet's Theorem, give an explicit representation for these distributions in terms of the extreme points. It turns out that techniques employed in this last paper can be used to identify the extreme points for certain convex sets of log-convex functions. The purpose of this paper is to present these results. GRA

N80-18823# Wisconsin Univ. - Madison. Mathematics Research Center.
ON THE ESTIMATION OF FUNCTIONS OF SEVERAL VARIABLES FROM AGGREGATED DATA Summary Report
Nira Dyn and Grace Wahba. Jul. 1979. 39 p. refs.
(AD-A077105; MRC-TSR-1974) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This work was motivated by the problem of obtaining a smooth density function over a geographical region from data aggregated over irregular subregions. Minimization of a family of roughness criteria given 'volume' data lead to smooth multivariate functions Laplacian histosplines, having a certain order of the iterated Laplacian of constant value in each of the subregions and satisfying natural boundary conditions on the boundary of the region. For inexact data, e.g., in case of estimating an underlying density given counts of events by subregions, Laplacian smoothing histosplines are constructed, analogous to smoothing splines in the univariate case, and a method for choosing the smoothing parameter is presented. For both cases of exact and inexact data, modified roughness criteria, independent of the region, are discussed, and results known for point-evaluation data are extended to the case of aggregated data. GRA

N80-18824# Wisconsin Univ. - Madison. Mathematics Research Center.
FFT AS NESTED MULTIPLICATION, WITH A TWIST
Carl deBoor. Jun. 1979. 12 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077099; MRC-TSR-1968) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A simple, yet complete and detailed description of the Fast Fourier Transform for general N is given, with the aim of making the underlying idea quite apparent. To help with this didactic goal, a simple twist, i.e., a shifting of information from rows to columns during the calculations, is introduced which allows to give a simple meaning to intermediate results and assures that the final results need no further reordering. GRA

N80-18825# Wisconsin Univ. - Madison. Mathematics Research Center.
A NEWTON METHOD FOR THE PIES ENERGY MODEL
Norman H. Josephy. Jun. 1979. 33 p. refs.
(Contract DAAG29-75-C-0024; Grant NSF MCS-74-20584)
(AD-A077102; MRC-TRC-1971) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Newton's method is a well known and often applied technique for computing a zero of a nonlinear function. By using the theory of generalized equations, a Newton method has been developed to solve problems arising in both mathematical programming and mathematical economics. It is shown how Newton's method for generalized equations can be applied to the economic equilibrium problem of the Project Independence Evaluation System (PIES) Energy Model. Solutions to a simplified version of PIES are obtained using a Newton method, and comparisons are made to solutions which have appeared in the literature. GRA

N80-18826# Wisconsin Univ. - Madison. Mathematics Research Center.
HOGAN'S PIES EXAMPLE AND LEMKE'S ALGORITHM
Norman H. Josephy. Jun. 1979. 18 p. refs.
(Contract DAAG29-75-C-0024; Grants NSF MCS-74-20584; NSF DCR-74-20584)
(AD-A077103; MRC-TRC-1972) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Newton's method for generalized equations (Josephy (3)) was applied to the economic equilibrium problem of the Project Independence Evaluation System (PIES) Energy Model. The resulting algorithm involves solving a sequence of linear complementary problems. Lemke's complementary pivot algorithm is used for this purpose. In this paper, it is shown that the linear complementarity problems will be copositive plus when the negative of the elasticity matrix, -e, of the consumer's quantity vs. price relation has the following properties: (1) positive diagonals, (2) negative off-diagonals, and (3) strict diagonal dominance. These conditions are satisfied for Hogan's example. Thus, Lemke's algorithm will either converge to a solution or show that no solution exists. Under the conditions of Theorem 1 of Josephy, a solution to the linear complementarity problems will always exist. Hence, Lemke's algorithm can be used when the conditions of the Theorem 1 of Josephy are satisfied. GRA

N80-18827# Wisconsin Univ. - Madison. Mathematics Research Center.
GLOBAL AND SUPERLINEAR CONVERGENCE OF A CLASS OF SCALED VARIABLE METRIC METHODS
Klaus Ritter. Jun. 1979. 41 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077098; MRC-TSR-1967) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This paper considers a class of variable metric methods for unconstrained minimization. The update formulas are such that the quasi-Newton equation is not necessarily satisfied. Under appropriate assumptions on the function to be minimized, each algorithm in this class converges globally and superlinearly. Many practical problems in operations research may be reduced to minimizing a function with or without constraints. By means of penalty functions and similar techniques a constrained minimization problem can be converted into a sequence of unconstrained minimization problems. GRA

N80-18828# Wisconsin Univ. - Madison. Mathematics Research Center.
QUASI-NEWTON METHODS FOR GENERALIZED EQUATIONS
Norman H. Josephy. Jun. 1979. 26 p. refs.
(Contract DAAG29-75-C-0024; Grants NSF MCS-74-20584; NSF DCR-74-20584)
(AD-A077097; MRC-TSR-1966) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Newton's method is a well known and often applied technique for computing a zero of a nonlinear function. Situations arise in which it is undesirable to evaluate, at each iteration, the derivative appearing in the Newton iteration formula. In these cases, a technique of much modern interest is the quasi-Newton method, in which an approximation to the derivative is used in place of the derivative. By using the theory of generalized equations, quasi-Newton methods are developed to solve problems arising in both mathematical programming and mathematical economics. Two results concerning the convergence and convergence rate of quasi-Newton methods for generalized equations. Computational results of quasi-Newton methods applied to a nonlinear complementarity problem of Kojima. GRA

N80-18829# Wisconsin Univ. - Madison. Mathematics Research Center.
CALCULATING CONSTRAINTS ON RELATIONAL EXPRESSIONS
A. Klug. May 1979. 84 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077092; MRC-TSR-1961) Avail: NTIS
HC A05/MF A01 CSCL 12/1

A desirable feature of a database management system is the ability to support many views of the database via several user models. In order to provide this support while allowing the user to believe that his/her view and data model are the only ones, the database system must have a number of facilities. One of the most important of these is a mechanism to tell when view constraints will be satisfied given that the underlying database constraints are satisfied so that the user always sees what is expected. This paper deals with a particular instance of this problem where the constraints are functional dependencies and the views are created through relational algebra expressions. The problem immediately reduces to the problem of calculating all valid functional dependencies (and other constraints) on a relational algebra expression over relations in the base schema. The problem is undecidable in general but we give a sound and

complete algorithm when set difference is omitted from relational algebra. GRA

N80-18830# Wisconsin Univ., Madison. Mathematics Research Center.
NEWTON'S METHOD FOR GENERALIZED EQUATIONS Summary Report
Norman H. Josephy. Jun. 1979. 37 p. refs.
(Contract DAAG29-75-C-0024; Grants NSF MCS-74-20584; NSF DCR-74-20584)
(AD-A077096; MRC-TSR-1965) Avail: NTIS HC A03/MF A01 CSCL 12/1
Newton's method is a well known and often applied technique for computing a zero of a nonlinear function. By using the theory of generalized equations, a Newton method is developed to solve problems arising in both mathematical programming and mathematical economics. Two results concerning the convergence and convergence rate of Newton's method are proved for generalized equations. Examples are given to emphasize the application of this method to generalized equations representing the non-linear programming problem and the nonlinear complementarity problem. Computational results of Newton's method applied to a nonlinear complementarity problem of Kojima, and an invariant capital stock problem of Hansen and Koopmans are both presented. GRA

N80-18831# Battelle Human Affairs Research Centers, Seattle, Wash.
JACKKNIFE, RIDGE AND ORDINARY LEAST SQUARES ESTIMATORS OF REGRESSION PARAMETERS: A MONTE CARLO COMPARISON
Michael K. Lindell. Sep. 1979. 32 p. refs.
(Contract N00014-77-C-0127)
(AD-A077724; B-HARC-422-031) Avail: NTIS HC A03/MF A01 CSCL 12/1
This study reports the results of a Monte Carlo evaluation of the small sample performance of ordinary least squares OLS, ridge and jackknife estimators of regression coefficients. The primary criteria of evaluation are the mean square error MSE of the regression coefficients and the size of the t-statistics associated with these coefficients. The conditions studied are derived from a design in which two factors are varied the sample size to number of predictors N/P ratio and the metric quality of the data dichotomous and polychotomous. Results from 500 replications of each of six cells showed that OLS and jackknife estimators did not differ appreciably on either criterion. Ridge weights had substantially smaller MSE at the lowest levels of N/P 51. At high levels of N/P 201, ridge weights had a slightly greater MSE than either OLS and jackknifed weights. A dilemma in the use of t-statistics for ridge weights is presented. GRA

N80-18832# Texas Univ. at Austin.
SMOOTHING AND APPROXIMATION OF MULTIVARIATE FUNCTIONS Final Report, 10 Sep. 1977 - 9 Sep. 1979
E. W. Cheney. 31 Oct. 1979. 10 p. refs.
(Grant DAAG29-77-G-0215)
(AD-A078640; ARO-14900.9-M) Avail: NTIS HC A02/MF A01 CSCL 12/1
The goal of the research project was to proceed as far as possible in the study of a certain class of practical approximation problems. Namely, the problem is to reduce the complexity of multivariate functions by representing them precisely or approximately by combinations of univariate functions. A prototype problem is that of finding a best approximation to a function of two variables, F(x,Y), by a sum g(x) H(y). The prototype problem is thoroughly understood in the case that the functions involved are continuous and an approximation in the uniform sense is needed. GRA

N80-18833# Texas Univ. at Austin. Center for Cybernetic Studies.
A LINEAR PROGRAMMING APPROACH TO A SIMPLE LINEAR REGRESSION PROBLEM WITH LEAST ABSOLUTE VALUE CRITERION
R. D. Armstrong and M. T. Kung. Sep. 1979. 15 p. refs.
(Contracts N00014-75-C-0616; N00014-75-C-0569)
(AD-A078622; CCS-351) Avail: NTIS HC A02/MF A01 CSCL 12/1
This paper presents a linear programming approach to solve simple linear regression problems with the least absolute value criterion. The solution technique uses linear programming with an extended minimum ratio rule. A computational study indicates the efficiency of the algorithm. GRA

N80-18834# Princeton Univ., N. J. Dept. of Statistics.
ASYMPTOTIC INFERENCE FOR EIGENVECTORS
David E. Tyler. Oct. 1979. 27 p. refs.
(Contracts N00014-67-A-0151; N00014-75-C-0453; Grants DAHC04-74-G-0178; ERDA-E-111-2310)
(AD-A078960; TR-157-Ser-2) Avail: NTIS HC A02/MF A01 CSCL 12/1
Asymptotic procedures are given for testing certain hypotheses concerning eigenvectors and for constructing confidence regions for eigenvectors. These asymptotic procedures are derived under fairly general conditions on the estimates of the matrix whose eigenvectors are of interest. Applications of the general results to principal components analysis and canonical variate analysis are given. GRA

N80-18835# Princeton Univ., N. J. Dept. of statistics.
AN IMPLICIT FUNCTION THEOREM FOR GROUP EQUATIONS GENERATED BY A FINITE AUTOMATION
Philip R. Thrift. Aug. 1979. 10 p. refs.
(Contract N00014-79-C-0322)
(AD-A078959; TR-150-Ser-2) Avail: NTIS HC A02/MF A01 CSCL 12/1
The study of mathematical semantics involves the study of mappings from a formal language L to a configuration space C. In this paper we consider the special case where L = L(D), D is a finite automaton, C is a group G, and the semantic map is defined by associating each production of D with a group element of G, p approaches theta (P). A sequence of productions would then be mapped to a product of corresponding group elements. When the semantic map is observed on sentences in L(D), we discuss a graph-theoretic method of solving for theta. GRA

N80-18836# Kentucky Univ., Lexington. Dept. of Mathematics.
REALIZATION THEORY FOR MULTIVARIATE GAUSSIAN PROCESSES, 2: STATE SPACE THEORY REVISITED AND DYNAMICAL REPRESENTATIONS OF FINITE DIMENSIONAL Interim Report
Anders Lindquist and Giorgio Picci. Jul. 1979. 30 p. refs.
Presented at the 2d Intern. Conf. on Inform. Sci. and Systems, Patras, Greece, 9-14 Jul. 1979.
(Grants AF-AFOSR-3519-76; NSF Eng-79-03731; AF Proj. 2304)
(AD-A078749; AFOSR-79-1275TR) Avail: NTIS HC A03/MF A01 CSCL 12/1
The purpose of this paper is twofold. First, some of the results of Part I are generalized and clarified, reformulated in a mathematical framework which we now perceive as more natural and conceptually sounder, the basic concept being perpendicularly intersecting subspaces. By relating minimality of stochastic realizations to the factorization of certain Hankel operators, the connections to deterministic realization theory is further clarified. Furthermore, spectral domain criteria for minimality, observability and constructibility are presented. Secondly, stochastic differential equation representations are presented for all state spaces which are finite dimensional. The infinite dimensional case will be the topic of Part III of this sequence of papers. GRA

N80-18837# Florida Univ., Gainesville. Center for Mathematical System Theory.
MATHEMATICAL TECHNIQUES FOR NONLINEAR SYSTEM THEORY
R. E. Kalman and E. Emre. May 1979. 2 p.
(Contract AF-AFOSR-3034-76; AF proj. 2304)
(AD-A078715; AFOSR-79-1255TR) Avail: NTIS HC A02/MF A01 CSCL 12/1
The main topic of research concerned various algebraic characterizations of F mod G invariant subspaces in linear systems. Module-theoretic characterizations of these subspaces were obtained which showed among other results, that a module structure can be defined maximally on the ratio of V to R where

V is the maximal F mod G invariant subspace contained in the Kernal of H and R is the analogous maximal reachability subspace. A final solution of the so-called partial realization problem was obtained. GRA

N80-18838# Florida State Univ., Tallahassee. Dept. of Statistics.
THE EXTREME POINTS OF THE SET OF DECREASING FAILURE RATE DISTRIBUTIONS Interim Report
Naftali A. Langberg, Ramon V. Leon, James Lynch, and Frank Proschan. Aug. 1979. 18 p. refs. Revised.
(Grants AF-AFOSR-3678-78; NSF MCS-79-04698; AF Proj. 2304)
(AD-A078774; FSU-Statistics-M484-Rev; TR-78-5-Rev; AFOSR-79-1219TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Since the class of extended decreasing failure rate (EDFR) life distributions (i.e., distributions with support in (0, infinity)) is compact and convex, it follows from Choquet's Theorem that every EDFR life distribution can be represented as a mixture of extreme points of the EDFR class. We identify the extreme points of this class and of the standard class of decreasing failure rate (DFR) life distributions. Further, we show that even though the convex class of DFR life distributions is not compact, every DFR life distribution can be represented as a mixture of extreme points of the DFR class. GRA

N80-18839# California Univ., Los Angeles. Dept. of Mathematics.
PROBLEM IN STABILITY ANALYSIS OF FINITE DIFFERENCE SCHEMES FOR HYPERBOLIC SYSTEMS Interim Report, 6 Jan. 1978 - 31 May 1979
Moshe Goldberg. 1979. 6 p. refs.
(Grant AF-AFOSR-3046-76; AF Proj. 2304)
(AD-A078853; AFOSR-79-1285TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The research consists mainly of generalizing previous work to obtain new, easily checkable stability criteria for general, dissipative or nondissipative, explicit or implicit difference approximations to hyperbolic mixed initial-boundary value problems. The criteria obtained are independent of the basic scheme and are given solely in terms of the boundary conditions; thus they are significantly more convenient than traditional criteria. The results imply that many well known boundary conditions, when used in combination with arbitrary dissipative or nondissipative schemes, always maintain stability. GRA

N80-18840# Wisconsin Univ. - Madison. Mathematics Research Center.
AN ENERGETIC APPROACH TO HOMOGENIZATION PROBLEMS WITH RAPIDLY OSCILLATING POTENTIALS Summary Report
Hedy Attouch. Aug. 1979. 52 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A077134; MRC-TSR-1989) Avail: NTIS HC A04/MF A01 CSCL 12/1

It is shown that many, a priori distinct, problems of homogenization including the case of rapidly oscillating potentials can be studied, and the limit problem computed, in a unified way, through general compactness and convergence results for sequences of functionals of calculus of variations. The convergence notion is taken in variational sense, more precisely by the notion of Gamma-convergence introduced by De-Giorgi. GRA

N80-18841# Wisconsin Univ. - Madison. Mathematics Research Center.
A GLOBALLY AND QUADRATICALLY CONVERGENT ALGORITHM FOR GENERAL NONLINEAR PROGRAMMING PROBLEMS Summary Report
Michael J. Best (Waterloo Univ., Ontario), Jurgen Brauninger (Stuttgart Univ., W. Germany), Klaus Ritter (Stuttgart Univ., W. Germany), and Stephen M. Robinson. Jul. 1979. 22 p. refs. Sponsored in part by NSF.
(Contract DAAG29-75-C-0024; Grant NSF MCS-74-20584)
(AD-A077104; MRC-TSR-1973) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents an algorithm for the minimization of a nonlinear objective function subject to nonlinear inequality and equality constraints. The proposed method has the two distinguishing properties that, under weak assumptions, it converges to a Kuhn-Tucker point for the problem and under somewhat stronger assumptions, the rate of convergence is quadratic. The method is similar to a recent method proposed by Rosen in that it begins by using a penalty function approach to generate a point in a neighborhood of the optimum and then switches to Robinson's method. The new method has two new features not shared by Rosen's method. First, a correct choice of penalty function parameters is constructed automatically, thus guaranteeing global convergence to a stationary point. Second, the linearly constrained subproblems solved by the Robinson method normally contain linear inequality constraints while for the method presented here, only linear equality constraints are required. That is, in a certain sense, the new method 'knows' which of the linear inequality constraints will be active in the subproblems. The subproblems may thus be solved in an especially efficient manner. Preliminary computational results are presented. GRA

N80-18842# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
REMARKS ON THE CALCULATION OF THE KERNEL APPROXIMATION IN UNSTEADY AERODYNAMICS [REMARQUES SUR LE CALCUL DU NOYAU EN AERODYNAMIQUE INSTATIONNAIRE]
R. Barreau. Paris: Assoc. Aeron. et Astronautique de France. 1979. 35 p. refs. In FRENCH. Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978.
(Contract DRET-78-34-113-00)
(AAAF-NT-79-07; ISBN-2-7170-0534-X) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

Different analytic methods used in the calculation of unsteady aerodynamic forces are briefly reviewed. Emphasis is placed on calculating time and obtainable numerical precision of the inherent approximation. A kernel function method for deriving the approximations is then presented. In order to realisticaly compare the calculation of the integrals used in the different methods a computer program was used. Results show the kernel method to be twice as fast as any other method tried. Author (ESA)

N80-18843# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
IMPERFECT BIFURCATION AND BANACH SPACE SINGULARITY THEORY
Leif Arkyerd. 1979. 24 p. refs. Prepared in cooperation with Goeteborg Univ.
(CTH-Math-1979-12) Avail: NTIS HC A02/MF A01

The theory of imperfect bifurcation via singularity theory as developed to a Banach space setting is generalized. Banach control spaces which allow a useful uniform control of function parameters through universal unfolding are discussed. Among the results are tests for various germ properties and a discussion of their reducibility under a Liapunov-Schmidt type plitting, as well as a generalization of the finite dimensional unfolding and germ classification theory. Author (ESA)

N80-18844# Polytechnical Univ. of Madrid (Spain). Escuela Tecnica Superior de Ingenieros Telecommunication.
NUMERICAL INTEGRATION OF A CLASS OF SINUSOIDAL FUNCTIONS WHOSE ARGUMENT IS THE INTEGRAL OF A MONOTONIC INCREASING FUNCTION
J. Rivero Laguna, R. Diazdelalglesia, A. Castillo Holgado, and J. M. Hernando Rabanos. Feb. 1979. 10 p. refs. In SPANISH; ENGLISH summary.
Avail: NTIS HC A02/MF A01

A procedure for the evaluation of the integral from zero to T of cos Theta(t) dt, with T constant, where Theta (t) = the integral from zero to t of 2 eta f(zero) + f(d)(u) du, is presented. Numerical methods are used when f(d)(u) is a nonotonic increasing function. Three kinds of functions were studied: linear, tangetial, and hyperbolic. Results can be generalized to other functions. It is also possible to generalize the method to nonotonic decreasing functions with some modifications. Based on the subintegral function chosen, a rule is established for determining the number of integration sub-intervals necessary to meet a relative error criterion. The use of different methods of numerical integration

is considered. Application of the method to the calculation of the Fourier transformation spectrum of a modulated FM-Chirp signal is suggested. Author (ESA)

N80-18845# International Business Machines S. A. E., Madrid (Spain). Scientific Center.
A CENTER-COVARIANCE ADAPTIVE CLUSTERING ALGORITHM
F. Orti. Jun. 1978. 76 p. refs. Original contains color illustrations.
(IBM-SCR-02.78; ISBN-84-3600-046-3) Avail: NTIS HC A05/MF A01

A clustering algorithm, using a proximity measure as a weighted Euclidean distance in which the weight matrix is the inverse of the estimated covariance matrix for each cluster, is presented. Each sample is assigned to the cluster for which this weighted distance is minimum, provided that this minimum does not exceed a given threshold. Otherwise a new cluster with center in the sample is started, unless a given maximum number of clusters has been reached, in which case the sample is rejected and stored for later processing. The number of clusters is controlled by the periodic invocation of a merger routine (to merge clusters very near each other) and an elimination routine to get rid of clusters with very low densities. Several passes through the data are made until the percentage of rejected samples is low, or until a given number of passes is attained. After the clustering run is performed a post-run analysis is made to decide whether some clusters should be merged or not based on a statistical test. Result of some clustering runs on two generated data sets and a LANDSAT image are presented. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-18846 Texas Technological Univ., Lubbock.
ERROR RATES IN POISSON DISCRIMINATION Ph.D. Thesis
Mohammed Abdullah Shayib. 1979. 58 p.
Avail: Univ. Microfilms. Order No. 8003224

The optimal, actual, and plug-in error rates of allocation between two Poisson populations differing only in the value of the parameter are investigated. The optimal error rate can be found when the parameter is known, while for the other error rate calculations, the parameter has to be estimated. In the actual error rate the estimated value of the parameter is used in dividing the sample space only. In the plug-in estimate, the estimated value of the parameter, in addition to dividing the sample space, is used to estimate the probability density function. Results of a simulation study undertaken to estimate the error rates, check their variation, divide the sample space, and investigate sample size requirements are tabulated and plotted. Dissert. Abstr.

N80-18847 Wisconsin Univ., Madison.
BAYES SEQUENTIAL ESTIMATION PROCEDURES FOR LIFE TESTING PROBLEMS Ph.D. Thesis
Evan Eva Chen. 1979. 76 p.
Avail: Univ. Microfilms. Order No. 8001130

Statistical problems which arise when nonnegative observations become available in an ordered manner (life testing problems) are studied. The life testing problem with M machines and exponential lifetime distribution is introduced. Optimal stopping times are found for both the continuous time and discrete time approach and the results are extended to the Weibull distribution failure model. The asymptotic sampling theory properties of the Bayes sequential procedure are given and asymptotic normality of the Bayes estimator is also proven. Finally the Bayes fixed sample size procedure is defined and compared to the Bayes sequential procedure by computing the ratio of the expected total costs associated with the two procedures. By assuming a sampling cost and a set up cost, numerical results on the optimal choice of the number of machines to be put on test are given. Dissert. Abstr.

N80-18848 Texas A&M Univ., College Station.
COMBINATORIC CLASSIFICATION OF MULTIVARIATE NORMAL OBSERVATION VECTORS Ph.D. Thesis
Charles Leslie Dunn. 1979. 103 p.
Avail: Univ. Microfilms. Order No. 8003123

The problem of classifying an observation vector as coming from one of two multivariate normal distributions which differ both in their mean vectors and covariance matrices is considered. A search for the procedure which minimizes the expected cost of misclassification is conducted within the class of procedures based upon a certain combination of n independent univariate discriminations. An efficient search of this class of procedures is made by employing an algorithm of the implicit enumeration type used in integer programming. In the case of known population parameters, the independent discriminant functions and exact probabilities of misclassification are found. When the parameters are unknown estimates are introduced for the coefficients of each univariate discriminant function and for the probabilities of misclassification. A jackknife procedure is introduced in order to improve the estimation process. The method is applied to the problem classifying a set of male twins as to whether they are monozygotic or dizygotic. Dissert. Abstr.

N80-18849 Montana State Univ., Missoula.
USING INCOMPLETE MULTIVARIATE DATA TO SIMULTANEOUSLY ESTIMATE THE MEANS Ph.D. Thesis
Susan Marie Hinkins. 1979. 109 p.
Avail: Univ. Microfilms. Order No. 8003718

A Bayes and an empirical Bayes estimator of the mean vector from a multivariate normal data set with missing observations are presented. Both estimators resemble the ridge-regression estimate, which shrinks the maximum likelihood estimate towards an a priori mean vector. Both estimators are consistent for and asymptotically equivalent to the maximum likelihood estimate. Small sample properties of the Bayes estimator are found, including conditions under which it has smaller risk than the maximum likelihood estimate. Numerical examples indicate that under some conditions the empirical Bayes estimator may also improve on the maximum likelihood estimator. Two computer programs which provide useful methods for estimation when there are data missing are also presented. The program RFACTOR creates Rubin's factorization table. The program MISSMLE calculates the maximum likelihood estimates of the mean vector and variance-covariance matrix from a multivariate normal data set with missing data. Dissert. Abstr.

N80-18850 Indiana Univ., Bloomington.
THE EFFECTS OF SELECTED GRAPHIC DESIGN VARIABLES ON THE READABILITY OF MULTIPLE-LINE GRAPHS Ph.D. Thesis
George Wesley Bostick, Jr. 1979. 62 p.
Avail: Univ. Microfilms. Order No. 8003838

The separate and joint effects of three graphic design variables on the readability of multiple line graphs were examined. The three variables, each having two levels, were: (1) the method of representing scale markings, the levels being ruled grid and tick marks; (2) the method of representing data lines, the levels being line code and symbol code; and (3) the method of identifying data lines, the levels being labels and key. The three independent variables were combined in a (2)(2)(2) factorial design with repeated measures on all three variables. A multiple line graph was constructed depicting the fictional market values over time of four different agricultural exports to represent each of the eight experimental conditions. Each of the resulting eight graphs was identical except with respect to the combination of levels of the three independent variables. Dissert. Abstr.

N80-18851# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
ON THE WEAK CONVERGENCE OF A SEQUENCE OF GENERAL STOCHASTIC DIFFERENCE EQUATIONS TO A DIFFUSION
H. J. Kushner and Hai Huang. Oct. 1979. 41 p. refs.
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-77; NSF ENG-77-12946)
(AD-A078583; LCDS-TR-79-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

A convenient and useful method for showing weak conver-

gence, to a diffusion, of the interpolated solutions of a (not necessarily Markovian) sequence of stochastic difference equations is developed. The technique involves the use of averaging methods to show that the weak limit satisfies the martingale problem of Strook and Varadhan which is associated with the diffusion. A truncation method is developed so that it is only necessary to work with the parts of the process before first escape from an arbitrary but bounded domain. The assumptions cover a wide variety of applications in systems theory, mathematical biology and elsewhere, but the method of proof is adaptable to other special cases where our particular assumptions might not hold. Two applications are given in order to illustrate the relative ease of use of the method. The driving noise process in the difference equations can depend on the solution process of the difference equation, and one application where this is useful is given (a rate of convergence problem for simple stochastic approximations with sequentially averaged observations). GRA

N80-18852# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ON THE CUMULANTS OF CUMULATIVE PROCESSES
Walter L. Smith Oct. 1979 51 p refs
(Contract N00014-76-C-0550)
(AD-A078474; MIMEO-Ser-1257) Avail: NTIS HC A04/MF A01 CSCL 12/1

Cumulative processes were introduced in 1955 as a natural concomitant to the study of what the author called regenerative processes (Smith, 1955). In that first paper some basic results concerning cumulative processes were obtained; these were also explained, and the notions of cumulative and regenerative processes further detailed, in Smith (1958). For the purpose of the present discussion, the cumulative process is presented. GRA

N80-18853# Brown Univ., Providence, R. I. Center for Dynamical Systems.
ON A STOCHASTIC CONTROL PROBLEM WITH EXIT CONSTRAINTS Interim Report
Martin Day Jun. 1979 17 p refs
(Grant AF-AFOSR-3063-76; AF Proj. 2304)
(AD-A078372; AFOSR-79-1165TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper the logarithmic transformation of Fleming is used to discuss a specific problem of controlled diffusions. The problem is to minimize a certain quadratic functional of the applied drift while satisfying the requirement that the place where the process exists a domain is not in a specified subset of its boundary. The main result is that the solution of this problem is given by the logarithm of a related exit probability. GRA

N80-18854# Minnesota Univ., Minneapolis. School of Statistics.
OPTIMUM RULES FOR CLASSIFICATION INTO TWO MULTIVARIATE NORMAL POPULATIONS WITH THE SAME COVARIANCE MATRIX
Somesh DasGupta Oct. 1979 25 p refs
(Contract DAAG29-76-C-0038)
(AD-A077565; TR-359; ARO-13149.9-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

For the problem of classifying an observation into one of the two p-variate normal distributions with the same covariance matrix, various optimal rules are given for different situations depending on the knowledge of the parameters involved. GRA

N80-18855# Massachusetts Univ., Amherst. Dept. of Mathematics and Statistics.
SIMILARITY MEASURES ON BINARY ATTRIBUTE DATA
M. F. Janowitz Nov. 1979 44 p refs
(Contract N00014-79-C-0629)
(AD-A077627; TR-J7901) Avail: NTIS HC A03/MF A01 CSCL 12/1

The ability of commonly used similarity coefficients to recapture natural classifications in the presence of various types of errors is investigated by means of several computer simulations of a certain model of the classification problem. The goal is to establish the relative merits of the phylogenetic versus the phenetic methods of classification. GRA

N80-18856# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
OPTIONAL SAMPLING OF SUBMARTINGALES INDEXED BY PARTIALLY ORDERED SETS Interim Report
Robert Washburn, Jr. (Scientific Systems, Cambridge, Mass.) and Alan S. Willsky Oct. 1979 46 p refs
(Grant AF-AFOSR-3281-77)
(AD-A077409; LIDS-P-953; AFOSR-79-1153TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The optional sampling theorem for martingales indexed by a partially ordered set is true if the index set is directed. However, the corresponding result for submartingales indexed by a partially ordered set is generally false. In this paper we completely characterize the class of stopping times for which the optional sampling theorem is true for all uniformly bounded submartingales indexed by countable partially ordered sets. By assuming a conditional independence property, we show that when the index set is R to the 2nd power the optional sampling theorem is true for all uniformly bounded submartingales and all stopping times. This conditional independence property is satisfied in cases where the submartingales and stopping times are measurable with respect to the two-parameter Wiener process. A counter example shows that the optional sampling result is false for R to the n power when n greater than 2 even if the conditional independence property is satisfied. GRA

N80-18857# Iowa Univ., Iowa City. Div. of Educational Psychology.
THE ROLE OF EXCHANGEABILITY IN INFERENCE Research Report, 1 Jun. 1977 - 1 Aug. 1979
D. V. Lindley and Melvin R. Novick Aug. 1979 49 p refs
(Contract N00014-77-C-0428; RR0420401)
(AD-A077378; TR-79-8) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned with basic problems of statistical inference. The thesis is in three parts: (1) that inference is a procedure whereby one passes from a population (or sample) to a new individual; (2) that this connection can be established using de Finetti's idea of exchangeability or Fisher's concept of a subpopulation; and (3) in making the connection use must be made of the appropriate probability. These three principles are used in a variety of situations and the topics discussed include analysis of variance and covariance, contingency tables, and calibration. Some comments on randomization are also included. GRA

N80-18858# University of Southern California, Los Angeles. Social Science Research Inst.
RANK WEIGHTING IN MULTIATTRIBUTE UTILITY DECISION MAKING: AVOIDING THE PITFALLS OF EQUAL WEIGHTS Technical Report, Dec. 1978 - Dec. 1979
William G. Stillwell and Ward Edwards Sep. 1979 52 p refs
(Contract N00014-79-C-0038)
(AD-A078941; USC-001595-2T; SSRI-RR-79-2) Avail: NTIS HC A04/MF A01 CSCL 12/1

The notion of 'dominance' in multiattribute utility decision contexts leads to a change in the considered alternative set. The implications of this set change are discussed in relation to the conditions of Wainer's (Wainer, 1976) 'equal weights theorem' and the resulting sensitivity to weighting of importance dimensions demonstrated. Data from three multiattribute decision making studies are examined using four rank weighting techniques as well as equal weights. Rank weighting of importance dimensions demonstrate marked improvement of approximation as reflected in both Pearson and rank order correlations for measures of overall utility across alternatives within the nondominated subset. Implications for multiattribute utility application are discussed. GRA

N80-18859# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.
THE ASYMPTOTIC DISTRIBUTION OF MORTALITY RATES IN COMPETING RISKS ANALYSES
Joseph C. Gardiner Dec. 1979 16 p refs
(Contract N00014-79-C-0522; Grant BSRG-S07-RR07049-14)
(AD-A078948; RM-405) Avail: NTIS HC A02/MF A01 CSCL 12/1

For a sample of individuals from an animal or human

population under observation in a clinical trial or life test, mortality rates are defined for each risk to which the population is exposed. By considering only the crude risk functions and cause-specific failure rates in a basic competing risks model, these mortality rates are shown to have an asymptotic normal distribution. An expression for the asymptotic correlation between a pair of mortality rates is thus obtained and a necessary and sufficient condition for their asymptotic independence is investigated in some general situations with reference to only the cause-specific failure rates and the survival function of the individuals. GRA

N80-18860# University of Western Michigan, Kalamazoo. Dept. of Mathematics.

A WEIGHTED DISPERSION FUNCTION FOR ESTIMATION IN LINEAR MODELS

Gerald L. Sievers Oct. 1979 39 p refs
(Contract N00014-78-C-0637)
(AD-A077654; Mathematics-62) Avail: NTIS HC A03/MF A01 CSCL 12/1

Robust estimates for the parameters in the general linear model are proposed which are based on weighted rank statistics. The method is based on the minimization of a dispersion function defined by a weighted Gini's mean difference. An asymptotic distribution of the estimate is derived. Some examples are discussed which point out that the ranking can be based on a restricted set of comparisons and still retain high efficiency. GRA

N80-18861# Tennessee Univ., Knoxville. Dept. of Psychology.

CONVERGENCE OF THE CONDITIONAL DISTRIBUTION OF THE MAXIMUM LIKELIHOOD ESTIMATE, GIVEN LATENT TRAIT, TO THE ASYMPTOTIC NORMALITY: OBSERVATIONS MADE THROUGH THE CONSTANT INFORMATION MODEL

Fumiko Samejima Oct. 1979 116 p refs
(Contract N00014-77-C-360; RR0420401; NR Proj. 150-402)
(AD-A077706; RR-79-3) Avail: NTIS HC A06/MF A01 CSCL 12/1

The Constant Information Model can be used when we substitute a subset of equivalent, binary items, whose item characteristic functions are unknown, for the Old Test, or a subset of test items whose operating characterictics are known, in estimating the operating characteristics of item response. In so doing, it has been suggested that we choose items whose common discrimination power is low, so that the interval of latent trait, for which their common item characteristic functions in the Constant Information Model assumes positive values, is wide enough to cover the ability levels of all the examinees on which the operating characteristics of new items are to be estimated. This suggestion needs more investigation and precision, however, since it is expected from theory that the convergence of the conditional distribution of the maximum likelihood estimate, given latent trait, to the normality is slow for the values of latent which are close to the two endpoints of the above interval, in comparison with those close to the midpoint. In this paper, through a simulation study, the speed of convergence of the conditional distribution of the maximum likelihood estimate to the normality at various levels of latent trait is observed, using 20 hypothetical test sessions, in each of which 10 equivalent, binary test items are given. As was expected, the conditional distribution of the maximum likelihood estimate is skewed for the values of latent trait close to the two endpoints of the interval and the convergence is slower. GRA

N80-18862# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.

MAXIMUM LIKELIHOOD ESTIMATION OF A DISTRIBUTION FUNCTION WITH MONOTONE FAILURE RATE BASED ON CENSORED OBSERVATIONS Interim Report

W. J. Padgett and L. J. Wei Jun. 1979 18 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A077459; AFOSR-79-1035TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The maximum likelihood estimator of a distribution function with monotone failure rate is derived based on a set of observations subject to arbitrary right censorship. This estimator is defined everywhere on the positive real line while the Kaplan-Meier estimator may not be. The small sample properties of this estimator are indicated by results of a Monte Carlo study for the Weibull distribution. GRA

N80-18863# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.

A BAYESIAN NONPARAMETRIC ESTIMATOR OF SURVIVAL PROBABILITY ASSUMING INCREASING FAILURE RATE Interim Report

W. J. Padgett and L. J. Wei Aug. 1979 21 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A077458; TR-42; AFOSR-79-1033TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Bayesian nonparametric estimators of the survival function, the failure rate function, and the density function are obtained using jump processes as prior distributions on the space of increasing failure rate functions. The jump processes are more appealing intuitively than previously used Dirichlet processes, integral gamma process, and processes neutral to the right and have a meaningful physical interpretation. Examples are given and the estimates are compared with the maximum likelihood estimates. In addition, the Bayesian nonparametric estimators are presented for arbitrarily right-censored observations. Author (GRA)

N80-18864# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.

CONVERGENCE OF WEIGHTED SUMS OF RANDOM ELEMENTS IN TYPE p SPACES Interim Report

Robert Lee Taylor Jul. 1979 23 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A077438; TR-43; AFOSR-79-1034TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The study of probability density estimation led to estimates in the form of averages or weighted sums of random variables whose values are in function spaces (Parzen (1962) and Rosenblatt (1971)). As a application of the law of the iterated logarithm in linear measurable spaces, Kuelbs (1978) considered the rates of convergence in these density estimates. The estimates are not always averages of sequences of random elements in a Banach space but are more often weighted sums of arrays of random elements where the weights are not necessarily Toeplitz matrices. In this paper the convergence of weighted sums of arrays of random elements in Banach spaces of type p is obtained both in probability and almost surely. As corollaries these results have forms of Pruitt's (1963) and Rohatgi's (1971) results for Banach spaces and also have extensions for the results of Padgett and Taylor (1976). However, exact statements of the theorems are related to the possible applications for density estimation. GRA

N80-18865# Purdue Univ., Lafayette, Ind. Dept. of Statistics.

ON A CONJECTURE CONCERNING LEAST FAVORABLE CONFIGURATIONS IN CERTAIN TWO-STAGE SELECTION PROCEDURES

Klaus-J. Miescke and Joachim Sehr (Maine Univ.) Oct. 1979 16 p refs
(Contract N00014-75-C-0455)
(AD-A077591; MMS-79-29) Avail: NTIS HC A02/MF A01 CSCL 12/1

Given k normal populations with unknown means and a common known (or unknown) variance a two-stage procedure P sub 1 with screening in the first stage to find the population with the largest mean is under concern. It was proposed and studied previously by Cohen (1959), Alam (1970), Tamhane and Bechhofer (1977, 1979) and Gupta and Miescke (1979). But up to now a conjecture concerning least favorable parameter configurations in an indifference zone approach remained unproved for k = or > 3. In this paper we give a non-standard proof of the conjecture in case of k = 3 for P sub 1 which (under minor changes) works also for a simplified version P sub 2. Besides, the point is exposed where another (more intuitive) method of proof fails to work. GRA

N80-18866# Ohio State Univ., Columbus. Dept. of Statistics.

ANALYSIS OF VARIANCE WITH UNEQUAL VARIANCES

Edward J. Dudewicz and Thomas A. Bishop Nov. 1979 15 p refs
(Contract N00014-78-C-0543)

(AD-A077653; TR-193) Avail: NTIS HC A02/MF A01 CSCL 12/1

Analysis of variance (ANOVA) is often used in quality control studies. It assumes equal variabilities within groups, and no exact procedures have been available for cases with unequal variabilities. In this paper exact procedures are given and illustrated. An indication of the losses to be incurred by using the traditional F-test when variances are unequal is given. Author (GRA)

N80-18867# North Carolina Univ. at Chapel Hill. Dept. of Statistics.
NONPARAMETRIC REGRESSION BASED ON THE CONCOMITANTS OF ORDER STATISTICS Interim Report
Gordon Johnston Sep. 1979 16 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A077636; Mimeo-Ser-1249; AFOSR-79-1099TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The properties of nonparametric regression function estimates based on the concomitants of order statistics are investigated. GRA

N80-18868# Royal Netherlands Meteorological Inst., De Bilt.
LOGISTIC DISCRIMINANT ANALYSIS [DE LOGISTISCHE DISCRIMINANT ANALYSE]
S. Kruizinga 1978 19 p refs In DUTCH
(KNMI-V-310) Avail: NTIS HC A02/MF A01

Applications of the discriminant analysis method as a translation technique in weather forecasting are described. A linear function of the entry variables is used to arrive at a decision regarding the expected variable. In some cases, the yes/no decision is not followed, but an attempt is made to specify the probability of occurence independently of the entry variable. On this basis, further decisions are possible. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-18869*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONTROL SYSTEM DESIGNS FOR THE SHUTTLE INFRARED TELESCOPE FACILITY
J. David Rowell (Stanford Univ., Calif.), Eric K. Parsons (Stanford Univ., Calif.), and Kenneth R. Lorell Feb. 1980 40 p refs
(NASA-TM-81159; A-8018) Avail: NTIS HC A03/MF A01 CSCL 12B

The Shuttle Infrared Telescope Facility (SIRTF) image motion compensation system is described in detail and performance is analyzed with respect to system noise inputs, environmental disturbances, and error sources such as bending and feedforward scale factor. It is concluded that the SIRTF accuracy and stability requirements can be met with this design. K.L.

N80-18870# California Univ., Berkeley. Operations Research Center.
ASYMPTOTIC MEASURES OF SYSTEM PERFORMANCE UNDER ALTERNATIVE OPERATING RULES, 2
Richard E. Barlow and Esther Sid Hudes Jun. 1979 29 p refs
(Grant AF-AFOSR-3179-77; AF Proj. 2304)
(AD-A078827; ORC-79-7) Avail: NTIS HC A03/MF A01 CSCL 12/2

This is the second part of a study of stochastic processes generated by failures and repairs of components in a series system. In particular, we consider a two component series system where failure of component 1 shuts off component 2 but not vice versa. In Part I, selected measures of system performance were calculated for general failure and repair distributions as implicit functions of system availability. In order to obtain explicit results, we assume in this part that either component 1 or component 2 has exponential failure and repair distributions. For the case where component 1 has a general failure distribution, we obtain counter-intuitive results concerning the long run average of system uptimes. Intuitively, it is best to shut off an operating component when the system is down. However, this is not correct if the component failure distribution is IFR (or more generally NBUE) and we wish to maximize the long run average of system uptimes. We use the method of supplementary variables to obtain explicit results for important special cases. GRA

N80-18871# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
A HYBRID METHOD FOR THE SOLUTION OF SOME MULTI-COMMODITY SPATIAL EQUILIBRIUM PROBLEMS Management Sciences Research Report
Jong-Shi Pang Nov. 1979 28 p refs
(Contract N00014-75-C-0621)
(AD-A078514; MSRR-450; WP-35-79-80) Avail: NTIS HC A03/MF A01 CSCL 12/2

A unified formulation of the multi-commodity transportation and transshipment spatial equilibrium models has been devised as a linear complementarity problem with certain block structure. It is shown that a block successive overrelaxation method is applicable for solving the resulting complementarity problem. The method consists of solving a sequence of subproblems of the single-commodity type. These subproblems are to be solved by a special-purpose principal pivoting algorithm developed in an earlier paper. Computational experience of solving some fairly large problems by the proposed hybrid method is presented. GRA

N80-18872# California Univ., Berkeley. Operations Research Center.
ASYMPTOTIC MEASURES OF SYSTEM PERFORMANCE UNDER ALTERNATIVE OPERATING RULES, 1
Richard E. Barlow and Esther Sid Hudes Jun. 1979 44 p refs
(Grant AF-AFOSR-3179-77; AF Proj. 2304)
(AD-A078826; ORC-79-6) Avail: NTIS HC A03/MF A01 CSCL 12/2

This is the first part of a study of stochastic processes generated by failures and repairs of components in a series system. Selected asymptotic measures of system performance are calculated for a two component series system where failure of component 1 shuts off component 2 but not vice versa. Intuitively, it is best to shut off an operating component when the system is down. However, this is not correct if the component failure distribution is IFR (or more generally NBUE) and we wish to maximize the long run average of system uptimes. Part 2 uses the method of supplementary variables to obtain explicit results for important special cases. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-18873 Colorado Univ. at Boulder.
MULTIPLIER REPRESENTATIONS OF THE TWO-DIMENSIONAL LATTICE GROUP Ph.D. Thesis
Wesley Edward Mitchell 1979 85 p
Avail: Univ. Microfilms Order No. 8003002

There exist multipliers on the two-dimensional lattice group such that the multiplier dual is not smooth. Thus, classical methods will not suffice for the description of the multiplier dual. A set of generalized tensor product representations is constructed, beginning with irreducible multiplier representations induced from some normal subgroup. A complete decomposition theory is given for this set. Because of a relationship between certain of these generalized tensor products and multiplier regular representations, direct integral decompositions of multiplier regular representations are found. Furthermore, there are infinitely many mutually disjoint decompositions. The integrands have the property that, for a certain fixed subgroup N and any positive integer n, there is a decomposition satisfying: the restriction of each integrand to N is equivalent to a direct sum of n copies of the regular representation of the integers. Dissert. Abstr.

N80-18874 Oklahoma Univ., Norman.
CLASSIFICATION OF THE NORMAL SUBGROUPS OF GI SUB N (R) Ph.D. Thesis
Jeanna Beth Moore 1979 50 p

Avail: Univ. Microfilms Order No. 8004393

It is shown that for any ring R (not necessarily commutative) the solvability of certain systems of equations is sufficient to show that normal subgroups of GL sub n (R) are also sandwiched between two normal subgroups of the group of elementary transvections. The system of equations whose solvability is necessary are those whose coefficient matrix is obtained from an invertible matrix by deleting the ith row and jth column i and j and whose constant terms are all zero except for the first which is the element of the jth row and ith column of the inverse of the matrix. Various rings in which these systems are solvable are discussed. For example, these systems are shown to be solvable in division rings by use of Ore determinants. Other rings discussed are the ring of cross sections of a sheaf over a Boolean space and both products and direct limits of rings in which the systems are solvable. Dissert. Abstr.

N80-18875 Colorado Univ. at Boulder.
GENERALIZED INVERSES OF MATRICES OVER LOCAL RINGS Ph.D. Thesis
Jerry Dale Hopponen 1979 85 p
Avail: Univ. Microfilms Order No. 8002984

A theory of generalized inverses of rectangular matrices over an arbitrary local ring is presented, and related combinatorial results derived. The concept of a generalized inverse is used to discuss solutions of the matrix equation Ax = b. For fixed matrices A and B having the same rank over an arbitrary field, linear algebraic results are derived for relations between the null and range spaces of A and B. As a special case, some results are stated when the ground field is formally real, and additional relations are determined when B = A(T). A canonical form is developed for matrices over a local ring in which the maximal ideal is principal and the descending chain condition holds. Over such rings, it is shown that the conditions which are usually taken to define the various types of generalized inverses for a matrix A cannot begin to be satisfied unless A has a special canonical form. Dissert. Abstr.

N80-18876# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
STABILITY AND FIXED POINTS OF POINT DISSIPATIVE SYSTEMS Interim Report
Paul Massatt Jun. 1979 30 p refs
(Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A077410; AFOSR-79-1167TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The result requires the stronger assumption of compact dissipative. The principle result of this paper will be to get similar results under the weaker assumption of point dissipative. Need exists to add additional hypotheses on the space and the operator T. These hypotheses are naturally satisfied for stable neutral functional differential equations and retarded functional differential equations of infinite delay. The paper will be divided into four sections. The first will contain various definitions. The second will contain an abstract theorem relating point dissipative in one space to bounded dissipative in another, and to the existence of a fixed point. The third section will apply the result to stable neutral functional differential equations. The final section gives applications to retarded functional differential equations with infinite delay. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-18877# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MAGNETIC PROPERTIES OF AMORPHOUS HEISENBERG FERROMAGNET WITH RANDOM ANISOTROPY
R. Kishore, I. C. da Cunha Lima, and M. Cristina Forti Dec. 1979 15 p refs Revised Submitted for publication
(INPR-1641-RPE/097-Rev) Avail: NTIS HC A02/MF A01

Magnetization, susceptibility, and the critical temperature for a spin one amorphous Heisenberg ferromagnet with random local anisotropy are calculated in molecular field approximation for the exchange interaction. The effects of random fluctuations of the magnitude of the local anisotropy about its crystalline value are studied for various probaility distributions. It is found that for a given randomness, measured in terms of the root mean square fluctuation of the magnitude of the local anisotropy, the magnetization and the critical temperature depend more on the range, defined as the magnitude of the maximum value of the fluctuation from its mean value, than the shape of the probability distribution function. The effect of randomness decreases as the crystalline value of the anisotropy increases. Calculation of the susceptibility shows that above the critical temperature, randomness has no effect. Author

N80-18878# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
NOTES ON THE COORDINATE SYSTEMS AND TIME
Luiz Danilo D. Ferreira, Wilson Custodio C. DaSilva, and Hans U. Pilchowski Dec. 1979 56 p refs In PORTUGUESE; ENGLISH summary Presented at the Seminar. de Dinamica Orbital
(INPE-1634-RPE/093) Avail: NTIS HC A04/MF A01

The celestial coordinate systems used in astronomy to define the position of objects on the celestial sphere are examined. The transformations of a coordinate system into others and the relationship between astronomic and atomic times is discussed. A.W.M.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-18879 Rensselaer Polytechnic Inst., Troy, N. Y.
ANALYSIS OF ACOUSTIC VARIATIONS IN THE OCEAN PRODUCED BY COMBINED ENVIRONMENTAL EFFECTS Ph.D. Thesis
Kenneth George Hamilton 1979 165 p
Avail: Univ. Microfilms Order No. 8004759

Mathematical models of sound propagation in the ocean are formulated using ray theory. Variations in the ocean environment, such as currents, horizontal and vertical sound-speed changes, and bottom topography, are examined separately and in combination to ascertain their effects on acoustic amplitude and phase. Simplified approximations are derived in order to predict these effects. The effects of a combination of sound-speed and current fluctuations on propagation of a continuous wave (CW) signal in a deep ocean model are analyzed. The influence of sound-speed fluctuations on propagation of a CW signal in an ocean with a uniformly sloping bottom and a horizontal surface is analyzed using ray theory. A simplified approach is described for determination of phase perturbations produced by variations in sound speed and current in the ocean. The method is demonstrated for both shallow and deep ocean examples, when the phase perturbation arises from weak horizontal deviations from a horizontally uniform sound-speed structure. It is also illustrated for currents in the deep ocean, considering cases with and without horizontal variations in current speed. Dissert. Abstr.

N80-18880 New Orleans Univ., La.
MULTI-OBSTACLE ACOUSTIC SCATTERING Ph.D. Thesis
Lawrence Lamar Sorensen 1979 88 p
Avail: Univ. Microfilms Order No. 8004386

The simple source formulation was extended to the case of scattering of acoustic waves in two dimensions by several obstacles. The method consists of representing the velocity potential as the integral of an unknown source density times an appropriate Green's function, the integral to be taken over the contours enclosing the two dimensional scatterers. A computer program was used to implement this method and calculate the source density and farfield scattering amplitude. Cases which previously defied verification were checked using the reciprocity principle or the optical throrem. The former states that the interchange of source and observation points, both infinitely far removed from the scatterer, leaves the source density unaltered. The optical theorem, which relates the total scattering cross section to the real part of the forward scattering amplitude,

provides a non-linear check on the scattering amplitude. Sample problems considered include two circular cylinders, two elliptical cylinders and a circular cylinder above an infinite flat plat. Plots of farfield scattering amplitude and verification data are included. Dissert. Abstr.

N80-18881 Georgetown Univ., Washington, D.C.
INFLUENCE OF ABSORPTION ON ULTRASONIC NON-SPECULAR REFLECTIVITY Ph.D. Thesis
Tran Dai Kiem Ngoc 1979 82 p
Avail: Univ. Microfilms Order No. 8004699

A theoretical and experimental investigation of nonspecular ultrasonic reflectivity at a liquid-solid interface is described. The role of attenuation in the formulation of the plane wave reflection coefficient is analyzed. This attenuation-dependent reflection coefficient is used in a numerical integration method which is developed for the calculation of the reflected beam profile. The reflected profile is calculated for two specific cases: incidence near the Rayleigh angle for a water-stainless steel interface and incidence near the longitudinal critical angle for a water-Plexiglas interface. In each case, the nonspecular reflection effects are investigated as one parameter is varied and the others are kept unchanged. Comparisons are made with results obtained by the Bertoni and Tamir formulation for incidence at the Rayleigh angle. The theoretical predictions are then compared to experimental results obtained by the Schlieren visualization technique. Dissert. Abstr.

N80-18882*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF COHERENCE IN FAN NOISE STUDIES
Joseph R. Balombin Feb. 1980 26 p refs
(NASA-TP-1630; E-157) Avail: NTIS HC A03/MF A01 CSCL 20A

A study of fan noise was made by using the coherence function to obtain far field spectra that were coherent with the fan rotational rate. Choosing fan rotational rate as one of the two variables yielded new information about the far field noise generated during static fan testing. As a result of this coherent data processing, the inlet fan-tone noise present in static testing was determined to be mostly random when the rotor-alone and rotor-stator interaction tones were cut off. After the rotor-alone sound field was cut on, the sound pressure became coherent, and the angular extent of high coherence increased as fan speed was increased. In addition, the sound field was organized as a pattern of lobes whose amplitude varied slowly with time. Additional fan test results indicate that operating the fan with an inflow control device can partially reduce the fan-tone noise levels to those produced by coherent processing. R.E.S.

N80-18883# Royal Aircraft Establishment, Farnborough (England).
THE RESPONSE OF AN ELECTROSTATIC MICROPHONE TO AN AIRFLOW
R. Gamba Jun. 1979 30 p refs Transl. into English from Rev. d'Acoustique (France), v. 40, 1977 p 46-57
(RAE-Lib-Trans-2011; BR71912) Avail: NTIS HC A03/MF A01

The origins of the different pressure fluctuations picked up by a microphone in an air stream are discussed. The behavior of a condenser microphone when the direction of the airflow is perpendicular to the diaphragm is theoretically studied. Finally an experimental study is conducted during which the following parameters are varied: the average wind velocity (5-20 m/s); the percentage of turbulence (0.01-1%); and the diameter of microphone (1 inch, 1/2 inch, 1/4 inch). The output levels induced by turbulence and by a laminar quiet airflow are examined. The effect of the standard protection grill or ogive is studied in each case. M.G.

N80-18884*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PUBLICATIONS IN ACOUSTIC AND NOISE CONTROL FROM NASA LANGLEY RESEARCH CENTER DURING 1940-1979
Barbara A. Fryer, comp. Jan. 1980 104 p refs Update
(NASA-TM-80211) Avail: NTIS HC A06/MF A01 CSCL 20A

Reference lists of approximately 900 published Langley Research Center reports in various areas of acoustics and noise control for the period 1940-1979 are presented. Specific topic areas covered include: duct acoustics; propagation and operations; rotating blade noise; jet noise; sonic boom; flow surface interaction noise; structural response/interior noise; human response; and noise prediction. J.M.S.

N80-18885# Battelle Columbus Labs., Durham, N. C.
ATMOSPHERIC EFFECTS ON THE SPEED OF SOUND
E. A. Dean Aug. 1979 60 p refs Prepared in cooperation with Texas Univ. at El Paso
(Contract DAAG29-76-D-0100; DA Proj. 1L1-62111-AH-71) (AD-A076060; ERADCOM/ASL-CR-79-0100-4) Avail: NTIS HC A04/MF A01 CSCL 20/1

The small-signal speed of sound in humid air is calculated from a model which includes the real-gas effects from the equation of state for humid air and the vibrational dispersion due to N2, O2, and CO2 relaxation. Other atmospheric effects such as dispersion due to viscothermal and rotational relaxation, heat radiation, propagation along the air-ground boundary, the density gradient, turbulence, aerosols and fogs are considered and found to be unimportant for frequencies between 1 Hz and 5 MHz (at one atmosphere). The uncertainty in predicting the sound speed varies between 0.22 m/sec at -90 C to 0.05 m/sec at 90 C. Experimental results in humid air at 20 C and 30 C are in excellent agreement with the model. For the propagation frequency of 20 Hz, it is found that the presently used sound-ranging formula, c = 20.06 x square root of T sub s, where T sub s = .75t sub v - .25t - 273.2 (t sub v = virtual temperature), differs by up to 0.5 m/sec over the range -60 C to 60 C. A correction to the 'sonic' temperature determination is suggested which results in deviations of less than 0.05 m/sec over the temperature range from -60 C to 50 C and for relative humidities from 5% to 100%. GRA

N80-18886# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.
THE GENERATION OF A TOLLMIEN-SCHLICHTING WAVE BY A SOUND WAVE
John W. Murdock Aug. 1979 22 p refs
(Contract N00014-78-C-0491)
(AD-A075816; ATR-79(7775)-1) Avail: NTIS HC A02/MF A01 CSCL 20/1

A spectral numerical method is used to study the two-dimensional unsteady flow over a flat plate in the presence of a plane sound wave propagating parallel to the flow. For s = omega x/u at infinity = O(1), no observable interaction or energy interchange between the sound wave and the Tollmien-Schlichting wave is present. In the region (s - or < = 0) edge, an interaction occurs; the magnitude of this interaction is computed. A plane sound wave with dimensionless frequency omega nu/U-square at infinity = .000056 generates a Tollmien-Schlichting wave of the same frequency and an amplitude at the first neutral point .0001 times the sound-wave amplitude. Computations at a second, lower frequency result in a lower neutral point amplitude. The response of the boundary layer to large unsteady disturbances is discussed and compared with published behavior based on the boundary layer equations. Solutions of the Orr-Sommerfeld equation are examined and found to have a different character for s = or > O(1) consistent with the more complete equations. GRA

N80-18887# Pennsylvania State Univ., University Park. Applied Research Lab.
TRANSIENT ACOUSTIC RADIATION FROM ELASTIC PLATES Ph.D. Thesis
Seroj Mackertich Sengerdy Apr. 1979 112 p refs
(Contract N00024-79-C-6043)
(AD-A076772; ARL/PSU-TM-79-50) Avail: NTIS HC A06/MF A01 CSCL 20/1

An expression for the acoustic radiated pressure emanating from an infinite elastic plate excited by a unit impulse load for different observation angles and distances is obtained analytically. The solution is obtained by use of Fourier transform on time and Hankel transform on the radial coordinate. Using Cauchy contour integration theorem and regular and modified saddle-point methods, the inverse Fourier and Hankel transforms were

evaluated. The unit impulse response and convolution theorem was then utilized to obtain an expression for radiated pressure of an infinite elastic plate excited by constant magnitude load, square pulse and CW-pulse loads. The first arrival of acoustic wave at an observer point in the acoustic medium due to an impulse load was shown to correspond to the time of travel for the normal distance from the observer to the plate. After the first arrival, the acoustic pressure was shown to decay sinusoidally with an increasing period of oscillation. The decay rate for long times was shown to be the reciprocal of elapsed time. Similar response was shown for a square pulse and for a CW-pulse after the removal of the load. Author (GRA)

N80-18888# Naval Research Lab., Washington, D. C. Transducer Branch.
ACOUSTICAL BEHAVIOR OF THICK, COMPOSITE, FLUID-LOADED PLATES, CALCULATED USING TIMOSHENKO-MINDLIN PLATE THEORY Interim Report
Anthony J. Rudgers 16 Nov. 1979 27 p refs
(RR0110842)
(AD-A077671; NRL-8317) Avail: NTIS HC A03/MF A01 CSCL 20/1

The reflected and radiated acoustic fields of a thick, composite plate of infinite extent, consisting of a substrate layer bonded at an interface to a coating layer, which has fluid on one side and which is unconstrained on the other side, are calculated theoretically. The reflected and radiated acoustic fields are related by means of a structural response function that completely characterizes the elastic behavior of the composite plate and of the fluid. The composite-plate acoustical problem is analyzed by extending the Timoshenko-Mindlin theory of thick homogeneous plates. The Timoshenko-Mindlin thick-plate equations are used to describe the flexural waves generated in each of the two layers of the composite plate, owing either to a plane acoustic wave in the fluid impinging on the plate or to a point-force excitation of the plate. Two ideal types of bonding between the coating and the substrate are considered: the 'welded' bond, for which contiguous plate elements on either side of the interface move in complete unison, and the 'perfectly slipping' bond, for which such plate elements move in unison normal to the interface but independently parallel to the interface. The analytic form of the structural response function of a composite plate shows that in general a thick bilaminar composite plate of the type considered cannot be modeled by a simple homogeneous thick plate with artificial or 'average' material constants. The analysis also shows that the bond between the substrate and the coating significantly affects the acoustic reflection and radiation characteristics of the composite plate. GRA

N80-18889# Yale Univ., New Haven, Conn. Dept. of Systems and Information Sciences.
SURFACE SCATTERING STUDIES Final Report, Apr. 1978 - Jun. 1979
J. G. Zorning, P. M. Schultheiss, J. Snyder, S. Singhal, and D. C. Gilbert Aug. 1979 99 p refs
(Contract N00014-75-C-1014)
(AD-A078434; S/IS-7905) Avail: NTIS HC A05/MF A01 CSCL 20/1

Progress in a number of ongoing projects is reported. These include studies of bistatic and monostatic surface scattering strength, surface reverberation modelling, measurement of slope and correlation statistics of surfaces, and measurement of Doppler shifts and spread. The extension of previous scattering strength measurements to lower frequencies has shown the strengths observed to be 10 to 15 dB higher under similar wind conditions but with wavelengths approximately 8 times longer. These studies have led to the beginning of development of a model for reverberation based on a characterization of the surface as an ensemble of facets. A method for precision measurement of model tank waveheight and wave slope time series has been developed. The system is based on fine wire capacitance probes. It has been used to compile a set of slope measurements which is consistent with data reported by other investigators. A system for automatic measurement of time-space waveheight correlation has been developed. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-18890 California Univ., Irvine.
COLLECTIVE ION ACCELERATION CONTROLLED BY A GAS GRADIENT Ph.D. Thesis
Frederick Michael Mako, Jr. 1979 208 p
Avail: Univ. Microfilms Order No. 8002314

Several schemes were studied for attaining collective ion acceleration by the injection of an intense relativistic electron beam along magnetic field lines into a low pressure (less than 1 Torr of helium) neutral gas. Positive, zero, and negative gas pressure gradient schemes were examined. The case where the gas pressure decreases from the beam injection plane (the negative gradient scheme) is discussed. A simple collective ion acceleration model is presented. The model is modified to account for the electron energy distribution under the conditions where the ion energy is a maximum. A particle code was developed to enable a study of the complete, self consistent, initial condition problem. Dissert. Abstr.

N80-18891 Colorado Univ. at Boulder.
COLLISIONAL REDISTRIBUTION OF LIGHT SCATTERED BY ATOMIC VAPORS Ph.D. Thesis
Michael Gordon Raymer 1979 183 p
Avail: Univ. Microfilms Order No. 8003008

The effects of atomic collisions on the scattering of laser light by atomic vapors was examined. At high laser intensities, the light scattering was found to become stimulated, and was spectrally resolved into two components: stimulated Raman scattering (SRS) and stimulated collision induced fluroescence (SCF). A theory was developed to describe the behavior of SRS and SCF when the incident laser was of the pulsed type. The experimental results, including pressure dependence, focusing dependence, and directional dependence of the SRS and SCF, were found to be in agreement with the theory presented. Dissert. Abstr.

N80-18892 Missouri Univ. -Rolla.
NEGATIVE ION CHARGE TRANSFER OF THE REACTION OF S- AND O- WITH ATOMIC HYDROGEN PRODUCING H- IONS FROM 1500 TO 10 KEV Ph.D. Thesis
George Frederick Hagner 1979 88 p
Avail: Univ. Microfilms Order No. 8002322

The charge transfer reactions of O(-), S(-) with atomic hydrogen were studied from 1.5 to 10 KeV, and the reaction Cl(-) + O2 - O2(-) + Cl was studied from 10 eV to 10 KeV. The results are compared to a modified theoretical treatment for positive ions. A crossed beam technique was used to perform the measurements. The ion beam was produced by a conventional hot anode arc discharge. The neutral beam was produced by a joule heated tungsten oven. Counting techniques were used in the data collection. Dissert. Abstr.

N80-18893 Connecticut Univ., Storrs.
ROTATIONAL-VIBRATIONAL EXCITATION IN COLLISIONS OF ATOMIC IONS WITH DIATOMIC MOLECULES Ph.D. Thesis
James Donald Clark, Jr. 1979 238 p
Avail: Univ. Microfilms Order No. 8003743

Rotational vibrational excitation in atomic ion-diatomic molecule collisions are considered at intermediate ion projectile energies in the range of 1 - 3 keV. Collisions between He(+) and H2 are taken as an example. Three separate approaches are used in the description of the collision system. Inelastic energy transfer in collision systems and projectile scattering angle are calculated from a totally classical approach. Cross sections for scattering as a function of momentum transfer vector are calculated from a completely quantum mechanical approach. Molecular transitions from the ground rotational vibrational state to several excited rotational vibrational molecular states are considered. Dissert. Abstr.

N80-18894 Pittsburgh Univ., Pa.
DRIFT TUBE STUDIES OF ION-MOLECULE REACTIONS AT

HIGH AND LOW TEMPERATURES Ph.D. Thesis
Aikwo Chen 1979 135 p
Avail: Univ. Microfilms Order No. 8004855

A temperature variable drift tube mass spectrometer apparatus has been used to determine the rate coefficients for the charge- and atom-transfer reactions O(+)N2 and O(+)+O2 (from 300K to 900K), He(+)+H2 and He+D2 (from 78 to 300K), as well as the association reactions R + 2R, where R is He, Ne or Ar (from 78K TO 300K). For the atom transfer reaction O(+)+N2, the rate coefficient decreases from (1.2 + or - 0.1) x 10 to the minus 12th power cu cm/sec to 0.5/10 to the minus 12th power cu cm/sec as the temperature is increased from 300K to 900K. For the charge transfer reaction O(+)+O2, the rate coefficient decreases from (2.1 + or - 0.2)x 10 to the minus 11th power cu cm/sec at 300K to half this value as the temperature is raised to 700K. These results are in good agreement with heated flowing afterglow results.
Dissert. Abstr.

N80-18895 Oklahoma Univ., Norman.
COVARIANT ELECTRODYNAMICS IN A MEDIUM Ph.D. Thesis
Nak Hyung Hong 1979 59 p
Avail: Univ. Microfilms Order No. 8004389

The energy-momentum and angular momentum emission rates for an arbitrarily moving charge (whose speed is less than that of light in the medium) in a uniform transparent medium are calculated in manifestly covariant form. The calculations are executed for three types of stress tensors: Minkowski, Abraham, and Marx. It is found that the energy-momentum emission rates for all three tensors are found to be equal. Only for the Marx tensor is this rate independent of the orientation of the associated asymptotic space-like surface. The calculations are extended to a dyon of electric charge m. It is shown that all three tensors take the same form as those of the electric charge case except that e squared is replaced by e squared t (epsilon/mu)(m squared). It may be concluded, as far as radiation is concerned, that a magnetic monopole behaves like a charged particle of effective charge (square root of (epsilon/mu))(m).
Dissert. Abstr.

N80-18896 California Univ., Davis.
STUDIES IN MOLECULAR DYNAMICS OF THE FRICTION COEFFICIENT AND THE LORENTZ GAS Ph.D. Thesis
William Edward Alley 1979 184 p
Avail: Univ. Microfilms Order No. 8003494

Various hard sphere molecular dynamics studies are presented. The first describes a modification of Fick's diffusion law, required whenever long time correlations are present. For the Lorentz gas, the non-Markovan nature of the transport process is shown to correspond to a random walk where, after each step, the particle waits for a time as sampled from a waiting time distribution before making the next move. Second, the mass and size dependence of the friction coefficient as well as its dependence on boundary conditions is discussed. A molecular dynamics method is presented which calculates the infinite-mass friction coefficient of finite size hard-sphere particles. The applicability of hydrodynamics is considered to describe fluctuations in fluids on the molecular level. It is shown that the fluctuations present in a system of hard spheres, when placed between closely spaced parallel hard walls, lead to an acoustical resonance for those wavelengths which correspond to the spacing, or integer fractions thereof.
Dissert. Abstr.

N80-18897 Wisconsin Univ. - Madison.
AN INTENSE SOURCE OF NEGATIVE POLARIZED HYDROGEN IONS Ph.D. Thesis
Richard Stephen Raymond 1979 136 p
Avail: Univ. Microfilms Order No. 7928660

Experiments are described which were conducted to study the feasibility of producing an intense beam of negative polarized hydrogen ions by ionizing thermal polarized hydrogen atoms by collision with a fast beam. Results indicate that if negative hydrogen ions are used as the fast beam, the space charge electric fields associated with the ionizing beam seriously complicate formation of the negative polarized beam. Experiments have demonstrated that a beam of 45 keV neutral cesium atoms may be used to produce intense negative polarized hydrogen or deuterium beams. Negative beams with currents as high as 3.1 micro amps are produced by this method. The tensor polarization of a deuterium beam was measured to be 92% of expected value, with weak field ionization. The emittances of hydrogen and deuterium beams were measured and found to be sufficiently small for good transmission through accelerators. Prospects for an operating ion source using this method are discussed.
Dissert. Abstr.

N80-18898 Cornell Univ., Ithaca, N. Y.
COMPUTER SIMULATION AND THEORETICAL STUDIES OF MOLECULAR LIQUIDS Ph.D. Thesis
Sohail Murad 1979 294 p
Avail: Univ. Microfilms Order No. 8003966

Theoretical and simulation methods are developed and applied to both real and model fluids. A method for carrying out computer simulation studies of molecular liquids, based on quaternions was used to carry out detailed molecular dynamics studies of methane, vanadium tetrachloride, and hydrogen chloride. The simulation results for the fluids are compared with the available experiments data for thermodynamic properties, structure factor, mean squared torque, and diffusion coefficients. Quantum corrections to the thermodynamic properties are worked out. In an effort to simplify the use of site-site models in current theories, the expansion of such potentials in spherical harmonics was studied. Explicit analytical expressions are obtained for molecules of general shape, and the convergence of the series is studied for linear, tetrahedral, and octahedral molecules of various bond lengths. A second order perturbation theory is presented for the pair correlation function of a molecular fluid. The theory is compared with three integral equation methods and with simulation results, for both dipolar and quadrupolar fluids. Such comparisons are given for the harmonic coefficients of the pair correlation function, the thermodynamic properties, the mean squared torque, the dielectric constant, and the Kerr constant angular correlation parameter.
Dissert. Abstr.

N80-18899 Florida Univ., Gainesville.
ALTERNATIVE DECOUPLINGS OF THE ELECTRON PROPAGATOR Ph.D. Thesis
Gregory J. Born 1979 175 p
Avail: Univ. Microfilms Order No. 8002837

Several alternative decouplings of the electron propagator are investigated. Operator product decouplings are reviewed and discussed. The moment conserving decouplings which consist of Pade's approximants to the propagator moment expansion are investigated. A partitioning of the superoperator Hamiltonian is invoked, and a perturbation expansion of the superoperator resolvent is developed. Renormalized decouplings are considered, and the two particle one hole, Tamm-Dancoff approximation is specifically derived and investigated. The decoupling approximations are evaluated on the basis of computational applications in which the propagator poles are compared to experimentally determined ionization energies for several molecules.
Dissert. Abstr.

N80-18900 Texas A&M Univ., College Station.
STOPPING POWER MEASUREMENT IN THE 20-150 KeV REGION USING THICK TARGET BACK-SCATTERING: 1H AND 4He ON CARBON, SILICON AND GOLD Ph.D. Thesis
James David Pearce 1979 75 p
Avail: Univ. Microfilms Order No. 8003173

Stopping powers for 20-150 keV hydrogen and helium ions in carbon (graphite), silicon and gold were determined using thick target backscattering in an effort to assess the applicability and/or limitations of the technique for performing absolute stopping power measurements in the intermediate and low energy regions. Present calculations (which have an estimated probable error of less than 5%) are in good agreement with other measurements performed on 'bulk' type targets, but are significantly higher than those reported from thin film measurements. Due to the scarcity of stopping power data in the low and intermediate energy regions for bulk targets, much more experimental work is required before definite conclusions can be reached concerning the discrepancies in the measured stopping powers.
Dissert. Abstr.

N80-18901 Princeton Univ., N. J.
PRODUCTION OF A MOLECULAR BEAM OF LIGAND-FREE METAL CLUSTERS Ph.D. Thesis
Gregory Lee Griffin 1979 184 p
Avail: Univ. Microfilms Order No. 8003785

A multiple expansion cluster source (MECS) for producing a molecular beam of metal clusters is described. The unique advantages of the MECS are the ability to produce narrow particle size distributions and to control the mean cluster size. These features permit investigations in the areas of thin film deposition, sintering of supported metal catalysts, and aerosol separation processes. A theoretical treatment of the entropy of crystalline microclusters is described along with an apparatus to measure the photoionization potential of cluters in the beam.
Dissert. Abstr.

N80-18902 Florida Univ., Gainesville.
A MOLECULAR THERMODYNAMIC MODEL FOR AQUEOUS SOLUTIONS OF NONPOLAR COMPOUNDS AND MICELLE FORMATION Ph.D. Thesis
Robert James Brugman 1979 297 p
Avail: Univ. Microfilms Order No. 8002839

A thermodynamic process for micellization is developed which provides a basis for better understanding of molecular mechanisms important in the formation of micelles as well as other processes of aqueous solution. The foundation of a model of the micelle formation process is a unified molecular thermodynamic theory of aqueous solutions. For spherical gases, a modification of scaled particle theory is used for the excluded volume contribution while a mean field theory approach is used for intermolecular interactions. Extension of the model to aliphatic hydrocarbon solutes required development of an expression for the total interaction energy between a spherocylindrical solute and a spherical solvent. A primitive model for the thermodynamic properties of ionic micellization is tested using the aqueous solubility model and electrostatic theories.
Dissert. Abstr.

N80-18903# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SPIN WAVES IN ITINERANT ELECTRON SPIN DENSITY WAVE STATES
R. Kishore Oct. 1979 19 p refs Revised Submitted for publication
(INPE-1594-RPE/080-Rev) Avail: NTIS HC A02/MF A01

The transverse dynamical susceptibility and the spin wave stiffness constant of spin density wave states in itinerant electron systems are studied. The Hamiltonian is transformed by using a transformation which rotates the spin coordinate system locally, so that the new z direction lies in the direction of the local spin. For the transformed Hamiltonian, a self consistent many body theory is exploited to derive an exact expression for the transverse dynamical susceptibility. From the long wave length limit of the spin wave spectrum, given by the poles of the transverse dynamical susceptibility, an exact formula for the spin wave stiffness constant is obtained. Within the Hartree-Fock approximation, it reduces to the Fisher's formula for antiferromagnets.
A.W.H.

N80-18904*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
INDUCED RADIOACTIVITY IN RECOVERED SKYLAB MATERIALS
G. J. Fishman and C. A. Meegan Jan. 1980 13 p refs
(NASA-TM-78263) Avail: NTIS HC A02/MF A01 CSCL 20H

Four radioactive isotopes found in aluminum and stainless steel samples from Skylab debris were recovered in Australia. The low-level activity was induced by high-energy protons and neutrons in the space environment. Measurements of the specific activities are given.
Author

N80-18905# Air Force Geophysics Lab., Hanscom AFB, Mass.
COMMUTE: A COMPUTER CODE FOR NONCOMMUTATIVE ALGEBRA
Laurence S. Rothman Jul. 1979 30 p refs
(AF Proj. 2310)
(AD-A077360; AFGL-TR-79-0152; AFGL-ERP-666) Avail: NTIS HC A03/MF A01 CSCL 07/4

A computer code has been developed that operates on angular momentum and direction cosine operator products to form a reduced set of lower degree. The program has been used extensively in obtaining the eigenvalues and eigenvectors of the Hamiltonian describing the vibration-rotation levels of triatomic asymmetric rotor molecules. Examples of the use of the program as well as a listing are documented.
GRA

N80-18906# SRI International Corp., Menlo Park, Calif.
MECHANISMS OF MULTIPHOTON DISSOCIATION OF MOLECULAR IONS Summary Report, Nov. 1978 - Nov. 1979
Michael J. Coggiola and James R. Peterson Nov. 1979 4 p
(Contract N00014-76-C-1035)
(AD-A077227) Avail: NTIS HC A02/MF A01 CSCL 07/5

This report discusses the dissociation of molecular ions resulting from infrared photon absorption by highly vibrationally excited molecular ions. Photofragments will be identified and their dissociative lifetime determined where possible. Measurements will also be made of the fragment translational energy distribution. Results to date on ions such as CF3I-, CF3Br-, and C3F6- show that a strong correlation exists between this single photon dissociation process and the final step of multiphoton dissociation. Preliminary analysis indicates that the dissociation dynamics follow a simple statistical mechanism.
GRA

N80-18907# Naval Academy, Annapolis, Md.
THE EFFECT OF ELECTROSTATIC FIELDS ON REACTING MOLECULES Final Report, 1978 - 1979
Alan B. Whiting May 1979 31 p refs
(AD-A077581; USNA-TSPR-102) Avail: NTIS HC A03/MF A01 CSCL 07/3

The work synthesizes some model compounds whose structure provides a dipole for interaction with electric fields. The Diels-Alder addition of furan to maleic anhydride and 6,6-dimethylfulvene to maleic anhydride in electric fields of 0, 240, and 350 V/cm were studied, and they were set to react in a cell in which a static electric field was maintained. It was found that the furan addition was uneffected by the fields, but that the proportion of exo to endo isomers of the 6, 6-dimethylfulvene product changed in a qualitatively predictable way. The details are described in the papers.
GRA

N80-18908# Tennessee Univ., Knoxville.
SUMMARY QUESTIONNAIRE RESPONSE 7901, OCTOBER 1979 Progress Summary Report, Nov. 1978 - Oct. 1979
I. A. Sellin Oct. 1979 14 p refs
(Contract N00014-75-C-0474)
(AD-A075951; Rept-7901) Avail: NTIS HC A02/MF A01 CSCL 20/8

This document is an annual summary questionnaire response associated with work performed on the project entitled "Structure of Highly Ionized Heavy Ions and Associated Collision Phenomena in the MeV/nucleon Range."
GRA

N80-18909# New York Univ., N. Y. Dept. of Physics.
THEORY OF SATURATION SPECTROSCOPY INCLUDING COLLISIONAL EFFECTS
P. R. Berman, P. F. Liao, and J. E. Bjorkhom Sep. 1979 31 p refs
(Contract N00014-77-C-0553)
(AD-A075830) Avail: NTIS HC A03/MF A01 CSCL 07/4

A theory of saturation spectroscopy in three-level gas vapor systems, including collisional effects, is presented. Using a model of collisions in which they are phase-interrupting in their effect on level coherences and velocity-changing in their effect on level population densities, we calculate the absorption profile of a weak probe field on a given transition when an arbitrarily strong pump field acts on a coupled transition. Line shapes are derived for an arbitrary collision kernel describing the velocity-changing collisions, and these line shapes are evaluated for the collision kernel proposed by Keilson and Storer. Various limiting forms for the line shapes are derived and representative line shapes are displayed. Several new features of the line shapes, including collisionally-induced increased probe absorption are discussed. The line shapes are seen to reflect the various collisonal processes that may occur in atomic or molecular systems.
GRA

N80-18910# Washington Univ., Seattle. Dept. of Chemistry.
A CRUCIAL DEMONSTRATION OF STRONG COLLISION BEHAVIOR OF VIBRATIONAL ENERGY FOR GAS-SURFACE COLLISIONS
N. C. Flowers, F. C. Wolters, D. F. Kelley, and B. S. Rabinovitch. 1 Dec. 1979. 9 p. refs.
(Contract N00014-75-C-0690)
(AD-A078800; TR-14) Avail: NTIS. HC A02/MF A01. CSCL 20/13.

The Variable Encounter Method was applied to the study of the transient region in vibrational accommodation of reacting cyclobutene at surfaces. Collision efficiency declines with rise of temperature. Surface collisions are more efficient than binary gas phase encounters and, at temperatures below 450 K, the wall behaves like a theoretical strong collider. GRA

N80-18911# Naval Academy, Annapolis, Md.
THE KINETICS OF ION MOTION IN CaF2:Er. Final Report, 1978-1979.
8 Jun. 1979. 64 p. refs.
(AD-A077555; USNA-TSPR-97) Avail: NTIS. HC A04/MF A01. CSCL 20/6.

Optical density versus wavelength was measured for CaF2:Er(3+) crystals as a function of the temperature to which the crystals were heated prior to quenching. The quenching of the crystals had the effect of freezing in the high temperature equilibrium defect configurations in the crystal. The results obtained support assignments of the optical absorption lines to various defect configurations. It was observed that the absorption line at 537.43 nm increased in height by a factor of about 20 as a result of heating and quenching, supporting the assumption that it is the result of a monomer defect site. The behavior of the absorption lines at 537.06 nm and 537.92 nm support the models that these lines are due to low order clusters. The equilibrium among the defects of the CaF2:Er crystals can be described by an Arrhenius process characterized by an activation energy of 1.26 + or - 0.02 eV. The equilibrium, characteristic of the temperature from which the crystal was quenched, has been modeled to be established by mobile interstitial fluorines. GRA

N80-18912# Columbia Univ., New York.
T[illegible]PHYSICS OF SPIN-POLARIZED ATOMIC VAPORS. Final Report, 1 Mar. 1974 - 28 Feb. 1979.
W. Happer. Aug. 1979. 15 p. refs.
(Grant AF-AFOSR-2685-74)
(AD-A078589; AFOSR-78-1308TR) Avail: NTIS. HC A02/MF A01. CSCL 20/10.

The overall objective of the work supported by the Air Force Office of Scientific Research grant has been to explore the basic physical properties of spin polarized atomic vapors. These systems are of considerable interest to the civilian and military sectors of our society because they can be used to make very precise measurements of time, absolute rotation rates, and electromagnetic fields. For example, the U.S. time standard is the atomic cesium hyperfine frequency; very precise atomic frequency standards are used in satellites and on Earth for a wide variety of uses. Optically pumped magnetometers are used by the oil and mining industry for prospecting, by archaeologists for locating lost cities and sunken treasure ships, and by the navy for location of submarines. Optically pumped systems are currently being developed for use as gyroscopes which may have real advantages in terms of ruggedness and economy. In spite of the widespread practical utility of these systems, there is only limited research going on the related areas. There are no more than a dozen active research groups world wide and most are in foreign countries, including several excellent laboratories in the Soviet bloc. The goal of this work has been to maintain a center of excellence for the study of spin polarized atomic vapors, to ensure that outstanding students are introduced to the field from time to time and to coordinate our research activities with the needs of industrial and government laboratories for critical information and the needs of the university for high-quality basic research. GRA

N80-18913*# Colorado State Univ., Fort Collins. Dept. of Physics.
BROAD BEAM ION SOURCE OPERATION WITH FOUR COMMON GASES
Sung-Jae Pak and James R. Sites. Sep. 1979. 21 p.
(Contract N00014-76-C-0976; Grant NsG-3167; RR0210203)
(NASA-CR-162801; AD-A077561; SF24; SF-24) Avail: NTIS. HC A02/MF A01. CSCL 20/8.

A Kaufman-type broad beam ion source, used for sputtering and etching purposes, has been operated with Ar, Kr, O2 and N2 gas inputs over a wide range of beam energies (200-1200 eV) and gas flow rates (1-10 sccm). The maximum ion beam current density for each gas saturates at about 2.5 mA/sq. cm. as gas flow is increased. The discharge threshold voltage necessary to produce a beam and the beam efficiency (beam current/molecular current), however, varied considerably. Kr had the lowest threshold and highest efficiency, Ar next, then N2 and O2. The ion beam current varied only weakly with beam energy for low gas flow rates, but showed a factor of two increase when the gas flow was higher. GRA

N80-18914# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
LONG DURATION EXPOSURE EMULSION PACKAGE (LDEEP). Interim Report.
R. C. Filz. 19 Jul. 1979. 15 p.
(AF Proj. 2311)
(AD-A077362; AFGL-TR-79-0156; IP-277) Avail: NTIS. HC A02/MF A01. CSCL 20/8.

An exposure package has been designed to obtain measurements of trapped proton fluxes utilizing the NASA Long Duration Exposure Facility. The techniques are similar to those used in the 1960's to obtain trapped proton fluxes from Air Force recoverable satellites. The main novelty consists in the development of proton sensitive plastic detectors capable of withstanding the six month exposure planned for LDEF. At the planned LDEF altitude of 450 km, unshielded nuclear emulsion would become grossly over-exposed in six months. Early designs for LDEEP consisted of shielded emulsons with narrow cylindrical openings to allow trapped protons to enter. The discovery of the CR39 plastic detector by Cartwright et al opens up a new solution to this problem. The potential for obtaining the first reliable measurements of inner zone trapped protons of 1 to 10 Mev energy is discussed. Earlier electronic counter measurements are quite uncertain, and the NERV emulsion results covered are far too brief a time interval and were spatially limited. GRA

N80-18915# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EXPERIMENTAL AND THEORETICAL DETERMINATION OF THE VELOCITY DEPENDANCE OF THE SCATTERING CROSS SECTIONS IN MONOMER-DIMER NOBLE GAS COLLISIONS. Ph.D. Thesis - Goettingen Univ., West Germany [EXPERIMENTELLE UND THEORETISCHE BESTIMMUNG DER GESCHWINDIGKEITSABHAENGIGKEIT DES TOTALEN STREUQUERSCHNITTES BEI EDELGASATON-EDELGASDIMER STOESSEN]
Michael Dueker. Sep. 1978. 56 p. refs. In GERMAN.
(MPIS-19/1978) Avail: NTIS. HC A04/MF A01; Fachinformationszentrum, Goettingen, West Germany DM 10.95.

The total and integral scattering cross sections of noble gases were measured, using in the primary beam Ar, Kr, and Ne atoms, and for the secondary beam the dimers Ar2, Kr2, and Ne2. The cross section ratio obtained for each dimer referred to the monomers was compared with theoretically calculated values. The potential used for calculating the dimer scattering cross section was obtained by the sum of two known potentials, introducing some simplifying hypotheses. Charts are presented showing good agreement between experimental and calculated results. Author (ESA)

N80-18916# Research Inst. of National Defence, Stockholm (Sweden).
KVAST: A COMPUTER PROGRAM TO CALCULATE THE PROTECTION OFFERED BY BUILDINGS TO FALL-OUT RADIATION [KVAST - ETT DATORPROGRAM FOER BERAAKING AV BYGGNADERS SKYDDSFAKTORER FOER KVARVARANDE STRAALING]
Eva Elvers, Majorie Nilsson, and Goeran Danielson. Aug. 1979. 45 p. refs. In SWEDISH.
(FOA-C-20321-A2) Avail: NTIS. HC A03/MF A01.

An interactive computer program was prepared to predict

the protection factors against radioactivity. The protection factor is defined as the ratio between the radiation dose inside the building and the radiation dose outside the building. The calculation methods are described, and a user manual for the KVAST program is presented. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles, and reactor theory.

For space radiation see *93 Space Radiation*.

N80-18917 Massachusetts Univ., Amherst.
PION SCATTERING FROM THE MASS THREE SYSTEM. Ph.D. Thesis.
Jose Pablo Mestre. 1979. 116 p.
Avail: Univ. Microfilms. Order No. 8004964.

Realistic nuclear form factors were used to compute elastic and charge exchange pion scattering angular distributions from He-3 in the Glauber multiple scattering formalism. The resulting angular distributions were compared with those using the Schiff model wave function. Although both nuclear structure descriptions gave equivalent scattering shapes in the forward direction, using realistic nuclear form factors resulted in better agreement with experiment for backward angles. Two different pion nucleon approximations were studied. The first, a Gaussian pi-N parametrization, exhibited too strong a fall-off after 60 degrees, thereby deviating drastically from the experimental picture in the backward hemisphere. The second, a parametrization which included S and P partial waves, gave a much better description of the scattering. Dissert. Abstr.

N80-18918 Texas A&M Univ., College Station.
FIELD THEORETIC MODEL OF LOW-ENERGY PION-NUCLEON ELASTIC SCATTERING. Ph.D. Thesis.
Robert John McLeod. 1979. 104 p.
Avail: Univ. Microfilms. Order No. 8003165.

A relativistic model of pion-nucleon elastic scattering is derived by assuming pseudoscalar coupling and suppressing the contribution of the intermediate antinucleon states. This model is suggested as a relativistic extension of the Chew-Low model, which contains no antinucleons. The antinucleons in the pseudoscalar coupling were considered to give only a small contribution in the P waves, while being responsible for a large S wave phase shift not observed experimentally. Starting with the transition matrix for the lowest order Feynman graphs of the pseudoscalar coupling, the propagator for the intermediate nucleons is decomposed and the antinucleons separated. The transition matrix is then decomposed into its isospin and angular momentum channels. These Born termpartial wave helicity amplitudes are used as driving terms of a partial wave N over D method. Crossing is included in the infinite mass limit only. The results for crossing and the noncrossing approximation are examined. Dissert. Abstr.

N80-18919 Illinois Univ. at Urbana-Champaign.
A NODAL GREENS FUNCTION METHOD FOR MULTI-DIMENSIONAL NEUTRON DIFFUSION CALCULATIONS. Ph.D. Thesis.
Richard Douglas Lawrence. 1979. 195 p.
Avail: Univ. Microfilms. Order No. 8004214.

Green's functions for one-dimensional in-group diffusion-removal operators are used to generate a coupled set of one-dimensional integral equations defined over a subdomain or node. In order to efficiently accommodate changes in the cross sections due to thermalhydraulic feedback, the formalism is developed in terms of Green's functions calculated using reference values for the cross sections. The nodes are coupled by requiring continuity of the partial currents across the nodal interfaces. The integral equations are approximated using a weighted residual procedure applied within each node. The resulting matrix equations, when solved in conjunction with the linear form of the nodal balance equation, provide the necessary additional relationships between the interface partial currents and the flux within the node. The nodal method is applied to several light water reactor benchmark problems and to a four-group LMFBR problem. Dissert. Abstr.

N80-18920# North Carolina State Univ., Raleigh. Dept. of Physics.
INTENSE RELATIVISTIC ELECTRON BEAM INVESTIGATIONS. Final Report, 1 Jul. 1976 - 30 Apr. 1979.
Wesley O. Doggett. 30 Apr. 1979. 50 p. refs.
(Contract F49620-76-C-0007; AF Proj. 2301)
(AD-A078515; AFOSR-79-1310TR) Avail: NTIS. HC A03/MF A01. CSCL 20/9.

During this period research was performed at North Carolina State on collective ion acceleration in a vacuum diode geometry and in collaboration with a group from the Naval Research Lab on collective ion acceleration within an evacuated dielectric tube. Diode voltage and current wave forms along with transmitted beam energy and current were measured for a series of linear diameters and lengths. Beam energy loss was linear at the rate of approximately 12 j/cm. For the 8.3 and 15.9 cm length tubes, the Alfen limiting current was exceeded, indicating the creator of enough plasma for some current neutralization. Below the Alfen limit the current propagates in a pinched beam. The beam from velocity was 1.4 cm/nsec. Equipment for experimental work on electron beam propagation in evacuated magnetized pipes has been assembled and a theoretical study was made of intense electron beam equilibrium in magnetized pipes using a relativistic cold fluid model. GRA

N80-18921# Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands).
[RESEARCH ACTIVITIES IN HIGH ENERGY PHYSICS, 1977] Annual Report.
1978. 98 p. refs.
Avail: NTIS. HC A05/MF A01.

Instrumentation is described for experiments in high energy physics, pion muon research, and in 100 MeV chemistry. The MEA accelerator along with its digital and analog electronics is included. Research projects include electron scattering experiments, pion and muon physics as well as the extension of particle theory. Radio and nuclear chemistry, nuclear spectroscopy, and nuclear reactions are subjects of investigation as well. Author (ESA)

N80-18922# Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands).
[RESEARCH ACTIVITIES IN HIGH ENERGY PHYSICS, 1978] Annual Report.
1978. 109 p. refs.
Avail: NTIS. HC A06/MF A01.

Instrumentation is described for experiments in electron scattering, pion and muon physics, and in radio and nuclear chemistry. The operation of the MEA accelerator and its experimental facility is also reported. Research projects include the realization of a superconducting muon channel, nuclear muon capture, pion scattering, and the extension of particle theory. Radio and nuclear chemistry, including possible medical applications, are subjects of investigation as well. Author (ESA)

74 OPTICS

Includes light phenomena.

N80-18923 Arizona Univ., Tucson.
DESIGN AND PERFORMANCE OF AN EXPERIMENTAL DUAL-FREQUENCY DOPPLER LIDAR FOR REMOTE MEASUREMENT OF WIND VELOCITY. Ph.D. Thesis.
Wynn Lowell Eberhard. 1979. 216 p.
Avail: Univ. Microfilms. Order No. 8002923.

An experimental Dual Frequency Doppler Lidar (DFDL) instrument, based upon an acousto-optically modulated laser, was constructed and operated. It was capable of real time wind measurement, utilizing a minicomputer for data analysis and recording. Laboratory tests, including operation in a wind tunnel with seeded flow, confirmed the predicted differential Doppler shift. The functional dependence of signal to noise ratio on

equipment variables of the DFDL instrument were also verified in the wind tunnel. Outdoor wind measurements in both pure and hybrid DFDL configurations, with natural aerosols as targets, were performed. Good agreement was found between the lidar and a conventional anemometer adjacent to the sensed volume. Dissert. Abstr.

N80-18924# SRI International Corp., Menlo Park, Calif.
LIDAR OBSERVATIONS AT 0.7-MICROMETERS AND 10.6-MICROMETERS WAVELENGTHS DURING DUSTY INFRARED TEST 1 (DIRT-1)
Jan E. VanderLeen. White Sands Missile Range, N. Mexico US Army Electronics Research and Development Command. Sep. 1979. 57 p. refs
(Contract DAAG29-77-C-0001)
(AD-A075275; SRI-TR-3; ERADCOM/ASL-CR-79-0001-2) Avail: NTIS HC A04/MF A01 CSCL 17/5

This technical report describes lidar measurements and results using 10.6-micrometers lidar and the SRI Mark IX (0.7- micrometers) lidar systems during the Dusty Infrared Test 1 (DIRT-I). Transmission comparisons are made between the two wavelengths with artillery barrages, TNT explosions, and oil/rubber fire-generated dust and smoke clouds in a test zone midway (1 km) along the lidar path. A target at the end of the lidar path provided a reference backscatter return for the transmission measurements. Backscatter properties of the dust and smoke clouds are also discussed. Results of the DIRT-I program indicate that the broad particle size distribution present in the dust generated produced little if any wavelength dependent transmission effects. The few observed exceptions where greater 10.6-micrometers transmission is indicated generally can be explained by the presence of wavelength-dependent smoke along the optical path, which is also generated by the detonations. Backscatter-to-transmission relationships are grossly related but, in general, are quite nonlinear, as can be expected when multiple and specular scatter by the large particles, as well as strong attenuations, are involved. The oil/rubber fire generated dense black smoke that was totally opaque to the 0.7 micrometers lidar, while the 10.6 micrometers transmission measurements indicate a transmission of approximately 6%. GRA

N80-18925# ITT Electro-Optical Products Div., Roanoke, Va.
BIDIRECTIONAL COUPLER FOR FULL DUPLEX TRANSMISSION ON A SINGLE FIBER. Final Report, 1 May 1977 - 15 May 1979
A. R. Nelson, G. A. Gasparian, and G. W. Bickel. Aug. 1979. 190 p.
(Contract DAAB07-77-C-1798; DA Proj. 1L1-62701-AH-92)
(AD-A075467; CORADCOM-77-1798-F) Avail: NTIS HC A09/MF A01 CSCL 20/6

The primary objective of this contract is the development of a bi-directional coupler for single optical fiber transmission systems and the implementation of two such couplers in a full duplex link with simulated length of up to 8 km, 20 Mb/s data rate, and 10 to the -8th power BER. The primary approach adapted for this task is the fiber dichroic coupler. Other approaches were also investigated. When used in a duplex optical data link, this three port device constitutes a wavelength selective bi-directional coupler. GRA

N80-18926# Catholic Univ. of America, Washington, D. C. Vitreous State Lab.
DEVELOPMENT OF HIGH STRENGTH OPTICAL FIBER WAVEGUIDES USING RESIDUAL SURFACE COMPRESSION. Final Report, Jan. 1977 - May 1979
R. K. Mohr, O. H. El-Bayoumi, N. Lagakos, H. Hojaji, P. Klocek, R. Ingel, D. S. Ma, J. H. Simmons, and P. B. Macedo. Griffiss AFB, N.Y. RADC Oct. 1979. 118 p.
(Contract F19628-77-C-0084; ARPA Order 3282; AF Proj. 3282)
(AD-A078296; RADC-TR-79-252) Avail: NTIS HC A06/MF A01 CSCL 20/6

The primary objective of this project was to maximize the compressive strengthening obtained in low loss fibers made by the molecular stuffing process. The process being the doping of a porous high silica glass rod made by a phase separation and leaching process. The rod is subsequently sintered to form a solid glass prefrom from which fibers may be drawn. The ultimate goal being a fiber having greater than 100 ksi surface compression and loss less than 10 dB/km. As a major part of this effort, we have characterized the strengthening effects of compression and demonstrated that even moderate compression can be of value in many applications. Optical losses less than 10 dB/km are obtainable using molecular stuffing and we were able to produce preforms having greater than 75 ksi compression. Preforms and fibers having very high compression are difficult to produce and thus may not provide a practical method of dramatically increasing fiber strength. Surface compression on the order of 30 ksi is relatively easy to obtain, however, and compression of this magnitude can have significant effects on fatigue failure in many applications. We were able to demonstrate that fibers having surface compression showed no strength degradation when aged under load in air as long as the tensile load was less in magnitude than that of the compression. In fact, the strength of abraded samples was observed to improve with time. GRA

N80-18927# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
MeV GAMMA RADIATION OBSERVED BY A BALLOON-BORNE COMPTON TELESCOPE [GAMMA-ASTRONOMISCHE BEOBACHTUNGEN IN MEV-BEREICH MIT EINEM BALLONGETRAGENEN COMPTON-TELESKOP]
Franz Graml. Jan. 1979. 131 p. refs. In GERMAN
(MPI-PAE/Extraterr-151; ISSN-0340-8922) Avail: NTIS HC A07/MF A01

The construction of a telescope designed to take measurements from 1 to 20 MeV and identify point sources is described. During a flight in October 1977, radiation from the galactic anticenter as well as from NGC 4151, a Seyfert galaxy was examined. A determination of the cosmic ray spectra was made. Author (ESA)

N80-18928# Research Inst. of National Defence, Stockholm (Sweden).
A REVIEW OF FIBER OPTICS COMMUNICATIONS [FIBEROPTISK KOMMUNIKATION, EN OEVERSIKT]
Hans Ekblom. Sep. 1979. 74 p. refs. In SWEDISH
(FOA-C-30173-E2) Avail: NTIS HC A04/MF A01

A review of fiber optics communication is presented. The transmission capacity, the resistance to mechanical loads, and the sensitivity to environmental influences are examined. Some military applications are discussed and the trends for future development are estimated. Author (ESA)

N80-18063*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRACTICAL LIMITATIONS ON NOISELESS OPTICAL CHANNEL CAPACITY
S. A. Butman, J. Katz, and J. R. Lesh. *In its* The Deep Space Network. 15 Feb. 1980. p. 12-14. refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-18929 Missouri Univ. - Columbia.
EXCITATION OF ELECTRON PLASMA WAVES Ph.D. Thesis
Behrooz Maraghechi. 1979. 110 p.
Avail: Univ. Microfilms Order No. 8002381

The excitation of electron plasma waves by interaction of two electromagnetic waves is examined. Analysis is based on Maxwell's equations and the electron-gas moment equations. Formulas are derived for power absorption densities. Effects of static magnetic fields and inhomogeneties on absorption efficiency are studied numerically. Stimulated Raman backscattering of electromagnetic waves from electron plasma waves in magnetized plasma is investigated. Formulas are derived for the growth rate

and threshold power associated with scattering from Langmuir and upper hybrid waves in a homogeneous plasma. An analysis of spatial amplification of the decay waves in an inhomogeneous plasma is presented. Dissert. Abstr.

N80-18930 Ohio State Univ., Columbus.
TIME- AND SPACE-RESOLVED SPECTROSCOPIC STUDIES OF LOW-CURRENT NANOSECOND-DURATION SPARK DISCHARGES IN 90% ARGON AND 10% HYDROGEN AT ATMOSPHERIC PRESSURE Ph.D Thesis
Larry Lee Wiese 1979 313 p
Avail: Univ. Microfilms Order No. 8001857

Time and axially space resolved spectra were obtained from low current (6.3 and 15 ampere) 250 nanosecond duration spark discharges produced in a mixture of 90% argon and 10% hydrogen at atmospheric pressure using a coaxial cable discharge system. The widths and intensities of H sub alpha, H sub beta and selected Ar 2 spectral lines were used to characterize the behavior of the plasma. The plasma electron density obtained from Stark broadening was found to be of similar magnitude and behavior to that observed in higher current spark discharges. The experimental apparatus and the techniques which were developed are described. The numerical smoothing and nonlinear least squares curve fitting techniques which were used to analyze the data are discussed. Dissert. Abstr.

N80-18931 Colorado Univ. at Boulder.
INVESTIGATION OF THE HOLLOW CATHODE DISCHARGE AT HIGH CURRENT DENSITY Ph.D. Thesis
Bruce Eugene Warner 1979 287 p
Avail: Univ. Microfilms Order No. 8003024

Plasma diagnostics and discharge modeling were performed on a hollow cathode discharge in helium, at current densities in excess of .01 A/sq cm. Typical discharge conditions are a cathode separation of 11 mm, helium pressure of 4-8 torr, tube voltage of 400-600 V, and tube current of up to 3 A d.c. Spectroscopic measurements of Stark broadening are discussed. Modeling of the electron energy distribution by solution of the Boltzmann equation is described. The effects of the non Maxwellian electron energy distribution on the helium excited state populations and ionization and recombination rates are calculated by a collisional-radiative model. A two fluid theory of electron and ion transport in the hollow cathode discharge is developed, which uniformly treats the sheath and negative glow regions and the (numerically) difficult region in between. It calculates the spatial variations of the electron density, ion density, electric field and potential, and ion flow velocity. Dissert. Abstr.

N80-18932 Wisconsin Univ. - Madison.
LOWER HYBRID HEATING ASSOCIATED WITH MODE CONVERSION ON THE WISCONSIN OCTUPOLE Ph.D. Thesis
Thomas Llewellyn Owens 1979 190 p
Avail: Univ. Microfilms Order No. 7928655

A series of 1-10ms pulses of up to 40kW of radio frequency power at 140MHz were launched corresponding to the hot plasma lower hybrid resonance in the octupole. Coupling efficiencies greater than 95% were achieved by proper antenna placement near the edge of the plasma radial density profile. Substantial ion body temperature increases of delta T sub i = 37 eV (delta T sub i/T sub io = 12) in a helium plasma were measured from Doppler broadening of the helium 4686 Angstrom line using a Fabry-Perot interferometer. From spatial scans of ion temperature using a miniature transverse ion energy analyzer in a hydrogen plasmas, heating efficiencies in the range of 16-50% were found. The higher efficiencies in this range occur for denser plasmas. Dissert. Abstr.

N80-18933 Wisconsin Univ. - Madison.
RADIAL CONFINEMENT OF CENTRAL CELL PLASMA IN TANDEM MIRRORS Ph.D. Thesis
Lang I. Lao 1979 178 p
Avail: Univ. Microfilms Order No. 8001155

The single particle guiding center orbit analysis is carried out both numerically and analytically. It is demonstrated numerically using the magnetic field geometry and plasma parameters of the tandem reactor. The radial losses of particle and energy are studied in the fluid approximation. A set of transport equations are obtained by assuming the magnetic field in the three mirror cells to be square wells. A one dimensional tandem transport code was developed from a Tokamak code. Numerical solutions are obtained using parameters of PHAEDRUS and classical, resonant, and Bohm transport coefficients. It is demonstrated using the parameters of UW-TMR and resonant plateau ion transport coefficients that resonant radial transport can substantially lower the Q values of tandem mirror reactors. Dissert. Abstr.

N80-18934 Illinois Univ. at Urbana-Champaign.
MONTE CARLO SIMULATION OF NEUTRAL-BEAM INJECTION FOR MIRROR FUSION REACTORS Ph.D. Thesis
Ronald Lee Miller 1979 154 p
Avail: Univ. Microfilms Order No. 8004231

Energetic neutral-beam particles interact with the target plasma through electron-atom and ion-atom collisional ionization as well as ion-atom charge-transfer (charge-exchange) collisions to give a fractional trapping of the neutral beam and a loss of charge-transfer-produced neutrals which escape to bombard the reactor first wall. Appropriate interaction cross sections for these processes are calculated for the assumed anisotropic, non-Maxwellian plasma ion phase-space distributions. The target plasma is assumed to be confined by a Yin-Yang mirror-coil configuration and has distinct radial and axial density profiles as modeled in steady-state and three spatial dimensions. The energy and angular distributions of a population of neutral test particles are computed to give statistical estimates of neutral-beam trapping efficiency, non-uniform first-wall surface heating rates and first-wall sputtering-erosion for use in engineering-design calculations. A guide to the NUBIN computer is included. Dissert. Abstr.

N80-18935 Florida Univ., Gainesville.
STEADY-STATE AND TIME-DEPENDENT BEHAVIOR OF FUSION-FISSION HYBRID SYSTEMS Ph.D. Thesis
William Gerard Vernetson 1979 445 p
Avail: Univ. Microfilms Order No. 8002909

A stability analysis of point model systems representing pure fusioning plasmas as well as coupled fusion-fission systems was examined. The stability criteria for these systems were derived for constant plasma confinement conditions based on engineering perturbations of the system feedrate. The results of linearized point model plasma stability analysis of the thermal instability were shown to be applicable to hybrid plasmas and to be attainable from considerations of engineering related perturbations in the extrinsic plasma feedrate variable. A Tokamak fusion-fission hybrid design was selected for further analysis. The modeled hybrid system in linearized form was found to be stable provided certain hybrid plasma temperature and confinement time limits are met. Hybrid plasma behavior was examined under transient and overpower conditions. Dissert. Abstr.

N80-18936# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE INTERACTION OF LARGE-AMPLITUDE PLASMA WAVES WITH A MOVING ELECTRON PLASMA
Abraham C.-L. Chian Nov. 1979 11 p refs Submitted for publication
(INPE-1626-RPE/091) Avail: NTIS HC A02/MF A01

A fluid treatment of the interaction of large amplitude plasma waves with a moving electron plasma is presented. An exact dispersion relation is obtained. In addition, a condition for the occurrence of wavebreaking for the subluminous waves is determined. Author

N80-18937# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ON THE PROPAGATION OF RELATIVISTIC NONLINEAR ELECTROMAGNETIC WAVES IN A COLD PLASMA
Nov. 1979 36 p refs Submitted for publication
(INPE-1624-RPE/089) Avail: NTIS HC A03/MF A01

A general theory of relativistic nonlinear electromagnetic waves in a cold electron plasma is presented. Three modes of propagation are analyzed: (1) longitudinal waves, (2) transverse circularly polarized waves, and (3) coupled transverse-longitudinal waves. The dispersion relations are obtained. A number of relativistic and nonlinear effects are discussed. A.W.H.

N80-18938# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RELATIVISTIC NONLINEAR ELECTRON CYCLOTRON WAVES IN PLASMA
Abraham C.-L. Chian and Ruth B. Miranda Nov. 1979 10 p refs Submitted for publication
(INPE-1625-RPE/090) Avail: NTIS HC A02/MF A01

The propagation of relativistic nonlinear electron cylcotron waves in a cold streaming plasma is studied. The dispersion relation is analyzed and expressions for the resonance and cut-off frequencies are obtained. It is shown that the nonlinear dispersion relation for a streaming plasma can be obtained from the nonlinear dispersion relation for a stationary plasma by a Lorentz transformation. K.L.

N80-18939# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
WAVES IN HOT MAGNETIZED PLASMAS
J. A. Bittencourt Sep. 1979 72 p Revised
(INPE-1575-RRP/072) Avail: NTIS HC A04/MF A01

The fundamentals of plasma physics are considered. The theory of wave propagation in a hot plasma is extended to the case of a hot plasma immersed in an externally applied magnetic field. The characteristics of wave propagation in a plasma consisting of mobile electrons in a neutralizing background of stationary ions are analyzed in some detail for directions either parallel or perpendicular to the magnetic field. J.M.S.

N80-18940# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PARTICLE INTERACTIONS IN PLASMAS
J. A. Bittencourt Oct. 1979 48 p Revised
(INPE-1589-RPE/076) Avail: NTIS HC A03/MF A01

The dynamics of binary collisions are described and the concepts of differential scattering cross section, total scattering cross section, and momentum transfer cross section are introduced. These cross sections are explicitly calculated for the cases of the hard sphere model and of the Coulomb potential, due to the Debye shielding, are incorporated on the cross sections for the Coulomb potential. J.M.S.

N80-18941# Nagoya Univ. (Japan).
THERMAL CONDUCTIVITIES AND COEFFICIENTS OF THERMAL DIFFUSION OF A HIGH-TEMPERATURE PLASMA IN A UNIFORM MAGNETIC FIELD
Shobu Kaneko and Akihiro Yamao Jan. 1980 15 p refs
(IPPJ-432) Avail: NTIS HC A02/MF A01

The Boltzmann equation was used to evaluate the thermal conductivities and the coefficients of thermal diffusion of a plasma composed of electrons and singly charged positive ions. The distribution functions for electrons and ions are expanded in terms of Sonine's polynomials. Numbers of the expansion terms are changed from 6 to 50, and the convergence of this method is examined. Both the thermal conductivities and the coefficients of thermal diffusion evaluated from the expansions with 50 terms are shown to have accuracy of at least six decimal places for various strength of magnetic field. A.R.H.

N80-18942# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THEORETICAL ANALYSIS OF THE RESONANCE CONE IN AN INHOMOGENEOUS MAGNETOPLASMA COLUMN
H. Sanuki, T. Watanabe, and T. Ohnuma Jan. 1980 26 p refs
(IPPJ-433) Avail: NTIS HC A03/MF A01

The three dimensional behaviour of the high frequency resonance cone was investigated using an inhomogeneous slab magnetoplasma model under the quasistatic approximation and neglecting ion motion. The effect of finite k sub y and electron thermal motion are considered numerically, revealing that the cone angle is shifted to a slightly smaller angle and the reflection point also shifts toward the high density region compared with the results under the cold plasma approximation. Author

N80-18943# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MONTE CARLO SIMULATION OF PLASMA CONFINEMENT IN MIRROR AND CUSP FIELDS
Yukiharu Ohsawa and Tetsuo Kamimura Dec. 1979 28 p refs
(IPPJ-431) Avail: NTIS HC A03/MF A01

Plasma confinement times for mirror and cusp devices are investigated by using a Monte Carlo simulation model which can include the effects of binary collisions, arbitrary spatial change in the magnetic field, and external electric fields. For a mirror, the simulation results are in good agreement with theory. For a cusp (without an external electric field), the confinement time is found to be proportional to the plasma radius divided by the average velocity, which is approximately the same as the theoretical confinement time, but is quite different from that obtained from the Nagoya experiments. Collision effects are also considered. A.R.H.

N80-18944# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXPLOSION OF STRANGE ATTRACTORS EXHIBITED BY DUFFING'S EQUATION
Yoshisuke Ueda (Kyota Univ.) Dec. 1979 19 p refs
(IPPJ-430) Avail: NTIS HC A02/MF A01

Using analog and digital computers, the motion exhibited by Duffing's equation (called the chaotically transitional process) was investigated. The results obtained and the unsolved problems developed from them are summarized. Special attention is directed towards the transition of the processes under the variation of the system parameter. R.E.S.

N80-18945*# Miami Univ., Oxford, Ohio.
HIGH PRESSURE LASER PLASMA STUDIES Final Report
W. E. Wells 1980 63 p refs
(Grant NsG-1383)
(NASA-CR-162824) Avail: NTIS HC A04/MF A01 CSCL 20I

The operation of a nuclear pumped laser, operating at a wavelength of 1.79 micron m on the 3d(1/2-4p(3/2) transition in argon with helium-3 as the majority gas is discussed. The energy pathways in He-Ar gas were investigated by observing the effects of varying partial pressures on the emissions of levels lying above the 4p level in argon during a pulsed afterglow. An attempt is made to determine the population mechanisms of the 3d level in pure argon by observing emission from the same transition in a high pressure plasma excited by a high energy electron beam. Both collisional radiative and dissociative recombination are discussed. A.R.H.

N80-18946*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL RESULTS ON PLASMA INTERACTIONS WITH LARGE SURFACES AT HIGH VOLTAGES
Norman T. Grier 1980 12 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-81423; E-346) Avail: NTIS HC A02/MF A01 CSCL 20I

Multikilowatt power levels for future payloads can be more efficiently generated using solar arrays operating in the kilovolt range. This implies that large areas of the array at high operating voltages will be exposed to the space plasma environment. The resulting interactions of these high voltage surfaces with space plasma environments can seriously impact the performance of the satellite system. The plasma-surface interaction phenomena were studied in tests performed in two separate vacuum chambers, a 4.6 m diameter by 19.2 long chamber and a 20 m diameter by 27.4 m long chamber. The generated plasma density was approximately 1x10 to the 4th power/cu cm. Ten solar array panels each with areas of 1400 sq cm were used in the tests. Nine of the solar panels were tested as a composite unit in the form of a 3x3 solar panel matrix. The results from all the tests confirmed small sample tests results: insulators were found to enhance the plasma coupling current for high positive bias and arcing was found to occur at high negative bias. A.R.H.

N80-18947*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EXPERIENCE WITH ARC-HEATER SIMULATION OF OUTER PLANET ENTRY RADIATION
W. L. Wells and W. L. Snow Jan. 1980 30 p refs
(NASA-TM-80192) Avail: NTIS HC A03/MF A01 CSCL 14B

An electric arc heater was operated at 800 amperes and

100,000 pa (1 atm) with hydrogen, helium, and two mixtures of hydrogen and helium. A VUV-scanning monochromator was used to record the spectra from an end view while a second spectrometer was used to determine the plasma temperature using hydrogen continuum radiation at 562 nm. Except for pure helium, the plasma temperature was found to be too low to produce significant helium radiation, and the measured spectra were primarily the hydrogen spectra with the highest intensity in the pure hydrogen case. A radiation computer code was used to compute the spectra for comparison to the measurements and to extend the study to simulation of outer planet entry radiation. Conductive cooling prevented ablation of phenolic carbon material samples mounted inside the arc heater during a cursory attempt to produce radiation absorption by ablation gases.

Author

N80-18948# Naval Research Lab., Washington, D. C. Plasma Physics Div.
ELECTROMAGNETIC INSTABILITIES IN A FOCUSED ION BEAM PROPAGATING THROUGH A Z-DISCHARGE PLASMA. Interim Report
P. F. Ottinger, D. Mosher, and Shyke A. Goldstein. Oct. 1979. 26 p. refs.
(Contract ES-77-A-01-6021)
(AD-A076154; NRL-MR-4088) Avail: NTIS HC A03/MF A01 CSCL 20/9

A beam-plasma system consisting of a focused light ion beam propagating through a z-discharge plasma is analyzed for electromagnetic velocity space instabilities. In particular, the Weibel and the Whistler instabilities are studied. It is found that unstable modes do not grow fast enough to affect the beam propagation in a pellet-fusion-reactor chamber. GRA

N80-18949# Stanford Univ., Calif. Inst. for Plasma Research.
EVOLUTION OF TURBULENCE BY THREE-DIMENSIONAL NUMERICAL PARTICLE-VORTEX TRACING
Benoit Couet. Aug. 1979. 145 p. refs.
(Contract N00014-78-C-0272)
(AD-A076121; SU-IPR-793) Avail: NTIS HC A07/MF A01 CSCL 20/9

A new method for the numerical simulation of three-dimensional incompressible flows is described. Our vortex-in-cell (VIC) method traces the motion of the vortex filaments in the velocity field which these filaments create. The velocity field is not calculated by creating a mesh-record of the vorticity field, then integrating a Poisson's equation via the fast Fourier transform to get the stream function and generating a mesh-record of the velocity field. The computed scales of motion are assumed to be essentially inviscid. Viscous or subgrid-scale effects are incorporated into a filtering procedure in wave vector space. Three computational experiments were pursued in three-dimensional space. The velocity of translation of a single vortex ring was measured and compared with the Biot-Savart law. Next, the evolution in time of an infinite periodic array of closed vortex filaments (Taylor-Green) was studied. The third simulation follows a mixing layer from an initial state of uniform vorticity with two- and three-dimensional small perturbations. Streamwise perturbations lead to the usual roll-up of vortex patterns with spanwise uniformity. GRA

N80-18950# Naval Research Lab., Washington, D. C. Plasma Physics Div.
THEORY OF SECOND HARMONIC ELECTRON CYCLOTRON RESONANCE HEATING OF TOKAMAK PLASMA. Interim Report
Bertram Hui, Edward Ott, K. R. Chu, and Thomas Antonsen (MIT, Cambridge, Mass.). 26 Oct. 1979. 16 p. refs.
(AD-A077538; AD-E000336; NRL-MR-4104) Avail: NTIS HC A02/MF A01 CSCL 20/9

A theoretical and numerical study of Tokamak plasma heating by the second harmonic of the electron cyclotron resonance is presented. It is found that the extraordinary mode is very efficiently absorbed. In contrast to previous calculations, it is also found that the ordinary mode is well absorbed at oblique incidence to the toroidal magnetic field. This finding indicates the feasibility of heating devices of higher densities than would otherwise be possible. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-18951* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR SLICING CRYSTALS. Patent
John S. J. Benedicto, Bruce E. Woodgate, and Frederick C. Hallberg, inventors (to NASA). Issued 22 Jan. 1980. 5 p. Filed 15 May 1978. Supersedes N78-24386 (16 - 15, p. 1978)
(NASA-Case-GSC-12291-1; US-Patent-4,184,472; US-Patent-Appl-SN-906298; US-Patent-Class-125-23R; US-Patent-Class-51-235; US-Patent-Class-83-152; US-Patent-Class-83-870; US-Patent-Class-269-21) Avail: US Patent and Trademark Office CSCL 20B

The crystal slicing method is described as follows. A crystal is sliced in a plane parallel to flat, opposed parallel end faces of the crystal. The end faces of the crystal are gripped by a pair of opposed, perforated platens of a pair of vacuum chambers, one of which is translatable relative to the other. A blade cuts the crystal through the desired plane. A spring biases one of the vacuum chambers away from the other vacuum chamber while both of the faces are gripped by the vacuum chambers and the blade is cleaving the crystal. A sliced portion of the crystal gripped by one of the vacuum chambers is pulled away from the remainder of the crystal gripped by the second vacuum chamber when the crystal was cleaved by the blade through the plane. Official Gazette of the U.S. Patent and Trademark Office

N80-18952 State Univ. of New York at Stony Brook.
SILICATE MINERALS AT PRESSURE: CRYSTAL STRUCTURES AND ELASTICITY. Ph.D. Thesis
Louise Levien. 1979. 228 p.
Avail: Univ. Microfilms Order No. 8004410

Unit-cell and crystal structure parameters were measured on single crystals of four minerals mounted in diamond-anvil high pressure cells. Isothermal bulk moduli and their pressure derivatives were calculated by fitting the pressure and unit-cell volume data to a Birch-Murnaghan equation of state. The single-crystal moduli of diopside were determined using a method based on the phenomenon of Brillouin scattering. All Si-O-Si angles in these minerals decreased with increased pressure; that in quartz changes most. As pressure is increased, small decreases in the average silicate tetrahedral bond lengths took place in all four crystallographically unique tetrahedra studied. Larger decreases were observed in the average polyhedral distances in diopside. Dissert. Abstr.

N80-18953 Lyon Univ. (France).
CRYSTAL SITES MODELS. Ph.D. Thesis
Yves Emile Boudeville. 1977. 207 p.
Avail: Univ. Microfilms Order No. 8003229

The crystalline site where the doping transition metal ion is located in the crystalline matrix is examined. The features of these sites are found by models growing from six to two thousand atoms by applying parametrized crystal field theory. Variation laws for parameters are established according to the size of the models. For 2000 atoms model, conventional values of parameters are found accordingly to crystal field theory. An approach of (010) surface, defects, and holes is performed. In order to correlate catalytic selectivity and covalency of binding, studies on the electronic state of sites and the atoms, charges are performed on EHT-SCCC-MO models from 7 to 17 atoms, including 3 transition metal ions. These calculations are compared to more extended CNDO/2 studies using 33 atoms with 11 transition metal cations. Different forms of covalent binding are analyzed. Dissert. Abstr.

N80-18954 Illinois Univ. at Urbana-Champaign.
EXTREMAL EFFECTS IN ROTATIONALLY INELASTIC DIFFRACTION. Ph.D. Thesis
Lynn Charles Rathbun. 1979. 130 p.
Avail: Univ. Microfilms Order No. 8004259

The scattering of the hydrogenic molecules H2, D2, and

HD from vacuum cleaved MgO (001) along the /110/ azimuth was studied. A thermal beam at 300 K and 80 K was used. Emphasis was placed on the rotational inelastic processes which accompany diffraction of HD. The scattering of helium along both the /110/ and the /100/ azimuths was studied. Anomalous shifts and structure were seen in the diffraction lobes for scattering along the /110/ azimuth. Dissert. Abstr.

N80-18955 Lehigh Univ., Bethlehem, Pa.
ULTRAVIOLET SPECTROSCOPY OF ELECTRON TRAPPING CENTERS IN THERMALLY GROWN SiO FILMS Ph.D. Thesis
Dennis Dean Rathman 1979 246 p
Avail: Univ. Microfilms Order No. 8003066

Electron trapping centers found in thermally grown silicon dioxide films were studied. Thick SiO2 films contain a number of distinct electron trapping centers which were characterized by such quantities as their capture and photoionization cross sections. These quantities were determined from the study of the kinetics of both the trap filling and trap emptying processes. The kinetics of these processes were interpreted in terms of models incorporating first order rate equations. The photon energy dependence of the emptying process was studied for the photon energy range of 4 to 7 eV. Three distinct electron trapping centers were observed in wet, thermal oxide films which were not previously characterized by such quantities listed above. Dissert. Abstr.

N80-18956 Lehigh Univ., Bethlehem, Pa.
BOUND SMALL POLARON TRANSITIONS IN MAGNESIUM OXIDE AND BERYLLIUM OXIDE Ph.D. Thesis
Lewis Howard Mammel, Jr. 1979 162 p
Avail: Univ. Microfilms Order No. 8003063

An extended version of the bound small polaron model was used to calculate optical absorption spectra of BeO:[Li]O, MgO:[Li]O, and MgO:V(-). Zeroth and first moment shifts of the magnetic circular dichroism spectra were calculated for MgO:[Li]O. The extended model includes O(-) ion pi orbitals as well as pi orbitals and allows for dipole matrix elements arising from direct overlap as well as from admixture. The calculations were made using a Monte Carlo method whereby the vibrational motion of the lattice is taken into account by calculating electronic transitions at many different randomly distributed lattice configurations using a restricted form of vibronic coupling. It was found that important features of the spectra remain unaccounted for in spite of the extensions employed in the model. A suggestion is made for further work which might provide a more complete interpretation. Dissert. Abstr.

N80-18957 Illinois Inst. of Tech., Chicago.
NONLINEAR ULTRASONIC PARAMETRIC PROCESSES IN PIEZOELECTRIC SEMICONDUCTORS AND FERROELECTRIC INSULATORS Ph.D. Thesis
John Ephstrates Economou 1979 154 p
Avail: Univ. Microfilms Order No. 8003646

A phenomenological analysis is presented that takes into consideration the contributions of the nonlinear material coefficients to several nonlinear ultrasonic parametric processes in piezoelectric semiconductors and ferroelectric insulators. It is concerned specifically with: (1) ultrasonic frequency mixing phenomena, such as second harmonic and subharmonic generation; (2) the omega-2 omega three wave parametric process (phonon echo process) in which the interaction of pump (radiation) field at frequency 2 omega with an acoustic wave at frequency omega generates a backward traveling acoustic wave at frequency omega; and (3) the mixing of two acoustic waves to generate a microwave radiation field. Dissert. Abstr.

N80-18958 Illinois Univ. at Urbana-Champaign.
HYDROGEN CHEMISORPTION AND OXIDATION ON TRANSITION METAL CARBIDES Ph.D. Thesis
James Roger Bethin 1979 91 p
Avail: Univ. Microfilms Order No. 8004134

The catalytic activity of tungsten carbide was investigated with emphasis on the possible influence of point defects. The chemisorption of hydrogen on tungsten carbide and titanium oxycarbides was studied with differential scanning calorimetry. The catalytic activity of these materials for oxidation of hydrogen was determined by potentiostatic steady state and potentiodynamic measurements in acid electrolyte. Compositions of tungsten carbide surfaces were determined by X-ray photoemission and related to the catalytic behavior. Titanium oxycarbide surfaces were analyzed by Auger electron spectroscopy. Of the carbides tested only one WC preparation was able to chemisorb hydrogen. Both WC powders investigated catalyzed hydrogen oxidation with similar specific activities. Dissert. Abstr.

N80-18959 Cornell Univ., Ithaca, N. Y.
STRUCTURAL AND TRANSPORT PROPERTIES OF SIMPLE METALS UNDER HIGH PRESSURE Ph.D. Thesis
Joseph Benjamin Wai Tung Cheung 1979 232 p
Avail: Univ. Microfilms Order No. 8003906

The effect core polarization fluctuations have on the total energy of a metal were reviewed. A generalized Hamiltonian was analyzed with emphasis on the interactions of the core electrons. Perturbation theory was used to yield expressions for the contributions to the total energy. It is found that the core fluctuations, in addition to producing screened van der Waals interactions between the ions, also screen the various interactions in the metal and that the screening effects can be incorporated into a core dielectric function. An interpolation formula for the core dielectric function was obtained and the results were applied to the calculation of the equation of state of potassium. Results indicate that in potassium core effects contribute rather significantly to the energy and the equation of state. Dissert. Abstr.

N80-18960 California Univ., Santa Barbara.
HIGH TEMPERATURE EPR STUDY OF SUPERIONIC CONDUCTORS AND STRONGLY EXCHANGE COUPLED PARAMAGNETS Ph.D. Thesis
Cesar Augusto Por Deus Evora 1978 145 p
Avail: Univ. Microfilms Order No. 8003034

High temperature electron paramagnetic resonance (EPR) in solids was studied. The aspects covered were: (1) F(-) anion diffusion and the dynamic modulation of the crystalline field as it affects the ERP of a Mn2(+) impurity in the superionic conductor PbF2; and (2) the persistence of superexchange into the molten state of a paramagnet (MnF2), using fast relaxing, exchange coupled impurities to distinguish the effects of exchange from motional narrowing of the EPR above the melting point, T sub M. In the superionic conductor PbF2 the collapse of the F19 transferred hyperfine structure of the Mn2(+) EPR above 400 K is explained by F(-) anion diffusion. Above 620 K a linewidth dependence on the nuclear spin quantum number M55 of each Mn55 hyperfine component was observed. Using the Redfield relaxation theory it shown that this effect is caused by the dynamic modulation of the crystal field. Dissert. Abstr.

N80-18961 Princeton Univ., N. J.
ELECTROCHEMICAL KINETICS AT METAL AND SEMICONDUCTOR SURFACES: ROLE OF INTERFACIAL ENERGY BARRIERS Ph.D. Thesis
Harold Edward Hager 1979 157 p
Avail: Univ. Microfilms Order No. 8003786

The incorporation of ionic adsorption phenomena into electrochemical kinetic expressions is examined. Here the influence of specifically adsorbed ions upon the potential structure of the double layer is determined. This result is employed to interpret solution concentration effects observed in several reported hydrogen oxidation/reduction studies on platinum. The role of ionic half cell reaction products upon the performance characteristics of a photoassisted electrochemical cell is analyzed. The stability of semiconductor materials employed as photoelectrodes in water electrolysis systems is investigated. The feasibility of employing simple coating schemes to stabilize photocorrodible photoanode materials is discussed. Charge transport and electron/hole pair recombination in a photoassisted electrochemical cell are treated theoretically. An experimental program is outlined for the determination of the recombination velocity as a function of the system bias, illumination intensity, and electrolyte. Dissert. Abstr.

N80-18962 Pittsburgh Univ., Pa.
AN EXPERIMENTAL STUDY OF THE PHASE SEPARATION PROCESS NEAR THE CRITICAL POINT Ph.D. Thesis
Arthur Jay Schwartz 1979 134 p
Avail: Univ. Microfilms Order No. 8004876

A method developed for performing quenches on samples in their critical region and probing the phase separation process by light scattering is described. The spinodal ring, a maximum as a function of angle in the scattered cross section as measured by light scattering was examined. The maximum intensity of the scattering as well as its angular position were studied as a function of quench depth and composition. The limits of metastability were probed by quenching samples held off the critical isochore until spontaneous phase separation occurred. Dissert. Abstr.

N80-18963 Lehigh Univ., Bethlehem, Pa.
DEEP LEVEL TRANSIENT SPECTROSCOPY STUDIES OF RADIATION INDUCING DEFECTS IN SILICON Ph.D. Thesis
John Richard Troxell 1979 338 p
Avail: Univ. Microfilms Order No. 8003072

The use of deep level transient spectroscopy (DLTS) in characterizing lattice defects produced in silicon by electron irradiation both at room temperature and in situ at liquid helium temperatures is discussed. The electrical properties of the defects are cataloged and correlated with the results of electron paramagnetic resonance studies in order to identify the defect levels. Schottky barrier diodes, diffused, and ion implanted junctions are studied. Studies of the isolated vacancy, interstitial boron, and interstitial aluminum are reported. The construction of the DLTS spectrometer and the fabrication of the samples are considered. Dissert. Abstr.

N80-18964 Illinois Univ. at Urbana-Champaign.
STUDIES IN THE ELECTRONIC STRUCTURE OF MATTER Ph.D. Thesis
Coenraad Albert Swarts 1979 349 p
Avail: Univ. Microfilms Order No. 8004284

The results of various theories for the angular distribution of electrons photoemitted from the outer most p shell of rare gas atoms are compared. The theories compared are: (1) the local density theories of Slater and of Hohenberg, Kohn and Sham; (2) the pseudopotential method; (3) Hartree-Fock theory; and, (4) Amusia's random phase approximation with exchange. It is shown that the local density theories, although simple, generally fail to produce a reliable cross section. Extended Horckel theory is applied to GaAs, GaP and to the nitrogen isoelectronic trap in GaAs and GaP. The computed perfect crystal band structures are found to be in reasonable agreement with those computed with empirical pseudopotentials. By means of model calculations for an independent electron metal, exact lineshapes for the photon absorption, emission, and photoemission spectra of deep core states are obtained. Dissert. Abstr.

N80-18965# Texas Univ. at Austin. Dept. of Chemistry.
SEMICONDUCTOR ELECTRODES 25: THE P-GaAs/HEATYL VIOLOGEN SYSTEM. PHOTOELECTROCHEMICAL CELLS AND PHOTOELECTROCHROMIC DISPLAYS Technical Report, 1 Sep. 1979 - 31 Aug. 1980
Benjamin Reichman, Fu-Ren F. Fan, and Allen J. Bard 1 Oct. 1979 30 p refs Submitted for publication
(Contract N00014-78-C-0592)
(AD-A075812; TR-2) Avail: NTIS HC A03/MF A01 CSCL 20/12

The photoreduction of aqueous solutions of 1,1:-diheptyl-4,4:-bipyridyl (heptyl viologen, HV(2-)) bromide on p-GaAs was investigated. Under irradiation with light of wavelengths below 885 nm, the photoreduction of HV(2-) to form a precipitate of violet HVBr occurs on p-GaAs at a potential of approx 400 mV more positive than the reversible potential of the HV(2-)/HVBr couple on Pt. Oxidation of HVBr back to soluble HV(2-) occurs in the dark at more negative potentials. Photoelectrochemical low capacity storage cells based on this reaction with Cu, Ni, or HxNb2O5 counter electrodes were constructed. In such cells, under illumination, the p-GaAs electrode behaves as the cathode, a photovoltage develops and current flows in the external circuit, while HVBr precipitates on the electrode surface and the counter electrode is oxidized. In the dark, the current flows in the opposite direction, the p-GaAs is the anode and reduction occurs at the counter electrode. Such a cell also produces an alternating electrical output under periodic illumination. Photoelectrochromic cells based on this reaction and utilizing simultaneous addressing with light and electrical signals are also proposed. GRA

N80-18966# Texas Univ. at Austin. Dept. of Chemistry.
SEMICONDUCTOR ELECTRODES 27: THE P- AND N-GaAs-N, N'-DIMETHYL-4, 4'-BIPYRIDINIUM SYSTEM, ENHANCEMENT OF HYDROGEN EVOLUTION ON P-GaAs AND STABILIZATION OF N-GaAs ELECTRODES Technical Report, 1 Sep. 1979 - 31 Aug. 1980
Fu-Ren F. Fan 1 Oct. 1979 26 p refs
(Contract N00014-78-C-0592)
(AD-A075813; TR-3) Avail: NTIS HC A03/MF A01 CSCL 20/12

The photoelectrochemical (PEC) behavior of N,N:-dimethyl-4, 4:-bipyridinium (methyl viologen,MV (2-) at p- and n-type GaAs electrodes in aqueous solutions was studied. The reduction of MV(2-) at irradiated p-GaAs occurs at potentials approx. 450 mV less negative than those found at Pt electrode. The catalyzed reaction of the Photogenerated MV with water to produce hydrogen by irradiation of p-GaAs was demonstrated and the use of the MV-system as an intermediate in the photoassisted generation of hydrogen at semiconductors with high hydrogen over potentials suggested. The photooxidation of MV at n-GaAs occurred at potentials approx. 0.8 V less positive to those where the oxidation takes place at Pt. PEC cells of the form n-GaAs or p-GaAs/MV(2-),MV/M were also constructed. GRA

N80-18967# Vermont Univ., Burlington. Dept. of Chemistry.
APPLICATIONS OF THE MOESSBAUER EFFECT TO THE STUDY OF MIXED-VALENCE COMPOUNDS
David B. Brown and James T. Wrobleski Nov. 1979 33 p refs
(Contract N00014-75-C-0756)
(AD-A077640; TR-19) Avail: NTIS HC A03/MF A01 CSCL 07/3

The principal utility of Moessbauer Effect spectroscopy in the study of mixed-valence materials is its ability (through measurement of the chemical shift) to distinguish between different oxidation states of the same element in similar chemical environments. By using Moessbauer Effect spectroscopy it is possible to distinguish between trapped and delocalized valence states in mixed-valence compounds. In addition, the rather long lifetime of the Moessbauer experiment, as compared to other forms of spectroscopy, permits evaluation of the rate of intervalence electron exchange in mixed-valence materials. GRA

N80-18968# RCA Labs., Princeton, N. J.
HIGH-ENERGY ION IMPLANTATION FOR MULTIGIGABIT-RATE GaAs INTEGRATED CIRCUIT Annual Report, 15 May 1978 - 14 May 1979
S. G. Liu, E. C. Douglas, and C. P. Wu Aug. 1979 79 p refs
(Contract N00014-78-C-0367; RF54582001)
(AD-A076237; PRRL-79-CR-37) Avail: NTIS HC A05/MF A01 CSCL 13/8

The program objectives are: study of high-energy (about 1 MeV) ion implantation of donors into GaAs for multigigabit-rate integrated-circuit development and annealing of implanted GaAs using high-power lasers to remove lattice damage and activate implanted donors. Results obtained are: We have investigated implantation of 28Si(-) into semi-insulating GaAs with implant energies ranging from 40 keV to 1.2 MeV; we have analyzed the profiles and range statistics of 28Si-implanted GaAs with energies of up to 1.2 MeV using (Secondary Ion-Mass Spectroscopy) SIMS; we have investigated laser-annealing of high-dose Si-implanted GaAs using both a high-power Nd:glass laser and a ruby laser; optical absorption in Si-implanted GaAs wafers irradiated with high-power Nd:glass laser pulses has been studied; impurity distribution in as-implanted, thermally annealed, and laser-annealed samples has been investigated by SIMS; and investigation of 28Si(-) implantations in GaAs at the low-implant energy (-300 keV) shows that the electron concentration attained has an upper limit at the high-dose region and a lower limit at the low-dose region following thermal annealing. GRA

N80-18969# Pennsylvania State Univ., University Park. Materials Research Lab.
TEMPERATURE COMPENSATED PIEZOELECTRIC OXIDE

MATERIALS Final Report, 23 Feb. 1977 - 30 Nov. 1978
G. R. Barsch and K. E. Spear Sep. 1979 52 p refs
(Contract F19628-77-C-0131; AF Proj. 2305)
(AD-A077650; RADC-TR-79-219) Avail: NTIS
HC A04/MF A01 CSCL 20/2

In order to search for new temperature compensated materials for surface acoustic wave (SAW) devices with low ultrasonic attenuation and high electromechanical coupling, the following investigations were carried out: (1) Crystal growth for lead potassium niobate (PKN), Pb2KNb5O15 and for lithium metasilicate, Li2SiO3 by using the Czochralski method; (2) The complete set of elastic, dielectric and piezoelectric constants and of their temperature coefficients is reported for unpoled PKN; (3) The piezoelectric strain constants d(11) and d(14) of alpha-berlinite have been measured by the static x-ray method. The piezoelectric stress constants e(11) and e(14) calculated from these results are larger than the values previously determined ultrasonically; (4) The dielectric constant and the loss tangent of alpha-berlinite were measured from 1,000 to 1,000,000 Hz between -175 and -200 C. Two relaxation peaks are present in the loss tangent; and (5) In order to assess the reliability of the x-ray method the piezoelectric strain constants d(11) and d(14) of alpha-quartz were measured with this method. The value obtained for d(11) is in excellent agreement with the results obtained by other experimental methods. The value of d(14) obtained from the (024) reflection is about 30 percent larger than the values obtained by other methods. GRA

N80-18970# Spectrolab, Inc., Sylmar, Calif.
LOW RESISTIVITY-HIGH MINORITY CARRIER LIFETIME SINGLE CRYSTAL SILICON INVESTIGATION Interim Report, Jul. 1977 - Sep. 1978
Paul M. Stella and R. W. Opjorden Apr. 1979 50 p refs
(Contract F33615-77-C-2045; AF Proj. 2308)
(AD-A077684; AFAPL-TR-79-2031) Avail: NTIS
HC A03/MF A01

The objective of this program is to improve the performance of N+/P silicon solar cells by improving the minority carrier lifetime of moderate to low resistivity silicon material. The behavior of cells fabricated from improved material will be demonstrated by measuring electrical output without irradiation and after 1 Mev electrons and 10 MeV proton irradiation. This report discusses the first fifteen months' efforts toward developing and evaluating a new solar cell silicon material. During this time period, equipment and techniques for material growth have been developed along with analysis of methods for removing impurities from non-ultra pure silicon after wafer fabrication. Five preliminary ultra pure ingots have been grown using boron ion implantation and a single ingot using elemental gallium to provide the P dopant. Results are presented for solar cells made from the ingots. GRA

N80-18971# Naval Academy, Annapolis, Md.
DIPOLAR DEFECTS IN RARE-EARTH DOPED ALKALINE-EARTH FLUORIDES Final Report, 1978 - 1979
Michael K. Smith 15 May 1979 91 p refs
(AD-A077580; USNA-TSPR-99) Avail: NTIS
HC A05/MF A01 CSCL 20/2

It has become clear that simple point-defect models of relaxations in doped alkaline-earth fluorides are insufficient to explain experimental results. The idea that clusters of rare-earths may be associated with observed relaxations has been suggested. The writer attempted to study calcium fluoride crystals doped with two different rare-earth species, utilizing dielectric relaxation and ionic thermocurrent techniques to investigate the cluster hypothesis. If, in fact, a relaxation is associated with a dipolar cluster, hybrid relaxation involving both rare-earth species present should be observed. The finding (enclosed) provides useful new information concerning the defect structure of rare-earth doped calcium fluoride. GRA

N80-18972# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Summary Report, 1 Feb. - 30 Apr. 1979
Alan L. McWhorter 15 May 1979 88 p refs
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A078676; TR-1979-2; ESD-TR-79-150) Avail: NTIS
HC A05/MF A01 CSCL 20/12

This report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 February through 30 April 1979. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Analog Device Technology. Funding is primarily provided by the Air Force, with additional support provided by the Army, ARPA, NSF, and DOE. GRA

N80-18973# Dayton Univ., Ohio.
APPLIED SURFACE ANALYSIS WORKSHOP Final Report
John T. Grant Oct. 1979 67 p Conf. held at Danton Univ., Ohio, 13-15 Jun. 1979
(Contract F33615-79-C-5130)
(AD-A078830; UDR-TR-79-67; AFML-TR-79-4153) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report describes the Applied Surface Analysis Workshop held at the University of Dayton, Dayton, Ohio on 13-15 June 1979. Thirty-eight papers were presented at the Workshop, five of them being from invited speakers. Approximately 100 scientists active in the field of surface analysis participated in the workshop. GRA

N80-18974# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
APPLICATION OF NONLINEAR CRYSTALS Final Report
Carol J. Kastner and Jack J. Grossman 30 Jul. 1979 95 p refs
(Contract N00173-78-C-0161)
(AD-A077570; MDC-G7887) Avail: NTIS HC A05/MF A01 CSCL 20/12

Contents: Prior Work on Correlation and Convolution; Experimental -- Joint Transform Correlator (JTC), Frequency Conversion Facilities, NRL Transparencies, Convolutions with Square Apertures, Use of Image Plane Filters - Two Crystal Experiments, Internal Reflections, SHG and Noise, Convolution Non-linearity, Convolution Peak Intensity Ratios, Crystal Damage, N-Pattern Test of CD*A; Appendix A-I MDAC Contract Review; Appendix A-II - Theory - The Convolution and Correlation Operations, Frequency Conversion, Soviet Papers, and Determination of Bit Shift. GRA

N80-18975# Oregon Graduate Center for Study and Research, Beaverton.
FIELD ELECTRON AND ION SOURCE RESEARCH FOR HIGH DENSITY INFORMATION STORAGE SYSTEM Final Technical Report, Sep. 1977 - Dec. 1978
L. W. Swanson, J. Orloff, and A. E. Bell May 1979 203 p refs
(Contract F33615-76-C-1327; AF Proj. 3164)
(AD-A078520; AFAL-TR-79-1133) Avail: NTIS
HC A10/MF A01 CSCL 20/12

The purpose of this research program is the evaluation and characterization of high brightness field electron and ion sources suitable for use in high density information storage systems. In addition, preliminary evaluation of focussing optics suitable for forming submicron beams of both ions and electrons has been performed. Several new field electron source materials including Mo, LaB6, SmB6 and HfC have been examined. In addition, a complete characterization and comparison between the Zr/W(100) and built-up W(100) emitters operating in the thermal-field (TF) mode is reported. Such source parameters as angular intensity, energy distribution, beam noise spectrum, and source life have been measured. GRA

N80-18976# Varian Associates, Palo Alto, Calif.
RESEARCH ON InGaAs FET'S Interim Report
S. Banoy, T. Boyle, R. Fulks, S. Hyder, and C. Nishimoto Sep. 1979 65 p refs
(Contract N00014-78-C-0380; RF54581001; NR Proj. 251-030)
(AD-A078816; TR-1) Avail: NTIS HC A04/MF A01 CSCL 20/12

Virtually the whole effort for this period was spent in trying to grow by Vapor Phase Epitaxy (VPE) dislocation-free InGaAs on GaAs at In percentages above 25%. Of all the techniques tried, significant improvement came only after installation of a H2 bypass on the reactor. Field Effect Transistors (FETs) fabricated on the best of the pre-H2 bypass wafers showed sub-GaAs

values for the effective saturated velocity, and FETs have yet to be fabricated on the wafers grown with the H2 bypass. Efforts at ion-implanting the pre-H2 bypass wafers were not successful, presumably because of the heavy amount of dislocations in the material. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N80-18977 North Carolina Univ. at Chapel Hill.
INITIAL VALUE PROBLEMS ON NON-EUCLIDEAN TOPOLOGIES Ph.D. Thesis
Jeffrey Mann Bowen 1979 137 p
Avail: Univ. Microfilms Order No. 8005017

Einstein's equations of general relativity, studied as a Cauchy problem are presented. The equations are split into space-plus-time form, and the dynamical and kinematical variables are distinguished. The initial value equations are specialized to maximal, conformally flat initial spacelike hypersurfaces. Time symmetric solutions of the initial value equations are investigated. When the symmetry conditions are applied to the extrinsic curvature tensor, a simple form for the vacuum solution of the momentum constraint is obtained, representing an object with linear momentum. It is argued that the resulting three-geometry consists of two physically identical, asymptotically flat regions connected by an extremal area throat. Solutions including angular momentum and electric fields are also presented. The solutions found are purely geometric models that may represent moving, (classically) spinning, or electrically charged particles.
Dissert. Abstr.

N80-18978 Wisconsin Univ. - Madison.
APPLICATION OF THE SECOND LAW TO THE ANALYSIS AND DESIGN OF ENERGY SYSTEMS Ph.D. Thesis
William Joseph Wepfer 1979 297 p
Avail: Univ. Microfilms Order No. 7928679

The Second Law concept of available energy and how it applies to thermodynamic analysis and thermoeconomic design of energy systems is presented. After an introduction to the basic concept of available energy is presented, efficiency analyses and economic analyses are discussed. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N80-18979*# National Aeronautics and Space Administration, Washington, D. C.
NASA'S UNIVERSITY PROGRAM: ACTIVE PROJECTS, FISCAL YEAR 1979
1979 562 p
(NASA-TM-81777) Avail: NTIS HC A24/MF A01 CSCL 05A

Current information and related statistics are provided for each grant/contract/ cooperative agreement during the report period. Cross indexes by agreement number, field of science and engineering, and technical officer location are included.
A.R.H.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-18980# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
SOME RECENT DEVELOPMENTS IN MULTIPLE DECISION THEORY: A BRIEF OVERVIEW
Shanti S. Gupta and Deng-Yuan Huang Oct. 1979 15 p refs (Contract N00014-75-C-0455)
(AD-A077710; Mimeo-Ser-79-26) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper surveys some recent developments in multiple decision (selection and ranking) theory. The spirit and philosophy underlying this approach to comparing k populations are discussed briefly. Criteria to construct optimal multiple decision procedures, which are based on some 'modifications' of decision theory, are discussed. The combination of the indifference zone and the subset selection approach into a general framework is described. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N80-18981 University of Southwestern Louisiana, Lafayette.
THE DESIGN AND IMPLEMENTATION OF A RELATIONAL AND NETWORK DATABASE ACCESS LANGUAGE Ph.D. Thesis
Donald Jules Simon 1979 146 p
Avail: Univ. Microfilms Order No. 8002716

A mapping oriented query language is described which can interface with either a relational or network data base. An extended query language utilizes the relational calculus and a CODASYL-type data manipulation language as target languages to map the user's query into the respective data model. The user need not know which relations or records contain which attributes; the user merely provides XQL with (1) the attributes or fields he wants retrieved, and (2) the conditions under which they are to be retrieved. Also, XGL provides the user with functions such as SORT, COUNT, AVERAGE, MIN, and MAX, and provides the users of both relational and network models with a straightforward method of interfacing with either model. Furthermore it allows the users of a network model to view the data in a tubular representation as users of the relational model do.Dissert. Abstr.

N80-18982 Duke Univ., Durham, N. C.
QUALITY OF DECISION VERSUS DEPTH OF SEARCH ON GAME TREES Ph.D. Thesis
Dana S. Nau 1979 145 p
Avail: Univ. Microfilms Order No. 8003633

In the field of game playing, good results have been obtained by searching the game tree to some arbitrary depth and heuristically estimating its characteristics beyond that depth. For such a heuristic game tree search, there is a consensus that the quality of the decision improves as the search depth increases, but this agreement is based purely on empirical evidence. A mathematical theory modeling the effects of search depth on the probability of making a correct decision using a heuristic game tree search was developed. This application produced the surprising result that there is an infinite class of game trees for which searching deeper does not increase the probability of making a correct decision, but instead causes the decision to become more and more random. A mathematical proof of this statement is presented along with experimental verification of it, and a discussion of its significance for decision making in general.
Dissert. Abstr.

N80-18983 Florida Univ., Gainesville.
A SYSTEMATIC APPROACH TO LOGICAL DATABASE DESIGN Ph.D. Thesis
Der-Her Lo 1979 188 p
Avail: Univ. Microfilms Order No. 8002873

A step-by-step design process is presented which can guide the database designs to carry out the logical database designs

systematically so that high quality databases can be obtained and the designer productivity can be increased. Topics covered include requirement analysis and specification, application modeling, application integration, DBMS schema generation, and query skeleton generation. A prototype of the computer-assisted logical database design and based on the described design process is implemented. Dissert. Abstr.

N80-18984 Princeton Univ., N. J.
DATA DEPENDENCIES IN RELATIONAL DATABASE SCHEMES Ph.D. Thesis
Alberto Oscar Mendelzon 1979 78 p
Avail: Univ. Microfilms Order No. 8003792

The tableau method for representing and manipulating database schemes is used for developing an algorithm to determine whether a given join dependency is a logical consequences of a set of functional, multivalued and join dependencies. A notion of equivalence of database schemes is introduced, based on the equality of the fixed-point sets of the associated project-join mappings. It is shown that the implication testing method can be applied to the determination of whether two database schemes are equivalent under a set of functional and join dependencies. Finally, the notion of lossless decompositions and fixed-points of a database scheme is examined by introducing generalized mutual dependencies. It is shown that generalized mutual dependencies are equivalent to a special type of join dependencies, and furthermore, any join dependency is equivalent to a generalized mutual dependency plus a set of multivalued dependencies. Dissert. Abstr.

N80-18985*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMES RESEARCH CENTER PUBLICATIONS: A CONTINUING BIBLIOGRAPHY, 1978
Feb. 1980 139 p
(NASA-TM-81175; A-8079) Avail: NTIS HC A07 CSCL 05B

This bibliography lists formal NASA publications, journal articles, books, chapters of books, patents and contractor reports issued by Ames Research Center which were indexed by Scientific and Technical Aerospace Abstracts, Limited Scientific and Technical Aerospace Abstracts, and International Aerospace Abstracts in 1978. Citations are arranged by directorate, type of publication and NASA accession numbers. Subject, personal author, corporate source, contract number, and report/accession number indexes are provided. Author

N80-18986*# Lockheed Electronics Co., Houston, Tex.
IMAGE SELECTION SYSTEM: OPERATOR'S PROCEDURES MANUAL
C. C. DeValcourt Oct. 1975 51 p
(Contract NAS9-12200)
(NASA-CR-160467; JSC-10657; LEC-4366) Avail: NTIS HC A04/MF A01 CSCL 05B

Essential retrieval parameter tables on the Image Selection System were consolidated from two separate operations manuals to provide on example of a typical retrieval session. A.R.H.

N80-18987# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
ON DATABASE MANAGEMENT SYSTEM ARCHITECTURE Interim Report
Michael Hammer and Dennis McLeod Oct. 1979 43 p refs
Prepared in cooperation with the Univ. of Southern California, Los Angeles
(Contract N00014-76-C-0944)
(AD-A076417; MIT/LCS/TM-141) Avail: NTIS HC A03/MF A01 CSCL 05/2

Despite the many advances that have been made in the field of database management in the last two decades, in many respects the paradigm of database management has not changed much since its inception. Several long-standing assumptions pervade the field and exert a great influence on the architecture of database management systems, their functions, and the kinds of databases that they manage. This paper reconsiders some of these assumptions and suggests certain alternatives to them. In particular, it is argued that the concept of an integrated database ought to be supplanted by that of a federated database, a loose assembly of semi-independent components; the position of the database management system in the context of a total information system is reexamined, and arguments are made for extending its functional capabilities; and controlled logical redundancy in the schema is introduced as a means of improving the usability of a database and of enhancing its life-cycle performance. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-18988*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAMS FOR ESTIMATING CIVIL AIRCRAFT ECONOMICS
Dal V. Maddalon, John K. Molloy, and Milton J. Neubawer Jan. 1980 51 p refs
(NASA-TM-80196) Avail: NTIS HC A04/MF A01 CSCL 05C

Computer programs for calculating airline direct operating cost, indirect operating cost, and return on investment were developed to provide a means for determining commercial aircraft life cycle cost and economic performance. A representative wide body subsonic jet aircraft was evaluated to illustrate use of the programs. K.L.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-18989# Committee on International Relations (U.S. House).
INTERNATIONAL TRANSFER OF TECHNOLOGY
Washington GPO 1979 61 p refs Rept. of the President to the Congr. together with assessment of the rept. by the Congressional Res. Service for the Subcomm. on Intern. Security and Scientific Affairs of the Comm. on Intern. Relations, 95th Congr., 2d Sess., Dec. 1978
(GPO-37-153) Avail: SOD HC

The transfer of technology having significant national security implications are discussed in terms of the rational for the transfer from the United States to foreign countries. An assessment of the Executive response to the International Security Act is included. F.O.S.

N80-18990*# Transportation Systems Center, Cambridge, Mass.
IMPLICATIONS OF FUEL-EFFICIENT VEHICLES ON RIDE QUALITY AND PASSENGER ACCEPTANCE: WORKSHOP PROCEEDINGS Final Report, 6-8 Sep. 1979
Anna M. Wichansky, ed. and A. R. Kuhlthau, ed. (Virginia Univ.) Aug. 1979 120 p refs Conf. held at Woods Hole, Mass., 6-8 Sep. 1978
(NASA-CP-2096; DTS-532; DOT-TSC-RSPA-79-21) Avail: NTIS HC A06/MF A01 CSCL 13F

Topics discussed include ride quality and passenger acceptance problems associated with enhanced fuel efficiency of

automobiles and aircraft shifts in intermediate range (100-500 miles) travel from automobiles to public transit and implications of increased size disparity for ground transport freight and passenger vehicles using shared guideways. Major problem areas were identified and strategies for conducting pertinent research were outlined. A glossary of technical terms is included. K.L.

N80-18991*# Brobeck (William M.) and Associates, Berkeley, Calif.
STUDY OF ADVANCED ELECTRIC PROPULSION SYSTEM CONCEPT USING A FLYWHEEL FOR ELECTRIC VEHICLES Final Report
Francis C. Younger and Heinz Lackner Dec. 1979 231 p refs
(Contracts DEN3-78; EC-77-A-31-1011)
(NASA-CR-159650; DOE/NASA/0078-79/1;
WMB/A-4500-131-3-R1) Avail: NTIS HC A11/MF A01 CSCL 10B

Advanced electric propulsion system concepts with flywheels for electric vehicles are evaluated and it is predicted that advanced systems can provide considerable performance improvement over existing electric propulsion systems with little or no cost penalty. Using components specifically designed for an integrated electric propulsion system avoids the compromises that frequently lead to a loss of efficiency and to inefficient utilization of space and weight. A propulsion system using a flywheel power energy storage device can provide excellent acceleration under adverse conditions of battery degradation due either to very low temperatures or high degrees of discharge. Both electrical and mechanical means of transfer of energy to and from the flywheel appear attractive; however, development work is required to establish the safe limits of speed and energy storage for advanced flywheel designs and to achieve the optimum efficiency of energy transfer. Brushless traction motor designs using either electronic commutation schemes or dc-to-ac inverters appear to provide a practical approach to a mass producible motor, with excellent efficiency and light weight. No comparisons were made with advanced system concepts which do not incorporate a flywheel. M.G.

N80-18992*# Brobeck (William M.) and Associates, Berkeley, Calif.
AN AUTOMATICALLY-SHIFTED TWO-SPEED TRANSAXLE SYSTEM FOR AN ELECTRIC VEHICLE Final Report, Dec. 1978 - Dec. 1979
Hayden S. Gordon and Gregory V. Hassman Jan. 1980 34 p refs
(Contracts DEN3-84; EC-77-A-31-1044)
(NASA-CR-159746; DOE/NASA/0084-79/1;
WMB/A-131-4-R2) Avail: NTIS HC A03/MF A01 CSCL 13F

An automatic shifting scheme for a two speed transaxle for use with an electric vehicle propulsion system is described. The transaxle system was to be installed in an instrumented laboratory propulsion system of an ac electric vehicle drive train. The transaxle which had been fabricated is also described. J.M.S.

N80-18993# Wiss, Janney, Elstner and Associates, Inc., Northbrook, Ill.
CONTROL OF VIBRATION AND BLAST NOISE FROM SURFACE COAL MINING, VOLUME 1 Final Report, 1 Jul. 1975 - 28 Feb. 1978
John F. Wiss Dec. 1978 161 p
(Contract DI-BM-0255022)
(PB-299887/0; BM-OFR-103(1)-79) Avail: NTIS HC A08/MF A01; also available in set of 4 reports HC E16 as PB-299886-SET CSCL 13F

A series of controlled experiments was conducted at four surface coal mines to study the effects of certain blast parameters upon the ground and air vibration. Preliminary scale-model blasts were conducted at a quarry to provide basic data. Literature review is presented. GRA

N80-18994# Wiss, Janney, Elstner and Associates, Inc., Northbrook, Ill.
CONTROL OF VIBRATION AND BLAST NOISE FROM SURFACE COAL MINING, VOLUME 2 Final Report, 1 Jul. 1975 - 28 Feb. 1978
John F. Wiss and Patrick W. Linehan Dec. 1978 282 p
(Contract DI-BM-J0255022)
(PB-299888/8; BM-OFR-103(2)-79) Avail: NTIS HC A13/MF A01; also available in set of 4 reports HC E16 as PB-299886-SET CSCL 13F

A series of controlled experiments was conducted at four surface coal mines to study the effects of certain blast parameters upon the ground and air vibration. The experiments conducted at the mines are described and the variables evaluated are identified. The effects of the variables upon the peak amplitudes and frequency content of the seismic and air vibrations are included. GRA

N80-18995# National Technical Information Service, Springfield, Va.
TECHNOLOGY TRANSFER: GENERAL AND THEORETICAL STUDIES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Dec. 1979
Mary E. Young Dec. 1979 186 p Supersedes NTIS/PS-78/1274; NTIS/PS-77/1131; NTIS/PS-76/1008; NTIS/PS-75/884; COM-74-1194
(PB80-801509; NTIS/PS-78/1274; NTIS/PS-77/1131; NTIS/PS-76/1008; NTIS/PS-75/884; COM-74-11194) Avail: NTIS HC $30.00/MF $30.00 CSCL 05B

The cited reports cover research in technology transfer from 1977 to December, 1978. Topics on Government policies, aid to developing countries, feasibility studies, proposed methodologies, and theory are included. This updated bibliography contains 178 abstracts, 55 of which are new entries to the previous edition. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-18998 Colorado Univ. at Boulder.
SUPERGIANT CHROMOSPHERES Ph.D. Thesis
Gibor Saul Basri 1979 143 p
Avail: Univ. Microfilms Order No. 8002958

Observations with high spectral resolution that are calibrated in absolute flux units at the stellar surface are used to construct preliminary models of three late-type supergiants; beta Dra (G211) equal to Gem (G8Ib)), and Ori(M2Iab). The details of chromospheric emission formation in the low density atmospheres of supergiants are studied using partial redistribution radiative transfer codes. The strong coherency of the resonance line wings has a profound effect on the appearance of the emergent line profile and on the physical properties of the atmosphere that can be derived from it. Dissert. Abstr.

N80-18997*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ASSESSMENT OF GROUND-BASED TECHNIQUES FOR DETECTING OTHER PLANETARY SYSTEMS. VOLUME 1: AN OVERVIEW
David C. Black, ed. and William E. Brunk, ed. (NASA, Washington, D.C.) Feb. 1980 48 p refs Workshop held at Cambridge, Mass., Nov. 1979
(NASA-CP-2124; A-8002) Avail: NTIS HC A03/MF A01 CSCL 03A

The feasibility and limitations of ground-based techniques for detecting other planetary systems are discussed as well as the level of accuracy at which these limitations would occur and the extent to which they can be overcome by new technology and instrumenation. Workshop conclusions and recommenda-

tions are summarized and a proposed high priority program is considered. A.R.H.

N80-18998# Southampton Univ. (England). Dept. of Physics.
BALLOON-BORNE OBSERVATIONS OF NGC 4511 USING THE MISO TELESCOPE
F. Perotti, A. DellaVentura, G. Sechi, G. Villa, G. DiCocco (CNR, Bologna), R. E. Baker, R. C. Butler, A. J. Dean, S. J. Martin, and D. Ramsden Sep. 1979 5 p refs Sponsored jointly by UK Sci. Res. Council and CNR Prepared in cooperation with CNR
Avail: NTIS HC A02/MF A01

The Seyfert Galaxy NGC 4151 was observed from balloon altitudes using the MISO low energy gamma-ray telescope on May 23, 1977. The spectrum was measured over the range 0.04 to 20 MeV and a change in the spectral index was observed at about 2 MeV. The data at low energies are in good agreement with other hard X-ray data, but at higher energies the data are consistent with an exponential spectrum having an e-folding energy of 2.1 MeV. Author (ESA)

N80-18999# Royal Observatory, Edinburgh (Scotland).
[ASTRONOMICAL ACTIVITIES, 1977 - 1978] Annual Report
1978 54 p refs
(ISBN-0-9025-5321-6) Avail: NTIS HC A04/MF A01

The operation of celestial observation facilities, results obtained, and research projects for the year are reported. Using a Schmidt telescope located in Australia, a photographic survey of the southern sky is underway. Photographic techniques and other telescope oriented research is discussed. The use of an infrared telescope located in Hawaii is also mentioned. Image and data processing services, notably the cosmos machine for making measurements on photographs, are presented. Research activities deal with extragalactic phenomena, galactic structure, and stellar astronomy among other subjects. Author (ESA)

N80-19000# Royal Greenwich Observatory, Herstmonceux (England).
DOUBLE STAR OBSERVATIONS MADE WITH THE 28-INCH REFRACTOR: 1963-1970
R. W. Argyle, M. P. Candy, and L. S. T. Symms 1979 31 p refs
(Roy-Obs-Bull-184) Avail: NTIS HC A03/MF A01; Roy. Greenwich Obs., Herstmonceux, England £ 1.00

Results of 1151 observations of 225 star pairs are given with a comparison with available orbits. The third and last series of double star observations made with the 28 inch refractor at Herstmonceux are shown. Separations were measured using the comparison image micrometer, except in a few cases when the filar micrometer was used. Most observations were made using a magnification of x685, but on occasion x1387 was used when seeing was good. The results also include several pairs which were measured between 1960 and 1962, but which were not included in the previous lists. Author (ESA)

N80-19001# Hamburger Sternwarte (West Germany).
CURRENT APPLICATIONS OF SCHMIDT TELESCOPES IN ASTRONOMY
H. J. Wendker, ed. 30 Mar. 1979 50 p refs Partly in GERMAN and ENGLISH
(ISSN-0374-1583) Avail: NTIS HC A03/MF A01

Various programs throughout the world including the use of Schmidt telescopes are reviewed. In each case the telescope is described and its applications are outlined. Programs include spectroscopic surveys, the gathering of classification criteria for late-type stars, the compilation of spectral atlases, photometric studies, measuring light curves of T Tauri stars, and radial velocity determinations with objective prism spectra as well as spectrophotometry with crossed grating and prism. Also reported are studies of minor planets, galactic structure, and extragalactic work. Operating parameters for this instrument, such as polar alignment, wind sensitivity, collimation, and guiding are also covered. Author (ESA)

N80-19002# Geneva Observatory (Switzerland).
SYNTHETIC STELLAR SPECTRA: A LIBRARY OF CALCULATION PROGRAMS [SPECTRES STELLAIRES SYNTHETIQUES: PROGRAMMES DE CALCUL]
Yves Chmielewski 1979 123 p refs In FRENCH; ENGLISH summary
(Publ-Ser-B-Fasc-7) Avail: NTIS HC A06/MF A01

Programs used to compute solar or stellar spectra by quantitative analysis assuming local thermodynamic equilibrium are described. This set of programs allows for the rapid computation of single as well as blended lines. Routines used to prepare stellar models and to compute the state of a stellar atmosphere are also described. Author (ESA)

N80-18062*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY
R. M. Taylor *In its* The Deep Space Network 15 Feb. 1980 p 10-11 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-19003 Princeton Univ., N. J.
GALACTIC KINEMATICS OF MOLECULAR CLOUDS Ph.D. Thesis
Anthony Albert Stark 1979 95 p
Avail: Univ. Microfilms Order No. 8003795

The kinematics of molecular clouds in the galactic disk are studied to determine the magnitude of cloud to cloud velocity dispersions and systematic streaming motions. Three observational programs are reported: (1) a strip map of l = 180 deg from b = -9 deg to +8 deg (2) a 20 point map of the minor axis of M31; and, (3) three maps in the molecular ring, centered at 34 deg, l = 36 deg and l = 51 deg. Dissert. Abstr.

N80-19004 Nebraska Univ. - Lincoln.
AN ASTROPHYSICAL INVESTIGATION OF RADIUS AND MASS ANOMALIES AMONG SHORT PERIOD CEPHEIDS Ph.D. Thesis
Gordon David Niva 1979 118 p
Avail: Univ. Microfilms Order No. 8005300

Simultaneous photometric and spectroscopic observations were obtained for the short period Cepheids, SU Cas and TU Cas. Using these observations and a modified Wesselink method, in which the radius is obtained from a relation between the (V-R) color and the surface brightness, the radii of the stars were calculated and compared. The pulsation mode of SU Cas was tested by its position in the period radius diagram. The radius obtained gives weak support to the hypothesis that SU Cas is a first overtone pulsator. The spectroscopic radial velocities of TU Cas were combined with those of other authors and a least squares Fourier fitting technique was applied. The periods (previously obtained only from Fourier analysis of light curves) were confirmed and the time rate of change of the amplitudes of various modes was determined. Dissert. Abstr.

N80-19005 Princeton Univ., N. J.
HYDRODYNAMIC CALCULATIONS OF INTERSTELLAR CLOUD COLLISIONS Ph.D. Thesis
Mark Alan Hausman 1979 94 p
Avail: Univ. Microfilms Order No. 8003781

An algorithm for computing hydrodynamics in three dimensions treats a gas as if it were divided into a number of discrete mass-elements, each of which feels gravitational and viscous forces as well as a short-range force which simulates the effects of pressure gradients. The algorithm was used to examine the gross properties of collisions of interstellar HI clouds. A number of simulations with varying cloud mass ratios, relative velocities, and impact parameter are described. Results are examined. Dissert. Abstr.

N80-19006 California Univ., Santa Barbara.
THEORETICAL MODELS OF STELLAR FORMATION Ph.D. Thesis
Alan Paul Boss 1979 404 p

Avail: Univ. Microfilms Order No. 8003031

Theoretical models of the collapse and fragmentation of rotating interstellar clouds into single or multiple protostellar systems were constructed. A series of gravitational hydrodynamic computer codes were constructed in order to numerically follow the collapse of spherically symmetric (1 D), axially symmetric (2 D), and nonaxially symmetric (3 D) interstellar clouds. The Poisson equation for the gravitational potential is solved using a spherical harmonic expansion. The 1 D code was used to study the dynamic collapse of pressureless, isothermal, and adiabatic clouds as well as the equilibrium of an isothermal Bonnor-Ebert sphere. The 1 D code with its radiative transfer inclusion calculated the nonhomologous collapse of an initially isothermal cloud into the nonisothermal regime where rising temperature temporarily halts the collapse. The 2 D and 3 D codes were constructed so as to conserve angular momentum both locally and globally. With the 2 D code a rotating interstellar cloud collapses to form a rotating, near equilibrium ring. Numerical tests with the 2 D code as well as a completely analytic treatment of the collapse of a rotating, pressureless cloud confirm the reality of ring formation in axially symmetric clouds. The 3 D code was used to follow the collapse of rotating clouds subjected to various nonaxially symmetric perturbations. Dissert. Abstr.

N80-19007 Hawaii Univ., Honolulu.
THE FORMATION OF LATE O AND B STARS WITHIN DENSE MOLECULAR CLOUDS Ph.D. Thesis
Charles Arnold Beichman 1979 148 p.
Avail: Univ. Microfilms Order No. 8003277

The dense, hot cores of 24 molecular clouds were examined at infrared wavelengths between 2.2 and 25 micron m in search of embedded, luminous objects thought to be massive O and B stars at an early stage of their evolution. Nineteen of the clouds were examined at 20 micron m for high sensitivity to sources of low color temperature between 80 and 200 K. The 20 micron m searches revealed four objects too red to be discovered in previous searches at 2.2 and 10 micron m. Results indicate that infrared sources in molecular clouds tend to form in clusters whose characteristic size is very similar to that found in trapezium-like groups of O and B stars. It seems likely that molecular clouds fragment as their densities reach 10 to the 4th power/cu cm into independently collapsing nuclei separated by about 0.1 pc and each capable of producing one (or more) star(s). Some embedded infrared sources are surrounded by a small amount of ionized material. Dissert. Abstr.

N80-19008 Florida Univ., Gainesville.
EVOLUTION OF PRE-MAIN-SEQUENCE BINARY STAR SYSTEMS Ph.D. Thesis
Jon Kenneth West 1979 221 p.
Avail: Univ. Microfilms Order No. 8002914

A quasistatic polytropic model representing the pre-main-sequence contraction phase was applied to both components of close binary star systems. Models were calculated for eleven observed semi-detached close binaries published in the literature and the results were compared with the observed systems. The names and ages of the three that are likely to be pre-main-sequence are: U Caphei (610,000 years), X Trianguli (4.6 million years), and W Ursae Minoris (1.87 million years). The following four systems were found not to fit the pre-main-sequence model in this investigation: TV Cassiopeia, AI Draconis, Beta Persei, and TX Ursae Majoris. The following four systems could be pre-main-sequence with modifications to the model: Im Aurigae (350,000 years), delta Librae (820,000 years), U Sagittae (378,000 years), and V505 Sagittarii (1.89 million years). Dissert. Abstr.

N80-19009# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INFLUENCE OF THE B SUB x COMPONENT OF THE INTERPLANETARY MAGNETIC FIELD ON MAGNETOPAUSE RECONNECTION
W. D. Gonzales and A. L. C. Gonzales Dec. 1979 12 p. refs
Revised. Submitted for publication
(INPE-1645-RPE/101-Rev) Avail: NTIS HC A02/MF A01

The first clear evidence of an effect of the B sub x component of the interplanetary magnetic field (IMF) in magnetopause reconnection was obtained from polar ionospheric electric fields measured with balloons. This B sub x effect results in a north-south asymmetry in magnetopause reconnection, which favors one hemisphere over the other (according to the sign of B sub x) and displaces the main reconnection region from the nose to higher latitudes (according to the magnitude of B sub x). Thus, the reconnection line becomes shorter when B sub x is large enough, resulting in a smaller potential of reconnection. Author

N80-19010*# National Aeronautics and Space Administration, Washington, D. C.
THE COSMOS TODAY AND TOMORROW
E. Guseva Jan. 1980 4 p. Transl. into ENGLISH from Grazhk. Aviats. (USSR), no. 5, 1979 p. 27 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75736) Avail: NTIS HC A02/MF A01 CSCL 03B

The book "Tested on Oneself" is summarized and reviewed. Topics in the field of space flight and aerospace medicine are addressed. A.W.H.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology, and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-19011 Kansas Univ., Lawrence.
THE DEVELOPMENT OF COMPUTER PROGRAMS TO DETERMINE ATMOSPHERIC WINDS FROM ENTRY PROBE DATA AND POSSIBLE APPLICATIONS TO THE PIONEER VENUS MISSION Ph.D. Thesis
Trevor Charles Sorensen 1979 483 p.
Avail: Univ. Microfilms Order No. 8002809

Equations able to analytically determine atmospheric winds from probe entry data were derived and subsequently incorporated into a computer program to facilitate the processing and analysis of such data. The wind extraction equations used in this program depend only on an accurate determination of the actual trajectory parameters. Programs were developed to produce simulated differential long baseline interferometry and trajectory reconstruction data in order to test the applicability of the wind extraction program for analyzing the actual Pioneer Venus Mission probes entry data. From these simulated data test cases, it was concluded that the wind extraction program is able to extract the mean wind profiles from actual probe entry data of the Pioneer Venus Mission below an altitude of at least 50-60km, and if the data are of good enough quality, possibly up to about 100km altitude. Dissert. Abstr.

N80-19012 Colorado Univ. at Boulder.
CONVECTION IN ROTATING LAYERS WITH THERMAL WINDS AND APPLICATION TO JUPITER Ph.D. Thesis
David Henry Hathaway 1979 150 p.
Avail: Univ. Microfilms Order No. 8002980

A linear stability analysis is carried out for fluid layers under uniform rotation which possess both vertical and horizontal temperature gradients. In order to represent various latitudes with these plane parallel layers, a rotation vector is used which is generally oblique to gravity. The configuration is used to assess the preferred convective modes as a function of latitude. Two major effects arise: (1) the tilted rotation vector introduces a preference for roll like disturbances with north-south orientations, the preference is particularly strong in the equatorial regions, and, (2) the presence of a north-south temperature gradient produces a thermal wind shear which favors axisymmetric convective rolls oriented parallel to the flow in an east-west direction. The axisymmetric cloud bands observed on the planet Jupiter is suggested to be produced by the east-west convective instabilities. A simple radiative-convective model for Jupiter is used to estimate the parameter values relevant in the stability analysis. Dissert. Abstr.

N80-19013# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
SATURN'S MAGNETOSPHERE, RINGS, AND INNER SATELLITES Progress Report
J. A. VanAllen, M. F. Thomsen, B. A. Randall, R. L. Rairden, and C. L. Grosskreutz. Nov. 1979. 30 p. refs.
(Contract N00014-76-C-0016)
(AD-A076619; Rept-79-44) Avail: NTIS HC A03/MF A01 CSCL 03/1

The 31 August - 5 September 1979 observations together with those of the other Pioneer 11 investigators provide the first thoroughly credible discovery of the magnetosphere of Saturn and many detailed characteristics thereof. In physical dimensions and energetic charged particle population, Saturn's magnetosphere is intermediate between those of Earth and Jupiter. In terms of planetary radii, the scale of Saturn's magnetosphere more nearly resembles that of Earth and there is much less inflation by entrapped plasma than in the case of Jupiter. The orbit of Titan lies in the outer fringes of the magnetosphere. Particle angular distributions on the inbound leg of the trajectory (sunward side) have a complex pattern but are everywhere consistent with a dipolar magnetic field approximately perpendicular to the planet's equator. On the outbound leg (dawn side) there are marked departures from this situation outside of B r sub S, suggesting an equatorial current sheet having both longitudinal and radial components. The particulate rings and inner satellites have a profound effect on the distribution of energetic particles. GRA

N80-19014# Graz Univ. (Austria). Inst. fuer Meteorologie u. Geophysik.
RECENT DATA ON PLANETS IN THE SOLAR SYSTEM [NEUE ERKENNTNISSE UEBER UNSERE PLANETEN]
Helmut Rucker. Sep. 1977. 44 p. refs. In GERMAN. Presented at Austrian Physikalischen es., Leoben, West Germany, 30 Sep. 1977.
Avail: NTIS HC A03/MF A01

Data collected by the Mariner, Venera, Viking and Pioneer spacecraft are reviewed. The composition and characteristics of the atmosphere, measurements of the magnetic fields and surface morphology of the planets Mercury, Venus, Mars, and Jupiter are discussed. The biological experiments carried out by the Viking missions are detailed, concluding that no positive evidence of life on Mars was found. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-19015 Kansas Univ., Lawrence.
A NUMERICAL SIMULATION OF CHARGED PARTICLE INTERACTIONS WITH INTERPLANETARY SHOCK WAVES Ph.D. Thesis
Robert Blair Decker. 1979. 235 p.
Avail: Univ. Microfilms Order No. 8002750

A computer model, developed to numerically simulate the combined effects of a charged particle's energization at an interplanetary shock and propagation to a satellite-borne particle detector at the obsevation point, is described and the trajectory results examined. A charged particle's adiabatic motion is assumed to be scatter-free along the laminar spiral interplanetary magnetic field (IMF). The interplanetary shock wave is taken as a sun-centered sperical surface that expands radially outward. The plasma and field changes across the shock obey the jump conditions for a fast mode magnetohydrodynamic (MHD) shock wave. For a chosen shock model, a particle of specified observed kinetic energy and pitch angle at a given observation time and fixed observation point is followed numerically backward in time through the IMF and shock wave. The shock interaction is treated by solving the particle's exact orbit equations through the locally planar MHD shock discontinuity. Dissert. Abstr.

N80-19016 Colorado Univ. at Boulder.
SUNSPOT VECTOR MAGNETIC FIELDS AND MODEL UMBRAL ATMOSPHERES Ph.D. Thesis
Joseph Bearak Gurman. 1979. 205 p.
Avail: Univ. Microfilms Order No. 8002978

The Stokes parameters provide a complete description of the polarization of electromagnetic radiation. The Stokes polarimeter of the High Altitude Observatory, which is capable of measuring all four Stokes parameters simulataneously across a spectral line profile, was used to observe a round, unipolar sunspot in three absorption lines and the nearby continua. Observations in the weak Zeeman triple lambda 6302.50 A are used to derive the vector magnetic field B across the spot. Doppler shift measurements in the Zeeman-insensitive line Fe I lambda 5576.10 A show no significant vertical flows in the spot. Finally, Stokes profiles of the Zeeman-sensitive resonance line Na I D2 lambda 5889.96 A are used to probe the depth variation of the magnetic field and to obtain a model atmosphere for the umbra. Combination of the weak- and strong-line results indicates a horizontal variation in the sum of gas and magnetic pressure in the umbra. Acoustic turbulence is proposed to prevent the creation of flows which are not observed. Possible scales of such turbulence are discussed. Dissert. Abstr.

N80-19017# Megatek Corp., San Diego, Calif.
LA POSTA SOLAR RADIO MAPS Technical Document, May - Sep. 1979
P. E. Argo and F. L. Wefer. Sep. 1979. 62 p.
(Contract N00123-78-C-0043)
(AD-A076376; NOSC-TD-283) Avail: NTIS HC A04/MF A01 CSCL 03/1

The La Posta 18.3 m antenna has been used since 1972 to acquire radio maps of the solar disk at wavelengths of 0.86 and 2.0 cm. The NOSC in-house research program is supporting the continuation of this program through the peak of the present solar activity cycle (about 1981). During this period of operation, daily (5 days per week) radio maps at both wavelengths will be acquired. This report presents the radioheliogram data for the second quarter of 1979. GRA

N80-19018# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
SOLAR RADIATION TEST Final Report
Oct. 1979. 18 p. Supersedes MTP-4-2-826; MTP-5-2-593; MTP-6-2-532.
(AD-A075734; TOP-4-2-826; MTP-4-2-826; MTP-5-2-593; MTP-6-2-532) Avail: NTIS HC A02/MF A01 CSCL 03/2

Describes methods for evaluating the effects of solar radiation and heat on military materiel and its operation through the use of environmental chambers. Includes a procedure for establishing an equivalent high temperature for use in environmental chamber high-temperature tests. GRA

N80-18469*# Crimean Astrophysical Observatory (USSR).
SOVIET SHORT-TERM FORECASTS OF ACTIVE REGION EVOLUTION AND FLARE ACTIVITY
A. B. Severny, N. N. Stepanyan, and N. V. Steshenko. *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p. 72-88. refs. (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18470*# Institute of Applied Geophysics, Moscow (USSR).
FORECASTING OF SOLAR ENERGETIC RADIATION AT THE FORECAST CENTER OF THE INSTITUTE OF APPLIED GEOPHYSICS
S. I. Avdyushin, N. K. Pereyaslova, F. L. Dlikman, and Yu. M. Kulagin. *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p. 89-103. refs. (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18474*# Academia Sinica, Kunming (China). Yunnan Observatory.
SPIRAL SUNSPOTS AND SOLAR ACTIVITY FORECASTS
Ding You-ji and Zhang Bai-rong. *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1. Aug. 1979. p. 140-153. refs. (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18475*# Academy of Sciences, Peking (China). Solar Activity Prediction Group.
SOLAR ACTIVITY PREDICTIONS AT PEKING OBSERVATORY

In NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 154-162 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18476*# Academia Sinica, Nanking (China). Purple Mountain Observatory.
LONG-TERM FORECASTING OF SOLAR ACTIVITY
Xu Zhen-Tao, Zhao Ai-Di, Mei Yan-Lin, and Guo Quan-Shi *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 163-175 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18477*# Academia Sinica, Nanking (China). Solar Activity Prediction Group.
SHORT-TERM SOLAR ACTIVITY FORECASTING
Chen Xie-Zhen and Zhao Ai-Di *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 176-181 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18479*# Nagoya Univ., Toyokawa (Japan). Research Inst. of Atmospherics.
A REVIEW OF SHORT-TERM FLARE FORECASTING ACTIVITIES AT TOYOKAWA
Shinzo Enome *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 205-211 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18487*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
CORONAL HOLES INFERRED FROM THE FLEURS EAST-WEST SOLAR SCANS
Brian G. Fergusen *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 288-311 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18492*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
MSFC SOLAR ACTIVITY PREDICTIONS FOR SATELLITE ORBITAL LIFETIME ESTIMATION
H. C. Fuler, C. A. Lundquist, and W. W. Vaughan *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 378-384 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18493*# Michigan Univ., Pontiac. McMath-Hulbert Observatory.
EXAMPLES OF PROBLEM FLARES OR SITUATIONS IN PAST SOLAR-TERRESTRIAL OBSERVATIONS
H. W. Dodson, E. R. Hedeman, and O. C. Mohler *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 385-397 refs Sponsored in part by APL/JHU (For primary document see N80-18462 09-42)
(Grants NGL-23-005-275; NOAA-03-4-022-94)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18495*# Air Force Geophysics Lab., Hanscom AFB, Mass.
PPS76: A COMPUTERIZED EVENT MODE SOLAR PROTON FORECASTING TECHNIQUE
D. F. Smart and M. A. Shea *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 406-427 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

99 GENERAL

N80-19019# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 33, NUMBER 7
I. Kaufman, ed., Victoria S. Hewitson, ed. et al. 31 Jul. 1979 41 p
(AD-A075097; ESN-33-7) Avail: NTIS HC A03/MF A01 CSCL 05/2

This monthly publication presents brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by calling attention to current developments and to institutions and individuals engaged in these scientific efforts. The articles are written primarily by members of the staff of ONRL. Topics in this issue include: La Renaissance du Dirigeable - A solution in search of a problem; Chemistry at Swiss Universities; Formal Design Methodology - How to design computer systems without really using your head; UK Battery Research--Air Force; Solar Energy in Greece and Egypt; Fluid Dynamics at the Technische Hogeschool Delft; The Institut fuer Hydromechanik at the University of Karlsruhe; Materials Research at Leicester, Loughborough, and Leeds; High Strength Low Alloy Steels; Preoperative Hypothermic Renal Perfusion--Another use for the arterial catheter; and Semiconductor Injection Lasers. GRA

N80-19020# Southampton Univ. (England). Inst. of Sound and Vibration Research.
[RESEARCH AND PEDAGOGY IN NOISE AND VIBRATION CONTROL] Annual Report, 1979
Mar. 1979 43 p refs
Avail: NTIS HC A03/MF A01

Research and activities for the period 1978/79 are reported. Fields covered include fluid dynamics and acoustics, automotive engineering, operational acoustics and audiology as well as structural dynamics. Work in data analysis, electronic research and development, industrial noise research and development, and in noise and vibration control is also summarized. Pedagogical activities for the year are outlined. Author (ESA)

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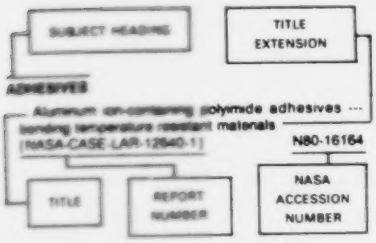

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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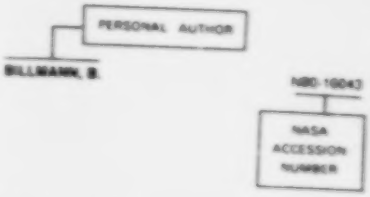

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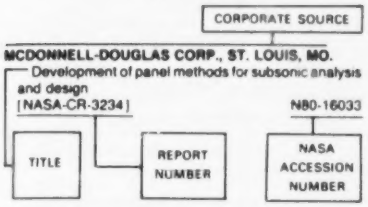

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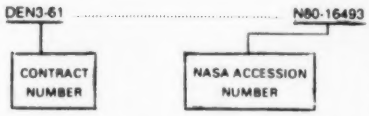

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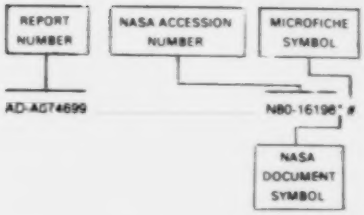

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INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

- NASA, NASA contractor, and NASA grantee reports
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CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

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24 COMPOSITE MATERIALS 1254

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ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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GENERAL

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Note: N.A. means that no abstracts were assigned to this category for this issue.

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TYPICAL CITATION AND ABSTRACT

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NASA ACCESSION NUMBER → **N80-10195*#** Teledyne Ryan Aeronautical Co., San Diego, Calif ← CORPORATE SOURCE

TITLE → **STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE**

PUBLICATION DATE

AUTHOR → D. J. Mourey 3 Sep 1979 409 p refs

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CONTRACT OR GRANT → (Contract NAS1-15624)

REPORT NUMBER → (NASA-CR-159149) Avail NTIS HC A18/MF A01

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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, APPLICATION OF SUPERHARD TRANSPARENT COATING TO HELICOPTER WINDSHIELDS
G. Wintermute, Goodyear Aerospace Corp., *Litchfield Park, Arizona* 85340 (DA0E3852; DAAK51 78 C 0024)

The objective is the Army Field Service evaluation of 10 UH-1 helicopter windshields coated with a superhard transparent coating for windshield surface abrasion protection.

The approach is to process (fabricate and coat) the 10 UH-1 helicopter righthand windshields with Goodyear Aerospace Corporation No. 211 coating (developed by Goodyear Aerospace Corporation under Army contract DAAj02-76-C-0004) and install them on operational Army helicopters for operational service evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0002, AAH AND BLACK HAWK CREW SEAT TESTING (DA0E3868)
D. Laananen, Simula Inc., *2223 S. 48th St., Tempe, Arizona* 85282 (DA0G0012; DAAK51-79-C-0016)

The objective of this program is to explore design techniques and criteria offering potential for improving helicopter seat crashworthiness.

The program consists of two tasks. The first task includes repairing and modifying an AAH-64 co-pilot/gunner seat, statically testing a candidate restraint system mounted on the modified seat, providing a test report, and instrumenting two restraint systems to be dynamically tested at the FAA Civil Aeromedical Institute (CAMI). The second task includes repairing a UH-60A pilot-co-pilot seat and providing it to the government for cadaver testing, providing test support that includes seat maintenance, conducting data analysis, and preparing a test report.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0003, AEROELASTIC APPLICATIONS OF TRANSONIC UNSTEADY AERODYNAMICS
T.Y. Yang, Purdue University, Purdue Research Foundation, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DF141240; AFOSR-78-3523)

This work unit supports the technical base functions of the Structural Mechanics Division of the Air Force Flight Dynamics Laboratory. It addresses the problem areas of transonic unsteady aerodynamics, flutter, aeroelastic optimization and integration of aeroelastic disciplines. The goal is to create a numerical, analytical and experimental array of techniques to integrate the aeroelastic design, analysis and testing of aircraft structures to reduce the cost of design, acquisition and operation of new aircraft. This work unit will obtain substantial improvements in our ability to design, analyze and optimize aircraft structures for unsteady aerodynamic forces, vibrations, flutter, loads and aeroelastic control system interactions.

Initial developments will include the application of transonic unsteady aerodynamic computer programs to flutter problems. Finite element structural programs will also be modified to automate the input of data and the presentation of results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, AUTOMATED LOW-COST WEATHER OBSERVATION SYSTEM (ALWOS)
R.R. Reynolds, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Equipment Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (RD590714)

OBJECTIVE: Develop a low-cost automatic weather station and sensor for the FAA. This station will essentially be a limited alternative to AV-AWOS. Only one ceiling and one visibility sensor will be used instead of three. Algorithms will be limited initially to 3000' ceiling and 1/4 through 7 miles visibility.

APPROACH: Contract for a laser ceilometer and forward scatter visibility device. Develop algorithms for these and incorporate into microprocessor. Contract for a no-moving-parts anemometer. Modify existing design for an aspirated temp/dew point sensor. Contract for a new digital-to-voice converter. Use AV-AWO type thunderstorm, precipitation and freezing rain detector. Interface sensors to microprocessor-based automatic station similar to our Sensor Processor and Display equipment. Build demonstration unit, test it and prepare specification for FAA procurement.

PROGRESS: Development of the first phase of ALWOS called WAVE (Winds, Altimeter and Voice Equipment) has been completed. Testing of the WAVE system is underway with installation planned for late December 1978.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

1.0005, BOLTED FIELD REPAIR OF COMPOSITE STRUCTURAL COMPONENTS
J. Watson, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DN981067; N62269-78-C-0272)

To develop and demonstrate bolted field repair techniques for composite monolithic skins with damage in the area of the substructure. To provide simplified composite repair methods for structures applicable to emerging Navy aircraft which can be performed by organizational level personnel with minimal special training and logistic support. This work is in support of work unit ZA601, Aircraft Technology, Agency Accession No. DN 681080.

Various designs will be analyzed and the most promising will be selected for fabrication and testing. Damages of up to 4-inch diameters in skins of thicknesses of up to 1/2 inch will be investigated. Included among the specific damage areas to be studied are the torque box skin adjacent to spars and ribs, and skin with associated damage to the substructure cap and skin attachment elements. Both conventional metal substructure and composite sine wave substructure will be considered. In all cases, the designs will be limited to repairs which can be performed in the field. Repair concepts will be designed so that

they can sustain a gross strain level in the repaired area of more than 4000 micro in./in. while restoring the original stiffness. In addition, the repair will enable the structure to retain a 150 DII internal pressure capability. Additional constraints such as outside access only, relaxed tolerance for field capabilities, minimal external protrusion and fuel containment will also be considered. Static tension tests and internal pressure tests will be performed on fabricated specimens to verify the selected designs and procedures.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0006, SERVICEABILITY EVALUATION OF F-14 COMPOSITE MAIN LANDING GEAR STRUT DOOR AND OVERWING FAIRINGS

J. Mahan, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN881339; N62269-77-C-0436)

To provide actual long-term-service environmental data for composite structures and to identify any potential environment-related problems which may exist. To evaluate durability, reliability and maintenance requirements of composite structures in the Navy operational environment. This work is in support of work unit ZA601, 'Aircraft Technology', Agency Accession No. DN 681080.

Under previous contracts, composite overwing fairings and main landing gear strut doors for the F-14 aircraft have been fabricated and will be installed on Navy fleet aircraft. Under this contract, the condition and maintenance requirements of these components will be closely monitored by contractor field service representatives. Instructions will be prepared for squadron and field service personnel containing non-destructive inspection schedules and methods, damage criteria and repair and maintenance procedures specifically for these components. All significant occurrences pertinent to the composite components during the service usage will be recorded. The composite fairings and doors will be left in service for a period of up to five years. Periodically a set of components will be removed for NavAirDevCen inspection and laboratory evaluation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0007, GROUND PERFORMANCE CRITERIA FOR MILITARY AIRCRAFT TIRES

P.C. Ulrich, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140880)

This effort supports the development of tire design, performance and laboratory test criteria/techniques and the development of new and improved tires for Air Force aircraft. Presently, tires are the highest single hardware grouping logistics and maintenance cost incurred for Air Force aircraft. Reduced aircraft all-weather operation capability and aircraft ground accidents are attributable to tire traction limitations. The objectives of this effort are to develop tire design and performance criteria, tire laboratory quality control and qualification test techniques, and to laboratory test and evaluate new tire designs. Accomplishment of these objectives will result in improving Air Force aircraft ground performance and reliability, and reduce Air Force logistics costs.

Unique tire test equipment in the AFFDL landing gear test facility will be used to establish tire force and moment properties under static, rolling, and braking conditions. Tire designs will be evaluated and new tire test techniques will be developed and verified by laboratory test and evaluation under the following work efforts: A. Cast tire evaluation, B. Siped tire evaluation, C. SAE tire tests D. Radial tire evaluation, and E. Bomb damage/repaired runway simulator.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, MULTIVARIATE DATA ANALYSIS - SIMULTANEOUS COMPARISON TEST

P.R. Krishnaiah, University of Pittsburgh, School of Arts & Sciences, Dept. of Mathematics & Statistics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DF140650; AFOSR-77-3239)

Part of AFFDL's responsibility is the development of advanced flight control systems and crew stations. The use of electro-optical, multi-function controls and displays in advanced crew stations places many new demands upon the pilot's visual and information processing channels. In addition, in order to compare candidate flight control systems and crew station components, simulations and flight tests are conducted in which pilot performance is measured. However, there is no single measure of pilot performance, thus requiring the collection of many kinds of performance data and their analysis by means of multivariate statistical techniques. The objective of this work effort is two-fold: (1) to examine visual information processing techniques employing fast Fourier transforms, and (2) to evaluate available multivariate statistical techniques for simultaneous comparison of mean vectors and the development of computer programs to implement these techniques. Objective 1 will result in optimized symbol formats for electro-optical displays in advanced crew stations. Objective 2 will provide a means of determining which of the candidate crew stations/flight control systems is best for the pilot.

OBJECTIVE 1 - automatic pattern recognition techniques will be employed to evaluate symbol confusability both within and between symbol sets. OBJECTIVE 2 - seven currently available multivariate statistical techniques will be evaluated by the contractor as to their robustness to violations of the assumptions of homogeneity of the population covariance matrix and the normality of the multivariate distribution. The most robust technique will be implemented by means of computer programs which will be available for use by AFFDL personnel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, HT 79-13 APPLICATION OF THE OPERATIONAL LOADS SURVEY (OLS) DATA

D.J. Merkley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3863)

Investigate and document selected aerodynamic and structural flight test data associated with the helicopter during operational maneuvers, to include the following topics: the effect of compressibility on rotor pressure distributions and maps of shock locations; the effect of vortex interactions; on rotor pressure distributions and maps of vortex interactions blade stagnation point locations as a function of azimuth-blade model participation factors based on various combinations of strains, accelerations and displacements; comprehensive analysis of simultaneously recorded data for selected flight conditions to allow for correlation of simultaneous events and correlation with analysis. The resulting documentation will aid the design, evaluation and development of improved rotor systems and helicopters to meet future Army operational needs.

The required procedures to investigate each of the above topics will be defined. Each of these topics will be investigated and documented separately with the aid of the data management and analysis system data-map (data from aeromechanics' test and analytics/management and analysis package, formerly known as OLS-DMS).

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0010, DEVELOPMENT OF AN ANALYTICAL TECHNIQUE TO PREDICT AIR CUSHIONED LANDING SYSTEM/COMPONENT PERFORMANCE

J. Kilner, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF139640; F33615-77-C-3054)

This work unit supports the development and demonstration of air cushion landing systems, ACLS, for Air Force aircraft. Presently, a reliable analytical technique is not available for evaluating the performance of existing and new, proposed designs for ACLS components as a functioning part of a total flight vehicle system. The objective of this work unit is to develop and verify this needed ACLS prediction technique. Availability of the technique will significantly improve the effectiveness of, and increase the confidence level for, ACLS development and demonstration. Realization of the dramatic improve-

ments to flight vehicle mobility, self-sufficiency, and response promised by ACLS' ability to operate on any relatively level surface requires ability to evaluate ACLS performance as part of the total flight vehicle under consideration. The analytical technique developed will provide this needed capability.

An existing aircraft performance prediction computer program will be modified by the addition of system and subsystem subroutines for air cushion system, ACS takeoff and landing systems. Ability will be provided to simulate aircraft equipped with either elastic or inelastic ACS trunks. Then, the computer program shall be verified by simulating the performance of the ACS-equipped Buffalo, XC-8A, aircraft and comparing the results with actual XC-8A ACS takeoff, landing and ground operation data. Next, computer program revisions will be made as required. Finally, a technical report and computer program user's manual will be prepared and delivered along with the computer program which will be checked out and verified for use on the CDC6600 computer at Wright-Patterson AFB.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, IN SITU CHARACTERIZATION OF HYDROPROCESSING CATALYSTS

M. Boudart, Stanford University, School of Engineering, Dept. of Chemical Engineering, *Stanford, California* 94305 (DAR79-10071)

Few techniques are applicable to in situ characterization of catalysts, especially hydroprocessing catalysts, where both high pressure and high temperature are required. This cooperative research program between Chevron Research Company and Stanford University will utilize both X-ray absorption edge measurements and Extended X-ray Fine Structure Spectroscopy (EXAFS) to characterize Co/Mo/Al2O3 and Ni/Mo/Al2O3 catalysts at pressures (up to 2000 psig) and temperatures (up to 400 degrees C) typical of those during hydroprocessing catalysis. The reactor will employ gas and liquid hydrocarbon feeds and will simulate a trickle bed reactor. The research program will include X-ray characterization of single-component systems (e.g., Co/Al2O3) before proceeding to the actual catalysts and will study the reduction and sulfidation processes as well. X-ray absorption analysis of a number of reference materials, including Ni, Co and Mo sulfides and oxides as well as solid solutions of these materials in the alumina support will aid in interpretation of the catalyst characterization data.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Applied Research

3.0002, LASER VULNERABILITY OF ADVANCED DESIGN SOLAR CELLS

R.L. Statler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980213)

The objective is to evaluate the vulnerability of advanced design solar cells to cw and pulsed high energy laser energy with the intent of defining specific damage modes and mechanisms. The results will provide guidelines for the design and manufacture of laser hardened solar cells for satellite applications.

Silicon and gallium arsenide solar cells now being developed by the AF for space missions will be subjected to cw and pulsed CO2 high energy laser radiation at 10.6 microns. Cell characteristics including forward and reverse V-I curves, spectral response, and V-I curves at amo will be measured before and after laser radiations. The changes observed in fundamental solar cell parameters will lead to an understanding of hardening procedures to be adapted in cell manufacture.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0003, THEORY OF THE DIELECTRIC CONSTANT WITH APPLICATIONS TO THE MOLECULAR MOTION AND STRUCTURE OF LIQUIDS

R.L. Fulton, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Chemistry, *205 Wildwood Dr., Tallahassee, Florida* 32306 (CHE77-23556 A01)

The frequency-dependent dielectric constant is simply related to time-dependent polarization fluctuations. These are in turn related to molecular position and orientation fluctuations, but, except for artificially simple models, the connection is not known explicitly. This project will study the second moments of the dielectric constant function, theoretically, with input from experiment, in order to assess the contribution of various kinds of molecular motions to the dielectric constant. In addition, the information so obtained will be used to assess the contribution of long-range polarization fluctuations to the surface properties of fluids.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, ATOMIC AND MOLECULAR PROCESSES

R.S. Berry, University of Chicago, Graduate School, Dept. of Chemistry, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (CHE79-01166)

This research is in the area of quantum chemistry. Dr. Berry intends to continue a program of research involving the spectroscopic, thermodynamic and dynamic properties of nonrigid clusters, especially to relate nature and degree of nonrigidity to spectral distribution, but also extending to the interpretation of correlated motion in molecules, atoms, and nuclei, and to the interpretation of the nucleation and melting of very small clusters. The major effort in the spectroscopic aspect of this research, the analysis of spectra of nonrigid clusters, will be directed toward high-resolution spectra of real molecules. It is his intention both to predict vibration-rotation spectra from theoretical calculations based on pair interactions, to make phenomenological fits of experimental spectral lines to the patterns predicted by the correlation diagrams, and from these fits, to predict additional lines and interpret the nature and degree of molecular nonrigidity. In addition to PF5 he intends to examine the rare gas halides such as HeI2 and NeI2 that are best known from their laser-induced fluorescence spectra, and the alkali trimers and tetramers, whose potential surfaces are becoming known from theoretical calculations. This research represents a continuation of that currently supported by Foundation grant CHE7617821.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0005, SPECTROSCOPIC STUDIES AT LOW TEMPERATURES

G.E. Ewing, Indiana University, Bloomington Campus, Graduate School, Dept. of Chemistry, *2805 E. 10th, Bloomington, Indiana* 47401 (CHE79-13166)

Dr. Ewing is supported by a grant from the Structural Chemistry and Thermodynamics Program to (a) determine the structure and properties of van der Waals molecules, and (b) to study vibrational energy transfer in simple cryogenic liquids. Spectroscopic studies will be conducted on van der Waals molecules to determine bond lengths, geometry and intermolecular potentials for X2-Y type systems (e.g., N2-Kr, O2-Xe). Studies will also be carried out on more complex systems, such as CO2-Ar and (HC triple bond CH)2. These experimental studies will be complemented by theoretical studies on the role of van der Waals molecules in energy transfer processes. Such studies will contribute to a deeper understanding of intermolecular interactions which are responsible for the physical properties of solids, liquids and compressed gases. The cryogenic liquid studies will focus on CO2, N2, O2 and F2. These studies will contribute to understanding chemical reactions in the liquid state and form a basis for following vibrational energy as it moves from molecule to molecule. Such simple cryogenic systems should serve as models which can be applied to the understanding of more complex liquids.

This research is a continuation of that currently supported by Foundation Grant, CHE-7618721.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, METAL INSULATOR TRANSITION MATERIALS

W.J. Croft, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0F4799)

The Army has a continuing need for very simple and rugged electronic devices of high reliability. The reduction of the number of components in a device to the absolute minimum for operation enhances the system reliability. Metal-insulator transition compounds represent the simplest solid-state devices for thermal switching of electric current - a single phase of a simple material that undergoes a large change in conductivity at the transition temperature. A typical material that undergoes this MOTT transition is vanadium dioxide which is being studied in detail.

This program will be concerned with the adaptation of the most suitable of the metal-insulator compounds to aircraft and missile applications. Consideration will be given to volume and current carrying capacity requirements for the several temperature ranges. Polycrystalline materials are being prepared by solid-state reaction in order to measure the bulk properties. Crystals are being grown by direct reduction of molten oxides and also by chemical vapor transport. Properties of these crystals are being compared with each other. Stability with temperature cycling, and effects of pressure and stoichiometry will be investigated. Efforts will be made to increase the size and perfection of the grown crystals.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0007, ELEVATED TEMPERATURE PROPERTIES OF METAL MATRIX COMPOSITES

A.P. Levitt, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0H4704)

The technical objective is to determine the elevated temperature mechanical properties of metal matrix composites which are potential candidates for use in helicopter transmission cases such as FP/Mg, Gr/Mg, SiC/Mg, SiC/Al, and Gr/Al. Elevated temperature mechanical properties and thermal cycling data will be determined over the range of temperatures and times. Fatigue life will be evaluated as a function of fiber volume fraction.

The approach will include the fabrication and purchase of composites, preparation of test specimens, and testing them for elevated temperature, tensile strength and modules, and compressive strength and modules at temperatures up to 500 degrees F for 4 hours as a function of fiber volume fraction. Also, thermal cycling properties will be determined and fatigue properties measured. The results will contribute to the selection of the best composite for the transmission case and to the required data base for these materials.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0008, CHEMISTRY OF EPOXY CURING REACTIONS

N.S. Schneider, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G4763)

To characterize the curing behavior and determine the mechanism of cure of epoxy resin systems of Army interest. To improve the reproducibility and reliability of epoxy resins used in structural, fiber-reinforced composites. Major thrust is aircraft survivability.

Model epoxy resin systems will be formulated containing the principal components which have been identified in two commercial resins of Army interest, SP250 and RaC7250. The study will emphasize the use of purified components for reaction and curing mechanism studies. In certain cases, analog model reactants will be used to provide soluble products which can be separated for complete identification. Methods will include differential scanning calorimetry (DSC), torsional braid analysis (TBA), fourier transform infrared spectroscopy (FTS-IR), and high performance liquid chromatography (HPLC).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0009, ENERGETIC EXPLOSIVE/PROPELLANT PREPOLYMERS AND BINDERS - NITROMERCURATION OF POLYDIENES AND POLYACETYLENES

J. Chien, University of Massachusetts, Amherst Campus, School of Natural Sciences & Mathematics, Dept. of Chemistry, *Amherst, Massachusetts* 01002 (DN975339; N00014-79-C-0265)

Nitro-substituted prepolymers and polymers are desirable for use in solid propellant and explosive formulations. The objective is to define the synthetic chemistry leading to nitro-substituted polyacetylenes and polydienes. Polynitroacetylene is the polymer analogue of hexanitrobenzene.

Energetic nitro-substituted polydienes and polyacetylenes will be synthesized by a new two-step nitromercuration technique. The degree of nitro substitution, glass transition temperatures, molecular weights and microstructures of the nitro-substituted polymers will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0010, SCATTERING THEORY AND CALCULATIONS FOR CHEMICAL REACTIONS AND ELECTRON IMPACT PROCESSES

D.G. Truhlar, University of Minnesota, Minneapolis Campus, School of Chemistry, Dept. of Chemistry, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (CHE77-27415)

Professor Truhlar and his co-workers will investigate the following research topics: (1) Quantum mechanical and semiclassical treatment of the chemical reaction of an electronically excited atom with a diatomic molecule. (2) Application of semiempirical model potentials to calculate differential cross-sections for electron impact spectroscopy. (3) Theoretical treatment of energy transfer processes involving vibrationally excited species. (4) Further development and testing of techniques for performing scattering calculations algebraically. (5) Use of approximations to simplify the theoretical treatment of rearrangement collisions, both electron-molecule collisions and chemical reactions. (6) Solution of the master equation (the equation for the time-dependence of the concentrations of species in various stages of excitation) for shock-tube dissociation of diatomic molecules using input data. This research represents a continuation of that currently supported by Foundation grant CHE75-06416.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0011, IMPROVED MEASUREMENT OF FUEL PROPERTIES

C.J. Nowack, U.S. Dept. of Defense, Navy, Naval Air Propulsion Center, Fuels Lubes & Power Dr Sys Gp, *1440 Pkwy. Ave., Trenton, New Jersey* 08628 (DN889799)

To investigate more refined methods for measuring fuel properties for both specification and research purposes.

Establish base line data from reference fuels (petroleum and non-petroleum derived hydrocarbons) and analyze them by gas chromatography (GC) and nuclear magnetic resonance (NMR). Correlate the GC and NMR data with present specification tests, and utilize these relationships to determine application of these advanced methods of fuel analysis for fuel specifications. If justified by results, establish new criteria for acceptance of JP-5 for Navy use based on compositional factors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0012, HYDROGEN ENTRY AND TRANSPORT MECHANISMS IN STRUCTURAL METALS 14057-MS

R.H. Heidersbach, University of Rhode Island, School of Engineering, Dept. of Ocean Engineering, *Administration Bldg., Kingston, Rhode Island* 02881 (DA0E9200; DAAG29 76 G0311)

To investigate hydrogen transport characteristics of structural metals, with emphasis on high hydrogen flux levels, as occur in hydrogen embrittlement cracking, and to investigate surface-entry mechanisms for hydrogen with and without the presence of molecular species which enhance hydrogen entry. Relevance - the research is complementary to a current study on the stress corrosion cracking characteristics of ESR and other high strength steels. Also, the Army has experienced failures of 7075-T6 aluminum, probably due to stress corrosion cracking. The structural alloys to be investigated are widely used by the Army in helicopters, ground mobility equipment, tanks, cannons, armored vehicles, and bridges. (1) Samples of as-cast and also electroslag-remelted (ESR) steels will be subjected to a selected set of controlled hydrogen fluxes, to examine the effect of remelt practice and subsequent impurity levels and microstructure on hydrogen transport. (2) Samples of 7xxx-series aluminum alloys will be studied as above in (1), to investigate the effect of aging on hydrogen susceptibility. (3) Utilization of infrared and Raman spectroscopy to study intermediate surface reactions which enhance hydrogen entry.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0013, METAL LAMINATE DEVELOPMENT FOR STRUCTURES

R.M. Johnson, Advanced Technology Center Inc., *P.O. Box 6144, Dallas, Texas* 75222 (DN890148; N00019-78-C-0491)

Develop metal laminates used for critical structural parts, but not at the expense of strength, corrosion resistance or stress corrosion resistance.

Explore the metal/metal laminates utilizing recently developed alloys of titanium and steel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0014, RAYLEIGH-BRILLOUIN LIGHT SCATTERING OF SEGMENTAL MOTION AND STRUCTURAL RELAXATION OF POLYMER LIQUIDS AND SOLIDS

C.H. Wang, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Chemistry, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR79-12457)

This research deals with light scattering as a means of probing the nature of the motions of the long molecular chains known as polymers. The motions of segments of the polymer chains and the structural relaxation when the system is subjected to hypersonic frequencies (in the GHz region) are of particular concern. Principal emphasis will be on solutions of polymers, for example the polystyrene-cyclohexane system, and detailed studies will be conducted of the entire Rayleigh-Brillouin spectra using the combined techniques of Fabry-Perot interferometry and photon correlation spectroscopy. Aqueous solutions of poly(methacrylic acid) and of poly(vinyl alcohol) will also be examined as a function of temperature, concentration, and molecular weight. These experiments will be used to test and refine a recent theory for the behavior of liquids. An additional thrust will be the examination of Brillouin scattering spectra of opaque, stretched films of poly(ethylene terephthalate) and of polyethylene with various degrees of crystallinity.

This is a renewal of NSF Grant DMR77-03707 and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, CONTACT STRESS ANALYSIS OF CERAMIC-TO-METAL INTERFACES

H.L. Kington, Signal Co. Inc., Airesearch Manufacturing Incorporated, *402 S. 36th St., Phoenix, Arizona* 85034 (DN875617; N00014-78-C-0547)

The objective of this research is to conduct analysis, specimen testing, and data correlation in order to provide an improved understanding of the local contact conditions that prevail at an interface between ceramic and metal components for gas turbine engines. The program will be specifically directed to study contact stresses between inserted ceramic turbine blades and a metal rotor.

A finite-element stress analysis procedure and structural evaluation technique consistent with the statistical nature of ceramic materials will be generated. Specimen testing will be conducted to obtain validation of these techniques and provide insight as to possible modifications of stress simulation or fracture prediction criteria.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0002, SOLID-STATE RADIO MAGNETIC/HORIZONTAL SITUATION INDICATOR (RMI/HSI)

B. Hoffman, Hughes Aircraft Co., Aerospace Groups, *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0D3523; DAAB07-77-C-2194)

The objective of this task is the development of a digitally addressable, programmable, solid-state RMI/HSI employing a flat panel display. This unit is intended to replace existing electro-mechanical devices and be compatible with new, in-development, digital sensors, processors and the MIL-STD-1553A(B) digital data bus.

Integrate a flat panel (solid-state) display, drive circuitry, programmable symbol generator, signal processor, and control unit to accept and display all appropriate RMI/HSI signals for demonstration and evaluation of feasibility for eventual incorporation in Army aircraft.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

4.0003, ELECTRONIC PROCESSES IN INDIUM-PHOSPHATE AND RELATED COMPOUNDS

L.H. Devaux, Hughes Aircraft Co., *3011 S. Malibu Canyon Rd., Malibu, California* 90265 (DN890136; N00019-79-C-0082)

Determination of the characteristics of bulk InP that relate to its utility as an avalanche photo diode. A primary goal of this work shall be to measure the electron and hole ionization coefficients of commercially available bulk InP and to estimate carrier lifetimes.

InP will be characterized for physical perfection and determination of carrier concentration and mobilities. Schottky barrier and P-N functions/structures will be used as analytical tools to determine ionization coefficients.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0004, NAVY VEHICLE DESIGN AND CONSTRUCTION - FUNDAMENTAL AERODYNAMIC STUDIES OF WING-BODY INTERFERENCE AT HIGH ANGLES OF ATTACK

J.N. Nielsen, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DN875550; N00014-78-C-0490)

A method has been developed for calculating with reasonable accuracy the forces and moments on the components of cruciform missiles at high angles of attack (up to 50 degrees) and Mach numbers up to 3.0. As a result of this work, a problem area has emerged which limits the accuracy and usefulness of this calculation method. As either angle of attack or Mach number are increased, the effect of the body on the wing is to substantially decrease the wing lift. It is not clear what causes the large wing-body interference and theoretical calculations to quantify the adverse effects are not available. The objective of this program is to determine the causes of the adverse wing-

body interference and to establish the theory and methodology which will allow calculation of the interference effects.

A fundamental study of wing-body interference effects at high angles of attack and supersonic speeds for missile configuration will be conducted. Recent advances in viscous and inviscid numerical computation techniques will be utilized, supplemented by detailed experimental work. The flow field in which a fin or wing might operate at high angles of attack and high Mach numbers will be calculated by extending a computer program for solving the Euler equations of motion for compressible flow. Later, vortex effects will be included. The predicted aerodynamic characteristics will be compared with experimental aerodynamic data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, STUDIES OF MAGNETOSPHERE-IONOSPHERE-ATMOSPHERE INTERACTIONS

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ATM74-20084 A02)

This grant will support investigations into several aspects of magnetosphere-ionosphere-atmosphere coupling. The research includes both data analysis and theoretical work. VLF data from Stanford University's experimental programs at Siple, Antarctica, and Roberval, Quebec, will be used to study the thermal plasma dynamics and wave-particle interactions in the magnetosphere. The results will be compared with energetic particles and thermal plasma data from various ground-based instruments including incoherent scatter radars, HF sounders, photometers, etc. Atmospheric electric field data from the polar cap regions acquired through cooperative programs with other institutions will also be studied. Theoretical work will be aimed at modeling magnetosphere-ionosphere-atmosphere coupling through particle and heat fluxes and through electric fields. Specific topics to be investigated include: (1) thermal plasma distribution and flow along magnetic field lines; (2) substorm electric fields and their effects on the plasmasphere-ionosphere system; (3) correlative studies of plasmapause-associated phenomena including generation of VLF and ULF waves, particle precipitation, and ionospheric troughs; (4) artificially induced precipitation of energetic electrons; (5) theoretical studies of electrical coupling between the magnetosphere, ionosphere and lower atmosphere; (6) model studies of controlled modification of the ionosphere and plasmasphere through particle precipitation, chemical release, and F-region heating; and (7) analysis of atmospheric electric field data from polar cap regions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0006, NEW FACILITIES FOR THE ANALYSIS OF BROADBAND VERY-LOW-FREQUENCY (VLF) RADIO SIGNALS

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DPP78-03601)

A system for spectrum analysis of broadband very low frequency (VLF) signals will be acquired. The system will be used to analyze VLF signals collected at Siple Station, Antarctica, and Roberval, Quebec, Canada. These VLF signals are used to investigate VLF wave interactions with charged particles in the earth's magnetosphere, a subject of major interest in solar-terrestrial physics.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

4.0007, RESEARCH ON WALL TURBULENCE 16651-E

R.F. Blackwelder, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DA0G9124; DAAG29-79-C-0137)

To experimentally determine the unsteady sequence of events associated with the turbulence bursting phenomena in the wall region of an incompressible turbulent boundary layer. Relevance - the research relates to the dynamics of turbulent flows which dominate viscous forces on high-speed vehicles such as missiles, projectiles and helicopters.

Special emphasis will be placed upon (1) exploring the effect of the probe size on the statistics measured by different sensors, (2) studying the dynamics of the streamwise vortices in the wall region, and(3) investigating the interaction between the low-speed streaks in the wall region and the high-speed sweeps associated with the outer flow.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0008, ELF/VLF PROPAGATION MEASUREMENTS

R.J. Dinger, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980135)

To measure the magnetic field strength in northern Norway of the signal radiated by the Wisconsin Test Facility (WTF) transmitter in the extremely low frequency (ELF) band.

A receiver capable of demodulating the signal broadcast by the WTF will be installed near Tromso, Norway. Measurements of the magnetic field strength will be made in August 1979, in coordination with rocket sounding tests to be conducted at Thule, Greenland, by the Air Force.

SUPPORTED BY U.S. Dept. of Defense, Defense Nuclear Agency

4.0009, MOTION DRIVE SIGNALS FOR FLIGHT SIMULATORS

W.T. Harris, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Advanced Simulations Concepts Lab., *Orlando, Florida* 32813 (DN794017)

Develop several methods for calculating motion drive signals in flight simulators and relate them to motion system characteristics, flight maneuvers and training effectiveness.

Select several methods from those found in use or in the literature. Perform a preliminary selection of algorithms to be evaluated for training effectiveness by two selection experiments; the first based on system performance measures (an in-simulator study), the second, a comparison of pilot control activity (in simulator to aircraft). Then evaluate the pre-selected algorithms using transfer of training methods.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulations Concepts Lab.

4.0010, HEAD AND EYE TRACKING SYSTEM STUDY

J.J. Kulik, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Advanced Simulations Concepts Lab., *Orlando, Florida* 32813 (DN994012)

In a pilot helmet-mounted display system, head/eye tracking subsystems are essential when the display is an area of interest type. Research is needed to determine the maximum allowable delay in presentation of visual scenes after head and eye movements. Work on eye motions to determine eye speeds and type of motion is needed to enable construction of predictors for use as compensation for overall system time constant to keep within acceptable limits.

A television system will be used to produce a spot which will follow the head and eyes as they move to various positions. Variable delays ranging from 4 to 154 milliseconds will be introduced between head/eye motion and the motion of the spot on the TV screen. The maximum allowable delay will be determined using standard human factors testing techniques. An electronic system will be built and used to determine angular eye velocities. A determination will be made as to whether or not final eye fixation points can be predicted from velocity curves (e.g. From maximum eye velocity vs. final eye position). If feasible, compensation will introduced into the testing to see if

total system time constant can be reduced to within acceptable limits.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulations Concepts Lab.

4.0011, MECHANICS OF SURFACE DAMAGE IN ELASTOHYDRODYNAMIC CONTACTS 16005-E

H.S. Cheng, Northwestern University, Evanston Campus, Technological Inst., Dept. of Mechanical Engineering & Astronautical Science, *633 Clark St., Evanston, Illinois* 60201 (DA0G8912; DAAG29-78-G-0199)

To gain a basic understanding of pitting and scuffing failures in heavily loaded lubricated contacts in gears, cams, and rolling element bearings. Relevance - the subject has a high priority in the design of military vehicles and aircraft, particularly in helicopter gear box design.

Analytic and numerical determinations of subsurface stress distributions at asperities will be carried out for normal and tangential surface loads as well as for thermal conditions. Two- and three-dimensional solutions will be formed and related to pitting and scuffing.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0012, THE TRAILING EDGE PRESSURE GRADIENT AS AN AIRFOIL DESIGN PARAMETER

A.I. Ormsbee, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aero. & Astro. Engineering/ Theo. & Appl. Mechanics, *207 Engineering Hall, Urbana, Illinois* 61801

A study is being conducted of the use of the trailing edge pressure gradient as an input parameter in the design of low-speed airfoils. Preliminary results indicate the possibility of extending the pressure recovery region into the airfoil wake, permitting an increase in CLmax.

SUPPORTED BY University of Illinois

4.0013, PLASMA DYNAMICS

A. Bers, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ENG79-07047)

A range of analytical, computational, and experimental problems associated with plasma phenomena is being explored. Activities center on the following topics: 1. Nonlinear wave interactions - stochastic particle dynamics in waves of finite amplitude, renormalized wave-wave interaction theory, and space-time evolutionary dynamics of nonlinear interactions are being explored. 2. Nonlinear fluctuation turbulence and transport theory - the creation and decay of non wave-like fluctuations (clumps, holes, etc.) are being studied. 3. Experiments with relativistic electron beams - laser-initiated reflexing in a diode, stimulated backscattering, and Stark broadening induced by intense electric fields are topics being investigated. 4. Experiments in nonlinear wave-particle interactions - this work focuses on measurements of phase space granulation in a counter-streaming electron beam system.

This is a continuation of research previously supported under NSF grant ENG-7700340 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0014, STATISTICAL IMAGE PROCESSING FOR REAL-TIME OPERATIONS

C.H. Chen, Southeastern Massachusetts University, School of Engineering, Dept. of Electrical Engineering, *North Dartmouth, Massachusetts* 02747 (DN975533; N00014-79-C-0494)

The objective of this effort is to improve the Navy's surveillance capability to detect, identify and track targets by creating and developing improved statistical and probabilistic methodology applicable to satellite technology.

Statistical and probabilistic research will be conducted in several areas, including (1) comparative evaluation of decision rules, (2) statistical feature extraction for image recognition and segmentation, (3) statistical contextual analysis of images, and (4) statistical modeling of images.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0015, THE ABSORPTION OF CO2 LASER RADIATION IN DENSE PLASMAS

D.R. Bach, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Nuclear Engineering, *Ann Arbor, Michigan* 48104 (ENG79-04820)

This research program is a study of non-linear interaction phenomena which arise when the radiation from a high intensity carbon dioxide laser beam interacts with a dense plasma. The interaction phenomena studied are closely related to the mechanisms important in the coupling of laser light with pellets of various kinds used in laser fusion experiments. Particular interest centers on experiments that involve laser penetration of a Z-pinch plasma whose density is greater than critical in order to understand both the interaction responsible for the penetration and the nature of plasma heating in the penetration region. Spatial and time dependencies of the plasma density are measured using a holographic interferometer. Thomson scattering measurements are also made in order to measure the temperature change in the plasma caused by the laser irradiation and to determine whether the penetration and heating is caused by turbulence. Separation of non-linear interactions from motion occurring on a hydrodynamic time scale is achieved with the aid of a short pulse laser system.

This is a continuation of research previously supported under NSF grant ENG-7620279.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0016, ENGINEERING SPECIALIZED RESEARCH EQUIPMENT - COMBUSTION RELATED PARTICULATE AND DROPLET SIZING INSTRUMENTATION

J.A. Nicholls, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (ENG79-11376)

An image analyzer is to be purchased. This instrument would be used by faculty members in the Department of Aerospace Engineering for a number of research projects relating to combustion particulate and droplet sizing measurements.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0017, COMMAND AND CONTROL - COLOR DISPLAY DESIGN GUIDE

M.M. Krebs, Honeywell Inc., Systems & Research Center, *2600 Ridgeway Pkwy. N.E., Minneapolis, Minnesota* 55413 (DN675169; N00014-78-M-0072)

The objective of the research is to develop a design guide, a set of principles for the design of aircraft displays which would incorporate the use of color. The integration of cockpit displays has created displays cluttered with information which increases pilot/operator workload. Color offers an additional dimension to information coding which appears to offer improved display information transfer. Color engineering technology is available for displays. However, the optimum application of color to the information to be displayed has not been established.

The technical approach will be based on a laboratory research program which will supplement available color research data. Additional inputs to the research data will be provided through working group sessions involving contractor and government representatives. The contractor will assimilate the research data, formulate a design guide, and make color coding recommendations for specific displays.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0018, DETERMINATION OF DIRECTIONAL WAVE SPECTRA FROM SAR

G.E. Carlson, University of Missouri, Rolla Campus, School of Engineering, Dept. of Electrical Engineering, *Rolla, Missouri* 65401 (DN975291; N00014-79-C-0343)

The objective of this research is to determine the feasibility of determining ocean wave directional spectra from less than full SAR images. Real-time global determination of directional wave spectra from SAR data is a critical need for all naval planning and operational missions.

SEASAT SAR data will be used to test the feasibility of this concept. Discrete Fourier transforms of portions of digitized range scans will be obtained from the same wave train which will produce a smoothed one-dimensional spectrum. Pairs of range scans will then be correlated to identify wave train offset from scan to scan giving wave train direction. Combined they will produce wave direction and frequency.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0019, STUDIES OF IONOSPHERIC IRREGULARITIES AND PLASMA INSTABILITIES IN THE MAGNETOSPHERE

R.N. Sudan, Cornell University, Ithaca Campus, Lab. of Plasma Studies, *159 Sapsucker Woods Rd., Ithaca, New York* 14850 (DN975322; N00014-79-C-0308)

The Navy needs quantitative information on the active state of the ionosphere and magnetosphere for radio communication applications and uses. In particular, density irregularities resulting from turbulence in the ionosphere and in the aurora will be studied. The dynamics of triggered Whistler emissions will also be studied.

Irregularities in the ionosphere and the aurora resulting from nonlinear interactions will be modeled in terms of a two-dimensional strong turbulence theory whose basis is the 'direct interaction approximation'. Analytical and numerical work on triggered Whistler emissions will be pursued in collaboration with Professor J. Denavit.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0020, TIES MODULAR PACKAGING STUDY

E. Grove, General Electric Co., A/C Equipment Division, *French Rd., Utica, New York* 13502 (DN981044; N62269-79-C-0007)

To establish a comprehensive modular packaging approach suitable for multisystem/multiplatform application of the TIES architecture. This contract supports work unit ZC910, Agency Accession No. DN681082.

Review present packaging techniques, develop new concepts, evaluate feasibility, and recommend and define a packaging scheme to facilitate the TIES architectural concept of programmable modules to configure future naval aircraft to differing mission requirements. Emphasis will be on the geometrically distributed nature of the TIES architecture, particularly the frequency conversion subsystem.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0021, ACOUSTIC EMISSION MONITORING OF FATIGUE CRACKING IN FULL-SCALE AIRCRAFT

Unknown, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890168; N00019-79-C-0218)

Investigate the feasibility of acoustic emission monitoring for real-time detection and location of fatigue crack initiation and growth in full-scale aircraft structure.

Acoustic emission monitoring systems, combining noise discrimination and frequency analysis concepts, will be used to detect and locate fatigue cracking in a high extraneous noise environment of a full-scale aircraft fatigue test.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0022, AIR CYCLE COMPRESSOR-EXPANDER

R. Smolinski, Ecton Corp., *5683 Webster St., Dayton, Ohio* 45414 (DA0P3645; DAAK70 79 C 0042)

Develop an air cycle (reversed Brayton cycle) compressor-expander with a coefficient-of-performance (COP) of one (1).

Conduct an exploratory development program using the rotary vane, positive displacement air cycle compressor-expander concept with special attention to reducing internal heat transfer from the compressor to the expander, reducing blade flexing and friction at rotor plates and end plates and increasing volumetric efficiency.

SUPPORTED BY U.S. Dept. of Defense, Army, Mobility Equipment Research & Development Command

4.0023, RADAR GROUND CLUTTER ANALYSIS AND SIMULATION

J. Haynes, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF098980)

To obtain statistical information concerning ground clutter return from varied terrain types and depression angles, to update the latest IITRI clutter model and incorporate this information into a radar simulation program. This will culminate in the development of an IH capability of simulating existing and proposed radar systems on our computer and testing the response of these systems to different types of accurately simulated ground clutter so that the optimum system parameters can be chosen.

To take the computer tapes containing the ground clutter return and statistically analyze them on the ASD computer system. Use this information to update the clutter model and develop a data file of clutter maps for evaluating system performance using a radar simulation program developed by IITRI for determining probability of detection in a dynamic clutter background. This study will include the generation of histograms of radar crosssection per unit area vs. number of samples, for the various terrain types and depression angles as well as the mean and standard deviation. These statistics will be done for the various clutter models, e.g., Rayleigh and log-normal to determine their validity.

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0024, ENERGY CONVERSION - EROSION STUDY IN TURBOMACHINERY

W. Tabakoff, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (DN875756; N00014-78-C-0590)

The objective of this project is to investigate the basic phenomena of erosion in association with solid particles and gas flows with possible application to turbomachinery parts which are exposed to particulate environments. The effort is experimental and theoretical in nature and will contribute to an increased understanding of the effects on performance of erosion phenomena as well as on engine life relative to naval and marine power plants and fixed installations.

Study will be made of the effects of particle size on erosion, effects of true impact angles of particles, and aerodynamic effects of temperature on erosion of alloys and development of a fluid mechanics approach to alleviate erosion. The final goal will be to develop a quantitative model to predict erosion in future advanced turbomachinery operating in particulate environments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0025, WEAPONRY - TURBULENT BOUNDARY LAYER SEPARATION IN ADVERSE PRESSURE GRADIENTS

R.L. Simpson, Southern Methodist University, School of Engineering & Applied Sciences, Dept. of Civil & Mechanical Engineering, *Hillcrest & University, Dallas, Texas* 75222 (DN975360; N00014-79-C-0277)

The objective of this study is to improve current knowledge of the structure of turbulence for separated and separating boundary layers in adverse pressure gradients. Such information

is needed for better design of diffusers and blade passage in aircraft turbojet engines, and ultimately should lead to improved propulsion systems for naval weaponry applications.

Experiments will be run on a flat plate in a wind tunnel test section with a two-dimensional mean flow. The turbulent boundary layer is established on the plate with the aid of a leading edge trip, and an adverse pressure gradient typical of an airfoil in a cascade is produced by contouring the upper wall of the test section. Measurements will be made in three dimensions, both upstream and downstream of separation, using hot wire anemometry in regions without backflow, and directionally sensitive laser velocimetry in other regions. The data will be analyzed and correlated, and the implications of the results on modeling of separated turbulent flows will be considered.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0026, COMPOSITE ANALYSIS

G.F. Carey, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

A Monte Carlo method is utilized to simulate a class of 'non-uniform' composites and a statistical technique applied in conjunction with finite element analysis of variational boundary value problems which are posed on the sample sub-domains. The procedure has been developed as an approach for determining estimates of the macroscopic material properties of fabricated composites. Some aspects of this continuing research have been presented at a meeting of the Engineering Mechanics Division of the ASCE in May and at the recent (November 1977) meeting of the Society of Engineering Science at Lehigh. The underlying theory is the subject of a proposal submitted to the Engineering Mechanics Section of NSF and will be undertaken collaboratively with Julian Pop of the Department of Aerospace Engineering and Engineering Mechanics .

SUPPORTED BY University of Texas

4.0027, ENGINEERING ANALYSIS OF ATTITUDE BEHAVIOR OF SPACE PROBES AND RIGID BODIES IN GENERAL

V. Szebehely, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Numerical and analytical methods are used to investigate the behavior of space probes as influenced by various perturbing effects, such as laser beams, nearby explosions, other gravitational effects, effects of rocket plumes, etc. The implication to the Texas economy is that several satellites which are photographing the Texas background regarding the growth of vegetation require high degree altitude stability in order to obtain precise photographic information. To maintain the proper orientation of these vehicles is a major engineering problem and this project tries to alleviate and solve the very same problem.

SUPPORTED BY University of Texas

4.0028, NAVY ENVIRONMENT - BALLOON COMMAND-CONTROL

P.R. William, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (DN775171; N00014-77-C-0108)

This research effort has as its goal the development of a lightweight, inexpensive, expendable scientific balloon command-control-tracking system that can be used by Navy researchers who wish to fly small expendable experiments to high altitudes without the requirement for payload recovery. This system will allow much flexibility combined with strict compliance with flight safety requirements imposed by the Federal Aviation Administration.

The contractor has developed a lightweight, expendable command receiver for balloon control. He has added a transmitter and power supply to the system, making the control unit independent of the primary scientific equipment. This combination makes possible fixing the balloon's position in slant range and azimuth. The contractor will now add an altitude read-out for precise location. The system will be field-tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0029, MECHANISMS OF RARE-GAS HALIDE LASERS

W. Koechner, Science Applications Inc., *1911 N. Fort Myer Dr., Suite 1200, Arlington, Virginia* 22209 (DN880097; N00173-78-C-0414)

To investigate the mechanisms occurring in rare gas laser plasmas and to determine the feasibility of generating efficient lasers in this media.

The contractor will develop a kinetics package which describes the atomic, ionic and neutral species reactions in electon-beam sustained rare-gas halide lasers. Diagnostic requirements designed to test the accuracy of the kinetics package will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0030, AN ANALYSIS OF THE THERMAL CONDUCTANCE OF DISSIMILAR METAL CONTACTS

L.S. Fletcher, University of Virginia, School of Engineering & Applied Science, Dept. of Mechanical & Aerospace Engineering, *Garrett Hall, Charlottesville, Virginia* 22903 (ENG78-24684)

The objective of this research is to investigate experimentally and theoretically the conduction heat transfer characteristics of metallic junctions composed of dissimilar metal junctions. Additionally, the dependence of the thermal contact conductance magnitude upon the direction of heat flow through the metallic contact (a phenomenon known as thermal rectification or directional bias) is evaluated. Supplementary goals for the research program include the generation of a substantial base of experimental contact conductance data, the development of a correlation to predict conductance values suitable for engineering applications, and the experimental determination of the effects of various parameters upon the thermal contact conductance and the thermal rectification at dissimilar metal interfaces.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, STUDIES OF NATURALLY-OCCURRING ELF AND VLF RADIOWAVES AND ASSOCIATED ULF AND PARTICLE PRECIPITATION PULSATIONS

R.R. Heacock, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM7819963)

There are still many aspects of particle precipitation into the auroral ionosphere that are not well understood. A principal goal of this project is to gain additional insight into these processes by focusing attention on precipitation pulsations that are associated with special events such as storm sudden commencement impulses, substorm break-up impulses, events of quasi-sinusoidal character, events for which the ELF/VLF noise amplitudes are modulated at ULF frequencies less than 1 Hz, in correlation with ULF magnetic field pulsations.

This project is one of many International Magnetosphere Study (IMS) related programs. Much of the effort also involves cooperation with investigators who are taking data on IMS satellites.

This grant continues study of the relationships between naturally occurring radio waves and auroral particle precipitation. More specifically the Carib-Peak ELF-VLF and riometer site will be maintained and operated, as will the associated data recording facility at Poker Flat Research Range. College and Fort Yukon riometer data will continue to be recorded on magnetic tape. Macquarie Island ELF data will be analyzed together with Carib ELF data for conjugate characteristics. Carib ELF data will continue to be supplied to IMS satellite experimenters as re-

quired for satellite-ground comparisons. Riometer pulsation data will be analyzed together with magnetic field pulsations, ELF data, and DMSP satellite electron precipitation data in efforts to understand the roles of pulsations and ELF in producing auroral particle precipitation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0002, CONTINUATION OF THE OPERATION OF MERIDIAN SCANNING PHOTOMETERS IN ALASKA DURING THE INTERNATIONAL MAGNETOSPHERIC STUDY

G.J. Romick, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM78-25249)

Meridian scanning photometers provide a ground-based technique for determining the particle precipitation characteristics associated with various magnetospheric regions. Thus, it is important during the International Magnetospheric Study (IMS) to operate systematically a number of these systems dispersed along a geomagnetic meridian to provide a space-time mapping of the magnetospheric activity. In addition, these observations provide a temporal link between periodic satellite or rocket observations.

This grant continues operation of the meridian scanning photometers at Poker Flat Research Rocket Range on a routine schedule and at Ft. Yukon, Alaska, on a reduced selected-day schedule, along the 57 degree east geomagnetic meridian, through the IMS until March 31, 1980.

The 4278A N2 ion, 6300A and 5577A OI and 4861A H emissions are monitored in a two-second horizon-to-horizon scan period with a filter tilting mode of operation also available when the ration of auroral to background intensity is low. Digital electronics and computer-formatted magnetic tape recordings are employed. In addition, stellar observations will be performed to determine the degree of cloudiness and an absolute intensity calibration will be made on each data tape.

Lists of available data will be sent to the World Data Center for distribution to interested scientists. Detailed photometric data will be available through direct contact between investigators.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0003, IMAGE PROCESSING

R.M. Batson, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-00991)

The Image Processing Facility will continue to provide custom processing of LANDSAT and planetary spacecraft pictures, and digital arrays of spatial geologic, geophysical, and geochemical data to support investigations of the Geologic Division.

Research will continue in the development of new techniques for the manipulation of spatial data. Specifically the following investigations are under way: 1. Derivation of topographic data by processes involving computation of ratios between bands of multispectral images. 2. Continued development of methods of correlating and displaying geophysical, geochemical, topographic and other non-image data. 3. Development of new multispectral clustering methods for image classification. 4. Development of digitally encoded catalogs of geologic features on the planets. 5. Development of techniques of using line digitizing equipment for editing and revising raster formatted data. 6. Continued development of techniques for making maps and mosaics, both in black and white and in color, of digital television images from spacecraft.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0004, PG-POLAR ICE INVENTORY

H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02361)

The history, mobility, and storage of water and other atmospheric volatiles on Mars has become a major area of scientific controversy, particularly since the start of the Viking missions. The history of the atmosphere, the total planetary volatile inventory, the age and formation of ubiquitous large and small channels, a host of glacial phenomena observed in Orbiter images all revolve on the basic issues of how much and when water evolved from the interior as well as where it is now stored.

Various hypotheses have been proposed concerning the fate of Martian volatiles. The only sinks which can be examined directly are those at the poles where we now have excellent stereo coverage. Stereo data on slopes and thicknesses will be combined with other geologic data to estimate the volatile inventory. These estimates will strongly influence future hypotheses. In addition, by counting and studying the morphology of craters on the ice, layered deposits, and adjacent polar terrain, it may be possible to evaluate the rate of formation and destruction of these materials. The hypotheses concerning climatic history and the possible presence of life on Mars are strongly dependent on the availability of water at present and in the past.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0005, EOLIAN FEATURES OF THE MARTIAN POLAR REGION

J.F. McCauley, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02381)

Viking Orbiter pictures indicate complex relationships among the various ice facies of the north polar cap, the large-scale, maturely developed dunes of the circumpolar sand seas, the layered terrain, and numerous wind erosion patterns superposed on these depositional features. We plan a detailed regional photogeologic analysis of these relationships, using our data bank of some 15,000 ground, aerial and satellite pictures of terrestrial eolian features for interpretive background. A main objective is to map the distribution and trends of the wind-formed terrains in the polar region of Mars in order to show their inferred evolution with time and relations to source materials and surface transportation regimes. Systematic measurements will be made of the major eolian landform types for statistical comparison with terrestrial features. Results of the photogeologic analysis will be applied to interpretations of the surface geologic processes and climatic history of Mars.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0006, GROUND-WATER HYDROLOGY OF THE COCONINO AQUIFER IN SOUTHERN APACHE CO., ARIZONA--A MATHEMATICAL ANALYSIS

P.P. Ross, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Flagstaff, Arizona* (AZ 78-046)

Coconino aquifer will be source of water for large ground-water withdrawals in near future. Coronado generating plant and possible construction of a second generating plant will require additional water. Also, more water will be needed to support construction and maintenance personnel and satellite industries. Pumpage may increase by 50,000 AF within the next few years. Effects of project pumpage are unknown because the ground water flow system is poorly defined in part of the area.

The principal objectives are: 1. to provide a preliminary estimate of the average recharge and discharge values and to define the aquifer characteristics of that part of the Coconino aquifer that is within southern Apache County, and 2. to determine the potential effects of the projected ground-water withdrawals.

Potentiometric surface, aquifer thickness, water-level decline and aquifer characteristic data at selected points are available. Additional data required include estimates of recharge and discharge. Recharge will be estimated by a flow net analysis and discharge will be estimated on the basis of available springflow,

streamflow and pumpage measurements. The model will be calibrated using steady-state and transient-state techniques. When the model is calibrated the project pumpage values will be used to simulate water-level declines for the years of 1985 and 2000.

Aquifer characteristics were analyzed, recharge was estimated by flow-net analysis, a two-dimensional digital model was constructed, and the steady-state calibration is almost complete. The most significant finding thus far is the realization of the relation between ground-water flow and subsurface structure and related secondary permeability.

Final steady-state calibration and transient-state verification. Write report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0007, SEISMIC HAZARD STUDY OF THE WESTERN PORTION OF THE GARLOCK FAULT, SOUTHERN CALIFORNIA

J.D. Scott, Fugro Inc., *3777 Long Beach Blvd., Long Beach, California* 90807

STATE TO WHICH PROJECT PERTAINS: California.

The purpose of the investigation is to determine the history of movement of the western Garlock Fault. To accomplish this the investigation will concentrate primarily in the vicinity of Castaic Lake, Twin Lakes, and Oak Creek Canyon where conditions are thought to be favorable.

The objectives of the investigation during the first year will be: 1) Analysis of aerial photographs to locate the best defined fault breaks, 2) Field reconnaissance to examine and verify surface ruptures and fault related features determined from aerial photograph analysis and existing literature, 3) Subsurface sampling by hand auger will be conducted to determine whether dateable deposits are present at the preliminary trench sites, 4) Trenches will be dug at selected localities to evaluate fault displacement relationships, 5) Level lines will be surveyed in the vicinity of trenches to provide elevation data, 6) Selected deposits will be dated by various methods to determine recurrence rates of fault movement.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0008, SATELLITE EQUATORIAL SCINTILLATION STUDY

M.R. Paulson, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Environmental Sciences Dept., *San Diego, California* 92152 (DN988526)

Acquire a data base which can be used to develop a statistical model of equatorial scintillation of satellite signals. Such a model could be used to predict the probability of the occurrence of significant equatorial scintillation at any given time and the extent to which satellite communications are adversely affected.

Record the signal amplitudes at Guam from the two gapfiller/MARISAT satellites at 257 and 1541 MHz for six months or more. This will provide data on scintillation activity and intensity at two frequencies and two elevation angles, 11 degrees and 51 degrees. Calculate amplitude distributions & cumulative amplitude distributions, mean and standard deviations, & fade duration distributions for several fade depths. These calculations would be made as a function of time for each of the satellites and each frequency.

SUPPORTED BY U.S. Dept. of Defense, Office of Naval Research, Earth Sciences Div.

5.0009, PENINSULAR RANGES TECTONICS

V.R. Todd, U.S. Dept. of the Interior, Geological Survey, La Jolla Marine Geology Lab, *8604 La Jolla Shores Dr., San Diego, California* 92037 (9540-01625)

STATE TO WHICH PROJECT PERTAINS: California.

Review and synthesize existing historic, seismic, geologic, and geodetic records of all faults with known or suspected Late Quaternary activity. Study satellite and high-altitude (1:90,000 to 1:230,000 scale) photography and other imagery for linear and other structural features that appear to reflect Late Quaternary tectonic activity. Study known or suspected young faults by intermediate-scale air photos (including low-sun-angle photos) and by detailed geologic mapping. Determine for each active fault the length, width of hazardous zone, distribution and nature of adjacent landslides, character, rate and chronology of past displacements from historic slip events, and Late Quaternary stratigraphic and geomorphic record. Compile bedrock geologic maps at scales of 1:24,000 and 1:62,500. Landslides will be mapped by photo-interpretation, and consolidated deposits will be classified and mapped.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0010, FLUVIAL HISTORY OF MARS

M.H. Carr, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02367)

Determine the distribution and age of run-off channels, outflow channels, and fretted channels.

Reconstruct the history of fluvial action on Mars and determine how it correlates with other events in the planet's history.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0011, MULTIVARIATE ANALYSIS OF GEOLOGIC VARIABLES APPLIED TO MINERAL RESOURCE ESTIMATION

W.D. Menzie, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9340-02125)

STATES TO WHICH PROJECT PERTAINS: Alaska, California, Nevada.

Prepare reports on the mineral resources of Big Delta Quadrangle, Alaska and Phillip Smith Quadrangle, Alaska. Construction of grade and tonnage, or contained metal, models for use in Walker Lake Quadrangle mineral resource assessment. Investigate spatial distribution of mercury deposits in the coast ranges of California. Test and modify a method of correcting for size-biased sampling of chromite deposits and report on the results.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0012, QUANTITATIVE MORPHOLOGY OF VOLCANOES

R.J. Pike, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02355)

Quantitative comparisons of Martian volcanoes with terrestrial edifices whose mode of origin is known are the immediate goals of the proposed research. Various aspects of Martian crustal properties, magmatic and volcanic processes, and geologic history ultimately will be interpreted from the resulting correlations or the absence of them. Other products will include a refined classification of central volcanoes on the terrestrial planets and improvements upon current sets of data that characterize different classes of volcanoes. The research is an integrated, long-term program of work on planetary volcanic landforms, with current emphasis on Mars, wherein a systematic, quantitative approach is applied to the interpretation of process from landform morphology. In FY 79, the topographic dimensions (especially height and breadth of the edifice and diameter, depth and circularity of the summit depression) of 15 large Martian volcanoes will be measured or remeasured from data that have been reduced photogrammetrically from Viking Orbiter images. Other, smaller edifices will be measured if the data can be generated. While these data are being prepared for Martian volcanoes, information on three of the most likely classes of candidate analogs on Earth - non-tholeiitic lava shields, tablemountains, and maars - will be reviewed, updated, and improved.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0013, FINE PARTICULATE MONITORING IN THE WESTERN ENERGY RESOURCE DEVELOPMENT AREA

T. Cahill, University of California, Davis Campus, School of Letters & Science, Dept. of Physics, *Davis, California* 95616 (R806459-01; J833C-083)

OBJECTIVE: Establish a baseline of air ambient fine particulate data in the Western Energy Resource Development Area.

APPROACH: A forty-station fine particulate sampling network will be deployed over the states of Arizona, New Mexico, Colorado, Utah, Wyoming, North Dakota, Montana, and South Dakota. The mass and elemental composition of aerosols in two size ranges (less than 2.5 micron, less than 15 micron) will be determined on the twice-weekly samples at each station. Correlations will be developed with meteorological data and other air quality measurements (e.g., visibility).

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0014, A QUANTITATIVE STUDY OF THE TEMPORAL VARIATIONS IN THE MAGNETOTAIL CONFIGURATION

R.E. Holzer, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (ATM79-16245)

This grant will help to develop a quantitative empirical model of the temporal changes of the magnetic flux pattern in the magnetotail utilizing IMS satellite and ground-based data. Previous work has yielded quantitative relations between the southward flux of the Interplanetary Magnetic Field (IMF), the auroral AL index, and flux transfers between the forward magnetosphere and the magnetotail. The observations of continuous changes of magnetic field (B) in the tail during significant flux transfer processes will be obtained for as many positions in the tail as possible. The previously developed quantitative relations, with appropriate time delays, will be employed in correlating the several series of observations of B. It is expected that a model of the continuous change in structure of the tail and hence its energy state will be evolved. Such an empirical model will be used in testing a number of theoretical predictions concerning magnetic tail transformations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0015, HIGH-RESOLUTION SENSING TECHNIQUES FOR SLOPE STABILITY STUDIES

R.B. Johnson, Colorado State University, School of Forestry & Natural Resources, Dept. of Earth Resources, *Fort Collins, Colorado* 80523 (9550-01954)

The U.S. Geological Survey and the National Bureau of Standards will jointly complete the study of high-resolution sensing techniques (other than remote sensing) for application to investigation of slope stability. This will include summarizing the state-of-the-art in the factors that contribute to slope instability, determination of those factors that are measurable by remote means and estimation of their vaules, determination of appropriate geophysical measurement techniques to be employed, completion of report summarizing all aspects of study, conclusions, and recommendations for use and further research.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0016, ELECTRONIC LAB SUPPORT

C.M. Mitchell, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9780-01758)

STATE TO WHICH PROJECT PERTAINS: Colorado.

The objectives are to provide laboratory and field support for equipment which is used in the development and application of new techniques for assessment and evaluation of mineral resources. During this year the truck magnetometer system will be installed in a new vehicle, new instrumentation will be developed for the scale model facility, a new airborne digital acquisition system will be tested and installed in the Porter aircraft and maintenance and field support will be supplied for other equipment.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0017, ISOTOPES OF THE UPPER MANTLE

M. Tatsumoto, U.S. Dept. of the Interior, Geological Survey, Branch of Isotope Geology, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9740-00384)

We plan to continue the study of Sm-Nd systematics in rocks from Stillwater Complex, Montana. Pb, U, and Th distribution in basalts will be determined. Pb and Nd isotopic compositions of Hawaiian rocks will also be determined with regard to the mantle evolution. We plan to study U-Th-Pb systematics and U isotopic composition of lunar and meteorite samples to compare its origin and history to the earth's evolution.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0018, INVESTIGATION OF THE CORE-MANTLE BOUNDARY, OF RAYLEIGH WAVE OVERTONES AND OF LOW-FREQUENCY BEHAVIOR OF SOURCES OF GIANT EARTHQUAKES

E.A. Okal, Yale University, Graduate School, *206 Elm, New Haven, Connecticut* 06520 (EAR79-03907)

This is a project for the investigation of attenuation and possible lateral heterogeneities at the Core-Mantle Boundary of the Earth, for the study of Rayleigh wave overtones as individual seismic phases, and for the investigation of the ultra-long period mechanism of some giant earthquakes using normal mode theory.

The principal investigator will also apply mode theory methods to other earthquakes, in particular to investigate quantitatively the proposed precursor to the giant 1960 Chilean earthquake; a preliminary analysis establishes the feasibility of such a study, which could have important consequences in our understanding of the kinematics of plate motion, and in dynamical problems such as the driving mechanism of the Chandler Wobble of the Earth.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0019, IDENTIFICATION OF PREFERRED DOUGLAS-FIR TUSSOCK MOTH SITES

R.C. Heller, University of Idaho, Forest Wildlife & Range Experiment Station, *Moscow, Idaho* 83843 (0070375; IDA-ES-0091)

OBJECTIVE: Produce correlative tree, stand and site information from color infrared aerial photographs which identify those factors which contribute to susceptibility of firs to Douglas-fir tussock moth epidemics.

APPROACH: The color infrared aerial photographs taken in 1974 will be interpreted to determine at each one-acre plot: Level of tussock moth defoliation damage; aspect of plot; slope of plot; height of dominant trees - age. Simple and multiple regressions will be made along with discriminant analysis techinques to test our hypotheses.

PROGRESS: Aerial color infrared photographs (scale 1:5,000) are being interpreted to determine whether the level of Douglas-fir tussock moth damage to fir stands in Oregon is related to aspect, tree age, stand density, slope, physiography, and/or stand openness. Approximately one-sixth of the photo interpretation is complete. Data are being recorded for rapid computer analysis. We have determined that tree height is poorly correlated with age. This is based on height and age measurements of 425 fir trees in the Umatilla National Forest, which is within our study area.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Idaho

5.0020, IMPROVING SURFACE-COAL REFUSE DISPOSAL SITE INSPECTIONS

R. Meister, Chicago Aerial Survey, *2140 Wolf Rd., Des Plaines, Illinois* 60018 (J0188027; L-77-C)

PURPOSE: Demonstrate the practicality of aerial photogrammetry for supplementing MSHA inspection of coal-waste structures in Appalachia.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Mines, Spokane Mining Research Center

5.0021, SEASAT PROGRAM - RESEARCH APPLICATIONS WITH TROPICAL CYCLONE DATA SETS

R.C. Gentry, General Electric Co., Management & Technical Services, *5030 Herzel Pl., Beltsville, Maryland* 20705 (7-931; MO-AO1-78-00-4323)

OBJECTIVES: Use wind, temperature and moisture measurements from SMMR and SASS, together with all other available data sets taken over three tropical cyclones, to evaluate usefulness of SEASAT-A for hurricane observations. Compare value of this full data set with requirements for making hurricane forecasts.

APPROACH: SEASAT data will be obtained on a moderate disturbance, a tropical storm and a tropical cyclone of full hurricane intensity. All three cases will be selected to insure maximum data availability, but the full hurricane case would further cover periods when the geosynchronous satellite is operating in the limited scan mode for the storm area and the NOAA Research Flight Center has one or more of its aircraft gathering data in the storm at low levels. Data from all sources will be intercompared in order to assess data validity and to set limits on probable errors in the various types of data. These data would then be used to study the structure and energetics of the three storms of varying intensity.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0022, NAVY ENVIRONMENT - UNDER-ICE ROUGHNESS

L.A. Leschack, Leschack Associates Ltd., *1111 University Blvd. W., Silver Spring, Maryland* 20902 (DN675351; N00014-76-C-0757)

The objectives of the proposed work are: (a) to evaluate the geographical and temporal variability of the under-ice roughness parameters in the Arctic Ocean; (b) to determine if the roughness parameters seem to remain relatively constant with respect to one another for different geographical areas from year to year, thence to determine whether this geographical variability can be well correlated with ridging intensity measurements derived from airborne data; (c) to determine whether under-ice roughness parameters can be estimated from satellite data.

Examine under-ice roughness parameters for geographical and temporal variability to determine quantitatively whether roughness variations can be grouped geographically. Attempt to correlate latest recorded under-ice roughness data with corresponding satellite data of the surface.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0023, SYSTEMS DEVELOPMENT AND EXPERIMENTATION - FORECASTER AIDS AND APPLICATIONS

H.M. ONeil, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Integrated Systems Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8C27037)

OBJECTIVE: To enhance the capability of forecasters at NWS operational sites through the use of new or improved products and the extended use of automation to provide these products.

APPROACH: Define the requirements for new or improved products and translate these requirements into AFOS-compatible software. Analyze man-machine interaction and optimize the software through experimentation.

PROGRESS: 1. Aviation Information and Retrieval System (AIRS) completed. 2. Evaluation of computer worded forecasts is underway. 3. Evaluation of Terminal Alerting Procedure (TAP) has begun.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service

5.0024, MARINE ENVIRONMENTAL PREDICTION - GREAT LAKES FORECASTING

N.A. Pore, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8C698203)

OBJECTIVE: 1. Wind--Develop and improve automated forecast techniques for winds over the Great Lakes. 2. Storm Surge--Expand and improve automated storm surge forecast technique. 3. Waves--Expand and improve the automated Great Lakes wave forecast system. 4. Fog--Develop automated technique for forecasting reduced visibility due to fog.

APPROACH: 1. A statistical approach will be taken to relate observed winds over the Great Lakes to atmospheric model output of LFM-II (MOS approach). Effects of low level atmospheric stability will be included. 2. Great Lakes storm surges will be related statistically to atmospheric circulation and stability by perfect prog and MOS techniques. 3. Great Lakes wave forecast technique will be modified by considering reduced fetch lengths due to ice. 4. A statistical approach will be used to relate observed reduced visibility due to fog occurrence to atmospheric model output.

PROGRESS: 1. Wind forecasts are made twice daily for 12 sections on the Great Lakes, based on LFM-II meteorological input data. 2. Extratropical storm surge forecasts are made twice daily for four locations, two on Lake Erie and two on Lake Huron. 3. Operational wave forecasts to 36 hours in advance are made twice daily for 64 locations on the Great Lakes. 4. Preliminary equations have been developed for probability of occurrence of fog on the Great Lakes.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0025, CLOUD/ICING/VISIBILITY ANALYSIS SYSTEM (CIVAS)

W.D. Mount, Geo Atmospherics Corp., *Box 117, Lincoln, Massachusetts* 01773 (DA0F2203; DAAD07-79-C-0089)

To provide Army aviators with an automated procedure for estimating the current threat of icing conditions on a scale of 5 km.

Existing computer programs for analyzing cloud and visibility conditions from standard airways and synoptic observations will be modified to add temperature/icing and reduce the grid size of 5 km.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0026, THE CHEMISTRY AND CHEMICAL EVOLUTION OF PLANETARY ATMOSPHERES

R.G. Prinn, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ATM77-01252)

This grant funds a theoretical and modeling study of the chemistry and chemical evolution of planetary atmospheres. Particular areas to be emphasized include photochemical models of the atmospheres of Venus, Mars, Jupiter, and Uranus, and the development of a unified theory of the origin and evolution of planetary atmospheres. This work is a follow-up to earlier work supported under NSF grant ATM-7414116.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0027, COASTAL MONITORING ASSESSMENT AND PREDICTION (COMAP)

G.F. Kelly, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Marine Fisheries Service, Northeast Fisheries Center, *Woods Hole, Massachusetts* 02543 (NEC-001)

The objectives of the COMAP task are three-fold: 1) To monitor the distribution and abundance of key ocean pulse-indicator species of fish and invertebrates in Buzzards Bay, Vineyard Sound and other coastal waters of New England; 2) To assess man's impact on the in-shore environment employing ocean pulse procedures to determine the state of health of fish and invertebrates in relation to contaminants in inshore waters, and 3) To provide coordination for environmental studies within the northeast state, federal and private agencies that are interested in coastal environmental investigations or related fisheries studies. Examples of specific studies employing the 38 ft. NMFS survey boat Phalarope II in in-shore waters include monitoring the abundance of green crabs, Carcinus maenes; edible mussels, Mytilus edulis; barnacles, balanus sp; and periwinkles, Littorina sp; as potenial indicators of hydrocarbon, PCB and heavy metal contamination. Samples of finfish and invertebrate specimens will be collected for chemical and physiological analyses at the NMFS Milford Biological Laboratory, Sandy Hook Laboratory, and the Gloucester Laboratory, Northeast Fisheries Center, or by investigators engaged in research contracts awarded to academics and other government agencies. Regular otter trawl surveys of finfishes will be done in the vicinity of Woods Hole for comparison with earlier data and to establish long-term trends in species abundance and contaminamt concentration. Sampling will be continued in Buzzards Bay and Vineyard Sound, using newston and plankton sampling gear, to measure the essential abundance of lobster larvae and eggs and larvae of other associated finfish and invertebrates. Studies of water column will be done at selected stations in conjunction with the above laboratories (NES-O37, 040 and 070). Arrangements have been made to coordinate surface water ground-truth observations from Phalarope II with NASA remote sensing flights over southern New England in March 1979. The coordination role of COMAP is directed principally toward implementing ocean pulse procedures in ongoing studies such as the 'Massachusetts coast-wide fisheries resource assessment' and EPA 'Mussel watch' or assisting academic teams of investigators, through contract, in initiating specialized environmental studies.

SUPPORTED BY U.S. Dept. of Commerce, National Marine Fisheries Service, Northeast Fisheries Center

5.0028, CALIBRATION OF MEASUREMENTS OF ATMOSPHERIC EMISSIONS

M.R. Torr, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Oceanic Sciences, *Ann Arbor, Michigan* 48104 (ATM76-23737 A01)

Weak emissions from the earth's atmosphere can be observed at certain wavelengths, by sensitive photometric devices looking at the nighttime sky. These nighttime airglow features are the data base used by a large number of researchers, across the country and around the world, to learn about chemical reaction rates, atmospheric and ionospheric concentrations, and other geophysical phenomena.

A problem for such work in the past has been one of absolute calibration of the photometric devices, and thus of derived parameters. Even some (claimed) strong geographical dependencies in observed effects have been subsequently found due simply to differences in 'absolute calibration' references used at different observatories. One traveling reference for universal intercomparison has proven most valuable to the field.

This grant provides the continued availability of a portable photometric calibration instrument to the atmospheric-emission-measurement community. In particular, this grant funds (in addition to on-going calibration of sources): a) Absolute calibration of the reference photometer and transfer standard against the National Bureau of Standards tungsten source. b) Subsequent derivation of an absolute calibration for each of the sources calibrated to date, and preparation of a summary report for distribution to the participants. c) Availability of the photometer at the calibration workshop to be held at the International Association of Geomagnetism and Aeronomy meeting, Canberra, 1979 and presentation of a report at the same meeting.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0029, MODIFICATIONS TO SOLID SOURCE MASS SPECTROMETER

V.R. Murthy, University of Minnesota, Minneapolis Campus, School of Earth Sciences, Dept. of Geology & Geophysics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (EAR78-25198)

This provides funds to upgrade the solid source mass spectrometer in the Department of Geology and Geophysics at the University of Minnesota. The upgrading will permit high precision Bb-Sr and Sm-Nd measurements to be carried out to a higher accuracy and precision, on a wide variety of geological samples. The equipment will be used in support of studies on meteorites, lunar samples and terrestrial silicate rocks and minerals.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0030, FORMATION OF ATMOSPHERIC AEROSOLS

K.T. Whitby, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Mechanical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (R803851-03; G603A-AC-007)

Aerosol size distributions have been measured in the St. Louis area as part of EPA's Project MISTT using aircraft and ground-based, self-contained mobile laboratories. The University of Minnesota's portion of the project included aerosol measurements aboard an aircraft and the operation of a mobile van on the ground under the plumes.

The past year was devoted primarily to data analysis, the development of new analysis techniques and reporting results of aerosol data obtained over the past several years in Project MISTT and the Roadway Aerosol Study.

During the coming year the Particle Technology Laboratory of the University of Minnesota will be measuring aerosol size distributions for EPA's Project STATE (Sulfur Transport and Transformation in the Environment) in Tennessee and for EPA's Project SCRUB in Alabama and Minnesota. The STATE Program is directed to describing reactions and atmospheric processes affecting plume behavior over time scales of 12-96 hours and distances out to 1000 km. By contrast the SCRUB program will provide an assessment of the transport and transformation occurring within a power plant plume with an SO2 scrubber out to distances of about 1000 km and travel times mostly less than 12 hours.

Resources will be provided to complete data analysis and report on Project MISTT and to participate in the planning of Project SCRUB and the subsequent data analysis. Other tasks include the measurement of gaseous and aerosol pollutants under and in plumes being characterized in Project STATE and development of an aerosol mobility chromatograph to determine molecular composition of sulfur-containing aerosols.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0031, PROGRAMMED IDENTIFICATION AND MAPPING OF FOREST AND HABITAT CATEGORIES

B.O. Benn, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (51584(1))

OBJECTIVE: The objective of this study is to demonstrate the feasibility of identifying and mapping forest and habitat categories by programmed recognition procedures using digital multispectral scanner data. Emphasis will be placed on Corps data needs relating to runoff and flood damage computations, floodplain information studies, and river basin planning.

APPROACH: The literature and pertinent government agencies will be scanned to determine the success of previous applications of digital image processing to mapping forest and habitat categories. Corps offices will be contacted to establish specific forest and habitat data needs and these needs will be used to define mapping classes of interest. The spectral and spatial properties of the vegetation constituents comprising the various map classes will be examined to establish the best criteria for discrimination of the desired classes using digital image processing techniques. Available digital image processing codes such as those in use at NSTL, EROS Data Center, and major universities will be scanned to select those best meeting the criteria established as best for discrimination of the desired forest and habitat classes. The codes selected will be applied to LANDSAT and thematic mapper type image data for selected test areas. Forest and habitat class maps produced from the image data will be compared to ground truth data to assess the performance of the digital image processing codes for acquiring forest and habitat data for Corps needs. Previous work at the WES on characterizing habitats of sensitive and endangered species, and preparation of habitat and range maps for specific species will be an integral part of the study effort. Test areas will be chosen to take advantage of previously acquired ground truth data. A report will be prepared documenting the study effort and providing guidance for application of mapping techniques that will meet Corps data needs. Initial emphasis will be placed on mapping forest categories with later efforts expanded to include the more complex problem of identifying and classifying habitats. This work addresses Mission Problem Nos. 2-1-54, 2-1-61, and 2-1-42.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

5.0032, SULFUR BUDGET IN POWER PLANT PLUMES - PROCESSING, MANAGEMENT AND ANALYSIS OF PROJECT STATE DATA

N. Gillani, Washington University, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (R805918-01; G603A-AA-015)

OBJECTIVE: This project continues the tasks performed during the first year of the grant, i.e. processing, management and analysis of data collected as part of the August 1978 Tennessee Plume Study (Phase I of Project STATE). Similar responsibilities will be undertaken for the Cold Weather Plume Study (Phase II of Project STATE).

APPROACH: Specific tasks include: (1) Software organization and development. (2) Data base system design and implementation, (3) Data analyses and model development, (4) Preparation for, and participation in, the STATE Cold Weather Plume Study field program, and (5) Production of an Aircraft Data Volume.

PROGRESS: Took part in Tennessee Plume Study, Summer 1979: Participated in Mission control activities, performed on-site data reduction, data validation and data volume production, data management, data analysis and produced a data volume for EMI aircraft, EPA/EPRI Plume Study, 1977.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0033, REMOTE INSTRUMENTAL TECHNIQUES FOR MONITORING ENERGY-RELATED AIR POLLUTANTS

J.A. Eckert, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., *P.O. Box 15027, Las Vegas, Nevada* 89114 (J833C-078)

OBJECTIVE: Assemble, test and report on an operational Raman downward-looking lidar incorporating real-time normalization of the MIE-scattered return using the Raman N2 return. Demonstrate Raman normalized technique in pristine areas in the vicinity of energy resource development and establish historical data base.

APPROACH: One solution to quantifying the airborne lidar returns is to simultaneously measure the Raman return from N2 molecules and the scattered return from particulates. The N2 distribution is known, and thus lidar returns made at different places and times can be compared.

PROGRESS: Lidar system has been constructed for use as test frame in Raman N2 experiments. Software has been written to simulate lidar returns for aid in system decision.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0034, DEVELOPMENT OF ENVIRONMENTAL KEYS

V. Webb, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., Environmental Photographic Interpretation Center, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J883A-038)

OBJECTIVE: Develop aerial photography interpretation keys as analysis aids for novice and experienced photo-interpreters, to examine photography for environmental characteristics, impacts and trends.

APPROACH: Using aerial photography collected for environmental assessment studies in support of EPA program and regional office, prepare guideline reports and photo displays for training and reference material, describing various environmental sites, areas, pollution sources, and environmental impacts.

PROGRESS: Photo interpretation guidelines on harbor pollution sources and detection of leachate from waste disposal sites.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0035, TSUNAMI NETWORK SUPPORT

H.E. Clark, U.S. Dept. of the Interior, Geological Survey, Albuquerque Seismological Laboratory, *Albuquerque, New Mexico* 87106 (9920-01263)

STATES TO WHICH PROJECT PERTAINS: New Mexico, California and Alaska.

The objectives to be sought in the current fiscal year are to operate Tide Systems and the TS-4 Seismic systems over the GOES SMS satellite network. The TT 2 Tide Systems will be operationally evaluated in an actual NWS facility located in La Jolla, California. The Tsunami Seismic Systems will be operationally evaluated in a realistic system configuration at the Albuquerque Seismological Laboratory, Albuquerque, New Mexico. Various parameters in the event detection and validation unit will be tested for optimum event detection for various types of earthquakes as to size and distance from the TS-4 Seismic System. Each microprocessor type TT-2 Tide and TS-4 Seismic System will be operated over the GOES SMS Satellite Network. The major equipment objective is to develop low-cost reliable new instrumentation for use in a proposed Tsunami Warning Network. Evaluation of the operation of ten new TT-2 Tide systems and two TS-4 Seismic Systems installed around the Pacific area will be performed.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0036, NE REGIONAL OXIDANT STUDY - AIRCRAFT MEASUREMENTS

L. Newman, Brookhaven National Lab., *Upton, New York* 11973 (D9-X0737; G603A-AD-036)

OBJECTIVE: The objective of this task is to obtain continuous measurements of O3, SO2, NOx, b-scat, and integrated hydrocarbon canister samples on a regional scale during a five-week field program.

APPROACH: The measurements will be made from an instrumented aircraft provided by the Brookhaven National Laboratory.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0037, OCEANOGRAPHY AT THE CONFLUENCE OF THE FALKLAND AND BRAZIL CURRENTS

A.L. Gordon, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (OCE78-23860)

This project will collect, process, and analyze a relatively dense network of physical oceanographic data to be taken in the vicinity of the abrupt boundary separating the Subtropical and Subantarctic water mass regimes in the western Argentine Basin of the South Atlantic Ocean. This boundary region if known as the Subantarctic Frontal Zone. The field work will be carried out aboard the R/V Atlantis II during a 35-day period in later 1979. The primary objectives of this project are: 1) to determine the thermohaline and chemical characteristics both at the Subantarctic Frontal Zone and within the Falkland and Brazil Current systems on either side of the front in order to identify the water masses encountered, and 2) to determine the continuity of these water masses across the front in order to study the circulation and transport processes in the vicinity of the front. The secondary objective is to determine the structure with depth of an eddy structure associated with the Subantarctic Frontal Zone. To meet these objectives the project plans to obtain hydrographic and nutrient data from stations along three east-west lines from Argentina's outer continental shelf to 45 degrees W. Stations will be spaced at average intervals of 25 nautical miles but will be closer together in the vicinity of the front. Upon completion of the 3 transects a 3-day period will be devoted to obtaining an array of stations within an eddy or strong frontal position of the Subantarctic Front, as located by satellite observations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0038, RUBIDIUM-STRONTIUM AGE STUDY OF PROTEROZOIC SHEAR BELTS IN WEST GREENLAND

N.K. Grant, Miami University, School of Arts & Sciences, Dept. of Geology, *Oxford, Ohio* 45056 (DPP77-23880 A01)

Miami University of Ohio will continue investigation of the radiometric ages of Proterozoic shear belts of West Greenland begun under Grant DPP 77-23880. Field research in 1977 was carried out in cooperation with geologists from Great Britain and Denmark, without NSF support. The 1978 field season was used to collect samples from within and adjacent to shear belts in the Nordre Stromfjord and Evighedsfjord regions. The objectives of this project are Rubidium-Strontium age dating and the determination of the thermal-tectonic histories of four major shear belts and the adjacent crustal blocks. The isotopic studies will be carried out in the geology laboratories of Miami University. The results of the isotopic studies of the samples will yield an age framework for the aerial geological and structural studies of a five-year joint project in the region by scientists from Great Britain and Denmark, sponsored by the Greenland Geological Survey.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0039, USE OF SEASAT-A ALTIMETER DATA FOR THE IMPROVED DETERMINATION OF THE GEOID, GRAVITY ANOMALY FIELD AND SEA SURFACE TOPOGRAPHY

R.H. Rapp, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Geodetic Science, *164 W. 17th Ave., Columbus, Ohio* 43210 (7-929; MO-A01-78-00-4326)

OBJECTIVE: Determination of more reliable values of ocean gravity and ocean geoids than are available from GEOS-3, using SEASAT's better accuracy and coverage.

APPROACH: The general approach will be the same as was used in the processing of GEOS-3 data. The bias removal and orbit error will be examined by fitting to a known long wavelength surface and introducing crossover constraints. This part of our study should improve sea surface determinations to better than the 1-2 m level expected from the initial orbit determination. More detailed error models than used in our GEOS-3 processing will be examined. The outcome from this will be a set of sea surface topography values from which gravity anomaly information can be obtained. In this case there will be a need to use a more precise formulation of this problem and possibly use some of the techniques suggested by Lelgeman although previous success with least square collocation in anomaly processing may indicate that this method should be improved for use with the SEASAT data.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0040, BOUNDARY LAYER MODEL IMPROVEMENT AND VALIDATION

A.K. Blackadar, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (R806048-0152; G603A-AB-019)

OBJECTIVE: 1. Model Surface Exchange Processes; 2. Model Planetary Boundary Layer, Wind, Temperature, Moisture Profiles; 3. Measure Wind, Temperature Profiles, along with other PBL characteristics.

APPROACH: Simplified numerical models will be compared with field data and other existing data sets.

PROGRESS: Models completed and being refined - data being taken.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0041, STUDIES OF THE ENVIRONMENTAL IMPACT OF EVAPORATIVE COOLING TOWER PLUMES

J.M. Norman, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (6815; EY-76-S-02-2463)

The objectives of this research are to characterize the environmental effects of evaporative cooling tower plumes. This involves obtaining a variety of field data around the Keystone-Connemaugh power plant in SW Pennsylvania such as: (a) plant operating conditions as inputs to a plant energy balance model to specify the tower as a source of heat and moisture for plume model validation studies; (b) temperature and droplet concentrations inside towers to relate environmental effects to tower characteristics; (c) aircraft turbulence measurements of temperature, water vapor and vertical velocity inside plumes for tests of plume model predictions and a better understanding of plume behavior; (d) surface-based Doppler Sodar measurements; (e) drift-drop size distribution measurements in plumes; (f) measurements of aerosol size distributions, particle identification and SO2 in merging stack and cooling tower plumes to define the sulfur balance in this region and predict deposition of sulate; and (g) measurement of ambient conditions from the surface to 10,000 feet altitude to provide background information for models. Techniques utilized include: (1) measurements within cooling water; (2) ground-based measurements such as with the Sodar equipment; and (3) use of instrumented aircraft for plume measurements of temperature, velocities, drift particle size, and SO2 concentration.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0042, MEASUREMENT OF IMPORTANT MINOR CONSTITUENTS IN THE MIDDLE ATMOSPHERE 13877-GSX

J.J. Olivero, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (DA0E9107; DAAG29-78-G-0083)

To investigate the concentration of trace constituents in the middle atmosphere (30-110 kilometers). The work will include, but not be limited to - (1) investigation of feasibility of sensing water vapor in the middle atmosphere; (2) improvement in current models of micro-particle concentration profiles in the D-

region; and (3) recommendation of techniques for direct measurement of micro-particles to establish their existence in the D-region. Better understanding of stratospheric and mesospheric processes is necessary for more accurate prediction of the effects of a perturbed atmosphere on transmission of electromagnetic signals utilized in Army systems.

(1) A comprehensive overview of current aeronomic models will be completed, including compilation of the important and potentially important minor constituents in the middle atmosphere. Recommendation of measurement methods will be made. (2) A simple structural model of the normal D-region, specifying charged particle composition will be formulated including estimations of micro-particle concentrations which are fundamental to ion charges and mobilities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0043, OCEAN CLIMATOLOGY AND MONITORING

M.C. Ingham, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Marine Fisheries Service, Northeast Fisheries Center, *Narragansett, Rhode Island* 02882 (NEC-084)

This task conducts studies of marine environmental conditions in the western North Atlantic and Gulf of Mexico, principally in coastal areas, utilizing climatological data bases and recent monitoring data, some of which are collected by task members. The understanding of environmental variation gained through these efforts is applied to studies of the effects of this variation on the distribution and abundance of living marine resources. Current year objectives include the following: 1) completion of a temperature climatology for EH Middle Atlantic Bight; 2) continued expansion of the ship of opportunity program for monitoring subsurface conditions; 3) continued surveillance of satellite data for determining the trajectories of warm core eddies passing through the slope water mass along the outer continental shelf; 4) continued accumulation and analysis of climatological data for Georges Bank and the Middle Atlantic Bight; 5) description and analysis of unusual shelf water conditions during the spring and summer of FY 1978; 6) surveillance and analysis of the shelf water for repetition in FY 1979; 7) completion of analysis of deep water replenishment in the Gulf of Mexico; 8) completion of study of relationship between environmental conditions and distribution of Menhaden Larvae in Onslow Bay, NC; 9) beginning of study of bottom water oxygen cycle during years following 1976 anoxic conditions in the New York Bight; 10) development and initiation of new cooperative studies with the SEFC; 11) develop and pursue cooperative fishery climatology studies with EDIS/CIAD and the NEFC; 12) continue efforts to describe seasonal variations in the cold cell on the middle Atlantic bight shelf; 13) continue support of the cooperative study of Blue crab climatology with VIMS and NEFC; 14) complete the development and initiate operational use of the undulating oceanographic recorder; 15) begin analyses and produce first reports on long-term variations in plankton and environmental features off Chesapeake Bay and in the Gulf of Maine and Eastward, from CPR samples; 16) completion of MARMAP OTP descriptive summaries; and 17) complete routine interfaces from MIS data base to statistical and graphical software libraries and from other data bases to the MIS data base.

SUPPORTED BY U.S. Dept. of Commerce, National Marine Fisheries Service, Northeast Fisheries Center

5.0044, DYNAMICS OF GULF STREAM MEANDERS

R.D. Watts, University of Rhode Island, Graduate School of Oceanography, *Administration Bldg., Kingston, Rhode Island* 02881 (OCE78-09655 A02)

This project will study the dynamics of the Gulf Stream as the Stream leaves the continental margin at Cape Hatteras and flows into deep water. In this region meanders develop and grow in an envelope increasing downstream. At present, both theoretical and observational inconsistencies exist regarding the structure and development of Gulf Stream meanders. This project involves specific tests to resolve these conflicts including analysis of a large set of existing temperature data, utilization of data produced concurrently from existing program (e.g., satellite infrared imagery), and collection of new data from an array of deep current meters and inverted echo sounders, instruments which are particularly well-suited for monitoring the position of the Gulf Stream.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0045, MODEL DEVELOPMENT FOR PREDICTING SOIL MOISTURE BY THERMOGRAPHY

J.A. Tunheim, South Dakota State University, School of Engineering, Dept. of Physics, *Brookings, South Dakota* 57006 (A-063-SDAK)

The proposed research involves theoretical and experimental investigations relating to the measurement of near-surface soil moisture by the use of remotely sensed thermal emittance. The general approach is to modify and use a heat flow model to calculate soil moisture differences from surface temperature deviations caused by the change in soil thermal properties with moisture content.

Field investigations will include the measurement of soil temperature profiles during the diurnal cycle together with soil moisture and thermal emittance. These measurements will be made on irrigated plots with several types of crop cover to delineate the role of the crop canopy in altering temperature patterns during nighttime hours. The temperature and soil moisture data will then be used to calculate parameters in the model needed to predict thermal emittance. Application of the model developed in this project will then be made to the interpretation of thermal data from earth resources satellites. Recommendations will be made pertaining to the use of thermal emittance data in irrigation scheduling.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0046, TARGETING MINERAL EXPLORATION EFFORT

J.V. Taranik, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Data Center, *Sioux Falls, South Dakota* 57198 (E-0018)

To demonstrate the usefulness of remote sensing data, geophysical data and data analysis techniques for targeting exploration effort, development of exploration plans, and rating the development of known mineral deposits in the light of environmental factors. Test sites have been selected in different geographic settings where petroleum and mineral deposits have been defined by ground exploration effort. Existing remotely sensed data and geophysical data will be evaluated in different scales, accuracies, and formats using different data analysis techniques. Characteristics of the data and principles of data analysis will be identified in the light of exploration information requirements. Conceptual geologic exploration models will be developed that will enable known deposits to be targeted from remote sensor and geophysical information. Areas where mineral deposits are suspected will then be targeted for ground-based exploration using the developed techniques. Success of the targeting procedures will be demonstrated through on-the-ground investigations. Training courses in the application of developed techniques will be conducted for government and industry personnel.

SUPPORTED BY U.S. Dept. of the Interior, Land Information & Analysis Office, EROS Data Center

5.0047, SEASAT PROGRAM - SOIL MOISTURE/SCATTEROMETER/SAR CORRELATION

B.J. Blanchard, Texas A & M University, College Station Campus, Texas Engineering Experiment Station, Remote Sensing Center, *College Station, Texas* 77843 (K7-975; MO-AO1-78-00-4332)

OBJECTIVE: To determine the range of the scattering coefficients (sigma o) received from SAR for all field conditions

from dry to saturated and compare SAR AND 1.6 GHz scatterometer sigma o values over the same field conditions. The results are expected to aid in the evaluation of the SEASAT-SAR's sensitivity to differences in soil moisture.

APPROACH: In order to establish the influence of soil moisture on data collected by the SEASAT SAR, three major categories of data will be obtained: ground samples, aircraft 1.6 GHz scatterometer sigma o values, and digitized SAR imagery. Data analysis will be directed toward the following major considerations: 1. Is the influence of soil moisture differences a major factor in the interpretation of the SEASAT SAR imagery? 2. How well does the SAR data correlate to measured soil moisture differences? 3. How well does the SAR data correlate to scatterometer data?

CURRENT PLANS AND/OR PROGRESS: Complete negotiations and execute a contract by September 30, 1978.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0048, COMMERCIAL AIRCRAFT DATA COLLECTION FOR MONEX

E.G. Astling, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (ATM7819895)

The objective of this project is to collect, digitize and archive flight level commercial aircraft wind and temperature observations over the south and southeast Asian Monsoon Experiment (MONEX) region. MONEX is a regional subprogram of the Global Atmospheric Research Program (GARP) which will occur at the same time as the First GARP Global Experiment (FGGE) also known as the Global Weather Experiment. The observations will be collected during two (summer and winter) intensive Special Observing Periods (SOP's) of one month each.

The data will be made available to MONEX scientists who will use them to supplement the other conventional and special observations collected during MONEX. They will also be used primarily for global numerical weather simulation and prediction work.

Aircraft crews will be asked to take the observations at 250 km. intervals along the flight tracks whenever the aircraft are above 6 km. The observations will consist of wind direction and speed and air temperature with time, altitude and location data. About 100 aircraft are equipped with automated data processing systems. These data will be added to the observations collected by crews on other aircraft to enhance the total data set.

MONEX is an experiment to increase understanding of the dynamics and thermodynamics of the atmosphere and ocean in the monsoon region of the world where the local monsoon wind and precipitation regimes are the most energetic on the globe. The Global Weather Experiment is designed to test and improve computerized global weather prediction models.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0049, LIGHT SCATTERING AND RADIATIVE TRANSFER BY ICE CLOUDS

K. Liou, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meterology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (ATM7826259)

This project is a program of experimental and theoretical research on light scattering by nonspherical ice crystals. It includes the experimental determination of the single-scattering parameters and phase matrix for artificial ice crystals with various shapes and sizes for wavelengths in the solar and infrared spectral regions through controlled laboratory experiments.

The research also involves the theoretical evaluation of the single-scattering and polarization parameters for hexagonal crystals by means of the geometrical ray tracing and the numerical method for symmetrical particles.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0050, PLANETARY MINERALOGY

P. Toulmin, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9710-00954)

The project is concerned with mineralogical studies of extraterrestrial planetary bodies by theoretical and remote analytical methods. Principal emphasis is on the analysis of Martian surface materials by means of two instruments on the Viking Mars Landers: an X-ray fluorescence spectrometer for elemental analysis of surface samples, and a gas chromatograph-mass spectrometer; the latter, in addition to its primary applications to the organic analysis of the Martian 'soil' and the analysis (by MS alone) of the Martian surface atmosphere, has provided useful data on volatile inorganic constitutents of the Martian surface. Laboratory simulations will be an important activity in FY 79. Active operation of the X-ray fluorescence spectrometers on Mars continues but is scheduled to end in January.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0051, URBAN POLLUTION CHARACTERISTICS, TRANSPORT AND DEPOSITION

J.A. Young, U.S. Dept. of Energy, Battelle Pacific Northwest Lab., *P.O. Box 999, Richland, Washington* 99352 (000540; EY-76-C-06-1830)

This project is designed to determine the nature and quantities of various energy-related pollutants which are emitted to the atmosphere, to determine the rates of transport and diffusion and deposition on the earth's surface, and the chemical and physical transformations during transport. The data obtained are used to develop parametrizations of the various processes for incorporation into numerical models which will then be tested and validated. Inert tracers are introduced into urban plumes or advantage is taken of the presence of inert atmospheric tracers (CO or fluorocarbons). Concentrations of these tracers and urban pollutants, like SO2, particulates, NOx, are then measured at various downwind distances using aircraft or ground-level vehicles. Data for various times and distances permit elucidation of the processes which are operative.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0052, FIELD ADVISORY PROGRAM DEVELOPMENT

R.E. Harris, University of Washington, Div. of Marine Resources, *Seattle, Washington* 98105 (A/FP-1)

OBJECTIVES: Provide for field advisory program development and interaction with other programs. 1. Start a new marine field agent and local advisory service on the Upper Olympic Peninsula, or at Fishermen's Terminal. Deciding which one involves additional discussion with industry and other leaders, experience with a satellite office at Fishermen's Terminal shared by existing field professionals, and the prospects for matching funds. TARGET DATE: 10/1/78. 2. Restructure the new Columbia River Marine field specialist from joint Washington/Oregon Sea Grant support to the emerging Columbia River Sea Grant program. The approach involves operation in a four-university consortium framework, with administration subcontracted to the WSU Cooperative Extension Service. TAAGET DATE: 2/1/78. 3. Continue to share talent with other Pacific Sea Grant programs.

ANTICIPATED BENEFITS: 1. Marine resource users in the Strait of Juan de Fuca and Puget Sound are going through radical change in their historical use patterns, brought on by too few fish to satisfy important competing needs, adjusting to the Boldt decision, and the still unknown impacts of the 200-mile limit--plus the increased risk of at least a four-fold increase in oil transported through northern Washington waters. With better information through marine extension educational programs, the users should be able to make better decisions in adjusting to these changes. 2. Columbia River resource users are also going through radical changes in their patterns, for reasons comparable to the above with the additional complication of too little stream flow to meet increasing needs for the river's waters. In this case the new marine specialist needs and will have the cooperation of major organizations already working various problems of the Columbia River, and access to the Cooperative Ex-

tension delivery systems and/or expertise of the Universities of Washington and Idaho, and Washington State and Oregon State Universities. To establish this, Bob Harris and Ken Hilderbrand visited, in addition to the universities, the following: Pacific Northwest Regional Commission; Pacific Northwest River Basins' Commission; Army Corps of Engineers; NMFS Columbia River Fisheries Development Program; Washington Water Research Center; NMFS Northwest and Alaska Fisheries Center.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0053, COMMUNICATIONS - DETERMINING THE EARTH'S MAGNETOSPHERIC STATE FROM COSMIC RAY ANISOTROPIES

J.T. Ely, University of Washington, School of Arts & Sciences, Dept. of Geophysics, *Seattle, Washington* 98105 (DN775381; N00014-77-C-0392)

Geomagnetic storms degrade or disrupt naval communications, navigation, and surveillance systems. There is indirect evidence that connection of a southward interplanetary magnetic field to the geomagnetic field may trigger magnetic storms either through increased entry of solar wind particle flux, through stimulated field line reconnection, or some combination. This experiment will measure the change in geomagnetic configuration due to connection by detecting anisotropies in the galactic cosmic ray flux. If successful, short-term forecasts of geomagnetic activity could be possible. Periods of geomagnetic activity are associated with spacecraft charging events that have caused permanent or temporary spacecraft damage, possibly due to increased solar wind entry.

Data from the ONR-305 experiment on the S3-4 satellite will be analyzed and correlated with the interplanetary magnetic field, geomagnetic indices, and spacecraft charging events.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0054, RURAL OXIDANT STUDIES AND THE ROLE OF NOX IN RURAL OXIDATION FORMATION

H. Westberg, Washington State University, School of Engineering, Dept. of Chemical Engineering, *Pullman, Washington* 99163 (R805343; G603A-AH-017)

OBJECTIVE: Ambient air measurements made for the detailed hydrocarbons, oxides of nitrogen, ozone, halocarbons and other pollutants by an aircraft and ground-level sampling program at several locations throughout the United States. The purpose of these studies is to investigate the transport and the transformation processes of pollutants in urban and rural areas.

APPROACH: Sophisticated state-of-the-art instrumentation is utilized in these studies for pollutant measurement. Both ground-level and aircraft sampling programs are utilized to investigate the transport of pollutants from an urban area to downwind rural or other urban areas.

PROGRESS: Several reports are available from past field study efforts by Washington State University. These reports in general identify the relationship between upwind urban transport to downwind high rural ozone levels. High rural ozone is associated with higher concentrations of transported O3 precursor compounds from anthropogenic sources.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0055, EXPERIMENTS IN SMALL-SCALE SURFACE MODIFICATION

C.R. Stearns, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (ATM78-08437)

This project will conduct small-scale (2000 sq. m less) airmass modification experiments. The purpose is to obtain surface aerodynamic and insolation properties related to the surface structure (for example, surface roughness, albedo, and heat transfer coefficient) so that, given relatively simple meteorological measurements or assumptions, models can be constructed to interrelate the wind stress on and the sensible heat flux from the surface. The gust frequency distribution will be determined as a function of surface roughness. The horizontal pressure gradient around the obstacle field will be measured.

The field experiments will be conducted on the ice of Lake Mendota, Wisconsin, in two major categories: (a) momentum transfer studies using roughness modification by arrays of diverse types of obstacles (baskets, barrels, or small conifer trees) of various sizes and in a variety of patterns, (b) combined heat transfer and momentum transfer experiments using albedo differences (for example, black versus white baskets) in the presence of sufficiently strong insolation.

In addition, previously collected turbulence data will be analyzed about a change in surface roughness.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0056, SURFACE TEMPERATURES AND TYPES, DISTRIBUTION AND MOVEMENT OF SEA ICE IN THE NORTH WATER AREA, 1973-1979

F. Muller, Eidgenossische Technische Hochule Zurich, *Leonhardstrasse 33, Zurich, Switzerland* (DPP78-26132)

This investigation of the large area of open water in northern Baffin Bay (the so-called 'North Water') consists of three coordinated phases: (1) a field phase of airborne remote sensing, (2) an analysis of satellite imagery, and (3) an assessment of the energy fluxes and sea ice dynamics of the area.

The objectives are to obtain the temporal variation of the radiation and heat balance at the air/sea/ice interface; the positions of open leads, refreezing zones, areas of open and consolidated pack ice, and pressure ridges; and to establish ground truth information for infrared satellite sensing of surface energy fluxes.

The project as submitted to NSF does not include field work support. The project is limited to the above phases (2) and (3) and can produce significant results in the event that the 1978-79 field program is not completely successful.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, AVIATION MEDICINE RESEARCH FOR AIRCREW SELECTION, RETENTION AND PHYSICAL PERFORMANCE STANDARDS

F.S. Pettyjohn, U.S. Dept. of Defense, Army, Medical Research & Development Command, Aviation Medicine Research Div., *Fort Rucker, Ozark, Alabama* 36360 (DA0B6895)

To provide the US Army information concerning the medical requirements for Army aircrew selection, retention, and physical performance.

To apply accepted medical research methodology and technology to accomplish the objective.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, DEVELOPMENT AND EVALUATION OF SIMPLIFIED INSTRUCTION FOR THE ACQUISITION OF NORMAL LANDING AND WEAPONS DELIVERY SKILLS

B. Jones, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF222030)

1. To compare the aim-point vs. visual impact point approach to final approach glidepath maintenance instruction. 2. To evaluate the segmented vs. whole task approach to teaching the 360 degree overhead pattern for: a. the landing task, and b. the 30 degree dive bomb task.

Two separate studies will be conducted on the ASPT using available personnel as subjects. Study I will compare aim-point

vs. impact point techniques of instruction on final approach glidepath control. Study II will compare two versions of task segmentation (forward and backward) i.e., chaining, with the whole task approach to the normal overhead pattern for two tasks. One task will be the 360 degree overhead landing pattern, the other, the 30 degree dive bomb delivery task.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, ASPT AIR-TO-AIR COMBAT SIMULATION SOFTWARE DEVELOPMENT

E.G. Monroe, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223870)

To increase the training capability of the advanced simulator for pilot training in the area of air-to-air combat. To accomplish this, the visual system will be improved to simulate the visual effect of cannon and rocket fire and the effects of sunglint and glare.

The existing ASPT software will be modified to generate a simplified additional moving model. The present system of software will be utilized to simulate cannon and rocket fire from the viewpoint aircraft. Program scoring algorithms for scoring pilot performance will be developed for display on a vector general. Finally, hardware and software modifications to the ASPT system will be developed to simulate the visual effect of sun-glint off a lead aircraft and glare on the viewpoint windshield.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, INSTRUCTIONAL SYSTEMS DEVELOPMENT AND EVALUATION OF SITUATIONAL EMERGENCY TRAINING

A. Freedy, Perceptronics Inc., *6271 Variel Ave., Woodland Hills, California* 91364 (DF052200; F49620-78-C-0067)

AF function - this research develops information necessary to assess a new approach to training pilot responses to critical aircraft emergencies. Deficiency - traditional approaches to training emergency responses center around the memorization of boldface (critical) steps which have been identified as critical to the safety of flight. Unfortunately, these steps do not always apply to every emergency condition, requiring the use of pilot judgment. However, since the pilot has not been specifically trained to consider alternative steps in the presence of such extenuating circumstances, he is less likely to respond with an effective set of actions. These circumstances, defined as the 'situation', should somehow modify the pilot's response when necessary. Objective - this investigation will examine the effectiveness of situational emergency training as an alternative to traditional emergency procedures training, and will study ways to expand a situational approach to meet operational needs. How research contributes - the efficiency and effectiveness of situational approaches to training emergencies will be determined with possible recommendations for AF-wide implementation of portions of these approaches to specific training problems.

An instructional systems development approach will be used to apply situational training concepts to an operational USAF aircraft training program. A squadron/aircraft current training program will be studied and a systems analysis of the information flow of emergency procedures data within the target squadron will be accomplished to determine the baseline workload required to sustain the training. A situational program will be created for the aircraft and will replace the existing program. Comparisons in pilot performance under each type of training will be used to assess the value of the situational concept to training emergency responses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0005, AIRCRAFT MAINTENANCE EFFECTIVENESS SIMULATION (AMES) MODEL

H. Kolkowitz, XYZYX Information Corp., *Canoga Park, California* 91303 (DN894036; N61339-77-D-0028)

To develop a training management/planning tool which will systematically examine the constituent training and human performance variables in aircraft maintenance to predict their effect on maintenance efficiency and cost and aircraft availability.

Design and develop the computer program and data analysis techniques. Test and debug the model through simulation of F-14 and SH-2F aircraft maintenance systems using actual 3M data as input. Develop a model use plan for subsequent efforts.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0006, NAVY ENVIRONMENT - DYNAMIC RESPONSE OF HUMAN HEAD AND NECK TO IMPACT ACCELERATION

R. Thorpe, Q E I Inc., *119 the Great Rd., Bedford, Massachusetts* 01730 (DN875201; N00014-78-C-0121)

The design of safety devices for pilots of fixed wing and rotary wing aircraft is dependent on our understanding of the response of the human body to extreme acceleration and impact forces. This research will assist in establishing this dynamic response of the human body to acceleration and impact forces.

The principal investigator will reduce and analyze the large amount of data on 3-D head-neck and torso response to impact acceleration that is being collected at the Naval Aerospace Medical Research Laboratory, detachment, New Orleans. Inertial sensor data, physiological data and sled data will be digitized and normalized to standard conditions and analysis performed on this data for application in dynamic response models. The principal investigator will also participate in experimental protocol planning and formation to provide analytical rationale for experimental procedures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, LSO LABORATORY SOFTWARE

J.T. Hooks, Logicon Inc., *P.O. Box 10179, San Diego, California* 92110 (DN994007; N61339-78-C-0151)

The implementation of a laboratory landing signal officer training system, and generation of data refining prototype LSO training system specification.

Software for speech generation and understanding, visual system hardware, and automated training programs will be implemented and functional requirements supporting the performance specifications of a prototpe LSO trainer will be refined through empirical exercise of the laboratory system.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

7.0002, HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS AND SCATTERING THEORY

J.V. Ralston, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Mathematics, *405 Hilgard Ave., Los Angeles, California* 90024 (MCS7902735)

The investigators will continue the work initiated in MCS-7610227. Their program deals with several topics in partial differential equations. These include: high frequency sound scattering, the asymptotic approximation and numerical computation of waves in elastic solids, the numerical computation of shock waves in gas dynamics, the existence theory for shock waves, the modelling of combustion processes, and the design of software for the numerical solution of boundary value problems.

Renewal of MCS-7610227 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0003, MOTION DRIVE SIGNALS FOR FLIGHT SIMULATORS - SOFTWARE SERVICES

R.M. Johnson, Appli Mation Inc., *1000 Woodcock Rd., Orlando, Florida* 32803 (DN794043; N61339-77-C-0155)

Provide software services for project 7744, motion drive signals for flight simulators. Support includes programming, documenting of various cockpit motion modules, engineering test modules, graphic plotting program and conversion of Meta symbol basic in-flight maneuver program to FORTRAN.

Modularize program requirements for uniform input/output and machine independence if possible. Code and evaluate various cockpit motion algorithms using standard engineering inputs.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Experimental Computer Simulation Lab.

7.0004, COMPUTER PROGRAMS FOR FLIGHT VEHICLE SYNTHESIS

H.H. Hilton, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

An overall systems concept utilizing an integrated approach incorporating basic aerodynamic, guidance, control, propulsion, and structural principles is being used to develop comprehensive, generalized simulation computer programs for flight vehicle synthesis. The purpose is to develop an educational tool to be used in the teaching of flight vehicle synthesis and optimization. Current capabilities include space vehicle flight programs, airplane missions, various structural programs to determine minimum weight and optimum construction, and printed and teletype graphical output on Calcomp.

Accuracy requirements for computerized synthesis were developed and an examination of estimation errors for two actual airplanes was undertaken by performing computational designs on two existing general aviation computer programs.

In addition, an error analysis was formulated for the determination of aircraft weight estimation accuracy sensitivity to possible errors in aerodynamic, weight and mission performance computerized synthesis analyses. Necessary computational time and implied design costs are also examined in relation to design accuracy in terms of computational iterative tolerances and the number of iterations necessary for achieving prescribed accuracies. A two-step approach was devised with initial large and subsequent fine tolerances, which assures the desired accuracy with substantial decreases in computational time and associated cost.

SUPPORTED BY University of Illinois

7.0005, CHEMICAL-THERMAL TIME-DEPENDENT BEHAVIOR OF INTERSTELLAR CLOUDS

M. Oppenheimer, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (112739-31A)

Develop a computer program capable of solving several complex time-dependent differential equations for the densities of chemical species and the rates of heating and cooling. Results to be presented to the Astrophysical community.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

7.0006, MARITIME PATROL AIRSHIP STUDY

J.W. Lancaster, Lancaster Analytics, *Canton, Ohio* (DN981128; N62269-78-M-4426)

Provide techical support to Navy LTA computer sizing and performance programs. In support of work unit No. DH814.

Troubleshoot and rectify computer program irregularities.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THERMODYNAMIC AND ELECTRONIC PROPERTIES OF VACANCIES IN HIGH QUALITY CRYSTALS

R.M. Emrick, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DMR78-25013)

The fundamental properties of lattice vacancies, which play an important role in the interaction and migration of the metal atoms in crystals, will be studied in high purity gold, palladium and platinum by de Haas-van Alphen techniques. Recent calculations show that a great improvement can be made in the quenching technique used in previous experiments on high purity gold. Considerable information will be gained about the vacancy propeties from new quenching studies, and about the electron scattering properties from de Haas-van Alphen measurements. The extension of the combination of these techniques to platinum and palladium will provide much valuable information about these materials from both the technological and basic scientific point of view.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, PLASMA LINE EXPERIMENTS WITH THE CHATANIKA INCOHERENT SCATTER RADAR

V.B. Wickwar, S R I International, Radio Physics Laboratory, *300 Ravenswood Ave., Menlo Park, California* 94025 (ATM78-00129 A01)

This grant funds an extensive series of plasma line experiments with the Chatanika radar. These experiments will extend the successful 'groundbreaking' observations made in January 1976, with emphasis on the auroral E region. However, if conditions permit, observations will also be made in the F region. Furthermore, in addition to measuring the plasma line spectra, the electron density and the electron and ion temperatures will also be measured. Whenever possible, optical measurements (all sky camera, low light-level TV and spectrophotometer) of the auroral emissions will be used. These plasma line experiments provide a ground-based method for examining the low energy suprathermal electron distribution produced by the energetic auroral primaries. They also serve as a way of examining the interaction of these low energy electrons with neutrals. Furthermore, this is done in the energy region 1/2 to 3 eV, -- an exceedingly difficult area to study by any other technique, and consequently, a region that has had minimal exploration. The experiments will be done in collaboration with French Incoherent Scatter Group, who will supply a physicist, an engineer, and a high-speed autocorrelator. For the interpretation of the observations, the collaborative effort with the French as well as the ongoing collaborative efforts with groups modeling the interactions of low-energy electrons, will continue.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0003, THEORETICAL RESEARCH ON LINERS

N. Rostoker, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (DN980182; N00014-75-C-0310)

To perform theoretical studies upon the dynamics of collapsing metallic liners including the rotation of the inside boundary. In addition, theoretical studies aimed at understanding the interaction between contained plasmas and liner surfaces will be studied. The overall objective is to contribute to studies of the feasibility of plasma heating via liner compression.

This program will utilize primarily analytical techniques to study the stability of liner surfaces. Theroetical studies will be undertaken of the reversed-field plasma comfiguration. The program will study specific electron beam configurations where b0

is absent and address the general problem of force-free configurations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0004, AN EXPERIMENTAL STUDY OF SPIN GLASSES AND DYNAMICS OF SUPERCONDUCTORS

R.L. Orbach, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR78-27129)

This research is a continuation and extension of work supported under Grant No. DMR-7682347 and constitutes the experimental part of a comprehensive investigation of the dynamics of magnetic spin glasses and fluctuation effects in superconductors. The spin glass study will concentrate on thin films of noble metal elements doped with manganese (Mn) as the magnetic impurity. The ac magnetic susceptibility of these films will be measured as a function of frequency. These films will also be incorporated into proximity effect sandwiches and the current-voltage characteristics of such structures will be determined. Such data allow one to draw definitive conclusions about the nature of the phase transitions in spin glass systems. Tunneling data for sandwiches with different thicknesses of the spin glass film lead to an absolute measurement of the pair breaking caused by the Mn spins. The spatial and temporal variations of the superconducting order parameter in granular aluminum or aluminum-germanium films doped with erbium as the spin label will be investigated via magnetic resonance and tunneling studies utilizing proximity effect sandwiches. The frequency dependence of the resistance of superconducting-normal-superconducting sandwiches will be used to study nonequilibrium superconductively with particular emphasis on branch relaxation rates. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, EXPERIMENTAL STUDY OF ANOMALOUS TRANSPORT IN THE LINEAR-CHAIN TRANSITION-METAL-TRICHALCOGENIDES

N.P. Ong, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR79-05418)

There is growing evidence that transport processes (such as electrical conductivity) in lower dimensional systems involve a new mechanism which is different from that known for conventional metals. This mechanism is related to the occurrence of charge density waves (CDW) in these systems. The MX3 compounds - where M is tantalum (Ta) or niobium (Nb) and X is selenium (Se) or sulfur (S) - form linear chains. A variety of instabilities occur in these systems (namely commensurate and incommensurate charge density wave states, and superconductivity). In addition, niobium triselenide (NbSe3) shows strikingly anomalous transport behavior in the charge density wave phase which cannot be explained by single-particle models. Recently, results from the study of effects of dilute impurities in NbSe3 have provided the strongest evidence to date for the Frohlich (sliding mode) conductivity in a metal. It now appears that NbSe3 and its alloys constitute an ideal system in which-current carrying collective modes (associated with the CDW condensate) can be studied conveniently. The work of the present project includes: 1. Further experiments designed to probe the properties of the nonlinear excitations and microwave absorption mode in NbSe3 (high-current galvanomagnetic behavior, ohmic breakdown under hydrostatic pressure, frequency dependence above 10 GHz, current response to nanosecond pulses). 2. A search using microwave measurements of collective modes in the layered compounds.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0006, ELECTRON CAPTURE BY MOLECULAR IONS IN SINGLE COLLISIONS AT KEV ENERGIES

A. Russek, University of Connecticut, Storrs Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Storrs, Connecticut* 06268 (INT79-05142)

Dr. Arnold Russek of the University of Connecticut is collaborating with Dr. Ignacio Alvarez-Torres, Dr. Carmen Cisneros-Gudino, and other members of the Physics Institute of the University of Mexico. Their research involves a joint theoretical and experimental study of interactions in collisions between molecular ions and atoms which lead to dissociation. The study will focus on energy loss, electron exchange process and angular distributions of dissociation fragments resulting from collisions in the energy range between 250 electron-volts and 700 electron-volts for a variety of collision systems. These systems are of interest in the development of controlled thermonuclear reactors. The study will provide fundamental knowledge of atomic structure for research in chemistry and physics.

Dr. Russek was previously funded by NSF under grant INT76-05772.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0007, A STUDY OF THE HISTORY OF IONOSPHERIC PHYSICS

C.S. Gillmor, Wesleyan University, Graduate School, Dept. of History, *Middletown, Connecticut* 06457 (SOC7602562A02)

Dr. Gillmor is continuing research on the social and intellectual history of ionospheric physics from early developments in the late nineteenth century to the present time. In his research, he has created a large data file concerning ionospheric physics and those working in this field during the last half century. The data will include author, title, and journal information on several thousand ionospheric physics articles published in the period 1920-1960. Further publication and citation data have been prepared for over 2000 ionospheric physics authors for the years 1961, 1971, and for a related sample of individuals for the period 1967-1973. In addition, very extensive mail-survey data have been analyzed (470 persons in 33 countries), along with information gathered during visits to about two dozen laboratories and in approximately 100 oral interviews conducted in Asia, Europe and North America. During the course of this grant, he is undertaking further interviews, archival research and computer analyses on the history of ionospheric physics. Articles and a monograph will result from this research.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Social & Economic Science

8.0008, COSMIC RAY CASCADES - IMPLICATIONS FOR PARTICLE PHYSICS AND ASTROPHYSICS ABOVE 10 TO THE 15TH POWER EV

T.K. Gaisser, University of Delaware, Graduate School, *Newark, Delaware* 19711 (INT78-17132)

The objective of this U.S.-Bulgarian cooperative project is to develop and apply computer simulation programs to study the collisions of high energy cosmic rays and particle interactions above 10 to the 15th power eV. This knowledge is needed for a better understanding of such phenomena as the collapse of stars which lead to 'black holes'.

Primary cosmic rays (high energy radiation comprised of electrons and the nuclei of atoms) impinge upon the earth from all directions of outer space with nearly the speed of light. These particles can be studied by observing the showers of secondary cosmic rays produced when the primary rays collide with atomic nuclei in the atmosphere. The high number of electrons resulting from this collision generate extensive air showers of lighter particles that cascade down through the atmosphere to the earth. These showers can be investigated by studying the particles which survive to strike ground level and by observing the flashes of scintillated light that the particles produce in the upper atmosphere.

In this project the U.S. group will perform experimental and theoretical investigations of these showers, while the Bul-

garian group (Dr. Todor Stanev, Institute of Nuclear Research, Sofia) will work on computer simulations of the cascade. Detailed Monte Carlo cascade calculations will be developed to investigate three problems in the interpretation of cosmic ray showers: multiple cores and large transverse momenta; delayed particles in showers; and Cerenkov radiation as a background for scintillation light in large air showers. A basic goal of the study is to determine what the primary cosmic rays are: mostly nuclei of hydrogen, of iron, or other heavy elements.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0009, EXTREME ULTRAVIOLET ENVIRONMENT

C.S. Weller, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN120101)

The exploration, description, analysis, and understanding of the ultraviolet (uv) environment of the earth and space are quite important since, from a fundamental standpoint, the strong optical effects of atoms and molecules occur in this part of the spectrum. This has in the past and will continue in the future to give new insight and opportunities for investigating solar-terrestrial relationships, establishing the behavior of the upper atmosphere and plasmasphere and their interactions, the interstellar medium and its interaction with the solar system, and developing uv space surveillance.

Observational data acquired from NRL Instruments on space vehicles such as the STP 72-1, OSO-8, and SOLRAD 11 satellites are analyzed and interpreted. New instrument probes are being developed with emphasis on spectral resolution in the extreme uv and imaging in the far uv.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0010, QUANTUM THEORY OF SOLIDS AND MOLECULES

J.R. Sabin, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (DMR79-09721)

This is a continuation of research previously supported by NSF Grant No. DMR7684577.

This work comprises the extension of previous studies of local exchange models applied to solids and molecules. One aim of this work is to extend those schemes to slabs and clusters in order to understand the chemisorption of small molecules on metal surfaces. A second aim is to modify the present Augmented Plane Wave (APW) code for three-dimensional crystals to take advantage of the flexibility of the Linear Combination of Atomic Orbitals (LCAO) method for other-than-energy quantities. A computer code is under development to convert from a converged APW potential (which can be generated rapidly to an analytic potential, followed by, at most, a few LCAO (Gaussian basis) iterations. An important aspect is the uniform application of a flexible method (LCAO, Gaussian, local exchange) to perfect three-dimensional crystals, slabs, and clusters.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, DEVELOPMENT OF AN INSTRUCTIONAL PROGRAM IN APPLIED OPTICS

L.W. Davis, University of Idaho, School of Letters & Science, Dept. of Physics, *Moscow, Idaho* 83843 (SER78-00969)

The goal of the project is to upgrade the Physics Department's instructional effort by developing a program of undergraduate study in the field of applied optics. Project activities will consist of identifying topics which should be emphasized (for example, theory and applications of electro-optic devices) in the course offerings. This will be accomplished by contacting a number of private and federal laboratories that either manufacture or use modern optical components or systems. We also will obtain curriculum improvement suggestions from the Optical Society of America, and talk to faculty at other schools who have experience in this matter. Actual improvement of subject matter dealt with in the existing classical optics course will then be tackled. A suggested plan of study for students wishing to concentrate in applied optics will be worked out. Quality research equipment on hand will be exploited for 'hands on' instructional use. We anticipate that a significant fraction of physics majors will be interested in the applied optics option, as there definitely is a need for graduates exposed to a full curriculum in optics, lasers, associated electronics, etc.

SUPPORTED BY U.S. National Science Foundation, Directorate for Science Education, Div. of Science Education Resources Improvement

8.0012, THEORY OF ELECTRON CORRELATIONS AT METALLIC DENSITIES AND ITS APPLICATIONS

K.S. Singwi, Northwestern University, Evanston Campus, Graduate School, Dept. of Physics, *633 Clark St., Evanston, Illinois* 60201 (DMR77-09937 A02)

This is a continuation of research previously supported by NSF grant DMR 7619863.

Theoretical investigations of the many-body problem of electron correlations and the dynamical behavior of electrons at metallic densities will be continued. The self-consistent theory which was developed previously will be extended and applied to a number of condensed matter systems including the electron-hole condensate in semiconductors, metallic surfaces and protons or positive muons in metals.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, MANY-BODY THEORY AND STATISTICAL MECHANICS OF CONDENSED SYSTEMS

C. Woo, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *633 Clark St., Evanston, Illinois* 60201 (DMR78-25708)

Research previously supported by DMR7618375. Theoretical research on many-body theory and statistical mechanics of condensed systems will be carried out. This will be focussed on the study of non-uniform systems. A particular thrust will be on solids which are orientationally non-uniform, such as liquid crystals, in which molecular theories will be used to understand the nature of phase transitions in these solids. Also, spatial non-uniformity will be examined in inhomogeneous quantum solids and liquids, in particular surface properties of helium liquids and adsorption phenomena. The last topic deals with several aspects of the correlated-basis-function method, as applied to Fermi systems including liquid helium-3, nuclear matter and Coulomb liquids. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0014, MAGNETIC IMPURITIES IN SUPERCONDUCTORS

D.M. Ginsberg, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR79-07771)

An investigation of the effect of magnetic impurities (chromium, manganese, iron, cobalt and nickel) on the superconducting properties of several transition metal elements (vanadium, niobium and tantalum) will be initiated. The appropriate dilute alloys will be fabricated via electron-beam coevaporation onto an unheated substrate; the resulting films will be removed from the substrate and characterized by electron microscopy and diffraction as well as mass spectroscopy. Superconducting parameters to be measured include the transition temperature and upper critical magnetic field. Electron tunneling measurements will be used to derive the electron density of states. These data will provide a test of several theoretical concepts and theories regarding the effect of magnetic interactions on the microscopic parameters of the ssperconducting state.

This is the first year of a three-year continuing grant.

This work is an extension of work supported under DMR-7680159.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, PROPERTIES OF OXIDES OF VANADIUM IN THE CRYOGENIC TEMPERATURE RANGE

P.H. Keesom, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR79-08356)

Incorporation of titanium (Ti) into vanadium sesquioxide, V2O3, leads to dramatic alterations in the temperature, resistivity jump, and enthalpy change associated with a metal-insulator transition which occurs in this material at low temperatures. These alterations are not properly understood. The goals of the present work are to provide information on the mechanism of this transition, and to help determine the role of magnetic exchange interactions in driving the transition. To this end, the resistivity and magnetic susceptibility, discontinuity, the thermoelectric anomaly, and a heat capacity anomaly are studied as a function of Ti doping; Ti acts as a magnetic diluent.

Vanadium oxide forms a series of Magneli type phases, V(n)O(2n-1) (n equals 3, 4, ...8). A wide range of properties occurs. Depending on the O/V ratio, one encounters effects due to low dimensionality associated with a cationic chain, metal-insulator transitions, and magnetic anomalies. It is of great interest to understand why such a wide range of physical phenomena occurs in systems that are so similar chemically and structurally. To this end, high quality single crystals are being grown, and electrical, magnetic, and heat capacity studies are being carried out.

First year of a three year continuing grant; renewal of work supported by DMR76-80551.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, EXPERIMENTS ON THE NUCLEON-NUCLEON FORCE, PARTICULARLY PARITY VIOLATION

R. Wilson, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY77-11115 A02)

This grant is a continuation of work previously carried out under PHY77-11115A01. Work will be done on parity violation in nuclear forces. Work will be done at several different laboratories including Grenoble France and the National Bureau of Standards.

Specific experiments include d(n,gamma)t in which the asymmetry of the gamma with respect to the spin of the neutron will be measured. The reactions involving gamma rays are n plus d yields t gamma, 35Cl plus n yields 36Cl plus gamma, 56Fe plus n yields 57Fe plus gamma.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0017, STATE TO STATE DIFFERENTIAL CROSS-SECTIONS

D.E. Pritchard, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (CHE7902967)

The research is in the area of quantum chemistry. It deals with the way in which molecules in one particular state react with others. Dr. Pritchard has recently demonstrated a novel technique for measuring angular distributions using the Doppler shift. He plans to apply this technique to the study of energy transfer and chemical reactions in collisions of state-selected diatomic molecules with atoms and with other diatoms. He will study the influence of initial vibration-rotation state and kinetic energy on the differential cross-section for the various product states. It is expected that this advance in specificity will reveal systematic relationships among these variables and that it will also provide highly refined data for comparison with various types of theoretical predictions. This research represents a continuation of that currently supported by Foundation grant CHE7681750.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0018, ATMOSPHERIC PHYSICS STUDIES

A. Dalgarno, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (144225-31A)

Computations for quantum mechanical calculations of the transition moments of molecular oxygen.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

8.0019, STATIC AND DYNAMIC PROPERTIES OF 4HE, 3HE, 3HE-4HE MIXTURES

R.B. Hallock, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics, *Amherst, Massachusetts* 01002 (DMR79-09248)

This work is a continuation and extension of work supported under NSF Grants DMR77-07727 and DMR78-07762. A detailed study of superfluid dynamics in helium-4 and helium-3, helium-4 mixtures will be carried out. Areas to be investigated include: (1) the decay of persistent currents in unsaturated helium-4 as a function of helium-3 concentration and substrate pre-plating, (2) the properties of third sound in helium-3, helium-4 mixtures including pulse shape anomalies and measurements of the attenuation, (3) third sound measurements in the vicinity of onset and, (4) studies of the helium-3 surface state on helium-4.

A second investigation will focus on the use of a unique X-ray scattering facility to study the structure factor of helium-3 and helium-4. In particular, the structure factor will be measured at (1) fixed temperature as a function of density, (2) fixed density as a function of temperature, and (3) fixed density in the vicinity of the lambda line. These measurements will be conducted for temperatures in the range of 0.3K to 20K and for pressures up to 30 atmospheres. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, THEORY OF SOME DISORDERED SYSTEMS

M.F. Thorpe, Michigan State University, Graduate School, Dept. of Physics, *13 Natural Resources Bldg., East Lansing, Michigan* 48824 (DMR79-09170)

Research previously supported by DMR7705983.

This research concerns the theory of disordered systems and involves the development and refinement of some theoretical techniques and their application to real systems. These systems are usually simple and can be adequately described by a Hamiltonian containing only a few parameters.

Some of the topics to be covered are: 1. Some applications of the equation of motion technique and its extension to computations of two magnon spectra. 2. An extension of work on annealed bond Ising models to Potts models and annealed site models. 3. The development of a real-space propagator formalism, for random walk problems with applications to polymers and superionics. 4. The study of the nature of the vibrational and electronic spectra of P2O5 and Si3N4.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, SMALL-ANGLE X-RAY SCATTERING STUDIES

P.W. Schmidt, University of Missouri, Columbia Campus, School of Arts & Sciences, Dept. of Physics, *130 Jesse Hall, Columbia, Missouri* 65201 (DMR79-03943)

Small-angle x-ray scattering experiments will be carried out to study the equilibrium properties of argon and nitrogen near the liquid-vapor critical point. Small-angle x-ray scattering is es-

pecially well-suited for these studies in the critical region where many other techniques are difficult or impossible to use. The reduced susceptibility and the long-range correlation length can be calculated from the scattering curves. An especially promising new technique will be used to evaluate the critical exponent which describes the decay of the pair correlation function with distance when the fluid is at the critical point. Techniques will be developed for calculating the particle-dimension distribution from the scattering data for systems of particles with the same shape but different size, and a new method of collimation corrections will be studied.

This research was previously supported by DMR 7514071.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, QUANTUM FIELD THEORY WITH DENSITY, TEMPERATURE, AND FIELD PERTURBATIONS

B.J. Harrington, University System of New Hampshire, School of Liberal Arts, Dept. of Physics, *Durham, New Hampshire* 03824 (PHY79-08545)

Research will be done in theoretical physics with a focus on quantum field theory with density, temperature, and field perturbations. Though perturbative contributions to the thermodynamics of a dense quark gas are well understood, very little is known about nonlinear, nonperturbative effects. These latter modes may be of significance at densities found in the interior of neutron stars, in the very early universe, and in heavy ion collisions. Questions that bear on the nature of the ground state of gauge field theories shall be investigated by considering 'color' electric and magnetic field perturbations. In addition, a number of intriguing and, as yet, unanswered questions concerning the peculiar behavior of gauge fields at finite temperature shall be explored. Finally, there will be an approach to higher order effects in perturbation theory that may permit the expansion of current techniques to theories with spontaneous symmetry breakdown.

This work is a continuation of that currently supported under NSF grant PHY77-11521.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0023, AURORAL PLASMA STABILITY

R.L. Kaufmann, University System of New Hampshire, University of New Hamsphire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM79-05572)

This award will continue a study of linear plasma instability in the auroral ionosphere. The immediate goal of this study is to be able to predict the detailed spectrum of high fequency wave turbulence that is generated by the energetic electrons which are actually measured on rocket flights. Analysis to date has used data from only a small part of one flight. This work will complete an investigation of this flight and permit analysis of data from a second flight that encountered a substantially different electron population. Another payload that is currently being constructed has been specifically designed to measure both energetic electrons and the electrostatic wave structures that have been predicted.

The overall aim is to understand wave phenomena in space plasmas.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0024, THEORY OF DISORDERED SOLID-STATE SYSTEMS

J.M. Luttinger, Columbia University, School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (DMR77-06716 A02)

Theoretical studies of disordered solid-state systems previously supported by DMR-7509939 will be continued. A combination of various mathematical methods will be used including path integrals, variational techniques and exactly soluble models. The emphasis of the previous research has been on equilibrium properties such as heat capacity, diamagnetism and phase transitions. The methods will be developed further to include non-equilibrium properties such as electrical conductivity. The latter is of special interest because of its connection to the 'Mott' problem; that is, the transition from localized to non-localized states. Another direction of this research will include the study of collective excitations of disordered systems, particularly in relation to the well-known low-temperature specific heat anomaly in spin-glasses.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, THEORY OF SUPERFLUID FERMI LIQUIDS

J. Serene, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (DMR7826530)

Theoretical research on the properties of superfluid Fermi liquids will be carried out. In particular, the nature of spatially non-uniform states in a superfluid will be examined, where the structure is substantially modified from its uniform equilibrium form. This occurs, for example, at distances from a boundary which are less than the superfluid coherence length (a few hundred Angstroms in superfluid helium-3). The superfluid state will also be strongly modified near the center of a quantized vortex line, which occurs in rapidly rotating superfluid helium-3B and in the superfluid regions of a rotating neutron star. Both the boundary effects and the structure of vortices will be investigated, paying close attention to related properties of superconducting microbridges and of vortices in type II superconductors.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, MOLECULAR MOTION AND NUCLEAR MAGNETIC RELAXATION

P.S. Hubbard, University of North Carolina, Chapel Hill Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Chapel Hill, North Carolina* 27514 (DMR79-08671)

Research previously supported by DMR7302626.

Theoretical research on the following topics involving molecular motion and nuclear magnetic relaxation will be carried out: 1. Correlation functions which involve the orientation and angular velocity of molecules in a fluid, and which are important in the theories of nuclear magnetic relaxation and other phenomena, will be calculated by use of the Mori method with truncated cumulant expansions of the memory functions. Evaluation of the correlation functions in terms of specific intermolecular potentials will be attempted. The various correlation functions and correlation times will be compared, and used to determine the relative contributions of different interactions to nuclear magnetic relaxation. 2. The Argyres and Kelley theory of spin relaxation will be applied to situations which cannot be adequately described by the Block-Redfield theories. 3. Nuclear magnetic relaxation of two different kinds of nuclei interacting through scalar interactions and relaxed by various mechanisms will be calculated in order to investigate how the scalar interaction becomes a relaxation mechanism when one kind of nucleus relaxes much more rapidly than the other.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, INVESTIGATION OF THE STABILITY OF A NON-NEUTRAL PLASMA COLUMN

C.M. Armstrong, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (PHY78-21575)

A controlled experimental investigation of the stability of a magnetically confined, non-neutral electron plasma with a significant ion component will be initiated. The experimental program will utilize the low current, non-relativistic magnetically

confined electron beam device in the Plasma Physics Laboratory at North Carolina State University. This device can provide a non-neutral electron plasma column which essentially matches the existing theoretical models. This allows an unambiguous comparison between the experimental results and the theoretical predictions. It also provides the ability to selectively control both the plasma state and its environment. Once the instability has been characterized and compared with theory, the various stabilizing mechanisms will be studied.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0028, THEORETICAL AND EXPERIMENTAL STUDIES OF QUADRUPOLAR SPIN GLASS SYSTEMS

D.G. Haase, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (959)

The project objective is a coordinated experimental study of the thermodynamic properties of ortho-parahydrogen mixtures and of closely related theoretical models. The molecular ordering of solid hydrogen, described by electric quandrupole-quadrupole coupling, is a tensor analog of the more usual scalar- and vector-order-parameter spin glasses. The experiments are designed to measure pressure change delta P/delta T and specific heat in the temperature and concentration range believed to correspond to the glass-like phase transition. The theoretical work relies heavily on computer simulation techniques to relate ground-state degeneracy, metastability and anomalous behavior of the measurable thermodynamic parameters. It is hoped that ambiguities with respect to the specific heat can be resolved and that contact can be made with recently published NMR experiments.

Preliminary experiments and computations have been begun within the past month (Jaunary, 1979) and we expect to complete this project by December, 1980.

SUPPORTED BY North Carolina State Government

8.0029, PROPERTIES OF ANISOTROPIC RELAXATION SEMICONDUCTORS

J.F. Schetzina, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (DMR79-11336)

The structural, optical and photoelectric properties of cadmium telluride thin films will be investigated. A two-source deposition technique in an ultra high vacuum chamber will be used to prepare hexagonal-phase CdTe layers. Films will be prepared with the vapor flow normal to the substrate and at an oblique angle of incidence. Preparation of double layer CdTe isojunctions will also be attempted. The structural properties of the layers will be studied using x-ray diffraction and electron microscopy facilities at North Carolina State University and at Oak Ridge National Laboratory. UV-visible-near IR reflectance and transmittance spectroscopy will be used to investigate the optical properties of the film samples. The photoelectric properties of these anisotropic layers will be measured using monochromatic radiation from a laser system in the wavelength range 400-700 nm. Photomagnetoelectric effect experiments will be performed to obtain values for excess carrier transport parameters. The effects of thermal and laser annealing on the structural, optical and photoelectric properties of the layers will also be investigated. The goal of this research is increased understanding of the physics of anisotropic relaxation semiconductors, with hexagonal CdTe serving as a prototype material.

This is a continuation of research initiated under NSF Grant DMR77-08443A01. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, SOLAR NEUTRONS

G.M. Frye, Case Western Reserve University, Graduate School, Dept. of Physics, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (ATM77-24836 A01)

This grant supports a research program for the detection and analysis of the neutron flux emitted during a large solar flare. The EOSCOR (Extended Observation of Solar and Cosmic Radiation) detector has the capability to detect the neutrons from a flare with 1% of the intensity of the August 4, 1972 flare at a balloon altitude of 5 mbar. For the August 4, 1972 flare 25,000 neutrons events would have been detected.

With this grant the original EOSCOR scintillation light collection method will be changed to use adiabetic light pipes which will improve the time of flight (TOF) resolution and pulse height uniformity. The resulting improvement in the knowledge of the proton spectrum in the detector will, in turn, make possible a more precise deduction of the solar neutron energy spectrum. A ten-day flight of the modified EOSCOR detector on a zero-pressure balloon is planned for September, 1979, which will be near the maximum of the present solar cycle. Ultimately the detector will utilize the Sky Anchor zero-pressure/superpressure long duration flight system being developed by NCARR at the National Scientific Balloon Facility (NSBF).

The research is being carried out in collaboration with Professor Victor Hopper's group at the University of Melbourne. The major objective is to observe solar activity by using energetic particles.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0031, COMMUNICATIONS SATELLITE SUPPLEMENT FOR TECHNICAL PHYSICS

E.J. Phillippi, Muskingum Area Technical College, Undergraduate School, *1555 Neward Rd., Zanesville, Ohio* 43701 (SER7900481)

This project will develop an educational supplement to physics courses in Mechanics, Heat and Sound, and Electricity and Light. Experiments in orbital mechanics, heat, wave mechanics, energy transfer and the like will be created and tested. These will be based on telemetry data and Doppler Shift information acquired by direct, real-time communication with an Orbiting Satellite Carrying Amateur Radio (OSCAR 8). Technical college students using relatively inexpensive instruments can readily do the necessary tracking and data collection.

The system provides strong motivation and an array of data around which significant, enriching instructional units can be built.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div. of Science Education Resources Improvement

8.0032, STUDIES IN GENERAL RELATIVITY THEORY

F.P. Esposito, University of Cincinnati, McMicken College of Arts & Sciences, Dept. of Physics, *Van Wormer Adm. Bldg., Room 204, Cincinnati, Ohio* 45221 (INT75-18457 A02)

This award is being given jointly by NSF and the Venezuelan Government to enable Drs. F. Paul Esposito and Louis Witten of the University of Cincinnati to carry on a cooperative research program in 'Studies in General Relativity Theory' with their Venezuelan colleague, Dr. Louis Herrera, of the Universidad Central de Venezuela.

Their studies of the properties of exact solutions of Einstein's General Relativity Equations and of the behavior of perfectly conducting fluids in strong magnetic and gravitational fields are important for the further development of black hole theory and have astrophysical applications in the understanding of stellar collapse.

This award is a renewal of a previous one given to these researchers on the same subject.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0033, RESEARCH INITIATION - A STUDY OF DEEP LEVELS IN ION-IMPLANTED GALLIUM ARSENIDE

T.K. Plant, Oregon State Higher Education System, Oregon State University, School of Engineering, Dept. of Electrical & Computer Engineering, *200 Covell Hall, Corvallis, Oregon* 97331 (DMR79-08424)

This study is concerned with identifying and electrically characterizing the deep level traps in ion-implanted gallium arsenide (GaAs). Although much data is available on deep levels in bulk-grown or epitaxial GaAs, no work has been done on ion-implanted material. Implants of oxygen, chromium and manganese in high-purity GaAs substrates will be electrically characterized. Hall effect and deep level transient spctroscopy measurements will also be made over the temperature range 4.2 degrees K-300 degrees K. Effects of thermal and laser annealing of the implanted layers will also be studied. Information on the changes in deep level trap concentrations, energy levels and capture cross-sections with annealing should be useful in identifying sources of degradation in ion-implanted GaAs Field Effect Transistors. This will be a University/Industry cooperative research activity undertaken jointly by investigators at Oregon State University and Hughes Research Laboratories.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, STUDIES IN NON-LINEAR CONTINUUM PHYSICS

R.S. Rivlin, Lehigh University, Center for the Application of Mathematics, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (MCS77-20599 A01)

Continuation of MCS-7406958.

Professor Rivlin will carry on his research program in nonlinear continuum physics with emphasis now on (1) wave propagation in non-linear isotropic and anisotropic materials, (2) electro-optical and magneto-optical effects, and (3) non-Newtonian fluid mechanics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

8.0035, NUCLEAR MAGNETIC RESONANCE STUDIES OF THE STRUCTURE OF GLASSES

P.J. Bray, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR77-08600 A02)

New developments utilizing NMR studies to answer basic scientific questions concerning glass structure will be carried out including the following projects: (1) The O17 NMR spectroscopy of glasses will be used to study oxygen bonding in the alkali borate and silicate systems. (2) Si29 NMR spectroscopy will be completed for glasses and compounds of the system K_2O-SiO_2 and applied to other alkali and alkaline earth binary silicates and ternary systems. The linewidths and isotropic chemical shifts will also be determined. (3) Newly-developed B10 NMR spectroscopy will be applied to several binary and ternary systems (e.g., Li_2O-B_2O_3 and Na_2O-B_2O_3-SiO_2). (4) Recent success in using NMR spectra to determine the structure of glasses in ternary systems will be extended to the systems Na_2O-B_2O_3-SiO_2, CdO-TeO_2-V_2O_5, La_2O_3-B_2O_3-CdO and K_2O-B_2O_3-P_2O_5. (5) Ionic motion in glasses will be studied by NMR to determine activation energies, extend present studies of diffusion in systems based on SiO_2 and B_2O_3 to glasses based on other oxides and more novel constituents, and test theories for the mixed-alkali effect.

This is a continuation of research begun under NSF Grant No. DMR76-07814.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, PROBLEMS IN RELATIVITY AND PATH INTEGRATION

C. DeWitt Morette, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy/Physics, *200 W. 21st St., Austin, Texas* 78712 (PHY77-07619 A02)

Research on topics in gravitation theory initiated under NSF grant PHY77-07619A01 will be continued.

DeWitt-Morette and Matzner are both members of the Center for Relativity of the University of Texas. At present, their respective lines of research can be fruitfully brought together to attack the problems of wave propagation and the interaction of radiation with strong gravitational fields. Indeed, from her investigations of path integration, DeWitt-Morette has become an expert on the WKB approximation for a variety of problems, including velocity-dependent potentials, Riemannian configuration spaces, scattering problems, and caustics. On the other hand, Matzner has developed a number of analytic and computational techniques (e.g., exact partial wave summations and computer programs for cross-section calculations) in the study of scattering by Black Holes and in the production of radiation in strong fields. Together they will use for the benefit of wave optics the analogy between: a) wave optics and its approximation classical mechanics, and b) wave mechanics and its approximation classical mechanics which has traditionally been used for the benefit of quantum physics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

8.0037, CRYSTAL GROWTH FROM VAPORS

F.E. Rosenberger, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR79-13183)

This research will be a fundamental study of the transport processes involved in crystal growth from vapors in closed cylindrical geometries. Emphasis will be on how compositional homogeneity and stability of growth depend on the (oscillatory) mass and heat transfer conditions in the vicinity of the solid-vapor interface. Supplementary theoretical (numerical) and experimental studies will determine transport (i.e. growth) rates in Physical and Chemical Vapor Transport systems as a function of ampoule geometry, orientation with reference to the gravity vector, temperature distribution and filling conditions.

Laser Doppler anemometry and differential interferometry will be used for vapor velocity measurements and flow visualization. Vapors and materials employed will be chemically characterized by matrix isolation, infrared and Raman spectroscopy, mass spectroscopy and atomic absorption spectroscopy. Transport rates will be studied by in-situ weighing with and electromicrobalance.

This is a continuation of research initiated under NSF Grant DMR75-03175-A01, and the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0038, ELECTRONIC PROPERTIES OF METALS AND ALLOYS IN HIGH MAGNETIC FIELDS

R.V. Coleman, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR78-02553)

The electronic structure and properties of layer crystals exhibiting charge density wave (CDW) transitions will be investigated experimentally. Measurements of quantum oscillatory phenomena at high magnetic fields will be made on single crystals of layer structure dichalcogenides and trichalcogenides. DC transport measurements including Hall effect, magnetoresistance and superconducting anisotropy will also be carried out. Both Shubnikov de Haas and de Haas van Alphen oscillations will be measured using AC modulation and harmonic detection. These techniques are being extended for use on the high field Bitter solenoids at the National Magnet Laboratory. Charge density wave formation in the chalcogenides will be studied and the effects of organic intercalation and pressure on the CDW will be

followed by measuring the quantum oscillatory phenomena. DC susceptibility, Hall effect and magnetoresistance as a function of temperature will also be used to correlate results with CDW formation.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0039, U.S.-U.S.S.R. COLLABORATION IN FUNDAMENTAL PHYSICS
L. Brown, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (PHY7906533)

This grant covers the immediate local costs of a six-week visit by two Soviet physicists, Dr. I.B. Khriplovich and L.M. Barkov, both Senior Scientists at the Institute of Nuclear Physics, Academy of Sciences, Siberian Division, Novosibirsk, USSR, to the University of Washington.

Dr. Barkov heads a world-famous atomic parity-violation experiment and Dr. Khriplovich has contributed greatly to the theoretical basis of this experiment. Their work is closely related to work of University of Washington physicists and their visit should help resolve presently existing experimental and theoretical discrepancies.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SEARCH FOR OTHER PLANETARY SYSTEMS IN THE UNIVERSE
K.M. Serkowski, University of Arizona, Lunar & Planetary Lab., *Tucson, Arizona* 85721

The radial velocity meter, invented by the applicant, has been in operation on the 154-cm telescope since July 1977. The instrument is used for searching for planets similar to Jupiter around stars similar to the Sun. If such planets have orbital periods as short as several weeks or months they may be detected during the next year. Detection of extrasolar planets would provide an impetus for intensifying a search for signals from civilizations on such planets. Also, it would be a great step towards explaining the origin of planetary systems.

In our radial velocity spectrometer the wavelength calibration for measuring Doppler shifts in stellar spectra is provided by a tiltable Fabry-Perot etalon, kept in vacuum at constant temperature. The stellar brightness at the etalon's transmission maxima, separated by our echelle spectrograph, is measured by a solid-state television camera attached to an image intensifier. This camera, which is being installed presently, replaces the previously used Digicon image tube which was losing its sensitivity.

The requested support is essential for continuation of the project.

SUPPORTED BY National Geographic Society

10.0002, EXPERIMENTAL RELATIVITY BY DAYTIME ASTROMETRY AT SCLERA
H.A. Hill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (AST79-08558)

SCLERA is a daytime astrometric installation with research emphasis on experimental and solar physics. The basic effort in the experimental relativity program is the observation of anomalous effects in the positions of planets near conjunction. That observation relies on the Sun's diameter for a reference length unmarred by the effects of the Earth's atmosphere or the instrument. The capacity to measure a diameter of the sun to the requisite accuracy for the experimental relativity program makes available a powerful tool for studying the sun. The primary concerns here have been the measurement of the solar oblateness, which is of considerable importance in experimental relativity, and the development of a solar seismology program for utilizing the low-order normal modes of oscillation as well as the well known five-minute oscillation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0003, THEORETICAL ASTROPHYSICS
C. McKee, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST77-23069 A01)

A number of topics in stellar, interstellar, and extragalactic astrophysics will be studied. In anticipation of forthcoming satellite observations, predictions will be made of the expected phenomena related to neutron stars which seem to be at the center of many x-ray sources. The answer to the outstanding question of how pulsars convert their spin energy into the peculiar radio emissions observed will be sought. The dynamics of an individual collapsing star and the questions of how gas clouds break up into proto-stellar fragments will be studied. A variety of calculations of interstellar chemistry will be pursued, with the aim of relating observations of interstellar molecules to the physical conditions (temperature, density) of the gas in which the the molecules exist. An interrelated group of studies of the Crab Nebula, compact variable radio sources in quasars and active galactic nuclei, and other quasar phenomena will be pursued in the hopes of increasing our understanding of these enigmatic objects. The problem of star formation will be one of the research areas covered in the first year.

This is a continuation of research under grant AST-7723069.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0004, STELLAR ASTROPHYSICS
F.H. Shu, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST78-27594)

The research topics to be investigated involve important unresolved issues of mass and energy flow in stellar objects which are currently of great interest. Specific plans involve the following areas: A. Previous work on mass transfer in semi-detached binary stars will be extended to include the effects of non-synchronous spin of the mass-losing star, and to consider the structural response of the mass-receiving star after it has come into contact with its companion. B. The contact discontinuity model of the structure of contact binaries will be used to begin a study of their evolution on nuclear timescales. It is proposed to derive the shapes of W Ursae Majoris stars from an observational program of high resolution spectroscopy. C. Continuing theoretical work on protostellar evolution will be carried to a successful completion. Then an effort will be begun to calculate the observable consequences which can be compared with the many ongoing observational projects on young stars being carried out, including the active program at Berkeley under the direction of Leonard V. Kuhi.

In addition to these definite plans, new leads which appear during the course of the investigations will be pursued if they appear especially promising.

Prior support was by NSF grant AST 77-21643A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0005, A THEORETICAL INVESTIGATION OF THE COMPOSITION AND STRUCTURE OF COMETS
D.A. Mendis, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (AST78-19008)

Comets are considered to be the most primitive and least evolved members of the solar system in many respects. Research on these objects thus bears on the origin and evolution of

the solar system. In this project, information of use to researchers in the interstellar medium should also be obtained. The aim of this project is to investigate theoretically the structure and composition of comets. The five principal areas to be studied are: 1. The physical and dynamical processes in the gases surrounding the comet, its atmosphere, ionosphere, and tail; 2. The interactions between comets and the solar wind; 3. The formation and shapes of cometary magnetic fields and the associated currents and plasma flow; 4. Physical properties of the nucleus and dust component, including their probable chemical compositions; 5. The interactions between cometary dust and plasma, particulary in the dust tails associated with some comets.

Prior support was by NSF grant AST 77-19879.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, PULSATING MAGNETOSPHERES

D.F. Smith, University of Colorado, Boulder Campus, Graduate School, Dept. of AstroGeophysics, *1200 University Ave., Boulder, Colorado* 80302 (AST78-19496)

An investigation of the recurrent pattern of emission of radiation in pulsars will be undertaken. The current flow pattern in oblique rotator non-neutral beam models of pulsar polar caps will be studied including the possibility of return currents everywhere in the caps for periods too slow for pair creation to occur. Such models favor radiation mechanisms since the particle energy density becomes comparable to the magnetic field energy density close to the pulsar light cylinder. The closed magnetosphere will be assumed force-free except for a thin boundary layer inside its boundary with the polar caps. The properties of this boundary layer will be self-consistently derived.

The goal is to construct a self-consistent particle flow pattern in a non-neutral pulsar polar cap and investigate its stability properties. This research could lead to an explanation of observed phase coherence in the pulsar subpulses over many rotation periods and a bunching mechanism for particles strong enough to explain the observed radiation. The results will also be applicable to rapidly rotating magnetic white dwarfs.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, THEORY OF PLASMA WAVES, ELECTRON STREAMS, AND RADIO-WAVE EMISSION DURING TYPE III SOLAR RADIO BURSTS

M.V. Goldman, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (ATM79-16837)

This award will extend for one final year National Science Foundation grant ATM76-14275, which has covered the three-year period August 1, 1976 through August 1, 1979. The research has been concerned with the theory of Type III solar radio wave emission. As a result of computer and analytical work, it has been found that the Langmuir wave packets excited by the electron streams can undergo self-focusing, or collapse, to small spatial scales. During the dynamical phase of collapse the packets radiate like antennae. The radiation is mainly at the first harmonic of the plasma frequency and is quadrapole in nature. It has been demonstrated that certain models of collapse are consistent with observations. The present work is for one final year of research on Type III bursts, to complete present Langmuir wave packets, including magnetic effects, wave-particle interactions, and break-up and recurrence of wave packets; and also to enable interaction between theory and incipient laboratory experiments.

The overall aim is to understand Type III radio emissions from the sun.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0008, INVESTIGATION OF STRATOSPHERIC IONS WITH BALLOON-BORNE MASS FILTER AND CONDUCTIVITY PROBES

R.C. Amme, University of Denver, School of Arts & Sciences, Dept. of Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM79-02594)

A two-year investigation of the relative abundances and masses of stratospheric ions and of the electrical conductivity resulting from their presence will be conducted. A mass filter package previously constructed under an Army Research Office grant will be flown on three balloon flights, two of which will involve a search for negative ions. Two flights will reach the 33-35 km altitude, while the third will reach 40-42 km. Sunrise effects on ion composition will be studied and altitude profiles of ion concentration will be obtained. The results will provide knowledge of the consequences of galactic and solar particulate radiation on the stratosphere and key data needed to improve understanding of atmospheric ion chemistry.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0009, SPECTROSCOPIC STUDY OF GALAXIES ASSOCIATED WITH QUASI-STELLAR OBJECTS

A.N. Stockton, University of Hawaii System, Manoa Campus, Inst. for Astronomy, Dept. of Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (AST78-21946)

Two fundamental questions motivate virtually all research on quasi-stellar objects (QSOs): (1) what is the ultimate nature of the energy source in these objects? and (2) how are they related to normal galaxies? To a certain extent these questions are correlated, in that if we were able to give a full and detailed answer to one of them, we surely would have some strong clues as to the answer to the other. Until recently, attempts to answer these questions have had to depend exclusively on observations of the QSOs themselves; the research to be carried out will seek to deal particularly with the second question through observations of the local environment of low-redshift QSOs. It has long been evident that QSOs are not frequently associated with rich clusters of galaxies and research has shown that bright QSOs are often associated with small groups of galaxies. It is possible and even likely that most QSOs have normal galaxy companions. It is unlikely that much more of scientific value would be achieved by ferreting out additional examples of low-redshift QSOs with associated galaxies at this stage. The extension of this work will seem to lie in the direction of (1) detailed, systematic studies of three or four of the associations already found, and (2) a deep photographic survey of a sample of QSOs in a somewhat higher redshift range.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, RADIAL VELOCITIES OF G AND K GIANTS LYING MORE THAN 500 PARSECS ABOVE THE GALACTIC PLANE

K.M. Yoss, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST78-08621)

Stars classified as G and K giants which lie 500 parsecs or more from the galactic plane and are within 7 degrees of both galactic poles will be identified by David Dunlop Observatory photometry standards, thereby significantly increasing the present sample.

Spectrograms will be obtained of these stars far out of the plane of the galaxy in order to measure radial velocities. These results in turn will let us determine the perpendicular velocity dispersion as a function of height from the plane and composition. The perpendicular galactic force K(z) can then be established with greater certainty than is presently the case.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, PARTICLES AND CURRENTS IN THE GEOMAGNETIC FIELD

D.B. Beard, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Physics & Astronomy, *112 Bailey Hall, Lawrence, Kansas* 66045 (ATM76-23448 A02)

This grant continues a study of planetary magnetospheres with emphasis on magnetotail sources of current and structure. Improved tail field predictions will be used in reanalyzing magnetic measurements of Mercury's magnetic field as a test of the improvement in theory. Further improvement of addition of time-dependence into present magnetopause and tail field expressions will permit a continuation of global electric fields throughout the magnetosphere during magnetic storms. Calculation of fields throughout the magnetosphere with a view to predicting the penetration rate of magnetosheath plasma through the magnetopause will be continued. Collaboration with colleagues at Imperial College in examining boundary electrical resistivity effects on currents, magnetic fields, and electric fields will continue. The calculation of the shape of the Jovian magnetosphere will be finished.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0012, ROCKET INVESTIGATION OF ELECTRON PRECIPITATION TRIGGERED BY VLF EMISSIONS

D.L. Matthew, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (DPP77-22401 A01)

This proposal is a continuation of grant number DPP77-22401.

In this NSF and NASA jointly-sponsored project, three Nike-Tomahawk rockets will be instrumented with electron spectrometers to study the plasma physics of wave-particle interactions in the earth's magnetosphere. These rockets will be launched from Siple Station, Antarctica, during the austral summer of 1979-80 in conjunction with balloons, satellites, ground-based, and other rocket observations of wave-particle interactions.

There will be three Universty of Maryland scientists under this grant at Siple Station during the 1979-80 field season.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

10.0013, OPTICAL STUDIES OF HIGH ENERGETIC ASTRONOMICAL SOURCES

W. Liller, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (AST78-23814)

Investigations of highly energetic astronomical sources will be continued using: (a) the all-sky photographs in the Harvard Collection, and (b) the various accessories and telescopes of the National facilities, especially Cerro Tololo Interamerican Observatory and instruments of other observatories. The emphasis in (a) will be on historical light curves of recently unidentified quasi-steller objects, x-ray source counterparts, and cataclysmic variables; in (b) we will concentrate on the identification and study of x-ray source counterparts, especially 'bursters', globular clusters, and extra-galactic systems.

This is a continuation of AST-7600527AO2.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0014, RESEARCH IN GALACTIC AND EXTRAGALACTIC ASTROPHYSICS

N.A. Bahcall, Princeton University, School of Natural Sciences, Dept. of Astrophysical Sciences, *Box 430, Princeton, New Jersey* 08540 (AST79-06328)

The following research projects will be carried out: 1) Optical properties of clusters and superclusters of galaxies, from nearby to distant sources (z less than 0.5 and greater than 0.02). The study will correlate optical properties with other important cluster parameters. The measured properties will include structure, classification, density distributions, core radii, central densities, mass segregation, and galactic content of the clusters and superclusters. 2) Optical identification and studies of newly discovered x-ray sources, including: a) unidentified high galactic latitude sources; b) rich clusters of galaxies; c) isolated galaxies and QSOs; d) globular star clusters.

The first study is ncessary for the understanding of the dynamics, formation, and evolution of clusters and superclusters of galaxies, which are the largest observed systems in the universe. It is also an important step in some cosmological applications and a necessary background investigation for planning future observations with the Space Telescope planned to be launched in 1983. The second study is important in determining the nature of new sources that are being discovered with X-ray satellites.

This is a continuation of AST-7615386A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0015, STUDIES IN STELLAR ASTRONOMY

L.B. Lucy, Columbia University, School of Arts & Sciences, Dept. of Astronomy, *Broadway & W. 116th St., New York, New York* 10027 (AST79-13179)

The research to be carried out under this grant will be concerned with studies of the physics of binary stars: 1) There will be a study of binary star formation - this will involve the use of computer codes capable of handling three-dimensional gas dynamics problems. 2) There will be an analysis of data on binary stars - this analysis will be aimed at obtaining further information on the physical mechanisms which lead to the formation of close binary stars. 3) An analysis will be made of the current theories of very close (contact) binary systems.

In addition to the studies of binary stars, single stars will also be studied. In particular there will be: 1) an investigation of the pulsation properties of models of A-type supergiant stars; 2) an investigation aimed at providing self-consistent models of dust-shrouded carbon stars; and 3) an investigation of models of stars showing unusual abundances of helium.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0016, HYDRODYNAMICAL INVESTIGATIONS OF GAS FLOW IN THE CENTRAL REGIONS OF SPIRAL GALAXIES

K.H. Prendergast, Columbia University, School of Arts & Sciences, Dept. of Astronomy, *Broadway & W. 116th St., New York, New York* 10027 (AST78-26959)

Theoretical investigations of the nature of gas kinematics in the central regions of spiral galaxies will be carried out. The purpose of this research is to assess the relative importance of explosive vs. non-explosive origins for non-circular motions in the central regions of normal spiral galaxies. This problem is related to the question of the generality of explosive phenomenon in galactic nuclei; i.e., is explosive release of energy a normal consequence of the evolution of galactic nuclei? This research centers on numerical hydrodynamical calculations of gas response both to point explosions in gaseous disks (explosive hypothesis) and to weakly non-axisymmetric gravitational fields (non-explosive hypothesis). The machine codes for carrying out these hydronumerical calculations have been written and tested on a number of problems. These codes will be used to generate grids of realistic physical models for detailed comparison with observations of gas kinematics in both external spiral galaxies and our own Galactic Center region. In particular, comparison of theoretical models with observations of the Galactic center

will make use of high resolution carbon monoxide and neutral hydrogen surveys.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0017, THEORETICAL SOLAR SYSTEM STUDIES
T. Gold, Cornell University, Ithaca Campus, Center for Radiophysics & Space Research, Dept. of Applied Physics, *Ithaca, New York* 14850 (AST79-16474)

Support is for research to be carried out at the Cornell Center for Radiophysics and Space Research in the field of solar system dynamics and evolution. The plans for the immediate future include further studies of the ring system of Uranus, studies of the dynamical implications of the neumerous new results of the Voyager mission, including the ring of Jupiter and the shapes of the satellites. In addition studies will be undertaken of other evolutionary effects for which the basic information is now at hand, and through which a more complete understanding of the solar system can be obtained.

Prior support was under NSF grant AST 78-09431.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0018, RARE GASES IN RETURNED LUNAR MATERIALS
O.A. Schaeffer, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Science, *Stony Brook, New York* 11790 (EAR79-06956)

This is a continuing study which had previously been supported by NASA but transferred to the NSF for support.

The study will continue K-Ar chronological studies of lunar materials by the 39Ar - 40Ar thermal release and laser probe methods. The long-term goal is to obtain a reliable chronology for the moon which will hopefully also yield information about the intense early cratering of the inner planets in the solar system.

Work will continue in the areas of: (1) further evaluating the laser technique, (2) continuing a laser probe study of Apollo 17 highland breccias so as to ascertain whether Apollo 17 highland breccias are cogenetic or not, (3) continue our search for ancient lunar material in 65015, (4) making a laser study of 73255 to unravel its complex chronology, and (5) make thermal release studies to support the laser work.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

10.0019, VLA STUDIES OF THE SOLAR CHROMOSPHERE AND TRANSITION REGION
M. Simon, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (ATM79-17608)

With the support provided here very high angular resolution radio observations, using the Very Large Array (VLA) of the National Radio Astronomy Observatory (NRAO), of the fine structure of the solar chromosphere and transition region will be performed. These observations will provide a direct measurement of the physical conditions in the fine structure and thus lead to the construction of atmospheric models that explicitly include these inhomogeneities. These observations will enable an assessment of the role that features such as spicules play in the solar atmosphere and hence contribute to an understanding of the energy balance and heating mechanisms in the chromosphere and transition region. In turn, this will improve our understanding of the way in which solar energy drives the solar atmosphere out beyond the orbit of the earth.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0020, THE ATMOSPHERES OF VERY LUMINOUS STARS - OBSERVATION AND THEORY
N.D. Morrison, University of Toledo, School of Arts & Sciences, Dept. of Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (AST78-27620)

This project will be concerned with a study of supergiant stars of spectral types A and F. Its objectives are to improve our current knowledge of the effective temperatures and surface gravities of such stars, to determine their mass-loss rates, and to understand the peculiarities of certain stars that appear to mimic supergiants. High-resolution visible and ultraviolet spectroscopic data and low-resolution photoelectric spectrophotometric data will be obtained and will be fitted to theoretical models of the atmospheres of these stars.

The evolution of massive stars is influenced by the mass-loss that takes place in these objects. The mechanism that causes this loss is poorly understood, and the research to be carried out will provide a check on current theories. Much of the mass of a massive star returns to the interstellar medium and enriches it with heavy elements. The stellar winds from massive stars may compress nearby compact interstellar clouds and trigger star formation. The study of stellar winds in massive stars will contribute to understanding both star formation and the chemical history of the galaxy.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0021, CLIMATIC VARIATIONS CAUSED BY THE INTERACTION OF THE SOLAR SYSTEM WITH DENSE INTERSTELLAR CLOUDS
R.J. Talbot, Rice University, Graduate School, Dept. of Space Physics & Astronomy, *6100 Main St., Houston, Texas* 77001 (ATM78-26776)

This award is for a study of processes which are predicted to have been an important influence upon the Earth in the past. Although having no immediate influence upon climate during our lifetime, the scientific understanding of the processes is necessary in order to fully decipher the mechanisms governing the climate system.

Effects upon Solar System objects (especially the Earth and the Sun) during its passage through dense interstellar clouds will be studied. Preliminary investigations have shown that several effects should have influenced the Earth during episodes numbering anywhere between approximately 10 (severe episodes) to approximately 10 to the 3rd power (very mild episodes). Topics predicted to be important and which will be studied are: (a) Influence of planetary atmospheres being exposed to cold interstellar material rather than the solar wind, (b) effects of interstellar dust within the Solar System and (c) the past strength of the solar luminosity and solar wind and the reversal of the solar wind into an accretion flow.

The overall aim is to understand the solar/terrestrial system and its interaction with the interstellar medium.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0022, EXTRAGALACTIC CHEMICAL ABUNDANCES
G.A. Shields, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST78-04575)

Chemical abundances in extragalactic objects are important clues to the evolution of normal and active galaxies. The research will mainly involve a study of the physical conditions and abundances in ionized nebulae in external galaxies and quasars. In the area of composite gradients across spiral galaxies, the observed line intensities of H II regions will be analyzed with detailed models including the effects of density fluctuations, internal dust, and metal absoption edges in the stellar atmospheres. Goals of the work include more accurate determination of the gradients in metal and helium abundances across H101 and of the dependence of the composition gradient on morphological type, and an understanding of the gradients in

terms of galactic evolution. For Seyfert galaxies and QSOs, models involving time-dependent ionization will be used in an effort to determine the O/H, N/O, and N/C abundances ratios, and to clarify the ionization mechanisms. Similar techniques will be used to study physical conditions and abundances in several Galactic nebulae. The research will be primarily theoretical, supplemented with new data obtained in collaboration with several observers.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0023, PLANETARIUM STAR PROGRAM ON RELATIVITY AND ASTRONOMY

M. Littmann, Hansen Planetarium, *15 S. State St., Salt Lake City, Utah* 84111 (OSS78-24354 A01)

This grant supplements an award to the Hansen Planetarium to produce and distribute a planetarium program on Einstein's contributions to astronomy on the occasion of the one hundreth anniversary of his birth. The demand for the packages has exceeded original expectations and these funds will permit the production and distribution of additional packages.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Office
of Science & Society

10.0024, SOLAR CORONAL ROTATION AND RECURRENT PHENOMENA IN INTERPLANETARY SPACE

G.D. Parker, Norwich University, Undergraduate School, Dept. of Physics, *Northfield, Vermont* 05663 (ATM79-11109)

During solar cycle 19, the discovery and first in situ observations of the solar wind opened a new chapter in solar-terrestrial physics. Following these pioneering investigations, a variety of spacecraft experiments were performed throughout solar cycle 20 and now provide a comprehensive view of solar wind variability. With these data and contemporaneous observations of the optical Sun, it is appropriate to inquire about the source of the solar wind which reaches the vicinity of the Earth.

Aiding this inquiry is the happy circumstance that the Sun rotates differentially. Solar wind plasma speed, the interplanetary magnetic field, and the galactic cosmic ray intensity near the Earth all show significant variability on the time scale of a solar rotation period. Because solar rotation is differential, space phenomena linked to solar rotation may be characterized by time scales indicative of the 'responsible' solar latitude. A requirement for deriving solar source latitudes for recurrent and corotating phenomena near the Earth is the determination of solar differential rotation at heights in the corona where the solar wind emanates. The research supported here seeks to establish the height, latitude, and time dependence of the rotation of the solar electron corona through analyses of K-coronameter data collected by the High Altitude Observatory during solar cycle 20. Coronal differential rotation will be compared with the temporal behavior of recurring space phenomena for evidence regarding latitudinal motions of the solar wind reaching the vicinity of the Earth.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0025, INFRARED AND OPTICAL OBSERVATIONS OF QUASI-STELLAR OBJECTS

G.L. Grasdalen, University of Wyoming, Graduate School, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (AST78-17189 A01)

This project will involve a survey of infrared and optical photometry of quasi-stellar objects using the recently completed 2.3 meter telescope of the University of Wyoming. A primary goal of this program will be an examination of the continuum properties of the spectrum of these objects. A second aspect of the research will be to observe the near infrared emission-line spectrum of several quasi-stellar objects. The comparison of infrared and optical line strengths will provide strong constraints on the physical conditions, especially the density, in the outer parts of these objects.

This is a continuation of AST-7817189.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-19021* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 119)
Feb. 1980 111 p
(NASA-SP-7037(119)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 341 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1980. Abstracts on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems are presented. Research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles are also presented. A.W.H.

N80-19022*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
ANALYSIS OF FUEL-CONSERVATIVE CURVED DECELERATING APPROACH TRAJECTORIES FOR POWERED-LIFT AND CTOL JET AIRCRAFT
Frank Neuman Apr. 1980 38 p refs
(NASA-TP-1650, A-7986) Avail: NTIS HC A03/MF A01 CSCL 02A

A method for determining fuel conservative terminal approaches that include changes in altitude, speed, and heading are described. Three different guidance system concepts for STOL aircraft were evaluated in flight: (1) a fixed trajectory system, (2) a system that included a fixed path and a real time synthesized capture flight path, and (3) a trajectory synthesizing system. Simulation results for the augmentor wing jet STOL research aircraft and for the Boeing 727 aircraft are discussed. The results indicate that for minimum fuel consumption, two guidance deceleration segments are required. A.W.H.

N80-19023*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
AEROACOUSTIC WIND-TUNNEL TESTS OF A LIGHT TWIN-BOOM GENERAL-AVIATION AIRPLANE WITH FREE OR SHROUDED-PUSHER PROPELLERS
H. Clyde McLemore and Robert J. Pegg Apr. 1980 88 p refs
(NASA-TM-80203, L-13371) Avail: NTIS HC A05/MF A01 CSCL 01B

Tests were conducted in the Langley full-scale tunnel to determine the aerodynamic performance and acoustic characteristics of four different pusher-propeller configurations on a twin boom, general aviation airplane. The propellers included a 2-blade free propeller, two 3-blade shrouded propellers, and a 5-blade shrouded propeller. The tests were conducted for a range of airplane angles of attack from about 0 deg to 16 deg for test speeds from 0 to about 36 m/sec and for a range of propeller blade angles and rotation speeds. The free propeller provided the best aerodynamic propulsive performance. For forward flight conditions, the free propeller noise levels were lower than those of the shrouded propellers. In the static conditions the free propeller noise levels were as low as those for the shrouded propellers, except for the propeller in-plane noise where the shrouded propeller noise levels were lower. J.M.S.

N80-19024*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
MILITARY AIRCRAFT AND MISSILE TECHNOLOGY AT THE LANGLEY RESEARCH CENTER: A SELECTED BIBLIOGRAPHY
Dal V. Maddalon Jan. 1980 43 p
(NASA-TM-80204) Avail: NTIS HC A03/MF A01 CSCL 02A

A compilation of reference material is presented on the Langley Research Center's efforts in developing advanced military aircraft and missile technology over the past twenty years. Reference material includes research made in aerodynamics, performance, stability, control, stall-spin, propulsion integration, flutter, materials, and structures. Author

N80-19025*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
WORKSHOP ON AIRCRAFT SURFACE REPRESENTATION FOR AERODYNAMIC COMPUTATION
T. J. Gregory, ed. and John Ashbaugh, ed. Feb. 1980 560 p
Workshop held at Ames Research Center, Moffett Field, Calif., 1-2 Mar. 1978
(NASA-TM-81170, A-8075) Avail: NTIS HC A24/MF A01 CSCL 02A

Papers and discussions on surface representation and its integration with aerodynamics, computers, graphics, wind tunnel model fabrication, and flow field grid generation are presented. Surface definition is emphasized. R.E.S.

N80-19026*# Michigan Univ., Ann Arbor
TRAJECTORIES OPTIMIZATION IN HYPERSONIC FLIGHT Final Report
Nguyen X. Vinh Mar. 1980 5 p refs
(Grant NsG-1448)
(NASA-CR-162846) Avail: NTIS HC A02/MF A01 CSCL 02A

Equations of motion were derived for the three dimensional flight of a lifting vehicles, taking into consideration all the main effects of different forces acting on a vehicle at orbital speeds. A set of equations was formulated which are valid for both the flight with lift modulation inside a planetary atmosphere and the Keplerian motion in the vacuum. The equations are independent of the physical characteristics of the vehicle. The only parameters involved are the maximum lift to drag ratio of the vehicle and a constant characterizing the atmosphere. The results obtained can be applied without modifications to any future reentry vehicle, regardless of its size, shape, and mass. A.R.H.

N80-19027# RAND Corp., Santa Monica, Calif.
ESTIMATING THE TIME REQUIRED TO TRANSITION AIRCRAFT FLEETS TO NEW SCHEDULED MAINTENANCE

INTERVALS Interim Report
I. K. Cohen and Eugene Poggio Oct. 1979 37 p
(Contract F49620-77-C-0023)
(AD-A078606; RAND/N-1247-AF) Avail: NTIS
HC A03/MF A01 CSCL 15/5

Typically, decisionmakers are called upon to make decisions on aircraft inspection intervals on the basis of very limited analytic information. Under such circumstances, decisionmakers are understandably concerned about the risks incurred in extending inspection intervals. This note presents in some detail a discussion of the phenomenon that although an immediate change is made in inspection intervals, it takes a considerable period of time for the fleet to transition to the changed interval. The slow fleet maturation may provide considerable opportunity to monitor and control the condition of the fleet during the transition period. Thus, in the case of extending inspection intervals, risk is reduced and spread over time while the payoff for the change is immediate. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-19028 Engineering Sciences Data Unit, London (England)
UNDERCARRIAGE DRAG PREDICTION METHODS
1979 31 p
(ESDU-79015; ISBN-0-85679-260-8; ISSN-0141-391-397X)
For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

A method for estimating the drag of an aircraft undercarriage is presented. The research is applied to the calculation of the drag of an aircraft in the landing approach. The results can be applied to virtually any type of fixed or retractable undercarriage at low speeds. ESDU (GRA)

N80-19029# Cambridge Univ. (England). Dept. of Engineering.
VISUALIZATION OF UNSTEADY JETS AND AERODYNAMIC NOISE FIELDS
S. N. Heavens 1979 51 p refs
(CUED/A-Turbo/TR-96; ISSN-0309-6521) Avail: NTIS
HC A04/MF A01

Flow visualization and noise measurement techniques were used to study the response of a subsonic jet to internal excitation by various types of disturbance. In experiments with rectangular nozzles, the flow was perturbed by vibration of the nozzle walls or by the insertion of a tunable side-branch cavity in the nozzle duct. Both methods resulted in the periodic formation of cylindrical vortices in the jet mixing layer and in intense sound emission from the nozzle exit region at 90 deg to the jet axis. In experiments with circular nozzles, the flow was excited by the sound field from a transducer situated on the axis of the nozzle plenum chamber. The response of the jet pulse excitation was also investigated, using the transient acoustic pulse from a spark discharge. In these experiments an apparent intensification of the sound wave was observed, notably at 90 deg to the jet axis and in the forward arc. Large scale quasistable vortex ring structures were generated in the mixing layer. Interactions between the vortex rings were observed, but they did not appear to result in additional noise. Author

N80-19030*# Bihrle Applied Research, Inc., Jericho, N. Y.
ROTARY BALANCE DATA FOR A TYPICAL SINGLE-ENGINE GENERAL AVIATION DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEG TO 90 DEG. 1: LOW-WING MODEL A
Randy S. Hultberg and William Mulcay Feb. 1980 400 p refs
(Contract NAS1-14849)
(NASA-CR-3100) Avail: NTIS HC A17/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a rotational flow environment utilizing a rotary balance are presented in plotted form for a 1/5 scale, single engine, low-wing, general aviation airplane model. The configuration tested included the basic airplane, various control deflections, tail designs, fuselage shapes, and wing leading edges. Data are presented without analysis for an angle of attack range of 8 to 90 deg and clockwise and counterclockwise rotations covering a range from 0 to 0.85. A.W.H.

N80-19031*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF A NUMERICALLY GENERATED ORTHOGONAL COORDINATE SYSTEM TO THE SOLUTION OF INVISCID AXISYMMETRIC SUPERSONIC FLOW OVER BLUNT BODIES
H. Harris Hamilton, II and Randolph A. Graves, Jr. Mar. 1980 61 p
(NASA-TP-1619; L-13353) Avail: NTIS HC A04/MF A01 CSCL 01A

A numerically generated orthogonal coordinate system (with the body surface and shock wave as opposite boundaries) was applied with a time asymptotic method to obtain steady flow solutions for axisymmetric inviscid flow over several blunt bodies including spheres, paraboloids, ellipsoids, hyperboloids, hemisphere cylinders, spherically blunted cones, and a body with a concavity in the stagnation region. Comparisons with experimental data and with the results of other computational methods are discussed. The numerically generated orthogonal coordinate system is described and applications of the method to complex body shapes, particularly those with concave regions, are discussed. A.W.H.

N80-19032# Weapons Systems Research Lab., Salisbury (Australia)
WIND TUNNEL TESTS OF A SPINNING 105 mm ARTILLERY SHELL MODEL WITH CANARD CONTROL SURFACES
C. Jarmey Sep. 1979 46 p refs
(AR-001-908; WSRL-0122-TR) Avail: NTIS
HC A03/MF A01

Tests were conducted to measure the aerodynamic characteristics of a spinning model of a 105 mm shell fitted with canard control surfaces. The tests covered an incidence range of -2 deg to 15 deg, a Mach number range of 0.70 to 0.95, and a control deflection range of zero to 30 deg. The effectiveness of the canards as pitch and yaw controls and for generating maneuvering forces is discussed. The conclusion is reached that available maneuvering forces would be small, and an example is given for a typical trajectory in which a maximum shift of 90 m from the unguided impact point could be obtained. F.O.S.

N80-19033*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A FLIGHT INVESTIGATION OF BLADE SECTION AERODYNAMICS FOR A HELICOPTER MAIN ROTOR HAVING NLR-1T AIRFOIL SECTIONS
Charles E. K. Morris, Jr., Darlene D. Stevens, and Robert L. Tomaine Jan. 1980 194 p refs Sponsored in part by AVRADCOM, St. Louis, Mo.
(DA Proj. TL2-62209-A-76)
(NASA-TM-80166; AVRADCOM-TR-80-B-2) Avail: NTIS
HC A09/MF A01 CSCL 01A

A flight investigation was conducted using a teetering-rotor AH-1G helicopter to obtain data on the aerodynamic behavior of main-rotor blades with the NLR-1T blade section. The data system recorded blade-section aerodynamic pressures at 90 percent rotor radius as well as vehicle flight state, performance, and loads. The test envelope included hover, forward flight, and collective-fixed maneuvers. Data were obtained on apparent blade-vortex interactions, negative lift on the advancing blade in high-speed flight and wake interactions in hover. In many cases, good agreement was achieved between chordwise pressure distributions predicted by airfoil theory and flight data with no apparent indications of blade-vortex interactions. R.E.S.

N80-19034# Naval Postgraduate School, Monterey, Calif.
TRANSVERSE OSCILLATIONS OF SMOOTH AND ROUGH CYLINDERS IN HARMONIC FLOW M.S. Thesis
Suleyman Ozkaynak Sep. 1979 79 p refs

(AD-A078271) Avail: NTIS HC A05/MF A01 CSCL 20/11

The dynamic response of elastically-mounted cylinders in a sinusoidally oscillating two-dimensional flow has been investigated both theoretically and experimentally. The experiments were carried out in a large U-shaped water tunnel, with smooth and sand-roughened circular cylinders. The results have been expressed in terms of lift coefficients, relative amplitudes of oscillation, Keulegan-Carpenter number, Reynolds number, Strouhal number, and a mass parameter. A theoretical analysis has been carried out by assuming the transverse force varies harmonically. Furthermore, the instantaneous values of the displacement have been predicted through the use of the Duhamel's integral. The results have shown that elastically-mounted cylinders undergo synchronous oscillations at a reduced velocity of 5.7 when the vortex shedding frequency coincides with the natural frequency of the cylinder. Away from the region of synchronization the cylinder is subjected to forced response by vortices shedding at a frequency smaller or larger than the natural frequency of the cylinder. GRA

N80-19035# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.

WALL PRESSURE FLUCTUATIONS DURING TRANSITION ON A FLAT PLATE Final Report, Oct. 1978 - Apr. 1979

Charles Joseph Gedney Apr. 1979 114 p refs

(Contract N00014-77-C-0084)

(AD-A075379; A/V-84618-1) Avail: NTIS HC A06/MF A01 CSCL 20/4

Detailed measurements of wall pressure fluctuations have been made in the intermittent region of a flat plate boundary layer. Digital sampling and processing were used. The properties of these pressure fluctuations were found to be similar to the previous measurements made in the fully turbulent region. The measurements were repeated with a single two dimensional surface roughness on the plate. The only changes in the results were a decrease in the transition Reynolds number from 2.0 to 1.2 million per foot and an increase in the decay rate of the longitudinal cross-spectral density magnitude by a factor of about 1.6. Emmons' analytical model of the burst rate in the transition region was found to be inaccurate. His model treats the sources of the turbulent spots as independent random events with prescribed probability density functions. Both a delta function and a constant were used as the source density functions and in each case the burst rate was about two times higher than the present measurements. GRA

N80-19036# Ballistic Research Labs., Aberdeen Proving Ground, Md.

FREE-FLIGHT BASE PRESSURE MEASUREMENTS ON 8 DEGREE CONES

Andrew Mark Jul. 1979 26 p refs

(DA Proj. 1W6-62618-AH-80)

(AD-A075365; AD-E430301; ARBRL-TR-02179) Avail: NTIS HC A03/MF A01 CSCL 19/4

Base pressure measurements are presented on two 8 deg half angle, right circular cones with a tip bluntness ratio of 1%. Data are obtained at three radical base locations: r/R sub b = 0, r/R sub b = .5, and r/R sub b = .917. A unique free-flight technique was employed to obtain the data. The cones were launched nearly vertically from special guns and the data were telemetered to ground stations. The launch Mach numbers were approximately 3 with corresponding Reynolds numbers of 3.6 million. Both the Mach number and the Reynolds number decreased monotonically from their launch value reaching 400 and 250,000 respectively at apogee. In the laminar flow regime, the centerline base pressure is measured to be a few percent higher than either of the other two. At early times in the trajectory, where the boundary layer was expected to be turbulent, the opposite effect is noted. GRA

N80-19037# New Mexico State Univ., Las Cruces. Physical Science Lab.

BALLOON SYSTEMS AND LAUNCH SUPPORT Final Report, 1 Oct. 1978 - 31 Jan. 1979

Stewart P. Bean and John R. Ground 15 Apr. 1979 18 p refs

(Contract F19628-77-C-0031)

(AD-A075385; AFGL-TR-79-0175) Avail: NTIS HC A02/MF A01 CSCL 14/2

The work performed under this contract consisted of: conducting balloon flight operations from selected sites; integrating GFE instrumentation and flight safety equipment into balloon borne payloads; providing engineering support for payload integration and integrity; fabricating, calibrating and repairing command control/telemetry equipment; analyzing data; and reporting flight results. GRA

N80-19038# New Mexico State Univ., Las Cruces. Physical Science Lab.

SOUNDING ROCKET AND BALLOON SYSTEMS SUPPORT Final Report, 15 Jun. 1976 - 15 Jun. 1979

Raymond A. Bumgarner and Arthur A. Gilcrease 18 Jul. 1979 7 p refs

(Contract F19628-76-C-0171; AF Proj. 6688)

(AD-A075384; PS-00945; AFGL-TR-79-0166) Avail: NTIS HC A02/MF A01 CSCL 14/2

The work performed under this contract consisted of the following; integrate, calibrate, and test, GFE range safety radar tracking beacon and parachute recovery systems; design and develop special devices as required, operate and maintain GFE telemetry station to support telemetry operations at WSMR, New Mexico, and calibrate equipment and perform analyses for air sampling balloon flights conducted at Holloman AFB, New Mexico. GRA

N80-19039# United Technologies Research Center, East Hartford, Conn.

INVESTIGATION OF THE AIRFLOW AT ROCKET TRAJECTORY AND WIND SENSOR LOCATIONS OF A MODEL HELICOPTER SIMULATING LOW SPEED FLIGHT. APPLICATION OF MODEL HELICOPTER TESTING, LASER VELOCITY, AND ROTOR WAKE FLOW VISUALIZATION TO INVESTIGATE THE AERODYNAMIC INTERFERENCE AT ROCKET TRAJECTORIES AND WIND SENSORS OF A HELICOPTER OPERATING IN LOW SPEED FLIGHT Final Report, May 1977 - Sep. 1979

Robert B. Taylor and Anton J. Landgrebe Sep. 1979 233 p refs

(Contract DAAG29-77-C-0013)

(AD-A075378; UTRC-R79-S12985-5; ARO-14277.1-E) Avail: NTIS HC A11/MF A01 CSCL 01/3

An experimental investigation was conducted to determine the airflow characteristics in the vicinity of a model helicopter to determine the aerodynamic interference at representative rocket trajectories and wind sensor locations of an Army AH-1G helicopter operating in low speed forward flight. Laser velocimetry and flow visualization techniques were applied in a wind tunnel to provide flow velocity and wake geometry data for use in a rocket aeroballistics analysis, correlation with theory, and for a systematic determination of the influence of the helicopter components (rotor, fuselage, and wing) and significant operating condition parameters (flight speed, flight direction, ground effect, gross weight, and aircraft/rocket attitude) on the airflow influencing rocket trajectories. In addition, the flow velocities at potential locations for a fire control wind sensor mounted on the helicopter were determined to evaluate potential wind sensor locations for accurately measuring flow velocities at the low flight speeds required in accordance with current terrain flying/rocket firing tactics. GRA

N80-19040# ARO, Inc., Arnold Air Force Station, Tenn.

WIND TUNNEL TEST TO INVESTIGATE AERODYNAMIC HYSTERESIS PHENOMENA OF THE F-4 AND F-11 AIRCRAFT MODELS

Joseph F. Herman AEDC 15 May 1979 37 p

(AD-A077196; AEDC-TSR-79-P27) Avail: NTIS HC A03/MF A01 CSCL 01/3

Wind tunnel tests were conducted to investigate aerodynamic hysteresis phenomena found in other investigations of the F-4 and F-111 aircraft models. A 1/20-scale model of the F-4C aircraft was used to obtain static force, moment and wing pressure data in pitch and sideslip over a Mach number range from 0.7 to 0.95. A 1/24-scale model of the F-111 aircraft was used to obtain static force and moment data for a Mach number range of 0.7 to 1.3. Data on the F-111 were obtained for wing

sweep angles of 26 and 54 deg. In addition, tuft and oil flow visualization data were obtained for selected configurations. GRA

N80-19041# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Recovery Crew Station Branch.
RECOVERY SYSTEM PRELIMIMINARY DESIGN. A SIMPLIFIED APPROACH TO DETERMINING STAGING, TIMING AND ALTITUDE REQUIREMENTS FOR FAST INFLATING PARACHUTES Final Report, 13 Feb. - 1 Jun. 1978
Michael W. Higgins Sep. 1979 74 p
(AF Proj. 6065)
(AD-A077548; AFFDL-TR-79-3007) Avail: NTIS HC A04/MF A01 CSCL 01/3

Determining a recovery system design that will take a specified act of initial conditions and will operate within a given set of constraints to provide a required final condition is a complex task. To perform this task, current design practices make extensive use of both person hours and computer time in an analytical 'cut and try' process. This report documents an analytical technique that takes a specified set of inputs (initial conditions, final conditions and operating constraints) and outputs a 'reasonable' recovery system preliminary design for fast inflating parachutes. The output includes the number of operating stages, the drag area of each operating stage, the reefing cutter times, and resulting altitude losses. The technique assumes a vertical trajectory, step function increases in parachute drag area, and that the recovery system is a point mass. The limitations of the analytical technique are discussed and recommendations are made with respect to reducing or removing the effects of these limitations. The analytical technique is applied to three different sets of conditions and constraints as example applications. Use of the analytical technique documented in this report will significantly reduce the assets required to arrive at a final recovery system design. GRA

N80-19042# Naval Postgraduate School, Monterey, Calif.
PROCEEDINGS OF A WORKSHOP ON V/STOL AIRCRAFT AERODYNAMICS, VOLUME 2
C. Henderson and M. F. Platzer 18 May 1979 474 p refs
Workshop held in Monterey, Calif., 16-18 May 1979
(AD-A078909) Avail: NTIS HC A20/MF A01 CSCL 20/4

Contents: Propulsion System/Airframe Interactions--Recent Applications of Theoretical Analysis to V/STOL Inlet Design, Inlet Operating Characteristics at High Angles of Attack, Low Speed Development of the Supersonic XFV-12A V/STOL Inlet, Subsonic VTOL Inlet Experimental Results, Inlet Ram Forces and Moments and V/STOL Aircraft, Theoretical Fan Velocity Distortions Due to Inlets and Nozzles, Aerodynamics of a Tilt-Nacelle V/STOL Propulsion System, Isolated Deflector Nozzle Static Tests for V/STOL Aircraft; V/STOL Aircraft Configurational Considerations and Developments--High Angle of Attack Aerodynamics at DTNSRDC, Development of High Lift Devices for Application to Advanced Navy Aircraft, YC-14 Low Speed Test Techniques, Vectored-Engine-Over-Wing Concept Development, Wind Tunnel Investigation of a Highly Maneuverable Supersonic V/STOL Fighter, Transition Characteristics of the External-Augmentor V/STOL Aircraft Concept, Calculation of Forces and Moments Acting on an Augmentor Wing for a VTOL Fighter in Hover or Transition Flight, Aerodynamics of an Advanced Jet Flap and an Ultra-STOL Application, and High Speed Aerodynamic Technology for V/STOL Fighter Attack Aircraft. GRA

N80-19043# Dayton Univ. Research Inst., Ohio.
FAR FIELD CONDITIONS FOR SUBSONIC FLOWS WITH SMALL SUPERIMPOSED HARMONIC OSCILLATIONS Interim Report, Dec. 1978 - Apr. 1979
Karl G. Guderley Jul. 1979 65 p refs
(Grant AF-AFOSR-3524-78; AF Proj. 2304)
(AD-A077693; UDR-TR-79-65; AFFDL-TR-79-3109) Avail: NTIS HC A04/MF A01 CSCL 20/4

For numerical work one needs boundary conditions (so called far field conditions) at the outer edge (or surface) of the region of the flow field for which the computations are carried out. In oscillatory flows with higher frequencies and Mach number close to 1 these conditions become crucial and the formulation in use at present which is patterned after far field conditions in steady flows becomes impractical if not useless. The far field conditions express the fact that no waves coming from infinity are present. Mathematically this appears in the form of the requirement that the far field can be represented by a superposition of particular solutions which represent outgoing waves. On this basis one obtains by the application of Green's formula a number of integral conditions. An example shows that even with this formulation one will encounter numerical difficulties (because of latent standing waves) if one tries to solve the flow equations by iteration. Fortunately the new far field conditions are well suited to a solution of the problem by direct elimination, possibly combined with a refinement of the results by the multigrid method of Brand. GRA

N80-19044# Science Applications, Inc., Irvine, Calif.
HYPERSONIC INTERFERENCE FLOW FLIGHT EXPERIMENT DESIGN Final Report, 15 Jun. - 15 Apr. 1979
L. A. Cassel, T. C. Duncan, and E. H. Lahti Jun. 1979 244 p refs
(Contract F33615-77-C-3043; AF Proj. 2404)
(AD-A078861; SAI-175-80-008-R; AFFDL-TR-79-3065) Avail: NTIS HC A11/MF A01 CSCL 20/4

An experiment has been defined to measure the aeroheating and loads resulting from three-dimensional shock wave/boundary layer interference in hypersonic flight. This report describes the definition of this flight experiment, including the instrumentation and electronics required to measure the interference heating and loads and transmit those measurements by telemetry to ground stations. The measurements include quasi-steady heat transfer rates and pressures as well as fluctuating pressures. Additional measurements are specified for specific definition of the experiment environment. The experiment is configured to investigate the interference flow at the base of a stabilizer on a missile launched from an F-4 aircraft. The missile is to be propelled to hypersonic speed by a solid propellant motor and the measurements are to be made at altitudes between 50 KFT and ground impact. The mechanical, structural, and thermal protection system specifications for the experiment carrier missile are provided in this report. Missile design and fabrication drawings are available under separate cover from the sponsoring agency. GRA

N80-19045# Scientific Research Associates, Inc., Glastonbury, Conn.
VISCOUS FLOW IN THE REGION OF A ROUNDED TRAILING EDGE Final Report, 1 Jul. 1978 - 30 Jun. 1979
Ralph Levy, W. Roger Briley, and Henry McDonald 31 Jul. 1979 41 p refs
(Contract N00019-78-C-0470)
(AD-A078588; R79-920003-F) Avail: NTIS HC A03/MF A01 CSCL 20/4

The Interactive Zone Embedding concept is a generalization of concepts which have been used for some time with boundary layer analyses. This concept has been extended to more complex flows using a potential flow for the outer zone and the compressible Navier-Stokes equations for the inner zone. In this interactive manner the flow about a rounded trailing edge was computed for two locations of the outer boundary. The calculations were performed on a 5:1 elliptic cylinder at a Mach number of 0.2 and a Reynolds number based on chord of 1,000. A body fitted conformal coordinate system was used. In the first instance the outer boundary was located approximately one chord from the ellipse and in the second the outer boundary was brought to about one-half chord of the ellipse. The displacement body was chosen as the interactive streamline and the potential flow over this streamline was computed as the sum of the analytic potential flow over the elliptic cylinder plus the flow from a series of sources. The strengths of these sources were determined to make the interaction streamline also be a streamline in the potential flowfield. The resulting potential flow was used to evaluate the static pressure at the outflow boundary of the Navier-Stokes zone. The calculations were performed with the large Navier-Stokes domain and were repeated with a smaller Navier-Stokes domain. The flow properties in the vicinity of the body of the two calculations were in excellent agreement. GRA

N80-19046# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
EXPERIMENTAL INVESTIGATION OF A CIRCULATION CONTROL AILERON Final Report, Oct. 1977 - Sep. 1978

Steven W. Prince Jul. 1979 29 p refs
(WF41421000)
(AD-A078825; DTNSRDC/ASED-79/08) Avail: NTIS
HC A03/MF A01 CSCL 20/4

A Circulation Control (CC) aileron was tested on a semispan wing-fuselage model at a dynamic pressure equal to 20 lb/sq ft (957 N/sq m) and a Reynolds number of 0.8 million per ft (2.62 million per m). Three different trailing edge geometries were used on CC ailerons of 10 and 20 percent of the half span. Blowing was controlled to produce jet momentum coefficients from 0.0017 to 0.0124. Rolling moment coefficients as high as 0.035 were recorded for the 20 percent CC aileron for angles of attack between 0 and 12 deg. The CC aileron was at least three times as effective as a pure reaction jet for the same amount of bleed air. Adverse yaw was large, on the order of one-half of the rolling moment. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-19047# Advisory Group for Aerospace Research and Development, Paris (France).
PROPULSION AND ENERGETICS PANEL WORKING GROUP 11 ON AIRCRAFT FIRE SAFETY. VOLUME 2: MAIN REPORT
B. P. Botteri, ed., M. Gerstein, ed., T. Horeff, ed., and J. Parker, ed. Nov. 1979 167 p 2 Vol.
(AGARD-AR-132-Vol-2; ISBN-92-835-1344-4) Avail: NTIS
HC A08/MF A01

Recent aircraft fire experience was analyzed and areas in which fire protection enhancement is needed were delineated. Technological opportunities that offer significant prospect for improvement of safety and personnel survivability were also identified. Because of the complexity of the overall problems, attention was focused upon turbine engine powered transport aircraft in a conventional (non-combat) operational environment. Conclusions and recommendations are summarized. R.E.S.

N80-19048*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DATA REDUCTION AND ANALYSIS OF GRAPHITE FIBER RELEASE EXPERIMENTS
Paul Lieberman, Albert R. Chovit, Benjamin Sussholz, and Howard F. Korman Jul. 1979 362 p refs
(Contract NAS1-15465)
(NASA-CR-159032; NASA/TRW-79-2) Avail: NTIS
HC A16/MF A01 CSCL 01C

The burn and burn/explode effects on aircraft structures were examined in a series of fifteen outdoor tests conducted to verify the results obtained in previous burn and explode tests of carbon/graphite composite samples conducted in a closed chamber, and to simulate aircraft accident scenarios in which carbon/graphite fibers would be released. The primary effects that were to be investigaged in these tests were the amount and size distribution of the conductive fibers released from the composite structures, and how these various sizes of fibers transported downwind. The structures included plates, barrels, aircraft spoilers and a cockpit. The heat sources included a propane gas burner and 20 ft by 20 ft and 40 ft by 60 ft JP-5 pool fires. The larger pool fire was selected to simulate an aircraft accident incident. The passive instrumentation included sticky paper and sticky bridal veil over an area 6000 ft downwind and 3000 ft crosswind. The active instrumentation included instrumented meteorological towers, movies, infrared imaging cameras, LADAR, high voltage ball gages, light emitting diode gages, microwave gages and flame velocimeter. A.R.H.

N80-19049# Computer Sciences Corp., Huntington Valley, Pa.
MICROPROCESSOR CONTROLLED EJECTION SEAT Final Report
Kathleen M. Breakey 23 Oct. 1979 208 p refs
(Contract N66269-78-C-0191)
(AD-A077479; NADC-79240-60) Avail: NTIS
HC A10/MF A01 CSCL 01/3

The operation of an ejection seat depends on a number of devices on the seat performing certain tasks at specific times. Traditionally, the timing and sequencing of these tasks have been controlled by fuses, gas lines and mechanical linkages, with marginal accuracy and limited logic. This effort was undertaken to demonstrate the feasibility of using a microprocessor to control these functions with increased accuracy and more sophisticated logic. The microprocessor provides timing by electronic clock, event sequencing via electrical signals, and sophisticated logic based on environmental inputs. In addition, the microprocessor, in conjunction with a gimballed rocket motor, provides the capability of performing a Vertical Seeking Maneuver in the event of an adverse attitude ejection. This report contains the software required to complement all these functions. GRA

N80-19050# Operational Research and Analysis Establishment, Ottawa (Ontario).
FEASIBILITY STUDY ON A CANADIAN CIVIL SAR PLAN FOR SEARCH AND RESCUE DUTIES
S. L. Milligan Apr. 1979 122 p
(AD-A075392; ORAE-M87) Avail: NTIS HC A06/MF A01
CSCL 06/7

The ability and willingness of the civil sector to assist the military in carrying out its statutory search and rescue (SAR) role is studied. Results are presented of a questionnaire to determine the available resources and general attitude. Existing civilian SAR groups are assessed to determine strengths and weaknesses of each type of organization. The role of federal and provincial government departments is explained. Recommendations include the development of a national volunteer SAR organization, which can be implemented in stages. GRA

N80-19051# Perceptronics, Inc., Woodland Hills, Calif.
AIRCRAFT EMERGENCY DECISIONS: COGNITIVE AND SITUATIONAL VARIABLES Annual Technical Report
Rosemarie Hopf-Weichel, Luigi Lucaccini, Joseph Saleh, and Amos Freedy Jul. 1979 171 p refs
(Contract F49620-78-C-0067; AF Proj. 2313)
(AD-A077413; PATR-1065-79-7; AFOSR-79-1175TR) Avail: NTIS HC A08/MF A01 CSCL 01/2

Military aircraft accidents are important not only to the individuals directly involved, but also to those responsible for preparing and maintaining combat-ready forces for the nation's defense. This report addresses problems underlying aircraft emergency situations. A literature review provided background information, and an analysis of selected accident reports. A workshop was convened to review the state-of-the-art of aircrew emergency decision training, safety research, and behavioral decision theory. A selected set of emergency situations was the basis of a preliminary classification of aircraft emergency situations in terms of several situational and decision making attributes. The classification is based on data derived from interviews with experienced military flying personnel. A taxonomy of emergency situation types was developed, incorporating both situational and task specific elements as cognitive attributes of the decision tasks performed under emergency conditions. On the basis of the taxonomy, three classes of emergency situations were found to be of interest: Situation 1 (predictable) Situation 2 (partly predictable), and Situation 3 (unpredictable). Initial training guidelines are suggested in light of the cognitive requirements of each class. GRA

N80-19052# RAND Corp., Santa Monica, Calif.
AIRCRAFT ICING DURING LOW-LEVEL FLIGHTS Interim Report
Robert R. Rapp Nov. 1979 19 p refs
(Contract F49620-77-C-0023)
(AD-A078843; RAND/N-1311-AF) Avail: NTIS
HC A02/MF A01 CSCL 91/2

The reasons why icing may hinder low and slow flights are presented. A crude measure of the potential of icing near the ground is presented and it is shown that, by this measure, icing may be a serious problem when flying over the higher terrain

of central Europe. Some suggestions for improving the measure of icing potential are given. GRA

N80-19053# Stencel Aero Engineering Corp., Asheville, N. C.
PROTOTYPE DEVELOPMENT PASSIVE, SEAT-MOUNTED LIMB RETENTION SYSTEM Final Report, Sep. 1977 - May 1979
May 1979 94 p refs
(Contracts N62269-77-C-0251; WF140000)
(AD-A076331; NADC-79201-60) Avail: NTIS HC A05/MF A01 CSCL 01/3

It has been well documented that the predominant cause of injury (both major and minor) occurring from combat ejections during the Southeast Asia conflict was due to flailing of the extremities as a result of increased ejection speed. A prototype passive seat mounted limb retention system was developed and manufactured which does not require the aircrewman to wear any additional devices or fasten additional restraint connections. It will not, in any way, compromise his movement in the cockpit or his control of the aircraft. This functional prototype device will undergo feasibility testing to determine acceptability for further development. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N80-19054# Federal Aviation Administration, Washington, D. C.
AIRBORNE RADAR APPROACH SYSTEM FLIGHT TEST EXPERIMENT Final Report
L. D. King and R. J. Adams Oct. 1979 127 p refs
(Contract DOT-FA79WA-4293)
(AD-A077900; FAA-RD-79-99) Avail: NTIS HC A07/MF A01 CSCL 17/7

The performance of airborne radar as an approach aid is analyzed using data from the airborne radar approach (ARA) system flight tests experiment. The experiment design, equipment used, and test objectives are reviewed. The ARA tests were performed utilizing the Bendix RDR-1400a airborne radar system. The test vehicle was a CH-53A helicopter. Test airspace environments included airport, remote sites, and offshore areas. Flight tests for ARA accuracy and procedures development were performed in both skin paint and single beacon radar operating modes. The technical and operating performance, in flight considerations, the development of pilot procedures, and detailed accuracy data for each area of testing are discussed. A.W.H.

N80-19055*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
NAVIGATION SYSTEMS FOR APPROACH AND LANDING OF VTOL AIRCRAFT
Stanley F. Schmidt and Richard L. Mohr Oct. 1979 63 p refs
(Contract NAS2-9430)
(NASA-CR-152335; AMA-79-15) Avail: NTIS HC A04/MF A01 CSCL 17G

The formulation and implementation of navigation systems used for research investigations in the V/STOLAND avionics system are described. The navigation systems prove position and velocity in a cartesian reference frame aligned with the runway. They use filtering techniques to combine the raw position data from navaids (e.g., TACAN, MLS) with data from onboard inertial sensors. The filtering techniques which use both complementary and Kalman filters, are described. The software for the navigation systems is also described. R.E.S.

N80-19056*# Ohio Univ., Athens. Avionics Engineering Center.
ANALYSIS OF FIRST AND SECOND ORDER BINARY QUANTIZED DIGITAL PHASE-LOCKED LOOPS FOR IDEAL AND WHITE GAUSSIAN NOISE INPUTS
Paul R. Blasche Mar. 1980 126 p refs
(Grant NGR-36-009-017)
(NASA-CR-162854; TM-25) Avail: NTIS HC A07/MF A01 CSCL 17G

Specific configurations of first and second order all digital phase locked loops are analyzed for both ideal and additive white gaussian noise inputs. In addition, a design for a hardware digital phase locked loop capable of either first or second order operation is presented along with appropriate experimental data obtained from testing of the hardware loop. All parameters chosen for the analysis and the design of the digital phase locked loop are consistent with an application to an Omega navigation receiver although neither the analysis nor the design are limited to this application. Author

N80-19057# Naval Postgraduate School, Monterey, Calif.
APPLICATION OF LORAN-C POSITIONING TO HYDROGRAPHIC SURVEYING M.S. Thesis
Kurt J. Schnebele Sep. 1979 51 p refs
(AD-A078278) Avail: NTIS HC A04/MF A01 CSCL 08/8

The possible application of hyperbolic Loran-C as a positioning system for hydrographic surveys was investigated. It was found that the present capabilities of the system did not meet the 40 meter (drms) accuracy required for offshore surveys. The use of differential Loran-C techniques and geodetic calibration procedures was examined. A field test was conducted in Monterey Bay, California, using a microwave positioning system to test the accuracy of the West Coast Loran-C chain, specifically the 9940-W and Y rates. Overland propagation corrections for the test area are presented. It was found that scrupulous application of the differential technique and rigorous calibration procedures improved the absolute position accuracy of a mobile Loran-C receiver to something less than 100 meters (drms). GRA

N80-19058# Colorado Research and Prediction Lab., Boulder.
LORAN-C PULSE TRANSIENT PROPAGATION. PART 1: GEOPHYSICAL AND GEOLOGICAL DATA BASE EVALUATION FOR LORAN-C GROUND WAVE PROPAGATION MEDIUM. PART 2: LORAN-C GROUND WAVE SECONDARY PHASE CORRECTIONS OVER NONHOMOGENEOUS PROPAGATION TECHNIQUES. PART 3: AN EXPERIMENTAL PROGRAM TO MEASURE ECD AND TEST THE TRANSIENT SOLUTION, WITH ADDENDUM Final Report, 1 Sep. 1978 - 1 May 1979
J. Ralph Johler, R. H. Doherty, and A. R. Cook May 1979 218 p refs
(Contract DOT-CG-842923-A)
(AD-A077551; CRPLI-78-9-Pt-1; CRPLI-78-9-PT-2; CRPLI-78-9-Pt-3; USCG-D-52-79-Pt-1; USCG-D-52-79-Pt-2; USCG-D-52-79-Pt-3) Avail: NTIS HC A10/MF A01 CSCL 17/7

The geophysical data available for a select propagation path for use in the study of the propagation of a Loran-C pulse is evaluated and recommendations for the initial estimates of ground geoelectric section resistivities is presented. A new rigorous technique for the computation and prediction of loran time difference coordinates from loran receiver geographic coordinates and visa versa is introduced by application to a specific loran overland situation. The full wave theoretical transient solution for the Loran-C pulse is employed. An experimental program to validate the theoretical transient solution for the Loran-C pulse is presented. GRA

N80-19059# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
STANDARD ENGINEERING INSTALLATION PACKAGE, AIR TRAFFIC RADIO CHANNEL CONTROL (ATRCC) EQUIPMENT Final Report
Nov. 1979 90 p refs
(AD-A077648; USACEEIA-SEIP-036) Avail: NTIS HC A05/MF A01 CSCL 17/7

This Standard Engineering Installation Package SEIP provides information for the engineering and installation of ATRCC facilities worldwide. Information provided consists of site survey data, siting criteria, installation specifications and instructions, a bill

of materials, quality assurance procedures and completion certification format. Information provided must be adapted to the specific ATRCC facility/location by the project engineer.
Author (GRA)

N80-19843# Draper (Charles Stark) Lab., Inc., Cambridge, Mass. Guidance and Navigation Advanced Programs Div.
CRUISE-MISSILE-CARRIER NAVIGATION REQUIREMENTS
George T. Schmidt and Roy H. Setterlund *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 10 p refs (For primary document see N80-19809 10-59)
(Contract F33657-78-C-0473)
Avail: NTIS HC A24/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-19060 Engineering Sciences Data Unit, London (England).
ESTIMATION OF THE ENDURANCE OF CIVIL AIRCRAFT WING STRUCTURES
1979 14 p
(ESDU-79024; ISBN-0-85679-272-1; ISSN-0141-3996) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $386.50

A method of analyzing the cumulative frequency spectrum for an aircraft wing station into discrete loading cycles in preperation for a fatique damage calculation is described. The calculations derive the mean life estimation of a wing structure. The results apply to civil or transport aircraft in which maneuver loadings are small. ESDU

N80-19061# Dynamics Research Corp., Wilmington, Mass. Systems Div.
APPLICATION OF THE ESTIMATION-BEFORE-MODELING (EBM) SYSTEM IDENTIFICATION METHOD TO THE HIGH ANGLE OF ATTACK/SIDESLIP FLIGHT OF THE T-2C JET TRAINER AIRCRAFT. VOLUME 2: SIMULATION STUDY USING T-2C WIND TUNNEL MODEL DATA Final Report
Harold L. Stalford and S. Ramachandran 23 Jun. 1978 275 p refs 3 Vol.
(Contract N62269-76-C-0342)
(AD-A079923; R-254U-Vol-2; NADC-76097-30-Vol-2; Rept-1273-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 20/4

This report presents the results of a feasibility study of the Estimation-Before-Modeling (EBM) method for aerodynamic parameter identification in the stall/post stall flight regimes. The feasibility study is conducted by processing synthetic flight data generated by exciting a wind tunnel model of the Navy's T-2C, a light jet trainer aircraft. It is carried out under realistic conditions by using the controls and the initial conditions of sixteen actual T-2C flight test data records to generate the sixteen synthetic maneuvers used in the study. The synthetic data are corrupted by realistic measurement noise levels representative of the actual. The EBM method is a two stage process. In the first stage, the corrupted data are processed one maneuver at a time using an extended Kalman-Bucy filter/Bryson-Frazier smoother to obtain estimated values of the states and of the forces and moments acting on the aircraft. In the second stage, subspace modeling together with a step-wise multiple linear regression technique is used to process the estimated values from all sixteen maneuvers together in parallel to identify a global state/control dependent model of the three force coefficients and the three moment coefficients. The identified global model compares well with the true values of the T-2C wind tunnel model. The EBM method is demonstrated to accurately identify the high nonlinearities of the T-2C wind tunnel model. The prediction accuracy of the identified global model is shown to be excellent by a comparison of the responses for a new maneuver and for the original sixteen maneuvers. GRA

N80-19062# Drexel Univ., Philadelphia, Pa.
SIGNIFICANCE OF LARGE SCATTER OF COMPOSITE PROPERTIES TO AIRCRAFT RELIABILITY Final Report
Pei Chi Chou and Robert Croman Sep. 1979 48 p refs
(Contract N62269-78-C-0267)
(AD-A077804; NADC-78094-60) Avail: NTIS HC A03/MF A01 CSCL 01/3

Statistical calculations have been made for the static load reliability of an aircraft fleet assuming typical metallic and composite strength distributions. A factor of safety is defined as the element strength divided by the 'weakest of the fleet' strength. Element strength is typical 'A' or 'B' basis material allowables. 'Weakest of the fleet' strength is calculated statistically assuming each aircraft to be made up of a realistic arrangement (in-series or in-parallel) of critical elements. Similar calculations are also made for fatigue life. It is shown that the reliability of the current damage tolerant design, such as multiple load path and crack stoppers, can be specified in quantitative terms. GRA

N80-19063*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
CLOSED LOOP MODELS FOR ANALYZING ENGINEERING REQUIREMENTS FOR SIMULATORS Final Report
Sheldon Baron, Ramal Muralidharan, and David Kleinman Feb. 1980 232 p refs
(Contract NAS1-14449)
(NASA-CR-2965) Avail: NTIS HC A11/MF A01 CSCL 14B

A closed loop analytic model, incorporating a model for the human pilot, (namely, the optimal control model) that would allow certain simulation design tradeoffs to be evaluated quantitatively was developed. This model was applied to a realistic flight control problem. The resulting model is used to analyze both overall simulation effects and the effects of individual elements. The results show that, as compared to an ideal continuous simulation, the discrete simulation can result in significant performance and/or workload penalties. J.M.S.

N80-19064# Grumman Aerospace Corp., Bethpage, N.Y.
CREW STATION DESIGN FACILITY FEASIBILITY STUDY Final Technical Report, Sep. 1977 - Dec. 1978
S. LaCarrubba May 1979 189 p
(Contract F33615-77-C-3067; AF Proj. 2403; AF Proj. 6190)
(AD-A078134; AFFDL-TR-79-3037) Avail: NTIS HC A09/MF A01 CSCL 01/3

This report addresses the feasibility of a new and unique facility capable of simulating the total range of lighting conditions experienced in military aircraft crew stations during operational flight. The facility would provide a means for evaluating the impact of extreme illumination levels on the legibility of displays and instruments/panel lighting systems to be incorporated in advanced crew stations. This facility would interface with the flight simulation test facilities already established at the Flight Control Development Laboratory at WPAFB. At the beginning of this effort, two baseline lighting simulation systems were selected for development. One configuration uses an opaque dome shaped lighting enclosure with internal sky illumination sources. The other configuration uses a translucent enclosure with external sky illumination sources. Techniques for simulating air-to-air and air-to-ground visual effects, terrain, and motion simulation were investigated for each baseline configuration. The principal conclusion of this study is that real levels of sky and sun luminance, colors and color shading can be simulated and controlled (with some limitations) utilizing the translucent dome lighting enclosure with external sky illumination sources. GRA

N80-19065# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
USAF DAMAGE TOLERANT DESIGN HANDBOOK: GUIDELINES FOR THE ANALYSIS AND DESIGN OF DAMAGE TOLERANT AIRCRAFT STRUCTURES, REVISION A Interim Report, Jan. 1977 - Nov. 1978
Howard A. Wood and Robert M. Engle, Jr. Mar. 1979 447 p Revised
(AF Proj. 2401)
(AD-A078216; AFFDL-TR-79-3021-Rev-A) Avail: NTIS

HC A19/MF A01 CSCL 01/3

This is the first edition of a handbook to support the USAF Airplane Damage Tolerance Requirements contained in MIL-A-83444. It provides specific background data and justification for the detailed requirements of MIL-A-83444 and provides guidelines and state-of-the-art analysis methods to assist contractor and USAF personnel in complying with the intent of the specification and in solving cracking problems in general, for metallic aircraft structures. The material in this document is general enough to be useful in the evaluation of the damage tolerance of in-service aircraft designed and qualified prior to the issuance of MIL-A-83444. The handbook was structured to provide a clear and concise summary of the specification, MIL-A-83444, as well as supporting analysis methods, test techniques, and nondestructive inspection (NDI). Methods are provided as state-of-the-art along with suggested and/or recommended practices, limitations, etc. Copies of appropriate USAF structural specifications are contained as an appendix. GRA

N80-19066# Boeing Aerospace Co., Seattle, Wash.

NEW REMOTELY PILOTED VEHICLE LAUNCH AND RECOVERY CONCEPTS. VOLUME 1: ANALYSIS, PRELIMINARY DESIGN AND PERFORMANCE/COST TRADE STUDIES Final Report, Mar. 1978 - Mar. 1979

Steven J. Baumgartner, James G. Brister, Vinod K. Rajpaul, and Roger F. Yurczyk Jun. 1979 259 p refs

(Contract F33615-78-C-3404; AF Proj. 2402)

(AD-A077475; AFFDL-TR-79-3069-Vol-1) Avail: NTIS

HC A12/MF A01 CSCL 01/3

Dynamic analysis, preliminary design, and performance/cost trade studies of air bag skid and air cushion concepts for launch and recovery of Boeing and Rockwell advanced RPV concepts have been conducted. Dynamic analysis was performed using the six degree-of-freedom computer program EASY. Dynamic simulations included perturbations to steady state flight, landing, and takeoff simulations. Launch and recovery concepts investigated were air bag skid system, air cushion recovery systems, integrated air cushion system, and air cushion launch platform. Performance/cost trade study factors investigated were complexity, fuel requirements, adverse weather capability, ground equipment and facility requirements, survivability/vulnerability, reliability and maintainability, and system acquisition and life cycle costs. Results of the study indicated that an air cushion system is a feasible means of recovery of an RPV such as the Boeing and Rockwell ARPV concepts. An air bag skid with an arrestor system is a feasible approach when minimum field length is a major design factor. Integrated air cushion systems for launch and recovery are greatly affected by engine characteristics. In each case, the launch and recovery systems are shown to be an integral part of the total vehicle design and strongly influence the airframe design. GRA

N80-19067# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.

PRELIMINARY AIRWORTHINESS EVALUATION UH-1H HELICOPTER EQUIPPED WITH MULTIPLE TARGET ELECTRONIC WARFARE SYSTEM (MULTEWS) Final Report, 13 Aug. - 2 Dec. 1977

Vernon L. Diekmann, Sherwood C. Spring, Mathews S. Mathews, III, John F. Hagen, and John S. Tulloch May 1978 187 p refs

(AD-A078476; USAAEFA-77-09) Avail: NTIS

HC A09/MF A01 CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a Preliminary Airworthiness Evaluation (PAE) of a UH-1H helicopter equipped with a Multiple Target Electronic Warfare System (MULTEWS) from 13 August through 2 December 1977. The evaluation was conducted at Edwards Air Force Base, California, and required 45 flights for a total productive flight time of 41 hours. The test program was terminated when the test aircraft sustained major damage during height-velocity testing. The addition of the MULTEWS equipment to the UH-1H airframe caused significant degradation in performance and handling qualities. Changes in the operator's manual should be made to reflect the changes in performance for MULTEWS configured aircraft. The MULTEWS installation also generally degraded the vibration characteristics of the UH-1H, increased structural loads, increased the maintenance workload, and degraded aircraft crashworthiness. The degradation in performance and handling qualities as well as the excessive vibrations and structural loads in the MULTEWS configured aircraft were attributed to the extremely high drag and turbulent wake of the externally mounted MULTEWS components. GRA

N80-19068# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

DIGITAL COMPUTER SOLUTION OF AIRCRAFT LONGITUDINAL AND LATERAL DIRECTIONAL DYNAMIC CHARACTERISTICS Final Report

John M. Griffin, Robert B. Yeager, Larry B. Jordan, and David A. Ratino Jul. 1979 173 p refs Revised

(AD-A078672; AFFDL-TR-78-203) Avail: NTIS

HC A08/MF A01 CSCL 01/3

Two FORTRAN IV computer programs are presented for the solution of aircraft longitudinal and lateral-directional transfer function factors and dynamic characteristics. The longitudinal program solves for the three-degree-of-freedom dynamic characteristics (phugoid damping ratio and natural frequency, short period damping ratio and natural frequency, etc.) and the numerator factors of the alpha, u, theta, h, and vertical acceleration transfer functions. The lateral-directional program solves for the three-degree-of-freedom characteristics (Dutch roll damping ratio and natural frequency, roll and spiral mode time constants, etc.) and the numerator factors of the beta, phi, y, and lateral acceleration transfer functions. In addition, some time histories and specialized handling qualities parameters can be computed and printed out. The equations and their underlying assumptions are discussed. The two complete computer programs are shown, and the input, output, and program functions are discussed. GRA

N80-19069# Human Engineering Labs., Aberdeen Proving Ground, Md.

A STUDY OF THE CANOPY DESIGN FOR THE ADVANCED ATTACK HELICOPTER BY USE OF COMPUTER GRAPHICS Final Report

Christopher C. Smith Aug. 1979 137 p refs

(AD-A078291; HEL-TM-13-79) Avail: NTIS

HC A07/MF A01 CSCL 01/3

A package of computer programs has been developed for use in helicopter canopy design. The programs compute point-wise measures of three important design factors for the transparent surfaces of an attack helicopter canopy. These factors are: (1) the internal glare; (2) the external glint; and (3) the optical distortions exhibited by the canopy design. The programs have been applied to modifications in the present canopy design on the YAH-64 Advanced Attack Helicopter. The results suggest that reduced internal glare is possible with slight additional glint and distortion by displacing the side windows 4 inches from the plane of the frame vertices and rotating the axis of curvature of the top window by 90 degrees and displacing it 1.5 inches. GRA

N80-19070# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Flight Systems Engineering.

DEVELOPMENT OF A NORMALIZED PROBABILITY DISTRIBUTION FOR LATERAL LOAD FACTORS DUE TO AIRCRAFT GROUND TURNING Final Report

John W. Rustenburg Aug. 1979 41 p refs

(AF Proj. 139A)

(AD-A077047; ASD-TR-79-5037) Avail: NTIS

HC A03/MF A01 CSCL 01/3

It was desirable to determine the expected frequency of occurrence of lateral load factors due to aircraft ground turning maneuvers for a specified airplane service life. In order to accomplish this determination, published and unpublished ground operations data measured on a C-141-A, DC-9-15, 727-100, KC-135, and F-105D aircraft was condensed and evaluated, and used in the development of a normalized side load factor probability distribution for ground turning. The normalized distribution can be used to predict the expected lateral load factor spectrum due to ground turns for any aircraft. A subordinate analysis of KC-135 and FB-111A data provided a normalized probability distribution of lateral load factor applicable to taxiing and landing. GRA

N80-19071# Army Command and General Staff Coll., Fort Leavenworth, Kansas.

THE F-16 WILD WEASEL: A FEASIBILITY STUDY M.S. Thesis. Final Report
Byron L. Huff 8 Jun. 1979 63 p refs
(AD-A077050) Avail: NTIS HC A04/MF A01 CSCL 17/4

This study attempts to determine the feasibility of the Wild Weasel proposal being made by General Dynamics Corporation. The investigation covers the NATO threat, a brief history of the Wild Weasel; the capabilities of the current Wild Weasel (F-4G Phantom); the capabilities of the F-16 Wild Weasel; and a cost comparison of the F-16 and F-4G Wild Weasel aircraft. The investigation reveals that an advanced Wild Weasel is necessary to contend with the Soviet air defense system and to be compatible with near-future Allied fighter aircraft. GRA

N80-19072# Dynamics Research Corp., Wilmington, Mass. Systems Div.
APPLICATION OF THE ESTIMATION-BEFORE-MODELING (EBM) SYSTEM IDENTIFICATION METHOD TO THE HIGH ANGLE OF ATTACK/SIDESLIP FLIGHT OF THE T-2C JET TRAINER AIRCRAFT. VOLUME 3: IDENTIFICATION OF T-2C AERODYNAMICS STABILITY AND CONTROL CHARACTERISTICS FROM ACTUAL FLIGHT TEST DATA Final Report
Harold L. Stalford 11 Apr. 1979 254 p refs 3 Vol.
(Contract N62269-76-C-0342)
(AD-A079924; R-287U-Vol-3; NADC-76097-30-Vol-3; Rept-1273-Vol-3) Avail: NTIS HC A12/MF A01 CSCL 20/4

This volume presents the results of the application of the Estimation-Before-Modeling (EBM) System Identification Method to high angle of attack/sideslip flight test data of the T-2C Jet Trainer aircraft. Eighteen maneuvers consisting of over 600 seconds of 20 hertz data are processed. An extended Kalman-Bucy filter/Bryson-Frazier smoother is used in the first step to provide state estimates and measurement biases and scale factors. In the second step of the EBM method, the step-wise multiple linear regression technique and subspace modeling are used to identify detailed models of C sub y, C sub l, C sub n and C sub m. Partial results are given for C sub x and C sub z. The state and control derivatives of the identified model agree well with the wind tunnel model. Most of the identified dynamic derivatives compare well with the theoretically predicted value at low alpha and some compare well at high alpha. GRA

N80-19073# Dynamics Research Corp., Wilmington, Mass. Systems Div.
APPLICATION OF THE ESTIMATION-BEFORE-MODELING (EBM) SYSTEM IDENTIFICATION METHOD TO THE HIGH ANGLE OF ATTACK/SIDESLIP FLIGHT OF THE T-2C JET TRAINER AIRCRAFT. VOLUME 1: EXECUTIVE SUMMARY Final Report
Harold L. Stalford 12 Nov. 1979 61 p refs 3 Vol.
(Contract N62269-76-C-0342)
(AD-A080025; R-303U-Vol-1; NADC-76097-30-Vol-1; Rept-1273-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report (Volume 1) summarizes the development and application of the Estimation-Before-Modeling (EBM) method for aircraft parameter identification in the non-linear flight regime. The method utilizes a Two-step approach wherein model independent states, forces and moments are first estimated and then state and control dependent model parametes are obtained using a Stepwise Multiple Linear Regression (SLMR) approach. In the second step (SLMR) the angle of attack and sideslip and control input space for all available flight data is divided into small subspaces and force and moment coefficients are modeled within each subspace. The method is applied to both simulated and actual flight data for a T-2C jet trainer aircraft in the stall and post-stall flight regimes. Volumes 2 and 3 of this report present detailed description of the EBM method and its application. GRA

N80-19074# Naval Air Development Center, Warminster, Pa.
PROCEEDINGS OF A WORKSHOP ON V/STOL AIRCRAFT AERODYNAMICS, VOLUME 1
C. Henderson and M. F. Platzer May 1979 604 p refs Workshop held in Monterey, Calif., 16-18 May 1979
(AD-A079115) Avail: NTIS HC A99/MF A01 CSCL 01/3

This report contains the proceedings of the Workshop on V/STOL Aircraft Aerodynamics held at the Naval Postgraduate School on May 16 to 18, 1979. This workshop was sponsored by the Naval Air Development Center. The workshop participants included representatives from industry, government, universities and abroad. GRA

N80-19075# Foster-Miller Associates, Inc., Waltham, Mass.
ANALYSIS OF TRUNK FLUTTER IN AN AIR CUSHION LANDING SYSTEM Final Report
Ashok B. Boghani and Roger B. Fish Aug. 1979 114 p refs
(Contract F33615-78-C-3412; AF Proj. 2307)
(AD-A079008; WP-7819; AFFDL-TR-79-3102) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report deals with explaining the occurrence of flutter in the Air Cushion Landing System (ACLS) trunks and suggesting means of suppressing it. Observations of flutter in several ACLS trunks indicate that the flutter is caused by the interaction between the trunk membrane and the flow at the trunk bottom. The flow creates a negative stiffness effect at the bottom which, if larger than the positive stiffness due to the tension of the trunk, induces flutter. A computer simulation based on this model succeeds in predicting the flutter observed in the XC-8A tests. Suggestions on solving the flutter problem are based on either modifying the trunk or modifying the flow. Computer simulations of several suggestions indicate that: (1) Providing a minimum gap; (2) Lowering the separation point; (3) chaning the operation conditions show good promise in suppressing the flutter. Two other suggestions, not simulated, which also have good potential for flutter suppression are: (1) Incorporating circular trunk, and (2) Incorporating hybrid trunk. GRA

N80-19076# Boeing Military Airplane Development, Seattle, Wash.
EASY ACLS DYNAMIC ANALYSIS, VOLUME 2. PART 2: COMPONENT COMPUTER PROGRAMS Final Report, Apr. 1977 - Jun. 1979
M. K. Wahi, G. S. Duleba, and P. R. Perkins Sep. 1979 296 p refs
(Contract F33615-77-C-3054; AF Proj. 2404)
(AD-A079803; AFFDL-TR-79-3105-Vol-2-Pt-2) Avail: NTIS HC A13/MF A01 CSCL 09/2

This volume contains a detailed description of the component subroutines and of other standard functions/subroutines which are used in the EASY dynamic analysis program. Macro-flow charts and some micro-flowcharts and listings are included. Sample output is included where appropriate. GRA

N80-19077# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THRUST VECTORING TO ELIMINATE THE VERTICAL STABILIZER M.S. Thesis
Roy Edward LaFroth Dec. 1979 134 p refs
(AD-A079852; AFIT/GAE/AA/79D-9) Avail: NTIS HC A07/MF A01 CSCL 01/3

Root locus analysis techniques are used to design an active thrust vector control system to provide the directional stability for an F-111 without the vertical stabilizer. A linear analysis of the lateral-directional modes is performed for the aircraft both with and without the vertical stabilizer. The aircraft with the vertical stabilizer is used as a baseline. Computer histories for discrete atmospheric turbulence and a covariance analysis for random turbulence are used for the evaluation. It is found that the thrust vector control produces a response as good as or better than the baseline aircraft. Requirements for the thrust vector deflection and rate of deflection are generated. The lowest possible rate of deflection for acceptable flying qualities is shown to be 1 rad/sec. GRA

N80-19078# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MINIMUM TIME TURNS WITH THRUST REVERSAL M.S. Thesis
Thomas L. Johnson Dec. 1979 77 p refs
(AD-A079851; AFIT/GAE/AA/79D-6) Avail: NTIS HC A05/MF A01 CSCL 01/2

The object of this study is to find the optimal trajectories and corresponding minimum turning times for a high performance aircraft with and without thrust reversal to perform a prescribed turn, and then to compare those trajectories and times to evaluate

the benefit of thrust reversal. Optimal control theory is applied to solve the minimum time to turn optimal control problem, using a suboptimal control problem approach and a second-order parameter-optimization method. The results of the study found that the suboptimal control approach was effective in solving the problem, that thrust reversal is beneficial in reducing turning time if the aircraft's initial velocity is above the corner velocity, and that thrust reversal is not beneficial in performing a minimum time turn without losing energy. GRA

N80-19079# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Aerospace Power Div.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF AIRCRAFT HYDRAULIC LINES INCLUDING THE EFFECT OF MEAN FLOW Final Report, Jul. 1977 - Jul. 1979
John H. Pletcher, Jr. Nov. 1979 204 p refs
(AF Proj. 3145)
(AD-A079746; AFAPL-TR-79-2104) Avail: NTIS HC A11/MF A01 CSCL 01/3

A mathematical model of a fluid transmission line was developed which included the effect of mean flow coupling with oscillatory flow. The analysis centered on solving the nonhomogeneous confluent hypergeometric equation with complex parameters using an infinite series and evaluating the solution using Ward's method. Experiments were run using an aircraft hydraulic system. The frequency response, vibration displacement, and standing pressure half wave were measured in a straight line and a line with bends for flow rates up to 9.5 gpm. A clampon transducer, which did not disturb the flow and could be easily moved, was used for the pressure measurements. In the absence of vibration the clampon transducer measurements were within 5% of readings taken with a conventional Statham in-line transducer. A sensitivity analysis showed the effect of small changes in geometry, temperature, steady-state pressure, fluid properties, entrained air content, and element volume. Using the new mathematical model, the attenuation and phase constant were calculated for hydraulic and air lines. Results compared well with experiment and published data. The new analysis and line model provide a means for the fluid systems engineer to accurately account for mean flow effects. GRA

N80-19080# Goodyear Aerospace Corp., Litchfield Park, Ariz.
THE FABRICATION AND TESTING OF PROTOTYPE UH-1 AIRCRAFT WINDSHIELDS MANUFACTURED WITH A SHEET INTERLAYER Final Report, 29 Mar. 1978 - 29 Jan. 1979
James O. Coast Aug. 1979 65 p refs
(Contract DAAG46-78-C-0008)
(AD-A077711; GERA-2378; USAAVRADCOM-TR-79-32; AMMRC-TR-79-50) Avail: NTIS HC A04/MF A01 CSCL 01/3

This program was conducted to determine the feasibility of fabricating helicopter windshields with a designated urethane sheet interlayer. Four sets of full-size UH-1 windshields consisting of two each of two different constructions were fabricated and tested. GRA

N80-19081# Lockheed-Georgia Co., Marietta.
AERODYNAMIC INVESTIGATION OF C-141 LEADING EDGE MODIFICATION FOR CRUISE DRAG REDUCTION, VOLUME 2 Final Report, Jun. 1977 - Sep. 1978
W. T. Blackerby and P. R. Smith Jun. 1979 319 p refs
(Contract F09603-77-A-0204)
(AD-A077688; LG78ER0233-Vol-2; AFFDL-TR-79-3059-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 01/3

A study of the aerodynamic design and high speed wind tunnel investigation of wing leading edge modifications for cruise drag reduction on the C-141 aircraft has been completed. Also investigated were the effects of a wing swept tip extension and trailing edge anti-drag bodies. These modifications were tested in the AEDC 16-Foot Transonic Facility, using a 0.044 scale C-141B model, to determine the effects on C-141 cruise aerodynamic characteristics and wing chordwise pressure distributions. Design of the leading edge modifications was based on the use of transonic wing theory, transonic airfoil theory and experience previously gained with a two-dimensional airfoil leading edge modification program. Force data results were analyzed to determine the effects on C-141 cruise drag, drag rise characteristics and cruise performance. Correlations were made with transonic theory using the measured chordwise pressure distributions. A fuel and cost savings evaluation was made of the selected leading edge configuration based on measured and predicted cruise performance improvements. GRA

N80-19082# Douglas Aircraft Co., Inc., Long Beach, Calif.
EVALUATION OF AIRCRAFT WINDSHIELD MATERIALS IN A SIMULATED SUPERSONIC FLIGHT ENVIRONMENT Final Report, May 1978 - Mar. 1979
J. B. Hoffman Jun. 1979 200 p refs
(Contract F33615-75-C-3105; AF Proj. 2202)
(AD-A078673; MDC-J7186; AFFDL-TR-79-3058) Avail: NTIS HC A09/MF A01 CSCL 01/3

A series of wind tunnel tests were conducted at Mach 2.4, 2.6 and 3.0 to determine material survivability and optical clarity for a variety of small, flat laminated and monolithic specimens of acrylic, urethane, glass, silicone and polycarbonate materials for potential use in the design of Mach 3.0 aircraft windshields. Twenty-seven specimens were tested to determine the material limitations and capabilities, which included an investigation of specific edge designs and the effect of edge structure on temperature distribution. The tests were conducted in a Mach 6 wind tunnel which utilized a shock generator to reduce the air stream to the desired flow across the outer surface of the specimens. The specimens were individually mounted in a pressurized box to provide a simulated cabin environment on their inner surface. Grid line photography was used to delineate inflight and permanent optical distortion. Material damage was evaluated and thermal gradients were documented. Prior to this test program, the aerodynamic effect of a Mach 2.4 through Mach 3.0 flight environment on transparent plastic and interlayer materials was unknown. The survival of these specimens demonstrated that laminated configurations consisting of acrylic/silicone/polycarbonate or urethane/urethane/polycarbonate, as well as glass/silicone/polycarbonate are viable candidates for aircraft windshields that would be exposed to a Mach 3.0 flight environment for short exposures. GRA

N80-19083# Sikorsky Aircraft, Stratford, Conn. Sikorsky Aircraft Div.
NADC ABC ROTOR MAPS Final Report
David T. Balsh 29 Jun. 1979 32 p refs
(Contract N62269-79-M-3221)
(AD-A078802; SER-69060) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report is the formal documentation of the rotor performance maps and includes a description of the anticipated 1995 IOC rotor configuration on which the rotor maps are based and substantiation for the methodology used in the generation of the maps. The rotor maps themselves are presented in the appendix of this report in both HESCOMP transcript sheet form and in computer input code form, (the latter is a copy of the listing obtained from a set of punched computer cards which will have been presented to NAVAIRDEVCEN. GRA

N80-19084# RAND Corp., Santa Monica, Calif.
MEASURING TECHNOLOGICAL CHANGE IN JET FIGHTER AIRCRAFT Interim Report
William L. Stanley and Michael D. Miller Sep. 1979 124 p refs
(Contract F49620-77-C-0023)
(AD-A077393; RAND/R-2249-AF) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report develops a technique to characterize the level of and change in jet fighter air vehicle technology. It complements other methods used to assess technological risks of new fighter concepts and to compare U.S. and foreign fighter technology. The technique uses multiple regression to relate time of appearance of an aircraft design to its level of technology. Resulting expressions measure performance consequences of technological advance in terms of such parameters as specific power, sustained load factor, Breguet range, and payload fraction. Measured in these terms, the rate of advance of U.S. fighter air vehicle technology is declining. The monetary cost of increasing the rate of advance could be very high. In the future, designers will have to balance increasingly difficult improvements in air vehicle technology against improvements in other technologies (such as

avionics or armament) that also enhance combat effectiveness. GRA

N80-19085# Systems Technology, Inc., Hawthorne, Calif.
DEVELOPMENT OF VTOL FLYING QUALITIES CRITERIA FOR LOW SPEED AND HOVER Final Report
Roger H. Hoh and Irving L. Ashkenas Dec. 1979 150 p refs
(Contract N62269-77-C-0278)
(AD-A079911; STI-TR-1116-1; NADC-77052-30) Avail: NTIS HC A07/MF A01 CSCL 01/2

A classification scheme has been developed to account for outside visual cues and cockpit displays in determining the required equivalent system forms for low speed and hover. Tentative criteria are presented in terms of a visibility scale which quantifies environmental conditions for the intended mission in a more fine-grained manner than simply specifying IMC or VMC. There are indications that rate and attitude systems may be used for partial IMC conditions but that a translational rate command system is required for low speed and hover in zero visibility. In general, most experiments indicate that advanced displays are not a substitute for augmentation. Tentative limiting conditions are defined for rate and attitude systems, but more data are required to define handling qualities for translational rate command systems. Since the existing data base is primarily oriented toward command/response characteristics, definition of the limiting conditions for turbulence and large discrete wind shears also requires more data. GRA

N80-19086# Systems Research Labs., Inc., Dayton, Ohio. Electronic Warfare Center.
DEVELOPMENT OF A VISUAL INSPECTION TECHNIQUE (OPTICAL ASSESSMENT OF AIRCRAFT TRANSPARENCIES)
Frank E. Ward, Anthony J. DeFrances, and Robert G. Eggleston (AMRL) Wright-Patterson AFB, Ohio AMRL Oct. 1979 129 p refs
(Contract F33615-77-C-0535; AF Proj. 2313)
(AD-A079369; AMRL-TR-79-67) Avail: NTIS HC A07/MF A01 CSCL 01/3

This work assessed the utility of different types of targets and psychophysical procedures for evaluating optical distortions induced by aircraft windscreens. Targets, both static and dynamic, were viewed through windscreens and the amount of distortion was judged by a magnitude estimation procedure. Judgements were analyzed by discriminant analysis to identify the targets that best facilitated good discrimination among windscreens. A psychophysical matching procedure was also evaluated. In some conditions, photographic representations of the distortion patterns were evaluated using the magnitude estimation procedures. The results of the work show that windscreen-induced distortion is a multidimensional attribute and is best evaluated by multiple inspection procedures. Specific static and dynamic targets are recommended for use in evaluating distortion. Correlations between physical measures of distortion and psychophysical judgments are reported as well as reliabilities for selected experiments. Suggestions for improvements and further work are included. GRA

N80-19087# Kay and Associates, Inc., Mount Prospect, Ill.
[AVIONICS LOGISTICS SUPPORT INCLUDING V/STOL, LAMPS, AND INSTRUMENT REPAIR] Final Report, 5 Dec. 1977 - 28 Aug. 1979
2 Nov. 1979 30 p refs
(Contract N60921-78-C-0014)
(AD-A077460) Avail: NTIS HC A03/MF A01 CSCL 01/3

This unclassified report contains information on the contractual effort of Kay and Associates, Inc. in support of the Naval Surface Weapons Center and the Naval Air Systems Command. The efforts encompassed a study concerning VSTOL vs LAMPS, Sea Based Air requirements, composition and configuration of future ship weapons, and screening of Source, Maintenance and Recoverability code changes. Additionally, this effort included the research and analysis of candidate instrument repair facilities with a view toward selecting specific instruments for various weapons systems for increased repair capability at the Intermediate level of Maintenance. GRA

N80-19088# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
A COMPUTER PROGRAM FOR ESTIMATING AIRCRAFT LANDING DISTANCE Interim Report, Aug. 1977 - Jul. 1979
Kervyn D. Mach Aug. 1979 39 p
(AF Proj. 3066)
(AD-A077169; AFAL-TR-79-2086) Avail: NTIS HC A03/MF A01 CSCL 01/2

This report describes a computer program which will estimate the runway length required to land a specified airplane. The program accepts inputs describing the aircraft gross weight, velocity, drag, and engine performance and computes the landing distance on specified runway surfaces. Sample results for a time-engine STOL transport are included. The computer program is described along with instructions for its use. GRA

N80-19089# National Technical Information Service, Springfield, Va.
REMOTELY PILOTED VEHICLES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Nov. 1975 - Nov. 1979
Guy E. Habercom, Jr. Dec. 1979 270 p Supersedes NTIS/PS-78/1246; NTIS/PS-77/1143; NTIS/PS-76/1034; NTIS/PS75-876
(PB80-802119; NTIS/PS-78/1246; NTIS/PS-77/1143; NTIS/PS-76/1034; NTIS/PS-75/876) Avail: NTIS HC $30.00/MF $30.00 CSCL 01C

Operation of vehicles under remote guidance and control is investigated. Aircraft, drones, and extraterrestrial explorers are among the areas researched. This updated bibliography contains 262 abstracts, 35 of which are new entries to the previous edition. GRA

N80-19090# Advisory Group for Aerospace Research and Development, Paris (France).
DYNAMIC ENVIRONMENTAL QUALIFICATION TECHNIQUES
Nov. 1979 40 p refs Meeting held in Williamsburg, Va., Apr. 1979
(AGARD-R-682; ISBN-92-835-1342-8) Avail: NTIS HC A03/MF A01

Dynamic qualification test procedures are discussed with emphasis on determining the resistance of equipment to the effects of environments peculiar to military operations and requirements. For individual titles, see N80-19091 through N80-19093.

N80-19091# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
APPLICATION OF MIL-STD-810C DYNAMIC REQUIREMENTS TO USAF AVIONICS PROCUREMENTS
J. H. Wafford *In* AGARD Dyn. Environ. Qualification Tech. Nov. 1979 11 p refs (For primary document see N80-19090 10-05)
Avail: NTIS HC A03/MF A01

The vibration requirements and the application of these requirements to the procurement of avionics equipment are discussed. Data obtained from external noise measurements and aerodynamically induced vibration are reported. R.C.T.

N80-19092# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany). Unternehmensbereich Flugzeuge.
DYNAMIC ENVIRONMENTS AND TEST SIMULATION FOR QUALIFICATION OF AIRCRAFT EQUIPMENT AND EXTERNAL STORES
G. Haidl, C. Lodge (British Aerospace Aircraft Group, Warton, England), and H. Zimmermann (Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen, West Germany) *In* AGARD Dyn. Environ. Qualification Tech. Nov. 1979 13 p refs (For primary document see N80-19090 10-05)
Avail: NTIS HC A03/MF A01

Equipment within an aircraft was exposed to a wide variety of environments during ground and flight operations in order to determine its reliability and performance under conditions which will be encountered during its service life. Test specifications based upon real environments, but simplified for simulation, were

established. Significant observations and results are reported. R.C.T.

N80-19093# British Aerospace Aircraft Group, Bristol (England).
CIVIL AIRCRAFT EQUIPMENT ENVIRONMENT QUALIFICATION TECHNIQUES
B. W. Payne and G. H. F. Nayler *In* AGARD Dyn. Environ. Qualification Tech. Nov. 1979 10 p refs (For primary document see N80-19090 10-05)
Avail: NTIS HC A03/MF A01

The vibration testing of civil aircraft equipment is discussed. The environmental test levels that are existing in international requirements for civil aircraft are presented. R.C.T.

N80-19094# Advisory Group for Aerospace Research and Development, Paris (France).
PARAMETER IDENTIFICATION
Nov. 1979 353 p refs Lecture held in Delft, Netherlands, 29-30 Oct. 1979 and in London, 1-2 Nov. 1979
(AGARD-LS-104; ISBN-92-835-1340-1) Avail: NTIS HC A16/MF A01

The present state of the art of aircraft parameter identification techniques is reviewed. A critical appraisal of current methods developed and applied to the problems of analysis of flight test data in a number of NATO countries is given. Particular emphasis is placed on the practical aspects of aircraft parameter estimation to generate information useful for the flight test engineer. For individual titles, see N80-19095 through N80-19104.

N80-19095# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
AIRCRAFT PARAMETER IDENTIFICATION METHODS AND THEIR APPLICATIONS: SURVEY AND FUTURE ASPECTS
P. G. Hamel *In* AGARD Parameter Identification Nov. 1979 26 p refs (For primary document see N80-19094 10-05)
Avail: NTIS HC A16/MF A01

An overall view of the methods for the determination of aircraft flight mechanic parameters from flight tests and the problems associated with them is given. Technologies in the field of instrumentation, data handling, and data processing as well as improved methodologies for optimum control input design are covered. The application spectrum for parameter identification including aircraft handling qualities investigations and acceptance testing is emphasized. J.M.S.

N80-19096*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IDENTIFICATION EVALUATION METHODS
Vladislav Klein *In* AGARD Parameter Identification Nov. 1979 21 p refs (For primary document see N80-19094 10-05)
Avail: NTIS HC A16/MF A01 CSCL 01C

Methods for airplane parameter estimation, the equation error method, output error method, and two advanced methods are presented and their basic properties described. The advanced methods include the maximum likelihood and extended Kalman filter method. For a better understanding of the estimation techniques a first-order scalar differential equation is used as a model of the system under test. Application of the methods to a general multivariable linear system is briefly outlined. A note on the parameter estimation in the frequency domain is also presented. Numerical examples along with the comparison of results from various methods are given. J.M.S.

N80-19097# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
PRACTICAL INPUT SIGNAL DESIGN
E. Plaetschke and G. Schulz (DFVLR, Oberpfaffenhofen, West Germany) *In* AGARD Parameter Identification Nov. 1979 19 p refs (For primary document see N80-19094 10-05)
Avail: NTIS HC A16/MF A01

The design of optimal inputs for identifying stability and control derivatives of the longitudinal and lateral motion of an aircraft is considered. First the purpose of input optimization, the constraints, and an overview of the literature is presented. Then two different procedures of input design are treated in more detail. Starting with investigations in the frequency domain the first method yields a multistep input signal, which fulfills specific spectral requirements. The second way of input design is based on the optimization of different measures of the Fisher information matrix, such as determinant or trace. Depending on the measure used, the designed signals differ with respect to their spectral composition. The discussed input signals, which were used in a flight test program, are compared with respect to the achieved accuracy of the identified stability and control derivatives. J.M.S.

N80-19098# National Aerospace Lab., Amsterdam (Netherlands).
ASPECTS OF FLIGHT TEST INSTRUMENTATION
J. H. Breeman, K. vanWoerkom, H. L. Jonkers, and J. A. Mulder *In* AGARD Parameter Identification Nov. 1979 22 p refs Prepared in cooperation with Technische Hogeschool, Delft, Netherlands (For primary document see N80-19094 10-05)
Avail: NTIS HC A16/MF A01

The design of the instrumentation system for parameter estimation tests is considered. Specifications of instrumentation for nonsteady flight testing are discussed along with general aspects and selection criteria of various transducer types. As practical examples parts of the high accuracy instrumentation systems developed for the determination of performance and stability and control characteristics for dynamic maneuvers are described. Problems of signal conditioning are discussed. J.M.S.

N80-19099# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
ANALYSIS OF AIRCRAFT PERFORMANCE STABILITY AND CONTROL MEASURES
J. A. MUlder, H. L. Jonkers, J. J. Horsten, J. H. Breeman, and J. L. Simons *In* AGARD Parameter Identification Nov. 1979 87 p refs Prepared in cooperation with National Aerospace Lab., Amsterdam (For primary document see N80-19094 10-05)
Avail: NTIS HC A16/MF A01

An overview is presented of the nonsteady flight test technique. Principal elements of this technique which is directed towards time efficient and accurate determination of performance characteristics as well as stability and control characteristics from measurements in nonsteady or quasi-steady flight, are: application of high quality flight test instrumentation systems; accurate reconstruction of the aircraft's motions; identification of nonlinear aerodynamic models; and calculation of performance, stability and control characteristics by correction of nonsteady or quasi-steady flight conditions towards prespecified nominal conditions. Main emphasis is on a tutorial exposition of the first three of these elements. In addition to the tutorial presentation some experimental results of various flight test programs are presented. J.M.S.

N80-19100*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AIRCRAFT IDENTIFICATION EXPERIENCE
Kenneth W. Iliff *In* AGARD Parameter Identification Nov. 1979 35 p refs (For primary document see N80-19094 10-05)
Avail: NTIS HC A16/MF A01 CSCL 01C

Important aspects of estimating the unknown coefficients of the aircraft equations of motion from dynamic flight data are presented. The primary topic is the application of the maximum likelihood estimation technique. Basic considerations that must be addressed in the estimation of stability and control derivatives from conventional flight maneuvers are discussed. Some complex areas of estimation (such as estimation in the presence of atmospheric turbulence, estimation of acceleration derivatives, and analysis of maneuvers where both kinematic and aerodynamic coupling are present) are also discussed. R.E.S.

N80-19101# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
ROTORCRAFT IDENTIFICATION EXPERIENCE
J. Kaletka *In* AGARD Parameter Identification Nov. 1979 32 p refs (For primary document see N80-19094 10-05)
Avail: NTIS HC A16/MF A01

An overview of the identification of stability and control derivatives of the rotorcraft with respect to practical aspects

and applications is presented. First an introduction to the basic dynamics and control of helicopters is given. The helicopter characteristics causing difficulties in the identification are discussed. Measurement and sensor problems are also discussed. Approaches to overcome the difficulties are presented. Emphasis is placed on the following two key elements of the identification procedure: (1) the selection of adequate mathematical models and identifiable derivatives of the helicopter to isolate significant model effects; and (2) possibilities of increasing the information content of flight test data by appropriate system excitation and by multiple-run evaluations. Identification results obtained from simulated and flight test data of helicopters by applying different identification methods are presented. R.E.S.

N80-19102# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
IDENTIFICATION EXPERIENCE IN EXTREME FLIGHT REGIMES
A. Jean Ross *In* AGARD Parameter Identification Nov. 1979 15 p refs (For primary document see N80-19094 10-05)
Avail: NTIS HC A16/MF A01

A mathematical model for identifying stability and control derivatives of fighter aircraft is presented. The principles of the statistical approach are described. The treatment of the nonlinear terms is described and the tests which should be applied to assess the validity of the results are discussed. Selected results from investigations of manoeuvres at high angles of attack are presented to show the types of problems which can be solved, and to illustrate some effects of nonlinearities. R.E.S.

N80-19103# Institut de Mecanique des Fluides de Lille (France).
WIND TUNNEL AND FREE FLIGHT MODEL IDENTIFICATION EXPERIENCE
R. A. Verbrugge, W. Charon, and M. Marchand (DFVLR, Brunswick) *In* AGARD Parameter Identification Nov. 1979 33 p refs (For primary document see N80-19094 10-05)
Avail: NTIS HC A16/MF A01

An overview of different experimental techniques used for parameter identification based on dynamic model tests in wind tunnel or in free flight is presented. The specific domain of application is defined for each test technique. Particular aspects of semi-free and free model tests techniques in wind tunnel or laboratory experiences are described. Data processing from the collection until the application of identification procedure is discussed in terms of (1) the nature and quality of the information, (2) the data acquisition software, (3) the state vector elaboration, and (4) some specific filter aspects and evaluation methods. A set of results illustrate each particular point. A review of the present state of these techniques is given and future field of application is discussed. R.E.S.

N80-19104# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
CLOSED LOOP ASPECTS OF AIRCRAFT IDENTIFICATION
R. Koehler and K. Wilhelm *In* AGARD Parameter Identification Nov. 1979 24 p refs (For primary document see N80-19094 10-05)
Avail: NTIS HC A16/MF A01

Specific problems of system identification applied to highly augmented aircraft with respect to flying qualities assessment are discussed. An introduction to the influence of augmentation system on dynamic response and flying qualities is given. The application of parameter estimation techniques to control loop systems and problems of control loop identification and equivalent system modellization are discussed. R.E.S.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices, and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-19105# Arinc Research Corp., Annapolis, Md.
AVIONICS INTERFACE DATA SUMMARIES: A-10A, EF-111A, F-4J, F-4G, F-15A, F-18A, F-111A, F-111E, F-111F, RF-4C
Oct. 1979 718 p refs
(Contract F33657-71-C-0567)
(AD-A077388; Rept-1750-01-2-2041) Avail: NTIS
HC A99/MF A01 CSCL 01/3

This document is one of a series of reports that describe Avionics interfaces for various USAF aircraft. GRA

N80-19106# Naval Aerospace Medical Research Lab., Pensacola, Fla.
COMPARISON OF SPECIFICATIONS FOR HEAD-UP DISPLAYS IN THE NAVY A-4M, A-7E, AV-8A, AND F-14A AIRCRAFT
Lawrence H. Frank Nov. 1979 65 p refs
(ZF51524004; SF55525401)
(AD-A080047; NAMRL-SR-76-6) Avail: NTIS
HC A04/MF A01 CSCL 01/4

This report provides, within a single document, a compendium of data on Head-Up Displays (HUDs) in U.S. Navy and U.S. Marine Corps aircraft that is germane to a Human Factors assessment of HUD design on pilot performance. The data in this report are compiled from current Naval Air Training and Operating Procedures Standardization (NATOPS) manuals and design specifications for each of the HUD units. Operational HUDs were found to vary dramatically from each other and the military specification for HUDs, MIL-D-81641(AS), with respect to symbology and formating. Furthermore, display clutter was reported by pilots to be a major problem. A comprehensive information processing evaluation of virtual image symbols and formating under dynamic conditions was recommended. Finally, none of the current Navy aircraft has a HUD control panel that complies to MIL-D-81641(AS), the military specification for HUDs. Pilots are required to bring their eyes back into the cockpit to ensure proper switch selection and, consequently, negate the primary purpose of maintaining a head-up mode. GRA

N80-19107# Bunker-Ramo Corp., Wright-Patterson AFB, Ohio.
FLIGHT PATH DISPLAYS Final Report, 15 Mar. - 1 Nov. 1978
Debra A. Warner Jun. 1979 106 p refs
(Contract F33615-78-C-3614; AF Proj. 2403)
(AD-A077181; AFFDL-TR-79-3075) Avail: NTIS
HC A06/MF A01 CSCL 01/3

Aircraft display technology has advanced to the state where the flight path display--an integrated format on which both the vertical and horizontal path are graphically represented--is feasible. This report researches efforts made to design flight paths for use in both fixed wing and rotary wing aircraft. Results from comparison evaluations of flight path and non-flight path displays are discussed and conclusions drawn with respect to desirable display symbology. A hypothetical flight path display designed as a result of the findings in the referenced studies is proposed for future testing and evaluation. GRA

N80-19814# General Research Corp., Santa Barbara, Calif.
VERIFICATION AND VALIDATION OF AVIONIC SIMULATIONS
Sabina H. Saib *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 6 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19832# Royal Aircraft Establishment, Farnborough (England).
SIMULATION OF A NIGHT VISION SYSTEM FOR LOW LEVEL HELICOPTER OPERATIONS
J. N. Barrett *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 24 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19837# British Aerospace Aircraft Group, Brough (England).
THE ROLE OF THE AIRCRAFT MODEL IN AVIONIC SYSTEMS SIMULATION
J. D. Bannister and R. Hicks *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan.

1980 14 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19838# Battelle Columbus Labs., Ohio.
AVIONICS EVALUATION PROGRAM: SIMULATION MODELS FOR THE EFFECTIVENESS ANALYSIS OF AVIONICS
David Welp, Ken Almquist, and Larry Rainey *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 4 p Prepared in cooperation with AFAL, Wright-Patterson AFB, Ohio (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19839# British Aerospace Dynamics Group, Bristol (England).
SIMULATION FOR WHOLE LIFE DEVELOPMENT
R. J. Morrow and R. Richards *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 11 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19840# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
A SIMULATION SUPPORT SYSTEM, THE DEVELOPMENT TOOL FOR AVIONIC SYSTEMS AND SUBSYSTEMS
John C. Ostgaard *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 11 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-19108*# California Univ., Berkeley.
TURBULENCE, COMBUSTION, POLLUTANT, AND STABILITY CHARACTERIZATION OF A PREMIXED, STEP COMBUSTOR
A. T. Ganji and R. F. Sawyer Washington NASA Jan. 1980 215 p refs
(Grant NsG-3028)
(NASA-CR-3230) Avail: NTIS HC A10/MF A01 CSCL 21E

A two dimensional combustion tunnel was constructed to study a lean premixed turbulent propane/air flame stablized behind a rearward facing step. Studied were: (1) the existence and importance of large coherent structures in turbulent reacting and nonreacting free shear layers behind the steps; (2) the effect of inlet temperature and reference velocity on combustion efficiency; (3) CO, NO2 and NO sub x production in the flame; and (4) the blowout and upstream propagation of the flame. In the ranges studied, the large coherent structures dominated both the reacting and the nonreacting free shear layers behind the step. The growth of the vortices and the propagation of the flamer were intimately linked. Vortex pairing was observed to be one of the mechanisms for introduction of fresh reactants into the shear layer and growth of the shear layer. Probe composition measurements of the flame showed that, in the recirculation zone, the reaction was above 99 percent complete, CO and unburnt hydrocarbons were above the equilibrium level NO sub x concentration was far below the equilibrium level and NO2 comprised a negligible fraction of NO sub x. R.E.S.

N80-19109# Calspan Advanced Technology Center, Buffalo, N.Y. Aerodynamic Research Dept.
TESTS OF AN IMPROVED ROTATING STALL CONTROL SYSTEM ON A J-85 TURBOJET ENGINE Final Technical Report, May 1976 - May 1979
Gary R. Ludwig Wright-Patterson AFB, Ohio AFAPL Aug. 1979 76 p refs
(Contract F33615-76-C-2092; AF Proj. 3066)
(AD-A077704; CALSPAN-XE-5933-A-104; AFAPL-TR-79-2060) Avail: NTIS HC A05/MF A01 CSCL 21/5

This report presents the results of testing a fast-acting rotating stall control system on a J-85 turbojet engine under sea level static conditions, both with and without inlet distortion. The control is an electronic feedback control system which uses unsteady pressure signals produced by pressure sensors within the compressor to detect incipient rotating stall and provide a correction signal when such a condition occurs. On the J-85 engine, the correction signal is used to drive a fast-response hydraulic actuator which operates intermediate stage compressor bleed doors and inlet guide vane flaps. The performance of the stall control was tested by closing the bleed doors until rotating stall occurred or until the control anticipated stall and held the bleed doors open. The tests showed that the control is capable of anticipating stall before it occurs and keeping the engine completely clear of stall at speeds up to 80 percent of design speed. No tests were performed above 80 percent of design because opening the bleed doors at such speeds might aggravate the stall rather than clear it. GRA

N80-19110*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF VTO THRUST REQUIREMENTS FOR A V/STOL AIRCRAFT WITH LIFT PLUS LIFT/CRUISE PROPULSION
George E. Turney and John L. Allen Feb. 1980 23 p refs
(NASA-TM-81429; E-351) Avail: NTIS HC A02/MF A01 CSCL 21E

A preliminary assessment was made of the VTO thrust requirements for a supersonic (Type B) aircraft with a Lift plus Lift/Cruise propulsion system. A baseline aircraft with a takeoff gross weight (TOGW) of 13 608 kg (30,000 lb) was assumed. Pitch, roll, and yaw control thrusts (i.e., the thrusts needed for aircraft attitude control in the flight hover mode) were estimated based on a specified set of maneuver acceleration requirements for V/STOL aircraft. Other effects (such as installation losses, suckdown, reingestion, etc.), which add to the thrust requirements for VTO were also estimated. For the baseline aircraft, the excess thrust required for attitude control of the aircraft during VTO and flight hover was estimated to range from 36.9 to 50.9 percent of the TOGW. It was concluded that the total thrust requirements for the aircraft/propulsion system are large and significant. In order to achieve the performance expected of this aircraft/propulsion system, reductions must be made in the excess thrust requirements. J.M.S.

N80-19111*# National Aeronautics and Space Administration, Washington, D. C.
STRUCTURAL ANALYSIS OF HOLLOW BLADES: TORSIONAL STRESS ANALYSIS OF HOLLOW FAN BLADES FOR AIRCRAFT JET ENGINES
A. Ogawa, Y. Sofue, and T. Isobe Oct. 1979 25 p refs Transl. into ENGLISH of "Chukuyoku no Kozokaiseki," Rept. NAL-TR-533 Natl. Aerospace Lab., Tokyo, May 1977, 15 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75718; NAL-TR-533) Avail: NTIS HC A02/MF A01 CSCL 21E

A torsional stress analysis of hollow fans blades by the finite element method is presented. The fans are considered to be double circular arc blades, hollowed 30 percent, and twisted by a component of the centrifugal force by the rated revolution. The effects of blade hollowing on strength and rigidity are discussed. The effects of reinforcing webs, placed in the hollowed section in varying numbers and locations, on torsional rigidity and the convergence of stresses, are reported. A forecast of the 30 percent hollowing against torsional loadings is discussed. A.W.H.

N80-19112# Royal Aircraft Establishment, Farnborough (England).
CONTRIBUTION OF PHOTOELASTIC ANALYSIS TO THE STUDY OF TURBO-ENGINE COMPONENTS
J. L. Guillo Nov. 1979 34 p Transl. into ENGLISH from

AGARD Conf. Proc. No. 248, Apr. 1979
(BR71985; RAE-Lib-Trans-2028) Avail: NTIS
HC A03/MF A01

Photoelastic measurements which determine the local stress concentrations, and the method of stress freezing in the analysis of three dimensional stress states are discussed in relation to jet engine components. The means employed for the preparation and carrying out of freezing operations and the equipment used in the operation are described. Examples of applying photoelastic measurement and stress freezing operations are presented. Emphasis is placed on the determination of the stress intensity factor which governs crack propagation under cyclic stress application. A.W.H.

N80-19113*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
CORE COMPRESSOR EXIT STAGE STUDY. 1: AERODYNAMIC AND MECHANICAL DESIGN
E. A. Burdsall, E. Canal, Jr., and K. A. Lyons. Sep. 1979. 128 p. ref.
(Contract NAS3-20578)
(NASA-CR-159714; PWA-5561-55) Avail: NTIS
HC A07/MF A01 CSCL 21E

The effect of aspect ratio on the performance of core compressor exit stages was demonstrated using two three stage, highly loaded, core compressors. Aspect ratio was identified as having a strong influence on compressors endwall loss. Both compressors simulated the last three stages of an advanced eight stage core compressor and were designed with the same 0.915 hub/tip ratio, 4.30 kg/sec (9.47 lbm/sec) inlet corrected flow, and 167 m/sec (547 ft/sec) corrected mean wheel speed. The first compressor had an aspect ratio of 0.81 and an overall pressure ratio of 1.357 at a design adiabatic efficiency of 88.3% with an average diffusion factor or 0.529. The aspect ratio of the second compressor was 1.22 with an overall pressure ratio of 1.324 at a design adiabatic efficiency of 88.7% with an average diffusion factor of 0.491. R.C.T.

N80-19114# American Inst. of Aeronautics and Astronautics, New York.
THE 4TH INTERNATIONAL SYMPOSIUM ON AIR BREATHING ENGINES
Apr. 1979. 425 p. refs. Symp. held at Lake Buena Vista, Orlando, Fla., 1-6 Apr. 1979
(Grant N00014-77-G-0069)
(AD-A078956) Avail: NTIS HC A18/MF A01 CSCL 21/5

Partial Contents: Inlet Flow Distortion; Operations/Cost/Maintenance; Aeroelasticity/Vibrations; Systems Integration; Fuels and Combustion; 3 Dimensional Flow and Boundary Layer/Shock Separation; Component Developements Compressors; and Ramjets. GRA

N80-19115# Calspan Advanced Technology Center, Buffalo, N.Y. Aerodynamic Research Dept.
BASIC STUDIES OF ROTATING STALL IN AXIAL FLOW COMPRESSORS. Final Report, Jun. 1976 - Apr. 1979
Gary R. Ludwig and Joseph P. Nenni. Sep. 1979. 150 p. refs.
(Contract F33615-76-C-2092; AF Proj. 3066)
(AD-A077690; CALSPAN-XE-5933-A-105;
AFAPL-TR-79-2083) Avail: NTIS HC A07/MF A01 CSCL 21/5

This report presents the results of a theoretical and experimental program aimed at obtaining a sufficient understanding of the rotating stall phenomena such that its onset and properties can be predicted under a wide set of circumstances. The theoretical research covers the development of two dimensional stability theories for compressible flows and the progress towards the development of a three dimensional theory for incompressible flow. The experimental work, performed in an annular cascade facility, studied the effects of rotorstator interference both on the steady-state performance of the blade rows and on rotating stall. The influence of circumferential distortion on the rotating stall boundary for the stage was also determined. Comparisons are made between the experimental results and the predictions of a two dimensional rotating stall stability theory which had been developed previously for incompressible flows. GRA

N80-19116# Calspan Advanced Technology Center, Buffalo, N.Y. Aerodynamic Research Dept.
AERODYNAMIC AND ACOUSTIC INVESTIGATIONS OF AXIAL FLOW FAN AND COMPRESSOR BLADE ROWS, INCLUDING THREE-DIMENSIONAL EFFECTS. Final Report, 1 Jun. 1976 - 31 Mar. 1979
Gregory F. Homicz, John A. Lordi, and Gary R. Ludwig. Aug. 1979. 145 p. refs.
(Contract F33615-76-C-2092; AF Proj. 3066)
(AD-A077712; CALSPAN-XE-5933-A-103;
AFAPL-TR-79-2061) Avail: NTIS HC A07/MF A01 CSCL 21/5

This report presents the results of a program designed to study the influence of three-dimensional effects on the aerodynamics and acoustics of axial flow fans and compressors. To avoid numerical solutions of the full nonlinear three-dimensional equations, a linearized analysis is employed. This is first applied to the determination of the steady loading on a three-dimensional annular blade row with a prescribed chamber line in inviscid compressible flow. The blades are represented by pressure dipole singularities in a lifting-surface formulation, and a collection procedure is presented for inverting the resulting integral equation. Comparisons are presented between the present results and those of two-dimensional strip theory and an inverse three-dimensional theory. Next the analysis is extended to the case of unsteady flow through the rotor, such as might be caused by inflow distortion or blade flutter. The integral equation for this case is somewhat more complicated, but appears to be solvable by a suitable extension of the procedure developed in the steady problem. Finally, further comparisons are presented between a theoretical model of rotor-stator interaction noise developed under a previous program and a current series of measurements made in an annular cascade facility. GRA

N80-19117# Systems Control, Inc., Palo Alto, Calif.
VARIABLE CYCLE ENGINE MULTIVARIABLE CONTROL SYNTHESIS: CONTROL STRUCTURE DEFINITION. Interim Report, 1 Sep. 1977 - 31 Aug. 1978
Stephen M. Rock and Ronald L. DeHoff. Feb. 1979. 174 p. refs.
(Contract F33615-77-C-2096; AF Proj. 3006)
(AD-A078670; AFAPL-TR-79-2043) Avail: NTIS
HC A08/MF A01 CSCL 21/5

The variable cycle aircraft turbine engine, GE23 JTDE, represents a prototype of future multimode propulsion plants. It is a sophisticated design of highly variable geometry and multiple control inputs. To control this engine, a large number of engine variables must be sensed. These include engine pressures, temperatures, rotor speeds, and airframe and inlet commands. A controller for this engine must therefore be multivariable (i.e., manipulating large numbers of input and output variables) and multifunctional (i.e., perform, in addition to control logic, data conditioning and fault diagnosis). The development of such a full authority digital electronic controller must utilize demonstrated multivariable design techniques to integrate adequately these complex system functions. A preliminary design of a controller for this variable cycle engine is described. It is implementable on a small digital computer (less than 16K words of storage), and is modular in design (subroutine format). Specific controller functions of transient regulation, steady state regulation, trajectory generation, signal processing, and fault detection and accommodation are incorporated in a way which allows experimentation with different techniques for each function without affecting the overall structure. Promising techniques for implementing each function are discussed. GRA

N80-19118# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
NOVEL CERAMIC TURBINE ROTOR CONCEPTS. Final Technical Report, 22 Sep. 1978 - 22 May 1979
L. J. Stoffer. Wright-Patterson AFB, Ohio. AFAPL. Sep. 1979. 93 p. refs.
(Contract F33615-78-C-2041; AF Proj. 3066)
(AD-A078669; R79AEG527; AFAPL-TR-79-2074) Avail: NTIS
HC A05/MF A01 CSCL 21/5

A novel design concept for a ceramic turbine rotor has been studied in detail for a non-man-rated, limited-life gas turbine engine application. The feature of the design involves keeping

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the rotating ceramic components in a compression state at all turbine operating conditions. An air-cooled composite material containment hoop is utilized at the outer diameter of ceramic air-cooled fins which support ceramic turbine blades in compression against a radially compliant wheel. The design study of this Compression Structured Ceramic Turbine Rotor included detailed material, heat transfer, and 3-D stress analyses. The study effort also looked at the operational limits of the design and a performance and economic analysis comparison to a baseline metal design. Conclusions and recommendations for future development are also presented in this report. GRA

N80-19119# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
EVALUATION OF FUEL CHARACTER EFFECTS ON J79 ENGINE COMBUSTION SYSTEM. Final Technical Report, 7 Jun. 1977 - 31 Aug. 1978
C. C. Gleason, T. L. Oller, M. W. Shayerson, and D. W. Bahr. Jun. 1979. 198 p. refs.
(Contract F33615-77-C-2042; AF Proj. 3048)
(AD-A078440; R79AEG321; AFAPL-TR-79-2015; CEEDO-TR-79-06) Avail: NTIS. HC A09/MF A01. CSCL 21/5.

Results of a program to determine the effects of broad variations in fuel properties on the performance, emissions, and durability of the J79-17A turbojet engine combustion system are presented. Combustor tests conducted at engine idle, takeoff, subsonic cruise, supersonic dash, cold day ground start, and altitude relight operating conditions with 13 different fuels are described. The test fuels covered a range of hydrogen contents (12.0 to 14.5 percent), aromatic type (monocyclic and bicyclic), initial boiling point (285 to 393 K), final boiling point (552 to 679 K) and viscosity (0.83 to 3.25 mm2/s at 300 K). At high power operating conditions, fuel hydrogen content was found to be a very significant fuel property with respect to linear temperature, flame radiation, smoke, and NO sub x emission levels. Carbon monoxide and HC emissions were very low at these conditions with all of the fuels. At engine idle operating conditions, CO, HC, and NO sub x emission levels were found to be independent of fuel hydrogen content, but a small effect of fuel volatility and/or viscosity was found. At cold day ground start conditions (to 329 K) lightoff was obtained with all fuels, but the required fuel-air ratio increased with the more viscous fuels. At altitude conditions, the current engine relight limits with JP-4/JP-5 fuel were essentially met or exceeded with all of the JP-4 or JP-8 based fuel blends. However, a very significant reduction in altitude relight capability was found when a No. 2 diesel fuel was tested. GRA

N80-19120# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
INVESTIGATION OF FAN BLADES SHROUD MECHANICAL DAMPING
Donald A. Rimkunas and H. Murray Frye. Jun. 1979. 79 p. refs.
(Contract F33615-77-C-2086; AF Proj. 2307)
(AD-A078439; PWA-FR-11065; AFAPL-TR-79-2054) Avail: NTIS. HC A05/MF A01. CSCL 21/5.

This program was conducted to investigate the effect of dry friction damping at the shroud interfaces on the structural dynamic characteristics of shrouded fan blades typical of current high performance jet engines. An analytical definition of the loads generated at the shroud faces for a general stick-slip condition was developed. The analytical load description includes the elastic case of a stuck or locked shroud as well as the case of a slipping shroud. These loads were used in a non-linear steady-state vibration analysis of the shrouded blade. Controlled vibration testing of the first-stage fan blade with a trailing edge shroud of a YF100 (prototype) turbofan engine was conducted. The blade was tested with variable shroud restraints to simulate the full range of boundary conditions from freely slipping to fully locked, including the intermediate condition of micro-slipping. The testing of the blade with a freely slipping shroud was inconclusive because of repeatability problems. Good agreement was found between the nonlinear analysis and test data for the stuck and micro-slip boundary conditions. GRA

N80-19121# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
REJUVENATION OF TURBINE BLADE MATERIAL BY THERMAL TREATMENT. Final Report, 15 Apr. 1978 - 15 Oct. 1978
Mike D. Ross, Gary T. Bennett, and Dennis C. Stewart. Jul. 1979. 98 p. refs.
(Contract F33615-76-C-5208; AF Proj. 7351)
(AD-A077527; FR-10961; AFML-TR-79-4032) Avail: NTIS. HC A05/MF A01. CSCL 21/5.

This report describes a two phase program designed to investigate the feasibility of applying thermal treatments at some fraction of a turbine blade's life to heal accumulated fatigue and creep damage thereby extending useful blade life. Test evaluations were conducted on cast test bars of two nickel-base superalloys: conventionally cast (CC) In 100 alloy and directionally solidified (DS) MAR-M200 Hf. In Phase 1, creep testing of cast specimens was used to select suitable rejuvenation heat treatments based upon recoverable creep life and strain. The effect of creep strain and subsequent rejuvenation on minimum mechanical property requirements and the maximum recoverable creep strain was also determined. In addition, the use of eddy current inspection was investigated as a method to provide specific NDI criteria for selection of components suitable for rejuvenation processing. The Phase 2 effort included determinations of the effectiveness of rejuvenation heat treatments in recovering repeated creep strain damage and in recovering specific amounts of low-cycle and high-cycle fatigue life. In addition, the effects of rejuvenation heat treatments in recovering cumulative creep/fatigue strain damage was determined. Finally an assessment was made of the technical and economic feasibility for extending useful turbine blade life by rejuvenation thermal treatments. GRA

N80-19122# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN ANALYSIS AND SYNTHESIS OF ENGINE CONDITION MONITORING SYSTEMS. M.S. Thesis
Jack W. Chapman, Jr. and Charles L. Page, Jr. Sep. 1979. 138 p. refs.
(AD-A077531; AFIT-LSSR-27-79B) Avail: NTIS. HC A07/MF A01. CSCL 21/5.

Engine condition monitoring systems have been developed to assist flight line maintenance activities and aid in the transition of aircraft engine maintenance philosophy from that of maximum operating time to reliability centered or on condition maintenance. This study includes a comprehensive review of past, current, and proposed Air Force applications of turbine engine monitoring systems to describe the major features of TEMS. Engine performance data output from TEMS to the various engine management functions are analyzed. The authors conclude that TEMS data and the existing or proposed engine management systems are not directly compatible. Moreover, the analysis indicates that implementation of TEMS and an on condition maintenance policy would require a greatly expanded data base to accomplish the required engine management record keeping, monitoring, and forecasting tasks. Several recommendations are offered for interfacing TEMS with the engine management systems. Areas for further research are suggested. GRA

N80-19123# AiResearch Mfg. Co., Phoenix, Ariz.
DEMONSTRATION PROGRAM FOR A FLEXIBLE DUCT VALVE FOR RAMJET ENGINE FUEL CONTROLS. Final Report, 15 Nov. 1978 - 28 Feb. 1979
James S. Roundy. 14 Sep. 1979. 67 p. refs.
(Contract N62269-77-C-0352)
(AD-A078529; AiResearch-41-2228; NADC-77138-60) Avail: NTIS. HC A04/MF A01. CSCL 21/5.

A demonstration program was conducted to develop a flex duct-type metering valve for use in the fuel control of ramjet engines for Navy missiles. This type valve has inherent advantages of simplicity, low cost, and high reliability that make it particularly attractive for this application. This type valve functions best when the leakage flow from the metering gap is bypassed back upstream of the fuel pump. GRA

N80-19124# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

ADVANCED INFRARED SIGNATURE PREDICTION PROGRAM. SPECTRAL CALCULATION OF RADIATION FROM A TURBINE PROPULSION SYSTEM AS INTERCEPTED BY AN OBSERVER (SCORPION). VOLUME 3: ANALYSIS
M. E. Wilton. Nov. 1979. 235 p. refs.
(Contract N00140-78-C-1072)
(AD-A078436; R78AEG314) Avail: NTIS HC A11/MF A01 CSCL 17/5

Current infrared-guided missiles can detect and destroy aircraft from relatively long distances. Future IR missiles will be even more sensitive and destructive. The engine designer must select cycles and engine configurations that present as small a target as possible to these missile threats. To accomplish this, he must know the IR emissions from the aircraft and be able to judge the success of schemes to suppress these emissions. Measurements are invaluable in determining the IR emissions for selected aircraft situations but cannot possibly be made for all aircraft and for all situations. This is obviously true in the engine design phase. In addition, understanding of the fundamental sources of these emissions is essential to the invention or evaluation of new suppression concepts. An accurate prediction pool, therefore, is vital to the process of reducing the vulnerability of an aircraft to IR-guided missiles. As a supplier of jet engines for military aircraft, the General Electric Company has developed a series of computer programs to predict the IR signatures and vulnerability of IR-guided missiles. The SCORPIO-N computer program presented in this report is the latest in the series. It is an outgrowth of the SCORPIO-IIIA program (Reference 1) and the SPRITE program (Reference 2) with improvements to the plume module which permit studies of truly three-dimensional flow fields. GRA

N80-19128# Vought Corp., Dallas, Tex.
POWER SYSTEM CONTROL STUDY. PHASE 1: INTEGRATED CONTROL TECHNIQUES. Interim Report, 1 Jul. 1978 - 15 Jun. 1979
D. E. Lautner, A. J. Marek, and J. R. Perkins. Wright-Patterson AFB, Ohio: AFAPL, Jun. 1979. 240 p. refs.
(Contract F33615-78-C-2018; AF Proj. 3145)
(AD-A078629; AFAPL-TR-79-2084) Avail: NTIS HC A11/MF A01 CSCL 01/3

This report documents the Phase 1 results of a two phase study program which addresses the integration of advanced power system control technologies into a reliable and fault tolerant system. The advanced control technologies integrated include electric engine start, automatic load management, microprocessor control implementations, design techniques for providing 'no-gap' power and an all 'solid state' electric power distribution system. Electric system performance requirements are established and preliminary designs of an integrated 'baseline' control system for single and multiengine aircraft for the 1990 operational time period are presented. Finally, stability analysis requirements and procedures are established for each of the two designs. During Phase 2, detail design of the power control system will be completed and a stability analysis will be conducted. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-19126*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF THE CONCEPT OF DYNAMIC TRIM CONTROL TO AUTOMATIC LANDING OF CARRIER AIRCRAFT
G. Allan Smith and George Meyer. Apr. 1980. 87 p. refs.
(NASA-TP-1512; A-7801) Avail: NTIS HC A05/MF A01 CSCL 01C

The results of a simulation study of an alternative design concept for an automatic landing control system are presented. The alternative design concept for an automatic landing control system is described. The design concept is the total aircraft flight control system (TAFCOS). TAFCOS is an open loop, feed forward system that commands the proper instantaneous thrust, angle of attack, and roll angle to achieve the forces required to follow the desired trajector. These dynamic trim conditions are determined by an inversion of the aircraft nonlinear force characteristics. The concept was applied to an A-7E aircraft approaching an aircraft carrier. The implementation details with an airborne digital computer are discussed. The automatic carrier landing situation is described. The simulation results are presented for a carrier approach with atmospheric disturbances, an approach with no disturbances, and for tailwind and headwind gusts. A.W.H.

N80-19127*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT EVALUATION OF CONFIGURATION MANAGEMENT SYSTEM CONCEPTS DURING TRANSITION TO THE LANDING APPROACH FOR A POWERED-LIFT STOL AIRCRAFT
James A. Franklin and Robert C. Innis. Mar. 1980. 32 p. refs.
(NASA-TM-81146; A-7957) Avail: NTIS HC A03/MF A01 CSCL 01C

Flight experiments were conducted to evaluate two control concepts for configuration management during the transition to landing approach for a powered-lift STOL aircraft. NASA Ames' augmentor wing research aircraft was used in the program. Transitions from nominal level-flight configurations at terminal area pattern speeds were conducted along straight and curved descending flightpaths. Stabilization and command augmentation for attitude and airspeed control were used in conjunction with a three-cue flight director that presented commands for pitch, roll, and throttle controls. A prototype microwave system provided landing guidance. Results of these flight experiments indicate that these configuration management concepts permit the successful performance of transitions and approaches along curved paths by powered-lift STOL aircraft. Flight director guidance was essential to accomplish the task. Author

N80-19128# Systems Research Labs., Inc., Dayton, Ohio.
HANDLING QUALITY REQUIREMENTS FOR ADVANCED AIRCRAFT DESIGN LONGITUDINAL MODE. Final Report, Feb. 1977 - Aug. 1978
Ralph H. Smith and Norman D. Geddes. Aug. 1979. 185 p. refs.
(Contract F33615-77-C-3011; AF Proj. 2090)
(AD-A077858; AFFDL-TR-78-154) Avail: NTIS HC A09/MF A01 CSCL 01/3

This report considers the problem of developing handling qualities specifications for aircraft with nonclassical dynamic response to control. These include closed loop flight control system effects on basic airframe dynamics, direct force control applications, digital flight control, integrated fire-flight control, and integrated display-flight control. Only the longitudinal mode is considered. Elements of classic pilot-vehicle analysis methodology are distilled against a theoretical framework for the prediction of pilot opinion rating to develop a simplified and practical approach to handling qualities prediction that is directly applicable to the development of specificatons for aircraft flight control system design. The most important effects of motion cues on handling qualities are included within this model. The methods proposed for the prediction and correlation of handling qualities are validated against the largest and most appropriate base of handling qualities data available; the agreement is nearly 100 percent. GRA

N80-19129# Naval Academy, Annapolis, Md.
MICROPROCESSOR CONTROL OF LOW SPEED V/STOL FLIGHT. Final Report, 1978 - 1979
Robert V. Walters. 8 Jun. 1979. 203 p. refs.
(AD-A077661; USNA-TSPR-100) Avail: NTIS HC A10/MF A01 CSCL 01/4

This paper considers the design of an improved three-axis stability augmentation system (SAS) for the AV-8B Advanced Harrier V/STOL aircraft using microprocessor-based digital control. It focuses on improving the handling qualities of the airplane through SAS redesign in the low speed flight regime. Particular attention is paid to the so-called 'weather-cocking' instability encountered in transition (hover to/from conventional) flight. There was a dearth of information about the Harrier's flight characteristics until the development of MCAIR's X22A AV-8B mathematical

model, which yielded a set of linearized stability derivatives for the aircraft. The first step toward improvement of the AV-8B SAS requires the use of these coefficients in the development of an analog/hybrid model of both the aircraft itself and of the unmodified SAS. The controller design uses digital state feedback control to relocate the system closed loop poles. It is concluded that this method of control represents a valid approach to the final solution of the Harrier's stability and control problems and that this controller design concept might be applied to future aerospace vehicles. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-19130# Federal Aviation Administration, Washington, D. C.
NONDESTRUCTIVE EVALUATION OF AIRPORT PAVEMENTS. VOLUME 2: OPERATIONAL MANUAL FOR PAVBEN PROGRAM AT TCC Final Report
David Yang. Sep. 1979. 123 p.
(Contract DOT-FA77WA-3964)
(AD-A079495; FAA-RD-78-154-Vol-2) Avail: NTIS
HC A06/MF A01 CSCL 01/5

The operation of PAVBEN program is presented. The job inputs consist of: (1) field data; (2) types of existing pavements; (3) facility classifications; (4) demand forecast and (5) local cost values. The default system contains all design data for: (1) 15 air transports; (2) 9 FAA regional cost values; (3) 8 types of pavement design; (4) 22 layer components; (5) 20 types of existing pavement and (6) universal mechanistic design model. The major outputs will be: (1) NDT inventory file; (2) present functional life; (3) computed engineering data; (4) pavement thickness and cost data and (5) cost/benefit analysis for four new pavements, three overlays and three keel constructions. The program is written in a high level language FORTRAN IV. R.E.S.

N80-19131*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A THEORETICAL ANALYSIS OF SIMULATED TRANSONIC BOUNDARY LAYERS IN CRYOGENIC-NITROGEN WIND TUNNELS
Jerry B. Adcock and Charles B. Johnson. Mar. 1980. 40 p. refs.
(NASA-TP-1631; L-13364) Avail: NTIS HC A03/MF A01
CSCL 14B

A theoretical analysis was made to determine the real gas effects on simulation of transonic boundary layers in wind tunnels with cryogenic nitrogen as the test gas. The analysis included laminar and turbulent flat plate boundary layers and turbulent boundary layers on a two dimensional airfoil. The results indicate that boundary layers in such wind tunnels should not be substantially different from ideal gas boundary layers at standard conditions. At a pressure of 9.0 atm, two separate effects produce deviations of real gas values from ideal gas values which are in the opposite direction from deviations at 1.0 atm and are of the same insignificant order of magnitude. Results also show that nonadiabatic boundary layers should be adequately simulated if the enthalpy ratio is the correlating parameter rather than the temperature ratio. J.M.S.

N80-19132*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
DESIGN CONSIDERATIONS FOR ATTAINING 250-KNOT TEST VELOCITIES AT THE AIRCRAFT LANDING DYNAMICS FACILITY
C. E. Gray, Jr., R. E. Snyder, J. T. Taylor, A. Cires, A. L. Fitzgerald, and M. F. Armistead. Feb. 1980. 29 p. refs.
(NASA-TM-80222) Avail: NTIS HC A03/MF A01 CSCL 14B

Preliminary design studies are presented which consider the important parameters in providing 250 knot test velocities at the Aircraft Landing Dynamics Facility. Four major components of this facility are: the hydraulic jet catapult, the test carriage structure, the reaction turning bucket, and the wheels. Using the hydraulic-jet catapult characteristics, a target design point was selected and a carriage structure was sized to meet the required strength requirements. The preliminary design results indicate that to attain 250 knot test velocities for a given hydraulic jet catapult system, a carriage mass of 25,424 kg (56,000 lbm.) cannot be exceeded. R.E.S.

N80-19133*# National Aeronautics and Space Administration, Washington, D. C.
METHODS OF SOUND SIMULATION AND APPLICATIONS IN FLIGHT SIMULATORS
K.-P. Gaertner. Jan. 1980. 98 p. refs. Transl. into ENGLISH of "Methoden der Gerawuschsimulation und ihre Anwendung in Flugsimulatoren", Rept-22, Gesellschaft zur Foederund der Astrophysikalischen forschung E. V., Forschungsinstitut fuer Antropotechnik, Meckenheim, West Germany, Apr. 1975. 105 p. Translation was announced as N77-29179. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75768; Rept-22) Avail: NTIS HC A05/MF A01
CSCL 14B

An overview of methods for electronically synthesizing sounds is presented. A given amount of hardware and computer capacity places an upper limit on the degree and fidelity of realism of sound simulation which is attainable. Good sound realism for aircraft simulators can be especially expensive because of the complexity of flight sounds and their changing patterns through time. Nevertheless, the flight simulator developed at the Research Institute for Human Engineering, West Germany, shows that it is possible to design an inexpensive sound simulator with the required acoustic properties using analog computer elements. The characteristics of the sub-sound elements produced by this sound simulator for take-off, cruise and approach are discussed. Author

N80-19134# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYTIC AND NUMERICAL INVESTIGATION OF THE CONVERGENCE FOR THE ADAPTIVE-WALL CONCEPT Final Report, Oct. 1977 - Mar. 1978
C. F. Lo and W. L. Sickles. AEDC. Nov. 1979. 40 p. refs.
Sponsored by the Air Force
(AD-A078203; AEDC-TR-79-55) Avail: NTIS
HC A03/MF A01 CSCL 01/3

Convergence of the iteration for the adaptive wall concept is analytically proved for two-dimensional and axisymmetric subsonic flows. One-step convergence formulae which determine the unconfined boundary conditions directly from two measured flow variables at the measuring surface are presented to accelerate the iterative procedure. The application of the one-step formulae to numerical examples of an NACA 0012 airfoil illustrates the capability of these formulae for subcritical as well as supercritical flows. GRA

N80-19135# ARO, Inc., Arnold Air Force Station, Tenn.
LASER-RAMAN FLOW-FIELD DIAGNOSTICS OF TWO LARGE HYPERSONIC TEST FACILITIES Final Report, 13 Apr. 1977 - 10 Jul. 1978
W. D. Williams, D. A. Wagner, H. M. Powell, and L. L. Price. AEDC. Dec. 1979. 41 p. refs.
(AD-A078289; AEDC-TR-7988) Avail: NTIS
HC A03/MF A01 CSCL 14/2

Laser-Raman scattering has been utilized to discover nonequilibrium N2 vibrational levels in a continuous, resistance-heated wind tunnel (Tunnel C) and in an arc-heated wind tunnel (Tunnel F). Vibrational temperatures of up to two times the bulk reservoir temperature have been measured in the Tunnel F free stream. A double-diaphragm device for delay of the Tunnel F nozzle expansion was found to significantly reduce the vibrational temperature level. In tunnel C, the vibrational temperatures were found to be dependent upon the water vapor concentration in the flow. It is hypothesized that water vapor-induced de-excitation of the vibrationally excited nitrogen molecules results in a

significant rise in local static temperature and corresponding reduction in Mach number. GRA

N80-19136# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE HISTORY OF STATIC TEST AND AIR FORCE STRUCTURES TESTING Final Technical Report
Bernard C. Boggs Jun. 1979 299 p refs
(AD-A077029; AFFDL-TR-79-3071) Avail: NTIS
HC A13/MF A01 CSCL 14/2

This report traces the history of aircraft static testing from its early beginning and follows the development of structures testing in the United States Air Force from 1917 to 1979. Those technologies that are related to structures testing are included which were important to airplane structures strength. Test technology development which provided test facilities, tests systems and test methods are covered for the static, dynamic, fatigue, and environmental simulation of subsonic, sonic, supersonic, hypersonic and re-entry aircraft missions. GRA

N80-19137# Advisory Group for Aerospace Research and Development, Paris (France).
TOWARD NEW TRANSONIC WINDTUNNELS
J. P. Hartzuiker, ed. (National Aerospace Lab., Amsterdam) Nov. 1979 78 p refs
(AGARD-AG-240; ISBN-92-835-1343-6) Avail: NTIS
HC A05/MF A01

Cryogenic concepts for transonic wind tunnels are examined including discussions of tunnel drive and support systems, tunnel performance, and cryogenic aerodynamics. Also presented is an investigation of the flow quality of three transonic tunnels with differing drive mechanisms. Factors effecting a more complete determination of tunnel flow quality are discussed. For individual titles, see N80-19138 through N80-19140.

N80-19138# Royal Aircraft Establishment, Bedford (England).
AN INVESTIGATION OF THE QUALITY OF THE FLOW GENERATED BY THREE TYPES OF WIND TUNNEL (LUDWIEG TUBE, EVANS CLEAN TUNNEL AND INJECTOR DRIVEN TUNNEL)
P. G. Pugh, H. Grauer-Carstensen (DFVLR, Goettingen, West Germany), and C. Quemard (CERT, Toulouse) *In* AGARD Towards New Transonic Windtunnels Nov. 1979 23 p refs (For primary document see N80-19137 10-09)
Avail: NTIS HC A05/MF A01

Flow quality in three wind tunnels with differing drive systems is examined. The investigation included measurements of (1) fluctuating static pressure on the sidewall of the test section; (2) turbulence immediately upstream of the contraction and in the test section; (3) fluctuations of flow angle (both pitch and yaw) in the test section; and (4) fluctuations of both pitot and static pressures in the test section flow. Factors important to the description of wind tunnel flow quality are also discussed. It is shown that the use of fluctuating static pressure as in index of flow quality in invalid when comparing wind tunnels having different forms of drive system or, possibly, even widely different types of test section. Fluctuations in flow angle are of much more direct consequence to the gathering of the usual types of data and can be measured using either appropriately designed yawmeters or with hot-film probes. M.H.

N80-19139*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF THE CRYOGENIC TUNNEL CONCEPT AND APPLICATION TO THE US NATIONAL TRANSONIC FACILITY
Robert A. Kilgore *In* AGARD Towards New Transonic Windtunnels Nov. 1979 27 p refs (For primary document see N80-19137 10-09)
Avail: NTIS HC A05/MF A01 CSCL 14B

A fan-driven, high Reynolds number, transonic cryogenic wind tunnel is described. The tunnel has a 2.5- by 2.5 m test section and is capable of operating from ambient to cryogenic temperatures at stagnation pressures up to 8.8 atm. An overview of the cryogenic concept and discussions of drive power requirements, support systems, and operating characteristics and performance of the wind tunnel are included. M.G.

N80-19140# National Aerospace Lab., Amsterdam (Netherlands).
THE CRYOGENIC WIND TUNNEL: ANOTHER OPTION FOR THE EUROPEAN TRANSONIC FACILITY
J. P. Hartzuiker, J. Christophe (ONERA, Paris), W. Lorenz-Meter (DFVLR, Goettingen, West Germany), and P. G. Pugh (RAE, Bedford, England) *In* AGARD Towards New Transonic Wintunnels Nov. 1979 15 p refs (For primary document see N80-19137 10-09)
Avail: NTIS HC A05/MF A01

A cryogenic wind tunnel concept is discussed. The tunnel should have a maximum stagnation pressure of 6 bars, 10 seconds running time, and the Reynolds number (based on mean aerodynamic chord) should be variable between 25 and 40 million, to enable extrapolation of test results to full scale conditions. The advantages and drawbacks of cryogenic testing as well as fundamental aspects of cryogenic aerodynamics are discussed. Comparative estimates for capital and operating costs are finally presented. M.G.

N80-19812# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
REMARKS ON SIMULATION. OBJECTIVES/AREAS OF USE/POSSIBILITIES/LIMITATIONS: AN OVERVIEW
Hans M. Franke *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 27 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19829# Societe Nationale Industrielle Aerospatiale, Marignane (France.) Div. Helicopteres.
DESIGN OF A SIMULATOR FOR STUDYING THE HELICOPTER - SDVEH [CONCEPTION D'UN SIMULATEUR DE VOL D'ETUDE POUR HELICOPTER - SOUEH]
Jl. Mascle, G. Catani, M. Sellier, and Jp. Letouzey *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p In FRENCH (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19830# Institute for Defense Analyses, Arlington, Va.
COST-EFFECTIVENESS OF FLIGHT SIMULATORS FOR MILITARY TRAINING
Jesse Orlansky and Joseph String *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-19141*# KMS Fusion, Inc., Ann Arbor, Mich. Div. of Material Sciences.
GLASS SHELL MANUFACTURING IN SPACE Quarterly Progress Report, 6 Sep. - 6 Dec. 1979
Robert J. Nolen, Mathias A. Ebner, and Raymond L. Downs 18 Jan. 1980 40 p
(Contract NAS8-33103)
(NASA-CR-161408; U976; QPR-4) Avail: NTIS
HC A03/MF A01 CSCL 22A

Residual gases always found in glass shells are CO_2, O_2 and N_2. In those cases where high water vapor pressure is maintained in the furnace, water is also found in the shells. Other evidence for the existence of water in shells is the presence of water-induced surface weathering of the interior shell surface. Water and CO_2 are the predominant volatiles generated by the pyrolysis of both inorganic and hydrolyzed metal-organic gels. The pyrolysates of unhydrolyzed metal-organic gels also contain, in addition to water and CO_2, significant levels of organic volatiles, such as ethanol and some hydrocarbons; on complete oxidation, these produce CO_2 and water as well. Water is most likely the initial blowing agent, it is produced copiously during the initial stages of heating. In the later stages, CO_2 becomes the dominant gas as H_2O is lost at increasing rates. Water in the

shell arises mainly from gel dehydration, CO_2 by sodium bicarbonate/carbonate decomposition and carbon oxidation, and O_2 and N_2 by permeation of the ambient furnace air through the molten shell wall. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories, and orbit and launching dynamics.

N80-19142*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
ORBIT DYNAMICS AND GEOGRAPHICAL COVERAGE CAPABILITIES OF SATELLITE-BASED SOLAR OCCULTATION EXPERIMENTS FOR GLOBAL MONITORING OF STRATOSPHERIC CONSTITUENTS
David R. Brooks. Mar. 1980. 76 p.
(NASA-TP-1606; L-12804) Avail: NTIS HC A05/MF A01 CSCL 03B

Orbit dynamics of the solar occultation technique for satellite measurements of the Earth's atmosphere are described. A one-year mission is simulated and the orbit and mission design implications are discussed in detail. Geographical coverage capabilities are examined parametrically for a range of orbit conditions. The hypothetical mission is used to produce a simulated one-year data base of solar occultation measurements; each occultation event is assumed to produce a single number, or 'measurement' and some statistical properties of the data set are examined. A simple model is fitted to the data to demonstrate a procedure for examining global distributions of atmospheric constitutents with the solar occultation technique. Author

N80-19143# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
EVOLUTION OF THE ORBITAL IMPROVEMENT PROGRAM
S. C. Dillon. Feb. 1979. 62 p. refs.
(Contract N00024-78-C-5384)
(AD-A078842; APL/JHU-TG-1320) Avail: NTIS HC A04/MF A01 CSCL 22/3

The Orbital Improvement Program (OIP) is a massive computer program that determines and predicts orbits for the Navy Navigation Satellite System (Transit system). The system became operational in 1963 and has played a vital part in providing all-weather navigation to worldwide users. The system has been continuously updated and improved. Today, navigation results are regularly under 10 m for operational satellites, providing accuracy far beyond any expectations of the early 1960's. This report describes the evolution of the program, its operational history, and how it has improved naviation accuracy. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities, ground support equipment, mobile transporters, and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-19144*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DEVELOPMENT OF A COMPOSITE GEODETIC STRUCTURE FOR SPACE CONSTRUCTION, PHASE 1A
31 Jan. 1980. 60 p. refs.
(Contract NAS9-15678)
(NASA-CR-160558; MDC-G8456) Avail: NTIS HC A04/MF A01 CSCL 22B

The development of a geodetic beam and beam builder for on orbit construction of large truss type space structures is discussed. The geodetic beam is a lightweight, open lattice structure composed of an equilateral gridwork of crisscrossing rods. The beam provides a high degree of stiffness and minimizes structural distortion, due to temperature gradients, through the incorporation of a new graphite and glass reinforced thermoplastic composite material with a low coefficient of thermal expansion. A low power consuming, high production rate, beam builder automatically fabricates the geodetic beams in space using rods preprocessed on Earth. Three areas of the development are focused upon: (1) geodetic beam designs for local attachment of equipment or beam to beam joining in a parallel or crossing configurations; (2) evaluation of long life pultruded rods capable of service temperatures higher than possible with the HMS/P1700 rod material; and (3) evalaution of high temperature joint encapsulant materials. A.W.H.

N80-19170*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
FY-79 - DEVELOPMENT OF FIBER OPTICS CONNECTOR TECHNOLOGY FOR LARGE SPACE SYSTEMS
Thomas G. Campbell. *In its* Large Space Systems Technol., 1979. Feb. 1980. p. 453-466. (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters, manned orbital laboratories, reusable vehicles, and space stations.

N80-19145*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
LARGE SPACE SYSTEMS TECHNOLOGY, 1979
James C. Ward, Jr., comp. Feb. 1980. 487 p. refs. Ann. Program Tech. Rev. (1st) held at Hampton, Va., 7-8 Nov. 1979.
(NASA-CP-2118; L-13488) Avail: NTIS HC A21/MF A01 CSCL 22B

Items of technology and developmental efforts in support of the large space systems technology programs are described. The major areas of interest are large antennas systems, large space platform systems, and activities that support both antennas and platform systems. For individual titles, see N80-19146 through N80-19172.

N80-19146*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
OFFSET WEAP RIB CONCEPT AND DEVELOPMENT
A. A. Woods, Jr. *In* NASA. Langley Res. Center. Large Space Systems Technol., 1979. Feb. 1980. p. 5-31. (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The applicability of the Wrap rib antenna design for offset feed configurations for antennas up to 300 m in diameter was assessed. The antenna design was defined for both symmetric and offset configurations in terms of surface quality, cost, weight, and mechanical complexity. A supporting deployable feed support structure was developed and characterized. K.L.

N80-19147*# TRW, Inc., Redondo Beach, Calif.
ADVANCED SUNFLOWER ANTENNA CONCEPT DEVELOPMENT
J. S. Archer. *In* NASA. Langley Res. Center. Large Space Systems Technol., 1979. Feb. 1980. p. 33-58. Sponsored by JPL. (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The feasibility of stowing large solid antenna reflectors in the shuttle was demonstrated for applications with 40 foot apertures at frequencies of 100 GHz. Concepts allowing extension of the basic concept to 80-foot apertures operable at 60 GHz were identified. K.L.

N80-19148*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CONSTRUCTION ALIGNMENT SENSOR FEASIBILITY DEMONSTRATIONS (LASER MEASUREMENT)
R. H. Anderson. *In* NASA. Langley Res. Center. Large Space Systems Technol., 1979. Feb. 1980. p. 59-76. (For primary document see N80-19145 10-15)

(Contract NAS7-100; JPL-955130)
Avail: NTIS HC A21/MF A01 CSCL 22B

The design theory and trade-offs involved in the selection of laser heterodyne sensors for use in active control of spacecraft structures are discussed. These sensors include a HeNe distance measuring system for structures requiring accuracies to .1 mm, a CO2 distance measuring system for measuring unambiuously down to .01 microns, and vibration sensors based on both HeNe and CO2 lasers. K.L.

N80-19149*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
JPL SELF PULSED LASER SURFACE MEASUREMENT SYSTEM DEVELOPMENT
Martin Berdahl *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 77-94 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The use of a self pulsed laser system for accurately describing the surface shape of large space deployed antenna structures was evaluated. Tests with a breadboard system verified functional operation with short time resolution on the order of .2 mm, nonambiguous ranging, and a maximum range capability on the order of 150 m. The projected capability of the system is resolution of less than .1 mm over a reasonable time period and a range extension to over 300 m. K.L.

N80-19150*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FY-79 - LSST ANTENNA TECHNOLOGY DEVELOPMENT
Thomas G. Campbell *In its* Large Space Systems Technol., 1979 Feb. 1980 p 95-114 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The development of technology needed to design, fabricate, transport, and deploy large antenna systems is reported. Accomplishments include: (1) development of scenarios for near term missions in communications, microwave radiometry, and radio astronomy; (2) conceptual designs for critical components of a hoop/column reflector; (3) development of a surface accuracy measurement system; and (4) development of electromagnetic analysis methods for large aperture antennas. K.L.

N80-19151*# Harris Corp., Melbourne, Fla.
DEVELOPMENT OF THE MAYPOLE (HOOP/COLUMN) DEPLOYABLE REFLECTOR CONCEPT FOR LARGE SPACE SYSTEMS APPLICATIONS
D. C. Montgomery and L. D. Sikes *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 115-156 refs (For primary document see N80-19145 10-15)
(Contract NAS1-15763)
Avail: NTIS HC A21/MF A01 CSCL 22B

The conceptual design, performance projections, and materials development for the maypole (hoop/column) reflector concept are summarized. Factors influencing configuration choices are discussed along with quad aperture/feed characteristics and antenna requirements based on missions. K.L.

N80-19152*# TRW, Inc., Redondo Beach, Calif.
SURFACE ACCURACY MEASUREMENT SENSOR FOR DEPLOYABLE REFLECTOR ANTENNAS (SAMS DRA)
Robert S. Neiswander *In* NASA Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 157-171 (For primary document see N80-19145 10-15)
(Contract NAS1-15220)
Avail: NTIS HC A21/MF A01 CSCL 22B

Specifications, system configurations, and concept tests for surface measurement sensors for deployable reflector antennas are presented. Two approaches toward the optical measurement of remote target displacements are discussed: optical ranging, in which the basic measurement is target-to-sensor range; and in particular, optical angular sensing, in which the principle measurements are of target angular displacements lateral to the line of sight. Four representative space antennas are examined. M.G.

N80-19153*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF ELECTROMAGNETIC ANALYSIS METHODS FOR LARGE APERTURE ANTENNAS
C. R. Cockrell, L. D. Staton, and P. K. Agrawal *In its* Large Space Systems Technol., 1979 Feb. 1980 p 173-185 refs (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

Both deterministic and statistical analysis methods for investigating large aperture antenna radiation patterns are examined. The effects of surface errors on radiation patterns are discussed. M.G.

N80-19154*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTROSTATIC FORMING
J. W. Goslee *In its* Large Space Systems Technol., 1979 Feb. 1980 p 187-192 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The electrostatic forming of antenna and reflector surfaces through the controlled deformation of a reflective membrane is described. M.G.

N80-19155*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SURFACE MEASURING TECHNIQUE
Robert B. Spiers, Jr. *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 193-198 ref (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

Measurement of the surface contour of a large electrostatically formed concave reflector using a modified Foucault or knife edge test is described. The curve of the actual electrostatically formed reflector surface is compared to a curve representing a reference sphere. Measurements of surface slope and deviation are calculated every 15 cm along the reflector's horizontal and vertical diameters. Characterization of surface roughness on a small scale compared to the laser spot size at the reflector are obtained from the increased laser spot size at a distant projection screen. M.G.

N80-19156*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRUCTURAL CONCEPTS FOR LARGE SPACECRAFT
H. G. Bush, W. L. Heard, Jr., and J. E. Walz *In its* Large Space Systems Technol., 1979 Feb. 1980 p 199-215 refs (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

Design concepts for deployable spacecraft structures are examined with particular emphasis on mass/area optimization, stowability, and assembly, and the relations of these requirements to functional design parameters. Component and modular concepts for platforms and reflectors, structural configurations for long columns, pretension columns, and joint concepts are discussed. A brief overview of astronaut and automated assembly studies is included. M.G.

N80-19157*# Vought Corp., Dallas, Tex.
ERECTABLE/DEPLOYABLE CONCEPTS FOR LARGE SPACE SYSTEM TECHNOLOGY
W. E. Agan *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 217-246 (For primary document see N80-19145 10-15)
(Contract NAS8-33431)
Avail: NTIS HC A21/MF A01 CSCL 22B

Erectable/deployable space structure concepts particularly relating to the development of a science and applications space platform are presented. Design and operating features for an automatic coupler clevis joint, a side latching detent joint, and a module-to-module auto lock coupler are given. An analysis of the packaging characteristics of stacked subassembly, single fold, hybrid, and double fold concepts is given for various platform structure configurations. Payload carrier systems and assembly techniques are also discussed. M.G.

N80-19158*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE FABRICATION: GRAPHITE COMPOSITE TRUSS WELDING AND CAP FORMING SUBSYSTEMS
L. M. Jenkins and D. L. Browning (General Dynamics/Convair)

In NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 247-261 ref (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

An automated beam builder for the fabrication of space structures is described. The beam builder forms a triangular truss 1.3 meters on a side. Flat strips of preconsolidated graphite fiber fabric in a polysulfone matrix are coiled in a storage canister. Heaters raise the material to forming temperature then the structural cap section is formed by a series of rollers. After cooling, cross members and diagonal tension cords are ultrasonically welded in place to complete the truss. The stability of fabricated structures and composite materials is also examined. M.G.

N80-19159*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STRUCTURAL ASSEMBLY IN SPACE
Jack W. Stokes and Edwin C. Pruett (Essex Corp.) *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 263-285 refs (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

A cost algorithm for predicting assembly costs for large space structures is given. Assembly scenarios are summarized which describe the erection, deployment, and fabrication tasks for five large space structures. The major activities that impact total costs for structure assembly from launch through deployment and assembly to scientific instrument installation and checkout are described. Individual cost elements such as assembly fixtures, handrails, or remote minipulators are also presented. R.C.T.

N80-19160*# Rockwell International Corp., Canoga Park, Calif. Satellite Systems Div.
SPACE CONSTRUCTION AND UTILITY DISTRIBUTION
K. A. Bloom *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 287-301 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

Technology advancement to effect an orderly development program leading to construction of space platforms was defined, in a program that utilized a viable platform and service module concept with concise OSS/OAST mission and payload models. Consideration was given to concepts for alternate platform servicing of the payloads described in the model. Using the baseline configuration, issues pertinent to platform development as well as orbit emplacement and operation and on orbit construction methodology were analyzed. These analyses provided the following data: (1) payload definitions and installation options; (2) identified structural and subsystems options; (3) developed integrated platform system concepts; and (4) identified technology deficiencies and recommended technology development timelines. R.C.T.

N80-19161*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A HIGH RESOLUTION SOIL MOISTURE RADIOMETER
L. R. Dod *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 303-312 ref (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The design of an L-band high resolution soil moisture radiometer is described. The selected system is a planar slotted waveguide array at L-band frequencies. The square aperture is 74.75 m by 74.75 m subdivided into 8 tilted subarrays. The system has a 290 km circular orbit and provides a spatial resolution of 1 km. The aperture forms 230 simultaneous beams in a cross-track pattern which covers a swath 420 km wide. A revisit time of 6 days is provided for an orbit inclination of 50 deg. The 1 km resolution cell allows an integration time of 1/7 second and sharing this time period sequentially between two orthogonal polarization modes can provide a temperature resolution of 0.7 K. R.C.T.

N80-19162*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LARGE SPACE SYSTEM CONTROL TECHNOLOGY OVERVIEW
Gary L. Parker *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 313-321 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The nature of the problems which confront large space structure technology controls are discussed. Emphasis is placed on the following: the basic performance requirements; structural model errors; the effect of certain disturbances (i.e., solar pressure, gravity gradient torques, and aerodynamic drag); and surface or figure control. R.C.T.

N80-19163*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LARGE SPACE SYSTEM CONTROL TECHNOLOGY STATUS AND ACCOMPLISHMENTS
G. Rodriguez and Gary L. Parker *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 323-342 refs (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

In the area of antenna modeling and control, preliminary structural models were defined for two representative parabolic reflectors. A control system design evolved for attitude control of the reflectors. The controller design was based on a lumped control concept where the control hardware (sensor and actuators) was mounted at the base of the antenna. In the area of distributed control, static shape control techniques were worked out to establish a prescribed vehicle shape. The corresponding estimation process for determination of vehicle shape from selected sensor measurements was also developed. A model order reduction study was conducted to find the best preflight dynamical models for on board controller design. The problems caused by truncation of the vehicle dynamics required to minimize on board computations were investigated. Estimator designs were developed for on board detection of large structure model errors. R.C.T.

N80-19164*# Purdue Univ., Lafayette, Ind.
LARGE SPACE SYSTEM CONTROL TECHNOLOGY MODEL ORDER REDUCTION STUDY
R. E. Skelton *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 343-357 Sponsored by JPL (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The mission control requirements for large space structures are presented as well as some of the problems associated with the active control of large structures in space. A generic model is introduced that contains most of the desired features in the modeling and control problem for large space structures. R.C.T.

N80-19165*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC CONTROLS ACTIVITY FOR LSST
R. C. Montgomery *In its* Large Space Systems Technol., 1979 Feb. 1980 p 359-381 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

Math models were developed for various types of large flexible structures. These models were used to study the uncontrolled dynamic characteristics of the structures in orbit and to devise control concepts in order to control their orientation and geometrical shape. Reduced order decoupled control of the 100 meter long free free beam were studied. The inplane orientation and shape of the beam was controlled in a decoupled manner with as few actuators as possible. Using two controllers, near each end of the beam, to produce a 0.01 radian pitch change, perfect decoupled control was achieved for the rigid body pitch theta mode and the first flexible mode A sub 1. R.C.T.

N80-19166*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERACTIVE ANALYSIS PROGRAM ACTIVITY
J. P. Young, H. P. Frisch, G. K. Jones (Boeing Aerospace Co.), and W. J. Walker *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 383-407 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The development of an analysis software system capable of performing interdisciplinary preliminary design analyses of large space structure configurations is discussed. Disciplines such as thermal, structures, and controls are to be integrated into a highly user oriented analysis capability. The key feature of the integrated analysis capability, a rapid and efficient system that will minimize solution turnaround time, is discussed. A.W.H.

N80-19167*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
JPL ANALYTICAL PERFORMANCE PREDICTION CAPABILITY
R. Chen *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 409-421 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The development of a computer code to simulate and predict the performance of large deployable antenna structures is discussed. The computer code is expected to account for all phases of hardware use, i.e., ground handling, boost, deployment, on orbit station keeping, and transfer from LEO to GEO, if applicable. In addition to accounting for static and dynamic loading of the basic structure, the variation in the precision of the reflector surface and the alignment of the feed support structure as a function orbit are scrutinized in order to accommodate electromagnetic analysis. Specific tasks directed towards the development of the computer code are reported and a number of thermal and structural models are discussed. A.W.H.

N80-19168*# Boeing Aerospace Co., Seattle, Wash.
LARGE SPACE SYSTEMS TECHNOLOGY ELECTRONICS: DATA AND POWER DISTRIBUTION
W. G. Dunbar *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 423-442 (For primary document see N80-19145 10-15)
(Contract NAS8-33432)
Avail: NTIS HC A21/MF A01 CSCL 22B

The development of hardware technology and manufacturing techniques required to meet space platform and antenna system needs in the 1980s is discussed. Preliminary designs for manned and automatically assembled space power system cables, connectors, and grounding and bonding materials and techniques are reviewed. Connector concepts, grounding design requirements, and bonding requirements are discussed. The problem of particulate debris contamination for large structure spacecraft is addressed. A.W.H.

N80-19169*# Alabama Univ., University.
SOLID-STATE SWITCH MODELING
Wilford D. Raburn *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 443-452 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

A model for predicting voltages and currents of passive loads during turn on and turn off of remote power controllers is presented. The model is concerned with two devices, a five ampere device and a twenty ampere device. The model is presented as a general circuit diagram. The load current is determined by the load parameters and the conditions at switching and the steady state conditions are reached according to time constants determined by the load. The model is used to analyze the turn on and turn off conditions of certain loads including a R-C load and a R-L load. A.W.H.

N80-19170*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FY-79 - DEVELOPMENT OF FIBER OPTICS CONNECTOR TECHNOLOGY FOR LARGE SPACE SYSTEMS c14
Thomas G. Campbell *In its* Large Space Systems Technol., 1979 Feb. 1980 p 453-466 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The development of physical concepts for integrating fiber optic connectors and cables with structural concepts proposed for the LSST is discussed. Emphasis is placed on remote connections using integrated cables. A.W.H.

N80-19171*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FLEXIBLE MATERIALS TECHNOLOGY
W. H. Steurer *In* NASA. Langley Res. Center Large Space Systems Technol., 1979 Feb. 1980 p 467-484 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

A survey of all presently defined or proposed large space systems indicated an ever increasing demand for flexible components and materials, primarily as a result of the widening disparity between the stowage space of launch vehicles and the size of advanced systems. Typical flexible components and material requirements were identified on the basis of recurrence and/or functional commonality. This was followed by the evaluation of candidate materials and the search for material capabilities which promise to satisfy the postulated requirements. Particular attention was placed on thin films, and on the requirements of deployable antennas. The assessment of the performance of specific materials was based primarily on the failure mode, derived from a detailed failure analysis. In view of extensive on going work on thermal and environmental degradation effects, prime emphasis was placed on the assessment of the performance loss by meteoroid damage. Quantitative data were generated for tension members and antenna reflector materials. A methodology was developed for the representation of the overall materials performance as related to systems service life. A number of promising new concepts for flexible materials were identified. Author

N80-19172*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ADVANCED MATERIALS FOR SPACE
Darrel R. Tenney, Wayne S. Slemp, Edward R. Long, Jr., and George F. Sykes *In its* Large Space Systems Technol., 1979 Feb. 1980 p 485-504 (For primary document see N80-19145 10-15)
Avail: NTIS HC A21/MF A01 CSCL 22B

The principal thrust of the LSST program is to develop the materials technology required for confident design of large space systems such as antennas and platforms. Areas of research in the FY-79 program include evaluation of polysulfones, measurement of the coefficient of thermal expansion of low expansion composite laminates, thermal cycling effects, and cable technology. The development of new long thermal control coatings and adhesives for use in space is discussed. The determination of radiation damage mechanisms of resin matrix composites and the formulation of new polymer matrices that are inherently more stable in the space environment are examined. Author

N80-19173*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE PROCESSING APPLICATIONS ROCKET PROJECT SPAR 4, ENGINEERING REPORT Final Report
Fred Reeves, comp. Jan. 1980 194 p
(NASA-TM-78235; M-287) Avail: NTIS HC A09/MF A01 CSCL 22A

The materials processing experiments in space, conducted on the SPAR 4 Black Brant VC rocket, are described and discussed. The SPAR 4 payload configuration, the rocket performance, and the flight sequence are reported. The results, analyses, and anomalies of the four experiments are discussed. The experiments conducted were the uniform dispersions of crystallization processing, the contained polycrstalline solidification in low gravity, the containerless processing of ferromagnetic materials, and the containerless processing technology. The instrumentation operations, payload power relay anomaly, relay postflight operational test, and relay postflight shock test are reported. A.W.H.

N80-19174# Air Force Geophysics Lab., Hanscom AFB, Mass.
SPACECRAFT CHARGING MODEL: TWO MAXWELLIAN APPROXIMATION Environmental Research Paper
P. Tsipouras and H. B. Garrett 13 Jul. 1979 29 p refs
(AF Proj. 7661)
(AD-A077907; AFGL-TR-79-0153; AFGL-ERP-667) Avail: NTIS HC A03/MF A01 CSCL 04/1

The ambient plasma environment at geosynchronous orbit is assumed to be represented by a two-component Maxwell-

Boltzmann particle distribution. Given this, the equations for ambient electron and ion currents to the spacecraft are easily integrated. Likewise, the secondary and backscattered currents can be expressed as integrals. The potential at which the currents balance gives the potential between the spacecraft and ambient plasma. The model is compared with actual data from ATS-5 and is found to agree within plus or minus 1, 200 V over a range of 0 to minus 10,000 V. The model is readily applicable to the simple environmental model of Garrett and DeForest (1979) and can be calibrated to any given satellite. Simple algorithmic expressions are also developed for the backscattered and secondary currents as a function of temperature and potential which promise a significant decrease in computer time without a significant loss in accuracy. GRA

N80-19175# Systems Consultants, Inc., Ridgecrest, Calif.
HARPOON PYROTECHNIC SHOCK STUDY Final Report, Jul. 1973 - Jul. 1979
Dan Powers (McDonnell Douglas Astronautics Co.), Charles E. Wright, and William N. Jones Sep. 1979 39 p refs
(Contract N00123-76-C-0340)
(AD-A078727; NWC-TP-6133) Avail: NTIS HC A03/MF A01 CSCL 16/4

A study was conducted to compare predicted Harpoon missile pyrotechnic shock response with Harpoon missile design criteria. This report discusses the pyrotechnic shock environment and component failures encountered in this type of environment. Correct shock test simulation techniques and 'state-of-the-art' limitations are delineated. Actual testing techniques and test apparatus that can be used to achieve the proper test environment are discussed. Both actual test data and predicted shock levels are presented. Shock spectra environment predictions are made for several types of explosive activated devices. Test data were measured during Harpoon ejection tests and are presented as shock spectra. GRA

N80-19176# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHOTOMETRY OF ARTIFICIAL SATELLITES APPLICATION TO THE GROUND ELECTRO-OPTICAL DEEP SPACE SURVEILLANCE (GEODSS) PROGRAM
John M. Souvari Oct. 1979 50 p refs
(Contract F19628-80-C-0002; AF Proj. 2128)
(AD-A078675; TN-1979-61; ESD-TR-79-261) Avail: NTIS HC A03/MF A01 CSCL 17/8

This note defines the basic concept of an astronomical photometric system and examines it in the context of the GEODSS program. Several different systems are developed. Each to fit a particular part of the overall mission for photometry in the GEODSS program. The different kinds of errors arising in each system are examined and their impact upon the goals of GEODSS photometry is assessed. Of particular note is the role of aliasing in the photometry of artificial satellites. It is concluded that if care is taken, photometry can be a useful part of the GEODSS program. GRA

N80-19177# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GEOMETRY, ARTIFICIAL SATELLITES, AND ORBIT DETERMINATION
Laurence G. Taff 4 Sep. 1979 20 p refs
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A077049; TN-1979-55; ESD-TR-79-215) Avail: NTIS HC A02/MF A01 CSCL 22/3

The large proper motions and diurnal parallaxes of earth-bound artificial satellites coupled with the use of devices more sophisticated than the photographic plate to record their motion force one to consider methods of analysis beyond the traditional ones. In particular, it is theoretically possible to deduce from the streak made by the passage of a celestial object a complete specification of its location and velocity. Thus, for artificial satellites, one has the possibility of orbital element set construction from a complete set of initial conditions without recourse to any approximations. In this report, I show how and why this is possible. The practical situation is less hopeful however, in that the distance and radial velocity can be determined only if the streak has measurable curvature. Extremely accurate plus or minus 0.05 sec/sec angular velocities should be obtainable. The positional accuracy is a function of the driving of the telescope. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-19178*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBIT ATTITUDE PROCESSOR. STS-1 BENCH PROGRAM VERIFICATION TEST PLAN
C. R. McClain (McDonnel Douglas Technical Services Co.) Jan. 1980 41 p ref
(JSC-16386; Rept-80-FM-7) Avail: NTIS HC A03/MF A01 CSCL 09B

A plan for the static verification of the STS-1 ATT PROC ORBIT software requirements is presented. The orbit version of the SAPIENS bench program is used to generate the verification data. A brief discussion of the simulation software and flight software modules is presented along with a description of the test cases. R.C.T.

N80-19179*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ORBITAL TRANSFER VEHICLE (OTV) ADVANCED EXPANDER CYCLE ENGINE POINT DESIGN STUDY Bimonthly Status Report, 1 Dec. 1979 - 31 Jan. 1980
J. A. Mellish 15 Feb. 1980 23 p
(Contract NAS8-33574)
(NASA-CR-161389; Rept-33574-M2; BMR-2) Avail: NTIS HC A02/MF A01 CSCL 22B

Progress in the development of a performance optimized engine system design for an advanced LOX/hydrogen expander cycle engine is reported. Analysis of the components and engine and the resulting drawings is discussed. The status of the orbit transfer vehicle liquid engine transient simulation computer model is given. J.M.S.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-19180# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
CRYSTAL-CONTROLLED PROJECTILE TELEMETRY TRANSMITTER Final Report
Robert E. Hicks, William D. Lipps, William C. Trimble, and Daniel D. Zimmerman Adelphi, Md. US Army Material Development and Readiness Command Jul. 1979 73 p
(AFOSR MIPR R-76-29)
(AD-A078214; HDL-CR-79-029-1) Avail: NTIS HC A04/MF A01 CSCL 09/6

This final report describes the task of redesigning a crystal-controlled projectile telemetering transmitter operating at L-band frequencies. The purpose of the transmitter is for deployment in artillery projectiles to telemeter various performance attributes. Prior efforts on this task included (1) a basic circuit design development by Harry Diamond Laboratories to demonstration electrical circuit feasibility, excluding packaging ruggedization considerations, and (2) a production engineering program by Motorola's Government Electronics Division. The approach taken in this effort was based upon the previous work and development of solutions to the complex problems encountered before. These included the combined performance of the oscillator stability, frequency multiplication, microwave stripline filtering, and rf power amplification in a small volume. In addition, the design was to be inexpensive and easily reproducible. A design was developed that proved to be adequate in satisfying the stability requirements and surviving the high acceleration forces

of the artillery environment. The electrical performance problem of the microwave stripline filter was not completely solved, and the proximity effects and resonant cavity responses at the transmitter frequency were determined to be the technical limitations to this design approach. Alternate design approaches have been proposed for solving this serious producibility problem. GRA

N80-19181# National Technical Information Service, Springfield, Va.
BIOTELEMETRY, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Jan. 1978 - Dec. 1979
Elizabeth A. Harrison Dec. 1979 64 p Supersedes NTIS/PS-78/1271; NTIS/PS-77/1121; NTIS/PS-76/1021
(PB80-802101; NTIS/PS-78/1271; NTIS/PS-77/1121; NTIS/PS-76/1021) Avail: NTIS HC $30.00/MF $30.00 CSCL 06B

The use of biotelemetry in biomedical information systems, biometeorology, animal and bird migrations, bioinstrumentation, electrocardiography, ecology, and electroencephalography are topics addressed. This updated bibliography contains 59 abstracts, 24 or which are new entries to the previous edition. GRA

N80-19182# National Technical Information Service, Springfield, Va.
BIOTELEMETRY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Dec. 1979
Elizabeth A. Harrison Dec. 1979 256 p Supersedes NTIS/PS-78/1269; NTIS/PS-77/1120; NTIS/PS-76/1020; NTIS/PS-75/855; NTIS/PS-75/094
(PB80-802093; NTIS/PS-78/1269; NTIS/PS-77/1120; NTIS/PS-76/1020; NTIS/PS-75/855; NTIS/PS-75/094) Avail: NTIS HC $30.00/MF $30.00 CSCL 06B

Biomedical information systems and the use of biotelemetry are reported. Biometerology, animal and bird migrations, bioinstrumentation, electrocardiography, ecology, and electroencephalography as related to biotelemetry are included. This updated bibliography contains 314 abstracts, 80 of which are new entries to the previous edition. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-19183*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ATTITUDE CONTROL STUDY FOR A LARGE FLEXIBLE SPACECRAFT USING A SOLAR ELECTRIC PROPULSION SYSTEM (SEPS)
A. F. Tolivar and R. W. Key 1 Mar. 1980 314 p
(Contract NAS7-100)
(NASA-CR-162878; JPL-Pub-80-14) Avail: NTIS HC A14/MF A01 CSCL 22B

The attitude control performance of the solar electric propulsion system (SEPS) was evaluated. A thrust vector control system for powered flight control was examined along with a gas jet reaction control system, and a reaction wheel system, both of which have been proposed for nonpowered flight control. Comprehensive computer simulations of each control system were made and evaluated using a 30 mode spacecraft model. Results obtained indicate that thrust vector control and reaction wheel systems offer acceptable smooth proportional control. The gas jet control system is shown to be risky for a flexible structure such as SEPS, and is therefore, not recommended as a primary control method. J.M.S.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-19184*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
FIELD RESONANCE PROPULSION CONCEPT
Alan C. Holt Aug. 1979 13 p refs
(NASA-TM-80961; JSC-16073) Avail: NTIS HC A02/MF A01 CSCL 21C

A propulsion concept was developed based on a proposed resonance between coherent, pulsed electromagnetic wave forms, and gravitational wave forms (or space-time metrics). Using this concept a spacecraft propulsion system potentially capable of galactic and intergalactic travel without prohibitive travel times was designed. The propulsion system utilizes recent research associated with magnetic field line merging, hydromagnetic wave effects, free-electron lasers, laser generation of megagauss fields, and special structural and containment metals. The research required to determine potential, field resonance characteristics and to evaluate various aspects of the spacecraft propulsion design is described. R.C.T.

N80-19185*# General Dynamics/Convair, San Diego, Calif.
CAPILLARY ACQUISITION DEVICES FOR HIGH-PERFORMANCE VEHICLES: EXECUTIVE SUMMARY
M. H. Blatt, R. D. Bradshaw, and J. A. Risberg Feb. 1980 103 p refs
(Contract NAS3-20092)
(NASA-CR-159658; GDC-CRAD-80-003) Avail: NTIS HC A06/MF A01 CSCL 21H

Technology areas critical to the development of cryogenic capillary devices were studied. Passive cooling of capillary devices was investigated with an analytical and experimental study of wicking flow. Capillary device refilling with settled fluid was studied using an analytical and experimental program that resulted in successful correlation of a versatile computer program with test data. The program was used to predict Centaur D-1S LO2 and LH2 start basket refilling. Comparisons were made between the baseline Centaur D-1S propellant feed system and feed system alternatives including systems using capillary devices. The preferred concepts from the Centaur D-1S study were examined for APOTV and POTV vehicles for delivery and round trip transfer of payloads between LEO and GEO. Mission profiles were determined to provide propellant usage timelines and the payload partials were defined. A.W.H.

N80-19186*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ADVANCED OXYGEN-HYDROCARBON ROCKET ENGINE STUDY Bimonthly Progress Report
C. J. OBrien 11 Feb. 1980 22 p
(Contract NAS8-33452)
(NASA-CR-161390; Rept-33452-M2) Avail: NTIS HC A02/MF A01 CSCL 21H

Preliminary identification and evaluation of promising liquid oxygen/ hydrocarbon (LO2/HC) rocket engine cycles is reported. A consistent and reliable data base for vehicle optimization and design studies, to demonstrate the significance of propulsion

system improvements, and to select the critical technology areas necessary to realize such advances is presented. J.M.S.

N80-19187# ARO, Inc., Arnold Air Force Station, Tenn.
BIPROPELLANT ENGINE PLUME CONTAMINATION PROGRAM. VOLUME 2: CHAMBER MEASUREMENTS, PHASE 2 Final Report
H. M. Powell, L. L. Price, and R. E. Alt AEDC Nov. 1979 113 p refs
(AD-A077435; AEDC-TR-79-28-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 21/8

A bipropellant rocket engine plume contamination test program was conducted in the AEDC Aerospace Chamber (10V). A 5-lbf-thrust rocket engine, burning MMH as the fuel and N2O4 as the oxidizer, was operated over a range of engine operating parameters in a cryogenically pumped vacuum chamber where the background pressure was maintained below 0.00001 torr. Using the electron beam fluorescence technique, species number densities and rotational temperture were measured in both the forward- and back-flow region of the plume exhaust. Additionally, Mie scattering measurements were performed for the forward-flow regions of the plume exhaust. GRA

N80-19188# ARO, Inc., Arnold Air Force Station, Tenn.
BIOPROPELLANT ENGINE PLUME CONTAMINATION PROGRAM. VOLUME 1: CHAMBER MEASUREMENTS, PHASE 1 Final Report, 5 Sep. - 12 Dec. 1977
R. E. Alt, J. A. Roux, R. E. Wood, and D. F. Franzine AEDC Dec. 1979 103 p refs
(AD-A078412; AEDC-TR-79-28-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 21/8

An experimental program to measure the mass flux in the backflow region of a 5-lbf bipropellant thruster at angles up to 147 deg with respect to the plume centerline using temperature-controlled and temperature-compensated quartz crystal microbalances (QCM'S) is presented. The measurements were conducted in a high vacuum cryogenic chamber (Aerospace Chamber 10V) at AEDC. Gaseous helium and liquid helium cryopanels provided a blank-off pressure in the ten to the minus 6th power torr range and maintained the background pressure in the ten to the minus 5th power torr range while pulse firing the motor (25 to 100 msec pulse width, 1- to 10 percent duty cycle). Chamber recovery time was a few tenths of a second. Several motor configurations and operating conditions were compared for potential contamination effects. GRA

N80-19189# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
FAILURE ANALYSIS AND RESIN EVALUATION OF IUS SRM-1 92 INCH PROTOTYPE MOTOR CASE Interim Report
R. W. Fillers, J. F. Ward, and P. K. Grant 28 Sep. 1979 34 p refs
(Contract F04701-78-C-0079)
(AD-A077407; TR-0079(4451-61)-1; SAMSO-TR-79-74) Avail: NTIS HC A03/MF A01 CSCL 21/8

The IUS SRM-1 92-in. diameter prototype Kevlar/epoxy motor case failed catastrophically at approximately 50 percent design load during hydrostatic burst testing on 18 October 1978. The Aerospace Materials Sciences Laboratory has carried out a failure analysis of the SRM-1 prototype motor case, briefly looked at two 18-in. subscale development vessels corresponding to SRM-1 and SRM-2, and carried out a preliminary evaluation of the epoxy resin system used for winding the motor case. Examination of the three motor cases and preliminary examination of the resin system suggest that poor adhesion is obtained between the Kevlar fiber and this epoxy resin and further that this resin system gels in three to four days at room temperature. The result of poor adhesion is not known but is expected to be detrimental to case performance in the dome regions. However, excessively long winding times (on the order of six days), coupled with the short gel times of an extremely brittle resin system plus a lack of temperature control during winding, result in an extremely nonuniform Kevlar/epoxy composite. Since the local strains incurred through both premature gellation and thermal excursions during manufacturing cannot be relieved in a brittle matrix, premature failure can occur in a stepwise fashion at loadings well below design expectations, especially if the composite layers are not uniformly loaded. GRA

N80-19190# Naval Surface Weapons Center, Dahlgren, Va.
ROCKET MOTOR BLAST EFFECTS AND PROPOSED ABLATIVE PROTECTION FOR RAM LAUNCHING SYSTEM EX 43 Final Report
Earl E. Biermann and Allen B. Coates Oct. 1979 92 p
(AD-A077037; NSWC/TR-79-376) Avail: NTIS HC A05/MF A01 CSCL 21/2

The test program described in this report was designed to: (1) investigate the severity of EX 43 launcher and ship damage caused by exhaust blast during flyaway and inadvertent restrained RIM 116A missile firings; and (2) investigate and recommend the type and amount of suitable protective materials required to prevent degradation in the impingement area. The four materials tested in the last phase of this program have been recommended for further qualification testing for survivability in a simulated shipboard environment. GRA

N80-19191# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL STUDIES OF MULTIPLE-SCATTERED LIGHT FROM LATEX SPHERES Final Report, Oct. 1976 - Nov. 1978
D. P. Weaver, B. P. Curry, and J. W. L. Lewis AEDC Oct. 1979 30 p refs
(AD-A076322; AEDC-TR-79-60) Avail: NTIS HC A03/MF A01 CSCL 21/8

This report presents the results of a series of light-scattering measurements on small, spherical particles of a known size distribution and index of refraction. The purpose of the study is to provide additional data for the evaluation of the multiple-scattering model used in a plume visibility code currently being developed for the Air Force. Measurements of both singly and multiple scattered laser radiation from aqueous suspensions of spherical latex particles were performed at several optical depths. Included are descriptions of the light-scattering apparatus and sample preparation techniques used in the study. Also, sample results of the experiments are presented in graphical form with normalized scattering intensity as a function of scattering angle. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-19192# Pennsylvania State Univ., University Park. Dept. of Chemistry.
SMALL-MOLECULE CYCLIC MODELS FOR THE SYNTHESIS OF NEW POLYPHOSPHAZENES SIDE GROUP CONSTRUCTION VIA LITHIOPHENOXY DERIVATIVES Interim Report
H. R. Allcock, T. L. Evans, and T. J. Fuller 29 Nov. 1979 29 p refs
(Contract N00014-75-C-0685)
(AD-A078183; TR-13) Avail: NTIS HC A03/MF A01 CSCL 07/3

Hexa(p-lithiophenoxycyclotriphosphazene) has been synthesized as an intermediate for the covalent attachment of metallo-, phosphino, carboxylato, alkyl, or tertiary alcohol units to the side group structure. These reactions are models for the preparation of the corresponding phosphazene high polymers. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-19193*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ASSESSMENT OF CARBON FIBER ELECTRICAL EFFECTS
Washington Mar. 1980 278 p refs Conf. held in Hampton, Va., 4-5 Dec. 1979
(NASA-CP-2119; L-13503) Avail: NTIS HC A13/MF A01 CSCL 11D

The risks associated with the use of carbon fiber composites in civil aircraft are discussed along with the need for protection of civil aircraft equipment from fire-released carbon fibers. The size and number of carbon fibers released in civil aircraft crash fires, the downwind dissemination of the fibers, their penetration into buildings and equipment, and the vulnerability of electrical/electronic equipment to damage by the fibers are assessed. For individual titles, see N80-19194 through N80-19205.

N80-19194*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPROACH TO THE ASSESSMENT OF THE HAZARD
Robert J. Huston *In its* Assessment of Carbon Fiber Elec. Effects Mar. 1980 p 11-27 refs (For primary document see N80-19193 10-24)
Avail: NTIS HC A13/MF A01 CSCL 11D
An overview of the carbon fiber hazard assessment is presented. The potential risk to the civil sector associated with the accidental release of carbon fibers from aircraft having composite structures was assessed along with the need for protection of civil aircraft from carbon fibers. K.L.

N80-19195*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RELEASE OF CARBON FIBERS FROM BURNING COMPOSITES
Vernon L. Bell *In its* Assessment of Carbon Fiber Elec. Effects Mar. 1980 p 29-57 (For primary document see N80-19193 10-24)
Avail: NTIS HC A13/MF A01 CSCL 11D
The results of a burn/explosion test program are presented. The amount of fiber released and the physical characteristics of the fibers are among the data reported. K.L.

N80-19196*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DISSEMINATION, RESUSPENSION, AND FILTRATION OF CARBON FIBERS
Wolf Elber *In its* Assessment of Carbon Fiber Elec. Effects Mar. 1980 p 59-71 (For primary document see N80-19193 10-24)
Avail: NTIS HC A13/MF A01 CSCL 11D
Carbon fiber transport was studied using mathematical models established for other pollution problems. It was demonstrated that resuspension is not a major factor contributing to the risk. Filtration and fragmentation tests revealed that fiber fragmentation shifts the fiber spectrum to shorter mean lengths in high velocity air handling systems. K.L.

N80-19197*# Bionetics Corp., Hampton, Va.
EVALUATION OF EQUIPMENT VULNERABILITY AND POTENTIAL SHOCK HAZARDS
Israel Taback *In* NASA. Langley Res. Center Assessment of Carbon Fiber Elec. Effects Mar. 1980 p 73-99 (For primary document see N80-19193 10-24)
Avail: NTIS HC A13/MF A01 CSCL 11D
The vulnerability of electric equipment to carbon fibers released from aircraft accidents is investigated and the parameters affecting vulnerability are discussed. The shock hazard for a hypothetical set of accidents is computed. K.L.

N80-19198*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LARGE-SCALE FIBER RELEASE AND EQUIPMENT EXPOSURE EXPERIMENTS
R. A. Pride *In its* Assessment of Carbon Fiber Elec. Effects Mar. 1980 p 101-136 refs (For primary document see N80-19193 10-24)
Avail: NTIS HC A13/MF A01 CSCL 11D
Outdoor tests were conducted to determine the amount of fiber released in a full scale fire and trace its dissemination away from the fire. Equipment vulnerability to fire released fibers was assessed through shock tests. The greatest fiber release was observed in the shock tube where the composite was burned with a continuous agitation to total consumption. The largest average fiber length obtained outdoors was 5 mm. K.L.

N80-19199*# Bionetics Corp., Hampton, Va.
SURVEYS OF FACILITIES FOR THE POTENTIAL EFFECTS FROM THE FALLOUT OF AIRBORNE GRAPHITE FIBERS
Ansel J. Butterfield *In* NASA. Langley Res. Center Assessment of Carbon Fiber Elec. Effects Mar. 1980 p 137-149 (For primary document see N80-19193 10-24)
Avail: NTIS HC A13/MF A01 CSCL 11D
The impact of the entry of graphite fibers into workplaces in the United States is discussed. Areas where an electrical failure could cause major problems include process and production systems, hospitals, and police/fire emergency communication systems. K.L.

N80-19200*# Operations Research, Inc., Silver Spring, Md.
ASSESSMENT OF THE RISK DUE TO RELEASE OF CARBON FIBER IN CIVIL AIRCRAFT ACCIDENTS, PHASE 2
Leon S. Pocinki, Merrill E. Cornell, and Lawrence Kaplan *In* NASA. Langley Res. Center Assessment of Carbon Fiber Elec. Effects Mar. 1980 p 157-182 refs (For primary document see N80-19193 10-24)
(Contract NAS1-15379)
Avail: NTIS HC A13/MF A01 CSCL 11D
The risk associated with the potential use of carbon fiber composite material in commercial jet aircraft is investigated. A simulation model developed to generate risk profiles for several airports is described. The risk profiles show the probability that the cost due to accidents in any year exceeds a given amount. The computer model simulates aircraft accidents with fire, release of fibers, their downwind transport and infiltration of buildings, equipment failures, and resulting ecomomic impact. The individual airport results were combined to yield the national risk profile. A.W.H.

N80-19201*# Little (Arthur D.), Inc., Boston, Mass.
ASSESSMENT OF RISK DUE TO THE USE OF CARBON FIBER COMPOSITES IN COMMERCIAL AND GENERAL AVIATION
J. Fiksel, Donald Rosenfield, and A. Kalelkar *In* NASA. Langley Res. Center Assessment of Carbon Fiber Elec. Effects Mar. 1980 p 183-211 refs (For primary document see N80-19193 10-24)
Avail: NTIS HC A13/MF A01 CSCL 11D
The development of a national risk profile for the total annual aircraft losses due to carbon fiber composite (CFC) usage through 1993 is discussed. The profile was developed using separate simulation methods for commercial and general aviation aircraft. A Monte Carlo method which was used to assess the risk in commercial aircraft is described. The method projects the potential usage of CFC through 1993, investigates the incidence of commercial aircraft fires, models the potential release and dispersion of carbon fibers from a fire, and estimates potential economic losses due to CFC damaging electronic equipment. The simulation model for the general aviation aircraft is described. The model emphasizes variations in facility locations and release conditions, estimates distribution of CFC released in general aviation aircraft accidents, and tabulates the failure probabilities and aggregate economic losses in the accidents. A.W.H.

N80-19202*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERSPECTIVE ON THE RESULTS
Robert J. Huston *In its* Assessment of Carbon Fiber Elec. Effects Mar. 1980 p 213-223 refs (For primary document see N80-19193 10-24)
Avail: NTIS HC A13/MF A01 CSCL 11D
The results of studies on the risk due to the use of carbon fibers in aircraft are assessed. Assumptions such as additional fire protection in the aircraft, new structural concepts, and the development of unique carbon composites are evaluated. Some findings from the national risk profile including equipment vulnerability and economic impact are discussed. A.W.H.

N80-19203*# Westinghouse Electric Corp., Pittsburgh, Pa.
EFFECTS OF CARBON/GRAPHITE FIBER CONTAMINATION ON HIGH VOLTAGE ELECTRICAL INSULATION
Thomas Garrity (DOE) and Charles Eichler *In* NASA. Langley Res. Center Assessment of Carbon Fiber Elec. Effects Mar. 1980 p 235-263 (For primary document see N80-19193 10-24)

Avail: NTIS HC A13/MF A01 CSCL 11D

The contamination mechanics and resulting failure modes of high voltage electrical insulation due to carbon/graphite fibers were examined. The high voltage insulation vulnerability to carbon /graphite fiber induced failure was evaluated using a contamination system which consisted of a fiber chopper, dispersal chamber, a contamination chamber, and air ducts and suction blower. Tests were conducted to evaluate the effects of fiber length, weathering, and wetness on the insulator's resistance to carbon/graphite fibers. The ability of nuclear, fossil, and hydro power generating stations to maintain normal power generation when the surrounding environment is contaminated by an accidental carbon fiber release was investigated. The vulnerability assessment included only the power plant generating equipment and its associated controls, instrumentation, and auxiliary and support systems. A.W.H.

N80-19204*# National Bureau of Standards, Washington, D.C.
EFFECTS OF CARBON FIBERS ON CONSUMER PRODUCTS
Robert A. Wise and C. Denver Lovett. *In* NASA. Langley Res. Center. Assessment of Carbon Fiber Elec. Effects. Mar. 1980 p 265-274 refs (For primary document see N80-19193 10-24)
(NASA Order L-81246-A)
Avail: NTIS HC A13/MF A01 CSCL 11D

The potential effects of carbon fibers on consumer products such as dishwashers, microwave ovens, and smoke detectors were investigated. The investigation was divided into two categories to determine the potential faults and hazards that could occur if fibers should enter the electrical circuits of the selected appliances. The categories were a fault analysis and a hazard analysis. Hazards considered were fire, flood, physical harm, explosion, and electrical shock. Electrical shock was found to be a possible occurrence related to carbon fibers. Faults were considered to be any effect on the performance of an appliance which would result in complaint or require service action. A.W.H.

N80-19205*# Transportation Systems Center, Cambridge, Mass.
RISK ASSESSMENT OF CARBON FIBER COMPOSITE IN SURFACE TRANSPORTATION
W. T. Hathaway and K. M. Hergenrother. *In* NASA. Langley Res. Center. Assessment of Carbon Fiber Elec. Effects. Mar. 1980 p 276-282 refs (For primary document see N80-19193 10-24)
Avail: NTIS HC A13/MF A01 CSCL 11D

The vulnerability of surface transportation to airborne carbon fibers and the national risk associated with the potential use of carbon fibers in the surface transportation system were evaluated. Results show airborne carbon fibers may cause failure rates in surface transportation of less than one per year by 1995. The national risk resulting from the use of carbon fibers in the surface transportation system is discussed. A.W.H.

N80-19206*# Boeing Aerospace Co., Seattle, Wash.
QUALITY CONTROL DEVELOPMENTS FOR GRAPHITE/PMR15 POLYIMIDE COMPOSITES MATERIALS
C. H. Sheppard and J. T. Hoggatt. Sep. 1979 187 p
(Contract NAS1-15009)
(NASA-CR-159182; D180-20545-2A) Avail: NTIS HC A09/MF A01 CSCL 11D

The problem of lot-to-lot and within-lot variability of graphite/PMR-15 prepreg was investigated. The PMR-15 chemical characterization data were evaluated along with the processing conditions controlling the manufacture of PMR-15 resin and monomers. Manufacturing procedures were selected to yield a consistently reproducible graphite prepreg that could be processed into acceptable structural elements. K.L.

N80-19207*# National Aeronautics and Space Administration, Washington, D. C.
DETERMINATION OF THE TECHNICAL CONSTANTS OF LAMINATES IN OBLIQUE DIRECTIONS
F. Vidouse. Oct. 1979 43 p refs. Transl. into ENGLISH of "Determination des Constantes Techniques des Stratifies dans les Directions Obliques - Theorie et Resultats Experimentaux", Rept. CRIF-PL-4. Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels, Nov. 1973 p 1-42. Translation was announced as N74-21166
Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75719; CRIF-PL-4) Avail: NTIS HC A03/MF A01 CSCL 11D

An off-axis tensile test theory based on Hooke's Law is applied to glass fiber reinforced laminates. A corrective parameter dependent on the characteristics of the strain gauge used is introduced by testing machines set up for isotropic materials. Theoretical results for a variety of strain gauges are compared with those obtained by a finite element method and with experimental results obtained on laminates reinforced with glass. K.L.

N80-19208# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Nonmetallic Materials Div.
TI-59 MAGNETIC CARD CALCULATOR SOLUTIONS TO COMPOSITE MATERIALS FORMULAS. Final Technical Report, Oct. 1977 - Oct. 1978
Stephen W. Tsai and H. Thomas Hahn. Apr. 1979 55 p ref
(AF Proj. 2419)
(AD-A078043; AFML-TR-79-4040) Avail: NTIS HC A04/MF A01 CSCL 11/4

This volume contains the description and instructions of magnetic cards for TI-59 programmable calculators. These tapes contain the key calculations of the stiffness and strength of unidirectional and symmetrically laminated composites. Both in-plane and flexural loadings can be applied. The initial stress and strain due to curing and moisture adsorption are also included in the strength calculation. With the aid of the magnetic cards, instant calculations can be made for practical use. The use of cards is also an effective teaching tool. The formulas used in the cards have been derived in another AFML report, entitled, 'Introduction to Composite Materials', AFML-TR-78-201. GRA

N80-19209# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
SINTERING OF BETA SILICON NITRIDE SOLID SOLUTIONS CONTAINING METAL OXIDE. Final Report, 1 Jul. 1978 - 30 Jun. 1979
T. Y. Tien. 1979 43 p refs
(Grant AF-AFOSR-3078-76; AF Proj. 9761)
(AD-A077415; TR-014536-78-1) Avail: NTIS HC A03/MF A01 CSCL 11/2

Reaction sintering of Beta-Si_3N_4 solid solutions was studied, using powder mixtures of SiO_2 and AlN; Si_3N_4, AlN and Al_2O_3; and Si_3N_4, SiO_2 and AlN. Although the different starting mixtures resulted in the same final composition, substantial differences in sintering kinetics take place depending on the influence of chemical reactions, vaporization, and densification by transient liquid phase sintering. This behavior can be explained qualitatively on the basis of the solid-liquid equilibria in the Si, Al/N,O system. Reaction sintered Beta-Si_3N_4 solid solutions with the highest densities were prepared from mixtures of Si_3N_4, AlN and Al_2O_3 powders without application of external pressure or additional densification aids. In contrast, mixtures containing SiO_2, showed less densification even with liquid present because of vaporization during sintering. GRA

N80-19210# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
THE OXIDATION OF GRAPHITIC MONOLAYERS ON Ni(110)
Radhesyam Sau and John B. Hudson. 1 Dec. 1979 21 p refs
(Contract N00014-75-C-0730)
(AD-A078512; TR-7) Avail: NTIS HC A02/MF A01 CSCL 11/8

The reaction between oxygen gas and a graphitic carbon monolayer formed on an initially clean Ni(110) surface has been studied by a combination of Auger electron spectrometric and molecular beam relaxation spectrometric techniques. The only gaseous reaction product observed is CO. The kinetics of the reaction at 873K are well described by a model involving oxygen adsorption at defects in the graphitic monolayer followed by reaction to produce CO at these points and the subsequent growth of holes in the carbon layer as reaction proceeds. GRA

N80-19211# Dyna East Corp., Wynnewood, Pa.
EFFECTS OF PROOF-TEST ON THE STRENGTH AND FATIGUE LIFE OF A UNIDIRECTIONAL COMPOSITE Interim Technical Report, 1 Apr. 1978 - 31 Mar. 1979
A. S. D. Wang, Pei Chi Chou, and James Alper Wright-Patterson AFB, Ohio AFML May 1979 32 p refs
(Contract F33615-77-C-5039; AF Proj. 2419)
(AD-A076334; AFML-TR-79-4089) Avail: NTIS HC A03/MF A01 CSCL 11/4

The effects of a static proof-load on the statistical distribution of the static strength and fatigue life of a unidirectional graphite-epoxy laminate (As-3501-05) are investigated experimentally. Loading mode for both the static and fatigue tests is restricted to uniaxial tension in the fiber direction. 6 ply tension coupons with dimensions of 22.9 cm x 1.9 cm are used; and all tests are conducted using a closed-loop Instron tester, under room temperature (21 C) and ambient humidity (60% R.H.) conditions. The data are analyzed using a two-parameter Weibull distribution in conjunction with the max. likelihood method for parameter estimation. Results show that proof-load can guarantee a min. static strength, and to less degree can assure a min. fatigue life. GRA

N80-19212# California Univ., Berkeley. Lawrence Berkeley Lab. Chemical Biodynamics Div.
X-RAY ABSORPTION STUDIES OF GRAPHITE INTERCALATES AND METAL AMMONIA SOLUTIONS Ph.D. Thesis
A. S. Robertson Sep. 1979 248 p refs
(LBL-9840) Avail: NTIS HC A11/MF A01

X-ray absorption spectroscopy (XAS) was used to study the arsenic fluorocomplexes, including the AsF5 and AsF6(-) intercalates of graphite, and rubidium metal-ammonia solutions. The As-F distances obtained for AsF3 and AsF5 gas are both in excellent agreement with electron diffraction data. A superior measurement which is significantly shorter than the accepted value of the bond distance in an undistorted AsF6(-) octahedra is reported. The data presented support the hypothesis that the AsF5 oxidizes graphite upon intercalation to produce AsF6(-). In the X-ray region, intensity and position changes of absorption transitions are explained. In the extended X-ray absorption fine structure region, the Rb-N bond distance and the relative number of nitrogen atoms in the first shell are measured. Information is provided about the nature of the metal-ammonia phase separation, phase transition, and density fluctuations. DOE

N80-19213# General Electric Co., Schenectady, N. Y. Metallurgy Lab.
DEVELOPMENT OF A LOW LOSS MAGNETIC COMPOSITE UTILIZING AMORPHOUS METAL FLAKES Progress Report, 19 Mar. - 18 Sep. 1979
Oct. 1979 60 p
(Contract ET-78-C-01-3205)
(CONS-3205-T2; SAPR-2) Avail: NTIS HC A04/MF A01

Composite specimens of amorphous metal flakes were made using several different binders and several different compaction parameters. The binders have included epoxies, anaerobic adhesives, polyimides, polyamidemides, polyehermides, and polyesterimides. Compaction variables included the time, temperature, and pressure of compaction flake size, and flake alignment. The best results were achieved using a polyetherimide and aligned flake. Packing factors of 87% were achieved in specimens which also exhibited high mechanical integrity and the ability to withstand a high temperature anneal. DOE

N80-19214# California Univ., Berkeley. Lawrence Berkeley Lab.
THE CORROSION OF SILICATE MATERIALS BY HYDROGEN GAS AND HYDROFLUORIC ACID SOLUTION
Stephen T. Tso Oct. 1979 115 p refs
(Contract W-7405-eng-48)
(LBL-9887) Avail: NTIS HC A06/MF A01

The reactions of silicate materials with hydrogen gas were studied. The mechanism for the reaction of pure silica glass with hydrogen gas investigated. Alumino-silicate glasses and calcium alumino silicate glasses were used to reveal the compositional effect on corrosion resistance. Different methods were employed to increase the corrosion resistance. Mullite was found to have potential as a material for coal gasification applications. The reactions between silicate glasses and hydrofluoric acid solution were also investigated. The difference in reaction rates for different glasses were explained on the basis of phase separation and crystallization. These two reactions (with hydrogen gas and hydrofluoric acid solution) are in strong contrast in several aspects. The latter is diffusion controlled while the former is kinetically controlled. Therefore, no empirical relative corrosion resistance betweem them was found. DOE

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-19215 Baylor Univ., Waco, Tex.
AN IMPROVED DISPERSION SYSTEM FOR SIMULTANEOUS MULTIELEMENT ANALYSIS BY FLAME SPECTROSCOPY Ph.D. Thesis
Betsy Ellen Malloy 1979 142 p
Avail: Univ. Microfilms Order No. 8003328

A wavelength dispersion system for use with a multichannel detector was developed for simultaneous multielement analysis. The system employs a monochromator with grating position fixed and incident angle varied by horizontal displacement of entrance slits. In additional, slits may be displaced vertically to create a two-dimensional system. Various aspects of instrumental performace were evaluated. The system was applied to the analysis of blood serum for sodium, potassium, and calcium, and to the analysis of clays for the exchangeable cations calcium, sodium, potassium, and lithium. The system has many of the advantages of a direct reading spectrometer, with the additional advantages of background correction and individual observation height optimization for each element. Dissert. Abstr.

N80-19216 British Library Lending Div., Boston Spa (England).
PROSPECTS FOR BROADENING THE RANGE OF INORGANIC BINDING AGENTS
M. M. Sychev and N. V. Arkincheeva Sep. 1979 9 p refs Transl. into ENGLISH from Neorganicheskie i organosilikatye pokrytiya 6th Union Conf. (USSR), 1973 20-23 Mar. 1973 p 350-355
(RTS-11804; BLL-RTS-11804) Avail: British Library Lending Div., Boston Spa, Engl.

In binding agents, the following transmutations occur: acid salt yields neutral salt yields basic salt yields hydroxy salt yields hydroxide. Of the acid binders, the salts of heteropoly acids and possibly a few sulfates show promise. Apart from these, the range of acid binders can be broadened by means of the oxynitrates and oxychlorides Zn, Cr, Ce, and Ti. In terms of obtaining alkaline binders, the hydroxy salts look promising. For some elements, the results of the analysis were corroborated by experiments. Acid binders were achieved by a synthesis of the basic salts of zironium as well as on the basis of acid soldium salts of phosphomolybdic and phosphotungstic heteroacids. Aluminate solutions are also proposed as binding agents. A.R.H.

N80-19217*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ISOELECTRIC FOCUSING OF RED BLOOD CELLS IN A DENSITY GRADIENT STABILIZED COLUMN
Adam J. K. Smolka and Teresa Y. Miller Feb. 1980 27 p refs Sponsored in part by the Universities Space Res. Assoc.
(NASA-TM-78268) Avail: NTIS HC A03/MF A01 CSCL 07D

The effects of Ficoll and cell application pH on red blood cell electrophoretic mobility and focusing pH were investigated by focusing cells in a density gradient stabilized column. Sample loading, cell dispersion, column conductivity, resolution of separation, and the effect of Ampholines were examined. K.L.

N80-19218# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.

PHOTOCHEMICAL TRANSIENTS OF ELECTRODE BOUND METHYLENE BLUE Progress Report, 15 Jun. 1978 - 1 Oct. 1979
Charles E. Baumgartner, Gary T. Marks, Herbert H. Richtol, and David A. Aikens. Dec. 1979. 14 p. refs.
(Contract N00014-78-C-0494)
(AD-A078908; TR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

A 520 nm transient was observed as the result of the interaction of methylene blue triplet with methylene blue bound to an electrode surface. The transient was observed by laser flash photolysis in an outgassed thin layer transparent electrochemical cell filled with a solution of .001 M methylene blue and 0.1M KCl in 50% aqueous methanol or 50% aqueous acetonitrile. The 520 nm transient is observed after application of an anodic potential of 0.1V to 0.7V vs Ag/AgCl for a few seconds on a Pt, Au or SnO2 electrode. The results indicate that methylene blue triplet is the precursor of the species associated with the 520 nm transient and this transient involves interaction of the triplet with electrodeposited dye. GRA

N80-19219# Columbia Univ., New York.
PICOSECOND LASER STUDIES OF AROMATIC RADICAL IONS Final Report, 1 Aug. 1976 - 31 Jul. 1979
K. B. Eisenthal. Nov. 1979. 8 p. refs.
(Grant DAAG29-76-G-0310)
(AD-A078721; ARO-14086.4-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

A sophisticated picosecond laser and detection system has been constructed and used to obtain new information on key energy relaxing phenomena in molecular systems. GRA

N80-19220# California Univ., Irvine. Combustion Lab.
EXPERIMENTAL ASSESSMENT OF NITROGEN OXIDES TRANSFORMATIONS WHILE SAMPLING COMBUSTION PRODUCTS Interim Report
Ronald Clinton Benson. Jan. 1978. 75 p. refs.
(Grant AF-AFOSR-2710-74; AF Proj. 2308)
(AD-A078090; UCI-ARTR-78-1; AFOSR-79-1232TR) Avail: NTIS HC A04/MF A01 CSCL 07/2

Analysis of combustion products is performed by conveying the exhaust effluents to instrumentation by means of a sample probe and sampling line. Frequently, the selection of sampling materials does not consider potential chemical transformations that can occur in the sample line and probe. Nitrogen oxides are combustion products that are especially vulnerable to transformations. Nitric oxide (NO) and nitrogen dioxide (NO2) are the primary components of NOx. The ratio of NO/NO2 emissions from combustion sources is not well established (due to the potential reduction of NO2 to NO in sample probes and sample lines) and the total emission of NOx is subject to uncertainty in some cases (due to potential removal of NOx in sample probes and sample lines). The objective of the present study is to investigate the extent of transformations of NOx in the presence of oxidizing and reducing species. Stainless steel and silica were the two sampling tube materials used in this investigation. Simulated combustion products of 500 ppm NO, 75 ppm NO2, 12% CO2 bal N2 at 25 C were common to all tests. The oxidizing species and concentrations considered included 1 and 5% O2. Various concentrations of carbon monoxide, hydrogen, and hydrocarbons were used for the reducing species. Temperature and pressure effects were evaluated in this particular study. The results indicated that transformation was more pronounced in stainless steel than silica. GRA

N80-19221# George Washington Univ., Washington, D. C. Dept. of Chemistry.
FINAL STATE CORRELATION EFFECTS IN AUGER LINESHAPES: APPLICATION TO SILICON DIOXIDE
David E. Ramaker. Nov. 1979. 63 p. refs. Submitted for publication.
(Contract N00014-78-C-0496; RR0130801; NR Proj. 056-681)
(AD-A078037; TR-1) Avail: NTIS HC A04/MF A01 CSCL 07/2

Final state correlation effects in Auger lineshapes are considered within the cluster LCAO-MO-CI theory with a parameterized Hamiltonian. A model problem is solved analytically to elucidate the role of final state hole-hole correlation and to understand the localization of the holes on rather small subclusters of the system. The relationship of the correlation effects to the relative magnitudes of the one-center hole-hole repulsion u and the bandwidth gamma has been previously reported; however, this previous work has been limited to metallic single element conductors. This work extends the theory to covalently bonded insulators (and possibly semiconductors) consisting of more than one element. GRA

N80-19222# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
SUBMILLIMETER WAVE SPECTROSCOPY AND TECHNOLOGY Final Report, 1 Jan. - 30 Jun. 1979
J. J. Gallagher. 8 Oct. 1979. 75 p. refs.
(Grant DAAG29-76-G-0280)
(AD-A078003; ARO-14104.5-PX) Avail: NTIS HC A04/MF A01 CSCL 07/4

The investigations performed during the final 6 months of the program are described. These included optically-pumped laser spectroscopy of liquid water and water vapor and submillimeter receiver investigations. Papers on work performed during this period are attached. GRA

N80-19223# Colorado State Univ., Fort Collins. Dept. of Chemistry.
ELECTROCHEMISTRY OF SOLUTES IN CHLOROALUMINATE MELTS AND THE DEVELOPMENT OF RELATED ELECTROCHEMICAL METHODOLOGY Final Report, 1 Apr. 1978 - 30 Jun. 1979
Robert A. Osteryoung and Janet G. Osteryoung. 1979. 23 p. refs.
(Grant AF-AFOSR-2978-76)
(AD-A078242; AFOSR-79-1242TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

Molten haloaluminates were investigated as solvent systems for the study of electrochemical reactions. The particular interest has been in the fact that systems, such as the molten tetrachloroaluminates, show significant acid-base dependent behavior which is reflected in solute electrochemistry. In the NaCl-AlCl3 system (sodium tetrachloraluminate), the acid-base chemistry of oxides and chalcogenides was investigated. The electrochemistry of Mo, Se and Te was investigated; Mo was studies in the basic melt (excess NaCl) while Se and Te were investigated as a function of melt acidity and a variety of acidity dependent electrochemical reactions were uncovered. The electrochemistry of Ni(II) was also investigated, and it was found that NiO2 was insoluble in the neutral and basic melt. At 175 C the melt becomes saturated with NaCl at about 1% excess. Although not subject to detailed investigation, it was found that oxygen reduction in this melt could be catalyzed by the presence of metal cations, such as Cu(I) and Mo(V). The electrochemistry of a number of aromatic polynuclear hydrocarbons was studied across the acidity range. All were shown to undergo a one-electron oxidation to the radical cation that was independent of melt acidity and, compared to ferrocene, oxidized at the same relative potential as in acetonitrile. The electrochemistry of a number of metal carbonyls was investigated in another room temperature melt, a 2:1 mixture of aluminum chloride and ethypyridinium bromide. GRA

N80-19224# SRI International Corp., Menlo Park, Calif.
PHOTODISSOCIATION AND PHOTODETACHMENT OF ATMOSPHERIC NEGATIVE IONS Final Report, 15 Aug. 1978 - 14 Aug. 1979
J. T. Moseley, L. C. Lee, R. V. Hodges, and G. P. Smith. Aug. 1979. 113 p. refs.
(Contracts F49620-78-C-0119; DAAG29-76-C-0023; DAHC04-73-C-0016; DAEA18-71-A-0204)
(AD-A078091; SRI-MP-79-66; AFOSR-79-1262TR) Avail: NTIS HC A06/MF A01 CSCL 07/4

Photodetachment and photodissociation cross section measurements have been made for a wide variety of negative ions considered to be of atmospheric importance at wavelengths of 2484, 3500, (3507 and 3569 combined) 4067, and 4131 angstroms. The ions for which cross sections were measured included O-, OH-, O2-, O3-, O4-, CO3-, CO4-, NO2-, NO3-, O2-, ClO2-, Cl3-, and BrO2-, as well as hydrates of many of these ions. The photodissociation of CO3- in the region of the

threshold near 6560 angstroms was reinvestigated in detail, because of the present controversy concerning the bond energy of this ion. These measurements more strongly confirmed our previous conclusion that the bond energy of this ion is less than 1.9 eV. All measurements were made using a drift tube mass spectrometer photodestruction apparatus and with a krypton ion laser or a rare gas halogen laser. GRA

N80-19225# Indiana Univ. at Bloomington. Dept. of Chemistry.
EVALUATION OF CLASSICAL VAPORIZATION AND IONIZATION INTERFERENCES IN A MINITIATURE ICP
R. N. Savage and G. M. Hieftje. Nov. 1979. 42 p. refs.
(Contract N00014-76-C-0838)
(AD-A077886; TR-23) Avail: NTIS. HC A03/MF A01. CSCL 07/4

The magnitude of several classical interelement interferences in a miniature ICP is found to be small but dependent on experimental conditions. The origin and manifestation of these interference (matrix effects are shown to be complex and influenced most strongly by: (1) observation window in the plasma's tail flame, (2) rf power, and (3) nebulizer gas flow rate. In particular, vaporization interference matrices (al and PO4) caused a depression in the intensities of both the neutral atom and ion lines of Ca with the Ca II line experiencing a larger effect than that of Ca I. Conversely, easily ionized elements (such as Na and Cs) enhanced both Ca and Mg neutral atom and ion line intensities, with the atom lines exhibiting a larger increase than those of the ions. Because both the neutral atom and ion lines of Ca and Mg are enhanced by Na and Cs, and to identical degrees, a simple shift in ionization equilibria seems not to produce the observed interference. Clearly, more fundamental knowledge concerning the formation and excitation of atoms in ICP sources is needed before interference mechanisms can be elucidated. GRA

N80-19226# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
DESIGN OF A PROGRAM FOR EXPERT DIAGNOSIS OF ACID BASE AND ELECTROLYTE DISTURBANCES
Ramesh S. Patil. May 1979. 42 p. refs.
(Contract N00014-75-C-0661)
(AD-A078413; MIT/LCS/TM-132) Avail: NTIS. HC A03/MF A01. CSCL 06/5

This research develops the diagnostic component of an interactive system for providing expert advice for the diagnosis, therapy and ongoing management of patients with acid-base and electrolyte disturbances. We have developed a hierarchic representation of a patient's illness which unifies the known facts about the patients, their suspected interrelationships, the hypotheses and how hypotheses account for various known and hypothesized facts. An expectation driven problem solver based on the hypothesized and reformulated paradigm performs the diagnosis. GRA

N80-19227# Thiokol Corp., Huntsville, Ala.
FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIS). VOLUME 1: TECHNICAL REPORT Final Report, Apr. 1978 - Dec. 1979
W. W. Schwarz. Dec. 1979. 279 p. refs. 2 Vol.
(Contract F04611-78-C-0027; AF Proj. 5730)
(AD-A079996; U-79-18-Vol-1; AFRPL-TR-79-91-Vol-1) Avail: NTIS. HC A13/MF A01. CSCL 07/4

This is the final report of a contract to establish the relationship between infrared spectra and propellant aging and to determine the applicability of this relationship to the prediction of service life of propellants. Equipment for measurement of infrared spectra by both attenuated total reflectance and through transmission was identified, and procedures for sample preparation and testing were developed and demonstrated. Computer programs for reducing the infrared spectra data and statistically analyzing them were developed and made operational on the CDC 6600 computer at the Air Force Rocket Propulsion Laboratory. Aging programs were conducted for two composite solid propellants, and the correlations between their infrared spectra and tensile properties as aging progressed were determined. Equations were established for the prediction of future tensile properties from spectral properties acquired during aging. The major accomplishments of this project are the establishment of methods for predicting propellant tensile properties from infrared spectral data during storage and the development of procedures and computer programs for rapidly and economically processing large amounts of infrared data. The results of this project are a major step toward predicting the remaining shelf life of solid propellant rocket motors from infrared measurements using small amounts of propellant associated with them. Recommendations for application of these results and for improving and extending the developed methods are included in the report. GRA

N80-19228# Thiokol Corp., Huntsville, Ala.
FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIS). VOLUME 2: USER'S MANUAL Final Report, Apr. 1978 - Dec. 1979
W. W. Schwarz and O. C. Smith. Dec. 1979. 219 p. refs. 2 Vol.
(Contract F04611-78-C-0027; AF Proj. 5730)
(AD-A079997; U-79-18-Vol-2) Avail: NTIS. HC A10/MF A01. CSCL 07/4

This is the final report to establish the relationship between infrared spectra and propellant aging and to determine the applicability of this relationship to the prediction of service life of propellants. This document (Volume 2 - User's Manual) describes the two computer programs E410 and E490 that were developed in order to reduce and statistically analyze the infrared spectral data. The version of these two codes decribed herein was made operational on the CDC 6600 computer at the Air Force Rocket Propulsion Laboratory. With minor modifications to these two FORTRAN codes themselves, along with the appropriate job control language, both E410 and E490 can also be made operational on an IBM 360/370 computer system. GRA

N80-19229# Pennsylvania State Univ., University Park.
PHOTOCHEMISTRY AND RADIATION CHEMISTRY OF VOLATILE SILANES AND GERMANES Progress Report, 1 Sep. 1978 - 31 Aug. 1979
F. W. Lampe. 1979. 34 p. refs.
(Contract EY-76-S-02-3416)
(COO-3416-13) Avail: NTIS. HC A03/MF A01

The following are reported reactions of methyl cations with ethylsilanes; reactions of ethyl, propyl, and butyl cations with methyl and ethylsilanes; the 14 nanometer photolysis of disilane; lifetimes and collisional stabilization of chemically activated ethylsilyl cations; formation of GeH(+) and the proton affinity of GeH4; and multiphoton infrared decomposition of silanes. DOE

N80-19230# California Univ., Berkeley. Lawrence Berkeley Lab.
CAMAC SYSTEM FOR COMPUTER CONTROL OF MICROWAVE SPECTROMETERS
G. Zizka, B. Turko, and B. Kolbe. 1 Jun. 1979. 20 p. refs.
(Contract W-7405-eng-48)
(LBL-9276) Avail: NTIS. HC A02/MF A01

An interface between a microwave spectrometer and a computer is described. It consists of three CAMAC modules and uses a standard CAMAC crate and controller. The hardware, in conjunction with appropriate software routines, was designed to synchronize measurements, to collect data, and to control the microwave frequency and other experimental parameters. DOE

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-19231 Illinois Univ. at Urbana-Champaign.
IN VIVO AND IN VITRO AGING OF PLASMA-SPRAYED ALUMINA ON 316L STAINLESS STEEL AND Ti6Al-4V ELI SUBSTRATES Ph.D. Thesis
James Lawrence Drummond. 1979. 156 p.
Avail: Univ. Microfilms. Order No. 8004160

Plasma spraying of alumina on metal substrates was

investigated as a fabrication method for prosthetic appliances. The response of this metal-alumina bond to aging in deionized, distilled water, Ringer's solution, Medium-199, and Sprague-Dawley rats was a significant decrease in adherence. Statistical analyses suggested the existence of at least two different modes of fracture occurring in the tensile pull-off tests. Analysis of the deionized, distilled water by flame emission spectroscopy revealed disproportionate removal of calcium and sodium when compared to the amount of aluminum removed. The analysis of Sprague-Dawley rats after implantation of these plasma-sprayed alumina metal composites indicated increased cellular activity of the thyroid and parathyroid glands, beginning degradation of the kidneys, and deposition of aluminum in rat tissues. A hypothesis of the role of aluminum in this process is presented. Dissert. Abstr.

N80-19232 Wisconsin Univ. - Madison.
THE EFFECT OF NICKEL AND NITROGEN ON VOID FORMATION IN VANADIUM Ph.D. Thesis
Randy George Lott 1979 197 p
Avail: Univ. Microfilms Order No. 8001158

The effects of 1 atomic percent nickel and 1 atomic percent nitrogen additions on void and precipitate formation in copper ion irradiated vanadium were determined. Results are compared to current theories of void nucleation and void growth. Voids were observed in all of the irradiated pure vanadium specimens. A decrease in void swelling and density was observed in specimens irradiated at 450 C and 550 C to doses in excess of 2 dpa. Vanadium-1% nitrogen specimens exhibited onyl sparse void populations when irradiated under conditions identical to the pure vanadium irradiations. When void nucleation was assisted by hydrogen doping, voids grew rapidly in the V-1% N alloy. Evidence of an incubation dose required for void nuclation was observed in the vanadium-1% nickel alloy. No voids were observed in the V-1% Ni specimens irradiated at 650 C to 1 dpa and 5 dpa and at 550 C to 1 dpa. Dissert. Abstr.

N80-19233 British Library Lending Div., Boston Spa (England).
PRACTICAL ELECTROPLATING PROPERTIES OF ELECTROCHEMICALLY DEPOSITED METAL AND ALLOY COATINGS. PART 1: GOLD AND GOLD ALLOYS
H. Benninghoff Oct. 1979 26 p refs Transl. into ENGLISH from Metalloberflaeche (West Germany) v. 33, no. 2, 1979 p 60-67
(BLL-TRS-11923) Avail: British Library Lending Div., Boston Spa, Engl.

The mechanical and electrical properties of gold and gold alloy electrochemically deposited coatings are discussed. R.E.S.

N80-19234 British Library Lending Div., Boston Spa (England).
STABILITY TO HEAT TREATMENT OF NICKEL-MANGANESE DEPOSITS CONTAINING SULPHUR
W. R. Wearmouth Nov. 1979 14 p refs Transl. into ENGLISH from Metalloberflaeche (West Germany), v. 32, no. 8, 1978 p 338-343
(BLL-RTS-11591) Avail: British Library Lending Div., Boston Spa, Engl.

The effect of manganese sulphamate on internal stresses and hardness in nickel deposits from the Ni-Speed electrolyte was investigated. It is shown that sulfur-containing additives can be used under certain conditions for hardening such deposits without entailing sulfur embrittlement at higher temperatures. The structure of nickel-manganese deposits and the effect of heat treatment are described with the aid of optical-metallographic and electron-micrographic studies. The fracture characteristics were obtained from fractographic photography for selected samples. A.R.H.

N80-19235 British Library Lending Div., Boston Spa (England).
THE LIQUIDUS SURFACE OF THE ALUMINUM-TITANIUM-BORON PHASE DIAGRAM AT THE ALUMINUM CORNER
Fumio Morimune, Hideo Shingu, Kojiro Kobayashi, and Ryohei Ozaki Aug. 1979 21 p refs Transl. into ENGLISH from Nippon Kinzoku Gakkaishi (Sendai City), v. 41, 1977 p 444-450
(BLL-RTS-11695) Avail: British Library Lending Div., Boston Spa, Engl.

Experiments based chiefly on solid-liquid separation by gravity segregation were conducted in order to establish whether the solid-liquid reactions at the boundaries between the TiB2 liquidus and TiAl3 liquidus surfaces, and between the TiB2 liquidus and Al liquidus surfaces, are eutectic or peritectic reactions. Present results for the phase diagram suggest that cast grains of aluminum are nucleated on TiB2 particles when the titanium and boron concentrations of the alloy lie in the range defined by the following inequality: $0 <$ total Ti - 2.07 X total B < 0.15. A.R.H.

N80-19236*# Nebraska Univ. - Lincoln.
GAS PHASE HYDROGEN PERMEATION IN ALPHA TITANIUM AND CARBON STEELS Progress Report, 1973 - 1978
Donald L. Johnson, Kiritkumar K. Shah, Bruce H. Reeves, and Vijay L. Gadgeel Washington NASA Apr. 1980 58 p refs (Grant NGR-28-004-025)
(NASA-CR-3190) Avail: NTIS HC A04/MF A01 CSCL 11P

Commercially pure titanium and heats of Armco ingot iron and steels containing from 0.008-1.23 w/oC were annealed or normalized and machined into hollow cylinders. Coefficients of diffusion for alpha-Ti and alpha-Fe were determined by the lag-time technique. Steady state permeation experiments yield first power pressure dependence for alpha-Ti and Sievert's law square root dependence for Armco iron and carbon steels. As in the case of diffusion, permeation data confirm that alpha-titanium is subject to at least partial phase boundary reaction control while the steels are purely diffusion controlled. The permeation rate in steels also decreases as the carbon content increases. As a consequence of Sievert's law, the computed hydrogen solubility decreases as the carbon content increases. This decreases in explained in terms of hydrogen trapping at carbide interfaces. Oxidizing and nitriding the surfaces of alpha-titanium membranes result in a decrease in the permeation rate for such treatment on the gas inlet surfaces but resulted in a slight increase in the rate for such treatment on the gas outlet surfaces. This is explained in terms of a discontinuous TiH2 layer. A.R.H.

N80-19237*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD OF FORMING DYNAMIC MEMBRANE ON STAINLESS STEEL SUPPORT Patent Application
J. L. Gaddis (Clemson Univ., S.C.) and Craig A. Brandon, inventors (to NASA) (Clemson Univ., S.C.) Filed 7 Feb. 1980 10 p Sponsored by NASA
(NASA-Case-MSC-18172-1; US-Patent-Appl-SN-119334) Avail: NTIS HC A02/MF A01 CSCL 11F

A method for forming a membrane on a porous stainless steel substrate is disclosed. The stainless steel substrate is prepared from sintered, powdered stainless steel and contacted with an aqueous nitrate solution of a suitable polyvalent metal such as iron, zirconium, tin, or thorium. Contact between the substrate and the aqueous nitrate solution is maintained until the flow rate diminishes indicating that the hydrous metal oxide membrane has formed. Variables affecting the process include the applied pressure, the pore size, and the concentration of the aqueous nitrate solution. The advantage of the method is that membranes are formed on stainless steel substrates without corroding the stainless steel. Membranes deposited on the surface of porous substrates are used in hyperfiltration to remove contaminating chemicals from aqueous solutions by reverse osmosis. Such reverse osmosis membranes are used in desalination and other water purification equipment, and may have application in textile industries for separating dyes from aqueous solvents. J.M.S.

N80-19238# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
ISS-SIMS SURFACE CHARACTERIZATION OF SMUT ON STAINLESS STEEL Final Report, Jul. 1978 - Jul. 1979
William L. Baun Oct. 1979 23 p refs
(AD-A078122; AFML-TR-79-4138) Avail: NTIS HC A02/MF A01 CSCL 11/6

Chemical treatments such as acid pickling on stainless steels frequently leave behind more contamination than was originally present. This contamination can be deleterious to further processing or the use of stainless steels in such applications as adhesive bonding. This chemical residue that is left behind following treatments such as acid pickling is usually called smut. Smut is formed in this work on 304 stainless steel by treatment

in sulfuric acid. The smut formed on the stainless steel is characterized by ion scattering spectrometry (ISS) and secondary ion mass spectrometry (SIMS). It was found that the majority of the smut formed on 304 stainless steel was not carbon or graphite but rather silicon in an oxidized form. This silicon rich smut was effectively removed by a further chemical treatment with sulfuric acid and chromic acid, a similar mixture to that often used for cleaning glass. This cleaning procedure is shown by the surface chemical analysis methods to produce a clean surface comparable to that obtained by abrasion. GRA

N80-19239# Colt Industries, Inc., Pittsburgh, Pa. Crucible Materials Research Center.
CONSOLIDATION OF TITANIUM POWDER TO NEAR NET SHAPES Final Report, 1 Feb. 1974 - 1 Mar. 1978
J. H. Schwertz, V. K. Chandhok, V. C. Peterson, and V. R. Thompson May 1978 333 p refs
(Contract F33615-74-C-5114)
(AD-A078039; AFML-TR-78-41) Avail: NTIS HC A15/MF A01 CSCL 11/6

This program was conducted to develop the technology necessary to establish a cost effective approach to the production of titanium alloy parts for both aircraft engine and airframe applications. This approach was based on a PM near-net shape process utilizing ceramic mold techniques in conjunction with HIP (Hot Isostatic Pressing) to a minimum machining envelope. Program objectives included: (1) the optimization of an existing PM process for the HIP of near-net shapes of titanium using low-cost tooling; (2) the reduction of the process to an efficient, cost effective, manufacturing procedure; and (3) thorough characterization of the end product. In cooperation with General Electric (GE) and McDonnell-Douglas (MCAIR) as sub-contractors, representative components and alloys were selected for this program. These were a Ti-17 compressor stub shaft and a Ti-6-4 keel splice former. Hot Isostatic Pressing parameters were optimized for both the Ti-17 and Ti-6-4 alloy using the ceramic mold process. SiO2 was chosen as the most promising mold material. The ability to produce near-net shapes of both engine and airframe components was successfully demonstrated. Both parts exhibited comparable properties to cast and wrought material with the exception of low cycle fatigue requirements on the engine stub shaft. The results indicate that a potential exists for the HIP process to reduce both input material and machining costs compared to current cast and wrought product. GRA

N80-19240# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Nonmetallic Materials Div.
CONTAMINATION OF THE ANODE AND CATHODE IN PHOSPHORIC ACID ANODIZING ELECTROLYTES Interim Report, Jul. 1978 - Jul. 1979
William L. Baun Sep. 1979 31 p refs
(AF Proj. 2419)
(AD-A077885; AFML-TR-79-4132) Avail: NTIS HC A03/MF A01 CSCL 13/8

The surface analysis of anodes and cathodes from phosphoric acid electrolytes by ion scattering spectrometry (ISS) and secondary ion spectrometry (SIMS) shows that contamination can occur under a variety of conditions. Contamination can occur both during and after anodization and either with or without the electrodes connected. These results point up the dynamic and ever changing character of the anodization process and suggests reasons for poor reproducibility of oxide chemistry and morphology. GRA

N80-19241# SRI International Corp., Menlo Park, Calif.
IMPROVED IMPACT FRACTURE RESISTANCE IN OXIDATION-TOUGHENED Si3n4-20 VOL% ZrO2 Technical Report, 2 Feb. 1979 - 1 Feb. 1980
D. A. Shockey and K. C. Dao Dec. 1979 19 p refs
(Contract N00014-76-C-0657)
(AD-A078833) Avail: NTIS HC A02/MF A01 CSCL 14/2

Dr. F. F. Lange is using an oxidation technique to induce compressive stresses in the near-surface regions of Si3N4-ZrO2 specimens. Silicon nitride powder is first thoroughly mixed with about 20 vol % zirconium oxide and 4 vol % Al2O3 powders, then hot pressed to achieve a fully dense plate. The plate is then given a subsequent anneal at 700 C for 5 hr in air. The zirconium oxynitride within several grain diameters of the surfaces is oxidized to the monoclinic form with an accompanying increase in molar volume of about 4-5%. The expansion of the lattice in the surface regions gives rise to substantial compressive stresses on the surface (and significant tensile stresses in the interior). GRA

N80-19242# Dayton Univ. Research Inst., Ohio.
DETERMINATION OF TEST TECHNIQUE INFLUENCE ON K SUB ISCC VALUES FOR ALUMINUM 7075-T651 Interim Report, Jan. 1978 - Apr. 1979
John J. Ruschau Aug. 1979 24 p refs
(Contract F33615-78-C-5002; AF Proj. 2421)
(AD-A077453; UDR-TR-79-32; AFML-TR-79-4117) Avail: NTIS HC A02/MF A01 CSCL 14/2

Threshold stress intensity values for stress corrosion cracking K sub ISCC were determined for aluminum alloy 7075-T651 using two different testing techniques: a constant displacement, decreasing stress intensity technique achieved via a bolt-loaded specimen, and a constant load, increasing stress intensity technique. The test specimen geometry was an ASTM standard 3/4-inch (19 mm) compact type specimen. A constant immersion, 3.5 percent by weight sodium chloride environment was used for evaluating both techniques. Test times were limited to 2000 hours. For the test period examined, the constant displacement technique yields an approximately 50 percent higher threshold for corrosion cracking than does the constant load technique. The bolt-loaded technique offers simplicity, is inexpensive, and is a useful technique when used to rank materials as to their relative susceptibility to corrosion cracking; however, caution should be employed when comparing K sub ISCC values obtained via different test techniques. GRA

N80-19243# National Bureau of Standards, Washington, D.C. Chemical Stability and Corrosion Div.
PASSIVE FILMS, SURFACE STRUCTURE AND STRESS CORROSION AND CREVICE CORROSION SUSCEPTIBILITY Annual Report, Nov. 1977 - Nov. 1978
J. Kruger, J. J. Carroll, A. J. Melmed, J. J. Ritter, and J. R. Ambrose Nov. 1978 37 p refs
(Contract NAONR-18-69)
(AD-A078596; NBSIR-79-1904; NBS-TSR-9) Avail: NTIS HC A03/MF A01 CSCL 11/3

Field ion microscopy (FIM) is capable of imaging defects such as sub-critical crack formation and growth, and surface rearrangements, and of detecting new surface phase formations, and other disturbances. Thus, we have used the technique to characterize various modes of hydrogen reactions with metal surfaces. Previous work from this laboratory has revealed examples of one mode, the initial crack formation and growth in the hydrogen-titanium and hydrogen-zirconium systems. In each case there were indications of preferential crystallographic attack producing cracks within the metal matrix approximately 10-15 atomic layers deep in the case of titanium, and 2-5 layers deep in the case of zirconium. In the present phase of the work, FIM was used to examine microscopic details of the initial stages of hydrogen interactions with some additional pure metals and metal alloys, i.e., niobium, aluminum, 304 stainless steel and iron-24 wt. chronium steel. The hydrogen-metal interactions occurred during the FIM imaging process with hydrogen pressures between ten to the minus 4th power and ten to the minus 6th power torr at metal temperatures between 20 and 80 K, and while the metal was subjected to stresses brought about by the electric field necessary for imaging the multifacted, approximately hemispherical metal surface. The method used involved comparison of micrographs obtained during inert gas imaging (neon, helium) with micrographs obtained in pure hydrogen or mixtures of hydrogen and inert gases. GRA

N80-19244# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
FORMATION OF POROUS FILMS ON TITANIUM ALLOYS BY ANODIZATION TREATMENTS Final Report, Jul. 1977 - Jul. 1979
William L. Baun Oct. 1979 31 p refs
(AF Proj. 2419)
(AD-A077676; AFML-TR-79-4133) Avail: NTIS HC A03/MF A01 CSCL 11/6

This investigation is part of a program which looks at the effects of surface treatments on surface chemistry and morphology of titanium and titanium alloys. This part considers the effect of surface treatments on the alloy titanium-6 aluminum-4 vanadium which use anodization to produce a porous oxide film. Porous anodized films on titanium alloys have shown to be advantageous for adhesive bonding and other purposes. Porosity may be achieved by increasing current density in the anodization bath by increasing the voltage, increasing the concentration of the electrolyte, increasing the temperature, or adding current carrying ions to the electrolyte. In this work, experiments are described in which each of the methods for increasing current density are accomplished. Characterization results on the surfaces of these anodized oxides are shown using scanning electron microscopy, ion scattering spectrometry, secondary ion mass spectrometry, and Auger electron spectrometry. Addition of lithium nitrate to phthalic acid electrolytes causes porosity in anodized films, but the lithium ions do not enter the oxide film. GRA

N80-19245# Army Materials and Mechanics Research Center, Watertown, Mass.

FATIGUE STRENGTH OF TRIP STEELS Final Report

Gregory B. Olson, Richard Chait, Morris Arzin, and Roger A. Gagne Jun. 1979 16 p refs

(DA Proj. 1L1-62105-AH-84)

(AD-A078592; AMMRC-TR-79-39) Avail: NTIS HC A02/MF A01 CSCL 11/6

Comparison of the S-N curves of warm-extruded TRIP steels, heat treated to give two stabilities with respect to deformation-induced martensitic transformation during testing, reveals a beneficial effect of the transformation on fatigue behavior under stress control conditions. The proportionality of fatigue strength to ultimate tensile strength is maintained to higher strength levels relative to other steels. For a stress ratio of R = 0.1, a fatigue strength at 10 to the seventh power cycles of 180 ksi (1,240 MPa) is obtained. GRA

N80-19246# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.

STRUCTURE AND PROPERTIES OF CAST ALLOYS

Harold D. Brody Sep. 1979 37 p refs

(Contract N00014-75-C-0800)

(AD-A077430; SETEC-MME-79-50) Avail: NTIS HC A03/MF A01 CSCL 11/6

Status of projects related to directional solidification of peritectics, segregration of nickel base superalloys, and casting of NITINOL are summarized. A paper is included which describes work done and needed on modelling of casting processes. GRA

N80-19247# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.

THE CORROSION FATIGUE BEHAVIOR OF A HIGH PURITY Al-Zn-Mg-Cu ALLOY

Edward F. Smith, III and D. J. Duquette Nov. 1979 213 p refs

(Contract N00014-75-C-0466)

(AD-A077461) Avail: NTIS HC A10/MF A01 CSCL 11/6

The effect of hydrogen on the corrosion fatigue behavior of an Al-5Zn-2.5Mg-1.5Cu alloy was investigated. In the study, a constant mean load (207 MN/sq m), S-N type test method was used to monitor the fatigue response under air and .5N NaCl environments. In both cases, specific experiments were conducted in an attempt to determine the operating failure mechanism. In the air fatigue case, all specimens failed in a transgranular mode. The cyclic stress-strain response of the alloy indicated that the alloy hardened as the fatigue process proceeded to the crack initiation stage. TEM examination of the dislocation substructure indicated a large density of dislocation dipoles in the slip bands. These observations are consistent with debris accumulation model suggested by Duquette and Swann. The model proposes that the accumulation of dipoles within the slip band and will exert an increasing cleavage stress across the slip plane. By using a conservative estimate of the dipole density it is possible to show that the dipole stress may reach levels in excess of 100 MN/sq m. Since this stress is thought to be additive to the applied stress levels, the model provides a plausible failure mechanism. In addition to the laboratory air environment, tests were also performed in an aerated, .5N NaCl solution. In comparison to the air fatigue properties, the tests conducted under open circuit conditions (-.750v vs SCE) resulted in a marked decrease in the fatigue response. These failures were characterized by intergranular initiation leading to a transgranular cleavage type propagation mode. It was found that moderate polarization (to -1.3v SCE) produced little change in the fatigue response. Author (GRA)

N80-19248# Rhode Island Univ., Kingston. Dept. of Ocean Engineering.

HYDROGEN ENTRY AND TRANSPORT MECHANISMS IN STRUCTURAL METALS Final Technical Report

R. Heidersbach, Michael Surkein, Ben Allen, and Jeffrey Jones Nov. 1979 42 p refs

(Grant DAAG29-76-G-0311)

(AD-A078812; TR-1; ARO-14057.4-MS) Avail: NTIS HC A03/MF A01 CSCL 11/6

This report summarizes the results of an investigation into the optimization of the electrochemical hydrogen permeation technique. The results of the research can be summarized as follows: (1) hydrogen permeation fluxes through iron membranes have been demonstrated to be affected by the reactivity of the membrane surfaces. The use of electroplated palladium entry and exit surfaces is recommended if the object of the study is to measure hydrogen mass transfer rates through a ferrous, or similar metal, membrane; (2) the apparent hydrogen diffusivity rates determined in this research are slower than those commonly reported in the literature; (3) diffusivities based on times to reach steady-state could not be calculated for electrochemically-charged membranes because steady-state fluxes were never reached during the one-week duration of the permeation experiments; and (4) an attempted determination of the effects of electroslag remelting on the hydrogen permeability of high strength steels could measure no significant difference between the steels tested. GRA

N80-19249# TRW, Inc., Cleveland, Ohio. Materials Technology.

EXPLORATORY DEVELOPMENT OF DIE MATERIALS FOR ISOTHERMAL FORGING OF TITANIUM ALLOYS Final Technical Report, 1 May 1976 - 30 Apr. 1979

Charles S. Kortovich and James M. Marder Jul. 1979 188 p refs

(Contract F33615-76-C-5105; AF Proj. 7351)

(AD-A078951; AFML-TR-79-4092) Avail: NTIS HC A09/MF A01 CSCL 11/6

A program was conducted to develop materials for isothermal forging dies exhibiting higher yield strength and creep resistance than currently used nickel-base superalloy and molybdenum alloy compositions. The technical approach involves two phases, the first including alloy development aimed towards improved casting, powder metallurgy and metastable carbide alloy compositions and the second including the fabrication of tooling of the most promising die material/process for the F-15 trunnion drag brace arresting gear. The alloy development study included the evaluation of TRW-NASA VIA, TAZ-8A, IN-792 and IN-100 in terms of tensile, creep rupture and thermal fatigue tests as well as lubricant compatibility tests with typical isothermal forging lubricants. The results indicated that a modified TRW-NASA VIA casting composition offered the greatest potential for applicability as a die material. GRA

N80-19250# Southeastern Center for Electrical Education, Inc., Auburn, Ala.

REPRESENTATION OF TIME DEPENDENT MECHANICAL BEHAVIOR OF RENE 95 BY CONSTITUTIVE EQUATIONS Final Report, Aug. - Oct. 1978

Sol R. Bodner (Technion-Israel Inst. of Tech.) Aug. 1979 40 p refs Submitted for publication

(Contract F33615-77-C-5003)

(AD-A077271; AFML-TR-79-4116) Avail: NTIS HC A03/MF A01 CSCL 11/6

The constitutive equations of Bodner-Partom are utilized to represent the time dependent inelastic properties of Rene 95 at 1200 F (649 C) over a wide range of uniaxial loading conditions. These include controlled monotonic straining, creep, stress relaxation, and cyclic loading. The material constants are obtained from a few test points and are used to calculate response

characteristics which are compared to corresponding test results. Some general conclusions on the inelastic behavior of Rene 95 are discussed. GRA

N80-19251# Ocean City Research Corp., N.J.
CORROSION OF ALUMINUM ALLOYS IN HIGH VELOCITY SEAWATER Final Report, Jul. 1978 - Jul. 1979
G. A. Gehring, Jr. Nov. 1979 47 p refs
(Contract N00014-78-C-0720)
(AD-A078435; OCR-ONR-3) Avail: NTIS HC A03/MF A01 CSCL 11/6

A study was undertaken to examine the corrosion behavior of selected aluminum alloys in high velocity seawater. The work is pertinent to the development of high speed ships by the U.S. Navy. The selected aluminum alloys included 1100-H14 and 5456-H117. Plate specimens of each alloy were exposed in a flow channel at test velocities ranging from 3 to 30 m/s. The affect of cathodic polarization on the velocity-related corrosion behavior of the 5456 alloy was also investigated. Under the flow conditions established in the study, the results show that: (1) both the rate and mode of corrosion are velocity-dependent for aluminum alloys; (2) velocity-related shifts in corrosion potential can occur; (3) polarization resistance measurements are inadequate for predicting corrosion rates of aluminum alloys in high velocity flow; (4) cathodic protection cannot retard velocity-induced corrosion of aluminum alloys; (5) cathodic polarization will tend to accelerate corrosion of aluminum alloys at all velocities tested; and (6) at higher velocities, the predominant reduction reaction associated with the corrosion of aluminum alloys is H2O plus le give OH - plus 1/2 h(2). GRA

N80-19252# Inco Research and Development Center, Suffern, N. Y.
ALLOY DEVELOPMENT OF OXIDE DISPERSION STRENGTHENED HIGH VOLUME GAMMA NICKEL-BASE SUPERALLOYS MADE BY MECHANICAL ALLOYING Final Report, Jun. 1978 - Jun. 1979
R. C. Benn Jul. 1979 65 p refs
(Contract N62269-78-C-0200)
(AD-A077615; Rept-4078.4) Avail: NTIS HC A04/MF A01 CSCL 11/6

The object of this work was to develop ODS alloys which would derive a significant high temperature strength increment from the retention of high volume fractions (≈50%) of gamma: at 2000 F (1093 C). Alloy structure and property investigations were conducted to determine the effects of W, Mo, Ta and Nb combinations substituted on an atomic weight basis into each of three Ni-Cr-Al ternary systems. Specifically, Cr:Al levels of 15:16, 12.5:17.5 and 10:17.5 at .% were chosen. Based on promising directional recrystallized structures and mechanical properties, three alloys were selected from the series of 12 compositions, for further development including the effects of B/Zr alloy modifications, extrusion, hot rolling and heat treatment studies on the directional recrystallization response, structure and mechanical properties. The work confirmed that the high volume fraction of gamma, characteristic of these alloys, is an effective means of improving the intermediate temperature strength of ODS superalloys. GRA

N80-19253# American Chemical Society, Washington, D. C.
PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON WEAR AND CORROSION Final Report, 1 May - 30 Sep. 1979
Robert S. Shane Jun. 1979 98 p refs Symp. held in Washington, D.C., 4-6 Jun. 1979
(Contract F49620-79-C-0082; AF Proj. 2303)
(AD-A077406; AFOSR-79-1139TR) Avail: NTIS HC A05/MF A01 CSCL 11/6

This symposium on wear and corrosion included a specialized session which addressed corrosion from the viewpoints of economics, research direction, regulation, and standardization, as well as the technical viewpoints of coatings, inhibitors cathodic and anodic protection, and the selection of materials for design. The wear session includes papers on automotive problems, gas path seals, energy development, and material processing. GRA

N80-19254# Rockwell International Science Center, Thousand Oaks, Calif.
SURFACE TREATMENT FOR ALUMINUM BONDING Final Technical Report, 28 Jul. 1978 - 15 Jul. 1979
Tennyson Smith Oct. 1979 212 p refs
(Contract DAAK10-78-C-0274)
(AD-A076950; SC5180.17FTR) Avail: NTIS HC A10/MF A01 CSCL 11/6

At present the most widely used method for treating aluminum prior to bonding is the sulfochrom etch process (FPL, etch). Due to the carcinogenic nature of chromates, various companies and government agencies have been attempting to find new durable nonchromate-containing systems which can be used to treat aluminum prior to bonding. The objective of this project was to discover a nonacid (nonchromate) surface treatment for Al 2024-T3 that would be both strong and durable. Initial studies indicated that a simple degrease and water soak process (STAB(1)) would provide strong durable joints. However, further testing revealed this process to be hard to reproduce on a consistent basis. A second process (STAB(2)) was discovered that was equally as simple but was also difficult to reproduce. A third process, even more simple (STAB(3)) was discovered which did prove reproducible. This process eliminates the degrease step and involves no energy input (room temperature dip in super-concentrated sodium hydroxide). There are only three steps involved, a sodium hydroxide solution dip, a rinse and dry. This report gives the details of these three processes, the bond strength and endurance results and why each process did or did not work satisfactorily. Author (GRA)

N80-19255# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
HYDROGEN EFFECTS ON FLOW LOCALIZATION AND FRACTURE IN TYPE 304L STAINLESS STEEL
G. R. Caskey 1979 10 p Presented at Gordon Res. Conf., Andover, N.H., 9-13 Jul. 1979
(Contracts EY-76-C-09-0001; AT(07-2)-1)
(DP-MS-79-57; CONF-790773-1) Avail: NTIS HC A02/MF A01

The onset of plastic instability, localization of plastic flow, and fracture in type 304L austenitic stainless steel are modified by the presence of hydrogen. It is not certain, however, whether the observed changes in behavior are attributable to the direct effect of hydrogen on plastic flow or to the intervention of a hydrogen-induced brittle fracture process. The effects are observed in both smooth bar and single edge notched specimens and are dependent on deformation temperature. DOE

N80-19256# Bendix Corp., Kansas City, Mo.
MECHANICAL PROPERTIES OF ELECTROPLATED NICKEL RINGS FOR BATH AGING STUDY
P. M. Heffley Nov. 1979 17 p ref
(Contract EY-76-C-04-0613)
(BDX-613-2303) Avail: NTIS HC A02/MF A01

Hydraulic burst tests were performed on electroplated nickel rings as part of a bath aging study. Ring tensile properties were measured. An invalid failure mechanism was observed for rings having a significant gradient in wall thickness over the height. Finite element method stress analysis models established the probable cause and helped set limits for future specimen dimension tolerances. DOE

N80-19257# National Technical Information Service, Springfield, Va.
STRESS CORROSION OF STAINLESS STEELS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Nov. 1979
William E. Reed Dec. 1979 339 p Supersedes NTIS/PS-78/1340; NTIS/PS-77/1187; NTIS/PS-76/1018
(PB80-803208; NTIS/PS-78/1340; NTIS/PS-77/1187; NTIS/PS-76/1018) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Worldwide research on stainless steel stress corrosion and stress corrosion resistant steels are covered in this report. Stress corrosion cracking and fatigue are studied. In addition, studies on electrochemistry, phase studies, environments, processing, and testing are included. Stainless steel performance in chemical plants, nuclear reactors, and biological implants is discussed. This updated bibliography contains 333 abstracts, 72 of which are new entries to the previous edition. GRA

N80-19258# National Technical Information Service, Springfield, Va.
STRESS CORROSION OF STAINLESS STEELS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Nov. 1979
William E. Reed Dec. 1979 117 p Supersedes NTIS/PS-78/1339; NTIS/PS-77/1186; NTIS/PS-76/1016; NTIS/PS-75/786
(PB80-803190; NTIS/PS-78/1339; NTIS/PS-77/1186; NTIS/PS-76/1016; NTIS/PS-75/786) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

This compilation covers research on deformation, cracking, electrochemistry, additives, kinetics, test methods and solutions in relation to stress corrosion. A majority of the research concerns nuclear reactor materials, spacecraft components, and coal gasification plants. Design criteria and corrosion resistance are also discussed. This updated bibliography contains 111 abstracts, 36 of which are new entries to the previous edition. GRA

N80-19259# National Technical Information Service, Springfield, Va.
POWDER METALLURGY OF ALUMINUM. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Dec. 1979
William E. Reed Dec. 1979 199 p Supersedes NTIS/PS-78/1310; NTIS/PS-77/1096; NTIS/PS-76/0957; NTIS/PS-75/697 2 Vol.
(PB80-803216; NTIS/PS-78/1310; NTIS/PS-77/1096; NTIS/PS-76/0957; NTIS/PS-75/697) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

The citations cover Government-sponsored research involving aluminum and aluminum alloy powder compaction, pressing, sintering, joining, and heat treatment. Studies on mechanical properties and structure are included. The fabrication and testing of products are also cited. This updated bibliography contains 192 abstracts, 30 of which are new entries to the previous edition. GRA

N80-19260# National Technical Information Service, Springfield, Va.
POWDER METALLURGY OF ALUMINUM. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Dec. 1979
William E. Reed Dec. 1979 314 p Supersedes NTIS/PS-78/1311; NTIS/PS-77/1097; NTIS/PS-76/0958 2 Vol.
(PB80-803224; NTIS/PS-78/1311; NTIS/PS-77/1097; NTIS/PS-76/0958) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Worldwide research on powder metallurgy of aluminum and aluminum alloys are cited in the bibliography. Studies on sintering, pressing, fabrication, dispersion hardening, compacting, and testing are included. Processes such as welding, reinforcement, and powder production are also covered. This updated bibliography contains 307 abstracts, 10 of which are new entries to the previous edition. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-19261 British Library Lending Div., Boston Spa (England).
ACTIVATION BY MEANS OF COLLOIDAL PALLADIUM IN THE ELECTROPLATING OF ABS COPOLYMERS. 2: THE NATURE OF THE PALLADIUM/TIN (2) CHLORIDE ACTIVATING SOLUTION
Chr. Petrov, M. Entsheva, and A. Lirkov Oct. 1979 27 p refs Transl. into ENGLISH from Metalloberflaeche (West Germany), v. 33, no. 2, 1979 p 68-74
(BLL-RTS-11924) Avail: British Library Lending Div., Boston Spa, Engl.

A radiochemical technique was used to record: (1) the change in concentrate aging brought about by the addition of a large excess of solid tin (2) chloride to the hydrochloric acid/palladium chloride solution; and (2) the effect of washing with water and with organic solvents on an activated plastic surface. The data emphasize the colloidal nature of the concentrate and the activating solutions prepared from it. A mechanism is proposed for the processes taking place between preparation of the concentrate and placing activated plastic test pieces in the accelerating solution. K.L.

N80-19262 British Library Lending Div., Boston Spa (England).
WAYS TO INORGANIC POLYMERS
J. Hansmann Oct. 1979 25 p refs Transl. into ENGLISH from Gummi, Asbest, Kunstst. (West Germany), v. 29, no. 7, 1976 p 440-449
(BLL-RTS-11805) Avail: British Library Lending Div., Boston Spa, Engl.

The essential molecular structural elements for material properties can be divided into the following groups: molecular properties; chain length and chain length distribution; strengthening and loosening of the super-molecular structure, especially by additives; texture (all materials of super-molecular order); and molecular movement in the body. Polymers are considered in terms of priority from the viewpoints of chemical structure (type and bonding of the atoms or groups) and of the form, size, and order of the macromolecule. A.R.H.

N80-19263*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COMPARISON OF THE TRIBOLOGICAL PROPERTIES AT 25 C OF SEVEN DIFFERENT POLYIMIDE FILMS BONDED TO 301 STAINLESS STEEL
Robert L. Fusaro Feb. 1980 25 p refs
(NASA-TM-81413; E-328) Avail: NTIS HC A02/MF A01 CSCL 11G

A pin-on-disk type of friction and wear apparatus was used to study the tribological properties of seven different polyimide films bonded to AISI 301 stainless steel disks at 25 C. It was found that the substrate material was extremely influential in determining the lubricating ability of the polyimide films. All seven films spalled in less than 1000 cycles of sliding. This was believed to be caused by poor adherence to the 301 stainless steel or the inability of the films to withstand the high localized tensile stresses imparted by the deformation of the soft substrate under sliding conditions. The friction coefficients obtained for six of the polyimides varied between 0.21 to 0.32 while one varied between 0.32 to 0.39. K.L.

N80-19264*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF SRM FLEX BEARING MATERIALS AND PROCESSES
Thomas E. Wood Feb. 1980 20 p
(NASA-TM-78266) Avail: NTIS HC A02/MF A01 CSCL 11A

Tensile, peel, and shear testing was performed on combinations of primers, adhesives, tycements and rubber compounds cured at various times and temperatures. The materials used in the fabrication of the solid rocket motor flex bearing as well as in other systems were evaluated. A compatibility study between adhesives and tycements was initiated. The flex bearing mold design was reviewed by our tooling experts. R.C.T.

N80-19265# Royal Aircraft Establishment, Farnborough (England).
FORMATION OF ORGANOSILICON COMPOUNDS. 58: SYNTHESIS OF A CARBOSILANE WITH PROPELLANE STRUCTURE
G. Fritz and H. J. Vogt Sep. 1979 14 p refs Transl. into ENGLISH from Z. Anorg. Allg. Chem. (East Germany), v. 419, no. 1, 1976 p 2-8
(RAE-Lib-Trans-2029; BR71984) Avail: NTIS HC A02/MF A01

The organometallic synthesis of carbosilanes is reported. The synthesis of a carbosilance with propellane structure based on the coupling of four SiBr groups with CC14 ab by lithium is described. The most favorable conditions for the coupling reaction with CC14 are discussed along with the properties of the resulting compound. J.M.S.

N80-19266# Naval Postgraduate School, Monterey, Calif.
ACCURACY AND REPEATABILITY INDICES FOR JOINT OIL ANALYSIS PROGRAM DATA M.S. Thesis
Douglas Carlton Hatcher Sep. 1979 49 p refs
(AD-A078156) Avail: NTIS HC A03/MF A01 CSCL 11/8

This thesis examines spectrometric oil analysis data in an attempt to construct tables of statistical estimates for use in evaluating a laboratory's performance individually and in comparison to control laboratory. Tables of estimates were obtained from data provided by twenty six laboratories. GRA

N80-19267# Naval Research Lab., Washington, D. C. Ceramics Branch.
FAILURE CAUSING DEFECTS IN CERAMICS: WHAT NDE SHOULD FIND Interim Report
R. W. Rice, J. J. Mecholsky, S. W. Freiman, and S. M. Morey 30 Oct. 1979 37 p
(AD-A078234; NRL-MR-4075) Avail: NTIS HC A03/MF A01 CSCL 11/2

The various types of defects causing failure in a variety of ceramic materials are illustrated. Examples are drawn from such ceramics as piezoelectric, infrared transmitting and potential turbine materials. Both machining and processing defects are shown as sources of failure. The former are selected to illustrate the effects of machining parameters. Processing defects illustrated include pores, foreign particles and large grains, or clusters of these. Changes in the size of defects with specimen size are also noted. GRA

N80-19268# Douglas Aircraft Co., Inc., Long Beach, Calif.
PRIMARY ADHESIVELY BONDED STRUCTURE TECHNOLOGY (PABST). GENERAL MATERIAL PROPERTY DATA Final Report, Feb. 1975 - Sep. 1978
R. W. Shannon, P. Stifel, R. Beger, E. J. Hughes, and J. L. Rutherford Wright-Patterson AFB, Ohio AFFDL Sep. 1978 408 p
(Contract F33615-75-C-3016)
(AD-A077891; MDC-J6065A; AFFDL-TR-77-107) Avail: NTIS HC A18/MF A01 CSCL 11/1

This program investigated state-of-the-art adhesives, adhesive primers, surface treatments, and coatings to determine, through durability testing, a system that could be used to adhesively bond a primary aircraft structure. Test methods were also evaluated. Previous work indicated cyclic-stressed testing in hostile environments and, specifically, high moisture environments reduced the life and durability of a given adhesive system over the same system load to the same level at constant stress. Conclusions include: (1) stressed durability testing is required to determine if a given surface treatment is durable; (2) normal industry accepted processing tolerances on surface treatments are too wide to produce consistently durable bonded joints; (3) handling of surface treated details must be designed to prevent mechanical damage and contamination; (4) phosphoric acid anodize process was the surface treatment most tolerant to processing variations and inspectable; (5) adhesive primers from different suppliers demonstrated a large variation in environment resistance and corrosion protection capabilities; (6) the type of carrier used in adhesive films has a large effect on the moisture resistance of the adhesives; and (7) cyclic stressed testing in a hostile environment is necessary to determine the optimum adhesive durability. GRA

N80-19269# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering
COMPARISON OF CRYSTALLINITY AND MOLECULAR ORIENTATION BETWEEN SURFACE AND BULK OF SOME POLYMERS BY FTIR-ATR AND TRANSMISSION SPECTROSCOPY
M. K. Tse and C. S. Paik Sung Nov. 1979 15 p refs Presented at the Symp. on Spectroscopic Characterization of Mol. Struct. at Polymer Surfaces and Interfaces, Houston, Tex. Mar. 1980 Submitted for publication
(Contract N00014-78-C-0676)
(AD-A078243; TR-2) Avail: NTIS HC A02/MF A01 CSCL 11/9

Fourier transform IR transmission and multiple internal reflection spectroscopy were used to characterize polyethylene and polypropylene surfaces and to compare with their bulk properties in regard to the degree of crystallinity and molecular orientation. Surface crystallinity of the cold drawn polyethylene and polypropylene samples is found to be similar to the bulk crystallinity values. In order to improve accuracy of the surface orientation measurement, a new rotatable sample holder, which utilizes a double-edged square parallelogram rather than conventional single-edged rectangular trapezoidal plates was designed. This enables the polymer film to be mounted and rotated orthogonally while maintaining identical contact. As a result, the three optical constants, kx, ky, and kz can be determined by using four equations, thus providing a check on the reliability of the data. Preliminary results obtained with this new sample holder indicate that the surface of cold drawn polyethylene has lower orientation than bulk, while similar orientation values were observed when comparing the surface with the bulk of cold drawn polypropylene. GRA

N80-19270# Texas A&M Univ., College Station. Dept. of Chemistry.
CHARACTERIZATION AND ANALYSIS OF REACTIVE ORGANOMETALLIC POLYMERS
David E. Bergbreiter and James M. Killough 1 Dec. 1979 14 p refs
(Contract N00014-77-C-0426)
(AD-A078184; TR-4) Avail: NTIS HC A02/MF A01 CSCL 11/9

Lithiated cross-linked insoluble polystyrene polymers have been prepared by several different procedures and analyzed. The chromatographic analyses which have been developed for these organometallic polymers can accurately quantitate even small amounts of organolithium species. This analytical procedure is based on the reaction of 1,2-dibromodecane with polystyryllithium which generates an amount of 1-decene equal to the amount of polymeric lithium reagent. By analysis of other reaction products such as 1-bromobutane, adsorbed n-butyllithium reagent can be distinguished from polymeric lithium reagent. Evidence for adsorption of soluble alkyl-lithium reagent by polymeric organolithium reagent is also presented. Author (GRA)

N80-19271# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
EVALUATION OF A POLYURETHANE/POLYSTYRENE COMPOSITE CUSHIONING MATERIAL
Frank C. Jarvis Jul. 1979 21 p
(AD-A077918; PTPT-79-2) Avail: NTIS HC A02/MF A01 CSCL 11/9

An evaluation of a polyurethane/polystyrene composite cushioning material revealed that the dynamic cushioning characteristics of this material has a broader static stress range, for a specific peak acceleration, than some of the existing 2 pcf materials listed in the Military Handbook 304A, 'Package Cushioning Design'. Samples of materials identified as structural grade and cushioning grade together with intermediate grades of material formulations, were analyzed to determine the effect of the expanded polystyrene beads in the material formulation. GRA

N80-19272# Massachusetts Inst. of Tech., Cambridge
SURFACE CHEMICAL COMPOSITION - DEPTH PROFILE OF POLYETHER POLYURETHANEUREAS AS STUDIED BY FT-IR AND ESCA
C. B. Hu and C. S. Paik Sung Nov. 1979 18 p refs Presented at the Symp. on the Spectroscopic Characterization of Mol. Struct. at Polymer Surfaces and Interfaces, Houston, Tex., Mar. 1980 Submitted for publication
(Contract N00014-78-C-0676)
(AD-A078240; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/3

Chemical composition-depth profile in the range covering 100 A to 2 micron was obtained with well-characterized polyether poly(urethaneurea) elastomers by combining FT-IR internal reflection technique with ESCA. In FT-IR technique, either the incident angle of the internal reflection attachment was changed or a thin film, which is transparent to most of IR radiation, was cast directly on the reflection plate to reduce the depth of the IR beam penetration in order to obtain surface chemical composition at various depths. Our results show that the flexible, soft segment is more abundant on the surfaces, especially at

the air facing surface, as compared with the bulk composition. This trend is observed not only in the first 100 A, but also into a much deeper depth, such as 1 micron. Our results suggest that the migration of oligomers (approximately 5000 MW) such as trimers or pentamers, which have soft segments at both ends is responsible for the observed high content of soft segment on the surface. The presence of the oligomers are indicated by GPC and the extraction studies support that they have higher content of soft segment when compared with the bulk composition. GRA

N80-19273# Case Western Reserve Univ., Cleveland, Ohio.
HIGHLY CONDUCTING IODINATED FLUOROALUMINUM AND FLUOROGALLIUM PHTHACCYANINE POLYMERS Technical Report, 1 Jan. 1979 - 1 Jan. 1980
Paul M. Kuznesoff, Kenneth J. Wynne, Ronald S. Nohr, and Malcolm E. Kenney 1 Jan. 1980 13 p refs
(Contract N00014-75-C-0693)
(AD-A078188; TR-5) Avail: NTIS HC A02/MF A01 CSCL 07/4

Partial oxidation of the quasi-one dimensional fluoroaluminum and fluorogallium phthalocyanines with iodine yields species with appreciable electrical conductivities (1/0.01-1 ohm/centermeters); thermogravimetric, Raman spectroscopic, and mass spectrometric techniques have provided useful information about their compositions and nature. GRA

N80-19274# Akron Univ., Ohio. Inst. of Polymer Science.
EFFECT OF NUMBER OF CHEMICAL BONDS ON THE STRENGTH OF ADHESION BETWEEN GLASS AND POLYBUTADIENE
P. Dreyfuss, Y. Eckstein, O. S. Lien, and H. H. Dollwet Dec. 1979 23 p refs
(Contract N00014-76-C-0408)
(AD-A078237; TR-6) Avail: NTIS HC A02/MF A01 CSCL 13/5

Studies of the effect of chemical bonding on the joint strength of bonds formed between polybutadiene and glass were carried out. The number of chemical bonds was determined using 14 C labelled interfacial bonds and measuring the resulting radioactivity. The strength of the joint was found to increase as the number of chemical bonds increases. The presence of essentially all the radioactivity on the glass surface after peeling at 180 degrees indicated that fracture occurred without breaking the interfacial bonds. GRA

N80-19275# Harry Diamond Labs., Adelphi, Md.
VISCOELASTIC POLYMER FOR PRINTED-CIRCUIT-BOARD VIBRATION DAMPING
Mark R. Probst Sep. 1979 14 p
(DA Proj. 1L4-63317-D-112)
(AD-A077803; HDL-TM-79-22) Avail: NTIS HC A02/MF A01 CSCL 09/1

A viscoelastic polymer was selected as a possible means of vibration damping for electronic printed-circuit-board (PCB) assemblies in a surface-to-air guided-missile application. Thin layers of the self-adhesive polymer were bonded to dummy and real PCB assemblies, and accelerations were recorded at various PCB locations during sinusoidal vibration tests. For input levels of 1 and 2 g and logarithmic frequency sweeps from 10 to 2500 Hz, peak resonant acceleration levels were reduced to 15 percent of the peak levels recorded under the same conditions with no damping layers added. GRA

N80-19276# Pennwalt Corp., King of Prussia, Pa. Central Research and Development Dept.
THE CRYSTALLIZATION THERMODYNAMICS OF PIEZOELECTRIC COPOLYMERS
Harry Stefanou Nov. 1979 25 p refs
(Contract N00014-77-C-0130)
(AD-A078705; TR-2) Avail: NTIS HC A02/MF A01 CSCL 09/1

The crystallization of piezoelectric vinylidene fluoride-tetrafluoroethylene and vinylidene fluoride-hexafluoropropylene copolymers was investigated. Several compositions of each copolymer were synthesized and the melting point depression was evaluated as a function of composition. Models were examined in which the comonomers were included as defects in the crystal lattice or in which they were excluded. The need to use several approaches before a conclusion can be reached is clearly seen. Our studies indicate that the exclusion model is a less accurate description of the crystallization of these two copolymers. Values for the enthalpy of defect incorporation are evaluated and shown to be reasonable. GRA

N80-19277# Naval Research Lab., Washington, D. C. Ceramics Branch.
MACHINING FLAWS AND THE STRENGTH GRAIN SIZE BEHAVIOR OF CERAMICS Interim Report
R. W. Rice 28 Sep. 1979 28 p refs
(NRL Proj. M05-12; NRL Proj. P03-19)
(AD-A077536; AD-E000335; NRL-MR-4076) Avail: NTIS HC A03/MF A01 CSCL 11/2

A model for the strength-grain size dependence of ceramics failing from machining flaws is presented based on the observation that the size of machining flaws (C) shows little or no dependence on grain size. Two regimes of behavior are seen. At finer grain sizes, little or no strength dependence on grain size (G) exists because flaws are greater than G. For large G, the significant decrease of strength with increasing G is attributed by a transition from polycrystalline to either lower single crystal or grain boundary (i.e. bicrystal) fracture energies as the approximate constant (C) becomes significantly less than G as G increases. The transition between the two regimes is when C and G are similar. Extensive analysis of strength-grain size data, and more limited directly correlated fractographic data support the proposed model. Spontaneous cracking in non-cubic materials is shown to support the model, but not be an alternate explanation for the transitions seen in machined Al2O3 or BeO. This analysis also further supports the observation that machining flaws do not vary greatly with typical variations in machining parameters. Author (GRA)

N80-19278# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.
EFFECT OF ENGINE OPERATING ENVIRONMENTS ON LUBRICANT LOAD CARRYING CAPACITY OF HIGH GEAR LOAD OILS Final Report
P. J. Mangione Nov. 1979 34 p refs
(W0598000)
(AD-A078421; NAPC-PE-28) Avail: NTIS HC A02/MF A01 CSCL 21/5

Load carrying capacity evaluations were made on current and advanced esterbased synthetic lubricants which were exposed to the operating environments of gas turbine engines. The program also investigated the cause/effect of changes in load carrying capacity as related to additive depletion and possible additive/metal interaction through an adsorption or reactive process. The results indicated that both current oils and advanced high gear load oils experienced significant degradation in load carrying capacity with time in both engine and simulated engine bearing compartment environments. The percentage loss in load carrying capacity was greater with the high gear load oils, but neither oil was significantly influenced by the engine type sampled. However, the absolute rating of the degraded XAS-2354 oil remained above the degraded MIL-L-23699 oil absolute ratings. The lower load carrying capacity of used oils, attributed to additive depletion, appeared to be recoverable with new oil additions of a high gear load oil. However, this capability would not be realized in normal operation of an engine lubrication system. An effective pre-conditioning treatment of gear tooth surfaces with a high gear load oil was demonstrated and recommended for use in the 'run-in' of new or overhauled helicopter gearboxes for improved resistance to surface damage and extended service life. GRA

N80-19279# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.
CONDUCTION IN POLYDIACETYLENE BILAYERS
David R. Day and Jerome B. Lando Dec. 1979 17 p refs
(Contract N00014-77-C-0213)
(AD-A078755; TR-2), Avail: NTIS HC A02/MF A01 CSCL 11/9

Diacetylene monolayers polymerized at the gas water interface have a very poor conductivity. They do however exhibit a photoconductive and doping effect which can raise the conductivity over three orders of magnitude. Because of the initially low

conductivity, the polydiacetylene monolayers could at best only be considered a poor semiconductor after doping. The possibility still remains that more exotic dopants such as AsF5 that are successfully applied to other conjugated polymers may result in higher conductivities in polydiacetylene monolayers. GRA

N80-19280# Dayton Univ. Research Inst., Ohio.
DEVELOPMENT OF SURFACE INTERACTIONS AT POLYMER-METAL INTERFACES Final Report, 1 Apr. 1976 - 5 Apr. 1979
J. S. Solomon, D. L. Hall, and D. E. Hanlin Aug. 1979 139 p refs
(Contract F33615-76-C-5185; AF Proj. 7340)
(AD-A077276; UDR-TR-79-41; AFML-TR-79-4100) Avail: NTIS HC A07/MF A01 CSCL 11/6

Contents: Introduction; Metal Adherend Surfaces-Aluminum Alloys - Oxide Characterization; Elemental Distribution - Phosphorus, Copper, Magnesium; Titanium Alloys; Graphite Fibers; Bond Joint Characterization; Instrumental Modification--Secondary Ion Mass Spectroscopy, and Auger Electron Spectrocopy. GRA

N80-19281# Naval Research Lab., Washington, D. C.
THE EFFECT OF SEAWATER ON POLYMERS Interim Report
G. R. Baker and C. R. Thompson Nov. 1979 32 p refs
(NRL Proj. S02-43.801)
(AD-A077324; NRL-MR-4097) Avail: NTIS HC A03/MF A01 CSCL 11/9

The extent of interaction between a fluid and a polymer is monitored by changes in weight, dimension, and hardness. Results of the measurements reports reported here show that the type of interactions are dependent upon the specific material. Some materials undergo a simple diffusion process, while others interact in a complex manner, with several processes occurring simultaneously. Those materials that exhibit complex behavior require further study with appropriate end-use tests. GRA

N80-19282# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
MOISTURE EFFECTS ON THE MECHANICAL PROPERTIES OF HERCULES 3501-6 EPOXY RESIN Progress Report, Oct. 1977 - Oct. 1978
Joseph M. Augl Mar. 1979 47 p
(WR0220401)
(AD-A078616; NSWC/TR-79-41) Avail: NTIS HC A03/MF A01 CSCL 11/9

The following properties of the Hercules 3501-6 epoxy resin were determined: Young's modulus, shear modulus, Poisson's ratio, ultimate strength, and ultimate strain, all as a function of temperature (between 21 and 150 C) and as a function of moisture concentration corresponding to an equilibrium concentration from 0-100 percent relative humidity. The purpose of this investigation was to obtain the necessary constituent material property data for predicting the environmental response of 3501-6 carbon fiber reinforced composites. GRA

N80-19766# Joint Publications Research Service, Arlington, Va.
RAPID LABORATORY METHOD FOR TESTING OUTGASSING OF THERMOSTABLE PLASTICS AND RUBBER
V. D. Yablochkin, G. D. Solomin, V. A. Shchirskaya, N. A. Glazkova, Ye. A. Demchenko, N. Ye. Ostasheva, and E. I. Chukhno *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 1, (JPRS-75251) 5 Mar. 1980 p 73-79 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 50-54 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-19283*# Pennsylvania State Univ., University Park.
EVALUATION OF A LOCALLY HOMOGENEOUS FLOW MODEL OF SPRAY COMBUSTION Final Report
C-P. Mao, G. A. Szekely, Jr., and G. M. Faeth Washington NASA Apr. 1980 55 p refs
(Grant NGR-39-009-077)
(NASA-CR-3202) Avail: NTIS HC A04/MF A01 CSCL 21B

A model of spray combustion which employs a second-order turbulence model was developed. The assumption of locally homogeneous flow is made, implying infinitely fast transport rates between the phase. Measurements to test the model were completed for a gaseous n-propane flame and an air atomized n-pentane spray flame, burning in stagnant air at atmospheric pressure. Profiles of mean velocity and temperature, as well as velocity fluctuations and Reynolds stress, were measured in the flames. The predictions for the gas flame were in excellent agreement with the measurements. The predictions for the spray were qualitatively correct, but effects of finite rate interphase transport were evident, resulting in a overstimation of the rate development of the flow. Predictions of spray penetration length at high pressures, including supercritical combustion conditions, were also completed for comparison with earlier measurements. Test conditions involved a pressure atomized n-pentane spray, burning in stagnant air at pressures of 3, 5, and 9 MPa. The comparison between predictions and measurements was fair. This is not a very sensitive test of the model, however, and further high pressure experimental and theoretical results are needed before a satisfactory assessment of the locally homogeneous flow approximation can be made. Author

N80-19284*# Southwest Research Inst., San Antonio, Tex. Mobile Energy Div.
FUEL QUALITY COMBUSTION ANALYSIS Final Report, 6 Oct. 1978 - Jul. 1979
D. W. Naegeli and C. A. Moses May 1979 50 p refs
(Contract NAS3-21587)
(NASA-CR-162822; MED113) Avail: NTIS HC A03/MF A01 CSCL 21D

A high pressure research combustor operating over a wide range of burner inlet conditions was used to determine the effects of fuel molecular structure on soot formation. Six test fuels with equal hydrogen content (12.8%) were blended to stress different molecular components and final boiling points. The fuels containing high concentrations (20%) of polycyclic aromatics and partially saturated polycyclic structures such as tetralin, produced more soot than would be expected from a hydrogen content correlation for typical petroleum based fuels. Fuels containing naphthenes such as decalin agreed with the hydrogen content correlation. The contribution of polycyclic aromatics to soot formation was equivalent to a reduction in fuel hydrogen content of about one percent. The fuel sensitivity to soot formation due to the polycyclic aromatic contribution decreased as burner inlet pressure and fuel/air ratio increased. R.C.T.

N80-19285# Gough (Paul) Associates, Inc., Portsmouth, N.H.
TWO DIMENSIONAL CONVECTIVE FLAMESPREADING IN PACKED BEDS OF GRANULAR PROPELLANT Final Report, Nov. 1977 - Feb. 1979
Paul S. Gough Jul. 1979 159 p refs
(Contract DAAK11-78-C-0003; DA Proj. 1L1-61102-AH-43)
(AD-A075326; AD-E430304; PGA-TR-79-1; ARBRL-CR-00404) Avail: NTIS HC A08/MF A01 CSCL 19/4

A theoretical model is described for the digital simulation of flamespreading and pressure-wave propagation in axisymmetric, two dimensional propelling charges. The approach recognizes explicitly the presence of internal boundaries defined by jumps in porosity and allows for treatment of the influence of bag materials, liners, and additives on flamespreading. As one step toward the implementation of this model, a technique of numerical solution is presented for a geometrically complex region of two dimensional, two phase flow. Solutions are presented for three problems based on nominal data. GRA

N80-19286# George Washington Univ., Washington, D. C. Dept. of Chemistry.
MECHANISTIC STUDIES OF THE EFFECT OF LEAD SALTS ON DOUBLE BASE PROPELLANT COMBUSTION. THE USE

OF MODEL SYSTEMS Final Report, 1 Nov. 1975 - 31 Jul. 1979
Joseph B. Levy Sep. 1979 37 p refs
(Grant DAAG29-76-G-0087)
(AD-A075371; ARO-13249.1-C) Avail: NTIS
HC A03/MF A01 CSCL 21/9

In this program the effects of lead oxide (PbO) on the thermal decomposition of n-propyl nitrate have been studied as a model for double-base propellants containing lead salts as ballistic modifers. Only a small effect has been oberved with n-propyl nitrate at the temperature range investigated, 157-186 degrees C, but in the course of this study a very powerful catalysis by lead oxide of the thermal decomposition of nitroalkanes was discovered and investigated in some detail. GRA

N80-19287# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
DIESEL ENGINE ENDURANCE TEST WITH WATER-CONTAINING FIRE-RESISTANT FUEL Interim Report, Mar. - Sep. 1977
J. V. Moffitt, E. C. Owens, B. R. Wright, and W. D. Weatherford, Jr. Sep. 1979 59 p refs
(Contracts DAAG53-76-C-0003; DAAK70-78-C-0001)
(AD-A078665; AFLRL-94) Avail: NTIS HC A04/MF A01 CSCL 21/4

A production LDT-465-1C multifuel diesel engine was operated according to a double-length Army/CRC Wheeled Vehicle Test Cycle (420 total hours) using a fire-resistant diesel fuel containing 10 vol % water. The effects of this water-in-fuel macroemulsion on engine power output, deposits, wear, and oil degradation were examined. The results indicate that this fire-resistant fuel formulation, under the conditions evaluated, does not result in abnormal deposits nor are there any major effects (adverse or favorable) on engine wear or oil degradation. However, a significant loss in horsepower output as a function of test duration did result. Post-test examinations indicated the presence of fuel-origin deposits in the injection system which were attributed to the sugar-type surfactants used in this investigation. Author (GRA)

N80-19288# Florida State Univ., Gainesville. Dept. of Chemistry.
INVESTIGATION OF THERMOPLASTIC ELASTOMERS AS PROPELLANT BINDERS Final Report, 1 Jun. 1976 - 31 Aug. 1979
George B. Butler 29 Nov. 1979 72 p refs
(Grant DAAG29-76-G-0223)
(AD-A078691; ARO-13960.4-CX) Avail: NTIS
HC A04/MF A01 CSCL 21/9

It was the objective of the present investigation to conduct a fundamental study of the feasibility of utilizing or developing suitable thermoplastic elastomers for use in propellant technology, and considerable progress has been made toward achieving this objective. A wide variety of thermoplastic elastomers of novel structure have been synthesized, and their fundamental physical properties determined. As a result of this study, a number of carefully selected samples were submitted to personnel at Redstone Arsenal, Alabama, for evaluation as thermoplastic propellant binders. Verbal communication has strongly indicated that the present approach is a feasible one, and has made it possible to extrapolate to a set of 'necessary' properties of the material to meet the required objectives. GRA

N80-19289# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
TURBULENT BOUNDARY-LAYER ANALYSIS AND EXPERIMENTAL INVESTIGATION OF EROSIVE BURNING PROBLEM OF COMPOSITE SOLID PROPELLANTS Interim Report, 1 Oct. 1977 - 30 Sep. 1978
Mohan K. Razdan and Kenneth K. Kuo Mar. 1979 196 p refs Prepared for Atlantic Research Corp., Alexandria, Va.
(Contract F49620-78-C-0016; AF Proj. 2308)
(AD-A077351; AFOSR-79-1155TR) Avail: NTIS
HC A09/MF A01 CSCL 21/9

The purpose of this study was to investigate the frequently encountered phenomenon of erosive burning of composite solid propellants in rocket motors. Both theoretical and experimental studies were undertaken. In the theoretical model, the propellant burning process was described by considering a steady, two-dimensional, chemically reacting, turbulent boundary layer over a propellant surface. The diffusion-controlled gas-phase chemical reaction was modeled on the basis of the eddy-break-up concept. The theoretical model, comprised of a set of partial differential equations, was solved numerically. In the experimental work, a flat composite-propellant slab was burned in a test chamber by the flow of hot combustion gases which formed a turbulent boundary layer over the surface of the propellant. The burning rate of the propellant was measured by a high-speed motion picture technique at various pressures and free-stream velocities. Comparison of the theoretical results with the experimental data, obtained from the present study and that obtained from existing literature, showed a close agreement. GRA

N80-19290# SRI International Corp., Menlo Park, Calif.
DEFLAGRATION-TO-DETONATION TRANSITION IN HMS BASED PROPELLANTS Interim Report, 1 May 1978 - 30 Apr. 1979
M. Cowperthwaite, W. J. Murri, and J. T. Rosenberg Aug. 1979 24 p
(Contract F49620-77-C-0039; AF Proj. 2308)
(AD-A078845; AFOSR-79-1286TR; PYU-6069) Avail: NTIS
HC A02/MF A01 CSCL 21/9

Theoretical and experimental studies were undertaken to explain the mechanisms that establish conditions for the occurrence of the one-dimensional deflagration-to-detonation transition (DDT), and to formulate a satisfactory model for a quantitative description of this transition. The theoretical studies were concerned with the thermo-hydrodynamic treatment of DDT. The central problem is to model the propagation of the unsteady flame and the flow it produces ahead of the flame front. The compressive flows produced by an accelerating flame and by an accelerating piston were compared to provide a better physical understanding of the compressive action of an accelerating flame; conditions for shock formation in a compressive flow were formulated. The condition for shock formation in the compressed state is that the second derivative of the Lagrange pressure-specific volume compression curve be positive. When this condition is satisfied, a shock is always formed by an accelerating piston but not always by an accelerating flame. As the piston accelerates, the compression waves emanating from it overtake each other and coalesce to form a shock. But the accelerating flame can overtake and consume compressed material before the compression waves emanating from it coalesce to form a shock. In the experimental study, an assembly was designed to allow incorporation of stress gages into propellant charges during the casting process, thereby eliminating the expensive machining and grooving operations conventionally used in constructing targets for langrange gage experiment. GRA

N80-19291# Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.
EVAPORATION AND DISPERSION OF HAZARDOUS MATERIALS Final Report, 15 May 1978 - 14 May 1979
Charles Springer Jun. 1979 85 p refs
(Grant AF-AFOSR-3559-78; AF Proj. 2303)
(AD-A077399; AFOSR-79-1062TR) Avail: NTIS
HC A05/MF A01 CSCL 21/9

This work was undertaken in order to develop a state-of-the-art predictive model for the evaporation and dispersion of hazardous liquids, especially hydrozine family fuels and propellants, which might be accidently spilled. All of the several model elements have been assembled and combined in a FORTRAN computer program which will compute evaporation rates and limits of the hazardous region, that is, the maximum distance away from the centerline where a hazard would exist as well as the maximum distance down wind that a hazard would exist. Depending upon the input data supplied, the program will also predict the amount of water that would be required for sufficient dilution to eliminate the hazard, the effects of changing variables (as for example, the effects of changes in wind speed, or in air temperature or in atmospheric stability), and the effect of the passage of time (up to twenty-four hours) if weather conditions are updated hourly. In the latter case, allowances are made for composition changes in the remaining pool because of preferential evaporation of components, possible absorption of water from the

atmosphere, and absorption of (and reaction with) carbon dioxide from the atmosphere. A number of computations were made in order to determine the effects of changes in the several input parameters. Author (GRA)

N80-19292# Delaware Univ., Newark.
KINETICS AND MECHANISM OF DESULFURIZATION AND DENITROGENATION OF COAL-DERIVED LIQUIDS Quarterly Report, 21 Jun. - 20 Sep. 1978
B. C. Gates, J. R. Katzer, J. H. Olson, H. Kwart, and A. B. Stiles 16 Mar. 1979 134 p refs
(Contract EX-76-C-01-2028)
(FE-2028-15; QR-13) Avail: NTIS HC A07/MF A01

Studies of competing hydroprocessing reactions catalyzed by Ni-Mo/gamma-Al2O3 and involing quinoline, indole, dibenzothiophene, and naphthalene in n-hexadecane show that marked interactions exist. The naphthalene hydrogenation rate is reduced by the presence of quinoline; whereas the reactivity of quinoline is unchanged by the naphthalene. The rate of hydrodenitrogenation of indole, a non-basic nitrogen-containing compound is strongly reduced by the presence of quinoline, whereas the rate of hydro-denitrogenation of quinoline, a basic nitrogen-containing compound, is unaffected by the presence of indole. The hydrogenation reactions in the dibenzothiophene reaction network are inhibited severely as indicated by the reduction in their pseudo first-order-rate constants as are the hydrogenation reactions for naphthalene. Thus the hydrogenation rate is reduced 30-fold by increasing the inital quinoline concentration from 0.0 to 0.5 wt % in naphthalene hydrogenation and in dibenzothiophene hydrodesulfurization. The rate of direct sulfur removal is reduced by only 3-fold by increasing the quinoline concentration from 0.0 to 0.5 wt %. DOE

N80-19293# Lehigh Univ., Bethlehem, Pa.
CENTRIFUGAL FLUIDIZED COMBUSTION OF COAL Final Report
E. K. Levy and J. C. Chen Jan. 1979 130 p refs
(Contract EX-76-S-01-2516)
(FE-2516-9) Avail: NTIS HC A07/MF A01

Batch experiments on bed startup, minimum fluidization, and pressure drop were performed using room temperature air at atmospheric pressure. Particular attention was given to the effects of grid pressure drop, grid taper angle, mass of bed material, speed of rotation, and particle size and density on fluidization. The experiments demonstrated that it is possible to start up a centrifugal fluidized bed (CFB) from rest, that the system fluidizes in a predictable fashion, and that the minimum fluidization velocities and bed pressure drops are in good agreement with the theoretical models developed for the CFB. The experimental data indicate that it is possible to feed and remove solids continuously and achieve a stable bed thickness in a rotating fluidized bed. Experiments performed on particle elutriation show that the air flow rate at which particle loss is initiated is a strong function of the angular velocity of the bed and the bed thickness. At higher flow rates, the rate of particle loss depends on air flow rate, angular velocity, and bed thickness. DOE

N80-19294# Brookhaven National Lab., Upton, N. Y.
POTENTIAL OF BIOMASS CONVERSION IN MEETING THE ENERGY NEEDS OF THE RURAL POPULATIONS OF DEVELOPING COUNTRIES: AN OVERVIEW
V. Mubayi, J. Lee, and R. Chatterjee (State Univ. of New York, Stony Brook) 1979 18 p refs Presented at the Am. Chem. Soc. Natl. Meeting, Washington, D.C., 11-14 Sep. 1979
(Contract EY-76-C-02-0016)
(BNL-26721; CONF-790917-11) Avail: NTIS HC A02/MF A01

A preliminary assessment is presented of the contribution biomass conversion could make in the context of the rural areas of six developing countries: India, Indonesia, Peru, Sudan, Tanzania, and Thailand. The technologies selected for analysis are: anaerobic digestion of wet biomass to produce methane and pyrolysis of dry biomass to produce charcoal, liquid fuels, and low Btu gases. Preliminary estimates are made of the amounts of fuels that could be produced in each of the selected countries by a combination of these technologies. It was found that, with the exception of India, implementation of these technologies could potentially meet the future energy needs of their rural populations for both subsistence and development. DOE

N80-19295# California Univ., Livermore. Lawrence Livermore Lab.
METHANOL AS A TRANSPORTATION FUEL: ASSESSMENT OF ENVIRONMENTAL AND HEALTH RESEARCH
H. Timourian and F. Milanovich 18 Jun. 1979 97 p refs
(Contract W-7405-eng-48)
(UCRL-52697) Avail: NTIS HC A05/MF A01

The current status of knowledge on the health and environmental impacts resulting from the use of methanol and methanol-gasoline blends as automotive fuels is evaluated. The physical and technical background on methanol as an automotive fuel is reviewed, as well as the environmental, biological, and human health effects associated with the impact of methanol use and production. The main issues that must be resolved by further research programs, and recommended research to address the main issues are outlined. An extensive bibliography is included. DOE

N80-19296# Department of Energy, Bartlesville, Okla. Energy Technology Center.
PHYSICAL PROPERTIES OF GASOLINE/ALCOHOL BLENDS
F. W. Cox Sep. 1979 36 p refs
(BERC/RI-79/4) Avail: NTIS HC A01/MF A01

Exeprimental data were generated for the octane number, water tolerance, micro vapor pressure, and distillation characteristics of gasoline/alcohol blends. The alcohols studied were methanol, ethanol, n-propanol, i-butanol, and two synthetic methyl fuels, each at 5, 10, and 15 weight percent in two gasolines which had substantially different property values. Each physical property is discussed in reference to value changes brought about by gasoline differences and those brought about by alcohol differences. DOE

N80-19297# Colorado Energy Research Inst., Golden.
HYDROGEN AND METHANE SYNTHESES THROUGH RADIATION CATALYSIS Progress Report, 1 Sep. 1978 - 1 Aug. 1979
Sep. 1979 53 p refs
(Contract EG-77-C-02-4258)
Avail: NTIS HC A04/MF A01

The production of hydrogen through water radiolysis atCo-60 gamma energies, in the presence of solid oxide catalysts was studied to obtain an improved theoretical understanding of radiation-induced hydrogen generation within the framework of the electronic theory of catalysis. Correlation of hydrogen yield with catalytic activity, based on prior work, was difficult to attain and an assessment of experimental parameters was made. Three sets of observations appear of some significance, however: (1) antimony oxide (Sb2O3, Eg = 3.3) shows consistently a dramatic increase in catalytic performance which cannot be attributed solely to band gap values; (2) there appears to be a correlation between hydrogen yield and dielectric properties of the catalyst; and (3) gamma irradiation changes the constitutive electrical properties of oxide catalyst in a manner proportional to hydrogen yields. DOE

N80-19298# Carnegie-Mellon Univ., Pittsburgh, Pa.
THE CHEMISTRY OF SULFUR IN CHAR AND THE IMPLICATIONS FOR HYDROGASIFICATION/HYDRODESULFURIZATION Ph.D. Thesis
A. E. McIver Sep. 1979 289 p refs
(Contract EX-76-C-01-2449)
(FE-2449-9) Avail: NTIS HC A13/MF A01

Experimental results, which elucidate the factors which govern the equilibrium distribution of sulfur between organic sulfur in char and gaseous hydrogen sulfide, are presented. These experiments were conducted at between 1200 F and 1600 F, for values of the ratio (P/sub H2S//P/sub H2/) ranging from 1 to 100 atmospheric pressure and for several chars. The rank of the parent coals from which these chars were derived ranged from lignite to anthracite. It is shown that the partial pressure ratio (P/sub H2S//P/sub H2/) is the pressure-dependent parameter which governs the extent of char sulfidation. It is also shown that the extent of char sulfidation is not uniquely

dependent upon the char surface area, but decreases with increasing rank of the char, and the rank of the coal from which the char is derived. Char sulfidation is shown to be a reversible process. The kinetics of char desulfurization are shown to be a function of the physiochemical history of the char - i.e., char desulfurization is a path-dependent process. The analogy between the chemistries of oxygen and sulfur in char are explored, and the implications for coal sulfur management are outlined. DOE

N80-19299# Los Alamos Scientific Lab., N. Mex.
THERMOCHEMICAL PROCESSES FOR HYDROGEN PRODUCTION Progress Report, 1 Oct. 1978 - 31 Mar. 1979
Kenneth E. Cox, comp. Sep. 1979 23 p refs
(Contract W-7405-eng-36)
(LA-7937-PR) Avail: NTIS HC A02/MF A01

A 50 percent efficiency was obtained when an improved bismuth sulfate cycle design was coupled to a fusion energy source at 1500 K. The improved design was based on a reduction endothermic requirement for Bi_2O_3 $2SO_3$ decomposition and a lower voltage for SO_2 electrolysis that should result at lower acid concentrations. Experimental results showed an endothermic heat requirement of +172 kJ/mol for the decomposition of (Bi_2O_3) $2SO_3$) to (Bi_2O_3) (SO_3) and SO_3. Reaction times for bismuth sulfate decomposition were determined as a function of temperature. At 1240 K, < 1.5 min were required for the first two stages of decomposition from (Bi_2O_3) $(3SO_3)$ to (Bi_2O_3) (SO_3). In tests made to determine the feasibility of decomposing (Bi_2O_3) $(2SO_3)$ in a fluidized bed, the solid particles agglomerated when heated. Solid particles suitable for fluidization will be sought through new approaches. DOE

N80-19300# Physical Sciences, Inc., Woburn, Mass.
COAL PROCESSING FUEL CELL UTILIZATION. TASK 8: H2S REMOVAL BY CALCIUM-BASED SORBENTS
Girard A. Simons and W. T. Rawlins Mar. 1979 44 p refs
(Contract EW-78-A-21-8450)
(PSI-TR-167) Avail: NTIS HC A03/MF A01

A transport model was developed to describe the diffusion limited processes in SO_2 cleanup by limestone. Equilibrium calculations indicate an optimum thermodynamic limit of $(H_2S)/(H_2O)$ for a typical fluidized bed gasification process using limestone or dolomite at temperatures of 1000 to 1200 K; thus the minimum H_2S level which can be attained in the gasifier is probably near 100 ppM. Detailed kinetic investigations show that the kinetic rate constant for CaO with H_2S is of the same magnitude as that with SO_2 and that the activation energy for both reactions is less than 10 K cal/mole. The model takes into account the following: (1) the grain theory; (2) the addition of sulfur deposits; and (3) the effects of the calcination temperature and CO_2 background on the pore structure. R.E.S.

N80-19301# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
SOLID PROPELLANT COMBUSTION MECHANISM RESEARCH Annual Report, 1 Apr. 1978 - 31 Mar. 1979
L. H. Caveny, W. A. Sirignano, and S. W. Cheng Apr. 1979 41 p ref Sponsored in part by Army Ballistic Res. Lab.
(Contract N00014-75-C-0705; NR Proj. 092-516)
(AD-A078831; MAE-1373) Avail: NTIS HC A03/MF A01 CSCL 21/2

This research is directed at making direct measurements of the acoustic admittance of flames and interpreting those measurements in terms of flame models. Laser Doppler velocimetry (LDV) instrumentation, pressure detectors, and data analysis techniques were set up and used successfully to measure the acoustic response of a propane/air burner system. Applications of the techniques to solid propellants are described and are the subjects of the continuing research. GRA

N80-19302# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.
METHANOL AND METHYL FUEL CATALYSTS Quarterly Report, Jun. - Aug. 1979
Kamil Klier and Richard G. Herman Sep. 1979 10 p
(Contract ET-78-S-01-3177)
(FE-3177-4) Avail: NTIS HC A02/MF A01

It is shown that $CuO/ZnO/La_2O_3$ = 25/65/10, $CuO/ZnO/CeO_2$ = 25/65/10, and $CuO/ZnO/Al_2O_3$ = 60/30/10 wt percent catalysts are active in the synthesis of methanol from syngas. Analogous to the binary CuO/ZnO = 30/70 catalysts, an increase in methanol yield was noted over the cerium dioxide based catalyst when the CO_2 concentration in the syngas mixture was reduced from 6 percent to about 2 percent. A similar decrease in the CO_2 concentration over the aluminum-based catalyst, however, resulted in a decrease in catalytic activity. Thus, the roles played by the Al_2O_3 and CeO_2 supports are distinctly different. Over the lanthanum-based catalyst, a decrease in the $CO(CO_2)$ flow rate decreased the gas hourly space velocity and increased the H_2/C ration and appeared to result in the direct reaction of CO_2 with H_2. DOE

N80-19303# Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.
MIXING AND GASIFICATION OF COAL IN ENTRAINING FLOW SYSTEMS Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1979
L. Douglas Smoot and Paul O. Hedman Apr. 1979 25 p refs
(Contract EF-77-S-02-2666)
(FE-2666-T1; QTPR-8) Avail: NTIS HC A02/MF A01

Four cold-flow mixing tests were conducted to help resolve difficulties in reproducing gas mixing data. The difficulty was identified and corrected. Nine additional cold-flow mixing tests were also performed to investigate the effect of coal particles in place of silicon particles. The secondary jet swirl generator for use in the cold-flow facility was completed. The method of blanketing the coal feeder with an inert gas was modified during the period, and pressure gauges were added to the system to allow coal feeder and reactor pressures to be monitored. The feasibility of using specific ion electrodes for analysis of sulfide in the quench water was demonstrated. A two-dimensional axi-symmetric gasification model was formulated, coded, and evaluated. Comparison between prediction and measurement for both cold-flow and reacting gases were made. DOE

N80-19304# Exxon Research and Engineering Co., Bayton, Tex. Research and Development Div.
FLUID COKING OF COAL LIQUEFACTION RESIDUES: THE FOURTH RESIDUE Final Technical Progress Report
S. Zaczepinski Jan. 1979 73 p
(Contract EX-76-C-01-2422)
(FE-2422-28) Avail: NTIS HC A04/MF A01

The applicability of current fluid coking technology to processing of coal liquefaction residues was evaluated by characterizing the coal liquefaction residues and assessing the effect of major coking process variables on yields and operability. Summary statements of results obtained on residues 1, 3 and 4 are: the ash content and feed fraction boiling below 1000 F are the only major analytical differences between these three residues; the net liquid recovered expressed on an ash-free 1000 F+ feed basis shows no feed dependence and no process variable effects; and the liquids recovered in fluid coking of these residues are the 1000 F- fraction of the feed and net 1000 F+ boiling product liquid. The process will recover the feed fraction boiling below 1000 F, but the net liquid produced boils at temperatures greater than 1000 F fluid coking operability (bogging) does not appear to be a limit over the temperature range of interest. Interim results are reported on the fourth sample (H-coal vacuum still bottoms). The sample is high in ash and processing results are generally similar to the above. DOE

N80-19305# Institute of Gas Technology, Chicago, Ill.
ENVIRONMENTAL ASSESSMENT OF THE HYGAS PROCESS. VOLUME 1: HYGAS ENVIRONMENTAL CHARACTERIZATION, DATA SYNTHESIS, ANALYSIS, AND INTERPRETATION, TESTS 37 - 64 Interim Report
Robert J. Jonardi, Louis J. Anastasia, Michael J. Massey (Carnegie-Mellon Univ.), and Richard H. Karst Jun. 1979 207 p refs
(Contract EX-76-C-01-2433; Proj. 61014)
(FE-2433-25-Vol-1) Avail: NTIS HC A10/MF A01

Report data published in the form of monthly and quarterly reports covering HYGAS test 37 through 64 are analyzed. The current program state-of-the-art, is described and future tasks are outlined. The environmental data base is divided into parts one for the coal pretreatment section, and the other for the

gasification section and related downstream operations. The format employed is to identify the fate of selected coal constituents (for example, coal nitrogen, sulfur, and trace elements) along with other environmentally important species liberated or produced during the gasification process (for example, phenolic compounds). DOE

N80-19306# Hydrocarbon Research, Inc., Lawrenceville, N. J.
DEVELOPMENT OF A FAST FLUID BED GASIFIER, TASK 2 AND 3 Quarterly Progress Report, Oct. - Dec. 1978
Feb. 1979 23 p refs
(Contract EX-76-C-01-2361)
(FE-2361-40) Avail: NTIS HC A02/MF A01

A coal gasifier for low Btu gas utilizing the principle of the fast fluid bed unit operation is considered. The gasifier will be operated to determine operating parameters, feasibility and viability of a fast fluid bed gasifier. Procurement and construction of the experimental gasifier system was finished in December. A cold test program was also satisfactorily completed. The test lasted for seven days and included instrument checks, equipment evaluation and pressure testing for leaks. DOE

N80-19307# Purdue Univ., Lafayette, Ind.
SYSTEMS STUDIES OF COAL CONVERSION PROCESSES USING A REFERENCE SIMULATOR Quarterly Report, 1 Jan. - 31 Mar. 1979
G. V. Reklaitis, M. K. Sood, Y. Soni, B. W. Overturf, W. Weide, Jr., C. R. Wilkinson, J. Boo, and P. Buchanan Jun. 1979 90 p refs
(Contract EX-76-C-01-2275)
(FE-2275-11) Avail: NTIS HC A05/MF A01

Manuals were completed for the physical properties (PPR-OPS), process costing (PCOST), and detailed simulation (DSP-I) packages. A final manual was issued for the steady state pyrolysis system (SS/PP) model. The process simulation package (S4) was revised and used to execute simulations of the bulk methanation and water quench pyrolysis vapor recovery process sections. Sample results from these simulations are given. The DSP-I system was used to execute design calculations for the process steam and power generation section. Work was completed on the lift-tube model. The mixed algebraic and ordinary differential equation model is quite stiff and requires the use of Gear's implicit method for successful integration. Parameter studies indicate that, for purposes of converging the gasifier-combustion section recycle flows, a simplified form of the lift-tube model will suffice. However, for design of the device, the detailed model is required. DOE

N80-19308# Grace (W. R.) and Co., Memphis, Tenn. Agricultural Chemicals Group.
SYNTHESIS GAS DEMONSTRATION PLANT PROGRAM, PHASE 1 Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1979
M. R. Simpson 1979 27 p
(Contract ET-77-C-01-2577)
(FE-257706; QTPR-06) Avail: NTIS HC A03/MF A01

All activities regarding the commercial plant design, including the various trade-off studies, are essentially complete. Evidence of this stage of activity includes the delivery to DOE of all schematics, plot plans and plot elevations for the commercial plant. Demonstration plant design progressed satisfactorily (27.2 percent as of December 31, 1978, versus 58.4 percent complete as of March 31, 1979). Two additional pilot plant runs were completed. Coal feedstock was selected so as to verify the operability of the coal gasification process on coals of varying characteristics within the Kentucky No. 9 seam. Activities continued regarding development of the Environmental Report and of the various plans for obtaining raw materials and utilizing or otherwise disposing of products and by-products. Work has initiated in the areas of the capital and operating cost estimates and the phase 2 construction plan. DOE

N80-19309# Research Triangle Inst., Research Triangle Park, N. C.
POLLUTANTS FROM SYNTHETIC FUELS PRODUCTION: SAMPLING AND ANALYSIS METHODS FOR COAL GASIFICATION Final Report, Aug. 1978 - Jul. 1979
S. K. Gangwal, P. M. Grohse, D. E. Wagoner, D. J. Minick, and C. M. Sparacino Aug. 1979 102 p refs
(Grant EPA-R-804979)
(PB80-104656; EPA-600/7-79-201) Avail: NTIS HC A06/MF A01 CSCL 07D

Methods described for sampling and analyzing particulates, organic condensibles, and vapors or gases in the raw product stream of the gasifier as well as for solid residues include: (1) gas chromatography procedures for measuring fixed gases, C1-C5 hydrocarbons, sulfur gases, and C6-C8 aromatics; (2) atomic adsorption procedures for measuring toxic trace elements include those for arsenic, selenium, lead, cadmium, chromium, and mercury; (3) using polymeric sorbents to collect volatile or organics from the gas stream for analysis by glass capillary mass spectrometry; and (4) the prefractionation of tar by solvent partitioning into acid, base, and neutral fractions. Each fraction is analyzed by capillary GC/MS or high-performance liquid chromatography (HPLC). Typical results are given to illustrate the nature of the compounds studied, the methodologies, and their sensitivities. GRA

N80-19310# Catalytic, Inc., Philadelphia, Pa.
APPLICATION OF COKE PLANT CONTROL TECHNOLOGIES TO COAL CONVERSION Final Report, Aug. 1977 - Mar. 1979
S. M. Hossain, A. B. Cherry Cilione, and W. J. Wasylenko, Jr. Aug. 1979 214 p refs Sponsored by EPA
(Contract EPA-68-02-2167)
(PB80-108954; EPA-600/7-79-184) Avail: NTIS HC A10/MF A01 CSCL 13B

Process and waste stream characteristics from the by-product coke oven process are compared with selected gasification and liquefaction processes. Recommendations are given regarding control technologies for air, water, and solid wastes. State and Federal regulations for the disposal and treatment of coke oven wastes are presented, along with a brief assessment of health effects attributed to coke oven emissions. Study results indicate that a number of coke oven control technologies are applicable to coal conversion systems. By-product upgrading and fugitive emission control technologies may be readily transferable to analogous coal conversion applications. Desulfurization and wastewater treatment technologies, however, cannot be transferred readily to applications where significant differences exist in the composition, temperature, and pressure of the two categories of process/waste streams. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-19311 Ohio State Univ., Columbus
COOLING LIQUID He-3 BELOW 1 mK BY NUCLEAR DEMAGNETIZATION Ph.D. Thesis
Kevin Albert Muething 1979 295 p
Avail: Univ. Microfilms Order No. 8001789

The design and construction of a nuclear adiabatic demagnetization cryostat is detailed and the cooling of approximately 20 cc of liquid He-3 to a temperature of 0.4 mK is discussed. The net heat leak to the nuclear stage was only 5 nW and the run time being 1 mK was in excess of two days. The thermal resistances between the liquid He-3 and the nuclear spins of the copper bundle are examined. Extensive calculations and measurements show that the Kapitza resistance between the palladium heat exchanger and the He-3 is the dominant factor. A single mathematical approach to optimizing the cooling of the He-3 by minimizing the entropy production in the bundle is also presented. The results of this optimization can be used with a microprocessor based controller to automate the demagnetization process and to evaluate the effects of making changes in the apparatus. Dissert. Abstr.

N80-19312 British Library Lending Div., Boston Spa (England)
SEALING TECHNIQUES FOR ULTRA-HIGH VACUUM SYSTEMS
J. vanEsdonk Oct. 1979 17 p refs Transl. into ENGLISH from Lastechniek (Eindhoven), v. 44, no. 4, 1978 p 53-60

(BLL-RTS-11856) Avail: British Library Lending Div., Boston Spa, Engl.

Soldering techniques for joining metal to metal and joining metal to ceramics are described for sealing vacuum components without flux. Techniques discussed for metal to metal seals include high frequency soldering, soldering in an oven, and vacuum soldering. Techniques discussed for metal to ceramic seals include metallization and soldering, sealing by means of fusible ceramic, and thermocompressive sealing. A.W.H.

N80-19313 British Library Lending Div., Boston Spa (England).
IMPROVING THE PERFORMANCE AND ACCURACY OF EXTERNAL CYLINDRICAL GRINDING
Bencion Chackelecic Rubinovic, Vladislav Ivonovic Sivacek, Jakov Nikolajevic Trokij, and Valentin Ivanovic Kaplin. Oct. 1979. 22 p. refs. Transl. into ENGLISH from Wiss. Z. Tech. Hochsch. Karl-Marx-Stadt (East Germany), v. 19, no. 6, 1977 p. 717-726.
Avail: British Library Lending Div., Boston Spa, Engl.

A cylindrical grinding machine which enables both infeed and longitudinal grinding to be carried out with a single actively controlled tool is described. A gentle mechanical characteristic is used in the drive of the circular feed to achieve a natural negative feedback of the cutting forces. This reduces the cross-sectional error during external grinding and increases the accuracy of machining diametral dimensions in the centerless grinding process. K.L.

N80-19314# Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
MOISTURE MOVEMENT AND MOISTURE EQUILIBRIA IN PAVEMENT SYSTEMS. Final Report, Nov. 1971 - Dec. 1978
Barry J. Dempsey. Sep. 1979. 115 p. refs. Sponsored by Illinois State Dept. of Transportation and FHA.
(Proj. 1HR-604)
(PB80-120082; UILU-ENG-79-2017; ICHRP-179; FHWA/IL/UI-179) Avail: NTIS. HC A06/MF A01. CSCL 13B.

The data from the field test sites were analyzed and summarized. Procedures for determining and utilizing hydraulic parameters important to predicting moisture movement and moisture equilibria in soils and pavement materials were developed. By use of the field data and moisture model the influence of climate and intrinsic pavement conditions on subgrade moisture content and pavement behavior were analyzed. It is shown that parameters such as precipitation, temperature, time of year, and water table depth affected subgrade moisture content and pavement behavior. It is indicated that the moisture model provided the capability of predicting moisture content trends and the sensitivity of subgrade soils and pavement materials to various boundary conditions. GRA

N80-19315# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
EVALUATION AND CALIBRATION OF ROAD METER DEVICES FOR MEASURING PAVEMENT RIDEABILITY. Final Report, 1976 - 1979
B. F. Neal. Jun. 1979. 46 p. refs. Sponsored by Federal Highway Administration.
(PB80-110422; TL-653171; FHWA/CA/TL-79-14; Rept-19303-653171) Avail: NTIS. HC A03/MF A01. CSCL 13B.

The state-of-the-art of road meter technology and some recent significant advances are discussed. A velocity sensor for measuring axle movement to determine roughness rather than the normal method of mechanically determining the movement between axle and car body is evaluted. Finally, methods of road meter calibration, and limited tests of a dynamometer type calibration device are described. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-19316 Worcester Polytechnic Inst., Mass.
CHANNEL MEASUREMENT FOR WIDEBAND DIGITAL COMMUNICATION OVER FADING CHANNELS. Ph.D. Thesis
Kaveh Pahlavan. 1979. 184 p.
Avail: Univ. Microfilms. Order No. 8002694

Adaptive channel measurement obtained by feedback filtering, feed-forward, and probing technique is examined. A one-shot discrete matched filter (DMF) working at Nyquist rate as an upper bound for all conventional receivers is developed. Different channel measurement techniques working with DMF are compared in steady states average probability of error, transient (set up) time, and convergence problem. The decision feedback is superior to the other two in that it does not suffer from either saturation or any loss of packing density. The convergence of adaptive decision feedback channel estimation is critical and is studied by the conventional phase-plane analysis. It is shown that this technique suffers from 180 deg phase ambiguity which could be resolved by differentally encoding the input data. Dissert. Abstr.

N80-19317 British Broadcasting Corp., Kingswood (England). Research Dept.
SYNCHRONIZATION OF THE RADIO-4 (UK) TRANSMITTER CHAIN ON 200 kHz
G. H. Millard, R. D. C. Thoday, and H. M. Price. Dec. 1979. 24 p. refs.
(BBC-RD-1979/27) Avail: BBC, Kinswood Warren, Tadsworth, Surrey, Engl.

The means by which the carriers of three high power broadcast transmitters, operating at a frequency of 200 kHz, are phase locked are described. The effect on the service is examined. The phase locking system is described and its performance is assessed. The line signalling equipment and the equipment at the transmitting sites are described. A.W.H.

N80-19318 British Library Lending Div., Boston Spa (England).
ADJACENT-SIGNAL CHARACTERISTICS AND CO-CHANNEL INTERFERENCE OF A LAND MOBILE LINCOMPEX SYSTEM IN THE VHF BAND
S. Akiyama and Y. Kadokawa. Nov. 1979. 27 p. refs. Transl. into ENGLISH from Denpa Kenkyusho Kiho (Japan), v. 23, no. 123/124, 1977 p. 49-61.
(BLL-RTS-11914) Avail: British Library Lending Div., Boston Spa, Engl.

The application of a Lincompex (LPX), having a required frequency band width of 3 kHz, to a land mobile radio is discussed. The various characteristics of a trial manufactured SSB signal generator, the characteristics of the LPX radio equipment, and a report on the adjacent signal and cochannel interference characteristics are examined. A.W.H.

N80-19319# National Bureau of Standards, Washington, D.C. Electromagnetic Fields Div.
A STANDARD FOR RF MODULATION FACTOR
M. G. Arthur and G. R. Reeve. Sep. 1979. 89 p. refs.
(PB80-109085; FAA-RD-79-94) Avail: NTIS. HC A05/MF A01. CSCL 17G.

A modulation factor standard was developed to support the Instrument Landing System requirements for a measurement capability for the (ILS) and VHF omnidirectional radio range (VOR) navigation systems. The standard consisted of both a precision modulation meter and a stable amplitude-modulated signal source. Although designed primarily for ILS and VOR signals, it had general purpose capabilities within an rf range of 10 MHz to 500 MHz and an af range of 20 Hz to 20 kHz. Measurement uncertainty was less than 0.11 percent modulation below 90 percent modulation for ILS/VO tones of 90 Hz and above, and is somewhat greater at 30 Hz. R.C.T.

N80-19320*# National Aeronautics and Space Administration, Washington, D. C.
SIMULATION PROGRAM OF NONLINEARITIES APPLIED TO TELECOMMUNICATION SYSTEMS
Christian Thomas Dec. 1979 40 p Transl. into ENGLISH of "Programme de simulation de non-linearities applique aux systemes de telecommunications" Centre National d'Etudes Spatiales, Toulouse, France, Jan. 1978 39 p Translation was announced as N79-16185 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75511; CNES-NT-81) Avail: NTIS
HC A03/MF A01 CSCL 17B

In any satellite communication system, the problems of distorsion created by nonlinear devices or systems must be considered. The subject of this paper is the use of the Fast Fourier Transform (F.F.T.) in the prediction of the intermodulation performance of amplifiers, mixers, filters. A nonlinear memory-less model is chosen to simulate amplitude and phase nonlinearities of the device in the simulation program written in FORTRAN 4. The experimentally observed nonlinearity parameters of a low noise 3.7-4.2 GHz amplifier are related to the gain and phase coefficients of Fourier Service Series. The measured results are compared with those calculated from the simulation in the cases where the input signal is composed of two, three carriers and noise power density. R.C.T.

N80-19321*# Astro Research Corp., Carpinteria, Calif.
THE GEOMETRY OF THE 37-TILE MICROWAVE ANTENNA SUPPORT STRUCTURE
Laurence A. Finley 5 Mar. 1980 24 p Sponsored by NASA Prepared for JPL
(Contract JPL-955543)
(NASA-CR-162847; ARC-TN-1083) Avail: NTIS
HC A02/MF A01 CSCL 20N

The geometry of the support structure for a proposed parabolic shaped microwave antenna is examined. The surface of the antenna is comprised of 37 hexagonal shaped tiles, each connected to a truss module. The units are joined together to form a rigidized, faceted, concave parabolic surface. The geometry specifications are described through an explanation of the structural components which make up the antenna, a description of the coordinate system devised to identify the structure, and a presentation of the nondimensional results. A.W.H.

N80-19322*# Axiomatix, Los Angeles, Calif.
Ku-BAND RADAR THRESHOLD ANALYSIS
C. L. Weber and A. Polydoros 11 Jan. 1979 37 p refs
(Contract NAS9-15795)
(NASA-CR-160557; R8001-2) Avail: NTIS HC A03/MF A01
CSCL 17I

The statistics of the CFAR threshold for the Ku-band radar was determined. Exact analytical results were developed for both the mean and standard deviations in the designated search mode. The mean value is compared to the results of a previously reported simulation. The analytical results are more optimistic than the simulation results, for which no explanation is offered. The normalized standard deviation is shown to be very sensitive to signal-to-noise ratio and very insensitive to the noise correlation present in the range gates of the designated search mode. The substantial variation in the CFAR threshold is dominant at large values of SNR where the normalized standard deviation is greater than 0.3. Whether or not this significantly affects the resulting probability of detection is a matter which deserves additional attention. A.R.H.

N80-19323*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPTICAL-COMMUNICATION SYSTEMS FOR DEEP-SPACE APPLICATIONS
Victor A. Vilnrotter and Robert M. Gagliardi 15 Mar. 1980 60 p refs
(Contract NAS7-100)
(NASA-CR-162882; JPL-Pub-80-7) Avail: NTIS
HC A04/MF A01 CSCL 17B

The feasibility of using optical communication systems for data telemetry from deep space vehicles to Earth based receivers is evaluated. Performance analysis shows that practical, photon counting optical systems can transmit data reliably at 30 to 40 dB high rates than existing RF systems, or can be used to extend the communication range by 15 to 20 dB. The advantages of pulse-position modulation (PPM) formats are discussed, and photon counting receiver structures designed for PPM decoding are described. The effects of background interference and weather on receiver performance are evaluated. Some consideration is given to tracking and beam pointing operations, since system performance ultimately depends on the accuracy to which these operations can be carried out. An example of a tracking and pointing system utilizing an optical uplink beacon is presented, and it is shown that microradian beam pointing is within the capabilities of state-of-the-art technology. Recommendations for future theoretical studies and component development programs are presented. R.C.T.

N80-19324# Mitre Corp., Bedford, Mass.
COMPUTERIZED MODELS FOR DESIGN AND ANALYSIS OF COMPUTER COMMUNICATIONS SYSTEMS
Carl Tropper May 1979 131 p refs
(Contract F19628-78-C-0001; Proj. 5720)
(AD-A078022; MTR-3664; ESD-TR-79-128) Avail: NTIS
HC A07/MF A01 CSCL 17/2

This paper presents a comparison of several models that may be employed for the design and analysis of computer-communications networks. The comparison focuses on the algorithms used for the various facets of network design-routing algorithms, network reliability models, etc. Two models of particular interest have been singled out - one is in the area of protocol design, and the other is an overall network design program. GRA

N80-19325# Naval Postgraduate School, Monterey, Calif.
ACOUSTOOPTIC SPECTRUM ANALYSIS AND NARROWBAND INTERFERENCE EXCISION IN WIDEBAND SIGNAL ENVIRONMENTS Thesis Report, 1 Oct. 1975 - 30 Sep. 1979
F. Weldon Regan, III Sep. 1979 114 p refs
(AD-A078286; NPS62-79-011) Avail: NTIS
HC A06/MF A01 CSCL 17/8

This thesis is a study of performance measures for acoustooptic spectrum analysis, and optical excision of narrowband interference. A Gaussian laser beam model is developed and programmed for propagation through thin lenses. Effects of beam truncation by Bragg cell apertures are examined. Bragg cell performance is analyzed with respect to diffraction efficiency, information capacity, and response agility. A performance comparison is made between charge-coupled device and photodiode technologies in photodetector array applications. Overall excisor performance is discussed in terms of interference removal effectiveness and process corruption of residual information bearing signals. GRA

N80-19326# Polytechnic Inst. of New York, Farmingdale. Dept. of Electrical Engineering
CONTRIBUTATIONS TO SIGNAL PROCESSING FOR THE HALLO PROGRAM Final Technical Report, 1 Sep. 1976 - 30 Sep. 1979
A. Papoulis Nov. 1979 109 p refs
(Contract N00014-76-C-0144; ARPA Order 2684)
(AD-A078217; POLY-EE-79-058) Avail: NTIS
HC A06/MF A01 CSCL 17/9

A number of topics were investigated related to image restoration, clutter reduction, detection of moving targets, spatial and temporal filtering, and spectral estimation. These topics originated with various aspects of the HALLO program but have more general applications including underwater detection, target identification from undersampled radar returns, deconvolution, ultrasonics, detection of points and edges, detection of hidden periodicities and speech processing. GRA

N80-19327# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EXPERIMENTAL MEASUREMENTS OF GROUND REFLECTION ELEVATION MULTIPATH CHARACTERISTICS AND ITS EFFECTS ON A SMALL APERTURE ELEVATION TRACKING RADAR
David F. Sun 5 Mar. 1979 156 p
(Contract F19628-78-C-0002; ARPA Order 2752)

(AD-A077915; TN-1979-21; ESD-TR-79-38) Avail: NTIS
HC A08/MF A01 CSCL 17/9

Field measurements for collecting ground reflection data at L-band have been taken at several sites at the Hanscom Air Force Base and Fort Devens. These field data were used for (1) characterization of the multipath environment; (2) validation of propagation models developed for elevation multipath; (3) simulation of elevation angle estimation; and (4) evaluation of various spectral estimation methods and elevation angle estimation algorithms. 'Classical' and 'data adaptive' angular power spectral estimators have been employed as a means to characterize the multipath environment. The maximum entropy angular power spectral estimates appeared to yield better resolution of various multipath arrivals. For propagation model validation, the field measurement results and the computer simulation results have been compared in terms of the angular power spectrum for a variety of measurements made at these sites with various terrain conditions. In most cases, especially when the terrain variation was simple and could be quite accurately modeled as a series of simple rectangular ground plates, fairly good agreement between the propagation model predictions and the field measurement results was obtained in terms of the estimated elevation angles of the direct signal and the ground reflected signals, the number of the ground reflected signals and their multipath levels. GRA

N80-19328# Naval Ocean Systems Center, San Diego, Calif.
SCINTILLATION OF UHF SATCOM SIGNALS, OCURRENCE AT GUAM FROM MID-MARCH 1978 - JUNE 1979 Final Report
M. R. Paulson 15 Aug. 1979 38 p refs
(AD-A078287; NOSC/TR-328) Avail: NTIS
HC A03/MF A01 CSCL 04/1

The occurrence of significant scintillation at Guam has greatly increased over that observed during the 1976 solar activity minimum. The seasonal variation in scintillation shows a broad maximum, increasing in March and decreasing in October, with little scintillation during November through February. Scintillation frequently can cause uhf satellite communications outages of 6-8 hours a night, with occasional outages of 10 hours or more. Although only seasonal variation and solar activity dependence have been shown, there may be other, unidentified factors that affect the occurrence of scintillation. GRA

N80-19329# Georgia Inst. of Tech., Atlanta. Systems and Techniques Lab.
ELECTROMAGNETIC SHIELDING OF STRUCTURAL FOAMS BY USING INTERNAL CONDUCTIVE MATERIALS Final Report, 14 Feb. 1977 - 31 Dec. 1978
D. G. Bodnar and B. M. Jenkins Aug. 1979 76 p refs
(Contract DAAG46-77-C-0027; DA Proj. 1L1-62105-AH-84)
(AD-A078718; AMMRC-TR-79-49) Avail: NTIS
HC A05/MF A01 CSCL 09/1

This report summarizes the analysis performed during the program to assess the RF shielding effectiveness obtainable by using internal conductive materials in structural foams. The major emphasis was on the use of carbon/graphite fibers as the conductive material although consideration was given to metalized glass fibers and to metal particles. Several mathematical analysis techniques were considered for assessing shielding effectiveness including the method of moments, wire grid analysis, meteorological, and plane wave analysis. The plane wave analysis technique was deemed the most applicable. Calculations of shielding effectiveness are presented in the HF through UHF frequency range for various material characteristics. Test panels were fabricated and tested from 10-1,000 MHz. Carbon, graphite fibers and aluminum coated glass fibers were used as the filler material in the foam panels. Measured data are presented for different concentrations as well as for different types of filler material. Two of the materials tested provided adequate shielding for civilian radio frequency equipment application in the UHF (300-3,000 MHz) region. GRA

N80-19330# Ohio State Univ., Columbus. Electroscience Lab.
ASYMPTOTIC HIGH FREQUENCY TECHNIQUES FOR UHF AND ABOVE ANTENNAS Final Report, 1 Aug. 1976 - 31 Jul. 1979
R. C. Rudduck, R. J. Marhefka, W. D. Burnside, R. G. Kouyoumjian, and C. H. Walter Sep. 1979 88 p refs
(Contract N00123-76-C-1371)
(AD-A077651; ESL-784508-20) Avail: NTIS
HC A05/MF A01 CSCL 09/1

The overall scope of the program on Contract No. N00123-76-C-1371 between The Ohio State University ElectroScience Laboratory and the Naval Ocean Systems Center is to develop the necessary theory, algorithms and computer codes for simulating antennas at UHF and above in a complex ship environment. The work consists of: (1) basic scattering code development; (2) reflector antenna code development; and (3) basic studies to support items (1) and (2). This report describes the progress in each of these areas for the period 1 August 1976 to 31 July 1979. GRA

N80-19331# Ohio State Univ., Columbus. Electroscience Lab.
POINTING ACCURACY AND DYNAMIC RANGE IN A STEERED BEAM ADAPTIVE ARRAY
R. T. Compton, Jr. Nov. 1979 34 p refs
(Contract N00019-79-C-0291)
(AD-A078750; ESL-711847-4) Avail: NTIS
HC A03/MF A01 CSCL 09/3

This report examines the performance of a steered beam adaptive array as a function of the beam pointing error. The purpose is to determine how close the steered beam has to be to the actual desired signal arrival angle for good performance. It is shown that the beam pointing error that can be tolerated is essentially a question of dynamic range. The greater the desired signal dynamic range that must be accommodated by the array, the more accurate the beam pointing angle must be. GRA

N80-19332*# Naval Research Lab., Washington, D. C.
A UNIQUE RADIO OCEANOGRAPHIC RADAR Final Report
James E. Kenney (NASA. Langley Research Center) and Edward J. Walsh (NASA. Wallops Station) Nov. 1979 24 p
(Contract NASA Order L-17098-A)
(AD-A077364; NRL-MR-4086) Avail: NTIS
HC A02/MF A01 CSCL 17/9

A 36 GHz computer controlled airborne radar has been developed by NRL and NASA WFC which generates a false-color coded elevation map of the sea surface below the aircraft in realtime and can routinely produce ocean directional wave spectra with off-line data processing. GRA

N80-19333# Mathematical Applications Group, Inc., Elmsford, N. Y.
THE RADOT CODE SYSTEM TO CALCULATE THE RADAR RETURN FROM A FORESTED AREA Final Report
M. O. Cohen and E. S. Troubetzkoy Oct. 1979 91 p
(Contract DAAK70-78-C-0158)
(AD-A078471; MAGI-7065; ETL-0206) Avail: NTIS
HC A05/MF A01 CSCL 17/9

RADOT (Radar on Trees) is a system of FORTRAN computer codes designed to predict the radar return from a canopy of vegetation. The system combines a realistic simulation of the geometry of the trees of a forest with simple approximations as to the physics of radar scattering with individual branches and leaves. Program TREE is used to generate a prototype tree, for example, an oak tree. A tree run is based upon a detailed input description and need be performed only once for each tree type. The output is a tree model, described down to the level of individual branches and leaves, which can be combined with a 'library' of previously generated prototype trees, into a new library of prototypes. This new library subsequently serves as input to Program HIT, the main geometry code. Program FORGEN, the forest generator, combines user input with built-in distribution functions to place trees throughout a simulated forest area. The tree, itself, is one of the prototypes available from the library, scaled and reoriented by FORGEN. The output of FORGEN is a forest model which contains information as to the location, size, orientation and tree type of each tree in the forest. This forest model can be saved for all subsequent analyses involving this forest. Author (GRA)

N80-19334# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
PROCEEDINGS OF THE ANTENNA APPLICATIONS SYMPOSIUM Final Report
Sep. 1979 523 p refs Symp. held at Urbana-Champaign, Ill., 26-28 Sep. 1979
(Contract F19628-79-M-0015)
(AD-A077167) Avail: NTIS HC A22/MF A01 CSCL 17/9

Partial contents: Low Sidelobe Reflector Antenna for Tactical Radars; Low Sidelobe Parabolic Cylinder Antenna for Surveillance Radars; Near Field Blockage of an Ultralow Sidelobe Antenna; A Millimeter-Wave Scanning Antenna for Radar Application; Sidelobe Level Control for Unequally Spaced Arrays; A Low-Inertia Commutating Feed for Circular Arrays; Computer-Aided Fault Determination for an Advanced Phased Array Antenna; Resonance Phenomena on Multiple-Yagi Arrays; Radiation from Conformal Dipole Arrays Mounted on Dielectrically-Clad Conducting Cylinders; A Microwave Power Transmission Antenna System for the Solar Power Satellite; A Variable Impedance Radio Printed Circuit Balun; Design and Theory of Circularly Polarized Microstrip Antennas; A Common Aperture S- and X-Band Feed for the Deep Space Network; Air Launch Cruise Missile Instrumentation Antennas; Sectoral Scalar Horns for Precise Beam Control; Near Field Pattern Measurement Facility; Planar Near Field Measurements for Aircraft Antenna Applications; and A Safe Test Method for Effective Radiated Power Measurement. GRA

N80-19335# Federal Electric Corp., Vandenberg AFB, Calif. Performance Analysis Dept.
RANGE VERNIER Final Report, Jun. - Aug. 1979
Russell Roy Aug. 1979 48 p refs
(Contract F04703-77-C-0111)
(AD-A077178; PA300-T-39-32; SAMTEC-TR-79-2) Avail: NTIS HC A03/MF A01 CSCL 17/9

A collection of technical information pertaining to Range Vernier implementation on Coherent Signal Processor (CSP) radars at the Western Test Range (WTR) is presented. The Range Vernier technique is quite recent, having evolved since mid 1976. Under certain operational conditions, the technique can provide radial range measurements with Root Mean Square (RMS) noise values at subwavelength levels, plus modelable systematic error components. Measurements of such quality can significantly improve WTR metric test support capabilities. The information includes descriptions of the technique, mathematical construction of range measurements, mechanization techniques and requirements, together with error models. Also, potential applications and feasibility testing are discussed. GRA

N80-19336# Environmental Research Inst. of Michigan, Ann Arbor.
SYNTHETIC APERTURE IMAGING TECHNIQUES AT SHORT WAVELENGTHS Final Report, 1 Apr. 1976 - 30 Sep. 1979
Carl C. Aleksoff Nov. 1979 6 p refs
(Grant DAAG29-76-G-0184)
(AD-A078720; ERIM-122000-14-F; ARO-13735.4-ELX) Avail: NTIS HC A02/MF A01 CSCL 17/8

A number of bistatic synthetic aperture (SA) imaging techniques applicable to short wavelength radiation have been analyzed, and near real time two-dimensional SA imaging using visible light has been demonstrated. GRA

N80-19337# Rome Air Development Center, Griffiss AFB, N.Y.
MODES OF DIELECTRIC WAVEGUIDES OF ARBITRARY CROSS-SECTIONAL SHAPE
Leonard Eyges, Peter Gianino, and P. Wintersteiner Jun. 1979 50 p refs
(AF Proj. 2306)
(AD-A077032; RADC-TR-79-197) Avail: NTIS HC A03/MF A01 CSCL 09/3

An integral representation technique is presented for determining the modal propagation properties of a homogeneous cylindrical dielectric waveguide of arbitrary cross-sectional shape and index n1 embedded in a medium of index n2. Results are given for weakly guiding fibers of various shapes. Among these are rectangles and ellipses, which makes comparisons with previous work possible. GRA

N80-19338# Rome Air Development Center, Griffiss AFB, N.Y.
TROPOSPHERIC REFRACTIVE STUDIES FOR SPADATS RADAR SITES
Larry E. Telford May 1979 69 p
(AF Proj. 4600)
(AD-A077024; RADC-TR-79-177) Avail: NTIS HC A04/MF A01 CSCL 17/9

As prediction tracking radars have evolved, the corrections for tropospheric refractive bending and range error have become more important. Current operational requirements to track targets at elevation angles near the horizon have complicated tropospheric refraction corrections. In this report the tropospheric refractive environment is examined at nine SPADATS radar sites throughout the world. Site statistics are presented and a proposed correction algorithm is presented and tested. GRA

N80-19339# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
GROUND SYSTEMS FOR HF ANTENNAS Final Technical Reports, Dec. 1977 - Mar. 1979
W. L. Weeks and C. L. Chen Oct. 1979 44 p
(Contract F19628-78-C-0057; AF Proj. 2305)
(AD-A077691; RADC-TR-79-222) Avail: NTIS HC A03/MF A01 CSCL 09/5

Measurements on a full-scale model ground system on actual earth were found to agree at least qualitatively with results predicted in an earlier computer study. Such ground systems of suitable length may enhance the field strength of HF antennas at low angles by at least 10 percent. GRA

N80-19340# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
ELECTROMAGNETIC TRANSMISSION THROUGH A FILLED SLIT OF ARBITRARY CROSS SECTION IN A CONDUCTING PLANE OF FINITE THICKNESS
David T. Auckland and Roger F. Harrington Oct. 1979 145 p refs
(Contract F30602-79-C-0011; AF Proj. 2338)
(AD-A078477; RADC-TR-79-257) Avail: NTIS HC A07/MF A01 CSCL 20/3

Electromagnetic transmission through a filled slit in a conducting plane of finite thickness is investigated when the slit cross section is an arbitrary shape. A non-modal formulation is developed whereby the original problem is broken up, via the equivalence principle, into three isolated situations. An integral equation is written for each of these situations involving equivalent electric and magnetic currents as unknowns on the closed contour defining the slit cross section. These three integral equations are solved simultaneously and it is shown that they have a unique solution at all frequencies. A modal solution is also developed for the case when the slit cross section can be viewed as a sequence of two-dimensional rectangular cavities, each coupled to the other by an aperture. Results obtained from these two solutions are compared. Some additional slits, which cannot be solved by a modal solution, are investigated by the non-modal solution. Two approximate solutions are also investigated when the slit cross section is rectangular. For small slit widths w, such that k sub ow is much less than 1, the transmitted fields can be written in terms of a slit impedance for the TE case, and a slit polarizability for the TM case. An equivalent circuit is developed for the TE case and comparison with the modal solution is made for the slit impedance and transmission coefficient. The equivalent circuit involving the aperture impedance of a flange is shown to accurately determine the transmission characteristics of the slit. GRA

N80-19341# Naval Ocean Systems Center, San Diego, Calif.
A COMPUTER PROGRAM FOR ELF/VLF PULSE PROPAGATION IN A LATERALLY HOMOGENEOUS EARTH-IONOSPHERE WAVEGUIDE Interim Report, 1 Feb. - 30 Jun. 1979
R. A. Pappert and L. R. Shockey 31 Aug. 1979 57 p refs
(AD-A076306; NOSC/TR-444) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report contains a computer program designed to handle pulse propagation problems when the propagation channel is the Earth-ionospheric waveguide. The program is intended for use in the ELF/VLF bands for laterally homogeneous channels.

Mode data as a function of frequency from a waveguide program are required inputs to the present program. The mode data are interpolated using cubic splines, and the requisite integrals are treated numerically by means of the fast Fourier transform. GRA

N80-19342# Coastal Engineering Research Center, Fort Belvoir, Va.
A SYSTEM FOR USING RADAR TO RECORD WAVE DIRECTION
Michael G. Mattie and D. Lee Harris. Sep. 1979. 53 p. refs. Sponsored by Army.
(AD-A076307; CERC-TR-79-1) Avail: NTIS
HC A04/MF A01 CSCL 17/9

A radar system provides images of waves in the coastal zone to obtain wave direction information is described. The heart of the system is an X-band marine radar which operates at 9.375 megahertz with a 3 centimeter wavelength and a 0.05 microsecond pulse width. The records are accumulated by photographing the plan position indicator (PPI) scope. The system is designed for unattended operation and includes an automation unit that activates the radar at preset times, usually at 2 hour intervals. A sequence of one to nine photos is obtained on each of four ranges after which the system turns off until the next scheduled observation. Wave images show single and multiple long-crested wave trains permitting observation of wave refraction and shoaling. The information content in the radar images is similar to that in aerial photos. However, radar images can be collected at night, during overcast, and in light rain conditions. Radar imagery is more limited than aircraft imagery in geographical coverage and in the quality of the imagery. Good agreement was found between estimates of wave direction and length obtained with radar and those obtained with other observational techniques. Author (GRA)

N80-19343# New Jersey Inst. of Tech., Newark.
RAY OPTICAL DESCRIPTION OF WAVES GUIDED BY INTEGRATED DIELECTRIC CYLINDER-CONE STRUCTURES Final Technical Report, 29 Jan. 1976 - 31 May 1979
G. M. Whitman, P. Lisman, and S. J. Maurer. Oct. 1979. 57 p. refs. Prepared in cooperation with Analytical Science Corp., Mass. and New York Inst. of Techology
(Grant DAAG29-77-G-0094)
(AD-A076344; ARO-13677.1-ELX) Avail: NTIS
HC A04/MF A01 CSCL 20/3

The techniques of ray-optics, which have provided meaningful results in the study of electromagnetic and acoustic problems, are applied to the integrated dielectric cylinder-cone configuration. The method geometrical optics is presented. The eiconal and transport equations are derived. Asymptotic boundary conditions are discussed and a generalized reflection coefficient introduced. Before investigating the cylinder-cone non-separable geometry, and understanding of the ray structure in both an infinite dielectric cylinder and, separately, in an infinite dielectric cone is needed. This is accomplished in the report and, consequently, amplitude and phase information is attained. In addition, caustics are discussed. Caustics are envelopes of the ray systems and, thus, are surfaces which separate propagating and non-propagating (or complex evanescent) regions and characterize the modal ray systems in non-uniform regions. The report concludes with a discussion of the transition region between the cylinder and the cone. GRA

N80-19344# Naval Ocean Systems Center, San Diego, Calif.
STRATEGIC BLUE-GREEN OPTICAL COMMUNICATIONS PROGRAM PLAN. INVESTMENT STRATEGY TOWARD AN OPTICAL SOLUTION FOR SATELLITE-TO-SUBMARINE INFORMATION TRANSFER Technical Document, Jun. 1978 - Jun. 1979
K. J. Kelley, L. B. Stotts, G. C. Mooradian, and R. D. Anderson. 16 Jul. 1979. 49 p. refs.
(AD-A076345; NOSC/TD-269) Avail: NTIS
HC A03/MF A01 CSCL 17/2

A comprehensive data base in blue-green propagation and devices developed at NOSC and elsewhere was used to evaluate the feasibility of a space-based laser strategic satellite-to-submarine communication system designed to broadcast to operationally significant ocean areas of the world. Although a major capability in submarine communication can be obtained by sequentially transmitting data at a moderate rate to small spots that span the total operational area, this capability can be realized only by the correction of major deficiencies in the current blue-green technology base. Dramatically better optical filters and much more efficient and powerful lasers must be developed before the technical risk of the concept is reduced to a satisfactory level. Also required are the resolution of major uncertainties in the transmission of optical energy through clouds and a reduction in the uncertainties associated with present oceanic and cloud climatology data bases. The overall objective of the program is to determine the practicality and suitability of an optical solution for transmitting strategic information to submerged submarines. This document describes the current program plan. It outlines the various system approaches being pursued, the technical uncertainty areas in both channel characterization and subsystem technology, and the investment strategy to be followed to meet the objective. GRA

N80-19345# Advisory Group for Aerospace Research and Development, Paris (France).
TERRAIN PROFILES AND CONTOURS IN ELECTROMAGNETIC WAVE PROPAGATION
Albert W. Biggs, ed. (Kansas Univ., Lawrence). Dec. 1979. 378 p. refs. Presented at the Specialist Meeting of the Electromagnetic Wave Propagation Panel, Spatind, Norway, 10-14 Sep. 1979.
(AGARD-CP-269; ISBN-92-835-1345-2) Avail: NTIS
HC A17/MF A01

The propagation problems which are connected with terrain profiles and contours were addressed. Specifically examined were theoretical aspects, methods of digital terrain mapping, and terrain effects on antenna characteristics. For individual titles, see N80-19346 through N80-19371.

N80-19346# Middle East Technical Univ., Ankara (Turkey). Electrical Engineering Dept.
THE EFFECTS OF STRATIFIED GROUND ON CHARACTERISTICS OF THE INVERTED L ANTENNA
Edip Niver (Polytechnic Inst. of N.Y., Brooklyn) and Altunkan Hizal. *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation. Dec. 1979. 13 p. refs. (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

Characteristics of an inverted L antenna over a homogeneous moist ground, a poor ground, and a two layered ground consisting of a frozen layer of earth above a moist earth are studied numerically using an integral equation formulation. The feed of the antenna is elevated from the base of the antenna to avoid the discontinuity in the current at the feed and to increase the accuracy of the reflection coefficient approximation used in the formulation. The current distributions are calculated by solving a Hallen's type integral equation. The input admittance and radiation patterns are calculated as a function of the length of the horizontal section. The results show that the inverted L antenna studied possesses useful impedance and radiation characteristics. Author

N80-19347# Communications Research Centre, Ottawa (Ontario).
THE EFFECTS OF RE-RADIATION FROM HIGH-RISE BUILDINGS AND TRANSMISSION LINES UPON THE RADIATION PATTERN OF MF BROADCASTING ANTENNA ARRAYS
John S. Belrose, W. Lavrench (Nat. Res. Council, Ottawa), J. G. Dunn (Nat. Res. Council, Ottawa), C. W. Trueman (Concordia Univ., Montreal), and S. J. Kubina (Concordia Univ., Montreal). *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation. Dec. 1979. 11 p. refs. (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

Results of experimental measurements employing antenna modeling techniques on the re-radiation from model high rise buildings and power lines, are presented. It is found that high rise buildings are resonant in the middle of the MF broadcast band and that buildings located ten or more wavelengths (3 kilometers) from the MF broadcasting array could affect the far field pattern. It is shown that high voltage power transmission line towers, the connecting sky wires, and their image in the ground form loops which are resonant within the braodcast band.

A long power line is a system of over coupled, staggered tuned loops, and if the resonant frequency of the power line is that of a nearby broadcast station, the effects of re-radiation on the pattern of the MF broadcast antenna is large. Numerical modeling by the method of moments is in agreement with experiment although it is difficult to calculate the re-radiation from extended structures like power lines. The experimental and numerical modeling represent worst case situations, since the 'earth' is perfectly conducting and the structures employed are either insulated from or connected to it. J.M.S.

N80-19348# Mitre Corp., Bedford, Mass.
SURFACE FIELDS AND RADIATION PATTERNS OF A VERTICAL ELECTRIC DIPOLE OVER A RADIALLY VARYING GROUND SYSTEM
C. Teng and R. J. King (Wisconsin Univ., Madison) *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 p 4-1 - 4-19 refs (For primary document see N80-19345 10-32)
(Grant NSF ENG-75-16174)
Avail: NTIS HC A17/MF A01

The EM propagation over and radiation from radially varying ground systems are studied by numerical methods using the compensation theorem integral formulation. The source is taken to be a vertical electric dipole (VED) situated either on or above an azimuthally symmetric plane ground system having an assumed surface impedance profile which can vary arbitrarily in the radial direction. Particular attention is given to conventional HF radial wire systems laid on both well and poorly conducting earth, and to HF ground systems near a sloping beach. For one section, radial wire ground systems, the radiation patterns are found to be independent of increasing radial length if the magnitude of the composite surface impedance is within 90% of the surface impedance of the underlying ground. It is also found that the radially varying feature tends to suppress high-angle lobes which are otherwise present with highly conducting ground systems, especially if the surrounding ground is poorly conducting. Suitable combinations of VED height, and the length and number of radials tend to enhance the low angle radiation, as does the use of compound radial wire systems. A land-sea beach on which the water depth gradually increases is shown to have little effect on the radiation pattern compared to that for an abrupt coastline. J.M.S.

N80-19349# Saarland Univ., Saarbrucken (West Germany).
TERRAIN EFFECTS ON LOG-PERIODIC ANTENNA CHARACTERISTICS USING THE SINGULARITY EXPANSION METHOD
K. D. Rech and K. J. Langenberg *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 20 p refs (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

A vertical log-periodic directional antenna (LPDA) is investigated with singularity expansion method in free space, over a lossy ground and over a perfectly conducting halfspace using Nortons approximation for the Sommerfeld integrals. The influence of the feedingnetwork and of the mutual coupling of the elements as well as the influence of antenna thickness on the natural resonances is studied. The modes of the LPDA are presented and the current in frequency and time domain is computed in free space. Dependent on the ground parameters and the antenna height the pole migration in the complex frequency plane is shown and the appropriate modes are determined. Starting from the free space current distribution the transient fields of the vertical LPDA over ground are computed for various ground parameters and antenna heights. J.M.S.

N80-19350# Institute for Telecommunication Sciences, Boulder, Colo.
THEORIES OF GROUND WAVE PROPAGATION OVER MIXED PATHS
R. H. Ott *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 9 p refs (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

A review is given of some common techniques for predicting the field of a dipole transmitter over an irregular, inhomogeneous terrain profile. The effects of the atmosphere are not included except to modify the degree of 'earth bulging' by the appropriate earth's radius. Some of the topics included are: (1) the impedance boundary condition, (2) the integral equation and mode-match methods for field strength predictions, for a simple knife-edge obstacle on a spherical earth, (3) the double-knife-edge diffraction formula for field strength predictions, and (4) the fields of dipoles in layered media for calculating the transmission through forest-covered and vegetated media. Author

N80-19351# Polytechnic Inst. of New York, Farmingdale. Dept. of Electrical Engineering.
HIGH-FREQUENCY SIGNAL PROPAGATION AND SCATTERING IN GUIDING CHANNELS
L. B. Felsen *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 7 p refs (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

The Earth's environment contains propagation channels wherein waves can be guided because of the presence of transverse boundaries or transverse refractive index gradients. By a new approach, high frequency guiding by a single concave surface or by the boundary of an inhomogeneous surface duct is analyzed in terms of a judiciously chosen combination of rays and modes. In essence, the modes account for the cumulative effect of those rays that have experienced a great many reflections on the boundary. This hybrid formulation is appealing in that it requires far fewer rays and far fewer modes than if the field representation involves rays only or modes only, as has been customary. By an extension of the theory, it is shown that the hybrid method can also be applied to channels wherein guiding occurs between multiple transverse boundaries. Here, modes near cutoff can represent efficiently all those rays that have made many excursions between the channel walls. As an illustration, results are presented for a parallel plane waveguide excited by a line source. J.M.S.

N80-19352# Institute for Telecommunication Sciences, Boulder, Colo.
GROUND WAVE PROPAGATION OVER IRREGULAR, INHOMOGENEOUS TERRAIN: COMPARISONS OF CALCULATIONS AND MEASUREMENTS AT FREQUENCIES FROM 121 kHz TO 50 MHz
R. H. Ott *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 10 p refs (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

A method for calculating the ground wave field over irregular, inhomogeneous terrain was developed and comparisons with alternative analytical methods were made for idealized terrain profiles like concave parabolas, sea-land-sea paths, and single Gaussian ridges. The computer algorithm implementing an integral equation (called PROGRAM WAGNER) uses linear interpolation to represent the terrain height versus distance and a surface impedance which also varies with distance. The transmitting antenna height is arbitrary and is included in the integral equation formulation whereas the height of the receiving antenna is treated approximately by modifying the surface field at the observation point by an effective height-gain function. Comparisons of observed field strength measurements for several paths with field strength predictions based on PROGRAM WAGNER are given for frequencies ranging from 20 kHz to 50 MHz. Although most of the comparisons show encouraging agreement, the 20 mHz comparisons over an extremely rugged path in the Colorado Mountains provided a challenge for the algorithm. J.M.S.

N80-19353# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
AN EXPERIMENTAL STUDY OF SURFACE WAVE PROPAGATION ON A LOW PERMITTIVITY MEDIUM
J. Appel-Hansen and R. J. King *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 4 p refs Prepared in cooperation with Wisconsin Univ., Madison (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

It is experimentally shown that a surface wave having d to the minus 2 power dependence can propagate on a medium having a dielectric constant near unity, when excited by a low-gain

source near the interface. This occurs for both parallel and perpendicular polarization. Author

N80-19354# Norsk Marconi A.S., Oslo.
MULTIPATH ANALYSIS OF ILS GLIDE PATH
T. Breien *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 10 p refs (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

A major problem with instrument landing system slide path is the dependence of the signal quality upon site conditions. Unwanted scattering from the surroundings causes error in the guidance signal. A new method to analyze the problem is described. For practical use, the surroundings are modeled as a set of plane wedges. The scattering from each wedge is analyzed using uniform theory of diffraction (UTD), which assumes smooth, sharp and perfectly conducting wedges. Theoretical and practical work was carried out to study the influence of finite conductivity, surface roughness and round edges on the scattered signal. The conclusion is that for most glide path surroundings, UTD gives adequate accuracy. An effective UTD computer program for analysis of glide path performance was developed. Comparisons between computed and measured results show good agreement. R.E.S.

N80-19355# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
AIRBORNE MEASUREMENTS OF ELECTROMAGNETIC WAVE REFLECTIONS FROM LAND AND SEA WATER
Allen L. Johnson *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 17 p refs (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

Multipath fading caused by terrain reflections can disrupt an airborne communication or navigation system. The severity of the multipath is dependent upon the antenna illumination factor. Surface reflection coefficient, and the divergence of the reflected signal. Airborne measurements were used to verify that severe multipath is regularly encountered over water when the aircraft is communicating with a satellite at a low elevation angle. Techniques which can reduce the multipath fading effect include the use of directive antennas, circular polarization and diversity techniques. R.E.S

N80-19356# Nebraska Univ. - Lincoln. Electrical Engineering Dept.
SCATTERED RADIATION FIELDS FROM ROUGH SURFACES FULL WAVE SOLUTIONS
Ezekiel Bahar *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 12 p refs (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

Full wave solutions are derived for the scattered radiation fields from rough surfaces with arbitrary slope and electromagnetic parameters. These solutions bridge the wide gap that exists between the perturbational solutions for rough surfaces with small slopes and the quasi optics solutions. Thus, it is shown for example, that for good conducting boundaries the backscattered fields which are dependent on the polarization of the incident and scattered fields at low frequencies, become independent of polarization at optical frequencies. These solutions are consistent with reciprocity, energy conservation and duality relations in electromagnetic theory. Since the full wave solutions account for upward and downward scattering, shadowing and multiple scatter is considered. Applications to periodic structures and random rough surfaces are also presented. Author

N80-19357# Saarland Univ., Saarbrucken (West Germany).
THEORETICAL ASPECTS OF TRANSIENT RADIATION AND SCATTERING IN LOSSLESS TWO MEDIUM HALF SPACES
M. Doebrich and K. J. Langenberg *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 14 p refs (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

A vertical transient multipole is situated at the height Xi above a plane boundary separating two dielectric loss-less halfspaces. The potential of the primary and reflected field was evaluated by means of Fourier and Laplace transforms; their inversion was performed on the base of Cagniard's method. The relation between the Fourier integral representation and the generalized Sommerfeld integrals for multipoles is shown. R.E.S

N80-19358# Deutsche Bundespost, Darmstadt (West Germany).
THEORETICAL DISTRIBUTION FUNCTIONS OF MULTIPATH PROPAGATION AND THEIR PARAMETERS FOR MOBILE RADIO COMMUNICATION IN QUASI-SMOOTH TERRAIN
R. W. Lorenz *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 16 p refs (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01

Due to the superposition of many partial waves arriving from different directions, the field strength received by a mobile antenna is an intensely fluctuating function of space. For the planning of radio service areas, the statistical distribution of the amplitudes should be known to improve frequency efficiency. Three statistical distributions were considered: the Weibull distribution, the Nakagami-m-distribution and the mixture of Rayleigh and log-normal distributions. Formulas are given for the determination of the distribution parameters from measurements. For the choice of the best distribution, three different methods are discussed. Results from measurements in quasi-smooth terrain in the 450-mHz-range are presented. R.E.S.

N80-19359# Deutsche Welle, Cologne (West Germany).
ON THE INFLUENCE OF SURFACE STATISTICS, GROUND MOISTURE CONTENT AND WAVE POLARIZATION ON THE SCATTERING OF IRREGULAR TERRAIN AND ON SIGNAL POWER SPECTRA
K. J. Hortenbach *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 23 p refs (For primary document see N80-19345 10-32)
Avail: NTIS A17/MF A01

The scattering properties of different types of terrain were investigated making visible the shape and fine structure of the effective scattering area by plotting contours of constant average scattered power density on the main scattering plane. Computations and comparisons were carried out for Gaussian and actual roughness statistics, different polarizations, and moisture content of the ground. It is shown that the effective scattering area exhibits a detailed fine structure which is most complex when the angle of the incident radiation is near the pseudo-Brewster angle. This structure modifies the radiation patterns of antennas operating above irregular terrain as well as the signal characteristics. The power density spectrum of a signal transmitted or received by an aircraft flying over irregular terrain generally becomes spread due to the scattering process. The shape of the resulting spectrum depends on the orientation of the velocity vector of the aircraft relative to the scattering area and on its structure. It is also shown that the shape of the resulting spectrum has a fine structure and can be highly asymmetrical relative to the frequency of the directly incident wave which is verified experimentally. R.E.S.

N80-19360*# Massachusetts Inst. of Tech., Cambridge.
THEORETICAL MODELLING AND EXPERIMENTAL DATA MATCHING FOR ACTIVE AND PASSIVE MICROWAVE REMOTE SENSING OF EARTH TERRAIN
J. A. Kong, L. Tsang, M. Zuniga, R. Shin, J. C. Shiue, and A. T. C. Chang *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 8 p refs Prepared in cooperation with NASA Goddard Space Flight Center Greenbelt, Md. (For primary document see N80-19345 10-32)
Avail: NTIS HC A17/MF A01 CSCL 20N

Two theoretical models were developed to characterize terrain media: a random medium with a variance, a horizontal correlation length; and a homogeneous dielectric containing discrete scatterers. The earth terrain is modelled as layers of such scattering media bounded by air above and half-space below. Matching the theoretical results with experimental data collected from vegetation and snow-ice fields shows that: (1) for observation angles near nadir, rough surface effects are important; (2) for snow-ice field the horizontal correlation length is greater than the vertical correlation length whereas for vegetation field their relative sizes depend on the types of vegetation; (3) the

vertically polarized backscattering cross-section is always larger than the horizontally polarized backscattering cross-section for half-space scattering media; (4) for snow field displaying diurnal change, a three-layer model including a thin top layer caused by sunlight illumination must be used; and (5) for a random medium with equal horizontal and vertical correlation lengths, the measured data can also be matched with a corresponding discrete scatterer model. K.L.

N80-19361# British Aerospace Dynamics Group, Bristol (England).

SOME OF THE PROBLEMS IN DIGITAL TERRAIN MODEL CONSTRUCTION

G. B. Thersby *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 9 p (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01

Aspects of terrain which may effect electromagnetic wave propagation are identified. Arguments for and against accurate terrain modelling are presented from the point of view of both the user and the software designer. Two possible approaches to digital terrain modelling are outlined as examples and the problems associated with each are discussed. The problems associated with producing a data base which is efficient in terms of computer storage and access times and which comprehensively models the terrain and associated data necessary for advanced propagation prediction modelling techniques are discussed. K.L.

N80-19362# Missouri Univ. -Rolla. Electrical Engineering Dept.

AZIMUTH BEAMWIDTH EFFECT ON RADAR SENSED TERRAIN HORIZON PROFILES

Gordon E. Carlson and Paul W. Sapp *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 13 p refs (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01

A method is presented for smoothed horizon generation. The mathematical model used computes elevation angle measurements for a phase-monopulse radar by considering a number of individual scattering points within the antenna beamwidth at the horizon range. Simplification of the mathematical model permits rapid generation and thus reasonable computer costs. Example smoothed horizons are shown and errors due to mathematical model simplification are analyzed. The smoothed horizon generation method is applied to the simulation analysis of a horizon checkpointing system. Results indicate that good position identification can be achieved with relatively wide azimuth beamwidths. K.L.

N80-19363# German Military Geophysical Office, Traben-Trarbach (West Germany).

BIOLOGICAL AND GEOPHYSICAL FACTORS OF ELECTROMAGNETIC WAVE PROPAGATION AND THEIR USE IN DIGITAL DATA BANKS

Ekkehard R. Kuesters *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 8 p refs (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01

The development of a radar clutter data bank containing data about elevation and soil cover for the whole Federal Republic of Germany is discussed. The different categories of soil cover are to be correlated with their specific effects on the propagation of electromagnetic waves. The greatest problems in this respect arise with deciduous forest and farmland because of the phenological changes that take place during the year. A phenological observation net was established to obtain data. Since it was impossible to ascertain data for each grid field, a coarse subdivision of the Federal Republic of Germany was made into regions that are homogeneous with respect to the phenological events. Because of the influence of hydrometeors on electromagnetic wave propagation, the data bank also contains data about the altitude, vertical extension, frequency of occurrence, and drop spectra of the major cloud types. K.L.

N80-19364# Lincoln Lab., Mass. Inst. of Tech., Lexington.

PREDICTION OF RADAR COVERAGE AGAINST VERY LOW ALTITUDE AIRCRAFT

John R. Delaney and M. Littleton Meeks *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 15 p refs (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01

A model was developed for the effects of propagation on radar coverage accounting for refraction, diffraction, and reflection. The model was applied to digitized terrain data for three sites, one with relatively hilly terrain, one with relatively smooth terrain, and one with mixed terrain. Results show that approximating the radar coverage by the potential target locations within line of sight can be quite misleading. Results also show that the coverage of lower frequency radars can be better than that of higher frequency radars in terrain where diffraction is the dominant phenomena. Moreover, the coverage of lower frequency radars in reflection-dominated terrain can be quite satisfactory if sufficient power is transmitted. The results of a field experiment confirm that the model correctly combines the effects of diffraction and reflection. K.L.

N80-19365# Joint Radio Committee of the Nationalised Power Industries, London (England).

RADIO NETWORK AND RADIO LINK SURVEYS DERIVED BY COMPUTER FROM A TERRAIN DATA BASE

C. E. Dadson *In* AGARD Terrain and Contours in Electromagnetic Wave Propagation Dec. 1979 17 p refs (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01

A method of deriving calculations for the coverage area of mobile radio networks using a computer and a topographical data base is described. The topographical data base was manually produced from providing 800,000 height reference points at 0.5 kilometer intervals for England, Wales, and Scotland excluding Highlands and Islands. Path profiles are produced by the computer and calculations are provided for each 0.5 km point over the survey area, which can be up to a maximum of 90 km square. The computer requires the user to input details of the base station transmitter location, antenna height, radiated power, and type of antenna. K.L.

N80-19366# Communications Research Centre, Ottawa (Ontario).

VHF/UHF PATH-LOSS CALCULATIONS USING TERRAIN PROFILES DEDUCED FROM A DIGITAL TOPOGRAPHIC DATA BASE

F. H. Palmer *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 11 p refs (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01

A digital topograhic data base comprising some 150,000 sq. km of southern Ontario was established to allow terrain profiles profiles to be constructed automtically. The profiles, together with a variety of terrain surface cover information also derived from the data base, are used in the calculation of path loss, signal strength, and signal to noise ratios for various types of VHF/UHF systems. These calculations incorporate a number of additional factors necessary to achieve good agreement between predicted and measured path losses, including the effects of various types of terrain surface cover and of multiple, nonisolated obstacles. Comparisons of predictions and measurements made over a wide variety of terrain types indicate that rms prediction errors of 4 to 5 bd can be achieved in the VHF/UHF bands. K.L.

N80-19367# Genoa Univ. (Italy).

ELECTRIC FIELD COMPONENTS IN PRESENCE OF A SEA-SEA BOTTOM INTERFACE AT ELF

Giorgio Tacconi *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 7 p refs Sponsored in part by the Italian National Research Council, Genoa (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01

A conceptual theoretical recall as well as a collection of computed curves of the electric field rho component E sub phi, and relative phase versus distance, for a selection of bottom depths and frequencies, in the sea are presented. Such theoretical exercise is validated by some experimental results also presented in this paper. R.C.T.

N80-19368# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.

RADAR ALTIMETER MEASUREMENTS

Flemming Thomsen *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 11 p refs (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01

A theoretical method for calculating the output signal of a satellite radar altimeter as a function of time was developed for ice and snow covered areas. Satellite altimeters were applied by the Skylab S-193, the GEOS 3 and the SEASAT experiments. Pulse limited altimeters with pulse lengths between 10 and 100 nanoseconds were reviewed. The transmitted pulse was assumed to be rectangular. When the skin depth of the radiation was great, compared to the spatial width of the transmitted pulse, the subsurface material gave considerable contributions to the total echo. Considering altimeter measurements of snow and fresh water ice surfaces, we find skin depths ranging from 10 to several hundred meters. R.C.T.

N80-19369*# National Aeronautics and Space Administration, Washington, D. C.

A LASER PROFILOMETER FOR DIGITAL TERRAIN MAPPING

Bernard Rubin and Michael W. Fitzmaurice *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 11 p refs (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01 CSCL 20N

A preliminary design of a space-based decimeter accuracy ranging instrument is described along with the ranging subsystem, the pointing subsystem, and attitude reference. The measurement capabilities including ranging accuracy, the signal-to-noise ratio for water, ice, and solid Earth, footprint size, and atmospheric effects are defined and the overall system with its advantages and disadvantages are summarized. R.C.T.

N80-19370# Standard Elektrik Lorenz A.G., Pforzheim (West Germany).

AN EXPERIMENTAL INVESTIGATION OF MULTI-PATH SCATTERING AT L-BAND

P. Lewis *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 24 p refs (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01

The scattering effect responsible for large errors in the azimuth bearing measurements obtained with a 1 GHz monopluse receiver on a particular site when the source occupied different positions near the top of a distant hill was investigated. The received field distribution on a horizontal line of length 32 m directly in front of the monopulse antenna was sampled by a travelling probe antenna and recorded holographically. Computer processing of the hologram realised essentially a series of filtering operations to reconstruct sections of the field distribution (assuming 2 dimensional propagation in empty space) at different distances in front of the receiver, which were printed out as amplitude and phase plots. These images revealed the scattering mechanism, which included a ground reflected wave diffracted between two buildings. The reflection coefficient was in reasonable agreement with theoretical predicitons. A computer model of the scattering mechanism served both to confirm the interpretation of the experimental data and to investigate the effects of different components of the multi path field on the monopulse receiver. Maximum bearing errors to the order of 0.2 beamwidths were found. R.C.T.

N80-19371# Deutsche Bundespost, Darmstadt (West Germany).

DIFFRACTION PHENOMENA DURING MULTIPATH FADING

H. G. Gilo: *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 14 p refs (For primary document see N80-19345 10-32)

Avail: NTIS HC A17/MF A01

The measured electrical field strength height profiles at a receiving station located near a forest were verified. The experiments were performed on A 40-km link which operated at 9 GHz was investigated. The receiving aerial was set up on an elevator which moved up and down a 40-m tower. Electrical field strength height profiles were recorded with fade depths up to 26 dB. R.C.T.

N80-19372# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

SPECIAL TOPICS IN HF PROPAGATION

Vincent J. Coyne, ed. (RADC, Griffiss AFB, N.Y.) Nov. 1979 595 p refs In ENGLISH and FRENCH Symp. held in Lisbon, 28 May - 1 Jun. 1979

(AGARD-CP-263; ISBN-92-835-0253-1) Avail: NTIS HC A25/MF A01

The state-of-knowledge of HF propagation as it applies to commuunication, surveillance, and other systems contemplated or presently in use is presented in 49 papers. Topics cover operational considerations, modeling of ionospheric parameters, high latitude ionospheric effects, propagation through irregularities, remote sensing and ocean surveillance tunnel transmission and surface waves, and equipment considerations. For individual titles, see N80-19373 through N80-19419.

N80-19373# Royal Aircraft Establishment, Farnborough (England).

THE ROLE OF HF IN AIR-GROUND COMMUNICATIONS: AN OVERVIEW

B. Burgess *In* AGARD Spec. Topics in HF Propagation Nov. 1979 6 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

High frequency radio is a prime means for beyond line-of-eight air-ground communications and will remain as such into the foreseeable future, complementing Satellite communications where this latter system is employed. Various aspects that make up an HF communciations system and the contribution that they make to the overall system performance are reviewed. The needs of the modern user in the use of HF communications are considered with emphasis on the changing requirements on the HF link that the use of digital communications brings. Error rate performance, avoidance of interference, HF prediction techniques for Northern latitudes, and the role of channel evaluation techniques are addressed in order to acquaint the research worker with the status and trends in airborne HF communications and to indicate where further work may profitably be undertaken to eventually improve system performance. A.R.H.

N80-19374# Royal Aircraft Establishment, Farnborough (England). Radio and Navigation Dept.

HF COMMUNICATION TO SMALL LOW FLYING AIRCRAFT

N. M. Maslin *In* AGARD Spec. Topics in HF Propagation Nov. 1979 13 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

HF (2-30 mHz) radio communication is a principal means of beyond line of sight communication to aircraft. There are particularly serious problems for the small aircraft. Many factors degrade the overall received signal-to-noise ratio both at the ground and in the aircraft. To achieve satisfactory results, careful consideration should be given not only to the terminal radio equipment but also to the long term geographic planning and to the management of the frequencies to be used over mobile HF links. The worst HF communication problems occur for a short range air-ground sky-wave link at night which requires frequencies at the low end of the HF band. Working over a longer range link increasing the 'optimum working frequency', thus avoiding the poor antenna efficiencies and generally reducing external noise levels. It is shown that good frequency management, ground antenna directivity and the use of a number of geographically separated remote receiving stations are vital in providing satisfactory communications reliability to the small aircraft. Author

N80-19375# Army Avionics Research and Development Activity, Fort Monmouth, N. J. Communication and Sensor Div.

MODERN HF COMMUNICATIONS FOR LOW FLYING AIRCRAFT

John F. Brune and Bernard V. Ricciardi *In* AGARD Spec. Topics in HF Propagation Nov. 1979 15 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

An application of the HF propagation phenomenon that can provide relatively short range, reliable, terrain independent communications is described. It has been shown that communications out to ranges of 50 km, under varying terrain conditions, to and from low flying aircraft, is an extremely difficult problem especially for air mobile tactical forces. The US Army under the Nap-of-the-Earth Communications (NOE Comm) System program conducted extensive tests and analysis using the HF media for tactical communications with low-flying aircraft. The use of the near-vertical-incidence skywave (NVIS) portion of the HF channel for aircraft communications is described. The HF-SSB radio systems have the capability of operating in either a ground wave or NVIS mode. For the NVIS mode, the energy is directed vertically to the ionosphere and returned to the surface of the earth. The NVIS mode provides umbrella type coverage. Because of NVIS propagation, HF-SSB systems with appropriate antennas have the capability of providing communications coverage out to ranges greater than 50 km in any type of terrain. The NVIS mode is terrain independent. The characteristics of the HF NVIS mode are considered and the features required of a modern HF radio system to make efficient and practical utilization of the already overcrowded HF band are noted. A.R.H.

N80-19376# Barry Research Corp., Sunnyvale, Calif.
REAL-TIME ADAPTIVE HF FREQUENCY MANAGEMENT
Robert B. Fenwick and Terence J. Woodhouse *In* AGARD Spec. Topics in HF Propagation Nov. 1979 14 p (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

In 1972 the United States Air Force began a program aimed at improving tactical HF communications. The approach involved measurement in real time of the important unknowns: propagation, noise, and spectrum occupancy, and adapting operating frequencies in real-time to the conditions measured. A potential problem with this approach is causing harmful interference to other spectrum users. An exercise called TROPHY DASH III was conducted to assess the ability of a particular technique to permit real-time selection of frequencies while yielding acceptably low interference. TROPHY DASH III results are viewed as significant. First, in spite of extensive notification of other spectrum users, negligible interference was reported. Based upon these results, real-time adaptive sharing of the HF spectrum in the tactical theater appeared both valid and feasible for a limited number of high-priority users, and procurement of the AN/TRQ- 35(V) Tactical Frequency Management System was authorized. Author

N80-19377# Royal Aircraft Establishment, Farnborough (England). Radio and Navigation Dept.
ASSESSMENT OF HF COMMUNICATIONS RELIABILITY
N. M. Maslin *In* AGARD Spec. Topics in HF Propagation Nov. 1979 12 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The concept of circuit reliability for an HF sky-wave link is discussed. Its frequency dependence is considered together with the relationship to the median received signal-to-noise ratio for a given HF circuit. The importance of a study of this kind is the ability to be able to quantify changes that could be made for an HF circuit, in terms of reliability improvements, and hence to make decisions of the cost effectiveness of increasing transmitter power, antenna efficiencies, directional antenna design. A.R.H.

N80-19378# Forschungsinstitut der Deutschen Bundespost, Darmstadt (West Germany).
COMPARISON OF MEASURED AND PREDICTED MUF'S AT A REMOTE LOCATION
Th. Damboldt *In* AGARD Spec. Topics in HF Propagation Nov. 1979 6 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The times at which the signals are received first and last by ionospheric propagation during the diurnal cycle define the times where the frequency of the transmitted signal is equal to the path MUF (maximum usable frequency). Values of these transition times are taken from the field-strength records of a path from England to Germany and then compared with the predicted values. A further comparison is made between the observed MUF transition times and the ionogram critical frequencies at the approximate path mid-point, i.e., de Bilt in Holland for the above mentioned path. Good agreement is obtained between the ionogram critical frequencies and the measured MUF's. It is suggested that information obtained from signal-strength records can lead to substantial improvements in MUF predictions. This is of considerable importance since operational requirements usually exist for real-time situations and not for the average conditions computed by prediction programmes. A.R.H.

N80-19379# Mission Research Corp., Santa Barbara, Calif.
AUGMENTATION OF HF PROPAGATION
T. J. Barrett *In* AGARD Spec. Topics in HF Propagation Nov. 1979 13 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

It appears that chemical releases might be employed to scatter communication signals for limited critical periods. This technique is an augmentation to be used in the event of an emergency, or an apparent emergency. The technique, while short-lived, does provide communication coverage over vast areas (approximately 3000 mile range). In a nuclear environment, the chemical ion cloud allows the use of VHF transmissions, rather than HF, thus greatly reducing blackout durations. Assessing the nuclear environment provides information to avoid blackout caused by beta particle ionization and allows choice of optimum cloud location. This technique does not replace any current communication system but does provide a way to maintain communications for a few minutes which might otherwise be blacked out for hours. Potential applications of this technique include communication with NATO, fleets, subforces, SAC, and other tactical communications. Author

N80-19380# General Electric Co., Syracuse, N.Y.
TROPOSPHERIC EFFECTS ON HF PROPAGATION
George H. Millman *In* AGARD Spec. Topics in HF Propagation Nov. 1979 14 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

An evaluation is made of the effect of tropospheric refractive bending on the propagation of HF radio waves. The index of refraction in the troposphere is modeled in terms of the CRPL Reference Refractivity Atmosphere-1958, while the index of refraction in the ionosphere is defined in terms of the transverse-ordinary mode of propagation, the electron density being represented by a Chapman model. Ray tracings are performed based on the assumption that the propagation media are stratified into layers of constant refractive index. The ground scatter distance and the true and virtual reflection heights are calculated as a function of surface refractivity and various electron density profiles. The relationship between radar range and target-ground distance is also examined. The existence of long range propagation paths beyond 4500 km for specific tropospheric and ionospheric conditions is discussed. Author

N80-19381# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
TOWARD GLOBAL MONITORING OF THE IONOSPHERE IN REAL TIME BY A BOTTOMSIDE NETWORK: THE GEOPHYSICAL REQUIREMENTS AND THE TECHNOLOGICAL OPPORTUNITY
J. W. Wright and A. K. Paul *In* AGARD Spec. Topics in HF Propagation Nov. 1979 21 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

Various aspects of a proposed ionospheric sounding network are discussed. This network is composed of modern, digital ionosondes that are fully computer-interactive. These ionosondes could provide vertical incidence and oblique incidence ionograms, signal amplitude, direction of arrival information and polarization. The advantages of such a network of sophisticated ionosondes are outlined. J.M.S.

N80-19382# Polytechnic Inst. of New York, Farmingdale. Dept. of Electrical Engineering.
HYBRID RAY-MODE FORMULATION OF TROPOSPHERIC PROPAGATION
S. H. Cho, C. G. Migliora, and L. B. Felsen *In* AGARD Spec.

Topics in HF Propagation Nov. 1979 15 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

A method of analyzing radio propgation using a combination of ray and mode theory is addressed. Using as an illustration the propagation of radio waves in an elevated tropospheric duct, the emphasis is given to how the hybrid ray-mode approach could be readily applied to a number of different propagation related problems across the frequency spectrum. J.M.S.

N80-19383# Centre National d'Etudes des Telecommunications, Lannion (France).
THE INFLUENCE OF IONOSPHERIC MODELS ON CALCULATIONS OF DECAMETRIC WAVE PROPAGATION [INFLUENCE DES MODELES D'IONOSPHERE SUR LES CALCULS DE PROPAGATION DES ONDES DECAMETRIQUES]
R. Fleury and P. Gourvez *In* AGARD Spec. Topics in HF Propagation Nov. 1979 14 p refs In FRENCH; ENGLISH summary (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The ionospheric F2-layer critical plasma frequency foF2 is one key geophysical parameter among those involved in HF wave propagation. This means that the efficiency of numerical methods available for HF waves propagation simulation (e.g., ray tracing) is greatly limited by the uncertainties inherent to the foF2 input models. Observed planetary distributions of monthly median foF2 and those calculated by current models which give values of error bars on foF2 are compared systematically. Further, an accurate ray tracing method used with F2-region models in which foF2 is perturbed in amounts equal to typical values of its error bars helps to assess the influence of these error bars on HF waves propagation results. A.R.H.

N80-19384# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Electrical Engineering.
METHODS OF DETERMINING IONOSPHERIC STRUCTURE FROM OBLIQUE SOUNDING DATA
R. E. DuBroff, N. Narayana Rao, and K. C. Yeh *In* AGARD Spec. Topics in HF Propagation Nov. 1979 16 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The problem of determining ionospheric conditions from swept frequency oblique backscatter ionograms is considered. Emphasis is given to the methods developed to obtain an estimate of the equivalent electron density profile that results from the inversion of backscatter measurements. J.M.S.

N80-19385# Naval Research Lab., Washington, D. C. Communication Sciences Div.
THE GEOMORPHOLOGY OF THE HF BREAKTHROUGH PHENOMENON
John M. Goodman *In* AGARD Spec. Topics in HF Propagation Nov. 1979 13 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The morphological behavior of HF radio waves that propagate through the ionosphere and are observed at satellite levels is described. Using realistic models the types of information about the ionospheric structure that could be deduced from satellite measurements of ground-based HF signals of HF noise sources are studied. J.M.S.

N80-19386# Institut fuer Astrophysik und Extraterrestrische Forschung, Bonn (West Germany).
COUPLING BETWEEN THE NEUTRAL AND IONIZED UPPER ATMOSPHERE DURING DISTURBED CONDITIONS
G. W. Proelss *In* AGARD Spec. Topics in HF Propagation Nov. 1979 14 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

Classical ground-based ionospheric data coupled with satellite observation are used to unravel the problems associated with understanding the dynamics of the ionosphere during a geomagnetic storm. It is indicated that the Earth's ionized atmosphere cannot be understood and predicted in the absence of comparable knowledge about the neutral atmosphere. J.M.S.

N80-19387# Ionospharen-Institut Breisach (West Germany).
BASIC FINDINGS HELPFUL FOR IONOSPHERIC PREDICTIONS
E. Harnischmacher and K. Rawer *In* AGARD Spec. Topics in HF Propagation Nov. 1979 10 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The day-to-day fluctuations in the ionospheric parameters and how they appear tied to lunar includences are considered. In addition, the apparent planetary influences on the observed behavior of the F2 region critical frequency is discussed. J.M.S.

N80-19388# Centre National d'Etudes des Telecommunications, Lannion (France).
ON DETERMINING THE MAXIMUM USABLE FREQUENCY (MUF) [SUR LA DETERMINATION DE LA MUF CLASSIQUE]
R. Hanbaba *In* AGARD Spec. Topics in HF Propagation Nov. 1979 9 p refs In FRENCH (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

Calculation of the highest frequency at which radio waves can be propagated by ionospheric reflection between two given points is generally based on a representation of the propagation mode by a rectilinear path between the ground and the points in the ionosphere. By adopting Bradley and Dudeney's quasi parabolic model of variation with the altitude of the electric concentration, analytical expression can be obtained for the length of the ionospheric leap, the MUF, and the elevation angle of the radio path. However, for practical applications, it is necessary to use as simple a method as possible. A 'manual' method for determining the MUF and the elevation angle of the radioelectric path is presented. Transl. by A.R.H.

N80-19389# Air Force Geophysics Lab., Hanscom AFB, Mass.
CHARACTERISTICS OF THE HIGH LATITUDE IONOSPHERE PRODUCED BY AURORAL PARTICLE PRECIPITATION
James A. Whalen *In* AGARD Spec. Topics in HF Propagation Nov. 1979 12 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The general domains of the high lattidue ionosphere are described. How these domains relate in space and time to general magnetospheric domains and how these relations aid the understanding of high frequency propagation in the high latitudes is discussed. R.E.S.

N80-19390# Institute for Telecommunication Sciences, Boulder, Colo.
PERSPECTIVE ON THE PREDICTION OF AURORAL ABSORPTION
Vaughn Agy *In* AGARD Spec. Topics in HF Propagation Nov. 1979 16 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

Methods for the calculation of the effects of auroral absorption on high frequency (HF) communication circuits (or HF radar) are briefly described. The riometer is discussed in detail as the best method for establishing an adequate data base for the prediction of auroral absorption effects on HF communication circuits. The reasons to explain why, after 25 years of riometer measurement, there is still no adequate data base are reviewed. Questions remain about the geographic distributions, the temporal variations, and the relationships with polar cap absorption on one hand, and with magnetospheric substorms on the other. These questions are stated and briefly examined. R.E.S.

N80-19391# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
DIRECTION AND DOPPLER CHARACTERISTICS OF MEDIUM AND LONG PATH HF SIGNALS WITHIN THE NIGHT-TIME SUB-AURORAL REGION
R. W. Jenkins, E. L. Hagg, and L. E. Montbriand *In* AGARD Spec. Topics in HF Propagation Nov. 1979 18 p refs Sponsored in part by AFGL (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

During 1976, the large receiving array near Ottawa was used to record high frequency (HF) transmissions from a USAF Geophysics Laboratory aircraft 2000 km away over the northwest

Atlantic on four evening flights. Geomagnetic conditions ranged from quiet to active. Signals from individual array elements were separately recorded, and later analyzed to provide the Doppler shift and direction of the signal. Also used were oblique ionograms recorded on the aircraft for a similar path. The F-mode maximum usable frequencies (MUF) were below 5 MHz for the major portions of all evening flights. However, several weaker modes were observed to be present at much higher frequencies. They were examined for their potential utility in extending HF communications and surveillance. It is concluded that the Sporadic-E and skip-distance-focussed ground-sidescatter modes present an opportunity for limited HF operations in the subauroral region during evening hours, when very low F-mode MUF's would otherwise make such operations impossible. R.E.S.

N80-19392# Rome Air Development Center, Hanscom AFB, Mass.

RECENT ADVANCES IN HF PROPAGATION SIMULATION

Terence J. Elkins *In* AGARD Spec. Topics in HF Propagation Nov. 1979 17 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

The recent developments in high frequency propagation simulation are summarized. Practical applications of the developments are discussed. R.E.S.

N80-19393# James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Physics.

TRANSEQUATORIAL PROPAGATION THROUGH EQUATORIAL PLASMA BUBBLES: DISCRETE EVENTS

M. L. Heron *In* AGARD Spec. Topics in HF Propagation Nov. 1979 10 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

Recent results from the Jicamarca radar facility and satellite-borne plasma density probes have provided the general characteristics of rising depletions in the evening ionospheric plasma over the equator. The depletions are not spherical bubbles but extend along the magnetic field lines so that their feet are always in the lower F region. The bubbles are driven by E x B fields. Generally they move with the background ionosphere horizontally towards the east at about 125 m/s, but often they have a vertical component as well. A propagation model was developed, which uses the observed characteristics of the bubbles to predict radio wave guiding along the depleted tubes. The numerical model is set up to calculate power, Doppler shift, elevation and azimuth at the receiver of a transequatorial transmitter-receiver pair of stations. The numerical model was successfully evaluated in terms of a few observations of transequatorial propagation events. R.E.S.

N80-19394# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).

THE PHENOMENOLOGY OF TRANSEQUATORIAL RADIO PROPAGATION UNDER SPREAD-F CONDITIONS

J. Roettger *In* AGARD Spec. Topics in HF Propagation Nov. 1979 9 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

Three special phenomena of transequatorial propagation are described: (1) the frequency dependence of off-great-circle path points to steep horizontal gradients of ionization, caused by the spatial resonance effect in the postsunset equatorial F region; (2) the small scale irregularities of the equatorial spread F which are generated at the steep gradients give rise to strong amplitude fluctuations of transequatorial signals; (3) the upward rising depletions of ionization can duct and scatter very high frequency signals over distances of more than 6000 km. Author

N80-19395# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).

DETECTION, RANGING AND DRIFTSPEED MEASUREMENTS OF EQUATORIAL IONOSPHERIC IRREGULARITIES BY MEANS OF AIRGLOW OBSERVATIONS

G. Lange-Hesse and H. Lauche *In* AGARD Spec. Topics in HF Propagation Nov. 1979 7 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

Measurements of the emission rate distribution of the red oxygen line lambda = 630 nm in the night airglow with a panorama photometer at Tsumeb, Namibia show the occurrence of distinct airglow irregularities in the equatorial region. These irregularities are associated with irregularities in the electron density of the ionospheric F2-layer and show a nearly constant eastward drift with a average speed of about 100 m/s. The drift to the east is superimposed by an irregular movement to the south and north with a speed of about 200 m/s and more. R.E.S.

N80-19396# Leicester Univ. (England). Dept. of Physics.

HF WAVEFRONT IRREGULARITIES OBSERVED ON A LARGE APERTURE RECEIVING ARRAY

T. B. Jones and E. C. Thomas *In* AGARD Spec. Topics in HF Propagation Nov. 1979 11 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

The wavefronts of HF signals received on a large receiving array are investigated for a range of propagation conditions. The array consists of seven vertical elements spaced in a minimum redundancy configuration. The phase and amplitude on each element are measured and the whole array scanned every 0.1 sec. Signals received via ground waves and sky waves are investigated. The curvature of the wave front of the ground wave signals enables the location of the transmitter to be determined. The sky wave signals exhibit a wide variety of disturbance features. An attempt is made to relate these to the corresponding reflections in the ionosphere. K.L.

N80-19397# Army Communications Command, Fort Huachuca, Ariz.

A SPORADIC E PREDICTION TECHNIQUE

Miles A. Merkel and Roberto Rubio *In* AGARD Spec. Topics in HF Propagation Nov. 1979 8 p refs Prepared in cooperation with Atmospheric Sciences Lab., White Sands Missile Range, N. Mex. (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

A Sporadic E assessment technique was developed and implemented on electronic computer to facilitate computations and comparisons with experimental data. Very good agreement was found with the data in the mid-latitudes. Recommendations are made for approaches which should improve the accuracy and reduce computer run time. K.L.

N80-19398# Rome Air Development Center, Hanscom AFB, Mass. Electromagnetic Sciences Div.

SCATTER INJECTION/DUCTED MODE HF RADAR

Gary S. Sales *In* AGARD Spec. Topics in HF Propagation Nov. 1979 10 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

An extended range HF radar that uses Earth detached propagation modes to minimize losses was developed for detecting missile induced ionospheric perturbations. The ability of artificially generated irregularities to facilitate the injection/ejection of HF signals into ducted modes was studied theoretically. K.L.

N80-19399# Instituto Nacional de Meteorologia e Geofisica, Lisbon (Portugal).

IONOSPHERIC EFFECTS OF A SOLAR ECLIPSE IN THE CAPE VARDE ISLANDS [EFFETS IONOSPHERIQUES D'UNE ECLIPSE SOLAIRE DANS LES ILES DU CAP VERT]

A. S. Mendes, F. Bertin, P. Vila, and J. Papet-Lepine *In* AGARD Spec. Topics in HF Propagation Nov. 1979 4 p refs In FRENCH; ENGLISH summary Prepared in cooperation with Centre National d'etudes Telecommunications Issy-les-Moulineaux (France). (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

The installation of two ionosondes at SAL (Cape Verde, Islands) and at Ascension Island (conjugate point to SAL) as well as three polarimeters at SAL, DAKAR and BATHURST (Gambia) in addition to the permanent ionosonde in DAKAR made it possible to detect various ionospheric effects of the eclipse. The passage of the entire eclipse at supersonic speed seems to have produced a gravity wave front due to the cooling. The simultaneous foF2 and total electron content minima determine the initial time for the passage of a gravity-wave-like wake with a velocity around 250 ms/1 and whose fundamental period is 18 mn. The ionospheric electric field perturbation is due to the ionization loss in the E region dynamo in a cylindrical

region of 500 km radius. As a result of the upper F region 10 : 45 to 11 : 00 UT without any ionization loss at these levels. A thermospheric contraction flux appearing 20 mn after the eclipse maximum as well as a forced thermal diffusion flux were also noted. The results were essential for interpreting the more complex variations observed at subtropical and equatorial stations. A.R.H.

N80-19400# Birmingham Univ. (England).
GROUND-WAVE AND SKY-WAVE SEA-STATE SENSING EXPERIMENTS IN THE UNITED KINGDOM
E. D. R. Shearman, W. A. Sandham, E. N. Bramley, and P. A. Bradley *In* AGARD Spec. Topics in HF Propagation Nov. 1979 11 p refs Prepared in cooperation with the Science Research Council, Slough (England) (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The use of gound wave MF/HF radar and sky wave HF radar for sensing wave characteristics and surface currents was studied. Ground wave experiments revealed a marked dependence of echo amplitude on sea state for 77 m waves as a function of the wind dependent long wavelength cut-off of the sea spectrum. The 0.01 Hz Doppler resolution employed permitted identification of island and ship echoes with ships being tracked out to a 210 km range. Using synthetic aperture technique, wave directional features were established and correlated with wind data. A sky wave radar project involving on-line digital processing was initiated for daily monitoring of the North Atlantic at ranges from 1,000-3,000 km over a 60 deg arc. Comparisons are reported of radar deduced surface wind directions and magnitudes with those measured in oceanographic vessels. An extension of the statistical theory used in the analysis of radar spectra is presented. K.L.

N80-19401# Toulouse Univ. (France).
SEA-STATE DIRECTIONAL SPECTRA OBSERVED BY HF DOPPLER RADAR [ESTIMATION DU SPECTRE DIRECTIONNEL DES VAGUES PAR RADAR DECAMETRIQUE COHERENT]
P. Broche *In* AGARD Spec. Topics in HF Propagation Nov. 1979 12 p refs In FRENCH; ENGLISH summary (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The principal elements used in describing the sea surface, and the fundamental phenomena implied in the backscattering of the electromagnetic waves by this surface are reviewed. Results of experiments performed with a ground-wave HF Doppler radar are presented and compared with a sea-truth supplied by conventional oceanographic means. Two points are stressed: the estimation of the wind direction, by measuring the ratio of the amplitudes of the two Bragg lines in the doppler spectrum of the backscattered H.F. wave; and the estimation of the dominant frequency in the sea-state spectrum and of the significant height of the waves by measuring the cut-off frequencies which are present on both sides of the Bragg lines. A.R.H.

N80-19402# SRI International Corp., Menlo Park, Calif.
DEVELOPMENT OF HF SKYWAVE RADAR FOR REMOTE SENSING APPLICATIONS
Taylor W. Washburn, Lawrence E. Sweeney, Jr., James R. Barnum, and Walter B. Zavoli *In* AGARD Spec. Topics in HF Propagation Nov. 1979 17 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The capabilities of HF radar are discussed along with radar techniques and propagation management tools used to maximize radar performance. Methods are described for inferring radar sensitivity from cluster to noise measurements, minimizing interference problems in the crowded HF spectrum, and using the swept frequency continuous wave signal format to separate small moving targets from clutter and observe fine details within the clutter itself. K.L.

N80-19403# SRI International Corp., Menlo Park, Calif.
HF SKYWAVE RADAR ESTIMATES OF THE TRACK, SURFACE WIND AND WAVES OF HURRICANE ANITA
Joseph W. Maresca, Jr. and Christopher T. Carlson *In* AGARD Spec. Topics in HF Propagation Nov. 1979 13 p refs Presented at the Conf. on Coastal Eng., Hamburg, West Germany, Aug. 1978 (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The track of Hurricane Anita and the intensity of the surface wind and waves throughout the storm were estimated from high frequency skywave radar sea echo Doppler spectra measurements made over 3000 km away from the storm. Twenty-one maps of the surface wind direction within 250 km of the eye were generated. A track was computed from estimates of the hurricane center made from each wind direction map. Spatially averaged hurricane wind-speed, wind-direction, and wave-height radar estimates were compared to point measurements made at NDBO buoys and by reconnaissance aircraft. Agreement was within the nominal measurement accuracy of all the sensors. Comparison of point current measurement made nearly 290 km apart during Anita by the radar and moored open-ocean current meters show reasonable agreement. These experiments indicate that during a hurricane, HF skywave radar can provide operational surface data that are as accurate as the more recognized in-situ measurements. K.L.

N80-19404# SRI International Corp., Menlo Park, Calif.
OCEAN SWELL PARAMETERS FROM NARROW-BEAM HF RADAR SEA ECHO
Belinda Lipa and Donald Barrick *In* AGARD Spec. Topics in HF Propagation on Nov. 1979 12 p refs Prepared in cooperation with NOAA Wave Propagation Lab., Boulder, Colo. (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

Inversion methods are described for studying the HF radar sea-echo Doppler spectra, giving parameters of the ocean wave spectrum in the important long wavelength region. Radar spectra exhibiting very narrow spikes in the higher-order structures adjacent to the first-order lines are indicative of ocean swell with a single dominant wavelength; it is shown how to interpret such a radar spectrum to give swell period, direction and rms waveheight. When the higher-order echo peaks are more spread in frequency, a simple model for the swell yields a closed-form expression for the four second-order swell peaks; parameters identifiable from this model, in addition to swell rms height, direction, and dominant period, include the angular spread and frequency spread of the swell. Finally, when the swell Doppler peaks are quite spread, it is shown how to use integral inversion to give Fourier coefficients of the ocean-wave spectrum as a function of ocean wavelength. At a given wavelength these coefficients are interpreted in terms of a cardioid model for the angular distribution to give the mean wave direction and the angular spread. In normal surface-wave experiments, the major source of error or noise is the random surface height of the sea; the resulting statistics of the radar spectrum, are described and the propagation of uncertainty to the derived ocean parameters is traced. M.G.

N80-19405# Colorado Univ. at Boulder. Cooperative Inst. for Research in Environmental Sciences.
PRINCIPLES OF HF COMMUNICATION IN TUNNELS USING OPEN TRANSMISSION LINES AND LEAKY CABLES
James R. Wait, David A. Hill, and David B. Seidel *In* AGARD Spec. Topics in HF Propagation Nov. 1979 4 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The concept that electromagnetic waves can be guided by tunnels is covered. It is shown that the frequency must be greater than some cut-off value that typically is of the order of 50 MHz. When the tunnel contains axial conductors, the situation is changed dramatically, and there is no cut-off as such, although wave-guide type modes also propagate at the higher frequencies. J.M.S.

N80-19406# Universite Catholique de Louvain (Belgium). Laboratoire de Telecommunications et d'Hyperfrequences.
MODE CONVERTERS FOR HF TUNNELS TRANSMISSION
P. Delogne *In* AGARD Spec. Topics in HF Propagation Nov. 1979 14 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

Leaky feeder techniques used to guide electromagnetic waves in tunnels are discussed. These systems are based on the coupling

of the coaxial or bifiler mode with the monofilar mode. In contrast with the principle of continuous leaky feeders one can use discrete mode converters spaced along a nonleaky cable. After an analysis of the general properties of mode converters, a detailed description of various types is given: selective and wideband annular-slot converters for coaxial cables, leaky section, selective, and wideband converters for two-wire lines. M.G.

N80-19407# Queens Univ., Kingston (Ontario). Dept. of Electrical Engineering.

LEAKY COAXIAL CABLES FOR OBSTACLE DETECTION AND CONTINUOUS ACCESS GUIDED COMMUNICATIONS

N. A. M. Mackay, J. C. Beal, D. J. Gale, and J. L. Mason *In* AGARD Spec. Topics in HF Propagation Nov. 1979 11 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

Leaky coaxial cables utilized for continuous access guided communications and as a guiding medium in an obstacle detection scheme called guided radar are discussed. Techniques for predicting the performance of leaky cable installations in a variety of configurations are examined. A two-cable cavity resonantor test allows the coupling effectiveness of different cable designs to be measured in the laboratory, in free space, or in the presence of different surrounding environments. An associated theoretical treatment is developed, based upon extensions of coupled transmission line theory. This theoretical model of the cavity is extended to simulate a full scale guided radar system. M.G.

N80-19408# California Univ., Livermore. Lawrence Livermore Lab.

DEFINITION OF SUBSURFACE FEATURES BY GEOPHYSICAL PROBING

R. J. Lytle *In* AGARD Spec. Topics in HF Propagation Nov. 1979 7 p refs (For primary document see N80-19372 10-32) (Contract W-7405-eng-48)

Avail: NTIS HC A25/MF A01

An overview of advances in near surface geophysical probing is presented. Mathematical studies are covered as well as laboratory and controlled in-situ experiments. Developments in instrumentation, data processing, and data interpretation are included. J.M.S.

N80-19409# Lille Univ. (France). Dept. Electronique.

EXPERIMENTAL RESULTS ON THE FREE PROPAGATION OF UHF WAVES IN TUNNELS [RESULTATS EXPERIMENTAUX CONCERNANT LA PROPAGATION LIBRE DES ONDES UHF DANS LES TUNNELS]

P. Degauque, P. Mangez, B. Demoulin, and B. Gabillard *In* AGARD Spec. Topics in HF Propagation Nov. 1979 16 p refs In FRENCH (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

In mine passageways and generally in certain tunnels, it can be useful to establish radio communication over several hundred meters, if possible, with the aid of portable equipment. For this purpose radio communication in the high frequency range (400 MHz to 1 GHz) appears interesting. In fact, in this frequency band, the length of the wave is small enough in relation to the dimensions of the passage so that the dominant modes to be propagated correspond to rays which are reflected under grazing incidence. In this case, only a small amount of energy is lost by refraction on the walls. The loss obtained for different types of tunnels is presented. The case of rectilinear tunnels are considered first, and the influence of transverse geometry of the passageway and the roughness of the walls is demonstrated. Supplementary losses undergone by the wave when the tunnel contains one or more curves are also discussed. Transl. by A.R.H.

N80-19410# Institute for Telecommunication Sciences, Boulder, Colo.

EXCITATION OF THE HF SURFACE WAVE BY VERTICAL AND HORIZONTAL APERTURES

James R. Wait and David A. Hill *In* AGARD Spec. Topics in HF Propagation Nov. 1979 11 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

An exposition of the normal mode approach to ground wave propagation is presented. This formulation is adapted to the solution of the surface wave excitation problem. The principal end result is the residue series representation for the vertical electric field over a spherical earth when excited by either a vertical or a horizontal antenna. The derivation incorporates the essential features of prior analyses without becoming embroiled in the mathematical niceties of branch cuts and intricate and tricky deformation of integration contours in the complex wave number planes. J.M.S.

N80-19411# Liege Univ. (Belgium). Inst. Physique.

EFFECTIVE USE OF NATURAL MODES IN VHF AND UHF TUNNEL PROPAGATION

L. Deryck *In* AGARD Spec. Topics in HF Propagation Nov. 1979 15 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

An experimental study of the electromagnetic wave propagation in various tunnels, at frequencies between 1 MHz and 1,000 MHz is presented. The results obtained provide a better understanding of natural propagation mechanisms in underground galleries containing no transmission line. The analysis of these results reveals the existence of a cutoff frequency and a strong correlation between the propagation characteristics and the transverse dimensions of the tunnel. Further experiments are made in tunnels where a transmission line is used as a waveguide; they show under what conditions the natural modes can be useful in this case. These modes can advantageously replace the so-called monofilar mode which is generally used for coupling between the transmission line and the mobile transceivers. Experimental checking shows that when using a well adapted transmission line, exploitation of natural propagation can greatly reduce the cost of the line installation without reducing its performance. Author

N80-19412# Institute for Telecommunication Sciences, Boulder, Colo.

COMPARISON OF LOOP AND DIPOLE ANTENNAS IN LEAKY FEEDER COMMUNICATION SYSTEMS

David A. Hill and James R. Wait *In* AGARD Spec. Topics in HF Propagation Nov. 1979 9 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

The mutual impedance between electric and/or magnetic dipoles in a circular tunnel containing a leaky coaxial cable was derived for arbitrary dipole positions. For the usual case of large dipole separation, the bifilar mode approximation was used to compute the mutual impedance and associated transmission loss. For typical cable parameters, a broad minimum in transmission loss was found in the range from 2 to 10 MHz. In this frequency range, the transmission loss was slightly less for magnetic dipoles (loops) than for electric dipoles. R.C.T.

N80-19413# Colorado Univ. at Boulder. Cooperative Inst. for Res. in Environmental Sciences.

MODE CONVERSION BY TUNNEL NON-UNIFORMITIES IN LEAKY FEEDER COMMUNICATION SYSTEMS

David B. Seidel and James R. Wait *In* AGARD Spec. Topics in HF Propagation Nov. 1979 9 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

Using an idealized theoretical model, the inadvertent mode conversion between the bifilar and monofilar modes in a tunnel that contains a braided coaxial was investigated. The tunnel was allowed to have various kinds of lateral nonuniformities such as changes of wall conductivity and permittivity. Results indicate that such effects are very important in understanding leaky feeder systems. R.C.T.

N80-19414# James Cook Univ. of North Queensland, Townsville (Australia). Physics Dept.

A MOBILE HF IMPULSE SOURCE LOCATOR

M. L. Heron *In* AGARD Spec. Topics in HF Propagation Nov. 1979 9 p refs (For primary document see N80-19372 10-32)

Avail: NTIS HC A25/MF A01

A noise pulse locator designed to meet the needs of research into the structure of tropical cyclone (hurricane) systems but which may be easily adapted to storm location and tracking

applications is described. The principle and instrumentation of the noise pulse locator are discussed. The resolution, errors, and limitation of the equipment as deployed on an Orion aircraft are estimated and the areas of application and adaption of the instrument are noted. R.C.T.

N80-19415# Technology for Communications International, Mountain View, Calif.
A NEW COMPUTER-CONTROLLED HIGH FREQUENCY DIRECTION-FINDING AND TRANSMITTER LOCATING SYSTEM
R. L. Tanner *In* AGARD Spec. Topics in HF Propagation Nov. 1979 13 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

A direction finding and transmitter locating system is described. The following capabilities are evaluated: the ability to operate against very short duration signals with high accuracy; the ability against short range, high angle sky wave signals; single station locator capability; critical siting requirements; adaptability to automatic netting of a multistation system; and requirements for trained technical personnel. R.C.T.

N80-19416# Lowell Univ., Mass. Center for Atmospheric Research.
DIGITAL ON-LINE PROCESSING AND DISPLAY OF MULTIPARAMETER HF TRANSMISSION DATA
K. Bibl and B. W. Reinisch *In* AGARD Spec. Topics in HF Propagation Nov. 1979 9 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

Amplitude, phase, angle of arrival, polarization, frequency shift and signal travel time of a radio wave are simultaneously measured as functions of time and frequency in a new digital ionosonde, the Digisonde 128PS. For the study of the structure and motions of the ionosphere and its influence on Over-the Horizon detection systems, on sea-state measurements, on direction and location finding methods and on communication systems a selection of the measurable parameters is recorded and displayed in real time with the necessary resolution. Two main modes of operation are described, the ionogram mode using a Maximum Amplitude scheme for data compression and the Doppler-Drift Mode using preselected frequencies and range bins of data compression. Author

N80-19417# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
NEW TECHNOLOGY TO IMPROVE HF CIRCUIT RELIABILITY AND AVAILABILITY FOR REMOTE REGIONS
J. S. Belrose and L. R. Bode *In* AGARD Spec. Topics in HF Propagation Nov. 1979 11 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The research and development underway at the Communications Center, Ottawa, is described along with that in Canadian Industry. Topics discussed include: (1) trail-remote camp radio communications, (2) antennas for base station and trail use, (3) HF-SSB Transceiver, and (4) SSB tone decoder. F.O.S.

N80-19418# Surrey Univ., Guildford (England).
ELECTRICALLY SHORT HF AERIAL SYSTEMS
M. N. Sweeting and Q. V. Davis *In* AGARD Spec. Topics in HF Propagation Nov. 1979 21 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

The communications efficiency of electrically short HF aerials in a tactical field environment remains unacceptably poor. Some of results from a detailed, practical study of the problem, performed at full-scale are described and the effect on the aerial performance of several factors shown by the experiments to be important but not previously sufficiently recognized are discussed. F.O.S.

N80-19419# Rohde and Schwartz, Munich (West Germany).
RADIO-LINK COMPUTATIONS OPTIMIZE PATTERN SHARING OF SHORTWAVE ANTENNAS
A. Stark *In* AGARD Spec. Topics in HF Propagation Nov. 1979 17 p refs (For primary document see N80-19372 10-32)
Avail: NTIS HC A25/MF A01

Statistical data were obtained from forecast printouts to produce frequency-dependent, optimized values for the elevation angles of the radiation maximum and for the vertical beam-widths. R.C.T.

N80-19815# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
OBJECTIVES FOR BUILDING AN EXPERIMENTAL CCIS
Ingrid Hollinde *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 10 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19816# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
SIMULATION OF OVERALL AIR DEFENSE COMMAND AND CONTROL
Reinhard Hutter *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 15 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19817# Department of the Air Force, Washington, D.C. Tactical Systems Div.
THEATER AIR DEFENSE ENGAGEMENT SIMULATION-COMMAND/CONTROL/COMMUNICATIONS (TADENS-C(3)) AN APPROACH TO THEATER AIR DEFENSE MODEL/METHODOLOGY DEVELOPMENT
Urban H. D. Lynch *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

(Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-19420 British Library Lending Div., Boston Spa (England).
S-BAND MIC TRAPATT AMPLIFIER
S. Yangagawa and M. Ohtomo Oct. 1979 23 p refs Transl. into ENGLISH from Denki Tsushin Gakkai Gijutsu Kenkyu Hokoku (Japan) p 76-78
(BLL-RTS-11884) Avail: British Library Lending Div., Boston Spa, Engl.

A 3 GHz band MIC Trappat amplifier for second harmonic extraction mode with a simpler circuit configuration than previously developed is described. An Si N(+) PP(+) diode is used, and in pulse operation conditions of pulse width 5 micron s and repetition frequency 1 KHz, broad bandwidth and high output-bandwidth of 200 MHz (output 70 W, gain 7 dB) and output of 90 W (bandwidth 87 MHz, gain 8.7 dB) are achieved. The temperature characteristics of the amplifier were improved by using a temperature compensation method in which a portion of an alumina substrate was replaced by a rutile ceramic substrate. This resulted in an amplifier with a stable bandwidth greater than or equal to 0.2 deg/C and output greater than or equal to 60 W (gain greater than or equal to 8.8 dB) in the temperature range -40 to approximately 70 C. Author

N80-19421 British Library Lending Div., Boston Spa (England).
MONTE CARLO SIMULATION FOR INTEGRATED CIRCUITS
Katsuro Sagane and Hideyasu Karasawa Oct. 1979 27 p refs Transl. into ENGLISH from Denshi Tsushin Gakkai Kairo to Shisutemu *nr* on Ken Shiro (Japan), CST-74, 1974 p 97-104
(BLL-RTS-11885; CST-74) Avail: British Library Lending Div., Boston Spa, Engl.

A method for generating multidimensional normal random numbers that is suited to Monte Carlo simulation of integrated

circuits is presented. The method makes it possible to generate random numbers with accurate correlations in a short time and using a smaller core size than that required by direct application of Moonan's method. In actual simulation, it is made possible to change mean values, total variance, and correlation of element parameters, as well as structure of these factors, and to easily examine results of making such changes. The main features of a program for this simulation and an example of its application are described. In the method two factors, inter-pellet factors and in-pellet factors, are considered as factors responsible for variability element parameters, but the method may be easily expanded to deal with multifactor structures taking into account interbatch, or interslice factors, etc. M.G.

N80-19422 British Library Lending Div., Boston Spa (England).
A MATHEMATICAL INVESTIGATION OF THE DYNAMIC RESISTANCE OF A DC ELECTRICAL MACHINE
J. Hazdra P. Sos Oct. 1979 11 p ref Transl. into ENGLISH From Elektrotech. Obz. (Czechoslovakia), v. 67, no. 8, 1978 p 488-490
Avail: British Library Lending Div., Boston Spa, Engl.

A method for determining the probability of flashover in dc machines is discussed based on the time behavior of the current through the armature and the speed of the machine during a transition process of some kind. M.G.

N80-19423 British Library Lending Div., Boston Spa (England).
MINIATURE SYNCHRONOUS MOTORS WITH PERMANENT MAGNET ROTORS
H. Gerber Oct. 1979 31 p Transl. into ENGLISH from Neue Tech. (Switzerland), v. 15, no. 10, 1973 p 382-392
(BLL-RTS-11801) Avail: British Library Lending Div., Boston Spa, Engl.

The design of miniature synchronous motors with permanent magnet rotors is reviewed. The motors are defined as single phase motors running in synchronization with the mains and which include all those motor variants whose rotors possess permanent magnetic poles. Three designs of the magnet rotors are distinguished. They are rotors with an alternating stator field and reverse running lock, with a rotating stator field and reverse running lock, and with a rotating stator field and an electromagnetically determined direction of rotation. The principles and functions of the motor are defined for each design. The general characteristics of the motor are described including the high torque, the efficiency, and the rotor's running speed and starting torque. A.W.H.

N80-19424*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A LINEAR MAGNETIC MOTOR/GENERATOR Patent Application
Philip A. Studer, inventor (to NASA) Filed 7 Feb. 1980 27 p
(NASA-Case-GSC-12518-1; US-Patent-Appl-SN-119336) Avail: NTIS HC A03/MF A01 CSCL 09C

A linear magnetic motor/generator is described which uses magnetic flux to provide mechanical motion or electrical energy. The linear magnetic motor/generator includes an axially movable actuator mechanism. A permanent magnet mechanism defines a first magnetic flux path which passes through a first end portion of the actuator mechanism. Another permanent magnet mechanism defines a second magnetic flux path which passes through a second end portion of the actuator mechanism. A drive coil defines a third magnetic flux path passing through a third central portion of the actuator mechanism. The invention has potential applications on all types of spacecraft requiring the use of a motor or generator, or in environments requiring long life with minimum maintenance. Presently the invention is to be used in cryogenic refrigerators aboard future spacecraft. NASA

N80-19425*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COUPLED CAVITY TRAVELING WAVE TUBE WITH VELOCITY TAPERING Patent Application
Denis J. Connolly, inventor (to NASA) Filed 20 Feb. 1980 16 p
(NASA-Case-LEW-12296-1; US-Patent-Appl-SN-122966) Avail: NTIS HC A02/MF A01 CSCL 09A

A coupled cavity traveling wave tube is described which has a velocity taper, i.e., gradual velocity reduction, which affords beam wave resynchronization and thereby enhances efficiency. The required wave velocity reduction is achieved by reducing the resonant frequencies of the individual resonant cavities as a function of the distance from the electron gun through changes in the internal cavity dimensions. The required changes in cavity dimensions are accomplished, for example, by gradually increasing the cavity radius or decreasing the gap length from cavity to cavity. NASA

N80-19426*# Alabama Univ., University. Bureau of Engineering Research.
DEVELOPMENT OF MATHEMATICAL MODELS FOR SOLID STATE SWITCHING DEVICES Final Report
W. D. Raburn and J. C. Kim Jan. 1980 30 p
(Contract NAS8-33430)
(NASA-CR-161387; BER-249-25) Avail: NTIS HC A03/MF A01 CSCL 09A

Models are developed for two types of remote power controllers (RPC). The models give the equations for the currents and voltages for all elements of passive loads as a function of time for both turn-on and turn-off. It is shown that the RPC can be considered as a combination of current and voltage sources. Equations are given for these sources which are essentially independent of the load being turned on and off. Experimental results are given for several types of loads and comparisons are made with the results obtained using the models. R.C.T.

N80-19427*# Axiomatix, Los Angeles, Calif.
CRITIQUE OF A HUGHES SHUTTLE Ku-BAND DATA SAMPLER/BIT SYNCHRONIZER Interim Report
J. K. Holmes 14 Mar. 1980 29 p refs
(Contract NAS9-15795)
(NASA-CR-160556; R8003-1) Avail: NTIS HC A03/MF A01 CSCL 09C

An alternative bit synchronizer proposed for shuttle was analyzed in a noise-free environment by considering the basic operation of the loop via timing diagrams and by linearizing the bit synchronizer as an equivalent, continuous, phased-lock loop (PLL). The loop is composed of a high-frequency phase-frequency detector which is capable of detecting both phase and frequency errors and is used to track the clock, and a bit transition detector which attempts to track the transitions of the data bits. It was determined that the basic approach was a good design which, with proper implementation of the accumulator, up/down counter and logic should provide accurate mid-bit sampling with symmetric bits. However, when bit asymmetry occurs, the bit synchronizer can lock up with a large timing error, yet be quasi-stable (timing will not change unless the clock and bit sequence drift). This will result in incorrectly detecting some bits. A.R.H.

N80-19428# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
CHARACTERIZATION OF TUNGSTEN DISPENSER CATHODES USING ISS AND SIMS Final Report, Jan. - Jun. 1979
William L. Baun Oct. 1979 31 p refs
(AF Proj. 2303)
(AD-A077592; AFML-TR-79-4125) Avail: NTIS HC A03/MF A01 CSCL 09/1

Ion Scattering Spectrometry (ISS) and Secondary Ion Mass Spectrometry (SIMS) are used to characterize surface chemistry of barium-activated tungsten dispenser cathodes. Experiments were carried out at room temperature and at temperatures in which electron emission was occurring from the cathode structures. It was found that when the cathode structure was heated to a point at which electron emission began, barium concentration at the surface also increased. At that temperature, the barium is generated, transported through the porous tungsten matrix, and spread over the emitting tungsten surface. Apparently, sputtering rates from these barium rich surfaces were very high and when ion beams were used at conventional energies (1000 volts or more), the sputtering rate was sufficiently large to suggest that incomplete coverage of barium existed. When very low ion beam voltages were used (in tha neighborhood of 200-300 volts), and beam rastering techniques were employed, then results showed that the surfaces following activation were completely covered by barium. Under these conditions of complete

barium coverage, no oxygen was observed. When the surface was sputtered and tungsten appeared, oxygen also increased, but not to a point to indicate a full oxide coating. A model of Ba bonded to O bonded to W is suggested. GRA

N80-19429# Autonetics, Anaheim, Calif. Strategic Systems Div.
SOLID STATE POWER CONTROLLER VERIFICATION STUDIES Final Technical Report, Oct. 1978 - Jan. 1979
Carl O. Linder Jan. 1979 195 p
(Contract F33615-78-C-2065; AF Proj. 3145)
(AD-A078238; C79-85/201; AFAPL-TR-79-2029) Avail: NTIS
HC A09/MF A01 CSCL 01/3

This report documents the design and test of the Solid State Power Controllers (SSPCs) for the B-1 aircraft. The SSPCs were in qualification testing when the B-1 program was terminated. The testing and completion of the B-1 SSPC program, considered crucial to the advancement of the state-of-the-art in SSPC technology, is concluded and documented in this report. This report documents the accomplishments of the B-1 SSPC program together with the results of the tests completed during the study. Recommendations for future SSPC activities are included in the final section. A proposed MIL-P-81653 specification is attached as Appendix A. Author (GRA)

N80-19430# Air Force Weapons Lab., Kirtland AFB, N. Mex.
MICROCRACKS AND METALLIZATION BURNOUT Final Report
Armen E. Mardiguian Sep. 1979 88 p refs
(AD-A078019; AFWL-TR-78-92) Avail: NTIS
HC A05/MF A01 CSCL 09/1

This report describes the work done to determine the extent to which the reliability of integrated circuits (ICs) suffers when those ICs contain small cracks (microcracks) in their metallization. It was hypothesized that microcracked devices would undergo metallization at lower current pulses than unmicrocracked devices. Six hundred triple three-input NAND gates manufactured by Texas Instruments were used, of which 300 had been deliberately processed to have microcracks. The devices were first examined under a scanning electron microscope and electrically characterized on the AFWL Fairchild 5000. Different batches of both cracked and uncracked devices were then subjected to pulses varying in pulse width from 10 ns to 500 ns. The short pulse widths assured approximately adiabatic conditions, for which development of a theory of metallization burnout (MBO) was relatively straight-forward. Postpulse testing revealed that there is no significant difference between the levels at which cracked and uncracked devices underwent MBO. Author (GRA)

N80-19431# Edgerton, Germeshausen and Grier, Inc., Salem, Mass. Electronic Components Div.
PLASMA CATHODE THYRATRON Final Report, 1 Sep. 1977 - 23 Feb. 1979
David Fleischer and David Turnquist Sep. 1979 64 p refs
(Contract DAAB07-77-C-2704; DA Proj. 1L1-62705-AH-94)
(AD-A078864; DELET-TR-77-2704-F) Avail: NTIS
HC A04/MF A01 CSCL 09/1

An instant-starting hydrogen thyratron is described which incorporates a cathode requiring no warmup time, no standby power, and no separate heater power supply. Starting cold, time jitter is less than 1 ns; anode delay time is less than 200 ns; and the 0-30 second anode delay time drift is less than 100 ns. The cathode is a self-heating design made of impregnated tungsten. Even when cold, it provides sufficient emission capability to trigger readily and to prevent arcing. During operation, it attains full operating temperature via plasma heating effects and its own resistive dissipation; after shutdown, it remains active, in readiness for the next cold start, a cycle which can be repeated as often as desired. Thyratrons made with the new cathode display operating behavior and life comparable to conventional hydrogen thyratrons of equivalent size. GRA

N80-19432# Hull Corp., Hatboro, Pa. Thinco Div.
PROGRAM TO DESIGN, DEVELOPE, FABRICATE AND DELIVER THIN FILM CHIP INDUCTORS SUITABLE FOR HYBRID CIRCUIT APPLICATIONS Final Report
Stephen T. C. Chen Nov. 1979 32 p
(Contract N62269-78-C-0312; WF62580000)
(AD-A078840; NADC-78111-40) Avail: NTIS
HC A03/MF A01 CSCL 09/1

Inductors were fabricated using thin film techniques. The winding of an inductor was formed by depositing alternate layers of metal and dielectric material in steps of one-half turns. The optimization of Q-factor and self-resonant frequency were discussed. Comparison of circular and square geometry were made indicating that the circular one was preferred. Use of magnetic ferrite substrate to increase the inductance and the Q-factor has been achieved. Different methods for the measurements of inductance and Q-factor were described and the results of the measurement of a thin film inductor were given. GRA

N80-19433# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
DUAL BEAM DUAL MODE TWT Bimonthly Progress Report, 15 Aug. - 15 Oct. 1978
Nov. 1978 47 p
(Contract N00014-78-C-0791)
(AD-A077576; PT-5289; BMPR-2) Avail: NTIS
HC A03/MF A01 CSCL 09/1

This report describes the activities during the first two months of a development program designed to bring an existing high-band dual mode TWT up to the recent JSC specification for dual mode tubes. Test vehicles for design verification testing have been designed and ordered, tube design has been carried out, tooling improvements have been implemented, and design work on a new waveguide transition and collectors is described. GRA

N80-19434# Naval Ship Research and Development Center, Bethesda, Md.
INVESTIGATION OF ELECTROPLATED ELECTRICAL CONTACTS Final Report, Oct. 1965 - Oct. 1978
William H. Kohlmann Oct. 1979 56 p
(ZF61412001)
(AD-A075353; DTNSRDC-79/092) Avail: NTIS
HC A04/MF A01 CSCL 13/8

The relative deterioration by marine atmospheres of noble metal platings for electric contacts has been determined in the interests of improving the reliability of electrical connections in the marine environment and of conserving precious metals. In cooperation with the Electronics Industry Association P-5.1 Committee on Electrical Contacts, this Center investigated the effects of marine and laboratory salt spray atmospheres on various contact platings in order to determine optimum platings; the emphasis was on platings with silver underplating. The work described includes establishment of experimental techniques, equipment development, a discussion of the marine exposure site at Ft. Tilden, New York, and the laboratory salt spray environment and procddures. The results with various platings show that the use of nickel as an underplating is very undesirable, but 30 millionths of an inch of gold over 100 millionths of an inch of silver is superior, and 30 millionths of an inch of gold over 100 millionths of an inch of copper is adequate in the marine environment. An examination of 4000 hours of laboratory salt spray exposure and 108,000 hours (11-1/2 years) of marine exposure indicates a corrosion acceleration factor ranging from 18 to 25 for gold-over-nickel plating systems. GRA

N80-19435# Autonetics, Anaheim, Calif. Strategic Systems Div.
FLAT BUS FAULT SENSORS Final Report, Oct. 1978 - Oct. 1979
Carl O. Linder Oct. 1979 48 p
(Contract N62269-78-C-0213)
(AD-A077060; C79-951/201; NADC-77336-60) Avail: NTIS
HC A03/MF A01 CSCL 09/3

This report documents the development of an electric power distribution fault sensing technique for use on a 270 Vdc, two wire, flat bus, ungrounded aircraft power distribution system for operation in composite aircraft structures. The effort, performed by the Strategic Systems Division of Rockwell International, included the development, fabrication and delivery of six fault sensor breadboards. Author (GRA)

N80-19436# Northrop Corp., Des Plaines, Ill. Defense Systems Div.
I/J BAND LOW-COST CROSSED-FIELD AMPLIFIER Interim

Technical Report, 30 Sep. 1978 - 30 Mar. 1979
Robert R. Moats Nov. 1979 47 p refs
(Contract DAAB07-78-C-2981; DA Proj. 1L1-62705-AH-94)
(AD-A077322; DELET-TR-78-2981-1; Rept-094-009168; ITR-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

This program is directed toward development of an I/J band, linear format, injected-beam crossed-field amplifier (IBCFA) for electronic warfare. The IBCFA should be capable of power output of 1000W peak, 200W average, between 8.5 and 17 GHz with 20 dB gain. A laser-cut shaped-substrate meander line is to be used. E/F band IBCFA's are to be built and evaluated for electronic warfare applications: 3 kW peak pulse power and 1 kW average power output, 20 dB gain, 2-4 GHz; and for phased-array radar, 2 kW peak pulse power output at 10-15% duty, 25 dB gain, 3.0-3.6 GHz. Objective specifications for I/J-band devices are 1 kW peak pulse power and 200W average power output, 20 dB gain, 8.5-17 GHz. A previously built E/F-band CFA with laser-cut substrate was tested to determine its performance with respect to the phased array requirements. It was concluded that additional circuit length is required for increased gain. In addition, it will be desirable to add attenuation in the small-signal part of the tube to improve stability in the electronic warfare mode. A first round of I/J-band large-signal calculations was performed. It was concluded that a circuit pitch of 0.014 in. is desirable, and that cathode-to-ground voltage should be about 6500 v. Author (GRA)

N80-19437# RCA Advanced Technology Labs., Camden, N. J.
ANALOG BINARY PROGRAMMABLE TRANSVERSAL FILTER Interim Report, 30 Sep. 1977 - 31 Aug. 1978
D. A. Gandolfo and J. R. Tower Jun. 1979 66 p refs
(Contract F19628-77-C-0263; AF Proj. 4600)
(AD-A078860; RADC-TR-79-135) Avail: NTIS HC A04/MF A01 CSCL 09/5

The objective of this program is to develop a programmable CCD (Charge-Coupled Device) circuit capable of correlating a variety of binary-coded waveforms. This analog-binary correlator will store a binary waveform as a reference, and will then compare newly arriving signals to the reference waveform. In general, the signal will be a binary code that has been corrupted in the transmission channel so that upon arrival at the receiver, it really has an analog character (i.e., the amplitude varies continuously). Analog-binary correlation techniques have an important advantage over purely digital approaches. If the analog signal is directly compared to the reference, only a single correlation channel is required, whereas a digital correlator requires a separate channel for each bit of resolution in the analog-to-digital converter. Thus, a reduction in parts count, with attendant improvements in size, cost and reliability, is realized with the CCD correlator. The correlator is an important device because correlation of binary waveforms is a function widely used in spread spectrum systems, which offer important advantages for military communications and radar applications. Spread spectrum advantages include jam resistance, reduced detectability and improved signal-to-noise ratio for given transmitter power. Thus, the device whose design is described here should be broadly useful in military systems. Author (GRA)

N80-19438# Rockwell International Corp., Thousand Oaks, Calif. Electronics Rearch Center.
ION IMPLANTED GaAs INTEGRATED CIRCUIT PROCESS TECHNOLOGY Quarterly Technical Report, 1 Apr. - 30 Jun. 1979
F. H. Eisen and S. I. Long Aug. 1979 48 p refs
(Contract F49620-77-C-0087; ARPA Order 3384)
(AD-A078958; SC5110.18QR; AFOSR-79-1268TR; QTR-8) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report covers the third quarter, Phase 2 of a program on ion implanted planar GaAs integrated circuit technology. The overall objective of this program is the development of a manufacturable process for high-speed low-power GaAs logic circuits. The goal for Phase 1 was to establish the technology, and demonstrate its viability by fabricating circuits reaching MSI complexity. The goal for Phase 2 is to achieve the capability of fabricating GaAs ICs of LSI complexity. The program involves the Rockwell International Electronics Research Center and three subcontractors: Cal Tech, Cornell University and Crystal Specialties, Inc. The most important aspects of the work carried out in this quarter were the gaining of further insight into the causes for conversion of unqualified GaAs substrates, the fabrication of wafers with mask set AR3, and the preparation for evaluating the 3 x 3 parallel multiplier, a new circuit on AR3. This circuit will provide vital information for the design of the more complex circuits, on mask set AR4. GRA

N80-19439# Naval Surface Weapons Center, White Oak, Md. Underwater Systems Dept.
AN ACTIVE FILTER PRIMER Final Report
Arthur D. Delagrange 1 Mar. 1979 103 p refs
(W0476110)
(AD-A078847; NSWC/TR-79-137) Avail: NTIS HC A06/MF A01 CSCL 09/5

This report gives the basics of active filter design, both theory and practice. It is based on a seminar given in the Signal Processing Branch of the Surface Antisubmarine Warfare Division. It will be of interest to persons working in the fields of analog filter design or signal processing. GRA

N80-19440# Harry Diamond Labs., Adelphi, Md.
A NEW APPROACH TO THE DESIGN OF HIGHLY EFFICIENT REGULATED dc-TO-dc CONVERTERS
Philip M. Cowett, Jr. Oct. 1979 17 p
(DA Proj. 1X3-23831-D-690; HDL Proj. 692764)
(AD-A078627; HDL-TM-79-29) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report describes a novel approach to the design of efficient switching regulated dc-to-dc converters whereby an energy storage inductor and a commutating diode are in the output transformer primary circuit of the converter. This design has advantages of simplicity, economy, reliability in applications where high-output voltages, multiple-output voltages, or both are involved. GRA

N80-19441# TRW Defense and Space Systems Group, Redondo Beach, Calif.
MONOLITHIC MICROWAVE PREAMPLIFIER Technical Report, 1 Apr. 1978 - 30 Jun. 1979
A. Benavides, R. Kaelberer, and K. Weller Sep. 1979 39 p refs
(Contract N00014-77-C-0645; RF5481001)
(AD-A078522; TRW-251-028; TR-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

During the initial phase of this contract, TRW developed a computer model for GaAs Microwave Field-Effect Transistors, in order to study the noise and gain properties of such devices for different channel doping densities and geometry configurations. This model has proven to be accurate when compared against measured results of noise figure, S parameters, and temperature effects on noise figure of FET devices. At the present, TRW has made use of this computer model in designing a low noise integrated preamplifier to operate at X-band. The theoretical design of this amplifier is the subject of the present report. GRA

N80-19442# Harvard Univ., Cambridge, Mass. Applied Sciences Div.
NONEQUILIBRIUM PHENOMENA IN SUPERCONDUCTING PHASE-SLIP CENTERS Interim Report
Alan M. Kadin Oct. 1979 226 p refs
(Contracts N00014-77-C-0085; N00014-75-C-0648; Grant NSF DMR-79-04155)
(AD-A078441; TR-15) Avail: NTIS HC A11/MF A01 CSCL 20/3

This report presents the results of a study on the current-induced breakdown of superconductivity in a quasi-one-dimensional filament. This report has investigated the effects of a magnetic field H on nonequilibrium quasiparticle relaxation processes in superconductors by analyzing the I-V characteristics of long tin microbridges in a parallel field near T sub c(H). In the theoretical studies, using a generalized two-fluids picture to describe a quasi-one-dimensional superconductor near T sub c (for H equal 0), a heuristic derivation for a set of equations governing the temporal and spatial evolution of the charge imbalance (or branch imbalance) in the quasiparticles is provided. A novel consequence of the model is a prediction of intrinsic hysteresis in the dc current-voltage relation. The model also provides a convenient framework for dealing with ac effects in

PSC's, including resonance and synchronization in systems of closely-spaced PSC's and microbrobridges. GRA

N80-19443# Magnetic Corp. of America, Waltham, Mass.
MAGNETOHYDRODYNAMIC (MHD) MAGNET MODELING Interim Technical Report, Mar. - Sep. 1978
Z. J. J. Stekly, Robert D. Pillsbury, Jr., Alan R. Beckwith, and R. Doug Holmes Wright-Patterson AFB, Ohio Jun. 1979 225 p Prepared in cooperation with General Dynamics Corp., San Diego, Calif.
(Contract F33615-77-C-3117; AF Proj. 3145)
(AD-A078865; MCA-WP13-01; AFAPL-TR-79-2045) Avail: NTIS HC A10/MF A01 CSCL 20/3

This report presents the results of a study to establish scaling criteria for a lightweight, superconducting magnet system for use in magnetohydrodynamic power generation. The scaling criteria are used to determine the appropriate size for a model magnet to be built to demonstrate the major system parameters of a full scale, 30 MWe, magnet system. GRA

N80-19444# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
RESEARCH IN REMOTE SIGNAL TRANSMISSION ELECTRONICS
E. J. Kennedy, T. V. Blalock, J. Phelps, R. Rochelle, and F. Dyer 1 Oct. 1979 89 p ref
(Contract W-7405-eng-26)
(ORNL/Sub-7644/10; TR-EE/EL-10) Avail: NTIS HC A05/MF A01

Worst-case performance evaluation were made on an amplifier-discriminator circuit utilizing commercially available operational amplifier chips incorporated in a hybrid thick-film package, which is suitable for use to 250 C. Another hybrid thick film amplifier-discriminator system was developed and tested for use to 300 C. A dc-dc converter to supply +10v and -10v for amplifier power was designed, and evaluated up to an operating temperature of 300 C. Detailed design theory equations for high temperature dc-dc converters are presented. Significant problems with ceramic capacitors utilized at 300 C were found. DOE

N80-19445# Bendix Corp., Kansas City, Mo.
FIGURE-OF-MERIT FOR BARE AND COATED WIRES AND FLAT RIBBON JUMPERS
P. M. Heffley Nov. 1979 15 p
(Contract EY-76-C-04-0613)
(BDX-613-2304) Avail: NTIS HC A02/MF A01

A polymeric coating is proposed for use as a stiffener under high acceleration loads for wire and ribbon jumpers used in JMC's to bridge over circuitry. A dimensionless figure of merit is proposed for jumpers and bare and coated jumpers are compared via classical mathematical models and finite element model. Real production geometry, end attachment conditions, and acceleration direction factors are included in the finite element model. The results do not justify adding the coating. DOE

N80-19446# California Univ., Livermore. Lawrence Livermore Lab.
DETECTION OF A NORMAL ZONE IN INDUCTIVELY COUPLED SUPERCONDUCTING COILS
E. W. Owen Nov. 1979 23 p refs Presented at the Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83307; CONF-791102-3) Avail: NTIS HC A02/MF A01

A method is described for the electrical detection of a normal zone in inductively coupled superconducting coils. Measurements are made with two kinds of bridges, mutual inductance bridges and self-inductance bridges. The bridge outputs are combined with other measured voltages to form a detector that can be realized with either analog circuits or a computer algorithm. The detection of a normal zone in a pair of coupled coils, each with taps, is discussed in detail. The method also applies to a pair of coils when one has no taps and to a pair when one coil is superconducting and the other is not. The method can be extended, in principle, to a number of coils. A description is given of a technique for balancing the bridges at near the operating currents of the coils. DOE

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-19447*# National Aeronautics and Space Administration, Washington, D. C.
ATOMIZATION OF A LIQUID BY A SPRAY NOZZLE
S. S. Kutateladze, ed. Feb. 1980 279 p refs Transl. into ENGLISH of the book "Raspylivaniye Zhidkosti Forsunkami" Moscow-Leningrad, Izatelstvo Press, 1962, 285 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Gosuparstvennoye Energeticheskoye
(Contract NASw-3198)
(NASA-TM-75771) Avail: NTIS HC A13/MF A01 CSCL 20D

The theory of atomization by mechanical and pneumatic (or vapor) spray nozzles is discussed. Basic design recommendations resulting from generalization of the material and confirmed by experiments are given. Sprayers which are widely used in the furnaces of stationary steam boilers, the combustion chambers of gas turbines, and industrial furnaces are examined. J.M.S.

N80-19448*# DCW Industries, Studio City, Calif.
RECENT IMPROVEMENTS TO THE SPINNING BODY VERSION OF THE EDDYBL COMPUTER PROGRAM Interim Report
David C. Wilcox Nov. 1979 32 p refs
(Contract NAS2-10343)
(NASA-CR-152347; DCW-R-24-01) Avail: NTIS HC A03/MF A01 CSCL 20D

A conventional mixing length model specialized for thick boundary layers and a general model for pressure-strain correlation terms were added to the spinning version of EDDYBL. The models are discussed and modifications to the code input and output are presented. K.L.

N80-19449*# Illinois Univ., Chicago.
AN ANALYSIS OF TURBULENT DIFFUSION FLAME IN AXISYMMETRIC JET Final Report
Paul M. Chung and Kwan H. Im Apr. 1980 100 p refs
(Grant NsG-1150)
(NASA-CR-162884) Avail: NTIS HC A05/MF A01 CSCL 20D

The kinetic theory of turbulent flow was employed to study the mixing limited combustion of hydrogen in axisymmetric jets. The integro-differential equations in two spatial and three velocity coordinates describing the combustion were reduced to a set of hyperbolic partial differential equations in the two spatial coordinates by a binodal approximation. The MacCormick's finite difference method was then employed for solution. The flame length was longer than that predicted by the flame-sheet analysis, and was found to be in general agreement with a recent experimental result. Increase of the turbulence energy and scale resulted in an enhancement of the combustion rate and, hence, in a shorter flame length. Details of the numerical method as well as of the physical findings are discussed. R.C.T.

N80-19450*# FWG Associates, Inc., Tullahoma, Tenn.
MONODISPERSE ATOMIZERS FOR AGRICULTURAL AVIATION APPLICATIONS Final Report
Larry S. Christensen and Sidney L. Steely Feb. 1980 81 p refs
(Contract NAS3-21582)
(NASA-CR-159777) Avail: NTIS HC A05/MF A01 CSCL 20D

Conceptual designs of two monodisperse spray nozzles are described and the rationale used in each design is discussed. The nozzles were designed to eliminate present problems in

agricultural aviation applications, such as ineffective plant coverage, drift due to small droplets present in the spray being dispersed, and nonuniform swath coverages. Monodisperse atomization techniques are reviewed and a synopsis of the information obtained concerning agricultural aviation spray applications is presented. A.W.H.

N80-19451*# National Aeronautics and Space Administration, Washington, D. C.
MEMORY EFFECTS IN TURBULENCE
J. O. Hinze Nov. 1979 35 p refs Transl. into ENGLISH from Z. Angew. Math. Mech. (East Germany), v. 56, Oct. 1976 35 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75516) Avail: NTIS HC A03/MF A01 CSCL 20D

Experimental investigations of the wake flow of a hemisphere and cylinder show that such memory effects can be substantial and have a significant influence on momentum transport. Memory effects are described in terms of suitable memory functions. A.R.H.

N80-19452*# National Aeronautics and Space Administration, Washington, D. C.
CONVECTIVE FLOWS OF VISCOUS FLUID IN SPHERICAL LAYERS. CERTAIN ASTROPHYSICAL APPLICATIONS
I. M. Yavorskaya Mar. 1980 65 p refs Transl. into ENGLISH of "Konvektivnye Techeniya Vyazkoy Zhipdkosti V Sfericheskikh Sloykh. Nekotoryye Astrofizicheskye Prilozheniya", Rept. Pr-346 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-64 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75923; Pr-346) Avail: NTIS HC A04/MF A01 CSCL 20D

The convective stability of a viscous liquid in spherical layers is investigated taking into consideration rotation, the latitudinal temperature gradient, and shear flow. The results of calculating nonlinear convective motion in spherical layers are examined. A discussion is given of the applicability of the results obtained to studying convection in astrophysical objects. M.G.

N80-19453*# National Aeronautics and Space Administration, Washington, D. C.
OUTLINE OF RESEARCH ON OSCILLATING BOUNDARY LAYERS
J. Cousteix Nov. 1979 51 p refs Transl. into ENGLISH of paper from Colloq. on Appl. Aerodyn. Presented at 15th Colloq. on Appl. Aerodyn., Marseille, 7-9 Nov. 1978 p 1-22 Original language document was announced as A79-32279 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75806) Avail: NTIS HC A04/MF A01 CSCL 20D

The state of the art in the field of unsteady boundary layers is outlined with emphasis on turbulent boundary layers. The unsteady flows considered are mainly periodic with the external velocity varying around a zero or nonzero mean time value. The principal results obtained on laminar boundary layers are also presented. K.L.

N80-19454*# Florida Univ., Gainesville. Dept. of Engineering Sciences.
VORTICITY ASSOCIATED WITH MULTIPLE JETS IN A CROSSFLOW
Susan Braden 25 Apr. 1980 39 p refs Presented at the AIAA Southeastern Regional Student Conf., Atlanta, 24-25 Apr. 1980
(Grant NsG-2288)
(NASA-CR-162855) Avail: NTIS HC A03/MF A01 CSCL 20D

Vortex patterns from multiple subsonic jets exiting perpendicularly through a flat plate into a subsonic crossflow were investigated. Tandem and transverse jet configurations were examined using a paddle wheel sensor to indicate the presence and relative magnitude of streamwise vorticity in the flow. Results are presented in the form of contour plots of rotational speed of the paddle wheel as measured in planes downstream from the jets and perpendicular to the crossflow. Well developed diffuse contrarotating vortices were observed for the configurations studied. The location and strength of these vortices depended on the multiple jet configuration and the distance downstream from the jets. K.L.

N80-19455# Ballistic Research Labs., Aberdeen Proving Ground, Md.
NAVIER-STOKES SOLUTIONS FOR SPIN-UP FROM REST IN A CYLINDRICAL CONTAINER Final Report
C. W. Kitchens, Jr. Sep. 1979 54 p refs
(DA Proj. 1L1-61102-AH-43; DA Proj. 1L1-62618-AH-80)
(AD-A077115; AD-E430333; ARBRL-TR-02193) Avail: NTIS HC A04/MF A01 CSCL 20/4

An accurate and efficient predictor-corrector multiple-iteration scheme is adapted and used for the first time to solve the unsteady Navier-Stokes equations. Numerical solutions for Reynolds numbers up to 50,000 are obtained for the transient spin-up flow in a cylindrical container. The grid point distribution is optimized using coordinate transformations to simultaneously resolve details of both the interior and endwall/sidewall boundary layer flows formed during spin-up. Calculations for five test problems show consistency with previous computations and/or experimental measurements. Transient phenomena occurring at early time near the sidewall, including inertial oscillations and counter-rotating meridional flow, are reported and discussed. Computational experiments have been used to quantify the mass flow in the endwall boundary layers and investigate the compatibility condition used in Wedemeyer's spin-up model. GRA

N80-19456# Naval Ship Research and Development Center, Bethesda, Md.
AN EVALUATION OF THE TWO-PARAMETER MOMENTUM-INTEGRAL LAMINAR BOUNDARY LAYER CALCULATION METHOD OF HEAD Final Report
Christian H. VonKerczek and Nancy C. Groves Nov. 1979 57 p refs
(AD-A077325; DTNSRDC-79/019) Avail: NTIS HC A04/MF A01 CSCL 20/4

The two-parameter momentum-integral method of M.R. Head for the calculation of two-dimensional or axisymmetric, incompressible, laminar boundary layers is reworked into an analytical form, thereby eliminating the graphical data of Head's original method. The revised method is coded for digital computer solution and a number of test cases are computed. The numerical results for these test cases are compared with very accurate boundary layer solutions obtained by a finite-difference method and also results obtained using the Pohlhausen momentum-integral method. It was found that the Head method is vastly superior to the Pohlhausen method yet requires only about the same computational expense. Head's method yields very accurate results even for highly nonsimilar boundary layers. GRA

N80-19457# Polytechnic Inst. of New York, Farmingdale. Dept. of Mechanical and Aerospace Engineering.
NUMERICAL INTEGRATION OF COMPRESSIBLE, VISCOUS FLOW EQUATIONS Interim Report
Gino Moretti Sep. 1979 38 p refs
(Grant DAAG29-77-G-0072)
(AD-A077558; POLY-M/AE-79-40; ARO-14369.3-E) Avail: NTIS HC A03/MF A01 CSCL 20/4

A method for integrating the Navier-Stokes equations numerically is given, which takes the most advantage of the lambda-scheme for the integration of inviscid equations. Full details for supplementing the method (with the inclusion of imbedded shocks treatment) in two-dimensional unsteady flows are given. Results of one application are presented. GRA

N80-19458# California State Univ., Long Beach. Dept. of Mechanical Engineering.
THE CALCULATION OF MOMENTUM AND HEAT TRANSFER IN INTERNAL FLOWS AND IN FLOWS WITH SMALL REGIONS OF SEPARATION Final Technical Report, Jan. - Dec. 1978
Tuncer Cebeci Dec. 1978 71 p refs
(Contract N00014-77-C-0073)
(AD-A078484; ONR-CR-297-002-1) Avail: NTIS

HC A04/MF A01 CSCL 20/4

Numerical methods for solving boundary-layer equations are discussed and the application of the Box scheme to internal flows and to small regions of separated flow is decribed in detail. The Box scheme has previously been used with considerable success to solve a wide range of external two- and three-dimensional flows and is shown here to be equally successful when applied in internal and separated flows which require its use in an inverse manner. A nonlinear eigenvalue and a Mechul method are described: the former is simpler to use and is recommended for internal flow problems; the latter is more appropriate for calculations in and through small regions of separated flow. Turbulent flow is characterized by eddy-viscosity and eddy-conductivity assumptions which are shown to represent the mean-flow and heat-transfer properties, including transition, provided the location of the onset of transition is known. GRA

N80-19459# Naval Research Lab., Washington, D. C. Plasma Physics Div.

GAS CHANNEL FORMATION: DEPENDENCE OF HYDRODYNAMIC PHENOMENA ON THE INITIAL RADIAL PRESSURE PROFILE

Martin Lampe and Selig Kainer 30 Nov. 1979 27 p refs

(ARPA Order 3718; NRL Proj. R08-93)

(AD-A078917; NRL-MR-4129) Avail: NTIS

HC A03/MF A01 CSCL 20/4

The hydrodynamic processes resulting from 'instantaneous' heating of a cylindrical region of gas are studied by means of numerical integration of the fluid equations. Various initial overpressures and radial profiles of initial pressure are considered. For very smooth radial profiles, e.g., the Bennett profile, the evolution is very simple: the gas expands radially, a single outgoing shock forms, the density at late times undershoots the value at pressure balance by only about 10% and then increases to pressure balance slowly, monotonically, and adiabatically. For profiles that are more square in shape, or are sharply discontinuous, the evolution is much more complicated. A strong rarefaction typically occurs, of brief duration and in a narrow region about the axis. During the rarefaction, both the density and temperature fall well below the values at pressure balance. The rarefaction is abruptly terminated by an inward-propagating shock, followed by multiple density oscillations, which can form shocks for strong overpressures. The dependence of the time scales and strengths of the rarefactions and shocks on the initial overpressure and profile shape are calculated and discussed. GRA

N80-19460# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.

ON THE FEEDBACK PHENOMENON OF AN IMPINGING JET

Nagy Sabet M. Nosseir and Chih-Ming Hoh Sep. 1979 257 p refs

(Contract F49620-78-C-0060; AF Proj. 2307)

(AD-A078952; AFOSR-79-1263TR) Avail: NTIS

HC A12/MF A01 CSCL 20/4

The resonance phenomenon which occurs when a high speed turbulent jet impinges on a large flat plate is experimentally studied. The far field noise is also investigated for a wide range of impinging jet speeds. The study involves far field, near field, and surface pressure measurements. A feedback of pressure waves between the nozzle and the plate is found to be the mechanism responsible for the resonance. The feedback loop is formed by downstream traveling large coherent structures, and upstream acoustic waves propagating in the nearby stagnant region around the jet. The upstream acoustic waves are generated by the impingement of large scale structures on the plate. Near the nozzle exit these waves are locked in-phase with the oscillations of the thin shear layer, which is forced to roll into large eddies at the resonance frequency f(r). Furthermore, the experimental data revealed the following interesting results: (1) The total period of the feedback loop is an integer N times the resonance period, N being constant over a resonance frequency stage. A jump from one frequency stage to another (occurring at certain nozzle-to-plate separation distances), takes place through a quantum unit change in N, so as to preserve the phase lock between the two oscillations at the nozzle. (2) As the wavy shear layer evolves into large vortices, a strong interaction develops among the initial instability vortices. This phenomenon is referred to as 'collective interaction', and is believed to be the mechanism responsible for the sharp drop in the passage frequency of the vortices near the nozzle exit. The frequency drops from the high instability frequency f(in) to that of the resonance frequency f sub r. GRA

N80-19461# Naval Surface Weapons Center, White Oak, Md. Strategic Systems Dept.

INFLUENCE OF ROUGHNESS AND BLOWING ON COMPRESSIBLE TURBULENT BOUNDARY LAYER FLOW Final Report

Robert L. P. Voisinet Jun. 1979 220 p refs

(AD-A077642; NSWC/TR-79-153) Avail: NTIS

HC A10/MF A01 CSCL 20/4

The determination of the relative and combined effects of surface roughness and mass transfer on turbulent boundary-layer development, and in particular, on skin-friction drag was the prime objective of this study. Wind-tunnel tests were conducted in the NSWC Boundary-Layer Channel at a freestream Mach number of 2.9. The thick nozzle-wall boundary layer in the facility was subjected to a systematic variation of surface roughness and mass transfer conditions. Boundary-layer pressure and temperature surveys were obtained and skin friction was measured directly, using a skin-friction balance which had a provision for active blowing through the floating drag element. Data comparisons with skin-friction theories and law-of-the-wall velocity profile correlations are presented. GRA

N80-19462# General Atomic Co., San Diego, Calif.

TUBING FOR AUGMENTED HEAT TRANSFER Final Report

J. S. Yampolsky Jun. 1979 95 p refs

(Contract DEAC05-78OR-05761; GA Proj. 3257)

(GA-A-15442) Avail: NTIS HC A05/MF A01

The three areas of investigation covered are the manufacturing, the heat transfer-fluid flow performance, and the theoretical basis for the performance of spirally fluted tubes. The results of the investigation show that (1) the estimated price of spirally fluted tubing in quantity is equivalent to the cost of present commercially available welded tubing and is considerably lower than that of drawn tubing, and (2) spirally fluted tubing exhibits heat transfer-fluid flow performance advantages over conventional tubing which should lead to tubing cost savings of a factor of two over welded tubing and more for drawn tubing. This implies a lower cost for heat exchange equipment, since a significant part of the cost of this equipment is the cost of the tubing and the remainder of the cost is dependent on the amount of tubing. DOE

N80-19463# Los Alamos Scientific Lab., N. Mex.

STEADY-WAVE ANALYSIS OF THE EFFECT OF POROSITY ON VISCOUS AND INVISCID DETONATIONS BY USE OF A REACTIVE-POROUS ANALOG

R. L. Rabie Sep. 1979 29 p refs

(Contract W-7405-eng-36)

(LA-7819) Avail: NTIS HC A03/MF A01

A simple two-rate reactive material analog is used to determine reactive flow in a slightly porous medium. The rates govern the evolution of a chemical reaction coordinate and a solid volume coordinate, respectively. The rates are coupled so that mechanical phenomena can affect chemical phenomena and vice versa. Steady waves in both vicious and inviscid flow are examined, with variations in ignition criteria being of prime interest in the viscous flow. A particular result is that the steady state detonation velocity depends upon the ignition conditions. DOE

N80-19464# Oak Ridge National Lab., Tenn.

A COMPARISON OF THE RESULTS OF SEVERAL HEAT TRANSFER COMPUTER CODES WHEN APPLIED TO A HYPOTHETICAL NUCLEAR WASTE REPOSITORY

H. C. Claiborne, R. S. Wagner, and R. A. Just Dec. 1979 69 p refs

(Contract W-7405-eng-26)

(ORNL/TM-7112) Avail: NTIS HC A04/MF A01

A direct comparison of transient thermal calculations was made with the heat transfer codes HEATINGS, THAC-SIP-3D, ADINAT, SINDA, TRUMP, and TRANCO for a hypothetical nuclear waste repository. With the exception of TRUMP and SINDA the

codes agreed to within 5% for the temperature rises as a function of time. The TRUMP results agreed within 5% up to about 50 years, where the maximum temperature occurs, and then began an oscillary behavior with up to 25% deviations at longer times. The available version of SINDA was not compatible with the IBM compiler without an alternative method for handling a variable thermal conductivity. A programming error was discovered in the alternative method. Only HEATINGS, THAC-SIP-3D and ADINAT were used for the three-dimensional model calculations. The codes agreed within 5%; at distances of about 1 ft from the waste canister edge, temperature rises were also close to that predicted by the three-dimensional model. DOE

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-19465 British Broadcasting Corp., Kingswood (England). Research Dept.
COPAS: A HIGH SPEED REAL-TIME DIGITAL AUDIO PROCESSOR
G. W. McNally Nov. 1979 29 p refs
(BBC-RD-1979/26) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, Engl.

The design principles for a digital processor operating on high quality digital audio signals are discussed. The processor's nomenclature is COPAS. The architectural features of COPAS are described including the choice of processor, the internal bus layout, the support processor, and the program sequencing. The programming of COPAS is described and a program example is presented. The performance of COPAS and its applications are discussed. A.W.H.

N80-19466 British Library Lending Div., Boston Spa (England).
A GAS-SENSITIVE SEMICONDUCTOR DIRECTOR FOR GAS-CHROMATOGRAPHIC ANALYSIS
Oct. 1979 19 p refs Transl. into ENGLISH from Huaxue Xuebao (Mainland China), v. 35, no. 3, 4, 1977 p 183-192
(BLL-RTS-11943) Avail: British Library Lending Div., Boston Spa, Engl.

The basic properties of a detector for gas chromatographic analysis made from an n-type semiconductor with tin oxide as its major component were examined. The sensitivity of the detector is shown to be of the same order as that of the flame ionization detector. The n-type semiconductor detector was used in the gas chromatographic analysis of: (1) trace amounts of hydrogen in rare gases; (2) samples of the transformer oil in a power station; (3) the amounts of atmospheric pollutants in workshops of an ethylene plant; and (4) samples collected during the processes of oil drilling. Results of these analyses and field tests indicate that this type of chromatography may become a simple, rugged, and practical instrument with high sensitivity. J.M.S.

N80-19467 British Library Lending Div., Boston Spa (England).
LASER VIBRATION GYROSCOPE
A. A. Golovan and A. V. Salmin Jul. 1979 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (USSR), v. 21, no. 1, 1978, p 58-62
(BLL-RTS-11579) Avail: British Library Lending Div., Boston Spa, Engl.

A laser vibration gyroscope is used as an example to consider whether the effct of parameter drift of the sensitive element on the accurate ascertainment of the absolute angular velocity is appreciably attenuated by modulation of the useful signal. A comparative analysis of the measuring conversion transconductance and signal to noise ratio of a vibration gyroscope using a ring laser and vibration gyroscope of oscillator type is presented. A.W.H.

N80-19468*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HIGH TEMPERATURE PENETRATOR ASSEMBLY WITH BAYONET PLUG AND RAMP-ACTIVATED LOCK Patent Application
Kenneth E. Wood, inventor (to NASA) (Rockwell International, Downey, Calif.) Filed 7 Feb. 1980 14 p Sponsored by NASA
(NASA-Case-MSC-18526-1; US-Patent-Appl-SN-119335) Avail: NTIS HC A02/MF A01 CSCL 14B

A penetrator assembly adaptable to the very high temperature environment encountered in space vehicle atmospheric reentry is disclosed. Features of the assembly include a bayonet plug and a ramp activated lock, eliminating threaded surfaces which are subject to oxidation and subsequent failure. Columbium base metal with a silicide coating is used and provision is made for safety wiring of the ramping washers against unintended rotation in place. Application of the penetrator assembly to a high temperature, pressure probe, orifice installation for a space vehicle is illustrated. J.M.S.

N80-19469*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
THERMOCOUPLE, MULTIPLE JUNCTION REFERENCE OVEN Patent Application
Louis P. LeBlanc, inventor (to NASA) Filed 22 Feb. 1980 11 p
(NASA-Case-FRC-10112-1; US-Patent-Appl-SN-122965) Avail: NTIS HC A02/MF A01 CSCL 14B

An improved oven for maintaining the junctions of a plurality of reference thermocouples at a common and constant temperature is described. The oven is characterized by a cylindrical body defining a heat sink having an axially extended cylindrical cavity, a singularized heating element, an annular array of radially extended bores, and a temperature sensing device seated in the axial bore for detecting temperature changes as they occur in the spool and circuit. A diagram of the oven and thermocouples is presented and the design and applications of the invention are discussed. NASA

N80-19470# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
AN APPLICATION OF THE PHOTOMETRIC STEREO METHOD
Katsushi Ikeuchi and Berthold K. P. Horn Aug. 1979 30 p refs
(Contract N00014-77-C-0389)
(AD-A078125; AI-M-539) Avail: NTIS HC A03/MF A01 CSCL 20/6

The orientation of patches on the surface of an object can be determined from multiple images taken with different illumination, but from the same viewing position. This method, referred to as photometric stereo, can be implemented using table lookup based on numerical inversion of experimentally determined reflectance maps. Here we concentrate on objects with specularly reflecting surfaces, since these are of importance in industrial applications. Previous methods, intended for diffusely reflecting surfaces, employed point source illumination, which is quite unsuitable in this case. Instead, we use a distributed light source obtained by uneven illumination of a diffusely reflecting planar surface. Experimental results are shown to verify analytic expressions obtained for a method employing three light source distributions. GRA

N80-19471*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TEXTURE EXTRACTION ON THE ILLIAC 4 Final Report
Richard M. Brown and Marsha Jo Hannah 15 May 1979 40 p refs
(AD-A070523; NASA-TM-81002; IAC-TM-5768; IAC-Ref-77-15/1; ETL-0191) Avail: NTIS HC A03/MF A01 CSCL 14E

IAC has developed texture extraction programs that run on the ILLIAC IV parallel processor. It has used these programs to extract two different texture measures from 32 aerial images provided by ETL. These textures are based on the MAX-MIN technique on the computation of spatial dependence matrices. This report provides high-level descriptions of the texture

algorithms, the software system created to implement these algorithms, the test and verification efforts and the results and conclusions. GRA

N80-19472# Panametrics, Inc., Waltham, Mass.
DESIGN, CONSTRUCTION AND TESTING OF A MAGNETIC ELECTRON SPECTROMETER FOR DETECTING ELECTRONS TO 10 MeV, INCLUDING A PRELIMINARY DESIGN FOR A FLIGHT UNIT Final Report, Jun. 1977 - Sep. 1979
Frederick A. Hanser and Bach Sellers Sep. 1979 69 p refs
(Contract F19628-77-C-0180; AF Proj. 2311)
(AD-A078516; AFGL-TR-79-0229) Avail: NTIS
HC A04/MF A01 CSCL 14/2

A magnetic electron spectrometer for electrons to 10 MeV energy has been designed, constructed, and tested. The magnet assembly uses rare-earth/cobalt magnets and achieves a gap field of 4 - 4.5 kG. The operation of the spectrometer was tested with beta sources and position sensitive detectors. It was found that a coincidence detector in the entrance collimator eliminates most of the bremsstahlung background. Some internal baffles are also necessary to reduce scattered electron background. The tests showed that a magnetic spectrometer which can analyze electrons to more than 10 MeV can be readily constructed. A preliminary design for a flight unit magnetic electron spectrometer is given. GRA

N80-19473# Northeastern Univ., Boston, Mass. Electronics Research Lab.
AN RF OSCILLATOR FOR ROCKET-BORNE AND BALLOON-BORNE QUADRUPOLE MASS SPECTROMETERS Interim Report
Thomas A. Palasek Sep. 1979 46 p refs
(Contracts F19628-78-C-0218; F19628-76-C-0256; AF Proj. 2310)
(AD-A078797; AFGL-TR-79-0226; SR-2) Avail: NTIS
HC A03/MF A01 CSCL 14/2

This thesis deals with the development of a Radiofrequency (RF) Oscillator used in rocket-borne and balloon-borne quadrupole mass spectrometers. A new toroidal-shaped RF transformer has been developed along with new control circuitry for the modified Hartly oscillator that is used. Solutions to the problems of temperature stabilization and linearity are also discussed. Also included in this thesis is a review of quadrupole mass filter theory. GRA

N80-19474# General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
DEVELOPMENT OF PASSIVE HIGH PRESSURE GAUGES: FIELD EXPERIMENT Final Report, May 1978 - Jan. 1979
Jacques E. Schoutens, Craig C. Hudson, and Steven L. Senesac Jan. 1979 74 p refs
(Contract DNA001-78-C-0285)
(AD-A077194; AD-E300614; GE78TMP-102; DNA-4768F) Avail: NTIS HC A04/MF A01 CSCL 14/2

High pressure passive gauges capable of measuring peak shock pressures in the range of 2 to 25 kbar near detonating high explosives are being developed. The operation of these gauges is based upon the characteristics of second order transformations in pure metals or single crystals of alkaline halides and changes in the electrical characteristics of metal oxide varistors (MOV). This paper describes the results of an experiment in which three RbCl samples and four ZnO MOVs were placed against a 0.70 m thick concrete wall at the other side of which 2570 kg of explosives were detonated. The explosive and the concrete wall formed the driver end of a large shock tube. The tube and back of the wall were covered over with alluvium. At the gauge location, the alluvium depth was approximately 5 m. The samples were each located inside an individual pressure cell assembled into groups on steel plates to form gauges. The gauges were recovered some 2.5 m away from their original position. They had been translated and tumbled horizontally away from the burst point. The pressure cells were deformed and five out of seven samples were recovered--two MOVs and three RbCl. An examination of the RbCl samples indicated no phase change, meaning that the shock pressure appeared not to have reached the expected 12 kbar. The MOV samples were deformed, making the results of their reading of low confidence. Nevertheless, a tentative lower bound on the shock peak pressure can be placed at 9 kbar. The pressure cells suffered severe permanent deformation, leading to the conclusion that the dynamic stresses developed during their motion away from the burst point reached approximately 9 to 13 kbar. GRA

N80-19475# National Bureau of Standards, Washington, D.C. Fluid Engineering Div.
LOW VELOCITY PERFORMANCE OF A HIGH SPEED VANE ANEMOMETER Progress Report, 1 Jun. - 31 Jul. 1977
L. P. Purtell Sep. 1978 23 p refs
(Contract DI-BM-HO-166198)
(AD-A077457; NBSIR-78-1545) Avail: NTIS
HC A02/MF A01 CSCL 20/4

Performance of a high speed vane anemometer is evaluated over the speed range of 43.4 to 741 feet per minute including starting speed and stopping speed. The tests were performed in the NBS Low Velocity Airflow Facility which provides a uniform flow of low turbulence and utilizes a laser velocimeter as the velocity standard. GRA

N80-19476# Mead Technology Labs., Dayton, Ohio.
COLOR INK-JET DEMONSTRATION PROGRAM Final Report
19 Sep. 1979 81 p refs
(Contract DAAK70-78-C-0229)
(AD-A075377; FR-79-4; ETL-0196) Avail: NTIS
HC A05/MF A01 CSCL 14/5

A demonstration program was conducted to evaluate the use of ink-jet imaging technology for color map reproduction. A single-color laboratory copier was modified for three-color operation by adding two additional scan towers and ink-jet arrays. Extensive ink compatibility testing was performed to insure adequate operation with the system and the high wet strength map paper. The demonstration proved that the desired resolution and geometric fidelity could be obtained. Samples with 300 line-per-inch resolution were produced. True color balance could not be achieved within the funding and schedule constraints of the program, however, due to the breadboard nature of the device and the need for additional, individual channel controls and improved system reliability. GRA

N80-19477# Idaho National Engineering Lab., Idaho Falls.
THE 6-BEAM TEST, FOR GAMMA DENSITOMETER
R. R. Good 15 Aug. 1979 32 p refs
(Contract EY-76-C-07-1570)
(LTR-141-122) Avail: NTIS HC A03/MF A01

The results are presented of a test series designed to quantify the crosstalk between beams of a six-beam gamma densitometer data reduction program. DOE

N80-19478# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
PULSE HEIGHT ANALYZER/OSCILLOSCOPE DISPLAY INTERFACE
W. J. Woodward, Jr. Oct. 1979 14 p refs
(Contract EY-76-C-09-0001)
(DP-1534) Avail: NTIS HC A02/MF A01

A portable interfacing instrument is described that accepts digital information from a pulse height analyzer and displays it as an energy spectrum on an ordinary laboratory oscilloscope. DOE

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-19479 Duke Univ., Durham, N. C.
DEVELOPMENT OF A LASER-DOPPLER VELOCIMETER FOR USE IN THE AQUATIC ENVIRONMENT Ph.D. Thesis
John Robert Custer 1979 59 p
Avail: Univ. Microfilms Order No. 8002643

The development of a submersible laser Doppler velocimeter (LDV) for measuring turbulence in natural bodies of water is discussed. Comparison of the characteristics of currently used velocity transducers and those of an LDV current meter shows that the laser current meter represents a step in improving the

accuracy of velocity measurements in lakes, rivers, or the ocean. The restrictions which are imposed on such an instrument for the physics of laser velocimetry are described. The motion of typical oceanic particles is analyzed to determine whether or not they can follow the velocity fluctuations expected to be present in such flow. The results indicate that such particles can closely follow the motion of the fluid. The results include mean velocity profiles and mean-squared velocity fluctuation profiles taken in a tidal channel. Dissert. Abstr.

N80-19480*# Illinois Univ., Urbana. Gaseous Electronics Lab.
LASING CHARACTERISTICS OF GAS MIXTURES INVOLVING UFG: APPLICATION TO NUCLEAR PUMPING OF LASERS Final Report
J. T. Verdeyen and J. G. Eden 26 Mar. 1980 19 p. refs
(Grant NsG-1609)
(NASA-CR-162618) Avail: NTIS HC A02/MF A01 CSCL 20E

Intense blue-green fluorescence from a structured band centered at lambda approximately 484 nm was observed from Ar, CF3I and NF3 gas mixtures excited by an electron beam. This emission was tentatively assigned to the E yields A transition of the iodine monofluoride (IF) molecule. The fluorescence efficiency of the IF(E yields A) band and the IF (E) state radiative lifetime were estimated to be approximately 6% and 15 ns, respectively. The emission band structure, the short IF(E) radiative lifetime and the Franck-Condon shift between the E and A states suggest that IF is an attractive candidate for a blue-green laser. R.E.S.

N80-19481# Materials Research Labs., Ascot Vale (Australia).
ERRORS IN THE MEASUREMENT OF ANGLE WITH A LASER INTERFEROMETER
Lilian M. Ramsay and David B. Prowse Apr. 1979 14 p ref
(AD-A078048; MRL-TN-420) Avail: NTIS HC A02/MF A01 CSCL 20/6

It is shown that when a laser interferometer is used for general angle measurement, including the calibration of angle measuring instruments such as rotary tables, errors of 30 inches or more can occur unless great care is taken in the optical alignment. On the other hand, if the instrument is carefully aligned, an accuracy of + or - 14 degrees occurs. The errors that occur are independent of the sensitivity of the interferometer system. GRA

N80-19482# Naval Research Lab., Washington, D. C.
THE THEORY OF FREE ELECTRON LASERS Interim Report
P. Sprangle and Robert A. Smith 18 Sep. 1979 29 p refs
(DARPA Order 3817)
(AD-A075363; NRL-MR-4033) Avail: NTIS
HC A03/MF A01 CSCL 20/5

A general analysis is presented of free electron lasers in which a static periodic magnetic pump field is scatterd from a relativistic electron beam. The steady state formulation of the problem is fully relativistic and contains beam thermal effects. Growth rates associated with the radiation field, efficiencies, and saturated field amplitudes are derived for various modes of operation. Effects of space charge on the scattering process are included and shown to play a dominant role in certain situations. Scaling laws for the growth rates and efficiencies at a fixed radiation frequency as a function of the magnetic pump amplitude are obtained. The shear in beam axial velocity due to self fields is discussed and various methods of reducing it are suggested. Finally, a detailed illustration of a far infrared (lambda = 2mu m) two-stage free electron laser using a 3 MeV electron beam and a 2 cm wavelength magnetic pump field is presented. GRA

N80-19483# University of Southern California, Los Angeles.
INVESTIGATION OF SURFACE STABILIZED HIGH-PRESSURE GAS DISCHARGES Final Report, 22 May 1978 - 21 May 1979
Clad P. Christensen 20 Jun. 1979 24 p refs
(Contract N00173-78-C-0440)
(AD-A077040) Avail: NTIS HC A02/MF A01 CSCL 20/5

The research program described herein is an experimental investigation of problems associated with the production of stable, long-duration discharges in rare gas halogen mixtures. The work is oriented toward homogeneous, high-level excitation of small gas volumes (about 1 cu cm) with the ultimate goal being construction of a discharge-pumped rare gas halide laser which is capable of an output pulse duration greater than one microsecond. GRA

N80-19484# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
INJECTION LASER WAVEGUIDE COUPLER Final Report
R. R. Rice Jun. 1979 79 p refs
(Contract N00173-78-C-0087)
(AD-A077030) Avail: NTIS HC A05/MF A01 CSCL 20/6

The efficiency with which a double-heterostructure, GaAlAs laser diode can be edge-coupled to a Ti:LiNbO3 diffused waveguide has been studied using both theoretical and experimental approaches. Both the analytical and the numerical estimates of the coupling efficiency predict maximum efficiencies of approximately 50% for the laser diodes used in this program. Measurements of the sensitivity of the coupling efficiency to both transverse and longitudinal misalignment have been performed and these measurements show the coupling efficiency to be a slow function of the longitudinal separation and a strong function of the transverse offset. When the measured data are fit to an analytical model, the results indicate that a maximum coupling efficiency of about 50% has been achieved. Two coupler chips were fabricated and delivered to NRL. The coupler chips used a flip-chip design and were fabricated on silicon substrates. The units delivered to NRL had coupling efficiencies of 5% - 10% and thus fell short of the theoretically predicted efficiency. This result was due primarily to the stringent alignment tolerance imposed by the sensitivity of the coupling efficiency to transverse offset. GRA

N80-19485# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
CHEMICALLY PUMPED IODINE LASER Final Report
S. Hurlock, H. Laeger, and R. Wagner Kirtland AFB, N. Mex. AFWL Sep. 1979 230 p refs
(Contract F29601-78-C-0023; AF Proj. 3326)
(AD-A078919; AFWL-TR-79-52) Avail: NTIS
HC A11/MF A01 CSCL 20/5

The production of O2(1 delta) by the reaction of chlorine fluorosulfate (CFS) vapor and chlorine gas with concentrated basic hydrogen peroxide solutions was studied under conditions of controlled contact area, contact time, and temperature. Variables were temperature, CFS and C1(-2) flowrates, liquid flowrates, and liquid concentrations. Effluent flow, O(-2) flow, and O2(1 delta)/O2 were measured. O2(1 delta) yields with the CFS were lower than with C1(-2) due to quenching. O(-2) production was about the same, governed primarily by contact time, liquid flow and temperature. Qualitative quenching experiments identified serious quenchers present in the CFS system. GRA

N80-19486# Army Electronics Research and Development Command, Fort Monmouth, N. J.
DEVELOPMENT OF THE NEODYMIUM PENTAPHOSPHATE (NPP) LASER Final Report
J. Gualtieri Oct. 1979 49 p refs
(DA Proj. 1T1-61102-AH-46)
(AD-A078603; DELNV-TR-79-5) Avail: NTIS
HC A03/MF A01 CSCL 20/5

The structural properties of NPP are examined and the effect of twin domain boundaries on light propagation are discussed. Spectroscopic properties of NPP and other lanthanide pentaphosphates are outlined. The advantages of NPP as a laser material for miniature rangefinder and long distance fiber optic application are discussed. Laser and device considerations are reviewed and a miniature NPP laser cavity with all components individually removable for easy replacement (overall size 1.5 by 1.5 by 4.4 cm) are discussed. GRA

N80-19487# Illinois Univ. at Urbana-Champaign. Dept. of Aeronautical and Astronautical Engineering.
AN EFFICIENT ROTATIONAL NONEQUILIBRIUM MODEL OF A CW CHEMICAL LASER Final Report, 15 May 1978 - 14 May 1979

Lee H. Sentman and Warren Brandkamp Jul. 1979 113 p refs Prepared in cooperation with Textron Bell Aerospace, Buffalo, N.Y.
(Grant AF-AFOSR-3669-78; AF Proj. 2303)
(AD-A078485; AAE-TR-79-5; UILU-ENG-79-0505; AFOSR-79-1234TR) Avail: NTIS HC A06/MF A01 CSCL 20/5

An efficient rotational nonequilibrium model of a cw chemical laser was developed. The essential elements of the model and their influence on laser performance were shown by detailed comparison with a model which contains boundary layer flow striations, F atom wall recombination and detailed, finite rate kinetics (typically 21 species and 143 reactions). Rotational equilibrium and nonequilibrium species profiles, saturated gains, intensity distributions and power spectral distributions were compared for several cases. The rotational nonequilibrium model was coupled to a physical optics strip resonator code. GRA

N80-19488# Oak Ridge Associated Universities, Tenn.
PLANS FOR LASER HYPERFINE STRUCTURE MEASUREMENT AT UNISOR
H. K. Carter and C. R. Bingham 1979 6 p refs Presented at Intern. Symp. on Future Directions in Studies of Nuclei Far from Stability, Nashville, Tenn., 10 Sep. 1979
(Contract W-7405-eng-26)
(CONF-790976-1) Avail: NTIS HC A02/MF A01

The feasibility of optical spectroscopy experiments were studied in order to determine nuclear spins, moments, and changes in the root-mean-square charge radius. The technique is reviewed with the details for the experimental procedure described. The resolution and sensitivity expected is discussed. DOE

N80-19489# Oak Ridge Y-12 Plant, Tenn. Fabrication Systems Dept.
USE OF LASER INTERFEROMETER FOR POSITION FEEDBACK
W. E. Barkman Oct. 1979 19 p
(Contract W-7405-eng-26)
(Y-2188) Avail: NTIS HC A02/MF A01

Application of laser interferometer position-measuring systems to monitoring the position of machine tool slides is considered. It is indicated that the laser systems have an accuracy of + or - 0.5 parts/per/million and a maximum measuring velocity of 18m/min. The laser systems also permit the user to measure more directly the location of the point of interest. DOE

N80-19490# National Technical Information Service, Springfield, Va.
CARBON MONOXIDE LASERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Dec. 1979
Brian Carrigan Dec. 1979 228 p Supersedes NTIS/PS-76/0933; NTIS/PS-75/658; NTIS/PS-75/016;NTIS/PS-78 /1319; NTIS/PS-77/1107
(PB80-803133; NTIS/PS-78/1319; NTIS/PS-77/1107; NTIS/PS-76/0933; NTIS/PS-75/658; NTIS/PS-75/016) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

Gas discharge, gas dynamics electron beam, and infrared and chemical lasers involving carbon monoxide as a lasing medium are topics addressed. Molecular excitation, energy transfer, and reaction kinetics are discussed. Studies on laser pumping are included. This updated bibliography contains 221 abstracts, 11 of which are new entries to the previous edition. GRA

N80-19491# National Technical Information Service, Springfield, Va.
CARBON MONOXIDE LASERS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Dec. 1979
Brian Carrigan Dec. 1979 149 p Supersedes NTIS/PS-78/1321; NTIS/PS-77/1108; NTIS/PS-76/0934
(PB80-803141; NTIS/PS-78/1321; NTIS/PS-77/1108; NTIS/PS-76/0934) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

Carbon monoxide lasers are discussed with topics on excitation, plasmas, development, molecular reactions, equipment, optics, transitions, and gas mixtures. Studies on optical pumping gas dynamics, chemical reactions, kinetics, and performance are covered. This updated bibliography contains 142 abstracts, 15 of which are new entries to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-19492 Illinois Univ. at Urbana-Champaign.
ENERGY CONSERVATION IN THE U.S. ECONOMY FROM INCREASED RECYCLE OF OBSOLETE STEEL SCRAP Ph.D. Thesis
James Ray Brodrick 1979 111 p
Avail: Univ. Microfilms Order No. 8004142

An energy model of the steel industry is formed from information on both the steel production technologies and the scrap recycle industry. The model is optimizied by use of linear programming techniques to minimize the energy intensity of steel. The optimum point of obsolete scrap recycle is about six times the amount recycled in 1967 for a decrease of 8.5 percent in the existing energy intensity. With this amount of recycling, some scrap accumulated in disposal areas from previous years would have to be reclaimed. The scrap-intensive steelmaking processes, especially the all-scrap open hearth, increase their portion of the production, while the basic oxygen production decreases. The labor impact of this energy conservation measure is a tradeoff between the labor of the iron ore and coal mines to the labor of the scrap recycling insutry. As more scrap is recycled, the labor intensity of the steel producing system is increased. Dissert. Abstr.

N80-19493 Engineering Sciences Data Unit, London (England).
EQUILIBRIUM TEMPERATURES IN SELF-CONTAINED BEARING ASSEMBLIES. PART 5: EXAMPLES OF THE COMPLETE METHOD
1979 67 p
(ESDU-79002; ISSN-0141-2590; ISSN-0141-3996) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

Methods of estimating the temperature rise in a simple bearing assembly in order to assess the need for redesign or more refined analysis are presented. The bearing assemblies apply to all types of machinery from domestic appliances to spacecraft mechanisms. The developed analyses refer to simple bearing assemblies in which there is no separate, external, cooling system. It is applicable also to the estimation of temperatures at localized heat sources of moderate intensity in other types of assembly having a high degree of cylindrical symmetry. ESDU

N80-19494 British Library Lending Div., Boston Spa (England).
EXPERIMENTAL INVESTIGATION INTO THE HEAT FLUX IN THE PISTON AND CYLINDER LINER OF A HIGH-SPEED DIESEL ENGINE
Gerhard Woschni Oct. 1979 19 p refs Transl. into ENGLISH from MTZ Motortech. Z. (West Germany), v. 39, 1978 p 12 (BLL-RTS-11902) Avail: British Library Lending Div., Boston Spa, Engl.

The heat transfer in a high speed diesel engine with external supercharging was investigated. The heat balance, the measured temperature distributions, and the measured time variable surface temperatures were evaluated in order to separately determine the heat transmitted to the component pistons, cylinder head, and cylinder liner. A.W.H.

N80-19495*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DAMPING IN TAPERED ANNULAR SEALS FOR AN INCOMPRESSIBLE FLUID
David P. Fleming Apr. 1980 22 p refs
(NASA-TP-1646; E-124) Avail: NTIS HC A02/MF A01 CSCL 11A

Damping in annular seals is calculated for an incompressible fluid. Results show that damping in tapered seals optimized for stiffness is considerably less than that in straight seals for the same minimum clearance. Damping in rotating seals can promote

fractional frequency whirl. Neglecting fluid acceleration makes solution much easier, but leads to errors in calculated damping of up to 16 percent. K.L.

N80-19496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CALCULATED AND EXPERIMENTAL DATA FOR A 118-mm BORE ROLLER BEARING TO 3 MILLION DN
Harold H. Coe and Frederick T. Schuller 1980 37 p refs Proposed for presentation at Intern. Lubrication Conf., San Francisco, 18-21 Aug. 1980; sponsored by ASME and the Am. Soc. of Lubrication Engr.
(NASA-TM-81427; E-063) Avail: NTIS HC A03/MF A01 CSCL 13I

The operating characteristics for 118 mm bore cylindrical roller bearing are examined using the computer program CYBEAN. The predicted results of inner and outer-race temperatures and heat transferred to the lubricant generally compared well with experimental data for shaft speeds to 3 million DN (25,000 rpm), radial loads to 8900 N (2000 lb), and total lubricant flow rates to 0.0102 cu m/min (2.7 gal/min). M.G.

N80-19497*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FERROGRAPHIC AND SPECTROGRAPHIC ANALYSIS OF OIL SAMPLED BEFORE AND AFTER FAILURE OF A JET ENGINE
William R. Jones, Jr. Feb. 1980 20 p refs
(NASA-TM-81430; E-353) Avail: NTIS HC A02/MF A01 CSCL 21E

An experimental gas turbine engine was destroyed as a result of the combustion of its titanium components. Several engine oil samples (before and after the failure) were analyzed with a Ferrograph as well as plasma, atomic absorption, and emission spectrometers. The analyses indicated that a lubrication system failure was not a causative factor in the engine failure. Neither an abnormal wear mechanism, nor a high level of wear debris was detected in the oil sample from the engine just prior to the test in which the failure occurred. However, low concentrations of titanium were evident in this sample and samples taken earlier. After the failure, higher titanium concentrations were detected in oil samples taken from different engine locations. Ferrographic analysis indicated that most of the titanium was contained in spherical metallic debris after the failure. K.L.

N80-19498*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IDEAL SPIRAL BEVEL GEARS: A NEW APPROACH TO SURFACE GEOMETRY
R. L. Huston (Cincinnati Univ., Ohio) and J. J. Coy 1980 22 p refs Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, 18-22 Aug. 1980; sponsored by ASME
(NASA-TM-81446; E-366; AVRADCOM-TR-80-C-5) Avail: NTIS HC A02/MF A01 CSCL 13I

The fundamental geometrical characteristics of spiral bevel gear tooth surfaces are discussed. The parametric representation of an ideal spiral bevel tooth is developed based on the elements of involute geometry, differential geometry, and fundamental gearing kinematics. A foundation is provided for the study of nonideal gears and the effects of deviations from ideal geometry on the contact stresses, lubrication, wear, fatigue life, and gearing kinematics. M.G.

N80-19499*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ON THE CHARACTERISTICS OF CENTRIFUGAL-RECIPROCATING MACHINES
W. H. Higa 1 Feb. 1980 28 p
(Contract NAS7-100)
(NASA-CR-162881; JPL-Pub-79-108) Avail: NTIS HC A03/MF A01 CSCL 13I

A method of compressing helium gas for cryogenic coolers is presented which uses centrifugal force to reduce the forces on the connecting rod and crankshaft in the usual reciprocating compressor. This is achieved by rotating the piston-cylinder assembly at a speed sufficient for the centrifugal force on the piston to overcome the compressional force due to the working fluid. The rotating assembly is dynamically braked in order to recharge the working space with fluid. The intake stroke consists of decelerating the rotating piston-cylinder assembly and the exhaust stroke consists of accelerating the assembly. K.L.

N80-19500# Army Materials and Mechanics Research Center, Watertown, Mass.
CHARACTERISTICS OF MECHANICALLY FASTENED JOINTS OF CIP/HIP-1 BERYLLIUM Final Report
Shun-Chin Chou and James H. Rainey Aug. 1979 37 p
(DA Proj. 8X3-63304-D-215)
(AD-A078275; AMMRC-TR-79-48) Avail: NTIS HC A03/MF A01 CSCL 13/5

Mechanically fastened joints of CIP/HIP-1 beryllium were investigated. A standard ASTM pin-jointed bearing strength test was used to determine the effect of hole size and edge distance-to-thickness ratios on the bearing strength of beryllium plates. Joints for structures were studied by testing two types of arrangements of pin holes with different transverse pitches. From the standard ASTM pin-jointed bearing strength tests, it was determined that the design criterion for single-pinned joints of CIP/HIP-1 beryllium should be based on maximum stress instead of net cross-section stress. Furthermore, it was found that if the edge distance-to-pin diameter ratio was kept constant, the specimens would have the same bearing yield stress, bearing strength, and maximum bearing strain. In the investigation of structural bolted joints, the double-bolted joints show that the transverse pitch and hole pattern have no effect on the load-carrying capability. GRA

N80-19501# Westinghouse Research and Development Center, Pittsburgh, Pa.
INVESTIGATION OF WELD POOL STRUCTURE AND PROPERTY CONTROL IN PULSED ARC WELDING Annual Progress Report, 15 Sep. 1978 - 14 Sep. 1979
G. M. Ecer, G. G. Lessman, and H. D. Brody 9 Nov. 1979 57 p refs Prepared in cooperation with Pittsburg Univ., Pa.
(Contract N00014-77-C-0596)
(AD-A078222; Rept-79-9D4-PULSE-R1) Avail: NTIS HC A04/MF A01 CSCL 13/8

Full penetration pulsed current gas tungsten arc welds on Fe-26Ni alloy sheets were dimensionally and structurally analyzed. Weld pool kinetics and weld surface ripple formation were studied using high speed motion pictures, conventional and scanning electron metallography, and x-ray dispersive analysis. The two dimensional heat flow computer model developed during the last year was modified to reflect more realistic convective flow in the weld pool, anode size and atmospheric heat loss. Work on thick plate welds and the computational model for 3D heat flow and solute segregation under pulsing were initiated. Some degree of structural control in the weld fusion zone of full penetration welds was found to be feasible. A mechanism for the formation of weld surface ripples and a technique of estimating local solid growth rates from the ripples were proposed. GRA

N80-19502# United Technologies Research Center, East Hartford, Conn.
MODELING OF THE HOT ISOSTATIC PRESSING PROCESS Interim Report, 15 Jul. 1978 - 14 Jul. 1979
Brice N. Cassenti and K. J. Cheverton Sep. 1979 133 p refs
(Contract F49620-78-C-0090; AF Proj. 2307)
(AD-A078162; AFOSR-79-1236TR) Avail: NTIS HC A07/MF A01 CSCL 13/8

This report describes the first year of progress of a two year investigation to develop a modeling strategy to predict the final shape of components manufactured by the Hot Isostatic Pressing (HIP) process. When a powder metal is subjected to the high pressures at high temperatures there is a permanent reduction in the macroscopic volume by approximately 30 percent. The volume reduction, which is not included in classical creep and plasticity theories, necessitates the modification of the classical theories. The major part of this report concerns the development of a constitutive model for powder metals. A model for powder metals subjected to an external hydrostatic pressure has been developed and compares well with experimental results. The exact form of the theory depends on the results of mechanical tests presently being performed. The constitutive model is being incorporated into the MARC Analysis Research Corporation

(MARC) nonlinear finite element computer program and experiments analysis using the modified code will be performed to verify the accuracy of the theory. Once the theory has been verified it will be applied to the HIP of a disk where a sensitivity study will determine an efficient modeling strategy. The results and future plans of the program are discussed in detail. GRA

N80-19503# Naval Postgraduate School, Monterey, Calif.
WASTE HEAT RECOVERY UNIT DESIGN FOR GAS TURBINE PROPULSION SYSTEMS M.S. Thesis
Robert Meredith Combs Sep. 1979 301 p refs
(AD-A078154) Avail: NTIS HC A14/MF A01 CSCL 13/10

A design model for a once-through waste heat recovery unit with a segmented fin-tube arrangement was developed along with a simple model of a combined gas and steam (COGAS) turbine propulsion system. These models were integrated and applied in a computer program written in FORTRAN IV for the IBM 360-67 computer. Waste heat recovery unit designs were produced and tested at off-design conditions. Using the space constraints and power requirements of a Navy destroyer-type ship, one design was selected and employed to make estimates of possible fuel savings to be realized through the application of a COGAS system. GRA

N80-19504# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
EVALUATION OF DYNAMICALLY RIVETED JOINTS Final Report, 1 Oct. 1977 - 30 Sep. 1978
Basil P. Leftheris, H. Eidinoff, and R. E. Hooson Jul. 1979 71 p refs
(Contract N62269-77-C-0478; WF41400000)
(AD-A077223; RE-587; NADC-77202-30) Avail: NTIS HC A04/MF A01 CSCL 13/5

The performance of stress wave driven rivet installations is evaluated in terms of crack growth arresting capability, using precracked specimens subjected to constant amplitude and spectrum fatigue loading. Rivets installed in precracked holes using the Grumman Stress Wave Riveter SWR are shown to be effective in arresting crack growth. Residual stresses resulting from rivet coldwork are determined and the effective stress intensity factor K sub I is calculated. It is concluded that stress wave rivet installations offer significant potential weight saving for structures designed to a damage tolerant criteria. GRA

N80-19505# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
TRANSIENT THERMAL EFFECTS IN DISC BRAKES Final Report, Aug. 1977 - Jul. 1979
Ben J. Brookman, Jr. Nov. 1979 464 p refs
(AF Proj. 2402)
(AD-A078735; AFFDL-TR-79-3112) Avail: NTIS HC A20/MF A01 CSCL 13/6

An investigation was undertaken with the ultimate objective being to develop a general theoretical model for predicting temperatures within the stators, rotors, rim, torque tube, tire, fuse plug and bead seat of a typical disc brake assembly. The effort was divided into four phases: (1) Temperature Measurement Analysis, (2) Theoretical Analysis of Brake and Component Parts, (3) Full Scale Brake Tests, and (4) Correlation of results. GRA

N80-19506# Naval Ship Research and Development Center, Bethesda, Md.
ICE SEAL FOR ROTATING SHAFTS
Alfred B. Harbage, Jr. Oct. 1979 35 p
(ZR0220601)
(AD-A076308; DTNSRDC-79/085) Avail: NTIS HC A03/MF A01 CSCL 11/1

A sealing device utilizing water ice to form a very close-fitting liquid water capillary seal about a rotating shaft has been designed, built, and tested. The experimental shaft diameter was 6 in. (15.24 cm) and it rotated at 600 rpm. The observed leakage rates were below 0.05 cu in/sec (0.8 cu cm/s) for differential pressures up to 600 psi (4150 kPa). The maximum power required to drive the shaft was less than 500 W. A set of basic equations was developed to predict the seal performance. Experimental results indicate the basic equations are sufficiently accurate for future seal designs. GRA

N80-19507# State Univ. of New York at Buffalo.
GLOBAL BOUNDS AND APPROXIMATIONS FOR NONLINEAR DIFFUSION PROBLEMS Final Report
Paul William Davis 14 Sep. 1979 8 p refs Prepared in cooperation with Worcester Polytechnic Inst., Mass.
(Grant DAAG29-76-G-0239)
(AD-A076343; ARO-14245.5-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This final report briefly summarizes the development and application of approximation and bounding techniques to nonlinear diffusion equations modelling phenomena in lubrication theory, combustion theory, heat flow, etc. The development of mathematical techniques has been guided by the need to meet physical problems. The mathematical techniques have been used to illuminate the behavior of models of various nonlinear diffusion phenomena. Techniques include monotone approximation schemes and nonlinear comparison theorems. These permit, for example, deriving bounds on solutions of nonlinear diffusion equations by finding functions which satisfy appropriate sets of differential inequalities. A typical application of these techniques has been the exploration of the relation between the stationary approximation of combustion theory and the full, time-dependent model. GRA

N80-19508# Battelle Columbus Labs., Ohio.
HYDROGEN IN HY-130 WELD METAL Final Report, Jul. 1977 - Dec. 1978
Michael D. Hayes and Daniel Hauser May 1979 55 p refs
(Contract N00014-74-C-0407)
(AD-A077574) Avail: NTIS HC A04/MF A01 CSCL 11/6

This is the final report on a program designed to evaluate the potential for using rare-earth materials to getter hydrogen during welding. The end objective was to reduce the potential for hydrogen embrittlement in HY-130 steel welds. This report briefly summarizes work conducted during the first three years of the program, during which time several varieties of rare-earth containing-electrodes were produced. Cracking problems during drawing were encountered when rare-earth materials were added to high-strength filler wires. A method of addition was found wherein rare-earth silicon and rare-earth nickel compounds were incorporated into a rare-earth cored wire. This wire was then used as a cold-wire addition and weldments were produced by the gas metal-arc process. However, impact properties of these welds were below specified limits. This was partially attributed to the poor welding performance resulting from the rare-earth additions. Increased arc instability resulted in spatter, bead irregularity, and poor wetting action. Weldability improved when argon-O2 mixtures were used but the oxygen addition to the shielding gas oxidized all of the rare earths. GRA

N80-19509# SKF Industries, Inc., King of Prussia, Pa.
ESTABLISHMENT OF ENGINEERING DESIGN DATA FOR HYBRID STEEL/CERAMIC BALL BEARINGS Final Report, Apr. 1978 - Aug. 1979
F. R. Morrison, J. Pirvics, and T. Jonushonis Sep. 1979 63 p refs
(Contract N00019-78-C-0304)
(AD-A078934; SKF-AL79T033) Avail: NTIS HC A04/MF A01 CSCL 11/6

A hybrid steel/ceramic angular contact ball bearing was designed for optimum performance at 2.5 x 10 to the 6th power DN. A lot of bearings was fabricated to this design and life tests were conducted under two different loads. A detailed failure anlaysis was completed to define the causes for the premature silicon nitride ball failures. GRA

N80-19510# Department of Energy, Washington, D. C. Office of Technology Impacts.
ISSUES CONCERNING THE LIGHT-DUTY DIESEL
Sep. 1979 145 p refs
(DOE/EV-0050/1) Avail: NTIS HC A07/MF A01

Major issues in diesel-related policy considerations are discussed. The issues are summarized in three areas: health and environmental protection, fuel conservation, and economic and programmatic trade-offs. K.L.

N80-19511# National Technical Information Service, Springfield, Va.

THRUST, SLEEVE AND JEWEL BEARINGS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Nov. 1979
Guy E. Habercom, Jr. Dec. 1979 277 p Supersedes NTIS/PS-78/1287; NTIS/PS-77/1135 and NTIS/PS-76/0955 2 Vol.
(PB80-802630; NTIS/PS-78/1287; NTIS/PS-77/1135; NTIS/PS-76/0955) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Design, mechanical properties, and performance of thrust, sleeve, and jewel bearings are reported. Lubricantion effects, torque effects, bearing hydrodynamics, and bearing physical properties are topics addressed. This updated bibliography contains 270 abstracts, 45 of which are new entries to the previous edition. *GRA

N80-19512# National Technical Information Service, Springfield, Va.
THRUST, SLEEVE AND JEWEL BEARINGS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979
Guy E. Habercom, Jr. Dec. 1979 137 p Supersedes NTIS/PS-78/1286; NTIS/PS-77/1134; NTIS/PS-76/0953 and NTIS/PS-75/802 2 Vol.
(PB80-802622; NTIS/PS-78/1286; NTIS/PS-77/1134; NTIS/PS-76/0953; NTIS/PS-75/802) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Design and performance of thrust, sleeve, and jewel bearings are reviewed. Lubrication effects, torque effects, bearing hydrodynamics, and bearing physical properties are among the parameters investgated. This updated bibliography contains 134 abstracts, 3 of which are new entries to the previous edition. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-19513 Pittsburgh Univ., Pa.
MULTISTATE RELIABILITY MODELS AND SOME EXTENSIONS OF A UNIVARIATE SHOCK MODEL Ph.D. Thesis
William S. Griffith 1979 72 p
Avail: Univ. Microfilms Order No. 8004860

Axioms which may be used to define multistate coherent systems are examined. After obtaining some structural properties of such systems, their stochastic performance is modeled by using an expected utility function. Then an analogue of the Birnbaum reliability importance is developed, its properties discussed and some examples considered. Finally, a bivariate shock model which is used to unify various bivariate exponential distributions is considered. A number of results dealing with discrete NBU properties being transformed into continuous NBU properties in the bivariate setting are obtained. Dissert. Abstr.

N80-19514 British Library Lending Div., Boston Spa (England).
TESTING THE CONTACT CHARACTERISTICS OF ELECTRO-DEPOSITED COATINGS, PART 1
K.-L. Schiff and R. Schnabl Oct. 1979 29 p refs Transl. into ENGLISH from Metalloberflaeche (West Germany), v. 32, no. 10, 1978 p 423-429
(BLL-RTS-11808) Avail: British Library Lending Div., Boston Spa, Engl.

The requirements of electrical contacts are reviewed. Accelerated methods for corrosion testing contact materials and for the analytical examination of precious metal surfaces are presented with emphasis on contact resistance, electrical wear, ductility, and mechanical wear. Examples are included. A.R.H.

N80-19515*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
LIFE SCIENCES FLIGHT EXPERIMENTS PROGRAM, LIFE SCIENCES PROJECT DIVISION, PROCUREMENT QUALITY PROVISIONS
Gordon House Jan. 1980 18 p
(NASA-TM-80962; JSC-16427) Avail: NTIS HC A02/MF A01 CSCL 14D

Methods are defined for implementing quality assurance policy and requirements for life sciences laboratory equipment, experimental hardware, integration and test support equipment, and integrated payloads. K.L.

N80-19516# Stanford Univ., Calif.
ACOUSTIC MICROSCOPY FOR NONDESTRUCTIVE EVALUATION OF MATERIALS Semiannual Technical Report, 1 Feb. - 31 Jul. 1979
C. F. Quate 1979 85 p refs
(Contract F49620-78-C-0098; ARPA Order 3569; AF Proj. 2306)
(AD-A078088; SU-GL-3023; AFOSR-79-1259TR) Avail: NTIS HC A05/MF A01 CSCL 17/1

Research in the Field of acoustic microscopy is described for the first half of 1979. The properties and design of the acoustic transducer lens combination is detailed. The source of contact in the acoustic images for both material surfaces and integrated circuits is discussed with the view of determining how small changes in surface elastic properties alter the reflectivity for a spherically converging beam. The use of liquid gallium in the lens is described. Some of the work on the photoacoustic microscope is included. GRA

N80-19517# Stanford Univ., Calif.
RESEARCH ON NONDESTRUCTIVE TESTING Final Report, 1 Sep. 1978 - 31 Aug. 1979
G. S. Kino Oct. 1979 51 p refs
(Grant AF-AFOSR-3726-78)
(AD-A078483; SU-GL-3049; AFOSR-79-1261TR) Avail: NTIS HC A04/MF A01 CSCL 14/2

The aim of this year's work has been to establish new techniques for measuring the properties of materials with the ultimate aim of determining material properties such as hardness and yield strength and being able to predict the life and servicibility of mechanical structures. We have limited ourselves to acoustic measurement techniques. Our purpose is to correlate the results of acoustic measurements with the mechanical properties of the material of interest. The project has been divided into two parts: (1) the characterization of microstructure by acoustic NDE, and (2) the measurement of stress states by acoustic NDE. GRA

N80-19518# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
EVALUATION OF AND RECOMMENDED CHANGE TO THE RELIABILITY IMPROVEMENT WARRANTY (RIW) GUIDELINES M.S. Thesis
Mark C. Jacobson and Reagan L. Skaggs Sep. 1979 101 p refs
(AD-A077672; AFIT-LSSR-23-79B) Avail: NTIS HC A06/MF A01 CSCL 14/4

The reliability improvement warranty is a relatively new acquisition technique in government contracting. To encourage effective use of the technique, HQ USAF Directorate of Procurement Policy (LGP) published the pamphlet entitled Interim Guidelines Reliability Improvement Warranty (RIW) in July, 1974. This pamphlet provided guidance in the areas of application criteria, funding, provisions, determination of cost effectiveness, and general implementation and administrative information. Since the guidelines had not been revised since publication, the researchers' objectives were to determine if the guidelines were adequate and to obtain recommendations for improving those guidelines, if necessary. To meet those objectives, 24 individuals knowledgeable in the area of RIW were interviewed. Their perceptions were gathered through ten scaled response questions that addressed main areas within the guidelines. The distribution of responses were tested via the Kolmogorov-Sinirnov two sample test to determine the adequacy of the area. Interviewees also recommended changes to correct perceived problem areas via open ended response questions. The researchers concluded the guidelines were inadequate in a number of areas, e.g., evaluation of candidates, example clauses, administrative concerns and cost-benefit analysis among others. Suggestions for increased detail, more examples, deeper rationale and organization into a regulation were made. GRA

N80-19519# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AVIONICS RELIABILITY, ITS TECHNIQUES AND RELATED DISCIPLINES
Manfred C. Jacobson (AeG-Telefunken, Ulm, West Germany). Oct. 1979. 536 p. refs. In ENGLISH and FRENCH. Conf. held in Ankara, 9-13 Apr. 1979.
(AGARD-CP-261; ISBN-92-835-0254-X). Avail: NTIS. HC A23/MF A01.

A state of the art review of topics related to reliability and logistics in avionics systems is given. General concepts, reliability/availability requirements and demonstration, reliability and maintainability practices and effects in avionics design, development and production, software reliability, and logistics support aspects are among the topics discussed. For individual titles, see N80-19520 through N80-19561.

N80-19520# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF THE EVOLUTION OF THE RELIABILITY AND MAINTAINABILITY DISCIPLINES
M. B. Kline, J. Di Pasquale, T. A. Hamilton, and R. L. Masten. *In* AGARD. Avionics Reliability, Its Tech. and Related Disciplines. Oct. 1979. 24 p. Prepared in cooperation with Naval Weapons Center. (For primary document see N80-19519 10-38).
Avail: NTIS. HC A23/MF A01.

The results of a study of the development of the reliability and maintainability (R&M) disciplines are presented. The exponential rate of growth shown during this period is an indication of the dynamic nature and importance of these disciplines to system development, design, and operation. Family trees of each discipline developed to indicate the growth and branching of the relevant subject matter are presented. The direction and rate of growth of these disciplines in each of the decades of interest are analyzed along with projections of current and future trends. Applications of R&M in both the private and public sectors, including defense, space, energy, transportation, industrial and consumer items, are examined. J.M.S.

N80-19521# Royal Signals and Radar Establishment, Malvern (England).
DIFFICULTIES IN PREDICTING AVIONICS RELIABILITY
J. E. Green. *In* AGARD. Avionics Reliability, Its Tech. and Related Disciplines. Oct. 1979. 7 p. refs. (For primary document see N80-19519 10-38).
Avail: NTIS. HC A23/MF A01.

Avionics reliability prediction techniques are considered with particular attention given to factors which significantly influence reliability. These include types of aircraft, the duration and type of sortie, the frequency of use, and the incidence of reported but unconfirmed failures which nevertheless result in maintenance actions. It is shown that failures are nonexponentially distributed during a sortie, although conventional predictions are based on the exponential distribution. Therefore, various proposals for predicting avionics reliability are presented to overcome this discrepancy. The difficulties in making predictions for the latest microelectronic devices are considered with reference to MIL-HDBK-21 B and emphasis on the potential reliability of LSI and microprocessors. The significance of the choice of quality factors is noted. J.M.S.

N80-19522# Naval Postgraduate School, Monterey, Calif.
RELIABILITY GROWTH MODELS
W. M. Woods. *In* AGARD. Avionics Reliability, Its Tech. and Related Disciplines. Oct. 1979. 21 p. refs. (For primary document see N80-19519 10-38).
Avail: NTIS. HC A23/MF A01.

The concept of reliability growth models is introduced. Two reliability growth models are presented, one for time data and one for attributes data. Their uses are discussed and the methods for evaluating them are presented in graphical and tabular form. Both models show reasonable accuracy for reasonable amounts of testing under a wide variety of actual reliability growth and nongrowth. J.M.S.

N80-19523# Elektronik-System G.m.b.H., Munich (West Germany).
A SIMULATION PROGRAM FOR THE DETERMINATION OF SYSTEM RELIABILITY OF COMPLEX AVIONIC SYSTEMS
Christian Krause and Hubert Limbrunner. *In* AGARD. Avionics Reliability, Its Tech. and Related Disciplines. Oct. 1979. 9 p. ref. (For primary document see N80-19519 10-38).
Avail: NTIS. HC A23/MF A01.

The simulation program SIMZUV which computes system reliability according to the Monte Carlo method is described. This program enables the realistic consideration of complex failure logics of meshed systems, couplings of failures of different units and different mission phases, which is possible by the selection of a certain formulation of these marginal conditions. In its capacity as a simulation program, SIMZUV is capable of considering condition and time dependent failure rates and various unit reliability functions. It is shown that it is possible to perform the simulation of a substitute system of higher failure rates with short computer time, after a transformation of the failure rates. It is demonstrated that the reliability curve of the actual system can be computed from the reliability curve of the substitute system via a linear system of equations.

N80-19524# British Aerospace Dynamics Group, Stevenage (England).
MICRO-ELECTRONIC SYSTEMS RELIABILITY PREDICTION
P. D. T. OConnor. *In* AGARD. Avionics Reliability, Its Tech. and Related Disciplines. Oct. 1979. 9 p. refs. (For primary document see N80-19519 10-38).
Avail: NTIS. HC A23/MF A01.

Existing methods of parts stress analysis failure rate prediction, based upon US-MIL-HBK-217C, as applied to microelectronic logic and memory devices are reviewed. The extent to which the failure rate prediction formulas used in MIL HBK 217C are compatible with the physics of the various failure modes experienced, and with the failure statistics available, are investigated. The effects of the failure rate distributions of the various failure modes are considered in relation to the objective of deriving a simple constant-failure-rate prediction model. Proposals are made for methods of improving the effectiveness of micro-electronics reliability prediction both as a design aid and for forecasting, and for areas of further study. A proposed alternative model is presented, with an example of its use to predict the failure rate of a typical system. J.M.S.

N80-19525# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Dept. of Electrical Engineering.
MARKOVIAN AVAILABILITY MODEL FOR A NETWORK OF COMMUNICATING COMPUTERS
Thad L. Regulinski. *In* AGARD. Avionics Reliability, Its Tech. and Related Disciplines. Oct. 1979. 7 p. refs. (For primary document see N80-19519 10-38).
Avail: NTIS. HC A23/MF A01.

The availability function is modeled from a Markovian state-discrete, time-continuous formulation encompassing those adverse conditions which contribute to the network's total down time. The results of three and four state models are derived under assumption of temporally homogeneous, first order, Markovian process. Using sensitivity analysis, the effect of variation of state transition probabilities on the steady state availability function is examined and illustrated by an example. J.M.S.

N80-19526# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. des Systemes Balistiques et Spatieux.
FAST ESTIMATION OF THREE PARAMETERS OF WEIBULL LAW [ESTIMATION RAPIDE DES TROIS PARAMETRES D'UNE LOI DE WEIBULL]
Robert Attuly and Christian Bertin. *In* AGARD. Avionics Reliability, Its Tech. and Related Disciplines. Oct. 1979. 27 p. refs. In FRENCH. (For primary document see N80-19519 10-38).
Avail: NTIS. HC A23/MF A01.

Estimating the three parameters of Weibull distribution is a delicate operation particularly in the case of a small-size population. The maximum likelihood method (M.L.E.) leads to a system of equations requiring considerable calculation, moreover, the convergence of algorithms is not guaranteed by reason of the particular form of the probability function. The saturation method proposed uses the quasi-exhaustivity of a small number of statistics related to the population and gives results near those obtained by the M.L.E. method (when it can be used) and also provides the advantages of being easy, graphic, or

analytic. The method accounts for the size of the sample. Only the statistics associated with the population must be stored in the memory. In addition, the method is free (in the sense of E.T. Jayne) from errors related to the hypothesis of the rule. This point leads to the concept of a reduced parametric hypothesis, and in particular, to the four parametric law which generalizes the Weibull distribution, the gamma function, and the normal density function at the same time. Transl. by A.R.H.

N80-19527# Annc Research Corp., Annapolis, Md.
RELIABILITY IMPROVEMENT WARRANTY: AN OVERVIEW
Harold S. Balaban *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 9 p refs (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

The concept, genesis, and development of reliability improvement warranty (RIW) in the United States is reviewed. The application of RIW concepts to military procurements is dicussed. The rapidly increasing use of this procurement/logistic concept strongly suggests that RIW is now a viable approach to securing reliable and maintainable equipment at a reasonable cost. R.E.S.

N80-19528# Thomson-CSF, Orsay (France).
RELIABILITY CLAUSES IN CONTRACTS [LES CLAUSES DE FIABILITE DANS LES CONTRATS]
J. P. Plantard *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 8 p In FRENCH (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

The contents of two documents produced by an interministerial Working Group of the Committee for Telecommunication Coordination are examined with respect to the objectives, the most prominent technical points, and the details for their application. The documents cited contain recommendations for the introduction of reliability clauses for equipment and systems. Guidelines for establishing a reliability plan are included. Transl. by A.R.H.

N80-19529# Crouzet Aerospace and Systems, Valence (France).
THE INCREASE OF THE RELIABILITY OF ELECTRONIC EQUIPMENT SUBJECT TO RELIABILITY CLAUSES [ETUDE DE LA CROISSANCE DE LA FIABILITE D'UN EQUIPMENT ELECTRONIQUE SOUMIS A DES CLAUSES DE FIABILITE]
J. C. Chabin *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 9 p refs In FRENCH (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

The appearance of reliability warranties is one of the preponderant factors in the interest shown by equipment manufacturers in techniques for reliability forecasting. The results established at the beginning of work with material are often very far from the forecast, but the different tasks associated with the reliability programs applied to equipment allow for improvement in performance. Knowledge of the rule of reliability growth as a function of the time of accumulated operation of the equipment that is made the object of permanent efforts of improvement, should help the equipment manufacturer to better support his reliability forecast when negotiating a warranty. Transl. by A.R.H.

N80-19530# Service Technique des Telecommunications de l'Air, Paris (France).
RELIABILITY IMPROVEMENT DUE TO THE APPLICATION OF CLAUSES OF OPERATIONAL RELIABILITY [AMELIORATIONS DE FIABILITE DUES A L'APPLICATION DES CLAUSES DE FIABILITE OPERATIONELLE]
J. Laurenabu *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 9 p In FRENCH (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

Good reliability in the diverse constituents is necessary in order to obtain the good operational availability of any weapon system. All organized bodies charged with provisioning or maintaining equipment are concerned with obtaining the optimum reliability taking into account the imposed financial constraints. Reliability is determined by choices made from the time of equipment design, but it can be improved by observing its real operation and by modifying it. The system used to recognize and improve the reliability of certain equipment used on different aircraft in the French army is described and results are given for a concrete case. To be able to improve the reliability of equipment, the following are necessary: (1) gather data concerning failures (technical facts); (2) determine the actual reliability during use; (3) define the modifications to be made; (4) persuade the manufacturer to improve the reliability of the equipment and make modifications; and (5) control the incidences of improvements in reliability. Transl. by A.R.H.

N80-19531# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
PRODUCTION RELIABILITY ASSURANCE (PRA): TESTING
Artfried Weihe *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 10 p (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

Production reliability assurance (PRA) tests are all-equipment-reliability tests which are applied for assurance purposes during the production phase of major equipments once the formal qualification status concerning reliability is achieved. A fundamental principle of the tests is the liability of the present and/or if the corrective action required (CAR) line is exceeded by the plot of accumulated failures. Suitable test conditions for both producer and customer are obtained by selection of an appropriate CAR line and by restart of the plot after a specific test experience is gained. A comparison with fixed - length tests shows that shorter time to decisions is obtained in the case of PRA testing. R.E.S.

N80-19532# Thomson-CSF, Malakoff (France).
METHODS USED FOR DISCERNING THE RELIABILITY OF MILITARY AIRCRAFT RADAR [METHODES UTILISEES POUR CONNAITRE LA FIABILITE D'UN RADAR D'AVION D'ARMES]
J. C. Charlot *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 20 p In FRENCH (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

In an effort to ascertain the reliability of a radar onboard a military aircraft, Thomson-CFS formed an organization to collect and process the information necessary to measure the mean time of good operation. The methods for data acquisition, the members of the organization in 1979, the data management, and prospects for the future (extension to other equipment and information concerning component fabrication) are discussed. Transl. by A.R.H.

N80-19533# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
A FAULT TOLERANT ARCHITECTURE APPROACH TO AVIONICS RELIABILITY IMPROVEMENT
Donald C. Fraser and John J. Deyst *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 9 p refs (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

A difficult technology challenge in the reliability of avionics systems for advanced aircraft is identified. Three architectures are compared on the basis of a number of criteria which together constitute the issues which must be examined when considering the overall reliability, maintenance, and support problem. It is concluded from these comparisons and the limitations identified in contemporary approaches that the only effective and practical solution to the reliability challenge is through architecture. An advanced integrated, distributed fault and damage tolerant digital avionics system architecture is summarized which shows promise of meeting this challenge. Author

N80-19534*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRENDS IN RELIABILITY MODELING TECHNOLOGY FOR FAULT TOLERANT SYSTEMS
Salvatore J. Bavuso *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 12 P refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01 CSCL 14D

Developments in reliability modeling for large fault tolerant avionic computing systems are presented. Issues of state size and complexity, fault coverage, and practical computation are addressed. A two-fold developmental effort is described based on the structural and fault coverage modeling approaches. A technique which was successfully applied to an 865 state pure death stationary Markov model is presented. Of particular interest is a short computer program which executes very quickly to produce reliability results of a large state space model. This model also incorporates fault coverage states for processor, memory, and bus line replaceable units. A second structural reliability modeling scheme is aimed at solving nonstationary Markov models. This technique provides the tool required for studying the reliability of systems with nonconstant failure rates and includes intermittent/transient faults, electronic hardware which exhibits decreasing failure rates, and hydromechanical devices which typically have wearout failure mechanisms. Several aspects of fault coverage, including modeling and data measurement of intermittent/transient faults and latent faults, are elucidated and illustrated. The CARE II (computer-aided reliability estimation) coverage is presented and shortcomings to be eliminated are discussed. K.L.

N80-19535# Dowty Boulton Paul Ltd., Wolvenhampton (England).

NONELECTRONIC ASPECTS OF AVIONIC SYSTEM RELIABILITY

C. V. Kenmir, R. G. Hilton, and H. H. Dixon *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 12 p (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

Methods of obtaining actuation system integrity by means of redundancy are examined. The effects of control surface layout, number of power supplies, and the form of the avionics on the chosen solution are investigated. The effect of redundancy on defect rates is also discussed. Developments which improve reliability and remove constraints are considered. K.L.

N80-19536# Electronique Marcel Dassault, St. Cloud (France).

IMPACTS OF TECHNOLOGIES SELECTED ON THE RELIABILITY AND OPERATIONAL AVAILABILITY OF EQUIPMENTS. COST CONSIDERATIONS

J. M. Girard and M. Giraud *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 17 p refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

A single criterion, V, is proposed to allow manufacturers to evaluate the merits of technological variants once an equipment baseline version is designed and quoted. The V factor is computed for an airborne digital computer, a Doppler navigational radar, and a search and rescue beacon, each considered in three different versions. K.L.

N80-19537# Rome Air Development Center, Griffiss AFB, N.Y.

A NEW APPROACH TO MAINTAINABILITY PREDICTION

Joseph J. Naresky *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 14 p refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

A time synthesis maintainability prediction method was developed which directly relates diagnostic, isolation, and test subsystem characteristics to equipment/system maintainability parameters. A comprehensive set of time standards applicable to physical maintenance actions associated with equipment construction and packaging procedures is also provided. Predicted parameters include mean time to repair, maximum time to repair, mean maintenance man hours per repair, and fault isolation resolution. The method includes techniques for use with both preliminary and final design data. K.L.

N80-19538# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.

RELIABILITY GROWTH THROUGH ENVIRONMENTAL SIMULATION

Lawrence J. Phaller *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 8 p refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

Field data were used to identify unreliable line replaceable units and implement design improvements. The rate of reliability growth was found to be dependent on the unit complexity and the state of the art of the unit. Reliability growth occurred in both design and quality control. K.L.

N80-19539# Marconi-Elliott Avionic Systems Ltd., Rochester (England).

THE A-7 HEAD-UP DISPLAY RELIABILITY PROGRAMME

K. W. Boardman *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 14 p refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

The evolution of the head-up display from earlier forms of weapon aiming techniques is described. The A-7 head-up display is then introduced in terms of the reliability requirements and the contracting environment. Technical innovations introduced to meet the reliability requirements are described with emphasis on thermal design, ruggedized long life cathode ray tube technology, and durability of low voltage printed circuit connectors. The cost benefit of the reliability program is discussed. K.L.

N80-19540# Army Avionics Research and Development Activity, Fort Monmouth, N. J.

MILITARY ADAPTION OF A COMMERCIAL VOR/ILS AIRBORNE RADIO WITH A RELIABILITY IMPROVEMENT WARRANTY

Earl I. Feder and Douglas L. Niemoller (Bendix Corp., Fort Lauderdale, Fla.) *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 8 p (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

Low cost, small, lightweight airborne navigation receivers were acquired and reconfigured to meet U.S. Army aircraft specifications. The contract includes a clause requiring the manufacturer to assume responsibility for the field reliability and repair of each receiver for a minimum of four years. If successfully implemented, the reliability improvement warranty should increase reliability, availability, and maintainability and reduce the overall equipment life cycle costs. K.L.

N80-19541*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EMULATION APPLIED TO RELIABILITY ANALYSIS OF RECONFIGURABLE, HIGHLY RELIABLE, FAULT-TOLERANT COMPUTING SYSTEMS

Gerard E. Migneault *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 11 p refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01 CSCL 14D

Emulation techniques applied to the analysis of the reliability of highly reliable computer systems for future commercial aircraft are described. The lack of credible precision in reliability estimates obtained by analytical modeling techniques is first established. The difficulty is shown to be an unavoidable consequence of: (1) a high reliability requirement so demanding as to make system evaluation by use testing infeasible; (2) a complex system design technique, fault tolerance; (3) system reliability dominated by errors due to flaws in the system definition; and (4) elaborate analytical modeling techniques whose precision outputs are quite sensitive to errors of approximation in their input data. Next, the technique of emulation is described, indicating how its input is a simple description of the logical structure of a system and its output is the consequent behavior. Use of emulation techniques is discussed for pseudo-testing systems to evaluate bounds on the parameter values needed for the analytical techniques. Finally an illustrative example is presented to demonstrate from actual use the promise of the proposed application of emulation. M.G.

N80-19542# Rome Air Development Center, Griffiss AFB, N.Y. Reliability and Compatibility Div.

RELIABILITY ASSURANCE FOR LARGE SCALE INTEGRATED CIRCUITS

Robert A. McDonald *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 8 p refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

A procedure for assuring the reliability of large scale integrated circuits is presented. The procedure uses the parts of commercially proven architecture and circuit design while imposing strict procedures on the manufacture and testing of the devices. The program is divided into three broad areas of responsibility. The product evaluation group selects, analyzes, and prepares reports on devices of potential or current interest to the military. The reports are disseminated to government agencies and describe the physical construction, technology, packaging, workmanship, input protection problems, utilization difficulties, and electrical design risks. The electrical characterization group is tasked with characterizing specific devices selected for inclusion in the military specification system. The characterization effort generates the required acceptance tests that each part must pass before use and prepares device detail specifications. Overall effects of circuit loading, technology compatibility, and test vector generation are considered. The reliability assurance group stress tests the devices, assesses the failure modes, and projects a system use failure rate. M.G.

N80-19543# Thomson-CSF, Paris (France). Electron Tube Div.

RELIABILITY OF HIGH-BRIGHTNESS CRTS FOR AIRBORNE DISPLAYS

J. P. Galves and J. Brun *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 14 p (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

The reliability of high brightness monochrome or color cathode ray tubes (CRT's) for aircraft head-up display and head-down display systems is examined. The specification, which includes electrooptical performance and environmental conditions, defines the tube quality at zero operating time. Two typical examples of specifications are given. The problems encountered in designing tubes, and the solutions used to obtain the desired level of quality are briefly discussed. Reliability testing concerns random failures that occur during normal operation of the tube. After a short mathematical treatment of the principles involved, three examples of reliability tests carried out on CRT's are given. The electrooptical characteristics of CRT change during operation. This is mainly a cathode and screen wearing-out phenomenon. The life expectancy of a CRT depends on this evolution, and is thus a function of tube operating conditions. M.G.

N80-19544# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

RELIABILITY INVESTIGATIONS ON AN AUTOMATIC TEST SYSTEM

Hans-Herman Molter *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 13 p refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

Statistical methods, used to determine the reliability of a complex guided missile test system, are presented. When operating such a system, failures occur which are documented in failure reports. The failure-free periods between successive failure events are evaluated in the context of a Weibull distribution, yielding statements as to the mean time between failures, and the type of failure. The results are used to compare various systems; the influences exerted by differing operating conditions likewise become evident. The values determined in this way also contribute to localizing weak points, thus enabling purposive design measures to further increase the reliability of the test system. M.G.

N80-19545# Naval Postgraduate School, Monterey, Calif.

APPLICATION OF THE LOGNORMAL DISTRIBUTION TO CORRECTIVE MAINTENACE DOWNTIMES

Melvin B. Kline and Ronny Almog (Israeli Navy, Tel Aviv) *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 14 p refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

An analysis of corrective maintenance downtimes based on the assumption of the lognormal distribution is presented. Approximately 20 sets of existing maintainability demonstration and field data are analyzed using probability plots and goodness-of-fit tests to determine the appropriate distribution and distribution parameters. From the data analysis it is concluded that the lognormal distribution is a good descriptor of the distribution of corrective maintenance repair time. Fifteen of the nineteen cases from maintainability demonstrations of radically different designs tend to show that, with an acceptable level of significance, this assumption cannot be rejected. Similarly, the data analysis shows that the assumption of an exponential distribution should be rejected in seventeen of the cases. The percentage error in the 'mean time to repair', when assuming an exponential distribution instead of a lognormal distribution, as a matter of convenience, for calculating system availability, is found to be small. M.G.

N80-19546# Elliott-Automation Space and Advanced Military Systems Ltd., Camberley (England).

RELIABILITY MANAGEMENT OF THE AVIONIC SYSTEM OF A MILITARY STRIKE AIRCRAFT

A. P. White and J. D. Pavier *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 13 p refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

The system management techniques to achieve the reliability requirements for the avionic system of the Panavia Tornado aircraft are described. The method of apportionment of these requirements to each of the constituent parts of the system is explained. The aims, cost effectiveness, and experience to date of reliability demonstrations are outlined. M.G.

N80-19547# AEG-Telefunken, Ulm (West Germany).

INTRODUCTION TO SOFTWARE RELIABILITY: A KEY ISSUE OF COMPUTING SYSTEMS RELIABILITY

Gunter Heiner *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 13 p refs (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

An introduction to the problems of computing systems reliability is presented with special emphasis on software reliability. A survey of the fundamental approaches to achieve reliable software is given. Starting from a definition of the basic terms and a classification of various error types the concept of software reliability is examined. The problems involved in treating hardware and software reliability on common terms are discussed. For the purpose of illustrating the concept of software reliability, two simple reliability models are presented. The basic methods of attaining reliable computing are divided into the two complementary approaches of fault-avoidance and fault-tolerance. With regard to software reliability fault-avoidance is still the predominant approach. In this category the two classes of constructive and analytical methods are summarized and discussed. Constructive methods facilitate error-free software construction and provide for a good testability of the software. Analytical methods are used for software validation. The main techniques are proving, static, and dynamic analysis. Especially for systems meeting with very high safety requirements, there is need for software fault-tolerance. Two fundamental approaches to fault-tolerance by program diversity are presented and discussed. M.G.

N80-19548# Marconi Radar Systems Ltd., Chelmsford (England). Software Dept.

SOFTWARE RELIABILITY: UNDERSTANDING AND IMPROVING IT

L. Mackie *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 10 p ref (For primary document see N80-19519 10-38)

Avail: NTIS HC A23/MF A01

Concepts regarding software reliability are examined. Definitions are given of software, its quality, errors and software reliability. A few realities of software development are considered such as: the hardware/software people system; software requirements specifications; software testing; detection and correction of errors; and time necessary for software development. R.C.T.

N80-19549*# SRI International Corp., Menlo Park, Calif. Computer Science Lab.

FORMAL METHODS FOR ACHIEVING RELIABLE SOFTWARE

Jack Goldberg *In* AGARD Avionics Reliability, Its Tech. and

Related Disciplines Oct. 1979 9 p refs (For primary document see N80-19519 10-38)
(Contracts NAS1-13792; N00123-76-C-0195)
Avail: NTIS HC A23/MF A01

Requirements for reliable avionic systems are discussed in terms of the effectiveness of programming methodology. The need for methods to cope with the complexity of critical real-time systems is emphasized. Some general concepts about formal methods are presented and an example is given of the SRI hierarchical development methodology taken from the executive system of the SIFT fault tolerant computer. Formal methods with alternatives are compared and the prospects for introducing formal methods into practice are considered. R.C.T.

N80-19550# Institut de Recherche d'Informatique et d'Automatisme, Roquencourt (France).
QUANTITATIVE ASSESSMENTS OF SOFTWARE RELIABILITY
J. C. Rault, G. Memmi (ECA Automation, Saint-Cloud, France), and S. Dimont *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 11 p refs Prepared in cooperation with Thomson-CSF, Paris (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

A categorization and a description is given of those quantitative measures of software reliability leading to practical applications. The main approaches to quantitatively assessing software reliability are identified: models adapted from classical reliability theory wherein reliability is expressed in terms of software error rate; models based on sampling techniques applied to the error domain or to the input data domain; here reliability is related respectively to an estimate of the number of residual errors and to the probability of not using those input data leading to software failures; models based on program complexity measures; their basic principle is attempting to discover correlations between complexity measures and the most likely number of errors made during programming. Underlying assumptions and areas of application are indicated. It is concluded to the existence of methods of practical interest and of data that might help to understand how often, when, where, and why programmers introduce software errors and how software errors may be detected and corrected. R.C.T.

N80-19551# Rome Air Development Center, Griffiss AFB, N.Y.
AN ANALYSIS OF SOFTWARE RELIABILITY PREDICTION MODELS
Alan N. Sukert *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 11 p refs (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

Several mathematical models for predicting the reliability and error content of a software package were evaluated against error data extracted from the formalized testing of four software development projects. The results of the data collected are described using both Maximum Likelihood and Least Squares methods for estimating model parameters. Model predictions are compared on a total project, functional and error severity basis. Model predictions are also compared on an errors/day and errors/week basis for defining model time intervals. Conclusions concerning the application of these models are presented. R.C.T.

N80-19552# Gesellschaft fuer Wirtschaftliche Bautechnik m.b.H., Munich (West Germany).
ANALYTICAL SOFTWARE VERIFICATION
W. Ehrenberger and P. Puhr-Westerheide *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 25 p refs (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

Various methods for verifying the correctness of software are discussed. An example of a manual program analysis is given. A FORTRAN subroutine is analyzed, which consists of 166 code lines. Some automatic analysis methods are also discussed. A short survey is given on the various analysis methods used by automated testing tools. In the overall system level, the different kinds of applied testing strategies are mentioned. Testing in detail requires a convenient embedding of the modules to be tested. It is shown that testing in the module level can be done due to different methods as static analysis and dynamic analysis. R.C.T.

N80-19553# Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz (West Germany). Dept. of Quality Assurance of Electronic Systems.
SOFTWARE QUALITY AND ITS ASSURANCE
P. Weigel *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 11 p refs (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

The causes of failure and the development of software are discussed, and the technical means and measures for eliminating faults and impacting the software quality are described. In addition to the technical measures, the organizational means of software quality assurance are summarized. R.C.T.

N80-19554# Elliott-Automation Space and Advanced Military Systems Ltd., Camberley (England).
SOFTWARE DEVELOPMENT FOR TORNADO: A CASE HISTORY FROM THE RELIABILITY AND MAINTAINABILITY ASPECT
D. J. Harris *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 23 p (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

The methods and procedures adopted in the development program for the TORNADO aircraft are presented. Software development for TORNADO has been undertaken in four successive, but overlapping phases, namely definition, writing, testing and delivery. The key features in these four phases are given that have contributed to software reliability and maintainability. R.C.T.

N80-19555# Westinghouse Electric Corp., Hunt Valley, Md. Defense and Electronic System Center.
INTEGRATED LOGISTICS SUPPORT ADDS ANOTHER DIMENSION TO MATRIX MANAGEMENT
Richard M. Drake *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 11 p (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

The application of matrix management to integrated logistics support (ILS) is defined as a management and functional process for unified, coordinated acquisition of logistic resources required to support systems and equipments at all echelons of maintenance throughout their planned period of usefulness. The concept involves the scientific management of all necessary logistic products and services over the system life cycle with particular emphasis upon coherence, timeliness, execution, and reliability. The various elements of logistics services and the integration with matrix management are illustrated. The advantages and disadvantages of the integration are delineated and organizational diagrams are presented. The program management process is discussed with emphasis given to integrated quantitative planning and ILS products such as communicating and direction, and life cycle costs. A.W.H.

N80-19556# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Product Support Dept.
MEK: A NEW PROCEDURE FOR DEVELOPMENT OF MAINTENANCES POLICIES
Klaus Lewandowski *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 10 p (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

A procedure for the development of maintenance policies is presented for the general application in weapon system projects. The procedure is based on a detailed collection and evaluation of the maintenance expenditure expected for the weapon system. The maintenance expenditure is based upon the system technology, the reliability and maintability attributes including the given lifetime limitations, and the operational requirements and logistic concepts. The procedure is illustrated with an analysis of each step in the data collection process. The data collection process as defined begins with the task frequencies or specified values of the system specifications, proceeds to scheduled maintenance requirements, maintenance levels, personnel requirements,

technical publication requirements, and unscheduled maintenance requirements, and ends with a summary of the results. A.W.H.

N80-19557# Westinghouse Electric Corp., Hunt Valley, Md. Integrated Logistics Support Div.
THE IMPORTANCE OF INTEGRATED LOGISTICS SUPPORT CONSIDERATIONS DURING DESIGN
Robert C. Rassa *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 5 p (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

The relationship and interdependency of the integrated logistics support elements and their relationship to the design of the prime mission equipment is explored. The roles of the key personnel involved in the initial considerations are examined. Rules for the successful implementation of an integrated logistics support plan are developed and presented. A.W.H.

N80-19558# Ministry of Defence, London (England). Procurement Div.
THE INTEGRATED MANAGEMENT OF RELIABILITY AND MAINTAINABILITY IN PROCUREMENT
S. E. Shapcott and K. A. Brown *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 4 p (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

An effective procurement strategy for reliability and maintainability is discussed as documented in the DCAD Technical Publication 1/77: Achievement of Avionic Reliability and Maintainability through Integrated Management. The evolution of the strategy is reviewed, the requirements of the strategy are discussed, and the implementation of the strategy is examined. A.W.H.

N80-19559# Royal Air Force, Dereham (England). RAF Maintenance Data Centre.
RELIABILITY AND SUPPORT DATA FOR STATISTICAL EVALUATION
A. Andrews *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 14 p (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

The organization and procedures for aircraft data collection, using the maintenance data system, are described together with the methods of data storage, retrieval, and analysis. Various applications of the data as part of an integrated reliability management program are outlined. The problems in collecting and interpreting field data are discussed and difficulties in relating the data to the reliability measured in the design and development stages of new equipment are described. A.W.H.

N80-19560# Ministry of Defence, London (England).
COMPUTER SIMULATION MODEL OF THE LOGISTIC SUPPORT SYSTEM FOR ELECTRICAL ENGINEERING TEST EQUIPMENT
C. J. P. Haynes *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 13 p (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

A simulation model of the existing logistic support system for electrical engineering test equipment, developed as a research tool for evaluating the adequacy of analytical provisioning models is described. Two further simulations, developed to model alternative logistic support systems and to compare these with the current maintenance organization, are also described. The present logistic support system, the development of the three simulation models, and their potential uses are discussed. A.W.H.

N80-19561# Arinc Research Corp., Annapolis, Md.
THE RELIABILITY IMPROVEMENT WARRANTY AND ITS APPLICATION TO THE F-16 MULTINATIONAL FIGHTER PROGRAM
George Harrison *In* AGARD Avionics Reliability, Its Tech. and Related Disciplines Oct. 1979 9 p (For primary document see N80-19519 10-38)
Avail: NTIS HC A23/MF A01

The F-16 multinational fighter program is described, with particular emphasis on two aspects: the development of the F-16 reliability improvement warranty (RIW) program, and the coproduction agreements between the U.S. and the governments of Belgium, Denmark, Norway, and the Netherlands. The fundamentals of an RIW procurement, together with some of the variations that were used to suit particular applications, are described. Guidelines for RIW application are presented. A.W.H.

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-19562 Illinois Univ. at Urbana-Champaign.
AN APPROXIMATE FINITE-ELEMENT METHOD OF STRESS ANALYSIS OF NON-AXISYMMETRIC BODIES WITH ELASTIC-PLASTIC MATERIAL BEHAVIOR Ph.D. Thesis
James Neil Craddock 1979 143 p
Avail: Univ. Microfilms Order No. 8004169

A finite element method of analysis is developed for structural configurations which are derived from axisymmetric geometries but contain definite nonaxisymmetric features in the circumferential direction. The fact that the stress and strain conditions in these geometries are related to the corresponding axisymmetric solution is taken into consideration. A number of examples are presented and discussed to illustrate the accuracy of the method. The method of analysis is developed in two versions. The first version is for elastic, orthotropic materials. The second method is for elastic-plastic materials with a kinematic strain hardening model. As in the case of the elastic version, the second version also allows for orthotropic properties and the yield criterion is based on the Hill's yield function which reduces in the limit to von Mises-Hencky for isotropic materials. Dissert. Abstr.

N80-19563*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYDROELASTIC VIBRATION ANALYSIS OF PARTIALLY LIQUID-FILLED SHELLS USING A SERIES REPRESENTATION OF THE LIQUID
Jerrold M. Housner, Robert W. Herr, and John L. Sewall Mar. 1980 68 p refs
(NASA-TP-1558; L-13279) Avail: NTIS HC A04/MF A01 CSCL 20K

A series representation of the oscillatory behavior of incompressible nonviscous liquids contained in partially filled elastic tanks is presented. Each term is selected on the basis of hydroelastic vibrations in circular cylindrical tanks. Using a complementary energy principle, the superposition of terms is made to approximately satisfy the liquid-tank interface compatibility. This analysis is applied to the gravity sloshing and hydroelastic vibrations of liquids in hemispherical tanks and in a typical elastic aerospace propellant tank. With only a few series terms retained, the results correlate very well with existing analytical results, NASTRAN-generated analytical results, and experimental test results. Hence, although each term is based on a cylindrical tank geometry, the superposition can be successfully applied to noncylindrical tanks. K.L.

N80-19564*# Iowa Univ., Iowa City. Div. of Materials Engineering.
THE EFFECT OF TEST SYSTEM MISALIGNMENT IN THE DYNAMIC TENSION TEST
Han C. Wu, T. P. Wang, and M. C. Yip 1 Mar. 1980 44 p refs
(Grant NsG-1499)
(NASA-CR-162829; Rept-G302-80-001) Avail: NTIS HC A03/MF A01 CSCL 20K

The effects of test system misalignment are analyzed for dynamic tension tests using sheet type rectangular 1100-0 aluminum specimens. The strain rate is assumed constant only on the natural axis of the specimen even though the specimen is subjected to a constant strain rate test. The results include: (1) the lower the strain rate, the more significant the misalignment

errors become; (2) misalignment errors of 50% are found at the extreme fibers of the specimen; (3) the strain rate variation in the cross section decreases with increasing plastic strain and vanishes at plastic strain equal to 0.8% at the midspan of the specimen; and (4) the neutral axis shifts toward the centerline of the specimen as the plastic strain increases, but it reaches a limit and does not completely move back to the centerline. K.L.

N80-19565*# National Aeronautics and Space Administration, Washington, D. C.
THEORY OF TWISTED NONUNIFORMLY HEATED BARS
B. F. Shorr Feb. 1980 21 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk Mekhan. i Mashinostr. (USSR), no. 1, Jan.-Feb. 1960 p 141-151 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75758) Avail: NTIS HC A02/MF A01 CSCL 20K

Nonlineary distributed stresses in twisted nonuniformly heated bars of arbitrary cross section are calculated taking into account various elasticity parameters. The approximate theory is shown to be sufficiently general and accurate by comparison with experimental data. K.L.

N80-19566*# Boeing Co., Wichita, Kans.
DEVELOPING, MECHANIZING AND TESTING OF A DIGITAL ACTIVE FLUTTER SUPPRESSION SYSTEM FOR A MODIFIED B-52 WIND-TUNNEL MODEL Final Report, Jul. 1975 - Jan. 1980
John R. Matthew Mar. 1980 129 p refs
(Contract NAS1-14031)
(NASA-CR-159155; D3-1168-1) Avail: NTIS HC A07/MF A01 CSCL 01A

A digital flutter suppression system was developed and mechanized for a significantly modified version of the 1/30-scale B-52E aeroelastic wind tunnel model. A model configuration was identified that produced symmetric and antisymmetric flutter modes that occur at 2873N/sq m (60 psf) dynamic pressure with violent onset. The flutter suppression system, using one trailing edge control surface and the accelerometers on each wing, extended the flutter dynamic pressure of the model beyond the design limit of 4788N/sq m (100 psf). The hardware and software required to implement the flutter suppression system were designed and mechanized using digital computers in a fail-operate configuration. The model equipped with the system was tested in the Transonic Dynamics Tunnel at NASA Langley Research Center and results showed the flutter dynamic pressure of the model was extended beyond 4884N/sq m (102 psf). J.M.S.

N80-19567# General Dynamics Corp. Fort Worth, Tex.
FASTENER HOLE QUALITY, VOLUME 1 Final Technical Report, Jun. 1976 - Oct. 1978
P. J. Noronha, S. P. Henslee, D. E. Gordon, Z. R. Wolanski, and B. G. W. Lee Wright-Patterson AFB, Ohio AFFDL Dec. 1978 165 p
(Contract F33615-76-C-3113; AF Proj. 486U)
(AD-A077859; FZM-6809-Vol-1; AFFDL-TR-78-206-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13/5

This report describes the development of the equivalent initial flaw size concept as a potential design tool and the generation of equivalent initial flaw size data as a function of several manufacturing and design variables. Several factors or mechanisms that strongly affected the fatigue behavior of fastener holes have been identified and corrected to achieve a 100% improvement in fatigue life. Some of these improvements are being implemented in the F-16 production program and the improved drilling will be implemented in the C5A-H Modification Program. GRA

N80-19568# Naval Postgraduate School, Monterey, Calif.
DYNAMIC STRUCTURAL MODEL OF A SUBMERGED RING M.S. Thesis
Jack Thomas Waller, Jr. Sep. 1979 51 p refs
(AD-A078157) Avail: NTIS HC A04/MF A01 CSCL 13/10

A dynamic structural model of a submerged ring is developed using trigonometric series. It is constructed for use in conjunction with a finite element fluid model to examine the effects of cavitation on underwater shock loading of a structure. The governing equations and the time integration algorithm used in the model are described. Results predicted by the model are compared to known results. The program listing is given. GRA

N80-19569# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
AN ANALYSIS OF RESIDUAL STRESSES AND DISPLACEMENTS DUE TO RADIAL EXPANSION OF FASTENER HOLES Final Report, Jan. 1975 - Dec. 1978
A. F. Grandt and R. M. Potter Jul. 1979 37 p refs
(AF Proj. 2307)
(AD-A076370; AFML-TR-79-4048) Avail: NTIS HC A02/MF A01 CSCL 01/3

Pre-expanding fastener holes with an oversize mandrel has received considerable attention for use in aircraft structures, since this process has been shown to greatly improve the fatigue life of fastener holes. The deformation theory of plasticity is used here to determine the residual stress and displacement field caused by this process. Employing plane stress assumptions, general results are obtained for various interference levels and are presented in a graphical form useful to the designer. In addition, this analysis indicates that there is an optimum level of interference dependent primarily on the plate geometry. The optimum interference levels agree well with experience values established by fatigue testing in aircraft structural alloys. GRA

N80-19570# Sydney Univ. (Australia). Civil Engineering Labs.
NUMERICAL ANALYSIS OF RAFTS ON VISCO-ELASTIC MEDIA USING EIGENVECTOR EXPANSIONS
P. T. Brown and J. R. Booker Apr. 1979 41 p refs
(PB80-112907; R-346) Avail: NTIS HC A03/MF A01 CSCL 13B

Problems of a raft on a viscoelastic continuum are converted to equivalent elastic problems by means of a Laplace transformation. A numerical solution of the equivalent problem is obtained by the finite element method. The solution is converted into the form of an eigenvector expansion and then transformed into a numerical solution to the original problem by inverting the Laplace transform. This form of solution has the advantage of applying to any viscoelastic model, and of requiring little additional computation as a result of changing the viscoelastic model, the relative raft-soil stiffness or the load pattern. The application of the method is illustrated by results for circular rafts, strip footings of finite length, and rectangular rafts. Particular attention is paid to a realistic soil creep function which is asymptotic to a linear function or log time. GRA

N80-19571# Sydney Univ. (Australia). Civil Engineering Labs.
SURFACE SETTLEMENT OF A FINITE ELASTIC LAYER WHOSE MODULUS INCREASES LINEARLY WITH DEPTH
P. T. Brown and R. E. Gibson Apr. 1979 28 p refs
(PB80-112899; R-345) Avail: NTIS HC A03/MF A01 CSCL 13B

The behavior of a finite layer of elastic-material of constant Poisson's ratio which has a Young's modulus increasing linearly with depth and which rests on a rough rigid base, is investigated. Values of surface settlement at the center of a circular area of uniform loading and at the corner of a rectangular area of uniform loading are presented for values of Poisson's ratio of 1/2, 1/3 and 0, and for wide ranges of degree of inhomogeneity and loading breadth to depth ratio. GRA

N80-19572# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
DAMPING EFFECTS IN AEROSPACE STRUCTURES
Oct. 1979 193 p refs In ENGLISH and FRENCH Meeting held in Williamsburg, Va., 2-3 Apr. 1979
(AGARD-CP-277; ISBN-92-835-0244-2) Avail: NTIS HC A09/MF A01

Mathematical models, vibration tests, and predictions of structural damping are discussed in terms of aerospace problems where structural damping plays a basic role. Topics addressed include numerical modelling of structures to account for internal damping, spacecraft damping considerations in structural design, damping problems in acoustic fatigue, and damping effects in

joints and riveted specimens. For individual titles, see N80-19573 through N80-19584. A.W.H.

N80-19573# National Aerospace Lab., Amsterdam (Netherlands).
MATHEMATICAL FORMULATION OF DAMPING FOR STRUCTURAL RESPONSE ANALYSIS
H. H. Ottens *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 10 p refs (For primary document see N80-19572 10-39)
Avail: NTIS HC A09/MF A01

A survey of damping models that are commonly used in the structural response analysis of aerospace structures is presented. The various damping models are evaluated with respect to the required knowledge of structural damping, the mathematical complexity and the accuracy of the calculated response. The survey is limited to linear damping models and models which represent lightly damped structures are highlighted. A.W.H.

N80-19574# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
PREDICTION OF THE STRUCTURAL DAMPING OF A VIBRATING STIFFENED PLATE
Denys J. Mead *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 15 p refs (For primary document see N80-19572 10-39)
Avail: NTIS HC A09/MF A01

The sources of energy dissipation in a vibrating stiffened plate, typical of a fuselage stringer skin structure are outlined. For a particular specimen, the principal source was identified as the riveted joints attaching the skin to the stringer. These undergo oscillating tension/compression loads (in the direction of the rivet axis) when the plate vibrates. An experiment to measure the basic damping characteristic of a single riveted joint loaded harmonically is described. The non-linearity of the damping was demonstrated, as was the effect of an air pumping mechanism in the joint. The results of the experiment were used to predict the damping of a riveted stringer skin structure containing many such joints. The predicted damping is compared with the value actually measured. The results are of the same order of magnitude, but the numerical difference highlights the difficulties involved in undertaking such damping studies. A.W.H.

N80-19575# Genoa Univ. (Italy). Istituto di Scienza delle Costruzioni.
NUMERICAL MODELLING OF STRUCTURES TO ACCOUNT FOR INTERNAL DAMPING
Riccardo F. Baldacci, Alfred Corsanego, and Andrea DelGrosso *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 9 p refs (For primary document see N80-19572 10-39)
Avail: NTIS HC A09/MF A01

Various numerical analysis techniques are examined concerning the inclusion of the structural damping effects from the point of view of representing the structural behaviour by means of finite element models. The consequences of assuming some of the more popular damping models are discussed in terms of the solution algorithms. Uncoupling techniques that are only approximate when the structural models possess a nonproportional damping matrix are emphasized and criticized. Various diagonalization schemes are presented for the damping matrix and emphasis is given to the evaluation of the errors involved in the computation. A.W.H.

N80-19576# British Aerospace Aircraft Group, Brough (England).
SOME RECENT MEASUREMENTS OF STRUCTURAL DYNAMIC DAMPING IN AIRCRAFT STRUCTURES
E. J. Phillips *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 15 p refs (For primary document see N80-19572 10-39)
Avail: NTIS HC A09/MF A01

Values of structural damping obtained during a flutter investigation of a strike aircraft in several wing store configurations, in which the wings were excited by impulses at the wing tips are presented. A vibration test on a large underwing pylon mounted pod during which three suspensions were represented, and a vibration test on a box section shelf mounted on antivibration mounts are described. During the flutter investigation the structural damping was determined from the time decay of filtered accelerometer signals. In the vibration tests, the test items were excited sinusoidally and damping was obtained from accelerometer response curves at resonance. A.W.H.

N80-19577# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
EFFECT OF STRUCTURAL DAMPING ON THE DYNAMIC RESPONSE OF SPACECRAFT
M. Degener *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 19 p refs (For primary document see N80-19572 10-39)
Avail: NTIS HC A09/MF A01

The effect of structural damping on the dynamic response of spacecraft structures, especially satellites, is investigated. Special regard is given to the influence of intermodal damping coupling and of a nonlinear damping behaviour. Results of dynamic tests on satellite structures are studied. A method is presented to determine the dynamic response of a spacecraft structure, taking into account the nonlinear damping behaviour by means of a numerical, iterative procedure based on modal data. A.W.H.

N80-19578*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPACECRAFT DAMPING CONSIDERATIONS IN STRUCTURAL DESIGN
B. K. Wada and D. T. DesForges *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 18 p refs (For primary document see N80-19572 10-39)
(Contract NAS7-100)
Avail: NTIS HC A09/MF A01

The role of damping in the prediction of spacecraft structural responses and loads, and in the structural design of spacecrafts is discussed. The methods used to incorporate damping in the structural analysis are summarized and some experiences and procedures relating to damping in recent spacecraft design are discussed. Methods for modal testing and the experimental determination of damping, the use of discrete dampers, and the estimation of payload response are studied. A collection of damping data for recent spacecraft and related hardware is provided in the appendix. A.W.H.

N80-19579# Rome Univ. (Italy). Scuola d'Ingegneria Aerospaziale.
VIBRATION DAMPING ON SAN MARCO SATELLITES; RESULTS AND COMMENTS
Carlo Arduini and Alessandro Agneni *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 15 p refs (For primary document see N80-19572 10-39)
Avail: NTIS HC A09/MF A01

The damping data from dynamic tests of the San Marco structures is surveyed. The typical trend of the damping coefficient to decrease with frequency is confirmed. However, there is no clear evidence of significant variations with the input level. This feature is discussed in terms of the limits of the half power method. K.L.

N80-19580# Politecnico di Milano (Italy). Istituto di Ingegneria Aerospaziale.
DAMPING PROBLEMS IN ACOUSTIC FATIGUE
Vittorio Giavotto, Marco Borri, and Giorgio Cavallini (Pisa Univ.) *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 11 p refs (For primary document see N80-19572 10-39)
Avail: NTIS HC A09/MF A01

Damping information necessary for the fatigue design of wideband noise excited structures is identified. Damping mechanisms are considered and damping test results are presented for stiffened panels typical of aerospace structures. The need for models capable of accurately estimating damping effects is emphasized. K.L.

N80-19581# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Bauweisen- und Konstruktionsforschung.
DYNAMIC DAMPING INVESTIGATIONS ON COMPOSITES
H. Georgi *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 20 p refs (For primary document see N80-19572 10-39)

Avail: NTIS HC A09/MF A01

Characteristic regularities and data from a series of damping measurements on fiber reinforced composite materials and structures are presented. Experiments were carried out mainly on natural frequencies of lateral vibrations in free decay and forced excitation. Tests included composite materials with reinforcement by boron, carbon, glass, and synthetic fibers; structural components, sandwich and I-beams; and composite structures such as rotor blades. Experimental parameters considered were amplitude, temperature, vibration mode, frequency, air pressure, aspect ratio, and fiber orientation. Dynamic response properties of several composites were compared by means of a simple linear oscillation model with spring, mass, and damping values corresponding to the composite data. The structural damping of a wing box and a wind turbine blade was compared with the damping of the respective structural element. Numerical extrapolations of the damping behavior of beams differing from experimental configurations in fiber orientation, air pressure, etc. are discussed. K.L.

N80-19582# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

VISCOELASTIC DAMPING IN USAF APPLICATIONS

D. I. G. Jones, J. P. Henderson, and L. C. Rogers (AFFDL, Wright-Patterson AFB, Ohio) *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 24 p refs (For primary document see N80-19572 10-39)

Avail: NTIS HC A09/MF A01

The use of viscoelastic damping technology for vibration control in the United States Air Force is reviewed. The potential payoff in improved performance and maintainability of vibration critical systems such as large flexible spacecraft structures, digital electronics systems, and rotating jet engine components is very high. K.L.

N80-19583# Societe METRAVIB, Ecully (France).

REPORT ON THE USE OF ABATEMENT TECHNIQUES FOR PROBLEMS RELATED TO VIBRATIONS AND NOISE [BILAN SUR LA MISE EN OEUVRE DE TECHNIQUES D'AMORTISSEMENT POUR DES PROBLEMES LIES AUX VIBRATIONS ET AU BRUIT]

B. Duperray and L. Gaudriot *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 9 p In FRENCH (For primary document see N80-19572 10-39)

Avail: NTIS HC A09/MF A01

The 10 year history of METRAVIB involvement in using viscoelastic materials to solve the vibration and noise problems encountered in the industrial, mechanical, electrical, and naval and aerospace construction sectors is reviewed. Particular attention is given to the development of models of structural dynamics, and a viscoelastimeter as well as the transfer of information to industries interested in developing new products using glass fiber reinforced composites and high temperature materials such as glasses and ceramics. Specific applications are cited to demonstrate the effectiveness of the techniques used. Transl. by A.R.H.

N80-19584# Istituto di Tecnologia Aerospaziale, Rome (Italy).

DAMPING EFFECTS IN JOINTS AND EXPERIMENTAL TESTS ON RIVETED SPECIMENS

Luigi Balis Crema, Antonio Castellani, and Alfonso Nappi (SIAI Marchetti) *In* AGARD Damping Effects in Aerospace Struct. Oct. 1979 17 p refs (For primary document see N80-19572 10-39)

Avail: NTIS HC A09/MF A01

The importance of dynamic damping is highlighted with emphasis on the effect of riveted joints on energy dissipation. The state of the art in the field of joint damping is illustrated with reference to several theories on damping mechanisms. Results of tests carried out on specimens with riveted joints are discussed. K.L.

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-19585*# Lille Univ. (France).

SEA SURFACE TEMPERATURE OF THE COASTAL ZONES OF FRANCE. HEAT CAPACITY MAPPING MISSION (HCMM) Progress Report

P. Y. Deschamps, R. Frouin, G Cassanet, and F. Verger, Principal Investigators Dec. 1979 53 p refs Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20711. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM

(E80-10057; NASA-CR-162753; PR-2) Avail: NTIS HC A04/MF A01 CSCL 08C

The author has identified the following significant results. HCMM data analysis shows some mesoscale features which were previously expected to occur: summer coastal upwellings in the Gulf of Lions, tidal fronts bordering the English Channel, and cooler surface waters at the continental shelf break. The analysis of the spectral variance density spectra show that the interpretation of the data usually is limited by the HCMM radiometric performance (noise levels) at wavenumbers below 5 km in the oceanic areas; from this analysis it may also be concluded that a decrease of the radiometric noise level down to 0.1 k against an increase of the ground resolution up to 2 km would give a better optimum of the radiometric performances in the oceanic areas. HCMM data appear to be useful for analysis of the sea surface temperature field, particularly in the very coastal area by profiting from the ground resolution of 500 m.

N80-19586*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Systems and Services Div.

AS-BUILT DESIGN SPECIFICATIONS OF THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES). VOLUME 1: TEST AND APPENDICES

J. Everette, A. Rios, J. Good, C. Horton, D. McCarley, and M. Nieves, Principal Investigators Dec. 1979 335 p ERTS (Contract NAS9-15800)

(E80-10077; NASA-CR-160461; LEC-12904-Vol-1; JSC-14634-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-19587*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

QUANTITATIVE ESTIMATION OF PLANT CHARACTERISTICS USING SPECTRAL MEASUREMENT: A SURVEY OF THE LITERATURE

R. B. Cate, J. A. Artley, and D. E. Phinney, Principal Investigators Jan. 1980 43 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E80-10078; NASA-CR-160460; LEMSCO-14077; JSC-16298; SR-LO-00408) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-19588*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT DIGITAL ANALYSIS OF THE INITIAL RECOVERY OF THE KOKOLIK RIVER TUNDRA FIRE AREA, ALASKA
D. K. Hall, J. P. Ormsby, L. Johnson (Army Cold Regions Research and Engineering Lab., Fairbanks, Alaska), and J. Brown, Principal Investigators (Army Cold Regions Research and Engineering Lab., Hanover, N. H.) Dec. 1979 21 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10080; NASA-TM-80602) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. Considerable regrowth of vegetation was observed between August 1977 and August 1978, both in the field and through analysis of LANDSAT near infrared digital data. The spectral reflectances in the burned areas were found to increase with the age of the burn in a one year period due to vegetation regrowth. Regrowth was particularly evident in the lightly burned portions of the burned area. Image analysis techniques using the AOIPS system permitted delineation of burn severity categories. The conditions and type of ground cover prior to the fire influenced the severity of burning, as did the direction of the winds while the burning was in progress as determined from field and LANDSAT observations. More severe burning was induced by winds blowing in the northeastern and southeastern portions of the burned area.

N80-19589*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SMMR SIMULATOR RADIATIVE TRANSFER CALIBRATION MODEL 1: DERIVATION
Charles D. Calhoon, Susan Link, Michael Doyle, and Brian Krupp, Principal Investigators (Systems and Applied Sciences Corp., Riverdale, Md.) Aug. 1979 67 p refs ERTS
(E80-10081; NASA-TM-80244) Avail: NTIS HC A04/MF A01 CSCL 14B

There are no author-identified significant results in this report.

N80-19590*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A CRITICAL COMPARISON OF REMOTE SENSING AND OTHER METHODS FOR NONDESTRUCTIVE ESTIMATION OF STANDING CROP BIOMASS
C. J. Tucker, Principal Investigator Dec. 1979 15 p refs Submitted for publication ERTS
(E80-10082; NASA-TM-80607) Avail: NTIS HC A02/MF A01

There are no author-identified significant results in this report.

N80-19591*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISENSOR ANALYSIS OF HYDROLOGIC FEATURES IN THE WIND RIVER RANGE, WYOMING WITH EMPHASIS ON THE SEASAT SAR
James L. Foster and Dorothy K. Hall, Principal Investigators Oct. 1979 26 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10083; NASA-TM-80582) Avail: NTIS HC A03/MF A01 CSCL 08H

The author has identified the following significant results. Analysis of imagery obtained over west-central Wyoming indicates that Seasat SAR has capability for hydrologic mapping. Both the L-Band (Seasat) and the X-Band (aircraft) SAR imagery were useful for observing drainage detail. Streams have bright signatures on the SAR imagery because the riparian vegetation produces a rough surface and thus high radar returns. Lakes appear relatively bright on the Seasat image—presumably in response to surface ripples and waves induced by wind action. SAR imagery did not reveal snow at either the 23.5 cm (L-Band) or 2.8 cm (X-Band) wavelengths. Comparing Seasat and X-Band aircraft SAR imagery to LANDSAT RBV imagery, U-2 photography, and topographic maps of the Wind River Range, it appears that the SAR data do not seem to provide as much hydrologic information as do the other sensors in the visible and near infrared portions of the spectrum.

N80-19592*# Michigan State Univ., East Lansing.
USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION Annual Progress Report, 1 Jun. 1978 - 31 May 1979
Myles Boylan, Principal Investigator 1 Feb. 1980 113 p refs ERTS
(Grant NGL-23-004-083)
(E80-10085; NASA-CR-162783) Avail: NTIS HC A06/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-19593*# South Dakota State Univ., Brookings. Remote Sensing Inst.
REMOTE SENSING APPLICATIONS TO RESOURCE PROBLEMS IN SOUTH DAKOTA Semiannual Progress Report, 1 Jul. - 31 Dec. 1979
Victor I. Myers, Principal Investigator, R. G. Best, K. J. Dalsted, J. E. Eidenshink, R. Fowler, J. L. Heilman, and F. A. Schmer 31 Dec. 1979 122 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-42-003-007)
(E80-10086; NASA-CR-162784; SDSU-RSI-80-02) Avail: NTIS HC A06/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-19594# National Environmental Satellite Service, Washington, D. C.
NOAA SATELLITE MONITORING OF SNOW COVER IN THE NORTHERN HEMISPHERE DURING THE WINTER OF 1977
Donald R. Wiesnet, Michael Matson, and David F. McGinnis [1977] 18 p refs
Avail: NTIS HC A02/MF A01

Weekly snow and ice charts were used to prepare mean monthly data on snowcover for both North America and Eurasia. These data were then utilized to prepare simple regressions of antecedent snowcover vs. January, February, February and January-through March snowcover figures, demonstrating a number of statistically significant relationships for Eurasia and the Northern Hemisphere (land surface only). These relationships, despite the limited data sample (10 years of record), indicate that higher-than-average December snowcover tends to presage a winter of more-than-average snowcover. A.R.H.

N80-19595# Environmental Research and Technology, Inc., Concord, Mass.
COMPARATIVE STUDY OF ANOMALOUS GRAY-SHADE PATTERNS IN DMSP AND LANDSAT IMAGERY Final Report
James C. Barnes, C. James Bowley, Ronald G. Isaacs, and Allen J. Bussey Sep. 1979 105 p refs
(Contract N00228-77-C-3164)
(AD-A077902; ERT-P-3469; NEPRF-CR-79-05) Avail: NTIS HC A06/MF A01 CSCL 04/2

A comparative analysis of anomalous gray-shade patterns is performed using Defense Meteorological Satellite Program (DMSP) and LANDSAT multispectral imagery. Eight cases are analyzed where anomalous gray-shade patterns associated with reduced visibilities in light fog or haze are detected in DMSP imagery, and where corresponding LANDSAT data are available. In addition, a detailed theoretical analysis of the effects of water vapor absorption on the imagery is performed. The qualitative results of the imagery analysis indicate that within the anomalous gray-shade patterns as detected in the DMSP imagery, the LANDSAT MSS-4 (visible band) image will appear more hazy than the longer wavelength LANDSAT bands. The theoretical analysis indicates that simulated radiances from the DMSP are similar to the LANDSAT MSS-6 band, rather than to MSS-4. This apparent contradiction can be explained by considering the relative contributions of energy from the different spectral intervals comprising the total DMSP response rather tnan the response function alone; the different spatial resolutions of the DMSP and LANDSAT sensors may also be a factor. The results of the theoretical analysis further suggest that for realistic cases of high humidity and low visibility, it is the aerosol growth, not

the growth in water vapor, that increases the radiance measured by the DMSP Very High Resolution (VHR) sensor. GRA

N80-19596# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
LANDSAT MSS COORDINATE TRANSFORMATIONS
Berthold K. P. Horn and Robert J. Woodham Feb. 1978 56 p refs
(Contract N00014-75-C-0643)
(AD-A078418; AI-M-465) Avail: NTIS HC A04/MF A01 CSCL 14/5

A number of image analysis tasks require the registration of a surface model with an image. In the case of satellite images, the surface model may be a map or digital terrain model in the form of surface elevations on a grid of points. We develop here an affine transformation between coordinates of Multi-Spectral Scanner (MSS) images produced by the LANDSAT satellites, and coordinates of a system lying in a plane tangent to the Earth's surface near the sub-satellite (Nadir) point. GRA

N80-19597# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
PROTOTYPE OVERLAND FLOW TEST DATA: JUNE 1977 - MAY 1978
T. F. Jenkins, H. E. Hare, A. J. Palazzo, R. E. Bates, and C. J. Martel Nov. 1979 98 p refs
(AD-A078743; CRREL-SR-79-35) Avail: NTIS HC A05/MF A01 CSCL 13/2

A prototype overland flow land treatment system was operated at Hanover, New Hampshire, over a one-year cycle from June 1977 to May 1978. The individual data points collected over this period for water quantity and quality are presented as well as plant yields and nutrient uptake. The soil chemical and physical parameters measured are also presented along with a table of initial site characteristics. The meteorological measurements obtained in support of this effort are included to complete the data base. GRA

N80-19598# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STATISTICAL ANALYSIS OF TERRAIN AND WATER (ICE) BACKGROUNDS IN A WINTER SCENE FROM NORTHERN MICHIGAN Final Report
Anthony J. LaRocca Oct. 1979 299 p refs
(Contract N60530-79-R-0036)
(AD-A077554; ERIM-139900-2-F) Avail: NTIS HC A13/MF A01 CSCL 17/5

Data from infrared imagery on various terrain and water (ice, in this instance) backgrounds were collected and analyzed to present their statistical features. This report describes some of the characteristics in the form of histograms, ellipse 'pictures', and power spectra for the following infrared spectral bands: 3.5-3.9, 4.5-5.5, and 9.0-11.4 micrometers. Areas were chosen to show variability of results in a winter scene with respect to different times of the day and night. GRA

N80-19599# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STATISTICAL ANALYSIS OF TERRAIN AND WATER BACKGROUNDS IN THE VICINITY OF PORT HUENEME, CALIFORNIA
Anthony J. LaRocca Apr. 1979 156 p refs
(Contract N60530-78-C-0009)
(AD-A077025; ERIM-132300-3-T) Avail: NTIS HC A08/MF A01 CSCL 17/5

Data from infrared imagery on various terrain and water backgrounds have been collected by the Environmental Research Institute of Michigan and have been analyzed to present their statistical features. This work is being funded by the Optical Signatures Program to Support Navy Requirements. This report describes some of the characteristics in the form of histograms, ellipse 'pictures', and power spectra for the following infrared spectral bands: 2.0-2.6, 3.0-4.2, 4.5-5.5, and 9.0-11.4 microns. Special areas were chosen to demonstrate the variation in results with the selection of different backgrounds. GRA

N80-19600# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
TRI-BAR READING CORRECTION FOR OBLIQUE IMAGERY Final Report, Dec. 1978 - Jul. 1979
Edward L. Gliatti and Thomas Stanzione Jul. 1979 38 p refs (AF Proj. 2004)
(AD-A076340; AFAL-TR-79-1171) Avail: NTIS HC A03/MF A01 CSCL 14/5

Tri-Bar resolution targets are geometrically distorted when photographed at oblique angles. One of the effects of this distortion is the changing of the aspect (length to width) ratio of the bars. Targets parallel to the line of flight (crossline) at large oblique angles to nadir of the aircraft produce images with apparent increased aspect ratios due to the foreshortening of the bar/space width. Perpendicular targets to the flight direction (inline) at an oblique angle have their lengths foreshortened, thus reducing the aspect ratios. At 70 deg, original 5:1 aspect ratio tri-bar targets have apparent ratios of 14.6:1 crossline and 1.71:1 inline. A laboratory experiment was set up to simulating oblique imagery to determine what effects the changing aspect ratio has on the accuracy of tri-bar readings, after the insertion of normal geometrical corrections. Different target contrast ratios, target orientations, and cameras were used. Analysis of variance showed that for crossline targets, resolution readings corrected by the normal cosine geometrical factor provide accurate results for any contrast ratio or target orientation. GRA

N80-19601# IBM Federal Systems Div., Gaithersburg, Md.
INTERACTIVE DIGITAL IMAGE PROCESSING INVESTIGATION Final Report
W. C. Rice, J. S. Shipman, and R. J. Spieler 29 Dec. 1978 185 p refs
(Contract DAAK70-77-C-0166)
(AD-A076342; ETL-0172) Avail: NTIS HC A09/MF A01 CSCL 05/8

The objective of this investigation was to develop an interactive software package of general utility that can be used to support experiments and evaluate a class of interactive/automatic digital techniques whose goal is feature extraction/exploitation. The initial task was to survey and select techniques, algorithms and supporting functions that were to be included in the system. A maximum likelihood supervised classification algorithm, and an unsupervised classification (clustering) method. These and the associated support and evaluation functions were developed and implemented on the Digital Image Analysis Laboratory. Testing of the system was accomplished by performing experiments on areas for which both multi-dimensional images and ground truth were available. Analysis of experimental results validated the system. These experimental results were in good agreement with ground truth and further, supervised and unsupervised classification results were in substantial agreement. This report describes the data processing algorithms/techniques, software system, user guide information, and the experiment procedures used along with their results. GRA

N80-19602# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
BRUNEAU KNOWN GEOTHERMAL RESOURCE AREA: AN ENVIRONMENTAL ANALYSIS
S. G. Spencer, ed. and B. F. Russell, ed. Sep. 1979 146 p refs
(Contract EY-76-C-07-1570)
(EGG-GTH-5004) Avail: NTIS HC A07/MF A01

This part of Owyhee County is the driest part of Idaho. The Bruneau known geothermal resource area (KGRA) is associated with the southern boundary fault zone of the Snake River Plain. Thermal water, produced from numerous artesian wells in the region, is supplied from two major aquifers. Ecological concerns include the threatened Astragalus mulfordiae and the numerous birds of prey nesting in the Snake River canyon northwest of the KGRA. Extensive geothermal development may strain the limited health care facilities in the county. Ethnographic information suggests that there is a high probability of prehistoric cultural materials being remnant in the Hot Spring locality. DOE

N80-19603# Wyoming Univ., Laramie. Dept. of Geology.
VIDEO PROCESSING OF REMOTE SENSOR DATA APPLIED TO URANIUM EXPLORATION IN WYOMING Final Report
Richard A. Levinson, Ronald W. Marrs, and Fred Crockett 30 Jun. 1979 223 p refs

(Contracts EY-76-C-13-1648; F(05-1)-1648)
(GJBX-171(79)) Avail: NTIS HC A10/MF A01

LANDSAT satellite imagery and aerial photography, used to map areas of altered sandstone associated with roll-front uranium deposits, must be enhanced so that alteration spectral contrasts can be seen. Video image processing is a fast, low-cost, and efficient tool. For LANDSAT data, the 7/4 ratio produces the best enhancement of altered sandstone. The 6/4 ratio is most effective for color infrared aerial photography. Samples from Pumpkin Buttes show that iron is the primary coloring agent which makes alteration visually detectable. Eh and pH changes associated with passage of a roll front cause oxidation of magnetic and pyrite to hematite, goethite, and limonite in the host sandstone, thereby producing the alteration. Statistical analysis show that the detectability of geochemical and color zonation in host sands is weakened by soil-forming processes. Alternation can only be mapped in areas of thin soil cover and moderate to sparse vegetative cover. DOE

N80-19604# System Development Corp., Santa Monica, Calif.
REGIONAL SYSTEMS DEVELOPMENT FOR GEOTHERMAL ENERGY RESOURCES. PACIFIC REGION: CALIFORNIA AND HAWAII. TASK 1: IMPLEMENTATION PLAN DEVELOPMENT
D. W. Michler 26 Mar. 1979 509 p refs
(Contract ET-78-C-03-1530)
(DOE/ET-28432-1) Avail: NTIS HC A22/MF A01

The utilization of geothermal energy resources for the generation of electrical power is considered as an alternative to fossil fuels or nuclear energy. The development of implementation plans for the commercialization of geothermal resources is described. The plans represent 21 reservoir-site developments and 48 geothermal power plant developments. Each plan consists of three integrated elements: (1) a bar-chart schedule that depicts interdependencies among activities and shows significant milestones on the path from initial exploration to power on-line; (2) task descriptions; and (3) the responsible performers of each task. A set of recommendations for the accelerated development of geothermal energy resources is given and the potential implementors are identified. J.M.S.

N80-19605# System Development Corp., Santa Monica, Calif.
REGIONAL SYSTEMS DEVELOPMENT FOR GEOTHERMAL ENERGY RESOURCES. PACIFIC REGION: CALIFORNIA AND HAWAII. TASK 2: REGIONAL PROGRAM MONITORING AND PROGRESS EVALUATION
19 Mar. 1979 132 p refs
(Contract ET-78-C-03-1530)
(DOE/ET-28432-2) Avail: NTIS HC A07/MF A01

The status of power plant projects is reported and major problems for each of the power plants are identified. Recommendations to alleviate these problems are outlined. J.M.S.

N80-19606# System Development Corp., Santa Monica, Calif.
REGIONAL SYSTEMS DEVELOPMENT FOR GEOTHERMAL ENERGY RESOURCES. PACIFIC REGION: CALIFORNIA AND HAWAII. TASK 3: WATER RESOURCES EVALUATION
J. L. Sakaguchi 19 Mar. 1979 375 p refs
(Contract ET-78-C-03-1530)
(DOE/ET-28432-3/1) Avail: NTIS HC A16/MF A01

The availability of surface and ground water for potential use as power plant make-up water in the major geothermal areas of California and Hawaii was assessed. The analysis concentrated on identifying the major sources of surface and ground water, potential limitations on the usage of this water, and the resulting constraints on potentially developable electrical power in each geothermal resource area. The water requirements for representative types of energy conversion processes were developed using a case study approach. Cooling water requirements for each type of energy conversion process were estimated based upon a specific existing or proposed type of geothermal power plant. The make-up water requirements for each type of conversion process at each resource location were then estimated as a basis for analyzing any constraints on the megawatts which potentially could be developed. DOE

N80-19607# System Development Corp., Santa Monica, Calif.
REGIONAL SYSTEMS DEVELOPMENT FOR GEOTHERMAL ENERGY RESOURCES. PACIFIC REGION: (CALIFORNIA AND HAWAII). TASK 3: WATER RESOURCES EVALUATION, APPENDICES
19 Mar. 1979 343 p refs
(Contract ET-78-C-03-1530)
(DOE/ET-28432-3/2) Avail: NTIS HC A15/MF A01

The appendices for the water resources evaluation report are included for the Imperial Valley KGRA's Coso, Mono-Long Valley, Geysers Calistoga, Surprise Valley, Wendell Amedee, Glass Mountain, Lassen, Puna, and for power plant case studies. DOE

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-19608 Pittsburgh Univ., Pa.
DEVELOPMENT OF A Fe-Pb(Ti) SECONDARY BATTERY SYSTEM Ph.D. Thesis
Raymond Thomas Galasco 1979 277 p
Avail: Univ. Microfilms Order No. 8004849

The Fe-Ti redox couple battery system was modified in order to enhance its discharge performance by alleviating the performance limiting kinetic effects in the anodic half cell. The most successful results were obtained when lead was used as a reducing agent added to the anolyte. This new battery system was described as the Fe-Pb(Ti) secondary battery system. Development and analysis of this battery system was performed. The results indicated lead oxidation in the anodic half cell was the major cause of battery performance enhancement during the early stages of discharge. Development of both stationary and flow batteries was undertaken. The effects of polarization on battery performance were investigated. Dissert. Abstr.

N80-19609*# Florida Univ., Gainesville. Dept. of Electrical Engineering.
STUDIES OF SILICON p-n JUNCTION SOLAR CELLS Final Technical Report, Sep. 1977 - Dec. 1979
A. Neugroschel and F. A. Lindholm Dec. 1979 177 p refs
(Grant NsG-3018)
(NASA-CR-162832) Avail: NTIS HC A09/MF A01 CSCL 10A

To provide theoretical support for investigating different ways to obtain high open-circuit voltages in p-n junction silicon solar cells, an analytical treatment of heavily doped transparent-emitter devices is presented that includes the effects of bandgap narrowing, Fermi-Dirac statistics, a doping concentration gradient, and a finite surface recombination velocity at the emitter surface. Topics covered include: (1) experimental determination of bandgap narrowing in the emitter of silicon p-n junction devices; (2) heavily doped transparent regions in junction solar cells, diodes, and transistors; (3) high-low-emitter solar cell; (4) determination of lifetimes and recombination currents in p-n junction solar cells; (5) MOS and oxide-charged-induced BSF solar cells; and (6) design of high efficiency solar cells for space and terrestrial applications. A.R.H.

N80-19610*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER FUEL CELL PERFORMANCE CONSTRAINTS. STS/OPS PRATT WHITNEY FUEL CELLS. OPERATING LIMITS FOR MISSION PLANNING
Harry E. Kolkhorst Feb. 1980 35 p
(NASA-TM-80958; Rept-79-FM-45; JSC-16255) Avail: NTIS HC A03/MF A01 CSCL 10A

The orbiter fuel cell powerplant (FCP) performance con-

straints listed in the Shuttle Operational Data Book (SODB) were analyzed using the shuttle environmental control requirements evaluation tool. The effects of FCP lifetime, coolant loops, and FCP voltage output were considered. Results indicate that the FCP limits defined in the SODB are not valid. K.L.

N80-19611*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LSA FIELD TEST Annual Report, Aug. 1978 - Aug. 1979
Peter Jaffe 15 Dec. 1979 51 p
(Contract NAS7-100)
(NASA-CR-162798; JPL-Pub-80-5; DOE/JPL-1012-38) Avail: NTIS HC A04/MF A01 CSCL 10A

Degradation tests indicate that electrical degradation is not a slow monotonically increasing phenomenon as originally thought but occurs abruptly as the result of some traumatic event. This finding has led to a change in the test philosophy. A discussion of this change is presented along with a summary of degradation and failure data from all the sites and results from a variety of special tests. New instrumentation for in-field measurements are described. Field testing activity was expanded by the addition of twelve remote sites located as far away as Alaska and the Canal Zone. Descriptions of the new sites are included. R.E.S.

N80-19612*# Jay - Carter Enterprises, Inc., Burkburnett, Tex.
A 15 kWe (NOMINAL) SOLAR THERMAL-ELECTRIC POWER CONVERSION CONCEPT DEFINITION STUDY: STEAM RANKIN RECIPROCATOR SYSTEM Final Report
W. Wingenback and J. Carter, Jr. Jun. 1979 46 p refs
(Contracts DEN3-63; EX-76-A-29-1060)
(NASA-CR-159591; DOE/NASA/0063-79/1) Avail: NTIS HC A03/MF A01 CSCL 10A

A conceptual design of a 3600 rpm reciprocation expander was developed for maximum thermal input power of 80 kW. The conceptual design covered two engine configurations; a single cylinder design for simple cycle operation and a two cylinder design for reheat cycle operation. The reheat expander contains a high pressure cylinder and a low pressure cylinder with steam being reheated to the initial inlet temperature after expansion in the high pressure cylinder. Power generation is accomplished with a three-phase induction motor coupled directly to the expander and connected electrically to the public utility power grid. The expander, generator, water pump and control system weigh 297 kg and are dish mounted. The steam condenser, water tank and accessory pumps are ground based. Maximum heat engine efficiency is 33 percent; maximum power conversion efficiency is 30 percent. Total cost is $3,307 or $138 per kW of maximum output power. R.E.S.

N80-19613*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
TEETERED, TIP-CONTROLLED ROTOR: PRELIMINARY TEST RESULTS FROM MOD-0 100-kW EXPERIMENTAL WIND TURBINE
J. C. Glasgow and D. R. Miller 1980 16 p refs Presented at Wind Energy Conf., Boulder, Colo., 9-11 Apr. 1980; sponsored by Am. Inst. of Aeron. and Astronautics and the Midwest Res. Inst.
(Contract EX-76-I-01-1028)
(NASA-TM-81445; DOE/NASA/1028-80/26; E-365) Avail: NTIS HC A02/MF A01 CSCL 10B

Results of tests conducted using the MOD-0 100 kW experimental wind turbine are evaluated. The teetered rotor significantly decreased loads on the yaw drive mechanism and reduced blade cyclic flapwise bending moments by 25 percent at the 20 percent span location when compared to the rigid hub rotor. The teetered hub performed well, but impacted the teeter stops on occasion as wind speed and/or direction varied rapidly. The tip-controlled rotor performed satisfactorily with some expected loss of control when compared to the full span pitchable blade. The performance results indicate that a review of techniques used to calculate rotor power is in order. K.L.

N80-19614*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
INSTALLATION AND CHECKOUT OF THE DOE/NASA MOD-1 2000-kW WIND TURBINE GENERATOR
Richard L. Puthoff and John L. Collins 1980 25 p refs Presented at Wind Energy Conf., Boulder, Colo. 9-11 Apr. 1980; sponsored by Am. Inst. of Aeron. and Astronautics and the Midwest Res. Inst.
(Contract EX-77-A-29-1010)
(NASA-TM-81444; DOE/NASA/1010-80/6; E-364) Avail: NTIS HC A02/MF A01 CSCL 10B

The Mod-1 machine was assembled without the blades, tested, and sent to the site at Boone, North Carolina for erection. The blades were transported directly to the site. A series of checkout tests were then conducted to evaluate performance and loads. The results of these tests compared well with the design data. K.L.

N80-19615*# United Technologies Corp., South Windsor, Conn. Power Systems Div.
ADVANCED TECHNOLOGY LIGHT WEIGHT FUEL CELL PROGRAM Final Report, 28 Jul. 1978 - 28 Jul. 1979
R. E. Martin 1979 52 p refs
(Contract NAS3-21257)
(NASA-CR-159807; FCR-1657) Avail: NTIS HC A04/MF A01 CSCL 10B

The development of a long life, high performance, high efficiency, hydrogen oxygen alkaline fuel cell configuration for application to a NASA orbiting space vehicle is documented. Seven full-size 0.25 ft 2 active area single cells were constructed and tested at cell temperatures between 140 F and 200 F, current densities out to 500 ASF, and reactant pressures up to 30 psia. Cells incorporating platinum-supported-on-carbon catalyst anodes demonstrated 8,085 cell-hours of endurance operation with virtually no change in performance and 2,995 cell-hours of operation to a cyclical load profiles with no apparent loss in cathode performance due to high voltage operation. Cell edge frame materials and heat treated polybenzimidazole (PBI) matrix samples were corrosion tested in 42 wt % aqueous potassium hydroxide at 250 F. Based upon available test data, PBI appears unsuitable for use as a fuel cell matrix material. Five semiconducting oxides were evaluated as cathode catalysts and as cathode catalyst supports. The candidate supports LaMnO3 and LaNiO3 appear to have development potential and merit further study. K.L.

N80-19616*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 3: OPERATIONS AND SYSTEMS SYNTHESIS, PHASE 2 Final Report, Jan. - Nov. 1979
Nov. 1979 596 p refs 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160480; D180-25461-3) Avail: NTIS HC A25/MF A01 CSCL 10A

The results of the operations analyses are reported. Some of these analyses examined operations aspects of space vehicle in-space maintenance. Many of the analyses explored in great depth operations concerned the LEO Base cargo handling operations. Personnel transportation operations and cargo packaging were also analyzed. These operations analyses were performed to define the operational requirements for all of the SPS system elements so that equipment and facilities could be synthesized, and to make estimates of the manpower requirements. An overall, integrated, end-to-end description of the SPS operations is presented. The detailed operations analyses, upon which this integrated description was based, are included. F.O.S.

N80-19617*# Dow Corning Corp., Midland, Mich.
DEVELOP SILICONE ENCAPSULATION SYSTEMS FOR TERRESTRIAL SILICON SOLAR ARRAYS Final Report
Dec. 1979 57 p Prepared for JPL and DOE
(Contract JPL-954995)
(NASA-CR-162840; DOE/JPL-954995-80/6) Avail: NTIS HC A04/MF A01 CSCL 10A

A cost effective encapsulant system was identified and a silicone acrylic cover material containing a durable ultraviolet screening agent was prepared. The effectiveness of the cover material in protecting photo-oxidatively sensitive polymers was demonstrated. K.L.

N80-19618*# Sensor Technology, Inc., Chatsworth, Calif.
AUTOMATED ARRAY ASSEMBLY TASK IN-DEPTH STUDY OF SILICON WAFER SURFACE TEXTURIZING Final Report,

31 Dec. 1978 - 31 Jul. 1979
Gregory T. Jones and Sang S. Rhee Jul. 1979 70 p refs
Prepared for JPL and DOE
(Contract JPL-955266)
(NASA-CR-162883; DOE/JPL-955266-79/2) Avail: NTIS
HC A04/MF A01 CSCL 10A

Several aspects of silicon wafer surface texturizing were studied. A low cost cleaning method that utilizes recycled Freon in an ultrasonic vapor degreaser to remove organic and inorganic contaminants from the surface of silicon wafers as received from silicon suppliers was investigated. The use of clean dry air and high throughout wafer batch drying techniques was shown to lower the cost of wafer drying. A two stage texturizing process was examined for suitability in large scale production. Also, an in-depth gettering study with the two stage texturizing process was performed for the enhancement of solar cell efficiency, minimization of current versus voltage curve dispersion, and improvement in process reproducability. The 10% efficiency improvement goal was exceeded for the near term implementation of flat plate photovoltaic cost reduction. R.E.S.

N80-19619*# Ross (Bernd) Associates, San Diego, Calif.
DEVELOPMENT OF ECONOMICAL IMPROVED THICK FILM SOLAR CELL CONTACT Final Report, Apr. - Dec. 1979
Bernd Ross Dec. 1979 107 p refs Prepared for JPL and DOE
(Contract JPL-955164)
(NASA-CR-162849; DOE/JPL-955164-79/4; JPL-9950-287)
Avail: NTIS HC A06/MF A01 CSCL 10A

Metal screened electrodes were investigated with base metal pastes and silver systems being focused upon. Contact resistance measurements were refined. A facility allowing fixing in hydrogen and other atmospheres was acquired. Several experiments were made applying screenable pastes to solar cells. Doping investigations emphasized eutectic alloys reduced to powders. Metal systems were reviewed and base metal experiments were done with nickel and copper using lead and tin as the frit metals. Severe adhesion problems were experienced with hydrogen atmospheres in all metal systems. A two step firing schedule was devised. Aluminum-silicon and aluminum-germanium eutectic doping additions to copper pastes were tried on 2 1/4 in diameter solar cell back contacts, both with good results. R.E.S.

N80-19620*# SOL/LOS, Inc., Los Angeles, Calif.
A NEW METHOD OF METALLIZATION FOR SILICON SOLAR CELLS Final Report, Dec. 1978 - Sep. 1979
Milo Macha Dec. 1979 67 p Prepared for JPL and DOE
(Contract JPL-955318)
(NASA-CR-162823; DOE/JPL-955318-79/3; JPL-9950-288)
Avail: NTIS HC A04/MF A01 CSCL 10A

The new metallization process based on Mo-Sn system was studied. The reaction mechanism of MoO3 and its mixture with Sn was examined. The basic ink composition was modified in order to obtain a low ohmic contact to the cell. The electrical characteristics of the cells were comparable with the existing metallization processes. However, in comparison with the standard processes using silver as the contacting metal, the saving obtained by the use of the new process was substantial. K.L.

N80-19621*# Sanders Associates, Inc., Nashua, N. H. Energy Systems Center
HIGH TEMPERATURE SOLAR THERMAL RECEIVER Final Report
Dec. 1979 109 p Prepared for JPL and DOE
(Contract JPL-955454)
(NASA-CR-162831; JPL-9950-283) Avail: NTIS
HC A06/MF A01 CSCL 10A

A design concept for a high temperature solar thermal receiver to operate at 3 atmospheres pressure and 2500 F outlet was developed. The performance and complexity of windowed matrix, tube-header, and extended surface receivers were evaluated. The windowed matrix receiver proved to offer substantial cost and performance benefits. An efficient and cost effective hardware design was evaluated for a receiver which can be readily interfaced to fuel and chemical processes or to heat engines for power generation. K.L.

N80-19622*# General Electric Co., Schenectady, N. Y.
LOW COST POINT FOCUS SOLAR CONCENTRATOR, PHASE 1: PRELIMINARY DESIGN Final Report
16 Mar. 1979 235 p Prepared for JPL
(Contract JPL-955210)
(JPL-9950-273; NASA-CR-162830) Avail: NTIS
HC A11/MF A01 CSCL 10A

The preliminary design of a low cost point focus solar concentrator is presented. The analysis, design, testing, and manufacturing assessments are described. R.E.S.

N80-19623*# Varian Associates, Lexington, Mass.
SLICING OF SILICON INTO SHEET MATERIAL. SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SOLAR ARRAY PROJECT Final Report, 9 Jan. 1976 - 30 Sep. 1979
J. R. Fleming, S. C. Holden, and R. G. Wolfson 21 Sep. 1979 460 p Prepared for JPL and DOE
(Contracts NAS7-100; JPL-954374)
(NASA-CR-162828; DOE/JPL-954374-79/10; JPL-9950-272)
Avail: NTIS HC A20/MF A01 CSCL 10A

The use of multiblade slurry sawing to produce silicon wafers from ingots was investigated. The commercially available state of the art process was improved by 20% in terms of area of silicon wafers produced from an ingot. The process was improved 34% on an experimental basis. Economic analyses presented show that further improvements are necessary to approach the desired wafer costs, mostly reduction in expendable materials costs. Tests which indicate that such reduction is possible are included, although demonstration of such reduction was not completed. A new, large capacity saw was designed and tested. Performance comparable with current equipment (in terms of number of wafers/cm) was demonstrated. R.E.S.

N80-19624*# Boeing Engineering and Construction, Seattle, Wash.
LOW COST POINT FOCUS SOLAR CONCENTRATOR, PHASE 1
Mar. 1979 181 p Prepared for JPL
(Contract JPL-995209)
(NASA-CR-162848; JPL-9950-279) Avail: NTIS
HC A09/MF A01 CSCL 10A

Design concepts and plans for mass-production facilities and equipment, field installation, and maintenance were developed and used for cost analysis of a pneumatically stabilized plastic film point focus solar concentrator which has potential application in conjunction with Brayton cycle engines or supply of thermal energy. A sub-scale reflector was fabricated and optically tested by laser ray tracing to determine focal deviations of the surface slope and best focal plane. These test data were then used for comparisons with theoretical concentrator performance modeling and predictions of full-scale design performance. Results of the economic study indicate the concentrator design will have low cost when mass-produced and has cost/performance parameters that fall within current Jet Propulsion Laboratory goals. A.R.H.

N80-19625*# Acurex Corp., Mountain View, Calif. Alternate Energy Division
LOW-COST POINT-FOCUS SOLAR CONCENTRATOR, PHASE 1 Final Report
E. V. Nelson, T. C. Derbidge, D. Erskine, R. A. Maraschin, W. A. Niemeyer, M. J. Matsushita, and P. T. Overly 16 Mar. 1979 260 p Prepared for JPL
(Contract JPL-955208)
(NASA-CR-162839; JPL-9550-28; Acurex-FR-79-340) Avail: NTIS HC A12/MF A01 CSCL 10A

The results of the preliminary design study for the low cost point focus solar concentrator (LCPFSC) development program are presented. A summary description of the preliminary design is given. The design philosophy used to achieve a cost effective design for mass production is described. The concentrator meets all design requirements specified and is based on practical design solutions in every possible way. R.E.S.

N80-19626*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 1: SUMMARY

Gerald J. Barna, Raymond K. Burns, and Gary D. Sagerman. Jan. 1980. 89 p.
(Contract EC-77-A-31-1062)
(NASA-TM-81400; DOE/NASA/1062-80/4; E-312) Avail: NTIS. HC A05/MF A01. CSCL 10B

Various advanced energy conversion systems that can use coal or coal-derived fuels for industrial cogeneration applications were compared to provide information needed by DOE to establish research and development funding priorities for advanced-technology systems that could significantly advance the use of coal or coal-derived fuels in industrial cogeneration. Steam turbines, diesel engines, open-cycle gas turbines, combined cycles, closed-cycle gas turbines, Stirling engines, phosphoric acid fuel cells, molten carbonate fuel cells, and thermionics were studied with technology advancements appropriate for the 1985-2000 time period. The various advanced systems were compared and evaluated for wide diversity of representative industrial plants on the basis of fuel energy savings, annual energy cost savings, emissions savings, and rate of return on investment as compared with purchasing electricity from a utility and providing process heat with an on-site boiler. Also included in the comparisons and evaluations are results extrapolated to the national level. F.O.S.

N80-19627*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR SEMCO, LOXAHATCHEE, FLORIDA. Contractor Report, Oct. 1978 - Aug. 1979
Jan. 1980. 75 p. refs. Sponsored in part by DOE.
(Contract NAS8-32036)
(NASA-CR-161379) Avail: NTIS. HC A04/MF A01. CSCL 10A

The operational and thermal performance of a variety of solar systems installed in operational test sites are described. The analysis used is based on instrumented system data monitored and collected for at least one full season of operation. The long-term field performance of the installed system and the technical contributions to the definition of techniques and requirements solar energy system design are analyzed. The solar energy system was designed to supply domestic hot water for a family of four, single-family residences. It consists of two liquid flat plate collectors, single tank, controls, and transport lines. F.O.S.

N80-19628*# Wyle Labs., Inc., Huntsville, Ala.
THERMAL PERFORMANCE EVALUATION OF THE NORTHROP MODEL NSC-01-0732 CONCENTRATING SOLAR COLLECTOR ARRAY AT OUTDOOR CONDITIONS
Dec. 1979. 18 p. Sponsored in part by DOE.
(Contract NAS8-32036)
(NASA-CR-161354; WYLE-TR-531-39) Avail: NTIS. HC A02/MF A01. CSCL 10A

The thermal efficiency of the concentrating, tracking solar collector was tested after ten months of operation at the Marshall Space Flight Center solar house. The test procedures and results are presented. K.L.

N80-19629*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: A SEASONAL REPORT FOR SEMCO, MACON, GEORGIA. Contractor Report, May 1978 - Apr. 1979
Jan. 1980. 72 p. refs. Sponsored in part by DOE.
(Contract NAS8-32036)
(NASA-CR-161380) Avail: NTIS. HC A04/MF A01. CSCL 10A

The solar energy system for heating water in a single-family residence for a family of four is described. The system operation, the operating energy, energy savings, maintenance, and performance are analyzed. F.O.S.

N80-19630*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INSTALLATION GUIDELINES FOR SOLAR HEATING SYSTEM, SINGLE-FAMILY RESIDENCE AT NEW CASTLE, PENNSYLVANIA
Jan. 1980. 169 p. Sponsored in part by DOE.
(Contract NAS8-32093)
(NASA-CR-161355) Avail: NTIS. HC A08/MF A01. CSCL 10A

The solar heating system installer guidelines are presented for each subsystem. This single family residential heating system is a solar-assisted, hydronic-to-warm-air system with solar-assisted domestic water heating. It is composed of the following major components: (1) liquid cooled flat plate collectors; (2) water storage tank; (3) passive solar-fired domestic water preheater; (4) electric hot water heater; (5) heat pump with electric backup; (6) solar hot water coil unit; (7) tube-and-shell heat exchanger, three pumps, and associated pipes and valving in an energy transport module; (8) control system; and (9) air-cooled heat purge unit. Information is provided on the operating procedures, controls, caution requirements, and routine and schedule maintenance in the form of written descriptions, schematics, detail drawings, pictures, and manufacturer's component data. R.E.S.

N80-19631*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, VOLUME 1, PHASE 2: EXECUTIVE SUMMARY. Final Report
Nov. 1979. 38 p. Revised.
(Contract NAS9-15636)
(NASA-CR-160540; D180-25461-1-Vol-1-Rev-A) Avail: NTIS. HC A03/MF A01. CSCL 10A

A review of solar energy conversion and utilization is presented. The solar power satellite system is then described. Overall system definition and integration is discussed. Principal reference system study accomplishments and conclusions are presented. R.E.S.

N80-19632*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ANNUAL TECHNICAL REPORT, FISCAL YEAR 1979. VOLUME 1: EXECUTIVE SUMMARY. Annual Report
John W. Lucas. 15 Jan. 1980. 48 p. Sponsored in part by DOE.
(Contract NAS7-100)
(NASA-CR-159715; JPL-Pub-79-112-Vol-1) Avail: NTIS. HC A03/MF A01. CSCL 10A

Accomplishments of the Point-Focusing Distributed Receiver Technology project are presented. The following aspects of the project are discussed: information dissemination, concentrator development, receiver and heat transport network development, power conversion, manufacturing, systems engineering, and tests and evaluations. R.E.S.

N80-19633*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GLASS FOR LOW-COST PHOTOVOLTAIC SOLAR ARRAYS
F. L. Bouquet. 1 Feb. 1980. 65 p. refs. Sponsored in part by DOE.
(Contract NAS7-100)
(NASA-CR-162885; DOE/JPL-1012-40; JPL-Pub-80-12) Avail: NTIS. HC A04/MF A01. CSCL 10A

Various aspects of glass encapsulation that are important for the designer of photovoltaic systems are discussed. Candidate glasses and available information defining the state of the art of glass encapsulation materials and processes for automated, high volume production of terrestrial photovoltaic devices and related applications are presented. The criteria for consideration of the glass encapsulation systems were based on the low-cost solar array project goals for arrays: (1) a low degradation rate, (2) high reliability, (3) an efficiency greater than 10 percent, (4) a total array price less than $500/kW, and (5) a production capacity of 500,000 kW/yr. The glass design areas discussed include the types of glass, sources and costs, physical properties, and glass modifications, such as antireflection coatings. R.E.S.

N80-19634*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE EFFECTS OF REGIONAL INSOLATION DIFFERENCES UPON ADVANCED SOLAR THERMAL ELECTRIC POWER PLANT PERFORMANCE AND ENERGY COSTS
A. F. Latta, J. M. Bowyer, T. Fujita, and P. H. Richter. 1 Feb. 1980. 117 p. refs. Revised. Sponsored in part by DOE.
(Contract NAS7-100)
(NASA-CR-162886; JPL-Pub-79-39-Rev-1;

DOE/JPL-1061-17-Rev-1) Avail: NTIS HC A08/MF A01 CSCL 10A

The performance and cost of four 10 MWe advanced solar thermal electric power plants sited in various regions of the continental United States was studied. Each region has different insolation characteristics which result in varying collector field cross, plant performance, capital costs and energy costs. The regional variation in solar plant performance was assessed in relation to the expected rise in the future cost of residential and commercial electricity supplied by conventional utility power systems in the same regions. A discussion of the regional insolation data base is presented along with a description of the solar systems performance and costs. A range for the forecast cost of conventional electricity by region and nationally over the next several decades is given. R.E.S.

N80-19635# EIC, Inc., Newton, Mass.
INVESTIGATIONS OF THE SAFETY OF Li/SOCl2 BATTERIES Quarterly Report, 30 Mar. - 30 Jun. 1979
Kuzhikalail M. Abraham, Richard M. Mank, and Gerhard L. Holleck Nov. 1979 57 p refs
(Contract DAAG07-79-C-0564; DA Proj. 1L1-62705-AH-94)
(AD-A077894; C-536-3; DELET-TR-78-0564-3; QR-3) Avail: NTIS HC A04/MF A01 CSCL 10/3

Analysis of products from Li/SOCl2 cells during various modes of operation was carried out using cyclic voltammetry and infrared spectrometry. Infrared spectral data indicated that LiAlSCl2 and probably LiAlS2 are formed in cathode limited Li/SOCl2 cells during forced overdischarge and resistive load overdischarge. These compounds are formed from the reaction of Li2S, produced in the cell under these operational modes, with LiAlCl4. It has been found that the lithium thioaluminum compounds can be prepared from the reaction between Li2S and AlCl3. Analysis of products from cells utilizing Li2O/AlCl3 based electrolytes did not show any significantly different products after overdischarge or constant current 'charge'; preliminary studies showed that Li2S/AlCl3 based electrolytes may be useful as alternatives to LiAlCl4 in Li/SOCl2 batteries. GRA

N80-19636# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.
SURVIVABILITY OF REMOTE SITE ALTERNATE ENERGY SYSTEMS. VOLUME 1: SURVIVABILITY ANALYSIS Final Report, Sep. 1978 - Mar. 1979
Karl E. Scheuch and Glenn T. Baird Sep. 1979 82 p refs
(Contract F29601-78-C-0015; AF Proj. 2103)
(AD-A078118; AFESC/ESL-TR-79-21-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 10/3

As a result of increasing fuel costs and decreasing reserves, the USAF is studying the possibility of providing power to remote sites by means of alternate energy sources. Remote sites are identified and categorized. Several alternate energy sources are examined with respect to reliability, maintainability, and survivability against natural and man-made threats. Energy storage devices are also studied, and a final decision matrix is developed which relates these findings. Author (GRA)

N80-19637# Massachusetts Inst. of Tech., Cambridge. Water Resources and Hydrodynamics Lab.
WAVE POWER EXTRACTION BY FLOATING BODIES
C. C. Mei and J. N. Newman Nov. 1979 27 p refs
(Contract N00014-76-C-0214)
(AD-A078058) Avail: NTIS HC A03/MF A01 CSCL 10/2

The linearized theory of water waves is reviewed in the context of wave-energy absorbers. A global analysis is outlined, leading to relatively simple expressions for the maximum energy absorption. Calculations are presented for the performance of Salter cam in two dimensions, and of a Cockerell raft in both two and three dimensions. Similar rates of optimum energy absorption are anticipated for other devices including the Kaimei ship and French air bag. Author (GRA)

N80-19638# Naval Coastal Systems Center, Panama City, Fla.
DATA ANALYSIS FOR OCEAN THERMAL ENERGY CONVERSION (OTEC)
Susan M. Tuovila Nov. 1979 36 p
(AD-A077908; NCSC-TM-271-79) Avail: NTIS HC A03/MF A01 CSCL 08/10

Ocean Thermal Energy Conversion (OTEC) is the concept for a system which will extract energy from the ocean by taking advantage of the sizable temperture difference between surface and bottom water in a tropical ocean. A fundamental part of an OTEC system is a large section of heat exchangers through which the energy transfer is made. It is crucial to keep the surface of these heat exchangers clean because fouling by organisms in sea water can cause deterioration of the heat transfer effectiveness. The Naval Coastal Systems Center (NCSC) investigated cleaning techniques that would effectively prevent fouling in metal tubes over a long period of time. The physical structure and cleaning systems of the OTEC assembly at Panama City, Florida have been described in several papers and will be dealt with only briefly here. This report will describe the computer driven control and data analysis system used in conjunction with the mechanical system. This will include explanations of the physical computer setup and its interaction with hardware components of the system, the software methods of sampling and data management, and data analysis techniques. A brief discussion of the underlying theory of heat transfer is also included. GRA

N80-19639# UOP, Inc., Des Plaines, Ill. Corporate Research Center.
OPTIMIZATION OF Pt-DOPED KOCITE (TRADE NAME) ELECTRODES IN H3Po4 FUEL CELLS Final Technical Report, Sep. 1978 - May 1979
L. B. Welsh and R. W. Leyerle Aug. 1979 74 p refs
(Contract DAAG53-76-C-0014; DA Proj. 1L1-62733-AH-20)
(AD-A075372; TR-6) Avail: NTIS HC A04/MF A01 CSCL 09/1

The use of UOP Inc. Kocite (R*)-derived electrocatlysts as low-cost air and/or fuel electrocatalysts in phosphoric acid electrolyte fuel cells has been optimized with respect to some of the electrocatlyst and electrode structure parameters. Kocite-derived electrocatalysts are made from Kocite R* materials, which are composite structures consisting of pyropolymers chemically bonded to refractory substrates. Fuel cell electrodes are fabricated from these electrocatalysts and normally tested as anodes and cathodes in model fuel cells. Author (GRA)

N80-19640# Naval Civil Engineering Lab., Port Hueneme, Calif.
SOLAR-POWERED SUN TRACKER Final Report, Feb. 1977 - Sep. 1979
Carter J. Ward Jun. 1979 33 p refs
(ZF57571001)
(AD-A078653; CEL-TN-1556) Avail: NTIS HC A03/MF A01 CSCL 13/1

A solar-powered sun tracker believed to be capable of repositioning equipment to within 1 degree of the angle-of-incident radiation is described in this report. The proposed tracker is designed to reposition itself automatically after cloudy periods and should prove inexpensive as well as reliable. Included in this report are (1) a description of two tracker concepts, (2) a derivation of the heat-balance equation used to predict work available for equipment rotation, (3) a discussion of the experimental model fabricated to prove concept feasibility, and (4) an economic analysis comparing the cost of generating steam with a solar-powered boiler with the cost of generating steam with a coal-fired boiler. GRA

N80-19641# New Mexico Univ., Albuquerque Center for Environmental Research and Development.
SOLAR POWERED LIQUID PISTON STIRLING CYCLE IRRIGATION PUMP Research Report, 1 May - 31 Dec. 1978
G. C. Bell 10 Apr. 1979 29 p refs
(Contract ET-78-G-03-1894)
(SAN/1894-1) Avail: NTIS HC A03/MF A01

A laboratory prototype of the liquid piston Stirling cycle heat engine was constructed with modeling and simulation. A range of engine sizes was used to determine lift head ranges. Preliminary investigations of solar energy inputs indicate numerous feasible methods to operate heat engines. The maximum rate of pumping obtained was one liter per 26 seconds through 109 cm lift head. DOE

N80-19642# San Diego State Univ., Calif.
RESEARCH ON DYNAMICS OF TUNDRA ECOSYSTEMS AND THEIR POTENTIAL RESPONSE TO ENERGY RESOURCE DEVELOPMENT Progress Report, 1 May 1978 30 Apr. 1979
P. C. Miller Jan. 1979 133 p refs
(Contract EE-77-S-03-1525)
(DOE/SF-01525-1) Avail: NTIS HC A07/MF A01

The ecological effects (costs and benefits) of impacts that can be expected from the development and utilization of energy resources in the arctic were investigated. The impacts studied include: altered nutrient availability (nitrogen and phosphorus); altered patterns of soil water drainage; and vehicle tracks. The general ecosystem characteristics used as integrative measures of the possible ecological effects include annual primary production and the relative aboveground growth of the different species or growth forms comprising the vegetation. Plant growth forms were defined by height, leaf longevity, position of the perennating bud, and rooting pattern. The main conclusion of the research is that species respond individually in terms of nutrient and total nonstructural carbohydrates accumulation to fertilization, and that the growth forms studied are not distinctive from each other on the basis of plant nutrition or growth. DOE

N80-19643# Sandia Labs., Albuquerque, N. Mex.
LITHIUM BATTERY STORAGE AND DISCHARGE TESTS
S. C. Levy 1979 10 p refs Presented at 7th Intern. Conf. on Chemical Vapor Deposition, Los Angeles, 14 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0869C; CONF-791017-10) Avail: NTIS HC A02/MF A01

A six year storage and discharge test of ambient temperature lithium batteries was initiated. Lithium-sulfur dioxide cells from three manufacturers and lithium polycarbon monofluoride cells from a fourth manufacture were used. Capacity versus rate and temperature storage versus temperature and discharge at constant and pulsed loads were studied. Two problems were identified which will prevent cells from operating continuously for five years. They are: (1) corrosion of the glass in the glass-to-metal seal; and (2) corrosion of the anode-to-can contact. In addition, cells exposed to high temperature storage experienced corrosion of the aluminum to tantalum weld in the positive lead. DOE

N80-19644# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
MODELING THE SPACE CONDITIONING ENERGY DEMAND OF A COMMUNITY AS A FUNCTION OF WEATHER
E. R. Reiter, A. M. Starr, C. C. Burns, H. H. Leong, and G. R. Johnson Sep. 1979 16 p refs
(Contract EY-76-S-02-1340)
(COO-1340-65) Avail: NTIS HC A02/MF A01

The computer model which calculated the daily energy demand during the heating season of Greeley, Colorado, Cheyenne, Wyoming, and Minneapolis, Minnesota is discussed. The model was found to be excellently suited to test certain conservation strategies. However, preliminary tests of energy demands during the air conditioning season revealed gross inefficiency of some of the cooling systems presently in operation. DOE

N80-19645# Midwest Research Inst., Golden, Colo.
GENERAL RELIABILITY AND SAFETY METHODOLOGY AND ITS APPLICATION TO WIND ENERGY CONVERSION SYSTEMS
M. Edesess and R. D. McConnell Sep. 1979 52 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-35-234) Avail: NTIS HC A04/MF A01

In conventional system reliability calculations, each component may be in the operable state of the under repair state. These calculations derive system unavailability, or the probability of the system's being down for repairs. By introducing a third component state between 'operable' and 'under repair'-namely, 'defective, but defect undetected'-the methods developed in this report enable system safety projections to be made in addition to availability projections. Also provided is a mechanism for computing the effect of inspection schedules on both safety and availability. A reliability and safety program (RASP) is detailed which perform these computations and also calculates costs for system inspections and repairs. RASP is applied to a simplified wind energy conversion system example. DOE

N80-19646# General Electric Co., Schenectady, N. Y.
SCREENING EVALUATION OF ELECTRIC POWER CYCLES INTEGRATED WITH COAL GASIFICATION PLANTS
S. P. Gallagher and D. J. Ahner Sep. 1979 80 p refs
(EPRI-AF-1160) Avail: NTIS HC A05/MF A01

Potentially lower cost alternatives to present concepts for integrated gasification combined cycle power plants were investigated. A relatively simple, potentially low cost, non steambottomed cycle was evolved and the system thermal efficiency calculated. Thermal efficiencies were also determined for several steam-bottomed cycles. The non steam-bottomed cycle was found to have a thermal efficiency of 32 percent. The steam-bottomed cycles analyzed in the study showed efficiency estimates between 38.8 and 40.3 percent, substantially higher than the non steam-bottomed case. The efficiency for an integrated gasification combined cycle using gas turbines at current firing temperatures was estimated at 37.6 percent. Performance at this level suggests the possibility that integrated gasification combined cycles using current gas turbines may be attractive for near term application. DOE

N80-19647# Institute for Energy Analysis, Oak Ridge, Tenn.
ENERGY ACCOUNTING FOR SOLAR AND ALTERNATIVE ENERGY SOURCES
Warren D. Devine, Jr. Jun. 1979 76 p refs
(Contracts EY-76-C-05-0033)
(ORAU/IEA(R)-79-11) Avail: NTIS HC A05/MF A01

Several inadequacies in present energy accounting practices are considered and an energy-accounting framework based upon the actual services provided to end users is proposed. Fifteen categories of energy service are described, and some of their characteristics are identified. The proposed energy accounting framework consists of two matrices - an energy-service matrix and an energy-carrier matrix. The energy-service matrix displays quantities of energy services provided in various ways as well as quantities of energy carriers used to provide energy services. The energy-carrier matrix displays quantities of energy carriers used to produce and distribute energy carriers to ultimate consumers. This accounting framework is illustrated with 1972 energy data for the United States, and several observations are made relative to long range solar energy research and development policy. DOE

N80-19648# Los Alamos Scientific Lab., N. Mex.
CHARACTERIZATION AND ASSESSMENT OF SELECTED SOLAR THERMAL ENERGY SYSTEMS FOR RESIDENTIAL AND PROCESS HEAT APPLICATIONS
J. C. Hyde Aug. 1979 55 p refs
(Contract W-7405-eng-36)
(LA-7995-TASE) Avail: NTIS HC A04/MF A01

The environmental data presented are in partial response to the Technology Assessment of Solar Energy (TASE) program, an assessment of the potential environmental, socioeconomic, and institutional impacts of solar technologies on the national, regional, and local community levels. The results of studies of seven solar thermal energy applications are presented. Five of these are residential applications and the remaining two applications produce industrial process heat. For each application, a representative system model and preliminary designs of major system elements were established. Then the following data were generated: annual useful energy produced, type and weight of the basic component materials, environmental residuals generated during system operation, and land and water requirements, the system characteristics and the environmental impacts are discussed. DOE

N80-19649# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ON INFLUENCING THE OPERATING TEMPERATURES OF MOTOROLA AND ARCO SOLAR PHOTOVOLTAIC MODULES
P. Raghuraman 11 Oct. 1979 30 p refs
(Contract EY-76-C-02-4094)
(COO-4094-59) Avail: NTIS HC A03/MF A01

The electrical power output of photovoltaic solar cell

modules decreases with increasing cell temperatures. Two such efforts on Motorola and Arco Solar modules are detailed using test measurements and analysis to increase the heat transfer from the modules and thereby lower the cell operating temperatures. The radiant heat emitted by the rear stainless steel pan of Motorola modules was increased by painting the pan with black and with white paint. This produced a pan temperature cooling of 3.7 C to 5 C, resulting in an increased electrical power output of 1.7 to 1.95 percent. Arco Solar modules were oriented horizontally and vertically to compare the effect of natural with forced convection cooling in the interior air column of the module. Natural convective heat transfer by vertical orientation produced a 1 to 3.5 C cooling over forced convective cooling by horizontal orientation. This cooling resulted in an increased cell electrical power output of 1 to 2.5 percent. DOE

N80-19650# Central Maine Power Co., Augusta.
CATARACT HYDROELECTRIC DEVELOPMENT EXPANSION STUDY
Jan. 1979 68 p refs Prepared in cooperation with Tippetts-Abbett-McCarthy-Stratton, New York, N.Y.
(Contract EW-78-F-07-1796)
(DOE/ID-01796-1) Avail: NTIS HC A04/MF A01

The Cataract hydroelectric power plant and dam was constructed in 1937-1938 and has been operated continually since that date. This unit is a vertical shaft Kaplan type machine with a rated output of 6650 kW at a design head of 44 ft. Maximum output is 8000 kW. The feasibility of expanding this existing plant was studied. The results indicate the following: the available head and unused flow at the Cataract Project will support an additional 6250 kW of generating capacity, the estimated gross plant investment cost of this plant would be $5,230,000 at present day costs. If a fishway is required the investment is estimated to be $5,730,000; and based on the analysis of 60 y of historical flow records this capacity addition would generate an average of 15,910,000 kWh annually. This feasibility study indicates that redevelopment of the Cataract site is a marginally economic proposition, which might offer some savings, over the life of the unit. DOE

N80-19651# Parsons-Brinckerhoff-Tudor-Bechtel, San Francisco, Calif.
POTENTIAL HYDROELECTRIC POWER, VERTICAL TURBINE, SPILLWAY COMBINE BROADWATER DAM Final Report
David C. Willer Apr. 1979 237 p
(Contract EW-78-F-07-1822)
(DOE/ID-01822-1) Avail: NTIS HC A11/MF A01

A feasibility study was made of the hydroelectric power potential at Broadwater Dam in western Montana. Two alternative configurations for the potential project were evaluated and the economics of four possible sources of project funding were assessed. The optimal project alternative was determined to be the apron-mounted configuration. The final choice of funding would be dependent on the power purchaser. It was shown that, regardless of the configuration or funding source selected, the project would be feasible. The cost of the apron-mounted configuration, which would consist of four turbine-generator units for a total installed capacity of 9.76 MW, was estimated as $13,250,000 with financing provided by either a PL-984 loan or tax-exempt bonds. The cost per installed kilowatt was therefore $1,350, and the cost per kilowatt-hour was 19.6 mills. The average annual energy was estimated to be 56.44 million kWh. DOE

N80-19652# Duke Univ., Durham, N. C. Dept. of Mechanical Engineering and Materials Science.
PREPARATION AND CHARACTERIZATION OF HYDROGENATED AMORPHOUS BORON THIN FILMS AND THIN FILM SOLAR CELLS PRODUCED BY GLOW DISCHARGE DECOMPOSITION METHODS Quarterly Progress Report, 1 Jul. - 30 Sep. 1979
Franklin H. Cocks, Phillip L. Jones, and Louis J. Dimmey Nov. 1979 12 p refs
(Contract DE-AC03-79ET-23041)
(DOE/ET-2304-1; QPR-3) Avail: NTIS HC A02/MF A01

The production and characterization of hydrogenated amorphous boron thin films is discussed. Both intrinsic and doped a-boron thin films were produced. Film characterization efforts are primarily focused on controlling the optical band gap by annealing the as-deposited films in vacuum at 400 C, and measuring the resulting optical gap as a function of bake-out time. Because the optical band gap of a-boron is observed to vary from 0.8 eV to over 2.0 eV as a function of hydrogenation, it should be possible, by controlled annealing, to obtain a-boron films with an optimal band gap of 1.45 eV. DOE

N80-19653# Boeing Aerospace Co., Seattle, Wash.
EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS-Cu/SUB 2-x/Se Quarterly Technical Progress Report, 1 Aug. - 1 Nov. 1979
R. A. Mickelsen, J. M. Stewart, W. S. Chen, and L. F. Buldhaupt Nov. 1979 16 p refs
(Contract DE-AC04-79ET-23005)
(DOE/ET-23005-T2; QTPR-2) Avail: NTIS HC A02/MF A01

The feasibility of using CU/sub 2-x/Se as a semiconductor material for the low cost production of photovoltaic solar cells was investigated. The Cu/sub 2-x/Se films was produced by coevaporation from individually monitored Cu and Se vapor sources. With a substrate temperature of 170 C, single phase cubic Cu/sub 2-x/Se films were produced. These films had a direct band gap of 2.2 eV and an indirect band gap of 1.4 eV. DOE

N80-19654# Brookhaven National Lab., Upton, N. Y.
ELECTROLYSIS-BASED HYDROGEN STORAGE SYSTEMS OVERVIEW AND RATIONALE OF THE BROOKHAVEN NATIONAL LABORATORY MANAGED PROGRAM
A. Mezzina 1979 5 p Presented at the DOE Chem. Energy Storage and Hydrogen Energy Systems Contracts Rev. Meeting, Reston, Va., 12 Nov. 1979
(Contract EY-76-C-02-0016)
(BNL-26904; CONF-791127-4) Avail: NTIS HC A02/MF A01

A technological base in chemical/hydrogen storage technology is developed and near-term opportunities for technology transfer are identified. The emphasis is on conversion of our inexhaustible resources in a cost effective manner. Budget allocations are summarized showing electrolytic hydrogen production as the highest priority area. A budget activity summary is also presented. DOE

N80-19655# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: IMPACT ANALYSIS REPORT. VOLUME 2: SITE-SPECIFIC AND REGIONAL IMPACT ANALYSES Final Report, Jul. 1975 - Oct. 1979
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, and Martha W. Gilliland Mar. 1979 991 p refs
(Contract EPA-68-01-1916)
(PB80-113574; EPA-600/7-79-082B) Avail: NTIS HC A99/MF A01 CSCL 10A

The results of impact analyses conducted as a part of a technology assessment of the development of six energy resources (coal, geothermal, natural gas, oil, oil shale and uranium) in eight western states (Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah and Wyoming) during the period 1975-2000 are presented. The likely impacts of deploying typical energy resource development technologies at sites representative of the kinds of conditions likely to be encountered are described. Local and regional impacts are discussed. GRA

N80-19656# National Technical Information Service, Springfield, Va.
CADMIUM SULFIDE SOLAR CELLS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1977
Brian Carrigan Dec. 1979 256 p
(PB80-802218) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Citations from Federally-funded research cover cadmium sulfide solar cell theory, design, development, fabrication, and degradation. Studies include junctions with thin films of copper sulfide, selenides, and tellurides. The performance, testing, analysis, efficiency, and costs of these cells are covered. This

updated bibliography contains 248 abstracts, none of which are new entries to the previous edition. GRA

N80-19657# National Technical Information Service, Springfield, Va.
SOLAR ELECTRIC POWER GENERATION, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Oct. 1978 - Nov. 1979
Audrey S. Hundemann Dec. 1979 115 p Supersedes NTIS/PS-78/1109; NTIS/PS-77/0900; NTIS/PS-76/0797 (PB80-803034; NTIS/PS-78/1109; NTIS/PS-77/0900; NTIS/PS-76/0797) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

A worldwide literature survey cites power generation by direct conversion with solar cells and indirect conversion using solar heat. Topic areas cover solar tower power plants, orbital solar energy technology, photovoltaic power generation, and solar augmentation of hydroelectric power systems. A few abstracts pertain to the future role that solar energy will play in production of electric power and general studies comparing the technical and economic feasibility of various methods of electric power generation. Abstracts dealing with solar sea power generation and spacecraft power supplies are excluded. This updated bibliography contains 108 abstracts, all of which are new entries to the previous edition. GRA

N80-19658# National Technical Information Service, Springfield, Va.
SOLAR ELECTRIC POWER GENERATION, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Sep. 1978
Audrey S. Hundemann Dec. 1979 235 p
(PB80-803000) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Citations of Federally-funded research are presented pertaining to electric power generation by both direct conversion with solar cells and indirect conversion using solar heat. Topic areas cover equipment design, site surveys, economics, and feasibility studies of solar power satellite systems, photovoltaic systems, solar total energy systems, and central receiver solar thermal power systems. A few abstracts deal with phase change materials and thermal energy storage systems. This updated bibliography contains 228 abstracts, none of which is new to the previous edition. GRA

N80-19659# National Technical Information Service, Springfield, Va.
SOLAR ELECTRIC POWER GENERATION, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Oct. 1978 - Nov. 1979
Audrey S. Hundemann Dec. 1979 141 p Supersedes NTIS/PS-78/1108; NTIS/PS-77/0898; NTIS/PS-76/0796; NTIS/PS-75/691; NTIS/PS-75/346 (PB80-803018; NTIS/PS-78/1108; NTIS/PS-77/0898; NTIS/PS-76/0796; NTIS/PS-75/691; NTIS/PS-75/346) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Equipment design, site surveys, economics, and feasibility studies of solar power satellite systems, photovoltaic systems, solar total energy systems, and central receiver solar thermal power systems are discussed in the 134 Federally-sponsored research reports cited in this updated bibliography. All entries are new to the previous edition. GRA

N80-19660# National Technical Information Service, Springfield, Va.
SOLAR ELECTRIC POWER GENERATION, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1976 - Sep. 1978
Audrey S. Hundemann Dec. 1979 253 p
(PB80-803026) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Solar tower power plants, orbital solar energy technology, photovoltaic power generation, and solar augmentation of hydroelectric power systems are discussed in citations of worldwide reports. The technical and economic feasibility of various methods of electric power generation is also considered. This updated bibliography which contains 246 abstracts. None of the entries is new to the previous edition. GRA

N80-19661# National Technical Information Service, Springfield, Va.
SOLAR SEA POWER PLANTS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979
Audrey S. Hundemann Dec. 1979 314 p Supersedes NTIS/PS-78/1223; NTIS/PS-77/1056; NTIS/PS-76/0901 (PB80-802580; NTIS/PS-78/1223; NTIS/PS-77/1056; NTIS/PS-76/0901) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Federally-funded research studies dealing with the technical and economic feasibility of solar sea power plants are discussed. Topic areas cover condenser, evaporator, and heat exchanger design, and fouling and corrosion prevention. Site selection, dynamic modeling studies, and general studies dealing with solar sea power as an energy alternative are included. This updated bibliography contains 307 abstracts, 97 of which are new entries to the previous edition. GRA

N80-19662# National Technical Information Service, Springfield, Va.
SOLAR SEAPOWER PLANTS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979
Audrey S. Hundemann Dec. 1979 257 p Supersedes NTIS/PS-78/1224; NTIS/PS-77/1057; NTIS/PS-76/0902 (PB80-802598; NTIS/PS-78/1224; NTIS/PS-77/1057; NTIS/PS-76/0902) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

The present status and future prospects of using the ocean thermal gradient for production of electric power are discussed in these citations from worldwide research. Engineering, economic, and feasibility studies are covered, including studies dealing with systems and component design. This updated bibliography contains 250 abstracts, 126 of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-19663*# Orion Research, Inc., Cambridge, Mass.
WATER QUALITY MONITOR Final Report
Steven West, John Crisos, and Wilfred Baxter Mar. 1979 119 p refs Original contains color illustrations
(Contract NAS9-14229)
(NASA-CR-160412) Avail: NTIS HC A06/MF A01 CSCL 13B

The preprototype water quality monitor (WQM) subsystem was designed based on a breadboard monitor for pH, specific conductance, and total organic carbon (TOC). The breadboard equipment demonstrated the feasibility of continuous on-line analysis of potable water for a spacecraft. The WQM subsystem incorporated these breadboard features and, in addition, measures ammonia and includes a failure detection system. The sample, reagent, and standard solutions are delivered to the WQM sensing manifold where chemical operations and measurements are performed using flow through sensors for conductance, pH, TOC, and NH3. Fault monitoring flow detection is also accomplished in this manifold assembly. The WQM is designed to operate automatically using a hardwired electronic controller. In addition, automatic shutdown is incorporated which is keyed to four flow sensors strategically located within the fluid system. K.L.

N80-19664*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
AUTOMATED SYRINGE SAMPLER Patent Application
Gerald C. Purgold, inventor (to NASA) Filed 11 Jan. 1980 16 p
(NASA-Case-LAR-12308-1; US-Patent-Appl-SN-111438) Avail: NTIS HC A02/MF A01 CSCL 13B

The invention is housed within a housing and positionable within a test fluid medium where a pump causes continuous test fluid flow therethrough via inlet filters and a conduit. A plurality of sampling devices are disposed on a rack slidably received in the housing and are responsive to a remote signal

received through an antenna to a receiver to activate circuitry elements. When activated the circuitry provides power individually, collectively or selectively to servomechanisms thereby moving the actuator arm and its attached jawed bracket supporting an evacuated tube toward stationary needle. The septum is punctured by the open end of the needle contained within the protective sleeve and a sample of the fluid test medium in the conduit flows through the needle and is transferred to the tube. NASA

N80-19665# Science Spectrum, Santa Barbara, Calif.
A BIOLOGICAL WASTE WATER MONITOR STUDY USING DIFFERENTIAL LASER LIGHT SCATTERING FROM BACTERIA Final Report 15 Aug. 1978 - 14 Aug. 1979
Philip J. Wyatt Oct. 1979 41 p refs
(Contract F49620-78-C-0096; AF Proj. 2312)
(AD-A078527; SSI-2015-F; AFOSR-79-1278TR) Avail: NTIS HC A03/MF A01 CSCL 06/20

A ninety-minute bioassay of selected toxicants (monomethylhydrazine, dimethylhydrazine, nitrosodimethylamine, JP4, and JP8) in water has been confirmed. The method consists of measuring the differential light scattering (DLS) patterns of exponential phase bacterial suspensions in water containing the selected toxicant relative to a toxicant-free control suspension. The suspensions are illuminated by a fine laser beam and the light scattered as a function of angle with respect to the incident beam is recorded (the DLS pattern). Relative to the bacteria in the control, toxicant-free, suspension bacteria affected by the toxicants may change their shape, average size, size distribution, and/or number density. Any such changes will in general result in a changed DLS pattern relative to that of the control. The measurement of such differences forms the basis for the present bioassay technique. The bacterial suspensions are usually prepared from a bacterial chemostat source driven by peristaltic pumps of a Technicon manifold. Throughout an 8 hour sampling period, cultures will generally not vary by more than 20% in number density and negligibly in morphology. Within the ninety minute assay period, number density variations are less than 5%. GRA

N80-19666# Battelle Pacific Northwest Labs., Richland, Wash.
ALASKAN ENVIRONMENTAL RESEARCH. SECTION 12.0 OF PART 2: ECOLOGICAL SCIENCES Annual Report, 1978
W. C. Hanson and L. E. Eberhardt Jul. 1979 31 p refs
(Contract EY-76-C-06-1830)
(PNL-2850-Pt-2-Suppl) Avail: NTIS HC A03/MF A01

Ecological consequences of resource developments in northern Alaska were investigated. Qualitative and quantitative results that describe environmental costs incurred by petroleum resource extraction and transportation, including interaction of industrial activities with arctic foxes (Alopex lagopus), small mammals, and tundra-nesting birds in the Prudhoe Bay field and along the Trans-Alaska pipeline and haul road are presented. Similar information from the Colvile River delta, baseline information on moose (Alces alces) populations, caribou (Rangifer tarandus) range quality and use, and lichen communities that are or will be impacted by resource developments is included. Field experiments to determine lichen sensitivities to sulfur oxide concentrations likely to be encountered near pipeline pumping stations; food chain transfer of stable and radioactive elements that utilize a data base of some 19 years for comparative purposes; and evaluation of oil field development activities on rabies and other physiological phenomena in foxes are described. DOE

N80-19667# Battelle Pacific Northwest Labs., Richland, Wash.
MATHEMATICAL MODELS FOR ATMOSPHERIC POLLUTANTS. APPENDIX B: CHEMICAL AND PHYSICAL PROPERTIES OF GASES AND AEROSOLS Final Report
R. L. Drake, J. M. Hales, J. Mishima, and D. R. Drewes Aug. 1979 82 p refs
(Contract EY-76-C-06-1830)
(EPRI-EA-1131-App-B) Avail: NTIS HC A05/MF A01

Some of the important chemical and physical properties of gases and aerosols are described. These properties are required to determine the fate of airborne pollutants. The following chemical elements are discussed: hydrogen, oxygen, nitrogen, sulfur, and carbon. The tropospheric aerosol is considered from the point of view of an evolving population of particles. Particle and population properties are described, and examples of atmospheric aerosol distributions are presented. Finally, the sources and properties of airborne radionuclides from light-water reactors are discussed. DOE

N80-19668# Argonne National Lab., Ill.
ENVIRONMENTAL AND ECONOMIC EVALUATIONS OF ENERGY RECOVERY FROM AGRICULTURAL AND FORESTRY RESIDUES
Jerome P. Harper, Antonios A. Antonopoulos, and Andrew A. Sobek Aug. 1979 113 p refs
(Contract W-31-109-eng-38)
(ANL/EES/TM-58) Avail: NTIS HC A06/MF A01

Six biomass energy production model systems involving four conversion methods and five residues are described: hydrolysis of corn residues, pyrolysis of corn residues, combustion of cotton-ginning residues, pyrolysis of wheat residues, fermentation of molasses, and combustion of pulp and papermill wastes. Estimates of material and energy flows for those systems are given per 10 to the 12th power Btu of recovered energy. Regionalization of the model systems to the primary production region for the crop from which the residue is obtained was undertaken. The associated environmental consequences of residue utilization were then assessed for the production region. The environmental impacts of operating the model systems are examined. On the basis of estimates found in the literature, capital, operating, and maintenance cost estimates are given for the model systems. The study indicates that the most serious environmental impacts arise from residue removal rather than from conversion. DOE

N80-19669# Atlantic Research Corp., Alexandria, Va.
EVALUATION OF METHODOLOGY AND PROTOTYPE TO MEASURE ATMOSPHERIC SULFURIC ACID Final Report, Sep. 1976 - Nov. 1978
R. E. Snyder, M. E. Tonkin, and A. M. McKissick Aug. 1979 172 p refs
(Contract EPA-68-02-2467)
(PB80-107055; EPA-600/2-79-168) Avail: NTIS HC A08/MF A01 CSCL 13B

A method was developed to selectively assay ambient sulfuric acid aerosol. The method uses the vapor of a volatile amine (or amine derivative) to neutralize the acid as it is collected on a Teflon filter. The amine sulfate thus formed is thermally decomposed at 200 C to release sulfur dioxide, or other stoichiometrically related sulfur containing adducts, which are measured by a flame photometric detector. Immediate chemical fixation of the acid lessens the chance of side reactions with other substances on the filter, while the relatively low decomposition temperature aids in eliminating other sulfur-containing particles. Sulfur dioxide is also collected as a reagent complex on the filter, but is selectively removed by heating at 100 C. GRA

N80-19670# AeroChem Research Labs., Inc., Princeton, N. J.
MOBILE SOURCE NOx MONITOR, HYDROGEN-ATOM DIRECT CHEMILUMINESCENCE METHOD Final Report, Sep. 1977 - Mar. 1979
William R. Frenchu, Hermann N. Volltrauer, and William R. Frenchu Jul. 1979 43 p refs
(Contract EPA-68-02-2744)
(PB80-102759; EPA-600/2-79-120) Avail: NTIS HC A03/MF A01 CSCL 14B

An analyzer was developed for measuring motor vehicle NOx emission based on the chemiluminescence reaction of NO and NO2 with hydrogen atoms. This eliminates the need for an NO2 to NO converter as required with ozone chemiluminescence for NOx analysis. The hydrogen atom source is based on the thermal dissociation of molecular hydrogen on a hot tungsten filament. The unit has linear response to NOx over a concentration range from 4 ppm to greater than 3000 ppm. No interferences were observed with H2O, CO, CO2, toluene, isopentane, NH3, HCN, CH3NH2, or H2 at concentrations encountered in raw automobile exhaust. Oxygen and ethylene caused minor interferences which should be inconsequential in actual application. GRA

N80-19671# Southern Research Inst., Birmingham, Ala.
ELECTROSTATIC PRECIPITATIONS FOR COLLECTION OF

HIGH RESISTIVITY ASH Final Report, Nov. 1976 - Jan. 1979
D. H. Pontius, P. V. Bush, and W. B. Smith Aug. 1979 189 p refs
(Contract EPA-68-02-2193)
(PB80-112386; EPA-600/7-79-189) Avail: NTIS HC A09/MF A01 CSCL 13B

An investigation of electrode designs and methods for overcoming back corona was carried out, with the objective of developing a two stage electrostatic precipitator system capable of collecting high resistivity dusts with greater efficiency than can be achieved by conventional precipitators. Several alternative approaches were subjected to limited theoretical and experimental studies. Among the ideas considered were heated passive electrodes, a novel technique for injecting liquid or gaseous chemical reagents directly into the active corona region and various electrode geometries and energization schemes. The most promising approach appeared to be a three electrode geometry in which a screen electrode is used to trap ions originating from a back corona discharge, thus preventing those ions from interfering in the particle charging process. J.M.S.

N80-19672# Southern Research Inst., Birmingham, Ala.
ANALYSIS OF THERMAL DECOMPOSITION PRODUCTS OF FLUE GAS CONDITIONING AGENTS Final Report, 7 Jan. 1977 - 31 Mar. 1979
R. B. Spafford, E. B. Dismukes, and H. K. Dillon Aug. 1979 117 p refs
(Contract EPA-68-02-2200; Proj. 3832-27)
(PB80-111818; SORI-EAS-79-267; EPA-600/7-79-179) Avail: NTIS HC A06/MF A01 CSCL 13B

The reactions of several flue gas conditioning agents in a laboratory-scale facility simulating conditions in the flue gas train of a coal-burning power plant were studied. The compounds investigated were sulfur trioxide, ammonia, triethylamine, sodium carbonate, ammonium sulfate, and diammonium hydrogen phosphate. The predominant types of reactions observed in these experiments were thermal decomposition at high temperatures, recombination of decomposition fragments at lower temperatures, and reactions with normal components of the flue gas. The only significant environmental threat of any product identified was the formation of N-nitrosodiethylamine as the result of injecting triethylamine into the flue gas. This potent carcinogen was found in trace amounts when triethylamine was injected at 160 C. GRA

N80-19673# PEDCo-Environmental, Inc., Cincinnati, Ohio.
DEVELOPMENT OF AN EMISSION INVENTORY QUALITY ASSURANCE PROGRAM Final Report
David W. Armentrout Jun. 1979 56 p
(Contract EPA-68-02-2585)
(PB80-112345; EPA-450/4-79-006) Avail: NTIS HC A04/MF A01 CSCL 13B

Quality assurance is discussed both in general and in relation to emission inventories. Procedural elements of the inventory process are discussed along with typical error types and remedies. An approach is suggested for developing a quality assurance program for emission inventories. GRA

N80-19674# Harvard School of Public Health, Boston, Mass.
SETTING PRIORITIES FOR CONTROL OF FUGITIVE PARTICULATE EMISSIONS FROM OPEN SOURCES Final Report, Sep. 1977 - May 1979
D. W. Cooper, J. S. Sullivan, Margaret Quinn, R. C. Antonelli, and Maria Schneider Aug. 1979 136 p refs
(Grant EPA-R-805294)
(PB80-108962; EPA-600/7-79-186) Avail: NTIS HC A07/MF A01 CSCL 13B

Emission rates of suspended particles from open sources in the U.S. were estimated in order to set priorities for controlling fugitive particulate emissions. The major sources include unpaved roads, construction activities, wind erosion of cropland, paved roads, wildfires, and agricultural tilling. The control of unpaved road emissions (generally by paving), especially in cities, and the control of emissions from construction activities are concluded to deserve high priority in the effort to reduce total suspended particulate levels. K.L.

N80-19675# Environmental Research and Technology, Inc., Westlake Village, Calif.
USER'S GUIDE TO THE ELSTAR PHOTOCHEMICAL AIR QUALITY SIMULATION MODEL Progress Report, Apr. 1978 - Jun. 1979
Fred Lurmann Sep. 1979 506 p refs Sponsored by the Coordinating Res. Council, Inc., Atlanta
(PB80-109184; ERT-P-5287-600; NTIS/DF-79/001A) Avail: NTIS HC A22/MF A01 CSCL 13B

The ELSTAR model consists of a series of computer programs used to predict atmospheric concentrations of photochemical pollutants such as ozone, nitrogen dioxide and sulfates in a Lagrangian reference frame. The model includes the effects of meteorological transport, turbulent eddy diffusion, source emissions and chemical kinetic reactions. This manual describes the general structure and operational capabilities of the ELSTAR model. Detailed instruction are provided for input data specification and code operation to assist prospective users of the model. GRA

N80-19676# Environmental Protection Agency, Research Triangle Park, N.C.
AN EMPIRICAL APPROACH FOR RELATING ANNUAL TSP CONCENTRATIONS TO PARTICULATE MICROINVENTORY EMISSIONS DATA AND MONITOR SITING CHARACTERISTICS Final Report
Thompson G. Pace Jun. 1979 57 p refs
(PB80-113756; EPA-450/4-79-012) Avail: NTIS HC A04/MF A01 CSCL 13B

An empirical approach in which monitor siting characteristics and microinventory information are related to measured annual mean total suspended particulates (TSP) concentrations using multiple regression analysis was developed. The regression uses variables which consider the emissions and distances to both point and area sources and the effects of traffic and dust on nearby streets upon measured TSP concentrations. The methodology used in compilation of a microinventory is described. Procedures for developing and applying the empirical procedure are also described. GRA

N80-19677# Energy and Environmental Analysis, Inc., Arlington, Va.
SOURCES OF ATMOSPHERIC CADMIUM Final Report
Robert Coleman Aug. 1979 116 p refs
(Contract EPA-68-02-2836)
(PB80-121221; EPA-450/5-79-006) Avail: NTIS HC A06/MF A01 CSCL 13B

The used sources of cadmium and potential emission sources were were surveyed to determine which sources were the most significant both in terms of total emissions and potential ambient levels. It was estimated that about 850 tons of cadmium were emitted during 1974, with the largest estimated emitted during 1974, with the largest estimated emitted of cadmium being the production of zinc. Other sources identified were incinerators, iron and steel mills, fossil fuel combustion, smelters. GRA

N80-19678# Land-Air, Inc., Bethesda, Md. Applied Research Div.
ENGINEERING EVALUATION OF CONTROL TECHNOLOGY FOR H-COAL AND EXXON DONOR SOLVENT PROCESSES Final Report, Jan. 1977 - Mar. 1979
K. R. Sarna and D. T. Oleary Jul. 1979 125 p refs
(Contract EPA-68-02-2601)
(PB80-108566; EPA-600/7-79-168) Avail: NTIS HC A06/MF A01 CSCL 13B

The results of an evaluation of the control technology of two coal liquefaction processes, H-Coal and Exxon Donor Solvent, are presented. The effluent streams were characterized and quantified for both processes and plants (pilot and conceptualized commercial). The gaseous, liquid, and solid stream emissions were analyzed for their controllability, process complexity, and efficiency. Extrapolations to the larger commercial size were based partly on pilot plant data and (where such data was unavailable) engineering judgment. Several information gaps were encountered for liquid and solid effluent streams, especially as to composition. These deficiencies were pointed out and recommendations were outlined. GRA

N80-19679# Pacific Northwest Environmental Research Lab., Corvallis, Oreg. Freshwater Div.
NON-POINT SOURCE - STREAM NUTRIENT LEVEL RELATIONSHIPS: A NATIONWIDE STUDY. SUPPLEMENT 1: NUTRIENT MAP RELIABILITY Final Report
Theodore R. McDowell and James M. Omernik Sep. 1979 38 p refs Supplement to EPA-600/3-77-105
(PB80-112691; EPA-600/3-79-103) Avail: NTIS HC A03/MF A01 CSCL 13B

The national eutrophication survey (NES) maps of non-point source nitrogen and phosphorus concentrations in streams were evaluated for applicability and reliability. Interpretations on these maps which were based on data from 928 sampling sites associated with non-point source watersheds and the relationships of these data to general land use, and other macro-watershed characteristics, were compared with a nationwide set of non-point source stream nutrient data collected largely by the U.S. Geological Survey (USGS). In most areas where comparison could be made the mapped interpretations agreed relatively well with USGS data. Revised reliability map insets based on these analyses are provided for maps of total nitrogen and total phosphorus concentrations. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-19680 British Library Lending Div., Boston Spa (England).
SOLVING THE NON-LINEAR EQUATIONS OF DEEP CONVECTION
Ye. M. Pekelis 4 Jun. 1979 22 p refs Transl. into ENGLISH from Gidromet. Nauch. - Issled. Tsent. SSSR, T. Vyp. (USSR), v. 189, 1978 p 41-59 In ENGLISH and RUSSIAN
(BLL-Trans-1397-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

Starting with deep convection equations which describe mesoscale disturbances of the free atmosphere, laminar motion in a channel is considered for the case when the lower boundary is being deformed in an arbitrary fashion over a limited range. Finite defference solutions are used to find approximations of the horizontal and vertical velocities. F.O.S.

N80-19681 British Library Lending Div., Boston Spa (England).
POSSIBILITIES OF USING RADIATION IN THE OXYGEN ABSORPTION LINE AT LAMBDA = 2.53 mm ON SLANT PATHS FOR THERMAL SOUNDING OF THE ATMOSPHERE
Yu M. Timofeyev, and M. I. Trifonov 11 Jun. 1979 10 p refs Transl. into ENGLISH from Gosuparst Univ., Probl. Atmos. Phys., Coll. 15 (Leningrad), 1978 p 65-76
(BLL-Trans-1402-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

The possibility of using measurements of outgoing radiation along slant paths at the oxygen absorption lines for lambda equals 2.53 mm is analyzed for solving the problem of thermal sounding the atmosphere. The choice of this particular absorption line, based upon the Zeeman effect and the use of instruments of high angular resolution, is discussed. Calculations of outgoing atmospheric radiation and its variation are analyzed. Atmospheric models for examining the functional relationships between radiation and the atmospheric parameters are described. The integral form of the equation of transport for outgoing radiation along a slant direction in a spherically symmetrical atmosphere served as the basis for applying the various models. A.W.H.

N80-19682*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
CORONAL MAGNETIC STRUCTURE AND THE LATITUDE AND LONGITUDE DISTRIBUTION OF ENERGETIC PARTICLES, 1-5 AU Final Report, 15 Oct. 1978 - 15 Oct. 1979
E. C. Roelof and D. G. Mitchell 31 Oct. 1979 17 p refs
(Contract NAS8-33106)
(NASA-CR-161391) Avail: NTIS HC A02/MF A01 CSCL 04A

The relation of the coronal magnetic field structure to the distribution of approximately 1 MeV protons in interplanetary space between 1 and 5 AU is discussed. After ordering the interplanetary data by its estimated coronal emission source location in heliographic coordinates, the multispacecraft measured proton fluxes are compared with coronal magnetic field structure infrared as observed in soft X-ray photographs and potential field calculations. Evidence for the propagation and possible acceleration of solar flare protons on high magnetic loop structure in the corona is presented. Further, it is shown that corotating proton flux enhancements are associated with regions of low coronal X-ray emission (including coronal holes), usually in association with solar wind stream structure. M.G.

N80-19683*# Ohio State Univ., Columbus. ElectroScience Lab.
ATMOSPHERIC WATER VAPOR ABSORPTION AT 12 CO2 LASER FREQUENCIES Final Report
Robert J. Nordstrom, Michael E. Thomas, John F. Donovan, and Karl Gass Sep. 1979 82 p
(Contract JPL-955458)
(NASA-CR-162850; Rept-711934-1) Avail: NTIS HC A05/MF A01 CSCL 04A

Measurements of the absorption of CO2 laser radiation in the 9.4 micron band by pressure broadened water vapor samples are summarized. The water vapor temperatures used were 25, 30, and 35 C. K.L.

N80-19684*# Alabama Univ. in Huntsville. School of Science and Engineering.
MAGNETOSPHERIC RESEARCH Quarterly Progress Report, Dec. 1979 - Feb. 1980
Richard H. Comfort and James L. Horwitz Mar. 1980 7 p refs
(Contract NAS8-30563)
(NASA-CR-161410) Avail: NTIS HC A02/MF A01 CSCL 04A

Research concerning the magnetosphere is discussed in terms of satellite data analysis, instrument studies and developments, solar terrestrial studies, meetings, and consultants. R.E.S.

N80-19685# Washington Univ., Seattle. Space Sciences Div.
COORDINATED FIELD OPERATION OF BALLOON-BORNE AURORAL X-RAY EXPERIMENT FROM THE ATS-F SATELLITE CONJUGATE REGION Final Report 1 Mar. 1974 - 31 Jan. 1978
George K. Parks Nov. 1978 4 p
(Contract N00014-67-A-0103-0039; NR Proj. 012-724)
(AD-A078041) Avail: NTIS HC A02/MF A01 CSCL 04/1

The results obtained during this contract period have provided a basis for improving and developing new instruments. We have designed a new X-Ray imaging detector that is capable of taking snapshots of the sky in X-rays. Results from this detector design will provide additional information on electron precipitation scales and source dimensions. GRA

N80-19686# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
MEASUREMENT OF ELECTRON DENSITIES IN THE MIDDLE ATMOSPHERE USING ROCKET BORNE BLUNT PROBES
Thomas M. York White Sands Missile Range, N. Mex. Army Electronics Research and Development Command Oct. 1979 31 p refs Sponsored in part by Battelle Columbus Labs.
(Contract DAAG29-76-D-0100; DA Proj. 1L1-61102-B-53A)
(AD-A078148; ERADCOM/ASL-CR-79-0100-5) Avail: NTIS HC A03/MF A01 CSCL 04/1

Detailed consideration has been given to the determination of electron number density from conductivity data gathered by rocket borne blunt probes in the middle atmosphere. A definition of the difficulty of electron density determination is presented. The procedures of determination of ion densities in the middle atmosphere are reviewed and critically evaluated. The specific aspects of particle collection by a supersonic probe are evaluated and compared to those of a subsonic probe; it is indicated that compression (x10) regions will form in front of supersonic probes at altitudes up to 100 km, and that electron attachment rates

could significantly alter electron and negative ion concentrations. A summary of the analysis of negative conductivity data to indicate electron density is presented. Data from four days, January 31, 1972, and December 5, 1972 (WI), and October 2, 1975, and September 29, 1977 (WSMR), are reduced and electron density profiles presented; these are compared with the indication of electron density from other diagnostics. In the region of overlap of data, there is general agreement in the electron density predictions; the indication of electron density at altitudes below 70 km are new, but the theory for this region is felt to be most accurate. GRA

N80-19687# Lockheed Missiles and Space Co., Palo Alto, Calif.
IONOSPHERIC-MAGNETOSPHERIC PLASMA EXPERIMENT (IMPE) Final Report
E. G. Shelley 15 Oct. 1979 21 p
(Contract N00014-75-C-0099)
(AD-A078082; LMSC-D678863) Avail: NTIS
HC A02/MF A01 CSCL 04/1

The Ionospheric-Magnetospheric Plasma Experiment (IMPE) consists of three mass spectrometers covering the energy per charge range from 500 eV to 16 KeV and the mass range from 1 AMU to greater than 150 AMU plus four electron spectrometers covering the energy range from approximately 70 eV to 24 KeV. The IMPE was intergrated into the ARPA 301 payload as the MPA-002 prior to the integration of ARPA-301 with the spacecraft. The spacecraft was launched on 24 February 1979 into a low altitude polar orbit. On the basis of quick look data received at the satellite control facility, we were able to determine from the analog monitors that all of the experiment high voltage systems were operating as expected. The primary utilization of the IMPE data will be in coordinated studies with data from the SC-8 experiment on the SCATHA spacecraft.GRA

N80-19688# Aerodyne Research, Inc., Bedford, Mass.
NITRIC OXIDE ION AND URANIUM OXIDE ION STUDIES Final Report, 25 Mar. 1976 - 31 Mar. 1979
Fritz Bien Hanscom AFB, Mass. AFGL Jun. 1979 39 p refs
(Contract F19628-76-C-0178; DNA Proj. NWED-QAXHI002)
(AD-A077870; ARI-AR-171; AFGL-TR-79-0164) Avail: NTIS
HC A03/MF A01 CSCL 04/1

The radiative lifetimes of infrared active ions are of particular importance in determining the background radiation in a disturbed atmosphere. The geomagnetic field striates ionic species causing these radiators to form a non-uniform background. Thus, even at lower concentration than molecular species, ions play a more important role in the analysis of disturbed atmospheric signatures. This research was undertaken to measure the radiative lifetime and quenching of vibrationally hot ions NO- and UO-. These molecular ions are of particular importance because of their low ionization energies. Nitric oxide has the lowest ionization energy for those ions that can be formed from the natural atmospheric species, N2, O2, and O. The disappearance of NO- in the upper atmosphere is dependent only on its dissociative recombination rate. The uranium oxide ion is endothermic to dissociative recombination, thus it is one of the most important metallic oxide ions in the upper atmosphere. Since its disappearance depends on three body recombination, this ion would be an important contributor to the 11-14 micrometers infrared signature in a disturbed atmosphere. The measurement of the radiative lifetime and transfer rate of vibration energy from NO- to N2 has been measured and is presented in the appendix. GRA

N80-19689# Weston Observatory, Mass.
INVESTIGATION OF MAGNETIC FIELD PHENOMENA IN THE IONOSPHERE
John F. Devane and Edward A. Johnson Jan. 1979 33 p refs
(Contract F19628-76-C-0291; AF Proj. 7601)
(AD-A075356; AFG-TR-79-0044; SR-1) Avail: NTIS
HC A03/MF A01 CSCL 04/1

This report summarizes the work in maintaining a network of geomagnetic observatories designed to collect and digitally transmit variations of the geomagnetic field. Lightning protection was designed and installed on the induction coil magnetometers. Power supplies of the fluxgate magnetometers were updated, scale changes modified, cooling capacity increased. New temperature control of trailers installed. The changing total field component is traced over the past five years and a method of calibrating the fluxgate magnetometer is outlined. Author (GRA)

N80-19690# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
MODEL COMPUTATIONS OF RADIO WAVE SCINTILLATION CAUSED BY EQUATORIAL BUBBLES Scientific Report, Jul. 1978 - Jul. 1979
A. W. Wernik Hanscom AFB, Mass. AFGL Jul. 1979 80 p refs
(Contract F19628-78-C-0195; AF Proj. 4643)
(AD-A077028; UILU-ENG-79-2555; AFGL-TR-79-0165; SR-1)
Avail: NTIS HC A05/MF A01 CSCL 04/1

The apparent inhomogeneous nature of the equatorial electron density irregularities indicate that a new approach to the scintillation theory is required. Based on the available in situ electron density measurements and theoretical information, a simple two-dimensional, deterministic model of the equatorial bubble is developed. The parabolic equation for a wave traversing such a bubble is solved numerically. The computed amplitude pattern suggests that wave diffraction on edges formed by sharp horizontal electron density gradients may be a possible cause of scintillation at gigahertz frequencies. Comparison with the results obtained for a model of random irregularities with the same power spectrum shows that the medium characterized by sharp electron density gradients leads to stronger scintillation in a wide frequency range. The amplitude pattern, scintillation index, frequency dependence and scatter plots computed for the model agree well with observations. Author (GRA)

N80-19691# Boston Univ., Mass. Dept. of Astronomy.
DMSP AURORAL IMAGES AND THE GOOSE BAY IONOSPHERE Final Scientific Report, Oct. 1977 - 30 Sep. 1978
C. C. Chacko and Michael Mendillo Hanscom AFB, Mass. AFGL Jan. 1979 46 p refs
(Contract F19628-78-C-0011; AF Proj. 4643)
(AD-A077023; AFGL-TR-79-0023) Avail: NTIS
HC A03/MF A01 CSCL 04/1

The DMSP/Goose Bay data base consisting of all DMSP images obtained between December 9, 1971 and September 21, 1973 with Goose Bay in the field of view, forms the basis of this study aimed at examining auroral and ionospheric conditions prevailing in the vicinity of Goose Bay. It was found that little of a systematic nature could be deduced from attempts to correlate the presence of auroral activity near Goose Bay with parameters like delta foF2, delta TEC etc., although past studies had established that aurorally induced electron density enhancements in the upper ionosphere always occur a few degrees equatorward of the low latitude boundary of the continuous aurora. Another major result of the study is the finding that the phase of the auroral electro-jet activity is important in determining the proximity of continuous aurora to Goose Bay. Two case studies are discussed to illustrate the correspondences between auroral activity captured on DMSP images on the one hand and ionospheric parameters on the other. GRA

N80-19692# Army Military Personnel Center, Alexandria, Va.
DELTA7: A COMPUTER MODEL OF DELTA GROWTH Final Report
Dominic Izzo Oct. 1979 49 p refs
(AD-A077053) Avail: NTIS HC A03/MF A01 CSCL 08/3

Delta 7 is an interactive FORTRAN IV Computer Program written for the PDP-11 mini-computer. It accepts initial beach and river conditions, as well as a varying set of deepwater wave conditions, and produces a data set that outlines a planview of the coastline at specified time intervals. The coastline can subsequently be graphed using the Calcomp 1037 Drum Plotter with the XPLOT instruction of MAGIC. The use of computer simulation technique allows a comparison of the effects of varying the order of wave attacks on a developing river delta, which is supplied a constant amount of sediment per day. The conclusion is that random ordering produces approximately the same delta every time, whereas ordering the waves according to power results in a radical delta. This paper includes sample data, computer program and several graphs. GRA

N80-19693# SRI International Corp., Menlo Park, Calif.
ATMOSPHERIC ELECTRICITY AND MILITARY OPERATIONS Final Report
J. E. Nanevicz Nov. 1978 8 p refs
(Contract N00014-77-C-0326)
(AD-A078482) Avail: NTIS HC A02/MF A01 CSCL 04/2

Contents: An Airborne Electric Field-Meter System Used for Studying Electric Field Structure Near Thunderstorm Cells; A Triggered Lightning Strike to an Instrumented Learjet Aircraft; and Instrumented Learjet Aircraft Measurements of Static Electric Fields in and Around Florida Thunderstorm anvils. GRA

N80-19694# California Inst. of Tech., Pasadena. Seismological Lab.
BODY AND SURFACE WAVE MODELING OF OBSERVED SEISMIC EVENTS
David G. Harkrider, Donald V. Helmberger, and J. Bernard Minster Sep. 1979 106 p refs
(Contract F49620-77-C-0022; ARPA Order 3291)
(AD-A078056; AFOSR-79-1235TR) Avail: NTIS HC A06/MF A01 CSCL 08/1

The research performed under this contract during the period 1 Oct. 1978 through 31 March 1979 can be divided into three main topics, upper mantle studies, propagational distortions caused by non-planar structure and S wave generation by block movements near explosions. In Section 2, we discuss the upper mantle structure of northwestern Eurasia where long period and short period WWSS seismograms from nuclear explosions in the Soviet Union have been incorporated with published apparent velocity data to derive a compressional wave velocity model for the upper mantle beneath northwest Eurasia. The waveforms were modeled using generalized ray theory and a starting model was perturbed by trial and error until a fit was achieved. The seismograms from 9-13 deg exhibit impulsive first arrivals (Pn), implying a smooth, positive velocity gradient between depths of 60 and 150 km. A consistent pulse arriving about 2 seconds after Pn at the ranges 11 to 17 deg is modeled by positioning a low velocity zone between 150 and 200 km. In Section 3, glorified optics has been used to compare the waveform complications caused by two and three dimensional structures. A scheme is developed to synthesize seismic images, in which the direct rays give a preliminary feature of a structure, while the multiple boundes provide further information for improving and refining the model. In Section 4, we consider the problem of reflection and refraction of purely compressional waves incident on an interface separating identical solid half-spaces in which the condition of continuity of shear displacement at the boundary is generalized to one that allows slippage. GRA

N80-19695# Sandia Labs., Albuquerque, N. Mex. Telemetry Development Div.
FIELDS FROM A VERTICAL MAGNETIC DIPOLE
T. W. H. Caffey Sep. 1979 22 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0449) Avail: NTIS HC A02/MF A01

Both the E and H fields from a vertical magnetic dipole placed in the third layer of a three-layer Earth are derived. The results are applied to transmission beneath two Wyoming coal seams to see the effects of the overburden upon the voltage induced in a horizontal loop which is coplanar with the dipole. Beneath each seam, the effects of the overburden can be neglected when both the dipole and loop are at least one meter below the seam and when the operating frequency is less than 15 kHz. DOE

N80-19696# Sandia Labs., Albuquerque, N. Mex.
INDIRECT DEFORMATION (STRAIN) MEASUREMENTS AND CALIBRATIONS IN SANDIA TRIAXIAL APPARATUS FOR ROCK TESTING TO 250 C
W. R. Wawersik Sep. 1979 53 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0114) Avail: NTIS HC A04/MF A01

Indirect procedures for axial and radial strain measurements on rock in triaxial tests to 250 C are presented. The description of techniques includes discussions of all calibrations and of the accuracies of measurements. In addition, two examples are given to show how the techniques are implemented in triaxial compression and triaxial extension experiments. DOE

N80-19697# Argonne National Lab., Ill. Radiological and Environmental Research Div.
ON THE ROLE OF THE ATMOSPHERIC ZONAL INDEX CYCLE IN SOLAR/TERRESTRIAL COUPLING
Paul Frenzen 29 Jun. 1979 10 p refs Presented at the DOE Solar Terrest. Workshop, Los Alamos, N. Mex., 27-29 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-7906119-1) Avail: NTIS HC A02/MF A01

The coupling of variations in solar output to short term changes in terrestrial weather is discussed taking into account the role of upper atmospheric circulation shifts. K.L.

N80-19698# National Oceanic and Atmospheric Administration, Boulder, Colo.
GEODYNAMICS INTERNATIONAL - 15
Aug. 1979 64 p Prepared in cooperation with the Inter-Union Commission on Geodynamics, Vancouver, British Columbia
(PB80-111099; SE-19) Avail: NTIS HC A04/MF A01 CSCL 08G

Geodynamics Project is an international program of research on the dynamics and dynamic history of the Earth with emphasis on deep seated foundations of geological phenomena. This includes investigations related to movements and deformations, past and present, of the lithosphere and all relevant properties of the Earth's interior and especially any evidence for motions at depth. Reports on commission activities, working group activities, highlights of scientific symposis, and national committee reports are presented. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-19699 Wisconsin Univ. - Madison.
VISIBLE FLUX VARIATIONS ACROSS FINITE CLOUDS Ph.D. Thesis
Frederick Ray Mosher 1979 123 p
Avail: Univ. Microfilms Order No. 7918922

A radiative transfer model that treats visible flux variations across and within finite clouds of varying shapes was developed to investigate the parameters which influence the brightness patterns observed on satellite images. Simulations showed that fluxes coming from all external regions of finite cubic clouds departed significantly from the plane-parallel results. Regions of liquid water concentrations near the cloud top appeared as bright regions for the overhead sun, but had very little effect at large solar zenith angles. When the concentration was more than an optical thickness of 25 below the top, the bright spot disappeared. A tower on top of a cubic cloud appeared darker than the main body of the cloud for the overhead sun, and brighter than the main body when the sun was near the horizon. The relationship between albedo and solar zenith angle varied with cloud shape. Clouds simulated by assemblies of cubic elements matched aircraft flux measurements better when the overall cloud shape resembled the observed cloud shape than when the cubic elements were assembled into a simple shape of equivalent dimensions.
Dissert. Abstr.

N80-19700 British Library Lending Div., Boston Spa (England).
CALCULATIONS USING A MODEL OF THE SEASONAL VARIATION IN THE CONCENTRATION OF NITROGEN COMPOUNDS IN THE TEMPERATE STRATOSPHERE
I. L. Karol' 11 Jun. 1979 22 p refs Transl. into ENGLISH from Glav. Geof. Obs. T. (Leningrad), Vyp. 394, 1977 p 56-65 In RUSSIAN and ENGLISH
(BLL-Trans-1400-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

A one dimensional, nonstationary mathematical model of the stratosphere is presented. The model describes the seasonally fluctuating, vertical, macroturbulent transport of the oxides of nitrogen in the 10 to 50 km layer. The model also describes the photochemical transformation of these traces. The model is used to predict the concentration of ozone in the stratosphere,

to estimate the effect of authropogenic sources of oxides of nitrogen in the atmosphere, and to estimate the emission of such compounds from the engines of high flying aircraft. A.W.H.

N80-19701 British Library Lending Div., Boston Spa (England).
METHODS FOR ANALYSING THE HOMOGENEITY OF CLIMATOLOGICAL SERIES
N. V. Kobysheva and V. D. Antonevich 27 Jun. 1979 11 p refs Transl. into ENGLISH from Glav. Geof. Obs., T. (Leningrad), Vyp. 404, 1978 p 45-50 In RUSSIAN and ENGLISH
(BLL-Trans-1407-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

The problem of identification and removal of nonhomogeneity in climatological series is discussed. Homogeneity is defined to be a series whose values vary from year to year or from one period to another only in weather and climate for the given region. Climatological nonhomogeneity is defined in connection with the relocation of weather stations, changes in the location of meteorological instruments, or in the methods and times of observations. The differences between climatological nonhomogeneity and statistical nonhomogeneity are examined and methods to analyze each version of nonhomogeneity are discussed. A.W.H.

N80-19702 British Library Lending Div., Boston Spa (England).
STABILITY ANALYSIS OF KINETIC MODELS OF THE GLOBAL C-CYCLE: EXCHANGE OF CARBON BETWEEN LAND BIOTA AND ATMOSPHERE UNDER THE INFLUENCE OF MAN
G. H. Kohlmaier, E. O. Sire, G. Kratz, and U. Fischbach 27 Jun. 1979 16 p refs Transl. into ENGLISH from Ber. Bunsenges. Phys. Chem. (Weinheim), v. 82, 1978 p 1218-1223 In ENGLISH and GERMAN
(BLL-Trans-1421-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

The autonomous, natural dynamics of a certain subsystem (e.g. land biosphere) are described as the difference of an input and an output rate of a general non-linear structure. In particular the two-compartment system atmosphere-land biosphere is presented and treated as a materially open as well as a closed system. As a result, a non-linear approach may lead to opposed stability behaviour with respect to the corresponding linearized as well as to the ad-hoc-linear rate expressions obtained. It is noteworthy that the stability and instability transition occurred at a critical rate with values in the same order of magnitude as the present estimates of the anthropogenic transfer of biogenic carbon to the atmosphere. Some simple rules to determine the global stability of closed autonomous systems and apply them to the global carbon cycle are also presented. R.E.S.

N80-19703*# FWG Associates, Inc., Tullahoma, Tenn.
FOG DISPERSION Final Report
Larry S. Christensen and Walter Frost Mar. 1980 128 p refs
(Contract NAS8-33095)
(NASA-CR-3255) Avail: NTIS HC A07/MF A01 CSCL 04B

The concept of using the charged particle technique to disperse warm fog at airports is investigated and compared with other techniques. The charged particle technique shows potential for warm fog dispersal, but experimental verification of several significant parameters, such as particle mobility and charge density, is needed. Seeding and helicopter downwash techniques are also effective for warm fog disperals, but presently are not believed to be viable techniques for routine airport operations. Thermal systems are currently used at a few overseas airports; however, they are expensive and pose potential environmental problems. K.L.

N80-19704*# Georgia Inst. of Tech., Atlanta.
THE NASA/MSFC GLOBAL REFERENCE ATMOSPHERIC MODEL: MOD 3 (WITH SPHERICAL HARMONIC WIND MODEL) Final Report
C. G. Justus, G. R. Fletcher, F. E. Gramling, and W. B. Pace Mar. 1980 254 p refs
(Contract NAS8-32897)
(NASA-CR-3256; M-296) Avail: NTIS HC A12/MF A01 CSCL 04B

Improvements to the global reference atmospheric model are described. The basic model includes monthly mean values of pressure, density, temperature, and geostrophic winds, as well as quasi-biennial and small and large scale random perturbations. A spherical harmonic wind model for the 25 to 90 km height range is included. Below 25 km and above 90 km, the GRAM program uses the geostrophic wind equations and pressure data to compute the mean wind. In the altitudes where the geostrophic wind relations are used, an interpolation scheme is employed for estimating winds at low latitudes where the geostrophic wind relations being to mesh down. Several sample wind profiles are given, as computed by the spherical harmonic model. User and programmer manuals are presented. K.L.

N80-19705*# National Aeronautics and Space Administration, Washington, D. C.
CALCULATION OF THE RELATIONSHIP BETWEEN ATTENUATION AND INTENSITY OF PRECIPITATION FOR VARIOUS POLARIZATIONS
Dario Maggiori and Aido Paraboni Feb. 1980 30 p refs Transl. into ENGLISH of "Calcolo del legame attenuazione - intensita di precipitozione per varie polarizzazioni", Rept. IB4577, Fondazione Ugo Bordani, Rome, Oct. 1977 p 1-28 Translation was announced as N79-27382 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75779; IB4577) Avail: NTIS HC A03/MF A01 CSCL 04B

An algorithm is presented which investigates the behavior of attenuation and phase differences in circular and linear polarizations. R.E.S.

N80-19706# Air Force Geophysics Lab., Hanscom AFB, Mass.
PRELIMINARY ASSESSMENT OF AN AUTOMATED SYSTEM FOR DETECTING PRESENT WEATHER Instrumentation Paper
H. Albert Brown 26 Jun. 1979 37 p refs
(AD-A078031; AFGL-TR-79-0137; AFGL-IP-276) Avail: NTIS HC A03/MF A01 CSCL 04/2

The determination of subjective weather observations through the use of an automated array of weather sensors coupled with a decision tree program was examined through analysis of data gathered at the AFGL Weather Test Facility at Otis AFB, Mass. This report describes the instruments used in the array, the response of the instruments to type of weather observed, and the decision tree programs. Preliminary results indicate that a computer-controlled weather sensor array has potential value in determining objectively those types of weather previously relegated to human responsibility. Author (GRA)

N80-19707# University of Central Florida, Orlando. Dept. of Mathematics and Statistics.
SOME MODELS FOR CEILING Scientific Report, 1 Sep. 1978 - 31 Aug. 1979
Steven J. Bean, Paul N. Somerville, and Mark Heuser Hanscom AFB, Mass. AFGL 31 Aug. 1979 40 p
(Contract F19628-77-C-0080; AF Proj. 6670)
(AD-A078033; AFGL-TR-79-0221; SR-1) Avail: NTIS HC A03/MF A01 CSCL 04/2

There are many situations where it is useful to estimate the probability that some weather event will occur on some specified future date. A way of making the estimate is to calculate the proportion of time that the event occurred in previous years. There exist large environmental data bases that can be used to make such estimates. Because these data bases are so large, summaries are usually used. USAFETAC, Air Weather Service, regularly produces, for a large number of stations, a 'Revised Uniform Summary of Surface Weather Observations'. These 'RUSSWO's: provide a very convenient summary and are widely used. This report makes use of the Burr Curve with three parameters to effectively compact data on ceiling for a number of locations. The Burr Curve, which has a closed form cumulative distribution function, is used to model ceiling. Ceiling is modeled for 23 stations distributed throughout the world. Separate models are given for each station for each month and for each three-hour period of the day. Estimates of the error in using the model to estimate ceiling probabilities are given. GRA

N80-19708# Naval Air Systems Command, Washington, D. C.
GUIDE TO STANDARD WEATHER SUMMARIES AND

CLIMATIC SERVICES
J. W. Ownbey, ed. Jan. 1980 206 p Revised
(AD-A078660; NAVAIR-50-1C-524) Avail: NTIS
HC A10/MF A01 CSCL 04/2

This report provides a description of published and unpublished climatological summaries available from the climatic complex in Asheville, NC. It also includes a catalogue of the available summaries on a world-wide basis in continent-country-station order. GRA

N80-19709# University of Central Florida, Orlando. Dept. of Mathematics and Statistics.
SOME ADDITIONAL MODELS FOR RAINFALL Scientific Report, 1 Sep. 1978 - 31 Jun. 1979
Paul N. Somerville and Steven Bean, J. Hanscom AFB, Mass. AFGL 31 Aug. 1979 35 p
(Contract F19628-77-C-0080)
(AD-A077872; AFGL-TR-79-0220; SR-6) Avail: NTIS
HC A03/MF A01 CSCL 04/2

The Kappa distribution, which has a closed form cumulative distribution, is used to model daily rainfall for 24 stations distributed throughout the world. Separate models are given for each month. Estimates of the amounts of error in using the model to predict daily rainfall less than a stated amount are given. GRA

N80-19710# Scientific Systems, Inc., Cambridge, Mass.
MULTISPECTRAL CLOUD IDENTIFICATION STUDY Report, 14 Jul. 1977 - 14 Aug. 1978
Donald E. Gustafson, William H. Ledsham, Mary G. Fowler, and Eliot S. Blackman Hanscom AFB, Mass. AFGL Sep. 1978 277 p refs
(Contract F19628-77-C-0208; AF Proj. 6698)
(AD-A077873; AFGL-TR-78-0280) Avail: NTIS
HC A13/MF A01 CSCL 04/2

Tactical and meteorological considerations demand a knowledge of cloud cover on a global basis. Since areas exist which are either data poor or denied by hostile forces, it is reasonable to infer cloud parameters in these regions from satellite-borne passive sensors. Both channel selection and inversion methodology to maximize the amount of cloud information are currently open questions. This study deals with the problem of inferring both cloud and 'nuisance' parameters given four frequencies in the microwave region (10 GHz, 19 GHz, 37 GHz and 94 GHz) and ten frequencies in the thermal IR, near IR and visible region (.55, .72, 1.0, 1.6, 2.1, 3.8, 6.7, 10.5, 11.5, and 12.5 micrometers). Using simulated data, several studies were made. Results indicate that the iterated extended Kalman filter is a robust method of cloud parameter estimation, and that while some parameters such as cloud top height and liquid water content are well estimated, others such as cloud thickness are not. Finally, simple decision trees may be formulated to distinguish the scenes analyzed. GRA

N80-19711# Oklahoma Univ., Norman.
DYNAMIC DATA ASSIMILATION BY THE NOISE FREEZING METHOD Final Report
Y. K. Sasaki, Tom Baxter, and James S. Goerss Sep. 1979 82 p refs
(Contract N00228-77-C-3056; ZF52551792)
(AD-A077901; NEPRF-CR-79-03) Avail: NTIS
HC A05/MF A01 CSCL 04/2

A barotropic model was developed using a variational method to conserve mass and total energy. This model was then used to assimilate satellite data by adjusting the fluid depth so that gravity waves moved at about the same speed as meteorological waves. The analyses resulting from the assimilation runs were used to adjust the 1000-500 mb thickness in a baroclinic forecast system. Although results were obtained from only one experiment, they show some promise for improving forecasts, particularly in the southern hemisphere. A baroclinic global model was then developed so that the gravity waves could be decreased in speed during the period of data assimilation of satellite data. Initial tests suggest that imbalances in the model caused by data insertion can be controlled, thereby allowing a more accurate analysis of the satellite data. GRA

N80-19712# Air Weather Service, Scott AFB, Ill.
SATELLITE TRAINING COURSE NOTES. PART 4: CLOUD PATTERNS AND THE UPPER AIR WING FIELD
Roger Weldon Oct. 1979 99 p
(AD-A077557; AWS-TR-79-003-Pt-4) Avail: NTIS
HC A05/MF A01 CSCL 04/2

The information in this report was derived empirically from the study of SMS-GOES system satellite imagery and atmospheric data, analyses, and progs distributed by the United States' National Weather Service. The text provides simple comparisons between satellite-observed cloud patterns and the wind field. GRA

N80-19713# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
THE VISIOCEILOMETER: A PORTABLE CLOUD HEIGHT AND VISIBILITY INDICATOR
Robert S. Bonner and William J. Lentz Oct. 1979 40 p refs
(AD-A078332; ERADCOM/ASL-TR-0042) Avail: NTIS
HC A03/MF A01 CSCL 04/2

The first experimental prototype (model-1) visioceilometer has been developed. It measures cloud height from 50 to 3000 meters with 10 meter accuracy and calculates visibility from a sample volume up to 1 kilometer in length of the lidar return. It consists of a hand-held, battery-operated lidar which uses the AN/GVS-5 laser rangefinder optics. Measurements of visibility in fog and cloud ceiling height in clear air and rain were taken at the fog dispersion test facility at Otis Air Force Base, MA. In relatively homogeneous fogs, the visibility accuracy was comparable to standard transmissometers. The cloud ceiling accuracy was also comparable to the standard rotating beam ceilometer. GRA

N80-19714# Air Weather Service, Scott AFB, Ill.
AN INVESTIGATION OF RADAR RETURNS AND THEIR RELATIONSHIP TO SEVERE WEATHER OCCURRENCES Final Report
Werner Helmut Balsterholt Nov. 1979 102 p refs
(AD-A078858; AWS-TR-79-004) Avail: NTIS
HC A06/MF A01 CSCL 04/2

FPS-77 5.4 cm radar information was gathered throughout the US, geographically and temporally separated to delineate severe from non-severe thunderstorms. The critical success indicator is used to determine the relative reliability of various radar signatures investigated. Thunderstorm structure is reviewed and evolution and development of severe storms is discussed. Environments of severe storms is analyzed and related to well-established severe storm criteria. Results reveal the 30 dBz heights, when correlated with tropopause height or height of the total storm, are excellent signatures which frequently define those thunderstorms likely to be associated with severe weather. GRA

N80-19715# Science Applications, Inc., El Segundo, Calif.
RAIN ATTENUATION OVER EARTH-SATELLITE PATHS Final Report, 27 Dec. 1978 - 25 May 1979
Nathaniel E. Feldman May 1979 154 p
(Contract N00039-79-C-0136)
(AD-A075390; SAI-171-80-573-LA) Avail: NTIS
HC A08/MF A01 CSCL 04/2

This analysis of precipitation-attenuation over Earth-satellite paths extends R. K. Crane's model by correcting for measured total rainfall and frequency of occurrence. The authors convert Crane's model to a seasonal one and extend it up to 36 percent of the time. Four seasonal world maps show the location of the nine precipitation rate regions and another four show mean freezing height. A method for estimating the outage duration distribution is proposed and used to determine the mean daily outrage duration and the number of outages per day. GRA

N80-19716# Air Force Weapons Lab., Kirtland AFB, N. Mex.
CLOUDS Final Report
Mark K. Seager Aug. 1979 55 p refs
(AD-A078363; AD-E200400; AFWL-TR-79-108) Avail: NTIS
HC A04/MF A01 CSCL 04/2

This report is an in-depth Users Manual for the ANSI FORTRAN computer program CLOUDS. CLOUDS is designed in two major blocks: cloud field generation and cloud-free line-of-sight (CFLOS) calculation. The cloud field generation block models

observed cloud fields using rotated truncated ellipsoids and rotated eliptical cylinders. The user can specify an overall (total) cloud cover or cloud cover by base height, dimensions of the clouds to be used, and fraction of clouds to be cylinders. When the cloud field has been completed, two types of plots (two-dimensional printer plots and three-dimensional META Plots) can be generated in order to view the modeled cloud field. The CFLOS calculation block generates trajectory data using either direct intercept or a chase model. Alternately, a trajectory with one defender and one to four aggressors generated by the Trajectory Analysis Program (TAP) can be used. Instantaneous CFLOS and CFLOS over discrete time intervals are calculated between the defender and each aggressor. The trajectories are rotated some user specified number of times within the stationary cloud field and the CFLOS data are recalculated. GRA

N80-19717# University of Central Florida, Orlando. Dept. of Mathematics and Statistics.

A NEW MODEL FOR SKY COVER Scientific Report, 1 Sep. 1978 - 27 Aug. 1979

Paul N. Somerville and Steven J. Bean 27 Aug. 1979 37 p refs

(Contract F19628-77-C-0080; AF Proj. 6670)

(AD-A078368; AFGL-TR-79-0219; SR-5) Avail: NTIS HC A03/MF A01 CSCL 04/2

The S-distribution, which has a closed form cumulative distribution function is used to model sky cover. Models are developed for 23 stations distributed throughout the world, one for each month and for each three-hour period of the day. Estimates of the amounts of error in using the model to predict cloud cover less than a stated amount are given. Author (GRA)

N80-19718# Wisconsin Univ. - Madison. Space Science and Engineering Center.

INITIAL STUDIES IN OBJECTIVE FORECASTING OF MESOSCALE WEATHER USING INTERACTIVE COMPUTER SYSTEM

Carlyle H. Wash, Thomas M. Whittaker, and Donald R. Johnson 15 Jun. 1979 25 p refs

(Contract F19628-78-C-0137; AF Proj. 6670)

(AD-A077343; AFGL-TR-79-0247; SR-1) Avail: NTIS HC A02/MF A01 CSCL 04/2

Subsynoptic convective areas are isolated, monitored and forecast through extrapolation and advection using McIDAS, (Man-Computer Interactive Data Access System), and interactive computer video-display system. Research on isolating the convective areas focuses on development of statistics using digital visual and IR GOES satellite data to delineate areal coverage and intensity. McIDAS algorithms have been developed to: (1) compute the brightness centroid; (2) form a best-fit ellipse to the region; and (3) compute areal average IR and normalized-visual brightness. Sequences of brightness centers and geometric outlines serve as input extrapolation routines to project system movement and change in area coverage and intensity. Research also has been initiated on using vertically-integrated wind fields to advect meteorological fields and disturbances. Preliminary results using these techniques for short-range forecast are presented. Author (GRA)

N80-19719# Wisconsin Univ. - Madison. Dept. of Meteorology.

LIDAR MEASUREMENT OF BOUNDARY LAYER WINDS AND CONVECTIVE STRUCTURE Final Report, 1 Mar. 1976 - 30 Jun. 1979

Edwin W. Eloranta 20 Aug. 1979 177 p refs

(Grant DAAG29-76-G-0156)

(AD-A078590; ARO-13535.2-GS) Avail: NTIS HC A09/MF A01 CSCL 04/2

The following report is a summary of studies on planetary boundary layer visualization and remote determination of wind profiles and turbulence quantities by means of a lidar. These investigations rely on inhomogeneities in the natural aerosol distribution to delineate eddies in the boundary layer. Measurement of the rate of displacement of these eddies yield horizontal wind components. Observations of the daytime growth of the convective boundary layer are compared to a theoretical model. GRA

N80-19720# Naval Environmental Prediction Research Facility, Monterey, Calif.

WINTER SHAMAL IN THE PERSIAN GULF Final Report

Thomas J. Perrone Aug. 1979 179 p refs

(AD-A077727; NEPRF-TR-79-06) Avail: NTIS HC A09/MF A01 CSCL 04/2

Occurrence and air/sea effects of the winter shamal, a subsynoptic-scale wind phenomenon in the Persian Gulf region, are examined by means of a conceptual model which relates upper air and surface features to mesoscale weather events and conditions. Two case studies based on surface data and satellite imagery are presented to illustrate the model. A regional wind climatology and a collection of rules of thumb for shamal forecasting are provided. GRA

N80-19721# Oregon Graduate Center for Study and Research, Beaverton. Dept. of Applied Physics and Electronic Science.

EXPERIMENTAL PULSED LASER REMOTE CROSSWIND MEASUREMENT SYSTEM. FEASIBILITY STUDY AND DESIGN, PART 5 Final Report, 15 Nov. 1976 - 31 Dec. 1977

J. Fred Holmes, J. Richard Kerr, Richard A. Elliott, Myung H. Lee, Philip A. Pincus, and Michael E. Fossey Sep. 1978 62 p refs

(Contract DAAA25-76-C-0132; DA Proj. 1L1-62617-AH-19)

(AD-A077631; AD-E400339; SCF-I-IR(CR)-79-002-Pt-5; ARSCD-CR-79007-Pt-5) Avail: NTIS HC A04/MF A01 CSCL 04/2

Recent activity with regard to development of a pulsed laser, remote crosswind measurement system is described. Work was concentrated on system improvements and testing. The improvements included the ability to directly measure the average received intensity, a method of aligning the two laser beams so that they are colinear; normalization to compensate for turbulence strength and laser coherence, and accurate automatic gain calibration. Testing included a comparison of the pulsed crosswind system with in situ measurements and cw measurements of the time delayed statistics. Author (GRA)

N80-19722# University of Central Florida, Orlando. Dept. of Mathematics and Statistics.

SOME MODELS FOR WINDSPEED Scientific Report, 1 Sep. 1978 - 15 Jul. 1979

Steven J. Bean and Paul N. Somerville Hanscom AFB, Mass. AFGL 16 Jul. 1979 41 p

(Contract F19628-77-C-0080; AF Proj. 6670)

(AD-A077048; AFGL-TR-79-0180; SR-4) Avail: NTIS HC A03/MF A01 CSCL 04/2

Models are given for the probability of a windspeed greater than an arbitrary value, for each of 25 stations. The two parameter Weibull model is used. Separate sets of parameters are given for each station for each month and for each of the eight 3 hour periods of the day. Measures of 'goodness' of the models are given. GRA

N80-19723# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

ATLAS OF NAVAL OPERATIONAL ENVIRONMENTS: THE NATURAL MARINE ENVIRONMENT Final Report

Susan Lee Bales and Edward W. Foley Sep. 1979 345 p refs

(AD-A077033; DTNSRDC/SPD-0795-01) Avail: NTIS HC A15/MF A01 CSCL 04/2

From the viewpoint of some ship designers, a fundamental deficiency in the current process by which naval combatants are designed is the lack of interface and feedback between the design of the major subsystems of the total ship. In order to address this deficiency, the development of an 'Atlas of Naval Operational Environments' was proposed which included both threat (man-made) and natural (those occurring in nature) environments which naval forces could be expected to encounter. The Atlas would be directed to the ship combat systems designer. This report provides the natural environments required by the Atlas for nine global locations considered to be of importance for possible future naval operations (adversary encounters) in this century. The nine operational areas are located in or near the Norwegian Sea, the northern North Atlantic west of Scotland, the eastern Mediterranean west of Cyprus, the Japan Sea off

Korea, the Gulf of Aden off Saudi Arabia, the southeastern North Atlantic off Guinea, the North Pacific off the Aleutians, the Caribbean south of Cuba, and the Malacca Straits southeast of Singapore. Worst season (wind and waves) atmospheric and surface environmental data are included for each area. GRA

N80-19724# Florida State Univ., Tallahassee. Dept. of Oceanography.
EQUATORIAL PACIFIC OCEAN VARIABILITY: SEASONAL AND EL NINO TIMES SCALES
John C. Kindle. Sep. 1979. 152 p. refs.
(Contract N00014-75-C-0201; Grant NSF OCE-78-00611)
(AD-A077031; TR-167) Avail: NTIS HC A08/MF A01 CSCL 08/3

A nonlinear, single-layer numerical model is used to examine the baroclinic response of the equatorial ocean to time-variable winds. The rectangular model basin extends 1,500 km south of the equator and 15,000 km zonally; open boundary conditions are employed at the southern boundary. Attention is focused on the equatorially trapped wave response to symmetric, zonal time-dependant winds. The effects of mean currents, topography, coastline variation, thermodynamics and thermohaline mixing are neglected. In order to interpret the numerical solutions, analytic expressions for the vertical motion of the model pycnocline along the equator are derived from the linear theory of equatorial waves. Two types of wind distribution are considered: (1) a uniform wind across the entire basin and (2) a longitudinally bounded patch of wind stress within which the wind is uniform. The results given by the numerical model, linear theory, and the derived analytical expressions are also used to examine the general linear response of the equatorial ocean to time-variable winds as a function of the period of the forcing, the basin length and the stratification. The numerical model reproduces the observations of the average seasonal vertical displacement of the pycnocline at the eastern boundary. The analytical expressions reveal that equatorially trapped Kelvin waves excited between 180 and 120 degrees W are responsible for the large semi-annual response at the eastern boundary of the model. GRA

N80-19725# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
CLIMATIC CHAMBER TESTS OF A SURFACE ICE ACCRETION MEASUREMENT SYSTEM Final Report
Paul Tattelman. 26 Mar. 1979. 50 p. refs.
(AF Proj. 6670)
(AD-A077022; AFGL-TR-79-0079; AFGL-AFSG-408) Avail: NTIS HC A02/MF A01 CSCL 08/12

Climatic chamber tests of an off-the-shelf ice detection system manufactured by Rosemount Engineering Company were conducted to evaluate its capability to determine ice amounts measured on cylinders. One-hour tests were run for a variety of windspeeds, temperatures, and icing conditions. Some longer duration tests, up to 17 hours, were also performed. Analysis of the data indicates that the Rosemount system is highly correlated with the mass of ice measured on the cylinders when the data are divided into freezing rain and rime icing events. The Rosemount system is also highly correlated with ice thickness, but without the pronounced dependence upon the type of icing. In the light of positive test results, a method is proposed for utilizing the Rosemount system for observing ice accretion at the Earth's surface. GRA

N80-19726# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBER 310, ROUND NUMBER B-33, 27 AUGUST 1979 Meteorological Data Report
Aug. 1979. 22 p. refs.
(AD-A079990; ERADCOM/ASL-DR-1057) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702A GSRS, Missile Number 301, Round Number B-33, are presented in tabular form. GRA

N80-19727# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBER BR-3, ROUND NUMBER B-35, 31 AUGUST 1979 Meteorological Data Report
Aug. 1979. 25 p. refs.
(AD-A079991; ERADCOM/ASL-DR-1061) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of the 19702A GSRS, Missile Number BR-3, Round Number B-35, are presented in tabular form. GRA

N80-19728# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBERS 308, 309, ROUND NUMBERS B-31, B-32, 18 AUGUST 1979 Meteorological Data Report
Aug. 1979. 26 p. refs.
(AD-A079992; ERADCOM/ASL-DR-1055) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of the 19702A GSRS, Missile Numbers 308, 309, Round Numbers B-31, B-32, are presented in tabular form. GRA

N80-19729# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19306B GSRS, MISSILE NUMBERS 1043, 1045, ROUND NUMBERS V-64, V-65, 17 AUGUST 1979 Meteorological Data Report
Aug. 1979. 36 p. refs.
(AD-A079993; ERADCOM/ASL-DR-1054) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19306B GSRS, Missile Numbers 1043, 1045, Round Numbers V-64, V-65, are presented in tabular form. GRA

N80-19730# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBER 004, ROUND NUMBER B-30, 17 AUGUST 1979 Meteorological Data Report
Aug. 1979. 22 p. refs.
(AD-A079999; ERADCOM/ASL-DR-1053) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702A GSRS, Missile Number 004, Round Number B-30, are presented in tabular form. GRA

N80-19731# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702D GSRS, MISSILE NUMBER 023, ROUND NUMBER B-38, 8 SEPTEMBER 1979 Meteorological Data Report
Sep. 1979. 22 p. refs.
(AD-A080000; ERADCOM/ASL-DR-1065) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of the 19702D GSRS, Missile Number 023, Round Number B-38 are presented in tabular form. GRA

N80-19732# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12821A LANCE, MISSILE NUMBER 4819, ROUND NUMBER 335 NCL, 13 AUGUST 1979 Meteorological Data Report
Aug. 1979. 27 p. refs.
(AD-A079995; ERADCOM/ASL-DR-1052) Avail: NTIS HC A23/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12821A LANCE, Missile Number 4819, Round Number 335 NCL, are presented by tabular forms. GRA

N80-19733# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBER 311, ROUND NUMBER B-39, 10 SEPTEMBER 1979: METEOROLOGICAL DATA REPORT
Sep. 1979. 22 p. refs.
(AD-A080001; ERADCOM/ASL-DR-1067) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorolugical data gathered for the launching of 19702A

GSRS, missile number 311, round number 8-39 are presented in tabular form. GRA

N80-19734# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19304D GSRS, MISSILE NUMBER 1063, ROUND NUMBER V-67, 29 AUGUST 1979: Meteorological Data Report
Aug. 1979 19 p refs
(AD-A080062; ERADCOM/ASL-DR-1058) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19304D GSRS, missile number 1063, round number V-67, are presented in tabular form. GRA

N80-19735# Utah Univ., Salt Lake City. Dept. of Meteorology.
ANALYZE, CALCULATE, AND DEVELOP TECHNIQUES FOR WEATHER SATELLITE IMAGERY DATA
Elford G. Astling and Kuo-Nan Liou Jun. 1979 132 p refs
(F19628-78-C-0130; AF Proj. 6670)
(AD-A077292; AFGL-TR-79-0140; SR-1) Avail: NTIS HC A07/MF A01 CSCL 04/2

In conjunction with the inference of cloud composition and structure from satellites in all weather conditions, four synoptic cases including severe local storms, tropical disturbances, summertime convection and wintertime mid-latitude cyclones were selected. These cases occurred over the United States during periods when microwave and infrared satellite data from Nimbus VI satellite were available. Detailed studies of some dynamic and synoptic aspects of these cases were carried out. ESMR (Electronically Scanning Microwave Radiometer), SCAMS (Scanning Microwave Spectrometer) and THIR (Temperature Humidity Infrared Radiometer) data from the Nimbus VI satellite were documented along with the conventional atmospheric parameters. The organized microwave and infrared data and corresponding synoptic, radiosonde and cloud data are fundamental to the understanding and verification of the cloud sounding technique from satellites. GRA

N80-19736# Florida State Univ., Tallahassee. Dept. of Statistics.
RANDOMIZATION TESTS IN SUPPORT OF SOME STATISTICAL ANALYSES OF A WEATHER MODIFICATION EXPERIMENT
Ralph A. Bradley and Elton Scott Oct. 1979 19 p refs
(Contract N00014-76-C-0394)
(AD-A076336; FSU-Statistics-M521; TR-149-ONR) Avail: NTIS HC A02/MF A01 CSCL 04/2

The validities of analyses of variance and covariance applied to weather modification experimental data are examined through Monte Carlo samplings of the corresponding randomization distributions. It is found that the parametric tests approximate the randomization distributions well. Thus the use of parametric procedures in exploratory analyses of weather modification data, after appropriate transformation, is justified. The authors comment also on the issue of multiplicity of analyses in data explorations. It is pointed out that analyses that are closely related and explore inherent sources of experimental variation are unlikely to result in misleading conclusions. GRA

N80-19737# Texas A&M Univ., College Station. Dept. of Meteorology.
A COMPARATIVE ANALYSIS OF RAWINSONDE AND NIMBUS-6 AND TIROS-N SATELLITE PROFILE DATA Summary Report
James R. Scoggins, William E. Carle, Keith Knight, Vance Moyer, and Nine-Min Cheng Dec. 1979 85 p refs
(Grant DAAG29-76-G-0078)
(AD-A079295; ARO-13520.6-GSX) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report addresses the question regarding the extent to which satellite sounding data can be used to determine atmospheric structure. Comparisons are made between rawinsonde and satellite profiles in seven areas for a wide range of surface and weather conditions. Variables considered consist of temperature, dewpoint temperature, thickness, precipitable water, lapse rate of temperature, stability, geopotential height, mixing ratio, wind directions, wind speed, and kinematic parameters including vorticity and the advection of vorticity and temperature. In addition, comparisons are made in the form of cross sections and synoptic fields for selected variables. GRA

N80-19738# Texas A&M Univ., College Station. Dept. of Meteorology.
THE DETERMINATION OF ATMOSPHERIC STRUCTURE FROM QUANTITATIVE SATELLITE DATA Final Report, Jan. 1978 - Aug. 1979
James R. Scoggins Dec. 1979 8 p
(Grant DAAG29-76-G-0078)
(AD-A078980; ARO-13520.7-ASX) Avail: NTIS HC A02/MF A01 CSCL 04/2

The question regarding the extent to which satellite sounding data can be used to determine atmospheric structure was addressed. Comparisons were made between rawinsonde and satellite profiles in seven areas for a wide range of surface and weather conditions. Variables considered consist of temperature, dewpoint temperature, thickness, precipitable water, lapse rate of temperature, stability, geopotential height, mixing ratio, wind direction, wind speed, and kinematic parameters including vorticity and the advection of vorticity and temperature. In addition, comparisons are made in the form of cross sections and synoptic fields for selected variables. Sounding data from both the NIMBUS-6 and TIROS-N satellites were used. The NIMBUS-6 data were linearly interpolated in order to obtain soundings coincident in time with the rawinsonde soundings. The TIROS-N data were obtained concurrently with the rawinsonde data and no interpolation was performed. Geostrophic wind computed from smoothed geopotential heights provided large-scale flow patterns that agreed well with the rawinsonde wind fields. Surface wind patterns as well as magnitudes computed by use of the log law to extrapolate wind to a height of 10 m agreed well with observations. The results of this study demonstrate rather conclusively that satellite profile data can be used to determine characteristics of large-scale systems, but that small-scale features such as frontal zones cannot yet be resolved satisfactorily. GRA

N80-19739# Colorado State Univ., Fort Collins.
TROPICAL CYCLONE ORIGIN, MOVEMENT, AND INTENSITY CHARACTERISTICS BASED ON DATA COMPOSITING TECHNIQUES Final Report
William M. Gray Aug. 1979 130 p refs
(Contract N00228-76-C-2129; WF52551792)
(AD-A078624; NEPRF-CR-79-08) Avail: NTIS HC A07/MF A01 CSCL 04/2

Up-to-date results of recent tropical cyclone research at Colorado State University are presented. Particular attention is paid to new findings which impact on tropical cyclone analysis and forecasting efforts. Observational studies using large amounts of composited rawinsonde, satellite, and aircraft flight data have been performed to analyze global aspects of tropical cyclone occurrences, physical processes of tropical cyclone genesis, tropical cyclone intensity change, environmental factors influencing tropical cyclone turning motion 24-36 hours before the turn takes place, tropical cyclone intensity determination from upper tropospheric reconnaissance, and the diurnal variations of vertical motion in tropical weather systems. GRA

N80-19740# SRI International Corp., Arlington, Va.
THE LONG TERM IMPACT OF ATMOSPHERIC CARBON DIOXIDE ON CLIMATE
G. MacDonald, H. Abarbanel, and P. Carruthers Apr. 1979 184 p refs
(Contract EY-76-C-03-0115)
(SAN/115-136/2; JSR-78-07d) Avail: NTIS HC A09/MF A01

The sources of atmospheric CO2 are studied and the distribution of the present CO2 among the atmospheric, oceanic, and biospheric reservoir is addressed. The impact on climate as reflected by the average ground temperature at each latitude of significant increases in atmospheric CO2 is assessed via an analytic model of the atmosphere. Calculation with this zonally averaged model shows an increase of average surface temperature of 2.4 deg for a doubling of CO2. The equatorial temperature increases by 0.7 K, while the poles warm up by 10 to 12 K. Effects of the warming of the climate are discussed. DOE

N80-19741# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
CIRCUS PARTICLE DISTRIBUTION STUDY, PART 5 Air Force Surveys in Geophysics Interim Scientific Report
Ian D. Cohen 13 Jul. 1979 81 p ref
(AF Proj. 317J)
(AD-A077361; AFGL-TR-79-0155-Pt-5; AFGL-AFSG-414-Pt-5) Avail: NTIS HC A05/MF A01 CSCL 04/2

On 19 March 1978 an NC-130E aircraft obtained ice particle data in cirrus clouds near Albuquerque, N.M. Same data were also obtained from a high altostratus layer below the cirrus. Printouts of particle size and average number distribution for consecutive 30-sec periods during the flight are presented. Additionally, graphical displays of average particle spectra and 2-D particle examples are given for five 3- to 5-min periods when cloud conditions were relatively homogeneous. GRA

N80-19742# General Accounting Office, Washington, D. C. Community and Economic Development Div.
FEDERAL WEATHER MODIFICATION EFFORTS NEED CONGRESSIONAL ATTENTION
1 Nov. 1979 43 p
(PB80-108511; CED-80-5) Avail: NTIS HC A03/MF A01 CSCL 04B

Rainfall augmentation project are used to illustrate problems of weather modification programs. Results show a national weather modification research and development policy and that a program be developed with goals, objectives, priorities, and milestones should be defined. GRA

N80-19743# Virginia Highway and Transportation Research Council, Charlottesville.
ANALYZING HISTORICAL METEOROLOGICAL DATA FOR AIR QUALITY ANALYSIS Final Report, Jul. 1977 - Jun. 1979
Samuel F. Curling and Ronald L. Heisler Jun. 1979 36 p refs Sponsored in part by DOT
(PB80-107154; VHTRC-79-R54; FHWA/VA-79-R54) Avail: NTIS HC A03/MF A01 CSCL 04B

The development of three computer programs for analyzing historical meteorological data is described. The programs allow the computation of atmospheric stability categories by either of two recognized algorithms and admit the processing of temperature data as well as wind data. These programs were designed to aggregate and then analyze meteorological data on a season and hour of day basis. GRA

N80-19744# National Technical Information Service, Springfield, Va.
WEATHER MODIFICATION EFFECTS AND MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979
Roberta J. Brown Dec. 1979 266 p Supersedes NTIS/PS-78/1226; NTIS/PS-77/1106; NTIS/PS-76/0931; NTIS/PS-75/722; NTIS/PS-75/078
(PB80-802798; NTIS/PS-78/1226; NTIS/PS-77/1106; NTIS/PS-76/0931; NTIS/PS-75/722; NTIS/PS-75/078) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

The bibliography cites Government sponsored research reports concerning adverse and beneficial effects, effect on climate, legal aspects, ecological effects, and effect on water supplies. Studies related to the management and utilization of weather modification to increase the water supply in arid regions are included. Topics dealing with the theory of cloud seeding and precipitation nucleation are excluded. This updated bibliography contains 280 abstracts, 33 of which are new entries to the previous edition. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-19745# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)
COASTAL WATER TEMPERATURE IN THE SOUTHEASTERN PORTION OF BRAZIL UTILIZING OCEANOGRAPHIC DATA AND NOAA SENSOR DATA, VOLUME 2 [TEMPERATURAS DAS AGUAS DA COSTA SUDESTE DO BRASIL, OBTIDAS ATRAVES DE DADOS OCEANOGRAFICOS E DE DADOS DE SERIE NOAA - VOLUME 2]
Hector Manuel Inostroza Villagra and Jose Luiz Stech Sep. 1979 210 p In PORTUGUESE; ENGLISH summary Revised
(INPE-1569-RPE/070-Vol-2) Avail: NTIS HC A10/MF A01

A detailed analysis of 350 oceanographic stations resulted in the discovery of a marked seasonal tendency in the vertical temperature structure of the waters. A correlation was established between the surface and vertical thermal structure. With data from the global operational sea surface temperature computations experiment, temperature charts at the depth of 50 m were done for the four seasons of the year. K.L.

N80-19746# Naval Postgraduate School, Monterey, Calif.
REPRESENTATION OF HYDROGRAPHIC SURVEYS AND OCEAN BOTTOM TOPOGRAPHY BY ANALYTICAL MODELS M.S. Thesis
Alan J. Pickrell Sep. 1979 111 p refs
(AD-A078282) Avail: NTIS HC A06/MF A01 CSCL 08/10

Hydrographic surveys for nautical charting contain many discrete data points. Analytical models for ocean bottom topography could save computer storage and reduce the complexity of automating the nautical charting process, but they must meet stringent accuracy requirements. Polynomials, double Fourier series, finite elements, Duchon's analysis, Shepard's formula and Hardy's multiquadric analysis were investigated as possible modeling techniques. Multiquadric analysis in which the surface is represented by an analytical summation of mathematical surfaces such as cones and hyperboloids was the only method found to be suitable. An iterative method of model point selection was found to give the best results. Smooth and unambiguous junctions of adjacent models were made by using a Hermite polynomial weighted sum of overlapping areas. Highly irregular surfaces can be represented by about 20% of the original survey data points; more regular bottom topography can be represented by a smaller percentage. GRA

N80-19747# Naval Postgraduate School, Monterey, Calif.
THE EVALUATION OF DULL BEAM ECHO SOUNDERS IN HYDROGRAPHIC SURVEYING M.S. Thesis
Dean Robert Seidel Sep. 1979 85 p refs
(AD-A078273) Avail: NTIS HC A05/MF A01 CSCL 17/1

A limited area hydrographic survey was conducted in shallow water, using a launch equipped to sound concurrently with three beam widths, in order to evaluate the benefits of dual beam echo sounders. The narrow beam echo sounder has become commonplace in hydrographic surveying. This has reduced the bottom area insonified by the echo sounder's beam, which decreases the probability of detecting navigational hazards. The dual beam echo sounder, equipped with a narrow and wide beam, sounding concurrently, represents a relatively inexpensive means to increase the detection capabilities, while preserving the narrow beam operation. The wide beams detected significant peaks that were absent on the narrow beam trace. The wider hyperbolic returns of the wide beams served to emphasize the narrow beam returns over features with little horizontal extent. The narrow versus wide beam depth differences over feature peaks were found useful in isolating the peak's apex. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-19748*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF HABITUATION ON THE SUSCEPTIBILITY OF THE RAT TO RESTRAINT ULCERS
M. S. Martin, F. Martin, and R. Lambert Mar. 1980 12 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol. (France), v. 164, no. 4, 1970 p 826-828 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original Doc. prepared by Hopital Edouward Heriott, Lyon
(Contract NASw-3199)

(NASA-TM-76072) Avail: NTIS HC A02/MF A01 CSCL 06C

The frequency and gravity of restraint ulcers were found to significantly diminish in rats previously exposed to brief periods of immobilization. The rats' becoming habituated to restraint conditions probably explains this phenomenon. R.E.S.

N80-19749*# National Aeronautics and Space Administration, Washington, D. C.

NASA STANDARD PROCEDURES FOR THE MICROBIOLOGICAL EXAMINATION OF SPACE HARDWARE

Feb. 1980 31 p refs

(NASA-TM-80756; NHB-5340.1B) Avail: NTIS MF A01; SOD HC CSCL 06B

Microbiological assay procedures are described which assess the degree of microbial contamination of intramural environments where spacecraft hardware is assembled, tested and launched and also assess the level of microbial contamination on spacecraft hardware in relation to the known or anticipated environments of the target planets. It is emphasized that uniformity of procedures is of primary importance. However, portions of these procedures are written to include a degree of flexibility in that alternate techniques are described. Any change in these procedures, other than those specifically mentioned in alternate sections, is considered a deviation. R.C.T.

N80-19750*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF GRADED PHYSICAL LOAD ON THE STATE OF THE LIVER FROM MORPHOMETRIC DATA AND BIOCHEMICAL BLOOD INDICES OF RATS AGAINST A BACKGROUND OF HYPOKINESIA

B. A. Nikityuk, B. I. Kogan, V. A. Yermolyev, and L. V. Tindare Feb. 1980 8 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 4, Jul. - Aug. 1978 p 32-35 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75969) Avail: NTIS HC A02/MF A01 CSCL 06C

Tests were conducted on 100 sexually immature inbred August and Wistar male rats in order to determine the effects hypokinesia, physical load and phenamine on the liver. Weight and linear dimension fell in hypokinesia; total serum protein lowered and aldolase and cholesterol and beta-lipoprotein levels rose. Blood sugar content rose and liver glycogen fell. Interlinear differences of these indices are found. Rehabilitated physical loading against hypokinesia background diminished and at times completely prevented its negative effect. Extent of correction depended on animal species. Evidence of genotypical conditionality of organism adaptation to physical load in hypokinesia was found. R.E.S.

N80-19751*# National Aeronautics and Space Administration, Washington, D. C.

EFFECTIVENESS OF USING THYROCALCITONIN FOR THE PREVENTION OF A CALCIUM METABOLIC DISORDER IN THE MINERALIZED TISSUES OF RABBITS WITH 30 DAYS HYPOKINESIA

A. I. Volozhin, V. S. Shashkov, B. S. Dmitriyev, B. B. Yegorov, V. I. Lobachik, and A. I. Brishin Mar. 1980 11 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), v. 10, no. 2, May 1974, p 42-46 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75987) Avail: NTIS HC A02/MF A01 CSCL 06C

A 30 day hypokinesia in rabbits led to a considerable lag in weight gain for the skeletal bones, reduction in Ca45 uptake, and an increase in isotope resorption rate in the rapidly metabolized fraction of extremity bones. On the other hand, Ca45 content in the teeth and maxillae increased, which may be explained by redistribution of isotope among the various mineralized tissues. Injection of thyrocalcitonin (50 IU/day) produced a distinct normalizing effect on Ca45 uptake and resorption in the mineralized tissues of rabbits kept hypokinetic. Author

N80-19752*# National Aeronautics and Space Administration, Washington, D. C.

DYNAMICS OF ERYTHROCYTE COUNT, HEMOGLOBIN, AND CATALASE ACTIVITY IN RAT BLOOD IN HYPOKINESIA, MUSCULAR ACTIVITY AND RESTORATION

G. V. Taneyeva, G. M. Potapovich, N. A. Voloshko, and A. B. Uteshev Feb. 1980 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk Kaz. SSR, Ser. Biol., (USSR), no. 1, 1979 p 71-74 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-76058) Avail: NTIS HC A02/MF A01 CSCL 06C

Tests were conducted to prove that muscular exertion (in this instance swimming) of different duration and intensity, as well as hypodynamia, result in an increase of hemoglobin and number of red blood cells in peripheral blood rats. Catalase activity increased with an increase in the duration of swimming, but only up to 6 hr; with 7-9 hr of swimming as well as in hypodynamia, catalase activity decreased. It was also observed that under hypodynamia as well as in 3, 5 and 6 hr exertion (swimming) the color index of blood decreased. Pressure chamber treatment (for 8 min each day for one week), alternating a 2 min negative pressure up to 35 mm Hg with 1 min positive pressure, increased the erythrocyte count and hemoglobin content. R.E.S.

N80-19753*# National Aeronautics and Space Administration, Washington, D. C.

STATE OF THE MINERAL COMPONENT OF RAT BONE TISSUE DURING HYPOKINESIA AND THE RECOVERY PERIOD

A. I. Volozhin, G. P. Stupakov, M. N. Pavlova, and I. Sh. Muradov Mar. 1980 8 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter., (USSR), no. 2, 1979 p 30-33 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-76059) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments were conducted on young growing rats. Hypokinesia lasting from 20 to 200 days caused retarded gain in weight and volume of the femur and delayed development of the cortical layer of the diaphysis. In contrast, the density of the cortical layer of the femoral diaphysis increased due to elevation of the mineral saturation of the bone tissue microstructures. Incorporation of Ca into the bone tissue in hypokinesia had a tendency to reduce. Partial normalization of the bone tissue mineral component occurred during a 20 day recovery period following hypokinesia. R.E.S.

N80-19754*# National Aeronautics and Space Administration, Washington, D. C.

REACTION OF CHICKENS TO GRADUATED LENGTH OF EXPOSURE TO STRESS

J. Nvota, A. Grom, and A. Faberova Mar. 1980 14 p refs Transl. into ENGLISH from Biologia (Bratislava)(Czechoslovakia), v. 25, no. 11, 1970 p 797-803 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Slovak Acad. of Sci. and the Res. Inst. for Poultry breeding

(NASA-TM-76071) Avail: NTIS HC A02/MF A01 CSCL 06C

The reactions of 60 day old chickens Arbor Acres 60 X Vantress to immobilization stress lasting 1/2, 1, 2, 4 hours and to application of ACTH, manifested by activity changes in the systems hypophysis-adrenal gland and hypophysis-thyroid gland were studied. The highest activity increase in the two neuroendocrine systems of the chickens was found to occur after 1/2 hour exposure to stress. With prolonged stress the responses weakened and after 4 hours most of the values gradually regressed to their initial level. The responses of both systems were synchronized. Reactions of the chickens differed from those of laboratory rats in which an increased activity of the hypophysis-adrenal gland system coincided with attenuation of the hypophysis-thyroid gland system. R.E.S.

N80-19755# Joint Publications Research Service, Arlington, Va.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, V. 14, NO. 1

O. G. Gazenko, ed. 5 Mar. 1980 148 p refs Transl. into ENGLISH of Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow) 88 p
(JPRS-75251) Avail: NTIS HC A07/MF A01

Physiological and biological effects of manned space flight are considered with emphasis on long duration space flight. Reactions to altering work-rest cycles, hypocia, hypokinesia, and to head-pelvis accelerations are among the topics covered. For individual titles, see N80-19756 through N80-19777.

N80-19756# Joint Publications Research Service, Arlington, Va.

SCHEDULING WORK AND REST PERIODS DURING LONG-TERM SPACE FLIGHTS c54

B. S. Alyakrinskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1 (JPRS-75251) 5 Mar. 1980 p 1-14 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 3-8 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

A brief survey of space ergonomics, a field of science studying man's work capacity and methods of increasing efficiency is given. Emphasis is placed on the proper arrangement of work-rest cycles of crewmembers in long-duration space flight in order to optimize cosmonauts' activities in space. The usefulness of the laws of biorhythmology is also discussed. It is recommended that work-rest cycles in a prolonged space flight be arranged on a 24 hour basis with a normal day-night alternation, including an 8 hour night sleep and a 2 hour day rest. J.M.S.

N80-19757# Joint Publications Research Service, Arlington, Va.

EFFECTS OF FLIGHTS DIFFERING IN DURATION ON PROTEIN COMPOSITION OF COSMONAUTS BLOOD c52

Ye. V. Guseva and R. Yu. Tashpulatov *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 15-20 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 13-17 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

Adaptive changes in the protein composition of cosmonaut's blood detected after space flights of varying duration are examined. A short-term 2 day flight induced a decline of gamma-globulin (immunoglobulins G and A) and beta 2-glycoprotein fractions. Longer-term 16 and 18 day flights caused an increase in albumin and most globulin fractions. A long duration 49 day flight brought about an increase in the content of C sub 3c and C sub 4 factors of the complement and immunoglobulins G, A, and M. It is shown that return of the blood protein composition to normal after prolonged space flights takes a long period of time. J.M.S.

N80-19758# Joint Publications Research Service, Arlington, Va.

EFFECTS OF UNUSUAL SCHEDULES OF DAILY ACTIVITY AND SLEEP DEPRIVATION ON MAN'S FUNCTIONAL STATE AND WORK FITNESS c54

A. N. Litsov and I. F. Sarayev *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 21-29 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 17-23 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

Physiological functions, work capacity, and sleep characteristics of six healthy test subjects were studied for 30 days. The test subjects adhered to one of the three different regiments, (1) sleep from 2.00 a. m. to 10.00 a. m., (2) sleep from 6.00 p. m. to 2.00 a. m., and (3) sleep from 10.00 a. m. to 6.00 p. m. which were aggravated by 64 hr or 72 hr vigilance during the experiment. Demonstrated general and specific changes in physiological functions, work capacity and sleep are shown to be associated with how far work-rest cycles were shifted and how long they were applied. Prolonged vigilance caused similar changes in physiological functions, work capacity, and sleep. The test subjects showed very poor tolerance to an alteration in the work-rest cycle combined with sleep deprivation. J.M.S.

N80-19759# Joint Publications Research Service, Arlington, Va.

EFFECTS OF LONG-TERM SPACE FLIGHTS ON REACTIONS OF ADRENAL CORTEX AND MEDULLA

R. Kvetnyanski, R. A. Tigranyan, T. Torda, D. Repchakova, Ye. Yakhnova, and K. Murgash *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 30-35 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 24-27 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

Concentrations of corticosteron and catecholamines, and activities of catecholamine synthesizing enzymes, tyrosine hydroxylase, dopamine-beta-hydroxylase, and phenyl ethanol amine-N-methyl-transferase, were measured in the adrenals of rats flown for 19.5 days abroad the biosatellite Cosmos-782, synchronous and vivarium control animals sacrified on R + 0 and R + 26 days. The flown rats showed a moderate but significant increase in the adrenal weight, corticosteron concentration, and tyrosine hydroxylase activity on R + 0 day. These parameters returned to the normal on R + 26 day. These data give evidence that the adrenocortical and sympathoadrenal systems were not significantly stimulated by the space flight effects; therefore, weightlessness cannot be considered as a potent stressful agent. J.M.S.

N80-19760# Joint Publications Research Service, Arlington, Va.

CARDIOVASCULAR REACTION TO PERIODIC HEAD-PELVIS ACCELERATIONS ON A SHORT-ARM CENTRIFUGE c52

I. F. Vil-Vilyams and Ye. B. Shulzhenko *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 36-42 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 27-31 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

A result of 370 experiments in a 2 m-arm centrifuge, high human tolerance to acceleration of +0.8, 1.2, and 1.6 Gz (at the level of feet) was demonstrated. Cardiovascular reactions depended on the value, duration, and frequency of acceleration exposures. Cardiovascular responses included, primarily, changes in regional circulation of the legs. Author

N80-19761# Joint Publications Research Service, Arlington, Va.

REACTION OF HUMAN BLOOD TO CHRONIC EXPOSURE TO LOW DOSES OF CARBON MONOXIDE IN A CONFINED ENVIRONMENT c52

V. V. Zhuravlev, Z. M. Karelina, Ye. I. Nikitin, and V. P. Savina *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 43-48 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 43-48 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

The morphology, biochemistry, and acid-base equilibrium of blood of test subjects during chronic exposure to low doses of carbon monoxide in an enclosed environment was studied. R.E.S.

N80-19762# Joint Publications Research Service, Arlington, Va.

PROBABILITY OF ALTITUDE DECOMPRESSION DISORDERS WHEN BREATHING OXYGEN CONTAINING HUMAN WASTE GASES c52

A. V. Sedov, A. N. Mazin, and N. A. Surovtsev *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 49-53 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 36-39 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

The probability of altitude decompression disease in a hypobaric oxygen environment containing gaseous human wastes was explored. It was found that the development of the disease does not depend on the presence of wastes in the environment. Its frequency increases with exercises. The decrease of the barometric pressure to 308 mm Hg causes decompression disease only in the test subjects having traumatized limbs. The fre-

quency of the disease during further decrease in the pressure down to 198 mm Hg increases substantially. R.E.S.

N80-19763# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPEROXIA ON OXYGEN TRANSPORT PROPERTIES OF BLOOD **c52**
L. A. Ivanov and N. D. Chebotarev *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 54-59 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 39-42 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

In nine normal test subjects, aged 19-32, pO2, pCO2 and pH of arterial and venous blood were measured. The curve of oxyhemoglobin dissociation during 20 min inhalation of a 95% O2 containing mixture was analyzed. The studies demonstrate that during hyperoxia there is a shift to the left of the dissociation curve in native blood and standard curve (i.e., normalized to pH 7.4). This shift of the curve of oxyhemoglobin dissociation indicating an increase in hemoglobin affinity for oxygen seems to be one of the factors responsible for an increase in the pO2 arteriovenous difference and a much lower increment of venous pO2 than that of arterial pO2. Author

N80-19764# Joint Publications Research Service, Arlington, Va.
EXTERNAL RESPIRATION AND ACID-BASE BALANCE OF HUMAN BLOOD DURING LONG-TERM ANTIORTHOSTATIC HYPOKINESIA AND IN THE RECOVERY PERIOD **c52**
A. P. Golikov, V. Ye. Vorobyev, V. R. Abdrakhmanov, L. L. Stazhadze, V. V. Bogomolov, and S. C. Voronina *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 60-66 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 42-46 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

The external respiration and acid-base equilibrium of blood of 35 test subjects exposed to 49 day head-down (-4 deg) tilting and of 6 test subjects exposed to 182 day head-down (-4 deg) tilting was studied. The investigation found that a trend for a decrease in the respiration rate, lung ventilation, oxygen consumption occurred along with a relative increase in the exhalation time. With respect to the arterialized blood gases, a significant decrease in Pa sub O2, an increase in Pa sub CO2, and in the O2 alveolar-arterial difference were seen during the 49 day head-down tilting. During the 182 day head-down tilting a further increase in the CO2 arterio-alveolar difference was noted. These changes suggest shifts of the ventilation-perfusion ration in the lungs and, probably, disturbances of central regulation of respiration induced by head-down tilting. During the recovery period the above changes diminished gradually and disappeared by the 14th and 30th day after the 49 and 182 day head-down tilting, respectively. R.E.S.

N80-19765# Joint Publications Research Service, Arlington, Va.
DISTINCTIONS IN DEVELOPMENT OF PYROGENAL FEVER IN ANIMALS FOLLOWING PROLONGED HYPOKINESIA
P. V. Vasilyev, G. D. Glod, S. I. Sytnik, N. N. Uglova, and V. P. Melnikova *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 67-72 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 46-50 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

Experiments on rabbits with pyrogenal fever and amidopyrine injection were conducted. It was found that 15 and 30 day exposure to hypokinesia produced changes in the reactivity of thermoregulating centers -- overexcitation and depletion. These changes were more distinct after 15 day hypokinesia. R.E.S.

N80-19766# Joint Publications Research Service, Arlington, Va.
RAPID LABORATORY METHOD FOR TESTING OUTGASSING OF THERMOSTABLE PLASTICS AND RUBBER **c27**
V. D. Yablochkin, G. D. Solomin, V. A. Shchirskaya, N. A. Glazkova, Ye. A. Demchenko, N. Ye. Ostasheva, and E. I. Chukhno *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 73-75 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 50-54 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

Time-temperature dependence of concentrations of outgassing products of polymers and rubbers was studied. Applying the principle of time-temperature equilibrium, the exposure time for a laboratory rapid study of polymers at 100 C was estimated to be 1 hr for enamels, lacquers and dyes, 1.5 hr for block and sheet polymers, 2.5 hr for sealants and rubbers, and 4 hr for textile materials, measured from the time when the preassigned temperature was achieved. The rapid method can be recommended for preliminary chemical study of polymers at the stage of their laboratory testing. Author

N80-19767# Joint Publications Research Service, Arlington, Va.
EFFECTS OF 25 AND 50 MeV PROTONS ON HUMAN PERIPHERAL BLOOD LYMPHOCYTE CHROMOSONES IN VITRO **c52**
A. M. Totseva, N. I. Ryzhov, V. N. Garasimfnko, and Ye. Dermendzhiyev *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 80-87 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 54-60 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

The frequency and type of chromosomal abberations in human lymphocytes induced by 25, 50, 645 MeV protons and 200 kv X-rays were studied. It was shown that the yield of one-hit acentric fragments increased linearly and that of double-break aberrations increased exponentially with the irradiation dose. It was demonstrated that under the influence of radiations with high linear energy transfer the number of paired fragments increased and that of dicentrics and rings decreased. The test of total yield of chromosomal aberrations and their specific types helped to derive coefficients of relative biological effectiveness of the above irradiations. There was a quantitative correlation between the dose and yield of individual aberration types. R.C.T.

N80-19768# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF PROGRAM FOR THE CONTROL OF THE AUTOTROPHIC COMPONENT OF AN ECOLOGICAL SYSTEM THAT IS CLOSED WITH REGARD TO EXCHANGE OF GASES **c54**
A. S. Nasonov and V. S. Toroptsov *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 88-93 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 60-63 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

The requirements for the programmed control and performance of auotrophic and heterotrophic components of a closed ecological system were determined. Examples of pertinent computations are given. R.C.T.

N80-19769# Joint Publications Research Service, Arlington, Va.
EFFECT OF SODIUM BICARBONATE ON REACTIVITY AND TROPHICS OF VESTIBULAR ANALYZER **c52**
N. I. Arlashchenko *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 94-100 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 64-68 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

It is shown that prevention of motion sickness by intravenous injections of sodium bicarbonate is a direct result of trophic changes or effect of the chemical on the functional activity of central formations. Significant observations and results are reported. R.C.T.

N80-19770# Joint Publications Research Service, Arlington, Va.

EVALUATION AND FORECASTING OF MENTAL FITNESS OF FLIGHT PERSONNEL IN THE PRESENCE OF NEUROSIS c53

K. K. Ioseliani *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 101-106 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 68-72 (For primary document see N80-19755 10-51)

Avail: NTIS HC A07/MF A01

Features of psychic functions and mental performance of flight personnel suffering from various neuroses were examined by clinical and psychological methods. The most severe and persistent changes in mental performance were found in neurasthenics. Higher mental productivity was detected in 80% of subjects with other neuroses (neurotic states and reactions, asthenic state, emotional-vegetative instability) ($P < 0.001$). R.C.T.

N80-19771# Joint Publications Research Service, Arlington, Va.

DYNAMICS OF STRESS REACTION OF RATS DURING EXPERIMENTAL HYPOKINESIA VARYING IN DURATION, AND POSSIBILITY OF CORRECTION THEREOF

L. Y. Kirichek *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 107-111 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 72-74 (For primary document see N80-19755 10-51)

Avail: NTIS HC A07/MF A01

The dynamic intensity of the stress reaction in rats as a function of time of restriction of movement was surveyed. The time of maximum manifestation of stress was determined and the nature of change therein under the influence of some central neurotropic agents was demonstrated. R.C.T.

N80-19772# Joint Publications Research Service, Arlington, Va.

EFFECT OF BRIEF ANTIORTHOSTATIC HYPOKINESIA ON BLOOD IMMUNOGLOBULIN CONTENT c52

N. N. Mukhina, V. V. Chestukhin, V. Ye. Katlov, and A. P. Karpov *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75521) 5 Mar. 1980 p 112-115 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 74-75 (For primary document see N80-19755 10-51)

Avail: NTIS HC A07/MF A01

Proteins were assayed with antibody activity in blood samples from different organs, and the effect on levels thereof of brief antiorthostatic (head-down) hypokinesia, which simulates the acute period of adaptation to weightlessness was tested. R.C.T.

N80-19773# Joint Publications Research Service, Arlington, Va.

RAT PLASMA AND TISSUE LIPIDS AFTER A LONG-TERM SPACE FLIGHT

J. Ahlers, R. A. Tigranyan, E. Ahlers, E. Paulikova, and M. Praslicka *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 116-119 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 76-78 (For primary document see N80-19755 10-51)

Avail: NTIS HC A07/MF A01

Changes in the plasma and lipid metabolism of rats were studied one day after the rats had completed a flight aboard the Cosmos 782. The data were compared with the results of studies on animals involved in a ground based, synchronous experiment. Nonesterified fatty tissues were bioassayed. Results indicate there were changes in some parameters of lipid metabolism in rats such as signs of increased lipolysis in fatty tissue and increased mobilization of lipids. The changes in the spectrum of blood plasma and tissue lipids under the influence of prolonged weightlessness are discussed. A.W.H.

N80-19774# Joint Publications Research Service, Arlington, Va.

FUNCTIONAL CHANGES IN THE ADRENAL CORTEX DURING SIMULATION OF STRESS SITUATIONS IN THE PRESENCE OF HIGH CARBON MONOXIDE LEVELS c52

S. K. Kalandarov, V. P. Bychkov, and V. P. Savina *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, 1980 p 78-80 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 78-80 (For primary document see N80-19755 10-51)

Avail: NTIS HC A07/MF A01

Experiments conducted in a pressure chamber to study the combined effects of a high concentration of carbon monoxide, high temperature, and humidty on the functional state of the human adrenal cortex during a prolonged period are described. The experiments were a simulation of a malfunction of the life support systems during space flight. The experimental period varied from one to ninety days. The effects of these conditions upon the potassium and sodium content of erythrocytes, the blood plasma, and the glucocorticoid and mineralocorticoid functions of the adrenal cortex are discussed. A.W.H.

N80-19775# Joint Publications Research Service, Arlington, Va.

EFFECT OF HYPOXIA AND HYPERCAPNIA ON LACTATE AND PYRUVATE LEVELS IN RAT BLOOD AND MYCARDIUM

N. I. Mikhalkina *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 125-129 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 80-82 (For primary document see N80-19755 10-51)

Avail: NTIS HC A07/MF A01

The dynamics of the lactate and pyruvate levels of rats during brief, recurrent exposures to hypoxia and hypercapnia were studied. Changes in the glycolytic metabolism in the heart of a rat under the influence of these conditions are discussed. Changes in the blood and tissue of the left chamber of the heart versus changes in the right chamber are described. A.W.H.

N80-19776# Joint Publications Research Service, Arlington, Va.

STUDY OF RADIOPROTECTIVE EFFECT OF HIGH-INTENSITY MAGNETIC FIELDS ON MAMMALIAN CELL CULTURES c52

Z. Ye. Vnukova *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 130-133 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 83-84 (For primary document see N80-19755 10-51)

Avail: NTIS HC A07/MF A01

The combined effects of ionizing radiation and stationary magnetic fields on fibroblasts cultured in medium 199 and in Eagle's medium with 10% bovine serum and antibiotics are discussed. The radiation effect was evaluated according to the rate of restoration of cell division, the level of chromosomal aberrations in the first postradiation mitosis, and the cell survival. The cells were exposed to radiation from a Cs-137 source. An improvement in hematological parameters and a higher animal survival rate with a certain combination of these factors is discussed. A.W.H.

N80-19777# Joint Publications Research Service, Arlington, Va.

STUDIES OF THE EFFECTS OF STATIONARY MAGNETIC FIELDS ON RAT ERYTHRON

A. D. Pavlov, A. I. Solovyev, Yu. D. Goncharenko, and Ye. N. Pashukov *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 134-139 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 84-87 (For primary document see N80-19755 10-51)

Avail: NTIS HC A07/MF A01

The dynamics of erythropoiesis and erythropoietic activity of serum in rats under the influrnce of a stationary magnetic field are examined. Bioassayed results of the erythrocytes, reticulocytes, hemoglobin, and hematocrit are presented. The life span of erythrocytes was determined using Cr-51. Increased and/or decreases in the count of the erythrocytes, reticulocytes, hemoglobin, and hematocrit after certain periods of exposure are discussed. A.W.H.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-19778 California Univ., Davis.
A CONTINUUM MODEL OF PROTEIN TRANSPORT ACROSS THE ENDOTHELIUM IN THE LUNGS AND IN THE BODY OF HUMANS Ph.D. Thesis
James Paul Kohler 1979 433 p
Avail: Univ. Microfilms Order No. 8003517

A model of protein transport between two compartments of a multiphase, porous system is developed by volume averaging the species education of continuity over each of the two phases. The equation obtained by this method contains a mass transport parameter which represents the ratio of a complex function of diffusive and convective processes to a function of purely convective transport. The transport equation is used with experimental data obtained from a group of human subjects to model transport of the blood Beta globulin transferrin (MW = 76000, labeled with the radioisotopes In113) from the vascular to the interstitial compartment in the lung and to the extravascular compartment in the body as a whole. The experimental data are obtained from normal subjects and a heterogeneous group of patients by means of a noninvasive scintillation detection technique and blood sampling.
Dissert. Abstr.

N80-19779* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 203
Feb. 1980 58 p
(NASA-SP-7011(203)) Avail: NTIS HC E04 CSCL 06E

This bibliography lists 150 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1980. Author

N80-19780 Royal Aircraft Establishment, Farnborough (England).
ULTRASONIC DOPPLER DIRECTIONAL BLOOD FLOW VELOCITY METER
V. S. Postnikov, L. I. Yakimenkov, Yu. N. Gusev, and P. M. Zykov 13 Oct. 1978 7 p refs Transl. into ENGLISH from Izv. vuz Priboorostroenie (USSR), v. 19, no. 4, 1976 p 5-8
(RAE-Lib-Trans-1918) Avail: Royal Aircraft Estab. Farnborough, Engl.

A principle for detecting the sense of the velocity of a blood flow using ultrasonic Doppler (USD) meters is described. The USD meter operates in single frequency, continuous-signal conditions with a combined piezoelectric sender/receiver. R.C.T.

N80-19781* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 204
Mar. 1980 52 p
(NASA-SP-7011(204)) Avail: NTIS HC E04 CSCL 06E

This bibliography lists 140 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1980. Author

N80-19782*# Pennsylvania State Univ., University Park.
KIDNEY CELL ELECTROPHORESIS Progress Report
Paul Todd Jan. 1980 28 p
(Contract NAS9-15584)
(NASA-CR-160555) Avail: NTIS HC A03/MF A01 CSCL 06B

The following aspects of kidney cell electrophoresis are discussed: (1) the development and testing of electrophoresis solutions; (2) optimization of freezing and thawing; (3) procedures for evaluation of separated kidney cells; and (4) electrophoretic mobility characterization of kidney cells. R.E.S.

N80-19783*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF HYPOKINESIA ON CARDIAC CONTRACTILE FUNCTION AND NERVOUS REGULATION OF THE HEART
F. Z. Meyerson, V. I. Kapelko, M. S. Gorina, A. N. Shchegolkov, and N. P. Larinov Feb. 1980 13 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR, (USSR), no. 8, Aug. 1978 p 1138-1144 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75970) Avail: NTIS HC A02/MF A01 CSCL 06P

Longterm hypokinesia caused cardiac deadaptation in rabbits, which resulted in the diminishing of the left ventricular rate of contraction and relaxation, joined later by decreased vascular resistance. As a results, the ejection rate as well as stroke volume and cardiac output were normal. The decrease of the relaxation speed was more obvious at a high heart rate and results in shortening of the diastolic pause and diminishing of cardiac output. Hearts of the hypokinetic animals were characterized by normal maximal pressure developed by a unit of muccardial mass aorta clamping, decreased adrenoreactivity, and increased cholinoreactivity. This complex of changes is contrary to changes observed in adaptation to exercise, but is similar to changes observed in compensatory hypertrophy of the heart.
R.C.T.

N80-19784*# National Aeronautics and Space Administration, Washington, D. C.
ALIMENTARY HYPOKINESIA
K. S. Petrovskiy Mar. 1980 8 p Transl. into ENGLISH from Gig. Sanit. (USSR), no. 2, Feb. 1974, p 18-22 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75989) Avail: NTIS HC A02/MF A01 CSCL 06P

The problem of possible conservation of the natural activity of food products is discussed. The struggle for the preservation of the natural activity of food products is an important means of preventing the unfavorable consequences of long term hypokinesia. R.E.S.

N80-19785*# National Aeronautics and Space Administration, Washington, D. C.
METABOLISM DURING HYPODYNAMIA
I. V. Federov Feb. 1980 29 p refs Transl. into ENGLISH from Biol. Nauki (USSR), v. 15, no. 12, 1972 p 24-36 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75996) Avail: NTIS HC A03/MF A01 CSCL 06S

Physical immobilization, inaction due to space travel, a sedentary occupation, or bed confinement due to a chronic illness elicit similar alternations in the metabolism of man and animals (rat, rabbit, dog, mouse). After a preliminary period of weight loss, there is eventually weight gain due to increased lipid storage. Protein catabolism is enhanced and anabolism depressed, with elevated urinary excretion of amino acids, creatine, and ammonia. Glycogen stores are depleted and glyconeogenesis is accelerated. Polyuria develops with subsequent redistribution of body fluids in which the blood volume of the systemic circulation is decreased and that of pulmonary circulation increased. This results in depressed production of vasopressin by the posterior pituitary which further enhances urinary water and salt loss. Author

N80-19786*# National Aeronautics and Space Administration, Washington, D. C.
BLOOD CIRCULATION UNDER CONDITIONS OF WEIGHTLESSNESS
I. I. Kastyan and V. I. Kopanev Mar. 1980 25 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Seriya Biol. (USSR), no. 3, 1964 p 352-368 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76036) Avail: NTIS HC A02/MF A01 CSCL 06S

Experimental materials and published data on the problem of blood circulation in man and animals under conditions of short and long term weightlessness are summarized. The data obtained allow the conclusion, that when humans spent 5 days in a weightless state their blood circulation was not essentially distributed. Some features of the functioning of the cardiovascular system are pointed out: delay of adaptation rate, increase in

lability, etc. There is a discussion of the physiological mechanisms for the direct and indirect effect of weightlessness. The direct effect comprise the complex of reactions caused by the significant fall in hydrostatic pressure and the indirect embraces all the reactions arising in the organism resulting from disturbance of the systematic character of the analyzers that take part in the analysis of space realtions and the body's orientation in space.
R.E.S.

N80-19787*# National Aeronautics and Space Administration, Washington, D. C.
CERTAIN QUESTIONS OF THE ACCLIMATIZATION OF CONSTRUCTION WORKERS TO THE CONDITIONS OF A SUBTROPICAL CLIMATE
A. Babayev Sep. 1979 11 p refs Transl. into ENGLISH from Gig. Sanit. (USSR), no. 6, 1978 p 106-108 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75728) Avail: NTIS HC A02/MF A01 CSCL 06P

The period of active acclimatization was determined for construction workers coming into a subtropical climate. Changes were observed in metabolic processes, oxygen needs, pulse rate, arterial pressure, body and skin temperature, body weight, water consumption and loss, and the comfort zone of heat sensitivity. It was concluded that acclimatization is facilitated if introduction to the hot climate occurs in the mild cool season, rather than the summer. This also prevents heat prostration and improves the development of adaptive mechanisms. Author

N80-19788# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Aviation Vision Lab.
SPATIAL FILTERING AND MECHANISMS OF PERCEPTION
Arthur P. Ginsburg Apr. 1979 9 p refs Presented at the Conf. on Modeling and Simulation, Pittsburgh, 25-27 Apr. 1979 (AF Proj. 2313)
(AD-A077622; AMRL-TR-79-47) Avail: NTIS HC A02/MF A01 CSCL 14/5

Attempts have been made to distinguish between visual mechanisms as being space domain feature detectors or transform domain spatial frequency detectors. Those descriptions can be considered equivalent in terms of producing similar filtered images. However, Fourier-like transformation appears to be a more accurate description of the filtering process when biological data is considered. The two-dimensional discrete Fourier transform is a process that requires the input object to be multiplied by a bank of even symmetric cosinusoidal and odd symmetric sinusoidal space functions having periodicity. The periodicity corresponds to the number of cycles per receptive field width. The weighting function of the periodicity is alternating positive and negative values. These properties were related to the properties of cortical receptive fields. Certain receptive fields may functionally perform a generalized periodic analysis for spatial vision. Since these functions are two-dimensional, they are sensitive to orientation, similar to cortical receptive fields. Therefore, it was argued that the visual system contains mechanisms that can process spatial information consistent with the mathematical process of a two-dimensional discrete Fourier-like transform. This analysis of the filtering process of certain visual cortical mechanisms may lead to further understanding into visual perception. GRA

N80-19789# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE THOUSAND AVIATOR STUDY: 1969 - 1971 FOLLOW-UP PROGRAM WITH DISTRIBUTIONS AND INTERCORRELATIONS OF SELECTED VARIABLES
Neil R. MacIntyre, Albert Oberman, William Harlan, Robert E. Mitchell, and Ashton Graybiel Apr. 1979 232 p refs
(AF51524005)
(AD-A079700; NAMRL-MONOGRAPH-24) Avail: NTIS HC A11/MF A01 CSCL 01/2

The 1969-1971 evaluation of the U.S. Navy's 'Thousand Aviator' program was the fourth such follow-up examination since the study's inception in 1940. During this evaluation, follow-up status was determined in 995 of the original 1056 subjects (94.2%). In addition, the largest amount of physiologic, psychologic, and other medical data collected to date in the program was obtained on the 675 subjects tested in Pensacola, Florida. As with previous evaluations of the group, a summary of the methodologies employed and an overall view of distributions and interrelationships seemed necessary for a continued understanding of the program and its findings. This report describes in detail the methodology as well as the distributions and intercorrelations of 80 selected variables. Data are presented in the form of descriptive statistics, frequency histograms, and Pearson correlation coefficients. Comments deal exclusively with statistical considerations, and no interpretations are attempted.
Author (GRA)

N80-19790# National Technical Information Service, Springfield, Va.
BIOFEEDBACK. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1966 - Dec. 1979
Elizabeth A. Harrison Dec. 1979 76 p Supersedes NTIS/PS-78/1301; NTIS/PS-77/1188; NTIS/PS-76/0999; NTIS/PS-75/885; NTIS/PS-75/025
(PB80-803117; NTIS/PS-78/1301; NTIS/PS-77/1188; NTIS/PS-76/0999; NTIS/PS-75/885; NTIS/PS-75/025) Avail: NTIS HC $30.00/MF $30.00 CSCL 05J

Research reports on self-regulation of psychological and physiological processes are cited. Studies on learned control of blood pressure, motor reactions, brain waves, heart rate, and body temperature are included. This updated bibliography contains 68 abstracts, 7 of which are new entries to the previous edition.
GRA

N80-19757# Joint Publications Research Service, Arlington, Va.
EFFECTS OF FLIGHTS DIFFERING IN DURATION ON PROTEIN COMPOSITION OF COSMONAUTS BLOOD
Ye. V. Guseva and R. Yu. Tashpulatov *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 15-20 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 13-17 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19760# Joint Publications Research Service, Arlington, Va.
CARDIOVASCULAR REACTION TO PERIODIC HEAD-PELVIS ACCELERATIONS ON A SHORT-ARM CENTRIFUGE
I. F. Vil-Vilyams and Ye. B. Shulzhenko *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 36-42 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 27-31 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19761# Joint Publications Research Service, Arlington, Va.
REACTION OF HUMAN BLOOD TO CHRONIC EXPOSURE TO LOW DOSES OF CARBON MONOXIDE IN A CONFINED ENVIRONMENT
V. V. Zhuravlev, Z. M. Karelina, Ye. I. Nikitin, and V. P. Savina *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 43-48 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 43-48 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19762# Joint Publications Research Service, Arlington, Va.
PROBABILITY OF ALTITUDE DECOMPRESSION DISORDERS WHEN BREATHING OXYGEN CONTAINING HUMAN WASTE GASES
A. V. Sedov, A. N. Mazin, and N. A. Surovtsev *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 49-53 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 36-39 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19763# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPEROXIA ON OXYGEN TRANSPORT PROPERTIES OF BLOOD
L. A. Ivanov and N. D. Chebotarev. *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 54-59 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 39-42 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19764# Joint Publications Research Service, Arlington, Va.
EXTERNAL RESPIRATION AND ACID-BASE BALANCE OF HUMAN BLOOD DURING LONG-TERM ANTIORTHOSTATIC HYPOKINESIA AND IN THE RECOVERY PERIOD
A. P. Golikov, V. Ye. Vorobyev, V. R. Abdrakhmanov, L. L. Stazhadze, V. V. Bogomolov, and S. C. Voronina. *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 60-66 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 42-46 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19767# Joint Publications Research Service, Arlington, Va.
EFFECTS OF 25 AND 50 MeV PROTONS ON HUMAN PERIPHERAL BLOOD LYMPHOCYTE CHROMOSONES IN VITRO
A. M. Totseva, N. I. Ryzhov, V. N. Garasimfnko, and Ye. Dermendzhiyev. *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 80-87 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 54-60 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19769# Joint Publications Research Service, Arlington, Va.
EFFECT OF SODIUM BICARBONATE ON REACTIVITY AND TROPHICS OF VESTIBULAR ANALYZER
N. I. Arlashchenko. *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 94-100 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 64-68 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19772# Joint Publications Research Service, Arlington, Va.
EFFECT OF BRIEF ANTIORTHOSTATIC HYPOKINESIA ON BLOOD IMMUNOGLOBULIN CONTENT
N. N. Mukhina, V. V. Chestukhin, V. Ye. Katlov, and A. P. Karpov. *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75521) 5 Mar. 1980 p 112-115 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 74-75 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19774# Joint Publications Research Service, Arlington, Va.
FUNCTIONAL CHANGES IN THE ADRENAL CORTEX DURING SIMULATION OF STRESS SITUATIONS IN THE PRESENCE OF HIGH CARBON MONOXIDE LEVELS
S. K. Kalandarov, V. P. Bychkov, and V. P. Savina. *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, 1980 p 78-80 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 78-80 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19776# Joint Publications Research Service, Arlington, Va.
STUDY OF RADIOPROTECTIVE EFFECT OF HIGH-INTENSITY MAGNETIC FIELDS ON MAMMALIAN CELL CULTURES
Z. Ye. Vnukova. *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 130-133 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 83-84 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-19791*# Boeing Commercial Airplane Co., Seattle, Wash.
NASA TLA WORKLOAD ANALYSIS SUPPORT. VOLUME 1: DETAILED TASK SCENARIOS FOR GENERAL AVIATION AND METERING AND SPACING STUDIES
James L. Sundstrom. Mar. 1980 38 p refs
(Contract NAS1-13741)
(NASA-CR-3199; D6-32872) Avail: NTIS HC A03/MF A01 CSCL 05H

The techniques required to produce and validate six detailed task timeline scenarios for crew workload studies are described. Specific emphasis is given to: general aviation single pilot instrument flight rules operations in a high density traffic area; fixed path metering and spacing operations; and comparative workload operation between the forward and aft-flight decks of the NASA terminal control vehicle. The validation efforts also provide a cursory examination of the resultant demand workload based on the operating procedures depicted in the detailed task scenarios. R.C.T.

N80-19792*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECT OF FIELD OF VIEW AND MONOCULAR VIEWING ON ANGULAR SIZE JUDGEMENTS IN AN OUTDOOR SCENE
Edward A. Denz (San Jose State Univ., Calif.), Everett A. Palmer, and Stephen R. Ellis. Feb. 1980 20 p refs
(Grant NsG-2269)
(NASA-TM-81176; A-8083) Avail: NTIS HC A02/MF A01 CSCL 05I

Observers typically overestimate the angular size of distant objects. Significantly, overestimations are greater in outdoor settings than in aircraft visual-scene simulators. The effect of field of view and monocular and binocular viewing conditions on angular size estimation in an outdoor field was examined. Subjects adjusted the size of a variable triangle to match the angular size of a standard triangle set at three greater distances. Goggles were used to vary the field of view from 11.5 deg to 90 deg for both monocular and binocular viewing. In addition, an unrestricted monocular and binocular viewing condition was used. It is concluded that neither restricted fields of view similar to those present in visual simulators nor the restriction of monocular viewing causes a significant loss in depth perception in outdoor settings. Thus, neither factor should significantly affect the depth realism of visual simulators. Author

N80-19793# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
LEARNING BY UNDERSTANDING ANALOGIES
Patrick H. Winston. Jun. 1979 90 p refs
(Contracts N00014-75-C-0643; N00014-77-C-0389)
(AD-A078123; AI-M-520) Avail: NTIS HC A05/MF A01 CSCL 06/4

We use analogy when we say something is a Cinderella story and when we learn about resistors by thinking about water pipes. Experts use analogy when they learn Economics, Medicine, and Law. This paper presents a theory of analogy and describes an implemented system that embodies the theory. The specific competence to be understood is that of using analogies to deal with an unfamiliar situation. A teacher may supply the analogy or may not. The analogy may be between situations in a single domain or between situations in very different domains. Frames represent the situations. Relations are expressed in a way that is reminiscent of the case-grammar view of simple sentences. The essential computations tie pairs of frame-described situations

together and make knowledge about one become knowledge about the other. GRA

N80-19794# National Technical Information Service, Springfield, Va.
STRESS FACTORS ON PILOT PERFORMANCE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Dec. 1979
Elizabeth A. Harrison Dec. 1979 222 p Supersedes NTIS/PS-78/1289; NTIS/PS-77/1160; NTIS/PS-76/1043; NTIS/PS-75/033
(PB80-803075; NTIS/PS-78/1289; NTIS/PS-77/1160; NTIS/PS-76/1043; NTIS/PS-75/033) Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

The selected abstracts of research reports cover acceleration, circadian rhythms, physiology, psychology, neurology, man-machine systems, high altitude effects, noise effects, and vibration effects as related to stress factors on pilot performance. This updated bibliography contains 215 abstracts, 25 of which are new entries to the previous edition. GRA

N80-19813# Department of the Air Force, Washington, D.C. Tactical Systems Div.
REPRESENTING HUMAN THOUGHT AND RESPONSE IN MILITARY CONFLICT SIMULATION MODELS
Dennis K. Leedom *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 15 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19828# Defense Advanced Research Projects Agency, Arlington, Va.
AVIATION TRAINING USING VIDEO DISK TECHNOLOGY
Craig Fields and Steven Levin *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 2 p Prepared in cooperation with Interactive Television Co., Arlington, Va. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19770# Joint Publications Research Service, Arlington, Va.
EVALUATION AND FORECASTING OF MENTAL FITNESS OF FLIGHT PERSONNEL IN THE PRESENCE OF NEUROSIS
K. K. Ioseliani *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 101-106 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 68-72 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-19795*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.
PROJECT FIRES - FIREFIGHTERS INTEGRATED RESPONSE EQUIPMENT SYSTEM. VOLUME 1: PROGRAM OVERVIEW AND SUMMARY, PHASE 1A Final Report
Fred Abeles, Arnold Bruno, Robert Delvecchio, and Victor Himel Dec. 1978 48 p
(Contract NAS8-32329)
(NASA-CR-161399; PB-299050/5) Avail: NTIS HC A03/MF A01 CSCL 06Q

Current firefighters protective equipment was tested and evaluated against the protective ensemble performance standards (PEPS) requirements. A technology demonstration ensemble (TDE) was fabricated to demonstrate how the use of advanced equipment and technology could satisfy, to the fullest extent possible, the protective needs of the firefighter described by the PEPS. The TDE utilizes innovative approaches, advanced materials and equipment, and systems integration technology. Using the results of the test program and the PEPS document, a preliminary design of a prototype protective ensemble was performed. This design features materials and components that are available now and would offer increased firefighter protection in the near future. Author

N80-19796*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.
PROJECT FIRES - FIREFIGHTERS INTEGRATED RESPONSE EQUIPMENT SYSTEM. VOLUME 2: PROTECTIVE ENSEMBLE PERFORMANCE STANDARDS GOALS FOR FIREFIGHTER PROTECTION, PHASE 1A Final Report
Fred Abeles, Arnold Bruno, Robert Delvecchio, and Victor Himel Dec. 1978 143 p Revised
(Contract NAS8-32329)
(NASA-CR-161400; PB-299051/3) Avail: NTIS HC A07/MF A01 CSCL 06Q

The performance goals needed for the development of a structural firefighter's protective ensemble are presented. The protective ensemble is comprised of five integrated systems and provides body protection, breathing gas, cooling, illumination, and a communications capability. The performance requirements are defined along with associated methods for their evaluation. J.M.S.

N80-19797*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.
PROJECT FIRES - FIREFIGHTERS INTEGRATED RESPONSE EQUIPMENT SYSTEM. VOLUME 3: TEST AND EVALUATION REPORT, PHASE 1A Final Report
Fred Abeles, Arnold Bruno, Robert Delvecchio, and Victor Himel Dec. 1978 94 p
(Contract NAS8-32329)
(NASA-CR-161401; PB-299052/1) Avail: NTIS HC A05/MF A01 CSCL 06Q

Existing turnout gear was evaluated against the protective ensemble performance standards (PEPS). The equipment tested included eight models of helmets, four models of eyeshields, five representative turnout coats, ten pairs of gloves, five pairs of boots, four full-up combinations of turnout gear, and one personal cooling system. Physical testing and evaluation included impact, penetration, heat, flame, and cut resistance. Human factors testing and evaluation included mobility and dexterity, grip, cold insulation, heat insulation, fit, and retention. Performance of each individual item is rated in terms of the PEPS criteria. J.M.S.

N80-19798*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.
PROJECT FIRES - FIREFIGHTERS INTEGRATED RESPONSE EQUIPMENT SYSTEM. VOLUME 4: TECHNOLOGY DEMONSTRATION ENSEMBLE, PHASE 1A Final Report
Fred Abeles, Arnold Bruno, Robert Delvecchio, and Victor Himel Dec. 1978 24 p
(Contract NAS8-32329)
(NASA-CR-161402; PB-299053/9) Avail: NTIS HC A02/MF A01 CSCL 06Q

The Technology Demonstration Ensemble (TDE) demonstrates advanced concepts in a structural firefighter's personal protection system. This innovative design was conceived of as an integrated lightweight system that provides head-to-toes protection. Some of the features provided include: an ultralightweight breathing system built right into the turnout garment; conecpts which insure wrist, neck, and ankle protection; a helmet that incorporates a radio, public address system; and an emergency warning device. These and other features of the design are described. J.M.S.

N80-19799*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Technology Dept.
PROJECT FIRES - FIREFIGHTERS INTEGRATED RESPONSE EQUIPMENT SYSTEM. VOLUME 5: PROTOTYPE PROTECTIVE ENSEMBLE DATA PACKAGE, PHASE 1A Final Report
Fred Abeles, Arnold Bruno, Robert Delvecchio, and Victor Himel Dec. 1978 94 p refs
(Contract NAS8-32329)
(NASA-CR-161403; PB-299054/7) Avail: NTIS

HC A05/MF A01 CSCL 06Q

The preliminary design of a prototype protective ensemble for structural firefighters is presented. The protective garment system is comprised of five subsystems. Sketches and preliminary layout-type drawings used as a basis for defining the design characteristics of the protective garment subsystem are included. The design is based on the requirements of the protective ensemble performance standard, available materials characteristics, and on maintaining cost at a reasonable level. J.M.S.

N80-19800*# Life Systems, Inc., Cleveland, Ohio.

DEVELOPMENT OF A NITROGEN GENERATION SYSTEM Final Report

D. B. Heppner, R. D. Marshall, J. D. Powell, III, and F. H. Schubert Jan. 1980 63 p refs

(Contract NAS2-10096)

(NASA-CR-152333; LSI-TR-353-4) Avail: NTIS HC A04/MF A01 CSCL 06K

An eight-stage nitrogen generation module was developed. The design integrated a hydrazine catalytic dissociator, three ammonia dissociation stages and four palladium/silver hydrogen separator stages. Alternating ammonia dissociation and hydrogen separation stages are used to remove hydrogen and ammonia formed in the dissociation of hydrazine which results in negligible ammonia and hydrogen concentrations in the product nitrogen stream. An engineering breadboard nitrogen supply subsystem was also developed. It was developed as an integratable subsystem for a central spacecraft air revitalization system. The subsystem consists of the hydrazine storage and feed mechanism, the nitrogen generation module, the peripheral mechanical and electrical components required to control and monitor subsystem performance, and the instrumentation required to interface with other subsystems of an air revitalization system. The breadboard nitrogen supply subsystem was integrated and tested with a one-person capacity experimental air revitalization system. The integration, checkout and testing was successfully accomplished. R.E.S.

N80-19801*# National Aeronautics and Space Administration, Washington, D. C.

A DEVICE FOR DETERMINING THE INTENSITY OF PARTIAL SWEATING

V. A. Rayskiy, Ye. A. Vinogradov, and O. A. Safonov Mar. 1979 7 p Transl. into ENGLISH from Russian Patent no. 249546 (Appl. No. 1199864/31-16, 30 Nov. 1967) 3 p Submitted for publication Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75429) Avail: NTIS HC A02/MF A01 CSCL 06B

An invention which can measure partial perspiration is disclosed. The partial perspiration is measured with a specially shaped device tightly fastened to the body but not touching the skin area being studied. A special grid is used to keep the moisture-absorbing agent from touching the skin. R.E.S.

N80-19802*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.

HUMAN COMFORT RESPONSE TO RANDOM MOTIONS WITH COMBINED YAWING AND ROLLING MOTIONS

Ralph W. Stone, Jr. Aug. 1979 129 p refs

(Contract NAS1-14908)

(NASA-CR-159187; UVA/528156/MAE-CE79/128) Avail: NTIS HC A07/MF A01 CSCL 05H

The effects of random yawing and rolling velocities on passenger ride comfort responses were examined on a visual motion simulator. The effects of power spectral density shape and frequency ranges of peak power from 0 to 2 Hz were studied. The subjective rating data and the physical motion data obtained are presented. No attempt at interpretation or detailed analysis of the data is made. There existed during this study motions in all other degrees of freedom as well as the yawing and rolling motions, because of the characteristics of the simulator. These unwanted motions may have introduced some interactive effects on passenger responses which should be considered in any analysis of the data. R.E.S.

N80-19803# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.

HELICOPTER PILOT DETECTION OF THE TWO DIFFERENT CAMOUFLAGED HAWK BATTERIES

Charles C. Jorgensen and Nadean R. Jones Jul. 1978 10 p refs

(AD-A077954; ARI-RM-78-5) Avail: NTIS HC A02/MF A01 CSCL 15/7

The purpose of this study was to collect data comparing the camouflage effectiveness of the cage-supported light-weight camouflage screen (LCS) and the experimental shape disrupter system produced by the Mobility Equipment Research and Development Command (MERADCOM). The camouflaged Hawk battery systems were contrasted with a control Hawk battery having no camouflage. The data reported in this paper were collected by ARI for use by the US Army Air Defense Board (ADB) as part of a larger scale study for the US Army Air Defense School (USAADS). ARI was specifically tasked with determining the human pilot detectability of the batteries in contrast to other portions of the study dealing with satellite and photoimagery interpretations. The data presented refer only to helicopter pilots and the associated Hawk ground crews. The data that were collected appear to consistently support one camouflage system over the other. GRA

N80-19804# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

TOWARD A REMOTELY-MANNED ENERGY AND PRODUCTION ECONOMY

Marvin Minsky Sep. 1979 20 p

(Contract N00014-79-C-0260)

(AD-A078069; AI-M-544) Avail: NTIS HC A02/MF A01 CSCL 05/8

We can solve many problems of energy, health, productivity, and environmental quality by improving the technology of remote control. This will produce nuclear safety and security, advances in mining, increases in productivity, economies in transportation, new industries and markets. By creating 'mechanical hands' that are versatile and economical enough, we shape a new world of health, energy and security. It will take 10 to 20 years, and cost about a billion dollars. GRA

N80-19805# Human Engineering Labs., Aberdeen Proving Ground, Md.

EFFECTS OF ARTILLERY NOISE ON THE HEARING OF PROTECTED CREW PERSONNEL Final Report, May - Jun. 1978

David C. Hodge, G. Richard Price, Nancy L. Dukes, and Samuel J. Murff Oct. 1979 40 p refs

(DA Proj. 1L1-61102-B-74A)

(AD-A078664; HEL-TM-17-79) Avail: NTIS HC A03/MF A01 CSCL 06/19

A test was conducted to determine loading rates for three artillery systems, and both male and female crews participated. Audiometric and acoustical support were provided to assess the crews: noise exposure, look for trends in the threshold shift data, and compare the threshold shifts with that permitted under present damage risk criteria. The impulse noise exposures were quite variable, due to crew mobility and low zone charges. There were no instances of excessive threshold shift, and only a few instances of threshold shift approaching the allowable limits. There were no obvious trends across test conditions. The main auditory goal of the test, viz., to avoid excessive hearing losses, was achieved. GRA

N80-19806# Army Command and General Staff Coll., Fort Leavenworth, Kansas.

LIGHTWEIGHT PILOT HELMETS: THE ISSUE OF WEIGHT VERSUS PROTECTION M.S. Thesis Final Report

Richard W. Himmel 8 Jun. 1979 63 p refs

(AD-A076325) Avail: NTIS HC A04/MF A01 CSCL 06/17

This study addresses the problem of reducing the weight of pilot helmets while retaining relevant protective qualities. Existing helmet development standards are synthesized and compared in light of compatability, objectivity and standardization. The issue of decreased protection, as a result of weight reduction, is discussed in view of pilot opinion, accident experience, contemporary research and recent compromises in helmet development.

The investigation reveals distinct ambiguities in helmet development standards and incongruities between standards. The study recommends the deletion of penetration standards since they are incompatible with impact standards and prevent industry from using new materials to achieve light weight. Further, the study proposes a change to military specification MIL-H-83147 (USAF) that reflects the deletion of penetration standards and recognizes current technological developments. GRA

N80-19807# National Technical Information Service, Springfield, Va.
HUMAN WORK MEASUREMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Nov. 1979
Edith Kenton Dec. 1979 218 p Supersedes NTIS/PS-78/1197; NTIS/PS-77/1054; NTIS/PS-76/0945; NTIS/PS-75/797 (PB80-803166; NTIS/PS-78/1197; NTIS/PS-77/1054; NTIS/PS-76/0945; NTIS/PS-75/797) Avail: NTIS HC $30.00/MF $30.00 CSCL 05I

Reports dealing with measurement techniques of human work at jobs and tasks are summarized. Specific topics included are work, analysis and evaluation, workload management, operations analysis, task complexity, and performance measurement. This updated bibliography contains 211 abstracts, 43 of which are new entries to the previous edition. GRA

N80-19808# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
GENERAL METHODS TO ENABLE ROBOTS WITH VISION TO ACQUIRE, ORIENT AND TRANSPORT WORKPIECES Technical Report 5
J. Birk, R. Kelley, and T. Brownell Aug. 1979 245 p refs (Grants NSF APR-74-13935; Grants NSF DAR-14-13935) (PB80-106388; NSF/RA-790230; TR-5) Avail: NTIS HC A11/MF A01 CSCL 13I

The problem of giving robots the ability to work with unoriented objects is discussed in relation to automated batch manufacturing systems, particularly those in which unoriented parts in containers are transported between machines and storage. Some examples of robot systems are an automatic method of visually estimating the pose of an object held in a robot hand and a system employing vision which feeds workpieces directly from supply bins into machines and which can be reprogrammed to service different workpieces. GRA

N80-19756# Joint Publications Research Service, Arlington, Va.
SCHEDULING WORK AND REST PERIODS DURING LONG-TERM SPACE FLIGHTS
B. S. Alyakrinskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1 (JPRS-75251) 5 Mar. 1980 p 1-14 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 3-8 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19758# Joint Publications Research Service, Arlington, Va.
EFFECTS OF UNUSUAL SCHEDULES OF DAILY ACTIVITY AND SLEEP DEPRIVATION ON MAN'S FUNCTIONAL STATE AND WORK FITNESS
A. N. Litsov and I. F. Sarayev *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 21-29 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (Moscow), no. 1, 1980 p 17-23 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

N80-19768# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF PROGRAM FOR THE CONTROL OF THE AUTOTROPHIC COMPONENT OF AN ECOLOGICAL SYSTEM THAT IS CLOSED WITH REGARD TO EXCHANGE OF GASES
A. S. Nasonov and V. S. Toroptsov *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, no. 1, (JPRS-75251) 5 Mar. 1980 p 88-93 refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. Moscow), no. 1, 1980 p 60-63 (For primary document see N80-19755 10-51)
Avail: NTIS HC A07/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N80-19809# Advisory Group for Aerospace Research and Development, Paris (France).
MODELING AND SIMULATION OF AVIONICS SYSTEMS AND COMMAND, CONTROL AND COMMUNICATIONS SYSTEMS
Jan. 1980 553 p refs Presented at the Meeting of the Avionics Panel, Paris, 15-19 Oct. 1979
(AGARD-CP-268; ISBN-92-835-0255-8) Avail: NTIS HC A24/MF A01

Simulation techniques and their applications to avionics and command, control, and communication systems associated with airborne operations are addressed. Modeling methodology, experimentation, validation, and applications are covered. Emphasis is on avionics and airborne command and control, including the range from large-scale force-effectiveness and air defense simulations through flight simulators and real time avionics simulations. For individual titles, see N80-19810 through N80-19847.

N80-19810# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
AN INTRODUCTION TO THE SELECTION AND USE OF SIMULATION LANGUAGES c61
Robert G. Sargent *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 4 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

An introduction to the selection and use of simulation languages for digital computers is given. The topics discussed are the hierarchy of computer languages and their relationship to simulation, the advantages and disadvantages of using simulation languages, the factors to consider in selecting simulation languages for an organization and a language for solving a specific problem, some characteristics of the simulation languages GASP, GPSS, SIMSCRIPT, SIMULA, and SLAM, and future developments in simulation languages. The emphasis is on discrete and combined simulation languages. J.M.S.

N80-19811# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
AN INTRODUCTION TO STATISTICAL ANALYSIS OF SIMULATION OUTPUT DATA c65
Robert G. Sargent *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p refs Presented at the ACM 1976 Symp. on the Simulation of Computer Systems (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

Point and interval estimates (confidence intervals) of means for both terminal and steady state simulations are considered. The simple methods of replication, batch means, and regenerative cycles are presented in detail and applied to a model of a simple time shared computer system to illustrate their use. A brief discussion is included on sequential procedures and time series methods for obtaining these estimates. The advantages and

disadvantages of the various methods are given, including specific recommendations as to when certain methods might be used. J.M.S.

N80-19812# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
REMARKS ON SIMULATION. OBJECTIVES/AREAS OF USE/POSSIBILITIES/LIMITATIONS: AN OVERVIEW c09
Hans M. Franke. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 27 p. refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

An overview of the extensive application of computerized simulation to the study of flight mechanics is presented with special interest given to avionics and command and control and communication. Areas of use of simulation covered include: the field of research; planning pre-design, assessment, and feasibility; the development phase; testing; and the training simulator. Systems analysis and systems engineering activities in the planning of new weapon systems are discussed in terms of the use of simulation. J.M.S.

N80-19813# Department of the Air Force, Washington, D.C. Tactical Systems Div.
REPRESENTING HUMAN THOUGHT AND RESPONSE IN MILITARY CONFLICT SIMULATION MODELS c53
Dennis K. Leedom. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 15 p. refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

Conflict simulation models and the representation of human thought and response in such models are considered. The ideas presented relate to the modeling of conflict situations from single combat unit level up through theater force level. In particular, the use of such models for assessing the utility of tactical command and control (C2) systems is emphasized. J.M.S.

N80-19814# General Research Corp., Santa Barbara, Calif.
VERIFICATION AND VALIDATION OF AVIONIC SIMULATIONS c06
Sabina H. Saib. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 6 p. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

Avionic simulations require verification and validation so that the simulation results can be applied reliably to actual avionic systems. Software design methods as well as currently available automated aids for verification and validation are described. Reverification and revalidation of a simulation after changes are made is discussed. Simulations can be designed for ease of verification and validation. Guidelines to show how simulation software can be developed with verification in mind are presented. R.E.S.

N80-19815# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
OBJECTIVES FOR BUILDING AN EXPERIMENTAL CCIS c32
Ingrid Hollinde. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 10 p. refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

The problem of integrating the command and control information systems (CCIS) into the C(2) process is presented and feasible strategies to develop CCISs are discussed. An experimental CCIS, the EMFIS, was developed and was used in WINTEX/CIMEX 79 to clarify the preconditions for the use of ADP-support in the C(2) process. The performance of the EMFIS is described. R.E.S.

N80-19816# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
SIMULATION OF OVERALL AIR DEFENSE COMMAND AND CONTROL c32
Reinhard Hutter. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 15 p. refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

A computer model that quantifies the effect of early warning and command and control in terms of active air defense measures of effectiveness was developed. The model is described along with the main technical and operational procedures which will be followed in air defense in case of an air attack. The model is rather aggregated, highly input oriented, independent of specific systems and doctrines and thus offers flexibility of application to various technical and operational questions. The development status of other models is discussed. R.E.S.

N80-19817# Department of the Air Force, Washington, D.C. Tactical Systems Div.
THEATER AIR DEFENSE ENGAGEMENT SIMULATION-COMMAND/CONTROL/COMMUNICATIONS (TADENS-C(3)) AN APPROACH TO THEATER AIR DEFENSE MODEL/METHODOLOGY DEVELOPMENT c32
Urban H. D. Lynch. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 13 p. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

The theater air defense engagement simulation-command/control/communications (TADENS-C(3)) is a theater air defense model/methodology development whose goal is to timely produce a 'credible, agreeable, and usable' model/methodology to address tactical (strategic) theater air defense and its associated problems/issues. The model development scope is presented. R.E.S.

N80-19818# Shape Technical Center, The Hague (Netherlands).
SIMULATION OF AIR DEFENCE OPERATIONS AND MULTIPLE AIR COMBAT c06
H. R. Wilhelm. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 20 p. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

The air defence system simulation model in use at the SHAPE Technical Centre is described. The model comprises detailed submodels for airborne and ground-based early warning sensors, command and control operations, ground-controlled intercepts, multiple air combat engagements, and electronic countermeasure operations. Modifications in hand will include the simulation of surface-to-air missile systems and will permit the interactive running of the model as a one-sided wargaming system with a battle manager commanding and controlling his air defence force via graphics displays. The computer configuration used in running the model is described and also the specific software methods employed. A three dimensional graphics facility was developed to facilitate the evolution and validation of tactics for modern fighter aircraft and future missiles. Additional validation methods were applied, such as the correlation of model results with live flying trails. A brief account of past and possible future applications is presented. R.E.S.

N80-19819# NATO Programming Centre, Tongeren (Belgium).
SIMULATION WITHIN MILITARY DEFENCE SYSTEMS FOR TRAINING AND EVALUATION c06
Hans-Jochen Wunschmann. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 14 p. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

The use of simulated radar pictures to support war games within the NATO Air Defense Ground Environment system is discussed. Simulation hardware and software are described along with the different phases of war gaming. K.L.

N80-19820# Institute of Aviation Medicine, Farnborough (England).
REAL-TIME SIMULATION: AN INDISPENSABLE BUT OVERUSED EVALUATION TECHIQUE c06
V. David Hopkin and A. J. McClumpha. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 6 p. refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

Real time simulation is evaluated in relation to large man machine systems, particulary air traffic control systems. The limitations to using real time simulation to study computer

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assistance, system capacity, workloads, stress, boredom, and attitudes are discussed. K.L.

N80-19821# Elektronik-System G.m.b.H., Munich (West Germany).
DESIGN AND SIMULATION OF A C3 SYSTEM FOR SURVEILLANCE PURPOSE c66
Franz Herzmann and Helmut Sanders. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 13 p. refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

Communications, command, and control problems associated with the operation of a surveillance network and weapon systems are discussed. Tracing and allocation algorithms are designed and improved by simulating network operation. Weapon system operation, including coordination and target allocation, is also simulated. The system performance is tested using radar derived data. K.L.

N80-19822# Royal Signals and Radar Establishment, Malvern (England).
SIMBOX: A GENERAL PURPOSE DEFENSE SYSTEMS SIMULATOR c66
B. Davy. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 8 p. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

A simulation tool of sufficient flexibility to meet the simulation requirements of a variety of systems is presented. The design principles of SIMBOX are discussed and its use in assessing radar performance, tracking algorithms, and data handling systems is illustrated. K.L.

N80-19823# Mitre Corp., Bedford, Mass.
THE APPLICATION OF MODELING AND SIMULATION TO THE DEVELOPMENT OF THE E-3A c66
A. R. Shanahan. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 14 p. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

The role of modelling and simulation in developing an airborne radar, communications, and command-control system is discussed. The modelling diversity required during different stages of system development is emphasized. K.L.

N80-19824# Analytic Sciences Corp., Reading, Mass.
E-3A NAVIGATIONAL COMPUTER SYSTEM REAL-TIME ENVIRONMENTAL SIMULATOR c66
Richard D. Healy and Samuel Newman. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 8 p. refs. Prepared in cooperation with NADC, Warminster, Pa. (For primary document see N80-19809 10-59)
(Contract N62269-79-C-0020)
Avail: NTIS HC A24/MF A01

A software life-cycle support facility under development for the E-3A navigational computer system includes a real-time environmental simulator which is used to simulate both E-3A avionics and the operational environment so that software problems with the included AN/ARN-120 Omega Navigation Equipment (ONE) can be investigated and that the impact of software changes can be assessed by a simulated mission refly. The environmental simulator is a hybrid system hosted in two digital computers connected by a specially designed real-time digital data link. Real-time simulation software performs two distinct functions: provides computer-controlled analog and digital input data to the ONE and respond to ONE guidance outputs, and provides truth-model aircraft data which can be used as a precision navigation reference. Preliminary experience related to the design and construction of the environmental simulator for the software life-cycle support facility is presented, some of the practical problems encountered in developing the simulator are described, interim resolution and potential long-term solutions and current status are discussed. Particular emphasis is placed on describing procedures used for implementing the simulator development guidelines: maximum flexibility and minimum essential design. A.R.H.

N80-19825# Boeing Aerospace Co., Seattle, Wash.
A JTIDS PERFORMANCE MODEL FOR THE E-3A c66
James G. Taylor. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 13 p. refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

The communications link performance model developed to predict performance of joint tactical information distribution system (JTIDS) links between the E-3A and other aircraft and ground stations is described. The JTIDS is a time division multiple access system operating in the radio frequency band 962 to 1213 MHz and employs spread spectrum techniques. The model includes the performance effects on the JTIDS wideband frequency hopping receiver due to both the E-3A dual antenna system and specular and diffuse multipath signals. Laboratory tests were conducted which provided receiver performance data for signals routed through dual antenna and multipath simulators. This simulator approach was also used in similar tests conducted by SHAPE Technical Centre for NATO. The results were essentially identical in the two test programs. A flight test program was conducted which validated the link performance model. This validated model has greatly reduced costly E-3A flight testing and has provided predictions of JTIDS performance over a variety of communication link scenarios and flight conditions. Author

N80-19826# Marconi Space and Defence Systems Ltd., Hillend (Scotland).
A MISSION TRAINING SIMULATOR FOR THE NIMROD MR MK 2 AND SOME ASPECTS OF THE DERIVATION AND VERIFICATION OF ITS SYSTEM MODELS c66
K. Wells. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 6 p. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

Three MK. 1 simulators are undergoing a major avionics refit to reflect the changes in the RAF's Nimrod MR Mk. 2. This refit necessitates the modification to Mk. 2 standard of the two prime sensor systems, acoustics and radar. In addition, the navigation and central tactical systems are being updated. The modifications both to the acoustics and to the radar are discussed. The definition of operations requirement and engineering implementation specifications for both hardware and software are described. The need to verify models to reflect the continuously changing design baseline as a result of aircraft development and user experience is discussed. A.R.H.

N80-19827# Mitre Corp., Bedford, Mass.
APPLICATION OF COMPUTER SIMULATIONS TO DEVELOPMENT OF NATO E-3A AUTOMATIC TRACK INITIATION ALGORITHMS c61
E. S. Alvarez and C. J. Sworobowicz. *In* AGARD. Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980. 21 p. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

NATO E-3A airborne warning and control system will include the capability to initiate tracks automatically on targets of interest. Due to the complex and interacting nature of the automatic track initiation (ATI) process, development of a prototype ATI design must rely heavily on Monte Carlo computer simulations. Adaptable computer simulations were developed which provide the analyst with a versatile tool for evaluation of ATI design alternatives and performance sensitivities. Although the computer simulation was used for the E-3A ATI problem, it also has general application to the evaluation of overall tracking performance for the E-3A or for any track-while-scan system. The ATI design which evolved from this development effort utilizes a Kalman filter for track smoothing and prediction. A Kalman filter not only provides rapid and accurate determination of target position and velocity, but also provides estimates of tracking errors which can be used to advantage in the design of optimal adaptive correlation windows, maneuver detection thresholds, and track promotion/drop rules. Simulation results show that the ATI design provides excellent performance over a wide range of target conditions and target environments. A.R.H.

N80-19828# Defense Advanced Research Projects Agency, Arlington, Va.

AVIATION TRAINING USING VIDEO DISK TECHNOLOGY **c53**

Craig Fields and Steven Levin *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 2 p Prepared in cooperation with Interactive Television Co., Arlington, Va. (For primary document see N80-19809 10-59)

Avail: NTIS HC A24/MF A01

Video disks are a new technology that provide inexpensive storage (65 cent/disk) and rapid access (as little as 1/8 sec.) to large numbers (54,000 pictures/disk side) of photographs. For a typical airport, it is possible to store on a video disk compressed movies showing all runway, take-off, landing, circling, and approach paths. When such a disk is viewed on a player and television controlled by a simple microprocessor, the pilot can vicariously fly himself around an airport, land, take-off, taxi and circle. The pilot sees an image with photographic realism, can choose his own path and speed, and can choose time of day or weather conditions for the simulation trip. Such a system is one hundred times less expensive than a conventional flight simulator. Author

N80-19829# Societe Nationale Industrielle Aerospatiale, Marignane (France). Div. Helicopteres.

DESIGN OF A SIMULATOR FOR STUDYING THE HELICOPTER - SDVEH [CONCEPTION D'UN SIMULATEUR DE VOL D'ETUDE POUR HELICOPTER - SOUEH] **c09**

Jl. Mascle, G. Catani, M. Sellier, and Jp. Letouzey *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p In FRENCH (For primary document see N80-19809 10-59)

Avail: NTIS HC A24/MF A01

The conceptual stages in the design of a flight simulator (SDVEH), which will study the specific problems in the design and flight operations of military helicopters are reported. The principle characteristics of the flight simulator are delineated and points considered critical to the development of a helicopter program are discussed. The development and organization of the project are reported and a preliminary analysis of the exact needs of the SDVEH are presented. Transl. by A.W.H.

N80-19830# Institute for Defense Analyses, Arlington, Va.

COST-EFFECTIVENESS OF FLIGHT SIMULATORS FOR MILITARY TRAINING **c09**

Jesse Orlansky and Joseph String *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p refs (For primary document see N80-19809 10-59)

Avail: NTIS HC A24/MF A01

The cost and effectiveness of flight simulators used for military training are evaluated. Recent cost data of modern flight simulators are analyzed. A comparison of the skills learned in flight simulators and the effectiveness with which they are performed in actual flight versus the skills learned in actual flight only is discussed. Results show that pilots trained in the simulators use less flight time to perform various tasks than do those trained only in aircraft. A.W.H.

N80-19831# Le Materiel Telephonique, Trappes (France).

USING A LANGUAGE DEVELOPED FOR AIRCRAFT SIMULATORS [UTILISATION D'UN LANGAGE EVOLUE POUR LES SIMULATEURS D'AVIONS] **c61**

Michel G. Dreyfus *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 7 p In FRENCH; ENGLISH summary (For primary document see N80-19809 10-59)

Avail: NTIS HC A24/MF A01

The advantages and disadvantages of flight simulator computers using assembler languages and simulation computers using FORTRAN are discussed. The impact of each method on the analytical and programming methods employed at each stage of program writing, debugging, and modification is reviewed. The consequences of computing power and memory capacity are also discussed. A.W.H.

N80-19832# Royal Aircraft Establishment, Farnborough (England).

SIMULATION OF A NIGHT VISION SYSTEM FOR LOW LEVEL HELICOPTER OPERATIONS **c06**

J. N. Barrett *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 24 p (For primary document see N80-19809 10-59)

Avail: NTIS HC A24/MF A01

The development of night vision piloting aids to enable helicopters to operate at low altitude by night is discussed. An experiment which explored the problems and possibilities of a helmet mounted display for such helicopter night piloting tasks, using real time simulation techniques is described. The development of the helicopter simulation, and how the various components of the proposed night vision system were modelled and incorporated into the simulation are reported. The experimental design for the trials and how the limitations of the simulation were taken into account are discussed. A.W.H.

N80-19833# Institute for Defense Analyses, Arlington, Va. Systems Evaluation Div.

USE OF SIMULATION IN THE EVALUATION OF THE IFFN PROCESS **c66**

J. E. Freedman and S. H. Starr *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 20 p ref (For primary document see N80-19809 10-59)

Avail: NTIS HC A24/MF A01

A program to evaluate the ability of the ISS to support the identification process in an operational environment is described. The role that modeling and simulation will play in the evaluation is emphasized. The types of tests that are to be employed to accomplish the program objectives are discussed. The primary test vehicle: a hybrid, geographically distributed testbed consisting of a central simulation facility, manned operational C-2 systems, and manned mission simulators, is described. The technical requirements for the testbed are summarized and the considerations underlying their formulation are examined. An example of a test design that considers the subphase of the program, where a programmed airborne early warning aircraft is employed in support of defensive counterair operations, is included. A.W.H.

N80-19834# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

AIR-TO-AIR ENGAGEMENT SIMULATION **c66**

Goetz Wunderlich and Roland Braun *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 14 p (For primary document see N80-19809 10-59)

Avail: NTIS HC A24/MF A01

The development of an air to air engagement simulation multidual model which considers the aircraft, its avionics, armament, and the pilots behavior is discussed. The model will also consider the phase prior to combat including the fighter allocation, combat air patrol, ground controlled intercept capability, influence of early warning systems, etc. Assumptions, problems, and applications of the model are discussed. A.W.H.

N80-19835# Mitre Corp., Bedford, Mass.

THE MITRE INTERACTIVE COMMUNICATIONS ANALYSIS PROGRAM (MICAP) **c66**

John M. Ruddy *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 22 p (For primary document see N80-19809 10-59)

Avail: NTIS HC A24/MF A01

The MITRE interactive communications analysis program (MICAP), a user oriented computer program, is described. The program provides complex communications system performance and cost analysis. The program output, a graphical presentation of the data, permits system synthesis and modification through rapid and easy system parameter iteration to obtain a desired system performance measure. The program structure and capabilities include cost/performance tradeoff analysis. Examples of modeling and prediction of satellite communication performance are presented. Applications to cost/performance tradeoffs and evaluation of architectural alternatives are discussed. A.W.H.

N80-19836# Societe Nationale Industrielle Aerospatiale, Toulouse (France).

NEW POSSIBILITIES OFFERED BY A RADIO-INERTIAL HYBRID GUIDANCE SYSTEM DIGITAL SIMULATION

STUDY [NOUVELLES POSSIBILITIES OFFERTES PAR UN SYSTEME DE GUIDAGE HYBRIDE RADIO - INERTIEL ETUDIE EN SIMULATION NUMERIQUE] **c06**

D. Bussson, J. Irvoas, and J. Grosson *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 25 p In FRENCH; ENGLISH summary refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

A radio inertial guidance system was studied to increase the accuracy of aircraft guidance along the ILS beams and to ensure continuation of automatic landing in the event of a localizer transmitter failure. Developments in the guidance system are discussed including the detection of the Loc beam centerline after an undetected failure in the monitoring of the Loc axis alignment with the runway axis. A digital simulation study which demonstrated the system performance is described. A.W.H.

N80-19837# British Aerospace Aircraft Group, Brough (England).
THE ROLE OF THE AIRCRAFT MODEL IN AVIONIC SYSTEMS SIMULATION **c06**

J. D. Bannister and R. Hicks *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 14 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

The relevance and use of the aircraft model in avionics systems simulation is discussed. The interaction between elements of the avionic systems, the vehicle dynamics and the outside world, and simulation is described. The aircraft model is discussed to indicate the choice to be made in determining the level of complexity required to fulfill differing objectives. Aircraft models of different types are described. Some algorithms and solution techniques are presented along with an indication of the limitations inherent in the models. Two contrasting simulations are discussed to show the significance of the aircraft model in relation to the avionic system simulation. The first example illustrates the use of an aircraft model in a GP computer simulation of the interception of invading aircraft. The second example discusses the aircraft model used in a pilot in the loop real time simulation of the avionics system for an attack aircraft. In both examples practical considerations are included such as processor requirements and simulation system architecture. A.W.H.

N80-19838# Battelle Columbus Labs., Ohio.
AVIONICS EVALUATION PROGRAM: SIMULATION MODELS FOR THE EFFECTIVENESS ANALYSIS OF AVIONICS **c06**

David Welp, Ken Almquist, and Larry Rainey *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 4 p Prepared in cooperation with AFAL, Wright-Patterson AFB, Ohio (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

The avionics evaluation program (AEP), a library of seven detailed avionics performance assessment models all driven by a common, interactive software package is examined. The AEP provides an efficient means for performing tradeoff analyses among cost, reliability, maintainability, and performance of avionic configurations. The models are the air to ground mission analysis program, target acquisition, weapon delivery, survivability, communications, air to air mission analysis, and dogfight analysis. Each model is described. A.W.H.

N80-19839# British Aerospace Dynamics Group, Bristol (England).
SIMULATION FOR WHOLE LIFE DEVELOPMENT **c06**

R. J. Morrow and R. Richards *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 11 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

A special prupose, real time simulator suitable for whole life development of complex avionics control systems is described. Software flexibility, a current equipment selling point, demands a reappraisal of previous equipment development procedures. Problems with high speed information handling will occur during the development of new digital controllers when used for command and control, ESM and EW system are discussed. The need to simulate those real world factors that load the information to the digital processing system under development. R.C.T.

N80-19840# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
A SIMULATION SUPPORT SYSTEM, THE DEVELOPMENT TOOL FOR AVIONIC SYSTEMS AND SUBSYSTEMS **c06**

John C. Ostgaard *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 11 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

The simulation support facility required for the development and validation of the digital avionics information system are discussed. The design requirements for an integrated simulation support system are given with emphasis on the following: avionic system support; prototype system software support; prototype system hardware support; engineering studies; maintenance augmentation; and training assistance. R.C.T.

N80-19841# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
FIRE CONTROL FOR AIR-TO-AIR GUNNERY IN HIGH PERFORMANCE FIGHTER AIRCRAFT **c06**

Hans W. Pongratz *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

A survey on some of the aspects in air-to-air gunnery initiated by improvements in gun fire control are summarized. The simulation models used in the TKF simulation for gun fire control and gun scoring are presented. The necessary and the possible detail and accuracy of the implemented models is considered. R.C.T.

N80-19842# Electronique Marcel Dassault, St. Cloud (France).
SIMULATION FOR INTEGRATION WITH DYNAMIC TESTS OF THE LOGICAL ELEMENTS OF PRINCIPAL ONBOARD COMPUTERS [SIMULATEUR POUR INTEGRATION AVEC TESTS DYNAMIQUES DES LOGICIELS DE CALCULATEURS ENTRAUX EMBARQUES] **c06**

E. Bouthors *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 11 p In FRENCH (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

A system is described which was designed to simulate the environment of onboard computers and to furnish control methods which permit the adjustment and validation of logical elements before the effective integration of computers in real equipment environments. The essential characteristics of the system is to simulate the equipment environments, not at the level of their intrinsic operation, but at that of their interface with the computer in temporal, interactive, and information aspects. The simulation is made by the fusion of operator information with information registered on magnetic tape. This latter information simulates the different flight phases envisaged by tests while the operator information recreates in real-time, the action of the pilot and equipment. The possibilities of operating slowly and step-by-step confer a particular efficiency to the simulation and adjustment and validation of logical elements. Transl. by A.R.H.

N80-19843# Draper (Charles Stark) Lab., Inc., Cambridge, Mass. Guidance and Navigation Advanced Programs Div.
CRUISE-MISSILE-CARRIER NAVIGATION REQUIREMENTS **c04**

George T. Schmidt and Roy H. Setterlund *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 10 p refs (For primary document see N80-19809 10-59)
(Contract F33657-78-C-0473)
Avail: NTIS HC A24/MF A01

The modeling, simulation, and performance predictions used in determining aircraft avionics and transfer alignment requirements for a generic aircraft that would launch cruise missiles over water a considerable distance from a first TERCOM update area are discussed. The methodology used in allocating the allowable navigation errors between the CM guidance system and the cruise missile carrier aircraft avionics system is described. R.C.T.

N80-19844# National Aerospace Lab., Amsterdam (Netherlands).
A FLIGHT SIMULATION INVESTIGATION ON THE FEASI-

BILITY OF CURVED APPROACHES UNDER MLS GUIDANCE c66
L. J. J. Erkelens *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 18 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

A simulation investigation concerning the possibilities of executing laterally curved approaches with a wide body type of aircraft in a microwave landing system environment is described. The approach path variables were: final approach intercept altitude and angle of the turn. An Earth fixed circular segment connected the straight preturn segment with the final segment. A flight director operating in the instrument landing system tracking mode, supplied with minor modifications in the roll bar drive, is used as the primary instrument for guidance. Additional provisions are made to enable the pilot to monitor the approach. A total number of about 450 curved approaches, performed by three pilots, are flown on the simulator under various weather conditions. In addition to tracking data, subjective information like pilot ratings and comments are gathered. Curved approaches, with turn angles up to 180 deg can be carried out safely, provided that the altitude at which the turn is completed is not less than 305 m (1000 ft). Special provisions are needed with respect to the flight director roll bar drive, in order to achieve accurate tracking on the curved segment in strong wind conditions. M.G.

N80-19845# Boston Univ., Mass.
MODELING AND FLIGHT SIMULATION OF AN ACTIVE CONFIGURED AIRCRAFT UNDER M.L.S. GUIDANCE c66
A. Danesi, S. Smolka, and U. Chinappi *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 16 p Prepared in cooperation with Rome Univ., Italy (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

A mathematical formulation is presented to integrate the differential equations modeling a vehicle automatically guided along a curvilinear trajectory by a microwave landing system (M.L.S.). The augmented linear state equation, representing the open loop vehicle M.L.S: observer system, is given in standard phase variable form in which the altitude perturbations from the reference trajectory and numbers of its successive derivatives are assumed as state variables involved in a multifeedback flight control system. The state equation taken into consideration in system modeling handles separately the transfer function characteristics polynomial while the dynamical effects of the system zeros are included in the algebraic output equation relating the actual altitude perturbations to the state variables defined, in a rather fictitious fashion, in a state equation. The initial conditions to be imposed in the integration process must be consistent with the physical initial conditions on the actual trajectory considered in the problem at hand and for that purpose mathematical solution to the problem of transforming the initial conditions imposed on the physical state variables to the correspondent fictitious ones, is advanced. M.G.

N80-19846# Naval Air Development Center, Warminster, Pa.
MODELING THE HUMAN OPERATOR: APPLICATIONS TO SYSTEM COST EFFECTIVENESS c66
Norman E. Lane, Melvin I. Strieb (Analytics, Inc., Willow Grove, Pa.), and Walter Leyland *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

A technique for predicting system effectiveness which includes a consideration of realistic operator/system interactions is described. Operator interface cost effectiveness analysis (OICEA) combines system modeling with cost projections to evaluate the cost benefits of alternative proposed designs within appropriate mission contexts. Major avionics variables are integrated into a cohesive approach which simulates hardware and software functions and the performance of an operator interacting with these components, using a model called the human operator simulator. OICEA allows for systematic variation of key factors that influence ffectiveness, including degree and type of task automation, equipment and human reliability, scenarios and tactical doctrine, and operator characteristics. The OICEA methodology is summarized and applications to avionics and sensor improvements on a fixed wing antisubmarine warfare platform are documented. M.G.

N80-19847# Naval Air Development Center, Warminster, Pa.
PREDICTING FIELD OF VIEW REQUIREMENTS FOR VSTOL AIRCRAFT APPROACH AND LANDING c66
Paul M. Linton and Warren F. Clement *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 17 p refs Prepared in cooperation with Systems Technology, Inc., Mountain View, Calif. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

A rationale for quantitatively determining fixed-wing, vertical/short take-off and landing aircraft field of view requirements is developed. The interactions between human visual processes, the vehicle approach profile, and the operator flight path control performance are considered. A model specifies precise visual requirements for recovery aboard defined shipboard pads or forward sites. M.G.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-19848# Naval Postgraduate School, Monterey, Calif.
SECURITY KERNEL DESIGN FOR A MICRO-PROCESSOR-BASED, MULTILEVEL ARCHIVAL STORAGE SYSTEM M.S. Thesis
Aaron Ray Coleman Dec. 1979 109 p refs
(AD-A078281) Avail: NTIS HC A06/MF A01 CSCL 09/2

This thesis is a detailed design of a security kernel for an archival file storage system. Microprocessor technology is used to address a major part of the problem of information security in a distributed computer system. Utilizing multiprogramming techniques for processor efficiency, segmentation for controlled sharing, and a loop-free structures for avoiding intermodule dependencies, the Archival Storage is designed for implementation on the Zilog Z8001 microprocessor with a memory management unit. The concepts of a process structure and a distributed kernel are used in providing management of the shared hardware resources of the system. The security kernel primitives create a virtual machine environment and provide information security in accordance with a non-discretionary security policy. GRA

N80-19849# Texas Instruments, Inc., Dallas. Central Research Labs.
BINARY/ANALOG CCD CORRELATOR DEVELOPMENT Interim Report, 1 Aug. 1978 - 31 Jan. 1979
R. A. Haken and R. C. Pettengill Sep. 1979 49 p
(Contract F19628-78-C-0122; AF Proj. 4600)
(AD-A077572; TI-08-79-10; RADC-TR-79-21123) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report describes the design of a general-purpose, electronically programmable, 1024-bit binary/analog CCD correlator. The key features of the filter are: programmability of the reference signal, correlator length and weighting coefficient accuracy. This results in a filter with the flexibility to be operated in nine programmable configurations. Minimization of off-chip circuitry by including all analog and digital shift registers, clock drivers, logic, and output amplifiers on-chip. GRA

N80-19850# Maryland Univ., College Park. Dept. of Computer Science.
THE STRUCTURE OF SPECIFICATIONS AND IMPLEMENTATIONS OF DATA ABSTRACTION
Mark A. Ardis and Richard G. Hamlet Sep. 1979 53 p refs
(Grant AF-AFOSR-3181-77; AF Proj. 2304)
(AD-A077427; AFOSR-79-1154TR; TR-801) Avail: NTIS HC A04/MF A01 CSCL 05/2

A data abstraction is a collection of sets together with a collection of functions. An intuitive abstraction is unconnected with formalism: the sets and functions are supposed to be known

ab initio. Formal ideas enter when the abstraction is (1) implemented, a conventional program written to carry out the operations on actual data; and (2) specified, a mathematical characterization given to precisely describe its sets and functions. The intuitive abstraction, an implementation, and a specification share a syntax that names the sets and functions, and gives the function domains and ranges (as set names). The central question for any particular example of syntax is whether the semantics of the three ideas correspond: does the collection of objects and operations a human being was thinking of behave in the way the implementation's data and procedures behave? Do the mathematical entities behave as imagined? The questions can never be answered precisely, because the intuitive abstraction is imprecise. On the other hand precise comparison of specification and implementation is possible. This paper presents an algebraic comparison of specifications with implementations. It is shown that these abstractions always overlap, and have a common (lattice) structure that is valuable in understanding the modification of code or specification. GRA

N80-19851# Honeywell, Inc., St. Petersburg, Fla.
MILITARY ADAPTATION OF COMMERCIAL ITEM (MACI) PROGRAM ON ELECTRICALLY ALTERABLE READ ONLY MEMORY (EAROM) Interim Report, 15 Jul. 1978 - 15 Jan. 1979
Richard L. Wiker Oct. 1979 281 p refs
(Contract DAAB07-78-C-2935)
(AD-A078594; HONEYWELL-1079-16060; DELET-TR-78-2935-1; IR-1) Avail: NTIS HC A13/MF A01 CSCL 09/2

A military applications survey for EAROM devices was conducted. Three potential vendors of suitable EAROM devices were identified at GI, NCR and Nitron. Devices were procured and testing started. Measurement techniques were developed to characterize unique MNOS parameters. GRA

N80-19852# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
DESIGN AND ANALYSIS OF INTERCONNECTION NETWORKS FOR PARTITIONABLE PARALLEL PROCESSING SYSTEMS Interim Report
S. Diane Smith and Howard Jay Siegel Aug. 1979 297 p refs
(Grant AF-AFOSR-3581-78; AF Proj. 2304)
(AD-A078690; TR-EE-79-39; AFOSR-79-1272TR) Avail: NTIS HC A13/MF A01 CSCL 09/2

A single instruction stream - multiple data stream (SIMD) computer performs one algorithm (single instruction stream) on vectors of data of a control unit (CU), processing elements (PEs), and an interconnection network. The CU broadcasts instructions to the N Pes (where N is a power of two). The interconnection network is the mechanism that allows PEs to pass data among themselves. Four types of interconnection networks are discussed in this work: the Shuffle-Exchange network, the Cube network, the ILLIAC network, and the Plus-Minus 2 (PM2I) network. Each type has been discussed in the literature and used in an existing or proposed machine design. For each of these four network types, different hardware structures are considered. A recirculating network consists of one stage of switches that is reused until the data reach their final destinations. A combinational logic multistage network consists of several stages of switches and, usually, data is transferred in one pass through the network. In pipelined multistage networks, which are introduced, registers are inserted after each stage of a combinational logic multistage network. The data are divided into segments, and these segments are passed in a parallel-pipelined manner. Hardware implementations for recirculating, combinational logic multistage, and pipelined multistage networks are presented and analyzed. GRA

N80-19853# California Univ., Los Angeles. Graduate School of Management.
ON THE USE OF SIMULATION IN THE DESIGN AND IMPLEMENTATION OF DISTRIBUTED SYSTEMS
Bennet P. Lientz Dec. 1979 21 p refs
(Contract N00014-75-C-0266; NR Proj. 049-345)
(AD-A078322) Avail: NTIS HC A02/MF A01 CSCL 09/2

The need for planning and design of distributed systems has been stressed repeatedly. However, insufficient attention has been directed at the organized employment of mathematical and statistical tools which are computer based. Developed here is a general methodology for planning distributed systems using simulation as the major ingredient. Applications of the methodology are discussed. GRA

N80-19854# Los Alamos Scientific Lab., N. Mex.
COMPUTER APPLICATIONS Annual Report, 1 Oct. 1977 - 30 Sep. 1978
William Mort Saunders, Calvin L. Campbell (Dept. of Agriculture, Albuquerque, N. Mex.), Jean V. Lester (Dept. of Agriculture, Austin, Tex.), and Robert J. Payne Sep. 1979 28 p refs
(Contract W-7405-eng-36)
(LA-7844-PR) Avail: NTIS HC A03/MF A01

The application of computer technology to surveillance of slaughterplants in Texas. A pilot study of the New Mexico brucellosis eradication program; and the market cattle identification program in Texas is discussed. DOE

N80-19855# Boeing Computer Services, Inc., Seattle, Wash. Energy Technology Applications Div.
DISTRIBUTION DATA BASE DESIGN Final Report
D. J. Inglis Aug. 1979 59 p Sponsored by Elec. Power Res. Inst. 3 Vol.
(EPRI Proj. 1139-1)
(EPRI-EL-1150-Vol-1) Avail: NTIS HC A04/MF A01

An integrated distribution data base was designed and guidelines for economic evaluation and implementation of the design formulated. The conceptual design has a network structure which reflects the multiple-association relationship of the data. Implementation of the data base on a pilot basis is recommended. DOE

N80-19856# Boeing Computer Services, Inc., Seattle, Wash. Energy Technology Applications Div.
DISTRIBUTION DATA BASE DESIGN Final Report
D. J. Inglis Aug. 1979 308 p refs Sponsored by Elec. Power Res. Inst. 3 Vol.
(EPRI Proj. 1139-1)
(EPRI-EL-1150-Vol-2) Avail: NTIS HC A14/MF A01

The functional capabilities of the distribution data base are described along with economic evaluation of the system. DOE

N80-19857# Boeing Computer Services, Inc., Seattle, Wash. Energy Technology Applications Div.
DISTRIBUTION DATA BASE DESIGN Final Report
D. J. Inglis Aug. 1979 122 p refs Sponsored by Elec. Power Res. Inst. 3 Vol.
(EPRI Proj. 1139-1)
(EPRI-EL-1150-Vol-3) Avail: NTIS HC A06/MF A01

The practical implications of the distribution data base are presented. The data base logical design, physical implementation considerations, and digital mapping, are considered along with support system requirements and factors which effect implementation schedules. J.M.S.

N80-19858# National Technical Information Service, Springfield, Va.
RANDOM ACCESS MEMORIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979
Brian Carrigan Dec. 1979 216 p Supersedes NTIS/PS-78/1221; NTIS/PS-77/1100; NTIS/PS-76/0997; NTIS/PS-75/811
(PB80-802333; NTIS/PS-78/1221; NTIS/PS-77/1100; NTIS/PS-76/0997; NTIS/PS-75/811) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography cites Government-sponsored research reports on the design, development, and application of random access storage devices and materials. Studies are included on wall placement techniques, domain wall observation, microcircuitry, and software development. This updated bibliography contains 188 abstracts, 18 of which are new entries to the previous edition. GRA

N80-19859# National Technical Information Service, Springfield, Va.
RANDOM ACCESS MEMORIES, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress

Report, 1974 - 1977
Brian Carrigan Dec. 1979 249 p
(PB80-802341) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

Research on the design, development, and application of random access computer storage devices is cited in this bibliography of worldwide journal literature. Research on charge coupled devices in random access storage, random access memories in microprocessor applications, and reliability of random access memories are included. This updated bibliography contains 237 abstracts, none of which are new entries to the previous edition. GRA

N80-19860# National Technical Information Service, Springfield, Va.
RANDOM ACCESS MEMORIES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Nov. 1979
Brian Carrigan Dec. 1979 167 p Supersedes NTIS/PS-78/1222; NTIS/PS-77/1111; NTIS/PS-76/0998
(PB80-802358; NTIS/PS-78/1222; NTIS/PS-77/1111; NTIS/PS-76/0998) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

Research on the design, development, and application of random access computer storage devices is cited in this bibliography of worldwide journal literture. Research on charge coupled devices in random access storage, random access memories in microprocessor applications, and reliability of random access memories are included. This updated bibliography contains 161 abstracts, 18 of which are new entries to the previous edition. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-19881*# Intermetrics, Inc., Huntsville, Ala.
NSSC-2 OPERATING SYSTEM DESIGN REQUIREMENTS SPECIFICATION Final Report
T. T. Schansman and J. R. Bounds 15 Aug. 1979 78 p refs
(Contract NAS8-33382)
(NASA-CR-161396; IR-432) Avail: NTIS HC A05/MF A01 CSCL 09B

The design requirements and implementation standards for an NSSC-2 operating system are defined. An operating system diagram is presented along with system concepts and terminology. K.L.

N80-19882*# Research Triangle Inst., Research Triangle Park, N. C.
DEVELOPMENT AND USAGE OF A FALSE COLOR DISPLAY TECHNIQUE FOR PRESENTING SEASAT-A SCATTEROMETER DATA
Clayton B. Jackson Jan. 1980 66 p refs Original contains color illustrations
(Contract NAS1-15338)
(NASA-CR-159203) Avail: NTIS HC A04/MF A01 CSCL 09B

A computer generated false color program which creates digital multicolor graphics to display geophysical surface parameters measured by the Seasat-A satellite scatterometer (SASS) is described. The data is incrementally scaled over the range of acceptable values and each increment and its data points are assigned a color. The advantage of the false color display is that it visually infers cool or weak data versus hot or intense data by using the rainbow of colors. For example, with wind speeds, levels of yellow and red could be used to imply high winds while green and blue could imply calmer air. The SASS data is sorted into geographic regions and the final false color images are projected onto various world maps with superimposed land/water boundaries. K.L.

N80-19883*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALGORITHM FOR CALCULATING TURBINE COOLING FLOW AND THE RESULTING DECREASE IN TURBINE EFFICIENCY
James W. Gauntner Feb. 1980 23 p refs
(NASA-TM-81453; E-384) Avail: NTIS HC A02/MF A01 CSCL 09B

An algorithm is presented for calculating both the quantity of compressor bleed flow required to cool the turbine and the decrease in turbine efficiency caused by the injection of cooling air into the gas stream. The algorithm, which is intended for an axial flow, air routine in a properly written thermodynamic cycle code. Ten different cooling configurations are available for each row of cooled airfoils in the turbine. Results from the algorithm are substantiated by comparison with flows predicted by major engine manufacturers for given bulk metal temperatures and given cooling configurations. A list of definitions for the terms in the subroutine is presented. K.L.

N80-19864# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
DEPENDENCY DIRECTED REASONING FOR COMPLEX PROGRAM UNDERSTANDING
Howard Elliot Shrobe Apr. 1979 303 p refs
(Contract N00014-75-C-0643)
(AD-A079056; AI-TR-503) Avail: NTIS HC A14/MF A01 CSCL 06/4

Artificial Intelligence research involves the creation of extremely complex programs which must possess the capability to introspect, learn, and improve their expertise. Any truly intelligent program must be able to create procedures and to modify them as it gathers information from its experience. A crucial stepping stone in AI research is the development of a system which can understand complex programs well enough to modify them. The Programmer's Apprentice Project is attempting to develop an interactive programming tool which will help expert programmers deal with the complexity involved in engineering a large software system. This report describes REASON, the deductive component of the programmer's apprentice. REASON is intended to help expert programmers in the process of evolutionary program design. REASON utilizes the engineering techniques of modelling, decomposition, and analysis by inspection to determine how modules interact to achieve the desired overall behavior of a program. REASON coordinates its various sources of knowledge by using a dependency-directed structure which records the justification for each deduction it makes. Once a program has been analyzed, these justifications can be summarized into a teleological structure called a plan which helps the system understand the impact of a proposed program modification. GRA

N80-19885# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
COMPUTER AIDED EVOLUTIONARY DESIGN FOR DIGITAL INTEGRATED SYSTEMS
Gerald Jay Sussman, Jack Holloway, and Thomas F. Knight, Jr. May 1979 26 p refs
(Contract N00014-75-C-0643; Grant AF-AFOSR-3993-78; Grant NSF MCS 77-04828)
(AD-A078124; AI-M-526) Avail: NTIS HC A03/MF A01 CSCL 09/2

We propose to develop a computer aided design tool which can help an engineer deal with system evolution from the initial phases of design right through the testing and maintenance phases. We imagine a design system which can function as a junior assistant. It provides a total conversational and graphical environment. It remembers the reasons for design choices and can retrieve and do simple deductions with them. Such a system can provide a designer with information relevant to a proposed modification and can help him understand the consequences of simple modifications by pointing out the structures and functions which will be affected by the modifications. The designer's assistant will maintain a vast amount of such annotation on the structure and function of the system being evolved and will be able to retrieve the appropriate annotation and remind the designer about the features which he installed too long ago to remember, or which were installed by other designers who work with him. We will develop the fundamental principles behind such a

designer's assistant and we will construct a prototype system which meets many of these desiderata. GRA

N80-19866# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
COMPUTER AIDED EVOLUTIONARY DESIGN FOR SOFTWARE ENGINEERING
Charles Rich, Howard E. Shrobe, and Richard C. Waters Jan. 1979 23 p refs
(Contracts N00014-75-C-0643; N00014-75-C-0661)
(AD-A078060; AI-M-506) Avail: NTIS HC A02/MF A01 CSCL 09/2

This memorandum reports on a partially implemented interactive computer aided-design tool for software engineering. A distinguishing characteristic of this project is its concern for the evolutionary character of software systems. It draws a distinction between algorithms and systems, centering its attention on support for the system designer. Although verification has played a large role in recent research, this perspective suggests that the complexity and evolutionary nature of software systems require a number of additional techniques. Managing of complexity is a fundamental issue in all engineering disciplines. The authors identify three major techniques used in mature engineering fields which seem applicable to the engineering of software systems: incremental modelling; multiple and almost hierachical decomposition; and analysis by inspection. Along these lines they have (1) constructed a plan library to aid in analysis by inspection (the analysis of a program based on identifying standard algorithms and methods in it); (2) identified a small set of plan building methods which can be used to decompose a software system into loosely coupled subsystems; (3) developed the technique of temporal abstraction which makes it possible to model a program from a viewpoint which clearly separates the actions of generations and consumers of data; and (4) developed a dependency-based reasoning system uniquely suited to incremental and evolutionary program analysis. These methods are substantially language independent and have been applied to programs written in several commonly used languages. GRA

N80-19867# University of Southern California, Marina del Rey. Information Sciences Inst.
A FORMAL DEFINITION OF AMDL
Peter W. Alfvin Oct. 1979 79 p refs
(Contracts F30602-78-C-0008; DAHC15-72-C-0305)
(AD-A078035; ISI/RR-79-78) Avail: NTIS HC A05/MF A01 CSCL 09/2

Since the introduction of ISP, the use of hardware description languages (HDLs) has increased dramatically. Used originally to describe at the programming level the instruction sets of digital computers, hardware descriptions are now being used in applications such as design automation, emulation, compiler generation, and program verification - to name only a few. This surge of activity has put the existing HDLs to the thorough test, with each application area making its own set of demands on the languages. One common demand, however, is for a precise definition of the HDLs themselves. AMDL is an abstract form of the hardware description language ISPS. This report presents a formal definition of AMDL, using the techniques of denotational semantics as developed by Scott and Strachey. AMDL includes some nonstandard control and data structures which are easily handled by this definitional method. This report assumes familiarity with descriptive denotational semantics. GRA

N80-19868# Naval Research Lab., Washington, D. C. Communications Sciences Div.
SOFTWARE ENGINEERING PRINCIPLES
Louis Chmura and David Weiss Jun. 1979 610 p refs Sponsored in part by Naval Postgraduate School, Monterey, Calif.
(XF21241021)
(AD-A078005) Avail: NTIS HC A99/MF A01 CSCL 09/2

Since 1973, the Information Systems Staff at the Naval Research Laboratory (NRL) has studied many of the managerial and technical problems connected with Navy software acquisition, development, and maintenance. One observation has been that persons responsible for software could benefit greatly from training in state-of-the-art software engineering technology. Another has been that a better job of software design is essential if software is to meet requirements and be maintained inexpensively. These two observations have led to the course 'Software Engineering Principles', which addresses some important technical problems concerning software design. First taught in 1976 by NRL, the course is now presented annually by NRL together with the Naval Postgraduate School (NPS). 'Software Engineering Principles,' introduces some important design principles that encourage production of correct, understandable, and easily changed software products. Also examined are some software engineering research that may result in valuable design principles in the near future. The course will not turn one into an expert designer, but should improve one's ability to evaluate software proposals, progress, and products. It should also generate a better appreciation of design approaches, design problems, and ongoing research. GRA

N80-19869# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
METRICS OF SOFTWARE QUALITY Annual Report, 1 Jun. 1978 - 31 May 1979
Z. Jelinski and P. B. Moranda Aug. 1979 28 p refs
(Contract F49620-77-C-0099; AF Proj. 2304)
(AD-A077896; AFOSR-79-0976TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report covers the period from 1 June 1978, to 31 May 1979, during which the second of three phases was completed. This phase concentrated on the augmentation of the Program Testing Translator described in the Final Report on AFOSR F44620-74-C-008 of December 1976. The augmentation permits formation of links of greater length than those previously used. It also alleviates the process of composing the tracks of execution sequences, a requirement for establishing an automatic record of the status of testing. Applications have been made to an Air Force logistics model (Optimum Repair Level Analysis-ORLA). In these applications tests were made with the purpose of successively increasing the count of exercised tracks. Because there are numerous user-selected options the count so obtained was not truly indicative of the data base's effect on testing. Nonetheless progress has been made in determining the way to process programs automatically in the way indicated in the Annual Report for the preceding period. GRA

N80-19870# Lockheed Missiles and Space Co., Palo Alto, Calif.
GLOBALMIN: A COMPUTER PROGRAM FOR GLOBAL OPTIMIZATION Interim Report, Jul. 1976 - 15 Sep. 1979
Eldon R. Hansen 15 Nov. 1979 125 p
(Contract F49620-76-C-0003; AF Proj. 2304)
(AD-A078089; LMSC-D683307; AFOSR-79-1227TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

GLOBALMIN is a program for finding the global minimum of nonlinear function f C sq of n variables. It provides infallible bounds on the minimum value F^* of f in any prescribed box (a box is a parallelopiped with sides parallel to the coordinate axes). It also provides infallible bounds on the point(s) x^* at which the global minimum occurs. The implementation of an algorithm that provides infallible bounds on the global minimum of any twice continuously differentiable real function of n real variables on a closed, bounded domain is described. The algorithm also provides infallible bounds on the location of the global minimum. The algorithm uses interval arithmetic and requires the availability of several fundamental interval arithmetic processors for its operation. GRA

N80-19871# Naval Surface Weapons Center, Dahlgren, Va.
SOLUTION OF THE INTEGER CONCAVE PROGRAM USING THE ICON ALGORITHM, VOLUME 1 Final Report
Harlan W. Loomis Nov. 1979 130 p refs
(AD-A077842; NSWC/TR-3119) Avail: NTIS HC A07/MF A01 CSCL 12/2

The branch-and-bound technique has been the basis for algorithms to solve both the mixed integer linear program (having linear objective function, linear constraints, and integrality restrictions on some variables) and the concave nonlinear program (having a separable concave objective function and linear constraints). The subprograms for each of these branch-and-bound algorithms are linear programs with simple upper bounds. GRA

N80-19872# Maryland Univ., College Park. Computer Vision Lab.

LOG DIAMETER RESTRICTED BOTTOM-UP TRIANGLE CELLULAR ACCEPTORS UTCA'S
Reinhard Klette Sep. 1979 16 p refs
(Grant AF-AFOSR-3271-77)
(AD-A077526; TR-809; AFOSR-79-1160TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

The languages accepted by UTCA's in log diameter time are the same as those accepted by UTCA's in which a cell's new state depends only on its sons' states and not on its own preceding state. This set of languages remains the same if we allow log diameter plus constant time, but it increases if we allow 2 log diameter time. It is also shown that this set is the same as the set of languages generated by a special class of 'power of 2' OL-systems. GRA

N80-19873# California Univ., Davis. Signal and Image Processing Lab.
INTERFRAME ADAPTIVE DATA COMPRESSION TECHNIQUES FOR IMAGES
Jaswant R. Jain and Anil K. Jain Aug. 1979 195 p refs
(Grant DAAG29-78-G-0206)
(AD-A078841; ARO-16222.2-EL) Avail: NTIS HC A09/MF A01 CSCL 09/4

A method of interframe motion measurement and compensation, based on approximation of piecewise linear translation of small rectangular areas, is presented. This method significantly improves the temporal correlation and permits reduction of sampling rate along temporal axis. A technique of visual characterization of interframe characteristics, based on temporal cross-sections, is described. Some commonly used statistical models for prediction of the variances of transform coefficients, in intraframe and interframe transform coding, are compared. Results show that measured statistics in transform domain result in 2 to 4 dB improvement over commonly used separable covariance models. Interframe transform and hybrid coding schemes are compared against intraframe transform coding and some simple interframe predictive coding schemes. Also, distortion-rate curves for hybrid coding, based on models of interframe motion have been plotted. The applications of transform and hybrid coding to biomedical X-ray images has been considered. A method for joint optimization of source coding and channel coding for PCM transmission over noisy channels is presented. The performance of several transforms has been compared for some commonly used intraframe nonseparable covariance models. GRA

N80-19874# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
NUMERICAL AND DATA ANALYSIS TECHNIQUES APPLIED TO SCIENTIFIC RESEARCH, 3 Final Report, 1 Jan. 1976 - 31 Dec. 1978
Neil J. Grossbard, Joseph Martine, Edward N. Richards, Theodore Persakis, and Robert Boudreau 31 May 1979 74 p refs
(Contract F19628-76-C-0147)
(AD-A075383; BC-SDAL-79-1; AFGL-TR-79-0132) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes the mathematical and numerical analysis techniques used in the solution of three of the major problem efforts engaged in under Air Force Contract F19628-76-C-0147. Although many other problems were solved under this contract, the analysis and techniques utilized were for the most part similar with variations to those described in the two previous reports. GRA

N80-19875# General Research Corp., Santa Barbara, Calif. Systems Technology Group.
USING ASSERTIONS FOR ADAPTIVE TESTING OF SOFTWARE Interim Report
Dorothy M. Andrews Sep. 1979 15 p refs
(Contract F49620-79-C-0115; AF Proj. 2304)
(AD-A077398; GRC-TM-2270; AFOSR-79-1142TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

One way of assuring greater reliability of software is to improve testing techniques. Three of the key problems associated with software testing are: choosing adequate test cases, assuring correctness of results, and reducing the high cost of testing. By combining the capability of adaptive testing with use of executable assertions, it is possible to execute a program automatically with a large number of test cases over a wide range of input values. The usual goal of adaptive testing is to maximize some performance value (objective function) for the software by automated perturbation of the input parameters in such a way as to degrade the system performance to a specified limit but this technique only indirectly leads to locating errors. In software testing, the primary goal is to locate the maximum number of errors. Since software errors can be detected by executable assertions, these assertions can be used to define an objective function for the adaptive tester so that a program can be tested automatically and a mapping made of its 'error space'. A search algorithm is used to generate new test cases based on past performance data about the number of assertion violations. Software testing can become much more efficient and effective through use of adaptive testing with assertions because such extensive testing increases the possibility of finding any existing errors and of improving software reliability. GRA

N80-19876# Ohio State Univ. Research Foundation, Columbus.
METHODOLOGIES FOR COMPUTER PROGRAM TESTING Final Report, 1 Jul. 1977 - 30 Jun. 1979
B. Chandrasekaran and Lee J. White 10 Aug. 1979 131 p refs
(Grant AF-AFOSR-3416-77; AF Proj. 2304)
(AD-A077414; OSURF/760722/784741; AFOSR-79-1095TR) Avail: NTIS HC A07/MF A01 CSCL 09/2

This report summarizes research, on computer program testing, in particular the development of a strategy called the Domain Testing Strategy. For a large and important class of programs, this strategy enables the generation of test data which can test, in principle, for all errors in the control flow of a program. Among the constraints for practical application of the strategy is that the predicates that affect the control flow are linear in the input variables. The extension of the strategy to modular testing of programs is presented. The sensitivity of the strategy to changes in certain parameters is discussed and implementation of a pilot system to generate test data using this strategy is outlined. GRA

N80-19877# Maryland Univ., College Park. Computer Science Center.
CELLULAR D-GRAPH AUTOMATA WITH AUGMENTED MEMORY Interim Report
Tsvi Duritzki and Angela Wu Jun. 1979 20 p refs
(Grant AF-AFOSR-3271-77)
(AD-A077389; TR-771; AFOSR-79-1164TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper deals with cellular d-graph automata in which each node has internal memory proportional to log sub d-1 of N where N is the number of nodes in the underlying graph G. It is shown how such an automation can assign unique labels to the nodes of G in O(log sub d-1 of N) time. Such an automation can also count the number of nodes and edges in G in O(log sub d-1 of N) time. Algorithms for identifying all the cut nodes and all bridges in G, each in O(log sub d-1 of N) time, are also presented. GRA

N80-19878# Army Armament Research and Development Command, Dover, N. J. Management Information Systems Directorate.
BAYESIAN INTERACTIVE GRAPHICS RELIABILITY ASSESSMENT PROCEDURE (BIGRAP)
Irving E. Teviovitz and John G. Mardo 1978 74 p refs
(AD-A077641; MISD-UM-78-9) Avail: NTIS HC A04/MF A01 CSCL 09/2

BIGRAP is a package of interactive graphics programs, written for use on the TEKTRONIX 4014 Graphics Terminal connected to the ARRADCOM CDC 6500/6600 computer configuration. This package consists of a set of intricate programs that allows a user to input component success/failure data and a Boolean expression depicting system reliability logic for the purpose of assessing system reliability. The computer converts the logic expression to an algebraic expression for the system reliability as a function of the individual component reliabilities. A Bayesian statistical algorithm is then employed to provide the user with point and confidence interval estimates of system reliability. In addition the graphics feature of the package displays histograms and corresponding Beta distributions involved in the

analysis. The programs are run sequentially as a cataloged procedure using the BEGIN/REVERT utility. This report is intended to serve as a guide to potential users of BIGRAP for operation and interpretation of results. GRA

N80-19879# University of Southern California, Los Angeles. Dept. of Computer Science.
JOYCE: A LANGUAGE FOR COMPUTER NETWORKS
Per BrinchHansen Nov. 1979 43 p refs
(Contract N00014-77-C-0714; NR Proj. 048-647)
(AD-A078706) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report defines an experimental programming language called JOYCE which is intended for real-time applications controlled by microcomputer networks without common storage. The language includes distributed processes which communicate and synchronize themselves by means of procedure calls and guarded regions. The present version of the language is implemented on a PDP 11 single-processor system. The compiler is not available for distribution. GRA

N80-19880# Stevens Inst. of Tech., Hoboken, N. J.
FORTRAN PROGRAM OBLIQUE IN PL-FORMAT USER'S MANUAL
Daniel T. Valentine Nov. 1979 19 p refs
(Contract N00014-77-C-0062)
(AD-A077809; SIT-DL-7-899) Avail: NTIS HC A02/MF A01 CSCL 09/2

This manual accompanies the program listings and a magnetic tape containing two files, one of program OBLIQUE and one (the second) of program OBLIQ02. The programs OBLIQUE and OBLIQ02 plus the program PPEXACT are used in the procedure described herein to compute the blade bending moments of a propeller operating in an oncoming flow inclined to the propeller shaft. The theoretical analysis leading to and the operating of PPEXACT have been described by Tsakonas, et al. GRA

N80-19881# Colorado Univ., Boulder. Dept. of Computer Science.
A SOFTWARE LIFECYCLE METHODOLOGY AND TOOL SUPPORT Interim Technical Report
Leon J. Osterweil Apr. 1979 21 p refs
(Grants DAAG29-78-G-0046; NSF MCS-77-02194)
(AD-A076335; CU-CS-154-79) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper describes a system of techniques and tools for aiding in the development and maintenance of software. Improved verification techniques are applied throughout the entire process and management visibility is greatly enhanced. The paper discusses the critical need for improving upon past and present methodology. It presents a proposal for a new production methodology, a verification methodology, and the system architecture for a family of support tools. GRA

N80-19882# Stanford Univ., Calif. Dept. of Operations Research.
A BOUNDING TECHNIQUE FOR INTEGER LINEAR PROGRAMMING WITH BINARY VARIABLES
Frederick S. Hillier and Nancy Eileen Jacqmin Jun. 1979 17 p refs
(Contract N00014-76-C-0418; Grant NSF MCS-76-81259)
(AD-A075575; SU-TR-86) Avail: NTIS HC A02/MF A01 CSCL 12/1

We present a bounding technique for use in implicit enumeration algorithms for solving the integer linear programming problem with binary variables. The main assumptions used by this technique are the associated linear program, obtained by dropping the integrality constraints on the variables, possess a unique optimal solution. This optimal solution is not binary, and a good feasible solution to the original problem is available. An alternative to the last assumption which is weaker is also presented. We show that joint bounds can be obtained on the values of a subset of the variables. In addition we given an efficient method to implement this bounding technique. Finally, a class of problems particularly well-suited to this bounding procedure is specified. GRA

N80-19883# National Technical Information Service, Springfield, Va.
NATURAL LANGUAGE PROCESSING, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1977
Brian Carrigan Dec. 1979 271 p
(PB80-803281) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of Government-sponsored research cites reports on natural language in many areas of application. Topics such as speech recognition, computer programming, information storage and retrieval, question-answering systems, man computer, communications, artificial intelligence, syntactic analysis, and computational linguistics are included. This updated bibliography contains 271 abstracts, none of which are new entries to the previous edition. GRA

N80-19884# National Technical Information Service, Springfield, Va.
NATURAL LANGUAGE PROCESSING, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Dec. 1979
Brian Carrigan Dec. 1979 34 p Supersedes NTIS/PS-78/1312; NTIS/PS-77/1169; NTIS/PS-76/1027; NTIS/PS-75/864
(PB80-803299; NTIS/PS-78/1312; NTIS/PS-77/1169; NTIS/PS-76/1027; NTIS/PS-75/864) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of Government research cites reports on natural language in many areas of application. Topics such as speech recognition, computer programming, information storage, and retrieval, question-answering systems, man computer communications, artificial intelligence, syntactic analysis, and computational linguistics are included. This updated bibliography contains 64 abstracts, 34 of which are new entries to the previous edition. GRA

N80-19885# National Technical Information Service, Springfield, Va.
NATURAL LANGUAGE PROCESSING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Dec. 1979
Brian Carrigan Dec. 1979 174 p Supersedes NTIS/PS-78/1313; NTIS/PS-77/1170; NTIS/PS-76/1028
(PB80-803307; NTIS/PS-78/1313; NTIS/PS-77/1170; NTIS/PS-76/1028) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide journal literature cites reports on natural language in many areas of applications. Speech recognition, computer programming, information storage and retrieval question-answering systems, man-computer communications, artificial intelligence, syntactic analysis, and computational linguistics are topics included. This updated bibliography contains 174 abstracts, 31 of which are new entries to the previous edition. GRA

N80-19810# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
AN INTRODUCTION TO THE SELECTION AND USE OF SIMULATION LANGUAGES
Robert G. Sargent *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 4 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19827# Mitre Corp., Bedford, Mass.
APPLICATION OF COMPUTER SIMULATIONS TO DEVELOPMENT OF NATO E-3A AUTOMATIC TRACK INITIATION ALGORITHMS
E. S. Alvarez and C. J. Sworobowicz *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 21 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19831# Le Materiel Telephonique, Trappes (France).
USING A LANGUAGE DEVELOPED FOR AIRCRAFT SIMULATORS [UTILISATION D'UN LANGAGE EVOLUE POUR LES SIMULATEURS D'AVIONS]
Michel G. Dreyfus *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan.

1980 7 p In FRENCH; ENGLISH summary (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N80-19888# Maryland Univ., College Park. Computer Science Center.
LOCAL RECONFIGURATION OF NETWORKS OF PROCESSORS: ARRAYS, TREES, AND GRAPHS Interim Report
Tsvi Dubitzki, Angela Wu, and Azriel Rosenfeld Jul. 1979 27 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A077525; CSC-TR-790; AFOSR-79-1159TR) Avail: NTIS HC A03/MF A01 CSCL 09/4

This paper studies local reconfiguration of trees into arrays and vice versa. It also studies the construction of adjacency graphs and quadtrees for images stored in cellular array processors. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-19887 Rice Univ., Houston, Tex.
SEQUENTIAL GRADIENT-RESTORATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH GENERAL BOUNDARY CONDITIONS Ph.D. Thesis
Salvador Gonzalez 1979 87 p
Avail: Univ. Microfilms Order No. 8003861

The numerical solution of two classes of optimal control problems, called Problem P1 and Problem P2 for easy identification are considered. Problem P1 involves a functional 1 subject to differential constraints and general boundary conditions. It consists of finding the state, the control, and the parameter so that the functional 1 is minimized while the constraints and the boundary conditions are satisfied to a predetermined accuracy. Problem P2 extends Problem P1 to include nondifferential constraints to be satisfied along the interval of integration. Algorithms are developed for both Problem P1 and Problem P2. Dissert. Abstr.

N80-19888# Naval Research Lab., Washington, D. C.
PERFORMANCE COLLAPSE DUE TO OVERHEAD IN A SIMPLE, SINGLE-SERVER QUEUEING SYSTEM Final Report
John E. Shore 11 Dec. 1979 25 p refs
(RR0140941)
(AD-A078190; NRL-MR-4126) Avail: NTIS HC A02/MF A01 CSCL 12/1

We consider a simple model of overhead in batch computer systems and message switching systems: an exponential, single-server queueing system with finite storage capacity, constant arrival rate, and queue-length-dependent service time. We consider cases in which the expected service time consists of a constant plus a term that grows linearly or logarithmically with the queue length. We show that the performance of this system--as characterized by the expected number of customers in the system, the expected time in the system, and the rate of missed customers--can undergo a sudden collapse as the result of small changes in the arrival rate, the overhead rate, or the queue capacity. The system has the interesting property that increasing the queue capacity can decrease performance. In addition to equlibrium results, we consider the dynamic behavior of the model. We show that the system tends to operate in either of two quasi-stable modes of operation--one with low queue lengths and one with high queue lengths. System behavior is characterized by long periods of operation in both modes with abrupt transitions between them. We point out that the performance of a saturated system may be improved by dynamic operating procedures that return the system to the low mode. GRA

N80-19889# Princeton Univ., N. J. Dept. of Electrical Engineering and Computer Science.
GENERALIZATIONS OF THE SEQUENTIAL SIGN DETECTOR Interim Report
C. C. Lee and J. B. Thomas 1979 11 p refs Presented at the 17th Ann. Allerton Conf. on Communication, Control, and Computing, Princeton, N.J. 10-12 Oct. 1979 Submitted for publication
(Grant AF-AFOSR-3083-76; AF Proj. 2304)
(AD-A078110; AFOSR-79-1171TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Some generalizations of the classical ruin problem in probability theory are investigated. These generalizations are applied to analyze the sequential dead-zone limiter detector and the sequential four-level sign detector. The performances of these detectors are then compared to that of the sequential sign detector in terms of the relative efficiency (RE) and the asymptotic relative efficiency (ARE). GRA

N80-19890# Brown Univ., Providence, R. I. Center for Dynamical Systems.
DESIGN OF OPTIMAL TRACKING DISCRETE CONTROL SYSTEM Interim Report
Y. Bar-Ness (Tel Aviv Univ., Israel) and J. Feinstein (Tel Aviv Univ., Israel) Jul. 1979 44 p refs
(Grant AF-AFOSR-3063-77; AF Proj. 2304)
(AD-A078751; AFOSR-79-1284TR) Avail: NTIS HC A03/MF A01 CSCL 14/2

Output feedback with a series compensator is considered for controlling SISO discrete systems. MSE criterion of design is used in tracking a given input sequence. The plant can be unstable and/or nonminimum phase, while the compensator is constrained to be physically realizable and closed-loop configuration is both stable and physically realizable. Using variational methods the required compensator is found, and shown to be the necessary and sufficient optimal solution. GRA

N80-19891# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
AMORD: A DEDUCTIVE PROCEDURE SYSTEM
Johan De Kleer, Jon Doyle, Charles Rich, Guy L. Steele, Jr., and Gerald Jay Sussman Jan. 1978 49 p refs
(Contract N00014-75-C-0643; Grant NSF MCS-77-04828)
(AD-A078417; AI-M-435) Avail: NTIS HC A03/MF A01 CSCL 14/2

AMORD is a system for writing problem solvers. It encourages a style of expression in which the logical relationships of the knowledge and control structure of the problem solver are made explicit. A minimal set of mechanisms is supplied by AMORD so that most of the knowledge that must be formalized and the decisions that must be made in constructing a problem solving program must, to a large degree, be made explicit in AMORD. This makes AMORD a vehicle for expressing the structure of problem solvers. Once the problem solving structure has been formalized, the task of transferral to programs in programming languages is straightforward. The important aspect of AMORD is the discipline of explicit control it enforces, rather than the specific language or syntax in which the control knowledge is expressed. The basic mechanism of AMORD is the pattern-directed invocation of a set of rules operating on an indexed data base of assertions. We have implemented an interpreter for the rule-based system, AMORD, based on a non-chronological control structure and a system of automatically maintained data-dependencies. The purpose of this paper is to serve as a reference manual and as an implementation tutorial. It illustrates: (1) the discipline of explicit control and dependencies; (2) how to use AMORD; and (3) one way to implement the mechanisms provided by AMORD. GRA

N80-19892# Maryland Univ., College Park. Computer Science Center.
REGION REPRESENTATION: QUADTREES FROM BOUNDARY CODES
Hanan Samet Mar. 1979 40 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)

(AD-A076350; CSC-TR-741) Avail: NTIS HC A03/MF A01 CSCL 09/4

An algorithm is presented for constructing a quadtree for a region given its boundary in the form of a chain code. The algorithm makes use of some geometrical properties of the region to enable the detection of the maximal size blocks of the region without actually visiting all of the subblocks of the maximal size block. Analysis of the algorithm reveals that its execution time is proportional to the product of the perimeter and the log of the diameter of the region. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-19893 Duke Univ., Durham, N. C.
A RECURSION THEORETIC ANALYSIS OF CERTAIN GENERALIZATIONS OF RAMSEY'S THEOREM AND OF THE GALE-STEWART THEOREM Ph.D. Thesis
Peter George Clote 1979 114 p
Avail: Univ. Microfilms Order No. 8003615

Various combinatorial principles related to Ramsey's theorem are considered. These include square bracket partition relations, Nash-Williams' barrier theorem, Ramsey's theorem for clopen and open sets, and determinateness for clopen and open games. In each case a recursive theoretic analysis is given of the effective versions along with some corresponding results in models of arithmetic. An approximation theorem for the class of hyperarithmetical functions is proved. This theorem permits a close correlation between the 'order type' of a clopen set and the complexity for solutions of a given recursively presented problem. The Gale-Steward theorem is also proved. The recursion theoretic analysis implies that certain combinatorial principles cannot be proved in a weak form of second order arithmetic. By using indicator theory finitary versions of these principles are given which are true but unprovable in first order Peano arithmetic. Dissert. Abstr.

N80-19894 University of Southwestern Louisiana, Lafayette.
A MODIFICATION OF HUDSON'S TECHNIQUE FOR PIECEWISE LINEAR REGRESSION MODELS Ph.D. Thesis
Aubrey Dale Magoun 1978 102 p
Avail: Univ. Microfilms Order No. 7924277

The methodology in Hudson's iterative least squares procedure for ascertaining solutions to the piecewise regression problem with unknown join points is examined and a modification is presented. It is shown that the use of successive differences and smoothing techniques enhances the estimation problem set forth by the assumptions and models of Hudson. By using successive differences one can estimate point slopes and then test for collinearity versus noncollinearity. This enhances Hudson's technique due to the fact that one now has an estimate of how many piecewise linear splines are present and an interval estimate of the location of each join point. Likewise, using a concept in numerical analysis called divided differences one can also estimate the join point prior to the curve fitting procedure. Dissert. Abstr.

N80-19895 Ohio State Univ., Columbus.
ON THE PROBLEMS OF CONSTRUCTION AND STATISTICAL INFERENCE ASSOCIATED WITH A GENERALIZATION OF CANONICAL VARIABLES Ph.D. Thesis
Ashis SenGupta 1979 63 p
Avail: Univ. Microfilms Order No. 8001829

Given the partition of a p-dimensional random vector, V, into subvectors, generalized canonical variables (GCVs) are obtained whether or not the pupulation disperion matrix, D, is known. Regardless of the pattern of D, GCVs are constructed such that they are equi-correlated. When X is normally distributed with unknown (known) d, large sample (exact) GCVs are derived. Large sample distributions of the roots of determinantal equations leading to the construction of GCVs are deduced. Tests of hypotheses concerning the value of the generalized variance and the value of the equi-correlation are performed. The hypothesis that the k-vector GCVs is as good as the k+1 vector GCVs tested under large sample approximation. Properties of such tests are also dicussed. Dissert. Abstr.

N80-19896# Lockheed Missiles and Space Co., Palo Alto, Calif. Applied Mechanics Lab.
DESIGN AND IMPLEMENTATION OF A NEW DESCENT ALGORITHM FOR LOCAL OPTIMIZATION Final Report, 15 Jul. 1976 - 15 Sep. 1979
Paul S. Jensen 15 Nov. 1979 61 p refs
(Contract F49620-76-C-0003; AF Proj. 2304)
(AD-A078220; LMSC-D683306; AFOSR-79-1226TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

A new descent algorithm based on direction searches in the osculating plane as opposed to the negative gradient is described. The major practical difference between the implementation to this approach and quasi-Newton algorithms is the use of the Hessian in place of the inverse Hessian. Thus, the descent algorithm is most suitable for problems for which it is practical to recalculate the Hessian a number of times during the solution process. A number of comparative results with popular quasi-Newton algorithms are provided. Extensive discussion of the implementation details is included along with documentation of a convenient computer program CRATER for unconstrained optimization analysis. GRA

N80-19897# Maryland Univ., College Park. Computer Science Center.
LINEAR TIME CALCULATIONS OF GEOMETRIC PROPERTIES USING QUADTREES
Michael Shneier May 1979 17 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A078087; TR-770) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper describes algorithms for computing geometric properties of binary images represented as quadtrees. All the algorithms involve a simple traversal of the tree. Each algorithm, however, performs different operations at the nodes of the tree. Algorithms are presented for finding the area, centroid, union, intersection, and complement of binary images. All the algorithms are linear in the number(s) of nodes in the tree(s). GRA

N80-19898# Naval Ocean Systems Center, San Diego, Calif.
POWER SERIES FOR THE CALCULATION OF BESSEL FUNCTIONS FOR LARGE ARGUMENTS, PROVIDES J SUB NU (X) AND Y SUB NU (X), ACCURATE TO AT LEAST 14 PLACES
P. A. Barakos 1 Oct. 1979 7 p
(SF33334145)
(AD-A077899; NOSC/TD-282) Avail: NTIS HC A02/MF A01 CSCL 12/1

In certain applications such as acoustic wave scattering from internal waves, the Bessel functions J sub nu(x) and Y sub nu(x) for real order and large argument are required to be known accurately to at least 14 figures. Higher order terms in the power series developed by Goldstein and Thaler are presented herein. Applying these results allows J sub nu(x) and Y sub nu(x) to be determined accurately to at least 14 figures. GRA

N80-19899# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SPECIAL FUNCTION SOLUTIONS OF THE DIFFUSION EQUATION Final Report
John F. Polk Jul. 1979 35 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A075324; AD-E430307; ARBRL-TR-02182) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this report certain special functions are introduced and their properties discussed. In particular they are shown to be solutions of the diffusion(heat) equation satisfying special initial conditions. These functions are then used to obtain approximate solutions to initial-boundary value problems for the diffusion equation which are particularly accurate for small times. GRA

N80-19900# North Carolina Univ. at Chapel Hill. Dept. of Statistics.
NONLINEAR SYSTEMS WITH GAUSSIAN INPUTS: REPRESENTATION, IDENTIFICATION AND INVERSE PROBLEMS Interim Report

Stamatis Cambanis 1979 4 p refs Submitted for publication
(Contract AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A078597; AFOSR-79-1212TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The following questions are discussed for nonlinear systems with input Gaussian processes. How can the system be represented? How can the system be identified from the input and output processes? Does knowledge of the way the system responds to a certain Gaussian input determine the way it will respond to another Gaussian input or to a deterministic input? Does knowledge of the system and the statistics of the output determine the statistics of the input? GRA

N80-19901# Stanford Univ., Calif. Dept. of Computer Science.
FAST ALGORITHMS FOR SOLVING TOEPLITZ SYSTEM OF EQUATIONS AND FINDING RATIONAL HERMITE INTERPOLANTS
David Y. Y. Yun Jul. 1979 12 p refs
(Contract N00014-76-C-0330; Grant NSF MCS-77-23738)
(AD-A075376; SU-STAN-CS-79-748) Avail: NTIS
HC A02/MF A01 CSCL 12/1

We present a new algorithm that reduces the computation for solving a Toeplitz system to o(n log2 n) and automatically resolves all degenerate cases of the past. Our fundamental results show that all rational Hermite interpolants, including Pade approximants which is intimately related to this solution process, can be computed fast by an Euclidean algorithm. In this report we bring out all these relationship with mathematical justifications and mention important applications including decoding BCH codes. GRA

N80-19902# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
COMBINING AND UPDATING OF LOCAL ESTIMATES AND REGIONAL MAPS ALONG SETS OF ONE-DIMENSIONAL TRACKS Interim Report
Alan S. Willsky, Martin Bello, David A. Castanon, Bernard C. Levy, and George Verghese Nov. 1979 61 p refs
(Contract N00014-76-C-0346; Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A080034; LIDS-P-955; AFOSR-80-0080TR) Avail: NTIS
HC A04/MF A01 CSCL 12/1

In this paper we consider the problem of combining and updating estimates that may have been generated in a distributed fashion or may represent estimates, generated at different times, of the same process sample path. The first of these cases has applications in decentralized estimation, while the second has applications in updating maps of spatially-distributed random quantities given measurements along several tracks. The method of solution for the second problem uses the result of the first, and the similarity in the formulation and solution of these problems emphasizes the conceptual similarity between many problems in decentralized control and in the analysis of random fields. GRA

N80-19903# Brown Univ., Providence, R. I. Applied Mathematics Div.
ON THE WEAK CONVERGENCE OF A SEQUENCE OF GENERAL STOCHASTIC DIFFERENCE EQUATIONS TO A DIFFUSION Interim Report
H. J. Kushner and Hai Huang Oct. 1979 44 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-88; NSF ENG-77-12946; AF Proj. 2304)
(AD-A080082; AFOSR-80-0014TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

A convenient and useful method for showing weak convergence, to a diffusion of the interpolated solutions of a (not necessarily Markovian) sequence of stochastic difference equations is developed. The technique involves the use of averaging methods to show that the weak limit satisfies the martingale problem of Strook and Varadhan which is associated with the diffusion. A truncation method is developed so that it is only necessary to work with the parts of the process before first escape from an arbitrary but bonded domain. The assumptions cover a wide variety of applications in systems theory, mathematical biology and elsewhere but the method of proof is adaptable to other special cases where our particular assumptions might not hold. Two applications are given in order to illustrate the relative ease of use of the method. The driving noise process in the difference equations can depend on the solution process of the difference equation, and one application where this is useful is given (a rate of convergence problem for simple stochastic approximations with sequentially averaged observations). GRA

N80-19904# Pittsburgh Univ., Pa. Learning Research and Development Center.
CONSTRUCTIONS IN GEOMETRY PROBLEM SOLVING
James G. Greeno 27 Aug. 1979 116 p refs
(Contract N00014-78-C-0022; RR0420602; NR Proj. 157-408)
(AD-A076338; LRDC-1979/8; TR-3) Avail: NTIS
HC A06/MF A01 CSCL 12/1

The primary purpose of the report is to provide documentary evidence relevant to a model of planning knowledge that provides an explanation of constructions. The protocols are consistent with the general features of the model, but also show ways in which human problem solving involves processes more complex than those in the model. Illustrations of interaction between formal and informal reasoning processses are also noted. GRA

N80-19905# Pittsburgh Univ., Pa. Learning Research and Development Center.
THEORY OF CONSTRUCTIONS AND SET IN PROBLEM SOLVING
James G. Greeno, Maria E. Magone, and Seth Chaiklin 27 Aug. 1979 67 p refs
(Contract N00014-78-C-0022; RR0520602)
(AD-A076339) Avail: NTIS HC A04/MF A01 CSCL 12/1

Hierarchically organized knowledge about actions has been postulated to explain planning in problem solving. Perdix, a simulation of problem solving in geometry with schematic planning, knowledge is described. Perdix: planning knowledge enables it to augment the problem space it is given by constructing auxiliary lines. The planning system also provides a mechanism that can result in problem-solving set. Results of three experiments involving set and constructions seem consistent with the kinds of knowledge structures hypothesized in the model. Protocols given during solution of 11 geometry problems showed general agreement with the explanation of construction and set based on planning knowledge, but also indicated processes of human problem solving not represented in the model. Finally, the explanation of constructions is discussed in relation to the general question of ill-structured problems and creativity, and the explanation of set is discussed in relation to other phenomena in the problem-solving literature, including functional fixedness. GRA

N80-19906# Wisconsin Univ. - Madison. Mathematics Research Center.
ONE-SIDED CONTINUOUS DEPENDENCE OF MAXIMAL SOLUTIONS Summary Report
Eric Schechter Nov. 1979 23 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A079722; MRC-TSR-2016) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Existence of a maximal solution is proved for a differential equation satisfying a one-sided variant of Caratheodory's condition. The maximal solution is shown to dominate all solutions of a very general differential inequality. Also a best-possible condition is proved for the dependence of the maximal solution on the initial data and on the right-hand side of the equation. GRA

N80-19907# Wisconsin Univ. - Madison. Mathematics Research Center.
DISPERSION MAPPING THEOREMS Summary Report
R. Creighton Buck Sep. 1979 21 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-07244)
(AD-A079704; MRC-TSR-1995) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A function of three variables is often regarded as inherently simpler than a function of five variables, and there has been much attention given to the nature of complicated functions that can be expressed exactly in various ways in terms of simpler functions. From the viewpoint of computation, however, it is sufficient if a function F can be approximated arbitrarily well by combinations of simple functions. This paper deals with

the general structure of this process, and obtains specific theorems that help to describe its limitations, and necessary conditions on the functions F for which this is possible. More detailed applications will be made in the future. GRA

N80-19908# California Univ., Livermore. Lawrence Livermore Lab.
NOTE ON NORMALIZATION OF VARIABLES AND EQUATIONS
A. A. Mirin Mar. 1979 8 p refs
(Contract W-7405-eng-48)
(UCID-18083) Avail: NTIS HC A02/MF A01

It is shown that with 64-bit computer words and exponent ranges of several hundred, care must be exercised to avoid excessive roundoff error when solving coupled systems of partial differential equations. The proper normalization of variables is given as a remedy and an illustration of the procedure is presented. DOE

N80-19909# Addis Translations International, Portola Valley, Calif.
SOLUTIONS TO WAVE EQUATIONS USING AN ARTIFICIAL VISCOSITY METHOD
V. M. Goloviznin, A. A. Samarskii, and A. P. Favorskii Jun. 1979 39 p refs Transl. into ENGLISH of Preprint No. 70 Inst. Prikladnoj Matematiki (Moscow), 1976 Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11492; Preprint-70) Avail: NTIS HC A03/MF A01

Artificial viscosity is introduced for the solution of flows with shock waves accompanied by increasing entropy. Linear artificial viscosity does not distort the eigenfunctions of the original differential-difference and difference equation linearized about the equilibrium position. The numerical value of the coefficient is selected in the presence of artificial viscosity based on the conditions of the most repid attenuation of the high frequency oscillations defined by the linearized equations. The stability of linearized systems of equations in two-dimensional Cartesian and cylindrical coordinates in arbitary calculation meshes is investigated. K.L.

N80-19910# Oak Ridge National Lab., Tenn.
BALANCING THE GENERALIZED EIGENVALUE PROBLEM
R. C. Ward Oct. 1979 44 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-47) Avail: NTIS HC A03/MF A01

An algorithm is presented for balancing the A and B matrices prior to computing the eigensystem of the generalized eigenvalue problem Ax = lambda Bx. The three-step algorithm is specifically designed to precede the QZ-type algorithms, but improved performance is expected from most eigensystem solvers. The balancing algorithm computes permutations and two-sided diagonal transformations which are applied to A and B to produce matrices with certain desirable properties. Test cases are presented to illustrate the improved accuracy of the computed eigenvalues. DOE

N80-19911# Maryland Univ., College Park. Inst. for Physical Science and Technology.
FINITE ELEMENT METHOD FOR THE TRICOMI PROBLEM
A. K. Aziz and A. Werschulz (Maryland Univ., Baltimore County) Jul. 1979 17 p refs
(Contract EY-76-S-05-3443)
(ORO-3443-84; BN-913) Avail: NTIS HC A02/MF A01

The numerical solution of a class of second order equations of elliptic-hyperbolic type for phi(x) by the finite element method is addressed by solution of the equivalent first order system for the gradient of phi. The problem to be solved is described. Then an a priori error estimate is proved, and the coercivity of the bilinear form to be used is established. Next, the finite element method for general subspaces is described, and a general error bound is established. Finally, it is shown that the L sub 2 rate of convergence for linear elements may be increased from O(h) to O(h/sup 3/2/) by writing the subspace as a direct sum in a new way. DOE

N80-19912# National Technical Information Service, Springfield, Va.
INTEGRATION OF NONLINEAR DIFFERENTIAL EQUATIONS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Nov. 1979
Brian Carrigan Dec. 1979 214 p Supersedes NTIS/PS-78/1194; NTIS/PS-77/1058; NTIS/PS-76/0932; NTIS/PS-75/794; NTIS/PS-75/028
(PB80-802978; NTIS/PS-78/1194; NTIS/PS-77/1058; NTIS/PS-76/0932; NTIS/PS-75/794; NTIS/PS-75/028) Avail: NTIS HC $30.00/MF $30.00 CSCL 12A

Research is cited on the numerical integration of nonlinear differential equations. Included are variational methods, finite difference methods, Laplace transform techniques, Runge-Kutta methods, and conjugate gradient methods as well as solutions to two point boundary value problems and multipoint boundary value problems. This updated bibliography contains 207 abstracts, 36 of which are new entries to the previous edition. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-19913 Wisconsin Univ. - Madison.
EXTENSIONS OF THE BOX-COX TRANSFORMATION TO GROUPED-DATA SITUATIONS Ph.D. Thesis
Victor Manuel Guerro-Guzman 1979 154 p
Avail: Univ. Microfilms Order No. 7928642

The domain of application of the Box-Cox family of power transformations to include several grouped data situations is presented. Three main cases are: (1) one-dimensional data, (2) two dimensional data and (3) binary response models. The transformation is used as a normalizing technique to smooth count data. Both data which are completely grouped and data which are a mixture of grouped and exact observations are considered. Correlation tables, bivariate normal regression, and simple linear regression are also emphasized. It is shown that the Box-Cox transformation helps to improve the validity of the normal theory assumptions. Dissert. Abstr.

N80-19914 Cornell Univ., Ithaca, N. Y.
DISPERSION, PATTERNED AND STRUCTURED MATRICES: VEC OPERATORS AND RELATED TOPICS Ph.D. Thesis
Harold Victor Henderson 1979 192 p
Avail: Univ. Microfilms Order No. 8003936

A review of the vec operator which stacks the columns of a matric one under the other to form a single vector of all elements in the matrix, and an associated permutation matrix, called a vec- permutation matrix are discussed. A definition is given for a vec permutation matrix which leads to considerably simpler proofs of many results of current interest, including a property of reversing the order in Kronecker products. A variation of the vec operator, known as the vech operator, is described. For X square, vechX is defined in the same way as vecX, except that for each column of X only that part of it which is on or below the diagonal is put into vechX. Uses for vec and in multivariate analysis, in matrix differentation and in deriving Jacobians are also discussed. Dissert. Abstr.

N80-19915 Texas A&M Univ., College Station.
A DENSITY-QUANTILE FUNCTION APPROACH TO CHOOSING ORDER STATISTICS FOR THE ESTIMATION OF LOCATION AND SCALE PARAMETERS Ph.D. Thesis
Randall Lester Eubank 1979 130 p
Avail: Univ. Microfilms Order No. 8003125

A general approach to optimal spacings selection is presented that utilizes design technique for continuous parameter time series regression. This methodology is applied to several common distributions. The problems of optimal order statistic selection for estimation in censored samples, for quantile estimation and for summarizing large data sets are also considered. Dissert. Abstr.

N80-19916# Princeton Univ., N. J. Dept. of Statistics.
PREDICTING UNOBSERVABLE VALUES AND ESTIMATING MISSING ONES: A COORDINATE-FREE APPROACH, PART 2

Anne M. Houtman Jul. 1979 12 p refs
(Contract N00014-79-C-0322)
(AD-A078241; TR-156-Ser-2) Avail: NTIS HC A02/MF A01 CSCL 14/1

The solution to the missing value equation in designed experiments with general covariance structure is shown to be identical to the 'best' predictor of the missing data based on the observed data. GRA

N80-19917# Kentucky Univ., Lexington. Dept. of Mathematics.
A STOCHASTIC REALIZATION APPROACH TO THE SMOOTHING PROBLEM. REVISED Interim Report
Faris Badawi, Anders Lindquist, and Michele Pavon 1979 34 p refs Supersedes AFOSR-79-0808TR
(Grant AF-AFOSR-3519-78; AF Proj. 2304)
(AD-A078137; AFOSR-79-1274TR; AFOSR-79-0808TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The purpose of this paper is to develop a theory of smoothing for finite dimensional linear stochastic systems in the context of stochastic realization theory. The basic idea is to embed the given stochastic system in a class of similar systems all having the same output process and the same Kalman-Bucy filter. This class has a lattice structure with a smallest and a largest element; these two elements completely determine the smoothing estimates. This approach enables us to obtain stochastic interpretations of many important smoothing formulas and to explain the relationship between them. GRA

N80-19918# Naval Postgraduate School, Monterey, Calif.
PREDICTION INTERVALS FOR FIRST ORDER MARKOV PROCESSES M.S. Thesis
T. S. Murthy Sep. 1979 71 p refs
(AD-A078283) Avail: NTIS HC A04/MF A01 CSCL 12/1

A prediction interval is an interval that contains a future observation with a pre-specified probability. The limits of the interval are functions of known observations from a family of known distributions with given parameters. Though prediction intervals resemble confidence intervals, they differ from the latter conceptually. A confidence interval covers the value of a parameter of a distribution. A prediction interval, on the other hand, encloses the value of a random variable. GRA

N80-19919# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ON THE ASYMPTOTIC DISTRIBUTION OF U-STATISTICS Interim Report
Alan J. Lee Sep. 1979 15 p refs
(Contract AFOSR-75-2796)
(AD-A078117; MIMEO-SER-1255; AFOSR-79-1188TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The asymptotic distribution of a U-statistic is found in the case when the corresponding Von Mises functional is stationary of order 1. Practical methods for the tabulation of the limit distributions are discussed, and the results extended to certain incomplete U-statistics. GRA

N80-19920# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
TRIMMING THE LEAST SQUARES ESTIMATOR IN THE LINEAR MODEL BY USING A PRELIMINARY ESTIMATOR Interim Report
Raymond J. Carroll and David Ruppert Apr. 1979 22 p refs
(Contracts AFOSR-75-2796; NSF MCS-78-01240)
(AD-A078115; MIMEO-Ser-1220; AFOSR-79-1036TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper a class of estimators is investigated that represent a third possible method of defining a regression analogue of the trimmed mean. GRA

N80-19921# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ROBUST METHODS FOR FACTORIAL EXPERIMENTS WITH OUTIERS Interim Report
Raymond J. Carroll Jul. 1979 16 p refs
(AF Proj. 2304; AF-AFOSR-2796-75)
(AD-A077890; MIMEO-SER-1244; AFOSR-79-1097TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two factorial experiments with possible outliers are reanalyzed by means of robust regression techniques. We show that using M-estimates of regression results in efficient analyses which are easier to implement than the methods previously proposed. GRA

N80-19922# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ON THE ASYMPTOTIC NORMALITY OF ROBUST REGRESSION ESTIMATES Interim Report
Raymond J. Carroll and David Ruppert Jul. 1979 13 p refs
(Grants AF-AFOSR-2796-75; NSF MCS-78-01240)
(AD-A077888; MIMEO-SER-1242) Avail: NTIS HC A02/MF A01 CSCL 12/1

Huber's (1973) proof of asymptotic normality of robust regression estimates is modified to include the estimates used in practice, which have unknown scale and only piecewise smooth defining functions psi. GRA

N80-19923# Claremont Mens Coll., Calif. Inst. of Decision Science.
DELTA-EXACT LOWER CONFIDENCE BOUNDS FOR SERIES SYSTEM RELIABILITY
James B. Lucke and Janet Myhre Sep. 1979 25 p refs
(Contract N00014-78-C-0213)
(AD-A077524; Rept-79-2) Avail: NTIS HC A02/MF A01 CSCL 14/4

Recent modifications of the Likelihood Ratio method of computing lower confidence bounds for series system reliability are shown to have properties necessary for accurate application to actual data. This is shown by comparing various methods using simulations. GRA

N80-19811# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
AN INTRODUCTION TO STATISTICAL ANALYSIS OF SIMULATION OUTPUT DATA
Robert G. Sargent *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p refs Presented at the ACM 1976 Symp. on the Simulation of Computer Systems (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-19924# Hanford Engineering Development Lab., Richland, Wash.
PERFORMANCE MEASUREMENT SYSTEM: RECENT SYSTEMS DEVELOPMENT AND APPLICATIONS
R. A. Rigney 28 Mar. 1979 15 p refs Presented at 6th Internet Intern. Management System Assoc. Meeting, Garmisch-Partenkirchen, West Germany, 24 Sep. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1826-FP; CONF-790988-1) Avail: NTIS HC A02/MF A01

The performance measurement system (PMS), a system for managing a given project or program, is described. This system incorporates the value earned for work accomplished approach. Development and application of this system is discussed under the following headings: PMS vs conventional management control systems; PMS implementation on a project/program; PMS data elements (organization, planning and budgeting, accounting, analysis, reports and performance measurement data elements); PMS applications (FFTF, CRBRP, FMEF, and FMIT). DOE

N80-19818# Shape Technical Center, The Hague (Netherlands).
SIMULATION OF AIR DEFENCE OPERATIONS AND MULTIPLE AIR COMBAT
H. R. Wilhelm *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 20 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19819# NATO Programming Centre, Tongeren (Belgium).
SIMULATION WITHIN MILITARY DEFENCE SYSTEMS FOR TRAINING AND EVALUATION
Hans-Jochen Wunschmann *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 14 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19820# Institute of Aviation Medicine, Farnborough (England).
REAL-TIME SIMULATION: AN INDISPENSABLE BUT OVERUSED EVALUATION TECHIQUE
V. David Hopkin and A. J. McClumpha *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 6 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19821# Elektronik-System G.m.b.H., Munich (West Germany).
DESIGN AND SIMULATION OF A C3 SYSTEM FOR SURVEILLANCE PURPOSE
Franz Herzmann and Helmut Sanders *In* AGARD Modelling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19822# Royal Signals and Radar Establishment, Malvern (England).
SIMBOX: A GENERAL PURPOSE DEFENSE SYSTEMS SIMULATOR
B. Davy *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 8 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19823# Mitre Corp., Bedford, Mass.
THE APPLICATION OF MODELING AND SIMULATION TO THE DEVELOPMENT OF THE E-3A
A. R. Shanahan *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 14 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19824# Analytic Sciences Corp., Reading, Mass.
E-3A NAVIGATIONAL COMPUTER SYSTEM REAL-TIME ENVIRONMENTAL SIMULATOR
Richard D. Healy and Samuel Newman *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 8 p refs Prepared in cooperation with NADC, Warminster, Pa. (For primary document see N80-19809 10-59)
(Contract N62269-79-C-0020)
Avail: NTIS HC A24/MF A01

N80-19825# Boeing Aerospace Co., Seattle, Wash.
A JTIDS PERFORMANCE MODEL FOR THE E-3A
James G. Taylor *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19826# Marconi Space and Defence Systems Ltd., Hillend (Scotland).
A MISSION TRAINING SIMULATOR FOR THE NIMROD MR MK 2 AND SOME ASPECTS OF THE DERIVATION AND VERIFICATION OF ITS SYSTEM MODELS
K. Wells *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 6 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19833# Institute for Defense Analyses, Arlington, Va. Systems Evaluation Div.
USE OF SIMULATION IN THE EVALUATION OF THE IFFN PROCESS
J. E. Freedman and S. H. Starr *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 20 p ref (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19834# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
AIR-TO-AIR ENGAGEMENT SIMULATION
Goetz Wunderlich and Roland Braun *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 14 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19835# Mitre Corp., Bedford, Mass.
THE MITRE INTERACTIVE COMMUNICATIONS ANALYSIS PROGRAM (MICAP)
John M. Ruddy *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 22 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19836# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
NEW POSSIBILITIES OFFERED BY A RADIO-INERTIAL HYBRID GUIDANCE SYSTEM DIGITAL SIMULATION STUDY [NOUVELLES POSSIBILITIES OFFERTES PAR UN SYSTEME DE GUIDAGE HYBRIDE RADIO - INERTIEL ETUDIE EN SIMULATION NUMERIQUE]
D. Buisson, J. Irvoas, and J. Grossin *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 25 p In FRENCH, ENGLISH summary refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19841# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
FIRE CONTROL FOR AIR-TO-AIR GUNNERY IN HIGH PERFORMANCE FIGHTER AIRCRAFT
Hans W. Pongratz *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 13 p (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19842# Electronique Marcel Dassault, St. Cloud (France).
SIMULATION FOR INTEGRATION WITH DYNAMIC TESTS OF THE LOGICAL ELEMENTS OF PRINCIPAL ONBOARD COMPUTERS [SIMULATEUR POUR INTEGRATION AVEC TESTS DYNAMIQUES DES LOGICIELS DE CALCULATEURS ENTRAUX EMBARQUES]
E. Bouthors *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 11 p In FRENCH (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19844# National Aerospace Lab., Amsterdam (Netherlands).
A FLIGHT SIMULATION INVESTIGATION ON THE FEASIBILITY OF CURVED APPROACHES UNDER MLS GUIDANCE
L. J. J. Erkelens *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 18 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19845# Boston Univ., Mass.
MODELING AND FLIGHT SIMULATION OF AN ACTIVE CONFIGURED AIRCRAFT UNDER M.L.S. GUIDANCE
A. Danesi, S. Smolka, and U. Chinappi *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 16 p Prepared in cooperation with Rome Univ., Italy (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19846# Naval Air Development Center, Warminster, Pa.
MODELING THE HUMAN OPERATOR: APPLICATIONS TO SYSTEM COST EFFECTIVENESS
Norman E. Lane, Melvin I. Strieb (Analytics, Inc., Willow Grove, Pa.), and Walter Leyland *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan.

1980 13 p refs (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

N80-19847# Naval Air Development Center, Warminster, Pa.
PREDICTING FIELD OF VIEW REQUIREMENTS FOR VSTOL AIRCRAFT APPROACH AND LANDING
Paul M. Linton and Warren F. Clement *In* AGARD Modeling and Simulation of Avionics Systems and Command, Control and Commun. Jan. 1980 17 p refs Prepared in cooperation with Systems Technology, Inc., Mountain View, Calif. (For primary document see N80-19809 10-59)
Avail: NTIS HC A24/MF A01

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-19925 Pittsburgh Univ., Pa.
GENERALIZATIONS OF COMPACTNESS AND CARDINAL INVARIANTS OF SPACES Ph.D. Thesis
Mohammad Ismail 1979 108 p
Avail: Univ. Microfilms Order No. 8004861

The relationships among the cardinal invariants of topological spaces and also among properties such as countable tightness, sequential, and first countability for compact Hausdorff and related spaces are investigated. The concept of left-separated spaces is considered along with basic properties. The spaces of pointwise countable type, k-spaces, and sequential spaces are examined along with their cardinal variants. The invariants of homogeneous spaces and topological groups of pointwise countable type and the spaces in which countably compact sets are closed are also studied. Hereditary properties are examined. Results are presented and discussed. Dissert. Abstr.

N80-19926# South Carolina Univ., Columbia. Dept. of Mathematics Computer Science and Statistics.
ON THE WEAK LAW OF LARGE NUMBERS D(0,1): Interim Report
Robert Lee Taylor Jun. 1979 14 p refs
(Contract F49620-79-C-0140)
(AD-A078130; AFOSR-79-1038TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Weak laws of large numbers are obtained for random elements in D(0,1) where the convergence is in the sup-norm topology. For identically distributed random elements satisfying a compact integral condition, the weak law of large numbers holding pointwise is shown to be necessary and sufficient for the weak law of large numbers. In addition to a discussion of the compact integral condition, a weak law of large numbers is obtained for monotone increasing random elements, and convergence of weighted sums of independent, identically distributed random elements is obtained. GRA

N80-19927# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Labs.
DIFFERENTIAL GEOMETRY, SURFACE PATCHES AND CONVERGENCE METHODS
W. E. L. Grimson Feb. 1979 39 p refs
(Contract N00014-75-C-0643; Grant NSF MCS-77-07569)
(AD-A078061; AI-M-510) Avail: NTIS HC A03/MF A01 CSCL 06/4

The problem of constructing a surface from the information provided by the Marr-Poggio theory of human stereo vision is investigated. It is argued that not only does this theory provide explicit boundary conditions at certain points in the image, but that the imaging process also provides implicit conditions on all other points in the image. This argument is used to derive conditions on possible algorithms for computing the surface. Additional constraining principles are applied to the problem; specifically that the process be performable by a local-support parallel network. Some mathematical tools, differential geometry, Coons surface patches and iterative methods of convergence, relevant to the problem of constructing the surface are outlined. Specific methods for actually computing the surface are examined. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-19928 British Broadcasting Corp., Kingswood (England). Research Dept.
SURFACE ACOUSTIC WAVES: EXPERIMENTAL DEVICE FABRICATION
A. Roberts and K. Hacking Dec. 1979 18 p refs
(BBC-RD-1979/29) Avail: BBC, Kingswood Warren, Tadworth, Surrey, Engl.

An experimental surface acoustic wave (SAW) device production technique developed, using a steeping camera and safe chemical process is described. Devices can be made, operating in the frequency range from 15 to 100 MHz on a variety of piezoelectric substrates. Delays, frequency filters, and resonators are the most common device, but convolvers, dispersive filters, and many other types can be produced. The camera has proved accurate and reliable; its operation is automatically controlled from a punched data tape. The chemical processes require a high standard of care and cleanliness to achieve consistent results, but are capable of producing working devices up to 100 MHz. The stepping camera and the chemical processes are described, together with a brief introduction to the subject of surface acoustic waves. J.M.S.

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-19929*# Nebraska Univ. - Lincoln. Behlen Lab. of Physics.
DISSOCIATIVE AND DOUBLE PHOTOIONIZATION OF CO2 FROM THRESHOLD TO 90 A
Toshio Masuoka and James A. R. Samson [1979] 36 p
(Grant NGR-28-004-021)
(NASA-CR-162844) Avail: NTIS HC A03/MF A01 CSCL 20H

The molecular photoionization, dissociative photoionization and double photoionization cross sections for CO2 were measured from their onsets down to 90 A by using various combinations of mass spectrometers (a coincidence time-of-flight mass spectrometer and a magnetic mass spectrometer) and light sources (synchrotron radiation, and glow and spark discharge). It is concluded that the one broad peak and the three shoulders in the total adsorption cross section curve between 640 and 90 A are caused completely by dissociative ionization processes. Several peaks observed in the cross section curve for the total fragmentation CO(+)3, O(+) and C(+) are compared with those in the photoelectron spectrum reported for CO2. A.R.H.

N80-19930# Brookhaven National Lab., Upton, N. Y.
CLUSTER EFFECTS ON CHARGE STATE DISTRIBUTIONS FOR HEAVY ION MOLECULAR BEAMS
P. Thieberger 1979 11 p refs
(Contract EY-76-C-02-0016)
(BNL-26765) Avail: NTIS HC A02/MF A01

The charge state distributions of ions emerging from carbon foils, compared for equal velocity monoatomic and polyatomic negative ions incident on the foil are discussed. Such compari-

sons were performed for O2(-) vs O(-) and for C3(-) vs C(-) and C4(-) vs C(-). Measured charge state distributions are shown for carbon and oxygen respectively and how the observed effect varies with foil thickness for the oxygen case. In all cases, the distribution is shifted toward lower average charge states for the molecular beams and the effect persists even though attenuated up to and including the thickest foils used. The most straightforward interpretation of these results is that for each component of the cluster there are more correlated electrons available for pickup than for single ions. DOE

N80-19931# Washington Univ., Seattle.
FIELD THEORY OF PION-NUCLEUS INTERACTIONS
G. A. Miller 1979 7 p refs Presented at Ann. Conf. of the Am. Inst. of Physics, Houston, Tex., Feb. 1979
(Contract EY-76-C-06-1388)
(DOE/ER-01388-775; RLO-1388-775; CONF-790242-1) Avail: NTIS HC A02/MF A01

Some approximate solutions of the Low equations for pi-nucleon scattering, pi-nuclear scattering and the pp yields d pi(+) reaction are discussed. Results differ from those of other treatments by the inclusion of propagator modifications which act as cutoffs for terms involving pions of relatively small momenta. Because of these propagator modifications the use of a pi-nucleon T-matrix of long range is perfectly consistent with the idea that the fundamental pi-nucleon form factor is of very short range. The origin of these propagator modifications is shown to be a proper evaluation of the energy dependence of the off-shell pi-nucleon scattering amplitude. As a consequence of the theory, good agreement with pp yields d pi(+) data is obtained without the inclusion of large effects from rho-meson exchange terms. DOE

N80-19932# Virginia Univ., Charlottesville.
EXPERIMENTS ON THE NUCLEAR INTERACTIONS OF PIONS Progress Report, 1 Dec. 1979 - 30 Nov. 1980
R. C. Minehart and K. O. H. Ziock 1979 21 p refs
(Contract EY-76-S-05-4043)
(ORO-4043-39) Avail: NTIS HC A02/MF A01

Research on pion reactions is reported. A list of publications and an abstract of given reports are presented. A number of abstracts of talks to be given at meetings are included. Topics addressed include the elastic scattering of pions, pion quasifree scattering on cadmium isotopes, and pion double charge exchange on calcium isotopes. A.W.H.

N80-19933# Stanford Linear Accelerator Center, Calif.
NUCLEAR PHENOMENA AND THE SHORT DISTANCE STRUCTURE OF HADRONS
S. J. Brodsky Sep 1979 47 p refs
(Contract EY-76-C-03-0515)
(SLAC-Pub-2395) Avail: NTIS HC A03/MF A01

Topics involving nuclear collisions and their relation to aspects of quantum chromodynamics are discussed. These include: hadronic production in hadron-nucleus, lepton-nucleus, and nucleus-nucleus collisions; the question of shadowing in deep inelastic nuclear reactions; and the structure of the nuclear wave function at very short distances. A.W.H.

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-19934 Colorado Univ. at Boulder.
THE ELASTIC AND INELASTIC SCATTERING OF 0.8 GeV PROTONS BY Y-89 AND Zr-90 Ph.D. Thesis
Nicholas Joseph DiGiacomo 1979 253 p
Avail: Univ. Microfilms Order No. 8002967

The optical model and collective model DWBA approach to proton elastic and inelastic scattering was extended to momentum tranfer of four inverse Fermis. Elastic and inelastic proton scattering data at 0.8 GeV were taken on the middle mass nuclei Y-89 and Zr-90 with the high resolution spectrometer. The data were analyzed within the optical model and collective model DWBA and the results compared to similar analyses performed at projectile energies of 18 to 180 MeV. Approximations made in the theory to include relativistic effects were tested. The energy dependence of the projectile-nucleus empirical optical potential was clarified and a detailed optical model analysis of the elastic scattering was performed. The elastic and inelastic cross sections were found to be insensitive to the inclusion of spin orbit effects. Dissert. Abstr.

N80-19935*# United Technologies Corp., East Hartford, Conn.
ARGON/UF6 PLASMA EXPERIMENTS: UF6 REGENERATION AND PRODUCT ANALYSIS
Ward C. Roman Washington NASA Mar. 1980 93 p refs
(Contract NAS1-14329)
(NASA-CR-3258) Avail: NTIS HC A05/MF A01 CSCL 20I

An experimental and analytical investigation was conducted to aid in developing some of the technology necessary for designing a self-critical fissioning uranium plasma core reactors (PCR). This technology is applicable to gaseous uranium hexafluoride nuclear-pumped laser systems. The principal equipment used included 1.2 MW RF induction heater, a d.c. plasma torch, a uranium tetrafluoride feeder system, and batch-type fluorine/UF6 regeneration systems. Overall objectives were to continue to develop and test materials and handling techniques suitable for use with high-temperature, high-pressure, gaseous UF6; and to continue development of complementary diagnostic instrumentation and measurement techniques to characterize the effluent exhaust gases and residue deposited on the test chamber and exhaust system components. Specific objectives include: a development of a batch-type UF6 regeneration system employing pure high-temperature fluorine; development of a ruggedized time-of-flight mass spectrometer and associated data acquisition system capable of making on-line concentration measurements of the volatile effluent exhaust gas species in a high RF environment and corrosive environment of UF6 and related halide compounds. A.R.H.

N80-19936# Naval Research Lab., Washington, D. C.
THEORY OF THE RESISTIVE HOSE INSTABILITY IN RELATIVISTIC ELECTRON BEAMS
Han S. Uhm and Martin Lampe 26 Nov. 1979 48 p refs
(ARPA Order 3718)
(AD-A078189; NRL-MR-4111) Avail: NTIS HC A03/MF A01 CSCL 20/7

A Vlasov-Maxwell theory of the resistive hose instability is developed for an infinitely long relativistic electron beam propagating parallel to an applied axial magnetic field. Complete space charge neutralization by the ambient plasma, and paraxial flow (p(z)p:2 >> p(r)p:2 + p(theta)2 mu) are assumed. The analysis is performed for rigid-rotor and cold laminar flow equilibria. An integro-differential eigenvalue equation is obtained for the general case, and is reduced to an ordinary differential equation in either the cold laminar flow limit or the case of a square beam density profile. Using a variational technique, an approximate dispersion relation is found for arbitrary density profile, and evaluated in closed form for either the Bennett or square profile. Stability properties are illustrated and discussed in detail for a square profile, including the influence of the applied magnetic field (stabilizing), proximity to a conducting guide (stabilizing), and partial current neutralization (destabilizing). GRA

N80-19937# Los Alamos Scientific Lab., N. Mex. Health Research Div.
NUCLEAR WASTE MANAGEMENT TECHNOLOGY DEVELOPMENT ACTIVITIES Progress Report, Jan. - Dec. 1978
L. J. Johnson, comp. and B. H. Desilets, comp. Jun. 1979 75 p refs
(Contract W-7405-eng-36)
(LA-7921-PR) Avail: NTIS HC A04/MF A01

Development and application of assay instrumentation for measuring the radioactivity content of waste packages is reported. Work in developing test materials and laser-based instrumentation for in-place testing of high-efficiency particulate aerosol filters is discussed. Development and demonstration of a controlled air incinerator for treatment of radioactively contaminated combustible waste is described. Field data from the environmental geology

and hydrology aspect of shallow earth disposal of radioactively contaminated waste are reviewed and related to improvement of land burial technology. DOE

N80-19938# Washington Univ., Seattle. Dept. of Physics.
TESTING QUANTUM CHROMODYNAMICS IN ELECTRON-POSITRON ANNIHILATION AT HIGH ENERGIES
L. S. Brown 1979 13 p refs Presented at Orbis Scientiae 1979 Conf., Coral Gables, Fla., 15 Jan. 1979
(Contract EY-76-C-06-1388)
(DOE/ER-01388-777; RLO-1388-777; CONF-790150-6) Avail: NTIS HC A02/MF A01

Various measures of the distribution of hadronic energy produced in high energy electron-position annihilation provide precise tests of the promising fundamental theory of hadronic physics, quantum chromodynamics. Recent work on such energy cross section is reviewed. DOE

N80-19939# Battelle Pacific Northwest Labs., Richland, Wash.
STRESS ANALYSIS OF HIGH-LEVEL WASTE CANISTERS: METHODS, APPLICATIONS, AND DESIGN DATA
F. A. Simonen and S. C. Slate Oct. 1979 156 p refs
(Contract EY-76-C-06-1830)
(PNL-3036) Avail: NTIS HC A08/MF A01

An overview of stress analysis methods, structural design procedures, and design data is presented for canisters used to package solidified wastes, particularly borosilicate glass. In addition, waste processing, canister materials, fabrication and inspection methods, and performance testing are summarized. Sources of stress in canisters are lifting and handling loads, internal pressure, high temperature filling operations, transient heating and cooling, differential thermal expansions of canisters and glass, and impact loadings from low probability accidents. Results of case studies that illustrate applicable methods of stress analyses are presented for these sources of stress. Results of a test program to measure the creep strength of candidate canister materials are described. Methods to predict residual stress in the walls of waste canisters are discussed. DOE

74 OPTICS

Includes light phenomena.

N80-19940 Carnegie-Mellon Univ., Pittsburgh, Pa.
INTEGRATED OPTICS FOR RF SPECTRUM ANALYSIS AND ACOUSTIC MICROSCOPY FOR THE STUDY OF MATERIAL JOINTS Ph.D. Thesis
Chin Chung Lee 1979 204 p
Avail: Univ. Microfilms Order No. 8003407

Two topics in the areas of integrated optics and acoustic microscopy are discussed. The first topic investigates a number of novel integrated acoustooptics approaches for real time rf spectrum analysis. The second topic explores the utilization of scanning acoustic microscopy for the study of solid material joints, bonds, and composite. Both studies are carried out theoretically and experimentally. Dissert. Abstr.

N80-19941# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
THEORY OF EDGE DETECTION
D. Marr and E. Hildreth Apr. 1979 64 p refs
(Contract N00014-75-C-0643; Grant NSF MCS-77-07569)
(AD-A078063; AI-M-518) Avail: NTIS HC A04/MF A01 CSCL 20/6

A theory of edge detection is presented. (1) Intensity changes, which occur in a natural image over a wide range of scales, are detected separately at different scales. At a given scale, this is best done by finding the zero-crossings of gradient-squared G(x,y) * (I(x,y) for image I, where G(x,y) is a two-dimensional gaussian distribution, and gradient-squared is the Laplacian. (2) The physical phenomena that give rise to the intensity changes are localized. This allows one to construct rules for combining information from the different scales into a primitive description of the image. A physiological model for zero-crossing detection is proposed. GRA

N80-19942*# Hughes Aircraft Co., Irvine, Calif.
FORECAST ANALYSIS OF OPTICAL WAVEGUIDE BUS PERFORMANCE Final Report, 1 May - 5 Oct. 1979
R. LeDesma and M. D. Rourke Oct. 1979 76 p refs Prepared for JPL
(Contract JPL-955200)
(NASA-CR-162851) Avail: NTIS HC A09/MF A01 CSCL 20F

Elements to be considered in the design of a data bus include: architecture; data rate; modulation, encoding, detection; power distribution requirements; protocol, work structure; bus reliability, maintainability; interterminal transmission medium; cost; and others specific to application. Fiber- optic data bus considerations for a 32 port transmissive star architecture, are discussed in a tutorial format. General optical-waveguide bus concepts, are reviewed. The electrical and optical performance of a 32 port transmissive star bus, and the effects of temperature on the performance of optical-waveguide buses are examined. A bibliography of pertinent references and the bus receiver test results are included. A.R.H.

N80-19943# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
INTELLIGENT TRACKING TECHNIQUES Quarterly Report, 1 Jan. - 30 Mar. 1979
Thomas J. Willett 30 Mar. 1979 101 p refs
(Contract DAAK70-78-C-0167)
(AD-A077869; QR-2) Avail: NTIS HC A05/MF A01 CSCL 17/5

This is the Second Quarterly Report under a contract to investigate the design, test, and implementation of a set of algorithms to perform intelligent tracking and intelligent target homing on FLIR and TV Imagery. The intelligent tracker will monitor the entire field of view, detect and classify targets, perform multiple target tracking and predict changes in target signature prior to the target's entry into an obscuration. The intelligent tracking and homing system will also perform target prioritization and critical aimpoint selection. The intelligent tracker was defined in terms of its functions and a systems analysis of those functions led to a set of constraints. Analysis of the intelligent tracker embedded in AAH, RPV, PGM scenarios provided additional system requiremnts and goals. The base line frame to frame tracker was described and a number of variations. An effort was devoted to restucture the segmentation algorithms to sharpen their ability to segment small targets (4 lines high) in heavy clutter. Target signature prediction was analyzed in terms of two examples from the NV and EOL TV data base. Also included is a description of the NV and EOL TV data base. GRA

N80-19944# Eikonix Corp., Burlington, Mass.
ANALYTICAL STUDIES OF PHASE ESTIMATION TECHNIQUES, VOLUME 1 Final Technical Report, Sep. 1977 - Nov. 1978
R. Childlaw, A. Devaney, and R. Gonsalves Griffiss AFB, N.Y. RADC Sep. 1979 121 p
(Contract F30602-77-C-0176; ARPA Order 3223)
(AD-A078006; EC/2107401-TR-1-Vol-1;
RADC-TR-79-221-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 20/6

The phase retrieval problem consists of the wave aberration function of an optical system from intensity measurements made in the image plane. An adaptive optical system may then be corrected for the aberration to yield improved performance. Several algorithms for performing phase retrieval are discussed and the results of computer simulations are presented. The sensitivity of the algorithms with respect to type and magnitude of aberrations, image plane detector dimensions and noise levels, non-monochromaticity of incident radiation and the structured target objects is investigated. Results demonstrate the practicality of phase retrieval. GRA

N80-19945# Visidyne, Inc., Burlington, Mass.
BACKGROUND OPTICAL SUPPRESSION SYSTEM (BOSS)
O. Shepherd, T. F. Zehnpfennig, Saul Rappaport, and W. P. Reidy Hanscom AFB, Mass. AFGL 10 Oct. 1979 76 p refs
(Contract F19628-79-C-0005; AF Proj. 7670)
(AD-A077871; VI-493; AFGL-TR-79-0243; SR-2) Avail: NTIS HC A05/MF A01 CSCL 20/6

A background optical suppression scheme utilizing a double-beam interferometer-spectrometer with coaligned beams and tailored modulation, transfer functions is presented. The system is designed to enhance the detectability of localized sources in the presence of strong spatially structured background in the IR region of the spectrum. The principles of the double-beam interferometer, several different schemes for tailoring the system MTF, and the results of calculations of the signal-to-noise for a variety of MTFs and types of backgrounds, are discussed. The optical, mechanical and electrical components of the Visidyne laboratory double-beam interferometer are described. The data system and laboratory test source are also discussed. Laboratory measurements demonstrating the spatial and spectral filtering capabilities are presented. GRA

N80-19946# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

SOME PROPERTIES OF DISCONTINUITIES IN THE IMAGE IRRADIANCE EQUATION

Anna R. Bruss Apr. 1979 43 p refs

(Contract N00014-75-C-0643)

(AD-A078062; AI-M-517) Avail: NTIS HC A03/MF A01 CSCL 20/6

The image irradiance equation is a first-order partial differential equation. Part of this paper is a comprehensive guide to solving this kind of equation. The special structure of the image irradiance equation is explored in order to understand the relation of discontinuities in the surface properties and in the image intensities. GRA

N80-19947# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.

DEFT: ADVANCED STRUCTURES AND APPLICATIONS Final Report, 10 Jun. 1977 - Mar. 1979

Stephen T. Kowel, Phillipp G. Kornreich, Amaresh Mahapatra, Dennis Cleverly, and Thomas Szebenyi 30 Jun. 1979 112 p refs

(Contract DAAG53-76-C-0162)

(AD-A075373; TR-79-12) Avail: NTIS HC A06/MF A01 CSCL 17/8

During the period covered by this report, major progress was achieved in several areas, including the CdS sensor, light valve, and applications. The major impetus to this work is the desirability of a real-time, programmable sensor for use in image and signal processing. The basic result from any of these devices is a detected electronic signal current. The 30 MHz CdS/LiNbO3 sensor can now be routinely fabricated as a monolithic structure, using a metallized polymer pedestal for sampling. This permits the device to be incorporated in a camera-like box with a highly convergent commercial lens for use under typical incoherent illumination conditions. Extensive effort has led to the successful operation of both 35 MHz and 100 MHz devices based on our experience with the 30 MHz structure. Beyond the extra care required during the photolithography in order to obtain the three-fold increase in resolution, we had to overcome an excessively large acoustic loss encountered at the higher frequencies. GRA

N80-19948# Morgan Semiconductor, Inc., Garland, Tex.

GE-SI SUPERSONIC FLIR WINDOW Final Report, 1 Jul. 1978 - 31 Mar. 1979

A. R. Hilton Jul. 1979 49 p

(Contract F33615-78-C-5105)

(AD-A078371; AFML-TR-79-4085) Avail: NTIS HC A03/MF A01 CSCL 17/5

The purpose of the program was to evaluate the infrared optical properties and related physical properties of melt formed Germanium-Silicon alloys as potential supersonic FLIR window materials. The approach was to combine the infrared transparency of germanium with the excellent physical properties of silicon to produce a window material capable of withstanding the temperature excursions and rain drop impact occuring during supersonic flight. Attention was confined to alloys with silicon content below 50 atom % to avoid the intrinsic lattice absorption that occurs at 9 micrometers in the infrared for silicon or silicon rich alloys. A zone levelling technique was selected and modified in a manner expected to yield materials free of oxide absorption. A melt form method was selected rather than vapor phase because of the potential problems in scaling up to produce large FLIR windows. Unfortunately, the growth of alloy compositions with silicon content above 5% proved to be impossible to do at least under the operating conditions and with the equipment used. Major problems were long term temperature stability, zoning rates and reactivity of the molten alloys with quartz boats and ampoules. Although the concentration range up to 50 atom % silicon was covered, infrared transmission was not obtained for any compositions with silicon content above 5 atom%. Rain erosion samples were submitted for evaluation covering five compositions. Discussions related to the best Ge-Si alloy composition for FLIR applications are presented along with a projection of the related physical-optical parameters expected for that composition. GRA

N80-19949# Cincinnati Univ., Ohio. Solid state Electronics Lab.

OPTICAL CHANNEL WAVEGUIDE ARRAYS COUPLED TO INTEGRATED CHARGE-COUPLED DEVICES AND THEIR APPLICATIONS Interim Report

J. T. Boyd and D. A. Ramey 1979 25 p refs

(Grants AF-AFOSR-3032-76; NSF ENG-76-17145; AF Proj. 2305)

(AD-A077394; AFOSR-79-1124TR) Avail: NTIS HC A02/MF A01 CSCL 17/8

Device configurations of optical channel waveguide arrays coupled to integrated charge-coupled devices (CCDs) will be presented. Optical and electrical performance of these devices will be discussed. A channel waveguide array formed in a fan-out pattern is then introduced as a means of enhancing optical waveguide focal plane resolution in integrated optical devices utilizing optical waveguide lenses. High spatial resolution can thus be obtained without making detector spacings too small, thus avoiding detector problems with regard to fabrication, cross talk linearity and charge transfer efficiency. To fabricate the fan-out channel waveguide array, a new differential heating and photoresist lift-off process is discussed which allows high resolution patterns to be reproducibly formed in polyurethane. Propagation of light from a HeNe laser in these fan-out channel waveguide arrays has been demonstrated with only a small amount of scattering. Low scattering is consistent with the smooth channel waveguide surfaces apparent in scanning electron microscope pictures presented. Applications of optical channel waveguide arrays coupled to integrated CCDs to fiber multiplexing and transversal filtering will also be discussed. GRA

N80-19950# University of Central Florida, Orlando. Dept. of Mathematics and Statistics.

SOME MODELS FOR VISIBILITY Technical Report, 1 Sep. 1978 - 30 Jun. 1979

Paul N. Somerville, Steven J. Bean, and Sherrill Falls Jun. 1979 44 p refs

(Contract F19628-77-C-0080; AF Proj. 6670)

(AD-A075490; AFGL-TR-79-0144; SK-3) Avail: NTIS HC A03/MF A01 CSCL 04/2

Models for predicting the climatological probability of visibility less than a given number of miles at a given time and for twenty-two diverse locations are developed. The two parameter Weibull distribution is used. The first models require the two parameter values for each month and three hour periods of the day (96 sets of two parameters) for each station. The second models are general models, and for each station the two parameters are polynomial functions of the month and time of day. Estimates of the amount of error to be expected when using the models are given. GRA

N80-19951# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

DISPLAY WORKING GROUP JOINT DARCOM/NMC/AFLC/AFSC PANEL ON THE FIELD OF NIGHT VISION TECHNOLOGY Interim Summary Report

William N. Kama, Wayne L. Martin, and Gilbert G. Kuperman Oct. 1979 371 p refs Workshop held in San Diego, Calif., 16-18 Jan. 1979

(AF Proj. 7184)

(AD-A077061; AMRL-TR-79-101) Avail: NTIS HC A16/MF A01 CSCL 17/5

The purpose of this workshop was to define the doctrinal

and system requirements driving advanced display technology for next generation FLIR applications. To achieve this purpose, seven sessions were conducted. Four were tutorial in nature and three were discussion forums. The tutorial sessions (Sessions 1, 2, 3, and 6) covered the topics of mission/doctrine requirements, system requirements, human factors and sensor/display state-of-the-art. The discussion sessions (Sessions 4, 5, and 7) provided the attendees with the opportunity to interact with one another as well as to enter into informative and effective dialogue. Session 4 served as a 'question and answer' period for topics covered in the first three sessions; Session 5 covered the topic of defining common terms used within the sensor/display community and developing standardized image measurement techniques; while Session 7 served as a summary session whereby attendees attempted to summarize what had transpired at the Workshop. This report documents, in a concise and coherent manner, the proceedings that occurred during the conduct of this workshop. A summary of each session is provided along with summary papers and associated presentation materials submitted by participants. GRA

N80-19952# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Sciences.
DEVELOPMENT OF QUASI-HOMOGENEOUS OPTICAL SOURCES. Final Report, 1 Jan. - 31 Dec. 1978
Lorenzo M. Narducci. 1 Nov. 1979. 37 p. refs.
(Grant DAAG29-78-G-0098)
(AD-A079297; ARO-16054.2-A-P) Avail: NTIS
HC A03/MF A01 CSCL 20/6

This report summarizes our theoretical and experimental findings. It is divided into 4 sections. Section 1 contains a general introduction to the problem of partially coherent sources. Section 2 summarizes the main known results on Schell model and quasi-homogeneous sources. Section 3 contains a description of the experimental set up and of the accuracy of the instrumentation. Section 4 is a preprint of a recently submitted paper unauthored jointly with Dr. E. Collett and detailing the main experimental results obtained under ARO support. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-19953# Nagoya Univ. (Japan).
[CONFINEMENT AND HEATING OF HOT PLASMAS IN A HYBRID SYSTEM OF TOKAMAK AND STELLARATOR] Annual Review, Apr. 1978 - Mar. 1979
1979. 211 p. refs.
(ISSN-0547-1567) Avail: NTIS HC A10/MF A01

Activities reported relate to J.I.P.P. T-2 experiments; high beta pinch plasmas; radio frequency containment; high energy beam experiments; the Nagoya bumpy torus; laser-produced plasmas; basic experiments in plasma physics; atomic processes; technology and applied plasma physics; and plasma theory and computations. Additional information is provided on the computer center, the research information center, and common facilities including the technical services division, and the 125 MVA flywheel power supply facility. A list publications from April '78 to March '79 is included. A.R.H.

N80-19954*# Stanford Univ., Calif.
LANGMUIR PROBE MEASUREMENTS OF DOUBLE-LAYERS IN A PULSED DISCHARGE
J. S. Levine and F. W. Crawford. Mar. 1980. 48 p. refs.
(Grants NGL-05-020-176; NSF ATM-78-08440)
(NASA-CR-162845; SU-IPR-807) Avail: NTIS
HC A03/MF A01 CSCL 20I

Langmuir probe measurements were carried out which confirm the occurrence of double-layers in an argon positive column. Pulsing the discharge current permitted probe measurements to be performed in the presence of the double-layer. Supplementary evidence, obtained from DC and pulsed discharges, indicated that the double-layers formed in the two modes of operation were similar. The double-layers observed were weak and stable; their relation to other classes of double-layers are discussed, and directions for future work are suggested. Author

N80-19955# Indiana Univ. at Bloomington. Dept. of Chemistry.
CHARACTERISTICS OF THE BACKGROUND EMISSION SPECTRUM FROM A MINIATURE ICP. Ph.D. Thesis. Interim Report
R. N. Savage and G. M. Hieftje. 26 Nov. 1979. 22 p. refs.
Submitted for publication.
(Contract N00014-76-C-0838; Grants NSF CHE-76-10896; NSF CHE-77-22152)
(AD-A077876; TR-22; TR-28) Avail: NTIS HC A02/MF A01
CSCL 20/9

The spectral characteristics of the background radiation emitted by a miniature inductively coupled plasma are carefully examined and methods for reducing undesirable features discussed. Also investigated are the influences that several important experimental parameters, such as coolant tube length, RF power and coolant and nebulizer gas flow rates have on plasma background emission. The complex nature of the mini-ICP's background emission spectrum indicates that careful line selection criteria and background correction procedures be employed. Extending a torch's coolant tube to the bottom of the region being observed in the plasma proved to be the most effective method for reducing inexpedient spectral features. Acute changes in background emission levels with RF power and nebulizer gas flow rates indicate the need for careful control of these parameters to achieve high precision. Importantly, a comparison between mini-ICP and conventional ICP spectra reveals the basic similarity of the two sources. GRA

N80-19956# Naval Research Lab., Washington, D. C. Plasma Theory Branch.
A THEORY OF ANOMALOUS ABSORPTION, BACKSCATTER AND FLUX LIMITATION IN LASER PRODUCED PLASMAS. Interim Report
D. G. Colombant and W. M. Manheimer. 11 Oct. 1979. 68 p. refs.
(NRL Proj. 67H02-58a)
(AD-A075350; NRL-MR-4083) Avail: NTIS
HC A04/MF A01 CSCL 20/9

Fluid simulations of laser light absorption and backscatter are presented for various laser irradiances, wavelengths, target materials, laser pulse lengths and simulated prepulse conditions. Physical processes included in the model are inverse bremsstrahlung, resonant absorption, absorption by ion-acoustic fluctuations, and Brillouin backscatter. For the anomalous processes, self-consistent transport coefficients are derived and used throughout the time-dependent, one-dimensional code. Flux limitation is thus taken into account as a result of the physical processes included. Interplay between the various absorption mechanisms and backscatter are uncovered in this study. Comparisons with experiments are presented and suggestions for further experiments are made. GRA

N80-19957# Naval Research Lab., Washington, D. C. Plasma Physics Div.
THEORY OF ELECTRON CYCLOTRON RESONANCE HEATING OF TOKAMAK PLASMAS
Edward Ott, Bertram Hui, and K. R. Chu. 19 Sep. 1979. 70 p. refs. Sponsored by DOE.
(AD-A075362; NRL-MR-4028) Avail: NTIS
HC A04/MF A01 CSCL 18/1

A theoretical study of Tokamak plasma heating by the electron cyclotron resonance is presented. The density limitations imposed by accessibility are first reviewed. Then the predictions of linear theory (including relativistic effects on the wave absorption) are examined via solution of the ray equations in a toroidal Tokamak equilibrium. These solutions indicate quite favorable characteristics for large Tokamaks. Finally, the possibilities of scattering of the incident heating wave by existing drift-wave-type fluctuations and of parametric instability are examined; it is tentatively concluded that parametric instabilities and wave scattering should not be important in typical situations of interest. GRA

N80-19958*# Naval Research Lab., Washington, D. C. Upper Air Physics Branch.

MAGNETOSHEATH EFFECTS ON CYLINDRICAL LANGMUIR PROBES
Edward P. Szuszczewicz and Peter Z. Takacs 23 Oct. 1979 21 p refs Revised
(NASA Order W-14252)
(NASA-CR-162852; AD-A077043; NRL-MR-3683-Rev) Avail: NTIS HC A02/MF A01 CSCL 20/9

The response of cylindrical Langmuir probes in magnetoplasmas is studied from a perspective which focuses on the relative magnitudes of Larmor radius and sheath size. The approach results in a classification for magnetic field effects which involves not only the magnetic field strength but also the plasma parameters of density, temperature, and the applied probe potential. We specifically show that a 0.25 G field can have similar effects on the current collection properties of the probe in an ionospheric plasma N sub e approx. = 1,000,000/cu cm. as a 30 kG field would have in a hot, dense laboratory plasma N sub e approximately = 10 to the 15th power/cu. cm. The classifications are found to agree with new experimental results collected in an ionospheric plasma. The data also show: the effects of probe orientation on electron current collection from magnetoplasmas; that these effects can be important even when the electron Larmor radius is larger than the radius of the probe; and that substantial magnetic field effects occur when the probe's sheath is comparable to or greater than the Larmor radius. GRA

N80-19959# California Univ., Livermore. Lawrence Livermore Lab.
MAGNETIC MIRROR CONFINEMENT OF HIGH-ENERGY, HIGH-DENSITY PLASMA
F. H. Coensgen and T. C. Simonen 21 Aug. 1979 18 p refs
(Contract W-7405-eng-48)
(UCRL-82790) Avail: NTIS HC A02/MF A01

The confinement in single-cell magnetic mirror systems of plasmas close to thermonuclear conditions is discussed. The injection of low energy plasma is shown to suppress microinstabilities to sufficiently low levels that high-beta (beta approximately = 1) plasmas can be achieved and sustained by cross field injection of beams of neutral particles. Plasma confinement is found to improve with ion energy, electron temperature, and plasma size. Design parameters of a large mirror fusion test facility, designed to pursue confinement scaling to higher energies and larger plasma dimensions, are briefly reviewed. DOE

N80-19960# Los Alamos Scientific Lab., N. Mex.
NORMAL IONIZING SHOCK AS A THETA PINCH PREIONIZER
A. DeSilva Oct. 1979 21 p refs
(Contract W-7405-eng-36)
(LA-8064-MS) Avail: NTIS HC A02/MF A01

The normal ionizing shock wave is considered as a potential preionizer for high density, high bias field theta pinches. Available experimental data is compared with the theory of Kunkel and Gross which was written for plane geometry. Limitations to the validity of the theory due to finite ionization rate, and to radial plasma drift are determined. DOE

N80-19961# California Univ., Livermore. Lawrence Livermore Lab.
CONSEQUENCES OF INTENSITY CONSTRAINTS ON INERTIAL CONFINEMENT FUSION
R. E. Kidder 13 Sep. 1979 18 p refs Presented at 5th Workshop on Laser Interaction, Rochester, N.Y., 5 Nov. 1979
(Contract W-7405-eng-48)
(UCRL-83342; CONF-791109-1) Avail: NTIS HC A02/MF A01

It is shown that the conflicting requirements of high implosion efficiency (low corona temperature) and adequate energy transport (high corona temperature) can, together with other effects, limit useful infrared light intensities to values on the order of 100 Tw/sq cm. Increased interest in ultraviolet lasers, and the entry of charged particle drivers in the inertial confinement fusion (ICF) competition are consequences of this limitation. Analytical results based on a simple model are presented which show how the gain of an ICF target is modified by the existence of an arbitrary intensity constraint. DOE

N80-19962# California Univ., Berkeley. Lawrence Berkeley Lab.
NONLINEAR WAVE EVOLUTION IN VLASOV PLASMA: A LIE-TRANSFORM ANALYSIS
John Robert Cary Aug. 1979 298 p refs
(Contract W-7405-eng-48)
(LBL-8185) Avail: NTIS HC A13/MF A01

Nonlinear wave evolution on Vlasov plasma is analyzed using the Lie transform, a mathematical tool which is applicable to Hamiltonian systems. Dewar's general Lie transform theory is explained and is used to construct Deprit's Lie transform perturbation technique. The basic theory is illustrated by simple examples. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-19963 Cornell Univ., Ithaca, N. Y.
INVESTIGATION OF HIGHER ORDER FORBIDDEN REFLECTIONS IN Si AND Ge USING SYNCHROTRON RADIATION Ph.D. Thesis
Dennis Martin Mills 1979 248 p
Avail: Univ. Microfilms Order No. 8003962

Exploiting the unique properties of synchrotron radiation produced at the 12 GeV Wilson synchrotron, the forbidden (442) and (622) reflections in silicon and germanium were detected and measured. The reflections, whose integrated intensities are 5 to 6 orders of magnitude smaller than allowed reflections, arise in diamond structure materials from two distinct effects: the antisymmetric charge distribution due to directional bonding and the anharmonic thermal motion of the nucleus. The antisymmetric scattering amplitudes obtained along with the Si (222) were compared to predicted values derived from the measured and calculated scattering amplitudes of allowed reflections in silicon and with values determined from band structure calculations. The degree of agreement depended on the calculational method used. General experimental techniques for use at synchrotron radiation sources and the particular merits of using synchrotron radiation for the measurement of extremely weak forbidden reflections are discussed. Dissert. Abstr.

N80-19964 Illinois Univ. at Urbana-Champaign.
PHOTODESORPTION OF GASES FROM METAL AND SEMICONDUCTOR SURFACES Ph.D. Thesis
Robert David Moore 1979 177 p
Avail: Univ. Microfilms Order No. 8004234

Molecular photodesorption from metal and semiconductor surfaces was investigated. The techniques employed to obtain adequate sensitivity made use of a chopped light beam and synchronous particle counting by means of a mass spectrometer. Definitive measurements of the photodesorption efficiencies of several molecular species (Co_2, CO, H_2, and CH_4) from a number of metals and semiconductors are presented. Dissert. Abstr.

N80-19965 Illinois Univ. at Urbana-Champaign.
CRYSTAL GROWTH AND PHASE STABILITY OF METASTABLE INDIUM ANTIMONIDE BISMIDE THIN FILMS Ph.D. Thesis
John Leon Zilko 1979 103 p
Avail: Univ. Microfilms Order No. 8004315

Single crystal metastable indium antimonide bismide thin films were grown on (110) GaAs substrates by multitarget sputtering (MTS). The solid solubility of InBi in InSb was increased from 2.6 mole percent found in equilibrium alloys to 12 mole percent for MTS deposited metastable alloys. Films were grown on a rotating substrate from stationary InSb and Bi sputtering targets such that one monolayer or less of material impinged on the substrate per target pass. The Group 5 in flux ratio was greater than, or equal to one. The elemental incorporation probabilities of In, Sb, and Bi during growth consisted of two terms, a thermal sticking probability term, and a term accounting for resputtering. Dissert. Abstr.

N80-19966# Princeton Univ., N. J. Joseph Henry Labs. of Physics.
WHY DO GLASSY MATERIALS POSSESS ENERGY GAPS
D. C. Licciardello Dec. 1979 14 p refs Prepared in cooperation with Bell Telephone Labs., Murray Hill, N.Y.
(Contract N00014-77-C-0711; Grant NSF DMR-78-03015)
(AD-A078668) Avail: NTIS HC A02/MF A01 CSCL 07/4

We discuss the nature of transparency in glassy materials. The accepted view provides for energy gaps due to the persistence (into the glassy state) of structure in the electronic spectrum. An alternative mechanism, discussed here, follows from inclusion of a strong electron phonon interaction for localized electronic state. We examine the consequences of varying the strength of the interaction for a simple model, and predict a qualitatively different behavior for strong and weak coupling. GRA

N80-19967# Hewlett-Packard Co., Palo Alto, Calif. Solid State Lab.
VPE GROWTH OF (Al, Ga)As Final Technical Report, 15 Aug. 1977 - 15 Feb. 1979
Gerald B. Stringfellow Oct. 1979 133 p refs
(Contract F19628-77-C-0199; AF Proj. 2306)
(AD-A078264; RADC-TR-79-207) Avail: NTIS HC A07/MF A01 CSCL 20/12

The organometallic vapor phase epitaxial (OMVPE) growth process was utilized for the growth of Alx Ga1-x As alloys in both hot wall and cold wall reactor systems. Growth parameters including substrate temperature, V/III ratio, flow ratio, etc. were studied together with their influence on the electrical transport and luminescent properties of the epitaxial layers. Both p-type (Zn) and n-type (Te) dopants were used to achieve the desired doping profiles. Carbon and oxygen were found to be significant contaminants in these layers and two approaches to minimizing their concentration were studied. In the hot wall system HCl was added to the gas stream; in the cold wall system the use of graphite baffles was found to reduce the concentration of non-radiative centers. The photoluminescence efficiency of layers grown under optimized conditions were found to be comparable to that of LPE layers. Deep level transient spectroscopy (DLTS) measurements revealed two characteristic levels at approximately 0.41 eV and 0.49 eV respectively, with a weak dependence on compositions. Double heterostructure lasers were successfully fabricated from these layers and exhibited threshold current densities within a factor of 2 of layers of the same geometry using LPE material. GRA

N80-19968# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
CHARACTERIZATION OF LPE GROWN HgCdTe BY ION SCATTERING SPECTROMETRY Final Report, Jul. 1978 - Jul. 1979
William L. Baun Sep. 1979 29 p refs
(AF Proj. 2303)
(AD-A077884; AFML-TR-79-4124) Avail: NTIS HC A03/MF A01 CSCL 20/12

Results are shown here for low energy ion scattering spectrometry (ISS) experiments on mercury cadmium telluride (HCT) grown by liquid phase epitaxy (LPE) on CdTe substrates. By proper etching of the substrates and control of epitaxial growth conditions, surfaces of the zinc blend structure may be obtained in which 111 faces have a top layer of cadmium and mercury (A sites) or of tellurium (B sites). Ion scattering experiments at low energies (500 V or less) on epitaxial HCT show only A or B sites. However, when the helium or neon ion beam potential is raised to values conventionally used (1500-2500 V), then energy losses from both A and B atoms are observed. At these higher energies the ions sputter or displace the outer atoms or tunnel through to interact with atoms in the second layer. Spectra obtained at these higher energies show interesting fine structure which suggest that energy losses are occurring in multiple collisions and nonbinary scattering. Scattered ion yield curves, which for some elements, show oscillatory fine structure, are dramatically different for A and B surfaces. Even though these yield curves are very complicated because of the structure and number of elements, the fine structure may prove useful for further understanding of interaction of neighboring atoms. Yield curves along with low energy ion scattering spectra provide a unique method of analysis of the outermost atomic layer of epitaxial films. GRA

N80-19969# Stanford Univ., Calif. Electronics Labs.
STUDY OF THE ELECTRONIC SURFACE STATE OF 3-5 COMPOUNDS Final Report
W. E. Spicer 15 Oct. 1978 259 p refs
(Contract DAAK02-74-C-0069; DARPA Order 2182)
(AD-A076304) Avail: NTIS HC A12/MF A01 CSCL 09/1

In the past few years, we have made intensive studies of the physics of compound semiconductor interfaces. This report contains the most important results obtained during the contact period and is divided roughly into three parts dealing with Schottky-barrier formation, oxygen chemisorption, and cesium and cesium oxide overlayers. Following the overview, chapter 2 presents a model for the surface structure of GaAs which in now accepted. The next chapter demonstrates that Schottky-barrier pinning is due not to intrinsic surface states but to metal induced extrinsic states. Chapter 4 describes synchrotron radiation studies of Au Schottky-barrier formation on the IV-V semiconductors and presents a model of Schottky-barrier pinning based on defect formation induced by the Au overlayer. GRA

N80-19970# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MAGNETIC MOMENT VERSUS TEMPERATURE CURVES OF RARE-EARTH IRON GARNETS
Gerald F. Dionne Jul. 1979 22 p refs
(Contract F19628-78-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A077356; TR-534; ESD-TR-79-179) Avail: NTIS HC A02/MF A01 CSCL 11/6

Molecular-field coefficients of the heavy rare-earth iron garnets (Tb, Dy, Ho, Er, Tm, and YbIG) have been determined by fitting calculated and experimental magnetic-moment-vs-temperature curves. For these compositions, spin canting appears to cause a significant reduction in the net moment of the c sublattice. The results are compared with values of coefficients derived from paramagnetic susceptibility measurements and with other values determined without taking into account c sublattice canting. The capability of the computer program has been expended to permit magnetization-temperature calculations of compositions that contain as many as three different rare earth ions in the c sublattice. GRA

N80-19971# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
DETERMINATION OF MORPHOLOGY AND ELECTRONIC STRUCTURE IN SOLIDS WITH 20-1000 eV RADIATION Ph.D. Thesis
D. R. Denley Aug. 1979 174 p refs
(Contract W-7405-eng-48)
(LBL-9482) Avail: NTIS HC A08/MF A01

The techniques of absorption and photoemission are described using experiments on a variety of materials to analyze their morphology and electronic structure. The principles underlying the techniques of soft X-ray absorption and bulk and surface photoemission are discussed together with some of the experimental methods and instrumentation. A.W.H.

N80-19972# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
DETERMINATIONS OF ELECTRONIC STATES IN CRYSTALLINE SEMICONDUCTORS AND METALS BY ANGLE-RESOLVED PHOTOEMISSION Ph.D. Thesis
K. A. Mills Aug. 1979 152 p refs
(Contract W-7405-eng-48)
(LBL-9429) Avail: NTIS HC A08/MF A01

An important part of the theoretical description of the solid state is band structure, which relies on the existence of dispersion relations connecting the electronic energy and wavevector in materials with translational symmetry. These relations determine the electronic behavior of such materials. The elaboration of accurate band structures, therefore, is of considerable fundamental and practical importance. Angle-resolved photoemission (ARP) spectroscopy provides the only presently available method for the detailed experimental investigation of band structures. Its application to both semiconducting and metallic single crystals

is considered with emphasis on gallium arsenides, germanium gallium arsenides, gold, silver, and platinum. DOE

N80-19973# Argonne National Lab., Ill.
MOESSBAUER EFFECT INVESTIGATIONS OF THE ELECTRONIC AND MAGNETIC PROPERTIES OF RARE EARTH METALS AND INTERMETALLIC HYDRIDES
B. D. Dunlap, G. K. Shenoy, J. M. Friedt, P. J. Viccaro, D. Niarchos, H. Kierstead, A. T. Aldred, and D. G. Westlake 1979 17 p refs Presented at the INTERMAG-MMM Conf., New York, N. Y., 17 Jul. 1979
(Contract W-31-109-eng-38)
(CONF-790738-4) Avail: NTIS HC A02/MF A01

Moessbauer spectroscopy was used in a number of investigations of elemental rare earth (RE) metal and RE - transition metal intermetallic hydrides. Analysis of hyperfine parameters established the crystalline electric field (CEF) ground state for Dy(+) in DyH2 and for Er(3+) in ErH2 and YH2. In all cases the results are compatible with the presence of negatively charged hydrogen atoms. Long range magnetic ordering is observed in the RE-H2 compounds. In DyH2, short-range magnetic ordering is seen at temperatures up to twice the long-range transition temperature. As an example of an intermetallic hydride, the cubic Laves phase RE-iron compounds were studied. These form several stable hydride phases RE-Fe2H/sub x/2, with the maximum x being in excess of 4. The magnetic transition temperatures decrease to roughly half their original values for x = 3.5, and the RE-Fe exchange interaction is weakened. DOE

N80-19974# Northwestern Univ., Evanston, Ill. Dept. of Chemical Engineering.
SOLID STATE, SURFACE AND CATALYTIC PROPERTIES OF OXIDES Progress Report, 1 Aug. 1978 - 30 Sep. 1979
H. H. Kung Sep. 1979 11 p refs
(Contract ER-78-S-02-4987)
(COO-4987-1) Avail: NTIS HC A02/MF A01

The catalytic oxidative dehydrogenation of butene on iron containing oxides was studied in the hope of understanding the interrelationship among the bulk, the surface, and the catalytic properties of oxides. Emphasis was on the elucidation of the factors that determine the difference in selectivity for butadiene versus carbon dioxide on iron oxide and on zinc iron oxide, and on the determination of surface cation ratio in a solid solution of two binary oxides. It is found that the oxidation of butene to butadiene and to carbon dioxide takes place on two separate sites. The results show that zinc iron oxide is a more selective oxidation catalyst than iron oxide because it has a higher density of selective oxidation sites and a lower density of combustion sites, and because its combustion sites are less active than those on iron oxide. DOE

N80-19975# National Technical Information Service, Springfield, Va.
JOSEPHSON JUNCTIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Aug. 1978
George W. Reimherr Dec. 1979 237 p Supersedes NTIS/PS-78/1047; NTIS/PS-77/0841; NTIS/PS-76/0744 and NTIS/PS-75/590 2 Vol.
(PB80-802655; NTIS/PS-78/1047; NTIS/PS-77/0841; NTIS/PS-76/0744; NTIS/PS-75/590) Avail: NTIS HC $30.00/MF $30.00 CSCL 20L

The cited reports of Federally funded research discuss the theory, design, fabrication, performance, and applications of Josephson junctions. References to such applications as far infrared radiation detectors, microwave detectors, voltage standards, noise thermometry, and magnetometry are included. This updated bibliography contains 237 abstracts, 38 of which are new entries to the previous edition. GRA

N80-19976# National Technical Information Service, Springfield, Va.
JOSEPHSON JUNCTIONS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Aug. 1978
George W. Reimherr Dec. 1979 295 p 2 Vol.
(PB80-802663) Avail: NTIS HC $30.00/MF $30.00 CSCL 20L

The cited reports of worldwide research discuss theory, design, fabrication, performance, and applications of Josephson junctions. References to such applications as logic circuits, shift registers, data storage devices, far infrared detectors, microwave detectors, voltage standards, noise thermometry, and magnetometry are included. This updated bibliography contains 295 abstracts, none of which are new entries to the previous edition. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-19977# Texas Univ., Austin. Center for Particle Theory.
REINTRODUCING THE CONCEPT OF FORCE INTO RELATIVITY THEORY
S. Mahajan, Asghar Qadir, and Prashant Valanju Jul. 1979 37 p refs
(Contract EY-76-S-05-3992)
(ORO-3992-367) Avail: NTIS HC A03/MF A01

Reintroducing forces into the relativity theory is examined. The Kerr-Newmann geometry, and special cases of it, indicate that there is a short range repulsion in general. This repulsion suggests that naked singularities are physically feasible. It is also found that there is a gravito-electric repulsion which is important to consider in a grand unification scheme of strong, weak, and electromagnetic forces. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N80-19978 Wisconsin Univ. - Madison.
STRUCTURES IN AERONAUTICAL PHRASEOLOGY: FROM ENGLISH TO SPANISH Ph.D. Thesis
Francisco Xavier Almeida 1978 425 p
Avail: Univ. Microfilms Order No. 7915065

The creation of an English Phraseology, its adoption as the International Language for Aviation, and the establishment of the official ICAO (International Civil Aviation Organization) Spanish Phraseology are traced. The regulations and structures governing civil aviation are surveyed and some of the more important studies on the formulation of the Phraseology and on its applications to actual flight conditions are examined. An unexpected result of the investigation is that aeronautical radio can be a fertile ground in which to observe without interfering with the observation, the phenomena of dialects in contact, and the modification of certain dialects as a result of sociolinguistic pressures. Some confirmation is provided for a stratification scheme for Spanish dialects which reflects a popularly held view of many native speakers of Spanish. Dissert. Abstr.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-19979# Desmatics, Inc., State College, Pa.
AN APPROACH FOR PROVIDING MORE ACCURATE PROBABILITY ASSESSMENTS
Dennis E. Smith and Robert L. Gardner May 1978 104 p refs
(Contract DAHC19-76-C-0045; DA Proj. 2Q7-61102-B-74F)
(AD-A077994; ARI-TR-78-B7) Avail: NTIS HC A06/MF A01 CSCL 12/1

This report describes a possible approach for providing more

accurate probability assessments in those real-world decision-making situations for which relative frequency information generally does not exist. In this approach an estimated functional relationship is obtained from a comparison, in relative frequency base (RFB) problems, of a person's posterior probability assessments with the true posterior probabilities. Then, the functional relationship is used as a model to provide probability predictions for new problems by adjusting the person's corresponding probability assessments. Experimental evidence indicates that the resulting models can provide satisfactory probability predictions for problems having identical structure to those used in model construction. At this time, some obstacles prevent immediate use of these models for probability prediction in non-relative frequency base (NRFB) problems. However, it would be unwise to discount the feasibility of developing a practical RFB-based model for adjusting real-world probability estimates until the approach were tested with participants and problems in a field of common expertise (such as intelligence analysis or weather forecasting, for example) where more uniformity of background and experience exists. GRA

N80-19980# Naval Postgraduate School, Monterey, Calif.
GROUP DECISION MAKING WITH FEEDBACK M.S. Thesis
Amnon Tamir (Israeli Air Force) Sep. 1979 120 p refs
(AD-A078159) Avail: NTIS HC A06/MF A01 CSCL 05/10

A computer tool is developed for the purpose of eliciting group utilities for multiple attributes of one complex system relative to a base line. The procedure accommodates multiple users simultaneously providing anonymous feedback to each user to aid in the process of assessing utilities. The procedure provides complete visibility to a manager (umpire) of changes to the data base, so that the process can be monitored in real time. The software is written so that it is completely self-documented and user friendly. GRA

N80-19981# Naval Postgraduate School, Monterey, Calif.
COMPETITION IN THE ACQUISTION OF MAJOR WEAPONS SYSTEMS M.S. Thesis
Benjamin Russell Sellers Sep. 1979 128 p refs
(AD-A078268) Avail: NTIS HC A07/MF A01 CSCL 05/1

The objectives of this research are: (1) to examine the desirability of competition as expressed by current leaders in the field of major systems acquisition in DOD, in Congress, and in private industry; (2) to evaluate the adequacy of the guidance provided by the current acquisition instructions concerning the need, and the methods available, for generating competition in the acquisition of major weapon systems; and (3) to provide recommendations for improving the guidance contained in the instructions, including the development of a model to aid in making decisions regarding production competition. The results of this research indicate that competition is highly desirable, but that the subject is not adequately addressed in the current instructions. The major contribution of the study is the development of a production competition decision-making model which is presented in Chapter V. This chapter presents the benefits and various methods of obtaining a second production source. Also included is a discussion of the factors which influence the second sourcing decision and a model for determining which of the second sourcing methods, if any, is best suited for any particular acquisition program. It is written as a stand-alone chapter for use as a desk-guide by program managers and/or contracting officers who are faced with making decisions regarding production competition. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-19982*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACE SCIENCE DATA SERVICE: A STUDY OF ITS EFFICIENCIES AND COSTS
James I. Vette, Robert H. Hilberg, Donald E. Zuhl, and Albert E. West Dec. 1979 56 p refs
(NASA-TM-80760; NSSDC-79-09) Avail: NTIS HC A04/MF A01 CSCL 05B

Factors affecting the overall advantages and disadvantages of a centralized facility for both the data base and processing capability for NASA's Office of Space Science programs are examined in an effort to determine the best approach to data management in the light of the increasing number of data bits collected annually. Selected issues considered relate to software and storage savings, security precautions, and the phase-in plan. Information on the current mode of processing and on the potential impact of changes resulting from a conversion to a space science data base service was obtained from five user groups and is presented as an aid in determining the dollar benefits and advantages of a centralized system. A.R.H.

N80-19983*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE LEVELS OF EDIT, SECOND EDITION
Robert VanBuren and Mary Fran Buehler Jan. 1980 32 p refs
(Contract NAS7-100)
(NASA-CR-162880; JPL-Pub-80-1) Avail: NTIS HC A03/MF A01 CSCL 05B

The editorial process is analyzed, and five levels of edit are identified. These levels represent cumulative combinations of nine types of edit: Coordination, Policy, Integrity, Screening, Copy Clarification, Format, Mechanical Style, Language, and Substantive. The levels and types of edit, although developed for specific use with external reports at the Jet Propulsion Laboratory, cover the general range of technical editing, especially as it applies to an in-house technical publications organization. Each type of edit is set forth in terms of groups of actions to be performed by editor. The edit-level concept has enhanced understanding and communication among editors, authors, and publications managers concerning the specific editorial work to be done on each manuscript. It has also proved useful as a management tool for estimating and monitoring cost. Author

N80-19984# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
SERIALIZABILITY OF CONCURRENT DATABASE UPDATES
Christos H. Papadimitriou Mar. 1979 64 p refs
(Contract N00014-75-C-0661; Grants NSF MCS-77-01193; NSF MCS-77-05314)
(AD-A078414; MIT/LCS/TR-210) Avail: NTIS HC A04/MF A01 CSCL 05/2

A sequence of interleaved user transactions in a database system may not be serializable, i.e., equivalent to some sequential execution of the individual transactions. Using a simple transaction model we show that recognizing the transaction histories which are serializable is an NP-complete problem. We therefore introduce several efficiently recognizable subclasses of the class of serializable histories; most of these subclasses correspond to serializability principles existing in the literature and used in practice. We also propose two new principles which subsume all previously known ones. We give necessary and sufficient conditions for a class of histories to be the output of an efficient history scheduler; these conditions imply that there can be no efficient scheduler that outputs all of serializable histories, and also that all subclasses of serializable histories studied above have an efficient scheduler. Finally, we show how our results can be extended to far more general transaction models, to transactions with partly interpreted functions, and to distributed database systems. GRA

N80-19985# Gaertner (W. W.) Research, Inc., Stamford, Conn.
PROGRAMMING SUPPORT LIBRARY, VOLUME 1: FUNCTIONAL REQUIREMENTS Final Report
Carolyn M. Turcio, William M. Schreyer, Norman A. Adams, and Wolfgang W. Gaertner Oct. 1979 41 p
(Contract F30602-78-C-0103; AF Proj. 2531)
(AD-A078438; RADC-TR-79-241-VOL-1) Avail: NTIS HC A03/MF A01 CSCL 05/2

This report, Volume 1, contains the generic functional requirements for a programming support library. The requirements are presented at two levels of detail. Chapter 2 contains a brief summary of the requirements separated into Basic and Full PSL requirements. Chapter 3 contains the full wording of the requirements organized into nine categories. The specification for each individual requirement is followed by a brief description of its purpose. This volume may be used as the specification for a Full or Basic PSL under a software development contract. Volume 2 will be published at a later date. GRA

N80-19986# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
ON OPTIMIZATION OF QUERY PROCESSING STRATEGIES Interim Report
D. M. Chiu, Y. C. Ho, and P. A. Bernstein Oct. 1979 59 p refs
(Contract N00014-75-C-0648; Grant NSF ENG-78-15231)
(AD-A078470; TR-672) Avail: NTIS HC A04/MF A01 CSCL 05/2

This report examines the formulation of the query processing problem as an optimization problem. The real problem, which involves database states as parameters, is an intractable one. The problem can, however, be transformed into equivalent and simplified versions by making certain assumptions. In order to state these assumptions and the problem transformation on a formal basis, the notion of characterization is introduced. A characterization is a mapping of the database state space into a simplified parameter space. Meaningful simplification of the original problem is possible only when suitable characterizations can be found. The problem formulations in several important papers are reviewed and a detailed example is represented to illustrate some ideas. GRA

N80-19987# National Library of Medicine, Bethesda, Md.
NLM ONLINE SERVICES REFERENCE MANUAL
Jan. 1980 582 p Revised
(PB80-114531; NLM/MED-79/06) Avail: NTIS HC A25/MF A01 CSCL 05B

The operation of the various NLM online data bases is described. Specific information on modes of accessing these data bases, the commands which may be used, techniques for searching them, etc., is given. Instructions on the use of MEDLINE, AVLINE, CATLINE, NAME AUTHORITY FILE, SERLINE, TOXLINE, CHEMLINE, RTECS, TOXICOLOGY DATA BANK, CANCERLIT, CANCERPROJ, CLINPROT, EPILEPSY, MEDLEARN, BIOETHICS, HISTLINE, and HEALTH PLANNING AND ADMINISTRATION are included. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-19988# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1981, PROGRAM REVIEW, VOLUME 2
Washington GPO 1980 275 p refs Hearings before the Subcomm. on Transportation, Aviation and Communications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 30-31 Oct. 1979
(GPO-56-220) Avail: Subcomm. on Transportation, Aviation and Communications

A program review of NASA activities is presented with emphasis on the progress made in aeronautics during the past 12 months. Aerodynamics, materials and structures, aeronautical propulsion, and avionics and human factors are among the topics covered. Also, advances in vehicle technology are discussed including transport aircraft, general aviation aircraft, low speed aircraft, and high speed aircraft. J.M.S.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-19989*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EFFECTS OF TUNNEL AND STATION SIZE ON THE COSTS AND SERVICE OF SUBWAY TRANSIT SYSTEMS Final Report
Bain Dayman, Jr. Apr. 1979 55 p refs Sponsored by NASA
(Contract DOT-AS-60019)
(UMTA-CA-06-0116-79-2; JPL-Pub-79-67) Avail: NTIS HC A04/MF A01

The feasibility of less spacious, less costly underground rail mass transit system designs is studied. The major cost saving expected from alternative tunnel designs results from using precast concrete segment liners in place of steel. The saying expected for a two-foot decrease in the diameter of twin, single track tunnels is about two million dollars per route mile from 13 million dollars for precast concrete segment liners (a saving of about 16%). The cost per route-mile of a double track tunnel appears to be 15 to 25% higher than for the twin, single track tunnels. The effective cost saving expected from stations with four-car train capability instead of the usual eight-car trains is nearly 25% or seven million dollars per route mile. The saving in station costs can be obtained while improving service to the user (lower transit time and less waiting for trains) up to a capacity of 36,000 riders per hour in each direction. K.L.

N80-19990# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LOW-COST BUS-TUNNELS TO THE CENTRAL BUSINESS DISTRICT Final Report
Bain Jr. Dayman Nov. 1979 61 p refs
(Contract DOT-AS-600019)
(UMTA-CA-06-0116-79-1; JPL-Pub-79-57) Avail: NTIS HC A04/MF A01

The feasibility of using small diameter unventilated, hence relatively inexpensive tunnels for bus links between the central business district and outlying areas was investigated. The tunnels selected were 16 1/2 ft. inside diameter, the same as a single-track tunnel conventionally used for recently constructed U.S. subway rail systems. Concentration levels of exhaust emissions were within acceptable limits to a capacity of 150 diesel buses per hour for a one route-mile bus-tunnel; for a two route-mile tunnel, 54 buses per hour were acceptable. The costs of such an underground guideway are moderate ($16M per route-mile with simultaneous operation in both directions). Such a guideway can serve as a precursor to a Metro system since it can be converted to use by rail vehicles with little additional cost. An underground station is not mandatory to the bus-tunnel concept. A.R.H.

N80-19991# Systems Technology, Inc., Hawthorne, Calif.
DEVELOPMENT OF AERODYNAMIC DISTURBANCE TEST PROCEDURES, VOLUME 1: EXECUTIVE SUMMARY Final Report, 30 Sep. 1977 - 30 Mar. 1979
Richard H. Klein and Jeffrey R. Hogue Aug. 1979 33 p refs
(Contract DOT-HS-7-01716)
(PB80-108145; STI-TR-1117-1-Vol-1; DOT-HS-805078) Avail: NTIS HC A03/MF A01 CSCL 13F

The crosswind responses of twenty different vehicles were surveyed. Three test procedures were used in three different crosswind disturbance configurations. These were steering fixed, steering free, and driver control of lane position. The crosswind configurations were straight pulse, doublet pulse, and a shaped profile. Results show that passenger cars, station wagons, trucks, and most vans have virtually no crosswind sensitivity problems, whereas the VW Microbus, the pick/up camper (in winds higher than 35 mph), cars pulling trailers, and mopeds do have potential problems. GRA

N80-19992# Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN EXPERIMENTAL STUDY OF HIGHWAY AERODYNAMIC INTERFERENCES Final Report, Apr. 1977 - Oct. 1978
D. P. Telionis, C. J. Fahrner, and G. S. Jones Nov. 1978 82 p refs
(Contract DOT-HS-7-01590)
(PB80-109986; DOT-HS-805025) Avail: NTIS HC A05/MF A01 CSCL 13F

The aerodynamic forces of interference between two vehicles passenger cars and articulated trucks are investigated experimentally. Tests are conducted in the VPI towing tank and wind tunnels. The results have a rather qualitative character and indicate the order of magnitude of the expected forces and moments. The data match with reasonable accuracy with earlier test cases. It is revealed that the critical area is in the neighborhood of the front of the truck cabin for both the parallel passing and the opposite crossing. Overshoots of 50% to 100% of the aerodynamic components are encountered in very short periods of time. GRA

N80-19993# Gannett, Fleming, Corddry and Carpenter, Inc., Harrisburg, Pa.
EVALUATION OF OPERATION AND MAINTENANCE FACTORS LIMITING BIOLOGICAL WASTEWATER TREATMENT PLANT PERFORMANCE Final Report
Albert C. Gray, Jr., Paul E. Paul, and Hush D. Roberts Jul. 1979 168 p refs
(Contract EPA-68-03-2223)
(PB80-108947; EPA-600/2-79-078) Avail: NTIS HC A08/MF A01 CSCL 13B

Operations and maintenance programs at municipal biological wastewater treatment facilities were evaluated. The deficiencies in the areas of design, operation, maintenance, and administration were identified along with the deficiencies that could be overcome and operations that could be improved to upgrade plant performance to meet standards. Conclusions and recommendations are based on site visits made to 120 facilities and comprehensive evaluations conducted at 30 facilities. The highest ranked problem areas, based on frequency of a occurrence and severity of impact, were operator application of treatment concepts and testing to process control, infiltration/inflow, process control testing procedures, adequacy of operations and maintenance manual, industrial loading, training, hydraulic loading, treatment understanding, process controllability, and sludge treatment.GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-19994*# National Aeronautics and Space Administration, Washington, D. C.
X-RAY OPTICAL PROPERTIES OF A WOLTER TELESCOPE
A. Ondrusch Feb. 1980 77 p refs Transl. into ENGLISH of "Roentgenoptische Eigenschaften Eines Wltertelskops". Rept. MPI-PAE/Extraterr-146 Max-Planck-Inst. fuer Phys. und Astrophysik, Inst. fur Extraterrestrische Phys., Garching, West Germany, Sep. 1978 92 p Translation was announced as N79-33123 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-75811; MPI-PAE/Extraterr-146; Avail: NTIS HC A05/MF A01 CSCL 03A

Physical properties and the fabrication sequence of a Wolter telescope are discussed. Such telescopes are intended to examine the dust scattering halos after being placed in orbit by a booster rocket launched from Australia. R.E.S.

N80-19995*# Bardon Environmental Consultants, Inc., Birmingham, Ala.
ANALYSIS OF NOAA-MSFC GOES X-RAY TELESCOPE Final Report
David L. Shealy 31 Jul. 1979 53 p refs
(NASA Order H-34373-B)
(NASA-CR-161397) Avail: NTIS HC A04/MF A01 CSCL 03A

The general telescope system was assumed to be a paraboloid-hyperboloid in a Wolter Type 1 configuration. The equations which specify the telescope parameters and the resolution as a function of the collecting area are discussed as well as the spot size and point response function for off-axis rays. The measured resolution of the Goddard ATM X-ray telescope (S-056) is compared to the rms blur circle radius and the full width half maximum of the line spread function. An empirical scaling formula, Eq. 26, which transforms the rms blur circle radius into a more accurate measure of resolution, is introduced. The geometrical imaging properties of the proposed NOAA-MSFC GOES X-ray telescope are considered. Conclusions and alternate mirror designs are included. A.R.H.

N80-19996*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
APPLICATION OF DIGITAL IMAGE PROCESSING TECHNIQUES TO ASTRONOMICAL IMAGERY, 1979
Jean J. Lorre 1 Nov. 1979 75 p refs Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-162877; JPL-Pub-79-109) Avail: NTIS HC A04/MF A01 CSCL 03A

Several areas of applications of image processing to astronomy were identified and discussed. These areas include: (1) deconvolution for atmospheric seeing compensation; a comparison between maximum entropy and conventional Wiener algorithms; (2) polarization in galaxies from photographic plates; (3) time changes in M87 and methods of displaying these changes; (4) comparing emission line images in planetary nebulae; and (5) log intensity, hue saturation intensity, and principal component color enhancements of M82. Examples are presented of these techniques applied to a variety of objects. A.W.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-19997*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY MEDIUM DATA BOOK, SUPPLEMENT, 1975 - 1978
Joseph H. King Dec. 1979 279 p
(NASA-TM-80759; NSSDC/WDC-A-R&S-79-08-Suppl-1) Avail: NTIS HC A13/MF A01 CSCL 03B

Since the issurance of the Interplanetary Medium Data Book (NSSDC/WDC-A-R&S 77-04, 1977) which contains plots and listings of hourly average interplanetary field and plasma parameters covering the period November 27, 1963 through December 30, 1975, additional data are available which fill some 1975 data gaps and which extend the data coverage well into 1978. This supplment contains all the presently available data for the years 1975-1978. Interplanetary magneic field (IMF) data are from the IMP 8 triaxial fluxgate magnetometer experiment. Derived plasma parameters are form the IMP 7 and

IMP 8 instruments. Some of the early 1975 IMF data are from a HEOS 1 experiment. A.R.H.

N80-19998*# National Aeronautics and Space Administration, Washington, D. C.
ON THE CONTINUING STELLAR FORMATION IN THE CENTRAL REGIONS OF SOME GLOBULAR CLUSTERS AND THEIR RELATION TO THE PULSARS
B. V. Komberg Sep. 1979 22 p refs Transl. into ENGLISH of "O Prodolzhayushchemsya Zvezdoobrazovanii v Tsentral-nykh Oblastyakh Nekotorykh Sharovkh Skopleniy i Svyaz Poslednykh s Pulsarami", Rept. Pr-313 Academy of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-26 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75703; Pr-313) Avail: NTIS HC A02/MF A01 CSCL 03B

The discrepancy between the predicted and observed quantities of gas in the central regions of massive globular clusters is discussed. It is hypothesized that star formation continues in the central regions by means of gas released during stellar evolution or trapped by the central region when the globular clusters pass through the center of the galaxy. Nine globular clusters are indicated at distances less than 1000 ps from which radio pulsars or X-ray sources are observed. It is argued that they could have formed relatively recently in closed pairs in the central regions and then ejected at the stage of supernova bursts with velocities over 100 ks/s. K.L.

N80-19999*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
GRAVITATIONAL REDSHIFT SPACE-PROBE EXPERIMENT Final Report
R. F. C. Vessot and M. W. Levine Dec. 1979 147 p refs
(Contract NAS8-27969)
(NASA-CR-161409) Avail: NTIS HC A07/MF A01 CSCL 03B

A Scout D rocket was launched from Wallops Island, Virginia, carrying an atomic hydrogen maser oscillator system as the payload. The frequency of signals from the oscillator was monitored on the ground at Merritt Island, Florida, by using two hydrogen masers as comparison oscillators. The first-order Doppler shift in the signals was eliminated by a go-return transponder link to the payload, and the resulting data, representing the relativistic shifts, were recovered and recorded. The objective was to measure directly the effect of gravitational potential on the frequency of an atomic hydrogen maser assuming it to be a 'proper' clock. A gravitational effect amounting to some 4.5 parts in 10 to the 10th power was measured with an oscillator having a stability better than 1 part in 10 to the 14th power. Therefore, to make the best possible use of the oscillator, all frequency shifts at the 2 to 5 X 10 to the -15 power level in delta f/f in the system must be accounted for. This includes all the phase variations that can cause such a shift to appear. The experiment, the data available and the manner in which they were processed, and the results are described. A.R.H.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-20000# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE THEORETICAL TREATMENT OF PARTICLE SWARMS Final Report
R. D. Shelton and A. L. Arbuckle Sep. 1979 64 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A078218; AD-E430336; ARBRL-TR-02195) Avail: NTIS HC A04/MF A01 CSCL 20/8

Particle swarms come into consideration when a group of independent particles move without collision in a force field such that a fluid Hamiltonian can be written to represent the motion. Typical problems from several fields are collected and united under a single theoretical framework. The fields include such problems as fragment distributions from an exploding warhead, micrometeoroid distributions in the vicinity of the Earth, charged particle distributions in a magnetic bottle, focussing of photons by heavy stars and the design of a sprinkler system for uniform wetting. GRA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-20001*# California Inst. of Tech., Pasadena.
EMPIRICAL STUDIES OF SOLAR FLARES: COMPARISON OF X-RAY AND H ALPHA FILTERGRAMS AND ANALYSIS OF THE ENERGY BALANCE OF THE X-RAY PLASMA Final Report, 17 Nov. 1978 - 16 Nov. 1979
R. L. Moore 16 Nov. 1979 15 p refs
(Contract NAS8-33215)
(NASA-CR-161405) Avail: NTIS HC A02/MF A01 CSCL 03B

The physics of solar flares was investigated through a combined analysis of X-ray filtergrams of the high temperature coronal component of flares and H alpha filtergrams of the low temperature chromospheric component. The data were used to study the magnetic field configuration and its changes in solar flares, and to examine the chromospheric location and structure of X-ray bright points (XPB) and XPB flares. Each topic and the germane data are discussed. The energy balance of the thermal X-ray plasma in flares, while not studied, is addressed. A.W.H.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-20002*# University of West Florida, Pensacola.
A NOTE ON THE REVISED GALACTIC NEUTRON SPECTRUM OF THE AMES COLLABORATIVE STUDY Final Report
Hermann J. Schaefer Mar. 1980 9 p refs
(Contract NAS9-15417)
(NASA-CR-150554) Avail: NTIS HC A02/MF A01 CSCL 03B

Energy distributions of the neutron dose equivalents in the 0.1 to 300 Mev interval for the Ames and Hess spectra are compared. The Ames spectrum shows no evaporation peak, moves the bulk of the flux away from the region of elastic collision and spreads it more evenly over higher energies. The neutron spectrum in space does not seem to hear out the Ames model. Emulsion findings on all manned missions of the past consistently indicate that evaporation events are a prolific source of neutrons in space. A.R.H.

99 GENERAL

N80-20003*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
CONFERENCE OF REMOTE SENSING EDUCATORS (CORSE-78)
Washington Mar. 1978 664 p refs Conf. held at Stanford, Calif., 26-30 Jun. 1978
(NASA-CP-2102; A-7755) Avail: NTIS HC A99/MF A01

CSCL 05I

Ways of improving the teaching of remote sensing students at colleges and universities are discussed. Formal papers and workshops on various Earth resources disciplines, image interpretation, and data processing concepts are presented. An inventory of existing remote sensing and related subject cources being given in western regional universities is included. For individual titles, see N80-20004 through N80-20017.

N80-20004*# California Univ., Berkeley. Space Sciences Lab.

HISTORY AND FUTURE OF REMOTE SENSING TECHNOLOGY AND EDUCATION

Robert N. Colwell. *In* NASA. Ames Res. Center. Conf. of Remote Sensing Educators (CORSE-78). Mar. 1980. p 3-92. refs (For primary document see N80-20003 10-99)

Avail: NTIS. HC A99/MF A01. CSCL 05I

A historical overview of the discovery and development of photography, related sciences, and remote sensing technology is presented. The role of education to date in the development of remote sensing is discussed. The probable future and potential of remote sensing and training is described. R.E.S.

N80-20005*# California Univ., Berkeley. Space Sciences Lab.

IS REMOTE SENSING FAR OUT?

Ida R. Hoos. *In* NASA. Ames Res. Center. Conf. of Remote Sensing Educators (CORSE-78). Mar. 1980. p 93-102. refs (For primary document see N80-20003 10-99)

Avail: NTIS. HC A99/MF A01. CSCL 05I

A discussion of the perspective of remote sensing education is presented. Questions as to 'whose perspective it is' and 'on what does the perspective depend' are considered. R.E.S.

N80-20006*# California Univ., Santa Barbara. Dept. of Geography.

THE ATTRIBUTES OF A WELL-TRAINED REMOTE SENSING TECHNOLOGIST

John E. Estes. *In* NASA. Ames Res. Center. Conf. of Remote Sensing Educators (CORSE-78). Mar. 1980. p 103-118. refs (For primary document see N80-20003 10-99)

Avail: NTIS. HC A99/MF A01. CSCL 05I

Central concepts important to the training of the remote sensing technologist are presented. What employers appear to be looking for at this time in a prospective employee is discussed along with some ways in which faculty can get students interested in remote sensing. The attributes of a prime candidate and his goals are described. The current status of remote sensing education in colleges and universities is presented. R.E.S.

N80-20007*# Arizona Univ., Tucson.

A MULTIDISCIPLINARY APPROACH TO REMOTE SENSING EDUCATION

Philip N. Slater. *In* NASA. Ames Res. Center. Conf. of Remote Sensing Educators (CORSE-78). Mar. 1980. p 119-134. ref (For primary document see N80-20003 10-99)

Avail: NTIS. HC A99/MF A01. CSCL 05I

The multidisciplinary aspect of the remote sensing educational program at the University of Arizona is described. The philosophy of the multidisciplinary approach is discussed. R.E.S.

N80-20008*# South Dakota State Univ., Brookings. Remote Sensing Inst.

REMOTE SENSING RESEARCH ACTIVITIES RELATED TO ACADEMIC INSTITUTIONS

Victor I. Myers. *In* NASA. Ames Res. Center. Conf. of Remote Sensing Educators (CORSE-78). Mar. 1980. p 135-164. refs (For primary document see N80-20003 10-99)

Avail: NTIS. HC A99/MF A01. CSCL 05I

The role of research in the educational setting is discussed. Curriculum developments for integrating teaching and research are described. Remote sensing technology is used as an example of bridging the gap between research and application. Recommendations are presented for strengthing research groups. R.E.S.

N80-20009*# National Aeronautics and Space Administration, Washington, D. C.

NASA PROGRAMS IN TECHNOLOGY TRANSFER AND THEIR RELATION TO REMOTE SENSING EDUCATION

Richard H. Weinstein. *In* NASA. Ames Res. Center. Conf. of Remote Sensing Educators (CORSE-78). Mar. 1980. p 165-180 (For primary document see N80-20003 10-99)

Avail: NTIS. HC A99/MF A01. CSCL 05I

Technology transfer to users is a central feature of NASA programs. In each major area of responsibility, a variety of mechanisms was established to provide for this transfer of operational capability to the proper end user, be it a Federal agency, industry, or other public sector users. In addition, the Technology Utilization program was established to cut across all program areas and to make available a wealth of 'spinoff' technology (i.e., secondary applications of space technology to ground-based use). The transfer of remote sensing technology, particularly to state and local users, presents some real challenges in application and education for NASA and the university community. The agency's approach to the transfer of remote sensing technology and the current and potential role of universities in the process are considered. A.R.H.

N80-20010*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NASA'S WESTERN REGIONAL APPLICATIONS TRAINING ACTIVITY

Charles E. Poulton. *In its* Conf. of Remote Sensing Educators (CORSE-78). Mar. 1980. p 181-196 (For primary document see N80-20003 10-99)

Avail: NTIS. HC A99/MF A01. CSCL 05I

Direct involvement of educational institutions in the transfer of remote sensing technology must be increased so that the training component of the Westion Regional Applications Program can be expanded within the various states. The implications of essential goals in remote sensing education and training are considered in relation to the functions of the NASA University Affairs program. A.R.H.

N80-20011*# Colorado State Univ., Fort Collins.

OPPORTUNITIES AND PROBLEMS IN INTRODUCING OR EXPANDING THE TEACHING OF REMOTE SENSING IN UNIVERSITIES

Eugene L. Maxwell. *In* NASA. Ames Res. Center. Conf. of Remote Sensing Educators (CORSE-78). Mar. 1980. p 197-210 (For primary document see N80-20003 10-99)

Avail: NTIS. HC A99/MF A01. CSCL 05I

The need for degree programs in remote sensing is considered. Any education program which claims to train remote sensing specialists must include expertise in the physical principles upon which remote sensing is based. These principles dictate the limits of engineering and design, computer analysis, photogrammetry, and photointerpretation. Faculty members must be hired to provide emphasis in those five areas. A.R.H.

N80-20012*# Idaho Univ., Moscow.

THE USE OF MULTIMEDIA AND PROGRAMMED TEACHING MACHINES FOR REMOTE SENSING EDUCATION

Joseph J. Ulliman. *In* NASA. Ames Res. Center. Conf. of Remote Sensing Educators (CORSE-78). Mar. 1980. p 211-262. refs (For primary document see N80-20003 10-99)

Avail: NTIS. HC A99/MF A01. CSCL 05I

The advantages, limitations, and uses of various audio visual equipments and techniques used in various universities for individualized and group instruction in the interpretation and classification of remotely sensed data are considered as well as systems for programmed and computer-assisted instruction. A.R.H.

N80-20013*# Santa Clara Univ., Calif.

COMPUTER APPLICATIONS IN REMOTE SENSING EDUCATION

Ronald L. Danielson. *In* NASA. Ames Res. Center. Conf. of Remote Sensing Educators (CORSE-78). Mar. 1980. p 263-268. refs (For primary document see N80-20003 10-99)

Avail: NTIS. HC A99/MF A01. CSCL 09B

Computer applications to instruction in any field may be divided into two broad generic classes: computer-managed instruction and computer-assisted instruction. The division is based on how frequently the computer affects the instructional process and how active a role the computer affects the instructional

process and how active a role the computer takes in actually providing instruction. There are no inherent characteristics of remote sensing education to preclude the use of one or both of these techniques, depending on the computer facilities available to the instructor. The characteristics of the two classes are summarized, potential applications to remote sensing education are discussed, and the advantages and disadvantages of computer applications to the instructional process are considered. A.R.H.

N80-20014*# Denver Univ., Colo.
TEXTBOOKS AND TECHNICAL REFERENCES FOR REMOTE SENSING
Robert D. Rudd, Leonard W. Bowden (California Univ., Riverside), Robert N. Colwell (California Univ., Berkeley), and John E. Estes (California Univ., Santa Barbara) *In* NASA. Ames Res. Center Conf. of Remote Sensing Educators (CORSE-78) Mar. 1980 p 269-288 refs (For primary document see N80-20003 10-99)
Avail: NTIS HC A99/MF A01 CSCL 05B

A selective bibliography is presented which cites 89 textbooks, monographs, and articles covering introductory and advanced remote sensing techniques, photointerpretation, photogrammetry, and image processing. A.R.H.

N80-20015*# Arizona Univ., Tucson.
THE POINTABLE MULTISPECTRAL LINEAR ARRAY SYSTEM AND THE LARGE FORMAT CAMERA FOR EARLY 1980 SHUTTLE PAYLOADS
Philip N. Slater *In* NASA. Ames Res. Center Conf. of Remote Sensing Educators (CORSE-78) Mar. 1980 p 367-390 (For primary document see N80-20003 10-99)
Avail: NTIS HC A99/MF A01 CSCL 14E

Design options are described for the multispectral linear arrays which will provide data and facilities beyond those obtained by LANDSAT 1, 2, 3, and D (the thematic mapper) are considered. The features, uses, and risks of a 10M fine resolution pointable imager, a 15M/30M dual resolution pointable imager, a 30M selectable spectral resolution pointing imager, a 30M electronically pointable multi-temporal sampler, and a 40M/80M mixed resolution imager are described. A large format camera scheduled for 1981 shuttle launch which can obtain high spatial ground resolution (approximately 10M), a relative position accuracy of plus or minus 14M, and a relative heightening accuracy, by virtue of stereographic coverage, of between 7 and 28M depending on the base-to-height ratio used. A potential problem of the system is that it will orbit in the shuttle. A.R.H.

N80-20016*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DATA REDUCTION BY COMPUTER PROCESSING
Dale R. Lumb *In its* Conf. of Remote Sensing Educators (CORSE-78) Mar. 1980 p 391-452 refs (For primary document see N80-20003 10-99)
Avail: NTIS HC A99/MF A01 CSCL 09B

The automated analysis of remote sensing data, specifically digital processing of LANDSAT or other image data in numerical form was considered in a technical workshop which covered the teaching of digital image processing, including both theoretical and applied subjects and laboratory experience, and also reviewed NASA developed image processing software, and hardware/software systems employed at NASA-Ames Research Center in support of the Western Regional Applications Program (WRAP). A course titled Image Processing Lab, one of two courses required for a graduate minor in remote sensing at Arizona is examined as well as the rationale, content, and hardware/software support for this course. A.R.H.

N80-20017*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE REDUCTION OF REMOTE SENSING DATA BY VISUAL MEANS
Robert N. Colwell (California Univ., Berkeley), Charles E. Poulton, and Barry J. Schrumpf (Oregon State Univ., Corvallis) *In its* Conf. of Remote Sensing Educators (CORSE-78) Mar. 1980 p 453-526 refs (For primary document see N80-20003 10-99)
Avail: NTIS HC A99/MF A01 CSCL 05B

Issues likely to be of concern to educators called upon to teach courses involving the reduction (interpretation) of remotely sensed data by visual means are considered. Topics covered include: (1) information requirements of those using remotely-sensed data; (2) educational concepts involved in teaching students how to generate the desired information from a visual analysis of the data; (3) principles and techniques specific to the photointerpretation process; (4) concepts involved in the making of photographic measurements, as dictated by the geometry of remote sensing imagery; (5) the nature of the various kinds of mapping, plotting, and photointerpretation equipment; and (6) some special considerations with respect to the convergence of evidence and other principles involved in the interpretation of photographs. A recommended procedure for determining the usefulness of any given type of aerial or space photography in relation to the inventory of natural resources is included. A.R.H.

N80-20018# Association for Unmanned Vehicle Systems, Dayton, Ohio.
PROCEEDINGS OF THE ASSOCIATION FOR UNMANNED VEHICLE SYSTEMS AUVS '79: 6TH ANNUAL CONVENTION
1979 165 p refs Conv. held at San Diego, Calif., 29 May - 1 Jun. 1979
(AD-A077877) Avail: NTIS HC A08/MF A01 CSCL 01/3

Contents: Unmanned Vehicles on the Tactical Battlefield - Another Beginning; Why Unmanned Vehicles Can Be Effective; Unmanned Battlefield Reconnaissance Systems For The German Army; Automated Guidance for Ground Vehicles; Cruise Missile Air Launch In the Operational Environment; Advances In Anti-Jam Transmission of Reconnaissance Imagery Data; Unmanned Seaplanes For Naval Operations; Unmanned Systems For Reducing Our Taxes; and Cruising The Planets. GRA

N80-20019# Texas Technological Univ., Lubbock. Inst. for Electronics Science.
ANNUAL REVIEW OF RESEARCH UNDER THE JOINT SERVICE ELECTRONICS PROGRAM Interim Report
R. Saeks, K. S. Chao, J. Walkup, T. Newman, and L. R. Hunt Oct. 1979 160 p refs
(Contract N00014-76-C-1136)
(AD-A077652) Avail: NTIS HC A08/MF A01 CSCL 09/4

Contents: Quadratic Optimization Problems; Nonlinear Control; Nonlinear Fault Analysis; Qualitative Analysis of Large Scale Systems; Multidimensional System Theory; Optical Noise; and Pattern Recognition. GRA

N80-20020# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIR FORCE FLIGHT DYNAMICS LABORATORY FISCAL YEAR 1981. TECHNICAL OBJECTIVE DOCUMENT
Dec. 1979 87 p refs Supersedes AFFDL-TR-78-181
(AD-A078973; AFFDL-TR-79-3133; AFFDL-TR-78-181) Avail: NTIS HC A05/MF A01 CSCL 01/3

The document presents an overview of the four Technical Planning Objectives (TPO) and supporting data for each. These are extracted from the technical plan of the Air Force Flight Dynamics Laboratory (AFFDL). Information is largely based on AFFDL fiscal 1981 technology plan omitting specific funding and timing information of an 'Official Use Only' nature. Technical objectives are described for the technical areas of Structures and Dynamics, Vehicle Equipment/Subsystems, Flight Control and Aeromechanics. Points of contact for more information in each of the areas are identified. GRA

N80-20021# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 May - 31 Jul. 1979
Alan J. McLaughlin and Alan L. McWhorter 25 Sep. 1979 22 p
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A077589; ESD-TR-79-195) Avail: NTIS HC A02/MF A01 CSCL 09/5

Progress is reported in the following areas: digital integrated circuits, high-speed digital circuits, MNOS Memory, reconfigurable logic devices, processing, testing, and analysis, computer systems, solid state device research, quantum electronics, materials research, microelectornics, and analog device technology. A.R.H.

N80-20022# National Bureau of Standards, Washington, D.C.
JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS, VOLUME 84, NO. 5 Bimonthly Report, Sep. - Oct. 1979
1979 95 p refs
(PB80-103674) Avail: NTIS HC A05/MF A01 CSCL 07D

Results of research in the physical and engineering sciences, including physics, chemistry, engineering, mathematics, and computer science, is reported. Major emphasis is placed on measurement methodology and the basic technology underlying standardization. Specific topics covered include: (1) a high precision load cell mass comparator; (2) modulus and swelling relations in natural rubber crosslinked by dicumyl peroxide; (3) flow-induced fibril formation in polymer solutions; (4) surface changes in platinum crucibles; and (5) isoionic isotope exchange with hydroxylapatite and the dilution effect. J.M.S.

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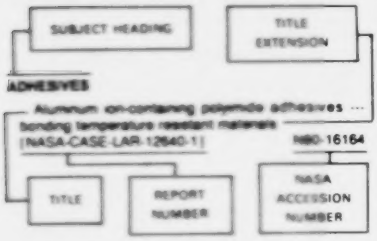

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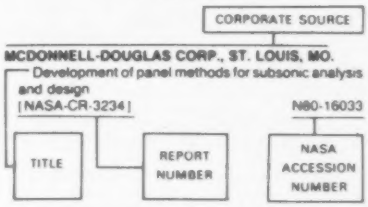

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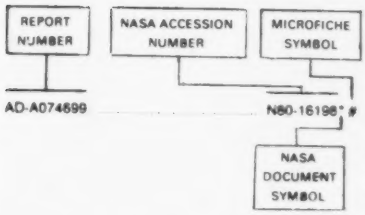

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
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GENERAL

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Note: N.A. means that no abstracts were assigned to this category for this issue.

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REPORT NUMBER

N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.

STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

D. J. Mourey 3 Sep. 1979 409 p refs

(Contract NAS1-15624)

(NASA-CR-159149) Avail: NTIS HC A18/MF A01

CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AIRCRAFT EMERGENCY POWER SUPPLY
J.N. Foutz, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Electronics Engineering & Sciences Dept., *San Diego, California* 92152 (DN988515)

Develop the criteria for a lightweight bi-directional power flow switching regulator power supply which can operate between a low voltage battery (emergency energy source) and the 27.0 volt dc generator bus. Bus power shall be converted to maintain the battery at optimum charge. Upon failure of the main generator the unit shall convert battery voltage to 27.0 volt dc to maintain bus power continuity.

Develop optimized topology and performance goals for a bi-directional switching regulator power supply that will service a low voltage battery and a 27.0 volt topology in the design of an emergency power supply.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0002, V/STOL AERODYNAMICS
L.V. Schmidt, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN998077)

Model the V/STOL jet reaction flow field including the presence of the aircraft shape, ground effect, cross winds and multiple jet configurations; increase the predictive capability of V/STOL related flow phenomena such as suckdown, hot gas reingestion and entrainment. These latter effects have a significant impact upon design analysis and evaluation for future Navy V/STOL aircraft.

(a) Theoretical: review existing modeling techniques for jet flows and extend concepts to the V/STOL environment. Develop computer techniques as analytic tools, and correlate results with existing data. (b) Experimental: conduct appropriate experiments for confirmation of new modeling techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0003, TITANIUM FIRES - TITANIUM ALLOY IGNITION AND COMBUSTION STUDY
B.A. Manty, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DN881167; N62269-77-C-0481)

The objective of this task is to apply the Glickstein model to various titanium alloys used in jet engines (Ti-8-1-1, Ti-6-4, Ti-6-6-2, Ti-6-2-4-2, and Ti-6-2-4-6) at several temperatures and establish its validity by studying the ignition and propagation characteristics in simulated compression environments. Determine parameters for design engineers. Determine the effects of alloying elements on the extent to which burning will be sustained. Determine the effects of coatings on ignition and propagation characteristics. This contract supports work unit ZM601, DN 681081.

Ignition and sustained combustion of titanium alloys are closely related phenomena. A laser beam will be utilized to cause ignition of an airfoil-shaped specimen in a special test rig. The aerodynamic and propagation mechanisms will be varied to simulate actual conditions. Once the various mechnaisms are understood the Glickstein analytical combustion model will be tested for its accuracy in predicting the process. The end result is to have significant parameters to provide titanium fires in operational jet engines.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0004, TRAJECTORIES OF LIQUID DROPLETS EJECTED FROM AN AGRICULTURAL AIRCRAFT
A.I. Ormsbee, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

Flow field models for an agricultural aircraft are being constructed for the determination of trajectories of droplets and solid particles ejected from the neighborhood of the wing trailing edge. Trajectories have been computed for a horseshoe vortex model in ground effect, and scaling laws for scale model testing have been established. Inclusion of propeller wake effects has been effected. A test program has been completed and the final report is in preparation.

SUPPORTED BY University of Illinois

1.0005, THUNDERSTORM FORECASTING FOR AVIATION
M.A. Alaka, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (RD5901)

OBJECTIVE: To develop, for the benefit of aviation, improved automated techniques for monitoring and forecasting thunderstorms in the 0-2 h range. To implement these techniques in the appropriate operational environment.

APPROACH: Statistical techniques will be used to generate 0-2 h probability and categorical forecasts of thunderstorms from digitized radar data, alone or in conjunction with other meteorological data.

PROGRESS: Forecast equations have been derived from a small set of dependent data. Efforts are underway to increase this data base. Display techniques have been developed for the D/RADEX System, and plans for testing them are being prepared.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

1.0006, NAVY VEHICLE DESIGN AND CONSTRUCTION - V/STOL LIFT JET INTERACTIONS
D. Kotansky, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DN975280; N00014-79-C-0130)

The successful design and development of VTOL aircraft equipped with powered lift-jet or powered lift augmentation systems requires a knowledge of the complex flow fields produced by these multiple jet lift systems in the hover mode both in and out of ground effect. Fundamental understanding of fountain upwash formation and development is a key element in the improvement of methods for the prediction of VTOL vehicle

aerodynamic performance characteristics in ground effect. Inaccurate or incomplete prediction of vehicle forces and moments in ground effect can lead to serious vehicle performance and stability and control problems in the vehicle development process. It is the objective of this experimental investigation to establish a quantitative link between the wall-jet flows on the ground plane and the resulting fountain upwash prior to airframe undersurface impingement.

The experimental apparatus will consist of a two jet nozzle arrangement with jet impingement normal to the ground plane. Both equal and unequal jet strengths will be considered. Precise hot film anemometer measurements will be made of the mean velocity profiles of wall jets prior to their interaction to form fountain upwashes. The fountain upwash flow will be surveyed immediately above the fountain formation region and at different heights in the upwash flow field.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0007, WING-STORE FLUTTER ANALYSIS METHODS
Unknown, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890167; N00019-79-C-0062)

Evaluate effectiveness of using automated numerical search techniques to identify the most critical wing-store flutter conditions for realistically complex configurations.

Extend existing search algorithms to accommodate nonconstant constraints on search parameters (store properties) and include store center-of-gravity locations and pylon flexibilities as additional search parameters. Compare analysis with wind-tunnel and flight data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0008, MARITIME PATROL AIRSHIP STUDY
N.D. Brown, Goodyear Aerospace Corp., *1210 Massillon Rd., Akron, Ohio* 44315 (DN981126; N62269-78-M-4580)

Design maritime patrol airship to U.S. Navy and U.S. Coast Guard requirements. In support of work unit No. DH814 and Agency Accession No. 881665.

Based on mission requirements provided by the Navy, design a maritime patrol airship complete with principal design and performance characteristics.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0009, NAVY VEHICLE DESIGN AND CONSTRUCTION - LIFTING SURFACE THEORY FOR THRUST AUGMENTING EJECTORS (ABBREV)
P.M. Bevilaqua, Rockwell International Corp., Columbus Aircraft Division, *4300 E. 5th Ave., Columbus, Ohio* 43216 (DN875520; N00014-78-C-0557)

The objective of this investigation is to develop a computational technique for thrust augmenting ejector analysis that will include the effects of conditions external to the ejector as well as flow within the ejector shroud. For thrust augmenting ejectors in V/STOL aircraft applications, the influence of the aircraft wing/body, the proximity of the ground in landing and takeoff and the requirement for shorter, more compact diffuser sections all have an influence on augmentor performance. Classical ejector analysis considers only conditions internal to the ejector shroud and therefore cannot satisfactorily predict overall ejector performance when installed in a V/STOL configuration.

The approach taken in this effort is to separate the ejector flow field into two regions: the flow through the ejector and the flow external to the ejector. A viscous inner solution that accounts for upstream influence is matched to an inviscid outer solution including free stream velocity normal to the ejector axis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0010, ACTIVE FLUTTER SUPPRESSION APPLICATION
L.J. Huttsell, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140410)

High performance fighter-attack aircraft are required to carry many combinations of external wing-mounted stores to obtain operational effectiveness. However, some wing/store configurations are found to be critical from the standpoint of preventing flutter from occurring within the desired operational flight envelope. Speed placards are the only suitable means of preventing this flutter, but this technique generally results in significant losses in aircraft performance. The objective of this program is to investigate via analyses the capability of various flutter suppression schemes.

Analyses will be conducted on the wing/store flutter suppression models developed under AFFDL contract to verify the control system design and to determine alternate compensation schemes. Along with the analytical effort, ground tests will be conducted on the flutter suppression model to verify the model and control system dynamics and to provide data to update the analyses. Analyses will be also conducted on other configurations (e.g., bending-torsion flutter) to provide bases for future wind tunnel tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, RELATIONSHIP BETWEEN PRODUCTIVITY AND R&D EXPENDITURES - THE CASE OF COMMERCIAL AIR TRANSPORTATION
R.C. Lenz, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (SRS79-10397)

Relationship between productivity and R&D expenditures in the U.S. commercial air transportation industry are the focus of this study. It will provide new information on the effectiveness of R&D investment for an industry of major economic importance which has demonstrated a high rate of increase in productivity. The project will examine data for 30 years and will research sequential relationships between R&D and productivity increases. This study will contribute materially to the literature quantifying the rate of return on R&D investment and will serve as a basis for further extension of the proposed method to other industries.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of Science Resources Studies

1.0012, REVIEW OF V/STOL CONCEPTS AND DEVELOPED AIRCRAFT
B. Lindenbaum, University of Dayton, School of Engineering, Dept. of Mechanical Engineering, *300 College Park Ave., Dayton, Ohio* 45469 (DN890146; N0019-78-C-0552)

Compile program data and technical data and assessment for all significant V/STOL aircraft concepts developed to date.

A group of highly qualified experts in the field of V/STOL aircraft will compile all necessary data and assessments, transform these data into a standard format and integrate them into a final report.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0013, ADVANCED COMPOSITE AFT FUSELAGE STRUCTURE DEVELOPMENT
C. Foreman, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN981066; N62269-78-C-0502)

The design and development of advanced composite aft fuselage types of construction which can satisfy the configuration and structural loading requirements of future naval aircraft, and the fabrication of critical structural subcomponent test specimens.

This is an eighteen month program consisting of two phases. In phase 1 the basic preliminary design will be performed including definition of materials, material combinations, material forms, type of construction, method of fabrication and

realistic cost impact. Element and coupon tests will be performed. The second phase will consist of prototype design and the design and fabrication of a critical subcomponent, and the preparation of detailed test plans for this subcomponent.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0014, SUPERSONIC WAVE DRAG PREDICTION
R. Stancil, Vought Corp., Flight Technologies Division, *P.O. Box 5907, Dallas, Texas* 75222 (DN879006; N00167-78-C-0005)

To derive improved techniques for predicting supersonic wave drag on generalized aircraft configurations. This contract is in support of DTNSRDC work unit 1600-078, reported under DN778004.

Apply the modified linear theory method (developed by the contractor) to overcome limitations of current supersonic area rule method. The modified linear theory calculation will be programmed into a non-axisymmetric body computer routine with an input geometry definition subroutine. A graphics geometry editing routine will also be incorporated. Prepare and verify program. Furnish program decks, user's manual and user training.

SUPPORTED BY U.S. Dept. of Defense, Naval Ship Research & Development Center, Aviation & Surface Effects Dept.

1.0015, MINI-RPV (REMOTELY PILOTED VEHICLES) PROPELLERS FABRICATION
R. Marker, Systems Research Lab. Inc., Rasa Division, *1055 J. Clyde Morris Blvd., Newport News, Virginia* 23602 (DA0E3851; DAAK51 78 C 0007)

To fabricate, by injection molding, 76 carbon/nylon, small diameter (21-30 inches) propeller blades using four (4) different open and ducted propeller blade aerodynamic designs furnished by the government.

TASK I - Analysis and Design: (a) conduct stress analysis to define blade retention; (b) conduct analytical vibration analysis; (c) perform detailed designs of total blade using government-furnished engine and airfoil data. TASK II - Templates and Molding of Test Blade: (a) make required aluminum blade airfoil section templates and wooden patterns for casting aluminum mold cavities; (b) injection mold a minimum of 8 blades of critical design. TASK III - Design Verification: (a) conduct static blade tensile tests to failure using carbon/nylon; (b) revise blade molds and conduct static load tests as required; (c) perform dynamic (spin) test of critical blade design using contractor test hub. TASK IV - Blade Fabrication and Final Static Proof Test: (a) fabricate 76 final blade designs, to include machined shank and retention for ground adjustability; (b) one blade of each of the four designs shall be static proof tested. Data vibration analysis fan plots for each blade design, static and dynamic test reports and drawings shall be furnished the government.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0016, AERODYNAMICS OF BALLISTICALLY DAMAGED ROTOR BLADES HT 79-15
D. Hollenbaugh, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3862)

To establish a realistic data base in the area of ballistically damaged rotor airfoil sectional aerodynamic forces in order to develop a better understanding of the effect of aerodynamic changes due to ballistic damage on helicopter performance.

Wind tunnel tests will be conducted of both standard metal and experimental composite material rotor blade sections. Two sets of tests will be run. The first will use sections with mechanically simulated damage to isolate the parametric effects of hole size, chordwise location, and peelback area. The second will use specimens damaged by 23mm HEI rounds for exact realistic correlation. Tests shall be conducted over a range of Mach numbers and angles of attack to simulate spanwise position and flight condition.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0017, HELICOPTER FATIGUE LIFE MONITORING REQUIREMENTS/BENEFITS EVALUATION
Unknown, Veda Inc., *1755 Jefferson Davis Hwy., Arlington, Virginia* 22202 (DN890130; N00019-78-C-0597)

Identify the utility of in-service fatique monitoring of Navy/Marine helicopters to acquire information concerning life expenditure of critical rotating and non-rotating components.

A study will be made of the effects of variations from assumed design mission usage on the life expenditure of critical components. The likely impact of such differences in life expenditure (if they were known) on maintenance/rework actions will be determined to permit evaluation of worth of alternative life monitoring systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0018, NEW STRATEGIC AIRLIFT CONCEPTS
E.A. Barber, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF141230; F33615-78-C-3024)

An analysis of a future conflict between NATO and Warsaw Pact forces indicates intense fighting, with corresponding rapid consumption of military equipment. This equipment must be replaced, and supplemented, at a rate possible only with rapid airlift. This scenario is the consequence of the increasing size of the Warsaw Pact forces, and it places demands on MAC and the strategic airlift equipment unforeseen a few years ago. The situation will require additional airlift resources, which may require the design of a new AF cargo aircraft. The AFFDL has the responsibility to conduct design integration studies and technology development for future systems. A conceptual design program will be conducted to determine the feasibility of new strategic airlift aircraft.

A contractor shall conduct a design integration study within the context of a scenario involving airlift to NATO forces. The design requirements will incorporate the findings of the massive rapid resupply study contracts presently being performed. The analysis will define the vehicle in terms of range, payload, speed and related parameters, as well as force size, maintenance requirements, interface with Army equipment, and similar support requirements. The payload requirements will reflect projections of future Army weapons specifically designed for the intense NATO conflict. The findings from this study will be suitable for specifying future technology requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, SUPERSONIC WING-BODY ANALYSIS AND DESIGN
P.E. Rubbert, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF139590; F33615-77-C-3051)

This work will be in support of designing and analyzing fighter aircraft becoming operational in the 1985 time frame. Many of these aircraft have geometrical shapes that present considerable difficulty in estimating aerodynamic properties. This includes calculations of the flow in and around the region of the engine inlet and over a highly blended wing/fuselage/inlet shape typical of advanced supersonic fighters. This effort will allow the aerodynamic properties of a vehicle to be estimated without running tunnel tests on impractical shapes. This will represent a substantial cost saving to the Air Force and will result in a computer program capable of computing the flow over highly complex aircraft shapes at supersonic speeds.

An advanced paneling method will be used to describe the aircraft to a computer program. This technique can be used to calculate the three-dimensional flow field about a complete aircraft. It is also amenable to the computation of internal flows such as ducts, inlets, and wind tunnels. This method will make use of source and doublet panels as the basic building blocks for geometrically describing the aircraft configuration. Output data

would consist of pressures and velocities at all boundary points, three component forces and moments, and streamlines both on the aircraft and in the flow field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, TRANSONIC UNSTEADY WIND TUNNEL MEASUREMENTS ON AN OSCILLATING WING WITH TIP STORES
H. Tijdeman, National Aerospace Lab., *Amsterdam, Netherlands* (DF140100; AFOSR-77-3233)

This work unit supports the aeroelastic evaluation of high speed aircraft. It will contribute to the development of improved unsteady aerodynamic methods to predict aircraft aeroelastic stability and structural dynamic response. The goal is to conduct unsteady aerodynamic tests on oscillating models in transonic wind tunnels, resulting in ultimate savings in the costs to design new aircraft. The capability to make these measurements will allow the orderly development of necessary analytical methods to optimize aircraft structures for minimum weight and cost.

The proposed effort is to perform transonic unsteady wind tunnel measurements on an oscillating wing with external stores. The objective is to obtain experimental data to guide improvements in transonic unsteady theories which will be used to ascertain flight safety of future air-combat fighters with respect to wing flutter.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, MATERIAL SUPPORT TECHNOLOGY - GUIDED ELASTIC WAVE PROPAGATION IN FERROIC MATERIALS
B.A. Auld, Stanford University, W.W. Hansen Lab. for Physics, Dept. of Applied Physics, *Stanford, California* 94305 (DN975336; N00014-79-C-0222)

Radar command and communications devices use delay lines. The objective of this work will be to study the fundamental aspects of elastic wave trapping and propagation at materials interfaces which could possibly result in new acoustic delay devices. This study will be concerned with the critical material properties at the interfaces that will enable elastic wave trapping and control subsequent propagation of the elastic wave.

The conditions necessary for elastic wave propagation at interfaces between oppositely polarized regions in both electrostrictive and piezoelectric ceramics will be studied. Effects of material properties such as elastic stiffness and piezoelectric coupling, of scattering and depolarization due to variations in local polarization, and of interface thickness on elastic wave trapping and propagation will be carried out. Similar studies of the above properties for single crystal domain walls in both ferroelectric and ferroelastic materials will also be studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0002, THEORY OF MANY-BODY PROCESSES IN CHEMICAL PHYSICS
W.P. Reinhardt, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Chemistry, *1200 University Ave., Boulder, Colorado* 80302 (CHE77-16307 A02)

Reinhardt and co-workers will continue to develop and to exploit ideas of L2 discretization of the continua involved in scattering, photoabsorption, and intense field multiphoton absorption and ionization, with special attention paid to the multiple continua which arise in single photon double electron ejection, heavy particle impact dissociation, and intense field processes. Systems such as H, He, O2, N2, NH, NH2, CH3-, LiF-, NaCl-, He2 ion, Ne ion will be involved in such studies. In related areas they will investigate the use of Lie group techniques and classical and semiclassical methods to obtain improved understanding and predictive abilities in dealing with atoms and molecules in highly excited states, and in intense field processes. Taking further advantage of recent rapid developments in classical and semiclassical mechanics, they will undertake development of a new formulation of unimolecular processes. Finally, beginning with the recent synthesis of scattering data suggested by the surprisal techniques of Levine and Bernstein, an attempt will be made to develop a formulation of quantum scattering theory appropriate to direct determination of various moments of the S-matrix, rather than the whole S-matrix itself.

This research represents a continuation of that currently supported by Foundation grant CHE-7419605.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

3.0003, NEUTRON DIFFRACTION CRYSTAL AND MOLECULAR STRUCTURE STUDIES
J.M. Williams, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (CHE78-20698)

The neutron diffraction structural studies of several academic scientists at Argonne National Laboratory are supported by a grant from the Structural Chemistry and Thermodynamics Program. Although a variety of research problems will be solved with the assistance of neutron diffraction data, a common objective of all projects will be the exact specification of hydrogen atoms in complex molecular systems. In particular, metal hydride and cluster compounds will be examined with the specific purpose of providing quantitative structural parameters for catalytic models.

This research is a continuation of that currently supported by Foundation Grant, CHE-7726650.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, LOCAL ATOMIC ARRANGEMENTS IN ALLOYS AND INTERMETALLICS
J.B. Cohen, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science, *633 Clark St., Evanston, Illinois* 60201 (DMR76-80662 A02)

This is a continuation of research employing X-ray and neutron diffraction techniques to characterize atomic arrangements in metallic materials associated with important dynamical lattice events. Among the areas under investigation are: 1. heterophase fluctuations in alloys which undergo phase transitions; 2. kinetics of order-disorder reactions; 3. premonitory effects prior to the first-order reaction in Cu3Au to ascertain if these are associated with anharmonic effects and possible relationship to other kinds of first-order transitions; 4. diffuse neutron scattering from age-hardened Al-Cu alloys to define quantitatively the internal stucture of a Gunier-Preston zone by computer simulation with measured short-range order parameters and displacements; 5. local atomic arrangements in ternary Heusler alloy systems which exhibit different ordering temperatures; and 6. detailed determination of the defect state in Ni1 plus or minus x Al1 plus or minus x to obtain the Warren short-range order parameters and, with computer simulation, the details of non-random arrangement. Lastly, a new method of diffuse scattering analysis is under study which could, for the first time, yield the separate mean displacement of AA and BB pairs in a concentrated binary alloy, and allow computer simulation of these displacements. This is a renewal of NSF Grant DMR73-07549-A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0005, RESEARCH INITIATION - REACTION OF POWDER INJECTION INTO LIQUID METALS
M. McNallan, University of Illinois, Chicago Circle Campus, School of Engineering, Dept. of Materials Engineering, *Box 4348, Chicago, Illinois* 60680 (DMR79-08198)

Despite the wide utilization of powder injection in process metallurgy, no general model has been established which can predict the reaction rates of the injected powders. The goal of

this research is to develop an advanced model of the reactive powder injection process by making use of current knowledge of the fluid dynamics of submerged gas jets. The effects of powder injection on the fluid dynamics of these jets will be determined. The reaction model will be tested and refined by applying it to the problems of copper deoxidation by injected powders. The oxygen concentration in the copper will be monitored continuously during the injection using a lime stabilized zirconia electrochemical cell. The fluid dynamics of the gas-particle jets in the liquid copper will be monitored by recording the pressure fluctuations in the nozzle. The effects of changing system parameters such as injection velocity, powder to gas ratio, and jet orientation will be investigated as well as the effects of changing powder properties such as particle size, density, and chemical nature.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0006, ELECTRONIC STRUCTURE AND MOMENTUM DISTRIBUTIONS FROM ELECTRON IMPACT IONIZATION

M.A. Coplan, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, Dept. of Chemistry, *College Park, Maryland* 20742 (CHE79-09430)

This research is in the area of quantum chemistry. Drs. Coplan, Moore, and Tossell are applying a recently-developed coincidence technique, using a multiple detector spectrometer controlled by a microcomputer, to problems of electronic structure and bonding in molecules. An expanded program is planned to follow-up the consequences of the work already accomplished as well as to extend the method to nitrogen bases, inorganic molecules with third-row atoms and transition metal atoms, thin films and molecules adsorbed on surfaces. To carry out the program a second bakeable spectrometer with higher energy resolution will be built. A sample handling system capable of transferring the vapors of the less volatile compounds will also be constructed. This research represents a continuation of that currently supported by Foundation grant CHE7615886.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0007, MECHANISMS FOR FAST DIFFUSION IN METALS

D. Turnbull, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Engineering & Applied Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DMR77-10151 A02)

Research previously supported by DMR76-21629.

The mechanisms underlying the phenomenon of 'fast diffusion' in metals will be investigated. The research will be centered on (1) the problem of the distribution of fast diffusing impurities over the various states (e.g., interstitial, atomic exciton, substitutional or cluster states) and (2) the effect of this distribution on the mechanical and electrical behavior of the alloys.

In particular, the research will include (1) the characterization of the effects of Au and Ag dissolution and precipitation on the yield stress of Pb single crystals at low temperature. Also, these effects will be interpreted on the basis of the knowledge of the states of impurity derived from the diffusivity and resistometric studies, (2) the measurement of the kinetics of formation of Au clusters resistometrically, and (3) the performance of Kirkendall type experiments, resistometric and position studies on the system Pb(Zn) in order to seek further evidence for the atomic mechanism of transport.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0008, CHARACTERIZATION OF HELICOPTER MATERIALS HARDENED AGAINST HEL RADIATION

R. Fitzpatrick, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0F4703)

The objective of this research effort is to provide data on the effects of high energy laser radiation on ceramic, metal and polymer materials that are planned for use in advanced Army systems. Hardening techniques will be applied and the relative merits of the hardening approaches will be measured.

Structural components in the form of hollow tubes and flat plate members will be irradiated while under load using both continuous wave and repetitively pulsed laser radiation at 10.6 microns. In addition, large diameter thin walled pressure missles will be flood loaded using large diameter CO2 laser beams. The large diameter cylinders will not be hardened in order to develop baseline response data. The test conditions will be carefully chosen to simulate the actual environment that the full scale Army system will be exposed to in a combat situation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0009, A STUDY OF THE SURFACE PLASMON STATE IN METALS AND DISORDERED BINARY ALLOYS

A.S. Karakashian, University of Lowell, Research Foundation, *Lowell, Massachusetts* 01854 (INT78-28037)

This award provides travel funds to allow co-principal investigators Dr. A. S. Karakashian and Dr. Y. Y. Teng, University of Lowell, to cooperate with Dr. K. P. Wang, National Taiwan University, and Dr. K. C. Lee, National Central University, Taiwan, on a study of the surface plasmon state in metals and disordered alloys. Refined and extended measurements of the electromagnetic waves detectable at the surface of metals and alloys will be made. Values of the fundamental electronic properties of metals and alloys, namely the bulk plasma frequency, the collision time, the conduction electron concentration, and the effective conduction electron mass will be determined. Drs. Lee and Teng, both experimentalists, will conduct complementary experiments at their respective institutions, while Drs. Wang and Karakashian, both theorists, will be responsible for calculations of surface plasmon excitation and propagation. This study is expected to better define the high frequency electronic properties of alloys and has importance in applications where alloys are exposed to these frequencies such as satellites, high altitude aircraft, etc. The project has been approved under the U.S.-Taiwan Cooperative Science Program and the counterpart scientists in Taiwan will receive support for their participation from the National Science Council.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

3.0010, CHEMICAL AND MICROSTRUCTURAL EFFECTS ON THE FRACTURE CHARACTERISTICS OF HIGH DENSITY POLYCRYSTALLINE ALUMINA

D.W. Smith, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engineering, *Houghton, Michigan* 49931 (DMR79-10012)

An investigation of the relationship between the fracture behavior of high density polycrystalline alumina and its microstructure and impurity distribution will be continued. The fracture toughness of alumina has been found to decrease as a result of calcium segregation to grain boundaries. Further studies will examine how doping with yttrium influences grain boundary segregation and intergranular versus transgranular fracture. Specimens of different doping concentrations will be prepared by hot pressing. Grain boundary segregation of impurities will be determined by Auger electron spectroscopy, and information concerning the crystallographic nature of cleavage will be determined by scanning transmission electron microscope electron channeling patterns.

This is a renewal of NSF Grant DMR76-08467.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0011, MATERIAL SUPPORT TECHNOLOGY - ELECTRIC, MAGNETIC AND THERMAL PROPERTIES OF MATERIALS FOR CRYOGENIC DEVICES

J. Daunt, Stevens Inst. of Technology, Cryogenics Center, *Castle Point Station, Hoboken, New Jersey* 07030 (DN775424; N00014-77-C-0404)

The objective of this task is to study the electronic, magnetic and thermal properties of cryogenic materials for use in superconducting surveillance and communication devices of interest to the Navy.

This task comprises a variety of experimental techniques. They include: (1) specific heat measurements of helium and xenon films on homogeneous substrates, (2) specific heat measurements of solid hydrogen isotopes and solid mixtures of the hydrogen isotopes down to about 0.1 degrees K, (3) continuous wave NMR studies of He3 submonolayer and multilayer films on coated homogeneous substrates, and (4) continuous wave NMR studies of solid hydrogen isotopes to tempeatures near 0.1 degrees K.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0012, MICROMECHANICAL PROPERTIES OF CRAZES 16123-MS

E.J. Kramer, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DA0G8987; DAAG29-79-C-0015)

To conduct studies of the micromechanical properties and structure of crazes in polymers which are brought about under both dry and environmental conditions. Relevance - crazing has been identified as a frequent precursor to fracture of polymeric materials which are important components of fuzes, gas masks, and other items of personnel protection and support, packaging, and aircraft canopies.

A new quantitative transmission electron absorption microscopy technique with very high spatial resolution will be used in the measurement of the micromechanical properties of crazes. The research includes comparisons of crazes grown in homogeneous stress fields and those in inhomogeneous fields; crazes grown in time-varying stress fields will be studied, as will the detailed structure and properties of the craze tip; molecular weight effects, strain hardening as related to molecular weight, and the influence of solute diffusion on the thickening mechanisms of environmental crazes are also topics to be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0013, SILICON CARBIDE EPITAXY FOR ELECTRONIC DEVICES

R.F. Davis, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Materials Engineering, *Raleigh, North Carolina* 27607 (DN975244; N00014-79-C-0121)

This work seeks new approaches to reliably and reproducibly grow silicon carbide of semiconductor grade for use in higher temperature Navy electromagnetic systems.

Cubic (beta) silicon carbide epitaxial films will be grown by organometallic low pressure vapor phase deposition and evaluated for its electronic properties. High pressure, high temperature growth technology will be developed as a backup.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0014, DEVELOPMENT AND APPLICATION OF MOLECULAR ORBITAL THEORY

J.A. Pople, Carnegie Mellon University, Graduate School, Dept. of Chemistry, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (CHE79-01061)

This grant supports research under the Quantum Chemistry Program for the development of molecular orbital theory, and its application to significant chemical problems. The techniques will be developed in a manner that will allow experimental chemists to use them on their own for investigations of molecular structure and reactivity. Applications receiving particular attention will include problems related to molecular vibrations and exploration of reactive energy surfaces.

Profesaor Pople will continue his theoretical investigations on the development of 'model chemistries'. These will include models of electron correlation, with particular emphasis on methods for the rapid evaluation of energy derivatives with respect to nuclear positions. An aim of this research is to open up the systematic exploration of reactive potential energy hypersurfaces for polyatomic intermediates. Key features of topology of these surfaces will be identified, with a view towards relating them to rates of elementary chemical reactions.

This is a renewal of research currently supported by NSF grant CHE7509808 at Carnegie Mellon University.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0015, LOCALIZED ELECTROCHEMICAL CORROSION CELLS 15539-MS

B.F. Brown, Brown University, Graduate School, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DA0F9298; DAAG29-78-G-0165)

To determine the solution chemistry of electrolytes existing in localized corrosion cells (e.g., pits and propagating stress corrosion cracks), and to investigate the corrosion behavior of metals in these solutions. Relevance - the research has relevance to inhibition of corrosion and catastrophic failure in aircraft, mobility vehicle structures and lightweight armor.

Macroscopic cells will be utilized which contain the concentrated electrolyte as determined by experimental measurements on solutions in propagating cracks in aluminum and other metals. Aluminum and other metal specimens will be exposed to the concentrated electrolyte to determine corrosion response, effect of environment on rate of repassivation of newly exposed surfaces, and electrochemical reaction kinetics of the specimen electrodes as a function of electrolyte chemistry.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0016, REAL-TIME DAMAGE MODES IN CARBON-CARBON COMPOSITE MATERIALS

P.H. Francis, Southwest Research Inst., *8500 Culebra Rd., P.O. Drawer 28510, San Antonio, Texas* 78228 (DN775516; N00014-77-C-0510)

Carbon-carbon materials are used in propulsion and reentry components of advanced strategic systems. Failure modes and mechanical properties are significantly affected by initial defect and flaw distributions and subsequent progressive damage under load. Significant damage (beyond the initial damage) can occur throughout the part under load before failure occurs. This research program will identify damage modes/mechanisms and subsequential constituent failure. Residual stresses, especially in circumferentially woven carbon-carbon materials, may significantly affect failure/damage behavior.

A significant number of carbon-carbon material test specimens will be evaluated. Test methods will be developed to utilize partial ring test specimens. Residual strains will be evaluated. Acoustic emission and scanning electron microscopy techniques will be used.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0017, SYNTHESIS AND PHYSICAL PROPERTIES OF TRANSPARENT ENGINEERING THERMOPLASTICS BLOCK COPOLYMERS 14072-C

J.E. McGrath, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Chemistry, *Blacksburg, Virginia* 24061 (DA0E9199; DAAG29 76 G0312)

It is proposed to investigate ductile glassy-glassy and glassy-crystalline block copolymers. Specifically, poly (aryl ether) polycarbonate and poly (aryl ether) - poly (alkylene terephthalate) systems will be studied in detail. Relevance - these new block copolymers potentially will have excellent dynamic,

mechanical and high strain rate properties and resistance to solvents. They will be candidate materials for helicopter windshields and as thermoplastics for engineering materials requiring stringent performance characteristics.

The chemistry and structural features that control phase separation and morphology will be investigated through the variation of the bisphenol in the polycarbonate structure, the diol in the terephthalate, block lengths, and block regularity. The dynamic shear moduli over a wide range of temperatures and frequencies will be used in evaluating viscoelastic characteristics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0018, MICROWAVE SPECTROSCOPY OF MOLECULAR IONS AND OTHER TRANSIENT SPECIES
R.C. Woods, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Chemistry, *500 Lincoln Dr., Madison, Wisconsin* 53706 (CHE79-50005 A07)

Professor Woods is supported by a grant from the Structural Chemistry and Thermodynamics Program to measure structural parameters for molecular ions. The construction of the apparatus necessary to measure not only microwave, but also optical and quadrupole mass spectroscopic data, will be completed. This instrumentation is unique and is required for determining accurate structural details for unstable, transient species. These structural species are central to the understanding of chemical reactions not only in laboratories, chemical plants, and the environment, but also in the astrophysical realm. The advanced measurement instrumentation developed under Woods' direction is expected to provide unique structural parameters.

This reseach is a continuation of that currently supported by Foundation Grant, CHE-7607374.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, MISSILE TECHNOLOGY/GSE - ROCKET EXHAUST EFFECTS
D.L. Booker, U.S. Dept. of Defense, Army, Missile Research & Development Command, Technology Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1132)

To obtain a theoretical model describing the flow of a rocket exhaust gas in a lightweight cylindrical tube during the launch phase. The model will include the effects of real gas flow, spin vane disturbance, and various nozzle and launch tube configuration parameters. Subscale cold gas experimental data performed at the University of Texas will be used to substantiate the computer results. To eliminate massive 'blow-by' during launcher design by the development of designer guidelines.

Contractor effort will be monitored closely to provide direction and support in the development of the overall ongoing program. Existing and future programs will benefit from the data as it becomes available through application of the theory and test results.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

4.0002, PASSIVE SEISMIC SURVEILLANCE
N.N. Bojarski, (No Performing Organization Reported), *California* (DN975321; N000140-79-C-0189)

In many military situations one wants to determine information about a source from remotely sensed data. Examples include the determination of a gun position, the direction of low flying aircraft and missiles, and tank and troop movements from data gathered by remote acoustic or seismic sensors. The objective of this task is the development of mathematical techniques for extracting desired information from gathered data.

Mathematical inverse problem techniques will be applied to the problem of locating gun positions from remotely sensed seismic data. Associated graphics will be explored to clearly represent solutions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0003, TRAILING EDGE SEPARATION ON AIRFOILS
T. Cebeci, California State University & Colleges, California State University, Long Beach Campus, School of Engineering, Dept. of Mechanical Engineering, *6101 E. 7th St., Long Beach, California* 90840 (DN775166; N00014-77-C-0156)

A major factor which influences the characteristics of airfoils and wings is the nature of the flow in the vicinity of the leading and trailing edges. The proposed research will be a theoretical study of the onset of unsteady separation in such regions at low speeds. In addition, studies will be made of: (a) the effects of roughness on two-dimensional and axially symmetric bodies at high Reynolds numbers; and (b) the drag of wings at small incidence.

The separation phenomenon will be studied, initially, within the framework of classical boundary layer theory; subsequently, it will be studied within the framework of interacting boundary layer theory. The separation region will be required to be slender. The emphasis will be on unsteady laminar flow; some consideration may be given to turbulent flow.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, CHARGE TRAPPING IN SILICON DIOXIDE
B. Deal, Fairchild Camera & Instrument Corp., Dept. of Semiconductor Device Research, *Palo Alto, California* 94303 (DN975407; N00014-79-C-0297)

Demands by future Navy and DOD electronic systems requirements for improved capability and reliability in silicon electron devices require improved understanding of the processing effects which dominate the quality of the passivating coatings. Trapping of charge in silicon dioxide as a result of fabrication methods must be understood.

Capacitance voltage measurements will be made on MoS structures produced by oxidizing silicon wafers. Avalanche charge injection will be used to study the trapping of charge in the oxide and these effects will be correlated with the trapping phenomena introduced by ionizing radiation, high field tunneling, sputtering, metal deposition, and ion implantation. Various processing variables will be studied to determine optimum conditions for minimizing trapped charge.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, COMMAND AND CONTROL - VOICE CONTROL, VOCABULARY DEVELOPMENT
M.W. Gradt, Logicon Inc., *P.O. Box 10179, San Diego, California* 92110 (DN875725; N00014-78-C-0692)

As aircraft design and operation get more complex, display and control functions may overload the crew member's visual and motor channels and degrade his performance. A potential solution is the application of advanced speech technology to perform certain display and control functions. A most important factor in man-computer dialogues is the vocabulary used. The vocabulary must fit the user, the machine, and meet operational/functional requirements. This research will address the problem of small vocabulary design for application to an operational fighter aircraft.

In man-computer vocabularies there are several syntactical variables; several affect the man and some affect the machine. Man's capability to learn and accept the vocabulary and the machine's ability to recognize and synthesize the words and phrases are two most important variables. The approach will involve the formulation of candidate vocabulary items and the experimental validation and optimization of the vocabulary.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, THE GENERATION AND GROWTH OF PC 1 GEOMAGNETIC PULSATIONS

O.G. Villard, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ATM78-26842)

This grant provides funds for studies of the generation and initial growth of Pc 1 geomagnetic pulsations (frequencies 0.2 - 5 Hz). The object of the studies is to extend our knowledge of the initial phase of Pc 1 pulsation events with the ultimate goal of being able to control the pulsations and use them for active experiments in the magnetosphere and ionosphere. Each of the three component studies is based on ideas about the generation or temporal growth of Pc 1 pulsation events, and the work draws heavily on the extensive collection of ultra-low-frequency and very-low-frequency data held by the Radioscience Laboratory at Stanford. Specifically, the three studies are the following: (1) A study of the possible modification of Pc 1 pulsation activity by electromagnetic noise in the Pc 1 frequency range produced by the San Francisco Bay Area Rapid Transit (BART) System, (2) A study of the possible stimulation of Pc 1 geomagnetic pulsations by naturally-occurring repetitive very-low-frequency activity, and (3) Measurement of the initial growth of Pc 1 pulsations, and comparison of the growth characteristics with those of triggered very-low-frequency emissions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0007, ELECTRONIC SURFACE STATES OF SILICON AND III-V COMPOUND SEMICONDUCTORS

W.E. Spicer, Stanford University, Stanford Electronics Lab., *Stanford, California* 94305 (DN975214; N00014-79-C-0072)

Future electronics systems for Navy and other defense applications will require the capabilities of advanced electron and electrooptic devices fabricated on silicon and compound semiconductors. Problems of reliability, fabrication, yield, and cost are directly related to the fundamental problem of trying to understand and control the processes which occur at the surfaces of these materials and at the interfaces with metals, insulators, and other semiconductors.

Using a complementary set of surface and thin film analytical techniques, the investigator will study the fundamental interactions which occur when various metals and insulators are deposited on compound semiconductor surfaces. Auger and photoemission spectroscopies will be used. One major goal is to deduce the role of surface defects (e.g. atom removal) in pinning the surface fermi level and thus establishing the Schottky barrier potential. Other questions to be answered are: What effect does oxygen contamination of the surface have on the Schottky barrier? What is the effect of the metal alloying with the semiconductor? Does surface segregation in the three element system have any impact on the resulting potential? Another effort will begin by searching for a material which minimizes the fermi level pinning followed by controlled introduction of defects to adjust the potential for specific device requirements. Surface preparation techniques will be a parameter in all the studies. Ultra pure, cleaved silicon and gallium arsenide materials will be emphasized. Schottky barrier diodes on silicon will be studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, ABSORPTION COEFFICIENT DETERMINATION USING PULSE LASER TECHNIQUES

L.B. Stotts, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Communications Systems & Technology Dept., *San Diego, California* 92152 (DN987518)

The primary objective of this effort is to demonstrate the feasibility of determining, in-situ, the optical absorption coefficient of ocean water using pulse laser techniques. This type of information is necessary to characterize energy transport of blue/green radiation through the ocean and will find use in proposed Navy surveillance and communications systems such as ODCS and the Navy/DARPA Strategic B/G Laser Satellite Communications Program.

An optical propagation link employing a narrow temporal pulse source and a fast irradiance detector will be immersed in an absorptive, particulate multiple scattering medium (water). The subsequent multipath time spreading of the initial pulse width by particulate multiple scattering will be recorded and used in conjunction with a radiative transfer model to determine the absorption coefficient. A comparison of this value with the known absorption coefficient of the medium will be made to assess the technique's accuracy. Various propagation media and/or propagation wavelengths will be used.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

4.0009, IMPACT IONIZATION AND HOT CARRIER TRANSPORT IN SEMICONDUCTORS 15295-EL

C.R. Crowell, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DA0F9082; DAAG29-77-G-0202)

To study ionization coefficients and velocity field relationships for electrons and holes in GaAs, InP and GaP. Relevance - direct and potential impact on the state of the art in photocathodes, advanced semiconductor micro- and millimeter wave devices, radar and EW systems are cited by Army reviewers.

Schottky barrier configurations will be used for carrier injection. Measurements will be made and models constructed using non-localized formulation of impact ionization. Transient analysis of space-charge limited current flow will be used for modeling velocity-field relationship.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0010, A STUDY OF SATELLITE POWER SYSTEMS

R. Kasper, National Academy of Sciences, National Research Council, *2101 Constitution Ave. N.W., Washington, District of Columbia* 20418 (PRM79-19687)

The National Academy of Sciences through the National Research Council will review studies, especially those pursued by the Department of Energy, of the concept of solar power satellites. The NAS work plan will focus in particular on environmental, technological, socio-economic, and international concerns that may derive from the execution and operation of satellites to be used for the generation and transmission to earth of solar power. The NAS study will attempt to identify critical scientific and technical issues in the evaluation of the satellite solar energy system as well as point out gaps in the studies undertaken by the Department of Energy. The independent critiques to be provided by the Academy will also include a comparison of solar energy satellite systems with alternative collection and transmission energy mechanisms.

The National Research Council through its Environmental Studies Board will establish a Committee on Satellite Power Systems. This committee, in cooperation with other pertinent units of the NRC, will conduct the study. The Committee may make use of panels, workshops, symposia, public meetings, consultants or other arrangements.

The Committee will also maintain close contact with both the Department of Energy and the National Aeronautics and Space Administration.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management

4.0011, PILOT HELMET MOUNTED DISPLAY SYSTEM

J.J. Kulik, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Advanced Simulations Concepts Lab., *Orlando, Florida* 32813 (DN994011)

Design and construct a feasibility model of a pilot helmet mounted display system. Design will use latest technologies in the fields of interest, computer image generation and head and eye tracking systems, to produce small, mobile inexpensive designs with superior performance characteristics.

System concept will be formulated and required basic research and high risk areas will be defined. Several experiments will be designed to define parameters required to accommodate

the capabilities of the human in the system loop. Studies to determine some of the human physical characteristics and limitations will be made to determine maximum allowable system delay and techniques to minimize them. A breadboard to demonstrate an acceptable system time constant will be built and demonstrated. Study will be made on the visual subsystem to define required parameters. A system design will be formulated and a specification based on the design will be written. Construction of the system either in-house or under contract will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulations Concepts Lab.

4.0012, DUST SUPPRESSION TECHNIQUES FOR ARMY OPERATIONS

G.W. Schanche, U.S. Dept. of Defense, Army, Corps of Engineers, Construction Engineering Research Lab., *P.O. Box 4005, Champaign, Illinois* 61820 (DA0C8150)

To develop and evaluate suppression techniques for limiting fugitive dusts in a combat zone. Recommended techniques will be used by field personnel in reducing visual obscuration caused by fugitive dusts on temporary helicopter landing pads, temporary landing strips, supply storage dumps, staging areas, combat roads. A report detailing the results of the study will be ready for distribution on Sept. 30, 1980. The report will include recommended dust suppression techniques including details on costs, durability and implementation procedures.

Currently available dust suppression techniques will be reviewed for applicability to the Army's needs. Where necessary, techniques will be modified or developed to fulfill the Army's needs. Several candidate techniques will be field evaluated for effectiveness, cost, durability and ease of implementation. Technique identification, modification and development will be performed in FY79. Field evaluations of candidate techniques will be performed in FY80. A technical report detailing the results of the study will be produced in FY80.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Construction Engineering Research Lab.

4.0013, AERODYNAMIC NOISE GENERATION FROM AND PRESSURE STRUCTURE IN TURBULENT SHEAR FLOWS

B.G. Jones, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Nuclear Engineering/Mechanical & Industrial Engin., *207 Engineering Hall, Urbana, Illinois* 61801

The mechanisms of aerodynamically generated noise in turbulent shear flows are being studied in relation to noise suppression. Analytical models are being compared to data on both velocity and pressure field statistical structure. Models of the turbulent pressure field structure are being applied in the dilation source model to predict radiated sound fields. Prediction of far-field sound in both broad band and narrow band compares well with measured sound power levels from simple jet flows. The static pressure transducer developed in our laboratory has been verified through comparison of measurements and theory as an accurate flow field measuring sensor. Models for the equilibrium turbulence range for pressure spectra show good agreement with processed data. Pressure-velocity single point correlation measurements in the jet mixing region are being compared with turbulent energy budget predictions.

SUPPORTED BY University of Illinois

4.0014, STUDIES OF THE DYNAMICS OF THE ATMOSPHERIC SODIUM LAYER

C.F. Sechrist, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engin, *207 Engineering Hall, Urbana, Illinois* 61801 (ATM77-00933)

This grant funds an experimental and theoretical study of the Earth's sodium layer, a permanent distribution of sodium atoms and ions located around 80-100 km altitude. In particular, it funds: 1. a computer modeling study of the chemistry and dynamics of the sodium layer. 2. a series of measurements and corresponding data analyses using the University of Illinois lidar (laser radar) system. 3. improvements in the lidar equipment. Successful completion of this work will pave the way to more definitive experimental work and will aid in understanding the ion chemistry of this region of the atmosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

4.0015, FABRICATE INTERACTIVE CONTROL SURFACE MODIFICATION KIT

S. Merle, Magnavox Government & Industrial Electronics Co., *1313 Production Rd., Fort Wayne, Indiana* 46808 (DN981039; N62269-78-C-0356)

Test and evaluate an ICP interactive control panel for use with an acoustic processor such as the AN AQA 7 V 4. This contract supports work unit ZU 701, Agency Accession No. DN68 1083.

The complexity of ASW systems has increased to such a level that more control switches are now required than ever before . The load on the operator has increased to the point where it takes much training and experience to effectively operate the equipment. Operator fatique is increased and thus efficiency is decreased. The ICP was developed to relieve operator load. By employing microprocessors with programs for presentation to the operator sets of 'choices' and 'alternatives', operator 'experience' can be placed in the software. The display of alternatives and their selection by the operator will be accomplished using 'touch entry' plasma panels with computer-prompted programs.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

4.0016, SHIPBOARD LAUNCHERS

E.A. Rawls, Chrysler Corp., *Old Gentilly St., New Orleans, Louisiana* 70129 (DN782095; N00123-76-C-0741)

Develop an engineering handbook identifying blast effects from stationary shipboard launchers.

Missile systems considered for stationary shipboard launchers include variants of Standard, SeaSparrow, Harpoon, ASROC, SAM-D and SeaPhoenix. Also included are the advanced surface-to-air Ramjet missiles (ASAR), vertical ejection launched aero reaction control (VELARC) type missiles, supersonic combustion Ramjet missile (SCRAM), and any conceptual modular missile systems. A thorough analysis of blast effects for each missile system will be conducted. Blast effects include thermal, pressure, erosive, acoustic, and corrosive damage caused by main rocket motor, missile booster, ejector, or various combinations. These effects are to be considered with respect to flyaway and restrained firings for both simple blast deflectors and plenum chambers. Possible damage to both the launcher and ship structure/systems will be assessed. The analysis will be verified with blast tests. Conceptual hardware to provide solution to blast-effect problems will be designed and demonstrated. The final report is a handbook describing the effects, the problems caused, demonstrated solutions, and guidelines for further engineering efforts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Weapons Center

4.0017, TWO-DIMENSIONAL UNSTEADY LAMINAR BOUNDARY LAYERS

K.C. Wang, Martin Marietta Corp., Martin Marietta Laboratory, *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DN875029; N00014-77-C-0650)

Unsteady separation which may manifest itself in the dynamic stall of wings and helicopter blades plays a central role in limiting the performance of many aeronautical systems. The proposed research will be directed to the development of a methodology to compute unsteady laminar flows with flow reversal and to apply this methodology to the development of a better understanding of the physics of such flows.

An unsteady, incompressible, laminar boundary layer theory will be developed for the computation of two- and three-dimensional flows. Particular emphasis will be placed on the implementation of a technique for treating the proper zones of de-

pendence implicit in the equations so that flow reversal can be studied accurately. An attempt will be made to develop a new criterion for unsteady separation. The initial studies will center about simple geometries such as ellipses and ellipsoids.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0018, NAVY VEHICLE DESIGN AND CONSTRUCTION - BOUNDARY VALUE AND NATURAL FREQUENCY ANALYSIS OF THIN SHELL STRUCTURES

B.K. Donaldson, University of Maryland, College Park Campus, School of Engineering, Dept. of Aerospace Engineering, *College Park, Maryland* 20742 (DN675635; N00014-76-C-0872)

Novel finite difference and finite element analytical techniques will be explored under this effort for the purpose of more effectively and efficiently determining the structural response of naval vehicle systems.

Research is being carried out under this task along the following lines: a new class of flat plate finite elements is being developed with straight edges such that an increased accuracy over previous elements should evolve; an improved technique is being developed to obtain increased accuracy for transient structural dynamic problems; utilization of energy techniques with arbitrary mesh finite difference grids to determine the response of plate and shell structures; and investigation of the effect of rapid load gradients on arbitrary mesh finite difference solutions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0019, A STUDY OF ANODE PHENOMENA IN HIGH INTENSITY ARCS

E. Pfender, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Mechanical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (ENG77-04108 A02)

The research is an analytical and experimental study of plasma-wall bounding layers and of anode phenomena induced by MHD effects as well as by melting and/or evaporation of anode material. A stepwise improvement of a previously introduced analytical model offers the opportuntiy to assess the importance of various effects on the arc in the anode region as, for example, convection and radiative cooling, melting, evaporation, and deviations from local thermodynamic equilibrium. The ultimate analytical models for the anode region are expected to approach experimental conditions so closely as to afford a quantitative comparison between theory and experiment. Information on the effects of anode melting and/or evaporation on the arc is obtained from time-resolved photography and qualitative spectroscopy. These results are crucial for the development of realistic models which take secondary effects into account. The research support is for the third year of NSF Grant ENG7704108 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0020, ENGINEERING SPECIALIZED RESEARCH EQUIPMENT - DROPLET BREAKUP IN HIGH SPEED COMBUSTION GAS FLOWS

L.H. Caveny, Princeton University, School of Engineering & Applied Sciences, Dept. of Mechanical & Aerospace Engineering, *Box 430, Princeton, New Jersey* 08540 (ENG79-10884)

A high speed framing camera is to be purchased for research on the breakup of burning droplets in combustion gas flows in the Mechanical and Aerospace Engineering Department at Princeton University. The proposed camera has the additional advantage of using short strips of film which lend themselves to specialized and rapid processing in conventional laboratory darkrooms.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0021, III-V HETEROJUNCTION STRUCTURES FOR LONG WAVELENGTH INJECTION LASERS (DARPA AO 3137)

C. Nuese, RCA Corp., *Washington Rd., Princeton, New Jersey* 08540 (DA0D3115; DAAB07-76-C-0872)

To develop efficient injection lasers operating at room temperature (300 degrees Kelvin) and emitting any desired wavelength in the 0.9-1.7 micron spectral range.

Heterojunction structures of quaternary III-V alloys (such as indium, gallium, arsenic, phosphorous) will be grown by the vapor phase epitaxy method. These structures will be evaluated for lattice matching using advanced metallurgical and electrical methods. Double heterojunction injection lasers will be fabricated, their performance evaluated, and growth techniques optimized for long-life room-temperature performance.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Night Vision & Electro Optics Lab.

4.0022, SUPERSONIC POKER CO LASER

W. Burckel, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (DF189200)

To experimentally and theoretically improve the understanding of the performance characteristics and physics of poker discharge techniques in supersonic CO electric discharge lasers. (Poker is a controlled avalanche ionization technique for high power discharge control without the use of electron beam guns.)

Laboratory experiments will be performed on a short-runtime supersonic CO electric laser using poker discharge techniques. Discharge physics and performance and stability characteristics, laser performance characteristics, and device-dependent effects will be experimentally and theoretically investigated for CW operation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0023, NONLINEAR AND ACTIVE OPTICAL DEVICES

C.L. Tang, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (ENG78-09887 A01)

The main objective of this research program is to explore new active and nonlinear optical devices for use in optical communication systems. The three main goals of this effort are to develop: (1) an electrically tunable semi-conductor laser, (2) an externally controlled Q-switchable semiconductor laser in order to achieve high peak power and sub-nanosecond pulse duration, and (3) a fast optical detector using a microwave field effect transistor (FET) in gallium arsenide (GaAs).

Initial success has been obtained with an electrically tunable external cavity semiconductor laser which shows great potential. Based upon early experiments, a fast optical detector appears feasible. Further work includes the integration of such photoconductive detectors with high purity optical waveguides.

This research was previously supported under NSF Grant ENG76-11729.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0024, RESEARCH INITIATION - BROADCAST COMPUTER COMMUNICATION NETWORK DESIGN AND ANALYSIS

A. Kershenbaum, Polytechnic Inst. of New York, Brooklyn Campus, Graduate School, Dept. of Electrical Engineering, *333 Jay St., Brooklyn, New York* 11201 (ENG79-08120)

Recent advances in technology in the areas of satellites, optical fibers, cable television, and ground packet radio make broadcast network design and analysis an area of major interest in the field of computer communications. This research focuses on several fundamental issues raised by broadcast networks.

The broadcast channel has the advantage of disseminating control information simultaneously to all nodes in the network. The new highly adaptive routing procedures made possible by broadcast control is a primary focus of the research. The objec-

tive function for cost optimization in broadcast networks which depends more on the node cost rather than the link cost is being investigated. Exact optimization algorithms for problems in network design are being developed to replace heuristics which were previously required.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0025, DUCTED IONOSPHERIC PROPAGATION

K. Toman, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903780)

Develop techniques for exploiting ionospheric characteristics which give rise to ducted and elevated propagation modes characterized by reduced attenuation. AF function - long-range detection. Deficiency/Opportunity - insufficient knowledge of effects of spatial distribution of ionization of long-range ionospheric ducting. Potential use of HF ducting in ionospheric channels for early warning. How research contributes - these modes may facilitate HF detection and communication over long ranges. Mode reliability considerations will impact on planning the development of conventional and long-range strategic HF radars.

Computer simulation of ionospheric ducting will be combined with radio ray propagation emphasizing the study of the behavior of unconventional, ducted modes. The specification of features characterizing various ionospheric regimes will be extended and refined to assess the likelihood, stability, frequency and elevation-angle characteristics of these modes. Scattering from irregularities will be simulated by introducing deterministic ionosphere scale-size models with a randomly varying component in ray propagation. Concepts will be developed to assess and reduce discrepancies between modelled ionospheres and measured ionospheric characteristics. Validation of simulated radio ray behavior with measurements may be realized. The role of horizontal and vertical refractive index gradients on injection and confinement of rays in ionospheric channels will be assessed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0026, ESM PROCESSING TECHNIQUES EVALUATION

J. Caschera, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF097980)

To assess trends in ESM processor technology as they apply to present and future ESM needs and requirements and to devise the criteria and means for evaluating preprocessor/processor configurations developed into hardware.

To generate pulse data digitally in the format outputted by candidate receivers at pulse data rates typical of the environment. This can be done by assembling a number of pulse generating devices and combining their outputs.

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0027, SINGULAR PERTURBATIONS AND ADAPTIVE CONTROL THEORY

A.J. Calise, Drexel University, School of Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (DN775636; N00014-77-C-0642)

Adaptive control theory has been applied to a number of problems in aerospace control systems (auto pilot systems). Future potential applications include control of V/STOL aircraft and variable geometry aircraft where the aircraft parameters vary widely throughout the flight profile. Recently, adaptive control techniques have been used increasingly for industrial process control systems. This task will investigate a new approach to adaptive control design which appears to provide significantly improved transient response, less sensitivity to system parameters and system order reduction for reduced computation.

Research will be performed on the variable structure approach to adaptive control design. Emphasis will be placed on possible variable structure feedback configurations which lead to desirable plant model error performance in the case when only plant outputs are available. Singular perturbation techniques for control system design will also be considered.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0028, EXPERIMENTAL STUDIES OF UNSTEADY FILM COOLING

L.T. Smith, Drexel University, School of Engineering, Dept. of Mechanical Engineering & Mechanics, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (ENG77-27946 A02)

This experimental study concerns heat transfer in unsteady film cooling. The experimental facility includes a Ludwieg Tube, an intermittent wind tunnel and a Schlieren system. With this facility, a well-controlled, unsteady, low subsonic main flow and injection flow is being obtained. Emphasis is placed on two areas: (1) study of the mixing process of the injection flow with either a laminar or turbulent boundary-layer flow, and (2) the measurement of the wall heat flux with film cooling and hence the isothermal film-cooling effectiveness. An existing analytical model is being modified to aid in interpreting the experimental results.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0029, SCHEDULING FOR MULTIPROCESSOR SYSTEMS

T.K. Agerwala, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Parallel and vector computer architectures are valuable for applications requiring high throughput on well ordered data such as weather modelling, ballistic missile defense, air traffic control and econometric modelling. The advantage of parallel and vector architectures is the potential increase gained through concurrently executing independent portions of the same program. This work is directed towards the study of effective implementation of scheduling strategies for parallel computer architectures in a three-year program which is in its second year.

Emphasis will be toward bridging the gap between high level languages and various scheduling strategies. Issues such as appropriate data structures and intermediate language constructs which facilitate scheduler implementations will be analyzed.

SUPPORTED BY University of Texas

4.0030, COAXIAL PLASMA GUN STUDY

W.C. Duesterhoef, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Continuation of previous study of coaxial plasma gun to produce high energy stream of plasma for injection into confining magnetic fields for plasma containment studies. Earlier work used hydrogen as gas; for current work interest is in gun characteristics with heavier deuterium and helium as working gases.

Diagnostics include magnetic probes, biased and unbiased electric probes, Faraday cup ion probes, particle energy analyzers, high speed photography, spectral line broadening measurement, and microwave interferometry.

SUPPORTED BY University of Texas

4.0031, PREDICTION OF INTERACTING SUPERSONIC BOUNDARY LAYERS

J.P. Lamb, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: The complex interaction of viscous and inviscid flow components in the supersonic, turbulent regime is being modelled, as a first order approximation, by integral techniques. The particular geometry being considered is a compression corner in planar or axisymmetric flow. The primary objective of the current work is to develop correlations for incipient separation conditions. Available experimental results show con-

tradictory trends and few prediction techniques have been developed.

SUPPORTED BY University of Texas

4.0032, ATMOSPHERIC BOUNDARY LAYER BEHAVIOR IN THE PRE- AND POST-SEVERE CONVECTION PERIODS

G.D. Emmitt, University of Virginia, School of Arts & Sciences, Dept. of Atmospheric Sciences, *Garrett Hall, Charlottesville, Virginia* 22903 (ATM78-20972)

Small-scale variability within the atmospheric boundary layer is an important factor in the evolution of convective storms. Atmospheric boundary layer studies in SESAME (Severe Environmental Storms and Mesoscale Experiment) will contribute to an understanding of the nature, magnitude, and role of small-scale processes in controlling the occurrence of convection. This research employs a tethered balloon sounding system to observe the structure of the atmospheric boundary layer during undisturbed, pre-storm and post-storm periods. Undisturbed studies, emphasizing the structure of low-level wind maxima, are conducted cooperatively with the operations of an acoustic echo supported by a storm scale radiosonde network. In additon, data from the extensive Doppler radar and surface meteorological station networks in SESAME are available to this research. Theoretical studies and descriptions of the structure and evolution of the boundary layer will be conducted in collaboration with other SESAME scientists.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

4.0033, IN-SITU MICROWAVE MEASUREMENTS OF LOSSY DIELECTRICS 15586-GS

R.J. King, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Electrical & Computer Engineering, *Madison, Wisconsin* 53706 (DA0G8911; DAAG29-78-G-0181)

To develop a simple homodyne system for the measurement of the complex dielectric constant of lossy materials at microwave frequencies. Relevance - this work potentially can lead to development of a nondestructive soil moisture measurement system since the dielectric constant of soils varies as a function of moisture content. Soil moisture is a fundamental parameter in hydrologic forecasting and was identified as a needed research area at the recent Military Hydrology Workshop. Wes has further identified this as a possible 'ground truthing' system for remotely sensed (aircraft or satellite) data.

Two techniques will be evaluated. In the first, a wave is propagated at right angles into the medium in which a modulated scatterer has been emplaced, thus allowing measurement of the complex plane wave propagation constant. The second technique involves guiding a transmission line mode along the air-medium interface using a bare ribbon conductor.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Army Research Office

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, CONTINUATION OF THE OPERATION OF THE IMS ALASKAN CHAIN OF MAGNETOMETERS, ALL-SKY CAMERAS AND RIOMETERS

G.J. Romick, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM78-25479)

The International Magnetospheric Study (IMS) is an international program designed to increase our knowledge of the morphology and dynamics of the plasma surrounding the earth. This program, started in 1976, is scheduled to continue in the data gathering phase through 1979. The United States' participation in the program features satellite transmission of magnetometer and riometer data from remote stations. All-sky cameras also operate at many of these stations. The Geophysical Institute was funded in 1976 to install and operate a chain of high-latitude stations in Alaska and northern Canada. The complete chain has only recently become fully operational and includes Canadian stations at Eureka, Johnson Point, Sachs Harbor, Cape Perry, Inuvik, and Alaskan stations at Arctic Village, Ft. Yukon, Poker Flat, College and Talkeeta.

This grant supplies funding to continue this data-gathering operational program through the end of 1979 with the possible extension into 1980.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0002, MERCURY GEOLOGIC MAPPING

H.E. Holt, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (9580-01856)

The overall objective of this project is the publication of a Geologic Atlas of Mercury composed of all or parts of 9 quadrangle maps at a scale of 1:5,000,000. Geologic mapping is based on the photographic data returned by Mariner 10 during its flybys of the planet Mercury in 1974-75. The procedure of analysis involves dividing the surface rocks into geologic units and mapping their distribution. The surface of Mercury records successive events that modified surficial distributions of materials; events resulting from internal processes such as volcanism and tectonism, as well as the external mechanism of meteorite impact. The resulting geologic maps will depict the stratigraphy and structure of the surface materials from which the sequence and nature of the major events that have affected the planetary surface can be recognized. A geologic and tectonic evolution of Mercury will be derived from the resulting geologic mapping.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0003, PHOTOGRAMMETRY

S.S. Wu, U.S. Dept. of the Interior, Geological Survey, Astrogeologic Studies Branch, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (9580-00992)

The objective of the photogrammetry project is to conduct research, develop and apply new photogrammetric technology to specialized spacecraft data reduction problems for the derivation of surface topography, on local and global scales of extraterrestrial planetary bodies. Spacecraft imaging systems include optical, radar wavelength and other remote sensing devices. Research involves development of both hardware and software for photogrammetric plotter systems.

By using their gravity fields, a topographic datum of Mars and the Moon is redefined. By synthesizing imaging and nonimaging data, global maps of Mars and the Moon are to be compiled and continuously enhanced. Using high resolution Viking photographs, detailed topographic contour maps of features of scientific interest on the martian surface will be compiled.

For the Venus mission and other future planetary mission flights, mapping technology using side-looking radar imagery will be developed from the investigation of this project.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0004, GEOLOGIC MAPS OF MARS, 1:15 MILLION SCALE

D.H. Scott, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02365)

This project will be a joint effort between geologists of the U.S. Geological Survey and those from several universities. Initially the geology will be mapped on transparent overlays to Viking orbital photos or subquadrangle photomosaics (scale 1:1.25M and 1:2M). Compilation of data will be made on stable-base cronaflex or cronapaque copies of the 1:15 million scale base map to be provided by the Flagstaff Cartographic Section. The map will consist of 5 sheets (4 Mercator equatorial sheets, 1 polar stereographic sheet including both poles). Geologic map-

ping will be started during October 1978 in the north polar and southwestern equatorial regions.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, SEASAT-A SATELLITE - EASTERN PACIFIC TUNA FISHERIES EXPERIMENT

R.M. Laurs, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Marine Fisheries Service, Southwest Fisheries Center, *P.O. Box 271, La Jolla, California* 92037 (SWC-903)

This is a demonstration experiment to evaluate the utility of ocean and weather products derived from SEASAT-A satellite measurements to Eastern Pacific Tuna Fisheries. The original objectives of the Eastern Pacific Tuna Fishery SEASAT-A experiment were to 1) evaluate the reliability of existing FAX products against those from SEASAT-A in assisting U.S. tropical tuna fishermen in making tactical fishing decisions; 2) evaluate the utility of SEASAT-A products in assisting U.S. Albacore fishermen in making tactical fishing decisions; (3) evaluate the potential of SEASAT-A products in providing useful information in managing the tropical tuna and albacore tuna fisheries; and 4) evaluate the usefulness of SEASAT-A products to ongoing research in fishery-oceanography in the Eastern Pacific. Because of the premature failure of the SEASAT-A satellite it is necessary to modify the original experimental design and approach. The modifications are pending and could be firm by mid-January 1979.

SUPPORTED BY U.S. Dept. of Commerce, National Marine Fisheries Service, Southwest Fisheries Center

5.0006, ENGINEERING GEOLOGIC STUDIES OF NATIONAL PETROLEUM RESERVE, ALASKA (NPRA)

R. Kachadoorian, U.S. Dept. of the Interior, Geological Survey, Alaskan Branch of Geology, *345 Middlefield Rd., Menlo Park, California* 94025 (9310-01972)

STATE TO WHICH PROJECT PERTAINS: Alaska.

Make engineering geologic investigations to provide necessary geotechnical analyses needed for petroleum exploration of the National Petroleum Reserve, Alaska. Investigations will include, but not be limited to, a) determining sources of construction material, and b) evaluating site locations of such facilities as airstrips, roads, drill sites, and construction camps.

Consult with participants in the National Petroleum Reserve, Alaska, program on a) engineering geology and permafrost-related engineering problems, and b) engineering geology-related environmental effects of exploration activities in the Reserve.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0007, INTERPRETATION OF SMALL VOLCANIC FEATURES

C.A. Hodges, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02356)

Plans for the current fiscal year include extensive literature research; acquisition of terrestrial photographs and maps in areas of specific relevance to Mars (e.g. Iceland, Alaska, Antarctica); review of pertinent LANDSAT imagery; and a systematic survey of Viking mosaics and identification of volcanic provinces and individual features. Progress will be reported at the Planetary Geology Principal Investigators' meeting in June.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0008, LAVA FLOW RHEOLOGY AND MARTIAN VOLCANIC PROCESSES

H.J. Moore, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02368)

Several of the older volcanic structures on Mars, such as Hydriaca Patera, will be examined in detail to see if their morphologies and features are consistent with terrestrial volcanoes that have erupted and extruded lava flows. Pictures taken by the Viking Orbiters will continue to be searched for features that resemble the table mountains of Iceland. Estimates of Bingham plastic yield strengths of Martian flows will continue.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0009, FOOTHILLS FAULT SYSTEM OF THE SIERRA NEVADA, CALIFORNIA

D.E. StuartAlexander, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9540-02190)

STATE TO WHICH PROJECT PERTAINS: California.

In this fiscal year the lineament studies from LANDSAT, SLAR and U-2 color IR imagery will be completed. Field checking of the lineaments will be started, and in selective areas intensive efforts will be made to establish recency of faulting.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0010, NORTH PACIFIC EXPERIMENT (NORPAX) - REMOTE SOUNDING OF TEMPERATURE OF OCEAN SURFACE IN CLOUDY ATMOSPHERES

M.T. Chahine, U.S. National Aeronautics & Space Admin., Jet Propulsion Lab., *4800 Oak Grove Dr., Pasadena, California* 91103 (OCE78-20991)

The work described in the initial project, OCE74-13738, has been successfully completed. This proposal is requesting 12-months additional support to (1) verify the accuracy of satellite-derived sea surface temperatures and cloud distributions, (2) verify a new approach to measure the temperature gradient in the lowest layer of the atmosphere, and to (3) include the NORPAX requirements in the development of a new high resolution multidetector temperature sounder under development. This work is principally supported by NASA.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0011, STUDIES OF THE DYNAMICS OF THE GEOMAGNETIC TAIL AND OF THE GEOMAGNETIC DISTURBANCE FIELD CURRENT SYSTEMS

G.L. Siscoe, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Atmospheric Sciences, *405 Hilgard Ave., Los Angeles, California* 90024 (ATM79-15251)

Two recent, important classes of observations, one showing the presence of large amplitude deformation waves on the boundary of the geomagnetic tail, the other revealing the existence of quasi-permanent patterns of electrical currents linking the magnetosphere and ionosphere, motivated the investigations supported by this grant. The first observation demonstrates the strong mutually interactive nature of the solar wind coupling to the geomagnetic tail, and raises this subject to a level of importance requiring intensive observational and theoretical analysis. This study is directed at documenting the phenomenology of the boundary waves, and their relationship to geomagnetic activity, through the analysis of spacecraft data sets. The analysis is supported by a theoretical effort to investigate the types of boundary waves that can be generated by the various suggested mechanisms relating the dynamics of the tail to magnetospheric storms and substorms.

The second part of the study is an attempt to unify the subject of the geomagnetic signatures of magnetospheric activity, which now is characterized by a diversity of separate signatures each with supposed counterparts in the form of separate physical processes. Unification will be attempted by investigating the variety of signatures that can be produced simply by varying the relative intensities of the structural components of the new, quasi-permanent current system. It is suspected that the putative partial ring current system may be a phantom constructed out of

one of the variety of signatures produced by the quasi-permanent current system. This idea will be explored in more detail.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0012, NORTH PACIFIC EXPERIMENT (NORPAX) - STUDIES OF EQUATORIAL DYNAMICS AND LONG PERIOD TRANSPORT VARIATIONS IN THE CENTRAL PACIFIC

R.A. Knox, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (OCE7823134)

This project is part of the North Pacific Experiment (NORPAX). The long-range goal of NORPAX is to understand fluctuations in the upper layers of the Pacific Ocean with time scales of months to years and space in excess of 1,000 kilometers, and the relationship of these oceanographic fluctuations to the overlying and adjoining atmosphere. Achievement of this goal should eventually lead to improved weather/climate prediction for both the Pacific Ocean and North America.

A major component of NORPAX is a coordinated field program to determine the space and time variability of the density and velocity fields in the upper layers of the Equatorial Pacific current system. This field program will occur between February 1979 and May 1980 and will involve the efforts of a number of scientists. Measurements will be made from ships, airplanes, and moored and drifting instruments.

This grant will provide for current meter measurements from three moorings on or near the equator at about 153 degrees W. Five current meters will be placed in the upper 250m of water on each mooring. The moorings will be deployed in September 1979 and retrieved in January 1980.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0013, TROPOSPHERIC SAMPLING

Weickmann, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 30302 (8G130536)

PROJECT OBJECTIVE: Conduct a three to six month pilot project involving a high flying non-pressurized aircraft for the collection of ice crystals and aerosols in anvils of cumulonimbus clouds in Dewar bottles and on filters, and the chemical analysis of the scavenged particles which are attached to these crystals by means of an X-ray emission method. For comparison, particles from non-convective cirrus layers will also be collected and will be analyzed in the same way.

CURRENT YEAR PLAN: Conduct the three to six month pilot project.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0014, ECHOSONDE COHERENCE AND PHASE STUDIES 15853-GS

E.H. Brown, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., Wave Propagation Lab., *Boulder, Colorado* 80302 (DA0G8975)

To investigate coherent effects in the propagation and scattering of sound in the atmosphere, particularly in relation to mean phase with a view towards remote sensing application for the measurement of atmospheric temperature and wind profiles. Relevance - the development of a simple, inexpensive, and continuous near real-time remote sensor of wind and temperature profiles of the lower atmosphere has a wide range of application: artillery ballistic corrections; transport and diffusion of smoke, dust and chemical agents plumes; high energy and electro-optical sensor atmospheric characterization; fog, ice and precipitation and formation and dissipation; and aircraft operations at airfields.

Theoretical investigation of echosonde mean phase, application of the results to development of an echosonde instrument for remote sensing of wind and temperature profiles, and comparison of acoustic soundings with in-situ wind and temperature measurements at the 300 meter instrumented tower at the Boulder Atmospheric Observatory.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0015, DEVELOPMENT OF HIGH-FREQUENCY ELECTROMAGNETIC TECHNIQUES

R.D. Watts, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9780-01756)

STATES TO WHICH PROJECT PERTAINS: Alaska, Utah, Washington, New Mexico.

Digitization and signal processing of airborne pulse sounding data from the Columbia Glacier will be carried out to produce accurate bottom profiles from the deeper parts of the glacier.

Development of high frequency CW and pulse systems for point-to-point measurements in salt and other high resistivity media will be completed and tests carried out in underground workings and between boreholes. Tests and development of radar systems for borehole measurements will be carried out.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0016, STUDIES IN REMOTE SENSING APPLIED TO GEOCHEMICAL EXPLORATION

F.C. Canney, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Exploration Research, *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9330-00815)

STATES TO WHICH PROJECT PERTAINS: Maine, Montana and Colorado.

The overall objective of this project is to develop remote-sensing techniques for identifying mineralized areas in regions of heavy vegetation. Vegetation can be used as a link between abnormal chemical conditions in the soil and an aircraft- or spacecraft-mounted sensor for the following reasons: (a) plants generally reflect their geological environment by their distribution patterns and minor-element content; and (b) laboratory and field studies have established that metal stressed and normal vegetation can have subtly different spectral characteristics. Therefore, a geochemical anomaly in a heavily forested area might be detected by spatial and/or spectral changes in the reflection of the vegetation canopy.

To date aerial surveys using color infrared film, multiband photography, and multispectral line scanners, coupled with the simpler interpretative techniques have not been successful in discriminating geochemical anomalies in heavily forested areas. Apparently the reflectance anomaly was totally obscured by variables unrelated to soil geochemistry. However, recent research in cooperation with W. Collins of NASA's Goddard Institute for Space Studies, and using a specially built high resolution airborne spectrometer, suggests that high resolution spectral data, where processed by computerized waveform analysis techniques, can be used to separate vegetation growing over a mineralized zone from background vegetation.

In the current year, additional testing of the instrument and analysis techniques will be done at several mineralized sites of different types.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0017, SEDIMENT MOVEMENT AND CHANNEL CHANGES IN RIVERS

R.H. Meade, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Bldg. 53 Denver Federal Ctr., Mail Stop 415 Box 25046, Lakewood, Colorado* 80225 (CR 75-102)

Sediment moves through river systems in response to specific events and changing conditions in drainage basins. These events and conditions are both natural (floods, climate changes) and artificially-induced (accelerated erosion, reservoirs, diver-

sions, channelizations). The response often takes place over periods measurable in decades or longer. The morphology of the river channels changes as sediment moves through the system.

To assess: (1) changes in river sediment loads over periods of decades or longer, and the factors (natural and artificial) that cause the changes; (2) rates at which rivers change their courses, shapes, and other morphologic features, both in their natural state and in response to artificial influences; (3) effects of infrequent catastrophic events or large-scale human influences on the 'equilibrium' sediment movement and channel morphology in rivers; (4) sources, pathways, and sinks of sediment in rivers.

Basically an historical approach, using available records and making some first-hand field studies. Records will include sediment-load data previously collected by USGS and other agencies; changes in channel morphology will be interpreted by comparing old and new maps plus available aerial photographs of selected rivers in the Upper Missouri Basin. Field studies will include repeated surveys of selected channels and tracer studies of sediment movement.

Daily sediment loads measured on Amazon River ranged from near 10**6 tons per day at Iquitos, Peru, to 3x10**6 tons per day at Obidos, Brazil. Effects of reservoirs on downstream sediment loads in Bighorn River are mixed: one reservoir definitely reduced loads downstream, another shows no discernible effect on sediment loads 200 km downstream after 12 years.

(1) Continue long-term field measurements of channel changes in East Fork River, Wyoming, and Powder River, Montana. (2) Complete analysis of data on sediment loads and hydraulic geometry of Amazon River. (3) Continue analyses of effects of reservoirs on downstream sediment loads and channel geometries.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0018 JOINT UNIVERSITY OF COSTA RICA - UNIVERSITY OF DELAWARE MARINE STUDIES PROGRAM

D. Maurer, University of Delaware, School of Marine Studies, *Lewes, Delaware* 19958

OBJECTIVES: (1) To initiate a well planned joint UCR-UD preliminary ecological assessment of commercial and megabenthic invertebrates of Golfo de Nicoya and begin to compile a solid knowledge base about Costa Rica's marine resources. (2) To provide a well equipped, modern, versatile and economical research vessel as a platform from which to do research which can also be used by UCR as a training platform for research vessel crews, oceanographic technicians and marine studies students at graduate and undergraduate levels. (3) To initiate a joint UCR-UD study of current circulation, pollutant dispersion and land use changes, using inexpensive remote sensing techniques. (4) To continue the exchange of personnel between UCR and UD, especially for graduate and technician training. (5) To provide UD as a model, based on its Sea Grant College and University National Oceanographic Laboratory System (UNOLS) status, as one approach to developing marine studies expertise and capability in an academic institution.

ANTICIPATED BENEFITS: (1) Training of 2 UCR research vessel crews and 8-10 oceanographic technicians. (2) Provide information to assess pollutional impacts in the Golfo de Nicoya. (3) Provide training on remote sensing of coastal processes and new information on the current circulation, pollutant dispersion and land use in and around de Golfo de Nicoya. (4) Provide research vessel as platform for UCR to conduct research and train students who are on their way to becoming professional marine scientists.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0019, PREPARATION AND DISTRIBUTION OF THE 1975-1979 U.S. NATIONAL REPORT TO THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS

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The various national committees to the International Union of Geodesy and Geophysics (IUGG) prepare reports on research performed in their countries and present these reports to the IUGG at its general assembly. The reports of the U.S. National Committee have been such valuable summaries of progress and bibliographic resources that the U.S. has continued to prepare them even though they are not required by IUGG. The 1975-1978 Report of the U.S. National Committee is to be published through an arrangement with the American Geophysical Union as four special issues (totalling approximately 1100 printed pages) of its journal Reviews of Geophysics and Space Physics. Thus the Report will receive wide visibility and use and can be properly archived and referenced. The Report comprises over 100 individual review articles with extensive bibliographics, each covering a specific subdisciplinary area of geophysics. As critical reviews of progress of U.S. research during the preceding four years, the Report is more than a monument to U.S. efforts and successes. Its extensive bibliographies are effective sources for specialists in a field to assess the current literature; for students to have a broad exposure to the full range of current geophysical activity in the U.S.; and for the researchers moving into new areas to place their own work in perspective.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0020, DISTRIBUTION OF SUBMERGED AQUATIC VASCULAR PLANTS IN CHESAPEAKE BAY, MARYLAND

R.R. Anderson, American University, School of Arts & Sciences, Dept. of Biology, *Mass. & Nebraska Aves. N.W., Washington, District of Columbia* 20016 (R805977; Q771 -Q131)

The proposed work has two objectives: 1. assess usefulness of archival remote sensing data for determining trends in distribution of submerged plants in Chesapeake Bay; and 2. produce distribution maps of submerged plants in Chesapeake Bay using aerial photography and field work as data sources. With regard to objective (1), the photographic data banks of government agencies and private flying companies will be searched for useful photography. It is anticipated that from 30 to 40 years of data are available over some areas of the Bay. Selected areas, depending on availability of data, will be studied intensively. The final product will be estimates of trends in SAV populations over time spans covered by the photographic data. With regard to the second objective, the aircraft photography and field data will be used to produce distribution maps inked on 1:24,000 U.S.G.S. quad sheets. The mapping project area includes 77 quad sheets which cover the Maryland waters of the Chesapeake Bay and tributaries.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab.

5.0021, NORSEX EXPERIMENT

J.P. Hollinger, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980132)

To investigate the coastal current flowing northbound off the Norwegian coast, creating an oceanic front, and the influence of fresh or brackish water flowing out of the fjords, especially in the spring. A correlative objective is to detemine the accuracy and utility of airborne remote microwave sensors to map currents and mass water movements on an all-weather basis.

To utilize the full complement of sensors, including active and passive microwave, laser, thermal infrared thermometer, environmental and air-lauched AXBTs and dropsondes aboard the NRL RP 3-A aircraft to measure the atmosphere and ocean surface off the Norwegian coast during NORSEX in March, 1979.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0022, CONTINUOUS OPERATION OF THE FRENCH METEOR RADAR ON PUERTO RICO, 1979-1980

R.G. Roper, Georgia Inst. of Technology, School of Geophysical Sciences, Dept. of Aerospace Engineering & Geophysical Sciences, *Atlanta, Georgia* 30332 (ATM78-10089 A01)

We are growing increasingly aware of a variety of important roles, in upper atmospheric physics, played by tidal motions. While such motions are difficult to measure, two techniques have significantly extended our knowledge for localized studies: incoherent scatter (I.S.) radars and meteor wind radars. The meteor wind radars are far less expensive, and provide valuable data in the 80-100 km range. An array of such meteor wind radars have (in conjunction with I.S. radars) provided valuable guidance in determining which tidal modes of atmospheric oscillation dominate in the middle latitude upper atmosphere. Very little data is available for lower latitudes, and interpretations are conflicting for this part of the globe.

This grant provides for operation of a meteor wind radar at a low latitude location to more globally extend understanding of winds and tidal oscillations in the mesopause region. The data produced will significantly extend our knowledge of mesopheric dynamics. Specifically, the location chosen is near Arecibo. There the continuous meteor wind radar data, in combination with the much more sporadic, but much more detailed and complete I.S. radar data, will allow much more definitive studies than otherwise possible.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0023, EFFECTS OF MINING AND LAND RECLAMATION ON HYDROLOGY OF SOUTHEASTERN KANSAS

A.M. Diaz, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Lawrence, Kansas* 66044 (KS 77-081)

Effects of past and present mining of coal, lead, and zinc in southeastern Kansas have caused degradation of streams draining the mined areas. Quantitative measures of the degradation and identification of source areas are needed to assess the effectiveness of pollution-control measures, the possible need for changes in mining and reclamation procedures, and design of a long-term quality-monitoring network in southeastern Kansas.

The objectives of this project are to apply the extensive water-quality data being collected in Project KS 76-076 and remotely sensed data from aircraft and LANDSAT to (1) identification from computer-enhanced imagery of point-source areas where poor-quality water discharges from old shaft mines, strip pits, collapsed areas, spoil embankments, and reclaimed areas, (2) evaluation of land-reclamation effects on water quality by analyzing areal and temporal changes in vegetative vigor in reclaimed areas, (3) establishment of a continuing monitoring program using computer-enhanced imagery to detect anomalies associated with acid drainage, and (4) use of results from above activities to design an improved long-term water-quality-sampling network for the mining area in southeastern Kansas.

Remote-sensing techniques will be used to obtain data for analysis with signal-enhancement systems and digital densitometers to discriminate differences in water quality, degrees of vegetative vigor, and 'hot spots' in mined areas vs. natural areas. The analyses will aid identification of sources of stream-quality degradation related to drainage from shaft mines, stripped areas, collapsed underground workings, and coal-processing activities. Photography and imagery will be obtained repetitively from aircraft and, as appropriate, from LANDSAT for comparison to water-quality data from Project KS 76-076. Additional ground-truth data will be collected in anomolous areas identified from the remotely sensed data. Finally, the data will be used to design a long-term quality-monitoring network in southeastern Kansas.

Multispectral-remote sensing data were obtained by the contractor, Daedalus Enterprises. Concomitant ground-level data were obtained from field measurements and chemical analyses of water samples from 30 sites in Cherry Creek. Preliminary review and analysis was begun for the remote sensing data. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0024, QUALITY OF WATER AND FLUVIAL SEDIMENT IN STREAMS DRAINING AREAS MINED FOR COAL, LEAD, AND ZINC IN SOUTHEASTERN KANSAS

A.M. Diaz, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Lawrence, Kansas* 66044 (KS 76-076)

The Kansas Department of Health and Environment needs (1) benchmark or baseline information on flow and current water-quality characteristics of streams draining areas in southeastern Kansas that have been deep-shaft and strip mined for coal, lead, and zinc; (2) an evaluation of water-quality degradation associated with the mining and with land-reclamation activities; and (3) an evaluation of the effects of implementing state and federal regulations of mining activities on water-quality degradation in areas that will be mined in the future.

The objective of this study is to provide the data and interpretive evaluations needed to define the water-quality characteristics and the water, chemical, and sediment discharge of streams draining areas mined for coal, lead, and zinc in southeastern Kansas.

Water-quality data from an intensive reconnaissance of streams draining areas mined for coal, lead, and zinc in southeastern Kansas will be evaluated for use in designing a comprehensive study of water and sediment quality and determining the water, chemical, and sediment discharge from the mined areas. The comprehensive study will include the establishment of gauging stations on selected streams and the periodic collection and analysis of water and sediment samples to determine the principal chemical and biological constituents, trace elements, and physical characteristics. Analyses of the water-sediment mixture will include the determination of nitrogen and phosphorus species, total organic carbon, chemical oxygen demand, pesticides, and herbicides. Analyses of sediment will include suspended sediment concentration and particle size and particle size of bed material.

Streamflow and water-quality data collection continued as scheduled at 18 sites in the project area. Field activities were coordinated with projects KS 77-081 (remote sensing) for collection of ground-truth data at about 30 sites in the Cherry Creek basin. Rating curves for streamflow and chemical parameters were developed from available data. Results from statistical analysis of the data indicate a high degree of correlation between major chemical parameters and specific conductance or streamflow. Because of this, the sampling program for the project has been realigned to include a reduced frequency of sampling for the third year of the project.

Continue data collection at selected sites. Complete data analysis and interpretation. Prepare final report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0025, THE CV-990 MULTI-SPECTRAL SCANNING RADIOMETER (MSR) MEASUREMENT PROGRAM FOR MONEX

W.L. Smith, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service, *Suitland, Maryland* 20233 (ATM79-00547)

The objective of this project is to operate and collect observations from a multi-spectral scanning radiometer (MSR) on board a research aircraft (the NASA CV-990) during the summer Monsoon Experiment (MONEX). The MSR measures shortwave (solar) and longwave (earth) radiation. Estimates of radiative fluxes, surface temperature (sea and land), vertically integrated water vapor profiles, cloud heights and temperature profiles are some of the products of these measurements. They will serve as 'ground' truth and 'fillers' for the broader scale satellite-based measurements that cover the entire MONEX region on a regular and frequent time-scale.

These data will be used by MONEX scientists in conjunction with complimentary MONEX data to study the large scale monsoon heat sources and sinks.

MONEX is a major study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmosphere and ocean in monsoon regions. Three research areas have been identified for this experiment. They are the Arabian Sea, the Bay of Bengal, and Indonesia-Malaysia. This research concentrates on the first of these areas. MONEX is important scientifically and also has significance for global agriculture, economics and politics. The initiative for MONEX is from the

government of India with the USSR and USA playing major roles. In addition to the benefits mentioned above, MONEX offers an excellent opportunity for scientific and technical cooperation between, and of mutual benefit to, the U.S., India and the USSR.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0026, AN ASSESSMENT OF REFRACTION ERROR AND DEVELOPMEMT OF METHODS TO REMOVE ITS INFLUENCE FROM GEODETIC LEVELING

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STATE TO WHICH PROJECT PERTAINS: Maryland.

The duration of the project is to be one year. The objective is to develop an algorithm for estimating the vertical temperature profile which is needed for Kukkamaki's refraction correction for leveling. The algorithm will construct the profile using solar radiation data historically observed by the National Weather Service. The model will be tested by comparing predicted solar radiation and temperature profiles with observed values obtained at several weather stations in the U.S.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0027, TERMINAL WEATHER PREDICTION - MEDIUM-RANGE AVIATION FORECASTING

K.F. Hebenstreit, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8D590502)

OBJECTIVE: To develop and implement operationally techniques to: (1) forecast weather elements required in the terminal forecast for projections in the range from 6- to 72-h, (2) organize this weather information for transmission on the National Distribution Circuit (NDC), and (3) automate the packaging of this weather information in appropriate product formats.

APPROACH: Derive forecast equations using the output parameters of operational numerical models, surface observations, appropriate geoclimatic constants, and other available information such as meteorological satellite data. Investigate and select for operational implementation statistical models which capture the maximum amount of predictive information from the historical data. Tailor organization of the weather forecast information for efficient transmission and optimal applications programming.

PROGRESS: Forecast equations for cloud amount, ceiling, and visibility for both early and final guidance are operational for contiguous states. Development testing of equations for these elements for Alaska is now in progress.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0028, PROJECT ASH CAN

S.J. Falkowski, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (6542)

The objective is to document the concentrations of selected aerosols and gases in the stratosphere as a function of latitude, altitude and season in the northern hemisphere. Balloon-borne particulate and gas samplers are flown to altitudes of 70,000, 80,000, and 90,000 feet from Alaska and Panama annually and from New Mexico seasonally except winter. Schedules are coordinated with Project Airstream, the aircraft-borne sampling program, which together with Project Ash Can, constitutes the DOE High Altitude Sampling Program. Filter papers are sent to the DOE Environmental Measurements Laboratory for analysis of particulate radioactivity. Exposed molecular sieve is analyzed at Argonne National Laboratory. Interpretative analysis of data is by EML and the Air Resources Laboratory, NOAA.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0029, AIRCRAFT DATA COLLECTION AND ANALYSIS FOR CORRELATION WITH THE COASTAL ZONE COLOR SCANNER

F. Polcyn, Environmental Research Inst. of Michigan, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (7-723; 03-8-A01-4299)

OBJECTIVE: Through combined empirical and theoretical approaches analyze calibrated narrow band multispectral scanner data acquired over various natural waters in the Gulf of Mexico to support the validation of Nimbus-G Coastal Zone Color Scanner (CZCS) data for the quantification of total phytoplankton pigments, and total suspended particulate concentrations.

APPROACH: (a) collect calibrated multispectral scanner data in the Gulf of Mexico with the ERIM M-7 narrow band module scanner; (b) provide absolute radiometeric calibration of the scanner system by ground measurements of system response characteristics before and after acquisition of ocean radiance data; (c) reduce the aircraft multispectral scanner data to equivalent zero altitude radiances for comparison with shipboard measurements and with NOAA calculations of atmospherically corrected CZCS data; (d) using the radiance data collected by the M-7, scan spatially simulated data to determine the effects of the averaging process inherent in the resolution of the CZCS and LANDSAT multispectral scanner systems; (e) prepare output products (using CZCS algorithms and algorithms developed in the New York Bight studies) giving the distribution of total suspended particulates and total phytoplankton pigments as determined both by the M-7 scanner and the CZCS; and (f) evaluate second derivative method as applied to raw CZCS data without atmospheric corrections.

CURRENT PLANS: Present plans are to conduct a major multi-unit and interdisciplinary experiment in the Gulf of Mexico during November, 1978. Participating in this effort will be science personnel onboard the RV Athena and the Texas A & M Gyre to acquire atmospheric and oceanic optical measurements. In addition, the Gulf test sites will be overflown by the NASA/AMES U-7 carrying the NASA/Goddard Ocean Color Scanner (OCS), and the ERIM Haviland C-7 aircraft carrying the narrow band M-7 module scanner. Information obtained will provide input to CZCS data validation and algorithm development for generating 'derived' output products.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0030, SEASAT PROGRAM - BATHYMETRY AND BOTTOM TOPOGRAPHY MAPPING

R.A. Schuchman, Environmental Research Inst. of Michigan, Radar & Optics Division, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (7-978; MO-AO1-78-00-4339)

OBJECTIVE: The investigation is concerned with the application of the SEASAT Synthetic Aperture Radar (SAR) to measure ocean wavelengths undergoing wave refraction and relating these changes to the presence of islands, shoals, and water depth.

APPROACH: Examine SEASAT SAR data collected over the Gulf of Alaska and select an SAR pass that has noticeable wave refraction present. The radar-equipped Canadian Convair 580 aircraft will also collect data over the Gulf of Alaska test site. A clear water test site in the Carribean will be selected for targets of opportunity. Selected portions of two acquired SEASAT passes will be digitized, and geometry and radiometric distortions in the SEASAT data will be corrected digitally. The data will be reduced into bathymetry maps using an oceanographically acceptable wave refraction model and the results will be compared to all available sea truth. The SAR image output data is to be corrected optically for geometric effects. Image data will be corrected optically to enhance wave trains and obtain spectra at selected locations; these data would then be reduced into a bathymetry map and compared.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0031, RADAR BACKSCATTER AND OPTICAL REMOTE SENSING STUDIES OF THE IONOSPHERE

A.F. Nagy, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Oceanic Sciences, *Ann Arbor, Michigan* 48104 (ATM7821768)

This grant supports studies of the physics and chemistry of the atmosphere and ionosphere in the following areas: Ionosphere-Plasmasphere Modeling - this numerical model solves the coupled continuity, momentum and energy equation of the major ions along a field line, between magnetically conjugate F region altitudes. Such a model, coupled with observational data from the Atmosphere Explorer satellites and incoherent radar backscatter facilities, will significantly enhance our understanding of ionosphere plasmasphere coupling. Radar Backscatter Spectra due to Non-Maxwellian Ion Velocity Distribution - in the presence of sufficiently large perpendicular electric fields, the ion velocity distribution becomes non-maxwellian. This work will calculate how the radar incoherent scatter spectra is affected by such a distribution, and what the corresponding implications are in the analysis and interpretation of results from high latitude incoherent scatter radar observatories. Airglow Studies - analysis of airglow measurements obtained by satellite, rocket and ground-based observation will continue. One study will analyze and interpret data obtained from combined rocket and satellite observations in order to determine the N2 vibrational temperature and the effects of vibrationally excited N2 on the atmosphere and ionosphere. Airglow equipment currently existing at the University of Michigan will be used to study vibrational excitation sources and sinks of N2 ion, reactions of O ion (2D) with N2, and the morphology of N ion emissions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0032, THE EFFECT OF COUNTRY DRAINAGE DITCHES ON WATER QUALITY AND QUANTITY IN SOUTH CENTRAL MINNESOTA

H.W. Quade, Mankato State University, School of Arts & Sciences, Dept. of Biology, *P.O. Box 34, Mankato, Minnesota* 56001 (A-040-MINN)

The proposed research plan involves field investigations followed by modeling and computer simulation of water quality as affected by an extensive country drainage ditch system related to agricultural land-use practices.

The first year would involve the following investigations which would aid in site selection for the second year as well as simulation and modeling in the third year: 1) qualitative physiographic drainage analysis of the ditches in relation to ditch sheds and effects on lakes and wetlands (pilot studies presently underway); 2) riparian (green belt) survey of the ditches; 3) aquatic macrobenthos indicator survey (pilot studies done on this); and 4) general land use from aerial surveys, EROS, etc.

The second year would involve selected ditch site data gathering including: 1) water chemistry (pilot study nearing completion); 2) water flow; 3) sediments (suspended and surficial in the ditches); 4) macrophyte survey involving temporal nutrient tie-up and release (pilot study nearing completion); and 5) benthic indicators (pilot studies done).

The third year would involve data processing, the developing of models, and computer simulation of water quality and quantity as a result of the ditches. Both deterministic and stochastic models would be developed. Final write-up and cartography would also be accomplished during the third year.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0033, LANDSAT CAPABILITIES FOR GENERAL WETLANDS MAPPING

B.O. Benn, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (31585)

OBJECTIVE: The overall objective of this study will be to demonstrate the applicability of LANDSAT data to the problem of mapping wetland boundaries and determining general information concerning type and character of wetland areas in the U.S.

APPROACH: A literature review will be conducted to examine previous and ongoing applications of satellite multispectral data to wetlands mapping. Appropriate Corps offices will be contacted to establish the Corps wetland data needs from which classes for mapping will be established. Digital image processing techniques will be screened for potential application by reviewing previous work and consideration of the dynamic spectral and spatial characteristics of wetland and upland vegetation constituents. Image processing techniques selected to have the most potential will be evaluated by applying them to selected test areas in both contract and in-house efforts. Wetlands maps prepared from LANDSAT and thematic type imagery will be compared to established ground-truth data to quantitatively rank the performance of the image processing techniques for mapping the desired wetlands class. Related work currently ongoing at the WES and in support of Corps district or division offices will be an integral part of this study. A report will be prepared documenting the study and providing guidance or use of those procedures deemed to have the most applicability to acquiring wetlands for Corps' purposes. This work addresses mission problem nos. 1-1-2 and 4-1-24.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

5.0034, LAND USE MAPPING AND DATA COMPILATION

G.L. Loelkes, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, Geography Program, *1400 Independence Rd., Mail Stop 821, Rolla, Missouri* 65401 (G-1)

The USGS is planning to complete over 400,000 square miles of land use and land cover mapping for FY-79. The USGS Land Use Mapping Program is an ongoing program to complete land use and land cover maps for the entire nation at a scale of 1:250,000 (1:100,00 in selected areas). These maps will help satisfy a long-standing need for a consistent level of detail, standardization of categories and consistent use of scale of a type of data needed by government planners and managers at national, state and regional levels. Aerial photographs and other remotely sensed data serve as the primary source materials used in compiling the land use and land cover maps.

The land use and land cover maps are complemented by three (in the case of cooperative agreements, four) associated maps at the same scale. These associated maps are: political units, hydrologic units, and census county subdivisions. In the case of cooperative agreements, the fourth associated map is federal land ownership.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0035, DEVELOP LASER FLUOROSENSORS FOR MONITORING SURFACE WATERS (ORGANIC CARBON)

M. Bristow, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., *P.O. Box 15027, Las Vegas, Nevada* 89114 (J884A-057)

OBJECTIVE: Develop an active airborne monitoring system capable of providing quantitative data on the concentration of total organics in surface waters.

APPROACH: The principle employed is an extension of the laboratory technique of spectrofluorometry. Water is irradiated with ultraviolet light of a specific wavelength and intensity. The resultant fluorescence emission is monitored using a monochromator-multichannel detector combination. The fluorescence signal arises from dissolved organic materials. The water Raman emission band is employed as a built-in reference source with which to compare the amplitude of information concerning the concentration of the dissolved organics.

PROGRESS: A firm correlation has been established between dissolved organic carbon (DOC) and normalized fluorescence measurements made on a large number of field samples.

Plans are being made to build an airborne laser fluorosensor based on this principle.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0036, APPLICATION AND DEMONSTRATION OF MULTISPECTRAL SCANNER (MSS) DIGITAL SYSTEM FOR ENVIRONMENTAL MONITORING

M.R. Dockter, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., *P.O. Box 15027, Las Vegas, Nevada* 89114 (J884A-043)

OBJECTIVE: Determine feasibility and demonstrate application of aerial multispectral scanning (MSS) for remote sensing of sediment in water, description of land use relationships, and silviculture/agriculture nonpoint sources of pollution. Optimize aerial thermal infrared scanner survey techniques.

APPROACH: Collection of surface and airborne MSS data to study atmospheric attenuation corrections and site-to-site algorithm transferability. Analyze results compared to EPA standard laboratory testing methods.

PROGRESS: Feasibility of airborne MSS system utility for environmental monitoring purposes has been established, and a field applications demonstration of a satellite scanner for an EPA coastal zone study has been completed.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0037, USE OF REMOTE SENSING TO DETERMINE THE HORIZONTAL DISTRIBUTION OF CHLOROPHYLL AND SURFACE CURRENTS IN LAS VEGAS BAY, LAKE MEAD, NEVADA

J. Deacon, University of Nevada, Las Vegas Campus, School of Arts & Letters, Dept. of Biology, *4505 S. Maryland Parkway, Las Vegas, Nevada* 89154 (R805045-01; J884A-044)

OBJECTIVE: Provide measurements of chlorophyll concentrations in support of an EPA program to develop a laser fluorosensor method for performing the measurements from an airborne platform.

APPROACH: Measurements are made and samples collected from boat at premarked locations coincident with an overflight by the aircraft-borne remote monitor. Samples are analyzed and compared to results from the remote monitor.

PROGRESS: A number of flights have been conducted over Lake Mead and correlations have been observed between the respective data bases.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0038, AIR-SEA-ICE INTERACTION INVESTIGATIONS WITH X-BAND RADAR

J.A. Warburton, University of Nevada, System Office, Desert Research Inst., *Reno, Nevada* 89507 (DPP78-21718)

An x-band weather radar, now in operation at Palmer Station, Antarctica, will continue to be used during 1979 and the austral summer of 1979-80 in an investigation of the mountain barrier effect on air mass motions, the effects of katabatic and foehn winds on near-shore ice movement and low-level convective elements associated with precipitation. The recorded radar images will also supply 'ground truth' for satellite measurements which are used by other antarctic meteorology projects supported by NSF. In addition, a joint study with the British Survey will be conducted on radar reflectance and precipitation rate relationships in snowfall conditions between Palmer Station Faraday Base. The field work will be concluded at the end of the austral summer of 1979-80 and will be followed by an in-depth analysis of the data obtained and publication of the results of the studies.

Logistics support is required for three scientists to visit Palmer during the austral summer of 1979-80.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0039, CHARACTERIZATION, MEASUREMENT AND MONITORING OCEANOGRAPHIC AND ENVIRONMENTAL DATA ACQUISITION AND MONITORING SYSTEM DEVELOPMENT

D.G. Dimmler, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973 (000920; EY-76-C-02-0016)

This project is concerned with the development of new methods and techniques in systems for large scale, continuous, automated, real-time remote sensing and monitoring of environmental conditions at many locations dispersed over large geographical areas. Special attention is directed toward: (1) assuring the accuracy of data by development or appropriate data verification techniques and instrumentation for filtering, sampling, integration, and averaging of parameters from sensors; (2) techniques and instrumentation for data communications systems which are suitable for transmission of remotely sensed data from, and commands to, remotely located stations; and (3) application of computer techniques for the purposes of automatic, real-time data acquisition, control of remote equipment and sensors, as well as improved data verification in real-time. Techniques for verification and ordering of collected data in real-time are considered to be of crucial importance to improve the data credibility as compared with that obtained from existing non-real-time techniques as well as to reduce the often excessive operating costs associated with traditional manual and semi-automated systems. Real-time, automated remote sensing, data acquisition and monitoring instrumentation systems which satisfy these basic requirements for high quality correlated synoptic data from remotely located stations are essential for large area regional environmental and biological studies related to airborne emission, health and safety monitoring, and physical atmospheric or oceanographic measurements which provide the basis for predictive modeling studies. Essential requirements for such systems are: (1) conservation of power and communication bandwidth for the remote sensing data acquisition and monitoring stations; (2) operation of command-response telemetry; and (3) communication capability between geographically dispersed remote stations and a central command and data acquisition station.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0040, REMOTE SENSING EXPERIMENTS FOR STUDIES OF THE CHRONOLOGICAL PLACEMENT AND SETTLEMENT PATTERNS OF THE HOPEWELLIAN PEOPLES (ABBREV)

N. Greber, Cleveland Museum of Natural History, *Wade Oval, Univ. Cir., Cleveland, Ohio* 44106 (BNS79-06279)

This grant provides support for systematic surveys within the Liberty and Seip Earthworks--large tripart Hopewell constructions in Ross County, Ohio. These surveys will be the first systematic, large-scale surveys within any large Hopewell earthwork. They will continue the study of Hopewell cultural dynamics which includes the recently completed excavations of the Edwin Harness Mound within the Liberty Earthworks. The results of these excavations reinforced proposed similarities in site morphology and artifact distributions between Seip and Harness. The presently proposed surveys will provide presently unavailable data on the extent and time depth of prehistoric activities within the earthworks, for testing further hypothesized relationships between the sites. Data will also be sought to aid in determining the relationships of these sites to the major Hopewell center at the Hopewell site itself.

The physical constraints on the survey, including the extent and present use of the land areas, require the use of non-destructive survey techniques. Since the success of remote sensing techniques is largely dependent upon local conditions, geophysical remote sensing systems--magnetic, resistivity, and surface radar--will be compared in pilot surveys over known archaeological

features. Other local geological data and all available archaeological data will be integrated with the results of these surveys, to determine the specific areas and the specific combination of survey techniques that are most effective. Small-scale excavations are planned for the recovery from prime areas of in situ materials suitable for radiocarbon dating. All cultural materials recovered will be processed for faunal, floral, and artifactual information which will aid in determining the type of prehistoric activities within the earthquakes.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Behavioral & Neural Sciences

5.0041, INVESTIGATIONS OF FERRAR GROUP ROCKS AND MT. EREBUS, SOUTH VICTORIA LAND, ANTARCTICA

P.R. Kyle, Ohio State University, Columbus Campus, Inst. of Polar Studies, *125 S. Oval Dr., Columbus, Ohio* 43210 (DPP77-21590 A01)

The Ohio State University, under continuing Grant DPP77-21590, will map and sample cumulate rocks at the Warren Range and Ferrar Dolerite sills in the Dry Valley area of McMurdo Sound. Samples of Ferrar Group rocks will be examined in detail using electron microprobe analyses of mineral phases and chemical and isotopic analyses of whole rock samples and mineral separates. An objective of this study is to test if assimilation of granite has occurred in Ferrar Dolerite sills and to use these data to evaluate an assimilation model proposed for the Kirkpatrick Basalt and to examine in detail the importance of fractional crystallization. If this model can be demonstrated it may allow a new insight into the composition of the upper mantle along the Transantarctic Mountains during the Jurassic. Mt. Erebus is an active volcano that has had a lava pool in the inner crater for the last several years. The Principal Investigator has been monitoring the eruptive pattern of Mt. Erebus for the past seven years. Research on the crater area of Mt. Erebus will continue to include geologic mapping, geophysics, remote sensing, and laboratory analyses of samples. Results will contribute to an understanding of the geologic and tectonic history of the McMurdo area during post-mid Cenozoic time.

The Ohio State University scientists will do research in Antarctica during the 1979-80 field season.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0042, RELATIONSHIP BETWEEN THE OZONE AND THE STRATOSPHERIC-TROPOSPHERIC CIRCULATION SIMULATED BY THE UCLA GENERAL CIRCULATION MODEL

M.E. Schlesinger, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Atmospheric Sciences, *126 Agricultural Hall, Corvallis, Oregon* 97331 (ATM7720681)

The objective of this research is the investigation of the relationship between ozone and air motions in the stratosphere and troposphere. In particular, the research is directed toward: (1) determining the relative contributions of the horizontal advection of ozone, the horizontal mass convergence, and the photochemical production and destruction of ozone in maintaining the observed longitudinal relatonship between total ozone and the upper tropospheric flow pattern in middle latitudes, and (2) further understanding of the maintenance of the latitudinal distribution of total ozone by the eddy meridional ozone transport in middle latitudes.

To investigate the relationship between ozone and the stratospheric-tropospheric flow requires knowledge of the four-dimensional distributions of both ozone and winds. Since the required data are not available from observations of the real atmosphere, the method of approach employs the January data simulated by the UCLA stratospheric-tropospheric general circulation model. In particular, the method of approach is to construct and analyze longitude-altitude cross-sections of ozone and the dynamical, thermodynamical and photochemical variables, and their time rates of change, at five-hour intervals extending over 60 simulated hours at 50 N latitude, the latitude where the zonal-mean and longitudinal-variation of the simulated total ozone are maximum.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0043, METEOROLOGICAL ANALYSIS FOR THE APPLICATION OF RAPS AQSMS

H.A. Panofsky, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (R805640; G603A-AB-045)

This proposal consists of 3 parts; all are aimed at air quality modeling dealing with urban problems and are to be verified with observations of T-6 St. Louis experiment (RAPS). In Part I, a simple vertical 2-dimensional atmosphere model will be applied and tested using various formulations of heat flux and mixing coefficients in the boundary layer. Part II will concentrate on the development of the proper lower boundary conditions in urban situations, particularly St. Louis and Los Angeles. A new method will be tested for deriving the correct ground parameters necessary to yield the proper surface energy balance using satellite infrared measurements for these two cities. Surface heat fluxes will be computed and compared with independent estimates. In Part III, the observed distribution of NOx and perhaps CO will be used to test an air quality model developed for Los Angeles, making use of observed temperatures, mixing depths and heat fluxes as well as estimates of these quantities by a quasi-2D horizontal hydrodynamic model.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0044, D-REGION CHEMISTRY AND DYNAMICS

A.J. Ferraro, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Electrical Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (ATM7819964)

This grant funds a research program having as its main emphasis theoretical studies supported by D-region controlled experiments utilizing the incoherent scatter, high power h.f. 'heater,' and air-glow facilities at the Arecibo Observatory and the cross-modulation facility of the Ionospheric Research Laboratory. The cross-modulation facility will be operational from University Park, Pennsylvania, as well as transported to Arecibo, Puerto Rico, during their coordinated programs.

The research program concentrates on two specific problem areas. D-Region Electrodynamics: Recent rocket measurements have established the prescence of strong vertical electric fields (approximately 1.0 volt/meter) in the D-region. Such data imply the need to examine the role of transport of charged particles as well as the chemistry of this region. A unique technique for monitoring the presence of these fields will be employed, relying upon modulating the vertical current system with an h.f. 'heater' and detecting the reradiated electromagnetic field from this so-called 'ionospheric antenna.' High Power Radio Wave Modification of the Lower Ionosphere: Upon the completion of the new high power h.f. facility at Arecibo by summer 1979, with an effective radiated power of 100 MW, a factor of five or more increase in electron density in the lower ionosphere can undergo significant modification as a result of ion chemistry changes induced by h.f. heating. A number of experiments will be done to study chemical models/rates and magneto-ionic theory.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0045, TEST OF THE LANDSAT-DATA COLLECTION SYSTEM IN THE SUSQUEHANNA RIVER BASIN

J.V. Funt, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *228 Walnut St., Harrisburg, Pennsylvania* 17108 (PA 73-051)

The potential use of earth orbiting satellite data relay systems for flood warning has not been well explored.

The objective of this project is to test the earth resources technology satellite-data collection system on key stream gages in the Susquehanna River Basin for flood warning.

Four data collection platforms will be field installed on stream gauges in the basin. Data relayed from the gauges will be provided to the Susquehanna River Basin Commission and the National Weather Service's River Forecast Center in Harrisburg.

Data collection platforms were installed at nine gauging stations in the Susquehanna River Basin for relaying data through the GOES satellite. Data collection platforms were operated at four gauging stations in the Susquehanna River Basin using the LANDSAT satellite to relay the data.

The operation of the LANDSAT data collection system will continue. The operation of the GOES data collection system will continue.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0046, AIR TRANSPORT OF POLLUTANTS

T.V. Crawford, E.I. du Pont de Nemours & Co. Inc., *P.O. Box A, Aiken, South Carolina* 29801 (672; AT(07-2)-1)

The major objective of the program is to develop (or adapt), test, apply, and validate mathematical models to calculate the transport, diffusion, resuspension, and deposition of atmospheric pollutants released from one or more point sources. Atmospheric transport processes are the primary means by which radionuclides and other pollutants are transported beyond the SRP site boundary. Because SRP is sharing the environment of the southeastern United States with other nuclear facilities, processes that influence the transport of pollutants at distances of 10 to 1000 km are of primary interest. Atmospheric dispersion models will be developed for the SRP site with the cooperation of appropriate modeling efforts at other DOE sites. Meteorological data from an existing instrumented TV tower and seven-tower network will be used to improve knowledge of the transport and diffusion characteristics within the planetary boundary layer. Atmospheric experiments will be planned and executed to test the models for predicting atmospheric dispersion in the SRP environment. Studies will be made of continuous releases from multiple sources and on instantaneous releases from a single point source. The effect of vertical transport, lids, shear, persistence, and low wind speeds on downwind concentrations of pollutants will be studied. Another objective of this program is to combine data generated from the experimental and aircraft programs with data collected under several other programs at the Savannah River Laboratory. The combined data base will be used to validate models which are used to calculate environmental effects of routine releases to the atmosphere and possible accidental releases.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0047, CONTINUOUS MONITORS FOR EFFLUENTS

W.W. Pitt, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (001609; W-7405-ENG-26)

The objective is the development of: (1) automated analytical systems for isolation and identification of specific pollutants; and (2) systems for continuous on-site monitoring of pollutants and health hazards. A three-pronged approach is being taken: (1) detailed characterization studies of specific effluents; (2) adaptation of existing detectors for use as environmental monitors; and (3) identification and conceptualization of new monitors for pollution detection and measurement. A prototype aquatic environmental monitor which continuously measures native fluorescence and the chemical oxygen demand has been assembled and installed for use in monitoring the treated wastewater from coal liquefaction tests. A prototype, portable remote sensing device for detecting fugitive emissions and spills containing polynuclear aromatic hydrocarbons has been assembled and is undergoing evaluation.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0048, SOLAR RADIATION INTENSITY STUDIES

N.K. Wagner, University of Texas, Austin Campus, School of Engineering, Dept. of Civil Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Two years of hourly solar radiation data gathered at each of four sites near Houston, Texas have been obtained from Houston Lighting and Power. These data will be correlated with independently obtained standard meteorological data. The objective is to provide a technique for estimating available solar energy from standard meteorological observations (which are abundant) for locations where solar intensity observations are not available. The work will be completed in this second year of the effort.

SUPPORTED BY University of Texas

5.0049, CRYSTALLIZATION OF PYROXENES AND PYROXENE-BEARING ROCKS

J.S. Huebner, U.S. Dept. of the Interior, Geological Survey, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (EAR79-08505)

This is a continuation of work previously funded by NASA but transferred to NSF. Work will continue on the phase relations and physical properties of pyroxenes, and to apply the results to problems in lunar and terrestrial petrogenesis, using a combination of optical and microprobe-chemical analyses, X-ray and electron diffraction, and experimental petrology. The basic goal is to create an essential data base for investigators of planetary magma genesis and metamorphism.

Major activities include experimental efforts to measure the rates of Ca, Mg, and Fe diffusion in pyroxenes; the mathematical modelling of pyroxene and olivine diffusion processes in lunar basalt 77115 and the growth of augite exsolution lamellae in noritic breccia 77215; the description of phase relations in the model basalt system CaO-MgO-SiO2-plagioclase; and the partitioning of chromium between silicate crystals and melts at 10-30 kbar.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0050, REMOTE SENSING AND ECOLOGICAL RESEARCH IN WETLANDS

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Wetlands are poorly understood, hydrologically controlled environments. They are essential elements in estuarine, marine, lacustrine, and riverine productivity. Information on: (1) wetland hydrologic variables and their relation to wetland vegetation, (2) wetland dynamics and boundary fluctuations, (3) short- and long-term temporal changes and, (4) other ecological aspects as needed to improve our understanding of these ecosystems and to aid in classification and mapping. Wetland plants may serve as sensitive hydrologic indicators giving information on water (oxygen) stress or water quality parameters such as salinity, turbidity, pH, nutrients, or the presence of various pollutants.

To determine the spectral characteristics of wetland vegetation and relate these to interpretation of remotely-sensed data. To develop improved methodology for mapping and classifying coastal and inland wetlands in cooperation with other interested government agencies and non-government groups or individuals. To examine seasonal and long-term changes in wetland ecology as related to changes in environmental parameters including hydrology, water quality, and land use. To assist with interdisciplinary studies requiring biological research and remote sensing such as the Potomac Estuary Study. To aid in the development of models that utilize remote sensing data as part of the prime data base.

Develop cooperative research projects. Cooperators include WRD Districts, TVA, Topography Division (USGS), USFWS, NASA, JPL, interested state agencies and local groups, and others. Work with all types of remotely-sensed data and available types of analysis equipment in order to achieve the best possible results in a variety of wetland studies. Assist in interdisci-

plinary studies by providing biological and remote sensing information that can be related to study objectives.

(1) Cooperative inland wetlands project with the Topography Division completed and final report prepared. (2) Cooperative project with TVA -mapping should be complete by December 1977, wetland classification system for Tennessee Valley Region is in preparation. (3) Dismal Swamp project - 1:100,000 vegetative map completed; 33 observation wells, 8 staff gauges and 35 temporary benchmarks have been installed. Preliminary report has been started. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0051, HYDROLOGIC INTERPRETATIONS BASED ON HEAT-FLUX ANALYSES AND THE APPLICATION OF REMOTELY SENSED INFORMATION

E.J. Pluhowski, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (NR 70-048)

Aside from thermal loading stemming from powerplant operations, little has been done to assess man's influence on the thermal patterns of natural streams. Near stream environmental changes due to man's activities may adversely impact stream ecology by altering stream temperatures. In addition to stream-temperature problems, evaluation of remote sensing instrumentation as a method of detecting sources of thermal pollution, sedimentation, and erosion in large water bodies as well as current circulation has obvious application to a wide variety of hydrologic problems. (A) To isolate and evaluate the effect of man-imposed changes on stream-temperature patterns; (B) identify stream-temperature patterns under a variety of climatic regimen; (C) to assess near shore current patterns in Lake Ontario using turbidity plumes as tracers; (D) to evaluate the utility of the LANDSAT III thermal imager as a means of detecting thermal plumes in the lake; and (E) to continue work in defining the utility of remotely sensed land-use information as a means of improving streamflow estimates.

Pairs of water-courses consisting of a 'control' stream (one under essentially natural conditions) and one or more streams that have been altered by man's activities have been instrumented in selected basins of the northeast U.S. Comparisons of 'altered' stream and its control should reveal the effects of environmental changes on water-temperature patterns. High-altitude photographs and LANDSAT imagery will be used to detect transitory hydrologic phenomena such as heat and turbidity plumes, shoreline erosion, and ground-water inflow to streams.

Cooling water discharge at the rate of 30 cubic meters per second and flowing as a surface jet orthogonal to the shoreline produced a thermal plume in Lake Ontario that extended 1km off shore and was 2km in width in August 1978. The thermal plume created by the power plant located 19 miles northeast of Rochester, N.Y., changes shape rapidly in response to wind speed and direction. It is anticipated that the 19 degrees C rise in temperature above ambient lake levels created by the heated power plant discharge will be detectable by the HCMM satellite.

To continue field operations at the Ginna power plant for the purpose of detailing both thermal and turbidity plume dynamics under a variety of seasonal conditions. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0052, NE REGIONAL OXIDANT STUDY - AIRCRAFT MEASUREMENTS OF AIR QUALITY AND METEOROLOGICAL PARAMETERS

J. Gregory, U.S. National Aeronautics & Space Admin., Langley Research Center, *Hampton, Virginia* 23665 (D9-F0758; G603A-AD-040)

OBJECTIVE: The objective of this task is to obtain continuous measurements of O3, NOx, NO, CN, temperature, dewpoint, and air speed during a two-week period from July 31 to August 14, 1979.

APPROACH: The measurements will be made from an instrumented aircraft provided by the Langley Research Center.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0053, DETERMINATION OF TERRESTRIAL AGES OF ANTARCTIC METEORITES

J.C. Evans, Battelle Memorial Inst., *P.O. Box 999, Richland, Washington* 99352 (DPP78-24012)

The Battelle Memorial Institute, Pacific Northwest Laboratories, will carry out determinations of the terrestrial ages of antarctic meteorites. Terrestrial ages are the lengths of time since meteorites have entered the earth's atmosphere and have been resting on the surface of the earth. In the cases of the meteorites to be analyzed for terrestrial ages, they fell on the East Antarctic Ice Sheet and have subsequently been riding passively on or in the ice sheet as it flows slowly away from the centers of ice accumulation. Terrestrial ages give minimum ages for the existence of the ice sheet, and glaciologists will be able to use terrestrial ages for other interpretations of ice sheet history. Non-destructive analyses will be made on a large number of the antarctic meteorites now available for research, for such radioactive isotopes as 53Mn, 40K, 238U, and 232Th. These data will also be of use in studying the pre-terrestrial history of the meteorites and the history of the radiation flux of the Sun.

No antarctic field work is planned under this grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0054, GLACIOLOGY--WATER, ICE, AND ENERGY BALANCE OF SNOW AND GLACIERS, AND SNOW AND ICE PHYSICS

M.F. Meier, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 57-077)

Much of the nation's streamflow and soil moisture recharge are provided by snowmelt, and snow can be measured and managed for hydrologic purposes. Yet snow is highly variable in space and time, and no method yet exists for synoptic monitoring of areal extent. Glaciers are sensitive indicators of climate trends, have significant regulating effects on streamflow, may produce outburst floods and other hazards, and are useful analogs to several important geophysical processes. Yet glacier heat and mass balances cannot be quantitatively related to meteorologic parameters, the flow and storage of water in ice is poorly understood, and the englacial and subglacial environment presents severe measurement difficulties.

Develop methods for synoptic monitoring of snowcover, obtain understanding of how meteorological processes determine snow accumulation and melt, and develop improved techniques for predicting snow mass, distribution, and snowmelt runoff using conventional weather data. Determine how meteorological processes affected glacier mass balances, and how changes in mass balance affect glacier motion, glacier variations, and runoff from glaciers; use this knowledge and glacier variation data to construct climatic histories. Measure and develop an understanding of the physics of water flow through ice and at the ice/rock interface and determine how this affects glacier sliding. Understand why certain glaciers behave in anomalous ways (surges, calving retreats) and use this knowledge to minimize economic hardship in dangerous glacier situations.

Investigate the feasibility of using satellites and other remote sensing techniques for the measurement of mountain snow (extent, thickness, mass, and liquid water content). By operating a high-mountain field data network, attempt to relate snow changes to meteorologic elements. Develop numerical models relating water storage as snow to meteorologic input and runoff/evaporation output. Relate glacier mass balance at a field station to meteorological elements, and long-term changes in balance to runoff and ice flow. Use the resulting understanding to analyze variations of other glaciers in terms of climate. Measure water pressure and flow in, within, and out from various levels in and under a glacier, relate water movement to thermodynamics, hydraulics, and rheology of the local ice envi-

ronment, and relate water pressure and thickness to rate of glacier sliding. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0055, COLUMBIA GLACIER
M.F. Meier, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 77-158)

Recent work by Austin Post indicates that calving glaciers may become unstable and retreat very rapidly, causing a great increase in the discharge of icebergs. Columbia Glacier is the only calving glacier in Alaska which has not yet made such a rapid retreat in Neoglacial or modern time. Indications exist which suggest that such a retreat may be imminent. The increased discharge of icebergs drifting into Valdez Arm might cause accidents to or interruptions of the movement of tankers carrying oil from Valdez.

Determine the probability that Columbia Glacier will go into a rapid retreat mode in the next few years, and if so, predict the approximate iceberg discharge.

Determine the stability of the present terminus by hydrographic studies, photogrammetry, and glacier flow studies, with special reference to the configuration and effect of the moraine shoal. Extend these studies to other calving glaciers to determine a calving law. Measure iceberg sizes, numbers, and drift trajectories and wind stress. Determine annual mass balance and discharge of the Columbia Glacier system. Use these data in numerical models to determine probable future behavior of terminus and iceberg flux. Conduct a sensitivity analysis of these results.

Hydrographic and sub-bottom surveys were conducted, and wind and wave data obtained, in and near Columbia Bay. The geodetic survey net was extended. Ice-velocity data were derived from air photography. Balance, motion, and thickness change were measured at 62 locations along the length of the glacier. Radioecho sounder design for airborne use has begun. Numerical models were investigated and some preliminary runs made. The glacier continues to thin near the terminus, and a very large embayment formed in 1977. The stability of the terminus appears to be precarious.

Complete project, except for final numerical anaylsis and report writing.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0056, NAVY ENVIRONMENT - ANALYSIS OF SEASAT-A SAR IMAGERY
D.A. Rothrock, University of Washington, Div. of Marine Resources, Polar Science Center, *Seattle, Washington* 98105 (DN975357; N00014-79-C-0418)

The objective of this effort is to analyze synthetic aperture radar (SAR) imagery of arctic sea ice obtained from SEASAT-A to obtain measurements of sea ice displacement versus distance along an axis 500 to 800 km long. These data will contribute to understanding how the distribution of ice thickness is changed by deformation.

Successive days of SAR imagery of sea ice from the same area will be compared and movements of reference features will be measured, thus providing the average daily velocity as a function of distance along lines 10 to 500 km in length. LANDSAT imagery will be used for ground truthing purposes, and will also be compared with SAR imagery to attempt to make a distinction between open water and thin ice.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0057, NORTH PACIFIC EXPERIMENT (NORPAX) - TRANSEQUATORIAL AIR XBT SECTIONS DURING THE SHUTTLE EXPERIMENT
E.D. Stroup, University of Washington, Graduate School, *Seattle, Washington* 98105 (OCE7823792)

This project is part of the North Pacific Experiment (NORPAX). The long-range goal of NORPAX is to understand fluctuations in the upper layers of the Pacific Ocean with time scales of months to years and space scales in excess of 1,000 kilometers, and the relatonship of these oceanographic fluctuations to the overlying and adjoining atmosphere. Achievement of this goal should eventually lead to improved weather/climate prediction for both the Pacific Ocean and North America.

One major component of NORPAX is a coordinated field to monitor the space and time variability of the density and velocity fields in the upper layers of the Equatorial Pacific Current system. This field program will occur between January 1979 and June 1980 and will involve a number of scientists. Measurements will be made from ships, airplanes and moored instruments. This grant will provide Dr. Stroup with the funds to organize and direct the 16 aircraft flights that will sample the equatorial temperature field by AXBTs. Dr. Stroup will insure the quality of the data, make analyses of the temperature fields and investigate relationships between the temperature fields and other oceanographic variables.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0058, SEASAT PROGRAM - THE USE OF SEASAT IMAGERY TO STUDY THE BERING SEA ICE
S. Martin, University of Washington, School of Arts & Sciences, Dept. of Oceanography, *Seattle, Washington* 98105 (7-976; MO-A01-78-4335)

OBJECTIVE: Use existing sea-ice program (OCSEAP) to provide ground truth for evaluation of SEASAT capability (SAR, SMMR, VIR, ALT) for characterization of ice cover in the Bering Sea. Use SEASAT data for study of ice dynamics and wave absorption by sea ice.

APPROACH: Three different observational scales will be employed: SEASAT images; aircraft overflights and surface truth; and laboratory modeling.

The high resolution SAR images will be used to study the response of ice during periods of cyclonic and anticyclonic circulation. The SMMR and the VIR will provide complimentary large-scale images of the ice in order to determine the distribution of ice types, the large-scale response and the ice behavior preceding and following the SAR turn-ons. Altimeter data will also be looked at to see if it yields meaningful information about either long waves propagating into the pack, or pressure ridge statistics.

Surface truth data of the ice edge will be obtained during a research cruise of the NOAA ship SURVEYOR along the ice edge in Bristol Bay during 1978. Also a helicopter will traverse the sea ice in Norton Sound, and plan several low-level photographic overflights about regions of large-scale grease ice formation. Two periods of surface truth observations are also planned during the fall of 1978 and the winter of 1979.

Plans are to continue present laboratory work on the properties of ice grown in a wave field. This will yield physical insight into the large scale processes observed by satellite.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0059, RURAL OXIDANT STUDIES AND THE ROLE OF NOX IN RURAL OXIDANT FORMATION
H.H. Westberg, Washington State University, School of Engineering, Dept. of Chemical Engineering, *Pullman, Washington* 99163 (R806683-01; G603A-AD-037)

OBJECTIVE: Aircraft and ground level measurements of ozone and its precursors will be made in the northeast United States with the intent of regional scale model validation. Because of the magnitude of the study, other government funded research groups will also participate in the meteorological and pollutant data collection program. Estimates of natural hydrocarbon emissions in this area of the United States will be made.

APPROACH: WSU will use an aircraft equipped with O3, NOx, and SO2 instrumentation to measure pollutant levels over large geographic areas of the northeastern United States. Grab samples for detailed hydrocarbons will be collected at strategic points along the flight path. These grab samples will be analyzed by sophisticated gas chromatographic techniques at a ground base site. The ground base site will also be fully

equipped to make several pollutant and meteorological measurements.

PROGRESS: WSU has performed several similar studies in past years. EPA reports of these activities are available. This study will not involve the use of any new measurement procedures but will collect more useful data for mathematic model validation.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0060, ECOLOGY OF MANGROVES IN THE EAST COAST OF PENINSULAR MALAYSIA

W.K. Gong, Universiti Sains Malaysia, School of Biological Sciences, *Minden, Penang, Malaysia* (ECRS - PROJECT 6)

OBJECTIVE: To survey the extent of mangroves on the east coast of peninsular Malaysia as well as the floral composition.

APPROACH: Aerial survey; on-spot investigation by line transects; soil analysis; and economic importance.

ECOLOGICAL PARAMETERS FOR AQUATIC STUDIES: Latitude, 2 degrees, 30 minutes, 6 degrees, 30 minutes. Water salinity, 30-34 parts per thousand. Water temperature, 27-31 degrees C. Water pH, 8.4-8.8.

SUPPORTED BY Esso Production Malaysia Inc.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, ANALYTICAL MODELLING OF LOAD-DEFLECTION BEHAVIOR OF INTERVERTEBRAL DISC SUBJECTED TO AXIAL COMPRESSION

M.L. Burns, Tuskegee Inst., Graduate School, *Tuskegee Institute, Alabama* 36088 (DF051970; AFOSR-78-3578)

AF function - the Air Force operational envronment involves exposure to a wide variety of mechanical forces including flail and impact. The body in general and the musculoskeletal system particularly is adversely affected by these forces. This is of special importance in cases of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. The lumbar region is subjected to most of the body load. One of the more common injuries is lumbar disc compression failure. A qualitative model for the mechanical behavior of the disc is needed. The overall objective of this research is to improve the knowledge of the physiology and mechanical properties of the human intervertebral disc. This work should provide essential information to understand the short duration, transient loading problems of the spinal disc and will also be applicable to the fields of diagnostic, preventive and reparative medicine. Deficiency - a mathematical model is needed for predicting the mechanical properties of individual discs and their associated vertebrae. Objective - seek an understanding of the mechanical properties and behavior of the spinal column. This interest ranges from problems associated with the man-machine environment subjected to external dynamic forces to those encountered in the selection of suitable materials for intervertebral disc replacement. Of particular interest is the biomechanical modelling of intervertebral joint response to axial compressions, where an intervertebral is understood to be an intervertebral disc and adjoining vertebrae. Contribution - directly supports research being conducted under sub-area 1.8

The initial task of this research will be to develop a computer program which can interpolate and adequately smooth the available creep response data of Kazarian. A mathematical analysis of experimental data will then be attempted, wherein, it may prove necessary to develop the analytical solutions of the 'Dominant Three-Kelvin-Unit Model'. It should then be possible to determine and tabulate Young's moduli and viscosity coefficients for the obtained analytical/mechanical models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0002, MEDICAL RESEARCH OF OPERATIONAL PROBLEMS IN ARMY AVIATION

F.S. Pettyjohn, U.S. Dept. of Defense, Army, Medical Research & Development Command, Aviation Medicine Research Div., *Fort Rucker, Ozark, Alabama* 36360 (DA0B6894)

To provide the US Army information and recommendations for protection of aviator health from medical hazards encountered in operational Army aviation.

To apply accepted medical research methods in Army aviation to fulfill the above objective.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0003, DEVELOPMENT OF MEASUREMENT TECHNIQUES FOR THE MEDICAL ASSESSMENT OF VISUALLY COUPLED SYSTEM (VCS) COMPONENTS

R.W. Wiley, U.S. Dept. of Defense, Army, Medical Research & Development Command, Bio-Optics Div., *Fort Rucker, Ozark, Alabama* 36362 (DA0E6734)

To develop measurement techniques for the medical assessment of Visually Coupled System (VCS) components.

It is possible to inadvertently compromise an aviator's safety and physiological performance when designing and fabricating a VCS. Therefore, the VCS hardware must be scrutinized carefully to insure mutual man-machine conformity. The first phase of the study will be concerned primarily with the helmet mounted sight (HMS) component of the VCS. The approach during this phase will be to conduct laboratory and flight tests to determine the aiming/tracking capabilities of a crew member using head orientation. The effects of eye dominance, helmet suspension, helmet weighting and target speed on accuracy will also be investigated. The second phase will be focused on the assessment of helmet mounted displays (HMD). Factors such as display color, image quality and size, brightness, contrast and their impact on the visual system of the crew member and consequent performance will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0004, INSTRUCTIONAL METHODS AND MEDIA

J. Reed, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223820)

To determine the contribution of a variety of instructional methods and media on tactical flying training.

Phase I - Using a randomized control-experimental group, training on the air refueling director lights trainer will be evaluated. Phase II Using a one-group pre-test experimental design, correlation techniques will be applied to determine the relationship of turkey shoot results, normal syllabus grades and time to first kill on a standard target in the SAAC. Phase III - Using a one-group pre-test/post-test experimental design for an aerial gunnery task, correlation techniques will be applied to determine the relationship to overall air combat outcomes based upon pilot experience, turkey shoot results, peer ratings, and instructor pilot evaluation. Progress in the TAC ACES II Program will also be measured. Phase IV - An experimental and control group design will be employed utilizing the tactical voice communiations trainer. Criterion performance will be evaluated to determine the training value of the device.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, KINETICS OF ENERGY METABOLITES IN HUMANS, DIABETES AND DRUG ACTION

G.L. Searle, U.S. Veterans Admin., Dept. of Medicine & Surgery, Medical Center, *4150 Clement St., San Francisco, California* 94121 (556-14-3966; 662-001-P)

The kinetics of energy metabolites (primarily glucose, its products and its precursors) are being evaluated in human and animal models.

Studies of the action of phenethylbiguanide (DBI) and dichloracetate (DCA) in conscious overnight fasted dogs indicate

that these two drugs in combination have significant hypoglycemic potential. In normal control animals the drugs increased glucose utilization by 150% and reduced glucose synthesis from lactate by one half. Glycemic level was, however, little affected. In the alloxan diabetic dog excessive glucose turnover was reduced by 34%, glucose synthesis from lactate was reduced by 56% and the blood glycemic level was reduced 17%.

In collaborative studies with NASA Ames Research a rat model proposed to reflect the altered metabolism of the muscular dystrophic state has been evaluated with respect to alanine turnover and glucose synthesis. Animals treated with CCl4 turned over -.56 mg alanine per minute vs. a value of 0.33 mg per minute for controls. The percentage of glucose synthesized from alanine was increased by a factor of approximately 2 in the CCl4 treated animal. CONCLUSIONS: These results suggest that it will be quite possible to quantitate, through the assessement of alanine turnover and gluconeogenesis therefrom, the degree of muscle protein wasting that is known to occur in space flight.

SUPPORTED BY U.S. Veterans Admin., Dept. of Medicine & Surgery

6.0006, AUTOMATED AIDS TO ISD

F. Brecke, Veda Inc., *7851 Mission Ctr. Ct., San Diego, California* 92108 (DN994006; N61339-78-C-0142)

To determine the feasibility of reducing the resources and time required to develop ISD-based training through consolidation of common elements and links across Navy aircrew tasks to form a data base for each step in the ISD analysis process.

Instructional psychologists will examine ISD data produced in previous efforts and demonstrate the feasibility of a general data base.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0007, LOW-COST APPROACH AND LANDING TRAINER REQUIREMENTS

K.W. Lindenberg, Appli Mation Inc., *1000 Woodcock Rd., Orlando, Florida* 32803 (DN894028; N61339-78-C-0134)

Low-cost, part-task trainers could radically improve training effectiveness. This effort will refine and perform an initial evaluation of a system developed for field evaluation.

An approach and landing refresher trainer will have known problems corrected and then enter iterative development at a field site to arrive at a system for initial evaluation. Trainer has been developed in the laboratory using low-cost, off-the-shelf components.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0008, AUTOMATED ADAPTIVE TRAINING FOR THE LANDING SIGNAL OFFICER

R. Breaux, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Human Factors Lab., *Orlando, Florida* 32813 (DN794013)

To develop, implement and test, in the context of an automated trainer, techniques for training which will improve the training progress of the landing signal officer (LSO) and thereby reduce cost in manpower and equipment, through development of models of the LSO task and pilot-LSO interaction. Use of modeling techniques can increase training effectiveness by providing objective performance measurement and guidance in skill acquisition at any point in the training process.

The effort consists of: (1) identification of visual and auditory cues; (2) development of models of the visual scene, pilot response, and pilot-LSO interaction; (3) application of voice recognition, performance measurement, and automated adaptive training technologies; and (4) empirical test of effectiveness of the training system.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0009, DETERMINATION AND IDENTIFICATION OF HUMAN BRAIN WAVE PATTERNS ASSOCIATED WITH COGNITIVE AND PERFORMANCE EVENTS (ABBREV)

E. Donchin, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Psychology, *Urbana, Illinois* 61801 (DN675068; N00014-76-C-0002)

The overall objective is to attempt to determine and identify human brain wave patterns associated with (1) particular stimuli; (2) cognitive events in a learning situation; and (3) performance events in a simulated aircraft cockpit. Such information could provide a basis for improving human performance in decision making and man-machine communication.

Experiments will continue on: (1) further elucidation of the event related potential (ERP) vocabulary, e.g., stability of P300/expectancy relationships and ERP differences between target and non-target stimuli; (2) biocybernetic tests in the cockpit environment, e.g., effects of turbulence-imposed work load on processing during simulated landing; and (3) development of a closed loop biocybernetic channel, i.e., one in which some parameter of the ERP is used by the controlling computer to modify system operating parameters, e.g., measures of work load and task sharing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0010, ANTHROPOMETRIC STUDY OF NAVAL AIRCREW PERSONNEL

H.G. Gregoire, U.S. Dept. of Defense, Navy, Naval Air Test Center, *Patuxent River, Maryland* 20670 (DN977636)

To develop a new, more useable anthropometric data base for use in the development and evaluation of aircrew stations, life support and survival equipment, emergency egress envelopes, and job classification of aircrew personnel.

A new anthropometric survey of aircrew personnel will be conducted. The effort will be accomplished in four phases. Phase I will be the identification/development of an appropriate measuring methodology. During Phase II the anthropometric parameters to be included will be identified and an optimal sampling strategy selected. The data collection will be accomplished in Phase III. The final phase will be the development of a report format which will optimize the usability of the data.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, ARTIFICIAL INTELLIGENCE AND HUMAN ERROR PREVENTION - A COMPUTER-AIDED DECISION MAKING APPROACH

R.W. Brady, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (OS-80020; OS161407 (TRAIS NO.))

The objective of this research is to demonstrate the feasibility of integrating an intelligent computer system into the cockpit of a civilian aircraft. The computer will be viewed as an adaptive crew member who could assist the pilot and during critical periods when demands upon the pilot may exceed his capability to respond quickly and coherently, and reduce his workload to decrease the likelihood of an aircraft accident. Specific goals for the system are that it performs non-critical tasks. The system shall inherently be able to plan and order tasks according to degree of criticality and shall be able to perform these tasks if requested by the pilot to do so.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary of Transportation

7.0002, CATEGORICAL MACHINE THEORY, WITH APPLICATIONS TO SYNTAX-DIRECTED TRANSLATION AND CONTROL THEORY

M.A. Arbib, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Computer & Information Science, *Amherst, Massachusetts* 01002 (MCS76-84477)

This research is defined by two types of questions: the first type addresses specific problems within the theories of computation and control; the second explores the applicability of various algebraic techniques. Questions within control theory include a unified theory of machine interconnection, the duality of estimation and control, the proper generalization of the internal model principle, and the extension of the theory of linear continuous-time systems to handle time-varying systems and delay-differential equations. Topics within computation theory include iterative theories, more applicable models of nondeterminism, graph automata, and the algebraic semantics of SIMULA-like languages. Algebraic techniques whose applications will be explored are algebraic theories and topoi (a topos is a general structure which can specialize to boolean or intuitionistic logic on the one hand, and to a category of sheaves as used in algebraic geometry on the other). These tools and those forged in earlier research on categorical machine theory will hopefully make it possible to solve problems in computation and control which would be impossible, or at least highly intractable, without them.

This is a continuation of grant MCS-7203733AO2.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0003, INTERPRETATION OF SATELLITE IMAGERY BY COMPUTER-QUANTITATIVE METHODS

P.R. Baumann, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (SER78-00001)

The objective of this proposed project is to develop a computer software system and related instructional materials that will provide undergraduate students the opportunity to learn how to interpret satellite imagery by using computer and quantitative techniques. Fourteen times a day both of NASA's LANDSAT satellites orbit the earth collecting land use and resource information from the earth's surface. Together, these satellites are able to scan any area of the globe, except the poles, every nine days. As living space in the United States and the world continues to shrink rapidly, land use and resource planning become more and more vital. Americans are being faced now and will continue to be faced for many years to come with the problem of how to use best their finite space and resources. To make informed decisions, up-to-date land use and resource information become vital. To employ this new technology for the purpose of acquiring information needed to make meaningful decisions about the use of our land and resources, it is necessary to make people aware of its capabilities and potential and to train people to use it, which represents the overall goal of this proposed project.

A course is to be developed which will provide students with experience in interpreting satellite imagery in the digital form by using computer and quantitative techniques. This approach has both economic and accuracy advantages over the almost universal photographic interpretation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Science Education, Div. of Science Education Resources Improvement

7.0004, IMAGE PROCESSING BY MEANS OF HIERARCHICAL RELAXATION SHAPE ANALYSIS

L.S. Davis, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Computer Sciences, *200 W. 21st St., Austin, Texas* 78712 (ENG79-04037)

Shape analysis is crucial to the solution of many problems in image pattern recognition. One of the most successful approaches to automatic shape analysis has been the syntactic approach. In this research program, a new syntactic analysis technique called hierarchical relaxation, based on representing shapes by stratified shape grammars from which contextual constraints on the organization of shapes can be automatically computed, is explored. Hierarchical relaxation was designed specifically to account for the ambiguity associated with extracting primitives from shapes, a problem not explicity dealt with in most syntactic pattern analysis schemes. Hierarchical relaxation is being investigated in the context of a real image pattern analysis problem - recognizing airplanes based on their silhouettes.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

7.0005, OPTIMAL SURFACE DESCRIPTIONS FROM LIMITED DATA

H. Fuchs, University of Texas, Dallas Campus, Graduate School, *Richardson, Texas* 75080 (MCS77-03905)

In many technical endeavors the surface of a three-dimensional solid must be reconstructed from limited data, either to enable comprehension of its overall structural characteristics, or to allow its automatic manipulation and analysis.

Past research has generated encouraging preliminary results for the class of situations in which the data are specified as a sequence of single contours, and a new algorithm which generates, from any sequence of contours, an optimum surface, according to a minimum-surface-area measure.

This research is attempting to generalize this approach to the large class of structures which contain a variable number of closed contours on each level. Methods of compressing the resulting surface description with minimum degradation to the structural definition are being explored. Such surface descriptions are increasingly used in computer-aided design, bio-medical research, numerical control, visual flight simulation, and topography.

SUPPORTED BY U.S. National Science Foundation, Div. of Mathematical & Computer Sciences

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, PURCHASE AND INSTALLATION OF A HIGH CURRENT, HIGH STABILITY ACCELERATOR

C.A. Barnes, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (PHY77-10134)

This grant will provide funds for the purchase and installation of a high current Van de Graaff accelerator. The voltage will be very stable, to plus or minus 1 KeV at full voltage current. The second year of this grant will provide funds for auxiliary equipment to implement a highly original research program in a wide variety of subjects in nuclear science with a strong emphasis on nuclear astrophysics.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0002, THE ENERGY DEPENDENCE OF PARTIAL PHOTOIONIZATION CROSS-SECTIONS IN THE SOFT X-RAY REGION

I.E. Lindau, Stanford University, Stanford Electronics Lab., Dept. of Electrical Engineering, *Stanford, California* 94305 (DMR79-13102)

The energy dependence of partial photoionization cross-sections in the far ultraviolet and soft x-ray regions, 20 to 2000 eV (600 to 6 A) will be determined in order to utilize the unique properties of synchrotron radiation as an excitation source. The adequacy of the Hartree-Fock description of the photoionization process will be tested for the 1s electrons of a few systems with great importance in chemisorption studies. The strengths of plasma as functions of excitation energy will be studied with particular emphasis on testing the validity of the sudden approximation close to threshold and the relative contributions to

the plasma strength of intrinsic and extrinsic losses. Resonance photoemission effects will be examined systematically for transition metals and rare earths, where excitation occurs into discrete states in a partially filled shell. The strong multielectron effects observed in the 4d, 5s, and 5p subshells of, for instance, cesium and barium will be compared in detail to the theoretical predictions of the random phase approximation with exchange (RPAE). The physical mechanism behind shake-up and shake-down processes will be studied for compounds with open d-shell configuration and later be extended to chemisorption of small molecules on 3d, 4d, and 5d transition metals.

Research previously supported by DMR77-02519-A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0003, U.S.-U.S.S.R. COLLABORATION IN PLASMA PHYSICS

B.D. Fried, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY7611129)

This grant will cover the domestic U.S. cost of a visit by the noted Soviet theoretical physicist V.E. Zakharov. Dr. Zakharov will join the ongoing plasma physics research at UCLA, and initiate studies of wave-particle energy transfer in turbulent plasma. This activity is part of the US-USSR Collaboration Program.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0004, RESEARCH IN ATOMIC AND MOLECULAR PHYSICS AT THE JOINT INSTITUTE FOR LABORATORY ASTROPHYSICS

A. Phelps, University of Colorado, Boulder Campus, Joint Inst. for Lab. Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (PHY79-04928)

Support of experimental and theoretical research in atomic and molecular physics will be continued at the Joint Institute for Laboratory Astrophysics. The JILA research program is grouped into four broad areas: 1) The interaction of electromagnetic radiation with atomic and molecular systems, particularly the interaction of intense laser radiation with atoms and molecules either in an isolated environment or when subject to perturbing collisions. 2) The study of negative ion physics and of photodetachment processes. 3) Collision processes involving state selected neutral or ionic atomic and molecular species. 4) Fundamental and precision measurements, particularly using the latest advances in atomic metrology.

In addition, one or two conferences and/or workshops will be held each year, to focus on topics of intense current interest and bring together specialists to discuss progress and prospects for various sub-fields.

This work is a continuation of that previously supported by Foundation grant PHY76-04761A02.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0005, CURRENT INHOMOGENEITIES IN CONDUCTORS

W.F. Love, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (DMR76-83362 A01)

A magnetooptic system for the detection of inhomogeneous current flow in conductors will be further developed and used to study single crystals of potassium grown under a variety of conditions, which exhibit a domain structure dependent on the method of fabrication. The magnetooptic technique, utilizing paramagnetic europium glasses exhibiting high Faraday rotation, can determine whether the domain structure is related to the anomalous behavior of potassium at low temperatures.

This research was previously supported under DMR 7683362.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0006, QUATERNARY SEMICONDUCTOR MATERIALS

E.M. Swiggard, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980021)

To prepare single crystal epitaxial films of the III-V compounds, to develop epitaxial growth technology, to lattice match layers to substrates and to develop those III-V epitaxial materials for Navy solid-state electronic and electrooptic devices.

Single crystals in epitaxial form such as Ga, In, As, and P have applications in electrooptic and electronic devices. These compounds will be prepared by various applicable expitaxial techniques including liquid phase and vapor phase. New methods of film growth are to be sought to improve material properties and processing technology. Structural match to InP substrates will be made so that the epitaxial films will be strain-free with low defect interfaces. Novel growth and purity control steps will be investigated to control impurity levels and substrate EPI interface. New material combinations will be investigated for both electrooptic materials and wide band gap semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval
Research Lab.

8.0007, RESONANCE SPECTRA OF SYNTHETIC METALLOPORPHYRINS

D.C. O'Shea, Georgia Inst. of Technology, School of Physics, Dept. of Physics, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DMR79-07758)

Resonance Raman spectroscopy promises to be a powerful technique for elucidating the vibrational and electronic structures of both the ground and excited states of synthetic metalloporphyrins. Previous work from Professor O'Shea's laboratory has shown that the variation in Roman spectrum with exciting laser wavelength ('excitation profile'), in weak coupling cases, can be explained in terms of coupling constants for the molecule. The goals of the present work are (1) to extend the range of Raman excitation wavelengths into the near ultraviolet in order to probe extremely strong resonance states of the metalloporphyrins and, (2) to develop the techniques of computerized resonance Raman difference spectroscopy in order to discern changes in the Raman spectra due to changes in the substituents on, or chemical environment of, the macrocycles.

Because of the close structural resemblance of the model porphyrins to chlorophyll, heme proteins, and other biological chromophores, these techniques, once developed, are expected to enable one to examine these important biological molecules and the effects of the environment on their activity. It has been shown, for instance, that small changes in cytochrome c structure can be discerned by resonance Raman difference techniques.

First year of a three-year continuing grant; renewal of work supported by DMR77-05971.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0008, CLASSICAL AND QUANTUM THEORY OF TURBULENT BEHAVIOR IN NONLINEAR SYSTEMS

J.B. Ford, Georgia Inst. of Technology, School of Sciences & Liberal Studies, Dept. of Physics, *Atlanta, Georgia* 30332 (DMR78-27584)

Research previously supported by DMR7611966. Theoretical research on turbulent behavior in nonlinear systems will be carried out. In particular a new theoretical description for turbulent trajectories in classical nonlinear Hamiltonian systems will be developed. The phenomenon of energy transport as heat in many-body, model nonlinear systems will be examined with

the possibility of demonstrating that it is a consequence of their underlying turbulent orbits, and to develop an analytic theory predicting the thermal conductivity of these models. Also, a quantum theoretical description of turbulent behavior will be developed for those systems in which turbulent behavior is known to occur classically. The common goal of these investigations will be to extend our knowledge regarding the stochastic properties of completely deterministic nonlinear systems which are of interest to many areas of condensed matter. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, RESEARCH PROGRAM IN MATERIALS SCIENCES
M.H. Cohen, University of Chicago, School of Physical Sciences, Dept. of Physics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (DMR78-24698)

Major collaborative programs are continued on disordered materials and on phase transitions. The former emphasizes disordered graphite intercalates, amorphous semiconductors, and glassy metals. The latter, representing a modification of the previous emphasis, stresses the role of metastability in transitions, especially in disordered and in two-dimensional materials.

Two newly initiated programs represent the addition of new capabilities to the prior program. These are: surface reactions, involving theoretical and experimental studies of reactions on solid surfaces; and the development of materials science applications of high resolution electron microscopy.

Partial support is also provided for the operation of central experimental facilities. This award is a continuation of DMR77-24223.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0010, STATISTICAL PROPERTIES OF PLASMA TURBULENCE
M. Raether, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Coordinated Science Laboratory/Physics, *207 Engineering Hall, Urbana, Illinois* 61801

The objective of this research project is to obtain information about turbulent plasma states that goes beyond the traditional description of these states in terms of correlation functions and/or power spectra. A system has been constructed that allows the measurement of one and two point probability densities of electron density fluctuations in a field of ion acoustic turbulence in a low pressure discharge in helium.

SUPPORTED BY University of Illinois

8.0011, WAVE-WAVE INTERACTIONS
M. Raether, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Coordinated Science Laboratory/Physics, *207 Engineering Hall, Urbana, Illinois* 61801

Studies of wave-wave interactions in an electron beam-plasma system led to the discovery of a spontaneous decay instability of a beam-plasma wave into an ion acoustic wave and an electron plasma wave. Good agreement was found with a theoretical model based on three-wave coupling.

SUPPORTED BY University of Illinois

8.0012, SPECTROSCOPIC INVESTIGATION OF PLASMA TURBULENCE
M. Raether, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801

In continuation of the consulting agreement between the University of Illinois and the University of Azarabadegan that was started in 1977, a cooperative research program in plasma physics was initiated during Dr. Raether's six-week stay at Tabriz in summer 1978. The principal investigators at Tabriz are Prof. Shirinpour and Prof. Moslehi-Fard. The program will be devoted to a spectroscopic investigation of plasma turbulence with the main objective to measure ion temperatures during ion acoustic turbulence.

SUPPORTED BY University of Illinois

8.0013, FABRICATION AND PROPERTIES OF ONE-DIMENSIONAL SYSTEMS
N.J. Giordano, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR79-06716)

An experimental program to study the properties of several different types of one-dimensional systems will be carried out. This work falls into two main categories. (1) The electrical properties of random one-dimensional systems will be studied to provide a detailed, quantitative test of recent theoretical predictions that Anderson localization should be observable in these systems. (2) A new type of superconducting point contact, the first in which the geometry of the contact region is under direct experimental control and its nature well characterized, will be investigated. This will allow a more detailed study of the physics of these devices than has been possible with point contacts of conventional design. Moreover, these point contacts should have good mechanical and thermal stability making them prime candidates for a number of practical applications.

In order to make the samples required for these experiments, several new techniques for fabricating ultra small structures will be developed. These techniques will not be limited to applications described above, but should also prove useful in many other microfabrication problems.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0014, COLLECTIVE STRUCTURE OF MASS-100 NUCLEI
P.C. Simms, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (PHY79-19187)

The interactions between nuclei are so complicated that it is necessary to treat most particles in a nucleus as an assembly with simple properties. Many aspects of nuclear structure can be described in terms of the collective properties of the assembly with a few nuclei treated as moving in the average potential created by the assembly. Nuclei with relatively large deformations have been found in the rare-earth and actinide regions, and a rotational description has been very successful for the properties of these nuclei. There has been no satisfactory description for the 'transitional' nuclei between closed shells and regions of strong deformation. This research program combines precise systematic measurements and detailed theoretical calculations to show that many transitional nuclei can be described as slightly deformed rotors. Excited nuclear states are produced by heavy-ion-(xn) reaction and studied with in-beam gamma ray spectroscopy; excitation functions, angular distributions, coincidence, directional correlation, linear polarization, and Doppler shift measurements are made on gamma rays. Energy levels and decay properties are determined and interpreted with a Coriolis-coupling calculation similar to that used for strongly deformend nuclei. This is the first increment of a three-year continuing grant, currently supported under NSF grant PHY-12610A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0015, APPLICATIONS OF QUANTUM ELECTRODYNAMICS TO PROCESSES OF CURRENT INTEREST IN ATOMIC AND NUCLEAR PHYSICS
W.R. Johnson, University of Notre Dame, College of Science, Dept. of Physics, *Notre Dame, Indiana* 46556 (PHY79-09229)

Research in theoretical atomic physics initiated under NSF grant PHY77-15141 will be continued. Among the topics to be investigated are: a) Relativistic random phase approximation (RRPA) calculations of susceptibilities and shielding factors for closed-shell atoms and ions throughout the periodic system. b) Development of a relativistic version of the multichannel quan-

tum defect theory (MQDT) and application of the MQDT in conjunction with the RRPA to study highly excited spectra and autoionizing resonances in closed-shell atoms and ions. c) Application of the RRPA to study core polarization corrections to the theory of optical rotations in Tl, Pb, and Bi.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0016, SOLID-STATE STUDIES OF AMORPHOUS MAGNETIC SOLIDS

C. Chien, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (DMR89-10536)

Mossbauer spectroscopy, magnetization, susceptibility, resistivity and X-ray diffraction measurements will be utilized to study the hyperfine interactions, structural properties, magnetic properties, transport properties, critical phenomena, percolation, spin glass behavior and collective excitations (spin waves) in amorphous magnetic solids. Some studies will be made in close collaboration with groups using other techniques, such as neutron diffraction. Solids which can be made in both crystalline and amorphous forms, amorphous solids with abundant antiferromagnetic exchange interactions, non-eutectic binary amorphous systems and nominally pure amorphous metals will be studied in order to gain further insight in these largely unexplored areas. The results of these studies provide needed information for the understanding of the intrinsic properties of amorphous magnetic solids, many of which also show potential for practical applications.

This research was previously supported by DMR 7709598.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, ATOMIC AND MOLECULAR PHYSICS

D. Kleppner, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (PHY79-09743)

Research will continue in several broad areas: atoms in strong electronic and magnetic fields, weakly bound molecules, atomic line broadening, and cold hydrogen atoms. Studies of atoms in high fields will be extended to the region where the magnetic interaction is stronger than the Coulomb interaction, and investigation of the weakly bound molecule NaAr. To develop techniques for high resolution studies of free-bound transitions, and to initiate studies of Rydberg molecules; a systematic study of line broadening in which the intensity and polarization of reradiation due to both elastic and inelastic collisions will be investigated, together with two newly predicted types of light-induced collisional energy transfer; applications of newly developed cold atomic hydrogen sources to precision measurements in excited atomic hydrogen.

This is the first year of a 4-year continuing grant.

This research is a continuation of that previously funded under NSF grant PHY77-09155A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0018, PHYSICS OF INTERSTELLAR MOLECULES

A. Dalgarno, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (144410-31A)

Computations necessary for the calculation of the rate coefficient for proton exchange reactions.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

8.0019, DEFECTS IN SEMICONDUCTORS

C. Penchina, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Amherst, Massachusetts* 01002 (DN675518; N00014-76-C-0890)

Development of electronic and optical components for naval communications and surveillance systems will require increased understanding of the properties of semiconductors. Understanding of the role of impurities and defects is imperative to the preparation of such materials and to prediction of their behavior in devices and in a radiation environment.

The investigator is using a variety of techniques to investigate the electronic nature of the deep level states in gallium arsenide produced by oxygen and chromium impurities. These techniques include photoionization cross-sections, photo-Hall effect, photocapacitance, and cathodoluminescence measurements. The effects of stress on these measurements are used to deduce defect symmetry properties, and temperature effects are used to deduce relationship of defect state to the band structure of the solid. Photoluminescence spectra having phonon sideband induced structure will be used to determine the magnitude of Franck-Condon shifts. Theoretical studies of the temperature dependence of the energy levels and on photoionization cross-sections will continue. Also calculations will be made on electroabsorption processes and their relation to site symmetries.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0020, ELECTRON TRANSPORT AND MAGNETIC INTERACTIONS IN METALS

J. Bass, Michigan State University, School of Arts & Letters, Dept. of Physics, *Soil Science Bldg., East Lansing, Michigan* 48824 (DMR77-04680 A02)

Experimental studies of low-temperature transport properties previously supported by DMR7514138 will be continued. Magnetothermoelectric measurements on simple metals at low and ultra-low temperatures will be done in order to achieve a better understanding of many-body effects in thermoelectricity (i.e., electron-phonon mass enhancement and the Nielsen-Taylor effects) and of the source of the Giant Magnetothermopower Oscillations which were discovered in aluminum and indium in recent research done in this project. Also, the sources and properties of the recently discovered low- and ultra-low-temperature thermoelectric anomalies in tungsten will be investigated. Finally the studies of dilute magnetic alloys using the technique of combining traditional transport and magnetic measurements with direct and independent determinations of the microscopic spatial distribution of impurities will be continued.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, INTERACTION OF ELECTRONS AND IONS WITH PLASMA

M. Seidl, Stevens Inst. of Technology, Graduate School, Dept. of Physics & Engineering Physics, *Castle Point Station, Hoboken, New Jersey* 07030 (PHY79-08555)

A study of the production and heating of volume plasmas by electron beams will be continued. The broad objective of the research is to explore the basic processes responsible for electron beam heating of plasmas confined in magnetic mirrors. The importance of the various interaction modes for transverse electron heating will be assessed. For this purpose the nonlinear evolution of the slow and fast cyclotron modes will be studied. The role of plasma and magnetic field inhomogeneities for transverse heating will be explored. Production of thin layers of dense plasmas on the surface of nonmetallic solids will be initiated. Three basic production methods will be explored: ohmic heating, electron bombardment, and ion bombardment. Ion emission from these surface plasmas will be studied. Particular attention will be paid to thermionic emission of alkali ions from zeolites and to secondary emission of negative hydrogen ions from surface plasmas produced by bombarding alkali hydrides with alkali ions.

This research is a continuation of that previously supported under NSF grant PHY-7707214A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0022, HYDROGEN PUMPED IODINE LASER
J.A. Blauer, Bell Aerospace Co., *P.O. Box 1, Buffalo, New York* 14240 (DF187160; F29601-76-C-0063)

The objective of this work is to develop a high energy, chemically pumped, electronic transition laser. Detailed studies of the H and HI reaction will be used to investigate energy transfer from vibrationally excited hydrogen molecules to iodine atoms and to demonstrate lasing by electronically excited iodine atoms at 1.315 microns.

Atomic hydrogen will be generated by shock heating mixtures of H(2) and Ar to 4500 degrees K. The hydrogen atoms will be expanded out of the shock tube through a nozzle where HI will be injected into the flow. Optimum cavity conditions will be sought to demonstrate lasing. Other techniques to generate sufficient flows of hydrogen atoms will be pursued. Other energy transfer systems will be evaluated as to their potential for high energy, chemically pumped, electronic transition lasers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

8.0023, LIMITED DIMENSIONALITY AND SURFACE EFFECTS IN METALLIC SYSTEMS
R.A. Buhrman, Cornell University, Ithaca Campus, Graduate School, Dept. of Applied Physics, *101 Sage Graduate Ctr., Ithaca, New York* 14850 (DMR77-09879 A02)

Experimental research on the electronic and magnetic properties of metals in limiting and unusual physical environments previously supported by DMR-7402609 will be continued. Static and dynamic transport techniques and resonance techniques will be used to investigate the quantum phenomena arising from size effects in microminiature metallic particles. The intent of this research is to advance the understanding of the transition regime between metallic and atomic-like behavior in such systems. The magnetic susceptibility of metals at or near free surfaces will be investigated by the use of high-resolution susceptibility measurements. A new surface-sensitive magnetic probe that is proposed for development will also be used. An exploratory investigation of the electrical and magnetic properties of ultra-finely dispersed cermet materials will be initiated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0024, CRITICAL BEHAVIOR OF ROTATION-INVARIANT FERROMAGNETS
O.A. McBryan, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Mathematics, *Ithaca, New York* 14850 (DMR77-04105)

Research in theoretical statistical mechanics will be carried out. In particular, the critical behavior of two-dimensional ferromagnets which have rotationally-invariant spin interactions will be investigated. The critical properties of these systems are believed to be similar to those of gauge-invariant quantum field theories in four dimensions which are currently used to describe the strong interactions of elementary particles. The relationship between these two branches of theoretical physics will be investigated. Also, it will be determined rigorously whether or not SO(n)-symmetric two-dimensional ferromagnets exhibit phase transitions at low temperatures.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, JOINT US-USSR COLLABORATION IN SEMICONDUCTOR PHYSICS (ABBREV)
J.W. Corbett, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Physics, *1400 Washington Ave., Albany, New York* 12222 (INT76-10315)

This grant is to support the establishment of a two-year collaboration between the Institute for the Study of Defects in Solids and the Institute for Semiconductor Physics in Novosibirsk, USSR. This collaboration will take the form of exchanges of senior scientists, joint projects and coordinated research programs in the area of semiconductors. US scientists are to be exposed to the current Soviet state of research in this field at one of the most advanced research centers in the USSR.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

8.0026, DEFECTS IN SEMICONDUCTORS
J.W. Corbett, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Physics, *1400 Washington Ave., Albany, New York* 12222 (DN123026; N00014-75-C-0919)

Studies of defects in semiconductors, defects produced by radiation or by ion implantation of foreign species, are of great importance to a broad spectrum of Navy electronics systems. Radiation effects studies support nuclear radiation vulnerability programs and ion implantation studies support new material and electron device technology.

The investigator combines a variety of theoretical and experimental techniques for identifying defects in semiconductors and understanding their effect on material properties. EPR, ENDOR, transient capacitance, Rutherford backscattering, channeling, and optical measurement techniques are used. Current efforts include studies of hydrogen-related defects in silicon, and studies of lithium, boron, and gold-related defects. Another problem area is the relationship of oxygen impurities and heat treatment on the defect nature of silicon. Recently, interest has risen on the problem of impurities related to dislocations and these will be studied. The renormalization group technique will be applied to the theory of defects. Studies will be made on nature of defects in laser annealed semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0027, OPTICAL STUDIES OF SUPERCONDUCTING TUNGSTEN BRONZES
E.M. Brody, University of Rochester, School of Engineering & Applied Science, Dept. of Aerospace & Mech Science, *260 Crittenden Blvd., Rochester, New York* 14627 (DMR78-12993)

Raman and Brillouin inelastic light scattering and photoelastic modulation ellipsometry will be used to study the electron and phonon properties affecting superconductivity in the hexagonal tungsten bronze system AxWO3 (A equals K, Rb, Cs, Tl) as a function of composition and temperature. The Brillouin studies will probe for acoustic phonon softening and permit the determination of the single crystal elastic moduli. Ellipsometry will be used to determine the optical constants necessary to interpret the Brillouin spectra. This work is important for determining the properties of materials which govern their macroscopic superconducting behavior.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0028, ENERGY DEPENDENCE OF X-RAY POLARIZATION ROTATION
G.G. Cohen, Vassar College, Graduate School, Dept. of Physics & Astronomy, *Raymond Ave., Poughkeepsie, New York* 12601 (DMR7810308)

Recent laboratory experiments have shown that the plane of polarization of a linearly polarized X-ray beam can be rotated by simple transmission through a (110) Si crystal. Both the amount of rotation and the amount of absorption of X-ray depended on the orientation of the crystal in the incident beam, an X-ray analog to optical birefringence.

Two new experiments will be performed: (1) study the effect at higher energy (Mo K alpha at 0.709A), varying such crystal parameters as the thickness; and (2) test the earlier results with a (110) Ge crystal by performing a polarization rotation experiment in the critical region near an absorption edge.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0029, NUCLEAR PHYSICS RESEARCH AT LOW & INTERMEDIATE ENERGIES

S.L. Blatt, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (PHY79-09157)

This is a continuation of research previously supported under grant PHY77-05021 A01. This grant will support a range of experiments in nuclear reactions, nuclear spectroscopy and related areas of nuclear science. The work will be carried out using a 7 MV Van de Graaff accelerator and at the University of Indiana Cyclotron. A special attribute of the Van de Graaff facility is the polarized ion source. Specific areas of research interest include polarization phenomena, properties of resonant nuclear states, radiative capture reactions, and intermediate energy reactions. Studies in atomic physics and nuclear astrophysics will be initiated.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0030, ELECTRICAL TRANSPORT IN FERROMAGNETIC METALS AND ALLOYS

L. Berger, Carnegie Mellon University, Mellon Inst. of Science, Dept. of Physics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DMR78-24679)

Two experiments will be done to observe two newly predicted effects involving the interaction of ferromagnetic domains with electrical currents in pure cobalt. In the first experiment, a direct current crossing the domain walls is expected to cause the coercive field (Hc) of the ferromagnet to decrease and even to vanish. In the second experiment, the dragging of domain walls by a current is expected to be facilitated by the application of a variable magnetic field.

In addition, the magnetoresistance of concentrated Pd-Fe, Pd-Co, Pd-Ni-Fe, Pt-Fe, and Pt-Co alloys will be measured at temperatures down to 4 degrees K. These materials are among the most likely to have a large and technically useful magnetoresistance. Also, the Hall effect of these alloys will be measured. The effect of alloy ordering on magnetoresistance will be studied. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, THEORETICAL INVESTIGATIONS IN HIGH-ENERGY AND ELEMENTARY PARTICLE PHYSICS

R.D. Carlitz, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY77-08287 A01)

Research will be done in theoretical physics to further our understanding of the elementary particles.

The investigations will be aimed at uncovering the basic laws that govern the interactions of the fundamental constituents of matter. At the present stage of our knowledge we have only a guess as to what these fundamental constituents are. We know that ordinary matter is composed of chemical elements and chemical elements are reducible to atoms and atoms are made up of atomic nuclei and electrons. The nuclei are themselves collections of protons and neutrons held together by the strong nuclear force. The electrons appear to be elementary (not composites of some other particles), but the protons and neutrons show themselves to be complex structures in a variety of experiments. This has led to the hypothesis that they are composed of more fundamental constituents. These hypothetical constituents of the proton and neutron are called quarks. They are hypothetical because, despite occasional claims to the contrary, no one has yet succeeded in convincing the community of physicists that he has detected a quark in an experimental apparatus.

The mathematical formulation of the laws of nature which govern the interactions and combinations of these quarks is very complicated, and we do not at this time know what final form it will take. Most of the work to be done in this project is involved with one or another aspect of this problem.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0032, LIGHT SCATTERING IN FLUIDS

W.I. Goldburg, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DMR77-09910 A02)

Under study are the dynamics of phase separation in fluids, the intensity and spectral width of light scattered from a tricritical mixture, and the low-frequency flicker noise (1/f noise) in a binary mixture near its critical point. The variation of critical temperature with sample size in binary mixtures of varying composition will be measured. Finally, a collaborative exploratory venture into biochemistry is planned - a study of pH oscillations in enzyme-catalyzed reactions in an immobilized enzyme system.

This is a continuation of research supported by Grant No. DMR 73-05247.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, EXPERIMENTS ON GASES AT LOW TEMPERATURE

G.M. Seidel, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR79-10006)

Research supported under NSF Grant No. DMR77-95593 will be continued with new emphasis being placed on the experimental problems associated with the production of a dense gas of spin-polarized atomic hydrogen. Such a gas has been predicted to a unique quantum mechanical system possessing unusual thermodynamical properties. A microwave discharge in a gas of molecular hydrogen will be used to dissociate the molecular hydrogen into atomic hydrogen. A helium-3, helium-4 dilution refrigerator will be used to cool the gas to temperatures as low as 0.1 degrees K after it has been spin-polarized by a high intensity magnetic field. The presence and density of the spin-polarized gas will be determined by superconducting microwave cavity techniques. The objective of this research is to study the stability of atomic hydrogen and, if stable, to study its many-body properties. Particular attention will be given to the question of the predicted Bose-Einstein condensation and possible superfluid state.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, DISSOCIATION OF FAST MOLECULAR HYDROGEN IONS ON NOBEL GASES

B.M. Doughty, East Texas State University, School of Science & Technology, Dept. of Physics, *E. Texas Station, Commerce, Texas* 75428 (T-561)

Cross-section measurements for 3s and 4s state hydrogen atom production by 10-150 keV H2 ions incident on Kr have been attempted with an experimental arrangement used previously for proton measurements. The experiment involves passing the beam through a 'thin' gas target cell and measuring Balmer radiations from the resulting fast hydrogen atoms in an evacuated flight tube. Production of ns state hydrogen atoms from H2 ions is more complicated than from proton projectiles both theoretically and experimentally. A new system has been constructed to alleviate several deficiencies in the proton apparatus. The new system has greater pumping speed, thus providing sharper gas boundaries and reduced background, or residual, emissions from the observation chamber. In addition, the beam can be observed in the collision region as well as in the evacuated observation chamber. This capability with the ability to monitor beam collisions with the wall of the collision chamber exit aperture provides a strong tool for investigating or eliminating aperture effects. Beam-aperture interactions have not been adequately studied in previous H2 ion measurements. Cross-sections

for production of 3p and 3d state hydrogen atoms will also be measured.

SUPPORTED BY Robert A. Welch Foundation

8.0035, DETERMINATION OF PROTON-INDUCED IONIZATION CROSS-SECTIONS OF SELECTED METALS
A.R. Zander, East Texas State University, School of Science & Technology, Dept. of Physics, *E. Texas Station, Commerce, Texas* 75428 (T-589)

Investigations of proton-induced ionization processes in thick metallic targets have been extended to proton energies below 100 keV. Values of absolute K-shell ionization cross-sections for incident protons for Z equals 20-30 metals have been obtained as a function of proton energy down to 60 keV. Comparison of the results to modified theoretical models for such collision processes appears to indicate that additional modifications may be required. The additional modifications may be dependent upon stopping power effects. This possibility is currently under investigation.

Additional studies of energetic heavy ions incident on various targets are under way in order to determine the relative contributions of one- and two-step vacancy production processes in such collisions. The results obtained to date are inconclusive due to relatively large radiative electron capture contributions.

SUPPORTED BY Robert A. Welch Foundation

8.0036, POSITRONIUM REACTIONS IN THERMOTROPIC LIQUID CRYSTALS AND OTHER MOLECULAR SUBSTANCES
J.D. McNutt, University of Texas, Arlington Campus, School of Science, Dept. of Physics, *Arlington, Texas* 76019 (Y-400)

The formation and reactions of positronium and the formation and properties of positronium compounds have been studied by measuring lifetime spectra for positrons annihilating in gases, and by measuring total cross-sections for the scattering of low-energy positrons from gas atoms. A complex temperature dependence, the first heretofore found for any gas, and a strong density dependence have been observed for the positronium yield in H2 gas at 293, 250, and 77 degrees K. O-Ps induced cavity formation occurs in 77K H2. The addition of concentrations of Ne to H2 at 77K strongly affects the formation probabilities for e plus H2 and for e plus (H2)n cluster states, the positronium yield, and the behavior of o-Ps in cavities. Preliminary results with C2H6 gas at 295K indicate the formation of e plus C2H6 at low gas densities, of e plus (C2H6)n cluster states at higher densities, positronium yields as high as 0.80, and the pronounced interaction of o-Ps with microscopic density inhomogeneities. Successful quantitative models have been developed for several of these effects; others remain unexplained. A monoenergetic, timed position beam has been utilized to accurately measure total scattering cross-sections for 2-75 eV positrons in Ne and Xe. The first measurement of positron-gas partial cross-sections has just been accomplished.

SUPPORTED BY Robert A. Welch Foundation

8.0037, MEASUREMENT OF THE COSMIC-RAY SIDEREAL ANISOTROPY ABOVE 1 TEV
H.E. Bergeson, Utah Higher Education System, University of Utah, School of Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (AST77-07627 A01)

An underground muon detector designed to measure the cosmic-ray sidereal anisotropy at galactic containment energies has been built in a mine near Heber, Utah. Three layers of plastic scintillators, totalling 37.3 sq. meters each, are located at a mean depth of 4.86 times 10 to the minus 4th power g cm to the minus second power. The median primary cosmic-ray rigidity is 1400 GV for detected events, and the counting rate exceeds 10 to the 8th power yr to the minus 1st power. A computer operates the experiment, performs periodic stability and calibration checks, and is also programmed to search for transient events and narrow-angle temporary anisotropies. The apparatus is complete and essentially operational. Continuous operation is expected in 1977. The sidereal anisotropy of cosmic rays will be measured for the next three years and the results reported.

This action provides additional funding and extends the duration of the grant number AST77 07627.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

8.0038, MATERIAL SUPPORT TECHNOLOGY - THIN FILMS, SURFACES, AND INTERFACES - A FOURIER-TRANSFORM THEORY OF THEIR ELECTRONIC STRUCTURE
H.J. Monkhorst, Utah Higher Education System, University of Utah, School of Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DN775345; N00014-77-C-0319)

The Navy has need for improved performance solid-state electronic devices. One limitation has been a less than adequate understanding of the surface and interface physics of these devices. This program will assess new techniques for obtaining an understanding of these semiconductor surfaces and interfaces.

A new theoretrial approach is being developed for electronic structure calculations on thin films, surfaces and interfaces. The Fourier-transform technique developed for bulk solid calculations is being adapted into a two-dimensional version for application to surfaces. In the first stage, energies and electronic states are calculated at the Hartree-Fock level. At a later stage, electron correlation effects will be included. The properties for simple prototype solids will be calculated first and eventually applied to semiconductors. Various surface reconstruction effects in these materials will be considered.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

8.0039, THEORETICAL STUDIES OF THE MAGNETIC PROPERTIES OF SOLIDS
D.L. Huber, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Physics, *Agriculture Hall, Madison, Wisconsin* 53706 (DMR79-04154)

Research previously supported by DMR7701057.

Theoretical research on the magnetic properties of solids will be carried out. The main emphasis will be on solids containing rare earth and transition metal ions. The specific projects to be pursued will include: 1) the calculation of the properties of rare earth magnets which focus on the dynamical behavior near a second order phase transition, 2) an investigation of the dynamics of quasi-one- and two-dimensional planar magnets, with a particular emphasis on effects which can be probed using ultrasonic, nuclear and paramagnetic resonant techniques, 3) the study of the properties of disordered magnets showing spin glass behavior, and 4) the investigation of energy transport among magnetic ions in paramagnetic crystals.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, MAGNITUDE AND VARIABILITY OF SOLAR SPECTRAL IRRADIANCE
G.E. Shaw, University of Alaska, Fairbanks Campus, School of Arts & Sciences, *Fairbanks, Alaska* 99701 (ATM78-12185)

Measurements of the absolute magnitude and variability of solar irradiance from ground stations are being recorded to determine if the sun's visible spectral irradiance is varying with time. The accuracy of the determination is expected to be 1% absolute, the precision (relative change) will be a few tenths of 1%. Because of improved calibration procedures these accuracies and precisions are about 5 times better than existing determinations. Solar variability, if it is observed, will be related to Zurich sunspot number, faculae indicies, solar flares and solar magnetic activity. In conjunction with measuring solar variability, aerosol spectral optical data will be collected at Mauna Loa.

These data will be related to sources and long range transport of aerosols accross the Pacific Ocean. Atmospheric ozone will also be studied by absorption of light in the Huggins and Chappuis bands.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0002, IONOSPHERIC ACCELERATION MECHANISMS

R.D. Sharp, Lockheed Missiles & Space Co. Inc., Space Sciences Laboratory, *3251 Hanover St., Palo Alto, California* 94304 (ATM79-11174)

This grant will support the analysis of data from a plasma experiment on the S3-3 satellite. The satellite is in a polar elliptical orbit with apogee at 8000 km and is exploring a region of space which has not previously been studied. A number of new discoveries have already been made with the experiment relating to the processes responsible for the acceleration of auroral particles. The central focus of the proposed investigation will be the understanding of these mechanisms and the related processes that energize ionospheric ions and inject them into the magnetosphere. In particular, the data will be analyzed for evidence of electric fields in the polar ionosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0003, AN IMAGE-DISSECTOR SCANNER SYSTEM FOR THE MT. LEMMON OBSERVATORY

E.M. Burbidge, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (AST78-09228)

A modern spectrophotometric system will be constructed for the UCSD-Minnesota 1.5 meter telescope on Mt. Lemmon, Arizona. The system will consist of an image detector scanner module, a data acquisition computer system and an integrating television camera for guiding and setting on faint objects. An interactive data reduction system for use on the UCSD campus is also included. The instrument will be constructed by the Lick Observatory shops. The proposed image dissector scanner will have exceptional capabilities for research applications on galactic stars, gaseous nebulae, other galaxies and the strong sources of radio radiation known as Quasi Stellar Objects.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0004, OBJECTIVE-PRISM RADIAL VELOCITIES OF STARS

A.R. Upgren, Wesleyan University, School of Science in Society, Dept. of Astronomy, *Middleton, Connecticut* 06457 (INT78-19336)

This is a joint program between the Van Vleck Observatory of Wesleyan University, Middletown, Connecticut and the Fundacion Centro de Investigacion de Astronomia 'Francisco J. Duarte' in Merida, Venezuela, for the purpose of determining the radial velocities of groups of stars. Astronomers at the two observatories participate in the measuring, reduction and analysis of the results of the observations which are made in Venezuela. The observations consist of photographs taken with the wide-field Schmidt Telescope using an objective prism which causes each star to appear as a small spectrum. The precision of a PDS microdensitometer raster scan capabilities is being compared with more traditional but much slower machines now in use. If reliable enough, its use will increase the speed of measuring the spectral line, by an order of magnitude or more. The radial velocities of many thousands of stars can be determined only by this method. They can then be used to provide new and extensive information on the basic stellar components of our Milky Way Galaxy as well as its rotation. The new Venezuelan Schmidt Telescope has two unique advantages for this program; it is the largest in the world equipped with an objective prism and it is located near the Equator and thus can view all parts of the sky. The work contemplated is a continuation of research under a previous award, NSF No. OIP75-06683.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological
& Internat. Affairs, Div. of International
Programs

10.0005, PARALLAXES OF NORTHERN AND SOUTHERN STARS

A.R. Upgren, Wesleyan University, School of Science in Society, Dept. of Astronomy, *Middleton, Connecticut* 06457 (AST78-19007)

All methods for the determination of cosmic distances outside the solar system ultimately depend on trigonometric parallaxes of stars. This fundamental method is of such importance for the calibration of the distance to all objects in the Universe that its precision must be evaluated most carefully. Such parallaxes cannot be determined except over a number of years of careful observation. This program will continue analysis of the systematic and accidental errors of past parallaxes, and determine new ones as necessary to assist in this endeavor.

A systematic difference appears to exist between the stellar parallaxes observed in the Northern and Southern Hemispheres. It amounts to 0.005 plus or minus 0.001 but its cause is unknown. Since the latitudes of the northern and southern observatories differ by more than 60 degrees, an astrometric telescope located near the Equator would be helpful in resolving the difference and identifying its cause. The new 65-cm refractor now in operation near Merida, Venzuela at latitude 8 degrees 48'N will be used to make parallax observations which could resolve the difference. In addition, parallaxes of some stars of individual interest will be observed there, mostly at deep southern declinations where no precise parallaxes are presently available. Studies on the origin and nature of existing differences between observations are already in progress and form a part of this program.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, A STUDY OF THE NEEDS OF ASTRONOMY AND ASTROPHYSICS FOR THE 1980'S

B.N. Gregory, National Academy of Sciences, *2101 Constitution Ave. N.W., Washington, District of Columbia* 20037 (C-AST78-28089)

The National Research Council of the National Academy of Sciences proposes to conduct a two-year study of the needs of astronomy and astrophysics, incorporating both ground-based and space investigations, for the 1980's. The study would be concerned with all aspects of observational astronomy (understood to include all regions of the electromagnetic spectrum, from radio waves to gamma rays; particle radiations; including neutrinos and muons; and gravitational waves) and laboratory astrophysics. The field of theoretical astrophysics and relativity would also be surveyed, as well as solar physics and planetary studies. The major goal of the study would be to formulate priorities for a comprehensive program in astronomy and astrophysics for the 1980's. This would be based upon studies of the following type: a review of the influence of the Greenstein Report on the development of astronomy and astrophysics during the 1970's; and examination of the advances in facilities design, technology, and management procedures since publication of the Greenstein Report, and hence to delineate the major astronomical and astrophysical problems to be addressed in the 1980's; an assessment of the extent to which current or approved facilities and programs will be able to meet the scientific challenges of the coming decade; a determination of what new facilities and programs will be needed to meet the scientific challenges of the coming decade. A report will be submitted at the end of the study.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, OBSERVATIONAL PROGRAM IN GROUND-BASED INFRARED ASTRONOMY

E. Becklin, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowalu St., Honolulu, Hawaii* 96822 (AST78-26028)

An observational program in ground-based infrared astronomy using the facilities of Mauna Kea, Hawaii, Observatory will be carried out. The program will consist principally of photometric observations in the atmospheric windows between 1 and 40 microns of both galactic and extragalactic sources. Initially the program would use the 2.2-m telescope, but later would employ both the 3.8-m United Kingdom and 3-m National Aeronautics and Space Administration's infrared telescopes. Within the Galaxy the earlier Cal. Tech. work on ionized hydrogen (HII) regions and molecular clouds, with particular reference at this time to very cool infrared sources, usual HII regions and infrared reflection nebulosity will be continued. Outside of the galaxy the research will be directed to the question of the nature of the strong infrared emission from the nuclei of certain galaxies. In both programs full advantage will be taken of Mauna Kea's excellent atmospheric transmission to emphasize observations at wavelengths longward of 10 microns. These observations will be complemented with 2-10 microns mapping and photometry and 2-4 microns filter-wheel spectrophotometry. Aperture synthesis radio observations of some of our infrared sources will be made at the very large array and the Cambridge, England five kilometer telescope.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0008, OBSERVATIONAL STUDIES OF THE SPECTROPHOTOMETRY OF QUIESCENT SOLAR PROMINENCES

D.A. Landman, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowalu St., Honolulu, Hawaii* 96822 (AST78-19006)

The study of quiescent prominences is important in other problems in solar physics, solar-terrestrial relations, and in other fields of astronomy. Prominences are luminous streamers, arches, and clouds of plasma observed above the edge of the sun extending into the chromosphere and corona. The ones to be studied are those which remain relatively quiescent. A proper understanding of the conditions in these prominences will lead eventually to an accurate determination of the helium to hydrogen abundance ratio, which is otherwise difficult to determine. This value will bear ultimately on the He to H ratio of the universe, and hence on all areas of astronomy. Information will also be gained on the magnetic fields and possibly on the mechanism of coronal heating. The observations made on the oscillations and perturbations of the material as seen in the spectra can be used to investigate the dynamics of energy propagation in the inner corona. Understanding of the ionization and excitation equilibrium of the prominences remains unsatisfactory. It is the study of this problem and of the discrepancies between the previous observations and the theoretical calculations that is the goal of the research to be carried out in this project.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, ASTRONOMICAL APPLICATIONS OF NEAR-INFRARED VIDICONS

R.K. Honeycutt, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Astronomy, *Memorial Hall, Bloomington, Indiana* 47401 (AST79-07552)

Astronomical research in the infrared has been hampered by the low sensitivity of most available imaging devices. A low light level integrating television system was designed and built at the Los Alamos Scientific Laboratory in 1976 and later duplicated at Indiana University by the principal investigator and his co-workers. This device is based on an RCA S-1 I-SIT vidicon. It will be used for several studies including time-resolved spectroscopy of several stars being observed simultaneously in the X-ray part of the spectrum by the high energy astrophysical observatory (HEAO-A) satellite. Observations will include binary stars suspected of having acretion rings, gas shells surrounding late-type stars, objects more readily visible in the infrared that are heavily obscured by dust in the visible wavelengths, and a number of external galaxies. Images have already been obtained and others are stored at Los Alamos. These and the images to be obtained at the Goethe-Link Observatory in Indiana will be analyzed with the new image analysis system at Indiana University. To facilitate the work at Goethe-Link, several items of hardware will be obtained or constructed. The hardware includes a second microcomputer to separate the telescope control and observing functions presently shared by a single microcomputer, a stellar gas shell filter, and an automatic guider for the telescope.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
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10.0010, INVESTIGATIONS OF GALACTIC STRUCTURE

F.J. Kerr, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (AST77-26898 A01)

The data from a 21-cm radio astronomy survey of the Southern Milky Way with the 64 meter Parkes telescope are being prepared for publication. The more extensive data from a companion survey with the 18 meter telescope are available as profiles, and will be in contour map form in the Spring, 1979. Some studies of these data have begun, including a new delineation of the warp of the Galaxy. A wide range of other investigations will be based on the Milky Way data. In addition, there are results from a 21-cm survey of the galactic center region. The third quadrant of galactic longitude is being studied optically and in various types of radio emission. A detailed 21-cm study of the Puppis window will be done, for comparisons between stars and gas. The results from an Arecibo Observatory study of distant spiral galaxies provide a statistically large sample of galaxies. Many of the galaxies detected at 21-cm will be photographed, in order to correlate the shape of the global profiles with features in theoretical appearance.

This is a continuation of work being done under AST-7726898.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, SOLAR FLARES AND THEIR INTERPLANETARY EFFECTS

D.M. Rust, American Science & Engineering Inc., Space Division, *955 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ATM79-18412)

This grant will support the development and implementation of the scientific programs of the International Solar Maximum Year. These include the Flare Build-up Study (FBS), The Study of Energy Release in Flares (SERF) and the Study of Travelling Interplanetary Phenomena (STIP). A major goal is to identify problems that will yield to a coordinated attack by combined measurements; of the interplanetary medium, for example, and observations of solar ejections. A Science Coordinator will perform the following tasks, as formulated by the Workshop on Energy Release in Flares and endorsed by the SMY Steering Committee: (a) provide a central focus for the communication of detailed observational plans and priorities between observatories (ground and space-borne), (b) assist in the development of the plans to carry out coordinated observing sequences, and (c) assist in the coordination of the scientific goals of the individual ground and space-borne observatories toward the ultimate goal of maximizing the collective science. Coordinated observations will be carred out during approximately thirty-five 3-4 day intervals per year. Between intervals, observations received will be evaluated, the scientific programs refined and results publicized. As time allows, a particular program to study flares with eruptive filaments will be pursued. Flares with eruptive filaments invariably result in stronger inter-

planetary and geophysical disturbances than noneruptive flares and are therefore of particular interest to solar-terrestrial physics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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10.0012, HYDRODYNAMIC CONVECTION IN THE CORE HELIUM FLASH

R.G. Deupree, Boston University, School of Liberal Arts, Dept. of Astronomy, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (AST79-05568)

The helium core flash is the event which signifies the thermonuclear ignition of helium in the central region of a star. The problems associated with this phenomenon are the inclusion of time-dependent turbulent convection, the interaction of the convective energy transport and the local nuclear heating, and the mixing and transport of material produced by these thermonuclear reactions.

The research to be carried out will involve calculations of the thermonuclear ignition of helium, making use of computer codes capable of carrying out the calculation in two spatial dimensions. These calculations will be aimed at defining the nature of the interaction of these features. Such calculations will provide information on the validity of techniques currently used in the treatment of convection, turbulence, and mixing.

SUPPORTED BY U.S. National Science Foundation,
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10.0013, VARIABLE STARS

E.P. Belserene, Maria Mitchell Observatory, *Nantucket, Massachusetts* 02554 (AST78-07405 A01)

The photographic plate collection of the Maria Mitchell Observatory is almost unique as a resource for the investigation of changing periods of pulsating variable stars. During the summer and fall of 1979 over 100 plates will be taken with the telescope at this Observatory. These plates will be analyzed to determine the behavior of variable stars in selected regions of the Galaxy. The Observatory will also provide data on the past optical behavior of astronomical objects of interest to spectroscopists and astronomers.

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10.0014, A TWO-FREQUENCY VLBI EXPERIMENT

J.M. Moran, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138

Very long baseline interferometry experiments were conducted to determine the spatial structure of molecular line emission from galactic radio sources. Some funds were diverted to the Spectral Lines Project for purchase of equipment.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0015, PETROLOGICAL AND MINERALOGICAL STUDIES

J. Wood, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31P-4P50-02)

Comprehensive studies are made of solid extraterrestrial material including returned lunar soil samples and meteorites by techniques of mineralogy and petrology, optical microscopy, X-ray diffraction, electron-probe microanalysis and scanning electron microscopy. Petrological studies lead to deductions about the origin and evolution of these materials.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0016, COMPUTER-CONTROLLED PHOTOGRAPHIC PHOTOMETRY SYSTEM

E.L. Turner, Princeton University, Graduate School, Dept. of Astrophysical Sciences, *205 Nassau Hall, Princeton, New Jersey* 08540 (AST78-22484)

This project will provide a PDS microdensitometer data acquisition facility for the Department of Astrophysical Sciences at Princeton University. The system consists of a minicomputer controlled instrument which translates photographic density (lightness and darkness) of each point in the picture. These numbers are stored on magnetic tape and later analyzed with a large computer or an interactive picture processing system. When applied to a photograph of some part of the sky taken through a large telescope, this process allows the determination of accurate brightnesses, positions in the sky, shapes, colors, etc. of various celestial objects.

The system will be a powerful facility which will be used by astronomers from Princeton as well as from other institutions in the area. Some of the projects include locating and studying galaxies outside our own. Clusters of galaxies and quasi-stellar objects will also be studied in order to answer questions concerning the nature, origin, evolution and structure of these largest and most distant objects in our universe.

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10.0017, HIGH DISPERSION SPECTROSCOPIC STUDIES OF GASEOUS NEBULAE IN THE REGION FROM 4000 TO 8500 A

S.J. Czyzak, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Astronomy, *164 W. 17th Ave., Columbus, Ohio* 43210 (AST76-15727 A02)

The spectrum of several planetary nebulae will be measured using sensitive equipment of the latest type. The device used will be the Schectman spectrometer mounted on the 5 meter telescope at Mt. Palomar, along with other instruments at Cerro Tololo Interamerican Observatory in Chile and Perkins Observatory in Ohio. The unique measurements to be made are accurate intensities of lines in the spectra of a few nebulae which can be used as indicators of what is to be expected in the ultra-violet spectrum of these objects. The measurement of ultraviolet light requires satellite observations, while the above observations can be done from the ground. The data obtained will improve knowledge of chemical compositions, the structure of the nebulae, and set standards with which other nebulae can be compared.

SUPPORTED BY U.S. National Science Foundation,
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10.0018, IDENTIFICATION AND PHOTOMETRY OF QUASI-STELLAR OBJECTS IN SELECTED HIGH-LATITUDE FIELDS

P.D. Usher, Pennsylvania State University, University Park Campus, School of Science, Dept. of Astronomy, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (AST78-21498)

The criterion of ultraviolet and infrared color excess and optical variability will be used to identify candidate quasi-stellar objects (QSOs) brighter than R approximately 20 magnitude in 10 Kapteyn Selected Areas at high galactic latitude. Variability and red or infrared excess will be used to separate QSOs from white dwarfs. The Selected Areas are centered on smaller faint-limit fields currently under investigation by Sandage. The research will supplement the faint-limit fields and provide further information toward problems of the isotropy and the spatial density of QSOs.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0019, RADIO ASTRONOMICAL OBSERVATIONS OF TWENTY-ONE CENTIMETER ABSORPTION LINES IN QUASI-STELLAR OBJECTS

A.M. Wolfe, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (AST79-07760)

The aim of this research is to study quasi-stellar objects (QSO or quasar) absorption-line systems by observing the 21 cm wavelength line of hydrogen. The 21 cm absorption lines serve as valuable probes in the extremely distant clouds in which they form for the following reasons: 1) the detection of 21 cm and Lyman alpha absorption at the same redshift allows one to deduce the excitation temperature of the absorption gas, which is an indicator of the proximity of the absorber to the background QSO; 2) Observations of 21 cm absorption lines with very-long-baseline (VLB) interferometers reveal information about the spatial extent of the absorbing gas across scales large enough to reflect spatial and kinematical properties peculiar to a galaxy; 3) the high spectral resolution available from radio autocorrelation spectrometers permit one to record the kinematics of the absorber in detail; and 4) the coincidence of 21 cm and optical absorption lines at the same redshift lead to serve upper limits on the variations of certain physical constants over cosmological time-scales. This is a continuation of AST-7615202A01.

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Directorate for Astronomical
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of Astronomical Sciences

10.0020, INVESTIGATION OF BINARY AND MULTIPLE STARS

D.S. Evans, University of Texas, Austin Campus, School of Arts & Sciences, Dept. of Astronomy, *200 W. 21st, Austin, Texas* 78712 (AST78-22483)

Investigations will be carried out of binary, multiple and possibly some single stars, using the visual surface brightness relation established by Barnes and Evans, and some other techniques. The results should provide measures of distances of structures within our own galaxy and even possibly in the Magellanic Clouds. They should improve definition of the Barnes-Evans relation in the critical region needed for the determination of distances and absolute magnitudes of variable stars with implications for galactic structure. They should provide data leading to better understanding of the formation, rotational properties and evolution dynamics of multiple stars, and also basic data for evolution of single stars.

Prior support was by NSF grant AST 77-01360 A01.

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of Astronomical Sciences

10.0021, SPECTROSCOPIC OBSERVATIONS OF QUASI-STELLAR OBJECTS

B.J. Wills, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST79-01182)

The University of Texas Radio Astronomy Observatory is engaged in a deep radio source survey (5000 sources per steradian), providing arc-second positional accuracy for the sources, which can then be optically identified with quasi-stellar objects (QSOs) and galaxies using even more accurate optical positions. The spectroscopic and other optical work on the identified radio sources will be continued. Telescopes at the University of Texas' McDonald Observatory, where linear detectors (a Self-Scanned Digicon and an Intensified Dissector Scanner) are now in routine operation, will be used. Principal programs include the study of large samples of bright and faint QSOs, which may be used to investigate the space density and luminosity evolution of QSOs, for quantitative statistical studies of line strengths and their dependece on redshift and other QSO properties, and for studies of interesting individual objects, such as the BL Lac-type ('lineless') objects, the extremely compact N galaxies and Seyfery-type nuclei, and QSOs with complex absorption-line spectra. Monitoring the emission-line strengths of some optically-variable QSOs, to constrain models of the geometry and physical conditions that occur in the broad line regions, will be continued. This work is a continuation of AST-7681338A01.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-20223*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TECHNOLOGY REQUIREMENTS AND READINESS FOR VERY LARGE AIRCRAFT
D. William Conner and John C. Vaughan, III Mar. 1980 14 p refs
(NASA-TM-81783) Avail: NTIS HC A02/MF A01 CSCL 01B

Common concerns of very large aircraft in the areas of economics, transportation system interfaces and operational problems were reviewed regarding their influence on vehicle configurations and technology. Fifty-four technology requirements were identified which are judged to be unique, or particularly critical, to very large aircraft. The requirements were about equally divided among the four general areas of aerodynamics, propulsion and acoustics, structures, and vehicle systems and operations. The state of technology readiness was judged to be poor to fair for slightly more than one-half of the requirements. In the classic disciplinary areas, the state of technology readiness appears to be more advanced than for vehicle systems and operations.
Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-20224* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETECTION OF THE TRANSITIONAL LAYER BETWEEN LAMINAR AND TURBULENT FLOW AREAS ON A WING SURFACE Patent
William R. Hood Issued 19 Feb. 1980 4 p Filed 27 Nov. 1978 Supersedes N79-16805 (17 - 08, p 0932)
(NASA-Case-LAR-12261-1; US-Patent-4,188,823; US-Patent-Appl-SN-964009; US-Patent-Class-73-147; US-Patent-Class-73-205L) Avail: US Patent and Trademark Office CSCL 01A

A system is disclosed for detecting the laminar to turbulent boundary layer transition on a surface while simultaneously taking pressure measurements. The system uses an accelerometer for producing electrical signals proportional to the noise levels along the surface and a transducer for producing electrical signals proportional to pressure along the surface. The signals generated by the accelerometer and transducer are sent to a data reduction system for interpretation and storage.
Official Gazette of the U.S. Patent and Trademark Office

N80-20225 Engineering Sciences Data Unit, London (England).
EXAMPLE OF PERFORMANCE ANALYSIS USING DATA OBTAINED CONCURRENTLY IN AIR-PATH, BODY AND EARTH AXES
1979 31 p
(ESDU-79018; ISBN-0-85679-263-2) Copyright. For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $674.50

A detailed work example of the application of the equations of motion to the solution of problems in aircraft point-performance work involving the use of several axis systems is presented. The example is the determination of lift and drag for a supersonic-cruise aircraft using data from air-data systems, bodymounted accelerometers and an inertial platform system. A particular feature is the extent to which account is taken of quantities which individually might be regarded as negligible but whose collective effects in an attempted high-accuracy analysis can be significant.
ESDU

N80-20226 State Univ. of New York at Buffalo.
STABILITY AND TRANSITION OF WAVE INDUCED BOUNDARY LAYER FLOWS Ph.D. Thesis
Yehia Mahmoud Amr 1979 157 p
Avail: Univ. Microfilms Order No. 8005630

A theoretical investigation of stability and an experimental investigation of transition of wall boundary layers developed within unsteady plane expansion waves and behind shock waves traveling into a gas at rest are discussed. The theoretical investigation involved three tasks: the use of approximate methods for the prediction of critical Reynolds numbers, a numerical integration of the Orr-Sommerfeld equation for the incompressible boundary layer flow at the expansion wave head, and the development of a multiple scales technique for nearly quasisteady, quasiparallel boundary layer flows. Thin film surface thermometers, flush hot film anemometers, and hot wire anemometers were used independently and simultaneously to detect boundary layer transition.
Dissert. Abstr.

N80-20227*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SPIN-RECOVERY PARACHUTE SYSTEM FOR LIGHT GENERAL-AVIATION AIRPLANES
Charles Bradshaw Apr. 1980 18 p refs Presented at the 14th Aerospace Mech. Symp., Hampton, Va. 1-2 May 1980 Submitted for publication
(NASA-TM-80237; L-13585) Avail: NTIS HC A02/MF A01 CSCL 01A

A tail mounted spin recovery parachute system was designed and developed by the NASA Langley Research Center for use on light general aviation airplanes. The system was designed for use on typical airplane configurations, including low wing, single engine, and twin-engine design. A mechanically triggered pyrotechnic slug gun is used to forcibly deploy a pilot parachute which extracts a bag that deploys a ring slot spin recovery parachute. The total system weighs 8.2 kg (18 lb). System design factors included airplane wake effects on parachute deployment, prevention of premature parachute

deployment, positive parachute jettison, compact size, low weight, system reliability, and pilot and ground crew safety. Extensive ground tests were conducted to qualify the system. The recovery parachute was used successfully in flight 17 times. J.M.S.

N80-20228*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
TRANSONIC UNSTEADY AIRLOADS ON AN ENERGY EFFICIENT TRANSPORT WING WITH OSCILLATING CONTROL SURFACES
M. C. Sandford, R. H. Ricketts, F. W. Cazier, Jr., and H. J. Cunningham. Feb. 1980. 9 p.
(NASA-TM-81788) Avail: NTIS HC A02/MF A01 CSCL 01A

An aspect ratio 10.8 supercritical wing with oscillating control surfaces is described. The wing is instrumental with 252 static orifices and 164 in situ dynamic pressure transducers for studying the effects of control surface deflection on steady and unsteady pressures at transonic speeds. Results from initial wind tunnel tests conducted in the Langley Transonic Dynamics Tunnel are discussed. Unsteady pressure results are presented for two trailing edge control surfaces oscillating separately at the design Mach number of 0.78. Some experimental results are compared with analytical results obtained by using linear lifting surface theory. Author

N80-20229*# National Aeronautics and Space Administration, Washington, D. C.
ON WINGS OF CIRCULAR DESIGN
Wilhelm Kinner. Oct. 1979. 7 p. refs. Transl. into ENGLISH from Z. Angew. Math. Mech. (East Germany), v. 16, no. 6, Dec. 1936 p 349-352. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75505) Avail: NTIS HC A02/MF A01 CSCL 01A

Prandtl's method of sources and sinks for air foils is used to investigate the aerodynamics of circular wings in constant flow. Lift distribution, total lift, and pitching moment are investigated as well as the influence of changes in the angle of attack. Author

N80-20230*# Remtech, Inc., Huntsville, Ala.
WAKE FLOWFIELDS FOR JOVIAN PROBE. Final Report
Carl D. Engel and Leroy M. Hair. Hampton, Va. NASA Langley Research Center. Mar. 1980. 62 p. refs.
(Contract NAS1-15819)
(NASA-CR-159235) Avail: NTIS HC A04/MF A01 CSCL 01A

The wake flow field developed by the Galileo probe as it enters the Jovian atmosphere was modeled. The wake produced by the probe is highly energetic, yielding both convective and radiative heat inputs to the base of the probe. A component mathematical model for the inviscid near and far wake, the viscous near and far wake, and near wake recirculation zone was developed. Equilibrium thermodynamics were used for both the ablation and atmospheric species. Flow fields for three entry conditions were calculated. The near viscous wave was found to exhibit a variable axial pressure distribution with the neck pressure approximately three times the base pressure. Peak wake flow field temperatures were found to be in proportion to forebody post shock temperatures. J.M.S.

N80-20231*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
OPERATIONAL IMPLICATIONS OF SOME NACA/NASA ROTARY WING INDUCED VELOCITY STUDIES
Harry H. Heyson. Feb. 1980. 53 p. refs. Presented at 3d Midwest Helicopter Safety Seminar, Joliet, Ill., 26-27 Feb., 1980; sponsored by FAA and Ill. Dept. of Transportation.
(NASA-TM-80232) Avail: NTIS HC A04/MF A01 CSCL 01A

Wind tunnel measurements show that the wake of a rotor, except at near-hovering speeds, is not like that of a propeller. The wake is more like that of a wing except that, because of the slow speeds, the wake velocities may be much greater. The helicopter can produce a wake hazard to following light aircraft that is disproportionately great compared to an equivalent fixed-wing aircraft. This hazard should be recognized by both pilots and airport controllers when operating in congested areas. Even simple momentum theory shows that, in autorotation and partial-power descent, the required power is a complex function of both airspeed and descent angle. The nonlinear characteristic, together with an almost total lack of usable instrumentation at low airspeeds, has led to numerous power-settling accidents. The same theory shows that there is a minimum forward speed at which a rotor can autorotate. Neglect of, or inadequate appraisal of this minimum speed has also led to numerous accidents. Ground effect and the problems it creates is discussed. R.E.S.

N80-20232*# Kentron International, Inc., Hampton, Va.
AERODYNAMIC DESIGN AND ANALYSIS OF THE AST-204, AST-205, AND AST-206 BLENDED WING-FUSE LARGE SUPERSONIC TRANSPORT CONFIGURATION CONCEPTS
Glen L. Martin and Kenneth B. Walkley. Mar. 1980. 49 p. refs.
(Contract NAS1-16000)
(NASA-CR-159223) Avail: NTIS HC A03/MF A01 CSCL 01A

The aerodynamic design and analysis of three blended wing-fuselage supersonic cruise configurations providing four, five, and six abreast seating was conducted using a previously designed supersonic cruise configuration as the baseline. The five abreast configuration was optimized for wave drag at a Mach number of 2.7. The four and six abreast configurations were also optimized at Mach 2.7, but with the added constraint that the majority of their structure be common with the five abreast configuration. Analysis of the three configurations indicated an improvement of 6.0, 7.5, and 7.7 percent in cruise lift-to-drag ratio over the baseline configuration for the four, five, and six abreast configurations, respectively. R.E.S.

N80-20233# ARO, Inc., Arnold Air Force Station, Tenn.
LASER-RAMAN MEASUREMENTS IN A DUCTED, TWO-STREAM, SUBSONIC, H2/AIR COMBUSTION FLOW. Final Report, 6 Sep. 1978 - 13 Aug. 1979
W. D. Williams, H. M. Powell, L. L. Price, and G. D. Smith. AEDC. Dec. 1979. 63 p. refs. Sponsored by AF.
(AD-A078112; AEDC-TR-79-74) Avail: NTIS HC A04/MF A01 CSCL 20/5

The laser-Raman diagnostic technique has been used for investigating a ducted, two-stream, subsonic, H2/air combustion flow with turbulent jet mixing and recirculation. A primary jet of high-velocity air was surrounded by an outer, low-velocity hydrogen stream. The duct-to-inner-nozzle diameter ratio was varied. The ratios were 2 and 10 for the two conditions investigated. The radial distributions of static temperature and species number densities were determined at several axial positions for each test condition. GRA

N80-20234# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Aeromechanics Div.
INVESTIGATION OF NUMERICAL TECHNIQUES FOR PREDICTING AERODYNAMIC HEATING TO FLIGHT VEHICLES. Final Report, May 1976 - Sep. 1977
Arthur B. Lewis, Jr. and Neil J. Sloski. May 1979. 120 p. refs. (AF Proj. 2404)
(AD-A078121; AFFDL-TR-79-3001) Avail: NTIS HC A06/MF A01 CSCL 20/4

The development of complex lifting configurations and high speed maneuvering vehicles has emphasized the need for numerical techniques to predict aerodynamic heating rates as a function of the vehicle trajectory. These numerical programs are not expected to eliminate the requirements for wind tunnel and flight testing, but will be an aid to more efficient use of experimentation time and improve confidence that all potential problem areas on the vehicle have been examined. Three programs, the Hypersonic Arbitrary Body Program, the MINIVER Program, and a third program were examined to determine their usefulness for vehicles with non-circular cross sections and large flat areas as exemplified by lifting reentry vehicles. The MINIVER code was found to be unsuitable for this; the Hypersonic Arbitrary Body Program was applicable to these shapes, but because of program limitations was used for only limited calculations. The last program also had limitations in the areas of geometry description and surface pressure calculations. Efforts were made

to remove these limitations and several shapes were investigated. The ultimate goal of this effort was to extend the capabilities of one or more of the heating codes; while no effort was made to improve MINIVER or the Hypersonic Arbitrary Body Program, significant improvements were made in the last program and inviscid flow field program. GRA

N80-20235# ARO, Inc., Arnold Air Force Station, Tenn.
AERODYNAMIC CHARACTERISTICS AND STORE LOADS OF THE 1/24-SCALE F-111 AIRCRAFT MODEL WITH SEVERAL EXTERNAL STORE LOADINGS Final Report, 18-23 Jun. 1979
C. F. Anderson AEDC Aug. 1979 48 p
(AD-A078677; AEDC-TSR-79-P48) Avail: NTIS
HC A03/MF A01 CSCL 20/4

The 1/24-scale F-111 aircraft model was tested to obtain simultaneous measurements of the aircraft and store aerodynamic loads and to evaluate the effects of the TAWDS pod on aircraft stability and control. Static stability and store loads data were obtained at 5 wing sweep angles for Mach numbers from 0.4 to 1.2. Data were also obtained for stabilizer deflections of + or - 10 deg and with the speed brake deflected 50 deg for some configurations. The angle of attack range was from -2 to 24 deg and the angle of sideslip range was from -10 to 10 deg. GRA

N80-20236# Neilsen Engineering and Research, Inc., Mountain View, Calif.
THE DEVELOPMENT OF RAPID PREDICTIVE METHODS FOR THREE-DIMENSIONAL TRANSONIC FLOW FIELDS ABOUT FIGHTER BOMBER AIRCRAFT, PART 1 Final Report, 1 Jan. 1975 - 30 Sep. 1979
Anthony J. Crisalli, Stephen S. Stahara, Jack N. Nielsen, and John R. Spreiter Jul. 1979 314 p refs
(Contract F44620-75-C-0047; AF Proj. 2307)
(AD-A078683; NEAR-TR-198; AFOSR-79-1281TR) Avail: NTIS HC A14/MF A01 CSCL 20/4

This report presents an overall account of the progress made on an essential component of the transonic store trajectory problem: the predicton of transonic flow fields about wing-body/pylon combinations representative of modern fighter-bomber aircraft. The emphasis here is on the development of predictive techniques which are sufficiently economical from the standpoint of computer cost to enable an aircraft designer to employ the techniques over a wide range of Mach number, angle of attack, and geometric parameters. The report presents several candidate transonic predictive methods and evaluates them by comparing their predictions of various flow field quantities with experimental data. The experimental data are taken from a parallel wind-tunnel test phase of the project, designed specifically for evaluating the predictive methods. The experimental data have been documented and archived in several test reports. The extensive comparisons of the theoretical predictions from the various predictive methods with the data comprise the major portion of this report. GRA

N80-20237# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
GROUND PLANE EFFECTS ON A CONTOURED SURFACE AT LOW SUBSONIC VELOCITIES M.S. Thesis
J. A. Krawtz Dec. 1979 115 p refs
(AD-A079877; AFIT/GA/AA/80M-3) Avail: NTIS
HC A06/MF A01 CSCL 20/4

The wing-in-ground effect phenomenon was examined by investigating the flow between a flat ground plate and a contoured upper plate. Velocity and turbulence intensity measurements were taken at various points in the flow with a Laser Doppler Velocimeter. Mach numbers studied were Mach 0.15 and Mach 0.2 at the exit plane of a 1 cm by 10 cm two-dimensional nozzle. Measurements were taken across the width of the jet, 5, 10, and 15 cm downstream with plate separations of 1, 2, and 5 cm and vertically without the ground plate. In addition measurements were taken near the top plate with conventional pressure measuring techniques and the results compared. The proximity of the ground plate had the effect of spreading the flow outward across the 10 cm width of the jet by 20%. The laser velocimeter showed the turbulence intensity to be constant across the potential core of the jet. Turbulence intensity increased beyond 10% in the boundary layers of the jet and in the plate boundary layer. The pressure measurement data correlated well with the laser velocimeter results. GRA

N80-20238# ARO, Inc., Arnold Air Force Station, Tenn.
COMPUTATION OF AXISYMMETRIC SEPARATED NOZZLE-AFTERBODY FLOW Final Report, 1 Oct. 1977 - 30 Jul. 1979
J. L. Jacocks AEDC Jan. 1980 31 p refs
(AD-A079694; AEDC-TR-79-71) Avail: NTIS
HC A03/MF A01 CSCL 20/4

The development of a computer program for solving the compressible, axisymmetric, mass-averaged Navier-Stokes equations is described. The basic numerical algorithm is the MacCormack explicit predictor-corrector scheme. Turbulence modeling is accomplished using an algebraic, two-layer eddy viscosity model with a novel modification dependent on the streamwise gradient of vorticity. Comparisons of computed results with experimental data are presented for several nozzle-afterbody configurations with either or simulated plumes. GRA

N80-20239# Wright State Univ., Dayton, Ohio. Dept. of Engineering.
AN APPROXIMATE ANALYSIS OF WING UNSTEADY AERODYNAMICS Final Report, 1 Sep. 1976 - 31 Jan. 1978
W. R. Wells May 1979 44 p refs
(Contract F33615-76-C-3145; AF Proj. 2307)
(AD-A079322; AFFDL-TR-79-3046) Avail: NTIS
HC A03/MF A01 CSCL 20/4

A brief review of the unsteady aerodynamics in lifting surface theory is reported. For utility in design application, simplified but accurate analytical expressions were developed for generalized unsteady aerodynamics of wings of finite aspect ratio and sweep. This includes a means of calculating the unsteady lift load on the wing and tail surface of arbitrary shape and angle of attack variation. In addition, a formulation to include the indicial aerodynamics in the longitudinal equations of motion of the aircraft was performed. Sample numerical solutions to the longitudinal equations for a step input in elevator deflection are presented for the Navion aircraft. From these calculations, a noted difference in angle of attack and pitch rate response can be seen for the cases of unsteady and quasi-steady aerodynamics. The apparent increase in damping effects in the aircraft response due to the unsteady aerodynamics indicate that various design constraints might be relaxed somewhat if the unsteady aerodynamics is modeled properly. GRA

N80-20240# Martin Marietta Labs., Baltimore, Md.
COMPUTATION OF THREE-DIMENSIONAL AERODYNAMIC FLOW Final Report, 1 Jul. 1976 - 31 Jan. 1980
K. C. Wang Jan. 1980 10 p refs
(Contract F49620-76-C-0004; AF Proj. 2304)
(AD-A080073; AFOSR-80-0034TR) Avail: NTIS
HC A02/MF A01 CSCL 20/4

The present contract continues an earlier one which extended from 1970-1976, F44620-70-C-0085. The purpose of this continued action was to make pioneering calculations of genuine three-dimensional laminar boundary layers. During the current contract period, efforts were first focused on investigations of: (1) the general characteristics of three-dimensional flow separation, especially for aerospace applications and (2) the boundary layer features and the magnus forces on spinning bodies such as spinning projectiles or missiles. Later emphasis gradually shifted to the boundary layer over an aircraft wing in contrast to that around a body of revolution studied theretofore. GRA

N80-20241# ARO, Inc., Arnold Air Force Station, Tenn.
REAL-GAS EFFECTS ON THE AERODYNAMICS OF BLUNT CONES AS MEASURED IN A HYPERVELOCITY RANGE Final Report, Jul. 1975 - Oct. 1978
C. J. Welsh, W. R. Lawrence, and R. M. Watt AEDC Oct. 1979 29 p refs
(AD-A075526; AEDC-TR-79-33) Avail: NTIS
HC A03/MF A01 CSCL 20/4

A 1,000-ft hypervelocity range was used in a free-flight investigation of real-gas effects on the aerodynamics of blunted 10-deg semiangle cones. The tests were made using nitrogen

and air test environments at a nominal velocity of 16,000 fps and at Reynolds number levels (based on model length and free-stream conditions) of about 400,000 and 2,000,000. Measurements indicate appreciable real-gas effects in the center-of-pressure and moment data. A discussion is also included of a new data reduction procedure devised to reduce nonlinear static stability data from small amplitude nonlinear motion histories. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations, and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-20242# SRI International Corp., Menlo Park, Calif. Aviation Systems Lab.
AIRBORNE AIDS FOR COPING WITH LOW-LEVEL WIND SHEAR. ALL-WEATHER LANDING SYSTEMS, ENGINEERING SERVICES SUPPORT PROJECT, TASK 2 Final Report, Jun. 1975 - Jul. 1979
W. H. Foy Jul. 1979 103 p refs
(Contract DOT-FA75WA-3650; SRI Proj. 4364)
(AD-A080589; FAA-RD-79-117) Avail: NTIS
HC A06/MF A01 CSCL 01/2

The development and testing of airborne displays, instrumentation, and procedures for aiding an airline jet transport pilot to cope with wind shear on approach and landing and on takeoff were studied. The task involved analysis of wind shear effects, development of wind models including shear and turbulence, specification of displays and instrument models, and conduct of six large scale piloted flight simulation exercises. A set of candidate standard wind shear models was developed. The beneficial effects of training in a moving base simulator were noted. Tests on the pilot aiding systems were conducted on both wide bodied (DC-10) and nonwide bodied (B-727) aircraft. The aiding systems tested included approach management techniques, go around decision aids, techniques for assisting the pilot during the go around maneuver, and head up displays. The operational and technical role of head up displays during flight operations with wind shear is emphasized. A.W.H.

N80-20243# SRI International Corp., Menlo Park, Calif.
DEVELOPMENT OF WIND SHEAR MODELS AND DETERMINATION OF WIND SHEAR HAZARDS Interim Report, Apr. - Nov. 1977
D. W. Ellis and M. G. Keenan Jan. 1978 96 p refs
(Contract DOT-FA75WA-3650; SRI Proj. 4364)
(AD-A080588; FAA-RD-79-119) Avail: NTIS
HC A05/MF A01 CSCL 01/2

Mathematically modeled and measured wind data represented as a function of both aircraft altitude and distance were flown with a fast-time computer model piloted by an idealized controller. The wind models and the runway position relative to each wind field were systematically varied to produce a number of different wind profiles. Relative comparisons of wind profile severity were made, based on aeronautical system performance in the computer. Potentially hazardous wind profiles were identified, and their relative severity designated as low, moderate, or high for purposes of piloted simulator tests. The piloted simulation results were used to verify the severity ratings. Effects of wind shear on aircraft are illustrated using simplified examples and then correlated with wind profile characteristics. Wind profile design techniques and implementation methods are discussed, and a set of candidate standard wind profiles is recommended. The results of the wind shear hazard determination indicate that the severity of a wind shear encounter is dependent on the position and alignment of the approach path with respect to the wind field and on the timing of the encounter, and that both wind shear in the vertical wind component and wind shear in the longitudinal wind component can produce a hazardous condition. High severity wind shear is also found to be hazardous on takeoff. J.M.S.

N80-20244# Atmospheric Science Associates, Bedford, Mass.
AIRFLOW EFFECTS ON RIMING MEASUREMENTS BY A WING TIP-MOUNTED ICE DETECTOR ON THE MC130E RESEARCH AIRPLANE Final Report, 1 Mar. - 31 Aug. 1979
Hillyer G. Norment 24 Aug. 1979 42 p refs
(Contract F19628-79-M-0006; AF Proj. 6670)
(AD-A077019; AFGL-TR-79-0194) Avail: NTIS
HC A03/MF A01

Sampling efficiencies for water drops in the diameter range 10 to 7000 microns are calculated theoretically at four proposed mounting sites for an icing indicator instrument on the wing tip of the AFGL MC130E airplane. Significant flux distortion of droplets in the diameter range 10 to 100 microns is indicated at all four sites. Sensitivity to angle-of-attack of the airplane also is found, and a nose-up angle-of-attack of at least 4 deg is recommended. Additional separation of the sensor probe from the wing tip surface of as little as one-half inch is indicated to substantially ameliorate the sampling problems. To obtain the sampling efficiencies, trajectories were calculated with use of a three-dimensional flow code that ignores effects of lift vorticity. Exploratory calculations with a similar code that includes lift indicate that the results obtained with the non-lifting flow are optimistic. GRA

N80-20245# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
F-4 PHANTOM AIRCREW SURVIVAL EQUIPMENT EVALUATION M.S. Thesis Final Report
William Edgar Lindsay 8 Jun. 1979 120 p refs
(AD-A076330) Avail: NTIS HC A06/MF A01 CSCL 06/7

The F-4 Phantom aircraft is equipped with an ejection seat which has space provided in a seat kit for the carriage of aircrew survival equipment. This study evaluated the utilization of this space and the equipment available for inclusion in this kit. The space is not being filled with appropriate equipment in many instances because the required density of the packed kit is too great, requiring local units to pack lead shot instead of survival equipment. The survival equipment available to the aircrew in the seat kit is generally of good quality and sound theoretical design. However, there are many areas in which the equipment has not been redesigned to use current technology and thus provide more and better equipment in a smaller space. Additionally, the average survival kit lacks the cold weather survival protective equipment required to sustain the downed aircrew member. This study contains specific recommendations for equipment redesign and selection for the F-4 survival seat pack. GRA

N80-20246# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
DEVELOPMENT OF A BIRD/AIRCRAFT STRIKE HAZARD ASSESSMENT METHODOLOGY M.S. Thesis
Jeffrey M. Jorgensen and Kent G. Smith Sep. 1979 80 p refs
(AD-A075584; AFIT-LSSR-10-79B) Avail: NTIS
HC A05/MF A01 CSCL 13/12

This thesis effort was an attempt to identify a managerial tool that could be used to make decisions when comparing alternative methods of reducing bird/aircraft strike hazards. The general theory was that there should be certain identifiable factors present on a base that affect the probability of a bird/aircraft strike. A relationship was developed by using information from several bases which related to their environment and aircraft operating procedures. Using multiple linear regression, a model was developed to explain how the base's strike rate is affected by these factors. The effort resulted in several conclusions and recommendations that could be used in further research efforts in this area of utmost importance to the Air Force. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N80-20247# National Weather Service, Silver Spring, Md. Techniques Development Lab.
NOWCAST AND SHORT-RANGE (0-2 HOUR) FORECASTS OF THUNDERSTORMS AND SEVERE CONVECTIVE WEATHER FOR USE IN AIR TRAFFIC CONTROL Final Report, Apr. 1978 - Nov. 1979
Mikhail A. Alaka, Robert C. Elvander, and Robert E. Saffle Nov. 1979 41 p refs
(Contract DOT-FA78WAI-886; FAA Proj. 152-461-01)
(AD-A080426; FAA-RD-79-98) Avail: NTIS HC A03/MF A01 CSCL 17/7

The development of improved automated techniques for monitoring and forecasting thunderstorms and severe local convective weather at and around air terminals is discussed. The products being developed are intended primarily for air traffic controllers. Weather radars with automatic signal digitizing capability are evaluated. The radar data processor (RADAP) which includes a minicomputer, color graphic and alphanumeric display devices, and communication ports is highlighted in the evaluation. The project D/RADEX (digitized radar experiment) is described. The D/RADEX network offers an interim means to develop and evaluate radar data processing techniques that are aimed for RADAP implementation. A.W.H.

N80-20248# SRI International Corp., Menlo Park, Calif.
INERTIALLY AUGMENTED APPROACH COUPLERS Final Report, Jun. 1975 - Jun. 1979
D. A. Tiedeman, F. B. Benson, L. V. Miller, R. J. Rudig, T. J. Schuldt, C. P. Shih, and E. D. Skelley Jun. 1979 131 p refs
(Contract DOT-FA75WA-3650; SRI Proj. 4364)
(AD-A080488; FAA-RD-79-118) Avail: NTIS HC A07/MF A01 CSCL 01/2

The results of a series of engineering design studies and tests of methods for acceleration augmentation of airplane control systems for approach and landing are presented. Emphasis is on the use of body-mounted accelerometers, which are reasonably inexpensive. Control laws were developed for several aircraft (CV-880, DC-10, B-727) and tested by simulation with both automatic and human pilots and include automatic landing systems, flight director with full ILS, and flight director for nonprecision approach. The modified flight director (MFD) control algorithms (pitch, roll, and thrust) were also tested in large-scale piloted flight simulations. Approach and landing performance on Category 1 and 2 ILS beams comparable to that with current systems on Category 3 beams was achieved along with improved performance over current systems in coping with low level wind shear. Performance comparable to that attainable with an expensive full inertial navigation system was demonstrated. J.M.S.

N80-20249*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
IMPROVED SUN-SENSING GUIDANCE SYSTEM FOR HIGH-ALTITUDE AIRCRAFT Patent Application
Robert D. Reed, inventor (to NASA) Filed 12 Mar. 1980 17 p
(NASA-Case-FRC-11052-1; US-Patent-Appl-SN-129783) Avail: NTIS HC A02/MF A01 CSCL 17G

A Sun sensing guidance system for high altitude aircraft is described. The system is characterized by a disk shaped body mounted for rotation aboard the aircraft in exposed relation to solar radiation and has a plurality of mutually isolated chambers. The photosensors are arranged in facing relation with the chamber openings for receiving incident solar radiation and responsively providing a voltage output. The photosensors are connected in a paired relation through a bridge circuit for providing heading error signals in response to detected imbalances in intensities of solar radiation incident on the photosensors of either pair of photosensors until a nulled relationship is achieved for the disk to the source of radiation. NASA

N80-20250*# Ohio Univ., Athens. Avionics Engineering Center.
ANALYSIS OF FIRST AND SECOND ORDER BINARY QUANTIZED DIGITAL PHASE-LOCKED LOOPS FOR IDEAL AND WHITE GAUSSIAN NOISE INPUTS
Paul R. Blasche 31 Mar. 1980 127 p
(Grant NGR-36-009-017)
(NASA-CR-162841; TM-75) Avail: NTIS HC A07/MF A01 CSCL 17G

Specific configurations of first and second order all digital phase-locked loops are analyzed for both ideal and additive white Gaussian noise inputs. In addition, a design for a hardware digital phase-locked loop capable of either first or second order operation is presented along with appropriate experimental data obtained from testing of the hardware loop. All parameters chosen for the analysis and the design of the digital phase-locked loop are consistent with an application to an Omega navigation receiver although neither the analysis nor the design are limited to this application. Author

N80-20251*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMULATION OF A NAVIGATOR ALGORITHM FOR A LOW-COST GPS RECEIVER
Ward F. Hodge Feb. 1980 23 p refs
(NASA-TM-81778) Avail: NTIS HC A02/MF A01 CSCL 17G

The analytical structure of an existing navigator algorithm for a low cost global positioning system receiver is described in detail to facilitate its implementation on in-house digital computers and real-time simulators. The material presented includes a simulation of GPS pseudorange measurements, based on a two-body representation of the NAVSTAR spacecraft orbits, and a four component model of the receiver bias errors. A simpler test for loss of pseudorange measurements due to spacecraft shielding is also noted. Author

N80-20252# Electronics Engineering Group (1842nd), Scott AFB, Ill. TRACALS/Electronics Systems Branch.
COMPUTER MODELING OF TERRAIN EFFECTS ON INSTRUMENT LANDING SYSTEM (ILS) GLIDE SLOPE SYSTEMS
James A. Baggett 15 Nov. 1979 30 p refs
(AD-A078228; Rept-1842-EEG/EEITN-TR-80-2) Avail: NTIS HC A03/MF A01 CSCL 17/7

This report describes the two major components of an instrument landing system (ILS); the localizer, which provides horizontal guidance, and the glide slope, which provides vertical guidance. GRA

N80-20253# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
STANDARD ENGINEERING INSTALLATION PACKAGE, NONDIRECTIONAL BEACON Final Report
15 Nov. 1979 119 p
(AD-A078204; USACEEIA-SEIP-013) Avail: NTIS HC A06/MF A01 CSCL 17/7

This Standard Engineering Installation Package (SEIP) provides information for the engineering and installation of NDB facilities worldwide. Information provided consists of site survey data, siting criteria, installation specifications and instructions, a bill of materials, quality assurance procedures and completion certification format. Information provided must be adapted to the specific NDB facility/location by the project engineer. GRA

N80-20254# Army Communications-Electronics Combat Developments Agency, Fort Huachuca, Ariz.
STANDARD ENGINEERING INSTALLATION PACKAGE AN/TSQ-117, AIRCRAFT CONTROL CENTRAL Final Report
31 Oct. 1979 73 p
(AD-A079776; USACEEIA-SEIP-027) Avail: NTIS HC A04/MF A01 CSCL 17/7

This standard engineering installation package assists project

officers, logisticians, engineers, and technicians to program, procure, engineer, and install the AN/TSQ-117. The document provides a system description with prerequisites that are essential for effective implementation of the AN/TSQ-117. The document also provides the necessary drawings, bill of materials, and quality assurance. GRA

N80-20255# Systems Research Labs., Inc., Dayton, Ohio.
AIRBORNE ELECTRONIC TERRAIN MAP SYSTEM: A LITERATURE REVIEW
Gilbert G. Kuperman (AMRL) and Anthony J. DeFrances Wright-Patterson AFB, Ohio AMRL Oct. 1979 59 p refs
(Contract F33615-79-C-0503; AF Proj. 7184; AF Proj. 2003)
(AD-A079402; AMRL-TR-79-92) Avail: NTIS HC A04/MF A01 CSCL 17/7

Currently, the United States Air Force is placing significant emphasis on low-altitude high-speed profiles for tactical aircraft survivability. In order to execute these terrain avoidance profiles, pilots require an efficient and credible source of terrain relief information for both accurate and safe navigation and to alleviate the high workload associated with the primary pilotage function. This report highlights many of the limitations of current airborne sources of cartographic information and describes a viable alternative--the Airborne Electronic Terrain Map System (AETMS). The AETMS consists of an in-the-cockpit, computer-generated, wide-area terrain map display, capable of providing forward-looking perspective and/or planimetric information. Because of the large integrated data base, real-time information source for many mission segments is provided. The system is totally self-contained and passive, which precludes the possibility of jamming and reduces detection probability. GRA

N80-20256# Aerospace Corp., El Segundo, Calif.
COMBINED PSEUDO RANGE AND DOPPLER POSITIONING FOR THE STATIONARY NAVSTAR USER Final Report
Paul S. Jorgensen Mar. 1979 46 p
(Contract F04701-78-C-0079)
(AD-A079543; TR-0079-4475-01-03; SAMSO-TR-79-79) Avail: NTIS HC A03/MF A01 CSCL 17/7

An early success in testing NAVSTAR user equipment was achieved with the Manpack receiver. Using only two satellites, NAVSTARS 1 and 2, the receiver accurately performed two-dimensional positioning while stationary. It was, in effect, combining pseudo range and integrated Doppler data. This concept of combining both types of data can be extended to three dimensions and to the operational phase 3 NAVSTAR. The stationary user can accomplish three-dimensional navigation with only three satellites. This capability is of interest to the Army since it would permit the stationary use of NAVSTAR with much greater elevation mask angles. With the baseline 24-satellite constellation, three-dimensional navigation can be accomplished with a 30-deg mask angle, but it will take a few minutes longer because of the extra time required for making integrated Doppler measurements. Using this technique, three-dimensional position will be obtained to within 16 meters about 90 percent of the time. This operational capability will enhance the Army's ability to use NAVSTAR in the presence of jamming, foliage, and terrain. GRA

N80-20257# Intradyne of Virginia, Inc., Vienna.
NAVSTAR GPS CIVIL APPLICATIONS STUDY Final Report
J. C. Hansen, M. X. Polk, and A. M. Webster, Jr. Jul. 1979 161 p
(Contract F04701-78-C-0188)
(AD-A078277; SAMSO-TR-79-63) Avail: NTIS HC A08/MF A01 CSCL 17/7

This report examines the impact on the civil navigation community and on military operations of introducing the NAVSTAR GPS for civil applications. Institutional, operational, technical and cost factors are considered and assessed. A low cost GPS user set for civil applications is employed to develop comparative costs for current vice GPS oriented civil navigation environments. GRA

N80-20258# Pennsylvania Univ., Philadelphia. Dept. of Civil and Urban Engineering.
OPTIMAL FLOW CONTROL OF AIR TRAFFIC Final Report
William J. Dunlay, Jr. and W. Bruce Allen Aug. 1979 155 p refs
(Contract DOT-OS-70065)
(PB80-105976; DOT-DPA-RSPA-50-79/15) Avail: NTIS HC A08/MF A01 CSCL 17G

Flow control procedures for air traffic initiated during periods of unusually high demand or low capacity are discussed. Aspects of flow control which are addressed include forecasting of demand and capacity, forecasting of congestion, and assignment of delays and landing and departure priorities. In particular, the demand capacity-buffer relationship is explored, with emphasis on improvement of forecasts and evaluation of their accuracy. It is shown that buffer size, which represents the excess number of aircraft in the airspace due to delays, can be estimated recursively and then forecasted on the basis of arrival forecasts and the number of landings recorded. Regression analysis is used to describe and predict flow rates of arrivals and departures. GRA

N80-20259# National Technical Information Service, Springfield, Va.
INERTIAL NAVIGATION AND GUIDANCE, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jun. 1976 - Jun. 1979
William E. Reed Jul. 1979 206 p Supersedes NTIS/PS-78/0735; NTIS/PS-77/0609; NTIS/PS-76/0552; NTIS/PS-75/436
(NTIS/PS-79/0762/9; NTIS/PS-78/0735; NTIS/PS-77/0609; NTIS/PS-76/0552; NTIS/PS-75/436) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

The design, development, performance, equipment, and applications of inertial navigation and guidance systems are reported. Reports on strapdown systems are included. This updated bibliography contains 197 abstracts, 36 which are entries to the previous edition. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-20260*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ROLE OF TECHNOLOGY AS AIR TRANSPORTATION FACES THE FUEL SITUATION
Cornelius Driver Mar. 1980 15 p Presented at Upper Midwest Council, Minneapolis, 1 Nov. 1979
(NASA-TM-81793) Avail: NTIS HC A02/MF A01 CSCL 01C

Perspectives on the air transportation fuel situation are discussed including intercity air traffic, airline fuel consumption, fuel price effects on ticket price, and projected traffic and fuel useage between now and the year 2000. Actions taken by the airlines to reduce consumption are reviewed, as well as efforts currently underway to improve fuel consumption. Longer range technology payoffs resulting from NASA research programs are reviewed and results from studies on the use of alternate fuels are discussed. A.W.H.

N80-20261*# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
A SINGULAR PERTURBATION ANALYSIS OF MINIMUM TIME LONG RANGE INTERCEPT Final Report
Anthony J. Calise Jan. 1980 50 p refs
(Grant NsG-1496)
(NASA-CR-162895) Avail: NTIS HC A03/MF A01 CSCL 01C

The application of singular perturbation theory for deriving algorithms suitable for on board real time computation of optimal aircraft trajectory control was investigated. Minimum time intercept in three dimensions was selected as a pilot problem formulation, and data for an early version F-4 aircraft was used to represent aircraft aerodynamic and propulsion characteristics. Results include

the derivation of nonlinear, near optimal feedback control laws that are readily implementable in an aircraft flight computer, performance results for a variety of initial conditions (including optimal intercept at short ranges), and a point mass three dimensional simulation suitable for representing fighter aircraft under closed loop optimal control. J.M.S.

N80-20262# Bell Helicopter Co., Fort Worth, Tex.
ROTOCRAFT FLIGHT SIMULATION, COMPUTER PROGRAM C81. VOLUME 3: PROGRAMMER'S MANUAL Final Report, Nov. 1976 - Aug. 1977
P. Y. Hsieh Oct. 1979 91 p
(Contract DAAJ02-77-C-0003; DA Proj. 1L2-62209-AH-76)
(AD-A077345; BHT-699-099-062-Vol-3; USARTL-TR-77-54C)
Avail: NTIS HC A05/MF A01 CSCL 01/3

This report consists of three volumes and documents the current version in the C81 family of rotorcraft flight simulation programs developed by Bell Helicopter Textron. This current version of the digital computer program is referred to as AGAJ77. The accompanying program for calculating fully coupled rotor blade mode shapes is called DNAMO5, and the rotor wake program is called AR9102. The first volume, the Engineer's Manual, presents an overview of the computer program capabilities plus discussions for the background and development of the principal mathematical models in the program. The models discussed include all those currently in the program. Volume 2, the User's Manual, contains the detailed information necessary for setting up an input data deck and interpreting the computed data. Volume 3, the Programmer's Manual, includes a catalog of subroutines and a discussion of programming considerations. The source tapes and related software for the computer programs documented in this report are unpublished data on file at the Applied Technology Laboratory, U.S. Army Research and Technology Laboratories (AVRADCOM), Fort Eustis, Virginia. GRA

N80-20263# Northrop Corp., Hawthorne, Calif. Aircraft Group.
ADVANCED FIREFLY ASSESSMENT GENERALIZED MECHANIZATION REQUIREMENTS REPORT Interim Report, 25 Oct. 1978 - Feb. 1979
S. J. Asseo Wright-Patterson AFB, Ohio AFAL Jun. 1979 112 p refs
(Contract F33615-78-C-1503; AF Proj. 7629)
(AD-A079752; AFAL-TR-79-1092) Avail: NTIS HC A06/MF A01 CSCL 19/5

The requirements for the design of the Generalized Mechanization of the FIREFLY concept of Integrated Fire and Flight Control to be implemented in a digital simulation has been completed. This generalized mechanization consists of a set of equations, algorithms, and control laws capable of being programmed into an airborne digital computer which can be specialized to perform successfully in a variety of tactical aircraft with differing avionics sensors, fire control algorithms, control laws, flight control systems, and weapon delivery modes. The document first addresses the scope of the requirements analysis followed by a description of the analysis done in deriving the requirements of the generalized mechanization. Finally, the requirements are summarized in a section discussing them explicitly in relation to their place in the overall fire control system. A discussion of the work done on the FIREFLY 2 familiarization and initial analysis of two of the potential advanced concepts for evaluation is contained in the appendices. GRA

N80-20264# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
EVALUATION OF PACKAGING FOR THE CN-1325/ASN-108 AHRS DISPLACEMENT GYRO, F-15 AIRCRAFT Final Report
Frank C. Jarvis Sep. 1979 17 p
(AD-A078707; PTPT-79-15) Avail: NTIS HC A02/MF A01 CSCL 13/4

The packaging evaluation of the CN-1325/ASN-108 AHRS Displacement Gyro (F-15) revealed that the pack is not adequate to provide the 15 G shock protection level required for this item. The field tests confirmed the laboratory results which produced a maximum impact force of 21 Gs. A prototype pack with corner pad cushion inserts was evaluated and found to be suitable as an interim or a permanent replacement for packaging this item. GRA

N80-20265# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
PRELIMINARY AIRWORTHINESS EVALUATION, AH-1G WITH THE AIRBORNE TARGET ACQUISITION FIRE CONTROL SYSTEM AND THE HELLFIRE MODULAR MISSILE SYSTEM INSTALLED Final Report, Jun. 1978 - Jan. 1979
Patrick J. Moe and Raymond B. Smith Jul. 1979 43 p refs
(AD-A078340; USAAEFA-78-02) Avail: NTIS HC A03/MF A01 CSCL 19/5

The AH-1G helicopter with the HELLFIRE modular Missile System (HMMS) and the Airborne Target Acquisition Fire Control System (ATAFCS) is being used as a surrogate trainer for the YAH-64 helicopter. The United States Army Aviation Engineering Flight Activity was tasked to provide quantitative and qualitative data on the handling qualities of the helicopter, obtain limited level flight performance data, and obtain limited handling qualities of the helicopter with only the ATAFCS installed. The test helicopter was a production AH-1G helicopter (212 tail rotor) modified with an ATAFCS mockup and carrying eight HELLFIRE missiles. Six productive flight test hours were flown in six flights. No shortcomings or deficiencies attributable to HMMS and ATAFCS installation were found. The AH-1G helicopter, with HMMS and ATAFCS installed, exhibits an additional equivalent flat plate area of 4.0 sq ft compared to the standard AH-1Q helicopter. The handling qualities of the helicopter with only the ATAFCS installed are essentially the same as the production AH-1G helicopter. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-20266# Hughes Aircraft Co., Los Angeles, Calif. Display Systems Lab.
DEVELOPMENT OF A COLOR ALPHANUMERIC LIQUID CRYSTAL DISPLAY Final Report, 1 Oct. 1977 - 20 May 1979
J. E. Gunther Warminster, Pa. NADC Dec. 1979 39 p refs
(Contract N62269-77-C-0477)
(AD-A079289; HAC-E0122; HAC-P90440; NADC-77212-30)
Avail: NTIS HC A03/MF A01 CSCL 01/3

This report encompasses efforts directed toward the development of a multicolor liquid crystal display suitable for aircraft command and control applications. The approach taken was to combine a striped, color-selective filter with previously developed matrix liquid crystal display technology. Two 1.75 x 1.75 inch displays and one set of LSI drive circuits were constructed. The displays provided 100 elements per inch horizontal resolution and 33 elements per inch vertical resolution, with each vertical element consisting of a red-green-blue triad. While the optical performance of the displays was limited, sufficient information was gained to ensure adequate viewability in subsequent designs. GRA

N80-20267# Arinc Research Corp., Annapolis, Md.
MECHANIZATION ARCHITECTURE FOR ENHANCEMENT OF AVIONICS PLANNING DATA BASE Final Report
S. Cotton and R. Gilbertson Sep. 1979 170 p
(Contract F33657-79-C-0567)
(AD-A075572; Rept-1750-01-1-2024) Avail: NTIS HC A08/MF A01 CSCL 05/2

This report presents the design of an enhancement to the mechanized version of the Avionics Planning Baseline (APB). For each Air Force aircraft, the APB records the force structure (for a 15-year period), the avionics suite, all present and planned modifications to the avionics suite, all class 4 and class 5 of those modifications, and all ROC/SON/GOR statements dealing with avionics requirements. GRA

N80-20268# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STUDY OF TWO AVIONICS LIFE CYCLE COST MODELS AND THEIR APPLICABILITY IN THE COMMUNICATIONS-ELECTRONICS-METEOROLOGICAL ENVIRONMENT M.S. Thesis
Nicholas J. Drobot and Martin H. Johnson Sep. 1979 159 p refs
(AD-A076981; AFIT/GSM/SM/79S-5) Avail: NTIS HC A08/MF A01 CSCL 14/1

This study determines the applicability of Life Cycle Cost (LCC)/Logistic Support Cost (LSC) models in the CEM environment. The scope of this study addresses two of the models identified (LSC, PRICE) with respect to three Air Force TACAN systems. A methodology is developed to evaluate each model based on the five desirable model characteristics: availability of input data, validity, sensitivity, completeness, and documentation. The results presented are also framed within the above model characteristics. The most important model characteristic, validity, is accessed by comparison with an AFCS cost study of NAVAIDs equipment. Based on the methodology, the results indicate that both models are applicable in the present and future CEM environment. GRA

N80-20269# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN OPERATING AND SUPPORT COST MODEL FOR AVIONICS AUTOMATIC TEST EQUIPMENT M.S. Thesis
Joel A. Guerra, Andrew J. Lesko, and Jose G. Pereira Sep. 1979 181 p refs
(AD-A075586; AFIT-LSSR-21-79B) Avail: NTIS HC A09/MF A01 CSCL 14/1

One of the fastest growing elements of weapon system support equipment which relates directly to Operating and Support (O and S) costs is Automatic Test Equipment (ATE). The importance of ATE has expanded to such a degree that it requires additional management attention. The importance is exemplified by the $600 million projected development and acquisition costs of ATE for the F-16. This amount of cost qualifies the F-16 ATE for major program status. This thesis documents the development of a model to estimate and measure O and S costs for Avionics ATE. The model will be an important addition to the tools used in ATE Life Cycle Costing (LCC) techniques. It is envisioned primarily as an evaluation tool to be used in ATE source selection, but may also be useful in various design trade-off studies. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-20270# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EXHAUST EMISSIONS CHARACTERISTICS FOR A GENERAL AVIATION LIGHT-AIRCRAFT TELEDYNE CONTINENTAL MOTORS (TCM) GTSIO-520-K PISTON ENGINE Final Report
Eric E. Becker Dec. 1979 94 p refs
(FAA Proj. 201-521-100)
(AD-A080433; FAA-NA-79-40) HC A05/MF A01 CSCL 21/7

General aviation piston engine exhaust emission tests were conducted to determine and establish total exhaust emission characteristics for a GTSIO-520-K engine. The engine is described along with the fuel flow system and the air cooling system. The test set up, procedures, and facilities are described and the computation procedures are presented. The results are summarized for the exhaust emissions, the maximum cylinder head temperatures, and the critical landing and takeoff cycle. A.W.H.

N80-20271*# Teledyne Continental Motors, Muskegon, Mich.
A 150 AND 300 kW LIGHTWEIGHT DIESEL AIRCRAFT ENGINE DESIGN STUDY Final Report
Alex P. Brouwers Apr. 1980 149 p refs
(Contract NAS3-20830)
(NASA-CR-3260; Rept-756) Avail: NTIS HC A07/MF A01 CSCL 21A

The diesel engine was reinvestigated as an aircraft powerplant through design study conducted to arrive at engine configurations and applicable advanced technologies. Two engines are discussed, a 300 kW six-cylinder engine for twin engine general aviation aircraft and a 150 kW four-cylinder engine for single engine aircraft. Descriptions of each engine include concept drawings, a performance analysis, stress and weight data, and a cost study. This information was used to develop two airplane concepts, a six-place twin and a four-place single engine aircraft. The aircraft study consists of installation drawings, computer generated performance data, aircraft operating costs, and drawings of the resulting airplanes. The performance data show a vast improvement over current gasoline-powered aircraft. R.E.S.

N80-20272*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF WATER INJECTION AND OFF SCHEDULING OF VARIABLE INLET GUIDE VANES, GAS GENERATOR SPEED AND POWER TURBINE NOZZLE ANGLE ON THE PERFORMANCE OF AN AUTOMOTIVE GAS TURBINE ENGINE
Edward L. Warren Mar. 1980 35 p
(Contract EC-77-A-31-1040)
(NASA-TM-81415; E-333; DOE/NASA/1040-80/10) Avail: NTIS HC A03/MF A01 CSCL 21E

The Chrysler/ERDA baseline automotive gas turbine engine was used to experimentally determine the power augmentation and emissions reductions achieved by the effect of variable compressor and power engine geometry, water injection downstream of the compressor, and increases in gas generator speed. Results were dependent on the mode of variable geometry utilization. Over 20 percent increase in power was accompanied by over 5 percent reduction in SFC. A fuel economy improvement of at least 6 percent was estimated for a vehicle with a 75 kW (100 hp) engine which could be augmented to 89 kW (120 hp) relative to an 89 Kw (120 hp) unaugmented engine. Author

N80-20273*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
ALTERNATIVES FOR JET ENGINE CONTROL Semiannual Status Report, 1 Sep. 1979 - 29 Feb. 1980
Michael K. Sain 1980 93 p refs
(Grant NsG-3048)
(NASA-CR-162911) Avail: NTIS HC A05/MF A01 CSCL 21E

Nonlinear modeling researches involving the use of tensor analysis are presented. Progress was achieved by extending the studies to a controlled equation and by considering more complex situations. Included in the report are calculations illustrating the modeling methodology for cases in which variables take values in real spaces of dimension up to three, and in which the degree of tensor term retention is as high as three. R.E.S.

N80-20274*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
JT9D-7A (SP) JET ENGINE PERFORMANCE DETERIORATION TRENDS
G. Paul Richter, W. J. Olsson, and N. B. Andersen 1980 24 p ref Presented at the Intern. Aircraft Maintenance Eng. Exhibition and Conf., Dallas, 8-10 Apr. 1980; sponsored by Hamilton Burr Publishing Co. · Prepared in cooperation with Pratt and Whitney Aircraft Group, East Hartford, Conn. and Pan American World Airways, Inc., Jamaica, N.Y.
(NASA-TM-81459; E-388) Avail: NTIS HC A02/MF A01 CSCL 21E

The levels, trends, and causes of engine performance deterioration were investigated. A series of installed engine calibrations (both on-the-ground and in-flight) were performed on two new Pan American World Airways 747 SP aircraft. The performance data gathered covered from before the first flight through approximately 1000 flight cycles and 6900 flight hours.

To accomplish the calibrations a special instrumentation system for ground testing of installed engines over a broad power range was used along with performing concurrent in-flight engine calibrations under revenue service conditions. Results of the analysis of the data, which provide a better understanding of short and long term performance deterioration of both engines and modules are presented. J.M.S.

N80-20275*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMUM SUBSONIC, HIGH-ANGLE-OF-ATTACK NACELLES
Roger W. Luidens, Norbert O. Stockman, and James H. Diedrich [1979] 20 p refs Prepared for the 12th Congr. of the Intern. Council of the Aeron. Sci., Munich, 13-17 Oct. 1980 and the 1980 Aerospace Congr. and Exposition, Los Angeles, 13-16 Oct. 1980; sponsored by the Soc. of Automotive Engr.
(NASA-TM-81491; E-406) Avail: NTIS HC A02/MF A01 CSCL 21E

The optimum design of nacelles that operate over a wide range of aerodynamic conditions and their inlets is described. For low speed operation the optimum internal surface velocity distributions and skin friction distributions are described for three categories of inlets: those with BLC, and those with blow in door slots and retractable slats. At cruise speed the effect of factors that reduce the nacelle external surface area and the local skin friction is illustrated. These factors are cruise Mach number, inlet throat size, fan-face Mach number, and nacelle contour. The interrelation of these cruise speed factors with the design requirements for good low speed performance is discussed. J.M.S.

N80-20276# Naval Ship Research and Development Center, Bethesda, Md.
FEASIBILITY STUDY OF AN ISOLATED REVERSE-TURBINE SYSTEM FOR GAS TURBINE ENGINES
Thomas L. Bowen Dec. 1979 133 p refs
(SF43432301)
(AD-A077898; DTNSRDC-79/033) Avail: NTIS HC A07/MF A01 CSCL 21/5

Aircraft gas turbine engines, as now configured for ship propulsion, are unidirectional in output rotation and, therefore, require the added complexity of a reversing transmission or a reversible-pitch propeller. This study explores the feasibility of a novel reverse-turbine concept which is configured to adapt to existing free-power turbine engines without additional clutches or separate drive trains. This device, termed the 'isolated reverse turbine', is sized for meeting that most demanding maneuver for a fixed-pitch propeller-driven frigate or destroyer, namely, the crash reversal maneuver. The reverse-turbine concept would replace the function of the reversing gear or the reversible-pitch propeller; it could also complement electrically actuated reverse transmissions by eliminating the need for braking resistors and switches. Because of the potentially wide applicability of this reverse-turbine concept, it is recommended that additionally substantiating data be obtained to demonstrate the practicality of required hardware components. Full-scale development is not recommended at this time because the status of the above-mentioned alternatives has not been fully evaluated. GRA

N80-20277# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
AERODYNAMICS OF ADVANCED AXIAL-FLOW TURBOMACHINERY Annual Report, 1 Oct. 1978 - 30 Sep. 1979
G. K. Serovy, Patrick Kavanaugh, Theodore H. Okiishi, and Elmer C. Hansen Nov. 1979 52 p refs
(Contract F49620-79-C-0002; AF Proj. 2307)
(AD-A079617; ISU-ERI-AMES-80060; TCRL-14; AFOSR-79-1325TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

A multi-task research program on aerodynamic problems in advanced axial-flow turbomachine configurations is being carried on at Iowa State University. The elements of this program are intended to contribute directly to the improvement of compressor, fan, and turbine design methods. Experimental efforts in intrapassage flow pattern measurement, unsteady blade row interaction, and control of secondary flow are included, along with computational work on inviscid-viscous interaction blade passage flow techniques. This first Annual Report summarizes progress to date and indicates the direction of each task for the immediate future. GRA

N80-20278# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
VELOCITY PROFILES IN A LONG INLET DUCT EMPLOYING A PHOTON CORRELATING LASER VELOCIMETER WITHOUT SEEDING M.S. Thesis
H. J. V. Rogers Dec. 1979 172 p refs
(AD-A079878; AFIT/GAE/AA/79D-16) Avail: NTIS HC A08/MF A01 CSCL 14/3

This thesis involves a practical application of the Malvern Laser Velocimeter System (LV). In this work, the LV was used to measure mean velocity profiles across the inside diameter of a duct which supplies air to the compressor of a jet engine. The engine, which is a General Electric J-85 turbo-jet engine is located in the Propulsion Laboratories of Wright-Patterson Air Force Base in Ohio. In addition to the mean velocity profiles, the LV was used to measure turbulence intensity profiles across the inside diameter of the duct at each of the three test points. To analyze the quality of the LV data as obtained, alternate mean velocity profiles and turbulence intensity profiles were obtained with the aid of a Hot Wire Anemometer System and a Pitot-Static Tube. During each of the traverses, or tests, with the LV System, the Hot Wire System and the Pitot-Static Tube, the engine was held at a fixed RPM, being 50% or 70% of maximum engine RPM. Good correlation was achieved between each of the three systems in respect to the mean velocity profiles obtained at each of the three test positions while the turbulence intensity profiles matched well in the regions of the flow where turbulence levels of 2% to 30% were encountered. GRA

N80-20279# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL STUDY OF STATIC THRUST AUGMENTATION USING A 2-D VARIABLE EJECTOR M.S. Thesis
Eli Kedem Dec. 1979 97 p refs
(AD-A079857; AFIT/GAE/AA/79D-7) Avail: NTIS HC A05/MF A01 CSCL 21/8

A short rectangular throat ejector was constructed and tested to determine the effects of a number of variables on thrust augmentation and mass augmentation. The variables included those associated with geometry (e.g., diffuser length/throat length, diffuser area ratio, diffuser sidewall angle, nozzle angles and positions) and those due to differences in primary mass flow rate distributions among the nozzles. There were two kinds of thrust augmentation that were calculated; the free thrust augmenting ratio and the isentropic thrust augmenting ratio. The free thrust augmenting ratio is the ratio of the ejector's measured thrust to the sum of the nozzles' measured thrust, if each of them were discharged separately to ambient pressure. The isentropic thrust augmenting ratio is the ratio of the ejector's measured thrust to the calculated thrust of the nozzles if discharged isentropically to the ambient pressure. A free thrust augmentating ratio as high as 1.63 and an isentropic thrust augmenting ratio of up to 1.29 were obtained. Mass augmentation which is the ratio of secondary flow to primary flow was in the range of 3.5 to 5. Some conclusions concerning design aspects were drawn also. They include the necessity of 3-D shrouding for the ejector's inlet and exit and the prevention of blowing high velocity air (primary and BLC flow) tangential to the ejector walls. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-20280*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WING/STORE FLUTTER WITH NONLINEAR PYLON STIFFNESS

Robert N. Desmarais and Wilmer H. Reed, III. Apr. 1980. 8 p. refs. Presented at the AIAA/ASME/ASCE/AHS 21st Structures, Struct. Dyn. and Mater. Conf., Seattle, 12-14 May 1980.
(NASA-TM-81789) Avail: NTIS. HC A02/MF A01. CSCL 01C.

Recent wind tunnel tests and analytical studies show that a store mounted on a pylon with soft pitch stiffness provides substantial increase in flutter speed of fighter aircraft and reduces dependency of flutter on mass and inertia of the store. This concept, termed the decoupler pylon, utilizes a low frequency control system to maintain pitch alignment of the store during maneuvers and changing flight conditions. Under rapidly changing transient loads, however, the alignment control system may allow the store to momentarily bottom against a relatively stiff backup structure in which case the pylon stiffness acts as a hardening nonlinear spring. Such structural nonlinearities are known to affect not only the flutter speed but also the basic behavior of the instability. The influence of pylon stiffness nonlinearities or the flutter characteristics of wing mounted external stores is examined. J.M.S.

N80-20281# Perceptronics, Inc., Woodland Hills, Calif.
ADAPTIVE ESTIMATION OF INFORMATION VALUES IN CONTINUOUS DECISION MAKING AND CONTROL OF ADVANCED AIRCRAFT. Final Report.
Randall Steeb, Yee-Yeen Chu, Cynthia Clark, Yo Ram Alperovitch, and Amos Freedy. Jun. 1979. 127 p. refs.
(Contract F44620-76-C-0094; AF Proj. 2313)
(AD-A077917; PATR-1037-79-6; AFOSR-79-1266TR) Avail: NTIS. HC A07/MF A01. CSCL 05/10.

This report describes research and development centered on evaluation of information needs in advanced operations. The selection of information for display is a recurrent, subjective decision involving many factors--aircraft state, environmental conditions, operator capabilities, and acquisition costs, among others. An adaptive computer model has been developed which incorporates these factors into a multi-attribute decision model. The program is designed to capture the operator's information seeking policy using a training algorithm based on pattern recognition techniques. The individual policy is then used for information system evaluation and for automated information management. Experimental tests of the adaptive modeling and information management approaches were made using a task simulation resembling multiple intercept operations in advanced aircraft. Individual subjects (8 in study) navigated a simulated aircraft through a hazardous, changing environment. The report includes an example application of the information management program to F-14 threat intercept operations and a set of system application guidelines. GRA

N80-20282# Dayton Univ. Research Inst., Ohio.
DEVELOPMENT OF STABILITY METHODS FOR APPLICATIONS TO NONLINEAR AEROELASTIC OPTIMIZATION. Final Report, Jan. 1978 - Jun. 1979.
R. F. Taylor. Jul. 1979. 189 p. refs.
(Grant AF-AFOSR-3487-78; AF Proj. 2307)
(AD-A077851; UDR-TR-79-64; AFFDL-TR-79-3114) Avail: NTIS. HC A09/MF A01. CSCL 20/4.

An approximate procedure is developed which determines efficiently and accurately the amplitude-dependent stability of nonlinear systems. This new procedure, which is referred to as the 'method of imposed disturbances', is shown to be especially applicable to studies of the sensitivity of nonlinear aeroelastic systems to changes in design variables. Emphasis is placed on airfoil and panel flutter instabilities in aerodynamically nonlinear flow. To develop the theory, modified forms of the van der Pol oscillator equation and of the Lewis servomechanism equation are studied. Based on the principle of conservation of energy in a limit cycle, approximate closed-form expressions are developed which relate the loading and the limit amplitude to system design variables. Results are compared to solutions obtained by numerical integration. GRA

N80-20283# ARO, Inc., Arnold Air Force Station, Tenn.
AIRCRAFT MOTION SENSITIVITY TO DYNAMIC STABILITY DERIVATIVES. Final Report, 1 Oct. 1977 - 30 Sep. 1978.
T. F. Langham. AEDC. Jan. 1980. 142 p. refs.
(AF Proj. 921E)
(AD-A079421; AEDC-TR-79-11) Avail: NTIS. HC A07/MF A01. CSCL 20/4.

A six degree-of-freedom, nonlinear dynamic derivative sensitivity study has been conducted on a fighter/bomber and an attack-type aircraft. The dynamic derivatives investigated in the study were C sub lq, C sub mq, C sub mp, C sub mr, C sub l beta, and C sub n beta. For the cross-coupling derivatives, C sub lq was shown to have the most significant effect on the level and 3-g turning flight motion, followed by C sub nq and C sub mp with the derivative C sub mr showing little to negligible effect in the same regime. For the acceleration derivatives, C sub l beta was shown to have a significant influence on the aircraft motion. The C sub n beta derivative had little effect on the simulated motion. The analysis also documents the configuration dependency of the cross-coupling derivatives and investigates the effects of nonlinear variations in the derivatives on the aircraft motion. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-20284# Transportation Systems Center, Cambridge, Mass.
AIRPORT GROUND ACCESS. Final Report.
M. Gorstein, L. Frenkel, and R. Marek (FAA, Washington, D.C.) Washington. FAA. Oct. 1978. 371 p. refs.
(AD-A068974; FAA-EM-79-4) Avail: NTIS. HC A16/MF A01. CSCL 01/5.

Ground access to airports is studied in terms of constrains on airport capacity and air travel. Case studies of sixteen commercial airports of various sizes and locales were prepared. Specific topics discussed include: the access capacity of representative airports; whether access needs at these airports are adequately considered in the planning process; potential solutions to noted access problems; and identification of projects for consideration by local public bodies and planning authorities which may improve airport access in selected cases. A 1978 update of the ground access to airports study prepared by the Federal Highway Administration (FHWA) is included. J.M.S.

N80-20285*# Old Dominion Univ. Research Foundation, Norfolk, Va.
SCALE MODEL STUDIES FOR ESTABLISHING THE FLOW PATTERNS OF A LOW-SPEED TUNNEL. Progress Report, 15 Mar. - 14 Sep. 1979.
P. S. Barna. Hampton, Va.: NASA, Langley Res. Center. Mar. 1980. 73 p. refs.
(Grant NsG-1563)
(NASA-CR-159234) Avail: NTIS. HC A04/MF A01. CSCL 14B.

Experiments were conducted in a model tunnel scaled down in a ratio of 1:24 from the full size prototype V/STOL tunnel at NASA Langley Research Center. The flow characteristics around the tunnel were studied and the location and causes of local flow separation and local recirculation were documented. The study of the interaction between the various components from which the tunnel is built, an experimental setup similar to the sequence of tunnel circuit components was constructed which enabled the various components to be tested either individually or in combination. The components were tested by the simple technique of blowing air through them, then measuring the velocity distribution at relevant sections. A.R.H.

N80-20286*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
REAL-TIME DATA REDUCTION CAPABILITIES AT THE LANGLEY 7 BY 10 FOOT HIGH SPEED TUNNEL.
Charles H. Fox, Jr. Jan. 1980. 317 p. refs.
(NASA-TM-78801) Avail: NTIS. HC A14/MF A01. CSCL 14B.

The 7 by 10 foot high speed tunnel performs a wide range of tests employing a variety of model installation methods. To support the reduction of static data from this facility, a generalized wind tunnel data reduction program had been developed for use on the Langley central computer complex. The capabilities of a version of this generalized program adapted for real time use on a dedicated on-site computer are discussed. The input specifications, instructions for the console operator, and full descriptions of the algorithms are included. J.M.S.

N80-20287# Environmental Engineering Consultants, Inc., Gainesville, Fla.
AEROSOL FILTER LOADING DATA FOR A SIMULATED JET ENGINE TEST CELL AEROSOL Final Report, Jan. - Jul. 1979
Dale A. Lundgren Tyndall AFB, Fla. Air Force Engineering and Services Center Aug. 1979 44 p
(Contract F08637-79-M-0784; AF Proj. 1900)
(AD-A078779; ESL-TR-79-28) Avail: NTIS HC A03/MF A01 CSCL 21/5

The Air Force routinely tests turbine engines in fixed test cells, some of which have been cited by state pollution control officials for violations of opacity regulations. A previous theoretical study, CEEDO-TR-78-53, predicted that relatively low efficiency and low cost techniques could bring jet engine test cells into compliance with air pollution regulations. The system proposed included a water cooling spray and a mist eliminator followed by a medium efficiency, high velocity, throw-away type glass filter media. The most serious limitation of velocity filtration is the aerosol mass loading and the potential for rapid pressure drop build up across the filter. Since filter loading characteristics could not be theoretically predicted, the objective of this follow-on work was to experimentally test and report the filter loading characteristics of glass fiber filters for possible application to jet engine test cell exhaust plume opacity control. Two types of glass fiber media were tested: (1) two different medium efficiency pre-filter media; and (2) two different high efficiency final filter media. GRA

N80-20288# National Technical Information Service, Springfield, Va.
AIRFIELD PAVEMENT EVALUATION, VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report
Guy E. Habercom, Jr. Jul. 1979 199 p Supersedes NTIS/PS-78/0685; NTIS/PS-77/0662; NTIS/PS-76/0581
(NTIS/PS-79/0754/6; NTIS/PS-78/0685; NTIS/PS-77/0662; NTIS/PS-76/0581) Avail: NTIS HC $28.00/MF $28.00 CSCL 01E

Durability, wear resistance, skid resistance, and surface qualities of airfield pavement structures are analyzed and evaluated. This updated bibliography contains 187 abstracts, 3 of which are new entries to the previous edition. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

No abstracts in this category.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories, and orbit and launching dynamics.

N80-20289*# Analytical and Computational Mathematics, Inc., Houston, Tex.
CODING, TESTING AND DOCUMENTATION OF PROCESSORS FOR THE FLIGHT DESIGN SYSTEM Final Report
22 Feb. 1980 24 p
(Contract NAS9-15787)
(NASA-CR-160552; ACM-TR-120) Avail: NTIS HC A02/MF A01 CSCL 22A

The general functional design and implementation of processors for a space flight design system are briefly described. Discussions of a basetime initialization processor; conic, analytical, and precision coasting flight processors; and an orbit lifetime processor are included. The functions of several utility routines are also discussed. M.G.

N80-20290# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ORBITAL ESTIMATION USING TWO-BODY CLASSICAL ORBITAL ELEMENTS AS MEASUREMENT UPDATES M.S. Thesis
Daryl G. Boden Dec. 1979 122 p refs
(AD-A079903; AFIT/GA/AA/79D-3) Avail: NTIS HC A06/MF A01 CSCL 22/3

Currently, the Space Defense Center (SDC) uses the position and velocity data of a satellite track to update the orbital elements of the satellite. An alternate approach would be to process the radar data at the tracking site and transmit two-body orbital elements to SDC as measurement updates. This would significantly reduce the data load at SDC. The truth model used in this study to evaluate performance and provide measurement updates to the filters includes the first four zonal harmonics and the first sectoral harmonic of the geopotential and the air drag. The estimator models include two-body dynamics and J sub 2 perturbations. In addition, the derivative of the semi-major axis is used to estimate the effects due to air drag. Perfect dynamics with measurement noise are assumed for the filter models. Three filters are evaluated: Least Squares, Bayes, and Kalman. The performance of the three filters is similar. The Bayes and Kalman Filters are nearly the same and indistinguishable in this study. All three filters performed adequately with the following exceptions. The filters diverge when singularities are present in the classical orbital elements. All three filters underestimate the covariance of the estimates. Finally, the filters track noise in the estimate of the derivative of the semi-major axis, degrading the prediction capabilities of the filters. GRA

N80-20291# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
USE OF AN AERODYNAMIC TURN TO MAXIMIZE THE ORBIT INCLINATION CHANGE FOR THE SPACE SHUTTLE ORBITER M.S. Thesis
Glenn S. Geary Dec. 1979 82 p refs
(AD-A079855; AFIT/GA/AA/79D-4) Avail: NTIS HC A05/MF A01 CSCL 22/1

Previous studies have shown that the space shuttle orbiter can achieve larger orbit inclination changes using an aerodynamic turn than can be obtained using a rocket motor burn. This analysis determines the angle of attack and bank angle histories which maximize the change in inclination angle while satisfying final altitude and velocity loss constraints. The angle of attack and bank angle are modelled as polynomial functions of time with unknown coefficients. The optimum values of the coefficients are determined by a gradient optimization technique. Additionally, the sensitivity of the change in inclination angle to changes in the orbit apogee altitude is examined. It is shown that the space shuttle orbiter can obtain higher inclination angle changes with higher apogee altitudes. GRA

N80-20292# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
STABILIZING AN UNSTABLE ORBIT ABOUT L3 IN THE SUN, EARTH, MOON SYSTEM USING LINEAR CONSTANT GAIN FEEDBACK M.S. Thesis
Doyne E. Smith Dec. 1979 80 p refs
(AD-A079860; AFIT/GA/AA/79D-10) Avail: NTIS HC A05/MF A01 CSCL 22/3

Equations of motion for a satellite in a planar elliptic four-body system are used to generate an orbit about L3. Initial conditions and a periodic reference orbit were found using a circular four-body model. Linear constant gain feedback is used to stabilize the orbit about L3 in the planar, elliptic four-body model. The computed L3 orbit is plotted against the reference orbit to assess the effectiveness of position, velocity and position/velocity feedback compensation systems. Also computed is the integrated control gain costs for each type of feedback system used. Long term

stable motion near libration point L3 was achieved using position/velocity feedback compensation. Position and velocity feedback when used separately were ineffective as stabilizing feedback compensation systems. The integrated control gain costs also indicate that linear constant gain feedback is not an economical method to stabilize this periodic orbit about L3.GRA

N80-20293# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION AND COMPARISON OF STABLE PERIODIC ORBITS IN THE VICINITY OF LAGRANGIAN POINTS L4 AND L5 TO A FOUR-BODY TRUTH MODEL M.S. Thesis
William D. Beekman Dec. 1979 126 p refs
(AD-A079683; AFIT/GA/AA/79D-2) Avail: NTIS HC A07/MF A01 CSCL 22/3

All previously discovered stable periodic orbits about the triangular libration points are tested on a planar restricted four-body truth model. The truth model is an algorithm developed from equations used by T. A. Heppenheimer for colony location used perturbation theory and the equation of the center. Only one of the orbits, developed by Wheeler using a very restricted four-body problem with Sun - Moon - Earth circular motion, is found to be relatively stable for at least twenty years. It is prograde about L4 having a period in resonance with the lunar synodic month. Two other orbits, one similar to Wheeler's and one 180 degrees out of phase found by Kolenkiewicz and Carpenter are marginally stable. GRA

N80-20294# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
NAVPAC: A SPACE-QUALIFIED NAVIGATION PACKAGE
D. L. Zitterkopf Feb. 1979 150 p
(Contract N00017-72-C-4401)
(AD-A077062; APL/JHU-TG-1317) Avail: NTIS HC A07/MF A01 CSCL 22/3

NAVPAC (Navigation Package) is a space-qualified receiver instrument designed and developed by APL for the Defense Mapping Agency. The use of NAVPAC represents the first application of the Navy Navigation Satellite System to reconstruct accurately the orbit of another space vehicle. It also represents the first system for automatically providing a precise time-annotation capability for an event that occurs on a spacecraft. NAVPAC contains three dual-channel receivers to acquire and track signals automatically from as many as three Navy Navigation Satellites that are in view simultaneously. To help meet the program goals, NAVPAC also includes a three-axis miniature electrostatic accelerometer. The goals of NAVPAC include accurately reconstructing a host-vehicle orbit, providing atmospheric density information, and improving the gravity field model. GRA

N80-20295# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DETERMINATION OF THE MINIMUM DELTA 5 TRANSFER TRAJECTORY FROM A LOW EARTH ORBIT TO A STABLE ORBIT AROUND THE LAGRANGIAN POINT L4 IN A RESTRICTED FOUR-BODY SYSTEM M.S. Thesis
Theron E. Weimer Dec. 1979 114 p refs
(AD-A079881) Avail: NTIS HC A06/MF A01 CSCL 22/3

In this report, the equations of motion for a satellite in restricted four-body motion are derived and examined. An algorithm is developed that produces a minimum delta 5 transfer trajectory from a low Earth orbit to establishment in Wheeler's stable periodic orbit around L4. Both a Hohmann transfer and an infinite velocity, straight-line transfer are examined as initial conditions for integration of the equations of motion. Transfer trajectories are determined to ten points around Wheeler's orbit so that a minimum delta 5 trajectory can be determined. Two types of minimum delta 5 values were found. One type is a true minimum value, the other type is a limiting value beyond which the target orbit cannot be reached. Results are presented on a transfer trajectory that gives a minimum delta 5 from the points examined. From these results a more accurate transfer location is estimated. GRA

N80-20701# Bayerische Akademie der Wissenschaften, Munich (West Germany).
ON THE USE OF LINES OF KERNEL FUNCTIONS FOR ORBITAL DETERMINATION [DIE NUTZUNG VON KERNFUNKTIONSREIHEN ZUR BAHNBESTIMMUNG]
Hermann Hauck *In its* Res. Program 78, Satellite Geodesy Program 1978 p 102-108 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

N80-20703# Bayerische Akademie der Wissenschaften, Munich (West Germany).
MOTION OF ARTIFICIAL EARTH SATELLITES IN RELATED ORBITS [ZUR BEWEGUNG KUENSTLICHER ERDSATGELLITEN IN BENACHBARTEN UMLAUFBAHNEN]
Karl Heinz Ilk and Wolfgang Seemueller *In its* Res. Program 78, Satellite Geodesy Program 1978 p 120-138 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities, ground support equipment, mobile transporters, and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-20296# ARO, Inc., Arnold Air Force Station, Tenn.
SPACECRAFT TEST CHAMBER CONTAMINATION STUDY IN THE AEDC MARK 1 FACILITY Final Report, Apr.-Jul. 1977
J. G. Pipes, D. F. Frazine, R. P. Young, E. N. Borson, and L. H. Rachal AEDC, Arnold AFS, Tenn. Jan. 1980 26 p refs
(AD-A079638; AEDC-TR-79-41) Avail: NTIS HC A03/MF A01 CSCL 14/2

Recent results of a contamination study in the Arnold Engineering Development Center Mark 1 space simulation chamber are presented. The measurements were associated with the Global Positioning System satellite test conducted in the Mark 1 facility between April 6, 1977, and July 24, 1977. Multiple internal reflection spectroscopy (MIRS) internal reflection elements (IRE's), thermal control surface witness plates, and quartz crystal microbalances (QCM's) were used to measure contaminants condensible during an extended chamber evacuation. An automatic particle counter was used to measure airborne particle density when the chamber was at atmospheric pressure. The nonvolatile residue wipe technique was employed to determine the general cleanliness of the chamber hardware. Temperature of the IRE's during chamber operation was between 150 and 200 K. One QCM was temperature controlled to a temperature of 238 K, the other QCM operated at 135 K. After chamber repressurization, the IRE's were scanned in the 2- to 15- micrometer wavelength region. Resulting spectra indicated a coating of diffusion pump fluid (DC704) at a concentration level just above the limit of detectability. GRA

N80-20641# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE SATELLITE STATION WETZELL [DIE SATELLITENBEOBACHTUNGSSTATION WETTZELL]
Hermann Seeger *In its* Rept. on Cartography and Geodesy Ser. 1: Original Rept. No. 73 1977 p 53-63 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20648# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PARTICIPATION OF SATELLITE OBSERVATION STATION WETZELL IN INTERNATIONAL OBSERVATION PROGRAMS, 1975-1977 [ZUR BETEILIGUNG DER SATELLITENBEOBACHTUNGSSTATION WETZELL AN INTERNATIONALGEN BEOBACHTUNGSPROGRAMMEN (1975-1977)]
Hermann Seeger and Peter Wilson *In its* Rept. on Cartography and Geodesy, Ser. 1: Original Rept. No. 73 1977 p 93-103

refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-20297# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
SAMPLED-DATA ANALYSIS IN PARAMETER SPACE
S. M. Seltzer Jun. 1979 31 p refs
(AD-A077879; DRSMI-T-79-64) Avail: NTIS
HC A03/MF A01 CSCL 14/2

This report describes a technique for determining the stability and dynamic characteristics of a digital control system in terms of several selected system parameters. The method requires that the system characteristic equation be available in the complex p-domain. An example is provided to further elucidate the technique. It is the capability that makes the method more powerful than most design techniques (which describe stability in terms of only one variable parameter or gain). GRA

N80-20298# Alabama Univ., Tuscaloosa.
SOURCES OF TRACKING ERROR IN MILLIMETER WAVE-LENGTH MISSILE GUIDANCE SYSTEMS
William Webb 31 May 1979 52 p refs
(Contract DAAG29-76-D-0100)
(AD-A078226; DRSMI-T-79-57) Avail: NTIS
HC A04/MF A01 CSCL 17/7

A number of sources of error degrade the tracking performance of practical millimeter radars. These include receiver noise, target noise, multipath, clutter, servo noise and propagation effects. In this technical note, these error sources are considered, and the available techniques for minimizing their influence are reviewed. A detailed analysis of a typical millimeter radar tracking a military target has been performed in order to evaluate the relative importance of the different sources of tracking error. Both frequency agile and fixed frequency operation are considered. GRA

N80-20299# Naval Surface Weapons Center, Dahlgren, Va.
EFFECT OF LINEAR APPROXIMATION FOR SATELLITE DOPPLER FREQUENCY IN GEODETIC POSITIONING Final Report
C. Harris Smith Oct. 1979 23 p refs
(AD-A078128; NSWC/TR-79-256) Avail: NTIS
HC A02/MF A01 CSCL 17/7

The Doppler principle has been used to track satellites since the early 1960's. When the data sampling interval was less than one second, this data has been treated as frequency data in orbit determination programs. This method results in an approximation when the number of cycles counted in an interval divided by the time interval is treated as a frequency in the equations of condition. The result of this truncated series is that it produces station heights that are about 1.4 meters too low. Therefore the data must be treated as range differences, even for sampling intervals as low as 1 second. GRA

N80-20300# BDF, Inc., Waltham, Mass.
AFSIM, AN AIR FORCE SATTELLITE INTERACTIONS MODEL Interim Report
Andrew Mazzella, Emile Tobenfeld, and Allen G. Rubin 29 Jun. 1979 16 p refs
(Contract F19628-78-C-0212; AF Proj. 7661)
(AD-A078032; AFGL-TR-79-0139; ERP-684) Avail: NTIS
HC A02/MF A01 CSCL 22/1

A computer program called AFSIM has been developed to conduct numerical simulations of plasma interactions with a satellite, assuming the satellite to be represented by an infinitely long cylinder and treating the plasma as discrete particles. The system is assumed to be uniform along the axis of the satellite. A number of features of the actual satellite are incorporated into the model with as much flexibility as possible to accommodate a wide range of conditions. GRA

N80-20301# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
SATELLITE CALIBRATION DATA, ANNUAL DATA REPORT Progress Report, Jan. - Dec. 1977
L. I. Murillo and L. Edwin Williamson Aug. 1979 406 p
(DA Proj. 1L1-62111-AH-71)
(AD-A075602; ERADCOM/ASL-DR-79-0001) Avail: NTIS
HC A18/MF A01 CSCL 22/2

This report contains data from observations of meteorological and radiative parameters at selected satellite calibration target sites. These sites include the highly reflective gypsum field in southcentral New Mexico, a dark lava surface, a nearby fresh water reservoir and over desert terrain. The report also contains narrative descriptions of the instruments in use at the target sites. GRA

N80-20694# Bayerische Akademie der Wissenschaften, Munich (West Germany).
ON THE VERIFICATION OF SATELLITE REFLECTANCE MEASUREMENTS [ZUR UEBERPRUFFUNG VON ENTFERNUNGSMESSUNGENNACH SATELLITEN]
Helmut Walter *In its* Res. Program 78, Satellite Geodesy Program 1978 p 38-44 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

N80-20697# Bayerische Akademie der Wissenschaften, Munich (West Germany).
THE EROS-DOPPLER OBSERVATION CAMPAIGN (EROS-DOC) [DIE EROS DOPPLER BEOBACHTUNGSKAMPAGNE (EROS-DOC)]
Wolfgang Schlueter, Hermann Seeger, Gerhard Soltau, Peter Wilson, and Peter Wolf *In its* Res. Program 78, Satellite Geodesy Program 1978 p 65-71 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-20302*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRUCTURAL TESTS ON A TILE/STRAIN ISOLATION PAD THERMAL PROTECTION SYSTEM
Jerry G. Williams Mar. 1980 46 p
(NASA-TM-80226) Avail: NTIS HC A03/MF A01 CSCL 22B

The aluminum skin of the space shuttle is covered by a thermal protection system (TPS) consisting of a low density ceramic tile bonded to a matted-felt material called strain insulation pad (SIP). The structural characteristics of the TPS were studied experimentally under selected extreme load conditions. Three basic types of loads were imposed: tension, eccentrically applied tension, and combined in-plane force and transverse pressure. For some tests, transverse pressure was applied rapidly to simulate a transient shock wave passing over the tile. The failure mode for all specimens involved separation of the tile from the SIP at the silicone rubber bond interface. An eccentrically applied tension load caused the tile to separate from the SIP at loads lower than experienced at failure for pure tension loading. Moderate in-plane as well as shock loading did not cause a measurable reduction in the TPS ultimate failure strength. A strong coupling, however, was exhibited between in-plane and transverse loads and displacements. Author

N80-20303*# Boeing Aerospace Co., Seattle, Wash.
TECHNOLOGY REQUIREMENTS FOR FUTURE EARTH-TO-GEOSYNCHRONOUS ORBIT TRANSPORTATION SYSTEMS.

VOLUME 3: APPENDICES Final Report
Vincent A. Caluori, Robert T. Conrad, and James C. Jenkins Hampton, Va. NASA Langley Res. Center Mar. 1980 146 p
(Contract NAS1-15301)
(NASA-CR-159174) Avail: NTIS HC A07/MF A01 CSCL 22B

Technological requirements and forecasts of rocket engine parameters and launch vehicles for future Earth to geosynchronous orbit transportation systems are presented. The parametric performance, weight, and envelope data for the LOX/CH4, fuel cooled, staged combustion cycle and the hydrogen cooled, expander bleed cycle engine concepts are discussed. The costing methodology and ground rules used to develop the engine study are summarized. The weight estimating methodology for winged launched vehicles is described and summary data, used to evaluate and compare weight data for dedicated and integrated O2/H2 subsystems for the SSTO, HLLV and POTV are presented. Detail weights, comparisons, and weight scaling equations are provided. A.W.H.

N80-20304*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LeRC REDUCED GRAVITY FLUID MANAGEMENT TECHNOLOGY PROGRAM
John C. Aydelott and E. Patrick Symons [1980] 19 p refs Prepared for the 1980 JANNAF Propulsion Meeting, Monterey, Calif., 11-13 Mar. 1980
(NASA-TM-81450; E-371) Avail: NTIS HC A02/MF A01 CSCL 22A

A survey of the reduced gravity fluid management technology program is presented. Information on reduced gravity fluid behavior, techniques for thermal control of cryogenic tankage, and design for fluid management systems are discussed. The development of Spacelab experiments, propellant management systems for orbit transfer vehicles, and computer techniques for simulating reduced gravity fluid dynamic processes is reported. A.W.H.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-20305# Pacific Missile Test Center, Point Mugu, Calif. Weapons Instrumentation Div.
MINICOMPUTER CONTROLLED SYSTEM FOR TESTING TELEMETRY RECEIVING AND RECORDING SYSTEMS
E. L. Law and G. J. Harbold, Jr. 10 Oct. 1979 53 p
(AD-A078803; PMTC-TP-79-30) Avail: NTIS HC A04/MF A01 CSCL 19/6

This report describes a minicomputer controlled system for testing telemetry receiving and recording stations and presents sample test results. Details of the interface between the minicomputer and the test equipment are also presented. The system can test a telemetry receiving and recording station in about one/fifth the time it takes to manually test the station. The test results are printed out and can be stored on the computer for trend analysis and other statistical analyses. The system accuracy is + or - 1.0 dB or better for all tests. The results of the various tests correlate well with each other and with manually performed tests. It has been demonstrated that a minicomputer controlled system can perform a good, fast, accurate test on a telemetry receiving and recording station. GRA

N80-20643# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CONTRIBUTIONS OF THE SFB 78/IFAG TO DOPPLER MEASUREMENTS FOR SATELLITE POSITIONING [DIE ARBEITEN DES SFB 78/IFAG AUF DEM GEBIET DER DOPPLERMESSUNGEN NACH SATELLITEN]
Peter Wilson and Hermann Seeger *In its* Rept. on Cartography and Geodesy, Ser. 1, Original Rept. No. 73 1977 p 73-80 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

No abstracts in this category.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-20306*# United Technologies Corp., South Windsor, Conn.
LIGHTWEIGHT FUEL CELL POWERPLANT COMPONENTS PROGRAM Final Report, 18 Mar. 1974 - 31 Dec. 1979
R. E. Martin 22 Feb. 1980 103 p refs
(Contract NAS8-30637)
(NASA-CR-161412; FCR-1656) Avail: NTIS HC A06/MF A01 CSCL 10B

A lightweight hydrogen-oxygen alkaline fuel cell incorporated into the design of a lightweight fuel cell powerplant (LFCP) was analytically and experimentally developed. The powerplant operates with passive water removal which contributes to a lower system weight and extended operating life. A preliminary LFCP specification and design table were developed along with a lightweight power section for the LFCP design, consisting of repeating two-cell modules was designed. Two, four-cell modules were designed incorporating 0.508 sq ft active area space shuttle technology fuel cells. Over 1,200 hours of single-cell and over 8,800 hours of two-cell module testing was completed. The 0.25 sq ft active area lightweight cell design was shown to be capable of operating on propellant purity reactants out to a current density of 600ASF. Endurance testing of the two-cell module configuration exceeded the 2,500-hour LFCP voltage requirements out to 3700-hours. A two-cell module capable of operating at increased reactant pressure completed 1000 hours of operation at a 30 psia reactant pressure. A lightweight power section consisting of fifteen, two-cell modules connected electrically in series was fabricated. J.M.S.

N80-20307# SRI International Corp., Arlington, Va.
IMPACT FUSION WITH A SEGMENTED RAIL GUN
R. A. Muller, R. L. Garwin, and B. Richter Dec. 1979 16 p refs

(Contract EY-76-C-03-0115)
(AD-A079811; SRI-JSN-79-05) Avail: NTIS HC A02/MF A01 CSCL 21/3

The rail gun offers an attractive alternative to the traveling wave rifle for the magnetic acceleration of macroscopic (0.05 g) bullets for impact fusion. In this paper we review the basic rail gun equations and indicate how energy efficiency can be designed into it. We set as our preliminary goal the delivery of 1 megajoule in 10 nanoseconds, with a specific energy of 20 MJ/g (i.e. a bullet mass of 0.05 g); these values are taken from the requirements being considered for heavy-ion fusion. Using these numbers the final particle velocity is 200 km/sec. For a delivery time of 10 nanoseconds, this velocity implies that the projectile length is about 2 mm. Impact fusion is feasible because of the coincidence that a bullet with all dimensions, roughly 2 mm has the required mass. GRA

N80-20308# Rockwell International Corp., Downey, Calif. Satellite Systems Div.
SOLAR ROCKET SYSTEM CONCEPT ANALYSIS Final Report, 19 Feb. - 30 Sep. 1979
Fred G. Etheridge Dec. 1979 233 p refs
(Contract F04611-79-C-0007; AF Proj. 5730)
(AD-A079117; SSD-79-175; AFRPL-TR-79-79) Avail: NTIS HC A11/MF A01 CSCL 21/8

The objective of the solar rocket concept analysis was to determine the potential value of solar-thermal rockets in large delta velocity space missions. A specific impulse of 872 seconds was achieved by passing hydrogen through a heat exchanger placed at the focal spot of a large parabolic dish solar concentrator mirror. With a windowed chamber type of thruster and a particle-laden hydrogen flow the specific impulse was 1041 seconds. Inflatable construction techniques were determined to be optimum for the large concentrating mirrors based on ease of deployment and low specific mass. It was concluded that the solar rocket offers the mission planner a viable option between the high payload-long trip time of the mercury ion bombardment system and the lower payload-short trip time of a LO2-LH2 stage. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-20309# Rockwell International Corp., Golden, Colo. Energy System Div.
CHEMISTRY RESEARCH AND DEVELOPMENT Progress Report, Nov. 1978 - Apr. 1979
F. J. Miner 5 Oct. 1979 35 p refs
(Contract EY-76-C-04-3533)
(RFP-2952) Avail: NTIS HC A03/MF A01

The status of the following studies is given: calorimetry and thermodynamics of nuclear materials; optimization of the cation exchange process for recovering americium and plutonium from molten net extraction residues; evaluation and comparison of bidentate extractants and methods for actinide recovery; an anion exchange-bidontate organophosphorus extraction process for molten salt extraction residues; plutonium recovery in the Advanced Size Reduction Facility; decontamination of Rocky Flats soil; separating lead and calcium from americium by chromate and oxalate precipitation; demonstration of the pyroredox process in the induction heated, tilt-pour furnace; process development for recovery of americium from vacuum melt furnace crucibles; plutonium peroxide precipitation process; and a comparative study of annular and Raschig ring-filled tanks. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N80-20310 Virginia Univ., Charlottesville.
INVESTIGATION OF ELONGATION OF BORON FILAMENT DURING FABRICATION AND ANNEALING Ph.D. Thesis
Jimmy Wayne Eason 1979 159 p
Avail: Univ. Microfilms Order No. 8004675

Elongation in boron filament during fabrication was investigated and found to be as great as 16 percent under certain conditions. It was also found to obey a relatively simple empirical relationship which yielded effective activation energies. A model for the elongation was proposed, and a computer program was designed to simulate the deposition and elongation of boron on a tungsten wire substrate. Internal residual stress distribution of boron/tungsten filament were also generated by the computer program. Good agreement was found between the proposed model and experimental results. Negative elongation (contraction) of boron filament was observed during annealing and found to be dependent upon the concentration of oxygen present in the annealing atmosphere. The contraction was also found to be the result of void formation at the core-born sheath interface. Dissert. Abstr.

N80-20311*# Little (Arthur D.), Inc., Cambridge, Mass.
AN ASSESSMENT OF THE RISKS PRESENTED BY CARBON FIBER COMPOSITES RELEASED FROM MOTOR VEHICLE FIRES
Donald B. Rosenfield, Joseph Fiksel, and Ashok Kalelkar Hampton, Va. NASA Langley Research Center Mar. 1980 87 p refs Sponsored in part by DOT
(Contract NAS1-15380)
(NASA-CR-159207; DOT-TSC-RSPA-80-4) Avail: NTIS HC A05/MF A01 CSCL 11D

A risk assessment was conducted to estimate the potential losses through 1993 due to the usage of carbon fiber (CF) composites in U.S. motor vehicles, including automobiles and trucks. A methodology was developed to compute estimated dollar losses by county and equipment type, using a Poisson model for the incidence of equipment failures. This approach incorporated data on the geographic distribution of potentially vulnerable facilities, as well as the mean CF exposure levels at which various equipment would fail. The results were then statistically aggregated to produce a national risk profile for estimated annual losses in 1993. The expected loss was $5,567 per year (1977 dollars), and the likelihood of exceeding $500,000 in annual losses was estimated to be at most one in ten thousand. The sensitivity of these results to major input parameters was investigated, and it was found that under extreme worst-case assumptions the annual loss would increase to about $1.5 million. J.M.S.

N80-20312*# Pennsylvania Univ., Philadelphia. Dept. of Electrical Engineering and Science.
HIGH ELECTRICAL RESISTIVITY CARBON/GRAPHITE FIBERS Final Report
F. Lincoln Vogel and William C. Forsman 17 Apr. 1980 26 p refs
(Grant NsG-1596)
(NASA-CR-162909) Avail: NTIS HC A03/MF A01 CSCL 11D

Carbon/graphite fibers were chemically oxidized in the liquid phase to fibers of graphite oxide. Resistivity increases as high as 10,000 times were obtained, the oxidized fiber decomposed on exposure to atmosphere. A factor of 1,000 remained as a stable increment. The largest change observed was 1,000,000 times. Best results were obtained on the most highly graphitized fibers. Electrochemical oxidation yielded a lower increase--about 10 times, but provided a controllable method of synthesis and insight to the mechanism of reaction. Tensile tests indicated that the strength of the fiber on oxidation was decreased by no more than 25 percent. Author

N80-20313*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC MODULUS AND DAMPING OF BORON, SILICON CARBIDE, AND ALUMINA FIBERS
J. A. DiCarlo and W. Williams [1980] 44 p refs Presented at the 4th Ann. Conf. on Composites and Advanced Mater., Cocoa Beach, Fla. 20-24 Jan. 1980 sponsored by the Am. Ceram. Soc.

(NASA-TM-81422; E-345) Avail: NTIS HC A03/MF A01 CSCL 11D

The dynamic modulus and damping capacity for boron, silicon carbide, and silicon carbide coated boron fibers were measured from -190 to 800 C. The single fiber vibration test also allowed measurement of transverse thermal conductivity for the silicon carbide fibers. Temperature dependent damping capacity data for alumina fibers were calculated from axial damping results for alumina-aluminum composites. The dynamics fiber data indicate essentially elastic behavior for both the silicon carbide and alumina fibers. In contrast, the boron based fibers are strongly anelastic, displaying frequency dependent moduli and very high microstructural damping. The single fiber damping results were compared with composite damping data in order to investigate the practical and basic effects of employing the four fiber types as reinforcement for aluminum and titanium matrices. K.L.

N80-20314*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CALCULATION OF RESIDUAL PRINCIPAL STRESSES IN CVD BORON ON CARBON FILAMENTS
Donald R. Behrendt. [1980] 15 p. refs. Prepared for the 4th Ann. Conf. on Composites and Advanced Mater., Cocoa Beach, Fla., 21-24 Jan. 1980; sponsored by the Am. Ceram. Soc.
(NASA-TM-81456; E-386) Avail: NTIS HC A02/MF A01 CSCL 11D

A three-dimensional finite element model of the chemical vapor deposition of boron on a carbon substrate (B/C) is developed. The model includes an expansion of the boron after deposition due to atomic rearrangement and includes creep of the boron and carbon. Curves are presented showing the variation of the principal residual stresses and the filament elongation with the parameters defining deposition strain and creep. The calculated results are compared with experimental axial residual stress and elongation measurements made on B/C filaments. For good agreement between calculated and experimental results, the deposited boron must continue to expand after deposition, and the build up of residual stresses must be limited by significant boron and carbon creep rates. K.L.

N80-20315*# SRI International Corp., Menlo Park, Calif.
DEVELOPMENT OF LaRC 180/NR150B2 POLYIMIDE GRAPHITE HYBRID COMPOSITES
Milan G. Maximovich, O. Bergren, and S. Lockerby. Mar. 1980 61 p. refs.
(Contract NAS1-15433)
(NASA-CR-159196) Avail: NTIS HC A04/MF A01 CSCL 11D

A method for co-curing NR150B2 and LaRC 180 prepregs into hybrid composites was developed. The processing characteristics and the properties of the hybrid composites were compared with those of laminates fabricated from the individual component prepregs. Resin forms were selected and optimized and a new NR150 formulation was investigated. The new formulation greatly facilitated the processing and the performance of this system. Quality control techniques were evaluated and developed; high quality laminates were fabricated from both individual resin systems, and hybrid laminates were successfully co-cured. Optimum hybrid forms were investigated and several novel approaches were explored. An optimum hybrid system was developed that utilizes a LaRC curing schedule but shows no degradation of mechanical properties after aging 500 hr in air at 260 C. J.M.S.

N80-20316*# Boeing Aerospace Co., Seattle, Wash.
DESIGN, FABRICATION AND TEST OF GRAPHITE/POLYIMIDE COMPOSITE JOINTS AND ATTACHMENTS FOR ADVANCED AEROSPACE VEHICLES. Quarterly Technical Progress Report, 1 Jul. - 30 Sep. 1979
D. E. Koumal. Washington: NASA. Oct. 1979. 92 p. refs.
(Contract NAS1-15644)
(NASA-CR-159110; QTPR-3) Avail: NTIS HC A05/MF A01 CSCL 11D

The design and evaluation of built-up attachments and bonded joint concepts for use at elevated temperatures is documented. Joint concept screening, verification of GR/PI material, fabrication of design allowables panels, definition of test matrices, and analysis of bonded and bolted joints are among the tasks completed. The results provide data for the design and fabrication of lightly loaded components for advanced space transportation systems and high speed aircraft. K.L.

N80-20317*# Bionetics Corp., Hampton, Va.
THE VULNERABILITY OF COMMERCIAL AIRCRAFT AVIONICS TO CARBON FIBERS
Jerome A. Meyers and Seymour Salmirs. Hampton, Va.: NASA, Langley Res. Center. Apr. 1980. 50 p. refs.
(Contract NAS1-15238)
(NASA-CR-159213) Avail: NTIS HC A03/MF A01 CSCL 11D

Avionics components commonly used in commercial aircraft were tested for vulnerability to failure when operated in an environment with a high density of graphite fibers. The components were subjected to a series of exposures to graphite fibers of different lengths. Lengths used for the tests were (in order) 1 mm, 3 mm, and 10 mm. The test procedure included subjecting the equipment to characteristic noise and shock environments. Most of the equipment was invulnerable or did not fail until extremely high average exposures were reached. The single exception was an air traffic control transponder produced in the early 1960's. It had the largest case open area through which fibers could enter and it had no coated boards. K.L.

N80-20318# Aerojet Solid Propulsion Co., Sacramento, Calif. Strategic Systems Div.
STRUCTURAL ASSESSMENT OF INVOLUTES. Final Report, Sep. 1977 - Jun. 1979
H. O. Davis and D. F. Vronay. Jun. 1979. 155 p. refs.
(Contract F33615-77-C-5051; AF Proj. 2420)
(AD-A077875; AFML-TR-79-4068) Avail: NTIS HC A03/MF A01 CSCL 14B

An apparatus was designed and constructed to use high vacuum and mass spectrometric techniques to determine total and partial vapor pressures above bulk liquid samples in the temperature range between -65 C and 25 C. Observations on the sulfuric acid-water system revealed complexities which interfered with the experimental goal, but which are of some interest in themselves. These interfering processes included long internal thermal relaxation times and chemical reactions. A pressure effect was observed on the melting curve of the sulfuric acid-water mixtures. GRA

N80-20319# ARO, Inc., Arnold Air Force Station, Tenn.
AEROTHERMAL EVALUATION OF HIGH-TEMPERATURE STRUCTURAL MATERIALS FOR USE IN HIGH-PERFORMANCE MISSILE DESIGN. Final Report, 11-12 Oct. 1978
J. O. Ievelts and R. K. Matthews. AEDC. Jan. 1980. 44 p. refs.
(AD-A080023; AEDC-TR-79-38) Avail: NTIS HC A03/MF A01 CSCL 11/4

A materials screening test was conducted in the von Karman Gas Dynamics Facility Wind Tunnel C to determine the performance of several high-temperature, polymeric and metallic composite materials being considered for use as missile structural components. Test conditions were representative of the aerothermal environment encountered during the projected flight of a high-performance, short-range air-to-air missile (SRAAM). GRA

N80-20320# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
PREDICTION AND VERIFICATION OF MOISTURE EFFECTS ON CARBON FIBER-EPOXY COMPOSITES. Progress Report, Oct. 1977 - Oct. 1978
Joseph M. Augl. 30 Mar. 1979. 47 p. refs.
(AD-A079557; NSWC/TR-79-43) Avail: NTIS HC A03/MF A01 CSCL 11/4

Moisture has an effect on the elastic as well as on the strength properties of composites. In this work we have experimentally verified the prediction of changes in the longitudinal shear modules G sub 12 as a function of moisture uptake and temperature. The properties of the bulk resin (measured independently as a function of temperature and moisture concentration) were used for predicting the composite response by using the simple Halpin-Tsai equation of micromechanics.

The excellent agreement between the predicted and observed values demonstrates the feasibility of predicting changes in (reversible properties) of composite in a natural service environment as suggested in a previous report. This predictive scheme considered simultaneously the concepts of diffusion, environmental modeling, micromechanics, and a finite difference laminate theory. GRA

N80-20321# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
INVESTIGATION OF IN SITU COMPOSITES FOR ELECTROMAGNETIC DEVICE APPLICATIONS WITH EMPHASIS ON DEVELOPMENT OF MICROWAVE TUBE CATHODES AND HIGH RESOLUTION DISPLAYS Final Technical Report, Jan. 1976 - Nov. 1978
John W. Goodrum Griffiss AFB, N. Y. RADC Sep. 1979 170 p refs
(Contract F19628-76-C-0153; AF Proj. 2306)
(AD-A079698; EES/GIT-A-1815; RADC-TR-79-174) Avail: NTIS HC A08/MF A01 CSCL 11/4

This report documents the results of a study to evaluate the potential of eutectic composite materials for use in electronic, optical and other devices. The composite materials may be a combination of metal-metal, metal-semiconductor, semiconductor-semiconductor, semiconductor-insulator, or insulator-insulator classes of materials. Device concepts, based on eutectic composites, were given preliminary technical and economic evaluation; brief descriptions of promising devices are listed. Eutectic-based cold cathode and display devices were evaluated by experiments to determine the performance of a prototype cathode device and to determine the design requirements for fabrication of a diode-type display. GRA

N80-20322# Sandia Labs., Albuquerque, N. Mex.
TRANSVERSE COMPRESSIVE TESTING OF THICK KEVLAR/EPOXY LAMINATES
T. R. Guess and R. H. Ericksen 1979 14 p Presented at 11th Natl. SAMPE Tech. Conf., Boston, Nov. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-0176; CONF-791116-3) Avail: NTIS HC A02/MF A01

A suitable geometry for measuring the transverse compressive properties of Kevlar 49 cloth/epoxy composites was defined. Two geometries and strain measuring methods were evaluated: straight-sided cylinders with strain calculated from total platen displacement (includes specimen end effects), and reduced-section cylinders with strain measured in the reduced gage region (no end effects). The straight-sided specimens had length to diameter ratios between 1.1 and 2.7 and were tested with their ends both dry and lubricated. At stress levels below failure, the stress-strain curves from the reduced-section samples were in good agreement with the straight-sided specimen data. Curves from both geometries lie within the same scatter band. Strength data from the reduced-section specimen were inconclusive. Based on this study, straight-sided cylinders with aspect ratios between 2.25 and 2.50 were selected as suitable specimens for characterizing the transverse compressive properties of thick Kevlar cloth/epoxy laminates. DOE

N80-20323# Illinois Univ., Urbana Dept. of Physics and Materials Research Lab.
LOW TEMPERATURE THERMAL CONDUCTIVITIES OF GLASSY CARBONS
A. C. Anderson 1979 9 p refs Presented at the 16th Intern. Thermal Conductivity Conf., Chicago, 7 Nov. 1979
(Contract EY-76-C-02-1198)
(COO-1198-1280; CONF-791134-3) Avail: NTIS HC A02/MF A01

The thermal conductivity of glassy carbon in the temperature range 0.1 to 100 K appears to depend only on the temperature at which the material was pyrolyzed. The thermal conductivity was related to the microscopic structure of glassy carbon. The reticulated structure was especially useful for thermal isolation at cryogenic temperatures. DOE

N80-20324# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
DAMPING OF ANISOTROPIC COMPOSITES STUDIED FROM THE PROPERTIES OF THE ROLLED COMPONENTS [VERFAHREN ZUR BESTIMMUNG DES DAEMPFUNGSVERHALTENS ANISOTROPER VERBUNDBAUTEILE AUS DEN EIGENSCHAFTEN DER LAMINATKOMPONENTEN]
Klaus Kehl 1978 137 p refs In GERMAN
(ILR-41; ISBN-3-79830-660-5) Avail: NTIS HC A07/MF A01

The rigidity and damping properties of the glass and carbon fiber reinforced plastics (GFK and KFK), were studied as well as applications to determining the frequencies and damping in the rolled product. Coefficients of rigidity for surface planes of disk and plates in the case of linear tension and torsion were calculated. Dynamic behavior, including unidirectional and multidirectional loads for composite materials was analyzed. The influence of temperature, frequency of vibration, and fiber orientation on the behavior of the reinforced plastics, and their applications were determined. The manufacture of membranes, tanks, tubes, and pipes was demonstrated. Author (ESA)

N80-20325*# National Bureau of Standards, Washington, D.C. National Measurement Lab.
ADVANCED COMPOSITES: DESIGN AND APPLICATION. PROCEEDINGS OF THE MEETING OF THE MECHANICAL FAILURES PREVENTION GROUP Final Report
T. Robert Shives and William A. Willard Oct. 1979 307 p refs Conf. held at Gaithersburg, Md., 23-25 May 1979 Sponsored in part by ONR, Arlington, Va., Naval Air Systems Command, Washington D.C., NASA Goddard Space Flight Center., and DOE, Washington, D.C.
(NASA-CR-162864; PB80-105109; NBS-SP-563; LC-79-600151) Avail: NTIS HC A14/MF A01 CSCL 11D

The design and application of advanced composites is discussed with emphasis on aerospace, aircraft, automotive, marine, and industrial applications. Failure modes in advanced composites are also discussed. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-20326 British Library Lending Div., Boston Spa (England).
APPLICATIONS OF LIQUID CHROMATOGRAPHY IN THE FIELD OF SURFACE-ACTIVE COMPOUNDS
P. Kikolski Oct. 1979 13 p refs Transl. into ENGLISH from Tluszczl Sprodki Piorace Kosmetyki (Poland), v. 32, no. 2, 1978 p 22-25
(BLL-RTS-11948) Avail: British Library Lending Div., Boston Spa, Engl.

Application of liquid chromatography to the analysis of detergents is discussed. Application of classical and high performance liquid/liquid, liquid/solid, ion exchange, and gel permeation chromatography to the analysis of detergent raw materials and final products is described. The analysis of nonionic compounds, olefine and paraffin sulfonates, alkanolamides, esters of polyhydric alcohol, and mixtures of various surfactants is discussed. A.W.H.

N80-20327 British Library Lending Div., Boston Spa (England).
ON FLAME SPREAD MECHANISM OVER COMBUSTIBLE SOLID SURFACE
K. Akita Nov. 1979 6 p refs Transl. into ENGLISH from Tokyo Daigaku Kogakubu Kiyo A (Japan), v. 15, 1977 p 70-71
(BLL-RTS-12027) Avail: British Library Lending Div., Boston Spa, Engl.

The mechanism of flame propagation over combustible solid surfaces and its connection to the question of unequal combustion over thick and thin objects was examined. The effects of the size and shape, the flame temperature and direction, the composition of the surrounding atmosphere, and the external air

flow velocity on the flame propagation mechanism were investigated. The size of thickness of the object was emphasized. The results of experiments measuring the rate of flame propagation vertically downwards and horizontally over flat surfaces of poly methyl methacrylate are discussed. A.W.H.

N80-20328 Engineering Sciences Data Unit, London (England).
THERMAL CONDUCTIVITY OF LIQUID CARBOXYLIC ACIDS
1979 9 p
(ESDU-79029; ISBN-0-85679-277-2) Copyright. For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $194.50

Values of thermal conductivity at saturation pressure are presented in tabular form for the liquid aliphatic carboxylic acids which are members of the following groups: n-alkanoic acids, isoalkanoic acids, and unsaturated alkanoic acids. The data on which these recommended values of thermal conductivity are based are the most reliable available and the range covered is from the melting point to approximately 0.9 of the critical temperature. The procedure used to obtain the values of thermal conductivity is presented and indicates the effect of pressure. A typical application is in the heat transfer calculations in chemical process plant design. ESDU

N80-20329 Engineering Sciences Data Unit, London (England).
VAPOUR PRESSURES AND CRITICAL POINTS OF LIQUIDS. 14: ALIPHATIC OXYGEN-NITROGEN COMPOUNDS
1979 27 p
(ESDU-79030; ISBN-0-85679-278-0) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $674.50

Saturated vapor pressures of organic oxygen-nitrogen compounds such as amines, amides, nitro compounds, and alcohols are presented along with the procedures used to derive the vapor pressure values. The data on which the values in the Tables are based are the most reliabile available and have been fitted and correlated by equations that are valid from the melting temperature (or triple point where it is known) upwards over the whole liquid range. Tabular values derived from these equations vary from just under 0.01 mmHg to the critical pressure, thus considerably extending the range of values obtainable from Antoine equations available for some of the compounds. This data is useful for the design of process plants such as compressors, distillation columns, heat exchangers, liquefaction plants, and reactors. ESDU

N80-20330 Cornell Univ., Ithaca, N. Y.
ASYMPTOTIC ANALYSIS OF NEAR-STOICHIOMETRIC FLAME PROPAGATION Ph.D. Thesis
Asok Kumar Sen 1979 129 p
Avail: Univ. Microfilms Order No. 8003985

A two reactant model, with general Lewis numbers K and L for oxidant and fuel respectively, was analyzed. It was found that the phenomenon occurs (in the absence of dissociation) whenever K is large enough and L is small enough, the precise conditions always being met in practice. In other words, diffusion alone provides a satisfactory explanation. Dissociation of the combustion products is incorporated into the analysis to show that, while it does explain the shift in the maximum frame temperature, it has only a subsidiary effect on the maximum burning rate. Dissert. Abstr.

N80-20331 Johns Hopkins Univ., Baltimore, Md.
ROLE OF CLUSTER SIZE AND SURFACE ON PHASE TRANSITIONS Ph.D. Thesis
Pazhayannur Krishnan Swaminathan 1980 111 p
Avail: Univ. Microfilms Order No. 8006949

The effect of excluded volume is incorporated into a physical cluster model for the gas-liquid phase transition using the Percus-Yevick approximation for a mixture of spherical clusters to treat the excluded volume. The analytic properties of the model are examined using an expansion in terms of a variable containing the fugacity and the pressure. Scaled particle theory for a mixture of spherocylinders is used to examine the question of phase transition from pure size effect among rod like particles. It is shown that scaled particle theory does not predict such a phase transition. The phase transition behavior of the interacting Dimer model and three other lattice models with anisotropic interaction are examined by analyzing exact series expansions. The properties of the models are related to the nature of clusters the interaction schemes lead to. Dissert. Abstr.

N80-20332 State Univ. of New York, Buffalo.
THE DEVELOPMENT OF AN ELECTROCHEMICAL METHOD FOR THE DETERMINATION OF THE EFFECTIVE VOLUME OF CHARGED POLYMERS IN SOLUTION AND ITS APPLICATION TO CONTINUING STUDIES OF METAL ION BINDING POLYELECTROLYTES Ph.D. Thesis
Peter Slota, Jr. 1979 159 p
Avail: Univ. Microfilms Order No. 8005715

An electrochemical method that is projected for the determination of the effective volume of a colloidally dispersed polyelectrolyte phase in aqueous media was evaluated. Experiments with the highly flexible carboxy methyl dextran gel and the more rigidly cross linked poly methacrylic acid resin were performed. With the well defined gel (resin) phase it was possible to measure the polymer volume as a function of every experimental condition employed to test fully the fundamental concepts developed. Application of this method for estimate of the effective volume of a weakly acidic (basic) polymer in solution was attempted. Metal binding of Cu(2) with the repeating functional units of the soluble polyelectrolytes, poly methacrylic acid and poly glutamic acid, was investigated in two salt media, sodium sulfate and sodium poly styrene sulfonate. Potentiometric measurements were made to facilitate the resolution of species formed as well as their formation constants. Dissert. Abstr.

N80-20333 Maryland Univ., College Park.
TWO-DIMENSIONAL, LAMINAR, MIXED (FORCED AND FREE) CONVECTION, RADIATIVE DIFFUSION FLAMES Ph.D. Thesis
Chun-Nan Liu 1979 195 p
Avail: Univ. Microfilms Order No. 8007097

The two dimensional, mixed mode (forced and free) convection, radiative and laminar diffusion flame over a vertical pyrolyzing fuel slab was investigated. Of particular interests were the variable distributions inside the boundary layer, the wall fluxes along the streamwise direction and the influence of eight parameters on the flame characteristics. Radiative heat transfer of absorbing emitting products, e.g., carbon dioxide, water vapor and soot, was assumed to be dominant only transversely and be negligible streamwisely. Based on this assumption, the boundary layer transport equations can be categorized as the parabolic type and thus were solved using a marching finite difference method. The radiation flux was formulated for the general nongray mixture of gases and soot. The exact and approximate formulas were obtained for numerical calculation. The pseudogray model was devised to reduce the computation time required by the nongray calculation. Dissert. Abstr.

N80-20334* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND MEANS FOR HELIUM/HYDROGEN RATIO MEASUREMENT BY ALPHA SCATTERING Patent
A. Bruce Whitehead (JPL) and Thomas A. Tombrello, inventors (to NASA) (JPL) Issued 18 Mar. 1980 8 p Filed 7 Nov. 1978 Supersedes N79-12416 (17 - 03, p 0329) Sponsored by NASA
(NASA-Case-NPO-14079-1; US-Patent-4,194,115; US-Patent-Appl-SN-958573; US-Patent-Class-250-308; US-Patent-Class-250-307) Avail: US Patent and Trademark Office CSCL 07D

An apparatus for determining helium to hydrogen ratios in a gaseous sample is presented. The sample is bombarded with alpha particles created by a self contained radioactive source and scattering products falling within a predetermined forward scattering angular range impact a detector assembly. Two detectors are mounted in tandem, the first completely blocking the second with respect to incident scattering products. Alpha particle/hydrogen or alpha particle/helium collisions are identified by whether scattering product impacts occur simultaneously in both detectors or only in the first detector. Relative magnitudes of the two pulses can be used to further discriminate against

other effects such as noise and cosmic ray events.
Official Gazette of the U.S. Patent and Trademark Office

N80-20335 Virginia Polytechnic Inst. and State Univ., Blacksburg.
FAST FOURIER TRANSFORM SQUARE WAVE VOLTAMMETRY Ph.D. Thesis
David Payne Binkley 1979 342 p
Avail: Univ. Microfilms Order No. 8005211

Fast Fourier transforms are introduced as a unique digital data handling tool for square wave voltammetry. The technique developed performs the current differencing scheme in the spatial frequency domain over spatial frequencies which are noise free. The technique is verified experimentally with solutions of lead (II) in HC1 and thallium (I) in HNO3. A FFT linear parameter estimation analysis is introduced as a digital data manipulation technique for fused peak analytical systems. The algorithm is tested theoretically and experimentally on various ratios of lead (II) to thallium (I) in nitric acid where the peak separation is approximately 70 millivolts. The algorithm performs the calculation over noise free spatial frequencies and significantly reduces the complexity of the calculation relative to the conventional case.
Dissert. Abstr.

N80-20336 Purdue Univ., Lafayette, Ind.
TIME RESOLVED ANALYSIS OF FLUORESCENT METAL CHELATES Ph.D. Thesis
Thomas Lee Craven 1979 131 p
Avail: Univ. Microfilms Order No. 8005850

Salicylidene-o-aminophenol (SoAP) is found to be a suitable ligand for the time resolved fluorescence analysis of group 3A metal ions. Results of studies on SoAP and on ion pair complexes of rhodamine B show that a correlation exists between bond strength and metal to metal fluorescence lifetime variations, and that a heavy atom effect model provides a means for the evaluation of ligands for time resolved fluorescence analysis. A propagation of errors treatment resulted in a more precise evaluation of a chelate system by the heavy atom effect. Precision in the multicomponent analyses was considered, both through guidelines for the determination of the fluorescence lifetime and through a propagation of errors treatment that includes lifetime uncertainties in multicomponent analysis. Two component time resolved analyses of aluminum and gallium via SoAP and three component analyses of group 3A metals were demonstrated. Dissert. Abstr.

N80-20337 Michigan State Univ., East Lansing.
SELECTED ION FRAGMENTATION WITH A TRIPLE QUADRUPOLE MASS SPECTROMETER Ph.D. Thesis
Richard Alan Yost 1979 105 p
Avail: Univ. Microfilms Order No. 8006213

The triple quadrupole system is a simple and efficient implementation of the selected ion fragmentation technique, whereby several ionic species are generated from a sample, ions of a particular mass are selected for fragmentation, and the resulting fragment ions are mass analyzed. The instrument consists of, in series, a dual chemical ionization/electron impact ionization source, a quadrupole mass filter, an RF-only quadrupole that can be pressurized with a collision gas, a second quadrupole mass filter, and an electron multiplier. The ion fragmentation process is performed by collision-induced dissociation, in which the ion acquires internal energy by collision with a neutral molecule. The RF-only quadrupole collision chamber provides focusing of scattered ions. The instrument is described and its performance evaluated.
Dissert. Abstr.

N80-20338*# National Aeronautics and Space Administration. Pasadena Office, Calif.
THERMAL REACTOR AND PROCESS Patent Application
Harry Levin, inventor (to NASA) (JPL) Filed 29 Feb. 1980 19 p
(Contract NAS7-100)
(NASA-Case-NPO-14369-1; US-Patent-Appl-SN-126063) Avail: NTIS HC A02/MF A01

A thermal reactor for pyrolytically decomposing silane gas into liquid silicon and hydrogen gas is presented. A water cooled injection probe introduces the silane tangentially into a reaction chamber heated well above the decomposition temperature of silane. An outer downwardly moving vortex containing the liquid silicon and an inner upwardly moving vortex containing hydrogen gas are formed. The liquid silicon deposits into the interior walls of the reaction chamber to form an equilibrium skull layer which flows to the bottom of the reaction chamber where it is removed. The hydrogen gas is removed from the top of the reaction chamber by a vortex finder.
NASA

N80-20339*# Polytechnic Inst. of New York. Aerodynamics Lab.
APPLICATION OF RAMAN DIAGNOSTICS TO COMBUSTION Final Report
S. Lederman, C. Posillico, and Anthony Celentano Apr. 1980 22 p refs
(Contract NsG-3108)
(NASA-CR-162901; POLY-M/AE-80-8) Avail: NTIS HC A02/MF A01 CSCL 21B

The use of laser Raman diagnostic techniques to measure the specie concentrations and their temperatures in combustion flow fields is discussed. The system designed to measure the specie concentrations, which included a ruby laser and a photodiode to trip the laser at the maximum light and heat output of the combustion process, is described and problems encountered in developing the system are reported. Photographs of the combustion process are presented and analyzed detailing the evolution of the combustion in terms of the photodiode and the lack of a noticeable Raman-Stokes signal. The absence of the Raman-Stokes signal is discussed.
A.W.H.

N80-20340*# Massachusetts Inst. of Tech., Cambridge. Sloan Automotive Lab.
COMBUSTION AND OPERATING CHARACTERISTICS OF SPARK-IGNITION ENGINES Final Report, Jan. 1979 - Jan. 1980
John B. Heywood, James C. Keck, Gian Paolo Beretta, and Paula A. Watts 28 Mar. 1980 13 p refs
(Grant NsG-3245)
(NASA-CR-162896) Avail: NTIS HC A02/MF A01 CSCL 21B

The spark-ignition engine turbulent flame propagation process was investigated. Then, using a spark-ignition engine cycle simulation and combustion model, the impact of turbocharging and heat transfer variations or engine power, efficiency, and NO sub x emissions was examined.
R.E.S.

N80-20341# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
THE STRUCTURE OF EDDIES IN TURBULENT FLAMES, VOLUME 1
Norman A. Chigier and Andrew J. Yule Mar. 1979 104 p refs Prepared in cooperation with Sheffield Univ., England
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A078625; SQUID-US-1-PU-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 21/2

High frequency response measurement techniques are used with data processing and conditional sampling to measure large eddy structure and coherence in the transitional flow region of turbulent diffusion flames. Comparisons are made between nonburning and burning flow conditions; these show physical similarity for cold and burning flows in the transitional region. Flow visualization shows quasi-laminar interface layers which are distorted, stretched and convoluted by vortex interactions. High-speed Schlieren color movies show axisymmetric wave and vortex ring formation. Velocity, temperature and ionization density measurements show that the transitional flow and the potential core of the jet are much longer in the flame than in the nonburning jet. A marked difference is found between the initial fundamental instability frequencies of the shear layers; the most amplified frequency predicted by stability theory for cold inviscid flow is found in the cold jet but not the flame. Increase in viscosity due to heat release causes delay and damping of the processes of vortex formation and coalescence; dilatation and buoyancy forces also contribute to differences between the flame and cold jet. Large eddies are shown to play an important role in the transitional region of turbulent jet flames.
GRA

N80-20342# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
EXTREMAL EFFECTS IN ROTATIONALLY INELASTIC DIFFRACTION Ph.D. Thesis

Lynn Charles Rathbun Mar. 1979 133 p refs
(Contract DAAB07-72-C-0259; Grant NSF DMR-76-82088)
(AD-A077151; UILU-ENG-78-2230; R-840) Avail: NTIS HC A07/MF A01 CSCL 07/4

The scattering of the hydrogenic molecules H2, D2, and HD from vacuum cleaved MgO (001) along the (110) azimuth has been studied. A thermal beam at 300 K and 80 K was used. Particular emphasis has been placed on the rotational inelastic processes which accompany diffraction of HD. Singularities in the scattering amplitude for the rotationally inelastic events have been found to significantly effect the scattered distributions. This effect, extremal scattering, has been explained in terms of a simple mechanism, allowing accurate calculation of the scattering profiles and angles. The scattering of helium along both the (110) and the (100) azimuths has also been studied. Anomalous shifts and structure have been seen in the diffraction lobes for scattering along the (110) azimuth. These are explained in terms of a wavelength dependent transition probability, calculated in the semiclassical approximation. GRA

N80-20343# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
MODELS FOR THE PHOTOELECTROLYTIC DECOMPOSITION OF WATER AT SEMICONDUCTING OXIDE ANODES Interim Report
J. H. Kowalski, K. H. Johnson, and H. L. Tuller 31 Dec. 1979 23 p refs
(Contracts N00014-78-C-0970; N00014-78-C-0366)
(AD-A079469; Rept-10) Avail: NTIS HC A02/MF A01 CSCL 07/4

Surface states at semiconducting TiO2/electrolyte interfaces are believed to play an important role in charge transfer and thereby the efficiency of photoelectrochemical processes at such interfaces. Theoretical calculations were therefore performed using the SCF-Xalpha-SW method to determine the position and character of surface states at various characteristic interfaces. At the TiO2/water interface, antibonding surface states were found which when occupied would explain the experimentally observed dissociation of water into hydroxyl groups at n-type semiconducting TiO2 surfaces. Similarly, antibonding surface states were found at the TiO2/OH interface which when occupied would tend to destabilize the OH bond. A likely mechanism for the dissociation of water and decomposition of certain photoanodes in photoelectrochemical cells based on the above results is presented. The effects of surface reconstruction at heavily reduced TiO2 surfaces on the validity of our calculations are also discussed. GRA

N80-20344# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
MOLECULAR ORBITAL CRITERIA FOR REDUCTIVE ELIMINATION FROM ORGANOTRANSITION-METAL COMPLEXES Interim Report
A. C. Balazs, K. H. Johnson, and G. M. Whitesides Dec. 1979 16 p refs
(Contract N00014-75-C-0970)
(AD-A079447; Rept-9) Avail: NTIS HC A02/MF A01 CSCL 07/4

The following molecular-orbital criteria for bond reforming and reductive elimination from organotransition-metal complexes have been found: (1) The existence of an occupied molecular orbital that is antibonding between the metal (M)site and reactants (H, CH3) and bonding between the reactants (H, CH3); and (2) This orbital should be the highest or nearly highest occupied molecular orbital of the metal-reactant complex for the reaction to occur at low temperature. The difference between the energy of this orbital and that of the highest occupied orbital, if nonzero, is a qualitative indication of the relative facility of the bond reforming activation energy. GRA

N80-20345# Defence Research Establishment Suffield, Ralston (Alberta).
A CHROMATOGRAPH INJECTION VALVE, AN APPARATUS FOR RAPID INSERTION OF MINIATURE GLASS SAMPLERS INTO THE CARRIER GAS FLOW OF A GAS CHROMATOGRAPH
W. J. Fennick and W. C. Carpenter Dec. 1979 20 p
(AD-A079882; DRES-TN-402) Avail: NTIS HC A02/MF A01 CSCL 07/4

An injection valve for the rapid insertion of miniature glass samplers into the column of a gas chromatograph has been designed and tested. The valve is constructed so that the carrier gas can be allowed to bypass the injection system and flow directly into the column or it can be diverted through a glass sampler tube where it entrains desorbed vapours and carries them into the chromatograph column. Diversion of the carrier gas is so rapid that the operational stability of the gas chromatograph is not affected. A description and general assembly drawing of the unit, together with experimental evidence of its performance, are presented. GRA

N80-20346# Materials Research Labs., Ascot Vale (Australia).
PERFORMANCE OF A GEL PERMEATION CHROMATOGRAPH AND ITS USEFULNESS IN EXAMINING MIXTURES OF ORGANIC MATERIALS
Ivan Grabovac and Carolyn E. M. Morris Jan. 1979 35 p refs
(AD-A079953; MRL-R-725) Avail: NTIS HC A03/MF A01 CSCL 07/4

As part of a programme of assessing the molecular properties of organic materials of defence interest, the performance of a locally designed gel permeation chromatograph fitted with a refractive index (R.I.) detector and an evaporative analyser (E.A.) detector has been examined. It was found that with the R.I. detector the performance is similar to that of other instruments. The response of the E.A. detector was found to depend on a number of operating conditions in an unforeseen manner which limits the usefulness of this detector. However, molecular weight distributions determined with the E.A. detector showed good agreement with the R.I. results. Using the two detectors simultaneously, a study has been made of a complex mixture of epoxy resins (an aircraft adhesive) and it has been shown that information relevant to the performance of advanced organic materials can be provided by such studies. GRA

N80-20347# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
THEORETICAL AND COMPUTATIONAL APPROACH TO MODELING FLAME IGNITION Interim Report
Elaine S. Oran and Jay P. Boris 18 Dec. 1979 30 p refs
(RR0240241)
(AD-A079306; NRL-MR-4131) Avail: NTIS HC A03/MF A01 CSCL 21/2

In this paper, time-dependent results obtained from a simplified but nonlinear analytic similarity solution and a detailed numerical simulation are used to study the relations between the fundamental processes occurring in the very early stages of flame ignition in homogeneous premixed gases. The parameters which may be varied are the composition of the mixture, the initial radius of energy deposition R sub 0, the duration of the heating TAN SUB 0, and the total energy deposited in the system E sub 0. The similarity solution plus the ignition delay times Tau sub c for the fuel-oxidizer mixture as a function of temperature can be used to calculate whether or not a given energy source is adequate to ignite the system. This simple procedure may then be calibrated using the time-dependent NRL detailed reactive flow models. The models include the thermophysical properties of the mixture, a full chemical kinetics scheme, the nonlinear convection of self-consistent fluid dynamics and the matrix molecular diffusion coefficients for the individual species. Results are presented for a selected mixture of H2-O2-N2 for two values of R sub 0 which show that a model must be constructed for a quench volume in order to complete the similarity solution calibration. GRA

N80-20348# Stanford Univ., Calif. Dept. of Mechanical Engineering.
DEVELOPMENT OF COMBUSTION DIAGNOSTICS AND APPLICATIONS TO TURBULENT COMBUSTION Interim Scientific Report, 16 Feb. - 30 Sep. 1979
R. K. Hanson and C. T. Bowman 1979 16 p refs
(Contract F49620-78-C-0026; AF Proj. 2308)
(AD-A079523; AFOSR-79-1320TR) Avail: NTIS HC A02/MF A01 CSCL 21/2

Measurements with a tunable diode laser absorption system have been conducted in steady, fluctuating and sooting atmospher-

ic-pressure flames produced in either a flat flame or a slot burner. Parameters measured include temperature, CO species concentration and CO spectroscopic parameters (line strengths and collision half widths). The measurements involve rapidly scanning the narrow-linewidth diode laser across individual vibration-rotation lines in the fundamental band of CO at 4.6 microns to record fully-resolved absorption line profiles in times as short as 100 microseconds. A conventional microprobe sampling system has been used to monitor CO and CO2 concentrations to enable comparisons between laser-based and conventional probe-based measurements; thermocouples have been used to allow comparisons with laser-based temperature measurements. Results in fuel-rich flames show good agreement between the laser-based and probe-based measurements. Work is in progress to extend the measurements to fuel lean stoichiometries. Work has progressed on assembly and checkout of a new facility for studies of the dynamics of fluctuating or turbulent combustion flows. The facility generates a two-dimensional shear flow which will be used to study the coupling between fluid dynamic and chemical processes in a turbulent mixing layer. GRA

N80-20349# General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.
PROCESSING RESEARCH ON CHEMICALLY VAPOR DEPOSITED SILICON NITRIDE Progress Report, 1 Feb. 1978 - 1 Oct. 1979
R. A. Tanzilli, J. J. Gebhardt, J. Dandrea, C. Dulka, and J. Hanson
Dec. 1979 187 p refs
(Contract N00014-78-C-0107)
(AD-A079328; Rept-79SDR2324) Avail: NTIS
HC A09/MF A01 CSCL 13/8

Processing research during this contract phase has explored the deposition kinetics of silicon nitride with a variety of furnace designs and silicon:nitrogen precursors including variations in the usual thermodynamic variables of pressure, temperature, flow rate and reactant concentrations. Two specific processes have been identified for forming flat plate and figured geometries in a 'hot-wall' reactor. In addition, a set of process conditions have been identified for forming flat plate material of comparable physical properties in a 'cold-wall' reactor at significantly higher deposition rates. GRA

N80-20350# Florida Univ., Gainesville. Dept. of Chemistry.
ATOMIC AND MOLECULAR GAS PHASE SPECTROMETRY Final Scientific Report, 1 Sep. 1975 - 30 Sep. 1979
James D. Winefordner 1979 46 p refs
(Contract F44620-76-C-0005; AF Proj. 2303)
(AD-A079657; AFOSR-79-1315TR) Avail: NTIS
HC A03/MF A01 CSCL 21/2

The research is divided into combustion diagnostics and analytical gas phase atomic and molecular spectrometry. New and improved techniques to spatially and temporally measure flame gas temperatures and species have been and are being developed. These techniques are all based upon fluorescence detection. By measuring the ratio of two fluorescence transitions (in a probe, such as indium) excited with two different wavelengths, the flame temperature can be measured with a precision and accuracy better than 50 K. The two main temperature techniques developed depend upon either the linear relationship between fluorescence and the excitation flux on the approach to saturation of the fluorescence with high excitation fluxes. The measurement of total species concentrations in flames and fluorescence quantum efficiencies is readily performed by measurement of the absolute fluorescence flux reaching a calibrated detector as a function of absolute laser flux. A rather simple graphical method allows both species concentration and species fluorescence quantum efficiencies to be measured. GRA

N80-20351# University of South Florida, Tampa. Coll. of Engineering.
COMBUSTION OF METHANOL COAL SLURRIES IN HARTMANN RESONATOR Final Report, 15 Aug. 1977 - 15 Mar. 1979
S. C. Kranc Mar. 1979 31 p refs
(Grant EF-77-G-01-2744)
(FE-2744-T2) Avail: NTIS HC A03/MF A01

A series of experiments were conducted to determine the combustion characteristics of mixtures of finely pulverized coal suspended in methanol. Such mixtures could be attractive alternate fuels since the advantages of methanol combustion are retained while raising the heating value on a mass basis. A second major aspect of this study was concerned with the development and application of the Hartmann atomizer to deliver the fuel. This is an air atomizer which produces intense gas pulsations that help to disrupt and disperse the fuel. Fuel mixtures using several coal types were tested. The fuels were burned in the wake of a disk baffle incorporating the atomizer and located in a water jacketed flame tube. Measurements of heat deposited in the water jacket and exhaust gas were made. Analysis of the data indicates that the coal suspension compare favorably to pure methanol under test conditions. DOE

N80-20352# Princeton Univ., N. J.
DETAILED MODELING OF DIESEL COMBUSTION
F. V. Bracco 1979 19 p refs Presented at DOT-TSC Conf. on Transportation Diesel Engine Fuel Economy Optimization, Cambridge, Mass., Sep. 1977
(Contract EC-77-S-02-4191)
(CONF-7709196-1) Avail: NTIS HC A02/MF A01

Combustion modeling techniques are considered that are approaching the point of being applicable to diesel engines. Combustion of a quiescent premixed charge in a constant volume bomb is studied. Progressively more complex charge and geometry configuration are then considered that are more and more relevant to diesel engine combustions. DOE

N80-20353# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
CHEMICAL KINETIC MODELING FOR COMBUSTION APPLICATIONS
F. L. Dryer and C. K. Westbrook Sep. 1979 45 p refs Presented at AGARD Propulsion and Energetics Panel Specialists Meeting on Combustion Modelling, Cologne, 27 Sep. 1979 Prepared in cooperation with Lawrence Livermore Lab., Calif.
(Contract W-7405-eng-48)
(UCRL-81777; CONF-790952-1) Avail: NTIS
HC A03/MF A01

The construction of detailed reaction mechanisms for the oxidation of typical hydrocarbon fuels, and the validation of these mechanisms through careful comparison between computed and experimental data are discussed. The derivation and validation of appropriate simplified reaction schemes for practical fuels are presented. The techniques involved in the development of both types of models are described and the results produced by each model are compared. DOE

N80-20354# California Univ., Berkeley. Lawrence Berkeley Lab.
TIME RESOLVED SPECTROSCOPY USING SYNCHROTRON RADIATION Ph.D. Thesis
E. D. Poliakoff Aug. 1979 112 p refs
(Contract W-7405-eng-48)
(LBL-9475) Avail: NTIS HC A06/MF A01

The use of synchrotron radiation for spectroscopic studies of the dynamic processes occurring in gas phase systems is discussed. A number of synchrotron radiation experiments are described with the majority concerned with the time dependent radiative decay of excited states following pulsed photon excitation. The properties of synchrotron radiation are reviewed and radiative fluorescent decay is discussed. Atomic lifetime measurements are reported and fragment radiative lifetimes following photodissociation are examined. Polarization of fragment fluorescence, to determine excited state electronic symmetry of dissociative surfaces, is described and fast fluorescence timing measurements to determine the excited state lifetimes of Kr and Xe are discussed. A.W.H.

N80-20355# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
DEVELOPMENT AND APPLICATION OF THE ELECTRO-CHEMICAL ETCHING TECHNIQUE Annual Progress Report
Aug. 1979 57 p refs
(Contract EY-76-S-05-4814)
(ORO-4814-T1) Avail: NTIS HC A04/MF A01

Advances in the development and application of the electrochemical etching technique for thermal and epithermal neutron dosimetry as well as track geometry determinations are discussed. The bulk and track etching rates were studied by evaluating the track geometry during electrochemical etching. The foil surface removed versus etching time for two different etchants at 1000 V, 2 kHz, and 22 C were studied. Results indicated that the bulk etching rates were constant for the two etchants. The track etching rate (as contrasted with the bulk etching rate) is determined by the microscope focus at various depths. The increase of track depth values as a function of etching time for the two etchants are plotted. The track cone angles were determined and found to be much larger for electrochemically etched polycarbonate foils than for most plastics etched with passive chemical techniques. DOE

N80-20356# Geological Survey, Lakewood, Colo. Water Resources Div.
DETERMINATION OF SELECTED ANIONS IN WATER BY ION CHROMATOGRAPHY Final Report, Mar. 1978 - Jun. 1979
Marvin J. Fishman and Grace Pyen Sep. 1979 37 p refs
(PB80-111941; USGS/WRI-79-101; USGS/WRD/WRI-79/083) Avail: NTIS HC A03/MF A01 CSCL 07D

Ion chromatography was used to determine the major anions in rain water and surface waters. Simultaneous analyses of a single sample for bromide, chloride, fluoride, nitrate, nitrite, orthophosphate, and sulfate are discussed. Chloride, nitrate, nitrite, orthophosphate, and sulfate, in several samples, were determined independently by automated calorimetric procedures. An automated ion selective electrode method used to determine fluoride is described. The results were compared. GRA

N80-20357# Universal Oil Products Co., San Diego, Calif. Fluid Systems Div.
RESEARCH AND DEVELOPMENT ON A SPIRAL-WOUND MEMBRANE SYSTEM FOR SINGLE-STAGE SEAWATER DESALINATION Final Report
R. L. Riley and C. E. Milstead 31 Oct. 1979 298 p refs
(Contract DI-14-34-0001-7543)
(PB80-114705; W80-01252; OWRT-S-0098(7543)(1)) Avail: NTIS HC A13/MF A01 CSCL 07D

The development of a spiral wound membrane system which approaches theoretical semipermeability and is sufficiently thin to provide transport of water at practical operating pressures and recovery rates for the single stage desalinization of sea water is reported. The thin film composite membranes are based on nitrogen containing polymers supported on a fabric reinforced porous supporting membrane. Tests on the membrane elements are described which determined the stability of the elements as functions of feed temperature, water recovery, dissolved oxygen, and cleaning techniques. Experience with the design, construction, installation, and operation of a reverse osmosis system which utilizes the spiral wound membrane elements is discussed. A.W.H.

N80-20358# TRW Space Technology Labs., Redondo Beach, Calif.
EVALUATION OF SENSITIZED FLUORESCENCE FOR POLYNUCLEAR AROMATIC HYDROCARBON DETECTION Final Report, Jan. - Jun. 1979
T. R. Smith Aug. 1979 47 p ref
(Contract EPA-68-02-2689)
(PB80-108475; EPA-600/7-79-207) Avail: NTIS HC A03/MF A01 CSCL 07D

An evaluation of a fluorescent spot test for detecting the presence of polynuclear aromatic hydrocarbons (PAHs) as a screening technique for samples to be analyzed by gas chromatography/mass spectrometry (GC/MS) is discussed. The test is based on the phenomenon of sensitized fluorescence and is capable of easily detecting 100 picograms of PAH in a microliter sample, a level of sensitivity adequate for screening combustion effluent samples. Two interferences were observed: highly colored samples require dilution to allow viewing of the fluorescence level, and samples containing substantial amounts of phthalate esters produce false positive results. GRA

N80-20359# Bureau of Mines, Washington, D. C. Div. of Nonmetallic Materials.
PERLITE: MINERAL COMMODITY PROFILES
Arthur C. Meisinger Aug. 1979 20 p refs
(PB80-111362) Avail: NTIS HC A02/MF A01 CSCL 08I

A glossy volcanic rock, perlite expands to about 20 times its original volume when heated to an appropriate temperature within its softening range. The resultant expanded product finds a variety of industrial and constructional applications owing to the material's low density with attendant properties of low thermal conductivity and high sound absorption. The United States is the world's principal producer and consumer of perlite. Industry structure, uses, reserves-resources, technology, supply-demand relationships, economic factors, and problems, operating factors and problems, and outlook to 2000 are discussed. GRA

N80-20360# Tennessee Valley Authority, Muscle Shoals, Ala. Air Quality Research Section.
DESIGN OF PHOTOCHEMICAL REACTION CHAMBER
L. Stockburger, III and J. F. Meagher Jul. 1979 39 p refs
(PB80-100654; TVA/ONR-79/02) Avail: NTIS HC A03/MF A01 CSCL 14B

A 1100 cu ft Teflon photochemical reaction chamber was constructed to study chemical reactions that occur in dilute coal fired power plant plumes. The design and characterization of the chamber are discussed. The experiments which are to be conducted under controlled conditions to study the gaseous and gas particulate reactions using actual flue gas under solar or simulated solar conditions are described. A.W.H.

N80-20361# Bureau of Mines, Washington, D. C.
BISMUTH: MINERAL COMMODITY PROFILES, AUGUST 1979
James F. Carlin Aug. 1979 17 p refs
(PB80-111438) Avail: NTIS HC A02/MF A01 CSCL 08I

Bismuth metal, produced primarily as a byproduct from the ores of other metals, principally copper and lead, is examined. The industry structure, uses, reserves-resources, technology, supply-demand relationships, byproducts and coproducts, strategic considerations, economic factors and problems, operation factors and problems, and outlook to the year 2000 for bismuth are topics addressed. GRA

N80-20362# Bureau of Mines, Washington, D. C.
CADMIUM
John M. Lucas Aug. 1979 20 p refs
(PB80-111420) Avail: NTIS HC A02/MF A01 CSCL 08I

Comprehensive data on cadmium are presented. Included are the following: industry structure; uses; reserves-resources; technology; supply-demand relationships; strategic considerations; economic factors and problems, environmental considerations (toxicity); operating factors and problems; and outlook to 2000. GRA

N80-20363# Clark Coll., Atlanta, Ga. Dept. of Physics.
VAPOR PRESSURE AND MELTING BEHAVIOR OF SULFURIC ACID-WATER SYSTEMS Final Report, Nov. 1974 - Aug. 1977
G. Raymond Brown and V. Rao Veluri Aug. 1979 30 p refs
(Grant EPA-R-804470)
(PB80-116007; EPA-600/3-79-077) Avail: NTIS HC A03/MF A01 CSCL 14B

Apparatus was designed and constructed to use high vacuum and mass spectrometric techniques to determine total and partial vapor pressures above bulk liquid samples in the temperature range between -65 C and 25 C. Observations on the sulfuric acid-water system revealed complexities which interfered with the experimental goal, but which are of some interest in themselves. These interfering processes included long internal thermal relaxation times and chemical reactions. A pressure effect was observed on the melting curve of the sulfuric acid-water mixtures. GRA

N80-20364# National Bureau of Standards, Washington, D.C. National Engineering Lab.
PURELY BUOYANT DIFFUSION FLAMES: SOME EXPERIMENTAL RESULTS Final Report
Bernard J. McCaffrey Oct. 1979 52 p refs

(PB80-112113; NBSIR-79-1910) Avail: NTIS HC A04/MF A01 CSCL 21B

Measurements of temperature and velocity using thermocouples and an impact probe were made in the near field of a purely buoyant diffusion flame produced by a porous refractory burner. Based on the time averaged center line value of V and delta T together with photographic records the flame was divided into three distinct regimes: (1) a continuous flame region, starting from the surface of the burner with Y equal to zero at the surface and rising with the height above the burner, Z to the 1/2 power, delta T is constant over this regime. Higher up is (2), an intermittent regime, with pulsating flame exhibiting approximately constant V and delta T tailing with z to the first power. Still higher is (3), the plume region which is most of the time, free of flames as predicted by conventional plume theory. Throughout the three regimes and indistinguishable among these was the consistency of the buoyancy relation. GRA

N80-20365# National Bureau of Standards, Boulder, Colo. National Engineering Lab.

NORMAL BUTANE: PROVISIONAL THERMODYNAMIC FUNCTIONS FROM 135 TO 700 K AT PRESSURES TO 700 BAR

Robert D. Goodwin Washington, D.C. Dept. of Commerce Sep. 1979 172 p refs Sponsored in part by Gas Research Inst.

(PB80-118193; NBSIR-79-1621) Avail: NTIS HC A08/MF A01 CSCL 07D

Thermophysical properties of n-butane are tabulated at integral temperatures along isobars over the entire range of fluid states. Results for the compressed liquid, from the triple to the boiling point, were estimated using the highly constrained, nonanalytic equation of state, because experimental P-rho-T data are lacking in this region. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion, and metallurgy.

N80-20366 British Library Lending Div., Boston Spa (England).

TESTING THE CORROSION PROTECTION PROPERTIES OF COATINGS BY MEANS OF PULSED DIRECT CURRENT

E. Babel Oct. 1979 19 p refs Transl. into ENGLISH from Plaste und Kautschuk (East Germany), v. 18, no. 12, 1971 p 931-935

(BLL-RTS-11872) Avail: British Library Lending Div., Boston Spa, England

Lacquered test pieces were connected as anodes in a measurement cell containing pure aerated water with a counter-electrode and were subjected to a low dc voltage with a low pulse frequency. The alternation between interruptions in the current and current impulses in the presence of water and atmospheric oxygen produced a concentrated stress equivalent to years of weathering. Resistance-time curves were determined from changes in the current flow, yielding information on the mechanism of corrosion and allowing conclusions to be drawn about the corrosion properties of protective systems on the basis of their specific overall resistance. Information on deficiencies in formulation can be obtained from the nature, size and number of blisters formed and the corrosion products produced. Blister formation also provides information on the watertightness of the protective film. If coatings are applied without defects then the measured results are largely independent of subjective assessments. A.R.H.

N80-20367 Missouri Univ. - Columbia.

APPLICATION OF INELASTIC ELECTRON TUNNELING SPECTROSCOPY TO THE STUDY OF INHIBITION OF ALUMINUM CORROSION Ph.D. Thesis

Recai Mehmet Ellialtiouglu 1979 113 p

Avail: Univ. Microfilms Order No. 8007146

Inelastic electron tunneling spectra contained peaks associated with all of the intermediate and final products which have been suggested in the free radical mechanism for corrosion of aluminum in CCl_4. The inhibitor molecule, formamide, in CCl_4 solution was found to preferentially adsorb on the aluminum oxide surface, suggesting that the inhibition mechanism is surface passivation rather than alteration of the corrosive medium. From the spectra of formamide and its deuterated derivatitives information was obtained on the identity of the adsorbed surface reacted specie, its orientation with respect to the oxide surface, the types of active sites involved, and the nature of the bonding between the oxide and the adsorbate. A model for the mechanism of inhibition by formamide is suggested. Dissert. Abstr.

N80-20368 Stanford Univ., Calif.

SUBGRAIN REFINEMENT STRENGTHENING IN STAINLESS STEEL ALLOYS Ph.D. Thesis

Rodney Henry Klundt 1979 265 p

Avail: Univ. Microfilms Order No. 8006320

The influence of subgrains on the elevated temperature deformation behavior of E-Brite 26-1, HT-9, DTO2 and Type 304 stainless steel was investigated. Tests were performed in both compression and torsion. The torsion tests allowed very large strains to be achieved under constant strain rate conditions. Each torsion sample was quenched under load when the test was completed to capture the substructure present during deformation. The quenched structures were evaluated by transmission electron microscopy to correlate the substructural characteristics with the test parameters. Strain-rate-change tests were conducted in compression to determine the degree of strengthening that could be achieved through subgrain refinement. Results are examined for each alloy. Dissert. Abstr.

N80-20369 Stanford Univ., Calif.

LARGE-STRAIN DEFORMATION OF A MILD STEEL AT INTERMEDIATE TEMPERATURES Ph.D. Thesis

David Lee Bourell 1979 250 p

Avail: Univ. Microfilms Order No. 8006293

Commercial grade, 1020 steel was warm rolled below the A1 transformation temperature in a multistep process. A substructure was developed by warm rolling, as evidenced by fine subgrains with high dislocation densities. The subgrain size was independent of warm-working strain, and increased with an increase in warm-working temperature. The room-temperature tensile properties were affected by warm working. The impact behavior is influenced by the crystallographic alignment of weak, cleavage planes in the rolling plane. A qualitative model is used to explain the appearance of cleavage separations, their absence at ambient test temperatures, and the propagation of the main crack in a ductile manner at test temperatures as low as -90 C. Tension testing of warm-worked steels at elevated temperatures revealed that steady-state plastic flow was not attained until strains of about 0.3. Prior warm working appears to have little effect on steady-state plastic flow. Dissert. Abstr.

N80-20370*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

AN EXPERIMENTAL, LOW-COST, SILICON-ALUMINIDE HIGH-TEMPERATURE COATING FOR SUPERALLOYS

Stanley G. Young and Daniel L. Deadmore 1980 16 p refs To be presented at the Intern. Conf. on Metal Coatings, San Diego, Calif., 21-25 Apr. 1980, sponsored by the Am. Vacuum Soc.

(NASA-TM-81455, E-385) Avail: NTIS HC A02/MF A01 CSCL 11F

An evaluation of a duplex silicon-slurry/aluminide coating is presented. The coating is cyclically tested in Mach 1 combustion gases for oxidation and thermal fatigue resistance at 1093 C and in Mach 0.3 gases for hot-corrosion resistance at 900 C. The base metal superalloys are ViA and B-1900. The coated B-1900 specimens performed much better in oxidation than similar specimens coated with aluminides and almost as well as the more expensive Pt-Al and MCrAlY (where M is Ni and/or Co) coatings deposited by the physical vapor deposition process. The coating also provided good hot corrosion protection. Metallographic, X-ray, and electron microprobe studies are used to characterize the coating, determine failure mechanisms, and study some of the changes due to exposure. M.G.

N80-20371# Army Materials and Mechanics Research Center, Watertown, Mass. Polymer Research Div.

RELIABILITY OF ENERGY DISPERSIVE X-RAY FLUORES-

CENCE ANALYSIS OF LOW-ALLOY STEELS
Bernard H. Strauss and Frederick P. Valente Jun. 1979 25 p
Presented at Denver X-ray Conf., Denver, 1977
(AD-A077154; AMMRC-TR-79-35) Avail: NTIS
HC A02/MF A01 CSCL 11/6

The reliability of energy dispersive X-ray fluorescence data for the analysis of low-alloy steels is reported for chromium, manganese, nickel, and molybdenum. The accuracy and precision of the analysis were evaluated for two mathematical models, linear and multiple regression, using twelve NBS standard reference samples. GRA

N80-20372# Rutgers - The State Univ., Piscataway, N. J. Dept. of Mechanics and Materials Science.
X-RAY ANALYSIS OF ACCRUED DAMAGE IN STRESS CORROSION AND CORROSION FATIGUE Interim Technical Report, 1 Dec. 1978 - 30 Nov. 1979
S. Weissmann, R. Yazici, T. Takemoto, T. Tsakalakos, and I. R. Kramer Dec. 1979 30 p refs
(Contract N00014-77-C-0191)
(AD-A078511; ONR-R-2) Avail: NTIS HC A03/MF A01 CSCL 11/6

The defect structure induced in 304 austenitic stainless steel by stress corrosion and in Al 2024 by corrosion fatigue was studied by X-ray rocking curve measurements of the grains and by X-ray Fourier analysis of the line profiles. The surface layer and bulk of the specimens were investigated, and a critical line width parameter corresponding to a critical excess dislocation density was determined that controlled the integrity of the microstructure. Improvements in the speed and efficiency of data collection were made by instrument automation and application of position-sensitive detectors. GRA

N80-20373# Sandia Labs., Livermore, Calif. Materials Development Div.
CORROSION RESISTANCE OF ZINC-LEVEL PLATED U-0.75 Ti
J. W. Dini and H. R. Johnson Sep. 1979 21 p refs
(Contract DE-AC04-76DP-00789; MIPR-T-311-1005)
(AD-A075539; SAND-79-8041) Avail: NTIS
HC A02/MF A01 CSCL 11/6

As part of a program for the U.S. Army directed at improving the corrosion performance of U-0.75 Ti, specimens were coated with Zn-10 Ni alloy electroplate and then subjected to various corrosion tests. This work revealed that the Zn-Ni coatings provided good protection for U-0.75 Ti in salt fog and in non-sealed moist-nitrogen systems. In sealed, moist-nitrogen environments the Zn-Ni coatings deteriorated quickly and provided no protection. Some plating with Zn alone, using some of the new non-cyanide plating solutions, was also attempted, but the results were inconsistent. GRA

N80-20374# Franklin Inst. Research Labs., Philadelphia, Pa.
STRESS CORROSION ENVIRONMENTAL EFFECTS ON AF 1410 Final Report, 1 May 1977 - 30 Apr. 1979
Victor V. Damiano 1979 82 p refs
(Grant AF-AFOSR-3341-77; AF Proj. 2307)
(AD-A078598; FIRL-F-C4708-01; AFOSR-79-1288TR) Avail: NTIS HC A05/MF A01 CSCL 13/8

AF 1410 plates available from Universal Cyclops through Air Force Materials Laboratory under contract F33615-73-C-5093 were welded using filler wire fabricated from sheet stock of the same composition as the base plate and from 1/16 inch Dia. weld wire prepared by Universal Cyclop from AF 1410 stock. The method of welding was cold wire-gas tungsten arc using manual feed. Satisfactory welds having mechanical properties as welded approaching the properties of the base plate in the double austenitized and aged condition were obtained. SCC tests demonstrated that nonhomogeneous microstructures in the fusion zone may result in nonuniform crack extension and seriously affect estimates made of the threshold level of stress intensity. GRA

N80-20375# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
ISS/SIMS CHARACTERIZATION OF UV/O SUB 3 CLEANED SURFACES Final Report, Jul. 1978 - Aug. 1979
W. L. Baun Oct. 1979 24 p refs
(AD-A078425; AFML-TR-79-4136) Avail: NTIS
HC A02/MF A01 CSCL 13/8

When solids are irradiated with ultraviolet light from a low pressure mercury discharge tube (UV/03), a complex reaction involving interaction of both photons and ozone produces a cleaning action on the surface. In this work, the efficiency of the UV/O3 method is evaluated using ISS and SIMS. The UV/O3 method is found to be useful for both surface cleaning and storage following cleaning by conventional techniques. GRA

N80-20376# TRW, Inc., Cleveland, Ohio.
CHARACTERIZATION OF CASTING DEFECTS IN TYPICAL CASTINGS OF A DIRECTIONALLY SOLIDIFIED SUPERALLOY Final Report, Oct. 1978 - Dec. 1978
J. M. Marder and C. S. Kortovich Aug. 1979 134 p refs
(Contract F33615-76-C-5373; AF Proj. 7351)
(AD-A077270; AFML-TR-79-4060) Avail: NTIS
HC A07/MF A01 CSCL 13/8

A program was conducted to assess the effects of casting defects in directionally solidified (DS) material. The technical approach involved two tasks, the first including the characterization of typical casting defects in F-100 1st and 2nd stage PWA-1422 production turbine blades and the second including the evaluation of thin sheet test specimens cast deliberately to contain defects. The defects included microshrinkage, inclusions and grain misorientation and represented a range of severity levels including conditions exceeding current production acceptance criteria. The analysis of production castings indicated that substantial decreases in the rejection rate could be achieved with only minor relaxation of the acceptability criteria. In addition, dross inclusions were found to be the single most frequent cause for casting rejections. GRA

N80-20377# Sandia Labs., Livermore, Calif. Materials Development Div.
INFLUENCE OF PURITY LEVEL ON THE MECHANICAL PROPERTIES OF HOT ISOSTATICALLY PRESSED BERYLLIUM
Ben C. Odegard, Jr. Sep. 1979 18 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8232) Avail: NTIS HC A02/MF A01

The procurement of a quantity of ultra-pure beryllium powder combined with special handling from powder to billet form resulted in the fabrication of high purity beryllium. The mechanical properties of these billets were contrasted to those of commercial grade billets to determine the influence of impurities and powder processing. The tensile test results show that the strength values are primarily dependent on the grain size in a behavior predictable by the Hall-Petch relationship. Only a fraction of the strength differential can be attributed to metallic impurities in solution. The grain size is controlled by the powder size distribution. The ductility is dominated by both grain size and oxide content. The fine grained, low oxide billets exhibited the highest ductilities. There is evidence to suggest that oxide distribution has a large influence on the ductility. The fracture toughness was highest for the high purity beryllium billets. DOE

N80-20378# Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF A PROCEDURE FOR ESTIMATING THE HIGH CYCLE FATIQUE STRENGTH OF SOME HIGH TEMPERATURE STRUCTURAL ALLOYS
P. Soo and J. G. Y. Chow 1979 21 p refs Presented at the ASME Winter Annual Meeting, New York, N.Y., 2 Dec. 1979
(Contract EY-76-C-02-0016)
(BNL-NUREG-26085; CONF-791205-5) Avail: NTIS
HC A02/MF A01

An evaluation made of the a test procedure involving a fast cycling rate was (40 Hz) and load controlled conditions. The validity of this procedure for extending current fatigue curves from 10 to the fifth power to 10 to the eighth power cycles and beyond, hinges upon the selection of an appropriate effective strain value, since the strain usually changes rapidly during the early stage of fatigue. Results from annealed 2 1/4 Cr-1 MO, type 304 stainless steel, Incoloy 800H and Hastelloy X, tested over a wide range of temperatures, show that the strain measured N/sub f/2 is a reasonable estimate since it gives an excellent correlation between the strain and load controled test in the 10 to the fifth power cycle range where the data overlap. It is

shown that the differences in cycling rate and early stress-strain history for the two tests do not significantly affect the correlation. It may, therefore, be concluded that such load control test procedures may be used as a valid fast way for extending currently available fatigue curves from 10 cycles, and currently available fatigue curves from 10 to the fifth power and 10 to the eighth power and beyond. DOE

N80-20379# Brown Univ., Providence, R. I. Div. of Engineering.
CORRELATIONS BETWEEN FRACTURE TOUGHNESS AND MICROSTRUCTURE IN 4140 STEEL, MRL E-113 M.S. Thesis
Trond K. Odegaard Jun. 1979 88 p refs
(Contract EY-76-S-02-3084)
(COO-3084-67) Avail: NTIS HC A05/MF A01

Correlations between the microstructure of an ultra high strength steel and material resistance to fracture, as measured by blunt notch Charpy impact tests and sharp crack K/sub IC/ tests, were investigated for a standard 870 C/oil and an experimental 1175 C/oil austenitizing treatment. The increase in sharp crack toughness with higher temperature austenitizing treatments, for the as-quenched and 200 C/oil temper conditions, was rationalized by a fracture criterion based on the notion that for fracture to occur, a critical strain, epsilon/sub f/, must be achieved over some critical distance, delta. The lath colonies were identified as the fracture controlling microstructural unit, and hence, their size was considered to be the critical distance, delta. Fracture toughness differences between the 870 C and 1175 C austenitizing treatments were qualitatively rationalized by the nature of the respective fracture morphologies. Good correspondence between J/sub IC/ and the so-called tearing modulus, T, as indicators of sharp crack fracture toughness, was observed. DOE

N80-20380# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
STRAIN HARDENING OF IRON, AXISYMMETRIC VS PLANE STRAIN ELONGATION
A. Razavi and G. Langford 1979 7 p refs Presented at the Intern. Conf. on the Strength of Metals and Alloys, Aachen, West Germany, Aug. 1979
(Contract EY-76-S-02-4072)
(CONF-790801-5) Avail: NTIS HC A02/MF A01

The flow stress of titanium gettered ferritic iron at high strains is measured for various shape changes including axisymmetric elongation and compression and plane strain elongation, both by symmetrical strip drawing and also by asymmetrical pure shear. The flow stress is evaluated after a complex deformation (such as chip cutting) by simple mechanical tests on portions of the macroscopic specimen. The flow stress and the microstructures are sensitive to the shape change employed. Comparative microstructures are shown in the various shape changes. The rate of strain hardening of body centered cubic iron appears to be sensitive to the deformation mode at high strains because of the different microstructures which may be related to the different crystallographic preferred orientations. It is shown that the internal shape change is not necessarily simply related to the external shape change. DOE

N80-20381# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
NICKEL CONTAMINATED TITANIUM WELD WIRE STUDY
G. R. Coffin and R. L. Sumstine 18 Jul. 1979 20 p
(Contract EY-76-C-07-1570)
(LTR-141-93) Avail: NTIS HC A02/MF A01

Titanium weld wire used to laser weld thermocouples to fuel rods was tested. It was found that the titanium filler wire was contaminated with nickel which was jacketed on the wire prior to the drawing process. A method was developed to inspect all filler wire for welding application. This method not only indicates the presence of nickel contamination but indicates quantity of contamination. The process is capable of the high speed inspection necessary for various high speed manufacturing processes. DOE

N80-20382# Aluminum Co. of America, Alcoa Center, Pa.
PRODUCTION OF ALUMINUM-SILICON ALLOY AND FERROSILICON AND COMMERCIAL PURITY ALUMINUM BY THE DIRECT REDUCTION PROCESS, PHASE B Interim Technical Report, 1 Mar. - 31 May 1979
Marshall J. Bruno Jun. 1979 22 p refs
(Contract EC-77-C-01-5089)
(CONS/5089-7; ITR-3) Avail: NTIS HC A02/MF A01

The effect of volatile sweep rate on bridge formation and product yield was determined. Higher volatile rates resulted in decreased yields and wider zones of condensation in the shaft. Attempts to charge ores and reduction carbon separately produced very low yields of metallic alloy. Remelt tests of reactor alloy products required temperatures of 1900 C for samples high in Ti. Low Ti-containing alloys melted at 1300 C. Operation of the O2 injected, side entry bench reactor was erratic and inconsistent due to formation of chemical burden bridging. Ferrosilicon alloy products containing 2 to 14% Al were made. Tendency for burden bridging was reduced. Cold modeling studies and compressive strength and abrasion resistance tests results are examined as well as those from fractional crystallization and remelt experiments. DOE

N80-20383# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
COMPUTER SIMULATION OF THE MARTENSITE TRANSFORMATION IN A MODEL TWO-DIMENSIONAL BODY
Sheree Chen, A. G. Khachaturyan, and J. W. Morris, Jr. Jun. 1979 7 p refs Presented at the Intern. Conf. on Martensite Transformations, Boston, 24-29 Jun. 1979
(Contract W-7405-eng-48)
(LBL-9346; CONF-7906103-1) Avail: NTIS HC A02/MF A01

An analytical model of a martensitic transformation in an idealized body is constructed and used to carry out a computer simulation of the transformation in a pseudo two dimensional crystal. The reaction is assumed to proceed through the sequential transformation of elementary volumes (elementary martensitic particles) via the Bain strain. The elastic interaction between these volumes is computed and the transformation path chosen so as to minimize the total free energy. The model transformation shows interesting qualitative correspondencies with the known features of martensitic transformations in typical solids. DOE

N80-20384# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
EFFECT OF HEAT TREATMENT ON FRACTURE OF TYPE 304L STAINLESS STEEL IN A HYDROGEN ENVIRONMENT
G. R. Caskey, Jr. and J. A. Donovan 1979 19 p Presented at the TMS-AIME Fall Meeting, Milwaukee, 16-20 Sep. 1979
(Contract EY-76-C-09-0001)
(DP-MS-79-18; CONF-790910-3) Avail: NTIS HC A02/MF A01

Thermal treatments significantly effect the mechanical behavior of Type 304L stainless steel tested in a high-pressure (69 MPa) hydrogen environment. A grain size increase from 10 to 350 micron m increased susceptibility to hydrogen damage and accentuated changes in fracture morphology. The Hall-Petch relation for yield strength was the same for tests in both hydrogen and helium environments. Sensitization increased ductility loss in hydrogen but did not change the fracture mode of smooth bar tensile specimens. Variation in quench rate from 0.25 to 50 K/sec had only a minor influence on susceptibility of hydrogen embrittlement. The absence of an abrupt load drop at fracture and change in fracture morphology for tests in high pressure hydrogen indicate that fracture initiated at or near the surface and rapidly propagated inward. DOE

N80-20385# Illinois Univ., Urbana. Graduate Coll.
ANALYTICAL ELECTRON MICROSCOPE STUDY OF THE OMEGA PHASE TRANSFORMATION IN A ZIRCONIUM-NIOBIUM ALLOY Ph.D. Thesis
Nestor John Zaluzec 1979 352 p
(Contract EY-76-C-02-1198)
(COO-1198-1279) Avail: NTIS HC A16/MF A01

Examination of the as-quenched omega phase morphology shows that the domain size of Zr-15% Nb is on the order of 30 A. No alignment of omega domains along < 222 > beta directions was observed and samples having undergone thermal cycling in thin foil form did not develop a long-period structure

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of alternating beta and omega phases below the omega transformation temperature. DOE

N80-20386# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FATIGUE CRACK PROPAGATION IN HASTELLOY X WELD METAL
T. Weerasooriya Nov. 1979 24 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6999) Avail: NTIS HC A02/MF A01

The fatigue crack growth rate of Hastelloy X weld metal increased with stress intensity, temperature, and inverse frequency. The results were correlated with the equation da/dN = (delta K)/sup n/, for constant frequency or constant temperature. The values of A and n were computed with a linear regression algorithm. With decreasing frequency at constant delta K and constant temperature (538 C) fatigue crack growth rates approach an upper limit. Fatigue crack growth rate of the weld metal was lower than that reported for base metal at 538 C and lower at 649 C for a frequency of 1 Hz. DOE

N80-20387# Argonne National Lab., Ill.
GRAIN-BOUNDARY DIFFUSION: STRUCTURAL EFFECTS, MODELS AND MECHANISMS
N. L. Peterson 1979 59 p refs Presented at the Am. Soc. of Metals Seminar, Milwaukee, 15-16 Sep. 1979
(Contract W-31-109-eng-38)
(CONF-7909100-1) Avail: NTIS HC A04/MF A01

Anisotropy, effect of orientation, crystallographic transformation, boundary type, dislocation dissociation, pressure, and isotope effects were considered. Diffusivity is different for various boundaries. Dissociated dislocation and stacking faults are not efficient paths for grain boundary diffusion. Results suggest a vacancy mechanism along the dislocation core, and involves atomic jumps away from the back towards the dislocation as well as jumps along the core. Measurements were made on nickel and silver. DOE

N80-20388# Lehigh Univ., Bethlehem, Pa.
PRESSURE SINTERING AND CREEP DEFORMATION: A JOINT MODELING APPROACH Progress Report, 1 Jan. - 31 Dec. 1979
M. R. Notis Oct. 1979 22 p refs
(Contract EY-76-S-02-2408)
(COO-2408-6) Avail: NTIS HC A02/MF A01

Work related to microchemical and microstructural aspects of the joint modeling of pressure sintering and creep in ceramic oxides is reported. Quantitative techniques for the microchemical analysis of ceramic oxides and for the examination of impurity segregation effects in polycrystalline ceramic materials were developed. This has included fundamental absorption corrections for the oxygen anion species as a function of foil thickness. The evolution in microstructure during the transition from intermediate stage to final stage densification during hot pressing of cobalt oxide and preliminary studies with doped oxides were studied. DOE

N80-20389# California Univ., Livermore. Lawrence Livermore Lab.
BLACK CHROME OUTGASSING STUDY
Tom Beat 1979 15 p Presented at the Integrated Contractor Conf., Oak Ridge, Tenn., 25-27 Sep. 1979
(Contract W-7405-eng-48)
(UCRL-82797) Avail: NTIS HC A02/MF A01

The outgassing of black chromium was studied in order to establish the vacuum outgassing characteristics for the pumping speed requirements. The method and equipment employed to conduct the outgassing studies are described along with the samples of black chromium used. The outgassing was studied under three conditions: (1) at ambient temperature, (2) at 350 C, and (3) at ambient temperature after the 350 C bake. The results are presented. A.W.H.

N80-20390# Battelle Pacific Northwest Labs., Richland, Wash.
CRYSTALLIZATION AND IRRADIATION EFFECTS IN AN AMORPHOUS ALLOY OF TYPE Fe40Ni38Mo4B18
N. Azam, L. LeNaour, C. Rivera, P. Grosjean, P. Sacovy, and J. Delaplace 1979 16 p refs Transl. into ENGLISH from J. Nucl. Mater. (Netherlands), v. 83, 1979 p 298-304
(PNL-TR-372) Avail: NTIS HC A02/MF A01

The structure of an amorphous alloy of the composition Fe40Ni38Mo4B18 either in the untreated fabricated state, or after various thermal treatments, or after irradiation with heavy ions is studied. The amorphous state is not modified by heat treatments at temperatures below 300 C. After several hours at 350 C, crystallization begins by forming crystals of an FeNi-base solid solution. The crystallization is complete after a two hour treatment at 500 C. This alloy, bombarded with 500 keV Ni(+) ions, proved to be practically insensitive to irradiation at the ambient temperature at high doses (6 x 10 to the 18th power ions/sq cm, i.e., approximately 100 dpa). A 100 to 150 C lowering of the crystallization temperature is observed under irradiation. DOE

N80-20391# Massachusetts Inst. of Tech., Cambridge. Corrosion Lab.
THE EFFECT OF PLASTIC DEFORMATION ON THE TRANSPORT OF HYDROGEN IN NICKEL
M. Kurkela and R. M. Latanision Sep. 1979 9 p refs Submitted for publication
(Contract N00014-78-C-0002; NR Proj. 036-127)
(AD-A077660; TR-3) Avail: NTIS HC A02/MF A01 CSCL 11/6

The permeation of hydrogen into crystalline metals may occur in part by lattice diffusion, by grain boundary, or other short circuit diffusion, or, in the case of specimens undergoing plastic deformation, by dislocation transport. In this work, electrochemical permeation measurements indicate that the apparent diffusivity of hydrogen is increased by several orders of magnitude when permeation specimens are plastically deformed and simultaneously charged with hydrogen. GRA

N80-20392# Bureau of Mines, Washington, D. C. Div. of Ferrous Metals.
MOLYBDENUM: MINERAL COMMODITY PROFILES
John T. Kummer May 1979 30 p refs
(PB80-110885) Avail: NTIS HC A03/MF A01 CSCL 08I

A refractory metallic element used principally as an alloying agent in steels, cast irons, and superalloys to enhance hardenability, strength, toughness, and wear and corrosion resistance, molybdenum is primarily added in the form of molybdic oxide or ferromolybdenum. It is frequently used in combination with chromium, columbium, manganese, nickel, tungsten, or other alloy metals to achieve desired metallurgical properties. Data presented include industry structure, uses, reserves-resources, technology, supply-demand relationships, byproducts and coproducts, strategic considerations, economic factors and problems, operating factors and problems, and outlook to 2000. GRA

N80-20393# Office of Technology Assessment, Washington, D. C.
TECHNICAL OPTIONS FOR CONSERVATION OF METALS: CASE STUDIES OF SELECTED METALS AND PRODUCTS
Sep. 1979 128 p
(PB80-102619; OTA-M-97; LC-79-600172) Avail: NTIS HC A07/MF A01 CSCL 11F

The kinds and amounts of waste that occur in this nation's use of eight critical metals and the technical options for reducing that waste are examined. The eight metals studied are: iron, copper, aluminum, manganese, chromium, nickel, tungsten, and platinum. In their levels of import dependence and in other respects, these metals are a representative sample of commercially important metals. GRA

N80-20394# National Technical Information Service, Springfield, Va.
STRESS CORROSION OF STEEL. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1979
William E. Reed Jan. 1980 306 p Supersedes NTIS/PS-78/1318; NTIS/PS-77/1179; NTIS/PS-76/1048; NTIS/PS-75/785
(PB80-803729; NTIS/PS-78/1318; NTIS/PS-77/1179; NTIS/PS-76/1048; NTIS/PS-75/785) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

The citations cover crack propagation, fracture, tests, surface finishing, working, coatings, deformation, and fatigue in relation

to stress corrosion. The majority of studies in this report are on nuclear reactor, aircraft, and spacecraft materials. Stainless steel stress corrosion is excluded. This updated bibliography contains 299 abstracts, 36 of which are new entries to the previous edition. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-20395 Case Western Reserve Univ., Cleveland, Ohio.
SYNTHESIS, CHARACTERIZATION, AND PROPERTIES OF ISOPRENE-METHYL METHACRYLATE COPOLYMERS Ph.D. Thesis
Alexander Sfirakis. 1979. 231 p.
Avail: Univ. Microfilms. Order No. 8001474

A series of well characterized isoprene-methyl methacrylate copolymers and the corresponding homopolymers were prepared by an emulsion polymerization technique at 50 C using a modified GR-S formulation. An equation was developed relating the glass transition temperature to the density of the copolymer. The dependence of penetrant transport properties on penetrant molecular size and on the composition of the copolymers was investigated along with dynamic mechanical and dielectric properties of the polymers. The knowledge obtained from this investigation is desirable for elucidation of structure property relationships, plasticization phenomena, and any modification of polymer structure induced by the presence of penetrants. Dissert. Abstr.

N80-20396 Washington State Univ., Pullman.
ELECTROCHEMICAL POLYMERIZATION AND DEPOSITION ON CARBON FIBERS Ph.D. Thesis
James Jerome Jakubowski. 1979. 124 p.
Avail: Univ. Microfilms. Order No. 8007240

The electrodic polymerization on carbon fibers of a variety of monomers having different functional groups was investigated. The effect of such polymer coating on the properties of polymer composites prepared from the coated fibers was demonstrated. The electropolymerization of novel monomers was pursued in some detail. In addition to usual vinyl polymerizations, some novel cyclic monomers were identified as capable of producing the desired polymer layer on fibers under appropriate polymerization conditions. In many instances, grafting of the surface polymer to the fiber was observed. Composite specimens were prepared by the incorporation of the coated fibers in an epoxy matrix. It was demonstrated that the effect of electropolymerization on the interfacial properties of the resulting composite was manifested in variations of the measured interlaminar shear and impact strengths of the composite specimens. Other observations are reported. Dissert. Abstr.

N80-20397*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
A FUNDAMENTAL APPROACH TO ADHESION: SYNTHESIS, SURFACE ANALYSIS, THERMODYNAMICS AND MECHANICS Final Report
Ranjani Siriwardane and James P. Wightman. Mar. 1980. 128 p. refs.
(Grant NsG-1124)
(NASA-CR-162903). Avail: NTIS. HC A07/MF A01. CSCL 11A.

The acid-base properties of titanium 6-4 plates (low surface area) were investigated after three different pretreatments, namely Turco, phosphate-fluoride and Pasa-Jell. A series of indicators was used and color changes were detected using diffuse reflectance visible spectroscopy. Electron spectroscopy for chemical analysis was used to examine the indicator on the Ti 6-4 surface. Specular reflectance infra-red spectroscopy was used to study the adsorption of stearic acid from cyclohexane solutions on the Ti 6-4 surface. A.R.H.

N80-20398*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPOSITE WALL CONCEPT FOR HIGH TEMPERATURE TURBINE SHROUDS: SURVEY OF LOW MODULUS STRAIN ISOLATOR MATERIALS
Robert C. Bill, Gordon P. Allen, and Donald W. Wisander. Mar. 1980. 27 p. refs. Presented at the 25th Ann. Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by ASME. Prepared in cooperation with Army Aviation Research and Development Command, Cleveland.
(NASA-TM-81443; AVRADCOM-TR-80-C-7; E-363). Avail: NTIS. HC A03/MF A01. CSCL 11A.

Plasma sprayed yttria stabilized zirconium oxide turbine seal specimens, incorporating various low modulus porous metal strain isolator pads between the zirconium oxide and a dense metal substrate, were subjected to cyclic thermal shock testing. Specimens that had a low modulus pad composed of sintered FeNiCrAlY fibermetal survived 1000 thermal shock cycles without spalling of the ceramic. A figure of merit for the low modulus pad materials taking into consideration the elastic modulus, thermal conductivity, strength, and oxidation resistance of the pad was proposed, and showed reasonable agreement with the thermal shock results. A potential surface distress problem on the zirconium oxide, associated with nonuniform temperature distribution and rapid stress relaxation was identified. One approach to solving the surface distress problem through application of laser surface fusion of the zirconium oxide layer showed some promise, but improvements in the laser surface fusion process are necessary to prevent process associated damage to the ceramic. K.L.

N80-20399# ARO, Inc., Arnold Air Force Station, Tenn.
THERMAL RESPONSE AND REUSABILITY TESTS OF ADVANCED FLEXIBLE REUSABLE SURFACE INSULATION (RSI) AND CERAMIC TITLE RSI SAMPLES AT SURFACE TEMPERATURES TO 1200 DEGREES F Final Report
E. C. Knox. AEDC, Arnold AFS, Tenn. May 1979. 46 p. refs.
(AD-A077887; AEDC-TSR-79-V29). Avail: NTIS. HC A03/MF A01. CSCL 20/13.

The surface analysis of anodes and cathodes from phosphoric acid electrolytes by ion scattering spectrometry (ISS) and secondary ion spectrometry (SIMS) shows that contamination can occur under a variety of conditions. Contamination can occur both during and after anodization and either with or without the electrodes connected. These results point up the dynamic and ever changing character of the anodization process and suggests reasons for poor reproducibility of oxide chemistry and morphology. GRA

N80-20400# California Univ., Los Angeles. Dept. of Materials.
STRUCTURE AND PROPERTIES OF GLASSES Final Report, 1 Oct. 1978 - 30 Sep. 1979
John D. Mackenzie. Nov. 1979. 12 p. refs.
(Grant AF-AFOSR-0019-79; AF Proj. 2303)
(AD-A080071; AFOSR-80-0053TR). Avail: NTIS. HC A02/MF A01. CSCL 11/2.

The elastic modulus of glasses are shown to be affected by ion-exchange because of the loss of unoccupied space in the glass network. The water content of beryllium fluoride glasses affects the ionic content although the fluorine ion is the current carrier because of defects in the glass caused by water. Transparent composites have been prepared by impregnating porous glass with polymethylmethacrylate. GRA

N80-20401# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
X-RAY DIFFRACTION ANALYSIS OF SELECTED PAINT PIGMENTS Final Report, 1975 - 1978
Bill Chapman. Mar. 1979. 97 p. refs.
(PB80-113061; TL-635314; FHWA/CA/TL-79/05). Avail: NTIS. HC A05/MF A01. CSCL 11C.

The use of X-ray diffraction to monitor pigment and filler contents of white and yellow traffic paints was investigated using dried films and extracted pigments. Correlations to titanium dioxide and lead chromate were acceptable. Correlations for talc and calcium carbonate ranged from poor to fair. Some insight into improving these correlations is discussed. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-20402* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ATOMIC HYDROGEN STORAGE Patent

John A. Woollam, inventor (to NASA) Issued 18 Mar. 1980 3 p Filed 29 Sep. 1977 Supersedes N78-19907 (16 - 10, p 1365) Division of U.S. Patent Appl. SN-67432, filed 13 Apr. 1976, US Patent-4,077,788

(NASA-Case-LEW-12081-2; US-Patent-4,193,827; US-Patent-Appl-SN-837794; US-Patent-Class-149-1; US-Patent-Class-423-648R; US-Patent-Appl-SN-676432) Avail: US Patent and Trademark Office CSCL 21D

Atomic hydrogen, for use as a fuel or as an explosive, is stored in the presence of a strong magnetic field in exfoliated layered compounds such as molybdenum disulfide or an elemental layer material such as graphite. The compound is maintained at liquid temperatures and the atomic hydrogen is collected on the surfaces of the layered compound which are exposed during delamination (exfoliation). The strong magnetic field and the low temperature combine to prevent the atoms of hydrogen from recombining to form molecules.

Official Gazette of the U.S. Patent and Trademark Office

N80-20403# Indian Inst. of Science, Bangalore. High Energy Solids Lab.

THERMAL DECOMPOSITION AND COMBUSTION STUDIES ON POTASSIUM PERCHLORATE/POLYSTYRENE PROPELLANT SYSTEMS

K. Kishore, V. R. Pai Verneker, and M. R. Sunitha 12 Jun. 1979 37 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Aug. or Sep. 1980

(Log-J11458) Avail: NTIS HC A03/MF A01

The thermal decomposition (TD) behavior of potassium perchlorate (KP) polystyrene (PS) system was studied in detail as well as the occurance of condensed-phase reactions in KP/PS propellant combustion. The TD and Combustion behavior of KP/PS propellant system was compared to that of ammonium perclorate/PS. Significant results are reported. R.C.T.

N80-20404*# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.

EXPERIMENTAL LABORATORY MEASUREMENT OF THERMOPHYSICAL PROPERTIES OF SELECTED COAL TYPES Final Report

William G. Lloyd 13 Sep. 1979 113 p refs Prepared for JPL

(Contracts NAS7-100; JPL-955381)

(NASA-CR-162913; JPL-9950-317) Avail: NTIS HC A06/MF A01 CSCL 21D

A number of bituminous coals of moderate to high plasticity were examined, along with portions of their extrudates from the JPL 1.5-inch 850 F screw extruder. Portions of the condensed pyrolysis liquids released during extrusion, and of the gaseous products formed during extrusion were also analyzed. In addition to the traditional determinations, the coals and extrudates were examined in terms of microstructure (especially extractable fractions), thermal analysis (especially that associated with the plastic state), and reactivity towards thermal and catalyzed hydroliquefaction. The process of extrusion increases the fixed carbon content of coals by about 5% and tends to increase the surface area. Coals containing 25% or more DMF-extractable material show an increase in extractables as a result of extrusion; those initially containing less than 20% extractables show a decrease as a result of extrusion. Both the raw and extruded samples of Kentucky no. 9 coal are highly reactive towards hydroliquefaction, undergoing conversions of 75 to 80% in 15 min and 85-94% in 60 min in a stirred clave. A.R.H.

N80-20405# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

EVALUATION OF FUEL CHARACTER EFFECTS ON THE F101 ENGINE COMBUSTION SYSTEM Final Report, 1 Aug. 1977 - 30 Sep. 1978

O. C. Gleason, T. L. Oller, M. W. Shayeson, and D. W. Bahr Jun. 1979 200 p refs

(Contract F33615-77-C-2043; AF Proj. 3048)

(AD-A077860; R79AEG405; AFAPL-TR-79-2018; CEEDO-TR-79-07) Avail: NTIS HC A09/MF A01 CSCL 21/4

Results of a program to determine the effects of broad variations in fuel properties on the performance, emissions and durability of the General Electric F101 augmented turbofan engine main combustion system are presented. Combustor rig tests conducted at engine idle, takeoff, cruise, dash, cold day ground start and altitude relight operating conditions with 13 different fuels are described. Fuel nozzle fouling tests conducted with the same fuels are also described. The test fuels covered a range of hydrogen contents (12.0 to 14.5%), aromatic type (monocyclic and bicyclic), initial boiling point (285 to 393 K), final boiling point (552 to 679 K) and viscosity (0.83 to 3.25 millimeters 2/s at 300 K). At high power conditions, fuel hydrogen content was found to have a very significant effect on liner temperature, smoke, and NOx levels. While smoke levels decreased with increasing hydrogen content, the levels were very low with all the fuels. At idle conditions, CO and HC levels correlated with fuel atomization/volatility parameters, but showed no relationship to hydrogen content. Cold day ground start and altitude relight also correlated with fuel atomization/volatility parameters, but showed no dependence on hydrogen content. Combustor liner life analyses yielded relative life predictions of 1.00, 0.72, 0.52, and 0.47 for fuel hydrogen contents of 14.5, 14.0, 13.0, and 12.0 percent, respectively. At the present state of turbine stator development, no fuel effect on life is predicted. Extended cyclic fuel nozzle valve gumming tests revealed significant effects of fuel type and temperature on nozzle life. The results correlated with laboratory thermal stability ratings of the fuels based on tube deposits alone. GRA

N80-20406# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapons Systems Lab.

TNT EQUIVALENCY OF BENITE PROPELLANT

M. F. Leondi and J. P. Chaltagirone Aug. 1979 56 p

(AD-A077108; AD-E400354; ARLCD-TR-79017) Avail: NTIS HC A04/MF A01 CSCL 19/1

In support of the Army-wide modernization program, the Manufacturing Technology Div of the U.S. Army Armament Research and Development Command developed design standards for structures required to withstand the effects of an explosion. The use of these standards--in a safe and cost effective manner--requires that the airblast characteristics of the energetic materials used by the Army be empirically determined. Since the air blast capabilities of Benite propellant are not available in the current literature, a TNT equivalency test program was initiated. Its objective was to determine the maximum airblast output from detonation of Benite propellant in terms of peak pressure and positive impulse compared to known characteristics of a hemishperical surface burst of TNT. Peak side-on blast overpressure and scaled positive impulse were measured for Benite propellant, using configurations that simulate the handling of bulk material during processing and shipment. Quantities of 10.43 and 41.8 kg were tested in orthorhombic shipping containers and fiberboard boxes. TNT equivalency values for each test series were obtained as a function of scaled distance by comparison to known pressure, arrival time, and impulse characteristics for hemispherical TNT surface bursts. Pressure and impulse equivalencies were found to be less than 65% for all quantities tested. GRA

N80-20407# Chevron Research Co., Richmond, Calif.

REFINING AND UPGRADING OF SYNFUELS FROM COAL AND OIL SHALES BY ADVANCED CATALYTIC PROCESSES Quarterly Report, Jan. - Mar. 1979

R. F. Sullivan Apr. 1979 41 p

(Contract EX-76-C-01-2315)

(FE-2315-37) Avail: NTIS HC A03/MF A01

Pilot plant tests on the hydrotreating of SRC-2 process product indicate that this coal-derived feed is suitable for refining using advanced commercial petroleum processing technology. Nitrogen

in the whole SRC-2 process product can be reduced to a concentration of less than 0.5 ppM in a single catalytic stage. Sulfur and oxygen can also be reduced to low levels; and at high severity, most of the aromatic compounds are converted to naphthenes. As the processing severity is decreased, product nitrogen increases and the product becomes more aromatic. In the latter case, further hydrotreating of the naphtha is required before it can be fed to the second stage of a catalytic reformer. Depending on the severity employed, the jet boiling range product must be further hydrogenated for specification jet fuel. Experiments were made to determine appropriate conditions for these processing steps. DOE

N80-20408# Naval Research Lab., Washington, D. C. Radiation Technology Div.
THERMAL INITIATION OF HIGH EXPLOSIVES WITH AN ELECTRON BEAM Final Report
A. Stolovy, E. C. Jones, Jr., J. B. Aviles, Jr., and A. I. Namenson 8 Nov. 1979 13 p refs
(RR0120141)
(AD-A077535; AD-E000338; NRL-8350) Avail: NTIS HC A08/MF A01 CSCL 19/1

The condition under which high explosives undergo thermal initiation were studied under dynamic conditions by measuring the temperature of samples while they were irradiated by 40 MeV electrons at the NRL Linac. Values were obtained for the thermal initiation threshold and the explosion temperature for the following high explosives: Composition B, TATB, HBX-1, PBX-9404 and Pentolite. Theoretical values based upon a single rate Arrhenius formula are in reasonable agreement with the experimental results. GRA

N80-20409# Atlantic Research Corp., Alexandria, Va. Research and Technology Div.
EXPERIMENTAL AND ANALYTICAL STUDY OF EROSIVE BURNING OF SOLID PROPELLANTS Annual Report, 1 Oct. 1978 - 30 Sep. 1979
Merrill K. King, Robert Beddini, Mohan Razdan, and Kenneth Kuo Nov. 1979 44 p refs
(Contract F49620-78-C-0016; AF Proj. 2308)
(AD-A079618; AFOSR-79-1323TR) Avail: NTIS HC A03/MF A01 CSCL 21/9

At Atlantic Research, erosive burning characteristics of eleven composite propellants were measured and found to agree well with predictions of a simplified first-generation model under most conditions. A second-generation more fundamental model for predicting burning rate versus pressure and cross flow velocity, given only compositional data, also yield predictions in close agreement with data. The most important parameter affecting crossflow sensitivity was no-cross flow burning rate, erosion sensitivity decreasing with increasing base rate. ARAP completed modifications to its SPEC model to enable calculation of cylindrical flows and performed preliminary evaluation for cold-flow simulations and erosive burning. Motor port diameter was identified as a key erosive burning scaling parameter through its effect on threshold conditions, and a simplified scaling relation was developed and verified. In addition, ARAP investigated the effects of combustion-turbulence interaction on predicted erosive burning. Penn State measured erosive burning rates of three AP-composite formulations in a device designed to give a well-defined turbulent boundary layer. The data agreed well with predictions made using a Penn State model based on a 2D turbulent boundary layer approach. Correlations relating burning rate to free stream velocity, and pressure were developed. The model was also extended to axisymmetric cylindrical port flow. GRA

N80-20410# Department of Energy, Bartlesville, Okla. Energy Technology Center.
THERMODYNAMICS OF ORGANIC COMPOUNDS Final Technical Summary Report, 1 oct. 1978- 30 Sep. 1979
William D. Good, Donald W. Scott, Norris K. Smith, Susan Lee-Bechtold, and Ann G. Osborn 1979 19 p refs
(AFOSR ISSA 79-0007; AF Proj. 2308)
(AD-A080072; AFOSR-80-0076TR) Avail: NTIS HC A02/MF A01 CSCL 21/4

Measurements were completed of the enthalpy of combustion of the ramjet fuel RJ-6. Measurements of the enthalpy of combustion of hexacyclic exo,exo-dihydrodinorbornadiene, hexacyclic endo,endo-dihydrodinorbornadiene and exo-tetrahydrodicyclopentadiene are in progress. Vapor pressure measurements were made on exo-tetrahydrodicyclopentadiene. Synthesis and purification of alkylindans and alkylnaphthalenes with high steric interactions continue at Oklahoma State University. GRA

N80-20411# IIT Research Inst., Chicago, Ill. Engineering Div.
INITIATION MECHANISMS OF SOLID ROCKET PROPELLANT DETONATION Final Interim Report, 1 Jan. 1975 - 30 Sep. 1979
A. N. Takata Nov. 1979 60 p refs
(Contract F44620-75-C-0059; AF Proj. 2308)
(AD-A079986; IITRI-J6352-FR; AFOSR-79-1324TR; IR-4)
Avail: NTIS HC A04/MF A01 CSCL 21/8

The purpose of this study is to identify mechanisms responsible for several accidental detonation of high-energy solid rocket propellant motors. During the past year a computer model was developed to predict the amount of foam or melt generated in cracks following sudden exposure of the crack to a cavity containing higher temperature/pressure gases than exists within the crack. In addition, an experimental design was developed to study deflagration to detonation transitions (DDT). Analytical predictions suggest that DDT can occur as a consequence of burning propellant cracks provided molten propellant is generated within the burning propellant cracks and the cracks are subjected to sufficiently high amplitude stress waves. The stronger the stress waves are, the less the amount of melt needed for DDT. DDT can be initiated by single burning cracks in close proximity to the motor case, or by multiple burning cracks which are similarly oriented by respect to each other and closely spaced. GRA

N80-20412# Institute of Gas Technology, Chicago, Ill.
SYNTHETIC FUELS FROM PEAT GASIFICATION
D. V. Punwani, S. A. Weil, J. E. Paganessi, and M. J. Kopstein (DOE, Washington, D.C.) 1979 7 p Presented at the 14th Intersoc. Energy Conversion Eng. Conf., Boston, 5-10 Aug. 1979
(Contract EW-78-C-19-0042)
(CONF-790803-55) Avail: NTIS HC A02/MF A01

U.S. peat resources are estimated to be about 1440 quads. Tests were conducted in laboratory and process development unit-scale equipment using peats. It was found that conversion of peat to synthetic fuel is technically feasible. The important gasification characteristics of the three peats is discussed. The peatgas process is described along with highlights of its economics for converting peat to substitute natural gas (SNG), benzene, and fuel oil. On the basis of the gasification characteristics, compared to coal, peat is a better raw material from which to make SNG as well as gasoline blending feedstock, in that a greater fraction of the energy results in these products and requires milder operating conditions. Also compared to coal, peat gasification permits more flexibility in the relative yields of gas and liquid hydrocarbons. The estimates show that the economics of converting peat (containing 50% moisture) to SNG is competitive with those of converting Eastern coal to SNG. DOE

N80-20413# Chem Systems, Inc., New York.
LIQUID PHASE METHANATION/SHIFT PILOT PLANT OPERATION AND LABORATORY SUPPORT WORK Final Report, 1 Jul. 1976 - 30 Nov. 1978
Mar. 1979 330 p
(Contract EX-76-C-01-2036)
(FE-2036-37) Avail: NTIS HC A15/MF A01

The liquid phase methanation (LPM) Pilot Plant construction was completed and shipped to the HYGAS Pilot Plant in Chicago, Illinois. The unit was reassembled and installed. Operations included seven runs totaling 2347 hours of on-stream time with 122 hours of methanation of HYGAS synthesis gas and 193 hours of steam-methane reformer gas. The basic operability of the process was demonstrated in this 50 fold scale-up from a smaller process development unit. Catalyst rate constants were determined and the LPM kinetic model was checked over a wide range of process conditions for three different catalysts. Information accumulated also includes extent of the shift reaction, by-product selectivities, catalyst bed fluidization and circulating

oil stability. An experimental program studying the rates of carbon formation in vapor-phase methanators was conducted. DOE

N80-20414# Rockwell International Corp., Canoga Park, Calif. Environmental and Energy Systems Div.
ADVANCED DEVELOPMENT OF A SHORT-RESIDENCE-TIME HYDROGASIFIER Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1979
Apr. 1979 86 p refs
(Contract ET-78-C-01-3125)
(FE-3125-5; QTPR-2) Avail: NTIS HC A05/MF A01

Minor modification to the 1-TPH design were made so that the injector could be accommodated within the existing pressure vessel as a nominal 3/4-TPH hydrogasifier injector. One injector made out of Type 321 stainless steel was fabricated and delivered to the test stand. Other existing reactor hardware components were reevaluated with the viewpoint of assessing the need for any modifications. The needed modifications were completed, and all of the hardware was readied for installation at the test stand. Design work on the hydrogen cooled recuperator was initiated. The purpose of the recuperator is to recover the sensible heat from the reaction products by transferring it to the reactant hydrogen. A three module, shell and tube, counterflow type of heat exchanger concept has been chosen for this recuperator, and detailed design drawings were nearly completed. DOE

N80-20415# Oklahoma State Univ., Stillwater.
PHOTOCHEMICAL CONVERSION OF COAL TO GASOLINE IN AN ENTRAINED BED REACTOR Ph.D. Thesis
S. Sundaram Jul. 1979 252 p refs
(Contract EY-76-S-05-5020)
(ORO-5020-T1) Avail: NTIS HC A12/MF A01

Reading anthracite, Pittsburg Hi-Seam, Illinois No. 6, Utah Emery, Montana Rosebud, coals and synthane char were entrained in a rapidly flowing stream of hydrogen and then interacted with photoproduced hydrogen atoms. The reactivity of Illinois No. 6 coal was studied in detail. Products were collected in traps cooled by liquid nitrogen. Gas yields qualitatively decrease in the order given, i.e., with decreasing rank. The gaseous hydrocarbon produced corresponded to gasoline in the C1-C8 range, all isomers present and identified by GC-MS. The liquid products contained benzene, toluene, xylenes, naphthalenes, phenanthrene, pyrene, fluoranthene, benzanthracene, and benzopyrenes. The results suggest that the product distribution, yield and percent conversion are probably controlled by a rate limiting step in which phenanthrene type precursors are cracked from the coal surface and followed by secondary H atom reactions to produce smaller hydrocarbons. DOE

N80-20416# Department of Energy, Pittsburgh, Pa. Energy Technology Center.
COAL LIQUEFACTION WITH SYNTHESIS GAS
H. R. Appell, R. D. Miller, E. G. Illig, E. C. Moroni, and F. W. Steffgen Sep. 1979 65 p refs
(PETC/TR-79/1) Avail: NTIS HC A04/MF A01

The effects of changing gas composition, temperature, pressure, solvents, catalysts and coal types were studied to better understand the process fundamentals and to lay the groundwork for studies in continuous reactors on a larger scale. A variety of coals were converted in batch autoclaves to a low sulfur fuel oil at temperature of 425 C and pressures of 2200 to 2400 psig, using 1:1 (H2:CO) synthesis gas at reaction times of 30 to 60 minutes at temperature. Although early work suggested that lignites could be readily liquefied without added catalytic agents, later experiments showed that a greatly improved product could be obtained by adding pyrite, which is normally present only in small amounts. Pyrite or, in particular, its reduction product pyrrhotite, appear to be important catalysts for coal liquefaction, and, in general, the reactivity of coals correlates well with the pyrite (or iron plus sulfur) content. DOE

N80-20417# Department of Energy, Pittsburgh, Pa.
TRACE AND MINOR ELEMENT ANALYSES OF COAL LIQUEFACTION PRODUCTS
R. G. Lett, J. W. Adkins, R. R. DeSantis, and F. R. Brown Aug. 1979 37 p refs
(PETC/TR-79/3) Avail: NTIS HC A03/MF A01

The feed coal and products from a single batch of a long term liquefaction run on the 400 lb coal/day process development unit were sampled. Trace and minor element determinations were made on the Virginia hvAb feed coal, gross liquid product, and centrifuged liquid product and centrifuge residue from both the first and second centrifuging of the liquid product. Spark source mass spectrometry was used to determine the distribution and general level of about sixty elements. More precise determinations of specific trace (copper, chromium, manganese, nickel, zinc, lead, and cadmium) and minor elements (iron, silicon, aluminum, magnesium, and potassium) were made for elemental balance purposes. Results are compared with those previously obtained from a Kentucky hvBb coal run. Centrifugation of the liquid product from the West Virginia coal results in a preferential removal of iron and several other elements which were not observed in the Kentucky coal run. DOE

N80-20418# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF COMBUSTION DATA TO UTILIZE LOW BTU GASES AS INDUSTRIAL PROCESS FUELS, PROJECT 61004. SPECIAL REPORT NO. 7: PREMIX TUNNEL BURNER
R. T. Waibel and E. S. Fleming May 1979 41 p refs
(Contract EX-76-C-01-2489)
(FE-2489-41) Avail: NTIS HC A03/MF A01

Data were gathered to determine the performance of a premix tunnel burner when retrofit with three low Btu fuel gases. The burner was fired on a pilot scale test furnace with a load simulating one zone of a continuous melting pot or one instant during the heat up of a batch melter. The low Btu fuel gases used for these combustion trials were Koppers-Totzek oxygen, Wellman-Galusha air, and Winkler air. All of the low Btu fuel gases exhibited stable flames when directly retrofit on the burner except Winkler air, which required a pilot flame to prevent blowoff. Koppers-Totzek oxygen gave a thermal efficiency somewhat greater than that for natural gas, while both Wellman-Galusha and Winkler air fuel gases were significantly lower. All of these fuel gases had flame lengths that were longer than that for natural gas. DOE

N80-20419# Energy and Environmental Analysis, Inc., Arlington, Va.
INDUSTRIAL FUEL CHOICE ANALYSIS MODEL. VOLUME 2: APPENDICES TO MODEL DOCUMENTATION
Jan. 1979 160 p refs
(Contract EJ-78-C-01-2832)
(DOE/EIA-2832/1-Vol-2-App) Avail: NTIS HC A08/MF A01

Description, documentation, and other information are included in these appendices dealing with industrial fuel choices; energy consumption data base; major fuel burning installation survey; American Boiler Manufacturers Association data file; midrange energy forecasting system; projection method; capacity utilization rates; nonboiler characteristics; boiler capital and O & M cost data; nonboiler capital and O & M cost data; approach to estimating energy impacts of the conversion regulatory program index or acronyms. DOE

N80-20420# Wayne State Univ., Detroit, Mich. Coll. of Engineering.
FLAME PROPAGATION, AUTOIGNITION AND COMBUSTION IN ALCOHOL-PETROLEUM-AIR MIXTURES AND OTHER ALTERNATIVE FUELS Final Report, 1 Aug. 1977 - 31 Dec. 1978
N. A. Henein Sep. 1979 11 p
(Contract EC-77-S-02-4486)
(COO-4486-5) Avail: NTIS HC A02/MF A01

The combination characteristics of the future alternative fuels in gasoline and diesel engines were investigated in order to develop future combustion engines designed for best energy conversion and minimum emissions. The process of combustion was studied both experimentally and theoretically. The experimental work consisted of instrumenting and running tests on three research engines and measuring the different combustion characteristics. The theoretical work included calculating and correlating the flame speed and ignition delay with different fuel and air properties and engine operating parameters. DOE

N80-20421# Worcester Polytechnic Inst., Mass.
KINETICS AND MECHANISMS OF CATALYTIC HYDROLIQUEFACTION AND HYDROGASIFICATION OF LIGNITE Quarterly Report, Apr.-Jun. 1979
Alvin H. Weiss 12 Jul. 1979 4 p
(Contract EF-77-S-01-2702)
(FE-2702-7) Avail: NTIS HC A02/MF A01

After an unsuccessful run in which lignite slurry coked to a solid mass in the reactor, operational problems were solved. Hydrogenation in the canister system at steady state was successfully carried out on anthracene oil (with and without catalyst) and on a 20% slurry of lignite and cobalt-molybdenum catalyst in anthracene oil at 425 C. Efforts were devoted to increasing the speed and accuracy of analytical procedures which are presently perceived as the limiting step in the accumulation of data. DOE

N80-20422# Mobil Research and Development Corp., Princeton, N. J.
EXPLORATORY STUDIES IN CATALYTIC COAL LIQUEFACTION Final Report, Jun. 1978 - Mar. 1979
D. D. Whitehurst, T. O. Mitchell, M. Farcsiu, and J. J. Dickert, Jr. Sep. 1979 167 p refs
(EPRI-AF-1184) Avail: NTIS HC A08/MF A01

Catalyst aging tests simulating H-coal conditions with Illinois No. 6 coal were run for approximately 10 days with Cyanamid 1442A (CoMo/Al2O3), Cyanamid NiMo/Al2O3, Armak NiMo/ Al2O3, Amocat 1A (CoMo/Al2O3), and Amocat 1B (Mo/Al2O3) catalysts. Fresh and aged catalysts were examined for hydrogenation, hydrocracking, isomerization, desulfurization, denitrogenation, and deoxygenation. Several minerals were also included in the tests. Fresh commerical catalysts, especially NiMo/Al2O3, appear to be undesirably active for the H-Coal process. All catalysts age extensively but the used catalysts are still quite active. Activities for all reactions are reduced in the presence of nitrogen compounds. It was found that 400 F product mixtures become more complex as catalysts age, and that the catalysts affect especially the highest boiling products, but lose the ability to lower molecular weight as they age. Hydrogen donor catalyst systems are described briefly. DOE

N80-20423# Sandia Labs., Albuquerque, N. Mex.
CATALYST CHARACTERIZATION IN COAL LIQUEFACTION Quarterly Report, 1 Apr. - 30 Jun. 1979
M. G. Thomas Oct. 1979 18 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1969; QR-3) Avail: NTIS HC A02/MF A01

A charge of neutron activated CoMo catalyst was prepared for use in the H-Coal Process Demonstration Unit. Catalysts tested in a fixed bed with low ash feedstock and in ebullated and fixed beds with higher-ash containing feedstocks corroborate other evidence that the regions of high reflectivity near used catalyst surfaces are due to the pressure of containment mineral matter, primarily iron and titanium. Parametric experiments with coal, preasphaltene, asphaltene, and oil in tubing reactors show that production of hydrocarbon gases increases in the series oil < asphaltene < preasphaltene, that both a CoMo catalyst and pyrite addition lowers the production of C1 to C4 hydrocarbons, and that pyrite significantly increases the amount of CO and CO2 generated. DOE

N80-20424# Southwest Research Inst., San Antonio, Tex. Mobile Energy Div.
STABILITY SURVEY OF HYDROCARBON FUELS Final Report
J. N. Bowden Oct. 1979 35 p refs
(Contract EW-78-C-03-1778)
(BETC-1778-4) Avail: NTIS HC A03/MF A01

The storage stability characteristics of No. 2 diesel fuels, JP-4 turbine fuels, and unleaded and leaded gasolines were evaluated. The 43.3 C storage stability test, which included gum determinations after periods of 4, 8, 16, and 32 weeks, was conducted on all samples. The thermal stability of the JP-4 fuels was also measured. Results indicate that the JP-4 fuels are the most stable, followed by the unleaded gasolines, leaded gasolines, and the diesel fuels. None of the jet fuels showed any degree of deterioration during the 32 weeks of storage, while at least one of each type of gasolines and four diesel fuels appeared to have some measure of unstability. DOE

N80-20425# Fluor Engineers and Constructors, Inc., Irvine, Calif.
COAL LIQUEFACTION TEST CENTER Quarterly Technical Progress Report, Oct. - Dec. 1978
Jun. 1979 69 p
(Contract EX-76-C-01-1517)
(FE-1517-78) Avail: NTIS HC A04/MF A01

Repairs from the damage incurred during the August fire were completed along with major modifications to the J-A608C/D hydrogenation reactor recycle pumps. Integrated operation of the Cresap Pilot Plant was carried out for two periods of 24 and 40 hours during Runs 014 and 015. Extraction operations in the front end totaled 37 and 7 hours for these runs. On stream hydrogenation time in section 600 consisted of 154 hours processing feedstock from storage and 64 hours on fresh extract. Because of the short periods of stabilized operation, characterization data collected were minimal. However, it is estimated that depth of extraction was about 75% on coal during each run. Hydrogenation effected about 80% conversion of +880 F material and 60% sulfur reduction in final product. DOE

N80-20426# Conoco Coal Development Co., Library, Pa. Research Div.
ZINC HALIDE HYDROCRACKING PROCESS FOR DISTILLATE FUELS FROM COAL Annual Technical Progress Report, 1 Feb. 1978 - 31 Jan. 1979
C. W. Zielke, Melvyn Pell, C. R. Greene, J. T. Maskew, and R. T. Struck 15 May 1979 105 p refs
(Contract EX-76-C-02-1743)
(FE-1743-68) Avail: NTIS HC A06/MF A01

Final results from the continuous bench-scale work showed that single-stage liquefaction of Montana subbituminous coal can be operated up to 427 C and in multiple-stage operation, the final stage at 17.5 MPa can be as high as 496 C without coke formation. This will permit increased throughput and eliminate a melt extraction step in the process. A study of crushing and drying of subbitiminous coal showed that the oxygen level in the drying gases can be controlled to a level where no degradation of the coal results. An economic study comparing direct coal feeding with producing SRC-1 and feeding it to zinc chloride processing showed an incentive for direct coal feeding. DOE

N80-20427# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SURVEY OF BIOMASS GASIFICATION. VOLUME 1: SYNOPSIS AND EXECUTIVE SUMMARY
Jul. 1979 45 p
(Contract EG-77-C-01-4042)
(SERI/TR-33-239-Vol-1) Avail: NTIS HC A03/MF A01

The conversion of biomass into a clean burning gaseous fuel that can be used to retrofit existing gas/oil boilers, to power engines, to generate electricity, and as a base for synthesis of methanol, gasoline, ammonia, or methane is considered with emphasis on biomass gasification. Aspects reviewed include the technical background necessary for understanding the science, engineering, and commercialization of biomass; the present status of gasification processes; economics/gas conditioning; fuel synthesis; and the institutional role to be played by the federal government. Recommendations for future research and development are presented. DOE

N80-20428# McElroy (Ralph) Co., Austin, Tex.
PRODUCTION OF METHANE USING AN ANAEROBIC FILTER
Knud B. Pedersen Apr. 1979 20 p Transl. into ENGLISH of Produccion de Metano Usando un Filtro Anaerobico (Puerto Rico), 5 Aug. 1978 22 p Sponsored by DOE Prepared for Argonne National Lab., Ill.
(ANL-Trans-1164) Avail: NTIS HC A02/MF A01

The treatment of waste products using an anaerobic process results in methane gas as a by-product and this gas can be used as a source of energy. The viability of producing methane gas - under the conditions which are valid for Puerto Rico - from domestic sewage, using an anaerobic filter, are considered. DOE

N80-20429# Missouri Univ. -Rolla. Materials Research Center.
CHEMICAL AND PHYSICAL STABILITY OF REFRACTORIES FOR USE IN COAL GASIFICATION Quarterly Progress Report, 1 Aug. - 31 Oct. 1979
Abbas Fakhr and Delbert E. Day 31 Oct. 1979 25 p refs
(Contract EY-76-S-02-2904)
(COO-2904-14) Avail: NTIS HC A02/MF A01

The corrosion resistance of refractories, especially the bond phases, in high pressure/high temperature gases and liquids present in coal gasification environments are described. The results of completed exposures are given. Comparison of liquid versus vapor exposure, for various castables is given. As previously observed for castables exposed to pure steam, all the dense alumina castable had a higher strength after exposure to either the saturated vapor or immersed in liquid, compared with their controls (fired at 5000 F in air for 18 h). Results are reported. DOE

N80-20430# Argonne National Lab., Ill.
SUPPORT STUDIES IN FLUIDIZED-BED COMBUSTION 1978 ANNUAL REPORT Annual Report, Jul. 1977 - Sep. 1978
I. Johnson, G. J. Vogel, S. H. D. Lee, D. S. Moulton, and F. F. Numes Aug. 1979 112 p refs
(Contract W-31-109-eng-38)
(PB80-112758; ANL/CEN/FE-78-10; EPA-600/7-79-203)
Avail: NTIS HC A06/MF A01 CSCL 13B

Results of laboratory and process scale EPA studies supporting the national development of atmospheric and pressurized fluidized bed combustion (PFBC) of coal are presented. Limestone sulfation enhancement experiments showed CaCl2 and MgCl2 to be more effective than NaCl in increasing the pore size and hence the sulfation capability of calcined limestones. Experiments to evaluate coal pyrolysis char as a feedstock for FBC were conducted on Wyoming subbituminous coal pyrolyzed at about 650 C. Char combustion efficiencies were 94-99 percent. The use of oil shale for SO2 emission control in FBC was evaluated. Considerably larger quantities of shale (than limestone or dolomite) would be required because of shale's lower CaO content. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-20431 California Univ., San Diego.
DYNAMIC GREEN'S FUNCTIONS FOR LAYERED MEDIA AND APPLICATIONS TO BOUNDARY-VALUE PROBLEMS Ph.D. Thesis
Randy Jay Apsel 1979 374 p
Avail: Univ. Microfilms Order No. 8006878

A method to calculate the three-dimensional dynamic Green's functions for layered viscoelastic media is developed. The formulation of the method and the subsequent application to problems in theoretical seismology are presented. The formulation of an integral equation approach involving the Green's functions used to study boundary value problems and the subsequent application to problems in earthquake engineering are discussed. Dissert. Abstr.

N80-20432 Ottawa Univ. (Ontario).
THE PRESSUREMETER: APPLICATION OF PAVEMENT DESIGN Ph.D. Thesis
Jean-Louis Charles Briaud 1979 467 p
Avail: Univ. Microfilms Order No. 8005516

Special pressuremeter, termed the Briaud pressuremeter, has been designed and built specifically for use in pavement engineering; also, a standard test procedure has been established. Both the special pressuremeter and test procedure are proposed as a basis for the traffic load design of flexible airport pavements. The pressuremeter probe is short and monocellular, and the test measures a cyclic modulus. The short probe allows tests to be performed every 0.3 m from the pavement or ground surface down to a depth of 1.8 m. The Briaud pressuremeter is portable and relatively inexpensive, the test is of short duration, and the results give a direct assessment of the condition of the pavement with depth. Dissert. Abstr.

N80-20433 Tennessee Univ., Knoxville.
SEISMIC DESIGN OF REINFORCED CONCRETE BUILDINGS: AN INELASTIC RESPONSE SPECTRUM APPROACH Ph.D. Thesis
Prospero Dionisio Bernal 1979 212 p
Avail: Univ. Microfilms Order No. 8005367

The applicability of the inelastic response spectrum approach (IRSA) was evaluated as a tool for the design of moment resisting, reinforced concrete frames under seismic excitation. The applicability of this method can be measured by the accuracy (or lack of it) of the predicted inelastic demands when compared to those obtained from a rigorous, step-by-step, inelastic dynamic analysis. In order to test the applicability of the method, two frames were designed for various combinations of ground motions and design ductilities and then analyzed using DRAIN-2D, a computer program with inelastic dynamic analysis capabilities. Design procedures were developed to insure that the inelastic action in the frames designed according to the IRSA would be restricted to the beams. Dissert. Abstr.

N80-20434 Carnegie-Mellon Univ., Pittsburgh, Pa.
SPACE TRUSS DESIGN: THE POLYHEDRAL CHAIN GROUP Ph.D. Thesis
Martin Frank Rooney 1979 219 p
Avail: Univ. Microfilms Order No. 8003410

A method for the structural design of polyhedral chain three dimensional trusses conforming to four connected regular growth patterns is presented. The method employs artificial intelligence search techniques and knowledge of polyhedral truss behavior. An approximate method of analysis, using the behavior of an equivalent centroidal rigid frame to model the behavior of a polyhedral chain structure, is provided. A technique for numbering connector configurations is developed, and the point at which nonlinear behavior ensues is discussed. A FORTRAN program for generating, drawing, and performing geometrically nonlinear analysis on polyhedral chain structures is furnished. Dissert. Abstr.

N80-20435 California Univ., Los Angeles.
SYSTEM IDENTIFICATION STRUCTURAL DYNAMICS: AN APPLICATION TO WIND FORCE ESTIMATION Ph.D. Thesis
Stepan Sahag Simonian 1979 225 p
Avail: Univ. Microfilms Order No. 8007449

A second order nonlinear dynamic programming filter developed to inexpensively handle large order linear dynamical system is applied to the wind force identification problem. The differential equations governing the along wind buffering of multistory structures by gusts are formulated. The floor level acceleration response power spectral density (PSD) matrices are derived in terms of PSD models for wind gusts. A detailed first order sensitivity analysis of the derived auto-PSD models is performed with respect to some unknown stucture and gust model paramters. Using a simulated and noise polluted version of an auto-acceleration PSD data, some of the unknown stuctural and gust parameters are identified using a Monte Carlo version of the recursive nonlinear dynamic programming filter in the frequency domain. Ambient vibration experimental considerations are discussed. Dissert. Abstr.

N80-20436 Washington Univ., Seattle.
STRUCTURAL EVALUATION OF SULPHUR-ASPHALT PAVEMENTS Ph.D. Thesis
Abdulaziz Turki Abdulla Al-Otaishan 1979 737 p
Avail: Univ. Microfilms Order No. 7927736

Sulphur asphalt mixes from a structural standpoint are evaluated. The principles of the rational method of pavement design were used in this study for the evaluation of the four sulphur asphalt test pavements located at US 69, Lufkin, Texas, US 77, Kenedy County, Texas, LA 108, Sluphur, Louisiana, and US 93-95, Boulder City, Nevada. Design curves based on Elastic theory and material equivalencies are reported. Other operational procedures as well as significant results are discussed. Dissert. Abstr.

N80-20437*# National Aeronautics and Space Administration, Washington, D. C.
THE APOLLO SPACECRAFT: A CHRONOLOGY VOLUME 4, 21 JANUARY 1966 - 13 JULY 1974
Ivan D. Ertel, Roland W. Newkirk, and Courtney G. Brooks 1978 476 p refs
(NASA-SP-4009; LC-69-60008) Avail: NTIS MF A01; SOD HC CSCL 22B

This final volume of the chronology is divided into three parts: (1) preparation for flight, the accident, and investigation; (2) recovery, spacecraft redefinition, and the first manned flight; and (3) man circles the moon, the Eagle lands, and manned space exploration. Congressional documents, offical correspondence, government and contractor reports, memoranda, working papers, and minutes of meetings were used as primary sources. A relatively few entries are based on press releases and newspaper and magazine articles. A.R.H.

N80-20438# Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE EFFECTS OF PITCHING RATE ON THE HYDRODYNAMIC PROPERTIES OF HYDROFOILS
M. C. Hyman Oct. 1979 8 p refs Presented at the AIAA/SNAME Conf. on Advanced Marine Vehicles, Baltimore, Md., 3 Oct. 1979
(Contract N00024-78-C-5610)
(AD-A079810; VPI-AERO-100) Avail: NTIS HC A02/MF A01 CSCL 20/4

Little or no test data is available to verify theory predicting lift, drag and pitching moment of a hydrofoil in the presence of pitching motion commonly encountered in hydrofoil craft. The present paper presents the results of a wind tunnel investigation of the effects of pitching motion on two hydrofoil configurations. The results are compared to prediction techniques given in the U.S.A.F. DATCOM (Ref. 1). Finally, a verified force and moment prediction technique is presented. GRA

N80-20439# Naval Postgraduate School, Monterey, Calif.
LIFT ANALYSIS ON THE BOW SEAL OF THE SURFACE EFFECT SHIP TESTCRAFT XR-3 M.S. Thesis
James R. Snider Sep. 1979 55 p refs
(AD-A078507) Avail: NTIS HC A04/MF A01 CSCL 13/10

Experimental test runs were conducted to determine lift forces acting on the bow seal of the captured air bubble testcraft, XR-3. These forces, plotted versus turn rate for varying center-of-gravity locations, are presented and analyzed. GRA

N80-20440# California Univ., Berkeley. Earthquake Engineering Research Center.
ANSR-2: ANALYSIS OF NONLINEAR STRUCTURAL RESPONSE, USER'S MANUAL
Digambar P. Mondkar and Graham H. Powell Jul. 1979 90 p refs
(Grant NSF ENV-76-04264)
(PB80-113301; UCB/EERC-79/17; NSF/RA-790266) Avail: NTIS HC A05/MF A01 CSCL 13B

A general purpose computer programs for the static and dynamic analysis of nonlinear structures is described. Both large displacements and inelastic effects are included. Several features of the program are discussed. The most important of these are: (1) a comprehensive restart option; (2) provision to allow static and dynamic analyses in any sequence; (3) provision for static analysis with prescribed nodal displacements as well as nodal loads; (4) provision for out-of-phase support motions to be specified for earthquake analysis; (5) provision for time delay (traveling wave) effects to be specified for forces and displacements in dynamic analyses; and (6) out-of-core solves for both symmetrical and unsymmetrical equations. GRA

N80-20441# National Bureau of Standards, Washington, D.C. Center for Materials Science.
THE SCIENCE OF CERAMIC MACHINING AND SURFACE FINISHING 2
Bernard J. Hockey, ed. and Roy W. Rice, ed. (NRL, Washington, D.C.) Oct. 1979 528 p refs Presented at Symp. held at Gaithersburg, Md., 13-15 Nov. 1978; sponsored by AFOSR, Bolling AFB, Washington, D.C., and Am. Ceramic Soc., Columbus, Ohio, ONR, Arlington, Va.
(PB80-110133; NBS-SP-562; LC-79-6000149) Avail: NTIS HC A23/MF A01 CSCL 13/4

The machining and surface finishing operations employed in the production and reliable use of ceramics are discussed. Areas of investigation include the mechanisms of abrasive machining and surface finishing, a technology assessment of machining and surface finishing, the effects of machining and surface finishing on ceramic properties, and the relation of hardness to machining. A.W.H.

N80-20442# Kentucky Bureau of Highways, Lexington. Div. of Research.
STATEWIDE SURVEY OF SKID RESISTANCES OF PAVEMENTS, 1978 Interim Report
Rolands L. Rizenbergs and James L. Burchett Jul. 1979 141 p
(PB80-106404; ; RR-528) Avail: NTIS HC A07/MF A01 CSCL 13B

Results of tests on 2,943 miles of state primary roads and 2,405 miles of state secondary roads are reported. About 10 percent of both the state primary mileage and the state secondary mileage had an average skid number of 28 or less. These pavements, in particular, should be considered for de-slicking. GRA

N80-20443# Connecticut Dept. of Transportation, Wethersfield. Bureau of Highways.
PAVEMENT RECYCLING-BITUMINOUS CONCRETE AND CONCRETE MIX DESIGNS Interim Report, Oct. 1978 - Mar. 1979
Robert Christman and Keith Lane Jul. 1979 76 p refs
(HPR Proj. 569)
(PB80-106263; FHWA/CT-569-1-79-10) Avail: NTIS HC A06/MF A01 CSCL 13B

Trial mixes developed from both salvaged bituminous concrete and portland cement concrete pavement materials were tested in the laboratory. Salvaged materials investigated included crushed and cold milled bituminous concrete and crushed 40 x 12 ft concrete pavement slabs with wire mesh reinforcing. Laboratory results indicated the feasibility of full scale bituminous recyling projects using central plant mixing of salvaged and virgin aggregate by the heat transfer method and both in place full depth and surface recycling. The concrete tests provided good results in terms of strength properties and demonstrated the potential of concrete recycling. Mesh separation and removal did not present any insurmountable problems. GRA

N80-20444# Sydney Univ. (Australia). Civil Engineering Labs.
WEB DISTORTION AND FLEXURAL-TORSIONAL BUCKLING
Gregory J. Hancock, Mark A. Bradford, and Nicholas S. Trahair Jun. 1979 29 p refs
(PB80-116221; R-349) Avail: NTIS HC A03/MF A01 CSCL 13M

In an I-section member with a slender, unstiffened web, a combined buckling mode may occur in which the web distorts and reduces the member's torsional resistance, and consequently its resistance to lateral (or flexural-torsional) buckling. An approximate analysis of the effect of web distortion on the elastic flexural-torsional buckling of a simply supported I-section member is presented. This analysis leads to a closed form interaction equation, relating the critical uniform moment and axial load acting on the member. The buckling moments and loads determined from this equation are compared with the results of a more sophisticated finite strip analysis, and are shown to be of high accuracy. The effects of different member cross sections on distortional buckling are investigated. GRA

N80-20445# Sydney Univ. (Australia). Civil Engineering Labs.
ASSESSMENT OF ENVIRONMENTAL WIND CONDITIONS BY WIND TUNNEL MODEL STUDIES
K. C. S. Kwok May 1979 40 p refs
(PB80-115926; R-348) Avail: NTIS HC A03/MF A01 CSCL 13M

The acceptance criteria for environmental wind conditions used in wind tunnel model tests for building developments are

discussed. These criteria are compared with other published criteria and shown to be in good agreement. The techniques used in conducting these wind tunnel model tests and the probabilistic technique used in the assessment of the prospective environmental wind conditions are discussed. GRA

N80-20446# Auburn Univ., Ala. Dept. of Civil Engineering.
STATISTICAL INVESTIGATION OF PAVEMENT SKID RESISTANCE DATA Final Report
R. K. Moore and C. M. Ford. Jun. 1979. 239 p. refs. Prepared in cooperation with the Federal Highway Admin., Washington, D.C. and sponsored in part by Alabama State Highway Dept.
(PB80-116114; HPR-89; FHWA/RD-79-S0910) Avail: NTIS HC A11/MF A01 CSCL 13B

Regression analysis was used, with skid number data (2490 cases) measured on the Southern By-Pass (U.S. Highway 80) in Montgomery, Alabama, from 1969 to 1975, to develop equations that predict skid number and skid number ratio. The independent variables included service time, traffic, elapsed time since last rainfall, rainfall amount, aggregate type, aggregate mixture, calendar month, and air temperature at time of test. Logarithmic transformations were also used, but the regression models developed were not satisfactory for prediction purposes as indicated by the coefficient of multiple determination (r squared) and the standard error of estimate. GRA

N80-20447# Sydney Univ. (Australia). Civil Engineering Labs.
ANALYSIS OF THE CONSOLIDATION OF LAYERED SOILS USING THE METHOD OF LINES
J. C. Small and J. R. Booker. Mar. 1979. 36 p. refs.
(PB80-112766; R-342) Avail: NTIS HC A03/MF A01 CSCL 08M

The consolidation of a cross anisotropic horizontally layered soil is analyzed using a method in which the solution is decomposed into its Fourier components for plane strain and Fourier-Bessel components for axial symmetry. The method has distinct computational advantages over the usual finite element approach and leads to the significant computational savings and has the added advantage that it may be easily implemented on the minicomputer. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-20448* National Aeronautics and Space Administration. Pasadena Office, Calif.
SATELLITE PERSONAL COMMUNICATIONS SYSTEM Patent
Norman B. Reilly (JPL) and Joel G. Smith, inventors (to NASA) (JPL). Issued 19 Feb. 1980. 9 p. Filed 30 May 1978. Supersedes N78-25275 (6 - 16, p 2101). Sponsored by NASA
(NASA-Case-NPO-14480-1; US-Patent-4,189,675;
US-Patent-Appl-SN-910707; US-Patent-Class-325-4;
US-Patent-Class-325-8; US-Patent-Class-325-9;
US-Patent-Class-325-14) Avail: US Patent and Trademark Office CSCL 17B

Voice channel communication between low power mobile stations dispersed over a large area is provided by a system which includes a geostationary satellite utilizing a large UHF antenna that can receive a transmission from a caller and retransmit it over any one beam of a matrix of narrow beams, so the chosen beam covers an area in which a designated called party is located. A single up-link control channel occupying a narrow frequency band, can be utilized to receive dial up signals from a caller, and another single down link control channel can be utilized to ring up the called party located anywhere within the continental United States. The satellite antenna includes a matrix of feed horns that not only direct the beams in a controlled matrix onto the area of the continental United States, but also permit detection of the region from which the caller's signal is transmitted and the region from which the called party's answer is received, to enable the interconnection of signals received from these two regions. The system is particularly useful for rural areas.

Official Gazette of the U.S. Patent and Trademark Office

N80-20449 British Library Lending Div., Boston Spa (England).
DIGITAL-PHASE METHOD OF FORMING SINGLE SIDE-BAND SIGNALS
Wojciech Stepniewski and Hubert Trzaska. Oct. 1979. 23 p. refs. Transl. into ENGLISH from Prace Inst. Lacznosci (Poland), 1977. p 29-41
(BLL-RTS-11857) Avail: British Library Lending Div., Boston Spa, Engl.

The deficiencies of previous methods of forming single sideband signals are defined and the advantages of using a system which can be tuned over a wide range of frequencies are discussed. Hitherto, it was impossible to construct such a system due to the lack of phase shifters which produce a stable phase shift of + or - pi/2 over a wide range of frequencies. It is proposed to use phase shifters based on flip-flop multivibrators for this purpose. The possibility is also presented of using the harmonics of a balanced mixer supplied with high frequency current of rectangular form. J.M.S.

N80-20450 Dartmouth Coll., Hanover, N.H.
SUBSTORM-RELATED VLF CHORUS EVENTS: LOCAL-TIME DEPENDENCE AND RELATIONSHIP TO NEWLY-INJECTED CLOUDS OF DRIFTING ENERGETIC ELECTRONS Ph.D. Thesis
Trevor William Thomas. 1979. 253 p.
Avail: Univ. Microfilms Order No. 7921597

VLF chorus, a naturally occurring, electromagnetic wave phenomenon generated in the Earth's magnetosphere during interactions between VLF waves and energetic electrons was studied. The macrostructure of a 9 day period of VLF ground station data, recorded at two antarctic stations was studied using compressed time scale spectrograms. A magnetically quiet period was chosen for analysis, within which isolated substorms occurred. It was found that chorus frequently occurs in events, the most characteristic feature of which is an initial rise in the upper cut off frequency of the chorus band. Two interpretations of the chorus events were investigated based on the time dependence theory. The first model suggests that the observed rise in frequency is due to an inward convection of a bunch of electrons under a substorm enhanced westward electric field. The second model suggests that the dispersion is responsible for the time evolution of the events. Dissert. Abstr.

N80-20451 Michigan State Univ., East Lansing.
THEORETICAL AND EXPERIMENTAL STUDY OF THE PROXIMITY EFFECTS OF THIN-WIRE ANTENNA IN PRESSURE OF BIOLOGICAL BODIES Ph.D. Thesis
Khalid Karimullah. 1979. 159 p.
Avail: Univ. Microfilms Order No. 8006140

The electromagnetic coupling caused by placing a biological body in the vicinity of a radiating antenna was studied. A numerical solution to the above mentioned problem is presented and the current distribution on the antenna and the induced electric fields inside the biological body are quantified. Experiments were conducted using a plexiglass container of suitable dimensions filled with saline solution to represent the biological body. Perturbation of input impedance from its free space value is plotted as a function of distance of separation between antenna and the body. Dissert. Abstr.

N80-20452 Michigan State Univ., East Lansing.
INDUCED ELECTROMAGNETIC FIELDS IN CONDUCTING BODIES IRRADIATED BY MAGNETIC FIELDS AND MICROWAVES Ph.D. Thesis
Jen-Hwang Lee. 1979. 248 p.
Avail: Univ. Microfilms Order No. 8006149

A theoretical method for determining the eddy current induced by a uniform RF magnetic field or a beam of RF magnetic field in a biological body is developed. The body of rotational symmetry is subdivided into a number of circular rings with various radii and cross sectional areas. The eddy current induced by the impressed magnetic field is considered, physically, as induced

by a circulatory impressed electric field associated with the uniform impressed magnetic field. The eddy current is the product of the complex conductivity and the induced electric field. Using these relations and the point matching method, a set of simultaneous equations for the induced electric fields is obtained. A numerical method for quantifying the induced EM field on the surface of an irradiated biological body based on two coupled, surface integral equations is also developed. Dissert. Abstr.

N80-20453*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MEMORY-BASED FRAME SYNCHRONIZER Patent Application
James K. Niswander and Raymond J. Stattel, inventors (to NASA) Filed 12 Mar. 1980 23 p
(NASA-Case-GSC-12430-1; US-Patent-Appl-SN-129779) Avail: NTIS HC A02/MF A01 CSCL 17B

The memory frame synchronizer is comprised of a serial to parallel converter to convert a serial input data stream to a constantly changing parallel data output. This provides a data format which can be easily and dynamically changed. The process is accomplished using programmable memory arrays to perform the functions of the sync word recognizer and of the counter decoding logic. The parallel data output is supplied to programmable sync word recognizers each consisting of multiplexer and random access memory (RAM). The multiplexer is connected to both the parallel data output and an address bus. The RAM is used as an associative memory or decoder and is programmed with the pattern of binary 1's and 0's necessary to identify a specific sync word. NASA

N80-20454# University of Southern California, Los Angeles. Image Processing Inst.
IMAGE UNDERSTANDING RESEARCH Semiannual Technical Report, 1 Apr. - 30 Sep. 1979
Ramakant Nevatia and Alexander A. Sawchuk 30 Sep. 1979 153 p refs
(Contract F33615-76-C-1203; ARPA Order 3119)
(AD-A078034; USCIPI-910) Avail: NTIS HC A08/MF A01 CSCL 05/8

This technical report summarizes the image understanding and smart sensor research activities. The research program has, as its primary purpose, the development of techniques and systems for understanding images. Methodologies range from low level image processing principles, smart sensor CCD LSI circuit design, up to higher level symbolic representations and relational structure manipulation. GRA

N80-20455# Martin Marietta Aerospace, Orlando, Fla.
MULTIENVIRONMENT ACTIVE RF SEEKER TEST AND EVALUATION PROGRAM, MARFS TEST Final Report, 9 Jan. 1978 - 30 Sep. 1979
Sep. 1979 50 p refs
(Contract DAAK40-78-C-0046)
(AD-A078161; OR-15764) Avail: NTIS HC A03/MF A01 CSCL 17/7

The MARFS seeker is a 17 GHz circularly-polarized 10 watt pulsed solid-state seeker employing polarization agility, monopulse tracking, and polarization diverse signal processing. It was determined, at that time, that extensive tower and captive flight tests would be required to establish the usefulness of this particular seeker design and to collect data enabling further developments of detection and tracking algorithms. This report describes the support provided during these tests. It lists the tests supported, the alterations made, the maintenance performed, and the additional problems that were encountered. GRA

N80-20456# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
INVESTIGATION OF TRANSFORM TECHNIQUES FOR SOLVING ELECTROMAGNETIC RADIATION AND SCATTERING PROBLEMS
R. Mittra, S. W. Lee, and W. L. Ko Dec. 1979 96 p refs
(Contract N00014-75-C-0293)
(AD-A077895; UIEL-79-13; UILU-ENG-79-2560) Avail: NTIS HC A05/MF A01 CSCL 20/3

In this project, we attack electromagnetic scattering and the diffraction problems by using a spectral domain formulation, which generally yields accurate results in a numerically efficient manner. Several published papers are attached in which the research was supported by this project. GRA

N80-20457# New Mexico Univ., Albuquerque. Dept. of Electrical Engineering and Computer Science.
CALCULATION OF THE SINGULARITY EXPANSION METHOD PARAMETERS FROM THE TRANSIENT RESPONSE OF A THIN WIRE Final Report
Kah-Song Cho and J. T. Cordaro Sep. 1979 80 p refs
(Grant AF-AFOSR-3723-78)
(AD-A078852; EE-264(79)AFOSR-723-1; AFOSR-79-1306TR) Avail: NTIS HC A05/MF A01 CSCL 20/3

The problem of determining the singularity expansion method SEM parameters from transient thin-wire data is examined. A computer code is used to generate response data. The SEM parameters are computed from these data. For noisy data, it is shown that the parameter values can be improved by signal averaging. GRA

N80-20458# TRW Defense and Space Systems Group, Redondo Beach, Calif.
FINITE ELEMENT APPLICATION TO TRANSIENT SCATTERING PROBLEMS Final Report, Jan. 1978 - Oct. 1979
A. Sankar and T. C. Tong 31 Oct. 1979 131 p refs
(Contract F49620-78-C-0049; AF Proj. 2301)
(AD-A078682; TRW-79-002-AFOSR; AFOSR-79-1302TR) Avail: NTIS HC A07/MF A01 CSCL 20/3

Finite element method is applied to compute the induced current distributions on arbitrarily-oriented thin wire in the time domain due to arbitrary pulses. The required mathematical equations and computer code are developed. The predictions by this method compare very well with other techniques. Advantages of this approach are mentioned. GRA

N80-20459# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
A STANDARDIZATION EVALUATION POTENTIAL STUDY OF THE COMMON MULTI-MODE RADAR PROGRAM Final Report, Jan. - Sep. 1979
J. Gregory Jolda and Janine L. Thomas Nov. 1979 193 p refs
(AF Proj. 2003)
(AD-A079678; AFAL-TR-79-1195) Avail: NTIS HC A09/MF A01 CSCL 17/9

The cost impact of standardization as applied to Air Force avionic systems is discussed in this report. Several life-cycle cost estimates were made on the ASD Common Multi-Mode Radar program using the Standardization Evaluation Program (STEP) model. Costs for development, operation, and support of a common (standard) radar system are compared with like costs estimated for using individually developed radar systems across applicable aircraft. The STEP model is described, the Common Multi-Mode Radar program is discussed, and the STEP model application to this radar program is documented. STEP estimates project life-cycle costs of unique radar systems to be twice those of a common radar system. Results are discussed in terms of STEP runs and ASD costing estimates, and STEP model use is described. GRA

N80-20460# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
CHARACTERIZATION OF NONSTATIONARY CLUTTER Phase Report, 15 Jun. - 30 Sep. 1978
Donald J. Lewinski Griffiss AFB, N.Y. RADC Nov. 1979 45 p refs
(Contract F30602-78-C-0120; AF Proj. 4506)
(AD-A079655; RADC-TR-79-267) Avail: NTIS HC A03/MF A01 CSCL 17/9

A mathematical model for nonstationary and/or nonhomogeneous clutter is proposed and developed. The first order probability density function of the clutter power is treated as the expected value of a conditional density which is a function of random parameters. General expressions are derived and selected plots are given for Nakagami conditional density functions with mean values which have the following distributions: uniform, gamma, log uniform and log normal. It is seen that the limiting behavior of all the considered cases is similar. GRA

N80-20461# Harry Diamond Labs., Adelphi, Md.
NEAR-MILLIMETER WAVE TECHNOLOGY BASE STUDY. VOLUME 1: PROPAGATION AND TARGET/BACKGROUND CHARACTERISTICS
Stanley M. Kulpa Nov. 1979 157 p refs
(DA Proj 1L1-61102-AH-44)
(AD-A079620; HDL-SR-79-8-Vol-1) Avail: NTIS
HC A08/MF A01 CSCL 17/9

This study is a comprehensive summary of the Near-Millimeter Wave (100 to 1000 GHz) technology base and its potential applications. The state of the art is reviewed, and technology gaps are identified. Volume 1 contains the results of that portion of the Study devoted to the analysis of various factors influencing atmospheric propagation and target/background signatures. Comparison is made between theoretical predictions and limited experimental data in several key areas. Topics discussed include clear air absorption, the effects of atmospheric particulates (rain, fog, clouds, etc.) turbulence, measurement techniques, and the signature characteristics of a variety of targets and backgrounds at near-millimeter (NMM) wavelengths. A summary is given of research thrusts which would be useful in establishing a more reliable data base for evaluating near-millimeter wave systems applications. Also included is a list of facilities and organizations actively involved in this technology, plus a comprehensive reference list of current and historical literature pertinent to the material in this volume. GRA

N80-20462# Ohio State Univ., Columbus. ElectroScience Lab.
BASIC RESEARCH IN THREE-DIMENSIONAL IMAGING FROM TRANSIENT RADAR SCATTERING SIGNATURES Final Report, 1 Jul. 1977 - 31 Mar. 1979
Jonathan D. Young Jun. 1979 62 p refs
(Contract DASG60-77-C-0133)
(AD-A079423; ESL-784785-5) Avail: NTIS
HC A04/MF A01 CSCL 17/9

The transient radar scattering signatures of a set of cone-like objects were studied, and techniques for creation of images using these signatures were investigated. The signatures were obtained from model measurements on two coherent 10:1 bandwidth complex scattering cross-section measurement systems. Ramp response signatures were generated from the measured data, and their relationship to target geometrical characteristics were analyzed. Two techniques for imaging from the signatures gathered at near nose-on look angles were investigated: Limiting Surface Imaging and Physical Optics Inverse Diffraction. Useful images, with some loss of detail, were produced. GRA

N80-20463# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
A VARIATIONAL APPROXIMATION FOR SCATTERING OF SCALAR WAVES BY STOCHASTIC SURFACES
E. P. Gray, R. W. Hart, and R. A. Farrell Jul. 1979 119 p
(Contract N00024-78-C-5384)
(AD-A077066; APL/JHU-TG-1322) Avail: NTIS
HC A06/MF A01 CSCL 20/14

A variational method is developed for the scattering of scalar waves by statistically rough surfaces. It provides a procedure for recasting other approximations so that errors cancel to first order, and also yields a quantity that is indicative of the quality of the approximation. The method is tested by application to a corrugated surface for which some exact solutions are known. Scattering from stocbastically rough surfaces continues to be of importance in many areas, but analytical difficulties generally preclude obtaining an exact solution to significant problems. Accordingly, various approximation methods are used. Since no quantitative index of approximation quality is generally available, there is often doubt not only as to which method is best but even whether any available one is adequate. GRA

N80-20464# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
ON CORRELATION PARAMETERS FOR SOME BINARY SEQUENCES OF LENGTHS 31 AND 63 FOR SPREAD-SPECTRUM MULTIPLE-ACCESS COMMUNICATIONS M.S. Thesis
David William Haguma Gahutu May 1979 141 p refs
(Contracts DAAB07-72-C-0259; DAAG29-78-C-0016; Grants DAAG29-78-G-0114; NSF ENG-78-06630)
(AD-A077152; UILU-ENG-78-2238; R-845) Avail: NTIS
HC A07/MF A01 CSCL 17/2

The correlation parameters of some binary sequences of lengths 31 and 63 for spread-spectrum multiple-access (SSMA) communication are evaluated. The peak correlation parameters are the key parameters needed to determine the worst interference at any of the correlation receivers in a SSMA communications system due to the presence of other users and the multipath signals. These peak correlation parameters are readily obtained from the correlation data presented in this thesis. The performances of some new and old candidate sieves for optimal binary sequence phases are compared. When the number of binary sequences required exceeds the number in one set of a given family, one option is to use two or more sets of sequences from the family. This motivated the evaluation of the peak cross-correlation between two different sets of Gold sequences of length 31. Finally, the mean-square partial correlation parameters of some binary periodic sequences are computed. GRA

N80-20465# Northeastern Univ., Boston, Mass.
SIGNAL PROCESSING CIRCUIT DEVELOPMENT Final Technical Report, 22 Dec. 1976 - 21 Mar. 1977
Basil L. Cochrun Griffiss AFB, N.Y. RADC Nov. 1979 52 p refs
(Contract F19628-77-C-0087)
(AD-A079053; RADC-TR-79-262) Avail: NTIS
HC A04/MF A01 CSCL 17/5

This report covers the modification of an Air Force owned IR-CCD scanning system for one dimensional scans. The modifications provide electronic instrumentation for two dimensional scanning and horizontal and vertical sweep circuitry for video display. GRA

N80-20466# Utah Univ., Salt Lake City. Dept. of Computer Science.
NOISE SUPPRESSION METHODS FOR ROBUST SPEECH PROCESSING Semiannual Technical Report, 1 Apr. - 30 Sep. 1979
Steven F. Boll, Dennis Pulsipher, and H. Ravindra Oct. 1979 70 p refs Sponsored in part by DARPA
(Contract N00173-73-C-0045; ARPA Order 3301)
(AD-A079321; UTEC-CSC-79-163) Avail: NTIS
HC A04/MF A01 CSCL 17/2

Robust speech processing in practical operating environments requires effective environmental and processor noise suppression. This report describes the technical findings and accomplishments during this reporting period for the research program funded to develop real-time, compressed speech analysis-synthesis algorithms whose performance is invariant under signal contamination. Fulfillment of this requirement is necessary to insure reliable secure compressed speech transmission within realistic military command and control environments. Overall contributions resulting from this research program include the understanding of how environmental noise degrades narrow band, coded speech, development of appropriate real time noise suppression algorithms, and development of speech parameter identification methods that consider signal contamination as a fundamental element in the estimation process. This report describes the current research and results in the areas of noise suppression using the dual input adaptive noise cancellation using the LMS and gradient lattice algorithms, to spectral analysis and synthesis using the constant-Q transform, articulation rate change techniques, analytic continuation of band limited signals or signal extrapolation, and two-dimensional automatic gain control. GRA

N80-20467# Montana State Univ., Bozeman.
AN ANALYSIS OF PLASTIC SHOCK WAVES IN SNOW
Robert L. Brown Nov. 1979 21 p refs
(Contract DAAG29-78-G-0089; DA Proj. 4A1-61102-AT-24)
(AD-A080051; CRREL-79-29) Avail: NTIS HC A02/MF A01
CSCL 08/12

An analytical study of the propagation of shock waves in snow was carried out to evaluate the response of medium density snow to high rates of loading. One solution was developed for steady shock waves; this resulted in calculation of pressure jump, density jump and stress wave speed. Correlation with available

experimental data was found to be good. Nonsteady shock waves were also considered in order to evaluate wave attenuation rates in snow. Very few data were available to compare with the analytical results, so no definite conclusions on the part of the study could be made. The results show, however, that shock waves that produce plastic deformation attenuate at extremely high rates and that differences in pressure between two waves are quickly eliminated within a short distance. Calculations were also made to evaluate the effect of wave frequency on attenuation rates. The results show that for plastic waves, frequency is not a predominant factor for determining attenuation rates. GRA

N80-20468# Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
WAVE PROPAGATION IN THREE-DIMENSIONAL INELASTIC MEDIA Final Report, 26 Jan. 1976 - 15 Sep. 1979
T. C. T. Ting Dec. 1979 9 p refs
(Grant DAAG29-76-G-0121)
(AD-A080081; ARO-13157.3-E) Avail: NTIS
HC A02/MF A01 CSCL 20/4

The research supported by the Army grant was to study some aspects of three dimensional waves in inelastic media. Inelastic media include elastic-plastic materials and viscoelastic solids. This report contains a summary of the results obtained from this investigation. GRA

N80-20469# RAND Corp., Santa Monica, Calif.
TRANSIENT RESPONSE OF A HETERODYNE RECEIVER: IMPLICATIONS FOR A TIME-OF-ARRIVAL SYSTEM Interim Report
Thomas Finley Burke Nov. 1979 226 p
(Contract F49620-77-C-0023)
(AD-A078373; RAND/R-2418-AF) Avail: NTIS
HC A11/MF A01 CSCL 17/3

A directional antenna is a filter whose response varies with direction. A modulated signal transmitted from such an antenna produces different farfield waveforms in all directions (except for possible symmetry). The response of a receiver to the transmission will vary with position in the antenna pattern of the emitter. This effect is ordinarily negligible but it could limit the ultimate performance of any system that accepts off-axis signals and relies upon the details of waveform. In a leading-edge TOA system used to determine the location of a pulsed emitter, the several receivers necessarily lie at different angular positions from the emitter. This analysis indicates that in a simple, idealized TOA system that would otherwise be entirely free from error, the waveform effect arising from a directional emitter can lead to errors of several dozen meters in the computed location. GRA

N80-20470# Rome Air Development Center, Griffiss AFB, N.Y.
EXPERIMENTAL IMAGE COMPRESSION SUBSYSTEM (EICS) COMMUNICATION TESTING Progress Report, Mar. - Jun. 1979
Anthony R. Fanelli Sep. 1979 30 p
(AF Proj. 6244)
(AD-A077546; RADC-TR-79-261) Avail: NTIS
HC A03/MF A01 CSCL 17/2

The Experimental Image Compression System (EICS) was developed to effectively transmit intelligence and reconnaissance image data over narrowband links in minimum time. This report covers testing accomplished on the EICS. Testing was conducted over actual communications circuits in real time, with the most significant being the Troposcatter and Microwave links. GRA

N80-20471# Armed Forces Communications and Electronics Association, Eatontown, N. J.
THE ART OF COMMUNICATIONS INTERFACES; TECHNOLOGY INSERTION IN THE C3I ARENA: PROCEEDINGS OF THE 4TH ANNUAL SEMINAR Final Report
Bernard D. DeMarinis (Booz-Allen and Hamilton, Inc., Tinton Falls, N.J.) Nov. 1979 154 p Seminar held at Eatontown, N.J., 14-15 Nov. 1979
(AD-A078344; AFCEA-FM-4) Avail: NTIS HC A08/MF A01 CSCL 17/2

Several papers by leading authorities on the design, application, and logistical support of Very High Speed Integrated Circuitry (VHSIC) in communications systems that are emerging in the newly developed state-of-the-art and are being fielded are presented for discussion. The impact of VHSIC on new communications equipments and systems is presented by proponents from the U.S. Army's Electronics Research and Development Command (ERADCOM), the Communications Research and Development Command (CORADCOM), and Communications Electronics Materiel Readiness Command (CERCOM). In addition, three papers from industrial proponents on VHSIC design, application, and support are given. GRA

N80-20472# Bendix Corp., Baltimore, Md. Communication Div.
SAMPLING DIGITAL MULTIPLE CHANNEL SAME FREQUENCY REPEATER STUDY Final Report, Aug. 1978 - Apr. 1979
William F. Lawrence and William F. Kruszewski Wright-Patterson AFB, Ohio AFAL Jun. 1979 70 p refs
(Contract F33615-78-C-1457; AF Proj. 7662)
(AD-A078817; AFAL-TR-79-1078) Avail: NTIS
HC A04/MF A01 CSCL 17/2

The feasibility of modifying an AN/ZRC-1 multiple single frequency repeater was investigated. The present design used an analog sampling scheme to allow the simultaneous repeating of up to four separate analog voice radio links, using only one frequency per link. It was found that this scheme did not lend itself to wideband digital signals such as those found with the TSEC/KY-58 voice encryption equipment. Instead, a new approach is described which would provide a sampling single frequency repeater for wideband digital signals. GRA

N80-20473# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A NOTE ON ALMOST NOISELESS CHANNELS
Barney Reiffen 4 Oct. 1979 20 p Presented at the 1979 IEEE Intern. Symp. on Inform. Theory, Grignano, Italy, 25-29 Jun. 1979
(Contract F19628-80-C-0002; AF Proj. 649L)
(AD-A077588; TN-1979-66) Avail: NTIS HC A02/MF A01 CSCL 17/2

An 'almost noiseless' channel is defined. The definition corresponds to many physical channels operating at high signal-to-noise ratio. Attention is focused on the decrement in capacity and computation cutoff rate as the noise increases from zero. It is shown that the decrement in R(comp) is dominated by a term proportional to the square root of the noisiest transition probability, alpha, to a nominally noiseless output. In contrast, the decrement in C in many cases of interest is dominated by a term proportional to -(alpha)ln(alpha). Accordingly the decrement in R(comp) can significantly exceed the decrement in C. This paper was presented at the 1979 IEEE International Symposium on Information Theory held in Grignano, Italy on 25-29 June 1979. GRA

N80-20474# SRI International Corp., Menlo Park, Calif.
A MODEL OF NATURAL HF RADIO NOISE IN SEVERELY DISTURBED PROPAGATION ENVIRONMENTS Topical Report, 17 Nov. 1977 - 31 Mar. 1979
Gary H. Price and Georgellen Smith 31 Mar. 1979 32 p refs
(Contract DNA001-77-C-0063; DNA Proj. S99-QAXH)
(AD-A077619; AD-E300627; DNA-4930T) Avail: NTIS
HC A03/MF A01 CSCL 17/2

A model is developed that describes the impact of severe propagation losses on the natural noise environment at high frequencies. GRA

N80-20475# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MILLSTONE HILL RADIO STAR CALIBRATION
W. L. Oliver Aug. 1979 86 p refs
(Contract F19628-78-C-0002)
(AD-A079037; STK-103; ESD-TR-79-217) Avail: NTIS
HC A05/MF A01 CSCL 17/9

A comprehensive analyses of all radio-star calibration measurements made since May 1975 with the Millstone Hill Tracking Antenna is described. No evidence is found to indicate that mechanical offsets in the antenna structure have changed during this period. Previous suspicions that such changes might be continually occurring are shown to have arisen from acute mathematical correlation ambiguities encountered in fitting models to the monthly results. In addition, it is found that the high

stability of the LED-type encoders installed in November 1977 has virtually eliminated this last source long-term variation in pointing offset. Only known mechanical modifications, causing discrete changes in pointing error model, have caused the pointing-error model to change since this date. Calibration of the octagonal rail/cam-follower system used by the Tracking Antennas as an off-axis azimuth encoder system is also investigated. Evidence is presented that the primary pointing errors that arise from inaccuracies in this system are due to an offset between the azimuth axis and the geometric center of the rail octagon, an ellipticity of the tower perimeter upon which the rails are mounted, and a slight bowing of the rails, the center offset being an estimated 0.3 mm, the rail geometry being 0.05 mm out of round, and the rails being bowed a maximum of 0.02 mm from straightness. These deficiencies cause pointing errors on the order of 10 mdeg. GRA

N80-20476# Lister Hill National Center for Biomedical Communications, Bethesda, Md.
BIOMEDICAL COMMUNICATIONS EXPERIMENTS. USING THE COMMUNICATIONS TECHNOLOGY SATELLITE: TECHNICAL EVALUATION Final Report
George R. Thoma. Aug. 1979. 100 p. refs.
(PB80-111016; LHNCBC-79-13) Avail: NTIS
HC A05/MF A01 CSCL 17B

The objectives, method, and conclusions of a Technical Evaluation of the Public Health Services network consisting of six small Earth terminals linked via the Communications Technology Satellites are documented. The technical performance of the networks is evaluated in terms of channel quality, system capability availability, equipment maintainability, and its capability for broad geographical coverage, channel sharing, and digital transmission. Causes for deficiencies observed in performance are indentified and corrective measures discussed. GRA

N80-20477# National Bureau of Standards, Washington, D.C. National Engineering Lab.
CHARACTERIZATION OF ELECTRICAL IGNITION SOURCES WITHIN TELEVISION RECEIVERS Final Report
George J. Rogers and David D. Evans. Oct. 1979. 64 p. refs.
Sponsored in part by Consumer Product Safety Commission, Washington, D.C.
(PB80-103450; NBS-TN-1109) Avail: NTIS
HC A04/MF A01 CSCL 17B

The ignition of television receivers initiated by electrical failures in the circuitry was examined by studying four receivers. Selected locations within the circuitry were stressed by introducing full or partial short circuits to simulate the failure of electronic components. The temperatures and increased power dissipation generated by short-circuited components were recorded. Although component temperatures greater than 500 C were achieved, no flaming ignition sources were generated. GRA

N80-20478# National Technical Information Service, Springfield, Va.
TROPOSPHERIC SCATTER COMMUNICATIONS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
William E. Reed. Jul. 1979. 223 p. Supersedes NTIS/PS-78/0718; NTIS/PS-77/0625; NTIS/PS-76/0553; NTIS/PS-75/459
(NTIS/PS-79/0750/4; NTIS/PS-78/0718; NTIS/PS-77/0625; NTIS/PS-76/0553; NTIS/PS-75/459) Avail: NTIS
HC $28.00/MF $28.00 CSCL 17B

The research covers data transmission, multiplexing, digital, and microwave systems and equipment. Studies on troposcatter propagation are included. Federally sponsored research as well as some foreign reports are included in the citations. This updated bibliography contains 214 abstracts, 11 of which are new entries to the previous edition. GRA

N80-20479# Federal Communications Commission, Washington, D.C. Policy Development Div.
SPEECH BANDWIDTH REDUCTION Final Report
John B. ONeal, Jr. (North Carolina State Univ., Raleigh) and Philip B. Gieseler. Aug. 1979. 29 p. refs.
(PB80-103955; FCC/PRB/PD-79/02) Avail: NTIS
HC A03/MF A01 CSCL 17B

The current state-of-the-art in techniques for reducing the bandwidth needed to represent the human voice waveform is reviewed. If techniques exist for significantly reducing the 3 KHz bandwidth while maintaining sufficient quality, the radio frequency bandwidth could be proportionately reduced. The status of speech baseband compression is still in the laboratory stage or just emerging. None of it has been applied in any large commercial operation. Technology is available for reducing the 3 KHz voice bandwidth by a factor of 10, but at this stage this technology is not useful because a desirable level of performance and cost have not been achieved. The basic conclusion is that techniques currently available for significantly reducing speech bandwidth produce a concomitant degradation in speech quality. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-20480 British Library Lending Div., Boston Spa (England).
SOLID-STATE AMPLIFIERS AND IMAGE CONVERTERS
N. I. Krasnikov and S. V. Svechnikov. Oct. 1979. 25 p. refs. Transl. into ENGLISH from Poluprovodnikovaya Tekhnika 1 Mikroelektronika (Kiev), v. 7, no. 7, 1972, p. 17-27
(BLL-RTS-11799) Avail: British Library Lending Div., Boston Spa, Engl.

A technology assessment of solid state amplifiers and image converters is presented. R.E.S.

N80-20481 British Library Lending Div., Boston Spa (England).
A NORMAL YOKE FOR THE DETERMINATION OF THE MAGNETIC CHARACTERISTICS OF ELECTRICAL SHEETS
Alfred Fiebiger. Oct. 1979. 115 p. refs. Transl. into ENGLISH of Ein Normaljochzur Bestimmung der Magnetischen Kenngrossen von Elektroblechen (Brunswick), Bericht E-6, Physikalisch-Technische Bundesanstalt, Dec. 1976. 115 p.
(BLL-RTS-11946; Ber-E-6; ISSN-0341-6674) Avail: British Library Lending Div., Boston Spa, Engl.

The standardization of test procedures to determine the true magnetic properties of electrical steel sheets is discussed. A number of test methods which are based upon the magnetic properties of electrical steel sheets, according to their final industrial application, are described. The use of the steel sheets in magnetic circuits is discussed and the magnetic properties of the electrical steel sheets usually determined by two measured variables are reviewed. A.W.H.

N80-20482 Stanford Univ., Calif.
LUMP PARTITIONING OF INTEGRATED-CIRCUIT BIPOLAR TRANSISTOR MODELS FOR HIGH-FREQUENCY APPLICATIONS Ph.D. Thesis
Nelson Nai-Hin Chan. 1979. 214 p.
Avail: Univ. Microfilms. Order No. 8006299

A two lump high frequency model was derived using the lump partitioning technique for an integrated bipolar transistor over a frequency range up to f sub T and a full current range. Excellent agreement between model and measured S parameters was obtained for the Stanford Bipolar Transistors with an f sub T of 500 MHz. A physical basis was provided for the two lump model. There are two major physical mechanisms responsible for the high frequency behavior of the integrated bipolar transistors. For low currents it is the AC crowding effect which causes more current flow in the periphery of the emitter area than in the center. For high currents it is the sidewall transistor action which induces a significant amount of minority charge that controls the high frequency response of the device. The combination of these two effects provide a guide to partition the one lump model into two sections, one section with most of the ac response and the other section with only dc response. Dissert. Abstr.

N80-20483 Purdue Univ., Lafayette, Ind.
METAL-INSULATOR-SEMICONDUCTOR ASPECTS OF MONOLITHIC ZINC OXIDE SURFACE ACOUSTIC WAVE STRUCTURES Ph.D. Thesis
Michael Edwin Cornell 1979 270 p
Avail: Univ. Microfilms Order No. 8005849

The nonideal electrical behavior of the metal ZnO SiO2 Si(MZOS) configuration constitutes an important factor in the performance of monolithic ZnO SAW devices. The observations described herein emphasize the use of MIS measurements to study the electrical properties of the MZOS system. The major areas of investigation involved process induced damage to the Si-SiO2 subsystem and electronic charge injection/trapping within the ZnO films. A procedure whereby the charge distribution is established as a quasi time independent distribution is described. Comparison studies of the C-V characteristics of the MZOS-C and Si-SiO2 system, a ZnO etch back experiment, and capacitance time observation of the change injection phenomena are examined. A model is advanced based upon the physical nature of the piezoelectric ZnO films to explain charge injection and the dipole formation within the ZnO film. Dissert. Abstr.

N80-20484 Marquette Univ., Milwaukee, Wis.
THEORY AND APPLICATIONS OF NEGATIVE DIFFERENTIAL RESISTANCE IN THE CURRENT-VOLTAGE CHARACTERISTICS OF METAL-INSULATOR-METAL DIODES Ph.D. Thesis
David M. Drury 1978 171 p
Avail: Univ. Microfilms Order No. 8006526

The negative differential resistance phenomenon that has been observed in the current-voltage characteristics of some MIM diodes was investigated theoretically. Deficiencies of the present theory purporting to explain this phenomenon were pointed out. A theory was developed to explain the observed negative differential resistance. According to this theory, if the diode bias voltage is sufficiently large, an electron can tunnel inelastically through the insulating layer of the diode by emitting a surface plasmon that propagates in the insulating layer. The mathematical analysis of the proposed stimulated inelastic tunneling theory was performed using an idealized two dimensional model of an MIM diode. The electric and magnetic field distributions of the surface plasma wave in the diode's insulating layer were derived and used to obtain the interaction Hamiltonian of the tunneling electrons. Second order time-dependent perturbation theory was used to obtain the stimulated inelastic tunneling rate. An equation relating the inelastic tunneling current to the bias voltage was obtained. Dissert. Abstr.

N80-20485 New York Univ., N. Y.
AN ACQUISITION AID FOR A PHASE LOCKED LOOP Ph.D. Thesis
Donald Richard Ucci 1979 286 p
Avail: Univ. Microfilms Order No. 8006478

A method for acquisition of a phase lock loop receiver is presented. A structure designed for this purpose is described. The method uses an iterative technique to estimate the frequency of an unknown Doppler shifted unmodulated carrier signal imbedded in noise. The acquisition process can be achieved even if the system is below threshold. The acquisition times for a given probability of error are presented for two modes of operation - one which provides a reduced acquisition time but requires more hardware complexity, and another which produces slightly less reduced acquisition times but a simpler hardware design. Results for a hardware implementation are presented. Dissert. Abstr.

N80-20486 Stanford Univ., Calif.
PLACEMENT AND ROUTING ALGORITHMS FOR HIERARCHICAL INTEGRATED CIRCUIT LAYOUT Ph.D. Thesis
Bryan Thomas Preas 1979 210 p
Avail: Univ. Microfilms Order No. 8006344

Algorithms for the automatic layout of custom integrated circuits were developed. These algorithms are suitable for the design of very large scale integrated circuits. Hierarchical decomposition is used to reduce the circuit complexity to the level that it can be comprehended by the designer. At each level of the hierarchy, the layout problem consists of the placement and interconnection of rectangular blocks of arbitrary size and shape. The layout is modelled using graph theoretical methods. The problem is broken down into two major sub-problems, placement and routing. Placement consists of a constructive initial placement followed by iterative improvement. The interconnection or routing process first finds a general layout topology for the interconnection nets and then a detailed routing using constructive and iterative improvement methods. The algorithm minimizes layout area and assures 100% routing completion. Dissert. Abstr.

N80-20487* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALYST SURFACES FOR THE CHROMOUS/CHROMIC REDOX COUPLE Patent
Jose D. Giner (Giner, Inc.) and Kathleen J. Cahill, inventor (to NASA) (Giner, Inc.) Issued 11 Mar 1980 8 p Filed 29 Nov 1978 Supersedes N79-14538 (17 - 05, p 0618) Sponsored by NASA
(NASA-Case-LEW-13148-1; US-Patent-4,192,910; US-Patent-Appl-SN-964754; US-Patent-Class-429-101; US-Patent-Class-429-105; US-Patent-Class-429-107; US-Patent-Class-429-109) Avail: US Patent and Trademark Office CSCL 09A

An electricity producing cell of the reduction-oxidation (REDOX) type is described. The cell is divided into two compartments by a membrane, each compartment containing a solid inert electrode. A ferrous/ferric couple in a chloride solution serves as a cathode fluid which is circulated through one of the compartments to produce a positive electric potential disposed therein. A chromic/chromous couple in a chloride solution serves as an anode fluid which is circulated through the second compartment to produce a negative potential on an electrode disposed therein. The electrode is an electrically conductive, inert material plated with copper, silver or gold. A thin layer of lead plates onto the copper, silver or gold layer when the cell is being charged, the lead ions being available from lead chloride which was added to the anode fluid. If the REDOX cell is then discharged, the current flows between the electrodes causing the lead to deplate from the negative electrode and the metal coating on the electrode will act as a catalyst to cause increased current density. Official Gazette of the U.S. Patent and Trademark Office

N80-20488*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
APPARATUS FOR DAMPING OPERATOR INDUCED OSCILLATIONS OF A CONTROLLED SYSTEM Patent Application
John W. Edwards and John W. Smith, inventors (to NASA) Filed 29 Feb 1980 24 p
(NASA-Case-FRC-11041-1; US-Patent-Appl-SN-126064) Avail: NTIS HC A02/MF A01 CSCL 09C

The invention relates to an adaptive filter for suppressing operator induced oscillations of a control system such as a pilot controlled aircraft or spacecraft. The novelty of the invention is in the filter arrangements which effectively estimate frequency and amplitude to produce a signal that will provide damping without rate limiting. NASA

N80-20489# Syracuse Univ., N. Y.
MEASUREMENT OF ELECTRICAL CONDUCTIVITY IN CARBON/EPOXY COMPOSITE MATERIAL OVER THE FREQUENCY RANGE 75 MHz TO 2.0 GHz Phase Report, 1 Oct. 1977 - 31 Dec. 1978
W. F. Walker and Roger E. Heintz Oct. 1979 58 p refs Prepared in cooperation with Rochester Inst. of Technology, N.Y.
(Contract F30602-76-C-0121; AF Proj. 2338)
(AD-A078008; RADC-TR-79-255) Avail: NTIS HC A04/MF A01 CSCL 09/3

A stripline technique for the measurement of longitudinal and transverse conductivity of graphite (carbon)/epoxy composite materials over the VHF/UHF (75 MHz to 2.0 GHz) range is described. The method is unusual in that it is essentially free of the uncertain effects of contact resistance between the sample and the measurement apparatus. The underlying theory of the method rests on the relationship between the conductivity of the sample and the lossy standing wave patterns established on the strip transmission line. The method accommodates a range

of sample conductivities from 100 mhos/m. (e.g. transverse carbon/epoxy) to aluminum (approx. 10 to the 7th power mhos/m). Actual measurements were made from 75 MHz to 2 GHz. The method itself should be usable from 50 MHz to 4 GHz. GRA

N80-20490# Varian Associates, Palo Alto, Calif.
MULTIBAND KLYSTRON STUDY Final Report, 31 Mar. 1978 - 30 Jun. 1979
A. D. Larue Oct. 1979 61 p
(Contract F30602-78-C-0124; AF Proj. 4506)
(AD-A078036; RADC-TR-79-248) Avail: NTIS
HC A04/MF A01 CSCL 09/5

The present study indicates that a reasonable interspersed S-Band and C-Band computer cavity broadband multiband klystron is feasible. Computer results suggest a 10 percent operating bandwidth at S-Band and a 5 percent operating band at C-Band. Author (GRA)

N80-20491# Varian Associates, Palo Alto, Calif. Microwave Tube Div.
HIGH POWER MILLIMETER WAVE AMPLIFIER Interim Report, 1 Nov. 1978 - 30 Apr. 1979
S. Hegji, Howard Jory, R. Morwood, A. Nordquist, and R. Symons Sep. 1979 34 p refs Sponsored in part by Ballistic Missile Defense, Advanced Technol. Center
(Contract F30602-78-C-0011; ARPA Order 3192; AF Proj. 192C)
(AD-A078007; RADC-TR-79-235; IR-3) Avail: NTIS
HC A03/MF A01 CSCL 09/5

This report contains the results of the testing of rebuilt Gyro-TWT. This rebuilt tube incorporates an extra length of interaction circuit. The rebuilt tube achieved a small signal gain of 17db and was prone to oscillations. The Gyro-TWT was rebuilt a second time and included, among other improvements, rf loss on the interaction circuit. The results of the initial cold test on this tube are included. Also included in this report are further calculations on TE Gyro-TWT's operating in the fundamental and the second harmonic using a small signal dispersion relation computer program. GRA

N80-20492# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Oceanographic Lab.
THERMISTOR ARRAY IMPEDANCE CONSIDERATIONS
Clifford R. Holland Jun. 1978 17 p refs
(AD-A079886; NORDA-TN-26) Avail: NTIS
HC A02/MF A01 CSCL 09/1

This study examines the effects of cable resistance changes on temperature measurement accuracy when using a typical thermistor array for ocean temperature measurements. The analysis demonstrates that while some of the effects can be calculated or calibrated out, the major effects of insulation leakage can not be so corrected. Depending on choice of thermistor, measurement errors as large as a few deg Celsius are possible, with errors of a few tenths of a deg Celsius likely. Even with great care, errors of a few hundredths of a degree Celsius are probable. To avoid sensitivity to cable impedance changes, it is strongly recommended that appropriate signal conditioning electronics be utilized at the thermistor sensor. The use of signal conversion and line driving electronics will insure that the accuracy of measured parameters will be maximally preserved during transmission to the output end of the array. GRA

N80-20453# Analysis and Computer Systems, Inc., Burlington, Mass.
DEVELOPMENT OF NUMERICAL TECHNIQUES AND COMPUTER SYSTEMS FOR DESIGN, ANALYSIS AND FABRICATION OF INTERDIGITAL TRANSDUCERS AS SURFACE ACOUSTIC WAVE DEVICES Final Technical Report, 24 May 1978 - 31 Mar. 1979
Lawrence J. Elterman Griffis AFB, N.Y. RADC Aug. 1979 301 p
(Contracts F19628-76-C-0257; F19628-78-C-0028; AF Proj. 2305; AF Proj. 4600)
(AD-A079623; RADC-TR-79-181) Avail: NTIS
HC A14/MF A01 CSCL 17/1

Computerized, mathematical and analytical techniques were developed, refined and applied to the description, analysis and synthesis of surface acoustic wave (SAW) transduction structures and devices. Efficient mapping techniques between the various description mathematical models and techniques in support of electron beam fabrication of SAW interdigital transducers were developed and refined. A number of computer programs were completed ranging in complexity and size from modifications to existing programs, to design and development of complex analytical techniques utilizing numerical control methodology. GRA

N80-20484# University of Southern California, Los Angeles. Electronic Sciences Lab.
EVALUATION OF GALLIUM NITRIDE FOR ACTIVE MICROWAVE DEVICES Annual Report, Oct. 1978 - Sep. 1979
M. Gershenzon Oct. 1979 21 p
(Contract N00014-75-C-0295; RR0210203)
(AD-A079319;) Avail: NTIS HC A02/MF A01 CSCL 07/4

Planar single crystal layers of GaN that are almost defect free and completely transparent can now be grown routinely by CVD on basal plane sapphire substrates. The native shallow donor density still remains high (ten to the 18th power - ten to the 19th power/cc) unaltered by growth under varying Ga:N ratios, but decreasing somewhat with increased growth rate. The results of growth under N2 at high pressures are inconclusive at present. Doping with Ge or C during growth does not compensate the donor. Low temperature photoluminescence studies of proton implanted samples and of samples grown in the absence of H2 provide additional evidence that the shallow donor is not associated with H. Work is in progress to interpret much fine structure observed in the luminescence spectra, to complete the identification and characterization of donors and acceptors introduced by ion implantation and to observe any effects on the native donor density caused by the implantation of Ga and of N. GRA

N80-20495# Missouri Univ. -Rolla.
ION IMPLANTATION IN PEROVSKITE TYPE FERROELECTRICS Final Progress Report, 1 Nov. 1976 - 31 Oct. 1979
Robert Gerson 20 Dec. 1979 15 p refs
(Grant DAAG29-77-G-0001)
(AD-A080078; ARO-14313.1-P) Avail: NTIS
HC A02/MF A01 CSCL 07/4

The object of this work was to study ion implantation in perovskite ferroelectrics and to investigate the conductive behavior of implanted layers. Implantation experiments were carried out on strontium titanate, barium titanate (single crystal and ceramic), titanium dioxide (rutile), lithium niobate, and lithium tantalate. Ion beams attempted were H(+), B(+), Cl(+), Ni(+), Fe(+), Ar(+), As(+), Ta(+), and Nb(+). In general the most effective ion in producing conductivity was boron, B(+). Significant conductivity was measured in the substrates above, except for single crystals of barium titanate and lithium tantalate. Boron implanted in strontium titanate and subsequently annealed resulted in highly conductive layers, whose sheet resistance could be between 100 and 100,000 ohm per square. The charge carrier mobility in this system was 5 sq. cm/volt sec at room temperature, increasing to 100 sq. cm/volt sec at 77 K. Implantation doses were 10 to the 16th power to 10 to the 17th power ions/sq. cm. The implantation depth, as revealed by chemical stripping experiments, was about 500 nm. A conductive anomaly was measured in some samples at 105 K, the cubic-tetragonal transition temperature. GRA

N80-20496# TRW Defense and Space Systems Group, Redondo Beach, Calif.
GaAs ANALOG INTEGRATED CIRCUITS (GaAs RF-LSI), PHASE 1. VOLUME 2: APPENDICES Progress Report, 5 Jun. 1978 - 5 Jun. 1979
Aug. 1979 151 p refs
(Contract N00039-78-C-0305)
(AD-A079589) Avail: NTIS HC A08/MF A01 CSCL 09/5

The derivation of the field effect transistor modeling code is explained and the program listing is presented. Supplementary processing data are included with supporting analysis and data for the analog multiplier designs. A.R.H.

N80-20497# TRW Defense and Space Systems Group, Redondo Beach, Calif.
GaAs ANALOG INTEGRATED CIRCUITS (GaAs RF-LSI), VOLUME 1 Technical Progress Report, 5 Jun. 1978 - 5 Jun. 1979
Aug. 1979 185 p refs
(Contract N00039-78-C-0305)
(AD-A079588) Avail: NTIS HC A09/MF A01 CSCL 09/5

The overall objective of the GaAs RF-LSI Development Program is the development of a family of monolithic GaAs analog integrated circuits operating at frequencies through X-band, and the implementation of a monolithic X-band receiver which combines a number of these building block circuits. The aim of the first phase effort was to amass the analysis, design, and process technology tools with which to implement the building block circuits and later the receiver. The general objective of Phase 1, Device, Process and Circuit Techniques Investigation, was to undertake the device and process technology development necessary to support the Phase 2, MSI Building Block Development. Closely coupled with the actual process development were theoretical studies addressing optimization of devices and circuit techniques for monolithic implementation. The following is a brief task by task summary of the work accomplished. The sections which follow this introduction are expanded discussions of each of the tasks. GRA

N80-20498# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
ON THE PHYSICAL REALIZABILITY OF BROAD-BAND EQUIVALENT CIRCUITS FOR WIRE LOOP AND DIPOLE ANTENNAS Interim Report, 1 Sep. 1977 - 31 May 1979
Gary W. Streable and L. Wilson Pearson May 1979 163 p refs
(Grant AF-AFOSR-3452-77; AF Proj. 2301)
(AD-A079961; RR-79-1; AFOSR-80-0003TR) Avail: NTIS HC A08/MF A01 CSCL 20/14

Results of a study of the feasibility of using Singularity Expansion Method (SEM) data to synthesize broad-band equivalent circuits for loop and wire structures are reported. The positive realness of admittances derived are studied, on the basis of both pole-pair groupings and eigenmode groups within the SEM formalism. Synthesized circuits are given for a center-driven and a quarter-driven straight wire antenna, and for a circular loop. Results are compared with those derived by means of numerical solution of the time-dependent integral equations for each structure. The sensitivities of the response to changes in the values of poles and to circuit element values are considered. GRA

N80-20499# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
ON THE PHYSICAL REALIZABILITY OF BROADBAND LUMPED-PARAMETER EQUIVALENT CIRCUITS FOR ENERGY-COLLECTING STRUCTURES Final Report
L. Wilson Pearson (Mississippi Univ., University) and Donald R. Wilton Jul. 1979 44 p refs
(Grant AF-AFOSR-3452-77)
(AD-A079962; RR-79-2; AFOSR-80-0004TR) Avail: NTIS HC A03/MF A01 CSCL 20/14

The practical implementation of equivalent circuits which represent the energy delivered to an arbitrary load impedance by an antenna or a port on a scatterer is discussed. Particular attention is paid to the positive-real function issues associated with the equivalent admittance of the structure when evolved from the point of view of the Singularity Expansion Method. A proof is given which establishes that the admittances associated with current eigenmode contributions to the total current are individually positive-real functions. An ad hoc approach to approximating these admittances with simpler pole-pair positive-real admittances is given for high-Q structures. A brief survey of the applicable circuit synthesis algorithms and their features is provided. Some fundamental considerations in the implementation of the sources representing the energy coupled from the incident wave are presented. GRA

N80-20500# Stanford Univ., Calif. Integrated Circuits Lab.
FABRICATION, CHARACTERIZATION AND OPTIMIZATION OF POSFET (PVF2-SILICON) PIEZOELECTRIC TRANSDUCERS FOR LOW FREQUENCY 100 Hz TO 500 KHz UNDERWATER ACOUSTIC APPLICATIONS Final Report, 1 Jul. 1978 - 31 Aug. 1979
James D. Plummer Oct. 1979 90 p refs
(Contract N00014-78-C-0614)
(AD-A079113; TR-FR-DPG582) Avail: NTIS HC A05/MF A01 CSCL 17/1

PVF2 is a new organic polymer piezoelectric material. Its unique features include an acoustic impedance closely matched to liquid environments, linearity to a broad range of input signals, wide bandwidth and mechanical strength and flexibility. In comparison with commonly used ceramic piezoelectric materials, PVF2 has a lower electromechanical coupling coefficient, a lower dielectric constant and higher dielectric losses at frequencies greater than or equal to 500 KHz. Because of these different material properties, system applications of PVF2 require different trade-offs than the ceramic materials. This report describes an investigation, both theoretical and experimental, of the potential applications of PVF2 in low frequency (100 Hz-500 KHz) underwater sound applications. Both reception and transmission of sound are considered and the experimental performance of several types of PVF2 and integrated silicon/PVF2 transducers are described. GRA

N80-20501# Ames Lab., Iowa.
FABRICATION OF SUPERCONDUCTING WIRE COMPOSITES BY DIRECTIONAL SOLIDIFICATION
J. D. Verhoeven, E. D. Gibson, D. Finnemore, J. Ostensen, and L. Goodrich Jun. 1979 48 p refs
(Contract W-7405-eng-82)
(IS-4698) Avail: NTIS HC A03/MF A01

Processes were developed for the fabrication of composite superconducting wire using directional solidification and chill casting techniques. The superconducting properties were comparable to commercial superconducting wire. DOE

N80-20502# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
INFLUENCE OF MAGNETIC ORDERING ON THE SUPERCONDUCTING PROPERTIES OF AMORPHOUS (Zr/SUB 1-X/Er/SUB X/)3Rh ALLOYS
W. L. Johnson Aug. 1979 21 p refs
(Contract EY-76-C-03-0822)
(CALT-822-110; DOE-TR-97) Avail: NTIS HC A02/MF A01

The effect of Er impurities on the superconducting properties of an amorphous Zr3Rh alloy was studied. The Er impurities were foundt o exhibit mangnetic behavior characteristic of a free Er(3+) ion in a weak crystal field. Magnetic ordering of the Er moments was observed to occur at a temperature T/sub M/ which is proportional to the Er concentration. This ordering strongly influenced superconductivity as evidenced by anomalous behavior in the concentration dependence of T/sub c/. For concentrations near the critical Abrikosov-Gorkov value superconductivity appeared to be induced by magnetic ordering. The superconducting critical field H/sub c2/(T) was strongly effected by magnetic ordering and could be used to deduce information concerning the nature of the ordering. The results are analyzed in terms of theoretical models. DOE

N80-20503# Bendix Corp., Kansas City, Mo.
PRODUCTION OF THIN FILM NETWORKS WHICH UTILIZE CHROME-GOLD CONDUCTORS
D. A. Rathbun Jul. 1979 8 p Presented at the ISHM Conf., Los Angeles, 13 Nov. 1979
(Contract EY-76-C-04-0613)
(BDX-613-2257; CONF-791113-3) Avail: NTIS HC A02/MF A01

Many thin film networks (TFNs), designed and manufactured for DOE programs utilize gold films 3 to 9 microns thick evaporated over a chromium film. The chromium film is evaporated over sputtered tantalum nitride film, and the substrate material is 0.027 in. (0.686 mm) thick alumina. The TFNs must have high film adhesion characteristics, meet high bondability requirements, and allow stable electrical parameters. Various production techniques ensure these high reliability TFNs. DOE

N80-20504# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.

DETERMINING THE MODE OF HIGH VOLTAGE BREAKDOWNS IN VACUUM DEVICES
H. C. Miller, E. J. Furno, and J. P. Sturtz 1979 22 p refs
(Contract EY-76-C-04-0656)
(GEPP-OP-469) Avail: NTIS HC A02/MF A01

Photography, recording of the voltage waveform, and monitoring of the X-ray output were used to investigate breakdown in vacuum. Results indicate that breakdowns may be divided into two types: vacuum (interelectrode) breakdown - characterized by a diffuse moderately bright discharge, a relatively slow and smooth voltage collapse and a large burst of X-rays; and surface (insulator) flashover - characterized by a bright discharge with a very bright filamentary core, a relatively fast and noisy voltage collapse, and no X-ray burst. Thus, the results indicate that useful information concerning the type of breakdown in a vacuum device can be obtained by monitoring the voltage (current) waveforms and the X-ray output. DOE

N80-20505# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
MULTIPLE PROPERTY VARIATIONS IN COAXIAL CYLINDRICAL CONDUCTORS DETERMINED WITH MULTIPLE-FREQUENCY EDDY CURRENTS
W. E. Deeds and C. V. Dodds Nov. 1979 63 p refs
(Contract W-7405-eng-26)
(NUREG-CR-0967; ORNL/NUREG/TM-335) Avail: NTIS HC A04/MF A01

To expedite and automate the taking of readings, computer programs were written that take simultaneous measurements of the magnitude and phase of the output voltage from an eddy current pickup at several different frequencies on standards with known properties. Empirical formulas are then constructed from powers of various possible functions of the magnitude and phase readings, and the formulas are fitted to the desired properties of the material by a least-squares process. Finally, the empirical formulas are used with readings on unknown samples to determine their properties. The computer programs, written in FORTRAN, are especially designed to be used with coils coaxial with multiple layers of cylindrical conductors, possibly containing defects. However, the instrument calibrating, data taking, and formula fitting parts of the programs are actually applicable to any configuration of coils and conductors. DOE

N80-20506# National Bureau of Standards, Washington, D.C. Electron Devices Div.
MEASUREMENT TECHNIQUES FOR HIGH POWER SEMICONDUCTOR MATERIALS AND DEVICES Annual Report, 1 Oct. 1977 - 30 Sep. 1978
Oct. 1979 144 p refs
(DOE/RA-0041; NBSIR-79-1756) Avail: NTIS HC A07/MF A01

Results of research directed toward the development of measurement methods for semiconductor materials and devices which will lead to more effective use of high-power semiconductor devices in applications for energy generation, transmission, conversion, and conservation are reported. Emphasis is on the development of measurement methods for materials for thyristors and rectifier diodes. The use of thermally stimulated current and capacitance measurements and other deep level measurement techniques developed as a means for characterizing lifetime-controlling or leakage source defects in power grade silicon material and devices are described. Procedures to enable spreading resistance measurements of thyristor starting material and layer profiles to be made on a reliable basis are included. DOE

N80-20507# Gould, Inc., Spring House, Pa.
SUPERCONDUCTING FAULT CURRENT LIMITER Quarterly Technical Progress Report, 8 Aug. - 7 Nov. 1978
1979 104 p refs
(Contract ET-78-C-01-3015)
(CONS/3015-T1; QTPR-1) Avail: NTIS HC A06/MF A01

The suitability of using a superconducting fault current limiter (SCFCL) in conjunction with other superconducting apparatus or transmission lines was investigated. Literature search, consultation, analysis, and experimentation were carried out to derive a set of operational parameters for a SCFCL and to answer key questions as to the feasibility of a superconducting element to meet these performance objectives. Substantial progress was made on several of these program tasks. A comprehensive search of the literature on SCFCL devices and applications was initiated; the references which were obtained to date are evaluated within a framework into which additional references can be added as they are received. Device analyses were also started in order to determine to what extent the various proposed SCFCL devices meet the requirements of the power system. DOE

N80-20508# Sandia Labs., Albuquerque, N. Mex.
MICROSTRUCTURAL STUDIES OF THICK FILM RESISTORS USING TRANSMISSION ELECTRON MICROSCOPY
T. V. Nordstrom and C. R. Hills 1979 14 p refs Presented at the ISHM Conf., Los Angeles, 13 Nov. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0387C; CONF-791113-4) Avail: NTIS HC A02/MF A01

The microstructure of thick film resistors of the DuPont 1400 series fired on 96% Al2O3 at 850 C was characterized using transmission electron microscopy. Samples were prepared by a combination of precision grinding and ion milling. Each sample was examined for crystallinity, phase morphology, particle size, elemental composition and phase identification. X-ray energy dispersive spectroscopy was used for elemental composition determination and electron diffraction for phase identification. Microstructure of the 1421 (100 omega/square) material is composed of lead ruthenate crystals in a lead silicate glass along with quartz crystals. For both resistors most crystallites are surrounded by the glassy phase. DOE

N80-20509# National Bureau of Standards, Washington, D.C. National Engineering Lab.
A 20 BIT PLUS SIGN, RELAY SWITCHED D/A CONVERTER
T. Michael Souders and Donald R. Flach Oct. 1979 25 p refs
(PB80-105331; NBS-TN-1105) Avail: NTIS HC A02/MF A01 CSCL 09E

A multirange, 20-bit + sign, voltage output d/a converter is described. The converter exhibits less than 1 ppm (of full scale range) linearly error, and temperature coefficients of gain, offset and linearly of less than 0.5 ppm/C. The design is based on the R-2R ladder network in the current steering mode, using miniature latching relays with mercury wetted contacts for switching. There are ten buffered temperature controlled unsaturated standard cells which comprise the voltage reference. Techniques with design details are presented for minimizing errors due to relay thermal emf's, for implementing a self calibration of linearity errors, and for obtaining optional coding formats. Calibration techniques are discussed and representative calibration data are presented. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-20510 Engineering Sciences Data Unit, London (England).
FLUCTUATING RESPONSE OF CIRCULAR CYLINDERS IN SMALL GROUPS IN FLUID FLOW: DISCUSSION AND GUIDE TO DATA AVAILABLE
1979 41 p
(ESDU-79025; ISBN-0-85679-273-X) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

The response of cylinders in small groups and methods of alleviating oscillation problems are examined. A brief description of the content of currently available sources of data is provided. The derived information can be used to assess the possibility of flow induced oscillation problems of, for example, a group of chimney stacks or a multiple pipe run in a chemical plant. This may apply to small groups of up to six to eight cylinders, but

excludes specific references to grouped cables or heat exchanger tube bundles. ESDU

N80-20511 Engineering Sciences Data Unit, London (England).
FLUID MECHANICS, INTERNAL FLOW SUB-SERIES. VOLUME 7: A GUIDE TO FAN SELECTION AND PERFORMANCE
1979 88 p
(ESDU-79037; ISBN-0-85679-286-1) Copyright. For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

Guidance is provided on the selection of suitable fan types for particular internal flow systems and data to assess their performance. The research may be used in the design and tendering for systems associated with air conditioning, cooling, ventilation, forced draughts, and wind tunnels. Information is given on the performance and selection of various types of axial-flow, centrifugal-flow, mixed-flow, and cross-flow fans including guidance on electric motors and noise. ESDU

N80-20512 Engineering Sciences Data Unit, London (England).
HEAT PIPES: PROPERTIES OF COMMON SMALL-PORE WICKS
1979 11 p
(ESDU-79013; ISBN-0-85679-257-8) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $290.50

The effective thermal conductivity, the minimum capillary radius, and the permeability of commonly used heat pipe wicks are examined. The data apply to the following types of wick: annular screens, screen covered grooves, multiple screens, plain or sintered spherical particles, and sintered felted metal fibers. ESDU

N80-20513 Virginia Univ., Charlottesville.
DYNAMICS OF FLEXIBLE ROTORS PARTIALLY FILLED WITH A VISCOUS INCOMPRESSIBLE FLUID Ph.D. Thesis
Scott Lynn Hendricks 1979 125 p
Avail: Univ. Microfilms Order No. 8004603

A linear theory is developed to study the motion of a hollow circular cylinder rotating with constant angular velocity and partially filled with a viscous incompressible fluid. A two-dimensional theory which ignores axial motion in the fluid is discussed. This theory exhibits all of the essential features of liquid-rotor coupling and is used to analyze a simple rotor configuration, and explore the ramifications of the analysis. The full three dimensional theory is then developed and used to analyze more complicated rotors. The results of the analysis predict that over a range of operating speeds, the rotor-fluid system is unstable. The extent of this unstable region is determined by the system parameters. The interplay between the viscosity of the fluid and damping on the rotor is especially important in determining stability boundaries. Dissert. Abstr.

N80-20514 Illinois Univ. at Chicago Circle, Chicago.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF HEAT TRANSFER BETWEEN A GAS-SOLID FLUIDIZED BED AND IMMERSED TUBES Ph.D. Thesis
Nanak Singh Grewal 1979 350 p
Avail: Univ. Microfilms Order No. 8007460

The heat transfer coefficient between an electrically heated single horizontal tube and a 0.305 m square air-solid fluidized beds of glass beads, dolomite, sand, silicon carbide and alumina particles. The effect of particle size, shape, density, and specific heat; air mass fluidizing velocity; tube size; tube material; bed depth, heat flux and distributor design on heat transfer rate is investigated. Dissert. Abstr.

N80-20515 Minnesota Univ., Minneapolis.
SOLUTION OF THE EQUATIONS OF CONVECTIVE HEAT, MASS, AND MOMENTUM TRANSFER BY THE FINITE-ELEMENT METHOD USING QUADRILATERAL ELEMENTS Ph.D. Thesis
Satish Ramadhyani 1979 196 p
Avail: Univ. Microfilms Order No. 8006668

A finite element procedure was developed that overcomes the Reynolds number limitation. The procedure involved the use of the weighted residual technique with a special shape function that accounted or the influence of the convective terms in the governing conservation equations. The procedure was developed in detail for two dimensional flow situations, but the ease of extension to three dimensional flow situations was a significant consideration in its development. This has dictated the use of quadrilateral elements rather than the otherwise simpler triangular elements, since the three dimensional counterpart of a quadrilateral was hexahedron. Hexahedral blocks were employed to fill an arbitrary three dimensional domain more easily than did tetrahedra. Dissert. Abstr.

N80-20516 Michigan State Univ., East Lansing.
FLUID FLOW THROUGH A PARTIALLY FILLED CYLINDER Ph.D. Thesis
Raymond Nicholas Greenwell 1979 90 p
Avail: Univ. Microfilms Order No. 8006121

The laminar flow of viscous incompressible fluid through a partially filled circular cylinder is studied. For this problem the Navier-Stokes equations can be transformed into Laplace's equation, and the region of solution is the interior of two intersecting circles. The region is mapped to the unit circle by a conformal transformation, so that the problem may be solved by the Poisson integral formula. It is found that the flow rate can be increased by as much as 27.3% by not filling the cylinder all the way. For the case where the region of solution is the interior of two circles intersecting at right angles, the computations simplify and the integration can be performed analytically. For the case of the nearly-half filled cylinder, a perturbation method is used on the solution of the half filled circular cylinder. The results obtained from these special cases agree with the previously obtained results. Dissert. Abstr.

N80-20517 Minnesota Univ., Minneapolis.
NONGEOSTROPHIC BAROCLINIC INSTABILITY OF TWO FLUIDS Ph.D. Thesis
James Theodore Bradford 1979 197 p
Avail: Univ. Microfilms Order No. 8006588

The interfacial stability of two fluids under differential rotation in a tall, right circular cylinder was investigated. The differential speeds are such that the Rossby number of the flow is small. Geostrophic conditions prevail in the interior, undisturbed flow and the results of interfacial shape calculations using the geostrophic velocity profiles in each fluid are compared with experimentally measured interface shapes. A linearized stability analysis, including interfacial tension and viscous effects at the interface and end caps was performed on the nongeostrophic equations of motion. Experiments were conducted in which instability regions corresponding to the wave numbers $n = 1$ and $n = 2$ are determined. Qualitative observations are made concerning the presence of amplitude and frequency vacillations characteristic of finite amplitude baroclinic waves under supercritical conditions. Dissert. Abstr.

N80-20518 Purdue Univ., Lafayette, Ind.
LABORATORY STUDY OF THERMAL AND FLOW STRUCTURES IN HEATED AND/OR COOLED LAYERS OF WATER Ph.D. Thesis
Massoud Behnia 1979 235 p
Avail: Univ. Microfilms Order No. 8005833

The basic internal transport processes in natural waters and the interactions at the air-water interface was investigated. To this end, thermal and flow structure in a stratified layer of water heated by a radiation source and/or cooled by forced air flow over the surface was studied in the laboratory. Accurate temperature measurements were obtained using a Mach-Zehnder interferometer which did not disturb or distort the temperature, radiation and flow fields. The flow structure was studied qualitatively by visualizing the patterns with dye injection, particle tracing (fish scales) and shadowgraph techniques. Temperature fluctuations and thermal plume activities were detected by a thermistor. Dissert. Abstr.

N80-20519 California Inst. of Tech., Pasadena.
CAVITATION INDUCED INSTABILITIES ASSOCIATED WITH TURBOMACHINES Ph.D. Thesis
David Miner Braisted 1980 196 p
Avail: Univ. Microfilms Order No. 8006277

A linear stability analysis was developed which was based upon the understanding that auto-oscillation is a function of the entire hydraulic system including the cavitating inducer. Using the experimentally obtained transfer functions of two impellers, the analysis successfully predicted both the onset and frequency of auto-oscillation. The stability of the dynamic pump test facility is significantly reduced by the increased dynamically active character of the inducers at the lower cavitation number. In addition, the stability of the dynamic pump test facility was found to be particularly sensitive to the mass flow gain factor and pump impedance. Dissert. Abstr.

N80-20520 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE DYNAMICS OF AN ULTRASONIC CAVITATION BUBBLE Ph.D. Thesis
Chinenyenwa Okereke 1979 175 p
Avail: Univ. Microfilms Order No. 8005225

The dynamics of the bubble are represented by a problem in partial differential equations, the governing equations of which are the continuity equation and the Navier-Stokes equation for a compressible liquid. A finite difference scheme was developed for generating the exact solution of the problem. It was not possible to obtain a solution that would satisfy both the governing equations and all the boundary conditions. The problem has more boundary conditions in pressure than can be satisfied. Consequently, it is not a valid mathematical statement and is not a legitimate representation of the dynamic behavior of the cavitation bubble. Dissert. Abstr.

N80-20521 Minnesota Univ., Minneapolis.
DEVELOPMENT AND APPLICATIONS OF A LAMELLAR MODEL FOR ANALYSIS OF LIQUID-LIQUID MIXING Ph.D. Thesis
Julio Mario Ottino 1979 230 p
Avail: Univ. Microfilms Order No. 8006659

Mixing, a process that involves fluid mechanics, diffusion, and chemical reactions is analyzed. In general, these three mechanisms govern reaction in any reacting mixture. These mechanisms are integrated in a common frame of description. Analysis is divided in two parts: a continuum description of the mechanical mixing of fluids (with neither diffusion nor reaction) and a lamellar mixing model for mixing of diffusing and reacting fluids. Mechanical mixing of fluids is interpreted as deformation of contact interfaces or material surfaces and is described by continuum mechanical arguments. Mixing of diffusion and reacting fluids is interpreted in terms of a lamellar model. This is a continuum, deterministic description based on a Lagrangian point of view for computation of interactions between local fluid motion, diffusion, and chemical reaction. The attributes of each model are delineated. Dissert. Abstr.

N80-20522 Purdue Univ., Lafayette, Ind.
A CONTRIBUTION TO THE STABILITY OF ELECTRICALLY CONDUCTING BOUSSINESQ FLUIDS BY THE ENERGY METHOD Ph.D. Thesis
Alan Morris Greenburg 1979 100 p
Avail: Univ. Microfilms Order No. 8005885

The energy method of Reynolds and Orr, for flows subject to finite disturbances, is extended to include approximate base flows and flows in which inertial and/or Lorentz forces of the base flow are of comparable or greater magnitude than the impressed body force field. The extension given is consistent with the well-known Boussinesq approximation. Two new stability criteria were established which demonstrate the effect of allowing approximate base flows. The universal stability boundary considers only the extremal characteristics of the base flow. The optimal stability boundary criteria applies variational techniques and utilizes more details of the base flow to obtain the largest possible stability region consistent with the theory. The theory is applied to the problem of heated Couette flow, both with and without internal viscous heating. Dissert. Abstr.

N80-20523 Stanford Univ., Calif.
EVOLUTION OF TURBULENCE BY THREE-DIMENSIONAL NUMERICAL PARTICLE-VORTEX TRACING Ph.D. Thesis
Benoit Couet 1979 145 p
Avail: Univ. Microfilms Order No. 8006306

A method for the numerical simulation of three dimensional incompressible flows is described which traces the motion of the vortex filaments in the velocity field which these filaments create. Three computational experiments were pursued in three dimensional space. The velocity of translation of a single vortex ring was measured and compared with the Biot-Savart law. The agreement was excellent. Next, the evolution in time of an infinite periodic array of closed vortex filaments was studied. The results were compared with those obtained previously by the spectral method. The Fourier mode spectra were in very good agreement. The third simulation followed a mixing layer from an initial state of uniform vorticity with two and three dimensional small perturbations. Streamwise perturbations lead to the usual roll-up of vortex patterns with spanwise uniformity. Substantial streamwise vortex deformation and stretching is generated by the spanwise perturbations. Dissert. Abstr.

N80-20524 Stanford Univ., Calif.
KINEMATICS AND DYNAMICS OF VORTEX RINGS IN A TUBE Ph.D. Thesis
James Gordon Brasseur 1979 228 p
Avail: Univ. Microfilms Order No. 8006294

Kinematic theory and flow visualization experiments are combined to examine the dynamic processes which control the evolution of vortex rings from very low to very high Reynolds numbers, and assess the effects of the wall as a vortex ring travels up a tube. The vortex ring are modeled as a circular vortex filament axisymmetrically placed in an infinitely long tube. Using the Biot-Savart law, a kinematic expression which linearly relates a given distribution of vorticity to its velocity field, the closed form solutions to the nonsteady potential and streamline fields are obtained. Reynolds number relationships are established and quantitative differences among the three Reynolds number groups are discussed. Dissert. Abstr.

N80-20525 Oregon State Univ., Corvallis.
GAS FLOW IN FLUIDIZED BEDS OF LARGE PARTICLES: EXPERIMENT AND THEORY Ph.D. Thesis
Goran N. Jovanovic 1979 166 p
Avail: Univ. Microfilms Order No. 8007123

Gas mixing was studied in a fluidized bed which is 0.483 m by 0.127 m (19 in. by 5 in) in cross section and has transparent plexiglass panels on the front and back. Experiments were conducted in a bed with and without tube array. Sand and dolomite particles with mean particle diameter of 1.3 mm (0.051 in.) to 4.0 mm (0.157 in.) were used. Gas velocities varied from minimum fluidization velocity to an excess velocity of 2.5 m/s. Two large particle fluidization regimes are described and experimental evidence is presented in support of the existence of slow bubble and exploding bubble regimes. A semi-theoretical equation establishing the boundary between these two modes of fluidization is derived. A new model, called the meandering flow model, is proposed for gas flow through fluidized beds of large particles. The concept of meandering flow is developed on the basis of actual physical movements of gas. Dissert. Abstr.

N80-20526 Virginia Polytechnic Inst. and State Univ., Blacksburg.
PULSATILE LAMINAR FLOW SEPARATION IN AN EXPONENTIALLY DIVERGING TUBE Ph.D. Thesis
Frederick James Walburn 1979 142 p
Avail: Univ. Microfilms Order No. 8005230

A laser Doppler anemometer technique was developed and used to study steady and unsteady flow through rigid circular tubes. An experimental arrangement was presented which includes a design which significantly reduced beam refraction effects as the laser beams pass through the circular glass tube. A Tektronix 4051 data acquisition system was used to acquire the data, process it and display non-dimensional axial velocity profiles on a digital plotter. It was found in steady flow through a diverging circular channel that a threshold Reynolds number existed for which the flow separated initially at the furthest downstream end of the channel divergence. With increasing Reynolds number above threshold, the point of flow separation defined by Prandtl's criterion moved upstream, such that for any given axial location x sub i, there corresponded a characteristic Reynolds number at which the flow was completely separated downstream of x sub i. Upstream, the flow remained laminar and attached. Dissert. Abstr.

N80-20527*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROGRESS IN TURBULENCE MODELING FOR COMPLEX FLOW FIELDS INCLUDING EFFECTS OF COMPRESSIBILITY
David C. Wilcox (DCW Industries, Inc., Studio City, Calif.) and Morris W. Rubesin Washington Apr. 1980 73 p refs
(NASA-TP-1517; A-7916) Avail: NTIS HC A04/MF A01 CSCL 20D

Two second-order-closure turbulence models were devised that are suitable for predicting properties of complex turbulent flow fields in both incompressible and compressible fluids. One model is of the 'two-equation' variety in which closure is accomplished by introducing an eddy viscosity which depends on both a turbulent mixing energy and a dissipation rate per unit energy, that is, a specific dissipation rate. The other model is a 'Reynolds stress equation' (RSE) formulation in which all components of the Reynolds stress tensor and turbulent heat-flux vector are computed directly and are scaled by the specific dissipation rate. Computations based on these models are compared with measurements for the following flow fields: (a) low speed, high Reynolds number channel flows with plane strain or uniform shear; (b) equilibrium turbulent boundary layers with and without pressure gradients or effects of compressibility; and (c) flow over a convex surface with and without a pressure gradient. A.R.H.

N80-20528*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONTROLLED OVERSPRAY SPRAY NOZZLE Patent Application
Willibald P. Prasthofer, inventor (to NASA) Filed 29 Feb. 1980 16 p
(NASA-Case-MFS-25139-1; US-Patent-Appl-SN-126138) Avail: NTIS HC A02/MF A01 CSCL 20D

A nozzle for suppressing overspray of multiingredient ablative materials is described. The nozzle includes a cylindrical inlet which converges to a restricted throat. A curved juncture between the cylindrical inlet and the convergent portion, with a predetermined radius of curvature, affords unrestricted and uninterrupted flow of the ablative material. A divergent bell shaped chamber and an adjustable nozzle exit are utilized which provide a highly effective spray pattern for suppressing overspray to an acceptable level and producing a homogeneous jet of material that adheres well to the substrate. NASA

N80-20529*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va. Aerothermodynamics Branch.
COMPLETE SUPERSONIC FLOWFIELDS OVER BLUNT BODIES IN A GENERALIZED ORTHOGONAL COORDINATE SYSTEM Final Report
Peter A. Gnoffo 17 Sep. 1979 45 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal, May 1980
(NASA-TM-81784; Log-J11338) Avail: NTIS HC A03/MF A01 CSCL 20D

A general orthogonal coordinate system is used to describe various axisymmetric and two-dimensional shapes. Close approximations to planetary probe configurations are possible. The full Navier-Stokes equations are discretized in this coordinate system in a manner based on Allen and Cheng's numerical procedure. The blow shock is treated as a discontinuity which floats between grid points. Completely coupled flows over the forebody, base, and near wake were calculated over a cylinder, sphere, and an approximation to the Viking Aeroshell. Some problem areas in determining the base flow for increasing Reynolds number are discussed. In particular, it is found that the mean free path of the fluid near the wall immediately below the corner of the Viking Aeroshell, which experiences a severe expansion, can becume greater than the local mesh size required to resolve the boundary layer in the forebody. R.E.S.

N80-20530# Montana State Univ., Bozeman. Mechanical Engineering Dept.
DETERMINATION OF FORCES ON ARBITRARY CONCAVE BODIES IN HIGH SPEED RAREFIED GASES
C. R. Wimberly 4 Dec. 1979 32 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal, Sep. - Oct. 1980
(Log-J11513) Avail: NTIS HC A03/MF A01

A method is presented for representing the forces imparted to general concave surfaces in high speed rarefied gases with variable accomodation at the surface and for a wide range of molecular speed ratios. A procedure previously developed for variations in momentum transfer is also presented that allows for predictions of coefficients from the free molecule flow through the transition regime to continuum flow. In the analysis, the molecules are assumed to obey Maxwell's velocity distribution law before and after collisions, reflecting directionally in a cosine distribution. The colliding molecules are assumed to have variable accomodation at the surface, where the surface temperature is uniform. The resulting general equations are then presented and applied to some simple concave bodies. Author

N80-20531*# General Electric Co., Lynn, Mass.
CALCULATION OF OBLIQUE-SHOCK-WAVE LAMINAR-BOUNDARY-LAYER INTERACTION ON A FLAT PLATE Final Report
Uriel Goldberg and Eli Reshotko Mar. 1980 87 p refs Prepared in cooperation with Case Western Reserve Univ., Cleveland
(Grant NGR-36-027-064)
(NASA-CR-159829) Avail: NTIS HC A05/MF A01 CSCL 20D

A finite difference solution to the problem of the interaction between an impinging oblique shock wave and the laminar boundary layer on a flat plate is presented. The boundary layer equations coupled with the Prandtl-Meyer relation for the external flow are used to calculate the flow field. A method for the calculation of the separated flow region is presented and discussed. Comparisons between this theory and the experimental results of other investigators show fairly good agreement. Results are presented for the case of a cooled wall with an oncoming flow at Mach number 2.0 without and with suction. The results show that a small amount of suction greatly reduces the extent of the separated region in the vicinity of the shock impingement location. M.G.

N80-20532*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACTORS AFFECTING CLEANUP OF EXHAUST GASES FROM A PRESSURIZED, FLUIDIZED-BED COAL COMBUSTOR
R. James Rollbuhler and John A. Kobak Mar. 1980 37 p refs
(NASA-TM-81439; E-382) Avail: NTIS HC A03/MF A01 CSCL 20D

The cleanup of effluent gases from the fluidized-bed combustion of coal is examined. Testing conditions include the type and feed rate of the coal and the sulfur sorbent, the coal-sorbent ratio, the coal-combustion air ratio, the depth of the reactor fluidizing bed, and the technique used to physically remove fly ash from the reactor effluent gases. Tests reveal that the particulate loading matter in the effluent gases is a function not only of the reactor-bed surface gas velocity, but also of the type of coal being burnt and the time the bed is operating. At least 95 percent of the fly ash particules in the effluent gas are removed by using a gas-solids separator under controlled operating conditions. Gaseous pollutants in the effluent (nitrogen and sulfur oxides) are held within the proposed Federal limits by controlling the reactor operating conditions and the type and quantity of sorbent material. M.G.

N80-20533# Naval Postgraduate School, Monterey, Calif.
HOT WIRE ANEMOMETER INVESTIGATION OF TURBULENCE LEVELS AND DEVELOPMENT OF LIQUID CRYSTAL FLOW VISUALIZATION TECHNIQUES FOR THE RECTILINEAR CASCADE TEST FACILITY M.S. Thesis
William R. Miller Sep. 1979 63 p refs
(AD-A078284) Avail: NTIS HC A04/MF A01 CSCL 20/4

Using hot wire anemometry, a base line turbulence intensity level was determined for the Rectilinear Cascade at the U.S. Naval Postgraduate School Turbopropulsion Laboratory. The turbulence with straight inlet guide vanes was compared to the turbulence without guide vanes. Results indicated a uniform though slightly greater turbulence level when using guide vanes. The

use of liquid crystal thermography was investigated as a technique for visualizing flow across cascade test blades. Methods of applying crystals to and resistance heating of the blade surface were investigated in bench tests. Recommendations are made which should lead to the successful application of the technique in the cascade wind tunnel. GRA

N80-20534# Naval Postgraduate School, Monterey, Calif.
OSCILLATING FLOW ABOUT TUBE BUNDLES M.S. Thesis
Mehmet Ali Cinar Sep. 1979 122 p
(AD-A078269) Avail: NTIS HC A06/MF A01

The lift, drag, and inertia coefficients have been determined experimentally for various tube bundles and for two cylinders at various relative positions subjected to harmonically oscillating flow. The force coefficients for the inline force have been analyzed through the use of the Morison's equation and the Fourier analysis. The transverse force or the lift force has been expressed in terms of its maximum value. The results have shown that the interference between the cylinders can give rise to complex flow patterns and to unexpectedly large force transfer coefficients. The results with two cylinder experiments have shed considerable light on the wake interference in harmonic flows. GRA

N80-20535# Naval Ship Research and Development Center, Bethesda, Md.
DETERMINATION OF STREAMLINE GEOMETRY AND EQUIVALENT RADIUS OVER ARBITRARY BODIES WITH APPLICATION TO THREE-DIMENSIONAL DRAG PROBLEM Interim Report, 1978 - 1979
Tsze C. Tai Dec. 1979 63 p refs
(WR0230201; WR0230200)
(AD-A077878; AERO-1261; DTNSRDC-79/080) Avail: NTIS HC A04/MF A01 CSCL 20/4

An exact method has been developed for determining the streamline geometry and equivalent radius over general three dimensional bodies. This method requires knowledge of either a theoretical or experimental surface inviscid pressure distribution. The full inviscid momentum equations, written in nonorthogonal curvilinear coordinates, are reduced to a set of three first-order ordinary differential equations for determining the streamline geometry. Based on analytical relationships among coordinate variables and the streamline direction, two additional first-order equations are derived for calculating the equivalent radius. Numerical examples, which include an elliptic paraboloid and a wing-fuselage-nacelle configuration, have been considered. Calculated streamline pattern exhibits correct trend, although no comparison has been made because of lack of available data. Application of the method to three dimensional drag problems has been demonstrated. In addition to providing the correct streamline geometry for obtaining the skin friction via the axisymmetric analogue, numerical results show that the method is capable of determining the three dimensional flow separation associated with the free-vortex layer for evaluating the interference drag. GRA

N80-20536# Oregon Univ., Eugene. Dept. of Physics.
TURBULENCE AND STATISTICAL MECHANICS Final Report, 1 Jul. 1976 - 30 Sep. 1979
Russell J. Donnelly Nov. 1979 258 p refs
(Grant AF-AFOSR-2880-76; AF Proj. 2301)
(AD-A079757; AFOSR-79-1357TR) Avail: NTIS HC A12/MF A01 CSCL 07/4

This report summarized research during the period July 1, 1976 to October 1, 1979 directed to understanding turbulence in superfluid helium heat transport. This study showed, for the first time, how to create a reasonably homogeneous turbulent flow in a test section of a heat flow channel. The first systematic study of the power spectrum of turbulent fluctuations was completed. Several theoretical studies of helium 2 were also published, treating elementary excitations, temperature dependent energy levels, equations of motion and restricted geometries. GRA

N80-20537# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A NUMERICAL STUDY OF NORMAL-SHOCK/TURBULENT BOUNDARY LAYER INTERACTIONS M.S. Thesis
Lowell C. Keel Dec. 1979 77 p refs
(AF Proj. 2307)
(AD-A079858; AFIT/GAE/AA/79D-8) Avail: NTIS HC A05/MF A01 CSCL 20/4

The hybrid finite difference code developed by MacCormack was applied to the investigation of transonic normal-shock turbulent boundary layer interactions. The computations were performed for the half plane of a symetric two dimensional duct by establishing a symmetry boundary condition at the upper boundary. Both first and second order center line boundary conditions were imposed with no measurable difference observed. A two point linear extrapolation of the primative variable was unsuccessfully attempted at the subsonic outflow boundary, but a simple zero gradient condition gave satisfactory results at four different outflow boundary positions relative to the shock wave. Numerical results (M = 1.51, 1.40 and 1.3 Re = 3,000,000 per ft) were compared with the experimental data reported by Abbiss and East. Even though the data exhibit three dimensional effects, the two dimensional computations show agreement within approximately 10%. The differences observed in the numerical-experimental comparisons were all consistent with expected three dimensional trends. Although not conclusive, the potential of adding simple three dimensional corrections to the two dimensional code shows promise for improving the experimental-numerical agreement. GRA

N80-20538# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A CALIBRATION OF THE PRESTON TUBE IN LIQUID FLOW SYSTEMS M.S. Thesis
Brian A. Maher Dec. 1979 78 p refs
(AD-A079876; AFIT/GAE/AA/79D-10) Avail: NTIS HC A05/MF A01 CSCL 20/4

The justification of Preston tube usage is based on a universal similarity law that relates the velocity profile in fully developed pipe flow to that of a boundary layer associated with external flow. The Preston tube measures these velocities at the wall and when calibrated for flow in a pipe, provides a means of determining the local wall shear stress. This study is intended to extend the validity of this method to other working fluids such as liquids. Four separate size Preston tubes are used in three different experiments. The oil pipe provided a unique fluid in a narrow bore pipe and encompassed Reynolds numbers from just turbulent flow to 11600. Results indicated a calibration for oil that closely matched established air data. In the water tunnel experiment some difficulty was encountered for low speed flow but results above Re = 12800 precisely matched that for air. Each tube tested provided similar data and effectively proved the validity of Preston's method for water. GRA

N80-20539# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
RECENT DEVELOPMENTS IN COMPUTATIONAL TECHNIQUES FOR APPLIED HYDRODYNAMICS Final Report
David L. Book, J. P. Boris, M. J. Fritts, R. V. Madala, B. E. McDonald, N. K. Winsor, and S. T. Zalesak Dec. 1979 75 p refs
(RR0110941; RR0140302)
(AD-A079305; NRL-MR-4095) Avail: NTIS HC A04/MF A01 CSCL 20/4

Recently developed techniques for numerical solution of fluid equations are reviewed. Both convective equations and Poisson's equations are discussed. The emphasis is on methods developed and in use at NRL, although brief descriptions of competitive and related methods are included as background material. Examples and applications are given, with particular attention to the advantages of vector computers. GRA

N80-20540# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
STABILITY OF SELF-SIMILAR FLOW: UNIFORM IMPLOSION OF AN ABLATIVELY DRIVEN SHELL Interim Report
D. L. Book and Ira B. Bernstein (Yale Univ.) Dec. 1979 32 p refs
(AD-A079890; AD-E000350; NRL-MR-4132) Avail: NTIS HC A03/MF A01 CSCL 20/4

The linear stability of a uniformly imploding shell, modeled

as an ideal polytropic fluid, is investigated. Two types of unstable modes are found: incompressible irrotational perturbations localized at the outer surface, ascribable to Rayleigh-Taylor instability, and compressible modes, associated with convective instability. KIDDER'S (1976) result for the Rayleigh-Taylor modes is shown to hold independently of the form of the shell density profile. By means of a variational principle it is shown that the criterion for convective instability is the existence of a region within which the differential of p times rho to the negative gamma power in respect to r=0. Analytic solutions for both spatial and temporal dependence of the perturbations are presented, and the results applied to pellets imploded by the action of a laser or charged-particle beam. GRA

N80-20541# ARO, Inc., Arnold Air Force Station, Tenn.
PARTICLE DIAGNOSTICS USING MIE SCATTERING AND IMAGE INTENSIFICATION TECHNIQUES Final Report, Aug. - Oct. 1978
R. L. McGuire, J. W. L. Lewis, D. P. Weaver, and B. P. Curry
AEDC Jan. 1980 38 p refs
(AD-A079888; AEDC-TR-79-42) Avail: NTIS
HC A03/MF A01 CSCL 20/4

The visualization of a particulate-laden flow field immersed within a hypersonic flow has been achieved using Mie scattering. The visualization technique employed the injection of a modulated laser beam which was expanded to provide observation of a broad spatial region of the particulate plume. The Mie scattered radiation was detected by an image intensifier tube, the output of which was detected by a fast-framing camera. A description is provided of this system, the analysis of the data, and the results. GRA

N80-20542# Washington Univ., Seattle. Dept. of Oceanography.
INITIAL-VALUE PROBLEMS IN STRATIFIED SHEAR FLOWS Ph.D. Thesis
Jerre Eugene Bradt 1979 149 p refs
(Grant AF-AFOSR-3655-78; AF Proj. 2307)
(AD-A079525; AFOSR-79-1358TR) Avail: NTIS
HC A07/MF A01 CSCL 20/4

The question of the stability of steady state solutions in geophysical fluid flows is addressed through qualitative analysis and quantitative examples. The inviscid linear stability theory of stratified shear flows and the solution of the stability problem using normal modes and Fourier-Laplace transforms are discussed. Two numerical examples are used to illustrate the relationship of various physical parameters to the stability of the system and to trace the development of the instability for short, intermediate and long times. The examples are (1) two layer fluid of infinite extent with application to the air-sea interface and (2) a two-layer fluid having a free surface and finite depth with application to a salt wedge estuary. The initial-value problem is solved using a power series expansion for short times, superposition of modes for intermediate times and asymptotic analysis for long times. The asymptotic expansion applicable in non-conservative systems is compared with the approximate solution using ray techniques, which are valid in conservative systems, and analytic continuation of the eigenvalues into the complex wavenumber plane. GRA

N80-20543# Mississippi State Univ., Mississippi State. Engineering Industrial Research Station.
THREE-DIMENSIONAL LAMINAR SOLUTION OF THE NAVIER-STOKES EQUATIONS USING BODY-FILTERED COORDINATE SYSTEMS, PART 2 Final Report
C. W. Mastin, J. F. Thompson, A. Ghosh, and T. H. Fu Nov. 1979 27 p refs
(Grant AF-AFOSR-2922-76; AF Proj. 2304)
(AD-A080046; MSSU-EIRS-ASE-79-2; AFOSR-80-0084TR)
Avail: NTIS HC A03/MF A01 CSCL 20/4

Numerical methods are developed for constructing body-fitted curvilinear coordinate systems for the region surrounding an arbitrary three dimensional body. Finite difference schemes are investigated for solving the Navier-Stokes equations on body-fitted coordinates. Solutions are computed for flow about a sphere and a finite wing. GRA

N80-20544# Mississippi State Univ., Mississippi State. Engineering Industrial Research Station.
NUMERICAL SOLUTION OF THE TWO-DIMENSIONAL INCOMPRESSIBLE AVERAGED NAVIER-STOKES EQUATIONS FOR FINITE ARBITRARY SHAPED ISOLATED BODIES, PART 1 Final Report
Z. U. Warsi, B. B. Amlicke, and J. F. Thompson Nov. 1979 59 p refs
(Grant AF-AFOSR-2922-76; AF Proj. 2304)
(AD-A080093; MSSU-EIRS-ASE-79-1; AFOSR-80-0083TR)
Avail: NTIS HC A04/MF A01 CSCL 20/4

Numerical solutions of the two dimensional averaged Navier-Stokes equations for the prediction of laminar, transitional, and turbulent flow fields around finite bodies of arbitrary shapes have been considered. Numerically generated body-fitted curvilinear coordinates and the relevant metric terms are used to provide the finite-difference solutions of the Navier-Stokes and the equations of turbulent quantities. Complete flow fields, including the boundary layer parameters, are obtained by using the zero, one and two-equations models for Schubauer's elliptical section, NACA663-018 airfoil, and a circular cylinder at free stream Reynolds numbers of 159,000, 1.2 and 1.4 million per foot respectively. In addition, a two-equation model with an algebraic-stress closure has also been developed. GRA

N80-20545# New York Univ., N. Y. Dept. of Applied Science.
NONLINEAR WAVE PROCESS HIERARCHIES AND THE CYCLIC DEVELOPMENT OF QUASI-ORDERED STRUCTURES IN TURBULENT SHEAR FLOWS Final Report, 1 Jul. 1977 - 30 Jun. 1979
Robert Vagilio-Laurin Nov. 1979 35 p refs
(Contract F49620-77-C-0119; AF Proj. 2307)
(AD-A079619; NYU/DAS-79-18; AFOSR-79-1322TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The nonlinear wave interpretation and description of the large scale coherent structures commonly observed in free as well as bounded turbulent shear flows has been discussed. The experimentally observed cyclic development of nonlinear two dimensional vorticity concentrations in homogeneous, incompressible, free mixing layers has been linked to the growth/equilibration of finite amplitude, spatially amplifying instabilities and their cyclic regeneration under the action of intrinsic secondary instabilities evoked by flow nonlinearity. The mathematical modeling of such nonlinear behavior in terms of matched asymptotic expansion solutions of the Navier-Stokes equations, being reported under separate cover, has been reviewed. The relevance of the physical viewpoint and the mathematical model to more general turbulent flows has been examined and supported by an analysis of selected, conditionally sampled, measurements in transitional and turbulent boundary layers. On that basis, a dominant role of specific nonlinear wave processes has been indicated, and the approach to their systematic mathematical modeling from first principles has been outlined. GRA

N80-20546# Wisconsin Univ. - Madison. Mathematics Research Center.
FINITE-AMPLITUDE SOLITARY WATER WAVES Final Summary Report
C. J. Amick (St. Johns College, Cambridge, England) and J. F. Toland (Essex Univ., England) Oct. 1979 118 p refs
(Contract DAAG29-75-C-0024)
(AD-A079718; MRC-TSR-2012) Avail: NTIS
HC A06/MF A01 CSCL 20/4

This paper considers the existence problem for solutions of the free boundary value problem which arises from the question of the existence of solitary gravity waves, moving without changes of form, and with constant velocity, on the surface of ideal fluid in a horizontal canal of finite depth. The analysis imposes no restriction on either the slope or the amplitude of the wave, and we prove that there exists a connected set of solitary waves containing waves of all slope between 0 and PI/6. It is then proved that each of these solitary waves has finite mass, and, as a consequence, that F = 1, where F is the Froude number. This, in turn, tells us that the solitary wave decays faster than exp(-alpha abs.val.(x/h), where alpha is an element of (0, alpha-bar) and (tan alpha-bar) = F squared. Finally, it is shown that, in a certain limit, these solitary waves converge to a

solitary Stokes wave of greatest height, and the validity of Stokes' conjecture for solitary waves is considered, but not resolved. GRA

N80-20547# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeronutronic Div.
TRANSITION TO TURBULENCE IN FREE SHEAR-LAYERS Final Report, Oct. 1974 - Oct. 1979
A. Demetriades Oct. 1979 80 p refs
(Contract F44620-75-C-0016; AF Proj. 2307)
(AD-A080066; U-6573; AFOSR-80-0056TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

Part 1 of this report presents an investigation of the transition to turbulence in free shear layers. A theoretical analysis is performed to drive a formula for predicting transition, based on the novel approach used earlier by the same investigators to predict transition in wakes and boundary layers. The formula so derived shows that the transition Reynolds number increases as the non-dimensional velocity ratio decreases, and also as the fast side Mach number and slow side total temperature are increased. An experiment to test the theory was performed; together with earlier transition data, the new data provide good support for the theory. However, a strong dependence of the transition Reynolds number on unit Reynolds number characterizes the available data, whereas the theory does not predict such dependence. In Part 2 of this report a brief account is given on the measurement of temperature fluctuations in a cooled compressible turbulent wake. The results endorse the novel detection technique utilized, and support theoretical predictions made earlier under this contract. GRA

N80-20548# Iowa Inst. of Hydraulic Research, Iowa City.
FLUID AND THERMODYNAMIC CHARACTERISTICS OF COMPRESSIBLE RECOIL Final Report, Jun. 1978 - Aug. 1979
Ching Jen Chen and Enzo O. Macagno Aug. 1979 81 p refs
(Grant DAAG29-78-G-0120)
(AD-A078587; ARO-16016.1-A-3E) Avail: NTIS HC A05/MF A01 CSCL 19/6

Fluid dynamic aspect of recoil mechanisms is studied with simple one dimensional analysis as well as two dimensional numerical analysis. Method and procedure for experimental simulation is given. Full scale and reduced scale simulation is analyzed for its advantages and disadvantages. A new numerical scheme called 'finite differential' method is developed to solve the two dimensional unsteady Navier-Stokes equation. The new method utilizes the local analytical solution of the total problem. The solution of the problem is obtained by assembling the local analytic solution. The method is shown to be capable of solving flows with high Reynolds numbers. GRA

N80-20549# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
TECHNIQUE FOR MEASURING THE APPARENT THERMAL CONDUCTIVITY OF FLAT INSULATION
J. P. Moore, D. L. McElroy, and S. H. Jury Oct. 1979 51 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6494) Avail: NTIS HC A04/MF A01

A technique for measuring the apparent thermal conductivity, gamma, of flat insulations - either batt or loose - is described. This technique consists of a flat Nichrome-screen wire sandwiched between two samples and heated electrically. Results from a limited experimental test are described and compared with results from a pipe insulation tester. Thermal modeling of this system shows that accurate measurement with gamma down to 0.01 W/mK and insulation thicknesses below 0.089 m (3 1/2 in.) should be straightforward. Measurement of gamma for material as thick as 0.305 m (12 in.) should also be possible with a lateral guard scheme to reduce heat flow along the screen wire heater. DOE

N80-20550# Sandia Labs., Albuquerque, N. Mex. Fluid Mechanics and Heat Transfer Div.
INTRODUCTION TO COMPUTATIONAL TECHNIQUES FOR BOUNDARY LAYERS
Frederick G. Blottner Sep. 1979 84 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0893) Avail: NTIS HC A05/MF A01

Finite difference procedures to solve boundary layer flows in fluid mechanics are explained. The governing equations and the transformations utilized are described. Basic solution techniques are illustrated with the similar boundary layer equations. Nonsimilar solutions are developed for the incompressible equations. Various example problems are solved, and the numerical results in the FORTRAN listing of the computer codes are presented. DOE

N80-20551# Engineering Societies Commission on Energy, Inc., Washington, D. C.
BASIC RESEARCH IN ENGINEERING: FLUID DYNAMICS AND THERMAL PROCESSES
Aug. 1979 98 p refs Presented at the Fluid Dyn. and Thermal Processes Workshop, Lexington, Ky., 1 Feb. 1979
(Contract EF-77-C-01-2468)
(FE-2468-54; CONF-790240-1) Avail: NTIS HC A05/MF A01

Critical areas for research in fluid mechanics, separation phenomena, energy processing, and energy reactions are identified and discussed for four workshop papers. DOE

N80-20552# Sandia Labs., Albuquerque, N. Mex.
TWO-PHASE JET LOADS
David Thomasko 1979 29 p refs Presented at the 7th Water Reactor Safety Res. Inform. Meeting, Gaithersburg, Md., 5-9 Nov. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1963C; CONF-791118-1) Avail: NTIS HC A03/MF A01

An approximate engineering model characterizing two phase jets emanating from circumferential or longitudinal breaks in a typical pressurized water reactor piping system was developed. Three computer codes were employed to investigate jet load experiments in detail. GRA

N80-20553# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
A CALCULATING TECHNIQUE FOR THE FLOW FIELD AROUND A HYDRAULIC TURBINE [EIN VERFAHREN ZUR BERECHNUNG DES STROEMUNGSFELDES UM STRAHLTRIEBWERKE]
Eberhard Goede 1978 97 p refs In GERMAN
(ILR-37; ISBN-3-79830-651-6; ISSN-0341-0587) Avail: NTIS HC A05/MF A01

The panel method is discussed in terms of minimizing the leakage effect when calculating liquid flows around a turbine. A choice of panels is given for specific sections which shows a correct representation of the flow. A mathematical model is presented which aids the best panel. Author (ESA)

N80-20554# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
THEORETICAL STUDY OF STEADY VORTEX RINGS IN THE CASE OF VARIABLE PARTITIONING OF THE FORCE [THEORETISCHE UNTERSUCHUNG STATIONAERER RINGWIRBELSTROEMUNGEN MIT UNSTETIGER WIRBELSTAERKENVERTEILUNG]
Wilfried Poppe Dec. 1978 99 p refs In GERMAN
(MPIS-29/1978) Avail: NTIS HC A05/MF A01; Max-Planck Inst. Fuer Stroemungsforsch., Goettingen, West Germany DM 16.35

Norbury's method of calculating the nucleus of annular vortexes and their translation velocity was verified. The case of a small nucleus (with respect to diameter of the ring) as well as a nonsymmetric nucleus were studied. The methods of calculation and the numerical methods used to study the variable partitioning of turbulent energy are described. Author (ESA)

N80-20555# National Technical Information Service, Springfield, Va.
BOUNDARY LAYER TRANSITION, VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Nov. 1977 - Nov. 1979
Guy E. Habercom, Jr. Dec. 1979 259 p Supersedes NTIS/PS-78/1344; NTIS/PS-77/1116; NTIS/PS-78/1344; NTIS/PS-75/818
(PB80-803265; NTIS/PS-78/1344; NTIS/PS-77/1116;

NTIS/PS-76/0940; NTIS/PS-75/818) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Topics on boundary layer transition including laminar to turbulent flow in gases at subsonic, transonic, supersonic, and hypersonic velocities; transition in the boundary layer flow of various liquids; flow transition involving structural and configurations forms; experimental equipment; facilities tests, and methods are presented. Mathematical and computer aided analyses and methods of inducing inhibiting transition are addressed. Applications of boundary layer research to aerospace vehicles, wings, airfoils, geometric forms, and models are discussed. This updated bibliography contains 259 abstracts, 57 of which are new entries to the previous edition. GRA

N80-20556# Purdue Univ., Lafayette, Ind. Water Resources Research Center.

LABORATORY STUDY OF FLOW AND THERMAL STRUCTURES IN HEATED AND/OR COOLED LAYERS OF WATER

M. Behnia and R. Viskanta Aug. 1979 234 p refs

(Contract DI-14-34-0001-6075; OWRT Proj. B-077-IND(5))

(PB80-120694; *PWRRC-TR-123; W80-01799) Avail: NTIS HC A11/MF A01 CSCL 13B

The basic internal transport processes in natural waters and the interactions at the air water interface were studied. Thermal and flow structure in a stratified layer of water heated by radiation source and/or cooled by forced air flow over the surface was studied in the laboratory. The transport processes occurring in impounded waters were simulated in a test cell. Heating from below of a nonuniformly stratified layer of water was studied to obtain understanding of turbulent mixing processes in an inherently unstable situation. A model based on conservation principles and turbulence was developed which agreed reasonably well with the experimental data. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-20557 Stanford Univ., Calif.

MODELING AND ERROR ANALYSIS OF A SUPERCONDUCTING GRAVITY GRADIOMETER Ph.D. Thesis

Kai Yuen Wang 1979 257 p

Avail: Univ. Microfilms Order No. 8006366

The feasibility of a cryogenic gravity gradiometer is demonstrated. A pair of superconducting accelerometers were constructed and tested in a push pull arrangement. The resolution of the experimental unit is estimated to be about 50 E. A study to model the responses of the gravity gradiometer to the various external inputs is conducted. The mathematical equations derived are used in the design of the loaded diaphragm proof mass. The error sources of the gravity gradiometer are identified. The theory of electronic damping for the cryogenic device is developed. An experimental circuit for the noiseless damping of a single accelerometer is described. Dissert. Abstr.

N80-20558 Johns Hopkins Univ., Baltimore, Md.

DIGITAL WAVEFORM RECORDING AND COMPUTER ANALYSIS OF ACOUSTIC EMISSION AND ULTRASONIC TRANSIENTS DETECTED BY OPTICAL AND PIEZOELECTRIC PROBES Ph.D. Thesis

Borislav Roro Djordjevic 1980 150 p

Avail: Univ. Microfilms Order No. 8006909

Innovative optical probes and conventional piezoelectric transducers were used to detect acoustic emission and ultrasonic transients in solid materials. Digital signal recording and computer analysis methods were developed for critical evaluation of the these transients. The fast digitizing acquisition system permitted coincident and simulataneous two channel recording thus allowing direct comparison of the same event as sensed by two different detectors. Optical detection of carefully controlled acoustic emission events confirmed the suspected inadequacy of piezoelectric transducers for recording the actual waveforms characteristic of the source. In addition, optical detection showed that piezoelectric transducers have limited capability for direct reproduction of ultrasonic waveforms even for the case of normally incident plane wavefronts. Dissert. Abstr.

N80-20559* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CDS SOLID STATE PHASE INSENSITIVE ULTRASONIC TRANSDUCER Patent

Joseph S. Heyman, inventor (to NASA) Issued 25 Mar. 1980 8 p Filed 26 Jul. 1978 Supersedes N78-29871 (16 - 20, p 2725)

(NASA-Case-LAR-12304-1; US-Patent-4,195,244; US-Patent-Appl-SN-928130; US-Patent-Class-310-311; US-Patent-Class-29-25.35; US-Patent-Class-310-327; US-Patent-Class-310-334; US-Patent-Class-310-360) Avail: US Patent and Trademark Office CSCL 14B

A phase insensitive ultrasonic transducer which includes a CdS crystal that is annealed for a selected period of time and at a selected temperature to provide substantially maximum acoustic attenuation at the operating frequency of the transducer is described. Two electrodes are attached to the crystal with amplifier means and a signal processing system connected to one of the electrodes to provide an ultrasonic receiver.

Official Gazette of the U.S. Patent and Trademark Office

N80-20560* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

ATTACHING OF STRAIN GAGES TO SUBSTRATES Patent

Meyer M. Lemcoe (Battelle Columbus Labs., Ohio) and Harry E. Pattee, inventors (to NASA) (Battelle Columbus Labs., Ohio) Issued 25 Mar. 1980 4 p Filed 16 Feb. 1978 Supersedes N78-18393 (16 - 09, p 1160) Sponsored by NASA

(NASA-Case-FRC-10093-1; US-Patent-4,195,279; US-Patent-Appl-SN-878539; US-Patent-Class-338-2; US-Patent-Class-219-85R; US-Patent-Class-219-85CA; US-Patent-Class-219-85CM) Avail: US Patent and Trademark Office CSCL 14B

A method and apparatus for attaching strain gages to substrates is described. A strain gage having a backing plate is attached to a substrate by using a foil of brazing material between the backing plate and substrate. A pair of electrodes that are connected to a current source, are applied to opposite sides of the backing plate, so that heating of the structure occurs primarily along the relatively highly conductive foil of brazing material. Field installations are facilitated by utilizing a backing plate with wings extending at an upward incline from either side of the backing plate, by attaching the electrodes to the wings to perform the brazing operation, and by breaking off the wings after the brazing is completed.

Official Gazette of the U.S. Patent and Trademark Office

N80-20561 Pennsylvania State Univ., University Park.

TRANSIENT RESPONSE OPTIMIZATION OF PIEZOELECTRIC DISC TRANSDUCERS BY TIME DOMAIN TECHNIQUES Ph.D. Thesis

Henry Alan Wolf 1979 250 p

Avail: Univ. Microfilms Order No. 8006072

Design procedures for reducing the mechanical ringing of piezoelectric disc transducers under impulsive electrical excitation are examined. The transducer was treated as a three port device: the two mechanical ports and one electrical port. Improvements to the transient response were sought through the determination of appropriate matching networks at the ports. The optimization of specified time domain characteristics was accomplished by performing a gradient search over a parameter space defining the port matching configurations. The transducer and mechanical matching sections were modeled using the Mason equivalent circuit and the distributed parameter wave guide model. Transformation to the time domain was achieved using a numerical approximation to the Laplace transform. Dissert. Abstr.

N80-20562 Purdue Univ., Lafayette, Ind.
SOME ASPECTS OF BLOCK QUANTIZATION WITH APPLICATIONS TO SOURCE CODING AND DIGITAL HOLOGRAPHY Ph.D. Thesis
James Atlee Bucklew 1979 109 p
Avail: Univ. Microfilms Order No. 8005837

It is shown that the mean square error for optimal uniform and nonuniform one dimensional quantizers is given by the quantizer input variance minus the output variance. In the two-dimensional case when the random variable has a circularly symmetric probability density, an expression that indicates whether a polar or Cartesian format produces a smaller mean square error is derived. The independent two dimensional Gaussian case is considered in detail and tabulations are made of the expected mean square error for a number of quantizer output levels. An error expression is also derived for spectral phase coding, a polar format coding scheme. The scheme is shown to be insensitive to changes in signal statistics. Finally, several computer generated holograms with information represented in polar and rectangular format are compared and error expressions are derived.
Dissert. Abstr.

N80-20563* National Aeronautics and Space Administration. Pasadena Office, Calif.
VELOCITY SERVO FOR CONTINUOUS SCAN FOURIER INTERFERENCE SPECTROMETER Patent
Rudolf A. Schindler, inventor (to NASA) (JPL) Issued 18 Mar. 1980 6 p Filed 24 Feb. 1978 Supersedes N78-22891 (16 - 13, p 1778) Sponsored by NASA
(NASA-Case-NPO-14093-1; US-Patent-4,193,693; US-Patent-Appl-SN-880729; US-Patent-Class-356-346) Avail: US Patent and Trademark Office CSCL 14B

A velocity servo for continuous scan Fourier interference spectrometer of the double pass retroreflector type having two cat's eye retroreflectors is described. The servo uses an open loop, lead screw drive system for one retroreflector with compensation for any variations in speed of drive of the lead screw provided by sensing any variation in the rate of reference laser fringes, and producing an error signal from such variation used to compensate by energizing a moving coil actuator for the other retroreflector optical path, and energizing (through a highpass filter) piezoelectric actuators for the secondary mirrors of the retroreflectors.
Official Gazette of the U.S. Patent and Trademark Office

N80-20564*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
AN INITIAL ASSESSMENT OF THE PERFORMANCE ACHIEVED BY THE SEASAT-1 RADAR ALTIMETER
William F. Townsend Feb. 1980 41 p refs
(NASA-TM-73279) Avail: NTIS HC A03/MF A01 CSCL 14B

The results of an initial on-orbit engineering assessment of the performance achieved by the radar altimeter system flown on SEASAT-1 are presented. Additionally, the general design characteristics of this system are discussed and illustrations of altimeter data product are provided. The instrument consists of a 13.5 GHz monostatic radar system that tracks in range only using a one meter parabolic antenna pointed at the satellite nadir. Two of its unique features are a linear FM transmitter with 320 MHz bandwidth which yields a 3.125 nanosecond time delay resolution, and microprocessor implemented closed loop range tracking, automatic gain control (AGC), and real time estimation of significant wave height (SWH). Results presented show that the altimeter generally performed in accordance with its orginal performance requirments of measuring altitude to a precision of less the 10 cm RMS, significant wave height to an accuracy of + or - 0.5 m or 10%, whichever is greater, and ocean backscatter coefficient to an accuracy of + or - 1 db, all over an SWH range of 1 to 20 meters. J.M.S.

N80-20565*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INORGANIC SPARK CHAMBER FRAME AND METHOD OF MAKING THE SAME Patent Application
Thomas M. Heslin, inventor (to NASA) Filed 7 Mar. 1980 22 p
(NASA-Case-GSC-12354-1; US-Patent-Appl-SN-128229) Avail: NTIS HC A02/MF A01 CSCL 14B

A spark chamber frame includes a number of beams formed from an inorganic materials such as cermic or glass which are connected together with an inorganic bonding material having substantially the same thermal expansion as the beam material. A number of wires also formed from an inorganic composition are positioned between opposed beams so that wires are uniformly spaced and form a grid. Four hold-down straps, also formed of ceramic or glass and having substantially the same chemical and thermal properites as the beam material, overlie the wires and are bonded to the beams. NASA

N80-20566# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Electro-optics Technology Branch.
PASSIVE FIBER OPTIC GYRO STUDY Final Report, 1 May - 31 Jul. 1979
Tom L. Williamson and Douglas A. Wille Oct. 1979 62 p refs
(AD-A079471; AFAL-TR-79-1197) Avail: NTIS HC A04/MF A01 CSCL 17/7

The report summarizes the principles of operation of the passive fiber optic gyro. It starts with a discussion of the Sagnac effect and proceeds to a theoretical prediction of the optimum shot noise limited performance. An overview of the major requirements and problems associated with the principal components follows. This leads to a discussion of the signal processing, some conclusions, and recommendations with respect to specific areas for further investigations. GRA

N80-20567# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
HOLOGRAPHIC INTERFEROMETRIC SURVEY OF BOUNDARY LAYER TRANSITION IN AN AXISYMMETRIC FREE CONVECTION THERMAL BOUNDARY LAYER M.S. Thesis
Gregory S. Meserve Dec. 1979 73 p
(AD-A079880; AFIT/GAE/AA-79D-12) Avail: NTIS HC A04/MF A01 CSCL 14/2

Unique optical data from the laminar and transition regions of an axisymmetric free convection thermal boundary layer are presented. The boundary layer encompasses a vertically oriented right circular cylinder kept at a constant wall temperature and suspended in a quiescent air environment. Pulse laser holographic interferometry was used to obtain a measurement of the temperature distribution through the boundary layer. Schlieren methods are used to photograph the boundary layer to provide a qualitative description of the transition region. An approach is outlined to find an approximate numerical solution for the temperature distribution through the boundary layer. Integral equations are developed for a differential control volume within the boundary layer after which assumed velocity and temperature distributions are used to reduce the integral equations to first order non-linear differential equations. The differential equations are non-dimensionalized and numerical techniques are used in an attempt to obtain a solution. Quantitative data from the laminar region resulted in a discrepancy between theoretical and experimental evaluation of a local Nusselt number. Qualitative observation of the transition region reveals a fringe reversal phenomena that could possibly be associated with the fundamental mechanisms of transition. GRA

N80-20568# Argonne National Lab., Ill.
EVALUATION OF SOME CRYOGENIC SENSORS AND INSTRUMENTATIONS FOR A LARGE SUPERCONDUCTING MHD MAGNET
S. H. Kim, S. T. Wang, N. S. Kim, and M. Lieberg 1979 15 p refs Presented at Cryogenic Engr. Conf., Madison, Wis., 21-24 Aug. 1979
(CONF-790815-30) Avail: NTIS HC A02/MF A01

The evaluation of six accelerometers, 95 strain gages, and 110 thermometers to be installed in a large superconducting MHD magnet is discussed. The sensors will monitor stress and strain levels of the support structures, mechanical perturbations, and temperature variations during cooldown, warmup, transportation, and operation of the magnet. K.L.

N80-20569# National Bureau of Standards, Washington, D.C.
AMERICAN NATIONAL STANDARD N538-1979 CLASSIFICATION OF INDUSTRIAL IONIZING RADIATION

GAUGING DEVICES Final Report
Oct. 1979 31 p
(PB80-11012; NBS-HB-129; ANSI-N538-1979;
LC-79-600113) Avail: NTIS HC A03/MF A01 CSCL 06R

This American National Standard applies to the radiation safety aspects of gauging devices, commonly called gauges, which use sealed radioactive sources or X-ray tubes for the determination of control of thickness, density level, interface location, or qualitative or quantitative chemical composition. This standard establishes a system for classification of gauging devices based on performance specifications relating to radiation safety. In addition to specific tests for both use conditions and accident conditions, guidelines for other safety features and considerations are presented. GRA

N80-20570# National Bureau of Standards, Washington, D.C. National Measurement Lab.
FRAME C: A COMPACT PROCEDURE FOR QUANTITATIVE ENERGY-DISPERSIVE ELECTRON PROBE X-RAY ANALYSIS Final Report
R. L. Myklebust, C. E. Fiori, and K. F. J. Heinrich Sep. 1979 115 p refs
(PB80-110307; NBS-TN-1106) Avail: NTIS HC A06/MF A01 CSCL 14B

A data evaluation procedure (FRAME C) for carrying out quantitative electron probe microanalysis with a lithium-drifted silicon detector was developed for use with a small computer. The procedure consists of a background correction calculated from two selected background regions of interest, a simple method of resolving overlapping peaks, and the matrix corrections for characteristic radiation. To save computation time, small groups of adjacent channels (regions of interest) in the multichannel analyzer rather than individual channels are used for the calculations. The method for computing the overlap factors is described. Examples of several types of analyses are presented. GRA

N80-20571# Colorado Univ. at Boulder. Dept. of Electrical Engineering.
DISPERSION AND ATTENUATION CHARACTERISTICS OF MODES IN A TEM-CELL WITH A LOSSY DIELECTRIC SLAB
John C. Tippet and David C. Chang Aug. 1979 38 p refs
(Contract NBS-CST-8447)
(PB80-105141; NBSIR-79-1615) Avail: NTIS HC A03/MF A01 CSCL 14B

Dispersion and attenuation characteristics of the dominant mode in a transverse electromagnetic cell, loaded with a lossy dielectric slab, were investigated. It is shown that, while the insertion of the lossy material can indeed lower the Q factor of the higher order modes, the attenuation of the dominant mode also increases drastically as frequency increases. GRA

N80-20645# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ELABORATION OF THE TIME SYSTEM OF THE SATELLITE OBSERVATION STATION WETTZELL FROM 1972-1977 [DER AUFBAU DES ZEITSYSTEMS DER SATELLITENBEOBACHUNGSSTATION WETZELL IN DGN JAHREN 1972-1977)]
Klemens Nottarp and Ingo Zeitel *In its* Rept. on Cartography and Geodesy, Ser. 1: Original Rept. No. 73 1977 p 87-91 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20696# Bayerische Akademie der Wissenschaften, Munich (West Germany).
THE GERMAN-AUSTRIAN DOPPLER OBSERVATION CAMPAIGN [UEBER DEN DERZEITIGEN STAND DER ARBEITEN IM DEUTCHEN ANTEIL DER DEUTSCH OESTERREICHISCHEN DOPPLERMESSKAMPAGNE]
Wolfgang Schlueter, Hermann Seeger, Gerhard Soltau, Peter Wilson, and Peter Wolf *In its* Res. Program 78, Satellite Geodesy Program 1978 p 54-64 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-20572 Maryland Univ., College Park.
DOWNSTREAM MIXING GASDYNAMIC LASERS: A NUMERICAL SOLUTION Ph.D. Thesis
Karungulam Natesan Parthasarathy 1979 164 p
Avail: Univ. Microfilms Order No. 8007108

A numerical solution for downstream mixing gasdynamic laser flows is considered. In particular, the supersonic mixing flows of vibrationally excited N2 with cold CO2 and H2O downstream of the nozzle exits is studied. The unsteady, two dimensional Navier-Stokes equations, fully coupled with the appropriate finite rate vibrational kinetic equations are solved by means of a time dependent finite difference numerical technique. The main thrust of the work is the investigation of the fluid dynamic and kinetic aspects of mixing. The detailed, but complex vibrational kinetic processes that occur in the CO2-N2 system are simplified by the use of either a two mode model, or a three mode model. The effect of the boundary layers issuing from the nozzles on the mixing phenomenon is studied. Dissert. Abstr.

N80-20573 Stanford Univ., Calif.
GENERATION OF 16 MICRON RADIATION USING STIMULATED ROTATIONAL RAMAN SCATTERING IN HYDROGEN Ph.D. Thesis
William Richard Trutna, Jr. 1979 134 p
Avail: Univ. Microfilms Order No. 8006360

Stimulated rotational Raman scattering was used to frequency shift a CO2 TEA laser from 10.6 micrometers to 16.95 micrometers. Two techniques were used to lower the CO2 laser power requirements: a 25 transit Raman cell was constructed, which maintains a high pump intensity over a long distance, to maximize Raman gain; and, four wave mixing was utilized to generate 16.95 micrometer signal at the kilowatt level to inject into the Raman amplifier. Since the CO2 laser tends to oscillate at many axial mode frequencies, a study to determine the dependence of Raman gain and Stokes bandwidth upon the pump laser bandwidth was undertaken. The results were experimentally verified using a variable bandwidth Nd:YAG laser at 1.06 micrometers. The results of experiments with an antiresonant ring resonator operated with a low pressure pulsed CO2 laser are described. Dissert. Abstr.

N80-20574*# National Aeronautics and Space Administration Pasadena Office, Calif.
METHOD AND APPARATUS FOR CONVECTION CONTROL OF METALLIC HALIDE VAPOR DENSITY IN A METALLIC HALIDE LASER Patent Application
Thomas J. Pivirotto, inventor (to NASA) (JPL) Filed 14 Mar 1980 14 p
(Contract NAS7-100)
(NASA-Case-NPO-15021-1; US-Patent-Appl-SN-130496) Avail: NTIS HC A02/MF A01 CSCL 20E

A method and apparatus for convection control of metallic halide vapor density in a metallic halide laser are described. A reservoir containing copper chloride is heated so that the copper chloride is maintained in a liquid form. The apparatus includes a means for flowing a buffer gas (neon) over the liquid copper chloride to provide a mixture of copper chloride vapor and neon above the liquid copper chloride. A conduit for providing fluid communication between the reservoir containing the copper chloride vapor/neon mixture and the laser is also included. The copper chloride vapor density in the laser is related to the liquid copper chloride temperature and the neon flow rate through the reservoir. Neon is also provided directly to the laser in order to provide a further means of controlling the copper chloride vapor density in the laser. NASA

N80-20575*# Ohio State Univ. Research Foundation, Columbus.
ERROR ANALYSIS FOR A SPACEBORNE LASER RANGING SYSTEM
Erricos C. Pavlis Dec. 1979 89 p refs
(Grant NsG-5265; OSURF Proj. 711055)
(NASA-CR-162887; Rept-290) Avail: NTIS HC A05/MF A01 CSCL 20E

The dependence (or independence) of baseline accuracies, obtained from a typical mission of a spaceborne ranging system, on several factors is investigated. The emphasis is placed on a priori station information, but factors such as the elevation cut-off angle, the geometry of the network, the mean orbital height, and to a limited extent geopotential modeling are also examined. The results are obtained through simulations, but some theoretical justification is also given. Guidelines for freeing the results from these dependencies are suggested for most of the factors. M.G.

N80-20576# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ELECTROOPTICAL DEVICES Semiannual Technical Summary Report, 1 Oct. 1978 - 31 Mar. 1979
Charles E. Hurwitz 31 Mar. 1979 20 p refs
(Contract F19628-78-C-0002; AF Proj. 2611)
(AD-A077153; ESD-TR-79-183) Avail: NTIS
HC A02/MF A01 CSCL 20/5

This report covers work carried out with support of the Department of the Air Force during the period 1 October 1978 through 31 March 1979. The current objectives of the electrooptical device program are: (1) to perform life tests on GaIn AsP/InP double-heterostructure (DH) diode lasers operating in the 1.0- to 1.3-micrometer wavelength region and analyze the degradation mechanisms, and (2) to fabricate and study avalanche photodiodes of similar composition GaInAsP operating in the same wavelength region. GRA

N80-20577# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SEPARATION CONTROL IN ALL APT LIGHT PIPE M.S. Thesis
W. H. Bailey, Jr. Dec. 1979 92 p refs
(AD-A079904; AFIT/GAE/AE/79D-1) Avail: NTIS
HC A05/MF A01 CSCL 20/5

An experiment was performed to determine separation regions inside a high energy laser (HEL) beam relay light pipe. The pipe is part of the beam relay system used in conjunction with the CO2 Gas Dynamic Laser (GDL) system under development by the Air Force Weapons Laboratory. It was found that the air flowing through the pipe separated at the elbows. This separation can cause uneven radial heating attributed to molecular absorption. The self-induced thermal distortion of the beam can cause phase distortions degrading the beam. A study of separation control systems within the pipe was made. A full-scale axisymmetric model was studied on the water table. Areas of separation were found by flow visualization using dye injection. A brief evaluation of suction and blowing to control separation showed both of these methods acceptable. Separated regions discovered at each elbow on the water table were the focus of study for a full-scale air flow plexiglass model. The turbulent flow in the pipe was studied using smoke injection to reveal air motion in the pipe. Mass flow rates of air through the pipe were 1 lb/min and 8 lbs/min. Suction and blowing were assessed as flow separation control methods. GRA

N80-20578# United Technologies Research Center, East Hartford, Conn.
BEAMED ENERGY COUPLING STUDIES Final Technical Report, 1 Jun. 1977 - 31 May 1979
M. C. Fowler, L. A. Newman, and D. C. Smith. Edwards AFB, Calif. AFRPL Jan. 1980 134 p refs
(Contract F04611-77-C-0039; AF Proj. 2308)
(AD-A080037; UTRC/R79-922895; AFRPL-TR-79-51) Avail: NTIS HC A07/MF A01 CSCL 21/8

This report describes the analytical and experimental results of a study to determine the feasibility of using molecular seeds to couple CO2 laser radiation and CO laser radiation to the working fluid, H2, of a high performance rocket thruster. The gas mixtures studied experimentally were H2/H2O, H2/D2O, and H2/NH3 at CO2 laser wavelengths. The promise of CO as an absorber of CO laser radiation was established analytically. To attain the high temperatures, 1000-6000K, desired, these mixtures were placed in a cell positioned in a diagnostic apparatus which determined the spatial variation of the mixture absorption coefficient and temperature about the axis of a hot, dense plasma sustained by focused high power CW CO2 laser radiation. The measurements on these mixtures indicated their performance as couplers to exceed expectations created by the analytical study. In addition, it was found that in the absence of plasma, the temperature of the mixtures could be raised to temperatures as high as 2000-4000K simply by absorption by the mixture of laser energy at the high power beam focal spot to create the observed laser sustained flame. Further work is needed to determine the conditions under which this flame can be sustained in the laser energized rocket thruster. GRA

N80-20579# ARO, Inc., Arnold Air Force Station, Tenn.
STUDIES OF THE STATISTICAL BIAS AND SIGNAL CHARACTERISTICS OF LASER VELOCIMETERS Final Report, Jul. 1976 - Sep. 1977
D. O. Barnett and T. V. Giel, Jr. AEDC Jan. 1980 147 p refs
(AD-A079634; AEDC-TR-78-65) Avail: NTIS
HC A07/MF A01 CSCL 14/2

Analyses are presented of (1) the statistical bias individual realization laser velocimeters (LV's) and (2) the theoretical signal amplitudes obtained from dual-scatter (fringe) LV's. The analyses are compared to experimental data obtained from a subsonic, confined, seeded jet. The statistical bias study reviews the various formulations relating LV sampling characteristics to the velocity field and shows that, theoretically, bias is reduced by random sampling, introduction of fixed-time delays between samples, and nonuniformities in seeding. These concepts are tested by a bias simulation program which simulates LV response to a turbulent flow by applying various sampling laws to hot-wire anemometer data. The finite-difference algorithms suggested by various investigators to eliminate bias from LV data fail if the sampling rate is less than the local integral time scale of the turbulent flow. Velocity data for the near field of a uniformly seeded subsonic jet exhausting into a plenum were obtained by pitot probes, hot-wire anemometers, and a Bragg-diffracted laser velocimeter. No consistent bias of the data was observed, indicating that routinely correcting LV data for statistical bias may lead to significant errors. GRA

N80-20580# Brookhaven National Lab., Upton, N. Y.
FREE ELECTRON LASER: AN INTRODUCTION
C. Pellegrini 1979 7 p refs Presented at the Free Electron Laser Workshop, Riva del Garda, Italy, 4 Jun. 1979
(Contract EY-76-C-02-0016)
(BNL-26501; CONF-7906123-1) Avail: NTIS
HC A02/MF A01

The theory and operating principles of the free electron laser are discussed. DOE

N80-20581# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EFFICIENT HIGH ENERGY INFRARED THIRD HARMONIC GENERATION IN GASES AND LIQUIDS FOR LASER FUSION APPLICATIONS Final Report, 1 Mar. 1977 - 28 Feb. 1979
H. Kildal and S. R. J. Brueck May 1979 21 p
(COO-4251-7) Avail: NTIS HC A02/MF A01

A 4% third harmonic generation (THG) energy conversion efficiency was achieved and for 8-nsec-duration input pulses in a liquid CO-O2 medium (10 cm path length). The THG input-output characteristics in the saturation and pump-depletion regime were measured. A 2% THG power conversion efficiency was obtained for 120-nsec duration input pulses in liquid CO-O2-SF6 mixtures. A theoretical model was developed for two-photon resonant THG processes in different focusing geometries. Liquid CO two-photon resonance parameters were measured in various diluents. The calculated resonant third-order susceptibility for different CO concentrations were verified. The nonresonant third-order susceptibility in liquid CO-O2 and the wave-vector mismatch in liquid CO-O2 mixture was measured. Phase-matching techniques for THG were developed. Alternate systems for tripling of CO2 and HF laser radiation were analyzed, and a 1- to 10-nsec pulse duration CO2 laser facility and cryogenic liquid Dewars with 10 cm to 1 m optical path lengths were constructed. DOE

N80-20582# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INVESTIGATION OF Hg2 AS A DISCHARGE PUMPED OPTICAL STORAGE MEDIUM Final Report
D. J. Ehrlich and R. M. Osgood, Jr. Dec. 1978 30 p refs
(Contract ED-78-S-02-4630)

(COO-4630.A000-1) Avail: NTIS HC A03/MF A01

The extraction of energy from metastable Hg2 by optical techniques is considered. Topics covered include: (1) assessment of optical extraction techniques for laser fusion applications; (2) demonstration of 20X enhancements in the population of the UV-radiating level by optical pumping with mid-IR lasers; (3) analysis of the IR optical pumping process through the induced emission spectrum; (4) parametric studies of the excitation wavelength, temperature and pressure dependences of extraction by optical pumping; (5) studies of the saturation of mid-IR optical pumping; (6) modeling of large-scale extraction for laser fusion applications; (7) studies of optical pumping of Hg2 by high power ArF laser (193 nm) radiation, and (8) studies of Hg2 excimer structure and collisional destruction rates. DOE

N80-20583# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.

CONCEPTUAL DESIGN STUDY OF THE HYLIFE LITHIUM WATERFALL LASER FUSION CHAMBER Annual Report, Fiscal Year 1978

29 Sep. 1978 109 p refs

(Contract W-7405-eng-48)

(UCRL-13944) Avail: NTIS HC A06/MF A01

Conceptual design studies of the target chamber defined the general configuration and dimensions of the chamber and the inlet plenum, orifice plate, and nozzle concepts required to generate the desired lithium jet fall. Preliminary studies were performed of the target chamber interfaces with the liquid lithium supply system, the laser system, the pellet injection system, and the target chamber mounting and support system. Target chamber environmental effects resulting from typical thermonuclear burns were evaluated. The outlet region of the target chamber was outlined conceptually, and preliminary design considerations were given to the annual graphite reflector regions of the target chamber and the associated liquid lithium coolant passages. DOE

N80-20584# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

A STUDY OF THE COLLISION PROCESSES IN THE THERMIC ENERGY REGION BY USING ATOMS EXCITED BY LASER LIGHT [UNTERSUCHUNGEN VON STOSSPROZESSEN MIT LASERANGEREGTEN ATOMEN IN THERMISCHEN ENERGIEBEREICH]

Harald Tischer Aug. 1978 68 p refs In GERMAN

(MPIS-2/1978; ISSN-0436-1199; Rept-2) Avail: NTIS HC A04/MF A01; Max-Planck Inst. fuer Stroemungsforsch., Goettingen, West Germany DM 12.90

An argon laser was used to investigate the conditions of excitation of Na atoms. Problems encountered with laser stability and in obtaining the desired energy density in the shock region are discussed. Measurements of the transverse dispersion which varied with the polarization of the laser beams are presented. Author (ESA)

N80-20585# National Technical Information Service, Springfield, Va.

GALLIUM ARSENIDE LASERS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Nov. 1979

Brian Carrigan Jan. 1980 202 p Supersedes NTIS/PS-78/1326; NTIS/PS-77/1176; NTIS/PS-76/1042; NTIS/PS-75/792; NTIS/PS-75/044

(PB80-803612; NTIS/PS-78/1326; NTIS/PS-77/1176; NTIS/PS-76/1042; NTIS/PS-75/792; NTIS/PS-75/044) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

The design, development, and applications of gallium arsenide lasers are discussed. Studies on band theory, optical modulators, emission spectra, optical pumping, tuning, and efficiency of these lasers are included. This updated bibliography contains 195 abstracts, 22 of which are new entries to the previous edition. GRA

N80-20586# National Technical Information Service, Springfield, Va.

HYDROGEN FLUORIDE AND DEUTERIUM FLUORIDE LASERS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS, 1976-1979

Bryan Carrigan Dec. 1979 160 p refs Supersedes NTIS/PS-78/1307; NTIS/PS-77/1168; NTIS/PS-733

(PB80-803273; NTIS/PS-78/1307; NTIS/PS-77/1168; NTIS/PS-76/0979; NTIS/PS-75/733) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

The chemical reactions, molecular interactions, kinetics, and quantum mechanics in hydrogen fluoride and deuterium fluoride laser development are cited. Studies on excitation, optical equipment, gas mixtures, and window materials for these lasers are included. The spectral output, power, efficiency, applications, and performance of HF and DF lasers are also covered. This updated bibliography contains 160 abstracts, 18 of which are new entries to the previous edition. GRA

N80-20642# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

SFB 78/IFAG PROJECTS FOR LASER MEASUREMENT OF DISTANCES TO SATELLITES [UEBER VORHABEN DES SFB 78/IFAG ZUR LASERENTFERNUNGSMESSUNG NACH SATELLITEN]

Klemens Nottarp, Hermann Seeger, and Peter Wilson *In its* Rept. on Cartography and Geodesy Ser. 1: Original Rept. No. 73 1977 p 63-72 refs In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

N80-20693# Bayerische Akademie der Wissenschaften, Munich (West Germany).

SELECTION OF A RUBY LASER FOR USE AS AN ILLUMINATING LASER FOR THE BMK75 OR AS A REFLECTING LASER FOR SRS [KONZEP EINES RUBINLASER FUER WAHLWEISEN BETRIEB ALS BELEUCHTUNGSLASER FUER DIE BMK 75 ODER ENTFERMUNGSMESSLASER FUER DAS SRS]

Klemens Mottarp *In its* Res. Program 78, Satellite Geodesy Program 1978 p 31-35 refs In GERMAN (For primary document see N80-20691 11-42)

Avail: NTIS HC A09/MF A01

N80-20695# Bayerische Akademie der Wissenschaften, Munich (West Germany).

EXTENDING THE NEODYMIUM-YAG LASER REFLECTANCE MEASURING SYSTEM TO LUNAR MEASUREMENTS AT THE WETZELL STATION [ZUR ERWEITERUNG DES NEODYMIUM-YAG LASERENTFERNUNGSMESSYSTEMS DER STATION WETTZELL FUER ENTFERNUNGSMESSUNGEN ZUM MOND]

Peter Wilson *In its* Res. Program 78, Satellite Geodesy Program 1978 p 45-49 refs In GERMAN (For primary document see N80-20691 11-42)

Avail: NTIS HC A09/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-20587 Virginia Univ., Charlottesville.

ROTOR MODEL PARAMETERS ESTIMATION AND ROTOR BALANCING STUDIES WITH QUADRATIC PROGRAMMING Ph.D. Thesis

Emerson Keith Woomer 1979 133 p

Avail: Univ. Microfilms Order No. 8004602

The parameter estimation problem is formulated as an optimization process in which unknown constants in the system model are adjusted to give the best agreement between the measured response of the rotor to an applied unbalance and the predicted response from the model. A computer code based on Lemke's algorithm for quadratic programming is used to demonstrate the reliable, efficient computation of rotor balance weights when upper bounds are placed on the weight magnitudes. Heuristic criteria for estimating best choices of balance weight locations are evaluated by comparing the predictions based on the criteria to optimal locations determined by exhaustive search or estimated by random sampling. The influence of the distribution of intrinsic shaft unbalance on optimal balance weight locations and on the magnitudes of normalized curves of shaft deflections and phases is also studied. Dissert. Abstr.

N80-20588*# Georgia Inst. of Tech., Atlanta.
SURFACE TEMPERATURES AND GLASSY STATE INVESTIGATIONS IN TRIBOLOGY, PART 3 Final Report
Scott S. Bair and Ward O. Winer Washington NASA Apr. 1980 85 p refs
(NASA-CR-3272) Avail: NTIS HC A05/MF A01 CSCL 20L

Research related to the development of the limiting shear stress rheological model is reported. Techniques were developed for subjecting lubricants to isothermal compression in order to obtain relevant determinations of the limiting shear stress and elastic shear modulus. The isothermal compression limiting shear stress was found to predict very well the maximum traction for a given lubricant. Small amounts of side slip and twist incorporated in the model were shown to have great influence on the rising portion of the traction curve at low slide-roll ratio. The shear rheological model was also applied to a Grubin-like elastohydrodynamic inlet analysis for predicting film thicknesses when employing the limiting shear stress model material behavior. K.L.

N80-20589*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
COMPUTER CIRCUIT CARD PULLER Patent Application
Ralph W. Sawyer and Bill Szwnalski, inventors (to NASA) Filed 12 Mar. 1980 11 p
(NASA-Case-FRC-11042-1; US-Patent-Appl-SN-129778) Avail: NTIS HC A02/MF A01 CSCL 13I

A handtool for facilitating the removal of printed circuit cards is described. The device is adapted to sit on spaced, parallel rail surfaces of a card rack having a plurality of printed circuit cards. The device includes a cylindrical bar adapted to sit on the rail surfaces of the rack, a blade projected radially from the bar adapted to be received beneath a card rail, and a handle affixed to the bar in diametric opposition to the blade for facilitating manipulation of the blade for unplugging and lifting the card at its rail. NASA

N80-20590*# National Aeronautics and Space Administration, Washington, D. C.
GRINDING AND POLISHING ARTICLES IN BULK: BURNISHING
Karl Schmotz Mar. 1980 22 p Transl. into ENGLISH from Galvanotechnik (West Germany) v. 63, no. 9, 15 Sep. 1972 p 818-827 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75774) Avail: NTIS HC A02/MF A01 CSCL 13H

Various processes and equipment used for burnishing different materials are discussed. Drum and vibration installations are considered, as are processing chemicals and additive materials used in the burnishing process. R.E.S.

N80-20591*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICATION OF ROLLING-ELEMENT BEARINGS
Richard J. Parker [1980] 26 p refs Proposed for presentation at Intern. Lubrication Conf., San Francisco, 18-21 Aug. 1980; sponsored by ASME and the Am. Soc. of Lubrication Engr.
(NASA-TM-81449; E-370) Avail: NTIS HC A03/MF A01 CSCL 13I

The lubrication of rolling element bearings is surveyed. Emphasis is on the critical design aspects related to speed, temperature, and ambient pressure environment. Types of lubrication including grease, jets, mist, wick, and through the race are discussed. The historical development, present state of technology, and the future problems of rolling element bearing lubrication are discussed. A.W.H.

N80-20592# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE PARTICLE DYNAMICS OF TARGET PENETRATION Final Report
James Dahn Sep. 1979 109 p
(DA Proj. 1L1-61102-AH-43)
(AD-A077114; AD-E430331; ARBRL-TR-02188) Avail: NTIS HC A06/MF A01 CSCL 19/4

New approaches are proposed for describing some of the principal features of target penetration by a projectile in the ordnance velocity range. These features include the following observed facts: (1) curved trajectories including the possibilities of perforation, embedment or ricochet, (2) loss of mass by erosion, and (3) breakup of the projectile into sizable pieces. Each of the approaches proposed is illustrated by examples. In addition, a considerable amount of literature on the subject is reviewed in order to place these new approaches in context. After providing historical background on his topic, the author develops and illustrates his basic ideas concerning a constant mass penetrator. He then extends the theory to the case of a variable mass penetrator, and considers a model of projectile breakup. GRA

N80-20593# Army Armament Research and Development Command, Dover, N. J. Fire Control and Small Caliber Weapon Systems Lab.
DESIGN OF HELICAL COMPRESSION SPRINGS Final Report
Henry P. Swieskowski Aug. 1979 64 p refs
(AD-A077113; AD-E400353; ARSCD-TR-79002) Avail: NTIS HC A04/MF A01 CSCL 13/9

In this mathematical study on helical spring design, three basic types of load requirements are distinguished and treated individually: (1) the load at assembled height; (2) the load at minimum compressed height; and (3) the energy content of the spring. Conventional load and stress deflection formulas are modified by the replacement of dependent variables with independent values. The ratio of the final spring deflection over the working stroke is formulated to show the variation of the final stress with various required load-space conditions. Optimum design parameters are established to minimize the final operating stress value. Direct and simplified analytical design procedures are developed for round wire and rectangular wire compression springs. Also presented are nomographs for use as design aids and detailed numerical design examples. This study combines design characteristics and stress advantages of nested spring systems versus a single spring for equivalent load conditions. GRA

N80-20594# Grumman Aerospace Corp., Bethpage, N.Y.
HYDRAULIC DIAGNOSTIC MONITORING SYSTEM
31 May 1979 267 p
(Contract N62269-78-C-0041)
(AD-A077552; NADC-TR-76389-30) Avail: NTIS HC A11/MF A01 CSCL 13/7

The purpose of the Hydraulic Diagnostic Monitoring System (HYCOS) is to warn of impending failure of hydraulic system components by onboard sensors continuously monitoring failure-indicating parameters. The monitoring system consists of three basic types of sensors: analog, discrete, and fiber-optic. These sensors feed information to a self-contained, centrally located display panel through interface circuits that are easily accessible to ground maintenance personnel. The panel has circuit and system test capability which detects malfunctions of the display indicators, electronic equipment, and sensor circuits. Task 1 encompassed the design, development and procurement of hardware, sensors and microprocessors for two diagnostic monitoring systems. Task 2 installed one system on the F-14 a Hydraulic Simulator for system component reliability demonstrations. The task also covered simulated component failures and diagnostic system reaction. GRA

N80-20595# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
COIL SPRING FAILURES IN AEROSPACE HARDWARE Interim Report
Steve W. Frost and Kenneth T. Kamber Nov. 1979 27 p refs
(Contract F04701-79-C-0080)
(AD-A077808; TR-0080-5950-01-2; TR-79-19) Avail: NTIS HC A03/MF A01 CSCL 13/9

The failures of coil springs used in aerospace hardware because of fatigue and stress corrosion are evidence that there are reliability problems with these springs. The obvious and not so obvious origins of these reliability problems are discussed here. GRA

N80-20596# Oak Ridge Y-12 Plant, Tenn.
INERTIA AND FRICTION WELDING OF ALUMINUM ALLOY 1100 TO TYPE 316 STAINLESS STEEL
M. A. Perkins Oct. 1979 25 p refs Revised
(Contract W-7405-eng-26)
(Y-2165-Rev) Avail: NTIS HC A02/MF A01

The inertia and friction-welding processes were evaluated for joining aluminum alloy 1100-H14 and Type 316 vacuum-induction melted, vacuum-arc remelted stainless steel. While both processes consistently produced joints in which the strength exceeded the strength of the aluminum base metal, 100 percent bonding was not reliably achieved with inertial welding. The deficiency points out the need for development of nondestructive testing techniques for this type of joint. Additionally, solid-state volume diffusion did not appear to be a satisfactory explanation for the inertial and friction-welding bonding mechanism. DOE

N80-20597# Babcock and Wilcox Co., Alliance, Ohio. Research and Development Div.
DEVELOPMENT OF AUTOMATED WELDING PROCESSES FOR FIELD FABRICATION OF THICK-WALLED PRESSURE VESSELS: ELECTRON BEAM METHOD Quarterly Report, 1 Jan. - 31 Mar. 1979
Charles M. Weber 1979 34 p
(Contract EF-77-C-01-2606)
(FE-2606-T1; QR-6) Avail: NTIS HC A02/MF A01

The development and demonstration of an electron beam welding procedure for welding 8-inch thick SA 387 Grade 22 Class 2 steel are reported. A total of 414 welds were made. Partial penetration welding procedures capable of producing defect free, 4 inch welds were developed in the horizontal position. Defect free partial penetration welds were made at vacuum pressures of up to 30 microns. Several 5-inch thick defect free welds were made in the horizontal position. Attempts to produce defect free partial penetration welds in the vertical position were unsuccessful. DOE

N80-20598# Oak Ridge Y-12 Plant, Tenn. Fabrication Systems Dept.
PULSE-WIDTH-MODULATED AMPLIFIER DRIVES FOR MACHINE TOOLS
W. E. Barkman Nov. 1979 10 p
(Contract W-7405-eng-26)
(Y/DX-02) Avail: NTIS HC A02/MF A01

The use of a dc servo controller to convert command and feedback information into an error signal that is used to drive a dc motor is discussed. The controller utilizes a summing technique that compares an input command voltage with a feedback voltage from an external transducer. The resultant error signal is applied to a linear or a switching servo amplifier. While the output of the linear amplifier may have the ideal representation of the desired drive signal, it does result in substantial power dissipation within the amplifier and requires forced air cooling for power ratings above 100 to 200 W. The switching amplifier avoids this problem by rapidly changing the state of its output stage from a conducting to a nonconducting condition, thereby minimizing the operation of the output stage in the high power dissipation region. The design and operation of the amplifier drive are described. DOE

N80-20599# Argonne National Lab., Ill. Chemical Engineering Div.
DECONTAMINATION OF METALS CONTAINING PLUTONIUM AND AMERICIUM
M. G. Seitz, T. J. Gerding, and M. J. Steindler Jun. 1979 57 p refs
(Contract W-31-109-eng-38)
(ANL-79-13) Avail: NTIS HC A04/MF A01

A conceptual design of a melt refining process to decontaminate plutonium- and americium-contaminated metals is described. The process includes single-stage refining of contaminated metals to produce a metal product which would have less than 10 nCi/g of TRU-element contamination. Two plant sizes were considered. The smaller conceptual plant processes 77 kg of metal per 8 hour period and may be portable. The larger one processes 140 kg of metal per 8 hour period, is stationary, and may be near the maximum size that is practical for a metal decontamination process. DOE

N80-20600# National Technical Information Service, Springfield, Va.
GAS BEARINGS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1971 - Nov. 1979
Guy E. Habercom, Jr. Dec. 1979 286 p Supersedes NTIS/PS-78/1277; NTIS/PS-77/1122; NTIS/PS-16/0970; NTIS/PS-75/808; NTIS/PS-76/0969
(PB80-802499; NTIS/PS-78/1277; NTIS/PS-77/1122; NTIS/PS-76/0970; NTIS/PS-75/808; NTIS/PS-76/0969)
Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

The design, performance, and applications of gas bearings are investigated in these research reports. Gas bearing configuration, gas flow, lubrication, bearing loading, and bearing stability are among the parameters reviewed. This updated bibliography contains 279 abstracts, 16 of which are new entries to the previous edition. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-20601 Pennsylvania State Univ., University Park.
INTERNAL QUALITY OF ALUMINUM DIE CASTINGS Ph.D. Thesis
Lester Wayne Garber 1979 255 p
Avail: Univ. Microfilms Order No. 8006003

The effects of experimental manipulations and random variations of several process variables on the internal quality of aluminum die castings are investigated. Particular consideration is also given to determine whether entrapped air or internal solidification shrinkage is the principal cause of the greatest volume of porosity within aluminum die castings. The independent variables in the experimental design are intensification pressure, fast shot plunger velocity, die temperature gradient, metal temperature in the holding furnace, and die open time. High levels of intensification pressure and low levels of fast shot plunger velocity are found to produce castings of better internal quality. Of the random variations tested, biscuit lengths and pressure-related variables are found to affect internal quality. Internal solidification shrinkage, and not entrapped air, is found to be the principal cause of the greatest volume of porosity within aluminum die castings. Dissert. Abstr.

N80-20602# Stanford Univ., Calif. Dept. of Operations Research.
BOUNDING THE RELIABILITY OF MULTISTATE SYSTEMS
David A. Butler Aug. 1979 38 p refs
(Contract N00014-75-C-0561)
(AD-A075579; TR-193) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report develops a number of upper and lower bounds for the reliability of multistate systems, that is, systems for which each component may exist in one of a finite number of states. These bounds are based on notions of multistate minimal paths and minimal cuts. The bounds are far more easily computed than the exact system reliability. In order to further reduce the computations required and obtain sharper bounds, a modular-decomposition-based bound is developed for multistate systems. GRA

N80-20603# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
COMMON CAUSE FAILURE ANALYSIS TECHNIQUES: A REVIEW AND COMPARATIVE EVALUATION
Dale M. Rasmuson, Gary R. Burdick, and James R. Wilson Sep. 1979 177 p refs
(Contract EY-76-C-07-1570)
(TREE-1349) Avail: NTIS HC A09/MF A01

Reviews and evaluations of selected common cause failure analysis (CCFA) techniques are presented for experienced reliability

analysts who are new to systems where common cause failures contribute significantly to the system reliability characteristics. General characteristics of a CCFA are discussed and suggestions for implementing each characteristic are given. A flow chart which summarizes and evaluates the references is presented. DOE

N80-20604# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Bremen (West Germany). Inst. fuer Angewandte Materialforschung.
REPORT ON THE ACOUSTIC EMISSION EXAMINATION OF GLASS-FIBER-REINFORCED PLASTIC PIPES
W. Brockmann and K. Wolitz Oct. 1979 18 p
(UCRL-Trans-11520) Avail: NTIS HC A02/MF A01

From the results reported, it can be concluded that acoustic emission analysis is suitable as a technique for quality control of high-pressure pipes, because it permits critical processes (fiber breaks) to be distinguished from noncritical processes (delamination, breaks between fibers) at pressure loads up to the rated load. If further tests with a larger number of test specimens can establish a statistically significant correlation between the proportion of fiber breaks below the rated pressure and the bursting pressure which actually occurs, it will be possible, by using acoustic emission analysis and test loads up to the rated pressure, to dispense with an individual test at double rated load, which in its own right can damage, beyond the critical point, a system designed for a load. The use of acoustic emission analysis thus leads to increased safety of the pipes. DOE

N80-20605# Hanford Engineering Development Lab., Richland, Wash. Materials Engineering Dept.
ACOUSTIC EMISSION: WHO NEEDS IT AND WHY?
J. C. Spanner May 1979 27 p refs Presented at the Intern. Conf. on Acoustic Emission, Anaheim, Calif., 10 Sep. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1808-FP; CONF-790966-2) Avail: NTIS HC A03/MF A01

The growing industrial interest in acoustic emission is examined. Some of the inherent limitations of conventional nondestructive test methods are discussed, and several surveys of defects found during the manufacture and operation of pressure boundary components are reviewed. Acoustic emission offers potential for providing increased assurance of both initial and continued structural integrity. Furthermore, if acoustic emission is properly applied in conjunction with fitness-for-purpose criteria, it may be possible to reduce present manufacturing costs without compromising actual structural adequacy. DOE

N80-20606# Los Alamos Scientific Lab., N. Mex.
STATUS OF RADIOGRAPHIC STUDY, DEVELOPMENT, AND NEW APPLICATIONS IN THE LASL NONDESTRUCTIVE TESTING GROUP
L. E. Bryant, Jr. Oct. 1979 15 p
(Contract W-7405-eng-36)
(LA-UR-79-2648) Avail: NTIS HC A02/MF A01

Topics discussed include replacement of betatron with a racetrack microtron, development of tomography, cineradiography, and flash X ray applications. DOE

N80-20607# Nevada Automotive Test Center, Carson City.
NDT (NON-DESTRUCTIVE TEST)/ROAD CORRELATION Final Report
Henry C. Hodges and Henry C. Hodges, Jr. 18 Apr. 1979 19 p
(Contract DOT-HS-7-01589)
(PB80-106636; DOT-HS-805-034) Avail: NTIS HC A02/MF A01 CSCL 13F

Several nondestructive test (NDT) methods were compared and water coupled ultrasonics produced the most accurate and repeatable data for three dimensionally positioning tire anomalies. For the continuation of the evaluation of water coupled ultrasonics 75 recapped test tires were obtained, including bias, bias-belted and radial, and scheduled for 10,000 miles of highway durability. The tires, in general, only obtained one-third that mileage due to catastrophic failures and treadwear anomalies. These tires were NDT-inspected prior to test and after test to analyze the ability of water coupled ultrasonics to differentiate between those tire anomalies which lead to degraded road performance and those which do not. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-20608 Florida Univ., Gainesville.
ON THE THEORY OF CYCLIC VISCOPLASTICITY Ph.D. Thesis
Chian-Eong Yen 1979 260 p
Avail: Univ. Microfilms Order No. 8005513

A theory of cyclic viscoplasticity is developed to describe the observed rate- and history-dependent behavior of structural materials under complex loading conditions. It quantitatively accounts for the viscid effect, the anisotropic yield surface distortion, and the material behavior observed under cyclic loading conditions including cyclic hardening, cyclic softening, and the material memory of prior loading history. The theory includes a hardening rule, a rate-dependent flow rule, and an expression for the inelastic modulus of the quasi-static effective stress-effective inelastic strain curve. Computations are carried out for uniaxial random cyclic loading for type 304 stainless steel at elevated temperature and for simulations of experiments for pure aluminum under complex combined tension-compression and torsion loadings. Dissert. Abstr.

N80-20609 Michigan State Univ., East Lansing.
MEASUREMENT OF TRANSIENT RESPONSE OF A CENTRAL CRACK TO A TENSILE PULSE Ph.D. Thesis
Abdurahman Ahmed Sukere 1979 120 p
Avail: Univ. Microfilms Order No. 8006193

The behavior of a crack in a stress wave environment was investigated. The crack was approximated by electromachined slots in the center of thin aluminum specimens. A tensile impact apparatus was developed for generating a plane tensile pulse with a ramp function profile. Dynamic displacements along the crack surface were measured using a laser interferometric displacement gage. The data were analyzed within the bounds of linear elastic mechanics to estimate the dynamic stress intensity factor. The experimental results for the dynamic crack displacements were found to oscillate, a phenomena attributed to the cancellation and reinforcement of the incident waves by the various scattered waves. Dissert. Abstr.

N80-20610 Purdue Univ., Lafayette, Ind.
FINITE-ELEMENT ANALYSIS OF PROBLEMS INVOLVING STRESS SINGULARITIES Ph.D. Thesis
Wen-Sheng Chan 1979 206 p
Avail: Univ. Microfilms Order No. 8005839

Singular finite elements that contain a square root type of stress singularity were developed for the analysis of crack problems. Several static crack problems, i.e., center, single edge, and double edge cracks, were solved and compared with an available analytical solution. In the dynamic case, the Newmark method was used to integrate the time variable. Both stationary cracks subjected to dynamic loadings and cracks moving with a constant velocity were considered. For the moving crack problems, the dynamic stress intensity factor was computed for an elastic strip subjected to prescribed boundary displacements as well as a simple tension. An 8 node quadrilateral finite element was developed for the lap joint analysis. Effects of the overlap length, and ratio of adherend thickness to adhesive thickness, and clamping forces applied at the edges of overlapping were investigated. Dissert. Abstr.

N80-20611 Tennessee Univ., Knoxville.
FRACTURE MECHANICS OF BI-MATERIAL INTERFACE CRACKS Ph.D. Thesis
Setunath Anna Swamy 1979 132 p
Avail: Univ. Microfilms Order No. 8005428

The behavior of bimetallic interface cracks was investigated. A plate composed of two dissimilar materials bonded together along a straight line containing a center crack was studied. The problem represented an idealization of an adhesive joint or a composite structure with an interfacial flaw or crack. Solutions

obtained using three different approaches were compared in order to develop a recommended procedure for analyzing interface crack problems. The first method was based on the hybrid crack tip element method. Standard eight node isoparametric elements, with modifications to account for singularity, were also used to analyze the problem. Two distinct techniques using this general approach were studied - one based on the mapping technique and the other based on the displacement technique. The mapping technique involved the use of two dimensional isoparametric elements with the midside nodes shifted to the quarter point location. The displacement technique involved the use of two dimensional isoparametric elements with numerically integrated shape functions. Dissert. Abstr.

N80-20612 Wisconsin Univ. - Madison.
A DIAGONALLY DOMINANT SOLUTION FOR THE CYLINDER END PROBLEM AND A NON-AXISYMMETRIC ELASTICITY SOLUTION FOR A TRUNCATED SPHERICAL DOME Ph.D. Thesis
Terry Dale Gerhardt 1979 181 p
Avail: Univ. Microfilms Order No. 8001609

A method for the elasticity solution of the cylinder problem with axisymmetric torsionless end loading is presented. Consideration is given to the specification of arbitrary stresses or displacements on the end of a semi-infinite cylinder with a stress free lateral surface. Utilizing the Papkovich-Neuber potentials, a solution to this problem is obtained in the form of a nonorthogonal eigenfunction expansion. The expansion coefficients must be determined from an infinite system of linear algebraic equations. A Galerkin formulation is presented which makes this system of equations diagonally dominant, allowing the precise calculation of the eigenfunction coefficients regardless of how many equations are kept before truncation. This solution is shown to yield an accurate calculation of cylinder stresses and displacements. A nonaxisymmetric solution for Navier's equations in spherical coordinates is obtained through a direct method, rather than the usual Papkovich-Neuber approach. The solution is specialized to solve the problem of a truncated spherical dome with a closed top. Dissert. Abstr.

N80-20613 Pennsylvania State Univ., University Park.
VIBRATION OF PLATES OF VARIOUS GEOMETRIES Ph.D. Thesis
Earl George Williams 1979 157 p
Avail: Univ. Microfilms Order No. 8006070

Point-driven, flat, thin aluminum plates of various geometries with free boundaries were studied. A theory which allows the mean of the driving point admittance to be predicted over a wide frequency range at any point on these plates was used. The prediction was compared to the experimentally determined admittance. The expected minimum and maximum variations about this mean were predicted and compared to the experimental data over a broad frequency range. Measured loss factors for these free plates were used in the theoretical models. The actual admittance versus frequency for a center driven rectangular plate was predicted using a mode sum technique and compared to measured data. A simple algebraic formula was used to predict the resonance frequencies of the rectangular and square plates with free boundaries. Dissert. Abstr.

N80-20614 Wisconsin Univ. - Madison.
A DIFFERENTIAL POPULATION SYNTHESIS APPROACH TO MASS SEGREGATION IN M92 Ph.D. Thesis
William John Tobin 1979 148 p
Avail: Univ. Microfilms Order No. 8004747

Spectra obtained with a intensified Reticon scanner are presented of 26 low metal stars and of the center and one quarter intensity positions of M92. Spectral coverage is from 390 to 870 nm with resolution better than 1 nm in the blue and 2 nm in the red. Individual pixel signal to noise is about 100. Dwarf features are notably absent from the M92 spectra. Numerical estimates of 36 absorption features are extracted from every spectrum, as are two continuum indices. Mathematical models are constructed describing each feature's dependence on stellar color, luminosity, and metal content and then used to estimate the metal content of 6 of the stars for which the metal content is not known. For 10 features reliably measured in M92's center and edge a mass segregation sensitivity parameter is derived from each feature's deducted luminosity dependence. Dissert. Abstr.

N80-20615 Tufts Univ., Medford, Mass.
CLOSED CELL STRUCTURES USING TRIANGULAR PLATES Ph.D. Thesis
Henry Robert Poydar 1979 131 p
Avail: Univ. Microfilms Order No. 8006712

A method is described by which closed cell structures of single curvature may be constructed using triangular folded plate elements of equal size. When viewed in the transverse plane, these structures are seen to be portions of a regular polygon. Methods for obtaining matrices for nodal coordinates and element connectivity are described. Schlegel diagrams are introduced as a way to help visualize connectivity. This information is used to construct a 350 pound, portable, plywood and aluminum prototype structure which is 9.46 feet high, 8.00 feet wide, and 8.43 feet long. A load was applied along the centerline of the crown of the structure and the nodal displacements measured. The measured displacements were compared to computed values. It is shown that small structures may be constructed using the prescribed method and that their structural response to imposed loads may be predicted by the analysis of a representative plane frame and the application of an appropriate amplification factor. Dissert. Abstr.

N80-20616 Cornell Univ., Ithaca, N. Y.
TIME-DEPENDENT INELASTIC ANALYSIS BY THE BOUNDARY ELEMENT METHOD AND THE FINITE ELEMENT METHOD Ph.D. Thesis
Maheshchandra Amritial Morjaria 1979 91 p
Avail: Univ. Microfilms Order No. 8003956

Numerical schemes for solution of problems of time-dependent inelastic deformation in metallic bodies using the boundary element method and the finite element method are presented. The formulations utilize combined creep-plasticity constitutive theory with state variables to model material behavior. The boundary element method is applied to general plane stress/strain and plate bending problems. The finite element method is applied to plane stress/strain as well as axisymmetric problems. Numerical solutions for some problems are obtained to illustrate the procedures and their versatility. It is concluded that both the formulations are very general and can be easily applied to problems with complicated geometrics and loading histories. However, with regards to solution time and solution accuracy, the boundary element method is somewhat more efficient than the finite element method for this class of problems. Dissert. Abstr.

N80-20617 North Carolina State Univ. at Raleigh.
AN INVESTIGATION OF RIB STIFFENED HYPERBOLIC COOLING TOWER UNDER STATICAL LOADS USING DISCRETE FIELD AND GALERKIN FINITE ELEMENT METHODS Ph.D. Thesis
Debasish Kumar Roy 1979 171 p
Avail: Univ. Microfilms Order No. 8005566

A rational analysis for rib stiffened hyperbolic shells of revolution is developed. The discrete field macro approach is applied and intended to take advantage of the discretely symmetric structural configuration in the circumferential direction for any axisymmetric shell of revolution. The resulting mathematical model covering the variation in the meridional direction is developed using the finite element numerical technique. The rib-shell interaction is enforced through a set of field displacement compatibility equations by matching rib and shell displacements at rib-lines. The Galerkin finite element method is used to find the rib and shell displacements. A computer program is written for the purpose of investigating either a hyperbolic curved rib, shell of revolution or rib stiffened cooling tower when subjected to statical loads. Several heuristic rib stiffened cooling towers are studied for various load cases. Dissert. Abstr.

N80-20618 Purdue Univ., Lafayette, Ind.
SINGULAR FINITE ELEMENT SHAPE FUNCTIONS IN ESTIMATING STRESS INTENSITY FACTORS Ph.D. Thesis
George Hans Staab 1979 129 p
Avail: Univ. Microfilms Order No. 8005945

The general procedure for extracting the stress intensity factor from the finite element solution is discussed. This procedure

is shown to be applicable to mixed mode analysis, such as the oblique edge crack problem. The various methods available for estimating the stress intensity factor are examined and shown to produce acceptable results, which depend on the manner in which the stress intensity factor is estimated. Two shape functions, representing both a simple and a complex displacement field, are used to analyze several problems of practical importance. Each function is shown to accurately estimate the stress intensity for these problems, thus providing further verification that the number of terms used to define the singular element displacement field is of minimal importance. The problems analyzed are the oblique edge crack, beam bending, a split beam, and two bi-material problems. The problem of an interfacial crack along the bond line of two dissimilar media is found to be a case of limited applicabilty for the shape functions considered.

Dissert. Abstr.

N80-20619*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ON THE NONLINEAR DEFORMATION GEOMETRY OF EULER-BERNOULLI BEAMS

Dewey H. Hodges, Robert A. Ormiston, and David A. Peters. Apr. 1980 57 p refs

(NASA-TP-1566; A-7985; AVRADCOM-TR-80-A-1) Avail: NTIS HC A04/MF A01 CSCL 20K

Nonlinear expressions are developed to relate the orientation of the deformed beam cross section, torsion, local components of bending curvature, angular velocity, and virtual rotation to deformation variables. The deformed beam kinematic quantities are proven to be equivalent to those derived from various rotation sequences by identifying appropriate changes of variable based on fundamental uniqueness properties of the deformed beam geometry. The torsion variable used is shown to be mathematically analogous to an axial deflection variable commonly used in the literature. Rigorous applicability of Hamilton's principle to systems described by a class of quasi-coordinates that includes these variables is formally established.

K.L.

N80-20620*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NONLINEAR STATIC TPS ANALYSIS

Jerrold M. Housner and Ramon Garcia. Mar. 1980 20 p refs

(NASA-TM-81785) Avail: NTIS HC A02/MF A01 CSCL 20L

A nonlinear analysis which includes the effect of mismatch and filler bar was developed to predict the strain isolator pad reuseable surface insulation through-the-thickness interface stresses. Parametric studies were conducted for simulated shock loading on square tiles. Expected loads on an actual tile were also studied. The results indicate that when no mismatch is present, linear solutions tend to give nonconservative maximum stresses relative to the nonlinear solutions. When mismatch is present, the linear maximum stresses are only conservative at low load levels and highly nonconservative at high load levels. Although the presence of filler bar reduces maximum tensile stresses in some cases, it does not appear that the nominal dimension filler bar can reduce the nonlinear stress to a level at which the linear solution becomes conservative relative to the nonlinear solution. Moreover, on an outboard trailing edge elevon tile at descent with +20 deg flap, the linear analysis is 49% nonconservative relative to the nonlinear analysis with filler bar.

K.L.

N80-20621*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.

USE OF TWO-DIMENSIONAL TRANSMISSION PHOTOELASTIC MODELS TO STUDY STRESSES IN DOUBLE-LAP BOLTED JOINTS: LOAD TRANSFER AND STRESSES IN THE INNER LAP Progress Report

Michael W. Hyer. Mar. 1980 65 p refs

(Grant NsG-1621)

(VPI-E-80-9) Avail: NTIS HC A04/MF A01 CSCL 20K

The determination of the stress distribution in the inner lap of double-lap, double-bolt joints using photoelastic models of the joint is discussed. The principal idea is to fabricate the inner lap of a photoelastic material and to use a photoelastically sensitive material for the two outer laps. With this setup, polarized light transmitted through the stressed model responds principally to the stressed inner lap. The model geometry, the procedures for making and testing the model, and test results are described.

K.L.

N80-20622# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

THERMO-ELASTIC-PLASTIC STRESSES IN HOLLOW CYLINDERS DUE TO QUENCHING

J. D. Vasilakis and P. C. T. Chen. Oct. 1979 23 p refs

Presented at the 25th Conf. of Army Mathematicians, Baltimore, 6-8 Jun. 1979

(DA Proj. 1L1-61101-A-91A)

(AD-A077109; ARLCB-TR-79025) Avail: NTIS HC A02/MF A01 CSCL 20/11

A hollow cylindrical tube rapidly quenched for the purpose of developing a high strength material structure is analyzed. The quenching creates severe thermal stresses early in the quenching cycle while later the material transformation by virtue of a volume change in the transformed material causes large transformation stresses. The transient temperature distributions and the elastic treatment of the stresses has been treated previously. The present work is an attempt to consider the thermo-elastic-plastic aspects of the problem. The von Mises' yield criterion and the Prandtl-Reuss stress strain relations are used. Results are calculated based on a new finite difference approach.

GRA

N80-20623# Systems Research Labs., Inc., Dayton, Ohio.

AN EVALUATION OF FOUR CURRENT MODELS TO PREDICT THE CREEP-FATIGUE INTERACTION IN RENE 95 Technical Report, Jan. 1977 - Aug. 1978

Henry L. Bernstein. Jun. 1979 111 p refs

(Contract F33615-76-C-5191; AF Proj. 7351)

(AD-A077168; SRL-6909-TR; AFML-TR-79-4075) Avail: NTIS HC A06/MF A01 CSCL 11/6

Four current models for the creep-fatigue interaction were evaluated for their ability to predict fatigue behavior at 1200 F (650 C) of thermochemically processed Rene 95--an advanced nickel-base superalloy used for turbine disks. These models are the Strawrange-Partitioning Model, the Frequency-Separation Model, the Ostergren Model, and the Damage-Rate Model. A series of strain controlled fatigue tests was conducted to evaluate these models. These tests consisted of continuously cycling tests at two different frequencies, various types of strain-hold tests, and dual-rate continuously cycling tests. These fatigue tests were divided into two groups--baseline tests and verification tests. The baseline tests were used to determine the constants in the models and the correlation ability of the models. The verification tests were used to determine the predictive ability of the models. The best correlation of the baseline tests was to within a scatter band of plus or minus 3.6 and was achieved by the Frequency-Separation Model and the Ostergren Model. The other two models had scatter bands greater than plus or minus 5. The best prediction of the verification tests was to within a factor of plus 5.2 and was achieved by the Ostergren Model. The other models predicted the verification tests from factors of plus or minus 6.1 to plus or minus 18. Each of the models consistently overpredicted or underpredicted the lives of certain types of tests that form the data base. Based upon the results of this study, it was concluded that these models in their present form could not adequately predict the fatigue life of Rene 95 at 1200 F (650 C).

GRA

N80-20624# Army Materials and Mechanics Research Center, Watertown, Mass. Mechanics of Materials Div.

ON THE LOAD DISPLACEMENT RELATION FOR A CRACKED RECTANGULAR SPECIMEN WITH CONSTRAINED ENDS Final Report

Oscar L. Bowie and Francis I. Baratta. Jul. 1979 17 p refs

Submitted for publication

(DA Proj. 1L1-62105-AH-84)

(AD-A075527; AMMRC-TR-79-46) Avail: NTIS HC A02/MF A01 CSCL 20/11

Relations are presented between the net force, the end displacement, and the stress intensity factor for cracked rectangular panels subjected to uniform displacement. Two configurations are considered: an edge-cracked panel and a

center-cracked panel. If the stress intensity factor is already known in terms of the normal displacement, then the resulting formulation allows the determination of that stress intensity in terms of the applied load and vice versa. GRA

N80-20625# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE PREDICTION OF MASS LOADED NATURAL FREQUENCIES AND FORCED RESPONSE OF COMPLEX, RIB-STIFFENED STRUCTURES M.S. Thesis
L. B. Glensek. Dec. 1979. 149 p. refs.
(AD-A079856; AFIT/GAE/AA/79D-5) Avail: NTIS
HC A07/MF A01 CSCL 20/4

An experimental investigation was conducted to determine the validity of an algorithm developed by Whaley (Ref. 14) to approximate the natural frequencies of a complex structure under arbitrary mass loading conditions, when only the unloaded natural frequency and mode shape data is known. The chosen test specimen was a curved, rib-stiffened panel from a C-141 Starlifter, aircraft. The panel was suspended from the ceiling by bungy cords and tested in an unloaded configuration and nine separate mass loaded configurations. Then using only unloaded data the generalized mass and generalized stiffness for each mass loaded configuration were computed, and the natural frequencies for each configuration were computationally predicted using the aforementioned algorithm. The theoretical and experimental results were then compared to detemine the amount of error incurred in the approximation technique. The theory of how to ultimately determine the overall forced response of the specimen was discussed and an error model was developed to enable an examination of the reliability of the algorithm in predicting forced response. Recommendations concerning future test procedures, areas requiring further study, and the use of the algorithm were made. GRA

N80-20626# Wisconsin Univ. - Madison. Mathematics Research Center.
ENERGY RELEASE RATE CALCULATIONS FOR INTERFACE EDGE CRACKS BASED ON A CONSERVATION INTEGRAL Summary Report
A. Nachman (Old Dominion Univ.) and J. R. Walton (Texas A and M Univ., College Station). Nov. 1979. 14 p. refs.
(Contracts DAAG29-75-C-0024; F49620-79-C-0076; Grant AF-AFOSR-3290-77)
(AD-A079723; MRC-TSR-2017) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A certain conservation integral, the so called M-integral, recently exploited by L. B. Freund in the calculation of stress intensity factors for cracks in homogeneous elastic media, is applied to the calculation of energy release rates for interface edge cracks. Specifically, for an edge crack along the interface between two elastic wedges of different opening angles and dissimilar elastic properties, and that is subjected to point loads at the apex, a relation is derived among the length of the crack, the energy release rate of the crack, the applied loads, the wedge angles and the material parameters. GRA

N80-20627# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECT OF IMPERFECTIONS ON THE COLLAPSE OF RECTANGULAR PLATES USING VARIATIONAL CALCULUS M.S. Thesis
Lyle G. Peck. Dec. 1979. 73 p. refs.
(AD-A079905; AFIT/GAE/AA/79D-14) Avail: NTIS
HC A04/MF A01 CSCL 11/4

An analysis is made of the effect of initial imperfections in geometry on the collapse of simply-supported rectangular plates. A Reissner-type variational principle is employed to evaluate the load versus lateral displacement of elastic, elastic-plastic and orthotropic plates subject to compressive loading along two edges. Imperfection size and shape, plate thickness and aspect ratio, and for orthotropic material, the ply orientation is examined. The results indicate that the load-displacement curve is sensitive to the initial imperfection, particularly for elastic-plastic materials. The effect of plate size and aspect ratio are similar for all the plates considered with the collapse stresses higher for elastic plates than for elastic-plastic plates. The effect of plasticity becomes insignificant for thin plates when compared with plates with elastic properties. In general, it can be stated that the imperfection function determines the plate's collapse load. For orthotropic plates the effect of ply orientation is significant at aspect ratios less than 1 but relatively insignificant at higher values when comparing the minimum collapse stresses. The difference is dependent upon the magnitude of the ratio of Young's moduli in the major material axes. GRA

N80-20628# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYTICAL/EXPERIMENTAL INVESTIGATION OF THE INSTABILITY OF COMPOSITE CYLINDRICAL PANELS M.S. Thesis
Marvin L. Becker. Dec. 1979. 89 p.
(AD-A079850; AFIT/GAE/AA/79D-3) Avail: NTIS
HC A05/MF A01 CSCL 11/4

An analytical and experimental program was conducted to study the instability of 8-ply laminated cylindrical panels (graphite-epoxy) subjected to an axial compressive loading. The analysis included three different ply orientations, five different boundary conditions on the vertical edges, and three different panel sizes. The analytical buckling loads were obtained by using the linear bifurcation branch of the STAGS-C computer code, and several nonlinear collapse analyses were also made on selected configurations. The experimental tests were conducted by the Air Force Flight Dynamics Laboratory using a specially designed test fixture. Relatively good agreement was obtained between the analytical and experimental buckling loads, particularly when the nonlinear collapse load was used. The linear bifurcation results were 11 - 28% higher than the nonlinear results, indicating that the nonlinear effects in circular composite panels are important. The boundary conditions (especially w and v) had the greatest influence on the buckling load, followed by the aspect ratio and finally the ply orientation. The (+ or - 45)2s panels exhibited an unusually large increase in the buckling load when the aspect ratio was small and the in-plane displacements were restrained at the edges. GRA

N80-20629# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COLUMN BUCKLING OF ISOTROPIC AND COMPOSITE BEAMS USING A TRUNCATED FOURIER SERIES M.S. Thesis
J. Louis Insprucker, III. Dec. 1979. 139 p. refs.
(AD-A079862; AFIT/GA/AA/80M-2) Avail: NTIS
HC A07/MF A01 CSCL 13/13

A trigonometric approach to finite difference calculus was applied to solve for beam buckling loads using a virtual work method. The trigonometric equation, a truncated Fourier series, permitted varying the buckling load by adjusting a wavelength parameter. Values for the buckling load of a variety of beams - uniform, homogeneous, variable and discontinuous inertias, composite - were found under a wide range of boundary conditions. An optimization scheme was used which determines the critical load by locating the intersection of two buckling load curves. The method is accurate as long as points of interest - maximum inertia, discontinuities - are modeled by the nodal arrangement. The trigonometric approach provided improved accuracy over the conventional approach for a wide range of wavelengths. For an infinite value of the wavelength, the trigonometric approach converges to the conventional one. A variable mesh designed to concentrate nodes about points of interest was found to be relatively ineffective when compared to a uniform mesh. Composite materials were modeled using an equivalent flexural rigidity. GRA

N80-20630# California Univ., Berkeley. Dept. of Mechanical Engineering.
RIGID-PLASTIC FINITE-ELEMENT ANALYSIS OF PLASTIC DEFORMATION IN METAL-FORMING PROCESSES Progress Report, May 1978 - May 1979
C. C. Chen and Shiro Kobayashi. Aug. 1979. 141 p. refs.
(Contract F33615-77-C-5111; AF Proj. 2418)
(AD-A078987; AFML-TR-79-4105) Avail: NTIS
HC A07/MF A01 CSCL 13B

Metal-forming processes of extrusion, drawing, ring compression, and closed-die forging were analysed by the rigid-plastic finite-element method. According to the individual problem

characteristics, the method was modified in order to deal with the steady-state configurations of the extrusion and drawing problems, the neutral flow point (or region) problems of ring compression, and the complexity in geometric changes of the closed-die forging problems. The present investigation is a complete study of the axisymmetric steady-state extrusion and drawing processes, including multipass extrusion and drawing. Detailed deformation mechanics were revealed, showing the influence of the previous deformation history on the flow pattern in the current pass. To solve the neutral flow problems in ring compression, a variational formulation was developed for the case where the frictional stress is dependent on the relative velocity at the die-workpiece interface. The finite-element solutions of ring compression were then obtained under various friction conditions for several materials. Some of the results were compared with the approximate theoretical solutions and experimental results. It was concluded that this modified finite-element scheme does provide a useful tool for the analysis of neutral flow problems and for industrial applications. The closed-die forging problems are characterized by very complex geometries, large rigid portions, and rapid changes in velocity fields. GRA

N80-20631# Bristol Univ. (England). Physics Lab.
STATES OF STRESS AND STRAIN IN ADHESIVE JOINTS, INCLUDING PHOTOELASTIC IMAGING OF DEFECTS IN ADHERENDS Interim Scientific Report, 30 Sept. 1977 - 30 Sep. 1979
J. P. Sargent 30 Nov. 1979 52 p refs Sponsored in part by European Office of Aerospace Research
(Grant AF-AFOSR-3448-77; AF Proj. 2307)
(AD-A079515; AFOSR-79-1359TR) Avail: NTIS HC A04/MF A01 CSCL 11/1

Water migration across the thin epoxy resin layer in model adhesive joints causes strongly inhomogeneous swelling. The swelling is the principal cause of stress systems which are being examined by analysis of the pattern of Newton's rings formed between a glass cover slip and an optical flat. Enhancement of water migration by normal stresses fracture mechanics test piece, designed to investigate water uptake by adhesives, is reported. Photoelastic imaging of ultrasonic waves can be utilized to investigate defects in opaque solids. Instead of using a piezoelectric detector, the reflected sound from a defect is actually observed in a visualizing block of quartz, after propagating from the specimen to the block across an acoustic coupling. Experiments and a computer model are described. GRA

N80-20632# Sandia Labs., Albuquerque, N. Mex.
BIAS ERRORS IN A RANDOM VIBRATION EXTREMAL CONTROL STRATEGY
D. O. Smallwood and D. L. Gregory 1979 18 p ref Presented at the Shock and Vibration Symp., Colorado Springs, Colo., 16 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1222; CONF-791053-1) Avail: NTIS HC A02/MF A01

The theoretical basis for an extremal control strategy in random vibration testing is discussed. Except for special cases this strategy results in bias errors. Formulas for estimating the bias are given, and methods for minimizing the errors are suggested. It is concluded that a sequential averager should not be used for this control strategy as its use will result in an unknown bias error. DOE

N80-20633# Akron Univ., Ohio.
EXPERIMENTAL STUDY OF CAP AND THICKNESS INFLUENCE ON THE VIBRATION RESPONSE AND DAMPING OF FLEXIBLE FLUID-COUPLED COAXIAL CYLINDERS
Mamerto Chu, Samuel Brown (Babcock and Wilcox Co., Akron, Ohio), Brian Lieb (Babcock and Wilcox Co., Akron, Ohio), and Joseph Lestingi (General Motors Corp., Flint, Mich.) 1979 52 p refs
(Contract EY-76-C-15-2395)
(CONF-790615-14) Avail: NTIS HC A04/MF A01

The response of a set of coaxial cylinders with water in the annulus is studied. The effects of cylinder thickness and the fluid filled annulus gap size on the resonant frequencies and mode shapes of the cylinders are presented; also included is an evaluation of damping for selected gaps and cylinder thicknesses. Details of the experiment setup and procedures are outlined. DOE

N80-20634# General Atomic Co., San Diego, Calif.
DISTRIBUTION OF STEADY STATE TEMPERATURES AND THERMOELASTIC STRESSES IN CYLINDRICAL SHELL WITH INTERNAL HEAT GENERATION AND COOLED ON BOTH SIDES OR ONLY ON ONE SIDE
Gilbert B. MeleseDHospital Oct. 1979 80 p
(Contract DE-AT03-76ET-35300)
(GA-A-15509) Avail: NTIS HC A05/MF A01

General expression for steady state temperatures and elastic thermal stress distribution are derived for a hollow fuel element cooled on both sides. The main simplifying assumptions consist of one dimensional heat transfer and a single medium. Dimensionless numerical results are plotted in the case of uniform internal heat generation and for constant thermal conductivity. Solid rods and flat plates are treated as special cases. As could be expected, cooling on both sides rather than on only one side, leads to significant reduction in maximum fuel temperature and thermal stresses for a given power density, or to a significant increase in power density for either given maximum temperature drop in the fuel or for maximum tensile thermal stress. DOE

N80-20635# Rochester Univ., N. Y.
MATERIALS AND MECHANICS OF RATE EFFECTS IN BRITTLE FRACTURE Progress Report, Oct. 1978 - Oct. 1979
S. J. Burns Oct. 1979 19 p
(Contract EY-76-S-02-2422)
(COO-2422-22) Avail: NTIS HC A02/MF A01

A thermodynamic formulation for a crack driving force was experimentally used in linear elastic fracture mechanics, elastic plastic fracture mechanics and creep fracture. In linear elastic and elastic plastic fracture mechanics, mechanical stability criteria are established from the load versus the load point displacement in two test specimens that differ only in crack area. These tests were also used to measure the fracture toughness in several heat treated steels. Creep cracking of PMMA shows that there is a sharp transition to unstable fracture in a plot of the log of the steady state crack velocity versus the crack driving force at several selected temperatures. In addition, it is shown that the athermal crack driving force is independent of rate and temperature. A method for electronically recording the crack driving force versus the crack area was used on double cantilevered beam specimens. Temperature and crack rate dependences were measured near the ductile to brittle transition temperature in a low carbon steel. DOE

N80-20636# Massachusetts Univ., Amherst.
DYNAMIC BUCKLING OF A RIGID-PLASTIC CYLINDRICAL SHELL: A SECOND ORDER DIFFERENTIAL EQUATION SUBJECT TO FOUR BOUNDARY CONDITIONS Final Report
K. Zak, M. A. Veluswami, and G. Horvay 1979 23 p refs
(Contract EY-76-S-02-4122)
(COO-4122-29) Avail: NTIS HC A02/MF A01

Three methods of solutions are considered: (1) power-series expansion (in conjunction with Pade approximants); (2) cosine-series solution, and its pair obtained by the variation of parameters method; and (3) pseudo-Hill analysis. But only method no. 1 is carried to completion, including a numerical confirmation that, for the aluminum test shell of Vaughan-Florence, the results coincide with those of Horvay-Veluswami-Stockton, based on time-consuming (and expensive) numerical forward integration. Solution method no. 2 is stopped short of numerical calculations; and method no. 3 is outlined in its principal features. Comments on post-buckling behavior are included. DOE

N80-20637# Massachusetts Univ., Amherst. Dept. of Civil Engineering.
EXTENSION OF THE VAUGHAN-FLORENCE ANALYSIS OF DYNAMIC BUCKLING OF A RIGID-PLASTIC CYLINDRICAL SHELL
G. Horvay and M. A. Veluswami 1979 21 p refs
(Contract EY-76-S-02-4122)

(COO-4122-28) Avail: NTIS HC A02/MF A01

The results of the HVS analysis based on the full equation are compared with those of the VF analysis, for a steel core support barrel representative of industrial nuclear powerplant practice. It is found that the decrease in criticality is not as spectacular as it is for the aluminum test shell of VF. DOE

42 GEOSCIENCES (GENERAL)

N80-20638# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 1: ORIGINAL REPORT NO. 73 [NACHRICHTEN AUS DEM KARTEN UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE HEFT NR. 73]

1977 246 p refs In GERMAN Original contains color illustrations

(Rept-73) Avail: NTIS HC A11/MF A01

Papers describing the work of the Institute for the past 25 years include a description of the satellite observation station Wettzell. Geodetic data collection from Doppler and laser distance measurements, from altimeter and gravimetric evaluations, from the study of earth tides and photogrammetry are discussed, along with the cartographic representation of these data. For individual titles, see N80-20639 through N80-20673.

N80-20639# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

THE 25 YEARS AT THE INSTITUTE FOR APPLIED GEODESY [25 JAHRE INSTITUT FUER ANGEWANDTE FEODAESIE (1952-1977)]

Rudolf Foerstner *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 7-37 refs In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

A chronological review of the important events since the foundation of the Institute 25 years ago is presented. The various phases of its organization and its relationship with other institutions are described. The goals fixed at the different stages of the IFAG's development in geodesy, mapping, and photogrammetry are examined. Author (ESA)

N80-20640# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

A SURVEY OF THE GEODETICAL WORK OF THE IFAG FROM 1952-1977 [EIN UEBERBLICK UEBER DIE GEODAETISCHEN ARBEITEN DES IFAG (ABT. 2 DES DGFI) VON 1952-1977] c46

Hermann Seeger, Rudolf Brein, Dieter Ehlert, Dieter Lelgemann, Klemens Nottarp, Bernd Richter, and Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 39-51 In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

Survey of the 25 years of geodetical research undertaken by the IFAG is presented. The improvement of the triangulation network and geoid determination, research on gravimetry and Earth tides, and the exploitation of data from geodetic satellites are described and future projects stated. Author (ESA)

N80-20641# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

THE SATELLITE STATION WETZELL [DIE SATELLITENBEOBACHTUNGSSTATION WETTZELL] c14

Hermann Seeger *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 53-62 refs In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

The observation station Wettzell was created in collaboration with other institutes to modernize the research techniques of the IFAG in geodesy and geodynamics. The conception, realization, and installation of the Institute are described, and the technical devices camera, and a third generation laser ranging system. Author (ESA)

N80-20642# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

SFB 78/IFAG PROJECTS FOR LASER MEASUREMENT OF DISTANCES TO SATELLITES [UEBER VORHABEN DES SFB 78/IFAG ZUR LASERENTFERNUNGSMESSUNG NACH SATELLITEN] c38

Klemens Nottarp, Hermann Seeger, and Peter Wilson *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 63-72 refs In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

First and third generation pulsed laser measurement systems for satellite positioning are described, and the contribution of the IFAG to the development to these systems is reported. The systems are given with emphasize on the latter's neodymium-yag lasers. Precision reached in satellite geodesy is higher than with photographic positioning techniques. Author (ESA)

N80-20643# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

CONTRIBUTIONS OF THE SFB 78/IFAG TO DOPPLER MEASUREMENTS FOR SATELLITE POSITIONING [DIE ARBEITEN DES SFB 78/IFAG AUF DEM GEBIET DER DOPPLERMESSUNGEN NACH SATELLITEN] c17

Peter Wilson and Hermann Seeger *In its* Rept. on Cartography and Geodesy. Ser. 1. Original Rept. No. 73 1977 p 73-80 refs In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

Microwave Doppler measurements of artificial satellite distances, investigated by the IFAG, are presented. With the support of the Navy Navigation Satellite System, geocentric positions as well as their narrow variation due to polar movement are determined. Observations achieved in collaboration with European tracking stations are reviewed and the technical instrumentation is detailed. Author (ESA)

N80-20644# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

CONTRIBUTIONS TO THE UTILIZATION OF ALTIMETER DATA [ARBEITEN ZUR NUTZUNG VON ALTIMETERDATEN] c46

Dieter Lelgemann *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 81-85 refs In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

The geodetic use of high precision altimeters is examined. Radars placed in artificial satellites contribute to the determination of a global coordinate system and the knowledge of the characteristics of the graviational field. The Hudson Bay project with five observation stations and the short-arc method used for equalization are described briefly. Author (ESA)

N80-20645# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

ELABORATION OF THE TIME SYSTEM OF THE SATELLITE OBSERVATION STATION WETTZELL FROM 1972-1977 [DER AUFBAU DES ZEITSYSTEMS DER SATELLITENBEOBACHUNGSSTATION WETZELL IN DGN JAHREN 1972-1977)] c35

Klemens Nottarp and Ingo Zeitel *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 87-91 .efs In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

The different techniques for time measurement used by the IFAG are described. Narrower time intervals used to be determined as the techniques of distance measurement developed. The progressive definition of the standard frequency and the improvements of timing devices are elaborated. Results obtained from collaborating stations are compared and discussed. A synchronization precision should reach five nanoseconds. Author (ESA)

N80-20646# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

PARTICIPATION OF SATELLITE OBSERVATION STATION WETZELL IN INTERNATIONAL OBSERVATION PROGRAMS, 1976-1977 [ZUR BETEILIGUNG DER SATELLITENBEOBACHTUNGSSTATION WETZELL AN INTERNATIONALGEN

BEOBACHTUNGSPROGRAMMEN (1975-1977)] **c14**
Hermann Seeger and Peter Wilson *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 93-103 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The participation of the Wetzell satellite observation station in international observation programs from 1975 to 1977 is reported. Observations of the GEOS satellites from Wettzell and other stations, C-band radar measurements, the European Doppler measurment campaign EDOC 1 and 2, and the European laser distance measurement campaign are briefly reviewed.
Author (ESA)

N80-20647# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ELABORATING AN ASTRONOMICAL LONGITUDE SYSTEM [ARBEITEN AM ASTRONOMISCHEN LAENGENNETZ]
Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 105-109 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The problem of astronomical longitude determination is examined. Systematic local variations in the astronomical longitude system are due to the consistency of the initial point. Relative longitude systems combination of these relative systems, comparing traditional geodetic and satellite methods eliminates errors and leads to a longitude systems homogeneous over Western Europe.
Author (ESA)

N80-20648# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DETERMINATION OF AZIMUTH AND ASTRONOMICAL COORDINATES **c43**
Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 111-115 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The determination of astronomical coordinates and azimuth from Laplace stations is examined. Observations from stations examining the vertical variation are discussed. A precision of 5 min. of arc can be reached for each component. A greater density of points will contribute more to precision than will improvements in the measurement possibilities.
Author (ESA)

N80-20649# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DETERMINATION OF VARIATIONS OF TIME DEPENDENT COORDINATES THROUGH ASTRONOMICAL AND DOPPLER OBSERVATIONS [ZEITABHAENGIGE KOORDINATENAENDERUNGEN, BESTIMMT DURCH ASTRONOMISCHE BEOBACHTUNGEN UND DURCH DOPPLERBEOBACHTUNGEN] **c46**
Wolfgang Schlueter *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 117-120 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

Variations in time dependent astronomical positioning determined by circumzenithal and by Doppler measurements are described. These variations are either determined physically from polar movement and earth crust deformations, or related to systematic experimental errors on the star coordinates or derived from experimental error. An error analysis compared circumzenithal observations and Doppler observations. Among others, an advantage of Doppler observations lies in its higher precision, its independence from weather, and automatic measuring capability.
Author (ESA)

N80-20650# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CONTRIBUTIONS TO THE DETERMINATION OF THE GEOID IN WEST GERMANY [ARBEITEN ZUR BESTIMMUNE DES GEOIDES IN DER BUNDESREPUBLIK DEUTSCHLAND] **c43**
Dieter Leigemann *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 121-125 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The astrogeodetical estimation of the geoid derived from the local components of vertical derivation is described, and the regional representation examined. The combination of this method with the gravimetrical determination of the geoid for an automatic calculation is briefly discussed.
Author (ESA)

N80-20651# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE TRIANGULATION NETWORK IN WEST GERMANY [UNTERSUCHUNGEN IM HAUPTDREIECKSNETZ DER BUNDESREPUBLIK DEUTSCHLAND] **c43**
Dieter Ehlert *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 127-130 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The development of the West German triangulation system is described. The precision of the network, including improvements, is examined. Corrections to consider in the experimental techniques and mathematical approach are discussed.
Author (ESA)

N80-20652# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
EARTH TIDES [ARBEITEN ZUR ERDGEZEITENUNTERSUCHUNG] **c45**
Rudolf Brein *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 131-133 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

A method of determining Earth tides from gravimetric data is described. The influence of harmonic forces on the Earth's crust at various time periods, and alterations of the shape of the Earth directly predictable by solar and lunar influences are investigated briefly.
Author (ESA)

N80-20653# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
RESEARCH ON GRAVIMETRY AT IFAG [GRAVIMETRISCHE FORSCHUNGSARBEITEN AM INSTITUT FUER ANGEWANDTE GEODAESIE] **c46**
Heinrich Beetz and Bernd Richter *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 135-140 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

Research of the institute in gravimetry is presented. The construction of the West German gravity network is described. Gravimetric maps are discussed and the choice of sites for new stations is examined.
Author (ESA)

N80-20654# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CARTOGRAPHY APPLICATIONS AND RESEARCH [DIE KARTOGRAPHIE IN PRAXIS UND FORSCHUNG] **c43**
Walter Satzinger *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 141-142 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The evolution of cartography in response to growing needs for more precise representation is briefly related. Progress in reprography and data processing have results in improved quality at lower cost. The increasing number of applications of cartography to photogrammetry are mentioned.
Author (ESA)

N80-20655# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DEVELOPMENT, STATUS, AND GOALS OF CARTOGRAPHIC AUTOMATION [ENTWICKLUNG, AUFGABENSTELLUNG UND ZIELE DER KARTOGRAPHISCHEN AUTOMTION] **c43**
Wilhelm L. Pfrommer *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 143-148 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

Progress in cartography with the development of automation is related briefly. Equipment in use by the EDV includes an interactive digitizing system (ARISTOGRID CD400), a cartographic automation system (coragraph DC3), and a high precision drafting table (coragraph 1700).
Author (ESA)

N80-20656# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AUTOMATIC ACQUISITION AND PROCESSING OF CARTOGRAPHIC DATA [AUTOMATIONSGESTVETZTE ERFASSUNG UND AUFBEREITUNG KARTOGRAPHISCHER DATEN] **c43**
Theodor Johannsen *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 149-156 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The acquisition and processing of cartographic data is examined. Cartographic data gathered through photogrammetry, statistics or other means are digitized for computation; coordinates of points, their nature and alphanumeric symbols are recorded. Automatic drawing from optical sensors or scanners is described along with error control and correction procedures. Examples are given of the relative precision obtained at different production rates. Author (ESA)

N80-20657# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON PRECISION IN THE GATHERING AND PRODUCTION OF CARTOGRAPHIC DATA [GENAUIGKEITSUNTERSUCHUNGEN BEI ERFASSUNG UND AUSGABE KARTOGRAPHISCHER DATEN] **c43**
Theodor Johannsen *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 157-159 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The accuracy of digitizers in analog to digital conversion is examined. Measurements show that the scale error introduced is inferior to the resolution power of the apparatus. Improved precision can be obtained by means of an optical interferometer. Errors introduced by manual operations are discussed. Satisfactory results are obtained in the case of same-scale work and also when translating to a smaller scale. Author (ESA)

N80-20658# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
COMPUTER BASED GENERALIZATION FOR THE ELABORATION AND EXTENSION OF TOPOGRAPHIC MAPS [RECHNERGESTUEZTE GENERALISIERUNG BEI DGR HERSTELLUNG UND FORTFUEHRUNG TOPOGRAPHISCHER KARTEN] **c43**
Fred Christ *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 161-165 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

Research and programming for a computer based system for automatic mapping is described. The concept of calculator-based map generalization is exposed. Interactive, semi-automatic, and automatic generalization systems are presented. Author (ESA)

N80-20659# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
GRAPHIC PRODUCTION OF MAPS ON SCREENS OR PHOTOCOMPOSITION DEVICES [GRAPHISCHE AUSGABE VON KARTEN AUF BILDSCHIRM UND LICHTZEICHENMASCHINE] **c43**
Helmut Uhrig *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 167-169 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

Two image retrieval systems are described and compared. A cartographic system is discussed which converts numeric map data into analog images either on a screen or on a precision charting machine. Choice of a system depends on the desired speed and precision. Author (ESA)

N80-20660# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE DATA BANK IN THE CARTOGRAPHIC AUTOMATION SYSTEM [DIE DATENBANK IM KARTOGRAPHISCHEN AUTOMATIONSSYSTEM] **c43**
Wigand Weber *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 171-173 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The storage of data points on a magnetic disk unit for use in the production of topographic maps is described. The data are available over telephone lines to multiple users and also accessible for editing and other types of computer manipulation. The advantages of this flexibility are discussed. Author (ESA)

N80-20661# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE TOPOGRAPHIC SYNOPTIC MAP 1:200,000 [DIE TOPOGRAPHISCHE UEBERSICHTSKARTE 1:200,000 (TUEK 200)] **c43**
Rolf Boehme *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 175-176 In GERMAN Original contains color illustrations (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The page by page development of the 1:200,000 synoptic topographic map is briefly described. Samples of this highly informative document are reproduced. Author (ESA)

N80-20662# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE SYNOPTIC MAP 1:500,000 (WORLD, SERIES 1404) [DIE UEBERSICHTSKARTE 1:500,000 (WORLD, SERIE 1404)] **c43**
Rolf Boehme *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 177-178 In GERMAN Original contains color illustrations (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The 1:200,000 synoptic map is briefly described. A sample produced by IFAG is presented as well as a sample produced by the French National Geographic Institute. Author (ESA)

N80-20663# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE INTERNATIONAL WORLD MAP 1:1,000,000 (IWK) [DIE INTERNATIONALE WELTKARTE 1:1,000,000 (IWK)] **c43**
Wolfgang Weber *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 179-182 In GERMAN Original contains color illustrations (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The development of the 1:1000,000 world map requested by the United Nations is briefly described. Samples of the 1942 and 1977 editions of the same maps are presented. Author (ESA)

N80-20664# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PHOTOGRAMMETRY IN IFAG FROM 1952 TO 1977 [DIE PHOTOGRAMMETRIE IM IFAG 1952-1977] **c43**
Hans Belzner *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 187-192 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The development of photogrammetric studies in the IFAG is reviewed. Collaboration with other institutions, in particular, with the Organisation Europeene d Etudes Photogrammetriques Experimenteles (OEEPE) is examined. Work in orthophototechniques from aircraft and satellites is described. Contributions to development in the Middle East are mentioned. Author (ESA)

N80-20665# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON SPECTRAL SIGNATURES IN CENTRAL PERSPECTIVE REPRESENTATION [ZUR BERUECKSICHTIGUNG VON OBJEKTEIGENSCHAFTEN IN ZENTRALPERSPEKTIVEN ABBILDUNGEN] **c43**
Joern Sievers *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 193-197 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

Object signature in aerial photography is briefly studies. Nonuniformity in tone (over the picture) due to sunlight reflection

in vertical photographs is discussed, and the effect of different Sun angles is shown in several photographs. Author (ESA)

N80-20666# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ORTHOPHOTO TECHNIQUES AND PHOTOMAPS [ORTHOPHOTOTECHNIK UND LUFTBILDKARTE] c43
Rudolf Olach *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 199-201 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The orthophototechnique and the development of orthophotoplans and aerial photographic maps is examined. Precision in orthophotographic techniques, the applications of orthophotoplans and their structure are described. Author (ESA)

N80-20667# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AERIAL AND SPACE-BORNE PHOTOGRAPHIC MAPS [LUFTBILD UND WELTRAUMBILDKARTEN] c43
Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 203-210 refs In GERMAN Original contains color illustrations (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The production of topographic aerial photography and spaceborne photomaps is described. Aerial photomaps are produced from orthophotographs with additional cartographic information. Rapid execution of photomaps, and difficulties of scale reduction by classical or automatic means are mentioned as justification for aerial and spaceborne photographic mapping. Author (ESA)

N80-20668# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
OBTAINING SURFACE INFORMATION FOR TOPOGRAPHY AND TOWN AND COUNTRY PLANNING FROM REMOTE SENSING [DAS GEWINNEN VON FLAECHENNUTZUNGS INFORMATIONEN MITTELS FERNERKUNDUNGSVERFAHREN FUER AUFGABEN DGR TOPOGRAPHIE UND DER LANDESPLANUNG] c43
Klaus Niemz *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 211-217 In GERMAN Original contains color illstrations (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

Methods developed for future Earth reconnaissance flights are described and discussed. Four test regions with different characteristics were selected: test region 1 (North Germany) for oceanic and coastal studies; test region 2 (Lower Main/Taunus/Wetterau) for town and country planning applications; test region 3 (Upper Rhine/Black Forest) for vegetation and forestry applications; test region 4 (Baltic region) for geological applications. Results obtained with a Bendix-11-channel scanner are presented and compared with LANDSAT 2 data. Different crops and land uses are characterized by color separation utilizing the DIBIAS system and the maximum likelihood method. Author (ESA)

N80-20669# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DIGITAL HEIGHT MODEL WITH ITEK CORRELATOR [DIGITALES HOEHENMODELL MIT DEM ITEK KORRELATOR] c43
Gerhard Lindig *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 219-223 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

Emphasis is given to the utilization of this model in the restitution of orthophotos. The most important factors taken into consideration include: determination of heights as accurately as possible; obtaining the least possible drop in correlation; rapid extraction of correlation; avoidance or domination of Floats; avoidance or recognition of Swings; elimination of systematic adaptation of parameters to different local conditions; filling in correlation loss gaps. It is concluded that the ITEK correlator EC5 can greatly contribute to the obtaining of height information for the orthophoto and also for height line maps. Author (ESA)

N80-20670# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE FUTURE OF ANALYTICAL EVALUATION EQUIPMENT [ERWARTUNGEN AN ANALYTISCHE AUSWERTEGERAETE] c43
Karl Schuerer *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 225-227 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

Developments in image measurement techniques are covered with emphasis on comparators and analog evaluation techniques. Advantages and disadvantages found in both techniques are considered. The feasibility of an apparatus incorporating the advantages of both systems and computer technology is addressed. Applications in practical photogrammetry and in the field of research are included. Author (ESA)

N80-20671# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DIGITAL MAP BASES FROM PHOTOGRAMMETRIC MEASUREMENTS [DIGITALE KARTENGRUNDLAGEN AUS PHOTOGRAMMETRISCHEN MESSUNGEN] c43
Hermann G. Neubauer *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 229-231 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

Progress in electronic data processing has led to the development of accurate automated equipment for the production of all types of maps, systems, in which out-of-date information is eliminated and new objects, of particular interest, are introduced. Various calculation procedures associated with the transfer of measured data to digital maps are indicated: adaptation to the map's coordinate system; division of stereogram areas into areas of similar usage; association of measurements from adjacent stereograms; incorporation of modifications from field comparisons; preparation of data for storage in data banks. The automatic generation of height lines from discrete points is discussed. The corresponding coloration of different cultures can also be handled in this way. Author (ESA)

N80-20672# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TASKS AND POSSIBILITIES OF DIGITAL IMAGE DATA PROCESSING IN PHOTOGRAMMETRY [AUFGABEN UND MOEGLICHKEITEN DGR DIGITALEN BILDVERARBEITUNG IN DGR PHOTOGRAMMETRIE] c43
Bernd-Siegfried Schulz *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 233-235 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

A technique to accelerate fabrication and improve the quality of topographic maps made from primary data is described. Applications include remote sensing from aircraft and satellites. The treatment of data from LANDSAT 1, 2, and 3 is discussed. Optical and geometrical effects are corrected and contrast enhanced. High sensitivity is achieved enabling various surface coverages to be identified and studied in detail (different types of region, forests, geographical, and geological features). Correlations between different parts of a single image and between different images are studied and exploited. Author (ESA)

N80-20673# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AIRPORT OBSTACLE MAPS [FLUGPLATZ HINDERNISKARTEN] c43
Heinz Bannach *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1974 p 237-240 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

The application of photogrammetry to the study of the effects of obstacles on a aircraft takeoff and landing is considered with emphasis on safety. Observation clearance limits required by the International Civil Aviation Organization are discussed along with regulations in force in Germany. A technique utilizing a high precision stereocomparator to determine the heights of various

man-made and natural objects is described. The way in which the measurements are made and interpreted is presented as a function of the real conditions prevailing. A practical example is given. Author (ESA)

N80-20674# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPORTS ON CARTOGRAPHY AND TOPOGRAPHICAL MEASUREMENTS. SERIES 1: ORIGINAL REPORT NO. 74 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE HEFT NR. 74]
1978 78 p refs In GERMAN; ENGLISH summary
(Rept-74) Avail: NTIS HC A05/MF A01

Subjects dealt with in four separate papers are: (1) a computerized treatment of displacements on topographical maps of the Federal Republic of Germany (FRG) which frees the cartographer from certain routine tasks; (2) aerial photography of the FRG and West Berlin (flight details are given together with documentation on existing photographs); (3) the equipping of a special symbol disk with interchangeable symbols and its accuracy in cartographic work; and (4) data reduction as well as line generalization problems in cartography as optimization tasks. Five books treating communication problems, field and laboratory geomorphological studies, and other cartography problems are reviewed. For individual titles, see N80-20675 through N80-20678.

N80-20675# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON THE DISPLACEMENT PROBLEM AS PART OF A PROCESS IN GENERALIZING TOPOGRAHICAL MAPS. PROPOSITION FOR HIERARCHICAL ORDER AND THE SEARCH FOR EDP ASSISTED SOLUTIONS [ZUM PROBLEM DER VERDRAENGUNG ALS TEILVORGANG DER GENERALISIERUNG TOPOGRAPHYISCHER KARTEN. HIERARCHIEVORSCHLAG UND VERSUCH EINER EDV-GESTUETZTEN LOESUNG] **c43**
Roland Schittenhelm *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 5-19 refs In GERMAN; ENGLISH summary (For primary document see N80-20674 11-42)
Avail: NTIS HC A05/MF A01

Based on the results obtained from the investigation of practical cases of displacement on official maps of Germany, an order is proposed for map elements which could be observed during displacement. Solutions are given for three line element displacement cases (displacement by a compulsory point, displacement by a further element which is broadened or displaces itself, disentanglement of double hairpin bends of curved and broadened line elements). These have the advantage of freeing the cartographer from many routine tasks. Author (ESA)

N80-20676# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TWENTY-FIVE YEARS OF AERIAL PHOTOGRAPHY BY THE INSTITUTE OF APPLIED GEODESY [JAHRE LUFTBILDNACHWEIS DES INSTITUTS FUER ANGEWANDTE GEODAESIE] **c43**
Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 21-38 refs In GERMAN; ENGLISH summary (For primary document see N80-20674 11-42)
Avail: NTIS HC A05/MF A01

After a short survey of aerial photography developments in Germany after the Second World War, some details are given about the aerial photography documentation which the institute possesses. Information is also given about the number and frequency of photo flights over a period of ten years. A detailed list of aerial photographs of the German estates is presented together with a list of aerial photography archives existing in Germany. Author (ESA)

N80-20677# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A SYMBOL DISK WITH INTERCHANGEABLE SYMBOLS AND ITS APPLICATIONS TO CARTOGRAPHY [EINE SYMBOLSCHEIBE MIT AUSWECHSELBAREN SYMBOLEN UND IHRE EINSATZMOEGLICHKEIT IN DER KARTOGRAPHIE] **c43**
Helmut Uhrig *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 39-53 refs In GERMAN; ENGLISH summary (For primary document see N80-20674 11-42)
Avail: NTIS HC A05/MF A01

A simple disk system that is both accurate and easily modifiable was sought. The system developed possesses 72 symbols which can be positioned by the user employing the cut and peel process or a technical method of reproduction. Specially positioned studs and holes assure that the disk is correctly centered, that the masks are in the right position, and that the unwanted part of the disk is correctly covered. A water distribution map is taken as an example. The maximum positioning error on the map itself resulting from the use of this technique is 32 microns. Author (ESA)

N80-20678# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
LINE GENERALIZATION AND DATA REDUCTION FROM A MATHEMATICAL OPTIMIZATION POINT OF VIEW [LINIENGENERALISIERUNG UND DATENREDUKTION UNTER DEM GESICHTSWINKEL DER MATHEMATISCHEN OPTIMIERUNG] **c61**
Wigand Weber *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 55-66 refs In GERMAN; ENGLISH summary (For primary document see N80-20674 11-42)
Avail: NTIS HC A05/MF A01

Two solutions are described. In the first, a polygonal substitute for the original curve is sought, the control points of which lie within a tolerable lateral distance range from the original curve; the maximum value of this range is constant for data reduction and self adapting with respect to local information density behavior for generalization. In the second, a rigorous formula using the lateral distances between successive points on the original curve and a reference line is used. Author (ESA)

N80-20679# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPORTS ON CARTOGRAPHY AND TOPOGRAPHICAL MEASUREMENTS. SERIES 2: TRANSLATIONS
1978 127 p refs
(Rept-35) Avail: NTIS HC A07/MF A01

Eleven texts are presented concerning automated displacement of point and line features in cartographic generalization, a digital terrain model for large surfaces and direct storage access, photomapping tidal flat areas, testing the accuracy of cartographic equipment, color separation, locational characteristics and computer assisted cartographic generalization, computer assisted thematic mapping, digitizing geometric data for thematic mapping, and some programs for the transformation of the contents of available maps according to different map projections. For individual titles, see N80-20680 through N80-20690.

N80-20680# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A PROGRAM FOR THE FULLY AUTOMATED DISPLACEMENT OF POINT AND LINE FEATURES IN CARTOGRAPHIC GENERALIZATION **c43**
Fred Christ *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 5-30 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

A program for the fully automated displacement of point and line features in cartographic generalization is described. The basic algorithm is a correlation of the displacement effects of the features when deriving a small scale map from a large scale map. Raster based processing is used. K.L.

N80-20681# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A DIGITAL TERRAIN MODEL FOR LARGE SURFACES AND DIRECT STORAGE ACCESS **c43**
Rainer Detering *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 31-34 refs (For primary document see N80-20679 11-42)

Avail: NTIS HC A07/MF A01

A digital terrain model based on an equidistant grid structure which uses nonlinear interpolation while storing numerical values of elevations and slopes is proposed. The model, characterized by its high storage capacity and universality, is based on bicubic spline functions. The mathematically exact solution of a common adjustment in the total domain of definition is limited in favor of a pointed interactive change of input data. Author (ESA)

N80-20682# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

THE PRODUCTION OF PHOTOMAPS FROM TIDAL FLAT AREAS **c43**

Guenter Hake *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 35-41 refs (For primary document see N80-20679 11-42)

Avail: NTIS HC A07/MF A01

Clearly visible water lines from a series of infrared aerial photographs taken at the time of rising tides in tidal flat areas are digitized and transformed into contours by the allocation of individual elevation values. The cartographic combination of the contour representation and rectified aerial photographs from the time of the lowest water level leads to a photomap with a very high information content. Changes in elevation and volume can be calculated from subsequent photographs. Author (ESA)

N80-20683# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

TESTING THE ACCURACY OF CARTOGRAPHIC EQUIPMENT: FIRST RESULTS **c43**

Theodor Johannsen *In its* Rept. on Cartography and Topographical Meas. Ser 2: Transl. 1978 p 43054 refs (For primary document see N80-20679 11-42)

Avail: NTIS HC A07/MF A01

Different methods of testing digitizers and plotters were developed and verified. Apart from simple tests (without the use of any additional equipment), profiles were measured with high precision using a laser interferometer. In addition, a technique was developed to establish the errors introduced by an operator when manually guiding the cursor for digitizing. It is concluded that absolute scale measurements and accurate local tests require equipment with resolution and accuracy exceeding those of the instrument to be measured by at least an order of magnitude. Author (ESA)

N80-20684# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

ADP-SUPPORTED COLOR SEPARATION **c74**

Hans Kern *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 55-64 (For primary document see N80-20679 11-42)

Avail: NTIS HC A07/MF A01

Automated color separation is treated as a special topic of thematic computer cartography. Its aim is to develop a procedure satisfying the highest demands for quality and precision while flexibly treating the question of whether a map should be drafted in color or in black and white. A scheme for integrating computer cartography into spatial analysis processes is discussed. Algorithms are presented which provide an ample variety of hatching for any type of area and prevent the overlapping of thematic symbols. Hatching identifications and color indices are introduced. Author (ESA)

N80-20685# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

LOCATIONAL CHARACTERISTICS AND THE SEQUENCE OF COMPUTER ASSISTED PROCESSES OF CARTOGRAPHIC GENERALIZATION **c43**

Werner Lichtner *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 65-75 refs (For primary document see N80-20679 11-42)

Avail: NTIS HC A07/MF A01

A sequence of generalization processes for computer assisted operation is proposed which is intented to avoid both repetition of processes and frequent correction during batch compilation with the aid of interactive optical display systems. Particular attention is given to effects producing a lack or an excess of space and to locational changes in features and phenomena. Specific examples involving buildings and roads are discussed, as are displacement processes and the smoothing of contours and other linear phenomena. Good results are obtained with this method which has the advantage of homogeneity over manual methods. Author (ESA)

N80-20686# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

COMPUTER-ASSISTED THEMATIC MAPPING FOR FEDERAL PLANNING **c43**

Wolf-Dieter Rase *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 77-83 refs (For primary document see N80-20679 11-42)

Avail: NTIS HC A07/MF A01

To satisfy the needs for thematic maps on different levels of quality and quantity, computer assisted techniques were implemented in the map production process. Choropleth, graduated symbol, and other map types are plotted on an in-house minicomputer system with graphic peripherals. Remarks on the economic efficiency of computer assisted thematic cartography supplement the technical information. Author (ESA)

N80-20687# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

DIGITIZING OF GEOMETRIC DATA FOR THEMATIC MAPPING: STATE-OF-THE-ART AND FUTURE DEVELOPMENTS **c43**

Klaus Tuerke *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 85-91 refs (For primary document see N80-20679 11-42)

Avail: NTIS HC A07/MF A01

The cartographic data structures suitable for thematic computer mapping are surveyed and the data formats and digitizing procedure used in a production oriented environment are described in detail. Presently, interactive digitizing by experienced cartographic personnel is the most economic way of generating a geometric data base; improved techniques of automatic data acquisition, however, will shift the cartographer's function from mass data encoding to interactive correction, generalization, and administration of scanned data. Author (ESA)

N80-20688# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

EXPERIENCES GATHERED WITH A SYMBOL DISK WITH INTERCHANGEABLE SYMBOLS **c61**

Helmut Uhrig *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 93-106 refs (For primary document see N80-20679 11-42)

Avail: NTIS HC A07/MF A01

A simple disk system that is both accurate and easily modifiable was sought. The system developed possesses 72 symbols which can be positioned by the user employing the cut and peel process or a technical method of repoduction. Specially positioned studs and holes assure that the disk is correctly centered, that the masks are in the right position, and that the unwanted part of the disk is correctly covered. A water distribution map is taken as an example. The maximum positioning error on the map itself resulting from the use of this technique is 32 microns. Author (ESA)

N80-20689# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

DATA CAPTURE FOR CARTOGRAPHIC DATA BASES **c60**

Helmut Uhrig *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 102-113 (For primary document see N80-20679 11-42)

Avail: NTIS HC A07/MF A01

The establishing of cartographic data bases from a 1:1 million map of the German Federal Republic showing administrative boundaries and from a world map of the same scale is described. It is concluded that only two digitizing procedures are valid; these are digitizing according to an original map of large scale or to an enlarged manuscript and digitizing 1:1. Author (ESA)

N80-20690# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

MAP PROJECTION CHANGE: SOME PROGRAMS FOR THE TRANSFORMATION OF THE CONTENTS OF AVAILABLE MAPS ACCORDING TO DIFFERENT MAP PROJECTIONS c43
Ingo Wilski *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 115-127 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

Some FORTRAN programs are presented for the transformation of digitized map contents into geographical coordinates (Mercator and Lambert projections) and for the mass transformation of spherical geographical coordinates into rectangular map coordinates. Thirteen different map projections are considered, the graphical output being presented as a visual display and/or by a machine drawing. Author (ESA)

N80-20691# Bayerische Akademie der Wissenschaften, Munich (West Germany).
RESEARCH PROGRAM 78, SATELLITE GEODESY PROGRAM [DIE ARBEITEN DES SONDERFORSCHUNGSBEREICHES 78 SATELLITENFEODAESIE IM JAHR 1977]
Manfred Schneider, comp. 1978 177 p refs In GERMAN; ENGLISH summary
(Astron-Geodaet-Arb-38; ISBN-3-76969-781-2; ISSN-0340-7691) Avail: NTIS HC A09/MF A01

The research program and operation of the Wetzell tracking station are discussed in terms of their contribution to the European space effort. Direction and distance measurements as well as Doppler observations are reviewed. Mathematical methods used in geodetic research are surveyed. For individual titles, see N80-20692 through N80-20704.

N80-20692# Bayerische Akademie der Wissenschaften, Munich (West Germany).
IMPROVED TABLES OF COORDINATES ALLOTTED TO THE WETZELL SATELLITE TRACKING STATION [VERBESSERTE UND ERGAENZTE KOORDINATENVERZEICHNISSE FUER DEN BEREICH DER SATELLITENBEOBACHTUNGSSTATION WETTZELL] c43
Eberhard Billich and Hermann Seeger *In its* Res. Program 78, Satellite Geodesy Program 1978 p 18-28 ref In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

A more accurate set of coordinates was determined for benchmarks within the satellite tracking station. These were identified on a map with the appropriate data for each benchmark presented in tabular form. Author (ESA)

N80-20693# Bayerische Akademie der Wissenschaften, Munich (West Germany).
SELECTION OF A RUBY LASER FOR USE AS AN ILLUMINATING LASER FOR THE BMK75 OR AS A REFLECTING LASER FOR SRS [KONZEP EINES RUBINLASER FUER WAHLWEISEN BETRIEB ALS BELEUCHTUNGSLASER FUER DIE BMK 75 ODER ENTFERMUNGSMESSLASER FUER DAS SRS] c36
Klemens Mottarp *In its* Res. Program 78, Satellite Geodesy Program 1978 p 31-35 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

The upgrading of the laser system at the Wetzell satellite tracking station is discussed. The possibility of using the same ruby laser for both direction and reflectance measurements is examined. The pulse slicing mode is compared to the pulse transmission mode. Author (ESA)

N80-20694# Bayerische Akademie der Wissenschaften, Munich (West Germany).
ON THE VERIFICATION OF SATELLITE REFLECTANCE MEASUREMENTS [ZUR UEBERPRUFFUNG VON ENTFERNUNGSMESSUNGENNACH SATELLITEN] c15
Helmut Walter *In its* Res. Program 78, Satellite Geodesy Program 1978 p 38-44 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

Error reduction techniques used by the Wetzell satellite tracking station for reflectance and Doppler measurements are discussed. Computer programs used to remove instrumental error and atmospheric refraction errors are outlined. Author (ESA)

N80-20695# Bayerische Akademie der Wissenschaften, Munich (West Germany).
EXTENDING THE NEODYMIUM-YAG LASER REFLECTANCE MEASURING SYSTEM TO LUNAR MEASUREMENTS AT THE WETZELL STATION [ZUR ERWEITERUNG DES NEODYMIUM-YAG LASERENTFERNUNGSMESSYSTEMS DER STATION WETTZELL FUER ENTFERNUNGSMESSUNGEN ZUM MOND] c36
Peter Wilson *In its* Res. Program 78, Satellite Geodesy Program 1978 p 45-49 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

The upgrading of the laser system at the Wetzell station is discussed. Improvements include an increase in the energy output, the development of a greater pointing accuracy, and refinements in the hardware and software systems. Author (ESA)

N80-20696# Bayerische Akademie der Wissenschaften, Munich (West Germany).
THE GERMAN-AUSTRIAN DOPPLER OBSERVATION CAMPAIGN [UEBER DEN DERZEITIGEN STAND DER ARBEITEN IM DEUTCHEN ANTEIL DER DEUTSCH OESTERREICHISCHEN DOPPLERMESSKAMPAGNE] c35
Wolfgang Schlueter, Hermann Seeger, Gerhard Soltau, Peter Wilson, and Peter Wolf *In its* Res. Program 78, Satellite Geodesy Program 1978 p 54-64 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

The contributions made by the 15 German and Austrian Doppler observation stations to the calculation of more precise transformation parameters for a national triangulation network are described. Verification of the scale and orientation of this network, and the extension of this verification to central Europe are considered. Calculation of the geocentral coordinates NWL-9D (NSWC-9z-2) and WGS-72 was facilitated by network measurements. Author (ESA)

N80-20697# Bayerische Akademie der Wissenschaften, Munich (West Germany).
THE EROS-DOPPLER OBSERVATION CAMPAIGN (EROS-DOC) [DIE EROS DOPPLER BEOBACHTUNGSKAMPAGNE (EROS-DOC)] c15
Wolfgang Schlueter, Hermann Seeger, Gerhard Soltau, Peter Wilson, and Peter Wolf *In its* Res. Program 78, Satellite Geodesy Program 1978 p 65-71 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

Data from the Doppler observation program (EROS-1) conducted by eight satellite observation stations are presented. The calculations are discussed in reference to the broadcast ephemeris and the precise ephemeris. Author (ESA)

N80-20698# Bayerische Akademie der Wissenschaften, Munich (West Germany).
DEVELOPMENT OF DOPPLER OBSERVATIONS AT WETZELL DURING 1975-1976 [UEBER DIE AUSWERTUNG DER DOPPLERBEOBACHTUNGEN IN WETTZELL 1975-1976] c48
Wolfgang Schlueter *In its* Res. Program 78, Satellite Geodesy Program 1978 p 72-77 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

Parallel astronomical and satellite observations of the Navy satellite system were made to clarify systematic differences between Doppler and astronomical methods of evaluating movement of the pole and the behavior of long term Doppler measurements. Data for 18 months of observations are presented. Author (ESA)

N80-20699# Bayerische Akademie der Wissenschaften, Munich (West Germany).
COMPARISON OF ALGORITHMS FOR THE SUMMATION OF SPHERICAL PLANE FUNCTIONS [VERGLEICH VON ALGORITHMEN ZUR SUMMATION VON KUGELFLAECHENFUNKTION] c64

Michael Gerstl *In its* Res. Program 78, Satellite Geodesy Program 1978 p 81-88 refs In GERMAN; ENGLISH summary (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

Parameters related to the Earth's gravity field as expressed by sums of spherical harmonics are discussed. Algorithms to evaluate the sums are investigated. The algorithms observe the stability minimal storage requirements and the number of operations. The results obtained for the speed of the algorithms are discussed. Author (ESA)

N80-20700# Bayerische Akademie der Wissenschaften, Munich (West Germany).
PROBLEMS OF APPROXIMATION BY MEANS OF SAMPLING FUNCTIONS [ZUR PROBLEMATIK DER APPROXIMATION MITTELS SAMPLING-FUNKTIONEN] c64
Heinz Fritz Schmidt *In its* Res. Program 78, Satellite Geodesy Program 1978 p 89-101 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

An introduction to the theory of representation of the functions by means of a system of basic functions is presented. The possibility of approximation through sampling functions and point parameters is explained. Examples of practical interpolation in a one dimensional field are provided. A verification of an approximation with sampling functions is treated, showing the problem of sampling point distribution and sampling functions as a basis for the definition of the spherical functions. Author (ESA)

N80-20701# Bayerische Akademie der Wissenschaften, Munich (West Germany).
ON THE USE OF LINES OF KERNEL FUNCTIONS FOR ORBITAL DETERMINATION [DIE NUTZUNG VON KERNFUNKTIONSREIHEN ZUR BAHNBESTIMMUNG] c13
Hermann Hauck *In its* Res. Program 78, Satellite Geodesy Program 1978 p 102-108 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

The determination of orbits is dependent upon the solution of the Lagrangian equations for perturbation. Development of the proximity criterion of Legelmann allows a valid interpolation with the aid of kernel functions. A network of equidistant points is then set on the Earth's surface, each having a potential, the result of which is the resolution of the set problem. Author (ESA)

N80-20702# Bayerische Akademie der Wissenschaften, Munich (West Germany).
THE RGST CHAIN PROGRAM FOR THE DETERMINATION OF POTENTIAL COEFFICIENTS AND STATION COORDINATES [DIE REST-PROGRAMMKETTE FUER DIE BESTIMMUNG VON POTENTIALKOEFFIZIENTEN UND STATIONSKOORDINATEN] c43
Christoph Reigber *In its* Res. Program 78, Satellite Geodesy Program 1978 p 111-119 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

The dynamic method of satellite geodesy uses the numerical integration of the equations of motion to determine the temporal motion in relation to its reference orbit. A computer program REST is described which permits corrections to be performed for uncertainties introduced into the equations by the relief of the Earth and the elastic parameters of the Earth, Sun, and Moon. Author (ESA)

N80-20703# Bayerische Akademie der Wissenschaften, Munich (West Germany).
MOTION OF ARTIFICIAL EARTH SATELLITES IN RELATED ORBITS [ZUR BEWEGUNG KUENSTLICHER ERDSATELLITEN IN BENACHBARTEN UMLAUFBAHNEN] c13
Karl Heinz Ilk and Wolfgang Seemuller *In its* Res. Program 78, Satellite Geodesy Program 1978 p 120-138 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

The relative motion of a satellite and its booster in low Earth orbit is studied as a problem of movement of potential masses governed by the Newton-Euler equations. The derivation of the solution is presented. Author (ESA)

N80-20704# Bayerische Akademie der Wissenschaften, Munich (West Germany).
STUDY FOR A PROJECT FOR A EUROPEAN HIGH PRECISION LASER NETWORK [PROJEKTSTUDIE FUER SATELLITEN-LASERNETZ HOECHSTER GENAUIGKEIT IN EUROPA] c43
Walter Ehrnsperger and Martha Naebauer *In its* Res. Program 78, Satellite Geodesy Program 1978 p 139-158 refs In GERMAN; ENGLISH summary (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

Based upon simulated satellite transits of various heights, the attainable accuracy for a European network is investigated. The parameters are ranges as measured with third generation lasers or ranges in combination with optical directions. Numerical results for five stations and up to 100 satellite tracks are compared. Author (ESA)

N80-20705# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPORTS ON CARTOGRAPHY AND TOPOGRAPHICAL MEASUREMENTS. SERIES 1: ORIGINAL REPORTS [NACHRICHTEN AUS DEM KARTEN UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE HEFT NO. 77]
1978 179 p refs In GERMAN; ENGLISH summary Original contains color illustrations
(Rept-77; ISSN-0469-4236) Avail: NTIS HC A09/MF A01

Eight papers are presented dealing with photogrammetry, remote sensing, data enhancement using computer techniques (including least squares calulations), and application of Skylab and LANDSAT data to small scale cartography. Also treated are the production and analysis of multispectral images, definition of a reflective quantity for remote sensing data, and a calculation method for setting data for analog plotters. For individual titles, see N80-20706 through N80-20713.

N80-20706# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CONTRIBUTIONS TO THE CREATION OF A CONCLUSIVE SYSTEM OF CONCEPTS OF PHOTOGRAMMETRY AND AERIAL PHOTOGRAPH CARTOGRAPHY [BEITRAG ZUM AUFBAU EINES GESCLOSSENEN BEGRIFSSYTEMS DER PHOTOGRAMMETRIES UND DER LUFTBILDKARTOGRAPHIES] c43
Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 7-35 refs In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

In connection with the revision of the German standard DIN 18 716 (photogrammetry and remote sensing) a review is presented of the conceptual connections within the fields of image recording, image processing and image evaluation as well as aerial photograph cartography, which is to serve as a contribution to the creation of a theoretical basis for photogrammetry and aerial photograph cartography. Author (ESA)

N80-20707# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE PROBLEM OF OBTAINING DATA FOR THE DIGITAL HEIGHT MODEL [PROBLEME DER DATENGEWINNUNG FUER DAS DIGITALE HOEHENMODELL] c43
Gerhard Lindig *In its* Rept. on Cartography and Topographical meas. Ser. 1: Original Rept. 1978 p 37-48 refs In GERMAN; ENGLISH summary Presented at Intern. Symp. der IGP, Komm 3, Moscow, 1978 (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

The point coordinates for the Digital Height Model were measured with the necessary accuracy by photogrammetric methods. Problems were encountered in obtaining correct ground heights for wooded and built-up areas, for breaks of slope or for large fields with poor contrast by manual as well as by

automatic scanning. These problems were solved only by improving the original data using computer techniques. Author (ESA)

N80-20708# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A METHOD FOR EXAMINING RELATIONSHIPS BETWEEN MULTISPECTRAL DATA [EINE METHODE ZUE PRUEFUNG CON ABHAENGIGKEITEN ZWISCHEN MULTISPEKTRALEN DATEN] **c43**
Bernd-Siefgried Schulz *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 49-69 refs In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

A method to examine multispectral vectors of characteristics with regard to significant difference applied for instance, to problems of spectral object speeration, is presented. This method differs from former procedures by using (least squares) adjustment and visual evaluation of the corrections obtained as a result. The method saves computing time and can also be applied to large quantities of data. The method is tested through the use of several examples. Author (ESA)

N80-20709# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
SETTING DATA FROM MULTISTAGE ANALYTICAL ORIENTATION [EINSTELLDATEN AUS MEHRSTUFIGEN ANALYTISCHEN ORIENTIERUNGSVORGAENGEN] **c43**
Karl Schuerer *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 71-84 refs In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

From the angles of rotation and the base components determined during the multistage analytical orientation, setting data for different analog plotting instruments are calculated. Preliminary experience shows that these data influences the economy of analog plotting considerably. Author (ESA)

N80-20710# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
POSSIBILITIES OF APPLICATION OF LANDSAT AND SKYLAB DATA TO SMALL SCALE CARTOGRAPHY [VERWENDUNGSMOEGLICHKEITEN VON LANDSAT UND SKYLABAUFNAHMEN IN DER KLEIMASSTAEBIGEN KARTOGRAPHIES] **c43**
Klaus Niemz *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 85-140 refs In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

The possibility of producing small scale topographic maps from the 70 mm film taken from Skylab and multispectral scanner data from LANDSAT is discussed. Maps with scales from 1:100,000 to 1:2,800,000 are considered. The production equipment is described. Author (ESA)

N80-20711# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON THE WRITING ACCURACY OF THE REPRODUCTION UNIT OF THE OPTRONICS SYSTEM P1700 [ZUR SCHRIEBGENAUIGKEIT DER WEIDERGABEEINHEIT IM OPTRONICS SYSTEM P1700] **c43**
Bernd-Siegfried Schulz *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 141-148 In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

A method for determining the accuracy of the plotting system of a digital image scanning device is described. A method is shown for eliminating linear affine distortions by introducing corrections into the writing mechanism. Author (ESA)

N80-20712# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PRODUCTION OF COLOR COMPOSITES FORM MULTISPECTRAL DATA RECORDS [DIE HERSTELLUNG VON FARBKOMPOSITEN AUS MULTISPEKTRALAUFNAHMEN] **c43**
Hans Peter Groetsch *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 149-160 In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

Production techniques and applications for color composites made from multispectral images are described. The use of Diazofoils results in higher accuracy than possible with film processes. Author (ESA)

N80-20713# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPORT OF THE IGP WORKING GROUP 7-9 'SPECTRAL SIGNATURES OF OBJECTS' [BERICHT DER IGP-ARBEITSGRUPPE 7-9 'SPEKTRALE SIGNATUREN VON OBJEKTEN']
Joern Sievers *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 161-166 In GERMAN; ENGLISH summary Presented at Symp. der Komm. 7 (Interpretation der daten) der Intern. Ges. fuer Photogrammetries, Frieburg/Br, West Germany, Jul. 1978 (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

A reflection quantity useful for remote sensing is established. In addition, the treatment of problems of accuracy in the determination of spectral object signatures is discussed in detail. Author (ESA)

N80-20714# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
INFORMATION RELATIVE TO CARTOGRAPHY AND GEODESY. SERIES 2: TRANSLATIONS
1978 44 p refs
(Rept-37; ISSN-0469-4244) Avail: NTIS HC A03/MF A01

Computation problems in using altimeter data for orbit determination are presented, along with a mathematical model for least squares estimation of geoidal undulations, sea surface topography, etc. For individual titles, see N80-20715 through N80-20716.

N80-20715*# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON ORBITAL FITTING WITH ALTIMETER DATA **c43**
D. Leigemann *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 5-34 refs (For primary document see N80-20714 11-42)
(Contract NAS6-2481)
Avail: NTIS HC A03/MF A01

Using altimeter data from a single pass, orbital fiting of these data is investigated. The stability problems of this special kind of short are method as well as the problem in the case of a mean Keplerian ellipse are discussed in detail. It is shown that short periodic perturbations can influence the size of the eccentricity of the satellite orbit computed from these data. In this way the desired result, the corrections of d zeta to the geoidal undulations, may be falsified. Author (ESA)

N80-20716# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON A MATHEMATICAL MODEL FOR REMOTE SENSING ALTIMETRY **c43**
D. Leglemann *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. p 35-42 refs Presented at 1st Gen. Assem. of European Assoc. Sensing Lab., Strasbourg, 23-24 Mar. 1977 (For primary document see N80-20714 11-42)
Avail: NTIS HC A03/MF A01

A parameter model for a least squares estimation of geoidal undulations, sea surface topography etc., which is considered as the basic tool for the use of altimetry as a remote sensing method, is outlined in its general geodetic aspects. Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-20717* National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES. A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 24
Jan. 1980 91 p
(NASA-SP-7041(24)) Avail: NTIS HC $10.50 CSCL 05B

This bibliography lists 345 reports, articles, and other documents introduced into the NASA scientific and technical information system between October 1, 1979 and December 31, 1979. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. J.M.S.

N80-20718 Stanford Univ., Calif.
REMOTE SENSING OF OCEAN SURFACE CURRENT AND CURRENT SHEAR BY HF BACKSCATTER RADAR Ph.D. Thesis
Eng-Chong Ha 1979 153 p
Avail: Univ. Microfilms Order No. 8006317

Radio backscatter experiments to verify the feasibility of radio measurement of ocean current, and its vertical shear were conducted using radar operating at four frequencies covering the range from 3 to 30 MHz. Concurrent in-situ measurements were obtained by tracking spar buoys using a microwave ranging system. Both radar and buoy inferred currents agree generally in their variation with time and depth. Inversion of the Laplace transform relating the radar inferred Doppler velocity as a function of frequency to the vertical profile of the current is achieved numerically. Two estimators of Bragg line width based on the area of the spectral curve and the second moment about its centroid, respectively, are applied to over 100 hours of radar data. It is concluded that multifrequency backscatter ground-wave radar at HF constitutes a powerful technique for mapping current and its vertical profile in the top few meters of the ocean. Dissert. Abstr.

N80-20719 Tennessee Univ., Knoxville.
APPLICATION OF LANDSAT IMAGERY TO MONITOR SAND DUNES MOVEMENT IN THE SAHARA DESERT Ph.D. Thesis
Ahmed Mokhtar Brera 1979 347 p
Avail: Univ. Microfilms Order No. 8005371

Band 5 and band 7 imagery available from LANDSAT 1 and LANDSAT 2 for the period between 1972 and 1976 over selected test areas in the Libyan Desert was used to identify and map distinct units on the ground. The results obtained were supported by ground truth data obtained from the selected sites in he form of topographic, geologic, and soil maps, aerial photographs, and meteorological information. The findings indicate that global surveillance of the status of dryland ecosystems and of land use can be achieved most economically through the use of LANDSAT imagery if proper image analysis techniques are used. Sand dune movement of the magnitude one kilometer and more can be detected easily using the proposed system. Dissert. Abstr.

N80-20720 Case Western Reserve Univ., Cleveland, Ohio.
RESOURCE AND ENERGY CONSTRAINTS OF REGIONAL AND GLOBAL AVAILABILITY OF ALUMINUM COPPER, AND IRON 1975 - 2000: A COMPUTER STUDY Ph.D. Thesis
Aldo Francis Barsotti 1979 482 p
Avail: Univ. Microfilms Order No. 8005352

A computer submodel of a world integrated model system indicates that globally the resources and reserves of all three metals are more than adequate to meet projected metal needs, not only for the remainder of this century, but for at least through the year 2025 (assuming some accuracy of projections over that time horizon). The share of total energy needs accounted for by the metal (aluminum, copper and iron) industry varies considerably among countries. Based on economic settings in the model, and projections in growth of downline metal production capacity, the model indicates that forecasted energy production will be inadequate and have a major constraining effect on metal supply in most regions by the year 2000. The regions most affected by that shortage are Oceania, Japan, and Latin America. Because of its total lack of energy resources, Japan will be most vulnerable. Dissert. Abstr.

N80-20721*# Commonwealth Scientific and Industrial Research Organization, Ryde (Australia).
HEAT CAPACITY MAPPING MISSION (HCMM) Progress Report, 31 Aug. - 30 Nov. 1978
K. G. McCracken, Principal Investigator 30 Nov. 1979 2 p
Sponsored by NASA HCMM
(E80-10066; NASA-CR-162587) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-20722*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
[EARTH SURVEY APPLICATIONS DIVISION: RESEARCH LEADING TO THE EFFECTIVE USE OF SPACE TECHNOLOGY IN APPLICATIONS RELATING TO THE EARTH'S SURFACE AND INTERIOR]
Nov. 1979 298 p refs ERTS
(E80-10084; NASA-TM-80550) Avail: NTIS HC A13/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-20723*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
[EARTH SURVEY APPLICATIONS DIVISION: RESEARCH LEADING TO THE EFFECTIVE USE OF SPACE TECHNOLOGY IN APPLICATIONS RELATING TO THE EARTH'S SURFACE AND INTERIOR] Annual Report, 1979
Lloyd Carpenter, ed. Jan. 1980 322 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10087; NASA-TM-80642; AR-2) Avail: NTIS HC A14/MF A01 CSCL 05B

Accomplishments and future plans are described for the following areas: (1) geology - geobotanical indicators and geopotential data; (2) modeling magnetic fields; (3) modeling the structure, composition, and evolution of the Earth's crust; (4) global and regional motions of the Earth's crust and earthquake occurrence; (5) modeling geopotential from satellite tracking data; (6) modeling the Earth's gravity field; (7) global Earth dynamics; (8) sea surface topography, ocean dynamics; and geophysical interpretation; (9) land cover and land use; (10) physical and remote sensing attributes important in detecting, measuring, and monitoring agricultural crops; (11) prelaunch studies using LANDSAT D; (12) the multispectral linear array; (13) the aircraft linear array pushbroom radiometer; and (14) the spaceborne laser ranging system. For individual titles, see N80-20724 through N80-20785.

N80-20724*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
GEOBOTANICAL EXPLORATION
M. Labovitz, E. Masuoka, and A. Siegrist, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 2-4 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 06C

There are no author-identified significant results in this report.

N80-20725*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

GEOLOGICAL/GEOPHYSICAL RESOURCE ASSESSMENT
R. C. Belcher, V. Gornitz, E. J. Masuoka, and K. T. Meehan, Principal Investigators. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 5-17 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08F
There are no author-identified significant results in this report.

N80-20726*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELD MODELING AND CRUSTAL STUDIES
P. T. Taylor and G. D. Mead, Principal investigation. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 19-20 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20727*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPHERICAL HARMONIC MODELS OF THE CORE FIELD
R. A. Langel, G. D. Mead, and R. H. Estes, Principal Investigators. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 21-29 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20728*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRUSTAL ANOMALY REPRESENTATION
R. A. Langel, Principal Investigator. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 30-38 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20729*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANOMALY VERIFICATION: COMPARISON OF POGO MAGNETIC DATA WITH AEROMAGNETIC MEASUREMENTS
P. T. Taylor, Principal Investigator. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 39-52 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20730*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REGIONAL MODELING: THE KENTUCKY ANOMALY
M. A. Mayhew, H. H. Thomas, and P. J. Wasilewski, Principal Investigators. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to The Earth's Surface and Interior. Jan. 1980 p 54-60 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08F
There are no author-identified significant results in this report.

N80-20731*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REGIONAL MODELING: THE IVREA ZONE
P. J. Wasilewski, M. A. Mayhew, and H. H. Thomas, Principal Investigators. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 61-62 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08F
There are no author-identified significant results in this report.

N80-20732*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPRETATION OF GEOID ANOMALIES IN THE VICINITY OF SUBDUCTION ZONES
D. C. McAdoo, Principal Investigator. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 63-67 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20733*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOBAL GEOLOGY AND GEOPHYSICS USING SATELLITE-DERIVED DATA
Herbert Frey, Principal Investigator. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 68-69 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20734*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOPHYSICAL ATLAS
P. D. Lowman, Principal Investigator. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 70-72 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20735*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARATIVE PLANETOLOGY/CRUSTAL EVOLUTION
Herbert Frey, Principal Investigator and P. D. Lowman, Jr. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 73-74 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20736*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRUSTAL DEFORMATION: CRUSTAL DYNAMICS PROJECT
H. Frey, R. J. Allenby, and P. D. Lowman, Jr., Principal Investigators. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 77-80 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20737*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INVESTIGATION OF CRUSTAL DYNAMICS USING VLBI
Chopo Ma and James W. Ryan, Principal Investigators. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior. Jan. 1980 p 81-83 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20738*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRUSTAL STRUCTURE AND DYNAMICS OF SOUTHEASTERN US
R. J. Allenby and M. A. Mayhew, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 84-85 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20739*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLATE BOUNDARY DEFORMATION IN CALIFORNIA
P. D. Lowamn, Jr., Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 86-95 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20740*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE SELECTION OF STATION SITES FOR OBSERVING STRAIN STREPS AND EARTHQUAKE FORERUNNERS IN CALIFORNIA
H. S. Liu, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 96-97 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08K
There are no author-identified significant results in this report.

N80-20741*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GSFC SITE STABILITY
W. J. Webster, Jr. and R. J. Allenby, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 98 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08K
There are no author-identified significant results in this report.

N80-20742*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEODETIC STABILITY OF THE GREEN BANK, WEST VIRGINIA VLBI SITE
P. D. Lowman, W. J. Webster, Jr., and R. J. Allenby, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 99-102 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20743*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTHQUAKE AND CRUSTAL DEFORMATION STUDIES
S. C. Cohen, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 103-108 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08K
There are no author-identified significant results in this report.

N80-20744*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOBAL INTRA-PLATE VOLCANISM
Han-Shou Liu, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 109-110 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20745*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF A SEISMIC DATA COLLECTION PLATFORM
W. J. Webster, Jr. and R. J. Allenby, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 111-113 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08K
There are no author-identified significant results in this report.

N80-20746*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRUSTAL MOTION MEASUREMENTS IN CALIFORNIA (SAFE)
D. E. Smith, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 114-115 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08K
There are no author-identified significant results in this report.

N80-20747*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEODYN PROGRAM SYSTEMS DEVELOPMENT
B. H. Putney, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 118-120 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08E
There are no author-identified significant results in this report.

N80-20748*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAVITY MODEL DEVELOPMENT
F. J. Lerch, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 121-127 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08N
There are no author-identified significant results in this report.

N80-20749*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAVITY MODEL IMPROVEMENT FOR SEASAT
F. J. Lerch, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 128-132 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20750*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GRAVITY FIELD IN THE CENTRAL PACIFIC FROM SATELLITE-TO-SATELLITE TRACKING AND IMPLICATIONS FOR MANTLE CONVECTION
J. G. Marsh, Principal Investigator *In its* Earth Survey Appl.

Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 133-139 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08N
There are no author - identified significant results in this report.

N80-20751*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UNEXPLAINED LAGEOS PERTURBATION
D. P. Rubincam, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 140-144 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08N
There are no author-identified significant results in this report.

N80-20752*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MANTLE CONVECTION AND SUBCRUSTAL STRESS
Han-Shou Liu, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 146-147 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20753*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFORMATION THEORY DENSITY DISTRIBUTION
D. P. Rubincam, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 148-156 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20754*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ENHANCED NODAL EQUILIBRIUM OCEAN TIDE AND POLAR MOTION
B. V. Sanchez, Prinicpal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 157-164 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N80-20755*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR MOTION RESEARCH
M. A. Graber, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 165-166 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N80-20756*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DETERMINATION OF GM
David E. Smith, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 167-170 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR MOTION AND EARTH ROTATION RESULTS FROM LAGEOS
David E. Smith, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 171-173 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-20758*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SEASAT ALTIMETER HEIGHT BIAS USING FOUR BERMUDA OVERFLIGHTS
R. Kolenkiewicz, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 176-186 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 14B
There are no author-identified significant results in this report.

N80-20759*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF SEA STATE ON ALTIMETER MEASUREMENTS
R. Kolenkiewicz, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 187-189 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08C
There are no author-identified significant results in this report.

N80-20760*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEAN SEA SURFACE COMPUTATION USING GEOS-3 ALTIMETER DATA
J. G. Marsh, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 190-197 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08C
There are no author-identified significant results in this report.

N80-20761*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEAN CIRCULATION
R. E. Cheney, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 198-202 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08C
There are no author-identified significant results in this report.

N80-20762*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STARLETTE ORBIT ANALYSES FOR OCEAN TIDAL STUDIES
T. L. Felsentreger and J. G. Marsh, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 203-206 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08C

There are no author-identified significant results in this report.

N80-20763*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE MONITORING OF FOREST COVER CONDITIONS
D. Williams, S. Wharton, and R. Nelson, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 209-212 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-20764*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SURFACE MINE MONITORING
J. R. Irons, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 213-215 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08I

There are no author-identified significant results in this report.

N80-20765*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA-CENSUS APPLICATION PILOT TEST (APT) AND URBAN AREA DELINEATION STUDIES
D. Toll and S. Wharton, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 216-219 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 13B

There are no author-identified significant results in this report.

N80-20766*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPROVEMENT IN CLASSIFICATION ACCURACY OF LANDSAT MSS DATA IN AREAS OF MOUNTAINOUS TERRAIN
C. Justice, B. Holben, and S. Wharton, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 220-223 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-20767*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOURCES OF VARIATIONS IN LANDSAT AUTOCORRELATION
M. L. Labovitz, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 224-227 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-20768*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF LEAF WATER CONTENT IN THE NEAR INFRARED
Compton J. Tucker, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 230-234 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 06C

The author has identified the following significant results. Simulated spectral reflectances using different leaf water contents resulted in different reflectance changes in the 0.7 to 2.5 micron region of the spectrum. Consideration of the solar spectral irradiance and atmospheric transmission characteristics shows that the 1.55 to 1.75 micron spectral interval is the best suited band in the 0.7 to 2.5 micron region for monitoring plant canopy water status from space platforms. The 1.48 to 1.75 micron spectral interval is the best suited band for ground-based monitoring of plant canopy water status. The 1.50 to 1.63 micron region shows the greatest spectral radiance changes with a simulated leaf dehydration.

N80-20769*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLANT STRESS AND RELATIONSHIPS TO SPECTRAL RESPONSES
J. B. Schutt, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 235-237 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 06C

The author has identified the following significant results. Comparison of the near infrared reflectance curves of cotton plants grown in a chamber, greenhouse, and in the field show that field cotton has the lowest relfectance over the regions from 0.8 to 1.3 microns and 1.92 to 2.5 microns, with greenhouse and growth chamber spectra with higher reflectances in respective order. The reflectance levels from 1.42 to 1.92 microns (1.55 to 1.75 microns) were independent of lighting conditions. Spectral response curves recorded in the near-UV and near-IR regions for tomato leaves subjected to O3, SO2, and their combination, show that greater consistency in detectability was found in the new-UV. Results show that visible damage first appeared at the upper surface of a leaf, while incipient damage was first detected at the under surface.

N80-20770*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONITORING DROUGHT IN COLORADO WITH LANDSAT MSS
C. J. Tucker and D. W. Deering, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 238-241 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N80-20771*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF WHEAT IRRIGATION FREQUENCY ON REFLECTANCE IN SELECTED SPECTRAL BANDS
E. W. Chappelle, F. W. Wood, and W. W. Newcomb, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 242-246 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-20772*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OFF-NADIR VIEWING EFFECTS ON SPECTRAL ASSESSMENT OF GREEN BIOMASS
D. W. Deering, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 247-251 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02C

The author has identified the following signficant results. Off-nadir pointing of remote sensors decreased the red radiance and increased the infrared radiance in a situation of sparse ground cover and low levels of green biomass by increasing the proportion of the measured spectral response that was affected by interaction with the plant material component of the vegetation scene. The

magnitude of the spectral radiance value changes with changes in off-nadir viewing angle indicate that from 0 deg to 20 deg no significant radiometric adjustments are necessary, but at larger veiw angles, adjustment-to-nadir algorithms may be necessary for many applications. The infrared/red ratio vegetation index exhibited enhanced sensitivity to the green biomass in low biomass situations.

N80-20773*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL ANISOTROPY OF VEGETATION CANOPIES
D. S. Kimes, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 252-256 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02F
There are no author-identified significant results in this report.

N80-20774*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIME OF DAY EFFECTS ON WHEAT REFLECTANCE IN FIFTEEN SELECTED BANDS
E. W. Chappelle, F. W. Wood, and W. W. Newcomb, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 257-259 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-20775*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASSESSING SOYBEAN LEAF AREA AND LEAF BIOMASS BY SPECTRAL MEASUREMENTS
B. N. Holben, C. J. Tucker, and C. Fan, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 260-263 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02C
The author has identified the following significant results. Red and photographic infrared spectral radiances were correlated with soybean total leaf area index, green leaf area index, chlorotic leaf area index, green leaf biomass, chlorotic leaf biomass, and total biomass. The most significant correlations were found to exist between the IR/red ratio data and green leaf index and/or green leaf biomass ($r2 = 0.85$ and 0.86 respectively).

N80-20776*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RELATIVE SENSITIVITY OF FIFTEEN SPECTRAL BANDS TO CHANGES IN SOYBEAN CANOPY COVER FOR WET AND DRY SOILS
E. W. Chappelle, R. Bell, F. W. Wood, D. W. Deering, and M. Labovitz, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 264-268 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-20777*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIOMETRIC RESOLUTION FOR MONITORING VEGETATION: HOW MANY BITS ARE NEEDED?
C. J. Tucker, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 269-275 ref ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02C
The author has idenfified the following significant results. The solar zenith angle has an effect on the noise equivalent change in reflectance. Two hundred fifty-six quantizing levels gave a 1% to 3% improvement per channel over 64 quantizing levels, and a 1% improvement per channel over 128 quantizing levels. No improvements were found for 256 vs 512 levels. Either 128 or 256 quantizing levels appear optimum for orbital monitoring of terrestrial vegetation for thematic mapper bands 3 and 4, or similar sensor bands. However, the data rate for 256 quantizing levels is 12.5% higher than the data rate for 128 levels, other parameters being equal. The thematic mapper was found to be closely matched to the scene dynamic radiance range for targets without incorporating variable gain control in the instrument.

N80-20778*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THEMATIC MAPPER VERSUS MULTISPECTRAL SCANNER FOR CROP MONITORING
B. L. Markham, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 276-280 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-20779*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRA OF ISOLATED VEGETATIONAL CONSTITUENTS
E. W. Chappelle and F. W. Wood, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 281-282 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-20780*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SPECTRAL METHOD FOR DETERMINING THE PERCENTAGE OF GREEN HERBAGE MATERIAL IN CLIPPED SAMPLES
C. J. Tucker, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 283-286 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-20781*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVALUATION OF A SPECTRAL METHOD FOR PERCENTAGE GREEN DETERMINATION USING CLIPPED RANGELAND FORAGE SAMPLES
D. W. Deering, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 287-290 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-20782*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT-D ASSESSMENT SYSTEM
D. Williams, D. Deering, K. Meehan, and J. Tucker, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 292-296 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-20783*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MULTISPECTRAL LINEAR ARRAY SENSOR DEVELOPMENT
C. C. Schnetzler, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 297-298 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 14B
There are no author-identified significant results in this report.

N80-20784*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LINEAR ARRAY PUSHBROOM RADIOMETER DATA ANALYSIS
J. Irons and S. Wharton, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 299-302 ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 14B
There are no author-identified significant results in this report.

N80-20785*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACEBORNE LASER RANGING SYSTEM
W. D. Kahn, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 303-308 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 20E
There are no author-identified significant results in this report.

N80-20786# Electrotechnical Lab., Ibaraki (Japan).
MICROWAVE REMOTE SENSING TECHNOLOGY FOR THE MARINE OIL POLLUTION SURVEILLANCE
Toshio Nenoto, Ichiro Yokoshima, Yoshihiko Kato, Takehiko Hidaka, Yutaka Kurioka, Minoru Yokota, Shinobu Hashimoto, Hiroshi Nakano, and Masahiko Yamaguchi Aug. 1979 166 p refs In JAPANESE; ENGLISH summary
(Rept-202) Avail: NTIS HC A08/MF A01
The existing state of oil pollution in the adjacent seas of the Japanese Archipelago, the techniques used in the oil detection and monitoring, and technical problems to be met in carrying out the patrol mission concerned with the enforcement of marine environment protection law are outlined. Functional requirements of a practical surveillance system useful for facilitating the activities to prevent the marine oil pollution are given. Basic mechanisms of interactions of microwaves at the air-sea water and air-oil-sea water interfaces are described. Reflection coefficients and emissivities of clean sea and polluted sea are exemplified under a number of different conditions of the temperature and salinity of sea water, observing frequency, and polarization of electromagnetic wave. The mechanisms of interaction between microwave signals and the atmospheric component gases and water droplets of various sizes are described, and examples of parameters useful for calculations of practical atmospheric attenuation and emission of microwaves are given. J.M.S.

N80-20787*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ASSESSMENT OF SATELLITE AND AIRCRAFT MULTISPECTRAL SCANNER DATA FOR STRIP-MINE MONITORING
Ernie W. Spisz and Joyce T. Dooley Washington Mar. 1980 39 p Original contains color illustrations
(NASA-TM-79268; E-187) Avail: NTIS HC A03/MF A01 CSCL 08I
The application of LANDSAT multispectral scanner data to describe the mining and reclamation changes of a hilltop surface coal mine in the rugged, mountainous area of eastern Kentucky is presented. Original single band satellite imagery, computer enhanced single band imagery, and computer classified imagery are presented for four different data sets in order to demonstrate the land cover changes that can be detected. Data obtained with an 11 band multispectral scanner on board a C-47 aircraft at an altitude of 3000 meters are also presented. Comparing the satellite data with color, infrared aerial photography, and ground survey data shows that significant changes in the disrupted area can be detected from LANDSAT band 5 satellite imagery for mines with more than 100 acres of disturbed area. However, band-ratio (bands 5/6) imagery provides greater contrast than single band imagery and can provide a qualitative level 1 classification of the land cover that may be useful for monitoring either the disturbed mining area or the revegetation progress. However, if a quantitative, accurate classification of the barren or revegetated classes is required, it is necessary to perform a detailed, four band computer classification of the data. J.M.S.

N80-20788# RAND Corp., Santa Monica, Calif.
DISTANCE ESTIMATION FROM COGNITIVE MAPS Interim Report, Nov. 1977 - Feb. 1979
Perry W. Thorndyke Nov. 1979 50 p refs
(Contract N00014-78-C-0042; NR Proj. 157-410)
(AD-A080098; RAND/R-2474-ONR) Avail: NTIS HC A03/MF A01 CSCL 08/2
Four experiments investigated map clutter as a source of distortion in distance estimates. In experiments 1 and 2, subjects estimated distances between pairs of points on a memorized map. In experiment 1, subjects learned relative distances among cities incidentally; in experiment 2, they learned them intentionally. In both experiments, estimates increased as a linear function of the number of intervening points along the path. In experiment 3, subjects estimated distances while viewing the map. The clutter effect was reduced but not eliminated. In experiment 4, the clutter effect was demonstrated using subjects' pre-experimental knowledge of U.S. geography. GRA

N80-20789# SRI International Corp., Menlo Park, Calif.
INTERACTIVE AIDS FOR CARTOGRAPHY AND PHOTO INTERPRETATION Final Technical Report, 12 May 1976 - 9 Oct. 1979
Martin A. Fischler, G. J. Agin, H. G. Barrow, R. C. Bolles, and L. Quam Dec. 1979 129 p refs
(Contract DAAG29-76-C-0057; ARPA Order 2894)
(AD-A079553) Avail: NTIS HC A07/MF A01 CSCL 08/2
Research at SRI International under the ARPA Image Understanding Program was initiated to investigate ways in which diverse sources of knowledge might be brought to bear on the problem of analyzing and interpreting aerial images. The initial phase of research was exploratory and identified various means for exploiting knowledge in processing aerial photographs for such military applications as cartography, intelligence, weapon guidance, and targeting. A key concept is the use of a generalized digital map to guide the process of image analysis. The results of this earlier work were integrated in an interactive computer system called 'Hawkeye'. This system provides not only basic facilities necessary for a wide range of tasks in cartography and photo interpretation, but also a framework within which other applications can be readily demonstrated. GRA

N80-20790# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Remote Sensing Branch.
INTERACTIVE DIGITAL SATELLITE IMAGE PROCESSING SYSTEM FOR OCEANOGRAPHIC APPLICATIONS Final Report
Albert E. Pressman and Ronald J. Holyer Apr. 1978 18 p
(AD-A079697; NORDA-TN-23) Avail: NTIS HC A02/MF A01 CSCL 08/10
The NORDA oceanographic satellite remote sensing program will emphasize data exploitation as opposed to data collection. This emphasis is because the collection technology has already far outstripped our ability to utilize the data for oceanographic purposes. The satellite data system described herein is an essential component for development and demonstration of processing, analysis, and interpretation methodology. The NORDA system includes a near real-time capability to receive GOES and limited VHRR data for screening purposes. GRA

N80-20791# California Univ., Livermore. Lawrence Livermore Lab.
REMOTE SYSTEM SOFTWARE
Terry H. Gong 17 May 1979 29 p refs

(Contract W-7405-eng-48)
(UCID-18191) Avail: NTIS HC A03/MF A01

Remote system software for a digital seismic system is described. The system consists of four remote stations in California, Nevada, and Utah that transmit seismic data to a central computer. DOE

N80-20792# Nevada Bureau of Mines and Geology, Reno.
ASSESSMENT OF LOW- TO MODERATE-TEMPERATURE GEOTHERMAL RESOURCES OF NEVADA Final Report, Apr. 1978 - Jun. 1979
D. T. Trexler, Thomas Flynn, and Brian A. Koenig 1979 36 p refs
(Contract ET-78-S-08-1556)
(NVO-01556-1) Avail: NTIS HC A03/MF A01

A geothermal resource map of Nevada was produced that provides detailed information on low- to moderate-temperature geothermal systems, and that also evaluates their potential for direct non-electric utilization. The information shown on the map can be divided into two categories: spot data and regional assessment (or potential evaluation). Specific geochemical information, such as temperature, pH, and chemical species, is represented by approximately 300 circle and diamond-shaped symbols. Thirty-seven larger regions were evaluated for their potential for direct-use on the basis of a numerical technique, which is fully described. An additional 15 sites were designated as areas that may provide a basis for investigations, but that lack sufficient data for a detailed potential evaluation at this time. DOE

N80-20793# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Grafische Datenverarbeitung und Strukturerkennung.
EXPERIMENTS IN DIGITIZING LINE STRUCTURES BY A RASTER SCAN PROCESS [ERFAHRUNGEN MIT DER DIGITALISIERUNG VON RASTERMAESSIG ERFASSTEN LINIENSTRUKTUREN, TEIL 2]
Karl-Heinz Klein, Thomas Kreifelts, Karl Pick, and Gerd Woetzel 1978 54 p refs In GERMAN
(GMD-Mitt-37) Avail: NTIS HC A04/MF A01

An interactive computer system was designed for producing contour maps from stored digital data. A FORTRAN program, ISOLIN, is described. The program was written for a Siemens 4004/151 computer to drive a line plotter and a film output device. The system permits the rapid and economic drawing of maps in a production environment. Author (ESA)

N80-20794# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Grafische Datenverarbeitung und Strukturerkennung.
DETERMINATION OF LINES AND NODES FROM IMAGES
Gerd Woetzel 1978 68 p refs In GERMAN
(GMD-Mitt-44) Avail: NTIS HC A04/MF A01

A method for reducing the cost of digitizing existing base maps through the use of automated cartographic techniques is described. The lines and nodes of the cartographic systems are transformed into contours on a display through the generation of a skeleton from binary images. Algorithms are described which are used to combine information from different maps onto one improved map. Author (ESA)

N80-20795# National Technical Information Service, Springfield, Va.
WATER RESOURCES IN ARID AND SEMIARID REGIONS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Sep. 1979
Robena J. Brown Dec. 1979 249 p Supersedes NTIS/PS-78/1066; NTIS/PS-77/0947; NTIS/PS-76/0838; NTIS/PS-75/737
(PB80-802259; NTIS/PS-78/1066; NTIS/PS-77/0947; NTIS/PS-76/0838; NTIS/PS-75/737) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

The citations cover reports concerned with water quality, resource management, potable water consumption, and irrigation as they apply to arid and semiarid regions, particularly those in the western regions of the United States. Hydrology, modeling, and water allocation are also covered along with studies on water conservation measures, which will add to the water resources in these areas. This updated bibliography contains 243 abstracts, 52 of which are new entries to the previous edition. GRA

N80-20796# Economics, Statistics and Cooperatives Service, Washington, D. C.
MAJOR USES OF LAND IN THE UNITED STATES, 1974
H. Thomas Frey Nov. 1979 39 p refs
(PB80-114226; AER-440) Avail: NTIS HC A03/MF A01 CSCL 02B

The United States has a land area of 2,264 million acres. The major use of this acreage in 1974 was: cropland, 465 million acres; forest land, 718 million acres; urban, recreational, and other special uses, 182 million acres; and miscellaneous land, 302 million acres. From 1969 to 1974 cropland, pasture and range, and forest land each decreased about 1 percent while special uses increased 6 percent. GRA

N80-20797# Environmental Monitoring and Support Lab., Las Vegas, Nev.
AIRBORNE LASER FLUOROSENSING OF SURFACE WATER CHLOROPHYLL a Interim Report, Jan. 1976 - Aug. 1978
M. Bristow, F. Nielsen, R. Furtek, and J. Baker Aug. 1979 79 p refs Prepared in cooperation with Nev. Univ., Las Vegas
(PB80-113400; EPA-600/4-79-048) Avail: NTIS HC A05/MF A01 CSCL 14B

A prototype airborne laser fluorosensor for monitoring surface water chlorophyll 'a' was tested over Lake Mead, Nevaga. Trends in the remotely sensed data are in close correspondence with ground truth data. It is suggested that system performance can be improved by concurrently gauging the water optical attenuation coefficient and by implementing chlorophyll 'a' analyses on ground truth samples. GRA

N80-20798# Bureau of Mines, Pittsburgh, Pa. Pittsburgh Mining and Safety Research Center.
PLASTIC CANOPY: A COMPUTER PROGRAM FOR THE STRUCTURAL ANALYSIS OF PROTECTIVE CANOPIES
Kenneth D. Winters, Gary R. Gavan, and James C. Aault 1979 205 p refs Prepared in cooperation with Woodward Associates, Inc., San Diego, Calif.
(PB80-122724; BM-IC-8795) Avail: NTIS HC A10/MF A01 CSCL 08I

FORTRAN 4 computer program for the structural analysis of protective canopies used in underground mines to protect equipment operators from roof falls and rollover protective structures used in surface mines to protect equipment during vehicle overturn accidents, is described. The program, entitled PLASTIC CANOPY, permits rapid and inexpensive calculation of the utimate strength and deformation characteristics of a canopy for a variety of static loading conditions. Other features of the program include prediction of buckling of a beam member under combined axial compression loading and bending, plotting of the input geometry of the structure, and plotting of the deformed shape of the loaded structure. Program description, input instructions, program listing, and four example problems are included. GRA

N80-20799# Bureau of Mines, Washington, D. C. Div. of Nonmetallic Minerals.
LITHIUM MINERAL COMMODITY PROFILES
Richard H. Singleton Sep. 1979 31 p refs
(PB80-123011) Avail: NTIS HC A03/MF A01 CSCL 08I

The United States consumes over one-half of the world's lithium and provides about 70 percent of the market economy world's supply of lithium. Data are presented on domestic and worldwide lithium production, consumption, and reserves to monitor and analyze supply-demand relationships. Data on lithium including industry structure, uses, resources, technology, byproducts and coproducts, strategic considerations, economic factors and problems, operating factors and problems, and outlook to 2000. GRA

N80-20800# General Accounting Office, Washington, D. C. Energy and Minerals Div.
ANALYSIS OF CURRENT TRENDS IN U.S. PETROLEUM AND NATURAL GAS PRODUCTION
7 Dec. 1979 11 p

(PB80-116056; EMD-80-24) Avail: NTIS HC A02/MF A01 CSCL 08I

Petroleum and natural gas production in the U.S. is forecasted through the 1990's. It is concluded that production will decline in the 1980's, but could be stabilized in the 1990's provided new enhanced oil recovery techniques are utilized. Developments in frontier areas are also addressed. GRA

N80-20801# Texas Univ. at San Antonio. Div. of Environmental Studies.

ANALYSIS OF WATER RESOURCES REQUIREMENT FOR THE ENHANCED (TERTIARY) OIL RECOVERY IN THE SOUTHERN PLAINS REGION OF THE UNITED STATES

Chia Shun Shih and Susan H. Hamilton Sep. 1979 222 p refs

(Contract DI-14-34-0001-8120)

(PB80-110869; W80-01005; OWRT-B-218-TEX(1)) Avail: NTIS HC A10/MF A01 CSCL 08I

Water resources requirements are analyzed in terms of both water quantity and quality, for the anticipated enhanced oil recovery operations to be implemented in the Southern Plains region of the United States. The enhanced oil recovery potential of each oil-producing reservoir in the four states of Texas, Oklahoma, New Mexico, and Louisiana is assessed using parameters describing the basic characteristics of crude oil and the reservoir formation. The water quality impacts of enhanced recovery method are assessed considering surface water pollution by discharged chemicals and waste waters, groundwater pollution by the fracture of well casings, and infiltration of chemical and oil/water mixtures. GRA

N80-20802# Michigan State Univ., Hickory Corners. W. K. Kolloge Biological Station.

PUBLIC INFORMATION AND LAKE EUTROPHICATION: A CASE STUDY OF GULL LAKE IN SOUTHWESTERN MICHIGAN Completion Report, Jul. 1971 - Jun. 1974

George H. Lauff, Brian Moss, and David F. Tague Nov. 1979 74 p refs

(Contracts DI-14-21-0001-3599; DI-14-31-0001-4094)

(PB80-113715; W80-01255; OWRT-B-021-Mich(2)) Avail: NTIS HC A04/MF A01 CSCL 08H

The principal cause of the decline of Gull Lake's water quality is shown to be phosphorus enrichment from septic systems and over-fertilized lawns. Efforts directed toward obtaining a reduction in phosphorus input through a community education and action program are described, including a monitoring program to provide extensive baseline data and dissemination of evidence documenting Gull Lake's degradation; factors which have improved water quality algal increases and changes, and the rate and extent of hypolimnetic oxygen depletion. It is recommended that sewage be diverted from Gull Lake and the use of lawn fertilizers containing phosphorus be eliminated on property adjacent to the lake. GRA

N80-20803# Lockheed Electronics Co., Inc., Las Vegas, Nev. Remote Sensing Lab.

COMPUTER PROCESSING OF MULTISPECTRAL SCANNER DATA OVER COAL STRIP MINES Final Report, 1 Jan. - 30 Jun. 1978

Charles E. Tanner Mar. 1979 62 p refs

(Contract EPA-68-03-2636)

(PB80-111677; EPA-600/7-79-080) Avail: NTIS HC A04/MF A01 CSCL 08I

Aircraft multispectral scanner data acquired over six coal strip mines in the states of Wyoming, Montana, Colorado, and Arizona were processed on the Data Analysis System (DAS) using a clustering approach to automatic pattern recognition. The classification results demonstrated that a level one hierarchy of vegetation features, manmade features, and disturbed areas could be easily obtained with a minimum amount of time. GRA

N80-20804# Centec Consultants, Inc., Reston, Va.

FUNCTIONAL ANALYSIS OF THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER (WRSIC)

6 Sep. 1979 52 p

(Contract DI-14-34-0001-9601)

(PB80-111842; W80-01201; OWRT-9601(1)) Avail: NTIS HC A04/MF A01 CSCL 08H

In particular, the analysis focused on the relationship of WRSIC to technology transfer and other activities of the Office of Water Research and Technology. Information presented is the result of a modern systems approach that structurally defines the WRSIC mission in terms of detailed functions. Two of the major tools used and their application to the WRSIC mission are described. A graphic overview of the WRSIC information system is included. Recommendations for improving the ability of WRSIC to satisfy present and near future requirements are discussed. GRA

N80-20805# American Society of Civil Engineers, New York. Urban Water Resources Research Council.

INTERNATIONAL SYMPOSIUM ON URBAN HYDROLOGY: PROCEEDINGS OF TWO SPECIAL SESSIONS, SPRING ANNUAL MEETING, AMERICAN GEOPHYSICAL UNION

M. B. McPherson, ed. Sep. 1979 130 p refs Conf. held in Washington, D.C., 28 May 1979

(Grant NSF ENV-77-15668)

(PB80-123078; TM-38; NSF/RA-790249) Avail: NTIS HC A07/MF A01 CSCL 08H

Advances made in the field of urban hydrology are discussed including a greatly increased use of urban runoff mathematical models. Urban hydrology and conventional hydrology are discussed and background information on the development of International Hydrology Program is presented, including identification of research objectives. GRA

N80-20648# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

DETERMINATION OF AZIMUTH AND ASTRONOMICAL COORDINATES

Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 111-115 refs In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

N80-20650# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

CONTRIBUTIONS TO THE DETERMINATION OF THE GEOID IN WEST GERMANY [ARBEITEN ZUR BESTIMMUNE DES GEOIDES IN DER BUNDESREPUBLIK DEUTSCHLAND]

Dieter Leigemann *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 121-125 refs In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

N80-20651# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

THE TRIANGULATION NETWORK IN WEST GERMANY [UNTERSUCHUNGEN IM HAUPTDREIECKSNETZ DER BUNDESREPUBLIK DEUTSCHLAND]

Dieter Ehlert *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 127-130 refs In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

N80-20654# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

CARTOGRAPHY APPLICATIONS AND RESEARCH [DIE KARTOGRAPHIE IN PRAXIS UND FORSCHUNG]

Walter Satzinger *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 141-142 In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

N80-20655# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

DEVELOPMENT, STATUS, AND GOALS OF CARTOGRAPHIC AUTOMATION [ENTWICKLUNG, AUFGABENSTELLUNG UND ZIELE DER KARTOGRAPHISCHEN AUTOMTION]

Wilhelm L. Pfrommer *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 143-148 In GERMAN (For primary document see N80-20638 11-42)

Avail: NTIS HC A11/MF A01

N80-20656# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

AUTOMATIC ACQUISITION AND PROCESSING OF CARTOGRAPHIC DATA [AUTOMATIONSGESTVETZTE ERFASSUNG UND AUFBEREITUNG KARTOGRAPHISCHER DATEN]
Theodor Johannsen *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 149-156 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20657# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON PRECISION IN THE GATHERING AND PRODUCTION OF CARTOGRAPHIC DATA [GENAUIGKEITSUNTERSUCHUNGEN BEI ERFASSUNG UND AUSGABE KARTOGRAPHISCHER DATEN]
Theodor Johannsen *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 157-159 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20658# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
COMPUTER BASED GENERALIZATION FOR THE ELABORATION AND EXTENSION OF TOPOGRAPHIC MAPS [RECHNERGESTUEZTE GENERALISIERUNG BEI DGR HERSTELLUNG UND FORTFUEHRUNG TOPOGRAPHISCHER KARTEN]
Fred Christ *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 161-165 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20659# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
GRAPHIC PRODUCTION OF MAPS ON SCREENS OR PHOTOCOMPOSITION DEVICES [GRAPHISCHE AUSGABE VON KARTEN AUF BILDSCHIRM UND LICHTZEICHENMASCHINE]
Helmut Uhrig *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 167-169 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20660# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE DATA BANK IN THE CARTOGRAPHIC AUTOMATION SYSTEM [DIE DATENBANK IM KARTOGRAPHISCHEN AUTOMATIONSSYSTEM]
Wigand Weber *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 171-173 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20661# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE TOPOGRAPHIC SYNOPTIC MAP 1:200,000 [DIE TOPOGRAPHISCHE UEBERSICHTSKARTE 1:200,000 (TUEK 200)]
Rolf Boehme *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 175-176 In GERMAN Original contains color illustrations (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20662# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE SYNOPTIC MAP 1:500,000 (WORLD, SERIES 1404) [DIE UEBERSICHTSKARTE 1:500,000 (WORLD, SERIE 1404)]
Rolf Boehme *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 177-178 In GERMAN Original contains color illustrations (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20663# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE INTERNATIONAL WORLD MAP 1:1,000,000 (IWK) [DIE INTERNATIONALE WELTKARTE 1:1,000,000 (IWK)]
Wolfgang Weber *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 179-182 In GERMAN Original contains color illustrations (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20664# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PHOTOGRAMMETRY IN IFAG FROM 1952 TO 1977 [DIE PHOTOGRAMMETRIE IM IFAG 1952-1977]
Hans Belzner *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 187-192 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20665# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON SPECTRAL SIGNATURES IN CENTRAL PERSPECTIVE REPRESENTATION [ZUR BERUECKSICHTIGUNG VON OBJEKTEIGENSCHAFTEN IN ZENTRALPERSPEKTIVEN ABBILDUNGEN]
Joern Sievers *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 193-197 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20666# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ORTHOPHOTO TECHNIQUES AND PHOTOMAPS [ORTHOPHOTOTECHNIK UND LUFTBILDKARTE]
Rudolf Olach *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 199-201 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20667# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AERIAL AND SPACE-BORNE PHOTOGRAPHIC MAPS [LUFTBILD UND WELTRAUMBILDKARTEN]
Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 203-210 refs In GERMAN Original contains color illustrations (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20668# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
OBTAINING SURFACE INFORMATION FOR TOPOGRAPHY AND TOWN AND COUNTRY PLANNING FROM REMOTE SENSING [DAS GEWINNEN VON FLAECHENNUTZUNGS INFORMATIONEN MITTELS FERNERKUNDUNGSVERFAHREN FUER AUFGABEN DGR TOPOGRAPHIE UND DER LANDESPLANUNG]
Klaus Niemz *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 211-217 In GERMAN Original contains color illstrations (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20669# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DIGITAL HEIGHT MODEL WITH ITEK CORRELATOR [DIGITALES HOEHENMODELL MIT DEM ITEK KORRELATOR]
Gerhard Lindig *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 219-223 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20670# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE FUTURE OF ANALYTICAL EVALUATION EQUIPMENT [ERWARTUNGEN AN ANALYTISCHE AUSWERTEGERAETE]
Karl Schuerer *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 225-227 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20671# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DIGITAL MAP BASES FROM PHOTOGRAMMETRIC MEASUREMENTS [DIGITALE KARTENGRUNDLAGEN AUS PHOTOGRAMMETRISCHEN MESSUNGEN]
Hermann G. Neubauer *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 229-231 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20672# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TASKS AND POSSIBILITIES OF DIGITAL IMAGE DATA PROCESSING IN PHOTOGRAMMETRY [AUFGABEN UND MOEGLICHKEITEN DGR DIGITALEN BILDVERARBEITUNG IN DGR PHOTOGRAMMETRIE]
Bernd-Siegfried Schulz *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 233-235 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20673# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AIRPORT OBSTACLE MAPS [FLUGPLATZ HINDERNISKARTEN]
Heinz Bannach *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1974 p 237-240 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20675# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON THE DISPLACEMENT PROBLEM AS PART OF A PROCESS IN GENERALIZING TOPOGRAHICAL MAPS. PROPOSITION FOR HIERARCHICAL ORDER AND THE SEARCH FOR EDP ASSISTED SOLUTIONS [ZUM PROBLEM DER VERDRAENGUNG ALS TEILVORGANG DER GENERALISIERUNG TOPOGRAPHYISCHER KARTEN. HIERARCHIEVORSCHLAG UND VERSUCH EINER EDV-GESTUETZTEN LOESUNG]
Roland Schittenhelm *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 5-19 refs In GERMAN; ENGLISH summary (For primary document see N80-20674 11-42)
Avail: NTIS HC A05/MF A01

N80-20676# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TWENTY-FIVE YEARS OF AERIAL PHOTOGRAPHY BY THE INSTITUTE OF APPLIED GEODESY [JAHRE LUFTBILDNACHWEIS DES INSTITUTS FUER ANGEWANDTE GEODAESIE]
Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 21-38 refs In GERMAN; ENGLISH summary (For primary document see N80-20674 11-42)
Avail: NTIS HC A05/MF A01

N80-20677# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A SYMBOL DISK WITH INTERCHANGEABLE SYMBOLS AND ITS APPLICATIONS TO CARTOGRAPHY [EINE SYMBOLSCHEIBE MIT AUSWECHSELBAREN SYMBOLEN UND IHRE EINSATZMOEGLICHKEIT IN DER KARTOGRAPHIE]
Helmut Uhrig *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 39-53 refs In GERMAN; ENGLISH summary (For primary document see N80-20674 11-42)
Avail: NTIS HC A05/MF A01

N80-20680# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A PROGRAM FOR THE FULLY AUTOMATED DISPLACEMENT OF POINT AND LINE FEATURES IN CARTOGRAPHIC GENERALIZATION
Fred Christ *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 5-30 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

N80-20681# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A DIGITAL TERRAIN MODEL FOR LARGE SURFACES AND DIRECT STORAGE ACCESS
Rainer Detering *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 31-34 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

N80-20682# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE PRODUCTION OF PHOTOMAPS FROM TIDAL FLAT AREAS
Guenter Hake *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 35-41 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

N80-20683# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TESTING THE ACCURACY OF CARTOGRAPHIC EQUIPMENT: FIRST RESULTS
Theodor Johannsen *In its* Rept. on Cartography and Topographical Meas. Ser 2: Transl. 1978 p 43054 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

N80-20685# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
LOCATIONAL CHARACTERISTICS AND THE SEQUENCE OF COMPUTER ASSISTED PROCESSES OF CARTOGRAPHIC GENERALIZATION
Werner Lichtner *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 65-75 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

N80-20686# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
COMPUTER-ASSISTED THEMATIC MAPPING FOR FEDERAL PLANNING
Wolf-Dieter Rase *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 77-83 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

N80-20687# nstitut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DIGITIZING OF GEOMETRIC DATA FOR THEMATIC MAPPING: STATE-OF-THE-ART AND FUTURE DEVELOPMENTS
Klaus Tuerke *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 85-91 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

N80-20690# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
MAP PROJECTION CHANGE: SOME PROGRAMS FOR THE TRANSFORMATION OF THE CONTENTS OF AVAILABLE MAPS ACCORDING TO DIFFERENT MAP PROJECTIONS
Ingo Wilski *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 115-127 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

N80-20692# Bayerische Akademie der Wissenschaften, Munich (West Germany).
IMPROVED TABLES OF COORDINATES ALLOTTED TO THE WETZELL SATELLITE TRACKING STATION [VERBESSERTE UND ERGAENZTE KOORDINATENVERZEICHNISSE FUER DEN BEREICH DER SATELLITENBEOBACHTUNGSSTATION WETTZELL]
Eberhard Billich and Hermann Seeger *In its* Res. Program 78,

Satellite Geodesy Program 1978 p 18-28 ref In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

N80-20702# Bayerische Akademie der Wissenschaften, Munich (West Germany).
THE RGST CHAIN PROGRAM FOR THE DETERMINATION OF POTENTIAL COEFFICIENTS AND STATION COORDINATES [DIE REST-PROGRAMMKETTE FUER DIE BESTIMMUNG VON POTENTIALKOEFFIZIENTEN UND STATIONSKOORDINATEN]
Christoph Reigber *In its* Res. Program 78, Satellite Geodesy Program 1978 p 111-119 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

N80-20704# Bayerische Akademie der Wissenschaften, Munich (West Germany).
STUDY FOR A PROJECT FOR A EUROPEAN HIGH PRECISION LASER NETWORK [PROJEKTSTUDIE FUER SATELLITEN-LASERNETZ HOECHSTER GENAUIGKEIT IN EUROPA]
Walter Ehrnsperger and Martha Naebauer *In its* Res. Program 78, Satellite Geodesy Program 1978 p 139-158 refs In GERMAN; ENGLISH summary (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

N80-20706# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CONTRIBUTIONS TO THE CREATION OF A CONCLUSIVE SYSTEM OF CONCEPTS OF PHOTOGRAMMETRY AND AERIAL PHOTOGRAPH CARTOGRAPHY [BEITRAG ZUM AUFBAU EINES GESCLOSSENEN BEGRIFSSYTEMS DER PHOTOGRAMMETRIES UND DER LUFTBILDKARTOGRAPHIES]
Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 7-35 refs In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

N80-20707# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE PROBLEM OF OBTAINING DATA FOR THE DIGITAL HEIGHT MODEL [PROBLEME DER DATENGEWINNUNG FUER DAS DIGITALE HOEHENMODELL]
Gerhard Lindig *In its* Rept. on Cartography and Topographical meas. Ser. 1: Original Rept. 1978 p 37-48 refs In GERMAN; ENGLISH summary Presented at Intern. Symp. der IGP, Komm 3, Moscow, 1978 (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

N80-20708# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A METHOD FOR EXAMINING RELATIONSHIPS BETWEEN MULTISPECTRAL DATA [EINE METHODE ZUE PRUEFUNG CON ABHAENGIGKEITEN ZWISCHEN MULTISPEKTRALEN DATEN]
Bernd-Siefgried Schulz *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 49-69 refs In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

N80-20709# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
SETTING DATA FROM MULTISTAGE ANALYTICAL ORIENTATION [EINSTELLDATEN AUS MEHRSTUFIGEN ANALYTISCHEN ORIENTIERUNGSVORGAENGEN]
Karl Schuerer *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 71-84 refs In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

N80-20710# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
POSSIBILITIES OF APPLICATION OF LANDSAT AND SKYLAB DATA TO SMALL SCALE CARTOGRAPHY [VERWENDUNGSMOEGLICHKEITEN VON LANDSAT UND SKYLABAUFNAHMEN IN DER KLEIMASSTAEBIGEN KARTOGRAPHIES]
Klaus Niemz *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 85-140 refs In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

N80-20711# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON THE WRITING ACCURACY OF THE REPRODUCTION UNIT OF THE OPTRONICS SYSTEM P1700 [ZUR SCHRIEBGENAUIGKEIT DER WEIDERGABEEINHEIT IM OPTRONICS SYSTEM P1700]
Bernd-Siegfried Schulz *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 141-148 In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

N80-20712# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PRODUCTION OF COLOR COMPOSITES FORM MULTISPECTRAL DATA RECORDS [DIE HERSTELLUNG VON FARBKOMPOSITEN AUS MULTISPEKTRALAUFNAHMEN]
Hans Peter Groetsch *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 149-160 In GERMAN; ENGLISH summary (For primary document see N80-20705 11-42)
Avail: NTIS HC A09/MF A01

N80-20715*# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON ORBITAL FITTING WITH ALTIMETER DATA
D. Leigemann *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 5-34 refs (For primary document see N80-20714 11-42)
(Contract NAS6-2481)
Avail: NTIS HC A03/MF A01

N80-20716# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON A MATHEMATICAL MODEL FOR REMOTE SENSING ALTIMETRY
D. Leglemann *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. p 35-42 refs Presented at 1st Gen. Assem. of European Assoc. Sensing Lab., Strasbourg, 23-24 Mar. 1977 (For primary document see N80-20714 11-42)
Avail: NTIS HC A03/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *85 Urban Technology and Transportation.*

N80-20806 North Carolina State Univ. at Raleigh.
COMPARISON OF THEORETICAL AND EXPERIMENTAL SOLAR CELL PERFORMANCE Ph.D. Thesis
Ching Yuh Robert Fang 1979 235 p
Avail: Univ. Microfilms Order No. 8005560

A detailed comparison of the theoretically predicted performance of silicon solar cells and the experimentally observed performance is presented. The comparison includes the dark one

through five characteristics, the spectra response characteristics, and one through five characteristics under air mass zero illumination. In general it is found that the agreement between theory and experimental behavior is very good. This good agreement is obtained for a variety of cells fabricated with junction depths ranging from 0.1 micrometer to more than 1 micrometer and for base layer resistivities from 10 ohms-cm to 0.1 ohms-cm. Dissert. Abstr.

N80-20807 Rensselaer Polytechnic Inst., Troy, N. Y.
A COMPARATIVE STUDY OF THE ENERGY ALTERNATIVES FOR THE STATE OF NEW YORK. Ph.D. Thesis
Lewis Chester Cohen. 1979. 303 p.
Avail: Univ. Microfilms. Order No. 7922226

The energy supply and demand picture for the State of New York is examined. The alternatives available to meet future needs are compared. The subject matter is addressed in an interdisciplinary fashion, focusing on the economic, health, environmental, and technological state of the art of the various options. Major economic factors affecting the energy supply problem are illustrated. Various energy alternatives are discussed, which include coal use for gasification versus electrification, large scale generation of electricity, cogeneration, district heating and total energy systems, low lead hydrogeneration of electricity, fuels from biomass, wood, solid waste, solar, and wind. A suggested optimal energy path is developed, along with a scenario of how energy needs should be met. Dissert. Abstr.

N80-20808* National Aeronautics and Space Administration. Pasadena Office, Calif.
PORTABLE HEATABLE CONTAINER. Patent
Lien C. Yang, inventor (to NASA) (JPL). Issued 18 Mar. 1980. 5 p. Filed 19 Apr. 1978. Supersedes N78-24554 (16 - 15, p. 2002). Sponsored by NASA.
(NASA-Case-NPO-14237-1; US-Patent-4,193,388; US-Patent-Appl-SN-897831; US-Patent-Class-126-263; US-Patent-Class-149-15; US-Patent-Class-149-37; US-Patent-Class-220-429) Avail: US Patent and Trademark Office. CSCL 10B

A container is provided which can be designed to heat its outer surface to sterilize it, or to heat its inner surface and any contents therewithin. In a container that self sterilizes its outer surface, the container includes a combustible layer of thermite-type pyrotechnic material which can be ignited to generate considerable heat, and a thin casing around the combustible layer which is of highly thermally conductive materials such as aluminum which can be heated to a high temperature by the ignited combustible layer. A buffer layer which may be of metal, lies within the combustible layer, and a layer of insulation such as Teflon lies within the buffer layer to insulate the contents of the container from the heat.
Official Gazette of the U.S. Patent and Trademark Office

N80-20809 Florida Univ., Gainesville.
STUDIES OF P-N JUNCTION SILICON SOLAR CELLS. Ph.D. Thesis
Shing Chong Pao. 1979. 104 p.
Avail: Univ. Microfilms. Order No. 8005484

A silicon solar cell structure which makes use of the positive charges in a passivating silicon dioxide layer to induce a high-low junction in the front emitter surface is designed, fabricated, and analyzed. It is shown experimentally that this structure avoids the degrading effects associated with heavily doped regions and exhibits high values of open circuit voltage. Experimental methods are developed to determine parameters that influence the performance of conventional silicon p-n junction solar cells. One of these methods, which employs the temperature dependence measurement of the minority carrier recombination current in a thin transparent emitter, allows determination of energy bandgap narrowing in heavily doped regions having doping concentrations up to about 10 to the 21 power per cu cm. A second method determines the effective surface recombination velocity describing the high-low junction in a back surface field solar cell. As an additional result, this method provides an estimate of the carrier lifetime in both high and low injection levels. Dissert. Abstr.

N80-20810* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMBINED SOLAR COLLECTOR AND ENERGY STORAGE SYSTEM. Patent
Ronald N. Jensen, inventor (to NASA). Issued 11 Mar. 1980. 6 p. Filed 28 Apr. 1978. Supersedes N78-23567 (16 - 14, p. 1868).
(NASA-Case-LAR-12205-1; US-Patent-4,192,290; US-Patent-Appl-SN-900843; US-Patent-Class-126-437; US-Patent-Class-126-434; US-Patent-Class-165-32; US-Patent-Class-126-419) Avail: US Patent and Trademark Office. CSCL 10A

A combined solar energy collector, fluid chiller and energy storage system is disclosed. A movable interior insulated panel in a storage tank is positionable flush against the storage tank wall to insulate the tank for energy storage. The movable interior insulated panel is alternately positionable to form a solar collector or fluid chiller through which the fluid flows by natural circulation. Official Gazette of the U.S. Patent and Trademark Office

N80-20811 California Univ., Los Angeles.
ENERGY CONSERVATION IN THE US: SOME INTERDISCIPLINARY APPROACHES WITH AN EMPHASIS ON INDUSTRIAL COGENERATION. Ph.D. Thesis
Ali Khaki-Kashani. 1979. 273 p.
Avail: Univ. Microfilms. Order No. 8007434

The potential for energy conservation in the United States through industrial cogeneration and energy recovery from municipal solid waste was evaluated. Candidate industries with the highest potential for industrial cogeneration were identified, current and advanced energy conversion systems for cogeneration were analyzed and various cogeneration strategies to maximize the potential fuel savings, were considered. Future market potential, potential energy savings, and the national benefits of industrial cogeneration were studied. Technical analyses for cogeneration systems were performed at several industrial sites and detailed institutional, environmental, and economic analyses were conducted for major categories of institutional settings. The impact of the National Energy Act on the commercialization of industrial cogeneration was discussed. The current status of the various processes available for energy recovery from municipal solid waste was assessed along with the costs associated with each process. Dissert. Abstr.

N80-20812*# Motorola, Inc., Phoenix, Ariz.
MARKET DEFINITION STUDY OF PHOTOVOLTAIC POWER FOR REMOTE VILLAGES IN THE UNITED STATES
Clyde Ragsdale and Prosper Quashie. Feb. 1980. 71 p.
(Contract DEN3-49; Contract DE-AI01-79ET-20485)
(NASA-CR-159800; DOE/NASA/0049-80/1) Avail: NTIS HC A04/MF A01 CSCL 10B

A grass roots evaluation of the market potential was carried out for photovoltaic applications in remote villages in the U. S. and its possessions. An estimate of almost 14 MWp available for conversion from a potential to a real market was defined. The total power potential was based on the energy needs of almost 400 sites reported by Federal agencies and inputs from over 100 Indian tribes. The methodology used, the results achieved, and some recommendations of how to convert this domestic market potential into a real market are detailed. R.E.S.

N80-20813*# Honeywell, Inc., Minneapolis, Minn.
QUALIFICATION TEST PROCEDURES AND RESULTS FOR HONEYWELL SOLAR COLLECTOR SUBSYSTEM, SINGLE-FAMILY RESIDENCE
Washington, D.C. DOE. Feb. 1977. 43 p. Prepared for NASA and DOE.
(Contract NAS8-32093)
(NASA-CR-161382) Avail: NTIS HC A03/MF A01 CSCL 10B

The test procedures and results in qualifying the Honeywell single family residence solar collector subsystem are presented. Testing was done in the following areas: pressure, service loads, hail, solar degradation, pollutants, thermal degradation, and outgassing. R.E.S.

N80-20814*# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
ANALYSIS AND EVALUATION IN THE PRODUCTION PROCESS AND EQUIPMENT AREA OF THE LOW-COST

SOLAR ARRAY PROJECT Quarterly Report, May - Aug. 1979
H. Goldman and M. Wolf Aug. 1979 63 p refs Prepared for JPL and DOE
(Contract JPL-954798)
(NASA-CR-162904; DOE/JPL-954796-79/7) Avail: NTIS HC A04/MF A01 CSCL 10A

The energy consumed in manufacturing silicon solar cell modules was calculated for the current process, as well as for 1982 and 1986 projected processes. In addition, energy payback times for the above three sequences are shown. The module manufacturing energy was partitioned two ways. In one way, the silicon reduction, silicon purification, sheet formation, cell fabrication, and encapsulation energies were found. In addition, the facility, equipment, processing material and direct material lost-in-process energies were appropriated in junction formation processes and full module manufacturing sequences. A brief methodology accounting for the energy of silicon wafers lost-in-processing during cell manufacturing is described. Author

N80-20816*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.
DEVELOPMENT OF LOW COST CONTACTS TO SILICON SOLAR CELLS Quarterly Report, 15 Oct. 1979 - 15 Jan. 1980
D. P. Tanner Jan. 1980 31 p refs Prepared for JPL and DOE
(Contracts JPL-955244)
(NASA-CR-162905; DOE/JPL-955244-80/4) Avail: NTIS HC A03/MF A01 CSCL 10A

The results of the second phase of the program of developing low cost contacts to silicon solar cells using copper are presented. Phase 1 yielded the development of a plated Pd-Cr-Cu contact system. This process produced cells with shunting problems when they were heated to 400 C for 5 minutes. Means of stopping the identified copper diffusion which caused the shunting were investigated. A contact heat treatment study was conducted with Pd-Ag, Ci-Ag, Pd-Cu, Cu-Cr, and Ci-Ni-Cu. Nickel is shown to be an effective diffusion barrier to copper. J.M.S.

N80-20818*# Mobil Tyco Solar Energy Corp., Waltham, Mass.
LARGE AREA SILICON SHEET BY EFG Annual Progress Report, 1 Oct. 1978 - 30 Sep. 1979
14 Mar. 1980 74 p refs Sponsored in part by DOE
(Contract JPL-954355)
(NASA-CR-162907; JPL-9950-313; DOE/JPL-954355-79/11) Avail: NTIS HC A04/MF A01 CSCL 10A

Recent advances toward silicon growth stations and improved electronic quality of multiplesilicon are discussed. These advances were made in large measure by studies in which the composition of the gas environment around the meniscus area was varied. By introducing gases such as CO2, CO, and CH4 into this region, reproducible increases in diffusion length and cell performance were realized, with the best large area (5 cm x 10 cm) cells exceeding 11% efficiency. R.E.S.

N80-20817*# Sensor Technology, Inc., Chatsworth, Calif.
PHASE 2: ARRAY AUTOMATED ASSEMBLY TASK LOW COST SILICON SOLAR ARRAY PROJECT Quarterly Technical Report, Oct. - Dec. 1979
Gregory T. Jones Dec. 1979 39 p Prepared for JPL and DOE
(Contract JPL-954865)
(NASA-CR-162912; JPL-9950-316; DOE/JPL-954865-79/8; QTR-8) Avail: NTIS HC A03/MF A01 CSCL 10A

Several microwave systems for use in solar cell fabrication were developed and experimentally tested. The first system used a standing wave rectangular waveguide horn applicator. Satisfactory results were achieved with this system for impedance matching and wafer surface heating uniformity. The second system utilized a resonant TM sub 011 mode cylindrical cavity but could not be employed due to its poor energy coupling efficiency. The third and fourth microwave systems utilized a circular waveguide operating in the TM sub 01 and TM sub 11 but had problems with impedance matching, efficiency, and field uniformity. R.E.S.

N80-20818*# Eagle-Picher Industries, Inc., Miami, Okla. Miami Research Labs.
STUDY PROGRAM TO DEVELOP AND EVALUATE DIE AND CONTAINER MATERIALS FOR THE GROWTH OF SILICON RIBBONS Final Report
L. A. Addington, P. D. Ownby, B. B. Yu, M. W. Barsoum, H. V. Romero, and B. G. Zealer Dec. 1979 124 p refs
(Contracts NAS7-100; JPL-954877)
(NASA-CR-162899; DOE/JPL-954877-79/6; JPL-9950-309) Avail: NTIS HC A06/MF A01 CSCL 10A

The development and evaluation of proprietary coatings of pure silicon carbide, silicon nitride, and aluminum nitride on less pure hot pressed substrates of the respective ceramic materials, is described. Silicon sessile drop experiments were performed on coated test specimens under controlled oxygen partial pressure. Prior to testing, X-ray diffraction and SEM characterization was performed. The reaction interfaces were characterized after testing with optical and scanning electron microscopy and Auger electron spectroscopy. Increasing the oxygen partial pressure was found to increase the molten silicon contact angle, apparently because adsorbed oxygen lowers the solid-vapor interfacial free energy. It was also found that adsorbed oxygen increased the degree of attack of molten silicon upon the chemical vapor deposited coatings. Cost projections show that reasonably priced, coated, molten silicon resistant refractory material shapes are obtainable. J.M.S.

N80-20819*# MB Associates, San Ramon, Calif.
USE OF GLASS REINFORCED CONCRETE (GRC) AS A SUBSTRATE FOR PHOTOVOLTAIC MODULES Final Report
James L. Eirls 12 Mar. 1980 109 p refs
(Contracts NAS7-100; JPL-955281)
(NASA-CR-162898; DOE/JPL-955281-80/4; JPL-9950-300; MB-R-80/05) Avail: NTIS HC A06/MF A01 CSCL 10A

A substrate for flat plate photovoltaic solar panel arrays using a glass fiber reinforced concrete (GRC) material was developed. The installed cost of this GRC panel is 30% less than the cost goal of the Near Term Low-Cost Flat Plate Photovoltaic Solar Array Program. The 4 ft by 8 ft panel is fabricated from readily available inexpensive materials, weighs a nominal 190 lbs., has exceptionally good strength and durability properties (rigid and resists weathering), is amenable to mass production and is easily installed on simple mountings. Solar cells are encapsulated in ethylene/vinyl acetate with Tedlar backing and Korad cover film. The laminates are attached to the GRC substrate with acrylic transfer tape and edge sealed with silicone RTV adhesive. J.M.S.

N80-20820*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1979 GODDARD SPACE FLIGHT CENTER BATTERY WORKSHOP
Gerald Halpert, ed. Apr. 1980 521 p refs Workshop held in Greenbelt, Md., 13-15 Nov. 1979
(NASA-CP-2117) Avail: NTIS HC A22/MF A01 CSCL 10C

Papers discussing the latest results of testing, analysis, and development of the sealed nickel cadmium cell system are presented. Metal hydrogen and lithium cell technology and applications are also discussed. The purpose of the workshop was to share flight and test experience, stimulate discussion on problem areas, and to review the latest technology improvements. For individual titles, see N80-20821 through N80-20863.

N80-20821*# National Aeronautics and Space Administration, Washington, D. C.
OVERVIEW OF NASA BATTERY TECHNOLOGY PROGRAM
Robert W. Riebling *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 5-11 (For primary document see N80-20820 11-44) Avail: NTIS HC A22/MF A01 CSCL 10C

Highlights of NASA's technology program in batteries for space applications are presented. Program elements include: (1) advanced ambient temperature alkaline secondaries, which are primarily nickel-cadmium cells in batteries; (2) a toroidal nickel cadmium secondaries with multi-kilowatt-hour storage capacity primarily for lower orbital applications; (3) ambient temperature lithium batteries, both primary and secondaries,

primarily silver hydrogen and high-capacity nickel hydrogen.
R.E.S.

N80-20822*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECOMMENDATIONS OF OSTA FLIGHT TECHNOLOGY IMPROVEMENT WORKSHOP-POWER SUBSYSTEMS PANEL
Luther W. Slifer, Jr. *In its* The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 13-27 refs (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
The recommendations of the power subsystems panel are discussed; The thrust is directed at radiometric problems. Areas that need development are defined for both spacecraft power subsystems and power supplies for experiments and instruments.
R.E.S.

N80-20823*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PANEL DISCUSSION: BRIDGING THE GAP TECHNOLOGY DEVELOPING FLIGHT HARDWARE
Floyd E. Ford *In its* The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 29-46 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
The development of an engineering data base for aerospace batteries is discussed.
R.E.S.

N80-20824*# Army Electronics Research and Development Command, Fort Monmouth, N. J.
LITHIUM CELL TECHNOLOGY AND SAFETY REPORT OF THE TRI-SERVICE LITHIUM SAFETY COMMITTEE
Edward Reiss *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 47-55 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
The organization of the Tri-Service Lithium Safety Committee is described. The following areas concerning lithium batteries are discussed: transportation--DOT Exemption 7052, FAA; disposal; storage; individual testing/test results; and battery design and usage.
R.E.S.

N80-20825*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NASA/MARSHALL'S LITHIUM BATTERY APPLICATIONS
L. E. Paschal *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 57-66 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
A general lithium battery is described and a summary of lithium battery applications is presented. Four aspects of a particular lithium battery, the inducement environmental contamination monitoring battery, are discussed-design and construction details, thermal vacuum tests, projection tests, and acceptance tests.
R.E.S.

N80-20826*# Naval Ocean Systems Center, San Diego, Calif.
HIGH ENERGY DENSITY BATTERY DEVELOPMENT STATUS REPORT
Alvin Willis *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 69-82 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
The Navy applications for high energy density batteries are described.
R.E.S.

N80-20827*# Honeywell Power Sources Center, Horsham, Pa.
GALILEO LITHIUM/SO2
Larry Blagdon *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 83-95 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
The current status of the Galileo lithium SO2 battery is described. The following general requirements of the battery are discussed: (1) electrical characteristics, (2) storage, (3) reliability, and (4) performance.
R.E.S.

N80-20828*# Mallory (P. R.) and Co., Inc., Burlington, Mass.
SULFUR STUDIES ON LITHIUM SULFUR DIOXIDE BATTERIES
A. N. Dey *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 97-110 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
Studies investigating the chemistry of the lithium SO2 batteries are described.
R.E.S.

N80-20829*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRICAL, THERMAL AND ABUSIVE TESTS ON LITHIUM THIONYL CHLORIDE CELLS
Harvey Frank *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 111-119 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
Electrical characterizations, thermal characterizations, and outer limits tests of lithium thionyl chloride cells are discussed. Graphs of energy density vs power density and heat rate vs time are presented along with results of forced reversal and high rate discharge tests.
K.L.

N80-20830*# GTE Labs., Inc., Waltham, Mass.
LITHIUM THIONYL CHLORIDE HIGH RATE DISCHARGE
Keith A. Klinedinst *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 121-133 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
Improvements in high rate lithium thionyl chloride power technology achieved by varying the electrolyte composition, operating temperature, cathode design, and cathode composition are discussed. Discharge capacities are plotted as a function of current density, cell voltage, and temperature.
K.L.

N80-20831*# Boeing Aerospace Co., Seattle, Wash.
LITHIUM BATTERY DISCHARGE TESTS
Chris J. Johnson *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 135-146 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
The long term discharge of a variety of lithium cells was characterized and the susceptibility of the cells to chemical variation during the slow discharge was tested. A shunt resistor was set across the terminals to monitor the voltage as a function of time. Failures were identified by premature voltage drops.K.L.

N80-20832*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CHARACTERIZATION OF PROTOTYPE SECONDARY LITHIUM BATTERY
Robert Somoano *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 147-154 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
The performance characteristics of ambient temperature secondary lithium batteries were determined through continuous cycle tests with periodic current and voltage measurements. Cycle life of the lithium anode was found to be an important problem area as was the formation of dentrite breakage and subsequent shorting. Energy density was increased by using more efficient cathode structures.
K.L.

N80-20833*# EIC, Inc., Newton, Mass.
RECHARGEABLE AMBIENT TEMPERATURE LITHIUM CELLS
Gerhard Holleck *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 155-167 refs (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C
The cycling performance of a secondary lithium cell with a 2-methyl THF lithium hectofluorarsenate electrolyte is discussed. Stripping efficiency, dendritization, passivation on standing, and discharge efficiency are considered.
K.L.

N80-20834*# Exxon Enterprises, Inc., Somerville, N.J. Battery Div.

THE EXXON RECHARGEABLE CELLS
Paul A. Malachesky *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 169-178 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The design and performance of ambient temperature secondary cells based on the titanium disulfide cathode are discussed. These limited performance products were developed for microelectronic applications such as solar rechargeable watches and clocks which require low drain rate and do not require many deep cycles. K.L.

N80-20835*# Power Conversion, Inc., Mount Vernon, N. Y.
HIGH TEMPERATURE STORAGE CHARACTERISTICS OF LITHIUM SULFUR DIOXIDE CELLS
Tom Watson *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 179-188 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

Hermetically sealed SO2 cells were developed to eliminate SO2 diffusion and its adverse effects on shelf life. A two part barrier coating material was applied to the internal surface of the glass seal and cured under a predetermined thermal profile in order to prevent the self discharge associated with glass seal corrosion. K.L.

N80-20836*# Space and Missile Systems Organization, Los Angeles Air Force Station, Calif.
NATO: IN-ORBIT EXPERIENCE
John J. Capulli *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 191-203 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The performance of the NATO-111-A and NATO 111-B satellite battery is reported. The electrical power subsystem is briefly described. The electrical characteristics and the reconditioning experience of the batteries is cited. The in-orbit experience is compared with results of preflight accelerated life tests. J.M.S.

N80-20837*# RCA American Communications, Inc., Piscataway, N. J.
RCA SATCOM: IN-ORBIT EXPERIENCE
Paul W. DeBaylo and Stephen J. Gaston (RCA Astro-Electronics) *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 205-213 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01

The system characteristics of the Satcom batteries and Satcom power system are briefly discussed. Performance of the nickel cadmium 22 cell batteries onboard in parallel with independent redundant charges providing the charge rates is reported. Performance onboard reconditioning with individual cell bypasses with 1 ohm resistors is discussed for the F-1 and F-2 spacecraft. J.M.S.

N80-20838*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UPDATE OF THE IUE BATTERY IN-FLIGHT PERFORMANCE
Smith E. Tiller *In its* The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 215-229 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The in-flight performance data of two 17-cell, 6-ampere-hour nickel cadmium spacecraft batteries are presented covering 22 months of operation. Fluctuations in the battery voltage and the battery temperature are presented for spacecraft movement throughout a beta range of 0 to 130 deg. The battery discharge voltages during the peak eclipse seasons, daily seasons, and daily eclipse periods are noted. Finally, the spacecraft data are compared to data from a 6-ampere-hour test pack and test flight data. M.G.

N80-20839*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISCUSSION OF THE SAGE ANOMALY
David Baer *In its* The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 231-241 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The performance of a nine-ampere-hour, nickel cadmium cell operating in a satellite power system is examined. Data for battery average dissipation, voltage profiles, battery temperatures, and the percent of recharge versus orbit are presented. The occurence of undervoltage and increased recharge/orbit percentages are examined and suggestions are made as to their causes. M.G.

N80-20840*# European Space Agency, Noordwikj (Netherlands).
ESA BATTERY DEVELOPMENT
H. J. Young and D. Goudot *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 243-259 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The improvement of nickel cadmium batteries and the development of a silver hydrogen cell for spacecraft power systems are discussed. The design of nickel cadmium batteries is examined with a particular emphasis on weight reduction concepts. Results from performance tests on silver hydrogen cells are given and comparisons are made with current nickel cadmium cells. M.G.

N80-20841*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
PARALLEL 50 AMPERE HOUR NICKEL CADMIUM BATTERY PERFORMANCE IN THE MODULAR POWER SUBSYSTEMS (MPS)
Donald A. Webb *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 261-268 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The thermal performance of 50-ampere-hour, nickel cadmium batteries for use in a modular spacecraft is examined in near-Earth orbit simulation. Battery voltage and temperature profiles for temperature extreme cycles are given and discussed. M.G.

N80-20842*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
NASA 50 AMP HOUR NICKEL CADMIUM BATTERY WASTE HEAT DETERMINATION
Vernon C. Mueller *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 269-275 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

A process for determining the waste heat generated in a 50-ampere-hour, nickel cadmium battery as a function of the discharge rate is described and results are discussed. The technique involved is essentially calibration of the battery as a heat transfer rate calorimeter. The tests are run at three different levels of battery activity, one at 40-watts of waste heat generated, one at 60, and one at 100. Battery inefficiency ranges from 14 to 18 percent at discharge rates of 284 to 588 watts, respectively and top-of-cell temperatures of 20 C. M.G.

N80-20843*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LDEF HEAT PIPE EXPERIMENT POWER SYSTEMS
Smith E. Tiller *In its* The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 277-284 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

A heatpipe experiment for a long duration exposure facility is described. The design and configuration of the power system of the spacecraft is reported with emphasis placed on its solar array panels, 12-ampere hour 18-cell nickel battery, and its electronic controller. R.C.T.

N80-20844*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
THE 20 WATT-HOUR PER KILOGRAM NICKEL CADMIUM ENERGY STORAGE FOR INTELSAT V
Jon Armantrout *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 287-306 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The life durability of a nickel cadmium energy storage battery for the INTELSAT 5 Satellite is discussed. Configuration

performance characteristics of the battery are given as well as a summary of some of the flight battery tests. R.C.T.

N80-20845*# TRW, Inc., Redondo Beach, Calif.
TDRSS BATTERY LIFE CYCLE TESTS INTERIM REPORT
Eddison W. Kipp. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 307-320 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The design features of the tracking and data relay satellite system battery are described. Some of the life cycle tests performed on the battery are reported. R.C.T.

N80-20846*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LIFE TEST RESULTS OF THE NASA STANDARD 20 AMPERE HOUR CELLS
Gerald Halpert. *In its* The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 321-330 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The data collected from life cycle tests results of a 20-ampere cells are discussed. A total of 50 cells were evaluated. R.C.T.

N80-20847*# TRW, Inc., Redondo Beach, Calif.
BATTERY RECONDITIONING, SUMMARY OF TRW EXPERIENCE
Willard R. Scott. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 331-342 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The data collected from the results of battery reconditioning accumulated from three different spacecraft programs are summarized. The basic design characteristics of the programs are also presented. R.C.T.

N80-20848*# TRW, Inc., Redondo Beach, Calif.
ADDITIONAL REVERSAL CHARACTERISTICS OF SEALED NICKEL CADMIUM CELLS
Paul F. Ritterman. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 343-354 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The reversal characteristics of nickel cadmium cells are discussed. The evolution of hydrogen from the positive electrode is described when the nickel cadmium cell is completely discharged. Results indicate that one ampere hour of overdischarge in reversal can generate enough hydrogen to increase the cell pressure of an average size cell, 20- to 50-ampere hour cell, by 120 psi. R.C.T.

N80-20849*# Aerospace Corp., Los Angeles, Calif.
REVERSAL OF NICKEL CADMIUM CELLS
Charles Badcock. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 355-365 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The design of nickel cadmium cells are discussed. The pressure voltage profiles of these cells during low rate reversal are also summarized. R.C.T.

N80-20850*# TRW, Inc., Redondo Beach, Calif.
CELL SHORT CIRCUIT, PRESHORT SIGNATURE
Charles Lurie. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 367-375 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

Short-circuit events observed in ground test simulations of DSCS-3 battery in-orbit operations are analyzed. Voltage signatures appearing in the data preceding the short-circuit event are evaluated. The ground test simulation is briefly described along with performance during reconditioning discharges. Results suggest that a characteristic signature develops prior to a shorting event. J.M.S.

N80-20851*# Martin Marietta Corp., Denver, Colo.
POCKET NICKEL CADMIUM CELL AND BATTERY EVALUATION
John W. Lear. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 377-388 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The Nickel Cadmium 129-ampere hour cell was tested in order to characterize the cell under controlled conditions. Results of charge characterization and discharge characterization are reported. Ampere hour efficiency, open circuit stand, and cycle life operation results are included. The battery is briefly described. J.M.S.

N80-20852*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
NWSC NICKEL CADMIUM SPACECRAFT CELL ACCELERATED LIFE TEST PROGRAM DATA ANALYSIS
John Lander. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 391-406 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

An analysis of the data leading to a proposed accelerated life test scheme to test a nickel cadmium cell under spacecraft usage conditions is described. The amount and concentration of electrolyte and the amount of precharge in the cell are discussed in relation to the design of the cell and the accelerated test design. A failure analysis of the cell is summarized. The analysis included such environmental test variables as the depth of discharge, the temperature, the amount of recharge and the charge and discharge rate. A.W.H.

N80-20853*# Coppin State Coll., Baltimore, Md.
ACCELERATED TEST DESIGN
Patrick P. McDermott. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 407-417 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The design of an accelerated life test program for electric batteries is discussed. A number of observations and suggestions on the procedures and objectives for conducting an accelerated life test program are presented. Equations based on nonlinear regression analysis for predicting the accelerated life test parameters are discussed. A.W.H.

N80-20854*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEVELOPMENT OF FAILURE MODEL FOR NICKEL CADMIUM CELLS
Amitava Gupta. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 419-439 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The development of a method for the life prediction of nickel cadmium cells is discussed. The approach described involves acquiring an understanding of the mechanisms of degradation and failure and at the same time developing nondestructive evaluation techniques for the nickel cadmium cells. The development of a statistical failure model which will describe the mechanisms of degradation and failure is outlined. A.W.H.

N80-20855*# Telesat Canada, Ottawa (Ontario).
MISSION SIMULATOR TEST DATA
E. A. Hendee. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980 p 441-452 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

A real time mission simulation test program of nickel cadmium cells, performed in conjunction with the Anik 1A2 satellite, is reviewed. Simulation of the temperature profiles, the electrical profiles, the depth of discharge, and the rate of charge and discharge is reported. The type of separator used in the cells and the transfer of electrolytes during overcharge are discussed. A.W.H.

N80-20856*# Boeing Aerospace Co., Seattle, Wash.
ANALYTICAL MODELING OF BATTERY CYCLE LIFE
Sidney Gross. *In* NASA. Goddard Space Flight Center. The 1979 Goddard Space Flight Center Battery Workshop. Apr. 1980

p 453-459 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

An analytical model related to the physical and chemical processes involved in battery wear and failure is discussed. The model is described using the data from the Crane tests. A.W.H.

N80-20857*# Bell Telephone Labs, Inc., Millington, N.J.
THE PRACTICAL LIMIT OF LOADING NICKEL HYDROXIDE ELECTRODES
E. J. McHenry *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 461-468 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The effect of compression loads on positive nickel hydroxide electrodes is reported. Results show the electrodes could be compressed up to 20,000 kilograms without any change in capacity. A.W.H.

N80-20858*# Bell Telephone Labs., Inc., Murray Hill, N. J.
NICKEL ELECTRODE PLATE THICKENING STUDY
Madeline Bernhardt and Dean W. Maurer *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 471-485 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

The rate of thickening of the nickel electrode with cycling, under geochronous conditions, was investigated. The experimental procedures used to study the effects of various operational parameters on the rate of the thickness growth are outlined. The parameters included temperature, electrolyte composition, manufacturing lot, cycle parameters, and reconditioning methods. A.W.H.

N80-20859*# Eagle-Picher Co., Joplin, Mo.
AEROSPACE ELECTRODE LINE
Lee Miller *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 487-491 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

A facility which produces electrodes for spacecraft power supplies is described. The electrode assembly procedures are discussed. A number of design features in the production process are reported including a batch operation mode and an independent equipment module design approach for transfering the electrode materials from process tank to process tank. A.W.H.

N80-20860*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UPDATE, COMPARING DIFFERENT PLATE TREATMENTS AND DESIGN
David Baer *In its* The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 493-497 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

Eight electrochemical cells were tested for precycling capacity and compared. The cell design variables included teflon treatment, silver treatment, light loading, and a polypropylene separator. Data are presented in tabular form. A.W.H.

N80-20861*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
INTELSAT-V: NICKEL-HYDROGEN BATTERY
G. VanOmmering *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 499-513 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

A design program for the development of a nickel hydrogen battery is described. The design and design advantages of the battery are discussed. The general characteristics of the battery such as the strain gage cell pressure monitoring and the automatic low temperature heater control are reported along with the performance characteristics. A.W.H.

N80-20862*# Eagle-Picher Co., Joplin, Mo.
AIR FORCE NICKEL-HYDROGEN FLIGHT EXPERIMENT
Lee Miller *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 515-524 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

A gas leakage test, a capacity test, a charge retention test, and an electrolyte leakage test were among the tests conducted on a nickel hydrogen battery in a flight environment. The battery design features and its performance in each test are discussed. A.W.H.

N80-20863*# Rockwell International Corp., Seal Beach, Calif.
NICKEL HYDROGEN CELL CHARACTERIZATION TEST RESULTS
Burt Otzinger *In* NASA. Goddard Space Flight Center The 1979 Goddard Space Flight Center Battery Workshop Apr. 1980 p 525-531 (For primary document see N80-20820 11-44)
Avail: NTIS HC A22/MF A01 CSCL 10C

Charge control studies on nickel hydrogen cells are discussed. Characterization test data for the cells are presented in graphical form. The test areas covered were capacity versus temperature, ampere-hour cycling efficiency, and the charge method which involved voltage level with current limiting. A.W.H.

N80-20864*# General Electric Co., Philadelphia, Pa. Space Div.
MOD 1 WIND TURBINE GENERATOR FAILURE MODES AND EFFECTS ANALYSIS
Feb. 1979 95 p
(Contracts NAS3-20058; EX-77-A-29-1010)
(NASA-CR-159494; DOE/NASA/0058-79/1) Avail: NTIS HC A05/MF A01 CSCL 10B

A failure modes and effects analysis (FMEA) was directed primarily at identifying those critical failure modes that would be hazardous to life or would result in major damage to the system. Each subsystem was approached from the top down, and broken down to successive lower levels where it appeared that the criticality of the failure mode warranted more detail analysis. The results were reviewed by specialists from outside the Mod 1 program, and corrective action taken wherever recommended. A.R.H.

N80-20865*# Honeywell, Inc., Minneapolis, Minn.
SOLAR ENERGY HEATING SYSTEM DESIGN PACKAGE FOR A SINGLE-FAMILY RESIDENCE AT NEW CASTLE, PENNSYLVANIA
Aug. 1977 187 p Prepared for DOE
(Contract NAS8-32093)
(NASA-CR-161356) Avail: NTIS HC A09/MF A01 CSCL 10A

The design of a solar heating and hot water system for a single family dwelling is described. Cost trade studies on the energy conservation and architectural features of the solar house are discussed. The present status of verification for the single family heating system, i.e., proof that the components and the system meet applicable physical and functional requirements, is reported. The system integration drawings, the major subsystems drawings, and the architect's specifications and plans are included. A.W.H.

N80-20866*# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
SOLAR HEATING SYSTEM DESIGN PACKAGE FOR A SINGLE-FAMILY RESIDENCE AT WILLIAM O'BRIEN STATE PARK, MINNESOTA
Jul. 1977 173 p Prepared for NASA and DOE
(Contract NAS8-32093)
(NASA-CR-161357) Avail: NTIS HC A08/MF A01 CSCL 10A

The plans, specifications, cost trade studies, and verification status of a prototype solar heating and hot water system for the Minnesota Department of Natural Resources's single-family dwelling located at O'Brien State Park, 30 miles east of Minneapolis, Minnesota are presented. R.E.S.

N80-20867# Army Armament Research and Development Command, Dover, N. J. Management Information Systems Directorate.
THE APPLICATION OF DC-DC ENERGY CONVERSION IN A SOLAR ENERGY SYSTEM Final Report
John P. Tobak Sep. 1979 156 p

(AD-A077112; AD-E400363; ARMID-TR-78002) Avail: NTIS HC A08/MF A01 CSCL 10/2

Expressions of voltage gain, current, and efficiency are developed for each of five different methods of DC-DC energy conversion. One of the five methods is selected as the design model for a prototype converter to be used in solar energy applications. Both the prototype's performance and the test methods employed are described. Efficiencies as high as 86% are measured along with a constant voltage line regulation of 0.04 volts per volt and a constant voltage load regulation of 0.034 volts per ohm. The prototype acts as a constant 12-volt power supply capable of delivering up to 10-amp currents. GRA

N80-20868# Little (Arthur D.), Inc., Cambridge, Mass.

WIND ENERGY IN THE MOUNTAINS OF NEW HAMPSHIRE AS A POTENTIAL ENERGY SOURCE FOR PORTSMOUTH NAVAL SHIPYARD Final Report

William A. Vachon, William T. Downey, Frederic March, Frederick R. Madio, Gerald A. Schimke, and John E. Wade Oct. 1979 188 p

(Contract N00014-79-C-0536; NR Proj. 521-710)

(AD-A076975) Avail: NTIS HC A09/MF A01 CSCL 04/2

A feasibility study was conducted to determine whether the wind energy in the mountainous regions of New Hampshire could be used as a possible energy course for the Portsmouth Naval Shipyard in Portsmouth, New Hampshire. The results indicate that there is adequate wind energy available at mountain sites to drive even the largest wind turbine generators (WT's) now planned, and that many potential sites exist in relatively close proximity to utility lines. Eight specific sites were identified on the basis of available wind speed data, the incidence of s ere icing, environmental constraints, plus on-site interpretation of vegetative deformation by the wind (tree flagging). Based on the experiences of this study there appears to be a limited number of available WT sites which have sufficient geographic extent to support large clusters (i.e., farms) of WT's of approximately 20-100 MW rating. Technically, the local utility can 'wheel' power to the Naval Shipyard from mountain sites, but doing so would not be cost-effective for the Shipyard because of an abundance of on-site, low-cost cogenerated electricity. A simple near-term approach to wind power development in New Hampshire appears to be through the private exploitation of WT clusters of less than 5 MW capacity on private land. GRA

N80-20869# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.

MILITARIZED THERMOELECTRIC POWER SOURCES

G. Guazzoni, A. Herchakowski, and J. Angello Jul. 1979 9 p refs

(DA Proj. 1L1-62705-AH-94)

(AD-A075609; DELET-TR-79-17) Avail: NTIS HC A02/MF A01 CSCL 10/2

Thermoelectric power sources are being developed to provide multifuel, silent, maintenance free tactical power generators for forward area applications. Recent technology improvements, state of development, and performance characteristics of the 100-Watt and 500-Watt Thermoelectric Power Sources are presented. Author (GRA)

N80-20870# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

COMPUTER SIMULATION OF A SOLAR ENERGY SYSTEM WHICH UTILIZES FLAT-PLATE COLLECTORS M.S. Thesis

Barry Eugene Prins Dec. 1979 102 p refs

(AD-A079906; AFIT/GAE/AA/79D-15) Avail: NTIS HC A06/MF A01 CSCL 10/2

This thesis is a computer simulation of a solar energy system that utilizes flat-plate solar collectors. By using available data from the U.S. Weather Bureau, the location and orientation of the collector, characteristics of the collector, and the type of storage and backup heat system in use, it is possible to find the amount of solar energy collected and transferred to storage. A life cycle cost analysis can be accomplished by using financial data and an inflation-discount function to reduce all costs to present year dollars. By varying any of a number of parameters the operator can determine what effect it has on the amount of energy collected and the life cycle costs. Results of running the program for a solar water heater system indicate that such a system is cost effective, when compared to a gas water heater system, only when the federal and state tax incentives were taken into account. However, electricity is approximately three times as expensive as gas per BTU of energy gained so the solar energy system is economically feasible when compared to an electric water heating system. GRA

N80-20871# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

N-TYPE MOLYBDENUM DISELENIDE-BASED LIQUID JUNCTION SOLAR CELLS: A NON-AQUEOUS ELECTROLYTE SYSTEM EMPLOYING THE CHLORINE/CHLORIDE COUPLE

Lynn F. Schneemeyer, Mark S. Wrighton, Angelica Stacy, and Michell J. Sienko 19 Dec. 1979 20 p Submitted for publication Prepared in cooperation with Cornell Univ., Ithaca, N.Y.

(Contract N00014-78-C-0630; NR Proj. 051-696)

(AD-A079712; TR-3) Avail: NTIS HC A02/MF A01 CSCL 10/2

Single crystal, n-type MoSe2 is shown to serve as a stable photoanode in an electrochemical cell employing a nonaqueous (CH3CN) solution of Cl2/Cl(-) as the redox active material. The photoanode reaction is 2Cl(-) Cl2 and the cathode reaction is Cl2 2Cl(-). The MoSe2 is qualitatively better than MoS2 (0.5% efficiency) which has a larger band gap (1.7 eV), but both materials are rugged in the nonaqueous solution while both photocorrode in aqueous Cl(-) solutions. In H2O, the I3(-)/I(-) couple is excellent but in CH3CN it yields lower efficiency than the Cl2/Cl(-) couple. The stable Cl2(-)/Cl(-) system provides evidence that a transparent, reversible, non-O2 sensitive redox couple can be useful in n-type semiconductor-based liquid junction cells employing a direct band gap material having optimum solar response. GRA

N80-20872# Boeing Aerospace Co., Seattle, Wash.

EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS Cu(2-x)Se Quarterly Technical Progress Report, 1 May - 1 Aug. 1979

R. A. Mickelsen, J. M. Stewart, W. S. Chen, and L. F. Buldhaupt Aug. 1979 17 p refs

(Contract DE-AC04-79ET-23005)

(DOE/ET-23005/T1; QTPR-1) Avail: NTIS HC A02/MF A01

The feasibility of using Cu/sub 2-x7Se as a semiconductor material for the low cost production of photovoltaic solar cells was studied. The emphazis was to produce Cu/sub 2-xSe films of good uniformity and reproducibility. The films are deposited onto glass substrates heated to approximately 200 C. The Cu and Se are evaporated from separate sources, each individually monitored for rate by quartz crystal microbalances. The techniques used are readily adaptable for scale up to large volume production. Preliminary measurements of optical absorption, electron diffraction, and Hall measurements were made. DOE

N80-20873# Thermo Electron Corp., Waltham, Mass.

DOE/JPL ADVANCED THERMIONIC TECHNOLOGY PROGRAM Progress Report, Dec. 1978 - Jan. 1979

1979 63 p refs

(Contract EY-76-C-02-3056)

(COO-3056-37; PR-37) Avail: NTIS HC A04/MF A01

Continuing research on thermionic converters is described. Topics include thermionic converter plasma studies, low temperature converter development, component hardware development, and combustion-heated thermionic device. Basic surface experiments, tripole converter experiments, design of cylindrical converter, and high efficiency conversion experiments are described. DOE

N80-20874# Sandia Corp., Albuquerque, N. Mex. Advanced Energy Projects Div.

MECHANICAL ENERGY STORAGE TECHNOLOGY DEVELOPMENT Annual Report, 1978 - 1979

Sep. 1979 31 p refs

(Contract EY-76-C-04-0789)

(SAND-79-1151) Avail: NTIS HC A03/MF A01

Program efforts to evolve components for flywheel energy storage systems are described. Components discussed include: commercial wheels, bearings, and vacuum technology. R.E.S.

N80-20875# Sandia Corp., Albuquerque, N. Mex. Fluid Mechanics and Heat Transfer Div.
NUMERICAL SIMULATION OF DUAL-MEDIA THERMAL ENERGY STORAGE SYSTEMS
Robert J. Gross, Charles E. Hickox, and Colin E. Hackett Aug. 1979 32 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2282) Avail: NTIS HC A03/MF A01

A finite-difference, predictor-corrector, numerical technique is used to solve for fluid and solid temperature distributions in one dimensional flow through a finite length packed bed. The method allows for temperature dependent properties, time varying inlet conditions and nonuniform initial conditions. Computed results agree with the classical Schumann model to within 1% in simulations which exhibit thermal gradients as large as 310 C/m. Additional examples illustrate the attractive characteristics of the method, namely its accuracy, flexibility, ease of implementation, and computational efficiency. DOE

N80-20876# Burns and McDonnell, Kansas City, Mo.
FEASIBILITY OF COGENERATION APPLICATION OF A 4.8 MW FUEL CELL POWER PLANT AT A SANTA CLARA, CALIFORNIA PAPER MILL Final Report
D. E. Criner Jul. 1979 300 p refs
(Contract ET-78-C-03-2189)
(SAN-2189-T1; Rept-78-805-4-005) Avail: NTIS HC A13/MF A01

The feasibility of employing a 4.8-MW fuel cell power plant in a cogeneration mode was evaluated. Ways for utilizing the waste heat from the fuel cell within the paper mill were studied. Several uses were identified which would reduce the amount of process steam now generated by conventional fossil fuel boilers in the paper mill. The electrical energy from the fuel cell could be fed to the municipal electric system or could be used directly by the paper mill, depending upon the form of ownership for the fuel cell. Economic analyses were performed for several scenarios involving different fuels and ownership arrangements. Breakeven capital costs for the fuel cell power plant were computed for the various scenarios. Sensitivity studies were performed to determine the impact of variations in assumed base values for fuel price, electric rates, and other parameters. The environmental implications of the fuel cell power plant were also assessed. DOE

N80-20877# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
ENERGY EFFICIENT BUILDINGS PROGRAM Annual Report
Aug. 1979 68 p refs
(Contract W-7405-eng-48)
(LBL-9576; EEB-79-5) Avail: NTIS HC A04/MF A01

Experimental and theoretical research into energy use in buildings, and the analysis of energy conservation strategies and measures are outlined. Topics discussed include: (1) building envelopes program; (2) ventilation program; (3) indoor air quality - gas stove emissions; (4) DOE-1 computer program for building energy analysis; (5) schools program; (6) hospitals program; (7) energy efficient windows program; (8) energy efficient lighting program; and (9) passive systems analysis and design. DOE

N80-20878# Argonne National Lab., Ill. Energy and Environmental Systems Div.
PROJECTIONS OF DIRECT ENERGY CONSUMPTION BY MODE: THE 1975 - 2000 BASELINE
Rita E. Knorr and Marianne Miller Aug. 1979 139 p refs
(Contract W-31-109-eng-38)
(ANL/CNSV-4) Avail: NTIS HC A07/MF A01

A comprehensive set of activity and energy-demand projections are presented for each of the major transportation modes and submodes. Projections were developed for a business-as-usual case which provides a benchmark for assessing the impact of potential conservation strategies. This baseline case assumes a continuation of present trends and no new energy-conserving programs beyond currently mandated fuel economy stands. However, because of anticipated changes in personal vehicle fuel economy, fuel prices, modal shifts, and a lower than historic rate of economic growth, projected growth rates in transportation activity and energy consumption depart from historic patterns. The factors responsible for this departure are discussed. The assumption and methodologies used to develop the modal projections are described and the projections are discussed with other efforts. DOE

N80-20879# Illinois Univ., Chicago. Dept. of Energy Engineering.
THERMAL FLUID SELECTION FOR LONG-DISTANCE HEAT TRANSMISSION
S. Szepe and J. M. Calm 1979 8 p refs Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979 Prepared in cooperation with Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(CONF-790803-47) Avail: NTIS HC A02/MF A01

A model for evaluating fluids for long distance thermal energy transport is presented. The model uses power function approximations for physical and economical relations, and its simplified version provides analytical insights into the optimal allocation of major cost components as well as a solution for the total transmission cost. The model was used to develop a criterion for screening candidate liquids for long distance thermal energy transport. The criterion derived is dependent on the physical properties and unit costs of the candidate fluids, and on the transport requirements. It can be used for fast screening and ranking of a great number of fluids. This approach may save considerable effort by eliminating the need for detailed engineering, economic, environmental, and safety studies on those fluids which would ultimately prove economically undesirable. Representative fluids are discussed and compared with the reference case of transmission by hot water. DOE

N80-20880# Dubin-Bloome Associates, New York.
HEAT-PUMP-CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEM DEVELOPMENT Final Report
Fred S. Dubin, Paul Herzog, and Amos Halfon Aug. 1979 450 p refs
(Contract W-31-109-eng-38)
(ANL/CNSV-TM-8) Avail: NTIS HC A19/MF A01

The performance of heat-pump centered integrated community energy systems (HP-ICES) is reported for two case studies, one in Washington, D.C. and the other in Boston, Massachusetts. The ice-generating HP-ICES uses the heat of fusion of water as a heat source for the heat pump, thus converting the water into ice. The ice is sorted in a bin and used the following summer for cooling, which, therefore, could be considered a byproduct of heating. The annual source energy input and the return on investment is cited for each project. The life cycle annual average cost and annual average operating and administration cost for the HP-ICES is given in comparison to corresponding quantities and costs of a conventional central system with equal heating and cooling capacity. DOE

N80-20881# Technical Information Center, Oak Ridge, Tenn.
ENERGY INFORMATION DATA BASE Report, Feb. 1978 - Sep. 1979
Sep. 1979 124 p refs Supplement to TID-4579-R10
(DOE/TIC-4579-R10-Suppl-6) Avail: NTIS HC A06/MF A01

Changes and additions to TID-4579-R10 (the authority list for serial titles) are presented. The supplement is cumulative from February 1978. DOE

N80-20882# Midwest Research Inst., Golden, Colo.
CONVERSION SYSTEM OVERVIEW ASSESSMENT. VOLUME 1: SOLAR THERMOELECTRICS
T. S. Jayadev, J. Henderson, J. Finegold, and D. Benson Aug. 1979 214 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-35-078-Vol-1) Avail: NTIS HC A10/MF A01

An assessment of thermoelectrics for solar energy conversion is given. There is significant potential for solar thermoelectrics in solar technologies where collector costs are low; e.g., Ocean Thermal Energy Conversion and solar ponds. Reports of two studies by manufacturers assessing the cost of thermoelectric generators in large scale production are included and several new concepts thermoelectric systems are presented. DOE

N80-20883# Midwest Research Inst., Golden, Colo.
WIND ENERGY INFORMATION DIRECTORY
Oct. 1979 30 p refs
(Contract EG-77-C-01-4042)
(SERI/SP-69-290) Avail: NTIS HC A03/MF A01

Wind Energy Information was prepared to provide researchers, designers, manufacturers, distributors, dealers, and users of wind energy conversion systems, with easy access to technical information. This directory lists organizations and publications which have the main objective of promoting the use of wind energy conversion systems, some organizations that can respond to requests for information on wind energy or make referrals to other sources of information, and some publications that occasionally include information on wind energy. DOE

N80-20884# Physical Sciences, Inc., Woburn, Mass.
PERFORMANCE MODEL FOR MOLTEN CARBONATE FUEL CELLS Final Report, 5 Jul. 1978 - 5 Jul. 1979
G. Wilemski, T. Wolf, D. Bloomfield, M. L. Finson, E. R. Pugh, and K. L. Wray Aug. 1979 171 p refs
(Contract ET-78-C-03-2083)
(TR-190) Avail: NTIS HC A06/MF A01

The development of a performance model for molten carbonate fuel cells is reported. Key physical and chemical phenomena modeled include mass transport, ohmic losses, electrode kinetics, fuel and oxidant utilization, gas phase convective heat transfer and in-plane heat conduction through cell hardware. Numerical schemes were developed and programmed to calculate overpotential versus current density curves for individual electrodes, current-voltage performance curves for entire cells, the cell current density distribution, and the cell temperature distribution. Agreement between model predictions and available experimental data for isothermal electrode and cell performance ranges from good to excellent. Predictions of nonisothermal cell performance are also presented and discussed. DOE

N80-20885# Energy and Environmental Analysis, Inc., Arlington, Va.
INDUSTRIAL SECTOR TECHNOLOGY USE MODEL (ISTUM): INDUSTRIAL ENERGY USE IN THE UNITED STATES, 1974 - 2000. VOLUME 2: RESULTS Final Report
Oct. 1979 117 p
(Contract EX-76-C-01-2344)
(DOE/FE-2344/2) Avail: NTIS HC A06/MF A01

The results of the initial base-case run of ISTUM are presented in four sections: (1) introduction; (2) projected trends in industrial fuel consumption; (3) projected contributions of technologies to the industrial sector (fossil, conservation, solar, geothermal, coal direct heat cogeneration, conventional technologies); and (4) service sector perspectives of ISTUM base-case results (steam sector, intermediate and dirty direct heat, coal-capable indirect heat, machine-drive service sector, electrolyte sector, space heat, not coal-capable indirect heat, calcining, glass melting, brick and clay firing, iron making, steel reheating). DOE

N80-20886# Brookhaven National Lab., Upton, N. Y.
HYDROGEN STORAGE FOR AUTOMOBILES
G. Strickland 1979 4 p refs Presented at the DOE Chem. Energy Storage and Hydrogen Energy Systems Contracts Rev. Meeting, Reston, Va., 12 Nov. 1979
(Contract EY-76-C-02-0016)
(BNL-26906; CONF-791127-5) Avail: NTIS HC A02/MF A01

An analysis of hydrogen-fueled automobiles is presented. The hydrogen is stored either as a metal hydride at moderate pressure in TiFe-Mn-H/sub x/ and at low pressure in MgH/sub x/ catalyzed with 10 wt % Ni, or it is stored in hollow glass microspheres at pressures up to about 400 atm. Each system is briefly described. The results of the vehicle analysis are compared with those for the conventional automobile and with electric vehicles powered by Pb-acid or Ni-Zn batteries. Comparisons are made on the basis of automobile weight, initial user cost, and life-cycle cost. The results are limited to those for the 5-passenger vehicle in the period 1985-1990, and are provided as probable and optimistic values. DOE

N80-20887# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
RESIDENTIAL SOLAR HEATING AND COOLING USING EVACUATED TUBE SOLAR COLLECTORS: CSN SOLAR HOUSE 3 Final Report, 1 Feb. 1976 - 30 Sep. 1978
D. S. Ward, J. C. Ward, and H. S. Oberoi Mar. 1979 119 p refs
(Contract EY-76-S-02-2858)
(COO-2858-24-Summ) Avail: NTIS HC A06/MF A01

A residential solar heating and cooling system utilizing an array of evacuated tube solar collectors was evaluated. The evacuated tube collectors were removed and replaced with a state of the art liquid-heating flat plate solar collector array. The installation, performance, and operating experience of the evacuated tube solar collector integrated with the CSU Solar House 3 residential sized solar heating and cooling system was examined. DOE

N80-20888# General Atomic Co., San Diego, Calif.
INSTALLATION AND STARTUP OF THE FIXED MIRROR SOLAR CONCENTRATOR COLLECTOR FIELD SUBSYSTEM Final Report, 31 Jan. 1977 - 31 Mar. 1979
G. H. Eggers Jun. 1979 111 p refs
(Contract EY-76-C-04-0789)
(GA-A-15344; SAND-79-7015) Avail: NTIS HC A06/MF A01

The design, fabrication, installation, and startup of the fixed mirror solar concentrator is described. The total system cost was $773 per m squared. The system cost projection for a commercial plant is $188.73 per m squared. At design conditions, with the oil inlet temperature at 245 C and the oil outlet temperature at 316 C, the peak system efficiency at noon was 36.8%. DOE

N80-20889# Woodard-Clyde Consultants, San Francisco, Calif. Fossil Fuel and Advanced Systems Div.
ENVIRONMENTAL ASSESSMENT METHODOLOGY: SOLAR POWER PLANT APPLICATIONS. VOLUME 3. ENVIRONMENTAL IMPACT ASSESSMENT APPLICATION Final Report
K. Nair and A. Sicherman May 1979 112 p refs
(EPRI Proj. 551)
(EPRI-ER-1070-Vol-3) Avail: NTIS HC A06/MF A01

The environmental impact assessment methodology described in another volume is applied to a problem of site selection for solar thermal power plants. Environmental impact assessment of selected solar-thermal sites are compared. Certain potential impacts of solar-thermal and wind energy central systems are examined. In appendix A a data base system that was used to organize the literature on selected data base sites is described. Appendix B contains detailed calculations and preliminary data used in the environmental impact assessment. Appendix C presents a discussion of generic attributes for measuring biological impacts. Appendix D is a selected bibliography of general references dealing with environmental impacts of solar-thermal and wind energy central systems. DOE

N80-20890# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
EVALUATION OF A SULFUR OXIDE CHEMICAL HEAT STORAGE PROCESS FOR A STEAM SOLAR ELECTRIC PLANT
Joshua Dayan, Scott Lynn, and Alan Foss Jul. 1979 198 p refs Revised
(Contract W-7405-eng-48)
(LBL-7868-Rev) Avail: NTIS HC A09/MF A01

A technically feasible process configuration was developed for the sulfur oxide system, 2 SO3 reversible 2 SO2 + O2 in energy storage. Complete material and energy balances are presented for a base case that represents a middle range of expected operating conditions. Equipment sizes and costs were estimated for the base case to obtain an approximate value for the cost of the electricity that would be produced from such an installation. In addition, the sensitivity of the efficiency of the system to variations in design and operating conditions was determined for the most important parameters and design details. The overall efficiency of converting heat into electricity is about 26%. DOE

N80-20891# Sandia Labs., Albuquerque, N. Mex.
DARRIEUS VERTICAL AXIS WIND TURBINE PROGRAM OVERVIEW
Richard H. Braasch 1979 15 p refs Presented at the 4th Biennial Conf. and Workshop on Wind Energy Conversion Systems, Washington, D.C., 28 Oct. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP00789)
(SAND-79-2146C; CONF-791097-1) Avail: NTIS HC A02/MF A01

Some of the more salient recent developments in the Darrieus vertical axis wind turbine technology are presented. First generation costs and future plans are discussed. Potential design improvements are presented along with their cost benefits. Aerodynamic structural, and system analyses capabilities were developed to support and evaluate the system design. DOE

N80-20892# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
WIND ENERGY SYSTEMS Quarterly Review, 1 Jul. - 30 Sep. 1979
Dec. 1979 176 p
(Contract EG-77-C-01-4042)
(SERI/PR-351-480) Avail: NTIS HC A09/MF A01

An overview of the wind energy systems (WES) program is presented. The objectives, accomplishments, activities, and outputs of each of the tasks in the WES program are described. DOE

N80-20893# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
OPTICAL ANALYSIS AND OPTIMIZATION OF LINE FOCUS COLLECTORS
P. Bendt, A. Rabl, H. W. Gaul, and K. A. Reed Sep. 1979 73 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-34-092) Avail: NTIS HC A04/MF A01

A macroscopic approach to the optical analysis of a solar concentrator is described. The method yields all the parameters needed for the optical design of line focus parabolic troughs. The flux at the receiver is determined as a function of concentrator along with receiver size, width of Sun, and optical errors. All causes of image spreading are quantified as angular standard deviation. Ray tracing with a real reflector and a real Sun is shown to be equivalent to convoluting the angular acceptance function of a perfect concentrator with an effective radiation source. This effective source, in turn, is obtained by convoluting the distribution function of optical errors with the angular profile of the Sun. The problem is reduced to two dimensions by projecting the three dimensional motion of the Sun on the plane normal to the tracking axis. In this frame the apparent width of the Sun increases with incidence angle. A formula and a simple graphical procedure are provided for finding the optimal geometric concentration ratio, maximizing net power output. The results are illustrated by specific examples. DOE

N80-20894# TRW, Inc., McLean, Va. Energy Systems Group.
THERMAL ENERGY STORAGE APPLICATION AREAS
Mar. 1979 105 p
(Contract EC-77-C-01-5113)
(CONS/5113-T4) Avail: NTIS HC A06/MF A01

The use of thermal energy storage in the areas of building heating and cooling, recovery of industrial process and waste heat, solar power generation, and off-peak storage and load management in electric utilities is reviewed. DOE

N80-20895# Center for Legislative Improvement, Denver, Colo.
ENERGY SOURCE BOOK
Dewitt John and Davey Klearman Aug. 1979 167 p
(Contract EW-78-X-48-0409)
(DOE/TIC-10190) Avail: NTIS HC A08/MF A01

Data are compiled on energy sources for the Rocky Mountain Region. The National Energy Act, major Federal energy legislation, and the state energy legislation, 1974-1979, are covered. Energy consumption and conservation are discussed with the aid of charts and statistics. Topics discussed include potential for energy conservation in the Mountain-Plain States; potential energy savings from Weatherization; residential energy conservation programs; and thermal efficiency standards for new buildings; energy reserves and production by state: oil, gas, coal, and uranium; potential for energy production from renewable and non-conventional sources; oil refining capacity; pipelines and movement of petroleum; electrical generation; water requirements for energy production; and severance taxes in the Mountain-Plain States. Information sources and a glossary are provided. DOE

N80-20896# Brookhaven National Lab., Upton, N. Y.
PERFORMANCE OF HEAT PUMPS AT ELEVATED EVAPORATING TEMPERATURES WITH APPLICATION TO SOLAR INPUT
E. A. Kush 1979 9 p refs Presented at the ASME Ann. Meeting, New York, 3-7 Dec. 1979
(BNL-26772; CONF-791205-15) Avail: NTIS HC A02/MF A01

The performance of the heat pump component in the solar-assisted heat pump (SAHP) system was investigated under conditions attendant to series solar input. Theoretical predictions, results of systematic experiments run on a special heat pump simulator, and interpretation/analysis of how high coefficients of performance heat pumps can be used in installed SAHP systems are presented. DOE

N80-20897# Los Alamos Scientific Lab., N. Mex.
THE 1-GWh DIURNAL LOAD-LEVELING SUPERCONDUCTING MAGNETIC ENERGY STORAGE SYSTEM REFERENCE DESIGN. APPENDIX C: DEWAR AND STRUCTURAL SUPPORT
J. G. Bennett and F. D. Ju Sep. 1979 56 p refs
(Contract W-7405-eng-36)
(LA-7885-MS-Vol-6) Avail: NTIS HC A04/MF A01

The mechanical aspects of the dewar to contain a 1-GWh superconducting coil in a 1.8 K helium bath are discussed along with the means for supporting the coil and dewar against the rock of an underground excavation. DOE

N80-20898# Oak Ridge National Lab., Tenn.
PERSPECTIVE ON WORLD ENERGY
Truman D. Anderson 25 Sep. 1979 25 p
(Contract W-7405-eng-26)
(DOE/TIC-10273) Avail: NTIS HC A02/MF A01

The problems associated with a rapidly increasing world population in the midst of fixed land resources are addressed. The unconventional resources of oil, gas, and uranium are compared in terms of abundance to conventional reserves. Nuclear fission energy is evaluated for its capability of solely supporting the world energy demands. DOE

N80-20899# Spectrolab, Inc., Sylmar, Calif.
DESIGN AND FABRICATION OF PROTOTYPE COMBINED PHOTOVOLTAIC/THERMAL NON-TRACKING COLLECTOR
H. Jandorf, L. Flourswetz, and F. M. Schwartz Jun. 1979 56 p
(Contract EY-76-C-04-0789)
(SAND-79-7014) Avail: NTIS HC A04/MF A01

Work performed to design, fabricate, test and analyze future production costs of a combined photovoltaic/thermal collector is summarized. Design improvement recommendations and future applications of the combined collector are considered. DOE

N80-20900# Wisconsin Univ. - Madison.
INTERFEROMETRIC STUDY OF THE NATURAL CONVECTION CHARACTERISTICS OF FLAT PLATE, SLAT AND VEE-CORRUGATED SOLAR COLLECTORS Final Report
M. M. ElWakil and J. W. Mitchell 30 Jun. 1979 7 p
(Contract EY-76-S-02-2971)
(COO-2971-6) Avail: NTIS HC A02/MF A01

The natural convection heat transfer relations for the heat transfer between absorber and cover plates of solar collectors were studied. Interferometric techniques were employed to evaluate the local coefficients. Average values were obtained by integration of the local values. The results are presented in terms of correlations between Nusselt number and Grashof number. The investigations were carried out over tilt angles of 45 to 90 degrees. The Grashof number range tested was representative of that existing in flat plate collectors. The various geometrics included large flat enclosures, small aspect ratio enclosures representative of honeycomb or slat collectors, vee-corrugated

(vee-grooved) collectors, and compound parabolic concentrators. DOE

N80-20901# California Univ., Berkeley. Lawrence Berkeley Lab.
METHODOLOGY FOR EVALUATING PHYSICAL CONSTRAINTS ON RESIDENTIAL SOLAR ENERGY USE
P. L. Smith and S. T. McCreary 1979 73 p refs
(Contract W-7405-eng-48)
(UCRL-15001) Avail: NTIS HC A04/MF A01

A procedure is set forth for assessing physical constraints on solar energy use at the site scale and for computerized findings as a data base for analysis at the community, sub-community, and individual parcel scales. Background information regarding the development of the project is presented. Next, the solar technologies being considered, their requirements for optimal performance, and physical constraints on the achievement of those requirements are described. This theoretical discussion is followed by a description of its application to a case study community. A discussion of the types of analyses in which the computerized data can be used is followed by a discussion of the way in which these analyses can be used at various points in governmental and private planning and decision-making processes. DOE

N80-20902# Mitre Corp., McLean, Va.
STATUS OF THE DOE BATTERY AND ELECTROCHEMICAL TECHNOLOGY PROGRAM
R. Roberts Sep. 1979 177 p refs
(Contract ET-78-C-01-3295)
(MTR-8026) Avail: NTIS HC A09/MF A01

Research on electrochemical storage systems is reviewed with emphasis on secondary batteries. Batteries in the research, development, and demonstration phases include nickel/iron, lithium/metal sulfide, zinc/chloride, metal/air, and hydrogen/chlorine. Supporting research on the morphology of active materials and cell performance is also reviewed. Potential contributions of the battery program to electric vehicles, photovoltaic systems, distributed electrical systems, and industrial energy conservation are discussed. K.L.

N80-20903# Battelle Pacific Northwest Labs., Richland, Wash.
ECONOMICS OF THERMAL ENERGY STORAGE FOR COMPRESSED AIR ENERGY STORAGE SYSTEMS
S. C. Schulte Aug. 1979 8 p refs
(Contract EY-76-C-06-1830)
(PNL-SA-7949) Avail: NTIS HC A02/MF A01

The costs of compressed air energy storage (CAES) systems utilizing thermal energy storage are compared with the costs of conventional CAES systems and combustion gas turbine systems. Comparisons are made on the basis of system energy cost levelized over system operating lifetime (mills/kWh). Two principal conclusions resulted from the study. First, given today's fuel prices and the expected fuel prices in the 1980's, conventional CAES systems yield lower energy cost estimates than combustion gas turbine systems. Second, thermal energy system storage/adiabatic CAES systems yield equivalent and, in some instances, slightly lower energy cost estimates than conventional CAES systems while requiring considerably less turbine fuel oil. DOE

N80-20904# Battelle Pacific Northwest Labs., Richland, Wash.
ECONOMICS OF COMPRESSED AIR ENERGY STORAGE EMPLOYING THERMAL ENERGY STORAGE
S. C. Schulte and R. W. Reilly Nov. 1979 34 p refs
(Contract EY-76-C-06-1830)
(PNL-3191) Avail: NTIS HC A03/MF A01

System design and capital cost estimates are adopted from three independent studies to arrive at a series of levelized energy costs over a system's lifetime. In addition, some analyses are provided to gauge the sensitivity of these levelized energy costs to fuel and compression energy costs and to system capacity factors. The systems chosen for comparison are conventional CAES, hybrid CAES, adiabatic CAES, and an advanced-design gas turbine. In conventional CAES systems the heat of compression generated during the storage operation is rejected to the environment, and later, during the energy generation phase, turbine fuel must be burned to reheat the compressed air. In the hybrid systems some of the heat of compression is stored and reapplied later during the generation phase, thereby reducing turbine fuel requirements. The adiabatic systems store adequate thermal energy to eliminate the need for turbine fuel entirely. The gas turbine is included within the report for comparison purposes. DOE

N80-20905# Department of Energy, Washington, D. C.
BIOMASS ENERGY SYSTEMS: ENVIRONMENTAL READINESS DOCUMENT
Sep. 1979 50 p
(DOE/ERD-0021) Avail: NTIS HC A03/MF A01

A number of environmental and socio-economic impacts of biomass energy systems are identified. The large land and water requirements for terrestrial biomass energy production might lead to socio-economic conflicts. It might also lead to an increase in potential for air and water erosion of the soil. Severe ecosystems impacts would result from disturbing 100 million acres of marginal farm land and 350 million acres of forest land. Removal of residues could increase nutrient removal and reduce the amount of organic matter returning to the soil and limit future biomass production. Air pollution from the direct combustion of biomass must be considered. The systems of ethanol with stillage is dependent on the feedstock. The energy costs to purify the ethanol and pollution control costs appear to prevent economical production of ethanol in the near term. DOE

N80-20906# Poly Solar, Inc., Garland, Tex.
LOW COST THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS Quarterly Report, 15 Mar. - 30 Jun. 1979
J. D. Crownover and G. A. VanderLeeden Jul. 1979 20 p refs
(Contract DE-AC03-79ET-23048)
(DOE/ET-23048/1; QR-1) Avail: NTIS HC A02/MF A01

Major efforts during this period were directed to the organization and planning of the overall technical approaches, particularly in regard to the preparation of metallurgical silicon substrates. The zone-melting technique was selected for the preparation of substrates, and a moving-coil zone-melting apparatus was designed and constructed. A chemical vapor deposition apparatus for the deposition of the active region of solar cell was also designed and constructed. In addition, the purification of metallurgical silicon by acid-extraction was investigated semi-quantitatively. DOE

N80-20907# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
LIMITS TO ENERGY MODELING
A. M. Weinberg Sep. 1979 19 p refs
(Contract EY-76-C-05-0033)
(ORAU-IEA-79-16(0)) Avail: NTIS HC A02/MF A01

The limitations of energy modeling are described. Possible approaches to energy policy that avoid the necessity of depending on uncertain predictions are discussed. R.E.S.

N80-20908# Stanford Univ., Calif. Dept. of Operations Research.
DETERMINING THE FEASIBILITY OF INCORPORATING WATER RESOURCE CONSTRAINTS INTO ENERGY MODELS Final Report
N. Buras Aug. 1979 132 p refs Sponsored by Elec. Power Res. Inst.
(EPRI-EA-1147) Avail: NTIS HC A07/MF A01

The availability of regional water resources for energy related activities is discussed in terms of the feasibility of integrating these availabilities into energy models. Following reviews of water resources data bases, of technologies involved in energy development, and of energy models with regional disaggregation, two models are used for the study of this integration: the Regional Energy System Optimization Model (RESOM), and the Energy Policy Model (EPM). Water resources constraints are introduced in these models, and exploratory computer runs using demonstration scenarios are made. The test scenarios assumed that nonenergy users would make increasing demands upon regional water resources, leaving limited amounts of increasingly more expensive water for energy activities. The results of the exploratory runs demonstrate the feasibility of

integrating water resources availabilities and water consumption data into energy-economy models. DOE

N80-20909*# Paragon Pacific, Inc., El Segundo, Calif.
WIND ENERGY SYSTEM TIME-DOMAIN (WEST) ANALYZERS USING HYBRID SIMULATION TECHNIQUES Final Report
John A. Hoffman Oct. 1979 30 p refs Prepared for NASA and DOE
(Contracts DEN3-26)
(NASA-CR-159737; PPI-1030-6; DOE/NASA/0026-79/1) Avail: NTIS HC A03/MF A01 CSCL 10B

Two stand-alone analyzers constructed for real time simulation of the complex dynamic characteristics of horizontal-axis wind energy systems are described. Mathematical models for an aeroelastic rotor, including nonlinear aerodynamic and elastic loads, are implemented with high speed digital and analog circuitry. Models for elastic supports, a power train, a control system, and a rotor gimbal system are also included. Limited correlation efforts show good comparisons between results produced by the analyzers and results produced by a large digital simulation. The digital simulation results correlate well with test data. K.L.

N80-20910# National Technical Information Service, Springfield, Va.
SOLAR WATER PUMPS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979
Audrey S. Hundemann Dec. 1979 71 p Supersedes NTIS/PS-78/1288; NTIS/PS-77/1161
(PB80-802531; NTIS/PS-78/1288; NTIS/PS-77/1161) Avail: NTIS HC $30.00/MF $30.00 CSCL 02C

Design concepts and the technical and economic feasibility of using solar energy to pump water are discussed in abstracts from worldwide literature. Topic areas cover the use of solar heat actuated Rankine cycle engines and free cylinder Stirling engines for solar powered water pumps, pumps driven by photovoltaic modules, and application of solar pumps to irrigation and electric power generation. This updated bibliography contains 85 abstracts, 25 of which are new entries to the previous edition. GRA

N80-20911# General Accounting Office, Washington, D. C. Energy and Minerals Div.
HOW TO BURN COAL EFFICIENTLY AND ECONOMICALLY, AND MEET AIR POLLUTION REQUIREMENTS: THE FLUIDIZED-BED COMBUSTION PROCESS
9 Nov. 1979 56 p
(PB80-107501; EMD-80-12) Avail: NTIS HC A04/MF A01 CSCL 13B

The Department of Energy's program to demonstrate fluidized bed coal combustion are presented as well as ways the program could be improved. It specifically recommends that the Secretary of Energy: (1) enter into an interagency agreement with the Department of Defense to place industrial demonstration plants in Defense industrial facilities; and (2) enter into an interagency agreement with the Tennessee Valley Authority for hosting the 200-megawatt utility demonstration plant. The questionable need and utility of a component test and integration unit are discussed and options for terminating the contractor and selling or modifying the facility for other uses are suggested. GRA

N80-20912# Cedar Associates, Evanston, Ill.
SNOW AND ICE ACCUMULATION AT SOLAR COLLECTOR INSTALLATIONS IN THE CHICAGO METROPOLITAN AREA Final Report
Ross B. Corotis, Charles H. Dowding, and Edwin C. Rossow Aug. 1979 109 p Sponsored in part by DOE, Washington, D.C.
(PB80-113749; NBS-GCR-79-181) Avail: NTIS HC A06/MF A01 CSCL 10A

Observations and data concerning snow and ice on eighteen flat plate solar collector installations in the Chicago area are presented. The data were collected in February and March of 1979, following a record snowfall in January. Nearly all of the installations were on the roofs of buildings, and about half were mounted flush with the roof. The remainder were mounted on racks at an angle to the roof. Sketches and photographs of the buildings and snow accumulation, weather data for the entire winter, and comments of the owners are included, as well as a technique for the extraction of linear measurements from the photographs. GRA

N80-20913# New Mexico Univ., Albuquerque. Dept. of Physics.
SOLAR PONDS FOR RESIDENTIAL HEATING, HEAT EXTRACTION FROM A SALT GRADIENT SOLAR POND Final Report, 19 Aug. 1976 - 30 Jun. 1977
F. Zangrando and H. C. Bryant Jul. 1979 41 p refs Sponsored in part by New Mexico Energy and Minerals Dept., Santa Fe
(PB80-108624; NMEI-45) Avail: NTIS HC A03/MF A01 CSCL 10A

A salt gradient solar pond is an efficient, low cost solar energy collection and long range storage system for low temperature heat. Research efforts to establish operational parameters, selection criteria for the materials to be used, cost and performance are described. The physical behavior of doubly diffusive systems exposed to the environment was also studied. GRA

N80-20914# New Mexico Energy Inst., Las Cruces. Mechanical Engineering Dept.
AN ECONOMICAL SOLAR HEATED AND COOLED RESIDENCE FOR SOUTHERN NEW MEXICO Final Report, 1 Sep. 1976 - 31 Aug. 1979
Thomas R. Mancini and Phillip R. Smith Jul. 1979 51 p refs
(PB80-108616; NMEI-16) Avail: NTIS HC A04/MF A01 CSCL 13A

The construction and performance of 'Skytherm' solar heated and cooled passive house located on the campus of New Mexico State University in Las Cruces, New Mexico are described. GRA

N80-20915# National Zoological Park, Washington, D.C.
NATIONAL SOLAR HEATING AND COOLING PROGRAMS
Aug. 1979 64 p refs Presented at the Intern. Solar Energy Society Congress, Atlanta, 28 May - 1 Jun. 1979
(Contract DE-AC01-79CS-30108)
(PB80-104987; CCMS-109) Avail: NTIS HC A04/MF A01 CSCL 13A

Status reports on the national solar heating and cooling programs of seventeen countries participating in the Committee on the Challenges of Modern Society's Solar Energy Pilot Study are presented. R.E.S.

N80-20916# Bureau of Reclamation, Denver, Colo. Electric Power Branch.
DEVELOPMENT AND EVALUATION OF A MODEL DOUBLY-FED MACHINE
F. R. Schleif Sep. 1979 75 p refs
(PB80-100662) Avail: NTIS HC A04/MF A01 CSCL 09C

The design and development of a model doubly-fed machine system was studied and evaluated for potential application on two generators and the pump/generating units of pump-storage projects. It was found that this problem of instability can be overcome. The machine has a wide variety of capabilities which are indicated to presently practical for exploitation to satisfy special needs such as adjustable speed, rapid synchronizing ability, system damping, or superior frequency control of an isolated system. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-20917 California Inst. of Tech., Pasadena.
ATMOSPHERIC TRANSPORT OF ACIDITY IN SOUTHERN CALIFORNIA BY WET AND DRY MECHANISMS Ph.D. Thesis
Howard Michael Liljestrand 1980 179 p
Avail: Univ. Microfilms Order No. 8006281

Acid precipitation samples were analyzed to determine acid and base composition. The concentrations of major cations and anions as well as trace weak acids were determined. The chemical

composition of the precipitation samples collected were modeled in several ways: (1) chemical balances to determine the contributions of sea salt, soil dust, stationary sources, mobile sources, and nonpoint sources of ammonia; (2) multiple regression analysis to relate ground level measurements of air quality and atmospheric conditions with rainwater nitrite plus nitrate and sulfate concentrations; and (3) gas-liquid equilibrium models.
Dissert. Abstr.

N80-20918 Marquette Univ., Milwaukee, Wis.
TRACE CHARACTERIZATION OF METALS IN SOLID SAMPLES AND AIR POLLUTANTS Ph.D. Thesis
Horng-Yih Wei 1978 159 p
Avail: Univ. Microfilms Order No. 8006562

A method for direct characterization of trace metals in solid samples is described. Solid samplers were first ground to powders and mixed with graphite powder followed by direct non-flame spectrophotometry. Several experimental parameters were studied for the determination of lead, cadmium and silver in rock samples via atomizers. Two novel methods are also described for the determination of lead pollutants in air. Subliter samples of air drawn through 6.4 mm diameter porous graphite disk were analyzed by either (1) direct non-flame atomization or (2) by a technique involving electrodeposition onto a tungsten coil which is subsequently used as an atomizer. Analytical results achieved on atmospheric samples by both of these methods are shown to agree well with results achieved using conventional methods.
Dissert. Abstr.

N80-20919 Arizona Univ., Tucson.
POLLUTANT FORMATION IN FLAT LAMINAR OPPOSED JET DIFFUSION FLAMES Ph.D. Thesis
Werner Artur Hahn 1979 206 p
Avail: Univ. Microfilms Order No. 8006739

It is shown that the opposed jet diffusion flame has one useful attribute that distinguishes it from all other diffusion flames. This feature is the one-dimensionality of the flame with respect to temperature, concentration, and axial (but, clearly, not radial) velocity profiles. This is shown by first applying a similarity transform on the radial velocity, converting the partial differential equations to ordinary differential equations and then numerically solving the momentum, energy, and species balance equations in a fully coupled manner. The numerical, variable mesh algorithm required for the solution of the resulting large set of very stiff, boundary valued, ordinary differential equations is presented. The model then allows determination of the correct velocity boundary conditions such that the flame is (mathematically) flat and one-dimensional.
Dissert. Abstr.

N80-20920*# National Aeronautics and Space Administration, Washington, D. C.
A GLOBAL BIOGEOCENOTICAL BIOSPHERE SIMULATION
N. N. Moiseyev Mar. 1980 12 p refs Transl. into ENGLISH from Biogeofiz. i Mate. Metody Issled. Geosistem (Moscow), 1978 p 37-49 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-76042) Avail: NTIS HC A02/MF A01 CSCL 13B

This model of the D. Forrester type, constructed in differential equations, predicts the food and mineral supply for the factors biosphere population, depending on two socio-economic factors, until about the year 2500. If contemporary rates of natural resources utilization are maintained and there is no management of the environment, food resources will begin to limit human population growth after 2200, and mineral resources will after 2300. A decrease in the biosphere pollution, increase in effective agricultural production, and discovery of new energy sources may forestall or completely avert the onset of a crisis situation. Conservation measures, according to the model, are to a considerable extent realizable only if carried out simultaneously in both areas.
Author

N80-20921# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: COAL EXTRACTION AND PREPARATION
Sep. 1979 98 p refs
(DOE/EDP-0050) Avail: NTIS HC A05/MF A01

The environmental strategy to be used by DOE to resolve environmental concerns associated with coal extraction and preparation will be to: (1) schedule environmental research in coordination with the development of the technology through its research, development and demonstration phases; (2) identify what environmental research is already underway; (3) provide for an Environmental Coordination Committee to ensure that the appropriate research is conducted in a timely manner; (4) schedule compliance activities, such as National Environmental Policy Act (NEPA) documents and Environmental Readiness Documents (ERD's) at appropriate times in the RD and D cycle; and (5) develop a monitoring approach to track the compliance of each technology with applicable Federal, State and local standards and with the performance goals established for that technology. The initial evaluation of the coal extraction and preparation program indicates that the demonstrations of technologies in the program will be undertaken within existing industrial mining/preparation facilities and therefore will not present significant identifiable impacts. Project-specific Environmental Assessment or Impact Statements will be made on a project specific basis. Even so, assessments must be made prior to the employment of program elements.
DOE

N80-20922# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN FOR SPACE APPLICATIONS
Sep. 1979 83 p refs
(DOE/EDP-0057) Avail: NTIS HC A05/MF A01

The planning and management requirements and schedules needed to evaluate and assess the environmental, health, and safety aspects of the Space Applications Program are identified. Environment is defined in its broadest sense to include environmental, health (occupational and public), safety, socioeconomic, legal, and institutional aspects. Topics considered include: (1) space nuclear power system nuclear fuel fabrication; (2) space nuclear power system heat source fabrication; (3) testing of subsystems and assembled systems; (4) research and development in support of space nuclear system development; (5) nuclear system responses to launch and reentry accidents; and (6) nuclear system environmental behavior and recovery.
DOE

N80-20923# Los Alamos Scientific Lab., N. Mex. Health Div.
PROTOTYPE PARTICULATE STACK SAMPLERS WITH SINGLE-CUT NOZZLE AND MICROCOMPUTER CALCULATING/DISPLAY SYSTEM
John C. Elder, Larry G. Littlefield, and Marvin I. Tillery 1979 20 p refs Presented at the Symp. on Advances in Particulate Sampling and Measurement, Daytona Beach, Fla., 7 Oct. 1979 (Contract W-7405-eng-36)
(LA-UR-79-2421; CONF-791018-1) Avail: NTIS HC A02/MF A01

A prototype particulate stack sampler (PPSS) was developed to improve on the existing EPA method five sampling apparatus. Its primary features are (1) higher sampling rate (56 l/min), (2) display (on demand) of all required variables and calculated values by a microcomputer-based calculating and display system; (3) continuous stack gas moisture determination; (4) a virtual impactor nozzle with 3 mu mass median diameter cutpoint which collects fine and coarse particle fractions on separate glass fiber filters; (5) a variable-area inlet to maintain isokinetic sampling conditions; and (6) conversion to stainless steel components from the glass specified by EPA method five.
DOE

N80-20924# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
DESIGN OF DATA ACQUISITION AND CONTROL SYSTEMS FOR ENVIRONMENTAL MONITORING AND MICROCLIMATE CONTROL M.S. Thesis
Daniel Paul Fuoco May 1979 83 p refs
(Contract EC-77-S-02-4397)
(COO-4397-T3) Avail: NTIS HC A05/MF A01

The automation and optimization of fruit production are discussed. The equipment that was developed are described as well as a brief methodology that considers how this equipment came to be.
DOE

N80-20925# California Univ., Livermore. Lawrence Livermore Lab. Environmental Instrumentation Group.
SURVEY OF INSTRUMENTATION FOR ENVIRONMENTAL MONITORING: MAJOR UPDATE. VOLUME 3: RADIATION
Sep. 1979 448 p
(Contract W-7405-eng-48)
(LBL-1-Vol-3) Avail: NTIS HC A19/MF A01

A comprehensive survey of instrumentation for environmental monitoring is presented. Consideration is given to instruments and techniques and to those developed for other purposes but having possible applications to radiation monitoring. The results of the survey are given as descriptions of the physical and operating characteristics of available instruments, critical comparisons among instrumentation methods, and recommendations of promising methodology and development of new instrumentation. Information is also given regarding the pollutants to be monitored, their characteristics and forms, their sources and pathways, their effects on the ecosystem, and the means of controlling them through process and regulatory controls. DOE

N80-20926# Woodard-Clyde Consultants, San Francisco, Calif.
ENVIRONMENTAL ASSESSMENT METHODOLOGY: SOLAR POWER PLANT APPLICATIONS. VOLUME 1. ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY Final Report
K. Nair and A. Sicherman May 1979 161 p refs
(EPRI Proj. 551)
(EPRI-ER-1070-Vol-1) Avail: NTIS HC A08/MF A01

A methodology for environmental impact assessment of solar power stations based on decision analysis is presented. A general overview of the methodology is given including a discussion of the issues warranting a formal analysis, the advantages of decision analysis from the decision maker's perspective, and some case study examples where the methodology was applied. The step-by-step implementation procedure for performing an environmental impact assessment using the methodology is described. The manner in which the methodology can incorporate cost into the analysis, both as a concern and as a yardstick of comparison, is discussed. Decision analysis and cost-benefit analysis are compared and contrasted. The appendix includes a bibliography concerning methods used by industry and/or government to make monetary estimates of environmental impacts. DOE

N80-20927# Oregon State Univ., Corvallis. Dept. of Atmospheric Science.
THEORETICAL ANALYSIS OF PERTURBATION SOLUTIONS TO THE PROBLEM OF INERTIAL CAPTURE OF AEROSOL PARTICLES Interim Report
S. C. Yoon Jul. 1979 34 p refs
(Contract EY-76-S-06-2227)
(RLO-2227-727-7) Avail: NTIS HC A03/MF A01

Perturbation solutions are sought to the problem of inertial capture of aerosol particles. An exact solution is obtained for the particle velocity along the axis of symmetry. The exact solution suggests that the perturbation solution is extremely accurate for all Stokes numbers except those very near the critical Stokes number. Also, under certain boundary conditions, the exact solution shows that inertial capture can occur even for particle with Stokes numbers less than the critical Stokes number. A computer extension technique is examined for the analysis and improvement of the perturbation series. DOE

N80-20928# Battelle Pacific Northwest Labs., Richland, Wash.
COMPREHENSIVE STUDY OF DRIFT FROM MECHANICAL DRAFT COOLING TOWERS Final Report
N. S. Laulainen, R. O. Webb (Environmental Systems Corp., Knoxville, Tenn.), K. R. Wilber (Environmental Systems Corp., Knoxville, Tenn.), and S. L. Ulanski (James Madison Univ., Harrisonburg, Va.) Sep. 1979 233 p refs
(Contract EY-76-C-06-1830)
(PNL-3083) Avail: NTIS HC A11/MF A01

Drift from mechanical draft cooling towers was studied by the simultaneous measurement of cooling tower source emission parameters meteorological variables, and drift deposition patterns during seven of eight test runs. Results from six of these test runs are presented and discussed. Substantial variation in drift emissions were noticed. Large day-to-day variations for a given cell and large cell-to-cell variations were observed. Meteorological conditions during the drift study were characterized by relatively high winds, warm temperatures and moderate humidities. The relatively high winds increased the uncertainty in the measured deposition patterns. In spite of the large (factor of 2 or 3) uncertainty in the measured deposition rates, preliminary calculations of drift deposition rates are in agreement with each other for test run 1. DOE

N80-20929# Energy and Environmental Analysis, Inc., Arlington, Va.
ADEQUACY ANALYSIS OF AIR QUALITY MONITORING ACTIVITIES RELEVANT TO CALIFORNIA THERMAL ENHANCED OIL RECOVERY FIELDS
Judy Matthews and J. Thomasian Nov. 1979 139 p refs
(Contract ET-78-C-01-3092)
(SAN-12093-1) Avail: NTIS HC A07/MF A01

A summary of enchanced oil recovery (EOR) activities in California is presented. Ambient air monitoring requirements are discussed in terms of state and Federal regulations. In addition, ambient air quality monitoring in California is considered with emphasis on specific monitoring requirements for new source regulation. An inventory of California EOR air quality monitoring activity is given and the adequacy of the air monitoring activity in the California EOR fields is discussed. DOE

N80-20930# Brookhaven National Lab., Upton, N. Y.
COAL-CONVERSION TECHNOLOGIES: SOME HEALTH AND ENVIRONMENTAL EFFECTS
S. C. Morris, P. D. Moskowitz, W. A. Sevian, S. Silberstein, and L. D. Hamilton Feb. 1979 27 p refs
(Contract EY-76-C-02-0016)
(BNL-5103; TID-4500) Avail: NTIS HC A03/MF A01

Selected health and environmental concerns of four coal conversion and four existing technologies are compared. Quantitative occupational health and safety estimates are presented covering extraction, transportation, distribution, processing, and conversion activities; also included are estimates of public health damage arising from fuel transportation and air pollution impacts. Qualitative estimates of health damage due to polycyclic organic matter and reduced sulfur are discussed. In general, energy inefficiencies, residuals, and implied environmental and health damages increase as follows: (1) direct combustion of natural gas and oil; (2) direct combustion of synthetic gas and oil; (3) central station electric power from synthetic gas; (4) central station electric power from coal; and (5) central station electric power from combustion of synthetic liquid fuels. Compliance and conflict of these technologies with Clean Air Act Amendments and other legislation are discussed. DOE

N80-20931# Water Research Centre, Stevenage (England).
[STUDIES OF WATER, 1978-1979] Annual Report
1979 32 p refs
Avail: NTIS HC A03/MF A01

Studies on water and health, wastewater treatment, water oriented economic problems, and environmental protection and monitoring are reported. The health effects of trace constituents in drinking water are discussed. Effluent quality and possibilities for its improvement are mentioned. The use of better methods and improved instrumentation in relation to environmental protection matters is discussed. Author (ESA)

N80-20932# Municipal Environmental Research Lab., Edison, N. J. Wastewater Research Div.
BIODEGRADATION AND TREATABILITY OF SPECIFIC POLLUTANTS Final Report
Edwin F. Barth and Robert L. Bunch Oct. 1979 69 p refs
(PB80-106438; EPA-600/9-79-034) Avail: NTIS HC A04/MF A01 CSCL 13B

Laboratory studies of the fate and effects of organics and metals in biological wastewater treatment processes are considered. The relationships between analytical control tests and biodegradation test methods are discussed. Various laboratory apparatuses for both continuous flow and static biodegradation methods are described. Both aerobic and anaerobic test results are included in the report. GRA

N80-20933# Research Triangle Inst., Research Triangle Park, N. C.
INTERPRETATION OF ENVIRONMENTAL ASSESSMENT DATA Final Report, Mar. 1978 - Sep. 1979
N. H. Sexton, F. W. Sexton, L. I. Southerland, and T. D. Hartwell. Sep. 1979. 242 p. refs.
(Contract EPA-68-02-2156)
(PB80-108160; EPA-600/7-79-226) Avail: NTIS
HC A11/MF A01 CSCL 13B

The preliminary attempts to formulate viable models for interpreting environmental assessment data are reported. The models are evaluated using data from the four most comprehensive environmental assessments. A format for entering environmental assessment results on FORTRAN computer sheets is presented and more complete data entry sheets are discussed. Various previously proposed models (source severity, source assessment models SAM/I, SAM/IA, and SAM/IB) are investigated using the data from the four previously mentioned studies. Correlations between biotests and chemical results, and between biotests, were calculated using the data from these four studies, a summary of possible correlations is presented. GRA

N80-20934# SRI International Corp., Menlo Park, Calif.
STRUCTURE REACTIVITY CORRELATIONS FOR ENVIRONMENTAL REACTIONS Final Report, 1 Apr. - 15 Aug. 1979
Theodore Mill. Sep. 1979. 66 p. refs.
(Contract EPA-68-01-4109)
(PB80-110323; EPA-560/11-79-012) Avail: NTIS
HC A04/MF A01 CSCL 07D

Many of the key rate constants needed to predict rates of transformation and transport of organic chemicals in water and air can be estimated from structure reactivity correlations (SRC) with reasonable accuracy. These rate constants can be coupled with environmental parameters such as pH or oxidant concentrations to provide estimates of rates of these processes under a variety of environmental conditions. An example is shown of the use of SRC methodology to estimate rate and equilibrium constants for a specific chemical. GRA

N80-20935# Science Applications, Inc., Pleasanton, Calif.
SYSTEMATIC SENSITIVITY ANALYSIS OF AIR QUALITY SIMULATION MODELS Final Report, Jan. - Dec. 1978
Robert J. Gentilne and J. Peter Vajk. May 1979. 107 p. refs.
(Contract EPA-68-02-2942)
(PB80-112162; EPA-600/4-79-035) Avail: NTIS
HC A06/MF A01 CSCL 13B

Systematic sensitivity and uncertainty analysis methods are reviewed and assessed for applications to air quality simulation models. Basic variables, mathematical foundations, user motivations and preferences, computer implementation properties, and costs (including both human and computer resources) are presented. Both deterministic and sampling methods are evaluated. Deterministic methods include the time-and user-honored method of arbitrary parameter adjustments by trial and error, variational methods, and by Green's function method (for kinetics systems only). Sampling methods include Monte Carlo sampling of the outputs of air quality models to compute variances and a Fourier analysis method of sampling model outputs to compute expectation values of sensitivity coefficients. GRA

N80-20936# Tennessee Valley Authority, Muscle Shoals, Ala. Div. of Environmental Planning.
APPLICATION OF GERMANIUM DETECTORS TO ENVIRONMENTAL MONITORING
Dale W. Nix, Robert P. Powers, and Larry G. Kanipe. Mar. 1979. 131 p. refs.
(PB80-113624; TVA/EP-79/08; EPA-600/7-79-054) Avail: NTIS HC A07/MF A01 CSCL 13D

The problems involved in applying germanium defectors to the analysis of environmental samples are discussed. All aspects of germanium spectroscopy equipment, system installation, quality control, energy and efficiency calibration, spectral analysis, analytical sensitivities, and cost considerations are surveyed. GRA

N80-20937# Brower Electronics Lab., Raleigh, N.C.
BETA GAUGE OPERATION MANUAL Final Report, Aug. 1976 - May 1979
Joe Seibert and Tom Sager. Aug. 1979. 38 p.
(Contract EPA-68-02-2431)
(PB80-112337; EPA-600/2-79-167) Avail: NTIS
HC A03/MF A01 CSCL 13B

Complete beta gauge operating instructions for Federal test cycles are included as well as set up and calibration procedures. A trouble shooting guide provides instructions for locating problems. GRA

N80-20938# Air Pollution Technology, Inc., San Diego, Calif.
DEVELOPMENT OF SUPERIOR ENTRAINMENT SEPARATORS Final Report, Oct. 1976 - Mar. 1979
Seymour Calvert and Harry F. Barbarika. Aug. 1979. 163 p. refs.
(Contract EPA-68-02-2189)
(PB80-112394; EPA-600/7-79-180) Avail: NTIS
HC A08/MF A01 CSCL 13B

A design for entrainment separators for scrubbers was developed. The problems of separation efficiency, suspended solids deposition, and plugging of the entrainment separator were of primary concern. A pilot scale entrainment separator (ES) coupled to a scrubber and designed to handle a nominal gas flow rate of 1.4 cu m/s (3,000 ACFM) was designed, built and tested. The effect of ES performance on particulate emissions of a typical fossil fueled boiler was evaluated. The experimental program included measurements of entrainment size distribution and loading, entrainment collection efficiency, solids deposition character and rate, and ES washing efficiency. Results were compared with available models and criteria for effective washing were developed. GRA

N80-20939# National Marine Fisheries Service, Galveston, Tex. Environmental Research Div.
ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO, 1977 - 1978. VOLUME 3: CHEMICAL AND PHYSICAL INVESTIGATIONS Annual Report, 1977 - 1978
William B. Jackson, ed. Sep. 1979. 722 p. refs.
(Contract EPA-IAG-DS-E693)
(PB80-107899; NOAA-79092004) Avail: NTIS
HC A99/MF A01 CSCL 13B

The results of chemical and physical investigations of the operating Buccaneer oil field off Galveston, Texas are presented. The tasks completed include: (1) identifying alterations in the marine ecosystem due to the development of an oil field; (2) determining the pathways and bioaccumulation of heavy metals and selected nonmetal discharge constituents; (3) describing seasonal circulation patterns in the oil field; and (4) constructing a hydrocarbon model. K.L.

N80-20940# Environmental Protection Agency, Washington, D.C. Effluent Guidelines Div.
DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES AND NEW SOURCE PERFORMANCE STANDARDS FOR THE MINERAL MINING AND PROCESSING POINT SOURCE CATEGORY Final Report
Douglas M. Costle, Thomas C. Jorling, Swep T. Davis, Robert B. Schaffer, and Ronald G. Kirby. Jul. 1979. 468 p. refs.
(PB80-110299; EPA-440/1-76-059B) Avail: NTIS
HC A21/MF A01 CSCL 13B

The mineral mining and processing industry was studied in order to develop guidelines for existing point sources and standards of performance and pretreatment standards for additional sources. Supporting data and rationale for development of the effluent limitations guidelines and standards of performance are presented. GRA

N80-20941# Environmental Protection Agency, Ann Arbor, Mich. Technology Assessment and Evaluation Branch.
EVALUATION OF EXHAUST COLLECTION CONFIGURATION ON DIESEL PARTICULATE MEASUREMENT
Thomas Penninga. May 1979. 12 p.
(PB80-104995; TAEB-79-8) HC A02/MF A01 CSCL 13B

Five different configurations of exhaust collection hardware were tested on a 1975 Mercedes Benz 300D and a 1979 Oldsmobile 350 CID Diesel. The average results for each configuration were compared to a baseline particulate emission number for each vehicle. A direct correlation was found between collection configurations and mass particulate emissions. GRA

N80-20942# Kerr (Robert S.) Water Research Center, Ada, Okla. Source Management Branch.
INDICATORY FATE STUDY Final Report, May 1978 - Feb. 1979
L. H. Myers, Thomas E. Short, Jr., Bill L. DePrater, Fred M. Pfeffer, Donald H. Kampbell, and John E. Matthews. Washington, D.C. EPA Aug. 1979 106 p.
(PB80-102809; EPA-600/2-79-175) Avail: NTIS
HC A06/MF A01 CSCL 13B

The media disposition of specific priority pollutants are addressed. Composite samples were obtained from the influent, effluent, residuals, and air from 12 industrial biological treatment systems. These samples were extracted and analyzed by gas chromatography for organic constituents, by atomic absorption for metals, and by EPA methodology for phenolics, cyanide, and mercury. Participating industries included: (1) organics and plastics; (2) pharmaceuticals; (3) pesticides; (4) rubber; (5) wood preservative; and (6) petroleum refining. GRA

N80-20943# Argonne National Lab., Ill. Energy and Environmental Systems Div.
DEVELOPMENT OF AN EXAMPLE CONTROL STRATEGY FOR LEAD
Albert E. Smith, Marshall R. Monroch, Byung S. Cho, and Danna M. Hediger. Apr. 1979 125 p. refs.
(PB80-123029; EPA-450/2-79-002; AQPS-1.2-123) Avail: NTIS HC A06/MF A01 CSCL 13B

A methodology for the development of a control strategy conforming with the requirements for lead implementation plans found in Part 51 of Title 40 of the Code of Federal Regulations is presented in guideline form. A fictitious three-county area is used to illustrate some of the quantitative and qualitative procedures employed in developing the control strategy. The guideline covers the following topics: development of baseline emission inventory and air quality data; projection and allocation of emissions; application of models and analysis of modeling results; and the testing, evaluation, and selection of available strategies. GRA

N80-20944# Little (Arthur D.), Inc., Cambridge, Mass.
FURTHER CHARACTERIZATION OF SORBENTS FOR ENVIRONMENTAL SAMPLING Final Report, Mar. 1978 - Jun. 1979
J. F. Piecewicz, J. C. Harris, and P. L. Levins. Sep. 1979 47 p. refs.
(Contract EPA-68-02-2150)
(PB80-118763; EPA-600/7-79-218) Avail: NTIS
HC A03/MF A01 CSCL 13B

Results are given of an experimental program to evaluate the breakthrough characteristics of sorbent resins for sampling of organic vapors using an elution analysis chromatographic technique. The effects of water vapor and CO2, at levels typical of gaseous effluents from combustion processes, on retention of nonpolar and polar species on two commonly used sorbents (XAD-2 and Tenax-GC) were studied. Effects on XAD-2 were small but the volumetric capacity of Tenax-GC was substantially decreased. Other sorbents were characterized for potential use in vapor sampling systems: coconut-based charcoal, petroleum-based charcoal, silica gel, Ambersorb XE-340 and Xe-347, and XED-8. Other significant results are reported. GRA

N80-20945# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
LIGHT-DUTY DIESEL GASEOUS EMISSIONS MEASUREMENT - COMPARISON OF DILUTION TUNNEL TEST RESULTS TO CERTIFICATION CELL TEST RESULTS
Jeff Alson. Jan. 1979 13 p.
(PB80-115991; SDSB-79/04) Avail: NTIS HC A02/MF A01 CSCL 13B

Gaseous emissions data are summarized for eleven light-duty diesel vehicles using both the standard certification test procedure and the dilution tunnel test procedure which incorporates particulate measurement. The greatest variability was found in the HC variability inherent in measuring HC and, in the extreme cases, also to equipment inconsistencies between the test cells. CO, NOx and CO2 data from the dilution tunnel test procedure were generally in good agreement with the certification data with the only trend being slightly lower NOx and CO2 values from the dilution tunnel. This is hypothesized as a possible dynamometer effect. It is concluded that there are no significant differences in the two test procedures with regards to the measurement of gaseous emissions. GRA

N80-20946# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
USER'S GUIDE FOR NUMERICAL MODELING OF BUOYANT PLUMES IN A TURBULENT, STRATIFIED ATMOSPHERE
Ralph G. Bennett and Michael W. Golay. Feb. 1979 228 p. refs. Sponsored by Consolidated Edison Co., N. Y. and Northeast Utilities Service Co., Hartford, Conn.
(PB80-114549; MIT-EL-79-004) Avail: NTIS
HC A11/MF A01 CSCL 13B

A widely applicable computational model of buoyant, bent-over plumes in realistic atmospheres is developed. A three-dimensional picture of a steady state plume is constructed from a sequence of time-dependent, two-dimensional plume cross sections-each cross section of the sequence is spaced progressively further downwind as it is advected for a progressively longer time by the prevailing wind. The buoyancy sources in the plume include the sensible heat in the plume, the latent heat absorbed or released in plume moisture processes, and the heating of the plume by a radioactive pollutant in the plume. Atmospheric variables are allowed to be functions of height, and the ambient atmospheric turbulence is included in the simulations. GRA

N80-20947# PEDCo-Environmental, Inc., Durham, N.C.
THE IMPACT OF FUTURE DIESEL EMISSIONS ON THE AIR QUALITY OF LARGE CITIES Final Report
Roy A. Paul. May 1979 228 p. refs.
(Contract EPA-68-02-2585)
(PB80-113657; EPA-450/3-79-005) Avail: NTIS
HC A11/MF A01 CSCL 13B

The impact of diesel-powered vehicles in the central business districts of New York, Chicago and Los Angeles was studied. Annual particulate matter emissions from automobiles, taxis, buses and light-duty trucks were projected to the year 2000. The emissions were correlated with air monitoring data in order to calculate the impact on air quality. Significant increases were predicted in atmospheric particulate matter because of increased diesel engines. GRA

N80-20948# Mitre Corp., McLean, Va. Metrek Div.
ASSESSMENT OF THE IMPACT OF RESOURCE RECOVERY ON THE ENVIRONMENT Final Report
Judith G. Gordon. Aug. 1979 147 p. refs.
(Contract EPA-68-03-2596)
(PB80-102874; EPA-600/8-79-011) Avail: NTIS
HC A07/MF A01 CSCL 13B

The environmental effects of municipal solid waste disposal in 1990 and the changes in these effects resulting from implementation of resource recovery from municipal solid waste are assessed. The direct effects of municipal solid waste disposal as well as the secondary effects of substituting materials recovered from municipal solid waste for raw materials in the production of steel, aluminum, glass, and energy are considered. Energy conservation resulting from use of recovered scrap in materials production and energy production by recovery of energy from municipal solid waste is also evaluated. The analysis is based on specific scenarios for municipal solid waste disposal in 1990 without and with implementation of resource recovery. GRA

N80-20949# Land-Air, Inc., Holloman, N. Mex. Applied Research Div.
CONTROL TECHNOLOGIES FOR PARTICULATE AND TAR EMISSIONS FROM COAL CONVERTERS
C. Chen, C. Koralek, and L. Breitstein. Jul. 1979 115 p. refs.
(Contract EPA-68-02-2601)
(PB80-108392; EPA-600/7-79-170) Avail: NTIS
HC A06/MF A01 CSCL 13B

Solid and tar particulate emissions in raw product gases from several types of coal gasifiers are characterized in terms of their total quantities, chemical composition, and size distribution. Control technologies for particulate emissions were assessed with respect to the limitations of the control device and to existing and proposed regulations. Fabric filters were not suitable

where tar particulates were found or at higher than 300 C. Electrostatic precipitators operated as high as 1100 C. Rotary cyclones showed the widest range of applicability, but conventional cyclones were most economical for particles larger than 50 microns. Solid and tar particulate emissions collected for 250,000 scfd of a medium-Btu gas contained up to 1.6 million kg of particulate. GRA

N80-20950# Land-Air, Inc., Holloman, N. Mex. Applied Research Div.
HOT GAS CLEANUP PROCESS Final Report, Jan. 1977 - Mar. 1979
A. Bekir Onursal Jul. 1979 155 p refs
(Contract EPA-68-02-2601)
(PB80-108467; EPA-600/7-79-169) Avail: NTIS
HC A08/MF A01 CSCL 13B

The results of a study to identify and classify 22 hot gas cleanup (HGC) processes for desulfurizing reducing gases at above 430 C according to absorbent type into groups employing solid, molten salt, and molten metal absorbents are presented. Each process is described in terms of its status, chemistry, operating characteristics, problems, and uncertainties. The applicability of non HGC processes to a variety of coal gasification systems for several end uses for the product gases is assessed. Advantages and disadvantages of HGC relative to conventional low temperature cleanup systems with respect to thermal efficiency, the presence and/or emissions of tars, particulates, and NOx, and corrosion are described. GRA

N80-20951# Vanderbilt Univ., Nashville, Tenn. Center for Environmental Quality Management.
DEVELOPMENT OF A BIOLOGICAL SIMULATION MONITOR FOR JOINT MUNICIPAL/INDUSTRIAL TREATMENT SYSTEMS Final Report, 1 Jun. 1975 - 31 May 1977
Ann N. Clarks, W. Wesley Eckenfelder, and John A. Roth Aug. 1979 173 p refs
(Grant EPA-R-803740)
(PB80-111032; EPA-600/2-79-180) Avail: NTIS
HC A08/MF A01 CSCL 14B

Hardware for wastewater source causing chronic or acute inefficiency in the performance of a joint biological treatment facility was evaluated. Bench and pilot scale bio-treatment studies of selected industrial wastes at various loadings were performed. Several monitoring techniques were applied to the treatment systems, and the parameters identified in pretreatment guidelines were monitored as measures of removal efficiencies. GRA

N80-20952# New Mexico Univ., Albuquerque. Technology Application Center.
REMOTE SENSING APPLIED TO POLLUTION MONITORING. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jun. 1979
Gerald F. Zollars Jul. 1979 51 p Sponsored in part by NTIS, Springfield, Va.
(NTIS/PS-79/0732/2) Avail: NTIS HC $28.00/MF $28.00
CSCL 13B

Articles are cited from the international literature concerning the use of remote sensors to aid in the monitoring of air and water pollution. Use of lasers, optical radar systems, aerial photography, and satellite observations are included. (Contains 194 citations) GRA

N80-20953# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
GUIDELINES TO THE AIR QUALITY MANAGEMENT SYSTEMS, REVISED
Apr. 1979 167 p refs Revised
(PB80-109978; NATO/CCMS-71-Rev) Avail: NTIS
HC A08/MF A01 CSCL 13B

Several air quality management systems in NATO countries are described with emphasis on the formulation of strategy plans. Major strategy plan options, criteria for the selection of control strategies, surveillance technique, possible interactions with other environmental media and the necessity for revision of strategy plans are discussed. GRA

N80-20954# KLD Associates, Inc., Huntington, N. Y.
DEVELOPMENT OF DROPLET SIZING FOR THE SCRUBBING SYSTEMS Final Report
Hector Medecki, K. C. Wu, and D. E. Magnus Research Triangle Park, N. C. EPA Jul. 1979 124 p refs Sponsored in part by Ind. Environ. Res. Lab.
(Contract EPA-68-02-2111)
(PB80-108574; EPA-600/7-79-166) Avail: NTIS
HC A06/MF A01 CSCL 14B

The development and characteristics of the DC-2 Droplet Counter as used to evaluate scrubbing systems are described. The measurement of entrained droplets and their concentrations in gas streams is important in pollution control technology. The use of a hot-wire sensor can successfully measure the desired parameters for droplets in the size range from 1 to 500 micrometers. Extensive testing in the laboratory are described a comparison with results from the Brink impactor is given. A correlation of results for these two measurement techniques was achieved. Field tests at four different sites are also described. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-20955 Adelphi Univ., Garden City, N. Y.
A STUDY OF MAGNETOGRAVITY WAVES Ph.D. Thesis
Meyer Bouscher 1980 92 p
Avail: Univ. Microfilms Order No. 8006397

The geometry of magnetogravity wave surfaces in an incompressible, isothermal, inviscid, nonrotating, flat, horizontally stratified perfectly conducting atmosphere was studied in order to verify that such waves may contribute heavily to the heating of the upper solar atmosphere. The equations of the wave surface were determined from those of the wave normal surface using the envelope construction. The locations of the cuspidal edges were determined for vertical, horizontal, and oblique magnetic fields. In addition, a line of self-intersection was found along the directions of the horizontal and oblique fields. The existence of the line of self-intersection suggests that magnetogravity waves, at least those of high enough frequency, can carry energy upward along the solar magnetic field, thus lending support to Lighthill's conjecture. Dissert. Abstr.

N80-20956 Wisconsin Univ. - Madison.
PRECIPITATION AND ACCUMULATION ESTIMATES FOR EAST ANTARCTICA, DERIVED FROM RAWINSONDE INFORMATION Ph.D. Thesis
David Howard Bromwich 1979 156 p
Avail: Univ. Microfilms Order No. 8004706

A rigorous analysis of the rawinsonde data from 9 coastal stations and one on the plateau is given. A special attempt is made to resolve the key boundary layer properties. A systematic and important bias in the record due to missed observations during storms is demonstrated. Estimates for these missing values which are obtained from multilinear regression equations increase the computed annual poleward water vapor transport at two stations by more than 30 percent. Other significant observations are reported. Dissert. Abstr.

N80-20957 Stanford Univ., Calif.
CRYSTALLIZATION AND METASOMATISM OF THE CUCHILLO MOUNTAIN LACCOLITH, SIERRA COUNTY, NEW MEXICO Ph.D. Thesis
David Kent McMillan 1979 298 p
Avail: Univ. Microfilms Order No. 8006330

The Cuchillo Mountain laccolith, of early Tertiary age, is a hypabyssal, quasiconcordant mass of porphyritic monzonite enclosed by carbonate strata of Pennsylvanian age. It is comagmatic with a thick sequence of propylitized volcanic rocks that are extensively exposed in adjacent areas. Rocks of the laccolith were pervasively propylitically altered, with a principal change from andesine monzonite porphyry to albite porphyry.

Pre-emplacement crystallization is represented by a phemocryst assemblage that comprises minerals observed in chilled margins other than as groundmass. Post-emplacement crystallization is represented by groundmass consisting of microlitic alkali feldspar hosted by quartz, and an assemblage of micarolitic products that are not present in the chilled margins. Large-scale redistribution of constituents, chiefly the major alkalies, is reflected by increasing intensities of albitization, epidotization, chloritization, and iron oxidation from the margins toward the interior of the intrusion, and by apparently complementary potassium enrichment near the margins. Dissert. Abstr.

N80-20958 Oregon State Univ., Corvallis.
STRONTIUM ISOTOPIC AND TRACE ELEMENT GEOCHEMISTRY OF THE SADDLE MOUNTAINS AND GRANDE RONDE BASALTS OF THE COLUMBIA RIVER BASALT GROUP Ph.D. Thesis
Dennis Oliver Nelson 1980 234 p
Avail: Univ. Microfilms Order No. 8007125

Variations in trace element and Sr isotopic compositions in the Columbia River Basalt (CRB) are discussed. These compositions reflect complex and variable origins for the CRB magmas. Among the most varied is the Saddle Mountains Basalt (SMB) in which Sr ratios vary from 0.7078 to 0.7147 + or - 0.002. The higher ratios reflect contamination through consistent correlations with major element compositions. Age and field relations suggest that the contaminated flowrocks are not the result of progressive contamination of a single magma, but rather reflect the contamination of independent magmas during this ascent. The Pomona and Elephant Mountain Basalts (SMB) reflect mantle values. These basalts erupted from the Chief Joseph dike swarm along with the Grande Ronde (GRB) and Wanapum Basalts. Together, the GRB and SMB indicate a mantle source with Sr ratios varying from 0.7043 to 0.7081. Dissert. Abstr.

N80-20959 California Univ., San Diego.
MARINE GEOLOGY AND TECTONIC EVOLUTION OF THE NORTHWESTERN MARGIN OF THE CALIFORNIA CONTINENTAL BORDERLAND Ph.D. Thesis
James Keene Crouch 1979 116 p
Avail: Univ. Microfilms Order No. 8006883

The geology and history of the northwestern margin of the California continental borderland are examined using data from seismic-reflection profiling and bottom sampling. It is suggested that the northwestern margin of the borderland along with the western Transverse Ranges was rifted from an original tectonic setting off northern Baja California begining about 18 m.y. ago. During the rifting event, the Franciscan and Great Valley belts underlying the outer borderland were translated northwestward along a ridge-trench transform fault resulting in: (1) a repetition of these belts in the borderland off Southern California, and (2) clockwise rotation and subsequent thrusting of these belts (western Transverse Ranges) against the southern Coast Ranges. Dissert. Abstr.

N80-20960 Purdue Univ., Lafayette, Ind.
FINITE-DIFFERENCE SYNTHETIC SEISMOGRAMS FOR KINEMATIC MODELS OF THE EARTHQUAKE SOURCE Ph.D. Thesis
Juan Manuel Espindola 1979 162 p
Avail: Univ. Microfilms Order No. 8005867

The dynamic displacement field of kinematic dislocation in two dimensions is modeled by a finite-difference technique in skew coordinates. The scheme involves the solution of the heterogeneous, elastic vector wave equation subjected to dislocation conditions. Algorithms are included to model the free surface and absorbing artificial boundaries which simulate an infinite half-space. Specification of faults with arbitrary dip is implemented by means of the skew-coordinate system. Other source parameters such as time-history, slip-function, and rupture velocity are user selected. Near-field synthetic seismograms were calculated by this procedure for selected source parameters for two cases of geologic interest (i.e., buried basin and layer over a half space). These examples illustrate the influence of fault parameters and local geology on ground motion. Significant effects due to the heterogeneous media and various fault and source parameters suggest that the method can provide a new realistic modelling tool for the study of the interaction between the earthquake source and the local geology in the near-field for long period ground motion. Dissert. Abstr.

N80-20961 Stanford Univ., Calif.
A NON-GAUSSIAN STOCHASTIC MODEL APPLIED TO DECONVOLUTION AND SEISMOGRAM INVERSION Ph.D. Thesis
Robert John Godfrey 1979 97 p
Avail: Univ. Microfilms Order No. 8006313

An algorithm that iteratively removes the source waveform present in a suite of seismograms was developed and tested on real data. Assuming a non-Gaussian reflectivity model, both the color and phase effects of the source waveform were removable from the seismogram. The main ingredient in the algorithm is a zero memory (instantaneous) non-linear estimator of reflection coefficient amplitude. Forcing a filtered version of the seismogram to resemble these estimates was accomplished iteratively. An algorithm that converts a deconvolution into acoustic impedance is proposed. A feature of the algorithm is the ability to merge additional information, besides the deconvolution, into the computation of impedance. Dissert. Abstr.

N80-20962 Purdue Univ., Lafayette, Ind.
THE GENERATION OF SYNTHETIC SEISMOGRAMS FOR LATERALLY HETEROGENEOUS MODELS USING THE FINITE DIFFERENCE TECHNIQUE Ph.D. Thesis
Frederick Elwood Mazzella 1979 239 p
Avail: Univ. Microfilms Order No. 8005914

A method for the generation of synthetic seismograms for two-dimensional heterogeneous models specified only by P wave (dilatation) velocity is developed. Synthetic seismograms are calculated for seven heterogeneous (both vertical and horizontal) geologically realistic models. Each model is described graphically and is accompanied by a displacement seismogram record section for the vertical and horizontal components. These record sections reveal significant amplitude and time effects which result from the velocity structure. Dissert. Abstr.

N80-20963 Stanford Univ., Calif.
PRE-STACK PARTIAL MIGRATION Ph.D. Thesis
Ozdogan Yilmaz 1979 126 p
Avail: Univ. Microfilms Order No. 8006373

A procedure to improve conventional seismic data processing by removing the degrading effect of wide offsets on dipping events so that they stack coherently is proposed. The pre-stack partial migration provides the interpreter with a high quality common midpoint (CMP) stack section which can be subsequently migrated. The theory of pre-stack partial migration is based on the double square root equation, which describes seismic imaging with many shots and receivers. The double square root operator in common midpoint space can be approximately separated into two terms, one involving only migration effects and the other involving only moveout correction. This separation provides an analysis of conventional processing. Estimation of errors in the separation yields the equation for pre-stack partial migration. Dissert. Abstr.

N80-20964*# California Inst. of Tech., Pasadena. Seismological Lab.
HOTSPOTS AND THE EVOLUTION OF THE MANTLE
Don L. Anderson [1979] 33 p refs
(Grant NGL-05-002-069)
(NASA-CR-162906; Contrib-3432) Avail: NTIS HC A03/MF A01 CSCL 08G

Trace element patterns show that continental and ocean island basalts are complementary to mid-ocean ridge basalts (MORB). The relative sizes of the two source regions can be estimated from enrichment/depletion patterns. Their combined volume, computed from estimates of whole mantle abundances, occupies the entire upper mantle. The source regions appear to be the result of an early differentiation of the mantle. The MORB source evolved from the melt fraction which lost its late stage enriched fluids to the overlying plume source. The MORB source is primarily garnet and clinopyroxene, consistent with it being an eclogite cumulate. Author

N80-20965# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

VALIDATION OF THE DAIRCHEM CODE 1: QUIET MIDLATITUDE CONDITIONS
Melvin G. Heaps and Joseph M. Heimerl Sep. 1979 42 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A077880; ERADCOM/ASL-TR-0041) Avail: NTIS HC A03/MF A01 CSCL 04/1

Two long-standing problems in the atmospheric sciences have been the correct modeling of the ion chemistry in the earth's atmosphere and the proper determination of the ion species and densities through in situ measurements. Comparison between experimental data and simulations of those data by computer modeling of atmospheric chemistry is a means of validating the computer code as well as indicating which processes are in need of further study. The DAIRCHEM computer code is used here to simulate data taken in the midlatitude D region during quiet conditions. Comparison between the total positive ion density profile derived from rocket measurements and the one computed by the code shows very good agreement in the 30 to 90 km range, with the exception that the simulated ion density profile is of somewhat smaller magnitude that the experimental one in the 60 and 75 km region. Such a discrepancy is only partially explained by the uncertainties in the ionization rate of NO due to Lyman alpha radiation. Comparison between the measured and the computed electron density profiles shows that the measured profile is consistently of a smaller magnitude that the computer profile in the 65 and 85 km range. GRA

N80-20968# Lamont-Doherty Geological Observatory, Palisades, N. Y.
OBSERVATIONS OF POSITION, OCEAN DEPTH, ICE ROTATION, MAGNETIC DECLINATION AND GRAVITY TAKEN AT THE FRAM 1 DRIFTING ICE STATION Progress Report, Mar. - May 1979
Kenneth Hunkins, Thomas Manley, and Werner Tiemann Sep. 1979 70 p refs
(Contract N00014-76-C-0004)
(AD-A077063; LDGO-CU-1-79; TR-1) Avail: NTIS HC A04/MF A01 CSCL 08/10

The Arctic Ocean north of Greenland is a relatively unexplored area. FRAM I was a research station established on drifting pack ice to carry out geological, geophysical, oceanographic and biological studies in this region. This report contains geophysical data collected at the FRAM I drifting station. These data include station positions determined by satellite navigation, echo soundings, ice floe azimuths, magnetic declination and gravity readings. GRA

N80-20967# Washington Univ., Seattle. Quaternary Research Center
PERIGLACIAL RESEARCH Final Report, 10 Jan. 1972 - 30 Sep. 1979
Chester M. Burrous 31 Oct. 1979 13 p
(Grants DA-ARO(D)31-124-73-G42; DAAG29-76-G-0056)
(AD-A079280; ARO-10804-10; ARO-12913.9-GS) Avail: NTIS HC A02/MF A01 CSCL 08/13

The problems studied comprised various forms of frost action in soils, including deformation, upfreezing of objects, and slope movements during freezing and thawing; uplift of objects by ice surfaces during freezing; and determination of unfrozen water content of frozen soils. GRA

N80-20968# Naval Research Lab., Washington, D. C. Geophysical and Plasma Dynamics Branch.
PRELIMINARY REPORT OF NUMERICAL SIMULATIONS OF INTERMEDIATE WAVELENGTH ExB GRADIENT DRIFT INSTABILITY IN IONOSPHERIC PLASMA CLOUDS
M. J. Keskinen, S. L. Ossakow, and P. K. Chaturvedi (Berkeley Research Associates, Arlington, Va.) 26 Nov. 1979 24 p
(AD-A079313; NRL-MR-4116; AD-E000344) Avail: NTIS HC A02/MF A01 CSCL 04/1

Two dimensional numerical simulations of intermediate wavelength (100-1000m) ExB gradient-drift instability in local unstable regions of large F region ionospheric plasma clouds were performed, using an initial one dimensional (y), cloud geometry, for plasma cloud density gradient scale lengths L - 3, 6, 10 km. For conditions typical of 200 km barium releases, it was that linearly unstable modes saturated by nonlinear generation of linearly damped modes along the y direction (parallel to ExB drift). In the nonlinear regime, power laws are observed. These results are compared with recent in situ experimental measurements and theoretical predictions. R.E.S.

N80-20969# Naval Research Lab., Washington, D. C. Plasma Physics Div.
PRELIMINARY REPORT OF NUMERICAL SIMULATION OF INTERMEDIATE WAVELENGTH COLLISIONAL RAYLEIGH-TAYLOR INSTABILITY IN EQUATORIAL SPREAD F Interim Report
M. J. Keskinen and P. K. Chaturvedi (Berkeley Research Associates, Arlington, Va.) 7 Dec. 1979 26 p refs
(DNA Proj. NWET-I25AAXYX960; NRL Proj. H02-42; NRL Proj. A03-16)
(AD-A079307; AD-E000344; NRL-MR-4116) Avail: NTIS HC A03/MF A01 CSCL 04/1

Computer simulations of the intermediate wavelength (100 to 1000 m) collisional Rayleigh-Taylor instability were performed using parameters typical of the post-sunset bottomside (300 km) equatorial F region ionosphere. For ambient electron density gradient scale lengths L - 5, 10, 15 km it was found that the linearly unstable modes saturate by nonlinear generation of linearly damped vertical modes with the result that in the nonlinear regime, power laws are observed in the horizontal and vertical one-dimensional power spectra with n - 2 to 2.5. These results are consistent both with in situ experimental data and theoretical prediction. K.L.

N80-20970# Los Alamos Scientific Lab., N. Mex.
REVIEW OF IONOSPHERIC DISTURBANCES RESULTING FROM SOME NATURALLY OCCURRING EVENTS
M. M. Hoffman Nov. 1979 21 p refs
(Contract W-7405-eng-36)
(LA-7984-MS) Avail: NTIS HC A02/MF A01

Some known and some potential sources of atmospheric disturbances were investigated in a review of scientific papers selected to illustrate the roles of naturally occurring phenomena in generating observable ionospheric effects. Reports of acoustic and ionospheric effects resulting from the Alaskan earthquake of 1964 were used as a guide to the nature of signals generated by all seisms. Scaling these effects to smaller seisms is considered. Some models for enhanced acoustic coupling between the earth and atmosphere are discussed. Investigations of signals generated within the atmosphere by meteorological events are also reviewed. DOE

N80-20971# Colorado School of Mines, Golden. Evacuation Engineering and Earth Mechanics Inst.
DETERMINATION OF BASALT PHYSICAL AND THERMAL PROPERTIES AT VARYING TEMPERATURES, PRESSURES, AND MOISTURE CONTENTS Progress Report
R. J. Miller 31 Aug. 1979 82 p
(Contract EY-77-C-06-1030)
(RHO-BWI-C-55; PR-3) Avail: NTIS HC A05/MF A01

The rock mechanics testing performed for Rockwell Hanford Operations is summarized. Cores were supplied from drill hole DC-4 on the Hanford Site, characterized geologically, and tested for thermal and physical properties for designing long-term underground storage of radioactive waste materials. Uniaxial and triaxial results indicate strengths similar to drill hole DC-6, but significantly higher than drill hole DC-8. Trends with density, depth, confining pressure, and temperature, however, were similar for the three drill hole locations tested. DOE

N80-20972# Colorado School of Mines, Golden. Evacuation Engineering and Earth Mechanics Inst.
DETERMINATION OF BASALT PHYSICAL AND THERMAL PROPERTIES AT VARYING TEMPERATURES, PRESSURES, AND MOISTURE CONTENTS Progress Report
R. J. Miller 13 Aug. 1979 80 p
(Contract EY-77-C-06-1030)
(RHO-BWI-C-54; PR-2) Avail: NTIS HC A05/MF A01

The rock mechanics testing performed for Rockwell Hanford Operations is summarized. Cores were supplied from drill hole DC-8 on the Hanford Site, characterized geologically, and tested for thermal and physical properties for designing long-term underground storage of radioactive waste materials. Results

indicate significantly lower strengths for drill hole DC-8 than determined for drill hole DC-6 or for the drill holes reported on in the previous fiscal year tests. However, trends were found to be similar between drill holes DC-6 and DC-8. DOE

N80-20973# Battelle Columbus Labs., Ohio.
CHARACTERIZATION AND ANALYSIS OF DEVONIAN SHALES AS RELATED TO RELEASE OF GASEOUS HYDROCARBONS Quarterly Progress Report, Jan. - Mar. 1979
R. S. Kalyoncu, J. P. Boyer, and M. J. Snyder 15 Apr. 1979 240 p
(Contract EY-76-C-05-5205)
(ORO-5205-10) Avail: NTIS HC A11/MF A01

This program has the objective of determining the relationships between the shale characteristics, hydrocarbon gas contents, and well location, and thereby provide a sound basis for (1) assessing the productive capacity of the Eastern Devonian Gas Shale deposits and (2) guiding research, development, and demonstration projects to enhance the recovery of natural gas from the shale deposits. The Y-1 well in Allegany County, New York was sampled in September 1978. 412 samples were collected from the Allegany County, New York well. Characterization data on Y-1 (EGSP New York No. 1), Allegany County, New York well is reported and discussed. Analysis of the hydrocarbon gases in Y-1 samples indicates that the longer chain hydrocarbon gases (ethane, propane, butane) in these shales are significantly higher than in previous wells. The carbon contents of the Y-1 (Allegany County, New York) well, on the other hand, are somewhat lower than predicted from the hydrocarbon gas contents. There is still a positive relationship between the carbon and hydrocarbon gas contents, however. A similar relationship is also apparent between the sulfur and hydrocarbon gas contents. No unusual trends are observed in the porosity values, and a reasonable agreement exists between the measured Hg-intrusion values and those calculated from the density data. Higher porosity values are associated with low bulk densities. From limited lithological observations New York shales exhibit variable clay, mineral, and quartz contents. Generally, low levels of pyrite and carbonate minerals are observed. The low pyrite and carbonate contents noted in the powder examination of the samples are supported by the EDAX results showing low Ca and S contents. DOE

N80-20974# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ASTROGRAVIMETRIC DETERMINATION OF THE GEOID Ph.D. Thesis - Tech. Hochschule Darmstadt, West Germany [EIN VERFAHREN ZUR ASTRO-GRAVIMETRISCHEN GEOIDBESTIMMUNG]
Dieter Lelgemann 1978 51 p refs In GERMAN
(Ser-C/Diss-247-Mitt-147) Avail: NTIS HC A04/MF A01

The computation of the geoid by several methods, including the Runge-Krarup theorem, is discussed using data taken in Germany. The use of a series of Kernel functions and the interpolations by astrogravimetric methods are reproduced for the German field. Author (ESA)

N80-20975# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DIFFERENTIAL GEOMETRY APPLIED TO GEODESY IN THE CASE OF THE GRAVITY FIELD OF THE EARTH Ph.D. Thesis - Tech. Hochschule, Darmstadt, West Ger. [UEBER GEODAETISCHE DIFFERENTIALGEOMETRIE IM ERDSCHWEREFELD]
Juergen Brennecke 1979 91 p refs In GERMAN
(Ser-C/Diss-250-Mitt-148) Avail: NTIS HC A05/MF A01

Applications of three dimensional geodesy in the domain of geometric representations of the gravitational field are presented. The method of calculation, based on Cartan and differential geometry in a Euclidean space, is used with a three dimensional orthonormal moving reference system. The study of the curvatures, considered as a fundamental parameter for the geometry of the gravitational field, aids in calculating exactly or approximately in three dimensional geodesy. Author (ESA)

N80-20976# National Geodetic Survey, Rockville, Md.
OPTIMIZATION OF HORIZONTAL CONTROL NETWORKS BY NONLINEAR PROGRAMMING
Dennis G. Milbert Aug. 1979 50 p refs
(PB80-117948; NOAA-TR-NOS-79-NGS-12; NOAA-79100108)
Avail: NTIS HC A03/MF A01 CSCL 08E

Some practical aspects of horizontal control network design are considered, and the techniques of linear and nonlinear programming are briefly reviewed. Rotationally invariant constrains are written for the coordinate variance sum at each station. These constrains are also quasi-homogeneous in the sense that a Moore-Penrose generalized inverse is used in computation. The objective function to be minimized is a cost proportional to the number of observations. Results are displayed for serval test networks. Methods of improvement of the design algorithm are then discussed. GRA

N80-20977# National Geodetic Survey, Rockville, Md.
NATIONAL GEODETIC SURVEY DATA: AVAILABILITY, EXPLANATION AND APPLICATION
Joseph F. Dracup Jan. 1979 47 p refs
(PB80-118615; NOAA-TM-NOS-NGS-5; NOAA-79100501)
Avail: NTIS HC A03/MF A01 CSCL 08E

A concise listing of geodetic publications and papers of general interest and their sources of availability are presented. Also included are detailed references to the application of geodetic control and practices. GRA

N80-20978# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
LONG-PERIOD TERMS IN THE NEUTRAL DENSITY OF THE UPPER ATMOSPHERE
A. Eisner and S. M. Yionoulis Nov. 1979 96 p refs
(Grant NSF ATM-77-21020)
(PB80-119464; JHU/APL-CP-076) Avail: NTIS HC A05/MF A01 CSCL 04A

A simple atmospheric density model is presented for Transit satellite altitudes (900 to 1200 km), based on 4.3 years (1974-1978) of data for all five Transit System satellites. The model incorporates altitude, solar, magnetic, annual, semiannual, diurnal, and seasonal-latitudinal variations. In addition to these known effects, a month period evidenced in the data was incorporated into the model. Several attempts (using different models) failed to elicit the four angle (local time) component of the diurnal effect. The results lead to the conclusion that diurnal variation is too weak to be detected. GRA

N80-20979# Universities Space Research Association, Boulder, Colo.
THE PRESENT STATUS OF ATMOSPHERIC ELECTRICITY, REPORT OF THE USRA ATMOSPHERIC ELECTRICITY STUDY PANEL Final Report
M. H. Davis 18 Sep. 1979 18 p
(Grant NSF ATM-78-19247)
(PB80-111479; USRA/BLDR-9/1) Avail: NTIS HC A02/MF A01 CSCL 04B

The present status of research in atmospheric electricity is examined. Recent directions of electrical research are discussed in the context of the atmospheric sciences. It is concluded that research in atmospheric electricity is now well positioned for significant advances, despite its relative isolation and unpopularity. GRA

N80-20980# Weidlinger Associates, New York.
RESONANCE ZONES ON THE SURFACE OF A DIPPING LAYER DUE TO PLANE SH SEISMIC INPUT
G. L. Wojcik Jan. 1979 99 p refs
(Grant NSF PFR-78-15049)
(PB80-107907; NSF/RA-790200; Rept-11) Avail: NTIS HC A05/MF A01 CSCL 08K

The local effects of lateral geologic inhomogeneity on surface ground motion during earthquakes was studied using a mathematical model. The model consisted of a surface dipping layer overlaying a halfspace, with plane SH waves incident from the halfspace in the downdip direction. Surface motion over the layers calculated for transient (time domain) and harmonic (frequency domain) inputs. An extension of the analysis suitable for Love wave excitation, is described. Applications include seismic zonation, critical facility sitting, building rehabilitation and ground failure. GRA

N80-20981# National Environmental Satellite Service, Washington, D. C.
AN IMPROVED MODEL FOR THE CALCULATION OF LONGWAVE FLUX AT 11 MICROMETERS
P. G. Abel and A. Gruber Oct. 1979 33 p refs
(PB80-119431; NOAA-TM-NESS-106; NOAA-79101901) Avail: NTIS HC A03/MF A01 CSCL 04A

A method for the prediction of outgoing longwave flux from satellite radiance measurements at 11 micrometers is presented. The method offers improved accuracy in estimated flux, especially at extreme flux values. It substantially reduces the discrepancy between the SR and ERB measurements, and also reduces derived outgoing longwave flux in the subtropical regions. GRA

N80-20640# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A SURVEY OF THE GEODETICAL WORK OF THE IFAG FROM 1952-1977 [EIN UEBERBLICK UEBER DIE GEODAETISCHEN ARBEITEN DES IFAG (ABT. 2 DES DGFI) VON 1952-1977]
Hermann Seeger, Rudolf Brein, Dieter Ehlert, Dieter Lelgemann, Klemens Nottarp, Bernd Richter, and Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 39-51 In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20644# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CONTRIBUTIONS TO THE UTILIZATION OF ALTIMETER DATA [ARBEITEN ZUR NUTZUNG VON ALTIMETERDATEN]
Dieter Lelgemann *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 81-85 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20649# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DETERMINATION OF VARIATIONS OF TIME DEPENDENT COORDINATES THROUGH ASTRONOMICAL AND DOPPLER OBSERVATIONS [ZEITABHAENGIGE KOORDINATENAENDERUNGEN, BESTIMMT DURCH ASTRONOMISCHE BEOBACHTUNGEN UND DURCH DOPPLERBEOBACHTUNGEN]
Wolfgang Schlueter *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 117-120 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20652# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
EARTH TIDES [ARBEITEN ZUR ERDGEZEITENUNTERSUCHUNG]
Rudolf Brein *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 131-133 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20653# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
RESEARCH ON GRAVIMETRY AT IFAG [GRAVIMETRISCHE FORSCHUNGSARBEITEN AM INSTITUT FUER ANGEWANDTE GEODAESIE]
Heinrich Beetz and Bernd Richter *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 135-140 refs In GERMAN (For primary document see N80-20638 11-42)
Avail: NTIS HC A11/MF A01

N80-20698# Bayerische Akademie der Wissenschaften, Munich (West Germany).
DEVELOPMENT OF DOPPLER OBSERVATIONS AT WETZELL DURING 1975-1976 [UEBER DIE AUSWERTUNG DER DOPPLERBEOBACHTUNGEN IN WETTZELL 1975-1976]
Wolfgang Schlueter *In its* Res. Program 78, Satellite Geodesy Program 1978 p 72-77 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-20982 Florida Univ., Gainesville.
ESTIMATING NOCTURNAL SURFACE TEMPERATURE IN FLORIDA USING THERMAL DATA FROM GEOSTATIONARY SATELLITE DATA
Ellen Yee-Ling Chan Chen 1979 294 p
Avail: Univ. Microfilms Order No. 8005447

Satellite data from the SMS/GOES system were used to study winter nocturnal surface temperature patterns on both a spacial and temporal basis. The areas of special interest were the Everglades Agricultural Area and transects perpendicular to the coast in central Florida. Consistent, persistent thermal patterns were observed which were highly correlated with 1.5 in ambient air temperature observed concurrently. Thermal patterns observed by the satellite on clear, calm nights revealed that the thermal characteristics of the soil/plant surface predominately influence the surface temperature. This influence overshadows latitudinal effects. Water (open, marsh, and soil moisture) was apparently the next most important factor after soil characteristics)organic versus mineral soils). The organic soil of the Everglades Agricultural Area was cold because of the low conductivity, heat capacity and bulk density; however, areas of excessively drained sandy mineral soils were also detectably colder. Dissert. Abstr.

N80-20983 Wisconsin Univ. - Madison.
SUMMER CIRCULATION OVER SOUTH AMERICA FROM SATELLITE DATA Ph.D. Thesis
Hassan Virji 1979 162 p
Avail: Univ. Microfilms Order No. 8004748

Cloud winds obtained from geostationary satellite images for the southern summer are used to describe the tropospheric circulation over tropical and subtropical South America. The cloud winds are objectively interpolated onto a 5 degree grid and the gridded data are used to obtain the diurnal and time-averaged, upper (300-100 mb) and lower (900-700 mb) level tropospheric motion fields. Relative vorticity, horizontal divergence, and rotational and irrotational components of the mean circulation are estimated from the gridded data. The midtropospheric vertical motion field is determined through the kinematic method and the result is compared with estimates obtained from cloud area and heat budget methods using conventional radiosonde data. Upper level momentum and vorticity budgets for the mean circulation are also determined. Dissert. Abstr.

N80-20984 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA, SERIES A MONOGRAPHS. VOLUME 3, NO. 1: A STUDY OF PREDICTION OF CHARACTERISTIC SYNOPTIC STRUCTURES WITH THE AID OF A NUMERICAL MODEL OF THE HUMID ATMOSPHERE Ph.D. Thesis [METEOROLOGISCHE ABHANDLUNGEN, SERIE A, MONOGRAPHIEN. BAND 3, HEFT 1: UNTERSUCHUNG ZUR VORHERSAGE CHARAKTERISTISCHER SYNOPTISCHER STRUKTUREN MIT HILFE EINES NUMERISCHEN MODELLS DER FEUCHTEN ATMOSPHAERE]
Eberhard Reimer Verlag Dietrich Reimer 1977 121 p refs In GERMAN Sponsored by Forschungsgemeinschaft
Copyright. Avail: Verlag Dietrich Reimer, Berlin

The condensation process on a large scale is represented by isentropic surfaces in a model of atmospheric moisture. A system of equations represents the isobaric surface despite difficulties in representing the isentropes in the plane. Thermodynamic calculations applied to the case of condensation and evaporation in the scale of the space are given. The proposed numerical model uses potential temperatures as vertical coordinates, giving improved accuracy. Author (ESA)

N80-20985# California Univ., Los Angeles.
INTERNATIONAL SCIENTIFIC INTEREST IN THE QUESTION OF CO2 INDUCED CLIMATE CHANGE
G. L. Potter Sep 1979 10 p
(Contract W-7405-eng-48)

(UCID-18332) Avail: NTIS HC A02/MF A01

A survey to investigate the international interest in the CO2 effects on the climate is discussed. The gist of the survey dealt with predicting the future atmospheric CO2 concentrations, the climatic effects, the environmental effects, and the social, political, and economic consequences of a global environmental change. The various countries involved in researching the CO2 questions and their responses to the survey are discussed. A.W.H.

N80-20986*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

SIMULATION STUDY OF A GEOMETRIC SHAPE FACTOR TECHNIQUE FOR ESTIMATING EARTH-EMITTED RADIANT FLUX DENSITIES FROM WIDE-FIELD-OF-VIEW RADIATION MEASUREMENTS

William L. Weaver and Richard N. Green Washington Apr. 1980 29 p refs

(NASA-TP-1629; L-13373) Avail: NTIS HC A02/MF A01 CSCL 04B

Geometric shape factors were computed and applied to satellite simulated irradiance measurements to estimate Earth emitted flux densities for global and zonal scales and for areas smaller than the detector field of view (FOV). Wide field of view flat plate detectors were emphasized, but spherical detectors were also studied. The radiation field was modeled after data from the Nimbus 2 and 3 satellites. At a satellite altitude of 600 km, zonal estimates were in error 1.0 to 1.2 percent and global estimates were in error less than 0.2 percent. Estimates with unrestricted field of view (UFOV) detectors were about the same for Lambertian and limb darkening radiation models. The opposite was found for restricted field of view detectors. The UFOV detectors are found to be poor estimators of flux density from the total FOV and are shown to be much better as estimators of flux density from a circle centered at the FOV with an area significantly smaller than that for the total FOV. J.M.S.

N80-20987# Minority Services, Inc., Washington, D.C.

INFERRED CLIMATOLOGY FOR U.S. AIRPORTS Final Report

Roy E. Wyett Nov. 1979 141 p ref

(Contract DOT-FA78WAI-881)

(AD-A080487; FAA-RD-79-110; FAA Proj. 152-462) Avail: NTIS HC A07/MF A01 CSCL 01/5

Based on climatological data from airports where weather observations are taken, a climatological value is derived for most U.S. airports. This value represents the percentage of time over a period of a year that one could expect to encounter ceilings less than or equal to 1,500 feet and/or visibilities less than or equal to 3 miles. R.C.T.

N80-20988# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

THE 19304D GSRS, MISSILE NUMBER 1046, ROUND NUMBER V-66, 23 AUGUST 1979

Aug. 1979 19 p

(DA Proj. 1P6-65702-D-127)

(AD-A079989; ERADCOM/ASL-DR-1056) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19304D GSRS, Missile Number 1046, Round Number V-66, are presented in tabular form. GRA

N80-20989# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

THE 19304B GSRS, MISSILE NUMBERS 1139, 1051 AND 1037, ROUND NUMBERS V-61, V-62 AND V-63, 9 AUGUST 1979

Aug. 1979 22 p

(DA Proj. 1P6-65702-D-127)

(AD-A079994; ERADCOM/ASL-DR-1050) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of the 19304B GSRS, Missile Numbers 1139, 1051 and 1037, Round Numbers V-61, V-62 and V-63, are presented in tabular form. GRA

N80-20990# Air Force Geophysics Lab., Hanscom AFB, Mass.

A TEST OF THE CLIMATIC NORMALITY OF SYNTHETIC PROFILES OF ATMOSPHERIC LIQUID WATER CONTENT OVER THE USSR IN 1973 Environmental Research Papers

Y. Izumi 12 Jul. 1979 45 p refs

(AF Proj. 6670)

(AD-A077021; AFGL-TR-79-0154; AFGL-ERP-668) Avail: NTIS HC A03/MF A01 CSCL 04/2

To test the climatic normality of profiles of atmospheric liquid water content generated from conventional weather data for 11 stations in the U.S.S.R., profiles for the mid-seasonal months of 1973 were compared with profiles randomly selected from the 5-year period 1968-1972. No cause was found to suspect that 1973 was climatically atypical. GRA

N80-20991# Naval Oceanography Command Detachment, Asheville, N.C.

US NAVY AND MARINE CORPS METEOROLOGICAL STATION CLIMATIC SUMMARIES Progress Report, 1945 - 1977

Oct. 1979 248 p Supersedes AD-A012376

(AD-A076976) Avail: NTIS HC A11/MF A01 CSCL 04/2

The weather station climatic summaries included consist of approximately four pages per station: a climate narrative, station history, and two pages of tabular meteorological data. Data from sixty-one weather stations are reported. A.W.H.

N80-20992# Naval Environmental Prediction Research Facility, Monterey, Calif.

MONTHLY CLIMATOLOGY FOR EVAPORATION DUCT OCCURRENCE IN THE NORTH ATLANTIC OCEAN Final Report

Wayne Sweet Jun. 1979 41 p refs

(WF52551792)

(AD-A075524; NEPRF-TR-79-01) Avail: NTIS HC A03/MF A01 CSCL 04/2

Evaporation duct climatologies are given for 10 North Atlantic Ocean weather stations. Statistics for evaporation duct height, a measure of duct intensity, are presented in the forms of frequencies of occurrence for each month and histograms of percentages of occurrence for mid-months of each of the four seasons. These data can be used both for operational planning and as input to war gaming. GRA

N80-20993# Sandia Labs., Albuquerque, N. Mex. Environmental Research Div.

WIND CHARACTERISTICS FOR FIELD TESTING OF WIND CONVERSION SYSTEMS

Robert E. Akins Nov. 1979 55 p refs

(Contract EY-76-C-04-0789)

(SAND-78-1563) Avail: NTIS HC A04/MF A01

Techniques are presented to determine placement of instrumentation to be used in measurement of wind characteristics for field testing of wind energy conversion systems (WECS). Potential errors in the measurement of a reference wind velocity as a result of physical separation between an anemometer and a WECS and interference between the WECS and the reference anemometer are outlined. Methods of correcting errors caused by both of these sources are developed. DOE

N80-20994# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.

MARINERS WEATHER LOG

Elwyn E. Wilson, ed. Sep. 1979 81 p

(PB80-113277; NOAA-79100101) Avail: NTIS HC A05/MF A01 CSCL 04B

In addition to its regular sections, the safety of the port of Manila as a shelter from tropical storms and the average number of tropical cyclones in the northwest Pacific area during 1978 are discussed. GRA

N80-20995# National Meteorological Center, Washington, D. C.

DAY-NIGHT DIFFERENCES IN RADIOSONDE OBSERVATIONS OF THE STRATOSPHERE AND TROPOSPHERE

Raymond M. McInturff, Frederick G. Finger, Keith W. Johnson, and James D. Laver Sep. 1979 54 p refs

(PB80-117989; NOAA-TM-NWS-NMC-63) Avail: NTIS HC A04/MF A01 CSCL 04B

Day-night differences in temperature and height were used

as the basis for a system designed to achieve compatibility between data measured by various radiosonde instruments. The resultant compatibility adjustments in reported data were prerequisite to the analysis of stratospheric constant-pressure charts above the 100 mb level, and for some instrument types they were significant even at tropospheric levels. GRA

N80-20996# Illinois State Water Survey, Urbana.
ECONOMICS OF WEATHER MODIFICATION: A REVIEW
Steven T. Sonka 1979 63 p refs
(Contract NOAA-7-14291)
(PB80-110398; ISWS/RI-89/79; W80-01008) Avail: NTIS
HC A04/MF A01 CSCL 04B

Gross benefits and costs of potential weather modification activities and the elements vital to a credible economic analysis of such activities are discussed. Precipitation augmentation, hail suppression, hurricane suppression, fog dispersal, and lightning suppression are among the activities evaluated. GRA

N80-20997# Illinois State Water Survey, Urbana.
HYDROMETEOROLOGICAL CHARACTERISTICS OF SEVERE RAINSTORMS IN ILLINOIS
Floyd A. Huff 1979 24 p refs
(PB80-110406; ISWS/RI-90/79; W80-01009) Avail: NTIS
HC A02/MF A01 CSCL 04B

A summary of available information on heavy rainstorms in Illinois obtained from analyses of data from various sources is presented. Primary emphasis is placed on the frequency distribution of areal mean rainfall in severe rainstorms having durations of 6 to 48 hours and producing excessive amounts over areas of 25 to 10,000 square miles. GRA

N80-20998# North Carolina State Univ. at Raleigh. Dept. of Geosciences.
BASIC STUDIES FLOW AND DIFFUSION OVER HILLS Final Report, 1 Sep. 1976 - 31 Aug. 1977
S. P. S. Arya and J. C. R. Hunt (Cambridge Univ., England) Sep. 1979 39 p refs Prepared in cooperation with Cambridge Univ., England
(Grant EPA-R-804653)
(PB80-112014; EPA-600/4-79-053; NCSU-FMR-5) Avail: NTIS HC A03/MF A01 CSCL 04B

Experiments were conducted with models of a bell shaped hill and a 2-D steep ridge in EPA's meteorological wind tunnel and salt-water stratified towing tanks in order to study the flow and diffusion of pollutants in complex terrain under both neutral and stably stratified conditions. Measurements were made of the flow structure as well as the concentration patterns around the hills due to point sources located at different heights and positions relative to the hills. GRA

N80-20999# National Weather Service, Washington, D.C.
METEOROLOGICAL CRITERIA FOR STANDARD PROJECT HURRICANE AND PROBABLE MAXIMUM HURRICANE WINDFIELDS, GULF AND EAST COASTS OF THE UNITED STATES
Richard W. Schwerdt, Francis P. Ho, and Roger R. Watkins Sep. 1979 347 p refs
(PB80-117997; NOAA-TR-NWS-23; NOAA-79101101) Avail: NTIS HC A15/MF A01 CSCL 04B

The criteria for determining wind fields along the Gulf and East coasts of the United States for the most severe hurricane reasonably characteristic of a region and for the hurricane producing the highest possible sustained wind at a specified coastal location are presented. A single limiting value for the meteorological parameters of peripheral pressure and central pressure is determined. Upper and lower limits are determined for the radius of maximum winds, forward speed, track direction, and inflow angle. Interrelations between the several parameters and latitude or longitude are investigated. GRA

N80-21000# National Oceanic and Atmospheric Administration, Washington, D. C. Federal Coordinator for Meteorological Services and Supporting Research.
NATIONAL WINTER STORMS OPERATIONS PLAN
Oct. 1979 43 p
(PB80-118425; FCM-79-3; NOAA-79100503) Avail: NTIS
HC A03/MF A01 CSCL 04B

The special arrangement made in order to furnish special weather observations used in warning of severe winter storms along the Gulf and East Coasts from November 1978 to April 1979 are described. GRA

N80-21001# National Center for Atmospheric Research, Boulder, Colo.
THE HAILPAD: CONSTRUCTION AND MATERIALS DATA REDUCTION, AND CALIBRATION
Alexis B. Long, Richard J. Matson, and Edwin L. Crow Aug. 1979 89 p refs
(Grant NSF ATM-77-23757)
(PB80-103989; NCAR/TN-144/STR) Avail: NTIS
HC A05/MF A01 CSCL 04B

The materials from which hailpads are constructed, the procedures for reducing hailpad data, and the methods used to calibrate these instruments are examined. It was found that a second degree polynomial adequate describes the pad calibration relation between dent minor axis and hail stone diameter. The effect of wind on the calibration is studied. GRA

N80-21002# National Environmental Satellite Center, Washington, D. C.
SATELLITE ACTIVITIES OF NOAA 1978
Jun. 1979 23 p
(PB80-112782; NOAA-79100504) Avail: NTIS
HC A02/MF A01 CSCL 04B

The NOAA elements that participate in the polar orbiting and geostationary satellite systems are listed with descriptions of their individual programs. Satellite data uses described include wind and temperature determination, environmental warning services, and the monitoring of ocean, hydrological, agricultural, and fishery conditions. Space support activities are also discussed. K.L.

N80-21003# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
GATE RADAR RAINFALL ATLAS
Michael D. Hudlow and Vernon L. Patterson Mar. 1979 158 p refs
(PB80-121130; NOAA-79102201) Avail: NTIS
HC A08/MF A01 CSCL 04B

As a part of the GARP Atlantic Tropical Experiment (GATE), quantitative precipitation observations were made during the summer of 1974 for an experimental array centered at 8 deg 30 min N. latitude and 23 deg 30 min W. longitude using four C-band digital radars complemented by shipboard rain gages. High resolution rainfall data sets covering a circular area (master array) extending approximately 204 km from the center of the experimental array were derived and were archived at the two GATE World Data Centers. The rainfall products were derived by using the hourly precipitation accumulations for 4 km square data bins as input. GRA

N80-21004# National Weather Service, Washington, D.C.
NATIONAL WEATHER SERVICE FORECASTING HANDBOOK NO. 1: FACSIMILE PRODUCTS
Robert E. Rieck, ed. Jul. 1979 307 p
(PB80-125255; NOAA-79112304) Avail: NTIS
HC A14/MF A01 CSCL 04B

The method of production of facsimile products in the National Weather Service is explained. Formats are presented along with the theory behind the products. Theory is intended to acquaint the forecaster with the basic thinking behind the production of the facsimile product and to identify and explain the appropriate forecast model. GRA

N80-21005# Texas Dept. of Water Resources, Austin.
THE ECONOMIC EFFECTS OF WEATHER MODIFICATION ACTIVITIES. PART 1: CROP PRODUCTION Final Report
William Allaway, Lawrence Lippke, Robert Riggio, and Comer Tuck Mar. 1979 59 p refs
(Contract DI-14-06-D-7587)
(PB80-112048; TDWR/LP-21-1) Avail: NTIS
HC A04/MF A01 CSCL 02B

The relationships between yield, technology, and weather for three crops in a fourteen county region of Texas were quantified

in order to estimate the economic effects of weather modification activities. Multiple regression analysis was used to estimate the crop yield response to assumed increases in average precipitation. The estimates of increased crop production were converted to monetary values and an input-output model was used to give a preliminary estimate of the economic activity generated in the region by increased crop revenues. Results of the study indicate that there are substantial direct increases in agricultural incomes resulting from assumed increases in average precipitation. GRA

N80-21006# Texas Dept. of Water Resources, Austin.
THE ECONOMIC EFFECTS OF WEATHER MODIFICATION ACTIVITIES. PART 2: RANGE PRODUCTION AND INTERINDUSTRY ANALYSIS Final Report
Lawrence Lippke Mar. 1979 92 p refs Sponsored by the Office of Atmospheric Resources Management
(Contract DI-14-06-D-7587)
(PB80-112055; TDWR/LP-21-2) Avail: NTIS
HC A05/MF A01 CSCL 02B

The response of range yield to changes in the average amount of precipitation is studied. It is estimated that rainfall during the spring months is very important determining the condition of the range during the rest of the year. More specifically, a 10 percent increase in rainfall in April would have the largest effect on total income to area livestock producers. Studies of the total economic effects of additional rainfall in the Big SpringSnyder area reveals that an estimated increase of 984 thousand dollars to the total income could be realized if March rainfall was increased by 10 percent. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-21007 Florida State Univ., Tallahassee.
EQUATORIAL PACIFIC OCEAN VARIABILITY-SEASONAL AND EL NINO TIME SCALES Ph.D. Thesis
John Clifton Kindle 1979 148 p
Avail: Univ. Microfilms Order No. 8007470

A nonlinear, single-layer numerical model was used to examine the baroclinic response of the equatorial ocean to time-variable winds. The rectangular model basin extended 1,500 km south of the equator and 15,000 km zonally; open boundary conditions were employed at the southern boundary. Attention is focused on the equatorially trapped wave response to symmetric, zonal time-dependent winds. Numerical simulations of the anomalous El Nino event were performed by initializing the model at some stage of the average seasonal solution and, subsequently, modifying the mean winds in the central and western Pacific. Discussion is focused on the effects of the magnitude, duration and timing of both the relaxation and the subsequent intensification phases. Dissert. Abstr.

N80-21008# Synectics Corp., Rome, N. Y.
BATHYMETRIC DATA REDUCTION SUBSYSTEM Final Technical Report, Aug. 1976 - Oct. 1978
P. Bell and R. Howarth Griffiss AFB, N.Y. RADC Sep. 1979 49 p
(Contract F30602-76-C-0412; AF Proj. 4302)
(AD-A079624; C-T0756-W; RADC-TR-79-212) Avail: NTIS
HC A03/MF A01 CSCL 08/2

The subject final technical report covers Phase 1 - the Basic Operating Capability of the Bathymetric Data Reduction Subsystem. The report discusses and evaluates problems encountered during Phase 1 and the solutions which Synectics Corporation provided to these problems. There are four parts to this report. First, a discussion of problems which is basically mathematical. Secondly, discussion of software accomplishments pertain to subsystem development. Part 3, method of inaccuracies occurring in data input and manipulation are discussed. Finally, the fourth part evaluates the scope and limitations of the hardware configuration along with system software provided by Data General Corporation. GRA

N80-21009# Maryland Univ., Cambridge. Horn Point Environment Labs.
DECLINE OF SUBMERGED AQUATIC PLANTS IN CHESAPEAKE BAY
J. Court Stevenson, Nedra Confer, and Catherine B. Pieper Jul. 1979 18 p Sponsored in part by Md. Dept. of Natural Resources, Annapolis, and EPA, Washington, D.C.
(PB80-114747; FWS/OBS-79/24) Avail: NTIS
HC A02/MF A01 CSCL 08A

Highlights from the comprehensive document, 'Summary of Available Information on Chesapeake Bay Submerged Vegetation', are presented. The eleven most important submerged aquatic plants, their functions in primary production and in providing habitat, and the reasons for their decline are described. Natural stresses, such as overgrazing by animals, hurricanes, warning trend, and natural diseases are discussed. Man-induced stresses include pollution from sewage, agriculture, and petrochemicals as well as turbidity and displacement by dredging and boat traffic. GRA

N80-21010# National Ocean Survey, Rockville, Md. Test and Evaluation Lab.
WAVE SENSOR SURVEY
Richard L. Ribe Jul. 1979 48 p
(PB80-118581; NOAA-TR-NOS-78; NOAA-79101102) Avail: NTIS HC A03/MF A01 CSCL 08C

A study of selected scientific and engineering literature was conducted to survey the state-of-the-art of wave measurement technology. Brief descriptions of representative wave sensors and their principles of operation are given. GRA

N80-21011# Delaware Univ., Newark.
DELAWARE SEA GRANT COLLEGE PROGRAM Annual Report, 1977 - 1978
1979 27 p refs
(PB80-122401; NOAA-79102404) Avail: NTIS
HC A03/MF A01 CSCL 08I

The activities of the Delaware Sea Grant College Program in fiscal year 1977-78, in which more than 30 individual research and education projects were carried out in seven major program areas, are summarized. The Delaware phase of the national project was devoted to the study of rip currents. Controlled Environment mariculture has remained a major area of activity and progress. GRA

N80-21012# Georgia Marine Science Center, Savannah.
HYDROGRAPHIC OBSERVATIONS IN THE GEORGIA BIGHT (APRIL 1978)
S. R. Lasley, L. P. Atkinson, J. J. Singer, and W. S. Chandler Jul. 1979 101 p refs
(Grant NOAA-04-7-158-44126)
(PB80-111453; TRS-79/5; NOAA-79092405) Avail: NTIS
HC A06/MF A01 CSCL 08J

Chemical and physical data obtained during Georgia Bight Cruise (10-23 April 1978) aboard the R/V Columbus Iselin is presented. The investigation was part of a larger multi-institutional Department of Energy program to understand event scale, physical, chemical and biological processes of the South Atlantic Bight, the continental shelf region from Cape Hatteras to Cape Canaveral. The study reported here is concentrated in the Georgia Bight near Brunswick, Georgia. GRA

N80-21013# State Univ. of New York at Buffalo. Dept. of Civil Engineering.
COMPUTER MANUAL FOR CALCULATING WAVE-HEIGHT DISTRIBUTIONS ABOUT OFFSHORE STRUCTURES Interim Report
Volker W. Harms, Bijan Safaie, Shiu Nam Kam, and Joannes J. Westerink Sep. 1979 173 p Sponsored in part by NOAA, Rockville, Md., and New York Sea Grant Inst., Albany
(PB80-109150; SUNYBUF/WREE-79/04) Avail: NTIS
HC A08/MF A01 CSCL 13J

Programs are presented for the diffraction of water waves by isolated cylindrical structures of arbitrary cross-sectional geometry. The solution of the boundary value problem is obtained using Greens' function. Programs are presented for the integral equation solution and an approximate superposition solution.

Usage guidelines and illustrative examples are presented along with numerical accuracy and limitations of the programs. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-21014*# National Aeronautics and Space Administration, Washington, D. C.
ON THE CELLULAR AUTOIMMUNE MECHANISM FOR ELIMINATING ERYTHROCYTES NORMALLY AND UNDER EXTREME INFLUENCES
Ya. I Pukhova, I. A. Terskov, A. Ya. Anikina, and A. V. Shashkin Mar. 1980 15 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 2, Mar. - Apr. 1979 p 16-22 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75735) Avail: NTIS HC A02/MF A01 CSCL 06C

The presence of an autoimmune cellular mechanism for destroying erythrocytes on the basis of results of experiments in vivo is demonstrated in the blood and the organs. This mechanism is made up of a population of immunocompetent killer-lymphocytes which originates in the bone marrow and the thymus, and which is manifested in the local hemolysis effect. J.M.S.

N80-21015*# National Aeronautics and Space Administration, Washington, D. C.
ADRENOCORTICAL RESPONSE IN RATS SUBJECTED TO A STRESS OF RESTRAINT BY IMMOBILIZATION WHETHER ACCOMPANIED BY HYPOTHERMIA OR NOT
Laia Buchel, Monique Prioux-Guyonneau, and Lola Libian Apr. 1980 10 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol. (France), v. 168, no. 10-12, 1974 p 1202-1207 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76119) Avail: NTIS HC A02/MF A01 CSCL 06C

The restraint associated with hypothermia which increases the adrenal activity in rats was investigated. In rats with nomothermia or light hypothermia, the plasma and adrenal corticosterone levels increase at least threefold whatever the duration of restraint. Their return to normal values depends on the duration of the restraint. Exposure to cold produces in free rats a light hypothermia with an increase of the plasma and adrenal corticosterone levels, and in restraint animals an important hypothermia which does not potentiate the stimulation of adrenocortical activity induced by the restraint alone. R.C.T.

N80-21016*# National Aeronautics and Space Administration, Washington, D. C.
REDUCTION OF THE DURATION OF RESTRAINT FOR THE PRODUCTION OF EXPERIMENTAL ULCERS IN RATS: APPLICATION TO THE STUDY OF PROTECTIVE SUBSTANCES
L. Buchel and D. Gallaire Apr. 1980 7 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol. (France), v. 157, no. 6, 1963, p 1225-1228 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76136) Avail: NTIS HC A02/MF A01 CSCL 06C

An experiment is described which was designed to cause ulcers in rats, but requiring less restraint time than previously used procedures. The method and results are presented. F.O.S.

N80-21017*# National Aeronautics and Space Administration, Washington, D. C.
FIFTH WORKING CONFERENCE (SPACE BIOLOGY) AT THE 21ST PLENARY SESSION OF COSPAR
S. S. Yurov Mar. 1980 4 p Transl. into ENGLISH from Radiobiologiya (USSR), v. 18, no. 4, May 1979 p 786 Conf. held at Innsbruck, 28 May - 10 Jun. 1978 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76107) Avail: NTIS HC A02/MF A01 CSCL 06C

Space radiobiology is discussed with emphasis on the biological effects of heavy charged particles. Findings of spaceborne experiments on fungi, eggs, and seeds are presented. K.L.

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N80-21018 Pennsylvania State Univ., University Park.
PLASMA CORTISOL LEVELS AND AUDITORY FUNCTIONING IN HUMANS EXPOSED TO SHORT AND PROLONGED DURATIONS OF NOISE Ph.D. Thesis
Thomas Edward Bennett 1979 154 p
Avail: Univ. Microfilms Order No. 8005976

Audiometric and hormonal effects of noise exposure were studied in male and female subjects exposed to moderately intense noise (85 dBA, broadband, pink noise) for short and prolonged durations. The major focus was on: (1) characterizing changes in circulating cortisol levels (using radioimmunoassay) before, during, and after noise exposure; (2) measuring the effects of noise on three facets of auditory perception (pure tone threshold sensitivity, level of initial masing perception, and loudness discrimination ability); and (3) examining possible relationships among duration of noise exposure, curculating hormone levels, and hearing ability in male and female human subjects. It was established that noise exposure results in a decreased ability to detect pure tones (threshold shifts), an increased ability to detect changes in loudness (a recruitment phenomenon), and a decreased ability to detect, tones in the presence of background noise (discrimination impairments). Dissert. Abstr.

N80-21019*# National Aeronautics and Space Administration, Washington, D. C.
INITIAL DYNAMICS OF THE EKG DURING AN ELECTRICAL DEFIBRILLATION OF THE HEART
I. I. Bikov, Ya. P. Chebotarov, and V. G. Nikolaev Apr. 1980 12 p refs Transl. into ENGLISH from Fiziol. Zh. Akad. Nauk Ukr RSR (USSR), v. 15, no. 3, 1969 p 322-327 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-76002) Avail: NTIS HC A02/MF A01 CSCL 06P

In tests on 11 mature dogs, immobilized by means of an automatic blocking and synchronization system, artefact free EKG were obtained, beginning 0.04-0.06 sec after passage of a defibrillating current. Different versions of the start of fibrillation were noted, in application of the defibrillating stimulus in the early phase of the cardiac cycle. A swinging phenomenon, increasing amplitude, of fibrillation was noted for 0.4-1.5 sec after delivery of a subthreshold stimulus. Conditions for a positive outcome of repeated defibrillation were found, and a relationship was noted between the configuration of the exciting process with respect to the lines of force of the defibrillating current and the defibrillation threshold. It was shown that the initial EKG dynamics after defibrillation is based on a gradual shift of the pacemaker from the myocardium of the ventricles to the sinus node, through phases of atrioventricular and atrial automatism. Author

N80-21020*# National Aeronautics and Space Administration, Washington, D. C.
ATHEROSCLEROTIC CHANGES OF VESSELS CAUSED BY RESTRICTION OF MOVEMENT
G. S. Gvishiani, N. G. Kobakhidze, M. G. Mchedlishvili, and T. I. Dekanosidze Mar. 1980 7 p refs Transl. into ENGLISH from Soobshch. Akad. Nauk Gruz. SSR (USSR), v. 59, no. 3, 1970 p 701-704 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-76022) Avail: NTIS HC A02/MF A01 CSCL 06S

The effect of restriction of movement on the development of atherosclerosis was studied in rabbits. Drastic restriction of movement for 20 and 30 days causes atherosclerotic alterations of the aorta and shifts in ECG which are characteristic of coronary atherosclerosis. At the same time, shortening of the duration of

blood coagulation and an increase in the content of catecholamines and beta-lipoproteids occur. R.C.T.

N80-21021*# National Aeronautics and Space Administration, Washington, D. C.
COLD SHIVERING ACTIVITY AFTER UNILATERAL DESTRUCTION OF THE VESTIBULAR APPARATUS
G. I. Kuzmina. Mar. 1980. 11 p. refs. Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 65, no. 11, 1979. p 1655-1660. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-76099) Avail: NTIS HC A02/MF A01 CSCL 06P

The bioelectric activity of muscles (flexors and extensors of the forelimbs and hindlimbs) during cold shivering after unilateral destruction of the vestibular apparatus. It was found, that unilateral delabyrinthing produces bilateral facilitation of cold shivering in the flexor extremities more pronounced on the ipsilateral side. In the extensor muscles there was an absence of bioelectric activity both before and after delabyrinthing. Enhancement of cold shivering in the flexor extremities following intervention was evidently conditioned by removal of the inhibiting effect of the vestibulary apparatus on the function of special centers. R.C.T.

N80-21022*# National Aeronautics and Space Administration, Washington, D. C.
GLYCEROL TEST IN DIAGNOSING INCREASED INTRALABYRINTH PRESSURE
B. Ya. Limar, N. S. Mischanchuk, M. V. Kulikova, and V. I. Yermilova. Mar. 1980. 10 p. refs. Transl. into ENGLISH from Zh. Ushnykh Nosovykh Gorlovykh Bolez. (USSR), no. 6, Nov. - Dec. 1979. p 55-59. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76110) Avail: NTIS HC A02/MF A01 CSCL 06E

The problem of increased intralabyrinth pressure as one of the causes of cochlear-vestibular disorders is discussed. A technique for conducting the glycerol test is presented. R.C.T.

N80-21023*# National Aeronautics and Space Administration, Washington, D. C.
COAGULATING ACTIVITY OF THE BLOOD, VASCULAR WALL, AND MYOCARDIUM UNDER HYPODYNAMIA CONDITIONS
B. V. Petrovskiy, ed., E. I. Chazov, ed., and S. V. Andreyev, ed. Mar. 1980. 10 p. Transl. into ENGLISH from the book "Aktual Nyye Problemy Gemostaziologii, Molekulyarno-Biologicheskye i Fiziologicheskiye Aspekty" Moscow, Nauka Press, 1979. p 45-52. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76056) Avail: NTIS HC A02/MF A01 CSCL 06S

In order to study the effects of hypodynamia on the coagulating properties of the blood, vascular wall, and myocardium, chinchilla rabbits were kept for varying periods in special cages which restricted their movements. At the end of the experiment, blood samples were taken and the animals were sacrificed. Preparations were made from the myocardium venae cavae, and layers of the aorta. Two resultant interrelated and mutually conditioned syndromes were discovered: thrombohemorrhagic in the blood and hemorrago-thrombotic in the tissues. R.C.T.

N80-21024*# National Aeronautics and Space Administration, Washington, D. C.
PROPHYLAXIS AND TREATMENT OF SEASICKNESS
M. Yefremenko. Mar. 1980. 7 p. ref. Transl. into ENGLISH of Morsk. Sb. (USSR), no. 6, Jun. 1979. p 40-42. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76108) Avail: NTIS HC A02/MF A01 CSCL 06E

Depending upon the dominant type of symptoms, seasickness is divided into three forms: nervous, gastro-intestinal, and cardiovascular. Various medications are recommended appropriate to these forms. The first goal is normalization of impaired system functions as well as metabolism and the electrolyte and acid-base condition of the organism. Dietary recommendations are made and specific suggestions on the use of physical exercise, including prophylatic vestibular training exercises. Author

N80-21025*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF SPACE FLIGHT ON SODIUM, COPPER, MANGANESE AND MAGNESIUM CONTENT IN THE SKELETAL BONES
A. A. Prokhonchukov, V. P. Taitsev, B. A. Shakhunov, V. A. Zhizhina, A. G. Kolesnik, and N. A. Komissarova. Oct. 1979. 11 p. refs. Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 6, Nov. - Dec. 1978. p 65-70. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75506) Avail: NTIS HC A02/MF A01 CSCL 06P

Sodium content decreased in the human skeletal bones and rose in the rat bones following space flight. In man copper content rose in the femoral bone and decreased in the vertebral body and the sternum, but was unchanged in the rest of the bones. Magnesium content was decreased in the femoral bone and the sternum, and in the vertebrae, but remained unchanged in the rest of the bones. Possible mechanisms of the changes detected are discussed. Author

N80-21026*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF HYPOKINESIA AND HYPODYNAMIA ON THE INTRAORGANIC ARTERIES OF THE HEART
L. A. Aleksina. Mar. 1980. 7 p. refs. Transl. into ENGLISH from Arkh. Anat., gistol. embriol. (USSR), v. 61, no.11, 1971. p 92-95. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76069) Avail: NTIS HC A02/MF A01 CSCL 06S

The experiments were performed on rabbits kept in small cages for 2-12 weeks. Their motor activity was greatly restricted. The arteries of the heart were injected with an India ink-gelatine mass; injection was directly into the coronary arteries. After fixation in 10% formaline solution 120 micron sections were cut. These were cleared by the Malygin method and examined with a light microscope. After exposure to hypokinetic conditions the picture of the cardiac arterial bed changed. During the first weeks the capillaries of the myocardium were significantly constricted, their course becoming sinuous. With prolonged exposure to hypokinetic conditions the vessels were found to dilate gradually and myocardial architectonics changed. Author

N80-21027# Illinois Univ. at the Medical Center, Chicago. Dept. of Occupational and Environmental Medicine.
MODEL FOR MEASURING THE HEALTH IMPACT FROM CHANGING LEVELS OF AMBIENT AIR POLLUTION: MORBIDITY STUDY
Tsukasa Namekata, Bertram W. Carnow, Zanet Flournoy-Gill, Eileen B. OFarrell, and Domenic Reda. Aug. 1979. 74 p. refs.
(Contract EPA-68-02-2492)
(PB80-107030; EPA-600/1-79-024) Avail: NTIS HC A04/MF A01 CSCL 06T

The relationship between human health and ambient air concentrations of the major pollutants in the city of Chicago is examined using linear regression models to quantitatively estimate the degree of the air pollution contribution to emergency room visits for cardiac and respiratory diseases. According to the results, sulfur dioxide based on patient exposure levels accounts for about 13% of the variation of emergency room visits for acute bronchial and lower respiratory infections and about 22% for total cardiac diagnoses. Nitric oxide based on measurements from the closest site to the hospitals can account for about 7% of the variation of visits for total respiratory diagnoses, 6% for allergic conditions and upper respiratory infections, 4% for total cardiac diagnoses and 4% for hypertension and vascular heart diseases. GRA

N80-21028# Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
ABSORPTION CHARACTERISTICS OF PROLATE SPHEROIDAL MODEL OF MAN AND ANIMALS AT AND NEAR RESONANCE FREQUENCY. Final Report, 15 Sep. 1976 - 15 Mar. 1978

Vijai K. Tripatai and Hyuckjae Lee. Aug. 1979. 74 p. refs.
(Grant EPA-R-804697)
(PB80-108293; EPA-600/1-79-025) Avail: NTIS
HC A04/MF A01 CSCL 06R

The absorption characteristics of prolate spheroidal models consisting of homogeneous biological tissues radiated with plane waves at an arbitrary angle of incidence at and near the resonance frequency were evaluated. A general formulation of Stevenson's method in the third approximation is presented which can be applied to an arbitrary angle of incidence and leads to an improvement in frequency range of validity and accuracy as compared with first order solutions. The extended boundary condition emthod is also presented since it was found to be inplementable for realistic models at frequencies approaching resonance. GRA

N80-21029# Research Triangle Inst., Research Triangle Park, N. C.
FORMULATION OF A PRELIMINARY ASSESSMENT OF HALOGENATED ORGANIC COMPOUNDS IN MAN AND ENVIRONMENTAL MEDIA. Annual Report, Nov. 1976 - Dec. 1978
Edo D. Pellizzari, Mitchell D. Erickson, and R. A. Zweidinger. Jul. 1979. 469 p. refs.
(Contract EPA-68-01-4731)
(PB80-112170; EPA-560/13-79-006) Avail: NTIS
HC A20/MF A01 CSCL 06S

A model is developed for making a comparative assessment of halogenated organics in man and environmental media. The most prominent and biologically important substances are selected for an epidemiological study. K.L.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-21030# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
K-LINES: A THEORY OF MEMORY
Marvin Minsky. Jun. 1979. 25 p. refs.
(Contract N00014-79-C-0260)
(AD-A078116; AI-M-516) Avail: NTIS HC A02/MF A01 CSCL 05/10

Most theories of memory suggest that when we learn or memorize something, some representation of that something is constructed, stored, and later retrieved. This raises questions like: How is information represented? How is it stored? How is it retrieved? Then, how is it used? This paper tries to deal with all of these at once. When you get an idea and want to remember it, you create a K-line for it. When later activated, the K-line induces a mental state resembling the one that created it. A partial mental state is a subset of those mental agencies operating at one moment. This view leads to many ideas about the development, structure and physiology of Memory, and about how to implement frame-like representations in a distributed processor. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-21031# National Technical Information Service, Springfield, Va.
SIGNS AND DISPLAY SYSTEMS: GRAPHIC DESIGN AND HUMAN ENGINEERING. A BIBLIOGRAPHY WITH ABSTRACTS. Progress Report, 1964 - Nov. 1979
Edith Kenton. Dec. 1979. 196 p. Supersedes NTIS/PS-78/1195; NTIS/PS-77/1081; NTIS/PS-76/0967; NTIS/PS-75/073
(PB80-803158; NTIS/PS-78/1195; NTIS/PS-77/1081; NTIS/PS-76/0967; NTIS/PS-75/073) Avail: NTIS
HC $30.00/MF $30.00 CSCL 05E

The bibliography contains annotated references to research reports covering varied aspects of design of signs and displays, particularly in the transportation field. Specific topics include: highway sign design; highway sign legibility; traffic control devices; transportation graphics; visual perception of aircraft instrument display systems; human engineering of symbols; and legibility of maps. This updated bibliography contains 189 abstracts, 19 of which are new entries to the previous edition. GRA

N80-21032# Federal Aviation Administration, Washington, D. C.
SUMMARY OF DEPARTMENT OF TRANSPORTATION/FEDERAL AVIATION ADMINISTRATION TASK FORCE ON CREW WORKLOAD REPORT. Final Report, May 1977 - Aug. 1978
George C. Hay, Charles D. House, and Richard L. Sulzer. Dec. 1978. 216 p. refs.
(AD-A068189; FAA-EM-78-15) Avail: NTIS
HC A10/MF A01 CSCL 01/2

An analysis of the total accident experience of U.S. certificated air-route carriers reveals that there is no evidence that a flight-deck crew of two in an appropriately designed aircraft is less safe than a crew of three pilots. A review of the procedures followed in the airworthiness certification of recent U.S. air carrier aircraft indicates that manufacturers have demonstrated pilot workload in a fully modern and competent fashion, under the cognizance of FAA, and that actual crew complement approval is based on both the results of the workload demonstrations and the experience gained in a significant flight test program. A.R.H.

N80-21033*# Virginia Univ., Charlottesville. Dept. of Civil Engineering.
HUMAN COMFORT RESPONSE TO DOMINANT RANDOM MOTIONS IN LONGITUDINAL MODES OF AIRCRAFT MOTION
Ralph W. Stone, Jr. Jan. 1980. 130 p. refs.
(Contract NAS1-14908)
(NASA-CR-159186; UVA/528156/MAE-CE79/130) Avail: NTIS HC A07/MF A01 CSCL 05H

The effects of random vertical and longitudinal accelerations and pitching velocity passenger ride comfort responses were examined on the NASA Langley Visual Motion Simulator. Effects of power spectral density shape were studied for motions where the peak was between 0 and 2 Hz. The subjective rating data and the physical motion data obtained are presented without interpretation or detailed analysis. There existed motions in all other degrees of freedom as well as the particular pair of longitudinal airplane motions studied. These unwanted motions, caused by the characteristics of the simulator may have introduced some interactive effects on passenger responses. J.M.S.

N80-21034*# Virginia Univ., Charlottesville. Dept. of Civil Engineering.
HUMAN COMFORT RESPONSE TO RANDOM MOTIONS WITH A DOMINANT PITCHING MOTION
Ralph W. Stone, Jr. Feb. 1980. 94 p. refs.
(Contract NAS1-14908)
(NASA-CR-159140; UVA/528156/MAE-CE79/117) Avail: NTIS HC A05/MF A01 CSCL 05H

The effects of random pitching velocities on passenger ride comfort response were examined on the NASA Langley Visual Motion Simulator. The effects of power spectral density shape and frequency ranges from 0 to 2 Hz were studied. The subjective rating data and the physical motion data obtained are presented. No attempt at interpretation or detailed analysis of the data is made. Motions in all degrees of freedom existed as well as the intended pitching motion, because of the characteristics of the simulator. These unwanted motions may have introduced some interactive effects on passenger responses which should be considered in any analysis of the data. J.M.S.

N80-21035# Virginia Polytechnic Inst. and State Univ., Blacksburg. Human Factors Lab.
RESEARCH ON NEW ELECTRONIC DISPLAY TECHNOLOGIES. Annual Summary Report, 1 Mar. 1978 - 31 Oct. 1979

H. L. Snyder, James C. Gutmann, and Willard W. Farley. Dec. 1979. 45 p. refs.
(Contract N00014-78-C-0238)
(AD-A079323; VPI-HFL-79-12/ONR-79-1) Avail: NTIS HC A03/MF A01 CSCL 05/8

This report summarized the work performed during the first year, dealing with two tasks. The first task, entitled 'Human Engineering Survey and Analysis', reviews the current flap panel display technologies, a summary of the human operator-critical characteristics of each technology, a technical summary of relevant human operator visual characteristics, and an evaluation of each technology by current visual display theoretical evaluation approaches. The second task, entitled 'Hue/Luminance Contrast Tradeoffs,' involved laboratory research designed to develop a metric by which luminance contrast and chrominance contrast can be traded off in display design to provide a metric of total effective display contrast. Work to date on both these tasks is summarized in this report. GRA

N80-21036# Calspan Advanced Technology Center, Buffalo, N.Y.
ESTABLISHMENT OF THE REPEATABILITY OF PERFORMANCE OF THE SA103C THREE YEAR OLD CHILD TEST DUMMIES Final Report, Sep. 1978 - Jun. 1979
Kenneth N. Naab and Stephen A. Baum. Jun. 1979. 137 p. refs.
(Contract DOT-HS-8-02022)
(PB80-112204; CALSPAN-6385-V-1; DOT-HS-805-071) Avail: NTIS HC A07/MF A01 CSCL 13L

The performance repeatability of four SA103C three year old child test dummies was investigated. The primary measures of dummy sled test performance analyzed with the statistical methods were: (1) peak head resultant acceleration; (2) peak chest resultant acceleration; (3) maximum head horizontal displacement and (4) maximum knee horizontal displacement. An analysis of the absolute deviations of each data point from the overall means demonstrated that the dummy variations were within an acceptable level for all performance measures. In addition, performance comparison overlay time history graphs are presented for direct comparisons. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-21037*# Timoc International Co., Flintridge, Calif.
MIL-M-38510/470 TEST VECTORS: FAULT DETECTION EFFICIENCY MEASUREMENT VIA HARDWARE FAULT SIMULATION Final Report, Nov. 1979 - Mar. 1980
Constantin C. Timoc. 10 Mar. 1980. 67 p. refs. Prepared for JPL.
(Contracts NAS7-100; JPL-955502)
(NASA-CR-162916; JPL-9950-308) Avail: NTIS HC A04/MF A01 CSCL 09B

The stuck fault detection efficiency of the test vectors developed for the MIL-M-38510/470 NASA was measured using a hardware stuck fault simulator for the 1802 microprocessor. Thirty-nine stuck faults were not detected out of a total of 874 injected into the combinatorial and sequential parts of the microprocessor. Since undetected faults can create catastrophic errors in equipment designed for high reliability applications, it is recommended that the MIL-M-38510/470 NASA be enhanced with additional test vectors so as to achieve 100% stuck fault detection efficiency. K.L.

N80-21038# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
AUTOMATED SYNTHESIS OF DIGITAL HARDWARE MODULES: SIMULATION AND VERIFICATION OF INTERCONNECTIONS Final Report, 1 Jun. 1978 - 31 Aug. 1979
Alice C. Parker and Donald E. Thomas. 31 Oct. 1979. 18 p. refs.
(Grant DAAG29-73-G-0070)
(AD-A078463; ARO-13670.16-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

The research described in this final report involves two basic areas: automated design and optimization of digital hardware, and simulation and verification of interconnections between digital system modules. Both of these are part of the CMU-DA (Design Automation) project (formerly called the RT-CAD project). We have investigated strategies for computer-aided optimization of the control part of digital systems hardware by developing a discrete optimization technique and a strategy for applying this technique. In addition, we have developed a design aid for computer interconnection evaluation by simulation techniques. Finally, we have begun to design a system to formally verify that a description of interconnections is functionally correct. GRA

N80-21039# California Univ., Los Angeles. Graduate School of Management.
GUIDELINES FOR EVALUATION OF MINICOMPUTER HARDWARE AND SOFTWARE: A USERS PERSPECTIVE
Bennet P. Lientz. Dec. 1979. 49 p. refs.
(Contract N00014-75-C-0266)
(AD-A078460) Avail: NTIS HC A03/MF A01 CSCL 09/2

Guidelines are presented for the evaluation and selection of hardware and system software for minicomputers. The evaluation is presented from a non-technical user point of view as opposed to a detailed technical comparison. The issues covered include defining an approach for computing, acquiring a minicomputer system, negotiation with vendors, installation and operation. Case examples are given along with examples of failure. GRA

N80-21040# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
MAGNETIC BUBBLE RESEARCH Final Report, 15 Aug. 1975 - 30 Sep. 1978
Millard G. Mier. Nov. 1979. 55 p. refs.
(AF Proj. 2305)
(AD-A078702; AFAL-TR-79-1128) Avail: NTIS HC A04/MF A01 CSCL 09/2

Geometrical analysis techniques are used to derive computer memory system characteristics to support a hypothetical but realistic Air Force tactical mission scenario. Commercially available computer memory systems which might fulfill this requirement are reviewed and found unsuitable. Four emerging technologies which appear to have potential for fulfilling this requirement in the mid-1980's are reviewed and projected characteristics of a suitable capacity system based on each technology derived. The most promising technology, magnetic bubble memory, is examined and a major barrier to development is found to be the accurate characterization of materials supporting micron-sized magnetic bubbles. Standard techniques are examined for characterization of materials supporting very small magnetic bubbles. The failing of all techniques is optical microscopic resolution of these bubbles.

Three new techniques for this characterization, based on magnetic susceptibility changes with applied magnetic field, are examined and found to be suitable for small magnetic bubbles. A fast running Control Data Corporation (CDC) FORTRAN extended computer analysis program is described for analyzing experimental data and calculating all the static bubble materials parameters. GRA

N80-21041# National Technical Information Service, Springfield, Va.
MICROCOMPUTERS: GENERAL APPLICATIONS, PART 1, VOLUME 4. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. - Dec. 1977
Brian Carrigan Jul. 1979 309 p
(NTIS/PS-79/0726/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography of worldwide research literature cites studies on the applications of microcomputers. These include automotive, testing, navigation, instrumentation, biomedical, machine tools, and other applications. This updated bibliography contains 303 abstracts, none of which are new entries to the previous edition. GRA

N80-20689# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DATA CAPTURE FOR CARTOGRAPHIC DATA BASES
Helmut Uhrig *In its* Rept. on Cartography and Topographical Meas. Ser. 2 Transl. 1978 p 102-113 (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-21042 Purdue Univ., Lafayette, Ind.
HIGH ORDER FINITE DIFFERENCE METHODS FOR ELLIPTIC BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Ronald Fernand Boisvert 1979 200 p
Avail: Univ. Microfilms Order No. 8005835

An analysis of high order finite difference methods (HODIE) for the solution of linear elliptic boundary value problems in bounded regions of the plane, with particular attention to the Helmholtz problem is presented. The method attains high order accuracy while using only a compact nine point stencil whose coefficients are O(h) perturbations of a standard nine point discretization of the Laplacian (no derivative information is required). The implementation of a HODIE method for the Dirichlet problem for the Helmholtz equation on a rectangle is examined. The basic HODIE difference equation is then extended to handle mixed boundary conditions and nonrectangular domains. A fourth order discretization of the Helmholtz equation on a rectangle with constant coefficient mixed boundary conditions using a compact stencil is derived. Dissert. Abstr.

N80-21043*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
ISIS USERS MANUAL
Carolyn Grantham Mar. 1980 118 p refs
(NASA-TM-80144) Avail: NTIS HC A06/MF A01 CSCL 09B

A user manual for the interactive software invocation system (ISIS) is presented. The operational concepts and syntax of the interactive programming language are documented. K.L.

N80-21044*# Systems and Applied Sciences Corp., Riverdale, Md.
ADAPTATION AND OPTIMIZATION OF A LINE-BY-LINE RADIATIVE TRANSFER PROGRAM FOR THE STAR-100 (STARSMART)
Pamela L. Rarig Hampton, Va. NASA Langley Res. Center Mar. 1980 34 p refs
(Contract NAS1-15481)
(NASA-CR-159238) Avail: NTIS HC A03/MF A01 CSCL 09B

A program to calculate upwelling infrared radiation was modified to operate efficiently on the STAR-100. The modified software processes specific test cases significantly faster than the initial STAR-100 code. For example, a midlatitude summer atmospheric model is executed in less than 2% of the time originally required on the STAR-100. Furthermore, the optimized program performs extra operations to save the calculated absorption coefficients. Some of the advantages and pitfalls of virtual memory and vector processing are discussed along with strategies used to avoid loss of accuracy and computing power. Results from the vectorized code, in terms of speed, cost, and relative error with respect to serial code solutions are encouraging. K.L.

N80-21045*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
WORKSHOP ON REAL-TIME PROGRAMMING FOR NASA FLIGHT PROJECT
John C. Knight Feb. 1980 11 p Workshop held at Hampton, Va., 17-19 Oct. 1979; sponsored by NASA, Langley Research Center, Hampton, Va. and the Inst. for Computer Applications in Science and Engineering
(NASA-TM-80236) Avail: NTIS HC A02/MF A01 CSCL 09B

The role of high-level languages in the preparation of real time flight software is discussed. K.L.

N80-21046# Maryland Univ., College Park. Dept. of Computer Science.
REGION REPRESENTATION RASTER-TO-QUADTREE CONVERSION
Hanan Samet May 1979 30 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A078086; TR-766) Avail: NTIS HC A03/MF A01 CSCL 05/8

An algorithm is presented for constructing a quadtree for a binary image given its row-by-row description. The algorithm processes the image one row at a time and merges identically colored sons as soon as possible so that a minimal size quadtree exists after processing each pixel. This method is spacewise superior to one which reads in an entire array and then attempts to build the quadtree. Analysis of the algorithm reveals that its execution time is proportional to the number of pixels comprising the image. GRA

N80-21047# Stanford Univ., Calif. Electronics Labs.
SYNDIA USERS GUIDE
Warren E. Cory Aug. 1979 40 p
(Contracts DAAG29-79-C-0047; N00014-75-C-0601)
(AD-A075538; SU-SEL-79-028; TR-176) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes how to use the Syndia/Syngra system available at SU-SCORE. This system accepts a BNF-like grammar specification and automatically generates syntax diagrams on a Tektronix graphics terminal. Syndia is the major component of this system. Syngra acts as an interface between Syndia and the SUDS2 graphics editor. Syndia performs no ambiguity or consistency checks on the BNF input. This report assumes that the reader is familiar with BNF and syntax diagram representations of grammars. GRA

N80-21048# Stanford Univ., Calif. Dept. of Operations Research.
DOCUMENTATION OF A COMPUTER PROGRAM FOR HILLIERS HEURISTIC PROCEDURE IN INTEGER LINEAR PROGRAMMING
Nancy E. Jacqmin Jul. 1979 58 p ref
(Contract N00014-76-C-0418; Grant NSF MCS-76-81259)
(AD-A075576; TR-88) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report gives documentation for the computer code HEUR for finding good approximate solutions to integer linear programming problems using Hillier's heuristic procedure. A listing of the program with sample input and output is included. GRA

N80-20678# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
LINE GENERALIZATION AND DATA REDUCTION FROM

A MATHEMATICAL OPTIMIZATION POINT OF VIEW [LINIENGENERALISIERUNG UND DATENREDUKTION UNTEF DEM GESICHTSWINKEL DER MATHEMATISCHEN OPTIMIERUNG]
Rigand Weber *In its* Rept. on Cartography and Topographical Meas. Ser. 1 Original Rept. No. 74 1978 p 55-66 refs
In GERMAN; ENGLISH summary (For primary document see N80-20674 11-42)
Avail: NTIS HC A05/MF A01

N80-20689# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany)
EXPERIENCES GATHERED WITH A SYMBOL DISK WITH INTERCHANGEABLE SYMBOLS
Helmut Uhrig *In its* Rept. on Cartography and Topographical Meas. Ser. 2 Transl. 1978 p 93-106 refs (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N80-21049 Stanford Univ., Calif.
DESIGN AND PERFORMANCE OF LOCAL COMPUTER NETWORKS Ph.D. Thesis
John F. Shoch 1979 216 p
Avail: Univ. Microfilms Order No. 8006353

Alternative architectures for local computer networks are compared and a systematic effort to measure the performance characteristics of one such network is presented. Most networks fall into one of five major families: (1) partially connected systems using store-and-forward techniques; (2) star networks or hierarchical configurations; (3) rings and loops; (4) radio based approaches using packet broadcasting; and (5) multiaccess bus structures. From evaluation and analysis, one of the most attractive designs is found to be the use of a shared passive bus, run with a distributed control procedure. Performance of a system of this type is measured under conditions of normal load, high load, and overload. Under normal load there are very few errors, low delay, and the network easily supports the offered traffic. Under extremely high load the network utilization remains high (over 97%) and the sytem does not become unstable.
Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-21060*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ASYMPTOTIC EIGENSTRUCTURES
Peter M. Thompson and Gunter Stein Apr. 1980 36 p refs
(Contract NAG1-2)
(NASA-CR-162900; LIDS-P-982) Avail: NTIS
HC A03/MF A01 CSCL 12A

The behavior of the closed loop eigenstructure of a linear system with output feedback is analyzed as a single parameter multiplying the feedback gain is varied. An algorithm is presented that computes the asymptotically infinite eigenstructure, and it is shown how a system with high gain, feedback decouples into single input, single output systems. Then a synthesis algorithm is presented which uses full state feedback to achieve a desired asymptotic eigenstructure.
Author

N80-21061# Maryland Univ., College Park. Computer Science Center.
TEXTURE PRIMITIVE EXTRACTION USING AN EDGE-BASED APPROACH
Tsai-Hong Hong, Charles R. Dyer, and Azriel Rosenfeld May 1979 34 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD A078085; TR-763) Avail: NTIS HC A03/MF A01 CSCL 05/8

Many textures are characterizable as a collection of primitive elements arranged over a background field. This paper defines an edge-based procedure for extracting primitives from textures. The technique groups edges into region boundaries by joining facing pairs of edge points. A pilot evaluation is performed by examining the usefulness of these primitives for texture classification.
GRA

N80-21052# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
SENSITIVITY ADAPTIVE CONTROL OF A MAGNETIC SUSPENSION SYSTEM M.S. Thesis
Yick Man Chan May 1979 97 p refs
(Contract DAAG29-78-C-0016; Grants NSF ENG-74-20091; AF-AFOSR-3633-78; NSF INT-77-20969)
(AD-A077148; UILU-ENG-78-2236; DC-25) Avail: NTIS
HC A05/MF A01 CSCL 13/8

This project is concerned with the study of the behavior of a particular stochastic system, the magnetic suspension system, under the application of the Sensitivity Adaptive Feedback with Estimation Redistribution (SAFER) Control Algorithm. Matrix factorization techniques are used in the controller and estimator design for the system. Simulation results indicate that the magnetic suspension system can operate satisfactorily under the SAFER control method; and factorization techniques indeed enhance the numerical stability of computations. However, due to the complex structure of the SAFER control method, real time application of the algorithm may require faster computing device or simplified mathematical model. Its application will be most pertinent to system with slow time constants.
GRA

N80-21053# Wisconsin Univ. - Madison. Mathematics Research Center.
CLOSED-LOOP EIGENVALUE SPECIFICATION FOR INFINITE DIMENSIONAL SYSTEMS AUGMENTED AND DEFICIENT HYPERBOLIC CASES Summary Report
D. L. Russell Nov. 1979 118 p refs
(Contract DAAG29-75-C-0024; Grant AF-AFOSR-0018-79)
(AD-A079727; MRC-TSR-2021) Avail: NTIS
HC A06/MF A01 CSCL 12/1

We introduce a method for reduction of a class of distributed parameter control systems to a corresponding control canonical form which has the same intermediate 'control Jordan form' as the original system. Using this reduction together with certain results concerning the completeness and independence properties of complex exponentials we are able to study the problem of eigenvalue specification (pole placement for certain classes of hyperbolic systems which are more general than those discussed in the earlier paper).
GRA

N80-21054# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
COMPLIANCE AND FORCE CONTROL FOR COMPUTER CONTROLLED MANIPULATORS M.S. Thesis
Matthew Thomas Mason Apr. 1979 74 p refs
(Contract N00014-77-C-0389)
(AD-A077708; AI-TR-515) Avail: NTIS HC A04/MF A01
CSCL 13/8

Compliant motion occurs when the manipulator position is constrained by the task geometry. Compliant motion may be produced either by a passive mechanical compliance built into the manipulator, or by an active compliance implemented in the control servo loop. The second method, called force control, is the subject of this report. In particular, this report presents a theory of force control based on formal models of the manipulator and the task geometry. The ideal effector is used to model the manipulator, and the task geometry is modeled by the ideal surface, which is the locus of all positions accessible to the ideal effector. Models are also defined for the goal trajectory, position control, and force control. These models are useful in two respects. First, the model of force control provides precise semantics for force control primitives in manipulator programming languages. The model also defines a simple interface between the manipulator and the programmer, isolating the programmer from the fundamental complexity of low-level manipulator control.

Second, the formalism provides a method of synthesizing force control programs for compliant motion. A force control program is modeled as a set of equations in the components of manipulator velocity (angular velocity) and force (torque). The task geometry constraints can be modeled similarly. GRA

N80-21055# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raungahrt.
IMPROVEMENT OF A PROCESS TO IDENTIFY THE PARAMETERS FOR THE OPTIMAL CONTROL MODEL (BBN) [ENTWICKLUNG EINES VERFAHRENS ZUR IDENTIFIKATION DER PARAMETER DES BBN-MODELLS]
Uwe Kirchhoff 1978 146 p refs In GERMAN
(ILR-40; ISBN-3-79830-657-5) Avail: NTIS HC A07/MF A01

A description and mathematical representation of the functions of the optimal control model in time, and considering the limits of speed and vibration of the vehicle are given. The model must reproduce the structure of the model, different processes were adopted to obtain the parameters for the signal transmission, namely dead time, the time constant for the delay of neuromuscular action, and also the input signals from the ground which have been amplified by an optical regulator and a Kalman filter. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-21056 Maryland Univ., College Park.
HOMOLOGICAL INDICES AND HOMOTOPY CONTINUATION Ph.D. Thesis
Kathleen Tongue Alligood 1979 71 p
Avail: Univ. Microfilms Order No. 8006748

Topological conditions which ensure the existence of a path of solutions through a homotopy from a function with known solutions to the function in question are investigated. These conditions include nonzero intersection classes and such nonzero homological classes as the Lefschetz, Montgomery-Eilenberg, and Dold indices for fixed points and coincidence points. Equivariant results are also obtained, such as the Kakutani frame problem for 2- and 3-dimensional spheres. A relative index, analogous to the C.T. Yang homological index for spaces with involutions, is defined and applied to a generalized Borsuk-Ulam theorem. Dissert. Abstr.

N80-21057 State Univ. of New York, Buffalo.
RESULTS ON SUPERCOMPACT CARDINALS Ph.D. Thesis
Julius Barry Barbanel 1979 101 p
Avail: Univ. Microfilms Order No. 8005631

Various aspects of the notion of supercompactness are explored. The elementary embeddings that are associated with normal ultrafilters on supercompact cardinals are examined. In particular, a characterization based upon cofinality is established of which cardinals are fixed points of the embeddings. Given a supercompact cardinal, the collection of all associated normal ultrafilters can be put into a nice tree structure using the restriction operation on normal ultrafilters. The notion of an extendable normal ultrafilter is also discussed. It is established that every level has at least one nonextendible element, and that some levels have many non-extendible elements. Finally it is shown how assumptions about large cardinals above a supercompact cardinal yield additional structure information about the tree of normal ultrafilters. Dissert. Abstr.

N80-21058 Oregon State Univ., Corvallis.
NONLINEAR DIFFRACTION THEORY BY AN EIGENFUNCTION EXPANSION OF THE GREEN'S FUNCTION Ph.D. Thesis
Min-Chu Chen 1980 179 p
Avail: Univ. Microfilms Order No. 8007119

A second-order nonlinear diffraction theory is developed and discussed for a large diameter circular cylinder under the action of surface gravity waves of finite amplitude in water of finite depth. Boundary value problems are derived by using a perturbation expansion and the solutions for the diffracted waves are given in terms of Fredholm integral equations in which the resolvent kernel is a Green's function. Green's functions are obtained by the eigenfunction expansion method and the velocity potentials for the diffracted waves are recovered from Fredholm integral equations which incorporate the prescribed inhomogeneous boundary conditions and the Green's functions. Green's functions are extended to the second-order boundary value problem by an expansion in a complete set of orthonormal eigenfunctions. The dimensionaless hydrodynamic forces and moments on the cylinder are presented. Dissert. Abstr.

N80-21059*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPLYING INTEGRALS OF MOTION TO THE NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS
Donald J. Vezewski Mar. 1980 29 p refs
(NASA-TM-58225; JSC-16511) Avail: NTIS HC A03/MF A01 CSCL 12A

A method is developed for using the integrals of systems of nonlinear, ordinary, differential equations in a numerical integration process to control the local errors in these integrals and reduce the global errors of the solution. The method is general and can be applied to either scalar or vector integrals. A number of example problems, with accompanying numerical results, are used to verify the analysis and support the conjecture of global error reduction. Author

N80-21060# Maryland Univ., College Park. Computer Science Center.
SHAPE SEGMENTATION USING RELAXATION
Wallace S. Ruthowski, Shmuel Peleg, and Azriel Rosenfeld May 1979 31 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A078084; TR-762) Avail: NTIS HC A03/MF A01 CSCL 05/8

Relaxation is applied to the segmentation of closed boundary curves of shapes. The ambiguous segmentation of the boundary is represented by a directed graph structure whose nodes represent segments, where two nodes are joined by an arc if the segments are consecutive along the boundary. A probability vector is associated with each node; each component of this vector provides an estimate of the probability that the corresponding segment is a particular part of the object. Relaxation is used to eliminate impossible sequences of parts, or reduce the probabilities of unlikely ones. In experiments involving airplane shapes, this almost always results in a drastic simplification of the graph, with only good interpretations surviving.Author (GRA)

N80-21061# Maryland Univ., College Park. Dept. of Computer Science.
COMPUTING PERIMETERS OF IMAGES REPRESENTED BY QUADTREES
Hanan Samet Apr. 1979 20 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A078083; TR-755) Avail: NTIS HC A02/MF A01 CSCL 05/8

An algorithm is presented for computing the total perimeter of a binary image represented by a quadtree. The algorithm explores each segment of the border once and only once. Analysis of the algorithm shows that its worst-case average execution time is proportional to the product of the log of the image diameter and the number of nodes in the tree. Author (GRA)

N80-21062# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A RECURSIVE LAGRANGIAN FORMULATION OF MANIPULATOR DYNAMICS AND A COMPARATIVE STUDY OF DYNAMICS FORMULATION COMPLEXITY
John M. Hollerbach Jun. 1979 26 p refs
(Contract N00014-77-C-0389)
(AD-A078067; AI-M-533) Avail: NTIS HC A03/MF A01 CSCL 05/8

A recursive formulation of manipulator dynamics based on the Lagrange equations has been developed. The efficiency of this formulation allows the dynamics to be computed in real time. The formulation is analogous to recently developed recursive Newton-Euler dynamics and shares the latter's efficiency. A

comparison of the number of adds and multiplies required under different Lagrangian, Newtonian, and tabular formulations shows that recursive formulations based either on the Lagrange or on the Newton equations offer the overall best method of dynamics calculation. GRA

N80-21063# Maryland Univ., College Park. Computer Vision Lab.
FAST PARALLEL REALIZATION OF MATRIX MULTIPLICATION Interim Report
E. V. Krishnamurthy and Reinhard Klette. Nov. 1979. 31 p. refs.
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A080074; TR-834; AFOSR-TR-80-0079) Avail: NTIS HC A03/MF A01 CSCL 12/1

Fast parallel matrix multiplication algorithms in SIMD (Single-Instruction-Multiple-Data) and MIMD (Multiple-Instruction-Multiple-data) modes are described for implementation in a parallel-binary matrix processing system with facilities for bit-wise parallel Boolean operation and power-of-two shifts on Boolean matrices. A comparative study of these algorithms is made on the basis of their relative time-complexities, when conventional binary and prime-modulus arithmetic are used for forming the matrix product. GRA

N80-21064# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF BAYESIAN APPROACH TO UPDATING AIR FRAME CERs M.S. Thesis
Walter D. Dietrich. Sep. 1979. 179 p. refs.
(AD-A077064; AFIT/GSM/SM/76D-30) Avail: NTIS HC A09/MF A01 CSCL 15/5

This study investigates a Bayesian approach for developing a parametric equation which will estimate the recurring cost of the next lot/unit of an airframe program. Recurring costs are predicted because definitionally these costs are expected to reflect the cost for a follow-on production unit. Although the data base used for this study consisted of production cost information, the Bayesian approach may be useful for providing a parametric estimate of production cost using recurring costs from a prototype effort. However, until definitional problems associated with separating engineering and tooling costs into recurring and nonrecurring categories are resolved, predictions of production or next unit engineering and tooling costs will be marginal. Because of the definitional problem, total cost, (nonrecurring and recurring) was used in this study to develop Bayesian updated CERs for the engineering and tooling categories. GRA

N80-21065# Wisconsin Univ. - Madison. Mathematics Research Center.
AN ESTIMATE RELATED TO THE STRONG MAXIMUM PRINCIPLE Summary Report
Haiem Brezis and Pierre-Louis Lions. Sep. 1979. 11 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A079705; MRC-TSR-1995) Avail: NTIS HC A02/MF A01 CSCL 12/1

Some of the most useful and important tools in the study of elliptic boundary value problems are maximum principles. So called strong maximum principles provide strict inequalities when appropriate conditions are fulfilled. In this work a strong maximum principle is improved by exhibiting an explicit estimate sharper than what follows from usual arguments. GRA

N80-21066# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
ON THE EXISTENCE OF SIMPLE LIAPUNOV FUNCTIONS FOR LINEAR RETARDED DIFFERENCE DIFFERENTIAL EQUATIONS
L. A. Carvalho, E. F. Infante, and J. A. Walker. Jul. 1979. 34 p. refs.
(Contract N00014-76-C-0278; Grants AF-AFOSR-3092-76; NSF MCS-78-18858)
(AD-A075553) Avail: NTIS HC A03/MF A01 CSCL 12/1

Liapunov functions of simple form have been used for the study of stability properties of difference-differential equations. In this paper we provide necessary and sufficient conditions for the existence of such functions. GRA

N80-21067# Wisconsin Univ. - Madison. Dept. of Statistics.
SOME NEW MATHEMATICAL METHODS FOR VARIATIONAL OBJECTIVE ANALYSIS USING SPLINES AND CROSS VALIDATION
Grace Wahba and James Wendelberger. Sep. 1979. 38 p. refs.
(Contract N00014-77-C-0675; Grant NSF ATM-75-23223)
(AD-A079302; UWIS-DS-578) Avail: NTIS HC A03/MF A01 CSCL 12/1

Sasaki (1960) introduced the idea of numerical variational analysis for objective analysis of meterological fields. In the most general form of variational analysis considered here we seek a function phi(x,y,p,t,) of four variables representing a meteorological field of interest, say height, temperature, or a component of the wind field, as a function of ground projection coordinates (x,y), the vertical coordinate p, and time, t. This function should be suitably close to the height, temperature or wind field as measured at a finite set of positions, pressures and times, it should reflect known behavior of such fields, and it should be 'smooth' in some sense. GRA

N80-21068# Wisconsin Univ. - Madison. Mathematics Research Center.
THE BOLTZMANN EQUATION WITH A SOFT POTENTIAL. PART 1: LINEAR, SPATIALLY-HOMOGENEOUS Summary Report
Russell Caflisch. Oct. 1979. 42 p. refs.
(Contract DAAG29-75-C-0024; Grants NSF MCS-78-09525; NSF MCS-76-07039)
(AD-A079706; MRC-TSR-2005) Avail: NTIS HC A03/MF A01 CSCL 12/1

The Boltzmann equation describes the evolution of a large system of particles. The configuration of particles changes due to the motion of the particles and the collisions of particles. The collisions proceed according to the force law between particles. The 'soft' forces considered here are ones for which the total effect of collisions is smaller for a particle of higher energy. If the system is close to equilibrium, then its evolution can be described approximately by linear equations. In this paper the linear Boltzmann equation with a soft potential is solved for all time. Previously only 'hard' potentials had been considered. GRA

N80-21069# Wisconsin Univ. - Madison. Mathematics Research Center.
ABSTRACT OPTIMALITY THEORY Summary Report
Szymon Dolecki. Oct. 1979. 62 p. refs.
(Contract DAAG29-75-C-0024; Grant AF-AFOSR-0018-79; NR Proj. 041-404)
(AD-A079707; MRC-TSR-2006) Avail: NTIS HC A04/MF A01 CSCL 12/1

This work presents an abstract optimality theory. The discussed concepts (e.g., extremal, Lagrangian, duality) are more general and much simpler than their familiar counterparts used in more concrete framework. They admit geometrical interpretations and help to clarify the underlying ideas of the theory. Consequently, the presented theory suggests further theoretical developments and possible applications. GRA

N80-21070# Wisconsin Univ. - Madison. Mathematics Research Center.
ON THE MAXIMALITY OF THE SUM OF TWO MAXIMAL MONOTONE OPERATORS
H. Attouch. Nov. 1979. 13 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A079724; MRC-TSR-2018) Avail: NTIS HC A02/MF A01 CSCL 12/1

A wide variety of problems involving nonlinear partial differential equations, subject to boundary conditions, may be shown to have solutions by establishing that the associated differential operators satisfy a certain technical condition. This condition, called maximal monotonicity, allows the use of a well developed abstract theory which includes results about existence, regularity, etc., of solutions of operator equations. It is quite useful, therefore, to have easily verified conditions which imply that an operator is maximal monotone. Frequently an operator may be regarded as the sum of simpler components. This paper gives a new sufficient condition which guarantees that the sum

of two maximal monotone operators is again maximal monotone. GRA

N80-21071# Wisconsin Univ. - Madison. Mathematics Research Center.
BIFURCATIONS OF A MODEL DIFFUSION-REACTION
R. Ania. Nov. 1979. 28 p. refs. Presented at Conf. on Dyn. Systems, Asilomar, Calif., 9-14 Dec. 1974. Submitted for publication.
(Contract DAAG29-75-C-0024)
(AD-A079725; MRC-TSR-2019) Avail: NTIS
HC A03/MF A01 CSCL 12/1

After some general observations on kinetic, compartmental and distributed systems a model suggested by Roessler is explored. Bifurcations to unsymmetric steady and uniform oscillatory states from the uniform steady states are demonstrated and the former are shown to break down into oscillations of increasing complexity. GRA

N80-21072# Wisconsin Univ. - Madison. Mathematics Research Center.
A GLOBALLY CONVERGENT BALL NEWTON METHOD Summary Report
K. L. Nickel. Nov. 1979. 34 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A079728; MRC-TSR-2022) Avail: NTIS
HC A03/MF A01 CSCL 12/1

A new n-dimensional Newton method is presented. In each step a whole n-dimensional ball is determined rather than a single new approximation point. This ball contains the desired zero of the given function. The method is globally convergent. If the given initial ball does not contain any zero, then the method stops after a finite number of steps. Depending upon the assumptions which are made, the convergence of the ball radii is linear, superlinear or quadratic. Author (GRA)

N80-21073# Wisconsin Univ. - Madison. Mathematics Research Center.
ON SUBHARMONIC SOLUTIONS OF HAMILTONIAN SYSTEMS Summary Report
P. H. Radinowitz. Nov. 1979. 37 p. refs.
(Contracts DAAG29-79-C-0024; N00014-76-C-0300)
(AD-A079729; MRC-TSR-2023) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Some existence results for T periodic solutions of (0.1) were presented in (1) for superquadratic Hamiltonian systems using finite dimensional minimax arguments together with estimates suitable to pass to a limit. An improved existence mechanism was introduced in (2) and applied to some of the superquadratic problems of (1) as well as to several subquadratic cases. It will show here that these problems possess not only one T periodic solutions z sub 1 but infinitely many distinct subharmonic solutions z sub k. A word of caution must be entered at this point. Although z sub k has period kT, it may not be the case that z sub k has minimal (i.e., primitive) period kT. Indeed simple examples show that there may be an upper bound on the minimal period of z sub k. GRA

N80-21074# Wisconsin Univ. - Madison. Mathematics Research Center.
ON EFFICIENT TIME-STEPPING METHODS FOR NONLINEAR SECOND ORDER HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS Summary Report
R. E. Ewing. Sep. 1979. 28 p. refs.
(Contract DAAG29-75-C-0024; Grants DAAG29-78-G-0161; NSF MCS-78-09525)
(AD-A079731; MRC-TSR-1996) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Techniques useful for efficiently time-stepping Galerkin methods for various types of time-dependent partial differential equations are presented and analyzed. Second-order quasilinear hyperbolic problems with smooth solutions are studied as a simple model problem for illustrating the widely applicable techniques. The procedure involves the use of a preconditioned iterative method for approximately solving the different linear systems of equations arising at each time-step in a discrete-time Galerkin method. Optimal order L2 spatial errors and almost optimal order work estimates are obtained for the second-order hyperbolic equation. Author (GRA)

N80-21075# Ohio State Univ. Research Foundation, Columbus. Dept. of Mathematics.
COMBINATORIAL PROBLEMS OF APPLIED DISCRETE MATHEMATICS Final Report, 15 Jun. 1972 - 30 Sep. 1977
D. K. Ray-Chaudhuri. Dec. 1979. 225 p. refs.
(Contract N00014-67-A-0232)
(AD-A079521; OSURF-760075/783430) Avail: NTIS
HC A10/MF A01 CSCL 12/1

This research program studied several important combinatorial problems that arise in the fields of statistical design of experiments, mathematical theory of communication, information theory, switching theory, information retrieval and graph theory. GRA

N80-21076# Lincoln Lab., Miss. Inst. of Tech., Lexington.
PRACTICAL ASPECTS OF GAUSSIAN INTEGRATION
R. B. Holmes. Oct. 1979. 53 p. refs.
(Contract F19628-80-C-0002)
(AD-A079030; EDS-TR-79-265) Avail: NTIS
HC A04/MF A01 CSCL 12/1

A method for accurate numerical integration is proposed and illustrated by a variety of examples. The method depends on an ability to efficiently evaluate the weights and abscissas of Gaussian quadrature formulas, and software to achieve this purpose is also presented. GRA

N80-21077# IBM Watson Research Center, Yorktown Heights, N.Y.
NUMERICAL METHODS FOR STIFF NONLINEAR AND QUADRATIC DIFFERENTIAL EQUATIONS Interim Report
Werner Liniger. 1979. 11 p. refs.
(Contract F49620-77-C-0088; AF Proj. 2304)
(AD-A079303; AFOSR-79-1276TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Generalizations of multistep and one-leg methods were defined for implicit differential systems with algebraic constraints. Such systems occur frequently in circuit analysis. An error analysis was carried out for three particular methods of this type, associated with an A(0) - contractive second-order Adams formula resulting from earlier research under this contract. Successful numerical tests of these methods were carried out. A complete set of affine invariants was derived for all two-by-two systems of first-order quadratic differential equations. These invariants provide a criterion for deciding to which affine equivalence class any given system belongs. It was shown that each contains a system which is equivalent to a single second-order equation in one unknown. Efficient numerical methods were developed for finding running solutions of the Josephson interferometer equations. Starting from perturbation solutions for small nonlinearities, the problem was formulated as a periodic boundary value problem and solved by finite differences and by continuation with respect to a parameter governing the 'degree of nonlinearity' of the problem. The existence of discontinuum of running solutions of the above mentioned equations was proved for arbitrarily strong nonlinearities with dissipation. For vanishing dissipation, the existence of a continuum of solutions was proved. GRA

N80-21078# Decisions and Designs, Inc., McLean, Va.
DECISION ANALYSIS: ENGINEERING SCIENCE OR CLINICAL ART
D. M. Buede. Nov. 1979. 62 p. refs.
(Contract N00014-79-C-0068; ARPA Order 3668)
(AD-A079035; TR-79-2-97) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper examines two philosophical poles concerning the structuring of decision-analytic models. The engineering science approach uses complex, engineering-like models to link the decision maker's alternatives to his or her value structure; a computer then calculates the decision-analytic answer. The clinical art approach develops a simple model that structures the decision maker's thoughts concerning a decision in such a way that the critical issues in choosing one alternative over another are readily apparent. Three exemplary applications of each philosophical pole are used to demonstrate that at the extremes, the work of practitioners can be categorized as we describe. A

discussion of the two practical extremes of decision analysis is then presented. In this discussion, dichotomous characteristics are assigned to the decision maker, the decision, and the analyst's constraints to portray conditions under which either the engineering science approach or the clinical approach would be more effective in producing appropriate insight and understanding. Then the implications of each approach are described in terms of the tools and procedure the decision analyst uses. Finally, the selection of the approach the decision analyst might use in any given application is graphically portrayed and discussed in terms of the points made in this paper. GRA

N80-21079# Brookhaven National Lab., Upton, N. Y.
DIFFERENTIAL GEOMETRIC METHODS FOR SOLVING NONLINEAR CONSTRAINED OPTIMIZATION PROBLEMS AND A RELATED SYSTEM OF NONLINEAR EQUATIONS: GLOBAL ANALYSIS AND IMPLEMENTATION
Kunio Tanabe 1978 10 p refs Presented at the Intern. Congr. on Numerical Methods for Eng., Paris, 27 Nov. - 1 Dec. 1978
(Contract EY-76-C-02-0016)
(BNL-26729; CONF-7811143-1) Avail: NTIS HC A02/MF A01

Robust method that can produce convergence from a very poor initial estimate of the optimal solution for larger problems are discussed. A differential geometric method is developed specifically to obtain robust algorithms without resorting to the penalty type approach in particular, a generic class of feasibility-improving gradient acute projection (FIGAP) methods and their Levenberg-Marquardt type modifications is developed for solving the general nonlinear constrained minimization problems. Each method in this class is an amalgamation of a generalized gradient projection method and a generalized Newton-Raphson method which, respectively, take care of reducing the value of the objective function and satisfying constraint equations at the same time. A unified theory is developed for the methods by using extensively the concept of various generalized inverses and related projectors, which facilitates geometric interpretation of the FIGAP methods. DOE

N80-21080# Los Alamos Scientific Lab., N. Mex.
IMPACT OF VECTOR PROCESSORS ON ALGORITHMS
B. L. Buzbee and A. L. McKnight Nov. 1979 7 p
(Contract W-7405-eng-36)
(LA-8123-MS) Avail: NTIS HC A02/MF A01

Algorithm construction is discussed in terms of obtaining high performance form advance computers architectures such as STAR 100, Cray-1 and other vector and parallel processors. In order to demonstrate how minor changes in the algorithm can greatly effect the computer efficiency a problem in diffusion is presented. J.M.S.

N80-21081# Los Alamos Scientific Lab., N. Mex.
GENERAL LEAST-SQUARES FITTING PROCEDURES TO MINIMIZE THE VOLUME OF A HYPERELLIPSOID
E. Alan Wadlinger Oct. 1979 11 p refs
(Contract W-7405-eng-36)
(LA-8096-MS) Avail: NTIS HC A02/MF A01

Several methods for determining the shape parameters, which in two dimensions are the Courant-Snyder parameters, and the volume of an ellipse or hyperellipse that represents a set of phase-space points in a two-or-more dimensional hyperspace are presented. The ellipse parameters are useful for matching a beam to an accelerating or transport system and in studies of emittance growth. The fitting procedure minimizes the total volume of a hyperellipse by adjusting the ellipse shape parameters. The total volume is the sum of the individual particle volume defined by the hyperellipse that passes through a particle's phase-space point. A two dimensional space is considered first; then results are generalized to a higher number of dimensions. DOE

N80-21082# Oak Ridge National Lab., Tenn.
LECTURES ON THE PRACTICAL SOLUTION OF DIFFERENTIAL EQUATIONS
L. Dresner Nov. 1979 113 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6920) Avail: NTIS HC A06/MF A01

The practical solution of ordinary and partial differential equations are presented. Explanitory material is given as well as detailed examples drawn from the fields of neutron transport, mass transfer, gas dynamics, and superconductivity,. In all cases the emphasis is placed on the attainment of practical results. DOE

N80-21083# California Univ., Livermore. Lawrence Livermore Lab.
INTERPOLATION AND DATA FITTING WITH SPLINES
F. N. Fritsch Nov. 1979 30 p refs
(Contract W-7405-eng-48)
(UCID-18329) Avail: NTIS HC A03/MF A01

A continuing education course. (interpolation and data fitting with splines) is presented. The following aspects of the course are treated: course description, course requirements, course structure, course outline and schedule, enrollment history, and software availability. DOE

N80-21084# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
ON THE SCALE OF FLUCTUATION OF RANDOM FUNCTIONS
Erik H. Vanmarcke Apr. 1979 64 p refs
(Grants NSF ENV-76-19021; NSF PFR-78-15898)
(PB80-107865; R79-19; NSF/RA-790199) Avail: NTIS HC A04/MF A01 CSCL 12A

Results are presented for the average crossing rate and for the probability distribution of extremes of moving averages or integrals of random processes that are ergodic in the mean. The results are asymptotically exact when the averaging time grows to infinity and provide excellent approximations for all but very small averaging times. Perspectives are provided on the unifying role of the Gaussian random process toward which any stationary random process converges through local averaging or integration. The scale of fluctuation theta sub x is identified as a key parameter of any stationary random process. It is formally defined in terms of the variance function, but it has simple interpretations in terms of the autocorrelation function and the spectral density function. GRA

N80-20699# Bayerische Akademie der Wissenschaften, Munich (West Germany).
COMPARISON OF ALGORITHMS FOR THE SUMMATION OF SPHERICAL PLANE FUNCTIONS [VERGLEICH VON ALGORITHMEN ZUR SUMMATION VON KUGELFLAECHEN-FUNKTION]
Michael Gerstl *In its* Res. Program 78, Satellite Geodesy Program 1978 p 81-88 refs In GERMAN; ENGLISH summary (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

N80-20700# Bayerische Akademie der Wissenschaften, Munich (West Germany).
PROBLEMS OF APPROXIMATION BY MEANS OF SAMPLING FUNCTIONS [ZUR PROBLEMATIK DER APPROXIMATION MITTELS SAMPLING-FUNKTIONEN]
Heinz Fritz Schmidt *In its* Res. Program 78, Satellite Geodesy Program 1978 p 89-101 refs In GERMAN (For primary document see N80-20691 11-42)
Avail: NTIS HC A09/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method, and stochastic processes.

N80-21085 Purdue Univ., Lafayette, Ind.
SOME CONTRIBUTIONS TO GAMMA-MINIMAX AND EMPIRICAL BAYES SELECTION PROCEDURES
Ph.D. Thesis
Ping Hsiao 1979 151 p
Avail: Univ. Microfilms Order No. 8005893

Results on gamma minimax selection procedures and empirical Bayes selection procedure are obtained and discussed. A problem of selecting populations close to a control is considered. It is assumed that there are (k + 1) normally distributed populations.

and one of them is a control population. A zero-one type loss function is defined. Bayes rules, gamma-minimax rules and minimax rules are derived and compared. Secondly the problem of selecting the t-best populations is examined. It is shown that if the populations have Polya Frequency Type 2 densities, then the natural selection rule is a gamma-minimax rule. Finally, a problem of selecting populations better than a control is considered. When the populations are uniformly distributed, empirical Bayes selection rules are derived for a linear loss function for both the known control parameter and the unknown control parameter cases. Dissert. Abstr.

N80-21086 Rensselaer Polytechnic Inst., Troy, N. Y.
ROBUST PROCEDURES FOR THE MULTIVARIATE NORMAL DISTRIBUTION Ph.D. Thesis
Nancy Jo Klein Delaney 1979 141 p
Avail: Univ. Microfilms Order No. 8004756

Two procedures are presented for joint estimation of location and dispersion parameters at or near the multivariate normal distribution. One procedure is based on characteristic functions and the other is based on a generalized likelihood function. Although of different origin, both procedures yield estimates which are jointly robust, consistent and asymptotically normal. Simulation studies show that these procedures are relatively efficient in normal sampling and out-perform traditional estimators in nonnormal sampling. Both procedures also provide outlier identification measures automatically via self weighting of the observations and protect estimates from distortions which could be caused by such spurious observations. Examples with real data show the application of these procedures to various multivariate analyses. Dissert. Abstr.

N80-21087# Princeton Univ., N. J. Dept. of Statistics.
CONSISTENT ESTIMATION OF VARIANCE PARAMETERS FROM MANY SMALL SAMPLES WITH DIFFERENT MEANS
Nicholas P. Jewell and Gillian M. Raab (Edinburgh Univ.) Oct. 1979 17 p refs
(Contract N00014-79-C-0322)
(AD-A078227; TR-159-Ser-2) Avail: NTIS HC A02/MF A01 CSCL 12/1

Where sets of observations are normally distributed with variances related to the mean of each set, the mean values become nuisance parameters when we wish to pool information about the variances from a large number of sets of information. This paper considers the problem of obtaining consistent estimators of the variance parameters where no assumptions or prior knowledge are available about the mean values. When the variance is proportional to the square of the mean we obtain an estimator for the constant of proportionality which is always consistent, by a marginal likelihood approach, but this method cannot be generalized to other variance functions. Integrated, modified, and partial conditional likelihood methods are investigated for this example and suggest methods for the general example when the standard deviation is small compared with the mean. The partial conditional likelihood method may be a useful general method of eliminating nuisance parameters in problems where the methods proposed by Kalbfleisch and Sprott (1970) are not applicable. GRA

N80-21088# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.
LOCAL ASYMPTOTIC NORMALITY FOR PROGRESSIVELY CENSORED LIKELIHOOD RATIO STATISTICS AND APPLICATIONS
Joseph C. Gardiner Nov. 1979 30 p refs
(Contract N00014-79-C-0522)
(AD-A077005; RM-394) Avail: NTIS HC A03/MF A01 CSCL 12/1

Several investigations were made of the notion of local asymptotic normality of a family of probability distributions. The usefulness of this concept in problems of the theory of asymptotic estimation and hypothesis testing was demonstrated. A comprehensive examination of sets of conditions can be found ensuring the Lan for different families of probability distributions. Much attention has been focused on distributions connected with sequences of independent and identically distributed iid observations or those associated with a homogeneous Markov chain. In this paper conditions are presented ensuring the Lan for distribution connected with certain observations, which are neither independent nor identically distributed, when a class of stopping variables is incorporated in a natural way into the basic framework. The primary motivation for our study is the following situation which arises naturally in the context of clinical trials and life tests. GRA

N80-21089# Stanford Univ., Calif. Dept. of Operations Research.
SIMULATING GENERALIZED SEMI-MARKOV PROCESSES
Lawrence D. Fossett Sep. 1979 104 p refs
(Contract N00014-76-C-0578; Grants NSF MCS-75-23607; NSF MCS-79-09139)
(AD-A075549; TR-50) Avail: NTIS HC A06/MF A01 CSCL 12/1

One approach to modeling queueing networks and other complex stochastic systems which has received some attention in the literature is the generalized semi-Markov process (GSMP). This idea is an example of the supplementary variables approach to non-Markovian systems. This approach supplements the natural description of the system by variables which contain information about the past history of the system. In this way, a model of a non-Markovian system can be made Markovian. For GSMPs the supplementary variables are clocks which record the amount of time until the occurrence of various events which could influence the system. Our approach to this problem is to find closely related regenerative processes on which to base the central limit theorem for the process under study. New results in the theory of Markov chains on a general state space make it clear how these regenerative processes can be constructed. GRA

N80-21090# Stanford Univ., Calif. Dept. of Statistics.
SMOOTHNESS PRIORS AND THE DISTRIBUTED LAG ESTIMATOR
Hirogutu Akaik Aug. 1979 21 p refs
(Contract N00014-75-C-0442)
(AD-A075574; TR-40) Avail: NTIS HC A02/MF A01 CSCL 12/1

Shiller's distributed lag estimator based on a smoothness prior demonstrates the potential of the Bayesian approach to statistical model building. Nevertheless, when the number of significant lag coefficients is small the assumption of smoothness of the pattern of the lag coefficients may not be appropriate. In this paper, to cover such a situation, the smoothness is assumed for the behavior of the coefficients viewed in the frequency domain. This definition leads to a smoothness prior with a particularly simple form. Numerical result shows that the estimator based on this smoothness prior produces good estimates of the lag coefficients where Shiller's prior produces highly biased estimates. It is also observed that the new estimator produces reasonable results even when the Shiller's prior is more appropriate. The danger of introducing a bias by assuming a Bayesian model is stressed in the discussion. GRA

N80-21091# Stanford Univ., Calif. Dept. of Operations Research.
PROPERTIES OF ISOTONIC ESTIMATORS OF MEAN LIFETIME IN A SIMPLE PROTOTYPE DEVELOPMENT MODEL Ph.D. Thesis
Thomas P. McWilliams Aug. 1979 113 p refs
(Contract N00014-75-C-0561)
(AD-A075578; TR-194) Avail: NTIS HC A06/MF A01 CSCL 12/1

Consideration of a simple prototype development/reliability growth model leads to observation of variables X1, X2, ... Xk where the X1 are independent and are assumed to have the same distribution type with individual means lambda sub i. The problem is to estimate the lambda sub i, which are assumed to be non-decreasing due to design improvements in the device under development. For many common distributions, estimation via the restricted maximum likelihood principle leads to estimates which are the isotonic regression of the X1 with appropriate weights. This paper finds the distribution of lambda cap sub k, the mle of lambda sub k, when the X1 are exponentially distributed. Lambda cap sub k is then compared with X-bar and Xk, two competing estimates of lambda sub k. Gamma, normal, and

Weibull distributed X1 are also considered, and the usefulness of lambda cap sub k is seen to depend on the relative magnitude of the variances and means of the X1. Results are also examined when the restricted mles are generated assuming the lambda sub i are a non-decreasing and concave function of 1. GRA

N80-21092# Stanford Univ., Calif. Dept. of Operations Research.
ON THE CANDIDATE DATE PROBLEM WITH A RANDOM NUMBER OF CANDIDATES
C. Derman, G. J. Lieberman, and S. Ross Aug. 1979 14 p refs Prepared in cooperation with Columbia Univ., N.Y. and California Univ., Berkeley
(Contracts N00014-75-C-0561; N00014-75-C-0620; N00014-77-C-0299; Grants NSF MCS-78-25146; AF-AFOSR-3213-77)
(AD-A075577; TR-192) Avail: NTIS HC A02/MF A01 CSCL 12/1

A decision maker has a total of M candidates to interview sequentially. The decision maker must either accept or reject the candidate being interviewed after he has been ranked with respect to his predecessors. Once rejected a candidate cannot be reconsidered; once a candidate is accepted no further interviews are carried out. The objective is to select the candidate in such a way as to maximize the probability of choosing the best of all M candidates (assuming every ordering of interviews is equally likely). GRA

N80-21093# Wisconsin Univ. - Madison. Mathematics Research Center.
THE USE OF THE TETRACHORIC SERIES FOR EVALUATING MULTIVARIATE NORMAL PROBABILITIES Technical Summary Report
Bernard Harris and Andrew P. Soms Oct. 1979 39 p refs
(Contract DAAG29-75-C-0024)
(AD-A079721; MRC-TSR-2015) Avail: NTIS HC A03/MF A01 CSCL 12/1

The tetrachoric series is a technique for evaluating multivariate normal probabilities frequently cited in the statistical literature. In this paper we have examined the convergence properties of the tetrachoric series and have established the following. For orthant probabilities, the tetrachoric series converges if the absolute value of rho sub ij < 1/(k-1), 1 < or = i <; < or = k, j - or - k, where rho sub ij are the correlation coefficients of a k-variate normal distribution. The tetrachoric series for orthant probabilities diverges whenever k is even and rho ij < 1/(k-1) or k is odd and rho sub ij > 1/(k-2), 1 < or = ; <; < or + k Other specific results concerning the convergence or divergence or divergence of this series are also given. The prinicpal point is that the assertion that the correlation matrix is positive definite is false. GRA

N80-21094# Wisconsin Univ. - Madison. Mathematics Research Center.
NEARLY BALANCED INCOMPLETE BLOCK DESIGNS
Ching-Shui Cheng (California Univ., Berkeley) and Chien-Fu Wu Nov. 1979 20 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-79-01846; NSF MCS-79-09502)
(AD-A079726; MRC-TSR-2020) Avail: NTIS HC A02/MF A01 CSCL 12/1

A class of nearly balanced incomplete block designs is defined. This extends the concept of regular graph designs of John and Mitchell (1977) to the unequally replicated case. Some necessary conditions on the existence of such designs are derived. Methods of construction are given for some special cases. For five or six varieties, the 'best' nearly balanced incomplete block designs and their efficiencies are tabulated. GRA

N80-21095# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.
PROBABILISTIC METHOD FOR GROUPING DATA
C. L. Begovich Nov. 1979 191 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-65) Avail: NTIS HC A09/MF A01

A probabilistic method for grouping data was developed to incorporate measurement error into standard cluster analysis procedures. In the analysis, the data are perturbed by Monte Carlo techniques to simulate the experimental error, and the resultant data sets are clustered. By varying the number of clusters, a procedure is given to estimate the unknown number of groups. This technique and other standard procedures for determining the number of groups are described and compared for three different examples. The probabilistic method is shown to have advantages for determining the number of groups and the probabilities for a sample's membership in the hypothesized groups. DOE

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-21096# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
LOCAL SEARCH FOR THE ASYMMETRIC TRAVELING SALESMAN PROBLEM
C. Kanellakis and C. H. Papadimitriou Aug. 1979 29 p refs
(Grants NSF ATR-76-12036; NSF DAR-78-17826)
(PB80-118532; LIDS-P-927; NSF/RA-790232) Avail: NTIS HC A03/MF A01 CSCL 12B

The application of tour-to-tour improvements to the asymmetric traveling salesman problem (ATSP) is reported. An extension of the Lin-Kernighan local search algorithm was employed to solve the ATSP. Theoretical algorithm was employed to solve the ATSP. Theoretical results pertinent to the local search are presented together with a heuristic for the ATSP. Computational results strongly indicate that the algorithm used is very suitable for the solution of very large instances of the ATSP. Theoretical results which guided the design of the heuristic are discussed as well as some other aspects of local search and ATSP. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-21097# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
SEQUINS AND QUILLS: REPRESENTATIONS FOR SURFACES TOPOGRAPHY
Berthold K. P. Horn May 1979 17 p refs
(Contract N00014-77-C-0389)
(AD-A078068; AI-M-536) Avail: NTIS HC A02/MF A01 CSCL 05/8

The shape of a continuous surface can be represented by a collection of surface normals. These normals are like a porcupine's quills. Equivalently, one can use the surface patches on which these normals rest. These in turn are like sequins sewn on a costume. These and other representations for information which can be obtained from images and used in the recognition and description of objects in a scene are briefly described. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-21098 Stanford Univ., Calif.
INSTANTANEOUS KINEMATICS OF MULTIPLE DEGREE-OF-FREEDOM MOTIONS Ph.D. Thesis
Jnaneshwar Hanumanth Nayak 1979 159 p
Avail: Univ. Microfilms Order No. 8006355

Results for the first order of instantaneous kinematics of three, four, and five degree-of-freedom motions are obtained and discussed. A unified approach is given for the so-called canonical description of the first order properties of a motion with any number of freedoms between one and six. Specifically, the

following is developed: Taylor series expansions of motions; the determination of canonical coordinate systems; the determination of instantaneous invariants; and the study of the loci of the instanteous screws. Application of the theory to the analysis of various linkage configurations is also discussed. Dissert. Abstr.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-21099 City Univ. of New York, N. Y.
BRILLOUIN SCATTERING IN XENON NEAR THE CRITICAL POINT Ph.D. Thesis
Dennis Wonica 1979 241 p
Avail: Univ. Microfilms Order No. 8006480

The behavior of sound in xenon was investigated along the critical isochore and for temperatures .05 - 10 C above a critical temperature of 16.62 C. A laser Brillouin scattering experiment was assembled which used optical heterodyne detection combined with spectrum analysis and signal averaging. Sound velocity and sound attenuation data were obtained for frequencies in the region 1 - 15 MHz. Scattering angles were 0.36, 0.72, 1.44, and 2.69 deg. Electronic and optical instrumental effects were very carefully measured and deconvolved from observed spectra. A nonlinear least squares optimization algorithm was implemented using Fortran and used in a curve fitting procedure to accurately extract the Brillouin shift and Brillouin linewidth, from which the sound velocity and attenuation were determined, respectively. Dissert. Abstr.

N80-21100*# Columbia Univ., New York. Psychophysics Lab.
DEVELOPMENT AND EVALUATION OF A GENERAL AVIATION REAL WORLD NOISE SIMULATOR Final Report
Eugene Galanter and Richard Popper Mar. 1980 21 p refs (Grant NsG-1541)
(NASA-CR-159237) Avail: NTIS HC A02/MF A01 CSCL 20A

An acoustic playback system is described which realistically simulates the sounds experienced by the pilot of a general aviation aircraft during engine idle, take-off, climb, cruise, descent, and landing. The physical parameters of the signal as they appear in the simulator environment are compared to analogous parameters derived from signals recorded during actual flight operations. The acoustic parameters of the simulated and real signals during cruise conditions are within plus or minus two dB in third octave bands from 0.04 to 4 kHz. The overall A-weighted levels of the signals are within one dB of signals generated in the actual aircraft during equivalent maneuvers. Psychoacoustic evaluations of the simulator signal are compared with similar measurements based on transcriptions of actual aircraft signals. The subjective judgments made by human observers support the conclusion that the simulated sound closely approximates transcribed sounds of real aircraft. K.L.

N80-21101*# National Aeronautics and Space Administration, Washington, D. C.
A MODEL THEORY FOR THE FIBROUS ABSORBER. PART 1: REGULAR FIBRE ARRANGEMENTS
F. P. Mechel Mar. 1980 33 p refs Transl. into ENGLISH from Acustica, (West Germany), v. 36, no. 2, 1976 - 1977 p 53-64 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Univ. of the Saarland Acoustics Lab., Saarbrucke
(Contract NASw-3199)
(NASA-TM-75800) Avail: NTIS HC A03/MF A01 CSCL 20A

The axial propagation of sound waves in a model consisting of parallel fibers is calculated. The viscous forces and the thermal conduction are taken into account. This leads to viscous waves and to thermal waves besides the usual acoustic compression wave. The potential function for the total field near a fiber is treated as the superposition of the radiated field from the fiber itself and of the scattered fields from all the other fibers. The explicit field equations for a regular square fiber arrangement is derived and the influence of the order of symmetry of the arrangement is discussed. This leads to simplifications in the field equations and to field equations for the case of a homogeneous fiber distribution. J.M.S.

N80-21102# Naval Ocean Systems Center, San Diego, Calif.
SIX-FOOT LINE TRANSDUCER CALIBRATION PROCEDURE: EXPLAINS THEORY, METHODOLOGY, AND PROCEDURES USED AT SENSOR ACCURACY CHECK SITE (SACS), LONG BEACH, CALIFORNIA
Oct. 1979 45 p
(AD-A079522; NOSC/TD-291) Avail: NTIS HC A03/MF A01 CSCL 17/1

This technical document concerns the theory, method, and procedures by which the 6 foot line transducer in the moveable carriage at the Sensor Accuracy Check Site (SACS), Long Beach, California is to be calibrated. The equipment, physical and electronic setup, detailed data acquisition procedure, data quality assurance, and data reporting requirements are included. The procedure results in a measurement-to-measurement repeatability better than -0.7 dB. GRA

N80-21103# Purdue Univ., Lafayette, Ind. Dept. of Electrical Engineering.
RANDOM SIGNAL FLAW DETECTION Final Report, 21 Aug. 1975 - 28 Feb. 1979
Vernon L. Newhouse and Eric S. Furgason Jun. 1979 99 p refs
(Contract F33615-75-C-5252; AF Proj. 2387)
(AD-A078443; AFML-TR-79-4077) Avail: NTIS HC A05/MF A01 CSCL 17/1

This report describes four areas of work. In the first area random signal beam forming techniques are developed which make it possible to transmit several independent beams from a phased array using the same number of incoherent noise sources. Following this ultrasound beam scanning techniques are demonstrated in which random signal correlation systems and RF correlation systems using quadrature phase techniques are used in methods for scanning the intensity profile of ultrasound transducer beams using respectively broadband signals and narrow band signals. In addition two types of deconvolution procedure are described and demonstrated which have been successful in improving the effective resolution of ultrasound correlation systems when viewing surface features. Finally the design and construction of a random signal correlation system is described which uses an electronic delay line. GRA

N80-21104# Texas Univ. at Austin. Applied Research Labs.
PARRAY TECHNICAL PAPERS PRESENTED AT SCIENTIFIC AND TECHNICAL MEETINGS
Tommy G. Goldsberry, Voldi E. Maki, Jr., Wiley S. Olsen, C. Richard Reeves, and David F. Rohde 2 Aug. 1979 143 p refs
(Contract N00039-76-C-0231; ARPA Order 2910)
(AD-A077726; ARL-TR-79-4) Avail: NTIS HC A07/MF A01 CSCL 17/1

The parametric acoustic receiving array (PARRAY) exploits the inherent nonlinearity in the pressure-density relationship of water to achieve directional reception of low frequency acoustic waves using only two small high frequency transducers and some associated electronics. This report describes the PARRAY and summarizes several papers on the subject that have been presented at scientific and technical meetings. Copies of the papers are included as appendices. Procedures for selection of optimal parameter values are developed. State of the art advances in stable oscillators, reception of sideband signals with very small modulation indices, and simple high efficiency transducer elements are described. Results of experiments with a 340 m aperture PARRAY are presented which demonstrate that the experimental PARRAY is ambient noise limited in Lake Travis (Texas). GRA

N80-21105# Oak Ridge National Lab., Tenn.
ACOUSTIC EMISSION MONITORING OF STEEL AND CONCRETE STRUCTURAL ELEMENTS WITH PARTICULAR REFERENCE TO PRIMARY NUCLEAR CONTAINMENT STRUCTURES

D. J. Naus 1979 38 p refs Presented at the Intern. Conf. on Acoustic Emission, Anaheim, Calif. 10 Sep. 1979
(Contract W-7405-eng-26)
(CONF-790966-1) Avail: NTIS HC A03/MF A01

Advancements in nondestructive testing utilizing acoustic emission (AE) are discussed in terms of in-service monitoring of the structural integrity of primary containment structures. The capability of AE to monitor the structural integrity of primary nuclear containments was assessed. Intermediate pressure vessels tested under the Heavy-Section Steel Technology (HSST) Program and relatively simple concrete structures were monitored by AE while under test. The results of this monitoring program are discussed. DOE

N80-21106# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
NOISE MEASUREMENTS AND QUALITY ASSURANCE Final Report, 1977 - 1979
Roger D. Smith and Mas M. Hatano Mar. 1979 131 p refs Sponsored in part by FHA
(PB80-107246; FHWA/CA-79/06; TL-657253) Avail: NTIS HC A07/MF A01 CSCL 20A

A quality assurance program was developed for calibration of noise measurement equipment and the certification of personnel responsible for making noise measurements. The program is designed for use by the eleven districts and the transportation laboratory of the California Department of Transportation (Caltrans). An evaluation of various equipment calibration program alternatives was made and the most suitable to Caltrans' needs was selected and developed in detail. This program involves a mobile calibration and operator testing set-up that can be taken to each District office on an annual basis. Traceability to the National Bureau of Standards (NBS) is established by using standard microphones periodically calibrated by NBS. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-21107# Missouri Univ. -Rolla. Dept. of Physics.
COHERENCE IN PENNING IONIZATION AND FIRST KIND COLLISIONS: VOLUME RECOMBINATION OF IONS/ELECTRONS Progress Report, Dec. 1978 - Dec. 1979
L. D. Schearer and W. F. Parks Dec. 1979 27 p
(Contract N00014-75-C-0477; NR Proj. 343-011)
(AD-A079742; Rept-12) Avail: NTIS HC A03/MF A01 CSCL 07/4

A thermal energy beam of helium atoms in the metastable state is used to coherently excite ions of Sr, Ca, and Ba in a Penning collision. The anisotropic excited state distributions appears as Polarized line emission from the excited ions. The degree of ion alignment may be used to determine the populations of the quasi-molecular states of the ion-atom pair. The coherent emission is also utilized to obtain Hanle signals from which the radiative decay rate of the excited ion is determined. This is the first case in which coherence is produced in a collision process involving Penning ionization. The alignment of the Penning ions is an important new parameter in the description of these reactions. In an effort to extend such observations to molecular systems a nitrogen molecular metastable beam source was demonstrated. The use of metal vapor targets and the excitation rate of the excited states of Cd and Zn in energy transfer collisions with the N2(m) enable us to determine the vibrational distribution of the A 3Sigma state of N2 in the beam. Energy transfer cross sections and some Penning cross sections were measured in the beam system. GRA

N80-21108# Pittsburgh Univ., Pa. Atomic Sciences Inst.
ATOMIC AND MOLECULAR PROCESSES Progress Summary Report
M. A. Biondi, R. Johnson, and J. N. Bandsley 31 Oct. 1979 9 p
(Contract N00014-76-C-0098; ARPA Order 2686)
(AD-A079324; TPSR-26) Avail: NTIS HC A02/MF A01 CSCL 07/4

Contents: Electron-Ion Recombination under Laser Plasma Conditions; Ion-Molecule reactions of Laser Interest; Ion-Ion Recombination; Electron Collisions with Molecules; and Ion-Molecule Reactions. GRA

N80-21109# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EFFECTS OF HIGH PRESSURE ON MOLECULAR ELECTRONIC SPECTRA. 2: MORSE-POTENTIAL FORMULATION
Robert C. Tompkins Nov. 1979 23 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A079898; AD-E430346; ARBRL-TR-02202) Avail: NTIS HC A02/MF A01 CSCL 07/4

The effects of high pressure on electronic spectra are treated on the basis of a Morse potential by a method analogous to that used in deriving the well-known Drickamer model. Expressions are presented for evaluating configuration-coordinate parameters for spectroscopic data. GRA

N80-21110# Michigan State Univ., East Lansing. Dept. of Chemistry.
PHOTOIONIZATION STUDIES OF MOLECULAR DYNAMICS AND ENERGETICS Final Technical Report, 15 Sep. 1975 - 14 Dec. 1978
G. E. Leroi Jul. 1979 5 p refs
(Contract N00014-76-C-0434; NR Proj. 394-009)
(AD-A079814) Avail: NTIS HC A02/MF A01 CSCL 07/4

The primary scientific accomplishment during the contractual period was the completion of a sophisticated, computer-controlled photoionization mass spectrometric instrument which was designed in our laboratory. Photoionization efficiency curves for parent and daughter ions of the chlorofluoromethanes, of acetonitrile and perdeuteroacetonitrile, and preliminary curves for several other molecules of aeronomical interest, were obtained. The potentiality of the instrumentation to study ion-molecule reactions was also successfully explored. GRA

N80-21111# Washington Univ., Seattle.
ANGULAR MOMENTUM TRANSFER IN DEEPLY INELASTIC COLLISIONS
R. Vandenbosch 1978 26 p refs Presented at the Conf. on Dynamical Properties of Heavy-Ion Reactions, Johannesburg, 1 Aug. 1978
(Contract EY-76-C-06-1388)
(RLO-1388-395; CONF-780857-3) Avail: NTIS HC A03/MF A01

Various experimental methods for determining the magnitude and the alignment of the angular momentum transferred from the initial relative orbital motion into the rotation of the final products are reviewed. The results from sequential fission studies are discussed. Comparisons with various theoretical models are presented. Evidence for the importance of both one body dissipation and the excitation of collective degrees of freedom is presented. DOE

N80-21112# California Univ., Livermore. Lawrence Livermore Lab.
SECONDARY ELECTRON RADIATION
V. V. Smirnov, ed. Feb. 1979 222 p refs Transl. into ENGLISH of Vtorichnoe Elektronnoe Izluchenie (Leningrad), 1977
(UCRL-Trans-11465; VAAP-SA-79/21) Avail: NTIS HC A10/MF A01

The characteristics of secondary electrons (energy spectra, angular distributions) are discussed using 26 papers on the energy and spatial characteristics of secondary electrons. The studies are directed towards the determination of the yields, spectra, and spatial distribution of secondary electrons, including low energy electrons, forming under the action of photon radiation in materials used for developing ionizing radiation detectors. The processes associated with the passage of electrons of various energies through matter (measurement of the energy loss spectra, degradation spectra, channelling, and shadowing effects) are examined. The development of theoretical methods for the determination of the characteristics of secondary electron radiation

and for the description of processes that accompany the passage of radiation through matter is discussed. A.W.H.

N80-21113# Illinois Univ., Urbana. Graduate Coll.
HIGH PRESSURE PHOTOPHYSICS OF ORGANIC MOLECULES Ph.D. Thesis
L. A. Brey 1979 105 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1278) Avail: NTIS HC A06/MF A01

High pressure spectroscopic studies on several classes of organic compounds were made both in fluid solution (to 10 kbar) and in polymeric media (to 40 kbar). Three studies were conducted in fluid solution and concern the effect of solvent viscosity on the nonradiative deactivation rates from electronically excited states. Pressure was utilized to attain high viscosities in organic solvents at room temperature. The primary experimental technique used was fluorescence emission spectroscopy. In the fourth study, observations were made both in fluid solution and in plastic films. The focus of this study was the effect of pressure on the solvent-chromophore dispersion interaction in several polyenes and the concomitant changes in both the radiative and nonadaptive rates from the excited states. Extensive use was made of fluorescence lifetime measurements and excitation spectra. DOE

N80-21114# California Univ., Berkeley. Materials and Molecular Research Div.
LASER INDUCED FLUORESCENCE OF TRAPPED MOLECULAR IONS Ph.D. Thesis
F. J. Grieman Oct. 1979 255 p refs
(Contract W-7405-eng-48)
(LBL-10021) Avail: NTIS HC A12/MF A01

An apparatus for obtaining the optical spectra of molecular ions is described. The technique includes the use of three dimensional ion trapping laser induced fluorescence, and gated photon counting methods. The ions, which are produced by electron impact, are confined in a radio frequency quadrupole ion trap of cylindrical design. Because the quadrupole ion trap allows mass selection of the molecular ion desired for study, the analysis of the spectra obtained is greatly simplified. The ion trap also confines the ions to a region easily probed by a laser beam. DOE

N80-21115# Argonne National Lab., Ill.
PHYSICS WITH FAST MOLECULAR-ION BEAMS
D. S. Gemmell, ed. 1979 348 p refs Conf. held at Argonne, Ill., 20-21 Aug. 1979
(Contract W-31-109-eng-38)
(ANL/PHY-79-3) Avail: NTIS HC A15/MF A01

The interactions of fast (MeV) molecular-ion beams with matter are discussed with emphasis on such specialized topics as molecular-ion dissociation and transmission, wake effects, ionics charge states, cluster stopping powers, beam-foil spectroscopy, electron-emissions studies with molecular-ion beams, and molecular-ion structure determinations. DOE

N80-21116# Argonne National Lab., Ill.
DETERMINATION OF MOLECULAR-ION STRUCTURES THROUGH STUDIES OF THE COLLISIONALLY-INDUCED DISSOCIATION OF FAST (MeV) MOLECULAR IONS
Donald S. Gemmell, Patrick J. Cooney, and Elliot P. Kanter 1979 18 p refs Prepared for 8th Intern. Conf. on Atomic Collision in Solids, Hamilton, Canada, 13-14 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790843-10) Avail: NTIS HC A02/MF A01

High-resolution studies of the angle and energy distributions of fragments detected in coincidence from the foil-and gas-induced dissociation of fast (MeV) polyatomic molecular ions are described. The aim of the measurements is to explore the possibilities that these new techniques offer for determining the stereochemistry of molecular ions. DOE

N80-21117# Argonne National Lab., Ill.
COMPARISON OF JET SIZE IN ANTI-NEUTRINO PROTON INTERACTIONS WITH THAT IN POSITRON ELECTRON ANNIHILATION
M. Derrick, A. Fridman, P. Gregory, F. Lopinto, B. Musgrave, J. Schlereth, P. Schreiner, R. Singer, S. J. Barish, and R. Brock 1979 13 p refs Prepared in cooperation with Carnegie-Mellon Univ., Pittsburgh and Purdue Univ., Lafayette, Ind.
(Contract W-31-109-eng-38)
(ANL-HEP-PR-79-17) Avail: NTIS HC A02/MF A01

Using new antineutrino proton charged current data from a 15 foot hydrogen bubble chamber, some properties of the antineutrino induced hadronic jets are studied. The angular size of the jets is measured and compared with results from positron electron annihilation. The jets in the two processes are found to be quite similar in terms of the variables sphericity, thrust, and energy flow. DOE

N80-21118# Ohio State Univ., Columbus. Dept. of Physics.
DENSE AND DILUTE INSTANTON-ANTI-INSTANTON PAIR CONFIGURATIONS
William F. Palmer 1979 10 p refs
(Contract EY-76-C-02-1545)
(COO-1545-263) Avail: NTIS HC A02/MF A01

A Yang-Mills gauge field configuration is described which for large values of a separation parameter is an instanton-anti-instanton pair. At a minimum finite separation the field is a pure gauge. The interaction is calculated for large and small separations. According to an approximation algorithm the configuration is the most important quantum fluctuation about the exact solutions. DOE

N80-21119# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
PROGRAM IN MEDIUM ENERGY PHYSICS RESEARCH Progress Report, 1 Dec. 1978 - 30 Nov. 1979
H. B. Willard, P. R. Bevington, E. Winkelmann, and R. A. Leskovec 31 Oct. 1979 8 p refs
(Contract EY-76-S-02-2146)
(COO-2146-13) Avail: NTIS HC A02/MF A01

Theoretical medium energy nuclear physics research is reviewed in abstract length summaries. Research topics include the measurement of the spin core correlation parameter A sub NN in proton-proton elastic scattering at 796 MeV, proton-deuteron elastic scattering at 796 MeV, single and double pion production from 800 MeV proton-proton collisions, and the spin dependence of pion production by 800 MeV proton-proton collisions. A.W.H.

N80-21120# California Univ., Berkeley. Lawrence Berkeley Lab. Physics, Computer Science and Mathematics Div.
KAON-PROTON BACKWARD ELASTIC SCATTERING BETWEEN 476 AND 1084 MeV/c Ph.D. Thesis
Robert Preston Hamilton Sep. 1979 124 p refs
(Contract W-7405-eng-48)
(LBL-8969) Avail: NTIS HC A06/MF A01

The differential cross section for kaon-proton backward elastic scattering was measured in steps of 10 to 20 MeV/c between 476 and 1084 MeV/c. A negative kaon beam was focused onto a 21 cm long liquid hydrogen target and the forward scattered protons were identified kinematically by means of a single arm magnetic spectrometer. A Monte Carlo computer program aided in the subtraction of background events and in the calculation of correction factors. The data have an average statistical precision of 2.5 percent which is an order of magnitude improvement over previous results. Together with a partial wave analysis, the data give additional evidence for a resonance between 1700 and 1725 MeV. DOE

N80-21121# California Univ., Berkeley. Lawrence Berkeley Lab.
NUCLEAR COLLISION AT E/A IS EQUIVALENT TO T/SUB F/
J. Randrup Jul. 1979 23 p refs Presented at the Symp. on Heavy-Ion Phys. from 10-200 MeV/AMU, Upton, N.Y., 16-20 Jul. 1979 Prepared in cooperation with Nordisk Inst. for Teoretisk Atomfysik, Copenhagen
(Contract W-7405-eng-48)
(LBL-9520; CONF-790743-8) Avail: NTIS HC A02/MF A01

A qualitative discussion of nuclear collisions in which the bombarding energy per nucleon is up to the order of the Fermi kinetic energy is presented. The significant processes encountered as bombarding energy increases from a few MeV to energies large in comparison with rest energies are sketched. An estimate of the nucleon mean free path is obtained, and nuclear dynamics

at moderate excitation is discussed. The calculated distribution of promptly emitted neutrons from the collision of 152 MeV C-12 with Gd-158 is shown. DOE

N80-21122# Fermi National Accelerator Lab., Batavia, Ill.
DEEP INELASTIC MUON SCATTERING AT FERMI LAB
M. Mugge Sep. 1979 44 p refs
(Contract EY-76-C-02-3000)
(COO-3000-T2) Avail: NTIS HC A03/MF A01

Experiment E203/391 was designed to have high sensitivity to any number of muons in the final state. This allowed a broad range of lepto-induced physics to be studied ranging from exotic 4 and 5-muon final states to deeply fundamental inelastic structure function measurements. The experimental apparatus and triggers are described along with the general scheme of the analysis. The results of the multimuon final states are outlined. DOE

N80-21123# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
STUDY OF THE INTERACTIONS OF RARE GAS MOLECULES BY MEASURING TOTAL AND DIFFERENTIAL TRANSVERSE SCATTERING Ph.D. Thesis - Goettingen Univ., West Germany [UNTERSUCHUNG VON EDELGAS-MOLEKUEL-WECHSELWIRKUNGEN DURCH MESSUNG TOTALER UND ROTATIONSAUFGELOESTER DIFFERENTIELLER STREUQUERSCHNITTE]
Jens Schleusener Aug. 1978 149 p refs In GERMAN
(MPIS-15/1978; ISSN-0436-1199; Rept-15) Avail: NTIS HC A07/MF A01; Max-Planck Inst. fuer Stroemungsforsch., Goettingen, West Germany DM 24.75

A universal instrument for measuring transverse dispersions was built. A precise determination was made of the energy potentials from the diffraction oscillations for He-Ne and D2-Ne, and for a superposition of rapid oscillations for Ar-Kr and Ar-CH4. For the system ND-Ne, the differential transversal rotative effect was measured in the case of the interaction of neutral particles. Author (ESA)

N80-21124# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
MEASURES OF THE TRANSVERSE DIFFERENTIAL EFFECT FOR THE ROTARY EXCITATION OF THE MOLECULE HD COLLIDING WITH Ne AND D2 Ph.D. Thesis - Goettingen Univ., West Germany [MESSUNG DIFFERENTIELLER WIRKUNGSQUERSCHNITTE FUER DIE ROTATIONSANREGUNG VON HD-MOLEKUELEN IM STOSS MIT Ne UND D2]
Friedrich Huisken Aug. 1978 127 p refs In GERMAN
(MPIS-16/1978; ISSN-0436-1199; Rept-16) Avail: NTIS HC A07/MF A01; Max-Planck Inst. fuer Stroemungsforsch., Goettingen, West Germany DM 21.30

The systems HD-Ne and HD-D2 were examined by a method of pseudostatistical analysis for the case of inelastic collisions. The range of transverse dispersions was studied for different levels of shock energy in relation with the molecular rotation and scattering angle. A comparison was made between elastic and inelastic systems. For the system HD-Ne, measurements of the inelastic transverse dispersion differential show correct values for the anisotropic potentials. Author (ESA)

N80-21125# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
DIRECT OBSERVATION OF THE REACTIONS OF THE ATOM O(1D) WITH HALOGEN COMPOUNDS OF METHANE AND WITH METHANE AND WATER [DIREKTE UNTERSUCHUNG DER REAKTION VON O(1D)-ATOMEN MIT HALOGENIERTEN METHANEN, METHAN UND WASSER]
Karl Kaufmann Nov. 1978 58 p refs In GERMAN
(MPIS-25/1978) Avail: NTIS HC A04/MF A01; Max-Planck Inst. fuer Stroemungsforsch., Goettingen, West Germany DM 11.70

Excited atoms of oxygen O(1D) produced by photolysis of ozone can react with halogen compounds of methane (namely the freons) in the upper atmosphere. An instrument was constructed to simulate the conditions of the reaction and analyze the reaction products. Results for the freons, CF3Br, CH4, and H2O are presented which show the distributions among the different possible reactions. Author (ESA)

N80-21126# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
A STUDY BY OPTICAL SPECTROSCOPY OF CHEMILUMINESCENT REACTIONS BETWEEN IONS AND MOLECULES FOR N(+)+NO YIELDS N2(+)* +O Ph.D. Thesis - Goettingen Univ. [UNTERSUCHUNG CHEMILUMINESZENTER IONEN-MOLEKUEL-REAKTIONEN]
Dietrich Brandt Mar. 1979 134 p refs In GERMAN Sponsored in part by Deut. Forschungsgemeinschaft (DFG)
(MPIS-4/1979) Avail: NTIS HC A07/MF A01; Max-Planck Inst. fuer Stroemungsforch., Goettingen, West Germany DM 22.95

A spectrometer, adapted to determine the excitation level after a reaction between monatomic ions and diatomic molecules, is described. The photons emitted during the interaction of the ion beam and the gas were counted. UV emissions were observed in the spectral bands between 3,000 and 4,400 A during the interaction between ions N(+) and the gas NO at shock energy levels between 1 and 20 eV. A hypothesis concerning shock energy was used to compare the measurements and results of the simulation. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-21127 Stanford Univ., Calif.
UNIFIED GAUGE THEORIES IN NUCLEAR PHYSICS Ph.D. Thesis
Brian David Serot 1979 387 p
Avail: Univ. Microfilms Order No. 8006351

The application of unified gauge field theories to theoretical nuclear physics is discussed. Two problems are investigated in detail: the use of parity violation in semileptonic interactions with nuclei to determine the structure of the unified theory of the weak and electromagnetic interactions, and the extension of an existing relativistic nuclear quantum field theory to include the isovector pi and rho mesons within a spontaneously broken non-Abelian gauge theory. Dissert. Abstr.

N80-21128# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
REMOTE EXPERIMENTAL FACILITY TO SOLIDIFY SRP HIGH-LEVEL WASTE
R. M. Galloway, M. J. Plodinec, E. L. Wilhite, and P. H. Chismar 1979 21 p refs Presented at Am. Nucl. Soc. Meeting, San Francisco, 12 Nov. 1979
(Contract EY-76-C-09-0001)
(DP-MS-79-53; CONF-791103-33) Avail: NTIS HC A02/MF A01

A small-scale equipment was developed and installed in a remotely operated experimental facility at the Savannah River Laboratory (SRL) to study immobilization of radioactive waste in glass. The facility has been in operation for nine months. During this period, two 25 liter batches of high-level waste from different SRP waste storage tanks were processed. The waste was boiled in sodium hydroxide to dissolve alumina trihydrate, washed with water to remove soluble salts, dried in a fluid bed dryer, and vitrified in a joule heated melter. Off-gases from the melter were collected for characterization. DOE

N80-21129# Department of Energy, Las Vegas, Nev. Operations Office.
NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS Quarterly Report, Apr. - Jun. 1979
Sep. 1979 62 p
(NVO-196-11) Avail: NTIS HC A04/MF A01

Seven subtasks are reported on: seismic, geology/hydrology, media (argillite, tuff, granite), NTS support, quality assurance,

technical overview, and spent fuel test. Yucca Mountain is recommended by USGS. DOE

N80-21130# Battelle Pacific Northwest Labs., Richland, Wash.
RESEARCH AND DEVELOPMENT ACTIVITIES: HIGH-LEVEL WASTE IMMOBILIZATION PROGRAM Quarterly Progress Report, Jan. - Dec. 1978
J. L. McElroy, J. E. Mendel, W. F. Bonner, and M. H. Henry May 1979 142 p refs
(Contract EY-76-C-06-1830)
(PNL-2999-Pt-1; PNL-2999-Pt-2) Avail: NTIS HC A07/MF A01

Progress reports from the high level waste immobilization program dealing with research activities on the solidification of high level radioactive waste are presented. Progress in waste fixation process development, waste form characterization, and alternative waste fixation processes are discussed. A.W.H.

N80-21131# Battelle Pacific Northwest Labs., Richland, Wash.
WASTE ISOLATION SAFETY ASSESSMENT PROGRAM. A BRIEF DESCRIPTION OF THE THREE-DIMENSIONAL FINITE ELEMENT GROUND-WATER FLOW MODEL ADAPTED FOR WASTE ISOLATION SAFETY ASSESSMENTS
C. R. Cole and S. K. Gupta Aug. 1979 57 p
(Contract EY-76-C-06-1830)
(PNL-2652) Avail: NTIS HC A04/MF A01

The three dimensional finite element ground water model described is for complex multilayered systems. The model is capable of simulating single layered systems having variable thickness or multilayered systems where not only thickness is varied, but the number of layers can be changed to agree with the vertical geological section. Supporting programs developed to plot grid values, contour maps and three dimensional graphics of the input data used in simulation are discussed. The capabilities of the model are discussed using a test case consisting of the multilayered ground water system beneath Long Island, New York. DOE

N80-21132# Sandia Labs., Albuquerque, N. Mex.
SENSITIVITY ON THE PARAMETERS OF THE REGIONAL HYDROLOGY MODEL FOR THE NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS
R. L. Iman, J. M. Davenport (Texas Tech. Univ., Lubbock), R. K. Waddell (Geological Survey, Denver), H. P. Stephens, and D. I. Leap (Texas Tech. Univ., Lubbock) 1979 31 p refs Presented at 1979 DOE Statistical Symp., Galtinburg, Tex., 24 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1197C; CONF-791016-3) Avail: NTIS HC A03/MF A01

Statistical methodology was applied to the investigation of the regional hydrologic systems of a large area encompassing the Nevada test site (NTS) as a part of the overall evaluation of the NTS for deep geologic disposal of nuclear waste. Statistical techniques including Latin hypercube sampling were used to perform a sensitivity analysis on a two dimensional finite element code of 16 geohydrologic zones used to model the regional ground-water flow system. The Latin hypercube sample was modified to include correlations between corresponding variables from zone to zone. From the results of sensitivity analysis it was found that: (1) the ranking of the relative importance on input variables between locations within the same geohydrologic zone were similar, but not identical; and (2) inclusion of a correlation structure for input variables had a significant effect on the ranking of their relative importance. The significance of these results is discussed with respect to the hydrology of the region. DOE

N80-21133# Los Alamos Scientific Lab., N. Mex.
SELECTION OF POWER PLANT ELEMENTS FOR FUTURE REACTOR SPACE ELECTRIC POWER SYSTEMS
D. Buden, G. A. Bennett, K. Cooper, K. Davidson, D. Koenig, L. B. Lundberg, R. Malenfant, H. Martz, W. Ranken, and R. E. Riley Sep. 1979 354 p refs
(Contract W-7405-eng-36)
(LA-7858) Avail: NTIS HC A16/MF A01

Various types of reactor designs, electric power conversion equipment, and reject heat systems to be used in nuclear reactor power plants for future space missions were studied. The designs included gas cooled, liquid cooled, and heat pipe reactors. For the power converters, passive types such as thermoelectric and thermionic converters, and dynamic types such as Brayton, potassium Rankine, and Stirling cycles were considered. For the radiators, heat pipes for transfer and radiating surface, and pumped fluid for heat transfer with heat pipes as the radiating surface were considered. A heat pipe reactor design, thermoelectric converters, and a heat pipe radiator were selected. DOE

N80-21134# Reynolds Electrical and Engineering Co., Inc., Las Vegas, Nev.
OPERATIONAL RADIOACTIVE WASTE MANAGEMENT PLAN FOR THE NEVADA TEST SITE
Jul. 1979 44 p Prepared in cooperation with DOE, Las Vegas, Nev.
(Contract EY-76-C-08-0410)
(NVO-185-Rev-1) Avail: NTIS HC A03/MF A01

Procedures and methods for the safe receiving, processing, disposal, or storage of radioactive waste are presented. Nevada test site radioactive waste disposition program guidelines, procedures for radioactive waste management, description of storage areas and facilities, and a glossary of specifications and requirements are included. DOE

N80-21135# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Plant.
TEMPERATURES GENERATED BY UNDERGROUND STORAGE OF DEFENSE WASTE CANISTERS
M. H. Tennant 1979 9 p refs Presented at Symp. on the Sci. Basic for Nucl. Waste Management, Boston, 26-29 Nov. 1979
(Contracts EY-76-C-09-0001; DE-AC09-76SR-0001)
(DP-MS-79-37; CONF-791112-11) Avail: NTIS HC A07/MF A01

For conditions conductive to leaching, i.e., moisture in contact with glass, the glass surface temperature would essentially be the canister cavity temperature because temperature rises across wet annuli are small. In turn, canister cavity temperatures are dominated by canister spacing for a given canister power and decay curve. Actual canister powers may be as much as 40% less than those used for these calculations. For dry salt in contact with the storage container, the temperature rises across the annuli may be large. The container temperature would tend to peak earlier for dry annuli than for wet annuli. When canister cavity temperatures peak, salt temperatures would be increased over normal approximately 500 feet in any direction extending from the repository. DOE

N80-21136# California Univ., Davis.
HIGH ENERGY PARTICLE PHYSICS RESEARCH Annual Progress Report
1979 16 p refs
(Contract EY-76-S-03-0034)
(SAN-0034-191-T1) Avail: NTIS HC A02/MF A01

Theoretical high energy physics research is reviewed in abstract length summaries. Research topics include the production of jets and single particles at large transverse momentum in photon-photon collisions, tests of quantum chromodynamics in two photon collisions, gluon jet production, and Higg's particle production. A.W.H.

N80-21137# Brown Univ., Providence, R. I. Dept. of Physics.
RESEARCH PROGRAM IN THEORETICAL HIGH-ENERGY PHYSICS Progress Report
D. Feldman, H. M. Fried, G. S. Guralnik, Kyungsik Kang, and Chung-I Tan Oct. 1979 19 p refs
(Contract EY-76-C-02-3130)
(COO-3130TA-347) Avail: NTIS HC A02/MF A01

Research topics in high energy theoretical physics are discussed. Included in the problems studied were flavor mixing angles in flavor gauge theory; grand unification schemes; neutral current phenomenology; charmonium decays; perturbative aspects of soft hadronic phenomena within the framework of the dual topological expansion; Regge trajectory slopes and the shape of the inclusive spectra; bound states in quantum electrodynamics; calculations of the Lamb Shift and hyperfine splitting in hydrogen;

collective behavior of instantons in quantum chromodynamics; 1/N expansion and mean field expansion techniques; group theoretic studies of spontaneous symmetry breaking; and fibre bundles applied to the topological aspects of gauge theories.
DOE

74 OPTICS

Includes light phenomena.

N80-21138* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NONCONTACTING METHOD FOR MEASURING ANGULAR DEFLECTION Patent
Emmett L. Bryant, inventor (to NASA) Issued 19 Feb. 1980 4 p Filed 23 Oct. 1978 Supersedes N79-11866 (17 - 02, p 0252)
(NASA-Case-LAR-12178-1; US-Patent-4,189,234; US-Patent-Appl-SN-953390; US-Patent-Class-356-152; US-Patent-Class-350-25; US-Patent-Class-350-285; US-Patent-Class-356-150) Avail: US Patent and Trademark Office CSCL 20F

An apparatus is described for indicating the instantaneous angular deflection of an object about a selected axis without mechanical contact with the object. Light from a light source is transmitted through a flat refractor to a converging lens which focuses the light through another flat refractor onto a differential photocell. The first flat refractor is attached to the object such that when the object is deflected about the selected axis the refractor is also deflected about that axis. The two flat refractors are identical and they are placed an equal distance from the converging lens as are the light source and the photocell. The output of the photocell which is a function of image displacement is fed to a high gain amplifier that drives a galvanometer which rotates the second flat refractor. The second refractor is rotated so that the image displacement is very nearly zero making the galvanometer current a measure of the deflection of the object about the selected axis.
Official Gazette of the U.S. Patent and Trademark Office

N80-21139 California Inst. of Tech., Pasadena.
OPTICAL DETERMINATION OF THE PROPERTIES OF EXCITONS BOUND TO IMPURITIES IN SEMICONDUCTORS Ph.D. Thesis
Kenneth Robert Elliott 1980 176 p
Avail: Univ. Microfilms Order No. 8006278

The electronic and optical properties of excitons bound to impurities in semiconductors are addressed with emphasis on the electronic structure of bound exciton states. The fundamental process in which a bound exciton is formed on a neutral acceptor in silicon is also reported. Three lines are shown to be in the absorption spectra of the acceptors Al, Ga, and In in silicon. Of the various schemes used to explain these lines, it is determined from the relative oscillator strengths that the correct scheme is one in which two $j=3/2$ holes are coupled to form states with total angular momentum $J=0$ and $J=2$. The cubic environment of the crystal in the neighborhood of the impurity leads to a splitting of the $J=2$ state. In the bound exciton spectra of Si:Tl, it is shown that four lines are in contrast to the three lines observed for the acceptors Al, Ga, and In. Other significant observations as well as the results are reported. Dissert. Abstr.

N80-21140* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIFFRACTOID GRATING CONFIGURATION FOR X-RAY AND ULTRAVIOLET FOCUSING Patent
Sidney O. Kastner, inventor (to NASA) Issued 11 Mar. 1980 7 p Filed 18 Sep. 1978 Supersedes N78-32857 (16 - 23, p 3142)
(NASA-Case-GSC-12357-1; US-Patent-4,192,994; US-Patent-Appl-SN-943086; US-Patent-Class-250-280; US-Patent-Class-250-277CH; US-Patent-Class-350-162R; US-Patent-Class-356-334) Avail: US Patent and Trademark Office CSCL 20F

An aspheric grating is described which is operable to image local or distant point sources sharply in a designated wavelength, i.e., produce a perfectly stigmatic image in the given wavelength at grazing angles of incidence. The grating surface comprises a surface of revolution defined by a curve which does not have a constant radius of curvature but is defined by a nonlinear differential equation.
Official Gazette of the U.S. Patent and Trademark Office

N80-21141*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND APPARATUS FOR DOPPLER FREQUENCY MODULATION OF RADIATION Patent Application
Jack S. Margolis (JPL), Daniel J. McCleese (JPL), Michael S. Shumate (JPL), and Clay H. Seamen (JPL) Filed 3 Nov. 1978 13 p Sponsored by NASA
(NASA-Case-NPO-14524-1; NASA-Case-NPO-14527-1; US-Patent-Appl-SN-957452) Avail: NTIS HC A02/MF A01 CSCL 20F

A method and apparatus is disclosed for frequency modulating radiation, such as from a laser, for optoacoustic detectors, interferometers, heterodyne spectrometers, and similar devices using two oppositely reciprocating cat's-eye retro-reflectors to Doppler modulate the radiation. By reciprocally moving both retroreflectors, the center of mass is maintained constant to permit smooth operation at many Hertz. By slightly offsetting the axis of one retroreflector relative to the other, multiple passes a light beam may be achieved for greater Doppler shifts with the same reciprocating motion of the retroreflectors. A Doppler shift of 2(v/c) V sub 0 occurs for each pass.
NASA

N80-21142*# Battelle Columbus Labs., Ohio.
ULTRAPURE GLASS OPTICAL WAVEGUIDE DEVELOPMENT IN MICROGRAVITY BY THE SOL-GEL PROCESS Final Progress Report, Mar. - Sep. 1979
Shyama P. Mukherjee 22 Feb. 1980 58 p refs Prepared for JPL
(Contract JPL-955361)
(NASA-CR-162910; JPL-9550-307) Avail: NTIS HC A04/MF A01 CSCL 20F

The alkali-borosilicate system was selected as the glass system for the preparation of ultrapure low loss glasses suitable for optical communication. The effect of different oxide contents on the absorption loss was critically reviewed. One composition was chosen to develop the gel preparation procedure in the alkali-borosilicate system. In addition, several procedures for the preparation of gels based on two different approaches were developed. The influence of different preparation parameters were investigated qualitatively. Several conclusions are drawn from the results.
J.M.S.

N80-21143*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
INVESTIGATION OF DIRECT INTEGRATED OPTICS MODULATORS Annual Status Report, 1 Nov. 1978 - 30 Nov. 1979
T. E. Batchman Mar. 1980 69 p refs
(Contract NsG-1567)
(NASA-CR-162894; UVA/528171/EE80/102) Avail: NTIS HC A04/MF A01 CSCL 20F

Direct modulation techniques applicable to integrated optics data preprocessors were investigated. Several methods of modulating a coherent optical beam by interaction with an incoherent beam were studied. It was decided to investigate photon induced conductivity changes in thin semiconductor cladding layers on optical waveguides. Preliminary calculations indicate significant changes can be produced in the phase shift in a propagating wave when the conductivity is changed by ten percent or more. Experimental devices to verify these predicted phase changes and experiments designed to prove the concept are described.
J.M.S.

N80-21144# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
DIRECTIONAL SELECTIVITY AND ITS USE IN EARLY VISUAL PROCESSING
D. Marr and S. Ullman Jun. 1979 64 p refs Sponsored in part by ARPA
(Contract N00014-75-C-0643; Grant NSF-MCS-77-07569)
(AD-A078054; AI-M-524) Avail: NTIS HC A03/MF A01 CSCL 05/8

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The construction of directionally selective units, and their use in the processing of visual motion, are considered. The zero-crossings of Delta 2G(x,y)-I(x,y) are located, as in Marr Hildreth (1979). In addition, the time derivative d/dt Delta 2G(x,y)-I(x,y) is measured at the zero-crossings, and serves to constrain the local direction of motion to within 180 degrees. The direction of motion is determined in a second stage by combining the local constraints. The second part of the paper suggests a specific model of the information processing carried out by the X and Y cells of the retina and the LGN, and certain classes of cortical simple cells. A number of psychophysical and neurophysiological predictions are derived from the theory. GRA

N80-21146# Naval Research Lab., Washington, D. C. Electro-Optical Technology Program Office.
PASSIVE INFRARED SURVEILLANCE. PART 1: MODEL FORMULATION Interim Report
Richard A. Steinberg Sep. 1979 43 p refs
(AD-A075603; EOTPO-52; NRL-8320) Avail: NTIS HC A03/MF A01 CSCL 17/4

A new theoretical procedure is presented for calculating the performance of scanning background limited (BLIP) infrared sensors with adaptive threshold signal-processing logic. The performance predictions obtained with this model are background-conditional, i.e., are valid only for a given infrared background scene, presumably specified as a radiance map of arbitrary (but deterministic) structure. The nonstationary statistical nature of the photocurrent is explicitly taken into account. The basic approach involves a combination of some results from optical communications theory with a formalism for the threshold-crossing statistics of nonstationary noises. The present work is pursued further in a companion paper in which various simplifying approximations and illustrative numerical examples are presented. The theory developed in these two papers is directly applicable to design parameter trade-off studies for infrared search and track (IRST) devices. GRA

N80-21148# Army Aeromedical Research Unit, Fort Rucker, Ala. Human Tolerance and Survivability Div.
A DIRECT MEASURE OF CRT IMAGE QUALITY
Robert W. Verona, Harry L. Task, Victor C. Arnold, and James H. Brindle Sep. 1979 24 p refs Presented at the Soc. of Photo-Optical Instrumentation Engr. Intern. Symp., San Diego, Calif., 27 Aug. - 1 Sep. 1979
(DA Proj. 3A1-61101-A-91; DA Proj. 4E4-64207-D-425)
(AD-A075610; USAARL-79-14) Avail: NTIS HC A02/MF A01 CSCL 17/2

This paper describes a direct measuring technique for determining the image quality of raster-scanned cathode-ray tube (CRT) displays. This technique is based on the Modulation Transfer Function (MTF) theory and human visual psychophysical data. The rationale for the technique is discussed from a theoretical as well as functional viewpoint. The instrumentation necessary to obtain these measures in manual and automatic modes is discussed. Data obtained using this measurement technique are analyzed and compared with the theoretical performance of the displays. The image quality of new CRT displays procured for the U.S. Army's Advanced Attack Helicopter is being specified and tested using this direct measuring technique. GRA

N80-21147# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
EFFECT OF WEATHER AT HANNOVER, FEDERAL REPUBLIC OF GERMANY, ON PERFORMANCE OF ELECTROOPTICAL IMAGING SYSTEMS. PART 3: UNCERTAINTIES IN COMPARISON OF FLIR PERFORMANCE IN THE 3-5 AND 8-12 MICROMETERS BANDS Final Report
L. M. Biberman Sep. 1979 36 p refs
(Contract MDA903-79-C-0202)
(AD-A079574; AD-E500110; IDA-P-1128;
IDA/HQ-75-17589) Avail: NTIS HC A03/MF A01 CSCL 17/5

This paper addresses aerosol contributions to the atmospheric problem, the uncertainties in predicting electrooptical system performance through the atmosphere in both the 3-5 and 8-12 micrometer bands because of uncertainties about aerosol composition and size distribution, and the effects of both aerosol composition and size distribution. GRA

N80-21148# Minnesota Univ., Duluth. Dept. of Physics.
OPTICAL DETECTION OF FIBER PARTICLES IN WATER Final Report, Mar. 1976 - Sep. 1978
S. R. Diehl, D. T. Smith, and M. Sydor Aug. 1979 73 p
(Grant EPA-R-804361)
(PB80-116866; EPA-600/2-79-127) Avail: NTIS HC A04/MF A01 CSCL 14B

Light scattering by individual particulates is used in a multiple-detector system to categorize the composition of suspended solids in terms of broad particulate categories. The scattering signatures of red clay and taconite tailings, the two primary particulate contaminants in western Lake Superior, along with two types of asbestiform fibers, amphibole, and chrysotile, were studied in detail. A method was developed to predict the concentration of asbestiform fibers in filtration plant samples for which electron microscope analysis was done concurrently. Fiber levels as low as 50,000 fibers/liter were optically detectable. The method offers a fast and inexpensive means for measuring, either on a continuous basis or as discrete samples, the fiber levels of filtration plant output. Further calibration of the instrument could enable analysis for other specific particulate contaminants as well. DOE

N80-20684# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ADP-SUPPORTED COLOR SEPARATION
Hans Kern *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 55-64 (For primary document see N80-20679 11-42)
Avail: NTIS HC A07/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-21149 Illinois Univ. at Chicago Circle, Chicago.
NONIDEAL COMPENSATION IN MHD GENERATORS Ph.D. Thesis
David A. Carl 1979 274 p
Avail: Univ. Microfilms Order No. 8009457

Nonideal compensation, the distortion of the total magnetic flux density by the induced magnetic flux density despite the presence of compensating bus bars, was examined with one and two dimensional models. The conducting fluid was assumed to be an incompressible liquid at a constant velocity. The iterative solution technique used in both models consisted of iterating between an equivalent circuit model that solves for the air gap current distribution, given the total magnetic flux density distribution, and a magnetic field model that solves for the total magnetic flux density distribution, given the air gap current distribution. End loss was modeled by a shunt resistance. The one dimensional model was intended to indicate general trends. The two dimensional model was intended to provide a more detailed analysis. Dissert. Abstr.

N80-21150 Stanford Univ., Calif.
COLLISIONAL EFFECTS ON ELECTROSTATIC WAVES IN ISOTROPIC PLASMAS Ph.D. Thesis
Ronald Wilensky 1979 183 p
Avail: Univ. Microfilms Order No. 8006369

The effect of electron neutral collisions on electrostatic wave propagation in an isotropic Lorentz plasma was investigated. The linearized Boltzmann equation was solved assuming the neutrals are stationary and infinitely heavy. Electron-neutral scattering is described by an arbitrary scattering cross section. For a small sinusoidal perturbation of the plasma, the resultant electron velocity distribution is the sum of an arbitrary isotropic distribution plus an incremental function represented by an infinite continued fraction containing all the Allis transport collision frequencies. From this distribution, a dispersion relation for electrostatic wave propagation was derived. Solutions of this relation are found for

three representative collision processes (constant mean free path, constant mean free time, and Ramsauer scattering) for both Maxwellian and nonMaxwellian equilibrium electron velocity distributions.

N80-21151 Wisconsin Univ. - Madison.
DIVERTOR EXPERIMENTS IN A TOROIDAL PLASMA, WITH ExB DRIFT DUE TO AN APPLIED RADIAL ELECTRIC FIELD Ph.D. Thesis
Edward Jonathan Strait 1979 244 p
Avail: Univ. Microfilms Order No. 8004746

The ExB drift arising from an externally applied electric field was examined for application in a Tokamak or other toroidal magnetic plasma confinement device to remove plasma and impurities from the region near the wall and reduce the amount of plasma striking the wall. Among the possible advantages of this scheme are easy external control over the rate of removal of plasma, more rapid removal than the naturally occuring rate in a magnetic divertor, and simplification of construction if the magnetic divertor is eliminated. Results of several related experiments performed in a levitated octupole are presented. A model based on the plasma's perpendicular dielectric constant and perpendicular conductivity is described which suggests that such an electric field applied perpendicular to the magnetic field will be inversely proportional to plasma density, allowing the electric field to penetrate the plasma on the scale length of the density profile. Dissert. Abstr.

N80-21152 Wisconsin Univ. - Madison.
STABILITY ANALYSIS OF CYLINDRICAL VLASOV EQUILIBRIA Ph.D. Thesis
Robert Wesley Short 1979 204 p
Avail: Univ. Microfilms Order No. 8001628

A method is presented for the stability analysis of cylindrically symmetric collisionless plasmas. The method is applied to any such plasma which is described by the Vlasov-Poisson or Vlasov-Maxwell equations. The plasma and field equations are linearized and Fourier analyzed in the ignorable coordinates theta and zeta. The coordinates of the particle trajectories in phase space are represented as Fourier series in time and the perturbed distribution function is obtained by integration over unperturbed orbits. The method is first presented for the Vlasov-Poisson equations, and demonstrated by a calculation of the lower hybrid drift instability in a plasma with a rigid rotor distribution function. The method is then extended to the fully electromagnetic case and applied to a relativistic E layer interacting with a warm background plasma. Dissert. Abstr.

N80-21153 Missouri Univ. - Columbia.
BACKSCATTERING OF ELECTROMAGNETIC WAVES FROM ELECTROSTATIC WAVES IN A MAGNETIZED PLASMA Ph.D. Thesis
Sinan Karin Bilikmen 1979 126 p
Avail: Univ. Microfilms Order No. 8007130

Stimulated backscattering which arises from the parametric decay of an intense electromagnetic wave into an electrostatic wave and a backscattered electromagnetic wave was investigated. The analysis was facilitated by derivation of a pair of coupled differential equations for the amplitudes of the backscattered and scatterer waves by using Maxwell's equations and two fluid equations for homogeneous, inhomogeneous, bounded and unbounded magnetized plasmas. The backscattering of an intense electromagnetic wave was examined, while propagating in the ordinary mode along a number density gradient and perpendicular to a uniform static magnetic field. The stimulated backscattering of electromagnetic waves from extraordinary waves propagating normal to a magnetic field in a plasma of finite length was also studied. Dissert. Abstr.

N80-21154# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PROCEEDINGS OF USSR-JAPAN JOINT SEMINAR ON PLASMA DIAGNOSTICS
O. Pavlichenko and J. Fujita Jan. 1980 228 p refs Proc. held at Nagoya, Japan, 13-17 Nov. 1979
(IPPJ-438) Avail: NTIS HC A11/MF A01

The development of high temperature plasma diagnostics suitable for nuclear fusion research is discussed with emphasis on diagnostics for the large JT-60 and T-15 Tokamaks. Recent results on the KhTI, the T-15, the JIPP T-2 stellarator/tokamak, the TORUIT-4, the TRIAM-1, and the DIVA/JFT-2a are reported. Topics covered include measuring nonstationary and anisotropic density fluctuations using electromagnetic wave scattering, the development of a twin optically-pumped far infrared CH3OH laser; SMM wave laser scattering apparatus for measuring waves and turbulences in Tokamak plasmas; the role of impurity spectra in tokamak devices; diagnosing dense plasmas with ruby laser holography; heavy ion beam probes for potential measurement; supersound plasma counter-streaming interaction and thermalization inside open magnetic traps; and the collision of high energy plasma streams. A.R.H.

N80-21155# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STEADY MOTIONS EXHIBITED BY DUFFING'S EQUATION: A PICTURE BOOK OF REGULAR AND CHAOTIC MOTIONS
Yoshisuke Ueda (Kyoto Univ., Japan) Jan. 1980 14 p refs Presented at the Eng. Foundation Conf. on New Approaches to Nonlinear Problems in Dyn., Monterey, Calif., 9-14 Dec. 1979
(IPPJ-434) Avail: NTIS HC A02/MF A01

Various types of steady states take place in the system exhibited by Duffing's equation. Among them harmonic, higher harmonic and subharmonic motions are popularly known. Then ultrasubharmonic motions of different orders are fairly known. However chaotic motions are scarcely known. Analog and digital computers are used to survey of the whole aspect of steady motions exhibited by Duffing's equation. Author

N80-21156# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DEFLAGRATION WAVE FORMED BY ION BEAM. PART 3: WITH ENERGY OF DIRECT FUSION REACTION
Keishiro Niu, Takashi Abe, and Moritake Tamba Jan. 1980 15 p refs
(IPPJ-435-Pt-3) Avail: NTIS HC A02/MF A01

The structure of the deflagration wave which is formed in a target bombarded by an ion beam was analyzed. Stationary deflagration and/or detonation waves are formed at the surface of the target in a case in which the reaction energy of direct fusion and/or the beam energy deposited in the target are less than a critical value. On the other hand, no solution for stationary wave exists, if the energy deposited in the wave exceeds a critical value. In the latter case, the time-dependent fundamental equations reduce approximately to a self-similar type of equations. Numerical integrations are carried out for this type of differential equations, and an example of self-similar deflagration wave numerically obtained is plotted in the figures. A.R.H.

N80-21157# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NUMERICAL STUDY OF CURRENT-DRIVEN COLLISIONAL DRIFT AND ALFVEN INSTABILITIES IN A SHEARED MAGNETIC FIELD
Ken-ichi Nishikana Jan. 1980 34 p refs
(IPPJ-436) Avail: NTIS HC A03/MF A01

A set of coupled eigenmode equations for drift and shear Alfven mode in a sheared magnetic field is solved numerically including effects of parallel current, the full ion dynamics and electron-ion collisions. Detailed studies are made on the eigenmode structures of both the modes and combined effects of current and finite-beta. An outstanding result is that the current-driven drift mode shows, at some moderate beta value, a peculiarity in dispersion and its eigenmode structure is deformed to a shape different from the usual one, which means the strong coupling of drift mode to shear Alfven mode due to the combined effects. In the most cases except this, the effects of finite-beta and collisions are found to be stabilizing. A.R.H.

N80-21158# Nagoya Univ. (Japan). Inst. of Plasma Physics.
HIGH POWER ION-IRRADIATION TEST FOR CTR FIRST WALL
A. Mohri, K. Narihara, Y. Tomita, T. Tsuzuki, Z. Kabeya, K. Akaishi, and A. Miyahara Jan. 1980 12 p refs
(IPPJ-437) Avail: NTIS HC A02/MF A01

High power irradiation of ions on metal surface can be obtained by using plasma anode for electron beam generation. The irradiation power of 600 keV protons was 50 MW/sq cm which is comparable with pulse power loading of CTR Tokamak first wall at a strong major disruption. Damage of 304 stainless

steel by this irradiation was different from by usual irradiation of ions at low power level. A.R.H.

N80-21159*# Science Applications, Inc., McLean, Va.
STRONGLY TURBULENT STABILIZATION OF ELECTRON BEAM-PLASMA INTERACTIONS Interim Report
H. P. Freund, I. Haber, P. Palmadesso, and K. Papadopoulos 9 Nov. 1979 43 p
(NASA Order W-14365)
(NASA-CR-162843; AD-A078231; AD-E000340; NRL-MR-4127) Avail: NTIS HC A03/MF A01 CSCL 20/9

The stabilization of electron beam interactions due to strongly turbulent nonlinearities is studied analytically and numerically for a wide range of plasma parameters. A fluid mode coupling code is described in which the effects of electron and ion Landau damping and linear growth due to the energetic electron beam are included in a phenomenological manner. Stabilization of the instability is found to occur when the amplitudes of the unstable modes exceed the threshold of the oscillating two stream instability. The coordinate space structure of the turbulent spectrum which results clearly shows that soliton-like structures are formed by this process. Phenomenological models of both the initial stabilization and the asymptotic states are developed. Scaling laws between the beam-plasma growth rate and the fluctuations in the fields and plasma density are found in both cases, and shown to be in good agreement with the results of the simulation. GRA

N80-21160# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
DEVELOPMENT, TESTING AND EVALUATION OF MHD MATERIALS AND COMPONENTS DESIGNS Quarterly Report, Jul. - Sep. 1978
John W. Sadler, J. Bein, and D. L. Black Dec. 1978 94 p refs
(Contract EX-76-C-01-2248)
(FE-2248-22) Avail: NTIS HC A05/MF A01

Laboratory screening tests, including electrochemical corrosion and anode arc erosion tests, are reported. Results of electrochemical tests are presented which imply that for MHD channels operating under liquid slagging wall conditions the deleterious reactions with slag, presently recognized as limiting channel operation, metallic Fe formation at the cathode, and O2 gas release and cavitation at the anode, can be prevented with the use of ionic oxide electrodes. Initial results of investigations of arc impingement damage to selected metallic anode materials over the temperature range of 185 C to 650 C are presented. DOE

N80-21161# California Univ., Livermore. Lawrence Livermore Lab.
FORMATION OF TOROIDAL PLASMA CONFINEMENT CONFIGURATONS BY USING HOT ELECTRONS
C. W. Hartman 9 Aug. 1979 15 p refs
(Contract W-7405-eng-48)
(UCID-18239) Avail: NTIS HC A02/MF A01

Two means for producing closed, toroidal pinch like configurations with hot electrons starting from a microwaves heated, hot electron plasma confined in open fields are described. The final configurations are directly related to Spheromak and Tormac. DOE

N80-21162# Wisconsin Univ. - Madison. Dept. of Physics.
VACUUM ULTRAVIOLET SPECTROSCOPIC STUDY OF PLASMA IMPURITIES IN THE TOKAPOLE 2 POLOIDAL DIVERTOR EXPERIMENT Ph.D. Thesis
R. J. Groebner May 1979 231 p refs
(Contract EY-76-S-02-2387)
(COO-2387-111) Avail: NTIS HC A11/MF A01

The main diagnostics were two vacuum ultraviolet spectrometers, which were used to identify impurities, observe impurity behavior, and measure the line radiated power in tokapole 2, a Tokamak with a four node poloidal diverter. Impurity concentrations and the effects of impurities on gross plasma characteristics were determined with an impurity doping technique. The electron temperature was estimated by a time dependent coronal model describing the time history of the oxygen ions. The ion temperature was obtained from Doppler broadening measurements. Energy loss processes were studied with a power balance analysis. DOE

N80-21163# Exxon Research and Engineering Co., Linden, N.J.
MATERIAL IMPLICATIONS OF DESIGN AND SYSTEM STUDIES FOR INERTIAL CONFINEMENT FUSION SYSTEMS
J. A. Maniscalco and W. R. Meier Dec. 1978 9 p ref Presented at the Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla. 29 Jan. 1979 Prepared in cooperation with Lawrence Livermore Lab., Calif.
(Contract W-7405-eng-48)
(UCRL-82041; CONF-790125-82) Avail: NTIS HC A02/MF A01

The material requirements for inertial confinement fusion (ICF) reactors are presented. The requirements are defined and analyzed by describing the environment created from the process of generating energy with ICF, and then analyzing the ICF reactor concepts which were designed to cope with this hostile environment. DOE

N80-21164# Princeton Univ., N. J.
TECHNIQUES FOR MEASURING THE ALPHA-PARTICLE DISTRIBUTION IN MAGNETICALLY CONFINED PLASMAS
D. E. Post, D. R. Mikkelsen, R. A. Hulse, L. D. Stewart, and J. C. Weisheit Oct. 1979 53 p refs
(Contract EY-76-C-02-3073)
(PPPL-1592) Avail: NTIS HC A04/MF A01

Methods are proposed for measuring the alpha particle distribution in magnetically confined fusion plasma using neutral atom doping beams, ultraviolet spectroscopy, and neutral particle detectors. In the first method, single charge exchange reactions are used to populate the n = 2 and n = 3 levels of He(+). The ultraviolet photons from the decaying excited states are Doppler shifted by 5 to 10 Angstroms from those produced by the thermalized alpha particle ash. In the second method double charge exchange reactions enable fast neutralized alpha particles to escape from the plasma and be detected by neutral particle analyzers. Detector configurations are analyzed, count rates are estimated, and their detectability is discussed. A preliminary analysis of the feasibility of the required neutral beams is presented, and exploratory experiments on esisting devices are suggested. DOE

N80-21165# Department of Energy, Washington, D. C. Office of Fusion Energy
FUSION TECHNOLOGY DEVELOPMENT
Aug. 1979 151 p refs
(DOE/ET-0116/1) Avail: NTIS HC A08/MF A01

Conceptual design studies of fusion energy and fusion reactos are presented. The magnetics of fusion reactors are discussed with an overview of a large coil program included. Plasma heating, fueling, and exhaust systems for the reactors are described and research on materials for fusion reactors is discussed. A.W.H.

N80-21166# Argonne National Lab., Ill.
ADVANCES IN MHD TECHNOLOGY
M. Petrick, R. V. Shanklin, III (DOE, Washington, D.C.), and G. Rudins (DOE, Washington, D.C.) 1979 52 p refs Presented at the Advances in Coal Util. Symp., Louisville, Ky., 14-15 May 1979
(Contract W-31-109-eng-38)
(CONF-790598-5) Avail: NTIS HC A04/MF A01

The operation of magnetohydrodynamic (MHD) generators is discussed. The thermodynamic and economic potential, the technical status and recent advances, and the environmental issues associated with MHD power plants are examined. A national program for developing MHD conversion is described and experimental MHD generator operations in the U.S. and U.S.S.R. are reported. A.W.H.

N80-21167# Oak Ridge Y-12 Plant, Tenn.
VELOCITY SPACE INSTABILITIES OF ALPHA PARTICLES IN TOKAMAK REACTORS
D. J. Sigmar 1979 16 p refs Presented at Course and Workshop on Phys. of Plasmas near Thermonucl. Conditions, Varenna, Italy, 27 Aug. - 7 Sep. 1979
(Contract W-7405-eng-26)

(DOE/TIC-11016) Avail: NTIS HC A02/MF A01

The conditions for the linear theory and the anomalous relaxation of the velocity space instability of isotropic alpha distribution functions are discussed. Mathematical models show that such distributions actually arise under thermonuclear conditions in a Tokamak reactor, particularly for the case of imperfect alpha particle confinement. The toroidal geometry of the problem is described and the derivations which display the linear instability of the compressional plasma waves are presented. A.W.H.

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-21168 British Library Lending Div., Boston Spa (England).
MATHEMATICAL MODELS OF SOME CONTROLLED CRYSTALLIZATION PROCESS
A. Gosiewski and M. Niezgodka. Oct. 1979. 19 p. refs. Transl. into ENGLISH from Arch. Automatyki Telemechaniki (Poland), v. 23, no. 3, 1978 p 255-265
(BLL-RTS-12032) Avail: British Library Lending Div., Boston Spa, Engl.

The process of controlled crystal growth from a binary melt is examined. A mathematical model of this process is formulated in the form of a system of two phase parabolic boundary problems with free interface relating to the temperature and concentration fields. The boundary conditions are used as process control variables. An integral equivalent representation of the model is presented. A control problem whose objective is to achieve the desired dynamic properties of the phase change interface and to attain a fixed terminal state is described. A.W.H.

N80-21169 Cornell Univ., Ithaca, N. Y.
LOAD RELAXATION AND TRANSMISSION ELECTRON MICROSCOPY STUDIES OF GERMANIUM Ph.D. Thesis
Shin-Wu Chiang. 1979. 165 p.
Avail: Univ. Microfilms. Order No. 8003907

The log sigma - log xi data obtained from load relaxation experiments on Ge single crystals are analyzed using a rheological model. A systematic transition from concave upward to concave downward curvature occurs with increasing temperature, corresponding to a transition from glide controlled to climb/cross-slip controlled deformation. Also faulted dipoles ranging in height from 3 to 12 nm in deformed weak beam transmission electron microscopy techniques. Only intrinsic, Z-shape faulted dipoles are observed. Lattice fringe images of large faulted dipoles yield stacking fault energy of 78 + or - 7 sq/mJm. As determined from the height and width of faulted dipoles viewed end-on in lattice fringe images, the value for the stacking fault calculated from anisotropic elasticity theory increases from 78 to 160 sq/mJm as the height decreases from 5 to 3 nm.
Dissert. Abstr.

N80-21170 Maryland Univ., College Park.
EFFECTS OF SURFACE STRUCTURE ON SECONDARY ELECTRON EMISSION Ph.D. Thesis
Marten Leendert DenBoer. 1979. 72 p.
Avail: Univ. Microfilms. Order No. 8006757

The strong indications of low energy electrons with most materials has led to their widespread use as a probe of the surface region. Perhaps the simplest experiment utilizing electrons is to measure the total secondary yield as a function on incident electron energy. Although such a plot appears smooth, there are many small, but relatively abrupt inflections that can be enhanced by differentation with respect to incident electron energy. In particular, sudden increases in yield are associated with the thresholds for the excitation of core states, i.e., the so-called appearance potentials. To clarify the mechanism for this effect, the energy distribution of electrons contributing to these features was analyzed. It is found that at threshold, while the elastic yield decreases due to the opening of a new inelastic channel, the total yield in general increases because of the inelastic scattering of electrons from Auger recombination of the created core holes. This produces a shower of low energy electrons which are responsible for most of the increase in yield.
Dissert. Abstr.

N80-21171 Pennsylvania State Univ., University Park.
STUDY OF RAMAN LINEWIDTHS AS A FUNCTION OF STRUCTURE, BONDING AND TEMPERATURE Ph.D. Thesis
Regis Joseph Betsch. 1979. 174 p.
Avail: Univ. Microfilms. Order No. 8005977

The anomalous Raman line broadening in crystalline materials was studied. To differentiate between the various sources of line broadening, an empirical model of the Raman scattering process was developed. The digitized Raman spectra were analyzed using smoothing and curve fitting routines developed on an IBM 370/168 computer. The capabilities of the automated system and the analysis software were examined using the Raman spectrum of diamond. The materials studied which exhibit anomalous linewidth behavior were: LaB6, rutile (TiO2), and sillenite (Bi12GeO20).
Dissert. Abstr.

N80-21172 Stanford Univ., Calif.
PHASE TRANSITIONS IN LATTICE GAUGE THEORIES Ph.D. Thesis
Eduardo Hector Fradkin. 1979. 231 p.
Avail: Univ. Microfilms. Order No. 8006311

The phase structure of gauge theories on a lattice are discussed. The analogies between four dimensional gauge theories and two dimensional magnetic systems are analyzed. An analogy between the two dimensional Planar ferromagnet and the four dimensional Abelian gauge theory is discussed. The behavior of gauge theories with dynamical matter (Higgs) fields is examined. The role of local (gauge) symmetries in random magnetic systems is discussed.
Dissert. Abstr.

N80-21173# Stanford Linear Accelerator Center, Calif.
PARITY NONCONSERVATION IN POLARIZED ELECTRON SCATTERING AT HIGH ENERGIES
C. Y. Prescott. Oct. 1979. 15 p. refs. Presented at the Intern. Workshop on Neutral Current Interactions in Atoms, Cargese, Corsica, 10-15 Sep. 1979
(Contract EY-76-C-03-0515)
(SLAC-Pub-2409) Avail: NTIS HC A02/MF A01

Observations of parity violation in inelastic scattering of electrons at high energy are discussed. The kinetics of the process, the idealized case of scattering from free quark targets, experimental techniques and results, and relations to atomic physics of parity violation in bismuth and thallium atoms are analyzed.
DOE

N80-21174# Illinois Univ., Urbana. Dept. of Physics.
STUDIES IN THE ELECTRONIC STRUCTURE OF MATTER Ph.D. Thesis
C. A. Swarts. 1979. 350 p. refs.
(Contract EY-76-C-02-1198)
(COO-1198-1268) Avail: NTIS HC A15/MF A01

The results of various theories for the angular distribution of electrons photoemitted from the outermost p shell of rare gas atoms are compared. The theories compared are the local density theories of Slater and of Hohenberg, Kohn and Sham, the pseudopotential method, Hartree-Fock theory, and random phase approximation with exchange. Extended Huekel theory is applied to GaAs, GaP, and to the nitrogen isoelectronic trap in GaAs and GaP. The computer perfect crystal band structures are found to be in reasonable agreement with those computed with empirical pseudopotentials. Nitrogen impurity levels in GaAs and GaP are calculated using a cluster model. By means of model calculations for an independent electron metal, exact lineshapes are obtained for the photon absorption, emission and photoemission spectra of deep core states.
DOE

N80-21175# Los Alamos Scientific Lab., N. Mex.
ROLES OF CRYSTAL FIELDS IN MAGNETIC SUPERCONDUCTING RARE-EARTH RHODIUM BORIDES
S. Maekawa (Tohoku Univ.) and C. Y. Huang. 1979. 9 p. refs. Presented at the Intern. Conf. on Crystalline Elec. Field and Structural Effects in F-Electron Systems, Philadelphia, 12 Nov. 1979
(Contract W-7405-eng-36)

(LA-UR-79-3174; CONF-791142-3) Avail: NTIS HC A02/MF A01

The structural effects of the tetragonal crystal field of rare earth ions on both magnetic and superconducting properties of RRH4B4 are discussed. Special attention is paid to RRh4B4, with R = Ho, Er, and Tm, and the pseudoternaries Er/sub 1-x/Ho/sub x/Rh4B4 and Er/sub 1-x/ Tm/sub x/Rh4B4. The lowest crystalline anisotropy field is described. DOE

N80-21176# Los Alamos Scientific Lab., N. Mex.
GROUND STATES AND MAGNETIC RESPONSES OF MODEL VALENCE-FLUCTUATION SYSTEMS
B. H. Brandow 1979 9 p refs Presented at Intern. Conf. on Crystalline Elec. Field and Structural Effects in F-Electron Systems, Philadelphia, 12-15 Nov. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3144; CONF-791142-4) Avail: NTIS HC A02/MF A01

Variational ground state wavefunctions are presented and optimized for two model valence-fluctuation systems based on Anderson lattice Hamiltonians in the U approaches infinity limit. Although these wavefunctions are approximate, they are treated in an essentially exact manner. The response of the ground state to a magnetic field is discussed. DOE

N80-21177# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
MOLECULAR BEAM PHOTOIONIZATION AND GAS-SURFACE SCATTERING Ph.D. Thesis
S. T. Ceyer Sep. 1979 244 p refs
(Contract W-7405-eng-48)
(LBL-9838) Avail: NTIS HC A11/MF A01

The energetics of the ethylene ion-molecule reactions was investigated. The energetics of the solvated ethlyene dimer ion was investigated by the photoionization of the ethylene trimer. The absolute proton affinity of NH3 and the proton solvation energies by more than one NH3 were determined by molecular beam photoionization. In addition, the NH3(+) - NH3 interaction energy was measured by photoionization of the neutral van der Waals dimer. The scattering of helium atomic beams from a high Miller index platinum surface that exhibits ordered, periodic steps on the atomic scale to probe the effect of atomic steps on the scattering distribution is explored. The design, construction and operation of a beam surface scattering apparatus are described. DOE

N80-21178# Stanford Linear Accelerator Center, Calif.
PARITY VIOLATION IN DEEP INELASTIC ELECTRON SCATTERING
R. E. Taylor Nov. 1979 16 p refs Presented at the Intern. Conf. on Nucl. Phys. with Electromagnetic Interaction, Maine, 5-9 Jun. 1979
(Contract EY-76-C-03-0515)
(SLAC-Pub-2432; CONF-790610-6) Avail: NTIS HC A02/MF A01

Neutral currents in electron scattering and the Weinberg-Salam model are reviewed. Results from neutrino interactions and deep inelastic electron scattering experiments are discussed. The SLAC-Yale experiment which measured a difference in the e-d inelastic cross section for right- and left-handed electrons is described. The polarized source, beam monitors, scattering experiment, checks of helicity dependence, and results are discussed. DOE

N80-21179# Argonne National Lab., Ill. Materials Science Div.
ENERGY OF < 100 > COINCIDENCE TWIST BOUNDARIES IN TRANSITION METAL OXIDES
D. Wolf 1979 14 p refs Presented at the 3rd Europhys. Topical Conf. on Lattice Defects in Ionic Crystals, Canterbury, England, 17 Sep. 1979
(Contract W-31-109-eng-38)
(CONF-7907101-2) Avail: NTIS HC A02/MF A01

The energies of coincidence twist boundaries formed by rotation about a < 100 > axis in stoichiometric transition metal oxides crystallizing in the NaCl structure (such as NiO, MnO, and CoO) were calculated using the ionic type potentials for these materials. From a relaxation calculation it is found that the energies of the most prominent coincidence twist boundaries at 36.87, 22.62, 28.07, and 16.26 deg lie above the energy of the free /100/ surface. DOE

N80-21180# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.
MECHANICAL PROPERTIES OF CRYSTALLINE SOLIDS Progress Report, 1 Dec. 1978 - 30 Nov. 1979
Che Yu Li and E. W. Hart 1 Sep. 1979 60 p refs
(Contract EY-76-S-02-2172)
(COO-2172-29) Avail: NTIS HC A04/MF A01

Transient deformation, grain boundary sliding, and grain boundary cavitation processes in the Zircaloys were investigated. A second generation deformation model based on state variables, which represents transient deformation, was experimentally verified. Experimental capabilities for investigating grain boundary anelasticity were developed along with unified phenomenological models for grain boundary anelasticity and grain boundary sliding. Theoretical modeling of stress relaxation in thin films was included. DOE

N80-21181# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany). Abt. Atom- und Molkuel physik.
MEASUREMENTS AND CALCULATIONS OF ELECTRONIC EXCITATION FROM COLLISIONS BETWEEN ATOMS OF ALKALIS AND MERCURY IN THE ENERGY RANGE 10 eV TO 1400 eV [MESSUNG UND BERECHUNG INTEGRALER ELEKTRONISCHER ANREGUNGSQUERSCHNITTE FUER ALKALI-QUECKSILBER-STOSSSYSTEME IM ENERGIEBEREICH ZWISCHEN 10 UND 1400 eV]
Gebhard Moritz Nov. 1978 151 p refs In GERMAN
(MPIS-24/1978) Avail: NTIS HC A08/MF A01; Max-Planck Inst. fuer Stroemungsforsch., Goettingen, West Germany DM 27.15

Exchanges between the alkali metals Na, K, Cs, Rb, and Hg were studied by measuring the radiation emitted in a dispersion chamber when the alkali beam interacts with the mercury atoms. Spectrum analysis and intensity measurements show that the dominant factor is the scattering of the lowest resonance level of the alkali. Application of quantum mechanics (with the solution of the Schroedinger equations) gave exact solutions in the low energy domain. Author (ESA)

N80-21182# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
COMPENSATION MECHANISMS IN GaAs. STUDY OF CHROME AND OXYGEN IN THIS MATERIAL AND THEIR INFLUENCE IN OBTAINING SEMI-INSULATING GaAs Final Report [PHENOMENES DE COMPENSATION DANS GAAS. ETUDE DU CHROME ET DE L'OXYGENE DANS CE MATERIAU ET CONSEQUENCES POUR L'OBTENTION DE GAAS SEMI-ISOLANT]
G. M. Martin, A. Mitonnean, A. Mircea-Roussel, A. Mircea, J. P. Farges, G. Jacob, J. P. Hallais, and G. Poiblaud Jun. 1979 85 p refs In ENGLISH and FRENCH
(Contract DGRST-77-7-0085)
(LEP-79/640 SME-645-C) Avail: NTIS HC A05/MF A01

Crystal ingots of doped GaAs were characterized using electrical and optical techniques in order to study the deep compensation mechanisms responsible for the materials semi-insulating qualities. The crystals were doped with varying amounts of oxygen and chromium. Hall effect measurements and results from optical transient current spectroscopic analysis were compared with diverse chemical analyses. The relationship of doping concentration on electron mobility in deep crystal layers and the electrical properties of this type of semiconductor material are discussed. Author (ESA)

N80-21183# National Bureau of Standards, Washington, D.C. National Measurement Lab.
STANDARD X-RAY DIFFRACTION POWDER PATTERNS. SECTION 16: DATA FOR 86 SUBSTANCES Final Report
Marlene C. Morris, Howard F. McMurdie, Eloise H. Evans, Boris Paretzkin (Joint Committee on Powder Diffraction Standards, Swarthmore, Pa.), Johan H. deGroot (Joint Committee on Powder Diffraction Standards, Swarthmore, Pa.), Camden R. Hubbard (Joint Committee Powder Diffraction Standards, Swarthmore, Pa.), and Simon J. Carmel Oct. 1979 190 p refs Prepared in

cooperation with Joint Committee on Power Diffraction Standards, Swarthmore, Pa.
(PB80-110364; NBS-MONO-25-SECT-16; LC-53-61386) Avail: NTIS HC A09/MF A01 CSCL 20B

Standard X-ray diffraction patterns are presented for 86 substances. Fifty-eight of these patterns represent experimental data and 28 are calculated. The experimental X-ray powder diffraction patterns were obtained with an X-ray diffractometer. All of values were assigned Miller indices determined by comparison with computed interplanar spacings consistent with space group extinctions. The densities and lattice constants were calculated and the refractive indices were measured whenever possible. The calculated X-ray powder diffraction patterns were computed from published crystal structure data. Both peak height and integrated intensities are reported for the calculated patterns. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-21184 Oregon Univ., Eugene.
ACCELERATING PARTICLES IN GENERAL RELATIVITY (STATIONARY C-METRIC) Ph.D. Thesis
Hamid Farhoosh 1979 133 p
Avail: Univ. Microfilms Order No. 8005762

The physical and geometrical properties of uniformly accelerating particles in the general theory of relativity are examined. The structure of the Killing horizons in the static vacuum C-metric which represents the gravitational field of a uniformly accelerating Schwarzschild like particle (nonrotating and spherically symmetric) is studied. It is shown that for $A(2)m(2) < 1/27$ there exist two physically meaningful Killing horizons. The results are generalized to include the effects of the rotation of the source. For small acceleration and small rotation, the solution reveals the existence of three Killing horizons. The radial geodesic and nongeodesic motions in the static vacuum C-metric (nonrotating case) are also investigated. Finally, the radiative behavior of the stationary charged C-metric representing the electrogravitational field of uniformly accelerating and rotating charged particle with magnetic monopole and the NUT-parameter are investigated. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-21185# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
PLANNING AND CONTROL OF RESEARCH AND DEVELOPMENT PROJECTS WITH CONTRIBUTIONS FROM SPACE TECHNOLOGY [PLANUNG UND UEBERWACHUNG VON FORSCHUNGS- UND ENTWICKLUNGSPROJEKTEN]
Bernd J. Madauss Nov. 1978 311 p refs Partly in GERMAN and ENGLISH
Avail: NTIS HC A14/MF A01

The principal planning and control methods are elaborated to include technical and engineering tasks, financial and personnel management. General rules are given which have come from not only the space program, but from management of such large engineering projects as the Caracas subway system. Annexes contain examples of forms and flow charts used as tools in such projects. Author (ESA)

N80-21186# General Technology Systems Ltd., London (England).
STUDY AND IMPLEMENTATION OF AN ESA COMPUTERIZED PLANNING SYSTEM, PHASE 1. VOLUME 2: DATA FILES AND UPDATING
P. Brunt, G. E. Hall, and L. W. Steines Jan. 1978 173 p 6 Vol.
(Contract ESA-3172/77-F-WMT)
(GTS-760972-Vol-2; ESA-CR(P)-1222-Vol-2) Avail: NTIS HC A08/MF A01

A computerized system which simulates the planning activities, formalizes the decision making process, and aids management information retrieval for the European Space Agency is described. It is indicated that the system permits the analysis of statistical cost data; the manipulation of price levels, currencies and cost elements, the prediction of national space expenditure capabilities and of the margin available for new projects, the selection and 'fitting' of projects into the margin, and the comparison of manpower requirements with forecast industrial capacity. Raw data files are provided as well as instructions for updating. Author (ESA)

N80-21187# General Technology Systems Ltd., London (England).
STUDY AND IMPLEMENTATION OF AN ESA COMPUTERIZED PLANNING SYSTEM, PHASE 2. VOLUME 4: UPDATING OF SUBPROGRAMS ESA 1-5
G. E. Hall, L. W. Steines, and P. Brunt Oct. 1978 82 p 6 Vol.
(Contract ESA-3172/77-F-WMY(SC))
(GTS-760972-Vol-4; ESA-CR(P)-1222-Vol-4) Avail: NTIS HC A05/MF A01

A computerized system has been defined and implemented which simulates the planning activities, formalizes the decision making process and aids mangement information retrieval for the European Space Agency. Five subprogram blocks permit the analysis of statistical cost data, the manipulation of price levels, currencies and cost elements, the prediction of national space expenditure capabilities and of the margin available for new projects; the selection and fitting of projects into the margin, and the comparison of manpower requirements with forecast industrial capacity. The detailed activities necessary for updating the planning system subprograms are given. Author (ESA)

N80-21188# General Technology Systems Ltd., London (England).
STUDY AND IMPLEMENTATION OF AN ESA COMPUTERIZED PLANNING SYSTEM, PHASE 2. VOLUME 5: PROJECT RETURNS AND BENEFITS
P. Brunt, G. E. Hall, and W. Spiess Dec. 1978 154 p 6 Vol.
(Contract ESA-3172/77-F-WMT)
(GTS-760972-Vol-5; ESA-CR(P)-1222-Vol-5) Avail: NTIS HC A08/MF A01

A computerized system was defined and implemented which simulates the planning activities, formalizes, the decision making process, and aids management information retrieval for the European Space Agency. Five subprogram blocks permit the analysis of statistical cost data; the manipulation of price levels, currencies and cost elements; the prediction of national space expenditure capabilities and of the margin available for new projects; the selection and 'fitting' of projects into the margin; and the comparison of manpower requirements with forecast industrial capacity. The definition and programming of the segment of the program dealing with the evaluation of project returns and benefits are presented. The functions foreseen for the program in use, program structure, coding instructions, and description of subprograms are included. Author (ESA)

N80-21189# General Technology Systems Ltd., London (England).

STUDY AND IMPLEMENTATION OF AN ESA COMPUTERIZED PLANNING SYSTEM. EXECUTIVE SUMMARY
P. Brunt and G. E. Hall. Oct. 1978. 32 p. 6 Vol.
(Contract ESA-3172/77-F-WMT)
(GTS-760972-Vol-6; ESA-CR(P)-1222-Vol-6) Avail: NTIS HC A03/MF A01

A computerized system was defined and implemented which simulates the planning activities, formalizes the decision making process, and aids management information retrieval for the European Space Agency. Subprogram blocks which permit the analysis of statistical cost data, the manipulation of price levels, currencies and cost elements, the prediction of national space expenditure capabilities and of the margin available for new projects, the selection and 'fitting' of projects into the margin, and the comparison of manpower requirements with forecast industrial capability are described. Subprograms which provide the additional capability to evaluate project returns and benefits are also discussed. Author (ESA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-21190* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS, SUPPLEMENT 16
Jan. 1980. 59 p.
(NASA-SP-7039(16)) Avail: NTIS HC $8.50 CSCL 05B

Abstracts are cited for 138 patents and patent applications introduced into the NASA scientific and technical information system during the period July 1979 through December 1979. Each entry cib consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or patent application. J.M.S.

N80-21191# Pennsylvania Univ., Philadelphia. Dept. of Decision Sciences.
DESCRIPTION OF THE WHARTON/ODA SYSTEM
David Oppenheim, ed., James S. Ribeiro, ed., and E. Gerald Hurst, Jr., ed. Dec. 1979. 22 p. refs.
(Contract N00014-75-C-0440)
(AD-A079601; Rept-79-12-02) Avail: NTIS HC A02/MF A01 CSCL 05/2

The purpose of this document is to give a brief introduction to the hardware available in the Wharton Computer Center and the Decision Aiding Systems Laboratory (DASL), and to summarize the software which has been developed at Wharton under the Operational Decision Aiding Project. More detail about most of these features is available; in particular, some of the other software developed for use on the Wharton system may be of interest to other contractors, now that the system is easily accessible via the ARPANET. GRA

N80-21192# Pattern Analysis and Recognition Corp., Rome, N. Y.
ADVANCED QUERY TECHNIQUES. Final Report, 19 Sep. 1977 - 19 Jun. 1979
C. P. Mah and John M. Morris. Oct. 1979. 182 p. refs.
(Contract F30602-77-C-0161; AF Proj. 4594)
(AD-A079626; RADC-TR-79-260) Avail: NTIS HC A09/MF A01 CSCL 05/2

The report describes an RADC sponsored R D effort directed at providing an improved natural language access to differently formatted target databases. Section I defines functional characteristics of on-line intelligence information systems within the current state-of-the-art; describes the rationale of the AQT effort, and provides a comparison between the AQT approach and other approaches inherent in the existing information systems with a practical orientation. Section 2 describes basic concepts of the AQT approach (extended relational data models, intermediate query language, table driven translation). Linguistic implementation of natural language query techniques is provided in Section 3. Section 4 deals with the methodology of accessing differently formatted target databases. Section 5 describes some special problems in querying target databases (e.g., generic keys, ellipsis, purging a context, conversational postulates). Section 6 constitutes a detailed description of the presently available AQT testbed system. Section 7 provides criteria for evaluation of user interface languages for database management systems. Section 8 is a statement of conclusions including present status and results; operational evaluation criteria; areas for further work, plans, summary and directions. GRA

N80-21193# National Technical Information Service, Springfield, Va.
MANAGEMENT INFORMATION SYSTEMS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS. Progress Report, Nov. 1977 - Nov. 1979
Jack E. Jones. Dec. 1979. 133 p. Supersedes NTIS/PS-78/1069; NTIS/PS-77/0918; NTIS/PS-76/0779; NTIS/PS-75/601
(PB80-802739; NTIS/PS-78/1069; NTIS/PS-77/0918; NTIS/PS-76/0779; NTIS/PS-75/601) Avail: NTIS HC $30.00/MF $30.00 CSCL 05B

General studies as well as application studies in the fields of transportation, education, personnel management, and military sciences are cited. This updated bibliography contains 126 abstracts, 65 of which are new entries to the previous edition. GRA

N80-21194# Capital Systems Group, Rockville, Md.
THE IMPACT OF BEHAVIORAL AND TECHNICAL INFORMATION INTERVENTIONS ON INDUSTRIAL R AND D PROJECTS. Final Report
Edwin E. Olson, Elizabeth C. Fake, Dale G. Lake, and Brigitte D. Huybrechts. 15 Nov. 1979. 214 p.
(Grant NSF DSI-77-18073)
(PB80-110265) Avail: NTIS HC A10/MF A01 CSCL 05B

The acquisition, use, and transfer of information both within the research and development lab and between the research and development lab and the engineering and manufacturing divisions in one company were investigated. The experiments included information searches for individual projects, information specialists joining project teams, workshops to improve the management of information, and improved communication between research and development scientists and engineers and their clients in the operating divisions. Findings about the correlation of behavioral and technological changes in technical information and the quality of research and development results, and implications for augmenting existing formal and informal channels of communication are discussed. GRA

N80-21195# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
SOURCE CODING WITH SIDE INFORMATION AND UNIVERSAL CODING
Robert G. Gallager. Sep. 1979. 41 p. refs.
(Grant NSF ENG-77-19971)
(PB80-108343; LIDS-P-937) Avail: NTIS HC A03/MF A01 CSCL 09D

Two problems concerning noiseless source coding with side information are considered. It is shown that not only is the maximum reliable transmission rate unaffected by whether or not the encoder has access to the side information, but also the block error probability is essentially unaffected and that, in a sense, all the encoder need know about the source is the alphabet size. The second problem considered is that where neither the encoder nor decoder knows the side information and good performance, in some sense, is required for all values of side information (i.e., universal coding). It is shown that the minmax redundancy and the maxmim redundancy, are essentially the same for variable length codes. Finally, a similar minmax, maxmim equivalence for error probability with block codes is established. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-21196# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.
DESCRIPTION OF DATA ENTRY FOR AUTOMATED COST ESTIMATING
N. H. VanWie Oct. 1979 40 p
(Contract W-7405-eng-26)
(K/CSD/TM-29-Rev-1) Avail: NTIS HC A03/MF A01

A series of computer programs, developed to aid the computational and reporting phases of preparing a project cost estimate are presented. The data base for a project is subdivided into three types of data or files: a title file, a nucleus file, and a file of cost sheets with optional schedules. The data requirements and formatting specifications for preparation of these files are described. Examples are presented and alternative approaches to accomplish an end result are explained. DOE

N80-21197# Real Estate Research Corp., Chicago, Ill.
MARKETING AND MARKET ACCEPTANCE DATA FROM THE RESIDENTIAL SOLAR DEMONSTRATION PROGRAM. VOLUME 1: DETAILED ANALYSIS, AUTUMN 1979
1979 218 p refs Sponsored in part by HUD
(PB80-115298; HUD-0050579) Avail: NTIS HC A10/MF A01 CSCL 05C

The marketing and market acceptance components of HUD's residential solar heating and cooling demonstration program, designed to promote the development of a self-sustaining solar energy industry, are analyzed. The actual experiences of actors and institutions involved in the market acceptance of solar houses are described. Emerging trends in the characteristics, opinions, and actions of participants in the demonstration program are identified and explored. All findings are based on marketing interviews with program participants, with a market acceptance model used to guide analysis. Practical information relevant to the construction industry and solar manufacturers is emphasized. GRA

N80-21198# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
GEOTHERMAL ENERGY MARKET PENETRATION: DEVELOPMENT OF A MODEL FOR THE RESIDENTIAL SECTION
Allen C. Goodman Sep. 1979 34 p refs
(Contracts EX-76-A-36-1008; DE-AI01-79ET-27025)
(PB80-118359; APL/JHU-QM-79-209; APL/JHU-GEMS-006; MCGER-79/003) Avail: NTIS HC A03/MF A01 CSCL 05C

A model was developed that examines the feasibility of using geothermal technology in heating residential structures. Specific account is taken of the small contribution of new housing to the total stock in any given year and of the durability of houses and their furnaces. Both aspects constrain the penetration of geothermal energy into the residential market. Other market penetration paradigms are discussed and a simple model of market penetration is presented that is based on the premise that homeowners will not abandon an existing furnace until its economic life is over. Behavioral parameters are considered and the model is extended from 20 to 40 years. Methods are discussed for collecting the needed data to determine market penetration, and ideas are proposed of ways to induce homeowners to give up economically viable furnaces to allow the firm providing the energy to reduce costs. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-21199# Committee on Commerce, Science, and Transportation (U. S. Senate).
PATENT POLICY, PART 2
Washington GPO 1980 110 p refs Joint Hearings before Comm. on Commerce, Sci., and Transportation and the Comm. on the Judiciary, 96th Congr., 2d Sess., 25 Jan. 1980
(GPO-58-551) Avail: Comm. on Commerce, Sci., and Transportation

Legislation and corresponding testimony concerning Federal policy for allocating patent rights to exploit inventions made in the course of government-sponsored research and development is presented. Emphasis is placed on stimulating the industrial innovation process by contributing to more effective utilization of such inventions. J.M.S.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-21200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPPORTING RESEARCH AND TECHNOLOGY FOR AUTOMOTIVE STIRLING ENGINE DEVELOPMENT
William A. Tomazic 1980 20 p Presented at 5th Intern. Automotive Propulsion System Symp., Dearborn, Mich., 14-18 Apr. 1980
(NASA-TM-81495; E-400; DOE/NASA/1040-80/13) Avail: NTIS HC A02/MF A01 CSCL 13F

The technology advancement topics described are a part of the supporting research and technology (SRT) program conducted to support the major Stirling engine development program. This support focuses on developing alternatives or backups to the engine development in critical areas. These areas are materials, seals control, combustors and system analysis. Specific objectives and planned milestone schedules for future activities as now envisioned are described. These planned SRT activities are related to the timeline of the engine development program that they must support. A.M.S.

N80-21201*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUEL ECONOMY SCREENING STUDY OF ADVANCED AUTOMOTIVE GAS TURBINE ENGINES
John L. Klann Mar. 1980 57 p
(Contract EC-77-A-31-1040)
(NASA-TM-81433; E-357; DOE/NASA/1040-80/11) Avail: NTIS HC A04/MF A01 CSCL 13F

Fuel economy potentials were calculated and compared among ten turbomachinery configurations. All gas turbine engines were evaluated with a continuously variable transmission in a 1978 compact car. A reference fuel economy was calculated for the car with its conventional spark ignition piston engine and three speed automatic transmission. Two promising engine/transmission combinations, using gasoline, had 55 to 60 percent gains over the reference fuel economy. Fuel economy sensitivities to engine design parameter changes were also calculated for these two combinations. Author

N80-21202*# Cleveland State Univ., Ohio.
ERROR ANALYSIS IN THE MEASUREMENT OF AVERAGE POWER WITH APPLICATION TO SWITCHING CONTROLLERS Contractor Report, Oct. 1978 - Oct. 1979
James E. Maisel Mar. 1980 84 p refs Sponsored by NASA
(Contract EC-77-A-31-1044)
(NASA-CR-159792; DOE/NASA/3222-80/1) Avail: NTIS HC A05/MF A01 CSCL 10B

Power measurement errors due to the bandwidth of a power meter and the sampling of the input voltage and current of a power meter were investigated assuming sinusoidal excitation and periodic signals generated by a model of a simple chopper system. Errors incurred in measuring power using a microcomputer with limited data storage were also considered. The behavior of the power measurement error due to the frequency responses

of first order transfer functions between the input sinusoidal voltage, input sinusoidal current, and the signal multiplier was studied. Results indicate that this power measurement error can be minimized if the frequency responses of the first order transfer functions are identical. The power error analysis was extended to include the power measurement error for a model of a simple chopper system with a power source and an ideal shunt motor acting as an electrical load for the chopper. The behavior of the power measurement error was determined as a function of the chopper's duty cycle and back EMF of the shunt motor. Results indicate that the error is large when the duty cycle or back EMF is small. Theoretical and experimental results indicate that the power measurement error due to sampling of sinusoidal voltages and currents becomes excessively large when the number of observation periods approaches one-half the size of the microcomputer data memory allocated to the storage of either the input sinusoidal voltage or current. M.G.

N80-21203*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AMTV HEADWAY SENSOR AND SAFETY DESIGN Final Report, Dec. 1978 - Jan. 1980
A. R. Johnston, M. Nelson, P. Cassell, and J. T. Herridge. Jan. 1980. 71 p. refs. Sponsored by NASA. Prepared in cooperation with Battelle Columbus Labs., Ohio.
(Contract DOT-AT-60008T)
(NASA-CR-162717; UMTA-CA-06-0088-80-1; JPL-Pub-79-120) Avail: NTIS HC A04/MF A01 CSCL 13F

A headway sensing system for an automated mixed traffic vehicle (AMTV) employing an array of optical proximity sensor elements is described, and its performance is presented in terms of object detection profiles. The problem of sensing in turns is explored experimentally and requirements for future turn sensors are discussed. A recommended headway sensor configuration, employing multiple source elements in the focal plane of one lens operating together with a similar detector unit, is described. Alternative concepts including laser radar, ultrasonic sensing, imaging techniques, and radar are compared to the present proximity sensor approach. Design concepts for an AMTV body which will minimize the probability of injury to pedestrians or passengers in the event of a collision are presented. K.L.

N80-21204# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
ELECTRIC AND HYBRID VEHICLE PROGRAM Quarterly Report, Apr. - May 1979
Aug. 1979. 31 p. refs.
(DOE/CS-0026-7) Avail: NTIS HC A03/MF A01

Progress in U.S. programs on the design, development, production, and performance testing of electric powered and hybrid electric powered vehicles is briefly summarized. DOE

N80-21205# Cambridge Systematics, Inc., Mass.
URBAN MASS TRANSPORTATION ENERGY CONSERVATION: SRGP OPERATING INSTRUCTIONS AND PROGRAM DOCUMENTATION, VOLUME 5 Final Report
J. F. MacMann and R. E. Nestle. Oct. 1979. 120 p. refs.
(Contract EM-76-C-01-8628)
(DOE/PE/8628-1-Vol-5) Avail: NTIS HC A06/MF A01

A computer program for Short Range Generalized transportation Policy (SRGP) analysis developed for use in analyzing the energy conservation potential of a broad spectrum of transit, carpooling, vanpooling, parking, pricing, and other transportation system management measures is described. It is intended for use in either an areawide or corridor context and in what is referred to as a sketch planning style of analysis. Output includes changes in fuel consumption, vehicle emissions, vehicle miles of travel, and modal shares for drive alone, shared ride, and transit. Changes in travel behavior are forecast relating to auto ownership, work trip mode choice, and the frequency, destination, and mode choice for both shopping and social/recreational nonwork travel. Using a random sample household forecasting procedure, SRGP is a modified version of the program UMODEL, distributed by the U.S. Urban Mass Transportation Administration as part of UTPS, the Urban Transportation Planning System. DOE

N80-21206# Cambridge Systematics, Inc., Mass.
URBAN TRANSPORTATION ENERGY CONSERVATION: CASE CITY APPLICATIONS OF ANALYSIS METHODOLOGIES, VOLUME 3 Final Report, Jul. 1976 - Sep. 1978
T. J. Atherton and J. H. Suhrbier. Oct. 1979. 160 p. refs.
(Contract EM-76-C-01-8628)
(DOE/PE/8628-1-Vol-3) Avail: NTIS HC A08/MF A01

Disaggregate travel demand methodologies were applied to the analysis of potential energy conservation strategies in three urban areas: Denver, Colorado; Fort Worth, Texas; and San Francisco, California. The methodologies are sketch planning in nature and include the forecasting of changes in automobile ownership; work trip model shares by drive alone, shared ride, and transit; nonwork trip frequency, destination, and mode choice; fuel consumption and vehicle emissions. Policies analyzed include those related as employer based ride sharing, parking management, transit, pricing, and traffic operations. Considerable variations in the potential effectiveness was found, among the three urban areas, depending in large part on the availability of alternative travel modes such as transit. Descriptions are provided of the individual policy analyses performed, the methods by which example policies were analyzed, the necessary data preparation activities, and the procedures used to adapt the set of travel demand models to the unique conditions of each of the three metropolitan areas. DOE

N80-21207# Cambridge Systematics, Inc., Mass.
URBAN TRANSPORTATION ENERGY CONSERVATION: ANALYTIC PROCEDURES FOR ESTIMATING CHANGES IN TRAVEL DEMAND AND FUEL CONSUMPTION, VOLUME 2 Final Report, Jul. 1976 - Sep. 1978
T. J. Atherton and J. H. Suhrbier. Oct. 1979. 153 p. refs.
(Contract EM-76-C-01-8628)
(DOE/PE/8628-1-Vol-2) Avail: NTIS HC A08/MF A01

Analytical tools used to evaluate the effectiveness of alternative transportation policies in achieving reductions in overall fuel consumption are presented. To ensure a high measure of accuracy, the analysis goes beyond the first order effects, i.e., the shift from single occupant autos as the mode chosen for the work trip to more fuel efficient means of travel. Questions treated include what will happen with the autos left at home as a result of increased carpooling for work trips. The methodology developed links together several disaggregate travel demand models to predict auto ownership, work trip mode choice, and nonwork travel demands. The theoretical basis for the travel demand models used is introduced. These models and their linkages both with each other and with the various submodels are described. The assumptions made in developing the model system and using it to forecast responses to alternative transportation policies are included. Emphasis is placed on the conceptual framework of the model system and specification of the individual models and submodels. DOE

N80-21208# Cambridge Systematics, Inc., Mass.
ANALYTICAL PROCEDURES FOR URBAN TRANSPORTATION ENERGY CONSERVATION: SUMMARY OF FINDINGS AND METHODOLOGIES, VOLUME 1 Final Report, Jul. 1976 - Apr. 1979
J. H. Suhrbier and W. D. Byrne. Oct. 1979. 54 p. refs. 5 Vol.
(Contract EC-76-C-01-8628)
(DOE/PE/8628-1-Vol-1) Avail: NTIS HC A04/MF A01

Analytical methodologies are described and illustrated for use in analyzing the energy conservation potential of candidate urban transportation measurements. Quantitative methodologies oriented to carpooling, vanpooling, transit, pricing, traffic regulation and control, and auto ownership are provided based on the use of disaggregate behavioral travel demand models. Changes are indicated in trip frequency and distribution as well as in travel model, operating conditions, and vehicle miles of travel. Trip-based estimates of fuel consumption and vehicle emissions are included. The methodologies employ manual sketch planning procedures, a programmable calculator, or a fully-calibrated computer program utilizing a random sample household enumeration forecasting technique. The developed methodologies were applied in cooperation with metropolitan planning organizations representing the Dallas-Fort Worth, San Francisco, and Denver urban areas. DOE

N80-21209# Booz-Allen and Hamilton, Inc., Bethesda, Md. Energy and Environment Div.

MECHANICAL ENERGY STORAGE TECHNOLOGY FOR TRANSPORTATION APPLICATIONS PROJECT PLAN
30 Nov. 1979 50 p refs Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15138; Rept-2613-005-001) Avail: NTIS HC A03/MF A01

Flywheel systems for regenerative braking and load leveling in electric and hybrid vehicles were studied with emphasis on safety and economy. It is concluded that the use of flywheel energy storage regenerative braking and load leveling systems will upgrade the performance of electric and hybrid vehicles and improve the fuel economy of heat engine/flywheel vehicles to a level required for acceptable market penetration. DOE

N80-21210# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TEST AND EVALUATION REPORT OF THE ERDC HYBRID-ELECTRIC VAN (HEVAN)
G. J. Klose May 1979 67 p
(Contract EX-76-A-31-1011)
(DOE/TIC-10232) Avail: NTIS HC A04/MF A01

The HEVAN or Hybrid-Electric Van is a battery powered electric vehicle with an on board gasoline fueled electric power generation unit. The HEVAN was developed from a Volkswagen transporter chassis. It is propelled by a series wound dc traction motor rated at 20 HP (14.9 kW) which is powered by sixteen 6-volt SGL lead acid batteries of nominally 96 volts. The motor power is controlled by an SCR chopper with a bypass contractor and drives the vehicle through a four-speed VW transaxle. The conventional VW hydraulic brake system is used; there is no provision for regenerative braking. The on board electric power generator consists of a 16-HP (11.9kW) gasoline engine driving a 7.5 kW alternator with a dc rectifier; this provides electrical power either directly to the drive motor or to the battery pack, depending on the battery charge state and the motor power requirements. Numerous tests were conducted with pure electric operation, but only limited results were obtained in the hybrid mode due to continual problems with the motor generator set. DOE

N80-21211# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY STORAGE SYSTEMS FOR AUTOMOBILE PROPULSION
L. G. OConnell 26 Nov. 1979 35 p
(Contract W-7405-eng-48)
(UCID-18320) Avail: NTIS HC A03/MF A01

Energy storage power systems that are credible alternatives to the internal combustion engine system are evaluated. It is concluded that automotive electrical power systems can be developed for various performance levels. Most electricity using vehicles will weigh more and cost more than their internal combustion engine equivalents. If performance of these vehicles is reduced, they can be more cost competitive. Mechanical energy storage propulsion systems appear useful as power boosters for certain mission applications. DOE

N80-21212# Strasbourg Univ. (France). Bureau d'Economie Theorique et Appliques.
INNOVATIONS AND TECHNOLOGY TRANSFER. THE ROLE OF THE EUROPEAN SPACE AGENCY, VOLUME 1 Final Report [INNOVATIONS ET TRANSFERTS TECHNOLOGIQUES: LE ROLE DE L'AGENCE SPATIALE EUROPEENE]
Patrice Brendle, Patrick Cohendet, Regis LaruedeTournemine, Helwig Schmied, and Daniel Vitray Feb. 1979 79 p In FRENCH 2 Vol.
(Contract ESA-3669/77-F-DKR(SC))
(ESA-CR(P)-1219-Vol-1) Avail: NTIS HC A05/MF A01

The areas of the economy most receptive to technology transfer, or which are most likely to readily absorb technological innovations were identified. Industrial opinion was solicited concerning the promotion of technical innovations resulting from activities in the European Space Agency (ESA). The sectors where most technology transfer occurs are telecommunications, optics, solar energy, and data processing. The monetary value of the ESA contribution has been determined for various technical sectors. In the view of industry, ESA has a role to play in both fundamental research, and in reducing costs of development. The patent system must be ameliorized within the member states to meet competition in external markets. Author (ESA)

N80-21213# Strasbourg Univ. (France). Bureau d'Economie Theorique et Appliques.
INNOVATIONS AND TECHNOLOGY TRANSFER. THE ROLE OF THE EUROPEAN SPACE AGENCY. VOLUME 2: ANNEXES [INNOVATIONS ET TRANSFERTS TECHNOLOGIQUES: LE ROLE DE L'AGENCE SPATIALE EUROPEENE, RAPPORT ANNEXE]
Patrice Brendle, Patrick Cohendet, Regis LaruedeTournemine, Helwig Schmied, and Daniel Vitry Feb. 1979 41 p In FRENCH 2 Vol.
(Contract ESA-3669/78-F-DKR(SC))
(ESA-CR-(P)-1219-Vol-2) Avail: NTIS HC A03/MF A01

The economic measures used to determine the contributions of ESA and the methods of data analysis are described. An analysis of present and proposed market impact of 37 product areas, including the financial contribution attributes to ESA activities is presented. Efforts of various European governmental agencies to promote technology transfer are outlined. Author (ESA)

N80-21214# Massachusetts Univ., Amherst. Water Resources Research Center.
URBANIZATION AND WATER QUALITY PLANNING: THE 208 EXPERIENCE IN MASSACHUSETTS
Harry E. Schwarz, Brandon B. Johnson, Robert J. Caiazzo, and Debra E. Pincus Jan. 1979 146 p refs Prepared in cooperation with Clark Univ., Worcester, Mass.
(Contract DI-14-34-0001-8023)
(PB80-106743; W80-00870; Pub-104; OWRT-A-104-Mass(1)) Avail: NTIS HC A07/MF A01 CSCL 13B

The degree of urbanization in an area that would affect the scope of the planning process, public participation in planning, and the plan itself was examined. Three measures of urbanization were used: the percentage of the region in urban land use; the proportion of the population served by sewers; and the population density. Each of these was an independent variable in assessing the interregional variation of attributes of the plans and of the planning process. It was found that the degree of urbanization does not appear to have been a significant factor in the 208 planning process. GRA

N80-21215# Public Technology, Inc., Washington, D. C.
PRIORITY R AND D NEEDS OF URBAN AMERICA, RESOURCE DOCUMENT
1979 22 p
(Grant NSF ISP-76-11055)
(PB80-106164; NSF/RA-790191) Avail: NTIS HC A02/MF A01 CSCL 13B

Priority statements for 1977 and 1978 of ten Task Forces on the Urban Consortium for Technology Initiatives are reported. The Consortium is a national cooperative of 36 cities and urban counties established to identify research and development needs of urban governments and to channel resources into the most critical areas. By identifying and establishing priorities for urban needs the Consortium provides local governments with a structured means of working together with the nation's R & D resources. Networking of local governments also provides a collective purchasing power. Priority needs were identified by each of the following Task Forces: Community and Economic Development; Criminal Justice; Energy Environmental Services; Fire Safety and Preparedness; Health; Human Resources; Management (finance and personnel); Public Works and Public Utilities; and Transportation. A precis of each listed need is included. GRA

N80-21216# District of Columbia Dept. of Environmental Services, Washington, D.C. Water Resources Management Administration.
EVALUATION OF DEWATERING DEVICES FOR PRODUCING HIGH-SOLIDS SLUDGE CAKE
Alan F. Cassel and Berinda P. Johnson Aug. 1979 192 p
(Contract EPA-68-03-2455)
(PB80-111503; EPA-600/2-79-123) Avail: NTIS HC A09/MF A01 CSCL 13B

Pilot plant dewatering tests were made to establish design and operating parameters for dewatering municipal waste water sludges on recessed plate filter presses, continuous belt presses, and retrofit units for a vacuum filter. Results from the 1.5 year study showed that when dewatering lime and ferric chloride-conditioned sludges, the recessed plate presses consistently produced a 30 to 40 percent solids filter cake. Belt presses produced cake solids from 25 to 30 percent when the polymer conditioning dosage was optimized. When used as a retrofit device to a vacuum filter, the belt press gave cake solids in the 30 to 40 percent range. Design parameters are developed to dewater a mixture of 67 percent secondary and 33 percent primary sludge in a full scale plant installation. GRA

N80-21217# Union Carbide Corp., South Charleston, W.Va. Chemicals and Plastics Div.
TREATMENT OF ORGANIC CHEMICAL MANUFACTURING WASTEWATER FOR REUSE Final Report, Apr. - Dec. 1976
Michael Scherm, Patrick M. Thomasson, Lester C. Boone, and Lawrence S. Magelssen Aug. 1979 173 p refs
(Grant EPA-S-801398)
(PB80-105166; EPA-600/2-79-184) Avail: NTIS
HC A08/MF A01 CSCL 13B

The quality of water produced by each step of a state-of-the-art, commercially available process sequence and the feasibility and economics of renovating organic chemical wastewater for reuse as boiler feedwater or cycle cooling water were demonstrated using a 5-gpm pilot facility, located in Puerto Rico. The sequence consisted of sedimentation/filtration, carbon adsorption, pressure filtration, reverse osmosis, and ion-exchange. A pilot-scale boiler tested the product water as boiler feedwater at pressures, temperatures, and heat fluxes typical of full-scale manufacturing facilities. The cooling water test-loop studies indicated that special metallurgy would be required for the use of this renovated wastewater for cooling water. The total annualized cost of wastewater renovation to boiler feedwater quality at 67 percent water recovery, not including the cost of sludge or brine disposal, was $7.50/1000 gallons of product water in 1978. GRA

N80-21218# Bendix Research Labs., Southfield, Mich.
COLLISION AVOIDANCE RADAR BRAKING SYSTEMS INVESTIGATION, PHASE 3 STUDY Final Report, Sep. 1976 - May 1979
William R. Faris, Carl P. Tresselt, and Henry C. Yee May 1979 249 p refs
(Contract DOT-HS-6-01450)
(PB80-108939; RLD-8904; DOT-HS-805-049) Avail: NTIS
HC A11/MF A01 CSCL 13L

The potential application of an anticipatory radar braking system in preventing motor vehicle accidents is described. The system description is divided into three sections: the design of the radar sensor, including the signal processing electronics, control panel display, and installation of the entire subsystem on the test vehicles. The design of the brake actuation subsystem and the anti-lock subsystem, and information about installation of these two subsystem on test vehicles; and functional tests conducted with the two test vehicles equipped with the radar braking system, is outlined. GRA

N80-21219# Systems Technology, Inc., Hawthorne, Calif.
DEVELOPMENT OF AERODYNAMIC DISTURBANCE TEST PROCEDURES. VOLUME 2: TECHNICAL REPORT Final Report, 30 Sep. 1977 - 30 May 1979
Richard H. Klein and Jeffrey R. Hogue Aug. 1979 188 p refs
(Contract DOT-HS-7-01716)
(PB80-118383; DOT-HS-805-079; TR-1117-1-2) Avail: NTIS
HC A09/MF A01 CSCL 13F

The crosswind responses of twenty different vehicles were surveyed. Three test procedures were used in three different crosswind disturbance configurations. These were steering fixed, steering free, and driver control of land position. The crosswind configurations were straight pulse, doublet pulse, and a shaped profile. results showed that passenger cars, station wagons, trucks, and most vans have virtually no crosswind sensitivity problems, whereas the VW Microbus, the pickup/camper (in winds higher than 35 mph), cars pulling trailers, and mopeds do have potential problems. The collected test procedures, performance measures, crosswind configurations, and definitions of the relationship between subjective driver ratings and the objective measures. GRA

N80-21220# Vermont State Dept. of Health, Burlington.
OZONE AND ULTRAVIOLET RADIATION DISINFECTION FOR SMALL COMMUNITY WATER SYSTEMS Final Report
Linden G. Witherell, Ray L. Solomon, and Kenneth M. Stone Jul. 1979 49 p refs
(Contract EPA-68-03-2182)
(PB80-108418; EPA-600/2-79-060) Avail: NTIS
HC A03/MF A01 CSCL 13B

Ozone and ultraviolet radiation were used as alternatives to chlorine for disinfection in several small existing community water systems. Both ozone and ultraviolet light were found to be inferior to chlorination from the standpoint of operation and maintenance requirements and maintaining disinfection in the distribution system. A disinfectant residual was found to be necessary even in the small water distribution systems studied. Neither ozone or ultraviolet provide a residual disinfectant. The main problem with chlorination in small community water systems is inadequate operation and maintenance. Inadequate operation and maintenance is a general problem of small community water systems, not limited to the disinfection aspect. GRA

N80-21221# American Society of Civil Engineers, New York. Urban Water Resources Research Council.
CHALLENGES IN URBAN RUNOFF CONTROL (PLANNING, IMPLEMENTATION AND SIMULATION) Final Report
M. B. McPherson Aug. 1979 47 p refs
(Grant NSF ENV-77-15668)
(PB80-107873; TM-37; NSF/RA-790172) Avail: NTIS
HC A03/MF A01 CSCL 13B

Areawide planning for water pollution management was undertaken in a majority of metropolitan areas. Urban runoff considerations were an issue in many of these areas. In an effort to promote long range conjunctive quantity and quality planning, a dozen seminars, workshops, and conferences hosted by areawide planning agencies were conducted. Responses to points raised at these presentations plus findings from the monitoring of four on-going local jurisdiction master planning projects are reported. The postponed role of stream standards and the implications of their future enforcement are examined. Plan flexibility, cost allocation, available technology, scale of investments and technical interrelationships are considered. GRA

N80-21222# Envirotech Corp., Salt Lake City, Utah. Eimco Process Machinery Div.
CHEMICAL PRIMARY SLUDGE THICKENING AND DEWATERING
David DiGregorio, J. Brian Ainsworth, and Keith J. Mounteer Jul. 1979 290 p refs
(Contract EPA-68-03-0404)
(PB80-108970; EPA-600/2-79-055) Avail: NTIS
HC A13/MF A01 CSCL 13B

The thickening and dewatering characteristics of chemical primary sludges were studied. Alum primary and ferric primary sludges were produced in parallel trains of a pilot operated using a municipal wastewater. Gravity thickening was evaluated using continuous, pilot scale gravity thickeners; dissolved air flotation thickening evaluations were performed using batch, bench-scale equipment. Sludge dewatering evaluations were performed for all chemical primary sludges using a pilot scale bowl centrifuge, vacuum belt filter and filter press. Correlations developed relating performance of each unit operation to specific characteristics identified for each chemical primary sludge are presented. An economic analysis of centrifugation and vacuum belt filtration of each chemical primary sludge is also presented. GRA

88 SPACE SCIENCES (GENERAL)

N80-21223# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.

[RESEARCH ACTIVITIES OF THE INSTITUTE FOR EXTRATERRESTRIAL PHYSICS] Annual Report, 1978 [TAETIGKEITSBERICHT 1978]
Jan. 1979 258 p refs In GERMAN Original contains color illustrations
(MPI-PAE/Extraterr-150; ISSN-034-8922) Avail: NTIS HC A12/MF A01

In situ plasma measurements in the vicinity of the Earth were taken. Experiments in the fields of infrared, X-ray, and gamma ray astronomy, and cosmic ray research are described. Progress in spectroscopic techniques, nonlinear optics, and laser spectroscopy is noted. Author (ESA)

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-21224*# National Aeronautics and Space Administration, Washington, D. C.
IMAGE PROPERTIES OF AN X-RAY TELESCOPE OF THE WOLTER-1 TYPE WITH EMPHASIS ON CONTRAST REDUCTION BY DIFFUSE REFLECTION Ph.D. Thesis
R. Lenzen Jan. 1980 105 p refs Transl. into ENGLISH of "Abbildungseigenschaften eines Roentgenteleskops vom Type Wolter-1 unter Besonderer beruecksichtigung der Kontrastverminderung Durch Diffuse Reflexion", West Germany, 1978 p 1-123 Original language document announced as A79-41829 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75805) Avail: NTIS HC A06/MF A01 CSCL 03A

Theoretical and experimental results are presented on the geometrical-optic imaging properties of a Wolter-1 type paraboloid-hyperboloid X-ray telescope. Particular consideration is given to the effect of microroughness of the mirror on the imaging properties. Experiments were conducted in which scattering properties were determined as a function of wavelength, incidence angle, and roughness of the plane mirrors. Results indicate the need for optimization of mirror material and polishing technology as well as the development of improved mirror manufacturing techniques. The use of transmission gratings along with the Wolter-1 type telescope in spectroscopy applications is discussed. Author

N80-21225# California Univ., Berkeley. Lawrence Berkeley Lab.
SUPERCONDUCTING MAGNET SYSTEM FOR THE SPIRIT COSMIC RAY SPACE TELESCOPE
M. A. Green, J. M. DeOlivares, G. Tarle, P. B. Price, and E. K. Shirk Aug. 1979 18 p refs Presented at the Cryog. Eng. Conf., Madison, Wis., 21 Aug. 1979
(Contract W-7405-eng-48)
(LBL-9699; CONF-790815-32) Avail: NTIS HC A02/MF A01

The SPIRIT (a superconducting passive iron isotope telescope) experiment which requires a large volume of 2T field in order to achieve enough resolution to study heavy primary cosmic rays is discussed. It is proposed that the SPIRIT superconducting magnet system and its experimental package would be used in one of the space shuttles. The superconducting magnet design, based on thin high current density solenoid technology, is described. The superconducting magnet system consists of a number of coils which generate a 2T induction within the experiment, and at the same time allow free access to the package by cosmic rays. The superconducting magnet system uses a high current density conductor which is protected by a shorted secondary circuit. The magnet coils are to be cooled by pumped two phase helium which is circulated through tubes. Refrigeration is supplied from a large liquid helium dewar. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-21226 Johns Hopkins Univ., Baltimore, Md.
INTERSTELLAR MATTER AND EXTRAGALACTIC LIGHT Ph.D. Thesis
Rodney Charles Anderson 1979 246 p
Avail: Univ. Microfilms Order No. 8006911

Analyses of two experimental programs designed to estimate the density of the universe are reported. First, the Copernicus satellite was used to observe hydrogen and deuterium absorption in local interstellar matter. Secondly, two far ultraviolet spectrometers were used to study galactic plane light scattered off interstellar dust, in order to measure the scattering properties of the dust, and also to detect cosmic background radiation. The interstellar absorption spectra were obtained using bright, close stars as light sources. The density and temperature of interstellar hydrogen and deuterium along the line of sight to each target star were obtained by fitting appropriate models to the data. A set of acceptable densities and temperatures is presented for each star. Dissert. Abstr.

N80-21227 Cornell Univ., Ithaca, N. Y.
LATE-STAGE EVOLUTION OF SUPERNOVA REMNANTS Ph.D. Thesis
William Isaac Newman 1979 257 p
Avail: Univ. Microfilms Order No. 8003969

The evolution of spherically symmetric supernova remnants is examined by analytic and numerical means. The blast is assumed to take place in an homogeneous interstellar medium with a uniform density and an initially constant total energy. An approximate representation of the radiative cooling is included, precipitating a thermal instability and producing a cold dense shell. The dynamical transition from adiabatic to radiation dominated behavior is numerically simulated by a modified form of the pseudo viscosity method. Dissert. Abstr.

N80-21228 City Univ. of New York, N. Y.
THE HIGH LATITUDE EXTENSIONS OF GALACTIC SPIRAL ARMS Ph.D. Thesis
Judith Ellen Soukup 1979 202 p
Avail: Univ. Microfilms Order No. 8006747

The high z extensions of spiral arms in our galaxy were investigated observationally and theoretically. Numerical calculations of interstellar gas flow in a tightly wound spiral density wave were performed. The equations were time dependent; the two spatial dimensions were along the streamlines in the galactic plane and perpendicular to the plane. The analog between one dimensional gas flows into a potential hill and into a converging diverging nozzle is discussed to show exactly why and where a shock forms in a spiral arm. Two thermodynamic models of the gas are considered: an isothermal gas and a gas whose temperature increases with height from the galactic plane. Dissert. Abstr.

N80-21229 Wisconsin Univ. - Madison.
THE STRUCTURE AND DYNAMICS OF H2 REGIONS Ph.D. Thesis
Gary Lee Welter 1979 80 p
Avail: Univ. Microfilms Order No. 8001642

The early evolution of H2 regions, through the first few 100,000 years, is investigated under conditions of enhanced central density and increasing cluster luminosity. It is found that a D type ionization front can overtake the precursor shock under conditions of a fairly steep density-gradient such as may exist just beyond a stellar dust cocoon, or as new stars turn on within the H2 region. The shock is converted into a strong, outward moving pressure pulse as it is ionized. Rayleigh-Taylor instability in the shocked layer occurs as the ionization front approaches the shock, but the neutral globules so produced have a comparatively small and short term effect on nebular dynamics. The evolutionary effects of different recombination rates within the ionization front and different cooling rates within the shocked layer are investigated and found to be small. Possible modifica-

tions which the presence of dust or stellar winds could produce are briefly considered. Dissert. Abstr.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-21230 Pennsylvania State Univ., University Park.
AN INVESTIGATION AND ANALYSIS OF THE DENSITY AND THERMAL BALANCE OF THE MARTIAN IONOSPHERE Ph.D. Thesis
Ronald Perry Rohrbaugh 1979 176 p
Avail: Univ. Microfilms Order No. 8006049

The density and thermal balance of the Martian ionosphere were investigated and compared with the observational data from Vikings 1 and 2. The effects of diffusion and thermal conduction perpendicular to the assumed magnetic fields were included. An analysis of the thermalization of energetic O2(+) produced by the major ion neutral reactions was developed and presented. Dissert. Abstr.

N80-21231 Florida State Univ., Gainesville.
ON THE PRODUCTION OF LONG-PERIOD COMETS BY STELLAR PERTURBATIONS OF THE OORT COMET CLOUDS Ph.D. Thesis
Barbara Schreur 1979 118 p
Avail: Univ. Microfilms Order No. 8007506

A model cloud surrounding the Sun is established, and the perturbation to the orbits of the comets in this cloud as a result of the action of passing stars are presented. The model cloud of comets consists of some 100,000 comets with orbital orientations selected at random, and perihelion and aphelion distances selected to give a reasonable concentration of the space densities of the comets toward the Sun. A distribution of 100 passing stars was chosen to be representative of the probability of a given type of star passing at a given distance from the Sun. A perturbation of each cometary orbit due to each passing star was calculated. The individual perturbations were calculated as impuluses to be applied instantaneously to the orbit of a comet. As a check on the accuracy of this method, a number of perturbations were calculated by numerically integrating the equations of motion. The impulse method was found to be sufficiently accurate to determine the changes in the distribution of orbital parameters. Dissert. Abstr.

N80-21232 Cornell Univ., Ithaca, N. Y.
GEOMORPHOLOGY OF MARTIAN VALLEYS Ph.D. Thesis
David Christopher Pieri 1979 293 p
Avail: Univ. Microfilms Order No. 8003975

A broad range of topics related to Martian valleys are discussed including: terminology, classification, distribution, morphology, age, quantitative analysis of pattern, physics of flow, origin, and the relation of Martian valleys to climatic change. Channels are distinguished from valleys on the basis of: (1) the greater size of the large channels; and (2) the presence of flow erosions morphology in channels. Valleys generally are small (less than 5 km wide, less than 1 km deep), show little direct evidence of erosion by flow, and form ramified networks which coalesce down regional slopes. Data on morphology and planimetric characteristics of 240 Martian valley networks are presented. Dissert. Abstr.

N80-21233 California Univ., Los Angeles.
IMPACT CRATERS FROM CENTIMETERS TO MEGAMETERS Ph.D. Thesis
Steven Kent Croft 1979 282 p
Avail: Univ. Microfilms Order No. 8007428

The physics of cratering is related to the geology of craters by interpretation of empirical morphometrical relations determined for observed craters in terms of physical mechanisms known to be operative in cratering. A crater modification model is presented which quantitatively reproduces interior and ejecta volumes, rim heights and widths, apparent depths, and floor diameters of complex lunar craters. Diameter measurements are presented for central peak, peak ring, and multiring basins on the Moon, Mercury, Mars and the Earth. Rings of basins on all four planets are assigned to structural classes that are defined by morphological, morphometrical and geophysical criteria. Empirical relationships between structurally equivalent classes of rings are derived. Dissert. Abstr.

N80-21234*# Missouri Univ. -Rolla. Dept. of Chemistry.
TRANSPORT PROPERTIES IN THE ATMOSPHERE OF JUPITER Semiannual Progress Report, Jul. - Dec. 1979
Louis Biolsi, Jr. 1979 35 p refs
(Grant NsG-1369)
(NASA-CR-162897) Avail: NTIS HC A03/MF A01 CSCL 03B

The computer program used to obtain transport properties for the Hulburt-Hirschfelder potential was tested. Transport properties for the C-C interaction were calculated. Rough estimates for transport properties for the important ablation species were obtained as well as estimates of transport properties for some of the species associated with photochemical smog. The results are discussed. A.R.H.

N80-21235*# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
OUTER SATELLITE ATMOSPHERES: THEIR EXTENDED NATURE AND PLANETARY INTERACTIONS Final Report, Feb. 1979 - Mar. 1980
William H. Smyth Apr. 1980 104 p refs
(Contract NASw-3174)
(NASA-CR-162902; FR-7) Avail: NTIS HC A06/MF A01 CSCL 03B

Highly developed numerical models are applied to interpret extended-atmosphere data for the sodium cloud of Io and the hydrogen torus of Titan. Solar radiation pressure was identified and verified by model calculations as the mechanism to explain two different east-west asymmetries observed in the sodium cloud. Analysis of sodium line profile data, suggesting that a Jupiter magnetospheric wind may be responsible for high speed sodium atoms emitted from Io, and preliminary modeling of the interaction of the Io plasma torus and Io's sodium cloud are also reported. Models presented for Titan's hydrogen torus are consistent both with the recent Pioneer 11 measurements and earlier Earth-orbiting observations by the Copernicus satellite. Progress is reported on developing models for extended gas and dust atmospheres of comets. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-21236 Stanford Univ., Calif.
TO THE SOLAR FOCI Ph.D. Thesis
David Sonnabend 1979 324 p
Avail: Univ. Microfilms Order No. 8006356

The theory that the Sun is likely to act as a lens for gravitational radiation, with foci in the outer solar system is discussed. It is suggested that missions to these foci have the potential of directly measuring the density structure of the Sun. Other applications include gravitational wave astronomy and tests of general relativity. The theory is examined with emphasis upon the engineering aspects of focal missions - primarily spacecraft design and performance. Other topics studied include solar optics, gravitational wave detectors, navigation, and the design of missions for different purposes. Specifically, it will be shown that shuttle launched chemical rockets have a substantial capability for reacting some foci; and that all can be reached with large payloads using nuclear isotope - electric propulsion. Dissert. Abstr.

N80-21237*# Lockheed Missiles and Space Co., Palo Alto, Calif.

ANALYSIS OF TIME DEPENDENT PHENOMENA OBSERVED WITH THE LPSP OSO-8 INSTRUMENT Final Report
John W. Leibacher 15 Oct. 1979 170 p refs
(Contract NASw-3053)
(NASA-CR-162908) Avail: NTIS HC A08/MF A01 CSCL 03B

Data obtained by the Laboratoire de Physique Stellaire et Planetaire's ultraviolet spectrometer onboard the OSO-8 spacecraft were analyzed in an effort to dynamically model the solar chromosphere as an aid in enhancing knowledge of the dynamical processes themselves and of spectral line formation in the dynamic chromosphere. Repeated spectral scans of strong, optically thick resonance lines formed in the solar chromosphere were examined for indications of oscillatory velocities and intensities among other indications of velocity which were studied, the blue peak is reasonably well defined, and the position of a parabolic filter fitted by the least squares method was used to define it. Observed chromospheric oscillation periods are discussed as well as the variations in altitude of the emitting region which result primarily from the motion up and down during the oscillation. A.R.H.

N80-21238*# Stanford Univ., Calif. Inst. of Plasma Studies.
DOPPLER OBSERVATIONS OF SOLAR ROTATION
P. H. Scherrer Mar. 1980 11 p refs Submitted for publication
(Contracts NAS5-24220; N00014-76-C-0207; Grants NGR-05-020-559; NSF ATM-77-20580)
(NASA-CR-162886; SU-SUIPR-804) Avail: NTIS HC A02/MF A01 CSCL 03B

Daily observations of the photospheric equatorial rotation rate using the Doppler effect mode at the Sanford Solar Observatory are presented. These observations show no variations in the rotation rate that exceed the observational error of about one percent. The average rotation rate is indistinguishable from that of sunspots and large scale magnetic field structures. J.M.S.

N80-21239*# Stanford Univ., Calif. Inst. for Plasma Research.
ON THE NATURE OF THE APPARENT RESPONSE OF VORTICITY AREA INDEX TO THE SOLAR MAGNETIC FIELD
J. M. Wilcox and P. H. Scherrer Mar. 1980 23 p refs
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-77-20580)
(NASA-CR-162915; SU-SUIPR-802) Avail: NTIS HC A02/MF A01 CSCL 03B

The characteristics of tropospheric circulation that are involved in the apparent response of the vorticity area index (VIA) as the solar magnetic field is carried past the Earth by the solar wind are discussed. It is shown that the response is concentrated in the tropospheric regions of most intense circulation, i.e. the central portions of well-formed low pressure troughs. Factors that must be considered when assessing the Sun-weather effect in the years from 1947 to 1978 are included. J.M.S.

N80-21240*# Stanford Univ., Calif. Inst. of Plasma Research.
THE ROTATION OF THE SUN: OBSERVATIONS AT STANFORD
J. M. Scherrer, J. M. Wilcox, and L. Svalgaard Feb. 1980 34 p refs
(Contract NAS5-24420; Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-77-20580)
(NASA-CR-162914; SU-SUIPR-799) Avail: NTIS HC A03/MF A01 CSCL 03B

Daily observations of the photospheric rotation rate using the Doppler effect made at the Stanford Solar Observatory since May 1976 are analyzed. Results show that these observations show no daily or long period variations in the rotation rate that exceed the observational error of about one percent. The average rotation rate is the same as that of the sunspot and the large-scale magnetic field structures. J.M.S.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

99 GENERAL

N80-21241# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 33, NUMBER 11
R. E. Machol, ed. and Dodie Thomas, ed. Nov. 1979 53 p
(AD A079711; ESN-33-11) Avail: NTIS HC A04/MF A01 CSCL 05/2

This is a monthly publication presenting brief articles concerning recent developments in European Scientific Research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by calling attention to current developments and to institutions and individuals engaged in these scientific efforts. The articles are written primarily by members of the staff of ONRL and occasionally articles are prepared by, or in cooperation with, members of the scientific staff of the United States Air Force's European Office of Aerospace Research and Development and the United States Army Research and Standardization Group. Articles are also contributed by visiting Stateside scientists. GRA

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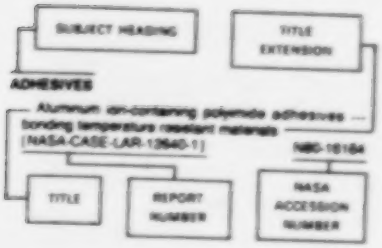

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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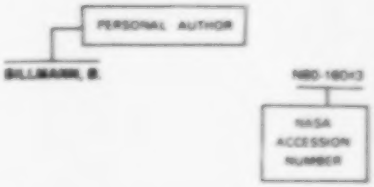

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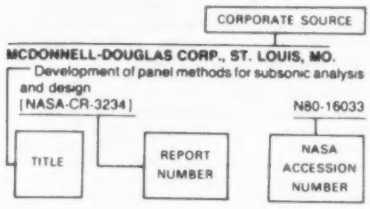

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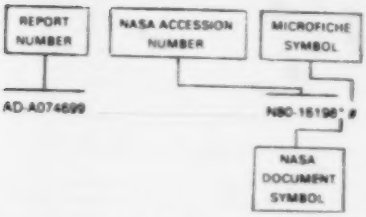

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MPIS-4/1979 ..... N80-21126 #
MPIS-15/1978 ..... N80-21123 #
MPIS-16/1978 ..... N80-21124 #
MPIS-24/1978 ..... N80-21181 #
MPIS-25/1978 ..... N80-21125 #
MPIS-29/1978 ..... N80-20554 #

MRC-TSR-1995 ..... N80-21065 #
MRC-TSR-1996 ..... N80-21074 #
MRC-TSR-2005 ..... N80-21068 #
MRC-TSR-2006 ..... N80-21069 #
MRC-TSR-2012 ..... N80-20546 #
MRC-TSR-2015 ..... N80-21093 #
MRC-TSR-2017 ..... N80-20626 #
MRC-TSR-2018 ..... N80-21070 #
MRC-TSR-2019 ..... N80-21071 #
MRC-TSR-2020 ..... N80-21094 #
MRC-TSR-2021 ..... N80-21053 #
MRC-TSR-2022 ..... N80-21072 #
MRC-TSR-2023 ..... N80-21073 #

MRL-R-725 ..... N80-20346 #

MSSU-EIRS-ASE-79-1 ..... N80-20544 #
MSSU-EIRS-ASE-79-2 ..... N80-20543 #

MTR-8026 ..... N80-20902 #

NADC-TR-76389-30 ..... N80-20594 #

NADC-77212-30 ..... N80-20266 #

NASA-CASE-FRC-10093-1 ..... N80-20560*
NASA-CASE-FRC-11041-1 ..... N80-20488* #
NASA-CASE-FRC-11042-1 ..... N80-20589* #
NASA-CASE-FRC-11052-1 ..... N80-20249* #

NASA-CASE-GSC-12354-1 ..... N80-20565* #
NASA-CASE-GSC-12357-1 ..... N80-21140*
NASA-CASE-GSC-12430-1 ..... N80-20453* #

NASA-CASE-LAR-12178-1 ..... N80-21138*
NASA-CASE-LAR-12205-1 ..... N80-20810*
NASA-CASE-LAR-12261-1 ..... N80-20224*
NASA-CASE-LAR-12304-1 ..... N80-20559*

NASA-CASE-LEW-12061-2 ..... N80-20402*
NASA-CASE-LEW-13148-1 ..... N80-20487*

NASA-CASE-MFS-25139-1 ..... N80-20528* #

NASA-CASE-NPO-14079-1 ..... N80-20334*
NASA-CASE-NPO-14093-1 ..... N80-20563*
NASA-CASE-NPO-14237-1 ..... N80-20808*
NASA-CASE-NPO-14369-1 ..... N80-20338* #
NASA-CASE-NPO-14480-1 ..... N80-20448*
NASA-CASE-NPO-14524-1 ..... N80-21141* #
NASA-CASE-NPO-14527-1 ..... N80-21141* #
NASA-CASE-NPO-15021-1 ..... N80-20574* #

NASA-CP-2117 ..... N80-20820* #

NASA-CR-3260 ..... N80-20271* #
NASA-CR-3272 ..... N80-20588* #
NASA-CR-159110 ..... N80-20316* #
NASA-CR-159140 ..... N80-21034* #
NASA-CR-159174 ..... N80-20303* #
NASA-CR-159186 ..... N80-21033* #
NASA-CR-159196 ..... N80-20315* #
NASA-CR-159207 ..... N80-20311* #
NASA-CR-159213 ..... N80-20317* #
NASA-CR-159223 ..... N80-20232* #
NASA-CR-159234 ..... N80-20285* #
NASA-CR-159235 ..... N80-20230* #
NASA-CR-159237 ..... N80-21100* #
NASA-CR-159238 ..... N80-21044* #
NASA-CR-159494 ..... N80-20864* #
NASA-CR-159737 ..... N80-20909* #
NASA-CR-159792 ..... N80-21202* #
NASA-CR-159800 ..... N80-20812* #
NASA-CR-159829 ..... N80-20531* #
NASA-CR-160552 ..... N80-20289* #
NASA-CR-161356 ..... N80-20865* #
NASA-CR-161357 ..... N80-20866* #
NASA-CR-161382 ..... N80-20813* #
NASA-CR-161412 ..... N80-20306* #
NASA-CR-162587 ..... N80-20721* #
NASA-CR-162717 ..... N80-21203* #
NASA-CR-162841 ..... N80-20250* #
NASA-CR-162843 ..... N80-21159* #
NASA-CR-162864 ..... N80-20325* #
NASA-CR-162886 ..... N80-21238* #
NASA-CR-162887 ..... N80-20575* #
NASA-CR-162894 ..... N80-21143* #
NASA-CR-162895 ..... N80-20261* #
NASA-CR-162896 ..... N80-20340* #
NASA-CR-162897 ..... N80-21234* #
NASA-CR-162898 ..... N80-20819* #
NASA-CR-162899 ..... N80-20818* #
NASA-CR-162900 ..... N80-21050* #
NASA-CR-162901 ..... N80-20339* #
NASA-CR-162902 ..... N80-21235* #
NASA-CR-162903 ..... N80-20397* #
NASA-CR-162904 ..... N80-20814* #
NASA-CR-162905 ..... N80-20815* #
NASA-CR-162906 ..... N80-20964* #
NASA-CR-162907 ..... N80-20816* #
NASA-CR-162908 ..... N80-21237* #
NASA-CR-162909 ..... N80-20312* #
NASA-CR-162910 ..... N80-21142* #
NASA-CR-162911 ..... N80-20273* #
NASA-CR-162912 ..... N80-20817* #
NASA-CR-162913 ..... N80-20404* #
NASA-CR-162914 ..... N80-21240* #
NASA-CR-162915 ..... N80-21239* #
NASA-CR-162916 ..... N80-21037* #

NASA-SP-4009 ..... N80-20437* #
NASA-SP-7039(16) N80-21190*
NASA-SP-7041(24) N80-20717*

NASA-TM-58225 ..... N80-21059* #
NASA-TM-73279 ..... N80-20564* #
NASA-TM-75505 ..... N80-20229* #
NASA-TM-75506 ..... N80-21025* #
NASA-TM-75735 ..... N80-21014* #
NASA-TM-75774 ..... N80-20590* #
NASA-TM-75800 ..... N80-21101* #
NASA-TM-75805 ..... N80-21224* #
NASA-TM-76002 ..... N80-21019* #
NASA-TM-76022 ..... N80-21020* #

NASA-TM-76042 ..... N80-20920* #
NASA-TM-76056 ..... N80-21023* #
NASA-TM-76069 ..... N80-21026* #
NASA-TM-76099 ..... N80-21021* #
NASA-TM-76107 ..... N80-21017* #
NASA-TM-76108 ..... N80-21024* #
NASA-TM-76110 ..... N80-21022* #
NASA-TM-76119 ..... N80-21015* #
NASA-TM-76136 ..... N80-21016* #
NASA-TM-78801 ..... N80-20286* #
NASA-TM-79268 ..... N80-20787* #
NASA-TM-80144 ..... N80-21043* #
NASA-TM-80226 ..... N80-20302* #
NASA-TM-80232 ..... N80-20231* #
NASA-TM-80236 ..... N80-21045* #
NASA-TM-80237 ..... N80-20227* #
NASA-TM-80550 ..... N80-20722* #
NASA-TM-80642 ..... N80-20723* #
NASA-TM-81415 ..... N80-20272* #
NASA-TM-81422 ..... N80-20313* #
NASA-TM-81433 ..... N80-21201* #
NASA-TM-81439 ..... N80-20532* #
NASA-TM-81443 ..... N80-20398* #
NASA-TM-81449 ..... N80-20591* #
NASA-TM-81450 ..... N80-20304* #
NASA-TM-81455 ..... N80-20370* #
NASA-TM-81456 ..... N80-20314* #
NASA-TM-81459 ..... N80-20274* #
NASA-TM-81491 ..... N80-20275* #
NASA-TM-81495 ..... N80-21200* #
NASA-TM-81778 ..... N80-20251* #
NASA-TM-81783 ..... N80-20223* #
NASA-TM-81784 ..... N80-20529* #
NASA-TM-81785 ..... N80-20620* #
NASA-TM-81788 ..... N80-20228* #
NASA-TM-81789 ..... N80-20280* #
NASA-TM-81793 ..... N80-20260* #

NASA-TP-1517 ..... N80-20527* #
NASA-TP-1566 ..... N80-20619* #
NASA-TP-1629 ..... N80-20986* #

NATO/CCMS-71-REV ..... N80-20953 #

NBS-GCR-79-181 ..... N80-20912 #

NBS-HB-129 ..... N80-20569 #

NBS-MONO-25-SECT-16 ..... N80-21183 #

NBS-SP-562 ..... N80-20441 #
NBS-SP-563 ..... N80-20325* #

NBS-TN-1105 ..... N80-20509 #
NBS-TN-1106 ..... N80-20570 #
NBS-TN-1109 ..... N80-20477 #

NBSIR-79-1615 ..... N80-20571 #
NBSIR-79-1621 ..... N80-20365 #
NBSIR-79-1756 ..... N80-20506 #
NBSIR-79-1910 ..... N80-20364 #

NCAR/TN-144/STR ..... N80-21001 #

NCSU-FMR-5 ..... N80-20998 #

NEAR-TR-198 ..... N80-20236 #

NEPRF-TR-79-01 ..... N80-20992 #

NMEI-16 ..... N80-20914 #
NMEI-45 ..... N80-20913 #

NOAA-TM-NESS-106 ..... N80-20981 #

NOAA-TM-NOS-NGS-5 ..... N80-20977 #

NOAA-TM-NWS-NMC-63 ..... N80-20995 #

NOAA-TR-NOS-78 ..... N80-21010 #
NOAA-TR-NOS-79-NGS-12 ..... N80-20976 #

NOAA-TR-NWS-23 ..... N80-20999 #

NOAA-79092004 ..... N80-20939 #
NOAA-79092405 ..... N80-21012 #
NOAA-79100101 ..... N80-20994 #
NOAA-79100108 ..... N80-20976 #
NOAA-79100501 ..... N80-20977 #
NOAA-79100503 ..... N80-21000 #

NOAA-79100504 ..... N80-21002 #
NOAA-79101101 ..... N80-20999 #
NOAA-79101102 ..... N80-21010 #
NOAA-79101901 ..... N80-20981 #
NOAA-79102201 ..... N80-21003 #
NOAA-79102404 ..... N80-21011 #
NOAA-79112304 ..... N80-21004 #

NORDA-TN-23 ..... N80-20780 #
NORDA-TN-26 ..... N80-20492 #

NOSC/TD-291 ..... N80-21102 #

NRL-MR-4095 ..... N80-20539 #
NRL-MR-4116 ..... N80-20968 #
NRL-MR-4116 ..... N80-20969 #
NRL-MR-4127 ..... N80-21159* #
NRL-MR-4131 ..... N80-20347 #
NRL-MR-4132 ..... N80-20540 #

NRL-8320 ..... N80-21145 #
NRL-8350 ..... N80-20408 #

NSF/RA-790172 ..... N80-21221 #
NSF/RA-790191 ..... N80-21215 #
NSF/RA-790199 ..... N80-21084 #
NSF/RA-790200 ..... N80-20960 #
NSF/RA-790232 ..... N80-21096 #
NSF/RA-790249 ..... N80-20805 #
NSF/RA-790268 ..... N80-20440 #

NSWC/TR-79-43 ..... N80-20320 #
NSWC/TR-79-256 ..... N80-20299 #

NTIS/PS-75/044 ..... N80-20585 #
NTIS/PS-75/073 ..... N80-21031 #
NTIS/PS-75/436 ..... N80-20259 #
NTIS/PS-75/459 ..... N80-20478 #
NTIS/PS-75/601 ..... N80-21193 #
NTIS/PS-75/733 ..... N80-20586 #
NTIS/PS-75/737 ..... N80-20795 #
NTIS/PS-75/785 ..... N80-20394 #
NTIS/PS-75/792 ..... N80-20585 #
NTIS/PS-75/808 ..... N80-20600 #
NTIS/PS-75/818 ..... N80-20555 #
NTIS/PS-76/0552 ..... N80-20259 #
NTIS/PS-76/0553 ..... N80-20478 #
NTIS/PS-76/0581 ..... N80-20288 #
NTIS/PS-76/0779 ..... N80-21193 #
NTIS/PS-76/0838 ..... N80-20795 #
NTIS/PS-76/0940 ..... N80-20555 #
NTIS/PS-76/0967 ..... N80-21031 #
NTIS/PS-76/0969 ..... N80-20600 #
NTIS/PS-76/0970 ..... N80-20600 #
NTIS/PS-76/0979 ..... N80-20586 #
NTIS/PS-76/1042 ..... N80-20585 #
NTIS/PS-76/1046 ..... N80-20394 #
NTIS/PS-77/0609 ..... N80-20250 #
NTIS/PS-77/0625 ..... N80-20478 #
NTIS/PS-77/0662 ..... N80-20288 #
NTIS/PS-77/0918 ..... N80-21193 #
NTIS/PS-77/0947 ..... N80-20795 #
NTIS/PS-77/1081 ..... N80-21031 #
NTIS/PS-77/1116 ..... N80-20555 #
NTIS/PS-77/1122 ..... N80-20600 #
NTIS/PS-77/1161 ..... N80-20910 #
NTIS/PS-77/1166 ..... N80-20586 #
NTIS/PS-77/1176 ..... N80-20585 #
NTIS/PS-77/1179 ..... N80-20394 #
NTIS/PS-78/0685 ..... N80-20288 #
NTIS/PS-78/0718 ..... N80-20478 #
NTIS/PS-78/0735 ..... N80-20259 #
NTIS/PS-78/1066 ..... N80-20795 #
NTIS/PS-78/1069 ..... N80-21193 #
NTIS/PS-78/1195 ..... N80-21031 #
NTIS/PS-78/1277 ..... N80-20600 #
NTIS/PS-78/1288 ..... N80-20910 #
NTIS/PS-78/1307 ..... N80-20586 #
NTIS/PS-78/1318 ..... N80-20394 #
NTIS/PS-78/1326 ..... N80-20585 #
NTIS/PS-78/1344 ..... N80-20555 #
NTIS/PS-79/0726/4 ..... N80-21041 #
NTIS/PS-79/0732/2 ..... N80-20952 #
NTIS/PS-79/0750/4 ..... N80-20478 #
NTIS/PS-79/0754/6 ..... N80-20288 #
NTIS/PS-79/0762/9 ..... N80-20259 #

NUREG-CR-0987 ..... N80-20505 #

NVO-185-REV-1 ..... N80-21134 #

NVO-196-11 ..... N80-21129 #
NVO-01556-1 ..... N80-20792 #

NYU/DAS-79-18 ..... N80-20545 #

ONR-R-2 ..... N80-20372 #

OR-15764 ..... N80-20455 #

ORAU-IEA-79-16(0) ..... N80-20907 #

ORNL/CSD/TM-65 ..... N80-21095 #

ORNL/NUREG/TM-335 ..... N80-20505 #

ORNL/TM-6494 ..... N80-20549 #
ORNL/TM-6920 ..... N80-21082 #
ORNL/TM-6999 ..... N80-20386 #

ORO-4814-T1 ..... N80-20355 #
ORO-5020-T1 ..... N80-20415 #
ORO-5205-10 ..... N80-20973 #

OSURF-760075/783430 ..... N80-21075 #

OTA-M-97 ..... N80-20393 #

OWRT-A-104-MASS(1) ..... N80-21214 #

OWRT-B-021-MICH(2) ..... N80-20802 #
OWRT-B-218-TEX(1) ..... N80-20801 #

OWRT-S-0098(7543)(1) ..... N80-20357 #

OWRT-9601(1) ..... N80-20804 #

PATR-1037-79-6 ..... N80-20281 #

PB80-11012 ..... N80-20589 #
PB80-100654 ..... N80-20360 #
PB80-100662 ..... N80-20916 #
PB80-102619 ..... N80-20393 #
PB80-102809 ..... N80-20942 #
PB80-102874 ..... N80-20948 #
PB80-103450 ..... N80-20477 #
PB80-103955 ..... N80-20479 #
PB80-103969 ..... N80-21001 #
PB80-104967 ..... N80-20915 #
PB80-104995 ..... N80-20941 #
PB80-105109 ..... N80-20325* #
PB80-105141 ..... N80-20571 #
PB80-105166 ..... N80-21217 #
PB80-105331 ..... N80-20509 #
PB80-105976 ..... N80-20258 #
PB80-106164 ..... N80-21215 #
PB80-106263 ..... N80-20443 #
PB80-106404 ..... N80-20442 #
PB80-106438 ..... N80-20932 #
PB80-106636 ..... N80-20607 #
PB80-106743 ..... N80-21214 #
PB80-107030 ..... N80-21027 #
PB80-107246 ..... N80-21106 #
PB80-107501 ..... N80-20911 #
PB80-107865 ..... N80-21084 #
PB80-107873 ..... N80-21221 #
PB80-107899 ..... N80-20939 #
PB80-107907 ..... N80-20980 #
PB80-108160 ..... N80-20933 #
PB80-108293 ..... N80-21028 #
PB80-108343 ..... N80-21195 #
PB80-108392 ..... N80-20949 #
PB80-108418 ..... N80-21220 #
PB80-108467 ..... N80-20950 #
PB80-108475 ..... N80-20358 #
PB80-108574 ..... N80-20954 #
PB80-108616 ..... N80-20914 #
PB80-108624 ..... N80-20913 #
PB80-108939 ..... N80-21218 #
PB80-108970 ..... N80-21222 #
PB80-109150 ..... N80-21013 #
PB80-109978 ..... N80-20953 #
PB80-110133 ..... N80-20441 #
PB80-110265 ..... N80-21194 #
PB80-110299 ..... N80-20940 #
PB80-110307 ..... N80-20570 #
PB80-110323 ..... N80-20934 #
PB80-110364 ..... N80-21183 #
PB80-110398 ..... N80-20996 #
PB80-110406 ..... N80-20997 #
PB80-110869 ..... N80-20801 #

PB80-110885 ..... N80-20392 #
PB80-111016 ..... N80-20476 #
PB80-111032 ..... N80-20951 #
PB80-111362 ..... N80-20359 #
PB80-111420 ..... N80 20362 #
PB80-111438 ..... N80-20361 #
PB80-111453 ..... N80-21012 #
PB80-111479 ..... N80-20979 #
PB80-111503 ..... N80-21216 #
PB80-111677 ..... N80-20803 #
PB80-111842 ..... N80-20804 #
PB80-111941 ..... N80-20356 #
PB80-112014 ..... N80-20998 #
PB80-112048 ..... N80-21005 #
PB80-112055 ..... N80-21006 #
PB80-112113 ..... N80-20364 #
PB80-112162 ..... N80-20935 #
PB80-112170 ..... N80-21029 #
PB80-112204 ..... N80-21036 #
PB80-112337 ..... N80-20937 #
PB80-112394 ..... N80-20938 #
PB80-112758 ..... N80-20430 #
PB80-112766 ..... N80-20447 #
PB80-112782 ..... N80-21002 #
PB80-113061 ..... N80-20401 #
PB80-113277 ..... N80-20994 #
PB80-113301 ..... N80-20440 #
PB80-113400 ..... N80-20797 #
PB80-113624 ..... N80-20936 #
PB80-113657 ..... N80-20947 #
PB80-113715 ..... N80-20802 #
PB80-113749 ..... N80-20912 #
PB80-114226 ..... N80-20796 #
PB80-114549 ..... N80-20946 #
PB80-114705 ..... N80-20357 #
PB80-114747 ..... N80-21009 #
PB80-115298 ..... N80-21197 #
PB80-115926 ..... N80-20445 #
PB80-115991 ..... N80-20945 #
PB80-116007 ..... N80-20363 #
PB80-116056 ..... N80-20800 #
PB80-116114 ..... N80-20446 #
PB80-116221 ..... N80-20444 #
PB80-116868 ..... N80-21148 #
PB80-117948 ..... N80-20976 #
PB80-117989 ..... N80-20995 #
PB80-117997 ..... N80-20999 #
PB80-118193 ..... N80-20365 #
PB80-118359 ..... N80-21198 #
PB80-118383 ..... N80-21219 #
PB80-118425 ..... N80-21000 #
PB80-118532 ..... N80-21096 #
PB80-118561 ..... N80-21010 #
PB80-118615 ..... N80-20977 #
PB80-118763 ..... N80-20944 #
PB80-119431 ..... N80-20981 #
PB80-119464 ..... N80-20978 #
PB80-120694 ..... N80-20556 #
PB80-121130 ..... N80-21003 #
PB80-122401 ..... N80-21011 #
PB80-122724 ..... N80-20798 #
PB80-123011 ..... N80-20799 #
PB80-123029 ..... N80-20943 #
PB80-123078 ..... N80-20805 #
PB80-125255 ..... N80-21004 #
PB80-802259 ..... N80-20795 #
PB80-802499 ..... N80-20600 #
PB80-802531 ..... N80-20910 #
PB80-802739 ..... N80-21193 #
PB80-803158 ..... N80-21031 #
PB80-803265 ..... N80-20555 #
PB80-803273 ..... N80-20586 #
PB80-803612 ..... N80-20585 #
PB80-803729 ..... N80-20394 #

PETC/TR-79/1 ..... N80-20416 #
PETC/TR-79/3 ..... N80-20417 #

PMTC-TP-79-30 ..... N80-20305 #

PNL-SA-7949 ..... N80-20903 #

PNL-TR-372 ..... N80-20390 #

PNL-2652 ..... N80-21131 #
PNL-2999-PT-1 ..... N80-21130 #
PNL-2999-PT-2 ..... N80-21130 #
PNL-3063 ..... N80-20928 #
PNL-3191 ..... N80-20904 #

POLY-M/AE-80-8 ..... N80-20338* #

PPI-1030-6 ..... N80-20909* #

PPPL-1592 ..... N80-21164 #

PR-2 ..... N80-20972 #
PR-3 ..... N80-20971 #
PR-37 ..... N80-20873 #

PTPT-79-15 ..... N80-20264 #

PUB-104 ..... N80-21214 #

PWRRC-TR-123 ..... N80-20556 #

QR-1 ..... N80-20906 #
QR-3 ..... N80-20423 #
QR-6 ..... N80-20597 #

QTPR-1 ..... N80-20507 #
QTPR-1 ..... N80-20872 #
QTPR-2 ..... N80-20414 #
QTPR-3 ..... N80-20316* #

QTR-8 ..... N80-20817* #

R-342 ..... N80-20447 #
R-348 ..... N80-20445 #
R-349 ..... N80-20444 #
R-840 ..... N80-20342 #
R-845 ..... N80-20464 #

RADC-TR-79-174 ..... N80-20321 #
RADC-TR-79-181 ..... N80-20493 #
RADC-TR-79-212 ..... N80-21008 #
RADC-TR-79-235 ..... N80-20491 #
RADC-TR-79-248 ..... N80-20490 #
RADC-TR-79-255 ..... N80-20489 #
RADC-TR-79-260 ..... N80-21192 #
RADC-TR-79-261 ..... N80-20470 #
RADC-TR-79-262 ..... N80-20465 #
RADC-TR-79-267 ..... N80-20460 #

RAND/R-2418-AF ..... N80-20469 #
RAND/R-2474-ONR ..... N80-20788 #

REPT-2 ..... N80-20584 #
REPT-9 ..... N80-20344 #
REPT-10 ..... N80-20343 #
REPT-11 ..... N80-20980 #
REPT-12 ..... N80-21107 #
REPT-15 ..... N80-21123 #
REPT-16 ..... N80-21124 #
REPT-35 ..... N80-20679 #
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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1509

02 AERODYNAMICS 1513

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1516

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1517

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1519

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION N.A.

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1521

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1523

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1526

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1526

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 1529

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 1530

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1531

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1533

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING 1533

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1534

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 1534
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1535
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 1535
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1539
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1541
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1545
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 1552
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 1555
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1556
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 1564
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33 ELECTRONICS AND ELECTRICAL ENGINEERING 1572
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34 FLUID MECHANICS AND HEAT TRANSFER 1578
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35 INSTRUMENTATION AND PHOTOGRAPHY 1581
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For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 1583
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37 MECHANICAL ENGINEERING 1586
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 1589
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 1589
Includes structural element design and weight analysis; fatigue; and thermal stress.
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GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) 1594

43 EARTH RESOURCES 1596

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 1597

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 1605

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 1608

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 1610

Includes weather forecasting and modification.

48 OCEANOGRAPHY 1615

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 1615

Includes genetics.

52 AEROSPACE MEDICINE 1617

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES N.A.

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 1618

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 1619

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 1621

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS N.A.

Includes computer networks.

63 CYBERNETICS 1623

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 1624

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 1627

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS N.A.

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS N.A.

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

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71 ACOUSTICS 1628
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For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 1630
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 1631
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 1632
Includes light phenomena.

75 PLASMA PHYSICS 1634
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 1635
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1639
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT N.A.
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1640
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1640
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1641
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 1641

89 ASTRONOMY 1643
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1649
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1650
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1653
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION N.A.
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

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Note: N.A. means that no abstracts were assigned to this category for this issue.

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N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif

STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

D. J. Mourey 3 Sep. 1979 409 p refs

(Contract NAS1-15624)

(NASA-CR-159149) Avail: NTIS HC A18/MF A01

CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, THERMAL-ACOUSTIC EFFECTS ON AIRCRAFT STRUCTURAL LIFE

P. Seide, University of Southern California, School of Engineering, Dept. of Civil Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF143060; AFOSR-79-0013)

This work unit supports the AF mission by providing technical solutions to structural integrity problems caused by high intensity noise generated in the operation of aircraft systems. The problem area is the degradation of the structural integrity due to sonic fatigue resulting in an increased maintenance burden and expensive retrofits. Present analytical techniques do not account for high temperature effects on structural elements. The program objective is to provide analytical methods to account for high temperature effects on the dynamic response of lightweight structural elements in an intense sonic environment. The Air Force will benefit from reduced maintenance costs and increased operational useage of aircraft systems.

The effects of thermal loads combined with high intensity noise on the dynamic behavior of lightweight structural elements will be investigated. Mathematical formulations will be developed for the peak response distribution with varying membrane effects, nonlinear spring effects and multimodal effects on the structure. An analytical expression for the fatigue damage resulting from these effects will be developed. A test program will be established and conducted to verify the theoretical techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0002, UNSTEADY VORTEX ENTRAPMENT ON AN AIRFOIL

J.E. Keesee, U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab., *Air Force Academy, Colorado Springs, Colorado* 80840 (DF282300)

AF function - technology base, counter air, close air support. Deficiency - flight vehicles currently designed in accordance with steady flow aerodynamic characteristics do not utilize potential performance capabilities available from dynamic stall and similar unsteady separation effects. How research contributes - this effort evaluates the formation, persistence and overall influence of energetic vortices produced by unsteady airfoil motions. The work ties to and is an extension of current research by FJSRL investigators in unsteady separation. Objectives - the research seeks to determine the feasibility of trapping a vortex generator by unsteady motions near the surface of an airfoil. An assessment of the correlation of airfoil motion, vortex intensity motion and stability, and the resultant surface loading will subsequently be made. Additionally, an analytical model will be developed to describe the results. This will lead to an improved understanding of the role of the various physical mechanisms on the flow field and suggest possible improvements in flight vehicle design and maneuvering techniques.

An NACA 0012 airfoil immersed in a subsonic wind tunnel flow will be oscillated in two degrees of freedom using a microcomputer drive providing for both pitching motion and axial translation. Transient and oscillatory motions will be analyzed. Flow field parameters will be measured using a multicomponent laser Doppler velocimeter and surface pressure transducers together with a minicomputer data acquisition system. A collateral analytical effort will be directed at generating a model describing the flow field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

1.0003, PENETRATION EQUATION DEVELOPMENT

W.S. Strickland, U.S. Dept. of Defense, Air Force, Armament Lab., *Eglin Air Force Base, Florida* 32542 (DF644710)

The objective of this program is to develop analytical equations for predicting the penetration of selected warhead fragment designs into aircraft fuel tanks.

The approach to this problem consists of three phases (1) an ADTC test program (2) data reduction (3) penetration equation development. The test program is designed to collect baseline data on the penetration of select warhead fragment designs into a fluid filled tank. Two orthogonal cameras will be used to photograph the fragment impact on the exterior plate. Two additional cameras will be used to photograph the fragment trajectory through the fluid. The second phase will consist of analyzing the film data to determine the impact orientation, fragment velocity, and drag coefficients for the specified fragment designs. Maximum penetration depths as a function of impact orientation, impact velocity and fragment design characteristics will be recorded. The final phase consists of formulating empirical equations for use in vulnerability models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0004, INTEGRATED FLIGHT/WEAPON CONTROL SYSTEM (IFWC)

W.J. Murphy, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF143570; F33615-79-C-3604)

This work unit supports the development of proposed new weapon platform control system technologies. This program will impact the problem encountered by pilots of tactical aircraft in achieving proper launch envelopes for guided weapons. The objective is to design and test automatic and semi-automatic flight control systems which will fly the attacking aircraft to the required launch envelopes for guided weapons. This system will improve the accuracy of the weapon system, reduce pilot workload needed to launch the weapon, and increase survivability of the fighter weapon system.

The contractor will perform a literature search to establish the state of the art for this technology. He will then design an IFWC system capable of delivering both AA and AG guided weapons. Finally, he will evaluate the system using both piloted and non-piloted simulations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, STRUCTURAL PANEL RESPONSE TO HIGH INTENSITY NOISE

C. Mei, University of Missouri, Rolla Campus, Graduate School, *103 Parker Hall, Rolla, Missouri* 65401 (DF056000; F49620-79-C-0169)

AF function - Air Force flight vehicles. Deficiency - present analysis methods, although conservative, are inaccurate regarding amplitude and frequency response. Objective - to improve analytical/predictive capability. How work contributes - extends an established method to handle complex structural panels, and correlates computation with experiment.

Apply the quasilinearization method to extend the finite element method to analyze the large deflection response of structures subject to broadband acoustic excitation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0006, DESIGN AND CONSTRUCTION OF PAVEMENTS ON EXPANSIVE SOILS (EVALUATION OF THE SWELL CHARACTERISTICS OF AIRFIELD PAVEMENT SUBGRADES)

R.G. McKeen, University of New Mexico, Graduate School, *University Hill N.E., Albuquerque, New Mexico* 87106 (177801 (HRB NO.))

Phase 2 - Provide indicator test for use in rapid swell predictions or as criteria for initiating a detailed soils investigation. Test methods considered involve measurement of the volume response of soils to moisture and load changes. Phase 3 - Provide procedures for studying in situ moisture retention force profiles and their variation with climate. Procedures are intended to produce design data. Study the load-retention force-volume relationship for various soils and the influence of chemical stabilizers on this relationship. Phase 4 -Conduct a study of airport pavement roughness already measured on some twenty runways with subgrade properties in order to quantify the influence of pavement stiffness on heave-roughness relationships.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0007, DEVELOPMENT OF EXPERIMENTAL VIDEO MULTIPLEX METHOD FOR INTEGRATED COCKPIT DISPLAY SYSTEM

J. Moran, General Electric Co., Aerospace Electronic Systems Division, *French Rd., Utica, New York* 13502 (DN081109; N62269-79-C-0037)

To assemble a demonstration wide-band video multiplexing means for experimentation and evaluation. To use the results of this work to specify an operation system for integrated aircraft displays.

To use or modify commercially available equipment to synthesize display formats into a TV raster which is modulated out a VHF carrier. Different VHF carrier frequencies are used to accommodate the various desired display formats. All carriers are transmitted over a common line and the desired carrier is selected at the receiving end by a tunable VHF receiver.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0008, INVESTIGATION OF LASER SHOCK PROCESSING

S.C. Ford, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF142150; F33615-78-C-3217)

This work effort supports requirements for aircraft structural integrity as documented in MIL-STD-1530A. Improved methods of increasing fatigue performance are needed to comply with these requirements. The objective of this program is to investigate laser shock processing as a technique for improving the fatigue performance of metal joints and provide basic data for selecting processing parameters. Improved fatigue performance in aircraft structure increases safety, decreases weight requirements and reduces both procurement and maintenance costs of aerospace systems.

Aluminum joint specimens will be laser shock processed and fatigue tested. Increases in fatigue initiation time and decreases in crack growth rates will be characterized. An assessment of the system requirements need for the employment of laser shock processing in the manufacture of aerospace structures will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, INFLUENCE OF ENVIRONMENTAL PARAMETERS ON BIRD HABITAT SELECTION NEAR AIRFIELDS

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AF function - a major problem confronting military and civilian aircraft is the bird aircraft strike hazard. One billion dollars is spent worldwide on an annual basis to repair damage from bird strikes. The majority of the damaging small bird strikes is due to blackbirds and starlings. Deficiency - starlings and blackbirds pose a threat to aircraft mainly because they roost communally, fly in dense flocks when leaving and returning to the roost and feed in large flocks in open, grassy areas. A better understanding of bird behavior and ecology is needed to effectively decrease the bird aircraft strike hazard. Objective - the main objective of this effort is to study bird behavior and roost ecology by comparing three different types of blackbird and starling roost sites in order to determine how the roost affects the energetics efficiency of these species. The study should suggest alterations in the roost sites that would encourage the birds to move elsewhere. How research contributes - this research should suggest landscape alterations near airfields that would result in starling and blackbird roost relocations. Air installation compatible use zoning (AICUZ) could be affected by the resultant energetics model, thus reducing the probability of roost formation near airfields.

Vegetation height and density will be measured to topographically characterize vegetation types that are selected as nocturnal roost sites. Air temperature, humidity, precipitation, wind velocity and thermal radiation will be measured to microclimatologically characterize vegetation types that are selected as roost sites and adjacent areas not selected. Determinations will be made as to how environmental variables affect the positioning of birds within the roost. Comparison of metabolic cost within and outside the roost, as well as between roost sites will be made to determine the energetic efficiency of birds within various roost sites. Based on energetic efficiency, a model will be constructed that will provide for prediction of what a good roost site is based on topography and environmental variables.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0010, AUXILIARY POWER UNIT (APU) LABORATORY

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To develop and operate an in-house capability to test either contractually developed APU components or develop new APU concepts, to provide quick reaction response to requests for technical assistance and problem solution from using Air Force organizations such as SPO's and other laboratories.

Build and maintain suitable laboratory facilities for conducting tests on APU components or concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0011, TURBINE AERO-MECHANICAL ANALYSIS

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To provide data and analytical tools to aid laboratory engineers in evaluating contractor turbine engine designs (aero-thermo-mechanical) and proposals.

(NOFORN) This effort is of a continuing nature involving the origination of computer programs and updating old efforts

with new techniques. Of primary importance is the generation of realistic turbine engine performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0012, CRF/J85 TRANSIENT INVESTIGATION
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The primary objectives of this program are to determine the effects of speed transients on compressor performance, to obtain detailed information on compressor operating paths during transient operation, and to investigate the cause of compressor performance differences between transient and steady-state operation. This information will primarily be used to evaluate transient compressor test techniques for application to APL's CRF.

A J85-5 engine will be instrumented for transient compressor testing, the instrumentation will be interfaced with a MOD COMP II computer system for storage and processing of test data. An analysis of the data will be made in order to relate specific aerodynamic parameters to changes in performance that result during transient operation that can lead to compressor stall.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0013, TURBINE ENGINE CONTROL SYSTEM DEVELOPMENT - IN-HOUSE
L.L. Small, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451970)

The objective of this in-house effort is twofold - to develop, fabricate and test high response turbine engine sensors so vitally necessary for advanced propulsion system control, and using this instrumentation as an input and a digital computer as processor, to develop and evaluate new control modes including optimal control techniques for the complex, multi-input and multi-output turbine engine control systems of the future.

The technical approach to this in-house effort consists of several interrelated tasks: (1) development of an analog and digital data acquisition/reduction capability for an engine test cell, (2) development, fabrication, and experimental evaluation of high response gas turbine engine sensors for possible control system applications, (3) analysis of various digital J-85 engine models and updating of these models from actual engine test data, (4) evaluation of classical control schemes with emphasis on closed loop control of unique engine parameters such as compressor discharge corrected airflow and turbine inlet gas temperature, and (5) the evaluation of modern control theory (i.e., using the state variable plant representation) as applied to actual engine control.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0014, ASSESSMENT OF FLIGHT DYNAMICS TECHNOLOGIES FOR LOW COST DEFENSE SUPPRESSION CRUISE MISSILE (DSCM) ALTERNATIVES
E.L. Fleeman, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144230)

The Air Force function for this effort is to assess flight dynamics technologies for low cost defense suppression cruise missile alternatives. The opportunity to be gained by this effort is the identification of unique technologies for an alternate approach to defense suppression. The objective of this effort is to provide a quantitative assessment of the effects of missile configuration alternatives on flight dynamics technologies and performance. The work contributes to laboratory planning for a balanced technology program in the area of unmanned vehicles.

An in-house design will be conducted to assess a ground-launched cruise missile utilizing a second stage rocket penetrator. Emphasis will be given to minimizing size and cost by considering a low cost turbojet engine for efficient subsonic cruise at high altitude. A second stage rocket with supersonic penetration speed will be considered for reduced reation time against a radiating target. Trade-offs will be conducted of missile size (driven by warhead size) and speed alternatives and assessments will be made of the effects on flight dynamics technologies and performance. A technical memorandum will be prepared documenting results of this effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, CONVECTION HEATING TECHNOLOGY FOR STRUCTURAL TESTING
G.R. Holderby, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143020)

Recent USAF aircraft have seen a large increase in the structural use of composite and plastic materials. These materials have a broad range of coefficients of absorption and reflectivity versus wave length. This has caused results of tests using standard radiation heating techniques to be questioned. The convection heating technology for structural testing will develop the in-house capability to simulate flight thermal environments using convective heating techniques. These techniques will increase the facility's flexibility in conducting thermal tests of aircraft, missiles and structural components, thereby increasing their capability for mission accomplishment.

The program effort will be directed toward designing and building test systems to enable study of convection heating and related control problems including effects of velocity, flow conditions, humidity and air temperature.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, REVISION OF FLYING QUALITIES SPECIFICATION MIL-F-8785B
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This work unit supports an update of the military flying qualities requirements contained in MIL-F-8785B, Flying Qualities of Piloted Airplanes. The problem is that these requirements are not applicable to many advanced flight control concepts - the requirements must be updated to correct these deficiencies. The objectives are to 1) complete a current revision of MIL-F-8785B, and 2) continue the revisions and reformat into a prime-standard and handbook. The payoff from this effort will be a consistent set of design and flight test flying qualities requirements that will allow new and advanced technologies to be incorporated into new aircraft system developments, in order to ensure mission success without penalties caused by overdesign.

A current revision effort will be coordinated and finalized as a conversion to MIL-F-8785C. Comments received from this process will be used to plan the development of the prime-standard and the handbook. In addition, new flying qualities data from flight test, simulation or analysis will be gathered. This data will be compared with existing or proposed criteria. Existing flying qualities criteria will be validated or modified, or new ones will be formulated, for incorporation in the handbook.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, LOAD APPLICATION METHODS - COMPUTER PROGRAMS FOR THE DESIGN AND EVALUATION OF STRUCTURAL TESTING HARDWARE AND METHODS
M.D. Richardson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142840)

A system of computer programs will be developed to support the structural testing of aerospace and other related vehicles, components and design concepts. The programs will permit efficient design and evaluation of test methods, testing fixtures and hardware. Emphasis will be placed on utilization of AFFDL/FBT computer resources currently being used only for test control and data acquisition and processing. The programs will permit project engineers not skilled in computer methods to make decisions regarding test program design and evaluation with an increased degree of confidence, thus increasing test

safety and integrity. This effort will improve AFFDL/FBT's ability to experimentally determine the structural integrity reliability of military vehicle structures and advanced aerospace structural concepts.

Three levels of computer software will be developed. Level (1) will be structured toward programmable calculator solution, level (2) interactive terminal application, and level (3) batch terminal application. The programs will use state-of-the art methods in structural analysis with emphasis on structures and elements utilized within FBT.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, ADVANCED TAKEOFF AND LANDING SYSTEMS (ATALS) TEST MACHINE DEVELOPMENT

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This effort supports the development of advanced takeoff and landing systems for Air Force aircraft, including remotely piloted vehicles (RPV). The mobility and flexibility of current aircraft are restricted because conventional landing gear require them to be operated from prepared, vulnerable, fixed airfields. Also, current RPV launch from aircraft and parachute/helicopter recovery is expensive. Presently, laboratory test systems do not exist for the test and evaluation, and development of design and performance criteria for new advanced takeoff and landing systems (ATALS). The objective of this effort is to develop and install laboratory test systems which are most needed for the development and evaluation of new ATALS. The laboratory test facilities resulting from this effort will provide an effective, timely means to develop and evaluate ATALS which will significantly improve the performance and life cycle costs of Air Force aircraft.

Under this effort two ATALS laboratory test systems will be developed, fabricated, installed and checked out. A dynamic test machine will be placed in operation for simulating taxi, takeoff, and landing maneuvers of ATALS equipped models. And a test platform will be placed in operation for the testing of three-dimensional ATALS equipped models to establish ATALS operating characteristics during critical phases of takeoff and landing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, AIR NAVIGATION TECHNIQUES

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To orient, guide and execute exploratory development in aircraft navigation systems and associated navigation sensors, including consolidation of separate technologies for aircraft inertial navigation and attitude heading reference into a common system, integration of functional navigation components to obtain synergistic effects, and guiding development of systems with low life cycle cost, (LCC) improved reliability and maintainability (R&M) and reduced size and weight. All of the work performed under this block directly supports problem areas addressed in OPNAV STO's and VANMAT technical strategies.

The approach includes both in-house efforts and guidance to industry to a) investigate new concepts to improve INS performance and LCC, b) deliver strapdown rate sensors with high rate capabilities, low cost, and minimal environmental sensitivities, c) develop new techniques for rapid, in air alignment of inertial systems d) test and evaluate an experimental model nuclear magnetic resonance NMR gyroscope, and e) develop advanced velocity sensors. Detailed approaches are contained in NavAirDevCen air navigation techniques block program plan for FY80 of 15 May 1979.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Command Control & Guidance Admin.

1.0020, RESEARCH ON MULTIPURPOSE CORROSION INHIBITORS FOR AEROSPACE MATERIALS IN NAVAL ENVIRONMENT

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To minimize corrosion failures such as corrosion fatigue stress corrosion cracking, wear and general corrosion in naval aircraft through one process or product. To develop and formulate new multipurpose versatile inhibitors or inhibitor system which can protect high strength structural alloys steels and Al alloys from various forms of corrosion. To produce applicable methods and/or products for fleet which can be incorporated into paint primers, lubricants and surface treatment procedures.

Known mechanisms of corrosion reactions specific to naval aircraft corrosion failure problems are considered to generate few basic steps fundamental to overall corrosion controlling concepts. Each step will be studied individually and attempts will be made to develop or search chemical componds mostly inorganic as single function inhibitors to control them. The current state of the art electrochemical and metallurgical methods will be used to characterize their corrosion mitigating chemical properties. The unique aspect of this program is that the corrosion inhibiting properties of all these different chemical compounds functional inhibitors will be combined together into a formula to produce a multi-functional inhibitor of a versatile nature. The technique of phase transfer catalysis will be used to dissolve inorganic compounds into organic solvents.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0021, DISTRIBUTED STORE AIRLOADS

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Air Force function - aircraft-stores compatibility. Opportunity -structurally efficient store design and certification of stores on aircraft. Goal - development of analytical and wind tunnel techniques to obtain distributed store airloads. How work contributes - provides more accurate airloads data to improve structural design of stores and reduce flight envelope restrictions.

The approach will be to conduct pressure model and segmented store model wind tunnel tests to determine the best wind tunnel technique to obtain distributed airloads. Resulting accumulated data will be compared to the analytical results. The analytical technique will be based on the computer aided missile synthesis (CAMS) computer program. This program will be modified to calculate the airloads distributed over the store while in an interference flow field. Existing and future flow field data will be used as inputs into this modified computer program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, ABSOLUTE REACTION AND QUENCHING RATES OF VIBRATIONALLY EXCITED HYDROXYL RADICALS BY INORGANIC AND ORGANIC MOLECULES

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The goal of this research is to establish the effects of reactant vibrational energy on the rates of reaction in a series of exothermic bimolecular exchange reactions in which the vibrational energy is greatly in excess of the activation energy. The investigation involves studying the physical quenching and chemical reactivity of vibrationally excited hydroxyl radicals particularly in the ninth vibrational level (v' equals 9). Reactions of OH(v' equals 9) with the following molecules are to be studied; CO, H2, HCl, HBr, HI, H2O, H2S, NH3, CH4, C2H6, and

C3H8. In addition, preliminary studies of the reactions of OH(v' equals 9) with C2-C4 olefins, benzene and toluene, which at pressures of a few torr undergo more complex addition reactions with OH(v' equals 0), will be carried out. Total rates of removal of OH(v' equals 9) will be determined in a low pressure (1 torr) fast flow discharge system; the predominant removal path - reaction and/or quenching - will be established by analysis of the yields of the major products using gas chromatography and by examination of the relative intensities of the vibration-rotation bands from 500 to 1100 nm. For those molecules whose rates of chemical reaction differ significantly from the corresponding rates for OH(v' equals 0), temperature studies (240-440 degrees K) will be performed to determine whether the excess vibrational energy changes the effective activation energy or the preexponential factor. These rate constant data will aid in developing computer models of chemical processes in the upper atmosphere, in auroras, and in comets where hydroxyl radicals have been observed. In addition, this research will clarify the reactions of vibrationally excited OH in several combustion systems where it is known to be present.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0002, THE STRUCTURE OF AMORPHOUS MATERIALS

A.I. Bienenstock, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (DMR73-02356 A01)

Research previously supported by NSF grant GH-40785 (DMR-7302356), will be continued and expanded. The objective of this research is the determination of atomic arrangements in amorphous materials whose structures cannot be unambiguously determined by other techniques. The main method involves measurement of the extended x-ray absorption fine structure (EXAFS) of crystalline and amorphous materials using the synchrotron radiation facility at the Stanford Linear Accelerator (SLAC). It is proposed to develop improved techniques for analysis of the EXAFS data which depends on an iterative least squares analysis in a manner analogous to that used to refine coordinates in modern x-ray diffraction structure determinations. Materials to be studied include: crystalline and amorphous germanium and selenium; germanium selenide and telluride; and alloy systems such as Tl-As-Se, Ag-AS-Se, Au-As-Se and Ga-As-Se.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0003, TEMPERATURE AND PRESSURE DEPENDENCE OF THE STRUCTURE OF LIQUID METALS

C.N. Wagner, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Materials, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR78-09929)

This is a study of the structure dependence of liquid metals as a function of temperature and pressure. The atomic arrangement of liquid state atoms is described by the interference function I(K). This quantity is used to evaluate the atomic distribution function g(r) by Fourier transformation, and is directly accessible from diffraction experiments. The interference functions I(K) will be evaluated for liquid Ga, Rb, Cs, Sn, In, Zn and Cd from the x-ray scattering patterns up to 1773 degrees K and 1 to 5 kbars pressure between room temperature and 573 degrees K. The transmission technique will be employed using monochromatic Mo-K alpha and W-K alpha radiation in conjunction with a position sensitive x-ray detection system which will provide accurate data, particularly at small scattering angles. The pressure dependence of I(K) will yield information about the applicability of the Kirkwood superposition principle required to compute the pair potential function from the atomic distribution and direct correlation functions. The interference function I(K) in the range of K equal to zero and twice the Fermi momentum can be directly correlated with the electronic transport properties of liquid metals. Lastly, using known pseudopotential form factors, the temperature and pressure coefficients of resistivity will be calculated and compared with experimental values. This is a continuation of research previously funded under NSF Grant DMR74-08532 A01. This is the first year of a two year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0004, CREEP BEHAVIOR UNDER VERY LOW STRESSES

F.A. Mohamed, University of Southern California, School of Engineering, Dept. of Mechanical Engineering & Materials Science, *3551 University Ave., Los Angeles, California* 90007 (DMR77-27619)

This is a fundamental investigation of creep behavior of metallic materials at low stress levels. In the limit of high temperatures and low stresses, polycrystalline materials deform viscously by the Nabarro-Herring mechanism. This type of deformation, which involves diffusion of vacancies through the lattice, is sensitive to grain size: the steady-state creep rate is related to 1/d2 where d is the grain size. In addition, experimental evidence reveals the existence of the Newtonian-Harper-Dorn process in some materials over the same range of temperatures and stresses. Nevertheless, the Harper-Dorn creep rates, which are not describable by a known dislocation mechanism, are independent of grain size. The objectives of this research program are: (1) to clarify the substructural features of the Harper-Dorn process; (2) to investigate the relationship between the Harper-Dorn process and Nabarro-Herring creep; and (3) to examine Harper-Dorn creep as a general process of deformation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0005, EXCITED ELECTRONIC STATE RELAXATION

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Dr. Spears will study energy relaxation processes in excited electronic states of molecules and atoms. The vapor phase relaxation processes include radiationless decay to other electronic states, molecular dissociation and vibrational energy transfer. Additional relaxation processes in solution phase include molecular rotation, molecular ionization, and cage effects on molecular dissociation. The methods of excited state creation will use wavelength tunable lasers in the visible and ultraviolet regions of the spectrum. Laser pulses having variable durations from picoseconds to tens of nanoseconds will provide time resolved probe capability. The probe methods include absorption and fluorescence spectroscopy as well as several types of Raman spectroscopies. This research represents a continuation of that currently supported by Foundation grant CHE-7305256.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, SIMULTANEOUS IN-SITU INVESTIGATION OF DEFECT PRODUCTION BY ELECTRON MICROSCOPY AND ELECTRICAL RESISTIVITY

M. Meshii, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science & Engineering, *633 Clark St., Evanston, Illinois* 60201 (DMR77-14990-A01)

This is an in-situ investigation of defect production in metals under the influence of electron and ion irradiation, using high voltage electron microscopy and electrical resistivity measurements. Both techniques will be employed to study, in depth, defect production mechanisms over wide range of temperature and defect concentrations. As a first approach, the image function and anisotropy of the displacement threshold will be determined. Initially, measurements will be made on pure face-centered-cubic and body-centered-cubic metals, including Al, Ag, Cr and Nb. The knowledge gained from this investigation is expected to contribute important basic information to on-going

studies on fundamental aspects of radiation damage in metallic materials.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0007, MOLECULAR COLLISION PROCESSES

D. Secrest, University of Illinois, Urbana Champaign Campus, School of Chemical Sciences, Dept. of Chemistry, *Urbana, Illinois* 61801 (CHE76-14242 A02)

Accurate approximate techniques have been developed for handling rotational energy transfer in collisions. Secrest plans to explore the use of these techniques in reducing the effort involved in other forms of energy transfer. Vibrational to translational energy transfer will be studied for atom-diatomic molecule collisions, atom-polyatomic molecule collisions and vibrational to vibrational energy transfer in molecule-molecule collisions. These calculations will be used to study experimental results and the approximations commonly used in their interpretation. In all cases rotation will be handled accurately and vibration-rotation information will be available as a biproduct of these studies. These results are needed for understanding gas lasers, the chemistry of the upper atmosphere and molecular beam scattering data. The use of molecular beam data for the determination of intermolecular potentials will be studied with emphasis on the use of polarized beams to obtain information on the angle dependence of the interaction potential. The coupled channel T matrix formalism for exchange scattering will be adapted to the study of chemical exchange reactions. In these calculations as well, it is possible to greatly reduce the computational complexity through the use of angular momentum decoupling approximations. A thorough study of these techniques in conjunction with exchange reactions will be made. This is a continuation of research currently supported by Foundation Grant, GP-16458X).

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, MATERIALS RESEARCH LABORATORY

J.M. Honig, Purdue University, School of Science, Dept. of Materials & Research, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR77-23798)

Major interdisciplinary research programs are carried out in four thrust areas: (1) Acousto-Optic and Acousto-Electric Research -parallel development of fundamental research on the generation, propagation, and control of phonons in materials and of engineering applications in bulk and surface acoustic wave devices. (2) Research for Elucidating Transport Phenomena in Well-Characterized Oxides -preparation, characterization, and studies of electronic and ionic structure and transport in metallic oxides. (3) Complex Semiconducting Materials and Their Behavior under Extreme Perturbation - study of the electronic and optical properties of II-VI and III-V semiconductors under extreme conditions of pressure, laser excitation, and high magnetic fields. (4) Interfaces and Heterogeneous Catalysis - theory, preparation, analysis, and applications of ion-surface interactions.

In addition a number of individual projects are carried out under the category of General Materials Research. Support is also provided for upgrading, operation, and maintenance of a range of central facilities with emphasis on materials preparation, optics, and X-ray analysis.

This award is a continuation of DMR76-00889 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0009, ELECTRONIC STRUCTURE, ENERGY TRANSFER, AND LUMINESCENT PROPERTIES OF LANTHANIDE IONS IN OCTAHEDRAL SYMMETRY

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Design of materials that are efficient lumophors (phosphors and fluorescent materials), lasers, and energy transfer or energy up-conversion systems is, to a large extent, an empirical process. Desired atomic properties in these materials are long excited state lifetimes and efficient photoemission, both of which have been observed in the compounds Cs2NaLnC16 (Ln equals trivalent lanthanide). These two properties are determined by the electronic states of the lanthanide ions and the interactions of these states with structural features, for example the type and geometrical arrangement of ligands (C1,...) bonded to the lanthanide. As a step toward understanding these interactions, single crystals of Cs2NaLnC1 and its analogs are being studied with respect to: the structural phase transition that occurs in certain members of the series; electronic structure of the lanthanide ions at the unique, six-coordinate, octahedral site; and, electron-phonon interactions. The experimental procedure involves measurement of the temperature and concentration dependence of the electron paramagnetic resonance; optical absorption and magnetic circular dichroism; emission; and magnetic circularly polarized emission.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0010, DISPERSION MODELING

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The objective is to develop mathematical models to predict the dispersion characteristics of nuclear fuels uses in the space power program in the atmosphere, lithosphere and hydrosphere. Data generated in the laboratory which demonstrate the behavior of nuclear fuels in the environment are modeled mathematically. These models are used to statistically evaluate the risk of using space power systems.

SUPPORTED BY U.S. Dept. of Energy, Div. of Advanced Systems & Materials Production

3.0011, MOLECULAR MECHANICS OF CHEMICAL REACTIONS

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A three-year program of experimental and theoretical studies of the dynamics of simple chemical reactions, inelastic energy transfer, and 'quasi-liquid' interaction is planned. The major experimental projects include: (1) reactions and inelastic scattering of van der Waals molecules; (2) analysis of angular momentum disposal by means of laser-induced fluorescence; (3) solvation of solute molecules in small solvent clusters probed by laser-induced fluorescence; (4) an attempt to produce beams of solvated electrons and to measure the electron affinity of small clusters of water and ammonia molecules in collisions with hyperthermal alkali atom beams; (5) study of reactions and diffusion processes on coated surfaces, including vibrational excitation of incident molecules, stimulated surface ionization, and stimulation of membrane systems. Theoretical studies include several approaches to the analysis or prediction of vector properties of reactions, particularly by means of classical trajectory calculations, impulsive and statistical models and information theory methods. Also planned is a large-scale electronic structure calculation to obtain an accurate potential energy surface for bond exchange among three hydrogen molecules. This work is a continuation of that currently supported by Foundation grant MPS7102601 (GP-27622X).

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0012, FUNDAMENTALS OF DIRECTIONAL SOLIDIFICATION

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This is an advanced phase of a basic investigation on fundamentals of directional solidification. The objective of the current

work is to delineate the mechanism(s) responsible for obtaining homogeneous structures in rapidly solidified metals. Secondary objectives are to compare structure fineness and segregation with existing theory and to delineate areas where extension of existing theory is required. Materials employed are model alloys of constant partition ratio 'k' (such as Al-Cu alloys) and materials with a retrograde solidus (such as Zn-Cd). Techniques will be employed in achieving rapid solidification (10 to the 4th power-10 to the 8th power degrees C/sec) that: (a) require nucleation, such as 'splat cooling', and (b) do not require nucleation, such as 'layer glazing'. Structure and structural homogeneity will be determined quantitatively as a function of cooling rate. Results of critical experiments performed will delineate and distinguish the basic mechanism(s) important for achieving homogeneity. It is hypothesized that one or more of the following mechanisms is responsible for the homogeneity obtained in rapidly solidified metallic materals: (1) depression of the homogeneous nucleation temperature; (2) nucleation substantially below the liquidus temperature but above the temperature usually assumed to be the homogeneous nucleation temperature; (3) solute building in front of the growing interface; and (4) nonequilibrium interface kinetics. It is expected the results of this investigation will define the specific mechanism(s) and the conditions, necessary and sufficient, to achieve homogeneous structures in select rapidly solidified metallic systems. This program is an extension of research, previously funded by NSF Grant DMR76-21551. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0013, INFRARED AND OPTICAL DOUBLE RESONANCE SPECTROSCOPY

J.I. Steinfeld, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (CHE77-08323 A01)

In this program, Dr. Steinfeld will continue research on coherent transient and double resonance spectroscopy in the infrared and microwave regions, and extend these techniques into the visible portion of the spectrum. The infrared and microwave experiments will focus chiefly on those systems which will help to clarify interpretation of the results in terms of molecular inelastic processes, with particular emphasis on HCN. Other experiments will be directed toward rotational identification of transitions pumped by infrared lasers in asymmetric rotors such as vinyl halides and methanol.

In the visible-U.V. region, coherent transient and double resonance experiments will be carried out using the dye laser facility in the M.I.T. Spectroscopy Laboratory. Stark-switching methods will be used to generate nutation, echo and other multiple-pulse transients in electronically excited states of polar molecules, permitting measurement of the state dependence of T1 and T2 relaxation times. These methods will be applied to the analysis of congested spectra by Fourier Transform methods. In addition, I.R.-visible double resonance will be used in the study of the electronic spectra of infrared multiphoton states.

This research represents a continuation of that currently supported by Foundation grant CHE-76-11361.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0014, MAGNETIC INTERACTIONS AND PHASE TRANSITIONS OF POLYMERIC TRANSITION METAL COMPLEXES

W.M. Reiff, Northeastern University, School of Liberal Arts, Dept. of Chemistry, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR78-12191)

In the first area of interest, new linear and distinctly nonlinear zig-zag chain polymeric transition metal complexes are studied as part of a search for unusual manifestations of low dimensionality magnetic behavior. A primary goal in this work is systematic investigation of the effects of variation of intrachain superexchange as transmitted by a variety of polyatomic ligands on overall three-dimensional magnetic ordering.

The second area of interest includes: (a) cooperative, reversible order-disorder transitions of complexes; (b) reversible displacive transitions along a transition metal-organic ligand polymer chain; and, (c) irreversible temperature dependent changes of coordination number and geometry in the solid state.

The most important measurements are of field and temperature dependence of Mossbauer spectra, and magnetization of powders and crystals over the ranges 0 to 210kG and 1.5 to 400K respectively.

This is the first year of a three-year continuing grant.

This is a continuation of research supported under DMR 75-13592.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0015, THEORETICAL STUDIES OF POSITRON/MOLECULE SYSTEMS AND THEIR ANNIHILATION

P.E. Cade, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Chemistry, *Amherst, Massachusetts* 01002 (CHE77-08542 A01)

Dr. Cade will study the electronic structure of positron/molecule systems, which are chemical entities with very short lifetimes (about 10 to the minus 9th power sec) and hitherto unstudied properties. The major thrust of this research is to establish the existence (or not) of these unusual new species. The methods of quantum chemistry with extension to special requirements for positrons will be employed in these theoretical studies. Several investigations are planned: (1) Benchmark studies of small molecules such as (H anion; positron) and (Li; positron) with state-of-the-art theoretical methods. (2) The construction of computer programs and calculations on simple molecular-ion/positron systems such as (OH anion; positron), (CN anion; positron), and (N3 anion; positron) within the Restricted Hartree-Fock approximation. (3) Consideration of simple neutral-molecule/positron systems such as (O2; positron), (H2O; positron), (NH3; positron), etc; (4) Exploratory calculations on larger, chemically more interesting, molecule/positron systems using minimal STO basis set calculations (via Gaussian basis sets) within the Roothaan-Hartree-Fock theory. A central feature of these investigations will be a consideration of the annihilation characteristics of these molecule/positron systems. This research represents a continuation of that currently supported by Foundation grant CHE-7610117.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0016, MICROSTRUCTURE AND PROPERTIES OF POWDER-PROCESSES ALUMINUM- LITHIUM ALLOYS

S.M. Sastry, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF054940; F49620-79-C-0039)

AF function - the use of Al-Li alloys in aerospace structures provides the potential for weight and life-cycle-cost reductions. Opportunity - additions of Li to Al, Al-Cu and Al-Mg alloys have resulted in a considerable improvement of strength/weight and stiffness/weight ratios, with each weight per cent Li resulting in a 3 per cent reduction in density and a 6 per cent increase in Young's modulus. Alloys based on the Al-Li system are thus capable of developing unique and attractive combinations of high specific strength (10 per cent increase) and high specific modulus (10 per cent increase), thereby enabling potential weight savings in aircraft structural members. Objective - this research provides a systematic investigation of deformation and fracture characteristics of Al-Li alloys to identify beneficial alloying elements and microstructures, and to provide guidelines for the systematic development of rapid quenching and powder metallurgical methods for producing Al-Li alloys. A potential exists for improvements in the ductility and toughness of Al-Li alloys by the slip homogenization that can be effected by grain refinement and by ancillary element additions to provide a controlled dispersion of incoherent dispersoids. How work contributes - Al-Li alloys can provide significant weigh savings and life-cycle-cost reductions compared with existing aluminum alloys and composite materials in forward and aft fuselage structures and upper wing covers. Li-containing aluminum alloys

presently processed by conventional casting methods have unacceptable ductility and toughness.

The program is divided into three phases. In Phase I, a systematic investigation of modifications in microstructures and properties effected by rapid quenching and addition of ancillary alloying elements to binary Al-Li alloys will be conducted. In Phase II, the optimum ancillary alloying elements selected from Phase I will be added to Al-Cu-Li, Al-Mg-Li, and Al-Zn-Mg-Cu-Li alloys, and alloy powders will be produced as flakes and spherical powders by three different rapid-solidification techniques. The properties of the alloys as influenced by the powder type, consolidation and processing parameters will be studied. In Phase III, a detailed investigation will be conducted of microstructures, tensile properties, fracture toughness, creep, fatigue, and corr (Text Truncated - Exceeds Capacity)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, MOSSBAUER EFFECT STUDIES IN SOLID STATE CHEMISTRY

R.H. Herber, Rutgers the State University of New Jersey, New Brunswick Campus, School of Chemistry, Dept. of Chemistry, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR78-08615)

Research is being carried out in three related but distinct areas: lattice dynamics and vibrational anisotropy studies, structure and bonding in organotin compounds, and structure and bonding in solids containing Sn(II).

The first area involves study of the effect of radiation damage -especially that due to the formation of fission fragments - in a uranium-tin alloy in an attempt to elucidate the relationship between fission fragment damage and lattice temperature of the solid. Detailed lattice dynamical studies in the systems M2FeO4 and M Fe(Cn)5NO.nH2O are designed to examine the vibrational integrity of the Fe(VI)O4-- and Fe(II)(CN)5NO moieties, respectively. Other work involves a lattice dynamical study of NbS2.Sn and NbS2.Sn1/3 in order to gain a better understanding of van der Waals layer compound lattices.

The second area is concerned with the structure, bonding, and lattice dynamical properties of polynuclear organometallic compounds as related to further tests of the effective vibrating mass (EVM) model of intermolecular bonding forces.

The third area is concerned with the relationship between stoichiometry, solvation, and stereochemistry in a new class of tin (II) compounds with cyclic polyethers.

This is a continuation of work supported by DMR 76-00139. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0018, INTERDISCIPLINARY MATERIALS RESEARCH

H.H. Johnson, Cornell University, Ithaca Campus, Materials Science Center, Dept. of Materials Science & Engineering, *Ithaca, New York* 14850 (DMR76-81083 A01)

The award will support the continuation of major research programs on phase transitions, mechanical properties, surface science, optical phenomena, defect structures, and new solid state materials. In addition extensive experimental facilities will be partially supported, as well as some research of exploratory nature, directly or partly related to the major concentration areas.

This award is a continuation of DMR76-01281.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0019, DIFFRACTION STUDIES OF THE STRUCTURE OF GRAIN BOUNDARIES

S.L. Sass, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR76-24180 A01)

This is a continuation and extension of studies on the detailed nature of grain boundaries in metallic materials. Investigations underway include diffraction studies of: (i) the structure of high angle twist boundaries in Au; (ii) segregation to grain boundaries; and (iii) the surface structure of thin films. The results from the twist boundary study will be used to assess computer models of general grain boundaries. The research underway is designed to provide a detailed understanding of the atomic structure of grain boundaries both in the presence and absence of solute atoms. The knowledge gained is expected to enhance understanding of the influence of grain boundaries on properties of metallic materials. This is a continuation of NSF grant DMR76-24180.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0020, EFFECTS OF SINTERING CONDITIONS AND COMPOSITION ON PROPERTIES OF PEROVSKITE-STRUCTURE OXIDES

D.M. Smyth, Lehigh University, Materials Research Center, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DMR78-20072)

Ternary oxides having the perovskite structure have found major applications as ferroelectric capacitor dielectrics, piezoelectric transducers, and electrooptic materials. Their critical properties have been found to be extremely sensitive to processing details and to impurity content. Previous work on the defect chemistry of polycrystalline barium titanate and strontium titanate has produced a foundation of understanding and experimental techniques which has led to this study of the chemistry of the high temperature processing steps and the mode of impurity incorporation in the perovskite-structure titanates. This will involve an investigation of the amount of excess rutile incorporated as a function of impurity content and processing parameters. It will also include a study of the site-preference of selected trivalent impurities as a function of processing conditions. In the course of this program, the ability to prepare samples of precisely known composition has been demonstrated, and the high temperature, equilibrium conductivity measurement has been refined to give an accurate, geometry-independent measurement of the net amount of excess rutile and acceptor impurity in solid solution. As a supplement to the latter technique, electron paramagnetic resonance spectroscopy will be investigated as a supplemental means of identifying the lattice site occupation of specific impurities as a function of the conditions prevailing during the incorporation step.

This is a renewal of NSF Grant DMR74-21095 A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0021, MOLECULAR BEAM KINETICS - LASER AUGMENTED STUDIES

R.B. Bernstein, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Chemistry, *200 W. 21st St., Austin, Texas* 78712 (CHE77-11384 A01)

A basic research program in the field of molecular reaction dynamics is to be carried out. A number of elementary chemical reactions involving neutral reagents are to be studied in detail. The goal is to gain quantitative dynamical information such as state-to-state differential reaction cross sections, suitable for comparison with theory. An important question is the efficacy of internal excitation of a reagent molecule in promoting its reactivity, compared to that of the relative translational energy of the colliding reagents. The principal tool to be employed is the crossed molecular beam scattering technique, augmented by the use of tunable lasers coupled to the reactive scattering of vibrationally excited reagent molecule beams (e.g., HCl), and analogous experiments with electronically excited reagents, e.g., Hg(63Po) and 2; laser excitation studies with oriented molecule beams (e.g., CH3F); and selective detection of internally excited molecules (nascent reaction products). Associated theoretical-computational studies are also to be carried out. Such fundamental knowledge at the 'micro' level can serve as a guide to future research at the 'macro' level in the field of laser-induced chemistry. This research represents a continuation of that for-

merly supported at the University of Texas at Austin by Foundation grant CHE-7304940.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0022, ENERGETICS OF POLYMER CRYSTALLIZATION

B.L. Farmer, Washington State University, School of Engineering, Dept. of Materials Science & Engineering, *Pullman, Washington* 99163 (DMR77-20604)

The technique of energetics analysis - computerized molecular model building and evaluation - has been applied to a variety of questions relevant to the structure and properties of semicrystalline polymeric materials. This study deals with an investigation into several aspects of polymer crystallization using this same technique. Specific problems to be examined include the geometrics and energetics of the association of a chain segment on the crystal growth face, as well as the energetics involved in the movement of such a chain on the growth face, of the molecular folding process, of an orderly arrangement of chain folds into a regular surface, and of association of molecules with the fold surface. In order to focus the computational effort on the problems of interest, the calculations will simulate linear polyethylene, because of its relatively simple structure. In addition, experimental investigation of the cocrystallization of polyethylene and lightly chlorinated polyethylene will explore the role of a kinetic adsorption process in polymer crystallization. This study promises to further our knowledge and understanding of the molecular processes influencing polymer crystallization, especially when undertaken in the context of the already available wealth of experimental data and theoretical treatments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, TURBINE ENGINE LOW ASPECT RATIO TECHNOLOGY

P.R. Dodge, Garrett Corp., *402 S. 36th St., Phoenix, Arizona* 85034 (DF456730; F33615-74-C-2017)

This program extends the successful technology of AF contract F33615-68-C-1208 to low aspect ratio turbine blade problems, especially for high temperature cooled blades.

A time phased effort to identify the loss mechanisms of low aspect ratio cooled turbines will be pursued. Cold stationary and rotating rigs will be used to verify loss mechanisms and evaluate methods to reduce these losses. The approach to this improvement is expected to extend the work of F33615-68-1208.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0002, MIXED FLOW COMPRESSOR

J.L. Dodge, Signal Co. Inc., Airesearch Manufacturing Company, *402 S. 36th St., Phoenix, Arizona* 85034 (DF459910; F33615-79-C-2028)

Design, development and demonstration of a single stage mixed flow compressor that exhibits performance equivalent to todays state-of-the-art multi-stage axial compressor at substantially lower cost.

The program includes mechanical design and development in parallel with aerodynamic design of a single stage mixed flow compressor. Complete mapping of the compressor under simulated engine test conditions would follow the fabrication phase.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0003, THE STRUCTURE OF TURBULENT VELOCITY FIELDS

F.H. Champagne, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (DF055190; F49620-79-C-0224)

AF function - advanced aerospace vehicles. Opportunity - increased understanding of turbulence and turbulent velocity fields in diffusing and jet augmented flows. Objective - investigate the origin and evolution of puffs in relaminarizing flows and the structure of wakes and jets in co-flowing streams with pressure gradients. How work contributes - a better understanding of the turbulence relaminarization in ducts and the effects of downstream pressure gradient on the persistance of wakes and the mixing of co-flowing streams is directly applicable to many applications of interest to the Air Force in the design of advanced aerospace vehicles, namely, high speed diffusers, jet pumps and augmentors and combustion systems.

An experimental program will be pursued to study the origin and evolution of turbulent puffs in relaminarizing pipe flow. Data on the development of the puffs will be obtained using upstream flush mounted hot wire probes and an array of 10 hot wires panning the radius of the pipe at the exit plane. Investigation of wakes and jets with various downstream pressure gradients will be undertaken in a low turbulence wind tunnel being installed at the University of Arizona.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, ELECTRET TAPE SENSOR DEVELOPMENT

G.K. Miller, GTE Sylvania Inc., *Mountain View, California* (DF738980; F30602-78-C-0320)

The objective of this effort is to investigate and demonstrate a technique for the development of a line sensor that can be applied like tape to fences, interior and exterior building walls, aircraft skins, etc. The concept to be demonstrated is basically an active ultrasonic Doppler system using electret layers in the tape as radiating and receiving elements.

The results of previous work recommended that a dual system comprised of two electret strips fabricated on one substrate would be the most advantageous configuration for long transducer lengths. The approach for achieving the objective will be as follows: A) Identify the optimum design for the dual system configuration. B) Fabricate samples of the design considered optimum and measure radiation and receiving performance of this design. C) Modify the design based on the results obtained and have a laminates manufacturer fabricate long samples for evaluation and delivery. D) Based on the final transducer design, design and fabricate the driving and receiving electronics which will then be integrated with the transducer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0005, ELECTRON TRANSPORT IN ULTRA-THIN HETEROJUNCTIONS

P.D. Depkus, Rockwell International Corp., *3370 Miraloma Ave., Anaheim, California* 92803 (DN875608; N00014-78-C-0711)

Advancing the capability of Navy electronics systems required understanding of the properties of newly developed materials and their application to new electron device geometries. Ultra-thin heterojunctions in gallium arsenide and gallium aluminum arsenide can now be fabricated and their electronic transport properties must be investigated to verify their device potential.

Thin heterojunction devices will be fabricated by the metal-organic chemical vapor deposition (MO-CVD) technique. 50 to 1000 angstrom layers of gallium arsenide will be sandwiched between high resistivity gallium aluminum arsenide layers with abrupt change in composition at the junctions. Electron transport measurements will be made on the properties of the device for current flow parallel and perpendicular to the junctions. These will include C-V, I-V, DC conductance and Hall voltage measurements, in order to determine carrier concentration, mobility, and resistivity as a function of temperature, doping concentration, difference in bandgap between the two materials, and the layer thickness. Because of the thinness of the GaAs layer, carriers are quantized in the direction perpendicular to the junctions. The device properties will be investigated in

terms of this quasi-two-dimensional density of states and the energies of the resulting subbands in this quantum well. Initially, studies will concentrate on properties of a single well and later will be extended to multilayer structures for investigation of superlattice concepts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, REFURBISHMENT AND ENGINEERING SUPPORT OF RECOVERED ATTITUDE CONTROL SYSTEM AND UPDATING OF MIDAS PLATFORM LOGIC
E. Foglesong, Space Vector Corp., *Northridge, California* (DF248080; F19628-76-C-0278)

AF function - direct support of aerospace environmental research measurements program. Deficiency - lack of knowledge of rocket attitude control and behavior. Objective - to provide the Air Force with a refurbished, reliable, accurate and low cost attitude control system (ACS) and MIDAS platform for sounding rockets. How research contributes - contributes significantly to the cost-effectiveness and scientific utility of rocket-borne payloads which probe the aerospace environment.

Refurbish recovered rocket-borne attitude control systems and provide ancillary engineering and launch support services. Additionally, update MIDAS platform electronic logic and retrofit into existing systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0007, CLOSURE RELATIONS IN FLUID MECHANICS
D. Baganoff, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (ENG75-15230)

Purpose of this research project is to apply a closure scheme for the solution of the Boltzmann equation for shock-wave structure. Particular attention will be focused on implications of the operations of straining and shifting in velocity space and the physical consequences of the continuum interpretation of these closure relations. Complete shock-wave structure computations will be carried out starting with the 13-moment equations. Direct comparisons will be made of the fluid dynamic variables with purely numerical solutions to the same shock structure problem.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0008, BASIC STRUCTURE AND PROPERTIES OF TURBULENT SHEAR FLOWS
S.J. Kline, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DF053840; F49620-79-C-0010)

AF function - advanced airbreathing propulsion devices. Opportunity - increase understanding of the basic flow structure and computational ability for turbulent shear flows. Objective - increase understanding of basic flow structure of separating and separated flows. Study of effect of wall curvature on these flows and also on heat transfer will be made. How work contributes - improvement in both physical understanding and prediction ability will permit better design of any system (jet engines, turbine blades, diffusers, airfoil sections) in which these flows become limiting or controlling factors.

A combined experimental and theoretical program on turbulent shear flows has been established. Studies will be made of unseparated, separating and fully separated flows. Examination of transitory and fully stalled flows in diffusers will be accomplished. The effect of wall curvature on turbulence structure function and heat transfer will also be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, F100 NON-RECOVERABLE STALL INVESTIGATION
Unknown, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DF463970; F33615-79-C-2048)

To investigate the F100 non-recoverable stall phenomena and to develop working models that will duplicate the engine signature during non-recoverable stall.

Existing data from AEDC shall be analyzed for information content, data quality. Analytical models shall be developed from existing engine simulations and AEDC stall data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0010, EXPERIMENTAL INVESTIGATION OF COMPRESSOR ROTOR WAKES
R.P. Dring, United Technologies Corp., Research Labs, *400 Main St., East Hartford, Connecticut* 06108 (DF461860; F33615-77-C-2083)

The objective of this effort is to obtain experimental data which would improve the modeling of secondary flows incorporated in current through-flow axial compressor design systems.

Obtain accurate, detailed circumferential radial, and axial distributions of total and static pressure and the three components of the flow velocity downstream of a rotating axial compressor rotor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0011, VARIABLE GEOMETRY COMBUSTOR DEVELOPMENT
Unknown, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF462730; F33615-78-C-2043)

Design and develop a variable geometry combustor for optimized performance and emissions over its full operating range. A full annular demonstration will be developed to substantiate design interest and establish performance capabilities and limitations.

Conduct detailed component design, experimental analysis and full scale demonstrator development. Control techniques to be studied will include flow splitting and primary and secondary mixing controls.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0012, RESOC (RESEARCH ON SONOBUOY CONFIGURATIONS) REMOTE FUNCTION CONTROL
R. Wager, Magnavox Government & Industrial Electronics Co., *1313 Production Rd., Fort Wayne, Indiana* 46808 (DN981000; N62269-78-C-0369)

To determine the feasibility of selection depth, life, and channel of a sonobuoy during flight. This work supports work unit ZU701, Agency Accession No. DN 681083.

Develop a hand held control to interface with the sonobuoy for on the ground selection in addition to selection on the aircraft.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

4.0013, LASER VELOCIMETER MEASUREMENTS & ANALYSIS IN TURBULENT & MIXING FLOWS
H.D. Thompson, Purdue University, Purdue Research Foundation, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DF461070; F33615-77-C-2010)

To experimentally and analytically investigate the biasing of individual realization LDV signal and to investigate the feasibility of the use of fluorescent dye tracers in the study of mixing and turbulence.

The effort shall include the further development of existing turbulence and mixing models, the identification of the LDV signal biasing associated with the models and the development of carefully controlled experiments to measure the biases in

actual flows. A suitable experiment shall be defined and carried out to determine the feasibility of the use of fluorescent dye tracers in the study of mixing and turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0014, ADVANCED STRAIN GAUGE PRESSURE TRANSDUCER
Unknown, Gould Inc., Chesapeake Institute Division, *6711 Bay Meadow Dr., Glen Burnie, Maryland* 21061 (DF463040; F33615-78-C-2064)

To test and evaluate the impact of an improved strain gauge deposition process and lead-wire attachment technique on the operation of strain gauge pressure transducers used in gas turbine engine control and diagnostic systems.

Three phases: (1) bench test new strain gauge approach to validate operation and durability, (2) implement in a pressure transducer and evaluate performance, (3) piggyback engine test transducers to judge operational suitability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0015, RECOGNITION OF MOVING OBJECTS USING ONE VISUAL SENSOR
A.A. Desrochers, Boston University, School of Engineering, Dept. of Systems Engineering, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (DF054310; AFOSR-79-0039)

AF function - reconnaissance. Deficiency - inability to process images in a timely fashion. Objective-develop methods of recognizing moving aerial objects. How work contributes - reinforce conjecture that some regions of targets are informationally richer than others and that shape recognition is a hierarchical process.

Investigate transformations of moment invariants including the theory of algebraic invariants that apply to recognition of aircraft. Develop algorithms for classifying regions of an object that are silhouette invariant. Identify further topics for research in region analysis techniques, aspect invariant shape descriptions, and algorithms for processing moving images.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, AUDIO AVIONICS CONTROL/STATUS SYSTEM
L.A. Sorenson, Semcor Inc., *1500 N. Kings Hwy., Cherry Hill, New Jersey* 08034 (DN081138; N62269-79-C-0009)

Generation of a functional configuration governing the implementation of an audio avionics control and status system. The configuration is to define an overall aircraft avionics system which will enable the implementation of voice recognition and synthesis equipment as part of the overall avionics system configuration. This contracted effort supports work unit ZC101, Agency Accession DN 081123.

Study and analysis analyze modern day avionics system implementation multiplex data bus control status audio signals and trends then couple this with present and future VRAS technology projections for generation of a configuration which will allow for the incorporation of such technology VRAS when available.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0017, BOUNDARY LAYER TRANSITION AND PARTICLE INDUCED HEATING IN HYPERSONIC FLOW
M.S. Holden, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF053750; F49620-79-C-0003)

AF function - advanced aerospace vehicles. Deficiency - the predictive capability for boundary layer transition and for particle-induced heating on reentry vehicles is inadequate. Objective - to provide evidence leading to the development of a greater understanding of the gross features of the initial formation and growth of turbulent instabilities in the transition region of a hypersonic boundary layer. Also, to develop methods to predict the magnitude of particle-induced heating augmentation of hypersonic vehicles traveling in a dusty environment. How work contributes - once the relationships among geometry, ambient flow conditions, heating rates, and flow instabilities become better understood, rational engineering design methods can be developed to optimize the thermal protection and aerodynamic performance of reentry vehicles.

In the study of transition, high speed Schlieren photographs of the formation and development of instabilities in a laminar boundary layer, obtained with a camera capable of framing rates of up to 100,000 frames per second, will be correlated with the outputs from high frequency thin film gages mounted in the transition region of sharp and blunted cones at Mach numbers from 11 to 13. The characteristics of the regular instabilities observed upstream of transition and the formation and development of the turbulent bursts will be determined. In a previous experimental program, detailed heat transfer and pressure measurements were made to explore the various fluid dynamic mechanisms of key importance in particle induced heating augmentation. Based on this extensive data, the present program will develop models to describe the various interactions resulting in enhanced heating thereby generating methods to predict the heating resulting from single and multiple particle interactions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, ANALYSIS FOR MULTISTATIC GEOMETRIC IMAGE CORRECTION
R. Van Deusen, Cutler Hammer Inc., Ail Division, *Comac Rd., Deer Park, New York* 11729 (DF920440; F30602-79-C-0137)

Objective, to solve the problem of geometric distortion in the radar image data for a multistatic radar system. To remove the skew in this data by properly formatting and processing.

The unique and proprietary technique developed by Airborne Instruments Laboratory (AIL) will be refined and applied to the general bistatic high resolution (stretch data) wherein the target, transmitter and receiver are not all in the same plane. The method of solution will be an extension of the coherent unskewing and reconstitution logic (CURL) developed by AIL for the planar case. This technique will format the data such that the two-dimensional Fourier transform will produce a focused image for the baseline geometry.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0019, SYNTHESIS AND CHARACTERIZATION OF TRANSITION METAL COMPLEX SYSTEMS WITH NOVEL SOLID STATE PROPERTIES
L.V. Interrante, General Electric Co., General Electric Research & Development Center, *1 River Rd., Schenectady, New York* 12305 (DF054590; F49620-79-C-0051)

AF function - future Air Force flight operations require improved electromagnetic devices for use in flight control, reconnaissance and surveillance, signal processing and control, and environmental support. Deficiency - a need exists for new materials which can be exploited for the design of new concepts and classes of electronic and magnetic devices. Objective - to obtain the understanding and predictive capability necessary for effective utilization of the unique features of existing transition metal complexes in solid-state applications and to permit purposeful synthesis of new materials for satisfying the requirements. How work contributes - new electromagnetic materials will be synthesized and their properties identified.

The research focuses on the synthesis and characterization of new solid state materials containing planar transition metal complexes. The primary objectives are: 1) to elucidate synthetically useful structure-property relationships that ultimately will enable the directed synthesis of materials with desired solid state properties, and 2) to synthesize and characterize new materials with novel and useful electrical and/or magnetic properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, DESIGN GUIDELINES & OPTIMIZATION PROCEDURES FOR SUBSYSTEMS

W. Monsen, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF912180; F30602-78-C-0167)

A need exists for the development of systematic methodologies and procedures for the design of built-in test diagnostic subsystems. Such techniques should take into account the reliability characteristics of each isolatable module, the total proportion of equipment faults that the built-in test subsystem will recognize, the life-cycle costs (production, operating & support) associated with the diagnosis and isolation of each module failure, false alarm characteristics associated with each diagnostic plan and impact on equipment maintainability. All of the above should guide not only the choice of the diagnostic subsystem, but indicate just how the subsystem should be designed. What is needed are optimization tools, and algorithms which can be used during design to aid in forming the most efficient design configuration. Preliminary efforts in this area were pursued in-house and were included in MIL-STD-1591 (Analysis/Synthesis of on Aircraft Fault Diagnosis Subsystems).

The approach will involve relating such things as intended depth of BIT diagnosis and isolation, the proportion of total faults that the BIT is capable of detecting and diagnosing, false alarm characteristics and effects, the cost impacts (on life cycle-cost) of the BIT, and developing an optimized approach to the incorporation of BIT in a dependent equipment or system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0021, STATISTICAL INFORMATION PROCESSING TECHNIQUES FOR REMOTE SENSING DATA

D. Kazakos, State University of New York, Buffalo Campus, School of Engineering & Applied Science, Dept. of Engineering, *3435 Main St., Buffalo, New York* 14214 (ENG76-20295)

The problem of reduction of remotely sensed data with concurrent preservation of the interesting information is one of the main themes of this research plus developing computationally simple performance bound and of exploiting them for data reduction. Increased exploitation of the statistical structure of the data is advocated, which ordinarily would cause increased storage and computational load. The simultaneous consideration of data reduction algorithms and computationally simple performance bounds will alleviate this problem. Therefore, improved performance using the same computer resources will be the overall result of the research. The methods, when fully developed, will greatly enhance the operational capabilities of present and future remote sensing systems with automated data processing.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0022, RADIATIVE ENERGY TRANSFER IN GASES

R.D. Cess, State University of New York, Stony Brook Campus, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *Stony Brook, New York* 11794 (ENG76-82547 A01)

This research program concerns radiative energy transfer in gases, and involves the incorporation of radiative parameterizations into simple climate models, in order to estimate the sensitivity of the earth-atmosphere system to either man-made or natural climate perturbations; the inclusion of wind-blown dust into infrared radiative transfer formulations for the earth's atmosphere; an investigation into possible negative feedback mechanisms which might modify the projected global climate change resulting from the enhancement in atmospheric carbon dioxide through the burning of fossil fuels; and the development of an atmospheric radiation model for Saturn, with the goal towards producing a thermal structure model which is consistent with ground-based infrared emission observations.

This is a continuation of NSF Grant No. ENG-7204175 AO1.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Civil & Mechanical Engineering

4.0023, OPERATIONAL RELIABILITY EXPERIENCE TO IMPROVE RELIABILITY OF AF ELECTRONIC SYSTEMS

E. Florentino, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF707570)

This in-house effort will be concerned with (a) the collection from all Air Force data sources of information on the reliability of Air Force electronic comunication, command and control, surveillance, navigation, and display equipment; and (b) analysis of these data to determine the present field reliability of these items and comparison of predicted, measured, and observed field failures.

The field failure data collected will be analyzed to define the scope and impact on the reliability problem. Principal 'contributors' such as parts, equipment design, and human influences will be investigated. The influence of major offenders or 'weak links' in the system will be defined. Effects of equipment characteristics such as power output, complexity, and other factors on reliability will be determined. Reports on the above information will be published and disseminated to interested personnel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0024, FUEL CHARACTER EFFECTS ON J-79 SMOKELESS COMBUSTOR

C. Gleason, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF463590; F33615-79-C-2033)

Determine the effects of fuel characteristics (hydrogen content, end point, viscosity, aromatics types) on a lean primary zone, J-79 combustor. Compare results with similar data for a rich primary zone J-79 combustor. Determine if the lean primary zone combustor is more fuel tolerant than the rich primary zone combustor.

Through a sole-source contract to General Electric Co., perform tests on the smokeless combustor (lean primary zone) developed for the J-79. Both JP-4 and JP-8 are to be baseline fuels. Vary fuel hydrogen content, distillation end point, aromatics types and concentrations. Compare test results with similar data already obtained for rich primary zone combustor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0025, LONG BONE AND JOINT RESPONSE TO MECHANICAL LOADING

A.E. Engin, Ohio State University, Columbus Campus, School of Engineering, Dept. of Engineering Mechanics, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF055540; F49620-79-C-0110)

AF function- the Air Force operational environment involves exposures to a wide variety of mechanical forces which included flail and impact. These forces are of special significance in relation to the incidence of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. Despite design improvements on ejection seats, dislodging of the limbs occur frequently when the body is ejected into the windblast. The resulting 'flail injuries' are the dislocation of major articulating joints and various long bone injuries. Deficiency - abandoning disabled aircraft may be accomplished by either bailing out via seat ejection, or by the ejection of the encapsulated crew station containing one or more aircrew members. if separation from the disabled aircraft occurs by seat ejection, the body of the ejected crew member is subjected to a high speed air stream (windblast) generating large magnitudes of aerodynamic forces on the higher and lower extremities of the body. Objective - this research proposes a comprehensive program dealing with the biomechanics of the major articulating joints and long bones by considering the response of these joints and bones to both static and dynamic loads. Data collected from such a research program will be invaluable in understanding the flail injuries on a biomechanical basis and will provide the corner stone toward the establishment of preventive measures. How research contributes - this research will directly support Ro 1.7.1, 'Criteria for Limb Flail Injury Prevention.'

This proposal presents a comprehensive research program to study the biomechanics of flail injuries. The proposed research is divided into four phases. Phase I involves the collec-

tion of active muscle force data during simulation of windblast forces on the higher and lower extremities of the body. Phase II is concerned with quasi-static testing of the major articulating joints of cadavers in force ranges much beyond the tolerable levels by human subjects. The dynamic testing of the same joints under various impulsive load profiles will be carried out in Phase III. In the last phase of the program the fracture of long bones and dislocations of the joints will be investigated under both static and dynamic loading conditions by means of simulating as nearly as possible the appropriate mechanisms of injury. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, FINITE STATE MODELS OF MANNED SYSTEMS - VALIDATION, SIMPLIFICATION, AND EXTENSION

R.A. Miller, Ohio State University, Columbus Campus, School of Engineering, Dept. of Industrial & Systems Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF054000; AFOSR-79-0015)

AF function - Air Force operations involve a multitude of control related information processing and decision-making tasks which are performed by aircrew personnel. Deficiency - this research will increase the stock of tools available to the analyst for representing and analyzing the discrete control performance of networks of human operators. It may also point the way toward much more fundamental models suitable for the prediction of inference, decision and communication performance of manned systems. Objective - the main objectives of the study are to simplify the process of discrete control model construction and to clarify the theoretical basis, both mathematical and psychological, of discrete control modelling. Existing discrete control data bases will be used for this study. How research contributes - this research is a unique attempt to analyze discrete control decisions of the human operator in a weapon systems context. It is a direct step toward improved ability to predict manned system performance.

The proposed research will involve 1) an assessment of the robustness of previously developed discrete control models, 2) design and implementation of computer-aided procedures for the construction and identification of discrete control models of manned systems, and 3) some preliminary theoretical work on the feasibility of constructing heterarchical information processing systems to represent discrete control tasks, particularly networks consisting of manned systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, THERMAL ENERGY STORAGE/HEAT TRANSFER RESEARCH

T. Mahefkey, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF463170)

Conduct basic research on thermal energy storage and heat transfer as applied to Air Force spacecraft and aircraft power and thermal control subsystems. Initial phases of the research will center on thermophysical characterization and corrosion studies of integral heat pipe/thermal storage units, and analysis of their dynamic charge/discharge behavior.

Apparatus to process and deprocess file test liquid metal heat pipes will be purchased and assembled. Corrosion studies on S.S. and inconel 617 clad Na heat pipes will be conducted. Heat transfer modeling of O2 sorption systems will be initiated with appropriate subscale experimental investigations conducted concurrently.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0028, THEORY AND COMPUTER CODES FOR NON-EQUILIBRIUM PLASMAS

M. Stamm, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458820)

AF function - power, weaponry, communication, tracking and navigation. Deficiency - lack of knowledge of plasma interaction processes in MHD generators, gas discharges and lasers. Research -theoretical description of interaction processes in non-equilibrium plasmas. How research contributes - improved power systems, enhanced laser performance (quality, power, stability, lifetime). Valuable information on sheath development, pumping rates, laser gain, and plasma stability will be made accessible in terms of experimentally variable quantities.

Three different, yet coupled, aspects of non-equilibrium plasmas control their operation and govern their performance characteristics: (1) the electron energy distribution, (2) molecular kinetics, (3) plasma chemistry. A self-consistent theoretical investigation of plasma interaction processes is undertaken. The collisional Boltzmann equation is numerically solved to yield the electron energy distribution as a function of electric field, neutral number density, electron density, and species concentration. Molecular kinetics and plasma chemistry are consistently coupled into the calculation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0029, FRACTURE BEHAVIOR OF BORON ALUMINUM COMPOSITES AT ROOM AND ELEVATED TEMPERATURES

J. Awerbuch, Drexel University, School of Engineering, Dept. of Mechanical Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (DF054720; AFOSR-79-0079)

AF function - aerospace vehicle structure and propulsion system structure. Deficiency/opportunity - improved performance and durability in hostile environments requires advanced structural materials. Rational use of these materials demands understanding of their properties. Objective - to understand the fracture behavior of boron-aluminum composites at room and elevated temperatures. How work contributes -provides essential knowledge which will allow the benefits of metal-matrix composites (high stiffness and strength, low weight, low thermal expansion, high temperature/severe environment stability) to be applied to aerospace systems.

A combined experimental and analytical effort, with concentration on crack tip damage zones, damage growth and failure modes as well as on material characterization in terms of fracture strength and microstructural properties. B-Al (5.6 MIL, 6061-F) will be tested at room temperature and at 700 degrees F with a carefully selected range of flaw sizes and laminate orientations. Near-tip crack opening displacement will be measured using an interferometric displacement gage. Damage and flaw growth will be monitored by acoustic NDE methods and studied in detail by radiography, SEM, visible light photomicrography and other methods. Results will be correlated by LEFM and energy release rate analyses. Applicability of present theoretical results will be assessed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, MICROBIAL METHANE FERMENTATION KINETICS FOR TOXICANT EXPOSURE

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AF function - the Air Force uses large amounts of missile and jet fuels in routine operations. The toxicants proposed for study are those commonly found in AF industrial operations and are the main cause of digestor disruption at base sewage treatment plants. Deficiency - a lack of understanding of the effect of toxic substances on anaerobic methane bacteria has limited the use of microbial processes to solve pollution problems while generating energy in the form of methane gas. Objective - the objective of this study is to generate fundamental kinetic data from laboratory experiments to be used in developing a dynamic model to describe the response of methane fermentation systems to exposure to toxicants. How research contributes - this research will provide fundamental data on the effects of AF utilized chemicals on methane bacterial kinetics. Knowledge of the effects of such toxicants on anaerobic microbial processes will result in more effective use of an energy conserving procedure for disposal of AF generated pollutants.

Methane bacteria developed on an acetate-nutrient salt substrate will be used to study the effect of toxicant concentration,

acclimation, and temperature on monod kinetic coefficients. Both batch and continuous feed modes will be used to generate the kinetic coefficients. Representative toxicants to be studied are calcium, cadmium, nickel, chromium (VI), a cationic detergent, trichloroethylene, chloroform, ethyl benzene, gasoline, jet fuel (JP4) sulfide and hydrazine.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, PROPULSION INDUCED AERODYNAMICS OF V/STOL IN TRANSITION/STO

T.D. Beatty, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN081103; N62269-78-C-0036)

Development of a methodology for prediciton of propulsion induced aerodynamics of multi jet V/STOL aircraft in transition/STO flight regime. This contract supports work unit ZA601, Agency Accession No DN681080.

Advanced development of computerized prediction technique for V/STOL aerodynamics will be accomplished. An improved vortex and entrainment model will be incorporated together with a method to account for jet wake separation. An image system for ground effect will be modified to permit calcultions throughout the STO flight regime. Correlation of prediction with experiment will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0032, IR BACKGROUND MEASUREMENTS

A. Steed, Utah Higher Education System, Utah State University, School of Engineering, Dept. of Electrical Engineering, *Office in Engineering, Room L50, Logan, Utah* 84321 (DF249740; F19628-77-C-0203)

AF function - surveillance and detection, and support of USAF nuclear weapons effects development programs. Deficiency - spatial and time-varying infrared backgrounds interfere with target detection, tracking and identification. Therefore, their comparison with target emissions must be measured and understood. A lack of knowledge of the infrared properties of the upper atmosphere limits our ability to evaluate the effects of nuclear detonations on the aerospace environment. Therefore, these properties must be determined and understood. Research - measurements of infrared atmospheric emissions under both disturbed (auroral) and undisturbed conditions, utilizing rocket, satellite, balloon and aircraft platforms, supported by ground based in situ measurements, laboratory experiments and investigative studies. How research contributes - measurements of infrared atmospheric emissions provides information about atmospheric molecular composition as well as the spatial structure and temporal variations of infrared backgrounds. The results of this research are necessary for determining the characteristics of the infrared background and for predicting the infrared radiation from natural (air glow and auroral) sources as well as disturbed (nuclear or otherwise) backgrounds as they effect the design and operation of surveillance and detection systems.

To provide for the conducting of infrared field measurements utilizing sounding rocket, aircraft, balloon and satellite platforms, and to provide for the development of new instrumentation and measurement techniques and laboratory simulation studies. This effort is to include: a. Design, fabrication, testing and engineering calibration of cryogenic interferometers, circular variable filter spectrometers and radiometers. B. Design and fabrication of supporting ground-based diagnostic instrumentation and field support. C. Reduction and analysis of measurements data and folding of these results into existing codes for predictive modeling. D. Design up-dating of existing state-of-the-art infrared sensor systems. E. Design and development of new infrared sensor systems with greater sensitivity and high resolution than existing systems. F. Investigation of new measurements techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, OPTICAL STUDIES OF THE MAGNETOSPHERIC CUSP FROM WEST SPITSBERGEN

C. Deehr, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-24838)

Funding under this grant will permit, in cooperation with Scandinavian scientists, a program of optical observations in the magnetospheric cusp region to be carried out from two stations underneath the dayside aurora. The objectives of the program are to obtain morphological observations of the daytime aurora as well as spectra and vertical luminosity profiles of the optical emissions. This will be accomplished by using meridian scanning photometers, all-sky cameras and wavelength scanning spectrometers at Ny Alesund and Longyearbyen on West Spitsbergen which is at a high enough latitude to be dark during the winter day and still be under the moderately disturbed daytime aurora. The purpose of the proposed observations is to document the characteristics of the particle precipitation associated with the magnetospheric cleft and to map the extent of this precipitation during different levels of geomagnetic disturbance, thereby mapping in space and time the extent of the auroral substorm.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0002, AURORAL COUPLING STUDY

J. Kan, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (DF582330; F19628-79-C-0046)

AF function - communication, navigation. Deficiency - inadequate knowledge of the electrodynamic processes responsible for the high latitude ionosphere and the development of auroral arcs adversely affects specification and design of AF systems. Objective - to develop a theoretical model for the development for thin (approximately 1 km) auroral arcs and inverted-v structures (approximately 50 km extent) to apply results to interpretation of particles and fields measured from s3-2. How research contributes - provides information concerning major source of ionospheric irregularities. Thus provides information vital for design of communications surveillance and guidance systems. Provides practical understanding of interactive processes of magnetosphere with ionosphere.

Will use television imagery of auroral arcs to construct phenomenological model. The construct theoretical model solving simultaneous Vlasov-Maxwell equations. Results to be compared with electric and magnetic field gradients measured near intense precipitation events found in auroral oval by S3-2 satellite.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0003, SPECTRAL DEPENDENCY AND POLARIZATION OF LIGHT SCATTERED BY ATMOSPHERIC ICE CRYSTALS

G.G. Sivjee, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-17511)

Ice clouds play an important role in the atmospheric radiative transfer and in the interpretation of satellite data. This is especially important in the polar regions and high altitudes where ice crystals are a common constituent of the atmosphere. Therefore, it is essential that the scattering and absorption properties of ice crystals be property formulated and not approximated from ellipsoidal particles. Because of the inherent complexity of a mathematical formulation, we propose to conduct a field experiment to determine the effect of atmospheric ice crystals on the scattering of light in the visible and near-infrared. The presence of three distinct types of ice crystal phenomena at ground level around Fairbanks, (single ice crystals of a particular habit precipitate for periods of a day to a week) and the successful

development of precision spectrophotometers capable of operating under extreme low temperatures, have eliminated to a large extent the limitation imposed on field experiments to determine scattering properties of ice crystals. With these experiments the scattering of light by ice crystals, falling with a preferred orientation in the atmosphere, will be determined. The results will express the scattered irradiance per unit volume per unit steradian as a function of wavelength, scattering angle, orientation of the scattering plane to the vertical, and the concentration and size distribution of the ice crystals.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0004, SOIL INTERPRETATIONS AND SOCIO-ECONOMIC CRITERIA FOR LAND-USE PLANNING

D.F. Post, University of Arizona, Agricultural Experiment Station, Dept. of Soils Water & Engineering, *Tucson, Arizona* 85721 (0064486; ARZT-171471-51-20)

OBJECTIVE: Determine biophysical and socio-economic factors that influence non-urban land use. Organize and deliver existing biophysical and socio-economic land related data needed for land use policy making and planning. Identify and develop critically needed data and interpretations for land-use policy making and planning; develop and evaluate alternatives to overcome soil limitations affecting land-use and environmental degradation.

APPROACH: Case studies to determine the limitation-potential of Arizona soils for various land will be conducted, and related to economic parameters whenever feasible. Special consideration to improved storage and recovery of available information via computer technology will be researched to make this information more readily available to the land use planner. A numerically oriented, machine processed digital data collected by satellite to inventory and monitor Arizona soil resources will be investigated. This has great potential use as complementary tool to support and improve the current soil survey program in arid and semi-arid regions.

PROGRESS: Continued progress has been made on the comprehensive bulletin to accompany the Arizona General Soils Map. This year's effort has been mostly library research and editing of the written information. The major research effort continued in evaluating machine processed satellite data to mapping soils, vegetation and land use in Arizona. Soil scientists from the Bureau of Land Mgmt., Forest Service and Soil Cons. Service have assisted with the evaluation, and two soil scientists have effectively incorporated this data as an integral part of their soil survey operations. These scientists report a better quality soil map is possible and significant time savings have been noted. A representative rangeland site 4,000 hectares in size was selected for detailed study to identify and quantify the characteristics of the land which determine spectral response. Uniform spectral areas were identified, ground truth data collected, and this data is now being statistically analyzed and related to the numerical satellite values. The use of machine processed satellite data as a complementary tool to improve the quality of soil mapping and reduce the time required to produce soil maps has been demonstrated. However, additional research is needed and the field soil scientist must be educated about this technology before it will be routinely used.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative
Research Office, Arizona

5.0005, CRITERIA FOR DEFINING, MAPPING AND EVALUATING RANGE SITES

J.L. Stroehlein, University of Arizona, Agricultural Experiment Station, Dept. of Soils Water & Engineering, *Tucson, Arizona* 85721 (0068372; ARZT-170709-51-14)

OBJECTIVE: Define range sites in southeastern Arizona, develop criteria for mapping associations of sites and management interpretation, develop criteria for monitoring condition and trend, and analyze existing data at Santa Rita Experimental Range in terms of sites defined.

APPROACH: Vegetative production, cover and frequency by species will be analyzed in relation to soil texture, depth, gravel content and other characteristics using correlation, regression and ordination techniques to define sites. Sites defined above will be mapped on test areas at various scales of aerial photography to develop basis for extrapolating and interpreting field measurements. Sites with differing land use histories will be studied to determine reaction of plant communities to use as basis for monitoring condition and trend. Historical records at SRER will be analyzed in terms of sites to further characterize reaction of sites to management.

PROGRESS: Research by four master degree candidates and three Ph. D. candidates are currently in progress on this project. The one Ph. D. project is near completion. In this study on the Santa Rita Experimental Range, plant frequency and cover data and soil profile data were collected on 90 macroplots. The macroplots were selected to represent two precipitation zones, three groups of soils, and three levels of historical livestock use with the no use level represented by 50-year-old exclosures. Seven range sites were identified by cluster analyses of soil characteristics and plant frequency data. The soil factors which were effective in separating sites were depth and texture of the surface soil, gravel content, and presence or absence of a B horizon. Plant composition, species diversity, and species reaction to grazing were different among sites. One study nearing completion relates to a 10-year forage production data to soil characteristics, and a new study will relate production data over many years to precipitation. Two continuing studies emphasize plant frequency sampling procedures and their use in identifying range sites and evaluating condition and trend. Two studies near Winkelman, Arizona emphasize soil-vegetation relationships and the mapping of soil-vegetation sites by remote sensing.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative
Research Office, Arizona

5.0006, TRACE-ELEMENT RADIOGRAPHY, WITH EMPHASIS ON METEORITE STUDIES

D.S. Burnett, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sciences, *1201 E. California Blvd., Pasadena, California* 91109 (EAR76-84402 A01)

This is a continuation of research supported by NSF grant EAR76-84402 concerning the determination of trace element distributions by the method of particle track radiography. This sensitive technique may be used to determine the concentration and spatial distribution of trace amounts (.01-1 ppm) of elements such as boron, lead, bismuth, thorium, and uranium, in which specific nuclear reactions may be induced to yield alpha particles or fission fragments. Specific objectives of the project include (1) measurement of Th/U ratios in carbonaceous chondrite meteorites to check anomalous variations from the constant value of primitive solar system objects, (2) determination of Th/U distributions within individual meteorites, and (3) determination of the boron content of biogenic silica (sponge spicules) as a function of the salinity of the environment of growth. These meteorite studies will provide important data on the variability of isotopic abundances in primitive materials and on possible fractionation effects for actinides. These data provide constraints on possible theories of nucleosynthesis. The biogenic boron data may provide a means of determining salinities of ancient marine environments.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0007, A NEW THEORY OF IONOSPHERIC SPREAD F ECHOES

H.G. Booker, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (ATM78-02625)

This grant funds research on the physical mechanisms and radio propagation consequences of ionospheric irregularities. These irregularities have been recognized for about half a century, as manifestated by ionosonde 'spread F' echoes, yet we are still far short of a satisfactory understanding of these phenomena. This research treats a theory of spread F based, in the HF band, on an inverse power law spectrum of irregularities of ion-

ization density extending from an outer scale (wavelength/(2 pi)) linked to the scale-height of the atmosphere down to an inner scale of the order of the ionic gyroradius. The irregularities are assumed to be aligned along the earth's magnetic field and to have lengths of the order of the outer scale. It is also assumed that a weak extension of this spectrum, probably in the form of an angular spectrum of compressional plasma waves, exists from the ionic gyroradius down to the electronic gyroradius, and on this basis a theory is outlined of spread F echoes in the VHF band. This research will develop these theories and apply them to all forms of spread F.

Strong spread F is pictured as arising from an instability, not in the ionospheric plasma, but in the neutral atmosphere. Under evening and pre-sunrise conditions near the magnetic equator there can be unusually strong amplification with height in the fluid velocity associated with acoustic gravity waves, especially at frequencies just below the Brunt frequency where the phase-velocity of the waves is unusually low. This work will study the notion that the fluid velocity can then exceed the phase-velocity, leading to 'breaking' of the acoustic gravity waves and to consequent plasma turbulence.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0008, STUDIES OF PULSAR RADIO SIGNALS AFTER REMOVING INTERSTELLAR DISPERSION

B.J. Rickett, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (AST76-03745 A01)

This research program is designed to study the microstructure of pulsars at radio frequencies through use of on-line and off-line dispersion removal. That is, the smearing effect in the pulsar signal caused by the presence of interstellar material must be removed to permit analysis of the data. Data from the stronger pulsar pulses will be analyzed to reveal typical time scales and spectral widths of the microstructure. Further analysis of these microstructure data will concentrate on the radio spectrum, polarization and longitude dependence. This latter study will clarify the relationship between subpulses and micropulses. Development will be done of a practical swept local oscillator technique for on-line dispersion removal. This technique will be applied to study the morphology of microstructure of a much larger sample of (weaker) pulsars. The results will be compared with the 'polar cap' models of pulsar radiation. Results from this work will lead to better models and understanding of pulsar structure and radiation mechanisms.

This is a continuation of work previously supported under NSF grant AST76-03745.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

5.0009, SATELLITE-BASED AVIATION WEATHER FORECASTING

T.H. Vonder Haar, Colorado State University, School of Engineering, Dept. of Atmospheric Science, *Fort Collins, Colorado* 80523 (DF581930; F19628-78-C-0207)

AF function - weather observation, analysis and forecasting. Deficiency or opportunity - lack of adequate information to meet military weather support requirements. Objective - develop a procedure to utilize relatively fine scale geosynchronous satellite data (GOES), conventional synoptic scale weather data and a trained forecaster to produce improved short-range forecasts of terminal weather conditions. The procedure will emphasize automated forecast techniques and by careful monitoring of weather conditions will bring in the forecaster only where large and important weather changes are imminent. How development contributes - a successful development of this procedure will lead to improved short-range forecasts and also to a reduced workload for centralized forecasters.

A system will be set up to make automated short-range forecasts at a number of locations using geosynchronous satellite data. The computer will also scan objective forecasts and observations for the same locations. A technique will be developed to isolate locations and times when important, unforecast changes are likely to occur and a forecaster using satellite information could improve upon the forecast.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0010, MEASUREMENT AND ANALYSIS OF SOLAR RADIATION IN FOREST STANDS - A NEW APPROACH

K.L. Reed, Yale University, School of Forestry & Environmental Studies, *205 Prospect St., New Haven, Connecticut* 06511 (ATM78-05675)

This project will characterize the vertical distribution of solar radiation in forest stands. The experimental approach consists of reversing the classical source/sensor relationship by placing radiation sources at different vertical levels within forest stands and assaying the radiation transmitted through the above lying canopies. The radiation emitted from these stands is then measured using a sensitive light detector carried on an aircraft. Data produced in this manner are independent of ambient light conditions and, therefore, reflect only the influence of forest structure and foliar biomass upon radiation transmission. By characterizing the radiation climate in forest stands and simultaneously correlating this to measured structural features and foliar biomass distribution, a method can be developed to accurately estimate insolation in forest stands based upon stand structure and measurements of incident direct and diffuse radiation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0011, TECHNICAL SUPPORT FOR POLAR RESEARCH PROGRAMS

T.P. Kelly, U.S. Dept. of Defense, Navy, Naval Sea Systems Command, *Washington, District of Columbia* 20362 (DPP78-20114)

The Applied Physics Laboratory of Johns Hopkins University will maintain and operate the Airborne Research Data System (ARDS) and the magnetometer system on the Division of Polar Programs' research configured LC-130 logistics aircraft during the remainder of calendar year 1978. This activity will include assisting researchers with integrating their instruments on the aircraft prior to austral summer 1978/79 and providing the necessary field support during the airborne research missions in November and December, 1978.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0012, PREDICTING LAND USE EFFECTS ON RUNOFF QUANTITY AND QUALITY IN THE SOUTHEAST

L.H. Allen, State University System of Florida, University of Florida, U.S. Dept of Agriculture Federal Research Office, Soil & Water Research, *Gainesville, Florida* 32601 (0045185; 7602-20810-002)

OBJECTIVE: Determine effects of land use and improved management on reduction of N, P, and Cl losses from Spodosols. Determine watershed response for storms to determine methods of reducing stream nutrient loads. Determine feasibility of airborne microwave sensing of soil water of Spodosols.

APPROACH: Expand number of water quality sampling stations, types of analyses and number of stream flow recording sites to document effects of changing dairy land management practices. Determine nutrient contributions from stream channels, cattle holding areas, and dewatering of streambanks (subsurface flow) by measuring nutrient concentrations and movements from these sources. Maintain existing rainfall, groundwater, discharge, and weather measurements to compute nutrient loads and determine meteorological as well as land use factors on stream loads. Take intensive soil moisture parameter measurements to support airborne microwave experiments.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Florida - Antilles Area

5.0013, NAVY ENVIRONMENT - TRANSIENT PROCESSES IN OCEAN CURRENTS

W. Duing, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, Dept. of Marine & Atmospheric Sciences, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (DN575081; N00014-75-C-0173)

Increased knowledge of the spatial and temporal variability of oceanic current systems is essential if the Navy is to improve its ASW capability. Not only do these induce changes in sound propagation characteristics needed for ASW, but they also affect other missions such as search and rescue and salvage operations.

Direct observations are made of ocean current systems (such as the Florida current, the Somali current, and the equatorial undercurrent). These observations include moored current meters plus CTD and EBT profiles. In addition, infrared sea-surface temperature maps are obtained from satellites (such as the DMSP) for use in tracking the surface expression of such currents.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0014, RESEARCH ON ATMOSPHERIC WAVES AND CLIMATE VARIABILITY MECHANISMS

M.A. Geller, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (ATM77-18679 A01)

This work will complete research on planetary-scale waves in the atmosphere and on gravity wave instabilities in the vicinity of critical levels that was begun under NSF grants GA-41843 and DES74-08314. New efforts will be made to model nonmigrating atmospheric tides and to investigate over various altitude ranges the various mechanisms for giving rise to nonmigrating tidal components.

Initial investigations will be made of the feasibility of determining the yearly differences in the global distribution of diabatic heating in the troposphere from general circulation data, and in modelling the seasonal and yearly variations in the mass and heat transport by oceanic western boundary currents. The long term goal of these studies is an investigation of various atmospheric and oceanic processes that might affect climate variations on a seasonal and yearly time scale.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0015, SPECTROMETER FOR ULTRAVIOLET HORIZONS

R.A. Crabbs, Research Support Instruments Inc., *Timonium, Maryland* 21093 (DF583270; F19628-79-C-0044)

AF function - spacecraft guidance and control, target detection and tracking, surveillance. Deficiency - lack of sufficient information on UV horizons to develop horizon sensors. Objective - design, fabrication, test, and engineering field services for a spectrometer system to be flown on the shuttle or a satellite. How research contributes - this contract will provide the flight instrumentation required for observations of the earth limb in the ultraviolet. The flight measurements obtained by these instruments will be combined with laboratory calibrations, the viewing directions, and geophysical conditions to provide the earth's atmospheric radiance on a global basis for horizon sensor design assessment.

The ultraviolet spectrometer system will utilize small Ebert-Fastie spectrometers to cover the approximate wavelength range 120 to 400 nanometers. A telescope will be used to define the angular field-of-view. Scanning of the earth limb will be obtained by a mirror integral to the flight system. A series of promising wavelength bands will be observed from a three-axis stabilized platform.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, AIRFLOW NEAR WINGTIP

H.G. Norment, Atmospheric Science Associates, *363 Great Rd., Bedford, Massachusetts* 01730 (DF583540; F19628-79-M-0006)

AF function - design and operation of aircraft. Deficiency - more accurate icing information is required because new airframes such as the A10, HH-53, cruise missiles, RPV's and PGM's operate without anti-icing/deicing capabilities. Objective - to determine the effects of airflow on icing measurements made by a wingtip-mounted ice detector on the AFGL C130E cloud physics research airplane. How development contributes - objective measurements of icing are required to obtain icing probabilities for use in determining the need for anti-icing/deicing capabilities, in mission planning, in the setting of design criteria, and the development of operational procedures for flight safety.

Atmospheric Science Associates has developed computer codes for determining the effects of air flow on water drop sampling instruments mounted on the fuselage of the C130E airplane. These codes will be modified to determine airflow effects on the wingtip-mounted ice detector.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, ANALYSIS OF SMALL-SCALE SPATIAL AND TEMPORAL VARIABILITY OF PRECIPITATION IN NEW ENGLAND

F. Sanders, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ATM77-27634)

The aims of this research are: to record digital radar data covering a representative sample of New England storms; to seek parameters which will indicate quantitatively the degree and nature of organization in the observed precipitation patterns; to develop a climatology of the distribution of precipitation in this area; and to find empirical relations between the precipitation characteristics and those of the larger-scale environment. The observational tools include two radars, some special rain gauges and the conventional network of the National Weather Service.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0018, AURORAL CORRELATION STUDIES

G. Davidson, Photometrics Inc., *Lexington, Massachusetts* 02173 (DF582620; F19628-79-C-0066)

AF function - infrared optical detection systems. Deficiency - lack of knowledge of auroral atmospheric processes controlling infrared backgrounds. Objective - correlate visible and infrared emission measurements of auroral backgrounds. How research contributes - an analysis of existing auroral data will provide insight into the spatial and temporal characteristics of auroral backgrounds which can affect surveillance systems.

Calibrate, analyze, and correlate auroral data measured by a DMSP satellite, ground based photometers, and aircraft all sky cameras. By comparing simultaneous data from these sources, a spatial/temporal model of infrared auroral emissions can be inferred from known visible auroral structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, SATELLITE DATA REDUCTION ANALYSIS AND STUDIES

R.W. Fioretti, R D P Inc., *Waltham, Massachusetts* 02154 (DF580540; F19628-78-C-0226)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be predicted with sufficient accuracy. Objective - direct measurement of atmospheric density by satellite-borne accelerometers. Correlation of these results is made with coordinated experiments and solar and geophysical parameters to develop improved atmospheric models. How research contributes - permits development of accurate density forecasting techniques.

A MESA accelerometer was flown on each of three atmosphere explorer satellites. High accuracy, high resolution density data are obtained from this experiment. Telemetry data from this experiment, the EUVS experiment, and other coordinated aeronomical measurements are stored in a Sigma 9 computer at NASA/GSFC. Data are processed and accessed using a remote terminal at AFGL. Studies are to be performed to improve knowledge of atmospheric variability. Density, composition and temperature measurements will be analyzed to develop more accurate models of the geomagnetic activity effect. Also, variations related to solar radiation, latitude and local time will be investigated to provide empirical models of the neutral atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, COHERENCE TIME OF IONOSPHERIC REFRACTION

R.S. Allen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580890)

AF function - advanced radar and navigation systems. Deficiency -the sensitivity of radars which track deep space targets is severely limited by rapid loss of radio phase coherence caused by the time rate of change of refractive effects within the ionosphere. Objective -develop a technique to predict median coherence times for existing and proposed ADCOM radars which must perform deep space surveillance. Provide ADCOM with estimates of the hour to hour variability of the refractive effect with respect to its median value. How research contributes - provides basic statistics on coherent integration time which can be used in system design and trade-off evaluations for range extension to SPADATS radars and for the deep space surveillance radar system.

Use AFGL models and data to develop a technique to predict the median coherent integration time for existing and proposed ADCOM radars. Acquire and analyze observations representative of deep space radar sites to estimate the hour to hour variability of the coherent integration time.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, LARGE AREA AURORAL PROPAGATION ENVIRONMENT STUDY

J. Buchau, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583180)

AF function - satellite-borne radars and satellite communications. Deficiency - phenomenological understanding of high latitude phase scintillations (PS). Prediction and specification of ionospheric disturbances degrading VHF/UHF/SHF communications. Objective - to investigate the occurrence and severity of high latitude PS as a function of type of aurora and of the degree of geomagnetic disturbance. To verify the existence of the geometric enhancement of scintillations over the whole polar region and to document its effects on airborne reception of satellite communications.

To avoid the long lead time of installing PS measuring equipment onboard the airborne ionospheric observatory, AFGL and AFAL will make joint flights and ground observations in Canada and Greenland to collect PS data (AFAL) under various auroral conditions (midnight-, daytime-, polar-cap-aurora, quiet and disturbed) monitored by the AFGL instrumented aircraft. Using LES 9 signals the geometric enhancement of scintillations will be studied with several flights out of Alaska. Goose Bay ionospheric soundings and drift measurements and Chatanika incoherent scatter measurements will support the respective flight experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, ACTIVE CHARGE CONTROL METHODS

H.A. Cohen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583250)

AF function - satellite communications and survivability. Deficiency - electrical charging of satellites at geosynchronous altitudes by ambient particles causes anomalous switching of electronic circuitry which reduces system reliability and lifetime. Objective -development, testing and evaluation of active control techniques to simulate, prevent and control spacecraft charging. How research contributes - techniques and systems developed will be available for use on future AF satellites to optimally control electrical charging.

Contract developed charge ejection devices and systems will be tested in-house in laboratory vacuum systems, and the results will be compared against SCATHA rocket and satellite results with respect to ease of operation, ability to control charging, system complexity, power consumption and weight. Findings will be used to design new and better electrical charging control devices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, STRATOSPHERIC COMPOSITION

C.C. Gallagher, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF244790)

AF function - military operations of aircraft and missiles in the stratosphere. Deficiency - the environmental effects of AF stratospheric operations cannot be predicted because of a lack of knowledge of the normal species concentrations and their spatial and temporal variations. Further, the mixing properties and chemical interactions of jet engine or missile effluents are only poorly defined. Objective - develop the instrumentation, methods and techniques to determine stratospheric gaseous composition, especially minor species, and conduct an initial stratospheric sample collection program. How research contributes - the composition data is absolutely essential for the development of environmental impact, assessment models which will aid the Air Force in establishing stratospheric standards and criteria.

Stratospheric air samples will be obtained at various latitudes and altitudes utilizing cryogenic whole air samplers installed on balloons and aircraft. The gas samples will be retrieved and quantitative laboratory analysis of the gaseous composition will be made with a gas chromatograph, mass spectrometer and a detector for nitrogen oxides.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, LASER EXCITATION OF ATMOSPHERIC CONSTITUENTS

D.H. Katayama, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582800)

AF function - environmental impact of aerospace vehicles. Deficiency - detection and effects of aircraft effluents on the atmosphere. Objective - measure laser excitation parameters of atmospheric constituents. How research contributes - rotational structures of important constituents will be obtained by laser induced fluorescence techniques for identification and temperature determination purposes. Wavelengths at which strong fluorescence signals occur will be determined for detection purposes and excited states of aeronomic interest will be studied.

A computer controlled high resolution dye laser will be set up and apparatus for fluorescence experiments will be designed and constructed. During the construction period, joint experiments with scientists at other institutions will be conducted to keep abreast of latest developments in this field. Laser fluorescence experiments will commence when the experimental setup has been completed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, STATISTICAL SPECIFICATION OF CLOUD COVER AND PRECIPITATION

T.J. Keegan, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581500)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of adequate information to meet military weather support requirements. Objective -

to develop statistical relationships for the specification and prediction of total cloud amount and precipitation, based primarily on geosynchronous meteorological satellite data. How development contributes - successful development of these techniques will allow automated forecasts of cloud and weather conditions at many locations, satisfying AWS requirements specified in AWS TN 3-76.

A collection of GOES satellite video and IR data for northeast U.S. for the period March 77-March 78 will serve as a data base. Comparisons of satellite video and IR values around major Aviation Weather Stations will be made with reported weather conditions and algorithms developed to specify and predict for up to six hours the probability of occurrence of cloud and weather conditions. Efforts will be made to ensure accurate navigation, and corrections will be made for varying sun angle. Emphasis will be on the warmer regions and months to avoid difficulties in discriminating between snow-cover and cloudiness, which is the subject of IHWU 76700903.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, ANALYSIS AND MODEL DEVELOPMENT OF UPPER ATMOSPHERE SPECIES

C.R. Philbrick, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582880)

AF function - operation of satellite systems in the upper atmosphere. Deficiency - prediction of orbital ephemerides due to changes in the neutral atmosphere and specification of ionospheric disturbances that degrade satellite communications. Objective - to investigate the effects of solar and geomagnetic storms on the structure of the upper atmosphere and ionosphere in order to specify the physical processes involved and to model the atmospheric response. How research contributes - improved modeling of the response of the neutral atmosphere to geomagnetic storms will improve orbital element prediction and reduce the number of tracking passes needed to update orbital elements during disturbed periods. Modeling of ionospheric variations will improve specification of ionospheric propagation effects.

Data obtained from the S3-1 and S3-2 satellites and from rocket flights will be analyzed and the results used to develop empirical models of the response of the atmosphere to geomagnetic storms. Comparisons will be made with other data currently available which would help in developing the modeling and analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, CELESTIAL AND EARTH LIMB BACKGROUND MEASUREMENTS

B.D. Schurin, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583060)

AF function - surveillance, reconnaissance, detection. Deficiency - uncertainties in infrared background characteristics now severely limit design of LWIR surveillance and detection systems. Objective - to define the natural infrared background against which surveillance systems must operate. Specifically, to characterize the infrared radiative characteristics of the earth limb, zodiacal and celestial backgrounds at sensitivity levels and in spectral regions projected for future AF systems. How research contributes - space based LWIR systems must view their targets against the natural infrared background characterization of these backgrounds provides a baseline for LWIR mission capabilities and constrain the range of possible system design parameters.

A series of 7 rocket probe flights will be carried out to obtain survey data in the 3-30 micron region with advanced state-of-the-art cryogenically cooled sensors. From these data radiance models will be developed for the separate zodiacal, earth limb and celestial backgrounds. Two infrared sensors are being constructed as an in-house effort for the zodiacal measurements. These sensors will be integrated with payloads compatible with Castor-Lance vehicles and subsequently flown from Woomera, Australia. One experiment will obtain measurements to within 10 degrees of the sun, the other will make measurements at greater elongations and at the ecliptic pole. A series of three flights will be carried out to obtain celestial data in the 8-100 micron spectral region. One sensor is currently being refurbished and incorporates a three color focal plane array covering 8 to 32 microns. The other sensor is being designed and developed jointly by AFGL and NRL. This instrument will employ a five color array covering 8 to 120 microns. Three flights will be carried out to measure the diurnal variation of earth limb radiation in the infrared. These will take place at sunrise, noon, and sunset.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, IN SITU MEASUREMENTS OF FIELD-ALIGNED CURRENT SYSTEMS

B.M. Shuman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580740)

AF function - communications in and through the ionosphere, surveillance and detection. Deficiency - inability to cope with interference to these functions caused by magnetic storms and substorms. Objective - to obtain knowledge of the sources and mechanisms responsible for intense geomagnetic activity in order to develop polar substorm models which are needed for a prediction capability of the occurrence, intensity and duration of such activity. Specifically, to investigate magnetic field-aligned currents, ionospheric currents, and electron characteristics in the ionosphere and magnetosphere over the auroral regions during polar substorms. How research contributes -field-aligned currents are an important mechanism in the transfer of energy from the distant magnetosphere down to the auroral ionosphere where dissipation through electrojet current flow occurs in association with magnetic substorm disturbances. An improved definition of this coupling mechanism will significantly upgrade polar substorm models.

Data from two active experiments which measure the vector magnetic field and energetic electron fluxes aboard the polar orbiting Air Force satellite S3-2 will be analyzed to determine the position and intensity of field-aligned currents above the auroral oval, and also the spectral distribution of the current carriers. Coverage will be through all levels of magnetic activity, with emphasis on periods of strong magnetic disturbance. These results will be compared with those of other AFGL S3-2 experiments, and also with pertinent ground-based measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, ELECTRON ESA SATELLITE 78-1

R.P. Vancour, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581000)

AF function - navigation, communication and surveillance. Deficiency - disruptions in high latitude and HF communication systems and anomalous operation of space systems during magnetic disturbed conditions. Objective - to launch electron electrostatic analyzer detectors into polar sun-synchronous orbit to determine electron characteristics during disturbed times in the auroral oval. How research contributes - improved models of particle and current systems will result in improved predictions of time and amplitude of magnetic disturbances.

Two electron electrostatic analyzers (90 degrees apart) will be integrated and launched on AF satellite P78-1 into a circular polar sun-synchronous orbit (600 km). Data will be acquired in the auroral oval during normal and magnetically disturbed conditions, particularly, during magnetic storms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, OPTICAL OBSERVATIONS OF DEEP SPACE OBJECTS

S.P. Worden, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580810)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to test and perfect necessary hardware and software for use with large astronomical telescopes to produce high resolution data on earth-orbiting satellites. How research contributes -successful implementation of satellite surveillance utilizing the full high resolution capability of large astronomical telescopes will extend Air Force capabilities in the surveillance and monitoring of satellites by a factor of at least 50 in spatial resolution. Moreover, the extension of these techniques for use on newly developed and proposed multiple mirror telescope systems would increase this capability by up to a factor of 500. The impact of these image reconstruction systems on task objectives will be to provide higher resolution images of solar features than available with present equipment.

Instrumentation currently being developed under the lab director's fund project ILIR7A01 will be used to determine the limiting brightness of objects for which high spatial resolution information can be obtained. Towards this end a variety of test targets (satellite and solar system objects) will be studied, utilizing University of Arizona equipment and telescopes to be provided under contract with Arizona. Orbits for selected satellite test targets are to be provided by the Aerospace Corporation. Studies incorporating the new University of Arizona multiple mirror telescope (scheduled for completion in 1978) will determine whether multiple mirror telescopes may be used to obtain speckle interferometry data. This new instrument has an aperture equivalent to a conventional 7 meter telescope, and exceeds by a factor of 1.5 the largest existing telescope. It is the prototype for a class of new telescopes which may eventually exceed 30 meters in diameter. Such telescopes could in principle detect spatial structure smaller than 1 meter in extent on a satellite in synchronous earth orbit. Harvard University will develop under contract advanced image processing techniques for application to extended objects like the solar surface and larger satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, THE USE OF REMOTE SENSING TECHNIQUES FOR THE DETECTION OF CROP STRESS (DISEASE AND WATER)

G.R. Safir, Michigan State University, Agricultural Experiment Station, Dept. of Botany & Plant Pathology, *New Administration Bldg., East Lansing, Michigan* 48823 (0059700; MICL01077)

OBJECTIVE: Identify the major spectral and structural canopy components which contribute to the directional spectral reflectance of wheat, corn, sugarbeet, bean and soybean canopies suffering from disease and water stress. Calculate the theoretical detectability, using a mathematical directional reflectance model, of each of the above diseases for operational remote sensing systems and possibly for systems as yet undeveloped. Determine the relationship between aerial photographic ratings of diseases fields and crop yield.

APPROACH: For each canopy type, samples will be grown in the greenhouse and/or field and/or growth chamber. The biological and spectral canopy components will be measured throughout the growth cycle and analyzed. Control and stressed sample plants will be used for calculation of the spectral reflectance of a large area canopy by use of a mathematical canopy model. If the calculated canopy reflectances agree with canopy reflectances as measured in the field, then the canopy model will be used to estimate the importance of the individual canopy components to the canopy reflectances.

PROGRESS: A study was initiated to determine the effectiveness of aerial infrared photography for estimating the location and intensity of sugar cane rust. Imagery at several altitudes was collected along with ground truth information in the Dominican Republic for this purpose. The data is currently being analyzed. A study to evaluate the defoliation of oats by the cereal leaf beetle using aerial imagery will begin during the Summer of 1979.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Michigan

5.0032, STUDY OF GAS PHASE REACTIONS OF AERONOMIC INTEREST INVOLVING OH, HO2, O, Cl, AND H2O

J.G. Anderson, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM76-15654)

This grant funds an experimental study of three chemical reactions of importance in the middle atmosphere. These reactions are: OH plus HO2 yields H20 plus O2; HO2 plus O yields OH plus O2; Cl plus CH4 yields HCl plus CH3. Rate coefficients for these reactions will be determined by using a flowing discharge system with resonance fluorescence detection. A successful measurement of the rate coefficients for these reactions will aid greatly in computer modeling of man's effect on the ozone layer.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0033, MEASUREMENTS OF ELECTRICAL CONDITIONS IN THUNDERCLOUDS

W.P. Winn, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (ATM78-09710)

The objectives of this research are to measure the electrical conditions within thunderclouds and to relate them to precipitation. The electrical conditions will be measured using balloons and aircraft. The equipment used in these studies have been improved from previous experience.

In this research, the first year will be spent on the testing of the various instruments for measuring electric field. The demonstration of using an instrumented aircraft will add a new dimension for data collection within a thundercloud.

During the second year, the emphasis will be on the participation of TRIP 79 to be held at Socorro, New Mexico. This group will host the cooperative effort of the international thunderstorm program.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0034, ENVIRONMENT TREE VIGOR, BEETLE BIOLOGY IMPACT, DETECTION CONTROL OF DENDROCTONUS ADJUNCTUS

H.G. Kinzer, New Mexico State University, Las Cruces Campus, Agricultural Experiment Station, McIntire Stennis Program, *University Park, Las Cruces, New Mexico* 88003 (0066205; NM00016)

OBJECTIVE: To provide basic information on the interrelationships of environmental conditions, tree vigor, and bark beetle biology that will be of value in predicting impact making previsual detection, making management decisions, and for controlling Dendroctonus adjunctus.

APPROACH: Precise measurements of environmental factors will be made and their effect on tree vigor, determined. Environmental and host factors to be measured include precipitation, ground moisture, air temperature, relative humidity, age, aspect, and basal area. The relationship of tree vigor and impact of beetle attack will be measured under both natural stand conditions and areas where ecological conditions (and thereby tree physiology) are altered by such means as polyethylene ground cover, root pruning and crown thining. Trees in the latter situation will be highly instrumented and manually infested with known numbers of beetles. These instrumented trees will be photographed by airborne infrared photography techniques at intervals following infestation to determine if this method is feasible as a previsual detection method. Various chemicals will be tested for effectiveness in preventing bark beetle attack and also for killing the brood in infested trees.

PROGRESS: The biology, identification and gallery pattern characteristics of conifer infesting bark beetles was studied. A total of 32 species were found in conifers. Life history data were accumulated for the most prevalent species as were tree attack characteristics. A combination of the biological data ac-

cumulated and the gallery characteristics of each will be used to generate a field key to identify immature stages in the field. Results of chemical tests for the prevention of bark beetle attack were completed in 1978 and the results indicate that water carried Sevimol and Reldan both provide acceptable levels of protection from bark beetle hits and prevention of brood establishment. Performance data have been submitted to one manufacturer who is pursuing registration for labeling for a bark beetle protective spray. Studies indicate that Dendroctonus adjunctus populations may be successfully manipulated with pheromones. Exobrevicomin and frontalin in combination with resin stimulated aggregation and attack while verbenone was repellent. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New Mexico

5.0035, ENGINEERING AND INSTRUMENTATION SUPPORT FOR ROCKET LAUNCH OPERATIONS
K.E. Lane, New Mexico State University, Las Cruces Campus, Physical Science Lab., *P.O. Box 548, Las Cruces, New Mexico* 88070 (DF583440; F19628-79-C-0107)

AF function - command, control and communications. Deficiency -limited engineering and instrumentation support available at WSMR, New Mexico, to support scientific rocket launch operations. Objective -provide effective engineering and instrumentation support during the launching of scientific rockets at WSMR. How research contributes -instrumentation systems will be developed for each rocket to be launched by AFGL at WSMR. The engineering and instrumentation support will allow AFGL scientists to conduct aerospace investigations on a timely and cost-effective basis. Projects depending on this work include 6690, 2123, 2310, 7670 and 7659.

The technical approach includes integrating range safety, tracking and recovery systems into rocket payloads that will be launched at WSMR in support of various scientific programs. A telemetry facility will be maintained to provide for pre-launch testing of rocket instrumentation systems and to assure payload operational readiness. Operation of various telemetry facilities in support of rocket launch operations will be accomplished by use of government owned equipment located at WSMR. Coordination will be provided between AFGL instrumentation engineering and WSMR to satisfy documentation on other technical interface requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0036, LOW VISIBILITY EFFECTS ON REMOTE WIND SENSORS
R. Rubin, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Atmospheric Sciences Lab., *White Sands M.R., Las Cruces, New Mexico* 88002 (DA0F2118)

To identify methods of overcoming wind measurement limitations currently imposed on remote wind sensors by fog, mist, and other low visibility conditions.

Perform literature survey and theoretical analysis of means by which high relative humidity, fog, mist, snow, and non-turbulence conditions restrict wind probing by laser scintillation remote wind sensors currently being developed for tank applications. Identify optimum technique and available wavelength source needed to make scintillation wind sensors operative in low visibility environments.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0037, APPLICATION OF INFRASOUND AND GRAVITY WAVES TO THE STUDY OF THE ATMOSPHERE
W. Donn, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (ATM78-06771)

This grant funds research involving a novel atmospheric diagnostic technique: infrasound (sound waves of frequency too low to be audible to the human ear). Infrasound generated by the sonic boom from inbound Concorde supersonic transports is recorded at Palisades New York. Refraction effects on this received infrasound, arriving from distances of 150-1000 km, are determined by temperature and wind conditions in the stratosphere (40-50 km altitude) and lower thermosphere (100-130 km). The sonic boom can thus be used to provide temperature-wind information about these two altitudes from which the infrasound reflects. Daily observations show significant variations in these parameters. Natural infrasound of about a 5 second period is also radiated from the sea surface in regions of interfering ocean waves. Infrasound from this source also depends on the atmospheric temperature-wind field near the altitudes of reflection. This offers time continuous information about stratospheric and thermospheric temperature-wind fields. Application to the stratojet and poorly understood stratospheric warnings are prominent potential applications.

The observational technique is well established; this grant funds a pilot program to explore the degree to which these exciting potentials may in fact be realized.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0038, PLANNING, COORDINATION AND EVALUATION OF A IDOE SUPPORTED COLLABORATIVE U.S. PROGRAM FOR SEABED ASSESSMENT OF SOUTH-EAST ASIA (SEATAR)
D.E. Hayes, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (OCE7680038A03)

Dr. D.E. Hayes (Lamont) serves as coordinator of the steering committee for the Studies in East Asia Tectonics and Resources (SEATAR). Fourteen scientific investigators from eight U. S. academic institutions are cooperating in this large scale, multi-discipline, multi-nation project. The U. S. investigators are primarily concerned with the tectonic processes along the active margins of the several lithospheric plates converging in East Asia. The occurrences of natural resources (oil, minerals) formed by these processes are primarily the concern of East Asia scientists. The coordinating committee is responsible for providing opportunities to all U. S. investigators to submit proposals for SEATAR, for integrating these proposals into a comprehensive work plan and preparing the omnibus proposal for submission to IDOE. The committee is also responsible for providing the opportunity for the several investigators to meet and synthesize their results. Coordination is also required among SEATAR projects of other U. S. agencies (IPOD, Project MAGNET, LANDSAT) and also among the several groups from other countries participating in the SEATAR project (East Asia and European). One more year of field work (FY 1980) is planned plus a final year for data synthesis and publication.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0039, METEOROLOGICAL SUPPORT AND RESEARCH SERVICES
L.E. Niemeyer, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., Meteorology Lab., *Research Triangle Park, North Carolina* 27711 (D9-X0348-1; G603A-AA-030)

OBJECTIVE: Research will be conducted on various aspects of air pollution meteorology including the development and evaluation of air quality simulation models on all temporal and spatial scales, and the development and improvement of air pollution climatological techniques. These models and techniques are applied to various environmental problems and requirements.

APPROACH: The research is conducted in the laboratory and the field. Mathematical models are developed and then evaluated in field programs. Physical modeling studies of air pollution meteorology problems are conducted in a wind tunnel and water channel/towing tank.

PROGRESS: Reports on completed research are published as each study is finished and are available from the performing organization.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0040, DEVELOPMENT OF LINEAR MODELS FOR ANALYSIS OF REMOTELY SENSED DATA FOR FOREST LAND CHARACTERISTICS

B.J. Turner, Pennsylvania State University, University Park Campus, School of Forest Resources, *102 Ferguson Bldg., University Park, Pennsylvania* 16802 (0071500; PEN02285)

OBJECTIVE: Develop and apply discriminant functions from specific linear models to differention among forest land categories in remotely sensed data.

APPROACH: Specific linear models incorporating orthogonal contrasts among forest land categories will be designed and extended into canonical form for discrimination. Programming will be done in the Office of Remote Sensing of Earth Resources data processing system. Maps and color displays will be generated for comparative interpretation of the methods with other commonly use methods.

PROGRESS: A computer program to analyze remotely sensed data by a procedure called 'directed canonical analysis' (see previous yearly report) has been implemented. Results indicate that the directed canonical linear transformation will enhance linear relationships defined as contrasts between categories and groups of categories. Research on a program for the classification of spatially related multivariate data using the criterion of maximum likelihood under multivariate normality was completed and the program has been implemented. Enhanced computational efficiency was a primary developmental consideration. The result has been improved success in classification over that achieved with the Euclidean distance classifier, in use for some time, with a minimal increase in computing costs. A study has been undertaken to investigate the effects of the general and directed canonical analyses on classification accuracy. The techniques are being assessed relative to each other and relative to classifications based on the original raw data and on orthogonal axes generated by principal components analysis.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Pennsylvania

5.0041, THEORETICAL STUDIES OF MAGNETOSPHERIC PHENOMENA

W.J. Heikkila, University of Texas, Dallas Campus, Center for Space Sciences, *Richardson, Texas* 75082 (ATM78-03603)

This grant continues the work done on NSF grant ATM76-14916 during the next two years. It involves study of the latest observations of auroral phenomena, and on their theoretical interpretation.

In the past year the research effort has extended criticism of current magnetospheric theories, especially of magnetic reconnection, with four publications. At the same time a more positive approach was made based on induced fields, advancing a mechanism for producing very energetic particles. The model used is ready, and several papers on auroral observations are about ready for submission to a journal.

This grant will continue the work on both observations and the theory. The ultimate aim is to integrate both into a firm understanding of the origin of the aurora caused by magnetospheric dynamics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0042, STUDY OF SELECTED TOPICS IN AURORAL AND EQUATORIAL AERONOMY

B.A. Tinsley, University of Texas, Dallas Campus, Inst. for Physical Sciences, *Richardson, Texas* 75080 (ATM7703335A01)

This grant funds a program of theoretical and observational research on atmospheric optical and extreme ultraviolet emissions. Work will be done in two principal areas; Alaska and the equator. The Alaskan work consists of a joint observational program with the University of Alaska, using a combination of grille spectrometers and other optical instrumentation. Particular problems relating to emission from heavy ions precipitating in the auroral zone will be pursued. The equatorial work is concerned primarily with the study of optical emissions resulting from the loss of ring current ions due to charge exchange with geocoronal hydrogen.

This work is a continuation of work done on National Science Foundation grants ATM-7417651 and ATM-7519199.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0043, THE EFFECT OF EXTENDED MOUNTAIN RANGES ON THE ATMOSPHERIC FLOW

J. Paegle, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (INT77-21706)

This award to the University of Utah makes it possible for Drs. Julia and Jan Paegle to study 'the Effect of Extended Mountain Ranges on the Atmospheric Flow'. The Paegles will work in cooperation with J.V. Zubillaga, C.E. Ereno and N.O. Garcia of the Argentine Naval Hydrographical Service in Buenos Aires, Argentina.

The scientists will study and compare atmospheric flows over the Rocky Mountains and the Andes. Their work should contribute toward an understanding of the process of cyclogenesis or cyclone intensification that takes place on the lee side of these mountain ranges. The Argentinian colleagues will gather and prepare the data over the Andes mountains in the border between Argentina and Chile. Ocean data will be obtained from satellite measurements. The theoretical and numerical analyses will be done largely by the U.S. scientists.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

5.0044, NATIONAL ENVIRONMENTAL OVERVIEW PROGRAM

J.B. Epstein, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9510-01593)

STATES TO WHICH PROJECT PERTAINS: Entire United States.

The National Environmental Overview Program summarizes characteristics and geographic distribution of earth materials and nature and extent of geologic processes in the United States. Maps at a scale of the National Atlas (1:7,500,000) will be major products, although larger scale maps have been and will be prepared. The maps and reports will provide a geologic data base useful to the understanding of environmental problems on a national scale and will be useful for generalized decision making on land use, energy and mineral resource development and their environmental impact, and public health. While maps at this scale probably cannot solve specific problems, they will identify the problems and point out critical areas of potential geologic constraints and guide future topical research.

The program includes preparation of the following maps at 1:7,500,000: landslides, surficial materials, volcanic hazards, active faults, surface water availability, karst and its engineering problems, swelling clays, bedrock lithology, nuclear reactor sites and their geologic problems, density of faults, areas of coal strip mines, Quaternary Dating techniques, radioactive waste management sites, engineering geologic map of the United States, impact structures, and carbonate for SO2 scrubbing. A Quaternary map of the United States, (1:1,000,000 and 1:2,500,000) and various environmental and engineering geology derivative maps will be prepared. A geologic map data file is being prepared, and the feasibility of using LANDSAT imagery and computer graphics for national data will be tested.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0045, GATE DATA ANALYSIS AND RELATED STUDIES

R.J. Reed, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (ATM76-06200 A02)

The objectives of this research continue to be the investigation of: (1) the kinematics, dynamics, and thermodynamics of large-scale easterly (or African) waves and their relationship to smaller-scale convective activity. (2) The characteristics of long-period, large-scale fluctuations in the intensity of the Intertropical Convergence Zone (ITCZ). (3) The structure and behavior of meso-scale convective systems and their interaction with larger-scale tropical circulation features.

The observations collected during the Global Atmospheric Research Program (GARP) Atlantic Tropical Experiment (GATE) are being used to carry out these objectives. Collaboration with Gate scientists at other institutions is underway in an effort to utilize the knowledge gained from these investigations to describe the properties of convective cloud ensembles in terms of synoptic-scale variables; an important task for improving weather and climate prediction and simulation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, FORCE CUE REQUIREMENTS FOR AIR-TO-SURFACE WEAPONS DELIVERY SIMULATION

R.B. Brooks, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224460)

The purpose of this research is to evaluate effects of two different simulator force cueing modes (i.e., six-degrees-of-platform motion versus g-seat/g-suit stimulation) upon the training of A-10 conversion and air-to-surface weapons delivery tasks. If simulator force cueing can be shown to have minimal effects upon pilot training, or if necessary force cues can be generated by simple and inexpensive methods, (g-seat or g-suit), reductions in the life-cycle costs of A-10 simulators would be realized. ASPT's platform motion system has recently undergone modifications which will increase the iteration rate by a factor of four. This means that the motion, visual, and g-seat cues will be provided to the subject more rapidly and realistically than was possible in the past.

A transfer of training study will be conducted using recent UPT graduates as subjects. The flying tasks will be taken from two categories of A-10 maneuvers: conversion training and air-to-surface training. The subjects will fly these maneuvers in the A-10 ASPT (where automated performance measures and weapons delivery scores will be recorded) and in the actual A-10 aircraft (where instructor pilot ratings of flying performance and gunnery range scores will serve as criteria). For the ASPT portion of the study, the two conditions of force cues will be (1) six-degrees of platform motion on, g-seat and g-suit off and (2) six-degrees of platform motion off, g-seat and g-suit on. Two aspects of performance are of interest: rate of skill acquisition and final level of proficiency attained. A-10 ASPT performances will be compared with aircraft performances to determine the relationship between flying skills exhibited in the two systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, ASPT IP INTEGRATED DYNAMIC VISUAL DISPLAY DEVELOPMENT

R.G. Woodruff, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224240)

The objective is to develop an integrated dynamic visual display for the ASPT Advanced Instructor/Operator Station (AIOS) which will provide aircraft flight status information and predictor display information, including such parameters as airspeed, altitude, attitude, angle of attack, heading, g force and desired track. Ultimately the display will be used by instructor pilots in conjunction with the performance of flying training research in the ASPT.

Phase I - display design. IPs will be administered a questionnaire to determine what integrated display information would be useful to them for evaluating student pilot performance. From the analysis of the data, several display designs will be developed and sketched. IPs will then rank order the various designs. Phase II - display evaluation. The two highest ranking designs will be implemented on the ASPT AIOS. Ten IPs will each instruct one student under each display cofiguration, in addition to a condition in which only the usual AIOS/CI information is available. The number of trials required to reach a criterion level of proficiency will be recorded. IPs will be administered a questionnaire to determine the preferred display configuration. Parameteric and non-parametric statistical tests will be used to analyze the trials-to-criterion data and questionnaire data, respectively. If modified display is recommended, the cycle will be repeated until an optimal design is identified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, INFORMATION PROCESSING AND ERROR CORRECTION FOR OPERATOR PERFORMANCE PREDICTION AND DESIGN

R.A. Goldbeck, Ford Aerospace & Communications Corp., *Palo Alto, California* 94303 (DF055830; F49620-79-C-0147)

AF function - the Air Force has a long-term interest in performance and error-correction aspects of the human operator in equipment systems. Advancement in performance prediction is now needed for (1) a theoretically based prediction and modification methodology for general applicability to new system problems and (2) modification of system design to control and correct operator error effects. Deficiency - such advancement hinges upon integrating levels of operator performance ranging from the micro-theoretical level, as represented by Teichner's theory, to the macro level as represented by human engineering computer aided design (HECAD) and systems analysis of integrated network of tasks (SAINT). Objective - the research will add human information transmission modeling to the present prediction and design methodology of the HECAD. Human error prediction methodology will be extended to include the effects of operator detection and correction on performance. How research contributes - the research will provide computer simulator programs to enable improved design of system man-machine interfaces.

The first period of research will: (1) develop a validation task guiding the analyses of human information processes as part of overall man-machine information transfers, and provide a research vehicle for testing predictions of human performance, (2) design software and necessary hardware for the validation task, (3) analyze the validation task and describe it using both the hecad network and the Teichner information processing models, (4) examine the relationships between the models and their use so that possible cross contributions and supplementary application may be identified for an integrated performance prediction methodology and design model, (5) identify data needed to apply the prediction methodologies to the validation task for estimates of basic performance and error detection/correction performance, and select, modify, or develop data acquisition task(s) for collecting the data identified (6) design hardware and software for the data acquisition task (2), and (7) develop data collection methods for the validation and data-acquisition tasks, and conduct functional checkouts for these tasks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0004, DEVELOPMENT OF AN AUTOMATIC PRESSURE SUIT HEAD ENCLOSURE

R. Weis, International Latex Corp., *Frederica, Delaware* 19946 (DF323400; F33615-78-C-0610)

This procurement will develop an automatic pressure suit head enclosure to be assessed for possible use in advanced intercept aircraft. Requirements for mobility, visability, and maneuverability in a high g environment effectively exclude existing pressure suit helmets from this role. An automatically activated

device is desired, which in the event of cabin decompression would deploy, encapsulate, and seal the head/neck area to an otherwise passive, pressurizable coverall. It will make maximum use of the normally worn helmet, mask, and oxygen regulator, and is expected to provide fighter-compatible decompression protection without traditional and unacceptable pressure suit penalties of added weight and encumbrance.

This effort is part of a coordinated effort to develop fighter-compatible high-altitude protective gear. Subsequent efforts will address development of an optimized overall, and integration of essential life support systems (i.e., g-protection, thermal conditioning, etc), with assembly of a developmental prototype to follow. Development of acceptable head protection is being pursued first because it appears to be the single most critical ingredient to acceptance by the fighter community. Failure to obtain desired goals in this initial effort will permit reevaluation, revision or cancellation of program plans with a minimum of time and fiscal loss.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0005, IDENTIFICATION OF PSYCHOMOTOR AND PERCEPTUAL MEASURES FOR THE SELECTION OF PILOT TRAINEES

E.A. Fleishman, Advanced Research Resources Org., *4330 East West Hwy., Bethesda, Maryland* 20014 (DF233770; F33615-79-C-0004)

To secure the identification of possible measures of psychomotor and perceptual abilities that may be valid for the selection of pilot trainees, and to develop appropriate paradigms for the assessment of those abilities.

The contractor shall conduct a thorough review of past and ongoing research in the area of individual differences in psychomotor and perceptual abilities. He shall identify, and integrate under some theoretical basis, those abilities which appear likely to predict performance in pilot training. The contractor shall then develop, but not implement, means of measuring those abilities in a reliable, accurate, and simple means. A technical report shall be produced by the contractor documenting these efforts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0006, SESS DATA COMMUNICATOR PROTOTYPE

Unknown, Octek Inc., *Burlington, Massachusetts* 01803 (DF583680; F19628-79-C-0122)

Air Force function - Air Weather Service (AWS) Space Environmental Support System (SESS). Deficiency - escalating costs of labor-intensive data-gathering for SESS are exceeding resources and contraction of the SESS real-time data base seeems inevitable without automation of data-gathering. Objective - develop and test a prototype SESS data communicator (SESSDAC) for the automatic analysis and reporting of ground-acquired geophysical data for SESS. How research contributes - reduces costs of data-gathering for sess. Increases data quantity by upgrading of stations which are reporting only during manned shifts to 24 hours daily, seven days weekly. Permits consideration of adding new data-gathering stations.

A competitive procurement will select a contractor to design and fabricate a prototype SESS data communicator (SESSDAC). The automation of the functions of the SESS observers represents an effort to distribute processing to the SESS data-gathering locations. The front end processing to be performed by SESSDAC includes converting sensor system analog outputs into physical or engineering units, reducing the data volume by computing averages or maximum and minimum values, comparison with quiet day curves, and comparison with disturbance threshold values to provide a met watch capability. A goal in developing SESSDAC will be to be transparent to AWS operations by minimizing AWS efforts required to utilize SESSDAC. Existing sensor systems, communications circuits, and message formats will be used. Primary communications will be by existing polled teletype circuits with a backup capability using automatic answering terminals on military or commercial telephone networks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0007, DEVELOPMENT OF HIGH-G AUGMENTATION DEVICES

G.J. Kron, Singer Co., *Binghamton, New York* 13902 (DF228250; F33615-77-C-0055)

To design prototype high-g augmentation devices to enhance the g-cue environment of future simulators. The devices will load the pilot's limbs, head and shoulders to augment the simulation of high-g effects.

The approach is to award a 9 month study contract for the design of g-cueing devices. Prototype devices (hardware and software) will be designed to apply appropriate forces effectively and safely. The contractor will investigate such techniques and devices as straps, active should harness, active helmet, lower and upper body negative pressure, and a sound system for aural cueing. After these devices have been designed a separate contract for building the devices will be awarded. Milestones - contract award, 1 Mar 77, devices designed, 1 Nov 77, contract complete, 30 Nov 77.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0008, TRAINING REQUIREMENTS ANALYSIS FOR TACTICAL DOMAINS

G.A. Klein, Klein Associates, *Yellow Springs, Ohio* (DF055310; F49620-79-C-0179)

AF function - this research supports Air Force programs in flight and technical training, especially those that deal with training complex skills. Deficiency - basic skill acquisition such as that found in novice level training programs has been extensively studied and documented. It has often been the target of instructional systems development (ISD) analysis. Complex skill acquisition, on the other hand, is the least studied yet most costly type of training. Several questions exist regarding how to organize and structure training programs in this area, especially for skill categories involving tactical operations. Objective - the objective of this research is to formulate methods and techniques that can be used for defining training requirements in the areas of tactics, decision making, and critical combat skills. How research contributes - this research will determine if new ways of stating training requirements can impact instructional systems design for complex skill acquisition.

This research will study the differences between rule-following learning and situationally sensitive learning at high levels of proficiency (the expert operator such as an accomplished fighter pilot). Interviews with personnel who work in situations requiring analogical reasoning will be conducted to assess the difference between their types of problem solving tasks and environments where deductive or inductive reasoning is more effective. Descriptive models of how analogical reasoning is used in problem solving and decision making situations will be constructed, and an attempt will be made to develop prescriptive models for training analogical reasoning for certain complex skill categories.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, AEROMEDICAL CRITERIA FOR A-10 SIDE OPENING CANOPY DEVELOPMENT

J. Brinkley, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325040)

The Aeronautical Systems Division Deputy for A-10 has requested aeromedical consultation and support in the examination of crew safety aspects of an engineering change proposal to incorporate a side opening canopy (SOC) on the A-10 aircraft. Incorporation of the SOC includes deletion of the 0.3 second delay used in the current escape system to allow canopy clearance from the aircraft and crewmember body positioning and restraint prior to ejection catapult initiation. It also incorporates the addition of mild detonating cord (MDC) bonded to the

canopy which when ignited during the emergency escape sequence will weaken the canopy acrylic transparency and allow a canopy piercer on the ACES-11 ejection seat to break through the canopy. The benefits of the SOC include life cycle cost savings and a potential increase in low altitude recovery of ejected aircrew by eliminating the 0.3 second delay between initiation of the ejection sequence and seat movement up the ejection rails. Available data indicates a possibility of more ejection injuries. A detailed review of this concept is required to adequately quantify the crew safety aspects of this proposal.

A multidisciplinary team has been formed within the Aerospace Medical Research Laboratory to address specific tasks. These tasks include (1) collection and analysis of US Navy experience with through-the-canopy ejection systems, (2) definition of human head, neck and extremity impact exposure limit criteria from existing research data, (3) provision of technical guidance on the development of improved instrumentation to be used in rocket sled tests ejections to evaluate the through-the-canopy system (4) analysis of data collected during rocket sled test ejections, (5) technical support to the Air Force Flight Dynamics Laboratory to determine center of gravity variations associated with varied body positions, (6) support to the Air Force Flight Dynamics Laboratory in their computer analysis of ACES-11 performance and reaccomplishment of the lives saved study, (7) acceleration of ongoing research under work unit 72311606 to reduce shoulder harness reel-up delay, and (8) study of the feasibility to evaluate crew safety hazards associated with canopy penetration using existing mathematical modeling techniques. The results of these tasks will be presented to the deputy for A-10.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0010, MATS WIDE FIELD-OF-VIEW DISPLAY

G.R. McMillan, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325570)

To upgrade the multi-axis tracking simulator to permit presentation of wide angle, out-of-the-cockpit visual information. This upgrade is necessary to: 1. Conduct an analysis of pilot utilization of rotational motion cues in the presence of a wide field-of-view display, 2. Develop a manual control based technology to quantify and model the performance effects of complex wide field-of-view visual information, and 3. Provide human performance tradeoff data to asd that may be used in the design of simulator visual and motion systems. This work is in direct support of TN-ASD-AFHRL-AMRL-0602-77-66.

The upgrade will begin with a design study to be completed in mid-FY80. Fabrication of the display and projection systems and software Development is planned for FY80-81. The display will be integrated with the MATS cockpit and motion base at this point and experimentation will begin. An expansion of the graphics capability is planned for FY82. It is anticipated that the system will consist of a fixed-base hemispherical dome using projected television imagery.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0011, SAINT APPLICATION TO UPD-X

D.J. Seifert, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF323610)

To provide a realistic application of the systems analysis integrated network of tasks (SAINT) to a major subsystem development, the all-weather, wide area surveillance system - UPD-X. The SAINT technique has been under development in AMRL for some four to five years and has the potential for replacing the systems analysis, task analysis and operator interface definition portion of MIL-H-46855. The UPD-X development program has performed cost/trade-off analysis of four approaches to system implementation to fulfill the UPD-X requirement. The human engineering thrust involves evaluation of operator performance under various UPD-X system alternatives using the SAINT model. A working model of the major man-machine interfaces in the system of UPD-X will be used to provide a simulation capability for comparing approaches to system design.

The AMRL developed SAINT technique for simulation modeling will be applied to the established system parameters of the UPD-X system design approaches to predict, at an acceptable confidence level, the system performance of the proposed designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0012, INVESTIGATION OF CREW RESTRAINT SYSTEM BIOMECHANICS AND EFFECTIVENESS

N.S. Phillips, University of Dayton, School of Engineering, Dept. of Civil Engineering, *300 College Park Ave., Dayton, Ohio* 45469 (DF325310; F33615-79-C-0525)

USAF restraint systems are designed, procured, and evaluated using static load criteria only. Powered inertia reels are evaluated using rigid torso dummies. These are adequate approaches only if the effects of the dynamic impact environments and biodynamic responses encountered during emergency escape and aircraft crash are understood and can be accounted for using dynamic load factors which are developed from a quantified technology base. The development of mathematical analogs of the human body and restraint system, based upon adequate experimental data, offers a method that can be used to analytically determine optimum material properties for given operational conditions and a foundation for tests and evaluation criteria. This investigation shall: (1) quantify pertinent dynamic properties of restraint materials, (2) provide test data and mathematical models of ballistically activated restraint haulback devices, (3) develop experimental designs to investigate the effects of restraint harness loading on the human body, (4) provide guidelines for subhuman primate testing using dimensional scaling relationships and (5) develop restraint system evaluation techniques using both experimental and analytical approaches.

The contractor will conduct analytical and experimental investigations necessary to determine the dynamic mechanical response characteristics of USAF operational restraint systems under loads produced by -GX impact and rapid haulback of the restraint system shoulder straps. Using existing data and collecting data where necessary, the contractor will describe the performance characteristics of ballistically activated restraint haulback tensioning devices. He will also accomplish restraint system dynamic modeling studies in collaboration with AMRL/BBM. Analytical studies will be performed to provide guidelines for the design of experiments to be conducted with small primates to evaluate the efficacy of protective equipment. Dynamic tests will be performed as needed to determine the mechanical properties of restraint materials to describe their contribution to human body restraint system response.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0013, REEVALUATION OF THE WEIGHTED AIRMAN PROMOTION SYSTEM FOR GRADES E5 THROUGH E7

C.D. Gott, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233090)

To reevaluate the six factor weights of the current weighted airman promotion system (WAPS), to evaluate the effect of using decorations in current grade instead of the total decorations factor in waps, to consider NCO Leadership School, NCO Academy, Community College of the Air Force, and other job-related education courses as additional factors in the promotion system, and to examine whether or not a separate weighted formula should be established for those AFSCs which have no Specialty Knowledge Test, and to analyze the impact of the various combinations of weighting upon the promoted population characteristics.

To accomplish the objectives, an experimental promotion policy board consisting of six officers (O-5/O-6) and six NCOs (E-8/e-9) will be convened at AFHRL to review the records of a random sample of E-5 airmen eligible for promotion to E-6. The board will rank-order the sample for promotion with respect to the following selection factors--(1) Specialty Knowledge Test, (2) promotion fitness examination, (3) time-in-service, (4) time-in-grade, (5) total decorations, (6) airman performance

reports, (7) decorations in current grade, (8) NCO Leadership School (9) NCO Academy, (10) Community College of the Air Force, and (11) other job related education courses. Various combinations of selection factors will be displayed to the experimental board. Policy-capturing techniques, i.e., regression analysis and hierarchical grouping procedures, will be used to analyze the rankings of the board members. Milestones--11 Mar 77, completion of all preparation for convening the experimental board; 14-19 Mar 77, meeting of the experimental board at AFHRL; 15 May 77, completion of data analysis phase; 30 Jun 77, staff report including descriptions of alternative systems; 21 sep 77, identification by DPXXOP to AFHRL of alternative systems for impact analysis; 30 Nov 77, publication of TR (from 30 Jun 77 staff report); 31 Dec 77, completion of impact analysis using 78A6 promotion data; 15 Feb 78, staff report, impact analysis results; 31 Mar 78, publication of TR (from 15 Feb staff report); 30 Sep 78, completion of additional impact analysis; 31 Oct 78, staff report. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0014, HELICOPTER DISPLAY REQUIREMENTS
A. Hyman, U.S. Dept. of Defense, Army, Research Inst. for the Behavioral & Social Sciences, Org. & Systems Research Lab., Education Tech & Simulation Tech Area, *5001 Eisenhower Ave., Alexandria, Virginia* 22333 (DA644566)

To investigate how best to display surrounding terrain on a CRT so that the display can function as a visual aid to pilots flying night NOE missions.

Under daylight NOE flight conditions, very little time is available for the correct detection of obstacles and targets. Against this, detection and reaction time of the helicopter pilot is greatly reduced when NOE flight must be performed at night. Previous ARI NOE research has addressed various factors involved in obstacle detection, recognition, and avoidance, such as pilot response time as a function of aircraft velocity, obstacle shape and distance, and accuracy of judgments based on the perception of absolute distances. The present research effort will define the display requirements that are needed for a pilot to successfully use a low light level TV display as an aid for night NOE flight. The first experiment will identify the lowest display luminance level that will provide the pilot with sufficient information to permit successful night NOE flight. CRT size and the contrast (gamma) enhancement are the independent variables to be used.

SUPPORTED BY U.S. Dept. of Defense, Research Inst. for the Behavioral & Social Sciences, Org. & Systems Research Lab.

6.0015, WARNING SIGNS AND LABELS
R. Jensen, U.S. Dept. of Health Education & Welfare, Public Health Service, Center for Disease Control, National Inst. for Occupational Safety & Health, Division of Safety Research, *944 Chestnut Ridge Rd., Morgantown, West Virginia* 26505 (VLD-S23-820)

Warning signals and labels are becoming far more common in the occupational environment. Many NOISH criteria documents recommend warning signals or instructional postings. Several of the existing OSHA regulations require warning signs or labels. The expanded product liability laws have caused many manufacturers to add warning or instructions to tools and equipment. This increasing abundance of warning signs and labels raises several important questions. One obvious question is whether the written or symbolic material on a sign or label is designed for clear recognition and understanding by workers. Much research has been reported in the literature on highways signs, automotive design, and aircraft cockpit design. This project will extend this work to include industrial signs.

SUPPORTED BY U.S. Dept. of Health Education & Welfare, Center for Disease Control, National Inst. for Occupational Safety & Health

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, MATHEMATICAL SOFTWARE FOR LINEAR CONTROL AND ESTIMATION THEORY 16257-M
M. Athans, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0G8999; DAAG29-79-C-0031)

To provide both a theoretical numerical analysis and a set of high quality routines for the solution of problems in control and estimation theory. Relevance - control and estimation theory often arises in Army applications such as missile guidance and control and trajectory estimation, fire control and aircraft dynamics.

Linear problems in control theory will be addressed first. Here, the heavy use of numerical linear algebra techniques will form the foundation of the investigation. Portable and robust software will be produced as appropriate.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0002, THE IMPROVEMENT OF NUMERICAL METHODS FOR SOLVING ATMOSPHERIC AND OCEANIC MODELS
H. Kreiss, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (ATM77-15716 A01)

The objective of this research continues to be the development of improved numerical methods to solve the complete (non-hydrostatic) equations of hydrodynamics on meteorologically/oceanographically significant time scales. To achieve this objective filtering techniques for initial data are needed. Two promising techniques have been developed by Professor Kreiss which will be refined and tested. Also a general theory has been developed for constructing computational grids such that the flow can be computed accurately and efficiently in curved regions and boundary layers can be resolved. Work will continue in testing and applying that theory.

This research is designed to provide basic improvements in our ability to simulate geophysical circulations using numerical models. As such, it addresses one of the major objectives of the Global Atmospheric Research Program (GARP).

The computational tasks of this research will be carried out essentially at the National Center for Atmospheric Research (NCAR) in collaboration with NCAR scientists.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

7.0003, RESEARCH CONFERENCE ON RECENT ADVANCES IN VARIANCE COMPONENTS, G-INVERSES AND APPLICATIONS
J.S. Rustagi, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Statistics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DN975223; N00014-79-G-0014)

To improve the navy's surveillance capabilities by creating improved statistical and probabilistic methodology in the areas of variance components and generalized inverses related to problems in satellite remote sensing.

The contractor will organize and conduct a research conference on recent advances in variance components, g-inverses and applications to bring the latest developments to the attention of the user and statistical communities. The proceedings are expected to be published and disseminated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, MICROSCOPIC PARAMETERS OF TRANSITION METAL SUPERCONDUCTORS
T.H. Geballe, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (DMR76-21575 A01)

Extended X-ray Absorption Fine Structure Modulation Experiments at the Stanford Synchrotron Storage Ring will be used to study the microscopic parameters of importance in transition metal superconductivity. A series of well-documented compounds with the A-15 structure, such as Nb3Sn, NbGe, Nb3Ga and their derivatives, will be studied in order to correlate dynamic and static displacements within the unit cell with superconductivity.

Research previously supported under DMR76-21575.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, PLASMA PHYSICS
B.D. Fried, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY77-12873 A01)

Theoretical research in fundamental nonlinear plasma physics initiated under NSF grant PHY75-07809 A01 will be continued. Three principal areas are to be investigated: (I). Solitary wave structures in both unmagnetized and magnetized plasma. This includes the study of the evolution of Langmuir solitons in the presence of small perturbations; nonlinear drift wave phenomena; statistical theory of a system of large number of solitons; and the resonance absorption of electromagnetic waves in magnetized plasmas. (II). The kinetic approach to theories of low-frequency electromagnetic instabilities in general magnetic field geometries. Among the topics to be studied will be the linear and non-linear theories of kinetic tearing mode instabilities, as well as internal kink-like instabilities and the nonlinear evolution of kinetic drift wave instabilities and related energy transport phenomena. (III). Strong turbulence theory in plasmas, including the nonlinear-Schrodinger equation model of strong plasma turbulence; parametric processes in turbulent media; and cyclotron heating in a toroidal magnetic field.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0003, THE SUPERFLUID PROPERTIES OF LIQUID HELIUM
I. Rudnick, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR76-22306 A02)

Under NSF Grant DMR74-20823 simultaneous measurements were made of the velocity of first, second and fourth sound in superfluid Helium4 using an array of mechanical resonators. Supplementing these data with published data on the expansion coefficient and the entropy at one point, the complete thermodynamics of Helium4 were obtained from 1.2K to T and from vapor pressure to the melting curve. These measurements will be extended down to about 0.4K. Additional experiments to be undertaken with the array of resonators are: (a) a continuing study of the healing length of superfluid as a function of P and T; (b) a study of the Helium3 excitation spectrum in Helium3-Helium4 mixtures and (c) an investigation of the nature of sound propagation in the resonators when the helium is solid. Second sound in superfluid Helium3 has never been observed. Attempts will be made to detect it and measure its velocity using a spherical resonator and a frequency of approximately 3 cps. The fountain pressure in Helium3 will be sought and if found will be used to measure the entropy. For He II in a rotating, cylindrically symmetric vessel, the vortex distribution in equilibrium is not axially symmetric. The model of a rotating, weakly interacting Bose gas will be studied in order to understand how these rotational quantum-phase transitions occur. Additionally, the elastic theory of the recently speculated supersolids will be investigated, especially to understand if and how irrotationality can be consistent with a crystal structure. Although experiments have shown that the low frequency noise is an equilibrium phenomenon there is as yet no theoretical explanation consistent with the laws of thermodynamics. Various models will be investigated within the general framework of the theory of stationary, Gaussian, Markovian processes.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, MULTIPARTICLE SPECTROSCOPY EXPERIMENTS
P.E. Schlein, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY77-20762 A01)

This research is in the field of elementary particle physics. The area they will investigate is that of high multiplicity events produced in high-energy hadron-hadron collisions. This year they will continue the analysis of a CERN ISR experiment on high energy pp collision. They will also analyze data on single particle spectra from high-energy and pp interactions at FNAL. Developmental work on a calorimeter to be the basis of proposal to study jets at FNAL will continue.

This work is a continuation of that currently supported under NSF grant PHY-7720762.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0005, QUANTUM THEORY OF REACTIVE, DISSOCIATIVE AND INELASTIC MOLECULAR SCATTERING
R.T. Poe, University of California, Riverside Campus, School of Physical Sciences, Dept. of Physics, *Riverside, California* 92502 (CHE78-10291)

Professor Poe's grant is for research in the quantum chemical area of atom-molecule scattering. The fundamental process occurring in chemical reactions is the collision between atoms and/or molecules of reagents, with subsequent rearrangement of chemical bonds to form products. Three-dimensional quantum mechanical studies of atom-molecule reactive scattering will be carried out within the framework of the transition matrix formulation. Both formal theoretical development and specific applications will be studied. Theoretical development will involve the investigation and improvement of various approximation methods such as the adiabatic distorted wave method and the polarized target coupling method. Specific applications will emphasize reactions involving hydrogen atom isotopes and molecular hydrogen and also reactions involving hydrogen halides. Attention will also be given to the improvement of computational algorithms.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0006, SUPERCONDUCTIVITY OF MULTICOMPONENT MATERIALS
B.T. Matthias, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR77-08469)

A search for new superconducting materials will be undertaken in order to: 1) increase the maximum superconducting transition temperature, 2) increase the maximum critical field, and 3) increase and general knowledge of the occurrence of superconductivity in intermetallic systems. The effort will involve simultaneously the techniques of physics, chemistry and metallurgy. Synthesis of new multicomponent superconductors will be based in part on old hypotheses such as the electron-per-atom rules in binary systems and in addition search will be made for new rules or hypotheses for more complicated systems. Metallurgical properties such as hardness and ductility will be part of the study. Particular emphasis will be placed on combinations

of light elements such as boron, carbon, nitrogen, sulfur, and phosphorus with transition elements forming true ternary phases. Metallurgical properties of previously known superconductors will be improved.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, THEORY OF ELECTRON AND LATTICE DYNAMICS IN SOLIDS

L.J. Sham, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR77-09595 A01)

Three topics in the theory of electron and lattice dynamics in solids will be investigated: (1) The dynamics of electrons trapped in the semiconductor-oxide interface of a metal-oxide-semiconductor junction, with particular emphasis on superconductivity due to the dielectric influence of an insulator layer, validity of the effective mass approximation, the electron-electron interaction and the electron-phonon interaction. (2) The electronic contribution to lattice vibrations of crystals with surfaces, including the effective charge of semi-infinite ionic crystals or slabs. (3) The exact solution of the first-order change in the wave function of an electron in the Kronig-Penney model under perturbation to study the convergence rate of the usual first-order perturbation expression in terms of an infinite series of unperturbed states, and, if necessary, the development of variational and other methods for the first order change in the wave function.

This is a continuation of research previously supported under DMR73-07593.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, CONDENSED MATTER SPECTROSCOPY

W.C. Walker, University of California, Santa Barbara Campus, Graduate School, Dept. of Physics, *Santa Barbara, California* 93106 (DMR77-09954 A02)

Spectroscopic investigations of solids previously supported by NSF grant DMR7202991 will be continued and extended to new systems of interest. Three related research topics will be addressed. These include: 1) the electronic properties of heteronuclear excimers in solids, excimers of interest include Krypton-Oxygen and Xenon-Fluorine which result from both direct excitation and interaction with the self-trapped exciton in rare gas solids doped with diatomic and polyatomic molecules; 2) the electronic and vibrational properties of molecular solids; and 3) the electronic and vibrational properties of molecular solids disordered by heavy doping with various molecules. In support of this work studies on a variety of the halogen- and chalcogenide-containing pure molecular solids mentioned above, as well as others will be pursued. The experimental techniques to be used are those of low-temperature spectroscopy, including absorption, photoluminescence and photo-yield spectroscopy and lifetime measurements in the spectral range 2 to 30 electron volts. Derivative spectroscopy, particularly thermal modulation, will be used to study fine structure such as that due to persistent vibrational states in the solid phase. The experiments will be done with both conventional sources at Santa Barbara and with subnanosecond pulsed, synchrotron radiation at the Stanford Synchrotron Radiation Project.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, ELECTRON TUNNELING STUDIES OF SOLID SURFACES AND INTERFACES

P. Hansma, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DMR76-83423 A01)

Inelastic electron tunneling studies of adsorbed atoms and molecules on surfaces of metals and insulators previously supported by NSF grant DMR-7203276A02 will be continued. Specifically, inelastic electron tunneling spectroscopy will be used: (1) to identify new species, and possibly catalytic intermediates, on both oxides and supported metals, (2) to further develop the use of peak intensities of determining the orientation of surface species, (3) to extend research on electron beam damage in monolayers, (4) to explore reactions between monolayers and evaporated metals, atoms, and finally (5) to continue two fruitful collaborations in elastic and Josephson tunneling.

Experimental investigations of the bonding between carbon monoxide and metals supported on alumina will be continued. The long-term goal in this area is to find new and useful information about an important class of reactions: the synthesis of hydrocarbons from the products of coal gasification on supported metal catalysts.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0010, ELECTRON SPECTROSCOPIC STUDIES OF THE ELECTRONIC PROPERTIES OF TRANSITION-METAL-OXIDE SURFACES

V.E. Henrich, Yale University, Graduate School, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DMR78-23963)

A systematic study of the surface electronic properties of transition-metal oxides and perovskites, which are extremely important in catalysis and phototelectrolysis, will be carried out. Nearly perfect surfaces of TiO2 and SrTiO3 will be measured by the surface-sensitive electron-spectroscopic techniques of UPS, XPS, ELS, LEED and AES; the results of those measurements will be compared with developing theories. The program will also involve studies of the nature and origin of defect states on transition-metal-oxide surfaces. Defects will be produced in a controlled manner by ion or electron bombardment, cation deposition and the preparation of stepped surfaces, and the role played by d-electron configuration and ligand environment in the properties of both intrinsic and extrinsic (defect) surface states will be investigated. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, FUNDAMENTAL ASPECTS OF THE THEORY OF ATOMIC COLLISIONS

W. Lichten, Yale University, School of Arts & Sciences, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (PHY78-08432)

Theoretical research in Atomic Physics, currently supported under NSF grant PHY74-09408 A03 will be continued. The topics to be investigated include studies of basic atomic and molecular theory in: 1) atomic collisions, from the standpoint of the electron promotion model, 2) atomic and molecular processes in intense electromagnetic fields, 3) astrophysics of the interstellar medium.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0012, LIQUID AND SOLID HELIUM AT VERY LOW TEMPERATURES

E.D. Adams, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (DMR77-13933 A01)

Research begun under NSF grant No. DMR75-19548 will be continued and extended. The properties of liquid and solid helium-3 will be investigated with special emphasis on nuclear spin ordering and the associated magnetic properties of solid helium-3. Experiments on liquid helium include measurements of: 1) specific heat and the thermodynamic pressure, 2) nuclear magnetic resonance in the flowing superfluid, and 3) viscosity of the normal fluid.

Experiments on solid helium include: 1) high field effects on the pressure and entropy, 2) a variety of nuclear magnetic resonance studies on the solid produced by compressional cool-

ing, and 3) nuclear demagnetization of solid helium-3. A major aspect of the work is the completion of a nuclear demagnetization facility.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0013, ANGLE RESOLVED PHOTOEMISSION STUDIES OF SOLID SURFACES AND OVERLAYERS USING SYNCHROTRON RADIATION

Z. Hurych, Northern Illinois University, School of Liberal Arts & Sciences, Dept. of Physics, *DeKalb, Illinois* 60115 (DMR78-11663)

The experimental research program to study the electronic structure of solids, surfaces and interfaces by means of Ultraviolet Photoemission Spectroscopy (UPS) using synchrotron radiation which previously was supported by NSF grant DMR-7616436 A01 will be continued. The experimental studies will focus on two research areas. The first includes problems related to bulk as well as surface electronic structures of the layered semiconductor Bi2Te3 (both clean and with adsorbate), and calculation of the angular patterns that would ascertain the relative role of single (Bragg) and multiple scattering in the photoemission process. Also surface and bulk properties of selected sodium tungsten bronzes will be studied. The second area, representing a new effort, will be studies of the electronic properties of ordered chalcogen overlayers adsorbed on single crystal surfaces of a series of d-band metals, Ni, Ag and Cu. Here specific advantage will be taken of an active collaborative interaction with the theoretical group of Professor S. Y. Tong (University of Wisconsin at Milwaukee). Comparison of experiments with state-of-the-art theoretical treatment should allow, by means of identification of the symmetries and locations of the bonding sites, determination of the basic properties of the chemisorptive bond.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0014, ELEMENTARY-PARTICLE THEORY

R.J. Oakes, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics, *633 Clark St., Evanston, Illinois* 60201 (PHY78-11607)

The proposed work is in the field of theoretical physics, with emphasis on studies of interactions of elementary particles at high energies. Specific topics which will be examined include calculations of: A) Production of charmed baryon pairs in electron-position annihilation; B) Exclusive cross sections for neutrino induced production of heavy quarks; C) Cross sections for pair production of intermediate vector bosons in pp and pp colliding beams; D) Weak interactions at extremely high energies with particular relevance to the DUMAND project.

This work is a continuation of that currently supported under NSF grant PHY7611445.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0015, SUPERCONDUCTIVITY IN METAL-HYDROGEN SYSTEMS

C.B. Satterthwaite, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR77-08463 A01)

This research program is a continuation of the work presently supported under NSF grant No. DMR75-13083. Its primary focus is on superconducting metal hydrides and the effect of hydrogen absorption and superconductivity of other materials. It involves synthesis of thorium and palladium hydrides and deuterides, Nb3SiHx and single-crystalline Nb3Sn. Experimental projects include: (a) the development of a high-precision specific heat apparatus and study of the low-temperature specific heat of PdHx and PdDx; (b) a study of the 50K phase transition in PdH(D)x; and (c) a study of superconducting tunneling in Th4H15. It also includes collaboration research with other groups in: (a) an EXAFS study of PdHx; (b) neutron scattering experiments on Th4H15; and (c) photoelectron emission studies in the UV and soft X-ray region of thorium hydrides.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0016, FUNDAMENTAL PROCESSES AND INTERACTIONS IN METALS

J.C. Swihart, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DMR77-10549 A01)

Research begun under NSF grant No. DMR73-07590 will be continued and extended. The fundamental interactions which cause or might cause superconductivity will be studied with special emphasis on the electron phonon interaction. Calculations of the electron lifetime and phonon mass enhancement as a function of position on the Fermi surface will be undertaken. The transport properties, the thermopower, and electromigration will be investigated. A second broad area of research will be a theoretical study of the connection between infrared absorption data and the strength of the electron-phonon interaction. The role of impurities in the absorption process will be investigated.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0017, X-RAY STUDIES OF SOLID-STATE PROPERTIES - VALENCE CHARGE DENSITIES AND ACOUSTOELECTRICALLY AMPLIFIED PHONONS

R. Colella, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR77-27534)

Professor Colella's laboratory is developing techniques for inferring structural properties of solids from the diffraction of monochromatic X-rays. One part of the work is concerned with the nature of bonding in tetrahedrally coordinated semiconductors, specifically the III-V compounds. The details of the electronic structure, in particular the distribution of the valence (bonding) electrons, is open to question. To address this issue, Colella collaborators very carefully measure the intensities of quasi-forbidden X-ray diffraction peaks to infer the interatomic electron distribution. Extension of this work is concerned with the variation of bonding charge density as a function of applied pressure up to 100 Kbar in order to distinguish between effects due to thermal vibrations and changes in interatomic distances.

The second part of this work uses observation of satellite peaks on the wings of double-crystal X-ray diffraction peaks to observe acoustoelectrically amplified phonons (lattice vibrations). Use of this X-ray scattering technique permits study of crystals opaque to useful optical radiation. Under study are the anharmonicity of the acoustoelectric atomic vibrations; relation of anomalous transmission to momentum exchanged in the scattering process; and, use of time resolved experiments to discriminate between primary phonons and those generated through wall reflection and other processes.

This is a continuation of work supported under DMR 77-06744. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0018, DYNAMIC PROPERTIES OF LIQUID CRYSTALS

C.E. Tarr, University of Maine, Orono Campus, School of Arts & Sciences, Dept. of Physics, *36 Winslow Hall, Orono, Maine* 04473 (DMR78-10313)

The study of molecular dynamics and orientational order in liquid crystals provides a means of probing important liquid state parameters using well-understood techniques developed for the study of the solid state. Professor Tarr's work falls in this category. It includes several closely related nuclear magnetic resonance studies of liquid crystals. Each of the experiments makes use of the ordering effects of electric fields. In the first

experiment, the orientational dependence of deuteron quadrupole splitting is used to obtain uniaxial and biaxial order parameters in the smectic C phases of selectively deuterated compounds. Further, this technique is used to investigate the effects of electric field induced biaxiality in uniaxial phases. Finally, the transient molecular reordering giving rise to bulk flow in nematics is investigated using NMR to monitor molecular orientation in response to electric fields.

This is the first year of a three-year continuing grant.

It is a continuation of work supported by DMR 75-06474.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, EXTENSION OF MULTICHANNEL QUANTUM DEFECT THEORY TO COMPLEX MULTILIMIT ELECTRONIC STRUCTURES

M.L. Ginter, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (PHY77-14953)

This is a combined theoretical and experimental study in atomic and molecular physics which will extend existing methods for applying the current theoretical model (multichannel quantum defect theory) to include complex electronic structures (i.e., structures encountered in most real atomic and molecular problems) using extensive and highly resolved spectral data for Al, As, Sb, Bi and the elements in groups IIa and IV to critically test our results. For the quasi two-limit case we will determine (a) the practical limitations on MQDT parameterizations, (b) the relative contributions of angular momentum recoupling, configuration interactions, core polarization, etc. to specific channel structures, and (c) the relative compositions of the eigen states associated with channel structures in both the close and loose coupled regimes. For the quasi three- and four-limit cases we will determine (a) the suitability of graphical methods and (b) appropriate numerical substitutes to graphical approaches for application to systems with more than two limits. Appropriate experimental data aleady are in hand for Ca and the elements in group IV, while the remaining data will be obtained using existing instruments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0020, ENERGETIC PARTICLE INSTRUMENTATION RESEARCH

P.M. Hagan, Emmanuel College, Graduate School, Dept. of Physics, *400 the Fenway, Boston, Massachusetts* 02115 (DF266620; F19628-76-C-0039)

AF function - communications and surveillance. Deficiency -inability to predict solar particle effects on atmospheric and ionospheric environmental conditions. Objective - this is a research effort directed toward the design, development and construction of energetic particle detection instrumentation for satellite flight. Design instruments to measure energetic particle fluxes, discriminate species (electrons, protons and/or ions), and perform energy analysis. Instrumentation must be capable of discovering new scientific knowledge concerning the near-earth space energetic particle environment and be compatible with available Air Force satellite rides. The effort will cover the whole spectrum from design through construction and integration into the host satellite vehicle. Some adjustments in design may be required during integration to account for design discrepancies in the host vehicle. This re-design may have to be performed on extremely tight time schedules and, hence, personnel will have to be present during integration. How research contributes - provides instrumentation for detection and identification of energetic particles in space.

State-of-the-art instrumentation is developed and matched to available satellite rides with limited notice as to required sensitivities, data rates and limited power allotments. Instrumentation must be adapted to current research needs based on past experience and available components. New devices such as position sensitive detectors, micro-processors and magnetic materials must be integrated into current designs to obtain maximum spatial, angular and energy resolution consistent with reliability and delivery schedules. Instrumentation must be integrated into satellite payloads and adjustments and repairs made as required. Reports on all aspects of the instrumentation and data formats are prepared for utilization and interpretation in analysis of final data. Personnel remain available up to final launch for recalibration and repairs and assist in evaluation of data during launch and post-launch period. Final calibration is conducted following launch during the data reduction process. Passive detectors recovered from space flights are studied for intensity and identification of species, i.e., protons or electrons.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0021, EXTENSION OF SPIN-POLARIZED TUNNELING TECHNIQUES TO THE STUDY OF FERROMAGNETIC CRYSTALS

R.H. Meservey, Massachusetts Inst. of Technology, Francis Bitter National Magnet Lab., *170 Albany St., Cambridge, Massachusetts* 02139 (C670 T. O. 9)

This research will extend the technique of spin-polarized electron tunneling to single crystals and bulk ferromagnetic metals to allow measurements giving fundamental insight into the nature of ferromagnetism in metals. The fabrication of thin (20 A) aluminum tunnel junctions on clean surfaces of single crystals of nickel and other ferromagnets will allow these experiments to be carried out. The measurements with bulk single crystals will be in the regime where theoretical calculations including band structure and surface effects can be applied with considerably more confidence.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, PHYSICS OF INTENSE CHARGED PARTICLE BEAM

R. Davidson, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN980181; N00173-79-C-0036)

The area of charged particle beam technology is becoming increasingly important to the Department of the Navy. This program theoretically investigates the equilibrium, stability, transport and radiation properties of intense charged particle beams. The objective of the program is to develop theoretical scaling laws defining the importance of the processes mentioned previously.

Theoretical and computational plasma physics techniques will be applied to the investigation of the stability and transport properties of intense ion beams. The cyclotron maser instability will be investigated in parameter ranges of interest to the NRL gyrotron program. Theoretical studies will be undertaken of non-linear effects as they pertain to microstability behavior and anomalous transport in high-temperature plasmas.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0023, DYNAMICS OF GALAXIES

C. Lin, Massachusetts Inst. of Technology, School of Science, Dept. of Mathematics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (MCS78-04888)

Renewal of MCS-7513878.

The investigators will tackle some major unsolved galactic problems, with a new emphasis on related topics in plasma physics. These will include the maintenance of spiral structure, global instabilities of disc-shaped galaxies, barred galaxies and their properties, the evolution of nuclear species in galaxies, nonlinear effects in density waves, and other topics. Partial progress has already been made in some of these areas.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

8.0024, SUPERCONDUCTING TUNNELING INTO SINGLE CRYSTAL TANTALUM

M.L. MacVicar, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-07202)

A systematic investigation of strong coupling superconductivity in single crystal tantalum and single crystal vanadium will be made by means of tunneling studies. Strong coupling characteristics will be delineated at various temperatures between 0.3 and 4.4K. Similar experiments with Ta-In and Ta-Au junctions are planned to compare with Ta-Pb results. Fabrication techniques for single crystal vanadium substrate junctions will be developed. This work is important for characterization of the superconducting parameters in the transition elements.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, SINGLE-PARTICLE AND PAIR-TUNNELING SPECTROSCOPY OF A15 SUPERCONDUCTORS

A.M. Goldman, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (DMR78-08513)

Single-particle tunneling experiments will be carried out on V3Si and V3Ge single crystals and on films of Nb3Ge, Nb3Sn and V3Si. Complementary specific heat measurements will be made. Pair-field susceptibility of single crystals will be studied to obtain the spectrum of fluctuations of the order parameter and to determine the degree of anisotropy. Single-particle and pair tunneling experiments will be conducted on single crystals near the structural phase transition. These studies are important for testing microscopic theories of superconductivity for these compounds and for determining the relationship between the structural and superconducting transitions. This is a continuation of work sponsored under DMR-7601370.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, SURFACE ELECTROMAGNETIC WAVE STUDIES OF VARIOUS MATERIALS ON METAL SURFACES

R.J. Bell, University of Missouri, Rolla Campus, School of Arts & Sciences, Dept. of Physics, *103 Parker Hall, Rolla, Missouri* 65401 (DMR75-19153 A01)

This is a continuation of research on the development of surface electromagnetic wave spectroscopy (SEWS) as a technique to study a variety of surface reactions. During this phase of the program, the following will be undertaken: (1) completion of assessment of SEWS as a surface science technique; (2) completion of studies on physisorption and chemisorption of benzene on clean, well-characterized Cu and Ni surfaces as a function of oxygen content; and (3) hydrogenation studies of benzene on Ni surfaces. This is a renewal of NSF grant DMR75-19153.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, MEASUREMENTS OF THE 1-15 MEV EXTRA-TERRESTRIAL GAMMA-RAYS AND THE 3-70 MEV ATMOSPHERIC NEUTRONS

J.A. Lockwood, University System of New Hampshire, University of New Hamsphire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM78-09702)

This grant will support balloon flights in 1978 and 1979 of a new University of New Hamsphire (UNH) neutron and gamma-ray (n-gamma) detector capable of measuring the fluxes, energy spectra, and angular distributions of neutrons and gamma-rays in the energy intervals from 3 MeV to 70 MeV and 1 MeV to 15 MeV respectively. The new system is a modification of the UNH n-gamma detector previously flown. The detector consists of two banks of scintillators separated by 1.2 m with a time-of-flight (TOF) system between the two banks. The upper detector consists of twelve NE 213 liquid scintillators each 7.5 cm x 7.5 cm in size. The lower bank has ten 12.5 cm x 5 cm sodium iodide scintillators and six scintillators. The pulse shape discrimination (PSD) in each scintillator cell separates the protons and alphas produced by neutrons from the electrons produced by gamma-ray interactions. Pulse height analysis on each interaction coupled with TOF measurements enables the direction and energies of neutrons and gamma-rays to be determined. The two detector banks are separately enclosed in anti-coincidence charged particle shields.

The flights will produce: (1) a measurement of the diffuse cosmic gamma-ray flux from 1-15 MeV; (2) upper limits on discrete gamma-ray sources in the 1-15 MeV energy range; (3) accurate atmospheric gamma-ray flux values; (4) angular distributions of neutrons from 3-70 MeV at the top of the atmosphere; and (5) the neutron energy spectrum from 3-70 MeV.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0028, PROPERTIES OF OXIDES OF GAAS

F. Pollack, City University of New York, Brooklyn College, New School of Liberal Arts, Dept. of Physics, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (DN875662; N00014-78-C-0718)

The growth of oxides on the semiconductor gallium arsenide is an important technology area for several Navy systems requirements. Photolysis, solar energy conversion, and anodization of gallium arsenide for electron device application are areas which will benefit from improved understanding of the electrochemical nature of the growth process.

The investigator will investigate the nature of oxides grown by anodization techniques on gallium arsenide. In-situ, time-dependent optical measurements such as reflection, electroreflection and Raman scattering will be made. Such measurements will give evidence as to the effects of impurities, crystal surface orientation, type of electrolyte, growth temperature, electrical state of the electrochemical cell, and wavelength of illuminating radiation. Optical constants for the substrate and the growing oxide will be deduced from Kramers-Kronig analysis. Time dependent measurements will permit deduction of kinetic effects in the growth process. Previous results of Raman scattering on oxidized GaAs have indicated a breakdown of selection rules involving a forbidden to phonon, mechanisms will be investigated which explain such effect.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0029, THEORETICAL SOLID-STATE PHYSICS

J.L. Birman, City University of New York, City College, School of Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DMR78-12399)

Research previously supported by DMR76-20641.

Theoretical research in condensed matter physics will be carried out. The topics to be investigated will include: (1) novel applications of group theory; (2) optical properties of condensed matter, including resonant inelastic light scattering and optical properties in non-local media and surfaces; (3) anomalous electronic properties and structural phase transitions in A-15 superconducting alloys; (4) the 'inverse' periodic potential problem; (5) lattice dynamics of diamond, graphite, cuprous oxide and related compounds; and (6) optical and electronic properties of tetrahedral amorphous semiconductors.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, BLACK-HOLE PHYSICS AND RELATIVISTIC ASTROPHYSICS

S.A. Teukolsky, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (PHY78-09795)

Theoretical research in relativistic astrophysics and gravitation initiated under NSF grant PHY7607297A01 will be continued. The following topics will be investigated: 1) relativistic spherical collapse; 2) effect of gravitational waves from gravitational collapse on surrounding matter; 3) numerical calculation of gravitational wave fluxes; 4) dynamics of the Virgo supercluster; 5) tidal disruption of clusters of galaxies; 6) density profiles around cluster of galaxies; 7) hydrodynamical problems in astrophysics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0031, ELECTRON SPIN RESONANCE

R.H. Silsbee, Cornell University, Ithaca Campus, School of Physical Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR77-08464 A01)

Applications of the method of electron spin resonance to problems in solid-state physics previously supported by DMR-7420689 will be continued. The work progress focuses on the use of transmission electron spin resonance in metals using a variety of bilayer or multilayer samples. Three experiments are of specific interest. The first involves measurements on copper-ferromagnetic bilayers using alloy (palladium-iron) films of controllable Curie temperature with the aim of verifying existing models for spin coupling at the interface. A second is the study of the spin lattice relaxation process in polyvalent metals. The third involves developing a characterization and understanding of the interfacial boundary conditions for spin transport at the interface between a normal and a superconducting metal.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, ELECTRONIC STRUCTURE AND MAGNETIC EXCITATIONS IN DISORDERED MATERIALS

L.M. Roth, State University of New York, Albany Campus, School of Science & Mathematics, Dept. of Physics, *1400 Washington Ave., Albany, New York* 12222 (DMR75-18104 A01)

Research previously supported by DMR75-18104.

Theoretical research in condensed matter physics will be carried out. The emphasis will be on understanding the electronic structure of liquid and amorphous metals and alloys. The solution of this problem is one of the most challenging in these technologically important materials.

Single site theories, especially the effective medium approximation, will be applied to a potential model of a liquid metal to calculate the density of states and Knight shift, and with suitable extensions of the theory, conductivity and Hall effect. This approach will be applied to study mercury and other divalent liquid metals, amorphous metal-metalloid alloys and semiconducting alloys.

Also to be investigated are magnetic excitation in magnetic alloys using the coherent potential approximation. The spectral weight function and density of states will be compared with neutron diffraction results and computer simulation. Magnetic excitations in an amorphous ferromagnet will be studied using an extension of the effective medium approximation. Magnetization and specific heat will be calculated, and excitations at long and short wavelengths will be examined for various forms of the exchange. The effects of finite temperature will also be studied, for comparison with experimental results in amorphous metal-metalloid alloys.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, SEARCH FOR WIGNER LATTICE IN TWO DIMENSIONS

A.J. Dahm, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (DMR75-19542 A01)

This is a renewal of work supported by DMR75-19542.

Techniques are delineated to search for a Wigner lattice of electrons on the exterior side, or of ions on interior side, of the free surface of liquid helium. Studies will be made of the temperature and magnetic field dependences of the longitudinal and transverse vibrations of the lattice; plasma oscillations of a two-dimensional ion gas at low ion densities and sound modes of electrons bound to a helium film above a metal substrate will be probed. Research on ions in solid He will be continued.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, PHYSICS QUARTZ PROCESSING

J.J. Martin, Oklahoma State University, School of Arts & Sciences, Dept. of Physics, *Agricultural Hall, Stillwater, Oklahoma* 74075 (DF903320; F19628-77-C-0171)

The objective of this effort is to develop superior material for timing applications. How research contributes - development of new hardening techniques for quartz may result in superior quartz resonators. The Air Force function is navigation, communication, surveillance. Deficiency - presently available resonator materials suffer long term frequency instability and radiation damage.

The approach will be a study of the defects produced by various types of radiation and develop methods to overcome defect formation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

8.0035, MAGNETO-OPTICAL STUDY OF COOPERATIVE PHENOMENA IN DILUTE MAGNETIC MATERIALS

J.A. Griffin, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DMR77-23409)

The manner in which the behavior of magnetic materials is changed by the introduction of non-magnetic impurities is a topic of current interest in solid-state physics. This research deals with the 'percolation problem' and may provide new insight into the behavior of all magnetic materials. The systems to be studied will include those where: 1) the magnetic coupling is predominantly short-range exchange and the concentration p of magnetic ions is such that p is greater than pc, where pc is the percolation concentration; 2) the magnetic coupling is predominantly the long-range magnetic dipolar coupling and the concentration of magnetic ions is again such that p is greater than pc, and 3) the magnetic coupling is short-range but the concentration p is near pc. In each of these cases materials have been selected which not only represent experimentally accessible approximations to theoretically discussed models but which also are known to exhibit large optical magneto-optical effects. In these experiments, the magneto-optic behavior of these selected materials will be used as a sensitive probe of the magnetic behavior in order to test the current theories of critical behavior associated with the randomization.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, DYNAMIC AND STATIC RESPONSE OF INHOMOGENEOUS METALLIC SYSTEMS

S. Ying, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR76-10376 A01)

Research previously supported by DMR76-10376.

Theoretical research in condensed matter physics will be carried out. The main emphasis will be on the development and application of the density matrix formalism for studying the electronic properties of surfaces and localized defects in metals. This formalism will enable a generalization of previous work on chemisorption of the adsorbate and substrate.

This research will further the understanding of the behavior of metallic surfaces and the nature of the chemisorption process.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, THE COLLISIONAL DYNAMICS FOR COLLISIONS OF UF6 WITH ATOMS AND MOLECULES

R.L. Champion, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (DF056440; F49620-79-C-0219)

AF function - this proposed research primarily falls in the 6.3 research objectives which deal with weapon effects. The generation of electron, proton and heavier material beams and their effects on different targets will be studied. It is also intended that ways to limit or reduce the damage will be investigated. Deficiency - at present, data and methods to reduce the damage caused by particle beams is almost non-existent. Objective - an experimental program will be carried out to generate heavy particle beams and to study the damage caused by electrons, protons and heavier particle beams. Contribution -this research is a part of a comprehensive program in radiation and particle interaction with matter investigations.

A study of the collisional dynamics of UF(6) with atoms and molecules in the four areas below constitute the approach. (1) Study the reaction of UF(6-) with a variety of targets including atomic, diatomic and polyatomic species. The absolute total cross sections for the various reaction channels such as those given by (3) will be measured. These measurements should be accurate to within 10 percent. (2) The energy range of the experiments will be extended to include the region from below threshold for the different processes up to 1 kev. (3) A particularly interesting and potentially important aspect of the proposed research involves varying the initial internal energy distribution of the primary ion beam, UF(6-). This can be simply accomplished by varying the temperature of the surface attachment source, since UF(6-) has many low lying vibrational modes (and possibly electronic states) and is surely in thermodynamic equilibrium with the hot surface upon desorption. From statistical consideration, one would anticipate the branching ratios for the outgoing channels to be a sensitive function of the initial excitation energy of the parent ion. (4) An attempt will be made to analyze the experimental results in the framework of statistical models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0038, POSITIVE AND NEGATIVE ION COLLISION STUDIES

R. Geballe, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (PHY78-00856)

Measurements will be made of partial cross sections for reactions X- plus hv yields X* plus e-, where X will be Li, Na and K, by optical detection of the excited states. The measurements will be made in two distinct regions of interest. Near the excitation threshold, an absolute normalization of the cross sections will be made. Far from threshold, predictions of correlation effects will be tested. A separate set of experiments will measure cross sections for low energy resonant charge exchange collisions between highly ionized species and various neutrals. The low-energy, highly ionized beam will be produced in a modified, laser-induced plasma. Absolute measurements of X-radiation from excited states of the product ion will be attempted in order to determine partial cross sections.

This is a continuation of work supported by NSF Grant PHY76-02055 A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0039, ELECTRONIC ENERGY TRANSFER FROM NITROGEN IN THE A AND B STATES TO METAL ATOMS

S. Rosenwaks, Ben Gurion University of the Negev, *P.O. Box 2053, Beersheba, Israel* (DF289760; AFOSR-78-3718)

AF function - the Air Force Weapons Laboratory has identified this research as being germane to their specific interests. Deficiency - a lack exists in the understanding of electronic energy transfer processes. Research - this research is strongly supportive of AF programs in molecular dynamics and chemical lasers. Modern techniques will be employed for the production of excited nitrogen and for the production of metal atoms in low translational temperature. Energy transfer rates from molecular nitrogen to specific energy levels of the metal atoms will be calculated from experimental data. How research contributes - this grant provides for the expendable items associated with the research project. None of it will go to provide for salaries or items of permanent equipment. The data generated by this project will be of great value to AFWL in their laser program.

A great deal of work has been done on the subject of energy transfer from excited nitrogen to other molecules and atoms. This project will employ recently developed methods for producing molecular nitrogen in specific energy levels. Excited molecular nitrogen will be reacted with metal atoms and the emission from the excited states of the metal atoms will be measured with a calibrated optical system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, CONTINUED DEVELOPMENT OF INFRARED SPATIAL INTERFEROMETRY

F.J. Low, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST77-01261 A01)

Spatial interferometry offers the hope of achieving angular resolution ten times better than conventional observations in the infrared region of the spectrum. Such improvement will allow detailed comparisons with observations at visible and millimeter wavelengths which are vital to understanding the physical processes involved in a wide range of celestial objects.

A spatial interferometer has been constructed and successfully used at the University of Arizona. Using this instrument the limitations imposed by the earth's atmosphere will be studied in various wavelengths ranging from 2 to 20 microns. The instrument will be improved by the addition of a second baseline to more than double the instrumental efficiency. Methods of increasing the usable baseline, and hence, improving the obtainable resolution will be explored.

Observations will be made of circumstellar dust shells, stars and planetary systems in the process of formation and the nuclei of energetic galaxies.

This is a continuation of work supported under NSF grant MPS 75-00530.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, PHOTOASSISTED HETEROGENEOUS REACTIONS OF STRATOSPHERIC GASES

M.L. Robbin, Aerospace Corp., *2350 E. El Segundo Blvd., El Segundo, California* 90245 (ATM77-23435)

This grant funds a detailed examination of the mechanisms and rates of photoassisted hetereogeneous catalysis of CFCl3, CF2Cl2, and N2O, as well as wavelength dependencies for these processes on environmental and model surfaces of interest. In addition, the photoassisted heterogeneous oxidation of SO2 and the decomposition of H2O, processes also of considerable environmental interest, will be examined. These studies will be carried out using the powerful tool of photoacoustic spectroscopy, a technique particularly well suited for the proposed investigations, in combination with flow reactors equipped with sensitive mass spectrometric or gas chromatographic-electron capture detectors.

The results of these studies will be of considerable interest to the atmospheric sciences community. These studies will indicate the extent to which photoassisted heterogeneous catalysis of CFCl3, CF2Cl, and N2O can act to remove these compounds in the troposphere, thereby reducing stratospheric ozone depletion attributable to photolysis of these species in the upper atmosphere. Work on SO2 will determine the importance of this heterogeneous process in SO2 conversion to sulfate, currently

one of the major problems of interest in air pollution chemistry. The work on H2O will indicate the role of photo-assisted heterogeneous catalysis of this species in the generation of atmospheric hydrogen. The latter results, of course, will also be of interest to scientists involved in solar energy conversion processes based on the photolytic decomposition of water.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0003, ANALYSIS OF MOLECULAR SPECTRA

J.G. Phillips, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST7605905 A02)

The successful study of molecular structure, excitations and abundances in astrophysical sources requires extensive and reliable laboratory information on molecules. This information includes transition identifications, relative and absolute transition probabilities and dissociation energies. This research program will provide astrophysicists with such information. During the coming year, the analysis of ZrO will be completed. The infrared spectrum of TiO and the spectra of FeH and FeD will be studied. A program to measure the lifetimes of excited molecular states will be carried out. Computer generated synthetic spectra of ZrO will be compared with electronic furnace spectrograms and photoelectric scans. The laboratory measure, analyses and transition probabilities will be applied to studies of molecular spectra found in cool stars.

This action provides additional funding for work previously supported by NSF grant AST76-05905A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0004, INTERSTELLAR MOLECULAR LINE OBSERVATIONS AT 1 MM WAVELENGTH USING A JOSEPHSON MIXER

J. Edrich, University of Denver, Denver Research Inst., *University Park, Denver, Colorado* 80210 (AST76-24241 A01)

A mixer receiver for the detection of millimeter wavelength signals will be completed. The receiver will be used for observations of interstellar molecular lines. The receiver is based on a Josephson mixer and followed by a low-noise maser with more than 100 MHz bandwidth. New permanent Josephson junctions and a closed-cycle refrigerator will be used in order to obtain reliable field operation. Field tests will be conducted at the 36-foot NRAO millimeter telescope at Kitt Peak.

This work is a continuation of research previously supported by NSF grant AST 76-24241.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0005, BRIGHT STAR CATALOGUE AND PARALLEX CATALOGUE

W.F. VanAltena, Yale University, Graduate School, Dept. of Astronomy, *206 Elm, New Haven, Connecticut* 06520 (AST75-17847 A01)

The Yale Bright Star Catalogue and the Yale General Catalogue of Trigonometric Parallaxes will be updated with both improved and new data available since the previous editions were published in 1964 and 1963, respectively. A third of the bright stars have had changes or additions to their data. More than 1,200 new parallaxes are available. A thorough statistical analysis of the parallaxes will be undertaken to determine the best weighting system and reduction of the results from various observatories to a uniform system. The Stellar Data Center at Strasbourg will collaborate on the work.

Approximately two years will be required to complete and publish both catalogues.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, INFRARED AND OPTICAL PHOTOMETRY PROGRAMS AT LAS CAMPANAS OBSERVATORY

S.E. Persson, Carnegie Inst. of Washington, *1530 P St. N.W., Washington, District of Columbia* 20005 (AST76-22676 A01)

A photometric system suitable for use in the infrared spectral region will be completed for use on the 2.5 meter telescope at the Las Campanas Observatory in Chile. A general-purpose high-resolution spectrometer for use in the one to five micron region will be built.

Observational projects to be carried out using this photometric system include: 1) The extension of work on the stellar content of galaxies by means of recording and analyzing the distribution of energy as a function of wavelength in the red and infrared spectral regions. Particular attention will be paid to determining the fraction of heavy metals in stars. 2) Observations of southern hemisphere gaseous nebulae. Protostars will be located and their characteristics will be studied.

This research is a continuation of work previously supported under NSF grant AST 76-22676.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, SOLAR FLARE AND SOLAR-INTERPLANETARY PHENOMENA INVESTIGATED WITH HIGH-ENERGY CHARGED PARTICLES

J.A. Simpson, University of Chicago, Enrico Fermi Inst., *5801 S. Ellis Ave., Chicago, Illinois* 60637 (ATM77-24494 A01)

This grant will support the following: (1) A study of the physical conditions required for charged particle acceleration in solar flares (this problem will be attacked mainly by using the analysis of H and He isotopes and the relative abundances of key elements such as He, C, O, Si and Fe in the flux of flare particles). (2) A study of the dynamics and large scale magnetic configurations of the heliomagnetosphere arising from '11-year' changes in the solar magnetic field and plasmas (such as solar magnetic field polarity reversal) (analyzed by space experiments and neutron intensity monitors). (3) A study of the build-up and dissipation of corotating stream-stream interaction regions extending to approximately 15 astronomical units from the sun, and to determine their structure and related shocks. (These regions appear to play a significant role in solar modulation of cosmic rays near the ecliptic plane.)

The approach to this problem will be mainly by using data from Pioneer 10/11, space probes, neutron intensity monitor data and Jovian electron fluxes.

The overall aim is to study the energetic particle environment of the earth and the sun.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0008, COMPOSITION, PROPAGATION, AND ACCELERATION OF ENERGETIC PARTICLES IN THE SOLAR SYSTEM

P. Meyer, University of Chicago, Graduate School, Dept. of Physics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (ATM77-04809 A01)

Supported by the National Science Foundation, Prof. Meyer has carried out a research program aimed at elucidating problems connected with the acceleration and propagation of energetic particles in the solar system. Much of this work was concentrated on understanding the emission of relativistic electrons by the sun and in the solar system and on the effects of solar modulation of the electron component and its long-term changes with time.

This grant will extend these investigations for a period of three years. During that time he will continue the measurement using a balloon-borne particle spectrometer and coordinate this effort with the results from an instrument to be carried on the ISEE-C spacecraft. This latter instrument is being developed (with NASA support) and ISEE-C is scheduled for launch in late 1978. The ranges of electron energies observed by the balloon-borne detector and the satellite instrument overlap for a reasonably wide range, so that intercalibration is possible, but they are essentially complementary, with the satellite instrument covering electrons from 5 to 400 MeV, and the balloon instrument sensitive up to about 20 GeV. At energies below approximately 100 MeV, the balloon detector is dominated by atmospheric secondary particles and can not reliably determine the interplanetary electron spectrum.

The overall aim of this work is to understand a significant part of the solar 11-year variation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0009, SPECTRAL DIAGNOSTICS FOR TURBULENT ELECTRIC FIELDS IN SOLAR FLARES

P.M. Bakshi, Boston University, School of Liberal Arts, Dept. of Physics, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (INT76-21090 A01)

This award supplements an existing research project (INT-7621090) on the basic physics of solar flares, jointly established between the Department of Physics, Boston College, and the Observatoire de Paris, Meudon, France. The project is conducted under terms of the U.S./France Program of the National Science Foundation and the French National Center for Scientific Research.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological
& Internat. Affairs, Div. of International
Programs

10.0010, DEVELOPMENT AND EVALUATION OF SCHOTTKY DIODE DETECTORS AND HETERODYNE RADIOMETERS FOR SUBMILLIMETER ASTRONOMICAL STUDIES

H.R. Fetterman, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST78-18728)

This program will be a continuation of an effort to develop room temperature Schottky diode heterodyne radiometers in the submillimeter region of the spectrum in order to provide the sensitivity and resolution needed for many astronomical studies. During the past year a high-sensitivity receiver operating over a broad central range (0.4-1 millimeters) has been achieved, and the first planar diodes operating at high submillimeter frequencies have been developed.

Efforts will be made to improve the performance of these radiometers. An optimized receiver for 345 Gigahertz operation will be constructed. Attention will be directed to development of a laser local oscillator--both to finding wavelengths emissions that match astronomical lines of interest as well as the construction of a compact carbon-dioxide far infrared laser package that can be mounted on a radio telescope.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, A STUDY OF NONVARIABLE CEPHEID STRIP STARS AND A REINVESTIGATION OF THE CEPHEID DISTANCE SCALE

E.G. Schmidt, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (AST77-17520 A01)

The luminosities of the Cepheid type stars are important to the determination of the cosmic distance scale and to the studies of stellar evolution and pulsation. Although it has generally been assumed that the calibration of the luminosities based on Cepheids in galactic star clusters is reasonably correct, the use of the Stromgren four-color and H Beta photometry for several clusters with Cepheid members has resulted in distances which are smaller by about 20% than those previously found from main sequence fitting. There is some reason for believing that these new distances are more reliable. Because of the large impact that this has on the distance scale and on the study of evolution, further four-color and H Beta data for star clusters with Cepheid members will be obtained. These new data will make possible a recalibration of the Cepheid period-color-luminosity relation. Improved data on the intrinsic colors of Cepheids will also be obtained. Comparison with other Cepheid luminosity and color studies will be made. Observations will be obtained mainly at Kitt Peak and Cerro Tololo Observatories, with additional coverage locally at Behlen Observatory.

Prior support was by NSF grant AST 77-17520.

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Directorate for Astronomical
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of Astronomical Sciences

10.0012, COMPREHENSIVE ASSISTANCE TO UNDERGRADUATE SCIENCE EDUCATION PROGRAM

D.L. Moche, City University of New York, Queensborough Community College, Undergraduate School, Dept. of Physics, *56th & Springfield Aves., Bayside, New York* 11364 (SER78-06372)

The proposed project will improve astronomy education at Queensborough Community College in direct response to assessed local needs. It will: 1) construct an observatory on campus to house and facilitate optimal educational use of the observatory - quality 12' Cassegrain and seven other telescopes owned by Queensborough Community College; 2) develop and implement use of an astronomy laboratory manual containing observational activities and indoor exercises (some using data taken with our 12' Cassegrain) matched to student needs, abilities, and interests; 3) institute a viable program student-oriented research and astrophotography; 4) provide alternate learning resources (audio-cassettes, videotapes, sound-slide programs and written self-instructional materials) to supplement traditional lectures, for remedial enriching and home-bound instruction for the handicapped; and 5) initiate comprehensive self-assessment and evaluation of astronomy education at Queensborough Community College.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div.
of Science Education Resources
Improvement

10.0013, RELOCATION AND OPERATION OF THE BURRELL SCHMIDT-TYPE TELESCOPE OF THE WARNER AND SWASEY OBSERVATORY

P. Pesch, Case Western Reserve University, Graduate School, Dept. of Astronomy, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (AST77-20515)

This project will provide funds for the relocation of the Burrell Telescope of the Warner and Swasey Observatory of Case Western Reserve University from Cleveland, Ohio, to Kitt Peak, Arizona. This 61/91 cm Schmidt-type telescope is the largest of its type in the United States that is equipped with objective prisms. Its past use for wide field studies of the region of our Galaxy near the sun has been very successful. The recent development of improved photographic plates now makes it possible to undertake much deeper objective prism surveys. The relocation of the telescope to a superior astronomical site will (1) provide much improved observing conditions which will enable astronomers to utilize fully the capabilities of the telescope, and (2) make the telescope available (via the Kitt Peak National Observatory visitors' program) to the entire astronomical research community.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0014, STUDIES OF SOLAR-TERRESTRIAL RELATIONSHIPS AS MANIFESTED BY COSMIC RAY INTENSITY

M.A. Pomerantz, Franklin Inst. of the State of Pennsylvania, *20th & Benjamin Franklin Pkwy., Philadelphia, Pennsylvania* 19103 (ATM77-12615 A01)

This grant supports investigations of a variety of solar-controlled phenomena by analyses of cosmic-ray data recorded by ground-based detectors in conjunction with related solar and interplanetary observations. The work will focus on the unique potential of observations of modulations, anisotropies, and the flow patterns of relativistic cosmic rays for deducing critical information regarding large-scale electrodynamic properties of the solar atmosphere from the sun's immediate vicinity to the outer heliosphere. The principal objective is to study already available and forthcoming experimental results in order to further test, refine, and develop theoretical models of the physical mechanisms that give rise to transient and long-term intensity variations, radial and perpendicular gradients, three-dimensional anisotropies, periodic waves, and scintillations of galactic cosmic rays, and acceleration, coronal transport, injection, and interplanetary propagation of relativistic solar cosmic rays. Provision for the continued operation, during the impending period of increasing solar activity, of the Thule neutron monitor, which is a source of crucial data for all of these studies, will be made.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0015, COSMOLOGICAL INVESTIGATIONS AT MICROWAVE AND OPTICAL WAVELENGTHS

R.B. Partridge, Haverford College, Graduate School, Dept. of Astronomy, *Haverford, Pennsylvania* 19041 (AST7680201 A01)

Observations will be carried out which may help to answer three important cosmological questions: What are the masses of clusters of galaxies (and the mean mass density of the Universe)? And finally, when do galaxies form, and what is their early evolution like?

A large part of the mass in and around clusters of galaxies may be in some form of intergalactic matter. Observations in the microwave region have set limits on the amount of ionized gas. Faint intergalactic starlight will be observed to determine the ratio of virial mass to luminosity for a number of galaxy clusters.

Observations will be carried out which will exploit the cosmological information contained in the angular variations in intensity of the cosmic microwave background radiation. Measurements of, or upper limits on, the isotropy and homogeneity of the Universe will be done making more sensitive measurements of the distribution of the cosmic microwave background on several angular scales.

A search for galaxies in the process of formation, at early epoch, and therefore large red shifts will be attempted.

This is a continuation of research supported by AST76-80201.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0016, ASTROMETRIC STUDY OF NEARBY STARS

S.L. Lippincott, Swarthmore College, Graduate School, Dept. of Astronomy, *Swarthmore, Pennsylvania* 19081 (AST78-17937)

Discovery and study of stars in the solar neighborhood will be continued. The observations are long series of precision astrometric measurements of stars on photographic plates obtained with the 61-centimeter long-focus refracting telescope of the Sproul Observatory. The program emphasizes the study of binary star systems, which far outnumber the single stars.

The observations are analyzed to determine star distances from their parallactic shift--a reflection of the earth's annual motion about the sun. Data from extended periods of several years, or even decades for some objects, permit determination of orbital motions and periods of binary stars. A primary result is the determination in favorable cases of the masses of the stars, an important astrophysical parameter in the study of the origin, energy production and evolution of the various types of stars. Unresolved astrometric binary star systems are found, and studied from the long series of plates now available for many of these objects. Stars of very small mass are found in some of these systems. Selection of program stars emphasizes objects of current astrophysical interest, including many under study by astronomers using other techniques. An intensive study of both accidental and systematic errors will be continued, including the stability of the telescope when used over extended periods of time for astrometric measurements.

Prior support was by NSF grant AST 76-21315.

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of Astronomical Sciences

10.0017, APPLICATION OF HILL'S CURVES TO THE STUDY OF CLASSICAL TRIPLE STELLAR SYSTEMS

V. Szebehely, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712 (AST76-19654 A01)

Hill's method of curves of zero velocity discussed in his lunar theory will be extended to the study of the dynamical properties of classical triple stellar systems. His method used in his lunar theory will be generalized to three stellar masses that revolve around each other in the classical configuration: two forming a binary and the third revolving around this double star. Conditions of stability for such astronomically important systems are to be established analytically for any stellar masses, any eccentricities and any semi-major axes. These values will be compared to the observational data of actual stellar systems and the stability of known triple systems investigated. A comparison will also be made with Harrington's results obtained by numerical integration and his results extended to cases not included in his studies. The conditions for stability of arbitrarily high levels of hierarchical systems will be evaluated and applied to Evan's hierarchical system of multiple stars.

Prior support was by NSF grant AST 76-19654.

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of Astronomical Sciences

10.0018, INTERMEDIATE AGE CLUSTERS OF THE MAGELLANIC CLOUDS

P.W. Hodge, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST76-17598 A01)

The Magellanic Clouds in the Southern Hemisphere present a unique opportunity to study stellar evolutionary patterns for stars of moderate and low heavy element abundance. An observational program of determining color-magnitude (C-M) diagrams for populous intermediate-age clusters and the subsequent detailed comparison of them with theoretical models will be carried out. This research is a continuation of observations and analysis that led to the production of C-M diagrams for NGC 2164 and several clusters near it in the Large Megellanic Cloud (LMC), with the surprising result that these clusters showed evidence of different heavy element abundances even though their ages are nearly the same. A check on this result using superior observational material (Cerro Tololo Interamerican Observatory (CTIO) 4-meter plates already taken) will be done. The determination of C-M diagrams for additional LMC clusters and some SMC clusters will also be carried out.

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01 AERONAUTICS (GENERAL)

N80-21242# RAND Corp., Santa Monica, Calif.
THE REDUNDANCY OF SCHEDULED AND UNSCHEDULED MAINTENANCE Interim Report
I. K. Cohen, T. S. Donaldson, and T. M. Rodriguez Sep. 1979 42 p refs
(Contract F49620-77-C-0023)
(AD-A076962; RAND/N-1258-AF) Avail: NTIS HC A03/MF A01 CSCL 01/3

This note concerns the extent to which aircraft scheduled and unscheduled maintenance are redundant. It investigates the extent to which Periodic Inspection items on the F-4 aircraft are made visible at the flight line during unscheduled aircraft maintenance. The study focuses on inspection tasks behind aircraft doors, and assumes that once a door is removed for maintenance activity, the inspection item is visible. Visibility or accessibility for condition monitoring is defined as the frequency of door removals. The total number of removals for each aircraft door was counted, and a probability model was used to estimate the probability that a door would be opened within a given inspection interval. The results of this study indicate that most of the F-4 Periodic Inspection tasks are accessible for condition monitoring on the flight line during unscheduled aircraft maintenance. The note discusses the implications of these results for inspection policy. GRA

N80-21243# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE USE OF COMPUTERS AS A DESIGN TOOL
Jan. 1980 445 p refs Partly in ENGLISH and FRENCH
Flight Mech. Panel Symp. held at Neubiberg, West Germany, 3-6 Sep. 1979
(AGARD-CP-280; ISBN-92-835-0256-6) Avail: NTIS HC A19/MF A01

The positive and negative aspects of computerized aircraft design are considered including the cost and technical effectiveness, the benefits, and the difficulties and limitations of the whole process. Topics covered include: specifications and assessment of requirements; computer aided design and computer graphics; computational aerodynamics and design; structural analysis and design; and propulsion and system design. For individual titles, see N80-21244 through N80-21275.

N80-21244# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany). Wehrtechnische Systeme.
THE USE OF COMPUTER AIDED DESIGN METHODS IN AIRBORNE SYSTEMS EVALUATION c05
P. Ebeling and E. Pfisterer *In* AGARD The Use of Computers as a Design Tool Jan. 1980 11 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The application of computer aided design methods for predesign and evaluation purposes of airborne systems, especially in early phases, is considered. Two methods are presented. The first is the aircraft design computer program APFEL which is described in detail. The second application is the missile design program PROFET. Typical applications including some results are given. J.M.S.

N80-21245# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
CRITERIA FOR TECHNOLOGY c05
R. L. Haas *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A perspective on the use of computers in an approach to technology program planning is given. A rationale for cost benefit assessment of technology to form the foundations for the technology of systems is presented. An approach is defined which builds on techniques associated with computer aided design capability and is analogous in form to process control. A description of the basic process applied to a tactical fighter problem is discussed. J.M.S.

N80-21246*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
AN ACCEPTABLE ROLE FOR COMPUTERS IN THE AIRCRAFT DESIGN PROCESS c60
Thomas J. Gregory and Leonard Roberts *In* AGARD The Use of Computers as a Design Tool Jan. 1980 7 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 09B

Some of the reasons why the computerization trend is not wholly accepted are explored for two typical cases: computer use in the technical specialties and computer use in aircraft synthesis. The factors that limit acceptance are traced in part, to the large resources needed to understand the details of computer programs, the inability to include measured data as input to many of the theoretical programs, and the presentation of final results without supporting intermediate answers. Other factors are due solely to technical issues such as limited detail in aircraft synthesis and major simplifying assumptions in the technical specialties. These factors and others can be influenced by the technical specialist and aircraft designer. Some of these factors may become less significant as the computerization process evolves, but some issues, such as understanding large integrated systems, may remain issues in the future. Suggestions for improved acceptance include publishing computer programs so that they may be reviewed, edited, and read. Other mechanisms include extensive modularization of programs and ways to include measured information as part of the input to theoretical approaches. J.M.S.

N80-21247# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
THE USE OF COMPUTER BASED OPTIMIZATION METHODS IN AIRCRAFT STUDIES c05
Brian Edwards *In* AGARD The Use of Computers as a Design Tool Jan. 1980 27 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Multivariate optimization (MVO) computer programs used in the field of aircraft design are considered. The constitution of such programs, which embody an optimization method as well as a mathematical model of aircraft design and operation comprised of aircraft design synthesis and performance analysis methods, is discussed in general terms. Techniques for using MVO programs are emphasized in an effort to show how the optimization method can be used to explore the model and cultivate an insight into its characteristics. A discussion of some possible applications for MVO programs is included. J.M.S.

N80-21248# Techniche Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
SOME FUNDAMENTAL ASPECTS OF TRANSPORT AIRCRAFT CONCEPTUAL DESIGN OPTIMIZATION c05
E. Torenbeek *In* AGARD The Use of Computers as a Design Tool Jan. 1980 22 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Various design merit functions and program structures are discussed and program elements common to most design exercises are analyzed. Criteria are presented for optimum cruise conditions for aircraft with or without Mach number dependent drag polars and arbitrary propulsion systems. The constrained and unconstrained optima for design cruise speed and altitude, engine thrust, wing loading, and aspect ratio are presented in the form of generalized analytical expressions. They are based on closed-form equations for the payload weight fraction. A powerplant merit function is proposed, which can be used for assessing propulsion systems in the project study phase in isolation from the aircraft design. The method gives clear insight into the design problem structure and is adaptable to arbitrary ground rules and different data bases. The tradeoff between mission requirements, technological factors, and (optimum) design characteristics is evident from the criteria presented. J.M.S.

N80-21249# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
SURVEY PAPER ON COMPUTER AIDED DESIGN c05
D. Weinhauer *In* AGARD The Use of Computers as a Design Tool Jan. 1980 2 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A review of a specialists' meeting on computer-aided design in production design is presented. Conclusions and proposals developed at the meeting are described. R.E.S.

N80-21250# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
COMPUTER GRAPHICS AND RELATED DESIGN PROCESS AT MBB c61
Volkmar Antl and Werner Weingartner *In* AGARD The Use of Computers as a Design Tool Jan. 1980 19 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The CAD/CAM process and how it is realized is described. Examples of using computer graphics are given and then a description of the main system functions is presented. R.E.S.

N80-21251# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
COMPUTER GRAPHICS, RELATED DESIGN AND MANUFACTURE PROCESS AT DORNIER c61
J. Nagel, L. Thieme, and A. Hertor *In* AGARD The Use of Computers as a Design Tool Jan. 1980 9 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A computer systems program which concerns the definition and machining of the general outer contour surfaces of an aircraft is described. R.E.S.

N80-21252# British Aerospace Aircraft Group, Warton (England).
COMPUTER GRAPHICS AND RELATED DESIGN PROCESSES IN THE UK c61
R. I. Hocking and B. Reuben *In* AGARD The Use of Computers as a Design Tool Jan. 1980 13 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The use of computer graphics in British aerospace engineering and its integration with manufacturing is described. R.E.S.

N80-21253# Lockheed-California Co., Burbank.
DISTRIBUTED GRAPHICS SYSTEM FOR COMPUTER AUGMENTED DESIGN AND MANUFACTURE c61
A. N. Baker *In* AGARD The Use of Computers as a Design Tool Jan. 1980 4 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A new distributed graphics system was developed that expands the usefulness and range of applications of the Computer Graphics Augmented Design and Manufacturing (CADAM). The characteristics of both the central and distributed forms of CADAM are described as representative examples of the current state of the art. Future trends for interactive computer graphics are forecasted on the basis of anticipated developments in software and hardware. R.E.S.

N80-21254# Societe Nationale Industrielle Aerospatiale, Marignane (France.)
THE ROLE OF INTERACTIVITY IN COMPUTER-ASSISTED DESIGN AND FABRICATION [LE ROLE DE L'INTERACTIVITE DANS LA CONCEPTION ET LA FABRICATION ASSISTEES PAR ORDINATEUR] c61
Monique Slissa *In* AGARD The Use of Computers as a Design Tool Jan. 1980 3 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Computer-assisted design and fabrication requires the use of alphanumeric and graphic conversational techniques to support the man machine dialog during the product creation process. The definition of work space, in the most general sense, is very important, for example, in the case of the design of three dimensional forms, where interactivity permits choice in real time. These principles are used in research and development at Aerospatiale Marignane, and especially in the Systrid 1 System design of three dimensional objects and the Sigma program used for the design of geometric forms at Aerospatiale Toulouse.
Transl. by A.R.H.

N80-21255# British Aerospace Aircraft Group, Brough (England).
A FRAMEWORK FOR DISTRIBUTED DESIGN COMPUTING c62
A. W. Bishop *In* AGARD The Use of Computers as a Design Tool Jan. 1980 10 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Large, geographically dispersed design teams are now the norm in manufacturing industries. Computer systems are potentially useful for data storage, communications, interactive design, administrative functions and numerical calculations. A framework for the support of such applications systems in a dispersed environment against a background of rapidly changing hardware is described. R.E.S.

N80-21256# Societe Nationale Industrielle Aerospatiale, Marignane (France.)
USING THE COMPUTER TO PRODUCE ELECTRIC SCHEMAS [LIASSE ELECTRIQUE ASSISTEE PAR ORDINATEUR] c61
Jean-Pierre Pauzat *In* AGARD The Use of Computers as a Design Tool Jan. 1980 6 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

In nine years of operation, an aircraft of the Airbus type generates 16,500 plans which include 7,000 schemas, 5,000 equipment lists, and 4,500 tables. The information processed in these plans is estimated at about 80,000 definitions for cables and their branchings, 20,000 equipment definitions, 3,000 modifications definitions, and 40 validation standards required by clients. The electric cable information management system used to assist in the definition, design, and diffusion of electric schemas is described. This system also take into account the requirements of exterior services which use the schemas for preparation, production, and control or for use after purchase of the aircraft. The system for the computerized design of electric cables is used to design electric schemas on an interactive basis,

and adds to the information network all the data which supply the cable management information system. The design and application of both systems are discussed. Transl. by A.R.H.

N80-21257*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF ADVANCED COMPUTERS FOR AERODYNAMIC FLOW SIMULATION c02
F. R. Bailey and W. F. Ballhaus *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif. (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 01A

The current and projected use of advanced computers for large-scale aerodynamic flow simulation applied to engineering design and research is discussed. The design use of mature codes run on conventional, serial computers is compared with the fluid research use of new codes run on parallel and vector computers. The role of flow simulations in design is illustrated by the application of a three dimensional, inviscid, transonic code to the Sabreliner 60 wing redesign. Research computations that include a more complete description of the fluid physics by use of Reynolds averaged Navier-Stokes and large-eddy simulation formulations are also presented. Results of studies for a numerical aerodynamic simulation facility are used to project the feasibility of design applications employing these more advanced three dimensional viscous flow simulations. M.G.

N80-21258# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THE USE OF THE COMPUTER IN THE DESIGN OF AERODYNAMIC CONFIGURATIONS [UTLIISATION DE L'ORDINATEUR POUR LE DESSIN DE CONFIGURATIONS AERODYNAMIQUES] c05
Pierre Perrier *In* AGARD The Use of Computers as a Design Tool Jan. 1980 17 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The computer is of considerable assistance in both the optimization and evaluation of aerodynamic configurations with, however, very different degrees of efficiency, and very different methods of use. The operations used are not equivalent to those used for the analysis and synthesis usually alluded to in the development of an aircraft project. The general principles and the terminology used systematically in the design and definition of prototypes are presented along with the different levels of computation associated with each. Two relatively simple, concrete examples related to civil and military aircraft, are used to show the aid provided by computers in aerodynamic design. Developments which can be predicted for years to come are indicated, taking into account improved possibilities of computation. Transl. by A.R.H.

N80-21259# Aeritalia S.p.A., Torino (Italy).
WING DESIGN PROCESS BY INVERSE POTENTIAL FLOW COMPUTER PROGRAMS c05
Luciano Fornasier *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The approach to wing design by inverse technique is illustrated. A brief review of the numerical tools employed in the design process is given and the involved technology is discussed in some detail. Finally, an application to a design study aimed to demonstrate potential improvements of supercritical wing technology is described. M.G.

N80-21260# Boeing Commercial Airplane Co., Seattle, Wash.
THE ROLE OF COMPUTATIONAL AERODYNAMICS IN AIRPLANE CONFIGURATION DEVELOPMENT c05
Bertil Dillner and Chester A. Koper, Jr. *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The role of computational aerodynamics in the design of aircraft configurations in steady flow conditions is explored through several examples. Subsonic high lift and wing strake designs, and transonic cruise wing designs are included. The use of these computer methods can substantially increase airplane performance capabilities, while reducing risk, flow time, and testing requirements. An assessment is made concerning the factors that have contributed to advancing computational aerodynamics. Deficiencies of existing programs are also noted with particular attention given to the user-system interface. M.G.

N80-21261# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.
COMPUTATIONAL AERODYNAMIC DESIGN TOOLS AND TECHNIQUES USED AT FIGHTER DEVELOPMENT c05
P. Sacher, W. Kraus, and R. Kunz *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Various different numerical procedures to perform design trade-offs during fighter configuration development are discussed. An optimization cycle of techniques, necessary to cover the low speed range (high angle of attack), transonic speed (maneuvering capability), and the high speed supersonic region (maximum SEP) is described. Second stage optimization of components like direct design of wing, tail/canard, or maneuver devices is then presented giving further improvements of performance and leading finally to the definition of wind tunnel models. Experimental data compare well with predictions and emphasize the reliability of applied numerical methods. M.G.

N80-21262# Rockwell International Corp., Anaheim, Calif. Aircraft Div.
USE OF COMPUTERS IN THE AERODYNAMIC DESIGN OF THE HiMAT FIGHTER c05
R. D. Child, B. Panageas, and P. Gingrich *In* AGARD The Use of Computers as a Design Tool Jan. 1980 19 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The highly maneuverable aircraft technology remotely piloted research vehicle (HiMAT/RPRV) configuration was designed to achieve a high degree of transonic maneuverability. The performance goals for the advanced fighter concept were a sustained 8 g turn at Mach = 0.9, altitude of 9,144 meters, and a mission radius of 300 nautical miles. Additionally, supersonic acceleration capability would not be compromised. Preliminary trade studies established a 7,740 kilogram fighter baseline along with a 44 percent scale RPRV that would allow a low risk demonstration of the advanced technologies. Tests of the baseline configuration indicated deficiencies in the technology integration and design techniques. After substantial reconfiguring of the vehicle, with improvements in the analytical methods, the subcritical and supersonic requirements were satisfied. A high level of efficiency for subsonic conditions was realized with the linear theory-optimization techniques and variable camber system. Drag due to lift levels only 5 percent higher than 1/pi AR were obtained for the wind tunnel model at a lift coefficient of 1.0 for Mach numbers of up to 0.8. The transonic drag rise was progressively lowered with the application of nonlinear potential flow analyses. R.C.T.

N80-21263# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Theoretische Aerodynamik.
NUMERICAL METHODS FOR DESIGN AND ANALYSIS AS AN AERODYNAMIC DESIGN TOOL FOR MODERN AIRCRAFT c05
Wolfgang Schmidt *In* AGARD The Use of Computers as a Design Tool Jan. 1980 21 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The application and validation of several computational aerodynamic methods in the design and analysis of transport and fighter aircraft is established. An assessment is made concerning methods that solve transonic flow and boundary layers on maneuver flaps, wings, inlets, and bodies. Capabilities of subsonic and supersonic aerodynamic methods are demonstrated by the inlet integration on the Alpha-Jet design, supersonic Rautenfluegelanalysis, subsonic and supersonic wing optimization for a fighter and high lift device analysis. The accuracy of transonic methods is demonstrated by comparison of computed results to experimental data for transport and fighter-type wing body combinations, axisymmetric inlet flowfields, two element airfoil

systems and cascades. Special attention is given the capabilities of such methods to simulate wind tunnel effects. R.C.T.

N80-21264*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAINTENANCE OF NASTRAN (R) AS A STATE-OF-THE-ART COMPUTER PROGRAM c39
James L. Rogers, Jr. *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 01B

The maintenance requirements for a large, general purpose, finite element computer program are presented. The program is maintained as state-of-the-art on three computer systems (IBM, CDC, and UNIVAC) with respect to both finite element and computer technology. There are four primary areas involved in the maintenance effort: (1) error correction; (2) incorporation of advances in technology; (3) documentation; and (4) new level generation. The complexity of the maintenance effort is compounded by the sizes of the program (400,000 lines of code) and the documentation (7000 pages divided into seven manuals). R.C.T.

N80-21265# Royal Aircraft Establishment, Farnborough (England).
A COMPUTER BASED SYSTEM FOR STRUCTURAL DESIGN, ANALYSIS AND OPTIMIZATION c05
A. J. Morris, P. Bartholomew, and J. Dennis *In* AGARD The Use of Computers as a Design Tool Jan. 1980 26 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A modular computer program developed for the automated design of optimum structures subject to a variety of constraints is described. The program employs several complex optimization and duality techniques linked together by a control module which also provides a mechanism for interfacing the program with the commercially available structural analysis systems. Although this gives rise to a highly sophisticated program structure it is made simple to operate by the aid of a convenient command language which provides the communication link with the design engineer. R.C.T.

N80-21266# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Structural Dynamics Dept.
STRUCTURAL OPTIMIZATION WITH STATIC AND AEROELASTIC CONSTRAINTS c39
D. Mathias, H. Roehrle, and J. Artmann *In* AGARD The Use of Computers as a Design Tool Jan. 1980 11 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

An optimization program is presented which is based on the finite element method and, within the actual optimization step, works according to the gradient method. The DYNOPT computer program was applied to a clamped straight wing. The wing was statically loaded and had eccentric masses and rotational inertias representing rudders and actuators. These eccentricities ensured the coupling between the bending and torsional deformations. The minimum weight of the structure was obtained after 15 iteraction steps while all boundary conditions were observed. R.C.T.

N80-21267# Liege Univ. (Belgium). Aerospace Lab.
APPLICATIONS OF MIXED AND DUAL METHODS IN STRUCTURAL OPTIMIZATION c39
G. Sander, C. Fleury, and M. Geradin *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p refs (For primary document see N80-21243 12-01)
(Grant AF-AFOSR-311B-77)
Avail: NTIS HC A19/MF A01

An approach to structural optimization is described in which the original problem is replaced with a new sequence of explicit approximate problems and solved using either primal or dual algorithms. A primal solution scheme yields a mixed method, with properties lying between those of the optimality criteria techniques and those of pure mathematical programming methods. A dual solution scheme leads to generalization of the optimality criteria approaches, with a rational procedure for identifying the strictly critical constraints (including the classical subdivision of the design variables into passive and active groups). The structural optimization problem consists of the weight minimization of a finite element model with fixed geometry and material properties. The transverse sizes of the structural member are the design variables. In the optimality criteria and mathematical programmings approaches, the behaviorg constraints are approximated using virtual load considerations and linearization with respect to the reciprocal design variables. Examples of applications of the mixed and dual methods to various structures are presented. These include cases with stress, displacement, or flexibility constraints, as well as frequency constraints. A.W.H.

N80-21268# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
FINITE ELEMENTS AND THE OPTIMIZATION OF AERONAUTICAL STRUCTURES [ELEMENTS FINIS ET OPTIMISATION DES STRUCTURES AERONAUTIQUES] c05
C. Petiau and G. Lecina *In* AGARD The Use of Computers as a Design Tool Jan. 1980 16 p refs In FRENCH; ENGLISH summary (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

An optimization method which minimizes weight by using a finite element model is described. The optimization parameters, multiplicative factors of the stiffness of linked finite elements, are discussed. The optimization constraints which can be of different types, including technological minimum thicknesses, limited displacements, and limitations on flutter speed and dynamic responses, are delineated. The optimization process is iterative with each iteration containing three steps. The three steps are reported. Two examples of the optimization method are presented: the optimization of a delta wing and the optimization of a carbon epoxy empennage. A.W.H.

N80-21269# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
NEW COMPUTER APPLICATIONS FOR SPECIAL STRUCTURAL PROBLEMS c64
Juergen Massmann *In* AGARD The Use of Computers as a Design Tool Jan. 1980 23 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Characteristic properties of both the finite element and finite difference method are discussed concerning their efficient applicability for nonlinear dynamic structural analysis and design. Special features of the code are explained and their relevance is demonstrated in several examples concerning penetration and perforation problems, pressure distribution resulting from explosions in fluids, blast loading, and shock wave propagation. A.W.H.

N80-21270# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
COMPUTER PROGRAMS FOR THE DESIGN AND PERFORMANCE EVALUATION OF NACELLES FOR HIGH BYPASS-RATIO ENGINES c05
Richard Smyth *In* AGARD The Use of Computers as a Design Tool Jan. 1980 21 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The use of the computer as a design tool for the different stages of nacelle development and integration with the airframe is discussed. Trends in propulsion system development and methods of calculation suitable for computerized work with nacelles are reported. The computer program developed for nacelle synthesis consists of an executive program which uses program modules based on the engine component breakdown. The main program modules are the geometrical requirements, the inlet definition, the nozzle and afterbody definition, and the flow calculation. Each program module and its function in the executive program is discussed. The use of the computer program for the performance evaluation of nacelles during the aircraft design process is described. A.W.H.

N80-21271*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTERIZED SYSTEMS ANALYSIS AND OPTIMIZATION OF AIRCRAFT ENGINE PERFORMANCE, WEIGHT, AND LIFE CYCLE COSTS c07

Laurence H. Fishbach *In* AGARD The Use of Computers as a Design Tool Jan. 1980 15 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 21E

The computational techniques are described which are utilized at Lewis Research Center to determine the optimum propulsion systems for future aircraft applications and to identify system tradeoffs and technology requirements. Cycle performance, and engine weight can be calculated along with costs and installation effects as opposed to fuel consumption alone. Almost any conceivable turbine engine cycle can be studied. These computer codes are: NNEP, WATE, LIFCYC, INSTAL, and POD DRG. Examples are given to illustrate how these computer techniques can be applied to analyze and optimize propulsion system fuel consumption, weight and cost for representative types of aircraft and missions. F.O.S.

N80-21272# British Aerospace Aircraft Group, Preston (England).
MATHEMATICAL MODELLING IN MILITARY AIRCRAFT WEAPON SYSTEM DESIGN **c05**
N. Mitchell *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

One of the main tools used in weapon system design and analysis is the mathematical model, i.e., a complete mathematical representation of the aircraft weapon system, programmed for running on a digital computer. The main elements of a model are described and the use of models is discussed in the chronological phases of weapon system design and development, including trials planning and analysis, with the associated model matching. Examples of the use of models to investigate and resolve design problems are given, including integrated modelling between several companies. There is a rapid growth in number and use of digital computers in aircraft weapon systems and some typical modelling input to the software of these airborne computers is discussed. Author

N80-21273# British Aerospace Aircraft Group, Preston (England).
BACTAC: A COMBAT-WORTHY COMPUTERIZED OPPONENT **c61**
Ian Jones *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p ref (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The formulation and performance of a computerized opponent are described. The opponent is used at British Aerospace, Warton Division, for air combat simulation. Over a period of seven years, BACTAC has progressed from its initial state as a digital computer model of close combat without the man in the loop, to a versatile and tenacious interactive opponent for use in a single-dome, piloted, air combat simulator. The process of matching the mathematical model against fighter pilots in the simulator is described, together with an account of the learning which took place on both sides of the fight, and adjustment of tactics to the radically different performance of a new generation of aircraft and missiles. It is only in the combat simulator that fighter pilots and designers can investigate future generations of fighter aircraft. In this environment, BACTAC is proving its value to scientific research as a combat-worthy adversary, capable of exploiting the higher levels of performance and providing a known datum against which to rank pilots, competing aircraft and their weapon systems. Author

N80-21274# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
INTERACTIVE AIDED DESIGN SYSTEM FOR AIRCRAFT DYNAMIC CONTROL PROBLEMS **c08**
Wolfgang J. Kubbat, G. Oesterhelt, and U. Korte *In* AGARD The Use of Computers as a Design Tool Jan. 1980 18 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A computer aided design system is described for control law design and system synthesis. A short description of the available methods (continuous - discrete, time domain-frequency domain) is followed by an illustration of the practical work. The designer has access to the huge program system via a graphical CRT display and a keyboard. Selection of method (i.e., discrete vs. continuous complete vs. incomplete state feedback, optimal control vs. pole-placement, etc.) is followed by a dialogue designer-computer with immediate results presented in numerical and graphical form (plots, print-outs). Each result is stored and can be compared with any other one via dual plots. The system also allows for the input of disturbances like white or colored noise, ramps, steps, sine- and cosine-combinations. No practical restriction for the number of state variables is present. An example for aircraft application is included. Author

N80-21275# Air Force Flight Test Center, Edwards AFB, Calif.
THE USE OF ADVANCED COMPUTER TECHNIQUES IN FLIGHT TEST EVALUATIONS **c05**
David P. Maunder and Robert E. Lee *In* AGARD The Use of Computers as a Design Tool Jan. 1980 6 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The uses of advanced computer techniques in flight test evaluations at the AFFTC were examined. Uses of the computer for real time mission control, integrated systems development, flutter testing, and postflight data analysis are emphasized. F.O.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-21276 Engineering Sciences Data Unit, London (England).
TRANSONIC DATA MEMORANDUM: A FRAMEWORK RELATING THE DRAG-RISE CHARACTERISTICS OF A FINITE WING/BODY COMBINATION TO THOSE OF ITS BASIC AEROFOIL
1978 31 p
(ESDU-78009; ISBN-0-85679-269-1; ISSN-0141-4356) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $674.50

A framework for formulating a relationship between the drag-rise characteristics of a well-designed wing/body combination and the wing's basic airfoil is presented. Its application in aircraft design is considered as well as its use in reconciling the drag rise characteristics of a swept wing/body combination and its basic aerofoil. The results derived may be used to reconcile the known drag-rise characteristics of an existing wing design with the known drag-rise characteristics of its basic airfoil. The research applies to wings of aspect ratio greater than about 4 and sweep angles up to about 45 degrees. ESDU (GRA)

N80-21277 Engineering Sciences Data Unit, London (England).
TRANSONIC DATA MEMORANDUM: THE LIFT ACHIEVABLE BY AEROFOILS HAVING A PARTICULAR FORM OF SUPERCRITICAL UPPER-SURFACE PRESSURE DISTRIBUTION THAT YIELDS ONLY SMALL WAVE DRAG
1978 31 p
(ESDU-78010; ISBN-0-85679-270-5; ISSN-0141-4356) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $434.50

Drag-rise Mach number is estimated as a function of lift-coefficient and thickness/chord ratio for a family of airfoils characterized by a particular form of supercritical upper-surface pressure distribution. The result obtained may be used to provide exchange rates between parameters pertinent to the design of the basic two-dimensional section of swept-winged aircraft intended to cruise at high-subsonic Mach numbers. The research is applicable to thickness/chord ratios ranging from 6 percent to 18 percent chord and upper-surface pressure distributions having supercritical flow for up to 60 percent chord. ESDU (GRA)

N80-21278 Engineering Sciences Data Unit, London (England).
TRANSONIC DATA MEMORANDUM: NUMERICAL

METHODS FOR SOLVING THE POTENTIAL FLOW EQUATIONS FOR TWO-DIMENSIONAL AEROFOILS IN SUBSONIC AND TRANSONIC FLOWS, BRIEF DETAILS, TEST CASES AND EXAMPLES

1975 40 p

(ESDU-79009; ISBN-0-85679-271-3; ISSN-0141-4356) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC$434.50

Numerical methods for calculating pressure distributions for two-dimensional airfoils in subsonic and transonic potential flow are described and recommendations regarding the use of computer programs of the methods are made. Examples of the pressure distributions obtainable are included. The results obtained may be used to provide pressure distributions and force and moment coefficients on aerofoil sections for wings and rotors. The research applies to two-dimensional symmetrical and cambered airfoils of between 7% and 15% thickness chord ratio in potential flow with freestream Mach numbers from zero to near unity.

ESDU (GRA)

N80-21279*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUPERSONIC WINGS WITH SIGNIFICANT LEADING-EDGE THRUST AT CRUISE

A. Warner Robins, Harry W. Carlson, and Robert J. Mack Apr. 1980 28 p refs

(NASA-TP-1632; L-13316) Avail: NTIS HC A03/MF A01 CSCL 01A

Experimental/theoretical correlations are presented which show that significant levels of leading-edge thrust are possible at supersonic speeds for certain planforms having the geometry to support the theoretical thrust-distribution potential. The new analytical process employed provides not only the level of leading-edge thrust attainable but also the spanwise distribution of both it and that component of full theoretical thrust which acts as vortex lift. Significantly improved aerodynamic performance in the moderate supersonic speed regime is indicated.

Author

N80-21280*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPARISON OF PREDICTED AND EXPERIMENTAL REAL-GAS PRESSURE DISTRIBUTIONS ON SPACE SHUTTLE ORBITER NOSE FOR SHUTTLE ENTRY AIR DATA SYSTEM

Judy L. Shinn Apr. 1980 29 p refs

(NASA-TP-1627; L-13341) Avail: NTIS HC A03/MF A01 CSCL 01A

An experimental investigation of inviscid real-gas effects on the pressure distribution along the Space Shuttle Orbiter nose center line up to an angle of attack of 32 deg was performed in support of the Shuttle Entry Air Data System (SEADS). Free-stream velocities from 4.8 to 6.6 kn/s were generated at hypersonic conditions with helium, air, and CO2, resulting in normal-shock density ratios from 3.7 to 18.4. The experimental results for pressure distribution agreed closely with numerical results. Modified Newtonian theory deviates from both experiment and the numerical results as angle of attack increases or shock density ratio decreases. An evaluation of the use of modified Newtonian theory for predicting SEADS pressure distributions in actual flight conditions was made through comparison with numerical predictions.

R.E.S.

N80-21281*# Lockheed Missiles and Space Co., Huntsville, Ala.

RESULTS OF TWO TESTS IN THE MSFC 14 BY 14-INCH TRISONIC WIND TUNNEL, FA 27 (TWT-655) AND FA 28 (TWT-656) Final Report

William F. Braddock Dec. 1979 884 p refs

(Contract NAS8-32530)

(NASA-CR-161427; LMSC-HREC-TR-D697767) Avail: NTIS HC A99/MF A01 CSCL 01A

Wind tunnel tests were conducted in a 14- inch wind tunnel with a 0.004 scale model of the space shuttle launch vehicle in order to (1) determine the cause and possible aerodynamic alterations required to eliminate the Orbiter rolling moment couple; (2) determine configuration alterations to alleviate the forward Orbiter external tank loads; and (3) provide data to verify previous data.

R.E.S.

N80-21282*# Analytical Methods, Inc., Bellevue, Wash.

USSAERO COMPUTER PROGRAM DEVELOPMENT, VERSIONS B AND C Final Report 1974 - 1979

F. A. Woodward Washington, D.C. NASA Apr. 1980 82 p refs

(Contract NAS1-12900)

(NASA-CR-3227) Avail: NTIS HC A05/MF A01 CSCL 01A

Versions B and C of the unified subsonic and supersonic aerodynamic analysis program, USSAERO, are described. Version B incorporates a new symmetrical singularity method to provide improved surface pressure distributions on wings in subsonic flow. Version C extends the range of application of the program to include the analysis of multiple engine nacelles or finned external stores. In addition, nonlinear compressibility effects in high subsonic and supersonic flows are approximated using a correction based on the local Mach number at panel control points. Several examples are presented comparing the results of these programs with other panel methods and experimental data.

Author

N80-21283*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ADVANCED TECHNOLOGY AIRFOIL RESEARCH, VOLUME 2

1979 262 p refs Presented at conf., Langley Research Center, Hampton, Va. 7-9 Mar. 1978

(NASA-CP-2046; L-12232) Avail: NTIS HC A12/MF A01 CSCL 01A

A comprehensive review of airfoil research is presented. The major thrust of the research is in three areas: development of computational aerodynamic codes for airfoil analysis and design, development of experimental facilities and test techniques, and all types of airfoil applications.

R.E.S.

N80-21284*# National Aeronautics and Space Administration, Washington, D. C.

INVESTIGATIONS REGARDING THE DRAG CHARACTERISTICS OF FLOW-DISTURBING BODIES WHICH ARE ARRANGED IN LINE AND ATTACHED TO THE WALL

M. Balkowski and H. Schollmeyer Mar. 1980 15 p refs Transl. into ENGLISH from Abhandlungen (West Germany), no. 21, Dec. 1974 p 20-24 Original language document was announced as A75-23097 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Rheinisch-Westtaelische Technische Hochschule, West Germany

(Contract NASw-3198)

(NASA-TM-75788) Avail: NTIS HC A02/MF A01 CSCL 01A

The flow characteristics of rectangular bodies mounted on the base area of a rectangular closed wind tunnel are investigated. As many as four bodies are mounted in line with equal distances between successive bodies. The Mach number of the flowing air is in the range from 0.1 to 0.5. Total and individual drag values could be charged within a wide range by a suitable selection of the distance between successive bodies.

M.G.

N80-21285*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH SPEED TURBOPROPS FOR EXECUTIVE AIRCRAFT, POTENTIAL AND RECENT TEST RESULTS

Daniel C. Mikkelson and Glenn A. Mitchell 1980 26 p refs Presented for the Turbine-Powered Executive Meeting, (Phoenix), 9-11 Apr. 1980, sponsored by the Soc. of Automotive Engr.

(NASA-TM-81482; E-419) Avail: NTIS HC A03/MF A01 CSCL 01A

Four high speed propeller models were designed and tested in an 8x6 foot wind tunnel in order to evaluate the potential of advanced propeller technology. Results from these tests show that the combination of: increased blade number, aerodynamically integrated propeller/nacelles, reduced blade thickness, spinner area ruling, and blade sweep are important in achieving high propeller efficiency at the high cruise speeds.

R.E.S.

N80-21286*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THREE-DIMENSIONAL INTERACTIONS AND VORTICAL FLOWS WITH EMPHASIS ON HIGH SPEEDS
David J. Peake and Murray Tobak Mar. 1980 225 p refs
(NASA-TM-81169; A-6035) Avail: NTIS HC A10/MF A01 CSCL 01A

Diverse kinds of three-dimensional regions of separation in laminar and turbulent boundary layers are discussed that exist on lifting aerodynamic configurations immersed in flows from subsonic to hypersonic speeds. In all cases of three dimensional flow separation, the assumption of continuous vector fields of skin-friction lines and external-flow streamlines, coupled with simple topology laws, provides a flow grammar whose elemental constituents are the singular points: nodes, foci, and saddles. Adopting these notions enables one to create sequences of plausible flow structures, to deduce mean flow characteristics, expose flow mechanisms, and to aid theory and experiment where lack of resolution in numerical calculations or wind tunnel observation causes imprecision in diagnosing the three dimensional flow features. R.E.S.

N80-21287*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL EVALUATION OF A HELICOPTER ROTOR SECTION DESIGNED BY NUMERICAL OPTIMIZATION
R. M. Hicks and W. J. McCroskey (Army Aviation Res. and Development Command, St. Louis, Mo.) Mar. 1980 131 p refs
(NASA-TM-78622; AVRADCOM-TR-79-44; A-7956) Avail: NTIS HC A07/MF A01 CSCL 01C

The wind tunnel performance of a 10-percent thick helicopter rotor section design by numerical optimization is presented. The model was tested at Mach number from 0.2 to 0.84 with Reynolds number ranging from 1,900,000 at Mach 0.2 to 4,000,000 at Mach numbers above 0.5. The airfoil section exhibited maximum lift coefficients greater than 1.3 at Mach numbers below 0.45 and a drag divergence Mach number of 0.82 for lift coefficients near 0. A moderate 'drag creep' is observed at low lift coefficients for Mach numbers greater than 0.6. M.G.

N80-21288# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE GRAPHICAL DISPLAY OF MULTI-DIMENSIONAL AERODYNAMIC FLOW FIELD DATA M.S. Thesis
Elton Philip Amburn Dec. 1979 111 p refs
(AD-A080359; AFIT/GCS/MA/79D-1) Avail: NTIS HC A06/MF A01 CSCL 20/4

The Air Force Flight Dynamics Laboratory has solved aerodynamic problems using sophisticated numerical techniques. Large volumes of data are created during the numerical solution of a problem, and the purpose of this project was to build a computer graphics software system to display this data. The system is controlled by using a command language which is interpreted by a table-driven parser. The primary output of the system is computer generated movies of the aerodynamic data. GRA

N80-21289# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ALLEVIATION OF THE SIDE FORCE AND THE YAWING MOMENT ACTING ON A SLENDER CONE-CYLINDER BODY AT HIGH ANGLES OF ATTACK, USING SMALL JET INJECTION AT SUBSONIC AND TRANSONIC SPEEDS Annual Technical Report, Sep. 1978 - Sep. 1979
D. Almosnino and J. Rom Sep. 1979 54 p refs
(Grant DA-ERO-78-G-119; DA Proj. 1L1-61102-BH-57)
(AD-A080317) Avail: NTIS HC A04/MF A01 CSCL 20/4

The effects of small symmetrical jets on the side forces of slender bodies at high angles of attack are investigated. Control as well as alleviation of these forces are considered. The effects of Reynolds number and blowing rate are investigated. Side force alleviation is obtained for subsonic and transonic flows. It is found that variation of Mach number affects the magnitude and direction of side forces. GRA

N80-21290# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
ON STRONG SLOT INJECTION INTO A SUBSONIC LAMINAR BOUNDARY LAYER
M. Napolitano and R. E. Messick Nov. 1978 40 p refs
(Contract N00014-76-C-0359; SR0230101)
(AD-A080442; AFL-78-11-44) Avail: NTIS HC A03/MF A01 CSCL 20/4

This paper is concerned with the problem of strong slot injection into a subsonic laminar boundary layer at asymptotically high Reynolds number. The problem is formulated and the governing equations are presented within the context of triple deck theory. The linear problem, valid when the injection velocity is small, is solved analytically by Fourier Transform techniques. Graphical results are given for a wide range of slot lengths. A numerical technique for the nonlinear equations is presented and used to obtain solutions for various injection velocities. Separation is found to first occur downstream of the slot, where a recirculating flow bubble is formed. GRA

N80-21291# Ohio State Univ., Columbus. Dept. of Mechanical Engineering.
STUDY OF ROTOR WAKES AT VERY LOW ADVANCE RATIOS Final Report, 30 Jun. 1976 - 30 Jun. 1979
Henry R. Velkoff 15 Dec. 1979 95 p refs
(Grant DAAG29-76-G-0260)
(AD-A080711; ARO-14142.1-EX) Avail: NTIS HC A05/MF A01 CSCL 20/4

With the recognition of the importance of operation of military helicopters at very low altitudes and very low velocities, the need for data on airflow under these conditions became apparent. Work was initiated to obtain data at very low advance ratios typical of such low speed helicopter flight. The original goals of the research were to try to obtain a description of the flow field both time averaged and instantaneous. Because of prior experience with hot wire anemometry the effort was directed towards using a hot wire probe to get all three components of velocity. The effort resulted in an operational rotor drive and measuring system, a probe calibration and positioning system, frequency response determination, and acquisition of average value data. The low speed flow fields found, demonstrated a squirting affect that could be seen on both sides of the rotor at very low advance ratios. Two non-steady data acquisition systems were considered, one developed to the point of use but was found awkward to use, and a second interactive system which progressed to the point that initial tests using it in a time average mode illustrated the interactive capability. GRA

N80-21292# United Technologies Research Center, East Hartford, Conn.
VISCID/INVISCID INTERACTION ANALYSIS FOR SYMMETRIC TRAILING EDGES Final Report, 13 Oct. 1978 - 13 Nov. 1979
M. J. Werle 13 Jan. 1980 81 p refs
(Contract N00019-78-C-0604)
(AD-A080600; UTRC/R79-914493-5) Avail: NTIS HC A05/MF A01 CSCL 20/4

A general theory is presented for high Reynolds number steady boundary layer separation, with application here to the near wake region of blunt subsonic trailing edges. The theory is based on the concept of a thin viscous layer displacing and thus interacting with an inviscid flow. The governing equations are derived in a shear layer oriented coordinate system and subsequently simplified through use of Prandtl's Transposition Theorem. These are put in final form through introduction of turbulent Levy Lees type variables to minimize growth of the viscous layer in the computational domain. Solutions were first obtained for asymptotically large Reynolds numbers through use of Triple Deck scaling laws. A numerical algorithm was developed using an inverse viscous layer approach coupled with a direct inviscid flow solver. The method was found to be fast, stable and accurate through a comparative assessment with previously published flat plate trailing edge solutions. Blunt trailing edge separated flows were then studied providing the first such steady, high Reynolds number solutions ever produced. A numerical algorithm was also written for solving the finite Reynolds number form of the governing equations. The approach was a direct extension of the Triple Deck Solver. Good agreement has been achieved with recently published flat plate trailing edge solutions at a Reynolds number of 100,000. GRA

N80-21257*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF ADVANCED COMPUTERS FOR AERODYNAMIC FLOW SIMULATION
F. R. Bailey and W. F. Ballhaus *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif. (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 01A

N80-22233# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NOTE ON AN INSTABILITY MECHANISM FOR THE CORE OF A ROLLED-UP VORTEX SHEET
Jean-Pierre Guiraud and Radyadour K. Zeytounian *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 15-19 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 85-88 Original report in FRENCH previously announced as A79-34977 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

N80-22248# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SUBSONIC AND TRANSONIC FLOWS ON A VARIABLE SWEEP WING
Volker Schmitt and Francis Manie *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 1-23 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 219-237 Original report in FRENCH previously announced as A79-48849 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

N80-22249# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TURBINE BLADE WALL TEMPERATURE CALCULATION BY COUPLING OF INTERNAL CONDUCTION AND EXTERNAL CONVECTION
Anne-Elisabeth Cournut and Pierre Michard Michard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 25-33 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 239-243 Original report in FRENCH previously announced as A79-48850 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N80-21293*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EMERGENCY IN-FLIGHT EGRESS OPENING FOR GENERAL AVIATION AIRCRAFT
Laurence J. Bement Apr. 1980 25 p refs
(NASA-TM-80235; L-13615) Avail: NTIS HC A02/MF A01 CSCL 01C

In support of a stall/spin research program, an emergency in-flight egress system is being installed in a light general aviation airplane. To avoid a major structural redesign for a mechanical door, an add-on 11.2 kg pyrotechnic-actuated system was developed to create an opening in the existing structure. The airplane skin will be explosively severed around the side window, across a central stringer, and down to the floor, creating an opening of approximately 76 by 76 cm. The severed panel will be jettisoned at an initial velocity of approximately 13.7 m/sec. System development included a total of 68 explosive severance tests on aluminum material using small samples, small and full scale flat panel aircraft structural mock-ups, and an actual aircraft fuselage. These tests proved explosive sizing/severance margins, explosive initiation, explosive product containment, and system dynamics. R.E.S.

N80-21294*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA LOW- AND MEDIUM-SPEED AIRFOIL DEVELOPMENT
Robert J. McGhee, William D. Beasley, and Richard T. Whitcomb Mar. 1979 19 p Presented at NASA Conf. on Advanced Tech. Airfoil Res., Langley Research Center, Hampton, Va., 7-9 Mar. 1979
(NASA-TM-78709; L-12264) Avail: NTIS HC A02/MF A01 CSCL 01C

The status of NASA low and medium speed airfoil research is discussed. Effects of airfoil thickness-chord ratios varying from 9 percent to 21 percent on the section characteristics for a design lift coefficient of 0.40 are presented for the initial low speed family of airfoils. Also, modifications to the 17-percent low-speed airfoil to reduce the pitching-moment coefficient and to the 21-percent low speed airfoil results are shown for two new medium speed airfoils with thickness ratios of 13 percent and 17 percent and design-lift coefficients of 0.30. Applications of NASA-developed airfoils to general aviation aircraft are summarized. R.E.S.

N80-21295*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL RESULTS FOR AN IMPROVED 21-PERCENT-THICK LOW-SPEED AIRFOIL SECTION
Robert J. McGhee and William D. Beasley Apr. 1978 47 p refs
(NASA-TM-78650; L-11970) Avail: NTIS HC A03/MF A01 CSCL 01C

Low speed wind tunnel tests were conducted to evaluate the effects on performance of modifying a 23 percent thick low speed airfoil. The airfoil contour was altered to reduce the upper-surface adverse pressure gradient and hence reduce boundary layer separation. The chord Reynolds number varied from about 2,000,000 to 9,000,000. R.E.S.

N80-21296# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
COMPUTER SIMULATION OF CANOPY-PILOT RESPONSE TO BIRD-STRIKE Final Technical Report, 1 Jun. 1977 - 15 Sep. 1978
T. Belytschko, E. Privitzer, W. Mindle, and T. Wicks Wright-Patterson AFB, Ohio AMRL Oct. 1979 101 p refs
(Contract F33615-77-C-0529; AF Proj. 7231)
(AD-A080122; AMRL-TR-79-20) Avail: NTIS HC A06/MF A01 CSCL 06/5

A computer program was developed for simulating the complete scenario of a bird-strike event: bird-canopy impact, canopy-pilot impact, and the resulting response of the pilot. The response of the pilot was simulated by a previously developed head-spine model, but in order to predict the degree of pilot injury or impairment, a skull brain model based on the maximum strain criterion was incorporated. Additional features which were developed for these simulations are (1) a plate finite element with the capability of treating geometric nonlinearities due to large deflections and material nonlinearities; (2) a contact-impact algorithm for treating bird-canopy and canopy-helmet impact; and (3) a graphical display capability for illustrating the results of simulations. Simulations were first performed of bird-canopy impacts to determine the mesh refinement necessary to reproduce the magnitudes of experimentally observed deformations and the wave pattern of the observed displacement. It was found that only a very fine mesh proved satisfactory. This mesh could not be used in the computer simulations because of computer core-storage and cost limitations at our computer facility. Simulations of pilot response to canopy impact showed that the injury potential is quite sensitive to the initial impulse of the bird impact and its location relative to the pilot. A simulation with a 8 cm maximum deflection resulted in a head impact which was definitely tolerable. On the other hand, a 33% increase in this impluse was associated with irreversible injuries. GRA

N80-21297# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
ESTIMATION OF DYNAMIC WINDBLAST PRESSURE ON AIRCREWMAN EJECTION SYSTEMS Final Report
Thomas J. Zenobi 12 Dec. 1979 24 p
(WF41400000)
(AD-A080575; NADC-79168-60) Avail: NTIS
HC A02/MF A01 CSCL 20/4

This report is intended to help designers and engineers, primarily involved in the design of aircraft ejection systems, understand and estimate windblast pressure. Effects of windblast pressure are addressed for a range of sonic velocities. Windblast pressure curves of various altitudes are included. GRA

N80-21298# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
EVALUATION OF A CENTRAL DATA ENTRY SYSTEM (CDES) FOR TRANSPORT AIRCRAFT
Fred Volker Schick (Technische Univ., Brunswick), Dirk Brunner (Technische Univ., Brunswick), Ernst-Heinrich Neumann (Deutsche Lufthansa AG), and Hans-Dieter Schenk Jul. 1979 179 p refs
(DFVLR-FB-79-23) Avail: NTIS HC A09/MF A01

A Central Data Entry System (CDES) for transport aircraft was developed for saving panel space and for common operation of various onboard flight management systems. A fully functional CDES model was flown by 27 airline pilots under realistic mission conditions in a flight simulator based evaluation program. Pilot performance and judgment data were analyzed in view of comparing CDES entries with conventional entries and studying CDES location alternatives in the cockpit, turbulence effects on CDES handling, training required for familiarization with the CDES, layout of CDES hardware and software, and the range of CDES capacities. The results show good feasibility and a high degree of pilot acceptance. Author (ESA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-21299*# National Aeronautics and Space Administration, Washington, D. C.
GLOBAL POSITIONING SYSTEM FOR GENERAL AVIATION: JOINT FAA-NASA SEMINAR Summary Report
1978 236 p Seminar held at Washington, D. C., 16-17 Oct. 1978 Prepared in cooperation with FAA, Washington, D. C.
(NASA-TM-81017) Avail: NTIS HC A11/MF A01 CSCL 17G

Programs to examine and develop means to utilize the global positioning system (GPS) for civil aviation functions are described. User requirements in this regard are discussed, the development of technologies in the areas of antennas, receivers, and signal processors for the GPS are examined, and modifications to the GPS to fit operational and design criteria are evaluated. For individual titles, see N80-21300 through N80-21311.

N80-21300*# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
FAA NAVIGATION PROGRAM
Neal A. Blake *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 5-21 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The FAA navigation program, which includes two major activity areas: those associated with certification of navigation systems to meet current requirements and those associated with building the data base needed to define future system improvements is examined. The near term activities, including the VORTAC upgrading program, the development of the technical data base needed for certification of LORAN C and OMEGA as a part of the current air navigation system, and the development of area navigation standards are examined in regard to cost factors and user requirements. Future system activities discussed include analysis of alternative system configurations made up of system elements including VORTAC VOR-DME, OMEGA and differential OMEGA, LORAN C, and GPS. The interrelationships between the near and far term programs are discussed. A helicopter IFR program which includes an assessment of the operational suitability of several navigation system alternatives for meeting helicopter navigation requirements for CONUS and offshore operations is reported. A.W.H.

N80-21301*# Department of Defense, Washington, D. C.
DOD PROGRAM
Stephen Gilbert *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 23-48 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

User requirements for the NAVSTAR global positioning system are delineated from the point of view of the DOD. The system concept for NAVSTAR and the status of the program are discussed. A.W.H.

N80-21302*# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
FAA GLOBAL POSITIONING SYSTEM PROGRAM
Anthony Buige *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 49-55 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

An overview of the FAA global positioning system (GPS) program is presented. The program's emphasis is on the potential applications of the system to civil aviation. The program is examined in relation to investigations of low cost equipment technology and potential improvements and/or modifications to the system. GPS program concerns such as the signal to noise ratio of the satellites, the system performance, and the cost/performance considerations are discussed. Requirements for an ideal receiver to be implemented into the GPS are summarized. A.W.H.

N80-21303*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
NASA PROGRAM
Henry J. Reid, Jr. *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 57-64 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

Areas of the NASA global positioning system (GPS) related programs including satellite/navigation tracking, shuttle applications, land/sea applications, and civil aviation applications are described. The development of technologies for the GPS such as high precision RNAV, a collision warning/avoidance system, and an automated position, velocity, identification reporting system is discussed. A.W.H.

N80-21304*# Collins Avionics and Missiles Group, Cedar Rapids, Iowa.
[A GENERALIZED DEVELOPMENT MODEL FOR TESTING GPS USER EQUIPMENT]
Norbert Hemesath *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 65-73 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The generalized development model (GDM) program, which was intended to establish how well GPS user equipment can perform under a combination of jamming and dynamics, is described. The systems design and the characteristics of the GDM are discussed. The performance aspects of the GDM are listed and the application of the GDM to civil aviation is examined. A.W.H.

N80-21305*# Magnavox Co., Torrance, Calif.
[CIVIL APPLICATIONS OF GLOBAL POSITIONING SYSTEMS]
Vito Calibi *In* NASA, Washington Global Positioning System

for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 75-81 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

User requirements germane to civil applications in the GPS are discussed. The Z-set is discussed as a possible low cost set which might meet the civil requirement as a GPS receiver. A.W.H.

N80-21306*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
[A PROGRAM FOR PREDICTING ANTENNA RADIATION PATTERNS]
Melvin Gilreath *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 83-105 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The status of the aircraft antenna prediction program at Langley is reviewed with emphasis on the analytical techniques and computer programs developed for antenna siting and performance prediction. Scale-model aircraft are used to obtain experimental data for verification of analytical results. Computer generated models of the Boeing 737, the KC-135, the Cessna 402B, and the Gates lear jet are discussed. A.R.H.

N80-21307*# Stanford Telecommunications, Inc., Mountain View, Calif.
[DESIGNING LOW COST RECEIVERS FOR GENERAL AVIATION USERS]
Francis D. Natali *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 107-117 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

Approaches to the design of a low cost receiver which meets all IFR requirements for 2D area navigation are discussed. These include: (1) using current technology with a minimum of specialized LSI, a minimum of circuit complexity, and minimal use of critical components; (2) emphasized microprocessor technology; and (3) a special analog/digital chip fabrication. A low cost GPS receiver configuration with a single sequencing tracking channel is examined. Problem areas are indicated. A.R.H.

N80-21308*# Teledyne Systems Co., Los Angeles, Calif.
[DESIGN APPROACHES FOR GPS RECEIVERS/PROCESSORS]
Robert V. Nino *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 119-128 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The design philosophy for a low-cost GPS receiver-processor is discussed. F.O.S.

N80-21309*# Texas A&M Univ., College Station.
[NAVIGATION ALGORITHMS FOR LOW COST GLOBAL POSITIONING SYSTEMS]
Philip Noe *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 129-138 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

Minimum complexity satellite selection algorithms are discussed for the implementation of a low-cost GPS. F.O.S.

N80-21310*# Texas Instruments, Inc., Dallas.
[GPS USER EQUIPMENT AND REQUIREMENTS]
Walter H. Riley *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 139-155 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The application of technologies to solving problems in designing various classes of user equipment in a GPS is discussed. F.O.S.

N80-21311*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
[ARCHITECTURAL DESIGN OF AN IMPROVED GPS RECEIVER USING RF ANALOG LIS CIRCUITS]
Eugene Hoo *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 157-177 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The application of the oxide aligned transistor technology to develop transistors for use in the GPS is discussed. F.O.S.

N80-21312# Magnavox Government and Industrial Electronics Co., Fort Wayne, Ind.
INVESTIGATION AND ASSESSMENT OF HARDWARE FOR GUIDANCE OF GLIDING AIRDROP SYSTEMS Final Report, 9 Jun. - 31 Dec. 1978
Joseph R. Hennel, Lynn A. Gerig, Hugh R. Reader, and Jimmie R. Schiele Feb. 1979 280 p refs
(Contract DAAK60-78-C-0021; DA Proj. 1L1-62210-D-283) (AD-A079290; FWD79-2066; NATICK-TR-79/038) Avail: NTIS HC A13/MF A01 CSCL 15/5

Assessments were made of hardware and guidance techniques for Gliding Airdrop System employing partial and full-state guidance schemes. From the available candidate guidance schemes, the Army selected the following ones for further study to prepare system specifications and preliminary cost estimates: Minimum Cost Radial Homing, Radial Homing with Enhance Manual Control, Cone-of-Silence Homing, and Full-State Guidance. Airdrop systems with payload capacities of 227 KG, 909 KG, and 6800 KG are addressed. GRA

N80-21313# Naval Research Lab., Washington, D. C.
THE CONTRIBUTION OF NAVIGATION TECHNOLOGY SATELLITES TO THE GLOBAL POSITIONING SYSTEM Interim Report
Roger L. Easton, James A. Buisson, Thomas B. McCaskill, O. J. Oaks, Sarah Stebbins, and Marie Jeffries 28 Dec. 1979 26 p refs
(AD-A080548; AD-E000359; NRL-8360) Avail: NTIS HC A03/MF A01 CSCL 17/7

The Navigation Technology Satellites, developed by the Naval Research Laboratory, have been provided as a vehicle for the design and test of basic satellite navigation technology currently in use in the NAVSTAR Global Positioning System (GPS). Two satellites, TIMATION 1 and 2, were flown in 1967 and 1969 to demonstrate the concept of using synchronized clocks to provide time ranging for navigational purposes. Navigation Technology Satellite 1 (NTS-1), flown in 1974, introduced a rubidium atomic clock, and NTS-2, flown in 1977, introduced a cesium clock. Both clocks provided increasingly superior navigation accuracy. A hydrogen maser clock for even better performance and reduced dependency on ground updating is being developed. In addition to the clock development the technology satellites have tested the effect of the radiation environment, the use of retroreflectors for laser tracking, and improved solar cells and batteries. As a result of NTS-2 tests the Air Force's Space and Missile Systems Organization (SAMSO) program office stated that the NAVSTAR GPS concept had been successfully validated. GRA

N80-21314# National Bureau of Standards, Boulder, Colo. National Engineering Lab.
A STANDARD FOR RF MODULATION FACTOR
M. G. Arthur and G. R. Reeve Sep. 1979 94 p refs
(PB80-109085; NBS-TN-1016; FAA-RD-79-94) Avail: NTIS HC A05/MF A01 CSCL 17G

A modulation factor standard was developed to support the Federal Aviation Administration's requirements for a measurement capability for the ILS and VOR navigation systems. The standard consists of both a precision modulation meter and a stable amplitude-modulated signal source. Although designed primarily for ILS and VOR signals, it has general purpose capabilities within an RF range of 10 MHz to 500 MHz and an AF range of 10 Hz to 20 KHz. Measurement uncertainty is less than 0.11 percent modulation below 90 percent modulation for ILS/VOR tones of 90 Hz and above, and is somewhat greater at 30 Hz. A circuit description and an error analysis are included. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-21315# Royal Aircraft Establishment, Farnborough (England).

INVESTIGATIONS OF AN ACTIVE VIBRATION ISOLATION SYSTEM FOR HELICOPTERS

G. Reichert and H. Strehlow Nov. 1979 58 p refs Transl. into ENGLISH from Luftfahrt forschung und luftfahrttechnologie statusseminar (Bonn), 1978

(RAE-Lib-Trans-1993; BR73047) Avail: NTIS HC A04/MF A01

Active and passive methods of minimizing the effects of rotor induced excitation forces on the fuselage vibration characteristics by isolating the rotor/transmission system from the fuselage are described. Attention is focussed on an active control system which was developed for eventual use on the BO 105 research helicopter. The advantages of active control systems over passive systems for isolating the helicopter fuselage from rotor induced excitation are discussed. R.E.S.

N80-21316*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUPERSONIC CRUISE AIRCRAFT RESEARCH: AN ANNOTATED BIBLIOGRAPHY

Marie H. Tuttle Apr. 1980 21 p

(NASA-TM-81781) Avail: NTIS HC A02/MF A01 CSCL 01C

This bibliography, with abstracts, consists of 69 publications arranged in chronological order. The material may be useful to those interested in supersonic cruise fighter/penetrator/interceptor airplanes. Two pertinent conferences on military supercruise aircraft are considered as single items; one contains 37 papers and the other 29 papers. In addition, several related bibliographies are included which cover supersonic civil aircraft and military aircraft studies at the Langley Research Center. There is also an author index. Author

N80-21317*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SIMULATOR STUDY OF THE EFFECT OF CONTROL-SYSTEM TIME DELAYS ON THE OCCURRENCE OF PILOT-INDUCED OSCILLATIONS AND ON PILOT TRACKING PERFORMANCE WITH A SPACE-SHUTTLE-ORBITER CONFIGURATION

Donald R. Riley and G. Kimball Miller, Jr. Apr. 1980 91 p refs

(NASA-TP-1588; L-13131) Avail: NTIS HC A05/MF A01 CSCL 01C

Using a six degree-of-freedom motion-base simulator, the effect of control-system time delays on the occurrence of pilot-induced oscillations (PIO's) on the vehicle handling qualities and on pilot tracking performance for a landing-approach configuration of the Space Shuttle orbiter was studied. A linearized math model was employed which represented a 300-knot orbiter with almost all time delays removed. Additional time delays were then inserted following the pilot's hand-controller signals. Only pitch and roll commands were used for vehicle control. The simulation employed an air to air tracking task as a means of emphasizing PIO tendencies. Two astronauts, two research pilots, and one simulation engineer served as test subjects. Results showed that PIO's occurred when the amount of added time delay approximated that existing for the orbiter configuration flown in the approach and landing tests. Increasing the amount of delay increased PIO occurrences and resulted in degraded tracking performance. Decreasing the amount of time delay eliminated the PIO's. R.E.S.

N80-21318*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PARAMETRIC STUDY OF VARIATION IN CARGO-AIRPLANE PERFORMANCE RELATED TO PROGRESSION FROM CURRENT TO SPANLOADER DESIGNS

Thomas A. Toll Washington Apr. 1980 53 p refs

(NASA-TP-1625; L-13208) Avail: NTIS HC A04/MF A01 CSCL 01C

A parametric analysis was made to investigate the relationship between current cargo airplanes and possible future designs that may differ greatly in both size and configuration. The method makes use of empirical scaling laws developed from statistical studies of data from current and advanced airplanes and, in addition, accounts for payload density, effects of span distributed load, and variations in tail area ratio. The method is believed to be particularly useful for exploratory studies of design and technology options for large airplanes. The analysis predicts somewhat more favorable variations of the ratios of payload to gross weight and block fuel to payload as the airplane size is increased than has been generally understood from interpretations of the cube-square law. In terms of these same ratios, large all wing (spanloader) designs show an advantage over wing-fuselage designs. J.M.S.

N80-21319# Army Research and Technology Labs., Fort Eustis, Va. Applied Technology Lab.

AN ANALYTICAL INVESTIGATION OF THE EFFECT OF VARYING ROTOR TIP SPEED TO REDUCE HELICOPTER ACOUSTIC DETECTION

Bill W. Scruggs, Jr. and Kenneth D. Hampton Aug. 1979 34 p refs

(DA Proj. 1L1-62209-AH-76)

(AD-A076961; USARTL-TN-37) Avail: NTIS HC A03/MF A01 CSCL 01/3

The purpose of this study was to analytically determine the effect of incrementally varying helicopter rotor tip speed to decrease noise levels and detection distance. The basis for this study was that primary mission performance (PMP) would be maintained at each incremental change of rotor tip speed. A baseline helicopter was designed that met the Advanced Scout Helicopter (ASH) PMP requirements. It used a 700 fps tip speed four bladed rotor system. Four generic configurations of the baseline helicopter were also designed which met the PMP requirements. The design rotor tip speed of these configurations varied to 105, 95, 90, and 80 percent of the baseline tip speed. Overall sound pressure levels (OASPL), 1/3 octave band spectra, and detection distances were predicted for all helicopter configurations for a range of operational speeds. Results showed that the 90 percent (630 fps) tip speed configuration was optimum in terms of reduced OASPL. When all configurations were analytically displaced in distance to the point at which their noise signature could first be perceived, the 100 percent (700 fps) tip speed configuration was least detectable. It was also found that OASPL was not a reliable indicator of detectability and that ambient noise conditions had the largest net effect on detectability. GRA

N80-21320# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.

AIRWORTHINESS AND FLIGHT CHARACTERISTICS EVALUATION. OH-58C INTERIM SCOUT HELICOPTER Final Report, Jun. - Dec. 1978

Sherwood C. Spring, John R. Niemann, Thomas E. Burch, and Robert M. Buckanin Apr. 1979 205 p refs

(AD-A080138; USAAEFA-76-11-2) Avail: NTIS HC A10/MF A01 CSCL 01/3

The United States Army Aviation Engineering Activity conducted an airworthiness and flight characteristics evaluation of the OH-58C Interim Scout helicopter. Performance, handling qualities, and vibration characteristics were evaluated to provide engineering test data for use in the OH-58C Operator's Manual and to detect any aircraft deficiencies or shortcomings. The OH-58C was tested at Edwards Air Force Base, California (elevation 2302 feet), and alternate test site elevations of 4120, and 9980 feet. A total of 97 flights were conducted for a total of 123.5 flight hours. Due to the more powerful T63-A-720 engine installed in the helicopter, the hover and takeoff capability at heavy gross weights and high altitudes and the forward flight climb performance of the OH-58C is significantly improved over the OH-58A. Performance in terms of power required and fuel flow is slightly degraded when compared to the OH-58A at similar gross weights and altitudes and in general did not meet the estimates of the detail specification for the OH-58C. The

handling qualities and vibrations of the OH-58C are similar to the OH-58A when operating at similar gross weights and altitudes. Three handling qualities deficiencies relative to the low speed flight characteristics were identified. GRA

N80-21321# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PARAXIAL OPTICOVISUAL ANALYSIS OF THE F-111E WINDSCREEN WITH GENERIC APPLICATION
Bertram D. Targove and Rick Seid. Dec. 1979. 20 p. refs. (AD-A080143; AMRL-TR-79-107) Avail: NTIS HC A02/MF A01 CSCL 01/3

A portion of the F-111E Bird Impact Resistant Windscreen is analyzed utilizing paraxial optical techniques. An opticovisual analysis of likely visual effects are postulated from the paraxial optical analysis. These analyses indicate that variable meridional magnification and prism deviation variability are the significant parameters in producing deleterious binocular effects. GRA

N80-21322# Army Aviation Research and Development Command, St. Louis, Mo. Applied Technology Lab.
COST ANALYSIS OF A HELICOPTER TRANSMISSION AND DRIVE TRAIN
Richard F. Mulliken. Nov. 1979. 46 p. (AD-A080518; USAAVRADCOM-TM-80-D-2) Avail: NTIS HC A03/MF A01 CSCL 01/3

A cost analysis was conducted on a transmission and drive train system from a single-engine helicopter with an input of 1134 hp at 6600 rpm. Main rotor speed was 325 rpm. Details and subassemblies of this system were identified using the Army Technical Manual. Prices of spare parts were obtained from the Army Master Data File (AMDF). Irregularity in the prices found showed that it was impossible to identify specific cost drivers or to develop any valid cost baseline or to obtain valid comparative detail costs using this data base. In view of this situation, plans to analyze a second system were abandoned. A detailed review of the data obtained strongly indicated that gears, forgings, and castings are the cost drivers in this system. Since all such systems employ components of similar nature and function, this indication is applicable to other transmission systems and should therefore be useful as an aid in directing cost-reduction efforts. Manufacturing approaches by which costs on such parts may be reduced are suggested. GRA

N80-21244# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany). Wehrtechnische Systeme.
THE USE OF COMPUTER AIDED DESIGN METHODS IN AIRBORNE SYSTEMS EVALUATION
P. Ebeling and E. Pfisterer. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 11 p. refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21245# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
CRITERIA FOR TECHNOLOGY
R. L. Hass. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 12 p. refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21247# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
THE USE OF COMPUTER BASED OPTIMIZATION METHODS IN AIRCRAFT STUDIES
Brian Edwards. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 27 p. refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21248# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
SOME FUNDAMENTAL ASPECTS OF TRANSPORT AIRCRAFT CONCEPTUAL DESIGN OPTIMIZATION
E. Torenbeek. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 22 p. refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21248# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
SURVEY PAPER ON COMPUTER AIDED DESIGN
D. Weinhauer. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 2 p. (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21258# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THE USE OF THE COMPUTER IN THE DESIGN OF AERODYNAMIC CONFIGURATIONS [UTILISATION DE L'ORDINATEUR POUR LE DESSIN DE CONFIGURATIONS AERODYNAMIQUES]
Pierre Perrier. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 17 p. In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21259# Aeritalia S.p.A., Torino (Italy).
WING DESIGN PROCESS BY INVERSE POTENTIAL FLOW COMPUTER PROGRAMS
Luciano Fornasier. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 14 p. refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21260# Boeing Commercial Airplane Co., Seattle, Wash.
THE ROLE OF COMPUTATIONAL AERODYNAMICS IN AIRPLANE CONFIGURATION DEVELOPMENT
Bertil Dillner and Chester A. Koper, Jr. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 14 p. refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21261# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.
COMPUTATIONAL AERODYNAMIC DESIGN TOOLS AND TECHNIQUES USED AT FIGHTER DEVELOPMENT
P. Sacher, W. Kraus, and R. Kurtz. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 12 p. refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21262# Rockwell International Corp., Anaheim, Calif. Aircraft Div.
USE OF COMPUTERS IN THE AERODYNAMIC DESIGN OF THE HIMAT FIGHTER
R. D. Child, B. Panagesis, and P. Gingrich. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 19 p. refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21263# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Theoretische Aerodynamik.
NUMERICAL METHODS FOR DESIGN AND ANALYSIS AS AN AERODYNAMIC DESIGN TOOL FOR MODERN AIRCRAFT
Wolfgang Schmidt. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 21 p. refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21265# Royal Aircraft Establishment, Farnborough (England).
A COMPUTER BASED SYSTEM FOR STRUCTURAL DESIGN, ANALYSIS AND OPTIMIZATION
A. J. Morris, P. Bartholomew, and J. Dennis. *In* AGARD The Use of Computers as a Design Tool. Jan. 1980. 26 p. refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21268# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
FINITE ELEMENTS AND THE OPTIMIZATION OF AERONAUTICAL STRUCTURES [ELEMENTS FINIS ET OPTIMISATION DES STRUCTURES AERONAUTIQUES]
C. Petiau and G. Lecina. *In* AGARD The Use of Computers as

a Design Tool Jan. 1980 16 p refs In FRENCH; ENGLISH summary (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21270# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
COMPUTER PROGRAMS FOR THE DESIGN AND PERFORMANCE EVALUATION OF NACELLES FOR HIGH BYPASS-RATIO ENGINES
Richard Smyth In AGARD The Use of Computers as a Design Tool Jan. 1980 21 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21272# British Aerospace Aircraft Group, Preston (England).
MATHEMATICAL MODELLING IN MILITARY AIRCRAFT WEAPON SYSTEM DESIGN
N. Mitchell In AGARD The Use of Computers as a Design Tool Jan. 1980 12 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21276# Air Force Flight Test Center, Edwards AFB, Calif.
THE USE OF ADVANCED COMPUTER TECHNIQUES IN FLIGHT TEST EVALUATIONS
David P. Maunder and Robert E. Lee In AGARD The Use of Computers as a Design Tool Jan. 1980 6 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-21323*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF A SPINNING-MODE ACOUSTIC-TREATMENT DESIGN CONCEPT FOR AIRCRAFT INLETS
Laurence J. Heidelberg, Edward J. Rice, and Leonard Homyak Apr. 1980 29 p refs
(NASA-TP-1613; E-185) Avail: NTIS HC A03/MF A01 CSCL 21E

An aircraft-inlet noise suppressor method based on mode cutoff ratio was qualitatively checked by testing a series of liners on a YF-102 turbofan engine. Far-field directivity of the blade passing frequency was used extensively to evaluate the results. The trends and observations of the test data lend much qualitative support to the design method. The best of the BPF liners attained a suppression at design frequency of 19 dB per unit length-diameter ratio. The best multiple-pure-tone linear attained a remarkable suppression of 65.6 dB per unit length-diameter ratio. Author

N80-21324*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCES OF THREE FAN STATOR DESIGNS OPERATING WITH ROTOR HAVING TIP SPEED OF 337 METERS PER SECOND AND PRESSURE RATIO OF 1.54. RELATION OF ANALYTICAL CODE CALCULATIONS TO EXPERIMENTAL PERFORMANCE
Thomas F. Gelder, James F. Schmidt, and Genevieve M. Esgar Apr. 1980 53 p refs
(NASA-TP-1614; E-137) Avail: NTIS HC A04/MF A01 CSCL 21E

A hub-to-shroud and a blade-to-blade internal-flow analysis code, both inviscid and basically subsonic, were used to calculate the flow parameters within four stator-blade rows. The produced ratios of maximum suction-surface velocity to trailing-edge velocity correlated well in the midspan region, with the measured total-parameters over the minimum-loss to near stall operating range for all stators and speeds studied. The potential benefits of a blade designed with the aid of these flow analysis codes are illustrated by a proposed redesign of one of the four stators studied. An overall efficiency improvement of 1.6 points above the peak measured for that stator is predicted for the redesign. Author

N80-21325*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF SINGLE-STAGE AXIAL-FLOW TRANSONIC COMPRESSOR WITH ROTOR AND STATOR ASPECT RATIOS OF 1.19 AND 1.26 RESPECTIVELY, AND WITH DESIGN PRESSURE RATIO OF 2.05
Royce D. Moore and Lonnie Reid Washington Apr. 1980 103 p
(NASA-TP-1659; E-138) Avail: NTIS HC A06/MF A01 CSCL 21E

The overall and blade-element performances of a low-aspect-ratio transonic compressor stage are presented over the stable operating flow range for speeds from 50 to 100 percent of design. At design speed the rotor and stage achieved peak efficiencies of 0.876 and 0.840 at pressure ratios of 2.056 and 2.000, respectively. The stage stall margin at design speed was 10 percent. Author

N80-21326*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF UNCERTAINTIES IN TURBINE METAL TEMPERATURE PREDICTIONS
Francis S. Stepka Washington Apr. 1980 19 p refs
(NASA-TP-1593; E-228) Avail: NTIS HC A02/MF A01 CSCL 21E

An analysis was conducted to examine the extent to which various factors influence the accuracy of analytically predicting turbine blade metal temperatures and to determine the uncertainties in these predictions for several accuracies of the influence factors. The advanced turbofan engine gas conditions of 1700 K and 40 atmospheres were considered along with those of a highly instrumented high temperature turbine test rig and a low temperature turbine rig that simulated the engine conditions. The analysis showed that the uncertainty in analytically predicting local blade temperature was as much as 98 K, or 7.6 percent of the metal absolute temperature, with current knowledge of the influence factors. The expected reductions in uncertainties in the influence factors with additional knowledge and tests should reduce the uncertainty in predicting blade metal temperature to 28 K, or 2.1 percent of the metal absolute temperature. Author

N80-21327*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ELECTRICAL SERVO ACTUATOR BRACKET Patent Application
Ralph V. Sawyer, inventor (to NASA) Filed 20 Feb. 1980 10 p
(NASA-Case-FRC-11044-1; US-Patent-Appl-SN-135056) Avail: NTIS HC A02/MF A01 CSCL 21E

A bracket for an electrical servo actuator is disclosed which was developed particularly for jet engine fuel control values. Said servo actuator is mounted on a support arm which is allowed to pivot on a bolt through a fixed mounting bracket. The actuator is pivotally connected to the end of the support arm by a bolt which has an extension that passes through a slot in the fixed mounting bracket. An actuator rod extends from the servo actuator

to a crank arm which turns a control shaft. A short linear thrust of the rod pivots the crank arm through about 90 deg for full-on control with the rod contracted into the servo actuator, and full-off control when the rod is extended from the actuator.
NASA

N80-21328*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
PROGRAM FOR IMPACT TESTING OF SPAR-SHELL FAN BLADES, TEST REPORT
R. Ravenhall and C. T. Salemme Apr. 1978 95 p
(Contract NAS3-20801)
(NASA-CR-135393; R78AEG444) Avail: NTIS
HC A05/MF A01 CSCL 21E

Six filament-wound, composite spar-shell fan blades were impact tested in a whirligig relative to foreign object damage resulting from ingestion of birds into the fan blades of a QCSEE-type engine. Four of the blades were tested by injecting a simulated two pound bird into the path of the rotating blade and two were tested by injecting a starling into the path of the blade. R.E.S.

N80-21329*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
MANUFACTURE OF LOW CARBON ASTROLOGY TURBINE DISK SHAPES BY HOT ISOSTATIC PRESSING. VOLUME 2, PROJECT 1 Final Report
R. D. Eng and D. J. Evans Jan. 1979 10 p
(Contract NAS3-20072)
(NASA-CR-135410; PWA-5574-37) Avail: NTIS
HC A02/MF A01 CSCL 21E

The performance of a hot isotatic pressed disk installed in an experimental engine and exposed to realistic operating conditions in a 150-hour engine test and a 1000 cycle endurance test is documented. Post test analysis, based on visual, fluorescent penetrant and dimensional inspection, revealed no defects in the disk and indicated that the disk performed satisfactorily. R.E.S.

N80-21330*# IIT Research Inst., Chicago, Ill.
THERMAL FATIGUE AND OXIDATION DATA FOR DIRECTIONALLY SOLIDIFIED MAR-M 246 TURBINE BLADES
V. L. Hill and V. E. Humphreys Jan. 1980 45 p refs
(Contract NAS3-19696)
(NASA-CR-159798; IITRI-M6003-53) Avail: NTIS
HC A03/MF A01 CSCL 21E

Thermal fatigue and oxidation data were obtained for 11 plasma spray coated and 13 uncoated directionally solidified and single crystal MAR-M 246 blades. Blade coatings on the airfoil included several metal-oxide thermal barrier layers based on Al2O3, Cr2O3, or ZrO2. The 24 turbine blades were tested simultaneously for 3000 cycles in fluidized beds maintained at 950 and 25 C using a symmetrical 360 set thermal cycle. In 3000 cycles, only uncoated turbine blades exhibited cracking on the trailing edge near the platform; 3 of the 13 uncoated blades did not crack. Cracking occurred over the range 400 to 2750 cycles, with single crystal blades indicating the poorest thermal fatigue resistance. Oxidation of the uncoated blades was limited in 3000 cycles. All coatings indicated microscopically visible spalling at the trailing edge radius after 3000 cycles. Severe general spalling on the airfoil was observed for two multilayered coatings. Author

N80-21331*# AiResearch Mfg. Co., Phoenix, Ariz.
AIRESEARCH QCGAT PROGRAM Final Report
R. W. Heldenbrand and W. M. Norgren 10 Jan. 1979 199 p refs
(Contract NAS3-20585)
(NASA-CR-159758; AIRESEARCH-21-3071) Avail: NTIS
HC A09/MF A01 CSCL 21E

A model TFE731-1 engine was used as a baseline for the NASA quiet clean general aviation turbofan engine and engine/nacelle program designed to demostrate the applicability of large turbofan engine technology to small general aviation turbofan engines, and to obtain significant reductions in noise and pollutant emissions while reducing or maintaining fuel consumption levels. All new technology design for rotating parts and all items in the engine and nacelle that contributed to the acoustic and pollution characteristics of the engine system were of flight design, weight, and construction. The major noise, emissions, and performance goals were met. Noise levels estimated for the three FAR Part 36 conditions, are 10 to 15 ENPdB below FAA requirements; emission values are considerably reduced below that of current technology engines; and the engine performance represents a TSFC improvement of approximately 9 percent over other turbofan engines. A.R.H.

N80-21332*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
DEVELOPMENT OF IMPROVED HIGH PRESSURE TURBINE OUTER GAS PATH SEAL COMPONENTS Progress Report, Dec. 1976 - Oct. 1979
Lawrence T. Shiembob Jan. 1980 80 p
(Contract NAS3-20590)
(NASA-CR-159801; PWA-5568) Avail: NTIS
HC A05/MF A01 CSCL 21E

A plasma sprayed graded layered ceramic/metallic (ZrO2/CoCrAlY) seal was evaluated for JT9D turbine application by rig and engine tests. Four cyclic thermal shock rig tests were conducted during the program. Three completed 1000 simulated engine thermal cycle tests and the fourth completed 500 cycles without severe cracking or spalling. Three ceramic seals were installed in a JT9D experimental engine to evaluate the effect of the engine thermal environment on the seals. All three seals completed the test successfully without severe cracking or spalling. The three seals did have slight laminar cracks at the 85/15-40/60 ZrO2/CoCrAlY interface. The second engine test evaluated the rub capabilities of the seal. Six ceramic seals were installed in the engine with fourteen abrasive tip blades. Three of the six seals rubbed to a depth of 24 mils. Eight of the fourteen abrasive tip blades showed evidence of wear. Three of the eight blades wore a maximum of five mils. Engine rub test results demonstrated the potential of reducing turbine clearances and thereby improving engine performance by use of sprayed ceramic seals. J.M.S.

N80-21333*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE PERFORMANCE OF J85-21 COMPRESSOR AT 100 PERCENT OF DESIGN SPEED WITH AND WITHOUT INTERSTAGE RAKE BLOCKAGE
Roger A. Werner Mar. 1980 36 p refs
(NASA-TM-81451; E-377) Avail: NTIS HC A03/MF A01 CSCL 21E

Internal compressor instrumentation blockage effects on steady state J85-21 compressor performance at 100 percent of design speed are determined. The blockage was generated by instrumented vanes for the first three compressor stages and by removal rakes for stages 4 to 9. Individual flow passage blockages ranged up to 4.5 percent with the instrumented vanes and up to 22 percent with the removable interstage rakes. At a Reynolds number index of 1.0, pressure ratio and airflow remained unchanged with insertion of the interstage rakes, but efficiency dropped 0.3 percentage point. Compressor exit profiles, compressor stage static pressure rise coefficients, turbine exit temperature, and fuel flow are also presented. J.M.S.

N80-21334*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
DATA ANALYSIS OF P SUB T/P SUB S NOSEBOOM PROBE TESTING ON F100 ENGINE P680072 AT NASA LEWIS RESEARCH CENTER Final Report
C. H. Foote Mar. 1980 23 p
(Contract NAS3-19442)
(NASA-CR-159816; PWA-FR-12540) Avail: NTIS
HC A02/MF A01 CSCL 21E

Results from the altitude testing of a P sub T/P sub S noseboom probe on the F100 engine are discused. The resultss are consistent with sea level test results. The F100 engine altitude test verified automatic downmatch with the engine pressure ratio control, and backup control inlet case static pressure demonstrated sufficient accuracy for backup control fuel flow scheduling. The production P6 probe measured Station 6 pressures accurately for both undistorted and distorted inlet airflows. M.G.

N80-21335# Ford Motor Co., Dearborn, Mich.
X-RAY RADIOGRAPHY OF GAS TURBINE CERAMICS Annual Report, 1 Oct. 1978 - 30 Sep. 1979

D. J. Cassidy and M. F. Elgart Oct. 1979 28 p
(Contract N00014-78-C-0714)
(AD-A080440; AR-1) Avail: NTIS HC A03/MF A01 CSCL 11/2

This program was conceived for the purpose of investigating X-ray radiography and X-ray tomography in the detection of gross fabrication flaws in complex-shaped ceramic components such as those currently under development for advanced high temperature turbine engines. The first year effort of the program was directed towards the fabrication of ceramic test coupons with defects of known size and shape; the establishment of baseline data for the resolution of these defects using Microfocus X-ray equipment; the definition of equipment concepts for a computer assisted tomography (CAT) system; and the development of a CAT algorithm. Silicon nitride coupons with slot type defects (25-175 microns) and circular shaped defects (25-1000 microns) were fabricated. Baseline data were obtained from these test coupons using Microfocus X-ray and image enhancement techniques. A Computer Assisted Tomography (CAT) design concept was defined, which employs a computer-operated rotary stage, intensifying screen or X-ray film, TV camera, computer, digital image analyzer, and TV monitor. Computer reconstruction algorithms were investigated with respect to CAT and a preferred approach was determined. An appropriate CAT algorithm was written and tested. GRA

N80-21271*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTERIZED SYSTEMS ANALYSIS AND OPTIMIZATION OF AIRCRAFT ENGINE PERFORMANCE, WEIGHT, AND LIFE CYCLE COSTS
Laurence H. Fishbach *In* AGARD The Use of Computers as a Design Tool Jan. 1980 15 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-21336*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DYNAMICS STABILITY DERIVATIVES OF SPACE SHUTTLE ORBITER OBTAINED FROM WIND-TUNNEL AND APPROACH AND LANDING FLIGHT TESTS
Delma C. Freeman, Jr. Washington Apr. 1980 20 p refs
(NASA-TP-1634; L-13427) Avail: NTIS HC A02/MF A01 CSCL 01C

A comparison was made between ground facility measurements, the aerodynamic design data book values, and the dynamic damping derivatives extracted from the space shuttle orbiter approach and landing flight tests. The comparison covers an angle of attack range from 2 deg to 10 deg at subsonic Mach numbers. The parameters of pitch, yaw, and roll damping, as well as the yawing moment due to rolling velocity and rolling moment due to yawing velocity are compared. J.M.S.

N80-21337# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ACTIVE CONTROL TECHNOLOGY, VOLUME 1
1978 224 p refs Lecture held at Rhode-Saint-Genese, Belgium, 4-8 Dec. 1978 2 Vol.
(VKI-Lec-Ser-1979-1-Vol-1) Avail: NTIS HC A10/MF A01

Active control technology is assessed. The theory behind active control is analyzed and active control systems and techniques including fly by wire control, are discussed. Active control capabilities in conjunction with electronic technology are examined in relation to increasing aircraft performance, operational flexibility, and design flexibility. For individual titles, see N80-21338 through N80-21343.

N80-21338# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ACTIVE CONTROL TECHNOLOGY
Morris A. Ostgaard *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 59 p refs (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

Active control technology, defined as an extension of conventional feedback control systems which provide a multiple input, multiple output capability is assessed. Active control permits uncoupling of the aircraft equations for motion to allow full exploitation of the complete six degrees of control freedom as compared to the conventional four degrees of control freedom. Active control design considerations are discussed in which a B-52 aircraft was used as the test vehicle for the analysis, development, and flight demonstration of the load alleviation and mode stabilization concepts. Significant performance improvements in the areas of augmented stability, gust load alleviation, fatigue reduction, maneuver load control, ride control, and flutter mode control are reported. The historical background and the future potential of active control are discussed. A.W.H.

N80-21339# British Aerospace Aircraft Group, Warton (England).
ACTIVE CONTROLS FOR COMBAT AIRCRAFT
B. R. A. Burns *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 14 p refs (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

The effects of active controls technology on combat aircraft, in terms of weight reduction achieved, performance, and handling improvements are reviewed. It is shown that significant improvements in performance are achieved with artificial longitudinal stability coupled with automatic operation of combat flaps. The adoption of spin prevention and automatic maneuver limitation is discussed. The engineering features of a full time fly by wire system are presented. A.W.H.

N80-21340# Controle Automatique Generalise, Brussels (Belgium).
EXPERIMENTATION OF A GENERALIZABLE FLY-BY-WIRE CONTROL SYSTEM ON THE CONCORDE AIRCRAFT
J. C. Maffre and Y. Negre (Soc. Nacl. Ind. Aerospatiale, Toulouse, France) *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 19 p ref (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

The principle of fly by wire controls in flight operations using the Concorde aircraft as the test vehicle is analyzed. Two factors in the design study, the safety level to be achieved and certain basic aircraft data, such as the number and type of control surfaces, the number of hydraulic systems, etc., are highlighted. The fly by wire control system tested on the Concorde aircraft is described and the various operating modes of the hybrid system are discussed. The digital techniques used for the fly by wire computers are reported. Ground tests on the system, including the computer tests and the rig tests, are described. The flight tests are summarized and the results for the computer systems and the controllability of the Concorde aircraft are presented. A.W.H.

N80-21341# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
ENGINEERING OF CONTROL SYSTEMS AND IMPLICATIONS ON CONTROL LAW DESIGN
F. R. Gill *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 18 p refs (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

The state of the art of multiplexed digital flight control systems are reviewed in relation to integrity requirements and the means of achieving integrity. The need for variable and changeable control is discussed and the potential of pilot selectable task oriented control is examined. Several variable control concepts are discussed with emphasis placed on the problems in control law design. Integrity requirements are delineated and a multiplexed digital flight control system and its subsystems are described. A.W.H.

N80-21342# Marconi Avionics Ltd., Rochester (England).
HIGH INTEGRITY FIBER OPTIC DATA TRANSMISSION

A. J. Alexander *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 23 p refs (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

The problem of data transmission in high integrity, safety critical, airborne applications, as found in fly by wire flight control or active controls techniques, is addressed. The general principles of data transmission as applied to the overall system design considerations are discussed. Two data transmission media, electrical and fiber optic links, are described. Aspects of fiber optic system design and implementation, component design, and availability as well as installation techniques and practices are discussed. The complete absence of electromagnetic interference in the data transmission medium with fiber optics and the inherent electrical isolation and resistance to failure propagation are addressed. A.W.H.

N80-21343# Royal Aircraft Establishment, Bedford (England).
THE FLYING QUALITIES OF AIRCRAFT WITH AUGMENTED LONGITUDINAL AND DIRECTIONAL STABILITY
W. J. G. Pinsker *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 23 p refs (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

The flying qualities of relaxed stability aircraft, stabilized by various possible feedback strategies, are discussed. Flying qualities are defined as gust response, the behaviour near and beyond the stall, steady maneuvering characteristics, and control and stability during the ground roll. The augmentation of relaxed stability by active control using either direct feedbacks or indirect feedbacks is examined. A.W.H.

N80-21344# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ACTIVE CONTROL TECHNOLOGY, VOLUME 2
1978 411 p refs Lecture held at Rhode-Saint-Genese, Belgium, 4-8 Dec. 1978 2 Vol.
(VKI-Lec-Ser-1979-1-Vol-2) Avail: NTIS HC A18/MF A01

The technology of actively employing control to achieve aircraft design objectives is considered. Specific topics covered include gust alleviation, direct lift control, flutter suppression, and improved riding quality. For individual titles, see N80-21345 through N80-21353.

N80-21345# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
ACTIVE CONTROL TECHNOLOGY FOR GUST ALLEVIATION
B. Krag *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 78 p refs (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

Wind tunnel tests utilizing remotely controlled models were performed in order to develop a gust alleviation system for future application in a small twin-engined transport aircraft. Emphasis was placed on open loop gust compensation systems. Gust angle of attack as well as the complicated interaction of downwashes, dead-times, actuator lags, sensor position, and unsteady aerodynamic transient effects were measured. The design methodology of a mixed open loop and closed loop gust alleviation system is presented. J.M.S.

N80-21346# British Aerospace Aircraft Group, Warton (England).
GUST LOAD ALLEVIATION
H. Hitch *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 12 p (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

Mathematical modeling of gust loads on wings is discussed with emphasis on gust load alleviation. Aircraft dynamic models are included. Load reduction achievable with an ACT load alleviation system is discussed. J.M.S.

N80-21347# Rockwell International Corp., Los Angeles, Calif. Dynamics Technology Staff.
B-1 RIDE CONTROL SYSTEM DESIGN DEVELOPMENT AND TEST
John H. Wykes *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 16 p refs (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

The design development, including system requirements and mechanization details of the B-1 aircraft control configured vehicle (CCV) concept ride control system is presented. The design implementation is also discussed, including hardware and installation details. Flight test performance evaluations, comparisons of analytical and test data, system improvements, and flight crew evaluations are presented. While the detailed information is provided for a system designed to improve ride quality through control of structural motion, it is concluded that the technology discussed is applicable to load relief and even flutter suppression of flexible vehicles, military or commercial. J.M.S.

N80-21348# Calspan Corp., Buffalo, N. Y.
DIRECT FORCE CONTROL AND TESTING
Robert P. Harper, Jr. *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 46 p refs (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

Direct lift and direct side force control is considered in terms of the potential in active control technology. The influence of fly by wire control systems on the development of direct lift and direct side force control is emphasized. Control in crosswind landing and air to ground weapon delivery situations is discussed. Conclusions are given. J.M.S.

N80-21349# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
DIRECT FORCES FROM FLIGHT TESTING
Claudius LaBurthe *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 26 p (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

Flight testing analysis of direct forces is discussed. Three kinds of problems, which may be artificially separated for study and explanation, but are in fact deeply interconnected are described. The results of an in-flight experimentation of the use of direct forces on the variable stability Navion aircraft are discussed. R.E.S.

N80-21350# Liege Univ. (Belgium).
ANALYTICAL TOOLS FOR ACTIVE FLUTTER SUPPRESSION
M. Geradin *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 47 p refs (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

Two analytical aspects of flutter mode control systems are discussed: (1) the unsteady aerodynamics of the lifting surface, and (2) the synthesis of the control law using modern control theory. Aerodynamic modeling via mathematical modeling is described for two dimensional incompressible flow. R.E.S.

N80-21351# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
EXTERNAL STORE FLUTTER SUPPRESSION WITH ACTIVE CONTROLS
H. Hoenlinger and R. Destuynder *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 86 p refs Prepared in cooperation with ONERA, Laclerc (France) (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

A review is made of recent advances in the development of active flutter suppression systems. The methods used to optimize control laws for active flutter suppression are presented. Practical applications on wing store flutter cases are described. Wind tunnel and flight test results are shown illustrating the efficiency of the systems. Problems of integration into the flight control system and flight testing are discussed. R.E.S.

N80-21352# Marconi Avionics Ltd., Rochester (England).
FLYING QUALITIES AND PILOTING WITH RESPECT TO CONTROLS AND DISPLAYS
R. H. Holmes *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 29 p refs (For primary document see N80-21344 12-08)

Avail: NTIS HC A18/MF A01

The problems of head-up presentation of flight path angle are discussed with particular reference to the increased maneuvering envelopes available through the use of active control technology. The peculiar problems created by VSTOL Aircraft flight path presentation are described. It is concluded that the stability conferred by active controls together with head-up flight path angle display will markedly reduce pilot workload during low altitude flight. R.E.S.

N80-21353# Centre d'Essais en Vol, Istres (France).
FLIGHT TESTING OF SEVERAL CONTROL LAWS OF A FLY-BY-WIRE SYSTEM
Jean-Pierre Petit *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 18 p (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

A fly-by-wire system was installed on a Mirage 3 aircraft for study purposes. Pour pitch controls laws associated with one roll control law were developed and tested. More than 40 pilots flew the aircraft for evaluation. The fly-by-wire installation, the controls laws used, and the flight tests methods are described and the main results are summarized. R.E.S.

N80-21354*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A MODEL-BASED TECHNIQUE FOR PREDICTING PILOT OPINION RATINGS FOR LARGE COMMERCIAL TRANSPORTS Final Report
William H. Levison Washington NASA Apr. 1980 78 p refs
(Contract NAS1-15529)
(NASA-CR-3257) Avail: NTIS HC A05/MF A01 CSCL 01C

A model based technique for predicting aircraft handling qualities is described. Features of this procedure, which is based on the optimal control model for pilot/vehicle systems, include (1) capability to treat unconventional aircraft dynamics, (2) a relatively free form pilot model, (3) a simple scalar metric for attentional workload, and (4) a straightforward manner of proceeding from descriptions of the flight task environment and requirements to a prediction of pilot opinion rating. The method was able to provide a good match to a set of pilot opinion ratings obtained in a manned simulation study of large commercial aircraft in landing approach. Author

N80-21355*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
DESIGN OF A NONLINEAR ADAPTIVE FILTER FOR SUPPRESSION OF SHUTTLE PILOT-INDUCED OSCILLATION TENDENCIES
John W. Smith and John W. Edwards Apr. 1980 31 p refs
(NASA-TM-81349; H-1119) Avail: NTIS HC A03/MF A01 CSCL 01C

Analysis of a longitudinal pilot-induced oscillation (PIO) experienced just prior to touchdown on the final flight of the space shuttle's approach landing tests indicated that the source of the problem was a combination of poor basic handling qualities aggravated by time delays through the digital flight control computer and rate limiting of the elevator actuators due to high pilot gain. A nonlinear PIO suppression (PIOS) filter was designed and developed to alleviate the vehicle's PIO tendencies by reducing the gain in the command path. From analytical and simulator studies it was shown that the PIOS filter, in an adaptive fashion, can attenuate the command path gain without adding phase lag to the system. With the pitch attitude loop of a simulated shuttle model closed, the PIOS filter increased the gain margin by a factor of about two. A.R.H.

N80-21356# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MODEL ORDER REDUCTION USING THE BALANCED STATE REPRESENTATION THEORY, APPLICATION AND INTERACTIVE SOFTWARE IMPLEMENTATION M. S. Thesis
James Robert McClendon Dec. 1979 239 p refs
(AD-A080371; AFIT/GE/EE/79-22) Avail: NTIS HC A11/MF A01 CSCL 20/4

This report investigates a model order reduction technique developed by Dr. Bruce Moore of the University of Toronto, as applied to the B-52E flutter control problem currently under study by the Air Force Flight Dynamics Laboratory. The algorithm, which is based upon singular value analysis, is applied to the full twenty-fourth order model yielding an internally balanced representation which is balanced with respect to controllability and observability properties. The system is reduced in order, and comparisons are made between the Moore algorithm model and that obtained via a method used by the Air Force Flight Dynamics Laboratory. In addition to this investigation, an interactive program is presented which contains the model order reduction algorithm. Other capabilities include: estimation of the condition number with respect to inversion, singular value and condition number plotting vs. sample time for discrete time controllability, observability, and Hankel matrices, frequency response generation, and various special coordinate system transformation. GRA

N80-21357# Dynamic Controls, Inc., Dayton, Ohio.
RESEARCH AND DEVELOPMENT OF CONTROL ACTUATION SYSTEMS FOR AIRCRAFT, VOLUME 1 Final Report, Jun. 1977 - Feb. 1979
Gavin D. Jenny Aug. 1979 211 p refs
(Contract F33615-77-C-3077; AF Proj. 2403)
(AD-A080133; AFFDL-TR-79-3117-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 01/3

This report describes the development of a flutter suppression actuator technique and the wind tunnel evaluation of that technique. The report also describes the flightworthiness testing of a direct drive Fly-By-Wire flight control system applied to the aileron axis of an F-4 aircraft. Also included is an evaluation of an angular rate sensing augmentation actuator supplied to the Air Force for evaluation. Presented in the material are the test results of all three experimental evaluations. Further testing of the flutter suppression is recommended to clarify an anomoly in the results of the testing. The direct drive control system passed its environmental testing used to establish flight worthiness. The rate sensing actuator operated as designed. GRA

N80-21358# European Space Agency, Paris (France).
IN FLIGHT TESTS OF A PARAMETER INSENSITIVE CONTROLLER
Gerhard Kreisselmeier and Reinhold Steinhauser Nov. 1979 75 p refs Transl. into ENGLISH of "Flugversuchsergebnisse Mit Einem Parameterunempfindlichen Regler", Rept. DFVLR-FB-78-07 DFVLR, Oberpfaffehofen, West Germany, May 1978 Original report in GERMAN previously announced as N79-30197 Original German report available from DFVLR, Cologne DM 30.30
(ESA-TT-565; DFVLR-FB-78-07) Avail: NTIS HC A04/MF A01

A design procedure for controllers is presented which makes it possible to allow for all the demands made on control behavior. It was used to design a controller for the longitudinal motion of the DO-28D Skyservant that ensures maintenance of the desired flying qualities in both the guidance and the disturbance behavior throughout the flight range of the aircraft. The design pays particular attention to obtaining a low elevator setting speed and a harmonic time pattern of the elevator deflection. The influence of the airborne computer on the control behavior is examined and the results of the flight tests are compared with those of the simulations. Author (ESA)

N80-21274# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
INTERACTIVE AIDED DESIGN SYSTEM FOR AIRCRAFT DYNAMIC CONTROL PROBLEMS
Wolfgang J. Kubbat, G. Oesterhelt, and U. Korte *In* AGARD The Use of Computers as a Design Tool Jan. 1980 18 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-21359# O'Donnell and Associates, Inc., Pittsburgh, Pa.
HYPERVELOCITY WIND TUNNEL COMPONENTS STRUCTURAL EVALUATION, VOLUME 2 Final Report
D. Peterson and E. Westermann May 1979 288 p refs
(Contract N60921-78-C-0013)
(AD-A079317; ODAI-1270-8-79-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 14/2

A structural evaluation of the large threaded Pressure Vessels in the wind tunnel facility was performed using finite element techniques coupled with fatigue and fracture mechanics analyses of the critical locations. The results of this evaluation show that these threaded pressure vessels have limited fatigue life due to high stress concentrations at the root of the thread root radii in the threaded end closures. Design modifications were made to the most critical end closures (Bottom End of Mach 14/18 Heater Vessel and Inlet End of Driver Vessel) to increase the design life of these pressure vessels. The design life of all of the threaded pressure vessels was also increased by reducing the maximum pressure at which they are operated. Periodic inspection requirements which account for variable pressure cycling and mean stress effects were also developed for the critical areas of these threaded pressure vessels. The net result of the design modifications, reduced operating pressures and periodic inspection requirements is to increase the design life and confidence in the safety related structural integrity of the threaded pressure vessels in the wind tunnel facility. GRA

N80-21360# Royal Aircraft Establishment, Farnborough (England).
A HEAVY DUTY BALANCE CALIBRATION MACHINE FOR THE RAE 5 m LOW SPEED WIND TUNNEL
E. C. Brown London HMSO 2 Apr. 1979 42 p
(RAE-TR-79-039; BR69045) Avail: NTIS HC A03/MF A01

The background of the calibration problem and the description of the development and design of a calibrating machine for the balances likely to be used in the wind tunnel are presented. These balances include internal and external strain gauge balances for complete and half model testing, as well as a mechanical lever balance which can cope with tests on both forms of model. Maximum model normal forces will approach 130 kN in half model testing and up to 90 kN on complete models. The loading system of the calibrating machine is based on pneumatically-powered force generators controlled by a computer, and these are capable of generating any combination of loads in response to an input demand originating from a manually operated switchboard or from a stored program. A typical 400 point calibration occupies less than 12 machine hours of testing with one operator in attendance. Author (ESA)

N80-21361# National Bureau of Standards, Washington, D.C.
EVALUATION OF A MULTIMEGAVOLT IMPULSE MEASUREMENT SYSTEM
Randolph A. Bullock, David L. Hillhouse, and Robert E. Hebner, Jr. 15 Oct. 1979 102 p refs Sponsored in part by Bonneville Power Administration, Portland, Oreg.
(PB80-119720; NBSIR-79-1933) Avail: NTIS HC A06/MF A01 CSCL 14B

The calibration of a 4.5 MV impulse divider was evaluated by measuring both the input and output waveforms and the response of the divider to a low voltage step. The measured output was compared to an output calculated from the step response and the measured input waveform using Duhamel's Integral. The validity of the approach for this large measurement system was demonstrated for the specific waveforms studied. GRA

N80-22242# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF A LAMINAR LIGHTING DEVICE TO THE SMOKE VISUALIZATION OF FLOWS IN A WIND TUNNEL
Michel Philbert, Robert Beaupoil, and Jean-Pierre Faleni *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 25-34 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 173-179 Original report in FRENCH previously announced as A79-41304 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

N80-22252# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL FILTERS FOR ON-LINE PROCESSING OF MEASURING SIGNALS IN A CONTINUOUS WIND TUNNEL
Jean Appel *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 55-77 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 263-277 Original report in FRENCH previously announced as A79-48853 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-21362*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Jan. - Feb. 1980
15 Apr. 1980 154 p refs
(Contract NAS7-100)
(NASA-CR-162857; JPL-PR-42-56) Avail: NTIS HC A08/MF A01 CSCL 22D

Deep Space Network progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations is presented. For individual titles, see N80-21363 through N80-21381.

N80-21363*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1980 p 1-3 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N80-21364*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM: DESIGN FOR MEGABIT TELEMETRY c17
E. C. Gatz *In its* The Deep Space Network 15 Apr. 1980 p 4-8 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09F

A description is presented of the functional design of the additions to the Deep Space Network telemetry system to handle increased data rates up to 30 megasymbols per second. The new system design includes a new demodulator, additional digital recording and formatting, and augmented monitor and capability. Author

N80-21365*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN TRACKING SYSTEM, MARK 3-1979 c14
G. L. Spradlin *In its* The Deep Space Network 15 Apr. 1980 p 7-25 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The tracking system is one of eight generic Deep Space Network (DSN) systems. A description of how the tracking system

performs its primary functions of signal acquisition, radio metric data generation, data transmission, and performance validation is given. Included are the systems functional requirements and required performance based upon identified user and DSN needs. Block diagrams of the 26, 34, and 64 meter Deep Space Stations implementations are provided to indicate subsystem relationships and data flow paths. R.E.S.

N80-21366*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DSN VLBI SYSTEM MK 1-80 c14

W. D. Chaney and N. C. Ham *In its* The Deep Space Network 15 Apr. 1980 p 26-34 (For primary document see N80-21362 12-12)

Avail: NTIS HC A08/MF A01 CSCL 14B

The Deep Space Network Very Long Baseline Interferometry system MK 1-80 that is being implemented to provide navigation support to the Voyager Project is described. The system requirements and the implementation plan are also described. R.E.S.

N80-21367*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DSN LOAD FORECASTING FOR PROPOSED FUTURE NASA MISSION SETS

W. A. Webb *In its* The Deep Space Network 15 Apr. 1980 p 35-41 refs (For primary document see N80-21362 12-12)

Avail: NTIS HC A08/MF A01 CSCL 22A

A computer program (DSNLOAD) is described which provides Deep Space Network (DSN) load forecasting information given a proposed future mission set. In DSNLOAD, the DSN is analytically modeled so that spacecraft tracking schedules are determined periodically throughout the future period of interest. These schedules are determined from the view periods or available tracking times for each mission on one sample day each month and reflect a typical or average tracking situation for the month. These typical tracking schedules are then transformed into data which shows the load or 'how busy' each DSN station is 'on the average' at different times of the day. The DSNLOAD model includes required pre- and post-calibration periods and station 'overhead' such as maintenance or 'down' time. Also included in the model is the option of 'off-loading' some of the tracking load of a station which is overloaded onto another station. M.G.

N80-21368*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

VIKING ORBITER COMPLETION MISSION AND VIKING LANDER MONITOR MISSION

R. L. Gillette *In its* The Deep Space Network 15 Apr. 1980 p 42-45 refs (For primary document see N80-21362 12-12)

Avail: NTIS HC A08/MF A01 CSCL 22A

The mission objectives and status of the Viking-Orbiter Completion Mission and the Lander Monitor Mission are briefly discussed. The objective of the Orbiter Completion Mission is to obtain moderate resolution photographic coverage of Martian surface areas not previously photographed or inadequately covered during the earlier survey mission. The objectives of the Lander Monitor Mission are to: Obtain S-band ranging data from the surface of Mars periodically over a long time span for the conduct of radio science; and, obtain meteorology and imaging data from the surface of Mars periodically over a long time span to monitor and disseminate information to any significant changes with time. Tracking support for the missions is also discussed. M.G.

N80-21369*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

RADIO ASTRONOMY c89

R. M. Taylor *In its* The Deep Space Network 15 Apr. 1980 p 46-47 (For primary document see N80-21362 12-12)

Avail: NTIS HC A08/MF A01 CSCL 03A

Radio and radar astronomy observations supported by the Deep Space Network are described including pulsar observations, planetary radar imaging, and very long baseline interferometry observations of the compact radio nuclei of normal and extended galaxies and quasars. The results of a pulsar rotation constancy experiment are given and their implications discussed. M.G.

N80-21370*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

X-BAND UPLINK GROUND SYSTEMS DEVELOPMENT c32

R. Hartop, C. Johns, and R. Kolbly *In its* The Deep Space Network 15 Apr. 1980 p 48-58 refs (For primary document see N80-21362 12-12)

Avail: NTIS HC A08/MF A01 CSCL 17B

The design of an X-band exciter and transmitter control system is presented. For the exciter design such aspects as the block diagram, expected oscillator frequency stability, effect of instability of the cables between the control room and the antenna, improvement in uplink stability obtained with the transmitter phase control loop, expected frequency stability of exciter references for the doppler extractors, expected performance of the X-band range modulator, and the frequency stability improvement to be obtained with temperature control of the hardware environment are covered. M.G.

N80-21371*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

VLBI DETECTION OF CRUSTAL PLATE MOTION USING DSN ANTENNAS AS BASE STATIONS c46

D. D. Morabito, E. S. Claflin, and C. J. Steinberg *In its* The Deep Space Network 15 Apr. 1980 p 59-75 refs (For primary document see N80-21362 12-12)

Avail: NTIS HC A08/MF A01 CSCL 08G

Crustal plate motion data are presented with respect to each of the three Deep Space Network sites, Goldstone, Madrid and Canberra, based on a plate motion model. The technique of very long baseline interferometry (VLBI) is examined and its capabilities are discussed. The estimated crustal movement predicted by the model is compared with apparent movement measured by a transportable BLBI system across a plate boundary in Southern California. M.G.

N80-21372*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

A BENT PIPE DESIGN FOR RELAYING SIGNALS RECEIVED BY AN ORBITING DEEP SPACE RELAY STATION TO A GROUND c32

M. A. Koerner *In its* The Deep Space Network 15 Apr. 1980 p 76-84 (For primary document see N80-21362 12-12)

Avail: NTIS HC A08/MF A01 CSCL 17B

The feasibility of using a bent-pipe type system to relay the entire RF signal received by the Orbiting Deep Space Relay Station (ODSRS) is examined together with its receiving system noise to the ground station. Results indicate that the use of a bent-pipe channel appears feasible for each of the three ODSRS applications considered. Of the three applications considered, the maximum ODSRS transmitter RF power output required was 5.3 watts for a 25 Mbps, uncoded, suppressed carrier telemetry channel. This calculation assumed that the ODSRS/ground link frequency is 14 GHz, the ODSRS antenna diameter is 2 m, the ground antenna diameter is 5 m, and the ground receiving system uses an uncooled parametric amplifier. The results also indicate that ground adjustment of the ODSRS transmitter RF power output for different spacecraft, different spacecraft modes of operation, and changes in spacecraft/ODSRS range will normally be necessary to avoid violation of CCIR power flux density limitations. R.C.T.

N80-21373*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ARITHMETIC TECHNIQUES USED IN THE HIGH-SPEED FRONT END OF THE MULTIMEGABIT TELEMETRY MODEM c17

E. R. Wechsler *In its* The Deep Space Network 15 Apr. 1980 p 85-89 (For primary document see N80-21362 12-12)

Avail: NTIS HC A08/MF A01 CSCL 09F

Methods of processing two's complement binary data are presented. They were used in the design of the high speed front end of the multimegabit subsystem. The first method is for rounding with zero error in the mean and is useful when large numbers of rounded values are to be accumulated. The second method consists of attaching a '1' as a least significant bit to the output word of an analog to digital converter, thus processing it as an odd number with one more bit. This

compensates for the negative bias that analog to digital converters have when their zero is set for symmetrical positive and negative output ranges as is customary. When used with emitter coupled logic circuits, these methods result in simpler logic design. R.C.T.

N80-21374*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SENSITIVITY OF REFLECTOR BACKUP STRUCTURE WEIGHT TO VARIABLE WIND SPEED LOADINGS c39
R. Levy and D. Strain *In its* The Deep Space Network 15 Apr. 1980 p 90-99 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 20K

Backup structures for paraboloidal reflectors were designed for three diameters to support combinations of gravity, seismic, wind or snow loads. Changes in structure weights were determined as a function of change in wind speed. Low wind speeds were found to have only minor influence on weight, and extremely high hurricane type wind speeds had only a moderate effect on the weight. One of the backup structure designs was evaluated for performance and judged to be satisfactory for use either as a microwave antenna or solar collector. Author

N80-21375*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ANALYSIS OF A CLASS OF TOTALLY SELF-CHECKING CIRCUITS IMPLEMENTED IN AN NMOS CUSTOM LSI STRUCTURE c33
M. W. Seivers *In its* The Deep Space Network 15 Apr. 1980 p 100-107 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09C

Constant valued signal lines are replaced with a pair of signal lines such that a given logic state has a redundant representation. A class of Boolean algebra called morphic Boolean algebra is used to realize totally self-checking circuits to replace semipassive error handling circuitry. The expected nonclassical faults in a particular NMOS custom structure is presented and their effect on morphic circuits estimated. R.C.T.

N80-21376*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PULSE-POSITION-MODULATION CODING AS NEAR-OPTIMUM UTILIZATION OF PHOTON COUNTING CHANNEL WITH BANDWIDTH AND POWER CONSTRAINTS c32
R. G. Lipes *In its* The Deep Space Network 15 Apr. 1980 p 108-113 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

It is shown that the capacity, measured in nats per photon, of a pulse-position modulation (PPM) scheme involving Q uses of a channel that neglects thermal noise and makes binary decisions on the presence of photons (Z-channel) is very close to the optimum capacity for utilizing the Z-channel. For Q in excess of around 100, the differences in capacity are probably insignificant for any practical application. The PPM scheme capacity results as the optimum solution to a communication system design problem. R.C.T.

N80-21377*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE NETWORK CONTROL ROOM NOISE AND VIBRATION STUDY c14
J. C. Rayburn *In its* The Deep Space Network 15 Apr. 1980 p 114-119 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

Vibration and noise levels in two of the Deep Space Networks deep space station operations rooms were investigated as a cause of tracking equipment failures. Measured noise levels were compared to standard noise level criteria curves. Precision instrumentation was used to measure noise and vibration levels in the rooms and equipment racks. Findings resulting from analysis of the measured data coupled with onsite noise reduction tests are discussed. R.C.T.

N80-21378*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A FAST ALGORITHM FOR ENCODING THE (255,223) REED-SOLOMON CODE OVER GF(256) c61
R. L. Miller, T. K. Truong (Univ. of Southern California, Los Angeles), and I. S. Reed *In its* The Deep Space Network 15 Apr. 1980 p 120-129 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

A scheme for reducing the numerical complexity of the standard Reed-Solomon encoding algorithm is developed. The fast syndrome method and Lagrange interpolation are used to develop the algorithm. Both the number of multiplication and additions of this scheme are shown to be substantially fewer than is required by conventional encoding techniques. An advantage of this algorithm aside from speed is that its first step consists of performing a syndrome like calculation, which is implemented by using the existing syndrome algorithm used in the decoder. This fact is used to lower the total hardware cost of the encoder-decoder system. A.W.H.

N80-21379*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GENERAL SENSITIVITY ANALYSIS OF SOLAR THERMAL-ELECTRIC PLANTS c44
F. L. Lansing, E. W. Hayes, and C. S. Yung *In its* The Deep Space Network 15 Apr. 1980 p 130-142 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 10A

A unified and generalized treatment for predicting the technical performance of many present or future solar thermal electric power system designs and configurations is presented. In order to screen the major design parameters whose effect on performance is high and to assess the system improvement or deficiency resulting from their change, a sensitivity analysis is performed. The sensitivity, defined as the percentage change of output divided by the percentage change in input, is evaluated analytically for seven major system design parameters. These design parameters are: the solar radiation intensity, the ambient temperature, the optical-thermal characteristics of the collector subsystem (concentrator-receiver), the relative thermal efficiency for the energy conversion subsystem, the working fluid operating temperature, and the rate of fluid heat capacity. General performance sensitivity expressions are derived and numerically evaluated for the range of possible operating conditions. The effect of these major parameters on the system performance optimization is presented to identify future improvement areas and to pave the way for the second phase study in the economic sensitivity analysis on bus bar energy costs. A.W.H.

N80-21380*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF ANTENNA POINTING ERRORS ON RANGE DELAYS, PART 1 c32
T. Y. Otoshi *In its* The Deep Space Network 15 Apr. 1980 p 143-146 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

An experiment was performed to determine the effects of antenna pointing errors on range delays. It was found that when the 26 m antenna was scanned off target for antenna angle offsets within the 3 dB points of the main beam, the worst case range changes were less than plus or minus 7 cm with measurement uncertainties of about plus or minus 1.5 cm. The test setup which consisted of a 2.44 m diameter parabolic antenna with a zero delay device installed on top of a collimation tower, and a 20 kW transmitter, a 26 m antenna, and a Mu-2 ranging system is described along with the test procedure. Improvements in the test procedure are delineated. A.W.H.

N80-21381*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK OPERATIONS CONTROL CENTER (NOCC) IMPLEMENTATION STATUS REPORT c14
E. A. Garcia *In its* The Deep Space Network 15 Apr. 1980 p 147-148 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The implementation of changes to the network operations center (NOCC) required to support the Voyager Jupiter and Saturn encounters and DSN enhancements designed to reduce maintenance and operations cost is described. The hardware and software modification in support of the Jupiter encounter were primarily

to increase the telemetry data handling capability and intermediate data records production as required to support the two spacecraft operating at 115.2 kbps. The modifications to the network in support of high rate telemetry resulted in the addition of the third network log processor, along with four additional magnetic tape drives supporting two additional wideband channels from the deep space network. In support of the Voyager Saturn encounter and DSN operations, the NOCC is being augmented with the radio science real time monitor processor and supporting software. The upgrade of the video assembly processor to provide two additional channels of high resolution graphics is included. A.W.H.

N80-21382# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
LEGO: DEFINITION STUDY OF POTENTIAL OPERATION MODES FOR LARGE SPACELAB FACILITY PAYLOADS (LIRTS, EXSPOS, GRIST) Final Report
R. A. Henderson Jul. 1979 148 p refs
(Contract ESA-3721/78-F-HEW(SC))
(ESS/SS-947; ESA-CR(P)-1262) Avail: NTIS HC A07/MF A01

Feasible alternative mission operation modes with respect to minimizing mission costs were investigated for three large solar/astronomy instruments. Different mission modes are identified, consequences for operation, instruments design and development, and relative budgetary costs are presented and optimum mission modes are selected. A systems requirement is outlined and subsystem bardware identified to support the mission mode. Development plans and budgetary costs for the three instruments/missions modes are given. Author (ESA)

N80-21383# European Space Agency, Paris (France).
EISCAT-SAT: ASSESSMENT STUDY
Oct. 1979 40 p refs
(ESA-SCI(79)2) Avail: NTIS HC A03/MF A01

The EISCAT-SAT space mission intended to operate in conjunction with the European Incoherent Scatter (EISCAT) facility and other high latitude ground based remote sensing facilities in Northern Europe is described. The current knowledge and understanding of high latitude magnetospheric dynamics are reviewed. An appropriate model payload is described, and suitable spacecraft orbits are discussed. The region of prime interest is located on auroral field lines at altitudes of between 1 and 3 Earth radii. Orbits with inclinations in the range 63 deg to 90 deg, perigee altitudes 200 to 500 km and apogee altitudes up to 3 Earth radii are considered. It is shown that the expected results will contribute to a wide variety of geophysical studies. An assessment of orbit injection and maintenance requirements is presented, based on the use of the Ariane Launch vehicle, but with some consideration given to use of Space Transportation System. It is shown that a bipropellant motor with multirestart capability is required, and it is suggested that a modification of the Symphonie motor design would be suitable. Author (ESA)

N80-21384# European Space Operations Center, Darmstadt (West Germany).
MISSION ANALYSIS FOR TERRESTRIAL SATELLITES AND PLANETARY ORBITERS: SOFTWARE DESIGN AND ALGORITHM DESCRIPTION
G. Janin Paris ESA Aug. 1979 51 p refs
(ESA-STM-208) Avail: NTIS HC A04/MF A01

A mission analysis software system specifically designed to be used in a cost effectiveness environment is described. The system makes it possible to perform fast and accurate studies with low manpower and computing power. It is shown that the resulting software system, the unified system for orbit computation is flexible and efficient for mission analysis of all current ESA projects and for instaneous emergency mission planning. Author (ESA)

N80-21385# Engins Matra, Velizy (France).
DEFINITION STUDY OF POTENTIAL OPERATIONAL MODES FOR LARGE SPACELAB FACILITY PAYLOADS
D. Kaplan 1979 115 p
(Contract ESTEC-3785/78-F-HEW)
(Rept-60/859; ESA-CR(P)-1285) Avail: NTIS HC A06/MF A01

A study of possible design trade-offs for the large infrared telescope for skylab (LIRTS) was made with respect to such proposed mission configurations as LIRTS extended duration mission, power module supported mission, and autonomous free flying mode. The free flying mode was examined in detail regarding the minimum support structure, a deployable secondary mirror, and the requirement for larger liquid helium cryostats. Some rough order of magnitude of cost assessments were made in relation to modification of the focal plane instrument package and the manufacture of larger size cryostats taking the current ESTEC dewar cost for reference. Author (ESA)

N80-21386# European Space Operations Center, Darmstadt (West Germany).
GEOS RESCUE: MISSION PLANNING AND IMPLEMENTATION IN NEAR-REAL TIME
E. A. Roth Paris ESA Oct. 1979 28 p refs
(ESA-STR-204) Avail: NTIS HC A03/MF A01

The background events leading to the rescue of the GEOS mission after the launcher failure which put the spacecraft in a highly anomalous transfer orbit are presented. This failure made it impossible to attain the desired geostationary orbit. Mission analysis under extreme time pressure permitted the elements for a decision on the selection of a rescue orbit to be prepared. Parallel activities, all performed under difficult conditions, were orbit and attitude determination and the preparation of the implementation plan for the apogee motor firing. The many problems encountered and the constraints which had to be considered are recalled. Less than five days after launch and shortly before the continuous loss of power became critical, the satellite was injected into a safe 12 hour orbit providing an optimal scientific return. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-21387*# TRW Defense and Space Systems Group, Houston, Tex. Systems Engineering and Analysis Dept.
OPS BENCH NAVIGATION PROGRAM USER'S MANUAL
T. H. Wannamaker 8 Jan. 1980 86 p
(Contract NAS9-15722)
(NASA-CR-160560; Rept-34538-H002-R0-00) Avail: NTIS HC A05/MF A01 CSCL 22A

Operational information is detailed for a single-vehicle weighted least squares orbit determination program with the capability of generating and storing emphemerides for three tracking Data Relay Satellites. The tape and card inputs and input format, input tape unit assignments, a program deck setup for a program run, and sample cases illustrating the output of typical runs are described. M.G.

N80-21388# British Aerospace Dynamics Group, Stevenage (England). Space Div.
STUDY ON GROUND PROCESSING FOR THE PREPARATION OF OPTIMAL SATELLITE MANOEUVERS. VOLUME 1: SUMMARY AND TECHNICAL REPORT Final Report
P. R. Scott, comp. May 1979 60 p 3 Vol.
(Contract ESA-3489/78-D-JS(SC))
(BAe-TP-7734-Vol-1; ESA-CR(P)-1254-Vol-1) Avail: NTIS HC A04/MF A01

Attitude maneuvers of spin-stabilized satellites are examined with emphasis on maneuvers controlled by ground based sensors. Fuel savings achieved by appropriate choice of sensors are determined. It is concluded that possible savings are limited, because the maneuvers which occur most frequently (between two attitudes each approximately orthogonal to the sun line) are fairly efficient when executed using solar sensors. On the other hand, the use of ground based sensors would also give efficient maneuvers in such cases, provided that the starts were timed suitably. Three types of ground based sensor were studied, and it is shown that fan beam sensors give significantly better coverage than pencil beam sensors, whether of the infrared or albedo type. However, pencil beam sensors can be used in many

of the maneuvers which occur most frequently. Details of the computer programs written and the investigations carried out with them are given. The programs are suitable for planning maneuvers controlled by earth sensors. Author (ESA)

N80-21389# British Aerospace Dynamics Group, Stevenage (England). Space Div.
STUDY ON GROUND PROCESSING FOR THE PREPARATION OF OPTIMAL SATELLITE MANOEUVERS. VOLUME 2: USER'S MANUAL FOR THE THREE FORTRAN PROGRAMS ALG7, ALG8 AND CRV1 Final Report
P. R. Scott, comp. May 1979 66 p 3 Vol.
(Contract ESA-3489/78-D-JS(SC))
(BAe-TP-7734-Vol-2; ESA-CR(P)-1254-Vol-2) Avail: NTIS HC A04/MF A01

A user's guide is presented which refers to three programs written in FORTRAN to evaluate attitude maneuvers of spin-stabilized spacecraft controlled by any one of three types of ground based sensor: pencil beam IR, fan beam IR, and pencil beam albedo sensors. The first program determines the delay angle necessary to achieve a desired maneuver, the second determines maneuvers for input values of the delay angle and the third determines maneuver path curvatures. Author (ESA)

N80-21390# British Aerospace Dynamics Group, Stevenage (England). Space Div.
STUDY ON GROUND PROCESSING FOR THE PREPARATION OF OPTIMAL SATELLITE MANOEUVERS. VOLUME 3: PROGRAMMER'S GUIDE TO THE THREE FORTRAN PROGRAMS ALG7, ALG8, AND CRV1 Final Report
P. R. Scott, comp. May 1979 58 p 3 Vol.
(Contract ESA-3489/78-D-JS(SC))
(BAe-TP-7734-Vol-3; ESA-CR(P)-1254-Vol-3) Avail: NTIS HC A04/MF A01

The program structures of the three FORTRAN programs written within the optimal satellite maneuvers project is described. The main algorithm (ALG7), the back-up algorithm (ALG8) and the path curvatures program (CRV1) are discussed. Author (ESA)

N80-21391# Royal Aircraft Establishment, Farnborough (England).
SKYLAB 1 ROCKET, 1973-27B: ORBIT DETERMINATION AND ANALYSIS
D. G. King-Hele London HMSO 24 Apr. 1979 69 p refs
(RAE-TR-79-044; BR68406) Avail: NTIS HC A04/MF A01

The variations in inclination and eccentricity during the resonance phase of the orbit of the final-stage rocket which placed Skylab into orbit 14 May 1973 are analyzed, and values obtained for six lumped 31st-order harmonic coefficients in the geopotential. The variation in inclination before and after resonance is analyzed to determine the average atmospheric rotation rate lambda (rev/day). The average orbital accuracy in perigee height and orbital inclination is 90 m, though some orbits with Hewitt camera observations have much smaller sd (down to 10 m). As the orbit contracted under the influence of air drag, it passed slowly through the 31:2 geopotential resonance, when the track over the Earth repeats every 31 revolutions at intervals of 2 days. The observed variations in eccentricity are compared with those predicted by the (untested) theory for orbit contraction in an atmosphere with a strong (threefold) day-to-night variation in density. The comparison confirms the accuracy of the theory and of the CIRA 1972 atmospheric model. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-21392*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SKYLAB REACTIVATION MISSION REPORT
William B. Chubb Mar. 1980 387 p refs
(NASA-TM-78267) Avail: NTIS HC A17/MF A01 CSCL 22A

On July 11, 1979, Skylab impacted the Earth's surface. The debris dispersion area stretched from the South Eastern Indian Ocean across a sparsely populated section of Western Australia. The events leading to the reentry of Skylab are discussed and a final assessment of the Skylab debris impact footprint is presented. Also included are detailed evaluations of the various Skylab systems that were reactivated when control of Skylab was regained in mid-1978 after having been powered down since February 4, 1974. R.E.S.

N80-21393# Institute for Industrial Research and Standards, Dublin (Ireland). AMC Dept.
GROUND SUPPORT TEST EQUIPMENT RACK
P. A. Kelleher, T. D. Gaffney, B. A. Coghlan, and T. P. OConnor Jul. 1979 200 p refs
(Contracts ESA-3428/77-NL-HP(SC); IIRS-C15(78/6)-71103)
(ESA-CR(P)-1257) Avail: NTIS HC A09/MF A01

A computer-controlled ground support equipment rack for carrying out the complete routine test procedures on the units of a spacecraft power sub-system was defined and specified. The general system configuration was determined, standard instrumentation being selected where feasible. Selection criteria included, ease of programming, cost effectiveness, single vendor, service availability. Each unit of the system was then defined in detail and custom units, including a ten-module programmable load panel, were designed, breadboarded and tested. A comprehensive software package was developed which makes the system easy to program for engineers. An overview of the complete system covering description, capabilities, advantages and costs is provided. Author (ESA)

N80-21394# Contraves Corp., Zurich (Switzerland). Space Dept.
STUDY ON LARGE, ULTRA-LIGHT, LONG-LIFE STRUCTURES IN SPACE: PHASE 1 Final Report
M. C. Bernasconi Jul. 1979 220 p refs
(Contract ESTEC-3445/77-NL-PP(SC))
(ESA-CR(P)-1258) Avail: NTIS HC A10/MF A01

An overview of the concept of large space structures and their possible uses is presented. A large reflector antenna is described and its possible fields of application are summarized. Specifications for the reflector antenna including a performance definition, mission scope, and operational requirements are presented. A number of design concepts for the antenna are analyzed. Among these are a single mesh antenna, a tension wire antenna, and Balloon antenna. Author (ESA)

N80-21363*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1980 p 1-3 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-21365*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN TRACKING SYSTEM, MARK 3-1979
G. L. Spradlin *In its* The Deep Space Network 15 Apr. 1980 p 7-25 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-21366*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN VLBI SYSTEM MK 1-80
W. D. Chaney and N. C. Ham *In its* The Deep Space Network 15 Apr. 1980 p 26-34 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-21377*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE NETWORK CONTROL ROOM NOISE AND VIBRATION STUDY
J. C. Rayburn *In its* The Deep Space Network 15 Apr. 1980

p 114-119 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-21381*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK OPERATIONS CONTROL CENTER (NOCC) IMPLEMENTATION STATUS REPORT
E. A. Garcia *In its* The Deep Space Network 15 Apr. 1980 p 147-148 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-21429# European Space Agency, Toulouse (France). Earth Observation Programme Office.
METEOSAT CLEANLINESS CONTROL PRINCIPLES
P. G. Edwards and J. Marcoux *In its* Spacecraft Mater. in Space Environ. Dec. 1979 p 91-99 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-21395*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, VOLUME 4, PHASE 2 Final Report, Jan. - Nov. 1979
Dec. 1979 308 p refs Sponsored in part by DOE
(Contract NAS9-15636)
(NASA-CR-160565; D180-25461-4) Avail: NTIS HC A14/MF A01 CSCL 22B

Results of an overall evaluation of the solar power satellite concept are reported. Specific topics covered include: solid state sandwich configuration; parametric development of reliability design; power distribution system for solid state solar power satellites; multibeam transmission; GEO base system configuration; suppression of the heavy lift launch vehicle trajectory; conceptual design of an offshore space center facility; solar power satellite development and operations scenario; and microwave power transmission technology, advancement, development, and facility requirements. J.M.S.

N80-21396*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC EXPERIMENTS ON THE FLIGHT OF THE 1979 BIOLOGICAL SATELLITE, DRAFT PLAN
Jan. 1979 62 p Transl. into ENGLISH of draft plan "Nauchnyye Eksperimenty v Polete Biologische Sputnika" Moscow, 1979 63 p Translation was announced as N78-11171 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Med. and Biol. Probl., USSR Min. of Health and Intercosmos Council, Acad. of Sci., USSR
(Contract NASw-3199)
(NASA-TM-76017) Avail: NTIS HC A04/MF A01 CSCL 22A

The various physiological, biological, radiobiological, and radiation physics experiments to be conducted onboard the 1979 biological satellite are described. These experiments deal with the effects of space flight on living organisms, measurement of radiation, and possible methods of shielding spacecraft against such radiation. J.M.S.

N80-21397*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING NAVIGATION
W. J. ONeil, R. P. Rudd, D. L. Farless, C. E. Hildebrand, R. T. Mitchell, K. H. Rourke, E. A. Euler (Martin Marietta Aerospace) et al 15 Nov. 1979 322 p refs
(Contract NAS7-100)
(NASA-CR-162917; JPL-PUB-78-38) Avail: NTIS HC A14/MF A01 CSCL 22B

A comprehensive description of the navigation of the Viking spacecraft throughout their flight from Earth launch to Mars landing is given. The flight path design, actual inflight control, and postflight reconstruction are discussed in detail. The preflight analyses upon which the operational strategies and performance predictions were based are discussed. The inflight results are then discussed and compared with the preflight predictions and, finally, the results of any postflight analyses are presented. For individual titles, see N80-21398 through N80-21403.

N80-21398*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING NAVIGATION: INTRODUCTION
W. J. ONeil and R. P. Rudd *In its* Viking Navigation 15 Nov. 1979 p 1-29 refs (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22B

The design, control, and reconstruction of the flight paths of all four Viking vehicles is presented. The specification of requirements on the flight hardware is described along with the navigation strategies, procedures, operational software, and the inflight navigation. Features of the Viking navigation discussed include the precise determination of the spacecraft trajectories, prediction of the trajectories, design of the propulsive maneuvers required to effect the necessary trajectory changes, and calculation of the Lander descent guidance parameters. J.M.S.

N80-21399*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TRAJECTORY DESCRIPTION
D. L. Farless, L. H. Dicken, and R. E. Diehl *In its* Viking Navigation 15 Nov. 1979 p 30-47 (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22B

The launch, interplanetary, encounter, and Mars orbit phases of the Viking 1 and 2 spacecraft trajectories are described. Time history plots of several parameters relative to the trajectories are presented along with tables of the geocentric, heliocentric, aerocentric, and injection orbital elements appropriate to each of the spacecraft trajectories. J.M.S.

N80-21400*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERPLANETARY ORBIT DETERMINATION
K. H. Rourke, N. Jerath, C. H. Acton, W. G. Breckenridge, J. K. Campbell, C. S. Christensen, A. J. Donegan, H. M. Koble, N. A. Mottinger, and G. C. Rinker *In its* Viking Navigation 15 Nov. 1979 p 48-108 refs (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22B

A general description of the Viking interplanetary orbit determination activity extending from launch to Mars encounter is given. The emphasis is on the technical fundamentals of the problem, basic strategies and data types used, quantitative results, and specific conclusions derived from the inflight experience. Special attention is given to the use of the spacecraft-based optical measurements and their first application as a principal navigational data type for an interplanetary mission. The optical-based orbit determination, in fact, was the primary contributor to the exceptional interplanetary navigation accuracy experienced by both Viking missions. The Viking application of optical orbit determination relied in large part on the technology developed and demonstrated by the Mariner 9 Optical Navigation Demonstration. J.M.S.

N80-21401*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE ORBIT DETERMINATION
C. E. Hildebrand, D. H. Christensen, D. H. Boggs, G. H. Born, B. G. Williams, and Z. Shippony *In its* Viking Navigation 15 Nov. 1979 p 109-152 refs (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22A

The determination of the Mars-centered ephemerides of the Viking Orbiters and positions of the Landers from two way Doppler and range data is described. An overview of mission satellite orbit determination functions and methods is given. Topics covered include: postmaneuver orbit convergence, local orbit knowledge accuracies, the effects of interplanetary media, use of constrained solutions, and solving through trim burns. Procedure and results relevant to the determination of the planet gravity field are

included. Results relative to sensing Mars' gravity field during the extendeo mission are presented along with a discussion of the Phobos Flyby Experiment conducted during February 1977.
J.M.S.

N80-21402*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MANEUVER ANALYSIS
R. T. Mitchell, D. L. Farless, J. K. Miller, G. R. Hintz, M. J. Adams, N. P. Dwivedi, and D. L. Gray *In its* Viking Navigation 15 Nov. 1979 p 153-211 refs (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22A

The maneuver design for Viking was accomplished in two phases. First, there was the preflight design and strategy development that was dictated by mission objectives and requirements. Orbit determination and maneuver execution accuracy statistics were used, together with propellant budget considerations, to determine specific maneuver requirements and strategies. The second phase of the maneuver design occurred in flight. The maneuver analyses that were performed in flight, the software that was employed, and the actual inflight results for the entire orbital phase of the nominal Viking Mission are described with emphasis on prelanding objectives and geometry considerations. The actual adaptive design and implementation of the maneuvers as the mission progressed are considered. This design process included the minimization of both propellant usage and the effects of maneuver execution errors, while complying with several mechanization constraints. J.M.S.

N80-21403*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LANDER FLIGHT PATH ANALYSIS
E. A. Euler, G. L. Adams, and F. W. Hopper *In its* Viking Navigation 15 Nov. 1979 p 212-299 refs (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22A

The primary functions of the Lander Flight Path Analysis Team (LFPAT) were to (1) design the Viking Lander (VL) descent trajectory and compute the descent guidance parameters for command transmission to the Viking Lander and Viking Orbiter (VO), (2) reconstruct the VL trajectory from separation to touchdown using data transmitted from the VL to Earth via the VO during descent, and (3) predict the VL/VO relay link system performance during descent and post touchdown. The preflight VL capability, the history of proposed descent trajectory designs as the site selection process evolved, and the final trajectory design and guidance parameters for each vehicle are addressed along with the trajectory reconstruction process, including the overall reconstructed VL flight path summary and a detailed discussion of the entry trajectory and atmosphere reconstruction results. The postland relay link prediction function is discussed.
J.M.S.

N80-21404# Aerospace Corp., El Segundo, Calif. Engineering Group.
COMMUNICATION SATELLITE 1958 TO 1982 Interim Report
Donald H. Martin 10 Sep. 1979 442 p refs Supersedes TR-0077-2790-01-1
(Contract F04701-78-C-0079)
(AD-A078051; TR-0079-4417-01-1; SAMSO-TR-79-078; TR-0077-2790-01-1) Avail: NTIS HC A19/MF A01 CSCL 22/2

This report provides a description of each type of communication satellite that has been launched or will be launched by 1982. The development, purpose, and basic characteristics of each type of satellite are discussed, a picture of the satellite and a block diagram of its communication subsystem are presented, and various technical details and significant dates are tabulated. In addition to basic satellite properties such as size, weight, design life, and orbit, the descriptions include communications parameters such as operating frequencies and channelization; transmitter power; receiver noise figure and antenna sizes, beamwidths, and gains. In selected cases, the satellite description is supplemented with information on system operations and ground terminals. Extensive references to the open literature, upon which the descriptions are based, and a bibliography are included in the report. GRA

N80-21405# British Aerospace Dynamics Group, Stevenage (England). Space Div.
THE ANALYSIS OF TRAFFIC ROUTING PROBLEMS IN A MULTIBEAM MULTIDESTINATION SATELLITE, VOLUME 1 Final Technical Report
A. D. Craig, comp., K. Rooney, comp., P. R. Scott, comp., M. Burton, comp., and P. J. Ekins, comp. Aug. 1979 139 p
(Contract ESTEC-3645/78-NL-AK(SC))
(BAe-TP-7758; ESA-CR(P)-1263) Copyright. Avail: NTIS HC A07/MF A01

Mathematical models and associated software which allow the calculation of the traffic capability of multibeam satellite communications systems with various types and degrees of interconnectivity are presented. The models include idealized versions and a simulation. In a practical system the traffic capacity must be balanced against the complexity of the hardware associated with the interconnectivity. The hardware aspects of the interconnectivity are discussed and three examples of multibeam systems are analyzed in detail using the mathematical models developed. Author (ESA)

N80-21406# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
COASTAL OCEANS MONITORING SATELLITE SYSTEM (COMSS). VOLUME 1: EXECUTIVE SUMMARY Final Report
Mar. 1979 81 p Prepared in cooperation with Engins Matra Velizy, France; Technical Univ. of Denmark, Copenhagen; Logica Ltd. and Sira Inst. Ltd. Original contains color illustrations
(Contract ESA-3632/78-F-CG)
(ESS/SS-930; ESA-CR(P)-1281) Avail: NTIS HC A05/MF A01

A study of the major systems aspects associated with the Coastal Ocean Monitoring Satellite System (COMSS) and design studies of principal payload elements in the space segment are presented. The COMSS concept envisages a large 3-axis stabilized satellite incorporating several Earth observation sensors operating in the visible, infrared, and microwave regions of the spectrum. This satellite and the system of which it forms a part would be used for monitoring the economically and environmentally important coastal oceans regions of Europe and the World.
Author (ESA)

N80-21407# European Space Agency, Paris (France).
GEOS 3: REPORT ON THE PHASE-A STUDY
Dec. 1979 43 p refs
(ESA-SCI(79)12) Avail: NTIS HC A03/MF A01

A European mission into the distant geomagnetic tail of the Earth is outlined. The mission can be realized comparatively quickly and inexpensively because it is based on existing hardware and designs from the GEOS program. Three major exceptions are the propulsion system, which is taken from the SYMPHONIE program, part of the attitude-measuring subsystem, and the telecommunications subsystem. Although the experiment sensors will have to be modified or even completely redesigned to operate in the far tail, it will be possible to maintain the existing spacecraft interfaces for power, telemetry, telecommand, booms, etc. The GEOS spacecraft design has sufficient flexibility to allow an open announcement of opportunity. Like its prodecessors, GEOS-3 will be placed initially into a geostationary transfer orbit; its mass and dimensions being compatible with an Ariane double launch. The SYMPHONIE motor will then be used to inject the satellite into its final deep-tail orbit. The apogee of this orbit, which can be as much as 1.5 million km from Earth, will be kept in the tail by means of regular lunar flyby or by placing the spacecraft into an orbit about the antisunward Lagrangian point L2.
Author (ESA)

N80-21561# Politecnico di Milano (Italy).
THE SIRIO PROGRAM RESEARCH AND FUTURE TRENDS
F. Carassa *In* ESA SPACECAD 1979 Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 13-21 refs Prepared in cooperation with CNR, Milan (For primary document see

N80-21560 12-31)
Avail: NTIS HC A19/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-21408*# Rocketdyne, Canoga Park, Calif.
ORBITAL TRANSFER VEHICLE (OTV) ENGINE STUDY PHASE A, EXTENSION
A. J. Sobin 11 Mar. 1980 14 p
(Contract NAS8-32996)
(NASA-CR-161416; BMPR-4; ASR80-30) Avail: NTIS HC A02/MF A01 CSCL 22B

The current Phase A-Extension of the OTV engine study program seeks to provide additional expander and staged combustion cycle data that will lead to design definition of the OTV engine. The proposed program effort will optimize the expander cycle engine concept (consistent with indentified OTV engine requirements), investigate the feasibility of kitting the stage combustion cycle engine to provide extended low thrust operation, and conduct in-depth analysis of development risk, crew safety, and reliability for both cycles. Additional task will address costing of a 10k thrust expander cycle engine and support of OTV systems study contractors. A.R.H.

N80-21409*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STUDY OF THE EFFECT ON A TYPICAL ORBITER PAYLOAD THERMAL ENVIRONMENT RESULTING FROM SPECULAR REFLECTIONS FROM THE FORWARD ORBITER RADIATORS
R. Humphries, L. Turner, and J. W. Littles Mar. 1979 107 p refs
(NASA-TM-78270) Avail: NTIS HC A06/MF A01 CSCL 22B

The orbiter radiator external coating is highly specular silverized Teflon. Solar energy specularly reflected from these radiators on a typical payload which, when deployed, extends above the payload bay envelope was studied. The flux levels are compared assuming both diffuse and specular radiators. A.R.H.

N80-21410# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
PALLET TYPE STRUCTURE FOR DIFFERENT SPACE TRANSPORTATION SYSTEM (STS) MISSION MODES AS USED FOR SHUTTLE PALLET SATELLITES (SPAS) Final Report
Jul. 1979 87 p Original contains color illustrations
(Contract ESA-3790/78-F-FC(SC))
(MBB-R3700/2137-R; ESA-CR(P)-1267) Avail: NTIS HC A05/MF A01

The application of a modular payload support structure (MPSS) was analyzed for different Spacelab payloads. It was demonstrated that with a basis inventory of MPSS structure elements, sufficient flexibility can be achieved to support the envisaged range of space transformation system (STS) payloads. The MPSS structure is used as a carrier for the shuttle pallet satellite (SPAS). It utilizes a construction principle that satisfies future payload requirements at small structure cost compared with the total project cost. The performance characteristics of MPSS and its development status is given. A potential MPSS inventory is proposed and costed. Author (ESA)

N80-21411# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF PALLET-TYPE STRUCTURES AND SUPPORTING SUBSYSTEMS FOR DIFFERENT SPACE TRANSPORTATION SYSTEM (STS)/SPACELAB MISSION MODES Executive Summary Report
H. T. Uebelhack and W. Pritzer Aug. 1979 119 p
(Contract ESA-3756/78-F-HEW(SC))
(ESA-CR(P)-1274) Avail: NTIS HC A06/MF A01

The structural support required for various future experimental STMS payloads is defined and their required subsystem support is identified. The three different mission modes considered include the STS sortie mode the power module supported mode, and the free flying mode. A number of experiments and payloads were investigated with respect to their subsystems and structural requirements. Three structural modular concepts were defined and measured against the payload requirements. One structural concept called the panel structure was found to be most favorable with respect to flexibility in accepting payloads. Three payloads were further studied in order to define structural elements and the required subsystem support. Cost estimates were performed for the development/manufacturing programs of the structures and for a limited program of STS missions in the three different modes. Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-21412*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A DIGITALLY IMPLEMENTED COMMUNICATIONS EXPERIMENT UTILIZING THE COMMUNICATIONS TECHNOLOGY SATELLITE, HERMES
H. D. Jackson and J. Fiala Mar. 1980 19 p refs
(NASA-TM-81452; E-379) Avail: NTIS HC A02/MF A01 CSCL 17B

Developments which will reduce the costs associated with the distribution of satellite services are considered with emphasis on digital communication link implementation. A digitally implemented communications experiment (DICE) which demonstrates the flexibility and efficiency of digital transmission of television video and audio, telephone voice, and high-bit-rate data is described. The utilization of the DICE system in a full duplex teleconferencing mode is addressed. Demonstration teleconferencing results obtained during the conduct of two sessions of the 7th AIAA Communication Satellite Systems Conference are discussed. Finally, the results of link characterization tests conducted to determine (1) relationships between the Hermes channel 1 EIRP and DICE model performance and (2) channel spacing criteria for acceptable multichannel operation, are presented. J.M.S.

N80-21364*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM: DESIGN FOR MEGABIT TELEMETRY
E. C. Gatz *In its* The Deep Space Network 15 Apr. 1980 p 4-8 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09F

N80-21373*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ARITHMETIC TECHNIQUES USED IN THE HIGH-SPEED FRONT END OF THE MULTIMEGABIT TELEMETRY MODEM
E. R. Wechsler *In its* The Deep Space Network 15 Apr. 1980 p 85-89 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-21413*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY MONITORING PLATFORM ENGINEERING HISTORY AND ACHIEVEMENTS
Paul M. Butler May 1980 179 p refs
(NASA-TM-80758) Avail: NTIS HC A09/MF A01 CSCL 22B

In the fall of 1979, last of ten Interplanetary Monitoring Platform Satellite (IMP) missions ended a ten year series of flights dedicated to obtaining new knowledge of the radiation effects in outer space and of solar phenomena during a period of maximum solar flare activity. The technological achievements and scientific accomplishments from the IMP program are described. R.E.S.

N80-21414# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF THE APPLICATION OF THE INFRARED (IR) TEST TECHNOLOGY TO THE ESA/ISPM SPACECRAFT Final Report
A. Brang and G. Lorch 20 Jul. 1979 152 p refs
(Contract ESA-3839/79-NL-HP(SC))
(DS-ERT-13-79; ESA-CR(P)-1247) Avail: NTIS HC A08/MF A01

The investigation of the ESA International Solar Polar Mission (ISPM) spacecraft configuration and thermal environment regarding IR testing is described. Critical sub-units are identified and a test plan for the system thermal balance and thermal vacuum tests is established. The possible infrared IR test techniques are investigated and an optimized IR approach is selected. The method chosen is the skin heater technique in combination with the plate heater technique for the experiment apertures. The interfaces of existing test chambers are identified and a proper chamber is selected for ISPM IR testing. The layout of the IR heater system and the power supply system is discussed and performed skin heater feasibility tests are described. A critical comparison between the solar simulation approach and the IR approach regarding test costs, possible test errors and test hazards is performed and the consequences for the mathematical model are investigated. Author (ESA)

N80-21431# Centre National d'Etudes Spatiales, Paris (France).
CLEANLINESS ASPECT OF THE ARIANE PAYLOAD BAY
M. Desloire and R. Joeger. *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 117-128 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21432# Centre National de la Recherche Scientifique, Toulouse (France).
SPACE CONTAMINATION ASSESSMENT STUDY: FIRST APPLICATIONS TO PRESENT PROJECTS
B. Tatry *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 131-137 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21434*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Applied Mechanics Technology Div.
CONTAMINATION ENHANCED ELECTROSTATIC DISCHARGE MECHANISMS
J. A. Jeffrey and C. R. Maag *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 145-158 refs Sponsored by NASA (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01 CSCL 22B

N80-21439# European Space Research and Technology Center, Noordwijk (Netherlands).
ELECTROSTATIC CHARGING AND SPACE MATERIALS
J. Bosma and F. Levadou *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 189-207 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21441# Electrical Research Association, Leatherhead (England).
THE CHARGING AND DISCHARGING OF SPACECRAFT DIELECTRICS
D. K. Davies *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 217-223 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21444*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN ANALYTICAL APPROACH TO EVALUATION OF SPACE RADIATION EFFECTS ON MATERIALS FOR LONG-LIFE MISSIONS
J. Moacanin, A. Gupta, and W. F. Carroll *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 255-261 refs (For primary document see N80-21420 12-23)
(Contract NAS7-100)
Avail: NTIS HC A15/MF A01 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-21415# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY ON POINTING MOUNTS FOR THE SPACELAB MISSION DM2 Final Report
B. Doll, C. Etzler, K. Ernsberger, and R. Gunzenhauser May 1979 67 p
(Contract ESA-3829/79-D-HEW(SC))
(ESA-CR(P)-1249) Avail: NTIS HC A04/MF A01

The technical effects required to define the Demonstration Mission 2 (DM2) mission pointing tasks were investigated, to include an analysis of transport and provider costs. Various combinations of pointer and experiment are presented. The cost figures reveal that a reduction of the number, the mass and the diversified pointing requirements increases the preference for specially dedicated pointing systems besides IPS. The three cluster configuration seems to be the break even point of preference, when only one flight application is considered. When two flights are considered, if one of the pointing mounts can be reused in another mission, or when the number and pointing requirements of the experiments are sensitively reduced, as considered above, the combination of ONAPS and one or two DM2 Pointers is the most economic way to resolve the pointing problem. Author (ESA)

N80-21416# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SMALL POSITIONING AND HOLD MOUNT FOR SPACELAB EXPERIMENTS Final Report
H. Mair, K. Prisnett, H. M. Hall, and E. Wedel Jun. 1979 143 p
(Contract ESTEC-3874/78-NL-AC(SC))
(ESA-CR(P)-1265) Avail: NTIS HC A07/MF A01

A number of low mass Spacelab experiments were identified that require pointing in different directions but can rely on the orbiter attitude stability and accuracy. A payload capacity of 100 to 180 kg and a positioning accuracy of 0.1 degree with respect to the orbiter is considered to satisfy the accomodation and operational requirements of these experiments in an economic way. Based on existing and qualified hardware, a modular PHM-concept is presented that consists of bearing and drive assemblies, power electronics processor controlled data electron-

ies, and a locking mechanism. The adaption to special payload requirements and mounting locations within Spacelab will be achieved by adding of structural components designed to the spe ific mission requirements. The design of the drive units and the digital attitude control by a processor allows an increase in the performance of the mount using additional attitude sensors and ensures flexibility and adaptability. Author (ESA)

N80-21417# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
ACCURATE SPACECRAFT ATTITUDE ESTIMATION WITH THE ESA STARMAPPER
P. T. L. M. vanWoerkom and C. R. Traas 15 Sep. 1979 9 p refs Presented at 8th IFAC Symp. on Autom. Control in Space, Oxford, 2-6 Jul. 1979
(NLR-MP-78037-U) Avail: NTIS HC A02/MF A01

The design of a starmapper, an optical-electronic instrument with an array of photosensitive slits which are strapped to the spinning spacecraft is described. Recorded times of the passage of known stars over the slits, together with mathematical models of the spacecraft dynamics and starmapper instrument provide the basis for recursive estimation of the spacecraft attitude. The models are described and the attitude estimation approach is discussed. Author (ESA)

N80-21418# Saab-Scania, Linkoping (Sweden). Aerospace Div.
POSITIONING AND HOLD MOUNT (PHM) FOR SPACELAB EXPERIMENTS. PHASE 1: HARDWARE TECHNOLOGY STUDY Final Report
J. Andersson, R. Persson, B. Mortberg, H. Svensson, A. Arodell, S. Thorfred, and R. Stalefors Jun. 1979 163 p
(Contract ESA-3673/78-NL-AK(SC))
(ESA-CR(P)-1275) Avail: NTIS HC A08/MF A01

Positioning and hold mount (PHM) is a pointing system which is stabilized with respect to the orbiter frame but not inertially. Its pointing maneuvers are defined by electrical command signals from the Spacelab CDMS experiment computer. Experiments compatible with the proposed PHM design were identified, along with necessary design modifications to existing hardware. A conceptual PHM design was studied and the PHM development cost estimated. Performance and user costs for a few different pointing systems (e.g., PHM, SEM, IPS) were compared. A PHM design is proposed based upon existing hardware which features low total user cost and development cost, high payload mass/size capability and accomodation flexibility (max 250 kg), high performance with respect to the requirements (more than hemispherical coverage, high inherent accuracy) high safety, simple handling and operation suitable for improved (stabilized) versions and low development risk. Author (ESA)

N80-21438# European Space Agency, Toulouse (France). Earth Observation Programme Office.
METEOSAT CLEANLINESS CONTROL ACHIEVEMENTS
M. L. Reynolds (MATRA Espace, Velizy, France) and J. Kieffer *In its* Spacecraft Mater. in Space Environ. Dec. 1979 p 181-186 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines, and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-21419# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL STUDY OF THE PLUME CHARACTERISTICS OF A NEW MONOPROPELLANT HYDRAZINE THRUSTER Final Report, 1 Oct. 1977 - 30 Sep. 1978
W. D. Williams, T. D. McCay, H. M. Powell, and J. W. L. Lewis AEDC Jan. 1980 119 p refs
(AD-A080556, AEDC-TR-79-54) Avail: NTIS HC A06/MF A01 CSCL 21/9

An experimental study of the exhaust plume of a 0.44-N (0.1-1bf), hydrazine monopropellant thruster with a refurbished catalyst bed has been performed to characterize both the gas-dynamic and contamination properties of the vacuum plume expansion. The thruster was operated in a high-vacuum chamber over a thrust range of 0.44 to 1.10 N (0.1 to 0.25 bf) with a nominal 0.14-sec-on/9.86-sec-off duty cycle using initial catalyst bed temperatures of 367 and 478 K (200 and 400 F). The exhaust plume diagnostic systems employed included a mass spectrometer probe, a quartz crystal microbalance (QCM), and a laser Raman/Rayleigh scattering system. These systems determined plume species number densities and temperatures, mass deposition rates, and the level of particulates in the plume. Traditional engine performance parameters were also determined in order to relate performance and exhaust plume properties. GRA

N80-21448# Societe Europeene de Propulsion Saint-Medard-en-Jalles (France).
HIGH-TEMPERATURE RESISTANT MATERIALS FOR SPACE MOTORS
J. J. Choury *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 293-304 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-22240# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PERFORMANCE OF SMALL DOUBLE BASE SOLID PROPELLANT MOTORS
Vincent Borie and Paul Kuentzmann *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 153-163 Original report in FRENCH previously announced as A79-41302 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-21420# European Space Agency, Paris (France).
SPACECRAFT MATERIALS IN SPACE ENVIRONMENT
J. Dauphin, ed. and T. D. Guyenne, ed. Dec. 1979 338 p refs Proceedings of ESA Symp., Noordwijk, Netherlands, 2-5 Oct. 1979
(ESA-SP-145) Avail: NTIS HC A15/MF A01

The state-of-the-art in the field of Spacelab materials was discussed in the context of analysis methods, new materials developments, cleanliness and contamination (practice and theory), materials in various project types, radiation and electrostatic charge effects, and specific applications. For individual titles, see N80-21421 through N80-21450.

N80-21421# Institut fuer Naturwissenschaftlich- Technische Dienste G.m.b.H., Hamburg (West Germany).
OFFGASSING AND ODOR TESTS OF NON-METALLIC MATERIALS FOR SPACE CABINS c25
W. R. Eckert *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 3-4 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

Tests on nonmetallic materials used in the construction of space cabins are described including an offgassing test which involved heating a sample in an enclosed chamber. A sample of the atmosphere surrounding the tested material was analyzed using gas chromatography and combined gas chromatography/mass spectrometry. An odor test, which provided details of the trace contaminants released into the atmosphere by the nonmetallic materials, is described. The hazards involved in the use of such materials are discussed. Author (ESA)

N80-21422# European Space Research and Technology Center, Noordwijk (Netherlands).
THE METALLURGICAL EXAMINATION OF SPACECRAFT MATERIALS FAILURES c26
B. D. Dunn *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 5-21 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

Summaries of several failure analyses are presented, with a description of the techniques used. The normal techniques applied during these evaluations included low power and scanning electron microscopy, microprobe analysis, and metallography. The classical, metallurgical failure modes are discussed with emphasis on fatigue, stress corrosion, and hydrogen embrittlement. The problem of metallic particle contamination is also addressed. The majority of problems studied did not result from overload or under-design. Author (ESA)

N80-21423# Technochemie G.m.b.H., Dossenheim (West Germany). Verfahrenstechnik.
THERMAL ANALYTICAL METHODS FOR CHARACTERIZATION OF RESINS, PREPREGS AND COMPOSITES c24
H. Stenzenberger and M. Herzog *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 23-34 refs (For primary document see N80-21420 12-23)
(Contract ESTEC-2930/76-NL-PP(SC))
Avail: NTIS HC A15/MF A01

The differential scanning calorimetry (DSC) characteristics of seven model epoxy resin curing agent combinations is presented. In addition, the DSC cure behavior of a typical autoclave grade high temperature bismaleimide resin is evaluated. The calculation of cure cycles based on DSC data and time-temperature profiles of a commerical autoclave are demonstrated for two epoxy resins and a polyimide resin material. For a new high temperature epoxy resin formulation based on TGDDM and m-Aminobenzoic acid hydrazide, it is demonstrated that differential scanning calorimetry can be used to define the state of advancement of the resin and therefore to control the quality of carbon fiber unidirectional prepregs. Thermal mechanical analysis techniques are used to develop postcure cycles. Author (ESA)

N80-21424# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Coatings and Thermal Protection Materials Branch.
NEW SPACE MATERIALS DEVELOPMENTS IN THE UNITED STATES c24
W. L. Lehn *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 37-47 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The development and evaluation of transparent conductive coatings, conductive bulk materials and grounding techniques for application to high resistivity dielectric spacecraft materials to eliminate or control spacecraft charging are discussed. Techniques for the application of thin transparent conductive indium oxide, indium/tin oxide and other metal oxide coatings to Kapton, FEP Teflon, OSR and solar cell coverglasses are presented. The development of conductive bulk glass and stable low outgassing fabric type thermal control coatings as spacecraft charging control materials is presented. Author (ESA)

N80-21425# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
ADVANCED CARBON FIBER COMPOSITES FOR SPACECRAFT USE c24
D. H. Bowen *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 49-62 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

Basic methods for the preparation of carbon fibers are presented and the relationship between fiber properties and structure is described. Carbon fiber composites with carbon, metal and resin matrices are briefly reviewed and examples of applications for resin composites in spacecraft are described. The possible course of future developments is also discussed. Author (ESA)

N80-21426# Centre National de la Recherche Scientifique, Toulouse (France).
PAINTS, POTTING COMPOUNDS AND SILICONE VARNISHES WITH LOW OUTGASSING IN SPACE ENVIRONMENT c27
J. C. Guillaumon and J. Guillin *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 63-66 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

A purifying process was used to produce paints, potting compounds and varnishes with low outgassing under vacuum. Paints were made from purified silicon - coated binders showing a good stability under U. V. irradiations. The thermo-optical and outgassing properties of these paints were studied. Environment tests (thermal cycling, moisture resistance and U. V. irradiations) were also carried out. Silicone products usable as adhesives for bonding filters on solar cells, potting compounds for electronic modules, mastics and isolation varnishes, etc., were obtained by the same purifying process. Mechanical, optical, and outgassing properties were also studied. Author (ESA)

N80-21427# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
COATING AND CONTAMINATION EXPERIMENT ON LDEF c27
L. Preuss and W. Schaefer *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 71-80 refs (For primary document see N80-21420 12-23)
(Contracts DFVLR-BPT-01-TD-037-AK/RT; DFVLR-BPT-01-TB-067-B-AK/RT; BMFT-WRT-2076; DFVLR-BPT-01-TD-048-A-AK/RT; BMFT-WRT-2077; DFVLR-BPT-01-TD-019-B-AK/RT; BMFT-WRT-2079)
Avail: NTIS HC A15/MF A01

The lifecycle of geosynchronous satellites was examined in terms of reliable thermal control based on stable second surface mirrors (SSM). Flight measurements showed higher solar absorptance-degradation than measured on the ground. By means of a flight experiment on the long duration exposure facility (LDEF) and additional ground experiments, degradation of thermal coatings (SSMETC) was investigated. The flight experiment as well as the ground experiment test samples and values to be measured are presented. Author (ESA)

N80-21428# Aerospace Corp., El Segundo, Calif.
PRELIMINARY FLIGHT RESULTS FROM P78-2 (SCATHA) SPACECRAFT CONTAMINATION EXPERIMENT c27
D. F. Hall and A. A. Fote *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 81-90 refs Sponsored by AF (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The ML12 experiment was launched to determine if spacecraft charging contributes significantly to the rate that contaminants arrive at exterior spacecraft surfaces. The experiments consisted of two mass detectors and two trays of calorimetrically mounted thermal control coatings samples. Preliminary results from the first 6 months on orbit indicate that the vehicle has gradually accumulated a mass, which has not yet reached a magnitude sufficient to measurably affect solar absorptance of the spacecraft surface materials. Other significant results are reported. Author (ESA)

N80-21429# European Space Agency, Toulouse (France). Earth Observation Programme Office.
METEOSAT CLEANLINESS CONTROL PRINCIPLES c14
P. G. Edwards and J. Marcoux *In its* Spacecraft Mater. in Space Environ. Dec. 1979 p 91-99 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The development history of METEOSAT cleanlines control is described from its first steps to the final comprehensive form. Details of the resulting design features, material selection control and prelaunch/launch contamination control are given. Control techniques and procedures are described for manufacturing processes and testing. Materials selection problems are given to illustrate these. Cleanlines goals feasibility and their cost effectiveness are discussed. Author (ESA)

N80-21430* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ASSESSMENT OF SHUTTLE PAYLOADS GASEOUS

ENVIRONMENT CONTAMINATION AND ITS CONTROL c25

J. J. Scialdone *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 101-116 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

A prediction is given of the in-orbit gaseous environment and the contamination it could produce on cryogenic and room temperature surfaces of payloads in the shuttle bay. The time varying environment was obtained by the superposition of the calculated shuttle environment for a discrete time and payload induced environments measured in large space chambers. Representative contaminant surface accretions were calculated for flights 1 week and 1 month long for payloads having the largest source of outgassing and an orbit of 200 km. A number of calculations were based on the magnitude of the sources, the molecular natures, the decay rate with time, the sticking coefficients, the view factors, and the temperatures of the surfaces being contaminated. Significant results are reported. R.C.T.

N80-21431# Centre National d'Etudes Spatiales, Paris (France).
CLEANLINESS ASPECT OF THE ARIANE PAYLOAD BAY c18

M. Desloire and R. Jaeger *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 117-128 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The avoidance of payload contamination in the launch vehicle is discussed with respect to the brief time that the launch vehicle and payload are in the same vicinity. The specification and the precautions considered at the time of conception of the nose fairings and the equipment bay regarding the selection of materials, surface treatments, the equipment, and the wiring are presented. The integration procedures and cleaning and transport aspects of the equipment bay and the nose fairings are considered in addition to the precautions taken during their integration on the launch vehicle. Author (ESA)

N80-21432# Centre National de la Recherche Scientifique, Toulouse (France).
SPACE CONTAMINATION ASSESSMENT STUDY: FIRST APPLICATIONS TO PRESENT PROJECTS c18

B. Tatry *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 131-137 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

A computer program was developed to predict the induced environment and contaminating deposits on a spacecraft. Major contaminant sources were modeled and transport functions were calculated. The preliminary version of the CONTAM program is applicable only for altitudes greater than 400 km. It is utilized for contamination assessment studies on the request of SIRIO 2 and SPOT projects. Also included is a presentation of the contamination experiment during the launch of ARIANE. Author (ESA)

N80-21433# Centre National de la Recherche Scientifique, Toulouse (France).
EVALUATION OF KINETIC OUTGASSING UNDER VACUUM FOR POTTING COMPOUNDS AND PAINTS c25

J. Guillin *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 139-144 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The evaluation of contamination in space by use of a computer model is discussed in terms of kinetic outgassing of materials under vacuum. The weight loss under vacuum for potting compounds and thermal coating furnished by the manufacturer or purified in the laboratory was measured by 'micro-VCM' tests carried out at different temperatures and for periods as long as 2000 h. From these tests, equations of outgassing rates depending on time and temperature are proposed. It is shown that the Arrhenius equation is applicable for any temperature within the range studied and therefore it is possible to obtain 'activation energies' for the total outgassing of these materials. The effects of the purifying process and of the polymerization parameters (time, temperature) on outgassing energy and time dependance are also described. Author (ESA)

N80-21434*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Applied Mechanics Technology Div.
CONTAMINATION ENHANCED ELECTROSTATIC DISCHARGE MECHANISMS c18

J. A. Jeffrey and C. R. Maag *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 145-158 refs Sponsored by NASA (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01 CSCL 22B

The two problems of enhanced electrostatic discharge (ESD) and contamination are discussed. It is shown that there is a synergistic relationship between them such that one enhances the probability of occurance of the other. The action of both provides substantially more deleterious affects than the effects of both separately. Mechanisms for such a relationship are discussed as well as application to large advanced technology systems. Author (ESA)

N80-21435# European Space Research and Technology Center, Noordwijk (Netherlands).
MATERIALS REQUIREMENTS FOR SPACELAB AND SPACELAB PAYLOADS c24

J. E. Bennett and M. D. Judd *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 161-166 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The materials requirements applicable to the Spacelab project are listed with an explanation for each, based upon experience gained from NASA programs. Included are requirements regarding, flammability, outgassing, oxygen compatibility, radiation resistance, UV stability, corrosion resistance, restricted and forbidden materials, and lubricants. Materials control procedures for previously unused materials and off the shelf items are also outlined. Author (ESA)

N80-21436# European Space Research and Technology Center, Noordwijk (Netherlands).
MATERIALS POLICY FOR ADVANCED SCIENTIFIC SPACECRAFT c24

R. Thomas *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 167-174 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

Materials applications of the Space Telescope (ST) for GEOS and ISPM are discussed. Materials selection for the faint object camera are considered with respect to the low emission of condensible contaminants, low production of particles, high mechanical stability, wide temperature ranges, flammability, and stress corrosion cracking susceptibility control. To minimize the emission of volatile condensible materials (VCM), the standard WL and VCM tests were replaced by continuous measurement of VCM deposition on a QCM. The data were extrapolated to obtain an estimate of the orbital VCM deposit. Author (ESA)

N80-21437# British Aerospace Dynamics Group, Stevenage (England).
OTS/ECS MATERIALS POLICY c24

P. J. H. Molloy *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 175-179 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The development and implementation of a materials selection policy are described which were designed to minimize problems caused by outgassing and temperature extremes, and which were applicable to use by a consortium of 40 companies involved in a satellite construction contract. The methods of implementation of the policy, problems and achievements are noted. A more flexible attitude toward outgassing standards is recommended. Author (ESA)

N80-21438# European Space Agency, Toulouse (France). Earth Observation Programme Office.
METEOSAT CLEANLINESS CONTROL ACHIEVEMENTS c19

M. L. Reynolds (MATRA Espace, Velizy, France) and J. Kieffer *In its* Spacecraft Mater. in Space Environ. Dec. 1979 p 181-186 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The inflight behavior of the equipment used to assess the

contamination control program is described. As the Meteosat satellite was defined for application functions and not for technological activities, the analysis is derived from observed performance rather than through direct measurement. Particular emphasis is made on the radiometer cooler as this is the most sensitive component of the system. The diagnostic means used for detecting comtamination (mostly by water vapor), and the remedies applied, are also discussed. Author (ESA)

N80-21439# European Space Research and Technology Center, Noordwijk (Netherlands).
ELECTROSTATIC CHARGING AND SPACE MATERIALS c18
J. Bosma and F. Levadou *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 189-207 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The relevance of electrostatic cleanliness aspects of materials is addressed. There has been extensive progress in the study of the effects of electrostatic charging in thermal control coatings, and from the materials points of view electrostatic cleanliness can be implemented in a cost effective manner on future spacecraft projects. The materials are discussed on the basis of experimental data obtained in-house or under ESA contract. A survey of the on-going activities in several major European laboratories on electrostatic charging is presented. Author (ESA)

N80-21440# Toronto Univ. (Ontario). Dept. of Electrical Engineering.
SURFACE DISCHARGE ARC PROPAGATION AND DAMAGE ON SPACECRAFT DIELECTRICS c33
K. G. Balmain *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 209-215 refs (For primary document see N80-21420 12-23)
(Grant NRC-A-4140)
Avail: NTIS HC A15/MF A01

The propagation of a surface discharge arc or flash over on dielectrics such as Mylar, Teflon, and Kapton is reported. A propagation mechanism is discussed, in which the progress of the surface arc is controlled by the rate of removal of excess charge along filamentary tunnels filled with an overdense plasma of ionized discharge debris. Supporting evidence is drawn from area scanning measurements of discharge electrical properties, and from microscope photographs of permanent damage in the form of submicron diameter subsurface tunnels and surface grooves. Author (ESA)

N80-21441# Electrical Research Association, Leatherhead (England).
THE CHARGING AND DISCHARGING OF SPACECRAFT DIELECTRICS c18
D. K. Davies *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 217-223 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The analysis of spacecraft charging under electron and ion bombardment are discussed. The processes underlying charge equilibration in insulators under electron bombardment, which include backscattering, secondary emission and radiation induced conductivity, are reviewed. It is shown that the contribution of each of these processes is not unequivocally established. The observed discharges are described in terms of a demonstrable dependence of insulator electrical breakdown on indeterminate structural defects of impurities. The conceptual conditions for minimizing charge levels are also discussed but the prime conclusion is, however, that further experimental investigations must precede practical solutions. Author (ESA)

N80-21442# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
EFFECT OF RADIATIONS ON POLYMERS AND THERMAL CONTROL COATINGS c27
J. Bourrieau and A. Paillous *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 227-245 refs (For primary document see N80-21420 12-23)
(Contracts ESTEC-2015/74; ESTEC-2558/75; ESTEC-2515/75; ESTEC-2838/76; ESTEC-3184/77; ERNO-102010/A/37880)
Avail: NTIS HC A15/MF A01

A survey of the problem encountered with polymers and thermal control coatings submitted to radiations in space is presented. A theoretical study that models the degradation of the solar absorptance under electron and proton irradiations is described. The model takes the absorbed energy dose repartition within the material into account and assumes that the solar absorptance variation is imputed to color centers, the concentration of which can be expressed in terms of dose. The relevance of such a correlation is corroborated by measurements performed on two polymers and two white paints. An example of a radiation qualification test program carried out for OTS is given. Predicted degradations of the thermal control coatings are compared to data obtained after one year in orbit. Author (ESA)

N80-21443# Lockheed Missiles and Space Co., Palo Alto, Calif.
RANGE AND INTERACTION OF LOW ENERGY PROTONS IN METAL AND METAL OXIDE THERMAL CONTROL MATERIALS c27
S. A. Greenberg and M. McCargo *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 247-254 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The effects of low energy protons on the properties of typical metal and metal oxide thermal control materials are addressed from a fundamental mechanistic standpoint. A direct method for evaluating range energy relationship for protons in a variety of stopping media is described. Comparison of the results for metals of diverse atmospheric numbers has led to modification of existing range theory incorporating corrected electronic stopping cross sections. A phenomenological model for the proton induced coloration of zinc oxide pigments was formulated. Experimental results indicate that optically active defect centers are created which do not undergo self annihilation even at very high levels of proton bombardment. Author (ESA)

N80-21444*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN ANALYTICAL APPROACH TO EVALUATION OF SPACE RADIATION EFFECTS ON MATERIALS FOR LONG-LIFE MISSIONS c18
J. Moacanin, A. Gupta, and W. F. Carroll *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 255-261 refs (For primary document see N80-21420 12-23)
(Contract NAS7-100)
Avail: NTIS HC A15/MF A01 CSCL 22B

An analytical model was developed which quantifies effects on organic composite matrix materials of high energy electrons and of UV as well as interactions between the two radiations. Literature data on polyethylene were used to construct a degradation kinetics scheme corresponding to an Earth orbit at L-3. Analysis of the model showed that steady state concentrations of radicals put limits on accelerated test conditions. These conclusions were validated by an experimental study on polymethylmethacrylate using UV laser excitation. Relationships for balancing electron and UV radiations to equal acceleration factors are derived. Pulse radiolysis using an electron-beam along with time-resolved spectroscopy is shown to be able to separate primary form secondary reactions. Implications of these reactions to changes in engineering material properties are indicated. The use of mechanistic studies is discussed in the context of general test strategies for evaluating materials for space applications. Author (ESA)

N80-21445# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SPACE ENVIRONMENTAL EFFECTS ON POLYMER MATRIX COMPONENTS c27
R. C. Tennyson, J. S. Hansen, B. Uffen, D. Morison, and G. Mabson *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 263-271 refs (For primary document see N80-21420 12-23)
(Grants AFOSR-3694-78; NRC-A-2783)
Avail: NTIS HC A15/MF A01

Long and short term behavior of fiber reinforced polymer matrix composite materials subjected in a simulated space environment were investigated. Emphasis was placed on the

influence of thermal vacuum conditions on mechanical stiffness (E22), strength (sigma 2 U) and coefficient of thermal expansion (CTE). One important feature of these all tests involving the vacuum environment was made in situ, thus eliminating the possibility of specimen contamination by reaction with the atmosphere (moisture reabsorption). CTE data were exceeding six months duration. The resulting information will be useful in the design of spacecraft structures fabricated from this class of composite materials. Author (ESA)

N80-21446# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).
EFFECT OF SPACE CHARGED PARTICLE ENVIRONMENT ON OPTICAL COMPONENTS AND MATERIALS c74
J. Bourrieau and M. Romero *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 275-285 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

Permanent and transient effects induced by charged particles on optical materials are briefly reviewed. Models of material swelling and transmission loss, tests performed in these areas for materials used in Meteosat and SPOT, and results concerning the background noise induced in one D2B experiment are presented. Swelling is characterized by the linear contraction coefficient. It was found that its variations with the absorbed dose is not a function of exposure conditions for vitreous ceramics; for silicas, dose rate influence was observed. Transmission losses described by the variations of the absorption coefficient versus dose, were studied for some silica and glasses; as for swelling, the exposure conditions were found to have no effect on some materials. Author (ESA)

N80-21447# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Space and Ballistic Systems Div.
USE OF ULTRA-LIGHT ADHESIVE FOR THE METAL HONEYCOMB BONDING c24
J. Chanteranne *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 287-291 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The design of satellite panels in sandwich structures must be optimized in order to reduce the mass, by fitting the strength of the bonding menisci to the strength of the honeycomb core. This optimization applied to the satellite structures of the Intelsat V family has led to the use of an adhesive of very low surface mass (100 g/m2), which is unusual for the bonding of honeycomb. Manufacturing experience is described for such structures with adhesive films and the influence of the hygrometry of the bonding room, and of the use of a primer on the geometry and strength of the adhesive menisci formed on the honeycomb. Author (ESA)

N80-21448# Societe Europeene de Propulsion Saint-Medard-en-Jalles (France).
HIGH-TEMPERATURE RESISTANT MATERIALS FOR SPACE MOTORS c20
J. J. Choury *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 293-304 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The evolution during the past 15 years of the apogee boost motor, and in particular, nozzle design for solid propellant motors is described as a function of the continual improvements in materials. The high temperature throat materials used include phenolic composites and carbon-carbon composites. The general thermomechanical characteristics of these materials including ablation resistance are given, and the advantages shown for carbon-carbon materials. Author (ESA)

N80-21449# Wacker-Chemie G.m.b.H. Burghausen (West Germany).
WACKER RTV-S691, A SILICONE ADHESIVE WITH LOW OUTGASSING RATE c27
W. Hechtl *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 305-308 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

A commercially available two-component silicone adhesive is discussed. It is an addition curing adhesive, flexible at room temperature, which liberates no decomposition products during cure. The reaction is irreversible, and can proceed in a sealed environment. The physical properties are listed, and applications in bonding solar cells described. Author (ESA)

N80-21450# British Aerospace Dynamics Group, Stevenage (England). Dynamics Div.
THE USE OF MoS2 LOADED GREASES IN ANTENNA DESIGN MECHANISMS UNDER SIMULATED SPACE ENVIRONMENT c27
B. H. Baxter *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 309-319 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

Ball bearings, lubricated with MoS2 lubricated grease, and test run at 100 rpm and 0.000001 torr were examined after running periods of 13,000 to 50,000 hours. One pair, having minimum lubricant levels showed an increase in torque during the test, and analysis showed extensive chemical modification to the lubricant. In contrast the second two pairs of bearings which were lubricated with an excess of the same grease ran for 38,000 and 50,000 hours respectively. No chemical degradation was found and the bearings were in near perfect condition. Author (ESA)

N80-21451# Texas A&M Univ., College Station. Dept. of Chemistry.
SYNTHESIS AND STRUCTURE OF A NEW CLASS OF METALLO PHTHALO CYANATO (PYRIDINE OR THF) RUTHENIUM (2) AND CARBONYL PHTHALO CYANATO (PYRIDINE OR THF) OSMIUM (2) Interim Report
M. Tsutsui and Shuichi Omiya Jan. 1980 57 p refs
(Contract N00014-75-C-0417; NR Proj. 053-559)
(AD-A080167; TR-30) Avail: NTIS HC A04/MF A01 CSCL 07B

Carbonyl phthalo cyanato (pyridine) ruthenium (2) PcRu(CO)(Py), carbonyl phthalo cyanato pyridine osmium (2) PcOs(CO)(Py), and carbonyl phthalo cyanato (tetrahydrofuran) ruthenium (2) PcRu(CO)(THF) were prepared in pure form. They are among the first reported metallo phthalo cyanines with a carbonyl as one of their axial ligands. Furthermore, several new ways of synthesizing these complexes in quantitative yields have been established. The structure of PCOs(CO)(Py) were elucidated by the X-ray diffraction analysis. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-21452*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PREDICTING THE TIME-TEMPERATURE DEPENDENT AXIAL FAILURE OF B/A1 COMPOSITES
James A. DiCarlo 1980 28 p refs Presented at Symp. on Failure Modes in Composites, Las Vegas, Nev., 25-26 Feb. 1980, sponsored by Metallurgical Soc. of the Am. Inst. of Mining, Metallurgical and Petroleum Engr.
(NASA-TM-81474; E-408) Avail: NTIS HC A03/MF A01 CSCL 11D

Experimental and theoretical studies were conducted in order to understand and predict the effects of time, temperature, and stress on the axial failure modes of boron fibers and B/A1 composites. Due to the anelastic nature of boron fiber deformation, it was possible to determine simple creep functions which can be employed to accurately describe creep and fracture stress of as-produced fibers. Analysis of damping and strength data for B/6061 A1 composites indicates that fiber creep effects of creep on fiber fracture are measurably reduced by the composite fabrication process. The creep function appropriate for fibers with B/Al composites was also determined. A fracture theory is presented for predicting the time-temperature dependence of the axial tensile strength for metal matrix composites in general and B/A1 composites in particular. Author

N80-21453*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
EFFECTS OF MOISTURE, RESIDUAL THERMAL CURING STRESSES AND MECHANICAL LOAD ON THE DAMAGE DEVELOPMENT IN QUASI-ISOTROPIC LAMINATES
Ronald D. Kriz, Wayne W. Stinchcomb, and Darrel R. Tenney (NASA, Langley Research Center) Feb. 1980 129 p refs
(Grant NGR-47-004-129)
(NASA-CR-162921; VPI-E-80-5; IR-16) Avail: NTIS HC A07/MF A01 CSCL 11D

Classical laminate theory and a finite element model were used to predict stress states prior to the first formation of damage in laminates fabricated from T/300/5208. Crack patterns characteristic of the laminate in a wet or dry condition were also predicted using a shear lag model. Development of edge damage was recorded and observed during the test by transferring an image of the damage from the edge surface on to a thin acetate sheet such that the damage imprinted could be immediately viewed on a microfiche card reader. Moisture was shown to significantly alter the interior and edge dry stress states due to swelling and a reduction of elastic properties and to reduce the transverse strength in 90 deg plies. A model was developed in order to predict changes in first ply failure laminate loads due to differences in stacking sequence together with a wet or dry environmental condition. A.R.H.

N80-21454*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
EVALUATION OF MICRON SIZE CARBON FIBERS RELEASED FROM BURNING GRAPHITE COMPOSITES
B. Sussholz Hampton, Va. NASA. Langley Res. Center Apr. 1980 82 p refs
(Contract NAS1-15465)
(NASA-CR-159217; TRW-80-06) Avail: NTIS HC A05/MF A01 CSCL 11D

Quantitative estimates were developed of micron carbon fibers released during the burning of graphite composites. Evidence was found of fibrillated particles which were the predominant source of the micron fiber data obtained from large pool fire tests. The fibrillation phenomena were attributed to fiber oxidation effects caused by the fire environment. Analysis of propane burn test records indicated that wind sources can cause considerable carbon fiber oxidation. Criteria estimates were determined for the number of micron carbon fibers released during an aircraft accident. An extreme case analysis indicated that the upper limit of the micron carbon fiber concentration level was only about half the permissible asbestos ceiling concentration level. Author

N80-21455# Science Applications, Inc., Irvine, Calif.
CARBON-CARBON COMPOSITE MATRIX REACTIONS AND DENSIFICATION RESPONSE Final Report, 1 Nov. 1977 - 31 Oct. 1978
J. P. Pope 1979 59 p
(Contract F49620-78-C-0002; AF Proj. 2303)
(AD-A080380; AFOSR-80-0058TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

A mini hot isostatic pressure (HIP) autoclave has been fitted with internal and external diagnostic apparatus for monitoring decomposition rates and events of pressure-temperature-time scheduled carbonization of coal tar pitch. TGA's, high pressure liquid chromatography, gel permeation, and compositional analysis techniques have been used to parametrically study critical events of coal tar pitch carbonization. GRA

N80-21456# Oak Ridge National Lab., Tenn.
OUTGASSING BEHAVIOR OF CARBON-BONDED CARBON-FIBER THERMAL INSULATION
G. C. Wei, C. D. Reynolds, and G. W. Brassell 1979 7 p refs Presented at 14th Carbon Conf., University Park, Pa., 25 Jun. 1979
(Contract W-7405-eng-26)
(CONF-790625-8) Avail: NTIS HC A02/MF A01

A carbon-bonded carbon-fiber (CBCF3) thermal insulation was developed and has demonstrated acceptable strength, thermal conductivity, and outgassing properties for the selenide isotope generator. Primary outgassing at 1350 C and 0.1 mPa (10 to the minus 6th power torr) for 70 h seemed satisfactory because reabsorption during exposure to argon or air was minimal and the total weight loss during secondary outgassing was also very small. The total outgassing of CBCF3 insulation during generator startup and operation was equivalent to the weight loss during secondary outgassing, (i.e., 0.08 mg per gram of CBCF3 insulation). The dominating gaseous species of secondary outgassing are CO and CO2. Primary outgassing (1350 C at 0.1 mPa (10 to the minus 6th power torr) for 70 h) causes no increases in the thermal conductivity of CBCF3 insulation. Specimen size affected the first few hours of primary outgassing and thus the fraction of total amount of volatile species being driven off at the end of primary outgassing. DOE

N80-21457# Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.
IDENTIFICATION OF THE ELASTIC CONSTANTS FOR COMPOSITES USING MODAL ANALYSIS
Thomas G. Carne and J. A. Wolf, Jr. Aug. 1979 14 p refs Prepared in cooperation with General Motors Research Labs., Warren, Mich.
(Contract EY-76-C-04-0789)
(SAND-79-0527) Avail: NTIS HC A02/MF A01

A procedure is described for determining the elastic constants of isotropic materials based on an impact vibration test of freely supported panels. An attractive alternative to currently used techniques because of ease and speed with which the determinations can be made, this procedure is particularly applicable to fiber-reinforced composites, since the calculations yield average elastic constants rather than those of a small localized specimen of the material. As an overall test of the accuracy of the procedure, panels of known metallic materials are evaluated, and the values of their elastic constants are reproduced to within 3 percent of their reference values. DOE

N80-21458# Illinois Univ., Urbana. Dept. of Ceramic Engineering.
HYDROGEN CHEMISORPTION AND OXIDATION OF TRANSITION METAL CARBIDES Ph.D. Thesis
James Roger Bethin 1979 93 p refs
(COO-1198-1277) Avail: NTIS HC A05/MF A01

The chemisorption of H on WC and titanium oxycarbides was studied with differential scanning calorimetry. The catalytic activity of these materials for oxidation of H was determined by potentiostatic steady-state and potentiodynamic measurements in acid electrolyte. Compositions of WC surfaces were determined by x-ray photoemission and related to the catalytic behavior. Titanium oxycarbide surfaces were analyzed by Auger electron spectroscopy. Of the carbides tested only one WC preparation was able to chemisorb H. Both WC powders investigated catalyzed H oxidation with similar specific activities. Spectroscopic studies showed that the active surface of WC was a mixture of WO3 and a carbon-deficient WC phase. This result indicates that carbon vacancies are the active sites in tungsten carbide. DOE

N80-21459# Sandia Labs., Albuquerque, N. Mex.
HYDROGEN AND DEFECTS IN LASER ANNEALED AMORPHOUS SILICON
P. S. Peercy and H. J. Stein 1979 6 p refs Presented at Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 26 Nov. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1695C; CONF-791112-37) Avail: NTIS HC A02/MF A01

Hydrogenated amorphous silicon was crystallized by pulsed laser annealing to yield hydrogenated crystalline silicon. Nuclear reaction analysis was used to measure hydrogen concentrations and depth distributions. Infrared absorption measurements were used to study the chemically bonded hydrogen. The IR measurements also reveal that divacancies may remain in the lightly-damaged underlying crystalline region after annealing with laser energies sufficient to produce recrystallization. Divacancies anneal out by 350 C and defect structures in the vicinity of the bonded hydrogen change between 200 to 500 C. No evidence for point defects or chemically bonded hydrogen was found after anneals above 500 C. DOE

N80-21460# Los Alamos Scientific Lab., N. Mex.
BORON CARBIDE-CARBON COMPOSITES AND COMPOSITES FOR CRYOGENIC APPLICATIONS

H. Sheinberg 1979 24 p Presented at the Conf. of Powder Metallurgy, Poznan, Poland, 3 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1112; CONF-791036-1) Avail: NTIS HC A02/MF A01

An experimental program was conducted to prepare 50.8- mm- diam by 34.8 mm-thick cylinders of B4C and B4C-C composites with concentrations of carbon varying from 5.5 to 30 volume percent. In addition, three forms of carbon, natural flake graphite, synthetic graphite flour, and a fine furnace black were used as the source of the second phase. The sound velocity, compressive strength, coefficient of thermal expansion, electrical resistivity, and microstructure were determined as functions of composition. An enriched boron (B-10)-carbon composite was studied as an alternate material. DOE

N80-21423# Technochemie G.m.b.H., Dossenheim (West Germany). Verfahrenstechnik.
THERMAL ANALYTICAL METHODS FOR CHARACTERIZATION OF RESINS, PREPREGS AND COMPOSITES
H. Stenzenberger and M. Herzog *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 23-34 refs (For primary document see N80-21420 12-23)
(Contract ESTEC-2930/76-NL-PP(SC))
Avail: NTIS HC A15/MF A01

N80-21424# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Coatings and Thermal Protection Materials Branch.
NEW SPACE MATERIALS DEVELOPMENTS IN THE UNITED STATES
W. L. Lehn *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 37-47 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21425# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
ADVANCED CARBON FIBER COMPOSITES FOR SPACECRAFT USE
D. H. Bowen *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 49-62 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21435# European Space Research and Technology Center, Noordwijk (Netherlands).
MATERIALS REQUIREMENTS FOR SPACELAB AND SPACELAB PAYLOADS
J. E. Bennett and M. D. Judd *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 161-166 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21436# European Space Research and Technology Center, Noordwijk (Netherlands).
MATERIALS POLICY FOR ADVANCED SCIENTIFIC SPACECRAFT
R. Thomas *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 167-174 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21437# British Aerospace Dynamics Group, Stevenage (England).
OTS/ECS MATERIALS POLICY
P. J. H. Molloy *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 175-179 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21447# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Space and Ballistic Systems Div.
USE OF ULTRA-LIGHT ADHESIVE FOR THE METAL HONEYCOMB BONDING
J. Chanteranne *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 287-291 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-22250# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NEW APPROACH IN POWDER METALLURGY: COMPOSITE MATERIALS PRODUCED FROM BLENDING OF SUPERALLOY POWDERS
Michel Marty and Andre Walder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 33-45 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 245-254 Original report in FRENCH previously announced as A79-48851 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N80-21461 Engineering Sciences Data Unit, London (England).
VISCOSITY OF LIQUID ALIPHATIC HYDROCARBONS: ALKANES
1979 19 p
(ESDU-79027; ISBN-0-85679-275-6; ISSN-0141-4062; ISSN-0141-4070) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $482.50

Values of viscosity at saturation pressure are presented in tabular form for liquid straight and branched chain alkanes having the general formula C(n)H(2N+2). The procedure used to obtain the values of viscosity is presented and indicates the effect of pressure. ESDU (GRA)

N80-21462 Engineering Sciences Data Unit, London (England).
HEAT CAPACITY AND ENTHAPLY OF LIQUIDS: ALIPHATIC ALCOHOLS
1979 10 p
(ESDU-79028; ISBN-0-85679-276-4; ISSN-0141-4062) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $290.50

Values of saturated liquid heat capacity and enthalpy are presented in tabular form for the straight and branched chain alkanol ranging from methanol to hexadecanol. The range covered is from the melting point, the glass transition or the pour point to a value of Tr that exceeds 0.5. The procedure used to obtain the values of heat capacity is presented and indicates the effect of pressure. ESDU (GRA)

N80-21463°# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
RATE CONSTANT FOR THE REACTION OF HYDROXYL RADICAL WITH FORMALDEHYDE OVER THE TEMPERATURE RANGE 228-362 K
L. J. Stief, D. F. Nava, W. A. Payne, and J. V. Michael Mar. 1980 17 p refs
(NASA-TM-80666) Avail: NTIS HC A02/MF A01 CSCL 07D

Absolute rate constants for the reaction OH + H2CO measured over the temperature range 228-362 K using the flash photolysis-resonance fluorescence technique are given. The results are independent of variations in H2CO concentration, total pressure Ar concentration, and flash intensity (i.e., initial OH concentration). The rate constant is found to be invariant with temperature in this range, the best representation being k sub 1 = (1.05 ± or - 0.11) x 10 to the 11th power cu cm molecule(-1) s(-1) where the error is two standard deviations. This result is compared with previous absolute and relative determinations of k sub 1. The reaction is also discussed from a theoretical point of view. M.G.

N80-21464*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCESS FOR THE PREPARATION OF POLY-CARBORANYLPHOSPHAZENES Patent Application
Larry L. Fewell, Harry Rex Allcock (Pennsylvania State Univ., University Park), John Philip OBrien (Pennsylvania State Univ., University Park), and Angelo George Scopelianos, inventors (to NASA) (Pennsylvania State Univ., University Park) Filed 12 Mar. 1980 9 p
(NASA-Case-ARC-11176-2; US-Patent-Appl-SN-129798) Avail: NTIS HC A02/MF A01 CSCL 07D

Polydihalophosphazenes are allowed to react at ambient temperatures for at least one hour with a lithium carborane in a suitable inert solvent. The remaining chlorine substituents of the carboranyl polyphosphazene are then replaced with aryloxy or alkoxy groups to enhance moisture resistance. The polymers give a high char yield when exposed to extreme heat and flame and can be used as insulation. NASA

N80-21465*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
THERMODYNAMIC ANALYSIS OF TURBULENT COMBUSTION IN A SPARK IGNITION ENGINE. EXPERIMENTAL EVIDENCE
G. P. Beretta, M. Rashidi, and J. C. Keck 1980 51 p Presented at the Spring 1980 Meeting of the Western States Section, Irvine, Calif., 21-22 April 1980
(Grant NsG-3245)
(NASA-CR-162859; WSS-80-20) Avail: NTIS HC A04/MF A01 CSCL 21B

A method independent of physical modeling assumptions is presented to analyze high speed flame photography and cylinder pressure measurements from a transparent piston spark ignition research engine. The method involves defining characteristic quantities of the phenomena of flame propagation and combustion, and estimating their values from the experimental information. Using only the pressure information, the mass fraction curves are examined. An empirical burning law is presented which simulates such curves. Statistical data for the characteristics delay and burning angles which show that cycle to cycle fractional variations are of the same order of magnitude for both angles are discussed. The enflamed and burnt mass fractions are compared as are the rates of entrainment and burning. A.W.H.

N80-21466*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
IMPROVED SAMPLE MANAGEMENT IN THE CYLINDRICAL-TUBE MICROELECTROPHORESIS METHOD
Adam J. K. Smolka Feb. 1980 12 p refs
(NASA-TM-78269) Avail: NTIS HC A02/MF A01 CSCL 07D

A modification to an analytical microelectrophoresis system is described that improves the manipulation of the sample particles and fluid. The apparatus modification and improved operational procedure should yield more accurate measurements of particle mobilities and permit less skilled operators to use the apparatus. Author

N80-21467# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
A C(13) NMR STUDY OF THE ADSORBED STATES OF CO ON Rh DISPERSED ON Al2O3
T. M. Duncan, J. T. Yates, Jr., and R. W. Vaughan Jan. 1980 42 p refs Submitted for publication
(Contracts N00014-75-C-0960; N00014-77-F-0008)
(AD-A080708; TR-15) Avail: NTIS HC A03/MF A01 CSCL 07/4

The 13C NMR spectrum of carbon monoxide chemisorbed on supported rhodium has been studied. Lineshapes for two forms of chemisorbed carbon monoxide have been separated based on differences in spin-lattice relaxation times. These data have been used to estimate the molar integrated intensities for the infrared spectrum of various chemisorbed species reported previously. GRA

N80-21468# Brown Univ., Providence, R. I. Dept. of Chemistry.
PREPARATION AND PHOTOELECTRONIC PROPERTIES OF FeNbO SUB 4
John Koenitzer, Bijan Khazai, Jacob D. Hormadaly, Dwight Kirby, and Aaron Wold Jan. 1980 24 p refs
(Contract N00014-77-C-0387; NR Proj. 359-653)
(AD-A080247; TR-10) Avail: NTIS HC A02/MF A01 CSCL 07/4

The orthorhombic alpha-PbO2 phase of FeNbO4 was prepared and its photo-electronic properties measured. Sintered disks were shown to be n-type and gave a conductivity of 40 ohm-cm. Measurements of the photoresponse gave a flat-band potential between 0.1 and 0.4 V vs SCE at a pH of 8.5 and an optical band gap of 2.08(2) eV. Several higher-energy band gaps at 2.68(2), 2.94(2), 3.24(2) and 4.38(2) eV were also determined. There appears to be an enhancement of the quantum efficiency due to the presence of FeO6 active centers while retaining the fundamental characteristics of the (NbO6) octahedra. GRA

N80-21469# Arizona Univ., Tucson. Dept. of Chemistry.
QUALITATIVE ASPECTS OF AN INDUCTIVELY COUPLED PLASMA IN THE SPECTRAL REGION BETWEEN 120 - 185 NM Interim Technical Report
D. R. Heine, J. S. Babis, and M. B. Denton Jan. 1980 23 p refs
(Contract N00014-75-C-0513; NR Proj. 051-549)
(AD-A080629; TR-23) Avail: NTIS HC A02/MF A01

Investigations of the atomic emission lines produced by a variety of non-metals in the vacuum ultraviolet spectral region are reported. A number of promising analytical lines for oxygen, nitrogen, carbon, bromine, sulfur, and chlorine were observed between 120 and 185 nm using both photographic and electronic detection. A unique experimental configuration employing a side-arm torch which directly couples to the vacuum spectrometer/spectrograph is described. GRA

N80-21470# Purdue Univ., Lafayette, Ind. Center for Information and Numerical Data Analysis and Synthesis (CINDAS).
ABSORPTION COEFFICIENT OF ALKALI HALIDES, PART 2 Interim Report, 1 May 1978 - 30 Apr. 1979
H. H. Li Jul. 1979 149 p refs
(Contract F44620-76-C-0105; AF Proj. 2308)
(AD-A080208; CINDAS-55-Pt-2; AFOSR-80-0026TR-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 07/2

This report is the second part of the report entitled 'Absorption Coefficient of Alkali Halides'. In this second report, data analysis on the absorption coefficient in the multiphonon absorption region is carried out for LiF, NaF, NaCl, KBr, and KI. An equation is formulated to describe absorption coefficient as a function of both frequency and temperature. Constants in the equation were determined based on data fitting calculations and empirical correlations. The Urbach rule has been found to be applicable to the UV absorption edge of the transparent region; the equation derived in this study is considered to be its matching rule in the IR absorption edge. GRA

N80-21471# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ULTRAVIOLET ABSORPTION CROSS-SECTION OF MERCURIC BROMIDE M.S. Thesis
Gordon L. Franton Dec. 1979 72 p refs
(AD-A080364; AFIT/GEP/PH/79D-2) Avail: NTIS HC A04/MF A01 CSCL 07/4

This report is on the measurements of the ultraviolet absorption cross section of mercuric bromide (HgBr2) from 175.0 nm to 325.0 nm and discusses the need for such measurements. The ultraviolet radiation wavelengths from a hydrogen discharge lamp were selected by a vacuum monochromator (0.25 nm resolution) and passed through an absorption cell, made of fused quartz, containing the HgBr2. The experiments were conducted over the temperature range 110 C to 150 C corresponding to vapor pressures of 0.2 torr to 2.15 torr of the HgBr2. The results of this study are compared with the results of previous studies and clears up several discrepancies concerning the value of the absorption cross section. It further measures the value of the cross section of an absorption band at 184 nm that was not previously available. GRA

N80-21472# Naval Research Lab., Washington, D. C.
RADIAL DISTRIBUTION LEAST-SQUARES PROGRAM

(RADILS) USERS MANUAL
Peter Dantonio and John H. Konnert Oct. 1979 61 p
(RR0110341)
(AD-A076964; AD-E000329; NRL-MR-4104) Avail: NTIS HC A04/MF A01 CSCL 07/4

A rapidly converging radial distribution least squares program (RADILS) is available for the analysis of x-ray, neutron and electron diffraction data from liquid and amorphous materials. The program automatically generates a radial distribution function, G(r), essentially free from termination effects and determines the empirical background scale and shape, absolute scale factor, bulk density and coordination numbers, disorder parameters and interatomic distances for the first few highly ordered distances in the sample. GRA

N80-21473# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DIFFERENTIAL CROSS SECTION FOR ELECTRON DETACHMENT FROM NEGATIVE HYDROGEN IONS COLLIDING WITH NEUTRAL HYDROGEN ATOMS M.S. Thesis
Mark Richard Franz Dec. 1979 78 p refs
(AD-A080365; AFIT/GEP/PH/79D-3) Avail: NTIS HC A05/MF A01 CSCL 07/4

The first born approximation is used to calculate the differential cross section for electron detachment from H(-) ions colliding with hydrogen atoms. The differential and total cross sections are evaluated for the resultant hydrogen atom in the 1(s) or 2(s) state and the target hydrogen atom in any excited state up to n = 8. The scattering matrix includes the exchange of particles interaction, which has not been included in earlier work. The results are presented and compared with earlier work where possible. GRA

N80-21474# Ames Lab., Iowa.
EFFECT OF HYDROGEN CONTENT ON THE PROPERTIES OF REACTIVELY SPUTTERED AMORPHOUS Si-H
F. R. Jeffrey, H. R. Shanks, and G. C. Danielson 1979 8 p refs Presented at the 8th Intern. Conf. on Amorphous and Liquid Semiconductors, Cambridge, Mass., 27 Aug. 1979
(Contract W-7405-eng-82)
(ISM-237; CONF-790851-4) Avail: NTIS HC A02/MF A01

The production of hydrogenated a-Si films over a wide range of hydrogen densities by reactive sputtering is described. The films contain monohydride bonding. Deposition, conductivity, activation energy, and optical gap data are presented for the films. A.W.H.

N80-21475# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Chemistry Div.
AUTOMATIC ION-EXCHANGE CHROMATOGRAPHY IN CORROSIVE SOLVENT SYSTEMS
D. W. Hosmer and A. L. Gazlay 5 Oct. 1979 10 p ref Presented at the 23d Conf. on Anal. Chem. in Energy Technol., Gatlinburg, Tenn., 9 Oct. 1979
(Contract W-7405-eng-48)
(UCRL-83447; CONF-791049-10) Avail: NTIS HC A02/MF A01

An automated system for performing ion exchanging chromatography with corrosive solvents is described and evaluated. The system is controlled using a LSI-2 microcomputer and is capable of selecting six sample solvents and collecting six separate fractions. Results on the separation of plutonium from 8M HNO3 solutions are discussed. DOE

N80-21476# Oak Ridge National Lab., Tenn.
NEW FORTRAN COMPUTER PROGRAMS TO ACQUIRE AND PROCESS ISOTOPIC MASS SPECTROMETRIC DATA
D. H. Smith Sep. 1979 84 p
(Contract W-7405-eng-26)
(ORNL/TM-7002) Avail: NTIS HC A05/MF A01

The operation of new computer programs that acquire and process isotopic mass spectrometric data is described. Both functional and overall design aspects are addressed. The three basic program units - file manipulation, data acquisition, and data processing - are discussed. Step by step instructions are included and each subsection is described. DOE

N80-21477# Utah Univ., Salt Lake City. Dept. of Chemistry.
CARBON-13 MAGNETIC RESONANCE OF HYDROCARBONS Annual Report
David M. Grant and Ronald J. Pugmire 1979 17 p refs
(Contract ER-78-S-02-5006)
(DOE/ER-05006/1) Avail: NTIS HC A02/MF A01

The synthesis of hydroaromatic species, which represent models to be used in establishing correlative chemical shift parameters, is reported. Spectral interpretation of the resulting species in both the liquid and solid state couple with force field calculations, which provide information on conformational averaging and bond distortion, is discussed. Relaxation measurements performed on a number of condensed polynuclear aromatic, alkyl and hydroaromatic species, to establish the relative contributions of dipole-dipole spin rotation and chemical shift anisotropy relaxation mechanisms, are presented. Carbon 13 spin-lattice measurements and chemical shift studies on a number of the hydroaromatic compounds are discussed. A.W.H.

N80-21478# Air Products and Chemicals, Inc., Allentown, Pa.
DEMONSTRATION OF A NITROGEN BASED CARBURIZING ATMOSPHERE Quarterly Report, 1 Jan. - 31 Mar. 1979
Robert J. Peartree Jun. 1979 17 p
(Contract EM-78-C-01-5058; Contract DE-AC07-79CS-40234)
(CONS-5058-T2; DOE/CS-40234/2; QR-2) Avail: NTIS HC A02/MF A01

The energy consumption of two heat treating furnaces which employ different atmospheres was studied. Idle energy consumption tests on a box type furnace with a fibrous insulation indicate 7 to 14% lower fuel consumption when pure nitrogen replaces endothermic as a furnace atmosphere. Production energy consumption tests on an integral quench furnace are discussed. DOE

N80-21479# California Univ., Berkeley. Lawrence Berkeley Lab.
ROLE OF ACTIVE ELEMENTS AND OXIDE DISPERSIONS IN THE DEVELOPMENT OF OXIDATION-RESISTANT ALLOYS AND COATINGS
I. M. Allam, D. P. Whittle, and J. Stringer Jul. 1979 17 p refs Presented at TMS/AIME Fall Meeting, St. Louis, 15 Oct. 1978
(Contract W-7405-eng-48)
(LBL-9516; CONF-781093-3) Avail: NTIS HC A02/MF A01

Alloys in the CoCrAl system which form Al2O3 scales were studied. Co-10Cr-11Al being the basis composition. The alloys also contained between 0 and 1 wt % Y or Hf. Oxidation kinetics in dry air were measured over the temperatures range 1000 C to 1200 C for times up to 1000 h; thermal cycling tests were also carried out. The morphological development of the scales was studied in detail. Preferential oxidation of Hf and to a lesser extent Y, results in the formation of numerous oxide protrusions penetrating into the substrate alloy and these are largely responsible for the improvement in scale adherence. The pegs consist predominantly of Al2O3 which has grown inwards encapsulating the Hf- or Y-rich internal oxide particles. The size and distribution of the oxide protrusions play a decisive role in maintaining scale adherence over long exposure periods. The advantage of Hf additions over Y additions are discussed. DOE

N80-21480# Sandia Labs., Albuquerque, N. Mex.
INFRARED VISIBLE DOUBLE-RESONANCE IONIZATION SPECTROSCOPY
P. Esherick and R. J. M. Anderson 1979 7 p Presented at the Ann. Meeting of the Opt. Soc. of Am., Rochester, N.Y., 8 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1971C; CONF-791055-1) Avail: NTIS HC A02/MF A01

The multiphoton ionization of a molecule (NO) was observed as a result of the sequential excitation by a tunable infrared laser and a tunable dye laser. These double-resonance experiments which made it possible to obtain multiphoton ionization spectra (MIS) of specific rotational levels of the molecule selected by the initial IR transition are described. The following applications of the technique are demonstrated: a means of simplifying complex multiphoton ionization spectra of molecules, a means of sensitively and selectively detecting IR absorption of molecules and a means

of studying the dynamics of relaxation of molecules in excited rotation vibration states. DOE

N80-21481# Argonne National Lab., Ill.
EFFECTIVE MASS SPECTROMETER
D. Ayres 12 Oct. 1979 23 p refs
(Contract W-31-109-eng-38)
(ANL-HEP-CP-79-34) Avail: NTIS HC A02/MF A01

The history and major accomplishments of the effective mass spectrometer (EMS) are described. In the eight years since the EMS turned on, 21 experiments were completed by groups from nine institutions in 32 months of operation. Over 400 million triggers were recorded on magnetic tape, resulting in 29 journal publications to date. A list of experimental proposals for the EMS and a sampling of results are presented. DOE

N80-21482# Ohio Univ., Athens. Dept. of Chemistry.
AUTOMATED MEASUREMENTS OF INFRARED SPECTRA OF CHROMATOGRAPHICALLY SEPARATED FRACTIONS Final Report, Apr. 1976 - Oct. 1978
Peter R. Griffiths Oct. 1979 81 p refs
(Grant EPA-R-804333-01)
(PB80-122575; EPA-600/4-79-064) Avail: NTIS HC A05/MF A01 CSCL 14B

The interface of a Fourier transform infrared (FT-IR) spectrometer with both gas and high performance liquid chromatographs for the on line measurement of the spectra of eluting species is described. The optimization of the sensitivity of the infrared measurements of gas chromatographic effluents is discussed. The system was applied to the identification of trace organics in water after extraction using neutral polystyrene resins, elution by diethyl ether, and separation by gas-liquid chromatography. The application of dual beam FT-IR to the on line identification of peaks eluting from a high performance liquid chromatograph was investigated. The sensitivity of techniques for the in situ identification of species on specially prepared thin layer chromatographic plates is reported. A.W.H.

N80-21483# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Chemistry.
INVESTIGATION OF INTERMOLECULAR ASSOCIATION IN CONCENTRATED SOLUTIONS OF CELLULOSE ACETATE Final Report
G. C. Berry, T. S. Sham, and M. A. Leech 1979 12 p
(Contract DI-14-34-0001-7528)
(PB80-124670; W80-02297; OWRT-S-0012(7528)(1)) Avail: NTIS HC A02/MF A01 CSCL 07D

The role of intermolecular association in concentrated solutions of cellulose triacetate (CTA) is investigated with respect to its importance in controlling the properties of CTA films formed from concentrated solutions for use as membranes in desalination by the reverse osmosis technique. The studies reveal the presence of extensive intermolecular association of CTA, even in very dilute solutions. The data also reveal that CTA has a larger unperturbed dimension than secondary cellulose diacetate. Rheological data obtained on some moderately concentrated solutions also exhibit the effects of interchain association. It appears that association leads to the formation of loci of imperfectly ordered domains that act as crosslinks, forming a type of randomly branched structure. This extent of this structure may control the properties of films from such solutions. GRA

N80-21484# Cincinnati Univ., Ohio. Southwestern Ohio Regional Computer Center.
USER'S GUIDE FOR THE GAS CHROMATOGRAPHY AUTOMATION SYSTEM
Jonathan E. Kopke Oct. 1979 45 p refs
(Contract EPA-GS-05S-10458)
(PB80-125180; EPA-600/4-79-067) Avail: NTIS HC A03/MF A01 CSCL 14B

The gas chromatography automation system (GCAS) is an elaborate extension of the Varian 220L chromatography data system. The prescribed procedures for operating the GCAS are presented. The general principles of the system are discussed and the method interactions, the concentration pattern interactions, and the calibration procedures are described. The system manager's duties and responsibilities in maintaining the GCAS system are summarized. A.W.H.

N80-21485# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT. SOLVENT EVAPORATION: DEGREASING OPERATIONS Final Report
T. J. Hoogheem, D. A. Horn, T. W. Hughes, and P. J. Marn Aug. 1979 133 p refs
(Contract EPA-68-02-1874)
(PB80-128812; MRC-DA-640) Avail: NTIS HC A07/MF A01 CSCL 11K

Solvent degreasing and fabric scrubbing were studied from the standpoint of atmospheric emissions and their potential environmental impact. Emission factors for solvents emitted to the atmosphere from representative degreasing operations are discussed and several factors designed to measure the environmental hazard potential of degreasing operations are described. Various types of degreasing operations are reported and an analysis of the growth rate of solvents used in the operations is presented. Present and future aspects of degreasing pollution control technology are discussed. A.W.H.

N80-21486# National Technical Information Service, Springfield, Va.
LASER SPECTROSCOPY, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jan. 1980
Diane M. Cavagnaro Feb. 1980 202 p Supersedes NTIS/PS-79/0100; NTIS/PS-78/0107; NTIS/PS-77/0120
(PB80-804669; NTIS/PS-79/0100; NTIS/PS-78/0107; NTIS/PS-77/0120) Avail: NTIS HC $30.00/MF $30.00 CSCL 07D

This bibliography contains citations on laser spectroscopy. The research includes infrared, visible, laser photofragment, and laser microwave spectroscopy. Topics include spectrometer design, chemical analytical techniques, and spectral analysis. Raman spectroscopy is excluded. This updated bibliography contains 295 abstracts, 90 of which are new entries to the previous edition. GRA

N80-21487# National Technical Information Service, Springfield, Va.
LASER RAMAN SPECTROSCOPY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Jan. 1980
Diane M. Cavagnaro Feb. 1980 195 p Supersedes NTIS/PS-79/0056; NTIS/PS-78/0108; NTIS/PS-77/0119
(PB80-804446; NTIS/PS-79/0056; NTIS/PS-78/0108; NTIS/PS-77/0119) Avail: NTIS HC $30.00/MF $30.00 CSCL 07D

The theory and applications of laser Raman spectroscopy are cited, including studies on crystal structure, laser excitations of the molecule into different energy levels, gas analysis, and theoretical interpretation of spectra. This updated bibliography contains 188 abstracts, 16 of which are new entries to the previous edition. GRA

N80-21421# Institut fuer Naturwissenschaftlich- Technische Dienste G.m.b.H., Hamburg (West Germany).
OFFGASSING AND ODOR TESTS OF NON-METALLIC MATERIALS FOR SPACE CABINS
W. R. Eckert *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 3-4 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21430* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASSESSMENT OF SHUTTLE PAYLOADS GASEOUS ENVIRONMENT CONTAMINATION AND ITS CONTROL
J. J. Scialdone *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 101-116 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21433# Centre National de la Recherche Scientifique, Toulouse (France).
EVALUATION OF KINETIC OUTGASSING UNDER VACUUM FOR POTTING COMPOUNDS AND PAINTS
J. Guillin *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 139-144 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-21488*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF SUPERALLOY POWDER METALLURGY FOR AIRCRAFT ENGINES
R. L. Dreshfield and R. V. Miner, Jr. 1980 21 p refs Proposed for presentation at Intern. Powder Met. Conf., Washington, D.C., 22-27 Jun. 1980
(NASA-TM-81466; E-395) Avail: NTIS HC A02/MF A01 CSCL 11F

In the last decade, Government/Industry programs have advanced powder metallurgy-near-net-shape technology to permit the use of hot isostatic pressed (HIP) turbine disks in the commercial aircraft fleet. These disks offer a 30% savings of input weight and an 8% savings in cost compared in cast-and-wrought disks. Similar savings were demonstrated for other rotating engine components. A compressor rotor fabricated from hot-die-forged-HIP superalloy billets revealed input weight savings of 54% and cost savings of 35% compared to cast-and-wrought parts. Engine components can be produced from compositions such as Rene 95 and Astroloy by conventional casting and forging, by forging of HIP powder billets, or by direct consolidation of powder by HIP. However, each process produces differences in microstructure or introduces different defects in the parts. As a result, their mechanical properties are not necessarily identical. Acceptance methods should be developed which recognize and account for the differences. A.R.H.

N80-21489*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN INVESTIGATION INTO THE ROLE OF ADHESION IN THE EROSION OF DUCTILE METALS
William A. Brainard and Joshua Salik 1980 20 p refs Presented at the 35th Ann. Meeting of the Am. Soc. of Lubrication Engr., Anaheim, Calif., 5-8 May 1980
(NASA-TM-81458; E-028) Avail: NTIS HC A02/MF A01 CSCL 11F

Existing theories of erosion of ductile metals based on cutting and deformation mechanisms predict no material removal at normal incidence which is contradictory to experience. Thus, other mechanisms may be involved. The possible role of adhesive material transfer during erosion is investigated by both single particle impingement experiments and erosion by streams of particles. Examination of the rebounding particles as well as the eroded surface yields evidence of a significant adhesive mechanism for the ductile metals investigated. Author

N80-21490*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRIBOLOGICAL PROPERTIES OF SPUTTERED MoS SUB 2 FILMS IN RELATION TO FILM MORPHOLOGY
Talivaldis Spalvins Mar. 1980 17 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, 21-25 Apr. 1980; sponsored by the Am. Vacuum Soc.
(NASA-TM-81465; E-394) Avail: NTIS HC A02/MF A01 CSCL 11F

Thin sputter deposited MoS2 films in the 2000 to 6000 A thickness range have shown excellent lubricating properties, when sputtering parameters and substrate conditions are properly selected and precisely controlled. The lubricating properties of sputtered MoS2 films are strongly influenced by their crystalline-amorphous structure, morphology and composition. The coefficient of friction can range from 0.04 which is effective lubrication to 0.4 which reflects an absence of lubricating properties. Visual screening and slight wiping of the as-sputtered MoS2 film can identify the integrity of the film. An acceptable film displays a black-sooty surface appearance whereas an unacceptable film has a highly reflective, gray surface and the film is hard and brittle. Author

N80-21491*# National Aeronautics and Space Administration, Washington, D. C.
HIGH PRESSURE SINTERING OF NON-OXIDE MATERIALS
Masahiko Shimado, Noriyuki Ogawa, and Mitsue Koizumi Nov. 1979 7 p refs Transl. into ENGLISH from J. Jap. Soc. Powder Met., v. 25, no. 8 (Japan), Dec. 1978 p 275-276
(Contract NASw-3198)
(NASA-TM-75744) Avail: NTIS HC A02/MF A01 CSCL 11F

Pure materials of AlN, alpha-Si3N4 and TiC, without additives were sintered at 800 C to 1400 C under the pressures of 30 kbar and 50 kbar for 0.5 hours. The maximum density of sintered bodies for the cited materials was nearly 100% for AlN, 98% for TiC and 96% for alpha-Si3N4. A.R.H.

N80-21492*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FOULING AND THE INHIBITION OF SALT CORROSION Final Report
Daniel L. Deadmore and Carl E. Lowell Apr. 1980 16 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-81469; DOE/NASA/2593-80; E-401) Avail: NTIS HC A02/MF A01 CSCL 11F

In an attempt to reduce fouling while retaining the beneficial effects of alkaline earth inhibitors on the hot corrosion of superalloys, the use of both additives and the intermittent application of the inhibitors were evaluated. Additions of alkaline earth compounds to combustion gases containing sodium sulfate were shown to inhibit hot corrosion. However, sulfate deposits can lead to turbine fouling in service. For that reason, dual additives and intermittant inhibitor applications were evaluated to reduce such deposit formation. Silicon in conjunction with varium showed some promise. Total deposition was apparently reduced while the inhibition of hot corrosion by barium was unimpaired. The intermittant application of the inhibitor was found to be more effective and controllable. Author

N80-21493*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF FINE POROSITY ON THE FATIGUE BEHAVIOR OF A POWDER METALLURGY SUPERALLOY
R. V. Miner, Jr. and R. L. Dreshfield 1980 25 p refs Presented at Ann. Meeting of the Am. Inst. of Mining, Met. and Petroleum Engr., Las Vegas, Nev., 24-28 Feb. 1980
(NASA-TM-81448; E-367) Avail: NTIS HC A02/MF A01 CSCL 11F

Hot isostatically pressed powder metallurgy Astroloy was obtained which contained 1.4 percent fine porosity at the grain boundaries produced by argon entering the powder container during pressing. This material was tested at 650 C in fatigue, creep fatigue, tension, and stress-rupture and the results compared with previous data on sound Astroloy. The pores averaged about 2 micrometers diameter and 20 micrometers spacing. They did influence fatigue crack initiation and produced a more intergranular mode of propagation. However, fatigue life was not drastically reduced. A large 25 micrometers pore in one specimen resulting from a hollow particle did not reduce life by 60 percent. Fatigue behavior of the porous material showed typical correlation with tensile behavior. The plastic strain range life relation was reduced proportionately with the reduction in tensile ductility, but the elastic strain range-life relation was little changed reflecting the small reduction in sigma sub u/E for the porous material. R.C.T.

N80-21494# Massachusetts Inst. of Tech., Cambridge.
STUDY OF RESIDUAL STRESSES AND DISTORTION IN STRUCTURAL WELDMENTS IN HIGH STRENGTH STEELS Technical Progress Report, 1 Dec. 1977 - 30 Nov. 1979
Vassilios J. Papazoglu and Koichi Masubuchi Nov. 1979 99 p refs
(Contract N00014-75-C-0459)
(AD-A079920; Rept-82558) Avail: NTIS HC A05/MF A01 CSCL 13/5

Experimental results on temperature, strain and distortion during welding HY-130 steel are presented. The geometries include 1 inch thick plates and 0.75 inch cylindrical shells. Welding was performed using the gas metal arc, electron beam and laser processes. The experimental results are compared with predictions made by computer programs. Finally, through thickness

distributions of residual--stresses obtained using the Rosenthal-Norton sectioning technique--are presented. GRA

N80-21495# McDonnell-Douglas Research Labs., St. Louis, Mo.
INFLUENCE OF RARE-EARTH ADDITIONS ON PROPERTIES OF TITANIUM ALLOYS: PLANE-STRAIN FRACTURE TOUGHNESS, CREEP, AND HIGH-TEMPERATURE DEFORMATION OF Ti-6Al-4V WITH ERBIUM AND YTTRIUM ADDITIONS Technical Report, 1 Apr. 1978 - 31 Mar. 1979
Shankar M. L. Sastry, Richard J. Lederich, Peter S. Pao, and James E. ONeal 31 May 1979 70 p refs
(Contract N00014-76-C-0626)
(AD-A079806; MDC-Q0684) Avail: NTIS HC A04/MF A01 CSCL 11/6

The influence of additions of 0.05 wt% Y and 0.1 wt% Er on the room-temperature tensile properties, plane-strain and plane-stress fracture toughness, creep, and high-temperature high-strain-rate deformation characteristics of Ti-6Al-4V was studied. 75kg ingots of Ti-6Al-4V, Ti-6Al-4V-0.05Y and Ti-6Al-4V- 0.1Er were cast, forged, and rolled into 80-mm, 30-mm, and 13-mm plates. The Y and Er additions reduce the high-temperature flow stress of Ti-6Al-4V at strain rates of 0.05 and 0.5/s and significantly improve ingot-breakdown forging by suppressing the edge cracking. The Y-containing Ti-6Al-4V has lower flow stress and higher strain-rate sensitivity of flow stress and consequently better superplasticity than the reference alloy at 906 C at strain rates of .00001 to .001/s. The room-temperature plane-strain fracture toughness, yield stress, ductility, and high-temperature creep are not significantly altered by the rare-earth additions. GRA

N80-21496# California Univ., Berkeley. Dept. of Materials Science and Engineering.
ADVANCES IN THE HEAT TREATMENT OF STEELS
J. W. Morris, Jr., J. I. Kim, and C. K. Syn Jul. 1979 51 p refs
(Contracts N00014-75-C-0154; N00014-69-A-0200; F33615-73-C-5100; W-7405-eng-48; NR Proj. 031-762)
(AD-A080223; TR-9) Avail: NTIS HC A04/MF A01 CSCL 11/6

A number of important recent advances in the processing of steels have resulted from the sophisticated uses of heat treatment to tailor the microstructure of the steels so that desirable properties are established. These new heat treatments often involve the tempering or annealing of the steel to accomplish a partial or complete reversion from martensite to austenite. The influence of these reversion heat treatments on the product microstructure and its properties may be systematically discussed in terms of the heat treating temperature in relation to the phase diagram. From this perspective four characteristic heat treatments are defined: (1) normal tempering, (2) intercritical tempering, (3) intercritical annealing, and (4) austenite reversion. The reactions occurring during each of these treatments are described and the nature and properties of typical product microstructures discussed, with specific reference to new commercial or laboratory steels having useful and exceptional properties. GRA

N80-21497# Naval Ship Research and Development Center, Bethesda, Md.
FATIGUE CRACK GROWTH IN WELDBONDED ALUMINUM ALLOY STIFFENED PANELS UNDER PRESSURE LOADING
H. P. Chu, J. A. Hauser, and J. P. Sikora Dec. 1979 48 p refs
(SF43422593; SF5459052)
(AD-A080246; DTNSRDC-79/02) Avail: NTIS HC A03/MF A01 CSCL 11/6

An experimental study was conducted to characterize the fatigue crack growth behavior of stiffened panels under uniform lateral pressure loading. The panels were made of standard 5456 aluminum alloy and fabricated by weldbonding. Fatigue failure of the panels consisted of cracking of the stiffness followed by cracking of the skin. Crack growth rate data showed a maximum value in the stiffeners and a constant value in the skin before failure. A weldbonded stiffened panel could endure more fatigue cycles than a gas metal arc welded panel under similar loading. The panel data were correlated with base line materials data and represented by either of two simple equations in terms of fatigue crack growth rate versus stress intensity factor range. The stress intensity analysis for the panels was made by an approximation method considering the combined effects of tension and bending stresses. Accuracy of this method was verified by photoelastic measurements. GRA

N80-21498# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PROPERTIES OF ION-IMPLANTED AND DIFFUSED PHOTODETECTORS OF GERMANIUM AND GERMANIUM-SILICON ALLOYS M.S. Thesis
Irene Marie Nadeau Mills Dec. 1979 171 p refs
(AD-A080412; AFIT/GE/EE/79D-25) Avail: NTIS HC A08/MF A01 CSCL 07/4

The response of planar shallow junction Ge photodiodes displayed peak performance at the expected 1.46 micrometers wavelength. Responsivity and quantum efficiency were measured at approximately 0.9 micro A/micro W and approximately 80%, respectively, with leakage currents of approximately 6 micro A, typical for Ge photodiodes. Leakage currents were notably decreased in diffused diodes. The high values for responsivity and quantum efficiency could be attributed to the shallow junction (approximately 1 micrometer) designed to increase the amount of photogenerated current which could be collected by the p-n junction. The reason for the interest in photodetectors lies in fiber optic applications. Minimum fiber attenuation and dispersion occurs near 1.27 micrometers. Photodetectors at this wavelength require tailoring of the bandgap energy of Ge by adding about 10% Si. A quantum mechanical analysis of the energy band structure of the Ge-Si alloy is included with suggestions to obtain energy gap and effective mass values experimentally. Ge-Si photodetectors fabricated as shallow junction photodiodes should exhibit high photoresponse and quantum efficiency near 1.27 micrometers. GRA

N80-21499# Lockheed Missiles and Space Co., Palo Alto, Calif.
ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWDERS Research and Development Status report, 5 Sep. - 5 Dec. 1979
R. E. Lewis Dec. 1979 13 p ref
(Contract F33615-78-C-5203; DARPA Order 3575)
(AD-A080145; LMSC-D683922) Avail: NTIS HC A02/MF A01 CSCL 11/6

Advanced aluminum alloys are to be developed that will provide major payoffs for important new aircraft, spacecraft, and missile systems in the next decade. Payoffs will result from weight savings of structural components which, in turn, lead to increased range, payload, service life, and decreased life-cycle cost. Recently conducted feasibility and design tradeoff studies provide a basis for selecting certain property goals for improved aluminum alloys that will result in significant weight savings. These property goals are: (A) Specific Elastic Modulus - 133 times 10 to the 6th power in (B) Specific Elastic Modulus - 122 times 10 to the 5th power in, and Specific Yield Strength 7.96 times 10 to the 6th power in Goal A is a 30 percent increase in specific modulus of elasticity relative to Al 7075-T76, without significant loss in strength, toughness, fatigue strength, or stress corrosion resistance. Goal B is a 20 percent increase in specific modulus of elasticity accompanied by a 20 percent increase in specific strength, without significant loss in toughness, fatigue strength, or stress corrosion resistance. The objective of this program is to develop advanced aluminum alloys from rapidly solidified particulate that meet specific property goals. In addition, the program is to establish a metallurgical basis suitable for manufacturing scale-up and application to new weapon systems. GRA

N80-21500# Pratt and Whitney Aircraft, West Palm Beach, Fla.
ION-PLATED COATING ON TITANIUM ALLOY Final Report, 1 Sep. 1978 - 1 May 1979
Thomas A. Eckler Aug. 1979 46 p refs
(Contract F33615-78-C-5179)
(AD-A080132; PWA-FR-11825; AFML-TR-79-4109) Avail: NTIS HC A03/MF A01 CSCL 11/6

The trend to achieve higher thrust-to-weight ratios in advanced gas turbine engines has stimulated the need to develop structural

components which are more oxidation resistant and possess improved mechanical properties. In an effort to meet these goals noble metals were ion-plated on Ti-6Al-2Sn-4Zr-6Mo compressor blades. These blades represent an excellent medium for evaluating ion-plating on titanium gas turbine components. The ion-plated coatings evaluated were Pt, Pt/Rh and Au. Holograms were used to determine the effect of the coating on the normal frequency and mode shape. In addition, a combination of stress coat paint and strain gages were used to determine if the ion-plated coating alters the stress distribution. Fatigue and notch fatigue tests were run on coated and uncoated blades conditioned by heating at 454 C (850 F) for 125 hr and then tested at 454 C (850 F). Unlike other methods of coating, the ion-plating caused an increase in the high temperature fatigue strength. The oxidation resistance of the ion-plated materials was also substantially increased. GRA

N80-21501# Technische Univ., Vienna (Austria). Inst. fuer Chemistry Technologie Anorganische Stoffe.

THE INFLUENCE OF CHEMISTRY AND VARIOUS FABRICATION PARAMETERS ON THE PROPERTIES OF TUNGSTEN HEAVY METALS Annual Report, Jun. 1978 - Nov. 1979

B. Lux, G. Jangg, and H. Danninger Nov. 1979 73 p refs
(Grant DA-ERO-78-G-086)
(AD-A080480; AR-1) Avail: NTIS HC A04/MF A01 CSCL 11/6

The aim of this project is to improve tungsten heavy metals, particularly with regard to their ductility, porosity and density. The emphasis of the two-year program is to investigate the influence of the heavy metal composition, W content, binder composition and the chemical purity of raw materials on the properties of heavy metals. In addition, particular attention is given to the influence of the fabrication conditions on the quality of the product. GRA

N80-21502# TRW, Inc., Cleveland, Ohio. Materials Technology Lab.

RARE EARTH MODIFIED HIGH STRENGTH STEELS VIA P/M PROCESSING Technical Report, 1 Sep. 1978 - 30 Sep. 1979

A. A. Sheinker Dec. 1979 66 p refs
(Contract N00014-78-C-0672)
(AD-A080637; TRW-ER-8097) Avail: NTIS HC A04/MF A01 CSCL 11/6

Material processing studies were directed toward developing powder metallurgy methods for producing rare earth modified high strength 4340 steel with improved resistance to hydrogen embrittlement. Three different methods of making rare earth modified 4340 steel powders were explored: hydrogen gas atomization, mechanical alloying, and rapid solidification rate atomization. These studies included metallographic characterization of powders made by all three of these methods and preliminary mechanical property evaluation of compacted material made from hydrogen gas atomized powder. Hydrogen gas atomization of 4340 steel prealloyed with cerium by adding a 75% Ce - 25% Ni alloy to the melt produced powder particles which were irregular in shape, clean, and relatively free of nonmetallic inclusions. The mechanical properties of this powder material consolidated by hot isostatic pressing (HIP) at 2000 F (1370 K) and heat treated were generally lower than those of similarly heat treated, rare earth modified, wrought 4340 steels evaluated previously, due to a brittle condition in the prior particle boundaries of the compacted material. Mechanical alloying of hydrogen gas atomized 4340 steel powder containing no rare earths with either 75% Ce - 25% Ni or LaNi5 alloy powders by attriting in a special high-intensity ball mill showed that annealing of the steel powder prior to attriting was necessary in order for the attriting to be effective. Rapid solidification rate (RSR) atomization of a control heat of 4340 steel with no rare earth additions produced powder which were generally spherical in shape, clean, and relatively free of nonmetallic inclusions, but contained many internal voids. GRA

N80-21503# Michigan Technological Univ., Houghton.

BARRIERS TO THE MIGRATION OF INTERPHASE BOUNDARIES, PARTICULARLY IN STEEL Final Report, 15 Oct. 1976 - 14 Sep. 1979

H. I. Aaronson, T. Abe, J. R. Bradley, W. A. T. Clark, T. Obara, and G. J. Shiflet Dec. 1979 113 p refs
(Grant DAAG29-77-G-0019)
(AD-A080384; ARO-14217.1-MS; FR-17) Avail: NTIS HC A06/MF A01 CSCL 11/6

The growth kinetics of proeutectoid ferrite, in the form of grain boundary allotriomorphs, were measured vs. reaction temperature in Fe-C-X alloys where X was Si, Mn, Cr and Ni. Comparison of measured growth kinetics with those calculated often shows poor agreement with the local equilibrium model; order of magnitude agreement was obtained with both the pileup and the paraequilibrium models. A limiting alloying element penetration calculation, however, showed that only the paraequilibrium model is basically consistent with the experimental data. TEM studies showed that measured growth kinetics somewhat slower than those predicted by the paraequilibrium model are not due to carbide precipitation at austenite ferrite boundaries. Such slower growth kinetics appear to be best explained by a solute drag-like effect. Carbide precipitation at austenite ferrite boundaries in Fe-C-X alloys was shown to increase growth kinetics when X is Si, Ni and V. Incomplete transformation in Fe-C-Mo alloys was demonstrated to occur only when critical proportions of C and Mo are exceeded. Thermodynamics of the proeutectoid ferrite reaction in Fe-C alloys were reassessed using recent theory and thermodynamic data. Structural ledges were observed to occur reproducibly on planar facets formed during the beta yield alpha sub m Cu-Zn massive transformation. The misfit dislocation structure of the lamellar interfaces in the Co(Al)-CoAl eutectic was observed to be significantly affected by the presence of LRO in the CoAl phase. GRA

N80-21504# Naval Research Lab., Washington, D. C. Material Science and Technology Div.

FABRICATION AND PROCESSING TECHNOLOGY FOR IMPROVED CRACK TOLERANT PROPERTIES OF STRUCTURAL ALLOYS, CURRENT R AND D ACTIVITIES AND EMERGENT RESEARCH OPPORTUNITIES

L. R. Hettche and B. B. Rath Jan. 1980 78 p refs
(AD-A080546; AD-E000355; NRL-MR-4148; T-TPI/US/4/79)
Avail: NTIS HC A05/MF A01 CSCL 11/6

As a 1978/79 action item, the Metal Panel (TP-1) of The Technical Cooperation Program (TTCP) Sub-Group P initiated a survey on current R and D activities and emergent research opportunities in processing and fabrication technology which show potential to improve the crack tolerant properties of structural alloys. This action was in response to repeated requests from the Sub-Group P for information and recommendations for Sub-Group activities in this general area. The U.S. contribution to this survey is documented in this report. GRA

N80-21505# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering

ON THE MECHANISMS OF CORROSION OF Cu-9.4Ni-1.7Fe ALLOY IN AIR SATURATED AQUEOUS NaCl SOLUTION. 1: KINETIC INVESTIGATIONS

C. Kato, B. C. Ateya, J. E. Castle, and H. W. Pickering 6 Nov. 1979 31 p refs
(Contract N00014-75-C-0264)
(AD-A079959; TR-11) Avail: NTIS HC A03/MF A01 CSCL 11/6

The mechanism of formation of the protective layer on commercial Cu-9.4Ni-1.7Fe alloy in aerated 3.4 wt% NaCl solution at room temperature was investigated for various times up to 191 days. The weight of the sample, the weight of the corrosion product layer and the anodic and cathodic polarization curves were measured before and after the corrosion periods. Results of these experiments identify the rate limiting electrode reaction of the overall corrosion process to be oxygen reduction. They provide new insight into the kinetics of formation (parabolic) and structure of the corrosion-product layer, and they pinpoint the location of the rate-limiting oxygen reduction reaction. This location is found to be the surface of a thin, strongly adherent inner layer which is in contact with electrolyte as a result of the porous nature of the much thicker outer layer. Finally, results from specially designed experiments utilizing the electrocatalysts Pd and Pt are consistent with the view that the oxygen reduction rate is low due to a low electrocatalytic activity of the (inner) corrosion product surface for this reaction. GRA

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N80-21506# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.

ON THE MECHANISM OF CORROSION OF Cu-9.4Ni-1.7Fe ALLOY IN AIR SATURATED AQUEOUS NaCl SOLUTION. 2: COMPOSITION OF THE PROTECTIVE SURFACE LAYER

C. Kato, J. E. Castle, B. G. Ateya, and H. W. Pickering. 6 Nov. 1979. 33 p. refs.

(Contract N00014-75-C-0264)

(AD-A079963; TR-12) Avail: NTIS HC A03/MF A01 CSCL 11/6

The formation of protective layers on Cu-9.4Ni-1.7Fe alloy in air saturated, aqueous 3.4 wt% NaCl solution, both under natural corrosion and under potentiostatic conditions, have been studied by ESCA (XPS), SEM and X-ray diffraction. It was concluded that the protective film formed under open circuit corrosion conditions has the following features: (1) is comprised of a relatively thick outer layer mainly Cu2(OH)3Cl and an inner thin layer of probably Cu2O but also containing appreciable chloride and some nickel; (2) is rich in Cl throughout the film with a maximum concentration along a plane near the alloy/corrosion product interface; (3) is poor in Ni and Fe in the inner thin layer but rich in these elements further out from this region; and (4) has, in early stages of growth, an outer surface consisting of a cuprous (probably (Cu2O) compound which with time gives way to a carbonate and finally to a cupric (Cu2(OH)3Cl) compound. The maximum Cl content and the transition in Fe, Cu and Ni concentrations are rather sharply confined to the interface region between the thin inner and thick outer layers along which fracture occurs when the reaction product is stripped from the sample with tape. Thus, the fully developed protective film consists of at least two compositionally different layers which form a weak interface between them. GRA

N80-21507# Rutgers - The State Univ., Piscataway, N. J. Dept. of Ship Materials Engineering.

DETERMINATION OF PREFRACTURE FATIGUE DAMAGE

Robert Pangborn, Sigmund Weissmann, and Irvin R. Kramer. Jan. 1980. 185 p. refs. Prepared in cooperation with Naval Ship Research and Development Center, Bethesda, Md.

(Contract N00600-77-C-1134; ZR0020101)

(AD-A079538; DTNSRDC-80/006) Avail: NTIS HC A09/MF A01 CSCL 11/6

X-ray double crystal diffractometry and reflection topography were employed to examine the deformation response of single crystals and Al 2024 alloy specimens. A propensity for preferential work hardening of the surface layers compared to the bulk material was demonstrated for both tensile-deformed and fatigue-cycled metals. The cyclically induced defect distribution with depth from the specimen surface was also investigated as a function of the fraction of fatigue life. This led to a capability for predicting the fatigue life by a nondestructive X-ray diffraction method. Single crystals of silicon and aluminum pulled in tension exhibited a highly fragmented 'debris' layer, extending to about 100 microns in depth, and a core region featuring a much lower excess dislocation density and considerably less lattice breakup and disorientation. A similar decreasing gradient in the excess dislocation density from the surface to the bulk material was obtained for plastically deformed gold monocrystals for which no oxide layer is formed. Aluminum monocrystals cycled in the push-pull fatigue mode revealed a work-hardened surface layer and a transitional subsurface region between the surface layer and the core material. At sufficiently low stress amplitudes, no cyclic damage was introduced in the bulk despite the rapid generation and interaction of dislocations in the surface layer. GRA

N80-21508# American Univ., Washington, D. C. Dept. of Chemistry.

THE CHEMICAL NATURE OF ALUMINUM CORROSION. 1: ACTIVATION OF ALUMINUM SURFACES BY ALUMINUM SALTS. Progress Report

K. Sotoudeh, R. T. Foley, and B. F. Brown. Nov. 1979. 20 p. refs.

(Contract N00014-75-C-0799)

(AD-A079351; TR-10) Avail: NTIS HC A02/MF A01 CSCL 11/6

The activation of aluminum surfaces (alloys 1199-H14 and 7075-T6) by solutions of Al(NO3)3, AlBr3, AlCl3, Al2(SO4)2, Al(ClO4)3, AlI3, and NaCl of various concentrations has been measured. Experiments were also conducted in saturated solutions of aluminum acetate, benzoate, phosphate, chromate and fluoride. The dissolution rate of the alloys varies considerably with the salt, the nitrate and iodide being most aggressive. The corrosion rate in sulfate solutions is much less than the rate in bromide, chloride, or perchlorate. The pH of the various salt solutions is not the determining parameter but for a given salt (AlCl) the corrosion rate increases with decrease in pH. The experiments definitely demonstrate that the activation effect is not restricted to aluminum chloride and suggests a strong chemical effect in the pitting and stress cracking mechanism. GRA

N80-21509# Brown Univ., Providence, R. I. Div. of Engineering.

CREEP OF 2618 ALUMINUM UNDER SIDE STEPS OF TENSION AND TORSION AND STRESS REVERSAL PREDICTED BY A VISCOUS-VISCOELASTIC MODEL

William N. Findley. Aug. 1979. 36 p. refs.

(Grants DAAG29-78-G-0185)

(AD-A079284; EMRL-72) Avail: NTIS HC A03/MF A01 CSCL 11/6

Nonlinear constitutive equations were developed and used to predict the creep behavior of 2618-T61 Aluminum at 200 C (392 F) for combined tension and torsion stresses and under varying stress histories including side step stress changes and stress reversals. The constitutive equations consist of 5 components: linear elastic; time-independent plastic; nonlinear time-dependent plastic recoverable; nonlinear time-dependent nonrecoverable under positive stress; and nonlinear time-dependent nonrecoverable under negative stress. For time-dependent stress inputs, the modified superposition principle and strain hardening are used to describe the behavior of nonlinear time-dependent recoverable and nonlinear time-dependent nonrecoverable respectively. The theory which combines all these features, the viscous-viscoelastic theory, and other modified theories were used to predict from information from constant stress creep the creep behavior of 2618 aluminum under the above stress histories with very satisfactory agreement with the experimental results. GRA

N80-21510# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.

ULTRASONIC AND ACOUSTIC EMISSION DETECTION OF FATIGUE DAMAGE. Annual Technical Report, 1 Jun 1978 - 31 May 1979

S. R. Buxbaum, C. L. Friant, S. E. Fick, and R. E. Green, Jr. Jul. 1979. 74 p. ref.

(Contract F44620-76-C-0081; AF Proj. 2307)

(AD-A079277; AFOSR-79-1287TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

The purpose of the present research is to optimize existing ultrasonic and acoustic emission techniques and to investigate new ones for early detection of fatigue damage in aluminum alloys used in aircraft construction. An ultrasonic pulse-echo system was used during fatigue cycling to record conventional A-scan wave forms as well as to monitor ultrasonic attenuation on 7075-T651 aluminum alloy specimens possessing different surface conditions. In addition, acoustic emission signals were recorded simultaneously with the ultrasonic measurements on each test specimen using two different acoustic emission systems. The task of correlating evidence of cumulative fatigue damage and acoustic emission data was approached by the use of long term true-rms averaging of the system output and frequency domain analysis of acoustic emission signals recorded at selected intervals throughout the test. The integrity of the data was verified by independent electronic testing of the instrumentation, in situ eddy current and visual inspection, and metallographic examination. GRA

N80-21511# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.

FRACTURE AT ELEVATED TEMPERATURE IN DISPERSION STRENGTHENED ALLOYS. Final Technical Report, 1 Oct. 1975 - 30 Sep. 1979

Rishi Raj. 3 Dec. 1979. 37 p. refs.

(Grant AF-AFOSR-2930-76; AF Proj. 2306)

(AD-A080084; AFOSR-80-0043TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

This report describes important new findings in the understanding of intergranular cavitation and fracture in alloys which derive their creep strength from the presence of hard second phase particles, such as the nickel base superalloys. The work is primarily theoretical but is supported in most instances by simple experiments on model alloys. Criteria for the nucleation of cavities at high temperature are developed and it is shown that cavities are most likely to nucleate at particles in the grain boundaries. GRA

N80-21512# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Systems Support Div.

AN INVESTIGATION OF IMPROPERLY QUENCHED (SOFT) ALUMINUM PLATE. Final Report, Aug. - Oct. 1979

C. L. Harmsworth and G. J. Petrak. Dec. 1979. 65 p.

(AF Proj. 2418)

(AD-A079119; AFML-TR-79-4205) Avail: NTIS HC A04/MF A01 CSCL 11/6

A program was conducted to evaluate the effects on mechanical properties of a slack (slow) quench on one side of a plate following the solution heat-treatment of high strength aluminum alloys. Seven thick plates, ranging from 1-1/4 to 5-1/2 inches thick, were tested for their tensile properties. Hardness and electrical conductivity readings were taken on all of the specimens to ascertain whether or not recommended limits for these two indicators can accurately identify sub-strength (soft) material. One 5-1/2 inch thick plate of 2124-T851 was given a more extensive mechanical property evaluation than the others. On this plate it was observed that the tensile, compressions, bearing, strength of elemental joints, and notched fatigue strength at moderately high stress showed a significant reduction in properties. Smooth fatigue, crack growth resistance, fatigue crack growth, and corrosion resistance were not affected by the slack quench. Other plates of 7000- and 2000-series alloys were also evaluated. A wide range of conductivity and hardness values were correlated with mechanical properties. One 1-1/4 inch plate of 7075-T651 had low tensile properties on both sides, the cause of which is unknown. Within a given plate, hardness and conductivity measurements did correlate reasonably well with strength variations. Plate-to-plate correlations were less valid. GRA

N80-21513# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

HYDROGEN-INDUCED CLEAVAGE FRACTURE OF TYPE 304L AUSTENITIC STAINLESS STEEL

G. R. Caskey, Jr. 1979. 21 p. refs. Presented at Symp. on Fractography and Materials Sci., Williamsburg, Va., 27 Nov. 1979.

(Contracts EY-76-C-09-0001; AT(07-2)-1)

(DP-MS-79-24; CONF-791115-1) Avail: NTIS HC A02/MF A01

Type 304L stainless steel supersaturated with hydrogen gas fails in tension at 200 K to 250 K by brittle fracture. Fracture surfaces exhibit isolated facets oriented 0 deg to 30 deg to the tensile axis and have characteristics of cleavage fracture. The threefold symmetry of Laue back reflection photographs and trace analysis of deformation bands on the facets demonstrate that cleavage is along (111) planes. The fracture paths were identified as coherent twin boundaries on polished sections through facets and on microcracks across interior grains. Although cleavage fracture is not commonly observed in alloys with a face-centered cubic lattice, these observations for Type 304L stainless steel and similar observations on Nitronic-40 and Tenelon demonstrate that cleavage is possible under some circumstances in austenitic steels. DOE

N80-21514# Notre Dame Univ., Ind. Dept. of Metallurgical Engineering and Materials Science.

MICROSTRUCTURAL EFFECTS IN ABRASIVE WEAR, PHASE 1. Final Report, 15 Mar. 1977 - 1 Jul. 1979

Nicholas F. Fiore, T. H. Kosel, Joseph P. Coyle, John Fulcher, William Konkel, Mark Sturkal, and Stephen Udvardy. 16 Jul. 1979. 95 p. refs.

(Contract EF-77-S-02-4246)

(COO-424-9) Avail: NTIS HC A05/MF A01

Quantitative relations were established between microstructure and wear resistance for highly alloyed white irons and Co-base powder metallurgy alloys commonly used in coal mining, handling and conversion processes. The studies on cast irons and Co-base alloys clearly illustrate the importance of tailoring the microstructure of an alloy to the wear application in which it is employed. The wastefulness of indiscriminate alloying is obvious, as is the danger in the use of simple tools such as macrohardness to predict wear behavior. For Ni-hard 4 cast irons, wear correlates fairly well to quasi-static tensile properties. For both Ni-4 hard irons and Co-base alloys, SEMI-EDXS studies give insight as to the microscale flow-fracture processes governing wear. DOE

N80-21515# Hanford Engineering Development Lab., Richland, Wash.

EFFECT OF TEMPERATURE ON THE FRACTURE TOUGHNESS BEHAVIOR OF INCONEL X-750

W. J. Mills. Apr. 1979. 28 p. refs. Presented at Symp. on Fractography and Mater. Sci., Williamsburg, Va., 27 Nov. 1979.

(Contract EY-76-C-14-2170)

(HEDL-SA-1818; CONF-791115-2) Avail: NTIS HC A03/MF A01

Metallographic and electron fractographic examination of the Inconel X-750 fracture surfaces revealed that the slight increase in J/sub Ic/ at intermediate temperatures was associated with an intergranular to transgranular fracture mechanism transition. Under room temperature conditions, crack extension occurred primarily by an intergranular dimple rupture mechanism attributed to microvoid coalescence along a grain boundary denuded region. In the 427 C to 538 C regime, the fracture surface was dominated by a transgranular morphology consisting of poorly defined dimples coupled with a rather flat, faceted appearance. At the highest test temperature (649 C), intense heterogeneous slip initiated localized separation which resulted in a very faceted fracture surface morphology and a severe degradation in fracture toughness. DOE

N80-21516# Hanford Engineering Development Lab., Richland, Wash.

DUCTILE FRACTURE TOUGHNESS OF HEAVY SECTION PRESSURE VESSEL STEEL PLATE. A SPECIMEN-SIZE STUDY OF ASTM A 533 STEELS

J. A. Williams. Sep. 1979. 47 p. refs.

(Contracts EY-76-C-14-2170; DE-AC14-76FF-02170)

(NUREG-CR-0859; HEDL-TME-77-1) Avail: NTIS HC A03/MF A01

The ductile fracture toughness, J/sub Ic/, of ASTM A 533, Grade B, class 1 and ASTM A 533, heat treated to simulate irradiation, was determined for 10 to 100 mm thick compact specimens. The toughness at maximum specimen load was also measured to determine the conservatism of J/sub Ic/. The toughness of ASTM A 533, Grade B, Class 1 steel was 349 kJ/sq m and at the equivalent upper shelf temperature, the heat treated material exhibited 87 kJ/sq m. The maximum load fracture toughness was found to be linearly proportional to specimens size, and only specimen which failed to meet ASTM size criteria exhibited maximum load toughness less than J/sub Ic/. DOE

N80-21517# Westinghouse Electric Corp., Madison, Pa.

PITTING CORROSION IN 2-1/4 Cr-1 Mo STEEL TUBES: LOW TEMPERATURE TESTS

T. G. Chichester, S. A. Shiels, and G. R. Taylor. Sep. 1979. 25 p.

(Contract DE-AM02-76CH-94000)

(WARD-NA-3045-56) Avail: NTIS HC A02/MF A01

The potential inherent advantage of duplex tubes over single tubes in sodium steam generators was investigated with respect to pitting corrosion. Low temperature (less than or equal to 212F) corrosion tests of 2-1/4 Cr-1Mo steel duplex tube specimens, with and without heat flux are discussed. Corrosion rates and characteristics (pitting and general corrosion) are given for several different water chemistries. It is concluded that acidic conditions are more conducive to pitting corrosion than basic conditions, and, as expected, that the tube-to-tube interface is not effective in stopping general corrosion. It was, however, not possible to reach a conclusion on the efficacy of the tube-to-tube interface in preventing pitting corrosion. DOE

N80-21518# North Texas State Univ., Denton.
FORMATION OF SUPERSATURATED ALLOYS BY ION IMPLANTATION AND PULSED-LASER ANNEALING Ph.D. Thesis
Syd Robert Wilson Aug. 1979 174 p refs
(Contract EY-76-C-05-0033)
(ORO-0033-T1) Avail: NTIS HC A08/MF A01

Supersaturated substitutional alloys formed by ion implantation and rapid liquid-phase epitaxial regrowth induced by pulsed-laser annealing were studied using Rutherford-backscattering and ion-channeling analysis. A series of impurities (As, Sb, Bi, Ga, In, Fe, Zn, Cu) were implanted into single-crystal (001) orientation silicon at doses ranging from 1 x 10 to the 15th power/sq cm to 1 x 10 to the 17th power sq cm. The samples were subsequently annealed with a Q-switched ruby laser (energy density approximately 1.5 J sq cm, pulsed duration 15 x 10 to the 4th power sec). Ion-channeling analysis shows that laser annealing incorporates (Ga, In) and (As, Sb, Bi) impurities into substitutional lattice sites at concentrations far in excess of the equilibrium solid solubility. Channeling measurements indicate the silicon crystal is essentially defect free after laser annealing. DOE

N80-21519# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.
STRESS CORROSION CRACKING OF INCONEL 600 TURBINE IN DEAERATED HIGH TEMPERATURE WATER
T. S. Bulischeck, Y. S. Park, and D. vanRooyen Jun. 1979 50 p refs
(Contract EY-76-C-02-0016)
(NUREG-CR-0858; BNL-NUREG-51027; NRC-a-3205) Avail: NTIS HC A03/MF A01

Inconel 600 will undergo stress corrosion cracking (SCC) at grain boundaries when subjected to a high stress and exposed to water without oxygen at high temperature. Tests conducted to improve qualitative and quantitative understanding of factors influencing SCC in deaerated high temperature aqueous media indicate that intergranular SCC is produced quite readily in some heats of tubing (1) when exposed at constant deflection; (2) when slightly cold worked and subjected to straining at low rates; (3) when subjected to slow cyclic stress; or (4) when the electrochemical potential of stressed pieces is controlled. Cracking was produced in Inconel 600 under conditions that had not been examined and reported before. First trends of temperature dependence of SCC are discussed. Some tentative correlations are made with microstructural variables, although a simple relationship with such structure or prior processing has not been defined. Heating at 700 C for about 15 hours improved the SCC resistance dramatically. DOE

N80-21520# International Nickel Co., Inc., Suffern, N. Y. Research and Development Center.
EVALUATION OF HIGH CHROMIUM OVERLAYS TO PROTECT LESS ALLOYED SUBSTRATES FROM CORROSION IN A COAL GASIFICATION ATMOSPHERE Quarterly Report, 1 Sep. - 30 Nov. 1978
Edward P. Sadowski 1978 33 p refs
(Contract EF-77-C-01-2621)
(FE-2621-5) Avail: NTIS HC A03/MF A01

Inspection by Dy-chek and bend tests were completed. All AWS-ER 309 and INCONEL Filler Metal 72 weldments and fifteen of eighteen R139 weldments were bent 180 deg around a mandrel successfully. Mixed results were obtained on three of the R139 weldments. Stress-rupture testing at 1800 F shows no significant differences in the tensile strength of weldments due to filler metal, substrate or weld process and indicate that the substrates and welding process have an effect on the stress rupture strength. The weldments with the INCOLOY alloy 800H substrate with inert gas deposited overlays have the higher stress rupture strength. The submerged-arc weldments had the lowest stress rupture strength for each filler metal and substrate. DOE

N80-21521# Argonne National Lab., Ill.
CHARACTERIZATION OF IRRADIATED ZIRCALOYS: SUSCEPTIBILITY TO STRESS-CORROSION CRACKING Interim Report
F. L. Yaggee, R. F. Mattas, and L. A. Neimark Sep. 1979 113 p refs
(Contract W-31-109-eng-38)
(EPRI-NP-1155) Avail: NTIS HC A06/MF A01

Irradiated Zircaloy cladding specimens which experienced burnups from 6 to 30 MWd/kg U were gas-pressure tested in an iodine environment to investigate their stress-corrosion cracking (SCC) susceptibility. Several cladding sources were used in the investigation, and both PWR and BWR claddings were tested. The test temperatures ranged from 320 C to 360 C and the test hoop stresses ranged from 150 to 500 MPa (22 to 72 ksi). Two iodine concentrations, 6.0 and 0.6 mg/sq cm, were used in the tests. Failure times ranged from 360 s (6 min) at high stresses to 500,000s (142 h) at low stresses. For specimens that experienced a burnup of > or = 10 MWd/kg U, the 24-h failure stress was 177 + or - 18 MPa (25.6 + or - 2.6 ksi), regardless of the preirradiation metallurgical condition. Scanning electron microscopy and optical metallography were used to characterize the SCC failures. An analytical model for iodine SCC was developed which correlates reasonably well with the test results. DOE

N80-21522# Oak Ridge National Lab., Tenn.
OPTICAL PROPERTIES OF METALS BY SPECTROSCOPIC ELLIPSOMETRY
E. T. Arakawa, T. Inagaki, and M. W. Williams 1979 50 p refs Presented at 4th Intern. Conf. on Ellipsometry, Berkeley, Calif., 20 Aug. 1979
(Contract W-7405-eng-26)
(CONF-790857-1) Avail: NTIS HC A03/MF A01

The use of spectroscopic ellipsometry for the accurate determination of the optical properties of liquid and solid metals is discussed and illustrated with data for Li and Na. Additional data on liquid Sn and Hg from 0.6 to 3.7 eV are presented. Liquid Sn is Drude-like. The optical properties of Hg deviate from the Drude expressions, but simultaneous measurements of reflectance and ellipsometric parameters yield consistent results with no evidence for vectorial surface effects. DOE

N80-21523# Sandia Labs., Albuquerque, N. Mex.
INFLUENCE ON THE ELECTRONIC STRUCTURE OF PALLADIUM UPON HYDROGEN UPTAKE
A. C. Switendick 1979 8 p refs Presented at 2nd JIM Intern. Symp. on Hydrogen in Metals, Minakami Spa, Japan, 26 Nov. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1097C; CONF-791132-1) Avail: NTIS HC A02/MF A01

A supercell calculation for Pd32H was performed to model the influence of dilute hydrogen on the electronic properties of palladium. A hydrogen associated band was found approximately 0.70 eV below the palladium d-manifold of width < 0.25 eV indicating little hydrogen-hydrogen interaction. This band characteristic of the Pd6H complex has 0.50 electron associated with the hydrogen and almost one electron on the palladiums of which over half was d-like in character. Since this band was formed from states already filled in palladium (and was not a new bound state), the added hydrogen electron goes into states at the Fermi energy which were largely unperturbed d-states of the host. DOE

N80-21524# Oak Ridge National Lab., Tenn.
FATIGUE CRACK PROPAGATION IN THE HEAT-AFFECTED ZONE OF 2-1/4 Cr-1Mo STEEL AND ERNiCr-3 WELDMENTS Interim Report
T. Weerasooriya Oct. 1979 36 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6971) Avail: NTIS HC A03/MF A01

The fatigue crack growth rate at 510 C was examined in the heat-affected zone (HAZ) of a 2-1/4 Cr-1 Mo steel weldment as a function of frequency and stress intensity factor. The weldment was made of isothermally annealed 2-1/4 Cr-1 Mo steel base metal and ERNiCr-3 weld metal. Fatigue crack growth rate data for thermally aged HAZ material lies between the two scatter bands of data for the base metal and ERNiCr-3 filler metal at 510 C. Prior thermal aging up to 2,000 h at 566 C does not substantially change the fatigue crack growth rate of HAZ material at 510 C. DOE

N80-21525# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

CORROSION FATIGUE IN TITANIUM ALLOYS

R. J. H. Wanhill Nov. 1979 35 p refs Presented at SEECO 79 Soc. of Environ. Engr., May 1979

(NLR-MP-78039-U) Avail: NTIS HC A03/MF A01

An overview of alpha and alpha-beta titanium alloy corrosion fatigue is given. Most data concern constant amplitude fatigue crack propagation, but there are also results for crack propagation under variable amplitude loading and for smooth and notched fatigue life tests. Several guidelines for maximizing the resistance to corrosion fatigue are established and their practical significance is discussed. It is concluded that crack propagation predictions, both for constant and variable amplitude loading, must account properly for the occurence of cyclic stress corrosion.

Author (ESA)

N80-21526# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

THE EFFECT OF GUST LOAD ALLEVIATION ON FATIGUE AND CRACK GROWTH IN ALCLAD 2024-T3

J. B. deJonge and A. Nederveen 6 Mar. 1979 25 p refs Presented at ASTM Symp. on Effect of Load Spectrum Vehicles on Fatigue Crack Initiation and Propagation, San Francisco, May 1979

(NLR-MP-79011-U) Avail: NTIS HC A02/MF A01

Fatigues tests under flight simulation loading were done on simply notched sheet specimens made of ALCLAD 2024-T3 to assess the fatigue life increase obtained by gust alleviation. Test results did show an important increase in crack initiation life, but crack propagation life was little affected. The observed effect on fatigue life could be reasonably well predicted by Miner type life calculations. Miner type calculations, however, are bound to fail in predicting the effect of spectrum-variations such as deletion of g.a.g. cycle or small gust cycles. Author (ESA)

N80-21527# European Space Agency, Paris (France).

ORDERING EFFECTS IN TRANSITION METAL ALLOYS IN RELATION TO THEIR ELECTRONIC STRUCTURE

Guy Treglia Jan. 1980 96 p refs Transl. into ENGLISH of "Effets d'Order dans les Alliages de Metaux de Transition en Relation avec leur Structure Electronique", Rept. ONERA-NT-1978-9 ONERA, Paris Original report in FRENCH previously announced as N80-17215

(ESA-TT-600; ONERA-NT-1978-9) Avail: NTIS HC A05/MF A01

The ordering energy in transition metal alloys, unlike the cohesive energy, can be written as the sum of effective pair interactions. These interactions are defined here in terms of quantities calculated from the electronic structure of these metals. Two methods can be used. In the first ('annealed' alloy), the susceptibility chi sub q is obtained by means of a molecular field method using an extremization of the free energy, and the interaction identified by analogy with the Ising model. The best thermodynamic one-site approximation is found to be the coherent potential approximation (CPA). In the second method ('frozen' alloy), the ordering energy is given by a generalized perturbation method taking as reference state the completely disordered state treated within the usual CPA. These two methods lead to the same concentration-dependent effective pair interactions. This is true even if charge transfers are taken into account. A detailed numerical discussion shows the validity range of the model to be the same as that of CPA. Author (ESA)

N80-21528# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.

INFLUENCE OF MICROSTRUCTURE AND TEST TEMPERATURE ON TENSILE AND CREEP PROPERTIES OF TITANIUM ALLOYS

Albert Gysler and Gerd Luetjering (Ruhr Univ.) Jul. 1979 68 p refs

(DFVLR-FB-79-24) Avail: NTIS HC A04/MF A01

Short time tensile and creep tests were carried out at elevated temperatures up to 600 deg C on age hardened Ti-Al, Ti-Mo, Ti-6Al-4V, and Ti-8.8Al-4V alloys. The microstructural parameters studied include degree of particle hardening, grain, size, morphology and dimensions of alpha and beta phases, oxygen content and texture. The temperature dependance of the yield stress was influenced only by the oxygen content, while through variations of all other parameters the absolute yield stress values were varied by constant amounts over the whole test temperature range studied. The highest creep resistance was obtained for those microstructures which exhibited a large volume fraction of small coherent particles. Author (ESA)

N80-21529# Bureau of Mines, Avondale, Md.

COMPOSITION DEPTH PROFILES AND THE EFFECTS OF ANNEALING FOR ION-IMPLANTED ALLOYS

A. B. Campbell, B. D. Sartwell, and P. B. Needham, Jr. 1979 31 p refs

(PB80-122765; BM-RI-8387) Avail: NTIS HC A03/MF A01 CSCL 11F

Proton-included X-ray emmision and inert gas ion sputtering were utilized to generate composition depth profiles for Fe-Cr, Fe-Ni, and Fe-Al ion implanted alloys fabricated by implanting 25 keV Cr(±), Ni(±), or Al(±) into iron substrates. The data were fitted (utilizing a computer program) with symmetrical Gaussian profiles yielding values for the range and range straggle of the ions. These parameters were than compared with those calculated from theory. Changes in the profiles due to annealing were investigated and values for the diffusion coefficient were obtained assuming diffusion according to Fick's Law. For the Cr(±) and Ni(±) implantation, the profiles as-implanted agree reasonably well with theory and exhibit normal diffusion characteristics at 500 C. For the Al(±) implantation, the profile as implanted is much broader than predicted and exhibits substantial enhanced diffusion at temperatures up to 500 C.

GRA

N80-21530# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.

SUPERPLASTICITY IN SELECTED MAGNESIUM-BASE ALLOYS

M. M. Tilman, R. L. Crosby, and L. A. Neumeier 1979 23 p refs

(PB80-125875; BM-RI-8382) Avail: NTIS HC A02/MF A01 CSCL 11F

Commercial compositions of the alloys ZK60A (Mg-5.5Zn-0.45Zr) and AZ61A (Mg-6.5Al-1Zn) were melted, cast, and extruded to 3/8-inch diameter rod having average grain diameters of less than 10 micrometers. Tensile testing was conducted to delineate parameters of superplasticity at temperatures ranging from 270 to 330C and initial strain rates of 0.002 to 2.0/min. The strain-rate sensitivity index of both alloys was determined. Maximum elongations of over 680 pct and 700 pct were obtained for ZX61A and ZK60A, respectively. The potential for commercial superplastic forming would appear somewhat more favorable for ZK60A than for AZ61A, because ZK60A retains higher strengths after deformation than does AZ61A, and maximum superplasticity occurs at higher strain rates in ZK60A, which facilitates forming. GRA

N80-21531# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.

PROPERTIES OF MANGANESE-COPPER ALLOYS PREPARED FROM METAL POWDERS

J. L. Holman, R. L. Crosby, and L. A. Neumeier 1979 39 p refs

(PB80-125867; BM-RI-8383) Avail: NTIS HC A03/MF A01 CSCL 11F

Blends of minus 200-mesh elemental powders were compacted cold in directional and isostatic presses. With 1 pct binder, typical green densities ranged between 76 and 80 pct of theoretical when pressing at 30 or 48 tsi. Green strength increased with compacting pressure and copper content. As-sintered tensile strengths, sintered densities, strength, and ductility were determined. When aged to the damping condition, alloys containing 60 to 70 pct Mn exhibited > 40 pct specific damping capacity (SDC) at 5,000-psi stress, considerably higher than values reported for equivalent cast material. Effects of 1 or 3 pct Sn or Zn additions on SDC and other properties were assessed. GRA

N80-21422# European Space Research and Technology Center, Noordwijk (Netherlands).

THE METALLURGICAL EXAMINATION OF SPACECRAFT MATERIALS FAILURES
B. D. Dunn *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 5-21 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-22241# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF A TA6V TITANIUM ALLOY AFTER POWDER PRODUCTION BY THE CENTRIFUGAL PROCESS
Michel Marty, Henri Octor, Christiane Renon, and Andre Walder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 15-23 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 165-171 Original report in FRENCH previously announced as A79-41303 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

N80-22251# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOT SALT STRESS CORROSION CRACKING OF A TA6V ALLOY BY SODIUM CHLORIDE
Gilles Lapasset *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 45-53 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 255-261 Original report in FRENCH previously announced as A79-48852 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-21532*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF OXIDE ADDITIONS AND TEMPERATURE ON SINTERABILITY OF MILLED SILICON NITRIDE
Alan Arias Apr. 1980 21 p refs
(NASA-TP-1644; E-243) Avail: NTIS HC A02/MF A01 CSCL 11D

Specimens of milled alpha-Si3N4 with 0 to 5.07 equivalent percent of oxide additions were pressureless sintered at 1650 to 1820 C for 4 hours in nitrogen while covered with powdered Si3N4 + SiO2. Densities of less than or equal to 97.5 percent resulted with approximately 2.5 equivalent percent of MgO, CeO2, Y2O3, and three mixtures involving these oxides. Densities of greater than or equal to 94 percent were obtained with approximately 0.62 equivalent percent of the same additives. At most temperatures, best sinterability (density maxima) was obtained with 1.2 to 2.5 equivalent percent additive. J.M.S.

N80-21533*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CARBORANYLCYCLOTRIPHOSPHAZENES AND THEIR POLYMERS Patent Application
Larry L. Fewell, Harry Rex Allcock (Pennsylvania State Univ., University Park), John Philip OBrien (Pennsylvania State Univ., University Park), and Angelo George Sopelianos, inventors (to NASA) (Pennsylvania State Univ., University Park) Filed 12 Mar. 1980 10 p
(NASA-Case-ARC-11176-1; US-Patent-Appl-SN-129799) Avail: NTIS HC A02/MF A01 CSCL 07C

Carboranyl-substituted polyphosphazenes are prepared by heat polymerizing a carboranyl halocyclophosphazene at 250 C for about 120 hours in the absence of oxygen and moisture. The cyclophosphazene is obtained by allowing a lithium carborane, e.g., the reaction product of methyl-o-carborane with n-butyllithium in ethyl ether, to react with hexachlorocyclotriphosphazene at ambient temperatures and in anhydrous conditions. For greater stability in the presence of moisture, the chlorine substituents of the polymer are then replaced by aryloxy or alkoxy groups, such as CF3CH2O(-). The new substantially inorganic polymers are thermally stable materials which produce a high char yield when exposed to extreme temperatures, and can thus serve to insulate less heat and fire resistant substances. NASA

N80-21534*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION, FRICTION, AND WEAR OF BINARY ALLOYS IN CONTACT WITH SINGLE-CRYSTAL SILICON CARBIDE
Kazuhisa Miyoshi and Donald H. Buckley 1980 24 p refs Prepared for the Intern. Joint Lubrication Conf., San Francisco, 18-21 Aug. 1980; cosponsored by ASME and the Am. Soc. of Lubrication Engr.
(NASA-TM-79282; E-221) Avail: NTIS HC A02/MF A01 CSCL 11F

Sliding friction experiments, conducted with various iron base alloys (alloying elements are Ti, Cr, Mn, Ni, Rh and W) in contact with a single crystal silicon carbide /0001/ surface in vacuum are discussed. Results indicate atomic size misfit and concentration of alloying elements play a dominant role in controlling adhesion, friction, and wear properties of iron-base binary alloys. The controlling mechanism of the alloy properties is as an intrinsic effect involving the resistance to shear fracture of cohesive bonding in the alloy. The coefficient of friction generally increases with an increase in solute concentration. The coefficient of friction increases as the solute-to-iron atomic radius ratio increases or decreases from unity. Alloys having higher solute concentration produce more transfer to silicon carbide than do alloys having low solute concentrations. The chemical activity of the alloying element is also an important parameter in controlling adhesion and friction of alloys. M.G.

N80-21535# Electrochemical Technology Corp., Seattle, Wash.
A STUDY OF TRANSPORT PROCESSES AND INITIATION OF CORROSION UNDER PAINT FILMS Final Report, 1 Oct. 1978 - 30 Sep. 1979
Theodore R. Beck and Robert T. Ruggeri Nov. 1979 53 p refs
(Contract F49620-78-C-0029; AF Proj. 2303)
(AD-A079979; AFOSR-80-0028TR) Avail: NTIS HC A04/MF A01 CSCL 13/8

Combating corrosion of airplane structure is a large and increasing cost to the Air Force. Fundamental knowledge of how protective coatings function is required in order to develop improved coating systems. This research was directed to obtain quantitative knowledge of mass transport and kinetic mechanisms that result in initiation of corrosion under paint films. Mathematical modeling of transport processes and electrochemical tests on paint films were conducted concurrently. Coating systems of current use in the Air Force, polyurethane and epoxy, were examined. Experiments were conducted with detached films and with films on aircraft alloy aluminum and iron substrates. GRA

N80-21536# Dayton Univ. Research Inst., Ohio.
STATUS OF THE US AIR FORCE ORDERED POLYMERS RESEARCH PROGRAM Final Report, 1 May - 30 Sep. 1979
Thaddeus E. Helminiak (AFML) and Donald R. Wiff Jun. 1979 19 p Presented at the Ordered Polymer Res. Rev., Dayton, Ohio, 11-13 Jun. 1979
(Contract F49620-79-C-0097; AF Proj. 2303)
(AD-A080105; UDR-TR-79-73; AFOSR-80-0060TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

This report presents a general overview of the 'Ordered Polymer Research Review' organized by the University of Dayton Research Institute. The proceedings are included under the major headings Agenda, Abstracts, and List of Attendees. This research review was sponsored by the Air Force Office of Scientific Research. GRA

N80-21537# Army Materials and Mechanics Research Center, Watertown, Mass. Polymer Research Div.
HPLC AND GPC ANALYSIS OF EPON 828 EPOXY RESINS Final Report
Gary L. Hagnauer Nov. 1979 22 p
(DA Proj. 1L1-61102-AH-42)
(AD-A080221; AMMRC-TR-79-59) Avail: NTIS HC A02/MF A01 CSCL 07/4

EPON 828 samples manufactured in Australia, Canada, the United Kingdom, and the United States are analyzed using gel permeation chromatography (GPC) and reverse bonded-phase high performance liquid chromatography (HPLC). Variations in resin composition are monitored and quantitatively analyzed. Molecular weights calculated from GPC data are in close agreement with values determined by vapor phase osmometry. Differences in chemical composition are much more apparent when the resins are monitored using the HPLC method than by GPC. The results of the analyses and limitations of the methods are discussed. GRA

N80-21538# National Bureau of Standards, Washington, D.C. Fracture and Deformation Div.
STRESS CORROSION OF CERAMIC MATERIALS Annual Report, 1 Mar. - 30 Sep. 1979
S. W. Freiman, S. M. Wiederhorn, C. J. Simmons, E. R. Fuller, Jr., and P. N. Krishnan Dec. 1979 41 p refs
(Contract N00014-79-F-0030; RR0220201; NBS Proj. 5620454)
(AD-A080225) Avail: NTIS HC A03/MF A01 CSCL 11/2

A film deposition and surface analysis system has been set up. This system will be used for the analysis of the effect of stress on chemical reactions of ceramics with environments such as water. Preliminary results of Raman spectroscopy experiments suggest that there is an increase in the number of defects in the structure of fused silica under stress. A model describing the effect of water diffusion controlled crack growth has been derived. It was shown that the presence of a relatively K sub I independent region of crack growth has a significant effect on proof testing. GRA

N80-21539# Department of National Defence, Ottawa (Ontario). Environmental Protection Section.
MEASUREMENTS AND CALCULATIONS OF THE THERMAL RESISTANCE OF THREE SYNTHETIC-FIBRE BATTINGS
B. Farnworth, R. M. Crow, and M. M. Dewar Nov. 1979 36 p ref
(AD-A080616; DREO-818) Avail: NTIS HC A03/MF A01 CSCL 11/5

A theory of the combined transport of heat by radiation and by conduction in fibrous media is presented. The theory agrees well with the measured thermal resistance of three insulating battings and explains the difference between them without the inclusion of convective heat transfer being required. GRA

N80-21540# Ford Motor Co., Dearborn, Mich. Engineering and Research Staff.
TIME-TEMPERATURE STUDIES OF HIGH TEMPERATURE DETERIORATION PHENOMENA IN LUBRICANT SYSTEMS SYNTHETIC ESTER LUBRICANTS Final Report, 1 Apr. 1976 - 30 Sep. 1979
L. R. Mahoney, S. Korcek, P. A. Willermet, E. J. Hamilton, Jr., and R. K. Jensen 1979 144 p refs
(Contract F44620-76-C-0097; AF Proj. 2303)
(AD-A080135; AFOSR-80-0065TR) Avail: NTIS HC A07/MF A01 CSCL 11/8

A kinetic and mechanistic study of the autoxidation of liquid pentaerythrityl tetraheptanoate, PETH, in a stirred flow reactor at 180 to 220 C was completed. The results are consistent with the occurrence of a chain reaction scheme similar to that proposed for n-hexadecane autoxidation. This scheme includes the formation of monohydroperoxides by an intermolecular abstraction reaction, formation of alpha, gamma and alpha, delta-dihydroperoxides and hydroperoxyketones by intramolecular peroxy radical abstraction reactions and bimolecular termination reaction of peroxy radicals, and rapid conversion of alpha, gammma-hydroperoxyketones to cleavage acids and methylketones. Based upon the results of these inhibited autoxidation studies a method for establishing the relationships between structure and thermoxidative stability of synthetic ester lubricants has been developed. GRA

N80-21541# Manlabs, Inc., Cambridge, Mass.
CALCULATION OF CERAMIC PHASE DIAGRAMS Final Report, 1 Dec. 1975 - 30 Sep. 1979
Larry Kaufman 30 Nov. 1979 100 p refs
(Contract F44620-76-C-0060)
(AD-A080218; AFOSR-80-0041TR) Avail: NTIS HC A05/MF A01 CSCL 11/2

A data base is being developed for calculation of quasibinary and quasiternary phase diagrams of oxide and oxynitride ceramic systems. The current base covers combinations of Cr2O3, MgO, Al2O3, Fe2O3, Fe3O4, FeO, CaO, SiO2, Si3N4 and AlN. Lattice Stability, Solution and Compound Phase Parameters were derived covering the liquid, spinel, periclase, corundum alpha and beta quartz, crystobalite, tridymite and beta Si3N4 structures in all of the quasibinary systems composed of the data base compounds. Evaluation of these parameters permit calculation of the thermochemical properties of these systems in good agreement with limited thermochemical data. In addition, isothermal quasiternary systems of selected oxide and oxynitride systems composed of data base compounds have also been calculated over a wide range of temperature. The free energy of formation of beta sialons in the Si3N4-Al2O3-AlN system and the X phase in the SiO2-Al2O3-Si3N4 system have been calculated. GRA

N80-21542# Akron Univ., Ohio. Inst. of Polymer Science.
THE RELATION OF MOLECULAR STRUCTURE TO ADHESION Final Report, 15 May - 30 Sep. 1979
Alan N. Gent May 1979 84 p refs
(Contract F49620-79-C-0126; AF Proj. 2303)
(AD-A080134; AFOSR-80-0066TR) Avail: NTIS HC A05/MF A01 CSCL 11/1

Structural adhesives are required to have a number of properties. They must be easy to apply, rigid when set, and strong under both impact loading and sustained loading. Moreover, they must adhere tenaciously to metal surfaces, even in the presence of aggressive environments and over long periods of time. These features cannot at present be predicted from the results of simple physical or chemical tests, and thus the relation between molecular structure and successful use as an adhesive is not understood. This situation is of serious concern to developers of new adhesive systems and also to users of advanced adhesion technology, notably the Air Force. A series of technical presentations and discussions by leading research scientists in adhesion was therefore held at The University of Akron on May 29 and 30, 1979. Recommendations on a systematic program of research directed towards solving this serious scientific and technical problem were then brought forward by each discussion group for consideration and review. GRA

N80-21543# California Univ., Los Angeles.
STRUCTURE AND PROPERTIES OF GLASSES Final Report, 1 Sep. 1974 - 30 Sep. 1978
John D. Mackenzie Nov. 1979 18 p refs
(Grant AF-AFOSR-2764-75; AF Proj. 2303)
(AD-A080211; AFOSR-80-0052TR) Avail: NTIS HC A02/MF A01 CSCL 11/2

A theory was developed to calculate the expansion coefficient of oxide glasses and new glasses of high expansion prepared phase separation was found to have large effects on expansion. When the surface of glasses was treated by pressure, the ion-exchange rate was significantly increased. The elastic properties were affected by ion-exchange. GRA

N80-21544# Naval Ship Research and Development Center, Bethesda, Md. Ship Materials Engineering Dept.
OUTGASSING OF SHIPBOARD HYDRAULIC FLUIDS Final Report
Peter Demas Jan. 1980 26 p refs
(ZF43431001)
(AD-A080351; DTNSRDC/SME-79-17) Avail: NTIS HC A03/MF A01 CSCL 11/8

The outgassing characteristics of single samples of three classes of Navy hydraulic fluids were investigated in order to help establish a basis for determining the potential toxicity of resulting gases in ship's atmospheres. Hydraulic fluids studied were: neopentyl polyol ester (MIL-L-23699B); triaryl phosphate (experimental); and petroleum base hydrocarbons (MIL-L-17331F). The samples were sequentially exposed to temperatures of 50, 100, 250, and 450 C each for 3 hours, and the types and amounts of the outgassed products were determined. The neopentyl polyol ester hydraulic fluid emitted large numbers of carbon monoxide, aldehydes, and nitrogen oxides at 250 C, and

above. The triaryl phosphate hydraulic fluid emitted amounts of carbon monoxide, nitrogen oxides, and aldehydes in excess of the threshold limit value only when heated to 450 C. It contained a large amount of a phenol-type constituent. The petroleum base hydrocarbon hydraulic fluid emitted carbon monoxide at 250 C and above and aldehydes at 450 C in excess of threshold limit values. Of these emissions, the carbon monoxide and aldehydes from the neopentyl polyol ester and the phenol-type constituent from the triaryl phosphate are the most potentially hazardous. It is recommended that further outgassing studies be carried out on additional samples of each of the classes of hydraulic fluids studied to establish whether or not the behavior observed in this study is typical. This will provide a basis for materials modifications/substitutions to reduce potential hazards. GRA

N80-21545# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
PHYSICAL AGING STUDIES OF SEMICRYSTALLINE POLY(ETHYLENE TEREPHTHALATE)
Martin R. Tant and Garth L. Wilkes 9 Nov. 1979 26 p refs Submitted for publication
(Contract N00014-78-C-0629; NR Proj. 356-692)
(AD-A079607; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

Physical aging of semicrystalline poly(ethylene terephthalate) has been investigated as a function of crystalline content. Stress-strain, stress relaxation, and differential scanning calorimetry experiments were used to monitor the physical aging process. It was found that both the overall extent and the rate of physical aging in this material decrease with increasing crystallinity. Several possible reasons for this behavior are advanced and discussed. It was also found that the drawing behavior of amorphous PET changes significantly as physical aging progresses. Specifically, for samples aged and then elongated, the extent of localized deformation (necking) and associated strain-induced crystallization was greater for samples aged for longer periods of time. GRA

N80-21546# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
PHYSICAL AGING STUDIES OF STYRENE-BUTADIENE AND CARBONATE-SILOXANE BLOCK COPOLYMERS
Martin R. Tant and Garth L. Wilkes 19 Nov. 1979 25 p refs Submitted for publication
(Contract N00014-78-C-0629)
(AD-A079608; TR-2) Avail: NTIS HC A02/MF A01 CSCL 11/9

The physical aging process in styrene-butadiene and carbonate-siloxane block copolymers has been studied by monitoring the time dependent changes in mechanical and thermal properties. Specifically, stress-strain, stress relaxation and differential scanning calorimetry experiments were utilized. For the styrene-butadiene systems, it was found that the rate of physical aging increases with decreasing glassy content between 50 and 100% glass. However, the rate must decrease to zero when the percent glass reaches zero. The occurrence of physical aging was also noted in the polycarbonate siloxane block copolymer investigated. The data are discussed in light of the practical ramification of utilizing these block copolymers in material applications. GRA

N80-21547# Celanese Research Co., Summit, N.J.
PROCESSING MECHANISMS, STRUCTURE AND MORPHOLOGY OF HIGH TEMPERATURE POLYMERIC ALLOYS, PART 2 Final Technical Report, 1 Feb. 1977 - 31 Jan. 1979
Ian L. Hay, Jay R. Shaner, Peter Sullivan, Ted T. L. Chang, and Richard R. Kemmerer Mar. 1979 64 p refs
(Contract F49620-77-C-0046; AF Proj. 2303)
(AD-A080068; AFOSR-78-0954TR-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 11/9

The processing conditions expected to optimize interactions at a molecular level between poly-(bisbenzimidazobenzophenanthroline) (BBB) and polybenzimidazole (PBI) have been investigated and the reaction products evolved under these conditions examined. Studies of the mechanical properties and the morphology indicate that binary interactions between BBB-BBB, PBI-PBI and BBB-PBI may all be occurring. The BBB-BBB interactions occur at temperatures greater than 500 C but PBI-PBI and BBB-PBI interactions arise at temperatures more than 100 C lower. Mass spectroscopic studies indicate that the principal reaction products in the presence of PBI are water and phenol whereas with BBB alone only water is evolved. Moreover in the mixture of BBB-PBI, phenol is evolved at lower temperatures than is the case with PBI alone. Possible end group reactions and reactions with partially cyclized rings, consistent with the observed evolution of water and phenol, are proposed for the improved processability of BBB in the presence of PBI. Further work to confirm the proposed reactions and the use of other additives to enhance these reactions is recommended. GRA

N80-21548# Bendix Corp., Kansas City, Mo.
GAS PLASMA TREATMENT TO IMPROVE THE BONDABILITY OF A RTV SILICONE TO FOAMED POLYPROPYLENE
James S. Tira Jul. 1979 14 p Presented at the DOE Weapons Complex Ann. Adhesive Conf., Amarillo, Tex., 5 Jun. 1979
(Contract EY-76-C-04-0613)
(BDX-613-2224; CONF-790668-3-Rev) Avail: NTIS HC A02/MF A01

A chemically blown, injection molded polypropylene foam was used as a support collar. The polypropylene was foamed using 0.5 to 0.7 percent by weight of a nitrogen blowing agent. The collar was used in an environment which requires that it be coated with a thermal protective material. A RTV coating of 0.0150 + or - 0.005 in (0.381 + or - 0.127 mm) was selected as the thermal protective material. Control of the coating thickness, on the polypropylene part proved to be important. After several methods were considered, it was decided that molding the silicone over the approximately 90 sq in (581 cu cm) surface was the most efficient. Aluminum molds were used which have cavities slightly larger than the polypropylene part. Mixed and de-aired silicon was injected into the mold where it flows around the part and cures and bonds to the polypropylene. The two part, vinyl addition-type silicone was selected because of its reversion resistance, a low viscosity which allows it to be injected into the mold, and its ability to be cured in a confined space. DOE

N80-21549# Sandia Labs., Albuquerque, N. Mex.
CHARACTERIZATION AND AGING OF RUBBER MODIFIED EPOXIES
J. A. Sayre 1979 25 p refs Presented at the Process Technol. Rev. Conf., St. Petersburg, Fla., 11 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1858C; CONF-790967-1) Avail: NTIS HC A02/MF A01

A tranmission electron microscopy study for rubber modified epoxy cured with diethanol amine has shown that a broad distribution of particle sizes exists. Only 50 vol % of the particles have diameters greater than 0.1 micrometer am. The resin/rubber interface was within the 500 angstroms resolution limit of the method employed. A model was developed to predict physical properties of rubber modified epoxies over the life of weapon systems. Preliminary results show that the chief aging phenomenon occuring is increased crosslink density of the epoxy matrix. No changes in the rubber phase have been detected. The effect of increased crosslink density has been higher volume resistivity at 66% C, increased tensile strength, and decreased ultimate elongation. DOE

N80-21550# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
FATIGUE OF FIBER-REINFORCED PLASTICS. A LITERATURE SURVEY
Christer Lundemo 23 Aug. 1979 46 p refs
(Contract SWEDBESD-5061.012)
(FFA-TN-AU-1499) Avail: NTIS HC A03/MF A01

A review of constant amplitude fatigue of fiber reinforced plastic laminates taken from recent literature is presented. An inventory of test methods and choice of failure criteria is made. It has been found that the method of testing, which does not coincide with that used for metals, is of major importance for composite materials. Excellent fatigue properties for fiber controlled tension loaded laminates are reported. However, composites loaded in both tension and compression do suffer fatigue. It is, important to distinguish between different types of composites concerning type of fibers, matrix and different layup

angles. Fatigue test data should include observed stiffness change after a certain number of cycles, since the decrease in stiffness is a function of damage in the matrix and fiber/matrix interface. Suggestions for further fatigue testing, leading to better understanding of the fatigue life of wind turbine blades are included. Author (ESA)

N80-21426# Centre National de la Recherche Scientifique, Toulouse (France).
PAINTS, POTTING COMPOUNDS AND SILICONE VARNISHES WITH LOW OUTGASSING IN SPACE ENVIRONMENT
J. C. Guillaumon and J. Guillin *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 63-66 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21427# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
COATING AND CONTAMINATION EXPERIMENT ON LDEF
L. Preuss and W. Schaefer *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 71-80 refs (For primary document see N80-21420 12-23)
(Contracts DFVLR-BPT-01-TD-037-AK/RT; DFVLR-BPT-01-TB-067-B-AK/RT; BMFT-WRT-2076; DFVLR-BPT-01-TD-048-A-AK/RT; BMFT-WRT-2077; DFVLR-BPT-01-TD-019-B-AK/RT; BMFT-WRT-2079)
Avail: NTIS HC A15/MF A01

N80-21428# Aerospace Corp., El Segundo, Calif.
PRELIMINARY FLIGHT RESULTS FROM P78-2 (SCATHA) SPACECRAFT CONTAMINATION EXPERIMENT
D. F. Hall and A. A. Fote *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 81-90 refs Sponsored by AF (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21442# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
EFFECT OF RADIATIONS ON POLYMERS AND THERMAL CONTROL COATINGS
J. Bourrieau and A. Paillous *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 227-245 refs (For primary document see N80-21420 12-23)
(Contracts ESTEC-2015/74; ESTEC-2558/75; ESTEC-2515/75; ESTEC-2838/76; ESTEC-3184/77; ERNO-102010/A/37880)
Avail: NTIS HC A15/MF A01

N80-21443# Lockheed Missiles and Space Co., Palo Alto, Calif.
RANGE AND INTERACTION OF LOW ENERGY PROTONS IN METAL AND METAL OXIDE THERMAL CONTROL MATERIALS
S. A. Greenberg and M. McCargo *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 247-254 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21445# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SPACE ENVIRONMENTAL EFFECTS ON POLYMER MATRIX COMPONENTS
R. C. Tennyson, J. S. Hansen, B. Uffen, D. Morison, and G. Mabson *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 263-271 refs (For primary document see N80-21420 12-23)
(Grants AFFOSR-3694-78; NRC-A-2783)
Avail: NTIS HC A15/MF A01

N80-21449# Wacker-Chemie G.m.b.H. Burghausen (West Germany).
WACKER RTV-S691, A SILICONE ADHESIVE WITH LOW OUTGASSING RATE
W. Hechtl *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 305-308 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21450# British Aerospace Dynamics Group, Stevenage (England). Dynamics Div.
THE USE OF MoS2 LOADED GREASES IN ANTENNA DESIGN MECHANISMS UNDER SIMULATED SPACE ENVIRONMENT
B. H. Baxter *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 309-319 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-21551*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
MECHANICAL IMPACT TESTS OF MATERIALS IN OXYGEN EFFECTS OF CONTAMINATION
Paul M. Ordin Washington Apr. 1980 36 p refs
(NASA-TP-1571; E-047) Avail: NTIS HC A03/MF A01 CSCL 20K

The effect of contaminants on the mechanical impact sensitivity of Teflon, stainless steel, and aluminum in a high-pressure oxygen environment was investigated. Uncontaminated Teflon did not ignite under the test conditions. The liquid contaminants - cutting oil, motor lubricating oil, and toolmaker dye - caused Teflon to ignite. Raising the temperature lowered the impact energy required for ignition. Stainless steel was insensitive to ignition under the test conditions with the contaminants used. Aluminum appeared to react without contaminants under certain test conditions; however, contamination with cutting oil, motor lubricating oil, and toolmakers dye increased the sensitivity of aluminum to mechanical impact. The grit contaminants silicon dioxide and copper powder did not conclusively affect the sensitivity of aluminum. A.R.H.

N80-21552# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
IMPROVED SPECIFICATIONS FOR COMPOSITE PROPELLANT BINDERS ARMY WEAPON SYSTEMS
James G. Carver Jul. 1979 25 p
(AD-A078026; DRSMI-T-79-76) Avail: NTIS HC A02/MF A01 CSCL 21/9

This Project has been accomplished as part of the U.S. Army Materials Testing Technology Program, which has for its objective the timely establishment of testing techniques, procedures, or prototype equipment (in mechanical, chemical or nondestructive testing) to insure efficient inspection methods for materiel/material procured or maintained by DARCOM. GRA

N80-21553# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A METHOD FOR THE DETERMINATION OF THERMAL CONDUCTIVITY OF PROPELLANT MATERIALS BY DIFFERENTIAL SCANNING CALORIMETRY Final Report
Warren W. Hillstrom Dec. 1979 27 p Supersedes BRL-IMR-598
(DA Proj. 1L1-61102-AH-53)
(AD-A080540; ARBRL-TR-02204; AD-E430359; BRL-IMR-598) Avail: NTIS HC A03/MF A01 CSCL 07/4

Benzoic acid, polymethylmethacrylate, polytetrafluoroethylene, and X-14 (a high energy, double-base propellant) were heated through decomposition and their thermal analysis curves compared. X-14 undergoes a pyrolytic decomposition beginning at 413 deg K and peaking at 573 deg K. The thermal conductivities of small samples of propellant and polymer were calculated from measurements of their rate of heat flow into a heat sink in a modified Differential Scanning Calorimeter. This method will permit thermal conductivity measurements in small samples of sensitive

materials, thus reducing hazards in their handling, and giving the first measurement on some very sensitive materials. GRA

N80-21554# Westinghouse Electric Corp., Madison, Pa. Advanced Coal Conversion Dept.
ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION, FY 1978 Quarterly Progress Report, 1 Jul. - 30 Sep. 1978
28 Dec. 1978 123 p refs
(Contract EX-76-C-01-1514)
(FE-1514-93; QPR-4) Avail: NTIS HC A07/MF A01

A gasifier was to evaluate performance with coke breeze and char derived from coal using oxygen and steam as the gasification media. Since suitable chars were not available, direct coal feed to the gasifier was used. Four tests were run, TP-018-1 through -4, and operating summaries and test results are described. The operating results for Test TP-018-1 are summarized. Test TP-018-2 was the first gasifier test to be run with oxygen. Total time for the test exceeded 180 hours, with 50 hours of operation using Pittsburgh seam coal as feedstock. Product gas higher heating values of a dry basis ranged from 120 Btu/scf for coke breeze to 260 Btu/scf for Pittsburgh coal. An experimental test grid designed to show the effect of increased oxygen flow on reactor temperatures and heating values with the high-caking Pittsburgh seam coal was established and added to with each test conducted. Successful operation of the single stage gasifier reactor with oxygen was demonstrated with this series of tests with some rather significant results. Summaries of these results are given. DOE

N80-21555# Teledyne CAE, Toledo, Ohio.
GAS TURBINE DEMONSTRATION OF PYROLYSIS-DERIVED FUELS Technical Progress Report, 1 Apr. - 30 Jun. 1979
G. Jasas 1979 27 p refs
(Contracts ET-78-C-03-1839; DE-AC03-78ET-15313)
(SAN-1839-T2) Avail: NTIS HC A03/MF A01

As part of the national petroleum conservation effort, a potential nonpetroleum base alternate fuel for gas turbines was identified. The fuel was derived from agricultural and forestry products/wastes through a pyrolysis conversion. Three combustible products were produced - a heavy oil, residual char, and gas. Blending of the char and oil products yielded a two phase (slurry) fuel with a heating value that was approximately 85% (volumetric) of typical petroleum base fuels. DOE

N80-21556# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS: MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL Quarterly Report, 1 Oct. - 31 Dec. 1978
Y. K. Ahn, R. J. Brumberg, E. T. Nelson, R. P. Stringer, and R. C. Bailie (Environmental Energy Engineering, Inc., Morgantown, W. Va.) 25 Jan. 1979 52 p refs
(Contract ET-78-C-02-5022)
(COO-5022-T1) Avail: NTIS HC A04/MF A01

Candidate biomass materials for use in the experimental analysis portions of the project were identified. Standard procedures were developed for analyzing biomass and biomass conversion products from the thermal gravimetric analyzer (TGA) runs. Equipment was ordered for making modifications on the TGA's and process development units. In addition, a linear programming problem involving three biomass feedstocks for production of methanol used in three market sectors was formulated. The example problem was hand solved and is used as a model to develop a computer package for system optimization. DOE

N80-21557# Lummus Co., Bloomfield, N. J.
SOLVENT REFINED COAL PROCESS: DATA CORRELATION AND ANALYSIS Final Report
J. F. S. Frith, S. Viswanathan, and A. Gupta Aug. 1979 308 p Sponsored by the Elec. Power Res. Inst.
(EPRI-AF-1157) Copyright. Avail: Issuing Activity

Available pilot plant and other experimental data on coal liquifaction were evaluated and useful correlations for design and scale-up to commercial size plants were developed. The available operating data were obtained from three pilot plants. The reviewed data was organized into comparative tables to facilitate its use in subsequent studies. To reduce the data into forms useful for design calculations, a number of correlations were developed. Product yields were correlated with reaction severity expressed as hydrogen consumption. The liquefaction reactions were studied by calculating reaction rate constants for the processes of hydrogen consumption, coal conversion and organic sulfur removal. To aid the design of the vapor-liquid separation equipment, a means of characterzing coal liquids was proposed. This was used successfully with methods that are currently available to predict physical properties and vapor liquid equilibria for petroleum mixtures. DOE

N80-21558# Braun (C. F.) and Co., Alhambra, Calif.
COAL-TO-METHANOL VIA NEW PROCESSES UNDER DEVELOPMENT: AN ENGINEERING AND ECONOMIC EVALUATION Final Report
W. S. Chia, G. E. Good, and Y. S. Ng Oct. 1979 112 p Sponsored by Elec. Power Res. Inst.
(EPRI-AF-1227) Avail: NTIS HC A06/MF A01

The results of a screening study are presented evaluating two coal to methanol routes via processes under development. A total of two coals investigated in two different plant configurations: (1) Illinois No. 6 bituminous coal in an all methanol scheme; and (2) Wyodak subbituminous coal in a methanol and distillate fuel oil coproduction scheme. In both schemes the Liquid Phase Methanol process was used for the synthesis of methanol from cleaned and conditioned synthesis gas. All other processes incorporated in the plant configurations were commercially proven in the petrochemical, chemical, or petroleum refinery industry. The conceptual designs for the two grass roots coal conversion complexes each designed to produce approximately 300 billion Btu per day of storable fuels are presented; included are overall block flow diagrams, steam and utility balances, and water management schemes. Cost estimates, economic assessments, and overall thermal efficiencies are provided for each of the two processing schemes considered. DOE

N80-21559# Centre National d'Etudes Spatiales, Toulouse (France).
CATALOG OF EUROPEAN PYROTECHNIC DEVICES FOR USE IN SPACE
J.-P. Bouloumie, comp., J.-P. Yribarren, comp., and N. Cable, comp. Paris ESA Nov. 1979 350 p In FRENCH and ENGLISH Prepared in cooperation with ESTEC, Noordwijk, Netherlands
(ESA-SP-1021) Avail: NTIS HC A15/MF A01; ESA, Paris FF 120

Information about commercially available pyrotechnically activated devices suitable for applications in spacecraft and launchers is presented. Data concerning initiators, pressure cartridges, detonators, igniters, valves, cutters, transfer lines, motors, location aid systems and gas generators was obtained from questionnaires. Author (ESA)

N80-22229# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ULTRASONIC MEASUREMENT OF SOLID PROPELLANT BURNING RATE
Paul Kuentzmann, Jean-Claude Demarais, and Franck Cauty *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 71-90 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-1, Jan.-Feb. 1979 p 55-72 Original report in FRENCH previously announced as A79-30497 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-21560# European Space Agency, Paris (France). Mathematical Analysis Div.
SPACECAD 1979: COMPUTER-AIDED DESIGN OF ELECTRONICS FOR SPACE APPLICATIONS

T. D. Guyenne, ed. and S. Adamy, ed. Nov. 1979 433 p refs Partly in FRENCH and ENGLISH Presented at ESA/ESTEC Symp., Bologne, 19-21 Sep. 1979 Sponsored in part by Assoc. Electrotec. Ital. Prepared in cooperation with ESTEC, Noordwijk, Netherlands and Bologne Univ.
(ESA-SP-146; ISSN-039-6566) Avail: NTIS HC A19/MF A01

The state of the art is reviewed in applications in digital logic electronics, thermal and fluid loop analysis, electrical and electronic network analysis, steady state analysis of nonlinear networks, special application programs and techniques, algorithms for evaluation of nonlinear circuits, telecommunication systems simulators, telecommunication data analysis and measurement techniques, analysis of microwave circuit elements, spacecraft electronics design problems, passive microwave components, electronics reliability and failure analysis, active microwave networks. Two summaries on electrical thermal analogy and on future trends in the simulation of telecommunication channels are included. For individual titles, see N80-21561 through N80-21610.

N80-21561# Politecnico di Milano (Italy).
THE SIRIO PROGRAM RESEARCH AND FUTURE TRENDS **c15**
F. Carassa *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 241-248 refs (For in cooperation with CNR, Milan (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Experiments performed with the SIRIO satellite since its launch are described. Attenuation statistics at 11 to 12 and 17 to 18 GHz are given and work in progress with reference to frequency, extrapolation of the attenuation statistics, and communication studies are reviewed. Applications of frequencies above 10 GHz to satellite communications are discussed.
Author (ESA)

N80-21562# Marconi Co. Ltd., Great Baddow (England).
A PRACTICAL LOOK AT LOGIC SIMULATION AND TESTING **c33**
A. H. Boyce *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 25-30 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The limitations of logic simulation programs are discussed. The use of test verification and test generation programs is outlined and the practical implications are highlighted. The means of initialization are shown to be of great importance and various practical methods are examined which can ease the testability of a design so that computer assisted design (CAD) programs can be of value to the logic designer. The areas in which problems can still occur due to a lack of appreciation of the CAD tools are illustrated.
Author (ESA)

N80-21563# Dassault (E. M.) Co., St. Cloud (France).
ESTEL: A PROGRAM FOR SIMULATING AND TESTING LOGIC CIRCUITS [ESTEL: LOGICIEL D'EVALUATION PAR SIMULATION ET TESTS D'ENSEMBLES LOGIQUES] **c33**
G. Chatelain and G. Reynier *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 31-40 In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A computer program which simulates logic circuits is described. The system, ESTEL, is written in FORTRAN and ASSEMBLER 360 for an IBM 3032 or an ICL. The program is subdivided into compiling, simulation, and editing sections. A set of circuits in current use is stored for call ups as needed. It is possible to simulate the five logic levels, propagation time, circuit parallelism, and malfunctions. The circuit can be described either as a set of logic equations or as a collection of interconnected macro components.
Author (ESA)

N80-21564# European Space Agency, Paris (France).
SIMULATION OF A FAULT TOLERANT MEMORY CONTROLLER, USING THE LOGIC SIMULATOR PROGRAM ESTEL **c33**
E. Kristiansen *In its* SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 41-45 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The logic simulation program ESTEL was used for simulating a fault tolerant memory controller. The controller is described. Three simulations written at different stages in the design are discussed.
Author (ESA)

N80-21565# Saab-Scania, Linkoping (Sweden).
DIGSIM AS AN AID FOR EFFICIENT RELIABILITY ANALYSIS **c38**
Bengt Magnhagen *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 47-49 refs Prepared in cooperation with Linkoeping Univ., Sweden (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The computer assisted design system DIGSIM, used for digital design verification, is described. The algorithms of analysis which make it possible to calculate the function reliability for a design are discussed.
Author (ESA)

N80-21566# Danish Research Center for Applied Electronics, Hoersholm.
THERMAL DESIGN BY MEANS OF ELECTRICAL/THERMAL ANALOGIES **c33**
Paul Stangerup *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 53-64 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Thermal problems of moderate complexity, solved on a minicomputer using methods taken from electrical network analysis, are discussed. Typical thermal field problems are handled using a conversion program which generates input data for the network program from physical data. The method is illustrated with an example.
Author (ESA)

N80-21567# Ecole Nationale Superieure de Mechanique et d'Aerotechnique, Poitiers (France). Lab. d'Energetique Solaire.
DESCRIPTION OF A THERMAL MODEL LIBRARY FOR USE IN ELECTRICAL CAD PROGRAMS **c33**
J. B. Saulnier *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 65-76 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

An electrical/thermal analogy is described using the electrical analysis computer program ASTEC 3. ASTEC 3 allows the user to set up a library of thermal components by using the concept of a model (a model being a subnetwork, the numerical of which can be updated when it is implemented in the main circuit). These models can then be connected to set up a network describing complex phenomena which involve multimode heat transfer.
Author (ESA)

N80-21568# Ecole Nationale Superieure de Mechanique et d'Aerotechnique, Poitiers (France). Lab. d'Energetique Solaire.
SIMULATION OF SPACELAB FLUID LOOPS BY MEANS OF A COMPUTER AIDED DESIGN (CAD) ELECTRONICS ANALYSIS PROGRAM **c33**
A. Alexandre and J. B. Saulnier *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 77-87 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The fluid loops used in the Spacelab to transfer thermal energy to the orbiter were studied using the ASTEC 3 program. ASTEC 3 was developed for the description of electric networks. Simulations of one or both the air and water loops of Spacelab which show the influence of several parameters are discussed. The results, expressed graphically as the evolution of the temperature as a function of time in the various cases, are presented. It is shown that a set of models describing each physical subsystem can be derived from a modular program such as ASTEC to treat a great variety of problems in electronics, thermodynamics, or hydrodynamics.
Author (ESA)

N80-21569# European Space Research and Technology Center, Noordwijk (Netherlands).
TIME DELAY SIMULATION BY MEANS OF A VOLTAGE

CONTROLLED CURRENT SOURCE c33
J. P. Bouchez and J. G. Ferrante *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 89-96 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Various, methods used to simulate the fluid transport time in fluid loops systems or the time delay in electronics are reviewed and discussed. A method based on a corrective heat flux is developed and the advantages are discussed. The method was included in the SINDA thermal analyzer program. An example using the Spacelab mathematical model is presented which illustrates the means for introducing time delays in a complex network. Author (ESA)

N80-21570# Technical Univ. of Denmark, Lyngby. Inst. of Circuit Theory and Telecommunication.
LCP2: A GENERAL PURPOSE CIRCUIT OPTIMIZATION PROGRAM c33
Hans Gaunholt *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 99-109 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A computer program, developed to aid in the design of analog filters and equalizers is described. Among the design features offered are least square, least 2p, and minimax optimization. The program allows arbitrary specifications of the magnitude and the phase/group delay functions together with an efficient rational function option. The computation of network sensitivities together with two multiparameter sensitivity measures is discussed. Author (ESA)

N80-21571# European Space Agency, Paris (France).
ASTEC 3: SIMULATION PROGRAM FOR ELECTRIC CIRCUITS AND ANALOG SYSTEMS [ASTEC 3: PROGICIEL DE SIMULATION DE CIRCUITS ELECTRIQUES ET DE SYCTEMES ANALOGIQUES] c33
Marcel Barocas (Compagn. Intern. de Services en Informatique) *In its* SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 111-117 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The simulation program ASTEC 3 is described. The structure of ASTEC 3, which permits the designer either to describe a system, to simulate a steady state, to simulate transient states, or to simulate oscillatory states is discussed. Three examples of application are included. Author (ESA)

N80-21572# European Space Research and Technology Center, Noordwijk (Netherlands).
ESAMEC: COMPUTER-AIDED ANALYSIS AND DESIGN OF MICROWAVE ELECTRONIC CIRCUITS c33
J. G. Ferrante and U. K. Mortensen *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 119-125 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

ESAMEC, a general purpose computer program for the frequency domain analysis of microwave electronic circuits is described. ESAMEC handles a large variety of lumped and distributed elements and is capable of performing multiparameter optimization and sensitivity analysis. Author (ESA)

N80-21573# Danish Research Center for Applied Electronics, Hoersholm.
STEADY-STATE ANALYSIS OF PERIODIC NONLINEAR DIFFERENTIAL EQUATIONS BY EXTRAPOLATION c64
S. Skelboe *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 129-136 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The time domain steady state problem is formulated as an algebraic fixed point problem Z = F(Z) where F(Z) denotes integration over one period from the initial vector Z. The convergence of the contraction mapping Y sub (R + 1) = F (Y sub R), accelerated by extrapolation is analyzed. The rapidly decaying transients are removed by q leading iteration (q = 1 or 2), and the remaining transients are reduced by extrapolation applied to Y sub q, Y sub q + 1, ... Y sub Q + 1, ... Y sub Q + 2m where m is the number of slowly decaying transients. In the frequency domain approach, a number of discrete Fourier transforms are performed for windows with equal displacements. The transients of the spectral components decay in the same way as the transients of the time domain samples so that extrapolation can be applied to the spectral components to reduce the transients. Extrapolation methods are easily implemented in existing transient analysis programs since they do not interfere with the transient analysis but only use it for the computation of F. Author (ESA)

N80-21574# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
VOLTERRA SERIES ANALYSIS OF CLASS C AMPLIFIERS c33
S. Benedetto and E. Biglieri *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 137-146 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A computational method suitable for the analysis of highly nonlinear circuits is described. The method is based on a combination of the generalized Volterra series approach with a perturbation analysis of the circuit and with the nonlinear current method used in the classical Volterra analysis. The theory of the method is presented and applied to the analysis of a class C microwave amplifier. Author (ESA)

N80-21575# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).
NONLINEAR AC-ANALYSIS (PHINAL) c33
I. E. Kleihorst *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 147-150 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

An algorithm for spurious product calculations in nonlinear electronic circuits under periodic excitation is presented. A test program, Phinal, was designed to evaluate the method for its possibilities and limitations. A comparison of Phinol with the Volterra series is presented. Author (ESA)

N80-21576# Selenia S.p.A., Rome (Italy).
THE ORGANIZATION IN A SEMI-AUTOMATIC PROCEDURE OF THE PROGRAMS FOR THE COMPUTER-AIDED DESIGN OF MICROWAVE ANTENNAS c32
Valeria Caputo and Paolo deVincenti *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 153-156 (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A semiautomatic procedure is presented which allows the flexible management of the programs and of the flow of data between them. Flow charts are presented showing the interactions. An example of the semiautomatic procedure in designing microwave antennas is presented. Author (ESA)

N80-21577# Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Studio per le Telecomunicazioni Spaziali.
RAID: AN INTERACTIVE SYSTEM FOR REVISING AND PREPROCESSING RADAR IMAGES c32
A. Pawlina *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 157-162 refs Prepared in cooperation with Politec. di Milan (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A software system, (RAID), which permits the interactive processing of rainfall data from meteorological radar is described. The RAID facilities consist of the image displaying facility in two basic formats (AZLOR and PPI), the graphical selection and storage of subimages, the subimage enhancement with graphical quantization, the computation of statistics, and the displaying of relative diagrams. The software structure allows implementation on a minicomputer with 32K of main memory provided with a graphical terminal unit, a disc unit, and a magnetic tape unit. Author (ESA)

N80-21578# Warsaw Technical Univ. (Poland). Inst. of Electronics Fundamentals.
AN ORTHOGONAL SEARCH APPROXIMATION TO ACCEPTABILITY REGIONS AND ITS APPLICATION TO TOLERANCE PROBLEMS c64

L. Opalski, M. Styblinski, and J. Grodzki *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 163-168 refs (For primary document see N80-21560 12-31)
(Grant NSF INT-76-23091)
Avail: NTIS HC A19/MF A01

A technique of one dimensional orthogonal searches in which quadratic equations are solved to find points approximating the boundary of the acceptability region is described for a class of linear networks. The concept of a segment approximation to the acceptability region was introduced and its application to solving the design centering and tolerancing problems is discussed. Other applications of the technique are given. Author (ESA)

N80-21579# Bologna Univ. (Italy). Facolta di Ingegneria.
ANALYSIS AND OPTIMIZATION OF NONLINEAR CIRCUIT WITH PERIODIC EXCITATION c33
F. Filicori, V. A. Monaco, and C. Naldi (Politec. di Turin) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 171-176 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Automatic procedures for the optimization of nonlinear circuits, such as microwave class C amplifiers, are discussed in regard to nonlinear analysis. A harmonic analysis technique is introduced which reduces the analysis time. A similar procedure which is applied to the circuit parameter variations so that, with the help of a standard optimization method, a routine suitable for the automatic design is developed, is discussed. Author (ESA)

N80-21580# Waterloo Univ. (Ontario). Dept. of Electrical Engineering.
COMPUTER-AIDED DESIGN AND EVALUATION OF BIPOLAR TRANSISTORS AND CIRCUITS FOR HIGH EFFICIENCY MICROWAVE POWER CONVERSION c33
D. J. Roulston, P. R. Bryant, and I. N. Hajj *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 177-187 refs Prepared in cooperation with Illinois Univ., Urbana Sponsored jointly by Rockwell International Corp., Calif. and NSERC, Canada (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The use of two computer programs, BIPOLE And WATAND, to aid in the design and evaluation of microwave power transistors for the solar power satellite system is described. The programs were used to determine the transistor fabrication parameters to give high power conversion efficiencies when used in class C and class E circuit configurations. Author (ESA)

N80-21581# Bologna Univ. (Italy). Ist. di Elettronica.
PERIODIC STEADY-STATE ANALYSIS OF NONLINEAR CIRCUITS USING SPLINE FUNCTIONS c33
F. Filicori, M. R. Scalas, and C. Naldi (Politec. di Turin) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 189-193 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A method is proposed for the periodic steady state analysis of nonlinear circuits. The method is based on circuit partitioning into linear and nonlinear subnetworks and the representation of the current and voltage waveforms through periodic spline functions. The linear part of the circuit is characterized by its response to the current unit spline, while the nonlinear subnetwork is described by implicit nonlinear differential equations in the voltages and currents at the connections. The complete circuit is thus described by nonlinear time dependent equations which are periodic and are approximated by periodic splines. The possibilities of the proposed method are discussed in comparisons with the harmonic analysis approach. Author (ESA)

N80-21582*# Missouri Univ., Rolla. Dept. of Electrical Engineering.
PERFORMANCE EVALUATION OF TELECOMMUNICATION SYSTEMS USING COMPUTER SIMULATION c32
William H. Tranter *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 197-206 refs (For primary document see N80-21560 12-31)
(Contracts NAS9-13436; NAS9-14848)
Avail: NTIS HC A19/MF A01 CSCL 17B

The SYSTID time domain digital simulation technique is reviewed. A technique is illustrated which estimates the signal to noise ratio at a point in the simulation of a communication system. Signals having a lowpass or bandpass spectra are utilized. Simulation results show the technique to be accurate over a wide range of signal to noise ratios. Examples which illustrate application to both analog and digital communication systems are provided. Author (ESA)

N80-21583# University Coll., Dublin (Ireland).
SIMULATION OF MULTICHANNEL WIDEBAND SATELLITE COMMUNICATION SYSTEMS c32
M. ODroma and J. O. Scanlan *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 207-216 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A simulation program is developed which models complete communication systems consisting of many Earth stations transmitting and receiving one or more carriers through a multitransponder satellite while maintaining the direct analogy between the real and simulated signals for all carriers. The algorithms required to simulate the common amplification of signals are presented and means of isolating impairments such as multipath are discussed. Author (ESA)

N80-21584# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
TIME-DOMAIN SIMULATION OF A TELECOMMUNICATION DISTRESS SYSTEM c32
M. Ajmone Marsan, V. Castellani, and M. Pent *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 217-226 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A user oriented simulation approach for studying communication systems is presented. The approach is based on the analytic signal concept and complex envelope representation of signals. The characterization of some typical blocks of a communication system is provided. An example of a telecommunication distress system is presented. Author (ESA)

N80-21585# Christian Rovsing Ltd., Copenhagen (Denmark).
TECHNIQUES FOR THE ANALYSIS OF PROPAGATION EFFECTS ON COMMUNICATIONS SATELLITE PERFORMANCE c32
L. Erup and R. A. Harris (ESA, Paris) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 227-239 refs Prepared in cooperation with ESTEC, Noordwijk, Netherlands (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A program which analyzes the propagation effects in communications satellites operating at high microwave frequencies is described. Propagation phenomena are reviewed and simplified models developed. A technique is developed for the determination of bit error rate in a system affected by multiple impairments. The system model and programming techniques are described and an application example is given. Author (ESA)

N80-21586# Politecnico di Torino (Italy). Ist. di Elettronica.
DIGITAL SIMULATION OF ANALOG FILTERS: COMPARISON OF DIFFERENT METHODS c33
L. Lo Presti *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 241-248 refs (For primary document see N80-21560 12-31)
(Contract ESTEC-3699/78)
Avail: NTIS HC A19/MF A01

Several techniques for approximating a continuous system by a discrete model are described. Among them, particular attention is devoted to the Z Transform, the bilinear transformation and the state variables. The properties of the discrete approximation examined are discussed and compared; different types of input signals entering a two pole Butterworth filter are considered, and the outputs obtained through the algorithms are compared with the exact continuous waveforms. Author (ESA)

N80-21587# Marconi Co. Ltd., Chelmsford (England).
NOISE ANALYSIS OF FADING SATELLITE COMMUNICATION LINKS c32
P. G. Wright, B. G. West, and G. K. Smith *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov 1979 p 251-257 refs Prepared in cooperation with ESTEC, Noordwijk, Neth. (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

An anslysis is presented of the statistical behavior of the overall signal-to-noise ratio for a satellite communications link, subject to uplink and downlink weather fading and with a nonlinear amplifier in the satellite. This extends previous analyses in the characterization of the effect of the amplifier on input signal and noise, and the inclusion of the variation of receive station G/T with the downlink fading. A simple extension of the method allows other sources of random fading (e.g., antenna depointing) to be included. A computer program implementing the method for independent fade distributions has been written. Although primarily concerned with satellites, the method also applies to certain other communications systems. Author (ESA)

N80-21588# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
SIGNAL PROCESSING OF ORBITAL TEST SATELLITE DATA c32
K. G. Holleboom and J. M. H. Wagemans *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 259-266 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Propagation measurements at 11 GHz especially with signals transmitted by satellites OTS-2 and SIRIO are described. The radio signals and other data, important for propagation of radio waves, are processed by a chain of computers. Two microcomputers and a minicomputer are used for the three functions of the system: data collection, data transmission and data processing. Some correlations between signals and more detailed plots of events have been made. Attention is paid to the processing of data obtained from a rainmeter. Author (ESA)

N80-21589# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
MULTICARRIER OPERATION OF MICROWAVE TRANSISTOR POWER AMPLIFIERS c33
G. P. Bava, U. Pisani, and V. Pozzolo *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 267-272 refs (For primary document see N80-21560 12-31)
(Contract ESTEC-3334)
Avail: NTIS HC A19/MF A01

The junction temperature may influence considerably the transfer characteristics of a class C operating microwave transistor amplifier. This effect is analyzed in order to investigate the generation of intermodulation products with a multicarrier input signal. Comparison between experimental results and computer simulation, which makes use of the Shimbo method, is performed. Author (ESA)

N80-21590# Bell Telephone Labs., Inc., Holmdel, N. J.
SIMULATION OF TIMING AND CARRIER RECOVERY USING SYSTID c32
P. Balaban and K. S. Shanmugan *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 273-280 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The performance of digital carrier modulation schemes (such as, QPSK, OQPSK) depend on the accuracy of the timing and carrier phase recovery networks used in the receiver. A computer simulation model is described, which can be used for analyzing the performance of these networks. This model is applied to a particular modem which uses a quadrupling circuit and tuned filter for estimating the carrier phase, and a delay multiply and filter combination for clock recovery. The statistics of the timing and phase jitter are computed for typical channel conditions and the results are presented. The computations were performed with the time domain system simulation program SYSTID. Author (ESA)

N80-21591# Katholieke Universiteit te Leuven (Belgium). Dept. of Electrical Engineering.
ANALYSIS MODEL FOR RECTANGULAR MICROSTRIP RESONATORS c33
J. Thijs, P. Luypaert, and A. VandeCapelle *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 283-286 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

An analysis of open rectangular microstrip resonators for the fundamental as well as for the higher order modes is presented. This analysis is restricted to resonators of which the width is small in comparison with the length. In this case the ends of the resonator can be regarded as open circuits and the transversal current component can be neglected. The resonant frequencies obtained with this analysis have acceptable and interesting properties. Author (ESA)

N80-21592# Limoges Univ. (France). Lab. d'Electronique des Microondes.
DIELECTRIC RESONATOR IN A WAVEGUIDE c33
P. Guillon and Y. Garault *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 287-298 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Formulas are derived for the quality factor of a cylindrical dielectric resonator immersed in a radial and a longitudinal metallic waveguide; these being excited by the magnetic dipole mode of the resonator. Curves are obtained which give the variations of the Q factor as a function of the dimensions of the waveguide. Experimental results are presented which agree well with theory. Author (ESA)

N80-21593# Duisburg Univ. (West Germany). Dept. of Electrical Engineering.
A METHOD OF ANALYSIS AND DESIGN OF MICROSTRIP DIRECTIONAL COUPLERS CONSIDERING DISPERSION AND DISCONTINUITY EFFECTS c33
R. Mehran *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 299-303 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A method of analysis and design of microstrip rat race and branch line couplers is described. It is shown that the frequency dependent scattering parameters of these directional couplers and therefore their isolation, coupling and VSWR response can be related by simple formulas including dispersion and discontinuity effects. An optimization procedure in conjunction with identical 2 port matching networks connected at each port of the coupler is used to achieve wide band performance. Theoretical and experimental results are compared. Author (ESA)

N80-21594# Bologna Univ. (Italy). Ist. di Elettronica.
COMPUTATION OF THE SCATTERING PARAMETERS OF MICROSTRIP DISCONTINUITIES BY A FREQUENCY-DOMAIN TLM METHOD c33
Vittorio Rizzoli and Alessandro Lipparini *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 305-310 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A planar circuit consisting of a number of cascaded rectangular segments is simulated by a two dimensional transmission-line matrix and analyzed in the frequency domain by a fast computer algorithm. Some of the most common types of microstrip discontinuities can be fully characterized as special cases of the general topology considered, with a tradeoff between accuracy and GPU time requirements. Comparisons between computed and measured results are presented for the frequency band up to 12.4 GHz, encompassing the majority of present day space applications. Author (ESA)

N80-21595# Sachs/Freeman Associates, Inc., Bladensburg, Md.
CAD TECHNIQUES FOR INTRASYSTEM ELECTROMAGNETIC COMPATIBILITY (EMC) AT THE EQUIPMENT LEVEL c32
Ernest R. Freeman *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 313-318

refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The structure and definition of electromagnetic compatibility (EMC) analysis at the intrasystem and equipment levels is investigated. The application of CAD techniques is discussed in terms of 12 modes of undesired signal coupling into victim circuits. These modes are defined and the mechanisms involved are explained. The availability of specific CAD techniques is discussed. A qualitative comparison of model capability, interference mode, data availability and problem prevalence is presented.
Author (ESA)

N80-21596# Centre National d'Etudes Spatiales, Toulouse (France).
EMC: A PROGRAM FOR THE ANALYSIS AND PREDICTION OF ELECTROMAGNETIC PERTURBATIONS TRANSMITTED BY CONDUCTION [EMC: UN PROGRAMME D'ANALYSE ET DE PREDICTION DE PERTURBATIONS ELECTROMAGNETIQUES TRANSMISES PAR CONDUCTION] c32
J. P. Catani *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 319-324 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Starting from the description of a circuit or of a system described at component level, the program computes the amplitude of the perturbation as a function of time of the amplitude of the simulating frequency as well as different system interactions. The structure of the program and its applications are discussed, including some illustrative examples. The program is used with ICL-4 and CDC 7600 computers. The program is accessible on-line.
Author (ESA)

N80-21597*# Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
MODELLING SWITCHING-TIME EFFECTS IN HIGH-FREQUENCY POWER CONDITIONING NETWORKS c33
H. A. Owen, T. H. Sloane, B. H. Rimer, and T. G. Wilson *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 325-337 refs (For primary document see N80-21560 12-31)
(Grant NsG-3157)
Avail: NTIS HC A19/MF A01 CSCL 09C

Power transistor networks which switch large currents in highly inductive environments are beginning to find application in the hundred kilohertz switching frequency range. Recent developments in the fabrication of metal-oxide-semiconductor field-effect transistors in the power device category have enhanced the movement toward higher switching frequencies. Models for switching devices and of the circuits in which they are imbedded are required to properly characterize the mechanisms responsible for turning on and turning off effects. Easily interpreted results in the form of oscilloscope-like plots assist in understanding the effects of parametric studies using topology oriented computer-aided analysis methods.
Author (ESA)

N80-21598# Bologna Univ. (Italy). Ist. di Elettronica.
STATISTICS OF OPTICAL-FIBER TRANSFER-FUNCTION MEASUREMENTS: A COMPUTER-AIDED APPROACH c74
P. Bassi and M. Zoboli *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 339-344 refs Sponsored in cooperation with Telettra SPA and CNR, Rome (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The measurements of an optical fiber baseband transfer function is affected by errors that are difficult to deal with analytically. A computer program is described which processes measured data and yields a statistical evaluation of the transfer function, including information on the uncertainty that affects the measurements. The experimental error is shown not to be constant with respect to modulation frequency, but to increase with increasing frequency. Finally, some conclusions concerning the design of optical fiber transmission systems are drawn.
Author (ESA)

N80-21599# GTE-Telecomunicazioni S. p. A., Cassina de Pecchi (Italy).
EVANESCENT MODE WAVEGUIDE CIRCULATOR c32
A. DAmbrosio and S. Blo *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 347-355 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A modal description is presented of the performance of Ku band evanescent mode circulators, widely used either as switches or in parametric amplifiers in various space programs (CTS, OTS, ECS, ANIK-B). The solution of Maxwell equations was reduced to a set of infinite linear systems. In practice, a matrix order of 15 to 20 is sufficient to describe the device behaviour with good accuracy. A flexible computer program was developed to evaluate the effects that variations of physical parameters of the model produce on matching and bandwidth.
Author (ESA)

N80-21600# European Space Research and Technology Center, Noordwijk (Netherlands).
COMPUTER-AIDED DESIGN OF ADVANCED MICROWAVE FILTERS c33
R. J. Cameron *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 357-362 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

With increases in the amount of telecommunications channels to be accommodated by a given allocation of the frequency spectrum, severe specifications are imposed on the IF filters. Along with very steep out-of-band rejections and flat in-band responses come incompatible requirements for low loss and lightness (for satellite repeaters). A CAD procedure is described by which an optimally compliant microwave IF filter was designed, analyzed and constructed. Included are the design formulae of a novel realization technique.
Author (ESA)

N80-21601# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
CORRUGATED HORNS: COMPUTER ANALYSIS OF INPUT IMPEDANCE PROPERTIES AND OF MODE EXCITATIONS c32
V. G. Daniele, I. Montrosset, and R. S. Zich *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 363-366 refs Sponsored by Centro Studi e Lab. Telecom. (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

To minimize input reflection and excitation of unwanted modes in corrugated feeds, the most critical point is the transition between the guide with smooth wall and the one with corrugated wall. This junction has been theoretically examined by assuming impedance boundary conditions in the corrugated region. The Wiener-Hopf technique leads to an exact solution of this canonical problem and yields modal coupling coefficients. A set of numerical results is presented for different ratio between the inner and the outer radii of the corrugated guide.
Author (ESA)

N80-21602# Engins Matra, Velizy (France).
HOW TO USE CAD FOR DRIFT AND MARGINS STUDIES c38
B. Boucly and A. Lelaire *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 369-374 (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The problems presented by fabrication margins and drift for electronic circuits are complex. To solve these problems, CAD programs are very useful. A synthesis of the major available classes, their advantages and application ranges is presented, including a program which is synthesis between Monte Carlo simulation and analytical simulation, applied to electronic circuits.
Author (ESA)

N80-21603# Engins Matra, Velizy (France).
CAD BY AUTOMATIC SYNTHESIS OF FAILURE MODE EFFECT AND CRITICALITY ANALYSIS (FMECA). AN APPLICATION TO TEXT TREATMENT: THE DEBAT PROGRAM [L'AIDE A LA CONCEPTION PAR SYNTHESES AUTOMATIQUE DE FMECA. UNE APPLICATION DES TRAITEMENTS DE TEXTS: LE PROGRAMME 'DEBAT'] c33
J. Agostini *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 375-380 refs In FRENCH (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

The application of the DEBAT program to failure mode effects and criticality analysis with the goals of providing the criticity matrix and numerical values of selection criteria coefficients for system elements is presented. The DEBAT program is described and a detailed application example is given. Author (ESA)

N80-21604# University Coll. of Vigo (Spain).

FAILURE MODE ANALYSIS OF THE METEOSAT PIN DIODE VARIABLE PHASE SHIFTER USING A MICROWAVE CAD PROGRAM c33

A. Seoane Montenegro *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 381-384 refs (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

A complete failure mode analysis of the pin diode variable phase shifter embarked on METEOSAT satellite has been performed. The degradation of the performance has been simulated for short and open circuit failure cases by means of the ESA developed microwave CAD program, ESAMEC, which includes a four port hybrid element in a nodal formulation. Author (ESA)

N80-21605# Brussels Univ. (Belgium). Lab. d'Electronique et Radioelectricite.

A COMPUTER BASED METHOD GIVING THE EXPERIMENTAL NOISE PARAMETERS OF Q-POINTS THROUGH THE USE OF NEW NOISE SOURCES c33

R. Meys and M. Milecan (Etudes Tech. et Construc. Aerospatiales, Charleroi, Belgium) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 387-396 refs (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

A program is described for aiding in the experimental determination of noise parameters at microwave frequencies. It rests on a circuit model using two correlated noise wave sources. Both theoretical background and practical computerized implementations are discussed. Experimental results on microwave devices are presented. Author (ESA)

N80-21606# Palermo Univ. (Italy). Ist. di Elettrotecnica ed Elettronica.

COMPUTER-AIDED MODELLING OF MICROWAVE TRANSISTORS IN TERMS OF NOISE AND GAIN PARAMETERS c33

B. DiMaio, M. Sannino, and F. Sorbello *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 397-400 refs Sponsored by CNR, Palermo, Italy (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

The determination of noise (gain) parameters of microwave two ports has been often carried out through linearized methods, requiring some experimental provisions to avoid ill-conditioning situations. A more powerful linear-nonlinear combined procedure is presented that effectively removes the above drawbacks while improving the over-all accuracy. Author (ESA)

N80-21607# European Space Research and Technology Center, Noordwijk (Netherlands).

SIMULATION AND PERFORMANCE PREDICTION OF MEDIUM-POWER GaAs FET AMPLIFIERS c33

M. Gibson, J. G. Ferrante, and S. J. G. Strijk *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 401-404 refs (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

The transfer characteristics, i.e., fin/pout and phase, are computed and compared with the measured values for a single state X-band medium power FET amplifier operating at 10.1 GHz. The analysis consists of the determination of a suitable model for the FET including nonlinearities, and the application of a harmonic analysis computer program to the FET model in conjunction with suitable input and output matching networks to compute the transfer characteristics. Author (ESA)

N80-21608# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).

CAD OF AN OCTAVE BAND POWER FET AMPLIFIER c33

A. Rabier and M. Parisot *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 405-406 refs Sponsored by Direc. des Rech., Etudes, et Tech. (DRET) (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

Precise measurements of source and load impedances for maximum output power of GaAs MESFET have been made with the aid of a de-embedding method. The synthesis of these impedances in the octave band 6-12 GHz was carried out using a distributed element network optimized with the aid of a computer program (ACLINE 2-B). Author (ESA)

N80-21609# Consiglio Nazionale delle Ricerche, Bologna (Italy). CNR-LAMEL Lab.

A NEW EMPIRICAL MOS TRANSISTORS MODEL FOR ANALOG CIRCUITS SIMULATION c33

M. Impronta, G. Masetti (Ancona Univ., Italy), and M. Severi *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 407-414 refs (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

The mobility reduction and the channel length modulation phenomena of MOS transistors operating in saturation were modeled on the basis of experimental measurements. It is shown that, using only technological parameters, both the DC operating points and the small signal conductances of MOS transistors can be predicted. Author (ESA)

N80-21610# Technical Univ. of Denmark, Lyngby. Inst. of Electronics.

SOME ASPECTS IN THE SIMULATION OF BIPOLAR RF-POWER AMPLIFIERS c33

J. Vidkjaer *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 415-421 refs (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

The simulation of RF power amplifiers using the most common transistor models may often give misleading results. These problems appear due to incomplete modeling. The structure of a more effective transistor model is outlined and it is shown how this can be made a part of a simulation method where charges and flux linkages are used as state variables. The use of the method is demonstrated by two examples. Author (ESA)

N80-21611# Royal Aircraft Establishment, Farnborough (England).

AN INVESTIGATION INTO THE REAL GAS EFFECTS OF CRYOGENIC NITROGEN IN INVISCID HOMENTROPIC FLOW

C. M. Albone London HMSO May 1979 18 p refs (RAE-TM-Aero-1805; BR68895) Avail: NTIS HC A02/MF A01

The real gas effects of nitrogen at low temperatures are examined in terms of its use as a test gas in a high Reynolds number transonic wind tunnel. Inviscid, isentropic flow of a nonconducting gas is studied with the use of a simplified equation of state which enables an expression for enthalpy (and hence the terms in Bernoulli's equation) to be derived by analytic integration. Author (ESA)

N80-21612# Office of Technology Assessment, Washington, D. C.

BENEFITS OF INCREASED USE OF CONTINUOUS CASTING BY THE UNITED STATES STEEL INDUSTRY

Oct. 1979 41 p refs (PB80-104904; OTA/TM/ISC-2; LC-79-600177) Avail: NTIS HC A03/MF A01 CSCL 11F

The continuous casting process is described and the advantages of the process are examined. The rate of adoption of this technology in the U.S. steel industry is compared with that in the foreign steel industries. The factors that have constrained the greater adoption of continuous casting in the United States are briefly discussed and the economic costs and benefits of converting existing capacity to this new process are analyzed. GRA

N80-21613# National Bureau of Standards, Boulder, Colo.

HIGH RESOLUTION SENSING TECHNIQUES FOR SLOPE

STABILITY STUDIES Final Report, Oct. 1976 - Sep. 1978
Ramon L. Jesch, Robert B. Johnson, Donald R. Belsher, Arthur D. Yaghjian, and Michael C. Steppe Jan. 1979 142 p refs (FHWA Order 7-3-0001)
(PB80-124621; FHWA/RD-79/32) Avail: NTIS HC A07/MF A01 CSCL 13B

A four phase evaluation of high resolution remote sensing techniques for application to problems of determining slope stability is presented. The first two phases concentrated on documenting the subsurface features and associated characteristics which determine or influence slope stability. A variety of electromagnetic and acoustic remote sensing techniques which exhibited the greatest potential for detecting the subsurface features and characteristics were surveyed in phase three. Two techniques were chosen for further experimental and developmental pursuit: the existing FM-CW radar system, and the planar near field reconstruction approach. The existing FM-CW radar system was applied and analyzed in a series of field experiments to determine the subsurface structure at a designated test site in phase four. GRA

N80-21614# Sydney Univ. (Australia). Civil Engineering Labs.
FINAL ELEMENT ANALYSIS OF THE CONSOLIDATION OF LAYERED SOILS
J. R. Booker and J. C. Small Jul. 1979 33 p refs
(PB80-124092; R-350) Avail: NTIS HC A03/MF A01 CSCL 08M

A method formalyzing the consolidation of a horizontally layered cross anisotropic soil was developed and is based on the observation that if the field quantities are expressed as a Fourier series, then each Fourier component is uncoupled and may be analyzed separately. The final solution may then be found by recombining the Fourier components to synthesize the prescribed loading functions. There are distinct computational advantages over the usual finite element approach as well as significant computational savings. The method may easily be implemented on a mini-computer. GRA

N80-21615# Automated Management Systems, Inc., Lanham, Md.
MASS TRANSIT METRICATION: A RECOMMENDED POLICY AND METRIC CONVERSION PLAN FOR UMTA Final Report
Jul. 1979 130 p refs
(Grant DOT-UT-80015)
(PB80-125008; UMTA-IT-0209-79-1) Avail: NTIS HC A07/MF A01 CSCL 13B

Some actions are suggested which the Urban Mass Transportation Administration, the American Public Transit Association, and the Department of Transportation can take to best fill the perceived needs of members of the mass transit industry, and at the same time, use the proven techniques learned by those who have successfully converted to the metric system. The use of metric units on new designs based on the cumulative cost approach is recommended. The metrication activities of some organizations and their problems and successes are examined. With those companies which have already begun implementation of the metric system, it was found that engineering standards exist for virtually all the needs of the organization impacted by UMTA. GRA

N80-21616# Purdue Univ., Lafayette, Ind. School of Civil Engineering.
AN APPROACH TO DAMAGE ASSESSMENT OF EXISTING STRUCTURES
James T. P. Yao Oct. 1979 32 p refs
(Grant NSF ENV-77-05290)
(PB80-123482; CE-STR-79-4; NSF/RA-790245) Avail: NTIS HC A03/MF A01 CSCL 13L

The theory of fuzzy sets was applied to the complex problem of assessing damage to existing structures. Fuzzy sets consist of a mathematical model coupled with provision for the effect of human factors and construction process and experience. For each factor, the gravity of the adverse effect and its consequence are estimated by experts. The state-of-the-art of damage identification of existing structures is summarized and the fundamental elements of fuzzy sets and their pilot application to actual structure engineering examples are presented. Extensive data, equations and references are included. GRA

N80-21617# Transportation Research Board, Washington, D.C.
SUPERPLASTICIZERS IN CONCRETE
C. D. Johnston, B. R. Gamble, V. M. Malhotra, Mario Collepardi, and Mario Corradi 1979 51 p refs
(PB80-118631; TRB/TRR-720; ISBN-0-309-02970-8; LC-79-607977) Avail: NTIS HC A04/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13C

Topics discussed include: effects of superplasticizers on properties of fresh and hardened concrete low slump loss superplasticized concretes; superwater reduced concrete pavements and bridge deck overlays; performance of superplasticized concretes that have high water to cement ratios; optimum mix proportions for flowing concrete; and cement content measurements with the rapid analysis machine. GRA

N80-21618# National Bureau of Standards, Washington, D.C.
SPECIFICATIONS, TOLERANCES, AND OTHER TECHNICAL REQUIREMENTS FOR WEIGHING AND MEASURING DEVICES Annual Report
Harold F. Wollin, ed. Dec. 1979 219 p Supersedes COM-71-50614
(PB80-132343; NBS-HB-44; COM-71-50614; LC-79-600197) Avail: NTIS HC A10/MF A01 CSCL 14B

A handbook containing the specifications, tolerances, and other technical requirements for weighting and measuring devices is presented. The makeup of specific codes, as well as paragraph presentation and designation are included to assist the user. GRA

N80-21619# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
COMPOSITE STEEL: CONCRETE DESIGN. A COMPARISON OF THE MONOGRAPH ON TALL BUILDINGS, AISC-ACI, BS5400 AND THE GERMAN CODE OF PRACTICE FOR THE DESIGN OF STEEL COMPOSITE BEAMS
Ah-Kum Pang May 1979 173 p refs
(Grant NSF PFR-78-16324)
(PB80-125925; LEHIGH/FL-440-4) Avail: NTIS HC A08/MF A01

Composite steel-concrete construction is discussed using the results of a comparative study on the provisions of the codes and specifications pertaining to design and construction of composite structures in three countries: U.S.A., United Kingdon, and Germany. The provisions cover the design of composite beams both simply supported and continuous, encased beams, composite box girders, composite columns and formed metal deck. Two design examples, one on beam design and the other on column design using the American and British codes are presented to illustrate the differences in the codes. GRA

N80-21620# Building Technology, Inc., Silver Spring, Md.
EVALUATION AND ANALYSIS OF CURRENT EFFECTIVE BUILDING AND FIRE PREVENTION CODE ADMINISTRATION AND ENFORCEMENT PROGRAMS Final Report
John G. Degenkolb 31 Aug. 1979 236 p
(Contract FA-78-1030)
(PB80-125974) Avail: NTIS HC A11/MF A01 CSCL 13L

Nine communities recognized as having especially effective code administration and enforcement programs were analyzed. The analysis produced a list of essential features which should be present in an effective program, and a list of features which might improve the effectiveness of a code administration and enforcement program under certain conditions. The study divided the code administration and enforcement processes into a new building development and construction phase and a building maintenance and use phase. Techniques for improved productivity and communications also are included. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-21621 Oregon State Univ., Corvallis.
THE EFFECT OF RAIN ON SATELLITE COMMUNICATIONS ABOVE 10 GHz IN THE PACIFIC NORTHWEST Ph.D. Thesis
Rudolf Succo Engelbrecht 1980 170 p
Avail: Univ. Microfilms Order No. 8007120

The performance of satellite communications systems above 10 GHz was predicted from the existing local rainfall and other meteorological data, utilizing the available electromagnetic theory which links signal absorption, phase shift, and depolarization to drop size and shape. The distribution of rain induced attenuation along a potential space-earth path was derived as a function of three parameters: wavelength; point rainrate statistics; and path length. The amount of computation normally required for obtaining point rainrate distributions was greatly reduced by applying the methods of extreme value statistics to existing maximum short duration rainfall data. Significant results are reported.

Dissert. Abstr.

N80-21622 British Broadcasting Corp., Kingswood (England). Research Dept.
ERROR PROTECTION TECHNIQUES FOR LONGITUDINAL DIGITAL RECORDING OF AUDIO AND VIDEO SIGNALS
V. G. Devereux Dec. 1979 15 p
(BBC-RD-1979/30) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, England

Techniques for protection against errors arising during magnetic tape recording of digital audio and video signals are discussed. These errors mostly result from 'dropouts' which cause burst errors typically affecting several hundred successive bits. The error protection techniques considered include the use of (1) conventional error-detecting and correcting codes employing parity check bits, (2) data re-ordering to break up burst errors into shorter groups of errors which are easier to correct, and (3) the examination of signal characteristics so as to detect errors without employing parity check bits. General details of error protection methods are included that were designed to operate with specific experimental equipment for the recording of digital audio and video signals. Possible improvements in error protection methods for video recording are suggested.

Author

N80-21623*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
FUTURE LARGE BROADBAND SWITCHED SATELLITE COMMUNICATIONS NETWORKS Final Report
David H. Staelin and Robert R. Harvey Dec. 1979 281 p refs
(Contract NAS5-25091)
(NASA-CR-159961) Avail: NTIS HC A13/MF A01 CSCL 17B

Critical technical, market, and policy issues relevant to future large broadband switched satellite networks are summarized. Our market projections for the period 1980 to 2000 are compared. Clusters of switched satellites, in lieu of large platforms, etc., are shown to have significant advantages. Analysis of an optimum terrestrial network architecture suggests the proper densities of ground stations and that link reliabilities > 99.99% may entail less than a 10% cost premium for diversity protection at 20/30 GHz. These analyses suggest that system costs increase as the 0.6 power of traffic. Cost estimates for nominal 20/30 GHz satellite and ground facilities suggest optimum system configurations might employ satellites with 285 beams, multiple TDMA bands each carrying 256 Mbps, and 16 ft ground station antennas. A nominal development program is outlined.

E.D.K.

N80-21624*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF ADVANCED SUNFLOWER PRECISION DEPLOYABLE ANTENNA Final Report
M. M. Giebler and W. B. Palmer 21 Nov. 1979 67 p Prepared for JPL
(Contracts NAS7-100; JPL-955340)
(NASA-CR-162631; MEL-79-B-126) Avail: NTIS HC A04/MF A01 CSCL 09C

The maximum deployed diameter stowable in shuttle was determined for the original concept and for new more efficient concepts. Estimates of weight, surface accuracy and cost were made for the various configurations. Five critical technologies were identified which would be required to manufacture large solid deployable reflectors. These technologies are concerned with surface accuracy improvement and verification.

A.R.H.

N80-21625*# George Washington Univ., Washington, D. C. Dept. of Electrical Engineering and Computer Science.
ELECTROMAGNETIC BACKSCATTERING FROM A RANDOM DISTRIBUTION OF LOSSY DIELECTRIC SCATTERERS Final Report
Roger H. Lang Apr. 1980 54 p refs
(Grant NsG-5288)
(NASA-CR-162922) Avail: NTIS HC A04/MF A01 CSCL 20N

Electromagnetic backscattering from a sparse distribution of discrete lossy dielectric scatterers occupying a region 5 was studied. The scatterers are assumed to have random position and orientation. Scattered fields are calculated by first finding the mean field and then by using it to define an equivalent medium within the volume 5. The scatterers are then viewed as being embedded in the equivalent medium; the distorted Born approximation is then used to find the scattered fields. This technique represents an improvement over the standard Born approximation since it takes into account the attenuation of the incident and scattered waves in the equivalent medium. The method is used to model a leaf canopy when the leaves are modeled by lossy dielectric discs.

A.R.H.

N80-21626*# Southwest Research Inst., San Antonio, Tex.
THE RELATIONSHIP OF STORM SEVERITY TO DIRECTIONALLY RESOLVED RADIO EMISSIONS Final Report
R. O. Johnson, M. L. Bushman, and W. M. Sherrill Feb. 1980 48 p refs
(Contract NAS8-33371)
(NASA-CR-161381) Avail: NTIS HC A03/MF A01 CSCL 20N

Directionally resolved atmospheric radio frequency emission data were acquired from thunderstorms occurring in the central and southwestern United States. In addition, RF sferic tracking data were obtained from hurricanes and tropical depressions occurring in the Gulf of Mexico. The data were acquired using a crossed baseline phase interferometer operating at a frequency of 2.001 MHz. The received atmospherics were tested for phase linearity across the array, and azimuth/elevation angles of arrival were computed in real time. A histogram analysis of sferic burst count versus azimuth provided lines of bearing to centers of intense electrical activity. Analysis indicates a consistent capability of the phase linear direction finder to detect severe meteorological activity to distances of 2000 km from the receiving site. The technique evidences the ability to discriminate severe storms from nonsevere storms coexistent in large regional scale thunderstorm activity.

Author

N80-21627# Syracuse Univ., N. Y. Dept. of Electrical Engineering.
FEATURES STUDY: A STUDY OF RF EXTERNAL TRANSMISSIONS Final Technical Report, 15 Oct. 1978 - 30 Jun. 1979
J. Perini, B. Silverman, and E. Nyakabwa Griffiss AFB, N.Y. RADC Nov. 1979 78 p
(Contract F30602-78-C-0083; AF Proj. 0173)
(AD-A080604; RADC-TR-79-272) Avail: NTIS HC A05/MF A01 CSCL 20/14

Cepstrum and Fast Fourier Transform techniques are developed which provide a theoretical basis for determining the configuration of aircraft and space vehicles. Some of the limiting assumptions of the analysis, and possible problem areas are discussed. The antenna radiation pattern of an omnidirectional antenna is largely determined by the shape, composition, location and size of the features of the vehicle to which the antenna is attached. The objective of this effort was to develop a method

for determining the features and/or configuration of an aircraft or space vehicle from signals transmitted by those vehicles. A signal processing technique called Cepstral Processing offered the best chance to do this. Cepstral Processing is based on the fact that an RF signal sensed in the far field of the transmitting antenna will be a complex composite of the direct antenna signal path, and multipath reflections from vehicle wing suraces, landing gear struts, fuel pods, etc. This report documents two possible approaches for extracting required feature information from omnidirectional signals. The first approach is Time Signal Processing. The second approach is Antenna Radiation Pattern Processing. GRA

N80-21628# Ohio State Univ., Columbus. ElectroScience Lab.
ELECTROMAGNETIC SCATTERING BY A METALLIC DISK
Didier P. Mithouard and Daniel B. Hodge Sep. 1979 130 p refs
(Contract N00014-78-C-0049; NR Proj. 371-021)
(AD-A080441; ESL-710816-3) Avail: NTIS
HC A07/MF A01 CSCL 20/14

The scattering of electromagnetic waves by finite obstacles can be rigorously found for only two cases, the sphere and the disk. There exist two exact solutions to the scattering of an electromagnetic plane wave by a circular metallic disk. Flammer's and Meixner's exact approaches are successively considered and compared. In both cases, the fields are expanded in spheroidal vector wave functions, and the scattered field is uniquely determined by the boundary conditions on the surface of the disk and the edge condition. The purpose of this work is to find a solution valid everywhere; in particular, it is desired to obtain the surface current and near fields. A numerical test of the bistatic scattered far-field for normal incidence is presented. Problems encountered in Flammer's solution for arbitrary incidence are pointed out. The general form of the scattered field is derived from Meixner's vector potentials. This formulation is appropriate for near-field calculations. Another proof of Meixner's solution using dependence relations of the spheroidal vector wave functions is given. GRA

N80-21629# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Mathematics.
NONLINEAR WAVE PROPAGATION Annual Report
Mark J. Ablowitz 1979 9 p refs
(Grant AF-AFOSR-3674-78; AF Proj. 2304)
(AD-A080297; AFOSR-80-0047TR) Avail: NTIS
HC A02/MF A01 CSCL 20/14

The main thrust of the work has been the study of certain fundamental features of the nonlinear wave propagation which arises in the applications of many physical problems. Indeed, there are numerous disciplines in mathematics, mathematical physics and physics where these ideas have had an important impact. The work that has been accomplished relates to such diverse topics as nonlinear optics, the stability of physically important waves, special solutions to nonlinear equations, wave propagation in stratified fluids, ordinary differential equations without movable critical points etc. GRA

N80-21630# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PERFORMANCE OF A SOURCE/CHANNEL ENCODED IMAGERY TRANSMISSION SYSTEM M.S. Thesis
Robert A. Duryea Dec. 1979 147 p refs
(AD-A080172; AFIT/GE/EE/79D-12) Avail: NTIS
HC A07/MF A01 CSCL 09/4

The performance of an image transmission system which combines an image source encoding technique with communication channel codes is theoretically calculated and measured by simulation. The theoretical and simulated results show that replacing source data bits with error correction coding bits can reduce the distortion in the received image. The magnitude of the reduction depends on the transmission rate, the code rate (N/K) of the channel code, the procedures used to apply the channel code and the error rate of the communication channel. The image source encoding technique used is the two dimensional Discrete Cosine Transform. This technique is combined with both block and convolutional channel codes to form the source/channel encoded imagery transmission system. The distortion in the received image is measured using a weighted mean square error criterion in which the weighting is related to the frequency sensitivity characteristics of the human visual system. GRA

N80-21631# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CHARACTERIZATION OF TRANSCONDUCTANCE MULTIPLIER WEIGHT CIRCUITS FOR AN ADAPTIVE ANTENNA SYSTEM
Bruce C. Levens Jun. 1979 33 p
(Contract F19628-78-C-0002; AF Proj. 1227)
(AD-A080491; TN-1979-23; ESD-TR-79-161) Avail: NTIS
HC A03/MF A01 CSCL 09/5

Extensive testing of the transconductance multiplier weight circuits designed for the antenna nulling project indicates that a simple time delay feedthrough model fits the measured data very well. Properties of this model are derived and applied to the problem of determining the model parameters from measured data. Plots of actual measurements and model predictions are provided to demonstrate goodness of fit. GRA

N80-21632# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOME EFFECTS OF HARD LIMITING IN ADAPTIVE ANTENNA SYSTEMS
Franklin W. Floyd, Jr. and Joseph T. Mayhan Oct. 1979 37 p refs
(Contract F19628-80-C-0002; AF Proj. 1227)
(AD-A080531; TN-1979-15; ESD-TR-79-246) Avail: NTIS
HC A03/MF A01 CSCL 09/5

Adaptive antennas are often implemented with the Applebaum-Howells type adaptive processor. Analog circuit versions of the Applebaum-Howells processor usually include a hard limiter between each antenna port and its correlation mixer, primarily for dynamic range compression. Brennan and Reed analyzed the effects of hard limiting, and their conclusions suggest that it does not degrade the steady state performance of the adaptive processor. This paper shows that hard limited processors can perform much worse than those without hard limiting in situations where the correlation matrix of array signals has two or more eigenvalues of widely differing magnitudes and when a sensitivity threshold has been designed into the processor. The practical consequence is that (depending on the processor design parameters) when the adaptive antenna encounters two or more interference signals of different power levels, the larger signal can capture the hard limiter, allowing the smaller signals to pass through the processor unattenuated. Specific examples of this effect in both phased array and multiple beam adaptive antennas are presented. GRA

N80-21633# Naval Weapons Center, China Lake, Calif.
FEASIBILITY ASSESSMENT OF RADIOLOCATION SERVICE SHARING WITH FIXED, MOBILE AND FIXED-SATELLITE SERVICES IN 92- TO 95-GHz BAND Final Report
West E. Katzenstein Jan. 1980 25 p refs
(AD-A080661; NWC-TP-6135) Avail: NTIS
HC A02/MF A01 CSCL 09/3

This document is an analysis of the ability of the radiolocation service to share the 92- to 95-GHz band with the fixed, mobile, and fixed-satellite services. This analysis indicates that the required separation distances between radiolocation and the other services for limiting interference to acceptable levels are small and, hence, that sharing is feasible. GRA

N80-21634# Naval Weapons Center, China Lake, Calif.
PREFERRED FREQUENCY BANDS FOR RADIOLOCATION SERVICE BETWEEN 40 AND 300 GHz Final Report
West E. Katzenstein and Robert P. Moore Jan. 1980 11 p refs
(AD-A080658; NWC-TP-6134) Avail: NTIS
HC A02/MF A01 CSCL 09/3

The current International Table of Frequency Allocations identifies no frequency bands for radiolocation devices above 40 GHz. This document discusses the advantages of millimeter wavelengths to the radiolocation services and factors affecting the choice of bands for radiolocation. It is concluded that preferred bands for radiolocation exist in the centers of the atmospheric propagation windows between 40 and 300 GHz, namely in the vicinity of 70, 95, 140, and 240 GHz. Other bands removed

from the propagation windows are of value to short-range applications of radiolocation. GRA

N80-21635# Naval Ocean Systems Center, San Diego, Calif.
RECOVERY OF BANDLIMITED SIGNALS USING POISSON SAMPLES Final Report
D. M. Klamer 1 Oct. 1979 13 p refs
(AD-A080406; NOSC/TR-463) Avail: NTIS
HC A02/MF A01 CSCL 09/3

The problem of interpolation of bandlimited deterministic signals using Lagrange polynomials which are based upon observations taken at Poisson instants is considered. Let the signal be bandlimited to the interval (-3.14, 3.14) radians, and let the average sampling rate of the Poisson process be beta samples per second. When the Lagrange interpolation polynomials are based upon the Poisson sampling instants <(t(sub k>)) and the observed data <s(t(sub k>)), then the mean-squared error converges to zero as the number of observations increases to infinity for all sampling rates beta equal to or greater than 3(3.14)/2. The rate of convergence is exponential for beta greater than 3(3.14)/2. The above results hold for center point interpolation (i.e., an equal number of samples on each side of the interpolation point). For the case of extrapolation, the sampling rate must be increased to 3(3.14). GRA

N80-21636# Arizona Univ., Tucson. Dept. of Electrical Engineering.
EXPERIMENTAL INVESTIGATION OF ELECTROMAGNETIC PULSE (EMP) PROPAGATION IN A CONDUCTION PLASMA Final Report, 1 Oct. 1975 - 30 Sep. 1979
R. N. Carlile 29 Nov. 1979 20 p refs
(Grant AF-AFOSR-2949-76; AF Proj. 2301)
(AD-A079598; AFOSR-80-0001TR) Avail: NTIS
HC A02/MF A01 CSCL 20/14

The electromagnetic pulse (EMP) generated by a nuclear detonation has been the subject of extensive study. Computer codes have been developed which attempt to model the generation and propagation of the EMP due to both a high altitude and low altitude detonation. In some of these codes, the current density term which appears in Maxwell's equations due to conduction currents of secondary electrons is modeled as a function of conductivity which is spatially and time dependent. A more complete description of the conduction currents is given by the familiar fluid transport equations for mass, momentum and energy, which are collectively called the swarm equation. GRA

N80-21637# Arizona Univ., Tucson. Engineering Experiment Station.
A GEOMETRIC THEORY OF NATURAL OSCILLATION FREQUENCIES IN EXTERIOR SCATTERING PROBLEMS Annual Technical Report, 1 Oct. 1978 - 30 Sep. 1979
Allen Q. Howard, Jr. 30 Sep. 1979 30 p refs
(Grant AF-AFOSR-3727-78)
(AD-A079304; AFOSR-79-1305TR) Avail: NTIS
HC A03/MF A01 CSCL 20/3

The representation of the transient electromagnetic response of finite size, smooth, perfectly conducting objects in terms of a complex exponential series is the central ingredient of the singularity expansion method (SEM). The exponential terms correspond to the complex natural frequencies associated with the object geometry. That such a simple series can predict the force free response of complicated objects begs the question 'is there not a corresponding more direct method to compute the natural frequencies in exterior scattering problems.' To partially answer this question a geometric ray optics method, which because of its asymptotic nature is particulary suited to compute the higher order resonances, is described. The electrical path length depends upon the local principal radii of curvature of the surface. The primary result of this work is that a generalized WKB method can be employed to account for both the curvature and impedance boundary conditions. GRA

N80-21638# Auburn Univ., Ala. Engineering experiment station.
SINGULARITIES, COUPLING COEFFICIENTS, AND MODE VECTORS FOR A THIN WIRE SCATTERER PARALLEL TO A LOSSY GROUND Final Report
T. H. Shumpert 15 Dec. 1979 158 p refs
(Grant AF-AFOSR-0017-79; AF Proj. 2301)
(AD-A080094; AFOSR-80-0013TR) Avail: NTIS
HC A08/MF A01 CSCL 20/3

The Singularity Expansion Method (SEM) coupled with the reflection coefficient approximation seems to be an appropriate technique for analyzing a cylindrical scatterer over a finitely conducting ground. Pole locations of the cylinder over perfect ground calculated by investigators were found to be identical to those calculated in this analysis when the ground conductivity is large. Also, when the ground conductivity is reduced with the relative permittivity held at unity, calculated pole locations agree with those of the free space problem. These facts add credence to the reflection coefficient technique. In general, it is found that displacement of the singularities from their free space position is a function of discontinuity in the ground plane. The mechanism for discontinuity is seen to be somewhat immaterial. Mode vectors corresponding to first layer singularities show less or no dependence on the parameters of the problems. GRA

N80-21639# SRI International Corp., Arlington, Va.
SCATTERING FROM A RANDOM SURFACE
H. D. I. Abarbanel Dec. 1979 42 p refs
(Contract MDA903-78-C-0086; ARPA Order 2504)
(AD-A079526; SRI-JSR-78-12) Avail: NTIS
HC A03/MF A01 CSCL 20/1

This report gives a formulation of the problem of propagation of scalar waves over a random surface. By a judicious choice of variables it is able to show that this situation is equivalent to propagation of these waves through a medium of random fluctuations with fluctuating source and receiver. The wave equations in the new coordinates has an additional term, the fluctuation operator, which depends on derivatives of the surface in space and time. An expansion in the fluctuation operator is given which guarantees the desired boundary conditions at every order. This report treats both the cases where the surface is time dependent, such as the sea or surface, or fixed in time. Also discussed is the situation where the source and receiver lie between the random surface and another, possibly also random, surface. In detail, this report considers acoustic waves for which the surfaces are pressure released. The method is directly applicable to electromagnetic waves and other boundary conditions. GRA

N80-21640# Ohio State Univ., Columbus. Electroscience Lab.
RESEARCH ON NEAR FIELD PATTERN EFFECTS Final Report
N. Wang and W. D. Burnside Nov. 1979 27 p refs
(Contract N00019-78-C-0524)
(AD-A079325; ESL-711305-4) Avail: NTIS
HC A03/MF A01 CSCL 20/14

Under the present contract, a simple and efficient multiple-plate model has been developed for the aircraft substructures. Using this model, the tail, wings, stabilizer and engine housings can be easily simulated. A three dimensional model (i.e., prolate spheroid) is employed for investigating the radiation from an aircraft fuselage. In addition, high frequency solutions for the electric field due to antennas radiating from a perfectly conducting convex body are developed. The expressions are given in terms of a fixed ray coordinate system which follows the geodesic path on the conducting surface. These expressions are simple, compact, and are given in terms of some well known and tabulated Fock integrals. Furthermore, these expressions reduce to the geometrical optics solution in the 'deep' lit region and recover the Keller's surface ray representation in the deep shadow region. The continuity of the fields across the shadow boundary is also established. A major task of applying the high frequency solution to solve practical problems, (namely, determining the unique geodesic path on the conducting surface), is also accomplished in the case of a prolate spheroid. Numerical results obtained by employing the newly developed solution are in good agreement with eigenfunction solutions and measured results. GRA

N80-21641# Naval Ocean Systems Center, San Diego, Calif.
QUIET TIME LOWEST OBSERVABLE FREQUENCY (QLOF) CALCULATION PROGRAM Interim Report, Jan. 1978 - Jan. 1979

P. E. Argo and D. B. Sailors 1 Apr. 1979 17 p refs
(AD-A080035; NOSC/TD-231) Avail: NTIS
HC A02/MF A01 CSCL 20/14

The lowest observable frequency (LOF) for a specified hf circuit is important when one is specifying the propagation window for that circuit. This lowest frequency is an absorption controlled effect. The major cause of absorption at low and midlatitudes is the solar created ionospheric D-region. During quiet solar conditions this D-region responds directly to the amount of ionizing solar radiation reaching it. As shown in Bleiweiss (1970, 1972) and Argo and Hill (1977), this solar control is directly related to the solar zenith angle. Other relevant parameters are latitude, sunspot number, and season (calculated from Julian day), which are all described in Argo and Hill (1977). The computer program listing presented in the appendix contains the necessary subroutines for calculating the quiet time LOF (QLOF), and a sample control routine for driving the set of subroutines. GRA

N80-21642# Southern Methodist Univ., Dallas, Tex. Dallas Geophysical Lab.
ENERGY DISSIPATION OF RAYLEIGH WAVES DUE TO ABSORPTION ALONG THE PATH BY THE USE OF FINITE ELEMENT METHOD Interim Report
Eugene Herrin, Tom Goforth, and Ali A. Feizpour 31 Jul. 1979 165 p refs
(Contract F49620-76-C-0030; Grant NSF EAR-77-13114; AF Proj. 3291; DARPA Order 3291)
(AD-A079645; AFOSR-79-1317TR) Avail: NTIS
HC A08/MF A01 CSCL 20/11

A normally incident Rayleigh wave may be used for the investigation of a general vertical boundary and the attenuation of a viscoelastic medium. Use of energy conservation and proper boundary conditions produce 2N second order differential equations, N being the number of viscoelastic layers in the medium. The homogeneous part of the differential equations can be transformed into an eigenvalue problem by the use of finite element technique; the eigenvalue and eigenvectors of the eigenvalue problem are the wavenumbers and the displacement amplitudes of the viscoelastic layered medium. The real and imaginary parts of the wavenumber determine the phase velocity and the attenuation of the layered medium, respectively. Dispersion and the attenuation curves can be obtained by using different periods. The above wavenumbers can be used in the inhomogeneous differential equation; this equation contains the effect of the vertical boundary; solution of this equation determines the displacement at the vertical boundary. GRA

N80-21643# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
CURRENTS AND CHARGES ON CYLINDERS IN A PARALLEL-PLATE TRANSMISSION LINE Final Report, 30 Jun. 1976 - 30 Jun. 1979
T. T. Wu, M. Krock, R. W. P. King, D. J. Blejar, T. K. Sarkar, S. K. Wan, M. Owens, B. H. Sandler, J. E. Baum, and M. J. Miller Jul. 1979 84 p refs
(Grant AF-AFOSR-3073-76; AF Proj. 9751)
(AD-A079597; AFOSR-80-0005TR) Avail: NTIS
HC A05/MF A01 CSCL 20/14

The final report summarizes the results of a 3-year model study to evaluate how well a parallel-plate transmission-line structure simulates an electromagnetic pulse with a plane-wave front. The amplitude and phase of the electric field inside the model simulator have been measured at two high frequencies for which transmission-line theory does not apply. An approximate theoretical representation of the field is used to interpret the measured data. Differences between the actual field and the desired traveling plane-wave field are discussed, and possible methods to improve the field in the simulator are offered. GRA

N80-21644# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE USE OF COMPLEX FIELD VECTORS IN DIFFRACTION THEORY M.S. Thesis
Mark Edward Rogers Dec. 1979 87 p refs
(AD-A080245; AFIT/GEP/PH/79D-10) Avail: NTIS
HC A05/MF A01 CSCL 20/6

A rigorous solution to the diffraction problem is obtained using two complex field vectors. The field equations which are uncoupled in terms of Q-bar and P-bar can be integrated directly to yield a pair of uncoupled vector integral equations involving the tangential components of Q-bar and P-bar on an arbitrary open surface. When the surface is planar, the vector equations are expressed in a more usable set of six component integral equations. The restrictions in the derivation of these latter equations are that the initial E-bar and H-bar satisfy Maxwell's equations on the open surface, and that the resultant field is calculated at least several wavelengths from the initial field. The Rayleigh-Sommerfeld equation of scalar diffraction theory is obtained as a special case of the component set of equations. A discussion of the physical meaning of these component equations lends insight into the diffraction process. The complex field vector approach is seen to be a rigorous, yet simple and straightforward, method of solving the diffraction problem. GRA

N80-21645# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTERMODULATION MEASUREMENT IN THE UHF BAND AND AN ANALYSIS OF SOME BASIC CONDUCTING MATERIALS
Joseph C. Lee Nov. 1979 45 p refs
(Contract F19628-80-C-0002; AF Proj. 2029)
(AD-A080427; TN-1979-70; ESD-TR-79269) Avail: NTIS
HC A03/MF A01 CSCL 20/3

In a modern communications satellite, it is generally required that high-power multi-channel transmitters and super-sensitive broadband receivers be packed in a limited space. Because of the very large power level difference between transmit and receive signals and the limitation of frequency allocation, intermodulation (IM) interference due to passive residual nonlinearities in the high-power transmission path can be a real problem. This kind of problem did crop up during several communication satellite development programs. This report represents an effort toward a better understanding of the general IM phenomenon. Passive nonlinearities of resistivity in conducting material, in contrast with that due to contact junctions, were studied by careful measurement and analysis. Forward and backward traveling wave IM's in a long transmission line were distinguished and interpreted. New evidence concerning the deviation from Ohm's law by metal conductors was obtained and quantitative characterization of the weak nonlinear characteristics of good conductors was attempted. The IM production of steel, stainless steel, and graphite fiber were conclusively demonstrated. These materials are used in certain filter and antenna fabrications in aerospace applications for low thermal expansion or light weight. Intermodulations generated by many commonly used conducting materials were measured in the UHF band and analyzed in terms of resistivity nonlinearities. Contact nonlinearity at the most critical locations in the measurement was avoided by the use of quarter-wavelength couplings. Forward and backward traveling intermodulation waves in a transmission line were distinguished and interpreted. GRA

N80-21646# Naval Underwater Systems Center, New London, Conn. Special Projects Dept.
OPTIMUM DETECTION OF A RANDOMLY FREQUENCY-MODULATED CARRIER
Albert H. Nuttall Oct. 1979 137 p refs
(ZR0000101)
(AD-A079795; NUSC-TR-6177) Avail: NTIS
HC A07/MF A01 CSCL 09/3

The logarithm of the likelihood ratio for detection of a frequency-modulated signal tone, received in the presence of white Gaussian noise, is derived and expressed in the form of an infinite Volterra series. The amplitude of the received signal tone and the received noise power density level are presumed known; the additive phase shift is uniformly distributed; and the frequency modulating process is Gaussian, with a spectrum such that no carrier tone remains in the frequency modulated signal spectrum. This is called a fully-random signal herein. When the time bandwidth product (of observation time and signal bandwidth) is large enough, and there is at least a moderate amount of frequency modulation, the optimum processor is well-approximated by a filter followed by an energy detector; the filter passband is that of the spectrum of the received signal. The frequency modulation is termed moderate when the ratio of the RMS frequency deviation to the equivalent bandwidth of

the frequency modulating process is of the order of 2-3. Numerous approximations have been necessary to facilitate evaluation of some of the multiple integrals; to what degree the sufficient conditions cited above can be relaxed, without violating the conclusions, is unknown. GRA

N80-21647# Pennsylvania Univ., Philadelphia. School of Electrical Engineering.
REMOTE AND DISTRIBUTED ELECTROMAGNETIC RADIATORS Final Report, 25 Sep. 1978 - 24 Sep. 1979
Fred Haber Nov. 1979 10 p refs
(Contract DAAG29-78-C-0042)
(AD-A078977; UP-VFRC-17-79; ARO-16217.3-A-EL) Avail: NTIS HC A02/MF A01 CSCL 09/3

Methods of reducing the risk connected with operation of radio communication systems in a military environment were investigated. Two alternative approaches were pursued. The first involved methods of direct transport of RF power to remote radiators. Fiber optics, millimeter waves, and intercalated graphite as a low loss low weight conductive medium, were investigated. The second approach involved the use of a widely distributed sparse array as a receiver, transmitter and relay. The array method was found particularly appropriate, giving the effect of distributed obscure source difficult to locate. It was shown that the array can be physically isolated from users, requires very little power at each of its elements, can be made self-organizing with the help of its uses, and can provide diversity and reliability advantages. GRA

N80-21648# Naples Univ. (Italy). Ist. Elettrotecnico.
DIFFRACTION AT A SURFACE IMPEDANCE DISCONTINUITY: APPLICATION TO SEA-LAND RADIOWAVE PROPAGATION Annual Technical Report, Oct. 1978 - Sep. 1979
Giorgio Franceschetti and Vittorio G. Vaccaro Sep. 1979 41 p refs
(Grant DA-ERO-78-G-097; DA Proj. 1T1-61102-BH-57)
(AD-A080388; ATR-1) Avail: NTIS HC A03/MF A01 CSCL 20/14

Full solution of plane wave diffraction by a surface impedance discontinuity on a plane is presented. The solution is given for both normal and oblique incidence, the diffraction integral being evaluated asymptotically in a closed form. This solution extends previous results of Maliuzhinets, valid only for normal incidence, and singular at reflection boundaries. For practical application to radiowave propagation over the Earth, the field close to the surface is of interest. This is represented as incident, reflected, surface and extra term field, this last characteristic of the surface impedance discontinuity. In addition, a cylindrical wave, scattered by the discontinuity is present. The field produced by prescribed sources can be synthesized using a plane wave expansion and then applying results of the scattering analysis. GRA

N80-21649# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STATISTICAL MODEL FOR MULTIPATH REFLECTION EFFECTS OF ANTENNAS MOUNTED ON AIRCRAFT M.S. Thesis
Jeffrey L. Frack Dec. 1979 103 p refs
(AD-A080369; AFIT/GE/EE/79-14) Avail: NTIS HC A06/MF A01 CSCL 09/5

A statistical model of the effects of multipath reflections for antenna arrays mounted on aircraft is developed to predict antenna system performance as a function of communication signal arrival angle. Each array element is assumed to have an electric field pattern that is a Gaussian random process with known statistics. These assumptions are used to find the statistic for the array. From these statistics the performance of the antenna of the system can be found using three performance measures for the array: the probability that the array gain is above a threshold; probability level curves to show what threshold function the gain will be above a specified percentage of the time; and the probability that the array gain will be above some threshold on an entire interval. These performance measures are evaluated for a specific array configuration for a set of assumed statistics and then plotted versus arrival angle. The results for different array variance are compared and the result is that higher variance results in poorer average antenna performance. The same measures are than evaluated for an array whose statistics are determined from actual measured data. GRA

N80-21650# Selenia S.p.A., Rome (Italy).
SYNTHETIC APERTURE RADAR STUDY, VOLUME 1 Final Report
G. Meneghini, P. Porzio, J. Collomb (Thomson CSF, Paris), and P. Palluel (Thomson CSF, Paris) Apr. 1979 216 p 2 Vol.
(Contract ESA-3696/78-NL-AK)
(ESA-CR(P)-1242-Vol-1) Avail: NTIS HC A10/MF A01

A feasibility study for a high power amplifier used in pulsed mode in the average power range of 300 and 1000 watt and pulsed power 5000 watt and 20,000 watt is presented. After a detailed technical discussion and study of the tradeoffs for the transmitter parts (EPC, modulator, crow-bar and tube) and the relevant technology to be used, a solution for the synthetic aperture radar (SAR.) transmitter is proposed and illustrated in detail. An analysis of the time schedule and costs for the development and production of the proposed transmitter is given. Author (ESA)

N80-21651# Selenia S.p.A., Rome (Italy).
SYNTHETIC APERTURE RADAR STUDY, VOLUME 2 Final Report
G. Meneghini, P. Porzio, J. Collomb (Thomson CSF, Paris), and P. Palluel (Thomson CSF, Paris) Apr. 1979 272 p 2 Vol.
(Contract ESA-3696/78-NL-AK)
(ESA-CR(P)-1242-Vol-2) Avail: NTIS HC A12/MF A01

Results of a feasibility study for high power amplifiers used in pulsed mode in the average power range of 300 and 1000 E watt and pulsed power 5000 watt and 20,000 watt and applicable to the synthetic aperture radar transmitter are provided. Tables and figures generated during the study are presented. J.M.S.

N80-21652# ERA Ltd., Leatherhead (England).
STUDY OF AN ANTENNA SYSTEM FOR AN EXPERIMENTAL TV SATELLITE Final Report
N. Adatia, K. Keen, B. K. Watson, G. Crone, and N. Dang Mar. 1979 234 p refs
(Contract ESA-3285/77-NL-AK(SC))
(RFTC-420877; ESA-CR(P)-1245) Avail: NTIS HC A11/MF A01

The results of an investigation carried out to establish the feasibility of an antenna system for an experimental TV broadcast satellite application are described. The antenna is intended to generate a circularly polarized beam of elliptical cross section and high degree of polarization purity. The research described is concerned with the feasibility of realizing such a performance employing an elliptically contoured offset Cassegrain reflector system in conjunction with a circularly polarized corrugated rectangular horn feed. Experimental and theoretical results are presented for the radiation pattern characteristics of an elliptically contoured reflector system used in conjunction with linearly polarized and circularly polarized primary feed elements. Attention is then given to the performance and the limitations of the corrugated rectangular horn operated in circular polarization. Author (ESA)

N80-21653# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 1: (SUMMARY OF WORK). FACILITY DESIGN AND TEST RUNS Final Report
H. Bach, E. Lintz Christensen, Jesper E. Hansen, Frank Jensen, and Flemming Holm Larsen Apr. 1979 84 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-208-Vol-1; ESA-CR(P)-1272-Vol-1) Avail: NTIS HC A05/MF A01

An experimental facility for spherical near field testing of spacecraft antennas was designed and implemented in a radio anechoic chamber. Verification of the test method and the facility by measurement of an antenna near field and calculation of the associated radiation pattern was carried out. Author (ESA)

N80-21654# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 2: DATA COLLECTING AND

CONTROLLING SYSTEM. SYSTEM DESCRIPTION AND SOFTWARE Final Report
E. Lintz Christensen and Claus Kjaergaard Hansen May 1979 47 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-209-Vol-2; ESA-CR(P)-1272-Vol-2) Avail: NTIS
HC A03/MF A01

The design and construction of the software in a data collecting and controlling system is described, for the experimental spherical near field antenna test facility developed jointly by ESTEC and Electromagnetics Institute, the Technical University of Denmark. The data collecting and controlling system is based on an Intel microcomputer system. By means of an external bus system and external logic the microcomputer may trigger and read data from the displays (phase and amplitude displays) of the receiving system. The microcomputer also controls the positioning of the antenna probe tower by connections to the antenna positioner servo system and to position displays. Included in the system is a magnetic tape transport and formatter for the purpose of data storage. The external devices are accessed by the microcomputer by memory read/write operations. The execution time of instructions comprising memory read/write to the external devices exceeds the time for internal read/write operations by only a few microseconds. Author (ESA)

N80-21655# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 3: DATA COLLECTING AND CONTROLLING SYSTEM. HARDWARE Final Report
C. Kjaergaard Hansen May 1979 166 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-210-Vol-3; ESA-CR(P)-1272-Vol-3) Avail: NTIS
HC A08/MF A01

A data collection and control system (DCC) designed for the purpose of performing automatic near field measurements in closely spaced points on a spherical surface around large at antennas is described. The DCC system consists of a data bus system controlled by a microcomputer system. The microcomputer system comprises a microcomputer with the necessary software, a terminal, and a magnetic tape recorder. Features of the system described include the DCC hardware, INTEL 80/20 microprocessor system, minicomputer interface, magnetic tape recorder interface, processor interface, box interface, device interface, and programmability. J.M.S.

N80-21656# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 4: MICROSYS. MULTIPROGRAMMING SOFTWARE Final Report
Lars Thrane Apr. 1979 80 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-211-Vol-4; ESA-CR(P)-1272-Vol-4) Avail: NTIS
HC A05/MF A01

The functions of the real time multiprogramming system MICROSYS designed for use on an INTEL 80/20 microcomputer are defined. The multiprogramming system is used for the data collection and control system of the experimental spherical near field antenna test facility. The use of the monitor routines which are used to initiate and control concurrent process execution is described. Monitor tables, process tables, the individual semaphore tables, and the queueing technique are included. J.M.S.

N80-21657# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 5: ANTENNA POSITIONER SERVO SYSTEM Final Report
Flemming Hansen Apr. 1979 157 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-212-Vol-5; ESA-CR(P)-1272-Vol-5) Avail: NTIS
HC A08/MF A01

The design of a programmable dual axis digital servo system for the antenna positionner of an experimental spherical near field antenna test facility is described. The main specifications of the system include. Full computer programmability of speed and acceleration, speed in the range 0.1 - 20 deg/sec (1 hour/rev - 18 sec/rev), acceleration in the range 0.01 - to 2 deg/S sq, and microstepping for precision alignment. The servo system employs dc pancake motors powered by Class AB transistor amplifiers as the driving elements and optical incremental encoders as velocity feedback elements. The servo system is designed as a velocity servo, but closing the loop through a microprocessor converts the system to a position servo employing position feedback from synchro transmitters and at a later stage from inductosyns. Author (ESA)

N80-21658# TICRA ApS, Copenhagen (Denmark).
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 6: COMPUTER SIMULATION STUDIES Final Report
Frank Jensen 1 Aug. 1979 108 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(S-86-03-Vol-6; ESA-CR(P)-1272-Vol-6) Avail: NTIS
HC A06/MF A01

A general facility simulator for simulation of antenna measurements by the spherical near field technique is described and results of simulations are presented. It is shown that very high accuracies may be obtained by the spherical near field technique within reasonable requirements to the tolerances of the mechanical and the electrical parts of the set up. The spherical near field test facility at the Technical University of Denmark has been evaluated by simulation. The inaccuracies of the mechanical set-up are shown to cause inaccuracies on determination of the antenna directivity as small as + or - 0.03 db at a directivity level of 45 dBi. The receiver has only been investigated for small test antennas and, typically, the receiver will cause a directivity inaccuracy of + or - 0.07 dB at a level of 21 dBi. The most important sources of inaccuracies are identified and improvements of the set-up are suggested. Author (ESA)

N80-21659# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 7: SPHERICAL NEAR-FIELD TRANSFORMATION PROGRAM WITH PROBE CORRECTION (SNIFTC) Final Report
Flemming Holm Larsen Oct. 1978 44 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK; Grant DSIR-516-8158.E-451)
(LD-201-Vol-7; ESA-CR(P)-1272-Vol-7) Avail: NTIS
HC A03/MF A01

The program SNIFTC, written in FORTRAN, computes the radiated far field or radiation pattern of antennas. As input data SNIFTC uses the signal from a known field probe which scans the near field of the antenna on a spherical surface. Both the near field and the computed far field are described in spherical coordinates in points spaced equidistant in theta and phi. Correction for the aperture distribution of the probe is included. Running times of SNIFTC is of the order of nine minutes on an IBM370/165 computer for an antenna of the maximum diameter (80 lambda) which can be handled using core storage only. Author (ESA)

N80-21660# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 8: SPHERICAL NEAR-FIELD MEASUREMENTS FROM A COMPACT-RANGE VIEWPOINT Final Report
Arthur C. Ludwig and Flemming Holm Larsen Apr. 1979 66 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-213-Vol-8; ESA-CR(P)-1272-Vol-8) Avail: NTIS
HC A04/MF A01

A procedure is described in which the local plane wave field required for measuring the far field antenna pattern is generated by an array of sources distributed over the surface of a sphere. The probe weighting factors used in spherical near field measurements, by reciprocity, may be used as excitations for a spherical array, and the results must be a plane wave field inside a central portion of the sphere. Any deviations from a perfect plane wave indicate measurement errors, on a basis independent of the antenna under test. A computer program has been written to calculate this plane wave field, and the SNIFTC program has been modified to provide the excitation

factors. Several cases have been run showing that a virtually perfect plane wave field is achieved, confirming the theory and validating both programs. Phase deviations less than 0.04 deg and amplitude variations less than 0.003 dB have been found theoretically within a spherical quiet zone. Several cases have been run to evaluate the effects of truncating the array. It is shown that the size and the quality of the quiet zone is independent of the array radius for a full spherical array. For a truncated array the quiet zone becomes smaller when the array radius is decreased. Also very small arrays have been investigated and a case is treated where a 3 x 3 array at 1/3 of the Rayleigh distance produce a phase which is less than for a single element at the full Rayleigh distance. Author (ESA)

N80-21661# Analytical and Computational Mathematics, Zurich (Switzerland).

FLUCTUATING IONOSPHERIC INDEX INFLUENCE ON VHF TRACKING AND ONLINE: STUDY ON MERITS AND LIMITATIONS OF ONLINE CALIBRATION TECHNIQUES FOR VHF TRACKING

P. Kohler Oct. 1979 151 p refs
(Contract ESOC-3495/78-D-JS(SC))
(ESA-CR(P)-1279) Avail: NTIS HC A08/MF A01

Path length and phase perturbations of pulsed and continuous wave signals propagating through random dispersive media are examined theoretically. The main emphasis is on transionospheric VHF tracking applications. Bias terms and noise uncertainity of real time correction for the additional ionospheric delay are given. Multifrequency correction is shown to be affected by an inherently high noise level which is due to discrete approximation of the phase differentiation and the technically limited detection accuracy. A higher order, e.g., five frequency scheme is proposed. The lower power per channel is compensated under quiet conditions and high tracking elevation. This procedure yields potentially to a higher accuracy. Author (ESA)

N80-21662# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).

S BAND LOW GAIN ANTENNA PQM MANUFACTURING AND TEST Final Report

J. Torres, P. Pinto, F. Villa, and V. Tato Jul. 1979 78 p refs
(Contract ESTEC-3304/77-NL-AK)
(SB/AE/322-FR; ESA-CR(P)-1280) Avail: NTIS HC A05/MF A01

The development and testing are reported of a prequalification model of an S Band TT and C antenna which will meet the mechanical and environmental requirements of a TRICA specification. The specification is given for both an isolated and a spacecraft mounted antenna, followed by a description of fabrication techniques, testing procedures, and design optimization possibilities. Test records are provided, along with the fabrication procedures for a microwave stripline. The possibility of a resonant ring breakdown is investigated. Author (ESA)

N80-21663# National Telecommunication Information Administration, Boulder, Colo. Inst. of Telecommunication Sciences.

METHODS OF IMPROVING THE PERFORMANCES OF HF DIGITAL RADIO SYSTEMS Final Report

Clark C. Watterson Oct. 1979 135 p refs Sponsored in part by Army Communications-Electronics Engineering Installation Agency, Ft. Huachuca, Ariz.
(PB80-128606; NTIA-79/29) Avail: NTIS HC A07/MF A01 CSCL 17B

The bit-error-probability performances of HF digital radio systems with respect to channel and equipment additive, multiplicative, and nonlinear distortions were evaluated with respect to the nine system design features that affect the performances. The system design features are the fundamental pulse waveform, the keying method (ASK, PSK, APSK, FSK, and CPK), the multiplexing method (frequency and concentric multiplexing), the type of demodulator filter (matched and nonmatched nonadaptive filters and quasistatic and dynamic adaptive filters), the detection method (coherent, partially coherent, differentially coherent, and noncoherent), the transmitter power, the antennas, diversity, and error coding. Spectral efficiency (information rate/signal bandwidth) is also evaluated. The best combination of design features is determined. GRA

N80-21664# Federal Communications Commission, Washington, D. C. Rules Div.

LAND MOBILE SPECTRUM UTILIZATION: LOS ANGELES, CALIFORNIA, AND SAN DIEGO, CALIFORNIA

Larry D. Reed Nov. 1979 141 p refs
(PB80-124282; FCC/PRB/RDL-79/02) Avail: NTIS HC A07/MF A01 CSCL 17B

Radio frequency utilization by FCC licensees in Southern California is described. The licensees include among others: police and fire departments, hospitals, public utilities, commercial, marine and common carrier users. The extent of frequency utilization is described in terms of four 'occupancy categories' (zero, low, substantial and very high). The rationale for these categories and their relationship to measured usage data are given. Summary tables enable direct comparison of the use by the various individual radio services, e.g., police, business, taxicab, etc. Separate analyses are given for utilization by each of the land mobile services and frequency bands. GRA

N80-21665# Federal Communications Commission, Washington, D. C.

ADVISORY COMMITTEE ON CABLE SIGNAL LEAKAGE Final Report

1 Nov. 1979 247 p refs
(PB80-119605) Avail: NTIS HC A11/MF A01 CSCL 17B

The relationship between cable television system signal leakage, as measured at ground level, and the probability of harmful interference to aeronautical and other radio services was investigated. The report concludes that it is possible, on the basis of ground based measurements, to determine whether leakage fields in the airspace will be sufficient to cause interference. A regulatory scheme to prevent such interference is suggested. GRA

N80-21666*# New Mexico Univ., Albuquerque. Technology Application Center.

COMMUNICATION SATELLITE TECHNOLOGY, VOLUME 4. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1979

Gerald F. Zollars Jan. 1980 66 p Sponsored by NASA and NTIS
(NASA-CR-162789; PB80-803893; NTIS/PS-79/0332)
Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

The cited articles from the international literature concern all aspects of communication satellite technology. Included are articles on satellite networks, data transmission efficiency, time division multiple access, data links, and phase shift keying. This bibliography contains 239 citations. GRA

N80-21667# Middleton (David), New York.

PERFORMANCE OF TELECOMMUNICATIONS SYSTEMS IN THE SPECTRAL-USE ENVIRONMENT. PART 5: LAND-MOBILE AND SIMILAR SCENARIOS IN CLASS A INTERFERENCE

David Middleton Jun. 1979 91 p refs Sponsored by National Telecommunications and Information Administration
(PB80-127475; NTIA-CR-79-4) Avail: NTIS HC A05/MF A01 CSCL 17B

A canonical model of receiver performance in general Class A interference environments was constructed. Analytical and numerical evaluation of the probability of noninterference criteria (PNIC) was carried out as a function of an appropriately defined input signal-to-receiver noise ratio, for various ranges of parameter values, describing different nonGaussian noise fields, random walks with different variances, and signal sources with different propagation laws. Detailed quantitative results and examples are discussed. GRA

N80-21668# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.

MEASUREMENTS OF AN FM RECEIVER IN FM INTERFERENCE

John R. Juroshek Oct. 1979 40 p ref
(PB80-119316; NTIA-79/27) Avail: NTIS HC A03/MF A01 CSCL 17B

The performance of an FM landmobile receiver in FM interference was investigated. Measurements are described which show the effects of multiple interfering FM signals as a function

of modulation index, signal to interference ratio, signal to noise ratio, and frequency offset between the victim and interferer. The performance of the receiver was measured with various combinations of one to three interfering FM signals. The spectra of the audio output during various interference conditions is described. GRA

N80-21370*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
X-BAND UPLINK GROUND SYSTEMS DEVELOPMENT
R. Hartop, C. Johns, and R. Kolbly *In its* The Deep Space Network 15 Apr. 1980 p 48-58 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-21372*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A BENT PIPE DESIGN FOR RELAYING SIGNALS RECEIVED BY AN ORBITING DEEP SPACE RELAY STATION TO A GROUND
M. A. Koerner *In its* The Deep Space Network 15 Apr. 1980 p 76-84 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-21376*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PULSE-POSITION-MODULATION CODING AS NEAR-OPTIMUM UTILIZATION OF PHOTON COUNTING CHANNEL WITH BANDWIDTH AND POWER CONSTRAINTS
R. G. Lipes *In its* The Deep Space Network 15 Apr. 1980 p 108-113 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-21380*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF ANTENNA POINTING ERRORS ON RANGE DELAYS, PART 1
T. Y. Otoshi *In its* The Deep Space Network 15 Apr. 1980 p 143-146 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-21576# Selenia S.p.A., Rome (Italy).
THE ORGANIZATION IN A SEMI-AUTOMATIC PROCEDURE OF THE PROGRAMS FOR THE COMPUTER-AIDED DESIGN OF MICROWAVE ANTENNAS
Valeria Caputo and Paolo deVincenti *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 153-156 (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21577# Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Studio per le Telecomunicazioni Spaziali.
RAID: AN INTERACTIVE SYSTEM FOR REVISING AND PREPROCESSING RADAR IMAGES
A. Pawlina *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 157-162 refs Prepared in cooperation with Politec. di Milan (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21582*# Missouri Univ., Rolla. Dept. of Electrical Engineering.
PERFORMANCE EVALUATION OF TELECOMMUNICATION SYSTEMS USING COMPUTER SIMULATION
William H. Tranter *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 197-206 refs (For primary document see N80-21560 12-31)
(Contracts NAS9-13436; NAS9-14848)
Avail: NTIS HC A19/MF A01 CSCL 17B

N80-21583# University Coll., Dublin (Ireland).
SIMULATION OF MULTICHANNEL WIDEBAND SATELLITE COMMUNICATION SYSTEMS
M. ODroma and J. O. Scanlan *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 207-216 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21584# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
TIME-DOMAIN SIMULATION OF A TELECOMMUNICATION DISTRESS SYSTEM
M. Ajmone Marsan, V. Castellani, and M. Pent *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 217-226 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21585# Christian Rovsing Ltd., Copenhagen (Denmark).
TECHNIQUES FOR THE ANALYSIS OF PROPAGATION EFFECTS ON COMMUNICATIONS SATELLITE PERFORMANCE
L. Erup and R. A. Harris (ESA, Paris) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 227-239 refs Prepared in cooperation with ESTEC, Noordwijk, Netherlands (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21587# Marconi Co. Ltd., Chelmsford (England).
NOISE ANALYSIS OF FADING SATELLITE COMMUNICATION LINKS
P. G. Wright, B. G. West, and G. K. Smith *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 251-257 refs Prepared in cooperation with ESTEC Noordwijk, Neth. (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21588# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
SIGNAL PROCESSING OF ORBITAL TEST SATELLITE DATA
K. G. Holleboom and J. M. H. Wagemans *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 259-266 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21590# Bell Telephone Labs., Inc., Holmdel, N. J.
SIMULATION OF TIMING AND CARRIER RECOVERY USING SYSTID
P. Balaban and K. S. Shanmugan *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 273-280 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21595# Sachs/Freeman Associates, Inc., Bladensburg, Md.
CAD TECHNIQUES FOR INTRASYSTEM ELECTROMAGNETIC COMPATIBILITY (EMC) AT THE EQUIPMENT LEVEL
Ernest R. Freeman *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 313-318 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21596# Centre National d'Etudes Spatiales, Toulouse (France).
EMC: A PROGRAM FOR THE ANALYSIS AND PREDICTION OF ELECTROMAGNETIC PERTURBATIONS TRANSMITTED BY CONDUCTION [EMC: UN PROGRAMME D'ANALYSE ET DE PREDICTION DE PERTURBATIONS ELECTROMAGNETIQUES TRANSMISES PAR CONDUCTION]
J. P. Catani *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 319-324 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21599# GTE-Telecomunicazioni S. p. A., Cassina de Pecchi (Italy).
EVANESCENT MODE WAVEGUIDE CIRCULATOR
A. DAmbrosio and S. Blo *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 347-355 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21601# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
CORRUGATED HORNS: COMPUTER ANALYSIS OF INPUT IMPEDANCE PROPERTIES AND OF MODE EXCITATIONS
V. G. Daniele, I. Montrosset, and R. S. Zich *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 363-366 refs Sponsored by Centro Studi e Lab. Telecom. (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-22234# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SUPPRESSION OF ELECTROSTATIC RADIOELECTRIC INTERFERENCE ON AIRCRAFT
Jean-Louis Boulay *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 21-45 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 89-108 Original report in FRENCH previously announced as A79-34978 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-21669*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MULTISTAGE DEPRESSED COLLECTOR WITH EFFICIENCY OF 90 TO 94 PERCENT FOR OPERATION OF A DUAL-MODE TRAVELING WAVE TUBE IN THE LINEAR REGION
Peter Ramins and Thomas A. Fox Washington Apr. 1980 16 p refs
(NASA-TP-1670; E-9975) Avail: NTIS HC A02/MF A01 CSCL 09A

An axisymmetric, multistage, depressed collector of fixed geometric design was evaluated in conjunction with an octave bandwidth, dual mode traveling wave tube (TWT). The TWT was operated over a wide range of conditions to simulate different applications. The collector performance was optimized (within the constraint of fixed geometric design) over the range of TWT operating conditions covered. For operation of the TWT in the linear, low distortion range, 90 percent and greater collector efficiencies were obtained leading to TWT overall efficiencies of 20 to 35 percent, as compared with 2 to 5 percent with an undepressed collector. With collectors of this efficiency and minimized beam interception losses, it becomes practical to design dual mode TWT's such that the low mode can represent operation well below saturation. Consequently, the required pulse up in beam current can be reduced or eliminated, and this mitigates beam control and dual mode TWT circuit design problems. For operation of the dual mode TWT at saturation, average collector efficiencies in excess of 85 percent were obtained for both the low and high modes across an octave bandwidth, leading to a three to fourfold increase in the TWT overall efficiency. Author

N80-21670*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE SWITCHING POWER DIVIDER Patent Application
Ronald J. Stockton, inventor (to NASA) (Ball Aerospace Systems Div., Boulder, Colo.) Filed 12 Mar. 1980 24 p Sponsored by NASA
(NASA-Case-GSC-12420-1; US-Patent-Appl-SN-129793) Avail: NTIS HC A02/MF A01 CSCL 09A

A microwave switching power divider for selectively dividing and switching microwave energy among a plurality of outputs to antenna elements or other microwave devices such as filters, phase-shifters or other networks is disclosed. The power divider includes a pair of parallel, spaced-apart circular ground planes defining a microwave cavity with multi-port microwave power distributing switching circuitry formed on opposite sides of a thin circular dielectric substrate disposed between the ground planes. The power distributing circuitry includes a conductive disk located at the center of the substrate and connected to a source of microwave energy. Microwave energy propagates as standing waves within the cavity. A plurality of radial power dividing transmission lines for intercepting the standing waves are symmetrically disposed about and connected to the conductive disk. NASA

N80-21671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATIC THERMAL SWITCH Patent Application
Joseph W. Cunningham and Lawrence D. Wing, inventors (to NASA) Filed 21 Dec. 1979 23 p
(NASA-Case-GSC-12553-1; US-Patent-Appl-SN-106192) Avail: NTIS HC A02/MF A01 CSCL 09A

An automatic thermal switch to control heat flow is described which includes a first thermally conductive plate, a second thermally conductive plate and a thermally conductive switch saddle pivotally mounted to the first plate. A flexible heat carrier is connected between the switch saddle and the second plate. A phase-change power unit, including a piston coupled to the switch saddle is in thermal contact with the first thermally conductive plate. A biasing element biases the switch saddle in a predetermined position with respect to the first plate. When the phase-change power unit is actuated by an increase in heat transmitted through the first plate, the piston extends and causes the switch saddle to pivot thereby varying the thermal conduction between the first and second plate and through the switch saddle and flexible heat carrier. The biasing element, switch saddle and piston can be arranged to provide either a normally closed or normally opened thermally conductive path between the first and second plates. NASA

N80-21672*# National Aeronautics and Space Administration, Washington, D. C.
HIGH POWER THYRISTORS WITH 5 kV BLOCKING VOLTAGE. VOLUME 1: DEVELOPMENT OF HIGH-VOLTAGE-THYRISTORS (4.5 kV) WITH GOOD DYNAMIC PROPERTIES
Karlheinz Lock (Siemens A.G., Munich), Hubert Patalong (Siemens A.G., Munich), and Karl Platzoeder (Siemens A.G., Munich) Oct. 1979 35 p refs Transl. into ENGLISH from German report BMFT-FB-T-77-22, v. 1, Dec. 1977 Original language document was announced as N79-17164 Transl. by Kanner (Leo) Associates, Redwood City, Calif., Original doc. prep. by Siemens, A. G., Munich
(Contract NASw-3199)
(NASA-TM-75449; BMFT-FB-T-77-22) Avail: NTIS HC A03/MF A01 CSCL 09A

Using neutron irradiated silicon with considerably lower spread in resistivity as compared to conventionally doped silicon it was possible to produce power thyristors with breakdown voltages between 3.5 kV and 5.5 kV. The thyristor pellets have a diameter of 50 mm. Maximum average on-state currents of 600 to 800 A can be reached with these elements. The dynamic properties of the thryistors could be improved to allow standard applications up to maximum repetitive voltages of 4.5 kV. Author

N80-21673*# National Aeronautics and Space Administration, Washington, D. C.
InP AND GaAs CHARACTERIZATION WITH VARIABLE STOICHIOMETRY OBTAINED BY MOLECULAR SPRAY Final Report
J. Massies, N. T. Linh, J. Olivier, P. Faulconnier, and R. Poirier Dec. 1979 31 p refs Transl. into ENGLISH of "Etude de Surfaces de Phosphure d'Indium Obtenues sous Differentes Stoichiometries par la Technique des Jets Moleculaires. Application a la Realisation de Barrieres de Schottky", Rept. LCR-2270-DK Lab. de Central de Rech. Thomson-CSF, Orsay, France, Aug. 1977 31 p Original language document was announced as N79-27414 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75748; LCR-2270-DK) Avail: NTIS HC A03/MF A01 CSCL 09A

Both InP and GaAs surfaces were studied in parallel. A

molecular spray technique was used to obtain two semiconductor surfaces with different superficial compositions. The structures of these surfaces were examined by electron diffraction. Electron energy loss was measured spectroscopically in order to determine surface electrical characteristics. The results are used to support conclusions relative to the role of surface composition in establishing a Schottky barrier effect in semiconductor devices.
Author

N80-21674# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A REFLECTION COEFFICIENT TRANSFORMING CIRCUIT FOR PHASE SHIFTERS
Harry A. Atwater Oct. 1979 24 p refs
(Contract F19628-80-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A080490; TN-1979-36; ESD-TR-79-266) Avail: NTIS HC A02/MF A01 CSCL 09/5

Formulae are derived for the design of impedance transforming two port networks which transform the reflection coefficients of an arbitrary two state impedance termination such as a circuit containing a switchable semiconductor element. The transformed reflection coefficients at the input have equal magnitude for both states of the termination and differ in angle by a prescribed amount. In a reflection type phase shifter, these circuits eliminate amplitude fluctuations at the output when phase is switched.
GRA

N80-21675# Texas Univ. at Austin. Dept. of Chemistry.
SEMICONDUCTOR ELECTRODES. 24: BEHAVIOR AND PHOTOELECTROCHEMICAL CELLS BASED ON p-TYPE GaAs IN AQUEOUS SOLUTIONS
Fu-Ren F. Fan and Allen J. Bard 1 Dec. 1979 41 p refs
Submitted for publication
(Contract N00014-78-C-0592)
(AD-A080316; TR-5) Avail: NTIS HC A03/MF A01 CSCL 09/1

The electrochemical Behavior of single crystal p-type GaAs in aqueous solutions containing several redox couples (I3(-)/I(-), Fe(III)/Fe(II), Sn(IV)/Sn(II), Eu(III)/Eu(II)) in the dark and under irradiation is described. The observation that the difference in potential between that for the onset of photocurrent and the standard potential for the redox couple was 0.4 to 0.5 V, independent of the couple, leads to a revised model for semiconductor/electrolyte solution interface with semiconductors having a high density of surface states with energies within the band gap region. In such a surface controlled system, the Fermi level of the semiconductor is pinned at the surface state level. Several solar cells in which p-GaAs shows stable behavior are described.
GRA

N80-21676# Pennsylvania Univ., Philadelphia. Dept. of Systems Engineering.
SIGNAL PROCESSING FILTERS UNDER MODELING UNCERTAINTIES Interim Report
Saleem A. Kassam, Tong Leong Lim (Bell Telephone Labs., Holmdel, N.J.), and Leonard J. Cimini 1979 21 p refs
(Grant AF-AFOSR-3154-77; AF Proj. 2304)
(AD-A080184; AFOSR-80-0021TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

Matched and Wiener filters are considered for signal processing applications when the a priori information about signal and noise characteristics are not completely specified. The approach is to design filters which are saddle-point or max-min solutions for the criterion functional (mean-squared-error or signal-to-noise ratio) over the classes of allowable signal shapes and signal and noise spectral densities. Two-dimensional discrete-parameter processes are considered, and some numerical examples are presented.
GRA

N80-21677# Ohio State Univ., Columbus. Electroscience Lab.
ANALYSIS OF ELECTRICALLY THIN, DIELECTRIC LOADED CAVITY BACKED RADIATOR Final Report, 24 Sep. 1976 - 23 Sep. 1979
E. H. Newman Dec. 1979 76 p refs
(Grant DAAG29-76-G-0331)
(AD-A080603; ESL-4569-11; ESL-784569-11; ARO-14012.6-EL) Avail: NTIS HC A05/MF A01 CSCL 09/5

This summary describes the work on ARO Grant Number DAAG29-76-G-0331 from 24 September 1976 to 23 September 1979. The purpose of this grant is to develop the basic theory, algorithms and computational techniques to analyze the electrically thin, dielectric loaded, cavity backed radiator. The overall approach will be to develop techniques which are applicable to a wide class of geometries, and to apply these general techniques to this specific antenna.
GRA

N80-21678# Brown Univ., Providence, R. I. Center for Dynamical Systems.
DIFFUSION APPROXIMATIONS TO OUTPUT PROCESSES OF NON-LINEAR SYSTEMS WITH WIDE BAND INPUTS, AND APPLICATIONS Interim Report
Harold J. Kushner Jul. 1979 52 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-76; NSF ENG-73-03846; AF Proj. 2304)
(AD-A080207; AFOSR-80-0035TR) Avail: NTIS HC A04/MF A01 CSCL 09/4

Many problems in communication theory involve approximations of a Markov type to outputs of non-linear (feedback or not) systems, often so that Fokker-Planck techniques can be used. A general and powerful method is presented for getting diffusion approximations to outputs of systems with wide band inputs. The input is parameterized by epsilon and as epsilon approaches 0 the band width goes to infinity (loosely speaking). It is proved, under reasonable conditions on the systems and noise, that the sequence of system output processes converges weakly to a Markov diffusion process, which is characterized completely. Many communication systems fit the model of the paper and, in order to make mathematical sense out of many common developments of system properties, assumptions such as those of this paper are often required. The usefulness and relative ease of use of the method is illustrated by application to three examples: (a) phase locked loop, where a Markov diffusion approximation of the error process is developed, (b) adaptive antenna system, where an asymptotic analysis of the equations for the system is given, (c) di-diffusion approximation to the output of a hard limiter followed by a band pass filter; input-output S/N ratios are developed (a version of a classical problem of Davenport). Difficulties with the usual heuristic approaches to (a), (b) are discussed. The method is versatile and the models quite general. Since weak convergence methods are used, the approximate limits yield approximations to many types of functionals of the actual system.
GRA

N80-21679# RCA Government Communications Systems, Camden, N. J.
SOLID STATE POWER CONTROLLERS (ISEM-2A) Final Report
P. J. Coyle and C. L. Whitman Nov. 1979 65 p ref
(Contract N62269-77-C-0413)
(AD-A080482; NADC-79094-60) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report covers an engineering study to determine the optimum dc power controller configuration for ISEM-2A modules. The study indicates that two 10 amp or four 5 amp controllers can be mounted on one ISEM-2A frame, and that each 10 amp unit will have a predicted reliability of nearly one million hours before failure. Mounting of dc controllers using existing technology is discussed, and thermal performance of various frame material is tabulated and evaluations made. Finally, methods of circuit simplification using recently developed components, LSI and advanced packaging techniques which reduce cost, increase reliability and improve manufacturability are described.
GRA

N80-21680# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
RELIABILITY CHARACTERIZATION OF LSI MEMORIES Final Technical Report, Dec. 1977 - May 1979
Alvin T. Sasaki Griffiss AFB, N.Y. RADC Dec. 1979 184 p refs
(Contract F30602-78-C-0014; AF Proj. 2338)
(AD-A080481; RADC-TR-79-302) Avail: NTIS HC A09/MF A01 CSCL 09/5

The primary objective of this effort was to evaluate and characterize the reliability and failure modes of 4K Large Scale Integration (LSI) memories procured to the specification

requirements of MIL-M-38510/237. Secondary objectives were to evaluate the screening effectiveness of the detail specifications and to compare the relative effectiveness of high temperature accelerated life tests performed with both static and dynamic excitation. The program objectives were achieved by subjecting the test devices to a matrix of temperature cycling tests, high temperature non-operating life tests, and high temperature operating life tests with static and dynamic excitation. The part types under evaluation include a 1K x 4 bit NMOS static RAM (AM9130) and a 4K x 1 bit NMOS static RAM (AM9140). The test results indicated that the AM9130 and AM9140 devices have a high reliability potential. However, there was an insufficient number of life test failures to estimate the device failure rates based on the Arrhenius Reaction Rate Model. A total of eighteen devices of 240 total tested were failed at the completion of testing and all but two failures were attributed to a surface related mechanism(s). Seven of the eighteen device failures were due to marginal I(CC) values at the start of life testing and a single failure was attributed to a degraded input caused by static discharge or an electrical transient. GRA

N80-21681# University of South Florida, Tampa.
COMPUTER ROUTINES FOR USE IN SECOND-ORDER VOLTERRA IDENTIFICATION OF EMI Final Technical Report, 1 Oct. 1977 - 30 Sep. 1978
V. K. Jain and J. S. Osman Griffiss AFB, N.Y. RADC Nov. 1979 91 p refs
(Contract F30602-75-C-0118; AF Proj. 4540)
(AD-A079621; RADC-TR-79-266) Avail: NTIS HC A05/MF A01 CSCL 20/14

Computer routines are developed for application in Volterra modeling of weakly nonlinear systems. The FORTRAN program 'IGRAM' identifies the parameters of a linear black-box model as given by the pencil-of-functions method. The FORTRAN program 'HPMINV' yields high accuracy inversion of residue matrices that arise in Volterra system identification. GRA

N80-21682# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
THE 3.2 MILLIMETER WAVE TRANSMITTER TUBE Interim Report, 1 Oct. 1978 - 30 Jan. 1979
Ken Arnold Jan. 1980 31 p
(Contract DAAB07-78-C-3015; DA Proj. 1L1-62705-AH-94)
(AD-A080076; DELET-TR-78-3015-1) Avail: NTIS HC A03/MF A01 CSCL 09/1

Design trade-offs have been performed for 95 GHz coupled-cavity traveling wave tubes for two pulse power levels, 100 watts and 1000 watts, respectively. Results indicate that average power levels of 50 watts are feasible in the 100 watt peak power case and that 10 watt average power levels are feasible in the 1000 watt peak power case. GRA

N80-21683# National Bureau of Standards, Washington, D.C. Polymer Science and Standards Div.
PIEZOELECTRIC AND PYROELECTRIC APPLICATIONS OF PLASTICS
M. G. Broadhurst and S. Edelman Jan. 1980 11 p refs
Presented at the Symp. on New Appl. for Plastics, Houston, Tex., 23-28 Mar. 1980; sponsored by Am. Chem. Soc.
(Contract N00014-79-F-0012)
(AD-A079649; TR-14) Avail: NTIS HC A02/MF A01 CSCL 09/1

This paper summarizes the advantages and disadvantages of polymer piezoelectric and pyroelectric transducers relative to transducers made of ceramic materials. It is concluded that polymers are the material of choice for some special measurement problems and inferior for others. A large list of applications ranging from commercial to exploratory is given with references to further information. GRA

N80-21684# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
THERMAL OUTGASSING OF DC-93-500, A TWT ENCAPSULANT Final Report, 1 Jun. - 30 Sep. 1978
C. A. Gaulin, V. L. Knight, and M. Buechler Sep. 1979 37 p refs
(Contract F04701-78-C-0079)
(AD-A079745; TR-0079(4402)-2; SAMSO-TR-79-39) Avail: NTIS HC A03/MF A01 CSCL 09/1

The silicone traveling wave tube (TWT) encapsulant DC 93-500 has been subjected to thermal/vacuum analyses to verify its thermal stability and determine the extent of outgassing at the most severe expected operating conditions. Some limited comparisions have been made with a potential substitute encapsulant, Sylgard-184. The thermal stability of 93-500 is entirely satisfactory under the conditions studied (120 C, vacuum, long term). Significant outgassing was detected. Sufficient characterization was carried out to identify the mechanism of outgassing as being due to hydrolysis of silane by residual water in 93-500 base resin. The reaction produces volatile mono-vinyl silanol with appreciable quantities of hydrogen as a byproduct. The possible influence of the outgassing on the ultimate mechanical properties is discussed, as well as the potential for contamination of adjacent optical surfaces, and the possibility of the reaction as a source of hydrogen within the tubes. Firm answers to the additional questions raised by this study are not presently available. GRA

N80-21685# Pennsylvania State Univ., University Park. Applied Research Lab.
AN INVESTIGATION OF THE LOW FREQUENCY SOUND FIELD OF A REVERBERANT ENCLOSURE AND THE EFFECTS OF DIGITAL ELECTRONIC FEEDBACK Ph.D. Thesis
John Baptist Ochs Oct. 1979 223 p refs
(Contract N00024-79-C-6043)
(AD-A080532; ARL/PSU/TM-79-192) Avail: NTIS HC A10/MF A01 CSCL 20/1

The goals of this research has been to investigate the low frequency fluctuation of the characteristics of the sound field in comparison to those characteristics at high frequency and to implement electronic feedback, using a single Finite Impulse Response (FIR) filter, to beneficially change the degree of diffusion to increase the useful frequency range of reverberant enclosures for sound power measurements. This investigation included a computer model study and an experimental study in a model (6.82 cu m) enclosure of the frequency-by-frequency fluctuation of the time-averaged spatial mean squared pressure as it relates to sound power measurements; the normalized spatial variance, the probability density function and the cumulative distribution function of time-averaged squared pressure normalized to the spatial mean; the spatially averaged cross correlation coefficient; and the vector intensity. In this study, the open loop response and the fluctuations of the enclosure transfer function with source and receiver positions, wall absorption, and temperature have been investigated. The data from both the computer model and the experimental model showed that the feedback implemented in this study did not significantly affect the diffusion of the sound field. GRA

N80-21686# Rensselaer Polytechnic Inst., Troy, N. Y.
RESEARCH ON MICROWAVE JUNCTION GATE FIELD EFFECT TRANSISTORS Final Report, 1 Jun. 1976 - 31 May 1979
S. K. Ghandhi Dec. 1979 15 p
(Grant DAAG29-76-G-0172)
(AD-A080031; ARO-13586.5-EL) Avail: NTIS HC A02/MF A01 CSCL 09/1

This program has considered basic problems in the fabrication of junction-gate FET devices. We have shown that Ga(x)In(1-x)As layers can be grown of the appropriate composition (x = 0.468 + or - 3%) required to obtain a good lattice match to indium phosphide substrates. Additionally, techniques have been developed for in situ etch of substrates prior to epitaxial growth. Diffusion and masking techniques have been developed for making junctions with no enhanced lateral diffusion. These diffusions are carried out in the absence of an arsenic overpressure, and are limited to n-type layers at the present time. GRA

N80-21687# Purdue Univ., Lafayette, Ind. Lab. for Electroceramics.
THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Quarterly Report, 1 Aug. - 31 Oct. 1979
R. W. Vest Nov. 1979 31 p refs
(Contract N00019-79-C-0240)

(AD-A080095; QR-3) Avail: NTIS HC A03/MF A01 CSCL 09/1

Measurements of the density and ripening of RuO2 in thick film glasses as a function of temperature and amount of AlSiMag 614 (96% Al2O3) substrate dissolved in the glasses were conducted. The minor constituents (4%) in the substrate were found to have an anomalously large effect on the density. The ripening results were interpreted in terms of a phase boundary reaction rate limiting step, and the transfer coefficient was calculated from the data. A theoretical equation was derived for the initial stage sintering kinetics of RuO2 in the glass. This equation was combined with the results of the ripening study to predict the neck growth between RuO2 particles as a function of temperature and amount of dissolved substrate. GRA

N80-21688# Westinghouse Research Labs., Pittsburgh, Pa.
INDIUM PHOSPHIDE FOR HIGH FREQUENCY POWER TRANSISTORS Annual Report, 21 Feb. - 21 Mar. 1979
V. L. Wrick, G. W. Eldridge, R. C. Clarke, and M. C. Driner
Sep. 1979 93 p refs
(Contract N00014-78-C-0254; DARPA Order 3535)
(AD-A079812; Rept-243-023-T1) Avail: NTIS HC A05/MF A01 CSCL 09/1

This report covers the first year of studies aimed at determining the utility of InP for fabricating power microwave field effect transistors (FET). The initial phase of the work was concentrated on developing the technology necessary to complete a power FET based on current design philosophy. Ion implantation and vapor phase epitaxy (VPE) results are presented as a means for providing an active channel for the device. Further work is planned for VPE channels because of the potential benefits of buffer layers under development. Processing technology (etching, ohmic contacts) is reviewed. In addition, a review of gate technology is provided since this is the largest technology issue for the InP FET. The results of the gate studies has been a concentration of effort on developing a JFET during the conclusion of the program. GRA

N80-21689# MPB Technologies, Inc., Sainte-Anne-de-Bellevue (Quebec).
STUDY OF NOISE IN CROSSED-FIELD DEVICES Final Report, 15 Apr. 1977 - 30 Sep. 1979
Issie P. Shkarofsky and Ian P. W. Sinclair Nov. 1979 83 p refs
(Contract F49620-77-C-0106; AF Proj. 2305)
(AD-A080044; MPB-112-2; AFOSR-80-0032TR) Avail: NTIS HC A05/MF A01 CSCL 09/1

This research effort addresses the fundamentals of noise in electron beams in crossed field microwave tubes. Recent evolvement of new applications for DOD requires tubes with better noise characteristics in addition to the higher bandwidth and gain characteristics of crossed field devices. Much work was expended in this type of research up to 1969 but thereafter concepts have remained neglected and unexplored until 1977 when efforts were renewed. The approach here is to re-examine the analyses using simple models, to resolve various unknowns and gaps in knowledge and to investigate original unexplored avenues with which we can gain more insight into the mechanisms of fluctuation and modulation in electron beams travelling in crossed electric and magnetic fields. In the first year's effort, expressions were derived based on kinetic theory for the seven moments over the energy distribution function in a plasma thermionic diode with crossed electric and magnetic fields, both for the space-charge limited and magnetic-field limited situations. The expressions are given as integrals over the distribution function at the cathode surface, whose form is left arbitrary. Analytic results, valid in the region of the potential minimum, are provided in the space-charge limit when the potential profile is assumed to be parabolic in the vicinity of its minimum. The seven moments are the density profile, the two current flux components, the two mean velocity components and the two mean square velocity components. GRA

N80-21690# Harry Diamond Labs., Adelphi, Md.
INTERACTIVE ELECTRONIC CIRCUIT SIMULATION ON SMALL COMPUTER SYSTEMS
Brian L. Biehl Nov. 1979 119 p refs
(DA Proj. 1T1-61101-A-91A; DA Proj. 1L1-62120-AH-25)
(AD-A080055; HDL-TM-79-30) Avail: NTIS HC A06/MF A01 CSCL 09/3

The feasibility is determined of using small computer systems (including programmable desktop calculators and minicomputers) for interactive electronic circuit simulation. Several aspects of the simulator architecture are considered: the computer language, the data word format, the computing speed, and the computer memory configuration. Interactive circuit simulation on programmable desktop calculators is investigated using simulator program BIAS-D (BASIC), written in BASIC for HP9830A desktop calculator. Analysis techniques are presented which conserve memory and advantage of the idiosyncrasies of these small computers. Interactive-mode circuit simulation and batch-mode simulation on minicomputers are compared relative to the simulator architecture and required simulation speed. The more significant speed- and memory-dependent algorithms, used in circuit simulators are compared in detail. Also compared are the execution speeds of several different minicomputer systems, including the HP2100, the PDP 11/45, and the PRIME 400. The speed and memory requirements of these minicomputers executing BIAS-D are compared to an IBM 370/168 also executing BIAS-D. A new method for computing small-signal frequency response is introduced. Because complex arithmetic is not required, this technique is particularly suited to minicomputer simulators and requires minimal additional memory when implemented in a circuit simulator with a transient analysis capability. The frequency response of both linear and nonlinear circuits can be modeled, as can that of high-Q circuits. Magnitude and phase errors of less than 1 percent and 0.5 degrees, respectively, are easily attainable. GRA

N80-21691# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
DEVELOPMENT OF A PARTIAL-DISCHARGE DETECTION SYSTEM FOR TRAVELING-WAVE-TUBE TESTING Interim Report
Francis Hai and Kenneth W. Paschen 28 Sep. 1979 45 p refs
(Contract F04701-78-C-0079)
(AD-A077071; TR-0079(4402)-3; SAMSO-TR-79-40) Avail: NTIS HC A03/MF A01 CSCL 09/5

The development of a test system to detect and monitor partial discharges (PD) in a traveling wave tube (TWT) is described. The assembled system is capable of monitoring discharges of a magnitude ranging from 0.25 pC to above 250 nC. During this operation, the TWT can be subjected to pressures ranging from atmospheric to below .01 torr and to temperatures ranging from -20 to -90 C. Developmental studies, which included the analysis of various test circuits and the examination of test circuit calibration that resulted in the present test system are reported. Investigations in addition to the TWT tests that have been conducted with this system are discussed. For long-term testing of TWTs, a microprocessor controlled PD test system is proposed. GRA

N80-21692# Naval Research Lab., Washington, D. C.
REFINED FILTERING OF IMAGE NOISE USING LOCAL STATISTICS Interim Report
Jong-Sen Lee 16 Jan. 1980 17 p refs
(RR0140241)
(AD-A080530; AD-E000367; NRL-8374) Avail: NTIS HC A02/MF A01 CSCL 09/3

An effective algorithm for digital image noise filtering is presented. Most noise filtering techniques, such as the Kalman filter and transform domain methods, require extensive image modeling and produce filtered images with considerable contrast loss. The algorithm proposed in this report is an extension of Lee's local-statistics method modified to use local gradient information. It does not require image modeling, and it will not smear edges and subtle details. For both the additive and multiplicative noise cases the local mean and variance are computed from a reduced set of pixels depending on the orientation of the edge. Consequently, noise along the edge is removed, and the sharpness of the edge is enhanced. For practical applications when the noise variance is spatially varying and unknown an adaptive filtering algorithm is developed. Experiments show its good potential for processing real-life images. Examples

on images containing 256 by 256 pixels substantiate the theoretical development. GRA

N80-21693# Carnegie-Mellon Univ., Pittsburgh, Pa.
STUDIES IN SEMICONDUCTING METAL OXIDES IN CONJUNCTION WITH SILICON FOR SOLID STATE GAS SENSORS Progress Report, 1 Apr. 1977 - 30 Sep. 1979
A. G. Jordan and G. N. Advani Sep. 1979 122 p refs
(Contract EE-77-S-02-4346)
(COO-4346-2) Avail: NTIS HC A06/MF A01

A fundamental investigatinn of SnO2 and ZnO thin films with emphasis on their use in solid state gas detection is discussed. Methods of thin film preparation described include the chemical vapor deposition technique for SnO2 films and the radio frequency sputtering technique for SnO2 and ZnO films. The use of Auger electron spectroscopy, transmission electron microscopy, and X-ray diffractometry, in the analysis of these films is reported. Careful selection of the most useful films are made by applying these techniques to the films prepared. The electrical stability and gas sensitivity response of rf sputterd films are studied. Information regarding the mechanisms involved in gas detection are also presented. Some preliminary device structures using these films along with well established techniques for planar processing are also reported. DOE

N80-21694# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
TEST SPECIFICATION FOR TWO-SIDED PRINTED CIRCUIT BOARDS (FUSED TIN-LEAD FINISH)
Paris ESA Aug. 1979 61 p
(ESS-PSS-50/QRM-17E-ESTEC-ISS-1) Avail: NTIS HC A04/MF A01

A specification defining the minimum test program required for ESA approval of production lines for two-sided printed-circuit boards with fused tin-lead finish is presented. The mandatory test methods are described, and details of accept/reject criteria are given.

N80-21695# National Centre of Tribology, Risley (England). Space Tribology Lab.
THERMAL VACUUM QUALIFICATION AND ACCELERATED LIFE TESTS ON A BRITISH AEROSPACE DYNICS GROUP MODIFIED OTS DRIVE (MOD BAPTA)
K. Parker Aug. 1979 26 p
(Contract ESA-2584/75-MD)
(ESA-CR(P)-1269) Avail: NTIS HC A03/MF A01

The thermal vacuum qualification and accelerated life tests on a modified bearing and power transfer assembly (MOC BAPTA) are discussed. The modified BAPTA was operated at one revolution per hour for short periods under several thermal conditions. Two eclipse simulations were carried out with a rotational speed of one revolution per day. The accelerated life tests simulated approximately 10 years of real time operation in a geostationary satellite at two thermal conditions. During both tests, the motor operated satisfactorily with no evidence of irregularities in the stepping motion. During the qualification test, a small increase in electrical noise was observed for increasing slip ring current, and a significant reduction in this parameter occurred during the first thermal condition of the accelerated life test.
Author (ESA)

N80-21696# EMI Electronics Ltd., Hayes (England).
STUDY OF LOCAL OSCILLATOR STABILITY SPECIFICATIONS FOR SYNTHETIC APERTURE RADAR
J. Thraves, M. Kostka, S. Blake, and P. Morley Jul. 1979 244 p refs
(Contract ESTEC-3818/78-NL-AK(SC))
(ESA-CR(P)-1273) Avail: NTIS HC A11/MF A01

The theory of local oscillator noise performance was surveyed and the consequent degradation of a synthetic aperture radar (SAR) image derived. Local oscillator performance specifications including necessary amplifiers and multipliers (e.g., short term stability, a.m. spectral noise power density, f.m. spectral noise power density, r.m.s. phase error, spurious and harmonic generation, etc.) the consequent image degradation. The worst sources of degradation were identified and the possibility of improving the overall performance by modifying the overall degradation budget was analyzed. A completely justified specification to be used as a target for hardware is detailed.
Author (ESA)

N80-21697# National Bureau of Standards, Boulder, Colo. Thermophysical Properties Div.
HELIUM RESEARCH IN SUPPORT OF SUPERCONDUCTING POWER TRANSMISSION
David E. Daney Oct. 1979 64 p refs Prepared in cooperation with Brookhaven National Lab., Upton, N.Y.
(PB80-116502; NBSIR-79-1618) Avail: NTIS HC A04/MF A01 CSCL 09C

The preparation of computer codes and numerical computation of SPTL cool down were completed and the results are given. These calculations confirm original intuitive judgement that cool down times for the counterflow arrangement can be long, twenty days or more. Two sections of cable underwent extensive thermal cycling, and the results of these tests are given. The complex structure of the cable leads to unusual (although reproducible) load vs time curves. GRA

N80-21698# National Bureau of Standards, Washington, D.C.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY Progress Report, 1 Oct. 1978 - 31 Mar. 1977
W. Murray Bullis, ed. Nov. 1979 99 p refs Sponsored in part by Navy, DOE, and DNA
(ARPA Order 2397)
(PB80-120231; NBS-SP-400-38) Avail: NTIS HC A05/MF A01 CSCL 14B

The development of methods of measurement for semiconductor materials, process control, and devices is discussed. Both in house and contract efforts are included. The emphasis is on silicon device technologies. Principal accomplishments included: (1) refinement and extension of the analysis of the nondestructive, photovoltaic method for measuring radial resistivity variation of silicon slices; (2) development of a donor addition technique for testing for the presence of X levels in indium doped silicon; (3) development of a precision, wet chemical etching procedure for use in conjunction with X-ray photoelectron spectroscopy for profiling silicon dioxide silicon interfaces; (4) completion of thermodynamic calculations of equilibrium sodium density in oxidation atmospheres contained in polycrystalline silicon tubes; (5) initial extensions of the line width measurement procedure to partially transparent and reflection specimens and to submicrometer dimensions; and (6) completion of the development of a test pattern for characterizing a large scale-integration, silicon sapphire process. GRA

N80-21375*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ANALYSIS OF A CLASS OF TOTALLY SELF-CHECKING CIRCUITS IMPLEMENTED IN AN NMOS CUSTOM LSI STRUCTURE
M. W. Seivers *In its* The Deep Space Network 15 Apr. 1980 p 100-107 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09C

N80-21440# Toronto Univ. (Ontario). Dept. of Electrical Engineering.
SURFACE DISCHARGE ARC PROPAGATION AND DAMAGE ON SPACECRAFT DIELECTRICS
K. G. Balmain *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 209-215 refs (For primary document see N80-21420 12-23)
(Grant NRC-A-4140)
Avail: NTIS HC A15/MF A01

N80-21562# Marconi Co. Ltd., Great Baddow (England).
A PRACTICAL LOOK AT LOGIC SIMULATION AND TESTING
A. H. Boyce *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 25-30 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21563# Dassault (E. M.) Co., St. Cloud (France).
ESTEL: A PROGRAM FOR SIMULATING AND TESTING LOGIC CIRCUITS [ESTEL: LOGICIEL D'EVALUATION PAR SIMULATION ET TESTS D'ENSEMBLES LOGIQUES]

G. Chatelain and G. Reynier. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 31-40 In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21564# European Space Agency, Paris (France).
SIMULATION OF A FAULT TOLERANT MEMORY CONTROLLER, USING THE LOGIC SIMULATOR PROGRAM ESTEL
E. Kristiansen. *In its* SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 41-45 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21566# Danish Research Center for Applied Electronics, Hoersholm.
THERMAL DESIGN BY MEANS OF ELECTRICAL/THERMAL ANALOGIES
Paul Stangerup. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 53-64 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21567# Ecole Nationale Superieure de Mechanique et d'Aerotechnique, Poitiers (France). Lab. d'Energetique Solaire.
DESCRIPTION OF A THERMAL MODEL LIBRARY FOR USE IN ELECTRICAL CAD PROGRAMS
J. B. Saulnier. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 65-76 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21568# Ecole Nationale Superieure de Mechanique et d'Aerotechnique, Poitiers (France). Lab. d'Energetique Solaire.
SIMULATION OF SPACELAB FLUID LOOPS BY MEANS OF A COMPUTER-AIDED DESIGN (CAD) ELECTRONICS ANALYSIS PROGRAM
A. Alexandre and J. B. Saulnier. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 77-87 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21569# European Space Research and Technology Center, Noordwijk (Netherlands).
TIME DELAY SIMULATION BY MEANS OF A VOLTAGE CONTROLLED CURRENT SOURCE
J. P. Bouchez and J. G. Ferrante. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 89-96 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21570# Technical Univ. of Denmark, Lyngby. Inst. of Circuit Theory and Telecommunication.
LCP2: A GENERAL PURPOSE CIRCUIT OPTIMIZATION PROGRAM
Hans Gaunholt. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 99-109 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21571# European Space Agency, Paris (France).
ASTEC 3: SIMULATION PROGRAM FOR ELECTRIC CIRCUITS AND ANALOG SYSTEMS [ASTEC 3: PROGICIEL DE SIMULATION DE CIRCUITS ELECTRIQUES ET DE SYSTEMES ANALOGIQUES]
Marcel Barocas (Compagn. Intern. de Services en Informatique). *In its* SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 111-117 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21572# European Space Research and Technology Center, Noordwijk (Netherlands).
ESAMEC: COMPUTER-AIDED ANALYSIS AND DESIGN OF MICROWAVE ELECTRONIC CIRCUITS
J. G. Ferrante and U. K. Mortensen. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 119-125 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21574# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
VOLTERRA SERIES ANALYSIS OF CLASS C AMPLIFIERS
S. Benedetto and E. Biglieri. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 137-146 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21575# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).
NONLINEAR AC-ANALYSIS (PHINAL)
I. E. Kleihorst. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 147-150 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21579# Bologna Univ. (Italy). Facolta di Ingegneria.
ANALYSIS AND OPTIMIZATION OF NONLINEAR CIRCUIT WITH PERIODIC EXCITATION
F. Filicori, V. A. Monaco, and C. Naldi (Politec. di Turin). *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 171-176 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21580# Waterloo Univ. (Ontario). Dept. of Electrical Engineering.
COMPUTER-AIDED DESIGN AND EVALUATION OF BIPOLAR TRANSISTORS AND CIRCUITS FOR HIGH EFFICIENCY MICROWAVE POWER CONVERSION
D. J. Roulston, P. R. Bryant, and I. N. Hajj. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 177-187 refs Prepared in cooperation with Illinois Univ., Urbana Sponsored jointly by Rockwell International Corp., Calif. and NSERC, Canada (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21581# Bologna Univ. (Italy). Ist. di Elettronica.
PERIODIC STEADY-STATE ANALYSIS OF NONLINEAR CIRCUITS USING SPLINE FUNCTIONS
F. Filicori, M. R. Scalas, and C. Naldi (Politec. di Turin). *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 189-193 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21586# Politecnico di Torino (Italy). Ist. di Elettronica.
DIGITAL SIMULATION OF ANALOG FILTERS: COMPARISON OF DIFFERENT METHODS
L. Lo Presti. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 241-248 refs (For primary document see N80-21560 12-31)
(Contract ESTEC-3699/78)
Avail: NTIS HC A19/MF A01

N80-21589# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
MULTICARRIER OPERATION OF MICROWAVE TRANSISTOR POWER AMPLIFIERS
G. P. Bava, U. Pisani, and V. Pozzolo. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 267-272 refs (For primary document see N80-21560 12-31)
(Contract ESTEC-3334)
Avail: NTIS HC A19/MF A01

N80-21591# Katholieke Universiteit te Leuven (Belgium). Dept. of Electrical Engineering.
ANALYSIS MODEL FOR RECTANGULAR MICROSTRIP RESONATORS
J. Thijs, P. Luypaert, and A. VandeCapelle. *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 283-286 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21592# Limoges Univ. (France). Lab. d'Electronique des Microondes.
DIELECTRIC RESONATOR IN A WAVEGUIDE
P. Guillon and Y. Garault *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 287-298 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21593# Duisburg Univ. (West Germany). Dept. of Electrical Engineering.
A METHOD OF ANALYSIS AND DESIGN OF MICROSTRIP DIRECTIONAL COUPLERS CONSIDERING DISPERSION AND DISCONTINUITY EFFECTS
R. Mehran *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 299-303 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21594# Bologna Univ. (Italy). Ist. di Elettronica.
COMPUTATION OF THE SCATTERING PARAMETERS OF MICROSTRIP DISCONTINUITIES BY A FREQUENCY-DOMAIN TLM METHOD
Vittorio Rizzoli and Alessandro Lipparini *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 305-310 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21597*# Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
MODELLING SWITCHING-TIME EFFECTS IN HIGH-FREQUENCY POWER CONDITIONING NETWORKS
H. A. Owen, T. H. Sloane, B. H. Rimer, and T. G. Wilson *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 325-337 refs (For primary document see N80-21560 12-31)
(Grant NsG-3157)
Avail: NTIS HC A19/MF A01 CSCL 09C

N80-21600# European Space Research and Technology Center, Noordwijk (Netherlands).
COMPUTER-AIDED DESIGN OF ADVANCED MICROWAVE FILTERS
R. J. Cameron *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 357-362 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21603# Engins Matra, Velizy (France).
CAD BY AUTOMATIC SYNTHESIS OF FAILURE MODE EFFECT AND CRITICALITY ANALYSIS (FMECA). AN APPLICATION TO TEXT TREATMENT: THE DEBAT PROGRAM [L'AIDE A LA CONCEPTION PAR SYNTHESES AUTOMATIQUE DE FMECA. UNE APPLICATION DES TRAITEMENTS DE TEXTS: LE PROGRAMME 'DEBAT']
J. Agostini *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 375-380 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21604# University Coll. of Vigo (Spain).
FAILURE MODE ANALYSIS OF THE METEOSAT PIN DIODE VARIABLE PHASE SHIFTER USING A MICROWAVE CAD PROGRAM
A. Seoane Montenegro *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 381-384 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21605# Brussels Univ. (Belgium). Lab. d'Electronique et Radioelectricite.
A COMPUTER BASED METHOD GIVING THE EXPERIMENTAL NOISE PARAMETERS OF Q-POINTS THROUGH THE USE OF NEW NOISE SOURCES
R. Meys and M. Milecan (Etudes Tech. et Construc. Aerospatiales, Charleroi, Belgium) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 387-396 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21606# Palermo Univ. (Italy). Ist. di Elettrotecnica ed Elettronica.
COMPUTER-AIDED MODELLING OF MICROWAVE TRANSISTORS IN TERMS OF NOISE AND GAIN PARAMETERS
B. DiMaio, M. Sannino, and F. Sorbello *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 397-400 refs Sponsored by CNR, Palermo, Italy (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21607# European Space Research and Technology Center, Noordwijk (Netherlands).
SIMULATION AND PERFORMANCE PREDICTION OF MEDIUM-POWER GaAs FET AMPLIFIERS
M. Gibson, J. G. Ferrante, and S. J. G. Strijk *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 401-404 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21608# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
CAD OF AN OCTAVE BAND POWER FET AMPLIFIER
A. Rabier and M. Parisot *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 405-406 refs Sponsored by Direc. des Rech., Etudes, et Tech. (DRET) (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21609# Consiglio Nazionale delle Ricerche, Bologna (Italy). CNR-LAMEL Lab.
A NEW EMPIRICAL MOS TRANSISTORS MODEL FOR ANALOG CIRCUITS SIMULATION
M. Impronta, G. Masetti (Ancona Univ., Italy), and M. Severi *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 407-414 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21610# Technical Univ. of Denmark, Lyngby. Inst. of Electronics.
SOME ASPECTS IN THE SIMULATION OF BIPOLAR RF-POWER AMPLIFIERS
J. Vidkjaer *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 415-421 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-21699 Engineering Sciences Data Unit, London (England).
CROSSFLOW PRESSURE LOSS OVER BANKS OF PLAIN TUBES IN SQUARE AND TRIANGULAR ARRAYS INCLUDING EFFECTS OF FLOW DIRECTION
1979 16 p
(ESDU-79034; ISBN-0-85679-285-3; ISSN-0141-4011) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $386.50

Pressure loss data for crossflow of single phase fluids over banks of plain tubes set in square and equilateral triangular arrangements that may, or may not, be rotated are discussed. Data are given for superficial Reynolds numbers between 1 and 1,000,000, and apply for both heating and cooling of gases and liquids. Effects of stream inclination and tube outside surface roughness are included. ESDU (GRA)

N80-21700 Kansas State Univ., Manhattan.
AUGMENTATION OF TWO PHASE HEAT TRANSFER WITH IN-LINE STATIC MIXERS Ph.D. Thesis
Shih-Teh Lin 1979 282 p
Avail: Univ. Microfilms Order No. 8005535

The effects of the in line static mixers on two phase heat transfer and the pressure drop accompanied by boiling or condensation inside circular tubes were investigated. The heat transfer and pressure drop were obtained during single phase heating, subcooled boiling, saturated boiling as well as condensation of F-113 inside circular tubes with and without static mixers. Stochastic models were developed for two phase heat transfer and pressure drop accompanied by boiling or condensation inside circular tubes with in line static mixers. These models were based on the concept of the general population balance.
Dissert. Abstr.

N80-21701 Engineering Sciences Data Unit, London (England).
HEAT PIPES: PERFORMANCE OF CAPILLARY-DRIVEN DESIGN
1979 31 p
(ESDU-79012; ISBN-0-85679-256-X; ISSN-0141-402X) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

A method of calculating the maximum rate of heat transfer that a capillary driven heat pipe can sustain is provided as well as a method of calculating the actual rate of heat transfer with given thermal boundary conditions. Applications include rating calculations for heat pipes used in cooling systems or in air to air heat exchangers. The methods apply to tubular heat pipes that contain a single component working fluid and in which capillary forces drive the liquid flow in a wick structure.
ESDU (GRA)

N80-21702*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VELOCITY-SPLIT NAVIER-STOKES SOLUTION PROCEDURE FOR INCOMPRESSIBLE HIGH REYNOLDS NUMBER EXTERNAL FLOWS
Douglas L. Dwoyer Washington Apr. 1980 36 p refs
(NASA-TP-1655; L-13343) Avail: NTIS HC A03/MF A01 CSCL 20D

A method for solving the Navier-Stokes equations based on splitting the velocity vector into its rotational and irrotational parts was sucessfully applied to internal flow computations. The applicability of the method to external flows is examined by studying several model problems. The model problems are those of laminar and turbulent incompressible flow past a semi-infinite flat plate and laminar incompressible flow past a finite flat plate. For these problems, the procedure accurately reproduces the known solutions and is computationally very efficient even at high Reynolds numbers. Computational aspects of the method are discussed along with the possibility of using the procedure to retrofit a viscous capability into existing potential flow codes.
J.M.S.

N80-21703*# Cambridge Hydrodynamics, Inc., Mass.
STABILITY ANALYSIS FOR LAMINAR FLOW CONTROL, PART 2 Final Report
Steven A. Orszag Washington NASA Apr. 1980 23 p refs
(Contract NAS1-14907)
(NASA-CR-3249) Avail: NTIS HC A02/MF A01 CSCL 20D

Topics covered include: (1) optimization of the numerics of the SALLY stability analysis code; (2) relation between temporal and spatial stability theory; (3) compressible flow stability calculations; (4) spectral methods for the boundary layer equations; and (5) numerical study of nonlinear, nonparallel stability of incompressible flows.
A.R.H.

N80-21704*# Cambridge Hydrodynamics, Inc., Mass.
NUMERICAL SIMULATION OF SHEAR FLOWS OVER WAVY BOUNDARIES Final Report
Steven A. Orszag Washington NASA Apr. 1980 40 p refs
(Contract NAS1-15383)
(NASA-CR-3271; CHI-26) Avail: NTIS HC A03/MF A01 CSCL 20D

The full time-dependent two dimensional Navier-Stokes equations are solved using spectral methods to achieve high spatial accuracy and high order time-splitting methods together with conformal mapping methods to allow simulation of flow over steep waves, including general turbulent Reynolds stresses. The programs are used to study the properties of laminar and turbulent flow over a flat plate and in various wavy geometries. Results are compared with both available theory and experiment. For laminar flow, good agreement is achieved. For turbulent flow, the agreement is less satisfactory and may be explained by the simplified turbulent modelling use in the calculations.
A.R.H.

N80-21705# Naval Surface Weapons Center, Dahlgren, Va. Research and Technology Dept.
AN INTEGRAL METHOD AND ITS APPLICATION TO SOME THREE-DIMENSIONAL BOUNDARY-LAYER FLOWS
T. F. Zien 18 Jul. 1979 46 p refs
(ZR0140201)
(NSWC-TR-79-139) Avail: NTIS HC A03/MF A01

The simple integral method was developed and employed to provide accurate approximate solutions to a wide variety of problems in viscous boundary-layer flows and transient heat conduction with phase changes. A boundary value problem in ordinary differential equation is used as the model problem. Different schemes of the method used in earlier applications are examined along with a potentially more accurate scheme. On the basis of the comparison between the approximate solutions and the exact solution, the relative merits of the various schemes are assessed as well as the judicious choice of the approximate profiles for use in the calculation. The method is then applied to yield approximate solutions of a class of relatively simple three dimensional boundary-layer flows. Results on boundary layers on a semi-infinite flat plate with parabolic and circular inviscid surface streamlines, and boundary layers over an infinite yawed wing are presented in terms of skin-friction, and are all obtained in simple closed form. Comparisons with existing exact solutions indicate the accuracy of the method.
A.R.H.

N80-21706*#. National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMILARITY TESTS OF TURBINE VANES, EFFECTS OF CERAMIC THERMAL BARRIER COATINGS
Herbert J. Gladden 1980 14 p refs Proposed for Presentation at 1980 Natl. Heat Transfer Conf., Orlando, Fla., 27-30 Jul. 1980; sponsored by Heat Transfer and Gas Turbine Div. of ASME
(NASA-TM-81473; E-407) Avail: NTIS HC A02/MF A01 CSCL 20D

The role of material thermal conductivity was analyzed for its effect on the thermal performance of air-cooled gas turbine components coated with a ceramic thermal barrier material when tested at reduced temperatures and pressures. It is shown that the thermal performance can be evaluated reliably at reduced gas and coolant conditions; however, thermal conductivity corrections are required for the data at reduced conditions. Corrections for a ceramic thermal barrier coated vane are significantly different than for an uncoated vane. Comparison of uncorrected test data, therefore, would show erroneously that the thermal barrier coating was ineffective. When thermal conductivity corrections are applied to the test data these data are then shown to be representative of engine data and also show that the thermal barrier coating increases the vane cooling effectiveness by 12.5 percent.
A.R.H.

N80-21707# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
METHODS FOR MANUFACTURING HEAT PIPES FOR CIRCUIT CARDS Final Report, 30 Sep. 1977 - 31 Mar. 1979
Kal S. Sekhon and Lloyd A. Nelson Mar. 1979 90 p
(Contract DAAK40-77-C-0242)
(AD-A080188; FR79-12-292) Avail: NTIS HC A05/MF A01 CSCL 09/5

Manufacturing processes to fabricate heat pipes for circuit cards were evaluated. These included shell and wick fabrication, shell and wick joining, and vacuum/fill and testing. Cost effective processes were selected to meet production requirements. A production facility was designed based on cost trade-offs. The results of the evaluation, selection of recommended manufacturing

methods and the design of the production facility are presented. GRA

N80-21708# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

CALCULATION OF OPTIMAL COORDINATES FOR TWO-DIMENSIONAL INCOMPRESSIBLE FLOW Final Report

R. T. Davis and R. K. Rout. Jul. 1979. 141 p. refs.

(Contracts N00014-76-C-0359; N00014-76-C-0364; SR0230101)

(AD-A080443; AFL-79-7-47) Avail: NTIS HC A07/MF A01 CSCL 20/4

Two dimensional steady symmetric incompressible laminar flow past a class of blunt and sharp nosed bodies is investigated in optimal coordinates. The analysis is carried out for different problem parameters and the solution is specialized for the cases of the parabola, a semi-infinite thin flat plate and the flow against a vertical wall. The problem is formulated by mapping the body from a Cartesian plane into a conformal plane by applying a Schwarz-Christoffel transformation. Optimal coordinates are computed according to the classical first-order boundary-layer approximation as well as with a parabolized version of streamfunction vorticity form of the full Navier-Stokes equations. The analysis is carried out for two example problems, a semi-infinite thick plate and a semi-infinite blunted wedge. The solutions are obtained for different body geometries (bluntness parameters) in both examples. Results for skin friction, displacement thickness, pressure gradient parameter and optimal coordinates, for different problem parameters, are presented for unseparated flow cases. Physical quantities such as surface pressure gradient distribution, skin friction and displacement thickness for cases of flow past the parabola, the thin flat plate and flow against a vertical wall are compared with existing numerical and analytical results.GRA

N80-21709# Ballistic Research Labs., Aberdeen Proving Ground, Md.

MEASUREMENTS OF WEAK SHOCK WAVE REFLECTED PRESSURE HISTORIES ON A 2-DIMENSIONAL SURFACE Final Report

Brian P. Bertrand. Oct. 1979. 96 p. refs.

(AD-A080539; AD-E430357) Avail: NTIS HC A05/MF A01 CSCL 20/4

Reflected pressures have been measured on a 2 dimensional wedge over the range of 0 to 90 degrees of incidence for shock waves of 13.8 and 34.5 kPa over pressure. The higher than normal pressures predicted by regular reflection theory in the range of angles just prior to the onset of Mach reflection are found to agree closely with theory. Reflected pressures for a small range of angles of shock incidence greater than those for which regular reflection is predicted are found to exceed the highest predicted regular reflection values. The pressure history scales as expected in time as a function of distance from the starting edge of the reflecting surface. Curves of reflected pressure versus angle of incidence are presented for the two incident shock levels. Curves of pressure versus distance-scaled times are presented which can be used to determine instantaneous whole surface loads. GRA

N80-21710# Sybucon, Inc., Atlanta, Ga.

CALCULATION OF TIME DEPENDENT FLOWS WITH REVERSAL AND SEPARATION Final Report, 15 Jun. 1978 - 14 Jun. 1979

John F. Nash and Roy M. Scruggs. 15 Jun. 1979. 54 p. refs.

(Contract DAAG29-76-C-0045)

(AD-A080524; ARO-14039.1-EX) Avail: NTIS HC A04/MF A01 CSCL 20/4

Fundamental investigations have been performed on the behavior of unsteady compressible turbulent and laminar boundary layer, and boundary layer like flows experiencing local reversal and separation. An advanced numerical computational method was used, based on an implicit ADI numerical integration technique. The computing capability and economy of the method permit a systematic study of the subject flows, from first order to higher order representations. GRA

N80-21711# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.

EXACT SOLUTIONS FOR CONVECTIVE HEAT TRANSFER Final Report

John F. Polk. Aug. 1979. 25 p. refs.

(DA Proj. 1L1-61102-AH-43)

(AD-A076967; AD-E430318; ARBRL-TR-02186) Avail: NTIS HC A02/MF A01 CSCL 20/13

The convective heat transfer at a fluid/solid interface is investigated from a mathematical point of view. Through the use of a transformation, T sub h, a number of exact solutions of the heat equation satisfying convection or radiation type boundary conditions are developed from previously known solutions satisfying temperature-specified type boundary conditions. A general solution is obtained in the form of an integral representation and specific solutions are determined for some important particular choices of the boundary and initial data. GRA

N80-21712# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

AIR-WATER TESTING OF A FULL FLOW PERFORATED DRAG PLATE (BEVELED-SMALL HOLE) FOR MASS RATE MEASUREMENTS

James L. Anderson. Jul. 1979. 89 p. refs.

(Contracts EY-76-C-07-1570)

(EGG/SEMI-TR-009) Avail: NTIS HC A05/MF A01

The two phase mass flow rate measurement accuracy using a beveled full flow small hole perforated drag plate with a flow blockage of 33 percent was determined. The plate was used to make mass flow measurements in two component flows (air and water). The tests were conducted in horizontal 3 inch piping at superficial velocity ranges of 0.3 to 12 m/s for the air and 0.2 to 5 m/s for the water. The momentum flux measurement resulting from the drag plate was combined with a density measurement from a dual beam gamma densitometer to give the two phase mass flow rate. DOE

N80-21713# Los Alamos Scientific Lab., N. Mex.

MACH STEMS FORMED BY COLLIDING CYLINDRICAL DETONATION WAVES

Charles L. Mader and Douglas Venable. Sep. 1979. 20 p. refs.

(Contract W-7405-eng-36)

(LA-7869) Avail: NTIS HC A02/MF A01

Radiographic studies of laterally colliding, diverging, cylindrical detonation waves in PBX 9404 are reproduced numerically by use of the two dimensional Lagrangian hydrodynamic code 2DL with a shock initiation burn model called Forest Fire. The formation and growth of a Mach stem is described. DOE

N80-21714# Argonne National Lab., Ill. Energy and Environmental Systems Div.

SINGLE TUBE HYDRIDE HEAT EXCHANGER TEST FACILITY

Harold P. Egbert, Jeffrey S. Horowitz, and Gale M. Warapius. Sep. 1979. 23 p. refs.

(Contract W-31-109-eng-38)

(ANL/EES-TM-64) Avail: NTIS HC A02/MF A01

Heat exchanger tests were conducted to develop heat transfer data which would be needed to design a reasonably optimal HYCSOS device. To meet this primary objective, it was necessary to: (1) design and construct a test facility suitable for small scale heat transfer testing; (2) design and construct several representations of proposed HYCSOS heat exchangers; (3) test these designs under controlled conditions; and (4) reduce these data and report the results. The test facility design is described and testing procedures and results are discussed. DOE

N80-21715# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

TECHNICAL ASSISTANCE FOR THE EVALUATION OF FLUID LOOPS-COMPONENT (PELTIER COOLER). PHASE 1: REPORT

R. Best, U. Hingst, H. Kreeb, and W. Mueller. 1979. 117 p.

(Contract ESTEC-3774/78-NL-PP)

(ESA-CR(P)-1246) Avail: NTIS HC A06/MF A01

The refrigerator-heat pump effect for commercially available Peltier Element coolers (PE) integrated in a cooling system was investigated. Possible temperature stabilization of one side of the cooler and the necessary power supplies and power consumption for a given temperature range and heat load were

studied, along with mounting and integration problems. Performance data of bare PE's are degraded if the main input parameters are based on the heat sink and source plate and the heat flux from the source plate. The main limitations on the applicaton of PE's was the temperature difference between the heat source and sink, and for a normal array of elements was between 45 and 50 C and for a cascade arrangement less than or equal to 75 C. Author (ESA)

N80-21716# European Space Agency, Paris (France).
BOUNDARY LAYERS IN OSCILLATING FLOW
Jean Cousteix Dec. 1979 60 p refs Transl. into ENGLISH of 'Couches Limites en Ecoulements Pulse', ONERA, Paris Report ONERA-NT-1979-1, 1979 Original report in FRENCH previously announced as N80-17416
(ESA-TT-603; ONERA-NT-1979-1) Avail: NTIS HC A04/MF A01

The state of the art in the field of unsteady boundary layers is reviewed, beginning with some fundamental results obtained on oscillating laminar boundary layers. Experimental and theoretical progress in flows which are periodic in the mean, the external velocity varying about a zero or non-zero mean value, are emphasized. Author (ESA)

N80-21717# Aeritalia S.p.A., Torino (Italy).
SURVEY OF FLUID LOOP COMPONENTS: RADIATOR CONTROL UNIT Final Report
L. Bussolino Jun 1979 322 p refs
(Contract ESA-3661/78-NL-PP(SC))
(R-TC-79-TR-0005; ESA-CR(P)-1261) Avail: NTIS HC A14/MF A01

The detail assessment, trade-offs and supporting discussion that demonstrates the preference for simple bypass control for a Spacelab radiator and for an experiment dedicated radiator system is presented. The thermal control of the radiator is a critical item to ensure both the reliability of the radiator loop and the thermal compatibility with the Spacelab control loops. The thermal performance assessment and trade-offs regarding bypass and regenerative heat exchanger types of radiator control are described. Component descriptions, Spacelab interfaces, and the programmatic aspects of a radiator control unit including a development plan for bypass and regenerative heat exchanger types of control are presented. Author (ESA)

N80-21718# Bristol Univ. (England). Dept. of Mechanical Engineering.
ELECTROHYDRODYNAMICS: A STUDY OF MASS TRANSFER IN UNIPOLAR ELECTROPHORETIC FLOWS Ph.D. Thesis
Robert Wilfred Lionel Snaddon Nov. 1978 184 p refs
Avail: NTIS HC A09/MF A01

Discs of ion-exchange membrane were used to generate single streamer electrophoretic flows in n-hexane by the localised injection of unipolar charge in a plane parallel plate electrode system. The mass transfer properties of these flows was investigated with the aid of a laser-Doppler-anemometer. Polymethylmethacrylate lattices were used as light scattering particles in the anemometer studies and in photographic flow visualisation work. The electrophoretic flows exhibited a well ordered streamer structure with diameters similar to those of the charge emitters. Flow velocities of 20mm per sec were recorded with applied fields up to 200,000 Vm and streamer mass transfer varied nonlinearly with electrical power input. Velocity profiles of streamers at applied fields up to 37,500 Vm were used to estimate the efficiency of the electrophoretic mass transfer process which was found to be low (10 percent - 23 percent). Reasons for this are examined in the light of the charge, fluid, field and flow interactions, mobility, viscosity, current and voltage in the mass transfer process. Author (ESA)

N80-22226# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOT WIRE CONDITIONAL SAMPLING TECHNIQUES FOR TRANSITION INTERMITTENCY STUDIES
Daniel Arnal and Jean-Claude Juillen *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 31-43 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 22-31 Presented at DISA Conf., Marseille, 11-14 Sep. 1978 Original report in FRENCH previously announced as A79-30495 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

N80-22227# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TURBULENT BOUNDARY LAYERS IN OSCILLATING FLOW WITH A MEAN ADVERSE PRESSURE GRADIENT
Robert Houdeville and Jean Cousteix *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 43-62 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 32-48 Presented at 15th Assoc. Aeron. et Astronomique de France Colloq. d'Aerodyn. Appl. Marseille, 7-9 Nov. 1978 Original report in FRENCH previously announced as A79-32280 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

N80-22228# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BLADE-TO-BLADE FLOW OF IDEAL FLUID WITH WALL INJECTION
Alain LeMeur and Phillipe Morice *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 63-70 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestrial (Paris), No. 1979-1, Jan.-Feb. 1979 p 49-54 Original report in FRENCH previously announced as A79-30496 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

N80-22246# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPLORATORY STUDY OF A LAMINAR-TURBULENT TRANSITION PROCESS CLOSE TO LAMINAR BOUNDARY LAYER SEPARATION
Jean Cousteix and Guy Pailhas *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 79-85 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 213-218 Original report in FRENCH previously announced as A79-41308 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

N80-22253# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOISE GENERATED BY AN EDDY
Robert C. Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 79-84 ref Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 279-282 Original report in FRENCH previously announced as A79-48854 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-21719* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ACTIVE NUTATION CONTROLLER Patent
Henry C. Hoffman and James H. Donohue, inventors (to NASA) Issued 18 Mar. 1980 11 p Filed 19 Apr. 1978 Supersedes N78-23141 (16 - 14, p 1813)
(NASA-Case-GSC-12273-1; US-Patent-4,193,570; US-Patent-Appl-SN-897830; US-Patent-Class-244-165; US-Patent-Class-244-170) Avail: US Patent and Trademark Office CSCL 14B

An apparatus is described for controlling nutation motion in a spinning body, comprised of an angular accelerometer with its input axis perpendicular to the spin axis of the body, a flywheel with an axis of rotation perpendicular to the axis of the accelerometer and to the spin axis of the body, and a motor for driving the flywheel to attenuate or build nutation. The motor is controlled by circuitry that monitors the output of the angular accelerometer and drives the motor clockwise or counterclockwise during predetermined nutation angles synchronized to the zero crossover points of the accelerometer signal centered about the nutation peaks. The motor drive is phased to damp nutation motion to zero for stabilization. To increase the noise immunity of the system, when the output of the accelerometer falls below a threshold level, the circuitry operates in an open loop, beat mode where data representing the last accelerometer signal that exceeded that threshold level is stored, and the motor drive is controlled by the stored data. In a second version, the motor is controlled to supply a predetermined amount of nutation motion to a body undergoing testing on a spin table for energy dissipation evaluation. In each version, the use of an angular accelerometer rather than a linear accelerometer or gyro to monitor nutation enables placement of the nutation control apparatus at any location relative to the spin axis of the body requiring only crude orientation and no calibration.

Official Gazette of the U.S Patent and Trademark Office

N80-21720# Royal Aircraft Establishment, Farnborough (England).

A HIGH SPEED SPECTRAL RADIOMETER WITH FULL ELECTRONIC CONTROL

H. Albrecht and H. W. Spaude Nov. 1979 18 p refs Transl. into ENGLISH from Optik (West Germany), v. 53, no. 2, 1979 p 89-103

(RAE-Lib-Trans-2035; BR73046) Avail: NTIS HC A02/MF A01

A measurement setup which allows almost complete automatic spectral radiation measurement is described. The useful spectral range is from 0.25 to 2.5 micrometers and is scanned with a maximum speed of 0.5 micrometers/s, wavelength accuracy being 0.001 nm. The device has an electronic control and correcting system which evaluates the measurement signal in accordance with the complete spectral sensitivity function of the device. The control and correcting system is described. The device is discussed in connection with solar radiation measurements and their use. A.W.H.

N80-21721*# Lightning Technologies, Inc., Pittsfield, Mass.

CALIBRATION TESTS ON MAGNETIC TAPE LIGHTNING CURRENT DETECTORS

K. E. Crouch Washington NASA Apr. 1980 87 p refs (NASA Order CC-82279-A)

(NASA-CR-3270; LT-79-51) Avail: NTIS HC A05/MF A01 CSCL 14E

The low cost, passive, peak lightning current detector (LCD) invented at the NASA/Kennedy Space Center, uses magnetic audio recording tape to sense the magnitude of the peak magnetic field around a conductor carrying lightning currents. Test results show that the length of audio tape erased was linearly related to the peak simulated lightning currents in a round conductor. Accuracies of + or - 10% were shown for measurements made using a stopwatch readout technique to determine the amount of tape erased by the lightning current. The stopwatch technique is a simple, low cost means of obtaining LCD readouts and can be used in the field to obtain immediate results. Where more accurate data are desired, the tape is played and the output recorded on a strip chart, oscilloscope, or some other means so that measurements can be made on that recording. Conductor dimensions, tape holder dimensions, and tape formulation must also be considered to obtain a more accurate result. If the shape of the conductor is other than circular (i.e., angle, channel, H-beam), an analysis of the magnetic field is required to use an LCD, especially at low current levels. A.R.H.

N80-21722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATION OF SATELLITE TIME TRANSFER IN AUTONOMOUS SPACECRAFT CLOCKS

Andrew R. Chi Oct. 1979 15 p refs

(NASA-TM-80572) Avail: NTIS HC A02/MF A01 CSCL 14B

The conceptual design of a spacecraft clock that will provide a standard time scale for experimenters in future spacecraft., and can be sychronized to a time scale without the need for additional calibration and validation is described. The time distribution to the users is handled through onboard computers, without human intervention for extended periods. A group parallel binary code, under consideration for onboard use, is discussed. Each group in the code can easily be truncated. The autonomously operated clock not only achieves simpler procedures and shorter lead times for data processing, but also contributes to spacecraft autonomy for onboard navigation and data packetization. The clock can be used to control the sensor in a spacecraft, compare another time signal such as that from the global positioning system, and, if the cost is not a consideration, can be used on the ground in remote sites for timekeeping and control. A.R.H.

N80-21723*# National Aeronautics and Space Administration. Pasadena Office, Calif.

METHOD AND DEVICE FOR DESTRUCTIVE DETECTION OF A SUBSTANCE Patent Application

Lien C. Yang, inventor (to NASA) (JPL) Filed 28 Mar. 1980 27 p

(Contract NAS7-100)

(NASA-Case-NPO-14940-1; US-Patent-Appl-SN-135038) Avail: NTIS HC A03/MF A01 CSCL 14B

A method and device for destructively detecting the presence of a substance having predetermined characteristics is disclosed. A discharge grid is provided having a sufficiently high voltage potential across its grid electrodes so that the substance having the predetermined characteristics will cause an electric spark discharge to occur between electrodes. The electric spark discharge alters the predetermined characteristics of the substance by oxidation and/or vaporization so that the substance is no longer detectable by an electric spark discharge. A means for counting the number of electric spark discharges is provided. (A count provides an indication of the concentration of the substance having the predetermined characteristics.) NASA

N80-21724*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

EMERGENCY RELIEF VENTING OF THE INFRARED TELESCOPE LIQUID HELIUM DEWAR

Eugene W. Urban Mar. 1980 23 p refs

(NASA-TM-78271) Avail: NTIS HC A02/MF A01 CSCL 14B

An analysis is made of the emergency relief venting of the liquid helium dewar of the Spacelab 2 infrared telescope experiment in the event of a massive failure of the dewar guard vacuum. Such a failure, resulting from a major accident, could cause rapid heating and pressurization of the liquid helium in the dewar and lead to relief venting through the emergency relief system. The heat input from an accident is estimated for various fluid conditions in the dewar and the relief process as it takes place through one or both of the emergency relief paths is considered. It is shown that under all reasonable circumstances the dewar will safely relieve itself, and the pressure will not exceed 85 percent of the proof pressure or 63 percent of the burst pressure. J.M.S.

N80-21725# IBM Watson Research Center, Yorktown Heights, N.Y.

TIME-RESOLVED INFRARED SPECTRAL PHOTOGRAPHY

D. S. Bethune, J. R. Lankard, M. M. T. Loy, and P. P. Sorokin Jun. 1979 9 p refs

(Contract N00014-76-C-0907)

(AD-A079653) Avail: NTIS HC A02/MF A01 CSCL 14/5

A new technique was recently developed which allows broadband infrared absorption spectra to be photographed with approximately equal to 5 nsec time resolution, even under some conditions, in a single-shot. Experimental details and theoretical aspects of this method are discussed. Briefly, the technique utilizes third order nonlinearities of alkali metal vapors to achieve two objectives: (1) generation of a pulsed, broadband, infrared continuum beam (NU sub ir) which can probe the absorption of a sample and (2) subsequent conversion of this ir beam, with its encoded spectral information about the sample, to the visible,

where it can be photographically or photoelectrically recorded. GRA

N80-21726# Environmental Research Inst. of Michigan, Ann Arbor.
SILVER-HALIDE GELATIN HOLOGRAMS Interim Report
B. Chang and K. Winick Feb. 1980 7 p refs
(Contract F49620-78-C-0061; AF Proj. 2305)
(AD-A080298; AFOSR-80-0072TR) Avail: NTIS
HC A02/MF A01 CSCL 07/4

Volume phase holograms, whose holographic characteristics are similar to those of conventional dichromated gelatin holograms, can be formed employing commercial silver-halide films. Major advantages of silver-halide gelatin holograms are wide spectral response and lower exposure requirement. GRA

N80-21727# Hanford Engineering Development Lab., Richland, Wash.
APPLICATIONS OF SOLID STATE TRACK RECORDERS IN UNITED STATES NUCLEAR REACTOR ENERGY PROGRAMS
Raymond Gold, Frank H. Ruddy, and James H. Roberts Jun. 1979 16 p refs Tenth Internatl. Conf. on Solid State Nucl. Track Detectors, Lyons, France, 2-7 Jul. 1979
(Contract EY-76-14-2170)
(HEDL-SA-1806; CONF-790765-2) Avail: NTIS
HC A02/MF A01

The domain of solid state track recorder (SSTR) applications in United States nuclear reactor energy programs is discussed. The neutron energy region as well as the range of neutron flux/fluence intensity arising from these applications are also discussed. As a consequence, use of a variety of SSTR is entailed in US fast breeder reactor, light water reactor, and magnetic fusion energy reactor programs. A summary status is presented of selected SSTR experiments undertaken in these programs. DOE

N80-21728# Sira Inst. Ltd., Chislehurst (England).
DEVELOPMENT STUDY FOR A POLARIS SENSOR, PHASES 1A AND 1B Final Report
R. A. Brook, C. H. Gay, D. R. Lobb, D. J. Purll, ed., C. Rowbotham, and J. A. Smith Jun. 1979 268 p refs
(Contract ESTEC-3370/77)
(SIRA-6/5052; ESA-CR(P)-1253) Avail: NTIS
HC A12/MF A01

The prefered concept for a 10 to 30 arc second Polaris star sensor was selected from a number of solutions based on solid-state detectors. The three most attractive solutions required self-scanned array detectors, and studies were performed to investigate whether the major disadvantages of these detectors, namely radiation damage and the cooling requirement, would prevent their being used. The use of arrays was approved, and a preferred concept was selected based on the use a two-dimensional CCD imaging array to analyse a star field image produced by a conventional objective. Positional interpolation to an accuracy higher than the microprocessor-based electronics system is proposed to perform the required computation, calibration and control functions with sufficient flexibility to allow further development of the sensor. The lens design utilizes radiation resistant glasses in a titanium housing. The detector will be cooled by passive radiation to space. Estimated random noise and bias error performances are within specification. Author (ESA)

N80-21729# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
THE IMPACT OF DATA COMPRESSION ON SUPERVISED CLASSIFICATION OF AIRBORNE MULTISPECTRAL IMAGERY
W. Verhoef and N. J. J. Bunnik Apr. 1979 46 p ref
(Contract ESTEC-3568/78-NL-HP(SC))
(NLR-TR-79047-L; ESA-CR(P)-1260) Avail: NTIS
HC A03/MF A01

An assessment was made of the impact of on-board data compression on the information which a user could extract from multispectral imagery by supervised classification. To simulate the effect of data compression, available airborne MSS data on CCT were compressed and reconstructed and stored on another CCT in the original format. Both CCTs, containing the original and reconstructed miltispectral images of an agricultural scene in the Netherlands, were processed by a program for supervised maximum likelihood classification, while the ground locations of the training areas were exactly identical. The effects of data compression and the influence of training area orientation on inter- and intra-class statistics and on the final classification results were investigated. Data compression enhances overall class separability, but reduces distinction between similar classes. Along scan lines, assignment to classes becomes more uniform. Training samples from reconstructed imagery are less representative for along track signal variation, causing many image lines to remain unclassified. Author (ESA)

N80-21730# Bureau of Radiological Health, Rockville, Md.
INEXPENSIVE MICROWAVE SURVEY INSTRUMENTS: AN EVALUATION Final Report
William A. Herman and Donald M. Witters, Jr. Nov. 1979 9 p refs
(PB80-114028; DHEW/PUB-FDA-80/8102; FDA/BRH-80/25)
Avail: NTIS HC A02/MF A01 CSCL 14B

Three commercially available instrumentation used for the measurement of microwave oven emissions were tested and evaluated. The instruments were the micromate, the guard rod, and the interceptor and microscan. The test parameters included spacer accuracy, calibration, polarization ellipticity, AM response, and overload sensitivity. The ability of the instruments to distinguish oven leakage levels is discussed. A.W.H.

N80-21731# Electronics Research Lab., Adelaide (Australia).
RADIOMETRIC MEASUREMENTS USING LINE SCANNED INFRARED IMAGING SYSTEMS
G. V. Poropat Aug. 1979 22 p refs
(PB80-115819; ERL-0099-TR; AR-001-893) Avail: NTIS
HC A02/MF A01 CSCL 14B

The use of line scanned imaging systems in performing radiometric measurements is discussed. The collection of data which is used to determine the distribution of radiant energy from a source is evaluated and the interpretation of the data is examined in regard to the errors due to the detector field of view and the scanning process. The sources of the errors and their magnitude are considered, and guidelines for the analysis of the data are developed. GRA

N80-21732# Teledyne Geotechnical, Garland, Tex.
ADVANCED RECORDER DESIGN DEVELOPMENT Final Report, Jul. 1977 - Apr. 1979
J. R. Sherwin and J. D. Kerr 15 Apr. 1979 46 p
(Contract DOT-HS-7-01641)
(PB80-117930; DOT-HS-805-081) Avail: NTIS
HC A03/MF A01 CSCL 14B

The history behind the design, building, and testing of an advanced automotive crash recorder is related. The program produced a reasonably accurate and reliable device which records and stores two axes of horizontal acceleration data experienced by a vehicle during a crash. A target cost of fifty dollars per unit in quantities of 50,000 units and ease of installation were other design requirements that were met. In addition, the program tasks generated (1) a device to retrieve the recorded data; (2) a minicomputer system to establish a crash recorder data bank; and (3) an implementation plan. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-21733 Maryland Univ., College Park.
NAVIER-STOKES SOLUTION FOR CHEMICAL LASER FLOWS: STEADY AND UNSTEADY FLOWS Ph.D. Thesis
Ajay Prasannajit Kothari 1979 186 p
Avail: Univ. Microfilms Order No. 8006699

A computational fluid dynamic technique was applied to the solution of practical high energy laser flows. In particular, a third generation of supersonic diffusion chemical laser analysis is introduced, namely the complete solution of the Navier-Stokes equations for the laminar, supersonic mixing flow fields fully

coupled with chemical kinetics for both the hot and cold reactions for HF. Multicomponent diffusion is treated, in a fashion. Results are compared with more approximately, existing calculations.
Dissert. Abstr.

N80-21734 Cornell Univ., Ithaca, N. Y.
STUDY OF SUBMICRON PERIODIC STRUCTURES IN GaAs-GaAlAs DOUBLE HETEROSTRUCTURES: FABRICATION AND DISTRIBUTED-FEEDBACK INJECTION LASERS Ph.D. Thesis
Ji Liang Yang 1979 134 p
Avail: Univ. Microfilms Order No. 8004009

Both electron-resist gratings and photo-resist gratings were used as masks for submicron periodic structures. Electron-resist gratings were made by using scanning electron microscope and the effect of parameters such as electron dosage, beam current and developing time upon the quality of the gratings was determined. Photo-resist gratings were made holographically. After transferring submicron grating masks onto GaAs substrate by preferential chemical etching, ion-beam milling and radio-frequency sputter etching, GaAs and GaAlAs layers with different doping and composition were grown on the top by liquid phase epitaxy. Using GaAs-GaAlAs double heterostructures with periodic corrugation between substrate and first epitaxial layer, distributed feedback injection lasers were fabricated and then tested at different temperatures near 77 K.
Dissert. Abstr.

N80-21735*# RCA Labs., Princeton, N. J.
STUDY OF LPE METHODS FOR GROWTH OF InGaAsP/InP CW LASERS Final Report, 3 Aug. 1978 - 2 Jul. 1979
I. Ladany, F. Z. Hawrylo, R. T. Smith, and E. R. Levin Washington NASA Apr. 1980 47 p refs
(Contract NAS1-15440)
(NASA-CR-3268; PRRL-79-CR-40) Avail: NTIS HC A03/MF A01 CSCL 20E

Two methods for liquid phase growth of InGaAsP/InP lasers were studied. Single phase growth, based on saturated melts and 5 C supercooling, was compared to two phase growth excess InP and 20 C nominal supercooling. Substrates cut on the (100) plane were used, and morphology in both cases was excellent and comparable to that obtainable in AlGaAs materials. A high degree of reproducibility was obtained in the materials grown by the two phased method, which is therefore presently preferred for the preparation of laser material. A refractive index step of 0.28 and an index n = 3.46 were obtained for In.81Ga.19As.5P5 lasing at 1.3 microns. Oxide-stripe lasers with typical room temperature cw threshold currents of 180 mA were obtained and some of them showed single mode behavior without lateral cavity modifications. COntinuous operation of 800 h at room temperature was obtained without noticeable degradation.J.M.S.

N80-21738# GTE Sylvania, Inc., Mountain View, Calif. Electro-Optics Organization
SIMULTANEOUS SRS AND SHG IN LITHIUM IODATE Final Report, May 1978 - May 1979
Eugene O. Amman Jul. 1979 65 p refs
(Contract F49620-78-C-0077; AF Proj. 2301)
(AD-A079984; AFOSR-79-1328TR) Avail: NTIS HC A04/MF A01 CSCL 20/3

This report summarizes the results of a study of the simultaneous occurrence of stimulated Raman scattering (SRS), second-harmonic generation (SHG), and sum-frequency generation (SFG) in lithium iodate. The simultaneous occurrence of these processes in lithium iodate results in selectable, multiple outputs spanning the 0.54 to 0.65 micrometer region of the visible spectrum. The SRS/SHG/SFG device consists of a lithium iodate crystal placed inside a cw-pumped, repetitively Q-switched Nd:YAlO3 laser. Two-mirror and three-mirror versions of the SRS/SHG/SFG device were studied. The two-mirror SRS/SHG/SFG average power outputs that were achieved were 0.54 (1.13 W), 0.565 (78 mW), 0.592 (665 mW), 0.622 (98 mW), and 0.655 micrometers (107 mW). The three-mirror SRS/SHG/SFG outputs were 0.54 (950 mW), 0.565 (218 mW), 0.592 (202 mW), 0.622 (29 mW), and 0.655 micrometers (26 mW). Pulses obtained from the two-mirror setup were approximately 25 to 40 ns long; pulses obtained from the three-mirror setup were 4 to 10 ns long. Experimental and analytical studies were also carried out concerning interactions which occur between the simultaneous SRS, SHG, and SFG processes.
GRA

N80-21737# Army Materials and Mechanics Research Center, Watertown, Mass.
STUDY OF THE MELTING BEHAVIOR OF YAG SINGLE CRYSTAL BY OPTICAL DIFFERENTIAL THERMAL ANALYSIS Final Report
Jaroslav L. Caslavsky and Dennis J. Viechnicki Nov. 1979 23 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A080049; AMMRC-TR-79-56) Avail: NTIS HC A02/MF A01 CSCL 20/5

The melting point of yttrium aluminum garnet (YAG), reinvestigated by optical differential thermal analysis (ODTA), was found to be 1940 + or - 7 C. Above this temperature YAG liquids are opaque, suggesting the presence of two immiscible liquids. In the composition range 10.0 to 47.5 mol. % Y2O3, crystallization of the equilibrium phases can only occur in the presence of YAG nuclei; otherwise solidification of YAlO3 and Al2O3 will take place. A metastable phase diagram has been defined with a metastable eutectic at 23 mol. % Y2O3 77 mol. % Al2O3 and 1702 + or - 7 C. YAlO3 (perovskite) was found to melt incongruently with a peritectic temperature of 1916 + or - 7 C and a liquidus temperature of 1934 + or - 7 C. YAlO3 formed during metastable solidification transforms to YAG in the presence of Al2O3 at 1418 + or - 7 C. It is suggested that the metastability arises from the difficulty of the aluminum to attain fourfold coordination in the YAG structure.
GRA

N80-21738# Avco-Everett Research Lab., Mass.
EXCIPLEX LASER KINETICS Final Technical Report, 1 Mar. 1978 - 29 Sep. 1979
C. Duzy, J. H. Jacob, A. Mandl, A. K. Medhekar, and J. H. Parks Nov. 1979 44 p refs
(Contract N00014-78-C-0334; DARPA Order 3500)
(AD-A079033) Avail: NTIS HC A03/MF A01 CSCL 20/5

This contract was undertaken to obtain useful kinetic information necessary to evaluate various laser candidates with regard to their application as efficient, scalable laser systems. Historically, our approach at AERL involved developing a kinetic data base using as input the results of small-scale experiments and theoretical calculations, followed by laser code modeling of medium-scale laser experiments. In this way, a reliable, accurate model for the KrF* laser (249 nm) has evolved. Under this contract, kinetic information on XeF* (351 nm) HgCl* (558 nm), HgBr* (502 nm), ArF* (193 nm) as well as KrF* was collected. This includes heavy particle quenching of HgX*, three-body quenching of various rare gas halides and an experimental determination of the heterogeneous reactions producing HgCl2.
GRA

N80-21739# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
KINETIC RATE CONSTANTS FOR MERCURY HALIDE LASERS Interim Technical Report
George J. Collins 29 Oct. 1979 15 p refs
(Contract N00014-78-C-0266; ARPA Order 2840)
(AD-A079595) Avail: NTIS HC A02/MF A01 CSCL 20/5

This research is directed towards the measurement of total quenching rates for the Hg(6s6p) levels with a variety of chlorine and bromine halogen bearing molecules. This information is important to the development of more efficient mercury halide lasers. The objectives are to identify optimum halogen donors for all three lasers HgBr, HgCl, and HgI. An attempt has been made to pump these blue-green lasers in a more conventional technique, such as flash lamp pumping. Research is continuing to uncover other blue-green laser systems through photodissociation and optical pumping of metal halides.
GRA

N80-21740# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
STRONG TURBULENCE EFFECTS ON SHORT WAVELENGTH LASERS Final Report
Michael T. Tavis and Hal T. Yura 15 Dec. 1979 87 p refs
(Contract F04701-77-C-0078)
(AD-A079748; TR-0078(3608)-1; SDTR-79-24) Avail: NTIS

HC A05/MF A01 CSCL 20/6

The mean square wander angle of a focused laser beam transmitted through a homogeneous-isotropic turbulent medium has been determined by the use of the extended Huygens-Fresnel principle. The theory is developed for both weak and strong turbulence conditions for which the electromagnetic field statistics are known. A heuristic formula for the wander angle is developed which connects the turbulence regimes. Although the theory is general, numerical results are determined for uniformly illuminated laser aperture only. The mean square angle of arrival of a spherical wave source in the laser focal plane and detected in the laser aperture plane is also determined. The correlation function of the angle of arrival, determined by means of the centroid, and the angle of arrival, determined by means of a least squares fit of the received phase over the aperture, is discussed. It is shown that this correlation is nearly 100% in the regime of weak turbulence conditions. Finally, engineering formulas useful for hand calculation of wander angle and peak on-axis transmitted intensity in the focal plane of a tilt corrected laser beam are presented. GRA

N80-21741# Naval Research Lab., Washington, D. C.
LIGHT DISTRIBUTION NEAR THE LINE FOCUS IN A HSURIA LASER RESONATOR Interim Report
William H. Carter 24 Dec. 1979 12 p
(ARPA Order 3529)
(AD-A079891; AD-E000352; NRL-8347) Avail: NTIS
HC A02/MF A01 CSCL 20/5

The intensity distribution about the line focus inside a HSURIA resonator is obtained theoretically and used to study the gas break-down problem for high-energy lasers. GRA

N80-21742# National Bureau of Standards, Washington, D.C. Quantum Chemistry Group.
THEORETICAL STUDIES OF ELECTRONIC TRANSITION LASERS Annual Report, FY 1979
Morris Krauss and Walter J. Stevens 1979 7 p refs
(Contract N00014-79-F-0043)
(AD-A079596) Avail: NTIS HC A02/MF A01 CSCL 20/5

Self-absorption in electronic transition lasers can severely limit the efficiencies of such systems. We identified a bound-continuum X-A as well as possible bound-bound transitions which could absorb at the B-X lasing energy in Group 2 B-halides. Figure 1 shows the bound-continuum absorption transition for HgCl. Experimental evidence for these transitions is non-existent and ab initio calculations are required to obtain the spectroscopic properties of these systems. We can note parenthetically that the determination of the energies and spectroscopic properties of excimer and ion-pair type electronic transition lasers has relied heavily on ab initio calculation. A well-defined calculation scheme has been developed which is applicable over the entire periodic table. Relativistic-dependent pseudopotentials have been used in the calculation of the electronic structure and transition moments of HgCl. Compact but accurate bases have been determined variationally at the double zeta plus polarization level. The final wave functions, energies, and properties have been obtained at the first-order configuration interaction level of accuracy. Because pseudopotentials are used, the paraphanelia of computing the wavefunctions such as trial inputs and configuration interaction formula tapes are identical for all Group 2 B-halides, which would permit straightforward extension of the HgCl results. GRA

N80-21743# United Technologies Research Center, East Hartford, Conn.
ROTATIONAL POPULATION TRANSFER IN DF Final Report, 1 Feb. - 30 Sep. 1979
J. J. Hinchen and R. H. Hobbs 31 Dec. 1979 47 p refs
(Contract F49620-79-C-0032; AF Proj. 2303)
(AD-A080070; UTRC/R79-954560; AFOSR-80-0057TR) Avail: NTIS HC A03/MF A01 CSCL 20/5

Collisional transfer of population between rotational levels of DF was measured using an ir double resonance method. The data were used to calculate rotational rates. Pressure broadening of DF absorption was determined for the fundamental lines P6 through P18. Total molecular collisional rates were obtained from the absorption data and compared with the total of individual collisional rates for velocity, vibrational and rotational relaxation. The results were compared with two kinetic rate models. Observations were also made of rotational lasing and vibration to rotation transfer in DF. GRA

N80-21744# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
COMPETITION OF LONGITUDINAL AND TRANSVERSE MODES IN A CW HF CHEMICAL LASER Interim Report
Charles P. Wang and Robert L. Varwig Dec. 1979 26 p refs
(Contract F04701-79-C-0080; DARPA Order 3646)
(AD-A080382; TR-0080(5764)-1; SD-TR-79-16) Avail: NTIS
HC A03/MF A01 CSCL 20/5

Longitudinal and transverse mode competition in stable and unstable resonators of a single v J-transition cw HF chemical laser were investigated. Single longitudinal mode operation in a long (greater than 2 meters) resonator was achieved, and asymmetric mode spectra were observed. These observations indicate that there is strong mode competition and a frequency-dependent loss mechanism caused by a limiting aperture and the effect of saturation of anomalous dispersion. From these observations, it is possible to measure the effect of saturation on anomalous dispersion in a high-power chemical laser. GRA

N80-21745# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPARISON OF GERMANIUM-STAINLESS STEEL ELECTRODE CONFIGURATIONS FOR POSSIBLE UTILIZATION IN ELECTRIC DISCHARGE LASERS M.S. Thesis
Roger John Hoffman Dec. 1979 111 p refs
(AD-A080242; AFIT/GEP/PH/79D-5) Avail: NTIS
HC A06/MF A01 CSCL 20/5

An HF laser cavity was designed and constructed in which four electrode combinations were tested. The electrodes consisted of two stainless steel Chang-profiled electrodes and two 50-omega cm germanium electrodes. The four possible electrode combinations for anode and cathode were tested. Breakdown, sustaining, and arcing voltages were recorded, for each combination, over a range of 25-200 pulses per second for the following gases with their respective pressure ranges: helium, 50-90 Torr nitrogen, 5-30 sulfur-hexafluoride, 3-15 Torr. The use of germanium as a cathode material resulted in substantially greater suppression of arc formation than the use of stainless steel. Helium, which sustained arcs at 60 Torr and 100 pps with a stainless steel cathode-anode, was found to be arc-free at pressures up to 90 Torr with repetition rates as high as 200 pps using a germanium cathode. Similarly, sulfur-hexafluoride, which sustained arcing at 3 Torr and 150 pps with stainless steel electrodes was found to be arc-free at pressures over 13 Torr when germanium was used as a cathode. The use of germanium as both anode and cathode resulted in the highest suppression of arc formation. GRA

N80-21746# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
ROOM TEMPERATURE SYNTHESIS OF PURE Si, Si3N4, Si3N4O SUB n, AND K2SiF6 BY LASER PHOTOCHEMICAL REACTIONS
J. A. Merritt and L. C. Warren Sep. 1979 24 p refs
(AD-A080608; DRSMI-T-79-96) Avail: NTIS
HC A02/MF A01 CSCL 07/5

Using 11 watts/sq cm of 10.764 micron frequency of a CO2 laser line as a source to irradiate 35 torr total pressure of the reactants SiH4 and NF3 in various ratios of partial pressure at room temperatures, Si3N4, pure Si, Si3N4On, K2SiF6, and SiH(x)F(y) have been produced. This represents an energy efficiency well over 200 percent and is a cost-effective method of synthesizing the above material. GRA

N80-21747# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CHARACTERIZATION OF LASER ANNEALING OF ION IMPLANTED Ga As AND Si USING OPTIMAL REFLECTIVITY M.S. Thesis
Bill W. Mullins Dec. 1979 66 p refs
(AD-A080243; AFIT/GEP/PH/79D-6) Avail: NTIS
HC A04/MF A01 CSCL 20/12

The effect of laser annealing on ion implanted GaAs and Si has been assessed using optical reflectivity spectra. The spectra were recorded over the range of 2100A to 4500A and reflectivity

peaks were obtained near 2400A and 4100A for GaAs and 2700A and 3700A for Si. The magnitude of these peaks was then observed as a function of annealing parameters. Laser annealing was carried out using a 30 nsec ruby laser pulse. The GaAs samples were implanted 120 KeV Te at a fluence of 10 to the 14th power ions/sq. cm; Si samples were implanted with 30 KeV In at a fluence of 10 to the 15th power ions/sq cm. The reflectivity spectrum of implanted GaAs was found to return to that of unimplanted materials at an annealing energy density of approximately 0.35 J sq. cm. whereas the spectrum of Si was found to approach that of the unimplanted samples at energy densities of 1.34 J/sq. cm. The values obtained compare well with those obtained from other diagnostic techniques. GRA

N80-21748# Vanderbilt Univ., Nashville, Tenn. Dept. of Chemistry.
ULTRAVIOLET LASING TRANSITIONS IN DIATOMIC MOLECULES Final Report, 1 Dec. 1975 - 30 Sep. 1979
Joel Tellinghuisen Jan. 1980 30 p refs
(Contract N00014-76-C-0450; DARPA Order 2840)
(AD-A080299) Avail: NTIS HC A03/MF A01 CSCL 07/4

The work performed is primarily directed toward a better spectroscopic understanding of UV laser transitions in selected diatomic molecules. Specifically the work emphasizes the analysis of spectroscopic data for discrete (bound-bound) and diffuse (bound-free) transitions in the rare gas monohalide (RgX) molecules and discrete transitions in the homonuclear halogens. The primary accomplishments of the work include detailed rotational and vibrational analyses of the lasing B to X transition in XeF (3500 A) and the lasing D: to A: transition in Br2 (2900 A); (2) vibrational analyses of the lasing transitions B to X in XeCl (3100 A) and D: to A: in I2 (3400 A), and the nonlasing D to X transitions in XeF (2600 A) and XeCl (2350 A); analysis of the bound-free B to X and D to X transitions in other RgX molecules, with emphasis on KrCl; reanalysis of the D to X UV fluorescence spectrum of I2; determination of potential curves and intensity factors (Franck-Condon factors, stimulated emission cross sections) for all analyzed systems; determination of the energy ordering of the B and C states in KrCl, XeCl, and XeBr, using temperature-dependent emission spectroscopy; and characterization of a tesla discharge with respect to its temporal and thermal properties and its total radiant output. GRA

N80-21749# Los Alamos Scientific Lab., N. Mex.
THE RF LINAC PUMPED LASERS
W. E. Stein, T. R. Loree, C. A. Brau, and S. D. Rockwood 1979 5 p Presented at the Linear Accelerator Conf., Montauk, N.Y., 9-14 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2547; CONF-790927-10) Avail: NTIS HC A02/MF A01

Excitation of gas lasers by a small emittance beam of electrons from a RF linear accelerator is discussed. An experiment to test this concept is described. A 4 MeV side coupled, standing wave linear accelerator is being used to provide a pulsed electron current of 2 A with a 1 microsecond duration. The electron beam, focused to a 5 mm diameter spot, is confined in the high pressure gas by a superconducting solenoid with a central magnetic field of 3 T. The fluorescence of various rare gas halide mixtures as a function of pressure, the transport of the electron beam through the gas, and the optimum configuration of the electron beam, magnetic field, and the laser cavity are studies described. DOE

N80-21750# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
DEVELOPMENT OF FLUORIDES FOR HIGH POWER LASER OPTICS Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1979
J. F. Ready and H. Vora Jul. 1979 8 p
(Contract ED-78-C-08-1555)
(NVO-155-5) Avail: NTIS HC A02/MF A01

The development of LiF as a materail with low nonlinear refractive index and high ultraviolet transmission as a material for use in the laser fusion program is described. Measurements of stress induced birefringence on the forged material are discussed. The stability of forged LiF under conditions of high relative humidity is described and methods for polishing LiF are discussed. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-21751 Engineering Sciences Data Unit, London (England).
DESIGN OF DISC CAMS WITH SWINGING ROLLER FOLLOWERS: CALCULATION METHODS
1979 34 p
(ESDU-79021; ISBN-0-85679-266-7; ISSN-0141-4046) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $122.50

Kinematic data for external disc cams with swinging roller followers are calculated. The cam assembly design is applicable to the machine tool and automobile engineering, mining equipment, printing, packaging, textile, and special purpose machinery. The design applies to all external disc cams with swinging roller followers. Topics considered include pressure angle calculations; cam profile coordinate calculations; pitch curve radius of curvature calculations; cam profile cutting coordinate calculations; reference and derivation and examples. ESDU (GRA)

N80-21752 Engineering Sciences Data Unit, London (England).
DESIGN OF DISC CAMS WITH TRANSLATING FLAT-FACED FOLLOWERS: CALCULATION METHODS
1979 28 p
(ESDU-79023; ISBN-0-85679-268-3; ISSN-0141-4046) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161 $770.50

A systematic approach is presented for calculating kinematic data for external disc cams with translating flat-faced followers. The cams may be used for machine tool and automobile engineering, mining equipment, printing, packaging, textile, and special purpose machinery. The designs apply to all external disc cams with translating flat-faced followers. ESDU (GRA)

N80-21753*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPERATING CHARACTERISTICS OF HIGH-SPEED, JET-LUBRICATED 35-MILLIMETER-BORE BALL BEARING WITH A SINGLE-OUTER-LAND-GUIDED CAGE
Fredrick T. Schuller, Stanley I. Pinel (Industrial Tectonics, Inc.), and Hans R. Signer (Industrial Tectonics, Inc.) Washington Apr. 1980 16 p refs
(NASA-TP-1657; E-220) Avail: NTIS HC A02/MF A01 CSCL 13 I

Parametric tests of a 35 mm bore, angular contact ball bearing with a single outer land guided cage were conducted on a high temperature, high speed bearing tester. Provisions were made for jet lubrication of the bearing and for outer ring cooling. Test conditions included two different thrust loads and a combined thrust and radial load. Nominal shaft speeds were 28,000 to 72,000 rpm, with an oil-in temperature of 394 K (250 F). The bearing was successfully operated to 2.5 million DN at a maximum thrust load of 1334 N (300 lb) and at a combined 667 N (150-lb) thrust and 222 N (50-lb) radial load. Bearing temperatures increased with shaft speed and decreased with increasing lubricant flow rate. Inner-ring temperature was generally lower than outer ring temperature. Lower operating temperatures resulted from cooling the outer ring. Bearing power loss increased as the lubricant flow rate, speed, or load was increased. The increase in percent cage slip with increasing lubricant flow rate was minimal for all speed and load conditions tested. Percent cage slip decreased significantly when the thrust load was doubled, but it increased appreciably with speed. Author

N80-21754*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC TESTS OF A TRACTION DRIVE RETROFITTED TO AN AUTOMOTIVE GAS TURBINE
Douglas A. Rohn, Stuart H. Lowenthal, and Neil E. Anderson

1980 2 p refs Presented at the 5th Intern. Automotive Propulsion Systems Symp., Dearborn, Mich., 14-18 Apr. 1980 Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, Ohio
(Contract EF-77-A-31-1011)
(NASA-TM-81457; AVRADCOM-TR-80-8; DOE/NASA/1011-80/4) Avail: NTIS HC A02/MF A01 CSCL 13I

The results of a test program to retrofit a high performance fixed ratio Nasvytis Multiroller Traction Drive in place of a helical gear set to a gas turbine engine are presented. Parametric tests up to a maximum engine power turbine speed of 45,500 rpm and to a power level of 11 kW were conducted. Comparisons were made to similar drives that were parametrically tested on a back-to-back test stand. The drive showed good compatibility with the gas turbine engine. Specific fuel consumption of the engine with the traction drive speed reducer installed was comparable to the original helical gearset equipped engine. Author

N80-21755*# National Aeronautics and Space Administration, Washington, D. C.
STORAGE PEAK GAS-TURBINE POWER UNIT
B. Tsinkotski Jan. 1980 25 p refs Transl. into ENGLISH from Period. Polytech. Mech. Eng. (USSR), v. 22, no. 2, 1978 p 95-113 Original language document announced as A79-24507 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75757) Avail: NTIS HC A02/MF A01 CSCL 10B

A storage gas-turbine power plant using a two-cylinder compressor with intermediate cooling is studied. On the basis of measured characteristics of a .25 Mw compressor computer calculations of the parameters of the loading process of a constant capacity storage unit (05.3 million cu m) were carried out. The required compressor power as a function of time with and without final cooling was computed. Parameters of maximum loading and discharging of the storage unit were calculated, and it was found that for the complete loading of a fully unloaded storage unit, a capacity of 1 to 1.5 million cubic meters is required, depending on the final cooling. Author

N80-21756# Massachusetts Inst. of Tech., Cambridge. Surface Lab.
USE OF EXOELECTRONS TO STUDY SOLID FILMS Final Report
Ernest Rabinowicz and Mark Connelly Dec. 1979 114 p refs
(Contract DAAG29-77-C-0044)
(AD-A080627; ARO-15224.1-E) Avail: NTIS HC A06/MF A01 CSCL 20/11

Two new applications of exoelectron emission to tribology were studied, both involving non-metallic films (which emit few or no exoelectrons) on metallic substrates. The first application dealt with hard, wear-resistant coatings. Experiments were conducted to determine if exoelectrons could be used as a new technique to help detect premature defects and localized film failure. Plots of emission versus location could then be used to determine coating quality and the wear process involved. The second application was concerned with soft, organic coatings and the measurement of their wear-out and possible migration along a wear track. In order to facilitate these studies, a new apparatus was constructed which allows the sliding experiment to be carried out in the exoelectron-detection chamber. Thus, exoelectron emission, as well as friction can be measured continuously during the sliding test. This new testing procedure is much more flexible than the previous method, which involved frequent removals of the test specimen from the friction apparatus to the exoelectron test chamber and back again. The results show that exoelectron emission is an excellent means of determining localized film failure due to wear. Solid films incorporating graphite and molybdenum disulfide were found to wear monotonically, while some migration was observed with Teflon-containing coatings. GRA

N80-21757# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
THE CONTROL OF CONTAMINANTS IN CIRCULATING ENGINE LUBRICATING OIL Final Report
John A. Tichy Oct. 1979 64 p refs
(Contract N00014-79-C-0100)
(AD-A080458; ONR-CR-169-015-4F) Avail: NTIS HC A04/MF A01 CSCL 11/8

Proper lubrication filtration is essential if maintenance and reliability costs of mechanical systems are to be minimized. Filtering too little can cause high rates of wear and costly failures, while filtering too much can cause excessive maintenance costs. Better understanding is required such that the optimum level of filtration, between these two extremes, can be achieved. Optimum filtration is equally desirable even in the presence of an on-line wear monitoring system. For this reason a theory of filtration has been developed and is presented herein. This is the only theoretical treatment applicable to tribology, although an alternative purely empirical model due to Fitch is also available. In contrast to the empirical approach, the results are not dependent on a specific particle size distribution ('AC Fine Test Dust'), and the effect of governing parameters (filter grain size and void fraction, fluid flow rate and viscosity, etc.) can be predicted. The predictions of the theory are consistent with physical reasoning and the known properties of filters. The basic concepts developed can be directly applied to Naval lubrication systems, with a very quick pay-back in terms of reduced maintenance and reliability costs. A goal is to set up procedures such that optimum filtration can be achieved in Naval ship lubrication systems. GRA

N80-21758# Oklahoma State Univ., Stillwater. Fluid Power Research Center.
WEAR IN FLUID POWER SYSTEMS Final Report, 1 Jul. 1978 - 30 Jun. 1979
30 Nov. 1979 122 p refs
(Contract N00014-75-C-1157)
(AD-A079654; ONR-CR-169-004-2) Avail: NTIS HC A06/MF A01 CSCL 11/8

Contaminant wear is one of the critical factors in component life and reliability. Therefore, the detection and analysis of this wear is extremely important. In this study, it was determined that ferrography is an effective tool for this detection and analysis. A theoretical method was developed by which the behavior of both magnetic and non-magnetic particles in the fluid stream on the ferrogram can be predicted. This method indicates that very few magnetic particles will not be deposited on the ferrogram. This was verified experimentally. Tests were conducted on gear pumps, a hydrostatic transmission, and complete hydraulic system to verify the effectiveness of the ferrographic technique. These tests showed that changes in the wear rate of a system or component could be readily detected by the ferrograph. The lack of standardization of ferrographic procedures is delaying the acceptance of the ferrograph as a critical decision making instrument. A very advanced draft procedure has been prepared and is ready for consideration by the appropriate committee of the Society of Automotive Engineers. GRA

N80-21759# Argonne National Lab., Ill.
MECHANICAL AND ELECTRICAL PROPERTIES OF RESISTANCE WELDS AT CRYOGENIC TEMPERATURES
S. T. Wang, S. H. Kim, N. S. Kim, and H. Ludwig 1979 14 p refs Presented at Cryog. Engr. Conf., Madison, Wis., 21 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790815-25) Avail: NTIS HC A02/MF A01

The mechanical and electrical properties of resistance welds for a large superconducting magnet at cryogenic temperatures is reported. The specifications of the conductor are discussed and the equipment and fixtures are described. DOE

N80-21760# Santa Clara Univ., Calif.
EXHAUST CHARACTERIZATION OF NEAT ALCOHOL FUELED IC ENGINES Final Report
B. Pullman, R. Pefley, Richard Bechtold (DOE, Bartlesville, Okla.), and Jerry Allsup (DOE, Bartlesville, Okla.) Oct. 1979 30 p refs Sponsored by DOE
(BETC/P-B-B-1943-1) Avail: NTIS HC A03/MF A01

A late-model vehicle was converted to operate using methanol, gasoline, or ethanol as fuel and experimental work was done to obtain energy economy and exhaust emissions data for each of the three fuels. Results are compared at equal equivalence ratios

both with and without an oxidation catalyst in the exhaust system. Using a catalyst for emissions control, unburned (hydro) carbon emissions were lowest during lean operating conditions and were nearly the same for all three fuels under those conditions. Oxides of nitrogen emissions typically were reduced by over 50 percent in changing from gasoline to methanol or ethanol. Composition of the exhaust hydrocarbons was determined from analysis via gas chromatography. These data were used for calculating photochemical reactivities and comparisons were made among the fuels during cold start and FTP weighted tests. DOE

N80-21761# Notre Dame Univ., Ind. Dept. of Metallurgical Engineering and Materials Science.

MICROSTRUCTURAL EFFECTS IN ABRASIVE WEAR Quarterly Progress Report, 15 Jul. - 15 Sep. 1979

Nicholas F. Fiore and Thomas H. Kosel 15 Oct. 1979 38 p refs

(Contract EF-77-S-02-4246)

(COO-4246-10) Avail: NTIS HC A03/MF A01

Quantitative relations were established between microstructure and wear resistance of highly alloyed materials, including high-Cr white irons and experimental Co-base and Ni-base powder metallurgy (PM) alloys now used or potentially to be used in coal mining, handling and gasification. The wear under study were low stress abrasion, encountered in coal conversion and transfer applications, and gouging wear encountered in mining. The optimum microstructures for wear resistance were established as well as a better understanding of the physical and mechanical metallurgy of wear. DOE

N80-21762# National Centre of Tribology, Risley (England). Space Tribology Lab.

THERMAL VACUUM ACCELERATED LIFE TEST ON A PROTOTYPE TELDIX SINGLE-GIMBALLED MOMENTUM WHEEL

K. Parker and J. C. Anderson Jun. 1979 48 p

(Contract ESA-3368/77-NL-MD)

(ESA-CR(P)-1268) Avail: NTIS HC A03/MF A01

A prototype TELDIX single-gimballed momentum wheel (SGMW) has been tested in vacuum at isothermal temperatures and with various thermal gradients. The mechanism consists of a momentum wheel which is oscillated in one plane through + or - 5 deg angular motion by a stepper motor giving a nominal step size of 0.031 deg. During the accelerated life tests a total of 1.5 x 10 to the 7th power steps were carried out which represents more than 150 times the number of steps which would occur in a 7 year lifetime of operation in a communications satellite. Detailed measurements on the motion of the stepper motor were taken at intervals during the test and the distribution of step sizes presented as a histogram evaluation. Several minor variations in step size distribution occurred during the various tests which did not correlate with temperature level. The electrical performance of both the momentum wheel motor and stepper motor showed no change during the tests. The amount of wear on the teeth of the stepper motor was found to be consistent with the low torque exerted by the gimbal system and was insufficient to alter the tooth profile. Steel balls had been fitted to the gimbal bearings. Duroid cages were used and the transfer of lubricant from these cages had minimized steel wear in the bearings. Author (ESA)

N80-21763# National Centre of Tribology, Risley (England). Space Tribology Lab.

CASE INSTABILITIES IN A 42 mm OD/20 mm ID ANGULAR CONTACT BEARING

K. T. Stevens and M. J. Todd Paris ESA May 1979 31 p refs

(Contract ESA-2584/75-MD)

(ESA-CR(P)-1255) Avail: NTIS HC A03/MF A01

Spin tests were conducted on a series of angular contact, inner race separable bearings with phenolic cages using a variety of space approved lubricants. Three types of cage instability were observed in ED20 bearings and are probably typical of all such bearings; a high frequency radial vibration, an erratic axial vibration and a periodic change in cage running position from ball-riding to race-riding. The high frequency radial vibrations were observed only in outer-race-riding cages and, in cases of starved lubrication, give a significant torque increase. In cases of flooded lubrication they produce a torque decrease. The severity of the instability is increased with increasing lubricant viscosity and with increasing load. The vibrations tend to be at a single frequency which is proportional to the bearing speed. Axial instabilities are in the form of erratic and random motion and give rise to a severe torque penalty. They are always a feature of cages made with oversize ball pockets. The final form of instability gives only a small penalty in torque. Author (ESA)

N80-21764# Royal Aircraft Establishment, Farnborough (England).

A TIME-SHARING COMPUTER PROGRAMME TO DRIVE UP TO THREE INDEPENDENT FATIGUE TESTING MACHINES

W. Watt London HMSO May 1979 31 p refs

(RAE-TR-79054; BR70107) Avail: NTIS HC A03/MF A01

A PDP-8/E computer program is described which offers a choice from seven resident software sequence generators to each of three independent hardware waveform controllers which drive electrohydraulic fatigue testing machines. The program is controlled by teletype commands and paper tape input data. Under program control, each controller may be run at a specified fixed frequency or fixed loading rate. Various analysis counts are kept which may be typed on command. One generator takes its sequence from magnetic tape and is restricted to one controller at a time. Author (ESA)

N80-21765# Bristol Univ. (England). Dept. of Civil Engineering.

THE BEHAVIOR OF MODEL GROUND ANCHORS INSTALLED IN SAND AND SUBJECTED TO PULL-OUT AND REPEATED LOADING Ph.D. Thesis

David Victor Maddocks Apr. 1978 414 p refs

Avail: NTIS HC A18/MF A01

The interaction between anchora and sand was observed directly in a plane strain model system, and the shear failure of the sand studied. A continuous record of the interaction between the sand and the model anchors was made using a stereo photogrammetric technique. The model anchors represented a plate anchor and an anchor with a rigid, short, cylindrical body with either a smooth or a rough surface. The effect of a smooth shaft surrounding the tendons of the anchors with the rough, cylindrical bodies were investigated. The results of the model tests are assessed in relation to the performance of full scale anchors. Author (ESA)

N80-21766# National Technical Information Service, Springfield, Va.

LIQUID BEARINGS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979

Guy E. Habercom, Jr. Dec. 1979 149 p Supersedes NTIS/PS-78/1282; NTIS/PS-77/1125; NTIS/PS-76/0973

(PB80-802614; NTIS/PS-78/1282; NTIS/PS-77/1125; NTIS/PS-76/0973) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Design and performance of hydrostatic and hydrodynamic bearings are investigated in these reports gathered in a worldwide literature survey. Wear resistance, lubrication effectiveness, and performance in cryogenic and liquid metal environments are among the parameters reviewed. This updated bibliography contains 142 abstracts, 8 of which are new entries to the previous edition. GRA

N80-21767# National Technical Information Service, Springfield, Va.

LIQUID BEARINGS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979

Guy E. Habercom, Jr. Dec. 1979 101 p Supersedes NTIS/PS-78/1281; NTIS/PS-77/1124; NTIS/PS-76/0972; NTIS/PS-75/804

(PB80-802606; NTIS/PS-78/1281; NTIS/PS-77/1124; NTIS/PS-76/0972; NTIS/PS-75/804) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Government sponsored research reports covering the design and performance of hydrostatic and hydrodynamic bearings are cited. Research into wear resistance, lubrication effectiveness, and performance in liquid metal and cryogenic environments is

considered in 94 abstracts, none of which is new to the previous edition. GRA

N80-21768# Budd Co., Fort Washington, Pa. Technical Center.
MATERIAL APPLICATIONS IN FUTURE AUTOMOTIVE STRUCTURE. VOLUME 1: SUMMARY REPORT Final Summary Report, Oct. 1976 - May 1979
Herbert A. Jahnle Apr. 1979 21 p
(Contract DOT-HS-6-01479)
(PB80-118896; TCR-0385-Vol-1; DOT-HS-805-064) Avail: NTIS HC A02/MF A01 CSCL 13F

Candidate materials which might be used in future automotive structure were selected. These included steels, aluminum alloys, plastics and fiber reinforced composites. General materials property data, availability, manufacturability, cost and their effects on crashworthiness, durability and non damageability were evaluated. A total of three vehicle structures; body on frame, unibody and unibody van were investigated with the possible use of the candidate materials in mind. Finite element analysis and mass-spring modeling of the vehicle structures were completed to determine limits and boundaries of materials application. The existing structure with appropriate sectional properties were obtained from current production vehicles. GRA

N80-21769# New Mexico Univ., Albuquerque. Technological Application Center.
ANTIFRICTION BEARINGS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Dec. 1979
Peter Moore Jan. 1980 24 p Sponsored in part by NTIS
(PB80-803943) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

These 77 citations from the international literature provide descriptions of tribological studies of materials and designs that provide low friction performance. The articles include analyses and characterizations of bearing and lubricant systems. The environments considered entail temperatures from the cryogenic region to 900 C and loads up to 20,000 psi. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-21770# Los Alamos Scientific Lab., N. Mex.
EVALUATION OF IN-LINE NONDESTRUCTIVE ASSAY SYSTEMS Progress Report, 1 Apr. - 30 Jun. 1979
D. F. Bowersox, N. Ensslin, S. T. Hsue, L. G. Speir, C. A. Spirio, J. W. Tape, G. Walton, and R. B. Walton Oct. 1979 13 p refs
(Contract W-7405-eng-36)
(LA-8091-PR) Avail: NTIS HC A02/MF A01

Instruments specified for in-line nondestructive assay of process streams in spent nuclear fuels are described along with testing under realistic conditions for use in effective process control and materials accounting. DOE

N80-21771# National Bureau of Standards, Washington, D.C. National Engineering Lab.
IMAGE PATTERN RECOGNITION IN INDUSTRIAL INSPECTION
Gordon J. VanderBrug and Roger N. Nagel Sep. 1979 49 p refs
(PB80-108871; NBSIR-79-1764) Avail: NTIS HC A03/MF A01 CSCL 13H

The labor cost of manual inspection and the high cost of special purpose part delivery systems for robots led many manufacturers to investigate vision systems for use in manufacturing. Digital image processing and pattern recognition are providing the basis for a growing number of attempts to achieve an automated vision system. An historical perspective on image processing and pattern recognition is presented and state of the art examples of visual inspection systems, and robot vision systems is discussed. A list of other areas in manufacturing for the application of vision systems is included along with an assessment of the future of vision systems in manufacturing. GRA

N80-21585# Saab-Scania, Linkoping (Sweden).
DIGSIM AS AN AID FOR EFFICIENT RELIABILITY ANALYSIS
Bengt Magnhagen *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 47-49 refs
Prepared in cooperation with Linkoeping Univ., Sweden (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21602# Engins Matra, Velizy (France).
HOW TO USE CAD FOR DRIFT AND MARGINS STUDIES
B. Boucly and A. Lelaire *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 369-374
(For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-21772 Engineering Sciences Data Unit, London (England).
MEAN FLUID FORCES AND MOMENTS ON CYLINDRICAL STRUCTURES: POLYGONAL SECTIONS WITH ROUNDED CORNERS INCLUDING ELLIPTICAL SHAPES
1979 34 p
(ESDU-79026; ISBN-0-85679-274-8; ISSN-0141-4003; ISSN-0141-397X) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

The report provides mean fluid force and moment data for multi-sided cylindrical structures with rounded edges. The research results may be applied to the design of lighting standards, pylons, booms, aerial masts, struts, building towers, and stacks. The application relates to single and double wedge shapes, regular polygonal shapes with up to 20 sides, and elliptical shapes; for edge radii from zero to the radius of the inscribed circle, Re between about 5 x 10,000 and 3 x 1,000,000 and including allowances for the effect of flow turbulence and aspect ratio. ESDU

N80-21773 Stanford Univ., Calif.
STUDIES IN DYNAMICS AND THE APPLICATION OF ASYMPTOTIC METHODS IN SOLID MECHANICS Ph.D. Thesis
Bruce Einar Bennett 1979 122 p
Avail: Univ. Microfilms Order No. 8006289

A sequence of studies is presented including transient wave propagation, the application of wave front expansions to transient wave propagation and, finally, considerations in the application of an asymptotic expansions method to the static and dynamic analyses of thin elastic shells. The dynamic response of an elastic half space with an overlying acoustic fluid is investigated. The response of the solid is obtained from the solution of the same problem without the fluid. An example is given. Also, the propagation of a shock wave front across a curved fluid-solid interface is investigated using wave front expansions, or geometric optics. The practical difficulties that occur in the application of the asymptotic expansions method to the static analysis of elastic structures are discussed. Dissert. Abstr.

N80-21774 Virginia Univ., Charlottesville.
ASYMPTOTIC EVALUATION OF STRESS-INTENSITY FACTORS IN CRACKED SHELLS VIA A PATH INDEPENDENT INTEGRAL Ph.D. Thesis
James William Nicholson 1979 119 p
Avail: Univ. Microfilms Order No. 8004628

A path independent integral to calculate stress intensity factors for a cylindrical shell containing a finite length crack is presented.

The stresses in the neighborhood of the crack tip are proportional to the inverse square root of the distance from the crack tip. The amplitude of this singularity is called the stress intensity factor. The stress intensity factor depends on Poisson's ratio and the dimensionless crack length. Dissert. Abstr.

N80-21775*# California Univ., Los Angeles. School of Engineering and Applied Science.

X-RAY MEASUREMENTS OF STRESSES AND DEFECTS IN EFG AND LARGE GRAINED POLYCRYSTALLINE SILICON RIBBONS Final Report

C. N. J. Wagner. Aug. 1979. 22 p. refs. Prepared for JPL and DOE. Sponsored by NASA.
(NASA-CR-162629; JPL-9950-315; DOE/JPL-954851-79/2)
Avail: NTIS. HC A02/MF A01. CSCL 20K

The Bond method was employed to measure the lattice parameter in an area of 0.4 mm in diameter of EFG Si-ribbons to an accuracy of + or - 0.00008 A. A Bond goniometer was built which included a goniostat with a special specimen holder to mount ribbons 1 m in length and 75 mm in width which could be rotated about two orthogonal axes, and a Leitz microscope for precision alignment of a particular area into the center of the goniostat and the small primary X-ray beam. The (321) planes were found to be parallel to the surface of the ribbons with an angular spread of about 15 deg. The poles of the (111) planes clustered about an angle of 25 deg away from the surface normal, again with a spread of 10 deg. The lattice parameter of a small piece of ribbon material was found to be a sub o = 5.43075 A. A maximum stress of 115 MPa was observed in a fractured ribbon which corresponded to the fracture stress of single crystals of Si. J.M.S.

N80-21776# Washington Univ., Seattle. Dept. of Mechanical Engineering.

DYNAMIC STRESS INTENSITY FACTOR FOR UNSYMMETRIC DYNAMIC ISOCHROMATICS

A. S. Kobayashi and M. Ramulu. Jan. 1980. 34 p. refs.
(Contract N00014-76-C-0060; NR Proj. 064-478)
(AD-A080310; TR-37). Avail: NTIS. HC A03/MF A01. CSCL 20/11

The mixed mode, near-field state of stresses surrounding a crack propagating at constant velocity is used to derive a relation between the dynamic stress intensity factors K sub I, K sub II, the remote stress component sigma sub ox and the dynamic isochromatics. This relation together with an overdeterministic least-square method form the basis of a data reduction procedure for extracting dynamic K sub I, K sub II, and sigma sub ox from the recorded dynamic photoelastic pattern surrounding a running crack. The overdeterministic least-square method is also used to fit static isochromatics to the numerically generated dynamic isochromatics. The resultant static K sub I, K sub II, and sigma sub ox are compared with the corresponding dynamic values and estimates of errors involved in using static analysis to process dynamic isochromatic data are obtained. The data reduction procedure is then used to evaluate the branching stress intensity factor associated with crack branching and the mixed mode stress intensity factors associated with crack curving. Author (GRA)

N80-21777# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.

FIELDS NEAR A RAPIDLY PROPAGATING CRACK TIP IN AN ELASTIC PERFECTLY-PLASTIC MATERIAL Interim Report

J. D. Achenbach and V. Dunayevsky. Jan. 1980. 37 p.
(Contract N00014-76-C-0063)
(AD-A080591; NU-SML-TR-80-1). Avail: NTIS.
HC A03/MF A01. CSCL 20/11

Dynamic effects are investigated for the steady state fields of stress and deformation in three immediate vicinity of a rapidly propagating crack tip in an elastic perfectly plastic material. Both the cases of anti-plane strain and in-plane strain have been considered. The governing equations in the plastic regions are hyperbolic in nature. Simple wave solutions together with uniform fields provide explicit asymptotic expressions for the stresses and the strains in the near-tip regions. The dynamic solutions describe a region of plastic loading which completely surrounds the propagating crack tip. GRA

N80-21778# Texas Engineering Experiment Station, College Station.

THERMOPLASTIC ANALYSIS USING THE FINITE ELEMENT CODE AGGIE I Interim Report

David H. Allen and Walter E. Haisler. Dec. 1979. 44 p. refs.
(Contract N00014-76-C-0150; NR Proj. 064-534)
(AD-A080202; TEES-3275-79-4). Avail: NTIS.
HC A03/MF A01. CSCL 20/11

The authors have previously proposed a theoretical model for predicting structural response of elastic-plastic-creep materials subjected to variable temperature loadings. This model utilizes the combined isotropic-kinematic hardening rule in conjunction with the classical rate independent plasticity theory. The resulting constitutive law has been implemented into the finite strain finite element code AGGIE I. The authors have found it necessary to alter the formulation previously presented in order to obtain a concise numerical formulation. That modification is presented in this paper. In addition, a section is included which outlines supplementary information necessary for computer program input, followed by a computational procedure which is intended to aid programmers who wish to use this model. Finally, the results of several sample cases are presented. GRA

N80-21779# Army Materials and Mechanics Research Center, Watertown, Mass.

A VARIABLE LOAD STEP SOLUTION APPROACH FOR INCREMENTAL TANGENT MODULUS FINITE ELEMENT ANALYSIS Final Report

Dennis M. Tracey and Colin E. Freese. Sep. 1979. 24 p.
(DA Proj. 1L1-62105-AH-84)
(AD-A080392; AMMRC-TR-79-47). Avail: NTIS.
HC A02/MF A01. CSCL 20/11

This paper addresses the issue of load path discretization in incremental tangent modulus finite element analysis. The view is taken that discretization can best be accomplished during the course of the numerical solution by employing a constraint condition which restricts the level of structural stiffness approximation at each load step. By identifying a field variable which strongly influences the stiffness, a suitable constraint condition can be selected in terms of the nodal variables. With such a constraint, design of a solution algorithm for determining the step size along with the nodal variables is straightforward, as is demonstrated in the text. This variable load step solution approach provides the analyst with a simple yet efficient method for logically controlling step size, without having to resort to time consuming and costly reanalysis procedures to insure that the numerical approximation is within satisfactory tolerance. GRA

N80-21780# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

MODERN OPTIMAL CONTROL METHODS APPLIED IN ACTIVE CONTROL OF A CANTILEVER BEAM IN BENDING VIBRATION M.S. Thesis

Keith Daniel Sanborn. Dec. 1979. 71 p. refs.
(AD-A079859; AFIT/GA/AA/79D-9). Avail: NTIS.
HC A04/MF A01. CSCL 20/11

The equations of motion for a cantilever beam in bending vibration are developed in state vector form using a normal mode approximation. A linear optimal control system generates a feedback control proportional to the state which is represented by modal amplitudes and velocities determined using position information from sensors. The observer gain matrix and the feedback control gain matrix are both determined from a steady state optimal regulator which minimizes the related quadratic performance index. Control is applied through point force actuators. System response is shown to be very sensitive to actuator location. Singular perturbation provided a method through which control spillover could be minimized for the actuator locations chosen, however, it did not provide the means by which the actuators could be positioned such that the spillover effect could be eliminated. Robustness of system response to modal amplitude errors was very good, and the unstable controllers tested did not appear to seriously affect this robustness. Author (GRA)

N80-21781# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN EXPERIMENTAL WEIGHT FUNCTION METHOD FOR STRESS INTENSITY FACTOR CALIBRATION M.S. Thesis
Dan Bar-Tikva Dec. 1979 110 p refs
(AD-A079854; AFIT/GAE/AA/79D-2) Avail: NTIS
HC A06/MF A01 CSCL 20/11

The weight function procedure allows one to convert stress intensity factors K and crack displacement information obtained for one crack configuration and loading into the stress intensity factor solution for the same geometry and another loading. The feasibility of using the weight function idea for a two dimensional case with experimental results is demonstrated in this work. Mode I stress intensity factor K(I) measurements obtained by a laser interferometric technique, and 'crack mouth' opening displacement measurements were taken for an edge cracked strip subjected to four point bending. These results were used to construct (numerically) a weight function with the aid of a computer program written for this purpose. Results of K(I) for the same geometry with two different loading configurations, uniform tension and three point bending (with two different length to width ratios) were computed. These results agree favorably with the known solutions and demonstrate that a set of experiments for a single loading can accurately predict the stress intensity factor for any other loading configuration of the same geometry. The advantage of the weight function method would be particularly important if these loading configurations are difficult or impossible to reproduce in the laboratory. GRA

N80-21782# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STUDY OF SHORT CYLINDRICAL SHELLS WITH AND WITHOUT CUTOUTS UNDER PURE BENDING M.S. Thesis
Carl J. Bang, Jr. Dec. 1979 117 p refs
(AD-A079853; AFIT/GA/AA/79D-1) Avail: NTIS
HC A06/MF A01 CSCL 20/11

In this report, short cylindrical shells are studied under pure bending. An edge kinematic constraint loading method is adapted for use with the STAGSC computer code. With it, short unstiffened cylindrical shells are studied for prebuckling displacements and compared with axially stressed cylinders. End rings are added to note their influence. The bending is applied to short internally stiffened (smeared stringer theory) cylinders with the resulting buckling values and patterns contrasted against axial loading. The L/R range of interest is from .698 to 1.361. Symmetrical and unsymmetrical 12 inch cuts are added to the stiffened cylinder to study the resulting effects from this imperfection. The results indicate: (a) For short length (L/R + or - 10) cylinders, end loading by bending rotation causes structural deformation patterns different than long cylinder bending deflections. (b) The imposed boundary effect for unstiffened cylinders diminishes with L/R increase until L/R = 20 where there is no noticable deformation influence. (c) End ring stiffeners studied did not alter the basic short cylinder deformation patterns. (d) Compressive zone buckling failure under bending can be modeled through axial compression analysis. GRA

N80-21783# Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
MAXIMUM ENERGY-RELEASE RATE OF MIXED-MODE CRACK PROBLEMS AND ITS RELATION TO EXISTING FRACTURE CRITERIA Final Report, 15 Jun. 1976 - 15 Sep. 1979
Chien H. Wu Sep. 1979 7 p refs
(Grants DAAG29-78-G-0030; DAAG29-76-G-0272)
(AD-A079298; ARO-13174.4-E) Avail: NTIS
HC A02/MF A01 CSCL 20/11

This final report summarizes the analytical investigations conducted at the University of Illinois at Chicago Circle during the period from June 15, 1976 to September 15, 1979. The two main topics of investigation were crack branching and effects of crack-parallel load. A list of papers published under ARO-D sponsorship is included. GRA

N80-21784# Wisconsin Univ. - Madison. Mathematics Research Center.
THE INVERSE REFLECTION PROBLEM FOR A SMOOTHLY STRATIFIED ELASTIC MEDIUM Summary Report
W. Symes Oct. 1979 46 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A079708; MRC-TSR-2007) Avail: NTIS
HC A03/MF A01 CSCL 20/11

The subject of this paper is a version of the inverse reflection problem for a smoothly stratified elastic medium. The same mathematics describes the inverse problem of the vibrating string. This problem is solved in a constructive way. Also, a priori estimates are derived which exhibit the continuous dependence of the solution (index of refraction, relative sound speed) on the data (scattering or reflection measurements). GRA

N80-21785# Oklahoma Univ., Norman. School of Aerospace, Mechanical, and Nuclear Engineering.
A COMPARISON OF CLOSED-FORM AND FINITE-ELEMENT SOLUTIONS OF THICK, LAMINATED, ANISOTROPIC RECTANGULAR PLATES
J. N. Reddy Dec. 1979 43 p refs
(Contract N00014-78-C-0647)
(AD-A080533; OU-AMNE-79-19) Avail: NTIS
HC A03/MF A01 CSCL 11/4

In this study the effects of reduced integration, mesh size, and element type (i.e., linear or quadratic) on the accuracy of a penalty finite element based on the theory governing thick, laminated, anisotropic composite plates, are investigated. In order to assess the accuracy of the present element, exact closed-form solutions are developed for cross-ply and antisymmetric angle-ply rectangular plates simply supported and subjected to sinusoidally distributed mechanical and/or thermal loadings, and free vibration. GRA

N80-21786# Oklahoma Univ., Norman. School of Aerospace, Mechanical, and Nuclear Engineering.
ANALYSIS OF THICK RECTANGULAR PLATES LAMINATED OF BIMODULUS COMPOSITE MATERIALS
C. W. Bert, V. Sudhakar Reddy, and W. C. Chao Jan. 1980 29 p refs
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A080535; OU-AMNE-80-2; TR-11) Avail: NTIS
HC A03/MF A01 CSCL 11/4

A mixed finite-element analysis is presented for static behavior of rectangular plates having finite transverse shear moduli and different elastic properties depending upon whether or not the fiber-direction strains are tensile or compressive. As a benchmark to evaluate the validity and accuracy of the finite-element analysis, a closed-form solution is presented for the particular case of an unsymmetric-cross-ply plate having freely supported edges and subjected to a sinusoidally distributed normal-pressure loading. GRA

N80-21787# Argonne National Lab., Ill.
ULTIMATE STRENGTH, LOW STRESS CREEP CHARACTERISTICS, AND THERMAL INTERCEPT METHODS FOR AN EPOXY FIBERGLASS TENSION MEMBER SUPPORT
R. C. Niemann, J. D. Gonczy, J. A. Hoffman, K. F. Mataya, P. Smelser, and W. C. Young 1979 18 p refs Presented at the Cryogenic Eng. Conf., Madison, Wis., 23 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790815-22) Avail: NTIS HC A02/MF A01

A support system utilizing epoxy fiberglass tension members used for the UTSI Superconducting Dipole Magnet is described. Elements of the support system have a basic member which is a link in which a composite is wound around a mandrel. This element uses the strength of the material fibers in a most advantageous way. The flexural and torsional load inputs to the link at its end are minimized. A spherical bearing with a cylindrical outer surface functions as the central pin. Experience gained in the application with emphasis on tension member material, ultimate strength, creep, and heat intercepts is presented. DOE

N80-21788# Iowa State Univ. of Science and Technology, Ames. Dept. of Engineering Science and Mechanics.
PHOTOPLASTIC STUDY OF THE EFFECT OF FRICTION ON THE DEFORMATION AND FLOW OF RINGS IN AXIAL COMPRESSION
H. A. Gomide and C. P. Burger 1979 37 p refs Presented at the Spring Meeting of Soc. for Exptl. Stress Anal., San Francisco, 20 May 1979
(Contract W-7405-eng-82)

(ISM-238; CONF-790503-7) Avail: NTIS HC A03/MF A01

The influence of friction on the deformation, flow, and strain distribution of rings in axial compression was investigated using the method of photoplasticity. A rigid polyester resin (Laminac 4116) which exhibits plastic strain birefringence in visible light was used. Its deformation properties can be adjusted to best simulate aluminium undergoing hot deformation. Data from uniaxial tension and compression tests indicate that the polyester material may follow a modified von Mises yield criterion. Rings with geometry 6:3:2 (outside diameter:inside diameter:thickness) were compressed axially by different amounts (8 to 24%) between plates with different coefficients of friction. Results are compared with the mathematical solution for constant interface friction and with allowance for bulge formation. Three-dimensional strain distributions are determined and the position of the neutral radius through the thickness are presented. The results reveal an increase in the neutral radius where the contact area increases. The experimentally obtained strain distributions are integrated in the axial and radial directions and are compared with the external displacements that are measured on the deformed rings. DOE

N80-21789# Oak Ridge National Lab., Tenn.

STABLE CRACK GROWTH ESTIMATES BASED ON EFFECTIVE CRACK LENGTH AND CRACK-OPENING DISPLACEMENTS

J. G. Merkle and C. E. Hudson (Auburn Univ., Ala.) 1979 29 p refs Presented at Comm. on Safety of Nucl. Installations, Specialists Meeting on Plastic Tearing Instability, St. Louis, 25 Sep. 1979 Prepared jointly with Union Carbide Corp., Oak Ridge, Tenn.

(Contract W-7405-eng-26)

(CONF-790963-1) Avail: NTIS HC A03/MF A01

A method was developed for estimating the amount of stable crack growth that has occurred in a fracture toughness specimen that was loaded into the plastic range and for which only a monotonically increasing load-displacement curve was measured. The method was applied to data from several pressure vessel steels. The resulting J vs Delta a values compare favorably with a resistance curve obtained by the multiple specimen heat-tinting technique for A533, Grade B, Class 1 steel. The method for estimating stable crack growth uses several existing concepts heretofore mainly used separately. These concepts include an approximate expression for J for the compact specimen proposed by Andrews, the effective crack length concept of McCabe and Landes, the UK representation of the crack profile as a pair of straight lines intersecting at a hinge point, and Well's expression for relating the crack-opening displacement to the value of J. The value of the constraint factor, m, at the advancing crack tip is estimated by means of a relation between ductility and fracture toughness. DOE

N80-21790# Oak Ridge National Lab., Tenn.

PREDICTED STRAIN IN AUSTENITIC STAINLESS STEELS UNDER TRANSIENT STRESS

J. P. Hammond, V. K. Sikka, and M. K. Booker Nov. 1979 42 p refs

(Contract W-7405-eng-26)

(NUREG-CR-1042; ORNL/NUREG/TM-338) Avail: NTIS HC A03/MF A01

Tensile results on austenitic stainless steels were analyzed to develop means for predicting strains at stresses above design levels for reactor regulatory applications. Ten heats of type 316 and 19 heats of type 304 stainless steel in the mill-annealed and reannealed conditions at 24 C, 93 C, and 316 C and higher were tested. These tensile data were used to compute expected strains under in-service transient stresses (pressures). The effects of heat-to-heat variations on total strain (to 5 percent) at discrete stress levels by a rational polynomial equation incorporating three constants associated with the basic features of the true stress-true strain diagram were determined. Total maximum strains and ratios of maximum strain to yield strength were computed. DOE

N80-21791# General Atomic Co., San Diego, Calif.

EFFECT OF AGING AND COLD WORKING ON THE HIGH-TEMPERATURE LOW-CYCLE FATIGUE BEHAVIOR OF ALLOY 800H. PART 2: CONTINUOUS CYCLIC LOADING

R. E. Villagrana, J. L. Kaae, and J. R. Ellis (Oak Ridge National Lab.) Oct. 1979 36 p refs

(Contract DE-AT03-76ET-35300)

(GA-A-15558) Avail: NTIS HC A03/MF A01

The individual and combined effects of cold working (5 and 10 pct) and aging (4000 and 8000 h in the temperature range 538 to 760 C) on the high temperature, low cycle fatigue behavior of alloy 800H were investigated. The specimens were tested at the aging temperatures. Both the saturation stress range and the fatigue life were found to be history dependent. A history independent hardening mechanism, dynamic strain aging, was found to operate over the temperature range 450 to 650 C and to be maximized at 550 C. It is speculated that carbon is responsible for this dynamic strain aging. Finally, at temperatures above 538 C the Coffin-Manson plots indicate the possible existence of a history independent softening mechanism. DOE

N80-21792# Bettis Atomic Power Lab., West Mifflin, Pa.

APPLICATION AND EXPERIMENTAL QUALIFICATION OF THE EQUIVALENT SOLID PLATE METHOD TO THE ANALYSIS OF PERFORATED PLATES WITH SQUARE PENETRATION PATTERNS

D. P. Jones and G. M. Henry Oct. 1979 39 p refs

(Contracts EY-76-C-11-0014)

(WAPD-TM-1438) Avail: NTIS HC A03/MF A01

Approximate techniques are presented which facilitate the application of the equivalent solid plate properties for the square penetration pattern perforated plate geometry to axisymmetric analysis. The problem is discussed within the contex of the finite element method and appropriate material property relationships are derived which facilitate axisymmetric analysis. These techniques and relationships are also used in the formulation of a thin plate analysis. Finally, after a summary of the experimental methods, comparisons with experimental results are given which substantiate the assumptions made permitting the axisymmetric analysis. DOE

N80-21793# California Univ., Livermore. Lawrence Livermore Lab.

COMPUTER SIMULATION OF DUCTILE FRACTURE

Mark L. Wilkins and R. D. Streit 1979 12 p refs Presented at the ASME Winter Ann. Meeting, New York, 2 Dec. 1979

(Contract W-7405-eng-48)

(UCRL-83148; CONF-791205-8) Avail: NTIS HC A02/MF A01

The possibility of developing models of ductile fracture by correlating experiments with equivalent computer simulation is examined. Selected experiments were done to emphasize different aspects of the model. The strain field around notched tensile specimens of aluminum 6061-T651 is discussed. A series of geometrically scaled specimens are tested to fracture. The scaled experiments are conducted for different notch radius-to-diameter ratios. The strains at fracture are determined from computer simulations. An estimate is made of the fracture size effect. DOE

N80-21794# Oak Ridge National Lab., Tenn.

MECHANICAL PROPERTIES TEST DATA FOR STRUCTURAL MATERIALS Semiannual Progress Report, period ending 31 Jul. 1979

J. R. Distefano, comp. Oct. 1979 351 p refs

(Contract W-7405-eng-26)

(ORNL/BRP-79/5) Avail: NTIS HC A16/MF A01

Data are presented concerning mechanical properties of Alloy 718 and SS Types 304 and 308. High temperature structural design data for austenitic stainless steel weldments are given. Results obtained for transition weldjoint material are given. Neutron irradiation fatigue crack propagation in SS Type 316 breeder reactor material is considered as well as data for breeder reactor materials including Alloy 718 and Inconel X750, and testing data of SS Type 304 and 316. The effect of sodium on transition joints and corrosion fatigue of Cr-Mo steel is discussed along with helium effects and thermal aging studies of HTGR materials, and creep and strength of SiO_2. DOE

N80-21795# Rochester Univ., N. Y. Dept. of Mechanical and Aerospace Sciences.

DOUBLE TORSION TESTING: EVALUATION FOR ASTM E-24.07.02

J. C. Pollet and S. J. Burns 1979 12 p
(Contract EY-76-S-02-2422)
(COO-2422-17) Avail: NTIS HC A02/MF A01

Equipment is described for double torsion testing for large and long polymer (e.g., PMMA) double torsion samples. Pyroceram 9606 and soda lime glass were cut to size and precracked and after torsion testing the crack length was measured. DOE

N80-21796# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. for Aeroelasticity.
DEVELOPMENT OF MODAL TECHNIQUES USING EXPERIMENTAL MODAL DATA. END OF PHASE 2 REPORT
A. Bertram 20 Feb. 1979 20 p refs
(Contract ESTEC-2998/76-NL-PP(SC))
(DLR-IB-253-79/C/09; ESA-CR(P)-1256) Avail: NTIS HC A02/MF A01

Work performed during the development of three software packages for use in modal analysis is outlined, and the programs described. Program DIMOC is used for calculating the effect of small structural modifications, MODAS for modal coupling analyses, and RESPON for dynamic response analyses of a satellite coupled to a launcher. Author (ESA)

N80-21797# Bristol Univ. (England). Dept. of Mechanical Engineering.
DEFECT LOCATION IN STRUCTURES BY A VIBRATION TECHNIQUE Ph.D. Thesis
Peter Cawley Nov. 1978 127 p refs
Avail: NTIS HC A07/MF A01

A vibration technique for non-destructively assessing the integrity of structures using measurements of changes in the lower structural natural frequencies, made at a single point in the structure, in conjunction with a dynamic analysis of the system to detect, locate and quantify damage was developed. The mathematical model of the structure need not be sophisticated and one analysis is required for each type of structure to be tested. The dynamic finite element program written for the dynamic analysis work was designed and the natural frequency and pattern predictions were compared with experimental results from an aluminum plate and from carbon fibre reinforced plastic plates with a variety of ply orientations. A program was developed which provides the location of the damage site and estimation of damage severity from the results of the dynamic analysis and the changes in the structural natural frequencies. The measurement of natural frequencies from the Fourier transform of the structural response to an impulse was investigated and a method for improving the frequency resolution obtained from this type of test was developed. Results are presented from use of the technique on aluminum plate and carbon fibre reinforced plastic structures, including honeycomb panels. Author (ESA)

N80-21798# Sydney Univ. (Australia). Civil Engineering Lab.
DEVELOPMENT OF ANALYSIS FOR CYCLIC AXIAL LOADING OF PILES
H. G. Poulos May 1979 53 p refs
(PB80-124100; R-347) Avail: NTIS HC A04/MF A01 CSCL 13B

An economical method of analyzing the effects of cyclic loading on the ultimate axial load capacity and load settlement (stiffness) response of a single pile is described. The effects of cyclic loading are allowed for by determining the excess pore pressures generated along the pile by the cyclic loading, and by using an effective stress approach to estimate the influence of these excess pore pressures on soil modulus, pile-soil skin friction, and pile base resistance. GRA

N80-21264*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAINTENANCE OF NASTRAN (R) AS A STATE-OF-THE-ART COMPUTER PROGRAM
James L. Rogers, Jr. *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 01B

N80-21266# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Structural Dynamics Dept.
STRUCTURAL OPTIMIZATION WITH STATIC AND AEROELASTIC CONSTRAINTS
D. Mathias, H. Roehrle, and J. Artmann *In* AGARD The Use of Computers as a Design Tool Jan. 1980 11 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21267# Liege Univ. (Belgium). Aerospace Lab.
APPLICATIONS OF MIXED AND DUAL METHODS IN STRUCTURAL OPTIMIZATION
G. Sander, C. Fleury, and M. Geradin *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p refs (For primary document see N80-21243 12-01)
(Grant AF-AFOSR-3118-77)
Avail: NTIS HC A19/MF A01

N80-21374*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SENSITIVITY OF REFLECTOR BACKUP STRUCTURE WEIGHT TO VARIABLE WIND SPEED LOADINGS
R. Levy and D. Strain *In its* The Deep Space Network 15 Apr. 1980 p 90-99 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 20K

N80-22230# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DETERMINATION BY ELECTRICAL MEANS OF CRACK FRONTS IN THREE-DIMENSIONAL METALLIC PARTS
Georges Bandin and Humbert Policella *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) p 91-105 refs Transl. by ONERA in ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-1, Jan.-Feb. 1979 p 73-85 Original report in FRENCH previously announced as A79-30498 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

N80-22235# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOMOGENIZATION BY MIXED ASYMPTOTIC EXPANSIONS. COMPUTATION OF THE VIBRATIONS OF ELASTIC MEDIA WITH PERIODIC STRUCTURE
Roger Ohayon *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 47-60 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 109-118 Original report in FRENCH previously announced as A79-34979 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

N80-22243# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MIXED VARIATIONAL PRINCIPLES. COUPLING WITH THE DISPLACEMENT PRINCIPLE
Sophia Couryssafi *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 35-48 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestrial (Paris) No. 1979-3, May-Jun. 1979 p 181-190 Original report in FRENCH previously announced as A79-41305 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

N80-22244# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VIBRATION TESTS ON SMALL SCALE STRUCTURES AND MODELS
Henri Loiseau *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 49-68 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 191-206 Original report in FRENCH previously announced as A79-41306 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

N80-22254# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

IDENTIFICATION OF VIBRATIONAL BEHAVIOR MODELS OF COMPLEX STRUCTURES
Henri Berger and Jean-Pierre Chaquin *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 85-88 Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 283-285 Original report in FRENCH previously announced as A79-48855 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

42 GEOSCIENCES (GENERAL)

N80-21799# European Space Agency, Paris (France).
USE OF DATA FROM METEOROLOGICAL SATELLITES
B. Battrick, ed. and J. Mort, ed. Nov. 1979 263 p refs Partly in ENGLISH and FRENCH Proceedings of Tech. Conf., Lannion, France, 17-21 Sep. 1979; sponsored by ESA, Soc. Meteorol. de France and Organ. Meteorol. Mondiale (ESA-SP-143) Avail: NTIS HC A12/MF A01

The use of satellite data for numerical forecasting, climate and atmospheric environment, application to continental areas, and applications to ocean areas is discussed. For individual titles, see N80-21800 through N80-21821.

N80-21800# National Environmental Satellite Service, Washington, D. C.
METEOROLOGICAL SATELLITES: STATUS AND OUTLOOK c47
D. S. Johnson *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 3-14 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The performance of the Argos and Tiros-N satellites is assessed. Data from the very high resolution radiometer aboard the Tiros-N, the altimeter, scatterometer, and the synthetic aperture radar aboard the Seasat satellite, and the scanning multichannel microwave radiometer and coastal zone color scanner aboard the Nimbus-7 are presented. Author (ESA)

N80-21801# Hydrometeorological Centre of the USSR (Moscow).
APPLICATIONS OF SATELLITES IN HYDROMETEOROLOGY c47
I. P. Vetlov *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 15-28 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The use of the operational information from the METEOR satellite system and the results of scientific experiments carried out by means of these satellites are discussed. The discussion includes hydrometeorological information on the land and sea surface derived from multiband imagery, ice boundaries and concentration in rivers, lakes and reservoirs, and phytoplankton blooming in inland water bodies. The possibility of evaluating brush fire intensity and the area of burnt characteristics and requirements are analyzed. Author (ESA)

N80-21802# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
SATELLITE DATA FOR WEATHER ANALYSIS AND PREDICTION c47
B. Bizzari *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 31-42 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The basic motivations for meteorological satellites from a systems point of view are examined. The principles of remote sensing meteorological parameters are reviewed. The significance of measurements in the atmospheric windows and the absorption bands are discussed. The status of the satellite based global observing system is reviewed and the types of data available to the users are listed. The telecommunication services provided by meteorological satellites are reviewed. Author (ESA)

N80-21803# Freie Univ., Berlin (West Germany). Inst. fuer Meteorology.
SYNOPTIC SCALE SYSTEMS AS VIEWED FROM SPACE c47
M. Eckardt *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 31-42 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The synoptic scale of meteorological phenomenon is discussed. Higher latitude atmospheric phenomena such as cyclones and anticyclones are examined. Characteristics of the tropical atmosphere with respect to the synoptic scale are described. Features of both phenomena as viewed for severe storm development or heavy precipitation are discussed. Author (ESA)

N80-21804# Deutscher Wetterdienst, Offenbach am Main (West Germany).
SUBSYNOPTIC SCALE SYSTEMS AS VIEWED FROM SPACE c47
G. Steinhorst *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 53-63 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Subsynoptic scale systems are discussed using vertical atmospheric stability as a criterion for classifying the different phenomena. Satellite images are used to present typical examples of subsynoptic scale systems. The development and application of special forecasting techniques using conventional data as well as mesoscale climatological statistics from satellite imagery are discussed in regard to forecasting the mesoscale system. Author (ESA)

N80-21805# European Space Operations Center, Darmstadt (West Germany).
OPERATIONAL PRODUCTION OF CLOUD MOTION VECTORS (SATELLITE WINDS) FROM METEOSAT IMAGE DATA c47
R. A. Bowen, L. Fusco, J. Morgan, and K. O. Roeska *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 65-75 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

An operational system for the extraction of cloud motion vectors from METEOSAT image data is described. The main feature of the system is that it is based on automatic cross correlation tracking of the cloud patterns. The method used for image registration or navigation is discussed together with the procedure for manual editing of the final results using a man machine interactive process. The use of the interactive facilities for the extraction of cloud wind vectors is discussed. Author (ESA)

N80-21806# Meteorological Office, Bracknell (England).
QUANTITATIVE ANALYSIS OF RADIANCE DATA c47
D. E. Miller *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 77-83 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Techniques for determining sea surface temperature, cloudiness, and profiles of atmospheric temperature and humidity are reviewed. Emphasis is placed on the characteristics of operationally available satellite based products and their limitations. Author (ESA)

N80-21807# European Space Agency, Paris (France).
PROBLEMS OF USING SATELLITE INFORMATION IN NUMERICAL WEATHER PREDICTION c47
L. Bengtsson (European Centre for Medium Range Weather Forecasts) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 87-100 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Different methods of using satellite observations in numerical models are discussed. The results from a high resolution global model are presented. The analysis is related to the study of the impact of satellite information from the first GARP global experiment. Author (ESA)

N80-21808# Etablissement d'Etudes et de Recherches Meteorologiques, Paris (France).
QUANTITATIVE EVALUATION OF METEOSAT WIND

MEASUREMENT [EVALUATION QUANTIATIVE DES MESURES DE VENT METEOSAT] c47
F. R. Cayla *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 101-104 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The quality of wind velocity measuring by Meteosat was evaluated by comparison with classical measurements and with wind velocities deduced from conventional analysis. The results indicate an error in the order of 5 m/s above 850 mb, of 9 m/s at 500-850 mb, and of 11 m/sec below 500 mb.
Author (ESA)

N80-21809# National Meteorological Center, Washington, D. C.
THE IMPACT OF SATELLITE SOUNDINGS UPON NUMERICAL ANALYSIS AND PREDICTION: THE NMC EXPERIENCE c47
M. S. Tracton *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 105-112 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

A series of experiments designed to assess the impact of satellite soundings upon the NMC's numerical analysis and forecast system are described. Results indicate that remote sounding data produce little, if any, significant improvement in forecasts over the Northern Hemisphere. Evaluation of the reasons for this lack of impact leads to the conclusion that the information content of radiance derived soundings is superfluous to that already available from combination of the conventional data base and background field provided by the prediction model. Author (ESA)

N80-21810# Swedish Meteorological and Hydrological Inst., Norkoeping.
IMPACT OF SATELLITE INFORMATION ON SHORT RANGE NUMERICAL FORECASTS c47
N. Gustafsson *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 113-127 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

A meteorological satellite data impact experiment was performed utilizing the operational system for numerical analyses and forecasts. Analysis/forecast cycles were run every 6 hours during a 20 day period with and without satellites. Tiros-N satellite sounding data and satellite wind observations from the four operational meteorological geostationary satellites were utilized for the experiment. The experiment is described and the results are discussed.
Author (ESA)

N80-21811# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorology.
CLIMATE RESEARCH WITH SATELLITE DATA c47
E. Raschke *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 113-127 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Climatological analysis using meteorological satellite data is reviewed. Measurements of the following parameters, radiation budget at the top of the atmosphere, solar radiation budget at ground, stratospheric temperature, stratospheric ozone, cloudiness, and ice and snow cover are discussed. Results for quantitative cloud parameters, tropospheric water vapor content and transport, ocean surface temperature, and precipitation are presented.
Author (ESA)

N80-21812# Institut Royal Meteorologique de Belgique, Brussels.
RADIATION BUDGET AND THE SOLAR CONSTANT [BILAN RADIATIFS ET CONSTANTE SOLAIRE] c46
D. Crommelynck *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 137-143 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The difficulties and status of radiation budget measurements are discussed. The space-time variability of the components is examined. The difficulties and status of radiation budget measurements are discussed. The space-time variability of the components is examined. The characteristics of different types of radiometers are discussed and a special scanning radiometer is described. The importance of greater precision in the determination of the absolute value of the solar constant is emphasized.
Author (ESA)

N80-21813# European Space Agency, Paris (France).
DETERMINATION OF ATMOSPHERIC TEMPERATURE PROFILES AND TURBIDITY FROM SATELLITE OBSERVATIONS c46
H. Fischer (Meteorological Inst., Munich) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 145-153 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The principle of temperature sounding and methods for retrieving temperature profiles are described. Comparisons between temperature profiles determined either from satellite or radiosonde measurements are presented. The derivation of atmospheric turbidity from satellite measurements is discussed. It is estimated that the accuracy of the turbidity inferred from METEOSAT data is about 20 percent with respect to the range of medium to high turbidity.
Author (ESA)

N80-21814# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
OZONE MEASUREMENTS FROM SATELLITES [MESURES D'OZONE A PARTIR DE SATELLITE] c46
A. Girard *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 155-171 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Methods used to measure the ozone from satellites, including ultraviolet radiometry and infrared radiometry, pointed either at the Earth's limb or at the zenith are compared. The problems imposed by the restitution of the vertical concentration profile are discussed. Suggestions are presented regarding the necessity of additional laboratory measurements and the applications of atmospheric ozone measurements. Author (ESA)

N80-21815# Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
APPLICATIONS TO CONTINENTAL AREAS: INTRODUCTION NOTE [APPLICATIONS AUX ZONES CONTINENTALES NOTE D'INTRODUCTION] c43
J. Cruette *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 175-176 In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The characteristics of meteorological satellites are described and compared to those of Earth resources satellites. Three areas are proposed for the utilization of meteorological satellite data in continental areas: accessibility of satellite data, development of dialogue with the user, and evolution of the methodology.
Author (ESA)

N80-21816# Norwegian Water Resources and Electricity Board, Oslo.
SNOW AND ICE MAPPING: NORWEGIAN EXAMPLES FOR RUN-OFF PREDICTION c43
G. Oestrem, T. Andersen, H. Odegaard (IBM, Oslo), and R. delLlano (IBM, Oslo) *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 177-181 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

A method which relies on NOAA and TIROS data to evaluate the snow residue and to predict the corresponding melt water volume in a number of Norwegian high mountain basins is described. The method is to be used by hydroelectric power plant managers in order to plan production rates during the melt season.
Author (ESA)

N80-21817# European Space Agency, Paris (France).
SATELLITE CONTRIBUTION TO THE STUDY OF THE PHYSICAL PROPERTIES OF SOILS. UTILIZATION IN THE WATER AND AGRICULTURAL DOMAINS [APPORT DES SATELLITES A L'ETUDE DES PROPRIETES PHYSIQUES DES SOLS. UTILISATION DANS LES DOMAINES DE L'EAU ET L'AGRICULTURE]
Y. Vuillaume (Groupement pour le Develop. de la Teledetection Aerospatiale) *In its* Use of Data from Meteorol. Satellites Nov.

1979 p 183-189 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The utilization of satellite observation for improving the knowledge of renewable resources is examined. The physical properties of the soil which are accessible to remote detection are reviewed and the utilization of satellite data for evaluation of water and agricultural resources is analyzed. Author (ESA)

N80-21818# Joint Research Centre of the European Communities, Ispra (Italy).
AGROMETEOROLOGICAL APPLICATIONS [APPLICATIONS AGROMETEOROLOGIQUES] c43
G. Frayesse *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 191-197 refs In FRENCH; ENGLISH summary (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Insolation, soil moisture, precipitation, evapo-transpiration and canopy temperature (stress-degree-day concept) are analyzed for their importance in agromet models. The integration of data provided by meteorological and Earth observation satellites agricultural information systems is discussed. Author (ESA)

N80-21819# European Space Agency, Paris (France).
SEA SURFACE TEMPERATURE ANOMALY MAPPING USING THE NOAA SATELLITES c48
M. Albuisson (Ecole des Mines, Valbonne, France), J. M. Monget (Ecole des Mines Valbonne, France), and G. Nihous (Ecole des Mines, Valbonne, France) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 201-204 refs Sponsored by Centre Natl. d'Eploitation des Oceans (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

A method for processing NOAA very high resolution radiometers data is described. The method eliminates various types of noise and produces surface temperature maps with an accuracy suitable for oceanographic applications. An example of a climatology study based on data gathered from 1975 to 1978 on the Ligurian Sea is presented. Author (ESA)

N80-21820# Institute of Oceanographic Sciences, Wormley (England).
MONITORING THE SEA SURFACE c48
T. D. Allan *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 205-215 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The application of current satellite technology to the scientific study of the oceans is reviewed with emphasis on the performance of the microwave sensors carried on Seasat-1. A brief resume of the future plans of NASA and ESA in the field of oceanographic satellite is provided. Author (ESA)

N80-21821# Joint Research Centre of the European Communities, Ispra (Italy).
BIOLOGICAL APPLICATIONS INCLUDING POLLUTION MONITORING c45
B. Sturn *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 217-222 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The coastal zone color scanner (CZCS) on board the Nimbus-7 satellite is described. The CZCS measures upwelling spectral radiances from the ocean in five visible and one thermal IR band. The use of the CZCS to determine chlorophyll-a concentrations in the water is discussed. Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-21822*# National Aeronautics and Space Administration, Washington, D. C.
FINDINGS OF THE OPIT STUDY IN AMERICA
Alain Couzy et al Mar. 1980 18 p Transl. into ENGLISH of "Mission d'Etude en Amerique," Rept-79/1564-29, Paris, Mar. - Apr. 1979 p 1-19 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre National d'Etudes Spatiales (France)
(Contract NASw-3199)
(NASA-TM-76106; Rept-79/1564-29) Avail: NTIS HC A02/MF A01 CSCL 05B

The results of operational applications of American satellite remote sensing are presented. The application of data from satellites such as LANDSAT in European conditions is evaluated. J.M.S.

N80-21823*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
SPECTRAL ANALYSIS OF GEOS-3 ALTIMETER DATA AND FREQUENCY DOMAIN COLLOCATION
Kamil Eren Feb. 1980 158 p refs
(Grant NsG-5275)
(NASA-CR-162630; Rept-297) Avail: NTIS HC A08/MF A01 CSCL 05B

The mathematical background in spectral analysis as applied to geodetic applications is summarized. The resolution (cut-off frequency) of the GEOS 3 altimeter data is examined by determining the shortest wavelength (corresponding to the cut-off frequency) recoverable. The data from some 18 profiles are used. The total power (variance) in the sea surface topography with respect to the reference ellipsoid as well as with respect to the GEM-9 surface is computed. A fast inversion algorithm for matrices of simple and block Toeplitz matrices and its application to least squares collocation is explained. This algorithm yields a considerable gain in computer time and storage in comparison with conventional least squares collocation. Frequency domain least squares collocation techniques are also introduced and applied to estimating gravity anomalies from GEOS 3 altimeter data. These techniques substantially reduce the computer time and requirements in storage associated with the conventional least squares collocation. Numerical examples given demonstrate the efficiency and speed of these techniques. J.M.S.

N80-21824# Department of Energy, Washington, D. C. Oil and Gas Analysis Div.
PROJECTIONS OF ENHANCED OIL RECOVERY, 1985 - 1995
Joan Heinkel Sep. 1979 43 p
(DOE/EIA-0183/11; TR/ES/79-30) Avail: NTIS HC A03/MF A01

The production potential from thermal recovery methods, miscible and immiscible gas flooding, and chemical flooding methods were estimated. It was assumed that existing EOR technology is conventionally applied requiring a 10 percent real after tax rate of return similar to that assumed for conventional recovery method. Five alternative price paths for world supplies of crude oil were investigated. Supply possibilities from these enhanced methods are estimated as 0.9 million bbl/d in 1985 and show no variation despite the $6 range in price among the scenarios. Although thermal recovery techniques provide the bulk of production in the 1985-1995, they should decline in importance over time, providing 52 to 57 percent of ultimate recovery. Gas flooding will increase production over time to account for 37 to 41 percent of ultimate recovery and chemical flooding accounts for 6 to 7 percent. DOE

N80-21825# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
LASS: LAND APPLICATIONS SATELLITE SYSTEM. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jun. 1979 70 p Prepared in cooperation with Engins Matra and Christian Rovsing
(Contract ESA-3633/78-F-CG(SC))
(ESA-CR(P)-1250) Avail: NTIS HC A04/MF A01

An overall systems study has been prepared for the Land Applications Satellite System portion of the European Remote Sensing Program. Included are: definition and description of a technically feasible baseline overall system concept, evaluation of a development program best suited to the specific requirements and suppositions, recommendation of a supporting research and

technology programme necessary for predevelopment of critical items and technologies, and identification of the growth potential inherent to the system and its assessment versus future advanced missions. Author (ESA)

N80-21826# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
AN EVALUATION OF SPECTRAL- AND INTENSITY-DATA COMPRESSION METHODS
N. J. Mulder and N. Donker May 1979 37 p refs Original contains color illustrations
(Contract ESA-3601/78-NL-HP(SC))
(ITC-79/05/N/MU; ESA-CR(P)-1276) Avail: NTIS HC A03/MF A01

The results of an evaluation of data compression applied to Landsat-MSS data are presented. Of the methods tested, the older method of a KL-transform in the spectral domain, followed by clustering on hisrogram criteria on Principal Components 1 and 2 was chosen because it allows a clear distinction of spectral domain transforms and intensity domain transforms as two separate methods. An evaluation based on technical considerations is complemented by a visual interpretation by an experienced photo intepretor. Results are: (1) the spectral domain KL-transform does preserve all essential information even if the parameters are not optimal, per line KL-transform can be replaced by a fixed KL-transform for the frame; (2) clustering destroys most essential informaton, in particular PC 2 is hurt, and (3) using the Specht non parametric classification method (Sigma), the results on fixed PC is relatively the best, but only just acceptable for the user and then only for very coarse classification. Author (ESA)

N80-21827# General Accounting Office, Washington, D. C. Energy and Minerals Div.
GEOTHERMAL ENERGY: OBSTACLES AND UNCERTAINTIES IMPEDE ITS WIDESPREAD USE
18 Jan. 1980 51 p refs
(PB80-134430; EMD-80-36) Avail: NTIS HC A04/MF A01 CSCL 08I

This report to Congress assesses the development and potential of geothermal energy and discusses Federal actions needed to help accelerate geothermal development and use. GRA

N80-21815# Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
APPLICATIONS TO CONTINENTAL AREAS: INTRODUCTION NOTE [APPLICATIONS AUX ZONES CONTINENTALES NOTE D'INTRODUCTION]
J. Cruette *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 175-176 In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21816# Norwegian Water Resources and Electricity Board, Oslo.
SNOW AND ICE MAPPING: NORWEGIAN EXAMPLES FOR RUN-OFF PREDICTION
G. Oestrem, T. Andersen, H. Odegaard (IBM, Oslo), and R. delLlano (IBM, Oslo) *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 177-181 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21818# Joint Research Centre of the European Communities, Ispra (Italy).
AGROMETEOROLOGICAL APPLICATIONS [APPLICATIONS AGROMETEOROLOGIQUES]
G. Frayesse *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 191-197 refs In FRENCH; ENGLISH summary (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-21828* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
WIND WHEEL ELECTRIC POWER GENERATOR Patent
John W. Kaufman, inventor (to NASA) Issued 4 Mar. 1980 8 p Filed 24 Feb. 1978 Supersedes N78-22469 (16 - 13, p 2137)
(NASA-Case-MFS-23515-1; US-Patent-4,191,505; US-Patent-Appl-SN-880726; US-Patent-Class-415-2; US-Patent-Class-415-101) Avail: U S Patent and Trademark Office CSCL 10B

Wind wheel electric power generator apparatus includes a housing rotatably mounted upon a vertical support column. Primary and auxiliary funnel-type, venturi ducts are fixed onto the housing for capturing wind currents and conducting to a bladed wheel adapted to be operatively connected with the generator apparatus. Additional air flows are also conducted onto the bladed wheel; all of the air flows positively effecting rotation of the wheel in a cumulative manner. The auxiliary ducts are disposed at an acute angle with respect to the longitudinal axis of the housing, and this feature, together with the rotatability of the housing and the ducts, permits capture of wind currents within a variable directional range. Official Gazette of the U.S. Patent and Trademark Office

N80-21829* National Aeronautics and Space Administration, Washington, D. C.
ENERGY. A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 24 Bibliography Report, 1 Oct. - 31 Dec. 1979
Jan. 1980 1075 p
(NASA-SP-7043(24)) Avail: NTIS HC $15.00 CSCL 10B

This bibliography lists 1609 reports, articles, and other documents introduced into the NASA scientific and technical information system from October 1, 1979 through December 31, 1979. Author

N80-21830# Brookhaven National Lab., Upton, N. Y.
REVIEW OF RECENT RESEARCH ON ENERGY STORAGE IN RESIDENTIAL SOLAR TOTAL ENERGY SYSTEMS
Richard W. Leigh May 1979 15 p refs
(Contract EY-76-C-02-0016)
(BNL-51012) Avail: NTIS HC A02/MF A01

Current and recent research relevant to residential applications of solar total energy are reviewed. For each project or study, the types of energy storage devices chosen and the methods used to integrate them with solar collectors and backup devices are emphasized. Several general conclusions are distilled from the studies to guide subsequent research. DOE

N80-21831*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
AMPLIFIED WIND TURBINE APPARATUS Patent Application
William N. Myers, inventors (to NASA) and Leopold A. Hein Filed 12 Mar. 1980 16 p
(NASA-Case-MFS-23830-1; US-Patent-Appl-SN-129780) Avail: NTIS HC A02/MF A01 CSCL 10A

An amplified wind turbine apparatus is disclosed wherein ambient inlet air is prerotated in an air rotation chamber having a high pressure profile. A second rotation chamber adjacent and downstream of the turbine has a low pressure core profile whereby flow across the turbine is accelerated and thereafter exits the turbine apparatus through a draft anti-interference device. The draft device eliminates interference with ambient winds at the outlet of the turbine apparatus. Pivotable vanes controlled in

response to prevailing wind direction admit air to the chambers and aid in imparting rotation. NASA

N80-21832*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STUDY OF THE EFFECTS OF IMPURITIES ON THE PROPERTIES OF SILICON MATERIALS AND PERFORMANCE OF SILICON SOLAR CELL
C. T. Sah Feb. 1980 37 p refs Prepared for JPL and DOE
(Contract JPL-954685)
(NASA-CR-162626; JPL-9950-314; DOE/JPL-954685-80/3) Avail: NTIS HC A03/MF A01 CSCL 10A

Zinc is a major residue impurity in the preparation of solar grade silicon material by the zinc vapor reduction of silicon tetrachloride. It was found that in order to get a 17 percent AMI cell efficiency, the concentration of the zinc recombination centers in the base region of silicon solar cells must be less than 4 x 10 to the 11th power Zn/cu cm in the p-base n+/p/p+ cell and 7 x 10 to the 11th power Zn/cu cm in the n-base p+/n/n+ cell for a base dopant impurity concentration of 5 x 10 to the 14th power atoms/cu cm. If the base dopant impurity concentration is increased by a factor of 10 to 5 x 10 to the 15th power atoms/cu cm, then the maximum allowable zinc concentration is increased by a factor of about two for a 17 percent AMI efficiency. The thermal equilibrium electron and hole recombination and generation rates at the double acceptor zinc cancers were obtained from previous high field measurements as well as new measurements at zero field. The rates were used in the exact d.c. circuit model to compute the projections. R.E.S.

N80-21833*# Westinghouse Research and Development Center, Pittsburgh, Pa.
PHASE 2 OF THE ARRAY AUTOMATED ASSEMBLY TASK FOR THE LOW COST SOLAR ARRAY PROJECT Final Report, 1 Oct. 1978 - 30 Oct. 1979
R. B. Campbell, J. R. Davis, J. W. Ostroski, P. Rai-Choudhury, A. Rohatgi, E. J. Seman, and R. E. Stapleton 1979 151 p refs Prepared for JPL and DOE
(Contracts NAS7-100; JPL-954873)
(NASA-CR-162628; DOE/JPL-954873-79/08) Avail: NTIS HC A08/MF A01 CSCL 10A

The process sequence for the fabrication of dendritic web silicon into solar panels was modified to include aluminum back surface field formation. Plasma etching was found to be a feasible technique for pre-diffusion cleaning of the web. Several contacting systems were studied. The total plated Pd-Ni system was not compatible with the process sequence; however, the evaporated TiPd-electroplated Cu system was shown stable under life testing. Ultrasonic bonding parameters were determined for various interconnect and contact metals but the yield of the process was not sufficiently high to use for module fabrication at this time. Over 400 solar cells were fabricated according to the modified sequence. No sub-process incompatibility was seen. These cells were used to fabricate four demonstration modules. A cost analysis of the modified process sequence resulted in a selling price of $0.75/peak watt. R.E.S.

N80-21834*# Westinghouse Research and Development Center, Pittsburgh, Pa.
EFFECT OF IMPURITIES AND PROCESSING ON SILICON SOLAR CELLS. VOLUME 1: CHARACTERIZATION METHODS FOR IMPURITIES IN SILICON AND IMPURITY EFFECTS DATA BASE Quarterly Report
R. H. Hopkins, J. R. Davis, A. Rohatgi, R. B. Campbell, P. D. Blais, P. Rai-Choudhury, R. E. Stapleton, H. C. Mollenkopf (Hemlock Semiconductor Corp.), and J. R. McCormick (Hemlock Semiconductor Corp.) Jan. 1980 296 p refs Prepared for JPL and DOE
(Contract JPL-954331)
(NASA-CR-162627; DOE/JPL-954331-80/9; JPL-9950-299; QR-17) Avail: NTIS HC A13/MF A01 CSCL 10A

Two major topics are treated: methods to measure and evaluate impurity effects in silicon and comprehensive tabulations of data derived during the study. Discussions of deep level spectroscopy, detailed dark I-V measurements, recombination lifetime determination, scanned laser photo-response, conventional solar cell I-V techniques, and descriptions of silicon chemical analysis are presented and discussed. The tabulated data include lists of impurity segregation coefficients, ingot impurity analyses and estimated concentrations, typical deep level impurity spectra, photoconductive and open circuit decay lifetimes for individual metal-doped ingots, and a complete tabulation of the cell I-V characteristics of nearly 200 ingots. R.E.S.

N80-21835*# City of Huntsville, Ala.
SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT THE SENIOR CITIZEN CENTER, HUNTSVILLE, ALABAMA Final Report
Feb. 1980 140 p Sponsored by NASA
(Contract EG-77-A-01-4071)
(NASA-CR-161384) Avail: NTIS HC A07/MF A01 CSCL 10B

The solar energy system installed at the Huntsville Senior Citizen Center is described. Detailed drawings of the complete system and discussions of the planning, the hardware, recommendations, and other pertinent information are presented. R.E.S.

N80-21836*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR IBM SYSTEM 2, TOGUS, MAINE Contractor Report, May 1978 - Apr. 1979
Jan. 1980 68 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161383) Avail: NTIS HC A04/MF A01 CSCL 10B

The solar energy system, SIMS Prototype System 2, was designed to supply domestic hot water to single family residences. The system consists of flat plate collectors, silicone working fluid, storage tanks, pumps, heat exchanger, controls, and associated plumbing. The long term field performance of the installed system was analyzed and the results are described. R.E.S.

N80-21837*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FLAME TUBE PARAMETRIC STUDIES FOR CONTROL OF FUEL BOUND NITROGEN USING RICH-LEAN TWO-STAGE COMBUSTION
Donald F. Schultz and Gary Wolfbrandt 1980 25 p refs Presented at Western States Sect. of the Combust. Inst. of Spring Meeting, Irvine, Calif., 21-22 Apr. 1980
(Contract EF-77-A-01-2593)
(NASA-TM-81472; DOE/NASA/2593-80/15; E-405) Avail: NTIS HC A02/MF A01 CSCL 21B

An experimental parametric study of rich-lean two-stage combustion in a flame tube is described and approaches for minimizing the conversion of fuel-bound nitrogen to nitrogen oxides in a premixed, homogeneous combustion system are evaluated. Air at 672 K and 0.48 MPa was premixed with fuel blends of propane, toluene, and pyridine at primary equivalence ratios ranging from 0.5 to 2.0 and secondary equivalence ratios of 0.5 to 0.7. Distillates of SRC-II, a coal syncrude, were also tested. The blended fuels were proportioned to vary fuel hydrogen composition from 9.0 to 18.3 weight percent and fuel nitrogen composition from zero to 1.5 weight percent. Rich-lean combustion proved effective in reducing fuel nitrogen to NO sub x conversion; conversion rates up to 10 times lower than those normally produced by single-stage combustion were achieved. The optimum primary equivalence ratio, where the least NO sub x was produced and combustion efficiency was acceptable, shifted between 1.4 and 1.7 with changes in fuel nitrogen content and fuel hydrogen content. Increasing levels of fuel nitrogen content lowered the conversion rate, but not enough to avoid higher NO sub x emissions as fuel nitrogen increased. M.G.

N80-21838# Hughes Aircraft Co., Los Angeles, Calif.
HIGH EFFICIENCY SOLAR PANEL, PHASE 2, GALLIUM ARSENIDE Interim Report, 15 Sep. 1977 - 15 Jan. 1979
G. Vendura, S. Kamath, and G. Wolfe Jul. 1979 65 p refs
(Contract F33615-77-C-3150; AF Proj. 682J)
(AD-A079635; HAC-SCG-90324M; HAC-REF-E0773; AFAPL-TR-79-2058) Avail: NTIS HC A04/MF A01 CSCL 10/2

This interim report presents the progress of the GaAs High Efficiency Solar Panel program (Phase II) goal of development

of space qualified solar cells of 16 percent efficiency AMO during the period of September 1977 through January 1979. Results of development research involving the basic GaAs substrate, the epitaxial reactors, LPE growth processes, ohmic contacts/metallizations, welding capability, and environmental testing are included. Efforts to increase substrate size and fabrication yield to enhance the feasibility of larger scale GaAs solar cell production are also detailed. GRA

N80-21839# Nuclear Assurance Corp., Atlanta, Ga.
ALTERNATIVES FOR WATER BASIN SPENT FUEL STORAGE: EXECUTIVE SUMMARY AND COMPARATIVE EVALUATION
Sep. 1979 140 p
(Contract EW-78-C-09-1051)
(SRO-1051-1; NAC-C-7915) Avail: NTIS HC A07/MF A01

Alternatives to conventional methods for water basin storage of irradiated light water reactor fuel assemblies (spent fuel) are identified and evaluated. A recommendation is made for development or further evaluation of one attractive alternative: proceed to develop fuel disassembly with subsequent high density storage of fuel pins (pin storage). DOE

N80-21840# Delaware Univ., Newark. Coll. of Engineering.
THEORY OF THIN-FILM PHOTOVOLTAICS Quarterly Report, 1 Jul. - 30 Sep. 1979
Karl W. Boer 1979 4 p
(Contract DE-AC01-79ET23103)
(DOE/ET/23103/12; QR-2) Avail: NTIS HC A02/MF A01

An attempt is made to obtain a first classification of nonideal current voltage characteristics, based on integration of Poisson and transport equations with specific attention to the boundary conditions between emitter and junction. The analysis confirms previous findings; namely, that major deviations from the ideal characteristics can be obtained when the recombination within the junction becomes marked. DOE

N80-21841# Duke Univ., Durham, N. C. Dept. of Mechanical Engineering and Materials Science.
PREPARATION AND CHARACTERIZATION OF HYDROGENATED AMORPHOUS SILICON THIN FILMS AND THIN FILM SOLAR CELLS PRODUCED BY ION PLATING TECHNIQUES Quarterly Progress Report, 1 Apr. - 30 Jun. 1979
Franklin H. Cocks, P. L. Jones, and L. Dimmey Jun. 1979 23 p refs
(Contract DE-AC03-79ET-23041)
(DOE/ET-23041/2; QPR-2) Avail: NTIS HC A02/MF A01

The production of a-Si thin films by glow discharge decomposition of silane and by the controlled ion plating of high purity silicon through glow discharges composed of silane, hydrogen, and argon using a modified Takagi apparatus is discussed. Thin films produced by both glow discharge decomposition of silane with and without magnetic confinement and by ion plating are characterized and compared using X-ray diffractometry, infrared spectrometry, optical absorption spectroscopy, and by their temperature dependence of resistivity. Films are produced at approximately ten times the decomposition rate obtained using glow discharge decomposition of silane, even with magnetic field containment. In addition, the resulting thin film properties compare favorably with those obtained from glow discharge produced films. DOE

N80-21842# California Univ., Livermore. Lawrence Livermore Lab.
EFFECT OF A HEATED ATMOSPHERE ON THE TEMPERATURE DEPENDENCE OF THE TOTAL EMITTANCE OF BLACK CHROME SOLAR ABSORBER PIPES M.S. Thesis
Thomas Alexander Reitter Oct. 1979 79 p refs
(Contract W-7405-eng-48)
(UCRL-52851) Avail: NTIS HC A05/MF A01

An apparatus for measuring the total hemispherical emittance of pipes of length suitable for in a prototype solar collector is reported. The apparatus was used to measure the total hemispherical emittance as a function of temperature of black chrome, nickel, and bare steel surfaces, before and after exposure to heated humid or dry air atmospheres. Exposure to a heated atmosphere lowered the emittance of the black chrome surfaces on the order of 20%. Similar exposure increased the emittance of the bare steel surface significantly, but had no effect on the nickel surface. It was hypothesized that the lowering of the black chrome emittance is due to the oxidation and subsequent outgassing of carbon contaminants on and in the black chrome layer. The actual causes may be a combination of this and other effects. However, due to the complexity of the black chrome layer it was not possible to explain the changes in the black chrome emittance in terms of changes in the coating. DOE

N80-21843# Teledyne Energy Systems, Timonium, Md.
SELENIDE ISOTOPE GENERATOR FOR THE GALILEO MISSION Final Report
Jun. 1979 267 p refs
(Contract ET-78-C-01-2865)
(TES-33009-46) Avail: NTIS HC A12/MF A01

Technical activities performed for the radioisotope thermoelectric generator for the Galileo Mission (RTG/GM) are described. The activities include: RTG/GM spacecraft interfaces, generator design, generator performance/thermal analysis, mission integration studies, component development, materials compatibility and outgassing, reliability, and safety. R.E.S.

N80-21844# Sandia Labs., Albuquerque, N. Mex. Photovoltaic Advanced Systems Test Facility (PASTF).
PHOTOVOLTAIC ADVANCED SYSTEMS TEST FACILITY CONTROL AND DATA-ACQUISITION SYSTEM
Daniel A. Pritchard Oct. 1979 76 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0927) Avail: NTIS HC A05/MF A01

The control and data acquistion system of the Photovoltaic Advanced Systems Test Facility (PASTF) is described. The system responds to both hardware and software needs of the test facility. A minicomputer implements and controls distributed data acquisitions. Extensive data manipulation and graphic display capability exists. The system is easy to use as a result of wide range of operating software and multiple control languages. DOE

N80-21845# Martin Marietta Corp., Denver, Colo.
HELIOSTAT FIELD WIND-EFFECTS TEST Final Report
Feb. 1979 333 p refs
(Contracts EY-76-C-03-1110; DE-AC03-76ET-20422)
(DOE/ET-20422/2; SAN-1110-79-2) Avail: NTIS HC A15/MF A01

Data on the wind effects on a heliostat field under various field configurations and wind conditions are presented. Tests were performed in an environmental wind tunnel. A total of seventy-seven test runs were performed, and the data was recorded for various configurations. The areas represented relatively high and low packing density of heliostats in the field, and thus results can be applied to a wide range of heliostat field configurations. A compendium of the results and conclusions drawn from the test is presented. DOE

N80-21846# Boeing Engineering and Construction, Seattle, Wash.
SOLAR CENTRAL RECEIVER PROTOTYPE HELIOSTAT, VOLUME 1 Final Technical Report
1 Jun. 1979 207 p refs
(Contract EG-77-C-03-1604)
(SAN-1604-1) Avail: NTIS HC A10/MF A01

A prototype heliostat design for a solar central receiver is presented in detail. The manufacturing installation, and maintenance procedures are described. DOE

N80-21847# Stearns-Roger Corp., Denver, Colo.
SOLAR THERMAL REPOWERING SYSTEMS INTEGRATION Final Report
L. J. Dubberly Aug. 1979 156 p refs Sponsored in part by SERI, Golden, Colo.
(Contract EG-77-C-01-4042)
(SERI/TR-8037-1) Avail: NTIS HC A08/MF A01

Solar repowering interface requirements for water/steam and salt or sodium-cooled central receivers are defined for unit sizes ranging from 50 MWe non-reheat to 350 MWe reheat. Balance of plant cost estimates are presented for each of six combinations of plant type, receiver and percent solar repowering. DOE

N80-21848# Midwest Research Inst., Golden, Colo.
ANALYSIS OF A HEAT EXCHANGER-THERMOELECTRIC GENERATOR SYSTEM
Jon Henderson 1979 7 p refs Presented at the 14th Intersoc. Energy Conversion Engineering Conference, Boston, 5-10 Aug. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-35-253; CONF-790803-56) Avail: NTIS HC A02/MF A01

Analysis of a thermoelectric generator (TEG) in an ocean thermal energy conversion (OTEC) application is presented. An analytic model was developed for describing the heat exchanger-TEG interactions. This model was used to illustrate limitations of applying conventional fixed junction temperature assumptions to systems experiencing significant temperature drops across the heat exchanger surfaces. Design methods were developed for determining the thermoelectric element geometry that produces maximum output power. Results show that a heat exchanger-TEG system may deliver about 100 W/sq m of heat exchanger surface. This compares favorably with conventional OTEC schemes. DOE

N80-21849# Brookhaven National Lab., Upton, N. Y.
USE OF EARTH COUPLING IN SOLAR ASSISTED HEAT PUMPS
P. D. Metz, E. A. Kush, and J. N. Andrews 1979 11 p refs Presented at a Nordic Symp. on Earth Heat Pump Systems, Goteborg, Sweden, 15-16 Oct. 1979
(Contract EY-76-C-02-0016)
(BNL-26748; CONF-791119-1) Avail: NTIS HC A02/MF A01

The use of thermal coupling between the earth and the storage element of a solar source heat pump system was investigated. Four buried tanks and five configurations of serpentine plastic pipe with various control strategies were studied. System heating and cooling performance, detailed earth temperature profiles, and soil thermal properties were measured. Experimental results were used to validate heat flow models. The integration of ground coupling with solar heat pump systems is explained, the tank and pipe field configurations are described, and the heat flow model development is outlined. The experimental results, are reported and are compared to model predictions. DOE

N80-21850# California Univ., Berkeley. Lawrence Berkeley Lab.
AEROSPACE TECHNOLOGY REVIEW FOR LBL WINDOW/PASSIVE SOLAR PROGRAM Final Report
R. Viswanathan Jun. 1979 388 p refs
(Contract W-7405-eng-48)
(LBL-9608; EEB-W-79-13) Avail: NTIS HC A17/MF A01

A review of aerospace literature to uncover material pertinent to the Window and Passive Solar Programs is reported. Areas covered are: optical shutters, soils, thermal storage and transfer, optical properties of materials and clouds, human engineering, high efficiency light sources and solid state electronics, thermal and optical properties of landscape and building materials, and measurement and diagnostic techniques. DOE

N80-21851# Lockheed Missiles and Space Co., Sunnyvale, Calif.
EVALUATION OF SELECTIVE ABSORBERS Semiannual Report
1979 12 p refs
(Contracts DE-AC04-78CS-15361)
(TP-5461) Avail: NTIS HC A02/MF A01

Six selective absorber materials were characterized with respect to initial optical properties and abbreviated environmental exposures. For the plated black chrome, uniformity was poor in terms of a/sub s/ and epsilon as measured on 1 sq ft panels. Short term environmental exposures caused no substantial changes in optical or physical properties of the materials. DOE

N80-21852# Argonne National Lab., Ill.
APPLICATION OF GLASS TECHNOLOGY TO NOVEL SOLAR ENERGY COLLECTORS
Kent A. Reed 1979 17 p refs Presented at Am. Sci. Glass Blowers Soc. Symp., Detroit, Mich., 29 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-7906118-1) Avail: NTIS HC A02/MF A01

Various compound parabolic concentrator (CPC) configurations are described and the application of glass technology to CPC absorbers, evacuated receivers, and evacuated tube receivers are considered. Also a floodlamp collector concept and a fluorescent tube collector concept are discussed. DOE

N80-21853# California Univ., Livermore.
ECONOMIC ANALYSIS OF SOLAR INDUSTRIAL PROCESS HEAT SYSTEMS. A METHODOLOGY TO DETERMINE ANNUAL REQUIRED REVENUE AND INTERNAL RATE OF RETURN
W. C. Dickinson and K. C. Brown 17 Aug. 1979 46 p refs
(Contract W-7405-eng-48)
(UCRL-52814) Avail: NTIS HC A03/MF A01

To permit an economic evaluation of solar industrial process heat systems, a methodology to determine the annual required revenue and the internal rate of return was developed. First, a format is provided to estimate the solar system's installed cost, annual operating and maintenance expenses, and net annual solar energy delivered to the industrial process. Then an expression is presented that gives the annual required revenue and the price of solar energy. The economic attractiveness of the potential solar investment can be determined by comparing the price of solar energy with the price of fossil fuel, both expressed in levelized terms. DOE

N80-21854# Sandia Labs., Albuquerque, N. Mex.
REVIEW OF SELECTED ON-SITE DOE SMALL SOLAR THERMAL POWER PLANT EXPERIMENTS
Robert L. Alvis 1979 12 p ref Presented at the Fourth Annual National Conf. on Technology for Energy, Albuquerque, N. Mex., 30 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1040C; CONF-791052-1) Avail: NTIS HC A02/MF A01

Three solar power plants are reviewed that were developed in an effort to find an alternate energy source for powering irrigation pumps. Power generation by the conversion of solar energy is shown to be technically feasible in the construction and operation of these three solar thermal power systems. The thermal cycling inherent in solar energy is shown to be more stressful on the system components and requires special design attention to obtain satisfactory performance. The economic benefit of these one-of-a-kind systems are not competitive with the conventional power systems. However, predictions for similar systems in large production indicate that power could be generated for approximately 5 cents/kWh in the Southwest. Recent increases in conventional energy costs, and continuing component development, are combining to make solar power systems a potential near-term reality. DOE

N80-21855# California Univ., Livermore. Lawrence Livermore Lab.
COMPOSITE-LAMINATE FLYWHEEL-ROTOR DEVELOPMENT PROGRAM
S. V. Kulkarni 9 Nov. 1979 13 p refs
(Contract W-7405-eng-48)
(UCRL-83554) Avail: NTIS HC A02/MF A01

The tapered thickness Stodola rotor concept is considered with emphasis on improving the performance of the rotor. Topics discussed include: (1) redesigning the Stodola rotor to increase the energy density; (2) testing laminate coupons to establish the degree of strength anisotropy of various quasi-isotropic laminates; (3) spin testing of constant thickness, composite laminate rotors to establish a relationship between design data and failure speed; (4) developing a matched-metal-die compression molding process to fabricate thick, high fiber volume, low void content composite panels; and (5) exploring the feasibility of manufacturing low cost rotors from structural sheet molding compounds. DOE

N80-21856# Brookhaven National Lab., Upton, N. Y.
MULTI-OBJECTIVE ENERGY ANALYSIS
E. A. Cherniavsky Nov. 1979 29 p refs Presented at NATO Advanced Res. Inst. Conf., Upton, N.Y., 12 Nov. 1979
(Contract EY-76-C-02-0016)
(BNL-26882; CONF-791152-1) Avail: NTIS HC A03/MF A01

Analytic models, which are applied to energy planning problems in an effort to assess the probable impacts of alternative courses of action on vital social concerns such as the quality of the environment, the state of the economy, or extent of dependence on insecure foreign energy sources, were studied. The tradeoffs between different social objectives were identified and quantified. Associated problems are explored and discussed in the light of experience with applications to energy planning models. Conclusions are drawn concerning the most fruitful directions for future research in this area. DOE

N80-21857# Cambridge Systematics, Inc., Mass.
ANALYTIC PROCEDURES FOR URBAN TRANSPORTATION ENERGY CONSERVATION. VOLUME 1: SUMMARY OF FINDINGS AND METHODOLOGIES Final Report
J. H. Suhrbier and W. D. Byrne Apr. 1979 40 p refs
(Contract EM-76-C-01-8628)
(Cons-8626-T1-Vol-1) Avail: NTIS HC A03/MF A01

Analytical methodologies are described and illustrated for use by metropolitan planning organizations and other state and local transportation agencies in analyzing the energy conservation potential of candidate urban transportation measures. Quantitative methodologies oriented to carpooling, vanpooling, transit, pricing, traffic regulation and control, and auto ownership are provided based on the use of disaggregate behavioral travel demand models. Changes are indicated in trip frequency and distribution as well as in travel model, operating conditions, and vehicle miles of travel. Trip-based estimates of fuel consumption and vehicle emissions are included. Application of the developed methodologies was performed in cooperation with metropolitan planning organizations representing the Dallas-Fort Worth, San Francisco, and Denver urban areas. DOE

N80-21858# Eagle-Picher Industries, Inc., Joplin, Mo. Couples Dept.
RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF NICKEL-IRON BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1978
Oct. 1979 45 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-78-13) Avail: NTIS HC A03/MF A01

The technical approach and a summary of the progress that was achieved towards the development of a nickel-iron battery suitable for use in electric vehicles are presented. DOE

N80-21859# EcoSystems, Inc., McLean, Va.
POTENTIAL FOR SOLAR/CONSERVATION TECHNOLOGIES IN THE STATE OF WASHINGTON
David Baylon, J. Brautigam, H. Reichmuth, B. Boulter, S. Gross, A. Stewart, and S. Worthman 4 Apr. 1979 70 p refs
(Contract EG-77-G-01-4099)
(WAOENG-79-3) Avail: NTIS HC A04/MF A01

A data base for Washington State energy consumption by fuel type is presented and divided into energy end use temperatures and types. Solar/conservation technologies are classed according to their immediacy as options for use, cost effectiveness, current availability, and compatibility with intended uses. The effect of presently feasible solar conservation technologies on Washington State energy consumption, if fully deployed, amounts to approximately 15 percent of the total 1974 energy use. Agricultural, industrial, commercial and residential end uses are also discussed. DOE

N80-21860# Eltra Corp., Plymouth Meeting, Pa. C and D Batteries Div.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF LEAD-ACID BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1978
Oct. 1979 69 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-78-7) Avail: NTIS HC A04/MF A01

Progress status during the period from 4/15/78 to 8/31/78 is reported for each task in the Program's Work Breakdown Statement scheduled to be activated. The general considerations required for electric vehicle battery design are presented. The procedures followed in generating its ISOA design are described. DOE

N80-21861# Globe-Union, Inc., Milwaukee, Wis. Glove Battery Div.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF LEAD-ACID BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1978
Oct. 1979 41 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-78-9) Avail: NTIS HC A03/MF A01

Considerable improvements in the design of the ISOA battery have been accomplished. The Expander Research Program has yielded a successful microelectrode technique and new grounds were broken on the understanding of the expanders role and its optimization in the lead-acid system. DOE

N80-21862# General Electric Co., Santa Barbara, Calif.
COMBINED THERMAL STORAGE AND TRANSPORT FOR UTILITY APPLICATIONS
Sep. 1979 176 p refs
(EPRI-EM-1175) Avail: NTIS HC A09/MF A01

The technical and economic factors in utilizing thermal storage and transporting thermal energy from electric utilities to industrial, commercial, and residential users distant from the utility plant were investigated. As thermal transport media, high temperature water (HTW), steam, hot oil, and molten salt were considered for the temperature range capabilities of a light water reactor and a high sulfur coal burning plant. The cost elements of a dual pipeline, sendout and return, were found and optimized for selected cases. The loss of electric output per megawatt of thermal energy extracted was found for a range of HTW and steam extraction and return temperatures, and used as part of the basis for the revenue required from delivered thermal energy to replace this lost electric output. The use of HTW for transport was found to be significantly cheaper than all alternative media except for temperatures above 340 C. DOE

N80-21863# Institute for Energy Analysis, Oak Ridge, Tenn.
ARE THE ALTERNATIVE ENERGY STATEGIES ACHIEVABLE?
Alvin M. Weinberg Sep. 1979 29 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-79-15(0)) Avail: NTIS HC A03/MF A01

The constraints on penetration of energy technologies (time and information, net energy, and capital cost) are discussed. Related to the energy/time exchange is the economic cost of intermittency of energy supply. Renewable energy sources, particularly solar sources, are characteristically intermittent. To eliminate intermittency imposes a cost that must be considered in planning energy futures based on renewable sources. The article concludes that alternative energy strategies are achievable if they are subsidized by the government in the form of support for research, development and demonstration projects. R.E.S.

N80-21864# Tennessee Univ., Tullahoma. Space Inst.
DEVELOPMENT PROGRAM FOR MHD DIRECT COAL-FIRED POWER GENERATION TEST FACILITY Quarterly Technical Progress Report, Apr. - Jun. 1978
J. B. Dicks, Y. C. L. Wu, and R. C. Attig 25 Jan. 1979 52 p refs
(Contract EY-76-C-01-1760)
(FE-1760-34) Avail: NTIS HC A04/MF A01

The following program activities are described: vitiation heater/combustor development, NO/sub x/ testing, relative temperature measurement in support of combustion of combustor testing, progress in the design and construction of the coal fired flow facility, and materials experimentation to determine the rate of potassium loss from seeded coal slag at various temperatures. DOE

N80-21865# Oak Ridge National Lab., Tenn. Chemistry Div.
MOLTEN CARBONATE FUEL CELL PROGRAM: EMF AND TEMPERATURE RELAXATION IN LiKCO 3 TILES, TRANSFERENCE CELL MEASUREMENTS Progress Report, 1 Jan. - 31 Mar. 1979
J. Braunstein, H. R. Bronstein, A. R. Manner, J. Nwalor, and Duane H. Smith Dec. 1979 18 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7003) Avail: NTIS HC A02/MF A01

Progress was made in resolving the thermoelectric contribu-

tions to the relaxing electromotive forces (EMF) of electrolyzed LiKCO3-LiAlO2 tiles in a study of mass transport in molten carbonate fuel cell electrolytes. The thermoelectric effect was a measurable contribution, but only in the early stages of the relaxation. Preliminary measurements with the transference EMF cell are reported along with estimates of the transference number in LiKCO2. DOE

N80-21866# Burns and Roe, Inc., Woodbury, N. Y.
CONCEPTUAL DESIGN OF AN AFBC ELECTRIC POWER GENERATING PLANT. VOLUME 3: APPENDICES
E. Kimel, S. Panico, J. Bianchini, M. Novack, J. Armstrong, and J. Wysocki Feb. 1979 328 p
(Contract EF-77-C-01-2455)
(FE-2455-27-Vol-3) Avail: NTIS HC A15/MF A01

Aspects of the conceptual design of an atmospheric fluidized-bed combustion (AFBC) electric power generating plant are examined including: coal and limestone preparation; fluidized-bed combustor performance, boiler design, performance, and cost; the development of model facilities for boiler performance testing; projections on the limestone feed requirements for a 600 MWe AFBC plant using subbituminous western coal; testing with such coals; and limestone availability in the U.S. DOE

N80-21867# Midwest Research Inst., Golden, Colo.
SURVEY OF SOLAR THERMAL TEST FACILITIES Progress Report, 1 Jan. - 31 Dec. 1978
Keith Masterson Aug. 1979 127 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-34-083) Avail: NTIS HC A07/MF A01

The facilities that are presently available for testing solar thermal energy collection and conversion systems are briefly described. The Department of Energy programs and test needs for distributed concentrating collectors are identified. The needs and facilities that are suitable for testing components of central receiver systems, several of which are located overseas, are identified. The appendices contain data sheets and tables which give additional details on the technical capabilities of each facility. DOE

N80-21868# California Univ., Livermore. Lawrence Livermore Lab.
ALUMINUM-AIR POWER-CELL SYSTEM DESIGN
Robert V. Homsy 4 Oct. 1979 7 p refs Presented at the First International Workshop on Reactive Metal-Air Batteries, Bonn, 9 Jul. 1979
(Contract W-7405-eng-48)
(UCRL-82497-Rev-2; CONF-790759-2-Rev-2) Avail: NTIS HC A02/MF A01

The reaction of Al with water and air in NaOH electrolyte, an electrochemical system being developed as a possible source of automobile propulsion, is examined. The Al-air cell is a small part of a large powercell system. Five subsystems support the operation of the Al-air cell: air, electrolyte, hydrargillite, water, and coolant. A computer program to calculate the flowrate, chemical composition, and temperature of each stream is discussed. Four parameters (oxygen stoichiometric factor, current density, temperature of entering air, and temperature of crystallizer for Al(OH)3 are varied to measure system response, and the results are presented. DOE

N80-21869# Washington State Univ., Pullman. Environmental Research Center.
WASHINGTON STATE ENERGY USE PROFILE, 1960-1978
G. Allen, C. Culver, E. Quarles, and J. Robertson Jun. 1979 145 p refs
(WAOENG-79-1) Avail: NTIS HC A07/MF A01

An overview of demographic and economic factors, energy use, energy resources, and prices is presented. Energy use by fuel type: petroleum, natural gas, and coal is covered along with electricity use, supply, and prices. Energy use disaggregated by end use and consuming sector is covered for the residential, commercial, industrial, agricultural, and transportation sectors. DOE

N80-21870# Prototech, Inc., Newton Highlands, Mass.
ENERGY SAVINGS BY MEANS OF FUEL CELL ELECTRODES IN ELECTRO-CHEMICAL INDUSTRIES Progress Report, 1 Nov. - 31 Jan. 1978
Robert J. Allen, Walter Juda, R. W. Lindstorm, and H. G. Petrow 19 Mar. 1979 72 p refs
(Contract ET-78-C-02-4881)
(COO-4881-6) Avail: NTIS HC A04/MF A01

Data are presented for air depolarized cathode performance in caustic half cells and hydrogen depolarization of anodes for the electrowinning of zinc. Investigation with air depolarized Pt cathodes in caustic half cells include: progress of the one year old RA19 type air diffusion cathode; data involving incorporation of a Hg/HgO reference electrode into the standard hardware; studies investigating cathode loading vs. cell performance; continued evaluation of thin, porous, conducting substrates; and cathode performance as a function of electrolyte concentration. In the area of zinc electrowinning, short term tests (4 hours) with pure hydrogen feeds were carried out under various cell operating conditions. In addition, tests with CO-containing hydrogen were initiated utilizing different levels of carbon monoxide poison. A preliminary economic evaluation for electric energy savings versus hydrogen costs is presented. DOE

N80-21871# Sandia Labs., Albuquerque, N. Mex. Component and Subsystem Development Div.
TECHNOLOGY ASSESSMENT: LINE-FOCUS CONCENTRATORS
J. F. Banas Sep. 1979 11 p refs Presented at the Solar Industrial Process Heat Conf., San Francisco, 31 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-2221c; CONF-791024-10) Avail: NTIS HC A02/MF A01

Eleven solar thermal collectors and two systems are evaluated in order to define engineering development problems requiring solution to commercialization initiatives. The major engineering problems and near-term development emphasis are described. DOE

N80-21872# Los Alamos Scientific Lab., N. Mex.
SOLAR ENERGY RESEARCH AT LASL Progress Report, 1 Oct. 1977 - 31 Mar. 1978
Charles A. Bankston and Donald A. Neeper Oct. 1979 81 p refs
(Contract W-31-109-eng-36)
(LA-7741-PR) Avail: NTIS HC A05/MF A01

Research on solar collectors, studies and evaluations of both passive and active solar heating systems, and information dissemination activities are described. DOE

N80-21873# Sandia Labs., Albuquerque, N. Mex.
GRAIN BOUNDARY PASSIVATION AND SOLAR CELL IMPROVEMENT IN POLYCRYSTALLINE SILICON
D. S. Ginley and C. H. Seager 1979 7 p refs Presented at the Photovoltaic Advan. R and D Ann. Rev. Meeting, Denver, 17 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-78-2280C; CONF-790991-1) Avail: NTIS HC A02/MF A01

The possible applications of recently discovered grain boundary chemical passivation treatments (utilizing monatomic hydrogen) for polycrystalline silicon are discussed. Also, evidence indicating that it may be possible to substantially increase solar cell efficiencies by this technique is presented. DOE

N80-21874# Sandia Labs., Albuquerque, N. Mex.
SOLAR RADIATION MODEL VALIDATION
I. J. Hall, R. R. Prairie, E. C. Boes, and H. E. Anderson 1979 21 p refs Presented at DOE/Div. of Distributed Solar Technol. Contractor's Program Rev. Meeting, Bethesda, Md., 30 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-2121C; CONF-791081-1) Avail: NTIS HC A02/MF A01

Three solar radiation models were used in developing the augmented SOLMET solar data tapes for the 26 SOLMET sites and the 222 ERSATZ solar data tapes. One of the models, a theoretical one, predicts the solar noon radiation for clear sky conditions from the optical air mass, precipitable water vapor and turbidity variables. A second model, an empirical one, predicts the hourly total horizontal radiation from meteorological vari-

ables. And a third model, also an empirical one, predicts the hourly direct normal radiation from the hourly total horizontal radiation. To assess the accuracy of these models, data was obtained from several U.S. National Weather Service Stations and other sources and the models were used to estimate the solar radiation. The model radiation values were then compared with observed radiation values. The most important results of these comparisons are described. DOE

N80-21875# Pennsylvania State Univ., University Park. Dept. of Architectural Engineering.
PERFORMANCE OF A SOLAR ENERGY-ASSISTED HEAT PUMP HEATING SYSTEM: ANALYSIS AND CORRELATION OF FIELD-COLLECTED DATA M.S. Thesis
Ronald Craig Williams Aug. 1979 219 p refs
(Contract E\-76-S-02-2704)
(COO-2704-T1) Avail: NTIS HC A10/MF A01

An analysis of building energy usage and thermal load for the Solar Building during the winter heating seasons of 1974-75 and 1975-76 is reported. The one-story office building is located in Albuquerque, New Mexico. Its mechanical heating and cooling equipment is categorized as a solar-assisted heat pump system consisting of solar collectors, water thermal storage, a water to water heat pump and five smaller water-to-air heat pump packaged units. Building energy usage examined with emphasis on the time of day energy was consumed and the source from which the energy was obtained. The rate of electrical energy consumption was found to be very dependent on building use. High rates of electrical energy usage during occupied periods required cooling during parts of even the coldest days. Mechanical equipment heating was found to vary as a function of building usage as well as a function of the indoor-outdoor temperature differential. DOE

N80-21876# Midwest Research Inst., Golden, Colo.
SOLAR POND FOR INDUSTRIAL PROCESS HEAT
K. C. Brown, M. Edesess, and T. S. Jayadev Oct. 1979 7 p refs Presented at the Solar Ind. Process Heat Conf., Oakland, Calif., 31 Oct. - 2 Nov. 1979
(Contract EG-77-C-01-4042)
(SERI/TD-351-460; CONF-791024-11) Avail: NTIS HC A02/MF A01

Solar ponds offer perhaps the simplest technique for conversion of solar energy to thermal energy, which can be used for industrial process heat. It is unique in its capability in acting both as collector and storage. Further, the cost of solar pond per unit area is less than any active collectors available today. Combination of these economic and technical factors make solar ponds attractive as a fuel saver in industrial process heat (IPH) applications. Detailed calculations are given for solar ponds in two specific applications: providing hot water for aluminum can washing in a manufacturing plant and hot water for washing in a large commercial laundry. With the help of computer codes, it is shown that solar ponds are far more cost effective than any other solar IPH technology for these applications. DOE

N80-21877# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
LOW COST PERFORMANCE EVALUATION OF PASSIVE SOLAR BUILDINGS
Larry S. Palmiter, L. Blair Hamilton, and Michael J. Holtz Oct. 1979 60 p refs
(Contract EG-77-C-01-4042)
(SERI/RR-63-223) Avail: NTIS HC A04/MF A01

An approach to low cost instrumentation and performance evaluation of passive solar heated buildings is presented. Beginning with a statement of the need for a low cost approach, a minimum list of measured quantities necessary to compute a set of recommended performance factors is developed. Conflicts and confusion surrounding the definition of various performance factors are discussed and suggestions are made for dealing with this situation. Available instrumentation and data processing equipment is presented. The recommended system would monitor approximately ten variables and compute numerous performance factors on site at a projected system cost of less than $3,000 per installation. DOE

N80-21878# Boeing Engineering and Construction, Seattle, Wash.
CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM: COLLECTOR SUBSYSTEM EXTENDED LIFE TEST Final Report
18 May 1979 27 p refs
(Contract EY-76-C-03-1111)
(DOE/ET/20424-1; SAN-1111-9) Avail: NTIS HC A03/MF A01

To evaluate long term durability and stability of heliostat reflector and enclosure materials an extended life test program was performed on research experiment heliostats. The reflectors and enclosures were periodically evaluated and analyzed for the effects of dirt, sunlight, wind and thermal cycling on the mechanical and optical properties of Tedlar and changes in the Mylar reflector tension and reflectivity. The purpose of the program was to obtain data through measurements and observation to aid in heliostat design improvement. The key areas of technical concern were: (1) enclosure and reflector optical property retention; (2) enclosure and reflector mechanical property retention; and (3) reflector creep (or loss in membrane tension) using bonded joints. Results are summarized and discussed. DOE

N80-21879# Berkeley Solar Group, Calif.
PERFORMANCE MONITORING OF A PASSIVE SOLAR HEATED HOUSE, STOCKTON, CALIFORNIA Interim Report
Anthony Wexler Sep. 1979 50 p refs Sponsored by EPRI
(EPRI-ER-1177) Avail: NTIS HC A03/MF A01

The data acquisition system used in monitoring the performance of the passive solar demonstration home in Stockton, California is described. Details about the data logger, the sensors, and the installation procedure are given. The house is briefly described and some of the problems encountered in the project are discussed. DOE

N80-21880# Technische Univ., Berlin (West Germany). Institut fuer Luft- und Raumfahrt.
STUDY ON EUROPEAN ASPECTS OF SOLAR POWER SATELLITES, VOLUME 1 Final Report
J. Ruth and W. Westphal Jun. 1979 137 p refs
(Contract ESA-3705/78-F-DK(SC))
(ESA-CR(P)-1266) Avail: NTIS HC A07/MF A01

A study on implications of the potential electricity supply for Western Europe by Solar Power Satellites (SPS) and of their implementation problems around the turn of the century is presented. Three objectives in this scope have been pursued to provide a decision platform for on-going study and research activities: (1) to establish an information base including relevant data collection and basic SPS-systems understanding; (2) to identify and preliminary assess specific European problems of SPS utilization; and (3) to accomplish recommendations for early study activities of particular European concern. The last item is directly derived from the evaluations of the second study objective and must be seen in the context with SPS activities of the USA. It is concluded that the special European environment calls for special European utilization feasibility analyses, while the principal technical feasibility of a SPS-system should be taken over from U.S. studies. Moreover, if the USA stops its activities, an implementation of a SPS-system for Western Europe would be impractical in the considered time frame (2000-2030). Author (ESA)

N80-21881# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
TORSIONAL OSCILLATIONS OF THE ROTOR DISC FOR HORIZONTAL AXIS WIND TURBINES WITH HINGED OR TEETERED BLADES, PART 12
Lennart S. Hultgren (MIT) 23 Aug. 1979 39 p refs
(Contract SWEDBESD-5061.012)
(FFA-TN-AU-1499-PT-12) Avail: NTIS HC A03/MF A01

The coupling of torsional oscillations of the rotor disc and the blade motions was analyzed for horizontal axis wind turbine hinged or teetered blades. The blades and the tower were assumed to be perfectly rigid. The vibrational analysis was linear and the antisymmetric blade flapping motion was found be decoupled. Expressions for the eigenfrequencies of the system were obtained. Analytical solutions were constructed for forced vibrations due

to gravity, wind shear and tower shadow. Large resonant torsional responses were found to be possible. Numerical examples are presented. Author (ESA)

N80-21882# Danish Research Center for Applied Electronics, Hoersholm.
PREDICTION OF THE THERMAL BEHAVIOR OF METAL HYDROGEN BATTERY CELLS Final Report
A. Laursen, U. Fabricius, P. Stangerup, and S. Skelboe Apr. 1979 128 p refs
(Contract ESTEC-3346/77-NL-HP(SC))
(ESA-CR(P)-1271) Avail: NTIS HC A07/MF A01

A thermal equivalent model of a NiB2 and an AgH2 battery cell was defined to enable the thermal operation of the cell to be simulated using a computer. The various parts of the cells in terms of thermal parameters, i.e., thermal capacity and conductivity were determined. In parallel with the theoretical calculations of these parameters, measurements were carried out to verify or support the calculation. The heat flow generation profile were measured in an isothermal calorimeter under various cycling routines of the cells. Simulation of cell operation were carried out on a computer, and internal temperatures of the cell were calculated. Author (ESA)

N80-21883# International Science and Technology Inst., Inc., Washington, D. C.
HYDRO FOR THE EIGHTIES: BRINGING HYDROELECTRIC POWER TO LOW INCOME PEOPLE. THE WORK BOOK. A SLIDE PRESENTATION: AUDIO CASSETTE AND WORKBOOK
Sep. 1979 44 p
(Contract CSA-B9AA-007)
(PB80-103948; CSA/LN-2435) Avail: NTIS HC A03/MF A01 CSCL 10B

The rationale for developing low cost hydroelectric power is presented. Simplified descriptions of techniques for use by community groups to evaluate prospects for small hydro development are given. The pre-feasibility or reconnaissance stage is presented in a step-by-step form. Feasibility studies, licensing and financing procedures are outlined with guidelines identified. GRA

N80-21884# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: IMPACT ANALYSIS REPORT. VOLUME 1: INTRODUCTION AND SUMMARY Final Report, Jul. 1975 - Oct. 1979
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha W. Gilliland, Edward J. Malecki, Edward B. Rappaport, Frank J. Calzonetti, Mark S. Eckert, Timothy A. Hall et al. Mar. 1979 185 p refs
(Contract EPA-68-01-1916)
(PB80-113566; EPA-600/7-79-082A) Avail: NTIS HC A09/MF A01 CSCL 10A

The results of impact analyses conducted as a part of a three year technology assessment of the development of six energy resources (coal, geothermal, natural gas, oil, oil shale and uranium) in eight western states (Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah and Wyoming) during the period 1975-2000 are reported. Both site-specific and regional impact analysis results are summarized. GRA

N80-21885# National Bureau of Standards, Washington, D.C.
DATA REQUIREMENTS AND THERMAL PERFORMANCE EVALUATION PROCEDURES FOR SOLAR HEATING AND COOLING SYSTEMS
Elmer R. Streed, ed., J. Lemming, Ove Jorgensen, Per Isakson, and Guy-Roland Perrin Aug. 1979 87 p refs Sponsored in part by DOE Prepared in cooperation with Technical Univ. of Denmark, Lyngby, Royal Inst. of Tech., Stockholm, and Ecole Polytechnique Federale de Lausanne, Switzerland
(NBS Proj. 7422413)
(PB80-120173; NBSIR-80-1980) Avail: NTIS HC A05/MF A01 CSCL 13A

Standardized nomenclature and procedures are presented to serve as a guide to monitor and evaluate research or demonstration type solar hot water or heated and/or cooled systems, components, and buildings. Performance factors, data requirements, measurement parameters, and data analysis methods are described for typical solar energy systems. GRA

N80-21886# General Accounting Office, Washington, D. C. Energy and Minerals Div.
HYDROPOWER, AN ENERGY SOURCE WHOSE TIME HAS COME AGAIN
11 Jan. 1980 96 p
(PB80-127715; EMD-80-30) Avail: NTIS HC A05/MF A01 CSCL 10B

Recent price increases in imported oil demonstrate the urgency for the U.S. to rapidly develop its renewable resources. One such renewable resource for which technology is available now is hydropower. Studies indicate that hydropower potential, particularly at existing dam sites, can save the county hundreds of thousands of barrels of oil per day. But problems and constraints-economic, environmental, institutional, and operational-limit is full potential. Federal programs have had little impact on helping to bring hydro projects on line. Specifically, the Department of Energy's Small Hydro Program could do more to overcome hydro constraints and problems through an effective outreach program and more emphasis on demonstration projects. GRA

N80-21887# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
AN ELECTRIC CONVERSION FOR MECHANICAL-HYDRAULIC GOVERNORS OF WATER WHEEL TURBINES
C. L. Clemans, L. E. Eilts, and F. R. Schleif Dec. 1979 45 p refs Supersedes PB-213619
(PB80-116759; REC-ERC-79-16) Avail: NTIS HC A03/MF A01 CSCL 10A

A conversion system for upgrading performance of conventional mechanical governors for hydraulic turbines was developed. The conversion retains the proven long term stability of the ball head speed reference but replaces the dashpot function with tentative terms from an independent frequency sensor. The result upgrades the governor system from temporary-droop type to a higher order double-derivable type. Installation is simple. All original mechanical apparatus is retained for startup and standby; control can be transferred instantly. The advantages are a higher sensitivity to small system speed deviations and faster, smoother responses to system load control. GRA

N80-21888# AiResearch Mfg. Co., Torrance, Calif.
FLYWHEEL ENERGY STORAGE SWITCHER. VOLUME 1: STUDY SUMMARY AND DETAILED DESCRIPTION OF ANALYSIS Final Report, Sep. 1977 - Jan. 1979
L. M. Cook, W. T. Curran, R. McConnell, and A. K. Smith Apr. 1979 442 p refs
(Contract DOT-FR-777-4247-1)
(PB80-121478; FRA/ORD-79/20.1-Vol-1; AiResearch-79-15651-1) Avail: NTIS HC A19/MF A01 CSCL 13F

The application of flywheel energy storage to the railroad switchyard locomotive was studied to determine the practicality and viability of such a system. The system, as originally conceived, required the use of separately excited traction motors and a major task of the study was to test separately excited version of the Electro-Motive Division's D77 traction motor. The attractiveness of the system is very dependent on the operational scenario of the switching locomotive. The operation of locomotives at three Ratyards were studied, Dillard (Southern Railway System), Baldwin (Seaboard Coast Line), and Whitefish (Burlington Northern). Also, a large amount of data concerning the operation environment of switching locomotives was collected. It is concluded that a boxcar was required to carry the energy storage unit because no room existed on the locomotive. This, combined with the increased auxiliary load, results in the same energy consumption with or without the FESS system, for a typical flatyard operation in spite of the energy recuperated and reused. Brake maintenance savings, although significant, are not sufficient to give an attractive return on investment. GRA

N80-21889# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVER-

SITY APPLIED PHYSICS LABORATORY Quarterly Report, Jul. - Sep. 1979
Oct. 1979 25 p refs Sponsored in part by DOE
(PB80-125651; JHU/APL/EQR/79-3) Avail: NTIS HC A02/MF A01 CSCL 10A

Work in developing energy resources, utilization concepts, and storage methods is reported. The first section, geothermal energy development planning, reports progress of various geothermal-related tasks. The tasks include the ongoing Atlantic Coastal Plain Geothermal Energy Market Survey, Delmarva Geothermal Development Prospectus, analysis geothermal energy at Crisfield, Md., analysis of the Crisfield well data, and comments on limited tasks. The second section, operational research, hydroelectric power development, contains a report on the survey of smallscale hydroelectric in the southeastern states and an analysis of institutional, legal, environmental, and economic factors. Landfill methane recovery and liquefied natural gas safety are also discussed. GRA

N80-21379*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GENERAL SENSITIVITY ANALYSIS OF SOLAR THERMAL-ELECTRIC PLANTS
F. L. Lansing, E. W. Hayes, and C. S. Yung *In its* The Deep Space Network 15 Apr. 1980 p 130-142 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring, and contamination control.

N80-21890* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ENVIRONMENTAL IMPACT STATEMENT FOR THE KENNEDY SPACE CENTER, 1978 - 1979 REVISION Final Report
Oct. 1979 339 p refs Revised Original contains color illustration supplements
(NASA-TM-81015) Avail: NTIS HC A15 CSCL 13B

The ongoing operation of KSC for expendable launch vehicles and automated spacecraft, continued development of facility capabilities, and the approved follow-on operations of the Space Transportation System and associated payloads are described. Emphasis is placed on the expendable launch vehicle and space shuttle traffic projected as of January, 1979. The maximum potential effect on the environment is addressed. Site specific environmental effects are summarized. It is indicated that all potential impacts will be localized, of short duration, controllable, and of minimum severity. The impact on land use, air and water quality, weather, and noise effects is covered. J.M.S.

N80-21891*# Systems Applications, Inc., San Rafael, Calif.
INTRODUCTORY STUDY OF THE CHEMICAL BEHAVIOR OF JET EMISSIONS IN PHOTOCHEMICAL SMOG Final Report
Gary Z. Whitten and Henry Hogo May 1976 115 p refs Sponsored in part by FAA, Washington, D. C.
(Contract NAS2-8821)
(NASA-CR-152345; EF76-04R) Avail: NTIS HC A06/MF A01 CSCL 13B

Jet aircraft emissions data from the literature were used as initial conditions for a series of computer simulations of photochemical smog formation in static air. The chemical kinetics mechanism used in these simulations was an updated version which contains certain parameters designed to account for hydrocarbon reactivity. These parameters were varied to simulate the reaction rate constants and average carbon numbers associated with the jet emissions. The roles of surface effects, variable light sources, NO/NO2 ratio, continuous emissions, and untested mechanistic parameters were also assessed. The results of these calculations indicate that the present jet emissions are capable of producing oxidant by themselves. The hydrocarbon/nitrous oxides ratio of present jet aircraft emissions is much higher than that of automobiles. These two ratios appear to bracket the hydrocarbon/nitrous oxides ratio that maximizes ozone production. Hence an enhanced effect is seen in the simulation when jet exhaust emissions are mixed with automobile emissions. A.R.H.

N80-21892*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP) DATA REPORT FOR TAPES VL0011 AND VL0013 Progress Report, 10 Jan. - 2 Oct. 1977
J. D. Holdeman, Thomas J. Dudzinski, and Marvin W. Tiefermann Mar. 1979 63 p refs
(NASA-TM-81462; E-393) Avail: NTIS HC A04/MF A01 CSCL 13B

In-situ measurements of atmospheric ozone, carbon monoxide, clouds, and related meteorological and flight information obtained during 1122 flights of aircraft VH-EBE and N655PA from January 10 through October 2, 1977 are reported. In addition, tropopause pressures obtained from time and space interpolation of achieved data for the dates of the flights are included. R.E.S.

N80-21893*# National Aeronautics and Space Administration, Washington, D. C.
ETEKOS EXPERIMENTAL ECOSYSTEM
Vyacheslav Viktorovich Alekseyev and Victor Vol'fovich Sapozhnikov Mar. 1980 11 p Transl. into ENGLISH from Priroda (USSR), no. 10, Oct. 1979 p 70-75 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Moscow State Univ.
(Contract NASw-3198)
(NASA-TM-76079) Avail: NTIS HC A02/MF A01 CSCL 13B

A description is given of an experimental ecosystem, or Etekos, which was developed at the Moscow University. The experiment lasted about one year, and the results obtained are itemized. Author

N80-21894*# National Aeronautics and Space Administration, Washington, D. C.
ETEKOS EXPERIMENTAL ECOLOGICAL SYSTEM
V. V. Alekseyev, A. A. Geogiyev, Yu. I. Gorbatov, M. Ya. Lyamin, V. N. Maksimov, V. V. Sapozhnikov, G. G. Shinkar, and Ye. L. Shirokova Mar. 1980 9 p refs Transl. into ENGLISH from Biol. Nauki (USSR), no. 7, Jul. 1979 p 95-99 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76080) Avail: NTIS HC A02/MF A01 CSCL 13B

The problem of changes in the ecology resulting, for example, in increases in water temperature because of discharges from large thermal power plants is considered. An experiment creating a model of such an ecological system is described. J.M.S.

N80-21895# Department of Energy, Washington, D. C. Environmental Measurement Lab.
AIR SAMPLING WORKSHOP
Harry Schulte Jun. 1979 28 p Workshop held at New York, 24-25 Oct. 1978
(EML-359) Avail: NTIS HC A03/MF A01

Air sampling strategies for the occupational environment are reviewed. Strategies comprise the elements of implementing an air sampling program including deciding on the extent of sampling selecting appropriate types of measurement, placing sampling instruments properly, and interpreting sample results correctly. All of these elements are vital in the reliable assessment of occupational exposures yet their coverage in the industrial hygiene literature is meager. The status of air sampling strategy is covered. It concluded that air sampling strategy is an elementary state and urgently needs concerted attention from the industrial hygiene profession. DOE

N80-21896# Industrial Environmental Research Lab., Research Triangle Park, N. C.
POLLUTION CONTROL PRACTICES, FUEL CONVERSION AND ITS ENVIRONMENTAL EFFECTS
H. Gold (Water Purification Associates, Cambridge, Mass.), J. A. Nardella (DOE, Germantown, Md.), and C. A. Vogel Aug. 1979 9 p refs Repr. from Chem. Engineering Progr., v. 75, no. 8,

Aug. 1979 p 58-64 Presented at AICHE, Miami Beach, Fla. Nov. 1978
(PB80-119704; EPA-600/J-79-032) Avail: NTIS HC A02/MF A01 CSCL 13B

Water-related effects that could be expected from siting specific conversion plants at given locations in the major coal and oil shale bearing regions of the U.S. were investigated. The synthetic fuel technologies examined include: coal gasification to convert coal to pipeline gas; coal liquefaction to convert coal to low-sulfur fuel oil; coal refining to produce a de-ashed, low-sulfur solvent-refined (clean) coal; and oil shale retorting to produce synthetic crude. The results presented include the range of water requirements, the conditions for narrowing the range and optimizing the use of water, the ranges of residual solid wastes, and the cost and energy requirements for wastewater treatment. GRA

N80-21897# Association of Bay Area Governments, Berkeley, Calif.
EXAMPLE CONTROL STRATEGY FOR OZONE. VOLUME 1: GENERAL GUIDANCE FOR NONATTAINMENT AREAS Final Report
Apr. 1979 133 p refs
(Contract EPA-68-02-3001)
(PB80-121445; EPA-450/2-79-001A-Vol-1; OAQPS-1.2-120)
Avail: NTIS HC A07/MF A01 CSCL 13B

Guideline information is presented to assist states and local agencies in preparing ozone control strategies for nonattainment areas. The guideline covers the following topics: intergovernmental cooperation, development and assessment of air quality and emissions data, modeling to related air quality to emissions, control strategy analysis and assessment, plan adoption, and the continuing planning process. This volume covers general guidance to nonattainment areas. GRA

N80-21898# Southwest Research Inst., San Antonio, Tex.
CHARACTERIZATION OF GASEOUS AND PARTICULATE EMISSIONS FROM LIGHT DUTY DIESELS OPERATED ON VARIOUS FUELS Final Report
Charles T. Hare Jul. 1979 342 p refs
(Contract EPA-68-03-2440)
(PB80-122443; EPA-460/3-79-008) Avail: NTIS HC A15/MF A01 CSCL 13B

Gaseous and particulate emissions of a non-routine nature were measured in the extracts of two light-duty diesel-powered automobiles. These vehicles were a Mercedes 240D and a Volkswagen Rabbit Diesel. Visible exhaust smoke, regulated gaseous polutants, and exhaust odor were also measured. Five fuels were used in its investigation, representing broad ranges in sulfur content, hydrocarbon-type composition, density, centane index, and a number of other properties. Vehicle operating procedures used for test purposes included both those specified in Federal Regulations and several others simulating different driving situations. The results of a statistical analysis of the particulate emissions data is included as is an analysis of gaseous emissions and particulate size data. GRA

N80-21899# SRI International Corp., Menlo Park, Calif.
ANALYSIS OF HIGH NO2 CONCENTRATIONS IN CALIFORNIA, 1975 - 1977
J. R. Martinez and K. C. Nitz Aug. 1979 105 p refs
(Contract EPA-68-02-2835)
(PB80-123060; EPA-450/4-79-034A; Rept-6780-12; Rept-6780-13) Avail: NTIS HC A06/MF A01 CSCL 13B

During the period 1975-1977, 51 monitoring stations in California collectively recorded about 1,800 sit-days in which hourly nitrogen dioxide (NO2) concentrations exceeded 0.20 ppm. The potential causes of these high NO2 events, the physical phenomena involved in their occurrence, and their spatial and temporal patterns were studied. In addition, the potential association between emission sources and the frequency and magnitude of high NO2 levels at the various locations was analyzed. The relationship between annual maximum hourly levels and annual mean concentration was explored, and the quality of the NO2 data was evaluated. GRA

N80-21900# Environmental Protection Agency, Ann Arbor, Mich. Standard Development and Support Branch
HEAVY-DUTY ENGINE BASELINE PROGRAM (1969) AND 1983 EMISSION STANDARDS DEVELOPMENT Final Report
Timothy P. Cox, Glenn W. Passavant, and Larry D. Ragsdale May 1979 109 p refs
(PB80-120678; SDSB-79-23) Avail: NTIS HC A06/MF A01 CSCL 13B

The U.S. EPA was mandated by the 1977 Clean Air Act Amendments (CAAA) to determine revised HC and CO emission standards for 1983 model year heavy duty engines. These revised emission standards were to be based on a 90% reduction from the average of actually measured emissions from uncontrolled (1969 model year) gasoline fueled engines. To comply with the provisions of the 1977 CAAA, ECTD began a baseline testing program. The vehicle/engine selection and procurement efforts, as well as the engine preparation and testing programs are discussed. It also includes a presentation and discussion of the 1969 emissions data. GRA

N80-21901# Research Triangle Inst., Research Triangle Park, N. C.
MULTIMEDIA ENVIRONMENTAL GOALS FOR ENVIRONMENTAL ASSESSMENT. VOLUME 3: MEG CHARTS AND BACKGROUND INFORMATION SUMMARIES (CATEGORIES 1-12) Final Report, May 1978 - Jun. 1979
G. L. Kingsbury, R. C. Sims, and J. B. White Aug. 1979 510 p
(Contracts EPA-68-02-2612; EPA-68-02-3132)
(PB80-115108; RTI-1603-23-01F-Vol-3; EPA-600/7-79-176A)
Avail: NTIS HC A22/MF A01 CSCL 06T

Multimedia environmental goals (MEG's) are levels of significant contaminants (in ambient air, water, or land or in emissions of effluents conveyed to the ambient media) that are judged to be (1) appropriate for preventing certain negative effects in the surrounding populations or ecosystems, or (2) representative of the control limits achievable through technology. The following organic pollutant categories are discussed: aliphatic hydrocarbons; alkyl halides; ethers; halogenated ethers and epoxides; alcohols; glycols; epoxides; aldehydes; ketones; carboxylic acids and derivatives; nitrives; amines; azo compounds; hydrazine derivatives; nitrosamines. GRA

N80-21902# Research Triangle Inst., Research Triangle Park, N. C.
MULTIMEDIA ENVIRONMENTAL GOALS FOR ENVIRONMENTAL ASSESSMENT. VOLUME 4: MEG CHARTS AND BACKGROUND INFORMATION SUMMARIES (CATEGORIES 13-26) Final Report, May 1978 - Jun. 1979
G. L. Kingsbury, R. C. Sims, and J. B. White Aug. 1979 486 p refs
(Contracts EPA-68-02-2612; EPA-68-02-3132)
(PB80-115116; RTI-1603-23-01F-Vol-4; EPA-600/7-79-176B)
Avail: NTIS HC A21/MF A01 CSCL 06T

Multimedia Environmental Goals (MEG's) are levels of significant contaminants or degradents (in ambient air, water, or land or in emissions of effluents conveyed to the ambient media) that are judged to be (1) appropriate for preventing certain negative effects in the surrounding populations or ecosystems, or (2) representative of the control limits achievable through technology. MEG's are projected for the following organic compounds: thiols, sulfides, disulfides; sulfonic acids, sulfoxides; benzene, substituted benzene; hydrocarbons; halogenated aromatic compounds; aromatic nitro compounds; phenols; halogenated phenolic compounds; nitrophenols; fused polycyclic hydrocarbons; fused nonalternant polycyclic hydrocarbons; heterocyclic nitrogen compounds; heterocyclic oxygen compounds; heterocyclic s compounds; organophosphorus compounds. GRA

N80-21903# California Univ., Davis. Crocker Nuclear Lab.
AMBIENT AEROSOL SAMPLING WITH STACKED FILTER UNITS Final Report
T. A. Cahill, R. A. Eldred, J. Barone, and L. Ashbaugh Feb. 1979 83 p refs
(Contract DOT-FM-11-9238)
(PB80-126147; FHWA/RD-78/178) Avail: NTIS HC A05/MF A01 CSCL 13K

Studies were conducted on the use of Nuclepore filters to perform a dichotomous particle size separation in ambient aerosols.

Optimization of the resulting stacked filter unit was undertaken, with incorporation of information from theoretical analyses, laboratory studies, and tests in a variety of ambient conditions. The stacked filter unit was improved by development of antibounce coatings for the coarse filter, incorporation of a new fine filter, and addition of a pneumatic constant flow device. The unit was shown to quantitatively collect particles between 2.5 micrometers and 15 micrometers on the coarse filter, and 0 to 2.5 micrometers on the fine filter, with a separation curve similar to that of the human respiratory tract. GRA

N80-21904# Environmental Sciences Research Lab., Research Triangle Park, N.C.
GRIDDED ANNUAL POLLUTANT EMISSIONS EAST OF THE ROCKY MOUNTAINS
Terry L. Clark May 1979 180 p refs
(PB80-124258; EPA-600/4-79-030) Avail: NTIS
HC A09/MF A01 CSCL 13B

Annual pollutant emissions of particulates, sulfur dioxide, nitrogen oxides, hydrocarbons, and carbon monoxide from point and area sources are apportioned to 80-km grid squares on a 35 by 30 grid network. The domain of the network includes southern Canada and much of the United States east of the Rocky Mountains. In addition, the emissions of the five pollutants are apportioned to 20-km grid squares on a 40 by 40 grid network, which is a subset of the previously mentioned grid network. The domain of the 40 by 40 grid network encompasses the area roughly from Columbus, Ohio to Portland, Maine and from Richmond, Virginia to Ottawa, Ontario. These emission inventories, the design of the gridding procedures and the major source classifications responsible for much of the emissions are discussed. GRA

N80-21905# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
LONG-RANGE TRANSPORT AND TRANSFORMATION OF SO2 AND SULFATE Final Report, May 1977 - Apr. 1979
Teizi Henmi and Elmar R. Reiter Nov. 1979 185 p refs
(Grant EPA-R-805271)
(PB80-134950; EPA-600/4-79-068) Avail: NTIS
HC A09/MF A01 CSCL 13B

Technical descriptions and computer programs are presented for two models that calculate long-range transport, diffusion, transformation of SO2 to sulfate, and dry and precipitation deposition of initially emitted SO2. One model treats the mixing layer height as constant; the other (at the expense of computer time) varies the mixing layer height diurnally and tracks pollutants in three layers--the daytime mixing layer, the nocturnal ground-based stable layer, and the daytime mixed layer that remains above the nocturnal stable layer. Application of the multi-layer model over a region encompassing the Ohio River Basin produced patterns of SO2 and sulfate concentrations that are statistically correlated with observed concentrations. GRA

N80-21906# Environmental Protection Agency, Research Triangle Park, N.C. Standards Development Branch.
STANDARD SUPPORT AND ENVIRONMENTAL IMPACT STATEMENT. VOLUME 2: PROMULGATED STANDARDS OF PERFORMANCE FOR STATIONARY GAS TURBINES
Sep. 1979 64 p
(PB80-126022; EPA-450/2-77-017B-Vol-2) Avail: NTIS
HC A04/MF A01 CSCL 13B

Standards of performance to control nitrogen oxides and sulfur dioxide emissions from new, modified, and reconstructed stationary gas turbines in the U.S. are being promulgated under section III of the Clean Air Act. Information on the public comments made after proposal and on the EPA responses and differences between the proposed and promulgated standards is presented. GRA

N80-21907# Biller (William F.) East Brunswick, N.J.
STUDIES IN THE REVIEW OF THE PHOTOCHEMICAL OXIDANT STANDARD Final Report
William F. Biller Jan. 1979 173 p refs
(Contract EPA-68-02-2589)
(PB80-125099; EPA-450/5-79-004) Avail: NTIS
HC A08/MF A01 CSCL 13B

Studies were performed in three areas to support the review of the photochemical oxidants standard: (1) the desirability of changing from a photochemical oxidants to an ozone standard; (2) the suitability of alternate ways of expressing the standard and; (3) the assessment of health risks at alternate levels of the standard. From the first study, it was concluded that a change to an ozone standard could lead to benefits in administering the standard with little or no loss in protection of the public health and welfare. The second study concluded that national ambient air standards should be expressed in a statistical form. In the third area the mathematical methodology was developed for estimating the risk that health effect thresholds for sensitive populations will be exceeded during a given period of time at alternate levels of the ambient air quality standard. GRA

N80-21908# Environmental Sciences Research Lab., Research Triangle Park, N.C. Atmospheric Chemistry and Physics Div.
IMPLEMENTATION OF A MICROCOMPUTER-MODIFIED ELECTRICAL AEROSOL ANALYZER
Charles W. Lewis Aug. 1979 52 p refs
(PB80-125057; EPA-600/2-79-140) Avail: NTIS
HC A04/MF A01 CSCL 14B

A commercial electrical aerosol analyzer was modified through addition of a digital voltmeter, a microcomputer, and a printer. In unattended operation, the system can acquire a differential particle size distribution, print and plot the resulting spectrum in any of these possible representations, and repeat the cycle at preselected intervals. Details of the system assembly and instructions for its operation are given. GRA

N80-21909# National Oceanic and Atmospheric Administration, Rockville, Md.
FEDERAL PLAN FOR OCEAN POLLUTION RESEARCH, DEVELOPMENT AND MONITORING, FISCAL YEARS 1979 - 1983
Aug. 1979 230 p
(PB80-128820; NOAA-80010205) Avail: NTIS
HC A11/MF A01 CSCL 13B

Federal Plan No. One for fiscal years 1979-1983 is presented. The broad range of subject matter addressed by almost a thousand projects comprising the current $165 million Federal ocean pollution research, development, and monitoring efforts is described. A comprehensive statement of national needs and problems based on public and private sector input is presented. A general overview of ocean pollution problems in the waters of the U.S. is provided and the adequacy of the current Federal response to these problems is analyzed by problem area. Initial priorities are assigned to the research and development, and monitoring needs as identified. GRA

N80-21910# National Oceanic and Atmospheric Administration, Rockville, Md.
REPORTS OF THE SUBCOMMITTEES ON: NATIONAL NEEDS AND PROBLEMS, DATA COLLECTION, STORAGE, AND DISTRIBUTION, MONITORING, RESEARCH AND DEVELOPMENT
Aug. 1979 184 p Sponsored by Federal Coordinating Council for Science, Engineering, and Technology
(PB80-135213; NOAA-80011001) Avail: NTIS
HC A09/MF A01 CSCL 13B

Subcommittee reports are presented as working papers for the Federal plan for ocean pollution research, development and monitoring fiscal years 1979-83. GRA

N80-21911# Industrial Environmental Research Lab., Research Triangle Park, N. C.
EPA/IERL-RTP PILOT ELECTROSTATIC PRECIPITATOR: SELECTED EXPERIMENTS, 1978 Final Report, Jun. 1978 - Jun. 1979
D. W. VanOsdell, L. E. Sparks, G. H. Ramsey, and B. E. Daniel Nov. 1979 64 p refs
(PB80-124829; EPA-600/7-79-238) Avail: NTIS
HC A04/MF A01 CSCL 13B

Experiments with a pilot-scale electrostatic precipitator (ESP) are described. The precharger test results were inconclusive removal efficiency was 10-20% better with the precharger for most size ranges, but its operation was erratic. In the reentrainment test, sparking produced more and larger particulate than other reentrainment mechanisms. No size distribution change pattern

was established. The study of low, mass, and particle size as a function of sample probe position showed that parameter variations do exist. In the study of the effects of humidity on collection efficiency, increased moisture had a strong impact on improved performance. Moisture lowered the particulate resistivity, allowing increased electrical fields. GRA

N80-21912# PEDCo-Environmental, Inc., Cincinnati, Ohio.
OVERVIEW OF POLLUTION FROM COMBUSTION OF FOSSIL FUELS IN BOILERS OF THE UNITED STATES Final Report, Jan. - Jun. 1979
P. W. Spaite and T. W. Devitt Oct. 1979 69 p refs
(Contract EPA-68-02-2603)
(PB80-124969; EPA-600/7-79-233) Avail: NTIS HC A04/MF A01 CSCL 13B

The fossil-fuel-fired boiler population of the U.S. are described. Data is given on the number and capacity of boilers for categories most relevant to producing pollution. Information presented includes: type of fuel burned (coal, residual oil, distillate oil, natural gas); usage sector (utility, industrial, commercial); size category (less than 25 million Btu/hr, 25-250 million Btu/hr, greater than 250 million Btu/hr); and heat transfer configuration (water tube, fire tube, cast iron). Fuel consumption data are presented for each type of fuel burned in each usage sector. These data are used to estimate the amount of sulfur oxide, nitrogen oxide, and particular air emissions produced by boiler operation. Other air pollutants are discussed qualitatively. Solid waste and water pollution from boiler operation is discussed generally. GRA

N80-21913# Research Triangle Inst., Research Triangle Park, N. C.
SYMPOSIUM PROCEEDINGS: ENVIRONMENTAL ASPECTS OF FUEL CONVERSION TECHNOLOGY, IV Final Report, Sep. 1978 - Sep. 1979
Franklin A. Ayer, comp. and N. Stuart Jones, comp. Sep. 1979 572 p refs Conf. held at Hollywood, Fla., Apr. 1979
(Contract EPA-68-02-3132)
(PB80-134729; EPA-600/7-79-217) Avail: NTIS HC A24/MF A01 CSCL 21D

The proceedings document presentations made at the symposium on Environmental Aspects of Fuel Conversion Technology. The symposium acted as a colloquium for discussion of environmentally related information on coal gasification and liquefaction. The program included sessions on program approach, environmental assessment, and control technology development. GRA

N80-21821# Joint Research Centre of the European Communities, Ispra (Italy).
BIOLOGICAL APPLICATIONS INCLUDING POLLUTION MONITORING
B. Sturm *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 217-222 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation *see 93 Space Radiation.*

N80-21914 Stanford Univ., Calif.
EARLY CRETACEOUS TECTONICS AND DEPOSITION OF THE GLANCE CONGLOMERATE, SOUTHEASTERN ARIZONA Ph.D. Thesis
William Leonard Bilodeau 1979 176 p
Avail: Univ. Microfilms Order No. 800291

The stratigraphic, sedimentological, and structural characteristics of the Glance Conglomerate are examined and aspects of the middle Mesozoic tectonic environment are discussed, particularly the critical relation between sedimentation and tectonics. The deposits, mapped thickness variations, lithofacies changes, and paleocurrent flow directions all suggest that the Glance Conglomerate is a proximal alluvial fan deposit shed from a rising mountain block into a local subsiding basin bounded on at least one side by normal faults. The structural setting is strikingly different from that found farther to the north. Three tectonic models are developed to explain the difference in back-arc tectonic style. Dissert. Abstr.

N80-21915*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE ROLE OF UPPER TROPOSPHERIC JET STREAKS AND LEE-SIDE CYCLOGENESIS IN THE DEVELOPMENT OF LOW LEVEL JETS IN THE GREAT PLAINS
L. W. Uccellini Mar. 1980 17 p refs
(NASA-TM-80653) Avail: NTIS HC A02/MF A01 CSCL 04A

A review of 15 cases of low level jets (LLJ) which developed in the Great Plains is presented. For 12 out of the 15 cases, a systematic upper level flow pattern was isolated which includes the existence of a trough over the southwest United States and the propagation of upper level jet streaks from the Rocky Mountains toward the Great Plains. This flow pattern is responsible for lee side cyclogenesis or lee side troughing that produces the pressure gradients needed for the development of the LLJ. For the other three cases, a blocking ridge existed over the Great Plains and the upper level flow is relatively weak. It is during these situations that the classic, diurnal oscillating LLJ was observed. A more detailed review of four cases indicates that the subsynoptic scale adjustments associated with the upper level jet streak's forcing of lee side cyclogenesis could be an important factor in the development of LLJ's in the Great Plains. M.G.

N80-21916*# Old Dominion Univ. Research Foundation, Norfolk, Va.
GROUND TEMPERATURE MEASUREMENT BY PRT-5 FOR MAPS EXPERIMENT Final Report
S. K. Gupta and S. N. Tiwari Apr. 1978 89 p refs
(Grant NsG-1282)
(NASA-CR-158966) Avail: NTIS HC A05/MF A01 CSCL 08M

A simple algorithm and computer program were developed for determining the actual surface temperature from the effective brightness temperature as measured remotely by a radiation thermometer called PRT-5. This procedure allows the computation of atmospheric correction to the effective brightness temperature without performing detailed radiative transfer calculations. Model radiative transfer calculations were performed to compute atmospheric corrections for several values of the surface and atmospheric parameters individually and in combination. Polynomial regressions were performed between the magnitudes or deviations of these parameters and the corresponding computed corrections to establish simple analytical relations between them. Analytical relations were also developed to represent combined correction for simultaneous variation of parameters in terms of their individual corrections. R.E.S.

N80-21917# Rondout Associates, Inc., Stone Ridge, N.Y.
REGIONAL SEISMIC WAVE PROPAGATION Semiannual Technical Report, 1 Jan. - 30 Jun. 1979
Paul W. Pomeroy Jul. 1979 50 p refs
(Contract F49620-78-C-0043; ARPA Order 3291)
(AD-A079982; Rept-03-79-1; AFOSR-79-1331TR; SATR-3)
Avail: NTIS HC A03/MF A01 CSCL 08/14

The research reported here was carried out to enhance our understanding of seismic wave propagation at regional distances in the central portion of the USSR. Results in this region are contrasted with those from the Western USSR and with data from eastern North America. GRA

N80-21918# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
SHORT-TIME MASS VARIATION IN NATURAL ATMOSPHERIC DUST
Teddy L. Barber Nov. 1979 49 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A079792; ERADCOM/ASL-TR-0045) Avail: NTIS HC A03/MF A01 CSCL 04/1

Aerosols are not perfectly mixed in the atmosphere, but reside in miniclouds, even in a relatively clear atmosphere. This report presents a mathematical treatment relating mass loading to optical backscatter, and some of the inherent problems in examining light scattering from natural dust in a theoretical manner are discussed. Lidar backscatter data were taken in a desert environment and related to mass loading variations over 30-second periods. Four of the 30-second segments of the data are presented. In these four segments, the estimated relative mass loading was observed to fluctuate up and down with the highest mass loading about eight times that of the lowest mass loading. These mass loading fluctuations were observed at one position 15 meters above the ground. GRA

N80-21919# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
VALIDATION AND RECEIVER DESIGN FOR A RANDOM POINT PROCESS MODEL OF ATMOSPHERIC RADIO NOISE M.S. Thesis
John F. Stach Dec. 1979 65 p refs
(AD-A080214; AFIT/GE/EE/79-34) Avail: NTIS HC A04/MF A01 CSCL 20/14

An investigation of low frequency atmospheric radio noise (ARN) indicates that the return stroke from lightning discharges is the major source of the noise. A model of ARN is then presented which is based on the return stroke. The model consists of the sum of two marked Poisson processes. The sum of marked Poisson process can be thought of as a single marked Poisson process with a transformed rate and a mixture density on the marks. The complete statistical description of this process is then derived and a minimum probability of error processor is designed using the ARN model as the noise. The theoretical amplitude probability distribution (APD) is then derived for the output of a quadrature envelope detector using the ARN model as an input. The theoretical APD curves were then compared to a measured APD curve from CCIR Report 322 and two measured APD curves from an article by K. Furutsu and T. Ishida. The linear mean square error (MSE)between the theoretical and measured curves when plotted on Rayleigh paper is .018, and .015 for the Furutsu and Ishida data and .018 for the CCIR data. Based on the first order statistics, the model is found to be a good representation of low frequency ARN. It is therefore recommended that the model be used to evaluate receiver performance in the low frequency channel and that a more thorough validation study be done including a validation of higher order statistics. GRA

N80-21920# Physical Dynamics, Inc., La Jolla, Calif.
NOISE SUPPRESSION AND BALANCING EXPERIMENTS USING A SUPERCONDUCTING MAGNETIC GRADIOMETER Interim Report
Ronald E. Sager and Walter N. Podney Sep. 1979 200 p refs
(Contract N00014-77-C-0254; ARPA Order 3370)
(AD-A076960; PD-LJ-R-195) Avail: NTIS HC A09/MF A01 CSCL 08/14

We present a noise suppression technique which allows detection of tiny fluctuating magnetic gradients in the presence of a very large dc gradient field. We describe our superconducting gradiometer, its response to rotations in an arbitrary magnetic field, and various external sources of noise in the gradiometer output. As ambient dc gradient field is shown to be identical to the gradients produced by some 'equivalent dipole' and gradient noise in the gradiometer from a nearby magnetic object is treated as arising from small perturbations in the position and orientation of the equivalent dipole. We describe an empirical alignment technique for aligning the gradiometer to suppress noise introduced by such gradient fluctuations and use it to demonstrate suppression of total gradiometer noise to essentially the level of inherent instrument noise at frequencies down to one milliHertz. A computer calculation which models the gradiometer noise as a function of gradiometer orientation reproduces essentially all features of experimental gradiometer noise measurements, and provides evidence that our model for the instrument's response to gradient fields is correct. Author (GRA)

N80-21921# Rochester Univ., N. Y. Dept. of Chemistry.
STUDY OF INTERMOLECULAR INTERACTIONS OF OZONE Progress Report, 1 Dec. 1978 - 15 Jul. 1979
John S. Muenter 1979 5 p
(Contract EE-77-S-02-4321)
(COO-4321-2; PR-2) Avail: NTIS HC A02/MF A01

The intermolecular interactions of sulfur dioxide with itself, argon, and water are examined. The use of radio frequency and microwave spectroscopy to study van der Waals molecules containing sulfur dioxide is described. Methods of generating molecular beams of sulfur dioxide dimer and the water-sulfur dioxide hydrogen bonded complex are discussed. A.W.H.

N80-21922# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.
EARTH-ATMOSPHERE RADIATION BUDGET ANALYSES DERIVED FROM NOAA SATELLITE DATA, JUNE 1974 - FEBRUARY 1978, VOLUME 1
Jay S. Winston, Arnold Gruber, Thomas I. Gray, Jr., Marylin S. Varnadore, Charles L. Earnest, and Luke P. Mannello Aug. 1979 338 p
(PB80-106859; NOAA-79092712-Vol-1;
NOAA-S/T-79-187-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 04A

Earth atmosphere radiation budget data, as determined from the scanning radiometers (SR) aboard NOAA operational satellites, are presented in analyzed maps for the period June 1974 through February 1978. The mapped data are displayed on a Mercator projection from 60 degrees N-60 degrees S and polar stereographic projections poleward of 50 degrees N and S. The quantities displayed are albedo, absorbed solar radiation, outgoing longwave radiation, and net radiation. GRA

N80-21923# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.
EARTH-ATMOSPHERE RADIATION BUDGET ANALYSES DERIVED FROM NOAA SATELLITE DATA, JUNE 1974 - FEBRUARY 1978, VOLUME 2
Jay S. Winston, Arnold Gruber, Thomas I. Gray, Jr., Marylin S. Varnadore, and Charles L. Earnest Aug. 1979 338 p
(PB80-106867; NOAA-79092713-Vol-2;
NOAA-S/T-79-187-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 04A

Earth atmosphere radiation budget data as determined from the Scanning Radiometers (SR) aboard NOAA operational satellites are presented in analyzed profiles for the period June 1974 through February 1978. The quantities displayed are albedo, absorbed solar radiation, outgoing longwave radiation, and net radiation. The profiles are based on zonal means at every 2.5 degrees latitude for the entire latitude circle and for three longitudinal sectors: 0 degrees-117.5 degrees E, 120 degrees E-122.5 degrees W, and 120.0 degrees W-2.5 degrees W. GRA

N80-21924# National Technical Information Service, Springfield, Va.
THE CHEMISTRY AND PHYSICS OF OZONE IN THE STRATOSPHERE AND UPPER ATMOSPHERE, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jan. 1980
Diane M. Cavagnaro Feb. 1980 215 p Supersedes NTIS/PS-79/0073; NTIS/PS-78/0063; NTIS/PS-77/0020
(PB80-804677; NTIS/PS-79/0073; NTIS/PS-78/0063;
NTIS/PS-77/0020) Avail: NTIS HC $30.00/MF $30.00 CSCL 04A

The bibliography contains selected abstracts of research reports concerning chemical reactors and kinetics, particle physics, photochemistry, transport processes, and atmospheric models of ozone in the stratosphere. Analysis and sounding procedures and data are excluded. Effects of supersonic transport aircraft exhaust on ozone concentrations are included. This updated bibliography contains 208 abstracts, 59 of which are new entries to the previous edition. GRA

N80-21925# National Technical Information Service, Springfield, Va.
TECTONICS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - Feb. 1980
Audrey S. Hundemann Feb. 1980 273 p Supersedes NTIS/PS-79/0089; NTIS/PS-78/0082; NTIS/PS-77/0088
(PB80-804529; NTIS/PS-79/0089; NTIS/PS-78/0082;

NTIS/PS-77/0088) Avail: NTIS HC $30.00/MF $30.00 CSCL 08G

Abstracts dealing with plate tectonics, remote sensing of terrain features, geologic faults, ocean bottom spreading, geomagnetic anomalies, paleomagnetism, and geomorphology are cited. This updated bibliography contains 266 abstracts, 26 of which are new entries to the previous edition. GRA

N80-21371*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI DETECTION OF CRUSTAL PLATE MOTION USING DSN ANTENNAS AS BASE STATIONS
D. D. Morabito, E. S. Claflin, and C. J. Steinberg *In its* The Deep Space Network 15 Apr. 1980 p 59-75 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 08G

N80-21812# Institut Royal Meteorologique de Belgique, Brussels.
RADIATION BUDGET AND THE SOLAR CONSTANT [BILAN RADIATIFS ET CONSTANTE SOLAIRE]
D. Crommelynck *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 137-143 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21813# European Space Agency, Paris (France).
DETERMINATION OF ATMOSPHERIC TEMPERATURE PROFILES AND TURBIDITY FROM SATELLITE OBSERVATIONS
H. Fischer (Meteorological Inst., Munich) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 145-153 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21814# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
OZONE MEASUREMENTS FROM SATELLITES [MESURES D'OZONE A PARTIR DE SATELLITE]
A. Girard *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 155-171 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-22236# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EARTH RADIATION BUDGET: SIMULATION OF FLUXES AND ACCELEROMETRIC MEASUREMENTS
Thierry Duhamel and Philippe Marchal *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 61-72 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 119-134 Original report in FRENCH previously announced as A79-11358 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-21926*# Beam Engineering, Inc., Sunnyvale, Calif.
HIGH RESOLUTION VERTICAL PROFILES OF WIND, TEMPERATURE AND HUMIDITY OBTAINED BY COMPUTER PROCESSING AND DIGITAL FILTERING OF RADIOSONDE AND RADAR TRACKING DATA FROM THE ITCZ EXPERIMENT OF 1977
Edwin F. Danielson, R. Stephen Hipskind (Oregon State Univ.), and Steven E. Gaines (San Jose State Univ., Calif.) Apr. 1980 117 p refs
(Contract NAS2-10023)
(NASA-CR-3269) Avail: NTIS HC A06/MF A01 CSCL 04B

Results are presented from computer processing and digital filtering of radiosonde and radar tracking data obtained during the ITCZ experiment when coordinated measurements were taken daily over a 16 day period across the Panama Canal Zone. The temperature relative humidity and wind velocity profiles are discussed. A.W.H.

N80-21927*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
LIGHTNING TECHNOLOGY: PROCEEDINGS OF A TECHNICAL SYMPOSIUM
Apr. 1980 444 p refs Symp. held in Hampton, Va., 22-24 Apr. 1980; sponsored in cooperation with Fla. Inst. of Technol. and DOT
(NASA-CP-2128; L-13666; FAA-RD-80-30) Avail: NTIS HC A19/MF A01 CSCL 04B

Several facets of lightning technology are considered including phenomenology, measurement, detection, protection, interaction, and testing. Lightning electromagnetics, protection of ground systems, and simulated lightning testing are emphasized. The lightning-instrumented F-106 aircraft is described. For individual titles, see N80-21928 through N80-21952.

N80-21928*# Bonn Univ. (West Germany). Radioastronomical Inst.
A WAVE GUIDE MODEL OF LIGHTNING CURRENTS AND THEIR ELECTROMAGNETIC FIELD
Hans Volland *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 3-19 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Lightning channels are considered as resonant wave guides in which only standing resonant wave modes can be excited. Two types of discharging currents develop. Type 1 is an aperiodic wave; type 2 is a damped oscillation. The electromagnetic radiation field of both types of currents is calculated and compared with the observation. J.M.S.

N80-21929*# Florida Univ., Gainesville. Dept. of Electrical Engineering.
CALCULATIONS OF LIGHTNING RETURN STROKE ELECTRIC AND MAGNETIC FIELDS ABOVE GROUND
M. A. Uman, Y. T. Lin, R. B. Standler, M. J. Master, and R. J. Fisher (Kaman Sciences Corp., Colo. Springs) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 21-28 refs (For primary document see N80-21927 12-47)
(Contracts N00014-75-C-0143; F33615-79-C-3412; Grant NSF ATM-76-01454)
Avail: NTIS HC A19/MF A01 CSCL 04B

A lightning return stroke model with which the two station electric and magnetic fields measured at ground level can be reproduced is used to compute fields at altitudes up to 10 km and at ranges from 20 m to 10 km. These calculations provide the first detailed estimates of the return strokes fields that are encountered by aircraft in flight. With the advent of modern aircraft utilizing low voltage digital electronics and reduced electromagnetic shielding by way of structures containing advanced composite materials, these calculations are of considerable practical interest. Further, since airborne electric and magnetic field measurements are presently being attempted, a comparison of the calculations presented with appropriate experimental data, when they are available, will constitute a test of the return stroke model. J.M.S.

N80-21930*# Arizona Univ., Tucson. Inst. of Atmospheric Physics.
SUBMICROSECOND RISETIMES IN LIGHTNING RADIATION FIELDS
C. D. Weidman and E. P. Krider *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 29-38 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Measurements of lightning electric fields, E, and dE/dt signatures were made near Tampa Bay, Florida, under conditions where the field propagation from the source to the detector was entirely over sea water. The fast transitions found on the initial portion of return stroke E waveforms have 10 to 90 percent risetimes ranging from 40 to 200 nsec, with a mean of 90 nsec. The maximum dE/dt values during these transitions range from 5 to 80 (V/m)microsec, with a mean of about 30 (V/m)microsec when normalized to a distance of 100 km. The initial risetimes of stepped-leader impulses that occur just prior to the first return

stroke in cloud-to-ground flashes are very similar to the fast transitions in return strokes. The dE/dt values during leader steps range from 10 to 40 (V/m)/microsec with a mean of 20 (V/m)/microsec when normalized to 100 km. The fast impulses superimposed on large-amplitude intracloud waveforms have E risetimes and dE/dt values similar to those of the leader steps. J.M.S.

N80-21931*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
MEASUREMENT OF ELECTROMAGNETIC PROPERTIES OF LIGHTNING WITH 10 NANOSECOND RESOLUTION
C. E. Baum, E. L. Breen, J. P. ONeill, C. B. Moore (New Mexico Inst. of Mining and Technology), and D. L. Hall *In* NASA Langley Res. Center Lightning Technol. Apr. 1980 p 39-83 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Electromagnetic data recorded from lightning strikes are presented. The data analysis reveals general characteristics of fast electromagnetic fields measured at the ground including rise times, amplitudes, and time patterns. A look at the electromagnetic structure of lightning shows that the shortest rise times in the vicinity of 30 ns are associated with leader leader streamers. Lightning location is based on electromagnetic field characteristics and is compared to a nearby sky camera. The fields from both leaders and return strokes were measured and are discussed. The data were obtained during 1978 and 1979 from lightning strikes occuring within 5 kilometers of an underground metal instrumentation room located on South Baldy peak near Langmuir Laboratory, New Mexico. The computer controlled instrumentation consisted of sensors previously used for measuring the nuclear electromagnetic pulse (EMP) and analog-digital recorders with 10 ns sampling, 256 levels of resolution, and 2 kilobytes of internal memory. J.M.S.

N80-21932*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
ELECTROMAGNETIC SENSORS FOR GENERAL LIGHTNING APPLICATION
Carl E. Baum, Edward L. Breen, John P. ONell, Charles B. Moore (New Mexico Inst. of Mining and Technology), and Gary D. Sower (Edgerton, Germeshausen and Grier, Inc., Albuquerque, N. Mex.) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 85-118 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Electromagnetic sensors for general lightning applications in measuring environment are discussed as well as system response to the environment. This includes electric and magnetic fields, surface current and charge densities, and currents on conductors. Many EMP sensors are directly applicable to lightning measurements, but there are some special cases of lightning measurements involving direct strikes which require special design considerations for the sensors. The sensors and instrumentation used by NMIMT in collecting data on lightning at South Baldy peak in central New Mexico during the 1978 and 1979 lightning seasons are also discussed. The Langmuir Laboratory facilities and details of the underground shielded instrumentation room and recording equipment are presented. J.M.S.

N80-21933*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPANDED INTERLEAVED SOLID-STATE MEMORY FOR A WIDE BANDWIDTH TRANSIENT WAVEFORM RECORDER
Robert M. Thomas, Jr. *In its* Lightning Technol. Apr. 1980 p 119-129 (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

An interleaved, solid state expanded memory for a 100 MHz bandwidth waveform recorder is described. The memory development resulted in a significant increase in the storage capacity of a commercially available recorder. The motivation for the memory expansion of the waveform recorder, which is used to support in-flight measurement of the electromagnetic characteristics of lightning discharges, was the need for a significantly longer data window than that provided by the commercially available unit. The expanded recorder provides a data window that is 128 times longer than the commercial unit, while maintaining the same time resolution, by increasing the storage capacity from 1024 to 131 072 data samples. The expanded unit operates at sample periods as small as 10 ns. Sampling once every 10 ns, the commercial unit records for about 10 microseconds before the memory is filled, whereas, the expanded unit records for about 1300 microseconds. A photo of the expanded waveform recorder is shown. J.M.S.

N80-21934*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BROADBAND ELECTROMAGNETIC SENSORS FOR AIRCRAFT LIGHTNING RESEARCH
Thomas F. Trost (Texas Technological Univ.) and Klaus P. Zaepfel *In its* Lightning Technol. Apr. 1980 p 131-152 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A set of electromagnetic sensors, or electrically-small antennas, is described. The sensors are designed for installation on an F-106 research aircraft for the measurement of electric and magnetic fields and currents during a lightning strike. The electric and magnetic field sensors mount on the aircraft skin. The current sensor mounts between the nose boom and the fuselage. The sensors are all on the order of 10 cm in size and should produce up to about 100 V for the estimated lightning fields. The basic designs are the same as those developed for nuclear electromagnetic pulse studies. The most important electrical parameters of the sensors are the sensitivity, or equivalent area, and the bandwidth (or rise time). Calibration of sensors with simple geometries is reliably accomplished by a geometric analysis; all the sensors discussed possess geometries for which the sensitivities have been calculated. For the calibration of sensors with more complex geometries and for general testing of all sensors, two transmission lines were constructed to transmit known pulsed fields and currents over the sensors. J.M.S.

N80-21935*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
AIRBORNE LIGHTNING CHARACTERIZATION
Robert K. Baum *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 153-171 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A WC-130 aircraft was instrumented with wideband electromagnetic field sensors and flown near active thunderstorms to obtain data on the characteristics of nearby and direct strike lightning. An electric field ground station and time-of-arrival network provided time correlated data to identify the three dimensional locations of the discharge and the different events in the lightning flash. A description of the sensors, calibration procedures, and recording equipment is presented. Data are presented on return stroke characteristics in the 5 to 50 km range. Author

N80-21936*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
MAGNETIC TAPE LIGHTNING CURRENT DETECTORS
Keith E. Crouch (Lightning Technology, Inc.) and William Jafferis *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 173-183 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Development and application tests of a low cost, passive, peak lightning current detector (LCD) found it to provide measurements with accuracies of + or - 5 percent to + or - 10 percent depending on the readout method employed. The LCD uses magnetic audio recording tape to sense the magnitude of the peak magnetic field around a conductor carrying lightning currents. The test results showed that the length of audio tape erased was linearly related to the peak simulated lightning currents in a round conductor. Accuracies of + or - 10 percent were shown for measurements made using a stopwatch readout technique to determine the amount of tape erased by the lightning current. Where more accurate data are desired, the tape is played and the output recorded on a strip chart, oscilloscope, or some other means so that measurements can be made on that recording. Conductor dimensions, tape holder dimensions, and tape formulation must also be considered to obtain a more accurate result. J.M.S.

N80-21937*# Southwest Research Inst., San Antonio, Tex.
A STUDY OF THE COMPARATIVE PERFORMANCE OF SIX LIGHTNING WARNING SYSTEMS

Richard L. Johnson, Donald E. Janota (Bureau of Mines, Pittsburgh), and J. Edmund Hay *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 187-203 refs (For primary document see N80-21927 12-47)
(Contract DI-BM-JO-387207)
Avail: NTIS HC A19/MF A01 CSCL 04B

An analysis of mining explosive accident reports indicates a need for clear and ample warning of approaching electrical storms to reduce injuries/fatalities due to lightning induced premature detonation. Six lightning warning devices were comparatively evaluated at three test sites. The devices tested were: (1) flash counter, (2) corona point, (3) radioactive probe, (4) field mill, (5) azimuth/range locator, and (6) triangulation locator. The test sites were chosen to provide system evaluation under varied thunderstorm conditions. The devices were tested at San Antonio, Texas, Kennedy Space Center, Florida and Langmuir Laboratory, New Mexico. Comparative performance is reviewed in terms of alarm reliability, false alarm, and failure to alarm probabilities. Lightning warning system requirements and methods of relating warning criteria to explosive hazard are discussed. J.M.S.

N80-21938*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN AUTOMATIC LOCATING SYSTEM FOR CLOUD-TO-GROUND LIGHTNING
E. Philip Krider (Lightning Location and Protection, Inc.), Alburt E. Pifer (Lightning Location and Protection, Inc.), and Martin A. Uman (Lightning Location and Protection, Inc.) *In its* Lightning Technol. Apr. 1980 p 205-214 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Automatic locating systems which respond to cloud to ground lightning and which discriminate against cloud discharges and background noise are described. Subsystems of the locating system, which include the direction finder and the position analyzer, are discussed. The direction finder senses the electromagnetic fields radiated by lightning on two orthogonal magnetic loop antennas and on a flat plate electric antenna. The position analyzer is a preprogrammed microcomputer system which automatically computes, maps, and records lightning locations in real time using data inputs from the direction finder. The use of the locating systems for wildfire management and fire weather forecasting is discussed. A.W.H.

N80-21939*# Bonn Univ. (West Germany). Radioastronomical Inst.
A NETWORK OF AUTOMATIC ATMOSPHERICS ANALYZER
Josef Schaefer, Hans Volland, Paul Ingmann, Andrew J. Eriksson (National Electrical Engineering Research Inst.), and G. Heydt (Heinrich-Hertz-Inst. fuer Nachrichten Technik, Berlin) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 215-225 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The design and function of an atmospheric analyzer which uses a computer are discussed. Mathematical models which show the method of measurement are presented. The data analysis and recording procedures of the analyzer are discussed. A.W.H.

N80-21940*# SRI International Corp., Menlo Park, Calif.
SHIELD TOPOLOGY IN LIGHTNING TRANSIENT CONTROL
E. F. Vance and F. M. Tesche (LuTech, Inc.) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 229-244 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A formalism in which the interaction of a system with an electromagnetic source is described by sets of scattering, penetrations, and propagation functions is reviewed and interpreted in the context of the lightning interaction problem. In this formalism, the system is decomposed into simple volumes separated by closed shield surfaces. These surfaces are nested and interconnected to produce higher levels of shielding and subvolumes within a given level. The interaction analysis uses scattering theory to define current and charge densities on the shield surface in conjunction with the diffusion, apertures, and transmission line analysis to define penetration through shield imperfections and propagation within the protected volume. Author

N80-21941*# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
THE SEM DESCRIPTION OF INTERACTION OF A TRANSIENT ELECTROMAGNETIC WAVE WITH AN OBJECT
L. Wilson Pearson and Donald R. Wilton (Mississippi Univ., University) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 245-263 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The singularity expansion method (SEM), proposed as a means for determining and representing the transient surface current density induced on a scatterer by a transient electromagnetic wave is described. The resulting mathematical description of the transient surface current on the object is discussed. The data required to represent the electromagnetic scattering properties of a given object are examined. Experimental methods which were developed for the determination of the SEM description are discussed. The feasibility of characterizing the surface current induced on aircraft flying in proximity to a lightning stroke by way of SEM is examined. A.W.H.

N80-21942*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
TRANSIENT CORONA EFFECTS ON A WIRE OVER THE GROUND
Kenneth C. Chen *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 265-281 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The nuclear EMP effect on VLF/trailing wire antennas is investigated in relation to new features of corona effects. Previous experimental results on transmission lines with corona under E $<$ 80 kV/cm recorded in the nanosecond time frame are analyzed. A nonlinear macroscopic model which describes a transmission line with corona is discussed. The model not only accounts for overall waveform, but also describes the sharp changes in the waveform associated with the corona onset. A.W.H.

N80-21943*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
SIMULATION OF ELECTROMAGNETIC ASPECTS OF LIGHTNING
Carl E. Baum *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 283-299 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Electromagnetic processes peculiar to the direct-strike case are reviewed with respect to their implications for lightning electromagnetic simulation. At low frequencies (quasistatic) there are important surface-charge-density and corona effects in addition to the surface-current-density effects. At resonant frequencies the frequency-spectral content of the excitation and properties of the arc (attachment, detachment, time history, spatial distribution, resistance, etc.) are significant. Of great complexity in all this are nonlinear aspects of the arc and corona around the system of interest. The complexity of these various processes requires rigor in the simulator design. Potential simulation concepts are presented and their relative merits are discussed. Author

N80-21944*# General Electric Co., Syracuse, N.Y. Semiconductor Products Dept.
A UNIVERSAL PROCEDURE FOR EVALUATION AND APPLICATION OF SURGE-PROTECTIVE DEVICES
In NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 303-325 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The source, nature, and frequency of occurrence of transients must be identified and a representative standard test wave chosen for proof testing. The performance of candidate suppressor devices then can be evaluated against the withstand goals set for the equipment. The various suppressors divide into two classes of generic behavior. The key to a universal procedure for evaluating both classes lies in representing transients as quasi-current sources of defined current impulse duration. The available surge current is established by the Thevenin equivalent transient voltage and source impedance. A load line drawn on the V-I characteristic graph of the suppressor quickly determines the clamping voltage

and peak current. These values then can be compared to the requirement. The deposited energy and average power dissipation for multiple transients also can be calculated. The method is illustrated with a design example for motor vehicle alternator load dump suppression. A.R.H.

N80-21945*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONDUCTIVE SURGE TESTING OF CIRCUITS AND SYSTEMS
Peter Richman (KeyTek Instrument Corp.) *In its* Lightning Technol. Apr. 1980 p 327-344 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Techniques are given for conductive surge testing of powered electronic equipment. The correct definitions of common and normal mode are presented. Testing requires not only spike-surge generators with a suitable range of open-circuit voltage and short-circuit current waveshapes, but also appropriate means, termed couplers, for connecting test surges to the equipment under test. Key among coupler design considerations is minimization of fail positives resulting from reduction in delivered surge energy due to the coupler. Back-filters and the lines on which they are necessary, are considered as well as ground-fault and ground potential rise. A method for monitoring delivered and resulting surge waves is mentioned. A.R.H.

N80-21946*# IIT Research Inst., Chicago, Ill.
RESPONSE OF SURGE PROTECTION DEVICES TO FAST RISING PULSES
I. N. Mindel *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 345-361 Sponsored by FAA (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Two types of lightning protection modules incorporating leadless (pill type) Zener like devices were evaluated with regard to their ability to suppress EMP induced transients. Two series of tests were performed to evaluate the ability of these modules to react to fast rate of rise (> 1Kv/ns) transients, and the attenuation introduced and the ability to limit damped sinusoid pulses which may be induced due to an EMP resulting from a nuclear detonation. Author

N80-21947*# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
DIRECT EFFECTS OF LIGHTNING ON AN AIRCRAFT DURING INTENTIONAL PENETRATIONS OF THUNDERSTORMS
Dennis J. Musil and John Prodan *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 363-370 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

An armored T-28 aircraft was struck by lightning on two different days while participating in the 1979 severe environmental storm and mesoscale experiment in Oklahoma. The T-28, which is specially armored and instrumented, was making intentional penetrations of thunderstorms and was struck twice on 30 May and once on 5 June. Various degrees of damage, mainly in the form of large burn spots and holes, resulted to the aircraft. Author

N80-21948*# Electro Magnetic Applications, Inc., Albuquerque, N. Mex.
STATE-OF-THE-ART METHODS FOR COMPUTING THE ELECTROMAGNETIC INTERACTION OF LIGHTNING WITH AIRCRAFT
F. J. Eriksen, R. A. Perala, and John C. Corbin, Jr. (Wright-Patterson AFB, Ohio) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 371-391 refs (For primary document see N80-21927 12-47)
(Contract F33615-79-C-3412)
Avail: NTIS HC A19/MF A01 CSCL 04B

Nuclear electromagnetic pulse (NEMP) coupling codes and methods are evaluated and summarized. The differences between NEMP and lightning interaction with aircraft are discussed and critical parameters peculiar to lightning are examined. R.E.S.

N80-21949*# McDonnell Aircraft Co., St. Louis, Mo.
ANOTHER LOOK AT AIRCRAFT-TRIGGERED LIGHTNING
D. W. Clifford *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 393-416 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04/2

There is positive evidence that a rapidly moving aircraft charged to high potentials by triboelectric processes can trigger lightning discharges by passage through freezing precipitation. The freezing zone in a nonstormy rain cloud is shown to be an electrically volatile region because of the potent charge exchange mechanisms which are active in agitated mixtures of supercooled water droplet and ice. Several intensifying effects are suggested which can be produced by the passage of an aircraft through this precipitation, resulting in a highly-ionized wake which acts like a trailing conductor. If weak charge centers are present in the cloud, the ionized wake acts to short out the gradient field resulting in very high potentials at the aircraft. The high potentials explain the electrical activity at the aircraft described by pilots, including intense corona, sparks and radio interference terminating in a loud discharge. Lightning strikes to naval aircraft towing gunnery targets at the end of long steel cables are described, showing that the same triggering mechanism may be involved in those cases. Recommendations are made to include triggering experiments in government flight programs now in progress. Author

N80-21950*# Northrop Corp., Hawthorne, Calif. Aircraft Group.
F-5F SHARK NOSE RADOME LIGHTNING TEST
George W. Scott *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 421-429 refs Sponsored by Air Force (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A unique F-5F radome wtih a geometry similar to a Shark Nose profile was tested with a high voltage Marx generator, 1,200,000 volts in order to demonstrate the effectiveness of the lightning protection system with currents from 5,000 amperes or greater. An edge discontinuity configuration is a characteristic feature in the forward region of the radome and occasionally serves as an attachment point. The results of nineteen attachment tests at various aspect angles with an air gap of one meter indicated that no damage occurred to the dielectric material of the radom. The test proved the effectiveness of the lightning protection system. R.E.S.

N80-21951*# Lightning and Transients Research Inst., Minneapolis, Minn.
ANALYSIS AND MEASUREMENTS OF LOW FREQUENCY LIGHTNING COMPONENT PENETRATION THROUGH AEROSPACE VEHICLE METAL AND GRAPHITE SKINS
John D. Robb and Ta Chen (Texas Instruments, Inc.) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 431-448 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

An analysis of the shielding properties of mixed metal and graphite composite structures has illustrated some important aspects of electromagnetic field penetration into the interior. These include: (1) that graphite access doors on metallic structures will attenuate lightning magnetic fields very little; conversely, metal doors on a graphite structure will also attenuate fields from lightning strike currents very little, i.e., homogeneity of the shield is a critical factor in shielding and (2) that continuous conductors between two points inside a graphite skin such as an air data probe metallic tubing connection to an air data computer can allow large current penetrations into a vehicle interior. The true weight savings resulting from the use of composite materials can only be evaluated after the resulting electromagnetic problems such as current penetrations have been solved, and this generally requires weight addition in the form of cable shields, conductor bonding or external metallization. Author

N80-21952*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
FULL SCALE LIGHTNING TEST TECHNIQUE
Lawrence C. Walko and John G. Schneider (Technology/Scientific Service, Inc.) *In* NASA. Langley Res. Center Lightning Technol.

Apr. 1980 p 449-450 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A test technique was developed for applying a full scale mean value (30 kiloampere peak) simulated lightning return stroke current on a complete flight ready aircraft to assess the threat of lightning to aircraft electrical circuits. A computer-aided generator design was used to establish the parameters of the test system. Data from previous work done on development of low inductance current paths determined the basic system configuration. R.E.S.

N80-21953*# Engineering Analysis, Inc., Huntsville, Ala.
VERIFICATION OF INTERIM SIMULATED ATMOSPHERIC TURBULENCE Final Report
Frank B. Tatom and S. Ray Smith 10 Mar. 1980 24 p refs (Contract NAS8-33714)
(NASA-CR-161432; EAI-TR-80-001) Avail: NTIS HC A02/MF A01 CSCL 04B

During horizontal and near-horizontal flight of the space shuttle orbiter, the effects of atmospheric turbulence on the vehicle are crucial in establishing the space shuttle design, control, and human pilot effects. The effects of both turbulent gusts and gust gradients (shears) must be taken into account. By means of a nonrecursive turbulence simulation model, twelve simulated turbulence time series for gusts and gust gradients were generated as part of a previous investigation. The current investigation was concerned with the spectral analysis of the time series based on the use of Fourier transform theory. A comparison between the computed spectra and the corresponding von Karman theoretical spectra is also included. A basic difference is explained between the computed and theoretical spectra which was identified as a result of the comparison. Conclusions and recommendations are presented. F.O.S.

N80-21954# Naval Environmental Prediction Research Facility, Monterey, Calif.
A USE OF TIME SERIES IN IMPROVING WEATHER FORECASTING Final Report
Frank D. Faulkner, Craig Comstock, and Robert R. Fossum Nov. 1979 27 p refs
(WF52551792)
(AD-A080056; NEPRF-CR-79-07) Avail: NTIS HC A03/MF A01 CSCL 04/2

Given the assumption that weather can be predicted more effectively by integrating the dynamic equations(s) than by examining trends, the question investigated here is whether time series can be used in the secondary routine to effect improvement. The method is described, the relevant equations are derived, a program using real meteorological data is made and run, and a measure of effectiveness is given. Limited study shows some definite promise. GRA

N80-21955# SRI International Corp., Menlo Park, Calif.
ESTIMATION OF WIND CHARACTERISTICS AT POTENTIAL WIND ENERGY CONVERSION SITES
Oct. 1979 149 p refs Prepared for Battelle Pacific Northwest Lab., Sequim, Wash.
(Contract EY-76-C-06-1830)
(PNL-3074) Avail: NTIS HC A07/MF A01

The development and application of a method for determining wind characteristics at candidate wind energy conversion sites where no available historical data exists are described. The method uses a mass consistent wind flow model (COMPLEX) to interpolate between stations where wind data are available. The COMPLEX model incorporates the effects of terrain features and airflow. The procedure requires acquisition and merger of wind data from three to five stations, application of COMPLEX to each of the seven to eleven eigenvectors, reconstruction of the hourly interpolated winds at the site from the eigenvector solutions, and estimating the wind characteristics from the simulated hourly values. Possible improvements to the procedure are discussed. DOE

N80-21956# Eurosat S.A., Geneva (Switzerland).
STUDY OF POTENTIAL BENEFITS FROM A EUROPEAN METEOROLOGICAL SPACE PROGRAM Final Report
J. B. Lagarde, B. Exartier, C. Miller, and J. Moscarola Aug. 1979 270 p refs
(Contract ESA-3802/78-F-FC(SC))
(JBL/PR/4462; ESA-CR(P)-1282) Avail: NTIS HC A12/MF A01

The technical benefits from a Eureopean meteorological space program (improved meteorological products) and the economic benefits resulting from expected forecast improvements were studied. The impact of this new facility on the generation of improved meteorological products has proved to be difficult to quantify. Improvement figures - twice higher in Africa/Middle East than in Europe - were produced. A sampling and extrapolation method was developed in order to evaluate the influence of improved weather predictions on the major economic activities, with agriculture and construction surveyed in detail. The benefits derived exceed the projected cost of the European meteorological space program by a factor of the order of 16, for all economic sectors in Europe/Africa/Middle East, over the period 1979 to 1990. Agriculture and construction, taken together, represent 2/3 of these benefits. Author (ESA)

N80-21957# Texas Dept. of Water Resources, Austin.
THE ECONOMIC EFFECTS OF WEATHER MODIFICATION ACTIVITIES. PART 3: IRRIGATED AND DRYLAND AGRICULTURE WITH ESTIMATES OF PRODUCTION, EMPLOYMENT, AND INCOME EFFECTS ON THE AREA ECONOMY Final Report
Mike Kengla, Roy Morey, Jim Hull, and Herbert W. Grubb Aug. 1979 64 p refs
(Contract DI-14-06-D-7587)
(PB80-118904; TDWR/LP-21) Avail: NTIS HC A04/MF A01 CSCL 02B

The potential effects that additional precipitation from weather modification through cloud seeding in the Big Spring-Synder, Texas area could be expected to have on irrigated farming, and the subsequent nonfarm economic impact on the region were studied. A regional input-output model is used to estimate the economy side effects of additional rainfall. GRA

N80-21800# National Environmental Satellite Service, Washington, D. C.
METEOROLOGICAL SATELLITES: STATUS AND OUTLOOK
D. S. Johnson *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 3-14 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21801# Hydrometeorological Centre of the USSR (Moscow).
APPLICATIONS OF SATELLITES IN HYDROMETEOROLOGY
I. P. Vetlov *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 15-28 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21802# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
SATELLITE DATA FOR WEATHER ANALYSIS AND PREDICTION
B. Bizzari *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 31-42 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21803# Freie Univ., Berlin (West Germany). Inst. fuer Meteorology.
SYNOPTIC SCALE SYSTEMS AS VIEWED FROM SPACE
M. Eckardt *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 31-42 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21804# Deutscher Wetterdienst, Offenbach am Main (West Germany).
SUBSYNOPTIC SCALE SYSTEMS AS VIEWED FROM SPACE
G. Steinhorst *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 53-63 refs (For primary document see N80-21799

12-42)
Avail: NTIS HC A12/MF A01

N80-21805# European Space Operations Center, Darmstadt (West Germany).
OPERATIONAL PRODUCTION OF CLOUD MOTION VECTORS (SATELLITE WINDS) FROM METEOSAT IMAGE DATA
R. A. Bowen, L. Fusco, J. Morgan, and K. O. Roeska *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 65-75 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21806# Meteorological Office, Bracknell (England).
QUANTITATIVE ANALYSIS OF RADIANCE DATA
D. E. Miller *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 77-83 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21807# European Space Agency, Paris (France).
PROBLEMS OF USING SATELLITE INFORMATION IN NUMERICAL WEATHER PREDICTION
L. Bengtsson (European Centre for Medium Range Weather Forecasts) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 87-100 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21808# Etablissement d'Etudes et de Recherches Meteorologiques, Paris (France).
QUANTITATIVE EVALUATION OF METEOSAT WIND MEASUREMENT [EVALUATION QUANTIATIVE DES MESURES DE VENT METEOSAT]
F. R. Cayla *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 101-104 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21809# National Meteorological Center, Washington, D. C.
THE IMPACT OF SATELLITE SOUNDINGS UPON NUMERICAL ANALYSIS AND PREDICTION: THE NMC EXPERIENCE
M. S. Tracton *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 105-112 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21810# Swedish Meteorological and Hydrological Inst., Norkoeping.
IMPACT OF SATELLITE INFORMATION ON SHORT RANGE NUMERICAL FORECASTS
N. Gustafsson *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 113-127 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21811# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorology.
CLIMATE RESEARCH WITH SATELLITE DATA
E. Raschke *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 113-127 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-21958# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
DATA FROM OTEC SITE CHARACTERIZATION STUDIES IN THE GULF OF MEXICO AND TROPICAL SOUTH ATLANTIC
Robert L. Molinari, John B. Hazelworth, and Donald A. Ortman Sep. 1979 266 p refs
(PB80-120595; NOAA-79103001; NOAA-TM-ERL-AOML-39)
Avail: NTIS HC A12/MF A01 CSCL 08J

Data collected at the Mobile site and west of Tampa, Florida, and in the tropical South Atlantic are presented. The data was analyzed and the data reduction techniques are given. Tables, lists, and graphs are used to present the information. GRA

N80-21819# European Space Agency, Paris (France).
SEA SURFACE TEMPERATURE ANOMALY MAPPING USING THE NOAA SATELLITES
M. Albuisson (Ecole des Mines, Valbonne, France), J. M. Monget (Ecole des Mines Valbonne, France), and G. Nihous (Ecole des Mines, Valbonne, France) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 201-204 refs Sponsored by Centre Natl. d'Eploitation des Oceans (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21820# Institute of Oceanographic Sciences, Wormley (England).
MONITORING THE SEA SURFACE
T. D. Allan *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 205-215 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-21959*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF IMMOBILIZATION STRESS ON THE LEVEL OF MACROERGIC PHOSPHATES IN THE BLOOD OF RATS
V. I. Pudov and V. A. Sosenkov Mar. 1980 7 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 5, 1977 p 73-75 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76021) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of immobilization for 1, 2, and 24 hours, and of daily (for 2 hours for 7 days) immobilization on the blood nucleotide (ATP, ADP, AMP) level was studied on 79 male rats. A progressive reduction of the ATP content was most pronounced in immobilization for 24 hours. This was accompanied by an increase of lymphopenia and eosinopenia. A fall of the relative weight of the thymus and a weight gain of the adrenal glands was observed along with a reduction of ascorbic acid concentration in both of them. In case of daily immobilization for 2 hours, the ATP and ADP content on the 1st and 2nd day was below the normal level, and then showed a gradual increase, with complete normalization in 6-7 days, except for inorganic phosphorus the level of which remained lower than normal. R.E.S.

N80-21960*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF TRANQUILIZERS ON ANIMAL RESISTANCE TO THE ADEQUATE STIMULI OF THE VESTIBULAR APPARATUS
Ya. B. Maksimovich and N. V. Khinchikashvili Mar. 1980 9 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 42, no. 6, Jun. 1979 p 606-610 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76109) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of tranquilizers on vestibulospinal reflexes and motor activity was studied in 900 centrifuged albino mice. Actometric studies have shown that the tranquilizers have a group capacity for increasing animal resistance to the action of adequate stimuli to the vestibular apparatus. Author

N80-21961*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF IMMOBILIZATION ON ARTICULAR CARTILAGE: AUTOHISTORADIOGRAPHIC FINDINGS WITH S35
C. DiGiovanni and E. deSantis Mar. 1980 33 p refs Transl. into ENGLISH from Arch. Putti Chir. Organi Movimento (Italy), v. 28, 1977 p 23-47 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Catholic Univ., Rome
(Contract NASw-3199)
(NASA-TM-76070) Avail: NTIS HC A03/MF A01 CSCL 06C

The effect of immobilization on the articular cartilage of rabbits was studied by light microscope. The knee joint of each rabbit was immobilized in a plaster in a position midway between flexion and extension for a 10 to 120 days period. Degenerative changes in the articular cartilage of increasing severity were observed. The fixation of the labeled SO4 by cartilage cells was decreased in advanced immobilization. R.E.S.

N80-21962*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF THE EFFECT OF SPACE FLIGHT FACTORS ON CHROMOSOMES IN SEEDS
L. G. Dubinina Mar. 1980 4 p Transl. into ENGLISH from the book "Issledovaniya Deystiviya Faktorov Kosmicheskogo Poleta na Khromosomy i Semenakh" Moscow, Nauka Press, 1978 p 106-107 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76113) Avail: NTIS HC A02/MF A01 CSCL 06C

Frequency of mutations in postflight air-dry Crepis capillaris seeds, kept for five days aboard an artificial satellite was 36.0 + or - 1.9%, vs. 19.01 + or - 1.2% for seeds in a similar ground experiment. Both groups of seeds were prepared in identical concentrations and were treated by the same mutagen. The spectrum of mutations in postflight Crepis capillaris seeds contained a large number of chromosome-type mutations and some cells showed multiple alterations. Postflight seeds not treated with mutagens had a slightly higher level of mutability. R.E.S.

N80-21963*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF MOTOR PATTERNS ON WATER-SOLUBLE AND MEMBRANE PROTEINS AND CHOLINESTERASE ACTIVITY IN SUBCELLULAR FRACTIONS OF RAT BRAIN TISSUE
L. Z. Pevzner, L. Venkov, and L. Cheresharov Apr. 1980 9 p refs Transl. into ENGLISH from Ukr. Biokhim. Zh. (USSR), v. 50, no. 1, 1978 p 20-24 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Acad. of Sci., Leningrad and Bulgarian Acad. of Sci., Sofia
(Contract NASw-3198)
(NASA-TM-76115) Avail: NTIS HC A02/MF A01 CSCL 06C

Albino rats were kept for a year under conditions of daily motor load or constant hypokinesia. An increase in motor activity results in a rise in the acetylcholinesterase activity determined in the synaptosomal and purified mitochondrial fractions while hypokinesia induces a pronounced decrease in this enzyme activity. The butyrylcholinesterase activity somewhat decreases in the synaptosomal fraction after hypokinesia but does not change under the motor load pattern. Motor load causes an increase in the amount of synaptosomal water-soluble proteins possessing an intermediate electrophoretic mobility and seem to correspond to the brain-specific protein 14-3-2. In the synaptosomal fraction the amount of membrane proteins with a low electrophoretic mobility and with the cholinesterase activity rises. Hypokinesia, on the contrary, decreases the amount of these membrane proteins. Author

N80-21964*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECTS OF RESTRAINT ON UPTAKE OF RADIOACTIVE SULFATE IN THE SALIVARY AND GASTRIC SECRETIONS OF RATS WITH PYLORIC LIGATION
J. A. Chayvialle, R. Lambert, and D. Ruet Mar. 1980 9 p refs Transl. into ENGLISH from Comt. Rend. Soc. Biol. (France), v. 166, no. 1, 1978 p 114-118 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76073) Avail: NTIS HC A02/MF A01 CSCL 06C

The effects of restraint on the amount of nondialysable radioactive sulfate in the gastric wall and the gastric juice and saliva were investigated. It was found that restraint provokes a significant decrease in salivary radioactive sulfate. This, in turn, is responsible for the decrease of sulfate in the gastric contents observed under these conditions in rats with pyloric ligation. Esophageal ligation associated with this prevents passage of saliva and lowers the amount of radioactive sulfate in the gastric juice. Restraint causes then an increase in the amount of sulfate in the gastric juice, the value observed being very much lower than that of rats with a free esophagus. At the level of the gastric wall, the change observed during restraint does not reach a significant threshold. R.E.S.

N80-21965*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF SCENEDESMUS ACUMINATUS GREEN ALGAE EXTRACTS ON THE DEVELOPMENT OF CANDIDA LIPOLYTIC YEAST IN GAS CONDENSATE-CONTAINING MEDIA
B. I. Bilmes, G. A. Kasymova, V. I. Runov, and N. N. Karavayeva Mar. 1980 7 p refs Transl. into ENGLISH from Uzh. Biol. Zh. (USSR), no. 4, Apr. 1979 p 12-14 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76081) Avail: NTIS HC A02/MF A01 CSCL 06C

Data are given of a comparative study of the growth and development as well as the characteristics of the biomass of the C. Lipolytica yeast according to the content of raw protein, protein, lipids, vitamins in the B group, and residual hydrocarbons during growth in media with de-aromatized gas-condensate FNZ as the carbon source with aqueous and alcohol extracts of S. acuminatus as the biostimulants. It is shown that the decoction and aqueous extract of green algae has the most intensive stimulating effect on the yeast growth. When a decoction of algae is added to the medium, the content of residual hydrocarbons in the biomass of C. lipolytica yeast is reduced by 4%; the quantity of protein, lipids, thamine and inositol with replacement of the yeast autolysate by the decoction of algae is altered little. Author

N80-21966*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES OF GAS METABOLISM, GAS HOMEOSTASIS AND TISSUE RESPIRATION IN RATS DURING PROLONGED HYPOKINESIA
V. L. Popkov, E. S. Mailyan, Yu. S. Galusko, Ye. A. Kovalenko, Ye. I. Zaytseva, I. A. Nitochkina, L. V. Stulova, and A. F. Ryazhskiy Dec. 1979 10 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 66, no. 12, 1970, p 1808-1812
(Contract NASw-3198)
(NASA-TM-75982) Avail: NTIS HC A02/MF A01 CSCL 06C

The oxygen uptake and tissue gas homeostasis of restrained albinic rats remained relatively constant during a 60 day experiment. The gas metabolism in some tissues changed, and O2 consumption increased in the liver and decreased in the myocardium. Capacity for physical work was reduced by five times. Hypokinesia for 60 days resulted in a delay in the animals growth. Author

N80-21967*# National Aeronautics and Space Administration, Washington, D. C.
CONTENT OF LIPIDS IN BLOOD AND TISSUES OF ANIMALS DURING HYPODYNAMIA
I. V. Federov, Yu. P. Rylnikov, and T. M. Lobova Jan. 1980 11 p refs Transl. into ENGLISH from Kardiologiya (USSR), v. 13, no. 7, 1973 p 50-54 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76023) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments on 97 rats and 50 rabbits were undertaken to study the influence of hypodynamia on the lipid content in the blood, liver, heart, and in the aorta. Reduction of muscular activity contributed to the increase of cholesterol and beta lipoprotein levels in the blood and to accumulation of cholesterol in the liver and the heart. The total lipid content in these tissues decreased. In the aorta the total lipid content increased, while lecithin and cephalin figures went down. The character of biochemical changes in hypodynamia resembles in many ways the lipid metabolism changes in atherosclerosis. Author

N80-21968*# National Aeronautics and Space Administration, Washington, D. C.
METABOLISM AND ACTIVITY OF ZOXAZOLAMINE IN WHITE RATS DURING FORCED IMMOBILIZATION WITH AND WITHOUT HYPERTHERMIA
L. Buchel and M. Murawsky. Mar. 1980. 24 p. refs. Transl. into ENGLISH from Arch. Sci. Physiol. (France), v. 27, 1973 p. 37-53. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76074) Avail: NTIS HC A02/MF A01 CSCL 06C
The influence of restraint of rats held either at normal body temperature or at lowered body temperature as related to the effects of the muscle relaxant zoxazolamine was studied. The techniques used and experimental results obtained are presented. R.C.T.

N80-21969# Drexel Univ., Philadelphia, Pa. Dept. of Chemistry.
PHYSICAL AND CHEMICAL STUDIES OF CHLOROPHYLL IN MICROEMULSIONS. Progress Report
Raymond A. Mackay. 1979. 22 p. refs.
(Contract EG-77-S-02-4452)
(COO-4452-001) Avail: NTIS HC A02/MF A01
Initial studies were designed to provide fundamental information on both the nature of photoreactions in microemulsions and the utility of these media as solvents for absorbers of solar energy. As a test system, the photoreduction of absorbed dye (methyl red and crystal violet) sensitized by chlorophyll a in an anionic mineral oil in water microemulsion was studied. Using ascorbate as the water soluble reducing agent and pigment concentrations of less than one per drop, the reaction exhibits a pseudo first order dependence on crystal violet, but a pseudo zero order dependence on methyl red. The effect of sensitizer, ascorbate concentration, and light intensity on the quantum yield was also examined. These studies were then extended to include concentrated chlorophyll solutions, microemulsions of varying charge type, product catalysis and synthetic porphyrins. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation, and weightlessness.

N80-21970* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: CUMULATIVE INDEX, 1979
Jan. 1980. 355 p.
(NASA-SP-7011(202)) Avail: NTIS HC $11.00 CSCL 06E
This publication is a cumulative index to the abstracts contained in the Supplements 190 through 201 of 'Aerospace Medicine and Biology: A Continuing Bibliography.' It includes three indexes-subject, personal author, and corporate source. Author

N80-21971*# National Aeronautics and Space Administration, Washington, D. C.
AGE RELATED CHANGES IN THE BONE TISSUE UNDER CONDITIONS OF HYPOKINESIA
E. P. Podrushnyak and E. I. Suslov. Apr. 1980. 7 p. refs. Transl. into ENGLISH from Fiziol. Zh. (USSR), v. 9, no. 6, Nov. - Dec. 1973 p. 841-843. Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by USSR Academy of Medical Sciences, Kiev.
(Contract NASw-3199)
(NASA-TM-76019) Avail: NTIS HC A02/MF A01 CSCL 06S
Microroentgenography of nine young people, aged 24-29, before and after hypokinesia (16-37 days strict bed rest), showed that the heel bone density of those with initially high bone density generally decreased and that of those with initially low bone density generally increased. X-ray structural analysis of the femurs of 25 corpses of accidentally killed healthy people, aged 18-70, data are presented and discussed, with the conclusion that the bone hydroxyapatite crystal structure stabilizes by ages 20 to 25, is stable from ages 25 to 60 and decreases in density after age 60. It is concluded that bone tissue structure changes, both with age, and in a comparatively short time in hypokinesia. Author

N80-21972*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
DEVELOPMENT OF A STEREOFLUOROSCOPY SYSTEM. Final Report
D. B. Rivers. Oct. 1979. 30 p. refs.
(Contract NAS9-15287)
(NASA-CR-160568) Avail: NTIS HC A03/MF A01 CSCL 06B
A technique of 3-D video imaging, was developed for use on manned missions for observation and control of remote manipulators. An improved medical diagnostic fluoroscope with a stereo, real-time output was also developed. An explanation of how this system works, and recommendations for future work in this area are presented. R.C.T.

N80-21973*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF SYREPAR AND OXAPHENAMIDE ON LIVER FUNCTION IN EXPERIMENTAL HYPOKINESIA
L. N. Skakun. Jan. 1980. 9 p. refs. Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 41, no. 4, Jun. - Aug. 1978 p. 465-469. Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Ternopol Medical Inst., USSR.
(Contract NASw-3198)
(NASA-TM-76011) Avail: NTIS HC A02/MF A01 CSCL 06S
Experiments on albino rats showed that 30 day hypokinesia changes the reaction of the liver to cholagogues. The choleretic action of oxaphenamide as well as its inhibitory effect on synthesis of bile acids diminishes, while the influence of bilirubin secretion increases. Author

N80-21974*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF HYPERBARIC OXYGENATION ON CARBOHYDRATE METABOLISM PROTEIN SYNTHESIS IN THE MYOCARDIUM DURING SUSTAINED HYPODYNAMIA
G. A. Makarov. Jan. 1980. 9 p. refs. Transl. into ENGLISH from Kardiologiya (USSR), v. 14, no. 2, 1974 p. 73-77. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(NASA-TM-76012) Avail: NTIS HC A02/MF A01 CSCL 06S
Glycolysis and the intensity of protein synthesis were studied in 140 white male rats in subcellular fractions of the myocardium during 45 day hypodynamia and hyperbaric oxygenation. Hypodynamia increased: (1) the amount of lactic acids; (2) the amount of pyruvic acid; (3) the lactate/pyruvate coefficient; and (4) the activities of aldolase and lactate dehydrogenase. Hyperbaric oxygenation was found to have a favorable metabolic effect on the animals with hypodynamia. R.E.S.

N80-21975*# National Aeronautics and Space Administration, Washington, D. C.
RELIABILITY AND INFORMATION CONTENT OF TESTS WITH CARDIOLEADER IN CYCLIC TYPES OF SPORTS
V. L. Utkin. Mar. 1980. 11 p. refs. Transl. into ENGLISH from Teor. Prakt. Fiz. Kultury (USSR), no. 5, May 1979 p. 10-14. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76090) Avail: NTIS HC A02/MF A01 CSCL 06S

Tests with cardioleader to control the physical, technical and tactical preparedness of athletes in cyclic types of sports are discussed. Ways of increasing the reliability and information content of the tests were studied. R.E.S.

N80-21976*# National Aeronautics and Space Administration, Washington, D. C.
PRESERVATION OF EQUILIBRIUM IN ORTHOGRADE AND INVERTED BODY POSITIONS
L. P. Semenov and N. A. Rebyakova Mar. 1980 6 p Transl. into ENGLISH from Teor. Prakt. Fiz. Kulture (USSR), no. 5 May 1979 p 29-30 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76112) Avail: NTIS HC A02/MF A01 CSCL 06S

The mechanism for regulation of the vertical pose with retention of equilibrium in the inverted body position was investigated. R.E.S.

N80-21977*# National Aeronautics and Space Administration, Washington, D. C.
HAZARDS OF HIGH ALTITUDE DECOMPRESSION SICKNESS DURING FALLS IN BAROMETRIC PRESSURE FROM 1 ATM TO A FRACTION THEREOF
A. M. Genin Jan. 1980 10 p Transl. into ENGLISH of Conf. Paper from Inst. of Med. and Biol. Problems, Min. of Health, Moscow, 1979 p 1-12 Presented at 10th Conf. of Joint Soviet-Am. Working Group on Space Biol. and Med., Houston, Tex., Oct. 1979 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76015) Avail: NTIS HC A02/MF A01 CSCL 06S

Various tests related to studies concerning the effects of decompression sicknesses at varying pressure levels and physical activity are described. The tests indicate that there are no guarantees of freedom from decompression sicknesses when man transitions from a normally oxygenated normobaric nitrogen-oxygen atmosphere into an environment having a 0.4 atm or lower pressure and he is performing physical work. R.E.S.

N80-21978*# National Aeronautics and Space Administration, Washington, D. C.
MAIN TRENDS IN EXPERIMENTAL MORPHOLOGICAL RESEARCH IN ANGIOLOGY AND OUTLOOK FOR ITS DEVELOPMENT
N. A. Dzhevakhishvili and Ye. P. Melman Jan. 1980 10 p Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (USSR), v. 66, no. 2, 1970 p 21-25 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75980) Avail: NTIS HC A02/MF A01 CSCL 06E

The main prospective trends in the problem of collateral circulation and new trends in experimental angiology with respect to the effect of gravitational forces, hypodynamia and hypokinesia on the vascular bed are discussed. Author

N80-21979# Coast Guard Research and Development Center, Groton, Conn.
MARINE TRAFFIC DATA OF CHICAGO, ILLINOIS AND SOUTH SHORE OF LAKE MICHIGAN Final Report
J. J. Cherny, III, R. A. Silva, M. R. Young, and R. H. Charters Sep. 1979 118 p
(AD-A080060; CGR/DC-18/79) Avail: NTIS HC A06/MF A01 CSCL 15/5

Data was collected on the marine traffic and VHF-FM marine communications channel usage at Calumet Harbor, Chicago Harbor, and Lamont, Illinois, at the junction of the Chicago Sanitary and Ship Canal and Calumet-Seg Channel. The daily average of marine traffic, including large, medium, small and anchored vessels, and tugs-in-tow, transiting the Calumet Harbor/Indiana Harbor area is 48 and transiting Chicago Harbor is 312. The daily average of tug/barge and small vessel transits on the Chicago Sanitary and Ship Canal is 30; the Calumet-Seg Channel is 11. Approximately 300 hours of communications of VHF-FM Channel 16 and 150 hours of VHF-FM Channel 13 were recorded and monitored to determine channel efficiency (i.e., percentage of valid messages) and utilization. Channel 16 efficiency at Calumet Harbor is 47.76%; at Chicago Harbor, 66.50%; and at Lamont, 64.72%. R.E.S.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering, biotechnology, and space suits and protective clothing.

N80-21980*# Mitre Corp., Houston, Tex.
THE CREW ACTIVITY PLANNING SYSTEM BUS INTERFACE UNIT
M. A. Allen Dec. 1979 269 p refs
(Contract F19628-80-C-0001)
(NASA-CR-160566; MTR-473; JSC-18321) Avail: NTIS HC A12/MF A01 CSCL 05/4

The hardware and software designs used to implement a high speed parallel communications interface to the MITRE 307.2 kilobit/second serial bus communications system are described. The primary topic is the development of the bus interface unit. R.C.T.

N80-21981*# Life Systems, Inc., Cleveland, Ohio
TESTING EVALUATION OF THE ELECTROCHEMICAL ORGANIC CONTENT ANALYZER Final Report
R. J. Davenport Nov. 1979 69 p refs
(Contract NAS9-15402)
(NASA-CR-160569; LSI-TR-334-4) Avail: NTIS HC A04/MF A01 CSCL 06K

The breadboard electrochemical organic content analyzer was evaluated for aerospace applications. An awareness of the disadvantages of expendables in some systems resulted in an effort to investigate ways of reducing the consumption of the analyzer's electrolyte from the rate of 5.17 kg/30 days. It was found that the electrochemical organic content analyzer can result in an organic monitor in the water quality monitor having a range of 0.1 to 100 mg/1 total organic carbon for a large number of common organic solutes. In a flight version it is anticipated the analyzer would occupy .0002 cu m, weigh 1.4 kg, and require 10 W or less of power. With the optimum method of injecting electrolyte into the sample (saturation of the sample with a salt) it would expend only 0.04 kg of electrolyte during 30 days of continuous operation. R.E.S.

N80-21982*# Texas A&M Univ., College Station. Adriance Lab.
THE EFFECT OF VARIETY AND MATURITY ON THE QUALITY OF FREEZE-DRIED CARROTS. THE EFFECT OF MICROWAVE BLANCHING ON THE NUTRITIONAL AND TEXTURAL QUALITY OF FREEZE-DRIED SPINACH Final Report
1979 131 p refs
(Contract NAS9-12434)
(NASA-CR-160567) Avail: NTIS HC A07/MF A01 CSCL 06H

Using carrots, the quality of freeze-dried products was studied to determine the optimum varieties and maturation stages for quality attributes such as appearance, flavor, texture, and nutritive value. The quality of freeze-dried carrots is discussed in terms of Gardner color, alcohol insoluble solids, viscosity, and core/cortex ratio. Also, microwave blanching of freeze-dried spinach was

studied to determine vitamin interrelationships, anatomical changes, and oxidative deteriorations in terms of preprocessing microwave treatments. Statistical methods were employed in the gathering of data and interpretation of results in both studies. R.E.S.

N80-21983*# National Aeronautics and Space Administration, Washington, D. C.
PRINCIPLES FOR CLASSIFICATION OF WORK LOAD FOR WOMEN
A. O. Navakatikyan, A. P. Dibromenko, A. N. Karakashyan, and V. A. Buzunov Mar. 1980 9 p refs Transl. into ENGLISH from Gig. Tr. Prof. Zabol. (USSR), no. 2, Jul. 1979 p 10-14 Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-76084) Avail: NTIS HC A02/MF A01 CSCL 05H

In an attempt to develop guidelines for classification by degree of intensity of various kinds of physical work performed by women, the effects of different work loads on women as compared to men were studied under industrial and experimental conditions, including response of the cardiovascular and respiratory systems to specified physical exercises of increasing intensity. Physiological criteria for assessing female labor in terms of intensity are proposed. Author

N80-21984# Andrulis Research Corp., Bethesda, Md.
A STUDY OF AGENT-REACTIVE FABRICS FOR USE IN PROTECTIVE CLOTHING Final Report, May 1978 - Jul. 1979
Gerald Zon Dec. 1979 114 p refs
(Contract DAAK11-78-C-0060)
(AD-A079940; AD-E410219; ARC/LS/TR-0080-2; ARCSL-CR-80002) Avail: NTIS HC A06/MF A01 CSCL 15/2

A broad investigation has been carried out in order to obtain modified fabrics which exhibit catalytic activity toward hydrolytic decomposition of chemical warfare agents. The major areas of study included the development of chemically modified Nomex and cotton-blend fabrics, mechanistic inquiries with regard to factors which control simulant/agent hydrolysis, and the design and construction of a suitable fabric testing apparatus for comparative evaluation of candidate fabrics. GRA

N80-21985# European Space Research and Technology Center, Noordwijk (Netherlands) Product Assurance Div.
GUIDELINES FOR SPACECRAFT CLEANLINESS CONTROL
Paris ESA May 1979 33 p
(ESA-PSS-51/ORA-23-ESTEC-ISS-1) Avail: NTIS HC A03/MF A01

Possible spacecraft failures or malfunctions due to contamination are described. Ways are indicated in which contamination levels are predicted, spacecraft contamination is reduced, and contamination levels on and around the spacecraft are monitored. The cleaning procedures, the requirements regarding cleaning agents and cleanliness monitoring are discussed. Author (ESA)

N80-21986# Purdue Univ., Lafayette, Ind. School of Electrical Engineering
ADVANCED INDUSTRIAL ROBOT CONTROL SYSTEMS
R. Paul, J. Luh, T. Anderson, J. Bender, E. Berg, B. Brown, C. S. Lin, M. Remmiton, M. Walker, and C.-H. Wu Jul. 1979 92 p refs
(Grant NSF APR-77-14533)
(PB80-106396; TR-EE79-35; NSF/RA-790231; Rept-2) Avail: NTIS HC A05/MF A01 CSCL 13I

Work performed to improve the performance of current industrial robots by developing a consistent theory and task description language is described. The work includes: (1) the development of a simple joint motion control scheme to provide for the execution of structured robot task programs and to provide the capability of performing tasks on a moving conveyor; (2) the integration of teaching into the task program; (3) a direct on-line approach to motion time optimization; and (4) an approach to Cartesian motion control of a manipulator employing a fast exact method. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-21987*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MEMORY-BASED PARALLEL DATA OUTPUT CONTROLLER Patent Application
Raymond J. Stattel and James K. Niswander, inventors (to NASA) Filed 8 Mar. 1980 20 p
(NASA-Case-GSC-12447-1; US-Patent-Appl-SN-128230) Avail: NTIS HC A02/MF A01 CSCL 09B

A memory-based parallel data output controller which employs associative memories and memory mapping to decommutate multiple channels of telemetry data is described. The output controller contains a random access memory (RAM) addressed by a word counter which outputs an encoded peripheral device number and a most/least significant bit (MSB/LSB)-first flag. The device number and a bit counter address a second RAM which contains START and STOP flags to pick out the required bits. The MSB/LSB, START and STOP flags, and the serial input data go to a control block which selectively fills a shift register used to drive the parallel data output bus. A strobe pulse enables a decoder to select the appropriate peripheral device. A microcomputer connected to an address bus can be used to set the contents of the RAMs via multiplexers using the technique of memory mapping. NASA

N80-21988# Maryland Univ., College Park Vision Lab.
REGION PROPERTY COMPUTATION BY ACTIVE QUAD-TREE NETWORKS Interim Report
Tsvi Dubitzki, Angela Y. Wu, and Azriel Rosenfeld Nov. 1979 25 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A079988; TR-823; AFOSR-80-0091TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

Given a binary image stored in a cellular array, a local reconfiguration process can be used to reconnect some of the cells into a quadtree network representing the image. This quadtree can also be roped, i.e., nodes representing adjacent image blocks of the same size can be joined. Using the roped quadtree network, image properties such as perimeter and genus, as well as the quadtree distance transform, can be computed in O (tree height) = O (log image diameter) time, as can the area and centroid even without roping. GRA

N80-21989# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
RELIABILITY EVALUATION AND ELECTRICAL CHARACTERIZATION OF MEMORIES Final Report, Nov. 1976 - Oct. 1978

A. T. Sasaki Sep. 1979 228 p refs
(Contract F30602-77-C-0003; AF Proj. 2338)
(AD-A079627; RADC-TR-79-193) Avail: NTIS
HC A11/MF A01 CSCL 09/2

LSI memories implemented with five different semiconductor technologies were electrically characterized as a function of temperature, voltage and pattern sensitivity. No new technology related characteristics were revealed that would limit the performance characteristics of these memories. The CMOS/SOS memory was the only device to exhibit a pattern sensitivity, but this is not believed to be related to the CMOS/SOS technology. Only the two static memory types (NMOS and CMOS) exhibited the capability for full military temperature range operation, and the 85 C performance of the CMOS/SOS memory was severely degraded (although still useful) at 125 C. Studies of pattern effectiveness suggested that N type patterns could be used for electrical characterization. Except where N-square pattern sensitivities are present, as was the case with the CMOS/SOS RAM, little difference was observed between the N-squared and N functional test results. Pattern related timing variations were also negligible. Although efforts were made to identify N or N-to the three-halves power type patterns that would detect all types of defects, an N-squared pattern sensitivity was detected in the CMOS/SOS RAM. Without specific knowledge of the nature of the CMOS/SOS RAM deficiency, it is apparent that N-squared tests are necessary to detect these types of RAM deficiencies. It is recommended that future electrical characterization studies include provisions for determining the nature of observed device deficiencies. GRA

N80-21990# Engins Matra, Velizy (France). Lab. de Traitement des Images.
STUDY OF IMAGE ONBOARD PROCESSING METHODS
Gabriel E. Lowitz and Jean M. Vivier Jul. 1979 153 p refs
(Contract ESTEC-2898/78)
(N-60-826; ESA-CR(P)-1251) Avail: NTIS HC A08/MF A01

Various onboard image data compression strategies were tested and compared by simulation maximizing the compression rate while minimizing the difficulties of onboard implementation. One strategy used Karhunen-Loeve processing in the spectral domain followed by a cosine transform along the line in image space followed by a DPCM between adjacent lines. Another consisted of applying clustering directly in the multispectral space of the raw imagery. A large number of multispectral images were processed in digital simulation to find the upper limit of compression rate compatible with acceptable image quality. Recommendations from users of the data are outlined. From a theoretical point of view, without any implementation study, the strategy of direct clustering in the raw channels into a fixed number of classes is a good candidate but costly in terms of the onboard power it will require. Author (ESA)

N80-21991# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
MLAB: AN ON-LINE MODELING LABORATORY BEGINNER'S GUIDE, 1ST EDITION
George Hutchinson May 1979 185 p refs
(PB80-125396; NIH/DF-80/001D) Avail: NTIS
HC A09/MF A01 CSCL 09B

A guide to an on-line modeling laboratory (MLAB) intended to introduce the most commonly used features of MLAB in a useful way is presented. It is divided into six 'lessons' which are study units organized around some aspect of MLAB including numerical calculation, computation with matrices, graphics, curve fitting, and differential equations. GRA

N80-21992# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
MLAB: FIFTY-THREE EASY EXERCISES TO TEACH YOU MLAB 2-D GRAPHICS
Marvin Shapiro Nov. 1979 37 p
(PB80-125404; NIH/DE-80/001E) Avail: NTIS
HC A03/MF A01 CSCL 09B

A manual containing a set of exercises, with answers, designed to teach the user how to use the 2-D graphics facilities of an on-line modeling laboratory (MLAB) is presented. Each exercise is a simple problem for solution in MLAB, and the answer is given as the appropriate MLAB statements. A set of notes following the exercises is used to discuss the finer points involved in the solution. The three appendices contain the syntax for the graphics commands, including line and point types and defaults, and some general rules about windows. GRA

N80-21993# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
MLAB: AN ON-LINE MODELING LABORATORY. APPLICATIONS MANUAL
Gary D. Knott Aug. 1979 199 p
(PB80-125388; NIH/DF-80/001C) Avail: NTIS
HC A09/MF A01 CSCL 09B

Material on the theory of curve fitting and a number of examples and short theoretical development of common applications of an on-line modeling laboratory (MLAB) are given. The examples include a number of tutorial sequences which are useful for learning MLAB. GRA

N80-21994# General Services Administration, Washington, D.C. Automated Data and Telecommunications Service.
TELEPROCESSING SERVICES PROGRAM
Oct. 1979 104 p
(PB80-112824) Avail: NTIS HC A06/MF A01 CSCL 09B

The procedures to be followed in acquiring commercial teleprocessing (remote computing) services within a teleprocessing services program (TSP) are described. Topics covered include the following: submitting the request; cutoff dates and communication of requirements; using the TSP schedules; acquisition schedule; making TSP schedule selections under $10,000; evaluating TSP schedule contracts; using the basic agreement; benchmarks; software conversion; TSP schedule procurement documentation; finance and billing information; TSP schedule orders; TSP schedule invoice audit review; dissemination of TSP information; TSP user groups; and standards. GRA

N80-21995# General Services Administration, Washington, D.C. Federal Compiler Testing Center.
COMPILER VALIDATION REQUEST INFORMATION BOOKLET Final Report
George N. Baird Nov. 1979 16 p
(PB80-126345; FCTC/TR-79/04) Avail: NTIS
HC A02/MF A01 CSCL 09B

Information is provided to make the requester of validation services aware of the services offered by the Federal Compiler Testing Center, the Federal COBOL standard, the various levels of COBOL contained in the Federal standard. The impact of the Federal property management regulation pertaining to the use of COBOL compile validations is discussed and the process of validating COBOL compilers is described. GRA

N80-21996# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
MLAB: AN ON-LINE MODELING LABORATORY REFERENCE MANUAL
Gary D. Knott Jun. 1979 195 p refs
(PB80-125370; NIH/DF-80/001B) Avail: NTIS
HC A09/MF A01 CSCL 09B

A computer program experimentation with and evaluation of mathematical models is described. The heart of the system is a curve fitting program which will adjust the parameters of a model function to minimize the sum of the squared errors. Mathematical operators and functions, routines for teletype and CRT plotting, and mechanisms for saving data between sessions are described. GRA

N80-21248*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ACCEPTABLE ROLE FOR COMPUTERS IN THE AIRCRAFT DESIGN PROCESS
Thomas J. Gregory and Leonard Roberts *In* AGARD The Use of Computers as a Design Tool Jan. 1980 7 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-21997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
USER'S GUIDE FOR VECTORIZED CODE EQUIL FOR CALCULATING EQUILIBRIUM CHEMISTRY ON CONTROL DATA STAR-100 COMPUTER
Ajay Kumar (Old Dominion Univ. Research Foundation), Randolph A. Graves, Jr., and K. James Weilmuenster Apr. 1980 33 p
(NASA-TM-80193; L-13342) Avail: NTIS HC A03/MF A01 CSCL 09B

A vectorized code, EQUIL, was developed for calculating the equilibrium chemistry of a reacting gas mixture on the Control Data STAR-100 computer. The code provides species mole fractions, mass fractions, and thermodynamic and transport properties of the mixture for given temperature, pressure, and elemental mass fractions. The code is set up for the electrons H, He, C, O, N system of elements. In all, 24 chemical species are included. R.C.T.

N80-21998*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Systems and Services Div.
AS BUILT DESIGN SPECIFICATION FOR CLASSY, AN ADAPTIVE MAXIMUM LIKELIHOOD CLUSTERING METHOD
C. L. Horton and R. K. Lennington Feb. 1980 101 p
(Contract NAS9-15800)
(NASA-CR-160562; JSC-16466; LEMSCO-14546) Avail: NTIS HC A06/MF A01 CSCL 09B

The latest modifications to the CLASSY system and the associate postprocessor MAXLABEL are described. Software and hardware descriptions, control card modifications, and sample executions are given. M.G.

N80-21999*# Axiomatix, Los Angeles, Calif.
EVALUATION OF KU-BAND SPA AND EA-1 SOFTWARE, TASK NO. 2 Interim Report
James Dobbs 20 Mar. 1980 49 p refs
(Contract NAS9-15795A)
(NASA-CR-160559; R8003-2) Avail: NTIS HC A03/MF A01 CSCL 09B

The software for selected space shuttle components are examined for potential problem areas and possible suboptimal coding techniques. Errors discovered in the procedure termination routine are discussed. The technique used to store status flags is found not to be as efficient as possible, from both the standpoints of memory usage and processing time. Self-test routines are examined with the intent of providing a more detailed description of multiplexer/demultiplexer and display and control outputs. An example of a reconfiguration is presented with a block diagram to indicate the critical paths. A cross-reference table of status flags is given to aid in tracing the functional activity of software modules. M.G.

N80-22000*# Aerospace Corp., El Segundo, Calif.
RELIABILITY MEASUREMENT FOR OPERATIONAL AVIONICS SOFTWARE Final Report
John Thacker and F. Ovadia Sep. 1979 40 p refs
(Contract NAS1-14392)
(NASA-CR-159224; ATR-79(7590)-2) Avail: NTIS HC A03/MF A01 CSCL 09B

Quantitative measures of reliability for operational software in embedded avionics computer systems are presented. Analysis is carried out on data collected during flight testing and from both static and dynamic simulation testing. Failure rate is found to be a useful statistic for estimating software quality and recognizing reliability trends during the operational phase of software development. M.G.

N80-22001# Information International, Inc., Culver City, Calif.
A FEASIBILITY TEST OF THE GRAPHIX 1 OPTICAL CHARACTER RECOGNITION SYSTEM FOR THE CAPTURE OF PRINTED CYRILLIC TEXT Final Technical Report, Oct. 1978 - May 1979
A. K. Griffith, Russell Ham, Rich Schroeppel, and Bruce D. Clayton Griffiss AFB, N.Y. RADC Nov. 1979 98 p refs
(Contract F30602-78-C-0331)
(AD-A080431; RADC-TR-79-270) Avail: NTIS HC A05/MF A01 CSCL 09/2

The objective of this study was to test the feasibility of Graphix 1 to scan Cyrillic text. Twenty-seven pages of Doklady Akademii Nauk SSSR No. 3, 1976 supplied by Foreign Technology Division were scanned and digitized. The output from the optical character reader was formatted in accordance with the input requirements to FTD's SYSTRAN system. During the demonstration of Graphix 1, the system throughput rate was determined to be 30 characters per second with a rejection rate of 10.3%. This report discussed the procedures used to scan the text, results, enhancements to the system and the cost for a production system. GRA

N80-22002# Wisconsin Univ. - Madison. Mathematics Research Center.
COMPUTING OPTIMAL LOCALLY CONSTRAINED STEPS Summary Report
David M. Gay Oct. 1979 31 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-78-09525; NSF MCS-76-00324)
(AD-A079719; MRC-TSR-2013) Avail: NTIS HC A03/MF A01 CSCL 12/1

In seeking to solve an unconstrained minimization problem, one often computes steps based on a quadratic approximation q to the objective function. A reasonable way to choose such steps is by minimizing q constrained to a neighborhood of the current iterate. This paper considers ellipsoidal neighborhood and presents a new way to handle certain computational details when the Hessian of q is indefinite, paying particular attention to a special case which may then arise. The proposed step computing algorithm provides an attractive way to deal with negative curvature. Implementations of this algorithm have proved very satisfactory in the nonlinear least-squares solver NL2SOL. GRA

N80-22003# Wisconsin Univ. - Madison. Mathematics Research Center.
MOD: A LANGUAGE FOR DISTRIBUTED PROGRAMMING Summary Report
Robert P. Cook Oct. 1979 31 p refs
(Contract DAAG29-75-C-0024)
(AD-A079709; MRC-TSR-2008) Avail: NTIS HC A03/MF A01 CSCL 09/2

Distributed programming is characterized by high communications costs and the absence of shared variables and procedures as synchronization tools. MOD is a high-level language system which attempts to address these problems by creating an environment conductive to efficient and reliable network software construction. The concept of a processor module is introduced as well as a methodology for distributed data abstraction and process communication. In addition, a VHLN (virtual high-level language network) is proposed for system development. GRA

N80-22004# University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.
A COMPARISON OF IMAGE ENHANCEMENT TECHNIQUES
C. H. Chen and Jenshiun Chen Dec. 1979 13 p refs
(Contract N00014-79-C-0494)
(AD-A079318; SMU-EE-TR-8) Avail: NTIS HC A02/MF A01 CSCL 09/2

After a discussion of the statistical theory of image fields, the paper provides a critical comparison of the median filtering, autoregressive (AR), autoregressive and moving average (ARMA), and Kalman filtering of reconnaissance imagery with additive Gaussian noise. The Kalman filtering performs the best in image enhancement and requires relatively less amount of computation time. GRA

N80-22005# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
PRELIMINARY EVALUATION OF AN ALGORITHM FOR ANALYSIS OF STATIONARY RANDOM DATA FROM A MULTIPLE - INPUT LINEAR SYSTEM Final Report, Jan. - Dec. 1978

Henry Hidalgo and Wasyl Wasylkiwsky) Jul. 1979 173 p refs
(Contract MDA903-79-C-0202)
(AD-A079329; AD-E500114; IDA-P-1388; IDA/HQ-79-21079) Avail: NTIS HC A08/MF A01 CSCL 09/2

This paper deals with a preliminary evaluation of a mean-squared estimated algorithm for the extraction of a signal that is embedded in superposed stationary noise processes. The motivation for this study is the processing and interpretation of data obtained in recent experiments to measure gradients of magnetic fields induced by internal waves in a shallow ocean. The approach used is simulation of the signal and noise processes through construction of random time series for the signal and interfering noise processes whose spectra can readily be adjusted to study parametrically a wide range of situations. The principal conclusions are: (1) the algorithm, in the form commonly applied to the reconstruction of the output of the main data channel, is valid only if a very special form of linear relationship is assumed between each of the superposed time series in the main channel and the time series in each of the subsidiary channels; an assumption that can lead to grossly erroneous estimates of the signal spectrum and (2) severe cumulative bias errors can be introduced in the reconstructed signal, partial coherences and transfer functions through the algebraic operations necessary in the application of the algorithm. This procedure can lead to large uncertainties in the functional form of the reconstructed signal spectra and, even more important, to false indications of the state of partial coherence. GRA

N80-22006# Texas Univ. at Austin. Center for Cybernetic Studies.
A LINEAR PROGRAMMING ALGORITHM FOR CURVE FITTING IN THE L INFINITY NORM
R. D. Armstrong and M. G. Sklar (Saint Edwards Univ.) Oct. 1979 46 p refs
(Contract N00014-75-C-0569; NR Proj. 047-021)
(AD-A080454; CCS-354) Avail: NTIS HC A03/MF A01 CSCL 12/1

The L sub infinity norm has been widely studied as a criterion for curve fitting problems. This paper presents an algorithm to solve discrete approximation problems in the L sub infinity norm. The algorithm is a special-purpose linear programming dual method which employs a reduced basis and multiple pivots. Results of the computational experience with a computer code version of the algorithm are presented. GRA

N80-22007# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
SOME ALGORITHMS FOR THE RECURSIVE INPUT-OUTPUT MODELING OF 2-D SYSTEMS Interim Report
Bernard C. Levy, Martin Morf (Stanford Univ., Calif.), and Sun-Yuan Kung (Univ. of Southern Calif., Los Angeles) Dec. 1979 58 p refs
(Contract MDA903-78-C-0179; Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A080264; LIDS-P-962; AFOSR-80-0070TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper considers the deterministic and stochastic modeling of 2-D systems described by their input/output data. In the deterministic case, the modeling problem is formulated as a 2-D Pade approximation problem. By studying several possible geometries of approximation, we obtain several sets of recursions of the 2-D rational approximants. These results exploit the properties of 2-D Hankel matrices, and they are used here to characterize the 2-D rational transfer functions. In the stochastic case, the realization problem is viewed as a 2-D prediction problem. This problem is solved recursively by generalizing to the 2-D case an algorithm due to Levinson in the 1-D case. The predictors obtained by this algorithm are then showed to converge to the 2-D spectral factors of the output spectrum. GRA

N80-22008# Wisconsin Univ. - Madison. Mathematics Research Center.
APPLICATIONS OF SOFTWARE FOR AUTOMATIC DIFFERENTIATION IN NUMERICAL COMPUTATION Summary Report
L. B. Rall Jul. 1979 27 p refs
(Contract DAAG29-75-C-0024)
(AD-A077121; MRC-TSR-1978) Avail: NTIS HC A03/MF A01 CSCL 12/1

At present, software for formula translation is used routinely in numerical computation. On the other hand, although software for differentiation of formulas is easy to construct and widely available, many numerical analysts seem to be unaware of its existence and potential for numerical computation. A simple procedure for formula translation and differentiation will be described, and some significant applications will be indicated. In ordinary computation, these include solution of ordinary and partial differential equations by series methods (Taylor and Lie series, for example), solution of nonlinear systems of equations by Newton's method and its variants, and nonlinear optimization (constrained and unconstrained). Together with interval analysis, differentiation can be used to determine properties of functions and thus automate the application of certain theorems, such as ones for existence of fixed points of n-dimensional operators or solutions of nonlinear systems of equations. Another large field of application of differentiation is to automatic error analysis, either using the graph structure of the computation, or interval analysis. An example is given of a program for numerical integration in which automatic differentiation and interval analysis are combined to provide a priori and a posteriori error bounds for the results. GRA

N80-21250# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
COMPUTER GRAPHICS AND RELATED DESIGN PROCESS AT MBB
Volkmar Antl and Werner Weingartner *In* AGARD The Use of Computers as a Design Tool Jan. 1980 19 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21251# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
COMPUTER GRAPHICS, RELATED DESIGN AND MANUFACTURE PROCESS AT DORNIER
J. Nagel, L. Thieme, and A. Harter *In* AGARD The Use of Computers as a Design Tool Jan. 1980 9 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21252# British Aerospace Aircraft Group, Warton (England).
COMPUTER GRAPHICS AND RELATED DESIGN PROCESSES IN THE UK
R. I. Hacking and B. Reuben *In* AGARD The Use of Computers as a Design Tool Jan. 1980 13 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21253# Lockheed-California Co., Burbank.
DISTRIBUTED GRAPHICS SYSTEM FOR COMPUTER AUGMENTED DESIGN AND MANUFACTURE
A. N. Baker *In* AGARD The Use of Computers as a Design Tool Jan. 1980 4 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21254# Societe Nationale Industrielle Aerospatiale, Marignane (France.)
THE ROLE OF INTERACTIVITY IN COMPUTER-ASSISTED DESIGN AND FABRICATION [LE ROLE DE L'INTERACTIVITE DANS LA CONCEPTION ET LA FABRICATION ASSISTEES PAR ORDINATEUR]
Monique Slissa *In* AGARD The Use of Computers as a Design Tool Jan. 1980 3 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21256# Societe Nationale Industrielle Aerospatiale, Marignane (France.)
USING THE COMPUTER TO PRODUCE ELECTRIC SCHEMAS [LIASSE ELECTRIQUE ASSISTEE PAR ORDINATEUR]

Jean-Pierre Pauzat *In* AGARD The Use of Computers as a Design Tool Jan. 1980 6 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21273# British Aerospace Aircraft Group, Preston (England).
BACTAC: A COMBAT-WORTHY COMPUTERIZED OPPONENT
Ian Jones *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p ref (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21378*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A FAST ALGORITHM FOR ENCODING THE (255.223) REED-SOLOMON CODE OVER GF(256)
R. L. Miller, T. K. Truong (Univ. of Southern California, Los Angeles), and I. S. Reed *In its* The Deep Space Network 15 Apr. 1980 p 120-129 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N80-21255# British Aerospace Aircraft Group, Brough (England).
A FRAMEWORK FOR DISTRIBUTED DESIGN COMPUTING
A. W. Bishop *In* AGARD The Use of Computers as a Design Tool Jan. 1980 10 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-22009*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ASYMPTOTIC EIGENSTRUCTURES
Peter M. Thompson Apr. 1980 36 p refs
(Grant NAG1-2)
(NASA-CR-162625; LIDS-P-982) Avail: NTIS
HC A03/MF A01 CSCL 09B

The behavior of the closed loop eigenstructures of a linear system with output feedback is analyzed as a single parameter multiplying the feedback gain is varied. An algorithm is presented that computes the asymptotically infinite eigenstructure, and it is shown how a system with high gain feedback decouples into single input, single output systems. Then a synthesis algorithm is presented which uses full state feedback to achieve a desired asymptotic eigenstructure. Author

N80-22010# Boston Univ., Mass.
TOWARDS ASPECT INVARIANT FEATURE SETS FOR CHARACTERIZING THREE DIMENSIONAL OBJECTS Final Report
Alan A. Desrochers 1979 53 p refs
(Grant AF-AFOSR-0039-79; AF Proj. 2304)
(AD-A078428; AFOSR-79-1253TR) Avail: NTIS
HC A04/MF A01 CSCL 05/8

The problem of characterizing three dimensinal objects with a minimum number of feature sets is addressed. Previous research has been plagued by features which are a function of aspect angle and so efforts have concentrated on characterizing an object with several hundred prototype feature sets. In this work it is demonstrated that in many cases, the silhouette obtained from one view of the object can be derived from a linear transformation of the silhouette from another view. As a result of this relationship, a single set of moments which is invariant to such a general linear transformation can be used to characterize many views of the same object and hence the number of prototype feature sets required to specify an object is reduced. In addition, it is demonstrated that for some objects it is advantageous to partition the object into regions in order to find the region of the object which is least dependent upon aspect angle. GRA

N80-22011# Rice Univ., Houston, Tex. Dept. of Mechanical Engineering.
GRADIENT ALGORITHMS FOR THE OPTIMIZATION OF DYNAMIC SYSTEMS Interim Report
A. Miele 1979 85 p refs
(Grants AF-AFOSR-3075-76; NSF ENG-79-18667)
(AD-A079816; AAR-147; AFOSR-79-1360TR) Avail: NTIS
HC A05/MF A01 CSCL 12/1

Recent advances in the area of gradient methods for optimal control problems are reviewed. Single sub arc problems are treated. Specifically, two classes of optimal control problems, called problem P1 and problem P2 for easy identification, are solved. Problem P1 consists of minimizing a functional 1 which depends on the n-vector state x(t), the m-vector control u(t), and the p-vector parameter 3.14. The state is given at the initial point. At the final point, the state and the parameter are required to satisfy q scalar relations. Problem P2 differs from problem p1 in that the state, the control, and the parameter are required to satisfy k additional scalar relation along the interval of integration. Algorithms of the sequential gradient-restoration type are given for both problem 1 and problem 2. Problem P2 enlarges the number and variety of problems of optimal control which can be treated by gradient-restoration algorithms. Eight numerical examples are presented to illustrate the performance of the algorithms associated with problem P1 and problem P2. The numerical results show the feasibility as well as the convergence characteristics of these algorithms. GRA

N80-22012# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SPATIAL DOMAIN AND SPATIAL FREQUENCY DOMAIN IMAGING M.S. Thesis
Kevin William Kirlin Dec. 1980 147 p refs
(AD-A080414; AFIT/GEO/EE/79-3) Avail: NTIS
HC A07/MF A01 CSCL 09/3

An imaging system's object field to image field transformation operation is usually described in the spatial frequency domain using the system's transfer function. The limitation of this description is that the imaging system must be space-invariant. In contrast, an object field to image field transformation can be described in the spatial domain without requiring that the system be space-invariant. For the frequency domain, a summary of free-space and turbulent transfer functions is presented. For the spatial domain, the normal mode approach to imaging is described followed by a summary of spatial eigenvalue distributions and degrees of freedom expressions. The effect of additive background noise on the useable degrees of freedom of an image field is studied. The spatial domain and frequency domain are shown to be related when certain conditions are satisfied, one of which is space-invariance. The operation of two ideal, adaptive imaging receivers (the channel- matched filter and multiplicative-Phase Receivers) is described and their imaging performance is compared using turbulent coherent transfer functions and minimum average integrated mean square error expressions.
Author (GRA)

N80-22013# Naval Ocean Systems Center, San Diego, Calif.
HIGHER ORDER LOGIC FOR PLATFORM IDENTIFICATION IN A PRODUCTION SYSTEM. A METHOD OF EXTENDING THE CAPABILITIES OF A PRODUCTION SYSTEM APPLIED TO TACTICAL SITUATION ASSESSMENT
R. A. Dillard 17 Oct. 1979 49 p refs
(XR0140801)
(AD-A080555; NOSC/TD-288) Avail: NTIS
HC A03/MF A01 CSCL 09/4

This report describes a method of extending the capabilities of a production system applied to tactical situation assessment, to enable the system, whatever its type, to perform the higher order logical reasoning required for the solution of many platform identification problems. The method is implemented

through (1) production rules for constructing and updating an intermediate framework in the system's data base, a framework that supports the process of associating tracks with platforms; and (2) production rules for performing the association process by using, for example, the notion of complete subsets of platform files and track files, along with logical sequences of reasoning. Many of the system logic rules underlying this method have been implemented in an experimental production system and tested against hypothesized data. Two examples are given, along with a step-by-step description of the response of the system to each new piece of information. The method as it is described uses only data having high confidence values. However, the conclusions which would logically follow from different assumptions about particular tracks or platforms could be determined by recording logical conclusions derived from less certain data, then reinitializing the data base by removing previous conclusions and replacing selected questionable assertions with alternative assertions. GRA

N80-22014# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
STRUCTURE OF AUTOMATIC CONTROL SYSTEMS Interim Report, 1 Oct. 1978 - 30 Sep. 1979
A. Stephen Morse Nov. 1979 5 p
(Grant AF-AFOSR-3176-77; AF Proj. 2304)
(AD-A080307; AFOSR-80-0046TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The work in progress includes characterization of linear system parametrizations for which parameter adaptive control is possible, and development of a realization theory for linear analytic systems with finite Votteria series, using only linearly algebraic constructions. GRA

N80-22015# Rice Univ., Houston, Tex. Dept. of Mechanical Engineering.
FIRST-ORDER AND SECOND-ORDER NUMERICAL METHODS FOR OPTIMAL CONTROL PROBLEMS Interim Report
A. Miele 1979 14 p refs
(Grant AF-AFOSR-3075-76; NSF MCS-76-21657; AF Proj. 2304)
(AD-A080356; AFOSR-80-0086TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This lecture summarizes recent advances in the area of numerical methods for optimal control problems, with particular emphasis on the work performed by the Aero-Astronautics Group of Rice University. The following basic problems are considered; problems with general boundary conditions, problem with nondifferential constraints, and problem with multiple subarcs. First-order alogrithms are reviewed, in particular, the sequential ordinary gradient-restoration algorithm and the sequential conjugate gradient-restoration algorithm. Second-order algorithms are also reviewed, in particular, the modified quasilinearization algorithm. Here, the optimal initial choice of the multipliers is discussed. Transformation techniques are presented by means of which a great variety of problems of optimal control can be reduced to one of the formulations presented. Specifically, the following topics are treated; time normalization, free initial state, problems with bounded control, problems with bounded state, and Chebyshev minimax problems. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-22016*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MULTI-LEVEL ADAPTIVE TECHNIQUES (MLAT) FOR SINGULAR-PERTURBATION PROBLEMS
Achi Brandt 12 Oct. 1978 91 p refs
(Contract NAS1-14101)
(NASA-TM-80966; ICASE-78-18) Avail: NTIS
HC A05/MF A01 CSCL 12A

The multilevel (multigrid) adaptive technique, a general strategy of solving continuous problems by cycling between coarser and finer levels of discretization is described. It provides very fast general solvers, together with adaptive, nearly optimal discretization schemes. In the process, boundary layers are automatically either resolved or skipped, depending on a control function which expresses the computational goal. The global error decreases exponentially as a function of the overall computational work, in a uniform rate independent of the magnitude of the singular-perturbation terms. The key is high-order uniformly stable difference equations, and uniformly smoothing relaxation schemes. M.G.

N80-22017*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NUMERICAL METHODS FOR LARGE-SCALE, TIME-DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS
Eli Turkel 20 Aug. 1979 139 p refs
(Contracts NAS1-14101)
(NASA-TM-80967; ICASE-79-20) Avail: NTIS
HC A07/MF A01 CSCL 12A

A survey of numerical methods for time dependent partial differential equations is presented. The emphasis is on practical applications to large scale problems. A discussion of new developments in high order methods and moving grids is given. The importance of boundary conditions is stressed for both internal and external flows. A description of implicit methods is presented including generalizations to multidimensions. Shocks, aerodynamics, meteorology, plasma physics and combustion applications are also briefly described. Author

N80-22018# Washington Univ., St. Louis, Mo. Dept. of Systems Science and Mathematics.
THE CONSTRAINT METHOD FOR SOLID FINITE ELEMENTS Annual Technical Report, 1 Oct. 1978 - 30 Sep. 1979
I. Norman Katz 1979 87 p refs
(Contract AF-AFOSR-3312-77; AF Proj. 2304)
(AD-A080101; AFOSR-80-0082TR) Avail: NTIS
HC A05/MF A01 CSCL 20/11

The p-version of the finite element method is a new approach to finite element analysis which has been demonstrated to lead to significant computational savings, often by orders of magnitude (This approach was formerly called the constraint method; the new term p-version is more descriptive). Conventional approaches (called the h-version) generally employ low order polynomials as basis functions. Accuracy is achieved by suitably refining the approximating mesh. The p-version uses polynomials of arbitrary order p greater than or equal to 2 for problems in plan elasticity where CO continuity is required and polynomials of order p greater than or equal to 5 for problems in plate bending where CI continuity is required. Hierarchic elements which implement the p-version efficiently are used together with precomputed arrays of elemental stiffness matrices. CO solid elements of various shapes have been formulated. A major result that has recently been obtained on the convergence of the p-version of the finite element method is: in polynomial regions, the p-version converges approximately twice as fast as the h-version. GRA

N80-22019# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
UNCONSTRAINED VARIATIONAL STATEMENTS FOR INITIAL AND BOUNDARY-VALUE PROBLEMS
T. E. Simkins Oct. 1979 24 p refs Presented at the 25th Conf. of Army Mathematicians, Baltimore, 6-8 Jun. 1979
(DA Proj. 1L1-61102-AH-60)
(AD-A079407; AD-E440055; ARLCB-TR-79-029) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A procedure is developed for generating variational statements suitable for obtaining approximate solutions to boundary-initial value problems. The essence of the procedure is to introduce all boundary and initial conditions into the variational statement as natural boundary conditions. This is accomplished through the use of Lagrange multipliers in which all initial condition terms as well as boundary terms are determined analytically. The result is a variational statement in which completely unconstrained trial functions may be assumed as a basis for an approximate solution. Several applications are given, including

the response of a beam subject to a moving concentrated mass loading. GRA

N80-22020# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
A MARTINGALE METHOD FOR THE CONVERGENCE OF A SEQUENCE OF PROCESSES TO A JUMP-DIFFUSION PROCESS Interim Report
Harold J. Kushner Jul. 1979 28 p refs
(Contract N00014-76-C-0279; Grant AF-AFOSR-3063-76; NSF ENG-73-03846)
(AD-A080083; AFOSR-79-1273TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A convenient method for proving weak convergence of a sequence of non-Markovian processes x(epsilon) to a jump-diffusion process is proved. Basically, it is shown that the limit solves the martingale problem of Strook and Varadhan. The proofs are relatively simple, and the conditions apparently weaker than required by other current methods (in particular, for limit theorems for a sequence of ordinary differential equations with random right hand sides). In order to illustrate the relative ease of applicability in many cases, a simpler proof of a known result on averaging is given. GRA

N80-22021# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
AN EFFICIENT ALGORITHM FOR DETERMINING THE LENGTH OF THE LONGEST DEAD PATH IN A LIFO BRANCH-AND-BOUND EXPLORATION SCHEMA
Stefano Pallottino (Inst. per le Applicazioni del Calcolo Mauro Picone, Rome) and Tommaso Toffoli Jan. 1980 14 p ref
(Contract N00014-75-C-0661)
(AD-A079912; MIT/LCS/TM-149) Avail: NTIS HC A02/MF A01 CSCL 12/1

The length of the longest dead path (LLDP) is a widely used parameter in estimating the efficiency of branch-and-bound optimization algorithms that employ the LIFO exploration schema. Thanks to two original theorems, we are able to present a particularly attractive procedure for determining of the LLDP. In fact this procedure requires a number of storage variables which is independent of problem size and very small; moreover, the procedure is self-contained in the sense that it can be externally attached to any LIFO branch-and-bound program without interfering with its algorithms and data structures. GRA

N80-22022# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPARISON OF NUMERICAL ANALYSIS METHODS FOR SOLVING ONE-DIMENSIONAL ELLIPTIC DIFFERENTIAL EQUATIONS M.S. Thesis
Randy A. Smith Dec. 1979 158 p refs
(AD-A079861; AFIT/GAE/AA/79D-17) Avail: NTIS HC A08/MF A01 CSCL 12/1

Four numerical methods are used to solve a specific set of problems and then the methods are compared for accuracy and efficiency. The methods are: standard finite differences, collocation, Galerkin, and least squares. The latter three methods are finite element methods which use either Lagrange linear, Hermite cubic, or Hermite septic piecewise polynomials as interpolation functions. The problem set consists of second- and fourth-order, linear and nonlinear, differential equations with constant and variable coefficients. The linear equations govern elementary structural members and the nonlinear equation is a one-dimensional analog for transonic flow past an airfoil. The three major conclusions are: (1) the least squares method with Hermite cubic polynomials was the method of choice for the second-order linear equations; (2) the collocation method was chosen over Galerkin and the finite difference methods for the fourth-order equations; and (3) Galerkin method was chosen over the collocation method for the nonlinear problem. GRA

N80-22023# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
AN EQUIVALENCE BETWEEN TWO ALGORITHMS FOR QUADRATIC PROGRAMMING
Jong-Shi Pang Dec. 1979 28 p refs
(Contract N00014-75-C-0621; NR Proj. 047-048)
(AD-A079815; MSRR-452) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper, we demonstrate that the Vande Panne-Whinston symmetric simplex method when applied to a certain implicit formulation of a quadratic program generates the same sequence of primal feasible vectors as does the Von Hohenbalken simplicial decomposition algorithms specialized to the same program. Such an equivalence of the two algorithms extends earlier results for a least-distance program due to Cottle-Djang. GRA

N80-22024# Stanford Univ., Calif. Dept. of Statistics.
OPTIMAL WHEREABOUTS SEARCH FOR A MOVING TARGET
Lawrence D. Stone and Joseph B. Kadane 15 Nov. 1979 38 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A079802; SU-TR-40; SU-TR-279; ARO-14435.40-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper shows that solving the optimal whereabouts search problem for a moving target is equivalent to solving a finite number of optimal detection problems for moving targets. This generalizes the result of Kadane (5) for stationary targets. GRA

N80-22025# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
DEGREE SEQUENCES OF RANDOM GRAPHS
Gerard Cornuejols Nov. 1979 17 p refs
(Contract N00014-75-C-0621; NR Proj. 047-048)
(AD-A079744; MSRR-451; WP-36-79-80) Avail: NTIS HC A02/MF A01 CSCL 12/1

A property is said to be satisfied by almost all graphs on n vertices if the fraction of the graphs that satisfy it goes to 1 as n goes to infinity. For almost all graphs on n vertices the smallest vertex-degree is n/2 - square root (n log n)/2 + o (square root n). More generally we estimate the values in the tails of the degree sequence. GRA

N80-22026# Wisconsin Univ. - Madison.
ANALYSIS OF MIXED METHODS USING MESH DEPENDENT NORMS Technical Summary Report
I. Babuska (Maryland Univ., College Park), J. Osborn (Maryland Univ., College Park), and J. Pitkaranta (Helsinki Univ. of Technol.) Sep. 1979 36 p refs
(Contracts DAAG29-75-C-0024; E(40-1)-3443; Grant NSF MCS-78-02851)
(AD-A079738; MRC-TSR-2003) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper presents a new approach to the analysis of mixed methods for the approximate solution of 4th order elliptic boundary value problems. In this approach one introduces a pair of mesh dependent norms and proves the approximation method is stable with respect to these norms. The error estimates then follow in a direct manner. In a mixed method, one introduces an auxiliary variable, usually representing another physically important quantity, and writes the differential equation as a lower order system. One then considers Ritz-Galerkin approximation schemes based on a variational formulation of this lower order system, thereby obtaining direct approximations to both the original and auxiliary variables. Three particular mixed methods for the approximate solution of the biharmonic problem are examined in detail. GRA

N80-22027# Wisconsin Univ. - Madison. Mathematics Research Center.
IMPLIED ASSUMPTIONS FOR SOME PROPOSED ROBUST ESTIMATORS
Gina Chen and George E. P. Box Sep. 1979 64 p refs
(Contract DAAG29-79-C-0024)
(AD-A079732; MRC-TSR-1997) Avail: NTIS HC A04/MF A01 CSCL 12/1

Assumptions which could motivate various L-estimators and M-estimators are discussed. In particular, for samples of size ten a distribution in the contaminated exponential power family is found whose posterior mean approximates each of a number of proposed L-estimators. Also distributions in this family are found whose posterior modes approximate suggested M-estimators. GRA

N80-22028# Wisconsin Univ. - Madison. Mathematics Research Center.

FURTHER STUDY OF ROBUSTIFICATION VIA A BAYESIAN APPROACH
Gina Chen and George E. P. Box Sep. 1979 52 p refs
(Contract DAAG29-75-C-0024)
(AD-A079733; MRC-TSR-1998) Avail: NTIS
HC A04/MF A01 CSCL 12/1

A Bayesian model has been proposed which describes the generation of an observation by a process whereby with prior probability 1 alpha the usually assumed statistical structure is correct but with small probability alpha it is incorrect (for example, the observation has a very large variance). For a simple location estimate the nature of the down weighting of outlying observations produced by this model is studied and is compared with that of the presently popular M-estimators. GRA

N80-22029# Wisconsin Univ. - Madison. Mathematics Research Center.
CONVERGENCE OF ABSTRACT SPLINES
Carl DeBoor Nov. 1979 14 p refs
(Contract DAAG29-75-C-0024)
(AD-A079734; MRC-TSR-1999) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A sufficient condition is given for the convergence of abstract splines. We show that this condition is not necessary but that a slight perturbation of this condition is both necessary and sufficient. In the process, we also give a necessary and sufficient condition for a sequence of abstract spline projectors to be bounded. GRA

N80-22030# Wisconsin Univ. - Madison. Mathematics Research Center.
ON SOLVING ROBUST AND GENERALIZED LINEAR REGRESSION PROBLEMS
David M. Gay Sep. 1979 35 p refs Presented at Nonlinear Optimization and Appl., L'Aquila, Italy, 18-20 Jul. 1979
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A079735; MRC-TSR-2000) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Many researchers employ mathematical models. Most models contain parameters, which may be chosen to make the model fit the available data as well as possible (in a sense that depends on the model). In this paper we consider the problem of choosing the parameters for a common class of models in which the desired parameter vector minimizes an (unconstrained) objective function. We briefly give some examples of such problems, then discuss ways to exploit the common structure that these problems share. This leads us to discussing strategies for solving general unconstrained minimization problems and to point out the advantages of using a so-called 'model/trust-region approach,' wherein the change made in the current parameter estimate is chosen so as to approximately minimize a local model of the objective function on an estimate of the region about the current iterate where this local model is reliable. For problems in which the residual vector r(x) is a nonlinear function of x, we recommend generalizations of some techniques that have proven worthwhile in nonlinear least-squares problems in which the optimal residual vector $r(x^*)$ may be either large or small. GRA

N80-22031# University of Southeastern Massachusetts, North Dartmouth.
A COMPUTATIONAL METHOD FOR SOLVING PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS Final Report, 1 Jan. 1978 - 31 Jul. 1979
Thomas B. C. Shen Nov. 1979 41 p
(Grant AF-AFOSR-3538-78; AF Proj. 2308)
(AD-A079534; AFOSR-80-0017TR) Avail: NTIS
HC A03/MF A01 CSCL 20/13

This paper presents a new numerical method, the error method, for solving parabolic type partial differential equations, linear or nonlinear. In particular, more beneficial results in the application to nonlinear problems are compared with the regular successive iterative method. Three nonlinear examples were studied by using this method. All resulted in large reduction of number of iteration loops and CPU time required in comparing to the corresponding regular successive method used. Generalization and modification of this method appears appropriate to extend its application to elliptical type partial differential equation so that problems with 'isolated' events (such as those with ignition spots) may be handled with this method. GRA

N80-22032# Wisconsin Univ. - Madison. Dept. of Statistics.
AN INTRODUCTION TO APPLIED MULTIPLE TIME SERIES ANALYSIS
G. C. Tiao and G. E. P. Box Oct. 1979 43 p refs
(Grant DAAG29-78-G-0166; KO-A01-73-00-1531)
(AD-A080709; ARO-15734.1-M) Avail: NTIS
HC A03/MF A01 CSCL 12/1

An approach to the modelling and analysis of multiple time series is proposed. Properties of a class of vector autoregressive moving average models are discussed. Modelling procedures consisting of tentative specification, estimation and diagnostic checking are outlined and illustrated by three real examples. Various eigenvalue-eigenvector analyses are presented and some alternative approaches to multiple time series are briefly discussed. GRA

N80-22033# Wisconsin Univ. - Madison. Dept. of Statistics.
TRANSFORMING GROUPED BIVARIATE DATA TO NEAR NORMALITY
Victor M. Guerrero and Richard A. Johnson Nov. 1979 12 p refs
(Contract N00014-78-C-0722)
(AD-A080715; TR-592; ARO-15660.3-M) Avail: NTIS
HC A02/MF A01 CSCL 12/1

We are concerned with the use of power transformations when data on two variables are presented in a two way table. Situations where one or both variables are grouped into intervals are considered and regressions and the correlation obtained from the transformed data are examined. Also, by transforming back to the original scale, we obtain a smoothed version of the data. GRA

N80-22034# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CROSS VALIDATION OF SELECTION OF VARIABLES IN MULTIPLE REGRESSION M.S. Thesis
Joseph Richard Cafarella, Jr. Dec. 1979 129 p refs
(AD-A080407; AFIT/GOR/MA/79D-2) Avail: NTIS
HC A07/MF A01 CSCL 12/1

Techniques and criterion for selection of the 'best' subset of variables to be used in a regression model are reviewed. A model was developed using the Automatic Interaction Detection (AID) algorithm as a pre-screening device for locating those variables most important to the regression including interaction terms. Five previous models including the one developed by AID and one developed by Westinghouse on avionic characteristic data are used in cross validation experiments to determine the predictive power of these models on a new set of data points using the same set of variables. A cross validation R(2) value is discussed as a criterion for choosing between competing models. GRA

N80-22035# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NUMERICAL METHODS AND THE SOLUTION OF BOUNDARY VALUE PROBLEMS M.S. Thesis
Gale N. Nelson Dec. 1979 157 p refs
(AD-A080415; AFIT/GEP/PH/79D-7) Avail: NTIS
HC A08/MF A01 CSCL 12/1

A study of several numerical methods for the solution of boundary value problems, in both one and two-dimensions, was conducted using the CDC 6600 computer. The method of finite differences was employed for solution of the equations in differential form. These numerical solutions were compared to those obtained by transforming the original differential equation into integral form and approximating their solution using numerical integration via the trapezoid rule. All numerical experiments were conducted using Dirichlet boundary conditions. In the one-dimensional cases studied it was found that both methods are equivalent, i.e., yield identical solutions when the integral representation had a linear weighted Green's function kernel. For the two-dimensional investigation the steady-state heat conduction equation was analyzed. Again, the method of finite differences in two-dimensions was compared to the integral approach, using cubic splines. The method of finite differences was found to be superior in calculating the internal temperature, at all nodal points, as compared to the integral-spline solution. GRA

N80-22036# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
COLLOCATION WITH POLYNOMIAL AND TAUT SPLINES FOR SINGULARLY PERTURBED BOUNDARY VALUE PROBLEMS Interim Report
Joseph E. Flaherty and William Mathon Nov. 1979 55 p refs
(Grant AF-AFOSR-2818-75; AF Proj. 2304)
(AD-A080311; AFOSR-80-0085TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Collocation methods using both cubic polynomials and splines in tension are developed for second order linear singularly-perturbed two-point boundary value problems. Rules are developed for selecting tension parameters and collocation points. The methods converge outside of boundary layer regions without the necessity of using a fine discretization. Numerical examples comparing the methods are presented. GRA

N80-22037# Stanford Univ., Calif. Dept. of Statistics.
OPTIMAL LINEAR ESTIMATION OF BOUNDS OF RANDOM VARIABLES
Peter Cooke Sep. 1979 13 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A077068; TR-37; TR-276; ARO-14435.37-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of estimating the bounds of random variables has been previously discussed. Here we discuss optimality of estimates when the data is censored so that only the r largest or smallest of the observations is available for estimating a bound. For fixed r we find the linear function of the censored data which is the optimal estimator of a bound in the sense that, when the sample size is large, the estimator has smallest mean squared error among all such linear estimators. Provided r is not close to one, these estimators are almost optimal when the entire sample is available since, for example, when estimating an upper bound and the sample size is large, the largest few observations carry most of the information about the bound. This fact is illustrated in one case. GRA

N80-22038# Department of Defense, Fort Meade, Md.
A LEAST SQUARES INTERPOLATION SCHEME FOR CRYOGENIC THERMOMETERS USING A HAND-HELD PROGRAMMABLE CALCULATOR
Carl G. Gardner, Ellen M. Fyffe, and John J. Hudak Sep. 1979 21 p refs
(AD-A077069; R55-006-79) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method has been found to interpolate values from a large table of data quickly and accurately using a hand-held programmable calculator. Interpolation is accomplished by evaluation of polynomials which have previously been fit to the large data table. The method is perfectly general and in particular, is ideally suited to the interpolation of calibration tables in the laboratory while an experiment is in progress. GRA

N80-22039# Wisconsin Univ. - Madison. Mathematics Research Center.
NONLINEAR OSCILLATIONS AND BOUNDARY-VALUE PROBLEMS FOR HAMILTONIAN SYSTEMS
Frank H. Clarke (British Columbia Univ.) and I. Ekeland (Paris Univ.) Sep. 1979 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A079736; MRC-TSR-2001) Avail: NTIS HC A03/MF A01 CSCL 12/1

Hamilton's differential equations are basic in the study of theoretical mechanics. A particular class of motions of interest for such systems of equations are the periodic ones, which correspond to oscillations (vibrations) of the underlying physical system; the absence of such motions is usually associated with resonance phenomena. In this paper we give conditions on the Hamiltonian function H which guarantee the existence of periodic orbits, as well as other more general types of motions. One distinction with previous work on the subject is that we consider forced vibrations arising from external driving forces; another is that the solutions in question are characterized directly as the solutions of a specific minimization problem (i.e., we obtain a 'variational principle'), a feature which could prove useful for computational purposes. GRA

N80-22040# Kansas Univ., Lawrence. Dept. of Mechanical Engineering.
AN IMPROVED MONTE CARLO PROCEDURE FOR THE SOLUTION OF THE STEADY-STATE, TWO DIMENSIONAL DIFFUSION EQUATION WITH APPLICATION TO FLOW THROUGH POROUS MEDIA M.S. Thesis
James H. Turner 1979 197 p refs
(Contract DI-14-34-0001-6079)
(PB80-132616; W80-02607; OWRT-B-045-KAN(2)) Avail: NTIS HC A09/MF A01 CSCL 12A

Monte Carlo procedures for solving the diffusion equation of heat conduction and flow through porous media are considered. The so-called floating random walk Monte Carlo procedure offers advantages in terms of computer execution time for single point solutions and complex geometries over finite difference procedures. An improvement to the floating random walk is presented and is based upon the use of exact analytical solutions to the diffusion equation interpreted in probabilistic form. The results indicate that the improved procedure is more efficient than the conventional Monte Carlo procedure in terms of computer execution time and is competitive with, and may even be superior to, the ADI finite difference procedure in some cases. GRA

N80-21269# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
NEW COMPUTER APPLICATIONS FOR SPECIAL STRUCTURAL PROBLEMS
Juergen Massmann *In* AGARD The Use of Computers as a Design Tool Jan. 1980 23 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21573# Danish Research Center for Applied Electronics, Hoersholm.
STEADY-STATE ANALYSIS OF PERIODIC NONLINEAR DIFFERENTIAL EQUATIONS BY EXTRAPOLATION
S. Skelboe *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 129-136 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21578# Warsaw Technical Univ. (Poland). Inst. of Electronics Fundamentals.
AN ORTHOGONAL SEARCH APPROXIMATION TO ACCEPTABILITY REGIONS AND ITS APPLICATION TO TOLERANCE PROBLEMS
L. Opalski, M. Styblinski, and J. Grodzki *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 163-168 refs (For primary document see N80-21560 12-31)
(Grant NSF INT-76-23091)
Avail: NTIS HC A19/MF A01

N80-22225# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ADAPTIVE LINEAR FILTERING IN THE PRESENCE OF AN EVOLUTION NOISE OF POORLY KNOWN VARIANCE
Huu Thanh Huynh *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 15-30 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 11-22 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-22041# Wisconsin Univ. - Madison. Mathematics Research Center.
A STUDY OF REAL DATA Summary Report
Gina Chen and George E. P. Box Oct. 1979 71 p refs
(Contract DAAG29-75-C-0024)
(AD-A079737; MRC-TSR-2002) Avail: NTIS HC A04/MF A01 CSCL 12/1

Nine sets of real data are analyzed. The distributions within the contaminated exponential power family which best describe these data sets are obtained by maximum likelihood. It appears that heavy tailed distributions are often produced by secular inhomogeneity in mean and variance. A specific robust estimator would behave well if, in the real world, data occurred of the kind which favored it. In this paper more classical sets of data are considered and their characteristics are studied in relation to proposed robust estimators. GRA

N80-22042# Stanford Univ., Calif. Dept. of Statistics.
THE ANDERSON-DARLING STATISTIC
Michael A. Stephens 31 Oct. 1979 23 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A079807; SU-TR-39; SU-TR-278; ARO-14435.39-M)
Avail: NTIS HC A02/MF A01 CSCL 12/1

The Anderson-Darling statistic A squared is a goodness-of-fit statistic, based on the empirical distribution function. Its asymptotic distribution can be found for testing many important distributions when unknown parameters must be estimated from the data. Furthermore, A squared can be easily adapted so that only the asymptotic points are needed for testing purposes. A squared also is easy to calculate, and has overall good power properties. The report gives a review of A squared and tables for testing the following distributions - normal, exponential, gamma, extreme-value and Weibull, and logistic points are given also for testing any completely specified continuous distribution. GRA

N80-22043# Stanford Univ., Calif. Dept. of Statistics.
MINIMAX STOPPING RULES WHEN THE UNDERLYING DISTRIBUTION IS UNIFORM
Stephen M. Samuels Oct. 1979 57 p refs
(Contract N00014-76-C-0475; Grants DAAG29-77-G-0031; NSF MCS-76-07254)
(AD-A080387; SU-TR-38; SU-TR-277; ARO-14435.38-M)
Avail: NTIS HC A04/MF A01 CSCL 12/1

An invariance-based method of obtaining the minimax stopping rule when sampling from an unknown uniform distribution is presented and applied to two problems, maximizing the probability of selecting the smallest observation and minimizing the expected quantile of the observation selected. In the first problem the minimax rules use only the relative ranks of the observations; in the second they are shown to achieve asymptotic risk. Except for a few small values of the sample size, the minimax rules are the formal Bayes rules with respect to an improper a priori 'density' whose a posteriori density given the first two observations is proper. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-22232# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DIFFERENTIAL GAMES OF INTERCEPTION AND AERIAL COMBAT: SOLUTION BY DIFFERENTIAL DYNAMIC PROGRAMMING
Van Nhan Nguyen *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 78-54 Original report in FRENCH previously announced as A79-34976 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-22044# Naval Ship Research and Development Center, Bethesda, Md.
THE MAGNETIC INDUCTION OF THE SYSTEM CONSISTING OF A COIL AND A FERROMAGNETIC SPHERICAL BODY
Samuel H. Brown and F. Edward Baker, Jr. Dec. 1979 82 p refs
(AD-A080494; DTNSRDC-79/096) Avail: NTIS HC A05/MF A01 CSCL 20/3

The magnetic induction is calculated for two configurations consisting of: an infinitesimally thin prolate spheroidal current band carrying a stationary current surrounding a ferromagnetic prolate spheroidal shell, and an infinitesimally thin band internal to a ferromagnetic prolate spheroidal shell. The ferromagnetic body is assumed to be linear and homogeneous. The reduction of the solutions to that of a prolate spheroidal current band in free space is shown when the permeability of the ferromagnetic prolate spheroidal shell is allowed to approach that of free space. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-22045*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPECTRAL STRUCTURE OF PRESSURE MEASUREMENTS MADE IN A COMBUSTION DUCT
J. H. Miles and D. D. Raftopoulos (Toledo Univ.) 1980 46 p refs Presented at 99th Meeting of the Acoust. Soc. of Am., Atlanta, 21-25 Apr. 1980
(NASA-TM-81471; E-404) Avail: NTIS HC A03/MF A01 CSCL 20A

A model for acoustic plane wave propagation in a combustion duct through a confined, flowing gas containing soot particles is presented. The model takes into account only heat transfer between the gas and soot particles. As a result, the model depends on only a single parameter which can be written as the ratio of the soot particle thermal relaxation time to the soot particle mass fraction. The model yields expressions for the attenuation and dispersion of the plane wave which depends only on this single parameter. The model was used to calculate pressure spectra in a combustion duct. The results were compared with measured spectra. For particular values of the single free parameter, the calculated spectra resemble the measured spectra. Consequently, the model, to this extent, explains the experimental measurements and provides some insight into the number and type of particles. Author

N80-22046*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE SUPPRESSION DUE TO ANNULUS SHAPING OF AN INVERTED-VELOCITY-PROFILE COAXIAL NOZZLE
J. Goodykoontz and U. vonGlahn Apr. 1980 27 p refs Presented at 99th Meeting of the Acoust. Soc. of Am., Atlanta, 21-25 Apr. 1980
(NASA-TM-81460; E-389) Avail: NTIS HC A03/MF A01 CSCL 20A

An inverted velocity profile coaxial nozzle for use with supersonic cruise aircraft produces less jet noise than an equivalent conical nozzle. Furthermore, decreasing the annulus height (increasing radius ratio with constant flow) results in further noise reduction benefits. The annulus shape (height) was varied by an eccentric mounting of the annular nozzle with respect to a conical core nozzle. Acoustic measurements were made in the flyover plane below the narrowest portion of the annulus and at 90 deg and 180 deg from this point. The model-scale spectra are scaled up to engine size (1.07 m diameter) and the perceived noise

levels for the eccentric and baseline concentric inverted velocity profile coaxial nozzles are compared over a range of operating conditions. The implications of the acoustic benefits derived with the eccentric nozzle to practical applications are discussed. A.R.H.

N80-22047*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE SUPPRESSION DUE TO ANNULUS SHAPING OF CONVENTIONAL COAXIAL NOZZLE
U. vonGlahn and J. Goodykoontz 1980 19 p refs Prepared for the 99th Meeting of the Acoust. Soc. of Am., Altanta, 21-25 Apr. 1980
(NASA-TM-81461; E-390) Avail: NTIS HC A02/MF A01 CSCL 20A

A method which shows that increasing the annulus width of a conventional coaxial nozzle with constant bypass velocity will lower the noise level is described. The method entails modifying a concentric coaxial nozzle to provide an eccentric outer stream annulus while maintaining approximately the same through flow as that for the original concentric bypass nozzle. Acoustical tests to determine the noise generating characteristics of the nozzle over a range of flow conditions are described. The tests involved sequentially analyzing the noise signals and digitally recording the 1/3 octave band sound pressure levels. The measurements were made in a plane passing through the minimum and maximum annulus width points, as well as at 90 degrees in this plane, by rotating the outer nozzle about its axis. Representative measured spectral data in the flyover plane for the concentric nozzle obtained at model scale are discussed. Representative spectra for several engine cycles are presented for both the eccentric and concentric nozzles at engine size. A.W.H.

N80-22048*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN IMPROVED PREDICTION METHOD FOR THE NOISE GENERATED IN FLIGHT BY CIRCULAR JETS
James R. Stone and Francis J. Montegani 1980 33 p refs Prepared for the 99th Meeting of the Acoust. Soc. of Am., Atlanta, 21-25 Apr. 1980
(NASA-TM-81470; E-403) Avail: NTIS HC A03/MF A01 CSCL 20A

A semi-empirical model for predicting the noise generated by jets exhausting from circular nozzles is presented and compared with small-scale static and simulated-flight data. The present method is an updated version of that part of the original NASA aircraft noise prediction program relating to circular jet noise. The earlier method agreed reasonably well with experimental static and flight data for jet velocities up to approximately 520 m/sec. The poorer agreement at higher jet velocities appeared to be due primarily to the manner in which supersonic convection effects were formulated. The purely empirical supersonic convection formulation is replaced in the present method by one based on theoretical considerations. Other improvements of an empirical nature were included based on model-jet/free-jet simulated-flight tests. The effects of nozzle size, jet velocity, jet temperature, and flight are included. A.R.H.

N80-22049# Naval Ocean Systems Center, San Diego, Calif.
AIRCRAFT NOISE MONITORING AT NAVAL TRAINING CENTER AND MARINE CORPS RECRUIT DEPOT, SAN DIEGO, CALIFORNIA, IN 1978 AND 1979 Technical Report, Jul. 1978 - Jun. 1979
D. R. Schmidt and R. G. Klumpp Sep. 1979 24 p refs
(AD-A080261; NOSC/TR-465) Avail: NTIS HC A02/MF A01 CSCL 20/1

Aircraft noise from Lindbergh Field was measured during 1978 and 1979 at selected locations within the Naval Training Center (NTC) and the Marine Corps Recruit Depot (MCRD) and compared with noise measured in 1972. The comparison showed that at two locations the noise level had increased and at one location it had decreased. Noise contours based on the 1978-1979 measurements were generated for NTC and MCRD using a NOISEMAP computer program. Contours were then projected to 1985 by using assumptions concerning aircraft mix and numbers of operations. The projected contours show that if compliance with existing FAA noise regulations is obtained the noise impact of Lindbergh Field on NTC and MCRD will be reduced substantially. GRA

N80-22050# Naval Underwater Systems Center, New London, Conn. Special Projects Dept.
TRANSMISSION LOSS THROUGH CASCADED GRATINGS OF SIMPLY SUPPORTED HOLLOW BARS IN A FLUID LAYER
Ronald P. Radlinski and Francis E. Rembetski Dec. 1979 26 p refs
(AD-A080222; NUSC-TR-6117) Avail: NTIS HC A03/MF A01 CSCL 20/1

A presentation on the transmission loss of plane wave normally incident on multiple gratings of simply supported hollow bars immersed in a fluid layer between two fluid half spaces was made at the 96th meeting of the Acoustical Society of America, held in Honolulu, Hawaii, during November 1978. This report documents the text and visual aids in the presentation. GRA

N80-22051# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 117: F-16A IN-FLIGHT CREW NOISE
Herald K. Hille Jul. 1979 15 p
(AD-A080642; AMRL-TR-75-50-Vol-117) Avail: NTIS HC A02/MF A01 CSCL 01/2

The F-16 A is a USAF lightweight fighter. This report provides measured data defining the bioacoustic environments at the pilot's location inside this aircraft for 16 flight conditions. Data are reported for one location in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. GRA

N80-22052# British Aerospace Aircraft Group, Bristol (England).
SPACECRAFT STRUCTURAL ACOUSTIC STUDIES: THE DEVELOPMENT OF A PRACTICAL PREDICTION TECHNIQUE FOR NOISE INDUCED STRUCTURAL VIBRATION AND SOUND TRANSMISSION Final Report
R. J. Cummins and W. Cooper Jun. 1979 200 p refs
(Contract ESA-3343/77-NL-PP(SC))
(ESA/B44-7/0712; ESA-CR(P)-1264) Avail: NTIS HC A09/MF A01

A prediction method was developed for noise induced structural vibration and sound transmission based on the concepts of statistical energy analysis (SEA). A general statistical energy program, GENSTEP, was written in FORTRAN ANS language which is capable of solving problems modelled by the SEA techniques. An experimental program was also performed in order to establish necessary SEA parameters for a range of typical spacecraft structural components. The computer predictions show a good agreement with the measured response of simple structures exposed to broad band reverberant noise. The limitations of the current method are defined together with suggestions for future development. Author (ESA)

N80-22053# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
ARE LOCALLY REACTING ACOUSTIC LINERS ALWAYS BEHAVING AS THEY SHOULD?
T. Zandbergen 1 Sep. 1979 8 p refs Presented at 5th AIAA Aero-Acoustic Conf., Seattle, 12-14 Mar. 1979
(Contract NIVR-1850)
(NLR-MP-79002-U) Avail: NTIS HC A02/MF A01

The properties of a Helmholtz resonator type acoustic lining material may be seriously effected by intercellular water drain holes. This was shown by experiments on an actual aircraft engine liner where drain holes caused a considerable shift in the frequency for maximum attenuation. Futhermore the drain holes invalidate the assumption of local reaction which is usually made for this type of lining material in duct acoustics. This was confirmed by the phase differences measured between the signals of two microphones at the bottom wall of a cell of the material. In the absence of drain holes, such phase differences were also found when the free space acoustic wavelength was smaller than 3.5 times the cavity cross dimension. Some remarks

are made concerning problems associated with the application of the two microphone technique for in situ impedance measurements on a rather large cell material. Author (ESA)

N80-22224# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOISE GENERATED AERODYNAMICALLY
Robert Lesendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. 1979-1, Jan.-Feb. 1979 p 1-9 Original report in FRENCH previously announced as A79-30933 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

N80-22237# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROPELLER DRIVEN LIGHT AIRCRAFT NOISE
Claude Dahan, Leon Avezard, Georges Guillien, Christian Malarmey, and Jacques Chombard *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 73-84 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 129-137 Original report in FRENCH previously announced as A79-34980 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

N80-22238# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOISE GENERATED AERODYNAMICALLY
Robert C. Legendre *In its* La Rech. Aerospatiale Bi-Monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 85-87 ref Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 139-140 Original report in FRENCH previously announced as A79-34981 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-22054# Catholic Univ. of America, Washington, D. C. Dept. of Physics.
ELECTRONIC STOPPING POWER CALCULATIONS FOR ALL HEAVY IONS AT LOW VELOCITY IN ALL ELEMENTS
J. G. Brennan and D. J. Land Jan. 1980 60 p refs
(Contract N00014-78-C-0515)
(AD-A079643; TR-2) Avail: NTIS HC A04/MF A01 CSCL 20/8

Values of the electronic stopping power for projectiles from carbon to uranium in elemental targets from hydrogen through the transuranic elements at the Bohr velocity, v sub zero = (e to the 2nd power)/h-bar, are presented in sets of tables. The stopping powers were calculated within a modified Firsov model. An algorithm for determing the stopping power from v = 0 to v = 3 to 4v sub zero is discussed. The stopping powers, as obtained from this algorithm, are compared with an extensive collection of experimental data. The results are presented in a series of graphs. GRA

N80-22055# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
MOLECULAR ORBITALS AND SUPERCONDUCTIVITY Interim Report
K. H. Johnson, D. D. Vvedensky, and R. P. Messmer 31 Dec. 1979 58 p refs
(Contract N00014-75-C-0970)
(AD-A079470; Rept-11) Avail: NTIS HC A04/MF A01 CSCL 20/3

A real-space molecular-orbital description of electronic wavefunctions which are postulated to be the precursors of the superconducting state in metals, alloys, compounds, and noncrystalline materials is presented, based on self-consistent field X-alpha scattered-wave molecular-orbital calculations for clusters representing the local molecular environments in these materials. It is shown through a variety of examples that there is a persistent correlation between the occurrence of superconductivity in a material and the existence of molecular orbitals at the Fermi energy with coherent (i.e., in-phase) spatially extended bonding atomic-orbital components. It is also argued that, while these individual molecular-orbital components are usually one-dimensional or two-dimensional in nature, the composite precursor superconducting state of a material arises from a coherent three-dimensional network or array of these components. These criteria provide a basis for understanding the generally mutually exclusive incidence of superconductivity and magnetism among the elements of the periodic table, although they can also be used to explain the occasional coexistence of superconductivity and ferromagnetism or antiferromagnetism in some materials. The molecular-orbital criteria for superconductivity complement existing formal theories in that they appear to explain simply and directly certain observed chemical trends of superconductivity, and are naturally applicable to superconducting materials lacking long-range crystalline order, such as solid-solution alloys, amorphous alloys, and small particles. GRA

N80-22056# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MEASUREMENTS ON ELECTRON IMPACT EXCITATION FUNCTIONS OF XENON TRANSITIONS M.S. Thesis
Mark Douglas Stephen Dec. 1979 89 p refs
(AD-A080176; AFIT/SEP/PH/79D-11) Avail: NTIS HC A05/MF A01 CSCL 20/10

Electron impact excitation functions have been measured in xenon for excitation of some of the 6p, 6prime, 7prime, 8s, 5dprime, and 8d levels. A one centimeter diameter electron beam was used to excite the gas atoms. The beam was made nearly mono-energetic by use of the retarding-potential-difference method. Most of the xenon I excitation functions were sharply peaked around 18 eV. Broader excitation functions were measured which had peak cross sections at electron energies around 30 eV. Cascading from higher energy levels showed significant effects on selected optical excitation functions. The electron gun produced a current of approximately one milliamp. Measurement of some xenon II excitation functions produced by simultaneous ionization/excitation were obtained. The xenon II excitation functions demonstrated a maximum at approximately 35 eV, and a broader shape than the Xe I excitation functions. GRA

N80-22057# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS OF ELECTRON DRIFT VELOCITIES IN MOLECULAR GAS RARE GAS MIXTURES USING A FLOWING AFTERGLOW PLASMA M.S. Thesis
Richard F. Wittler Dec. 1979 118 p refs
(AD-A080178; AFIT/SEP/PH/79D-13) Avail: NTIS HC A06/MF A01 CSCL 20/9

Electron drift velocities are obtained in mixtures of Ar-N2, Ar-CO, and He-N2 using a flowing afterglow. Theoretical development of drift velocities in the molecular gas-rare gas mixture is discussed. Two factors are discussed which determine the electron collision frequency: the shape and magnitude of the electron elastic cross section of the buffer gas, and the threshold energy and magnitude of the inelastic processes. Drift velocity enhancement and differential negative conductivity caused by the presence of small amounts of molecular gas are discussed. Experimental drift velocity curves show good agreement with theoretical curves obtained by a numerical solution to the Boltzmann equation. Minor deviations indicate that metastable ionization should be included in the computer analog to better model electron density in the flowing afterglow. A drift tube design using up-to-date electronics is proposed. GRA

N80-22058# Mississippi Univ., University. Dept. of Physics and Astronomy.
MORE ON THE ACOUSTICAL METHOD FOR MEASURING ENERGY AND TANGENTIAL MOMENTUM ACCOMMODATION COEFFICIENTS Progress Report, 1978 - 1979
F. Douglas Shields Nov. 1979 22 p refs
(Contract N00014-78-C-0538)
(AD-A076972) Avail: NTIS HC A02/MF A01 CSCL 20/2

Additional measurement of the energy (EAC) and tangential

momentum accommodation coefficients (TMAC) of He and Ne on polycrystalline tungsten have been made using an acoustic technique previously reported. The measurements were made after the tungsten surface had been exposed to the atmosphere and after it had been flashed in a vacuum at 1240, 1460, 1770 and 2000 K. Three stable, reproducible surfaces were detected. These have been associated with an atomic oxygen film, upper molecular oxygen film, and an unknown film produced by atmospheric exposure. Comparison with molecular beam scattering experiments indicates that TMAC corresponds to the fraction of molecules scattered diffusely from polycrystalline surfaces and EAC to the diffuse fraction from single crystal surfaces. GRA

N80-22059# Los Alamos Scientific Lab., N. Mex.
ESCADT: A FORTRAN CODE FOR COMPUTING THE POSITIONS AND AREAS OF X-RAY PHOTOELECTRON SPECTRAL PEAKS
Lawrence E. Cox. Sep. 1979. 21 p. refs.
(Contract W-7405-eng-36)
(LA-7910) Avail: NTIS. HC A02/MF A01

The program ESCAD which uses least squares derived convoluting numbers to smooth and differentiate X-ray photoelectron spectra is described. Peak maxima are located by finding zero crossings of the first derivative and refined using a cubic polynomial fitting procedure. Background points are located using the product of the absolute value of the first derivative and the smoothed ordinate value. Peak areas, using both linear and scattered electron backgrounds, are computed. Spectra are corrected for changes in instrument sensitivity and energy calibration with gold standard data retrieved from a disk file. DOE

N80-22060# Oak Ridge National Lab., Tenn.
ELECTRON CAPTURE BY MULTICHARGED IONS COLLIDING WITH ATOMIC HYDROGEN
D. H. Crandall. 1979. 9 p. refs. Presented at Intern. Seminar on Ion-Atom Collisions (ISIAC 6), Tokai-mura, Japan, 6 Sep. 1979.
(Contract W-7405-eng-26)
(CONF-790950-1) Avail: NTIS. HC A02/MF A01

A survey of research of electron capture by multicharged ions colliding with atomic hydrogen is presented. Experimental techniques are outlined and typical results over a wide energy range are discussed. DOE

N80-22061# United Kingdom Atomic Energy Authority, Culham (England). Engineering Design Div.
ION OPTICS STUDIES FOR A FIELD EMISSION THRUSTER Final Report
P. F. Little and C. L. Thomas. Aug. 1977. 86 p. refs.
(Contract ESTEC-2336/74-AK)
(CLM/RR/E1/24) Avail: NTIS. HC A05/MF A01

A computational study of the ion trajectories in a field emission thruster is presented. An electrode system for accelerating Cs ions emitted from a linear array of points was designed in such a way as to produce a collimated beam with a minimum number of ions striking the electrodes. The electric field distribution around a finite array of pin emitters was calculated for arrays containing different numbers of emitters. This electrostatic problem was solved in three dimensions. A modified support structure was formulated in which end effects due to finite length were negligibly small. The trajectories of ions emitted from single pin emitter and from a sharp edge (a line source) were also traced through a system of electrodes as two-dimensional problems. The edge emitter is treated as if of infinite length, end effects being ignored. A two-dimensional electrode configuration is suggested in which back-bombardment of the is predicted to be negligible. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-22062*# Battelle Columbus Labs., Ohio.
ANALYSIS OF NUCLEAR WASTE DISPOSAL IN SPACE. PHASE 3. VOLUME 1: EXECUTIVE SUMMARY OF TECHNICAL REPORT Final Report
Eric E. Rice, Neil E. Miller, Kenneth R. Yates, William E. Martin, and Alan L. Friedlander. 31 Mar. 1980. 72 p. refs. 2 Vol.
(Contract NAS8-32391)
(NASA-CR-161418) Avail: NTIS. HC A04/MF A01. CSCL 18G

The objectives, approach, assumptions, and limitations of a study of nuclear waste disposal in space are discussed with emphasis on the following: (1) payload characterization; (2) safety assessment; (3) health effects assessment; (4) long-term risk assessment; and (5) program planning support to NASA and DOE. Conclusions are presented for each task. A.R.H.

N80-22063*# Battelle Columbus Labs., Ohio.
ANALYSIS OF NUCLEAR WASTE DISPOSAL IN SPACE. PHASE 3. VOLUME 2: TECHNICAL REPORT Final Report
Eric E. Rice, Neil E. Miller, Kenneth R. Yates, William E. Martin, and Alan L. Friedlander. 31 Mar. 1980. 376 p. 2 Vol.
(Contract NAS8-32391)
(NASA-CR-161419) Avail: NTIS. HC A17/MF A01. CSCL 18G

The options, reference definitions and/or requirements currently envisioned for the total nuclear waste disposal in space mission are summarized. The waste form evaluation and selection process is documented along with the physical characteristics of the iron nickel-base cermet matrix chosen for disposal of commercial and defense wastes. Safety aspects of radioisotope thermal generators, the general purpose heat source, and the Lewis Research Center concept for space disposal are assessed as well as the on-pad catastrophic accident environments for the uprated space shuttle and the heavy lift launch vehicle. The radionuclides that contribute most to long-term risk of terrestrial disposal were determined and the effects of resuspension of fallout particles from an accidental release of waste material were studied. Health effects are considered. Payload breakup and rescue technology are discussed as well as expected requirements for licensing, supporting research and technology, and safety testing. A.R.H.

N80-22064# Battelle Pacific Northwest Labs., Richland, Wash.
CERAMICS IN NUCLEAR WASTE MANAGEMENT
Thomas D. Chikalla and John E. Mendel. May 1979. 385 p. refs. Proceedings of an Intern. Symp. held in Cincinnati, Ohio, 30 Apr. - 2 May 1979, sponsored in part by the Nucl. Div. of the Am. Ceram. Soc.
(Contract EY-76-C-06-1830)
(CONF-790420) Avail: NTIS. HC A17/MF A01

The material aspects of national programs for the disposal of radioactive wastes in six countries are reviewed. Technical issues considered include waste form stability characterization, the immobilization of radioactive wastes by glass processing, ceramics processing, and glass ceramics processing; and the leaching of waste materials. The properties of nuclear waste forms, and the immobilization of special radioactive wastes are also discussed. A.R.H.

N80-22065# Rockwell International Corp., Richland, Wash. Energy Systems Group.
NUCLEAR WASTE REPOSITORY IN BASALT: PRECONCEPTUAL DESIGN GUIDELINES
Jun. 1979. 192 p. Prepared in cooperation with Vitro Engineering Corp., New York.
(Contract EY-77-C-06-1030)
(RHO-BWI-2-Rev-1) Avail: NTIS. HC A09/MF A01

The development of the basalt waste isolation program is discussed. The repository will be located within the Columbia

Plateau formations. These wastes will be stored such that the wastes may be retrieved from storage for a period after placement. After the retrieval period, the storage locations will be prepared for terminal storage. The terminal storage requirements will include decommissioning provisions. DOE

74 OPTICS

Includes light phenomena.

N80-22066# Hughes Aircraft Co., Malibu, Calif.
BLUE/GREEN COUPLED WAVE FILTER STUDY Final Report, 1 Jun. - 30 Nov. 1979
J. F. Lotspeich and D. M. Henderson Jan. 1980 42 p refs
(Contract N00014-79-C-0491)
(AD-A079805) Avail: NTIS HC A03/MF A01 CSCL 20/6

High-resolution measurements of AgGaS2 iso-index electro-optic filter samples have confirmed earlier theoretical predictions. We observed a filter passband of less than 1.0 A at 4970 A in a sample 3 mm thick and have achieved electrooptic control of transmission efficiency up to a maximum of 60% with about 1000 V. These results translate to filter passbands of less than 0.3 A in a 1-cm sample with comparable voltage requirements and with negligible electric power dissipation. The filter response for off-normal light beams indicates an FOV capability in excess of 60 half-angle (f/0.3) with less than a 20% increase in passband over that of the narrow-field condition. Fine tuning of the pass wavelength by temperature variation showed a tuning rate of 0.25 A/C. Theoretical characterization of iso-index materials demonstrated that crystals with large nonresonant birefringence and small fundamental bandgap shifts yield narrow passbands. A useful figure of merit for predicting filter performance was derived. Potentially useful materials include the II-VI mixed crystal semiconductors (CdS-ZnO) and the mixed ternary chalcopyrites (AgGaS2-CuAlS2). GRA

N80-22067# Hughes Aircraft Co., Tucson, Ariz. Missile Development Div.
HIGH STRENGTH RAPID PAYOUT FIBER OPTIC CABLE ASSEMBLY Semiannual Technical Report, Aug. 1978 - May 1979
D. S. Fox and R. A. Eisentraut Aug. 1979 168 p refs
(Contract DAAB07-78-C-2964)
(AD-A079633; FR79-56-0003; CORADCOM-78-2964-1) Avail: NTIS HC A08/MF A01 CSCL 20/6

This report summarizes preliminary results obtained in the investigation of the feasibility of a fiber optic cable payout assembly capable of high speed payout with simultaneous optical transmission. The results of both cable design studies and payout assembly (dispenser) design studies are described. Experimental results for both optical attenuation and payout performance are provided. GRA

N80-22068# Hughes Research Labs., Malibu, Calif.
FIBER OPTIC COUPLERS Interim Report, 1 Aug. 1978 - 31 May 1979
C. K. Asawa Nov. 1979 72 p refs
(Contract F19628-78-C-0201; AF Proj. 4600)
(AD-A079625; RADC-TR-79-263) Avail: NTIS
HC A04/MF A01 CSCL 20/6

The purpose of this contract is to conduct research and development of new fabrication techniques for couplers for use with single strand multimode optical fiber waveguides. The structures investigated under this contract were directional couplers and 8 by 8 planar transmission star couplers. Both theoretical and experimental characterization of the 8 by 8 transmission couplers were made. The waveguide structures were fabricated on a Nd-rich glass substrate using an ion-exchange process. The structure patterns were formed on the substrate by means of photolithography. Limited experiments demonstrating the fabrication of thick films by chemical vapor deposition on silica were also performed. GRA

N80-22069# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
INFRARED NONLINEAR OPTICS IN SEMICONDUCTORS Final Report, 1 Oct. 1975 - 30 Sep. 1979
Peter A. Wolf 1979 13 p refs
(Grant AF-AFOSR-2894-76; AF Proj. 2306)
(AD-A079656; AFOSR-79-1313TR) Avail: NTIS
HC A02/MF A01 CSCL 20/12

A variety of nonlinear optical processes in semiconductors, have been investigated experimentally and theoretically. Among them are: nonlinear optical-impurity interactions, spin-induced four-photon mixing, FIR difference frequency generation, parametric excitation of plasma waves: nonequilibrium carrier dynamics under intense laser excitation, and enhanced four-photon mixing in the Gunn effect regime. The ultimate goals of this work are the development of tunable IR sources; and the understanding of carrier dynamics in semiconductors. GRA

N80-22070# Arizona Univ., Tucson. Optical Sciences Center.
RESEARCH IN THE OPTICAL SCIENCES Final Technical Report, 1 Aug. 1977 - 31 Jul. 1979
Sep. 1979 69 p
(Contract F49620-77-C-0138; AF Proj. 2301)
(AD-A079299; AFOSR-79-1311TR) Avail: NTIS
HC A04/MF A01 CSCL 20/6

Contents: Optical Design, Fabrication and Testing; Quantum Optics and Radiometry; Optical Devices and Technology; and Optical Materials. GRA

N80-22071# Texas Technological Univ., Lubbock. Optical Systems Lab.
SPACE-VARIANT OPTICAL SYSTEMS Final Report, 30 Jun. 1975 - 30 Sep. 1979
John F. Walkup Nov. 1979 15 p refs
(Grant AF-AFOSR-2855-75; AF Proj. 2305)
(AD-A079816; AFOSR-79-1316TR) Avail: NTIS
HC A02/MF A01 CSCL 20/6

This report summarizes the results of analytical and experimental investigations of both two-dimensional and one-dimensional coherent optical processors for performing space-variant operations. The two dimensional processors have generally used multiplex holography as an approach to implementing a sampling theorem-based representation of the optical system of interest. The one-dimensional processors are variations of a generalized 1-D processor which has been shown to have a variety of applications. GRA

N80-22072# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ASYMPTOTIC ANALYSIS OF OFF-CENTER UNSTABLE CONFOCAL RESONATORS M.S. Thesis
Michael Paul Grone Dec. 1979 124 p refs
(AD-A080241; AFIT/GEP/PH/79D-4) Avail: NTIS
HC A06/MF A01 CSCL 20/3

A polynomial equation for the eigenvalues of the modes of off-center unstable confocal resonators is developed. A constant gain for steady state modes in a bare cavity is assumed. The field is a build-up from right and left-traveling diffraction components for a number of round trips through the resonator and geometrical components from the core region. Using an asymptotic expansion of the diffraction integral, the boundary conditions are developed. These, with the propagation equations across the resonator, are used to relate the diffraction and geometrical components to the diffraction amplitude after one round trip in the cavity. The polynomial equation for the eigenvalues is developed from the first round trip amplitude function, after approximating a slowly varying function of the field to be constant. A method is proposed for examining the behavior of the approximated function for the centered resonator case and including it in mode calculations if necessary. GRA

N80-22073# Washington Univ., St. Louis, Mo. Lab. for Applied Electronic Sciences.
FRESNEL LENS AND BEAM CONTROL IN OPTICAL WAVEGUIDE Final Report, 1 Jun. - 30 Sep. 1979
William S. C. Chang Oct. 1979 38 p refs
(Contract F49620-79-C-0145; AF Proj. 2306)
(AD-A080106; AFOSR-80-0042TR) Avail: NTIS
HC A03/MF A01 CSCL 20/6

Fresnel Lenses have the potential to out-perform other waveguide lenses. In this project, preliminary design parameters

for etched Fresnel lenses in LiNbO3 waveguide has been obtained. Optimum diffused LiNbO3 waveguide structures for the realization of a Fresnel lens have been identified. Reactive sputter etching has been experimentally investigated as a submicron etching technique. Theoretical analyses of the chirped grating as a Fresnel lens have been formulated. GRA

N80-22074# TRW, Inc., Philadelphia, Pa.
OPTICAL FIBER COMMUNICATIONS CABLE CONNECTOR Semiannual Report, 1 May - 1 Nov. 1979
James F. Ryley Jan. 1980 27 p
(Contract DAAK80-79-C-0772)
(AD-A080343; CORADCOM-79-0772-1) Avail: NTIS HC A03/MF A01 CSCL 20/6

Progress toward development of a multi-fiber, hermaphroditic, fiber optic cable connector is described. A brief survey of general approaches to fiber optic alignment schemes along with the present approaches philosphy is presented. Development status on the fiber alignment guide and preliminary connector design is summarized. Efforts toward developing a suitable fiber scribing machine for six fiber cable are introduced and future plans stated. GRA

N80-22075# ITT Electro-Optical Products Div., Roanoke, Va.
HIGH NA SINGLE MODE FIBERS Final Technical Report, 15 Sep. 1978 - 15 Mar. 1979
Frank I. Allers Jun. 1979 44 p
(Contract N00173-78-C-0196)
(AD-A080526; ITT-79-20-05) Avail: NTIS HC A03/MF A01 CSCL 20/6

Single mode fibers offer a useful medium for new sensor applications based on optical phase change detection. Examples are the optical gyroscope and temperature and acoustic sensors. Many of these applications require the single mode fiber to be used in a tightly coiled configuration. One limiting factor in sensor development is that single mode fibers with a numerical aperture (NA) of less than .15 exhibit a sharp increase in attenuation when subjected to bending and microbending. To overcome this limitation, the development of a high NA (greater than .15) single mode fiber was started under contract N00173-78-C-0196 to achieve improved handling and performance characteristics with respect to reduced bending and microbending losses. Single mode fibers with numerical apertures ~ 0.2 were developed using core compositions of SiO2/GeO2, SiO2/GeO2/P2O5, and SiO2/PeO5 and a B2O3/SiO2 cladding, and fabrication techniques were investigated which minimize the central index dip in the core of these fibers. The high NA fibers were evaluated for optical attenuation strung and spooled, at wavelengths of 0.63, 0/83 and 1/03 micron. In contrast to 0.1 NA single mode fibers which do not transmit when spooled, high NA fibers showed no significant attenuation increase when wound onto 10 cm diameter spools. Fiber attenuation was found to increase as a function of numerical aperture from 2.57 dB/km for a 0.1 NA fiber, to 16.6 dB/km for a 0.23 NA fiber at 0.83 micron evaluation wavelength. Selected single mode fibers showed variations in mean tensile strength from 1414 N/sq mm to 9413 N/sq. mm with N values of 7.5 and 55 respectively. GRA

N80-22076# Farleigh Dickinson Univ., Teaneck, N. J. Dept. of Physics.
SURVEY OF INFRARED ABSORPTION PHENOMENA AND EXPERIMENTAL METHODS FOR LIQUIDS AND SOLID FILMS Progress Report, 15 Jun. - 15 Sep. 1977
R. D. Moeller and V. D. Tomaselli Sep. 1979 71 p refs
(Contract DAAK10-77-C-0121)
(AD-A080551; AD-E410222; FDU-1; ARCSL-CR-79052) Avail: NTIS HC A04/MF A01 CSCL 20/6

A discussion of absorption phenomena in the infrared (2.5 to 15 micrometers) spectra region is presented. Mechanisms surveyed include the attenuation of electromagnetic waves by dielectrics and metals; molecular absorption processes, lattice vibrations in bulk and powdered dielectrics, band gap, free carrier and multiple phonon absorption in semiconductors; absorption in bulk and powdered metals; and absorption by polymeric one-dimensional conductors. Also presented is a review of quantitative methods of determining the optical constants of solids, liquids and gases and their possible sources of error. The results of quantitative absorption measurements on tri-n-butyl phosphate, polymethylmethacrylate, cellulose, polyvinyl alcohol, and ureaformaldehyde are included. GRA

N80-22077# Sandia Labs., Albuquerque, N. Mex.
ELECTRON-BEAM INDUCED ABSORPTION AND HARDENING IN FIBER-OPTIC WAVEGUIDES TO 1060 nm LASER PULSES
Murphy J. Landry and H. P. Davis Jul. 1979 25 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1208) Avail: NTIS HC A02/MF A01

The coupling efficiencies (output/input energy) before and after electron beam irradiation, the output energy density, the induced attenuation loss and its decrease as a function of time, and hardening as a function of the number of Febetron shots were determined for fiber-optic waveguides (FOW's). The physical and optical characteristics of fiber optic waveguides are discussed. The mechanical and optical setup used for studying the radiation induced loss to high laser transmitted energy in FOW's is described. Changes in the induced losses as a function of recovery time and the hardening effect observed in FOW's are reported. A.W.H.

N80-22078# Battelle Inst., Frankfurt am Main (West Germany).
STUDY ON INTERSATELLITE LASER COMMUNICATION LINKS Final Report
W. English Jul. 1979 292 p refs
(Contract ESTEC-3555/78-NL-PP(SC))
(BF-R-63.749-5; ESA-CR(P)-1259) Avail: NTIS HC A13/MF A01

A laser communication system was investigated which will be capable of establishing a two way 1 gigabit per second data link between two geostationary satellites with a bit error rate greater than or equal to 0.00001. By a critical evaluation of possible laser types the SHGONd:YAG laser and the CO2 laser were recognised as the most promising candidates to meet the fundamental system performance requirements. From a preliminary design of both systems and a comparative analysis at subsystem level, it is concluded that the CO2 laser system is more suited to meet the technical objectives and involves fewer development risks. For this preferred system, a design concept is outlined and detailed component performance requirements and operational characteristics are defined. A prominent design feature is the use of an external light pipe modulator in combination with appropriately selected laser lines (for signal transmitter and local oscillator) which provide a growth potential in bandwidth of up to 5 GHz. Author (ESA)

N80-22079# National Bureau of Standards, Boulder, Colo. National Engineering Lab.
TIME DOMAIN PULSE MEASUREMENTS AND COMPUTED FREQUENCY RESPONSES OF OPTICAL COMMUNICATIONS COMPONENTS
James R. Andrews and Matt Young Sep. 1979 36 p refs
(PB80-120066; NBSIR-79-1620) Avail: NTIS HC A03/MF A01 CSCL 20F

The application of the automatic pulse measurement system to measuring the pulse responses of optical communications components and to computing their impulse and frequency responses is described. Measurements of the properties of two glass fibers and an avalanche photodiode using both a pulsed GaAs laser dioxide wavelength and a Nd:YAG laser are discussed. All measurements were performed in the time domain. Frequency domain data were obtained from the time domain data by using the fast fourier transform. The impulse response was obtained by deconvolution. GRA

N80-21446# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).
EFFECT OF SPACE CHARGED PARTICLE ENVIRONMENT ON OPTICAL COMPONENTS AND MATERIALS
J. Bourrieau and M. Romero *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 275-285 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21598# Bologna Univ. (Italy). Ist. di Elettronica.
STATISTICS OF OPTICAL-FIBER TRANSFER-FUNCTION MEASUREMENTS: A COMPUTER-AIDED APPROACH

P. Bassi and M. Zoboli *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 339-344 refs Sponsored in cooperation with Telettra SPA and CNR, Rome (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-22080# Nagoya Univ. (Japan). Inst. of Plasma Physics.
COLLISIONAL EFFECTS ON THE ELECTROMAGNETIC INSTABILITY FOR A RELATIVISTIC ELECTRON BEAM PENETRATING A PLASMA
Toshio Okada and Keishiro Niu Feb. 1980 13 p refs
(IPPJ-439) Avail: NTIS HC A02/MF A01

The electromagnetic instability of a relativistic electron beam penetrating an infinite plasma was analyzed to determine the effect of collisions within the plasma upon the growth rate of a Weibel-type electromagnetic instability. The dispersion relation including the effect of collisions is solved analytically and numerically. It is found that collisions can enhance the growth rate of the electromagnetic instability in the case of low plasma temperature. Author

N80-22081# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A COMBINATION OF PERMANENT MAGNET AND MAGNETIC COIL FOR A LARGE DIAMETER ION SOURCE
Joshin Uramoto Feb. 1980 16 p
(IPPJ-440) Avail: NTIS HC A02/MF A01

A large diameter ion source for fast neutral beam injection is designed under a magnetic field composed of a circular ferrite permanent magnet and a usual coreless magnetic coil. As the magnetic field is reduced abruptly in a discharge anode, an ion source with a uniform ion current density over a large diameter is produced easily without a 'button' of ORNL duoPIGatron type ion source (a floating electrode to diffuse an axial plasma flow radially). Author

N80-22082# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CONTROL OF HORIZONTAL PLASMA POSITION BY FEEDFORWARD-FEEDBACK SYSTEM WITH DIGITAL COMPUTER IN THE JIPP T-2 TOKAMAK
K. Toi, K. Sakurai, S. Itoh, K. Matsuura, and S. Tanahashi Feb. 1980 29 p
(IPPJ-441) Avail: NTIS HC A03/MF A01

The confinement of high temperature, high density plasma and the control of the horizontal plasma position in a resistive shell tokamak, JIPP T-11, is reported by calculating the equilibrium equation of a large aspect ratio tokamak plasma, surrounded by a thin resistive shell of a skin time of 5.2 msec, every 1.39 msec with a digital computer. The required strength of the vertical field is determined by the control demand of two groups: a feedback term expressed by the deviation of plasma position from the desired one and proportion-integration-differentiation correction, and a feedforward term which is in proportion to the plasma current. The basic equations for the control of plasma position, derived from the tokamak equilibrium theory, are presented. The control system with the digital computer for tokamak equilibrium in JIPP T-11 is described along with the control system of horizontal plasma position. A.W.H.

N80-22083*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POTENTIALITIES OF TEC TOPPING: A SIMPLIFIED VIEW OF PARAMETRIC EFFECTS
James F. Morris 1980 21 p refs Presented at Intern. Conf. on Plasma Sci., Madison, Wisc., 19-21 May 1980; sponsored by IEEE
(Contract EC-77-A-31-1062)
(NASA-TM-81468; DOE/NASA/1062-80/5; E-399) Avail: NTIS HC A02/MF A01 CSCL 10A

An examination of the benefits of thermionic-energy-conversion (TEC)-topped power plants and methods of increasing conversion efficiency are discussed. Reductions in the cost of TEC modules yield direct decreases in the cost of electricity (COE) from TEC-topped central station power plants. Simplified COE, overall-efficiency charts presented illustrate this trend. Additional capital-cost diminution results from designing more compact furnaces with considerably increased heat transfer rates allowable and desirable for high temperature TEC and heat pipes. Such improvements can evolve of the protection from hot corrosion and slag as well as the thermal expansion compatibilities offered by silicon-carbide clads on TEC-heating surfaces. Greater efficiencies and far fewer modules are possible with high-temperature, high-power-density TEC: This decreases capital and fuel costs much more and substantially increases electric power outputs for fixed fuel inputs. In addition to more electricity, less pollution, and lower costs, TEC topping used directly in coal-combustion products contributes balance-of-payment gains. M.G.

N80-22084# Case Western Reserve Univ., Cleveland, Ohio. Plasma Research Lab.
CHARACTERISTICS OF PLASMA-BEAM WALL INTERACTIONS Final Report, Apr. 1978 - Jun. 1979
O. K. Mawardi, A. M. Ferendeci, and R. Mesli Jun. 1979 79 p refs
(Grant AF-AFOSR-3603-78; AF Proj. 2301)
(AD-A080309; AFOSR-79-1329TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

Highly energetic (approx. - 42 eV) and dense (approx. - 4 times 10 to the 17th power/cu. cm.) plasma beams with directed velocities (approx. – 20 cm/micrometers) obtained by an improved version of a Cheng type coaxial gun have been directed towards a perforated metallic plate to study the beam-hole interaction. Various diagnostic techniques such as optical interferometry, high speed photography, optical spectroscopy, voltage and current measurements have been performed to characterize the incident plasma beam and determine its different parameters in various conditions with and without the perforated plate. A single fluid model using the method of characteristics has been chosen to study the features of the escaping flow. The pressure of the perforated plate reduced the velocities as well as the temperature significantly thus modifying the properties and structure of the diverging jet. Observers provided evidence that a large amount of material has been ablated from the hole region and transported with the escaping jet. GRA

N80-22085# California Univ., Los Angeles. Dept. of Electrical Sciences and Engineering.
WAVES AND INSTABILITIES IN STEADY-STATE HIGH-BETA PLASMAS Final Report, 1 Oct. 1978 - 30 Sep. 1979
N. C. Luhmann, Jr. and Frances F. Chen Oct. 1979 84 p refs
(Contract F49620-78-C-0012; AF Proj. 2301)
(AD-A079516; UCLA-ENG-7964; AFOSR-79-1312TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

Stimulated Brillouin scattering has been conclusively identified in a microwave simulation experiment. The threshold and initial growth rate are in agreement with the convective finite interaction length theory. Saturation of the SBS ion waves and associated backscattered electromagnetic wave are observed and a tentative identification of ion trapping as the saturation mechanism has been made. Observations of spontaneous magnetic field generation at low power continued in an attempt to conclusively identify the saturation mechanism. The soliton flash has been studied together with the associated phenomena such as hot electron production, spontaneous magnetic field generation and ion wave instabilities. The finite beta waves and instabilities effort has also continued with primary emphasis on large diameter, high density plasma production. GRA

N80-22086# STD Research Corp., Arcadia, Calif.
MAGNETOGASDYNAMIC PHENOMENA IN PULSED MHD FLOWS Annual Summary Report, 1 Oct. 1978 - 30 Sep. 1979
David A. Oliver, Thomas F. Swean, Jr., D. M. Markaham, C. D. Bangerter, and S. T. Demetriades 1 Oct. 1979 66 p refs
(Contract N00014-77-C-0574; NR Proj. 099-415)
(AD-A079919; STD-UP-002-77-1; STPR-79-8) Avail: NTIS HC A04/MF A01 CSCL 20/9

This work is aimed at the understanding, description, and

prediction of magnetohydrodynamic phenomena exhibited under conditions of extremely high interaction and large magnetic Reynolds number. The plasmas which constitute the fluid medium in such flows may exhibit nonideal thermodynamic and kinetic behavior. The theoretical work has two principal objectives: the elucidation of basic phenomena in strong interaction high magnetic Reynolds number flows independently of specific experiments or machines, and the perfection of predictive theories to accurately describe and model specific experiments aimed at magnetohydrodynamic power production. In what follows we present the general mathematical description of magnetogasdynamic flows in the high magnetic Reynolds number regime. We present several illustrative calculations of quasi-one-dimensional transient effects in strong interaction flows. Two-dimensional high Reynolds number electricity results are presented including the realistic effects of nonuniform velocity and electrical conductivity resulting from hypersonic boundary layers and from shock-induced nonuniformities. GRA

N80-22087# Naval Research Lab., Washington, D. C.
THE TRANSIENT TOKAMAK Interim Report
W. M. Manheimer and N. K. Winsor Dec. 1979 11 p refs
(AD-A080544; AD-E000358; NRL-MR-4142) Avail: NTIS
HC A02/MF A01 CSCL 20/9

A tokamak plasma, and its toroidal current, can be generated by an intense pulsed ion beam. The beam is injected into a target plasma or empty vacuum chamber and then builds the plasma around it. It is shown that ignition is theoretically possible for a dense, high field tokamak. GRA

N80-22088# Naval Research Lab., Washington, D. C.
A SHEAR STABILIZED CYLINDRICALLY SYMMETRIC MIRROR PLASMA Interim Report
W. M. Manheimer Dec. 1979 7 p refs
(AD-A080545; AD-E000357; NRL-MR-4144) Avail: NTIS
HC A02/MF A01 CSCL 20/9

This memorandum report examines the possibility of shear stabilization of a cylindrically symmetric mirror plasma. GRA

N80-22089# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF SULFURHEXAFLUORIDE ON IONIZATION WAVES IN AN ARGON GLOW DISCHARGE M.S. Thesis
Darius S. Vunck Dec. 1979 98 p refs
(AD-A080177; AFIT/GEP/PH/79D-12) Avail: NTIS
HC A05/MF A01 CSCL 07/4

Sulfurhexaflouride was added in trace amounts to low pressure Argon glow discharge operated at 2.0 to 2.5 Torr and 1 to 30 mA. Using current modulation and voltage pulsing techniques, ionization waves were artifically driven and measured using a space-time correlation method developed by Stirand et al. It was found that the addition of SF6 affected the dispersion properties of the ionization waves by directing the phase velocity so that the waves trended toward a forward wave type from the original backward waves found in pure Argon. In addition, the injection of CO as a detaching mechanism into the Argon/SF6 discharges worked to reverse the effects of the SF6. GRA

N80-22090# National Aerospace Lab., Amsterdam (Netherlands). Sciences Services Div.
A FAST PARABOLIC MODULE FOR THE SOLUTION OF MHD CHANNEL FLOW EQUATIONS BETWEEN ELECTRODE WALLS
J. P. F. Lindhout, H. Snel, and W. F. H. Merck (Tech. Hogeschool, Eindhoven, Neth.) 12 Jun. 1979 22 p refs Presented at Intern. Symp. on Innovative Numerical Anal. in Appl. Eng. Sci., Versailles, France, 23-27 May 1977
(NLR-MP-77006-U) Avail: NTIS HC A02/MF A01

A total of two fourth-order methods, based on cubic-splines approximations, are proposed to solve parabolic differential equations. The cubic-splines approximation has a second-order accuracy, which is improved in both methods to fourth-order in different ways. In the first method, the second-order truncation term is estimated by differentiating twice the basic equations. In the other method a local Richardson extrapolation is applied at each marching station to obtain fourth-order accurate values at every two points; subsequent quintic Hermite interpolation is then used to obtain equally accurate values at the remaining points. A von Neumann stability analysis shows that the methods are unconditionally stable. Both methods are applied to a simple boundary-layer problem. The method with local Richardson extrapolation is employed to solve simultaneously the continuity and energy equation describing the behavior of the electron gas along the cathode in an magnatohydrodynamic channel. The results indicate that it is worthwhile to reconsider the model of the electrode-plasma interface. Author (ESA)

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Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-22091*# National Aeronautics and Space Administration, Washington, D. C.
SECONDARY ELECTRON EMISSION FROM SODIUM CHLORIDE, GLASS AND ALUMINUM OXIDE AT VARIOUS TEMPERATURE
A. R. Shulman, V. L. Makedonskiy, and I. D. Yaroshetskiy Jan. 1980 18 p refs Transl. into ENGLISH from Zh. Tekh. Fiz. (USSR), v. 23, 1953 p 1152-1160 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75754) Avail: NTIS HC A02/MF A01 CSCL 20L

The method of single impulses was used to measure the coefficients of the secondary electronic emission for 2 types of Al2O2, monocrystalline NaCl and glass at different temperatures and for different values of the energy of the primary electrons. The value of the secondary electron emission does not depend upon temperature. The effect of a gas film on the value of the secondary electron emission was detected. A.R.H.

N80-22092# Naval Surface Weapons Center, White Oak, Md.
MAGNETOMECHANICAL COUPLING AND MAGNETOSTRICTION IN VERTICALLY ZONED Tb.27Dy.73Fe2
H. T. Savage, R. Abbundi, and A. E. Clark 1 Nov. 1979 14 p refs
(ZF54581005)
(AD-A080061; NSWC/TR-79-463) Avail: NTIS
HC A01/MF A01 CSCL 20/3

We have prepared large grain-oriented samples of Tb(.27)Dy.73)Fe(2) by a vertical free-standing zone technique. The samples have larger values of magnetomechanical coupling and longitudinal magnetostriction than random polycrystalline samples prepared by arc melting. The materials have been characterized by microprobe and grain structure studies. GRA

N80-22093# Honeywell, Inc., St. Petersburg, Fla. Avionics Div.
TECHNOLOGY STUDY ON PIEZOELECTRIC MATERIALS Final Report, Jul. - Dec. 1978
W. B. Harrison and A. G. Thalheimer 20 Jul. 1979 58 p refs
(Contract DNA001-78-C-0328)
(AD-A079941; AD-E300644; DNA-4859F) Avail: NTIS
HC A04/MF A01 CSCL 20/2

The use of Honeywell's ring laser gyros technology is being considered for maneuvering reentry vehicle guidance where hostile nuclear radiation environments may be encountered by the ring laser gyro and its path length control (PLC) transducer. In an effort jointly sponsored by SAMSO and DNA, Honeywell and IRT 1 performed tests and analytical analysis on an operating laser gyro. It was shown that some 'mode hopping' transient motions were produced by the PLC transducer when subject to x-ray exposure. The materials used in the PLC transducer were analyzed and the high Z lead zirconate-lead titanate (PZ-PT) materials used in the transducer were considered as a partial cause of this phenomena. This program was therefore initiated to determine if lower Z materials, free of lead, were suitable replacements for the PZ-PT used in the PLC driver section of the transducer. GRA

N80-22094# ARACOR, Sunnyvale, Calif.
PHOTOEMISSION YIELDS AT LOW X-RAY ENERGIES Annual Technical Report, 1 May 1978 - 30 Sep. 1979
M. J. Berstein 30 Oct. 1979 17 p refs
(Contract F49620-78-C-0092; AF Proj. 2301)
(AD-A079983; ARACOR-TR-20-1; AFOSR-79-1327TR) Avail: NTIS HC A02/MF A01 CSCL 20/8

Photoelectron emission parameters have been studied using x radiation in the 1 to 6 keV range. A retarding-potential analyzer was developed to determine the yields of primary electrons about 50 eV and secondary electrons below 50 eV. Yields were measured at eight monochromatic x-ray energies using photoemitting surfaces of gold, silver, aluminum, titanium, silicon, deposited graphite, glass, anodized aluminum, Mylar and Saranwrap. The primary yields agreed well with previous results for Au, Al and Ti. The ratios of primary to secondary yields were highest at the low end of the photon-energy range; at 1.26 keV, these secondary-to-primary ratios ranged from about 6 for the oxides of Al and Si down to only 1.2 for Mylar. Supplementary total yield measurements on the above materials were made using pulsed low-energy x radiation. Studies were begun on measuring and analyzing the energy distribution of primary electrons. GRA

N80-22095# Colorado State Univ., Fort Collins. Dept. of Physics.
DIELECTRIC LAYERS ON 3-5 SEMICONDUCTORS Annual Report, Jun. 1978 - Sep. 1979
James R. Sites Oct. 1979 57 p refs
(Contract N00014-76-C-0976; RR0210203)
(AD-A079637; SF25) Avail: NTIS HC A04/MF A01 CSCL 20/12

Dielectric layers, particularly SiO2, Si3N4, and AlN, have been deposited on GaAs and other compound semiconductors for several purposes: (1) study of MIS structures, (2) encapsulation during annealing, and (3) electronic profiling of epitoxial layers. Development of the ion beam sputtering technique has paralleled the dielectric studies. GRA

N80-22096# Stanford Univ., Calif. Edward L. Ginzton Lab.
ELASTIC DOMAIN WALL WAVES IN FERROELECTRIC CERAMICS AND SINGLE CRYSTALS Annual Progress Report, 1 Feb. 1979 - 30 Jan. 1980
B. A. Auld Jan. 1980 31 p refs
(Contract N00014-79-C-0222)
(AD-A079715; SU-GL-3076) Avail: NTIS HC A03/MF A01 CSCL 20/3

A theoretical formulation is given for solving problems of elastic waveguiding by and wave scattering at a 'duct' consisting of a spatial variation of material parameters with an arbitrary profile function. Both nonpiezoelectric and piezoelectric materials are treated. For the latter case, examples of calculated displacement and electric potential fields are given for several guided modes and several widths of duct. GRA

N80-22097# Washington Univ., St. Louis, Mo. Semiconductor Research Lab.
IMPURITY AND DEFECT BEHAVIOR IN HIGH-PURITY EPITAXIAL GaAs Final Report, 1 Jan. 1978 - 31 May 1979
C. M. Wolfe and K. H. Nichols 28 Sep. 1979 130 p refs
(Grant AF-AFOSR-2950-76; AF Proj. 2306)
(AD-A079594; AFOSR-79-1328TR; Rept-59356-8) Avail: NTIS HC A07/MF A01 CSCL 20/12

Although a number of mechanisms have been proposed to explain the existence of impurity gradients in epitaxial GaAs, the impurity gradient model presented in this report shows that such effects are inherent to the growth process. That is, when the carrier concentrations in the substrate, growing layer, and at the growth surface are different at the growth temperature, non-uniform time-dependent electric fields are obtained in the layer. These fields can enhance or retard the motion of ionized impurities and defects during growth producing impurity gradients at the outer surface and different conductivity regions at the epitaxy-substrate interface. High temperature resistivity and Hall coefficient measurements were made on epitaxial layers and substrates and analyzed using a self-consistent four-band model to obtain quantitative results for the impurity gradient model for growth on heavily-doped n-type substrates predicts that thin (0.05 micrometers or larger) p-type regions at the epitaxy-substrate interface will be produced under conditions commonly encountered in the epitaxial growth of GaAs. GRA

N80-22098# Raytheon Co., Waltham, Mass. Research Div.
P-TYPE GALLIUM ARSENIDE EPITAXIAL GROWTH Final Report, 22 May 1978 - 22 May 1979
S. R. Steel, K. K. Johnson, B. D. Lanterwasser, A. D. Barlas, and L. Holway, Jr. 24 Oct. 1979 131 p refs
(Contract F33615-78-C-1456; AF Proj. 2002)
(AD-A079980; S-2559; AFAL-TR-79-1144) Avail: NTIS HC A07/MF A01 CSCL 20/12

At the beginning of this program, the rapid development of double-drift GaAs IMPATT diodes at X-band was being retarded by limited knowledge of the optimum growth conditions and the basic physical properties of p-type GaAs. Although p-type material with doping levels suitable for X-band double-drift devices was grown before this program began, profile control was sometimes erratic and wafer yield was poor. There was also a serious need for further data on hole velocities and ionization coefficients at the temperatures and electric fields existing in double-drift devices. In the first task of this program, we explored three p-type doping techniques, one involving zinc alkyl, and two involving zinc iodide formed as needed by chemical reaction. The zinc alkyl process was found to be chiefly useful for p-contacts; the two zinc iodide processes gave useful p-doping at levels suitable for devices from X- to Ka-band. In the second task of this program, we measured hole velocities as a function of electric field and temperature which averaged about 70 percent of those reported previously. We also determined ionization coefficients at very high fields, typical of high power Ka-band devices. In the third task, we grew X-band and Ka-band p-type low-high-low Read wafers with good reproducibility. GRA

N80-22099# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INTEGRAL EQUATION SPACE-ENERGY FLUX SYNTHESIS FOR SPHERICAL SYSTEMS Ph.D. Thesis
Eugene Wenceslaus Skluzacek Sep. 1979 81 p refs
(AD-A080409; AFIT/DS/PH/79-2) Avail: NTIS HC A05/MF A01 CSCL 20/8

The calculation of neutron flux distribution and growth rate for small, spherically symmetric systems usually requires extensive computing time on the largest machines. To minimize computing time, a compromise between the simplicity of diffusion theory and the accuracy of transport theory is needed. The Serber-Wilson method, Feynman's method, and early flux synthesis methods are used as the foundation for integral equation synthesis (IES) which is an approximate, numerical technique for obtaining the spatial and energy neutron flux distributions in multiplying systems. In IES, the integral form of the neutron transport equation is specialized to spatial dependence only, and then solved numerically for the two lowest order eigenfunctions. Similar specialization to energy dependence only yields a second set of trial eigenfunctions. Using standard perturbation methods, the two sets of trial eigenfunctions are synthesized into a single, two-dimensional solution. The IES technique was used to calculate the flux and multiplication factor, k, of the critical plutonium sphere, Jezebel. Results for k agreed to within 0.01% of published values, whereas the spatial flux, when normalized at the center, agreed to within 8% at the outer assembly boundary. The Jezebel calculation using IES required about 90 seconds CPU time on an IBM 360/75. Highly sophisticated codes require approximately ten minutes of CDC 7600 CPU time to compute the Jezebel flux and growth rate. GRA

N80-22100# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
HIGH TEMPERATURE HALL EFFECT IN INDIUM-DOPED SILICON M.S. Thesis
Gary E. Rattray Dec. 1979 84 p refs
(AD-A080244; AFIT/GEP/PH/79D-9) Avail: NTIS HC A05/MF A01 CSCL 20/3

Apparatus was designed and constructed to make resistivity and Hall coefficient measurements at temperatures up to 875 degrees Kelvin. Data was taken on three indium-doped silicon samples, and resistivity, Hall mobility, and carrier concentration calculated for temperatures through the exhaustion region. The

concentrations and activation energies of the various dopants were determined by fitting carrier concentration as a function of temperature to the charge balance equation. Four fits were made to the data from each sample. In order to determine the effect of assuming a Hall scattering factor (r-factor) of one, fits were made to low temperature data alone and then with the high temperature added. The fits were also made using an empirical, temperature dependent formula for the Hall scattering factor. The results indicated that the temperature dependent r-factor gave better fits for each sample. The values for concentrations and activation energies were also in better agreement with values obtained from other experimental techniques. GRA

N80-22101# Colorado State Univ., Fort Collins. Dept. of Physics.

SPUTTER DAMAGE IN GaAs EXPOSED TO LOW ENERGY ARGON IONS

H. E. Schmidt, P. E. Jen, and J. R. Sites Nov. 1979 15 p refs

(Contract N00014-76-C-0976; RR0210203)

(AD-A080119; SF-26) Avail: NTIS HC A02/MF A01 CSCL 20/12

Substrates of n-type GaAs were exposed to charge neutralized argon ion beams of energy ranging from 50 to 500 eV. Exposure times were 10-30 minutes with a beam density of 1 ma/sq cm. Schottky barrier diodes were formed on the sputtered surfaces using gold films. Capacitance and current measurements showed a marked decrease in barrier height for samples sputtered surfaces using gold films. Capacitance and current measurement showed a marked decrease in barrier height for samples sputtered with energies = 150 eV, though rectification persists to higher beam energies. Chemical etching of the damaged layer to restore the Schottky barrier height showed that the characteristic depth of heavy damage was 20-50 A, increasing with ion beam energy. GRA

N80-22102# Westinghouse Research and Development Center, Pittsburgh, Pa.

THE IMPLANTATION OF IMPURITY IONS AND PROTON BOMBARDMENT IN INDIUM PHOSPHIDE Final Report, 1 Jan. 1975 - 31 Mar. 1979

G. W. Eldridge 31 Aug. 1979 151 p

(Contract F44620-75-C-0034; AF Proj. 2306)

(AD-A080144; AFOSR-80-0044TR) Avail: NTIS HC A08/MF A01 CSCL 20/12

Ion Implantation of InP has been studied from qualification of substrates through characterization of the electrical transport properties of the resulting layers. InP(Fe) is found to have sufficient resistivity for typical device applications in contrast to InP(Cr). Residual damage from grit polishing compromised mobility and activation efficiency; a bromine-methanol etch polish yields superior surfaces and reduced residual damage. This etch-polish reveals either FeP precipitates or In inclusions in available InP(Fe) wafers. In contrast to GaAs(Cr), InP(Fe) has never exhibited anomalous compensation or conversion phenomena. Qualification consists of eliminating ingots with excessive precipitate or inclusion counts; consistent activation and mobility data are achieved using only this qualification. Acceptable activation and mobility can be achieved via 700 C annealing. Phosphosilicate glass deposited by the CVD technique provides effective encapsulation to this temperature. Undoped SiO2 fails due to stress and phosphorous absorption problems. Plasma deposited Si3N4 is effective to more than 750 C but it results in a shallow n(-) conversion layer presumably due to indiffusion of excess Si from the Si3N4. GRA

N80-22103# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

GLOW DISCHARGE OPTICAL SPECTROSCOPY OF ION IMPLANTED GALLIUM ARSENIDE M.S. Thesis

Suk Puangthum Dec 1979 86 p refs

(AD-A080413; AFIT/GE/EE/79D-29) Avail: NTIS HC A05/MF A01 CSCL 20/12

An optical input system to an existing Glow Discharge Optical Spectroscopy (GDOS) apparatus was designed aiming to improve its sensitivity. The GDOS, unmodified, was used to obtain impurity concentration profiles of annealed and unannealed ion implanted gallium arsenide samples. Implant energy was 120 KeV. Silicon ions were implanted with fluences of 5X10 to the 14th ions/sq cm, 1X10 to the 15th ions/sq cm, and 5X10 to the 15th ions/sq cm. Magnesium ions were implanted with fluences of 3X10 to the 15th ions/sq cm. Silicon implanted samples were encapsulated with aluminum nitride (AlN) films using a sputtering deposition technique. Magnesium implanted samples were encapsulated with 1000A silicon nitride (Si3N4) films deposited by the plasma enhanced chemical vapor deposition (PECVD) method. Samples were sputtered in a low pressure argon filled quartz chamber. Light emitted from elements of interest was monitored. Light intensity was converted to impurity concentration by comparison to the light intensity emitted by a standard sample of the same element. GRA

N80-22104# Vermont Univ., Burlington. Dept. of Chemistry.

SOLID STATE STRUCTURE AND ELECTRONIC PROPERTIES OF A MIXED-VALENCE TWO-DIMENSIONAL METAL, KCU4S3

David B. Brown, Jon A. Zubieta, P. A. Vella, James T. Wrobleski, Timothy Watt, W. E. Hatfield, and D. Day Jan. 1980 34 p refs Prepared in cooperation with North Carolina Univ., Chapel Hill. Submitted for publication

(Contract N00014-75-C-0756; N00014-76-C-0616)

(AD-A080624; TR-20; TR-9) Avail: NTIS HC A03/MF A01 CSCL 11/6

KCu4S3, prepared by the high temperature reaction of copper, potassium carbonate, and sulfur, crystallizes with a unique layered structure. Double layers of tetrahedrally - coordinated (by S) copper ions are separated by layers of potassium ions. Although formally a mixed-valence Cu(I,I,I,II) complex, all copper ions are crystallographically equivalent. Consistent with its Robin and Day Class III designation, KCu4S3 exhibits electrical conductivity characteristic of a metal. Room temperature compaction conductivities of ca. 4000/Ohm/cm increase to ca. 60000/Ohm/cm at 20K. The metallic nature of this two-dimensional material is supported by the temperature independent paramagnetism and the metallic reflectivity through the visible and near ultraviolet region of the spectrum. GRA

N80-22105# Research Triangle Inst., Research Triangle Park, N. C.

QUATERNARY ALLOY MICROWAVE MESFET Final Technical Report, 1 Mar. 1977 - 30 Sep. 1979

J. W. Harrison, S. B. Phatak, G. Keiner, M. A. Littlejohn, A. F. Schreiner, H. H. Stadelmaier, J. Hsu, and R. J. Trew 30 Nov. 1979 83 p refs

(Contract F49620-77-C-0062; AF Proj. 2306)

(AD-A079646; RTI/1437/00-02F; AFOSR-79-1321TR) Avail: NTIS HC A05/MF A01 CSCL 11/6

Liquid phase epitaxial growth techniques have been used to grow quaternary alloys, Ga sub 1-x In sub x P sub 1-y As sub y, on InP substrates, using (100), (111) A and (111) B orientations. Liquidus and solidus data at 660 C have been used to determine distribution coefficients for P, As, and Ga in the melt. Compositions lattice matched to InP have been grown as single crystals. A preliminary X-ray evaluation of structure shows no detectable long-range ordering. Best electronic properties to date have been a Hall mobility of 4000 sq cm/V-sec at room temperature with a carrier concentration of 3.8 times ten to the 16th power per cc in material which has not been intentionally doped. Deposition of gold contacts on alloy samples yielded nonlinear current-voltage characteristics, but with poorly defined barriers. GRA

N80-22106# Fairchild Camera and Instrument Corp., Palo Alto, Calif. Research and Development Lab.

STRUCTURAL AND ELECTRICAL INVESTIGATION OF THE Si-SiO2 INTERFACE IN THERMALLY OXIDIZED SILICON Final Technical Report, 1 Jul. 1978 - 30 Jun. 1979

B. E. Deal and R. R. Razouk Oct. 1979 47 p refs

(Grant DAAG29-78-C-0033)

(AD-A080574; ARO-16245.3-A-EL; ECOM-78-0033-1) Avail: NTIS HC A03/MF A01 CSCL 20/12

The dependence of fixed oxide charge density (Q sub ss)/q), interface state density (N sub st), and electron spin resonance P sub b signals on thermal oxidation process variables as well as their interrelationship has been investigated. Both n- and p-type silicon substrates having (111) and (100) orientation were employed in this study. Measurement techniques included

conventional 1 MHz capacitance-voltage (C-V) analysis, quasistatic C-V analysis, and electron spin resonance. The oxide charges resulting from postoxidation in situ anneal in nitrogen were found to be similar in nature and magnitude to those obtained following a similar treatment in argon. Some reduction in N sub st was observed for thicker oxides following a post-metallization H2 anneal. Strong evidence is obtained for a proportionality between ESR signals and interface states density with varying process parameters modifying the P sub b to N sub st relationship. The effects of iron ion implantation (before or after oxidation) on oxide charges and P sub b signals has also been investigated. This work, in addition to clarifying the relationship between fixed oxide charges, interface states, and ESR P sub b signals, demonstrates the significance of ESR as a tool in the characterization of the Si-SiO2 system. GRA

N80-22107# City Univ. of New York, N. Y.
GROWTH OF MERCURY CADMIUM TELLURIDE BY CURRENT CONTROLLED LIQUID PHASE EPITAXY Final Report, 30 Sep. 1978 - 29 Sep. 1979
Fred H. Pollak Dec. 1979 9 p refs
(Grant AF-AFOSR-3730-78; AF Proj. 2306)
(AD-A080578; AFOSR-80-0105TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

We have grown crystalline epitaxial layers of mercury cadmium telluride from a mercury-rich melt by the method of constant temperature current controlled liquid phase epitaxy (CCLPE). CCLPE is an attractive method of crystal growth for mercury cadmium telluride because it has the potential for achieving better uniformity than bulk crystal techniques. In addition it can be used for direct growth of p-n junctions by addition of suitable dopants. The lower growth temperature compared to bulk growth methods is expected to result in fewer vacancies. Growth was achieved under conditions where the substrate was hotter than the source as well as circumstances where the substrate was colder than the source. This indicated that the mass transport was driven by electromigration rather than the Peltier effect. Several layers were grown to a thickness of 30-100 microns. Best results were obtained on (111) oriented substrates. These layers were studied micrographically and with the use of X-ray diffraction methods. One 500 micron thick layer was also investigated by the electrolyte electroreflectance method in order to determine composition and homogeneity. This piece was found to have a mole fraction of cadmium telluride equal to 0.1. This represented a considerable mercury enrichment over the substrate and source. The variation in mole fraction of cadmium telluride over the surface of the sample (approx. 1 sq cm) was approximately 0.03. GRA

N80-22108# California Univ., Livermore. Lawrence Livermore Lab.
HYDRODYNAMIC MODELING OF HEATED QUARTZ CRYSTALS
H. C. Graboske, Jr. and K. L. Wong 23 Aug. 1979 28 p refs
(Contract W-7405-eng-48)
(UCID-18242) Avail: NTIS HC A03/MF A01

Quartz crystal detectors subjected to rapid, but extended, irradiative heating were modeled. The SiO2 equation of state is described and a discussion of the effects of solid-solid phase transitions is presented. The applicability and adequacy of some hydrodynamic simulation codes and the importance of an accurate equation state representation for studies that model low temperature and multiphase behavior were evaluated. DOE

N80-22109# Ames Lab., Iowa.
ELECTRONIC STRUCTURE OF THE VANADIUM DICHALCOGENIDES
H. W. Myron 1979 22 p refs Presented at the Intern. Conf. on Layered Materials and Intercolates, Nymegen, Neth., 28 Aug. 1979
(ISM-225; CONF-790879-1) Avail: NTIS HC A02/MF A01

The electronic structure of 1T-VS2 and 1T-VSe2, calculated using a nonspherical crystal potential, is discussed. The widths of the various sub-band manifolds follow trends previously determined for other materials which crystallize in the CdI2 structure. From the intrinsic Pauli paramagnetic susceptibility, a Stoner factor, effective exchange interaction and Coulomb pseudopotential are derived. The density of states above E sub F are found to be in good agreement with that determined by appearance potential spectroscopy. Additionally, the number of effective carriers is derived and agrees to within 20 percent of that determined experimentally. DOE

N80-22110# IBM Watson Research Center, Yorktown Heights, N.Y.
ELECTRONIC STRUCTURE OF MAGNETIC 3D METALS: GROUND STATE, FERMI SURFACE AND PHOTOEMISSION PROPERTIES
D. E. Eastman, J. F. Janak, A. R. Williams, R. V. Coleman (Virginia Univ., Charlottesville), and G. Wendin (Brookhaven Natl. Lab., Upton, New York) 1979 9 p refs Presented at Joint INTERMAG-MMM Conf., New York, 17 Jul. 1979
(Contract EY-76-C-02-0016)
(BNL-26659; CONF-790738-6) Avail: NTIS HC A02/MF A01

Various electronic and magnetic properties of the ferromagnetic 3d metals Ni, Co and Fe and related metals are described, including ground-state properties, Fermi surfaces and both one-electron and many-electron aspects of photoemission and optical absorption processes. Experimental de Haas-van Alphen results for the spin-polarized Fermi surfaces and angle-resolved photoemission results for the exchange-split energy-band dispersions for Ni, Co and Fe are summarized. Single-particle energy-band descriptions of these Fermi surfaces and band dispersions, as well as various ground-state properties (lattice constant, cohesive energy, bulk modulus, magnetic moment, hyperfine field, etc.) are given in terms of the density-functional theory. In general, these properties can be understood quite well within the single-particle picture. Troublesome questions concerning the exchange splitting, band dispersions and satellite structure of Ni are considered. Various optical and photoemission processes for Co, Fe, Ni and Cu exhibiting many-electron phenomena are discussed, including four-level absorption edges, resonances, photoemission relaxation effects, shake-up processes and Auger processes. DOE

N80-22111# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTRICAL PROPERTIES OF DISLOCATIONS IN ULTRA-PURE GERMANIUM
G. Scott Hubbard and E. E. Haller Jun. 1979 21 p refs Presented at 21st Elec. Materials Conf., Boulder, Colo., 27 Jun. 1979
(Contract W-7405-eng-48)
Avail: NTIS HC A02/MF A01

Defect states due to grownin dislocations in ultrapure p type germanium were observed using deep level transient spectroscopy and Hall effect. These states, found to be composed of two bands of acceptor type levels whose energy and half width are influenced by both the presence of hydrogen and the crystal growth direction are discussed. DOE

N80-22112# Oak Ridge National Lab., Tenn.
TRANSIENT MAGNETIZATION IN PRACTICAL COMPOSITE SUPERCONDUCTORS
S. S. Shen 1979 16 p refs Presented at the Cryog. Eng. Conf., Madison, Wisc., 21 Aug. 1979
(Contract W-7405-eng-26)
(CONF-790815-31) Avail: NTIS HC A02/MF A01

Magnetization measurements are presented along with an analysis on typical cryostable NbTi composite conductors with filament nonuniformly distributed in both circular and rectangular cross sections. Comparisons between the measurements and a previously reported transformer modes are discussed. Both transient magnetization and losses incurred in each sample which are described by functions of a unique time constant tau which depends strongly on the shape of the cross section are discussed. Saturation and anisotropy effects are analyzed. DOE

N80-22113# California Univ., Berkeley. Lawrence Berkeley Lab.
DIRECT IMAGING OF GRAIN BOUNDARIES
R. Gronsky Sep. 1979 55 p refs
(Contract W-7405-eng-48)
(LBL-9779) Avail: NTIS HC A04/MF A01

There are currently two types of microscopes which, in principle, are capable of imaging atom positions at grain boundaries. One, the field ion microscope, yields a projection of the specimen surface (approximately stereographic) by field ionization of an imaging gas at protruding atom sites, and provides topographic information in high-index pole regions which may be interpreted atom-by-atom. The other, a transmission electron microscope, yields a projection (approximately linear) of the entire specimen thickness by electron optical imaging and provides atomic resolution detail throughout the illuminated area. Both methods are described and compared, using examples from practical materials systems. DOE

N80-22114# Argonne National Lab., Ill.
MOESSBAUER STUDY OF METAL CATIONS IN THE CHEVRAL PHASES
Byron Stafford, C. D. Barnet, C. W. Kimball, and F. Y. Fradin 1979 7 p refs Presented at the Superconductivity in d- and f-Band Metals, San Diego, Calif., 21 Jun. 1979 Prepared in cooperation with Northern Illinois Univ., De Kalb
(Contract W-31-109-eng-38)
(CONF-790653-15) Avail: NTIS HC A02/MF A01

Moessbauer effect studies at Sn-119 and Fe-57 were made to examine the Sn and Fe motion and electronic states in the high critical temperature and high critical field superconductor SnMo6S8 with Fe additions. The temperature dependence of the Sn-119 Moessbauer effect is discussed. A structural model in which the SnMo6S8 cell centered cation strucure is modified by the addition of Fe at a channel location is proposed. A.W.H.

N80-22115# Battelle Inst., Frankfurt am Main (West Germany).
STUDY ON MATERIAL DEVELOPMENT FOR Ge:Be INFRARED DETECTORS Final Report
U. Brunsmann, J. U. Fischbach, and H. Egle Jul. 1979 57 p refs Original contains color illustrations
(Contract ESTEC-3604/78-NL-PP(SC))
(BF-R-63.774-1; ESA-CR(P)-1248) Avail: NTIS HC A04/MF A01

A special crystal growth apparatus, which allows the contamination of crystal with oxygen to be controlled was constructed and tested. The aim was the development of A technique for doping Ge-crystals with the beryllium needed for radiation detectors in the 20-50 micrometer wavelength region. A suitable and reliable doping method was elaborated. Several undoped and doped crystals were grown in a vacuum. The resulting material was evaluated with respect to the oxygen content, content of electrically active impurities, electrically and optically active Be content and the doping profile. The results show that the oxygen content of the host crystal is below 3 x 10 to the 14th power per cubic cm, while the Be contents higher than 10 to the 15th power are achieved having smooth doping profiles. Detectivity measurements performed on some preliminary sample detectors at 52 micrometers and 10 Hz yield 9 x 10 to the 10th power (cm x Hz to 0.5 power)/ watt at a background photon flux density of 1.5 x 10 to the 12th power photons per sq cm per sec. Author (ESA)

N80-22116# Florida Univ., Gainesville. Dept. of Electrical Engineering.
THE THEORETICAL AND EXPERIMENTAL STUDY OF THE TEMPERATURE AND DOPANT DENSITY DEPENDENCE OF HOLE MOBILITY, EFFECTIVE MASS, AND RESISTIVITY IN BORON-DOPED SILICON Final Report
Sheng S. Li Nov. 1979 54 p refs
(Grant NSF ENG-76-81828; ARPA Order 2397)
(PB80-120041; NBS-SP-400-47) Avail: NTIS HC A04/MF A01 CSCL 20L

Theoretical expressions for resistivity and conductivity mobility of holes as functions of dopant density and temperature were derived for boron doped silicon. A three band model consisting of a spherical, parabolic heavy hole band; a spherical, parabolic split off band was used in calculating the hole mobility since the model combined the contributions from scattering by lattice phonons, ionized impurities, and neutral impurities. The effects of hole-hole scattering and nonparabolicity of the light hole band were taken into account in the formulation. Resistivity measurements were performed on nine boron doped silicon slices using a planar four probe square array test structure. Formulations for the density of states effective mass, conductivity effective mass, and Hall effective mass are described. A.W.H.

N80-22117# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: AN AUTOMATED PHOTOVOLTAIC SYSTEM FOR THE MEASUREMENT OF RESISTIVITY VARIATIONS IN HIGH-RESISTIVITY CIRCULAR SILICON SLICES Final Report, Dec. 1975 - Oct. 1977
David L. Blackburn Nov. 1979 35 p refs Sponsored in part by DOE
(PB80-120058; NBS-SP-400-52; LC-79-60017B) Avail: NTIS HC A03/MF A01 CSCL 20L

An automated photovoltaic system was developed for nondestructive measurement or resistivity variations of high-resistivity circular silicon slices. The computer-based system for making the measurements is described, detailed construction diagrams are given to facilitate reproduction of the system, and a listing of the computer program for controlling the system is included. Comparisons between resistivity profiles determined using the automated photovoltaic system and the four-probe technique indicate that the photovoltaic system is adequate for production screening and incoming inspection of high-resistivity float-zoned silicon slices. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-22118# Kanner (Leo) Associates, Redwood City, Calif.
THERMODYNAMICS AND STATISTICAL MECHANICS OF SOME HYDRIDES OF THE LANTHANIDES AND ACTINIDES Ph.D. Thesis
Moshe H. Mintz Aug. 1979 155 p refs Transl. into ENGLISH of report NRCN-398 from Israel Atomic Energy Commission, Jun. 1976 155 p Prepared for Los Alamos Scientific Lab., N. Mex.
(LA-TR-79-41) Avail: NTIS HC A08/MF A01

The thermodynamic and physical properties of the hydrides of the lanthanides and actinides were studied. Statistical models were developed and applied to metal hydrogen systems. A kinetic study of the uranium hydrogen system was performed. The thermodynamic properties of the hydrides of neptunium, thorium, praseodymium, neodymium, samarium, and europium were determined. The samarium-europium-hydrogen ternary system was investigated. Mossbauer effect measurements of cubic neptunium bhydrides were interpreted according to a model presented. A comparison between the lanthanide and actinide hydrides is presented. DOE

N80-22119# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
THERMODYNAMICS OF AQUEOUS ELECTROLYTES AT VARIOUS TEMPERATURES, PRESSURES, AND COMPOSITIONS
Kenneth S. Pitzer Sep. 1979 30 p refs Presented at the Conf. on Thermodynamics of Aqueous Systems with Industrial Applications, Washington, D.C., 22 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9788; CONF-791063-1) Avail: NTIS HC A03/MF A01

The properties of fully ionized aqueous electrolyte systems are represented by relatively simple equations over wide ranges of composition. A simple equation commonly used for nonelectrolytes which fits the measured vapor pressure of water reasonably well is discussed. Over the somewhat more limited composition range up to saturation of typical salts such as NaCl, the equations representing thermodynamic properties with a Debye-Hueckel term plus second and third virial coefficients are described. These

same equations effectively predict the properties of mixed electrolytes. DOE

N80-22245# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SYMMETRIC VARIATIONAL FORMULATION OF HARMONIC VIBRATIONS PROBLEM BY COUPLING PRIMAL AND DUAL PRINCIPLES. APPLICATION TO FLUID-STRUCTURE COUPLED SYSTEMS
Roger Ohayon *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 69-78 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 207-211 Original report in FRENCH previously announced as A79-41307 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

No abstracts in this category.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-22120* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES, SUPPLEMENT 16
Jan. 1980 646 p
(NASA-SP-7039(16)-Section-2) Avail: NTIS
HC A99/MF A01 CSCL 05B

Citations of patents and patent applications for the period May 1969 through December 1979 are indexed according to subject, invention, source, U. S. patent number, and accession number. A.R.H.

N80-22121# Defense Technical Information Center, Alexandria, Va.
RETRIEVAL PERFORMANCE OF A KWOC INDEX TO THE 1498 WORK UNIT SUMMARY DATA BASE
Elaine Pontani Burress Jan. 1979 29 p refs
(AD-A079000; DTIC/TR-79/2) Avail: NTIS
HC A03/MF A01 CSCL 05/2

The retrieval performance of a technique for automated indexing using a controlled vocabulary (machine-aided indexing) is compared with that of a Key Word Out of Context index (KWOC). Twenty subject searches were performed using a data base of 635 summaries of Defense management data. Results show an average recall measurement of .73 for machine-aided indexing and .79 for the KWOC index. The average relevance measurements were .62 for machine-aided indexing and .60 for the KWOC index. GRA

N80-22122# Syracuse Univ., N. Y. School of Information Studies.
AN EVALUATION OF FACTORS AFFECTING DOCUMENT RANKING BY INFORMATION RETRIEVAL SYSTEMS Final Report, 1 Sep. 1978 - 29 Feb. 1980
Michael J. McGill Oct. 1979 129 p refs
(Grant NSF IST-78-10454)
(PB80-119506) Avail: NTIS HC A07/MF A01 CSCL 05B

Ranking algorithms used in a Boolean environment were studied. The ranking algorithms were tested using documents submitted by specific clearinghouses to the Current Index to Journals in Education data bases. Information need statements from individuals with interests congruent with the data base were used after searches were conducted by professional searchers, the retrieved documents were judged for relevance by the persons submitting the original information need statement. The algorithms were analyzed according to their ability to move relevant documents toward the beginning of the output list. It is found that when using a controlled vocabulary or the free text, it is possible to significantly improve the order of the output. GRA

N80-22123# Economics, Statistics and Cooperatives Service, Washington, D. C. Data Services Center.
TIME-SERIES DATABASE MANAGEMENT SYSTEM (T-DAM), VERSION 3.01
Robert Lee Otto and Harper G. Grimm, Jr. 9 Oct. 1979 93 p
(PB80-107600; USDA-DF-79-006A) Avail: NTIS
HC A05/MF A01 CSCL 05B

Documentation on how to load, manage, and use a data base management system designed specifically for economic time series data is presented. Specific instructions in mangement, limitations, policy, and some sample tasks are included. GRA

N80-22124# Economics, Statistics and Cooperatives Service, Washington, D. C. Data Services Center.
TIME-SERIES DATA BASE MANAGEMENT SYSTEM (T-DAM). USER'S GUIDE, VERSION 3.00
Robert Lee Otto Sep. 1978 160 p
(PB80-107618; USDA-DF-79-006B) Avail: NTIS
HC A08/MF A01 CSCL 05B

A data base management system designed specifically for economic time series data is described. The system provides the user with an on line capability of accessing files or subsets of files within a centralized data base. A user's guide is presented. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-22125# Committee on Public Works and Transportation (U. S. House).
AIRCRAFT PIRACY, INTERNATIONAL TERRORISM
Washington GPO 1979 440 p refs Hearings on H.R. 1834 and H.R. 2441 before the Subcomm. on Aviation of the Comm. on Public Works and Transportation, 96th Congr., 1st Sess., 28 Feb. - 1 Mar. 1979
(GPO-44-345) Avail: Subcomm. on Aviation.

Testimony delivered in support of efforts to amend the Federal

Aviation Act of 1958 relating to aircraft piracy, in order to provide a method of combating terrorism is presented along with a text of the bill. A.R.H.

N80-22126# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1980 254 p ref Rept. to accompany H.R. 6413 presented to the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., 22 Apr. 1980
(H-Rept-96-899; GPO-58-716) Avail: Comm. on Science and Technology

Recommended ammendments to the bill to authorize appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, and research and program management, and for other purposes are presented. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-22127*# IIT Research Inst., Chicago, Ill.
MANUFACTURING PROCESS APPLICATIONS TEAM (MATEAM) Annual Report
Edmund R. Bangs Jan. 1980 36 p
(Contract NAS8-32229)
(NASA-CR-161417; IITRI-J6499) Avail: NTIS HC A03/MF A01 CSCL 05A

The objectives and activities of an aerospace technology transfer group are outlined and programs in various stages of progress are described including the orbital tube flaring device, infrared proximity sensor for robot positioning, laser stripping magnet wire, infrared imaging as welding process tracking system, carbide coating of cutting tools, nondestructive fracture toughness testing of titanium welds, portable solar system for agricultural applications, and an anerobic methane gas generator. M.G.

N80-22128# Bradford National Corp., Washington, D.C.
ADVANCED AUTOMOTIVE PROPULSION SYSTEMS: INCENTIVE FINANCING
Washington, D. C. DOE Feb. 1979 60 p refs
(Contract EM-78-C-01-5181)
(CONS-5181-1) Avail: NTIS HC A04/MF A01

The need for Federal guarantees of financial obligations for advanced automotive propulsion systems research, development, demonstrations, and commercial availability was surveyed in order to facilitate development and rapid implementation of AAPS energy conservation programs. Results of the survey are presented along with a background review of the complexities of AAPS and of financial incentives. Conclusions and recommendations are given. J.M.S.

N80-22129# Transportation Research Board, Washington, D.C.
URBAN SYSTEMS OPERATIONS
Mohamed S. Ahmed, Allen R. Cook, Ronald H. Borowski, Matthys P. Cilliers, and Adolf D. May May 1979 124 p refs
(PB80-125818; TRB/TRR-722; LC-79-b07234;
ISBN-0-309-02972-4; ISSN-031-1981) Avail: NTIS HC A06/MF A01; paper copy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

Techniques used in various cities for reducing automobile traffic in sensitive areas and for managing freeway traffic are described, as well as the planning of rail station parking. Algorithms for detecting freeway incidents, the development of a model for freeway priority lanes, and the simulation of freeway traffic are also discussed. Improved air quality and other results of implementing transportation system management are evaluated. A.R.H.

88 SPACE SCIENCES (GENERAL)

N80-22130*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SCIENTIFIC RESEARCH WITH THE SPACE TELESCOPE: INTERNATIONAL ASTRONOMICAL UNION COLLOQUIUM NO. 54
Malcolm S. Longair (Mullard Radio Astronomy Obs.) and John W. Warner Oct. 1979 331 p refs Colloq. held in Princeton, N.J., 8-11 Aug. 1979; co-sponsored by COSPAR
(NASA-CP-2111) Avail: NTIS MF A01; SOD HC CSCL 03B

The application of the space telescope for extragalactic astronomy, planetary research, and stellar, interstellar, and galactic structural problems is discussed. Topics include investigations of small solar system objects, the physical characteristics of ionized gaseous nebulae, the central regions of active galaxies and quasars, problems of cosmology, and the distribution and composition of interstellar matter. For individual titles, see N80-22131 through N80-22144.

N80-22131*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE SPACE TELESCOPE OBSERVATORY c89
John N. Bahcall (Inst. for Advan. Study, Princeton, N.J.) and C. R. Odell *In its* Sci. Res. with the Space Telescope Oct. 1979 p 5-46 (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

A guide to the expected characteristics of the space telescope (ST) observatory is presented. The general objectives of the ST observatory are summarized. The plans for the development of the observatory are described with a brief history of the scientific activities; an account of the scope of the present program; a summary of the major responsibilities of the contractors; and a list of the project milestones are included. The performance characteristics of the observatory are provided including the imaging and stray light characteristics, pointing capabilitiy, and operational access. The expected performance characteristics of all six of the first generation science instruments are summarized. The mode of operations is described which includes a discussion of program options, guide star selection, methods of acquisition, and quick look data capabilities. A.W.H.

N80-22132*# Kitt Peak National Observatory, Tucson, Ariz.
PLANETARY ASTRONOMY WITH THE SPACE TELESCOPE c89
Michael J. S. Belton *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 47-75 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

Experimental methods in planetary astronomy are discussed using a comparison of the advantages and disadvantages in the astronomical methods of ground based, Earth-orbit, and deep space missions. Problem areas in planetary astronomy which demonstrate the utility and power of the space telescope (ST) over other methods are delineated. These include utilizing the ST for studying the atmospheric dynamics, stratospheric and upper atmospheric processes, and circumplanetary nebulae of the planets. The capability of the ST for solar system observations is summarized with a discussion of the increases in resolution and sensitivity of the ST over other Earth-orbiting telescopes highlighted. A.W.H.

N80-22133*# Hawaii Univ., Honolulu. Inst. for Astronomy.
INVESTIGATION OF SMALL SOLAR SYSTEM OBJECTS WITH THE SPACE TELESCOPE c89
David Morrison *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 77-97 (For primary document see N80-22130 12-88)
(Grant NGL-12-001-057)
Avail: NTIS MF A01; SOD HC CSCL 03A

The application of the space telescope (ST) to study small objects in the solar system in order to understand the birth and the early evolution of the solar system is discussed. The upper size limit of the small bodies is defined as approximately 5000 km and includes planetary satellites, planetary rings, asteroids, and comets.The use of the astronomical instruments aboard the ST, such as the faint object camera, ultraviolet and infrared spectrometers, and spectrophotometers, to study the small solar system objects is discussed. A.W.H.

N80-22134*# California Univ., Santa Cruz. Lick Observatory.
PHYSICAL CHARACTERISTICS OF IONIZED GASEOUS NEBULAE **c90**
Donald E. Osterbrock *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 99-121 refs (For primary document see N80-22130 12-88)
(Grant NSF AST-76-18440)
(Contrib-420) Avail: NTIS MF A01; SOD HC CSCL 03B

The high angular resolution and the capability of the space telescope to observe ultraviolet radiation are discussed in relation to investigating planetary nebulae. The physical characteristics of planetary nebulae particulary the abundances of the common light elements, the H2 regions, the angular size, and the surface brightness are reviewed. Differences between supernova remnants and planetary nebulae and H2 regions are discussed. A.W.H.

N80-22135*# Cornell Univ., New York. Dept. of Astronomy and Physics.
DISTRIBUTION AND COMPOSITION OF INTERSTELLAR MATTER **c90**
E. E. Salpeter *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 123-138 refs (For primary document see N80-22130 12-88)
(Grant NSF AST-78-20708)
Avail: NTIS MF A01; SOD HC CSCL 03B

Some of the problems associated with the observation of interstellar matter are described. The characteristics of the high resolution spectrograph are summarized and observations of matter distribution are given. R.C.T.

N80-22136*# Australian National Univ., Canberra. Research School of Physical Sciences.
LUMINOSITY FUNCTIONS AND EVOLUTION OF GLOBULAR CLUSTERS **c90**
K. C. Freeman *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 139-150 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

The stellar dynamics of globular clusters are addressed in terms of luminosity functions, chemical topics, and dynamical topics R.C.T.

N80-22137*# National Research Council of Canada, Victoria (British Columbia). Dominion Astrophysical Observatory.
POPULATION STATISTICS OF FAINT STELLAR AND NON-STELLAR OBJECTS **c89**
Sidney VandenBergh *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 151-164 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

A disc and halo population model is constructed to fit star counts and color data down to V approximately 23 at absolute value of b = 90 deg. This model is used to predict star counts and colors down to V approximately 30. Deviations from these extrapolated relationships provide constraints on the number of faint quasars and black dwarf stars. It is shown that extra-galactic globular clusters start contributing significantly to star counts at V approximately 25 and are more numerous than stars for V > 31. Morphological studies of galaxies with approximately 0.5, were made with the space telescope. Significant constraints on theoretical models that describe the evolution of clusters of galaxies are provided. R.C.T.

N80-22138*# Yale Univ. Observatory, New Haven, Conn.
SPACE TELESCOPE OBSERVATIONS OF NORMAL GALAXIES **c89**
Augustus Oemler, Jr. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 165-180 refs Sponsored in part by the Alfred P. Sloan Foundation (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

Observations of the stellar content of galaxies are discussed. Specific emphasis is placed on the following two types of observation: (1) those objects near enough to observe individual stars; and (2) those so distant that only their integrated light can be observed. R.C.T.

N80-22139*# Yale Univ. Observatory, New Haven, Conn.
GALACTIC EVOLUTION WITH THE SPACE TELESCOPE **c90**
Beatrice M. Tinsley *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 181-195 refs Sponsored in part by the Alfred P. Sloan Foundation (For primary document see N80-22130 12-88)
(Grant NSF AST-77-23566)
Avail: NTIS MF A01; SOD HC CSCL 03B

Some aspects of research on galactic evolution with the Space Telescope (ST) are discussed. Viewpoints are provided from which ST (and related ground based) studies can be planned. R.C.T.

N80-22140*# Hale Observatories, Pasadena, Calif.
THE CENTRAL REGIONS OF ACTIVE GALAXIES AND QUASARS **c90**
Wallace L. W. Sargent *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 197-214 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

Theories describing the central regions of nonthermal extragalactic sources (radio galaxies, Seyfert nuclei, quasars, etc.) are examined in the light of the experimental possibilities afforded by the Space Telescope. In particular, the theory which proposes the accretion of stars or gas onto a black hole as the explanation of the central engine is discussed. Planned observations directed towards the problem of the mass, size, and structure of the central engine, and the phenomenological questions regarding the general environment of the central engine are outlined. M.G.

N80-22141*# Institute for Advanced Study, Princeton, N.J.
ABSORPTION LINES IN THE SPECTRA OF DISTANT OBJECTS **c89**
John N. Bahcall *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 215-240 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

Studies that can be carried out with the Space Telescope of absorption line systems which may be expected to occur in the spectra of distant objects are discussed. The phenomenology of quasar absorption line systems is described and the principal suggested explanations are summarized. It is proposed that the numerous Ly-alpha systems are caused by extremely large hydrogenic halos around galaxies or clusters of galaxies. Two tests are also described for the origins of known absorption systems, the results of which will favor either the cosmological or intrinsic hypothesis. Absorption lines that are likely to be strongest are listed and a sample observing program is presented. M.G.

N80-22142*# Mullard Radio Astronomy Observatory, Cambridge (England).
RADIO ASTRONOMERS, X-RAY ASTRONOMERS AND THE SPACE TELESCOPE **c89**
Malcolm S. Longair *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 241-262 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

The use of the Space Telescope and the study of objects in the radio and X-ray wavebands, particularly extragalactic objects, are discussed. The scientific objectives of a number of projects which involve observations with the Space Telescope are described. M.G.

N80-22143*# Hale Observatories, Pasadena, Calif.
PRECISE DETERMINATION OF THE DISTANCES OF GALAXIES **c90**
G. A. Tammann (Basel Univ.) *In* NASA. Marshall Space Flight

Center Sci. Res. with the Space Telescope Oct. 1979 p 263-293 refs Sponsored in cooperation with the Swiss Nat. Sci. Found. (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

The use of the Space Telescope in the determination of the distances of galaxies is examined. The Space Telescope can check the local extragalactic distance scale to within 10-15 percent. The determination of relative distances of cosmic standard candles, viz. brightest M-supergiants and SNe I in E galaxies, is discussed. The M-supergiants map the velocity field out to v sub o approx. 3000 km s(-1) thus providing a firm basis for the determination of H sub o (global) from local distances, and the possibility to derive precise distances of all nearby field galaxies from their recession velocities. Photometry of the SNe I out to z = 0.5 leads to a direct determination of q sub o via the Hubble diagram, and the form of their light curves offers a fundamental test on the nature of redshifts. Other calculations are discussed. M.G.

N80-22144*# Princeton Univ., N. J.
THE PROBLEMS OF COSMOLOGY **c90**
P. J. E. Peebles *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 295-312 refs Sponsored in part by NSF (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

Three examples that illustrate the expected role of the Space Telescope in cosmological investigations are described addressing the distribution of globular star clusters, universe expansion, and other classical cosmological problems. M.G.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-22145 Union Graduate School, Ohio.
THE LENGTH OF THE SOLAR DAY AND THE EQUATION OF TIME: A DERIVATION FROM FIRST PRINCIPLES Ph.D. Thesis
James Elmore Brimhall 1979 110 p
Avail: Univ. Microfilms Order No. 8005604

The derivation presented relates the time kept by the true Sun to the time kept by the mean Sun (i.e., our clocks) which can be approached by analyses of the orbital motion of the Earth and the tilt of its rotational axis. The large secular perturbations to a two body model of the Earth-Sun system are taken into account by a periodic altering of certain orbital elements as the eccentricity of the Earth's orbit, the obliquity of the ecliptic (tilt of the Earth's axis), and the true longitude of perigee. The necessary numerical values of all such elements are evaluated and are included both as tubular data and graphs. Series expansions carry relevant quantities as unevaluated parameters to aid in interpreting the physical significance of various contributions. When carried through the first order of smallness in the appropriate quantities, disagreement throughout the entire year of 1979 with publications of the U. S. Naval Observatory approaches only 3 seconds for the length of the solar day and 70 seconds for the equation of time. Dissert. Abstr.

N80-22146*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME 1.0 mm MAPS AND RADIAL DENSITY DISTRIBUTIONS OF SOUTHERN HII/MOLECULAR CLOUD COMPLEXES
L. H. Cheung, J. A. Frogel, D. Y. Gezar, and M. G. Hauser Feb. 1980 33 p refs Submitted for publication
(NASA-TM-80654) Avail: NTIS HC A03/MF A01 CSCL 03A

Several 1.0 continuum mapping observations were made of seven Southern Hemisphere h12/molecular cloud complexes with 65 arcsec resolution. The radial density distribution of the clouds with central luminosity sources was determined observationally. Strong similarities in morphology and general physical conditions were found to exist among all of the southern clouds in the sample. J.M.S.

N80-22147*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO X-RAY PULSARS: 2S 1145-619 AND 1E 1145.1- 6141
R. C. Lamb, T. H. Markert, R. C. Hartman, D. J. Thompson, and G. F. Bignami Jan. 1980 16 p refs
(NASA-TM-80638; CSR-HEA-80-2) Avail: NTIS HC A02/MF A01 CSCL 03A

Observations from the Einstein observatory reveal a previously unreported source, 1e1145.1-6141, within 15 arcmin of 2s1145-619 and of comparable intensity during July 1979. Periodicity analysis of the data shows a 290 + or - 2s period for the 2s source and a 298 + or - 4s period for the IE source, confirming the previous Ariel V report of two periods in this range from this region of the sky. Author

N80-22148*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY SPECTROSCOPY OF LATE-TYPE STARS
J. H. Swank and N. E. White (Univ. of Maryland) Mar. 1980 23 p refs Presented at the Workshop on Cool Stars, Stellar Systems and the Sun, 31 Jan. 1980
(NASA-TM-80655) Avail: NTIS HC A02/MF A01 CSCL 03A

The solid state spectrometer on the Einstein Observatory determined .4 - 4.5 keV spectra for Capella, Algol and 6 RS CVn binaries. All show evidence for a bimodal distribution of emission measure with temperature with one component approximately 7 million degrees and one approximately 40 million degrees. The spread in values of both luminosity and emission measure is 10 for the low temperature component and approximately 500 for the high temperature component. Line emission due to Fe can be identified in most of them and abundances of Si, S and Fe are consistent with approximately solar values in all cases. Estimates indicate dimensions of the emitting regions are on the order of the stellar size and the binary separation for the low and high temperature components, respectively, unless the pressures are high. Variations in the flux were observed, mostly in the hard component for the RS CVn binaries, in the soft component for Capella. A flare was observed during primary eclipse of Algol. The possibility is discussed that the other variations could all be due to intrinsic variability with a time scale of hours-days rather than eclipse or modulation with photometric phase. Author

N80-22149*# TAI Corp., Huntsville, Ala.
ERROR BUDGET ANALYSIS FOR ADVANCED X-RAY ASTROPHYSICS FACILITY (AXAF) Final Report, Sep. 1979 - Mar. 1980
Dietrich Korsch Mar. 1980 40 p
(Contract NAS8-33516)
(NASA-CR-161425) Avail: NTIS HC A03/MF A01 CSCL 03A

The AXAF telescope was analytically investigated during the period from September 1979 to March 1980. The results of a performance evaluation in the presence of aligment errors and surface defects, a sensitivity analysis of every individual subsystem, and a diffraction analysis of the telescope assembly are presented. J.M.S.

N80-22150# European Space Agency, Paris (France).
ASTRONOMICAL USES OF THE SPACE TELESCOPE
F. Macchetto, ed., Pacini, ed., and M. Tarenghi, ed. 1979 434 p refs Proceedings of ESA/European Southern Obs. Workshop, Geneva, 12-14 Feb. 1979 Prepared in cooperation with European Southern Obs., Geneva
Avail: NTIS HC A19/MF A01

Opportunities for application of the Large Space Telescope are considered in the following areas: stars, interstellar matter and globular clusters, normal galaxies, active galaxies and cosmology. Special observational techniques and other space projects are also discussed. For individual titles, see N80-22151 through N80-22191.

N80-22151# Mullard Radio Astronomy Observatory, Cambridge (England).
THE SPACE TELESCOPE AND ITS CAPABILITIES
Malcolm S. Longair *In* ESA Astron. Uses of the Space Telescope

1979 p 5-26 Submitted for publication (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The specifications of the telescope cameras, spectrograph, and other instruments are presented. The necessity for early planning for telescope time and the use of the Large Space Telescope to complement ground based observations are emphasized. A hypothetical observation program is presented to show capabilities of the system and the constraints imposed by the equipment as well as by the scientific requirements of the program. Author (ESA)

N80-22152*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STATUS OF THE SPACE TELESCOPE PROJECT IN THE UNITED STATES
C. R. ODell *In* ESA Astron. Uses of the Space Telescope 1979 p 27-31 (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01 CSCL 03A

A general description of the evolution of the Large Space Telescope project is given, including mirror construction, interface requirements, and the review cycle for the scientific instruments. The anticipated participation of ESA scientists through the means of the Science Institute is discussed. Author (ESA)

N80-22153# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
STATUS OF THE SPACE TELESCOPE IN EUROPE
F. Macchetto *In* ESA Astron. Uses of the Space Telescope 1979 p 33-44 (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The contributions of the European Space Agency to the Large Space Telescope project are briefly reviewed including spacecraft hardware, personnel support, and the Faint Object Camera (FOC). Specifications of the FOC are given along with the performance characteristics for point sources and extended objects at F/96, F/48, and in the spectroscopic mode. Author (ESA)

N80-22154# Landessternwarte auf dem Koenigstuhl, Heidelberg (West Germany).
INVESTIGATING STAR FORMATION WITH THE SPACE TELESCOPE
I. Appenzeller *In* ESA Astron. Uses for the Space Telescope 1979 p 47-60 (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Observations crucial to the study of star formation and planetary system which can be made only with the Large Space Telescope are described. In the former case, UV and IR stellar photometry will improve the knowledge of the interstellar medium in general. The increased accuracy in the determination of the luminosity function of the solar neighborhood can aid in the study of the molecular cloud phase of star formation, while improved UV spectrograms of T-Tauri stars will contribute to the understanding of the evolution of low mass protostars. Star formation in extragalactic clouds can be studied in the nuclear regions of nearby spiral galaxies. With proper masking of their suns, planetary systems similar to the solar system should be visible out to 2.6 parsecs. Author (ESA)

N80-22155# Stockholm Observatory (Sweden).
OBSERVATIONS OF PRE-MAIN-SEQUENCE OBJECTS IN THE FAR-UV
G. Gahm *In* ESA Astron. Uses for the Space Telescope 1979 p 61-69 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

High resolution in the far UV with the Large Space Telescope is considered in terms of observing pre-main sequence objects such as T-Tauri stars and Herbig objects. It is indicated that: (1) line profiles of individual lines will be resolved, but also weaker emission lines from a number of elements at different ionization states; (2) combining these observations with multicolor photometry over a wide spectral range will help to deliniate the temperature/density/velocity structure of the stellar envelopes for comparison with models assuming mass outflow, infall, and turbulence; and (3) UV spectroscopy of T-Tauri stars with the ST combined with satellite X-ray observations will provide detailed information about the degree and character of coronal emission from these stars. Author (ESA)

N80-22156# Amsterdam Univ. (Netherlands). Inst. of Astronomy.
OBSERVING THE MISSING MASS WITH SPACE TELESCOPE
R. F. A. Staller and T. deJong *In* ESA Astron. Uses of the Space Telescope 1979 p 71-75 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The number of faint strs (M sub v < 26m) that should be observable with the Large Space Telescope wide-field camera in the directions of the galactic poles is considered. Such observations provide information about the low-mass end of the local stellar luminosity function (0.01 approximately M/M solar radii approximately 0.1). Those low-mass stars (sometimes called 'black dwarfs') probably account for the 'missing mass' in the solar neighborhood. Author (ESA)

N80-22157# Osservatorio Astronomico, Trieste (Italy).
HIGH RESOLUTION SPECTROSCOPY WITH SPACE TELESCOPE
Margherita Hack *In* ESA Astron. Uses of the Space Telescope 1979 p 77-83 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

High resolution (R 10,000 to 100,000) spectroscopy in the UV region of faint objects is considered for the study of the chemical evolution of the galaxy and the interaction between stars and the interstellar gas. It is shown that motions, density, and chemical composition of the interstellar gas in the vicinity of the Sun (d = or < 10 pcs) can be studied by observing interstellar absorption lines in the spectra of white dwarfs and in the chromospheric emission lines of dG-dM stars. Study of the outer envelopes of stars to determine if the interaction between star and interstellar medium consists only of mass loss, or if there is evidence of accretion from the interstellar medium is also discussed along with hot, main sequence stars in galactic clusters and in the Magellanic Clouds to relfect the chemical composition of the gas from which they were formed. Investigation of evolved stars and nonevolved chemically peculiar stars to show results of nuclear reactions in their atmospheres is covered. Author (ESA)

N80-22158# Basel Univ. (Switzerland). Inst. of Astronomy.
DENSITY AND METALLICITY GRADIENTS IN THE GALACTIC HALO
Roland Buser, Rolf P. Fenkart, Uli W. Steinlin, and Charles Trefzger *In* ESA Astron. Uses of the Space Telescope 1979 p 85-90 refs Sponsored by the Swiss Natl. Sci. Found. (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

An extension of the observations of stars in the galactic halo beyond the observing limits of ground based telescopes is recommended for the following investigations: the determination of chemical gradients, i.e., changes of stellar metal abundances in the galactic halo as functions of the distance from the galactic plane or the galactic center. The solution of these problems involves observations in: (1) RGU three color photometry of faint halo stars down to corresponding UBV magnitudes M sub V approximately 24 and M sub U approximately 26; (2) multicolor (N > or = 4) photometry of star fields down to a correspondance magnitude M sub V approximately 25, observed in a photometric system being designed for three dimensional classification of stars of spectral types later than about K5; and (3) spectral scans of selected faint halo stars used for optimum design and calibration of the RGU and multicolor systems. Author (ESA)

N80-22159# Technische Univ., Vienna (Austria). Inst. of Astronomy.
OBSERVATIONS OF CLOSE BINARY STARS USING THE FAINT OBJECT CAMERA
Karl D. Rakos *In* ESA Astron. Uses of the Space Telescope 1979 p 91-94 ref (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Observations of the brightness difference in the far UV of

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spectroscopic binaries, eclipsing binaries, and close double stars with known orbital elements of differently evolved companions are considered along with observations in UBV and Strogmgren systems. Determination of the absolute dimensions of stars, masses, radii, and luminosities, is emphasized. Application of the Large Space Telescope (LST) to these observations is discussed. It is shown that the experience and software for the reduction of area scanner measurements of double stars can be used for the reduction of proposed LST observations. J.M.S.

N80-22160# Strasbourg Univ. (France).
SPECTRAL CLASSIFICATION PROJECT
Mercedes Jaschek and Carlos Jaschek. *In* ESA. Astron. Uses of the Space Telescope. 1979. p 95-96. refs (For primary document see N80-22150 12-89)
Avail: NTIS. HC A19/MF A01

A discussion of possible problems associated with the use of stellar types in the classic region for characterizing individual stars in the UV region is presented. Stars of the same classification if considered at a higher resolution than that used when assigning them to a class may not be identical. Also, stars similar in one wavelength range are not necessarily identical in another. In view of the large variety of objects to be observed from Spacelab, a spectral classification project is of high priority. The number of stars required need only be about 1000 objects.Author (ESA)

N80-22161# Technische Univ., Vienna (Austria). Inst. of Astronomy.
MINOR PLANET OBSERVATIONS USING THE FAINT OBJECT CAMERA OF THE SPACE TELESCOPE: DIAMETERS, SURFACE PROPERTIES AND BINARY NATURE
R. Albrecht and H. J. Schober (Graz Univ.). *In* ESA. Astron. Uses of the Space Telescope. 1979. p 97-104. refs (For primary document see N80-22150 12-89)
Avail: NTIS. HC A19/MF A01

Minor planets have been observed in the last years for physical properties using photometry, polarimetry and IR-radiometry. It must be assumed generally that asteroids are one of the most important clues for the understanding of the origin and evolution of our solar system. Using the faint object camera (FOC) of the Space Telescope it will be possible to observe a large number of asteroids directly. It is proposed to use the FOC with the high resolution down to 0.022 arcsec per pixel to examine minor planets with respect to diameters and shapes, surface and detail studies, densities, and possibly the binary nature of selected asteroids. Author (ESA)

N80-22162# Observatoire de Marseille (France).
HII REGIONS AND RELATED PROBLEMS
G. Courtes. *In* ESA. Astron. Uses of the Space Telescope. 1979. p 105-118. refs. Prepared in cooperation with CNRS, Marseille (For primary document see N80-22150 12-89)
Avail: NTIS. HC A19/MF A01

The advantages for studying HII regions with the Space Telescope are outlined. They are useful as classification tools for remote objects, are easy to discriminate, and are the best tracers for spiral arms. They are in general the best criteria by which to characterize the early stages of evolution of their associated stars. Observations of HII regions from space using rockets and from Skylab are reviewed. Author (ESA)

N80-22163# Observatoire du Pic-du-Midi (France).
THE INTEREST OF HIGH RESOLUTION OBSERVATIONS IN HII REGIONS: A NEW KIND OF CONDENSATIONS IN THE ORION NEBULA
J. L. Vidal and P. Laques. *In* ESA. Astron. Uses of the Space Telescope. 1979. p 119-121 (For primary document see N80-22150 12-89)
Avail: NTIS. HC A19/MF A01

Photographs of the core of the Orion nebula taken in several emission lines through narrow band 10A interference filters were studied. The photographs show six nebular condensations whose diameters do not exceed the measured stellar diameters on the best plates taken. It is proposed that the condensations are partly ionized globules, the inside being neutral; the ionization front penetrating inside while the ionized matter becomes progressively diluted in the general medium. Author (ESA)

N80-22164# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany).
HIGHLY OBSCURED YOUNG STELLAR OBJECTS
H. Elsaesser. *In* ESA. Astron. Uses of the Space Telescope. 1979. p 123-133. refs (For primary document see N80-22150 12-89)
Avail: NTIS. HC A19/MF A01

Observations of the compact HII region and bipolar nebula S 106 indicate that a star is ionizing the gas in the two nebulous lobes. Rotation is suggested. Highly obscured objects such as these are associated with IR emission, and are often characterized by high amounts of linear polarization. The early phases of stellar evolution represented by these objects make them candidates for examination with the Large Space Telescope. Author (ESA)

N80-22165# European Southern Observatory, Geneva (Switzerland).
OBSERVATIONS OF SUPERNOVA REMNANTS WITH SPACE TELESCOPES
I. J. Danziger. *In* ESA. Astron. Uses of the Space Telescope. 1979. p 135-145. refs (For primary document see N80-22150 12-89)
Avail: NTIS. HC A19/MF A01

Observation of younger supernova remnants (SNR) could lead to an understanding of the physical situation in the ejected envelopes, while the wide field camera could provide statistics on the occurrence of SNR in galaxies of different types. The SNR in the Galaxy and Magellanic Clouds could provide proper motion measurements of the filaments of older SNR. Ultraviolet and violet spectroscopy could aid in abundance studies, especially C, N, O and Si, and in direct observational evidence of element formation. Study of the two optical pulsars can lead to a correct electrodynamical theory for these objects. Author (ESA)

N80-22166# Osservatorio Astrofisico di Arcetri, Florence (Italy).
SIGNIFICANCE OF SPACE TELESCOPE OBSERVATIONS FOR KNOWLEDGE OF CARBON ABUNDANCE IN PLANETARY NEBULAE
M. Perinotto and A. Renzini (Osservatorio Astron., Bologna). *In* ESA. Astron. Uses of the Space Telescope. 1979. p 147-156. refs (For primary document see N80-22150 12-89)
Avail: NTIS. HC A19/MF A01

The knowledge of carbon abundance in planetary nebulae and their control stars is very important for studies of stellar evolution and of chemical evolution in galaxies. This knowledge can be achieved by observation of the C III 1907, 1909 A and the C IV 1548, 1550 lines complemented by UV observations of nebulae is coming from the IUE satellite. However the IUE satellite apparently is not able to observe a number of objects which are very important to the subject, such as the planetaries of very low surface brightness. The predictions concerning carbon abundance in planetary nebulae as derived from stellar evolution theory are briefly presented. The value of observations of these objects with the Large Space Telescope is discussed. Author (ESA)

N80-22167# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
GLOBULAR CLUSTERS
Vittorio Castellani. *In* ESA. Astron. Uses of the Space Telescope. 1979. p 157-176. refs. Prepared in cooperation with Rome Univ. (For primary document see N80-22150 12-89)
Avail: NTIS. HC A19/MF A01

The Large Space Telescope will permit the gathering of the first exhaustive information on the main sequence in globular clusters (GC). It will be possible to obtain data down to and below the limiting mass for H ignition. Spectra of stars in the GC will answer questions about chemical inhomogeneities, element abundances, and in the case of white dwarfs, thermodynamic properties of degenerate and crystallized matter. Because it will be possible to see within GC, their dynamic structure evolution can be studied. Author (ESA)

N80-22168# Observatoire du Pic-du-Midi (France).
AN EXAMPLE OF THE INTEREST OF HIGH SPATIAL RESOLUTION PICTURES FOR THE STUDY OF GLOBULAR CLUSTERS
Michel Auriere. *In* ESA. Astron. Uses of the Space Telescope

1979 p 177-180 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Obtaining the intensities in several passbands of individual stars in the inner parts of concentrated globular clusters (GC) can be used to study mass segregation, radial color variations, and the nature of the central condensation of X-ray GC such as Messier 15. Ground based study of some concentrated GC show the centers completely resolved in stars. These techniques can be used to choose objects for study with the Large Space Telescope, with priority going to the central part of condensed core clusters. Author (ESA)

N80-22169# Osservatorio Astronomico Univ., Bologna (Italy).
WHAT CAN WE LEARN FROM THE SPACE TELESCOPE OBSERVATIONS OF WHITE DWARFS IN GLOBULAR CLUSTERS?
F. Fusi-Pecci and A. Renzini *In* ESA Astron. Uses of the Space Telescope 1979 p 181-185 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The Large Space Telescope will allow photometry of stellar objects down to m sub v approximately equal to 28. Using extant estimates of the white dwarf cooling times, the number of observable white dwarfs in a typical globular cluster is evaluated to be about 2.5 times the number of horizontal branch stars in the same cluster. Predictions can be made on the average mass and mass dispersion of white dwarfs in globular clusters. The mass-radius relation for degenerate stars can also be made. The relative distance moduli of various globular clusters could be determined with an uncertainty of + or - 0.03. As far as the determination of absolute distance moduli is concerned, the major uncertainty comes from the estimate of the effective temperature and bolometric correction of individual white dwarfs, the uncertainty in the luminosity being delta log L = 4 delta log T sub e where delta log T sub e is the uncertainty of T sub e. Author (ESA)

N80-22170# Royal Swedish Academy of Sciences, Stockholm.
THE USE OF SPACE TELESCOPE FOR THE DETECTION OF BLACK HOLES IN GLOBULAR CLUSTER CORES
A. Wyller *In* ESA Astron. Uses of the Space Telescope 1979 p 187-190 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Theoretical considerations, the discovery that several globular clusters are X-ray sources, and observational work on surface brightness distributions support the existence of a central black hole or compact group of neutron stars in some globular clusters. The wide field/planetary camera of the Space Telescope is uniquely suited for the resolution of this question. Author (ESA)

N80-22171# Uppsala Univ. (Sweden). Astronomical Observatory.
THE MAGELLANIC CLOUDS
Bengt E. Westerlund *In* ESA Astron. Uses in the Space Telescope 1979 p 193-206 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The important observational programs for the Large Space telescope in studying Magellanic Clouds are presented. Observations to V = 25 will give fundamental information about the main sequence field stars in the clouds. The distribution, chemical composition, and ages of stars of about one to four solar masses in the planetary nebula should contribute to our knowledge about the old and intermediate age population in the clouds. Accurate determination of the shape of the UV extinction curves in the clouds is important for the understanding of the interstellar medium in these galaxies. It will be possible to determine the geometrical distances to the clouds with a 10 percent accuracy with the faint object camera. Author (ESA)

N80-22172# Bonn Univ. (West Germany). Observatorium Hoher List.
STAR DENSITY DISTRIBUTION IN YOUNG AND OLD GLOBULAR CLUSTERS OF THE LARGE MAGELLANIC CLOUD
E. H. Geyer and U. Hopp *In* ESA Astron. Uses of the Space Telescope 1979 p 207-214 refs Prepared in cooperation with Wilhelm-Foerster Sternwarte (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Star counts of the two types of globular clusters (red and blue) in the large Magellanic Cloud (LMC) were made to compare star density distributions of these types of clusters. The red clusters have their blue stars more concentrated in their inner regions while the distribution of the blue and red stars within the young clusters is more or less uniform. For all the clusters of the LMC independent of type, the best polytropic index was n approximately equal to 2.75, confirming the quasistationary state of the clusters. Reliable total cluster masses can be determined with combined ground-based observations and use of the Large Space Telescope. Author (ESA)

N80-22173# Padua Univ. (Italy). Asiago Astrophysical Observatory.
THE STUDY OF GASEOUS NEBULAE IN GALAXIES WITH THE SPACE TELESCOPE
S. DOdorico, M. Perinotto (Osservatorio Astron. di Arcetri, Italy), and P. Benvenuti (ESA, Madrid) *In* ESA Astron. Uses of the Space Telescope 1979 p 215-227 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Some astrophysical problems concerning planetary nebulae, HII regions, and supernova remnants are considered in relation to areas where fundamental breakthroughs are expected with the Large Space Telescope. The relevance of observations above the atmosphere is discussed in detail for the following topics: distance scale and determination of individual masses of planetary nebulae in the Magellanic Clouds and their relation to energetic stellar winds from hot supergiants, and ionization and chemical composition in supernova remants. Author (ESA)

N80-22174# Royal Greenwich Observatory, Herstmonceux (England).
SPACE TELESCOPE AND THE CHEMICAL EVOLUTION OF GALAXIES
B. E. J. Pagel *In* ESA Astron. Uses of the Space Telescope 1979 p 229-239 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Relevant observations of stellar evolution include both abundances in different sorts of objects and data relating to the input assumptions underlying galactic evolutionary models, such as stellar birth and death rates as a function of time and the initial mass function. The following programs are recommended: (1) detailed study of the stellar population in the Magellanic Clouds near the oldest turnoff point from the main sequence; (2) ultraviolet colorimetry of extragalactic globular clusters; (3) spectra of galactic nuclei; (4) interstellar absorption line spectroscopy in the disks and outer parts of spiral and irregular galaxies; (5) surveys and spectroscopy of extragalactic planetary nebulae and supernova remnants; and (6) studies of the stellar population in giant HII regions. Author (ESA)

N80-22175# Groningen Rijksuniversiteit (Netherlands). Kapteyn Astronomical Inst.
DYNAMICS OF GALAXIES
P. C. vanderKruit *In* ESA Astron. Uses of the Space Telescope 1979 p 241-247 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The characteristics of the instrumentation of the Large Space Telescope most useful in studying the dynamics of galaxies are outlined. Recommended programs include: surface photometry and color measurements at faint levels, spatial mapping of systems of globular clusters well into the Virgo cluster, and the spectroscopy at moderate resolution (delta lambda/delta about 1000 to 10,000) of extended older populations. Author (ESA)

N80-22176# European Southern Observatory, Geneva (Switzerland).
ASTRONOMICAL OPPORTUNITIES AND CONSTRAINTS OF THE FAINT OBJECT CAMERA
Philippe Crane *In* ESA Astron. Uses of the Space Telescope 1979 p 249-258 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

Two extragalactic programs are explored as possible uses of the ESA Faint Object Camera. The first deals with determining nuclear velocity dispersion in normal galaxies, and the second with using galaxy core radii for cosmological purposes. The emphasis is on feasibility, therefore, realistic considerations of observing details have been included. Author (ESA)

N80-22177# European Southern Observatory, Geneva (Switzerland).

OBSERVATIONS OF RADIO GALAXIES AND OF NEBULOSITIES AROUND ACTIVE NUCLEI WITH THE SPACE TELESCOPE

Marie-Helene Ulrich *In* ESA Astron. Uses of the Space Telescope 1979 p 261-279 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

The determination of the radio luminosity function of galaxies at large redshifts, and the investigation of small nebulosities around Seyfert nuclei and galactic-scale nebulosities around quasars are discussed in terms of the capabilities and limitations of the Space Telescope. The necessary complementary ground based observations are described. Author (ESA)

N80-22178# University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.

LONG SLIT SPECTROSCOPY WITH SPACE TELESCOPE

M. J. Disney *In* ESA Astron. Uses of the Space Telescope 1979 p 281-288 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

A long slit spectroscope option for the Faint Object Camera, optimized for the spectroscopy of galactic nuclei is examined. A discussion of galactic nuclei, the calculations showing the required spectral resolution, and the calculated detected photon rates per spectral resolution element for a canonical galaxy are presented. Author (ESA)

N80-22179# Observatoire de Paris-Meudon (France).

HIGH RESOLUTION IMAGERY AND MEDIUM DISPERSION UV SPECTRA OF COMPACT PARTS IN PECULIAR GALAXIES PARTICULARLY GIANT CLUMPY IRREGULARS

J. Heidmann and C. Casini *In* ESA Astron. Uses of the Space Telescope 1979 p 289-292 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

Irregular galaxies and galactic structures are discussed in reference to the image resolution and UV medium dispersion spectroscopy capabilities of the Space Telescope. There are several Markarian galaxies identified as belonging to a peculiar class of galaxy. The clumpy irregular, being very large and different in their morphology from classical irregulars, are examined in particular. These galaxies are bright, with absolute magnitude from -18.9 to -21.1. They are large, with Holmberg diameters from 13 kpc to 36 kpc. Their 21 cm lines are wide, from 190 to 500 km/sec, implying large internal velocities. These properties, together with their UV excess, and the indications that the clumps may each be 50 times more massive than giant HII regions make them intersting candidates for study with the Space Telescope. Author (ESA)

N80-22180# European Space Agency, Madrid (Spain). Satellite Tracking Station.

SPECTROSCOPY OF ACTIVE GALAXIES

M. V. Penston *In* ESA Astron. Uses of the Space Telescope 1979 p 293-300 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

Several current research topics are reviewed in light of the greater spectral coverage offered by the Space Telescope. Emission lines from Seyfert galaxies, quasars, and nebulae in active galaxies are discussed. Absorption lines can be used in the study of the interstellar medium, the halo are the Milky Way galaxy, and the presence of lambda 2200 dust absorption at great distances. Author (ESA)

N80-22181# Leiden Univ. Observatory (Netherlands).

ACTIVE GALAXIES AT z GREATER THAN OR EQUAL TO 0.5

H. vanderLaan, P. Katgert, and H. R. deRuiter *In* ESA Astron. Uses of the Space Telescope 1979 p 301-302 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

Deep radio surveys providing radio source population studies and defining search material for active galaxies and their surroundings are reviewed. For example, color distribution as a function of apparent magnitude for galaxies identified with faint radio sources, shows a blue excess for galaxies with m sub r about 19 to 21 corresponding to z about 0.42 to 0.68. The origin of this blue excess is a problem well suited for the instrument and provided with the Space Telescope. Author (ESA)

N80-22182# European Southern Observatory, Geneva (Switzerland).

CLUSTERS OF GALAXIES

M. Tarenghi *In* ESA Astron. Uses of the Space Telescope 1979 p 305-314 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

The use of the Space Telescope in the investigation of galactic clusters is examined. Clusters are important targets for the Space Telescope (ST), but limitations are imposed by their extended size. The ST can be used advantageously to study the core radius regions of clusters of galaxies with $z > 0.25$. In the case of nearby clusters, ST can be used to study individual members of the clusters, in particular, cepheid variables in the Virgo cluster. For discovery of new, distant clusters, the serendipity mode can be used to obtain some 2000 sets of long exposure pictures per year covering 100 square degrees of sky. After discovery, work can progress in the classification of clusters and individual galaxies, the study of evolution of galaxies in clusters, and the study of the association between quasars of BL Lac objects and clusters. Author (ESA)

N80-22183# Royal Greenwich Observatory, Herstmonceux (England).

GALAXY CLASSIFICATION IN DISTANT CLUSTERS USING THE SPACE TELESCOPE

N. V. Vidal *In* ESA Astron. Uses of the Space Telescope 1979 p 315-319 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

The use of the faint object camera on the Space Telescope for the morphological classifications of the brightest galaxies in very distant clusters ($z <$ of $= 0.8$) is examined. Apparent size, surface brightness, the number of resolution elements, and the spacial resolution of the recording device are investigated as classification parameters. Author (ESA)

N80-22184# Durham Univ. (England). Dept. of Physics.

THE RELEVANCE OF THE SPACE TELESCOPE TO THE DISTRIBUTION OF GALAXIES

R. Fong *In* ESA Astron. Uses of the Space Telescope 1979 p 321-328 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

The Space Telescope can be effectively used to provide star/galaxy identification and classification by morphological type to aid in the automatic reduction of plates taken with ground-based telescope. Measuring machines can determine smoothed profiles on the photograhic plate. It is these smoothed profiles which are needed as standards for interpreting those of distant galaxies. Author (ESA)

N80-22185# Basel Univ. (Switzerland). Inst. of Astronomy.

COSMOLOGY WITH THE SPACE TELESCOPE

G. A. Tammann *In* ESA Astron. Uses of the Space Telescope 1979 p 329-343 refs Prepared in cooperation with European Southern Obs., Geneva (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

The use of the Space Telescope in cosmology related investigations is examined with particular emphasis on neutral hydrogen determination, mapping the Hubble flow, supernova, and the nature of red shifts. Nearly all of the cosmological programs with Space Telescope pose a very serious problem since it seems unlikely that ground-based observations will provide finding lists

of observable objects fainter than 24(m). It is suggested that the ST be used just to search and detect such objects at fainter levels where its performance is optimum. To use ST for reducing the percentage of error in the determination of the Hubble constant would require the method of averaging over n galaxies which is costly of observing time. ST can be efficiently used in mapping the Hubble flow, and it offers a unique chance to determine q sub o from supernovae and to verify the Doppler nature of cosmological redshifts. Author (ESA)

N80-22186# Technische Univ., Vienna (Austria). Inst. of Astronomy.
GLOBULAR CLUSTERS AS DISTANCE INDICATORS FOR GALAXIES
Werner W. Weiss *In* ESA Astron. Uses of the Space Telescope 1979 p 345-349 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The advantages afforded by the Space Telescope in using globular clusters as distance indicators are examined. Globular clusters (GC) can serve as indicators to distances as far as z = 0.1. It should be possible to do photometry of globular clusters at distances as far as 600 Mpc with the faint object camera. It should also be possible to discriminate GC from field stars and galaxies, to determine luminosity functions, to identify the brightest GC of a galaxy more accurately than from the ground, and to investigate to what extent the metallicity of GC changes from galaxy to galaxy. It is necessary to improve the calibration of some characteristic parameters of the GC population and to determinate via ground based astronomy of nearby galaxies to what extent these parameters are universally constant. Author (ESA)

N80-22187# Erlangen-Nuremberg Univ. (West Germany). Inst. of Physics.
IMAGE RESTORATION OF SPACE TELESCOPE PHOTOGRAPHS
A. W. Lohmann and G. P. Weigelt *In* ESA Astron. Uses of the Space Telescope 1979 p 353-361 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Image deconvolution techniques used for improving the spatial resolution of the Space Telescope photographs down to about 0.015 arc-seconds are described. Author (ESA)

N80-22188# Centre National de la Recherche Scientifique, Marseilles (France). Lab D'Astronomie Spatiale.
CORONAGRAPHY ON STARLIKE OBJECTS WITH THE SPACE TELESCOPE: EXPERIMENTAL SIMULATION AND EXPECTED PERFORMANCE
Nicolas Mauron *In* ESA Astron. Uses of the Space Telescope 1979 p 363-374 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The high angular resolution of the Space Telescope provides a strong motive for the use of a coronagraph in order to observe the nearest faint structures surrounding a bright starlike object (stars with planets or shells, nuclei of galaxies, underlying galaxies). An experimental simulation with diffraction limited optics and a Lyot system is described. Results show the possibility of detection of 2 x 10 to the minus 7th power relative intensity features at 1 arc second of the bright source. Author (ESA)

N80-22189*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACELAB WIDE ANGLE TELESCOPE (SWAT)
R. M. West (European Southern Obs., Geneva), T. R. Gull, K. G. Henize (NASA. Johnson Space Center), and F. Bertola (Osservatorio Astrofis., Asiago, Italy) *In* ESA Astron. Uses of the Space Telescope 1979 p 375-392 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01 CSCL 03A

A fast wide angle telescope that will be capable of imaging to the darker sky limit and in the ultraviolet wavelength region available above the atmosphere is described. The telescope (SWAT) has a resolution comparable to that of the large ground-based Schmidt telescope and a field of at least five degrees. A number of astrophysically important investigations can only be accomplished with such a telescope, e.g., detection of hidden, hot objects like hot white dwarfs and subwarfs in stellar binary systems, and energetic regions in globular clusters and galaxy nuclei. It permits unique studies of the UV-morphology of extended objects and allows discovery of very faint extensions, halos, jets, and filaments in galaxies. It can contribute to the investigation of dust in the Milky Way and in other galaxies and, with an objective prism, spectra of very faint objects can be obtained. The SWAT will localize objects for further study with the narrow-field Space Telescope. Author (ESA)

N80-22190# European Space Agency, Paris (France).
MOTIONS IN OUR GALAXY FROM SPACE TELESCOPE AND HIPPARCOS OBSERVATIONS
P. Lacroute *In its* Astron. Uses of the Space Telescope 1979 p 393-401 (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Hipparcos, a project for space astrometry allowing the accurate determinatons of parallaxes, positions, and proper motions in a very consistent system for at least 100,000 stars up to m - 11, is described. The absolute rotation of the resultant reference system remains unknown. It does not matter for the parallaxes, they are absolute. But the use of the proper motions is often dependent on the precision of the knowledge of the absolute rotation Hipparcos system. Author (ESA)

N80-22191# Observatoire de Paris-Meudon (France).
HIPPARCOS AND THE SPACE TELESCOPE: ASTROPHYSICAL IMPLICATIONS OF TWO COMPLEMENTARY ASTROMETRIC PROJECTS
C. Turon Lacarrieu *In* ESA Astron. Uses of the Space Telescope 1979 p 403-407 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Hipparcos project (High Precision Parallax Collecting Satellite) is described in reference to its association with the Space Telescope. The astrometric programs of Hipparcos and the Space Telescope are complemenary not only from a purely astrometric point of view, but also for their astrophysical implications. The Space Telescope can perform a limited number of measurements mainly on selected faint stars in narrow fields while the main results of Hipparcos can be a complete survey up to n sub B about 9 and very accurate measurements of the brightest stars (m sub B < 6). The basic set of observations of Hipparcos can be extended by the Space Telescope of fainter and/or more distant stars. Author (ESA)

N80-22192# European Space Agency, Paris (France).
SPECTROSCOPY AND VARIABILITY MISSION IN X-RAY ASTRONOMY: ASSESSMENT STUDY
Oct. 1979 47 p refs
(ESA-SCI(79)3) Avail: NTIS HC A03/MF A01

An assessment study of an X-ray astronomical observatory satellite is presented. The proposed spectroscopy and variability mission is designed to study carefully selected individual sources. The principal categories of objects to be studied are: nuclei of active galaxies and quasars, clusters of galaxies, X-ray emitting binary systems and their associated black holes, neutron stars or white dwarfs, X-ray burst sources, supernova remnants, and active stars and stellar coronae. A set of three instruments is proposed for the mission. The crystal spectrometers will follow iron emission and absorption features. The large area proportional counter array will have the high photon collecting power necessary to study variability in faint sources and to provide a monitor function for the crystal spectrometers. The phoswich detector will extend the spectral and variability measurements from a few keV to some 200 keV and will permit the detailed study of the recently discovered cyclotron features. Author (ESA)

N80-22193# European Space Agency, Paris (France).
TIMING AND TRANSIENT MISSION IN X-RAY ASTRONOMY: AN ASSESSMENT STUDY
Oct. 1979 43 p refs
(ESA-SCI(79)4) Avail: NTIS HC A03/MF A01

The proposed Spacelab timing and transient mission intends to study the temporal variability of a wide range of X ray emitters, to survey the sky every few days at a sensitivity on one Uhuru unit to monitor long term variability, to make a comprehensive

study of the complex transient and burst phenomena; and (4) to extend X-ray spectral measurement to much higher energies. The baseline payload considered consists of four instruments. A large area proportional counter will provide the high photon collection rate needed for the timing experiment. The hard X ray response will be obtained by incorporation of a phoswich detector. A unique wide field camera will image the sky to detect, locate, and measure X-ray transient events, as well as X-ray and gamma bursts. Finally in order to detect brighter and rarer gamma ray bursts a small wide field of view gamma ray burst detector is included. The total mass of the satellite including both payload and spacecraft is about 950 kg, which is compatible with an Ariane launcher. Volume and overall dimensions do not exclude the use of a dual launch configuration. An equatorial orbit at an altitude of less than 600 km will be required in order to keep the instrument background the lowest possible and most stable in time. The required orbital lifetime is three years. Bubble memories will provide 250 Mbits on board storage allowing an average data accumulation rate between successive transits over a single ground station of 40 Kbits/sec. Maximum accumulation rates of about 250 Kbits/sec will be available.
Author (ESA)

N80-22194# European Space Agency, Paris (France).
A FAST, WIDE-ANGLE TELESCOPE ON SPACELAB: SPACE SCHMIDT. AN ASSESSMENT STUDY
Oct. 1979 40 p
(ESA-SCI(79)5) Avail: NTIS HC A03/MF A01

A fast, wide angle telescope which will be operated from a Spacelab pallet on the space shuttle and will be capable of imaging to the darker night sky limit and in the ultraviolet wavelength range available from above the Earth's atmosphere is described. The scientific functions and possible missions for the telescope, such as studied of the UV morphology of galaxies, the detection of galactic and extragalactic hidden hot sources, and mapping the dust component of the Milky Way and external galaxies, are analyzed. The design of the telescope is discussed and its integration into the Spacelab systems is examined.
Author (ESA)

N80-22195# European Space Agency, Paris (France).
INFRARED SPACE OBSERVATION (ISO): ASSESSMENT STUDY
Oct. 1979 49 p ref
(ESA-SCI(79)6) Avail: NTIS HC A03/MF A01

ISO scientific objectives and program implementation are discussed. ISO comprises a cooled 60 cm diameter telescope in a 3-axis stabilized spacecraft which can be pointed within a 6 arcsec accuracy. The telescope and scientific instruments are cooled by helium gas from a cryostat containing initially 135 kg of superfluid helium. A number of instruments can be accommodated, consistent with the concept of an IR astronomy observatory. A model payload has been considered, which consists of a near IR imaging camera (1-5 micrometers), a dual range single drive Michelson inteferometer of high resolution, (2-25 micrometers). The planned ISO mission lifetime of 1 1/2 years enables it to be used for the study of a whole range of astrophysical objects at an unequalled sensitivity.
Author (ESA)

N80-22196# European Space Agency, Paris (France).
POLAR ORBITING LUNAR OBSERVATORY (POLO). ASSESSMENT STUDY
Oct. 1979 51 p
(ESA-SCI(79)7) Avail: NTIS HC A04/MF A01

The specific scientific objectives of POLO are described and the experimental techniques required to meet these objectives are discussed. A basic payload for the orbiter is proposed. Tracking of the orbiter and the Relay and 'bent-pipe' tracking of the orbiter via the Relay as well as additional objectives, not necessarily related to lunar science, are also discussed. It is shown that the orbital requirements of the mission can be satisfied by means of an Ariane I launcher with a 4th stage. In order to satisfy the pointing requirements of the payload, a 3-axis stabilized orbiter is required. Subsystem concepts, making extensive use of design inheritance from current and future projects are presented. It is shown that a relatively simple spin-stabilized Relay spacecraft with conventional subsystems is adequate to support the tracking and payload requirements. It is proposed to use ground stations at Kourou and Odenwald for tracking and data acquisition. The state of development of the required scientific instruments is discussed, and technical management and schedule aspects are outlined.
Author (ESA)

N80-21369*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY
R. M. Taylor *In its* The Deep Space Network 15 Apr. 1980 p 46-47 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 03A

N80-22131*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE SPACE TELESCOPE OBSERVATORY
John N. Bahcall (Inst. for Advan. Study, Princeton, N.J.) and C. R. Odell *In its* Sci. Res. with the Space Telescope Oct. 1979 p 5-46 (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

N80-22132*# Kitt Peak National Observatory, Tucson, Ariz.
PLANETARY ASTRONOMY WITH THE SPACE TELESCOPE
Michael J. S. Belton *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 47-75 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

N80-22133*# Hawaii Univ., Honolulu. Inst. for Astronomy.
INVESTIGATION OF SMALL SOLAR SYSTEM OBJECTS WITH THE SPACE TELESCOPE
David Morrison *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 77-97 (For primary document see N80-22130 12-88)
(Grant NGL-12-001-057)
Avail: NTIS HC MF A01; SOD HC CSCL 03A

N80-22137*# National Research Council of Canada, Victoria (British Columbia). Dominion Astrophysical Observatory.
POPULATION STATISTICS OF FAINT STELLAR AND NON-STELLAR OBJECTS
Sidney VandenBergh *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 151-164 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

N80-22138*# Yale Univ. Observatory, New Haven, Conn.
SPACE TELESCOPE OBSERVATIONS OF NORMAL GALAXIES
Augustus Oemler, Jr. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 165-180 refs Sponsored in part by the Alfred P. Sloan Foundation (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

N80-22141*# Institute for Advanced Study, Princeton, N.J.
ABSORPTION LINES IN THE SPECTRA OF DISTANT OBJECTS
John N. Bahcall *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 215-240 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

N80-22142*# Mullard Radio Astronomy Observatory, Cambridge (England).
RADIO ASTRONOMERS, X-RAY ASTRONOMERS AND THE SPACE TELESCOPE
Malcolm S. Longair *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 241-262 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-22197*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HELIUM SYNTHESIS, NEUTRINO FLAVORS, AND COSMOLOGICAL IMPLICATIONS
F. W. Stecker Dec. 1979 14 p
(NASA-TM-80604) Avail: NTIS HC A02/MF A01 CSCL 03B

The problem of the production of helium in big bang cosmology is re-examined in the light of several recent astrophysical observations. These data, and theoretical particle physics considerations, lead to some important inconsistencies in the standard big bang model and suggest that a more complicated picture is needed. Thus, recent constraints on the number of neutrino flavors, as well as constraints on the mean density (openness) of the universe, need not be valid. Author

N80-22198# National Technical Information Service, Springfield, Va.
QUASARS, PULSARS, AND BLACK HOLES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1980
Brian Carrigan Feb. 1980 274 p Supersedes NTIS/PS-79/0076; NTIS/PS-78/0161; NTIS/PS-77/0168
(PB80-804339; NTIS/PS-79/0076; NTIS/PS-78/0161; NTIS/PS-77/0168) Avail: NTIS HC $30.00/MF $30.00 CSCL 03B

Astronomical surveys of quasars, pulsars, and black holes are presented. Computer simulations, mathematical models, and other methods used for the verification of hypothesis about astrophysical processes are included. This updated bibliography contains 267 abstracts, 13 of which are new entries to the previous edition. GRA

N80-22134*# California Univ., Santa Cruz. Lick Observatory.
PHYSICAL CHARACTERISTICS OF IONIZED GASEOUS NEBULAE
Donald E. Osterbrock *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 99-121 refs (For primary document see N80-22130 12-88)
(Grant NSF AST-76-18440)
(Contrib-420) Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22135*# Cornell Univ., New York. Dept. of Astronomy and Physics.
DISTRIBUTION AND COMPOSITION OF INTERSTELLAR MATTER
E. E. Salpeter *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 123-138 refs (For primary document see N80-22130 12-88)
(Grant NSF AST-78-20708)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22136*# Australian National Univ., Canberra. Research School of Physical Sciences.
LUMINOSITY FUNCTIONS AND EVOLUTION OF GLOBULAR CLUSTERS
K. C. Freeman *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 139-150 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22139*# Yale Univ. Observatory, New Haven, Conn.
GALACTIC EVOLUTION WITH THE SPACE TELESCOPE
Beatrice M. Tinsley *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 181-195 refs Sponsored in part by the Alfred P. Sloan Foundation (For primary document see N80-22130 12-88)
(Grant NSF AST-77-23566)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22140*# Hale Observatories, Pasadena, Calif.
THE CENTRAL REGIONS OF ACTIVE GALAXIES AND QUASARS
Wallace L. W. Sargent *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 197-214 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22143*# Hale Observatories, Pasadena, Calif.
PRECISE DETERMINATION OF THE DISTANCES OF GALAXIES
G. A. Tammann (Basel Univ.) *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 263-293 refs Sponsored in cooperation with the Swiss Nat. Sci. Found. (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22144*# Princeton Univ., N. J.
THE PROBLEMS OF COSMOLOGY
P. J. E. Peebles *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 295-312 refs Sponsored in part by NSF (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-22199*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOYAGER DETECTION OF NONTHERMAL RADIO EMISSION FROM SATURN
M. L. Kaiser, M. D. Desch, J. W. Warwick, and J. B. Pearce Mar. 1980 15 p refs
(NASA-TM-80665) Avail: NTIS HC A02/MF A01 CSCL 03B

The detection of bursts of nonthermal radio noise from Saturn by the planetary radio astonomy experiment onboard the Voyager spacecraft is discussed. The emissions occur near 200 kHz with a peak flux density comparable to higher frequency Jovian emissions. The radiation is right-hand polarized and is most likely emitted in the extraordinary magnetoionic mode from Saturn's northern hemisphere. Modulation is apparent in the data which is consistent with a planetary rotation period of 10 hr 39.9 min. M.G.

N80-22200# European Space Agency, Paris (France).
COMET HALLEY MICROMETEOROID HAZARD WORKSHOP
Norman Longdon, ed. Oct. 1979 151 p refs Presented at ESA Intern. Workshop, Noordwijk, Neth., 18-19 Apr. 1979
(ESA-SP-153) Avail: NTIS HC A08/MF A01

The problem of micrometeoroid hazard is discussed with emphasis on the ESA/NASA Halley's comet flyby mission, is discussed. The main subjects are the micrometeoroid size distribution and number density in the environment of Halley's comet, and the theoretical and experimental results from the study of hypervelocity impact phenomena. A brief description of the Halley's comet mission and the design concepts which were adopted is described. For individual titles, see N80-22201 through N80-22219.

N80-22201# European Space Research and Technology Center, Noordwijk (Netherlands).
THE JOINT NASA/ESA COMETARY MISSION TO COMETS HALLEY AND TEMPEL 2
D. Dale, R. Pacaut, and R. Reinhard *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 3-5 (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

A potential cooperative NASA/ESA mission is described. It involves a rendezvous with comet Tempel 2 during its apparition in 1988, and a fast flyby of comet Halley at 1.53 astronomical units pre-perihelion at the end of 1985. ESA's share of the project is the provision of a probe to be released from the main spacecraft to the inner coma of comet Halley. NASA's share of

the project includes the main spacecraft and the solar electric propulsion system. Author (ESA)

N80-22202# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
PRELIMINARY DESIGN CONCEPTS FOR THE HALLEY PROBE SHIELD
R. Reinhard *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 7-15 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

Four different models for the size distribution of cometary dust particles are compared. To protect the probe, a dual-sheet bumper shield is proposed that consists of a 1 mm aluminum front sheet and a 2 x 3 mm aluminum rear sheet with embedded honeycomb structure and a 25 cm space between the front and rear sheet. Three distinct hazards to the shield are identified: (1) individual large particles, whose debris cloud impacts on and tears the rear sheet; (2) numerous intermediate size particles which produce holes in the front sheet; and (3) a very large number of small particles, which produce craters in the front sheet leading to its erosion. The individual hazards are calculated. It is concluded that the probe will survive with a high probability a total fly-by of the comet nucleus with a distance of closest approach of about 100 km. The largest uncertainty in the results is due to the difficulty of experimentally investigating large particle impacts at 50 km/s. Author (ESA)

N80-22203# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
A PARTICLE IMPACT DETECTOR FOR THE HALLEY PROBE
E. Gruen and J. A. M. McDonnell (Kent Univ., Engl.) *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 17-21 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

An experiment is proposed which measures the flux, size distribution and physical characteristics of cometary particulates as a function of distance from the nucleus. It will determine the penetration depth of micrometeoroids at an impact speed of 57 km/s, the dust production rate and material properties of cometary grains. The experiment uses the micrometeoroid shield of the Halley probe as sensitive area. It will consist of a combination of several sensors: impact ionisation detectors, capacitor discharge detectors, and microphones. These different space-flight-proven detectors will have overlapping ranges of sensitivity and will cover a mass from 10 to the minus 3 power g. to approx. 10 to the minus 16th power. The signals from the impact ionization detector and the microphones depend on the mass of the impacting particles, whereas the capacitor discharge detector identifies particles above a certain threshold. The three types of detectors will be used in combination with films of different thicknesses in order to determine the penetration limit which depends on both the mass and the bulk density of the impacting particles. Author (ESA)

N80-22204*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
EXPECTED CHARACTERISTICS OF LARGE DUST PARTICLES IN PERIODIC COMET HALLEY
Z. Sekanina *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 25-34 refs (For primary document see N80-22200 12-91)
(Grant NGR-09-015-159; Contract JPL-670057)
Avail: NTIS HC A08/MF A01 CSCL 03B

Observational evidence is presented for dust particles heavier than 0.01 millionth of a gram expelled from Comet Halley. Dust emitted around 1.5 AU pre-perihelion, the point in orbit where a probe would fly through the comet in 1985, should have contributed to an anomalous tail that could have been observed in 1910. From positions of the trailing boundary of the ordinary dust tail at that time, it is concluded that the production of dust started to increase steeply at 0.7 to 0.8 AU before perihelion. Observations in late January 1836 are used to derive the production of dust vs. time and the the expected number of large-particle impacts on the protective shield of the 1985 flythrough probe. From data on other comets, it is estimated that the size distribution for large particles is likely to vary inversely according to the fourth or slightly higher power of the size. Author (ESA)

N80-22205*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PHYSICAL MODELS OF COMET HALLEY BASED UPON QUALITATIVE DATA FROM THE 1910 APPARITION
Ray L. Newburn *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 35-50 refs (For primary document see N80-22200 12-91)
(Contract NAS7-100)
Avail: NTIS HC A08/MF A01 CSCL 03B

A semi-empirical theory was developed, tying the hydrogen production rate of a comet to its visual light curve. Two unknown constants, which are essentially the efficiencies of these two processes, are derived from the comets for which quantitative data exist. This theory has been applied to P/Halley, using the light curve of Yeomans, which was derived from the original 1910 observations, with aperture corrections applied. Given the hydrogen production rate, it is assumed that N(H2O) = 0.5 N(H) and that there is 0.2 N(H2O) of other species. From several converging lines of evidence the mass of dust is taken as half the mass of gas. The Sekanina-Miller distribution function of particle size is used. Particle velocities are calculated using Delsemmes version of the Probstein theory. From these, near nucleus dust density, flux, etc. are calculated. Dust envelope sizes are calculated from the old mechanical theory of tails. Extreme models are calculated from the old mechanical theory of tails. Extreme models are also furnished based upon a 'sum-of-negative-tolerance' approach. Author (ESA)

N80-22206# Sheffield Univ. (England). Dept. of Physics.
THE MICROMETEOROID HAZARD TO A SPACE PROBE IN THE VICINITY OF THE NUCLEUS OF HALLEY'S COMET
David W. Hughes *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 51-56 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

The micrometeoroid impact rate on the Halley probe is calculated as a function of the flyby distance. The number of meteoroid particles in specific log mass ranges, which will impact on a unit area of the leading surface of the probe are given. These numbers are compared with values obtained using the JPL model for the dust environment. The manner in which the impact rate varies as a function of distance along the flyby trajectory is also calculated. When producing a model of the environment in the inner coma of Comet Halley, two of the important parameters required in the calculation are the mass and the size of the central nucleus. The estimates that have been made of this mass are reviewed. Present opinion is that it lies in the range between 3 x 10 to the 16th power and 3 x 10 to the 19th power g. The density of this nucleus is probably around 1.1 g/cu.cm. The diameter of the body has been estimated to lie in the range between 4 and 75 km. This analysis indicates that 1.4 x 10 to the 17th power g and 6.2 km are reasonable values. Author (ESA)

N80-22207# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
FEEDBACK OF THE DUST COMA ON THE EVAPORATION PROCESS
H. U. Keller *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 57-60 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

Some results are presented from a new model which considers the multiple scattering of the solar radiation in the dust coma. The feedback of the dust coma on the sublimation of the surface of the cometary nucleus leads to a slight increase of gas and dust production rather than to the expected decrease by screening over a wide range of heliocentric distances. For the situation of the Comet Halley flyby, the terminal velocities of the dust grains resulting from the hydrodynamic interaction with the gas can be approximated in a simple form. The apex distance and maximum grain size are calculated. Author (ESA)

N80-22208# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
DUST HAZARD OF THE COMETARY PROBE
H. Fechtig *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 63-65 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

The probe through the coma of Comet Halley is hit by several thousands to several hundred thousands of dust particles per sq cm in the size range above .1 micrometers and 1 micrometer, respectively. With the relative velocity of 5 km/sec, heavy damage is to be expected. If one assumes a flythrough at 100 km distance from the nucleus, the probe is hit by particles up to 1 cm in diameter. The damage by 1 cm diameter particles is in the order of 10 cm penetration depth. The damage from smaller particles is less severe, but due to the increasing number of smaller particles, an erosional effect is expected. A multifoil shield is recommended for reducing the dust hazard.
Author (ESA)

N80-22209# European Space Agency, Paris (France).
PROTECTING THE EEC COMET HALLEY PROBE FROM METEOROID IMPACT
Hallock F. Swift (Intern. Appl. Phys. Inc.) *In its* Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 67-72 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

A practical and straightforward approach is proposed for evaluating effectiveness of spacecraft meteoroid shields. The analysis accounts for most of the physics governing relevant hypervelocity impact situations that is currently understood. Relatively few assumptions were required and these were made in a clearly conservative manner. As an example, the technique was applied to evaluate a dual element meteoroid shield designed to protect the ESA Comet Halley probe from a 0.01 probability mission threat (0.1 g meteoroid with a gross density of 0.5 g/cu cm impacting normally at 57 km/sec). A shield of reasonable dimensions was estimated to survive the encounter (0.5 mm aluminum bumper plate spaced 15 cm ahead of a structure consisting of a 1 mm aluminum plate supported by aluminum honeycomb).
Author (ESA)

N80-22210*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METEOROID PROTECTION FOR THE COMET HALLEY PROBE
D. Humes *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 73-76 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01 CSCL 03 B

The high closing speed of 57km/s between the spacecraft and Halley poses special problems in the design of the required meteoroid protection. A double wall structure with a total thickness equal to 0.1 to 1 times the diameter of the largest meteoroid encountered is sufficient to stop that meteoroid. However, the unusually high number of meteoroid impacts on the Halley probe will cause significant erosion of the outer wall so that failure of the second wall is more likely to occur from a small meteoroid passing through a previously created hole in the outer wall and then penetrating the second wall. Calculations of the shielding required based on this failure mode, show that a double wall structure must actually have a total thickness 1.2 to 7.3 times the diameter of the largest meteoroid encountered, depending on the size distribution of the meteoroids.
Author (ESA)

N80-22211# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PROBE PROTECTION AGAINST COMETARY METEOROID ATTACK
John H. Kieneke *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 77-83 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

An analysis is described for defining the limits of perforation protection against cometary meteoroids achievable by shielding systems. One and two element shield concepts of four materials are treated with worst case models which define meteoroid masses above which no perforation will occur. Dual element shields are shown to provide two to three orders of magnitude greater protection than single element shields. In the context of the ESA Comet Halley probe mass and area constraints, protection against meteoroid masses in excess of one gram, striking at 57 km/s, is demonstrated.
Author (ESA)

N80-22212*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. Technical Planning Office.
SPACE VEHICLE METEOROID SHIELDING DESIGN
Burton G. Cour-Palais *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 85-92 (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01 CSCL 22B

Design principles of spaced, multiwall meteoroid protection are investigated in the light of experimental data generated during the Apollo Program. The outer wall or shield is shown to be the most important element in the meteoroid-spacecraft interaction. The condition of the debris is primarily a function of the shock pressure, the melting points of the meteoroid and the shield, and the length of the meteoroid and thickness of the shield. Spacing between the walls is effective up to approximately 100 times the length of the meteoroid. The required thickness of the second wall is shown to be proportional to the meteoroid mass, velocity, and density, and to the spacing between the walls, taken with exponents dependent upon the condition of the debris. The effects of placing additional elements (insulation or honeycomb cells) between the two walls are discussed, and the efficiency of various protective configurations is presented. An analysis of the meteoroid protection proposed for the Comet Halley probe is included as an appendix.
Author (ESA)

N80-22213# Kent Univ., Canterbury (England).
MARGINAL HYPERVELOCITY PENETRATION STUDIES OF SINGLE AND DOUBLE FOIL STRUCTURES; EXPERIMENTAL MEASUREMENTS AND THE POSSIBILITIES OF A 2 MV MICROPARTICLE ACCELERATOR FOR COMET METEOROID PROBE DESIGN EXPLORED
J. A. M. McDonnell *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 93-97 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

Current measurements in the determination of the limiting projectile size required for the penetration of a given thickness of micron scale targets as a function of the projectile velocity (marginal penetration) are reviewed. Data is most abundant for impacts of iron projectiles on aluminum targets and extends to 16 km/s for single foils. Data on the penetration of aluminum protected by a 5 micron mylar meteoroid bumper is included. To provide design parameters for the ESA Comet Halley probe shield, an extension of single foil and thick target experiments seems the most promising approach by using an existing 2MV accelerated, studies at 57 km/s velocity and impacts on new materials such as lexan could readily be made. Dimensional scaling is not severe and the overlap of micron and millimeter data at lower velocities provides an accurate base for such corrections.
Author (ESA)

N80-22214# Centre National de la Recherche Scientifique, Toulouse (France). Dept. de Technologie Spatiale.
MICROCRATERS PRODUCED IN BRITTLE MATERIALS IN THE 1 TO 20 km/s VELOCITY RANGE
J. C. Mandeville *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 99-100 (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

Microcraters were produced in sodalime glass and fused quartz by polystyrene-divinylbenzene, aluminum, and iron projectiles with masses between 0.5 and 200 picograms and velocities between 0.5 and 15 km/sec. The experiments were done with a 1.5 MV vertical microparticle accelerator. For each projectile and target combination, craters were formed over a range of projectile velocities and masses. It is shown that a ratio of 2.2 + or - 0.2 between the diameter of the central part of the crater and the diameter of the projectile is valid for a range of velocities. The ratio of central pit diameter and depth to projectile diameter increases with increasing impact velocity. Figures showing the influence of the density of the projectile

upon the depth of the crater and the variation of crater diameter with the mass of the projectile are presented. Author (ESA)

N80-22215# Ernst-Mach-Inst., Freiburg (West Germany).
VELOCITY DEPENDANCES OF SOME IMPACT PHENOMENA
Eberhard Schneider *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 101-107 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

A variety of cratering phenomena is discussed, primarily with respect to their dependencies on impact velocity. Based on experimental evidence, three impact regimes can be established, an elastic, a plastic, and a hydrodynamic regime. Within the hydrodynamic regime, the cartering process becomes uniform and independent of the impact velocity. It is mainly controlled by projectile and target densities and by the kinetic projectile energy. For plate perforation, there exists a velocity threshold above which the perforation process becomes independent of the impact velocity. The degree of projectile fragmentation during plate perforation increases strongly with increasing velocity. A proposed penetration formula based on a single energy model was applied to a number of experimental data. This formula turned out to describe penetration depths within the hydrodynamic impact regime reasonably well up the highest impact velocities experimentally accessible. Author (ESA)

N80-22216# Technische Universitaet, Munich (West Germany).
MICROMETEOROID AND DUST SIMULATION
E. Igenbergs and H. Kuczera *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 109-114 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

The simulation regimes covered by different accelerators and work done to simulate micrometeoroid and dust impact are described. A small electromagnetic dust accelerator was developed, to simulate dust acceleration in the velocity regime between 0 and 1000 m/s. This transfers the energy to the dust. It can therefore operate in all sorts of environments, including ultra-high vacuum. A light gas gun also can accelerate projectiles up to 2 mm in diameter to velocities up to 6 km/s. Two-stage plasma accelerator uses the electromagnetic acceleration as injection and a plasma accelerator as second stage. This device can accelerate projectiles with a diameter between 100 and 250 microns to velocities around 20 km/s. The measurement techniques which were used are described. Author (ESA)

N80-22217# California Research and Technology, Inc., Woodland Hills.
REVIEW OF HYDRO-ELASTIC-PLASTIC CODE ANALYSES AS RELATED TO THE HYPERVELOCITY PARTICLE IMPACT HAZARD
M. H. Wagner and K. N. Kreyenhagen *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 115-120 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

Current capabilities as well as limitations of these finite difference codes techniques, particularly as related to design of particle impact shields, are discussed. Code capabilities were confirmed experimentally by observations of impacts in the 4-10 km/sec velocity regime. It is suggested that code analyses could be an important design aid for the Halley probe shield, particularly since the impact velocity of 57 km/sec is substantially above the 10 km/sec limitation of laboratory techniques. Different shield materials, thicknesses, and spacings can be evaluated over the range of expected particle impact conditions. When available, correlations with related experimental results to check the numerical techniques are recommended. Author (ESA)

N80-22218# European Space Agency, Paris (France).
THE TREATMENT OF THE PROBLEMS DUE TO HYPERVELOCITY IMPACT DURING A FAST FLY-BY (57 s) OF HALLEY'S COMET
M. J. VandenHoek (Phys. Intern. Co.) *In its* Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 121-129 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

The problem of hypervelocity-impact at 57 km/sec during the fast flyby of Halley's comet is discussed. The posibilities of numerical analyses by the use of explicit finite-difference codes, the experimental techniques, and the behavior of materials under these conditions are briefly described. Based on an extrapolation of existing data, some characteristics of the bumper-layout are discussed. It is shown that additional data may be required to optimize the design of the bumper. Author (ESA)

N80-22219# European Space Agency, Paris (France).
EXPERIMENTAL TECHNOLOGY FOR INVESTIGATING METEOROID THREATS TO DEEP SPACE PROBES
Hallock F. Swift *In its* Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 131-136 (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

To date no engineering simulation of a meteoric impact of submillimeter particles (closure velocity 57 km/s) has been feasible. The uses and limitations of current simulation methods, two stage light-gas guns, explosively actuated light-gas guns, electric rail guns are discussed, together with ideas on potential uses of electrostatic launchers, electrothermal accelerators, explosive shaped charge technology. It is concluded that electric rail gun technology represents the most likely approach for achieving accelerator performance levels of direct use for evaluating the meteoroid threat to deep space probes approaching an active comet. Author (ESA)

N80-22220# European Space Agency, Paris (France).
ASTEROID EXPLORATION MISSION (ASTEREX). AN ASSESSMENT STUDY
Oct. 1979 42 p
(ESA-SCI(79)1) Avail: NTIS HC A03/MF A01

The Asteroid Exploration (ASTEREX) mission is discussed. A spacecraft is placed in a carefully chosen orbit about the Sun (perihelion about 1 AU; aphelion about 3.5 AU) which takes it through the asteroid belt. A conventional propulsion system is used to correct the trajectory and to enable four or more asteroids to be approached within about 1,000 km. Specific scientific objectives to be addressed by the ASTEREX mission include: cratering, surface morphology, geology, mineralogy, shape, spin, size, density, close environment, and magnetism. It is concluded that it is essential to include in the payload a versatile imaging system and a radar altimeter. High priority is given to the inclusion of a magnetometer and an infrared spectrometer. The results of a limited statistical analysis of launch opportunities in 1986 are presented. It is shown that missions including 3 and 4 asteroid fly-bys can be acheived by means of an Ariane launcher equipped with a fourth stage. A number of spacecraft configurations are presented. The preferred option is a 3-axis stabilized spacecraft. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-22221*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC CLOUDS IN THE SOLAR WIND
L. F. Burlaga and L. Klein Mar. 1980 17 p refs Submitted for publication
(NASA-TM-80668) Avail: NTIS HC A02/MF A01 CSCL 03B

Two interplanetary magnetic clouds, characterized by anomalous magnetic field directions and unusually high magnetic field strengths with a scale of the order of 0.25 AU, are identified and described. As the clouds moved past a spacecraft located in the solar wind near Earth, the magnetic field direction changed by rotating approximately 180 deg nearly parallel to a plane which was essentially perpendicular to the ecliptic. The configuration of the magnetic field in the clouds might be that of a tightly wound cylindrical helix or a series of closed circular loops. One of the magnetic clouds was in a cold stream preceded by a shock, and it caused both a geomagnetic storm and a depression in the galactic cosmic ray intensity. No stream, geomagnetic

storm, or large cosmic ray decrease was associated with the other magnetic cloud. Author

N80-22222*# Stanford Univ., Calif. Inst. of Plasma Research.
GEOMAGNETIC ACTIVITY AND HALE SECTOR BOUNDARIES
Henrik Lundstedt, P. H. Scherrer, and J. M. Wilcox Feb. 1980 20 p refs
(Contract NAS5-24420; Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-77-20580)
(SU-SUIPR-801) Avail: NTIS HC A02/MF A01 CSCL 03B

The variation of the geomagnetic activity index Ap at the IMF sector boundaries (+ to - and - to +) is examined for three solar cycles, separating data into vernal and autumnal equinoxes. It is found that a reported increase in Ap as an effect of a Hale boundary can be better attributed to the occurrence of a negative IMF Bz component in the geocentric solar magnetospheric coordinate system and to the occurrence of high speed solar wind streams. M.G.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

99 GENERAL

N80-22223# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE BI-MONTHLY BULLETIN NUMBER 1979-1
ESA Nov. 1979 107 p refs Transl. by ONERA into ENGLISH of 'La Rech. Aerospatiale, Bull. Bimestriel' (Paris) No. 1979-1, Jan.-Feb. 1979 p 1-85 Original French report available from ONERA, Paris FF 36
(ESA-TT-599) Avail: NTIS HC A06/MF A01

Various topics include studies of noise generated aerodynamically, adaptive linear filtering, sampling techniques for hot wire signals, turbulent boundary layer and blade to blade flow, ultrasonic measurement of solid propellant burning rate, and determination of crack fronts in metallic parts. For individual titles, see N80-22224 through N80-22230.

N80-22224# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOISE GENERATED AERODYNAMICALLY c71
Robert Lesendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. 1979-1, Jan.-Feb. 1979 p 1-9 Original report in FRENCH previously announced as A79-30933 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

A wave equation satisfied by an acoustic potential for the noise generated by aerodynamic turbulence is presented. A definition of noise as a pulsation of the irrotational component of velocity and the distinction between sound and pseudosound are introduced to aid in the analysis. The wave equation is derived from a combination of equations of fluid mechanics and thermodynamics and contains a term relating the intensity of the noise source to the rate of variation of the specific mass. It is noted that integration of the acoustic potential equation allows a more accurate prediction of the direct effects of convection and refraction on noise propagation to be made. The mechanism of noise generation in turbulent flow is also discussed, taking into account the tendency of the fluid to avoid changes in volume. Author (ESA)

N80-22225# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ADAPTIVE LINEAR FILTERING IN THE PRESENCE OF AN EVOLUTION NOISE OF POORLY KNOWN VARIANCE c64
Huu Thanh Huynh *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 15-30 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 11-22 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

The application of the Kalman-Bury linear filter raises a particular problem when the covariance matrix of the evolution noise is poorly known. An algorithm for the adjustment of this covariance is presented for a linear, stationary system whose evolution noise has independent components. It comprises a preliminary test on observation residues (difference between actual observations and those predicted by the filter); the estimation of the covariance is then performed by a least square method on these residues. A numerical simulation, made on a simplified model of missile trajectory restitution, emphasizes the improvement of the state estimating over a classical filtering. Author (ESA)

N80-22226# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOT WIRE CONDITIONAL SAMPLING TECHNIQUES FOR TRANSITION INTERMITTENCY STUDIES c34
Daniel Arnal and Jean-Claude Juillen *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 31-43 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 22-31 Presented at DISA Conf., Marseille, 11-14 Sep. 1978 Original report in FRENCH previously announced as A79-30495 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

The intermittency phenomenon in an incompressible boundary layer transition was studied by conditional sampling of the hot-wire signal. The most important difficulty in this type of analysis was to determine a detection signal which permits the discrimination of the successive laminar and turbulent regions. When this problem was solved, it was then possible to determine separately the laminar and turbulent flow properties. Author (ESA)

N80-22227# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TURBULENT BOUNDARY LAYERS IN OSCILLATING FLOW WITH A MEAN ADVERSE PRESSURE GRADIENT c34
Robert Houdeville and Jean Cousteix *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 43-62 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 32-48 Presented at 15th Assoc. Aeron. et Astronomique de France Colloq. d'Aerodyn. Appl. Marseille, 7-9 Nov. 1978 Original report in FRENCH previously announced as A79-32280 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

The development of an unsteady turbulent boundary layer with a mean pressure gradient strong enough to induce separation was investigated in order to complete and extend results obtained for flat plate configurations. The longitudinal component of velocity was measured using hot-wire anemometers; the region of negative velocities was measured with an LDV system. The boundary layer was found to respond by forced oscillation to the perturbation of the potential flow. The average location of the zero skin friction moves periodically at the perturbation frequency. Comparison of average velocity profiles obtained from similarity solutions shows good agreement up to values of the shape parameter close to the separation value. Author (ESA)

N80-22228# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BLADE-TO-BLADE FLOW OF IDEAL FLUID WITH WALL INJECTION c34
Alain LeMeur and Phillipe Morice *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 63-70

refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 49-54 Original report in FRENCH previously announced as A79-30496 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

The perturbation of the subsonic, two dimensional flow of an ideal fluid in the region between turbine blades, caused by the injection of cooling gas at the walls, is considered. A model of irrotational, two fluid flow is used and variational principles approximated by finite elements are derived. The analysis takes into account free boundaries between various flows and is used to calculate velocity distributions and pressure profiles.
Author (ESA)

N80-22229# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ULTRASONIC MEASUREMENT OF SOLID PROPELLANT BURNING RATE **c28**
Paul Kuentzmann, Jean-Claude Demarais, and Franck Cauty *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 71-90 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-1, Jan.-Feb. 1979 p 55-72 Original report in FRENCH previously announced as A79-30497 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

Considering the inadequacy of current methods for measuring the burning rate of solid propellants, an ultrasonic device was developed that measures the grain thickness at a rate up to 5000 Hz. Satisfactory results were obtained on specimens up to 40 mm thick in steady or slowly varying conditions, such as erosive combustion. Composite, double base and autopyrolyzing propellants were tested in various temperature and pressure conditions, and intermediate materials between grain and transducer were determined.
Author (ESA)

N80-22230# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DETERMINATION BY ELECTRICAL MEANS OF CRACK FRONTS IN THREE-DIMENSIONAL METALLIC PARTS **c39**
Georges Bandin and Humbert Policella *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) p 91-105 refs Transl. by ONERA in ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-1, Jan.-Feb. 1979 p 73-85 Original report in FRENCH previously announced as A79-30498 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

An electrical means of measuring fatigue crack fronts in three dimensional metal parts is presented. The method consists of measuring the voltage drop (caused by the crack) in an electric current applied to the specimen by means of a movable double contact sensor and calibrating the values obtained by means of a rheoelectrical simulation. The geometry of the rheoelectrical tank was chosen to correspond to that of the specimen. The method was applied to specimens of rectangular, square and circular cross sections with semicircular, straight and circular cracks and was shown to give satisfactory results, localizing the crack to within 2 mm.
Author (ESA)

N80-22231# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE BI-MONTHLY BULLETIN NUMBER 1979-2
ESA Nov. 1979 89 p refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 75-140 Original French report available from ONERA, Paris FF 36
(ESA-TT-605) Avail: NTIS HC A05/MF A01

Work in widely separated disciplines in aerospace is discussed, including simulated aerial combat, instability in turbulent flow, electrostatic disturbances on aircraft, aircraft noise, computation of vibrations in elastic media, and a simulation of the flux of the radiation budget of the earth. For individual titles, see N80-22232 through N80-22238.

N80-22232# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DIFFERENTIAL GAMES OF INTERCEPTION AND AERIAL COMBAT: SOLUTION BY DIFFERENTIAL DYNAMIC PROGRAMMING **c66**
Van Nhan Nguyen *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 78-54 Original report in FRENCH previously announced as A79-34976 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

A two-dimensional realistic model for interception and air combat is presented, involving variable velocities and taking into account the characteristics of both aircraft and constraints on maneuvering (limited turning rates). A differential game of pursuit-evasion is then formulated on this basis; the chosen performance index takes into account the final relative distance and deviation angle. Complete determination of the optimal controls and trajectories is effected by differential dynamic programming. Illustrative examples of interception are presented.
Author (ESA)

N80-22233# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NOTE ON AN INSTABILITY MECHANISM FOR THE CORE OF A ROLLED-UP VORTEX SHEET **c02**
Jean-Pierre Guiraud and Radyadour K. Zeytounian *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 15-19 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 85-88 Original report in FRENCH previously announced as A79-34977 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

The mechanism which affects the structure of the rolled up vortex is discussed.
Author (ESA)

N80-22234# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SUPPRESSION OF ELECTROSTATIC RADIOELECTRIC INTERFERENCE ON AIRCRAFT **c32**
Jean-Louis Boulay *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 21-45 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 89-108 Original report in FRENCH previously announced as A79-34978 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

The paper reviews the main effects of accumulation of electrostatic charge on aircraft. Some models for corona discharge and the antenna discharge coupling phenomenon are presented as well as some of the principal methods of suppressing radio electrical disturbances. The mathematical demonstration of coupling between an electric discharge and an antenna is reviewed and interpreted, and experimental methods for determining two key functions which appear in the analysis are presented. The characteristics of orthogonal decoupling dischargers and dischargers with multiple and independent discharges are summarized and types of antistatic protection of dielectric surfaces are defined.
Author (ESA)

N80-22235# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOMOGENIZATION BY MIXED ASYMPTOTIC EXPANSIONS. COMPUTATION OF THE VIBRATIONS OF ELASTIC MEDIA WITH PERIODIC STRUCTURE **c39**
Roger Ohayon *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 47-60 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 109-118 Original report in FRENCH previously announced as A79-34979 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

The methods of homogenization of periodic heterogeneous structures are reviewed, and a mixed method of homogenization is proposed, which employs asymptotic expansions with multiple scales on both the primal and dual variables. Finite element calculations of the harmonic vibrations of periodic heterogeneous structures are presented.
Author (ESA)

N80-22236# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EARTH RADIATION BUDGET: SIMULATION OF FLUXES AND ACCELEROMETRIC MEASUREMENTS c46
Thierry Duhamel and Philippe Marchal *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 61-72 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 119-134 Original report in FRENCH previously announced as A79-11358 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

The use of an accelerometer in the Biramis project to measure the Earth's radiation budget is discussed, and models of the solar radiation flux, the Earth reflected radiation flux, and the Earth infrared radiation flux are presented. Simulation studies using these models are reported and are found to support the general accuracy of the accelerometric procedures. Causes of inaccuracy in accelerometric measurements are considered, and procedures for mitigating the errors are indicated. Author (ESA)

N80-22237# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)
PROPELLER DRIVEN LIGHT AIRCRAFT NOISE c71
Claude Dahan, Leon Avezard, Georges Guillien, Christian Malarmey, and Jacques Chombard *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 73-84 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 129-137 Original report in FRENCH previously announced as A79-34980 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

The acoustic field of a Rallye 235 aircraft was investigated by the microphone technique in conjunction with a model for predicting propeller noise. The microphone measurements were complemented by flyover noise measurements by a technique which made it possible to avoid difficulties associated with the Doppler effect. The calculation model was modified to take into account ground reflection, but although the model predicted well for the fly-away phase, the measured levels are higher than predicted for the approach phase. It is concluded that further analysis should take into consideration thickness noise and noise due to unsteady loading. Author (ESA)

N80-22238# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOISE GENERATED AERODYNAMICALLY c71
Robert C. Legendre *In its* La Rech. Aerospatiale Bi-Monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 85-87 ref Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 139-140 Original report in FRENCH previously announced as A79-34981 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

A justification is given of certain calculations presented on the production of aerodynamic noise in a turbulent fluid. A model for the acoustic field in an ideal fluid in isentropic irrotational flow is considered, and the extension of the model to the center of a turbulent field is carried out on the basis of a nonintegrated enthalpy equation. Author (ESA)

N80-22239# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE BI-MONTHLY BULLETIN NUMBER 1979-3
ESA Jan. 1980 87 p refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 153-218 Original French report available from ONERA, Paris FF 36
(ESA-TT-609) Avail: NTIS HC A05/MF A01

Topics include the functioning of small rocket motors, titanium alloy powder metallurgy, flow visualization in wind tunnels, stress analysis by mixed variational principles, vibration tests on models, harmonic vibration problems, and laminar flow. For individual titles, see N80-22240 through N80-22246.

N80-22240# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PERFORMANCE OF SMALL DOUBLE BASE SOLID PROPELLANT MOTORS c20
Vincent Borie and Paul Kuentzmann *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 153-163 Original report in FRENCH previously announced as A79-41302 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

A functioning model of a double-base solid propellant motor was developed reproducing the time evolution of the pressure, for various propellants and various initial temperatures. Two phenomena, ignored in elementary calculations were considered: the unsteadiness of combustion phenomena and of the flow within the chamber; and the propellant burning rate increase due to erosion. The stages that yielded a realistic model are described. Author (ESA)

N80-22241# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF A TA6V TITANIUM ALLOY AFTER POWDER PRODUCTION BY THE CENTRIFUGAL PROCESS c26
Michel Marty, Henri Octor, Christiane Renon, and Andre Walder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 15-23 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 165-171 Original report in FRENCH previously announced as A79-41303 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

Powder of TA6V was produced by the rotation electrode process in vacuum. The powder was consolidated by extrusion or isostatic hot pressing, giving rise to compositional inhomogeneities in the powder particles. It is shown that such inhomogeneities have an adverse effect on reduction in area and fatigue characteristics at room temperature. However, they are considerably less harmful than foreign inclusions of the type which arise in the case where a tungsten electrode is rotated in an argon atmosphere. Author (ESA)

N80-22242# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF A LAMINAR LIGHTING DEVICE TO THE SMOKE VISUALIZATION OF FLOWS IN A WIND TUNNEL c09
Michel Philbert, Robert Beaupoil, and Jean-Pierre Faleni *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 25-34 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 173-179 Original report in FRENCH previously announced as A79-41304 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

The application of a 1-W argon ion laser to the three dimensional smoke visualization of wind tunnel flows is studied. Photographs of turbulent flows past delta and swept wing models are presented and discussed. Author (ESA)

N80-22243# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MIXED VARIATIONAL PRINCIPLES. COUPLING WITH THE DISPLACEMENT PRINCIPLE c39
Sophia Couryssafi *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 35-48 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestrial (Paris) No. 1979-3, May-Jun. 1979 p 181-190 Original report in FRENCH previously announced as A79-41305 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

The results obtained from the application of the Hellinger-Reissmer two field (displacement and stress) modified variational principle are discussed. The Fraeijs de Veubeke principle is examined in terms of the constraint sigma = sigma which is introduced with a Lagrange multiplier. The results of numerical examples are given. Author (ESA)

N80-22244# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VIBRATION TESTS ON SMALL SCALE STRUCTURES AND

MODELS c39

Henri Loiseau *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 49-68 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 191-206 Original report in FRENCH previously announced as A79-41306 (For primary document see N80-22239 12-99)

Avail: NTIS HC A05/MF A01

Difficulties in vibration testing of small structures and models are discussed in terms of the relative size of the excitational, measurement, and suspension systems. Consideration is also given to the relatively high values of frequency as well as problems arising from three dimensionality. Various ways of correcting the influence on measurements of exciters and transducers plated in contact with the structure under analysis are also discussed. Other significant observations are reported. Author (ESA)

N80-22245# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

SYMMETRIC VARIATIONAL FORMULATION OF HARMONIC VIBRATIONS PROBLEM BY COUPLING PRIMAL AND DUAL PRINCIPLES. APPLICATION TO FLUID-STRUCTURE COUPLED SYSTEMS c77

Roger Ohayon *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 69-78 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 207-211 Original report in FRENCH previously announced as A79-41307 (For primary document see N80-22239 12-99)

Avail: NTIS HC A05/MF A01

A methodology is presented for the coupling of a primal principle and an indirect dual principle leading to a symmetric variational formulation for the harmonic vibrations problem. The symmetric formulation governing the elasto-acoustic vibration problems and more generally fluid-structure coupling are found directly. Author (ESA)

N80-22246# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

EXPLORATORY STUDY OF A LAMINAR-TURBULENT TRANSITION PROCESS CLOSE TO LAMINAR BOUNDARY LAYER SEPARATION c34

Jean Cousteix and Guy Pailhas *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 79-85 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 213-218 Original report in FRENCH previously announced as A79-41308 (For primary document see N80-22239 12-99)

Avail: NTIS HC A05/MF A01

The point and nature of laminar-turbulent transition were studied systematically in a small subsonic wind tunnel, using models with various angles of sweep and a wide range of angles of attack. The technique employed was based on sublimation of acenaphtene coatings and on hot-wire anemometer probing of the boundary layer. Transition was found to be a phenomenon whose characteristics are strongly influenced by such parameters as the pressure gradient. Author (ESA)

N80-22247# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

LA RECHERCHE AEROSPATIALE BI-MONTHLY BULLETIN NUMBER 1979-4

ESA Jan. 1980 90 p refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 219-285 Original French report available from ONERA, Paris FF 36

(ESA-TT-612) Avail: NTIS HC A05/MF A01

Topics include flows on a variable sweep wing, turbine wall temperature calculation, production of composite materials from prealloyed powders, salt stress corrosion cracking of a titanium alloy, wind tunnel signal measurements, noise generation by an eddy, and identification of a vibrational behavior model of complex structures. For individual titles, see N80-22248 through N80-22254.

N80-22248# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

SUBSONIC AND TRANSONIC FLOWS ON A VARIABLE SWEEP WING c02

Volker Schmitt and Francis Manie *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 1-23 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 219-237 Original report in FRENCH previously announced as A79-48849 (For primary document see N80-22247 12-99)

Avail: NTIS HC A05/MF A01

Experiments were performed on models of a variable sweep wing emphasizing flow separation and development vortex structures in the whold speed range and, in addition, the shape of shock waves at transonic speeds. The results of these tests are compared with those of calculations made with available codes such as an incompressible panel method for unseparated flows and an unsteady method based on a point discretization of tha vortex vector for separated flows. Transonic flows were calculated using different relaxation methods: one based on the perturbation theory and two others on the fuel potential equation. Author (ESA)

N80-22249# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

TURBINE BLADE WALL TEMPERATURE CALCULATION BY COUPLING OF INTERNAL CONDUCTION AND EXTERNAL CONVECTION c02

Anne-Elisabeth Cournut and Pierre Michard Michard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 25-33 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 239-243 Original report in FRENCH previously announced as A79-48850 (For primary document see N80-22247 12-99)

Avail: NTIS HC A05/MF A01

A method for calculating the wall temperature of a turbine blade subjected on its external face, to a convection flux, and cooled from inside by circulation of fresh air is presented. The method takes into account the conduction within the metal. The importance of this thermal conduction for interpreting experimental results is shown. Author (ESA)

N80-22250# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

A NEW APPROACH IN POWDER METALLURGY: COMPOSITE MATERIALS PRODUCED FROM BLENDING OF SUPERALLOY POWDERS c24

Michel Marty and Andre Walder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 33-45 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 245-254 Original report in FRENCH previously announced as A79-48851 (For primary document see N80-22247 12-99)

Avail: NTIS HC A05/MF A01

Composite materials produced from the blending of two superalloy powders of different compositions either by extrusion or by hot isostatic pressing (HIP) are considered. The extruded materials are less sensitive than the HIPed materials to grain boundary segregations, but the quality of densification is more in relation with the strain strength of the alloys. The tensile test properties and low cycle fatigue properties are in fair agreement with the law of averages. The notch sensitivity and the Charpy V- notch impact properties are influenced by additions of at least 25% of the more ductile alloy. Author (ESA)

N80-22251# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

HOT SALT STRESS CORROSION CRACKING OF A TA6V ALLOY BY SODIUM CHLORIDE c26

Gilles Lapasset *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 45-53 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 255-261 Original report in FRENCH previously announced as A79-48852 (For primary document see N80-22247 12-99)

Avail: NTIS HC A05/MF A01

The role of the environment and the mechanisms of hot salt stress corrosion cracking are examined. The specific influence of two metallurgic factors, structure and texture, on the resistance of the TA6V alloy is emphasized. An electrochemical model based

on the production, then electrolysis of titanium chloride to explain stress corrosion cracking is presented. The embrittlement of the alloy by electrochemically produced hydrogen and the resulting cleavages of alpha phase are discussed. J.M.S.

N80-22252# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

NUMERICAL FILTERS FOR ON-LINE PROCESSING OF MEASURING SIGNALS IN A CONTINUOUS WIND TUNNEL **c09**

Jean Appel. *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 55-77 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 263-277 Original report in FRENCH previously announced as A79-48853 (For primary document see N80-22247 12-99)

Avail: NTIS HC A05/MF A01

The design and capabilities of a simple cabled recursive digital filter of low cutoff frequency, used for real time processing of measurement signals in wind tunnels of the ONERA project, are described. This real time operating filter is low pass for wind tunnel applications but can easily be converted to a high pass or rejection filter for other applications. Cutoff or rejection frequencies of the order of 0.001 Hz can be obtained. Also discussed is the connection of this filter to a data acquisition unit for real time filtering of measurement data during a test.

Author (ESA)

N80-22253# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

NOISE GENERATED BY AN EDDY **c34**

Robert C. Legendre. *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 79-84 ref Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 279-282 Original report in FRENCH previously announced as A79-48854 (For primary document see N80-22247 12-99)

Avail: NTIS HC A05/MF A01

A very simple model of vorticity distribution in a turbulent flow is described. This model makes it possible to demonstrate a mechanism of noise generation during the temporal evolution of a viscous eddy. It is shown that the temporal variation of the specific mass determines the intensity of emitted sound, which is also related to the temporal variation of a centrifugal acceleration within a small fluid mass of high vorticity.

Author (ESA)

N80-22254# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

IDENTIFICATION OF VIBRATIONAL BEHAVIOR MODELS OF COMPLEX STRUCTURES **c39**

Henri Berger and Jean-Pierre Chaquin. *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 85-88 Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 283-285 Original report in FRENCH previously announced as A79-48855 (For primary document see N80-22247 12-99)

Avail: NTIS HC A05/MF A01

The difference between theoretical predictions and experimental results concerning structural vibrations are to be attributed to model errors. It is assumed that the structure under consideration is linear and modeled by a finite element scheme, and that only stiffness may be erroneously estimated. A method is proposed which, through previous determination of the regions where the stiffness is erroneously modeled, allows minimizing the errors between the results of theoretical calculation of vibrations by a finite element model and the measurements performed on the real structure during vibration tests.

Author (ESA)

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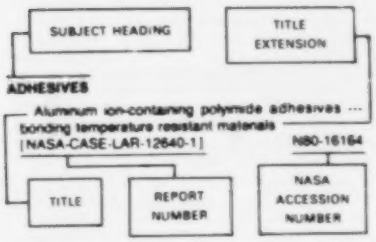

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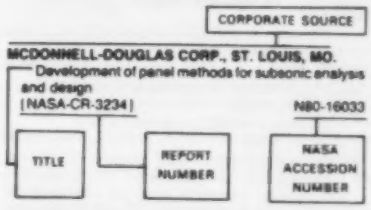

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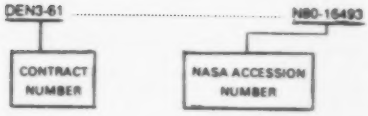

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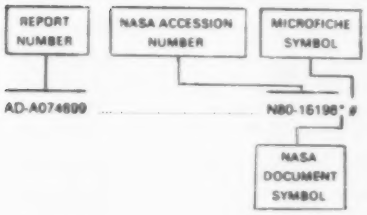

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ITT-79-20-05 ..... N80-22075 #

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JPL-PUB-78-38 ..... N80-21397* #

JPL-9950-299 ..... N80-21834* #
JPL-9950-314 ..... N80-21832* #
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JSC-16321 ..... N80-21980* #
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L-12232 ..... N80-21283* #
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L-13131 ..... N80-21317* #
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L-13316 ..... N80-21279* #
L-13341 ..... N80-21280* #
L-13342 ..... N80-21997* #
L-13343 ..... N80-21702* #
L-13427 ..... N80-21336* #
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LA-TR-79-41 ..... N80-22118 #

LA-UR-79-1112 ..... N80-21460 #
LA-UR-79-2547 ..... N80-21749 #

LA-7741-PR ..... N80-21872 #
LA-7869 ..... N80-21713 #
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LA-8091-PR ..... N80-21770 #

LBL-9516 ..... N80-21479 #
LBL-9608 ..... N80-21850 #
LBL-9779 ..... N80-22113 #
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LC-79-600177 ..... N80-21612 #
LC-79-600178 ..... N80-22117 #
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LEHIGH/FL-440-4 ..... N80-21619 #

LEMSCO-14546 ..... N80-21998* #

LIDS-P-962 ..... N80-22007 #
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LMSC-D683922 ..... N80-21499 #

LMSC-HREC-TR-D697767 ..... N80-21281* #

LSI-TR-334-4 ..... N80-21981* #

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MBB-R3700/2137-R ..... N80-21410 #

MDC-Q0684 ..... N80-21495 #

MEL-79-B-126 ..... N80-21624* #

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MRC-TSR-1997 ..... N80-22027 #
MRC-TSR-1998 ..... N80-22028 #
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MSRR-451 ..... N80-22025 #
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MTR-473 ..... N80-21980* #

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NAC-C-7915 ..... N80-21839 #

NADC-79094-60 ..... N80-21679 #
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NASA-CASE-ARC-11176-2 ..... N80-21464* #

NASA-CASE-FRC-11044-1 ..... N80-21327* #

NASA-CASE-GSC-12273-1 ..... N80-21719*
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NASA-CASE-MFS-23515-1 ..... N80-21828*
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NASA-CP-2046 ..... N80-21263* #
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NASA-CR-3249 ..... N80-21703* #
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NASA-CR-160569 ..... N80-21981* #
NASA-CR-161381 ..... N80-21626* #

NASA-CR-161383 ..... N80-21836* #
NASA-CR-161384 ..... N80-21835* #
NASA-CR-161416 ..... N80-21408* #
NASA-CR-161417 ..... N80-22127* #
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NASA-CR-161419 ..... N80-22063* #
NASA-CR-161425 ..... N80-22149* #
NASA-CR-161427 ..... N80-21281* #
NASA-CR-161432 ..... N80-21953* #
NASA-CR-162625 ..... N80-22009* #
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NASA-SP-7039(16)-SECTION-2 ..... N80-22120*
NASA-SP-7043(24) N80-21829*

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NASA-TM-75757 ..... N80-21755* #
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NLR-MP-78037-U ..... N80-21417 #
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E09	20.50	41.50
E10	22.50	45.50
E11	24.50	49.50
E12	27.50	55.50
E13	30.50	61.50
E14	33.50	67.50
E15	36.50	73.50
E16	39.50	79.50
E17	42.50	85.50
E18	45.50	91.50
E19	50.50	100.50
E20	60.50	121.50
E99 - Write for quote		
N01	28.00	40.00

VOLUME 18 NUMBER 13/JULY 8, 1980

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1659

02 AERODYNAMICS 1659

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1663

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1664

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1665

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1668

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1668

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1672

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1674

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1675

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13 ASTRODYNAMICS 1676

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 1677

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1677

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1678

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING 1678

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE N.A.

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION N.A.
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1679
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 1680
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1680
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1681
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1687
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 1690
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 1693
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1696
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 1697
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 1704
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 1709
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For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 1714
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 1716
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 1719
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 1721
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 1722
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) 1726

43 EARTH RESOURCES 1726
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 1728
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 1742
Includes air, noise, thermal and water pollution, environment monitoring; and contamination control.

46 GEOPHYSICS 1744
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 1747
Includes weather forecasting and modification.

48 OCEANOGRAPHY 1751
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 1751
Includes genetics.

52 AEROSPACE MEDICINE 1753
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 1755
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 1755
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY 1759
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) 1759

60 COMPUTER OPERATIONS AND HARDWARE 1759
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 1762
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 1764
Includes computer networks.

63 CYBERNETICS 1765
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 1765
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 1768
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 1769
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 1770
Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering*.

70 PHYSICS (GENERAL) 1770
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71 ACOUSTICS 1771
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For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 1772
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 1775
Includes elementary and nuclear particles, and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 1776
Includes light phenomena.

75 PLASMA PHYSICS 1778
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 1779
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1783
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) 1783
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1784
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1784
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 1786
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1786
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1786
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1787
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1789
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1789
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1790
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1790
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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TYPICAL CITATION AND ABSTRACT

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NASA ACCESSION NUMBER → N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif ← CORPORATE SOURCE

TITLE → STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

AUTHOR → D. J. Mourey 3 Sep 1979 409 p refs ← PUBLICATION DATE

CONTRACT OR GRANT → (Contract NAS1-15624)

REPORT NUMBER → (NASA-CR-159149) Avail: NTIS HC A18/MF A01 ← AVAILABILITY SOURCE

CSCL 01C ← COSATI CODE

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, ANALYSIS AND DEVELOPMENT OF GUST ALLEVIATION SYSTEMS FOR SMALL TRANSPORT AIRCRAFT
R.S. Shevell, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NAG 2-18)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0002, TRANSONIC AERODYNAMICS
J.D. Cole, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Mechanics & Structures, *405 Hilgard Ave., Los Angeles, California* 90024 (DF055790; F49620-79-C-0162)

AF function - aerospace vehicle design. Opportunity - possibly more economical transonic wing design. Objective - improved analytic techniques for compressible flow problems. How work contributes -numerical parameter optimization is often aided by analytic understanding.

Flow past a finite span wing with Mach number at infinity equal to one has only been addressed to date in a 1953 report from WPAFB by Dr. K.G. Guderley. Guderley's work will be extended to lift and sweepback. A monograph on transonic small disturbance aerodynamics incorporating the many scattered results obtained by Cole and others will be completed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0003, A STUDY OF STREAMWISE VORTICES
R.F. Blackwelder, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (NAG 1-19)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0004, PROGRAM OF RESEARCH IN HELICOPTER AERODYNAMIC THEORY
H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NAG 1-13)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0005, STRUCTURAL OPTIMIZATION WITH DAMAGE TOLERANCE CONSTRAINTS
R.T. Haftka, Illinois Inst. of Technology, School of Engineering & Physical Science, Dept. of Aerospace Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (NAG 1-5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0006, BOUNDARY LAYER STUDIES OF MODEL AND FULL-SCALE VTOL INLETS IN THE DIFFUSION LIMITED FLOW REGION
M.A. Boles, Indiana Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *1600 E. Washington Blvd., Fort Wayne, Indiana* 46803 (NAG 3-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0007, THE INTEGRATED MANUAL AND AUTOMATIC CONTROL OF COMPLEX FLIGHT VEHICLES
D.K. Schmidt, Purdue University, School of Aeronautics & Astronautics, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NAG 4-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

1.0008, DYNAMIC DISTORTION ANALYSIS TECHNOLOGY STUDY
W.G. Schweikhard, University of Kansas, Lawrence Campus, Graduate School, *214 Strong Hall, Lawrence, Kansas* 66044 (NAG 3-11)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0009, INVESTIGATION OF THE EFFECTS ON THE NEAR WALL TURBULENT BOUNDARY LAYER STRUCTURE BY DRAG REDUCING FLAT PLATE SURFACE GEOMETRY CHANGES
J.M. Wallace, University of Maryland, College Park Campus, School of Engineering, Dept. of Mechanical Engineering, *College Park, Maryland* 20742 (NAG 1-24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0010, RESEARCH APPLIED TO TRANSONIC COMPRESSORS IN NUMERICAL FLUID MECHANICS OF INVISCID FLOW AND VISCOUS FLOW
W.T. Thompson, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 3-9)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0011, A SUBSURFACE PANEL METHOD
J.P. Moran, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Aerospace Engineering & Me-

chanics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (NAG 2-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0012, INVESTIGATION OF FLIGHT TEST METHODS FOR THE PERFORMANCE OF GENERAL AVIATION AIRCRAFT

G. Bull, Mississippi State University, School of Engineering, Dept. of Aerophysics & Aerospace Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (NAG 1-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0013, AERODYNAMIC CONTROL IN STALLED FLIGHT

L.W. Gross, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF143540; F33615-79-C-3606)

This effort supports the Air Force function concerned with maneuver effectiveness, safety, and cost-effectiveness of combat aircraft. The problem is that the flying qualities of many modern combat aircraft degenerate to critical levels when the vehicle enters the stalled flight regime. This significantly reduces aircraft tracking capability, impairs maneuverability, and at times can lead to departure from controlled flight. The lack of reliable prediction methods for stall aerodynamics occasionally has resulted in insufficient attention being given to the stall aerodynamics during the design of the aircraft. Consequently, the subsequent discovery of stall/spin deficiencies following service initiation has penalized some operational aircraft by requiring flight restrictions which impair combat effectiveness without necessarily eliminating the occurrences of inadvertent departure. The problem is often rectified or perhaps only alleviated by extensive (and sometimes expensive) cut-and-try experimentation followed, in some cases, by expensive in-service modifications. The program objective is the achievement of reliable analytical prediction methods for the aerodynamic stability and control characteristics of combat aircraft in stalled flight. The methods are to be used for improving combat aircraft predeparture behavior, softening departure, and preventing excursions into developed spins. The military relevancy involves improved aircraft combat effectiveness, increased safety, and lower costs in terms of reduced aircraft losses.

The approach will employ mathematical modeling of the aircraft airflow, with solutions obtained by means of a digital computer. Initial efforts will be concerned with wings alone with subsequent studies treating increasingly more complicated configurations. Comparisons will be made with available experiments and the additional experiments needed will be identified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, AERODYNAMIC-STRUCTURAL STUDY OF CANARD WING, DUAL WING, AND CONVENTIONAL WING SYSTEM FOR GENERAL AVIATION APPLICATIONS

B.P. Selberg, University of Missouri, Rolla Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Rolla, Missouri* 65401 (NAG 1-26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0015, COUPLING OF TRANSPORT AND CHEMICAL PROCESSES IN CATALYTIC COMBUSTION

F.V. Bracco, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Sciences, *Box 430, Princeton, New Jersey* 08540 (NAG 3-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0016, ANALYSIS OF ROTATIONAL, TRANSONIC FLOWS IN TURBOMACHINERY

D.A. Caughey, Cornell University, Ithaca Campus, Sibley School of Aerospace & Mechanical Engineering, *Ithaca, New York* 14850 (NAG 3-19)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0017, INTEGRAL COMPOSITE SKIN AND SPAR DESIGN STUDIES

H.H. Forsch, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF141750; F33615-78-C-3209)

Advanced composite structures are beginning to be used in production military aircraft airframes since they offer a large potential for weight and cost savings. The amount of payoff realized by the use of composites will depend upon the efficiency of the design concepts used. A new concept dealing with integral composite skin and spars has a good potential for increasing the efficiency of composite wing structures. Therefore, the objective of this program is to obtain extensive design information on various integral skin and spar concepts so that these designs may be incorporated into future aircraft.

This effort will develop design data for several integral composite skin and spar concepts. An existing fighter aircraft will be used as a baseline, and new concepts will be developed to meet the specific requirements of this baseline. Activities to be conducted include preliminary design, detailed design and analysis, test specimen construction and extensive environmental testing under several loading conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, EXPERIMENTAL FLIGHT TEST EVALUATION OF J79 B/AL BLADES

R.J. Stabrylla, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF459270; F33657-76-C-0608)

The objective of this effort is to develop and structurally qualify boron/aluminum J-79 first stage blades for engine qualification testing and evaluate their durability response during subsequent experimental flight test exposure in an RF4/J79-15 turbine engine.

The approach consists of seven tasks. The first two tasks are to develop B/Al blades having improved bond quality and reproducibility suitable for structural, engine qualification and flight testing. The succeeding three tasks include design analysis and bench and structural FOD tests requisite for proceeding to engine qualification testing. The sixth task consists of the procurement of flight test replacement blades. The seventh task includes component build-up, engine installation, delivery to WPAFB for endurance testing and evaluation of flight test evaluation blades.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0019, SPLINE COLLOCATION FOR VISCOUS FLOW OVER AFTER-BODY CONFIGURATIONS

S.S. Rubin, University of Cincinnati, Graduate School, *305 Physics Bldg., Cincinnati, Ohio* 45221 (NAG 1-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0020, OPERATION OF A VISITOR, TOUR, AND AN AERONAUTICAL RESEARCH INFORMATION AND COMMUNICATION PROGRAM

K.E. Wiggins, Oklahoma State University, School of Education, Dept. of Curriculum & Instruction, *101 Gunderson Hall, Stillwater, Oklahoma* 74075 (NAS 2-10467)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0021, POLLUTANT FORMATION IN MONODISPERSE FUEL SPRAY COMBUSTION
N.P. Cernansky, Drexel University, School of Engineering, Dept. of Mechanical Engineering & Mechanics, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NAG 3-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0022, FREE-FIELD PROPAGATION OF HIGH INTENSITY NOISE
O.H. Daniel, Pennsylvania State University, University Park Campus, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (NAG 1-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0023, A COORDINATE MAPPING PROCEDURE FOR THE COMPUTATION OF VARIABLE DUCT ACOUSTICS
J.W. White, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAG 3-18)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0024, ANALYTICAL STUDY OF JET SHIELDING
C.H. Gerhold, Texas A & M University, College Station Campus, School of Engineering, Dept. of Mechanical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAG 1-11)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0025, FINITE ELEMENTS AND NAVIER-STOKES PROBLEMS
G.F. Carey, University of Texas, Austin Campus, School of Engineering, Dept. of Civil Engineering, *200 W. 21st, Austin, Texas* 78712 (NAG 2-5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0026, METHODS TO ESTIMATE INLET MOMENTUM EFFECTS OF V/STOL
T.D. Beatty, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN081101; N62269-78-C-0036)

To provide V/STOL manual type design charts for estimates of inlet RAM drag moment arm, and to determine conditions for inlet separation. This contract supports work unit ZA601, Agency Accession No. DN681080.

An inlet momentum effects computational program will be used parametrically to develop generalized RAM drag charts and charts to identify conditions for flow separation.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0027, CONVERSION OF FLIGHT RECORDS
Unknown, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (NAS 1-16005)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0028, SCRAMJET INLET ANALYSIS
S.N. Tiwari, Old Dominion University, School of Engineering, Dept. of Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NAS 1-15930)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0029, EDGE FUNCTION ANALYSIS
P.M. Quinlan, National University of Ireland, University College at Cork, *Cork, Ireland* (DF289830; AFOSR-79-0075)

AF function - structural design/analysis of aerospace vehicles. Deficiency - present inability to mathematically represent large structural sections in an efficient, inexpensive fashion. Present analysis methods are applied primarily to structural details and areas of high stress concentration. How research contributes - it will improve the accuracy and lower the cost of structural analyses for aerospace vehicles.

Professor Quinlan is developing the edge function method for structural analysis methods applicable to aircraft wing structures and star-shaped propellant grains. In addition to his own research, he has access to data from other agencies and institutions on the application of EFM to specific areas such as vibration, thick plate and fracture problems. His recent advances in 3-D stress analysis will be extended to include ellipsoidal shaped cavities in prismoidal bodies. He will also apply the EFM to vibrations in isotropic, orthotropic and geolotropic plates. He will visit USAF installations to conduct seminars and provide consultative guidance to structural design scientists.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, NEXT GENERATION COMMUNICATION SATELLITES - MULTIPLE ACCESS AND NETWORK STUDIES
T.E. Stern, Columbia University, School of Engineering & Applied Science, Dept. of Electrical Engineering & Computer Science, *Broadway & W. 116th St., New York, New York* 10027 (NAS 5-25759)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, SYNTHESIS OF PHOSPHATRIAZINES FOR POTENTIAL HIGH TEMPERATURE FLUIDS AND ELASTOMERS APPLICATION
K.L. Paciorek, Ultrasystems Inc., *2400 Michel Dr., Irvine, California* 92715 (DF054240; F49620-79-C-0037)

AF function - future Air Force flight operations require better environment-resistant materials. Deficiency - a need exists for fluids, lubricants and elastomers with better high temperature stability than presently existing materials. Objective - the objective of this research is to synthesize and characterize new polyfluorinated compounds with high thermal and oxidative stability and corrosion inhibiting properties. How work contributes - the work will determine the usefulness of the newly synthesized materials in high temperature applications.

The proposed research investigation is concerned with extension of previously developed phospha-s-triazine and related chemistry to the syntheses of polymers. The following polymeric systems will be considered: a) high molecular weight polyperfluoroalkylether chains terminated by monophospha and diphospha-s-triazines, b) monophospha-s-triazine rings joined by perfluoroalkyl and/or perfluoroalkylether chains, c) eight-membered rings joined by perfluoroalkylether chains. In addition, the applications of the above techniques to bromine-containing perfluorinated materials to obtain polymers with built-in cross-linking sites is contemplated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, ION IMPLANTATION TO INHIBIT THE CORROSION OF FERROUS METALS

P.J. Wilbur, Colorado State University, School of Engineering, Dept. of Mechanical Engineering, *Fort Collins, Colorado* 80523 (NAG 3-25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0003, FATIGUE OF TITANIUM ALLOYS

A.J. McEvily, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Metallurgy, *Box U-37, Storrs, Connecticut* 06268 (DF053740; F49620-79-C-0004)

AF function - resistance to damage due to fatigue processes is necessary to achieve the desired durability of airframe and engine structures. Opportunity - the AFML-MOU with the French has provided a unique condition to study the fatigue behavior of titanium alloys. Objective - to establish the principal mechanisms of fatigue damage in titanium alloys and the influence of processing variables on this damage. How work contributes - results will directly aid in the development of structural materials for future AF applications.

Two titanium alloys (Ti-5524S and Ti-685) will be experimentally examined under elevated temperature fatigue conditions. Characterizations of fatigue damage will be accomplished according to alloys, processing variables and fatigue environment parameters. Experiments will be conducted at room temperature and 540 degrees C and at 0.3 and 0.04 Hz. Failure surfaces will be examined by microscopy techniques to correlate micro/macro observations. In addition, the effects of overload on the fatigue resistance will be studied in terms of work retardation and the above-mentioned characterization parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0004, EFFECT OF LOAD INTRODUCTION ON GRAPHITE EPOXY COMPRESSION SPECIMENS

R. Reiss, Howard University, School of Engineering, Dept. of Mechanical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAG 1-23)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0005, THEORETICAL STUDIES OF THE DYNAMICS OF MOLECULAR PROCESSES AND THE ELECTRONIC STRUCTURE OF MOLECULES

M. Karplus, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Chemistry, *Cambridge Station, Cambridge, Massachusetts* 02138 (CHE76-17569 A02)

Dr. Karplus plans to continue the research program initiated under NSF Grant, GP-36104X. The research program deals with applications of theoretical methods to chemical problems. Classical and semi-classical techniques will be employed for the study of dynamical processes in isolated molecules and in molecules surrounded by a solvent medium. Initial studies will include cyclopropane isomerization and molecular dynamics studies of peptides in solution. In addition, semi-classical studies of excited state processes will focus on: (1) transitions from the excited to the ground states when symmetry restrictions yield zero dipole matrix elements; (2) photoisomerization and related conformational changes in conjugated systems; and (3) analysis of the resonance Raman spectra of retinal isomers. Ab initio and semi-empirical studies of the electronic structure of molecules will be continued. Many-body theory will be tested with model potentials and the X method will be used to study metal porphyrins.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, CALCIUM INORGANIC ELECTROLYTE BATTERIES

B. Higgins, Eagle Picher Industries Inc., *Joplin, Missouri* 64801 (DF461010; F33615-77-C-2020)

To explore the performance, safety, storage and life cycle cost potential of calcium-thionyl chloride and calcium-sulfuryl chloride batteries as a safer battery than lithium inorganic battery. Applications of interest include power for life support equipment, spacecraft, and missile standby/emergency ground equipment.

The project consists of two phases: (1) Development of cells and establishing basic data on both type batteries against a multitude of load possibilities. Select best potential approach, either thionyl chloride or sulfuryl chloride for follow-on work in second phase. (2) Further investigation mechanisms of selected approach and solution of problems on major deficiencies impeding safety and reliability. Additional investigations toward increased performance and demonstration in full-scale experimental hardware.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0007, THEORETICAL MODELS FOR LOW-DIMENSIONAL EXCHANGE-COUPLED INORGANIC AND ORGANIC CRYSTALS

Z.G. Soos, Princeton University, Graduate School, Dept. of Chemistry, *205 Nassau Hall, Princeton, New Jersey* 08540 (CHE77-27418)

Research previously supported by CHE7607377.

Theoretical research on low-dimensional organic and inorganic crystals will be carried out. In order to understand these important systems, the current theories will be extended to the regime where exchange and thermal energies are comparable, in order to gain more than qualitative information from magnetic resonance experiments. This theory will be tested on a number of compounds which consist of chains (or layers) of transition metal complexes or of stacks of organic radicals. Among the effects to be investigated are the theory of triplet exciton transitions, variable ionicity and related problems in excitation dynamics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, CREEP-FATIGUE INTERACTIONS IN NICKEL-BASED SUPERALLOYS

D.J. Duquette, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Metallurgical Engineering, *110 8th St., Troy, New York* 12181 (NAG 3-22)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0009, ELASTIC ANALYSIS OF A REALISTIC THREE-DIMENSIONAL CRACK CONFIGURATION

G. Sinclair, Carnegie Mellon University, Graduate School, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF054710; AFOSR-79-0078)

AF function - to improve fracture tolerant design capability, damage tolerance assessment methodology and residual life prediction for advanced aerospace vehicle and propulsion systems. Deficiency - present inability to predict fracture and crack growth in the many cases where 3-D effects are important. Objective - to understand the interaction between flaw configuration and distribution, structural member geometry, and applied loads for generic 3-D cases. How work contributes - this research provides an alternative approach and technical redundancy to the continuing Air Force research effort to develop realistic (and experimentally verified) crack growth and fracture analysis capability.

To apply two complementary methods - integral equations and advanced finite elements, in tandem, to the recalcitrant problem of determining the characteristic mechanical (stress, strain, displacement) fields in the vicinity of a 3-D crack in an elastic solid. This work will determine the crack front configuration as part of the problem solution rather than a priori specify this configuration, and will give particular attention to the

surface-crack intersection area. The research team combines the skills of outstanding mechanicians and applied mathematicians.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, QUANTUM THEORY OF ENERGY TRANSFER IN CHEMICAL REACTIONS
R.E. Wyatt, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Chemistry, *200 W. 21st St., Austin, Texas* 78712 (CHE78-08703)

Dr. Wyatt intends to carry out a quantum mechanical study of three-dimensional atom-diatomic molecule collision processes. Accurate and model studies of energy transfer are planned for both electronically adiabatic and electronically nonadiabatic collisions. Extensive close-coupling studies of vibration-rotation energy transfer are planned for the electronically adiabatic F plus H2 reaction. Distorted-wave and Franck Condon overlap models of resonance structure in chemical reactions will be investigated. For electronically nonadiabatic collisions detailed analysis of the structure and symmetry of electronic-rotational energy correlation diagrams will be carried out as a first step. Then, close-coupling studies of electronic nuclear energy transfer in reactive F(2P) plus H2 and nonreactive C ion (2P) plus H2 collisions will be made. Distorted-wave and overlap models will be extended to specific problems in the theory of electronic-nuclear energy transfer. These new results will provide a much more detailed understanding of how energy is transferred in chemical reactions.

This research represents a continuation of that currently supported by Foundation Grant CHE-7600186.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0011, WELD MICROSTRUCTURE, STRESS STATE AND THE EFFECT OF HYDROGEN ON FATIGUE CRACK INITIATION IN X-65 STEEL
M.R. Louthan, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Materials Engineering, *Blacksburg, Virginia* 24061 (NAG 2-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, DETERMINATION OF SEM PARAMETERS OF A THIN CYLINDRICAL SCATTERER PARALLEL TO A LOSSY GROUND USING A REFLECTION COEFFICIENT APPROACH
T.H. Shumpert, Auburn University, School of Engineering, Dept. of Electrical Engineering, *Auburn, Alabama* 36830 (DF054130; AFOSR-79-0017)

AF function - this proposed research falls in the 6.1 research objectives which deal with nuclear weapons effects. In particular, cylindrical models near ground planes are used to simulate aircraft near a ground plane in an emp environment. Deficiency - the interaction of the emp with cylindrical scatterers over lossy grounds needs to be analyzed in sufficient depth to determine how well this system can be used to approximate real systems. Objective - the objective of this research is to analyze an integral equation which was generated to treat the interaction of an emp with finite cylindrical scatterers over lossy ground planes. Contribution - provide useful models of an aircraft near a lossy ground plane in an emp environment.

A reflection coefficient approximation will be used to quantitatively determine the singularity expansion method (SEM) parameters of a finite length thin cylinder parallel to a lossy ground. These parameters (natural frequencies, natural modes and coupling coefficients) will be investigated and tabulated as a function of the orientation of the incident field, the distance from the scatterer axis to the ground, and the ground parameters conductivity and permittivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0002, FLUORESCENT PLASMA TRACER AND PERTURBATION EXPERIMENTS FROM SOUNDING ROCKETS
E.M. Wescott, University of Alaska, Fairbanks Campus, School of Arts & Sciences, Dept. of Geophysics, *Fairbanks, Alaska* 99701 (NAG 6-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0003, TRANSIENT RESPONSE OF ROTOR-BEARING SYSTEMS USING COMPONENT MODE SYNTHESIS
H.D. Nelson, Arizona State University, School of Engineering & Applied Sciences, Dept. of Engineering Science, *Tempe, Arizona* 85281 (NAG 3-6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0004, GEAR LUBRICATION AND COOLING STUDY
L. Akin, California State University & Colleges, California State University, Long Beach Campus, School of Engineering, Dept. of Chemical Engineering, *6101 E. 7th St., Long Beach, California* 90840 (NAG 3-20)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0005, IMPROVED FLOW VISUALIZATION BY USE OF RESONANT REFRACTIVITY
D. Bershader, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DF054530; AFOSR-79-0058)

AF function - aerospace vehicles. Opportunity - Air Force flight operations depend on the science of aerodynamics for the quantitative prediction of performance and loads on vehicle surfaces, both for operational use and especially for rational design. Optical methods viz shadowgraph, schlieren and interferometry are important and long established tools of experimental aerodynamics. There is a need for obtaining highly increased sensitivity in these refractive optical methods. With the use of laser sources, resonant refractivity should provide this needed highly increased sensitivity in refractive optical systems. Objective - to develop a resonant refractive system for air and to demonstrate its use with a simple flow field. How work contributes -this work will investigate the feasibility of using the resonant refractivity of sodium or other vapor to enhance the sensitivity of optical flow measurements by a factor of 100.

Theoretical and experimental graduate study and post-doctoral research are being done to provide a feasibility assessment and design recommendations for using resonant refractivity of sodium or other vapor to provide flow visualization for very weakly refractive flows.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, HEAT TRANSFER AND HYDRODYNAMIC STUDIES ON A CURVED SURFACE WITH FULL-COVERAGE FILM COOLINGS
J.P. Johnston, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (NAG 3-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0007, THE DESIGN METHODOLOGY OF DISTRIBUTED PROCESSING SYSTEMS
C.V. Ramamoorthy, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering & Com-

puter Sciences, *Berkeley, California* 94720 (DF055960; F49620-79-C-0173)

AF function - data processing for avionics. Deficiency - software engineering tools for distributed data processing are inadequate for efficient exploitation of inexpensive hardware. Objective - develop software engineering tools for distributed processing systems. How work contributes - successful completion of this research will establish basis of design theory for distributed computer systems.

The research will develop design methodology to establish a basis for design theory for the development of distributed processing systems. The design methodology will provide guidelines and design laws for the systematic design and construction of distributed processing systems such that the users' requirements are satisfied. The philosophy behind the approach is multi-functional, multi-level modeling of a distributed processing system. The research will develop models and techniques for the formal specification, decomposition, testing and validation of a distributed system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, INVESTIGATIONS RELATIVE TO STATISTICAL PROCEDURES FOR THERMAL VACUUM TEST OPTIMIZATION

R.E. Williams, Fort Lewis College, Undergraduate School, Dept. of Mathematics, *Durango, Colorado* 81301 (NAG 5-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0009, INVESTIGATION OF DISTRIBUTED MICROCOMPUTER METHODS FOR HIGH AUTHORITY AUTO FLIGHT SYSTEMS

W.R. Dunn, University of Southern Colorado, Graduate School, *2200 Bonforte Blvd., Pueblo, Colorado* 81001 (NAG 2-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0010, MICROWAVE CIRCUIT DESIGN

R. Chowdhary, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAS 5-26019)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0011, RESEARCH ON ASPECTS OF THE MASSIVELY PARALLEL PROCESSOR

A.P. Reeves, Purdue University, School of Electrical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (NAG 5-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0012, LASER RANGING AND RADIO INTERFEROMETRIC DATA FOR DETERMINATION OF GEOPHYSICAL PARAMETERS

Unknown, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAS 5-25833)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

4.0013, HYBRID OPERATOR MODELS FOR DIGITALLY IMPLEMENTED CONTROL SYSTEMS

G. Stein, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 1-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0014, APPLICATION OF PULSE CODE MODULATION (PCM) TECHNOLOGY TO AIRCRAFT DYNAMICS DATA ACQUISITION

C.A. Detmer, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF143050; F33615-79-C-3205)

The Air Force function for this effort is to study pulse code modulation (PCM) technology for future data acquisition. PCM offers the advantages of increased data accuracy and reduced test costs. The problem is that processing of data from a PCM data acquisition system could become so massive that the projected advantages would be reduced or eliminated. The goal is to design a data acquisition and analysis system and to identify rationale for the creation of that design. This work will improve the capability of the Flight Dynamics Laboratory to support Air Force systems.

The contractor will provide the design of a data acquisition and analysis system that uses PCM technology and a report of the rationale, considerations and judgments involved in the creation of that design. The contractor will consider using all, part or none of the present equipment. It will compare cost versus capabilities of different configurations. It will weigh advantages of in-the-air preprocessing versus additional time for ground processing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0015, STUDIES OF IMAGE ANALYSIS

W.E. Snyder, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Electrical Engineering, *Raleigh, North Carolina* 27607 (NAG 1-20)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0016, IMPROVED AND EFFICIENT LASER ANEMOMETERS

R.V. Edwards, Case Western Reserve University, School of Engineering, Dept. of Chemical Engineering, *University Cir., Cleveland, Ohio* 44106 (NAG 3-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0017, STUDY AND REVIEW OF PERMANENT MAGNETS FOR ELECTRIC VEHICLE PROPULSION MOTORS

Unknown, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DEN 3-189)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

4.0018, A HIGH TEMPERATURE SILICON-ON-SAPPHIRE PRESSURE SENSOR

S.K. Kahng, University of Oklahoma, Norman Campus, School of Engineering, Dept. of Electrical Engineering, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (NAG 1-14)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0019, ELECTRO-OPTICAL SYSTEM CONTROLLER AND PROCESSOR

D. Casasent, Carnegie Mellon University, School of Engineering, Dept. of Electrical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (NAG 3-5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0020, FORMULATE A MULTI-DIMENSIONAL, UNSTEADY, TURBULENT, COMPRESSIBLE, REACTING FLOW CODE FOR OTTO CYCLE CODES AND ENGINES
W.A. Sirignano, Carnegie Mellon University, School of Engineering, Dept. of Mechanical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (NAG 3-21)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0021, APPLICATION OF VARIABLE STRUCTURE SYSTEM THEORY TO AIRCRAFT FLIGHT CONTROL
A.J. Calise, Drexel University, School of Engineering, Dept. of Mechanical Engineering & Mechanics, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NAG 2-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0022, A NUMERICAL ALGORITHM FOR NONLINEAR FEEDBACK AND NONLINEAR CASCADE COMPENSATION
R.L. Carroll, University of South Carolina, School of Engineering, Dept. of Engineering, *Admin. Bldg., Room 115, Columbia, South Carolina* 29208 (DF054460; AFOSR-79-0001)

AF function - design missile control systems. Deficiency - the performance of an air-to-air missile in a simple-missile-target encounter is degraded with the lack of thrust magnitude control. Objective - the objective of this proposal is to design a novel algorithm which will produce the system control in the form of both a nonlinear state feedback plus a nonlinear cascade compensator. How work contributes - results in this study will aid in the design of thrust controllable missile systems.

An algorithm will be developed which is capable of generating both a nonlinear feedback control and a nonlinear open-loop control. The algorithm will be tested using a nonlinear model for the target-seeking problem. A comparison of the nonlinear controller for the target-seeking model will be made with a controller designed by linear-quadratic means.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, LIGHTNING SENSORS AND DATA INTERPRETATION
T.F. Trost, Texas Tech University, School of Engineering, Dept. of Electrical Engineering, *P.O. Box 4340, Lubbock, Texas* 79409 (NAG 1-28)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0024, SOLID EARTH DYNAMICS USING LASER GEODYNAMICS SATELLITE RANGE OBSERVATIONS
B.D. Tapley, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712 (NAS 5-25991)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0025, RESEARCH IN THE AREA OF PHYSICAL SCIENCES
Unknown, College of William & Mary, Williamsburg College, Graduate School, *Ewell Hall, Williamsburg, Virginia* 23185 (NAS 1-16042)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0026, THE REDUCED ORDER MODEL PROBLEM IN DISTRIBUTED PARAMETER SYSTEMS ADAPTIVE IDENTIFICATION AND CONTROL
C.R. Johnson, Virginia Polytechnic Inst. & State University, Graduate School, *Blacksburg, Virginia* 24061 (NAG 1-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0027, RESEARCH ON FLOW PHENOMENA RELATED TO HIGH POWER LASER
W.H. Christiansen, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF053980; F49620-79-C-0020)

AF function - high energy lasers. Opportunity - improve our understanding of the flow phenomena associated with modern high-power continuous wave gas lasers. Objective - develop new fundamental concepts for the interaction of laser radiation with flow and search out new approaches to improve performance. How work contributes - detailed quantitative understanding of fluid flow-laser radiation interaction will allow design trade-offs which optimize high power gas lasers performance.

A combined analytical and experimental program is being conducted. The proposed work will include the study of the interaction of the aerodynamics and discharge phenomena in flow lasers, the study of fluid optics involving the use of flow as an optical control element, a study concerned with the phenomena involving shear layers in nonequilibrium and reacting gases in a lasing cavity, and a study on pressure recovery systems applicable to lasers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, IN-SERVICE SHAPING OF ABRADABLE SEALS
J. Wolak, University of Washington, School of Engineering, Dept. of Mechanical Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (NAG 3-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0029, VHF-UHF DEEP FADING
A. Bushby, Instituto Geofisico del Peru, *Lima, Peru* (DF245970; AFOSR-76-2885)

AF function - communications, radar. Deficiency - signal fading causes high error rates in communications, loss of signatures in radar identifications. Objective - to determine and predict effects of the equatorial ionosphere on signals transmitted by satellites. How research contributes - predicts and maximizes message reliability. This work continues VHF, UHF and l band observations in Peru. The work will be extended to include observations at Negritos, a site displaced from the geomagnetic equator of scintillation and total electron content. Additional support will be given the AFAL/AFGL flight test program of communications satellite operation in the equatorial zone.

VHF and UHF satellite signals will be observed at three locations in Peru, and l band signals at one location. These will be supplemented by radar observations and will support on-board observations using AFAL and AFGL aircraft of the LES 8/9 satellites in order to establish communications characteristic of the equatorial ionosphere. This work continues to support the AFSATCOM II program and the AFGL/AFAL equatorial flight test programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, DEVELOPMENT OF CAPABILITIES FOR COMPUTER PROCESSING OF REMOTELY SENSED DATA
Unknown, Alabama Agricultural & Mechanical University, Graduate School, *Normal, Alabama* 35762 (NAG 8-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

5.0002, ANALYSIS OF MAGNETIC AND AURORAL DATA FROM THE IMS ALASKA MERIDIAN CHAIN OBSERVATORIES

S.S. Akasofu, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM76-12259)

In a companion grant entitled 'International Magnetospheric Study (IMS) Alaska Meridian and Longitudinal Array of Magnetometers and All-Sky Cameras', the Geophysical Institute of the University of Alaska will install, maintain and operate magnetometers, all-sky cameras and riometers in a chain of 17 observatories.

This grant will support the processing and analysis of a variety of data taken from the Alaskan meridian chain in order to facilitate studies with satellite and other ground-based data. The project will facilitate a cooperative program with the Environmental Data Service (EDS/NOAA), Space Environment Laboratory (SEL/NOAA) and the two Canadian meridian chains by providing processed auroral and magnetic data to the IMS scientific community. As such this grant will permit the goals of IMS to be achieved, i.e., coordinated research on magnetospheric dynamics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0003, S/M AND PERSONNEL FOR THE OPERATION AND MAINTENANCE OF THE POKER FLAT RESEARCH RANGE

N.B. Brown, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (NAS 6-3065)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Wallops Flight Center

5.0004, COMPUTER MODELING OF MOLECULAR SPECTRA FOR AURORAL STUDIES

V. Degen, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM76-80281)

This grant funds a program of auroral studies in which molecular spectra are modeled on a computer for comparisons with observed data. The analytical basis is a set of computer programs for the major N2 and N2 plus molecules. The experimental data are provided by the new Geophysical Institute optical facility located at Poker Flat, Alaska. The system features two fast spectrometers and a photometer, and computer-controlled data handling and display.

The purpose is to examine and quantify excitation processes and source conditions in various types of electron and proton auroras and to provide synthetic spectra for general reference. The proposed work will involve publication of data on hand, update of existing computer decks and coding of new band systems, conversion from IBM 360/40 to a new time-sharing system under Honeywell, and further auroral observations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0005, A THEORETICAL STUDY OF THE SUBSTORM PROCESSES

J.R. Kan, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-11371 A01)

It is generally agreed that the magnetospheric substorm results from an explosive conversion of magnetic energy generated by the interaction between the solar wind and the magnetosphere. The substorm triggering process responsible for the explosive energy conversion is still an open question. It is believed that the substorm triggering process is intimately related to the following fundamental problems in magnetospheric physics: (A) the mechanism for the magnetotail formation, (B) the magnetopause structure and the associated momentum-energy transfer process, and (C) the origin of the auroral current sheet.

This award will support theoretical research into these areas in order to improve our understanding of the magnetospheric substorm.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0006, IONOSPHERIC ACCELERATION MECHANISMS

R.D. Sharp, Lockheed Missiles & Space Co. Inc., Research Laboratory, *1111 Lockheed Way, Sunnyvale, California* 94088 (ATM77-09853 A01)

This grant will support the analysis of selected portions of the data from the energetic ion mass spectrometer experiment on the Air Force satellite 1976-65B. The experiment measures ions in the energy range 0.5 to 16.0 keV and separates the ionic components on the basis of mass per unit charge. The central focus of the investigation will be the understanding of the mechanisms responsible for the energization of ambient ionospheric ions which have been observed flowing upward out of the ionosphere into the magnetosphere with energies in the keV range. One important objective of the research will be the identification of the origin of the trapped particles in the Van Allen radiation belts.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0007, PLASMA-LINE STUDIES WITH THE INCOHERENT-SCATTER RADARS AT ARECIBO

V.B. Wickwar, S R I International, Radio Physics Laboratory, *300 Ravenswood Ave., Menlo Park, California* 94025 (ATM76-21305 A01)

This action funds the first year of a two-year continuing grant for studies of the Earth's ionosphere using the incoherent scatter radar facility at the National Astronomy and Ionosphere Center at Arecibo, Puerto Rico. Research to be done falls into two main parts. The first part centers around the analysis of existing data; the second involves new measurements. Included in the first are studies of plasma lines and photoelectron fluxes at Arecibo, and the analysis of data taken during past ionospheric heating experiments there. The second includes development of new data acquisition software for NAIC, new plasma line observations, and participation in future ionospheric heating experiments.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0008, DESIGN, FABRICATION, ASSEMBLY AND INSTALLATION OF AN INTERNATIONAL SUN-EARTH EXPLORERS-3 DATA BOX

F.S. Mozer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (NAS 5-25958)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

5.0009, MECHANISM OF SYNTHESIS OF AMINO, HYDROLY AND DICARBOXLEC ACIDS IN CARBONACIOUS CHONDRITES

S.L. Miller, University of California, San Diego Campus, Graduate School, Dept. of Chemistry, *P.O. Box 109, La Jolla, California* 92037 (NAGW 20)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space Science

5.0010, INVESTIGATION OF GEOMAGNETIC FIELD FORECASTING AND FLUID DYNAMICS OF THE CORE
Unknown, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NAS 5-25957)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

5.0011, EXPERIMENTAL AND THEORETICAL STUDY OF HETEROMOLECULAR NUCLEATION OF VAPORS OCCURRING IN THE ATMOSPHERE
P.P. Wegener, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (NAG 2-15)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0012, APPLICATION OF REMOTE SENSING TO THE MANAGEMENT OF DELAWARE'S COASTAL RESOURCES
V. Klemas, University of Delaware, School of Arts & Sciences, Dept. of Geography, *Newark, Delaware* 19711 (NAS 5-25934)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0013, LOGISTICS SUPPORT OF THE U.S. PROGRAM IN ANTARCTICA (LC-130 AIRCRAFT SUPPORT FOR THE GREENLAND ICE SHEET PROGRAM)
C.H. Nordhill, U.S. Dept. of Defense, *1776 Massachusetts Ave. N.W., Washington, District of Columbia* 20301 (DPP7610886A12)

LC-130 aircraft operated by Antarctic Development Squadron Six (VXE-6), the Navy squadron assigned to provide aviation support to the U.S. Antarctic Program, are going to be utilized to provide support to the Greenland Ice Sheet Program (GISP). This support will require between 300 and 400 flight hours.

The squadron is funded by NSF but by Congressional direction funds allocated for the U.S. Antarctic Program cannot be used for other projects. Consequently, this award is to provide the necessary funds from the Arctic Research Program for the aviation support provided by VXE-6 for GISP-78.

The Greenland Ice Sheet is the only continental ice sheet in the northern hemisphere. Several thousand years ago similar ice sheets covered nearly 30 percent of the Earth's surface. It is well known that in the past ice sheets have fluctuated in size. It is widely believed that glacial conditions will recur in the near future. The Greenland Ice Sheet Program is designed to determine the geophysical and geochemical characteristics of the major physiographic, environmental, thermal and dynamic zones of the ice sheet to study the factors controlling present and past mass balances, atmospheric processes and the ice sheet's response to climatic change.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0014, INVESTIGATION OF MICROWAVE RADIOMETER DATA IN GLOBAL NUMERICAL WEATHER PREDICTION
T.N. Krishnamurti, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Meteorology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (NAG 5-6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0015, DEVELOPMENT OF A TECHNIQUE TO ASSESS WETLANDS WASTE ASSIMILATION POTENTIAL INCORPORATING LANDSAT TECHNOLOGY
J.L. Cooley, University of Georgia, Inst. of Ecology, *Athens, Georgia* 30601 (NAS13-137)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0016, CONDUCT SHORT COURSES IN REMOTE SENSING
E.A. Martino, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Geography & Meteorology, *112 Bailey Hall, Lawrence, Kansas* 66045 (NAS13-131)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0017, MERIDIAN PHOTOMETER CHAIN
R.H. Eather, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Physics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (ATM77-04286 A01)

This grant funds the fielding, operation, and data analysis of a three-station meridian-scanning photometer chain along the Canadian auroral oval. Scientific objectives of the program include the investigation of subvisual pre-substorm signatures in spectral and spatial characteristics of the aurora, the details of spectral changes during poleward expansion and recovery, the role of protons in the substorm process, the nature of the diffuse aurora, and the integrated conductivity of the auroral region during substorm process. In coordination with satellites such as ISIS-II, TRIAD, and ISEE there is planned an investigation of field-aligned currents, the nature of near-Earth acceleration mechanisms, and their relationship to the latitude-time morphology of precipitation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0018, REEL DOWN/REEL UP TECHNIQUE FOR STRATOSPHERIC AND TROPOSPHERIC OBSERVATIONS
J.G. Anderson, Harvard University, Cambridge Campus, Graduate School, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAS 6-3061)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0019, RESEARCH IN IMAGE FILTERING AND DATA COMPRESSION
A.V. Oppenheim, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0020, STUDY IN PLANETARY AERONOMY
T.E. Cravens, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Oceanic Sciences, *Ann Arbor, Michigan* 48104 (NAGW 15)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0021, ANALYSIS OF THE THERMAL BALANCE OF THE VENUS IONOSPHERE
A.F. Nagy, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Oceanic Sciences, *Ann Arbor, Michigan* 48104 (NAS 5-25939)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0022, STIMULATING OPERATIONAL PRIVATE SECTOR USE OF EARTH OBSERVATION SATELLITE INFORMATION

L.F. Eastwood, Washington University, School of Engineering & Applied Science, Dept. of Electrical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (NASW 3331)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0023, LASER GEODYNAMICS EXPERIMENT STUDY OF POLAR MOTION, PLATE RIGIDITY AND PLATE MOTIONS

W.J. Morgan, Princeton University, School of Natural Sciences, Geological & Geophysical Sciences, *Box 430, Princeton, New Jersey* 08540 (NAS 5-25896)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0024, SET UP A COMPUTER SYSTEM FOR THE SPACECRAFT PLANETARY IMAGING FACILITY AT CORNELL

J.F. Veverka, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Astronomy, *Ithaca, New York* 14850 (NASW 3342)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0025, PLANETARY SUBSURFACE WATER ANALYZER INSTRUMENT DEVELOPMENT (PHASE 4 DEVELOPMENT EFFORT)

D.M. Anderson, State University of New York, Albany Campus, School of Science & Mathematics, Dept. of Geological Sciences, *1400 Washington Ave., Albany, New York* 12222 (NASW 3333)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0026, EXPERIMENTS IN THE FORMATION OF AEROSOLS BY PHOTO-OXIDATION OF SULFUR DIOXIDE

J.P. Friend, Drexel University, School of Science, Dept. of Chemistry, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NAG 2-10)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0027, DOCUMENTATION OF LANDSAT ASSESSMENT OF FOREST LAND COVER IN NORTHERN THAILAND

L. Miller, Texas A & M University, College Station Campus, Texas Engineering Experiment Station, *College Station, Texas* 77843 (NAS 5-25941)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0028, SATELLITE RANGING DATA ANALYSIS LAGEOS GEODYNAMICS EXPERIMENT #2

P.J. Shelus, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NAS 5-25898)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0029, EARTH STRAIN MEASUREMENTS WITH TRANSPORTABLE LASER RANGING SYSTEM - FIELD TECHNIQUES AND PLANNING LASER GEODYNAMICS EXPERIMENT #22

H.J. Dorman, University of Texas, Medical Branch at Galveston, Graduate School, *Galveston, Texas* 77550 (NAS 5-25897)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0030, STRATOSPHERIC PROCESSES

D.A. Tripp, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (ATM77-01869 A03)

Measurements exist of scattered solar ultraviolet flux as a function of various altitudes, solar zenith angles and viewing directions. These data have several important impacts on the current understanding of the stratosphere. We find that the data are extremely sensitive to the overhead atmospheric content of ozone. Application of a careful scattering model of the data could provide an especially accurate method of measuring the O3 overburden providing adequate cross-section information is available.

This action will fund a careful atmospheric dissociation rate calculation allowing for the dissociation rate due to the direct solar flux, due to the reflected light from the earth, due to first order atmospheric scattering, and due to higher order scattering. The goal of this would be to significantly improve measurement of atmospheric ozone contents. It would also enhance understanding of atmospheric science at Weber State University.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0031, RADIATIVE TRANSFER MODELS FOR THE EARTH RADIATION BUDGET STUDIES

S.N. Tiwari, Old Dominion University, School of Engineering, Dept. of Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NAG 1-21)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0032, APPLICATIONS OF LANDSAT IMAGING TO STATE INFORMATION SYSTEMS

R.H. Giles, Virginia Polytechnic Inst. & State University, School of Agricultural & Life Sciences, Dept. of Wildlife & Fisheries Science, *Blacksburg, Virginia* 24061 (NAS 5-25935)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0033, INVESTIGATION OF ANTARCTIC CRUST AND UPPER MANTLE USING MAGSAT AND OTHER GEOPHYSICAL DATA

C.R. Bentley, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Geology & Geophysics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAS 5-25977)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, ADVANCED CONCEPTS IN AIRCREW PERFORMANCE MEASUREMENT

D. Vruels, Canyon Research Group Inc., *32107 Lindero Canyon Rd., Suite 123, Westlake Village, California* 91361 (DF055170; F49620-79-C-0072)

AF function - this research supports Air Force flying training R and D programs. Deficiency - the science of objective aircrew performance measurement is rapidly developing in the Air Force, Army and Navy R and D communities in conjunction

with new training devices, especially operational flight trainers and full mission simulators. At this time this development is roughly in three parallel and separate tracks, one for each service, which do not take advantage of advances made within the community. While some measures will be unique to a specific service's aircraft and mission, other measures will share a commonality between services. At this time, our limited knowledge of performance measurement techniques does not allow rigorous standardization across efforts. Objective - the objective of this research will be to study aircrew performance measurement efforts within the Air Force, Army and Navy R and D communities and to develop a framework for establishing standards of how performance measurements should be made and reported. How research contributes - this research will determine if the three services can have complementary programs in aircrew performance measurement and specify in which areas commonalities can be maximized by establishing standards for measuring and reporting dependent measures in empirical research.

The principal investigator will examine ongoing programs in performance measures development among the three services as well as the current technologies which other R and D communities use to standardize or calibrate their measurements. Several candidate measures will be selected along a range of complexity and procedures for isolating the common elements will be developed. Standards will be attempted for these measures and, if successful, procedures which will permit the work to be expanded to other measures will be developed. This effort will be conducted under the supervision of a tri-service working group of scientists from the training R and D community which will guide the principal investigator in his selection of measures and evaluate the resulting standardization efforts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0002, THE ANNOYANCE OF IMPULSIVE HELICOPTER NOISE

K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NAG 1-17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

6.0003, MOLTEN CARBONATE CO2 CONCENTRATOR

J. Winnick, Georgia Inst. of Technology, School of Chemical Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAG 2-11)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, DETECTION OF MOTION UNDER TARGET UNCERTAINTY AND PERIPHERAL PRESENTATION

R.W. Sekuler, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Psychology, *633 Clark St., Evanston, Illinois* 60201 (DF055300; F49620-79-C-0088)

AF function - among the most critical functions subserved by human vision is the perception of human targets. Prompt and accurate detection of targets is an essential requirement for the effectiveness of critical Air Force missions. Deficiency - two factors prevent extrapolation of laboratory studies to field conditions: (1) there is little or no uncertainty concerning characteristics of targets to be detected, and (2) most studies of motion perception have used targets presented only in the central position of the visual field, while moving target detection depends a great deal upon the periphery of the field. Objective - the research will examine the way in which the visibility of moving targets is affected by prior knowledge of the target's speed and/or locus in the visual field. Motion perception in the periphery of the visual field will be examined, and possible individual differences in motion sensitivity will be explored. How research contributes -research results will have important implications for Air Force modeling and prediction of target acquisition performance under uncertainty conditions and may aid also in the selection of pilot trainees.

During the first year, studies will be undertaken to (1) determine the possibility of reducing the effect of uncertainty by informational prompts, (2) measure the time course of effect of uncertainty-reducing informational prompts, (3) determine the magnitude of uncertainty effects in peripheral and central regions of the visual field, and (4) determine the correlation between susceptibility to Fraser's movement illusion and other visual abilities as an initial step towards individual differences components in motion perception.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0005, MECHANICAL PROPERTIES OF FOUR HUMAN LONGBONES

H.W. Smith, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (DF056220; F49620-79-C-0183)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces which include flail and impact. These forces are of special significance in relation to the incidence of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. Despite design improvements on ejection seats, dislodging of the limbs occurs frequently when the body is ejected into the wind-blast. The resulting 'flail injuries' are the dislocation of major articulating joints and various longbone injuries. Deficiency - a means is required for obtaining mechanical behavior information on four human longbones (humerus, femur, tibia and fibula). A combined effort of engineering and medical investigations is required to complete a biaxial stress analysis of longbone subjected to combined flexure and torsion. Objective - this effort will provide an orderly method for acquiring data on the mechanical properties of human bone subjected to biaxial stress loadings as related to ejection from high speed aircraft. The information will be applied to improve design of ejection seats, seat restraints and limb restrainer methodology. How research contributes -this study will directly support RO 1.7.1 'criteria for limb flail injury prevention.'

Stiffness and strength tests will be conducted to derive combined stress data on human bone using a specially designed apparatus for applying bending and torsion simultaneously. Resulting parametric data will be directly useful in estimating and assessing ejection-related injury. Post-test microscopic examinations of the fracture initiation points and fracture patterns are planned in the proposed work.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0006, HUMAN INTERACTIONS IN AIRCRAFT MISHAPS

K.W. Wegner, Boston College, Chestnut Hill Campus, School of Education, Dept. of Education, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF054930; AFOSR-79-0102)

AF function - this research supports the Air Force flying training program and the Air Force safety program, particularly the work at the Air Force Inspection and Safety Center. Deficiency - very rarely do aircraft accidents occur in the absence of some human interaction, even in single seat aircraft. There is almost always other people who interact with the pilot, either directly or indirectly influencing the events of a mishap. This interaction is poorly specified in accident reports, making it difficult to analyze the sequence of events that lead up to a mishap. Objective - the objective of this research is to study human interaction in USAF aircraft accidents and evaluate different approaches for describing such interactions which will be useful for accident analysis and prevention. How research contributes - the result of this research will be a more thorough understanding of how various individuals interact with a pilot in an accident situation and how this interaction can be described. This information should impact applied research on aircrew training for emergency procedures and the technology of accident analyses.

The principal investigator will examine a sequence-of-events reporting system which would allow for interaction information in capsule form for easy retrieval from computerized accident data files. This reporting system would be based on a taxonomy of human error which would be the input tool for accident information. Research will determine if such a taxonomy

can adequately represent all of the significant human interactions so that they can be reconstructed from a coded data file summary for meaningful analyses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0007, EFFICIENT COMPUTATIONS AND REPRESENTATIONS OF VISIBLE SURFACES

W.A. Richards, Massachusetts Inst. of Technology, School of Humanities & Social Sciences, Dept. of Psychology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF053830; AFOSR-79-0020)

AF function - this research supports the wide variety of AF activities which rely on visual processes as the central components of task completion, with special applications to aircrew simulator visual systems and aircraft display systems. Deficiency - the detection and identification of a surface in the pilot's visual environment is especially critical to a number of tactical flying tasks, particularly those involving low level maneuvers. Just how a surface is perceived, and how this process can lead to a better visual presentation to the pilot in a simulator, is not fully understood. This information is needed for the design of training effective scene content for new generation flight simulators. Objective - the objective of this research is to discover efficient representations of surfaces which can be used for economical scene context modeling in visual simulation. How research contributes - this effort will provide knowledge of the human visual process which can be used in flight simulation, as well as in the design of other types of visual displays such as aircraft cockpit monitors.

This effort will use a new approach recently developed at MIT which views perception as a problem-solving exercise. Potential solutions are reduced to computational algorithms and these algorithms are compared to the performance of the human visual system, which is assumed to be the most parsimonious of all processors. The topics which will be addressed include perspective analysis (surface orientation), texture gradients, orthographic analysis, texture transparency, luminous objections, and motion shear and parallax.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0008, LANDSAT STUDY RELATING SOIL ZINC CONTENT TO DIABETES

I.G. Molnar, Lincoln University, School of Agriculture, Dept. of Agricultural & Natural Resources, *Jefferson City, Missouri* 65101 (NAG13-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

6.0009, PROPOSAL TO PARTICIPATE IN THE TESTING AND EVALUATION OF A TOTAL VIRAL SYSTEM

V.N. Smiley, University of Nevada, System Office, Desert Research Inst., *Reno, Nevada* 89507 (NAG 2-14)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, A PRELIMINARY IN VIVO STUDY OF THE EFFECTS OF ELECTRIC STIMULATION ON BONE INGROWTH TO TEXTURED SURFACES OF ORTHOPEDIC IMPLANTS

C.W. Pawluck, Columbia University, College of Physicians & Surgeons, Dept. of Orthopedic Surgery, *630 W. 168th St., New York, New York* 10032 (NAG 3-15)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

6.0011, THE AMYLOPHAST AS A GRAVITY SENSING DEVICE IN PLANTS

A.C. Leopold, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Botany, *Ithaca, New York* 14850 (NAGW 3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0012, DISSOLUTION TRANSFER CASTING OF BIOPOLYMERS

D.F. Gibbons, Case Western Reserve University, School of Engineering, Dept. of Biomedical Engineering, *University Cir., Cleveland, Ohio* 44106 (NAG 3-12)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

6.0013, COSMOS 1981 EXPERIMENT - CAROTID ARTERIAL FLOW AND PRESSURE MEASUREMENT OF PRIMATES

H.L. Stone, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Physiology & Biophysics, *Box 26901, Oklahoma City, Oklahoma* 73190 (NAS 2-10408)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0014, EFFECTS OF AIRCRAFT NOISE ON HUMAN ACTIVITIES

M.D. Arnoult, Texas Christian University, School of Arts & Sciences, Dept. of Psychology, *2800 S. University Dr., Fort Worth, Texas* 76129 (NAG 1-22)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

6.0015, ETIOLOGY OF DECONDITIONING OF ANTIGRAVITY MUSCLE IN RATS DURING WEIGHTLESSNESS

F.W. Booth, University of Texas, Health Science Center at Houston, School of Medicine, Dept. of Physiology, *Box 20036, Houston, Texas* 77025 (NAS 2-10500)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, STOCHASTIC ANALYSIS OF MULTIPLE-PASS-BAND SPECTRAL CLASSIFICATION SYSTEMS AFFECTED BY OBSERVATION ERRORS

C.P. Tsokos, State University System of Florida, University of South Florida, School of Natural Sciences, Dept. of Mathematics, *4202 Fowler Ave., Tampa, Florida* 33620 (NAG 1-9)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0002, MATHEMATICAL ENHANCEMENT OF DATA FROM SCIENTIFIC MEASURING INSTRUMENTS

J.W. Ioup, Xavier University of Louisiana, School of Arts & Sciences, Dept. of Physics, *7325 Palmetto St., New Orleans, Louisiana* 70125 (NAG 1-16)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0003, A COMPREHENSIVE MODEL TO DETERMINE THE EFFECTS OF TEMPERATURE AND SPECIES FLUCTUATIONS ON REACTION RATES IN TURBULENT REACTING FLOWS

W. Chinitz, Cooper Union College, School of Engineering, Dept. of Mechanical Engineering, *51 Astor Pl., New York, New York* 10003 (NAG 1-18)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0004, SPECTRAL MULTIGRID METHODS FOR THE TWO-DIMENSIONAL COMPRESSIBLE NAVIER-STOKES EQUATIONS WITH NONPERIODIC BOUNDARY CONDITIONS

W.D. Lakin, Old Dominion University, School of Sciences & Health Professions, Dept. of Mathmatical & Computing Sciences, *P.O. Box 6173, Norfolk, Virginia* 23508 (NAG 1-25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, DYNAMICAL BEHAVIOR OF A FLARING LOOP (A TWO-DIMENSIONAL, TIME-DEPENDENT MAGNETOHYDRODYNAMIC FLUX TUBE MODEL)

S.T. Wu, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (NAGW 9)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0002, COLLISION PROCESSES INVOLVING EXCITED ATOMS

F.T. Smith, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (PHY78-09647)

This is a project in atomic and molecular physics in which the interactions of atoms in excited states are studied, continuing grant PHY76-14436 A02.

The collisional interactions of electronically excited and ground state atomic beams are being investigated in two sophisticated molecular beam scattering facilities. In one facility, the energy and angular distributions of scattered neutral and ionic particles will be measured, using both time-of-flight and electrostatic energy analysis. Atom-atom and atom-molecule inelastic processes, including electronic excitation and collisional ion-pair formation, will be studied; coincidence techniques will be used to investigate the important Penning ionization reaction. Another experimental facility will use laser pumping techniques to modify and define the excited state beam composition for metastable rare gas projectiles allowing measurements of collisional excitation transfer rates for a specified excited state. Similar laser techniques will be applied to the excitation of alkali target atoms for investigations of other collisional processes, including excited state-excited state reactions. This program is a new area of atomic collisions concerned with the detailed dynamics of excited state collisions at elevated energies. Since little detailed dynamic information is available for these excited state interactions, many opportunities exist for this work to contribute to the understanding of the basic collisional energy transfer process.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0003, EXPERIMENTS WITH PHASE TRANSITIONS AT VERY HIGH PRESSURE

I.L. Spain, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (NAGW 8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

8.0004, INVESTIGATION OF MICROSCOPIC AND MACROSCOPIC PLASMA PROPERTIES WITH APPLICATION TO SPACE PLASMAS

G.R. Joyce, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (ATM76-82739)

This grant considers the application of numerical methods and analytical approximations to study the microscopic and macroscopic properties of space plasma systems. Specific areas to be studied include the following: the development and characteristics of potential double layers using solutions of the Vlasov equation and numerical simulations; the formation of double layers in the magnetospheres of Earth and Jupiter and associated particle acceleration and radio emissions; the observable effects of 100 kilovolt electrons and ions accelerated by Jupiter's moon Io; the development of turbulent cascades in magnetohydrodynamic plasmas; and the structure of the Jovian magnetosphere including the cold plasma, the current sheet and the energetic particles.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0005, AN ULTRAVIOLET IMAGING DETECTOR FOR SHUTTLE ASTRONOMY

H.W. Moos, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAGW 16)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0006, RELATIVITY, COSMOLOGY, AND RELATIVISTIC ASTROPHYSICS

W.H. Press, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY78-09616)

Theoretical research in gravitational physics currently supported under NSF grant PHY76-14852 A01 will be continued. The Harvard group will carry out a program of research in relativity, cosmology, and relativistic astrophysics. Specific problems which are to be examined include: regularization and renormalization techniques in the quantum theory of gravitation; nonspherical collapse of stars to black holes, and collisions of black holes; dissipative properties of self-gravitating, stellar-dynamic techniques for identifying gravitational radiation in numerical calculations; interaction of gravitational radiation with matter; and other related problems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0007, INVESTIGATION OF SOME CRITICAL PHENOMENA IN THE N-VORTEX SYSTEM WITH APPLICATION TO LARGE-SCALE TURBULENT NOISE SPECTRA

J.E. Young, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 1-12)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0008, HIGH-RESOLUTION SPECTROSCOPY EQUIPMENT

H.H. Stroke, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (PHY76-24470 A01)

This grant will provide for new capital equipment for the high resolution spectroscopy laboratory of New York University. The principal item is a tunable dye laser, which will extend the spectroscopic capabilities in both resolution and sensitivity.

This work is a continuation of that currently supported under NSF grant PHY-7624470.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Physiology Cellular & Molecular Biology

8.0009, THEORY AND DESIGN OF THE TANDEM JUNCTION SOLAR CELL WITH FRONT AND BACK COLLECTION

C.P. Goradia, Cleveland State University, School of Engineering, Dept. of Electrical Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NAG 3-23)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0010, DIAGNOSTIC EXPERIMENTS ON SUPERSONIC JET NOISE

D.K. McLaughlin, Oklahoma State University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Engineering N., Stillwater, Oklahoma* 74074 (NAG 1-10)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0011, MEASUREMENT OF TEMPERATURE AND DENSITY FLUCTUATIONS IN TURBULENCE USING AN ULTRAVIOLET LASER

G.A. Massey, Oregon Graduate Center, Graduate School, Dept. of Electrical Engineering, *19600 N.W. Walker Rd., Beaverton, Oregon* 97005 (NAG 2-9)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0012, HYDRODYNAMICS AND TURBULENCE IN QUANTUM FLUIDS

R.J. Donnelly, Oregon State Higher Education System, University of Oregon, School of Arts & Sciences, Dept. of Physics, *Johnson Hall, Eugene, Oregon* 97403 (NAG 2-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0013, SOME PROBLEMS IN THEORETICAL ATOMIC PHYSICS

R. Shakeshaft, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (PHY77-07406 A01)

Research initiated on NSF grant PHY77-07406 will be continued. Problems in theoretical atomic physics that will be worked on include: 1) the development of the theory accounting for the observed asymmetry in the cusp of the differential cross-section for charge transfer to the continuum; 2) the determination of (a) the convergence properties of expansions in powers of 1/n, where n is the principal quantum number, of radial hydrogenic matrix elements and (b) the n-dependence of the resonance energies of an excited atom in a static electric field; 3) relativistic effects in electron capture by protons from hydrogen atoms at very high velocities; 4) Lamb shift and vacuum fluctuation effects on a particle bound to a conducting wall; and 5) a single expansion of the form factor of an atom, valid over the entire range 0 is less than or equal to K which is less than or equal to infinity where K is the reciprocal wavelength.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

8.0014, MASS FLOW VELOCITY DISTRIBUTIONS IN THE SOLAR CHROMOSPHERE

D.A. Tripp, Utah Higher Education System, Weber State College, Undergraduate School, Dept. of Physics, *3800 Harrison Blvd., Ogden, Utah* 84403 (NAGW 19)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0015, THEORETICAL STUDIES OF CHEMICAL REACTIONS INVOLVING EXCITED ELECTRONIC STATES

J.B. Delos, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (CHE78-01595)

A number of fundamental difficulties have arisen in the theory of electronic excitations in molecular collisions. The conventional form of the theory leads to certain symmetry-violating couplings, unphysically large collision cross-sections for some processes, and inappropriate asymptotic behavior of some matrix elements. Many of these were resolved by Professor Delos' development of a quantum form of 'electron-translation-factors,' which describe the motion of the electrons as they are carried with the nuclei. These seemingly unimportant factors were found to have substantial effects which resolve the above-mentioned difficulties and lead to corrections to many coupling matrix elements. Continued investigations on the effects of these factors are planned, especially seeking numerical tests of the new form of the theory.

Collisions involving electron detachment have in the past been described by a 'complex-potential' model, but the simplest forms of this model are not in agreement with all the experimental data. A more general approach to the theory of these processes is being developed, and will be used to calculate the cross-sections (and corresponding rate constants) for elastic scattering and electron detachment, and the energy and angular distribution of detached electrons.

This research represents a continuation of that currently supported by Foundation grant CHE-7516119.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0016, PERFORMANCE IMPROVEMENT OF LEAD-TIN-SELENIUM (PB,-XSNXSE) SEMICONDUCTOR LASERS THROUGH USE OF FREQUENCY SELECTIVE OPTICAL FEEDBACK

G.E. Copeland, Old Dominion University, School of Sciences & Health Professions, Dept. of Physics & Geophysical Science, *P.O. Box 6173, Norfolk, Virginia* 23508 (NAG 1-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0017, PROPAGATION OF SOUND THROUGH THE EARTH'S ATMOSPHERE

A.J. Zuckerwar, Old Dominion University, School of Sciences & Health Professions, Dept. of Physics & Geophysical Science, *P.O. Box 6173, Norfolk, Virginia* 23508 (NAG 1-15)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0018, RESEARCH RELATED TO THE TECHNOLOGY OF RADIATION MACHINERY AND HIGH POWER GAS LASERS
A. Hertzberg, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (NAG 3-16)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SCIENTIFIC ACTIVITIES OF THE HIGH RESOLUTION ULTRAVIOLET SPECTROMETER AND POLARIMETER FOR THE SOLAR MAXIMUM MISSION
J.M. Beckers, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAS 5-25955)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0002, 15 UM DETECTORS FOR SHUTTLE INFRARED TELESCOPE FACILITY
A. Davidson, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAS 2-10436)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0003, A LABORATORY STUDY OF SILICATE CONDENSATION
K.L. Day, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST78-11306)

Laboratory apparatus for studying aspects of silicate condensation from two different approaches has been constructed. One set of experiments explores the complexities of the nucleation process when silicates nucleate from a mixture of SiO and Mg vapors. The other experiments study surface condensation of silicates as thin films from the vapor state. Both of these approaches are yielding data which are of use to astronomers and cosmochemists interested in primordial condensation.

It is hoped to further quantify the results, obtain optical constants for materials likely to form in space, and expand the experiments to more complex systems which more closely approximate astrophysical conditions.

This research was supported under grant AST 76-21385.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0004, SUBMILLIMETER LINE ASTRONOMY ON THE NASA 91.5CM AIRBORNE TELESCOPE
T.G. Phillips, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 2-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0005, INTERNATIONAL SUN-EARTH EXPLORER DATA REDUCTION
R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (NAS 5-25744)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0006, INTERNATIONAL SUN-EARTH EXPLORERS-A AND -B DATA REDUCTION AND ANALYSIS FOR THE ENERGETIC PARTICLES FLUX EXPERIMENT
K.A. Anderson, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (NAS 5-25980)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0007, INTERNATIONAL SUN-EARTH EXPLORER-A DATA REDUCTION AND ANALYSIS FOR THE QUASI-ELECTRIC FIELDS EXPERIMENT
F.S. Mozer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (NAS 5-25770)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0008, INTERNATIONAL SUN-EARTH EXPLORERS A & B DATA REDUCTION AND ANALYSIS FOR THE MAGNETIC FIELD INVESTIGATION
C.T. Russell, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (NAS 5-25772)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0009, THEORETICAL WORK IN HIGH ENERGY ASTROPHYSICS AND EXTRAGALACTIC ASTRONOMY
J.E. Felten, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (NAGW 12)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0010, SPECTROPHOTOMETRY OF QUASI-STELLAR OBJECTS
J.S. Miller, University of California, Santa Cruz Campus, Lick Observatory, *Mount Hamilton, California* 95140 (AST76-20843)

Though their existence was recognized over 12 years ago, the quasars (short for 'quasi-stellar radio sources', but also called 'quasi-stellar objects' or 'QSOs') remain enigmatic objects. Many astronomers believe they represent very energetic events taking place at great distances, but even their distances are a matter of dispute. The objective of the research is to obtain fundamental quantitative data on the optical spectra of a large sample of quasars. A systematic survey of a fairly large sample of QSOs using the Lick Observatory 120-inch cassegrain image-tube scanner to obtain moderate-resolution spectrophotometry will be carried out. Such parameters as emission-line intensities and profiles, continuum spectral energy distributions, and polarizations will be measured. These data will be used to investigate the physical processes taking place in QSOs and as a basis for comparison with published models for them. Also, evidence for systematic behavior in the optical spectra of QSOs as functions of apparent magnitude, red-shift, radio properties, and degrees of variability will be a major component of the study. The information on the physical conditions in quasars will be analyzed for clues to the relationship they may have to other kinds of objects and to the role they play in the universe in general.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0011, A THREE-DIMENSIONAL OBSERVATIONAL STUDY OF THE SOLAR 5-MINUTE OSCILLATIONS
E.J. Rhodes, University of Southern California, School of Letters Arts & Sciences, Dept. of Astronomy, *3551 University Ave., Los Angeles, California* 90007 (NAGW 13)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0012, STUDY OF X-RAY EMISSION FROM A & A PECULIAR STARS

Unknown, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NAG 8-300)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

10.0013, A PROBE OF THE CORONA WIND BOUNDARY IN THE HR DIAGRAM

Unknown, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NAG 8-316)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

10.0014, OPTICAL & INFRARED STUDIES OF STARS IN REFLECTION NEBULAE

Unknown, Wesleyan University, Graduate School, *Middletown, Connecticut* 06457 (NAG 8-335)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

10.0015, STRUCTURE OF THE LOCAL UNIVERSE AND THE STATISTICAL PROPERTIES OF GALAXIES

R.B. Tully, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (AST76-12159 A01)

The radiation emitted by neutral hydrogen (HI) has been detected from 1000 nearby galaxies, the vast majority of them observed for red-shifts at radio wavelengths for the first time. The combination of these results with approximately 600 red-shifts in the literature will make it possible to map the extragalactic neighborhood out to distances where galaxies are thought to recede at a velocity of 3000 km/s in much greater detail than possible previously. For red-shifts corresponding to 1000 km/s, our sample should be complete for all but extreme systems (e.g., the smallest dwarfs or compacts).

In addition to the red-shift, hydrogen flux (HI mass) and a profile width (elated to total mass) will be measured. Of major importance is a correlation discovered between the profile width and absolute galaxian luminosity which promises to provide a superior method of obtaining distances to galaxies. Consequently, it is potentially possible to locate all of the measured galaxies three-dimensionally in space independently of red-shift.

Major questions that this wealth of data will help resolve are: a) How do galaxies tend to group, on scales from small groups through to the supercluster? b) Are these groups or the supercluster stable or dissipating? c) How much angular momentum do groups or the supercluster contain? d) Is the Hubble expansion isotropic locally and what is the Hubble Constant? e) Is there evidence within groups of non-Doppler red-shifts? f) What is the luminosity function of galaxies based on this 'complete' sample? g) What are the statistics of the morphological properties of galaxies, including peculiarities?

This is a continuation of research done under grant AST 76-12159.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0016, SUBMILLIMETER ASTRONOMY AT THE NASA UNIVERSITY OF HAWAII 3-METER INFRARED TELESCOPE FACILITY

R.H. Hildebrand, University of Chicago, School of Physical Sciences, Dept. of Physics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (NAGW 4)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space Science

10.0017, INTERPLANETARY MONITORING PLATFORM-J DATA REDUCTION AND ANALYSIS

J.A. Simpson, University of Chicago, School of Physical Sciences, Dept. of Physics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (NAS 5-25731)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0018, HARDWARE FOR UNIFIED RADIO AND PLASMA WAVE EXPERIMENT INTERNATIONAL SOLAR POLAR MISSION INVESTIGATION

D.A. Gurnett, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (NAS 5-25999)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0019, INTERPLANETARY MONITORING OF PLATFORM-H & J SPACECRAFT ION AND ELECTRON EXPERIMENT

G. Gloeckler, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAS 5-25735)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0020, INTERPLANETARY MONITORING PLATFORM-J/PLASMA EXPERIMENT - DATA REDUCTION AND ANALYSIS

H.S. Bridge, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAS 5-25790)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0021, EVOLUTION OF NON-THERMAL RADIO SOURCES

W.A. Dent, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Amherst, Massachusetts* 01002 (AST78-04792)

The variable radio source monitoring programs being conducted at 2.7 gHz on the NRAO 300-foot antenna, at 7.8 gHz and 15.5 gHz on the 120-foot Haystack antenna, and at 31.4 gHz and 90.0 gHz on the 36-foot NRAO and 45-foot University of Massachusetts millimeter wave antennas will be continued.

These data will be used to study the long-term evolution of quasi-stellar objects, to investigate physical models of radio source outbursts, to search for correlations with variations at optical frequencies, and to help understand the relationship between radio source outbursts and the observed superluminal changes in source structure obtained from very long baseline interferometry.

This is a continuation of grant AST 76-06808 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0022, GASEOUS HALOES OF GALAXIES

D. York, Princeton University, School of Natural Sciences, Dept. of Astrophysical Sciences, *Box 430, Princeton, New Jersey* 08540 (NAGW 10)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space Science

10.0023, REDUCTION AND ANALYSIS OF STELLAR X-RAY SPECTRAL AND POLARIMETRIC DATA OBTAINED WITH THE COLUMBIA UNIVERSITY ORBITING SOLAR OBSERVATORY 8
R. Novick, Columbia University, Graduate School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (NAGW 18)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0024, OPTICAL MONITORING OF CYGNUS X-1, X PERSEI, AND OTHER X-RAY SOURCES
J.C. Kemp, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (NAGW 7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0025, OPERATION AND MANAGEMENT OF THE LUNAR AND SATELLITE LASER RANGING GROUND STATION EQUIPMENT AT MCDONALD OBSERVATORY, TEXAS
E.C. Silverberg, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NAS 5-25948)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0026, IRREGULAR SATELLITES AND TROJAN ASTEROIDS STUDY
Unknown, Utah Higher Education System, University of Utah, Graduate School, *310 Park Bldg., Salt Lake City, Utah* 84112 (NAGW 11)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

GENERAL

11.0001, SPACEMOBILE OPERATION AND MANAGEMENT OF AEROSPACE EDUCATION SERVICES PROJECT
K.E. Wiggins, Oklahoma State University, School of Education, Dept. of Curriculum & Instruction, *101 Gunderson Hall, Stillwater, Oklahoma* 74075 (NASW 3313)

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01 AERONAUTICS (GENERAL)

N80-22255* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 120
Mar. 1980 93 p
(NASA-SP-7037(120)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography contains abstracts for 297 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1980. A.R.H.

N80-22256* National Aeronautics and Space Administration, Washington, D. C.
A CUMULATIVE INDEX TO AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 118
Jan. 1980 779 p Revised
(NASA-SP-7037(118)) Avail: NTIS HC $10.00 CSCL 01A

Subject, personal author, corporate author, contract, and report number cumulative indexes are provided for documents cited in Aeronautical Engineering: A Continuing Bibliography from February 1979 through January 1980. (NASA SP 7037 supplements 106 through 117). A.R.H.

N80-22257# Sikorsky Aircraft, Stratford, Conn.
ANALYSIS OF HELICOPTER MAINTENANCE FAULT ISOLATION CRITERIA/TECHNIQUES Final Report, Oct. 1977 - Apr. 1979
Thomas N. Cook Oct. 1979 173 p refs
(Contract DAAJ02-77-C-0071; DA Proj. 1L2-62209-AH-76)
(AD-A080596; SER-510022; USARTL-TR-79-21) Avail: NTIS HC A08/MF A01 CSCL 01/3

The problems associated with fault isolation maintenance in Army aviation were investigated. The investigation included a detailed engineering analysis of historical maintenance data on the CH-54 helicopter and surveys of selected Army field activities throughout the United States. The investigation confirmed that fault isolation maintenance is a significant factor in the cost of operating Army helicopters. The most frequent criticism voiced by Army personnel in the field concerns the generally poor quality of troubleshooting data in current aircraft maintenance publications. In response to this problem, an improved approach to the development of fault isolation maintenance data for complex systems was developed. Called FIAT (Fault Isolation Analysis Technique), the proposed approach greatly facilitates the identification of symptom/cause relationships and the collection, processing and organization of data required for the preparation of maintenance manuals. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-22258 Illinois Univ. at Urbana-Champaign.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF TRANSONIC FLOW IN THE THROAT REGION OF ANNULAR AXISYMMETRIC, SUPERSONIC NOZZLES Ph.D. Thesis
Jonathan Craig Dutton 1979 175 p
Avail: Univ. Microfilms Order No. 8009020

A direct means of analyzing the throat flowfields in a variety of two-dimensional nozzle configurations including axisymmetric, annular, and planar nozzles was developed. Flowfield static pressure measurements were obtained for four nozzle configurations including an axisymmetric, Laval nozzle and three annular ones. Half-section cylindrical models were constructed and mounted on a splitter plate whose surface corresponds to a symmetry for the axisymmetric geometries under consideration. Readings from a grid of pressure taps arranged on the splitter plate allowed the determination of the static pressure fields in the nozzle throats. For all four cases tested, it was found that the agreement between the theoretical and experimental results is quite good through a significant region of the throat. Only near the bounding walls in the throat inlet region was there a noticeable discrepancy for some of the cases. Dissert. Abstr.

N80-22259 Catholic Univ. of America, Washington, D. C.
THE INFLUENCE OF YAW ANGLE UPON THE VORTEX WAKES OF STATIONARY AND VIBRATING CYLINDERS Ph.D. Thesis
Steven Eric Ramberg 1978 125 p
Avail: Univ. Microfilms Order No. 7816944

The vortex shedding frequency, the shedding angle, the base pressure, the vortex formation length and the wake width were measured for both stationary and vibrating yawed cylinders in the range of Reynolds numbers Re = 160 to 1100. The influence of end conditions was assessed for free ended cylinders of varying end geometries and for cylinders fitted with adjustable end-plates. It is concluded that the use of the Independence Principle is not valid for separated, yawed cylinder flows except in two special cases. The first case concerns the transverse vibration of the yawed cylinders when the vortex shedding processes are captured in a manner equivalent to the use of the Cosine Laws. The second instance is a result of substantial end effects upon the wakes of finite-length, stationary yawed cylinders. The universal Strouhal number concept for scaling the vortex wakes of bluff bodies at normal incidence was found to be valid for inclined cylinders. Dissert. Abstr.

N80-22260*# National Aeronautics and Space Administration, Washington, D. C.
TRANSONIC WING DFVLR-F4 AS EUROPEAN TEST MODEL

G. Redeker and Norbert Schmidt. Jan. 1980. 12 p. Transl. into ENGLISH from Nachrichten-Tech. Z. (West Germany), Jun. 1979, p 36-39. Original language document announced as A79-41234. Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by DFVLR, Brunswick.
(Contract NASw-3199)
(NASA-TM-75752) Avail: NTIS HC A02/MF A01 CSCL 01A

A transonic wing, the DFVLR-F4 was designed and tested as a model in European transonic wind tunnels and was found to give performance improvements over conventional wings. One reason for the improvement was the reduction of compression shocks in the transonic region as the result of improved wing design. E.D.K.

N80-22261*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VISCOUS-INVISCID CALCULATIONS OF JET ENTRAINMENT EFFECTS ON THE SUBSONIC FLOW OVER NOZZLE AFTERBODIES
Richard G. Wilmoth. Apr. 1980. 79 p. refs.
(NASA-TP-1626; L-13362) Avail: NTIS HC A05/MF A01 CSCL 01A

A viscous-inviscid interaction model was developed to account for jet entrainment effects in the prediction of the subsonic flow over nozzle afterbodies. The model is based on the concept of a weakly interacting shear layer in which the local streamline deflections due to entrainment are accounted for by a displacement-thickness type of correction to the inviscid plume boundary. The entire flow field is solved in an iterative manner to account for the effects on the inviscid external flow of the turbulent boundary layer, turbulent mixing and chemical reactions in the shear layer, and the inviscid jet exhaust flow. The components of the computational model are described, and numerical results are presented to illustrate the interactive effects of entrainment on the overall flow structure. The validity of the model is assessed by comparisons with data obtained form flow-field measurements on cold-air jet exhausts. Numerical results and experimental data are also given to show the entrainment effects on nozzle boattail drag under various jet exhaust and free-stream flow conditions. Author

N80-22262*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF THE FLOW FIELD SURROUNDING CIRCULAR-ARC BOATTAIL NOZZLES AT SUBSONIC SPEEDS
William K. Abeyounis and Lawrence E. Putnam. May 1980. 51 p. refs.
(NASA-TP-1633; L-13318) Avail: NTIS HC A04/MF A01 CSCL 01A

The effects of jet exhaust on the subsonic flow field surrounding boattail nozzles with attached and separated boundary layers were investigated. Measurements of local Mach numbers and flow angles were made at free-stream Mach numbers of 0.60 and 0.80 at an angle of attack of 0 deg. Jet exhaust flow was simulated with a solid cylindrical sting and with high pressure air at jet-nozzle total pressure ratios of 2.9 and 5.0. Results show strong effects of the jet-wave structure on the external flow field. The predicted local Mach numbers and flow angles for attached-flow nozzles with solid jet simulators obtained by using subsonic inviscid/viscous-flow theory are in good agreement with experimental data. Prediction of nozzle surface pressure distributions which include jet-entrainment effects also agree with experimental data for attached-flow nozzles with high pressure air jets. R.E.S.

N80-22263*# National Aeronautics and Space Administration, Washington, D. C.
A FINITE ELEMENT METHOD FOR THE COMPUTATION OF TRANSONIC FLOW PAST AIRFOILS
A. Eberle. Feb. 1980. 61 p. refs. Transl. into ENGLISH of "Eine Methode finiter Elemente zur Berechnung der Transonischen Potential-Stroemung um Profile", Rept. MBB-UFE-1352-0 Messerschmidt-Boelkow G.m.b.H., Munich, 23 Sep. 1977. 63 p. Translation was announced as N79-23935. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-75749; MBB-UFE-1352-0) Avail: NTIS HC A04/MF A01 CSCL 01A

A finite element method for the computation of the transonic flow with shocks past airfoils is presented using the artificial viscosity concept for the local supersonic regime. Generally, the classic element types do not meet the accuracy requirements of advanced numerical aerodynamics requiring special attention to the choice of an appropriate element. A series of computed pressure distributions exhibits the usefulness of the method. E.D.K.

N80-22264*# North Carolina State Univ. at Raleigh. Center for Acoustical Studies.
EXPERIMENTAL STUDY OF AIRFOIL TRAILING EDGE NOISE: INSTRUMENTATION, METHODOLOGY AND INITIAL RESULTS. M.S. Thesis
Mark B. Manley. 1980. 199 p. refs.
(Grant NsG-1377)
(NASA-CR-163007) Avail: NTIS HC A09/MF A01 CSCL 01A

The mechanisms of aerodynamic noise generation at the trailing edge of an airfoil is investigated. Instrumentation was designed, a miniature semiconductor strain-gauge pressure transducer and associated electronic amplifier circuitry were designed and tested and digital signal analysis techniques applied to gain insight into the relationship between the dynamic pressure close to the trailing edge and the sound in the acoustic far-field. Attempts are made to verify some trailing-edge noise generation characteristics as theoretically predicted by several contemporary acousticians. It is found that the noise detected in the far-field is comprised of the sum of many uncorrelated emissions radiating from the vicinity of the trailing edge. These emissions appear to be the result of acoustic energy radiation which has been converted by the trailing-edge noise mechanism from the dynamic fluid energy of independent streamwise 'strips' of the turbulent boundary layer flow. A.R.H.

N80-22265*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL PREDICTION OF NONLINEAR PROPAGATION EFFECTS ON NOISE SIGNATURES GENERATED BY SUBSONIC OR SUPERSONIC PROPELLER OR ROTOR-BLADE TIPS
Raymond L. Barger. May 1980. 18 p. refs.
(NASA-TP-1660; L-13388) Avail: NTIS HC A02/MF A01 CSCL 01A

The nonlinear propagation equations for sound generated by a constant speed blade tip are presented. Propagation from a subsonic tip is treated as well as the various cases that can occur at supersonic speeds. Some computed examples indicate that the nonlinear theory correlates with experimental results better than linear theory for large amplitude waves. For swept tips that generate a wave with large amplitude leading expansion, the nonlinear theory predicts a cancellation effect that results in a significant reduction of both amplitude and impulse. Author

N80-22266*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FULL-SCALE WIND TUNNEL-INVESTIGATION OF THE ADVANCED TECHNOLOGY LIGHT TWIN-ENGINE AIRPLANE (ATLIT)
James L. Hassell, Jr., William A. Newsom, Jr., and Long P. Yip. May 1980. 212 p. refs.
(NASA-TP-1591; L-13135) Avail: NTIS HC A10/MF A01 CSCL 01A

An investigation was conducted to evaluate the aerodynamic performance, stability, and control characteristics of the Advanced Technology Light Twin Engine airplane (ATLIT). Data were measured over an angle of attack range from -4 deg to 20 deg for various angles of sideslip between -5 deg and 15 deg at Reynolds numbers of 0.0000023 and 0.0000035 for various settings of power and flap deflection. Measurements were also made by means of special thrust torque balances to determine the installed propeller characteristics. Part of the investigation was devoted to drag cleanup of the basic airplane and to the evaluation of the effect of winglets on drag and stability. E.D.K.

N80-22267# Northrop Corp., Hawthorne, Calif. Aircraft Group.
TRANSONIC KERNEL FUNCTION METHOD FOR UNSTEADY FLOW CALCULATIONS USING A UNIFIED LINEAR PRESSURE PANEL PROCEDURE Final Report, 1 Mar. 1978 - 30 May 1979
D. D. Liu, W. S. Di, and M. T. Landahl Wright-Patterson AFB, Ohio AFFDL Oct. 1979 107 p refs
(Contract F33615-78-C-3202)
(AD-A080227; NOR-79-52; AFFDL-TR-79-3085) Avail: NTIS HC A06/MF A01 CSCL 20/4

A transonic kernel function method for unsteady flow calculations was developed. A unified linear presssure panel procedure is established to solve for two-dimensional problems in the subsonic, transonic, and supersonic flow regimes; consequently, a TLP2D computer code was developed. Numerical results are presented for pitching or flapping airfoils in these linear and nonlinear flow regimes. The mixed kernel function procedure is applied to a pitching Guderley airfoil in sonic flow. Comparisons with other results and discussions are given. Additional analytical studies include Landahl's general formulation of the phase correction method and the kernel function formulation of the Eckhaus-Landahl shock-jump model. Finally, assessments of and recommendations for the present work are given. GRA

N80-22268# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EVALUATION OF AN IMPROVED PARACHUTE TEST DATA ACQUISITION SYSTEM M.S. Thesis
Gary Alan Richardson Dec. 1979 109 p refs
(AD-A080240; AFIT/GCS/EE/79-13) Avail: NTIS HC A06/MF A01 CSCL 14/3

This project confirms the feasibility of a sixteen channel, self-contained data acquisition system that would be suitable to store data obtained during a parachute performance evaluation drop. The overall system is discussed in modular fashion to allow generalization to other portable data acquisition systems that must accept data at high rates but over relatively short time intervals. The storage medium for the proposed system utilizes magnetic bubble memory devices. GRA

N80-22269# Avco Corp., Wilmington, Mass.
PROJECTILE/SABOT DISCARD AERODYNAMICS Final Report
David Siegelman and Peter Crimi Aberdeen Proving Ground, Md. BRL Dec. 1979 92 p refs
(Contract DAAK11-77-C-0080)
(AD-A080538; AD-E430367; ARBRL-CR-00410) Avail: NTIS HC A05/MF A01 CSCL 19/1

An engineering analysis procedure which describes the sabot discard process for gun-launched projectiles has been modified in order to provide an improved tool for investigating the effects of sabot, projectile and launch parameters upon near field dispersive forces. Experimental test data generated by BRL has been used to formulate an improved engineering model of the interaction flow field which develops about the projectile/sabot petal package during the removal process. The experimental data indicated that individual compression wave intersections and reflections are present within the annular flow passage. In order to model this behavior, an integrated flow element approach utilizing local shock/expansion procedures has been evolved. GRA

N80-22270# Southeastern Center for Electrical Engineering Education, Inc., Orlando, Fla.
STABILITY ANALYSIS OF THE LOWER BRANCH SOLUTIONS OF THE FALKNER-SKAN EQUATIONS Final Technical Report, 17 May - 31 Jul. 1979
G. R. Verma, Will L. Hankey, and S. J. Scherr Wright-Patterson AFB, Ohio AFFDL Jul. 1979 41 p refs
(Contract F49620-79-C-0038; AF Proj. 2307)
(AD-A080743; AFFDL-TR-79-3116) Avail: NTIS HC A03/MF A01 CSCL 20/4

The stability of the Lower-Branch solutions of the Falkner-Skan boundary layers has been analyzed. A perturbation analysis of these boundary layers was performed resulting in the Rayleigh stability equation. Eigenvalue solutions were obtained for the Rayleigh equation for different adverse pressure gradient values. Propagation velocity and amplification factors were computed over the entire range of unstable wave numbers. All retarded flows were found to unstable for a small range of frequencies, with the amplification factor increasing as the extent of reversed flow increased. GRA

N80-22271# Sandia Labs., Albuquerque, N. Mex.
COMPARISON OF FIRST AND SECOND ORDER TECHNIQUES FOR COMPUTING OPTIMAL HORIZONTAL GLIDING TRAJECTORIES
Walton E. Williamson, Jr. 1980 17 p refs Presented at 18th AIAA Aerospace Sci. Meeting, Pasadena, Calif., 14 Jan. 1980
(Contract EY-76-C-04-0789)
(SAND-79-1347; CONF-800104-2) Avail: NTIS HC A02/MF A01

The problem of numerically computing maximum endurance subsonic gliding trajectories which remain in a horizontal plane and return to the original starting point is considered. The control is parameterized and numerical solutions for two different types of parameterization are shown. Piecewise continuous polynomial control approximations are shown to produce consistent results for the trajectories which should be very good approximations for the true optimal solution. DOE

N80-22272# European Space Agency, Paris (France).
CALCULATION OF THE INTERFERENCE EFFECTS BETWEEN THE ENGINE WING AND THE BASE WING OF A CIVIL AND MILITARY TRANSPORT AIRCRAFT BY THE VORTEX LATTICE METHOD
W. Schroeder Dec. 1978 101 p refs Transl. into ENGLISH of "Berechnung der Interferenzwirkung Zwischen Triebwerks- und Basisfluegel am Zivil-Militaerischen Transporter nach dem Wirbelleiterverfahren", Rept. DLR-IB-151-77/19 DFVLR and VFW-Fokker G.m.b.H., Bremen, Dec. 1977 Original report in GERMAN previously announced as X79-71705
(ESA-TT-493; DLR-IB-151-77/19) Avail: NTIS HC A06/MF A01

For incompressible symmetric flow, calculations of the interference between engine and basis wing of the VFW-Fokker 614 civil-military transport aircraft model were performed. The following parameters were used: angle of attack 0, 3, and 5 deg for three different engine wings each with -10%, 10%, 30% or 50% overlap between engine and basic wing. The results of the linear and nonlinear calculations are discussed. Author (ESA)

N80-22273# European Space Agency, Paris (France).
CALCULATION OF THE TURBULENT BOUNDARY LAYER ON AN INFINITE SWEPT WING USING A THREE-DIMENSIONAL MIXING LENGTH MODEL
Gert Reinhard Schneider Jul. 1979 70 p refs Transl. into ENGLISH of "Die Berechnung der Turbulenten Grenzschicht am Schiebenden Fluegel Unendlicher Spannweite Mittels eines Dreidimensionalen Mischungswegmodells", Rept. DLR-FB-77-73 DFVLR, Goettingen, West Germany, May 1978 Original report in GERMAN previously announced as X79-72041
(ESA-TT-534; DLR-FB-77-73) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 28.60

Experimental observations of three-dimensional turbulent boundary layers show that the direction of the shear stress is in general not parallel to the direction of the mean velocity gradient. Following this observation for the Reynolds shear stresses, a generalized mixing length model is developed based on a non-isotropically distributed eddy viscosity. The isotropic mixing length model currently used for three-dimensional flows is included as a special case. Calculations are carried out for the infinite swept wing situation of the VAN DEN BERG, ELSENAR and BOELSMA experiment. The comparisons show an improvement of the prediction over the isotropic calculations. Author (ESA)

N80-22274# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ACTIVITIES IN AEROSPACE RESEARCH Annual Report, 1978
1979 208 p refs Original contains color illustrations
Avail: NTIS HC A10/MF A01

Aerodynamics, wind tunnel testing, structures, propulsion, physics, and materials science are among the topics discussed.

Applications of aerospace research in industry are covered. Patents and publications issued during the year are listed. Author (ESA)

N80-22275# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SUPERCRITICAL WING DESIGN STUDIES FOR TRANSPORT AIRCRAFT. VOLUME 1: WING DESIGN AND WIND TUNNEL MEASUREMENTS Final Report
Guenter Binder, Hartmut Buers, and Hans-Joerg Proksch Bonn Bundesmin. fuer Forsch. u. Technol. Jul. 1979 94 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 2 Vol.
(BMFT-FB-W-79-06-Vol-1) Avail: NTIS HC A05/MF A01

The design work and wind tunnel measurements for a supercritical wing for a transport aircraft to supplement the airbus A 300 are described. Author (ESA)

N80-22276# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Theoretical Aerodynamics.
SUPERCRITICAL WING DESIGN STUDIES FOR TRANSPORT AIRCRAFT. VOLUME 2: THEORETICAL STUDIES Final Report
Willy Fritz, Stefan Leicher, Wolfgang Schmidt, and Hans-Werner Stock Bonn Bundesmin. fuer Forsch. u. Technol. Jul. 1979 148 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 2 Vol.
(BMFT-FB-W-79-07-Vol-2) Avail: NTIS HC A07/MF A01

The improvement of currently existing computer methods for the design of supersonic transport aircraft was studied. This was achieved by modifying both equation and boundary conditions. Wind tunnel wall effects were included as was viscous drag. The detailed comparisons document the present status of the different methods. Author (ESA)

N80-22277# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
FLUTTER INSTABILITIES IN AN ANNULAR CASCADE WITH SUPERSONIC RELATIVE FLOW
Pierre Salauen 1979 32 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-610)
(ONERA-NT-1979-3; ISSN-0078-379) Avail: NTIS HC A03/MF A01

A linearized three dimensional theory of the flow around a circular cascade of helical blades placed between two concentric cylinders was investigated. The relative flow was supersonic over the whole blade length, but the axial flow was subsonic. The influence of stagger angle, frequency, Mach number and number of blades on the stability of the first bending mode and the first torsion mode was studied. The first bending mode was always stable; the first torsion mode was usually unstable, but flutter was suppressed by reducing the number of blades, at least in the example considered. Author (ESA)

N80-22278# Engineering Sciences Data Unit, London (England).
A COMPARISON OF VARIOUS NUMERICAL METHODS FOR CALCULATING SUPERCRITICAL INVISCID ISENTROPIC FLOW OVER TWO-DIMENSIONAL AEROFOILS
R. H. Blockley Orpington, England Defense Res. Inform. Centre 1979 150 p refs
(Contract K/A72c/259/CB/A72c)
(S/T-Memo-4/75; BR47382) Avail: NTIS HC A07/MF A01

Numerical solutions of full potential flow equations are mutually compared with particular reference to the method of Garabedian and Korn. Comparisons of pressure distributions and aerodynamic force and moment coefficients for a small range of airfoils at Mach numbers for near-critical or supercritical flow are presented. Procedures for using the Garabedian and Korn program are recommended. An approximate method (transonic small perturbation method based on Krupp and Murman) is similarly compared with that of Garabedian and Korn. The airfoils studied are described. Author (ESA)

N80-22279# Royal Aircraft Establishment, Farnborough (England).
THREE-DIMENSIONAL VISCOUS AND INVISCID SEPARATION OF A VORTEX SHEET FROM A SMOOTH NON-SLENDER BODY
F. T. Smith (Imperial Coll. of Science and Technology) London HMSO Aug. 1978 40 p refs
(RAE-TM-Aero-3436; RAE-TR-78095; BR65538) Avail: NTIS HC A03/MF A01

The local behavior of a vortex sheet near its (smoothly curved) line of separation from a smooth surface is examined from both the inviscid and viscous aspects, as well as for the general three-dimensional case. The inviscid behavior is first found for a special case, followed by the general inviscid case. The main inviscid requirement is that locally the normal distance of the vortex sheet from the surface must be proportional to the nth power of its normal distance from the separation line, where n can take the values 3/2, 5/2, 7/2, etc. The viscous (triple deck) account the three dimensional incompressible separation then singles out the value n = 3/2 as being the only consistent value, but with the coefficient of proportionality above being dependent on the Reynolds number. An appendix considers further local flow properties beneath the vortex sheet are considered, raising the possibility of a second viscous separation near the main separation line. Author (ESA)

N80-22280# Royal Aircraft Establishment, Farnborough (England).
A COMMENT ON THE ORIGIN OF ENDWALL INTERFERENCE IN WIND TUNNEL TESTS OF AEROFOILS
K. G. Winter and J. H. B. Smith London HMSO 20 Aug. 1979 20 p refs
(RAE-TM-Aero-1816; BR70172) Avail: NTIS HC A02/MF A01

The interference effects of an airfoil spanning the working section of a wind tunnel due to the presence of boundary layers on the walls are discussed. Tests reveal behavior different from that predicted by theory. A qualitative assessment of the problem is made and it is suggested that the interference be explained in terms of changes in the displacement thickness of the boundary layers on the tunnel walls rather than in terms of induced effects from trailing vorticity. Author (ESA)

N80-22281# Royal Aircraft Establishment, Farnborough (England).
AERODYNAMIC CHARACTERISTICS OF MOVING TRAILING-EDGE CONTROLS AT SUBSONIC AND TRANSONIC SPEEDS
D. G. Mabey, D. M. McOwat, and B. L. Welsh London HMSO 25 Jun. 1979 27 p refs Presented at AGARD Fluid Dyn. Panel Meeting on the Aerodyn. Characteristics of Controls, May 1979
(RAE-TM-Struc-947; BR69932) Avail: NTIS HC A03/MF A01

Oscillatory pressures calculated and measured at high subsonic speeds for a swept back wing of aspect ratio 6 with a part span trailing-edge flap are compared. The flap was driven at frequencies of 1 Hz (quasi-steady) and 90 Hz at Mach numbers from 0.40 to 0.95 with both fixed and free transition over a range of Reynolds numbers from one to four million. The measured oscillatory pressures which depend strongly on the boundary layer displacement thickness at the hinge line, are presented. Tests with the flaps driven simultaneously at two frequencies (90 Hz and 131 Hz) at subsonic and transonic speeds are discussed. Author (ESA)

N80-22282# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
MEASUREMENT OF LOCAL SKIN FRICTION AND STATIC PRESSURE ON A SWEPT WING IN FLIGHT Final Report
A. Bertelrud Jul. 1979 77 p refs Prepared in cooperation with Swedish Air Force, Stockholm
(Contracts FMV-F-K-82223-76-001-21-001;
FMV-F-K-82223-77-001-21-001;
FMV-F-K-82223-77-116-21-001;
FMV-F-K-82223-78-003-21-001)
(FFA-AU-1370) Avail: NTIS HC A05/MF A01

A series of flight tests have been performed to explore the possibility of using multiple total head/static probes (modified Preston tubes) for the measurement of local skin friction and static pressure distribution in flight. The aircraft used in the experiment was a SAAB 32 A Lansen, which is a swept wing attack fighter. It is shown that the results obtained are reproducible and agree reasonably well with computations. Thin films

(McCroskey gauges) mounted on the leading edge showed no deviations in resistance after 19 flights. This indicates that the gauges can be used for qualitative, and probably also quantitative measurements in flight. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-22283*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RESOURCE MANAGEMENT ON THE FLIGHT DECK
George E. Cooper, ed., Maurice D. White, ed. (Cooper (George E.), Saratoga, Calif.), and John K. Lauber, ed. Mar. 1980 247 p ref Proceedings of a NASA/Industry Workshop, San Francisco, 26-28 Jun. 1979
(NASA-CP-2120) Avail: NTIS HC A11/MF A01 CSCL 05J

Several approaches to the training and selection of aircrew are presented including both industry and nonindustry perspectives. Human factor aspects of the problem are also examined with specific emphasis on the psychology of the flight deck situation. For individual titles, see N80-22284 through N80-22292.

N80-22284*# Texas Univ. at Austin.
SOCIAL PSYCHOLOGY ON THE FLIGHT DECK
Robert L. Helmreich *In* NASA. Ames Res. Center Resource Management on the Flight Deck Mar. 1980 p 17-30 (For primary document see N80-22283 13-03)
Avail: NTIS HC A11/MF A01 CSCL 05J

Social psychological and personality factors that can influence resource management on the flight deck are discussed. It is argued that personality and situational factors intersect to determine crew responses and that assessment of performance under full crew and mission conditions can provide the most valuable information about relevant factors. The possibility of training procedures to improve performance on these dimensions is discussed. Author

N80-22285*# Harvard Univ., Cambridge, Mass. Graduate School of Education.
AVIATION ACCIDENTS AND THE THEORY OF THE SITUATION
Lee Bolman *In* NASA. Ames Res. Center Resource Management on the Flight Deck Mar. 1980 p 31-58 refs (For primary document see N80-22283 13-03)
Avail: NTIS HC A11/MF A01 CSCL 05J

Social-psychological factors effecting the performance of flight crews are examined. In particular, a crew member's perceptual-psychological constructs of the flight situation (theories of the situation) are discussed. The skills and willingness of a flight crew to be alert to possible errors in the theory become critical to their effectiveness and their ability to ensure a safe flight. Several major factors that determine the likelihood that a faulty theory will be detected and revised are identified. M.G.

N80-22286*# United Air Lines, Inc., Denver, Colo.
FLIGHT SELECTION AT UNITED AIRLINES
William Traub *In* NASA. Ames Res. Center Resource Management on the Flight Deck Mar. 1980 p 61-75 (For primary document see N80-22283 13-03)
Avail: NTIS HC A11/MF A01 CSCL 05I

Airline pilot selection proceedures are discussed including psychogical and personality tests, psychomotor performance requirements, and flight skills evaluation. Necessary attitude and personality traits are described and an outline of computer selection, testing, and training techniques is given. M.G.

N80-22287*# British Airways, Middlesex (England).
BRITISH AIRWAYS' PRE-COMMAND TRAINING PROGRAM
L. F. J. Holdstock *In* NASA. Ames Res. Center Resource Management on the Flight Deck Mar. 1980 p 76-86 (For primary document see N80-22283 13-03)
Avail: NTIS HC A11/MF A01 CSCL 05I

Classroom, flight simulator, and in-flight sessions of an airline pilot training program are briefly described. Factors discussed include initial command potential assessment, precommand airline management studies course, precommand course, and command course. M.G.

N80-22288*# American Airlines, Inc., Ft. Worth, Tex.
UPGRADE AND INTERPERSONAL SKILLS TRAINING AT AMERICAN AIRLINES
W. W. Estridge and J. L. Mansfield *In* NASA. Ames Res. Center Resource Management on the Flight Deck Mar. 1980 p 87-96 (For primary document see N80-22283 13-03)
Avail: NTIS HC A11/MF A01 CSCL 05I

Segments of the interpersonal skills training audio visual program are presented. The program was developed to train customer contact personnel with specific emphasis on transactional analysis in customer treatment. Concepts of transactional analysis are summarized in terms of the make up of the personality, identified as the three ego states. These ego states are identified as the parent, the adult, and the child. Synopses of four of the tape programs are given. R.C.T.

N80-22289*# Swissair, Zurich (Switzerland).
CAPTAINS' TRAINING AT SWISSAIR
N. Grob *In* NASA. Ames Res. Center Resource Management on the Flight Deck Mar. 1980 p 97-106 (For primary document see N80-22283 13-03)
Avail: NTIS HC A11/MF A01 CSCL 05I

The objectives, crucial points, and problems of the individual phase of the captain's basic training are examined. The prerequisites to pilot selection are given as well as a generalized outline of pilot career progression. R.C.T.

N80-22290*# Eastern Air Lines, Inc., Miami, Fla.
LINE-ORIENTED FLIGHT TRAINING
Berton E. Beach *In* NASA. Ames Res. Center Resource Management on the Flight Deck Mar. 1980 p 107-118 (For primary document see N80-22283 13-03)
Avail: NTIS HC A11/MF A01 CSCL 05I

Some of the concepts related to a line-oriented flight training program are discussed. The need to shift from training in manipulative skills to something closer to management skills is emphasized. The program is evaluated in terms of its realistic approaches which include the simulator's optimized motion and visual capabilities. The value of standard operating procedures as they affect the line pilot in everyday operations are also illustrated. R.C.T.

N80-22291*# United Air Lines, Inc., Denver, Colo.
FLIGHT MANAGER AND CHECK-AIRMAN TRAINING
J. E. Carroll *In* NASA. Ames Res. Center Resource Management on the Flight Deck Mar. 1980 p 119-132 (For primary document see N80-22283 13-03)
Avail: NTIS HC A11/MF A01 CSCL 05I

An analysis of industry incidents, accidents, and related human factors research is given. The need to develop more effective resource management training for the flight deck crewmembers is discussed with specific emphasis on flight manager and check-airman training. R.C.T.

N80-22292*# North Central Airlines, Inc., Minneapolis, Minn.
LEFT SEAT COMMAND OR LEADERSHIP FLIGHT, LEADERSHIP TRAINING AND RESEARCH AT NORTH CENTRAL AIRLINES
Gramer C. Foster and Michael C. Garvey (Garvey (M. C.) and Associates, Inc.) *In* NASA. Ames Res. Center Resource Management on the Flight Deck Mar. 1980 p 133-146 refs (For primary document see N80-22283 13-03)
Avail: NTIS HC A11/MF A01 CSCL 05J

The need for flight leadership training for flight-deck crewmembers is addressed. A management grid is also described which provides a quantitative management language against which any number of management behaviors can be measured. R.C.T.

N80-22293# Army Safety Center, Fort Rucker, Ala.
PROJECTED ACCIDENT COSTS FOR THE ADVANCED SCOUT HELICOPTER
James E. Jenks, Jr. and James E. Hicks. Oct. 1979. 24 p. refs.
(AD-A080109; USASC-TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 01/2

This is the report of an analysis of the economic benefits of providing crashworthiness and other safety-related design improvements within future Army scout helicopters. The analysis was performed for use by the Advanced Scout Helicopter Project Manager (PM-ASH). The analysis baseline was all OH-58A major and minor aircraft accidents from January 1972 through December 1978. Projections are made for 11 candidate aircraft designs which may have potential use in the scout helicopter role as defined by PM-ASH. Accident rates and losses are derived for each candidate aircraft. Losses are projected for a 20-year period of peacetime operation. Projections are derived based on each candidate's design features and the effectiveness of these features under the particular conditions in each OH-58A accident. Recommendations are made regarding use of this data in an ASH development program. GRA

N80-22294# Army Safety Center, Fort Rucker, Ala.
SURVEY OF FORCED AND PRECAUTIONARY LANDING COSTS
Emil Spezia, G. D. Kimel, and Thomas Neese. Jul. 1979. 24 p.
(AD-A080110; USASC-TR-79-4) Avail: NTIS HC A02/MF A01 CSCL 01/2

A questionnaire survey was conducted to learn the costs of forced landings (F/Ls) and precautionary landings (P/Ls). The questionnaire elicited cost data in respect to (1) the effect each mishap had on the mission assigned the mishap aircraft; (2) man-hours lost by the crew and passengers; (3) man-hours required to recover the crew, passengers, and aircraft; (4) time the mishap aircraft was unavailable for flight; (5) man-hours required to make the aircraft flyable; and (6) the components that malfunctioned to cause these mishaps. The broad and obscure costs revealed by the survey are sufficient to justify the initiation of a concerted effort to prevent the causes of these mishaps. Prevention of the causes of these mishaps will allow aviation units to operate more efficiently, i.e., allow them to maintain a higher state of combat readiness. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-22295 Dayton Univ., Ohio.
OPTIMAL ESTIMATION APPLIED TO REDUNDANT STRAPPED DOWN INERTIAL SENSORS FOR NAVIGATION AND FLIGHT CONTROL Ph.D. Thesis
Jackie Wayne Bell. 1979. 213 p.
Avail: Univ. Microfilms Order No. 8008430

The capability of various algorithms for improved estimation of the sensor true outputs from a strapped down inertial reference assembly is examined. A secondary factor is the optimum combination of the estimated outputs from a set of redundant inertial sensors to form an orthogonal triad inertial reference. The algorithms are based upon various levels of sensor modeling in Kalman or fixed-gain optimal filters. The algorithms range from a second-order to a fourth-order filter for each sensor. The redundant sensor estimated outputs are combined through a weighted least squares estimator which provides a statistical average of the estimated sensor outputs transformed into body coordinates. Dissert. Abstr.

N80-22296*# Texas Univ. at Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
A STUDY OF AUTONOMOUS SATELLITE NAVIGATION METHODS USING THE GLOBAL POSITIONING SATELLITE SYSTEM Final Report
Byron D. Tapley. 20 Apr. 1980. 55 p. refs.
(Grant NsG-5154)
(NASA-CR-162635) Avail: NTIS HC A04/MF A01 CSCL 17G

Special orbit determination algorithms were developed to accomodate the size and speed limitations of on-board computer systems of the NAVSTAR Global Positioning System. The algorithms use square root sequential filtering methods. A new method for the time update of the square root covariance matrix was also developed. In addition, the time update method was compared with another square root convariance propagation method to determine relative performance characteristics. Comparisions were based on the results of computer simulations of the LANDSAT-D satellite processing pseudo range and pseudo range-rate measurements from the phase one GPS. A summary of the comparison results is presented. R.E.S.

N80-22297*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
A NEW ALGORITHM FOR HORIZONTAL CAPTURE TRAJECTORIES
John D. McLean. Mar. 1980. 21 p. refs.
(NASA-TM-81186; A-8111) Avail: NTIS HC A02/MF A01 CSCL 17G

An algorithm which transfers an aircraft from an initial position and heading to a final position and heading was developed for onboard synthesis of horizontal flight paths. The algorithm finds all solutions possible, and selects the one with minimum path length. Degenerate conditions in which one or more of the basic segments is missing are handled without difficulty. The solution to this problem is derived, and a FORTRAN listing of the algorithm is provided. E.D.K.

N80-22298# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
THE STOCHASTIC ANALYSIS OF DYNAMIC SYSTEMS MOVING THROUGH RANDOM FIELDS Interim Report
A. S. Willsky and N. R. Sandell. Nov. 1979. 49 p. refs. Prepared in cooperation with Analytic Sciences Corp., Reading, Mass.
(Contract N00014-76-C-0346; Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A080204; LIDS-R-958; AFOSR-80-0018TR) Avail: NTIS HC A03/MF A01 CSCL 17/7

This paper considers dynamic systems that move along specified trajectories across random fields, where the field acts as a driving force to the dynamic system. For a specific class of random fields equations were developed for the evolution of the covariance of the state of the dynamic system, and in the special case in which the trajectory is a straight line path followed by a 180 1/4 turn (i.e., an 'over and back' trajectory) a Markovian model that involves a change in the dimension of the state after the turn were developed. For this case this report also discusses the estimation problem using recently developed results on 'real-time smoothing'. GRA

N80-22299# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
GRAVITY MODEL EVALUATION FOR PRECISE TERRESTRIAL INERTIAL NAVIGATION. A SYSTEM ACCURACY APPROACH Ph.D. Thesis
Robert Miles Edwards. Dec. 1979. 280 p. refs.
(AD-A080170; AFIT/DS/EE/79-1) Avail: NTIS HC A13/MF A01 CSCL 17/7

Inertial navigation has evolved to the point that the traditional gravity model is a principle error source in precise systems. Since future systems may require a more accurate gravity model, a statistical performance evaluation is needed to compare candidate models on realistic scenarios. The present methods of model evaluation are Monte Carlo, which is computationally costly, and linear state space covariance analysis, which has troublesome trajectory and statistical model restrictions. This research developed a new statistical analysis technique based on a double integral expression of the navigation system error covariance. Numerical algorithms were formulated to approximate the covariance, and the accuracy and efficiency of these algorithms

were compared using a simple Schuler Loop example analysis. An algorithm based on a pair of nested, single integrals (Nested Integrals) was shown to be more efficient than direct approximation of the covariance double integral and was selected for further development. This Nested Integrals method was verified against linear state space covariance analysis results on a great circle trajectory and against Monte Carlo results on a hypothetical trajectory for an air-launched strategic missile. GRA

N80-22300# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DETERMINISTIC ANALYSIS OF THE EFFECTS OF SENSOR ERRORS ON STRAPPED-DOWN INS PERFORMANCE M.S. Thesis
Richard H. Reynolds 3 Dec. 1979 171 p refs
(AD-A080373; AFIT/GE/EE/79-30) Avail: NTIS HC A08/MF A01 CSCL 17/7

The operation of a strapped-down inertial navigation system in a high dynamic environment was simulated. Its performance was assessed using a laser gyro and a quartz-flexure accelerometer as the sensors. Using deterministic values for the sensor errors, the effects of the sensor errors on the INS performance was assessed. Emphasis is placed on the effects that the sensor errors have on the INS errors in a high dynamic environment. Structural mode effects on INS performance are also evaluated. Following this an analysis of the sensitivity of the INS errors in position and velocity to each inertial sensor is determined. GRA

N80-22301# Texas Instruments, Inc., Dallas. Equipment Group.
GLOBAL POSITIONING SYSTEMS (GPS). HIGH DYNAMIC USER EQUIPMENT (HDUE), VOLUME 1 Final Report, Jun. 1975 - Aug. 1979
10 Aug. 1979 30 p 3 Vol.
(Contract F04701-75-C-0180)
(AD-A076479; SAMSO-SD-TR-79-12-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/7

This HDUE Final Report has documented the technology, both hardware and software, and the philosophy that Texas Instruments implemented in their High Dynamic User Equipment for the GPS concept validation phase. The overall set as well as its individual modules has been explained. Texas Instruments HDUE concepts, techniques, and results of design-to-cost, producibility, reliability, and maintainability are reported. GRA

N80-22302# Naval Postgraduate School, Monterey, Calif.
SATELLITE NAVIGATION IN THE US COAST GUARD M.S. Thesis
Richard Sheridan Hartman, Jr. Sep. 1979 126 p refs
(AD-A081059) Avail: NTIS HC A07/MF A01 CSCL 17/7

This thesis investigates many of the issues surrounding the civil maritime navigation dilemma facing the USCG. At present, LORAN-C and OMEGA, which are hyperbolic radionavigation systems and TRANSIT, a Doppler shift satellite-based system, are the main systems employed in the civil maritime field. NAVSTAR GPS, a passive ranging satellite navigation system is, in the meantime, showing great promise as the replacement system for primary radionavigation in the U.S. There are several key questions, one involving national security, which must be answered, however, before NAVSTAR becomes operational. What positional accuracy will be made available to the civil community; What are the economics of the user equipments; Will NAVSTAR be accepted as a successful replacement for LORAN by the civil community. To aid in answering some of these questions, the results of an informal survey of the civil maritime industry are presented. The final outcome remains to be seen. These issues will require careful thought by this country's top leaders before any final committment to NAVSTAR can be made or prior to any decision to discontinue LORAN-C or OMEGA. GRA

N80-22303# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
COMPARISON OF THE MINILIR LOCATION SYSTEM AND THE NLR INERTIA MEASURING SYSTEM STALINS
A. J. L. Willekens 28 Jun. 1978 17 p
(NLR-MP-78026-U) Avail: NTIS HC A02/MF A01

Aircraft trajectories were determined using the optical location system (MINILIR) and the inertial measuring system (STALINS). The optical tracking was controlled with a movie camera mounted on the MINILIR tracker. A known position in flight was obtained with a high precision fan marker system RASP. The accuracy of the position and velocity data obtained using both systems is discussed. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-22304*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
PRELIMINARY INVESTIGATION OF MOTION REQUIREMENTS FOR THE SIMULATION OF HELICOPTER HOVER TASKS
Russell V. Parrish Apr. 1980 31 p refs
(NASA-TM-81801) Avail: NTIS HC A03/MF A01 CSCL 01C

Data from a preliminary experiment are presented which attempted to define a helicopter hover task that would allow the detection of objectively-measured differences in fixed base/moving base simulator performance. The addition of heave, pitch, and roll movement of a ship at sea to the hover task, by means of an adaption of a simulator g-seat, potentially fulfills the desired definition. The feasibility of g-seat substitution for platform motion can be investigated utilizing this task.Author

N80-22305*# Science Applications, Inc., Los Angeles, Calif. Economic Analysis Div.
PARAMETRIC STUDY OF HELICOPTER AIRCRAFT SYSTEMS COSTS AND WEIGHTS
Michael N. Beltramo Jan. 1980 179 p refs
(Contract NAS2-8703)
(NASA-CR-152315) Avail: NTIS HC A09/MF A01 CSCL 01C

Weight estimating relationships (WERs) and recurring production cost estimating relationships (CERs) were developed for helicopters at the system level. The WERs estimate system level weight based on performance or design characteristics which are available during concept formulation or the preliminary design phase. The CER (or CERs in some cases) for each system utilize weight (either actual or estimated using the appropriate WER) and production quantity as the key parameters. R.E.S.

N80-22306*# National Aeronautics and Space Administration, Washington, D. C.
AERODYNAMICS OF THE NEW GENERATION OF COMBAT AIRCRAFT WITH DELTA WINGS
M. P. Bohn Mar. 1980 26 p Transl. into ENGLISH of "Aerodynamique de la Nouvelle Generation d'Avions de Combat a Aile Delta", Rept. AGARD-CP-241 AGARD, Paris, Jun. 1978 p 11-1-11-13 Presented at the Multi-Panel Symp. on Fighter Aircraft Design, Florence, 3-6 Oct. 1977 Translation was announced as N78-30106 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75793; AGARD-CP-241) Avail: NTIS HC A03/MF A01 CSCL 01C

The use of delta wing aerodynamic design for modern fighter aircraft is discussed. Various current French fighter airplanes are utilized for comparisons. E.D.K.

N80-22307# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF AIRCRAFT HYDRAULIC LINES INCLUDING THE EFFECT OF MEAN FLOW Ph.D. Thesis
John H. Pletcher, Jr. May 1979 95 p refs
(AF Proj. 3145)
(AD-A080153; AFIT/DS/AA/79S-1) Avail: NTIS HC A05/MF A01 CSCL 01/3

A mathematical model of a fluid transmission line was developed which included the effect of mean flow coupling with oscillatory flow. The analysis centered on solving the nonhomogeneous confluent hypergeometric equation with complex parameters using an infinite series and evaluating the solution using Ward's method. Experiments were run using an aircraft hydraulic system. The frequency response, vibration displacement, and standing pressure half wave were measured in a straight line and a line with bends for flow rates up to 9.5 gpm. A clamp-on transducer, which did not disturb the flow and could be easily moved, was used for the pressure measurements. In the absence of vibration the clamp-on transducer measurements were within 5% of readings taken with a conventional Statham in-line transducer. A sensitivity analysis showed the effect of small changes in geometry, temperature, steady-state pressure, fluid properties, entrained air content, and element volume. Using the new mathematical model, the attenuation and phase constant were calculated for hydraulic and air lines. Results compared well with experiment and published data. The new analysis and line mode provide a means for the fluid systems engineer to accurately account for mean flow effects. GRA

N80-22308# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT Semiannual Summary Report, 1 Jan. 1962 - 30 Jun. 1979
Warren J. Williams 1 Nov. 1979 159 p refs Revised
(AD-A080580; NADC-13920-2) Avail: NTIS
HC A08/MF A01 CSCL 01/3

This report is a specialized summary of normal acceleration data recorded by counting accelerometers. Data are separated by calendar time and mission category. Only data reported in the counting accelerometer program are included. This is a semi-annual progress report, and it presents a specialized summary of the data in the counting accelerometer program. Statistics describing Navy and Marine aircraft cumulative g-count exceedances are calculated and tabulated. These tabulations are seperated by calendar time and into four major categories of fleet experience: Navy Training, Navy Combat, Marine Training, and Marine Combat. These data show that the load rate distributions (counts at 1000 hours) for most models and most g-levels have a non-normal distribution. Within a model (F-4N, F-8J, etc.) differences in the average load rates exist when data are separated by calendar time or mission category. GRA

N80-22309# Aeronautical Research Labs., Melbourne (Australia).
GENERATION OF A REPRESENTATIVE LOAD SEQUENCE FOR THE FATIGUE TESTING OF MACCHI MB 326H SPAR BOOMS
L. R. Gratzer Jan. 1979 26 p refs
(AD-A074155; ARL/Struc-Note-450) Avail: NTIS
HC A03/MF A01 CSCL 01/3

Testing techniques have been developed to allow more realistic load sequences. To take advantage of this, the design of such test sequences must also be improved and for several years large scale tests at ARL have relied on loads obtained from flight histories transformed as little as possible. In this way the probability structure of flight sequences can be restored. Until now however, the design of test histories has been almost entirely manual. This note describes the generation of histories by use of automatic data processing techniques and linear programming. The example used in this note is the Macchi center section spar boom which is being tested under the design load history to supplement earlier data obtained under less realistic load sequences. GRA

N80-22310# Textron Bell Helicopter, Fort Worth, Tex.
IMPROVED MANEUVER CRITERIA EVALUATION PROGRAM Final report, Sep. 1976 - Jul 1979
T. Wood and T. Wask Nov. 1979 79 p refs
(Contract DAAJ02-76-C-0064; DA Proj. 1F2-63211-D-157)
(AD-A080408; USARTL-TR-79-20) Avail: NTIS
HC A05/MF A01 CSCL 01/2

The Maneuver Criteria Evaluation Program (MCEP) is a digital computer program that solves the flight path equation of motion for a helicopter without auxiliary propulsion. The use of basic work, energy, and power relationships makes possible accurate representation of flight path trajectories. MCEP can be used to aid in the development of maneuver requirements that provide the necessary maneuver capability to perform the desired mission. The desired mission is simulated in MCEP by using individual flight controllers to 'fly' the helicopter through the mission profile. Key maneuver parameters are monitored throughout the flight profile to provide insight into the performance of the helicopter in achieving the desired flight trajectory. Three maneuvers have been modified to allow rotor rpm to be bled to use some of the rotor's stored energy. These maneuvers are a constant altitude acceleration maneuver, a collective pop-up maneuver, and a sideward acceleration maneuver. Correlation with flight test data is established to validate the bleed rpm maneuvers. The appendix to the report, the User's Guide, contains the detailed information necessary for setting up an input data deck for MCEP. GRA

N80-22311# Textron Bell Helicopter, Fort Worth, Tex.
AH-1S HIGH-SURVIVABLE TRANSMISSION SYSTEM Final Report, Oct. 1977 - Dec. 1978
Gary A. Cope Oct. 1979 89 p ref
(Contract DAAJ02-76-C-0008; DA Proj. 1F2-63208-D8-52)
(AD-A080568; USAAVRADCOM-TR-79-43) Avail: NTIS
HC A05/MF A01 CSCL 01/3

The objective of the work performed on this program was to demonstrate that the AH-1S main transmission system, modified with internal component improvements but without an emergency lubrication system, could operate for 30 minutes following the loss of lubrication. The internal component improvements were based upon work done under this program and work done under a previous Eustis Directorate contract, both conducted by Bell Helicopter Textron. Six different modified versions of the AH-1S transmission configuration were tested under this program. Four of the six transmission configurations had been run to failure previously and the results reported in USAAMRDL-TR-77-30. The loss-of-lube testing for the final two transmission configurations was conducted at 680 input horsepower (60 percent of maximum continuous power rating of the AH-1S) and 6600 input rpm. The first transmission configuration tested ran 25 minutes under loss-of-lube conditions before failure of the lower planetary stage. The second transmission configuration ran 54 minutes before failure of the lower planetary stage. Thus, the 30-minute loss-of-lube capability has been demonstrated for all transmission components. GRA

N80-22312# Textron Bell Helicopter, Fort Worth, Tex.
ROTORCRAFT FLIGHT SIMULATION, COMPUTER PROGRAM C81. VOLUME 1: ENGINEER'S MANUAL Final Report, Nov. 1976 - Aug. 1977
James R. VanGasbeek, T. T. McLarty, and S. G. Sadler Oct. 1979 394 p refs Supersedes USAAMRDL-TR-76-41A 3 Vol.
(Contract DAAJ02-77-C-0003; DA Proj. 1L2-62209-AH-76)
(AD-A079631; BHT-699-099-062-Vol-1; USARTL-TR-77-54A; USSAMRDL-TR-76-41A) Avail: NTIS HC A17/MF A01 CSCL 01/3

This report consists of three volumes and documents the current version in the C81 family of rotorcraft flight simulation programs developed by Bell Helicopter Textron. This current version of the digital computer program is referred to as AGAJ77. The accompanying program for calculating fully coupled rotor blade mode shapes is called DNAMO5, and the rotor wake program is called AR9102. The first volume, the Engineer's Manual, presents an overview of the computer program capabilities plus discussions for the background and development of the principal mathematical models in the program. The models discussed include all those currently in the program. GRA

N80-22313# Textron Bell Helicopter, Fort Worth, Tex.
ROTORCRAFT FLIGHT SIMULATION, COMPUTER PROGRAM C81. VOLUME 2: USER'S MANUAL Final Report, Nov. 1976 - Aug. 1977
James R. VanGasbeek Oct. 1979 511 p refs 3 Vol.
(Contract DAAJ02-77-C-0003; DA Proj. 1L2-62209-AH-76)
(AD-A079632; BHT-699-099-062-Vol-2; USARTL-TR-77-54B; USAAMRDL-TR-76-41B) Avail: NTIS HC A22/MF A01 CSCL 01/3

This report consists of three volumes and documents the current version in the C81 family of rotorcraft flight simulation

programs developed by Bell Helicopter Textron. This current version of the digital computer program is referred to as AGAJ77. The accompanying program for calculating fully coupled rotor blade mode shapes is called DNAMO5, and the rotor wake program is called AR9102. Volume 2, the User's Manual, contains the detailed information necessary for setting up an input data deck and interpreting the computed data. Volume 3, the Programmer's Manual, includes a catalog of subroutines and a discussion of programming considerations. The source tapes and related software for the computer programs documented in this report are unpublished data on file at the Applied Technology Laboratory, U.S. Army Research and Technology Laboratories (AVRADCOM), Fort Eustis, Virginia. GRA

N80-22314# Naval Ship Research and Development Center, Bethesda, Md.

THE EFFECT OF SHAFT ANGLE ON PERFORMANCE OF A CIRCULATION CONTROL HIGH-SPEED ROTOR AT AN ADVANCE RATIO OF 0.7

Kenneth R. Reader. Feb. 1980. 42 p. refs.

(AD-A080953; AERO-1262; DTNSRDC-80/015) Avail: NTIS HC A03/MF A01 CSCL 20/4

The performance of a high speed rotor model, designated the reverse blowing circulation control rotor (RBCCR), evaluated in a wind tunnel in the forward flight mode is discussed. The effects of rotor shaft angle of attack on rotor performance at the transition advance ratio of mu = 0.7 are specifically examined. The test variables include rotor thrust, blade collective pitch angle, tip Mach number, and rotor shaft angle. The RBCCR model demonstrates both the lift and trim capabilities required in the transitional flight regime. The model also shows that rotor efficiency and power sharing between shaft power and compressor power can be controlled by rotor shaft angle at an advance ratio of 0.7. M.G.

N80-22315# European Space Agency, Paris (France).

INVESTIGATIONS INTO AN ACTIVE VIBRATION ISOLATION SYSTEM FOR HELICOPTERS WITH RIGID AND ELASTIC AIRFRAME MODELING

Jean Skudridakis. 1979. 73 p. refs. Transl. into ENGLISH of "Untersuchung zu Einen Aktiven Schwingungsisolationssystem fuer Hubschrauber bei Starrer und Elastischer Zellenmodellierung". Rept. DLR-IB-552-78-6. DFVLR, Brunswick, Jun. 1978.

(ESA-TT-531; DLR-IB-552/78-6) Avail: NTIS HC A04/MF A01

A system for active rotor isolation was investigated to compensate for blade number harmonic excitation of the rotor and limit the static relative movement of the rotor drive unit. Several sensor configurations were studied for the first completed regulator design of a single rigid function model with a modified Riccati design. This single axis computer model was reviewed and extended for the elastic helicopter airframe modeling (by means of a modified Riccati design). Computer results show that the active rotor isolation is superior in design to all known passive rotor isolation systems. The regulators designed for the single axis computer model show very good isolation of vibration at the 4- and 8- fold rotation frequencies of the rotor, in conjunction with rapid swinging. In addition, the separation between the rotor drive unit and the airframe was reduced with an additional load factor. Author (ESA)

N80-22316# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

A PRACTICAL METHOD FOR PREDICTING ROUGHNESS EFFECTS ON AIRCRAFT

A. Berteirud. Nov. 1978. 54 p. refs.

(Contract SWEDBTD-71.348-U-253)

(FFA-AU-1413) Avail: NTIS HC A04/MF A01

A method for prediction of the extra drag due to surface roughness on aircraft is described. The method is based on use of a number of working charts for flow parameters and includes charts for the drag increments due to different types of roughness. In the introductory part, the flow around wings is described with emphasis on the variation of flow characteristics with flight conditions. Author (ESA)

N80-22317# European Space Agency, Paris (France).

CIVIL COMPONENT PROGRAM WING SECTION. PREDIMENSIONING OF A SUPERCRITICAL WING

Reinhard Arndt. Jul. 1979. 226 p. refs. Transl. into ENGLISH of "Ziviles Kommponentenprogramm 'Flugelsektion' - Vordimensionierung eines Flugels mit Ueberkritischem Profil". Rept. BMFT-FB-W-77-38. DFVLR, Cologne and MBR G.m.b.H., Hamburg, Nov. 1977. Original report in GERMAN previously announced as X79-72062.

(ESA-TT-542; BMFT-FB-W-77-38) Avail: NTIS HC A11/MF A01; ZLDI, Munich DM 47.45

To achieve an optimal wing structure with respect to stringer and rib pitch and their cross-sectional shape, an estimated dimensioning of 700 mm rib pitch based upon the structure optimization program 'Dascha' for rigid load cases was written. The coordinates are calculates from the contour program 'Geolan', based on the wing profile MBB A1-725-146 and using the wing geometry of the ZKP basic design 3 (A 300 B 10 X-2). The dimensioning estimate was made in relation to rigid load cases. To obtain a minimum of structure, this estimation should be repeated with other pitches and cross-sectional shapes. The elastic load cases which result in greater sectional sizes can then be taken into consideration. Author (ESA)

N80-22318# Defence Research Information Centre, Orpington (England).

TRIALS TO COMPARE THE STOPPING PERFORMANCE OF THREE ANTI-SKID SYSTEMS AND TO DEMONSTRATE METHODS OF DETERMINING AIRCRAFT STOP DISTANCES ON THE STANDARD MILITARY REFERENCE WET SURFACE

I. Beaty (Mech. Eng. Res. and Develop.) and R. W. Sugg (Mech. Eng. Res. and Develop.). London HMSO. Oct. 1979. 64 p. refs.

(S/T-Memo-3/79; BR70264) Avail: NTIS HC A04/MF A01

Tests were conducted to determine if there was any difference in the stop distance of a BAC 1-11 aircraft under wet runway conditions when fitted with three different modern anti-skid systems. By comparing the aircraft stop distances at the mu-meter reading of .6 it was concluded that although the two more modern systems appeared to give the shorter distance, the difference was small and based on insufficient data points to give a high degree of confidence. The aircraft Braking Force Coefficient versus speed and mu-meter reading from one of the runs was used to demonstrate the use a method to determine the stop distance on the standard military reference wet surface at the weight at which the aircraft was tested. A method of deciding on the suitability of a test runway for aircraft/mu-meter braking trials using National and NATO standards are presented as well as recommendations on how to conduct the trials and how to determine mu-meter speed/friction curves for the test surface. Author (ESA)

N80-22319# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

IN-FLIGHT HANDLING QUALITIES INVESTIGATION OF AIRBUS A 310 DLC. CONFIGURATIONS ON LANDING APPROACH USING THE DFVLR-HFB 320 VARIABLE STABILITY AIRCRAFT

Dietrich Hanke. Feb. 1979. 87 p. refs. In GERMAN; ENGLISH summary. Report will also be announced as translation (ESA-TT-630)

(DFVLR-FB-79-18) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 17.30

In-flight simulation of the longitudinal and lateral/directional dynamics of the Airbus A 310 aircraft using the DFVLR-HFB 320 variable stability aircraft was studied. The evaluation of different spoiler direct lift controls (DLC) concepts for longitudinal control was stressed. The influence of these concepts handling qualities and pilot-vehicle performance under real instrument landing systems (ILS) approach environmental conditions was determined. Sixty-three ILS approaches were flown by two pilots evaluating four aircraft/DLC configurations. The main handling quality parameter for DLC enhanced longitudinal control is the flight path to pitch attitude phase. A new general applicable flight path to pitch attitude phase criteria is proposed. Author (ESA)

N80-22320# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

ROUGHNESS EFFECTS ON FUEL CONSUMPTION FOR TWO COMMERCIAL AIRCRAFT: MCDONNELL DOUGLAS DC-9 AND DC-10 Final Report
A. Bertelrud Oct. 1979 48 p refs
(Contracts SWEDBTD-77-4869; SWEDBTD-78-5543)
(FFA-AU-1456) Avail: NTIS HC A03/MF A01

The effects of surface roughness on the fuel consumption of two typical passenger aircraft, McDonnell Douglas DC-9 and DC-10, are estimated. Typical cruise conditions and flights for the two aircraft types are considered. The roughness effects are estimated at two levels of sophistication; comprehensive and simplified. In the detailed approach the inviscid flow field around the wings is analyzed by means of a transonic, small perturbation code. The boundary layer is calculated with Bradshaw a straight-tapered swept wing code (with provision for distributed roughness). The simplified approach is basically a flat-plate analysis, which in many cases gave nearly the same results as the more sophisticated approach. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-22321*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
PILOT ASSESSMENT OF TWO COMPUTER-GENERATED DISPLAY FORMATS FOR HELICOPTER INSTRUMENT APPROACH
Frank R. Niessen, Perry L. Deal, and James M. Patton, Jr. May 1980 40 p refs
(NASA-TM-80151; L-13136) Avail: NTIS HC A03/MF A01 CSCL 01D

Two computer generated display formats were evaluated as primary displays by six research pilots in a fixed base simulator. One of the computer generated display formats was an electronic attitude director indicator (EADI) which featured three cue flight director, command information, superimposed on true perspective runway symbology. The other computer generated display format featured separate horizontal and vertical situation information with vector predictors. A baseline display, consisting of an electromechanical attitude director indicator (ADI) with a three cue flight director and a moving map, was used as a reference for the pilot evaluations. Author

N80-22322# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN AND IMPLEMENTATION OF A MICROPROCESSOR FLIGHT DAMAGE MONITOR M.S. Thesis
Brian Charles Johnson Dec. 1979 190 p refs
(AD-A080417; AFIT/GCS/EE/79-6) Avail: NTIS HC A09/MF A01 CSCL 01/3

In order to design a constrained layer damping treatment for aircraft components, the Air Force Flight Dynamics Laboratory at Wright-Patterson Air Force Base, Ohio requires a knowledge of vibration and temperature variations which a component encounters during its life. This report discusses the design and implementation of a microprocessor based system to acquire vibration and temperature information, and computes the cumulative damage factor versus frequency and temperature in real time. The cumulative damage factor is computed for one of eight user selectable frequency ranges and for a temperature range of -50 to -225 and is stored in a non-volatile memory. The designed systems uses an LSI11 microcomputer systems consisting of an LSI-11 processor, an analog-to-digital converter, a real-time clock, PROM, a non-volatile memory, and a serial interface. The software developed for this system controls the data acquisition, the computation of a fast Fourier transform (FFT), the power spectrum of vibration data, and the subsequent computation of the cumulative damage factor. The data acquisition and FFT modules were coded in assembly language, and the other modulus were coded in FORTRAN. The output of the system consists of a table containing the cumulative damage as a function of frequency and temperature. A bench model system was constructed and tested, and a proposal for a flight-worthy system is made. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-22323*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
TWO-DIMENSIONAL FINITE-ELEMENT ANALYSES OF SIMULATED ROTOR-FRAGMENT IMPACTS AGAINST RINGS AND BEAMS COMPARED WITH EXPERIMENTS
Thomas R. Stagliano, Emmett A. Witmer, and Jose J. A. Rodal Dec. 1979 363 p refs
(Grant NGR-22-009-339)
(NASA-CR-159645; ASRL-TR-154-13) Avail: NTIS HC A16/MF A01 CSCL 21E

Finite element modeling alternatives as well as the utility and limitations of the two dimensional structural response computer code CIVM-JET 4B for predicting the transient, large deflection, elastic plastic, structural responses of two dimensional beam and/or ring structures which are subjected to rigid fragment impact were investigated. The applicability of the CIVM-JET 4B analysis and code for the prediction of steel containment ring response to impact by complex deformable fragments from a trihub burst of a T58 turbine rotor was studied. Dimensional analysis considerations were used in a parametric examination of data from engine rotor burst containment experiments and data from sphere beam impact experiments. The use of the CIVM-JET 4B computer code for making parametric structural response studies on both fragment-containment structure and fragment-deflector structure was illustrated. Modifications to the analysis/computation procedure were developed to alleviate restrictions. E.D.K.

N80-22324*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
PERFORMANCE DETERIORATION BASED ON EXISTING (HISTORICAL) DATA; JT9D JET ENGINE DIAGNOSTICS PROGRAM
G. Phil Sallee 20 Apr. 1978 228 p refs
(Contract NAS3-20632)
(NASA-CR-135448; PWA-5512-21) Avail: NTIS HC A11/MF A01 CSCL 21E

The results of the collection and analysis of historical data pertaining to the deterioration of JT9D engine performance are presented. The results of analyses of prerepair and postrepair engine test stand performance data from a number of airlines to establish the individual as well as average losses in engine performance with respect to service use are included. Analysis of the changes in mechanical condition of parts, obtained by inspection of used gas-path parts of varying age, allowed preliminary assessments of component performance deterioration levels and identification of the causitive factors. These component performance estimates, refined by data from special engine back-to-back testing related to module performance restoration, permitted the development of preliminary models of engine component/module performance deterioration with respect to usage. The preliminary assessment of the causes of module performance deterioration and the trends with usage are explained, along with the role each module plays in overall engine performance deterioration. Preliminary recommendations with respect to operating and maintenance practices which could be adopted to control the level of performance deterioration are presented. The needs for additional component sensitivity testing as well as outstanding issues are discussed. J.M.S.

N80-22325*# Solar Turbines International, San Diego, Calif.
ADVANCED CERAMIC MATERIAL FOR HIGH TEMPERA-

TURE TURBINE TIP SEALS Final Report, Feb. 1976 - May 1979
J. W. Vogan, N. G. Solomon, and A. R. Stetson Jan. 1980 97 p refs
(Contract NAS3-20081)
(NASA-CR-159774; SR79-R-4482-43; RDR-1831-43) Avail: NTIS HC A05/MF A01 CSCL 11A

Forty-one material systems were evaluated for potential use in turbine blade tip seal applications at 1370 C. Both ceramic blade tip inserts and abradable ceramic tip shoes were tested. Hot gas erosion, impact resistance, thermal stability, and dynamic rub performance were the criteria used in rating the various materials. Silicon carbide and silicon nitride were used, both as blade tips and abradables. The blade tip inserts were fabricated by hot pressing while low density and honeycomb abradables were sintered or reaction bonded. Author

N80-22326*# Teledyne Continental Motors, Muskegon, Mich.
DESIGN STUDY: A 186 kW LIGHTWEIGHT DIESEL AIRCRAFT ENGINE Final Report
Alex P. Brouwers Apr. 1980 24 p
(Contract NAS3-20830)
(NASA-CR-3261) Avail: NTIS HC A02/MF A01 CSCL 21E

The design of an aircraft engine capable of developing 186 kW shaft power at a 7620 m altitude is described. The 186 kW design takes into account expected new developments in aircraft designs resulting in a reassessment of the power requirements at the cruise mode operation. Based on the results of this analysis a three phase technology development program is projected resulting in production dates of 1985, 1992, and 2000. R.E.S.

N80-22327*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
GENERAL AVIATION PROPULSION
Mar. 1980 437 p refs Conf. held in Cleveland, 28-29 Nov. 1979
(NASA-CP-2126; E-310) Avail: NTIS HC A19/MF A01 CSCL 21E

Programs exploring and demonstrating new technologies in general aviation propulsion are considered. These programs are the quiet, clean, general aviation turbofan (QCGAT) program; the general aviation turbine engine (GATE) study program; the general aviation propeller technology program; and the advanced rotary, diesel, and reciprocating engine programs. For individual titles, see N80-22328 through N80-22348.

N80-22328*# AiResearch Mfg. Co., Phoenix, Ariz.
AIRESEARCH QCGAT ENGINE, AIRPLANE, AND NACELLE DESIGN FEATURES
Roger W. Heldenbrand *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 11-43 (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

The quiet, clean, general aviation turbofan engine and nacelle system was designed and tested. The engine utilized the core of the AiResearch model TFE731-3 engine and incorporated several unique noise- and emissions-reduction features. Components that were successfully adapted to this core include the fan, gearbox, combustor, low-pressure turbine, and associated structure. A highly versatile workhorse nacelle incorporating interchangeable acoustic and hardwall duct liners, showed that large-engine attenuation technology could be applied to small propulsion engines. The application of the mixer compound nozzle demonstrated both performance and noise advantages on the engine. Major performance, emissions, and noise goals were demonstrated. A.R.H.

N80-22329*# AiResearch Mfg. Co., Phoenix, Ariz.
AIRESEARCH QCGAT ENGINE PERFORMANCE AND EMISSIONS TESTS
William M. Norgren *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 45-64 (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

Results of aerodynamic performance and emission tests, conducted on a specially designed QCGAT engine in the 17,793-N (4,000 lb) thrust class, are presented. Performance of the AiResearch QCGAT engine was excellent throughout all testing. No serious mechanical malfunctions were encountered, and no significant test time was lost due to engine-related problems. Emissions were drastically reduced over similar engines, and the engine exhibited good smoke performance. A.R.H.

N80-22330*# AiResearch Mfg. Co., Phoenix, Ariz.
AIRESEARCH QCGAT ENGINE: ACOUSTIC TEST RESULTS
Larry S. Kisner *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 65-100 refs (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

The noise levels of the quiet, general aviation turbofan (QCGAT) engine were measured in ground static noise tests. The static noise levels were found to be markedly lower than the demonstrably quiet AiResearch model TFE731 engine. The measured QCGAT noise levels were correlated with analytical noise source predictions to derive free-field component noise predictions. These component noise sources were used to predict the QCGAT flyover noise levels at FAR Part 36 conditions. The predicted flyover noise levels are about 10 decibels lower than the current quietest business jets. Author

N80-22331*# Avco Lycoming Div., Stratford, Conn.
QCGAT AIRCRAFT/ENGINE DESIGN FOR REDUCED NOISE AND EMISSIONS
Leonard Lanson and Kenneth M. Terrill *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 101-133 (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

The high bypass ratio QCGAT engine played an important role in shaping the aircraft design. The aircraft which evolved is a sleek, advanced design, six-place aircraft with 3538 kg (7,800 lb) maximum gross weight. It offers a 2778 kilometer (1500 nautical mile) range with cruise speed of 0.5 Mach number and will take-off and land on the vast majority of general aviation airfields. Advanced features include broad application of composite materials and a supercritical wing design with winglets. Full-span fowler flaps were introduced to improve landing capability. Engines are fuselage-mounted with inlets over the wing to provide shielding of fan noise by the wing surfaces. The design objectives, noise, and emission considerations, engine cycle and engine description are discussed as well as specific design features. A.R.H.

N80-22332*# Avco Lycoming Div., Stratford, Conn.
AVCO LYCOMING QCGAT PROGRAM DESIGN CYCLE, DEMONSTRATED PERFORMANCE AND EMISSIONS
Phil Fogel and Angelo Koschier *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 135-154 refs (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

A high bypass ratio, twin spool turbofan engine of modular design which incorporates a front fan module driven by a modified LTS101 core engine was tested. The engine is housed in a nacelle incorporating full length fan ducting with sound treatment in both the inlet and fan discharge flow paths. Design goals of components and results of component tests are presented together with full engine test results. The rationale behind the combustor design selected for the engine is presented as well as the emissions test results. Total system (engine and nacelle) test results are included. A.R.H.

N80-22333*# Avco Lycoming Div., Stratford, Conn.
AVCO LYCOMING QUIET CLEAN GENERAL AVIATION TURBOFAN ENGINE
Craig A. Wilson *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 155-187 refs (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

A fan module was developed using an existing turboshaft engine. The fan was designed using the latest in large engine noise control technology. A mixer was added to reduce the already low exhaust gas velocity. A nacelle incorporating sound treatment was provided for the test engine. A noise prediction model was used through the design process to evaluate the various design alternatives. Acoustic tests were then made to

verify the prediction and identify the noise characteristics of the fan, core, jet, and sound treatment. Analysis of the recorded data yielded close agreement with the expected results. Core noise, as was expected, was the predominant source of noise for the quiet clean general aviation turbofan (QCGAT) engine. Flyover noise predictions were made which indicated that the Avco Lycoming QCGAT engine would meet the goals set for the QCGAT program. R.E.S.

N80-22334*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF NASA QCGAT PROGRAM
Gilbert K. Sievers *In its* Gen. Aviation Propulsion Mar. 1980 p 189-193 (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

The application of large turbofan engine technology to small general aviation turbofan engines to achieve low noise, low emissions, and acceptable fuel consumption is described. R.E.S.

N80-22335*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW OPPORTUNITIES FOR FUTURE, SMALL, GENERAL-AVIATION TURBINE ENGINES (GATE)
William C. Strack *In its* Gen. Aviation Propulsion Mar. 1980 p 195-219 refs (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

The results of four independent contracted studies to explore the opportunities for future small turbine engines are summarized in a composite overview. Candidate advanced technologies are screened, various cycles and staging arrangements are parametrically evaluated, and optimum conceptual engines are identified for a range of 300 to 600 horsepower applications. Engine improvements of 20 percent in specific fuel consumption and 40 percent in engine cost were forecast using high risk technologies that could be technically demonstrated by 1988. The ensuing economic benefits are in the neighborhood of 20 to 30 percent for twin-engine aircraft currently powered by piston engines. Author

N80-22336*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN OVERVIEW OF NASA RESEARCH ON POSITIVE DISPLACEMENT GENERAL-AVIATION ENGINES
Erwin E. Kempke, Jr. *In its* Gen. Aviation Propulsion Mar. 1980 p 227-229 (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

The research and technology program related to improved and advanced general aviation engines is described. Current research is directed at the near-term improvement of conventional air-cooled spark-ignition piston engines and at future alternative engine systems based on all-new spark-ignition piston engines, lightweight diesels, and rotary combustion engines that show potential for meeting program goals in the midterm and long-term future. The conventional piston engine activities involve efforts on applying existing technology to improve fuel economy, investigation of key processes to permit leaner operation and reduce drag, and the development of cost effective technology to permit flight at high-altitudes where fuel economy and safety are improved. The advanced engine concepts activities include engine conceptual design studies and enabling technology efforts on the critical or key technology items. R.E.S.

N80-22337*# Teledyne Continental Motors, Muskegon, Mich. Aircraft Products Div.
THE SPARK-IGNITION AIRCRAFT PISTON ENGINE OF THE FUTURE
Kenneth J. Stuckas *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 231-245 (For primary document see N80-22327 13-07)
(Contract NAS3-21272)
Avail: NTIS HC A19/MF A01 CSCL 21E

Areas of advanced technology appropriate to the design of a spark-ignition aircraft piston engine for the late 1980 time period were investigated and defined. Results of the study show that significant improvements in fuel economy, weight and size, safety, reliability, durability and performance may be achieved with a high degree of success, predicated on the continued development of advances in combustion systems, electronics, materials and control systems. R.E.S.

N80-22338*# Teledyne Continental Motors, Muskegon, Mich. General Products Div.
LIGHTWEIGHT DIESEL AIRCRAFT ENGINES FOR GENERAL AVIATION
Steven G. Beremyi and Alex P. Brouwers *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 247-285 (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

A methodical design study was conducted to arrive at new diesel engine configurations and applicable advanced technologies. Two engines are discussed and the description of each engine includes concept drawings. A performance analysis, stress and weight prediction, and a cost study were also conducted. This information was then applied to two airplane concepts, a six-place twin and a four-place single engine aircraft. The aircraft study consisted of installation drawings, computer generated performance data, aircraft operating costs and drawings of the resulting airplanes. The performance data shows a vast improvement over current gasoline-powered aircraft. At the completion of this basic study, the program was expanded to evaluate a third engine configuration. This third engine incorporates the best features of the original two, and its design is currently in progress. Preliminary information on this engine is presented. R.E.S.

N80-22339*# Curtiss-Wright Corp., Wood-Ridge, N.J.
ADVANCED ROTARY ENGINE STUDIES
Charles Jones *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 287-311 refs (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

A review of rotary engine developments relevant to a stratified charge rotary aircraft engine is presented. Advantages in module size and weight, fuel efficiency, reliability, and multi-fuel capability are discussed along with developments in turbocharging, increased mean effective pressure, improved apex seal/trochoid wear surfacing materials, and high strength and temperature aluminum casting alloys. A carbureted prototype aircraft engine is also described. M.G.

N80-22340*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POSITIVE DISPLACEMENT TYPE GENERAL-AVIATION ENGINES: SUMMARY AND CONCLUDING REMARKS
Erwin E. Kempke, Jr. *In its* Gen. Aviation Propulsion Mar. 1980 p 313-314 (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

The activities of programs investigating various aspects of aircraft internal combustion engines are briefly described including developments in fuel injection technology, cooling systems and drag reduction, turbocharger technology, and stratified-charge rotary engines. M.G.

N80-22341*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA PROPELLER TECHNOLOGY PROGRAM
Daniel C. Mikkelson *In its* Gen. Aviation Propulsion Mar. 1980 p 315-325 refs (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

A program on propeller technology applicable to both low and high speed general aviation aircraft is summarized, and the overall program objectives and approach are outlined. M.G.

N80-22342*# Cessna Aircraft Co., Wichita, Kans. Accessory Div.
LOW SPEED PROPELLERS: IMPACT OF ADVANCED TECHNOLOGIES
Ira D. Keiter *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 327-343 refs (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

Sensitivity studies performed to evaluate the potential of several advanced technological elements on propeller performance, noise, weight, and cost for general aviation aircraft are discussed. Studies indicate that the application of advanced technologies to general aviation propellers can reduce fuel consumption in

future aircraft an average of ten percent, meeting current regulatory noise limits. Through the use of composite blade construction, up to 25 percent propeller weight reduction can be achieved. This weight reduction in addition to seven percent propeller efficiency improvements through application of advanced technologies result in four percent reduction in direct operating costs, ten percent reduction in aircraft acquisition cost, and seven percent lower gross weight for general aviation aircraft. M.G.

N80-22343*# Hamilton Standard, Windsor Locks, Conn.
ADVANCED TURBOPROP POTENTIAL FOR HIGH SPEED
Bernard S. Gatzen *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 345-359 (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

A turboprop propulsion system for general aviation aircraft, allowing high speed flight (to 0.8 Mach) is discussed. Design methodologies for aerodynamic and acoustic considerations and the performance and cost advantages of a prop-fan aircraft are presented. M.G.

N80-22344*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-SPEED-PROPELLER WIND-TUNNEL AEROACOUSTIC RESULTS
Robert J. Jeracki and James H. Dittmar *In its* Gen. Aviation Propulsion Mar. 1980 p 361-374 refs (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

Some aerodynamic concepts are presented together with an explanation of how these concepts are applied to advanced propeller design. The unique features of this propulsion system are addressed with emphasis on the design concepts being considered for the high speed turboprop. More particular emphasis is given to the blade sweep, long blade chords, and the large number of blades. R.C.T.

N80-22345*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED PROPELLER AERODYNAMIC ANALYSIS
Lawrence J. Bober *In its* Gen. Aviation Propulsion Mar. 1980 p 375-385 refs (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

The analytical approaches as well as the capabilities of three advanced analyses for predicting propeller aerodynamic performance are presented. It is shown that two of these analyses use a lifting line representation for the propeller blades, and the third uses a lifting surface representation. R.C.T.

N80-22346*# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
PROPELLER AEROACOUSTIC METHODOLOGIES
Kenneth D. Korkan and Gerald M. Gregorek *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 387-404 refs (For primary document see N80-22327 13-07)
(Grant NsG-3247)
Avail: NTIS HC A19/MF A01 CSCL 21E

The aspects related to propeller performance by means of a review of propeller methodologies are addressed. Preliminary wind tunnel propeller performance data are presented and the predominent limitations of existing propeller performance methodologies are discussed. Airfoil developments appropriate for propeller applications are also reviewed. R.C.T.

N80-22347*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA PROPELLER NOISE RESEARCH
George C. Greene *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 405-420 (For primary document see N80-22327 13-07)
Avail: NTIS HC A19/MF A01 CSCL 21E

The research in propeller noise prediction, noise/performance optimization, and interior reduction is described. Selected results are presented to illustrate the status of the technology and the direction of future research. R.C.T.

N80-22348*# Pennsylvania State Univ., University Park.
PROPELLER DYNAMIC AND AEROELASTIC EFFECTS
Barnes W. McCormick *In* NASA. Lewis Res. Center Gen. Aviation Propulsion Mar. 1980 p 421-432 refs (For primary document see N80-22327 13-07)
(Grants NsG-1308; NsG-3304)
Avail: NTIS HC A19/MF A01 CSCL 21E

Various aspects of propeller blade dynamics are considered including those factors which are exciting the blades and the dynamic response of the blades to the excitations. Methods for treating this dynamic system are described and problems are discussed which may arise with advanced turboprop designs employing thin, swept blades. Author

N80-22349*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF THERMAL CYCLING ON ZrO2-Y2O3 THERMAL BARRIER COATINGS
G. McDonald and Robert C. Hendricks 1980 10 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 21-25 Apr. 1980; sponsored by the Am. Vacuum Soc
(NASA-TM-81480; E-416) Avail: NTIS HC A02/MF A01 CSCL 21E

A study was made of the comparative life of plasma sprayed ZrO2-Y2O3 thermal barrier coatings on NiCrAlY bond coats on Rene 41 in short (4 min) and long (57 min) thermal cycles to 1040 C in a 0.3 Mach flame. Short cycles greatly reduced the life of the ceramic coating in terms of time at temperature as compared to longer cycles. Appearance of the failed coating indicated compressive failure. Failure occurred at the bond coat-ceramic coat junction. At heating rates greater than 550 kw/sq m, the calculated coating detachment stress was in the range of literature values of coating adhesive/cohesive strength. Methods are discussed for decreasing the effect of high heating rate by avoiding compressive stress. Author

N80-22350*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF ADVANCED TURBOPROP AND TURBOSHAFT ENGINES FOR LIGHT AIRCRAFT
G. Knip, R. M. Plencner, and J. D. Eisenberg Apr. 1980 62 p refs
(NASA-TM-81467; E-397) Avail: NTIS HC A04/MF A01 CSCL 21E

The effects of engine configuration, advanced component technology, compressor pressure ratio and turbine rotor-inlet temperature on such figures of merit as vehicle gross weight, mission fuel, aircraft acquisition cost, operating, cost and life cycle cost are determined for three fixed- and two rotary-wing aircraft. Compared with a current production turboprop, an advanced technology (1988) engine results in a 23 percent decrease in specific fuel consumption. Depending on the figure of merit and the mission, turbine engine cost reductions required to achieve aircraft cost parity with a current spark ignition reciprocating (SIR) engine vary from 0 to 60 percent and from 6 to 74 percent with a hypothetical advanced SIR engine. Compared with a hypothetical turboshaft using currently available technology (1978), an advanced technology (1988) engine installed in a light twin-engine helicopter results in a 16 percent reduction in mission fuel and about 11 percent in most of the other figures of merit. A.R.H.

N80-22351# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.
INVESTIGATION OF LUBRICANT CONCEPTS APPLICABLE TO FUTURE NAVY AIRCRAFT PROPULSION SYSTEMS
Final Report
A. J. Porazio, E. F. Pierce, and P. A. Karpovich Nov. 1979 51 p refs
(ZF54594001; WF54543300)
(AD-A079410; NAPC-PE-29) Avail: NTIS HC A04/MF A01 CSCL 11/8

Future lubrication requirements for Navy aircraft engines were estimated. Viable areas were evaluated to determine relative strengths and weaknesses of several systems. Among those areas investigated were ester lubricants, inserted ester lubricant systems, polyphenyl ethers and gas lubricated compliant bearings. GRA

N80-22352# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
THERMAL RESPONSE TURBINE SHROUD STUDY Final Report, Aug. 1978 - May 1979
E. J. Kawecki Wright-Patterson AFB, Ohio AFAPL Jul. 1979 135 p
(Contract F33615-78-C-2022; AF Proj. 3066)
(AD-A080620; PWA-FR-11867; AFAPL-TR-79-2087) Avail: NTIS HC A07/MF A01 CSCL 21/5

The program objective was to evaluate active clearance controls (ACC) for future military fighter and transport aircraft/engines, rank the candidate schemes, and recommend a future course of action. Fifty-one potential ACC concepts were reduced to twelve: five mechanical, two pneumatic, and five thermal. The fighter and transport missions selected were the Advanced Tactical Fighter (ATF), and the C141X strategic aircraft. Three levels of controls for ACC were considered: simple on/off two-position; open loop infinitely variable; and feedback (requiring a clearance sensor). On/off systems were selected for study because the majority of the benefit is obtained during cruise/dash and the open and feedback systems have positioning and reliability uncertainties. The criteria selected to evaluate the different schemes were net Life Cycle Cost benefits, to the fleet over the life of the weapons system. These criteria were based on a new-engine/new-aircraft application where efficiency improvements due to ACC were used to reduce aircraft and engine size for a fixed mission (range, payload, etc.). The detailed operation and impact (cost, weight, reliability, maintainability) of the twelve final schemes were evaluated by adopting each of the candidate schemes to selected stages in the base engines. ACC showed a significant net benefit in the transport high pressure turbine. On the low pressure turbine some schemes showed a net savings, but the amount was small. For the fighter application, ACC showed a significant net benefit in the high pressure turbine only. GRA

N80-22353# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Antriebstechnik.
DESIGN AND INVESTIGATION OF STATIC PRESSURE COMPRESSOR CASCADES BEHIND IMPULSE-ROTORS Ph.D. Thesis - Technische Hochschule
Reinhold Fuchs Mar. 1979 119 p refs In GERMAN; ENGLISH summary Report will be also announced as translation (ESA-TT-629)
(DFVLR-FB-79-17) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 21,30

The design, optimization, and wind tunnel testing for two dimensional cascades are described. The cascades decelerate the rotor outlet velocity of about M = 2 to subsonic stator outlet velocity by a multiple shock system realizing a high static pressure ratio. The multiple shock cascades with turning and without were tested in a cascade wind tunnel and compared with results of computations. Author (ESA)

N80-22354# National Gas Turbine Establishment, Farnborough (England).
A DIGITAL COMPUTER PROGRAM FOR THE SUBSONIC FLOW PAST TURBOMACHINE BLADES USING A MATRIX METHOD
W. J. Calvert and D. J. L. Smith London Aeron. Res. Council Nov. 1976 68 p refs Supersedes NGTE-R-328; ARC-37294 (ARC-R/M-3838; BR70994; NGTE-R-328; ARC-37294) Avail: NTIS HC A04/MF A01; HMSO £10 PHI

A computer program which analyzes the inviscid, subsonic compressible pressure distributions around the blades of axial, radial, and mixed flow turbomachines is described. The flow equations are combined to form a governing, Poisson type differential equation for the stream function and the numerical solution is obtained by a finite difference matrix method. Solutions for several turbomachines, giving flow patterns and velocity distributions are included. Author (ESA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-22355 Dayton Univ., Ohio.
DESIGN OF AN INTEGRATED FLIGHT/FIRE CONTROL SYSTEM INCLUDING MOVABLE GUN AND GIMBALED LINE OF SIGHT TRACKER Ph.D. Thesis
John Hazen Blakelock 1979 354 p
Avail: Univ. Microfilms Order No. 8008431

The design, analysis, and hybrid simulation of an integrated flight/fire control system (IFFC) including a movable gun and gimbaled line of sight tracker for the F-15 are discussed. The analysis includes a linear root locus analysis of the various control systems and a detailed discrete analysis of the sampled-data control system resulting from closing the outer control loops through the digital computer used to compute the prediction angle and to generate the inputs to the flight control systems. The capability of the IFFC system was tested against various target scenarios using a hybrid simulation. The results show that the IFFC with the movable gun is able to track a wide variety of target scenarios, including inverted flight to track an aircraft performing a split S, with the gun on track for a major portion of each run. Dissert. Abstr.

N80-22356*# Joint Inst. for Advancement of Flight Sciences, Hampton, Va.
EFFECT OF A FLEXIBLY MOUNTED STORE ON THE FLUTTER SPEED OF A WING Final Report
Harry L. Runyan NASA, Langley Res. Center Apr. 1980 25 p refs
(Grant NsG-1438)
(NASA-CR-159245) Avail: NTIS HC A02/MF A01 CSCL 01C

A passive system proposed for increasing the flutter speed of a wing with heavy concentrated weights involves the concept of mounting the store on a pitch pivot having a very low pitch stiffness relative to the wing stiffness. This concept was investigated utilizing a two dimensional approach involving 4 degrees of freedom, namely, wing bending, wing torsion, store pitch and store vertical translation. This preliminary analysis was very encouraging and the results demonstrate that, if the uncoupled store pitch frequency was below the wing bending frequency, the flutter speed was greatly increased. A second more complete analysis was developed utilizing a three dimensional structure, but retaining the two dimensional, incompressible unsteady airforces of Theodorsen. The details of the analysis are included. A.R.H.

N80-22357*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
THE DESIGN, TESTING AND EVALUATION OF THE MIT INDIVIDUAL-BLADE-CONTROL SYSTEM AS APPLIED TO GUST ALLEVIATION FOR HELICOPTERS Final Report
Robert Miller McKillip, Jr. Feb. 1980 92 p refs
(Grant NsG-2266)
(NASA-CR-152352; ASRL-TR-196-1) Avail: NTIS HC A05/MF A01 CSCL 01C

A type of active control for helicopters was designed and tested on a four foot diameter model rotor. A single blade was individually controlled in pitch in the rotating frame over a wide range of frequencies by electromechanical means. By utilizing a tip mounted accelerometer as a sensor in the feedback path, significant reductions in blade flapping response to gust were achieved at the gust excitation frequency as well as at super and subharmonics of rotor speed. E.D.K.

N80-22358*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
DESCRIPTION OF AN EXPERIMENTAL (HYDROGEN PEROXIDE) ROCKET SYSTEM AND ITS USE IN MEASURING AILERON AND RUDDER EFFECTIVENESS OF A LIGHT AIRPLANE
Thomas C. OBryan, Maxwell W. Goode, Frederick D. Gregory, and Marna H. Mayo May 1980 42 p refs

(NASA-TP-1647; L-12494) Avail: NTIS HC A03/MF A01 CSCL 01C

A hydrogen peroxide fueled rocket system, which is to be used as a research tool in flight studies of stall and spin maneuvers, was installed on a light, four place general aviation airplane. The pilot controlled rocket system produces moments about either the roll or the yaw body axis to augment or oppose the aerodynamic forces and inertial moments acting on the airplane during various flight maneuvers, including the spin. These controlled moments of a known magnitude can be used in various ways to help analyze and interpret the importance of the various factors which influence airplane maneuvers. The rocket system and its installation in the airplane are described, and the results of flight rests used to measure rudder and aileron effectiveness at airspeeds above the stall are presented. These tests also serve to demonstrate the operational readiness of the rocket system for future research operations. E.D.K.

N80-22359*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

DECOUPLER PYLON: WING/STORE FLUTTER SUPPRESSOR Patent Application

Wilmer A. Reed, III, inventor (to NASA) Filed 28 Mar. 1980 18 p

(NASA-Case-LAR-12468-1; US-Patent-Appl-SN-135057) Avail: NTIS HC A02/MF A01 CSCL 01C

A device for suspending a store from a support such as an aircraft wing is described. It comprises soft-spring means whereby the store pitch mode is decoupled from support modes and a low frequency active control mechanism which maintains store alignment. In the described embodiment, a pneumatic suspension system both isolates the store in pitch and, under conditions of changing mean load, aligns the store with the wing to which it is attached. The device allows the flutter speed of an aircraft flying with an attached store to be increased while reducing the sensitivity of flutter to changes in the pitch inertia and center of gravity location of the store. NASA

N80-22360# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

USING VERTICAL GUST ALLEVIATION TO IMPROVE THE TARGET TRACKING CAPABILITY OF THE CONTROL CONFIGURED YF-16 M.S. Thesis

Eric R. Molner Aug. 1979 278 p refs

(AD-A080520; AFIT/GGC/EE/79-5) Avail: NTIS HC A13/MF A01 CSCL 01/3

This thesis investigates the use of multiple aerodynamic control surfaces as a part of a flight control system configured to reduce aircraft pitch response to atmospheric disturbances. Coordinated deflection of two surfaces provides the desired gust alleviation with no decrease in system damping. At the same time, the commanded aircraft performance is improved relative to the performance of the baseline flight control system using a single control surface. The aircraft chosen for this analysis is the General Dynamics YF-16. This particular aircraft has a fly-by-wire electronic flight control system - an arrangement that permits the control surfaces to be electronically activated. A means of applying discrete vertical gusting to a modeled system is presented to permit evaluation of system performance. Using a simulation computer program, the YF-16 with baseline flight control system and Maneuver Enhancement augmentation are examined to determine gust response and pilot response characteristics. GRA

N80-22361# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE APPLICATION OF OUTPUT PREDICTIVE DIGITAL CONTROL TO WING FLUTTER SUPPRESSION AND TERRAIN FOLLOWING PROBLEMS M.S. Thesis

David E. Chaffin Dec. 1979 176 p refs

(AD-A080419; AFIT/GE/EE/79-9) Avail: NTIS HC A09/MF A01 CSCL 01/3

This thesis is a study of a digital control technique known as Output Predictive Control (OPC) or Model Algorithmic Control (MAC). In OPC, the behavior of the system is predicted using its impulse response function and the desired response is characterized by a reference trajectory. Controls are computed iteratively to drive the system output along the desired trajectory. In an earlier study, the system was made to follow the reference trajectory exactly, but only at the control application time; there were large oscillations of the output between control changes. In this study, the control calculation is reformulated as a least squares curve fit problem, allowing some deviation from the desired trajectory. This approach is applied as a regulator for a very lightly damped fourth-order single-input/single-output system and as a pitch axis autopilot in a simplified terrain following problem. A qualitative discussion of the robustness properties is included. The design of the controller is difficult due to the interrelationships of the internal parameters; however, the results of the terrain following example indicate that this is a viable approach for this problem. GRA

N80-22362# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

ANALYSIS OF THE EFFECTS OF HIGHER ORDER CONTROL SYSTEMS ON AIRCRAFT APPROACH AND LANDING LONGITUDINAL HANDLING QUALITIES M.S. Thesis

Muhammad Anwar Pasha Dec. 1979 236 p refs

(AD-A080519; AFIT/GE/EE/79-27) Avail: NTIS HC A11/MF A01 CSCL 05/8

The approach and landing longitudinal flying qualities data generated by Calspan using variable stability NT-33 aircraft combined with significant control system dynamics was analyzed. Three different approaches were used to determine the relationship between pilot ratings and the pilot workload, system sensitivity, and the system performance. An open-loop frequency response analysis showed that for a particular crossover frequency and phase margin (fixed performance), the phase angle (pilot workload) and slope of the phase curve (system sensitivity) at the crossover frequency correlated well with the pilot ratings. An optimum pilot lead time for pitch tracking, flight path angle tracking, and both pitch and flight path angle tracking tasks is determined by a closed-loop analog simulation using integral error squared as a performance measure. A correlation is found between pilot ratings and performance. An attempt is made to explain the landing task as a closed-loop pitch and flight path angle tracking task. The open-loop impulse response of the pitch attitude showed that the initial delay and the transient behavior of the pitch response have a direct impact on the pilot ratings, pilot induced oscillations, and comments. GRA

N80-22363# European Space Agency, Paris (France).

CONTROL SYSTEM DESIGN USING VECTOR-VALUED PERFORMANCE CRITERIA WITH APPLICATION TO THE CONTROL RATE REDUCTION IN PARAMETER INSENSITIVE CONTROL SYSTEMS

Gerhard Kreisselmeier Dec. 1978 39 p refs Transl. into ENGLISH of "Reglerentwurf mit Vektoriellen Guetekriterien und Seine Praktische Anwendung zur Stellgeschwindigkeitsreduktion bei Parameterunempfindlichen Reglern", Rept. DLR-FB-77-55 DFVLR, Oberpfaffenhofen, Nov. 1977 Original report in GERMAN previously announced as X79-71736

(ESA-TT-512-Rev; DLR-FB-77-55-Rev) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 17

A design strategy is suggested which uses for the optimization of the control system, a vector-valued performance-criterion such that a systematic step-by-step improvement of the performance vector is achieved, i.e., at each stage the performance of some components is improved without impairing that of the others, so that finally the optimal design is obtained. This technique is used to design a parameter-insensitive flight-path controller which, compared with earlier designs, has both a larger reduction in sensitivity and a considerable reduction in the maximal control rate. The design shows that a controller can have considerably reduced sensitivity without increasing the demands on the actuator system. This result is due primarily to the control rate being directly considered in the design. The controller-synthesis technique based on vector-valued performance-criteria as here suggested is feasible even when the number of design aspects is large. Author (ESA)

N80-22364# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DEFINITION OF A TWO LEVEL CONTROL SYSTEM FOR NONLINEAR AIRCRAFT MOTION

Albert Kirszenblat 1979 34 p refs In FRENCH; ENGLISH

summary. Report will also be announced as translation (ESA-TT-614)
(ONERA-NT-1979-7; ISSN-0078-3781) Avail: NTIS HC A03/MF A01

The utilization of fly by wire control systems is discussed in terms of the improvement of aircraft handling qualities. An approach to the problem of defining a control law well adapted to the whole flight envelope is presented. This system has a two level structure allowing a task oriented control and an augmentation of the aircraft stability. A nonlinear model of the aircraft dynamics is described incorporating the inertial coupling term, and the nonlinear aerodynamic effects. The model generates a trajectory, a reference control law vector, and an output vector which tracks a vector. This vector represents the maneuvering objectives assigned by the pilot at any time. A servo compensation which subordinates the aircraft motion to the model is also given. The control law is obtained by application of the optimal linear control theory to local linear models of the aircraft. Direct force control surfaces were easily incorporated in the computation of the control system. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-22365# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
DEVELOPMENT OF THE A-6/CIRCULATION CONTROL WING FLIGHT DEMONSTRATOR CONFIGURATION Final Report, Sep. 1975 - Jul. 1978
Robert J. Englar. Jan. 1979. 158 p. refs
(AD-A081241; DTNSRDC/ASED-79-01) Avail: NTIS HC A08/MF A01 CSCL 14/2

Wind tunnel investigations were conducted on a 1/8.5 scale model of the A-6/circulation control wing flight demonstrator aircraft in order to confirm the high lift capability of the concept, to improve lifting and control surfaces and to provide supporting data to assure safety of flight and adequate handling of the full-scale aircraft. The best configuration developed during these investigations produced a 2.2 fold increase in maximum coefficient of lift over the conventional A-6A high lift configuration. This circulation control wing configuration was compromised to simplify testbed aircraft modifications, reduce construction costs, and provide a larger range of parameters obtainable during flight testing, yet in the final configuration, still provided trimmed aerodynamic maximum coefficient of lift double that of the standard A-6A. A.R.H.

N80-22366*# Old Dominion Univ. Research Foundation, Norfolk, Va.
AUTOMATIC CONTROL OF A LIQUID NITROGEN COOLED, CLOSED-CIRCUIT, CRYOGENIC PRESSURE TUNNEL Progress Report, Oct. 1979 - Mar. 1980
S. Balakrishna and G. L. Goglia. Mar. 1980. 103 p. refs
(Grant NsG-1503)
(NASA-CR-162636) Avail: NTIS HC A08/MF A01 CSCL 01E

The control system design, performance analysis, microprocesser based controller software development, and specifications for the Transonic Cryogenic Tunnel (TCT) are discussed. The control laws for the single-input single-output controllers were tested on the TCT simulator, and successfully demonstrated on the TCT. F.O.S.

N80-22367*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH VOLTAGE SPARK CARBON FIBER DETECTION SYSTEM
Lien C. Yang. 15 Apr. 1980. 96 p. refs
(Contract NAS7-100)
(NASA-CR-162995; JPL-Pub-80-30) Avail: NTIS HC A05/MF A01 CSCL 14B

The pulse discharge technique was used to determine the length and density of carbon fibers released from fiber composite materials during a fire or aircraft accident. Specifications are given for the system which uses the ability of a carbon fiber to initiate spark discharge across a high voltage biased grid to achieve accurate counting and sizing of fibers. The design of the system was optimized, and prototype hardware proved satisfactory in laboratory and field tests. A.R.H.

N80-22368*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
MAGNETIC SUSPENSION AND BALANCE SYSTEM: A SELECTIVE ANNOTATED BIBLIOGRAPHY
Marie H. Tuttle, Robert A. Kilgore, and Richmond P. Boyden. Apr. 1980. 47 p.
(NASA-TM-80225; L-13196) Avail: NTIS HC A03/MF A01 CSCL 14E

This bibliography, with abstracts, consists of 188 citations arranged in chronological order by dates of publication. Selection of the citations was made for their relevance to the problems involved in understanding, designing, and constructing magnetic suspension and balance systems for use in wind tunnels. Author

N80-22369*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
WIND TUNNEL SUPPLEMENTARY MACH NUMBER MINIMUM SECTION INSERT Patent Application
Lana M. Couch, inventor (to NASA). Filed 28 Mar. 1980. 12 p.
(NASA-Case-LAR-12532-1; US-Patent-Appl-SN-135040) Avail: NTIS HC A02/MF A01 CSCL 14B

A device which changes the Mach number capability of a wind tunnel without permanently altering the existing nozzle of the tunnel is described. An insert is attached to the wall of the existing nozzle expansion area creating a second minimum section upstream of the model test section. The added insert may be removed without complicated and expensive changes to the basic wind tunnel. In the embodiment illustrated, a removable insert is disposed within the wind tunnel nozzle walls with a portion of the flow boundary layer being bled off from the tunnel via a passageway and tunnel exit to reduce the extent of separated flow normally occuring upstream of the insert contraction section. NASA

N80-22370# California Univ., Livermore. Lawrence Livermore Lab.
DEVICES FOR LAUNCHING 0.1-G PROJECTILES TO 150 KM/S OR MORE TO INITIATE FUSION. PART 2: RAILGUN ACCELERATORS
R. S. Hawke. 6 Jul. 1979. 54 p. refs
(Contract W-7405-eng-48)
(UCRL-52778-Pt-2) Avail: NTIS HC A04/MF A01

The possibility of using a railgun accelerator to launch 0.1-g projectiles to hypervelocities (150 km/s or more) to initiate thermonuclear fusion was studied. The analysis revealed that a railgun with a plasma arc armature is a viable approach to the goal. The railgun's probable performance was calculated and calculations that predict the amount of erosive drag between projectile and rail are presented. The properties of railgun and projectile materials which impose operational limits are delineated. DOE

N80-22371# Defence Research Information Centre, Orpington (England).
A MEANS OF SPECIFYING A STANDARD REFERENCE WET SURFACE FOR MILITARY AIRCRAFT
R. W. Sugg (Mech. Eng. Res. and Develop.) London HMSO Oct. 1979. 15 p. refs
(S/T-Memo-1/79; BR70262) Avail: NTIS HC A02/MF A01

The British civil aircraft requirements (BCAR) method of aircraft certification under wet conditions and the correction of stopping distances to a standard using a friction trailer is studied. The method is also examined for military aircraft. The use of the standard to accident investigation procedures and NATO standards is discussed. A standard military reference wet surface

and a way to correct aircraft performance to the standard are examined.
Author (ESA)

N80-22372# Defence Research Information Centre, Orpington (England).
AN INVESTIGATION INTO MEASURING RUNWAY SURFACE TEXTURE BY THE GREASE PATCH AND OUTFLOW METER METHODS
R. W. Sugg (Mech. Eng. Res. and Develop.) London HMSO Oct. 1979 33 p refs
(S/T-Memo-2/79; BR70263) Avail: NTIS HC A03/MF A01

A measurement of surface texture was used by some organizations as a means of specifying runway friction for stop distance calculations and certification purposes in spite of the conclusion by the American Society for Testing and Materials (ASTM) that it should be discontinued. A method of using surface texture to predict friction of ground vehicles at high speed was studied and it is concluded that within the limits found on runways it has only a very small effect on the prediction. It is recommended that where high speed prediction is necessary a more accurate method is to use equations based on test data. The difficulty in arriving at a single figure for surface texture was demonstrated by showing the variation that can occur along a runway and the large difference in readings between operators.
Author (ESA)

N80-22373# Royal Aircraft Establishment, Farnborough (England).
TESTS ON PNEUMATICALLY POWERED PRECISION FORCE GENERATORS
R. D. Law London HMSO Jan. 1979 35 p refs
(RAE-TM-Aero-3449; RAE-TR-79013; BR68395) Avail: NTIS HC A03/MF A01

The performance of two different types of pneumatic force generators was assessed covering forces up to a 100 kN, with a view to their use in balance calibrations in the RAE 5 m wind tunnel. Tests were performed on the force generators using a precision pneumatic control system, first in conjunction with a static balance test rig, followed by a series of tests to check the overall accuracy of performance against the 'dead-weight' force standard machines. Force generators using a rolling diaphragm seal produce forces to an accuracy within 0.01% of maximum output assuming a linear calibration. Individual values of force output are repeated to 0.003% of maximum output when checked against a simple balance under fixed experimental conditions.
Author (ESA)

N80-22374# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Entwurfs-Aerodynamik.
GRAVIMETRIC INVESTIGATION OF THE PARTICLE NUMBER DENSITY DISTRIBUTION FUNCTION IN THE HIGH SPEED CASCADE WIND TUNNEL FOR LASER-ANEMOMETRY MEASUREMENTS
Harro Bessling and Torsten Hinz (Bundesforschungsanstalt fuer Landwirtsch.) Jan. 1979 39 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-625)
(DFVLR-FB-79-12) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8.50

The conditions in high speed cascade wind tunnels were investigated to determine for the use of laser anemometers in measuring flow velocities. The natural particle number density present in the cascade wind tunnel was found insufficient for the application of the laser method. The effect of adding aerosols to increase the number of particles in the wind tunnel is discussed.
Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-22375*# Rockwell International Corp., Downey, Calif.
SPACE CONSTRUCTION SYSTEM ANALYSIS. PART 2: CONSTRUCTION ANALYSIS Final Report
J. A. Roebuck, P. A. Buck, G. W. Gimlich, H. S. Greenberg, R. J. Hart, J. Indrikis, A. E. LeFever, A. N. Lillenas, C. K. McBaine et al Apr. 1980 776 p
(Contract NAS9-15718)
(NASA-CR-160579; SSD-80-0038-Pt-2) Avail: NTIS HC A99/MF A01 CSCL 22A

The construction methods specific to the end to end construction process for building the ETVP in low Earth orbit, using the space shuttle orbiter as a construction base, are analyzed. The analyses concerned three missions required to build the basic platform. The first mission involved performing the fabrication of beams in space and assembling the beams into a basic structural framework. The second mission was to install the forward support structure and aft support structure, the forward assembly, and a TT&C antenna. The third mission plan was to complete the construction of the platform and activate it to begin operations in low Earth orbit. The integration of the activities for each mission is described along with the construction requirements and construction logic.
A.W.H.

N80-22376*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
SPACE CONSTRUCTION SYSTEM ANALYSIS. PART 2: COST AND PROGRAMMATICS Final Report
F. W. VonFlue and W. Cooper Apr. 1980 76 p
(Contract NAS9-15718)
(NASA-CR-160580; SSD-80-0039-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 22A

Cost and programmatic elements of the space construction systems analysis study are discussed. The programmatic aspects of the ETVP program define a comprehensive plan for the development of a space platform, the construction system, and the space shuttle operations/logistics requirements. The cost analysis identified significant items of cost on ETVP development, ground, and flight segments and detailed the items of space construction equipment and operations.
A.W.H.

N80-22377*# Rockwell International Corp., Downey, Calif.
SPACE CONSTRUCTION SYSTEM ANALYSIS. PART 2: SPACE CONSTRUCTION EXPERIMENTS CONCEPTS Final Report
J. A. Boddy, L. F. Wiley, G. W. Gimlich, H. S. Greenberg, R. J. Hart, A. E. LeFever, A. N. Lillenas, and R. S. Totah Apr. 1980 261 p
(Contract NAS9-15718)
(NASA-CR-160581; SSD-80-0040-Pt-2) Avail: NTIS HC A12/MF A01 CSCL 22A

Technology areas in the orbital assembly of large space structures are addressed. The areas included structures, remotely operated assembly techniques, and control and stabilization. Various large space structure design concepts are reviewed and their construction procedures and requirements are identified.
A.W.H.

N80-22378*# LinCom Corp., Pasadena, Calif.
SPS PHASE CONTROL SYSTEM PERFORMANCE VIA ANALYTICAL SIMULATION
W. C. Lindsey, A. V. Kantak, C. M. Chie, and R. W. D. Booth Mar. 1979 222 p refs
(Contract NAS9-15725)
(NASA-CR-160582; TR-7903-0977) Avail: NTIS HC A10/MF A01 CSCL 22A

A solar power satellite transmission system which incorporates automatic beam forming, steering, and phase control is discussed. The phase control concept centers around the notation of an active retrodirective phased array as a means of pointing the beam to the appropriate spot on Earth. The transmitting antenna (spacetenna) directs the high power beam so that it focuses on the ground-based receiving antenna (rectenna). A combination of analysis and computerized simulation was conducted to determine the far field performance of the reference distribution system, and the beam forming and microwave power generating systems.
A.R.H.

N80-22379*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE ORBIT IMU ALIGNMENT. SINGLE-PRECISION COMPUTATION ERROR

C. R. McClain Mar. 1980 31 p
(NASA-TM-80793; JSC-16468; Rept-80-FM-18) Avail: NTIS HC A03/MF A01 CSCL 22A

The source of computational error in the inertial measurement unit (IMU) onorbit alignment software was investigated. Simulation runs were made on the IBM 360/70 computer with the IMU orbit alignment software coded in hal/s. The results indicate that for small IMU misalignment angles (less than 600 arc seconds), single precision computations in combination with the arc cosine method of eigen rotation angle extraction introduces an additional misalignment error of up to 230 arc seconds per axis. Use of the arc sine method, however, produced negligible misalignment error. As a result of this study, the arc sine method was recommended for use in the IMU onorbit alignment software. R.E.S.

N80-22380*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ONORBIT IMU ALIGNMENT ERROR BUDGET
R. W. Corson Mar. 1980 22 p
(NASA-TM-80794; JSC-16463) Avail: NTIS HC A02/MF A01 CSCL 22A

The Star Tracker, Crew Optical Alignment Sight (COAS), and Inertial Measurement Unit (IMU) from a complex navigation system with a multitude of error sources were combined. A complete list of the system errors is presented. The errors were combined in a rational way to yield an estimate of the IMU alignment accuracy for STS-1. The expected standard deviation in the IMU alignment error for STS-1 type alignments was determined to be 72 arc seconds per axis for star tracker alignments and 188 arc seconds per axis for COAS alignments. These estimates are based on current knowledge of the star tracker, COAS, IMU, and navigation base error specifications, and were partially verified by preliminary Monte Carlo analysis. R.E.S.

N80-22381# Committee on Science and Technology (U. S. House).
UNITED STATES AND SOVIET PROGRESS IN SPACE: SUMMARY DATA THROUGH 1979 AND A FORWARD LOOK
Charles S. Sheldon, II Washington GPO Apr. 1980 100 p Presented to the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., Apr. 1980 Prepared by Congressional Research Service, Library of Congress
(GPO-59-476) Avail: SOD HC

The U.S. and Soviet space program are both large and comprehensive, competing across a broad spectrum of military applications, civil applications, orbital science, and deep space exploration. In recent years, the Soviet program has been the larger of the two, but answering who is ahead involves complex qualitative judgments. A brief history of how far the two major space powers have come in the past 22 years is presented. Specific aspects examined relate to (1) supporting resources for space flight; (2) manned flight comparison; (3) military vs civilian spce activities; (4) space application; and (6) future directions. A.R.H.

N80-22382# European Space Agency, Paris (France).
STRUCTURE AND SEGREGATIONS IN THE SOLIDIFICATION OF COMMERCIAL ALLOYS. STUDY ON THE POSSIBILITIES OF CARRYING OUT TESTS IN SPACELAB
Dieter Neuschuetz, Wigbert Gans, Hubert Coenen, and Juergen Poetschke Jul. 1979 22 p refs Transl. into ENGLISH of "Gefuegeausbildung und Seigerungen beim Erstarren Technischer Legierungen - Studie ueber Untersuchungsmoeglichkeiten im Spacelab", Rept. BMFT-FB-W-77-08 DFVLR, Cologne and Fried. Krupp G.m.b.H., Essen, 5 Oct. 1978 Original report in GERMAN previously announced as X79-72119
(ESA-TT-539-Rev; BMFT-FB-W-77-08-Rev) Avail: NTIS HC A02/MF A01; ZLDI, Munich DM 5,90

The experimental possibilities offered by Spacelab in the domain of the structure and segregation of metals and alloys undergoing solidification are examined. A systematic analysis is made of the influence of weightlessness on the solidification of metallic melts, the preparation of a schedule of conceivable Spacelab experiments, their critical discussion, and the selection and description of the following recommendable experiments: interaction between an advancing solidification front and suspended impurities, coagulation of solid particles in metallic melts, and interfacial diffusion along the solidification front. Author (ESA)

N80-22383# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
INTERSTELLAR FLIGHT: CHALLENGE AND CHANCE
Harry O. Ruppe Apr. 1977 26 p refs
(TUM-LRT-RT-KB-77/15) Avail: NTIS HC A03/MF A01

Information on planets outside the solar system is reviewed in view of possible exploratory missions. Project Daedalus, an interstellar ship based on a nuclear fusion drive is discussed along with other propulsion alternatives. Unmanned interstellar probes are discussed. Author (ESA)

N80-22384# European Space Agency, Paris (France).
BIORACK, A SPACELAB MULTIPURPOSE FACILITY. CELL AND MOLECULAR BIOLOGY: REPORT ON THE TECHNICAL FEASIBILITY STUDY
8 Jan. 1980 45 p
(ESA-DP/ST(80)1) Avail: NTIS HC A03/MF A01

The scientific objectives, performance requirements, design characteristics, auxiliary equipment, crew training and development, and manufacture schedule of the Biorack research facility are analyzed. Fourteen representative candidate experiments on the influence of the space environment on living matter were selected to serve as reference experiments for the technical feasibility and cost study. It is shown that the necessary hardware can be accomodated in a single Spacelab rack. The single components are interchangable and allow a flexible approach to each mission and scientific requirement. The detailed design, development, manufacture, integration and testing of Biorack require approximately 35 months. Author (ESA)

N80-22385# European Space Agency, Paris (France).
THE INTERNATIONAL COMET MISSION: REPORT ON THE PHASE A STUDY
5 Dec. 1979 68 p refs
(ESA-SCI(79)11) Avail: NTIS HC A04/MF A01

The scientific objectives, mission analysis, system design and management, and time schedule for the Halley, Tempel 2 Comet Mission are outlined. Current knowledge concerning the nature and origin of comets, including the nucleus, coma, and interaction with the solar wind is summarized. Instrumentation and payload of the spacecraft and the ESA probe are described along with design features. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-22386*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE ELLIPTIC ANOMALY
Guy Janin (European Space Operations Center, Darmstadt, West Germany) and Victor R. Bond Apr. 1980 15 p refs
(NASA-TM-58228) Avail: NTIS HC A02/MF A01 CSCL 22A

An independent variable different from the time for elliptic orbit integration is used. Such a time transformation provides an analytical step-size regulation along the orbit. An intermediate anomaly (an anomaly intermediate between the eccentric and the true anomaly) is suggested for optimum performances. A particular case of an intermediate anomaly (the elliptic anomaly) is defined, and its relation with the other anomalies is developed. Author

N80-22387# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INCLINED ELLIPTICAL ORBIT AND ASSOCIATED SATELLITE FIELD OF VIEW
Yi-Lee C. Lo 26 Sep. 1979 15 p ref
(Contract F19628-78-C-0002; AF Proj. 1227)
(AD-A080633; TN-1979-62; ESD-TR-79-229) Avail: NTIS HC A02/MF A01 CSCL 22/3

The 12 hour inclined elliptical satellite orbits are studied. The variations of the satellite range and field of view are plotted as a function of time since apogee passage. GRA

N80-22388# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A PHYSICIST'S GUIDE TO J SUB 2
Laurence G. Taff 3 Aug. 1979 41 p
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A080492; TN-1979-50; ESD-TR-79-194) Avail: NTIS HC A03/MF A01 CSCL 22/3

This report presents a first-order discussion of the perturbations in the orbital motion of a satellite about an oblate primary. The approach is non-traditional in that the secular changes in the semi-major axis, eccentricity, inclination, and longitude of the ascending node are all derived directly from the translational and rotational equations of motion. The exactly solvable problem of motion in the primary's equatorial plane is used to obtain the advance of the argument of periastron the consequent change in the time of periastron passage. In addition, a simple discussion of a very restricted three body problem is given to illustrate of the effects of third body perturbations. GRA

N80-22389# European Space Agency, Paris (France).
A SEMINUMERICAL PROCEDURE FOR THE CALCULATION OF GEOSTATIONARY ORBIT PERTURBATIONS CAUSED BY THE SUN AND THE MOON
M. C. Eckstein Aug. 1978 28 p refs Transl. into ENGLISH of "Ein Halbnumerisches Verfahren zur Berechnung der Stoerungen einer Geostationaeren Bahn durch Sonne und Mond", Rept. DLR-IB-552-77/23 DFVLR Oberpfaffenhofen, Sep. 1977 Original report in GERMAN previously announced as X79-73159
(ESA-TT-485-Rev; DLR-IB-552-77/23) Avail: NTIS HC A03/MF A01

A simplified semi-numerical perturbation method was developed for the special case of nearly geostationary satellites for orbits perturbed by the Sun and Moon. Whereas the analytical form of the perturbation terms can be derived from geometrical considerations, the coefficients are determined by multiple Fourier analysis of the perturbation equations. The perturbations are expressed in terms of equinoctial elements to avoid singularities for zero eccentricity and inclination. The expressions generated by the computer program are presented in the form of subprograms. Author (ESA)

N80-22390# European Space Agency, Paris (France).
INVESTIGATIONS TO DETERMINE THE ORBIT OF A EUROPEAN MICROWAVE SATELLITE
E. F. Jochim Aug. 1978 50 p refs Transl. into ENGLISH of "Untersuchung zur Bahnauslegung eines Europaeischen Mikrowellensatelliten", Rept. DLR-IB-552-77/26 DFVLR, Oberpfaffenhofen, Oct. 1977
(ESA-TT-486-Rev; DLR-IB-552-77/26) Avail: NTIS HC A03/MF A01

The fundamental relationships between orbital mechanics and coverage geometry for Earth reconnaissance satellites are presented in table and diagram form. As a preliminary to a mission study for Earth reconnaissance satellites using a microwave sensor (synthetic aperture radar) and an optical sensor, covering an area as far as possible simultaneously, three mission models were investigated for a given orbit height. In the final choice of orbit trade-off decisions must be made by the user. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-22391# Committee on Government Operations (U. S. House).
THE FALL OF NASA'S SKYLAB: THE COMMUNICATIONS PROBLEM
Washington GPO 1980 35 p refs Rept. presented by the Comm. on Govt. Operations to the Comm. of the Whole House on the State of the Union, 96th Congr., 2nd Sess., 11 Mar. 1980
(H-Rept-96-818; GPO-59-262; Rept-14) Avail: US Capitol, House Document Room

The nature, extent, and reasons for the failure of Skylab are reviewed. The internal planning problem and external information dissemination problem faced by NASA when the agency announced that Skylab would fall within the year and that rescue efforts would be dropped are examined in the light of the statutory regulation to provide the widest possible and appropriate disclosure of information. Issues discussed include (1) treatment of the orbital debris hazard; (2) legal responsibility for damage from Skylab; (3) degree of clarity in plans for alerting the public immediately before descent; (4) inadequate information on location and effect of impact; and (5) responses regarding pre-or post-impact retrieval. Findings, conclusions and recommendations are included. Important issues still unresolved are cited. A.R.H.

N80-22392*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems. Div.
SPACE CONSTRUCTION SYSTEM ANALYSIS. PART 2: PLATFORM DEFINITION Final Report
R. J. Hart, H. L. Myers, R. D. Abramson, P. N. DeJong, R. D. Donavan, H. S. Greenberg, J. Indrikis, J. S. Jandrasi, M. Manoff, C. K. McBaine et al Apr. 1980 312 p
(Contract NAS9-15718)
(NASA-CR-160578; SSD-80-0037-Pt-2) Avail: NTIS HC A14/MF A01 CSCL 22B

The top level system requirements are summarized and the accompanying conceptual design for an engineering and technology verification platform (ETVP) system is presented. An encompassing statement of the system objectives which drive the system requirements is presented and the major mission and subsystem requirements are described with emphasis on the advanced communications technology mission payload. The platform design is defined and used as a reference configuration for an end to space construction analyses. The preferred construction methods and processes, the important interactions between the platform design and the construction system design and operation, and the technology development efforts required to support the design and space construction of the ETVP are outlined. A.W.H.

N80-22393# Range Commanders Council, White Sands Missile Range, N. Mex. Safety Group.
RANGE SAFETY TRANSMITTING SYSTEMS, 406-549 MHz BAND
Nov. 1979 114 p Supersedes RSG-307-65
(AD-A080471; RSG-307-79; RSG-307-65) Avail: NTIS HC A06/MF A01 CSCL 17/2

The transmitting systems described herein comprise the basic command destruct transmitting systems in use at the various RCC member and associate member ranges. Sections describing each range's system and configuration and specifications for the various system components are also provided. Users of this document are encouraged to contact the range of interest to determine current configurations and obtain more detailed descriptions. GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-22394*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSONIC PRESSURE AND LOAD DISTRIBUTIONS FOR A GROUP OF SIMULATED LAUNCH VEHICLES
Thomas C. Kelly Apr. 1980 216 p refs
(NASA-TM-80195; L-13365) Avail: NTIS HC A10/MF A01 CSCL 22B

Pressure and load distributions for a related group of simulated launch vehicle configurations are presented. The configurations were selected so that the nose cone and interstage transition flare components were relatively close to one another and subject to mutual interference effects. Tests extended over a Mach number range from 0.40 to 1.20 at angles of attack from 0 deg to about 10 deg. The test Reynolds numbers, based on main stage diameter, were of the order of 0.00000098. E.D.K.

N80-22395# Auburn Univ., Ala. Engineering Experiment Station.
AN ANALYSIS OF THE EFFECTS OF TRANSVERSE VIBRATION ON THE ATTITUDE MOTION OF FREE-FLIGHT ROCKETS Final Report, 15 Dec. 1978 - 15 Dec. 1979
John E. Cochran, Jr., Grant A. Castleberry, and Stephen D. Rew. Redstone Arsenal, La. Army Missile Command. 14 Dec. 1979. 103 p. refs.
(Contract DAAK40-79-C-0030)
(AD-A080606; DRSMI/RL-CR-80-2) Avail: NTIS. HC A06/MF A01. CSCL 19/4

The results of an analysis of the effects of transverse vibration of a spinning, flexible, free-flight rocket during its guidance phase on its attitude motion subsequent to end of guidance (EOG) are presented. Two models of a spinning, flexible, free-flight rocket are described. One is a simple two body model. The other is a 'continuous' model. A physical explanation is given for the way transverse vibration during the guidance phase causes the appearance of a transverse angular rate at EOG. The two body model is used to obtain a simple equation from which estimates of the transverse angular rate can be found. Typical results from the two models are presented and agreement between the results is shown. GRA

N80-22396# European Space Agency, Paris (France).
THE USE OF RAM ROCKETS FOR HIGH ALTITUDE MISSILES
E. Riester. Dec. 1978. 72 p. refs. Transl. into ENGLISH of "Die Anwendung von Staustrahlraketen bei Flugkoerpern in Groesseren Hoehen", Rept. DLR-FB-77-47. DFVLR, Brunswick, Oct. 1977. Original report in GERMAN previously announced as X79-71390.
(ESA-TT-505; DLR-FB-77-47) Avail: NTIS. HC A04/MF A01; DFVLR, Cologne DM 29.60

The conditions under which a ram rocket is superior to a rocket as a power plant for the cruising phase of high altitude supersonic missiles are analyzed and defined. The influence of mission and power plant parameters on the payload of both kinds of engine units is investigated. The advantages of a booster-ram rocket combination over a two-stage rocket are pointed out. This advantage can be increased if the booster acceleration is terminated before the cruise velocity is reached and the ram rocket then continues the acceleration. In that case, the payload attains a maximum at a particular final booster velocity. The working regimes in the ram rocket combustion chamber needed to obtain these optimal conditions are deduced. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-22397*# Boeing Aerospace Co., Seattle, Wash.
TECHNOLOGY REQUIREMENTS FOR FUTURE EARTH-TO-GEOSYNCHRONOUS ORBIT TRANSPORTATION SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY Final Report
Vincent A. Caluori, Robert T. Conrad, and James C. Jenkins. Apr. 1980. 40 p. refs.
(Contract NAS1-15301)
(NASA-CR-3265) Avail: NTIS. HC A03/MF A01. CSCL 22B

Technologies including accelerated technology that are critical to performance and/or provide cost advantages for future space transportation systems are identified. Mission models are scoped and include priority missions, and cargo missions. Summary data, providing primary design concepts and features, are given for the SSTO, HLLV, POTV, and LCOTV vehicles. Significant system costs and total system costs in terms of life cycle costs in both discounted and undiscounted dollars are summarized for each of the vehicles. E.D.K.

N80-22398# European Space Agency, Paris (France).
FEASIBILITY STUDY OF A SPACELAB EXPERIMENTAL PLATFORM (SEAP)
D. Manski and P. Natenbruk. Oct. 1978. 460 p. refs. Transl. into ENGLISH of "Konzept- und Durchfuehrbarkeitsstudie einer Spacelab-Experimenten-Antriebsplattform (SEAP)", Rept. BMFT-FB-W-77-47. DFVLR, Cologne and ERNO Raumfahrttech. G.m.b.H., Bremen, Dec. 1977. Original report in GERMAN previously announced as X79-71394.
(ESA-TT-495; BMFT-FB-W-77-47) Avail: NTIS. HC A20/MF A01; ZLDI, Munich DM 96

The concept of a small Spacelab experiment propulsion platform to accomodate small free-flying shuttle payloads is considered. The orbit maneuvering propulsion system of the platform would economically utilize a monopropellant hydrazine system, while the eight attitude control thrusters of the fully three-axis stabilized system would use cold gas. The energy supply and telemetry/telecommand systems for the platform would be carried onboard, but due to the broad applicability of the design the energy for each payload cannot be provided by the platform. The platform could remain completely stabilized for a longer time in space, execute orbit maneuvers, and then return under its own power to the shuttle. Lightweight construction for the platform as well as highly energetic propulsion systems are unnecessary due to the relatively small specific shuttle costs. Thus it is possible to manufacture the platform cheaply, and more frequent utilization for the many free-flying shuttle experiments of the 80's will be possible. Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-22399# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
STAR PATTERN RECOGNITION AND SPACECRAFT ATTITUDE DETERMINATION, PHASE 1 Interim Report, FY 1978
John L. Junkins, Thomas E. Strikwerda, and L. Glenn Kraige. Oct. 1978. 67 p. refs.
(Contract DAAK70-78-C-0038)
(AD-A080355; VPI-E-79-4; ETL-0173) Avail: NTIS. HC A04/MF A01. CSCL 17/7

A new strapped down system for on board, real time spacecraft attitude determination is discussed. The electro-optical system is capable of sub-ten-arc second precision with no moving parts. The light-sensitive element is an array-type Charged Coupled Device (CCD) having about 2 x 10 to the 5th power silicon pixels. Parallel, high speed analog circuits scan the pixels (row by row) to locate and A/D convert only those pixel response values (about 100 to 200 per scan) about a preset analog threshold. Angular rate measurements from conventional rate gyros are used to estimate motion continuously. Three intermittently communicating microcomputers operate in parallel to perform the functions: (1) star image centroid determination; (2) star pattern identification and discrete attitude estimation (subsets of measured stars are identified as specific cataloged stars); (3) optimal Kalman attitude motion estimation/integration. The system is designed to be self-calibrating with provision for routine updating of interlock angles, gyro bias parameters, and other system calibration parameters. For redundancy and improved precision, two optical ports are

employed. This interim report documents Phase I of a three phase effort to research, develop, and laboratory test the basic concepts of this new system. Included in Phase I is definition, formulation, and test of the basic algorithms, including preliminary implementations and results from a laboratory microcomputer system. GRA

N80-22400# Ocean Electronic Applications, Inc., Key Biscayne, Fla.
AN ADAPTIVE TECHNIQUE FOR THE ACOUSTIC TRANSMISSION OF DIGITAL DATA FROM SUBOCEAN PLATFORMS Final Report, Sep. 1978 - Nov. 1979
Eric J. Softley. Nov. 1979. 88 p. refs.
(Contract DI-14-08-0001-17231)
(PB80-113541; OEA-790201) Avail: NTIS HC A05/MF A01 CSCL 09F

The technology of acoustic telemetry of data from underwater platforms was evaluated. Adaptive adjustment of the acoustic parameters together with the use of digital filtering are the foundation to the approach. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

No abstracts in this category.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-22401# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
ROTATING VALUE FOR VELOCITY COUPLED COMBUSTION RESPONSE MEASUREMENTS Final Scientific Report, 1 Jan. 1977 - 30 Sep. 1979
R. S. Brown and R. C. Waugh. 30 Nov. 1979. 80 p. refs.
(Contract F49620-77-C-0048; AF Proj. 2308)
(AD-A080220; AFOSR-80-0055TR) Avail: NTIS HC A05/MF A01 CSCL 21/8

GSD has investigated the dual valve approach for measuring propellant velocity coupled characteristics. Analytical studies have developed a mathematical analysis of the transient ballistics. The solution of the transient mass, momentum, and energy equations incorporates both linear and nonlinear velocity coupling, as well as pressure coupling, particle damping, flow turning, and nozzle losses in the analysis. The analysis shows that velocity coupling dominates the system response when the two valves operate 180 deg out of the phase. The analytical solutions agree with known solutions for low frequency, bulk mode conditions and for the frequency response characteristics at acoustic resonance. Studies were conducted to explore the limitations of the dual valve approach and to estimate the effects of experimental uncertainties. Parametric studies using the linear velocity coupling model indicated properties of the solution that suggested an approximate method for deriving the response from pressure data using the linear velocity coupling assumption. Parametric studies were also made using the nonlinear velocity coupling model. The results show the interaction of mean velocity magnitude, threshold velocity, and amplitude of the velocity oscillation on the predicted pressure oscillations. A method was developed to derive the velocity response from experimental data for a given threshold velocity, but no method was found for deriving threshold velocity from experimental data. GRA

N80-22402# Princeton Univ., N. J. Plasma Physics Lab.
INTERSTELLAR PROPULSION USING A PELLET STREAM FOR MOMENTUM TRANSFER
C. E. Singer. Oct. 1979. 20 p. refs. Submitted for publication
(Contract EY-76-C-02-3073)
(PPPL-1583) Avail: NTIS HC A08/MF A01

A pellet stream concept for interstellar propulsion is described. Small pellets are accelerated in the solar system and accurately guided to an interstellar probe where they are intercepted and transfer momentum. The propulsion system appears to offer orders of magnitude improvements in terms of engineering simplicity and power requirements over any other known feasible system for transport over interstellar distance in a time comparable to a human lifespan. DOE

N80-22403# European Space Agency, Paris (France).
COMBUSTION OF BORON IN AIRBREATHING ROCKETS: EFFECTS OF THE SECONDARY COMBUSTION CHAMBER
Antonios Boussios. Jul. 1979. 44 p. refs. Transl. into ENGLISH of "Verbrennung von Bor in Luftatmenden Raketenantrieben - Sekundaerbrennkammerprozesse". Rept. DFVLR-FB-78-03 DFVLR, Brunswick, Jan. 1978. Original report in GERMAN previously announced as X79-72110
(ESA-TT-535; DFVLR-FB-78-03) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 20.40

A performance comparison was calculated for a solid propellant containing 50% by weight of boron, and a powder injection where the propellant contained between 50% and 90% by weight of boron. The efficiency of combustion in the secondary chamber of an airbreathing rocket having powder injection was investigated using pressure changes from 2.5 to 11 bar, while keeping the boron percentage constant. A variation keeps the pressure constant and varies the boron percentage in the propellant between 50.5% and 87% by weight of boron. Author (ESA)

N80-22404# European Space Agency, Paris (France).
HOT GAS SIDE HEAT TRANSFER COEFFICIENTS IN HIGH ENERGY ROCKET ENGINES WITH THRUST VARIATIONS
Hans J. Sternfeld. Dec. 1978. 75 p. refs. Transl. into ENGLISH of "Heissgasseitage Waermeuberg@ingszahlen in Hochenergetischen Raketentriebwerken bei Schubvariation". Rept. DLR-FB-77-42 DFVLR, Lampoldshausen, West Germany, Aug. 1977. Original report in GERMAN previously announced as X79-71772
(ESA-TT-502-Rev; DLR-FB-77-42) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 29.90

The hot gas side heat transfer coefficient and heat flux in the combustion chamber and nozzle of oxygen/hydrogen, fluorine/hydrogen, and fluorine/ammonia rocket engines were determined. Thrust variation of the capacitatively cooled experimental rocket engines between 200 N and 1500 N was provided by a combustion chamber pressure variation between 3 bars and 15 bars. The results are presented as correlation equations of the form $St = A \times Re^{(B)} \times Pr^{(C)}$. The local hot gas side heat transfer coefficient was determined from the measured unsteady wall temperature distribution of the engine. The one dimensional analysis was based on the energy conservation law for the heat conductor. The measured temperature field was approximated by approximation functions in space and time. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-22405# Fiat Research Center, Orbassano (Italy).
AN APPROACH TO THE CORRELATION BETWEEN THE DEGREE OF CROSSLINKING OF ORGANIC COATINGS AND THEIR TECHNOLOGICAL PROPERTIES
A. Martina, C. Fulonari, and P. Bianco. 1979 21 p refs Presented at Eurocoatings 79-European Conf. on Paints and Coatings, Rome, 25-26 Jun. 1979
Avail: NTIS HC A02/MF A01

The dependence of some mechanical and chemical/physical properties upon time and temperature variables in the process of curing leading to paint hardening is studied. The quantitative characterization of polymer crosslinking applied to whole paints is discussed. Experiments which determine the degree of crosslinking for a filler used in automobile production by noting the amount of swelling in the solvent, the permeability to water vapor, the tensile strength, and the elongation are described.
Author (ESA)

24 COMPOSITE MATERIALS

Includes laminates.

N80-22406*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF METHOD OF LOADING AND SPECIMEN CONFIGURATION ON COMPRESSIVE STRENGTH OF GRAPHITE/EPOXY COMPOSITE MATERIALS
Ronald K. Clark and W. Barry Lisagor. Apr. 1980 44 p refs (NASA-TM-81796) Avail: NTIS HC A03/MF A01 CSCL 11D

Three test schemes were examined for testing graphite/epoxy (Narmco T300/5208) composite material specimens to failure in compression, including an adaptation of the IITRI 'wedge grip' compression fixture, a face-supported-compression fixture, and an end-loaded-coupon fixture. The effects of specimen size, specimen support arrangement and method of load transfer on compressive behavior of graphite/epoxy were investigated. Compressive stress strain, strength, and modulus data obtained with the three fixtures are presented with evaluations showing the effects of all test parameters, including fiber orientation. The IITRI fixture has the potential to provide good stress/strain data to failure for unidirectional and quasi-isotropic laminates. The face supported fixture was found to be the most desirable for testing [+ or - 45]s laminates.
A.R.H.

N80-22407*# Westinghouse Research and Development Center, Pittsburgh, Pa.
SILICONE MODIFIED RESINS FOR GRAPHITE FIBER LAMINATES Final Report
L. W. Frost and G. M. Bower. 28 Sep. 1979 75 p refs (Contract NAS3-21373)
(NASA-CR-159750; FR-79-9b7-SICOP-R1) Avail: NTIS HC A04/MF A01 CSCL 11D

The development of silicon modified resins for graphite fiber laminates which will prevent the dispersal of graphite fibers when the composites are burned is discussed. Eighty-five silicone modified resins were synthesized and evaluated including unsaturated polyesters, thermosetting methacrylates, epoxies, polyimides, and phenolics. Neat resins were judged in terms of Si content, homogeneity, hardness, Char formation, and thermal stability. Char formation was estimated by thermogravimetry to 1,000 C in air and in N2. Thermal stability was evaluated by isothermal weight loss measurements for 200 hrs in air at three temperatures. Four silicone modified epoxies were selected for evaluation in unidirectional filament wound graphite laminates. Neat samples of these resins had 1,000 C char residues of 25 to 50%. The highest flexural values measured for the laminates were a strength of 140 kpsi and a modulus of 10 Mpsi. The highest interlaminar shear strength was 5.3 kpsi.
M.G.

N80-22408*# Little (Arthur D.), Inc., Cambridge, Mass.
AN ASSESSMENT OF THE RISKS PRESENTED BY CARBON FIBER COMPOSITES RELEASED FROM MOTOR VEHICLE FIRES
Donald B. Rosenfield, Joseph Fiksel, and Ashok S. Kalelkar. Dec. 1979 87 p refs Sponsored in part by DOT
(Contract NAS1-15380)
(NASA-CR-159207; DOT-TSC-RSPA-80-4) Avail: NTIS HC A05/MF A01 CSCL 11D

A risk assessment was conducted to estimate the potential losses through 1993 due to the usage of carbon fiber (CF) composites in U.S. motor vehicles, including automobiles and trucks. Motor vehicle fires could conceivably release minute carbon fibers, which might disperse in the atmosphere, penetrate buildings or enclosures, and cause damaging shorts to electronic equipment. Of a total estimated 310,000 vehicle fires per year in the U.S., approximately 94,000 could potentially release carbon fibers. The average mass released was estimated to be about 20 grams per incident, based on forecasts, of CF usage through 1993 and experimental tests with burning CF composites. A methodology was developed to compute estimated dollar losses, incorporating data on the geographic distribution of potentially vulnerable facilities, as well as the mean CF exposure levels at which various equipment would fail. The results were then statistically aggregated to produce a national risk profile for estimated annual losses in 1993. The expected loss was $5,567 per year (1977 dollars), and the likelihood of exceeding $500,000 in annual losses was estimated to be at most one in ten thousand.
Author

N80-22409*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
NONLINEAR TEMPERATURE DEPENDENT FAILURE ANALYSIS OF FINITE WIDTH COMPOSITE LAMINATES
Aniruddha P. Nagarkar and Carl T. Herakovich. Dec. 1979 123 p
(Grant NsG-1250)
(NASA-CR-162868; VPI-E-79-36) Avail: NTIS HC A06/MF A01 CSCL 11D

A quasi-three dimensional, nonlinear elastic finite element stress analysis of finite width composite laminates including curing stresses is presented. Cross-ply, angle-ply, and two quasi-isotropic graphite/epoxy laminates are studied. Curing stresses are calculated using temperature dependent elastic properties that are input as percent retention curves, and stresses due to mechanical loading in the form of an axial strain are calculated using tangent moduli obtained by Ramberg-Osgood parameters. It is shown that curing stresses and stresses due to tensile loading are significant as edge effects in all types of laminate studies. The tensor polynomial failure criterion is used to predict the initiation of failure. The mode of failure is predicted by examining individual stress contributions to the tensor polynomial.
E.D.K.

N80-22410*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METHOD FOR MAKING PATTERNS FOR RESIN MATRIX COMPOSITES Patent Application
Manuel J. Fontes, inventor (to NASA). Filed 2 Apr. 1980 13 p
(NASA-Case-ARC-11246-1; US-Patent-Appl-SN-136660) Avail: NTIS HC A02/MF A01 CSCL 11D

A method for making laminate patterns for a resin matrix composite structural component is described. A sheet of paper is temporarily adhered to a model of the structural component. A tracer pen is positioned on the paper with an affixed spindle touching the model surface opposite the pen. The pen and spindle are moved along the path that maintains the aforementioned contacts. The resulting line traced on paper is a model constant thickness locus and provides a pattern for a single lamination of resin-impregnated fabric. The steps are repeated to make other patterns and each time the steps are repeated the distance between the tracer and the spindle is changed to correspond to the thickness of a lamination.
NASA

N80-22411*# National Aeronautics and Space Administration, Washington, D. C.
TESTING OF CONTAINERS MADE OF GLASS-FIBER

REINFORCED PLASTIC WITH THE AID OF ACOUSTIC EMISSION ANALYSIS
K. Wolitz, W. Brockmann, and T. Fischer Nov. 1979 11 p refs Transl. into ENGLISH from Neure entwicklungen und Besondere Verahren der ZFP (Berlin), v. 3, 1978 p 789-795 Proceedings of the First European Conf. on Non-Destructive Testing, Mainz, West Germany, 24-28 Apr. 1978 Translation was announced as A79-30328 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75737) Avail: NTIS HC A02/MF A01 CSCL 11D

Acoustic emission analysis as a quasi-nondestructive test method makes it possible to differentiate clearly, in judging the total behavior of fiber-reinforced plastic composites, between critical failure modes (in the case of unidirectional composites fiber fractures) and non-critical failure modes (delamination processes or matrix fractures). A particular advantage is that, for varying pressure demands on the composites, the emitted acoustic pulses can be analyzed with regard to their amplitude distribution. In addition, definite indications as to how the damages occurred can be obtained from the time curves of the emitted acoustic pulses as well as from the particular frequency spectrum. Distinct analogies can be drawn between the various analytical methods with respect to whether the failure modes can be classified as critical or non-critical. A.R.H.

N80-22412*# National Aeronautics and Space Administration, Washington, D. C.
ECONOMICAL PROCESSING OF FIBER-REINFORCED COMPONENTS WITH THERMAL EXPANSION MOLDING
K. Schneider Dec. 1979 34 p Transl. into ENGLISH of conf. Paper-79-011 from DGLR Presented at the Symp. über Wirtschaftliche Herstalltechniken, Cologne, 28 Mar. 1979 Original language document was announced as A79-32307 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3198)
(NASA-TM-75738; Paper-79-011) Avail: NTIS HC A03/MF A01 CSCL 11D

The concept of economical fabrication of fiber-reinforced structural components is illustrated with an example of a typical control surface (aileron). The concept provides for fabricating struts, ribs, and a cover plate as an integral structure in a hardening device and then joining the closure cover plate mechanically. Fabrication of the integral structure is achieved by the 'thermal expansion molding' technique. The hardening pressure is produced by silicone rubber cores which expand under the influence of temperature. Test results are presented for several rubber materials as well as for various structural pieces. The technique is demonstrated extensively for an aileron, consisting of five ribs, struts, and a cover plate. Economically, for a large scale technical production of an aileron, cost savings of twenty-five percent can be realized compared to those for a sheet metal structure. J.M.S.

N80-22413*# National Aeronautics and Space Administration, Washington, D. C.
ACOUSTIC EMISSION FROM COMPOSITE MATERIALS
I. C. Visconti and R. Teti Mar. 1979 31 p refs Transl. into ENGLISH of Conf. paper "Emissioni Acustiche dai Materiali Compositi", 1978 34 p Presented at the 3d Aimeccan. and Assoc. Meridionale di Meccan. Milan, 11-13 May 1978 Original language document was announced as A79-24063 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Napoli Univ.
(Contract NASw-3199)
(NASA-TM-75740) Avail: NTIS HC A03/MF A01 CSCL 11D

The two basic areas where the acoustic emission (AE) technique can be applied are materials research and the evaluation of structural reliability. This experimental method leads to a better understanding of fracture mechanisms and is an NDT technique particularly well suited for the study of propagating cracks. Experiments are described in which acoustic emissions were unambiguously correlated with microstructural fracture mechanisms. The advantages and limitations of the AE technique are noted. A.R.H.

N80-22414# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
EXPERIENCE FROM THE USE OF THE TRANSIENT MOISTURE RESPONSE COMPUTER PROGRAM W8GAIN FOR COMPOSITE MATERIALS
Christer Y. Lundemo Sep. 1979 69 p refs
(Contract FMV-F-K-82223-77-001-21-001)
(FFA-HU-2043) Avail: NTIS HC A04/MF A01

A computer program for transient moisture response of composite materials and the required input data are discussed. Some numerical results are presented and compared with experiments performed on graphite/epoxy T300/5208. The numerical results indicate that the weight-gain due to moisture could be well predicted when the input data are properly measured. There are large spreads in data presented in the literature between different investigations, probably due to different curing processes for the same material. It is suggested that the input data to a moisture response calculation must be measured in order to accurately predict the transient moisture response. Author (ESA)

N80-22415# National Technical Information Service, Springfield, Va.
CARBON AND GRAPHITE. PART 6: GLASSY CARBON. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979
William E. Reed Dec. 1979 74 p Supersedes NTIS/PS-78/1055; NTIS/PS-77/0849; NTIS/PS-76/0690; NTIS/PS-75/618 and NTIS/PS-75/183
(PB80-802424; NTIS/PS-78/1055; NTIS/PS-77/0849; NTIS/PS-76/0690; NTIS/PS-75/618; NTIS/PS-75/183) Avail: NTIS HC $30.00/MF $30.00 CSCL 11B

The research reports describe glassy carbon preparation, structure, properties, composites and alloys with metals. This updated bibliography contains 68 abstracts, 8 of which are new entries to the previous edition. GRA

N80-22416# National Technical Information Service, Springfield, Va.
CARBON AND GRAPHITE. PART 5: CARBON RESEARCH. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979
William E. Reed Dec. 1979 185 p Supersedes NTIS/PS-78/1054; NTIS/PS-77/0848; NTIS/PS-76/0689; NTIS/PS-75/617 and NTIS/PS-75/182
(PB80-802416; NTIS/PS-78/1054; NTIS/PS-77/0848; NTIS/PS-76/0689; NTIS/PS-75/617; NTIS/PS-75/182) Avail: NTIS HC $30.00/MF $30.00 CSCL 11B

The cited studies cover the use, physical and mechanical properties, production, and chemistry of various forms of carbon, such as carbon black, carbon foams, chars, coke, and activated carbon. This updated bibliography contains 180 abstracts, 17 of which are new entries to the previous edition. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-22417 Utah Univ., Salt Lake City.
DIRECT COUPLING OF A DENSE GAS CHROMATOGRAPH TO A MASS SPECTROMETER BY A SUPERSONIC MOLECULAR BEAM INTERFACE Ph.D. Thesis
Lenore Grace Randall Frank 1979 324 p
Avail: Univ. Microfilms Order No. 8008342

The dense gas chromatography/mass spectrometer (DGC/MS) coupling was accomplished by the use of supersonic molecular beam interface. Characteristices of supersonic jets and molecular beams pertinent to the design of such an instrument are discussed. This application of molecular beam formation appears to be unique in its requirements of a large pressure ratio (approximately 10 to the 8th power), low flow rates and

low final pressure. The interface which uses pumping speeds of 2400 l/sec and 12 l/sec in the beam forming chambers, the DGC, the detecting Perkin Elmer Model 270 mass spectrometer, and the improtant temperature control system are described.
Dissert. Abstr.

N80-22418 Northwestern Univ., Evanston, Ill.
VIBRATIONAL ENERGY TRANSFER IN POLYATOMIC GASES Ph.D. Thesis
Gordon Takeo Fujimoto 1979 151 p
Avail: Univ. Microfilms Order No. 8007374

Aspects of vibrational energy transfer in polyatomic gases. Vibrational deactivation (V-T/R) as well as inter and intramolecular collision induced vibrational energy transfer processes (V-V) are included. Emphasis is placed in two areas: vibrational energy processes in cyclopropane; and intramolecular vibrational energy transfer. It is shown that vibrationally excited molecules tend to have a smaller diffusion coefficient than ground state molecules. A treatment is presented which shows that the slower diffusion rate is due to the effect of intermolecular vibrational energy transfer.
Dissert. Abstr.

N80-22419 Illinois Univ. at Urbana-Champaign.
ELECTRON PARAMAGNETIC RESONANCE STUDIES OF HEXAKIS(UREA)METAL(3)IODIDES Ph.D. Thesis
Milton Leverne Cofield 1979 140 p
Avail: Univ. Microfilms Order No. 8009005

Electron paramagnetic resonance spectra were recorded and analyzed for both pure crystals and solution spectra of the trivalent titanium ion in the hexakis(urea)metal(3)iodides. The results of these studies on the single crystals, polycrystalline materials and solution spectra indicate: (1) a high temperature spectrum derived from trivalent titanium ions in sites of orthorhombic symmetry present to the degree of a few percent in pure crystals at all temperatures in the range 2.8-85 K; and (2) a low temperature spectrum consistent with the predictions of the dynamic interaction from which data the range of coupling energy and excited state splittings may be ascertained.
Dissert. Abstr.

N80-22420 Illinois Univ. at Urbana-Champaign.
ROTATIONAL SPECTROSCOPY OF MOLECULAR IONS Ph.D. Thesis
Leonard Edward Duda 1979 143 p
Avail: Univ. Microfilms Order No. 8009019

A method is described for the measurement of microwave rotational transitions of molecular ions. High resolution gas phase spectroscopy of molecualr ions is discussed. These are divided into two groups: (1) direct methods which measure the absorption of radiation by the ion; and (2) indirect methods (such as the technique described here) which measure the change in some other molecular parameter due to the absorption of radiation. Direct measurements of the rotational transitions in CO(+), HCO(+), and N2H(+), by radio astronomers and laboratory measurements are described. Several different types of indirect measurements are also discussed.
Dissert. Abstr.

N80-22421 Oklahoma State Univ., Stillwater.
COAL DERIVED LIQUIDS HYDROTREATMENT-CATALYSTS DEACTIVATION STUDY Ph.D. Thesis
Mohammed Mushtaq Ahmed 1979 375 p
Avail: Univ. Microfilms Order No. 7928189

The hydrotreatment catalysts activity decay while processing coal derived liquids is assessed. Two Co-Mo-alumina catalysts and one Ni-Mo-alumina catalyst were tested. Experimental runs were conducted at 10,400 KPa (1500 psig) for temperatures in the range of 371 C to 454 C using four different coal derived liquids as feedstocks. A semimechanistic model has been developed to represent the data obtained in the study. Carbonaceous depositions seem to be the primary cause for catalyst activity decay. Inorganic depositions are also responsible for catalyst activity decay and can result in permanent deactivation due to a loss in surface area, pore volume, and dilution of the active species on the catalyst surface.
Dissert. Abstr.

N80-22422 Utah Univ., Salt Lake City.
SOME X-RAY DIFFRACTION STUDIES OF HYDROGEN BONDING IN ORGANIC AND INORGANIC COMPOUNDS Ph.D. Thesis
Robert Jules Neustadt 1979 96 p
Avail: Univ. Microfilms Order No. 8008341

Bond shortening which can be interpreted as resulting from preferential stabilization of one resonance hybrid was investigated. This structure was solved by the heavy atom technique. A Patterson map was prepared and was used to locate the position of the bromine atoms in the unit cell of the crystal. This then provided information which resulted in phasing the observed structure factors. This compound has potential crystallographic use. It is an acidic phenol and in this sense similar to 2,4,6-trinitrophenol (picric acid). It forms easily crystallizable adducts with amines and at the same time introduces a heavy atom, which simplifies the structure determination.
Dissert. Abstr.

N80-22423 Pennsylvania State Univ., University Park.
FACTORS INFLUENCING ROTATIONAL RAMAN INTENSITIES AT HIGH TEMPERATURE Ph.D. Thesis
Chamnong Asawaroengchai 1979 121 p
Avail: Univ. Microfilms Order No. 8005971

The method of analysis of measured rotational Raman peak-height intensities to obtain the rotational temperature of the scattering diatomic molecules is presented. A computer program is presented which determines rotational temperature from the measured peak-height intensities of rotational Raman transitions. Corrections by factors f(J) and eta(J) are included. The values of f(J) are calculated from the value of X of the scattering molecules. The value of eta(J) is determined by assuming the vibrational temperature and rotational temperature are the same, and the calculation of the temperature is carried out by an iterative process until the rotational temperature and vibrational temperature agree within 0.01 K.
Dissert. Abstr.

N80-22424 Illinois Univ. at Urbana-Champaign.
LOW ENERGY SCATTERING IN AN ARGON AND METHANE SYSTEM Ph.D. Thesis
Leslie Neil Smith 1979 178 p
Avail: Univ. Microfilms Order No. 8009174

The theory for an argon-methane scattering system and several calculations in both the close coupling and coupled states schemes are presented. The problem is reduced to the irreducible A, E, and T representations and calculations in all these symmetries are performed and combined. Methane is treated as a rigid rotor. A total of two interaction potentials are employed and both contain an angle dependent term. Compound state resonances in this system are characterized. Close coupling and coupled states cross sections are compared in calculations with both interaction potential and in the A and E representations. Coupled states cross sections in all three representations are presented over a range of energies from 25-90 meV.
Dissert. Abstr.

N80-22425 Oklahoma Univ., Oklahoma City.
DEVELOPMENT OF SMALL SCALE LIQUID IGNITION TESTS Ph.D. Thesis
Kou-Chu Yiin 1979 181 p
Avail: Univ. Microfilms Order No. 8008667

An apparatus and an experimental procedure for small scale liquid flammability tests were developed. The N-tridecane, n-tetradecane and four mixtures of normal paraffins, from n-C12H26 to n-C15H32 were used to demonstrate the feasibility and effectiveness of the test apparatus. Both piloted and unpiloted ignition tests were conducted by using external radiant energy (heating source) supplied by tungsten filament lamps. The results indicate that the ignition times are primarily functions of incident irradiance (energy per unit area per unit time) for both piloted and unpiloted ignitions. As has been observed previously for the ignition of solids, the reciprocal of the ignition time for liquids also varies linearly with the incident irradiance; the minimum incident irradiance below which ignition did not occur (in infinite time) was found to be 0.06 cal/sq cm/sec for liquid n-tridecane and 0.078 cal/sq cm/sec for liquid n-tetradecane respectively. Other significant results are reported.
Dissert. Abstr.

N80-22426 California Univ., Los Angeles.
THE ELECTROCHEMISTRY OF MOLTEN LITHIUM CHLORATE AND ITS POSSIBLE USE WITH LITHIUM IN A BATTERY Ph.D. Thesis
Su-Chee Simon Wang 1979 117 p
Avail: Univ. Microfilms Order No. 8008551

A rotating disk was used to investigate anodic and cathodic reactions occurring at positive electrodes in molten lithium chlorate cells. Three anodic plateaus, 2.9V, 3.4V, and 4.6V and one cathodic plateau at around 2.5V were observed for a Ni rotating disk. For a Pt rotating disk, three different anodic plateaus, at 3.4V, 4.2V, and 4.6V were observed while the cathodic curves were about the same as those obtained for Ni. Chemical analysis for Cl(-) ions and O(-2) ions was carried out. After anodic or cathodic polarization of a Ni or Pt electrode at controlled current or potential, the LiClO3 electrolyte was sampled, dissolved in water, and analyzed. Gas evolving from the positive electrode during anodic operation was also analyzed. Dissert. Abstr.

N80-22427 Illinois Univ. at Urbana-Champaign.
EFFECT OF GRAVITY ON LEAN LIMIT FLAME PROPAGATION Ph.D. Thesis
David Lee Reuss 1979 332 p
Avail: Univ. Microfilms Order No. 8009141

A literature survey was conducted in order to learn what has been accomplished in the past 100 years in determining and understanding the occurrence of flammability limits. The knowledge acquired in this survey was used to determine the best test procedure for studying the effect of gravity on lean flammability limits and to determine how the occurrence of the limit is modeled. Upward and downward lean limit methane-air flames were studied and photographed in a 50 mm diameter tube open at the ignition end and closed at the other. A laser Doppler anemometer was constructed and used to measure the axial velocity profiles of an upward propagating lean limit flame and of flames during extinction in sublean limit mixtures. Diffuse illumination holographic interferograms of an upward propagating lean limit flame and a post extinction hot bubble were made. Observations are reported. Dissert. Abstr.

N80-22428 Pennsylvania State Univ., University Park.
PREDICTION OF THERMOPHYSICAL PROPERTIES OF PETROLEUM FRACTIONS Ph.D. Thesis
Mohammad-Reza Riazi 1979 243 p
Avail: Univ. Microfilms Order No. 8006043

Thermophysical properties of a petroleum fraction were predicted using properties of pure compounds together with a molecular type analysis of the fraction. For light (molecular weight (M) < 200) olefin free fractions, a n-alkane, n-alkylcyclopentane, n-alkylbenzene(NP-NN-NA) model was developed which describes the structure of the fraction. Only boiling point as a characteristic parameter was needed to choose a pure compound from each hydrocarbon group. Molecular weight, critical temperature, critical pressure, critical volume, liquid molar volume, density, refractive index, heat of vaporization, and ideal gas heat capacity of petroleum fractions and pure compounds were simply correlated to the absolute boiling point and specific gravity at 60/60 F. When tested against data on pure compounds and petroleum fractions, these correlations were comparable with or superior to those obtained from previously recommended methods. Dissert. Abstr.

N80-22429 Delaware Univ., Newark.
THE APPLICATION OF OPTIMAL ESTIMATION TO THE REAL TIME DIGITAL FILTERING OF ELECTROCHEMICAL WAVEFORMS Ph.D. Thesis
Paul Frederick Seelig 1978 321 p
Avail: Univ. Microfilms Order No. 7816912

An optimal recursive estimation technique known as the Kalman filter was implemented and evaluated for the real time (RT) analysis of voltammetric data. This RT technique was critically compared to non real time (NRT) and pseudo real time (PRT) algorithms for the analysis of data arising from four widely used electrometric methods of trace analysis. For synthetic data, synthetic aqueous analytes, and natural aqueous samples (sea water and tap water) a variety of NRT, RT, and PRT numerical algorithms were critically compared on the basis of the accuracy and precision of the concentration computed from the electrochemical current responses. It was found that in moderate to high signal to noise conditions (S/N > 5) PRT algorithms yielded results comparable (at the 95 percent confidence level) to the NRT and RT Kalman filter methods. Other significant results are reported. Dissert. Abstr.

N80-22430*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ULTRALEAN COMBUSTION IN GENERAL AVIATION PISTON ENGINES
J. E. Chirivella 1 Dec. 1979 246 p refs
(Contract NAS7-100)
(NASA-CR-163001; JPL-Pub-79-75) Avail: NTIS
HC A11/MF A01 CSCL 21B

The role of ultralean combustion in achieving fuel economy in general aviation piston engines was investigated. The aircraft internal combustion engine was reviewed with regard to general aviation requirements, engine thermodynamics and systems. Factors affecting fuel economy such as those connected with an ideal leanout to near the gasoline lean flammability limit (ultralean operation) were analyzed. A Lycoming T10-541E engine was tested in that program (both in the test cell and in flight). Test results indicate that hydrogen addition is not necessary to operate the engine ultralean. A 17 percent improvement in fuel economy was demonstrated in flight with the Beechcraft Duke B60 by simply leaning the engine at constant cruiser power and adjusting the ignition for best timing. No detonation was encountered, and a 25,000 ft ceiling was available. Engine roughness was shown to be the limiting factor in the leanout. R.C.T.

N80-22431*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DETONATION-FLAME ARRESTER DEVICES FOR GASOLINE CARGO VAPOR RECOVERY SYSTEMS Final Report
R. A. Bjorklund and P. R. Ryason Mar. 1980 245 p refs
Sponsored by NASA
(Contract Z70099-7-74328-H)
(NASA-CR-163009; JPL-Pub-80-18) Avail: NTIS
HC A11/MF A01 CSCL 21B

Empirical data on the deflagration-to-detonation run-up distance for flowing mixtures of gasoline and air in 15.2-cm-(6.0-in.-) diameter piping simulating a vapor recovery system are presented. The quenching capability of eight selected flame control devices subjected to repeated stable detonations was evaluated. The successful detonation-flame arresters were: (1) spiral-wound, crimped aluminum ribbon, (2) foamed nickel-chrome metal, (3) vertically packed bed of aluminum Ballast rings, and (4) water-trap or hydraulic back-pressure valve. Installation configurations for two of the more applicable arresters, the spiral-wound, crimped stainless-steel ribbon and the vertically packed bed of aluminum Ballast rings, were further optimized by a series of parametric tests. The final configuration of these two arresters was demonstrated with repeated detonation tests at conditions that simulated vapor recovery system operation. On these tests, the combustible mixture of gasoline and air continued to flow through the piping for periods up to 120 seconds after the initial detonation had been arrested. There was no indication of continuous burning or reignition occurring on either side of the test arresters. A.R.H.

N80-22432*# Little (Arthur D.), Inc., Cambridge, Mass.
ANALYSIS OF NASA JP-4 FIRE TESTS DATA AND DEVELOPMENT OF A SIMPLE FIRE MODEL
Phani Raj Apr. 1980 58 p refs
(Contract NAS1-15380)
(NASA-CR-159209; Rept-81857-6) Avail: NTIS
HC A04/MF A01 CSCL 21B

The temperature, velocity and species concentration data obtained during the NASA fire tests (3m, 7.5m and 15m diameter JP-4 fires) were analyzed. Utilizing the data analysis, a sample theoretical model was formulated to predict the temperature and velocity profiles in JP-4 fires. The theoretical model, which does not take into account the detailed chemistry of combustion, is capable of predicting the extent of necking of the fire near its base. Author

N80-22433# IBM Watson Research Center, Yorktown Heights, N.Y.
THE REACTION OF ACETYLENE WITH Ni(100) AND Ni (110) SURFACES AT ROOM TEMPERATURE
J. E. Demuth 1 Oct. 1979 32 p refs Submitted for publication
(Contract N00014-77-C-0366; NR Proj 056-123)

(AD-A078630; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/4

Ultraviolet photoemission spectroscopy using Hv = 21.2eV and filtered 40.8eV radiation as well as temperature programmed thermal desorption spectroscopy are used to investigate the chemical reaction of acetylene with Ni(100) and Ni(110) surfaces at room temperature. Striking crystallographic effects and several coexisting phases are observed and found to be coverage and temperature dependent. A methodology is described to predict the relative energy levels for a variety of adsorbed hydrocarbon fragments on Ni surfaces. Such levels together with the thermal desorption spectra are used to identify the observed species. In particular, CH and CCH species are isolated on Ni(100) and Ni(110) surfaces, respectively via low temperature adsorption and subsequent pulsed sample warming experiments. The room temperature adsorption phases are deduced using these ionization levels together with those of chemisorbed acetylene, atomic hydrogen and carbon. At room temperature on Ni(100) H, C, CH and C2H2 species form together below 2 Langmuirs exposure while CH species form thereafter, up to saturation exposure of 10 Langmuirs. On Ni(110), H and CCH species form below 1.5 Langmuirs exposure followed by the formation of CH2 and likely CH species. The relative stabilities of these species at elevated temperatures is: C2H2-C2H-CH-CH2. A model for the bonding of acetylene and its reaction to form CCH species on Ni(110) is proposed. GRA

N80-22434# Army Materials and Mechanics Research Center, Watertown, Mass. Polymer Research Div.

LIQUID CHROMATOGRAPHIC ANALYSIS OF HYDRAULIC FLUIDS Final Report

Gary L. Hagnauer and Beverley M. Bowse Nov. 1979 48 p
(AD-A080386; AMMRC-TR-79-57) Avail: NTIS HC A03/MF A01 CSCL 07/4

High performance liquid chromatography (HPLC) is a versatile analytical technique for the separation and detection of components in complex chemical mixtures. HPLC test methods are developed to fingerprint the chemical compositions and to quantitatively analyze specific components in hydraulic fluids. Petroleum-base and synthetic hydrocarbon-base hydraulic fluids conforming to existing military specifications and used by the U.S. Army Materiel Development and Readiness Command are considered in this report. Detailed methods and test procedures are developed for the analysis of a MIL-H-6083D hydraulic fluid. The precision and accuracy of each method is evaluated. Suggestions are made regarding the implementation of the methods in military specifications, in field testing, and in the development of hydraulic fluids. GRA

N80-22435# Texas A&M Univ., College Station. Dept. of Chemistry.

SOME NEW DEVELOPMENTS IN CHEMISTRY OF METALLOPHTHALOCYANINES Interim Report

Minoru Tsutsui (Shimane Univ., Matsue, Japan) and Kuninobu Kasuga Jan. 1980 53 p refs
(Contract N00014-75-C-0417)
(AD-A080205; TR-31) Avail: NTIS HC A04/MF A01 CSCL 07/3

Like many of the great moments in science, the chemistry of phthalocyanine and metallophthalocyanines began by an accidental discovery. In 1907, Braun and Tcherniac heated an alcoholic solution of o-cyanobenzamide in order to study some of its properties. After cooling, small amounts of a blue compound precipitated. The precipitate turned out to be phthalocyanine. This was the first time phthalocyanine was synthesized. In 1927, de Diesbach and von der Weid attempted to prepare o-xylenedicyanide from a mixture of o-dibromobenzene and cuprous cyanide by heating in pyridine at 200 C. However, they obtained a blue compound containing copper. Later this blue compound was identified as copper(2)-phthalocyanine. Thus, the preparation of the first metallophthalocyanine was also an accident. In the early 1930's, Linstead and his co-workers synthesized many metallophthalocyanines and reported that a phthalocyanine ligand consists of four units of isoindole and has a highly conjugated system. In 1933, for the first time, he used the term 'phthalocyanine', which comes from the Greek naphtha (rock oil) and cyanide (dark blue). Later Robertson et al., elucidated the structures of phthalocyanine and nickel(2), copper(2), and platinum(2) phthalocyanines using single crystal X-ray diffraction analysis. Since that time, many studies have been done on semiconductivity, photoconductivity, photochemical reactivity, photosynthetic activity, luminescence, and fluorescence which are based on the highly conjugated system of phthalocyanine and metallophthalocyanines. GRA

N80-22436# Texas A&M Univ., College Station. Dept. of Chemistry.

ELECTRON TRANSFER REACTIVITY ON NOVEL DIRHENIUM AND DIRHODIUM TETRAAZAANNULENE COMPLEXES Interim Report

Minoru Tsutsui, Rex Bobsein, K. M. Kadish, L. A. Bottomley, and D. Schaeper Jan. 1980 15 p refs
(Contract N00014-75-C-0417; NR Proj. 053-559)
(AD-A080181; TR-32) Avail: NTIS HC A02/MF A01 CSCL 07/4

The electron transfer reactivities of dirhenium and dirhodium carbonyl complexes of the macrocyclic ligans, 5,7,12,14-tetramethyldibenz o (b,i)(1,4,8,11) tetraaaz (14) annulene, (TMTAA), dibezo (b, i) (1,4,8,11) tetraaza (14) annulene, (TAA), and tetraphenylporphyrin, (TPP) were investigated by cyclic voltammetry and differential pulse polarography. Potentials are reported for the electrochemcial generation of pi cation and pi anion radicals of these complexes in the solvents dichloromethane and dimethylformamide. The potential differences between the pi radical reactions of the metallomacrocyclic complexes were compared to the potential differences of the pi radical reactions of the free macrocycles. GRA

N80-22437# Colorado Univ. at Boulder. Dept. of Chemistry.

STUDIES OF NEW CHEMICAL ANALYSIS TECHNIQUES Final Report, 1 Sep. 1975 - 30 Sep. 1979

Robert E. Sievers 1979 11 p refs
(Contract F44620-76-C-0031)
(AD-A080203; AFOSR-80-0020TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

Results are reported from a trace level analysis research program enveloping volatile metal chelate chemistry, gas chromatography, and environmental analysis. The overall thrust of the program was to develop sensitive and selective analytical techniques for a variety of samples. The methods employed involved various combinations of sample collection and concentration, derivatization and separation, and, finally, detection. Examples of the measurements considered include molybdenum and aluminum by a metal chelate derivatization/atomic absorption spectrophotometric technique, polynuclear aromatic hydrocarbon concentration on open-pore polyurethane (OPP) followed by liquid chromatographic analysis, herbicide separation on OPP columns, and nitrate ion and nitrogen oxide analysis by a derivatization/electron capture technique. A metal chelate containing material has been synthesized for use as a selective sorbent. The usefulness of the electron capture detector has been advanced by the addition of nitrous oxide to the carrier gas. With this technique, Selective Electron Capture Sensitization (SECS), additional sensitivity has been found for many compounds which normally are not detected by the electron capture detector. GRA

N80-22438# Defence Research Establishment Suffield, Ralston (Alberta).

PHYSICAL PROPERTIES OF A THICKENED SOLVENT

C. L. Chenier and G. A. Hill Jan. 1979 57 p
(AD-A064306; DRES-TN-435) Avail: NTIS HC A04/MF A01 CSCL 07/3

The density, vapor pressure, surface tension and viscosity of thickened Dowanol, DPM, were measured experimentally according to standard techniques. Each of the techniques is explained in detail and a brief summary of the theory is also presented. A new parameter called the 'dissolved density' was defined which promises to allow differentiation between thickening polymers. The addition of an acrylate polymer had no effect on the surface tension or vapor pressure of the solvent. The effect of thickener concentration on viscosity was determined over a range of shear rates where the thickened solutions were found to follow the power-law fluid model. GRA

N80-22439# Defence Research Establishment, Ottawa (Ontario).

ELECTROCATALYSIS STUDIES OF TRANSITION-METAL SILICIDES

David T. Fouchard and Christopher L. Gardner Dec. 1978 36 p refs In ENGLISH; FRENCH summary
(AD-A064205; DREO-793) Avail: NTIS HC A03/MF A01 CSCL 07/4

A series of transition metal silicides were evaluated as catalysts for the anodic oxidation of hydrogen in acid medium. Overall levels of activity were very low and relative levels of activity were very similar for all the compounds except CR3 SI which showed an activity roughly three times the others. Each of the compounds formed highly irreversible passive films when polarized anodically making them quite stable in acid medium. The usefulness of the compounds as catalyst support materials, however, is hindered by difficulties in obtaining efficient electrodeposition of active metals onto the compounds. The study also revealed that erroneous results can easily be obtained in electrocatalysis studies if care is not taken to exclude all traces of platinum from the test cell as platinum was found to migrate about the cell when platinum counter electrodes were used.
GRA

N80-22440# Naval Research Lab., Washington, D. C. Combustion and Fuels Branch.
THE EFFECT OF HALON 1301 FIRE EXTINGUISHING AGENT ON THE RESPONSE OF COMBUSTIBLE GAS INDICATORS Final Report
W. A. Affens 18 Jan. 1980 20 p refs
(NRL Proj. C05-19)
(AD-A080529; AD-E000363; NRL-MR-4150) Avail: NTIS HC A02/MF A01 CSCL 13/12

A combustible gas indicator (CGI) was tested in combustible vapor-air mixtures with and without the presence of halon 1301 vapors. CGI response to hydrocarbon vapors was reduced on the average of about 30 percent in the presence of halon 1301 vapors at fire extinguishment concentrations for hydrocarbon type fires (3.7 percent) and about 45 percent at inerting concentrations (7.4 percent). Some filament deterioration was noted in filaments which were exposed to halon vapors. Sensitivity loss for these filaments averaged about 9 percent.
GRA

N80-22441# IIT Research Inst., Chicago, Ill.
IDENTIFICATION OF REACTION INTERMEDIATES IN COMBUSTION REACTIONS INVOLVING HALOCARBON FLAME RETARDANTS Final Report
Alan Snelson and R. Butler 31 Dec. 1979 77 p refs
(Contract DAAG29-76-C-0038)
(AD-A080618; IITRI-C6372; ARO-14053.1-CX) Avail: NTIS HC A05/MF A01 CSCL 21/2

The pyrolysis of some perfluoro organic iodides have been used to prepare free radical species, of possible importance in flame inhibition chemistry, for infrared matrix isolation studies. The species CF3O2, C2F5, n-C3F7 and iso-C3F7 were identified and vibrational assignments made. For CF3O2, oxygen isotope studies were used to help in the vibrational assignments. Papers for publication have been prepared describing this work and are included in this report. Normal coordinate analyses for CF3O2 and C2F5 are currently in progress and will be submitted for publication in 1980. Preliminary data from these calculations strongly support the initial vibrational assignments made for CF3O2 and C2F5. Attempts were made to identify the species CF3O, t-C4F9, C6F5 and C6F5O2. Some evidence for the existence of CF3O was found but was not definitive. The results of these latter studies are described in the first section of this report.
GRA

N80-22442# IRT Corp., San Diego, Calif.
TRANSITION STATE THEORY AND THE COMPENSATION EFFECT IN CHEMICAL KINETICS
Robert L. Palmer 4 Feb. 1980 12 p refs Submitted for publication
(Contract N00014-77-C-0255; NR Proj. 056-527)
(AD-A080988; IRT-8162-004; TR-8) Avail: NTIS HC A02/MF A01 CSCL 07/4

Detailed balancing is applied to transition state theory with the result that the necessity of a compensation law relating the pre-exponential factor and the energy in chemical kinetics is clearly established. It is pointed out that the correct compensation behavior is achieved if the volume change that enters into the Clapeyron equation is taken to mean the volume change in phase space.
GRA

N80-22443# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
MOLECULAR BEAM SURFACE SCATTERING: THE DECOMPOSITION OF AMMONIA ON SINGLE CRYSTAL PLATINUM SURFACES M.S. Thesis
Jonathan Daniel Sokol Aug. 1979 107 p refs
(Contract W-7405-eng-48)
(LBL-9712) Avail: NTIS HC A06/MF A01

The interaction of ammonia with single crystal platinum surfaces is discussed. The adsorption/desorption processes, as well as the decomposition reaction using molecular beam scattering, and the reaction mechanisms and kinetics are included. Also described is a method for measuring system pumping speeds using molecular beams.
DOE

N80-22444# Sandia Labs., Livermore, Calif.
FUNDAMENTAL COMBUSTION AND DIAGNOSTICS RESEARCH AT SANDIA Progress Report, Apr. - Jun. 1979
M. A. Businow, ed. Aug. 1979 27 p refs
(Contracts EY-76-C-04-0789)
(SAND-79-8256) Avail: NTIS HC A03/MF A01

Several projects addressing aspects of combustion physics are briefly described. A quasi-classical trajectory, quantum mechanical threshold method is in excellent agreement with experiment for the H + O2 yields OH + O reaction. A theoretical model is developed for the selective reduction of NO by NH3. An experimental study of NH3-O2 flames is described. Probability of ignition and extinction of a CH4/air diffusion flame by a laser spark was measured vs spark-flame distance. Work on correlation functions in evaluating the normal mode approximation in combustion is reported. Data are presented which show that the j-dependence of Raman linewidths for N2 Q-branch is significant at both room and high temperatures for high J values. The coherent anti-Stokes Raman spectra of N2 hot bands were measured and found to fit the calculated spectrum. Stokes scattering from N2 was studied in different regions of a CH4 air flame.
DOE

N80-22445# California Univ., Berkeley. Lawrence Berkeley Lab.
FLAME STRUCTURE MEASUREMENT OF POLYMER DIFFUSION FLAMES
W. J. Pitz, W. J. Brown, and R. F. Sawyer Oct. 1979 29 p refs Presented at Combustion Inst. Western States Sect. Meeting, Berkeley, Calif., 15 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9567; CONF-791048-3) Avail: NTIS HC A03/MF A01

Flame structure measurements of polyethylene/opposed flow diffusion flames, obtained under steady-state conditions as extinction was approached, are discussed. The CO/CO2 ratio increases slightly as extinction is approached. Carbon monoxide significantly penetrates the luminous flame zone which is a departure from the flame sheet approximation. The composition profiles are similar within experimental error, thus justifying the use of the similarity assumption for modeling studies in the opposed flow configuration.
DOE

N80-22446# California Univ., Berkeley. Lawrence Berkeley Lab. Biology and Medicine Div.
INFORMATION ON MEMBRANES DERIVED FROM ELECTRICAL SURFACE CHARGE MEASUREMENTS
Tom S. Tenforde May 1979 11 p
(Contract W-7405-eng-48)
(LBL-10057) Avail: NTIS HC A02/MF A01

The characterization of changes that occur in the surface properties of cultured fibroblastic cells when they are transformed by an oncogenic virus was studied, specifically, those changes in cell surface macromoles and the cellular biochemical mechanisms which create these changes. The microscope method of electrophoresis was used. The results indicate that transformation leads to a reduced content of acidic glycoproteins at the surface of mouse fibroblasts, and that this biochemial alteration may be a consequence of a depression in the intracellular level of cAMP.
DOE

N80-22447# California Univ., Berkeley. Lawrence Berkeley Lab.
VIBRATIONAL ENERGY TRANSFER IN GAS PHASE WATER AND AMMONIA Ph.D. Thesis
F. E. Hovis, Jr. Sep. 1979 118 p refs
(Contract W-7405-eng-48)
(LBL-9955) Avail: NTIS HC A06/MF A01

The vibration to translation and rotation relaxation rate for NH3 was studied from 198 K to 398 K by the method of laser excited vibrational fluorescence. The self-deactivation rate constant decreases were calculated and compared to the rate constants for deactivation by He, Ar, N2, and O2. The temperature dependence of the deactivation is discussed. DOE

N80-22448# Los Alamos Scientific Lab., N. Mex.
FLOWING AFTERFLOW SPECTROSCOPY: AN ULTRASENSITIVE PROBE INTO SOLID-PHASE DECOMPOSITION KINETICS
G. W. Taylor and G. H. Andrews, Jr. 1979 30 p refs Presented at 5th Symp. on Chem. Probl. Connected with the Stability of Explosives, Bostod, Sweden, May 1979
(Contract W-7405-eng-36)
(LA-UR-79-3257; CONF-7905125-1) Avail: NTIS HC A03/MF A01

The thermal decomposition kinetics of high explosives are examined and a method to test the thermal stability of explosives is proposed. The flowing afterglow method which utilizes small explosive samples and an ultrasensitive analytical approach is the method discussed. The technique is described and efforts to elucidate the low-temperature kinetics of trinitrotriaminobenzene and nitroguanidine are discussed. DOE

N80-22449# European Space Agency, Paris (France).
STABILIZATION OF FLAME IN A RAMJET COMBUSTOR BY MEANS OF A PILOT GAS GENERATOR
Egbert Riester Dec. 1978 61 p refs Transl. into ENGLISH of "Flammenstabilisierung in Staustrahl-Brennkammern durch einen Pilot-Gasgenerator". Rept. DLR-FB-77-54 DFVLR, Brunswick, Nov. 1977 Original report in GERMAN previously announced as X79-72011
(ESA-TT-511-Rev; DLR-FB-77-54) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 28.20

The use of a pilot gas generator to shift the flameout limit in a ramjet combustion chamber toward a higher excess of air was investigated. Flame stabilization in ramjet combustion chambers is difficult, because of the high combustion-chamber inlet velocity and the low temperatures. Often, the flameout limit for lean mixtures is only slightly removed from the stoichiometric mixing ratio. The velocity curves were determined in a typical ramjet combustion chamber system. The lean-mixture flameout limits were measured, first without and then with a pilot gas generator, and compared. A small stoichiometrically-operating propane-oxygen burner is used as the pilot gas generator. Author (ESA)

N80-22450# European Space Agency, Paris (France).
INFLUENCE OF GRAVITY ON CHEMICAL VAPOR DEPOSITION PROCESSES
Georg Wahl, Julius J. Nickl, and Wolfgang Just Jan. 1980 70 p refs Transl. into ENGLISH of "Einfluesse der Schwerkraft bei der Beschichtung nach dem CVD-Verfahren". Rept. BMFT-FB-W-77-41 DFVLR, Cologne and Brown, Boveri und Cie, A.G. Heidelberg
(ESA-TT-544; BMFT-FB-W-77-41) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 17.45

The effect of gravity on the chemical vapor deposition process is described as twofold: it affects the convection in the stationary case, and it creates instabilities. The hydrodynamic theory of chemical vapor deposition process is described. Theoretical results are compared with deposition experiments (SiO2, Si3N4 deposition) and with fume experiments. In order to investigate experimentally the influence of gravity on the crystal structure, Si epitaxy experiments are proposed. The experimental arrangement necessary for these experiments is described and tested for TiN deposition experiments. Author (ESA)

N80-22451# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany)
LIQUID-VAPOR SATURATION DENSITY DATA
Dirk Rathmann, Daniel A. Sullivan, and Philip A. Thompson Mar. 1979 75 p
(MPIS-8/1979) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Karlsruhe, West Germany DM 14.10

Tables are presented for 72 gases and liquids. The values of the tables and the first critical data set correspond to the first cited reference on each page. The second critical data set refers to the authors' given as second (and third) citation. Most of the values given in the tables were reduced using the first critical data set. Author (ESA)

N80-22452# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
FUNDAMENTAL STUDIES OF DESALINATION BY FREEZING Final Report
Kenneth A. Smith and Adel F. Sarofim Jan. 1979 75 p refs
(Contract DI-14-20-3268)
(PB80-124316; W80-02155; OWRT-3268(1)) Avail: NTIS HC A04/MF A01 CSCL 07D

Studies on a pilot-scale crystallizer were used to determine the subcooling of the brine solution, the particle size distribution and the permeability of the ice product in a 6% by weight brine solution for various ice production rates, agitation power, and ice concentration. These data were used to generate ice crystal growth rates and nucleation rates to compare with generalized correlations developed for ice growth and nucleation. By application of population balance mathematics to a well-stirred continuous crystallizer, a quantitative relationship between ice particle size and ice production rate was developed. The growth kinetic parameters needed for application of the resulting relations were determined from a systematic study of the mass transfer to discs, spheres, and cylinders suspended in a turbulent agitated fluid. The results could be represented by a single correlation between the Sherwood number, the Schmidt number, and the Kolmogoroff power number, for a range of impeller designs and types, vessel aspect ratios, and impeller-to-vessel dimensions. Correlations for ice nucleation kinetics were determined from batch crystallizer studies for a wide range of salt concentration, solution subcooling, and agitation power. GRA

N80-22453# National Bureau of Standards, Washington, D.C.
JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS, VOLUME 84, NO. 4 Bimonthly Report, Jul. - Aug. 1979
1979 77 p refs
(PB80-124548; LC-62-37059) Avail: NTIS HC A05/MF A01 CSCL 07D

A series of papers are presented addressing disciplines of physical and engineering sciences. These include physics, chemistry, engineering, mathematics, and computer sciences. Major emphasis is placed on measurement methodology and the basic technology underlying standardization. Survey articles on topics closely related to technical and scientific programs are also presented. GRA

N80-22454# California Univ., Riverside. Statewide Air Pollution Research Center.
OXIDANT-PRECURSORS RELATIONSHIPS Final Report
Edgar R. Stephens and Oscar P. Hellrich Aug. 1979 74 p refs
(Grant EPA-R-803799)
(PB80-122278; EPA-600/3-79-076) Avail: NTIS HC A04/MF A01 CSCL 07D

New methods of ambient air analysis were used to define more clearly the relationships between oxidants and their precursors. Non-methane hydrocarbons, NOx, O2, and oxidants were measured at the same time and location (Riverside, California). The ambient air data presented are displayed as a series of conditional joint distributions. The correlations range from excellent ozone vs oxidant to poor or bimodal ozone with nonmethane-ethane organics (NMEO) or with NOx. The ratio of NMEO to NOx was always higher than indicated by inventories and showed a large scatter. No depletion of NMEO with respect to acetylene could be detected. GRA

N80-22455# TRW Defense and Space Systems Group, Redondo Beach, Calif.

CHEMICAL ANALYSIS OF WET SCRUBBERS UTILIZING ION CHROMATOGRAPHY Final Report, Sep. 1977 - Sep. 1978
Tobias R. Acciani and Ray F. Maddalone Jul. 1979 63 p refs
(Contract EPA-68-02-2165)
(PB80-124332; EPA-600/7-79-151) Avail: NTIS HC A04/MF A01 CSCL 07D

The elements required to develop a sampling and analysis program for a wet scrubber using ion chromatography as the analytical technique are examined. A sampling program for two different types of wet scrubbers: the venturi/spray tower (limestone) scrubber and the dual alkali pilot scrubber is described. The scrubber type, sample collection, and sample preservation are discussed. The theory and practice of ion chromatography as applied to wet scrubber samples are summarized. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-22456 Ohio State Univ., Columbus.
INITIAL HYDROGEN ATTACK KINETICS IN A CARBON STEEL Ph.D. Thesis
Marvin Grendel McKimpson 1979 159 p
Avail: Univ. Microfilms Order No. 8009312

The kinetics of the initial stages of hydrogen attack in a commercial 0.3% C steel (grade A516) were investigated using an in situ dilatometer. The time, temperature and hydrogen pressure dependences of the rate of sample expansion were measured at hydrogen pressures from 1 to 20 MPa and temperatures from 350 C to 475 C. Hydrogen attack induced sample expansion was observed to begin shortly after hydrogen exposure and then to proceed at a nearly constant rate throughout the incubation period preceding rapid attack. Results indicate that bubble growth during the incubation period occurs predominantly by grain boundary diffusion and suggest that this growth is driven by near-equilibrium internal methane pressures. Sample expansion in the subsequent stages of accelerating growth studied by various investigators probably is controlled by creep and methane generation. Dissert. Abstr.

N80-22457 Ohio State Univ., Columbus.
OXIDATION AND CARBURIZATION OF Fe-Cr AND Ni-Cr ALLOYS AT 850 AND 950 C IN CO/CO2 GAS MIXTURES Ph.D. Thesis
Jeffrey Alan Colwell 1979 255 p
Avail: Univ. Microfilms Order No. 8009268

Isothermal stability diagrams were used to predict the onset of carburization in various alloys exposed to the gas mixtures. A zirconia oxygen gauge was used to measure the oxygen activity and, therefore, the CO2/CO ratio, during an experiment. The carbide morphology generally consisted of a denuded zone between oxides (either as an external scale or internal precipitates) and carbides. An explanation based on ternary thermodynamic interaction effects is discussed. The transition from internal oxidation to external scaling in these CO/CO2 gases is between 15 and 20 wt.% Cr in the Fe-Cr alloys. Scanning electron microscopy was used to observe the surface oxide morphology. In most gas mixtures iron (Fe-Cr alloys) or nickel (Ni-Cr alloys) remained noble, relative to oxide formation. In these cases, pure iron or pure nickel crystals were present on the surface. Also, rumpled FeCr2O4 scales were identified on the surface of some Fe-Cr alloys. Dissert. Abstr.

N80-22458 Ohio State Univ., Columbus.
A STUDY OF THE INTERRELATIONSHIPS AMONG WEAR, FRICTION AND MICROSTRUCTURE IN THE UNLUBRICATED SLIDING OF COPPER AND SEVERAL SINGLE-PHASE BINARY COPPER ALLOYS Ph.D. Thesis
Peter Julian Blau 1979 360 p
Avail: Univ. Microfilms Order No. 8008769

Two sliding geometries were used for testing in low humidity (20 - 35% RH) environments: a block-on-ring configuration using 440 C stainless steel rings, and a pin-or-disk configuration using 52100 ball bearings for the tips of the rider pins. Low sliding velocities were used to minimize frictional heating (5.0 cm/sec for most tests). Emphasis was placed on understanding the nature of sliding-induced metal deformation in near surface regions. Experimental results were considered in light of recent models for wear and friction based on the role of stacking fault energy in determining modes of plastic deformation. A qualitative model for the deterioration of wear surfaces is proposed. Two possible mechanisms are suggested for the formation of thin, copper colored films on wear tracks on Cu - Al disks. Dissert. Abstr.

N80-22459 Pennsylvania Univ., Philadelphia.
A THEORY OF ALLOY FORMATION Ph.D. Thesis
Robert Michael Visnov 1979 190 p
Avail: Univ. Microfilms Order No. 8009474

A theory is presented designed to provide an expression for the heat of formation of an alloy which is rigorous to a certain order, flexible enough to treat other associated problems, and physically reasonable in the sense that its relation to the physical processes of alloy formation is clear. The resulting expression is the sum of several terms, including: the elastic energy of expansion or compression of the pure constituents to their alloy volume; a short range intercell electrochemical energy due to the transfer of charge between neighboring cells; and a long range Coulombic energy with a Madelung form which arises because of the net charge within atomic cells after charge transfer. Other energies, such as those due to the nonsphericity of the cells and the intercell exchange-correlation interaction are neglected. Dissert. Abstr.

N80-22460 Ohio State Univ., Columbus.
A STUDY OF CORROSION FATIGUE CRACK PROPAGATION OF 403 STAINLESS STEEL IN AQUEOUS ENVIRONMENTS Ph.D. Thesis
Lillian Abrego 1979 205 p
Avail: Univ. Microfilms Order No. 8008753

Cyclic crack growth rates were measured as a function of stress intensity range using compact tension specimens. The material investigated was 403 stainless steel in the quenched and tempered condition. Crack growth studies were conducted in laboratory air, water, sodium chloride, sodium sulfate, sodium phosphate, and sodium silicate solutions. The tests were performed at 25 and 100 C with the pH varied from 2 to 10. All tests were performed at a constant stress ratio with a sinusoidal wave form. In air, water and sodium chloride, crack growth rates were determined for a range of loading frequencies. The stress intensity threshold ranges was determined in air, water, sodium chloride, sodium sulfate, and sodium phosphate. Fractography was conducted with a scanning electron microscope on samples from each test condition. Significant results are reported. Dissert. Abstr.

N80-22461 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE PRECIPITATION SEQUENCE OF METASTABLE TETRAGONAL PHASES IN METALLIC SOLID SOLUTIONS Ph.D. Thesis
Roberto J. Rioja 1979 165 p
Avail: Univ. Microfilms Order No. 8003409

The precipitation sequence in three binary alloys has been investigated by means of transmission electron microscopy and differential scanning calorimetry. The alloys investigated were A1-4w/oCu, Cu-2w/oBe and Ni-(16-19)a/oV. These alloys exhibit similar features during the early stages of phase separation. Calorimetric analysis revealed the presence of endothermic reactions associated with the dissolution of the different phases encountered. The solvus temperature is shown to be dependent upon the size of the dissolving precipitates. Dissert. Abstr.

N80-22462 Illinois Univ. at Urbana-Champaign.
EXPERIMENTAL AND THEORETICAL MODELING STUDIES OF THE INITIATION OF CREVICE CORROSION Ph.D. Thesis
David William Siitari 1979 205 p
Avail: Univ. Microfilms Order No. 8009169

A theoretical model which accounted for transport and reaction processes within a corroding crevice was developed. The systems exhibited realistic crevice corrosion behavior. The results and theoretical predictions were compared in detailed

manner. Crevices were formed between the ends of two cylinders and spacings as small as 0.015 mm were studied. The transient current distribution within crevices was measured by means of a sectioned electrode technique and the electrode potential and pH were also continuously monitored. Experiments were performed with potentiostatic control and also under conditions of natural immersion. In contrast to previous experimental studies, the initial conditions at the moment of crevice formation were well defined. This enabled more rigorous mathematical descriptions to be formulated.
Dissert. Abstr.

N80-22463 Polytechnic Inst. of New York.
LASER INDUCED DIELECTRIC BREAKDOWN OF THE METAL CARBONYLS. Ph.D. Thesis
Yedidyah Langsam. 1979. 177 p.
Avail: Univ. Microfilms. Order No. 8008659

The method of laser induced dielectric breakdown was used to study the dissociation of the metal carbonyls. Following nonresonant excitation by a TEA CO2 laser, amorphous micrometallic particles were deposited. Laser induced dielectric breakdown was examined in terms of its origin, and the nature of the ensuing plasma state was investigated. Based upon the energetics of dissociation and the relative magnitudes of the rates of activation and deactivation for various collision partners of the plasma fluorescence, an energy transfer map as well as probable mechanisms were proposed. Using an optical multichannel analyzer, the identity of the various species within a laser induced plasma for a series of related reactant molecules was determined. Particle morphology was ascertained using a variety of physicochemical techniques.
Dissert. Abstr.

N80-22464*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF YTTRIUM, ALUMINUM AND CHROMIUM CONCENTRATIONS IN BOND COATINGS ON THE PERFORMANCE OF ZIRCONIA-YTTRIA THERMAL BARRIERS
Stephan Stecura. 1980. 12 p. refs. Presented at Intern. Conf. on Metallurgical Coatings, San Diego, Calif., 21-25 Apr. 1980
(NASA-TM-81485; E-423) Avail: NTIS HC A02/MF A01 CSCL 11F

A cyclic furnace study was conducted on thermal barrier systems to evaluate the effects of yttrium, chromium, and aluminum in nickel-base alloy bond coatings and the effect of bond coating thickness on yttria-stabilized zirconia thermal barrier coating life. Without yttrium in the bond coatings, the zirconia coatings failed very rapidly. Increasing chromium and aluminum in the Ni-Cr-Al-Y bond coatings increased total coating life. This effect was not as great as that due to yttrium. Increased bond coat thickness was also found to increase life.
Author

N80-22465*# National Aeronautics and Space Administration, Washington, D. C.
THEORY OF PLASTIC FLOW IN A THIN LAYER OF METAL
I. A. Kiyko. May 1980. 132 p. refs. Transl. into ENGLISH of Sci. Proc. no. 15 (Moscow), 1971. 65 p. Transl. by Agence Tunisienne de Public-Relations, Tunis. Original doc. prepared by Moscow State Univ., USSR
(Contract NSF C-504)
(NASA-TT-F-17154) Avail: NTIS. HC A07/MF A01. CSCL 11F

Analytical methods of investigation of the processes of plastic flow in a thin layer of metal inserted between the working surfaces of an instrument's part are dealt with. Approximation methods for solving concrete problems are proposed. The theoretical possibilities for the design of an instrument able to compensate in the flow process for the inaccuracy of a detail fabrication due to the finite rigidity of the instrument are analyzed. The flow processes under heat exchange conditions when the initial temperatures of the layer differ substantially from that of the instrument's parts are investigated.
E.D.K.

N80-22466*# Iowa Univ., Iowa City. Div. of Materials Engineering.
ANALYSIS OF TEST SYSTEM MISALIGNMENT IN THE CREEP TEST
Han C. Wu and T. P. Wang. 15 Apr. 1980. 40 p. refs.
(Grant NsG-1499)
(NASA-CR-162924; G302-80-002) Avail: NTIS HC A03/MF A01

Sheet type rectangular 1100-0 aluminum specimens were tested. The creep strain at the geometric centerline of the specimen is different than that at the neutral axis, and decreases with time. The effect of misalignment, which decreases with creep time, is minimized when creep tests are conducted with long pullrods and large initial strain level (high creep stress).
E.D.K.

N80-22467# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
SUPERSATURATED ALUMINUM ALLOY POWDERS. Final Scientific Report, 1 Oct. 1978 - 31 Sep. 1979
Dan Shechtman. Nov. 1979. 12 p. refs.
(Grant AF-AFOSR-3696-78; AF Proj. 2301)
(AD-A080193; EOARD-TR-80-6) Avail: NTIS HC A02/MF A01 CSCL 11/6

Four aluminum alloys were prepared as powders by the RSR Process. The compositions (in weight percents) were: (1) AL-7Fe-0.5Cr; (2) AL-7Fe-1.0Cr; (3) AL-7Fe-1.5CR; (4) AL-7Fe-1.0CR-0.2Ti-0.2v-0.2Zr. The alloys were compacted and extruded at 750 F with an extrusion ratio of 39.3 1. Microstructural investigations of both the powders and the bulk extrusion were made.
GRA

N80-22468# Pennsylvania State Univ., University Park. Applied Research Lab.
HOT CORROSION AND OXIDATION STUDIES OF COBALT BASED SUPERALLOYS AT 1000 C. M.S. Thesis
Gregory A. Dries. Oct. 1979. 260 p. refs.
(Contract N00024-79-C-6043)
(AD-A080163; ARL/PSU-TM-79-177) Avail: NTIS HC A12/MF A01 CSCL 11/6

Recently, the trend in superalloy design has been aimed toward the development of alloys which are resistant to the harmful effects of sodium sulfate formed within gas turbines operated in marine environments. This phenomenon, commonly referred to as hot corrosion, has been extensively studied. These studies have elucidated the mechanism of sodium sulfate attack and have led to the development of alloys resistant to hot corrosion. One approach to the development of alloys resistant to hot corrosion involves the formation of a protective oxide layer based on SiO2. The feasibility of this approach has been verified. The data reported in this study agree well with those of other investigators and show a significant increase in the resistance of alloys to hot corrosive attack with increased silicon content of the alloys. Two rather limiting observations were made from this study. First, the scales forming on the high silicon containing alloys were very susceptible to spalling as a result of temperature changes. A means should be developed to increase the adherence of these scales onto the metal substrate. Secondly, the high silicon containing alloys were very brittle and probably could not withstand the mechanical stresses occurring within operating turbines. It would be more feasible for these alloys to be utilized as a surface coating on an alloy whose mechanical properties are more in accord with turbine material requirements.
GRA

N80-22469# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
DEFORMATION AND FRACTURE OF ADVANCED ANISOTROPIC SUPERALLOYS. Final Report, 1 Oct. 1975 - 30 Sep. 1979
Anthony F. Giamei. Nov. 1979. 77 p. refs.
(Contract F44620-76-C-0028; AF Proj. 2306)
(AD-A080088; PWA-FR-12637; AFOSR-80-0033TR) Avail: NTIS HC A05/MF A01 CSCL 11/6

The modern single crystal superalloy baseline of Ni-5Al-2Ti-1Nb-9Cr-12W (by weight) was selected (PWA 1444). The Re/W ratio was varied from 0.0 to 1.0 as the Re + W was held constant at 12 wt %. Single crystals were grown with axial orientations of <001>, <110>, <111> from four different alloys and were fully heat treated (gamma prime solution + age). An additional alloy was made at 4Ta/4W/4Re in the three high symmetry orientations. Test specimens of the compressive and tensile creep/rupture design were obtained by sectioning or electrochemical machining. Creep data were obtained in tension

and compression with temperature/stress combinations of 816 C/650 Mpa, 899 C/380 MPa, 982 C/220 MPa, and 1066 C/138 MPa. Crystals were characterized by chemical analysis, optical metallography, and crystallographic orientation determination by the Laue method. GRA

N80-22470# Oregon Graduate Center for Study and Research, Beaverton.

EFFECT OF RETAINED AUSTENITE ON HYDROGEN EMBRITTLEMENT OF STEELS Final Report, 1 Sep. 1976 - 31 Aug. 1979

W. E. Wood 14 Nov. 1979 18 p refs

(Grants DAAG29-76-G-0317; DAAG29-78-G-0158)

(AD-A078988; ARO-13894.2-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

Ultrahigh strength steel alloys heat treated to 200,000 psi yield strength levels are notoriously sensitive to hydrogen induced delayed failure. In this program the effects of microstructure, especially that of retained austenite, on hydrogen induced (1) threshold stress intensity level; (2) crack growth rate; and (3) fatigue crack growth rate have been investigated. Microstructural variables investigated included prior austenite grain size, twinning, carbides, retained austenite, and indirectly, segregation. Emphasis in this study has been placed on the contribution of and stability of retained austenite. Optical, scanning electron microscopy, and transmission electron microscopy have been employed to establish microstructural details. Compact tension and bolt loaded fracture toughness specimens were used throughout the program. Precision hydrogen measurement were carried out by the Boeing Company. It was necessary to measure the hydrogen content for each sample, since it was not possible to introduce consistent hydrogen levels by cathodically charging. The influence of retained austenite is limited by its instability at the crack tip, where it has been shown to transform due to the intense stresses and strains in the plastic zone. Acoustic emission analysis was employed to detect and study the microscopic nature of crack growth as well as to establish a threshold stress intensity level. Test results showed that retained austenite, grain size, and probable segregation each contribute towards altering the hydrogen induced delayed failure characteristics. GRA

N80-22471# Minnesota Univ., Minneapolis. Dept. of Chemistry.

MOLECULAR DIPOLE MODEL FOR THE INTERNAL OPTIC MODES OF SURFACE ADSORBED MOLECULES, CLASSICAL IMAGE THEORY

Henry Nichols and Robert M. Hexter Jan. 1980 45 p refs

(Contract N00014-77-C-0209)

(AD-A080464; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/4

A molecular dipole model is developed to describe dipolar coupling in surface adsorbed molecules using classical image theory. Only the internal optic modes of the adsorbed molecules are considered. Expanding the dipoles associated with both real and image molecules in terms of the same molecular normal coordinate results in a frequency shift twice that previously expected for dipolar coupling in adsorbed molecules. Application of the model to carbon monoxide adsorbed on platinum indicates that the observed frequency vs. coverage behavior can be attributed to dipolar coupling. The irreducible corepresentations of Shubnikov type 2, or grey, groups are used to describe the symmetry and spectroscopic activity of the molecule-plus-image system. Infrared activity is associated only with molecular vibrations having non-zero dipole moment derivative components perpendicular to the surface. Raman activity is associated only with those molecular vibrations having non-zero Raman scattering tensor elements alpha(xx), alpha(yy), alpha(zz), or alpha(xy), where z is perpendicular to the surface. GRA

N80-22472# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE HUGONIOT OF 4340 STEEL RC 54-55 Final Report

Robert E. Franz and Joseph L. Robitaille Sep. 1979 16 p refs

(DA Proj. 1W6-62618-AH-80)

(AD-A076968; AD-E430321; ARBRL-MR-02951) Avail: NTIS HC A02/MF A01 CSCL 11/6

The Hugoniot of 4340 steel of Rockwell 'C' hardness 54-55 has been measured. The alpha or b.c.c. phase Hugoniot can be represented by the equation U = 4.67 + 1.44 u where U is the wave velocity and u is the particle velocity in km/s. The Hugoniot of the epsilon or h.c.p. phase above the 13GPa transition point is close to that of rolled homogeneous armor. GRA

N80-22473# Wisconsin Univ. - Madison.

SOLIDIFICATION OF HIGHLY UNDERCOOLED LIQUID METALS AND ALLOYS Final Report, 15 Aug. 1976 - 14 Aug. 1979

J. H. Perepezko 17 Jan. 1980 12 p refs Sponsored in part by Office of Naval Res.

(Grants DAAG29-76-G-0316; DAAG29-78-G-0157; DA Proj. 1L1-61102-BH-57)

(AD-A080791; ARO-14190.5-MS) Avail: NTIS HC A02/MF A01 CSCL 07/4

The undercooling and solidification of liquid alloys in fine droplet form has been examined by thermal analysis, X-ray diffraction and metallography. New maximum undercooling limits have been established for several metals and hypercooling has been demonstrated for the first time in a metallic system. In alloys, some aspects of the phase selection kinetics for formation of metastable phases have been identified in eutectic, peritectic and monotectic reactions. The use of droplet samples allows the measurement of thermodynamic properties of undercooled liquids and the study of microstructure development with changing undercooling. In some alloys, the effective isolation of nucleants that is possible with micron size droplets results in a continuous solidification to the amorphous state. The observations are presented in terms of the potential of undercooling for structure modification and rapid solidification technology. GRA

N80-22474# Oak Ridge National Lab., Tenn.

EFFECTS OF THERMOMECHANICAL TREATMENT ON PHASE STABILITY AND SWELLING IN ALLOY D9

E. H. Lee and A. F. Rowcliffe 1979 12 p

(Contract W-7405-eng-26)

(CONF-790979-1) Avail: NTIS HC A02/MF A01

The composition range for greater phase stability was investigated and processing methods to improve alloy homogeneity were modified. The irradiation response to variations of thermochemical treatment was studied for heat 7438 of alloy D9. A combination of diffraction analysis and energy dispersive spectroscopy was used to identify five major phases which develop in D9 during neutron irradiation. Results are reported. DOE

N80-22475*# New Mexico Univ., Albuquerque. Technology Application Center.

EUTECTIC ALLOYS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jan. 1980

Peter Moore Jan. 1980 66 p Sponsored in part by NASA and NTIS

(NASA-CR-162932; PB80-803877) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

These 250 abstracts from the international literature provide summaries of the preparation, treatments, composition and structure, and properties of eutectic alloys. Techniques for directional solidification and treatments including glazing, coating, and fiber reinforcement are discussed. In addition to the mechanical and thermal properties, the superconducting, corrosion, resistance, and thermionic emission and adsorption properties are described. GRA

N80-22476# Bureau of Mines, Washington, D. C.

COPPER

H. J. Schroeder Sep. 1979 25 p refs

(PB80-126030) Avail: NTIS HC A02/MF A01 CSCL 08I

In addition to data on byproducts and coproducts, comprehensive data on copper is presented including industry structure, uses, reserves-resources, technology, supply-demand relationships, strategic considerations, economic factors and problems, operating factors and problems, and outlook to 2000. GRA

N80-22477# Bureau of Mines, Washington, D. C. Office of Assistant Director, Metals, Minerals and Materials.

BERYLLIUM: MINERAL COMMODITY PROFILES

Benjamin Petkof Aug. 1979 17 p refs
(PB80-125438; LC-79-20066) Avail: NTIS HC A02/MF A01 CSCL 08I

Beryllium, a high-strength, lightweight metal with excellent anticorrosion characteristics is used in a large number of industrial applications. Comprehensive data presented on beryllium covers industry structure, uses, reserves-resources, technology, supply-demand relationships, byproducts and coproducts, strategic considerations, economic factors and problems, operating factors and problems and outlook to 2000. GRA

N80-22478*# New Mexico Univ., Albuquerque. Technology Application Center.
CORROSION CHARACTERISTICS OF NICKEL ALLOYS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Nov. 1979
Gerald F. Zollars Dec. 1979 125 p Sponsored by NASA and NTIS
(NASA-CR-163060; PB80-803042) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

This bibliography cites 118 articles from the international literature concerning corrosion characteristics of nickel alloys. Articles dealing with corrosion resistance, corrosion tests, intergranular corrosion, oxidation resistance, and stress corrosion cracking of nickel alloys are included. GRA

N80-22479# National Technical Information Service, Springfield, Va.
POWDER METALLURGY OF IRON. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979
William E. Reed Dec. 1979 232 p Supersedes NTIS/PS-78/1327; NTIS/PS-77/1177; NTIS/PS-76/0990; NTIS/PS-75/709
(PB80-803232; NTIS/PS-78/1327; NTIS/PS-77/1177; NTIS/PS-76/0990; NTIS/PS-75/709) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

These citations of Federally-funded research reports cover ferrous metal powder compacting, pressing, sintering and fabrication. Properties are discussed in relation to processing. This updated bibliography contains 225 abstracts, 19 of which are new entries to the previous edition. GRA

N80-22480# National Technical Information Service, Springfield, Va.
POWDER METALLURGY OF IRON, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Jan. - Nov. 1979
William E. Reed Dec. 1979 268 p Supersedes NTIS/PS-78/1329; NTIS/PS-77/1178; NTIS/PS-76/0992
(PB80-803240; NTIS/PS-78/1329; NTIS/PS-77/1178; NTIS/PS-76/0992) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Worldwide journal research is cited on compacting, sintering, pressing, forming, forging, and fabrication of ferrous metal powders. Mechanical properties, physical properties, and structure of powdered iron and steel products are also reported. Abstracts of research on iron powder production are included. This updated bibliography contains 261 abstracts, 124 of which are new entries to the previous edition. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-22481 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE VISCOELASTIC SHEAR BEHAVIOR OF A STRUCTURAL ADHESIVE Ph.D. Thesis
Erol Sancaktar 1979 116 p
Avail: Univ. Microfilms Order No. 8007947

A linear viscoelastic method of predicting the pure shear behavior from the bulk tensile data is presented. Constant strain rate, relaxation and creep measurements are given for bulk and bonded adhesive modes using symmetric rail shear and lap shear test specimens, respectively. Experimental results show that both bulk and bonded shear stress strain response have a region of near linear elasticity followed by a region of viscoelasticity terminating with yielding. Delayed failure and relaxation behaviors are observed in shear. Elastic shear stresses and strains are shown to be predictable from the tensile results. Viscoelastic stresses and strains, however, are not predictable by using the proposed method. Large viscoelastic strains are obtained in pure shear. The specimens display both goometric and stress strain nonlinearities in shear. The results suggest that model adhesive may exhibit different viscoelastic deformation mechanisms in shear and tension. Dissert. Abstr.

N80-22482 Missouri Univ., Kansas City.
AN INVESTIGATION OF PROPYLENE GLOW DISCHARGE POLYMERIZATION Ph.D. Thesis
Ashok Kumar Sharma 1979 230 p
Avail: Univ. Microfilms Order No. 8009375

The glow discharge polymerization of propylene was investigated using an electrodeless, electromagnetically coupled (inductive coupling perpendicular to the reactor) tubular reactor operating at a radio frequency of 27.120 MHz. The effects of polymerization parameters, i.e., time, monomer flow rate, inert gas, substrate position, and vacuum system efficiency on the rate of polymer deposition were studied in detail. It was observed that monomer flow rate (at constant pumping efficiency) exerts the greatest effect on the quality of polymer adhesion to glass and aluminum substrates. Good adhering polymeric films were obtained only at high flow rates (above 250 micromols/min reactor pressure 0.1 torr) where the deposition rate decreases with increase in monomer flow rate. This principle also applies to ethylene, propane and allyl bromide monomers. Dissert. Abstr.

N80-22483 Oklahoma Univ., Oklahoma City.
A RHEOLOGICAL STUDY OF ELASTOMERS Ph.D. Thesis
Man-Sheng Wang 1979 228 p
Avail: Univ. Microfilms Order No. 8008664

Creep results at room temperature during uniaxial, unconfined compressive loading of vulcanized and unvulcanized natural rubber and styrene-butadiene copolymer are presented. A combined equation of the power law and the sine hyperbolic function that relates strain with time was derived from the basic creep data. Creep rate was obtained by means of differentiation of the original creep data. The plot of creep rate versus time was used to understand the change of creep stages for the rubbers studied. The swelling of vulcanized rubbers in two organic solvents, paraffinic hydrocarbon (kerosene, C14H30) and one belonging to the aromatic family (benzene, C6H6), were investigated. Creep and rebound tests of those swollen rubbers were conducted and the results were compared with the ordinary samples. Dissert. Abstr.

N80-22484* Ultrasystems, Inc., Irvine, Calif.
STUDY OF CROSSLINKING AND DEGRADATION MECHANISMS IN SEALANT POLYMER CANDIDATES Final Report
K. L. Paciorek, J. Kaufman, T. I. Ito, J. H. Nakahara, and R. H. Kratzer Mar. 1980 63 p refs
(Contract NAS2-9779)
(NASA-CR-152346; SN-3003-F) Avail: NASA Ames Res. Center

Practical cross-linking and/or chain extension processes for perfluoroalkylether based sealants were studied. The two linking groups investigated were 1, 2, 4-oxadiazoles and s-triazines. The synthesis of difunctional, fully characterized, prepolymers and the evaluation of the curing reactions utilizing these materials are discussed. E.D.K.

N80-22485 University of Southern Mississippi, Hattiesburg.
MODIFICATION OF POLYMERIC SUBSTRATES FOR UTILIZATION AS BIOMEDICAL MATERIALS Ph.D. Thesis
James Alexander Pelezo 1979 253 p
Avail: Univ. Microfilms Order No. 8008115

Hydrophilic multiblock polyurethane elastomers were investigated for utilization as possible balloon ventricles in artificial cardiac devices. Such materials should possess a high degree of mechanical durability, be biologically compatible, and be processable from either the melt or from solution. Homogeneous solutions

of polysaccharides were prepared and used as novel reaction media for the preparation of hydrolytically labile urethane pendent groups. Several types of nylon 1, prepared by anionic polymerization of isocyanates, also served as model polymers that could release therapeutic agents or pesticides by hydrolysis. Two specific analytical techniques, ultraviolet spectrophotometry and high pressure liquid chromatography, were used as methods for evaluating the delivery of the amine to the aqueous medium. The high pressure liquid chromatography method was found to possess definite advantages over the UV spectrophotometric method. Dissert. Abstr.

N80-22486 Michigan Univ., Ann Arbor.
PHYSICAL PROPERTIES OF ELASTOMERIC POLYMER NETWORK Ph.D. Thesis
Mohammed Abdel-Gawwad Sharaf 1979 373 p
Avail: Univ. Microfilms Order No. 8007836

Stress-strain measurements carried out on networks formed from 1,4-polybutadiene (PBD) samples of various cis-trans stereochemical structures were examined. The networks were crosslinked using a variety of crosslinking techniques, specifically gamma radiation, high energy electrons, ultraviolet radiation, and peroxide cures. The networks obtained were studied up to and including rupture. The highly stereoregular ones exhibited strain-induced crystallization and showed anomalous deviations from linearity in their stress-strain isotherms at high elongation. Focusing special attention on the physical processes that culminate in rupture of the networks confirmed and extended the primary role played by strain-induced crystallization. As a consequence, the non-Gaussian effects, i.e., the limited chain extensibility, can occur under such conditions but is virtually impossible to characterize in the presence of the crystallization. Dissert. Abstr.

N80-22487 Drexel Univ., Philadelphia, Pa.
POWDER PROCESSING OF ULTRA-HIGH MOLECULAR WEIGHT POLYETHYLENE Ph.D. Thesis
George Wayne Halldin 1980 260 p
Avail: Univ. Microfilms Order No. 8008282

Ultra-high molecular weight polyethylene (UHMW-PE) has excellent impact strength and abrasion resistance properties but is available in powder form only and can generally be processed only by compression molding. The feasibility of using the solid state forming process of powder preform forging was examined in order to overcome these processing difficulties. The forging process, with dwell times in the die of only two minutes was found to give useful, and in some cases, superior, tensile and fracture toughness properties compared to compression molded material. The preform production technology was investigated in detail. Powder from three different manufacturers was characterized by a wide range of tests. The powder were shown to be appreciably different in terms of particle size and particle morphology. The compressibility and green strength of each powder was evaluated. Dissert. Abstr.

N80-22488 Illinois Univ. at Urbana-Champaign.
HIGH PRESSURE POLARIZED AND UNPOLARIZED FLUORESCENCE STUDIES OF MACROMOLECULES Ph.D. Thesis
George S. Chryssomallis 1979 150 p
Avail: Univ. Microfilms Order No. 8009002

The development of an instrument which can measure the linear polarization of fluorescence of a system under large hydrostatic pressure is discussed. High pressure was used to change the viscosity of the medium, which was necessary in order to characterize the relaxation processes of a fluorescent molecule in solution. The drawbacks of the temperature variation method could be avoided, and in certain cases the pressure variation method proved to be a valuable complement to the conventional ways of changing the viscosity. The validity and accuracy of the method of measurement and analysis was tested by using three fluorescent dyes in solution. Parallel temperature variation and pressure variation experiments confirmed that the two were equivalent in changing the solvent viscosity in the proximity of the rotating molecule. Dissert. Abstr.

N80-22489 Pennsylvania State Univ., University Park.
MASS TRANSFER IN LAMINAR FLOW FIELD WITH ULTRAFILTRATION AND ITS APPLICATION IN POLYMER FRACTIONATION Ph.D. Thesis
Wei-Chang Liauh 1979 156 p
Avail: Univ. Microfilms Order No. 8008439

The mass transfer of polymer molecules in a semipermeable laminar flow tube was studied. It mainly concerns three subjects: the development of porous capillary chromatography (PCC); the initial development of solute concentration distribution in Taylor dispersion; and the application of the finite difference method in process stimulation. The results have provided insight concerning the mass transport process in a laminar flow field with ultrafiltration, and have revealed the potential of a polymer fractionation technique based on this transport process. A mathematical model was developed to correlate solute retention time to solute Peclect number and consequently to the solute diffusion coefficient. By applying this model, PCC can be used to obtain polymer diffusion coefficients. Pertinent results are reported. Dissert. Abstr.

N80-22490 Utah Univ., Salt Lake City.
THE EFFECT OF THE MOLECULAR WEIGHT AND MOLECULAR WEIGHT DISTRIBUTION ON THE VISCOELASTIC FLOW FUNCTIONS OF LINEAR POLYSTYRENE SOLUTIONS Ph.D. Thesis
Hong Wen Gao 1979 407 p
Avail: Univ. Microfilms Order No. 8008340

The dependence of the steady and time dependent viscoelastic flow functions on the molecular weight and molecular weight distribution for linear polystyrene solutions in normal butyl benzene were determined. The shear stresses, and first and second normal stress differences for several linear mono and polydisperse polystyrene solutions undergoing steady state shearing, oscillatory shearing, and stress growth and stress decay were determined at 25 plus or minus 0.1 C in cone and plate geometry by means of a stiffened Weissenberg rheogoniometer. Stress growth at the onset of steady shearing and stress decay at the cessation of steady shearing for each polymer solution were measured at the highest shear rate obtainable with a 6 deg cone. Dissert. Abstr.

N80-22491*# Hughes Aircraft Co., Culver City, Calif. Advanced Technology Lab.
DEVELOPMENT OF ULTRAVIOLET RIGIDIZABLE MATERIALS Final Report
D. P. Salisbury Oct. 1979 42 p
(Contract NAS8-32895)
(NASA-CR-161426; FR-79-76-1290; HAC-F2545) Avail: NTIS HC A03/MF A01 CSCL 11G

A series of tests was performed to determine an optimum resin to be used as a UV rigidizable matrix in expandable rigidizable space structures. Commercially available resins including several types of polyesters, epoxies, epoxy-acrylics, an acrylic and a urethane were used as well as a polyester, produced by 3M Company's Solar Laboratory facility, which was found the best from the standpoint of physical properties and ability to be 'B' staged. Two other synthesized materials were also tested, but were not found to be superior to the Solar resin. An optimum fabric for use with the preferred resin was not found; however, the 15 ounce fabric from Solar Laboratories has the best combination of physical properties with respect to handling and processing characteristics. Expansion techniques for tubular structures, 'B' staging of the solar resin, and stowage techniques for up to 5 months were developed. A one meter high tetrahedron preprototype structure was prepared to evaluate and demonstrate stowage, deployment, and rigidization techniques. A.R.H.

N80-22492*# Solar Turbines International, San Diego, Calif.
DEVELOPMENT OF FIRE-RESISTANT, LOW SMOKE GENERATING, THERMALLY STABLE END ITEMS FOR COMMERCIAL AIRCRAFT AND SPACECRAFT USING A BASIC POLYIMIDE RESIN Final Report, 15 Dec. 1977 - 15 Apr. 1980
J. Gagliani, R. Lee, U. A. K. Sorathia, and A. L. Wilcoxson
15 Apr. 1980 176 p refs
(Contract NAS9-15484)
(NASA-CR-160576; SR79-R-4674-38) Avail: NTIS HC A09/MF A01 CSCL 07C

A terpolyimide precursor was developed which can be foamed by microwave methods and yields foams possessing the best seating properties. A continuous process, based on spray drying

techniques, permits production of polyimide powder precursors in large quantities. The constrained rise foaming process permits fabrication of rigid foam panels with improved mechanical properties and almost unlimited density characteristics. Polyimide foam core rigid panels were produced by this technique with woven fiberglass fabric bonded to each side of the panel in a one step microwave process. The fire resistance of polyimide foams was significantly improved by the addition of ceramic fibers to the powder precursors. Foams produced from these compositions are flexible, possess good acoustical attenuation and meet the minimum burnthrough requirements when impinged by high flux flame sources.
A.R.H.

N80-22493*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
STEADY-STATE WEAR AND FRICTION IN BOUNDARY LUBRICATION STUDIES
William R. Loomis and William R. Jones, Jr. May 1980 11 p refs
(NASA-TP-1658; E-129) Avail: NTIS HC A02/MF A01 CSCL 11G

A friction and wear study was made at 20 C to obtain improved reproducibility and reliability in boundary lubrication testing. Ester-base and C-ether-base fluids were used to lubricate a pure iron rider in sliding contact with a rotating M-50 steel disk in a friction and wear apparatus. Conditions included loads of 1/2 and 1 kg and sliding velocities of 3.6 to 18.2 m/min in a dry air atmosphere and stepwise time intervals from 1 to 250 min for wear measurements. The wear rate results were compared with those from previous studies where a single 25 min test period was used. Satisfactory test conditions for studying friction and wear in boundary lubrication for this apparatus were found to be 1 kg load; sliding velocities of 7.1 to 9.1 m/min (50 rpm disk speed); and use of a time stepwise test procedure. Highly reproducible steady-state wear rates and steady-state friction coefficients were determined under boundary conditions. Wear rates and coefficients of friction were constant following initially high values during run-in periods.
Author

N80-22494*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
FRICTION AND WEAR OF IRON-BASE BINARY ALLOYS IN SLIDING CONTACT WITH SILICON CARBIDE IN VACUUM
Kazuhisa Miyoshi and Donald H. Buckley May 1980 11 p refs
(NASA-TP-1612; E-260) Avail: NTIS HC A02/MF A01 CSCL 11F

Multipass sliding friction experiments were conducted with various iron base binary alloys in contact with a single crystal silicon carbide surface in vacuum. Results indicate that the atomic size and concentration of alloy elements play important roles in controlling the transfer and friction properties of iron base binary alloys. Alloys having high solute concentration produce more transfer than do alloys having low solute concentration. The coefficient of friction during multipass sliding generally increases with an increase in the concentration of alloying element. The change of friction with succeeding passes after the initial pass also increases as the solute to iron, atomic radius ratio increases or decreases from unity.
Author

N80-22495# Rochester Univ., N. Y. Dept. of Mechanical and Aerospace Sciences.
MICROSTRUCTURAL PROCESSES IN THE DEFORMATION AND FRACTURE OF POLYMERS Final Report, 1 Aug. 1976 - 30 Sep. 1979
J. C. M. Li 17 Dec. 1979 16 p refs
(Grants DAAG29-76-G-0314; DAAG29-78-G-0159)
(AD-A080029; ARO-13566.4-MS) Avail: NTIS HC A02/MF A01 CSCL 11/9

Shear bands in polystyrene were characterized with respect to their surface morphology, shear strain distribution, strain recovery by annealing, intersection behavior, splitting and joining processes, and yield criteria. Three kinds of shear bands are differentiated: fine bands, coarse bands, and thick bands. The first two kinds have different yield criteria, propagation modes, and surface appearances. The latter two kinds have many similarities. It seems that molecular alignment of directional defects must present in shear bands.
GRA

N80-22496# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
NEW METHODS FOR SOLID STATE EXTRUSION OF HIGHLY ORIENTED POLYMERS Interim Report
Michael P. C. Watts, Anagnostis E. Zachariades, and Roger S. Porter 14 Dec. 1979 29 p refs
(Contract N00014-75-C-0686)
(AD-A079128; TR-13) Avail: NTIS HC A03/MF A01 CSCL 11/9

Techniques are reviewed and extended for solid state deformation of semicrystalline polymers. Emphasis has been placed on solid state extrusion and its variations that include coextrusion, reversible plasticizers and powder deformation. The properties of extrudates are examined in regard to anisotropy with the goals of maximum orientation, tensile properties and the efficiency of deformation.
GRA

N80-22497# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
CROSSLINKING CHEMISTRY FOR FLUOROCARBON ETHER BIBENZOXALE POLYMERS Final Report, May 1976 - Jun. 1978
R. C. Evers and T. Abraham Nov. 1979 33 p refs
(AF Proj. 2419)
(AD-A079798; AFML-TR-79-4148) Avail: NTIS HC A03/MF A01 CSCL 11/9

Curable and hydrolytically stable FEB copolymers were synthesized by the acetic acid-promoted copolycondensation of tetrafluoroethylene oxide, hexafluoropropylene oxide-derived dithioimidate esters with fluorocarbon ether bis(o-aminophenol) monomers and a fluorocarbon bis(o-aminophenol) monomer containing an aliphatic hydrocarbon cure site. The structure of the cure site monomer was molecularly tailored to possess sufficient solubility and reactivity during the polycondensation reactions to permit incorporation of the appropriately structured cure sites into the FEB copolymer backbone. Thermogravimetric analysis and isothermal aging studies indicated high thermooxidative stability almost comparable to analogous FEB polymers void of the hydrocarbon cure sites. Isothermal aging in air at 260C (500F) and 288C (550F) for 200 hours led to weight losses of 7 and 17 percent, respectively. Preliminary formulation and curing studies demonstrated the reactivity of the cure sites to radical-induced cure reactions. Based on the low temperature viscoelastic properties, the high thermooxidative and hydrolytic stability, as well as the ready curability of the FEB copolymers, a broader use temperature range capability than currently available in state-of-the-art elastomer materials is envisioned.
GRA

N80-22498# California Inst. of Tech., Pasadena.
POLYMER ATTACHED CATALYSTS Final Report, 1 Mar. - 31 Aug. 1979
Robert H. Grubbs Jan. 1980 5 p refs
(Contract DAAG29-79-C-0051)
(AD-A080577; ARO-16358.1-C) Avail: NTIS HC A02/MF A01 CSCL 07/3

Monomers containing two ligand groups separated by either flat aromatic groups or long alkyl chains were prepared. These materials were used to make polymers, with nickel(2) or phi-rhodium(1) halides in order to link the monomer units. The major part of the study used 1,12-bis(diphenylphosphino)-dodecane as the monomer unit. Polymethylmethacrylate-Pt composites were evaluated as oxidation catalysts and as electrode coatings.
GRA

N80-22499# Defence Research Establishment, Ottawa (Ontario). Environmental Protection Section.
AN APPARATUS FOR THE MEASUREMENT OF THE WATER-VAPOUR PERMEABILITY OF TEXTILES
Brian Farnworth Jun. 1979 17 p refs
(AD-A074142; DREO-TN-79-1) Avail: NTIS HC A02/MF A01 CSCL 11/5

An apparatus has been constructed to measure the water vapor resistance of textiles, in particular those such as battings and piles that are highly air permeable and have low vapor resistances. The technique has been tested by measuring the

water vapor resistance of air gaps in the range 1 to 8 mm thickness. No systematic errors were observed with a random error in the resistance measurement equivalent to 0.5 mm of still air. GRA

N80-22500# Marquette Univ., Milwaukee, Wis. Dept. of Chemistry.
IMMOBILIZED MICELLES. Final Technical Report, 1 Sep. 1976 - 31 Oct. 1979
Steven L. Regen. 15 Jan. 1980. 9 p. refs.
(Grant DAAG29-76-G-0330)
(AD-A080587; ARO-14353.1-C) Avail: NTIS HC A02/MF A01 CSCL 11/9

Research carried out under this ARO-supported program has involved the preparation, development and mechanistic analysis of insoluble polymers exhibiting micelle or cosolvent-like properties. Motivation for this work derived from the expectation that such materials would be of considerable practical importance as catalysts for the hydrolytic destruction of mustard gas. GRA

N80-22501# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
NEW CONDUCTIVE POLYMERIC MATERIALS: COFACIAL ASSEMBLY OF MIXED VALENT METALLOMACROCYCLES. Interim Report
Tobin J. Marks, Karl F. Schoch, Jr., and Bhagyashree R. Kundalkar. 28 Jan. 1980. 35 p. refs.
(Contract N00014-77-C-0231)
(AD-A081010; TR-10) Avail: NTIS HC A03/MF A01 CSCL 07/3

This paper reports on an approach to control molecular stacking interactions in low-dimensional mixed valence materials by locking partially oxidized metallomacrocycles together in a cofacial orientation. Iodine doping of the face-to-face linked oligomers (M(Pc)O)n (M = Si, Ge, Sn; Pc = phthalocyaninato) produces electrically conductive polymers (M(Pc)O)Ix n with a wide range of x stoichiometries. Resonance Raman spectroscopy indicates that the iodine has oxidized the polymer chain. Polymer structure has been studied by X-ray powder diffraction, and it is possible to estimate interplanar spacings. Halogen doping of the (M(Pc)O) n materials is accompanied by electrical conductivity increases as large 1/10 to the 7th power (ohm cm); the general trend is sigma Si = or approximate sigma Ge = sigma Sn. Variable temperature conductivity and magnetic susceptibility data are reported. GRA

N80-22502# Sandia Labs., Albuquerque, N. Mex.
CHARACTERIZATION AND PROPERTIES OF PLASMA POLYMERIZED 2-VINYLPYRIDINE
K. W. Bieg, D. K. Ottesen, and K. L. Brower. Nov. 1979. 68 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-1798) Avail: NTIS HC A04/MF A01

The chemical structure, aging, thermal, and adhesive behavior of plasma deposited 2-vinylpyridine was investigated. The molecular structure of the plasma polymer is significantly different from the conventional, linear polymer and is strongly dependent on plasma reactor variables. Additional cyano, methyl, and olefinic groups were identified in the plasma polymer, and aromaticity retention was reduced at the more severe (low pressure, high RF power) reactor conditions studied. Postdeposition oxidation occurred, which followed approximately first order kinetics initially. Oxidation was significantly reduced in vacuum, inert gas, and hydrogen atmospheres. Thermal weight loss began at relatively low temperatures and appeared to accompany an exothermic, irreversible crosslinking reaction which began at about 100 C. A quantitative tensile pull adhesion test was developed. Using this technique, the plasma polymer aluminum cohesive bond strength was found to be 480 psi and was degraded at high humidity levels. DOE

N80-22503# Defence Research Information Centre, Orpington (England).
THE EFFECT OF PROCESSING CONDITIONS ON THE GENERAL PROPERTIES OF PLASTICS, PART 1
P. Thienel, G. Wuebken, J. Opfermann, G. Ziegmann, K. deZeeuw, K. Beyer, R. Krueger, N. Berndtsen, H. Berg, and G. Menges. London: HMSO, Aug. 1979. 41 p. refs. Transl. into ENGLISH from Kautsch. Gummi Kunstst. (West Germany), v. 31, no. 7, 1978 p. 510-519.
(DRIC-T-5721; BR70171) Avail: NTIS HC A03/MF A01

Structural features which are affected by manufacturing conditions are discussed. This includes molecular orientation, residual stress state and crystallinity, and structural formation. The production of parts by polystyrene injection molding and its effect on residual stress, orientation, and mechanical properties is considered. Finally, thermal shock treatment in the electroplating of plastics and its effect of relaxation curves, adhesive strengths and residual stresses are described. Author (ESA)

N80-22504*# New Mexico Univ., Albuquerque. Technology Application Center.
SILICON NITRIDES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE. Progress Report, 1973 - Nov. 79
Gerald F. Zollars and William R. Bozman. Feb. 1980. 83 p. Sponsored in part by NASA and NTIS.
(NASA-CR-162930; PB80-804289) Avail: NTIS HC A05/MF A01 CSCL 11B

This bibliography of citations to the international literature concerns studies of the properties of silicon nitrides. Topics covered are mechanical properties, microstructure, fracture strength, reaction kinetics, crack propagation, and high temperature tests of silicon nitrides. Applications of silicon nitrides in gas turbines and as a radome material are included. GRA

N80-22505*# New Mexico Univ., Albuquerque. Technology Application Center.
ALUMINUM OXIDES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE. Progress Report, 1973 - Nov. 1979
Gerald F. Zollars and William R. Bozman. Feb. 1980. 65 p. Sponsored in cooperation with NASA and NTIS.
(NASA-CR-162934; PB80-804271) Avail: NTIS HC A04/MF A01 CSCL 11B

A bibliography of 285 citations to the international literature concerning studies of the properties of aluminum oxides is given. Mechanical properties, fracture strength, microstructure, and high temperature tests are covered. GRA

N80-22506# National Technical Information Service, Springfield, Va.
THE CHEMISTRY OF RESINS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1977 - Jan. 1980
Diane M. Cavagnaro. Feb. 1980. 68 p. Supersedes NTIS/PS-79/0015, NTIS/PS-78/0050 and NTIS/PS-77/0063.
(PB80-804370; NTIS/PS-79/0015, NTIS/PS-78/0050; NTIS/PS-77/0063) Avail: NTIS HC $30.00/MF $30.00 CSCL 07C

The synthesis, polymerization, and chemical reactions of silicone and silicon-containing polymers and copolymers are considered in these citations of federally funded research. Topics include grafting and crosslinking reactions, radiation polymerization, and spectra and molecular structure as they relate to properties. This bibliography contains 61 abstracts, 14 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling, and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N80-22507 Illinois Univ. at Urbana-Champaign.
A STEAM PROCESS FOR THE GASIFICATION OF COAL. Ph.D. Thesis
Ronald Thomas Gibbs. 1979. 194 p.
Avail: Univ. Microfilms Order No. 8009042

A process was studied for the gasification of coal which uses superheated steam in excess of stoichiometric amounts as the heat source for the endothermic gasification reactions. Energy

to generate and superheat the steam was derived by burning a part of the cleaned product gas stream thus avoiding air pollution problems. The excess steam combined with the absence of oxygen in the reactor resulted in sulfur from the coal being converted to hydrogen sulfide with final removal as raw sulfur. Results show the feasibility of the process at temperatures above 1300 K. Further, results showed reasonable agreement with predictions made by the kinetic model. Dissert. Abstr.

N80-22508# Union Carbide Corp., Tonawanda, N.Y.
DIRECT IGNITION OF PULVERIZED COAL WITH ARC HEATED AIR
Philip R. Blackburn. 1980. 39 p. refs. Backup document for AIAA synoptic, 'Ignition of Pulverized Coal with Arc Heated Air', scheduled for publication in Journal of Energy, May - Jun. 1980.
Avail: NTIS. HC A03/MF A01.

Current power plant practice, with suspension fired boilers, involves consumption of large quantities of premium fuel to accomplish ignition of pulverized coal. A new approach to coal ignition is described. A vortex stabilized electric arc heater was attached to a full scale commercial pulverized coal burner. A continuous arc heated air jet was used as an ignition source. The equipment was operated in a power plant. Ignition was accomplished with igniter input power levels which are lower than conventional practice by a factor of six. Cost of an igniter system for a 150 million BTU/hr coal burner is estimated. It is shown that the arc igniter is economically viable and is competitive with conventional practice. Author

N80-22509*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
LABORATORY MEASUREMENTS IN A TURBULENT, SWIRLING FLOW. Final Report.
David P. Hoult. Nov. 1979. 52 p. refs.
(Grant NsG-3076)
(NASA-CR-159723). Avail: NTIS. HC A04/MF A01. CSCL 21D.

Measurements of soot inside a flame-tube burner using a special water-flushed probe are discussed. The soot is measured at a series of points at each burner, and upon occasion gaseous constitutents NO, CO, hydrocarbons, etc., were also measured. Four geometries of flame-tube burners were studied, as well as a variety of different fuels. The role of upstream geometry on the downstream pollutant formation was studied. It was found that the amount of soot formed in particularly sensitive to how aerodynamically clean the configuration of the burner is upstream of the injector swirl vanes. The effect of pressure on soot formation was also studied. It was found that beyond a certain Reynolds number, the peak amount of soot formed in the burner is constant. F.O.S.

N80-22510*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
LONG TERM STORAGE TEST OF TITANIUM MATERIAL WITH LIQUID FLUORINE PROPELLANT. Final Technical Report, 27 Jan. 1976 - 15 Nov. 1979.
J. R. Denson, W. D. English, J. Roth, and A. Toy. 15 Dec. 1979. 277 p. refs.
(Contracts NAS7-100; JPL-954450)
(NASA-CR-162872; TRW-29279-6006-RU-00; JPL-9950-320)
Avail: NTIS. HC A13/MF A01. CSCL 21I.

The compatibility of 6AL-4V Ti with propellant grade GF2 and LF2 at 77 K for up to 3 years was investigated. Titanium double coupons, annealed or heat treated, with 16 or 64 RMS finishes, were immersed in F2 in individual Pyrex capsules and stored under LN2 for 29 and 39 months. Pre and post immersion tests were performed on the propellant and coupons. Chemical analysis of the propellant did not reveal any significant changes due to titanium corrosion. Gravimetric, visual, microscopic, and metallurgical examination with pitting analysis did not reveal gross corrosion of the titanium although pitting appears to be greater after 39 months exposure. The increase in pit size and number raises the possibility of unpredictable crack propagation instability. Fracture toughness tests are necessary to define this possibility. Author

N80-22511# Naval Surface Weapons Center, Dahlgren, Va.
BURNING VELOCITIES OF A SOLID PROPELLANT, VIA A MICROWAVE TECHNIQUE, AT ELEVATED PRESSURES AND PRESSURIZATION RATES. Ph.D. Thesis - Pa. Univ., Apr. 1979. Report, 1976 - 1978.
L. H. Russell. Oct. 1979. 269 p. refs.
(AD-A079791; NSWC/TR-79-378). Avail: NTIS.
HC A12/MF A01. CSCL 21/9.

Presented are the results of a research effort to directly measure, via a microwave Doppler/phase shift technique, the burning rate of solid propellant in both steady and dynamic elevated pressure environments. The recession velocity of the propellant when it burned planarly within a small rectangular waveguide was directly proportional to the time rate of change of a measured relative phase angle. This relative phase angle was based upon the phase relationship between guided microwave reflections from two surfaces, one a reference plane and the other an effective plane created by the dielectric discontinuity at the burning propellant surface. In the pressure range from 500 to 10,000 psig, steady-state burning rate tests with a single base nitrocellulose gun propellant, M8, were sucessfully conducted in a large volume combustion fixture which incorporated a coaxial-to-waveguide adapter having unique pressure sealing microwave feedthroughs. In addition to yielding burning rate values intermediate to those from conventional closed chamber and strand burner tests, the experiments established the uncertainty in the proportionality constant linking M8 burning rate and the time derivative of relative phase angle. A one dimensional theoretical model was formulated and, with the aid of appropriately chosen constants, yielded predictions which agreed very well with the experimentally observed behavior of a solid propellant undergoing planar burning with in a waveguide. GRA

N80-22512# Louisiana State Univ. and A&M Coll., Baton Rouge. Div. of Engineering Research.
COMBUSTION KINETICS OF SELECTED AROMATIC HYDROCARBONS. Final Report, 1 Jun. 1977 - 31 Aug. 1979.
Richard A. Matula and Richard C. Farmer. Aug. 1979. 95 p. refs.
(Grant AF-AFOSR-3384-77; AF Proj. 2308)
(AD-A080103; AFOSR-80-0077TR). Avail: NTIS.
HC A05/MF A01. CSCL 21/4.

The primary objective of the research program is to develop an understanding of the high temperature pyrolysis, oxidation and carbon formation processes in selected aromatic-hydrocarbon/air-combustion systems. The results of this study can be subsequently utilized to optimize the use of high-aromatic-content synthetic jet-fuels in both present and future jet combustors. Specific objectives of the research are to: study the kinetics of aromatic hydrocarbon pyrolysis in temperature and ranges of interest; study the ignition and oxidation of aromatic hydrocarbon-air systems; measure the critical fuel-oxidizer equivalence ratio for incipient soot formation in aromatic hydrocarbon-air mixtures; and develop quasi-global and/or detailed oxidation mechanisms for these aromatic hydrocarbons based on experimental data and computer modeling of the reaction systems. GRA

N80-22513# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
BURNING TO DETONATION TRANSITION IN POROUS BEDS OF A HIGH ENERGY PROPELLANT
R. R. Bernecker, D. Price, and H. Sandusky. Nov. 1979. 77 p. refs. Presented at the 16th JANNAF Combust. Meeting, Monterey, Calif., 10 Sep. 1979.
(AD-A080315; NSWC/TR-79-351). Avail: NTIS.
HC A05/MF A01. CSCL 21/9.

The deflagration to detonation transition (DDT) behavior of porous charges of a high-energy propellant (VLU) has been studied at both high and low confinements. The region of accelarating pressure buildup, necessary for DDT, occurred shortly before (both in time and distance) a transition to detonation. Propagation of compressive waves in both directions was associated with the buildup. The origin of the event producing these waves is unknown, but it appears to be a rapid heat release mechanism such as a thermal explosion. The DDT characteristics observed for this propellant are quite similar to those observed for tetryl in previous

studies. The effect of confinement on the DDT susceptibility of this material at high porosities is small. GRA

N80-22514# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT ANB-3066 PROPELLANT Semiannual Report
Elizabeth M. Delabe. Nov. 1979. 397 p. refs
(AD-A080581; MANCP-417-79) Avail: NTIS
HC A17/MF A01 CSCL 21/9

This report contains test results from LGM-30 F G, Stage 2 and Stage 3 propellant. Data are shown in linear regression plots. The differences between polymers used in the propellant are shown in the composite plots for very low rate tensile, high rate tensile and stress relaxation data and is most evident in gradient stress relaxation modulus. Case liner bonds continue to show significant degradation although the rate of change has slowed. GRA

N80-22515# Los Alamos Scientific Lab., N. Mex.
SPECIFIC HEAT AND THERMAL CONDUCTIVITY OF EXPLOSIVES, MIXTURES, AND PLASTIC-BONDED EXPLOSIVES DETERMINED EXPERIMENTALLY
John F. Baytos. Sep. 1979. 13 p. refs
(Contract W-7405-eng-36)
(LA-8034-MS) Avail: NTIS HC A02/MF A01

Three tables show the specific heat and thermal conductivity of explosives and plastic-bonded explosives of interest to WX operations. Specific heat was determined by differential scanning calorimetry against sapphire standards. Thermal conductivity was determined by two means: the guarded hot-plate method or the differential scanning calorimeter comparative method on miniature samples. DOE

N80-22516# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
BIOMASS ENERGY CONVERSION WORKSHOP FOR INDUSTRIAL EXECUTIVES
1979. 77 p. Workshop held at Claremont, Calif., 9-10 Apr. 1979. Prepared in cooperation with Calif. Energy Comm., Sacramento
(Contract EG-77-C-01-4042)
(SERI/TP-62-299; CONF-790485) Avail: NTIS
HC A05/MF A01

The potential to turn industrial waste or residue into an energy source was discussed at a workshop which provided industrial managers with current information on using residues and wastes as industrial energy sources. Successful industrial experiences were described by managers from the food processing and forest product industries, and direct combustion and low-Btu gasification equipment was examined. Some major conclusions of the conference were: numerous current industrial applications of wastes and residues as fuels are economic and reliable; off-the-shelf technologies exist for converting biomass wastes and residues to energy; a variety of financial (tax credits) and institutional (PUC rate structures) incentives can help make these waste-to-energy projects more attractive to industry. Many of these incentives are still being developed and their precise impact must be evaluated on a case-by-case basis. DOE

N80-22517# Battelle Pacific Northwest Labs., Richland, Wash.
INVESTIGATION OF GASIFICATION OF BIOMASS IN THE PRESENCE OF CATALYSTS
L. K. Mudge, R. J. Robertus, L. J. Sealock, Jr., D. H. Mitchell, S. L. Weber, and G. E. Stegen. 1979. 34 p. refs. Presented at the 8th Biomass Thermoconversion Contractors Meeting, Seattle, 31 Jul. - 1 Aug. 1979
(Contract EY-76-C-06-1830)
(PNL-SA-7939) Avail: NTIS HC A03/MF A01

The technical and economic feasibility of catalyzed biomass gasification to produce methane, hydrogen, carbon monoxide, and synthesis gases for generation of ammonia, methanol, or hydrocarbons was studied. The effect of primary catalyst concentration on gasification rate, and systems for direct generation of ammonia synthesis gas and hydrogen were defined. No promising system for direct carbon monoxide production was found. A wood feed system was installed in the Process Development Unit (PDU) and proved to be reliable and effective for metering wood into the gasifier. Temperature control in the PDV reactor system was improved. Preliminary calculations on the feasibility of catalyzed gasification of wood to produce methanol are encouraging. Status of the project is also presented. DOE

N80-22518# UOP, Inc., Des Plaines, Ill. Corporate Research Center.
UPGRADING OF COAL LIQUIDS: UPGRADING DISTILLATES FROM COAL LIQUEFACTION Annual Report, 31 Jan. 1978 - 31 Jan. 1979
A. J. deRosset, Gim Tan, and Lee Hilfman. May 1979. 16 p. refs
(Contract EF-77-C-01-2566)
(FE-2566-26) Avail: NTIS HC A02/MF A01

The coal-derived naphthas from the H-Coal and Exxon Donor Solvent (EDS) processes were hydrotreated and reformed in research pilot plants to 100 Research Octane Number (RON) gasoline. The 400 F(+) distillates from the H-Coal and EDS processes converted by hydrotreating, hydrocracking and fluid catalytic cracking (FCC). In general, hydrotreatment is required prior to either hydrocracking or FCC to reduce excessive amounts of nitrogen and to enhance processability. Hydrotreating alone will give high yields of environmentally acceptable No. 2 fuel oil. Hydrogen consumption was high, however, a portion of the hydrogen can be recovered by reforming the hydrocracked naphtha to 100 RON gasoline. Additional hydrogen can potentially be recouped by steam reforming light gases. The hydrotreated distillates responsed to fluid catalytic cracking as well as petroleum derived stocks of comparable hydrogen content. FCC gasoline product octane numbers ranged from 92 to 99 RON. DOE

N80-22519# UOP, Inc., Des Plaines, Ill. Corporate Research Center.
UPGRADING OF COAL LIQUIDS: HYDROTREATING AND REFORMING EXXON DONOR SOLVENT (EDS) PROCESS DERIVED NAPHTHAS Interim Report
G. Tan and A. J. DeRosset. Feb. 1979. 48 p. refs
(Contract EF-77-C-01-2566)
(FE-2566-25) Avail: NTIS HC A03/MF A01

Exxon donor solvent (EDS) process naphtha which was processed in research pilot plants into 100 octane motor fuel by conventional refinery processes, using commercial UOP catalysts is described. The naphtha comprises principally cyclic hydrocarbons. In addition, it contains over 10 percent heterocyclic structures, such as phenols, pyridines, and thiophenes. Hydrotreatment was effective in reducing the sulfur and nitrogen to levels acceptable for reforming. Reforming the hydrotreated naphtha gave 90 volume percent of 100 octane gasoline. DOE

N80-22520# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF COMBUSTION DATA TO UTILIZE LOW-Btu GASES AS INDUSTRIAL PROCESS FUELS. PROJECT 61004 SPECIAL REPORT NO. 8: BOILER BURNER
R. T. Waibel and E. S. Fleming. May 1979. 40 p. refs
(Contract EX-76-C-01-2489)
(FE-2489-45) Avail: NTIS HC A03/MF A01

Data were gathered to determine the performance of a boiler burner with a gun-type fuel injector when retrofit with three low-Btu gases, the performance of natural gas was used as a base line for comparison. The burner was fired on the IGT pilot-scale test furnace, simulating one burner in a multiburner array of an industrial boiler. In order to fire the low-Btu gases at the 3.0 million Btu/hr rate and upstream pressure of 30 psia used for natural gas, the fuel injector was modified by increasing the sizes of the fuel orifices to permit delivery of the required fuel volume at sonic velocity. With the appropriate fuel injector, all the low-Btu fuels exhibited stable flames at fuel enthalpy inputs of 3.0 million Btu/hr. All the low-Btu fuel gases had longer flame lengths than natural gas, although not long enough to create flame impingement problems. The thermal efficiencies of the low-Btu gases ranged from 29.5 percent for Koppers-Totzek oxygen to 26 percent for Winkler air compared with 32 percent for natural gas. DOE

N80-22521# Engineering Societies Commission on Energy, Inc., Washington, D. C.
GUIDELINES FOR ECONOMIC EVALUATION OF COAL CONVERSION PROCESSES Final Report
Apr. 1979 83 p refs
(Contract EF-77-C-01-2468)
(FE-2468-44) Avail: NTIS HC A05/MF A01

Guidelines developed for use in preparing and reporting engineering designs, cost estimates, and financial analyses of large scale fossil energy facilities are presented, primarily for the preliminary economic analysis of coal conversion projects, producing either gas or coal liquids. In a preliminary estimate, the process, equipment, and site factors are sufficiently defined to justify a preliminary engineering design. However, the general structure and subject matter of these guidelines are applicable to either more simplified or more detailed analyses of energy facilities. Particular emphasis is placed on the treatment of capital cost estimates of new processes at various stages of technical development. Also, the financial methods and parameters to be used in determining the required selling price of products are defined in order to establish a base case for sensitivity analysis of technical, locational, or financial variables. DOE

N80-22522# Institute of Gas Technology, Chicago, Ill.
EQUILIBRIUM EFFECTS IN HIGH-PRESSURE HYDROGEN PRODUCTION FROM THERMOCHEMICAL WATER-SPLITTING CYCLES
James D. Schreiber, Jim R. Dafler, and Stephen E. Foh 1978 19 p refs Presented at 2d World Hydrogen Energy Conf., Zurich, 21 Aug. 1978
(Contract EC-77-C-02-4434)
(CONF-780807-8) Avail: NTIS HC A02/MF A01

A group of generalized relationships are presented for hydrogen production steps such that delta G the Gibb's free energy change for the reactions, a series of relationships between the hydrogen mole fraction and product pressure are defined. The trade-offs between product stream composition and input heat temperature are assessed. The degree to which feed stream impurities can be tolerated, given fixed operating variables, can also be determined. DOE

N80-22523# Katzen (Raphael) Associates, Cincinnati, Ohio.
GRAIN MOTOR FUEL ALCOHOL TECHNICAL AND ECONOMIC ASSESSMENT STUDY
Jun. 1979 368 p refs
(Contract EJ-78-C-01-6639)
(HCP/J6639-01) Avail: NTIS HC A16/MF A01

The technical and economical feasibility for production of motor fuel alcohol from a plant with a capacity of 50 million US gallons per year is evaluated. Included are a detailed process design using proven technology, a complete budget estimate of the plant investment including working capital, a detailed analysis of the annual operating cost using corn as the primary feedstock, and a complete financial analysis which establishes the alcohol selling price required to net to the investor a 15 percent discounted cash flow (interest rate or return). Other considerations for production of motor fuel alcohol are evaluated and discussed, namely: excursions on plant capacities; excursions on feedstock material; sensitivity analyses on financial parameters; and substitution of corn stover for coal as the fuel source. An assessment and commmentary on the agricultural, technological, and economic impact of a major gasohol program in the US are also given. DOE

N80-22524# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SURVEY OF BIOMASS GASIFICATION. VOLUME 2: PRINCIPLES OF GASIFICATION
T. B. Reed, comp. Jul. 1979 241 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-33-239-Vol-2) Avail: NTIS HC A11/MF A01

Biomass gasification and associated technologies are surveyed. The technical background necessary for understanding the science, engineering, and commercialization of biomass is presented. DOE

N80-22525# Technische Hochschule, Aachen (West Germany). Inst. fuer Eisenhuettenkunde.
PRESSURE-CHANGE UNDERGROUND GASIFICATION: THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF GASIFICATION Final Report
Christian Paul Beckervordersandforth, Jochen Belzer, Manfred Kuehn, Mehrdat Mohtadi, Wolfgang Sitte, Guenther Subklew, and Walter Terschueren Bonn Bundesmin. fuer Forsch. u. Technol. Jun. 1979 93 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-05) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 19.10

The extraction of SNG, reduction gas, and other gaseous fuels by means of in situ coal gasification with hydrogen, air, and oxygen mixtures was studied both theoretically and experimentally. Special emphasis was placed on the pressure-change process. Simulation experiments were carried out above ground at pressures up to 60 bar and temperatures up to 1000 C. A feasibility study was performed taking into account technical and economic factors. Author (ESA)

N80-22526# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).
A CHEMILUMINESCENCE STUDY OF OXIDES OF NITROGEN EVOLVED FROM PROPELLANTS
I. G. Wallace, R. J. Powell, and B. J. Downes London HMSO Sep. 1979 21 p Presented at 5th Symp. on Chem. Probl. Related to the Stability of Explosives, Baastad, Sweden, May 1979
(PERME-TR-146; BR70270) Avail: NTIS HC A02/MF A01

A chemiluminescence NO sub x analyzer was used to study nitrogen oxides evolution from single base and double base propellants. The technique illustrates the importance of total oxides of nitrogen as a means for determining the rate at which these materials decompose. The potential of the method as a rapid and unambiguous means of assessing factors such as stability and compatibility is evaluated. Author (ESA)

N80-22527# Pullman Kellogg, Houston, Tex.
COAL CONVERSION CONTROL TECHNOLOGY. VOLUME 1: ENVIRONMENTAL REGULATIONS; LIQUID EFFLUENTS Final Report, Apr. 1977 - Nov. 1978
L. E. Bostwick, M. R. Smith, D. O. Moore, and D. K. Webber Oct. 1979 540 p
(Contract EPA-68-02-2198)
(PB80-126469; EPA-600/7-79-228A-Vol-1) Avail: NTIS HC A23/MF A01 CSCL 13B

Environmental regulations for gaseous, liquid, and solid wastes, and the control technology for liquid effluents are addressed. Available and developing control technology was evaluated in view of federal, state, regional, and international environmental standards. GRA

N80-22528# Pullman Kellogg, Houston, Tex.
COAL CONVERSION CONTROL TECHNOLOGY. VOLUME 2: GASEOUS EMISSIONS; SOLID WASTES Final Report, Apr. 1977 - Nov. 1978
L. E. Bostwick, M. R. Smith, and D. K. Webber Oct. 1979 384 p
(Contract EPA-68-02-2198)
(PB80-126477; EPA-600/7-79-228B-Vol-2) Avail: NTIS HC A17/MF A01 CSCL 13B

The control technology of gaseous emissions and solid wastes is discussed. Available and developing control technology was evaluated in view of the requirements of federal, state, regional, and international environmental standards. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-22529 Missouri Univ., Rolla.
BEHAVIOR OF ELASTIC AND INELASTIC THREE-DIMENSIONAL BUILDING SYSTEMS FOR STATIC LOADS AND MULTICOMPONENT EARTHQUAKES Ph.D. Thesis
Prasert Kitipitayangkul 1979 394 p

Avail: Univ. Microfilms Order No. 8008399

The effect of interacting three dimensional ground motions on the response behavior of elastic and inelastic building systems is investigated. The structures are subjected to simultaneous input of static loads and multicomponent earthquake motions. The earthquake inputs are applied in any direction of the structural plane. The P-delta effect of the second-order moment resulting from the gravity load and the vertical ground motion is considered. A total of 26 numerical examples are investigated for various low rise and high rise building systems subjected to various loading cases of interacting ground motions. The response parameters of main interest are: (1) transverse, vertical, and torsional movements; (2) internal moments and their associated rotations; (3) energy absorption characteristics; (4) ductility factors and the excursion ratios; (5) the effect of different earthquakes; and (6) the effect of materials having different strain hardenings. Dissert. Abstr.

N80-22530 Illinois Univ. at Urbana-Champaign.
SIMPLE AND COMPLEX MODELS FOR NONLINEAR SEISMIC RESPONSE OF REINFORCED CONCRETE STRUCTURES Ph.D. Thesis
Mehdi SaiidiMovahhed 1979 200 p
Avail: Univ. Microfilms Order No. 8009156

A total of eight small scale ten story reinforced concrete test structures was analyzed using the Q-Model, and the results were compared with measured responses. The performance of the Q-Model was also examined for different earthquake records. Because no experimental result was available for these records, the calculated responses were checked against the results from the multidegree analytical model developed in the first part of this study. The overall performance of the Q-Model was satisfactory for different structures and earthquake records. Dissert. Abstr.

N80-22531 Illinois Univ. at Urbana-Champaign.
STATISTICAL ANALYSIS OF THE RESPONSE OF NONLINEAR SYSTEMS SUBJECTED TO EARTHQUAKES Ph.D. Thesis
Rafael Riddell 1979 312 p
Avail: Univ. Microfilms Order No. 8009144

The dynamic response of single degree of freedom nonlinear systems subjected to earthquake excitations is considered with the purpose of reviewing previous recommendations for deriving inelastic design spectra, and to evaluate the effect of damping combined with nonlinear behavior and the influence of the type of material nonlinearity on inelastic response. Three nonlinear models are used: the elastoplastic and bilinear idealizations, and a stiffness degrading model. Considering the various conditions and ground motions used, results for about 12,000 different cases are obtained and summarized in the form of inelastic response spectra. A statistical procedure is developed to analyze the data; from this analysis, factors for deriving the characteristic trapezoidal design spectrum are obtained. Such factors reflect, in an explicit manner, the effect of the damping factor and the type of material nonlinearity on inelastic response. Dissert. Abstr.

N80-22532 Illinois Univ. at Urbana-Champaign.
RESPONSE OF SIMPLE STRUCTURAL SYSTEMS TO TRAVELING SEISMIC WAVES Ph.D. Thesis
James Richard Morgan 1979 125 p
Avail: Univ. Microfilms Order No. 8009114

The dynamic response of a simple structural system with coupled translational and rotational degrees-of-freedom subjected to ground motion containing both translational and rotational components was studied to assess current building code procedures and arrive at bounds on the interrelationships between torsional and translational response. A discussion of various system parameters (coupled or uncoupled system, ratio of translational to torsional frequencies, magnitude of eccentricity between centers of mass and stiffness, ratio of translational stiffnesses, and building size) on the interaction between translation and rotation is presented. Tau-averaging was employed in the study. Comparisons of the results of the calculations with results obtained using current seismic building code approaches for buildings with real and accidental eccentricities are presented and discussed. Dissert. Abstr.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-22533 Connecticut Univ., Storrs.
THE EFFECT OF THE KERR METRIC ON THE PLANE OF POLARIZATION OF AN ELECTROMAGNETIC WAVE Ph.D. Thesis
Frederick Sun On Su 1979 108 p
Avail: Univ. Microfilms Order No. 8008693

The rotation of the plane of polarization for linearly polarized light rays propagating past a rotating massive body was examined. Two observers in different reference frames were utilized to observe the results for a special class of trajectories: those propagating parallel to the symmetry axis of the body. It is shown that the values for the change in polarization for the global inertial observer differ from that seen by the locally nonrotating observer. It is also shown that this class of trajectories exhibit maximal values - larger than what has been published before. Dissert. Abstr.

N80-22534 Illinois Univ. at Urbana-Champaign.
PERFORMANCE ANALYSIS OF DIRECT-SEQUENCE SPREAD-SPECTRUM MULTIPLE-ACCESS COMMUNICATION VIA FADING CHANNELS Ph.D. Thesis
David Edward Borth 1979 188 p
Avail: Univ. Microfilms Order No. 8008984

The channels considered are those for which the channel output consists of a strong stable specular signal plus a faded version of this signal. Such channels are the result of a transmission medium which gives rise to a major stable communication path and a number of additional weaker communication paths. The fading channel is modeled as a general wide-sense-stationary uncorrelated-scattering (WSSUS) channel - a model which is general enough to exhibit both time and frequency selectivity and to impose no restrictions on the fading rate. A discussion of the important parameters of the WSSUS channel is given and two important classes of WSSUS channels are developed from the general fading channel model: time-selective fading channels and frequency-selective fading channels. In analyzing the performance of direct-sequence SSMA communications via fading channels, two measures of system performance that are considered are average signal-to-noise ratio at the receiver output and the average probability of error. Dissert. Abstr.

N80-22535 Rutgers - The State Univ., New Brunswick, N. J.
ANALYSIS AND DESIGN OF HIGHLY DECOUPLED COLINEAR ANTENNAS Ph.D. Thesis
Donn VanDyke Campbell 1979 173 p
Avail: Univ. Microfilms Order No. 8008862

In communication systems used for simultaneous transmission and reception on adjacent frequencies cross-talk interference often occurs as a result of the strong mutual coupling of the collocated transmitting and receiving antennas. To solve this problem, a colinear antenna array consisting of two independently fed vertical half wavelength dipoles and a feed line 'isolator section' was designed. The colinear antenna arrangement minimizes radiation coupling. The isolator section, which is a new concept, practically eliminates parasitic currents induced on the outer surface of the feed line connected to the upper dipole. As a result, the inter-dipole coupling is greatly reduced and the dipoles operate independently and as if the feed line were not present. Moreover, field pattern distortion is practically eliminated since the feed line does not contribute to the antenna radiation. Dissert. Abstr.

N80-22536 Rutgers - The State Univ., New Brunswick, N. J.
A MICROWAVE RESONATOR AND CAVITY-BACKED SLOT ANTENNA BASED UPON THE GAUSSIAN BEAM MODES OF RECTANGULAR SYMMETRY Ph.D. Thesis
Charles Michael 1979 234 p
Avail: Univ. Microfilms Order No. 8008872

Gaussian beams, such as those produced in a laser, are characterized by cross-sectional field distributions which decay

rapidly away from the beam axis. The fields of the beam modes possessing rectangular symmetry are expressed in terms of a complete, orthogonal set of functions, the Gauss-Hermite polynomials. These functions exhibit extremely rapid decay transverse to the beam axis, a feature which eliminates the need for field confinement to the sides, as is required in conventional microwave structures such as waveguides, resonators, and horn antennas. Design formulas for a microwave resonator are developed in terms of these beam modes and an experimental cavity with a quality factor, Q, greater than 12,000 is described. A slot aperture is formed in one wall of the cavity to produce radiation into space. The field distribution of the finite length aperture is shown to have a Gaussian distribution in the transverse dimension in very good approximation and the radiation field due to this aperture distribution is calculated using the Fourier transform.
Dissert. Abstr.

N80-22537 Illinois Univ. at Urbana-Champaign.
INTERACTIVE FACSIMILE COMMUNICATION TECHNIQUES Ph.D. Thesis
Andrew Burton White. 1979. 109 p.
Avail: Univ. Microfilms. Order No. 8009207

Graphic communication systems for technical teleconferencing are examined. The responses to a questionnaire sent to the participants in a recent teleconference are reported. The results of this survey indicate effective technical teleconferences can be conducted with a two way voice channel, an image handling system, and a remote pointer. The results confirm that a cursor would be a useful addition to conversations involving graphics. Taped technical presentations are presented which show that both voice and nonverbal data can be combined on a single digital voice channel. To transmit the cursor information a new technique was developed that inserts this data at zero crossing in the voice waveform. The development of electronic hardware devices is also addressed.
Dissert. Abstr.

N80-22538 Illinois Univ. at Urbana-Champaign.
ELASTIC WAVE PROPAGATION IN RODS AND BARS Ph.D. Thesis
Thomas Roger Woodley. 1979. 95 p.
Avail: Univ. Microfilms. Order No. 8009217

The results of a literature search on the facts contained in the studies of classical problems of traveling waves in rods of circular cross section and rectangular bars are presented. The derivation of the equations of motion, boundary conditions, frequency equations, phase and group velocities, the rigid body motions associated with zero frequency solutions, and asymptotic solutions were assembled. During the investigation, new axial shear solutions for rectangular bars and a set of new frequency equations were discovered.
Dissert. Abstr.

N80-22539 Wyoming Univ., Laramie.
THE HYPERBOLIC WAVE THEORY OF FIRST-ORDER PHASE TRANSITIONS Ph.D. Thesis
Rodney William Cole. 1978. 134 p.
Avail: Univ. Microfilms. Order No. 8008006

A hyperbolic wave theory is developed and used to describe the catastrophe in the equation of state for systems exhibiting firts-order phase transitions. From the grand canonical ensemble a Burgers equation for the order parameter is derived in the state variables T and mu (temperature and chemical potential). It is found that both shock solutions consistent with the Maxwell equal-area construction and breaking solutions are predicted by this equation and that without stability requirements the grand canonical ensemble does not contain enough information to uniquely determine the solution. Entropy conditions are derived to uniquely determine the shock solution in the coexistence region. It is found that owing to the divergence of the correlation length and relaxation time, the concept of quasistatic change is not valid in the coexistence region, and that a nonequilibrium description must, therefore, be used.
Dissert. Abstr.

N80-22540 Arizona State Univ., Tempe.
RADAR SIGNAL CORRELATION SIDELOBE SUPPRESSION USING WALSH TECHNIQUES Ph.D. Thesis
Charles Edward Steuck. 1979. 231 p.
Avail: Univ. Microfilms. Order No. 8008583

Correlation sidelobe suppression in radar signal processing is considered. Certain binary valued sequences such that Walsh function analysis could be used to simplify the hardware are introduced. After a short treatment of binary valued Walsh functions, Woodward's ambiguity function is used to look at some of the problems that might arise from actually trying to use the proposed scheme. Also, binary valued sequences are extended to quaternary valued sequences that take on only the values 1 or -1 and i or -i. The results are similar for both the binary valued and the quaternary valued sequences. Problems associated with resolving multiple targets that have a wide separation in Doppler and the potential for resolving multiple targets in range only are considered.
Dissert. Abstr.

N80-22541 California Univ., Los Angeles.
THEORY AND DESIGN OF PRINTED ANTENNAS Ph.D. Thesis
Inam Elahi Rana. 1979. 167 p.
Avail: Univ. Microfilms. Order No. 8008515

The theory and design of antennas printed on a grounded substrate was studied. A Green's function approach was employed. By considering Pocklington's integral equation with proper choice of expansion and testing functions, solutions for current distribution and input impedance were obtained. As an example, printed wire antenna was analyzed. Numerical results illustrating the effect of substrate thickness and dielectric constant on the current distribution and input impedance are presented. An array of printed wire dipoles was also considered.
Dissert. Abstr.

N80-22542 Illinois Univ. at Urbana-Champaign.
ALUMINUM GALLIUM ARSENIDE/GALLIUM ARSENIDE HETEROJUNCTION PHOTOTRANSISTORS FOR FIBEROPTIC COMMUNICATIONS Ph.D. Thesis
Raymond Anthony Milano. 1979. 114 p.
Avail: Univ. Microfilms. Order No. 8009108

The operation of heterojunction phototransistor (HPT's) was investigated. It is shown that the device can provide high gain and fast response. The gain depends on base width, minority carrier diffusion length in the base, and the difference in bandgap energies between emitter and base. The frequency response of the heterojunction phototransistor was analyzed. The response time is shown to depend on the response of the base-emitter potential, to changes in optical input signal. The performance of the device as a detector for fiber optic communication systems was also analyzed. Theoretical calculations show that the base current and load resistance limit the HPT to applications in which moderate to high signal power is available. Heterojunction phototransistors fabricated by metalorganic chemical vapor deposition were experimentally characterized by measurements of the dc and small signal optical gain, the spectral response, and the response time. Results show that the MO-CVD fabricated devices are comparable to the best devices fabricated by liquid phase epitaxy.
Dissert. Abstr.

N80-22543*# Future Systems, Inc., Gaithersburg, Md.
AN ADVANCED DOMESTIC SATELLITE COMMUNICATIONS SYSTEM
Mar. 1980. 205 p. refs.
(Contract NASw-3300)
(NASA-CR-163004; FSI-242) Avail: NTIS HC A10/MF A01 CSCL 17B

An updated traffic projection for U.S. domestic satellite communications service covering a period of 15 years, mid-1980 to mid-1995 was prepared. This model takes into account expected technology advances and reductions in transmission costs, legislative and regulatory changes permitting increased competition, and rising energy costs which will encourage more extensive substitution of telecommunications for travel. The historical development and current status of satellite systems are discussed as well as the characteristics of follow-on systems. Orbital arc utilization, spacecraft configuration for single shuttle launch, Earth station configuration, and system costs are examined. Areas which require technology development include multiple beam frequency reuse antennas, on-board switching, intersatellite links, and ka-band operation. Packing and deployment schemes for enclosing the satellite within the shuttle orbiter bay must also be devised.
A.R.H.

N80-22544*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STUDY OF WRAP-RIB ANTENNA DESIGN Final Report
W. D. Wade, A. Sinha, and R. Singh 12 Dec. 1979 85 p
(Contracts NAS7-100; JPL-955345)
(NASA-CR-162929; LMSC-D714613) Avail: NTIS HC A05/MF A01 CSCL 09C

The results of a parametric design study conducted to develop the significant characteristics and technology limitations of space deployable antenna systems with aperture sizes ranging from 50 up to 300 m and F/D ratios between 0.5 and 3.0 are presented. Wrap/rib type reflectors of both the prime and offset fed geometry and associated feed support structures were considered. The significant constraints investigated as limitations on achievable aperture were inherent manufacturability, orbit dynamic and thermal stability, antenna weight, and antenna stowed volume. A data base, resulting in the defined maximum achievable aperture size as a function of diameter, frequency and estimated cost, was formed. E.D.K.

N80-22545*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
ULTRAMICROWAVE COMMUNICATIONS SYSTEM, PHASE 2 Final Report
5 Jan. 1980 33 p refs
(Contract NAS9-15617)
(NASA-CR-160573; MDC-E2209) Avail: NTIS HC A03/MF A01 CSCL 17B

Communications system design was completed and reviewed. Minor changes were made in order to make it more cost effective and to increase design flexibility. System design activities identified the techniques and procedures to generate and monitor high data rate test signals. Differential bi-phase demodulation is the proposed method for this system. The mockup and packaging designs were performed, and component layout and interconnection constraints were determined, as well as design drawings for dummy parts of the system. The possibility of adding a low cost option to the transceiver system was studied. The communications program has the advantage that new technology signal processing devices can be readily interfaced with the existing radio frequency subsystem to produce a short range radar. E.D.K.

N80-22546# Communications Research Centre, Ottawa (Ontario). Radio and Radar Research Branch.
THE GREAT LAKES PROPAGATION MEASUREMENT PROGRAM: COMPARISONS OF THE CANADIAN DATA WITH THE PREDICTIONS OF FCC R-6602
F. H. Palmer Feb. 1980 67 p refs
(CRC-1332) Avail: NTIS HC A04/MF A01

It was found that there was insufficient propagation data to determine reliably either the interference levels that would be encountered, or the applicability of the existing FCC R-6602 propagation curves, in the region of the Great Lakes. Accordingly, it was decided to conduct a joint study to assess, and if possible resolve, the propagation issues. Attention is confined to comparisons of observed field strengths in the Great Lakes area with those predicted by R-6602, and to an interpretation of the differences in terms of various paths and systems parameters. It is shown that, while the R-6602 curves accurately predict the long term (annual average) values of F(50,50) and F(50,10), they do not take into account observed diurnal and seasonal variatons of signal strengths of up to about 30 dB. Qualitatively, signal strengths over all paths are found to be higher at night than during the day and higher in summer than in winter. Empirical expressions are presented which relate the signal strengths predicted by R-6602 to those actually observed, and which take into account time of day, day of year, path length, and percentage of propagation path covered by water. F.O.S.

N80-22547*# Western Union Telegraph Co., Upper Saddle River, N.J.
THE 18/30 GHz FIXED COMMUNICATIONS SYSTEM SERVICE DEMAND ASSESSMENT. VOLUME 1: EXECUTIVE SUMMARY
T. Gabriszeski, P. Reiner, J. Rogers, and W. Terbo Jun. 1979 32 p 3 Vol.
(Contract NAS3-21359)
(NASA-CR-159546) Avail: NTIS HC A03/MF A01 CSCL 17D

The total demand for voice, video, and data communications services, and satellite transmission services at the 4/6 GHz, 12/14 GHz, and 18/30 GHz frequencies is discussed. Major study objectives, overall methodology, results, and general observations about a satellite systems market characteristics and trends are summarized. M.G.

N80-22548*# Western Union Telegraph Co., Upper Saddle River, N.J.
THE 18/30 GHz FIXED COMMUNICATIONS SYSTEM SERVICE DEMAND ASSESSMENT. VOLUME 2: MAIN TEXT
T. Gabriszeski, P. Reiner, J. Rogers, and W. Terbo Jun. 1979 328 p refs 3 Vol.
(Contract NAS3-21359)
(NASA-CR-159547) Avail: NTIS HC A15/MF A01 CSCL 17B

The total demand for communications services, and satellite transmission services at the 4/6 GHz, 12/14 GHz, and 18/30 GHz frequencies is assessed. The services are voice, video, and data services. Traffic demand, by service, is distributed by geographical regions, population density, and distance between serving points. Further distribution of traffic is made among four major end user groups: business, government, institutions and private individuals. A traffic demand analysis is performed on a typical metropolitan city to examine service distribution trends. The projected cost of C and Ku band satellite systems are compared on an individual service basis to projected terrestrial rates. Separation of traffic between transmission systems, including 18/30 GHz systems, is based on cost, user, and technical considerations. M.G.

N80-22549*# Western Union Telegraph Co., Upper Saddle River, N.J.
THE 30/20 GHz FIXED COMMUNICATIONS SYSTEMS SERVICE DEMAND ASSESSMENT. VOLUME 3: APPENDICES
T. Gabriszeski, P. Reiner, J. Rogers, and W. Terbo Jun. 1979 200 p refs 3 Vol.
(Contract NAS3-21359)
(NASA-CR-159548) Avail: NTIS HC A09/MF A01 CSCL 17B

The market analysis of voice, video, and data 18/30 GHz communications systems services and satellite transmission services is discussed. Detail calculations, computer displays of traffic, survey questionnaires, and detailed service forecasts are presented. M.G.

N80-22550# California Univ., Berkeley. Electronics Research Lab.
SUPERCONDUCTING WEAK LINKS FOR MIXING AT MILLIMETER-WAVE FREQUENCIES Final Report, 15 May 1973 - 30 Sep. 1979
T. VanDuzer Sep. 1979 11 p refs
(Grants DA-ARO(D)-31-124-73-G165; DAAG29-76-G-0191)
(AD-A080571; ARO-11796.4-EL; ARO-13678.4-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

A study is made for application of Josephson devices for millimeter-wave mixing. Technology for fabrication of small area silicon-coupled sandwich-type Josephson junctions is developed. A thin strip of superconducting metal film deposited on a degenerately doped silicon surface with a 0.1 - 0.3 micron gap cut across the film is shown to constitute a Josephson junction with certain significant advantages. A design of a Josephson junction two-dimensional array is made and its properties are studied theoretically. A model for calculation of the action of a developer on a resist is devised. Calculations of the effect of thinning a substrate on the exposure of electron resists are made. GRA

N80-22551# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering
A TEST FOR THE VALIDITY OF THE GENERALIZED GILBERT MODEL USING REAL COMMUNICATIONS CHANNELS M.S. Thesis

John F. Johnson, Jr. Dec. 1979 170 p refs
(AD-A080370; AFIT/GE/EE/79-18) Avail: NTIS
HC A08/MF A01 CSCL 17/2

A proposal has been made to use the generalized Gilbert model in a real time channel monitoring device. The purpose of the device is to calculate error statistics by observing an operational channel and, from the observations, estimate the model parameters. The parameter estimates can then be used to calculate the desired channel statistics. An estimator is developed which yields these parameters. The estimator and the model are tested using real communications channels. The model and/or estimator are found to be invalid when applied to the channel data available. A sensitivity analysis is conducted using the probability equations associated with the model. The sensitivity study indicates that the parameters of the generalized Gilbert model cannot be uniquely, simultaneously estimated from observations of the data.
Author (GRA)

N80-22552# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THRESHOLD OF THE VELOCITY GATE IN A CONTINUOUS WAVE RADAR WITH CONICAL SCAN TRACKING M.S. Thesis
Jonathan Paul Sunray Dec. 1979 101 p refs
(AD-A080411; AFIT/GE/EE/79-35) Avail: NTIS
HC A06/MF A01 CSCL 17/9

A study is made of the behavior of the velocity gate in a continuous wave radar with conical scan tracking. Adapting the analysis of the frequency modulation feedback demodulator (FMFB), two linear models are developed for the velocity gate. The first deals with the gate's response to a static doppler frequency offset and the second deals with its response to a varying doppler frequency. The dynamic model also incorporates the presence of narrowband, Gaussian noise at the input to the gate. The phase tracking error of the gate due to noise is determined as a function of the carrier-to noise ratio (CNR) in a bandwidth equal to the closed-loop noise bandwidth. Establishing the performance criterion to be the frequency tracking error, two definitions for the threshold of the gate are established. The first states the threshold occurs at the value of CNR for which the root-mean-square frequency tracking error due to noise exceeds half the 3db bandwidth of the IF filter within the gate. The second bases the threshold on the probability of the frequency error exceeding half the 3db bandwidth of the IF filter. Both definitions are applied to an example in which a second order velocity gate is considered.
GRA

N80-22553# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PREDICTED MICROWAVE ELCTROMAGNETIC BACKSCATTERING RETURNS FOR SIMPLE REFLECTIVE TARGETS M.S. Thesis
Frank DiBartolomeo, Jr. Dec. 1979 123 p refs
(AD-A080367; AFIT/GE/EE/79D-11) Avail: NTIS
HC A06/MF A01 CSCL 17/9

The problem of identifying the perfectly conducting sphere and the perfectly conducting, infinitely thin circular disk via the backscattered far field from the object with a known incident signal is examined. A method utilizing synthetic aperture radar principles to obtain slant range versus cross range image plots of the discrete point scatterers on an object is discussed. A computer program to calculate the far field backscattering from the sphere is developed. Another computer program, found in the literature, which calculates the far field backscattering from the infinitely thin circular disk, is extended for ka > or > 15. In the above programs, the backscattering is obtained as a function of frequency and treated as the frequency response of a linear system. The input to this system is 5 cycles of 10 GHz R-F. The return signal is the output of the system and is obtained by using conventional linear system theory. Since a sphere is symmetric, the same return is obtained at all aspect angles. This return is examined. However, returns from the circular disk are different at different aspect angles. These returns from the disk are examined.
GRA

N80-22554# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PULSE-WIDTH MODULATION OF SPREAD SPECTRUM CARRIERS M.S. Thesis
Frank Davis Tiller Dec. 1979 121 p refs
(AF Proj. 2277)
(AD-A080158; AFIT/GE/EE/79-39) Avail: NTIS
HC A06/MF A01 CSCL 17/2

Spread spectrum techniques can produce results in communication and navigation systems that are not possible with standard signal formats. The results of particular interest are the ability to screen messages from eavesdroppers, high resolution ranging and the rejection of interference. Three modulation schemes that exploit these spread spectrum properties are analyzed in this thesis. All three techniques use pulse-width modulation to encode sampled analog voice signals onto a digital phase coded carrier. The performance analysis assumes transmission in the presence of white Gaussian noise and CW jamming. The performance analysis uses maximum likelihood estimation to define the sample parameter estimate and associated error variance when probability density functions can be defined for the receiver sample outputs. When the density function is not available a second moment analysis is used to define the expected signal-to-noise ratio. The results are extended to include the introduction of signal dependent code noise into the receiver resulting from the degradation of the orthogonal code word structure. The impact of code noise on system performance is seen to grow with the number of users squared and the received signal energy.
GRA

N80-22555# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ADAPTIVE ARRAY WITH AUTOMATIC GAIN CONTROL M.S. Thesis
John Rodgers Sutton Dec. 1979 98 p refs
(AD-A080374; AFIT/GE/EE/79-36) Avail: NTIS
HC A05/MF A01 CSCL 17/4

A three-element adaptive array algorithm with Applebaum-Howells loops combined with a linear automatic gain control (AGC), was analyzed. Computer simulations of array performance for signal jammers were presented and analyzed. Jammer scenarios included were: narrowband and broadband, high power, centered and non-centered jammers about the array center frequency, and different automatic gain control response times. No fixed performance criteria were applied to SNR degradation and antenna pattern plots. A non-linear AGC was linearized by expanding the exponential attenuation function in a series and truncating the higher-order terms. The AGC is shown to destroy the typical monotonically decreasing SNR degradation of a constant power, narrow band jammer when its response time is near that of the adaptive loop. Simulation results show that an AGC can cause the adaptive weight amplitudes to vary significantly.
GRA

N80-22556# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INTERCEPT VULNERABILITY OF DIRECT SEQUENCE PSEUDO-NOISE ENCODED SPREAD SPECTRUM WAVEFORMS M.S. Thesis
Thomas J. Hall Dec. 1979 119 p refs
(AD-A080213; AFIT/GE/EE/79-15) Avail: NTIS
HC A06/MF A01 CSCL 17/4

Direct sequence pseudo-noise (PN) encoded spread spectrum (SS) waveforms are examined for their vulnerability to intercept and message reconstruction without knowledge of the PN code used. Two generic modulation formats are described and an intercept receiver model is proposed. Receiver outputs are calculated and it is shown that message reconstruction is possible for both generic modulation formats under appropriate conditions.
GRA

N80-22557# Naval Ocean Systems Center, San Diego, Calif.
HF SKYWAVE COMMUNICATIONS TEST PLAN
G. P. Francis Nov. 1979 29 p refs
(AD-A080165; NOSC/TD-309) Avail: NTIS
HC A03/MF A01 CSCL 17/2

The report describes a test to develop a data base that will be used to evaluate and analyze adaptive signal processing algorithms. Both wideband and narrowband data will be transmitted for analysis. The wideband data will be quadrature phase shift keyed. The narrowband data will be quadrature phase

shift keyed, biphase shift keyed, and quadrature differential phase shift keyed. GRA

N80-22558# Houston Univ., Tex. Dept. of Electrical Engineering.
REMOTE LINK UNIT FUNCTIONAL DESIGN: AN ADVANCED REMOTE TERMINAL FOR MIL-STD-1553B Interim Report, 2 Oct. 1978 - 31 Aug. 1979
Carlos J. Tavora, John R. Glover, Jr., and George W. Batten Oct. 1979 225 p
(Contract F33615-78-C-1634; AF Proj. 2003)
(AD-A080126; AFAL-TR-79-1176) Avail: NTIS HC A10/MF A01 CSCL 17/2

This report presents a functional design of the Remote Link Unit (RLU). The RLU is an intelligent remote terminal which is compatible with hierarchical distributed processing. It has interface modules capable of processing subsystem data on-the-fly and supporting a universal signal interface which can be configured under software control to input or output analog and digital signals of varied types. Electronic nameplates containing identification, interface requirements and signal processing programs are attached to avionics subsystems to support the RLU operational features. The RLU stand-alone processing capabilities provide fault tolerance and facilitate maintenance. Author (GRA)

N80-22559# Aeronautical Research Associates of Princeton, Inc., N. J.
THE DEVELOPMENT AND TESTING OF AN ULTRAVIOLET VOICE COMMUNICATION SYSTEM Final Report, Jun. 1978 - Jul. 1979
Michael E. Neer and Joseph M. Schlupf Jul. 1979 173 p refs
(Contract N66001-78-C-0180)
(AD-A080319; ARAD-394) Avail: NTIS HC A08/MF A01 CSCL 17/2

Measurements of the atmospheric propagation and scattering of ultraviolet radiation within the solar blind through the lower atmosphere have been made through the summer and fall months of 1978 in rural, industrial and maritime atmospheres. An ultraviolet propagation and scattering model has been improved as the result of these measurements and has been used successfully in an ultraviolet communications model. A research oriented, ultraviolet voice communications system has been designed and fabricated using the best available components. The communications system has been field tested and found to perform quite well with a maximum line of sight range of 4.7 km and maximum nonline of sight range of 1.6 km when the ozone level is moderately high. Several advances have been made in component design including triggering circuitry for the high repetition rate flashlamps, voice modulation electronics, pulse amplitude discriminator design, and the collimation of transmitted radiation. Investigations of multi-channel concepts and safety have also been completed. GRA

N80-22560# Naval Weapons Center, China Lake, Calif. Weapons Dept.
LOW CARRIER-TO-NOISE RATIO RECEPTION OF VIDEO DATA LINK SIGNALS: A LABORATORY INVESTIGATION Interim Report
W. H. Woodworth Aug. 1979 21 p
(WF32300000)
(AD-A080304; NWC-TP-6129) Avail: NTIS HC A02/MF A01 CSCL 17/2

Techniques involving analog pre-transmisson signal processing, wide deviation phase modulation, coherent detection, and field-rate recursive video filtering are combined into a transmission system capable of operating at carrier-to-noise ratios as low as -10 to -17 dB, depending on the type of noise or interference. System design concepts, test results, and planned improvements are described in detail. GRA

N80-22561# Teledyne Micronetics, San Diego, Calif.
ADVANCED RADAR DETECTION AND PROCESSING TECHNIQUES FOR LOW ELECTROMAGNETIC SCATTERING TARGETS Final Report, 19 May 1978 - 19 May 1979
Lee A. Morgan and Steven Weisbrod Sep. 1979 43 p
(Contract F30602-78-C-0163; AF Proj. 2314)
(AD-A080189; R19-79; RADC-TR-79-244) Avail: NTIS HC A03/MF A01 CSCL 17/9

Radar cross section measurements were made on Teledyne Micronetics. Radar Range using C-band one nanosecond pulses. The radar target was made up of retrodirective Luneberg lenses variously deployed on a turntable. The number of lenses varied from two to six. For each deployment of targets, the impulse response was experimentally determined with the help of a sampling scope and the complex conjugate of this impulse response was synthesized using power splitters and delay lines. This signal was then transmitted and the RCS enhancement was measured by reducing the level of the transmitted power until the maximum response was equal to a previously established reference level. Subsequently additional power splitters and delay lines were utilized to synthesize matched receiver response and a similar comparison technique was used to measure the increase in the RCS. The configurations which were tried included equal and unequal spacings and path geometries where the individual reflecting centers were separable and cases where they overlapped. The observed value of RCS enhancement were compared with the theoretical values and it was demonstrated that the agreement between the two values was in general well within one dB. GRA

N80-22562# Sperry Gyroscope Co., Great Neck, N. Y. Electromagnetic Sciences Div.
COLUMN NETWORK STUDY FOR A PLANAR ARRAY USED WITH AN UNATTENDED RADAR Interim Report
Gerald L. Hanley and Harry R. Perini Dec. 1979 44 p
(Contract F19628-78-C-0166)
(AD-A080566; RADC-TR-79-297) Avail: NTIS HC A03/MF A01 CSCL 17/9

Objectives of this program are to investigate design and fabrication techniques for an azimuthally phase-steerable planar array with dual-beams for elevation coverage. Network costs, network insertion loss, antenna pattern performance, and reliability are significant considerations. A stripline dual beam column network is being designed, fabricated and tested to demonstrate achievable performance and competitive techniques for production and installation costs are being studied. This report summarizes the work completed during the first half of the program: completion of the Antenna Conceptional design, development of all the required components, the design of the dual beam column network, and preliminary results of competitive techniques for production. GRA

N80-22563# ITT Gilfillan, Inc., Van Nuys, Calif.
POLARIZATION PROCESSING TECHNIQUES STUDY Final Report, Mar. 1978 - Mar. 1979
Albert Klein, David Hammers, Masaaki Fujita, George Ioannidis, Nhan Levan, Jeffery Bell, and Charles Lucas Nov. 1979 150 p refs
(Contract F30602-78-C-0119; AF Proj. 4506)
(AD-A080565; ITTG-9532-F; RADC-TR-79-285) Avail: NTIS HC A07/MF A01 CSCL 17/9

Polarization serves as a discrimant between radar targets and surrounding chaff and clutter. A dual channel system is required to utilize polarization information which exists in the target scattering matrix. Several methods are presented for designing an optimum polarization codes transmit waveform and matched coherent receiver based on target and clutter statistics. Simulation results for various target models against chaff show a significant increase in detectability for the two-channel system. GRA

N80-22564# American Electronic Labs., Inc., Farmingdale, N. J.
ELECTROMAGNETIC RADIATION SYSTEM (EMRS) FOR SUSCEPTIBILITY TESTING Quarterly Report, 1 Oct. - 1 Dec. 1978
Maragaretta V. Stone Fort Monmouth, N.J. Army Commun. Res. and Develop. Command Apr. 1979 15 p
(Contract DAAB07-76-C-0332; DA Proj. 1L7-62701-AH-92)
(AD-A080226; CORADCOM-76-0332-9) Avail: NTIS HC A02/MF A01 CSCL 14/2

The function of the Electromagnetic Radiation System (EMRS) is to generate electromagnetic energy to produce a constant field strength that can be automatically scanned as a function

of frequency. The design objective is to cover the frequency range of 30 hertz to 40 gigahertz with field strength intensities up to 200 volts per meter. This report describes system equipment status and results of performance tests in all demonstration frequency ranges (30-60 MHz, 1.0-2.1 GHz, 2.1-4.0 GHz and 12.4-18.0 GHz).
GRA

N80-22565# Brown Univ., Providence, R. I. Center for Dynamical Systems.
ANALYSIS OF A PHASE-LOCKED LOOP AND A GENERAL FEEDBACK SYSTEM WITH A LIMITER Interim Report
H. J. Kushner and Y. Bar-Ness. Oct. 1979 46 p refs
(Grant AF-AFOSR-3063-76; AF Proj. 2304)
(AD-A080357; LCDS-TR-79-5; AFOSR-80-0089TR) Avail: NTIS HC A03/MF A01 CSCL 12/1
A phase-locked loop (PLL) with a hard limiter and wide-band noise input is analyzed. A powerful method introduced in Kushner's 'Diffusion approximations to output processes of nonlinear systems with wide band inputs, and applications' for obtaining a close diffusion approximation to a system with the limiter greatly improves the tracking and acquisition properties over the classical PLL. This is demonstrated theoretically and supported by simulation results. Similar results hold for a standard feedback control problem with a limiter at the beginning of the forward loop. The results are a clear demonstration of the value of the new techniques of analysis which are employed. The techniques are applicable to other communications systems with nonlinearities and wide-band inputs.
GRA

N80-22566# Ohio State Univ., Columbus. ElectroScience Lab.
CHAFF RADAR CROSS SECTION STUDIES AND CALCULATIONS Interim Report, 1 Jan. 1975 - 30 Jun. 1977
R. J. Garbacz. May 1978 42 p refs
(Contract F33615-76-C-1024; AF Proj. 7633)
(AD-A080989; ESL-78-4346-7; AFAL-TR-79-1114) Avail: NTIS HC A03/MF A01 CSCL 17/4
The objective of Contract F33615-76-C-1024 has been to analytically and experimentally investigate chaff scattering and the reduction of antenna-related radar cross section. This final report summarizes results obtained during the interim 1 January 1976 through 30 June 1977 on the chaff aspect of the effort. Included are summaries of (1) an investigation of scattering by a long wire excited by either a plane wave or by a nearby short dipole with sinusoidal current distribution and (2) an experimental study of small foam shapes very densely coated with chaff filaments.
GRA

N80-22567# SRI International Corp., Menlo Park, Calif.
EXPERIMENTAL STUDY OF THE EFFECTS OF FAULTS ON SPHERICAL WAVE PROPAGATION, PHASE 1 Final Report, 29 Mar. - 30 Sep. 1979
J. C. Cizek, A. L. Florence, D. D. Keough, and J. T. Rosenberg. Oct. 1979 35 p refs
(Contract DNA001-79-C-0261; DARPA Order 3749)
(AD-A081080; SRI-PYU-8392) Avail: NTIS HC A03/MF A01 CSCL 08/7
A laboratory technique has been developed for investigating the effect on a spherical wave of a fault located close to a spherical explosive charge that is detonated to generate the wave. The medium is a grout that simulates tuff, the fault is idealized by Mylar sheets, and the sensor is a particle velocity gage. The gage principle is based on Faraday's law in that a voltage is induced in a conducting loop when a moving portion of the loop cuts the flux lines of a magnetic field. A measure of the wave-fault interaction was obtained by comparing records of particle velocity gages engulfed by waves that have not crossed faults with records of gages engulfed by waves that have crossed faults. From these comparisons, it was concluded that the technique is suitable for investigating wave-fault interactions.
GRA

N80-22568# Environmental Research and Technology, Inc., Concord, Mass.
AUTOMATIC WEATHER RADAR ECHO ASSESSMENT AND TRACKING Final Report, 15 Feb. - 30 Sep. 1978
Robert K. Crane. Hanscom AFB, Mass. AFGL Mar. 1979 140 p refs
(Contract F19628-78-C-0076; AF Proj. 6670)
(AD-A081061; AFGL-TR-79-0248) Avail: NTIS HC A07/MF A01 CSCL 17/9
Previously developed algorithms for automatic radar cell detection and tracking were adapted for real-time use on the AFGL Echo Track and Significance Estimator. Additional significance estimation algorithms were developed to reduce the number of detected cells to a manageable number for display and interpretation.
GRA

N80-22569# Oak Ridge National Lab., Tenn. Fusion Energy Div.
DESIGN OF A HYPERBOLIC MICROWAVE METALLIC LENS
T. Uckan. Dec. 1979 12 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7060) Avail: NTIS HC A02/MF A01
Problems caused by multiple reflections in the cavity walls of the EBT fusion research device are considered emphasizing the directivity of waves in the millimetric range. Microwave metallic lenses designed to focus the energy into a plane wave are shown to improve the directivity considerably. By implementing a 70-GHz standard-gain horn with a delay-type hyperbolic lens, which consists of a solid metallic disk with a number of equal size small holes has indicated a gain of 15 dB over the no lens case.
DOE

N80-22570# Research Inst. of National Defence, Stockholm (Sweden).
DIFFERENTIAL ABSORPTION LIDAR: EFFECTS OF SPECKLE NOISE
Kjell Oestberg. 1979 12 p refs
(FOA-B-30031-E1; ISBN-91-7056-052-8) Avail: NTIS HC A02/MF A01
The difference between direct detection and heterodyne detection with regard to speckle noise is demonstrated. The sensitivity imposed by the speckle noise on a range-resolving differential absorption lidar with heterodyne detection is shown. A formula for the standard deviation of estimated gas concentration is derived.
Author (ESA)

N80-22571# European Space Agency, Paris (France).
CALCULATION OF HETERODYNE DETECTION WITH FOCUSED RADIATION
Friedrich Malota. Jul. 1979 20 p refs Transl. into ENGLISH of "Berechnungen zum Heterodyne-Empfang mit Fokussierter Strahlung", Rept. DFVLR-FB-78-20 DFVLR, Oberpfaffenhofen, West Germany. Original report in GERMAN previously announced as X79-76600
(ESA-TT-552; DFVLR-FB-78-20) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 11.30
The principal problems associated with heterodyne detection when use is made of focused radiation are examined. Focusing the radiation represents one way of attenuating the demands made on the mechanical structure of an installation. Several possible arrangements of this type are explained and the signal-to-noise ratios associated with them are computed. The basis for this computation is constituted by the three-dimensional formulation of the focus region (Lommel-function). The manner in which the signal-to-noise ratio depends on the distance between the detector and the focal plane is investigated, and the results and the limitations of the computational methods are discussed.
Author (ESA)

N80-22572# Royal Aircraft Establishment, Farnborough (England).
AN AUTOMATED HF SIGNAL MEASUREMENT SYSTEM
J. E. Pesterfield. London HMSO 1979 31 p refs
(Rad-Nav-65; RAE-TR-78132; BR67660) Avail: NTIS HC A03/MF A01
An HF Measurement System at Cobbett Hill Radio Station is described. Measurements of signal strength and error rates of test transmissions made automatically under the control of a PDP8F digital computer are presented. The data are stored and subsequently analyzed to obtain, signal-to-noise, bit error temporal distribution, and fading morphology. Future expansion of the system is discussed and it is concluded that a large reduction

in the workload of station operators and test staff can be realized. Author (ESA)

N80-22573# Royal Aircraft Establishment, Farnborough (England).
A DEVICE FOR TRACKING THE FUNDAMENTAL FREQUENCY OF SPEECH AND ITS APPLICATION IN THE ASSESSMENT OF STRAIN IN PILOTS AND AIR TRAFFIC CONTROLLERS
J. B. Peckham London HMSO May 1979 56 p refs
(RAE-TR-79056; BR69831) Avail: NTIS HC A04/MF A01

The use of speech signals for assessing physiological and psychological changes resulting from strain in pilots and air traffic controllers is discussed. A device is described which tracks the fundamental frequency of the speech signal in order to quantify changes in the parameter due to strain is described. Author (ESA)

N80-22574*# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
COHERENT GENERATION OF THE TERRESTRIAL KILOMETRIC RADIATION BY NONLINEAR BEATINGS BETWEEN ELECTROSTATIC WAVES
A. Roux and R. Pellat (Ecole Polytechnique, Palaiseau, France) Mar. 1978 34 p refs
(Grant NGL-16-001-043)
(NASA-CR-162869; CRPE-NT-56) Avail: NTIS HC A03/MF A01 CSCL 20N

The propagation of electrostatic plasma waves in an inhomogeneous and magnetized plasma was studied. These waves, which are driven unstable by auroral beams of electrons, are shown to suffer a further geometrical amplification while they propagate towards resonances. Simultaneously, their group velocities tend to be aligned with the geomagnetic field. It is shown that the electrostatic energy tends to accumulate at, or near omega sub LH and omega sub UH, the local lower and upper hybrid frequencies. Due to this process, large amplitude electrostatic waves with very narrow spectra are observed near these frequencies at any place along the auroral field lines where intense beam driven instability takes place. These intense quasi-monochromatic electrostatic waves are shown to give rise to an intense electromagnetic radiation. Depending upon the ratio omega sub pe/omega sub ce between the electron plasma frequency and the electron gyro-frequency the electromagnetic wave can be radiated in the ordinary mode (at omega sub UH), or in the extraordinary (at 2 omega sub UH). As the ratio omega sub pe/omega sub ce tends to be rather small, it is shown that the most intense radiation should be boserved at 2 omega sub UH in the extraordinary mode. Author (ESA)

N80-22575# Physics Lab. RVO-TNO, The Hague (Netherlands).
REMOTE SENSING OF THE SEA BY RADAR. ANALYSIS OF AVAILABLE DATA AND RESULTS OF NOORDWIJK, 1977
G. P. deLoor Dec. 1978 58 p refs
(PHL-1978-53; TDCK-71720) Avail: NTIS HC A04/MF A01

A survey of results from radar observations of the sea is presented. Radar measurements conducted in the Netherlands are analyzed and compared with other radar observations. Results of project Noordwijk 77 are discussed in relation to the measurements. Author (ESA)

N80-22576# Physics Lab. RVO-TNO, The Hague (Netherlands).
ON THE PERFORMANCE OF A SIMPLIFIED MTI CANCELLER SELECTION RULE FOR FUCAS
H. F. A. Roefs Mar. 1979 24 p refs
(PHL-1979-13; TDCK-71965) Avail: NTIS HC A02/MF A01

A rainclutter suppression system implemented into the experimental phased array pulse radar system FUCAS is described. The optimal selection rule (under the assumption of a Rayleigh target) is derived and, since the actual realization of this rule would be too costly, a simplified selection mechanism based solely on the clutter suppression capabilities of the cancellers is introduced and its expected performance compared with the optimal rule. Author (ESA)

N80-22577# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
DETERMINATION OF THE FAR-FIELD FROM MEASURED NEAR-FIELD DATA THEORY AND MEASURING TECHNIQUE OF THE NEAR-FIELD FAR-FIELD TRANSFORMATIONS
Arno Schrott and Volker Stein Apr. 1979 109 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-616)
(DFVLR-Mitt-79-07) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 18.30

Methods for measuring the far field of antennas at distances that are small compared to the wavelength of the field are described. Both the compact test range and the near field far field transformation methods are described. Planar, cylindrical, and spherical transformation techniques are discussed. An error analysis and examples of the methods are provided. Author (ESA)

N80-22578*# New Mexico Univ., Albuquerque. Technology Application Center.
SATELLITE TELEVISION TRANSMISSION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Nov. 1979
Gerald F. Zollars Dec. 1979 197 p Sponsored by NASA and NTIS
(NASA-CR-162933; PB80-803059) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

The bibliography cites 190 articles from the international literature. Topics include domestic satellite television systems, satellite networks, satellite transmission, space law, ground stations, satellite design, and problems of international law, and cooperation created by satellite television transmission. GRA

N80-22579*# New Mexico Univ., Albuquerque. Technology Application Center.
SATELLITE ANTENNA TECHNOLOGY. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Nov. 1979
Gerald F. Zollars Dec. 1979 55 p Sponsored by NASA and NTIS
(NASA-CR-163128; PB80-802689) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

This bibliography of citations to articles from the international literature concerns satellite antenna technology. Topics stressed are antenna design studies dealing with antenna radiation patterns and antenna arrays. This bibliography excludes articles cited in the published searches titled Communications Satellite Technology. The bibliography contains 213 citations. GRA

N80-22580# National Technical Information Service, Springfield, Va.
RANDOME TECHNOLOGY. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979
William E. Reed Dec. 1979 137 p Supersedes NTIS/PS-78/1253; NTIS/PS-77/1153; NTIS/PS-76/1015 2 Vol.
(PB80-801897; NTIS/PS-78/1253; NTIS/PS-77/1153; NTIS/PS-76/1015) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

Reports from worldwide research are cited on the use of composite materials, ceramic materials, plastics, dielectrics, and protective coatings for radomes. Research on the design, construction, and fabrication is included. Performance evaluations are presented which cover wave transmission, insertion loss, effect of antenna radiation patterns, rain erosion, and impact resistance. This updated bibliography contains 134 abstracts, 30 of which are new entries to the previous edition. GRA

N80-22581# National Technical Information Service, Springfield, Va.
RADOME TECHNOLOGY, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Dec. 1976 - Nov. 1979
William E. Reed Dec. 1979 138 p Supersedes NTIS/PS-78/1252; NTIS/PS-77/1152; NTIS/PS-76/1014; NTIS/PS-75/847 2 Vol.
(PB80-801889; NTIS/PS-78/1252; NTIS/PS-77/1152; NTIS/PS-76/1014; NTIS/PS-75/847) Avail: NTIS

HC $30.00/MF $30.00 CSCL 09E

Reports from Federally-funded research are cited on the use of composite materials, ceramic materials, plastics, and protective coatings for radomes. Research on the design, construction, and manufacturing is included. Performance evaluations are presented which cover wave transmission, insertion loss, effect on antenna radiation patterns, rain erosion, and impact resistance. This updated bibliography contains 131 abstracts, 13 of which are new entries to the previous edition. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-22582 Illinois Univ. at Urbana-Champaign.
SPACE CHARGE REDUCTION IN AN EHD GENERATOR VIA FLUIDIC SWITCHING Ph.D. Thesis
Alek Chi-Heng Chen 1979 146 p
Avail: Univ. Microfilms Order No. 8009000

The effect of space charge reduction in an electrohydrodynamic (EHD) generator via fluidic switching was studied. An electrofluidic generator was shown to embody a significant advantage of space charge reduction using fluidic switching. At a certain range of frequency of fluidic switching, a substantial increase in output voltage beyond a steady flow EHD generator was obtained. A small model generator EFD-2 and a scaled up generator EFD-3 were built to study the effect of space charge reduction. Experiments were performed on EFD-2 and EFD-3 generators at various operating conditions. From experimental data and theoretical considerations, recommendations are presented for the future design of electrofluidic generators. Dissert. Abstr.

N80-22583 Pennsylvania Univ., Philadelphia.
GATE CONTROLLED DIODE FOR IONIC CONCENTRATION MEASUREMENT Ph.D. Thesis
Ching-Chang Wen 1979 222 p
Avail: Univ. Microfilms Order No. 8009477

A new type of chemically sensitive semiconductor device based on the operation of a gate controlled diode was designed and fabricated. By using the temperature gradient zone melting process to fabricate the device, both electrical and chemical shielding of the contact regions were obtained from the test solutions. The ion controlled diode (ICD) was biased into inversion by a reference electrode. The substrate-source admittance of the ICD was then measured at sufficiently high frequencies so that it was transit time limited. Theoretical analysis of blocked electrodes at equilibrium case and dynamic response were examined. Numerical methods were applied to solve the charge transport equations at different conditions for both cation and anion. It was found that the potential time response approximates an exponential behavior and the time constant is relatively insensitive to the boundary electric field. Dissert. Abstr.

N80-22584 Illinois Univ. at Urbana-Champaign.
A NEW ALGORITHM FOR THE TUNING OF ANALOG FILTERS Ph.D. Thesis
Charles John Alajajian 1979 108 p
Avail: Univ. Microfilms Order No. 8008956

An algorithm is proposed for the tuning of analog filters. Tellegen's theorem and the adjoint network concept are used to relate large changes in a set of tuning elements to desired voltage changes in the manufactured filter. The component values in the manufactured circuit are measured and the deviation of the voltages in the manufactured circuit from the corresponding voltages in the nominal circuit design are computed at a set of critical frequencies. A set of tuning resistors is chosen and this information is entered into the large change sensitivity expression. The changes in the tuning elements needed to reduce these voltages deviations to zero are computed by solving a set of linear algebraic equations whose rank is equal to the number of tuning elements plus one. It is shown that the method converges much faster to the desired solution than first order sensitivity and optimization methods. Dissert. Abstr.

N80-22585 California Univ., Los Angeles.
COMPUTER MODEL OF A CHARGE-COUPLED DEVICE FOR OPERATION IN A CIRCUIT SIMULATION PROGRAM Ph.D. Thesis
Michael Frank Caggiano 1979 188 p
Avail: Univ. Microfilms Order No. 8008464

The operation and applications of a flexible, one dimensional model of a charge coupled device programmed to operate in circuit transient analysis computer programs are described. The computer model embodies the expanded transfer inefficiency equations along with thermal generation effects and models for the CCD input and output interfaces. Although the model is comprehensive in scope, the subroutine structure, input-output functions and device parameter entries are designer oriented. The model as presently developed is expected to aid in the circuit design process employing charge-coupled devices as circuit elements. Dissert. Abstr.

N80-22586 Illinois Univ. at Urbana-Champaign.
ENCAPSULATION STUDIES AND PLANAR DEVICE FABRICATION IN GALLIUM ARSENIDE Ph.D. Thesis
Max John Helix 1979 90 p
Avail: Univ. Microfilms Order No. 8009058

Low temperature photoluminescence and Auger electron spectroscopy (AES) were used to study SiO2 and Si3N4 as encapsulants for high temperature annealing of GaAs. These encapsulants were used in the fabrication of planar diodes in GaAs, and the resulting electrical and optical properties of the devices were examined. Current-voltage characteristics for devices fabricated by Be implantation into liquid phase epitaxy and vapor phase epitaxy GaAs are compared, as well as characteristics of Zn-implanted and Zn-diffused devices. Also, preliminary studies are presented which indicate negligible lateral diffusion of Be when proper fabrication procedures are followed. Dissert. Abstr.

N80-22587 Illinois Univ. at Urbana-Champaign.
SOME MODIFICATIONS TO NEWTON'S METHOD FOR THE DETERMINATION OF THE STEADY STATE RESPONSE OF NONLINEAR CIRCUITS Ph.D. Thesis
Francis Benedict Grosz, Jr. 1979 136 p
Avail: Univ. Microfilms Order No. 8009052

Many methods have become available recently for the determination of the steady state of nonlinear circuits. The Newton method of Trick, Aprille and Colon is one of the more widely available methods. However, in certain cases, the method fails to converge to a steady state solution. Three modifications to the Newton method to increase convergence reliability or speed are proposed. The implementation of these modifications is discussed. Several example circuits are given and the results compared. Some guidelines for the use of these modified methods are also given. Dissert. Abstr.

N80-22588 Arizona State Univ., Tempe.
A STUDY OF ELECTROVISCOSITY IN A LIQUID CRYSTAL Ph.D. Thesis
John Hessler, Jr. 1979 169 p
Avail: Univ. Microfilms Order No. 8008576

A theory to explain the electroviscosity of the liquid crystal MBBA was developed. The electroviscosity theories for the other liquid crystals were shown to be nonapplicable. Inherent shear strength was shown to be a possible explanation for a published viscosity effect. The theory of producing this shear strength from an electric field was developed along with the effects on liquid crystal flow. The theory was compared with liquid crystal flow measurements. The electroviscosity in MBBA was degraded by the boundary layer effect as well as the effects of ion current. Several ways were found to reduce or eliminate these effects. The possibility of a 60 Hz three phase device was investigated. Dissert. Abstr.

N80-22589 Wisconsin Univ. - Milwaukee.
DYNAMIC BEHAVIOR OF INVERTER-FED INDUCTION MOTORS Ph.D. Thesis

Ahmed Diaa Z. M. El-Koushiry 1979 118 p
Avail: Univ. Microfilms Order No. 8009234

The dynamic behavior of the inverter fed induction motor over a wide range of speed is investigated. The inverters considered are of the forced commutation dc link type. Six-step and pulse width modulated voltage inverters are included. It is desired to find the minimal transition time for acceleration and deceleration without exceeding certain specified drive limits. Different types of loads are considered, including constant torque loads, step torque loads, inertia loads, and loads where torque is precisely related to motor speed. Most inverters use a linear frequency with time is suggested, in which a frequency-time pattern is obtained to insure speed changes to occur on the high torque, low current stable portion of the dynamic torque-speed characteristic. The least amount of inverter oversizing necessary to meet load dynamic requirements and overload conditions as well is determined. Dissert. Abstr.

N80-22590 California Univ., Los Angeles.
ELECTRICAL PROPERTIES OF SEMICONDUCTING OXIDE GLASSES BASED ON VANADIUM OXIDE Ph.D. Thesis
Chi-Hsiang Chung 1979 203 p
Avail: Univ. Microfilms Order No. 8008467

The electrical properties of binary and ternary semiconducting oxide glasses containing 55 mole % V_2O_5 and 45 mole % glass-forming oxides TeO_2 GeO_2, PbO, As_2O_3, BaO are discussed. Homogeneous glasses are made on all the binary systems. The condictivity of room temperature decreased in the following order: $55V_2O_5$, $45TeO_2$, $55V_2O_5$-$45P_2O_5$, $55V_2O_5$-$45As_2O_3$, $55V_2O_5$-$45GeO_2$, $55V_2O_5$-45PbO and $55V_2O_5$-45BaO. A theory to explain the conducting behavior of the binary glasses is developed. Dissert. Abstr.

N80-22591 American Univ., Washington, D. C.
MODIFIED PERTURBATION THEORY AND THE ELECTRICAL RESISTIVITY OF SIMPLE LIQUID METALS Ph.D. Thesis
Cornelius Patrick Brown 1979 188 p
Avail: Univ. Microfilms Order No. 8008557

The electrical resistivity of the liquid metals Li, Na, K, Be, Mg, Cd, Al and In were calculated using mass-renormalized form factors obtained from optimized model potentials and the modified perturbation theory of Shaw. It was found that renormalizing the form factors leads to marginally better agreement with experimental resistivities for the alkali metals Na and K, but has little effect on the calculated resistivities of polyvalent metals. The effect of renormalizing the prefactors in the Ziman expression for resistivity was also investigated. Dissert. Abstr.

N80-22592 Illinois Univ. at Urbana-Champaign.
ACCURACY TESTS FOR HIGH FREQUENCY ASYMPTOTIC SOLUTIONS Ph.D. Thesis
Mark Douglas Tew 1979 87 p
Avail: Univ. Microfilms Order No. 8009194

Three procedures for evaluating the accuracy of an asymptotic solution by examining its effect on satisfaction of boundary conditions are presented. Two of the procedures are suitable for assessing the accuracy of asymptotic solutions which give the surface fields of radiating or scattering bodies. Their use is illustrated by applying the procedures to proposed solutions to the problem of a magnetic dipole radiating on an infinitely long, perfectly conducting circular cylinder. The third procedure is used to evaluate the accuracy of asymptotic solutions that give the far field from a scattering or radiating body. Its use is illustrated by application to a proposed solution for the problem of scattering of an incident scalar wave by the vertex of an acoustically soft quarter-plane. In addition, two of the proposed tests can be used as an iterative equation, offering the possibility of systematic improvement of a proposed solution. Dissert. Abstr.

N80-22593 Illinois Univ. at Urbana-Champaign.
FAULT ANALYSIS OF ANALOG CIRCUITS Ph.D. Thesis
Adel Attalla Sakla 1979 135 p
Avail: Univ. Microfilms Order No. 8009157

The case is considered in which the measurement of all node voltages is possible under certain test conditions. In addition the simulation of the adjoint circuit on the computer is required. The approach can detect large parameter variations, is highly computationally efficient, and it does not require massive storage. The formulation permits identification of necessary and sufficient test measurement errors on the approach is investigated. The approach is adapted for fault detection in circuits with accessibility to only part of the nodes. Major application is the single fault identification. It is shown that input and output voltage measurements are enough to identify single faults. The extension of the approach to the fault analysis of analog circuits with some nonlinear elements is discussed. It is shown that any number of operating points on the 1-5 characteristic of the faulty nonlinear elements can be determined. Dissert. Abstr.

N80-22594 Illinois Univ. at Urbana-Champaign.
THE WAVEFORM DETECTION OF PERMANENT MAGNET STEP MOTORS AND ITS APPLICATION TO CLOSED-LOOP CONTROL Ph.D. Thesis
Chin-Woei Lin 1979 308 p
Avail: Univ. Microfilms Order No. 8009090

The feasibility and the applicability of the closed-loop control of the permanent magnet (PM) step motor through waveform detection are discussed. Since the mechanical encoder generates signals which are directly related to the position and indirectly to the speed of step motor, the closed-loop control through waveform detection is essentially an observability problem. Low cost closed-loop controllers are designed based on various types of waveform detection schemes. Constant-speed control as well as the single-step deadbeat damping control are realized by these waveform-detection schemes. Sophisticated microprocessor - aided control is also accomplished in the load-adaptive/power-supply-voltage-adaptive constant-speed control by using the time-delay switching approach, which subsequently broadens the applicability of the PM step motor. Dissert. Abstr.

N80-22595 California Univ., Los Angeles.
SWITCHING BEHAVIOR OF ZINC-DOPED SILICON N-P-N STRUCTURES Ph.D. Thesis
William Edward Kingsley 1979 110 p
Avail: Univ. Microfilms Order No. 8008493

The electron initiated zinc impurity impact ionization rate was measured. Photo-current multiplication data versus bias voltage was recorded for specially fabricated P(+)-N-N(+) zinc-doped diodes. The electric field was calculated using a computer program which solved the two dimensional Poisson's equation in conjunction with the electron and hole continuity equations. Switching behavior, related to impurity ionization, was observed in zinc-compensated N(+)-N-N(+) vertical epitaxial resistors. A correlation between the experimental data and a theoretically determined result was made incorporating the measured zinc impurity ionization coefficient to provide validation of that result. Fairly good qualitative agreement with the switching behavior was obtained. Dissert. Abstr.

N80-22596*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STEADY-STATE ANALYSIS OF A FAULTED THREE-PHASE FOUR-WIRE SYSTEM SUPPLYING INDUCTION MOTORS WITH NEUTRALS CONNECTED AND OTHER SINGLE-PHASE LINE-TO-NEUTRAL LOADS
Marion E. Wood Mar. 1980 67 p refs
(NASA-TM-80795; JSC-16517; IN-EH-80-03) Avail: NTIS HC A04/MF A01 CSCL 09C

Four wire Wye connected ac power systems exhibit peculiar steady state fault characteristics when the fourth wire of three phase induction motors is connected. The loss of one phase of power source due to a series or shunt fault results in currents higher than anticipated on the remaining two phases. A theoretical approach to compute the fault currents and voltages is developed. A FORTRAN program is included in the appendix. E.D.K.

N80-22597*# Sprague Electric Co., North Adams, Mass.
STUDY OF SURGE CURRENT EFFECTS ON SOLID TANTALUM CAPACITORS Final Report
20 Mar. 1980 100 p
(Contract NAS8-33424)
(NASA-CR-161433) Avail: NTIS HC A05/MF A01 CSCL 09C

Results are presented of a 2,000 hour cycled life test program conducted to determine the effect of short term surge current

screening on approximately 47 micron f/volt solid tantalum capacitors. The format provides average values and standard deviations of the parameters, capacitance, dissipation factor, and equivalent series resistance at 120 Hz, 1KHz, abd 40 KHz.

A.R.H.

N80-22598*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

IMPROVED TRAVELING WAVE TUBES

Erik Buck. 1980. 15 p. refs. Presented at Western Region Electronic Warfare Tech. Meeting, White Sands Missile Range, N. Mex., 21-24 Apr. 1980; sponsored by Assoc. of Old Crows (NASA-TM-81479; E-415) Avail: NTIS HC A02/MF A01 CSCL 09A

After a brief description of how a typical TWT works, multi-stage depressed collectors (MDC) are discussed. A quick method for computing the expected efficiency of a well engineered TWT is outlined to aid in estimating power supply needs. Applications of improved TWTs and a new power supply are suggested.

E.D.K.

N80-22599# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN ADAPTIVE DISTRIBUTED-MEASUREMENT EXTENDED KALMAN FILTER FOR A SHORT RANGE TRACKER, VOLUME 1 M.S. Thesis

Robert L. Jensen and Douglas Alan Harnly. Dec. 1979. 173 p. refs.

(AD-A080249; AFIT/GA/EE/79-1-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 17/5

An adaptive extended Kalman filter algorithm is designed to track a distributed (elliptical) source target in a closed loop tracking problem, using outputs from a forward looking infrared (FLIR) sensor as measurements. The filter adaptively estimates image intensity, target size and shape, dynamic driving noise, and translational position changes due to two effects: actual target motion, and atmospheric jitter. Atmospheric backgrounds are studied for the effect of temporal and spatial correlations on filter performance. A Monte Carlo analysis is conducted to determine filter performance for two target scenarios: approximately straight approach and cross range constant velocity. Good performance is obtained for the first two trajectories. For the second trajectory, a one sigma tracking error of .2 pixel (4 microrad) has a signal to noise ratio of 12.5. The filter adapts well to changes in image intensity, size, and shape.

GRA

N80-22600# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN ADAPTIVE DISTRIBUTED-MEASUREMENT EXTENDED KALMAN FILTER FOR A SHORT RANGE TRACKER, VOLUME 2 M.S. Thesis

Robert L. Jensen. Dec. 1979. 263 p.

(AD-A080238; AFIT/GA/EE/79-1-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 17/5

Previous truth model and filter equations are presented for the adaptive Kalman filter algorithm. Real data analysis for spatial correlations of background noise and for temporal correlations of background noise is demonstrated. Calculations and computer simulation considerations are included. The FORTRAN code for the main programs, and the library of subroutines, and plot programs are presented along with input parameters.

J.M.S.

N80-22601# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Detachment.

APPLICATION OF FERROFLUIDS AS AN ACOUSTIC TRANSDUCER MATERIAL

Pieter S. Dubbelday. 4 Dec. 1979. 30 p. refs.

(RR0110842)

(AD-A079314; NRL-MR-4030; AD-E000343) Avail: NTIS HC A03/MF A01 CSCL 09/1

Application of ferrofluids to electroacoustic transduction is described. Properties of ferrofluids relevant to the problem are given, and the basic equations and derivations are developed. Power transfer calculations are performed for a piston-type transducer, and a conceptual design is offered for a toroidal configuration.

GRA

N80-22602# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

PHASE RETRIEVAL USING AN IMAGING SENSOR M.S. Thesis

Charles V. Scull. Dec. 1979. 66 p. refs.

(AD-A080424; AFIT/GEO/EE/79-4) Avail: NTIS HC A04/MF A01 CSCL 09/3

This research study is concerned with spatial (relative) phase reconstruction using an imaging sensor. Specifically, work was completed which investigates the retrieval of the spatial phase of the aperture wavefront from sampled intensity data in the focal plane of an imaging sensor, where phase is not explicitly present. Techniques investigated are not interferometric methods, but are signal processing techniques that use the Fourier transform properties of a lens, analytics, and numerics to retrieve the spatial phase of the aperture field from intensity measurements in the focal plane of an imaging sensor. The techniques investigated include an analytic approach which is used to develop several numerical approaches, and the Gerchberg-Saxton Algorithm which is adapted to solve this specific phase retrieval problem. Finally, the results from simulations of these methods are compared yielding the Gerchberg-Saxton algorithm as the most promising method to approximate the relative phase in the aperture plane.

GRA

N80-22603# Westinghouse Research and Development Center, Pittsburgh, Pa.

INDIUM PHOSPHIDE FOR HIGH FREQUENCY POWER TRANSISTORS Interim Report, 21 Mar. 1978 - 21 Mar. 1979

V. L. Wrick, G. W. Eldridge, R. C. Clarke, and M. C. Driver. 28 Sep. 1979. 90 p. refs.

(Contract N00014-78-C-0254)

(AD-A080583) Avail: NTIS HC A05/MF A01 CSCL 20/12

Technology development is presented for the development of an InP power field effect transistor. Both ion implantation and vapor phase epitaxy results are presented as a means for providing an active channel. Processing technology (etching, ohmic contacts) is reviewed as well as a description of various approaches for gating n-type InP. Conclusions and plans for the last phase of the program are discussed. As a result of the first part of the program, work is to be concentrated on developing junction field effect transistor techniques.

GRA

N80-22604# Syracuse Univ., N. Y.

NONLINEAR CIRCUIT ANALYSIS PROGRAM (NCAP) DOCUMENTATION. VOLUME 1: ENGINEERING MANUAL Progress Report, May 1978 - Jul. 1979

John F. Spina (RADC, Griffiss AFB, N.Y.), Carmen A. Paludi, Jr. (RADC, Griffiss AFB, N.Y.), Donald D. Weiner, and James J. Whalen. Griffiss AFB, N.Y. RADC. Sep. 1979. 199 p. refs.

(Contract F30602-79-C-0011; AF Proj. 2338)

(AD-A076384; RADC-TR-79-245-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 09/3

The Nonlinear Circuit Analysis Program (NCAP) is a circuit analysis code which uses the Volterra approach to solve for the transfer functions and node voltages of nonlinear circuits. To increase the transportability, the code was written in ANSI FORTRAN. The code was revised and documented in a joint effort using both in-house and contracted manpower. This documentation is a result of that effort. The documentation is made up of three volumes: the Engineering Manual, the User's Manual, and the Programmer's Manual. The Engineering Manual, Volume 1, contains the introduction to the documentation, a description of the theory upon which NCAP is based, and the procedure for obtaining the input parameter data.

GRA

N80-22605# Syracuse Univ., N. Y.

NONLINEAR CIRCUIT ANALYSIS PROGRAM (NCAP) DOCUMENTATION. VOLUME 2: USER'S MANUAL Progress Report, May 1978 - Jul. 1979

Jon B. Valente (RADC, Griffiss AFB, N.Y.) and Sharon Stratakos. Griffiss AFB, N.Y. RADC. Sep. 1979. 82 p.

(Contract F30602-79-C-0011; AF Proj. 2338)

(AD-A076596; RADC-TR-79-245-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 09/3

The Nonlinear Circuit Analysis Program (NCAP) is a circuit analysis code which uses the Volterra approach to solve for the

transfer functions and node voltages of nonlinear circuits. To increase the transportability, the code was written in ANSI FORTRAN. The code was revised and documented in a joint effort using both in-house and contracted manpower. This documentation is a result of that effort. The documentation is made up of three volumes: the Engineering Manual, the User's Manual, and the Programmer's Manual. The User's Manual, Volume 2, contains a detailed description of the NCAP input language. The description includes the input commands and data requirements. Examples are used throughout the manual to aid the user in understanding the input language. GRA

N80-22606# Syracuse Univ., N. Y.
NONLINEAR CIRCUIT ANALYSIS PROGRAM (NCAP) DOCUMENTATION. VOLUME 3: PROGRAMMER'S MANUAL Progress Report, May 1978 - Jul. 1979
Jon B. Valente (RADC, Griffiss AFB, N.Y.) and Sharon Stratakos Griffiss AFB, N.Y. RADC Sep 1979 737 p refs
(Contract F30602-79-C-0011; AF Proj. 2338)
(AD-A076317; RADC-TR-79-245-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 09/3

The Nonlinear Circuit Analysis Program (NCAP) is a circuit analysis code which uses the Volterra approach to solve for the transfer functions and node voltages of nonlinear circuits. To increase the transportability, the code was written in ANSI FORTRAN. The code was revised and documented in a joint effort using both in-house and contracted manpower. This documentation is a result of that effort. The documentation is made up of three volumes: the Engineering Manual, the User's Manual, and the Programmer's Manual. GRA

N80-22607# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN OF A DIGITAL CONTROLLER FOR AN ELECTRON BEAM LITHOGRAPHY SYSTEM M.S. Thesis
Michael L. Weidner Dec 1979 246 p refs
(AD-A080169; AFIT/GE/EE/79-41) Avail: NTIS HC A11/MF A01 CSCL 13/8

A digital controller for an electron beam lithography system was designed using microprocessor technology. Due to the high speed requirements of the system the hardware controller was implemented using a microprogram sequencer. The controller was designed as a special purpose computer. The word length of the controller computer is 40 bits. The first twenty-three bits are control bits. The other seventeen bits are used to determine which word to execute next. A Z-80A microcomputer was used in the design as an input/output device. The Z-80A outputs the pattern data. The controller uses that data and sequences the electron beam to draw the requested pattern. The controller is double buffered for increased throughput. Since both the controller and the Z-80A are programmable, the capabilities of the system can be tailored to the needs of the user. GRA

N80-22608# Brookhaven National Lab., Upton, N. Y.
LOAD EXCITATION AT THE SUPERCONDUCTING CABLE TEST FACILITY
E. B. Forsyth, A. J. McNerney, and M. Meth Sep 1979 11 p Presented at the 7th Symp. on Superconducting Power Transmission, Moscow, Sep. 1979; sponsored by US/USSR Tech. Exchange Comm.
(Contract EY-76-C-02-0016)
(BNL-26641) Avail: NTIS HC A02/MF A01

The superconducting cable test facility was constructed to evaluate and demonstrate flexible superconducting power transmission cables under realistic conditions. Power supplies were installed to excite two superconducting cables either separately or simultaneously. The cables formed a straight run of 100 m with a pair of terminations rated for full current and voltage located at the east and west ends of the cable enclosure. The design and operation of the test facilities are discussed. DOE

N80-22609# Brookhaven National Lab., Upton, N. Y.
CALORIMETRIC MEASUREMENT OF ac LOSSES IN SUPERCONDUCTING CABLES OF SHORT LENGTHS
J. E. Jensen 1979 13 p ref Presented at the 7th Symp. on Superconducting Power Transmission, Moscow, Sep. 1979; sponsored by US/USSR Tech. Exchange Comm.
(Contract EY-76-C-02-0016)
(BNL-26712) Avail: NTIS HC A02/MF A01

The measurement of ac losses in superconducting cables by calorimetric means is necessary as a verification of electronic measurements on short high-current models and because the present method of electronic measurement is not applicable to longer cables with simultaneously applied high current and voltage. Consequently, after the first tests of Cable no. 101 showed higher losses than anticipated using the electronic wattmeter measurements, it was decided to attempt to verify these measurements calorimetrically. The results of test completed to date are reported. DOE

N80-22610# Oak Ridge National Lab., Tenn.
SATURATION AND ANISOTROPY EFFECTS OF MAGNETIZATION IN PRACTICAL COMPOSITE SUPERCONDUCTORS
S. S. Shen Oct. 1979 22 p refs
(Contract W-7405-eng-36)
(ORNL/TM-7036) Avail: NTIS HC A02/MF A01

Detailed magnetization measurements are presented, as well as an analysis on typical cryostable NbTi composite conductors (1 mm diameter and Cu/SC ratio of 6.5) with filaments nonuniformly distributed in both circular and rectangular cross sections. As a result of the excellent agreement between the measurements and a previously reported transformer model, both transient magnetization and losses incurred in each sample can be described by functions of a unique time constant tau sub o, which depends strongly on the shape of the cross section. Other prominent features of the measurement results, such as the deduction of values of J/sub c/ and matrix resistivity, are demonstrated. DOE

N80-22611# California Inst. of Tech., Pasadena. Lab. of Engineering Materials.
SUPERCONDUCTING PROPERTIES OF RAPIDLY QUENCHED AND HEAT TREATED Zr-V AND Hf-V FOILS
M. Tenhover Sep 1979 18 p refs
(Contract EY-76-C-03-0822)
(CALT-822-111) Avail: NTIS HC A02/MF A01

The results of rapid quenching and subsequent heat treatments on the superconducting properties of the Zr-V and Hf-V binary systems are presented. Metallic glasses can be prepared in these systems which have very attractive properties for practical application. The existence of a flexible glassy phase raises the prospect of alternative methods for the construction of superconducting devices. The As-quenched, partially crystalline material is characterized by small critical currents, yet relatively large upper critical fields and transition temperatures. Heat treatments considerably enhance the current carrying capability. DOE

N80-22612# Brookhaven National Lab., Upton, N. Y. Dept. of Physics.
INTERACTION OF SUPERCONDUCTING VORTICES: LECTURES PRESENTED AT THE CANADIAN MATHEMATICAL SOCIETY SUMMER RESEARCH INSTITUTE ON GAUGE THEORIES
Claudio Rebbi Sep 1979 19 p refs Lectures held at Montreal, Sep. 1979
(Contract EY-76-C-02-0016)
(BNL-26736) Avail: NTIS HC A02/MF A01

Results recently obtained on multivortex configurations are described. After a brief review of the model, a numerical analysis, performed by variational methods, of the interaction between two vortices is illustrated. The study, shows that two vortices attract or repel each other according to whether a dimensionless coupling constant lambda, characterizing the relative strength of the matter self-coupling versus the gauge coupling, takes a value smaller or greater than one. This agrees with results previously obtained for asymptotic separations of the vortices. For lambda = 1, in particular, the vortices appear in equilibrium at any separation, hinting to the existence of a much wider class of solutions to the field equations. The case lambda = 1 is considered in detail, illustrating analytical results which demonstrate that for this special value of the coupling constant solutions with any number of vortices at arbitrary positions do indeed exist. DOE

N80-22613# Oak Ridge National Lab., Tenn.
EDDY CURRENT HEATING OF IRREGULARLY SHAPED PLATES BY SLOW RAMPED FIELDS
Lawrence Dresner Sep. 1979 49 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6968) Avail: NTIS HC A03/MF A01

Eddy current heating of thin conducting plates of various shapes by a perpendicular field is studied, assuming that the magnetic field created by the eddy currents is negligible in comparison with the external field. The method introduces the stream function of the eddy currents, which is shown to satisfy Poisson's equation, and then employs a pair of complementary variational principles, the extrema of which equal the eddy current heating. Two such complementary principles give not only an estimate of the eddy current heating, but a bound on the error of the estimate as well. DOE

N80-22614# Sandia Labs., Albuquerque, N. Mex.
HIGH-TEMPERATURE ELECTRONICS: AN OVERVIEW
Richard C. Heckman 1979 8 p refs
(Contract EY-76-C-04-0789)
(SAND-79-2319A) Avail: NTIS HC A02/MF A01

The state of the art in high temperature electronics is briefly described and the major areas where developments are needed are identified. The geothermal program, high temperature oil and gas well logging, jet engine monitors, and circuits for operation in the sodium coolant loop of a breeder reactor have simulated research. DOE

N80-22615# Los Alamos Scientific Lab., N. Mex.
MICROPROCESSOR-BASED STEPPING MOTOR DRIVER
J. K. Halbig and S. F. Klosterbuer Sep. 1979 26 p refs
(Contract W-7405-eng-36)
(LA-7895) Avail: NTIS HC A03/MF A01

A versatile stepping motor driver to do beam diagnostic measurements is described. The driver is controlled by a microprocessor and can move eight stepping motors simultaneously. The driver can monitor and respond to clockwise and counterclockwise-limit switches, and it can monitor a 0 to 10 V dc position signal. The software controls start and stop vamping and maximum stepping rates. DOE

N80-22616# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
CADMIUM SULFIDES/COPPER SULFIDE HETEROJUNCTION CELL RESEARCH Technical Progress Report, 1 Jun. - 31 Aug. 1979
W. W. Anderson and A. D. Jonath Oct. 1979 38 p refs
(Contract EG-77-C-01-4042)
(SER-8033-1/2, LMSC-D-82842) Avail: NTIS HC A03/MF A01

Off stoichiometric resistivity control of Cds was achieved by cyclic sputtering of a Cd cathode in H2S/Ar and pure Ar. Resistivities of 1000 to 10,000 omega/cm were achieved. An effect of substrate metallization upon CdS deposition rate was identified as a temperature effect. The substrate metallization was found to change the radiative heat balance of the substrate glass. Differential thermal analysis measurements indicate that reactively sputtered Cu/sub x/S has the same phase change properties as single crystal Cu/sub x/S with x in the range 1.994 or equal to 1.997. DOE

N80-22617# Minnesota Univ., Minneapolis
CONTRIBUTION OF ELECTRONICALLY EXCITED STATES TO THE RADIATION CHEMISTRY OF ORGANIC SYSTEMS Progress Report, 1 Sep. 1978 - 31 Aug. 1979
S. Lipsky 1979 15 p refs
(Contract EY-76-S-02-0913)
(COO-913-70) Avail: NTIS HC A02/MF A01

The effect of n-perfluorohexane to quench both the emission and photoionization current of N,N,N',N'-tetramethyl-p-phenylenediamine (TMPD) in isooctane and in tetramethylsilane was investigated and shown to be consistent with an interaction of perfluorohexane with some relatively long-lived, coherently excited state of TMPD that is generated at the photoionization threshold and which decays either to the emitting state of TMPD or to a geminate ion pair. The 0 degrees and 90 degrees electron impact spectra of the stable isomers of C3, C4, and C5 saturated hydrocarbons were determined. Preliminary results show large structural effects on the lowest Rydberg singlet-triplet splittings. Two photon excited emission spectra of decalin, bicyclohexyl, and cyclohexane were observed in good agreement with previously reported one photon spectra. A weak emission from propylene was also detected. Other significant results are reported. DOE

N80-22618# Westinghouse Electric Corp., Pittsburgh, Pa.
DESIGN OF A 20-MJ SUPERCONDUCTING OHMIC-HEATING COIL
S. K. Singh, J. H. Murphy, M. A. Janocko, H. E. Haller, D. C. Litz, P. W. Eckels, J. D. Rogers, and P. Thullen 1979 7 p refs Presented at the 8th IEEE Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979 Prepared in cooperation with LASL
(Contract W-7405-eng-36)
(LA-UR-79-3260; CONF-791102-52) Avail: NTIS HC A02/MF A01

Conceptual designs of 20-MJ superconducting coils which were developed to demonstrate the feasibility of an ohmic-heating system were discussed. The superconductor materials were NbTi and Nb3Sn for the pool boil and forced-flow cooling, respectively. The coils were designed to be cryostable for bipolar operation from -7 to +7 tesla maximum field within one second. The structural design addresses the distribution of structure and structural materials used in the pulsed field environment. The cyclic stresses anticipated and the fatigue limits of the structural materials were examined in view of the operating life of the coil. The coils were designed to generate the flux swings while simultaneously meeting the limitations imposed by cooling, insulation, current density and the stresses in the materials. Both the pool and forced cooled conductors have the same criterion for cryostability, i.e., the conductor must return to the superconducting state from an initial temperature of 20 K while the full transport current is flowing through the conductor. DOE

N80-22619# Los Alamos Scientific Lab., N. Mex.
COMMUTATOR dc MACHINES USED AS MECHANICAL CAPACITORS IN A SERIES RESONANT OHMIC-HEATING CIRCUIT SIMULATION
Philip Thullen and D. M. Weldon 1979 6 p refs Presented at the 8th IEEE Symp. on Eng. Probl. of Fusion Res., San Francisco, 13-16 Nov. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3122; CONF-791102-40) Avail: NTIS HC A02/MF A01

From 8th symposium on engineering problems of fusion research, San Francisco, CA, USA (13 Nov. 1979). Rotating electrical machines, and in particular commutator dc machines can serve as a high-power energy-source for testing large, pulsed magnets. A pulsed power supply based on traction motors is described which will be used to test the LASL prototype 20-MJ superconducting Tokamak induction coil. DOE

N80-22620# Los Alamos Scientific Lab., N. Mex.
AXIAL CURRENTS, SUPERCURRENTS AND ANOMALIES IN SUPERSYMMETRIC QED
Thomas E. Clark 1979 9 p refs Presented at the Supergravity Workshop, Stony Brook, N.Y., 26 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2829; CONF-790989-1) Avail: NTIS HC A02/MF A01

The currents associated with the superconformal symmetries are defined as moments of the supercurrent, V/sub mu. All of the current (non-) conservation equations are known once the generalized trace of the supercurrent, D/sup alpha/V/sub alpha alpha/, is found. The superformal anomalies are shown to have coefficients given by beta of the Callan-Symanzik equation. In super QED there is an additional U(1) axial current whose anomaly has a coefficient with no radiative corrections. DOE

N80-22621# Siemens A.G., Munich (West Germany). Unternehmensbereicht Baulemente
ELECTRON BEAM WRITING ON SEMICONDUCTORS Final Report
Hartwig Bierhenke, Egmont Kutzer, Pascher Adolf, Hans Plitzner, and Peter Rummel Bonn Bundesmin. fuer Forsch. u. Technol.

Aug. 1979 134 p. refs. In GERMAN; ENGLISH summary. Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-16) Avail: NTIS HC A07/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 27.70

The results of a 3 year research project related to the production of integrated circuits are reported. Included are wafer exposure techniques, mask making, resist techniques, studies of alignment procedures, manufacturing of device samples, and radiation damage. The use of a commercially acquired electron beam machine in making microelectronic circuits is described.
Author (ESA)

N80-22622# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
A METHOD OF MEASURING THE TOTAL dc ELECTRIC FIELD IN THE VICINITY OF A SPACECRAFT USING ARTIFICIALLY INJECTED CHARGED PARTICLES
M. Pirre, M. Hamelin, T. R. Sanderson (ESTEC, Noordwijk, Netherlands), and G. L. Webb (ESTEC, Noordwijk, Netherlands). Apr. 1979 42 p. refs. Submitted for publication
(CRPE-NT-68) Avail: NTIS HC A03/MF A01

A method of measuring both the perpendicular and parallel dc electric field in the vicinity of a spacecraft using artificially injected charged particles is presented. The method uses a rendezvous between the spacecraft and injected particles after a number of complete gyrations around the magnetic field plus one partial gyration in order to measure the field and potential structure at short distances from the spacecraft. The characteristics of the measurements are evaluated with emphasis on the echo delay time of the particles and the sensitivity. The requirements for guns and detectors are assessed including their orientation, the beam intensity, and the detector time resolution and sensitivity.
Author (ESA)

N80-22623# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.
PLANAR TRANSISTORS AND IMPATT DIODES WITH ION IMPLANTATION. Final Report
Heinz Dorendorf, Hans Glawischnig, Leo Grasser, and Juergen Hammerschmitt. Bonn: Bundesmin. fuer Forsch. u. Technol., Nov. 1979 60 p. refs. In GERMAN; ENGLISH summary. Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-16) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 12.20

Low frequency planar n-p-n and p-n-p transistors were developed using ion implantation of boron and phosphorus by a drive-in diffusion. The electrical parameters of the transistors are comparable with conventionally produced transistors. The noise figure was improved and production tolerances were reduced. Silicon avalanche diodes for the microwave range were fabricated with implanted p-n junctions and tested for their high frequency characteristics. These diodes, made in an improved upside down technique, delivered output power of up to 40 mW at 30 GHz. Reverse leakage current and current carrying capacity were comparable to diffused structures.
Author (ESA)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers, hydrodynamics, fluidics, mass transfer, and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-22624 Illinois Univ. at Urbana-Champaign.
IDENTIFICATION OF THE DOMINANT FLOW STRUCTURE IN THE VISCOUS WALL REGION OF A TURBULENT FLOW. Ph.D. Thesis
Johannes Hubertus Antonius Hogenes. 1979 190 p.
Avail: Univ. Microfilms Order No. 8009061

The coherent eddy structure and the bursting phenomenon were explored in the viscous wall region of a fully developed turbulent pipe flow. Multiple wall probes were used to measure the velocity gradients in the axial and spanwise directions at the wall. Also multiple probes were used in the fluid downstream from the wall probes to measure the axial velocities at different radial positions. The dominant flow structure in the viscous wall region was found to be a simultaneous flow of high axial momentum fluid towards the wall and low axial momentum away from the wall. The nature of turbulence implies that inflows and outflows are distributed randomly in space and time, inducing inflow-outflow sequences (and vice versa). The common feature of these sequences is a rapid acceleration of the axial velocity fluctuations leading to inflexional velocity profiles.
Dissert. Abstr.

N80-22625 Minnesota Univ., Minneapolis.
NATURAL CONVECTION FROM OPENED- AND CLOSED-SIDED VERTICAL PARALLEL PLATES FROM FIN-TUBE CONFIGURATIONS. Ph.D. Thesis
Parviz Ahmadi Bahrami. 1979 101 p.
Avail: Univ. Microfilms Order No. 8006578

Experiments were performed to study the heat (mass) transfer characteristics for natural convection at the face-to-face surfaces of the parallel, square vertical plates. The experiments encompassed conditions where all the sides of the system were open to the ambient as well as conditions where one or both of the sides were closed. In addition, by the insertion of a horizational tube between the plates the experiments were extended to a natural convection fin and tube heat exchanger. The fin and tube heat exchanger configuration experiments showed that the heat transfer rates are independent of the exposed surface area of the plate and that the transfer occurs exclusively at the peripheral regions of the plate surfaces. These findings strongly suggest that, contrary to common belief, the transfer rates are proportional to the perimeter of the plate rather than to its surface area.
Dissert. Abstr.

N80-22626 Princeton Univ., N. J.
STABILITY OF VISCOSITY STRATIFIED FLOW BETWEEN ROTATING COAXIAL CYLINDERS. Ph.D. Thesis
Wing-Tsan Wong. 1980 181 p.
Avail: Univ. Microfilms Order No. 8008952

The flow of two concentric Newtonian liquid layers between rotating coaxial cylinders was chosen as a ideal model to study, by means of the principles of the linear theory of hydrodynamic stability, the fundamental nature of viscous liquid mixing. Interfacial instability due to infinitestimal wavy disturbances was examined using regular perturbation methods in the asymptotic limits of small and large wave numbers for axisymmetric modes. In the long wave regime(small wave number), instability was caused by inertial centrifugal force and the possibility of instability was greatly enhanced by the presence of viscosity stratification.
Dissert. Abstr.

N80-22627 Illinois Univ. at Urbana-Champaign.
CORRELATION AND SPECTRAL MEASUREMENTS OF FLUCTUATING PRESSURES AND VELOCITIES IN ANNULAR TURBULENT FLOW. Ph.D. Thesis
Randall Joe Wilson. 1979 162 p.
Avail: Univ. Microfilms Order No. 8009210

The fluctuating velocity field, the fluctuating static wall pressure, and the in stream fluctuating static pressure in an annular turbulent air flow system with a radius ratio of 4.314 were investigated. Direct measurements of the mean velocity profile, turbulent velocity field, fluctuating static wall pressure and in stream fluctuating static pressure were taken. The statistical values of the turbulent intensity levels, power spectral densities of the turbulent quantities, the cross correlation between the fluctuating static wall pressure and the fluctuating static pressure in the core region of the flow and the cross correlation between the fluctuating static wall pressure and the fluctuating velocity field in the core region of the flow were obtained. The velocity measurements were made with X-probe hot wire sensors utilizing standard constant temperature hot wire anemometry techniques.
Dissert. Abstr.

N80-22628 Illinois Univ. at Urbana-Champaign.
INERTIAL EFFECTS IN DROPLET MOTION. Ph.D. Thesis
Michael Bruce Stewart. 1979 45 p.
Avail: Univ. Microfilms Order No. 8009182

The effects of local or convective acceleration for three separate examples of axisymmetric viscous flows about spherical or nearly spherical objects were investigaged. The first example extends a steady, zero Reynolds number solution of flow around dielectric drop suspended in a second fluid on which a uniform electric field is superimposed. In the second example, the transient response of a droplet with variable internal mass and density is derived for two different forcing functions when the convective acceleration is negligible. The stream functions, retarding fluid forces and resulting droplet velocities are presented. The final example examines both the local and convective acceleration effects on a droplet translating through a viscous fluid with a velocity having a small fluctuating component. Dissert. Abstr.

N80-22629 California Univ., Los Angeles.
AN EXPERIMENTAL STUDY OF CONVECTION IN A ROTATING LAYER Ph.D. Thesis
Kenneth Eugene Heikes 1979 97 p
Avail: Univ. Microfilms Order No. 8008483

The results of an experimental study of convection in a thin horizontal layer of fluid rotating about a vertical axis are presented. Three Prandtl numbers were used and certain ranges of Taylor and Rayleigh numbers were covered. Emphasis was placed on the Kuppers-Lortz instability because of its relationship to fully developed turbulence. Dissert. Abstr.

N80-22630 Michigan Univ., Ann Arbor.
EXPERIMENTAL STUDY OF CYLINDRICAL, TWO PHASE DETONATIONS IN MONODISPERSE SPRAYS Ph.D. Thesis
Ram Bar-Or 1979 281 p
Avail: Univ. Microfilms Order No. 8007705

A specially designed detonation chamber was used to model cylindrical clouds of fuel sprays. Propagation velocities of cylindrical blast waves in all gaseous atmospheres and in correactive sprays were determined experimentally. The results indicated that blast waves attenuate faster propagating in sprays than in gas only and that the rate of attenuation depends on the mass loading of the liquid in the gas. The structure and propagation characteristics of detonation waves are sprays were observed, measured, and evaluated for volatile and non-volatile fuels. It was demonstrated that the detonation of non-volatile sprays is characterized by a long reaction zone and that the controlling mechanism in the reaction zone is the aerodynamic shattering of the liquid droplets. Explosive ignition was always observed in the wakes behind the shattered droplets of nonvolatile fuels in oxygen (or oxygen-rich atmospheres). Dissert. Abstr.

N80-22631 Rutgers - The State Univ., New Brunswick, N. J.
NATURAL CONVECTION IN RECTANGULAR AIR ENCLOSURES OF ASPECT RATIO LESS THAN ONE Ph.D. Thesis
Evi In Lee 1979 248 p
Avail: Univ. Microfilms Order No. 8008900

Natural convection heat transfer in rectangular air enclosures of aspect ratio between 0.1 and 1.0 for the Grashof number range of 1,000,000 to 30,000,000 was investigated both experimentally and numerically. Steady two dimensional laminar natural convection in these enclosures was analyzed using finite difference techniques. The heat transfer rates across the enclusures were measured interferometrically for the isothermal enclosure and the foam enclosure. Horizontal and vertical velocities within the enclosures were measured with a laser Doppler anemometer. The flow patterns within the enclosures were visualized by backlighting the enclosure with laser light and injecting cigarette smoke into the enclosure. Dissert. Abstr.

N80-22632*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HEATING RATE MEASUREMENTS OVER 30 DEG AND 40 DEG (HALF ANGLE) BLUNT CONES IN AIR AND HELIUM IN THE LANGLEY EXPANSION TUBE FACILITY
N. M. Reddy Mar. 1980 58 p refs
(NASA-TM-80207) Avail: NTIS HC A04/MF A01 CSCL 20D

Convective heat transfer measurements, made on the conical portion of spherically blunted cones (30 deg and 40 deg half angle) in an expansion tube are discussed. The test gases used were helium and air; flow velocities were about 6.8 km/sec for helium and about 5.1 km/sec for air. The measured heating rates are compared with calculated results using a viscous shock layer computer code. For air, various techniques to determine flow velocity yielded identical results, but for helium, the flow velocity varied by as much as eight percent depending on which technique was used. The measured heating rates are in satisfactory agreement with calculation for helium, assuming the lower flow velocity, the measurements are significantly greater than theory and the discrepancy increased with increasing distance along the cone. M.G.

N80-22633*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATUS OF LINEAR BOUNDARY-LAYER STABILITY AND THE e TO THE nTH METHOD, WITH EMPHASIS ON SWEPT-WING APPLICATIONS
Jerry N. Hefner and Dennis M. Bushnell Apr. 1980 50 p refs
(NASA-TP-1645; L-13313) Avail: NTIS HC A03/MF A01 CSCL 20D

The-state-of-the-art for the application of linear stability theory and the e to the nth power method for transition prediction and laminar flow control design are summarized, with analyses of previously published low disturbance, swept wing data presented. For any set of transition data with similar stream distrubance levels and spectra, the e to the nth power method for estimating the beginning of transition works reasonably well; however, the value of n can vary significantly, depending upon variations in disturbance field or receptivity. Where disturbance levels are high, the values of n are appreciably below the usual average value of 9 to 10 obtained for relatively low disturbance levels. It is recommended that the design of laminar flow control systems be based on conservative estimates of n and that, in considering the values of n obtained from different analytical approaches or investigations, the designer explore the various assumptions which entered into the analyses. E.D.K.

N80-22634*# California Univ., Los Angeles.
CRYOGENIC-COOLANT He4-SUPERCONDUCTOR DYNAMIC AND STATIC INTERACTIONS
S. Caspi, C. Chuang, Y. I. Kim, R. J. Allen, and T. H. E. Frederking Apr. 1980 90 p refs
(Grant NsG-3153)
(NASA-CR-3262; UCLA-ENG-7867) Avail: NTIS HC A05/MF A01 CSCL 20D

A composite superconducting material (NbTi-Cu) was evaluated with emphasis on post quench solid cooling interaction regimes. The quasi-steady runs confirm the existence of a thermodynamic limiting thickness for insulating coatings. Two distinctly different post quench regimes of coated composites are shown to relate to the limiting thickness. Only one regime, from quench onset to the peak value, revealed favorable coolant states, in particular in He2. Transient recovery shows favorable recovery times from this post quench regime (not drastically different from bare conductors) for both single coated specimens and a coated conductor bundle. E.D.K.

N80-22635*# B & K Engineering, Inc., Towson, Md.
LONG TERM TESTS OF THE HEPP LIQUID TRAP DIODE HEAT PIPE PROTOTYPE Final Report
Apr. 1980 11 p refs
(Contract NAS2-10203)
(NASA-CR-152358; BKO67-1004) Avail: NTIS HC A02/MF A01 CSCL 20D

The test results which were obtained with the HEPP liquid trap diode heat pipe prototype after it had been in storage for almost 27 months are presented. Transport data were obtained over the range of 150 to 220 K and reverse mode shutdown was measured with nominal operation at 180 K. J.M.S.

N80-22636# Naval Ship Research and Development Center, Bethesda, Md. Ship Acoustics Dept.
INFLUENCE OF FLUID LOADING ON THE TRANSMISSION ACROSS, RADIATION FROM, AND REFLECTION BY RIBS ON A PANEL Final Report
D. Crighton, T. Eisler, and G. Maidanik Jan. 1980 43 p
(AD-A080396; DTNSRDC/SAD/258E-1902) Avail: NTIS

HC A03/MF A01 CSCL 20/1

A formalism of the response of an infinite, plane, and uniform panel is derived in terms of the impulse response function. The modification of the impulse response function caused by attaching parallel line mechanical constraints is considered. It is shown that the impulse response function of the so constrained panel can be cast in the form of two terms. The first is simply the impulse response of the unconstrained panel. The second is a functional of the impulse response function of the unconstrained panel and the impedances of the line mechanical constraints. It is argued that the formalism so cast is particularly suitable for ascertaining the modification to the response introduced by line mechanical constraints (ribs). The argument is exemplified by deriving the expressions for the transmission coefficient across the ribs, the radiation to the far field generated by the presence of the ribs, and the change in the reflective properties of the panel introduced by the ribs. GRA

N80-22637# Martin Marietta Labs., Baltimore, Md.
UNSTEADY LAMINAR FLOW Final Report, Oct. 1977 - Jan. 1980
K. C. Wang Jan. 1980 13 p refs
(Contract N00014-77-C-0650)
(AD-A080192) Avail: NTIS HC A02/MF A01 CSCL 20/4

This report was aimed at developing the methodology for computing unsteady laminar boundary layers with flow reversal and establishing a new unsteady separation criterion. The calculation of two dimensional, unsteady boundary layers based strictly on the analogy with the steady, three dimensional problems has been completed. The results demonstrated the validity of the proposed unsteady separation criterion. As a prelude to understanding the full, three dimensional, unsteady problem, this report also treated an unsteady symmetry-plane boundary layer. Initial test calculations were successful, but the bulk of the computation remains to be carried out. GRA

N80-22638# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
THE VALIDITY OF VELOCITY CALCULATIONS BASED ON THE PLUG FLOW ASSUMPTION IN FLOW TUBE APPLICATIONS M.S. Thesis
Paul J. Wolf Dec. 1979 99 p refs
(AD-A080179, AFIT/GEP/PH/79D-14) Avail: NTIS
HC A05/MF A01 CSCL 07/4

The validity of linear velocity calculations based on the plug flow assumption were tested on flowing argon at 4.2, 5.0, 6.0, and 10.1 torr. The linear velocity of argon was experimentally determined along the centerline of a flow tube, using the argon afterglow technique. It was found that the linear velocity was 1.62 times the plug flow (average) velocity at a flow rate of 4576.0 standard cc/min and 1.77 times the plug flow velocity at 5262.4 standard cc/min. The velocity data taken at various distances from the centerline revealed a fully developed laminar flow. The velocity results differed from that predicted by the Poiseuille flow formula, and it was determined that this difference was mainly due to obstructions in the argon flow. It was concluded that the plug flow assumption can be used to obtain linear gas velocities in a fully developed laminar flow and approximate gas velocities if the laminar flow is not fully developed. A Stern-Volmer plot was constructed and the results indicated that the 1D - 1S multiplet of Ar V was responsible for the afterglow. GRA

N80-22639# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia) Research and Development Branch
WATER TUNNEL TESTS ON A NACA 16-309 SECTION EQUIPPED WITH A SIMPLE, SEALED FLAP
Eric A. Jones and Michael Mackay Dec. 1979 64 p refs
(AD-A080617, DREA-TM-79/C) Avail: NTIS
HC A04/MF A01 CSCL 20/4

Water tunnel tests are described of a NACA 16-309 section equipped with a 25% flap-chord ratio, simple, sealed flap. Lift and pitching moment coefficients are given for a range of angles of attack, flap angles and cavitation numbers. Drag data are not considered reliable and only a few values are presented. The results are also given of limited tests for the dependency of force, moment and cavitation inception data on Reynolds number over the range from 1,250,000 to 3,980,000. GRA

N80-22640# Physical Sciences, Inc., Woburn, Mass.
REMOTE MEASUREMENT OF DENSITY FLUCTUATIONS IN TURBULENT FLOWS Final Report, 1 Aug. 1978 - 31 Jul. 1979
J. S. Goela, T. F. Morse (Brown Univ.), and L. G. Piper 1 Aug. 1979 75 p refs
(Contract F49620-78-C-0099; AF Proj. 2307)
(AD-A080108; PSI-TR-189; AFOSR-80-0027TR) Avail: NTIS
HC A04/MF A01 CSCL 20/4

This report describes the results of a theoretical study carried out to explore the possibility of obtaining quantitative information about density fluctuations in an air turbulent flow. Specific techniques considered for analysis include a new three-level gain measurment technique, the use of laser induced gas breakdown as a diagnostic tool, and monitoring of the laser induced fluorescence signal. The effect of turbulence on the diagnostic design is considered and the possibility of conducting a laboratory experiment with the use of commercially available lasers is discussed. GRA

N80-22641# Dayton Univ., Ohio School of Engineering
ANALYSIS OF SOLIDIFICATION IN A CYLINDRICAL ANNULUS WITH INTERNAL FINS Final Report, Oct. 1977 - Oct. 1978
Howard E. Bandow and John N. Crip Wright-Patterson AFB, Ohio AFAPL Jul. 1979 83 p refs
(Contract F33615-77-C-2004; AF Proj. 3145)
(AD-A080131; UDR-TR-78-69; UDSE-TR-78-07; AFAPL-TR-79-2088) Avail: NTIS HC A05/MF A01 CSCL 10/3

Solutions are presented for the one dimensional and two dimensional inward solidification of a material contained in a cylindrical annulus. The outer boundary is insulated and the inner boundary is subject to a constant efflux via a heat pipe. Results are presented for the axisymmetric case and for the cases of three and six longitudinal fins of rectangular cross section. The fins extend radially from inner to outer radius and were symmetrically spaced in the circumferential direction. The phase change material was LiF-MgF2-KF and was assumed to be initially at the fusion temperature. GRA

N80-22642# New York Univ., N. Y. Dept. of Applied Science
A TWO DIMENSIONAL COMPRESSIBLE, NONLINEAR STABILITY ANALYSIS WITH APPLICATIONS TO THE STUDY OF BOUNDARY LAYER TRANSITION Final Report, 15 Sep. 1977 - 15 May 1978
Gabriel Miller and Andrew Callegari Oct. 1979 30 p refs
(Contract N00014-76-C-0183; NR Proj. 061-232)
(AD-A080987, NYU/DAS-79/16) Avail: NTIS
HC A03/MF A01 CSCL 20/4

A computer program which can investigate the nonlinear response of a compressible boundary layer on a flat plate to any imposed external disturbance has been produced. The program first computes the boundary condition near the leading edge utilizing linear stability theory and then determines the disturbance field downstream as a function of time, utilizing the MacCormack time splitting explicit technique. The program originally created to provide a fundamental understanding of boundary layer response to acoustical disturbances has been modified so that a wide range of parameters can be varied. The effects of Mach number and wall conditions can be computed utilizing the program. GRA

N80-22643# Naval Postgraduate School, Monterey, Calif.
A GENERAL PROCEDURE FOR OBTAINING VELOCITY FROM A SYSTEM OF HIGH RESPONSE IMPACT PRESSURE PROBES Technical Progress Report, Jul. 1978 - Jul. 1979
D. Adler and R. P. Shreeve Jul. 1979 90 p refs
(AD-A080798, NPS67-79-007) Avail: NTIS
HC A05/MF A01 CSCL 20/4

A technique to measure a high frequency, repetitively pulsating flow field is presented. Two impact tube probes and a Kiel probe, all with pressure transducers mounted in their tips are used. Five readings are required to identify a velocity vector at a point. In this report the technique, the numerical procedure and the computer program used are described. GRA

N80-22644# Iowa Inst. of Hydraulic Research, Iowa City.
EXPERIMENTS ON TRANSITIONAL OSCILLATORY PIPE FLOW
B. R. Ramaprian and S. W. Tu. Aug. 1979. 128 p. refs.
(Grant DAAG29-79-G-0017)
(AD-A081180; IIHR-221) Avail: NTIS HC A07/MF A01 CSCL 20/4

Fully developed oil flow in a smooth circular pipe at a mean Reynolds number of about 2100 was subjected to a nominally sinusoidal flow modulation at frequencies ranging from 0.05 - 1.75 Hz. It was observed that flow oscillation increased the critical Reynolds number and, under certain conditions, even brought about laminarization of the flow, which would be intermittently turbulent at the mean Reynolds number under quasi-steady (infinitely small oscillation frequency) conditions. The occurrence and extent of laminarization was, however, found to depend on factors such as the intermittency of turbulent puffs in the mean quasi-steady flow, frequency of oscillation, etc. Two series of experiments were performed. In one series, the oscillatory flow was almost completely laminarized. In the other series, the oscillatory flow was fully turbulent. In both the cases, instantaneous velocities in the flow were measured using Laser Doppler anemometry. The instantaneous velocity was decomposed into time-mean, periodic and random components employing ensemble averaging techniques. The experiments indicated that the laminarized oscillatory flow behaves very similar to laminar oscillatory flow at either end of the Strouhal number range studied. The oscillatory turbulent flow was found to depend on both the Strouhal number and the ratio of the oscillation frequency to some characteristic frequency of turbulence in the flow. GRA

N80-22645# Illinois Univ. at Urbana-Champaign. Dept. of Chemical Engineering.
IDENTIFICATION OF THE DOMINANT FLOW STRUCTURE IN THE VISCOUS WALL REGION OF TURBULENT FLOW
Johannes H. A. Hogenes and Thomas J. Hanratty. Aug. 1979. 194 p.
(Contract N00014-76-C-1034)
(AD-A080853; TR-2) Avail: NTIS HC A09/MF A01 CSCL 20/4

The coherent eddy structure and the bursting phenomenon were explored in the viscous wall region of a fully developed turbulent pipe flow. Multiple wall probes were used to measure the velocity gradients in the axial and spanwise directions at the wall. Also multiple probes were used in the fluid downstream from the wall probes to measure the axial velocities at different radial positions. The measurements were performed in a vertical flow system with an internal diameter of 20 cm and a Reynolds number of approximately 30,000. The dominant flow structure in the viscous wall region was found to be a simultaneous flow of high axial momentum fluid towards the wall and low axial momentum away from the wall. The nature of turbulence implies that inflows and outflows are distributed randomly in space and time, inducing inflow-outflow sequences (and vice versa). The common feature of these sequences is a rapid acceleration of the axial velocity fluctuations leading to inflexional velocity profiles. Profile inflexions are a flow phenomenon; they are a consequence of the outflow-inflow sequence. GRA

N80-22646# ARO, Inc., Arnold Air Force Station, Tenn.
A METHOD FOR ESTIMATING JET ENTRAINMENT EFFECTS ON NOZZLE-AFTERBODY DRAG Final Report, Oct. 1978 - Sep. 1978
R. C. Bauer. AEDC. Feb. 1980. 27 p. refs.
(AD-A080955; AEDC-TR-79-85) Avail: NTIS HC A03/MF A01 CSCL 20/4

A highly simplified analysis was used to derive an expression for estimating the induced afterbody drag caused by the turbulent jet-mixing process. The approach estimates the induced velocity produced by the jet-mixing process and uses small perturbation concepts to estimate the resulting pressure change on the afterbody surface from which the induced afterbody drag coefficient is obtained. The theoretical induced afterbody drag (entrainment drag) is combined with the maximum jet plume diameter blockage condition to form a correlation method that accounts for the effect of jet area ratio, exit angle, total temperature, molecular weight and ratio of specific heats for a given external stream Mach number, Reynolds number, and afterbody geometry. For verification, the correlation method was used to predict the drag of an H_2 and C_2H_4 jet from the measured drag of an N_2 jet and to predict the drag of a hot jet from the measured drag of a cold jet for both the 15- and 25-deg AGARD afterbody configurations in the Mach number range from 0.6 to 1.5. The average accuracy of the correlation method is better than 10% for both afterbody configurations and is 40 to 50 % more accurate than a correlation method based only on the blockage parameter. A brief numerical study indicates that the major parameter which correlates the jet entrainment effect is the product of the jet gas constant and total temperature. GRA

N80-22647# ARO, Inc., Arnold Air Force Station, Tenn.
GUMRAP: A COMPUTER PROGRAM FOR ANALYZING MOLECULAR FLOW IN COMPLEX ENCLOSURES Final Report, 1 Oct. 1978 - 24 Sep. 1979
Max Kinslow. AEDC. Feb. 1980. 45 p.
(AD-A080917; AEDC-TR-79-76) Avail: NTIS HC A03/MF A01 CSCL 20/4

The General Unwanted Energy Rejection Analysis Program (GUERAP), which uses a Monte Carlo ray trace technique to analyze complex optical systems, has been in use for a number of years. This report describes the development of a molecular ray trace computer code (GUMRAP) based upon the extensive geometric and Monte Carlo ray trace portion of GUERAP. Portions of GUERAP strictly concerned with radiation such as diffraction, refraction, and internal radiation have been removed, and a new gas-surface interaction subroutine REFLCT, based upon the reciprocity relation, has been included. A detailed description of the input variables is given, as is a listing of control cards so that GUMRAP can be run on an IBM 370/165 computer by anyone desiring to analyze the molecular flow in complex systems such as space chambers. GRA

N80-22648# Argonne National Lab., Ill. Systems Engineering and Technology Group.
ANALYTICAL MODELING OF A HYDRIDE HEAT EXCHANGER
Jeffrey S. Horowitz. Sep. 1979. 40 p. refs.
(Contract W-31-109-eng-38)
(ANL/EES-TM-61) Avail: NTIS HC A03/MF A01

In order to obtain some of the parametric features of the problem of conduction in a hydride bed, a computer program was developed. For simplicity a one-dimensional slab with constant temperature boundary conditions was considered. The phase change corresponding to the adsorption/desorption of hydrogen was modeled as a sharp increase in specific heat at the phase change temperature. All other thermal properties were assumed to be constant with temperature. The computer program was used to solve a number of cases with the results put into dimensionless form. The results of these runs, and the conclusion to be drawn are discussed. DOE

N80-22649# Kentucky Univ., Lexington. Dept. of Mechanical Engineering.
BASIC RESEARCH ENGINEERING: FLUID DYNAMICS AND THERMAL PROCESSES
L. D. Conta and R. F. Hill. Aug. 1979. 28 p. Workshop held at Lexington, Ky., 1-2 Feb. 1979. Prepared in cooperation with Engineering Societies Commission on Energy, Inc., Washington, D.C.
(Contract EF-77-C-01-2468)
(FE-2468-53) Avail: NTIS HC A03/MF A01

Specific research needs in fluid dynamics and thermal processes were identified during a workshop held to emphasize the importance of basic research in developing new technologies for meeting national energy problems. Specific research projects related to fluid dynamics, separation phenomena, energy processing, and energy reactions as well as programs for assessing the status of technology advancement in these fields and for making the results of these assessments accessible and useful to practicing engineers are recommended. DOE

N80-22650# Los Alamos Scientific Lab., N. Mex.
HEAT PIPE COMPUTER PROGRAM (HTPIPE) USER'S MANUAL
F. C. Prenger, Jr. Nov. 1979. 45 p. refs.

(Contract W-7405-eng-36)
(LA-8101-M) Avail: NTIS HC A03/MF A01

Program HTPIPE is a hydrodynamic model of heat pipe performance. The program was developed for high-performance liquid metal heat pipes but can easily be adapted to other working fluids if thermal transport property values are known. Several liquid return geometries can be analyzed including homogeneous wick, screen covered grooves, circular arteries and gutters. The program can be used to optimize the heat pipe design, to calculate performance limits, and to determine axial temperature and pressure profiles. The program is written in FORTRAN and is operational on CDC-6000 series computers. Sample problems are included. DOE

N80-22651# Los Alamos Scientific Lab., N. Mex.
SYMPATHETIC DETONATION
Allen L. Bowman and David E. Richardson (Hercules, Inc., Magma, Utah) 1979 18 p refs Presented at the 16th CPIA-JANNAF Combust. Meeting, Monterey, Calif., 10 Sep. 1979 Sponsored in part by Navy
(Contracts W-7405-eng-36)
(LA-UR-79-2769; CONF-790975-2) Avail: NTIS HC A02/MF A01

The results of a combined experimental and theoretical study of sympathetic detonation of VRO propellant are summarized. The extent of sympathetic reaction has been determined experimentally for different sizes and shapes of propellant. The experiments have been modeled numerically using the LASL reactive hydrodynamic code 2DE with Forest Fire burn rates. The critical separation distance for high-order detonation had been calculated for the cylindrical equivalents of 1, 2, and 3 inch cubes, and is in excellent agreement with experiment. The calculated behavior of the total system is shown with a computer-generated move, and details of the pressures in the air and in the acceptor are presented. DOE

N80-22652# Aeronautical Research Inst. of Sweden, Stockholm. Fluid Technology Lab.
FLEXNOZZLE STEERING OF ANALOG FLOW DIVERTERS
K. S. Nystroem (Sheffield Univ.) and R. F. Boucher 1979 53 p refs
(FFA-Memo-118) Avail: NTIS HC A04/MF A01

The concept of using a sharp-edged nozzle whose two edges are not parallel (nor necessarily straight) is shown to be effective in changing the Flexistor valve behavior from digital to analog. In the Flexistor valve the flow diversion between two outlets is achieved by small movement of one side of a two dimensional sharp-edged nozzle. Test measurements of flow division between the two outlets as a function of rotation of one side of the nozzle are presented for several geometries. Useful geometries giving a good analog function are noted. A feedback model developed as an aid to understanding the device behavior and as a design tool is described. This simple and continuous flow division is applicable to flows of liquids, slurries, or gases. A particularly useful area of application is that of by-pass where a controlled proportion of a fluid stream is diverted around a device. The device may, for example, be a heat exchanger. Because of the simplicity of Flexnozzle actuation a simple downstream temperature sensor/actuator is all that is required to close the loop for temperature regulation. Many similar by-pass situtations exist in process engineering. Author (ESA)

N80-22653# European Space Agency, Paris (France)
THE DETERMINATION OF THE LAVAL NOZZLE EXIT CONDITIONS AT A TOO HIGH COUNTER-PRESSURE ESPECIALLY FOR A PROPANE OXYGEN GAS GENERATOR
Egbert Riester Nov. 1978 65 p refs Transl. into ENGLISH of "Ermittlung des Austrittszustandes aus Lavalduesen bei zu Homen Gegendruck, Speziell bei einem Propan-Sauerstoff-Gasgenerator", Rept. DLR-FB-77-45 DFVLR, Brunswick, Sep. 1977 Original report in GERMAN previously announced as X79-71927
(ESA-TT-504-Rev; DLR-FB-77-45) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 21.60

The flow conditions in a supersonic nozzle including normal shock were investigated. A more dimensional calculation method for an ideal gas is presented to compute the nozzle exit parameters and the location of the shock. The boundaries of the pressure behind the nozzle were calculated. For gas from the combustion of propane and oxygen, it is shown that the consequences of real gas effects on the results of the method are small. Experimental measurements on nozzles with air flow show the validity of the method. At a propane oxygen gas generator, the exhaust temperature is very high; therefore, measurements are possible only in the jet behind the nozzle exit. The pilot pressure and the temperature measurements show that the chemical reaction in the combustion chamber was incomplete. Author (ESA)

N80-22654# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.
A THEORETICAL INVESTIGATION ON THE EFFECT OF THE PRESSURE STRAIN CORRELATIONS ON THE DEVELOPMENT OF THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS
Julius Christian Rotta Feb. 1979 77 p refs In GERMAN, ENGLISH summary Report will also be announced as translation (ESA-TT-618)
(DFVLR-FB-79-05) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 11.50

Two approximate formulas relating to the process of shear stress generation in three dimensional turbulent boundary layers were derived. The derivation makes use of the assumption that the mean products of pressure and rate of strain fluctuations contribute substantially to the directional differences of the resultant shear stress and the resultant mean rate of strain. Calculations are presented for turbulent boundary layers on infinite swept wings and the results are compared with experimental data. Author (ESA)

N80-22655# Delft Hydraulics Lab. (Netherlands).
BUBBLE CAVITATION IN RELATION TO LIQUID QUALITY
Daniel Marcus Oldenziel May 1979 296 p refs Submitted for publication
(Publ-211) Avail: NTIS HC A13/MF A01

Techniques to measure the cavitation strength in a flow are described. The techniques are based on the dynamics of a bubble in a liquid and on the theory of gas diffusion in liquids. The measuring instruments used in cavitation research are reviewed. Theoretical considerations of bubble dynamics in liquids are summarized and a mathematical model is presented which shows the effects of the quality of the liquid on the cavitation strength. A.W.H.

N80-22656# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
FINITE DIFFERENCE CALCULATION OF INCOMPRESSIBLE FLOW THROUGH A STRAIGHT CHANNEL OF VARYING RECTANGULAR CROSS SECTION, WITH APPLICATION TO LOW SPEED WIND TUNNELS
J. vanderVooren and A. Sanderse 26 Jun. 1979 30 p
(NLR-TR-77109-U) Avail: NTIS HC A03/MF A01

A fully-conservative finite difference algorithm is described to calculate the incompressible flow through a straight channel of varying rectangular cross section. Both the width and the height of the channel may vary independently. The algorithm was used successfully in the design of the German-Dutch low speed wind tunnel. Author (ESA)

N80-22657# Bristol Univ. (England). Dept. of Aeronautical Engineering.
THE IMPINGEMENT OF UNDEREXPANDED, AXISYMMETRIC JETS ON NORMAL AND INCLINED FLAT PLATES. VOLUME 1: TEXT
P. J. Lamont and B. L. Hunt Dec. 1977 75 p refs 2 Vol.
(Contract AT/2034/040GW)
Avail: NTIS HC A04/MF A01

The results of an extensive experimental study of the impingement of supersonic air jets upon a flat plate are presented. The supersonic jets were produced by a convergent-divergent nozzle with a conical exit section operated at two under-expansion ratios. The pressure distribution on the flat plate was recorded when the plate was set at distances between 0.5 and 15 exit diameters below the nozzle and inclined at angles to the jet

axis in the range from 90 deg to 30 deg. Shadowgraph pictures of the impinging flow field were taken for most cases. The pressure distribution results are of sufficient resolution to accurately define the plate pressure distributions in most cases. Analysis shows that a momentum method can predict the overall load normal to the flat plate at any inclination. Correlations between important parameters of the pressure distributions for normal impingement and certain free-jet characteristics were found, which may enable these parameters to be predicted in other free-jet conditions. Author (ESA)

N80-22658# Bristol Univ. (England). Dept. of Aeronautical Engineering.
THE IMPINGEMENT OF UNDEREXPANDED, AXISYMMETRIC JETS ON NORMAL AND INCLINED FLAT PLATES. VOLUME 2: FIGURES
P. J. Lamont and B. L. Hunt. Dec. 1977. 239 p. 2 Vol.
(Contract AT/2034/040GW)
Avail: NTIS. HC A11/MF A01

Figures generated in an extensive experimental study of the impingement of supersonic air jets upon a flat plate are presented. These include the pressure distribution on the flat plate and shadowgrah pictures of the impinging flow field. The pressure distribution results are of sufficient resolution to accurately define the plate pressure distributions in most cases. Analysis shows that a momentum method can predict the overall load normal to the flat plate at any inclination. Correlations between important parameters of the pressure distributions for normal impingement and certain free-jet characteristics were found, which may enable these parameters to be predicted in other free-jet conditions. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-22659# Aeronautical Research Labs., Melbourne (Australia).
AIRBORNE DATA PROCESSOR
K. F. Fraser and U. R. Krieser. Nov. 1978. 121 p. refs.
(ARL/Mech-Eng-153; AR-001-317). Avail: NTIS. HC A06/MF A01

Airborne equipment developed for use in the acquisition and recording of both analog and digital data is described. These data are recorded using a single analog magnetic tape transport. A reference frequency, for use in servo-speed control of the ground station tape reproducing machine, is combined with speech using a balanced modulator. Recording of these data is performed using direct techniques. Up to eight channels of analog data, which may require measurement over large bandwidth (up to 20 kilohertz), are time multiplexed at rates which are variable over a wide range. Recording of the multiplexed data is performed using frequency modulation techniques. A highly stable crystal oscillator generates an input clock for a time code generator which provides time-of-day in digital form. Up to 32 channels of analog data, requiring measurement at relatively low bandwidth but at high accuracy, are time multiplexed and converted to digital form using commercially available airborne equipment. The digital output from the above equipment together with that from the time code generator and from up to two digital transducers are multiplexed digitally. The digital data are serialized and converted to a form suitable for recording using the analog tape machine. Author

N80-22660*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ALIASED NOISE IN RADIOMETRIC MEASUREMENTS
Friedrich O. Huck, Stephen K. Park, Nesim Halyo, and Steven T. Stallman. May 1980. 26 p. refs.
(NASA-TP-1639; L-13410). Avail: NTIS. HC A03/MF A01. CSCL 14B

The magnitude of aliased noise that degrades the accuracy of continuous reconstructions of discrete radiometric measurements was evaluated as a function of the spatial response and sampling intervals of the radiometer, and of the resolution of the reconstructed measurements. A Wiener spectrum, representative of a wide range of scenes, was used to characterize the radiance fluctuations. E.D.K.

N80-22661*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN IMAGE READOUT DEVICE WITH ELECTRICALLY VARIABLE SPATIAL RESOLUTION Patent Application
Harry F. Benz, inventor (to NASA). Filed 28 Mar. 1980. 12 p.
(NASA-Case-LAR-12633-1; US-Patent-Appl-SN-135039). Avail: NTIS. HC A02/MF A01. CSCL 14E

The use of a standing acoustic wave charge storage device as an image readout device is described. A frequency f sub 1 is applied to the storage transfer device to create a traveling electric field in the device in one direction along a straight line. A second frequency f sub 2 which is a harmonic of f sub 1, has the same amplitude, and is phase stable with f sub 1 and is applied to the charge transfer device to create a traveling electric field in the opposite direction. Consequently, a standing wave is created along the straight line. When an image is focussed on the charge transfer device, light is stored in the wells of the standing wave. When the frequency f sub 2 is removed, the stored charges are moved to an output terminal. This terminal is connected to a utilization device where the received charges represent the image on the surface of the charge transfer device along a projection of the straight line. NASA

N80-22662*# Applied Science Associates, Inc., Apex, N. C.
RADAR ALTIMETER MEAN RETURN WAVE FORMS FROM NEAR-NORMAL-INCIDENCE OCEAN SURFACE SCATTERING Final Report
George S. Hayne. Wallops Island, Va.: NASA. Wallops Flight Center. Apr. 1980. 27 p. refs.
(Contract NAS6-2810)
(NASA-CR-156864). Avail: NTIS. HC A03/MF A01. CSCL 20N

For a nearly Gaussian transmitted pulse shape scattered from a nearly Gaussian distributed sea surface, a small argument series expansion of one term lead to a several term power series expression for the mean return waveform. Specific expressions are given for the first four terms. These results, which require less computer time than numerical convolution, are useful for data analysis from current or past radar altimeters and for design studies of future systems. Several representative results are presented for an idealized Seasat-1 radar altimeter. E.D.K.

N80-22663*# Applied Science Associates, Inc., Apex, N. C.
RADAR ALTIMETER MEAN RETURN WAVEFORMS FROM NEAR-NORMAL-INCIDENCE OCEAN SURFACE SCATTERING Final Report
George S. Hayne. Wallops Island, Va.: NASA. Wallops Flight Center. Oct. 1979. 26 p. refs.
(Contract NAS6-2810)
(NASA-CR-156864). Avail: NTIS. HC A07/MF A01. CSCL 08C

Under assumptions common in radar altimetry, the mean backscattered return power for a short-pulse radar and near-normal-incidence scattering from a rough ocean surface is given by the convolution of several terms. For a nearly Gaussian transmitted pulse shape scattered from a nearly Gaussian distributed sea surface, a small-argument series expansion of one of the terms within the convolution leads to a several-term power series expression for the mean return waveform. Specific expressions are given for the first four terms. These results, which require much less computer time than would the otherwise necessary numerical convolution, are useful for data analysis from current or past radar altimeters and for design studies of future systems. Several representative results are presented for an idealized Seasat-1 radar altimeters. Author

N80-22664# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPACT PASSIVE LASER GYROSCOPE FEASIBILITY

INVESTIGATION M.S. Thesis
Raymond A. Motes Dec. 1979 74 p refs
(AD-A080155; AFIT/GE/EE/79-26) Avail: NTIS
HC A04/MF A01 CSCL 17/7

The purpose of this research was to investigate the feasibility of a new passive laser gyro configuration. This new configuration consists of one small laser and five external mirrors, three of which make up the resonant cavity. A resonant cavity analysis was first done to determine the light wave propagation characteristics of a three mirror resonant ring. Error analysis was then used to determine the effects of various error sources on the output rotation rate measurements. Finally, the actual gyro was designed, built and tested. Rotation rate measurements were taken along with noise and long term bias drift measurements. Rotation measurements were taken from 0.1 deg/sec to 1.0 deg/sec with an RMS output noise of approximately 0.005 deg/sec. Long term bias drift measurements showed a bias drift, over a 30 minute period, of 0.03 deg/sec. Based on these measurements it was concluded that the new configuration is feasible.
GRA

N80-22665# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.
OPTIMIZING A REAL TIME ACOUSTICAL HOLOGRAPHY SYSTEM
W. F. Swinson (Auburn Univ.) 1 Oct. 1979 53 p refs
(DA Proj. 1L1-62303-A-214)
(AD-A080656; DRSMI/RL-80-2) Avail: NTIS
HC A04/MF A01 CSCL 14/5

This report documents work performed to improve a real time acoustical holography system used for the detection of flaws and disbonds in structures. The wave propagation phenomena and acoustical imaging techniques are discussed. A series of experiments were conducted to find optimum system alignment for improving image resolution. Sample real time acoustical holograms of flawed specimens are included in the work. A list of suggested system improvements is also given.
GRA

N80-22666# Tri-Con Associates, Inc., Cambridge, Mass.
THE DESIGN OF MASS SPECTROMETER ASSEMBLIES FOR SPACE SHUTTLE LAUNCHED SATELLITES Final Report, Jun. 1978 - Sep. 1979
George P. Murphy Hanscom AFB, Mass. AFGL Sep. 1979 40 p refs
(Contract F19628-78-C-0150; AF Proj. 2310)
(AD-A080439; C-169; AFGL-TR-79-0233) Avail: NTIS
HC A03/MF A01 CSCL 04/1

This report discusses the development of instrumentation to be flown on satellites which will be launched from the space shuttle. The instrument is a quadrupole mass spectrometer designed to measure preselected masses in the 1 AMU to 50 AMU region. A discussion of the various circuits will be included in this report along with a complete set of schematics and drawings.
GRA

N80-22667# Brookhaven National Lab., Upton, N. Y.
VACUUM ULTRA VIOLET MONOCHROMATORS
Malcolm R. Howells 1979 26 p refs Presented at Natl. Conf. on Synchrotron Radiation Instrumentation, Gaithersburg, Md., 4 Jun. 1979
(Contract EY-76-C-02-0016)
(BNL-26633; CONF-790651-7) Avail: NTIS
HC A03/MF A01

The performance of vacuum ultraviolet monochromators, in particular the general classes of Rowland circle, plane grating, and the torodial grating monochromators is examined. Approaches which hold the best promise for the future identified and the basis of these approaches and how they might be implemented is discussed.
DOE

N80-22668# California Univ., Livermore. Lawrence Livermore Lab.
MICROPROCESSOR-CONTROLLED PORTABLE NEUTRON SPECTROMETER
G. F. Hunt, R. C. Kaifer, D. R. Slaughter, R. E. Strout, II, and D. W. Rueppel 29 Aug. 1979 8 p refs Presented at the IEEE Nucl. Sci. Symp., San Francisco, 18-20 Oct. 1979
(Contract W-7405-eng-48)
(UCRL-82716; CONF-791037-2) Avail: NTIS
HC A02/MF A01

A neutron spectrometer that acquires and unfolds data in the field was developed for use in the energy range from 1 to 20 MeV. The system includes an NE213 organic scintillation detector, automatic gain stabilization, automatically stabilzed pulseshape discrimination, an LSI-II microprocessor for control and data reduction, and a multichannel analyzer for data acquisition. The system, with the exception of the multichannel analyzer, is mounted in a suitcase 47 by 66 by 23.5 cm. The mass is 23/5 kg.
DOE

N80-22669# Exxon Nuclear Idaho Co., Inc., Idaho Falls.
ULTRASONIC LIQUID-IN-LINE DETECTORS: DEVELOPMENT, EVALUATION, AND IMPLEMENTATION
T. C. Piper Oct. 1979 22 p refs
(Contract DE-AC07-79ID-01675)
(ENICO-1014) Avail: NTIS HC A02/MF A01

Ultrasonic liquid-in-line sensors designed and fabricated of 1/4 in. and smaller diameter tubing are discussed and evaluated. Problems of impedance matching and acoustic reflection are considered. Tone-burst excitation of piezoelectric crystals was found to be useful in producing sensors that behave predictably.
DOE

N80-22670# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Nachrichtentechnik.
CONTRIBUTION TOWARDS AUTOMATIC INVESTIGATION AND PERCEPTION OF TEXTURE IN DIGITIZED REMOTELY SENSED IMAGES Ph.D. Thesis - Technische Univ.
Rudolf Fiedler Feb. 1979 246 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-621)
(DFVLR-FB-79-08) Avail: NTIS HC A11/MF A01; DFVLR, Cologne DM 45,80

The problems that arise from the automated analysis of texture in images are reviewed. Mathematical algorithms are presented for the determination of texture and borders as well as texture classification. The description makes use of the frequency dependence of the image structure that characterizes texture. The interactive digital image processing system, DIBIAS, which provided the images for the analysis is described. Author (ESA)

N80-22671# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Nachrichtentechnik.
ENHANCEMENT OF MULTISPECTRAL SCANNER IMAGES BY DIGITAL FILTERING Ph.D. Thesis - Technische Univ.
Peter Nowak Jan. 1979 159 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-624)
(DFVLR-FB-79-11) Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 28

The possibilities of image restoration and image enhancement by means of two dimensional digital filtering were studied. The sensor system, possible distortions of the image signal, and the theory of nonrecursive digital filtering are discussed. Two design methods for digital filters are presented. The application of digital filtering to multispectral scanner imagery is described.
Author (ESA)

N80-22672# AEG-Telefunken, Ulm (West Germany). Fachbereicht Roehren.
INVESTIGATION AND DEVELOPMENT OF A GAS-DISCHARGE MATRIX DISPLAY WITH INHERENT STORAGE Final Report
Manfred Schiekel, Kurt Fahrenschon, Willi Junge, Guenter Peppel, and Ruediger Unbehaun Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1979 126 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. (BMFT-FB-T-79-25) Avail: NTIS HC A07/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 25,85

The physical principles and technology for a dc gas discharge matrix display with storage were investigated. The storage of the device is based on the dynamic properties of the discharge.

The display cells were addressed with pulses of less than 2 microseconds width making a limitation of the current with resistors unnecessary. In order to shorten the write-pulses, auxiliary discharges were used so as to supply the display cells with ions and metastables. The technology for fabricating devices of 100 x 100 sq mm was elaborated and a demonstration device was built. Author (ESA)

N80-22673# National Technical Information Service, Springfield, Va.
MAGNETOMETERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Dec. 1979
George W. Reimherr Jan 1980 231 p Supersedes NTIS/PS-78/1305; NTIS/PS-77/1184; NTIS/PS-76/1025; NTIS/PS-75/830 2 Vol.
(PB80-803752; NTIS/PS-78/1305; NTIS/PS-77/1184; NTIS/PS-76/1025; NTIS/PS-75/830) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B
Abstracts of reports on the theory, design, performance, and calibration of various types of magnetometers are presented. Only equipment studies are included. This updated bibliography contains 224 abstacts, 23 of which are new entries to the previous edition. GRA

N80-22674# National Technical Information Service, Springfield, Va.
MAGNETOMETERS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Dec. 1979
George W. Reimherr Jan 1980 220 p Supersedes NTIS/PS-78/1306; NTIS/PS-77/1185; NTIS/PS-76/1026 2 Vol.
(PB80-803760; NTIS/PS-78/1306; NTIS/PS-77/1185; NTIS/PS-76/1026) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B
Reports from a worldwide literature survey concerning the theory, design, performance, and calibration of various types of magnetometers are presented. Only equipment studies are included. This updated bibliography contains 213 abstracts, 49 of which are new entries to the previous edition. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-22675 California Univ., Los Angeles
A STUDY OF THE POLARIZATION CHARACTERISTICS OF STIMULATED EMISSION IN ORGANIC DYES Ph.D. Thesis
Kendall Charles Reyzer 1979 129 p
Avail: Univ. Microfilms Order No. 8008518
The polarization characteristics of stimulated emission in laser pumped organic dyes are analyzed. An arbitrary distribution of transition moments, saturation effects of the dye laser field, birefringence of the active medium due to operation away from line center, and rotational diffusion introduced by the Brownian motion of the molecules in solution are included in the analysis. Several applications are discussed including optoptic modulators, improved dye laser pumping efficiency, polarization selectability in dye lasers, and indirect measurement of the rotational diffusion time of a molecule in solution. Dissert. Abstr.

N80-22676 Illinois Univ. at Urbana-Champaign
LUMINESCENCE CHARACTERISTICS OF SINGLE AND MULTIPLE ALUMINUM GALLIUM ARSENIDE - GALLIUM ARSENIDE QUANTUM-WELL HETEROSTRUCTURE LASERS Ph.D. Thesis
Robert Michael Kolbas 1979 140 p
Avail: Univ. Microfilms Order No. 8009077
The luminescence properties of single and multiple Al_x-$Ga_{1-x}As$-GaAs quantum-well heterostructure lasers grown by metalorganic chemical vapor deposition are examined. They are shown to differ markedly from those of conventional double hetero-junctions because of the two dimensional nature of the active region. The experimental characteristics of quantum well recombination radiation are presented and are explained in terms of the properties of quantized carrier motion. Dissert. Abstr.

N80-22677 Columbia Univ., New York.
LASER LIGHT SCATTERING IN SURFACTANT SYSTEMS Ph.D. Thesis
Alan Michael Ganz 1979 186 p
Avail: Univ. Microfilms Order No. 8008725
Laser light scattering, a technique employing coherent radiation to examine macromolecular solution dynamics on he scale of the wavelength of light, was used to study the diffusion behavior of a variety of micelles formed by Triton X surfactants. Concentration dependent studies of the diffusion coefficients measured at 293 K were made in order to extrapolate a hydrodynamic radius for each micelle at infinite dilution. Laser light scattering in the presence of an external electric field - electrophoretic light scattering - is discussed. Results on the electrophoretic mobility of 1.1 micron polystyrene latex spheres using the light scattering chamber are examined. Dissert. Abstr.

N80-22678 Alabama Univ., University.
INVESTIGATION OF A POSSIBLE FLUID MIXING NUCLEAR PUMPED N2-CO2 LASER INCLUDING THE EFFECT OF ONE DIMENSIONAL FLOW Ph.D. Thesis
John Joseph Dearth 1979 90 p
Avail: Univ. Microfilms Order No. 8007591
Use of a fluid mixing system is proposed as a possible means to achieve a nuclear pumped CO2 laser. The system inherently avoids reported problems with electron diffusion pumping of the lower laser level and offers, in principle, to alleviate the reported need for enormous cooling flow rates. An N2-CO2 fluid mixing nuclear pumped system was examined by a one dimensional, constant uniform flow, vibrational temperature model, which was solved numerically. Dissert. Abstr.

N80-22679*# Laser Development Corp., Lexington, Mass.
DEVELOPMENT OF TUNABLE HIGH PRESSURE CO2 LASER FOR LIDAR MEASUREMENTS OF POLLUTANTS AND WIND VELOCITIES Contractor Report, Oct. 1977 - Jan. 1979
Jeffrey S. Levine, Michael Guerra, and Ali Javan Apr. 1980 24 p
(Contract NAS1-14885)
(NASA-CR-3274) Avail: NTIS HC A02/MF A01 CSCL 20E
The problem of laser energy extraction at a tunable monochromatic frequency from an energetic high pressure CO2 pulsed laser plasma, for application to remote sensing of atmospheric pollutants by Differential Absorption Lidar (DIAL) and of wind velocities by Doppler Lidar, was investigated. The energy extraction principle analyzed is based on transient injection locking (TIL) at a tunable frequency. Several critical experiments for high gain power amplification by TIL are presented. E.D.K.

N80-22680# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
STUDY OF APPLICABILITY OF ITERATIVE SATURATED GAIN MODEL IN CONFOCAL UNSTABLE RESONATOR ANALYSIS M.S. Thesis
Russell G. Sorenson Dec. 1979 80 p refs
(AD-A080361; AFIT/GEO/PH/79D-2) Avail: NTIS HC A05/MF A01 CSCL 20/5
An existing method of calculating the eigenmodes of confocal unstable strip resonators is reviewed. This method has the advantage of accurately accounting for diffraction effects but is limited to inclusion of an arbitrary symmetric gain distribution. An extension of this method to include a realistic saturated gain distribution is proposed. This gain distribution is calculated numerically by using an iterative technique to arrive at a self-consistent solution for both the gain and field distributions. Several appendicies are presented to aid in understanding the basic theory. GRA

N80-22681# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
LASER ANNEALING OF AND LASER INTERACTIONS WITH ION IMPLANT SEMICONDUCTING MATERIALS M.S. Thesis
Kenneth Reed Bradley Dec. 1979 74 p refs
(AD-A080363; AFIT/GEP/PH/79D-1) Avail: NTIS HC A04/MF A01 CSCL 20/12
A Q-switched ruby laser was used to irradiate implanted and unimplanted GaAs and Si. Time resolved reflectivity

measurements, which determine the length of time that the surface of the sample is melted, were performed during the laser annealing process. The length of melt versus energy density was plotted for both the implanted and unimplanted samples. No difference in the melt time was observed between implanted and unimplanted samples at high energy densities. The threshold for melting in the implanted samples was found to be lower than the virgin samples, and the energy density required to produce melting in GaAs was about 2/5 that needed for Si. The results obtained were compared to reported experimental work and numerical calculation on laser annealing. Optical reflectivity techniques, performed by Lt. Mullins were used to determine the crystallinity of the samples after annealing. GRA

N80-22682# Electronics Research Lab., Adelaide (Australia).
THE INFLUENCE OF WATER TURBIDITY ON THE PERFORMANCE OF A LASER AIRBORNE DEPTH SOUNDER
D. M. Philips Apr. 1979 29 p refs
(AD-A074153; ERO-0072-TR) Avail: NTIS HC A03/MF A01 CSCL 08/10

During flight trials of a laser airborne depth sounder (WRELADS), measurements were made of the optical attenuation coefficient of coastal waters in both South Australia and Queensland. Measurements of the attenuation coefficient at wavelengths from 400 nm to 600 nm are reported for a range of different water types, and the suitability for depth sounding of the laser wavelength 532 nm is confirmed. Variations of the attenuation coefficient at 530 nm over two vertical sections of sea water are reported and factors influencing the turbidity are suggested. Return signals recorded by the depth sounder are compared with measured attenuation coefficients of the water. It is shown that the maximum measurable water depth varies from below 4 to above 10 attenuation lengths, depending on the turbidity of the water. GRA

N80-22683# Defence Research Establishment Valcartier (Quebec).
PERFORMANCE AND DIAGNOSTIC MEASUREMENTS OF A SUPERSONIC HCl CHEMICAL LASER
S. J. Arnold, K. D. Foster, and D. R. Snelling Jun. 1979 25 p refs In ENGLISH; FRENCH summary
(AD-A071352; DREV-R-4139/79) Avail: NTIS HC A02/MF A01 CSCL 20/5

A supersonic purely chemical continuous wave HCl laser is described in which nonequilibrium concentrations of atomic chlorine are generated by the branch-chain reaction of NO with ClO2. The ClO2 is injected into a stream of NO in helium immediately upstream of the throat of a slit nozzle. The reacting gases then expand as a free-jet into a low-pressure region where HI is added to rapidly form vibrationally excited HCl. The maximum HCl multiline output power of 35 W obtained represents a chemical efficiency of approximately 4.5% based on the total exothermicity of the pumping reaction and the limiting flow rate of HI. GRA

N80-22684# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PHASE SEQUENCE ESIMATION FOR LASER LINE-SCAN IMAGERY IN THE PRESENCE OF RAYLEIGH FADING M.S. Thesis
David E. Meer Dec. 1979 127 p refs
(AD-A080368; AFIT/GE/EE/79D-24) Avail: NTIS HC A07/MF A01 CSCL 17/8

An airborne laser line-scan imaging system can determine the relative range to a target by power modulation of the illuminating laser and detecting the relative phase of the reflected signal with respect to the modulation phase reference. The amplitude of the reflected signal may fluctuate greatly due to such factors as speckle noise and the varying reflectivity of the target, resulting in the severe degradation of performance of commonly used phase detection circuitry. In this report, a maximum-a posteriori (MAP) phase sequence estimator is developed based upon the Viterbi algorithm. The signal is observed in additive, zero mean, white Gaussian noise and the statistics of the amplitude are assumed to be Rayleigh. Perfect knowledge of each realization of the signal amplitude is assumed and the sensitivity to errors in the amplitude estimate is investigated. Expressions for approximate mean-squared error and a lower bound on mean-squared error are developed and verified by a Monte Carlo simulation of the estimator. GRA

N80-22685# Northrop Research and Technology Center, Palos Verdes Peninsula, Calif.
INVESTIGATION OF EFFICIENT CO LASER FREQUENCY TRIPLING Final Report
H. Komine, E. A. Stappaerts, and A. S. Gerwer Kirtland AFB, N.M. AFWL Sep. 1979 144 p refs
(Contract F29601-78-C-0068; AF Proj. 317J)
(AD-A080810; AD-E200437; NRTC79-13R; AFWL-TR-79-71) Avail: NTIS HC A07/MF A01 CSCL 20/5

A thorough study on the feasibility of efficient CO laser frequency tripling in molecular gases was completed. Computer code calculations of nonlinear susceptibilities and detailed analysis of efficiency limitations were carried out for nine candidate molecules belonging to three different resonant enhancement schemes. The results of the study show that direct frequency tripling would yield small efficiencies. However, a two step conversion process involving an intermediate frequency shifting may provide large enhancement factors for efficient two photon resonant sum frequency generation. GRA

N80-22686# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
SURFACE-HOPPING MODEL FOR NEAR-RESONANT ELECTRONIC ENERGY TRANSFER
Jeffrey I. Steinfeld and David G. Sutton 3 Jan. 1980 29 p refs
(Contract F04701-79-C-0080)
(AD-A081234; TR-0080(5940-01)-4; SD-TR-79-20) Avail: NTIS HC A03/MF A01 CSCL 20/5

A surface-hopping model was developed to account for the large near-resonant electronic energy transfer cross sections in systems such as NF-Bi and O2-I, in which the dipole-dipole mechanism is formally forbidden. Multiple surface crossings are predicted to occur in NF-Bi at distances of approximately 8 A, because of long-range (R to the -5th power) dipole-induced dipole terms in the potential. This corresponds well with the measured transfer cross section of approximately 200 sq A. These terms are absent in O2-I, so that the leading term is the London dispersion interaction with an R dependence of R to the -6th power. The predicted crossing distance is approximately 3.5 A, in agreement with the smaller transfer cross section for this system. A Landau-Zener crossing probability is used to predict the temperature dependence of the thermally averaged cross section Q(T) for the I-atom laser pumping reaction. Requirements for a more accurate calculation are discussed. GRA

N80-22687# California Univ., San Diego.
VARIABLE PARAMETER FREE ELECTRON LASER
N. M. Kroll, P. L. Morton (Stanford Univ.), and M. N. Rosenbluth (Inst. for Advanced Study) Oct. 1979 24 p refs
(Contracts EY-76-C-03-0515; DE-AC03-76SF-00515; MDA903-78-C-0086)
(SLAC-PUB-2371) Avail: NTIS HC A02/MF A01

The use of the free electron laser (FEL) to produce a high power laser beam is examined. The design of the wiggler magnet used for the FEL is discussed. The effect of the variations of the magnetic wiggler field and wave length on the coupling of the electron energy to the optical laser beam is discussed. DOE

N80-22688# Brookhaven National Lab., Upton, N. Y. National Synchrotron Light Source.
TOUSCHEK LIFETIME FOR THE NSLS FREE ELECTRON LASER EXPERIMENT
Samuel Krinsky 1979 6 p refs Presented at the Workshop on Beam Current Limitations in Storage Rings, Upton, N.Y., 16-27 Jul. 1979
(Contract EY-76-C-02-0016)
(BNL-26668) Avail: NTIS HC A02/MF A01

The VUV-Ring designed to operate at an electron energy of 700 MeV with an average current of 1 Amp distributed in nine bunches is described. The use of the VUV-Ring for an experiment to study the operation of a free electron laser is discussed. For this purpose it is necessary to operate at an energy lower than 700 MeV, say 400 or 500 MeV. Since it is the peak current which determines the laser gain, it is hoped to achieve an average

current of 1 Amp distributed in three bunches, the length of a bunch being kept as short as possible. The combination of high peak current, small transverse dimensions, and low energy lead one to be concerned about the Touschek lifetime. In this note the Touschek lifetime for the free electron laser experiment is considered. DOE

N80-22689# California Univ., Livermore. Lawrence Livermore Lab.
THEORY AND SIMULATION OF LASER PLASMA COUPLING
W. L. Kruer 9 Aug. 1979 84 p refs
(Contract W-7405-eng-48)
(UCRL-83149) Avail: NTIS HC A05/MF A01

The theory simulation of laser plasma coupling processes are considered. Emphasis is given to their nonlinear evolution. The computerized simulation of plasmas using particle codes is given. The absorption of light via the generation of plasma waves is considered and a discussion of stimulated scattering of intense light is presented. DOE

N80-22690# Physical Sciences, Inc., Woburn, Mass.
INVESTIGATION OF CONCEPT OF EFFICIENT SHORT WAVELENGTH LASER Quarterly Progress Report, 1 Nov. 1978 - 31 Jan. 1979
R. H. Krech, L. G. Piper, E. R. Pugh, and R. L. Taylor Mar. 1979 16 p refs
(Contract ES-77-C-02-4223)
(COO-4223-7; PSI-TR-173) Avail: NTIS HC A02/MF A01

Quantitative analysis of data collected on the fluorescence emission (of lack thereof) from the UV photolysis of CIN3 is presented. The purpose of this investigation is to develop an efficient short wavelength laser based on a class of endoergic molecules (azides) with characteristics applicable to a laser fusion driver. It is found that there is essentially no fluorescence emission at 664.7 micron sec from CIN3 upon flash photolysis. Possible explanations for this anomalous result are considered. Progress on the solid azide laser demonstration experiment is reported. A discussion of initial experiments to detect CIN fluorescence at 665 microns and the supporting spectroscopy is given. DOE

N80-22691# Physics Lab. RVO-TNO, The Hague (Netherlands).
LIDAR: A STATISTICAL APPROACH
C. W. Lamberts Aug. 1978 47 p refs
(PHL-1978-31; TDCK-71317) Avail: NTIS HC A03/MF A01

Preliminary results are described for lidar experiments performed to obtain the optical parameters of the atmosphere under a variety of weather conditions. Software was developed to process either single shot measurements or a number of measurements statistically. It is shown that from the statistical approach a number of relations can be deduced between parameters obtained by lidar techniques and a number of atmospheric quantities recorded simultaneously with the lidar measurements. Author (ESA)

N80-22692# Physics Lab. RVO-TNO, The Hague (Netherlands).
TRANSFORMATION OF THE WAVELENGTH OF LASERS BY MEANS OF STIMULATED RAMAN SCATTERING (SRS)
M. J. M. vandeVen Nov. 1978 20 p refs
(Contract A71/KL/119)
(PHL-1978-44; TDCK-71520) Avail: NTIS HC A02/MF A01

It is shown that irradiation of the Raman active liquid CS2 with a short pulse 1.06 micrometers Nd-Yag laser results in wavelength conversion to larger infrared wavelengths by means of stimulated Raman scattering (SRS). The longer IR wavelengths are less harmful to the observer's eye. Contrary to previous experiments no stimulated Brillouin scattering (SBS) was observed to compete with the SRS process. Irridiation with a 1.06 micrometer pulse train shows both SRS and SBS radiation, thereby greatly reducing the conversion efficiency. Author (ESA)

N80-22693# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.
BIOLOGICAL BASE FOR AND OTHER ASPECTS OF A PERFORMANCE STANDARD FOR LASER PRODUCTS
F. Alan Andersen Oct. 1979 31 p refs Revised
(PB80-128648; FDA/BRH-80/31; DHEW/PUB/FDA-80-8092)
Avail: NTIS HC A03/MF A01 CSCL 06R

The biological basis for a performance standard for laser products is examined using the pattern of biological effects of light which are considered as hazardous to human health and safety. A classification of laser emissions is presented which defines the relative hazard of the emissions. The result of the classification scheme is four classes of laser products in the proposed laser product performance standard. The risks associated with accessible emission are discussed. GRA

N80-22694# National Technical Information Service, Springfield, Va.
X-RAY LASERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1969 - 1979
Brian Carrigan Jan. 1980 100 p Supersedes NTIS/PS-79/0011; NTIS/PS-78/0004; NTIS/PS-76/0993
(PB80-803828; NTIS/PS-79/0011; NTIS/PS-78/0004; NTIS/PS-76/0993) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

Citations of Federally-funded research on the theory, design, development, testing, and output of X-ray lasers are presented. Studies on sources, excitation, amplification, pumping, tuning, and optimization of these lasers are included. This updated bibliography contains 93 abstracts, 5 of which are new entries to the previous edition. GRA

N80-22695# National Technical Information Service, Springfield, Va.
ULTRAVIOLET LASERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1966 - 1979
Brian Carrigan Jan. 1980 216 p Supersedes NTIS/PS-79/0010; NTIS/PS-78/0003; NTIS/PS-76/0993
(PB80-803810; NTIS/PS-79/0010; NTIS/PS-78/0003; NTIS/PS-76/0993) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

Government-sponsored research on the design, development, theory, and diagnostics of ultraviolet lasers is cited. Studies on molecular reactions, electron transitions, excitation, tuning, and optical pumping of these systems are covered. Materials lasing in these wavelengths and optical equipment for these lasers are also included. This updated bibliography contains 209 abstracts, 23 of which are new entries to the previous edition. GRA

N80-22696# National Technical Information Service, Springfield, Va.
ACOUSTO-OPTICAL LASER MODULATORS AND DEFLECTORS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1969 - Nov. 1979
Brian Carrigan Dec. 1979 112 p Supersedes NTIS/PS-78/1186; NTIS/PS-77/1071
(PB80-801368; NTIS/PS-78/1186; NTIS/PS-77/1071) Avail: NTIS HC $30.00/MF $30.00 CSCL 20F

Citations of Federally-funded research on acousto-optic equipment in laser beam modulation, filtering, scanning, deflection, switching, and tuning are covered. The uses of these acousto-optical devices in imaging, fiber optics, optical communications, optical radar, and measuring instruments are described. Research on carbon dioxide and dye lasers is included. This updated bibliography contains 103 abstracts, 5 of which are new entries to the previous edition. GRA

N80-22697# National Technical Information Service, Springfield, Va.
ACOUSTO-OPTICAL LASER MODULATORS AND DEFLECTORS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979
Brian Carrigan Dec. 1979 117 p Supersedes NTIS/PS-78/1187; NTIS/PS77/1072
(PB80-801376; NTIS/PS-78/1187; NTIS/PS-77/1072) Avail: NTIS HC $30.00/MF $30.00 CSCL 20F

Abstracts of worldwide research on the theory and design of acousto-optical devices for laser beam modulation, deflection, splitting, mode locking, and tuning are presented. Studies on materials and their performance are covered. The applications of the acousto-optic interaction for the development of devices for optical information processing, optical modulators, switches, scanners, and color TV display systems are included. Simulation, testing, and performance of the equipment are also described.

This updated bibliography contains 112 abstracts, 17 of which are new entries to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-22698 Columbia Univ., New York.
OPTIMIZATION OF CAM-FOLLOWER SYSTEMS IN POLYDYNE CAM DESIGN Ph.D. Thesis
Nir Berzak 1979 296 p
Avail: Univ. Microfilms Order No. 8008702

High-speed polydyne cam-follower systems were analyzed. As a result of investigation of the structure of polynomial output motions satisfying prescribed terminal conditions, a method of representing the polynomial output motion as a function of independent parameters is outlined. Characteristics of the system are found to be inherent in the polynomial structure. Single degree-of-freedom mathematical models were used to represent the real system and the equation of motion with the aid of Laplace transformation. The relationship between the independent parameters and certain performance coefficients such as peak velocity, acceleration and shock of the output motion and initial velocity, acceleration and shock of the cam curve was established. Two methods of optimizations are presented: a point optimization and an optimization involving the matching of an entire motion. To assist the designer, guidelines in the form of a stepwise procedure are given for obtaining the optimal design. Dissert. Abstr.

N80-22699 Dayton Univ., Ohio.
DIGITALLY-CONTROLLED, VARIABLE-RELUCTANCE LINEAR POSITIONING SYSTEM Ph.D. Thesis
Donald Ellis Graham 1979 140 p
Avail: Univ. Microfilms Order No. 8008433

An approach by which proportional, linear motion is produced directly by an electrically powered prime mover and controller and which uses a variable reluctance solenoid having either of two configurations: a single excitation coil and return spring; or a dual configuration of opposed solenoids is described. A model of the solenoid and feedback control system and the control strategy and its implementation in hardware and software are presented. Dissert. Abstr.

N80-22700*# Boeing Commercial Airplane Co., Seattle, Wash.
TESTING OF RECIPROCATING SEALS FOR APPLICATION IN A STIRLING CYCLE ENGINE
J. F. Curulla and T. L. Beck Feb. 1980 76 p refs
(Contract NAS3-20612)
(NASA-CR-159820; DOE/NASA/0612-80/1; BCAC-D6-48915) Avail: NTIS HC A05/MF A01 CSCL 11A

Six single stage reciprocating seal configurations to the requirements of the Stirling cycle engine were evaluated. The seals tested were: the Boeing Footseal, NASA Chevron polyimide seal, Bell seal, Quad seal, Tetraseal, and Dynabak seal. None of these seal configurations met the leakage goals of .002 cc/sec at helium gas pressure of 1.22 x 10 to the 7th power PA, rod speed of 7.19 m/sec peak, and seal environmental temperature of 408 K for 1500 hours. Most seals failed due to high temperatures. Catastrophic failures were observed for a minimum number of test runs characterized by extremely high leakage rates and large temperature rises. The Bell seal attained 63 hours of run time at significantly lowered test conditions. E.D.K.

N80-22701*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
DYNAMIC RESPONSE TO ROTATING-SEAT RUNOUT IN NON-CONTACTING FACE SEALS
I. Etsion Apr. 1980 25 p refs
(NASA-TM-81490; E-392) Avail: NTIS HC A02/MF A01 CSCL 11A

The dynamic response of a flexibly mounted ring to runout of the rotating seat in mechanical face seals is analyzed assuming small perturbations. It is found that tracking ability of the stator depends only on its dynamic characteristics and operating conditions and is not affected by the amount of runout. Three different modes of dynamic response are shown and the condition for parallel tracking is presented. Author

N80-22702*# Kumm (Emerson L.), Tempe, Ariz.
DESIGN STUDY OF FLAT BELT CVT FOR ELECTRIC VEHICLES
Emerson L. Kumm Mar. 1980 159 p refs
(Contract DEN3-114; Contract EC-77-A-31-1044)
(NASA-CR-159822; P-1006) Avail: NTIS HC A08/MF A01 CSCL 13I

A continuously variable transmission (CVT) was studied, using a novel flat belt pulley arrangement which couples the high speed output shaft of an energy storage flywheel to the drive train of an electric vehicle. A specific CVT arrangement was recommended and its components were selected and sized, based on the design requirements of a 1700 KG vehicle. A design layout was prepared and engineering calculations made of component efficiencies and operating life. The transmission efficiency was calculated to be significantly over 90% with the expected vehicle operation. A design consistent with automotive practice for low future production costs was considered, together with maintainability. The technology advancements required to develop the flat belt CVT were identified and an estimate was made of how the size of the flat belt CVT scales to larger and smaller design output torques. The suitability of the flat belt CVT for alternate application to an electric vehicle powered by an electric motor without flywheel and to a hybrid electric vehicle powered by an electric motor with an internal combustion engine was studied. E.D.K.

N80-22703*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
OPEN ENDED RATCHET TYPE TUBING CUTTER Patent Application
Anthony S. Girala, inventor (to NASA) Filed 9 Apr. 1980 19 p
(NASA-Case-MSC-18538-1; US-Patent-Appl-SN-138944) Avail: NTIS HC A02/MF A01 CSCL 13I

A self-clamping tube and piping cutting tool requiring limited angular motion is described. It includes a handle attached to a C-shaped housing and has an opening sized to admit a pipe. Rotatably mounted within the housing is a C-shaped tool body carrying a set of clamping and support rolls and an edged cutting roll. These rolls contact a pipe at three circumferential points. Cutter advancing means advance the cutting roll toward the support rollers. The support rolls and cutting roll are rotatable independently of the C-shaped housing. A one way ratchet mechanism disposed between the C-shaped housing and the C-shaped tool body permits operation by movement in one rotational direction about the pipe axis. In another embodiment, the tool body is rotated by a power driven mechanism. In addition, an automatic cutter advancing means can be provided. NASA

N80-22704*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
MECHANICAL END JOINT SYSTEM FOR STRUCTURAL COLUMN ELEMENTS Patent Application
Harold G. Bush and Richard E. Wallsom, inventors (to NASA) (Vought Corp., Hampton, Va.) Filed 5 Dec. 1979 17 p
(NASA-Case-LAR-12482-1; US-Patent-Appl-SN-100611) Avail: NTIS HC A02/MF A01 CSCL 13I

A mathematical end joint system, useful for the transverse connection of strut elements to a common mode is described. Included are node joint half with semicircular tongue and groove and a strut joint half with semicircular tongue and groove. The two joint halves were engaged transversely and the connection was made secure by the inherent physical property characteristics of locking latches or by a spring-actioned shaft. A quick release mechanism is also described which provides rapid disengagement of the joint halves. NASA

N80-22705*# National Aeronautics and Space Administration, Washington, D. C.
ALGORITHM FOR THE STABILIZATION OF MOTION A BOUNDING VEHICLE IN THE FLIGHT PHASE
V. V. Lapshin Jan. 1980 39 p refs Transl. into ENGLISH of "Algoritm Stabilizatsii Dvizheniya Prygayushchego Apparatav Faze

Poleta" Preprint-50, Acad. of Sci. USSR, Inst. of Applied Math. Imeni M. v. Keldysh, Moscow, 1979 p 1-63 Translation was announced as N80-10497 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75695, Preprint-50) Avail: NTIS
HC A03/MF A01 CSCL 13I

The unsupported phase of motion of a multileg bounding vehicle is examined. An algorithm for stabilization of the angular motion of the vehicle housing by change of the motion of the legs during flight is constructed. The results of mathematical modelling of the stabilization process by computer are presented. E.D.K.

N80-22706# Shaker Research Corp., Ballston Lake, N. Y.
ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GUIDE. PART 7: BALANCING Interim Report, 15 Apr. 1976 - 15 Jun. 1979
D. S. Wilson, E. J. Gunther, A. B. Palazzo, L. E. Barrett, and P. E. Allaire Wright-Patterson AFB, Ohio AFAPL Jun. 1979 159 p refs
(Contract F33615-76-C-2038; AF Proj. 3048)
(AD-A080562, SRC-79-TR-Pt-7) Avail: NTIS
HC A08/MF A01 CSCL 13/9

This report summarizes the current technology in balancing rigid and flexible rotors. Balancing machines, balancing criteria and techniques, and the influence of shaft flexibility are discussed. GRA

N80-22707# Oak Ridge National Lab., Tenn.
STRESSES IN REINFORCED NOZZLE-CYLINDER ATTACHMENTS UNDER EXTERNAL MOMENT LOADINGS ANALYZED BY THE FINITE-ELEMENT METHOD: A PARAMETER STUDY
J. W. Bryson, W. G. Johnson, and B. R. Bass Aug. 1979 130 p refs
(Contract W-7405-eng-26)
(NUREG-CR-0506; ORNL/NUREG-52) Avail: NTIS
HC A07/MF A01

A parameter study was conducted on stresses in reinforced nozzle to cylinder attachments under external moment loadings as analyzed by the finite element method. Twenty five models were investigated. A three dimensional finite element program, CORTES-SA was used in the study. Each of the 25 models was analyzed for 6 individually applied external moment loadings, with 3 mutually orthogonal moment loadings on the nozzle end and 3 on the cylinder. Two of the nozzle reinforcement designs examined wear nozzle thickening or standards reinforcement 30 deg and triangular pad reinforcement. Essentially unreinforced models were also included for comparison. DOE

N80-22708# Battelle Columbus Labs., Ohio.
STRESS INDICES AND FLEXIBILITY FACTORS FOR NOZZLES IN PRESSURE VESSELS AND PIPING
E. C. Rodabaugh and S. E. Moore Jun. 1979 91 p refs
(Contract W-31-109-eng-38)
(NUREG-CR-0778; ORNL/Sub-2913/10) Avail: NTIS
HC A05/MF A01

Maximum stress intensities and flexibility factors for isolated nozzles in cylindrical portions of vessels and in straight pipe are evaluated. The computer generated data, along with other available test and/or calculated data, are used to develop correlation equations for use in the code. Recommendations for code changes are included. DOE

N80-22709# California Univ., Livermore. Lawrence Livermore Lab.
PROOF LOAD DETERMINATION FOR PRESSURE VESSELS WOUND WITH ARAMID FIBER
H. Thomas Hahn 3 Jul. 1979 35 p refs Presented at the ASTM Symp. on Test Methods and Design Allowables for Fibrous Composites, Dearborn, Mich., 3-4 Oct. 1979
(Contract W-7405-eng-48)
(UCRL-82643; CONF-791019-1) Avail: NTIS
HC A03/MF A01

A method of determining the proof pressure that can guarantee a design lifetime for Kevlar-49/epoxy pressure vessels is presented. The method is based on the assumption that, when taken from the same population, a statically strong vessel is also strong in stress-rupture. The lifetime data available at higher pressures are extrapolated to estimate the lifetime distributions at lower pressures. It is assumed that the lifetime distribution is exponential and that the characteristic lifetime is related exponentially to the applied pressure divided by the average burst pressure. Two examples are given to illustrate the method. DOE

N80-22710# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.
THE DIFFUSION OF WATER VAPOR IN HUMID AIR INTO THE BONDLINES OF ADHESIVELY BONDED METAL JOINTS
Walter Althof Feb. 1979 81 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-619)
(DFVLR-FB-79-06) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 15,40

The moisture content for five aircraft structural adhesives was determined as a function of environment and exposure time. The coefficient of diffusion was calculated and the correlation between the moisture content in the adhesive at saturation and the atmospheric humidity was estimated. Formulas to calculate the time dependent distribution of moisture in adhesive bonds are presented and their predictions are compared with experimental data. Author (ESA)

N80-22711# Rolls-Royce Ltd., Derby (England).
A RAY THEORY APPROACH FOR HIGH-FREQUENCY ENGINE-INTAKE NOISE
A. J. Kempton 1979 8 p refs Presented at Symp. on Mech. of Sound Generation in Flows, Goettingen, West Germany, 1979
(PNR-90001) Avail: NTIS HC A02/MF A01

The feasibility of incorporating a ray theory approach to the prediction of high frequency engine intake noise is demonstrated. Ray theory is used to model the propagation of the forward radiated broadband fan noise of a typical high bypass ratio aircraft engine. The use of ray theory to assess the effects of different liners on fan noise is discussed. Author (ESA)

N80-22712# Rolls-Royce Ltd., Derby (England). Engine Div.
MANUFACTURING OF ACOUSTIC LINERS FOR THE GAS TURBINE ENGINE
K. Bird 1979 13 p
(PNR-90003) Avail: NTIS HC A02/MF A01

The fabrication of a honeycomb divider between a plain support structure and a porous facing sheet is described. The machining and cutting of the honeycomb slab after immobilization with wax or by ice are described. Electrodischarge machining (spark machining) to perforate the sheet is discussed. Quality control using X-ray examination is shown. Author (ESA)

N80-22713# Rolls-Royce Ltd., Derby (England). Aero Div.
WEAR PARTICLE MONITORING
P. A. Mucklow 1979 27 p refs Presented at Condition Monitoring Res. and Develop. Group of Brit. Inst. of Non-Destructive Testing, 20 Feb. 1979
(PNR-90006) Avail: NTIS HC A03/MF A01

The effectiveness of monitoring systems presently used in aircraft gas turbines is discussed, and the sample analysis procedures are described. Systems which monitor wear particles in the oil through microscopic examination, debris quantification, alloy identification, and ferrography are examined. The practice of collecting and examining particles in the engine gas stream is described. Remote monitoring systems which provide a warning of the presence of wear without the need for regular inspection are discussed. Author (ESA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-22714*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULATION OF TRANSDUCER-COUPLANT EFFECTS ON BROADBAND ULTRASONIC SIGNALS
Alex Vary 1980 36 p refs Presented at Spring Meeting of the Am. Soc. of Nondestructive Testing, Philadelphia, 24-27 Mar. 1980
(NASA-TM-81489; E-427) Avail: NTIS HC A03/MF A01 CSCL 14D

The increasing use of broadband, pulse-echo ultrasonics in nondestructive evaluation of flaws and material properties has generated a need for improved understanding of the way signals are modified by coupled and bonded thin-layer interfaces associated with transducers. This understanding is most important when using frequency spectrum analyses for characterizing material properties. In this type of application, signals emanating from material specimens can be strongly influenced by couplant and bond-layers in the acoustic path. Computer synthesized waveforms were used to simulate a range of interface conditions encountered in ultrasonic transducer systems operating in the 20 to 80 MHz regime. The adverse effects of thin-layer multiple reflections associated with various acoustic impedance conditions are demonstrated. The information presented is relevant to ultrasonic transducer design, specimen preparation, and couplant selection. Author

N80-22715# Southwest Research Inst., San Antonio, Tex.
RESEARCH AND DEVELOPMENT OF NMR METHODS FOR THE NONDESTRUCTIVE CHARACTERIZATION OF INTERNAL STRESS AND STRAIN IN NONFERROMAGNETIC STRUCTURAL MATERIALS Final Technical Report, 1 Jun. 1976 - 31 Oct. 1979
G. A. Matzkanin 31 Dec. 1979 65 p refs
(Contract F44620-76-C-0114; AF Proj. 2306)
(AD-A080092; AFOSR-80-0106TR) Avail: NTIS HC A04/MF A01 CSCL 20/1

Two new nondestructive evaluation (NDE) methods for measuring residual stress in non-ferromagnetic metals have been investigated, namely, inductive nuclear magnetic resonance (NMR) and nuclear acoustic resonance (NAR). In metals, NMR is restricted to the surface by the electromagnetic skin effect while NAR is sensitive to the interior of the specimen as well as the surface. Results of NAR experiments on plastically deformed polycrystalline aluminum specimens were very encouraging. The NAR signature was found to vary with degree of plastic deformation in agreement with published NMR theory based on strain-induced quadrupole interactions. Shapes of the NAR signals from deformed aluminum were found to depend on the magnetic modulation frequency; it is suggested that this modulation dependence could form the basis for determining distributions of internal stress and strain in metals. Pulsed NMR experiments on bulk aluminum specimens were complicated by large electromagnetically generated acoustic transient signals not associated with nuclear resonance. Digital subtraction signal processing was used to discriminate against the spurious signals; however, it did not separate NMR signals from the electromagnetically generated transients. Pulsed NMR signals observed from aluminum in a powdered specimen of the superalloy IN-100 provides a basis for considering NMR and NAR for nondestructive measurements in this important class of alloys. GRA

N80-22716# Naval Surface Weapons Center, Dahlgren, Va.
ULTRASONIC C-SCAN TESTING OF MK38 MISSILE WARHEAD WELDMENTS Final Report
C. W. Anderson Jul. 1979 33 p refs
(AD-A075744; NSWC/TR-79-266) Avail: NTIS HC A03/MF A01 CSCL 13/5

The nondestructive determination of weld fusion for Mk38 Sparrow missile warhead casing weldments is discussed. The use of an ultrasonic C-scan technique is described, and the results are compared with destructive testing. Limitations imposed by geometric and dimensional tolerance considerations are also presented. The C-scan technique provides an accurate mapping of lack of fusion within the forward weld root and the aft weld sidewalls. The task is part of a larger effort to correlate weld geometry with weld strength to determine minimum weld requirements. GRA

N80-22717# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
STUDY OF NONDESTRUCTIVE EVALUATION METHODS FOR LAYERED STRUCTURES Final Technical Report, 1 Dec. 1976 - 31 Jul. 1979
N. K. Batra, C. M. Elias, and J. S. Leffler Wright-Patterson AFB, Ohio AFML Nov. 1979 141 p refs
(Contract F33615-77-C-5022; AF Proj. 2418)
(AD-A080969; SRL-6492; AFML-TR-79-4162) Avail: NTIS HC A07/MF A01 CSCL 14/2

Acoustic parameters of adhesively bonded layered structures were extracted from experimental CW spectra. Computer software was developed which yielded the best fit of the experimental spectra of such structures to theoretical spectra generated from the theoretical model of layered structures. The acoustic parameters for such a fit then corresponded to the structures under study. A sampled CW Doppler effect technique was developed to measure radial bolt-hole cracks under the fasteners in single- and multi-layered adhesively bonded structures. This technique measures the size of the cracks far more accurately than any of the previously used amplitude or time delay methods. An Ultrasonic Pseudorandom Signal Correlation System was designed, fabricated, and experimentally characterized. This type of instrument may be useful in applications where high signal-to-noise ratios are not obtainable by conventional methods. GRA

N80-22718# Union Carbide Corp., Oak Ridge, Tenn. Mathematics and Statistical Research Dept.
RISK ANALYSIS RELIABILITY
V. R. R. Uppuluri 1979 12 p refs Presented at the 1979 DOE Statistics Symp., Gatlinburg, Tenn., 24 Oct. 1979
(Contract W-7405-eng-26)
(CONF-791016-1) Avail: NTIS HC A02/MF A01

The mathematical foundations of risk analysis are addressed. The importance of having the same probability space in order to compare different experiments is pointed out. The following topics are discussed: consequences as random variables with infinite expectations; the phenomenon of rare events; series-parallel systems and different kinds of randomness that could be imposed on such systems; and the problem of consensus of estimates of expert opinion. DOE

N80-22719# Sandia Labs., Albuquerque, N. Mex.
APPLICATIONS OF QUALITY ASSURANCE/QUALITY CONTROL CONCEPTS TO NON-HARDWARE PROJECT MANAGEMENT
Joseph F. Calek Oct. 1979 63 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1921) Avail: NTIS HC A04/MF A01

The concepts of quality assurance and quality control, developed over 40 years ago for high quantity production of hardware, are now routinely and effectively applied to complex one-of-a-kind projects such as design and construction of nuclear power plants. Currently, quality assurance and quality control are being applied to projects where outputs are less tangible, e.g., software, services, technical judgements. To date, this latest application has resulted in some notable successes. DOE

N80-22720# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
REQUIREMENTS FOR A COMPONENT QUALITY-CONTROL AND PROCUREMENT PROGRAM
Paris ESA Nov. 1979 22 p
(ESA-PSS-54/QRC-01-ESTEC-Iss-1) Avail: NTIS HC A02/MF A01

A specification is presented which sets forth the minimum requirements of a component quality control and procurement program applicable to projects of the European Space Agency. It is to be applied by contractors and sub-tier contractors to all ESA contracts for development, fabrication and delivery of spacecraft and associated equipment in which the use of

best copy available

components with specific reliability/quality requirements is mandatory. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis, fatigue, and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-22721 Northwestern Univ., Evanston, Ill.
SMALL-SCALE YIELDING AT CRACK TIPS IN PLATES AND SHELLS. Ph.D. Thesis.
Thomas Arthur Bubenik. 1979. 131 p.
Avail: Univ. Microfilms. Order No. 8007358.

Deformation theory is used to model plastic deformation at the tips of cracks in flat plates and shells of arbitrary curvature. The plates and shells are thin, and the material exhibits strain hardening which is modeled by the use of a nonlinear stress-strain law. The deformation in the vicinity of the crack tips includes both stretching and bending, but the stretching is assumed to dominate. Thus, the stresses are tensile but with a nonuniform distribution through the thickness. This distribution depends on the material properties as well as on the geometry. The nonlinear near tip fields are singular and they are analyzed asymptotically. Assuming small scale yielding, path independent integrals, which are valid in regions close to the crack tips, are used to find the stress intensity factors by connecting the nonlinear near tip fields with the singular parts of the corresponding linearly elastic fields. Dissert. Abstr.

N80-22722 Northwestern Univ., Evanston, Ill.
STATIC AND DYNAMIC FRACTURE ANALYSIS FOR BONDED DISSIMILAR MATERIALS. Ph.D. Thesis.
Shiao-Hua Chen. 1979. 131 p.
Avail: Univ. Microfilms. Order No. 8008157.

An elastodynamic problem for a steadily moving crack parallel to the bond plane of two bonded dissimilar materials is investigated and the stress intensity factors are given for parameters of material combinations, crack interface distance, and the crack moving speed. An interface crack, which is subjected to a combined loading with a dominant tensile loading such that there is no overlapped crack tip, is considered with the assumption that a cohesive zone exists ahead of the crack tip. By appropriately prescribing boundary conditions in the cohesive zone, the problem is solved and a failure criterion is proposed. The problem of the delamination of an interface crack due to a vertical crack which has one tip intersect the interface and is subjected to pressure loading, is studied. A prediction is made for the tendency of the propagation of the crack. An application of this model to the features of a geophysical crack, which is used for heat extraction, is briefly discussed. Dissert. Abstr.

N80-22723 Engineering Sciences Data Unit, London (England).
ENDURANCE OF RIVETED LAP JOINTS (ALUMINUM ALLOY SHEET AND RIVETS).
1979. 21 p.
(ESDU-79031; ISBN-0-85679-279-0; ISSN-0141-3996). For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $578.50.

Fatigue endurance data is provided for riveted lap joints in aluminum alloy sheet. Life estimations of lightweight structures for aircraft, lightweight surface vessels, and other vehicles can be made from the data. The range of applicability is for aluminum alloy sheets and rivets where the geometrical ratios are in the ranges d/t: 1.9 to 4.4, p/t: 0.5 to 2.3 and p/d: 3.1 to 12.9. ESDU (GRA)

N80-22724 Engineering Sciences Data Unit, London (England).
STRESS CONCENTRATIONS AT GROOVES FOR RETAINING RINGS OR SEALS (WITH NOTES ON DESIGN AGAINST FATIGUE).
1979. 10 p.
(ESDU-79032; ISBN-0-85679-281-0; ISSN-0141-4089; ISSN-0141-4097). For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $290.50.

The maximum stress arising in circumferentially grooved cylindrical members under tension, bending, or torsion is discussed. Guidance is given for using the data for estimating the fatigue strength. Applications include gear box shafts carrying retaining rings, and pipes using O-seals at junctions with emphasis on elastic isotropic materials; groove proportions of depth to width ratio between 0.5 and 6.0 and radius to depth ratio between 0.2 and 0.03; and external to internal grooves of depth less than 1/5 of wall thickness but whose depth is small in relation to the diameter. ESDU (GRA)

N80-22725 California Univ., Los Angeles.
BEAM AND PLATE FINITE ELEMENTS INCLUDING TRANSVERSE SHEAR AND ROTARY INERTIA. Ph.D. Thesis.
Alexander Tessler. 1979. 187 p.
Avail: Univ. Microfilms. Order No. 8008541.

A hierarchy of conforming Timoshenko-type beam elements, and conforming and nonconforming isoparametric quadrilateral Mindlin-type plate elements are developed. The element formulations employ the transverse deflection and bending rotation kinematic variables. The concept of interdependent variable interpolations is introduced which provides the basic strategy for constructing suitable kinematic variable interpolations. Two types of beam elements are derived: virgin and constrained elements. The advantages of a shear constant method over a static condensation procedure are discussed. Numerical solutions for static and free vibration problems are presented. The plate elements include conforming 21 degrees-of-freedom (DOF) elements and nonconforming 16 DOF elements. Static and free vibration analyses are carried out for isotropic homogeneous plates. Dissert. Abstr.

N80-22726 Pennsylvania Univ., Philadelphia.
CUMULATIVE FATIGUE DAMAGE IN COPPER POLYCRYSTALS. Ph.D. Thesis.
Juan Carlos Figueroa. 1979. 172 p.
Avail: Univ. Microfilms. Order No. 8009403.

The physical basis of cumulative fatigue damage in a representative wavy slip material (copper) was investigated. The cyclic history effects and its resultant bulk dislocation substructures on the crack initiation and crack propagation mechanisms are highlighted. Push-pull tests with zero mean strain (or load), under plastic strain control conditions were carried out, and two amplitudes were selected. Dissert. Abstr.

N80-22727 Ohio State Univ., Columbus.
AN UPPER-BOUND ANALYSIS OF INELASTIC DEFORMATION IN TEXTURED HEXAGONAL POLYCRYSTALS (ZIRCALOY). Ph.D. Thesis.
Brent Larsen Adams. 1979. 106 p.
Avail: Univ. Microfilms. Order No. 8008755.

The inelastic deformation behavior of highly textured hexagonal metals is modelled by statistically weighting single crystal behavior over the range of orientations found in the polycrystal. Crystallographic texture is quantitatively specified with the crystallite orientation distribution function determined from a harmonic analysis of X-ray pole figure data. Power law creep under multiaxial loading conditions is modelled using a uniform strain rate upper bounding procedure which considers the effects of grain to grain in compatibility. Two distinct textures are modelled: a radial texture typical of fully annealed Zircaloy strip, and a bimodal texture typical of cold worked stress relieved Zircaloy tubing. The effects of stress free sources of strain-rate induced by preferred absorption of irradiation defects is considered in a model employing grain shape and size as well as fabrication Q-ratio as input parameters. The predicted behavior is shown to be very sensitive to grain shape. Interaction effects expected between creep and irradiation induced inelastic strain sources were investigated. Dissert. Abstr.

N80-22728 Northwestern Univ., Evanston, Ill.
A DISLOCATION DENSITY APPROACH TO FRACTURE AND FATIGUE. Ph.D. Thesis.
Carl Richard Vilmann. 1979. 107 p.

Avail: Univ. Microfilms Order No. 8008178

The plastic flow at the crack tip was characterized by two separate models both compatible with slip line theory. One model assumes the crack geometry to be slit like while the other assumes the tip to be blunted into a semicircle. Each model allows the stress field within the plastic zone to be determined. A relationship is presented by which the stress field within the plastic zone is related to a distribution of potent. producing stress and displacement. dislocations. A thermodynamic approach was used to derive a fracture criteria for each model. Dissert. Abstr.

N80-22729 Michigan Univ., Ann Arbor.
UNILATERAL CONSTRAINTS IN FRACTURE AND CONTACT PROBLEMS Ph.D. Thesis
David William Schmueser 1979 187 p.
Avail: Univ. Microfilms Order No. 8007830

Fracture and contact problems in solid mechanics involving unilateral constraints, or boundary conditions in the form of inequalities are discussed. A crack problem is considered which consists of an interface crack in a combined tension or compression and shear field. Both tensile and compressive normal loads are considered and numerical results for the contact zone extents, interface crack opening profiles, and stress intensity factors are presented. A periodic array of interface cracks is considered as a simple model for interface crack interaction in a second problem. Crack opening profiles and stress intensity factors are presented for various combinations of shear and tension compression loads. Dissert. Abstr.

N80-22730 California Univ., Los Angeles.
PARAMETER ESTIMATION IN STRUCTURAL DYNAMICS MODELS Ph.D. Thesis
David Richard Martinez 1979 294 p.
Avail: Univ. Microfilms Order No. 8008503

A method is presented for the estimation of parameters in structural dynamics models. A detailed development of the filter and transformation equations is presented, followed by a discussion of the measurement noise characteristics for the practical case, as well as the simulated data used in the numerical study. Results are given for the several cases of an example problem, demonstrating the effectiveness of the method. Following the conclusions are suggestions for future research. Dissert. Abstr.

N80-22731 Missouri Univ., Rolla.
A FINITE-ELEMENT FRACTURE PROPAGATION STUDY Ph.D. Thesis
Herbert George Smith, Jr. 1979 88 p.
Avail: Univ. Microfilms Order No. 8008403

The question of fracture propagation is treated with the finite element method. A combined strain energy density-maximum tangential stress theory is used to predict element failure in an iterative process. After fracture, a stress relief method allows the element to resist shear and normal compressive loads while not resisting normal tensile loads (normal loads in this case referring to that direction perpendicular to the axis of the crack). The procedure requires no special or hybrid elements. Dissert. Abstr.

N80-22732 Illinois Univ. at Urbana-Champaign.
FINITE ELEMENT ANALYSIS OF A DYNAMICALLY LOADED FLAT LAMINATED PLATE Ph.D. Thesis
Daniel William Pillasch 1979 109 p.
Avail: Univ. Microfilms Order No. 8009131

A finite element structural model was developed for the dynamic analysis of laminated, thick plates. The model uses quadrilateral elements to represent the shape of the plate and the elements are stacked in the thickness direction to represent various material layers. Nonlinear strain displacement relations were used to represent large transverse plate deflection. A finite difference technique was used to perform the numerical time integration. Assumptions were made about the response through the thickness of the plate that allow for the use of relatively large time increments in the numerical integration method. The results from the analytical model were compared with experimental results. Dissert. Abstr.

N80-22733*# Mechanical Technology, Inc., Latham, N. Y.
DEVELOPMENT OF PROCEDURES FOR CALCULATING STIFFNESS AND DAMPING OF ELASTOMERS IN ENGINEERING APPLICATIONS, PART 6
A. Rieger, G. Burgess, and E. Zorzi Apr. 1980 157 p. refs
(Contract NAS3-18546)
(NASA-CR-159838; MTI-80TR29) Avail: NTIS HC A08/MF A01 CSCL 20K

An elastomer damper was designed, tested, and compared with the performance of a hydraulic damper for a power transmission shaft. The six button Viton-70 damper was designed so that the elastomer damper or the hydraulic damper could be activated without upsetting the imbalance condition of the assembly. This permitted a direct comparison of damper effectiveness. The elastomer damper consistently performed better than the hydraulic mount and permitted stable operation of the power transmission shaft to speeds higher than obtained with the squeeze film damper. Tests were performed on shear specimens of Viton-79, Buna-N, EPDM, and Neoprene to determine performance limitations imposed by strain, temperature, and frequency. Frequencies of between 110 Hz and 1100 Hz were surveyed with imposed strains between 0.0005 and 0.08 at temperatures of 32 C, 66 C, and 80 C. A set of design curves was generated in a unified format for each of the elastomer materials. E.D.K.

N80-22734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NONLINEAR, THREE-DIMENSIONAL FINITE-ELEMENT ANALYSIS OF AIR-COOLED GAS TURBINE BLADES
Albert Kaufman and Raymond E. Gaugler Apr. 1980 22 p. refs
(NASA-TP-1669; E-074) Avail: NTIS HC A02/MF A01 CSCL 21E

Cyclic stress-strain states in cooled turbine blades were calculated for a simulated mission of an advanced-technology commercial aircraft engine. The MARC, nonlinear, finite-element computer program was used for the analysis of impingement-cooled airfoils, with and without leading-edge film cooling. Creep was the predominant damage mode (ignoring hot corrosion), particularly artund film-cooling holes. Radially angled holes exhibited less creep than holes with axes normal to the surface. Beam-theory analyses of all-impingement-cooled airfoils gave fair agreement with MARC results for initial creep. Author

N80-22735*# Kentron International, Inc., Hampton, Va. Technical Center.
A DESIGN PROCEDURE FOR A TENSION-WIRE STIFFENED TRUSS-COLUMN
William H. Greene Apr. 1980 36 p. refs
(Contract NAS1-16000)
(NASA-CR-3273) Avail: NTIS HC A03/MF A01 CSCL 20K

A deployable, tension wire stiffened, truss column configuration was considered for space structure applications. An analytical procedure, developed for design of the truss column and exercised in numerical studies, was based on equivalent beam stiffness coefficients in the classical analysis for an initially imperfect beam column. Failure constraints were formulated to be used in a combined weight/strength and nonlinear mathematical programming automated design procedure to determine the minimum mass column for a particular combination of design load and length. Numerical studies gave the mass characteristics of the truss column for broad ranges of load and length. Comparisons of the truss column with a baseline tubular column used a special structural efficiency parameter for this class of columns. E.D.K.

N80-22736*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
GEOMETRIC MODELING AND ANALYSIS OF LARGE LATTICED SURFACES
Adnan H. Nayfeh and Mohamed S. Hefzy Apr. 1980 65 p. refs
(Grant NsG-1185)
(NASA-CR-3156) Avail: NTIS HC A04/MF A01 CSCL 20K

The application of geometrical schemes, similar to geodesic domes, to large spherical antenna reflectors was investigated. The shape and size of flat segmented latticed surfaces which approximate general shells of revolution, and in particular spherical

and paraboloidal reflective surfaces, were determined. The extensive mathematical and computational geometric analyses of the reflector resulted in the development of a general purpose computer program capable of generating the complete design parameters of the dish. The program also includes a graphical self contained subroutine for graphic display of the required design. E.D.K.

N80-22737*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

APPLICATION OF TWO DESIGN METHODS FOR ACTIVE FLUTTER SUPPRESSION AND WIND-TUNNEL TEST RESULTS

Jerry R. Newsom, Irving Abel, and H. J. Dunn. May 1980 84 p. refs

(NASA-TP-1653; L-13177) Avail: NTIS HC A05/MF A01 CSCL 20L

The synthesis, implementation, and wind tunnel test of two flutter suppression control laws for an aeroelastic model equipped with a trailing edge control surface are presented. One control law is based on the aerodynamic energy method, and the other is based on results of optimal control theory. Analytical methods used to design the control laws and evaluate their performance are described. At Mach 0.6, 0.8, and 0.9, increases in flutter dynamic pressure were obtained but the full 44 percent increase was not achieved. However at Mach 0.95, the 44 percent increase was achieved with both control laws. Experimental results indicate that the performance of the systems is not so effective as that predicted by analysis, and that wind tunnel turbulence plays an important role in both control law synthesis and demonstration of system performance. E.D.K.

N80-22738# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

EFFECTS OF SHEAR DEFORMATION AND ANISOTROPY ON THE THERMAL BENDING OF LAYERED COMPOSITE PLATES

J. N. Reddy and Y. S. Hsu. Dec. 1979 28 p. refs

(Contract N00014-78-C-0647; NR Proj. 064-609)

(AD-A080534; OU-AMNE-79-20; TR-9) Avail: NTIS HC A03/MF A01 CSCL 20/11

A finite-element formulation of equations governing layered anisotropic composite plates subjected to thermal and mechanical loadings is presented. An exact closed-form solution is also presented for simply supported rectangular cross-ply laminated plates under sinusoidal loading to validate the finite element solutions obtained. The finite element results are in good agreement with the closed-form solutions and with the results of others. GRA

N80-22739# Rutgers - The State Univ., Piscataway, N. J. Dept. of Mechanics and Materials Science.

A FINITE ELEMENT SOLUTION OF THE COUPLED DYNAMICAL THERMOELASTICITY EQUATIONS IN A SLAB Final Report, 10 Jan. - 9 Oct. 1979

Y. Chen, H. Ghoneim, and J. Davis (Army Armament Res. and Develop. Command). 9 Jan. 1980 23 p. refs

(Grant DAAG29-79-G-0052)

(AD-A080712; ARO-16410.1-R-E) Avail: NTIS HC A02/MF A01 CSCL 20/13

A finite-element methodology has been presented to solve the one dimensional couple dynamical thermoelasticity. The spatial variable is discretized by the Galerkin scheme and the central difference scheme. The time variable is discretized by the Galerkin and the backward difference scheme. It was found that the two spatial discretization approaches give close comparison in accuracy when used in conjunction with the backward difference in time. To simulate the wave-like behavior in micro-time scale becomes expensive but there is no technical difficulty. To simulate the macro-time phenomena, the micro-time behavior would disappear. Two test problems are presented to show the micro- and the macro-time behaviors of the thermoelastic slab. The responses to a realistic set of pressure and temperature pulse inputs simulating the interior ballistic type of action are also presented. GRA

N80-22740# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

ANALYSES OF CROSS-PLY RECTANGULAR PLATES OF BIMODULUS COMPOSITE MATERIAL M.S. Thesis

V. Sudhakar Reddy and Charles W. Bert. Jan. 1980 112 p. refs

(Contract N00014-78-C-0647; NR Proj. 064-609)

(AD-A080483; OU-AMNE-80-1; TR-10) Avail: NTIS HC A06/MF A01 CSCL 20/11

A differential-equation formulation is presented for the equations governing the small-deflection elastic behavior of thick plates laminated of anisotropic bimodulus materials (which have different elastic stiffnesses depending upon the sign of the fiber-direction strains). This study is concerned with the problems of bending due to pressure loading, free vibrations, and thermal expansion of thick plates having finite transverse shear moduli. Large static deflections of thin plates are also analyzed by an approximate technique. A simple scheme is used for determining explicitly the location of the neutral surface which is defined on the basis of fiber-direction strain. This provides a basis for rational design of such plates. Exact closed-form solutions are presented for freely supported rectangular plates subjected to a sinusoidally distributed normal pressure. Based on experimentally measured bimodulus properties, some numerical computations are carried out. Good agreement is obtained when compared with numerical results existing in the literature for special cases. The results presented here can be used to validate finite-element codes being developed for analysis of thick plates laminated of bimodulus material. GRA

N80-22741# Pennsylvania State Univ., University Park. Applied Research Lab.

VIBRATION ISOLATION ON RIGID AND NONRIGID FOUNDATIONS Final Report

J. C. Snowdon. 23 Jul. 1979 120 p. refs

(Contract N00024-79-C-6043)

(AD-A074737; ARL/PSU-TH-79-137) Avail: NTIS HC A06/MF A01 CSCL 20/11

The problem of isolating machinery vibration from rigid and nonrigid substructures is analyzed in detail. The nonrigid substructures are modeled by clamped-clamped beams and by simply supported plates with small internal damping of the solid type. Both simple and compound mounting systems are analyzed. The advantages that result from the use of the compound mounting system are clearly apparent. The loss in isolation is described that results when nonrigid flanges or feet support the simply mounted item or the intermediate mass of the compound mounting system. The use is also analyzed of dynamic vibration absorbers or lumped masses to load the beamlike and platelike substructures at each mount location. The item of machinery is supported either by eight or by four antivibration mounts that have small damping of the solid type. It is shown how the number of beam and plate resonances that are excited can be reduced by judicious placement of the antivibration mountings. GRA

N80-22742# State Univ. of New York at Buffalo. Dept. of Engineering Science, Aerospace Engineering and Nuclear Engineering.

A GENERAL UNIQUENESS THEOREM IN NONLINEAR VISCOELASTICITY WITH APPLICATION TO TEMPERATURE AND IRRADIATION INDUCED CREEP PROBLEMS Summary Report

George A. Becus and F. A. Carelli. Aug. 1979 23 p. refs

(Contract N00014-75-C-0302)

(AD-A075738; Rept-112) Avail: NTIS HC A02/MF A01 CSCL 20/11

A general uniqueness theorem is first derived for a general constitutive relation in the form of a nonlinear memory integral with aging included. Uniqueness is proved for the solution to the dynamic mixed boundary value problem with small deformations. The general theorem is then specialized to a constitutive equation of the isotropic power law type governing thermoirradiation induced creep. GRA

N80-22743# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.

STRUCTURAL INELASTICITY 25: COMPUTATION OF NON-UNIQUE SOLUTIONS OF ELASTIC-PLASTIC TRUSSES

David L. White and Philip G. Hodge, Jr. Nov. 1979 12 p. refs

(Contract N00014-75-C-0177; NR Proj. 064-429)
(AD-A080354; AEM-H1-25) Avail: NTIS HC A02/MF A01 CSCL 13/13

It has recently been shown that the solution to certain well-defined boundary value problems for elastic/perfectly-plastic structures is non-unique. The present paper is concerned with the ability of finite-element computer programs to handle such solutions. Some problems arising from non-uniqueness are documented and techniques for circumventing those problems are evaluated by exploring the response of the program Non SAP to a variety of trusses with non-unique solutions. GRA

N80-22744# Naval Research Lab., Washington, D. C. Thermo-structural Materials Branch.
NOTCH DUCTILITY DEGRADATION OF LOW ALLOY STEELS WITH LOW TO INTERMEDIATE NEUTRON FLUENCE EXPLOSURES Interim Report
J. R. Hawthorne 14 Jan. 1980 31 p refs
(AD-A081003; AD-E000365; NRL-8357; NUREG-CR-1053)
Avail: NTIS HC A03/MF A01 CSCL 18/10

The extent and trend of Charpy-V (C sub v) notch ductility changes in reactor vessel materials with fluences of 1 X 10 (to the 18th power) to 10 X 10 (to the 18th power) n/square cm greater than 1 MeV were investigated with several thick section steel plates and submerged arc weld deposits irradiated at 288C (550 F). The materials were fully representative of reactor vessels now in service and had copper contents ranging from 0.10 to 0.40% and phosphorus contents ranging from 0.008 to 0.020%. Material irradiations were performed in a 2 MW pool reactor. The steels with high radiation sensitivity indicated an onset of notch ductility change at fluences of approximately 1.5 x 10 (to the 18th power) n/square cm by an elevation in the ductile-to-brittle transition temperature. Reductions in upper shelf were not observed at this fluence level but were in the range of 0 to 15% at approximately 4 x 10 (to the 18th power) n/square cm and between 15 to 44% at approximately 8 x 10 (to the 18th power) n/square cm. The data trend suggests a power law relationship of upper shelf reduction to fluence at low-to-intermediate fluences. The C sub v transition temperature elevation and upper shelf reduction with irradiation are compared to embrittlement projections by U.S. Nuclear Regulatory Commission Guide 1.99. A limited experimental comparison of radiation effects to dynamic fracture toughness and notch ductility is also presented. GRA

N80-22745# Rensselaer Polytechnic Inst., Troy, N. Y.
MODEL OF TORSIONAL BEHAVIOR IN THERMOMECHANICAL BENDING M.S. Thesis
Jeanne R. Beesley Apr. 1979 51 p refs
(Contract EM-78-S-02-4610)
(COO-4610-T1) Avail: NTIS HC A04/MF A01

An effort was made to model the response of high voltage transmission cables to the torsional loads which occur in the in situ condition of the cable buried in a pipe. Tests were run on a torsion machine in the laboratory which was able to accommodate a reversal of load. The behavior of the cable was studied as it went through cycles of being twisted in opposite directions alternately. Strain in the tape was measured, as were torque and angle. Mathematical models were derived to determine the torsional stiffness of the cable and the distribution of radial stress in the cable insulation. An attempt was made to compare these models to the test results. The torsional stiffness model compared favorably; however, the results for stress could not be analyzed due to the fact that the material constants which were needed could not be obtained. When these constants become available, the mathematical model will undergo further analyzation to determine its feasibility. DOE

N80-22746# California Univ., Livermore. Lawrence Livermore Lab.
FINITE-ELEMENT CALCULATION OF A HOPKINSON BAR TEST
M. Zaslawsky, C. Tatro, and T. Freeman 17 Oct. 1979 21 p refs Presented at 4th Intern. Congr. on Exptl. Mech., Boston, 25 May 1979
(Contract W-7405-eng-48)
(UCRL-83484; CONF-7905126-1) Avail: NTIS HC A02/MF A01

A finite element analysis of a Hopkinson bar test provided additional insight into wave propagation. In the test, a notched tensile specimen, together with the input and output bars, was subjected to a pressure pulse. In the calculations, this input pulse was duplicated and various material properties were used to describe the test specimens. The output pulses obtained from the analysis and the experiment were compared; the surface deformations recorded by a high-speed camera in the experiment were also compared to computationally obtained surface deformations. The analysis independently confirms the Bridgman stress distribution across the notch. DOE

N80-22747# Oak Ridge National Lab., Tenn.
FINITE ELEMENT MODEL FOR NONLINEAR SHELLS OF REVOLUTION
W. A. Cook Nov. 1979 54 p refs
(Contract W-7405-eng-36)
(LA-8138-MS) Avail: NTIS HC A04/MF A01

A finite element model for symmetrically loaded shells of revolution is described. The nonlinear geometric effects are accounted for by incrementing loads and iterating for equilibrium. The iteration process also allows for nonlinear materials. The shell model accounts for large strains, large rotations, and shear deformation. Three example problems demonstrate the versatility and accuracy of this model. An axially loaded cylinder and an internally pressurized spherical shell have large membrane strains, whereas a cylinder that deforms into a spherical shape has large rotations. DOE

N80-22748# Military Vehicles and Engineering Establishment, Christchurch (England). Armour and Materials Branch.
FRACTURE TOUGHNESS AND MICROSTRUCTURE OF A THICK Al-Zn-Mg EXTRUSION
I. G. Crouch Dec. 1978 30 p refs
(MVEE-78507; BR69362) Avail: NTIS HC A03/MF A01

Mechanical properties including fracture toughness characteristics were determined for Al 4.5 Zn-2.5 Mg rectangular extrusions. Tensile properties found to vary significantly with orientation, location within the section, and position along the length of the extrusions are discussed. These values have been correlated with the variable grain structure observed within the material. Using currently available fracture mechanics solutions for lug components, an estimation of a critical stress intensity is compared with the experimentally determined fracture toughness valves. Critical crack lengths are also given. Author (ESA)

N80-22749# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
FATIGUE CRACK PROPAGATION IN ALUMINUM ALLOY SHEET MATERIALS UNDER MANEUVER SPECTRUM AND CONSTANT AMPLITUDE LOADING
R. J. H. Wanhill Jun. 1978 25 p refs Submitted for publication Sponsored in part by Royal Netherlands Air Force Directorate of Material
(NLR-MP-78025-U) Avail: NTIS HC A02/MF A01

Aluminum alloy sheets were compared for fatigue crack propagation resistance under maneuver conditions and constant amplitude loading. Results of stress levels, crack growth rate, delta k value, and fracture toughness for each alloy are presented. Author (ESA)

N80-22750# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.
ON THE J-INTEGRAL AND OTHER EVALUATION METHODS OF ELASTIC-PLASTIC FRACTURE MECHANICS AS WELL AS ON THE LIMITS OF APPLICATION OF LINEAR-ELASTIC FRACTURE MECHANICS
Hans Peter Keller Jan. 1979 169 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-617)
(DFVLR-FB-79-03) Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 24.90

The critical stress intensity factor was determined for three steels and two aluminum alloys using linear elastic fracture mechanics and methods of elastic-plastic fracture mechanics. The use of the methods to determine the critical stress intensity

factor for ductile crack extension on small specimens is discussed. Author (ESA)

N80-22751# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.
DEVELOPMENT OF COMPARABLE TRIANGULAR SHELL FINITE ELEMENTS
Klaus Rohwer. Apr. 1979. 52 p. refs.
(DFVLR-FB-79-25) Avail: NTIS. HC A04/MF A01; DFVLR, Cologne DM 15.20

The development of ten triangular shell finite elements is described. With these elements it is possible to judge the efficiency of the discrete Kirchhoff method, the reduced integration scheme, and the reduced approximation procedure. The influence of the element curvature as well as the difference in power between a linear and a quadratic approximation are studied. Author (ESA)

N80-22752# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ON THE ASYMPTOTIC THEORY OF PLATES
Geert Zimmermann. Jul. 1979. 23 p. refs.
(MPIS-12/1979; ISSN-0436-1199) Avail: NTIS. HC A02/MF A01; Fachinformationszentrum Karlsruhe, West Germany DM 6.70

A mathematical formalism is developed which allows the elastic properties of plates to be described in three dimensions. The formalism makes use of an expansion in terms of a thickness parameter in order to arrive at approximate two dimensional plate equations. The existence of a format solution is discussed and confirmed by using Fourier transformations. Author (ESA)

N80-22753# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
THE INFLUENCE OF BENDING-TORSIONAL COUPLING ON THE BUCKLING LOAD OF GENERAL ORTHOTROPIC, MIDPLANE SYMMETRIC AND ELASTIC PLATES
J. F. M. Wiggenraad. 1977. 75 p. refs.
(Contract NIVR-1808)
(NLR-TR-77126-U) Avail: NTIS. HC A04/MF A01

The influence of bending-torsional coupling on the buckling load of general orthotropic, midplane symmetric and elastic plates was studied. This effect was analyzed for the case of infinitely long plate strips, resulting in approximate analytical solutions, which can be presented graphically for the entire range of the elastic constants. These solutions were obtained with the approximate method as applied by Thielemann. The results were compared with results for finite length panels as derived with the finite element method. The conclusion is drawn that buckling loads for plates with aspect ratio over 2 or 3, which demonstrate the bending-torsional coupling effect, can be estimated fairly well from the results for the infinitely long plate strip. Author (ESA)

42 GEOSCIENCES (GENERAL)

N80-22754# Institute of Ecology, Indianapolis, Ind.
ROLE OF ORGANIC SOILS IN THE WORLD CARBON CYCLE: PROBLEM DEFINITION AND RESEARCH NEEDS Summary Report
T. V. Armentano, ed. 1979. 37 p. refs. Presented at the Workshop on Organic Soils, Indianapolis, 7-8 May 1979.
(Contract DE-AC02-79EV-10040)
(DOE/ET-10040-1(Summ)) Avail: NTIS. HC A03/MF A01

Findings and recommendations of the workshop on organic soils are summarized. The major finding of the workshop is that organic soils are important in the overall carbon budget. Histosols and gleysols, the major organic soil deposits of the world, normally sequester organic carbon fixed by plants. They may now be releasing enough carbon to account for nearly 10 percent of the annual rise in atmospheric content of CO_2. Several strategies for peatland management are discussed, including creation, preservation, functional designation, and use of wetlands for agriculture and energy supply. DOE

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-22755*# Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab.
ESTIMATION OF EFFECTIVE HYDROLOGIC PROPERTIES OF SOILS FROM OBSERVATIONS OF VEGETATION DENSITY
Tobin E. Tellers and Peter S. Eagleson. Mar. 1980. 126 p. refs.
(Grant NsG-5306)
(NASA-CR-163002; RBO-7; OSP-87326; Rept-254) Avail: NTIS. HC A07/MF A01. CSCL 08M

A one-dimensional model of the annual water balance is reviewed. Improvements are made in the method of calculating the bare soil component of evaporation, and in the way surface retention is handled. A natural selection hypothesis, which specifies the equilibrium vegetation density for a given, water limited, climate soil system, is verified through comparisons with observed data. Comparison of CDF's of annual basin yield derived using these soil properties with observed CDF's provides verification of the soil-selection procedure. This method of parameterization of the land surface is useful with global circulation models, enabling them to account for both the nonlinearity in the relationship between soil moisture flux and soil moisture concentration, and the variability of soil properties from place to place over the Earth's surface. E.D.K.

N80-22756*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SURVEY OF METHODS FOR SOIL MOISTURE DETERMINATION
T. J. Schmugge, T. J. Jackson (Dept. of Agriculture, Beltsville, Md.), and H. L. McKim (CRREL). Nov. 1979. 76 p. refs. Presented at the Pecora Symp., Sioux Falls, S.D., Jun. 1979. Submitted for publication.
(NASA-TM-80658) Avail: NTIS. HC A05/MF A01. CSCL 08M

Existing and proposed methods for soil moisture determination are discussed. These include: (1) in situ investigations including gravimetric, nuclear, and electromagnetic techniques; (2) remote sensing approaches that use the reflected solar, thermal infrared, and microwave portions of the electromagnetic spectrum; and (3) soil physics models that track the behavior of water in the soil in response to meteorological inputs (precipitation) and demands (evapotranspiration). The capacities of these approaches to satisfy various user needs for soil moisture information vary from application to application, but a conceptual scheme for merging these approaches into integrated systems to provide soil moisture information is proposed that has the potential for meeting various application requirements. A.R.H.

N80-22757# National Environmental Satellite Center, Washington, D. C.
FUTURE UNITED STATES SATELLITE PROGRAMS OF INTEREST TO SNOW SCIENTISTS
Donald R. Wiesnet. 1979. 7 p.
Avail: NTIS. HC A02/MF A01

Orbital parameters and sensor characteristics are described for the Heat Capacity Mapping Mission, LANDSAT C, Seasat A, Nimbus G, and the Tiros N satellites. Implications for snow studies using the new and improved sensors are discussed. A.R.H.

N80-22758*# Computer Sciences Corp., Wallops Island, Va.
DETERMINING SEA-ICE BOUNDARIES AND ICE ROUGHNESS USING GEOS-3 ALTIMETER DATA
R. E. Dwyer and R. H. Godin (NOAA, Washington, D. C.). Wallops Island, Va. NASA Wallops Flight Center. Mar. 1980. 49 p. refs.
(NASA-CR-156862) Avail: NTIS. HC A03/MF A01. CSCL 08L

The GEOS-3 satellite and radar altimeter instrumentation are described, detailing the ice boundary discrimination technique

utilized and presenting an analyses of the GEOS-3 data with respect to satellite visual and IR imagery. A brief description of the GEOS-3 real time data system is also given. E.D.K.

N80-22759*# National Aeronautics and Space Administration, Washington, D. C.
PROGRAM FOR INTEGRATING MULTIZONAL PHOTOGRAPHS OF THE EARTH, TAKEN BY MKF-6 CAMERA, IN A COMPUTER
A. V. Agapov and S. T. Mosin Jan. 1980 14 p Transl. into ENGLISH of "Programma Sovmeshcheniya v EVM Mnogozonalnykh Fotosnimkov Zemli, Poluchennykh Fotokamerami MKF-6", Rept. Pr-323 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-13 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Acad. of Sci. USSR, Kolosov
(Contract NASw-3199)
(NASA-TM-75701; Pr-323) Avail: NTIS HC A02/MF A01 CSCL 14E

An algorithm and program are described, for integrating up to 6 simultaneously exposed photographs in different spectral ranges of the surface of the Earth, taken by MKF-6 cameras aboard Soyuz-22. Three of the reference marks are identified on 1 photograph and then are used to integrate the other photographs with the first. The program was compiled for the ES-1040 computer, as a standard subprogram in a system for computer processing of data of study of the Earth from space. Author

N80-22760*# National Aeronautics and Space Administration, Washington, D. C.
THE SOPHIA-ANTIPOLIS CONFERENCE: GENERAL PRESENTATION AND BASIC DOCUMENTS
Mar. 1980 50 p Transl. into ENGLISH of conf. paper from CNES, Operation Pilote Interministerielle de Teledetection, Paris Conf. held at Paris, Feb. 1980 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76132) Avail: NTIS HC A03/MF A01 CSCL 05A

The procedures and techniques used in NASA's aerospace technology transfer program are reviewed for consideration in establishing priorities and bases for joint action by technicians and users of remotely sensed data in France. Particular emphasis is given to remote sensing in agriculture, forestry, water resources, environment management, and urban research. A.R.H.

N80-22761# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
A COLOR RASTER SCANNING SYSTEM FOR DIGITIZING CARTOGRAPHIC DATA Final Technical Report, May 1976 - Jun. 1979
Douglas Modeen, Stephen Niemczyk, Frank Sundermeyer, and Richard Hubbard Griffiss AFB, N.Y. RADC Nov. 1979 114 p refs
(Contract F30602-76-C-0205; AF Proj. 4303)
(AD-A080469; HSER-7673; RADC-TR-79-286) Avail: NTIS HC A06/MF A01 CSCL 08/2

The final technical report on the color raster scanner system described the principal system requirements, and the technical considerations leading to the definition of the design approaches employed. The resulting system is composed of major functional elements in hardware, in software, and in the operator support interfaces. This latter area is of high importance in applying the scanner capabilities to obtain satisfactory results in the use of the scanned cartographic data. The report contains a functional description of the color raster scanner system in all its subdivisions, and includes results of test and evaluation as obtained. The major units of the system are the drum scanner unit, the data preprocessor, the control microprocessor with its I/O control and display hardware, the model 8/32 processor system, and the applications software which supports, controls, and integrates system operations. The hardware and software functional descriptions follow the flow of data from photodetection to its recording in digital form on magnetic tape. The software is described in its diverse applications of operator support, on-line processing of data as scanned and off-line processing of output scanned data to requirements which entail more extensive file manipulation. GRA

N80-22762# Army Engineer Topographic Labs., Fort Belvoir, Va.
PROTOTYPE IMAGE SPECTRUM ANALYZER (PISA) FOR CARTOGRAPHIC FEATURE EXTRACTION
Pi-Fuay Chen, Frederick W. Rohde, and William W. Seemuller Oct. 1979 69 p
(DA Proj. 4A1-61102-B-52C)
(AD-A080729; ETL-0204) Avail: NTIS HC A04/MF A01

An electro-optical system for obtaining two-dimensional Walsh transforms of cartographic images was developed. The system uses a plasma discharge device to generate visible two-dimensional Walsh function pattern masks. The cartographic imagery is placed in contact with the plasma tube, and the product of the mask and image is integrated with a single photodetector. The system is capable of producing 512 by 512 (262, 144), two-dimensional Walsh functions, and the same number of associated Walsh transform coefficients in about 14 seconds. The quantitative measurement and display of the relative magnitude of the first block of Walsh transforms (64 x 64) was facilitated with a system minicomputer and a CRT display. A set of selected cartographic images and targets were used to evaluate the system. It was discovered that most of the significant transform information appeared in the lower order Walsh transform coefficients, and further that each Walsh transform pattern is unique in itself and can be distinguished from the others for a limited set of well defined inputs. The dynamic range, the temporal response, and the symmetry of responses of the Prototype Image Spectrum Analyzer (PISA) were found to be relatively poor. GRA

N80-22763# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
ANALYSIS OF LASER RANGING AND VLBI OBSERVATIONS FOR GEODETIC PURPOSES Final Report, 1 Oct. 1977 - 31 Mar. 1979
I. I. Shapiro, C. C. Counselman, and T. A. Herring Hanscom AFB, Mass. AFGL 10 Aug. 1979 18 p refs Sponsored in part by Defense Mapping Agency
(Contract F19628-77-C-0271; AF Proj. 3204)
(AD-A077294; AFGL-TR-79-0196) Avail: NTIS HC A02/MF A01 CSCL 08/5

From three Very Long Baseline Interferometry (VLBI) experiments carried out in 1977 and 1978, the distances between the antenna at Onsala (Sweden) and radio telescopes at Haystack (Massachusetts), Green Bank (West Virginia) and Owens Valley (California) have been determined with formal standard errors as small as a few centimeters and repeatability generally within the 99% confidence interval of the root-sum-squares of these standard errors. Overall it appears that subdecimeter precision has been achieved in these estimates of baseline lengths. Using these data, we have also determined changes in UT1 and in the x and y components of polar motion. GRA

N80-22764# Oak Ridge National Lab., Tenn. Energy Div.
WATER AVAILABILITY FOR ENERGY IN 1985 AND 1990
Jerome E. Dobson and Alf D. Shepherd Oct. 1979 108 p refs
(Contract W-7405-eng-26)
(ORNL/TN-6777) Avail: NTIS HC A06/MF A01

The effects of the National Energy Plan (NEP) on water for energy demands in 1985 and 1990 are examined. Estimates of total consumption are compared with estimates of critical monthly surface-water supply, derived from streamflow and reservoir use data, in each WRC Aggregated Subarea in the conterminous United States. It is concluded that water availability will not inhibit implementation of the NEP because its conservation goals actually retard the growth of water for energy demands in most basins compared with what might be expected without the NEP. However, the results of this assessment and previous corroborative water for energy analyses show that, with or without the NEP, energy development will cause additional water availability problems on already stressed streams and reservoirs throughout much of the western United States, southern Florida, the Ohio River Basin, and the highly urbanized areas of the Eastern Seaboard. DOE

N80-22765# Rockwell International Corp., Richland, Wash. Basalt Hydrology Unit.

SURFACE HYDROLOGIC INVESTIGATIONS OF THE COLUMBIA PLATEAU REGION, WASHINGTON
L. S. Leonhart Jul. 1979 242 p refs
(Contract EY-77-C-06-1030)
(RHO-BWI-ST-6) Avail: NTIS HC A11/MF A01

The Washington State portion of the Columbia Plateau is divided into six hydrologic sub-basins on the basis of the principal surface drainage systems present, structural and topographic relationships, and political and other considerations. Baseline descriptions of the surface water systems and resources are presented for the Columbia Plateau with emphasis on the Pasco Sub-basin. A preliminary evaluation of the hydrology budget for each sub-basin is derived. The net exchange between surface and ground-water systems is evaluated and relative estimates of the net ground-water flow into or out of the sub-basin are obtained. An evaluation is made of hydrologic risk factors arising from: tributary flooding in eastern Washington; and major flooding of the Columbia River within the Pasco Sub-basin. Scenarios are presented for credible natural and man-generated catastrophic events. DOE

N80-22766# National Technical Information Service, Springfield, Va.
COMPUTER AIDED MAPPING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1979
Brian Carrigan Feb. 1980 154 p
(PB80-804305) Avail: NTIS HC $30.00/MF $30.00 CSCL 08B

Approximately 147 citations on the application of computer techniques to cartography from the worldwide journal literature are presented. Automatic mapping, geographic data bases, and computerized photomapping are included. GRA

N80-22767# National Technical Information Service, Springfield, Va.
COMPUTER AIDED MAPPING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - 1979
Brian Carrigan 29 Apr. 1980 181 p
(PB80-804297) Avail: NTIS HC $30.00/MF $30.00 CSCL 08B

Federally-sponsored research on the application of computer techniques to cartography is cited. Automatic mapping, geographic data bases, and computerized photomapping are included. Contains 174 abstracts. GRA

N80-22768# Bureau of Mines, Amarillo, Tex. Helium Operations.
HELIUM IN GROUND WATER AND SOIL GAS IN THE VICINITY OF BUSH DOME RESERVOIR, CLIFFSIDE FIELD, POTTER COUNTY, TEXAS
Philip W. Holland and David E. Emerson 1979 27 p refs
(PB80-125305; BM-IC-8807) Avail: NTIS HC A03/MF A01 CSCL 08D

Three independent reconnaissance geochemical surveys were conducted in the vicinity of the Bush Dome Reservoir in the Cliffside field near Amarillo to determine the helium content of area ground waters, area soil gases and ground waters, and of soil gases collected on a grid sampling pattern in the Cliffside field area. Results of the surveys were positive in that helium-in-water and helium-in-soil-gas anomalies were detected in portions of the Cliffside field area. GRA

N80-22769# State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse. School of Landscape Architecture.
LANDSCAPE VISIBILITY MAPPING: THEORY AND PRACTICE
John P. Felleman 1979 125 p refs Sponsored by NOAA
(PB80-130719; NOAA-79120704) Avail: NTIS HC A06/MF A01 CSCL 08B

The geographic extent of visibility is considered. A coherent conceptual construct of landscape visibility mapping is developed and the alternative methods of data organization are systematically articulated. A working definition of a comprehensive visibility model is presented and data assembly for the elements of the visibility model are discussed. Line of sight processing methods for stationary position and for moving observers are examined as well as visibility outputs, plan views, and perspectives. GRA

N80-22770# TRW, Inc., McLean, Va. Energy Systems Group.
OIL SHALE DATA BOOK
Jun. 1979 410 p
(Contract DE-AC01-78RA-32012)
(PB80-125636) Avail: NTIS HC A18/MF A01 CSCL 08I

A ready reference for evaluation of appropriate shale oil recovery technologies and associated processes is presented. Technologies addressed are: mining and crushing; ore haulage; beneficiation of lean ore; surface and in situ retorting; upgrading of shale oil and gas clean-up; shale disposal and waste water treatment; pipeline transportation. GRA

N80-22771# Resources for the Future, Inc., Washington, D. C.
MAJOR MINERAL SUPPLY PROBLEMS: A STUDY THE NONFUEL MINERALS POLICY REVIEW Final Report
Leonard L. Fischman, Jacob J. Kaplan, John J. Schanz, Jr., John E. Tilton, and John E. Jankowski, Jr. Sep. 1979 1108 p
(Contract ST-8A57)
(PB80-117674) Avail: NTIS HC A99/MF A01 CSCL 08I

From consumption and supply potential in countries, the study derived world demand, supply, and price projections to the year 2000 were derived for each of the commodity forms, through refined metal, in which each of the seven minerals is importantly consumed. Prior projections of world minerals consumption have been generally too high owing to over-estimation of long-term economic growth. Supply tightness seems to be in prospect for ferromanganese and ferrochromium, refractory chromite, and aluminum in its three principal forms of ore, alumina, and refined metal. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-22772 Delaware Univ., Newark.
DYNAMICS AND CONTROL OF LARGE HORIZONTAL-AXIS AXISYMMETRIC WIND TURBINES Ph.D. Thesis
Murray Steven Hirschbein 1979 471 p
Avail: Univ. Microfilms Order No. 8006484

The dynamic response of an entire rotor-tower wind turbine system was examined to provide insight into the nature and solution of dynamic problems that may be encountered during the operation of large horizontal-axis, axisymmetric wind turbines. The numerical results are presented for a 3 bladed, 300 ft. diameter wind turbine driving either constant or variable speed electrical power generating equipment. Three areas of wind turbine research were studied: steady state loading, stability and gust response. Blade pitch control was used effectively to reduce the steady fatigue loading from gravity, side winds, wind shear, and to attenuate gust loading. An integral part of this analysis was the development of an algorithmic approach to kinematics of wind turbine dynamics which allowed numerically exact equations of motion to be derived by a digital computer. Dissert. Abstr.

N80-22773 Columbia Univ., New York.
SILICON SCHOTTKY BARRIER SOLAR CELLS Ph.D. Thesis
Paul Panayotatos 1979 127 p
Avail: Univ. Microfilms Order No. 8009346

The expression for the recombination rate as a function of voltage, of illumination level, and of position in the space charge region of the Schottky barrier solar cells was derived. The recombination current density was derived by numerical integration

of the above expression. Information on the uncovering of deep recombination centers by the hole quasi Fermi level under increasing illumination is provided. It is found that the principal effect of recombination under illumination is the reduction of the photocurrent. Dissert. Abstr.

N80-22774*# Florida Solar Energy Center, Cape Canaveral.
SOLAR HEATING AND COOLING DEMONSTRATION PROJECT AT THE FLORIDA SOLAR ENERGY CENTER Final Report
Feb. 1980 175 p refs Sponsored in part by NASA
(Contract EG-77-A-01-4074)
(NASA-CR-161413) Avail: NTIS HC A08/MF A01 CSCL 10A

The retrofitted solar heating and cooling system installed at the Florida Solar Energy Center is described. The system was designed to supply approximately 70 percent of the annual cooling and 100 percent of the heating load. The project provides unique high temperature, nonimaging, nontracking, evacuated tube collectors. The design of the system was kept simple and employs five hydronic loops. They are energy collection, chilled water production, space cooling, space heating and energy rejection. Information is provided on the system's acceptance test results operation, controls, hardware and installation, including detailed drawings. R.E.S.

N80-22775*# Spire Corp., Bedford, Mass.
STUDY PROGRAM TO IMPROVE THE OPEN-CIRCUIT VOLTAGE OF LOW RESISTIVITY SINGLE CRYSTAL SILICON SOLAR CELLS
J. A. Minnucci and K. W. Matthei 7 Feb. 1980 119 p refs
(Contract NAS3-20823)
(NASA-CR-159833; FR-10056) Avail: NTIS HC A06/MF A01 CSCL 10A

The results of a 14 month program to improve the open circuit voltage of low resistivity silicon solar cells are described. The approach was based on ion implantation in 0.1- to 10.0-ohm-cm float-zone silicon. As a result of the contract effort, open circuit voltages as high as 645 mV (AMO 25 C) were attained by high dose phosphorus implantation followed by furnace annealing and simultaneous SiO2 growth. One key element was to investigate the effects of bandgap narrowing caused by high doping concentrations in the junction layer. Considerable effort was applied to optimization of implant parameters, selection of furnace annealing techniques, and utilization of pulsed electron beam annealing to minimize thermal process-induced defects in the completed solar cells. F.O.S.

N80-22776*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LITERATURE SURVEY OF PROPERTIES OF SYNFUELS DERIVED FROM COAL Interim Report
Thaine W. Reynolds, Richard W. Niedzwiecki, and John S. Clark Feb. 1980 162 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-79243; DOE/NASA/2593-79/8; E-150) Avail: NTIS HC A08/MF A01 CSCL 21D

A literature survey of the properties of synfuels for ground-based gas turbine applications is presented. Four major concepts for converting coal into liquid fuels are described: solvent extraction, catalytic liquefaction, pyrolysis, and indirect liquefaction. Data on full range syncrudes, various distillate cuts, and upgraded products are presented for fuels derived from various processes, including H-coal, synthoil, solvent-refined coal, donor solvent, zinc chloride hydrocracking, co-steam, and flash pyrolysis. Some typical ranges of data for coal-derived low Btu gases are also presented. R.E.S.

N80-22777*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED SCREENING OF ELECTRODE COUPLES
J. Giner and K. Cahill Feb. 1980 56 p refs
(Contract NAS3-20794; EC-77-A-31-1002)
(NASA-CR-159738; DOE/NASA/0794-80/1) Avail: NTIS HC A04/MF A01 CSCL 10B

The chromium (Cr(3+)/Cr(2+)) redox couple (electrolyte and electrode) was investigated to determine its suitability as negative electrode for the iron (Fe(3+)/Fe(2+))-chromium (Cr(3+)/Cr(2+)) redox flow battery. Literature search and laboratory investigation established that the solubility and stability of aqueous acidic solutions of chromium(3) chloride and chromium(2) chloride are sufficient for redox battery application. Four categories of electrode materials were tested; namely, metals and metalloid materials (elements and compounds), alloys, plated materials, and Teflon-bonded materials. In all, the relative performance of 26 candidate electrode materials was evaluated on the basis of slow scan rate linear sweep voltammetry in stirred solution. No single material tested gave both acceptable anodic an acceptable cathodic performance. However, the identification of lead as a good cathodic electrocatalyst and gold as a good anodic electrocatalyst led to the invention of the lead/gold combination electrocatalyst. This type of catalyst can be fabricated in several ways and appears to offer the advantages of each metal without the disadvantages associated with their use as single materials. This lead/gold electrocatalyst was tested by NASA-Lewis Research Center in complete, flowing, redox batteries comprising a stack of several cells. A large improvement in the battery's coulombic and energy efficiency was observed. F.O.S.

N80-22778*# AiResearch Mfg. Co., Phoenix, Ariz.
CONCEPT DEFINITION STUDY OF SMALL BRAYTON CYCLE ENGINES FOR DISPERSED SOLAR ELECTRIC POWER SYSTEMS Final Report, Sep. 1978 - Jun. 1979
Lyle D. Six, Thomas L. Ashe, Frank X. Dobler, and Ron T. Elkins Jan. 1980 135 p refs
(Contracts DEN3-69; EX-76-A-29-1060)
(NASA-CR-159592; DOE/NASA/0069-79/1; AiResearch-31-3328) Avail: NTIS HC A07/MF A01 CSCL 10B

Three first-generation Brayton cycle engine types were studied for solar application: a near-term open cycle (configuration A), a near-term closed cycle (configuration B), and a longer-term open cycle (configuration C). A parametric performance analysis was carried out to select engine designs for the three configurations. The interface requirements for the Brayton cycle engine/generator and solar receivers were determined. A technology assessment was then carried out to define production costs, durability, and growth potential for the selected engine types. R.E.S.

N80-22779*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE (SPS) SOLID-STATE ANTENNA POWER COMBINER Final Report, 13 Jun. 1979 - 31 Jan. 1980
29 Feb. 1980 108 p ref
(Contract NAS9-15636)
(NASA-CR-160574; D180-25895-1) Avail: NTIS HC A06/MF A01 CSCL 10A

A low loss power-combining microstrip antenna suitable for solid state solar power satellite (SPS) application was developed. A unique approach for performing both the combining and radiating function in a single cavity-type circuit was verified, representing substantial refinements over previous demonstration models in terms of detailed geometry to obtain good matching and adequate bandwidth at the design frequency. The combiner circuit was designed, built, and tested and the overall results support the view that the solid state power-combining antenna approach is a viable candidate for a solid state SPS antenna building block. R.E.S.

N80-22780*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE (SPS) FIBER OPTIC LINK ASSESSMENT Final Report
31 Jan. 1980 102 p refs
(Contract NAS9-15636)
(NASA-CR-160575; D180-25888-1) Avail: NTIS HC A06/MF A01 CSCL 10A

A feasibility demonstration of a 980 MHz fiber optic link for the Solar Power Satellite (SPS) phase reference distribution system was accomplished. A dual fiber-optic link suitable for a phase distribution frequency of 980 MHz was built and tested. The major link components include single mode injection laser diodes, avalanche photodiodes, and multimode high bandwidth fibers. Signal throughput was demonstrated to be stable and of high quality in all cases. For a typical SPS link length of 200 meters, the transmitted phase at 980 MHz varies approximately 2.5 degrees for every deg C of fiber temperature

change. This rate is acceptable because of the link length compensation feature of the phase control design. R.E.S.

N80-22781*# Interactive Resources, Inc., Point Richmond, Calif.
SOLAR PROCESS WATER HEAT FOR THE IRIS IMAGES CUSTOM COLOR PHOTO LAB Final Report
Mar. 1980 126 p Sponsored by NASA. Marshall Space Flight Center.
(Contract EX-76-C-01-2381)
(NASA-CR-161414) Avail: NTIS HC A07/MF A01 CSCL 10B

The solar facility located at a custom photo laboratory in Mill Valley, California is described. It was designed to provide 59 percent of the hot water requirements for developing photographic film and domestic hot water use. The design load is to provide 6 gallons of hot water per minute for 8 hours per working day at 100 F. It has 640 square feet of flat plate collectors and 360 gallons of hot water storage. The auxillary back up system is a conventional gas-fired water heater. Site and building description, subsystem description, as-built drawings, cost breakdown and analysis, performance analysis, lessons learned, and the operation and maintenance manual are presented. R.E.S.

N80-22782*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DISPERSED STORAGE AND GENERATION CASE STUDIES
Khosrow Bahrami, John A. Stallkamp, and Amy Walton 15 Mar. 1980 187 p refs
(Contracts NAS7-100; DE-AI01-79ET-29026)
(NASA-CR-162996; JPL-Pub-79-98) Avail: NTIS HC A09/MF A01 CSCL 10A

Three installations utilizing separate dispersed storage and generation (DSG) technologies were investigated. Each of the systems is described in costs and control. Selected institutional and environmental issues are discussed, including life cycle costs. No unresolved technical, environmental, or institutional problems were encountered in the installations. The wind and solar photovoltaic DSG were installed for test purposes, and appear to be presently uneconomical. However, a number of factors are decreasing the cost of DSG relative to conventional alternatives, and an increased DSG penetration level may be expected in the future. R.E.S.

N80-22783*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HANDBOOK OF SOLAR ENERGY DATA FOR SOUTH-FACING SURFACES IN THE UNITED STATES. VOLUME 1: AN INSOLATION, ARRAY SHADOWING, AND REFLECTOR AUGMENTATION MODEL
Jeff H. Smith 15 Jan. 1980 312 p refs 3 Vol.
(Contract NAS7-100; EX-76-A-31-1012)
(NASA-CR-162998; DOE/JPL-1012-25-Vol-1; JPL-Pub-79-103-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 10A

A quick reference for obtaining estimates of available solar insolation for numerous locations and array angles is presented. A model and a computer program are provided which considered the effects of array shadowing reflector augmentation as design variables. R.C.T.

N80-22784*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HANDBOOK OF SOLAR ENERGY DATA FOR SOUTH-FACING SURFACES IN THE UNITED STATES. VOLUME 2: AVERAGE HOURLY AND TOTAL DAILY INSOLATION DATA FOR 235 LOCALITIES. ALASKA - MONTANA
Jeff H. Smith 15 Jan. 1980 473 p Sponsored by NASA and DOE, Washington, D. C. 3 Vol.
(NASA-CR-162999; DOE/JPL-1012-25-Vol-2; JPL-Pub-79-103-Vol-2) Avail: NTIS HC A20/MF A01 CSCL 10A

Average hourly and daily total insolation estimates for 235 United States locations are presented. Values are presented for a selected number of array tilt angles on a monthly basis. All units are in kilowatt hours per square meter. R.C.T.

N80-22785*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HANDBOOK OF SOLAR ENERGY DATA FOR SOUTH-FACING SURFACES IN THE UNITED STATES. VOLUME 3: AVERAGE HOURLY AND TOTAL DAILY INSOLATION DATA FOR 235 LOCALITIES. NORTH CAROLINA - WYOMING
Jeff H. Smith 15 Jan. 1980 476 p Sponsored by NASA and DOE, Washington, D. C. 3 Vol.
(NASA-CR-163000; DOE/JPL-1012-25-Vol-3; JPL-Pub-79-103-Vol-3) Avail: NTIS HC A21/MF A01 CSCL 10A

The daily and hourly profiles used to compute total insolation data for 235 locations in the United States are presented. R.C.T.

N80-22786*# AeroChem Research Labs., Inc., Princeton, N. J.
DEVELOPMENT OF PROCESSES FOR THE PRODUCTION OF SOLAR GRADE SILICON FROM HALIDES AND ALKALI METALS Quarterly Report, 1 Jan. - 31 Mar. 1980
C. R. Dickson and R. K. Gould Apr. 1980 21 p refs Sponsored by NASA and DOE
(Contract JPL-955491)
(NASA-CR-162871; AeroChem-TN-212; DOE/JPL-955491-80/2; JPL-9950-326; QR-2) Avail: NTIS HC A02/MF A01 CSCL 10A

High temperature reactions of silicon halides with alkali metals for the production of solar grade silicon in volume at low cost were studied. Experiments were performed to evaluate product separation and collection processes, measure heat release parameters for scaling purposes, determine the effects of reactants and/or products on materials of reactor construction, and make preliminary engineering and economic analyses of a scaled-up process. R.E.S.

N80-22787*# Mechanical Technology, Inc., Latham, N. Y. Stirling Engine Systems Div.
DESIGN STUDY OF A 15 kW FREE-PISTON STIRLING ENGINE-LINEAR ALTERNATOR FOR DISPERSED SOLAR ELECTRIC POWER SYSTEMS Final Report, Sep. 1978 - Aug. 1979
George R. Dochat, H. S. Chen, S. Bhate, and T. Marusak Aug. 1979 189 p refs
(Contracts DEN3-56; EX-76-A-29-1060)
(NASA-CR-159587; DOE/NASA/0056-79/1; MTI-79TR47) Avail: NTIS HC A08/MF A01 CSCL 10B

A conceptual design of a free piston solar Stirling engine-linear alternator which can be designed and developed to meet the requirements of a near-term solar test bed engine with minimum risks was developed. The conceptual design was calculated to have an overall system efficiency of 38% and provide 15kW electric output. The free piston engine design incorporates features such as gas bearings, close clearance seals, and gas springs. This design is hermetically sealed to provide long life, reliability, and maintenance free operation. An implementation assessment study performed indicates that the free piston solar Stirling engine-linear alternator can be manufactured at a reasonable price cost (direct labor plus material) of $2,500 per engine in production quantities of 25,000 units per year. Opportunity for significant reduction of cost was also identified. R.E.S.

N80-22788*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL ENERGY STORAGE: FOURTH ANNUAL REVIEW MEETING
Mar. 1980 650 p refs Meeting held at Tysons Corner, Va., 3-4 Dec. 1979; sponsored by DOE
(NASA-CP-2125; E-428; CONF-791232) Avail: NTIS HC A99/MF A01 CSCL 10C

The development of low cost thermal energy storage technologies is discussed in terms of near term oil savings, solar energy applications, and dispersed energy systems for energy conservation policies. Program definition and assessment and research and technology development are considered along with industrial storage, solar thermal power storage, building heating and cooling, and seasonal thermal storage. A bibliography on seasonal thermal energy storage emphasizing aquifer thermal energy is included. For individual titles, see N80-22789 through N80-22829.

N80-22789*# Pacific Northwest Lab., Richland, Wash.
SEASONAL THERMAL ENERGY STORAGE PROGRAM
James E. Minor. *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 25-31 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

The Seasonal Thermal Energy Storage (STES) Program designed to demonstrate the storage and retrieval of energy on a seasonal basis using heat or cold available from waste or other sources during a surplus period is described. Factors considered include reduction of peak period demand and electric utility load problems and establishment of favorable economics for district heating and cooling systems for commercialization of the technology. The initial thrust of the STES Program toward utilization of ground water systems (aquifers) for thermal energy storage is emphasized. J.M.S.

N80-22790*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROGRAM DEFINITION AND ASSESSMENT OVERVIEW
Larry H. Gordon *In its* Thermal Energy Storage Mar. 1980 p 38-41 refs (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

The implementation of a program level assessment of thermal energy storage technology thrusts for the near and far term to assure overall coherent energy storage program is considered. The identification and definition of potential thermal energy storage applications, definition of technology requirements, and appropriate market sectors are discussed along with the necessary coordination, planning, and preparation associated with program reviews, workshops, multi-year plans and annual operating plans for the major laboratory tasks. J.M.S.

N80-22791*# Department of Energy, Washington, D. C. Energy Storage Systems Div.
SOLAR APPLICATIONS ANALYSIS FOR ENERGY STORAGE
T. Blanchard *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 43-46 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

The role of energy storage as it relates to solar energy systems is considered. Storage technologies to support solar energy applications, the status of storage technologies, requirements and specifications for storage technologies, and the adequacy of the current storage research and development program to meet these requirements are among the factors discussed. Emphasis is placed on identification of where the greatest potential exists for energy storage in support of those solar energy systems which could have a significant impact on the U.S. energy mix. J.M.S.

N80-22792*# Midwest Research Inst., Kansas City, Mo.
THERMAL ENERGY STORAGE SYSTEMS USING FLUIDIZED BED HEAT EXCHANGERS
V. Ramanathan, T. E. Weast, and K. P. Ananth *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 47-55 (For primary document see N80-22788 13-44)
(Contract DEN3-96)
Avail: NTIS HC A99/MF A01 CSCL 10B

The viability of using fluidized bed heat exchangers (FBHX) for thermal energy storage (TES) in applications with potential for waste heat recovery was investigated. Of the candidate applications screened, cement plant rotary kilns and steel plant electric arc furnaces were identified, via the chosen selection criteria, as having the best potential for successful use of FBHX/TES system. A computer model of the FBHX/TES systems was developed and the technical feasibility of the two selected applications was verified. Economic and tradeoff evaluations in progress for final optimization of the systems and selection of the most promising system for further concept validation are described. J.M.S.

N80-22793*# General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
THERMAL ENERGY STORAGE AND TRANSPORT
Walter Hausz *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 57-77 refs (For primary document see N80-22788 13-44)
(EPRI Proj. 1199-3)
Avail: NTIS HC A99/MF A01 CSCL 10B

The extraction of thermal energy from large LWR and coal fired plants for long distance transport to industrial and residential/commercial users is analyzed. Transport of thermal energy as high temperature water is shown to be considerably cheaper than transport as steam, hot oil, or molten salt over a wide temperature range. The delivered heat is competitive with user-generated heat from oil, coal, or electrode boilers at distances well over 50 km when the pipeline operates at high capacity factor. Results indicate that thermal energy storage makes meeting of even very low capacity factor heat demands economic and feasible and gives the utility flexibility to meet coincident electricity and heat demands effectively. J.M.S.

N80-22794*# General Electric Co., Schenectady, N. Y.
CONCEPTUAL DESIGN OF THERMAL ENERGY STORAGE SYSTEMS FOR NEAR-TERM ELECTRIC UTILITY APPLICATIONS
Eldon W. Hall *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 79-84 (For primary document see N80-22788 13-44)
(Contract DEN3-12; EPRI Proj. 1082-1)
Avail: NTIS HC A99/MF A01 CSCL 10B

Promising thermal energy storage systems for midterm applications in conventional electric utilities for peaking power generation are evaluated. Conceptual designs of selected thermal energy storage systems integrated with conventional utilities are considered including characteristics of alternate systems for peaking power generation, viz gas turbines and coal fired cycling plants. Competitive benefit analysis of thermal energy storage systems with alternate systems for peaking power generation and recommendations for development and field test of thermal energy storage with a conventional utility are included. Results indicate that thermal energy storage is only marginally competitive with coal fired cycling power plants and gas turbines for peaking power generation. J.M.S.

N80-22795*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INDUSTRIAL STORAGE APPLICATIONS OVERVIEW
Rudolph A. Duscha *In its* Thermal Energy Storage Mar. 1980 p 85-94 refs (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

The implementation of a technology demonstration for the food processing industry, development and technology demonstrations for selected near-term, in-plant applications and advanced industrial applications of thermal energy storage are overviewed. R.E.S.

N80-22796*# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
APPLICATIONS OF THERMAL ENERGY STORAGE TO WASTE HEAT RECOVERY IN THE FOOD PROCESSING INDUSTRY
F. Wojnar (Heinz (H. J.) Co.) and Wayne L. Lunberg *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 95-104 (For primary document see N80-22788 13-44)
(Contract EC-77-C-01-5002)
Avail: NTIS HC A99/MF A01 CSCL 10B

A study to assess the potential for waste heat recovery in the food industry and to evaluate prospective waste heat recovery system concepts employing thermal energy storage was conducted. The study found that the recovery of waste heat in canning facilities can be performed in significant quantities using systems involving thermal energy storage that are both practical and economical. A demonstration project is proposed to determine actual waste heat recovery costs and benefits and to encourage system implementation by the food industry. R.E.S.

N80-22797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLLECTION AND DISSEMINATION OF TES SYSTEM INFORMATION FOR THE PAPER AND PULP INDUSTRY
M. W. Dietrich and Howard Edde (Edde (Howard), Inc., Bellevue, Wash.) *In its* Thermal Energy Storage Mar. 1980 p 105-111 (For primary document see N80-22788 13-44)

(Contract DEN3-190)
Avail: NTIS HC A99/MF A01 CSCL 10B

A survey of U.S. and international paper and pulp mills using thermal energy storage (TES) systems as a part of their production processes was conducted to obtain sufficient operating data to conduct a benefits analysis encompassing: (1) an energy conservation assessment, (2) an economic benefits analysis, and (3) an environmental impact assessment. An information dissemination plan was then proposed to effectively present the benefits of TES to the U.S. paper and pulp industry. R.E.S.

N80-22798*# Sandia Labs., Livermore, Calif.
SOLAR THERMAL POWER STORAGE APPLICATIONS LEAD LABORATORY OVERVIEW
Lee G. Radosevich *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 113-124 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

The implementation of the applications elements of the thermal energy storage for Solar Thermal Applications program is described. The program includes the accelerated development of thermal storage technologies matched to solar thermal power system requirements and scheduled milestones. The program concentrates on storage development in the FY80 to 85 time period with emphasis on the more near-term solar thermal power system application. R.E.S.

N80-22799*# Sandia Labs., Albuquerque, N. Mex.
THERMAL STORAGE EXPERIENCE AT THE MSSTF AND PLANS FOR THE FUTURE
Thomas D. Harrison and Robert A. Randall *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 125-130 ref (For primary document see N80-22788 13-44)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A99/MF A01 CSCL 10C

The background of thermal storage development at the Midtemperature Solar Systems Test Facility is reviewed. The problems which were encountered are discussed and a course of action for resolving the problems is outlined. Scaling effects of going from laboratory models to full-size applications were determined and applied to thermal storage needs in near-term solar projects. R.E.S.

N80-22800*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THERMAL ENERGY STORAGE EFFORT AT JPL
Donald L. Young *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 131-140 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10C

The technical, operational, and economic readiness of parabolic dish systems for electric and thermal applications was investigated. A parabolic dish system was then developed to the point at which subsequent commercialization activities can lead to successful market penetration. The immediate possible applications of the dish system to thermal energy storage are discussed. R.E.S.

N80-22801*# Martin Marietta Corp., Baltimore, Md.
INTERNALLY INSULATED THERMAL STORAGE SYSTEM DEVELOPMENT PROGRAM
Owen L. Scott *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 141-155 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10C

A cost effective thermal storage system for a solar central receiver power system using molten salt stored in internally insulated carbon steel tanks is described. Factors discussed include: testing of internal insulation materials in molten salt; preliminary design of storage tanks, including insulation and liner installation; optimization of the storage configuration; and definition of a subsystem research experiment to demonstrate the system. A thermal analytical model and analysis of a thermocline tank was performed. Data from a present thermocline test tank was compared to gain confidence in the analytical approach. A computer analysis of the various storage system parameters (insulation thickness, number of tanks, tank geometry, etc.,) showed that (1) the most cost-effective configuration was a small number of large cylindrical tanks, and (2) the optimum is set by the mechanical constraints of the system, such as soil bearing strength and tank hoop stress, not by the economics. M.G.

N80-22802*# Sandia Labs., Livermore, Calif.
SANDIA LABORATORIES IN-HOUSE ACTIVITIES IN SUPPORT OF SOLAR THERMAL LARGE POWER APPLICATIONS
Raymond W. Mar *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 157-161 refs (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

The development of thermal energy storage subsystems for solar thermal large power applications is described. The emphasis is on characterizing the behavior of molten nitrate salts with regard to thermal decomposition, environmental interactions, and corrosion. Electrochemical techniques to determine the ionic species in the melt and for use in real time studies of corrosion are also briefly discussed. M.G.

N80-22803*# Texas Univ. at Austin. Energy Foundation of Texas.
HIGH TEMPERATURE UNDERGROUND THERMAL ENERGY STORAGE SYSTEM FOR SOLAR ENERGY
R. Eugene Collins *In* NASA. Lewis Res. Center Thermal Energy Storage Aug. 1980 p 163-171 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10C

The activities feasibility of high temperature underground thermal storage of energy was investigated. Results indicate that salt cavern storage of hot oil is both technically and economically feasible as a method of storing huge quantities of heat at relatively low cost. One particular system identified utilizes a gravel filled cavern leached within a salt dome. Thermal losses are shown to be less than one percent of cyclically transferred heat. A system like this having a 40 MW sub t transfer rate capability and over eight hours of storage capacity is shown to cost about $13.50 per KWh sub t. M.G.

N80-22804*# Comstock and Wescott, Inc., Cambridge, Mass.
DEVELOPMENT OF A THERMAL STORAGE MODULE USING MODIFIED ANHYDROUS SODIUM HYDROXIDE
Richard E. Rice and Peter E. Rowny *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 173-181 ref (For primary document see N80-22788 13-44)
(Contract DEN3-138)
Avail: NTIS HC A99/MF A01 CSCL 10C

The laboratory scale testing of a modified anhydrous NaOH latent heat storage concept for small solar thermal power systems such as total energy systems utilizing organic Rankine systems is discussed. A diagnostic test on the thermal energy storage module and an investigation of alternative heat transfer fluids and heat exchange concepts are specifically addressed. A previously developed computer simulation model is modified to predict the performance of the module in a solar total energy system environment. In addition, the computer model is expanded to investigate parametrically the incorporation of a second heat exchange inside the module which will vaporize and superheat the Rankine cycle power fluid. M.G.

N80-22805*# Institute of Gas Technology, Chicago, Ill.
HIGH-TEMPERATURE MOLTEN SALT THERMAL ENERGY STORAGE SYSTEMS FOR SOLAR APPLICATIONS
Randy J. Petri and T. D. Claar *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 183-190 refs (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10C

Alkali and alkaline earth carbonate latent-heat storage salts, metallic containment materials, and thermal conductivity enhancement materials were investigated to satisfy the high temperature (704 to 871 C) thermal energy storage requirements of advanced solar-thermal power generation concepts are described. Properties of the following six salts selected for compatibility studies are given: three pure carbonates, K_2CO_3, Li_2CO_3 and Na_2CO_3; two eutectic mixtures, $BaCO_3/Na_2CO_3$ and $K_2CO_3/NaCO_3$, and one off-eutectic mixture of Na_2CO_3/K_2CO_3. M.G.

N80-22806*# Oak Ridge National Lab., Tenn.
BUILDING HEATING AND COOLING APPLICATIONS THERMAL ENERGY STORAGE PROGRAM OVERVIEW
D. M. Eissenberg *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 191-201 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

Thermal energy storage technology and development of building heating and cooling applications in the residential and commercial sectors is outlined. Three elements are identified to undergo an applications assessment, technology development, and demonstration. Emphasis is given to utility load management thermal energy system application where the stress is on the 'customer side of the meter'. Thermal storage subsystems for space conditioning and conservation means of increased thermal mass within the building envelope and by means of low-grade waste heat recovery are covered. M.G.

N80-22807*# Oak Ridge National Lab., Tenn.
SUBCONTRACTED ACTIVITIES RELATED TO TES FOR BUILDING HEATING AND COOLING
Jim Martin *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 203-211 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

The subcontract program elements related to thermal energy storage for building heating and cooling systems are outlined. The following factors are included: subcontracts in the utility load management application area; life and stability testing of packaged low cost energy storage materials; and development of thermal energy storage systems for residential space cooling. Resistance storage heater component development, demonstration of storage heater systems for residential applications, and simulation and evaluation of latent heat thermal energy storage (heat pump systems) are also discussed. Application of thermal energy storage for solar application and twin cities district heating are covered including an application analysis and technology assessment of thermal energy storage. R.C.T.

N80-22808*# Purdue Univ., Lafayette, Ind.
THERMAL ENERGY STORAGE TESTING FACILITY
R. J. Schoenhals, H. F. Kuehlert, and C. P. Lin *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 223-231 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10C

The thermal performance of resistance storage heaters in respect to current standards is determined. The design and construction of a storage heater test facility with capability for measuring the performance of electric resistance heated storage units is described. The performance of commercial units are compared based on existing standards. Additional performance standards are proposed. R.C.T.

N80-22809*# Rocket Research Corp., Redmond, Wash.
APPLICATION OF THERMAL ENERGY STORAGE TO PROCESS HEAT RECOVERY IN THE ALUMINUM INDUSTRY
John McCabe *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 233-237 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

The economic viability and the institutional compatibility of a district heating system in the city of Bellingham, Washington are assessed and the technical and economic advantages of using thermal energy storage methods are determined. R.C.T.

N80-22810*# General Electric Co., Schenectady, N. Y. Corporate Research and Development.
HEAT STORAGE CAPABILITY OF A ROLLING CYLINDER USING GLAUBER'S SALT
C. S. Herrick and K. P. Zarnoch *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 239-259 refs (For primary document see N80-22788 13-44)
(Contract EM-78-C-05-5759)
Avail: NTIS HC A99/MF A01 CSCL 10C

The rolling cylinder phase change heat storage concept was developed to the point where a prototype design is completed and a cost analysis is prepared. A series of experimental and analytical tasks are defined to establish the thermal, mechanical, and materials behavior of rolling cylinder devices. These tasks include: analyses of internal and external heat transfer; performance and lifetime testing of the phase change materials; corrosion evaluation; development of a mathematical model; and design of a prototype and associated test equipment. R.C.T.

N80-22811*# Oak Ridge National Lab., Tenn.
THERMAL ENERGY STORAGE TEST FACILITY
Mark P. Ternes *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 261-264 (For primary document see N80-22788 13-44)
(Contract W-7405-eng-26)
Avail: NTIS HC A99/MF A01 CSCL 10C

The thermal behavior of prototype thermal energy storage units (TES) in both heating and cooling modes is determined. Improved and advanced storage systems are developed and performance standards are proposed. The design and construction of a thermal cycling facility for determining the thermal behavior of full scale TES units is described. The facility has the capability for testing with both liquid and air heat transport, at variable heat input/extraction rates, over a temperature range of 0 to 280 F. R.C.T.

N80-22812*# Oak Ridge National Lab., Tenn.
MATHEMATICAL MODELING OF MOVING BOUNDARY PROBLEMS IN THERMAL ENERGY STORAGE
A. D. Solomon *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 265-270 refs (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10C

The capability for predicting the performance of thermal energy storage (RES) subsystems and components using PCM's based on mathematical and physical models is developed. Mathematical models of the dynamic thermal behavior of (TES) subsystems using PCM's based on solutions of the moving boundary thermal conduction problem and on heat and mass transfer engineering correlations are also discussed. R.C.T.

N80-22813*# Oak Ridge National Lab., Tenn.
CRAWL SPACE ASSISTED HEAT PUMP
Mark P. Ternes *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 271-276 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

A variety of experiments and simulations, currently being designed or underway, to determine the feasibility of conditioning the source air of an air to air heat pump using stored ground heat or cool to produce higher seasonal COP's and net energy savings are discussed. The ground would condition ambient air as it is drawn through the crawl space of a house. Tests designed to evaluate the feasibility of the concept, to determine the amount of heat or cool available from the ground, to study the effect of the system on the heating and cooling loads of the house, to study possible mechanisms which could enhance heat flow through the ground, and to determine if diurnal temperature swings are necessary to achieve successful system performance are described. A.W.H.

N80-22814*# Delaware Univ., Wilmington. Inst. of Energy Conversion.
LIFE AND STABILITY TESTING OF PACKAGED LOW-COST ENERGY STORAGE MATERIALS
Galen R. Frysinger *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 277-281 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10C

Thermal cycling and performance tests, performed to verify the package integrity, life, and stability of the chub packaged materials system for storage coolness with application to residential air conditioning, are described. The moisture vapor retention characteristics of the laminate film for long term chub performance was determined. The stability, mechanical integrity, and thermal performance of chubs following mechanical shock, vibration, and temperature extremes is reported. A.W.H.

N80-22815*# General Electric Co., Santa Barbara, Calif.
EVALUATION OF THERMAL ENERGY STORAGE FOR THE

PROPOSED TWIN CITIES DISTRICT HEATING SYSTEM
Charles F. Meyer. *In* NASA. Lewis Res. Center. Thermal Energy Storage. Mar. 1980. p. 283-295. refs (For primary document see N80-22788 13-44)
Avail: NTIS. HC A99/MF A01. CSCL 10C

The technical and economic feasibility of incorporating thermal energy storage components into the proposed Twin Cities District heating project was evaluated. The technical status of the project is reviewed and conceptual designs of district heating systems with and without thermal energy storage were compared in terms of estimated capital requirements, fuel consumption, delivered energy cost, and environmental aspects. The thermal energy storage system is based on cogeneration and the storage of heat in aquifers. A.W.H.

N80-22816*# Research Triangle Inst., Research Triangle Park, N. C.
SIMULATION AND EVALUATION OF LATENT HEAT THERMAL ENERGY STORAGE
Tony W. Sigmon. *In* NASA. Lewis Res. Center. Thermal Energy Storage. Mar. 1980. p. 297-305. refs (For primary document see N80-22788 13-44)
(Contract DE-AC01-79ET-26707)
Avail: NTIS. HC A99/MF A01. CSCL 10C

The relative value of thermal energy storage (TES) for heat pump storage (heating and cooling) as a function of storage temperature, mode of storage (hotside or coldside), geographic locations, and utility time of use rate structures were derived. Computer models used to simulate the performance of a number of TES/heat pump configurations are described. The models are based on existing performance data of heat pump components, available building thermal load computational procedures, and generalized TES subsystem design. Life cycle costs computed for each site, configuration, and rate structure are discussed. A.W.H.

N80-22817*# Argonne National Lab., Ill.
EXPERIMENTAL EVALUATION OF THERMAL ENERGY STORAGE
J. G. Asbury and H. N. Hersh. *In* NASA. Lewis Res. Center. Thermal Energy Storage. Mar. 1980. p. 307-314. refs (For primary document see N80-22788 13-44)
Avail: NTIS. HC A99/MF A01. CSCL 10C

The technical performance of commercially available thermal energy storage (TES) residential heating units under severe weather conditions is discussed. The benefits and costs of TES to the user and utility companies were assessed. The TES issues, research and development needs, and barriers to commercialization were identified. The field tests which determined the performance characteristics for the TES are described and the TES systems, which included both ceramic and hydronic systems, are compared. A.W.H.

N80-22818*# Dayton Univ., Ohio.
DEVELOPMENT OF OPTIMUM PROCESS FOR ELECTRON BEAM CROSS-LINKING OF HIGH DENSITY POLYETHYLENE THERMAL ENERGY STORAGE PELLETS, PROCESS SCALE-UP AND PRODUCTION OF APPLICATION QUALITIES OF MATERIAL
Ival O. Salyer. *In* NASA. Lewis Res. Center. Thermal Energy Storage. Mar. 1980. p. 315-327 (For primary document see N80-22788 13-44)
Avail: NTIS. HC A99/MF A01. CSCL 10C

The electron irradiation conditions required to prepare thermally from stable high density polyethylene (HDPE) were defined. The conditions were defined by evaluating the heat of fusion and the melting temperature of several HDPE specimens. The performance tests conducted on the specimens, including the thermal cycling tests in the thermal energy storage unit are described. The electron beam irradiation tests performed on the specimens, in which the total radiation dose received by the pellets, the electron beam current, the accelerating potential, and the atmospheres were varied, are discussed. A.W.H.

N80-22819*# Honeywell, Inc., Minneapolis, Minn.
ACTIVE HEAT EXCHANGE SYSTEM DEVELOPMENT FOR LATENT HEAT THERMAL ENERGY STORAGE
Richard T. LeFrois. *In* NASA. Lewis Res. Center. Thermal Energy Storage. Mar. 1980. p. 337-352 (For primary document see N80-22788 13-44)
(Contract DEN3-38)
Avail: NTIS. HC A99/MF A01. CSCL 10C

Alternative mechanizations of active heat exchange concepts were analyzed for use with heat of fusion Phase Change Materials (PCM's) in the temperature range of 250 C to 350 C for solar and conventional power plant applications. Over 24 heat exchange concepts were reviewed, and eight were selected for detailed assessment. Two candidates were chosen for small-scale experimentation: a coated tube and shell that exchanger, and a direct contact reflux boiler. A dilute eutectic mixture of sodium nitrate and sodium hydroxide was selected as the PCM from over fifty inorganic salt mixtures investigated. Preliminary experiments with various tube coatings indicated that a nickel or chrome plating of Teflon or Ryton coating had promise of being successful. An electroless nickel plating was selected for further testing. A series of tests with nickel-plated heat transfer tubes showed that the solidifying sodium nitrate adhered to the tubes and the experiment failed to meet the required discharge heat transfer rate of 10 kW(t). Testing of the reflux boiler is under way. A.R.H.

N80-22820*# Naval Research Lab., Washington, D. C.
ENERGY STORAGE-BOILER TANK. Progress Report, 1979
Talbot A. Chubb, J. J. Nemecek, and D. E. Simmons. *In* NASA. Lewis Res. Center. Thermal Energy Storage. Mar. 1980. p. 353-359 (For primary document see N80-22788 13-44)
(Contract EC-77-A-31-1024; NRL Proj. M003)
Avail: NTIS. HC A99/MF A01. CSCL 10B

Activities performed in an effort to demonstrate heat of fusion energy storage in containerized salts are reported. The properties and cycle life characteristics of a eutectic salt having a boiling point of about 385 C (NaCl, KCl, Mg Cl2) were determined. M-terphenyl was chosen as the heat transfer fluid. Compatibility studies were conducted and mild steel containers were selected. The design and fabrication of a 2MWh storage boiler tank are discussed. A.R.H.

N80-22821*# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
THE SERI SOLAR ENERGY STORAGE PROGRAM
Robert J. Copeland, John D. Wright, and Charles E. Wyman. *In* NASA. Lewis Res. Center. Thermal Energy Storage. Mar. 1980. p. 361-374. refs (For primary document see N80-22788 13-44)
Avail: NTIS. HC A99/MF A01. CSCL 10A

In support of the DOE thermal and chemical energy storage program, the solar energy storage program (SERI) provides research on advanced technologies, systems analyses, and assessments of thermal energy storage for solar applications in support of the Thermal and Chemical Energy Storage Program of the DOE Division of Energy Storage Systems. Currently, research is in progress on direct contact latent heat storage and thermochemical energy storage and transport. Systems analyses are being performed of thermal energy storage for solar thermal applications, and surveys and assessments are being prepared of thermal energy storage in solar applications. A ranking methodology for comparing thermal storage systems (performance and cost) is presented. Research in latent heat storage and thermochemical storage and transport is reported. A.R.H.

N80-22822*# Grumman Aerospace Corp., Bethpage, N.Y.
ACTIVE HEAT EXCHANGE SYSTEM DEVELOPMENT FOR LATENT HEAT THERMAL ENERGY STORAGE
Joseph Alario and Robert Haslett. *In* NASA. Lewis Res. Center. Thermal Energy Storage. Mar. 1980. p. 375-383 (For primary document see N80-22788 13-44)
(Contract DEN3-39)
Avail: NTIS. HC A99/MF A01. CSCL 10C

Various active heat exchange concepts were identified from among three generic categories: scrapers, agitators/vibrators and slurries. The more practical ones were given a more detailed technical evaluation and an economic comparison with a passive tube-shell design for a reference application. Two concepts selected for hardware development are a direct contact heat exchanger in which molten salt droplets are injected into a cooler counterflowing stream of liquid metal carrier fluid, and a rotating drum scraper in which molten salt is sprayed onto the circumfer-

ence of a rotating drum, which contains the fluid heat sink in an internal annulus near the surface. A fixed scraper blade removes the solidified salt from the surface which has been nickel plated to decrease adhesion forces. Suitable phase change material (PCM) storage media with melting points in the temperature range of interest (250 C to 400 C) were investigated. The specific salt recommended for laboratory tests was a chloride eutectic (20.5KCl-24/5 NaCl-55.0MgCl 2% by wt.), with a nominal melting point of 385 C. A.R.H.

N80-22823*# Delaware Univ., Newark.
HEAT STORAGE IN ALLOY TRANSFORMATIONS
C. Ernest Birchenall. *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 385-390 (For primary document see N80-22788 13-44)
(Grant NsG-3184)
Avail: NTIS HC A99/MF A01 CSCL 10C

Heats of transformation of eutectic alloys were measured for many binary and ternary systems by differential scanning calorimetry and thermal analysis. Only the relatively cheap and plentiful elements Mg, Al, Si, P, Ca, Cu, Zn were considered. A method for measuring volume change during transformation was developed using x-ray absorption in a confined sample. Thermal expansion coefficients of both solid and liquid states of aluminum and of its eutectics with copper and with silicon also were determined. Preliminary evaluation of containment materials lead to the selection of silicon carbide as the initial material for study. Possible applications of alloy PCMs for heat storage in conventional and solar central power stations, small solar receivers and industrial furnace operations are under consideration. A.R.H.

N80-22824*# Clemson Univ., S.C. Dept. of Chemical Engineering.
IMMISCIBLE FLUID: HEAT OF FUSION HEAT STORAGE SYSTEM
D. D. Edie, S. S. Meisheimer, and J. C. Mullins. *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 391-399 refs (For primary document see N80-22788 13-44)
(Contract EY-76-S-05-5190)
Avail: NTIS HC A99/MF A01 CSCL 10C

Both heat and mass transfer in direct contact aqueous crystallizing systems were studied as part of a program designed to evaluate the feasibility of direct contact heat transfer in phase change storage using aqueous salt system. Major research areas, discussed include (1) crystal growth velocity study on selected salts; (2) selection of salt solutions; (3) selection of immiscible fluids; (4) studies of heat transfer and system geometry, and (5) system demonstration. A.R.H.

N80-22825*# Pacific Northwest Lab., Richland, Wash.
AQUIFER THERMAL ENERGY STORAGE PROGRAM
Kenneth Fox. *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 401-411 (For primary document see N80-22788 13-44)
(Contract EY-76-C-06-1830)
Avail: NTIS HC A99/MF A01 CSCL 10C

The purpose of the Aquifer Thermal Energy Storage Demonstration Program is to stimulate the interest of industry by demonstrating the feasibility of using a geological formation for seasonal thermal energy storage, thereby, reducing crude oil consumption, minimizing thermal pollution, and significantly reducing utility capital investments required to account for peak power requirements. This purpose will be served if several diverse projects can be operated which will demonstrate the technical, economic, environmental, and institutional feasibility of aquifer thermal energy storage systems. Author

N80-22826*# California Univ., Berkeley. Lawrence Berkeley Lab.
SEASONAL THERMAL ENERGY STORAGE IN AQUIFERS: MATHEMATICAL MODELING STUDIES IN 1979
Chin Fu Tsang. *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 581-589 refs (For primary document see N80-22788 13-44)
(Contract W-7405-eng-26)
Avail: NTIS HC A99/MF A01 CSCL 10C

A numerical model of water and heat flow in geologic media was developed, verified, and tested. The hydraulic parameters (transmittivity and storativity) and the location of a linear hydrologic barrier were simulated and compared with results from field experiments involving two injection-storage-recovery cycles. For both cycles, the initial simulated and observed temperatures agree (55c). A.R.H.

N80-22827*# Texas A&M Research Foundation, College Station.
COLD WATER AQUIFER STORAGE
Donald L. Reddell, Richard R. Davison, and William B. Harris. *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 591-599 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10C

A working prototype system is described in which water is pumped from an aquifer at 70 F in the winter time, chilled to a temperature of less than 50 F, injected into a ground-water aquifer, stored for a period of several months, pumped back to the surface in the summer time. A total of 8.1 million gallons of chilled water at an average temperature of 48 F were injected. This was followed by a storage period of 100 days. The recovery cycle was completed a year later with a total of 8.1 million gallons recovered. Approximately 20 percent of the chill energy was recovered. A.R.H.

N80-22828*# Auburn Univ., Ala. Water Resources Research Inst.
HOT-WATER AQUIFER STORAGE: A FIELD TEST
A. D. Parr, F. J. Molz, and P. F. Andersen. *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 601-606 (For primary document see N80-22788 13-44)
Avail: NTIS HC A99/MF A01 CSCL 10C

The basic water injection cycle used in a large-scale field study of heat storage in a confined aquifer near Mobile, Alabama is described. Water was pumped from an upper semi-confined aquifer, passed through a boiler where it was heated to a temperature of about 55 C, and injected into a medium sand confined aquifer. The injection well has a 6-inch (15-cm) partially-penetrating steel screen. The top of the storage formation is about 40 meters below the surface and the formation thickness is about 21 meters. In the first cycle, after a storage period of 51 days, the injection well was pumped until the temperature of the recovered water dropped to 33 c. At that point 55,300 cubic meters of water had been withdrawn and 66 percent of the injected energy had been recovered. The recovery period for the second cycle continued until the water temperature was 27.5 C and 100,100 cubic meters of water was recovered. At the end of the cycle about 90 percent of the energy injected during the cycle had been recovered. A.R.H.

N80-22829*# Pacific Northwest Lab., Richland, Wash.
EQUILIBRIUM GEOCHEMICAL MODELING OF A SEASONAL THERMAL ENERGY STORAGE AQUIFER FIELD TEST
J. S. Stottlemyre. *In* NASA. Lewis Res. Center Thermal Energy Storage Mar. 1980 p 607-619 refs (For primary document see N80-22788 13-44)
(Contract EY-76-C-06-1830)
Avail: NTIS HC A99/MF A01 CSCL 10C

A geochemical mathematical modeling study designed to investigate the well plugging problems encountered at the Auburn University experimental field tests is summarized. The results, primarily of qualitative interest, include (1) loss of injectivity was probably due to a combination of native particulate plugging and clay swelling and dispersion; (2) fluid-fluid incompatibilities, hydrothermal reactions, and oxidation reactions were of insignificant magnitude or too slow to have contributed markedly to the plugging; and (3) the potential for and contributions from temperature-induced dissolved gas solubility reductions, capillary boundary layer viscosity increases, and microstructural deformation cannot be deconvolved from the available data. Author

N80-22830*# Tuskegee Inst., Ala. Dept. of Electrical Engineering.
MEASUREMENT OF LOSS ANGLE, VOLUME RESISTIVITY AND SURFACE RESISTIVITY OF INSULATING MATERIALS USED ON SOLAR CELLS Final Report
C. V. Doreswamy. Apr. 1980 39 p refs
(Contract NsG-8038)
(NASA-CR-162925) Avail: NTIS HC A03/MF A01 CSCL 10A

The complete measuring and test system developed to measure the quality and the stability of insulating materials used on solar cell arrays for space application is described. The test set up and measurements are primarily aimed at the measurement and analysis of the degradation of the electrical insulating properties of material used on solar cells. Degradation characteristics of the material subject to thermal cycling, space plasma and very high electrical fields individually and in combination can be investigated. R.E.S.

N80-22831*# IBM Watson Research Center, Yorktown Heights, N.Y.
OPTIMIZATION OF SOLAR CELLS FOR AIR MASS ZERO OPERATION AND STUDY OF SOLAR CELLS AT HIGH TEMPERATURES, PHASE 4 Final Report
H. J. Hovel and J. M. Woodall. Mar. 1980. 56 p. refs.
(Contract NAS1-12812)
(NASA-CR-159230) Avail: NTIS HC A04/MF A01 CSCL 10A

The Pd contact to GaAs was studied using backscattering, Auger analysis, and sheet resistance measurements. Several metallurgical phases were present at low temperatures, but PdGa was the dominant phase in samples annealed at 500 C. Ti/Pd/Ag contacts appeared to have the lowest contact resistance. Etchback epitaxy (EBE) was compared to saturated melt epitaxy (SME) method of growing liquid phase epitaxial layers. The SME method resulted in a lower density of Ga microdroplets in the grown layer, although the best solar cells were made by the EBE method. Photoluminescence was developed as a tool for contactless analysis of GaAs cells. Efficiencies of over 8 percent were measured at 250 C. R.E.S.

N80-22832# GTE Labs., Inc., Waltham, Mass.
INVESTIGATION OF METHODS TO ELIMINATE VOLTAGE DELAY IN Li/SOCl SUB 2 CELLS Quarterly Technical Report, 19 Dec. 1978 - 19 Mar. 1979
Marc S. Dobrusin, Anthony Lombardi, Carl R. Schaikjer, and Clifton A. Young. Nov. 1979. 20 p. refs.
(Contract DAAB07-78-C-0558; DA Proj. 1L1-61102-AH-47)
(AD-A080125; DELET-TR-78-0558-2; QTR-2) Avail: NTIS HC A02/MF A01 CSCL 10/3

The film growth on lithium metal samples stored in LiAlCl4/SOCl2 electrolyte was measured as a function of storage temperature and lithium area to electrolyte volume (A/V) ratio. Micropolarization techniques were used to determine the capacitance and resistance of solid LiCl films on lithium electrodes, and from these values the thickness and resistivity of the films were calculated. When measured at higher temperature, the resistivity of LiCl layers was found to be lower. For higher A/V ratios, the film was thicker. The salt Li2B10Cl10 was found to have lower thermal stability than anticipated, and underwent partial decomposition when heated above 200 C to remove tetrahydrofuran following purification by crystallization from this solvent. GRA

N80-22833# GTE Labs., Inc., Waltham, Mass.
INVESTIGATION OF METHODS TO ELIMINATE VOLTAGE DELAY IN Li/SOCl SUB 2 CELLS Quarterly Technical Report, 19 Mar. - 19 Jun. 1979
Clifton A. Young, Marc S. Dobrusin, and Carl R. Schlaikjer. Nov. 1979. 60 p. refs.
(Contract DAAB07-78-C-0558; DA Proj. 1L1-61102-AH-47)
(AD-A080194; DELET-TR-78-0558-3; QTR-3) Avail: NTIS HC A04/MF A01 CSCL 10/3

The rate of growth of passivating films on lithium in SOCl2 and 1.8 M LiAlCl4/SOCl2 electrolyte has been measured by weight gain of stored lithium samples, and by pulse polarization measurements on stored cells. The film on lithium when measured in this way was found to be much thicker than when calculated from capacitance measured by pulse polarization. Micropolarization and capacitance measurements of lithium stored in 0.25 M Li2B10Cl10/SOCl2 have indicated that the film formed in this electrolyte is much thinner than that formed in 1.8 M LiAlCl4/SOCl2. GRA

N80-22834# Defence Research Establishment, Ottawa (Ontario). Chemical Sources Sect.
EVALUATION OF BB-248/U LEAD ACID BATTERY DURING CHARGE-DISCHARGE CYCLES AT LOW TEMPERATURE
G. R. L. Brossard and L. D. Gallop. Aug. 1979. 38 p. refs. In ENGLISH; FRENCH summary.
(AD-A074845; DREO-TN-79-15) Avail: NTIS HC A03/MF A01 CSCL 10/3

The behaviour of the lead-acid battery type BB-248/U has been studied during many consecutive charge-discharge cycles. The cranking current and the minimum terminal voltage were 285 A (or 300 A) and 6 V, respectively. The working temperature was successively room temperature, 0 C, -20 C and -40 C while the rechargeability period was only 2 hours. This work shows that such a rechargeability period - with a maximum charge current and an applied terminal voltage of 20 A and 14.25 V (or 16 V), respectively - is far too short to completely recharge the battery. Moreover, the rechargeability rate is only very slightly affected by the value of the maximum applied thermal voltage in the range of 14.25 V to 16 V. Finally, a significant decrease of reserve capacity measured at room temperature has been observed after many charge-discharge cycles at low temperatures. GRA

N80-22835# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Metals and Ceramics Div.
ZIRCONIUM POWER CHRACTERIZATION AND PROCESS IMPROVEMENT FOR THERMAL BATTERIES Final Report, Sep. 1975 - Dec. 1976
Robert F. Geisendorfer and K. S. Mazdiyasni. Nov. 1979. 127 p. refs.
(AF Proj. 7350)
(AD-A080344; AFML-TR-79-4069) Avail: NTIS HC A07/MF A01 CSCL 10/3

The inhouse program has resulted in a survey and characterization of existing production raw materials and product Zr metal powder as a heat source in the AF Maverick thermal battery. The variables most likely causing inconsistency and ignition sensitivity of zirconium metal powders are identified. The criteria for design and safety requirements for a laboratory scale zirconium-reduction-leach facility were established. The reduction and leach-wash cycle parameters were optimized to produce consistent quality fine particle 1-2-micrometer zirconium powder. The reduction scale up 400 grams per batch was achieved in order to produce sufficient quantities of Zr metal powder for performance tests and to evaluate variables. The technology was transferred to the industry for production of 50 pounds/batch Zr metal was accomplished. GRA

N80-22836# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
LITHIUM-THIONYL CHLORIDE BATTERY Quarterly Report, 1 Aug. - 31 Oct. 1979
A. N. Dey, N. Hamilton, W. Bowden, P. Witalis, and D. Cubbison. Feb. 1980. 60 p. refs.
(Contract DAAB07-78-C-0563; DA Proj. 1L1-62705-AH-94)
(AD-A080734; DELET-TR-78-0563-4; QR-4) Avail: NTIS HC A04/MF A01 CSCL 10/3

We have demonstrated a cell capacity of greater than 20 Amp-hr for the three inch flat cell on the GLLD test. We optimized these cells with regard to electrode area and cathode additive. This cell has now exceeded design performance goals. We optimized the very high rate wound D cell for electrolyte concentration, cathode additive and electrode length. The high rate D cells delivered 24 bursts or 8 Amp. hr/cell on the GLLD test cycle compared to 3 bursts from the currently used Ni/Cd batteries. We developed the 1.8 inch diameter cylindrical cell and tested it on the GLLD test. This cell delivered 12-13 Amp-hrs which was inferior to the flat cell and the high rate D cell. Accordingly, we discontinued any further development on this cell. We converted our test apparatus to the new GLLD test cycle which consists of alternating 20 Amp and 3.2 Amp pulses. The flat cells performed equally well under this new test regime. GRA

N80-22837# General Atomic Co., San Diego, Calif.
CLOSED-CYCLE GAS TURBINE: A PROVEN COGENERATION PLANT ADAPTABLE TO FOSSIL, NUCLEAR, AND SOLAR HEAT SOURCES
C. F. McDonald. Jun. 1979. 71 p. refs. Presented at Conf. on Energy Conversion and Solar Energy, Milan, Italy, 26 Sep. 1979.

(Contract EY-76-C-03-0167)
(GA-A-15322; CONF-790383-1) Avail: NTIS HC A04/MF A01

Existing operational closed-cycle gas turbine (CCGT) plants and projects nuclear, fossil, and solar plants of the future are reviewed. The benefits of the CCGT are discussed. DOE

N80-22838# Los Alamos Scientific Lab., N. Mex.
SUPERCONDUCTING MAGNETIC ENERGY STORAGE FOR ELECTRIC UTILITIES AND FUSION SYSTEMS
J. D. Rogers 1978 45 p refs Presented at the Instr. Soc. of Am. Meeting, Philadelphia, 16 Oct. 1978
(Contract W-7405-eng-36)
(LA-UR-78-1213; CONF-781025-1) Avail: NTIS HC A03/MF A01

Energy storage inductors, under development for load leveling and transmission line stabilization in electric utility systems and for driving magnetic confinement and plasma heating coils in fusion energy system are described. Superconducting magnetic energy storage (SMES) systems, which will store and deliver electrical energy for load leveling, peak shaving, and the stabilization of electric utility network are discussed. In the fusion area, inductive energy transfer and storage is being developed. Both 1-ms fast discharge theta pinch systems and 1 to 2-s slow energy transfer Tokamak systems have been demonstrated. The major components and the method of operation of a SMES unit are decribed, and potential applications of different size SMES systems in electric power grids are assessed. Results are given of a reference design for a 10-Gwh unit for load leveling, of a 30-MJ coil proposed for system stabilization, and of tests with a small-scale, 100-kj magnetic energy storage system. Fusion energy storage and transfer are results included. The common technology base for the various storage systems is examined. A.R.H.

N80-22839# California Univ., Livermore. Lawrence Livermore Lab.
SOLAR-HEATED GAS-TURBINE PROCESS USING SULFUR OXIDES FOR POWER PRODUCTION AND ENERGY STORAGE: M.S. Thesis
George Kohler Tyson, Scott Lynn, and Alan Foss Sep. 1979 108 p refs
(Contract W-7405-eng-48)
(LBL-9472) Avail: NTIS HC A06/MF A01

If any system of solar power generation is to provide a significant fraction of the power requirements of a community, some means of economical energy storage must be used. A process configuration using the heat of reaction of 2 SO3 reversible 2 SO2 + O2 for energy storage was developed and evaluated. The process uses the sulfur oxides directly in a gas turbine in a hybrid Brayton-Rankine cycle to produce electricity. Heat for the system is supplied during sunlit hours by a field of heliostats focused on a central solar receiver. When sunlight is not available, the storage system provides the heat to drive the gas turbine. An efficient process configuration for this power cycle is proposed. Detailed material and energy balances are presented for a base case that represents a middle range of expected operating conditions. The average cost of the electricity produced is estimated to be 7.7 cents/kW/sub e/hr. DOE

N80-22840# Los Alamos Scientific Lab., N. Mex.
TECHNOLOGY ASSESSMENT OF WIND ENERGY CONVERSION SYSTEMS
R. W. Meier and T. J. Merson Sep. 1979 48 p refs
(Contract W-7405-eng-36)
(LA-8044-TASE) Avail: NTIS HC A03/MF A01

Environmental data for wind energy conversion systems (WECSs) were generated. Two candidates were chosen to characterize the WECS that might be deployed if this technology makes a significant contribution to the national energy requirements. One EECS is a large machine of 1.5-MW-rated capacity that can be used by utilities. The other WECS is a small machine that is characteristic of units that might be used to meet residential or small business energy requirements. Energy storage systems are discussed for each machine to address the intermittent nature of wind power. Cost estimates were made for both large and small systems as required for input to the strategic environmental assessment simulation computer program. Material requirements, based on current generation WECSs, are discussed and a general discussion of environmental impacts associated with WECS deployment is presented. DOE

N80-22841# Argonne National Lab., Ill. Systems Engineering and Technology Group.
UNDERGROUND PUMPED HYDROELECTRIC STORAGE (UPHS)
C. A. Blomquist, A. A. Frigo, and S. W. Tam Apr. 1979 42 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-60) Avail: NTIS HC A03/MF A01

The operating characteristics of single- and double-stage, reversible, Franccis-type pump turbines are discussed. System studies are discussed in terms of machinery costs, plant sizes, and pump-turbine efficiencies, and results and conclusions are presented. In general, the utilization of advanced turbomachinery seems to be justified for underground pumped hydroelectric storage plants. DOE

N80-22842# Oak Ridge National Lab., Tenn. Energy and Environmental Systems Div.
LOW TEMPERATURE THERMAL-ENERGY STORAGE
C. S. Seagaser and J. E. Christian Mar. 1979 86 p refs
(Contract W-31-109-eng-38)
(ANL/CES/TE-79-3) Avail: NTIS HC A05/MF A01

Techniques and estimated costs of low temperature thermal energy storage (TES) devices applicable to integrated community energy systems (ICES) installations serving communities ranging in size from approximately 3000 to about 100,000 population are evaluated. The storage of thermal energy in the form of either hotness or coldness by virtue of a change in temperature of the material, or as latent heat of fusion in which the material changes from the liquid phase to the solid phase at essentially a constant temperature is described. Both types of material are considered for TES in ICES applications. DOE

N80-22843# Institute of Gas Technology, Chicago, Ill.
LITHIUM-METAL SULFIDE AND SODIUM-SULFUR BATTERIES FOR SOLAR ENERGY STORAGE
A. F. Sammells 19 Dec. 1978 12 p refs Presented at Reliability of Mater. for Solar Energy Workshop, Denver, Colo., 18 Dec. 1978
(Contract EC-77-C-02-4235)
(CONF-781228-3) Avail: NTIS HC A02/MF A01

The need for low-cost advanced batteries for solar energy storage is discussed, and the characteristics of the title batteries are described. The emphasis of the paper is on the status of materials problems associated with these batteries, including electrodes, current collectors, seals, and interelectrode spacing means. DOE

N80-22844# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
VACUUM DEPOSITED POLYCRYSTALLINE SILICON FILMS FOR SOLAR CELL APPLICATIONS: Quarterly Technical Progress Report, 29 Sep. - 31 Dec. 1978
Charles Feldman 15 Jan. 1979 69 p refs
(Contract ET-78-A-03-2208)
(SAN-2208-T1; QTPR-1) Avail: NTIS HC A04/MF A01

A vacuum deposition technique for forming polycrystalline silicon solar cells is being explored. Transition metal diboride layers, being examined as the cell's bottom electrode, were deposited on single crystal (sapphire) and polycrystalline (alumina) Al2O3 substrates. Graphite substrates were also examined. Boron doped p-type silicon layers were formed by co-deposition in the vacuum at substrate temperature between 1100 C and 1200 C. Silicon grain size in the films was between 4 microns and 6 microns depending on the deposition conditions (supersaturation ratio). The n-type silicon layer was formed by gaseous diffusion into p-type layer. Detailed secondary-ion mass spectra analysis of silicon, metal borides and substrates was carried out. The most satisfactory devices used TiB2 electrodes on alumina substrates. Solar cell AM 2 efficiencies of 1.8 percent were about the same as the planar cells formed previously by double-diffusion. DOE

N80-22845# EIC, Inc., Newton, Mass.
METHANOL-BASED HEAT PUMPS FOR STORAGE OF SOLAR THERMAL ENERGY, PHASE 1 Final Report, 25 Apr. 1977 - 30 Jun. 1978
P. O. D. Offenhartz, M. J. Turner, F. C. Brown, R. B. Warren, J. P. Pemsler, and S. B. Brummer Jan. 1979 109 p refs Prepared for Sandia Labs., Livermore, Calif.
(Contract EY-76-C-04-0789)
(SAND-79-8188) Avail: NTIS HC A06/MF A01

Reaction of CH3OH vapor with a solid state inorganic salt substrate to produce a solid methanolated salt can be used as the basis of a combined solar heat pump/thermal energy storage system. Experiments carried out indicate that the reaction of CaCl2 with CH3OH vapor to produce CaCl2.2CH3OH is well suited to heating and cooling applications. The heat of reaction is about 20 kcal per mole of CH3OH, and kinetics and thermodynamics of the reaction appear adequate down to a CH3OH pool temperature around -10 C. Analytical and experimental work on the design of the heat exchanger for the reacting salt bed indicate that high rates of heat transfer can be accomplihshed in a reasonably compact system; the indicated energy density for the solid-phase reactant is in excess of 13,000 Btu/cu ft, assuming that the void fraction for anhydrous CaCl2 is 85% or less. DOE

N80-22846# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
ENERGY INFORMATION DATA BASE CORPORATE AUTHOR ENTRIES, SUPPLEMENT 3 Progress Report, Jun. 1978 - Sep. 1979
Sep. 1979 51 p
(DOE/TIC-4585-R1-Suppl-3) Avail: NTIS HC A04/MF A01

This supplement contains additions to TID-4585-R1 and is intended for use with that publication. Supplements are cumulative from June 1978 until another revision is issued. DOE

N80-22847# Iowa State Univ. of Science and Technology, Ames. Dept. of Mechanical Engineering.
ENERGY CONSERVATION VIA HEAT TRANSFER ENHANCEMENT Quarterly Progress Report, 1 Jan. - 31 Mar. 1979
A. E. Bergles, G. H. Junkhan, and R. L. Webb Jun. 1979 48 p refs
(Contract ET-78-S-02-4649)
(COO-4649-5) Avail: NTIS HC A03/MF A01

The theory and practice of heat transfer enhancement are discussed. A technical literature file and manufacturers' file are reported and the initial patent technology information file is evaluated. Application studies on enhancement of waste heat recuperators and laminar internal flow heat transfer are described and data for the heat transfer and friction characteristics of internally finned tubes is discussed. Natural convection from rough surfaces is assessed. Major effort was directed toward planning of the Research Workshop on Energy Conservation Through Enhanced Heat Transfer. The Workshop, scheduled for May 24 and May 25, 1979 in Chicago, will be co-sponsored by NSF. DOE

N80-22848# Midwest Research Inst., Golden, Colo.
END-USE MATCHING OF SOLAR ENERGY SYSTEMS
F. Kreith, D. Kearney, and A. Bejan (Colo. Univ., Boulder) 1979 25 p refs Presented at the 2d Law of Thermodyn. Workshop, Washington, D.C., 14-16 Aug. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-34-325) Avail: NTIS HC A02/MF A01

The choice among available energy sources for a given task requires technical and economic tradeoffs on the part of the individual investor. From the national perspective, however, the effectiveness with which available energy sources are utilized may well become an overriding consideration. End-use matching is a procedure for introducing solar energy into the national energy infrastructure. The result of end-use matching is an identification of the most cost-effective combination of process energy needs, solar collector technology, geographic location, and economics by matching currently available solar system hardware with particular industrial processes and their locations. End-use matching methodology is discussed and first and second law thermodynamics analyses applied to a solar system producing process steam are illustrated. DOE

N80-22849# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
COMMUNICATION STRATEGY TO COMMERCIALIZE PASSIVE SOLAR ENERGY
D. R. Wolcott (Intern. Business Serv., Inc., Washington, D.C.) and F. F. Shoemaker 1979 6 p refs Presented at the Natl. Passive Solar Energy Conf., Kansas City, Mo., 3-5 Oct. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-69-412; CONF-791022-10) Avail: NTIS HC A02/MF A01

Although certain technical and economic issues remain to be clarified, passive solar market development is increasingly dependent upon communications such as information dissemination, education, training and promotional activities. Target audiences are identified as both recipients, and disseminators of passive solar communications. Form and quality of information are discussed in terms of the stages of an innovation adoption decision-making process. Several communication-related barriers which impede the commercialization of passive solar are discussed and general information and education response are suggested. A statement of precepts which should guide passive solar communication programs is also included. DOE

N80-22850# ICF, Inc., Washington, D. C.
ENERGY EXTENSION SERVICE PILOT PROGRAM EVALUATION REPORT: THE FIRST YEAR. VOLUME 2: PILOT STATE REPORTS
Sep. 1979 638 p Prepared in cooperation with Westat Res. Inc., Rockville, Md.
(Contract EY-77-C-01-2671)
(DOE/CS-2671-3) Avail: NTIS HC A99/MF A01

A discussion of the operations of the ten EES pilot-state programs during the period from October 1, 1977 through September 30, 1978 is presented. Each of the ten pilot states, Alabama, Connecticut, Michigan, New Mexico, Pennsylvania, Tennessee, Texas, Washington, Wisconsin, and Wyoming, received a grant to develop and implement a 19 month program. A case study description of the operations of the pilot program in each state is presented with special attention given to the two programs selected in each state for more detailed study and survey research. DOE

N80-22851# Waterloo Univ. (Ontario).
METHODS FOR REDUCING HEAT LOSSES FROM FLAT PLATE SOLAR COOLECTORS, PHASE 3 Final Report, 1 May 1977 - 31 Jan. 1979
K. G. T. Hollands, G. D. Raithby, F. B. Russell, and R. G. Wilkinson Mar. 1979 88 p refs
(Grant EY-76-G-02-2597)
(COO-2597-5) Avail: NTIS HC A05/MF A01

The present study extends earlier studies by examining the effect of the emissivities of both the absorber plate and the glass cover on the honeycomb's ability to suppress free convection, and on the radiative and conductive heat transfer which takes place across the honeycomb in the absence of free conversion. By means of heat transfer measurements on ten Mylar honeycomb, it is shown that the effect of the above emissivities on the suppression of convection by the honeycomb is slight and can probably be ignored. On the other hand, the measurements also showed that the effect of these emissivities on the nonconvective heat transfer is substantial, but not nearly so large as would have been predicted by existing theories. To explain this latter result theories were developed which take into account the important coupling (ignored by previous theories) between the conductive and radiative modes of heat transfer. These new theories predict the measured heat transfer rates to with about +-15%, depending on the emissivities. The results have direct application to evaluating solar collectors which combine a selective surface with a honeycomb. DOE

N80-22852# United Technologies Corp., South Windsor, Conn.
A 300 Btu GAS COMBUSTOR DEVELOPMENT PROGRAM, PHASE 1 Final Report
B. N. Baillif, F. H. Boenig, J. R. Grant (Pratt and Whitney Aircraft, West Palm Beach), and T. E. Holladay (Pratt and Whitney Aircraft,

West Palm Beach) Aug. 1979 100 p refs Prepared jointly with Pratt and Whitney Aircraft, West Palm Beach
(EPRI-AF-1144) Avail: NTIS HC A05/MF A01

Industrial turbines fired on medium heating value (MHV) gas (nominally 300 Btu/scf) synthesized from coal offer an attractive alternative means of producing electrical power in the future. Three MHV gas turbine combustor capable of meeting EPA NO/sub x/ requirements without water injection were designed, fabricated, and tested. Design of the combustion was based on a lean-premix concept. By premixing fuel and air in lean proportions prior to combustion flame temperatures and thus NO/sub x/formation were controlled. Tests were conducted in a single-can combustion rig at simulated engine conditions ranging from 40 to 125% of engine baseload (74 MW). Rig data were analyzed to obtain performance parameters of combustion efficiency, burner pressure loss, and exit temperature pattern factor. Results show that all three combustors meet the NO/sub x/ goal, with connected concentrations of 12 ppmv or less over the range of test conditions. DOE

N80-22853# Oak Ridge National Lab., Tenn.
FOSSIL ENERGY PROGRAM Progress Report, Sep. 1979
Nov. 1979 86 p refs
(Contract W-7405-eng-26)
(ORNL-TM-7095) Avail: NTIS HC A05/MF A01

Research and development programs that are in support of the increased utilization of coal and other fossil fuel alternatives to oil and gas as sources of clean energy are summarized. Topics covered include coal conversion development, materials engineering, a coal equipment test program, an atmospheric fluidized bed combustor for cogeneration, engineering studies and technical support, process and program analysis, environmental assessment studies, magnetic beneficiation of dry pulverized coal, technical support to the TVA fluidized bed combustion program, coal cogeneration/district heating plant assessment, chemical research and development, and technical support to major liquefaction projects. DOE

N80-22854# Oak Ridge National Lab., Tenn.
FOSSIL ENERGY PRGORAM Progress Report, Aug. 1979
Oct. 1979 98 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7057; Rept-61) Avail: NTIS HC A05/MF A01

A compendium is presented for monthly progress reports for the ORNL research and development programs that are in support of the increased utilization of coal and other fossil fuel alternatives to oil and gas as sources of clean energy. The projects reported this month include those for coal conversion development, materials engineering, a coal equipment test program,an atmospheric fluid bed combustor for cogeneration, engineering studies and technical support, process and program analysis, environmental assessment studies, magnetic beneficiation of dry pulverized coal, technical support to the TVA fluid bed combustion program, coal cogeneration/district heating plant assessment, chemical research and development, and technical support to major liquefaction projects. DOE

N80-22855# Oak Ridge National Lab., Tenn.
FOSSIL ENERGY PROGRAM Progress Report, Jul. 1979
Sep. 1979 72 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7031; Rept-60) Avail: NTIS HC A04/MF A01

A compendium is presented of monthly progress reports for the ORNL research and development programs that are in support of the increased utilization of coal and other fossil fuel alternatives to oil and gas as sources of clean energy. The projects reported include those for coal conversion development, materials engineering, a coal equipment test program, an atmospheric fluid bed combustor for cogeneration, engineering studies and technical support process and program analysis, environmental assessment studies, magnetic beneficiation of dry pulverized coal, technical support to the TVA fluid bed combustion program, coal cogeneration/district heating plant assessment, chemical research and development, and technical support to major liquefaction projects. DOE

N80-22856*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR FERN, TUNKHANNOCK, PENNSYLVANIA Contractor Report, May 1978 - Apr. 1979
Jan. 1980 81 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161392) Avail: NTIS HC A05/MF A01 CSCL 10A

The operational and thermal performance of a variety of solar systems installed in operational test sites are described. The analysis is based on instrumented system data monitored and collected for at least one full season of operation. The long-term field performance of the installed system is reported, and technical contributions to the definition of techniques and requirements for solar energy system design are made. The solar energy system was designed to supply space heating and domestic hot water for single-family residences. The system consists of air flat plate collectors, storage tank, pumps, heat exchangers, associated plumbing, and controls. F.O.S.

N80-22857# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Raumfahrt.
DEVELOPMENT AND PREPAPATION FOR SERIES PRODUCTION OF A MODULAR SOLAR SPACE HEATING SYSTEM, PHASES 1 AND 2 Final Summary Report
Ruediger Eichlepp, Herbert Grallert, Veit Merges, and Karl-Heinz Ott May 1979 247 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-02) Avail: NTIS HC A11/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 51.45

A modular solar space heating system for residential use at central European latitudes was examined experimentally. Technical as well as economic factors were included. The system selected for the experimental test consisted of flat plate solar collectors and cubic water tanks for energy storage. Two test houses in Germany were equipped with this system, both of then single-family houses. One of these houses is a special, newly constructed prefabricated home, the other was retrofitted with the system. Results are presented. Author (ESA)

N80-22858# Varta Batterie A.G., Kelkheim (West Germany). Forschungs- und Entwicklungszentrum.
GALVANIC CELLS WITH DOPED CaF2 AS A SOLID ELECTROLYTE Final Report
Manfred Koriath and Reinhard Braeutigam Bonn Bundesmin. fuer Forsch. u. Technol. Jun. 1979 67 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-03) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 13.65

Galvanic cells of the type Ca/CaF2/CuF2 were developed by first producing discharged cells with a thin film technique and later charging them. This method led to cells which showed a very high rate of self discharge. Since cells of this type cannot easily be manufactured in their charged state, it is recommended that further development efforts be discontinued. Author (ESA)

N80-22859# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DEVELOPMENT OF A 5.5 m DIAMETER VERTICAL AXIS WIND TURBINE, PHASE 2 Final Report
Guenter Binder, Albert Fritzsche, Arne Vollan, Anton Dekitsch, Roland Joos, Dieter Welte, Carl-C. Etzler, and Juergen Schmelzle Bonn Bundesmin. fuer Forsch. u. Technol. Jul. 1979 138 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-04) Avail: NTIS HC A07/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 28.55

The design work for the turbine, including the aerodynamic and structural dynamic investigations was performed, and the wind turbine built and tested in a wind tunnel. The rotor diameter of 5.5 m is not only a suitable size for the tests, but indicates that the results will contribute to the experimental data required for the design of large converters. The layout of the rotor, the construction methods and choice of materials favor series production, applying advanced mass production technology, without excluding the manufacture in developing countries. The

wind tunnel test performed with the two, three, and four blade version of the Darrieus-rotor and with Savonius-rotors of different heights confirmed the aerodynamic calculations. Possibilities to improve the efficiency of the Savonius-rotor and to simplify some details concerning design and manufacture were evaluated.
Author (ESA)

N80-22860# Stuttgart Univ. (West Germany). Inst. fuer die Technische Nutzung Solarer Energie.
TECHNICAL APPLICATIONS OF SOLAR ENERGY. Final Report
Abdelraouf Arafa, Wolfgang Arndt, and Gerhard Bilger. Bonn: Bundesmin. fuer Forsch. u. Technol. Jul. 1979. 272 p. refs. In GERMAN; ENGLISH summary. Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-06) Avail: NTIS. HC A12/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 56.70.

Experimental and theoretical investigations of the conversion of solar energy are presented, including: laboratory investigations with flat plate water collectors; hot water heat storage; development and measurements of selective surfaces; thermoelectric energy conversion; measurements of meteorological and radiation data; data acquisition; outdoor testing of water and air flat plate collectors; and measurement of the energy balance in a solar house. Photovoltaic experiments with flat and concentrating generators, a system study on photovoltaic systems, hybrid flat plate collectors (thermal and photovoltaic), and technology of Cu2S-CaS thin film solar cells are included. The improvement of solar cell use by light conversion with luminiscent substances and time resolved measurement of the global radiation spectrum is also considered.
Author (ESA)

N80-22861*# New Mexico Univ., Albuquerque. Technology Application Center.
SOLAR POWER SATELLITES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE. Progress Report, 1973 - Nov. 1979
Gerald F. Zollars. Dec. 1979. 88 p. Sponsored by NASA and NTIS.
(NASA-CR-162931; PB80-802697) Avail: NTIS. HC A05/MF A01. CSCL 10B.

This bibliography of 320 citations to the international literature concerns the development of solar power satellites. The design and construction of the satellite solar arrays and the technology of satellite solar energy conversion and transmission to Earth are the major topics covered. Feasibility analyses of the solar power satellite concept are also included.
GRA

N80-22862# Mitre Corp., McLean, Va. METREK Div.
NEW ENGLAND ENERGY DEVELOPMENT SYSTEMS CENTER (NEEDS). AN EXPERIMENT IN UNIVERSITY-INDUSTRY COOPERATIVE RESEARCH. VOLUME 1: SUMMARY OF RESULTS. Final Report
Zwi Kohorn. Jul. 1979. 39 p. refs. 2 Vol.
(Grant NSF CG-00007)
(PB80-112972; MTR-79W00188-Vol-1; NSF/RA-790260) Avail: NTIS. HC A03/MF A01. CSCL 10A.

The organizational structure, operating mechanism, accomplishments, and lessons of the New England Energy Development Systems (NEEDS) Center are reported. The NEEDS was established as an entity to test the effectiveness of Federal cost sharing in stimulating nonfederal investment in university research, and in facilitating the use of research and development results by industry. Twenty-five individual projects are described and categorized as to performance, source of cost sharing, and total project cost. Accomplishments are discussed with respect to: (1) linking private sector organizations with universities, (2) simulating cost-sharing from the private-sector, and (3) facilitating use of results.
GRA

N80-22863# Mitre Corp., McLean, Va. METREK Div.
NEW ENGLAND ENERGY DEVELOPMENT SYSTEMS CENTER (NEEDS). AN EXPERIMENT IN UNIVERSITY-INDUSTRY COOPERATIVE RESEARCH. VOLUME 2: CASE HISTORIES. Final Report
Zwi Kohorn. Jul. 1979. 140 p. refs. 2 Vol.
(Grant NSF CG-00007)
(PB80-112980; MTR-79W00188-Vol-2; NSF/RA-790261) Avail: NTIS. HC A07/MF A01. CSCL 10A.

Case histories of 25 projects involving the New England Energy Development Systems Center as a broker sponsor, and/or research and development (R and D) performer are reported. Projects are grouped into the energy areas of electricity generation, electrical distribution, and reported energy planning. Each case is a self-contained narrative, uniformly structured and sequenced under the following standard headings: project description, problem identification, recruitment, R and D funding, project management, R and D program, information dissemination, evaluation, and references.
GRA

N80-22864# National Technical Information Service, Springfield, Va.
SOLAR SPACE HEATING AND AIR CONDITIONING, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE. Progress Report, Sep. 1977 - Sep. 1978
Audrey S. Hundemann. Dec. 1979. 99 p.
(PB80-801707) Avail: NTIS. HC $30.00/MF $30.00. CSCL 13A.

Design, technical feasibility, performance, and economic factors pertaining to solar heating and cooling of buildings are discussed. Commercial buildings, schools, and residential buildings are covered, with emphasis on the assessment of solar heating and cooling systems for residential buildings. Solar energy as a national energy resource, solar energy research program alternatives, and social, environmental, and institutional factors affecting the feasibility of using solar energy for heating and cooling buildings are included. This updated bibliography contains 90 abstracts, none of which are new entries to the previous edition.
GRA

N80-22865# National Technical Information Service, Springfield, Va.
SOLAR SPACE HEATING AND AIR CONDITIONING, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE. Progress Report, Sep. 1977 - Oct. 1979
Audrey S. Hundemann. Dec. 1979. 153 p. Supersedes NTIS/PS-78/1017; NTIS/PS-77/0829; NTIS/PS-76/0728.
(PB80-801723; NTIS/PS-78/1017; NTIS/PS-77/0829; NTIS/PS-76/0728) Avail: NTIS. HC $30.00/MF $30.00. CSCL 13A.

Citations from worldwide literature on the use of solar energy to heat and cool buildings are presented, with emphasis on the heating and cooling of residential buildings, and performance simulation studies are cited. Abstracts pertaining to solar assissted heat pump systems and assessment of solar heated Rankine cycle cooling are included. This updated bibliography contains 146 abstracts, 49 of which are new entries to the previous edition.
GRA

N80-22866# National Technical Information Service, Springfield, Va.
SOLAR SPACE HEATING AND AIR CONDITIONING, VOLUME 4. CITATIONS FROM THE NTIS DATA BASE. Progress Report, Oct. 1978 - Oct. 1979
Audrey S. Hundemann. Dec. 1979. 235 p. Supersedes NTIS/PS-78/1015; NTIS/PS-77/0827; NTIS/PS-76/0727; NTIS/PS-75/689; NTIS/PS-75/345.
(PB80-801715; NTIS/PS-78/1015; NTIS/PS-77/0827; NTIS/PS-76/0727; NTIS/PS-75/689; NTIS/PS-75/345) Avail: NTIS. HC $30.00/MF $30.00. CSCL 13A.

Design, technical feasibility, performance, and economic factors pertaining to solar heating and cooling of buildings are discussed. Commercial buildings, schools, and residential buildings are covered, with emphasis on the assessment of solar heating and cooling systems for residential buildings. Solar energy as a national energy resource, solar energy research program alternatives, and social, environmental, and institutional factors affecting the feasibility of using solar energy for heating and cooling buildings are included. This updated bibliography contains 226 abstracts, all of which are new entries to the previous edition.
GRA

N80-22867# National Technical Information Service, Springfield, Va.
PASSIVE SOLAR SPACE HEATING AND COOLING.

CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Oct. 1979
Audrey S. Hundemann Dec. 1979 50 p
(PB80-801749) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Studies from worldwide literature on the passive solar heating and cooling of buildings are discussed. Abstracts cover design and performance simulation studies of trombe walls and air thermo-siphon solar heating systems. This report contains 45 abstracts. GRA

N80-22868# National Technical Information Service, Springfield, Va.
PASSIVE SOLAR SPACE HEATING AND COOLING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Oct. 1979
Audrey S. Hundemann Dec. 1979 66 p
(PB80-801731) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Design, technical feasibility, performance, and economic factors pertaining to passive solar heating and cooling of buildings are discussed. Abstracts cover trombe walls and air thermo-siphon solar heating systems, comparative economics of passive and active systems, and performance simulation studies. Contains 58 abstracts. GRA

N80-22869# National Technical Information Service, Springfield, Va.
OPTICAL COATINGS FOR SOLAR CELLS AND SOLAR COLLECTORS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report 1970 - Dec. 1979
Brian Carrigan Jan. 1980 230 p Supersedes NTIS/PS-78/1342
(PB80-803794; NTIS/PS-78/1342) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

This bibliography of worldwide journal literature cites reports on materials and research for the development of selective coatings for solar energy conversion devices. These materials include types of coatings or covers used to reflect or transmit solar radiation in order to optimize solar conversion to heat or electricity. Most studies concern antireflection, thermal control, or reflective coatings. Coatings which act as optical filters are also covered. This updated bibliography contains 223 abstracts, 54 of which are new entries to the previous edition. GRA

N80-22870# National Technical Information Service, Springfield, Va.
OPTICAL COATINGS FOR SOLAR CELLS AND SOLAR COLLECTORS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1978
Brian Carrigan Jan. 1980 248 p
(PB80-803778) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Materials and research for the development of selective coatings for solar energy conversion devices are described in these citations. These materials include types of coatings or covers used to reflect or transmit solar radiation in order to optimize solar conversion to heat or electricity. Most studies concern antireflection, thermal control, or reflective coatings. Coatings which act as optical filters are also covered. This updated bibliography contains 241 abstracts, none of which are new entries to the previous edition. GRA

N80-22871# National Technical Information Service, Springfield, Va.
OPTICAL COATINGS FOR SOLAR CELLS AND SOLAR COLLECTORS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979
Brian Carrigan Jan. 1980 47 p Supersedes NTIS/PS-78/1341; NTIS/PS-77/1036; NTIS/PS-76/0855; NTIS/PS-75/692; NTIS/PS-75/137
(PB80-803786; NTIS/PS-78/1341; NTIS/PS-77/1036; NTIS/PS-76/0855; NTIS/PS-75/692; NTIS/PS-75/137) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

The different development towards selective coating for solar energy conversion devices are described. This includes types of coatings or covers used to reflect or transmit solar radiation in order to optimize solar conversion to heat or electricity. Most studies concern antireflection, thermal control, or reflective coatings. Coatings which act as optical filters are also covered. This updated bibliography contains 40 abstracts, all of which are new entries to the previous edition. GRA

N80-22872# National Technical Information Service, Springfield, Va.
CADIUM SULFIDE SOLAR CELLS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Nov. 1979
Brian Carrigan Dec. 1979 43 p Supersedes NTIS/PS-78/1213; NTIS/PS-77/7051; NTIS/PS-76/0929; NTIS/PS-75/693 and NTIS/PS-75/089
(PB80-802226; NTIS/PS-78/1213; NTIS/PS-77/1051; NTIS/PS-76/0929; NTIS/PS-75/693; NTIS/PS-75/089) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Citations from Federally-funded research on cadmium sulfide solar cell theory, design, development, fabrication, and degradation are presented. Studies include junctions with thin films of copper sulfide, selerides, and tellurides. The performance, testing, analysis, efficiency, and costs of these cells are covered. This updated bibliography contains 35 abstracts, 22 of which are new entries to the previous edition. GRA

N80-22873# National Technical Information Service, Springfield, Va.
CADMIUM SULFIDE SOLAR CELLS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979
Brian Carrigan Dec. 1979 233 p Supersedes NTIS/PS-78/1214; NTIS/PS-77/1052 and NTIS/PS-76/0930
(PB80-802234; NTIS/PS-78/1214; NTIS/PS-77/1052; NTIS/PS-76/0930) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Worldwide research on cadmium sulfide solar cell design, development, fabrication, heterojunctions, doping, and performance are cited in this bibliography. Studies on defects, protective coatings, and arrays are included. Thin films of copper indium seleride, copper sulfide, indium phosphide, cadmium selenides, and cadmium tellurides are among those described in these photovoltaic systems. This updated bibliography contains 227 abstracts, 55 of which are new entries to the previous edition. GRA

N80-22874# Scientific Process and Research, Inc., Highland Park, N. J.
LOWERING OF ENERGY CONSUMPTION IN PLASTICS PROCESSING Progress Report, 1 Oct. 1977 - 31 Mar. 1978
Imrich Klein, Reuben Klein, and D. W. Riley 3 Apr. 1978 243 p
(Grant NSF APR-77-19512)
(PB-281113/1; SPR/NS-78/01) Avail: NTIS HC A11/MF A01 CSCL 11I

The objective of this research is to explore the potentials of a new plastics processing device-the Recycle Screw-to lower energy consumption and to improve the overall efficiency of the plastics extrusion process. The method used to conduct the research was a large scale computer based investigation employing SPR's computerized physical model of the plasticating extruder, EXTRUD*, and SPR's Data Bank of processing properties of plastics. Close to 1700 simulations were performed using physical properties representing 17 different resin grades covering the most widely used families of polymers. The study extended over 5 different extruder sizes and shows that the Recycle Screw offers the following features: (1) lower extrudate temperature of up to 200 degrees F.; (2) drastically lower requirements of costly heat stabilizers; (3) lower cooling load and cooling water requirements; (4) lower scrap production by generating higher quality-low temperature extrudate; (5) considerable increases in production rate on existing processing machinery; (6) decrease in capital investment by utilization of smaller cooling lines and associated plant facilities. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-22875*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE RELATIVE IMPORTANCE OF NOISE LEVEL AND NUMBER OF EVENTS ON HUMAN REACTIONS TO NOISE: COMMUNITY SURVEY FINDINGS AND STUDY METHODS
James M. Fields Mar. 1980 25 p refs Presented at 98th Acoustical Soc. of Am. Meeting, Salt Lake City, Utah, 26-30 Nov. 1979
(NASA-TM-81795) Avail: NTIS HC A02/MF A01 CSCL 13B

The data from seven surveys of community response to environmental noise are reanalyzed to assess the relative influence of peak noise levels and the numbers of noise events on human response. The surveys do not agree on the value of the tradeoff between the effects of noise level and numbers of events. The value of the tradeoff cannot be confidently specified in any survey because the tradeoff estimate may have a large standard error of estimate and because the tradeoff estimate may be seriously biased by unknown noise measurement errors. Some evidence suggests a decrease in annoyance with very high numbers of noise events but this evidence is not strong enough to lead to the rejection of the conventionally accepted assumption that annoyance is related to a log transformation of the number of noise events. Author

N80-22876# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: MAGNETOHYDRODYNAMICS
May 1979 199 p refs
(DOE/EDP-0045) Avail: NTIS HC A09/MF A01

The updated environmental development plan (EDP) for DOE's magnetohydrodynamics (MHD) program is presented. A brief summary of the environmental concerns identified in the original MHD EDP is given. MHD technology and DOE's MHD program are described and environmental concerns are identified. The environmental concerns associated with MHD are addressed and resolved are tabulated. An environmental concerns is developed. DOE

N80-22877# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.
COOLING TOWER RECIRCULATION AS INFLUENCED BY THE LOCAL ATMOSPHERIC FLOW FIELD, A NUMERICAL MODEL
Bryan R. Becker (The Univ. of Tennessee Space Inst., Tullahoma) and Walter Frost 1979 35 p refs Presented at the ASMG winter annual meeting New York, Dec. 1979
(Contract W-7405-eng-26)
(K/CSD/INF-79/6; CONF-791205-7) Avail: NTIS HC A03/MF A01

Cooling tower performance is adversely affected by the recirculation of stack effluent back into the tower intake louvers. A unique method of numerically modeling cooling tower plume recirculation is described. The structure of the wake region behind the tower is resolved using the equations of hydrodynamics. The flow field within the tower is modeled as porous media flow. Interior and exterior flow fields are coupled by matching pressures and flow rates at the intake louvers. DOE

N80-22878# Exxon Nuclear Idaho Co., Inc., Idaho Falls.
LOW-LEVEL AIRBORNE MONITORING TECHNIQUES UTILIZED IN A FIELD MEASUREMENT PROGRAM AT OPERATING PRESSURIZED WATER REACTORS
D. W. Akers, N. K. Bihl, S. W. Duce, J. W. Tkachyk, and B. G. Motes 1979 14 p Presented at the 23rd Conf. on Anal. Chem. in Energy Technol., Gatlinburg, Tenn., 9 Oct. 1979
(Contract EY-76-C-07-1570)
(CONF-791049-8) Avail: NTIS HC A02/MF A01

An in-plant measurement program underway at commercial nuclear power stations is described. Measurements were made of low level airborne radioactivity concentrations and release rates. A discussion of the measurement methods is given. The monitoring methods discussed include several types of radioiodine species samplers in addition to an atmospheric C-14 and tritium sampler. Each method is individually evaluated with emphasis upon: system description, observed detection limits, sample preparation, analysis, problems encountered in field use, and appropriate usage in a nuclear power plant ventilation system. DOE

N80-22879# Oak Ridge National Lab., Tenn.
ENVIRONMENTAL IMPACTS OF FOREST FERTILIZATION ON TERRESTRIAL ECOSYSTEMS
Dale W. Johnson 1979 26 p refs Presented at the Conf. on Forest Fertilization, Shelton, W. Va., 25 Sep. 1979
(Contract W-7405-eng-26)
(CONF-790980-1) Avail: NTIS HC A03/MF A01

Side effects such as imporved tree resistance to damage by air pollution and insect and disease attack are examined. The possibilities for managing mycorrhizal communities by fertilization and the effects of excessive nitrification are also discussed. While the prospects for managing mycorrhizal activity as well as controlling insect and disease outbreaks by fertilization are appealing, long-term ecological studies of forest fertilization effects on these as well as other ecosystem components will be necessary before these goals can be achieved. DOE

N80-22880# Oak Ridge National Lab., Tenn. Environmental Science Div.
GLOBAL STABILITY IN ECOLOGICAL MODELS WITH CONTINUOUS TIME DELAYS
W. M. Post (Tennessee Univ., Knoxville) and C. C. Travis 1979 14 p refs Presented at the Functional Differential and Integral Equations Conf., Morgantown, W. Va., 18 Jun. 1979
(Contract W-7405-eng-26)
(CONF-7906102-2) Avail: NTIS HC A02/MF A01

The stability properties of a general system of first-order integro-differential equations which describe the dynamics of interacting species populations are examined. A sufficient condition for the global stability of an equilibrium state is derived. This condition has intuitive biological interpretations and is verifiable in a finite number of arithmetical steps. This condition is shown to be both necessary and sufficient for global asymptotic stability of the equilibrium for communities of mutualistically interacting species. Application of the results to an ecological system is also provided. DOE

N80-22881# California Univ., Berkeley. Lawrence Berkeley Lab.
INSTRUMENTATION FOR ENVIRONMENTAL MONITORING: BIOMEDICAL
May 1979 301 p refs
(Contract W-7405-eng-48)
(LBL-1-Vol-4) Avail: NTIS HC A14/MF A01

An update is presented on instruments useful for measurements in biomedicine related to environmental research and monitoring. Descriptions of the physical and operating characteristics of available instruments, critical comparisons among instrumentation methods, and recommendations of promising methodology and development of new instrumentation are given. Methods of detection and analysis of gaseous organic pollutants and metals, including Ni and As, are presented. Instrument techniques and notes are included on atomic spectrometry and UV and visible absorption instrumentation. DOE

N80-22882# Los Alamos Scientific Lab., N. Mex.
NATIONAL IMPACTS ON VISUAL AIR QUALITY FROM A FUTURE ENERGY SCENARIO
D. Nochumson, M. Wecksung, and G. Gurule 1979 11 p refs Presented at ACPA Conf. on Visibility, Denver, 26 Nov. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3214; CONF-791139-1) Avail: NTIS HC A02/MF A01

A methodology was developed to evaluate impacts on atmospheric visual air quality for nonurban areas caused by regional haze. Estimated values of median visual range for 39 nonurban ambient air quality monitoring sites were shown to have a high correlation with observed values. A decline in median visual range is projected in regions of the west and the Gulf Coast where there is a substantial growth in the combustion of

sulfur containing fossil fuels--coal in particular. The projected decline in median visual range in mandatory Class One Federal areas, particularly in the Western US, may confict with Congress's goal of protecting these areas against visibility impairment. Regulations for defining visibility impairment remain to be defined. The meeting of the emission limitations of the state implementation plans is projected to significantly improve the low visibilities experienced in the Eastern US, particularly in the Ohio Valley and the surrounding region. DOE

N80-22883# Battelle Pacific Northwest Labs., Richland, Wash.
USE OF RECONNAISSANCE LEVEL INFORMATION FOR ENVIRONMENTAL ASSESSMENT
R. F. Foster, W. H. Rickard, J. A. Strand, and M. L. Warner Nov. 1979 46 p
(Contract EY-76-C-06-1830)
(NUREG-CR-0990; PNL-3080) Avail: NTIS HC A03/MF A01

Reconnaissance level inforamtion (RLI) sufficient for comparing the environmental and socio-economic features of candidate sites for nuclear power stations and for guiding plant design, baseline surveys, and operational practices is discussed. Environmental concerns of special importance for site evaluation include: aquatic ecology, terrestrial ecology, land and water use, socioeconomics, and institutional constraints. A scheme is suggested for using RLI to assign classifications to candidate sites based on the potential level of concern associated with the different environmental features. DOE

N80-22884# Los Alamos Scientific Lab., N. Mex.
FIBROUS AEROSOL STUDIES
L. W. Ortiz, M. I. Tillery, H. J. Ettinger, and J. I. Martinez Nov. 1979 45 p refs Sponsored in part by National Institute for Occupational Safety and Health
(Contract W-7405-eng-36)
(LA-8119-MS) Avail: NTIS HC A03/MF A01

Glass and asbestos fibers are discussed in terms of occupational safety and public health. Aerosol generation, aerodynamic size characterization, and sampler evaluation are among the topics studied. Several related subtopics on microscopy and asbestos are included. DOE

N80-22885# Greater London Council (England).
AIR POLLUTION AND PEDESTRIANIZATION: STUDIES AT THE UPPER NORWORD TRIANGLE. THE WESTOW HILL TRAFFIC EXPERIMENT
R. B. Sainsbury and R. Caswell 1977 30 p refs
(RM-496; ISBN-0306-7203) Avail: NTIS HC A03/MF A01; Greater London Council, London £2.30

Carbon monoxide, smoke, and lead concentrations were measured in the air of an urban area before and during a six month period when the area was closed to automobile traffic. Pollution levels were lower in the test area, but increased on the periphery. The measurement techniques are discussed and the reduced data presented. Author (ESA)

N80-22886# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Atmospheric Pollution Div.
LEAD, ITS SOURCES, DISPERSION AND ITS RELATION TO CO
A. L. Aggarwal Jan. 1979 42 p refs
(IG-TNO-G-770) Avail: NTIS HC A03/MF A01

Literature concerning the contribution of gasoline combustion to lead concentrations in the atmosphere is surveyed, and discussed in relation to lead pollution levels in the Netherlands. Lead concentration data are presented, with attempts made to correlate concentrations with season, traffic density, wind direction and speed, atmospheric stability, and background levels of lead. Simultaneous measurements for CO and Pb show a strong dependence of the Pb/CO relationship on season. Author (ESA)

N80-22887# Systems Applications, Inc., San Rafael, Calif.
PROCEDURES FOR EVALUATING THE PERFORMANCE OF AIR QUALITY SIMULATION MODELS
M. J. Hillyer, S. D. Reynolds, and P. M. Roth Oct. 1979 155 p refs
(Contract EPA-68-02-2593)
(PB80-125206; EPA-450/4-79-033) Avail: NTIS HC A08/MF A01 CSCL 13B

A procedural framework for objectively evaluating model performance was developed. Previous model evaluation studies are reviewed. Gaps in present knowledge that limit model evaluation are identified. GRA

N80-22888# Research Triangle Inst., Research Triangle Park, N. C.
PROCEEDINGS: SYMPOSIUM ON FLUE GAS DESULFURIZATION, VOLUME 1
Franklin A. Ayer, comp. Mar. 1979 638 p refs Proc. held at Las Vegas, Nev. 5-8 Mar. 1979
(Contract EPA-68-02-2612)
(PB80-133168; EPA-600/7-79-167A) Avail: NTIS HC A99/MF A01 CSCL 13B

Contents: overview of control technology-the bridge between energy utilization and environmental goals; health effects of SO2 and sulfates; energy, environmental, and economic impacts of flue gas desulfurization under alternative new source performance standards; status of development, energy and economic aspects of alternative technologies; economic and energy requirements of sulfur oxides control processes; combined coal cleaning and FGD, the interagency flue gas desulfurization evaluation study; status of flue gas desulfurization in the United States; recent results from EPA's lime/limestone scrubbing programs; compliance programs for SO2 emission; and SO2 and NOx removal technology in Japan. GRA

N80-22889# Research Triangle Inst., Research Triangle Park, N. C.
PROCEEDINGS: SYMPOSIUM ON FLUE GAS DESULFURIZATION, VOLUME 2
Franklin A. Ayer Mar. 1979 631 p refs Symp. held at Las Vegas, Nev., 5-8 Mar. 1979
(Contract EPA-68-02-2612)
(PB80-133176; EPA-600/7-79-167B) Avail: NTIS HC A99/MF A01 CSCL 13B

Contents: utility conventional combustion comparative environmental assessment - coal and oil; design and commercial operation of lime/limestone FGD sludge stabilization systems; power plant flue gas desulfurization using alkaline fly ash from western coals; environmental effects of FGD disposal - a laboratory/field landfill demonstration; summary of utility dual alkali system; the FGD reagent dilemma - lime, limestone, or thiosorbic lime; The status of industrial boiler FGD applications in the United States; status of the project to develop standards of performance for industrial fossil-fuel-fired boilers; and flue gas desulfurization applications to industrial boilers. GRA

N80-22890# Research Triangle Inst., Research Triangle Park, N. C.
OXIDANT-PRECURSOR RELATIONSHIPS UNDER POLLUTANT TRANSPORT CONDITIONS. OUTDOOR SMOG CHAMBER STUDY, VOLUME 1 Final Report, Jun. 1975 - Jun. 1978
J. E. Sickles, II, L. A. Ripperton, W. C. Eaton, and R. S. Wright Aug. 1979 125 p refs Prepared for Environmental Sciences Research Lab.
(Contract EPA-68-02-2207)
(PB80-109127; EPA-600/3-79-078A-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 04A

Multiple-day experiments were conducted in outdoor smog chambers to investigate the influence of simulated transport on ozone generation by various combinations of a surrogate urban hydrocarbon mixture and nitrogen oxides. The simulation of transport was accomplished by progressively diluting the contents of the chambers with purified air. Additional experiments were conducted to examine the ozone-generative potential of low reactivity hydrocarbons, to provide data for testing and validation of a computer-based photochemical simulation model, and to compare the behavior of two types of outdoor smog chambers. GRA

N80-22891# Research Triangle Inst., Research Triangle Park, N. C.
OXIDANT-PRECURSOR RELATIONSHIPS UNDER POLLUTANT TRANSPORT CONDITIONS. OUTDOOR SMOG CHAMBER STUDY, VOLUME 2: APPENDIXES Final Report,

Jun. 1975 - Jun. 1978
J. E. Sickles, II, L. A. Ripperton, W. C. Eaton, and R. S. Wright
Aug. 1979 435 p Prepared for Environmental Sciences Research Lab.
(Contract EPA-68-02-2207)
(PB80-109135; EPA-600/3-79-078B-Vol-2) Avail: NTIS
HC A19/MF A01 CSCL 04A

Multiple-day experiments were conducted in outdoor smog chambers to investigate the influence of simulated transport on ozone generation by various combinations of a surrogate urban hydrocarbon mixture and nitrogen oxides. The simulation of transport was accomplished by progressively diluting the contents of the chambers with purified air. Smog chamber analytical data for hydrocarbons, NO, O3, CO, CH2O, and condensation nuclei as well as dilution and meteorological data, are presented in tabular form. GRA

N80-22892# Woodard-Clyde Consultants, San Francisco, Calif.
MANUAL OF PRACTICE FOR PROTECTION AND CLEANUP OF SHORELINES. VOLUME 1: DECISION GUIDE Final Report, Apr. - Jul. 1979
Carl R. Foget, Eric Schrier, Martin Cramer, and Robert Castle
Aug. 1979 124 p 2 Vol.
(Contract EPA-68-03-2542)
(PB80-108830; EPA-600/7-79-187A-Vol-1) Avail: NTIS
HC A06/MF A01 CSCL 13B

A systematic, easy to apply methodology that can be used to assess the threat of an oil spill and select the most appropriate protection and cleanup techniques is presented. A detailed discussion of the factors involved in the decision-making process is given and includes oil characteristics, behavior and movement of oil, shoreline characterization and sensitivity, protection and cleanup priorities and implementation requirements, and impacts associated with cleanup operations. GRA

N80-22893# Woodard-Clyde Consultants, San Francisco, Calif.
MANUAL OF PRACTICE FOR PROTECTION AND CLEANUP OF SHORELINES. VOLUME 2: IMPLEMENTATION GUIDE Final Report, Apr. - Jul. 1979
Carl R. Foget, Eric Schrier, Martin Cramer, and Robert Castle
Aug. 1979 137 p 2 Vol.
(Contract EPA-68-03-2542)
(PB80-108848; EPA-600/7-79-187B) Avail: NTIS
HC A07/MF A01 CSCL 13B

Information required for the implementation of an effective response to an oil spill is considered. Specifically, information sources of oil spills and shoreline data are cited. Oil characteristics, behavior and movement of oil, shoreline characterization and sensitivity, protection and cleanup priorities and implementation requirements, and impacts associated with cleanup operations are included. GRA

N80-22894# SRI International Corp., Menlo Park, Calif.
SURVEY OF THE ROLE OF NOx IN NONURBAN OZONE FORMATION Final Report
J. R. Martinez and H. B. Singh Sep. 1979 156 p refs
(Contract EPA-68-02-2835)
(PB80-122815; EPA-450/4-79) Avail: NTIS
HC A08/MF A01 CSCL 04A

The role of oxides of nitrogen (NOx) in the formation of ozone (O3) in nonurban areas is summarized. A literature review, a survey of expert opinion, and analyses of field data are included. The results show that present knowledge about NOx/O3 interactions in nonurban areas is fragmentary, and that there is no direct quantitative description of the link between urban NOx and nonurban O3. A preliminary analysis of nine rural and suburban sites indicates that transport is the principal mechanism associated with ozone levels that exceed 100 ppb. The analysis further suggests that transport times of the order of six to eight hours are most likely to be associated with the high ozone observed at these sites. GRA

N80-22895# Battelle Columbus Labs., Ohio.
CRITERIA FOR ASSESSMENT OF ENVIRONMENTAL POLLUTANTS FROM COAL CLEANING PROCESSES Final Report, Sep. 1976 - Apr. 1979
R. A. Ewing, B. W. Cornaby, P. VanVoris, J. C. Zuck, and G. E. Raines 1979 202 p refs
(Contract EPA-68-02-2163)
(PB80-102791; EPA-600/7-79-140) Avail: NTIS
HC A10/MF A01 CSCL 06F

The development of criteria for assessing environmental pollutants associated with coal cleaning processes is described. The major criterion for ranking the importance of any pollutant is the relationship between its expected environmental concentration and the maximum concentration which presents no long-term hazard to humans or biota. Environmental concentrations depend on emission rates and the effects of physical transport and dispersion. GRA

N80-22896# Franklin Research Center, Philadelphia, Pa. Science Information Services Organization.
INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: ETHYLENE GLYCOL, PROPYLENE GLYCOLS AND BUTYLENE GLYCOLS Final Report
Lynne M. Miller 7 Mar. 1980 270 p refs
(Contract EPA-68-01-3893)
(PB80-109119; EPA-560/11-79-006) Avail: NTIS
HC A12/MF A01 CSCL 06F

Aspects of production, use, environmental exposure and biological effects of ethylene glycol, two isomers of propylene glycol (1,2-and 1,3-propanediol) and four isomers of butylene glycol (1,3- 1,4-, 2,3-, and 1,2-butanediol) are reviewed. The major source of environmental contamination by ethylene glycol and 1,2-propanediol is likely from the disposal of spent antifreeze and deicing fluids. However, limited monitoring data make it difficult to adequately assess environmental exposure to the glycols. The glycols are capable of being degraded by a variety of acclimated and unacclimated soil, water, and sewage microorganisms. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-22897 Florida State Univ., Tallahassee.
RELATIVISTIC GRAVITATION AND THE LARGE NUMBERS HYPOTHESIS Ph.D. Thesis
Roger Keith Parsons 1979 74 p
Avail: Univ. Microfilms Order No. 8008618

Dirac's modification of the Schwarzschild geometry is studied. This geometry represents the gravitational field of a point mass in a universe that expands in accordance with the large numbers hypothesis. It is shown that this geometry should be extended to include a region isometric to the Schwarzschild interior geometry and that free particles can enter this region in a finite proper time. Equations to determine the geometry for more general distributions of matter are proposed. It is shown that these equations are consistent with the large numbers hypothesis provided the interaction of the gravitational field with the spin one half particles in the universe is taken into account. Dissert. Abstr.

N80-22898 California Univ., Irvine.
A LABORATORY TEST OF THE INVERSE SQUARE LAW OF GRAVITY Ph.D. Thesis
Robert Evan Spero 1980 139 p
Avail: Univ. Microfilms Order No. 8008450

A laboratory test of the inverse square law of gravity was conducted. The almost null field inside a long precisely machined tube was probed by a test mass suspended from a torsion balance. In terms of a distance dependent gravitational constant G(r), the experiment is sensitive to variations in G(r) over the distance range of approximately 2 to 5 cm. Dissert. Abstr.

N80-22899 Northwestern Univ., Evanston, Ill.
THE RELATIONSHIP BETWEEN SEISMICITY AND CRUSTAL STRUCTURE IN THE WESTERN GREAT BASIN Ph.D. Thesis
Allen Hughes Cogbill, Jr. 1979 294 p
Avail: Univ. Microfilms Order No. 8007361

The possible relationships between the Nevada seismic zone and the anomalous seismicity and the crustal and upper mantle structure of the western Great Basin are examined. The data used are 16,629 gravity observations in the western Great Basin and relative teleseismic P wave delays measured by a local network near Mina, Nevada. The velocities inferred from the seismic refraction studies are converted to densities using newly derived density velocity relations for crustal rocks. Using crustal thicknesses and velocities inferred from refraction profiles as constraints, P wave delays and gravity anomalies in the Excelsior Mountains Region were used to infer that a zone of partially melted crustal or upper mantle material underlies the southwestern part of the region. Low wavenumber free air and Bouguer anomalies were compared to the corresponding low wavenumber topography to infer the isostatic balance of the western Great Basin. Dissert. Abstr.

N80-22900 State Univ. of New York at Stony Brook.
TOTAL NITROGEN CONTENT OF DEEP SEA BASALTS, WITH IMPLICATIONS FOR THE ORIGIN OF THE EARTH'S ATMOSPHERE Ph.D. Thesis
Thomas Lee Norris 1979 141 p
Avail: Univ. Microfilms Order No. 8009604

Various models have been suggested concerning the origin and evolution of the earth's atmosphere. An estimate of the nitrogen content of the mantle could further constrain atmospheric models. A variety of deep sea basalt glass and matrix and two USGS standard rock powders were studied. Total nitrogen content was determined by thermal neutron activation analysis via 14N(n,p)14C. The 14C was converted to carbon dioxide and counted in miniature low level proportional counters. The USGS standards do not give consistent nitrogen abundances between different laboratories. The abundances determined in this study were also not reproducible with other studies. The total nitrogen content from this work was G-2 with 44 + or - 4 ppm N and BCR-1 with 77 + or - 9 ppm N. 14C low temperature release patterns indicate these samples contain at least 30 percent of the total nitrogen bound near the surface. Dissert. Abstr.

N80-22901 Michigan Univ., Ann Arbor.
THE EVOLUTION OF OXYGEN AND OZONE IN THE EARTH'S ATMOSPHERE Ph.D. Thesis
James Fraser Kasting 1979 269 p
Avail: Univ. Microfilms Order No. 8007765

A one dimensional coupled flow photochemical model was used to examine different stages in the evolution of the terrestrial atmosphere. The amount of oxygen pressed in the prebiological atmosphere was calculated as a function of the volcanic outgassing rates of hydrogen and carbon monoxide and the rate of oxidation of the Earth's crust. The possibility that enhanced carbon dioxide levels may have kept the Earth's surface temperature above freezing in the face of decreased solar luminosity is discussed. Dissert. Abstr.

N80-22902 Princeton Univ., N. J.
THE CANONICAL FORMULATION OF SUPERGRAVITY AND THE QUANTIZATION OF THE ULTRALOCAL THEORY OF GRAVITY Ph.D. Thesis
Martin Lee Pilati 1979 125 p
Avail: Univ. Microfilms Order No. 8008567

The canonical formulation of supergravity and other geometrical, supersymmetric theories, are discussed. The Hamiltonian for supergravity and the spinning membrane are computed, and the possible usefulness of the Hamiltonian formalism for finding the underlying geometry is described. The quantization of the ultralocal theory of gravity is discussed. Dissert. Abstr.

N80-22903 California Univ., Los Angeles.
THE SCAVENGING OF ATMOSPHERIC TRACE GASES BY CLOUD DROPS AND SMALL RAINDROPS Ph.D. Thesis
Lal B. Baboolal 1979 227 p
Avail: Univ. Microfilms Order No. 8008456

The rate at which trace gases are removed from the atmosphere by falling cloud drops and small rain drops was investigated. The convective diffusion equation was solved for a trace gas diffusion through the atmosphere, onto and then into an initially solute free liquid drop falling at constant terminal velocity. Drops considered were of radii 8.6, 70.8, 142.3 and 305.5 micrometers. The convective diffusion equation was solved for zero flow, for the case of diffusion superimposed by Hadamard-Rybczynski flow inside the drop (HR-flow), and for the case of diffusion superimposed by the numerical solution to the complete Navier-Stokes equation of motion for incompressible flow. Dissert. Abstr.

N80-22904 Illinois Univ. at Urbana-Champaign.
WIND AND WAVE OBSERVATIONS IN THE MESOSPHERE USING COHERENT-SCATTER RADAR Ph.D. Thesis
Ian Douglas Countryman 1979 149 p
Avail: Univ. Microfilms Order No. 8009008

Measurements of backscattered signals from the mesosphere using the coherent scatter technique are reported. The multiheight, multidirectional wind measurements indicate that short period vertical velocity oscillations are usually evanescent vertically although propagating, reflected (trapped) modes are observed. Short period horizontal velocity oscillations are not consistently strong enough to be measurable for the pointing directions used. Tidal period horizontal winds are variable in amplitude and do not match theoretical predictions regarding uniform growth with height. Dissert. Abstr.

N80-22905 Oklahoma Univ., Norman.
MESOSCALE GRAVITY WAVES AS A POSSIBLE TRIGGER OF SEVERE CONVECTION ALONG A DRYLINE Ph.D. Thesis
Steven Edward Koch 1979 212 p
Avail: Univ. Microfilms Order No. 8008650

Perturbations in the surface moisture convergence field in the mesoscale environment along a dryline are shown to be manifestations of a wavelike mechanism responsible for triggering each of 11 severe storms. Mesonetwork data were analyzed and the following wave characteristics: horizontal phase speed C sub p = 22 m/s, median wavelength of 22 km, and mean periodicity of 17 min are discussed. Several hypotheses from classical hydrodynamic instability theory are considered as plausible explanations for the mesoscale disturbance. A cross spectral analysis of the data confirms the mesoanalytical estimates of the wave characteristics, and shows the waves to be confined to a region within 20 km of the dryline. Dissert. Abstr.

N80-22906 Utah Univ., Salt Lake City.
TOPOGRAPHICALLY INDUCED DIURNAL BOUNDARY LAYER OSCILLATIONS: TWO DIMENSIONAL SYNOPTIC SCALE MODELING Ph.D. Thesis
David Wilton McLawhorn 1979 185 p
Avail: Univ. Microfilms Order No. 8008411

A two dimensional boundary layer model is developed for the study of diurnal cycles in boundary layer convergence over synoptic scale sloping terrain and thermally inhomogeneous surfaces. To properly resolve the terrain configuration, a local terrain following coordinate system is developed. The local coordinate system has characteristics which are superior to the terrain following coordinate systems commonly used. Truncation errors are significantly reduced in the local system so variations in the flow field due to physical forcing are easily discernible from those due to truncation error. The model exhibits a sensitivity to lattitude though it is apparently not very sensitive to radiative flux divergence calculations. Dissert. Abstr.

N80-22907*# Old Dominion Univ. Research Foundation, Norfolk, Va.
THE CONTRIBUTION OF MOLECULAR RELAXATION IN NITROGEN TO THE ABSORPTION OF SOUND IN THE ATMOSPHERE Final Report
Allan J. Zuckerwar and Roger W. Meredith Apr. 1980 18 p refs
(Contract NsG-1324)
(NASA-CR-162928; PTR-80-4) Avail: NTIS HC A02/MF A01 CSCL 04A

Results and statistical analysis are presented for sound absorption in N2-H2O binary mixtures at room temperature. Experimental procedure, temperature effects, and preliminary results are presented for sound absorption in N2-H2O binary mixtures at elevated temperatures. E.D.K.

N80-22908*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
EARTH RADIATION BUDGET MEASUREMENTS FROM SATELLITES AND THEIR INTERPRETATION FOR CLIMATE MODELING AND STUDIES
Thomas H. VonderHaar, G. L. Stephens, and G. G. Campbell Apr. 1980 58 p refs
(Contract NAS1-15553)
(NASA-CR-159232) Avail: NTIS HC A04/MF A01 CSCL 04A

The annual and seasonal averaged Earth atmosphere radiation budgets derived from the most complete set of satellite observations available are presented. The budgets were derived from a composite of 48 monthly mean radiation budget maps. Annually and seasonally averaged radiation budgets are presented as global averages and zonal averages. The geographic distribution of the various radiation budget quantities is described. The annual cycle of the radiation budget was analyzed and the annual variability of net flux was shown to be largely dominated by the regular semi and annual cycles forced by external Earth-Sun geometry variations. Radiative transfer calculations were compared to the observed budget quantities and surface budgets were additionally computed with particular emphasis on discrepancies that exist between the present computations and previous surface budget estimates. R.E.S.

N80-22909# Purdue Univ., Lafayette, Ind. Dept. of Mathematical Sciences.
LATERAL BOUNDARY CONDITIONS FOR QUASISTEADY ATMOSPHERIC FLOWS Progress Report, 1 Jul. - 31 Dec. 1979
Paul Gordon 21 Dec. 1979 61 p refs
(Contract N00014-78-C-0308; NR Proj. 061-254)
(AD-A080199) Avail: NTIS HC A04/MF A01 CSCL 20/4

The quasisteady model is extended to include lateral boundary conditions. The approach is to first assume a well-posed complete time-dependent problem, including boundary conditions; it is stressed that to each boundary condition there should be associated a precise physical assumption. It is then shown that the quasisteady assumption can be applied consistently to both the partial differential equations and the boundary conditions, thereby obtaining a well-posed mathematical model with time scales suitable for large scale atmospheric flows. Three types of conditions are considered at the lateral boundaries: (1) outflow, (2) inflow (driven) velocity is specified and is essentially independent of the internal flow, (3) inflow (passive) - inflow is created primarily by the internal flow configuration. The upper boundary conditions include the two derived in an earlier paper, the continuous and discontinous boundary conditions, and a third condition, which is designed to allow the flow to propagate independently of the height of the region. Numerical solutions are obtained for various test cases, and convergence of the calculations is demonstrated. One sees that, although the calculations are reasonable, both from a mathematical and physical standpoint, the various calculations differ from each other very significantly, both qualitatively and quantitatively. It is suggested, therefore, that the process of specifying and evaluating boundary conditions will proceed more efficiently if more physical understanding is obtained in regard to relatively simple flows, such as a wave entering a stationary flow at a lateral boundary. GRA

N80-22910# SRI International Corp., Menlo Park, Calif.
ON THE SPATIAL RELATIONSHIP OF 1-METER EQUATORIAL SPREAD-F IRREGULARITIES AND PLASMA BUBBLES Topical Report, 15 Feb. - 1 Apr. 1979
Roland T. Tsunoda Apr. 1979 31 p refs
(Contract DNA001-79-C-0153; DNA Proj. I25AAXH)
(AD-A080549; DNA-4935T; AD-E300658; TP-2) Avail: NTIS HC A03/MF A01 CSCL 04/1

A radar experiment was conducted on 18 August 1978 at Kwajalein Atoll, Marshall Islands, to investigate the spatial relationship of 1 m equatorial spread-F irregularities to plasma bubbles (localized depletions in F-layer plasma density). East-west scans were made with ALTAIR, an incoherent-scatter radar, to spatially map (1) the backscatter produced by field-aligned irregularities, and (2) the electron-density distribution of the background F layer. Plasma bubbles were spatially mapped for the first time with an incoherent-scatter radar. By assuming invariance along the magnetic field lines (over distances of less than 100 km), we show that 1 m field-aligned irregularities are directly related to plasma bubbles. GRA

N80-22911# Hycor, Inc., Woburn, Mass.
HIGH ALTITUDE SMOKE PROGRAM (HASP-2) Final Report, 30 Apr. - 30 Sep. 1979
L. James Larson 26 Oct. 1979 14 p
(Contract F19628-79-C-0028; AF Proj. 6687)
(AD-A080964; AFGL-TR-79-0252) Avail: NTIS HC A02/MF A01 CSCL 19/1

A dispenser previously developed for high altitude (85,000 ft) release of smoke puffs in support of stratospheric turbulence studies was modified to incorporate direct thermal input to each launch tube. The modified dispenser was environmentally and functionally tested prior to delivery to Holloman AFB, N.M. for balloon test. The dispenser ejects six (6) smoke puff canisters containing equal weights of $TiCl_4$ and a 50/50 water-methanol mixture. GRA

N80-22912# California Univ., Livermore. Lawrence Livermore Lab.
SOURCES AND SINKS OF STRATOSPHERIC WATER VAPOR
H. W. Ellsaesser Nov. 1979 19 p refs Presented at NATO Advanced Study Inst. on Stratospheric Ozone, Aldeia das Acoteias, Algarve, Albufeira, Portugal 1-13 Oct. 1979
(Contract W-7405-eng-48)
(UCRL-83611) Avail: NTIS HC A02/MF A01

A tutorial review of the understanding of stratospheric H_2O and the processes controlling it is presented. Paradoxes posed by currently available observational data are cited and suggestions made as to how they might be resolved. Such resolution appears to require that the bulk of our current data provides unrepresentative and misleading vertical and latitudinal H_2O gradients immediately downstream from the tropical tropopause, and that there exists within the troposphere a mechanism different from or in addition to the tropical tropopause cold trap for driving air to the mixing ratios found in the lower stratosphere. Satisfaction of these requirements will reconcile much heretofore puzzling observational data and will obviate the necessity for a stratospheric sink for H_2O. DOE

N80-22913# Atomic Weapons Research Establishment, Aldermaston (England).
EARTHQUAKE FOCAL MECHANICS FROM RELATIVE AMPLITUDES OF P, pP AND sP: METHODS AND COMPUTER PROGRAM
R. G. Pearce London HMSO Aug. 1979 106 p refs
(AWRE-O-41/79; BR69944; ISBN-0-85518133-8) Avail: NTIS HC A06/MF A01; HMSO £2.50 PHI

A FORTRAN computer program which determines the orientation (with confidence limits) of an assumed double couple earthquake source given a series of teleseismically observed relative amplitudes, each of which relates the amplitudes of either P and pP, or P and sP, or pP and sP on one seismogram, is described. The use of the program is described with a description and explanation of the features and the input and output options. The program's range of applicability to various types of earthquake and seismogram is discussed. Author (ESA)

N80-22914# Danish Meteorological Inst., Copenhagen.
OCCURRENCES OF THE POLAR SLANT E CONDITION (SEC) AT NARSSARSSUAQ, GODHAVN, THULE, 1976
I. S. Primdahl 1977 46 p refs
(ISBN-87-7478-145-6) Avail: NTIS HC A03/MF A01

Tables of slant E condition (both certain and doubtful cases) scaled from the ionograms of Thule, Godhavn, and Narssarssuaq for the year 1976 are presented in the form of monthly data sheets. Author (ESA)

N80-22915# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
SOME RESULTS OF PRELIMINARY TESTS ABOUT THE CONTRAST VALUES SKY TO SEA (VISIBLE HORIZON) IN DEPENDENCE ON ENVIRONMENTAL PARAMETERS

Hans-Eberhard Hoffmann Mar. 1979 24 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-623)
(DFVLR-FB-79-10) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 5.10

The luminance of air and sea waters in the Baltic Sea was measured from a helicopter at heights of 15 m, 30 m, and 45 m. The measurements, which allowed a calculation of the contrast between air and sea as a function of various environmental parameters, are presented. The contrast was dependent on the angle between sunlight and measuring apparatus and on the height of the sea waves. Author (ESA)

N80-22916# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SOLAR TERRESTRIAL PREDICTIONS PROCEEDINGS, VOLUME 1. PREDICTION GROUP REPORTS
Richard E. Donnelly, ed. Aug. 1979 445 p refs Presented at the Intern. Solar-Terrest. Predictions and Workshop, Boulder, Colo., 23-27 Apr. 1979
(PB80-134588; NOAA-79112601-Vol-1) Avail: NTIS HC A19/MF A01 CSCL 04A

The current state-of-the-art of solar terrestrial predictions is reviewed. The applications and the future needs for solar-terrestrial predictions are discussed. GRA

N80-22917# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
A COMPARATIVE SYNOPSIS OF MODEL ATMOSPHERES FOR 1954, 1958, 1962 AND 1976 BELOW 47 KILOMETERS
Robert H. Cordella, Jr. and Jeanne M. Olore Aug. 1979 23 p refs
(PB80-137805; NOAA-TM-ERL-ARL-79; NOAA-79121202) Avail: NTIS HC A02/MF A01 CSCL 04A

A simple means of comparing atmospheric models to each other and to data records by reducing them to one equation for each parameter versus altitude is presented. Constants and variables are tabulated by year and a computer program for generating the dependent variables is included. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-22918 Columbia Univ., New York.
A STUDY OF ALMOST-INTRANSITIVITY AS A POSSIBLE CAUSE OF TERRESTRIAL CLIMATE CHANGES Ph.D. Thesis
Kaustubha Bhattacharya 1979 166 p
Avail: Univ. Microfilms Order No. 8008703

A simple one dimensional energy balance climate model was extended in several ways. The most important modification was the inclusion of a time-lag parameter into the albedo-parameterization. Time-dependent solutions for one version of the model exhibit Hopf bifurcation from a stable equilibrium to stable periodic oscillations as the time lag is increased. Other versions of the model exhibit Hopf bifurcation from a stable equilibrium to stable quasi-periodic oscillations with increase in the time lag. Both types of oscillation are characteristic of almost-intransitive behavior. The amplitude and period of the oscillations is comparable to that found in the geological record for glaciation cycles. Thus, it is shown that almost-intransitivity can be one of the causes for terrestrial climate change over a wide range of time scales, in particular for the glacial-interglacial transitions of the Pleistocene epoch. Dissert. Abstr.

N80-22919 Nevada Univ., Reno.
FINITE THEORY OF CLOUD DROPLET GROWTH BY CONDENSATION Ph.D. Thesis
Norman Francis Robinson 1979 120 p
Avail: Univ. Microfilms Order No. 8008368

A new growth rate formula (NGRF) is developed for the rate of growth of cloud droplets by condensation. The theory used is a modification of the Lees-Shankar theory in which the two stream Maxwellian distribution function of Lees is used in Maxwell's method of moments to determine the transport of water vapor to and heat away from the droplet. The conventional theory involving ordinary diffusion with a free molecular flow matching to the droplet surface is used to derive a refined conventional growth rate formula (RCGRF). Comparisons are given between NGRF, RCGRF, and the growth rate formula of Carstens and Carter. Dissert. Abstr.

N80-22920 Illinois Univ. at Urbana-Champaign.
A DIAGNOSTIC STUDY OF THE NONLINEAR EFFECTS OF TRANSIENT AND STATIONARY EDDIES ON THE WINTER MEAN CIRCULATION Ph.D. Thesis
Carl Edward Youngblut 1979 131 p
Avail: Univ. Microfilms Order No. 8009221

The nonlinear effects due to transient eddies and the self interactions of the stationary eddies are analyzed for the large-scale winter mean circulation, based on potential vorticity equation for the zonally asymmetric time averaged quasigeostrophic hydrostatic motions. Using the geopotential height for January 1963 the individual terms of the potential vorticity equation are evaluated. In order to estimate the role of the nonlinear effects in maintaining the stationary geopotential field, the same potential vorticity equation is solved for the geopotential by regarding these nonlinear terms as apparent sources. Since the diabatic heating term was not analyzed, an additional source was assumed as estimated from the residual of the potential vorticity equation, which may represent approximately the diabatic heating source. Using appropriate boundary conditions at the pole, the equator, the bottom surface and the top of the atmosphere, the geopotential solutions forced by the individual sources were numerically calculated and compared. Dissert. Abstr.

N80-22921 Oklahoma Univ., Norman.
THE USE OF THE FINITE ELEMENT METHOD IN METEOROLOGICAL MODELLING Ph.D. Thesis
John Dutton Warburton 1979 126 p
Avail: Univ. Microfilms Order No. 8008665

The ability of the finite element method to serve as the means of solving the equations which describe flow in the atmosphere is examined. The type of finite element approximation best suited for meteorological research is discussed. Five different finite elements using both linear and quadratic interpolation were tested in the space domain. The elements in order to determine the most accurate and efficient configuration. The concepts of lumped and consistent mass were examined and tested as were alternative methods of handling the computer implementation of the method. Dissert. Abstr.

N80-22922 Utah Univ., Salt Lake City.
LATENT HEAT INDUCED DIVERGENCE AND THE ULTRA-LONG WAVES OF THE SUBTROPICS AND MIDLATITUDES Ph.D. Thesis
Fred Parker Lewis 1979 280 p
Avail: Univ. Microfilms Order No. 8008339

Winter and summer Goddard Institute of Space Studies (GSS) data system test (DST) (prototype global atmospheric research project (GARP) data) time average fields are compared with several average data sets. An analysis of the GISS DST data involving kinematically and nonellipitcally computed divergent flow fields suggests that the positioning of the subtropical jets and ultra long waves (wavenumbers 1-3) may be partially in response to strong longitudinal variations in tropical convective heating. Experiments with divergent barotropic and two level primitive equation models were used to test the short (1-3 days) and long (15-30 days) range effects of large scale tropical heating patterns upon the subtropical and midlattitude long and ultra long waves and flow patterns. Two level primitive equation model experiments were conducted for the spherical earth with uniform mid and high lattitude net diabatic forcing. Long and short range tropical heating experiments with and without orography for mean Northern Hemisphere winter conditions were performed. Long and short range two level model tropical heating tests for the Southern Hemisphere winter in the presence of mountains were conducted. Dissert. Abstr.

N80-22923 Arizona State Univ., Tempe.
AN ANALYSIS OF PRECIPITATION PATTERNS AND TRENDS IN THE NORTH AMERICAN DESERT REGION Ph.D. Thesis
Harris Edward Williams 1979 344 p
Avail: Univ. Microfilms Order No. 8008586

Precipitation data for all stations with relatively long records (generally over 80 years) are analyzed in order to determine if there are any identifiable trends or cycles in the series. Regression analyses show that summer rainfall has been gradually increasing and that winter rainfall has been decreasing since about 1850. Autocorrelation of winter, summer, and annual rainfall values at selected long-term stations throughout the desert region shows that significant cycles exist in portions of the desert region at 80 to 90 years, 22 years, 4 to 6 years, and 2 year periods. Data are rank ordered and percentile values for each year are determined. The percentage of precipitation that falls in each season is determined to detect winter/summer dominance regimes. Annual, summer, and winter totals and summer/winter ratios of precipitation data are correlated with the double sunspot cycle. Dissert. Abstr.

N80-22924*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STRATCOM 8 EFFORT
Edith I. Reed, ed. Apr. 1980 221 p refs
(NASA-TP-1640) Avail: NTIS HC A10/MF A01 CSCL 04B

The ozone-nitrogen oxides ultraviolent flux interactions were investigated to obtain data on stratospheric photochemistry. The balloon, rocket, and aircraft operations are described along with the instruments, parameter measurements, and payloads. F.O.S.

N80-22925*# Radio Sciences Co., Melbourne, Fla.
SOLAR TERRESTRIAL RELATIONSHIPS RELATED TO THUNDERSTORMS AND BUV DARK CURRENT AND OZONE DATA Final Report, Jul. - Dec. 1979
John R. Herman 25 Jan. 1980 54 p refs
(NAS5-25663)
(NASA-CR-159957; RSCR-80-1) Avail: NTIS HC A04/MF A01 CSCL 04B

Solar terrestrial interactions as they affect Nimbus 4 BUV dark current and possibly affect thunderstorm occurrence are investigated. A solar wind index is calculated for 1970 to 1971. Dark current enhancements appear to be associated in some way with solar proton events and the solar wind index, but additional investigations by GSFC are required before conclusions can be drawn. Superposed epoch analysis of an index of North American thunderstorm occurrence reveals a discernible increase in the index magnitude on days 1 and 2 following solar proton events. There appears to be little or no 27 day recurrence tendency in thunderstorm occurrence frequency and no association with vorticity area index on a day to day basis. Author

N80-22926# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SUPPRESSION OF RIVER ICE BY THERMAL EFFLUENTS
George D. Ashton Dec. 1979 30 p refs
(AD-A080654; CRREL-79-30) Avail: NTIS HC A03/MF A01 CSCL 08/12

The ice suppression resulting from discharge of warm water into rivers during winter is analyzed with emphasis on two different cases. In Part 1 the case of a thermal effluent fully mixed across the flow section is analyzed to include the effects of unsteadiness in the effluent temperature and the meteorological variations. The location of the ice edge is determined either by a 0 C water temperature criterion or an equilibrium ice melting analysis. The choice of the applicable criterion emerges naturally from the analysis even though the location of the ice edge may be considerably different when a steady-state analysis is done. In Part 2 the case of a side discharge of heated effluent is analyzed, also in an unsteady manner, and the effects of transverse dispersion are included in the analysis. Comparisons are made in both Parts 1 and 2 to limited field data that are available. GRA

N80-22927# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MARKOV SIMULATIONS OF ONE-AND TWO-DIMENSIONAL WEATHER DATA BASES M.S. Thesis
Steven R. Schroeder Dec. 1979 182 p refs
(AD-A080217; AFIT/GOR/MA/79D-9) Avail: NTIS HC A09/MF A01 CSCL 04/2

In many cases, weather is only one of many inputs to a simulation model, so a realistic but simple weather simulation method should be included in the model. This paper has three major areas of concern: (1) a fairly extensive review of applications of one dimensional Markov and semi-Markov chains to weather data simulations, (2) a consideration of factors involved in and methods that are appropriate for extending Markov concepts to simulating gridded data in two or more dimensions, and (3) evaluation of the proposed methods in terms of realism and simplicity of application. A discussion of the general characteristics of real weather variables and observed weather data in the context of simulating weather as a stochastic process is also given. The data base used for the example consisted of gridded weekly maps of temperature departures from normal in an area of the United States. For most analyses, the data was converted to five states, from state 1 (coldest) to state 5 (warmest). In the real data, it was rare to have an occurrence of unequal and nonconsecutive states in adjacent grid points. Such occurrences were called 'unusual transitions', and one criterion for evaluating the realism of a weather simulation scheme was the frequency of generating such transitions. GRA

N80-22928# Stanford Univ., Calif. Stanford Electronics Lab.
RAPID-SCANNING MEASUREMENTS OF WIND-PRODUCED DOPPLER ON AN ASYMMETRICAL MICROWAVE TRANSHORIZON PROPAGATION PATH
Ronald Douglas Fleming Jun. 1979 143 p refs
(Contract N00014-75-C-0601)
(AD-A080592; SU-SEL-79-016; TR-4504-1) Avail: NTIS HC A07/MF A01 CSCL 04/2

Conventional methods for monitoring winds aloft have inherent spatial and/or temporal limitations that severely restrict their usefulness. An alternate solution is the use of transhorizon bistatic radio techniques. By using a phase-coherent system with some form of beam-swinging capability, it is possible to measure the wind-produced Doppler shifts associated with moving off-path scatterers. In this experiment a rapid data-gathering system is used to remotely probe the wind-field velocity structure in the common volume region of a 164 km transhorizon propagation path. The phase-stable system operates at 3.2 GHz and employs a 12 element horizontal receiving antenna array. The amplitudes and relative phases of the output signals from the individual elements are sequentially sampled and recorded at a 40 Hz rate. Off-line processing of the amplitude and phase data samples is used to 'scan' in azimuth a 0.3 deg wide fan beam through a 3.88 deg sector and to obtain virtual simultaneous Doppler spectra measurements at a continuum of angles within the sector scanned. An algorithm developed to identify the apparent source direction of each spectral component permits an appropriate weighting to be applied to the spectra on the basis of angle-of-arrival. The average Doppler shift (spectrum centroid) as a function of the array pointing angle is interpreted in terms of the average transverse wind speed and direction. GRA

N80-22929# University of Central Florida, Orlando. Dept. of Mathematics and Statistics.
STOCHASTIC MODELING OF CLIMATIC PROBABILITIES Final Report, 1 Jun. 1977 - 31 Aug. 1979
Paul N. Somerville and Steven J. Bean Hanscom AFB, Mass. AFGL Nov. 1979 22 p refs
(Contract F19628-77-C-0080; AF Proj. 6670)
(AD-A080559; AFGL-TR-79-0222) Avail: NTIS HC A02/MF A01 CSCL 04/2

This report summarizes the work done in the past two years in the Stochastic Modeling of Climatic Probabilities of weather events. Models are presented for visibility, windspeed, skycover, rainfall and ceiling. The models were each applied to more than twenty stations. GRA

N80-22930# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
FOG EVOLUTION IN THE VISIBLE AND INFRARED

SPECTRAL REGIONS AND ITS MEANING IN OPTICAL MODELING Research and Development Report
Richard D. H. Low Dec. 1979 59 p refs
(DA Proj. 1L1-61101-AH-71)
(AD-A080352; ERADCOM/ASL-TR-0046) Avail: NTIS HC A04/MF A01 CSCL 04/2

For the first time in the field of cloud physics, high-density fog drop-size data from the time near fog formation through the time near fog dissipation became available at 5 minute intervals from field measurements carried out at Meppen, Germany, on 3-4 March 1978. The fog was believed to have been brought about by frontal passage. Extinction coefficients in the 0.55 micrometers, 3.80 micrometers, and 10.6 micrometers spectral regions were calculated from the measured drop-size distributions and plotted as a function of time to depict optical evolution of the fog. Such spectral evolution in relation to fog microphysical evolution was examined in detail to attempt to formulate optical models or scaling laws for electro-optical sensors applications. A cursory comparison was made with the California advection and radiation-advection fogs observed at Fort Ord on 3 and 9 May 1978, respectively, because the available data portrayed only portions of their life cycles. Because of their low liquid water contents and high number concentration, the haze regimes in these fogs played a dominant role in 'messing up' spectral transmission in the 0.55 micrometers, and 3.80 micrometers regions, usually during the phase of fog formation. In the final analysis, the choice of a particular or a general model or scaling law should be dictated by the sensitivities and requirements of the electro-optical sensors to be deployed. GRA

N80-22931# European Space Agency, Paris (France).
NEW APPROXIMATE EQUATIONS FOR THE SATURATION PRESSURE OF WATER VAPOR AND FOR HUMIDITY PARAMETERS USED IN METEOROLOGY
Werner Boegel Jan. 1979 158 p refs Transl. into ENGLISH of "Neue Naeherungsgleichungen fuer den Saettigungsdruck des Wasserdampfes und fuer die in der Meteorologie Gebraeuchlichen Luftfeuchte-Parameter", Rept. DLR-FB-77-52 DFVLR, Oberpfaffen, West Germany, Oct. 1977 Original report in GERMAN previously announced as X79-72011
(ESA-TT-509; DLR-FB-77-52) Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 61.60

Approximate equations for the saturation pressure of water vapor in the pure as a function of temperature, for the corresponding inverse functions, and for some real-gas correction factors, based on the Goff-Gratch formulation were developed because the Groff-Gratch formulation of the thermodynamic properties of moist air, used by the World Meteorological Organization (WMO) as a basis for the calculation of humidity parameters, is often too complicated for direct applications. These amplified equations are used to establish methods for calculating the most important humidity parameters, e.g. dew-point temperature, relative humidity, mixing ratio etc. These methods, consisting for the most part of simple formulae, are tailored for meteorological applications, without assuming perfect gases. Author (ESA)

N80-22932# World Meteorological Organization, Geneva (Switzerland).
QUANTITATIVE METEOROLOGICAL DATA FROM SATELLITES
Christopher M. Hayden, Lester F. Hubert, E. Paul McClain, and Robert S. Seaman 1979 114 p refs Original contains color illustrations
(WMO-531; ISBN-92-63-10531-6) Avail: NTIS HC A06/MF A01; WMO, Geneva SWFR 20

The major quantitative information available from meteorological satellite measurements on a regular basis is discussed. Remote soundings of atmospheric temperature and moisture, winds derived from cloud motions observed by geostationary satellites, and Earth surface temperature are included. The application of quantitative satellite data (principally remote temperature soundings) in numerical weather analysis and prediction is also covered. Topics covered include: basic theory behind these quantitative measurements; problems and procedures involved in arriving at useful quantitative results and in applying the data; assessments of the quality of the derived quantities; and illustrations of the various types of data produced. Author (ESA)

N80-22933# Physics Lab. RVO-TNO, The Hague (Netherlands).
AEROSOL MEASUREMENTS DURING SPRING 1978: THEIR SIZE DISTRIBUTIONS AND OPTICAL PROPERTIES IN VISIBLE AND INFRARED WAVELENGTH REGIONS
M. J. M. vandeVen Oct. 1978 102 p refs
(PHL-1978-41; TDCK-71515) Avail: NTIS HC A06/MF A01

Daily aerosol measurements performed north of the Hague are described. The majority of the aerosol spectra, with sizes between 0.163 and 18 micrometers, appear to be composed of a superposition of a continental and a maritime aerosol. The optical properties of the aerosols are investigated also, by a monostatic Mie-lidar at 1.06 micrometers. The resulting extinction and backscatter are compared with the values of these scattering parameters calculated from Mie theory. There is good agreement for the extinction at visibilities beyond one kilometer. Foggy weather shows a much higher value for the extinction coefficient as calculated from Mie theory. The backscatter is about a factor of five larger for Mie theory. For 0.55, 0.6943, 5.0 and 10.6 micrometers the same parameters were calculated in order to give an idea about spectral behavior of the sampled aerosols. Author (ESA)

N80-22934# Physics Lab. RVO-TNO, The Hague (Netherlands).
MOVING PRECIPITATION CLUTTER SUPPRESSION FOR FUCAS
H. F. A. Roefs Jan. 1979 27 p refs
(PHL-1979-02; TDCK-71721) Avail: NTIS HC A03/MF A01

The implementation of a rainclutter suppression system in pulse radar systems such as FUCAS is discussed. Using a simplified rainclutter model, the minimum required clutter suppression as a function of the slant range is determined. It is shown that a set of 5 pulse cancellers provides sufficient clutter suppression for rainfall rates up to 3.5 mm/h. Author (ESA)

N80-22935# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
OPTICAL AND ATMOSPHERIC OPTICAL PARAMETERS DURING VISIBILITY TESTS IN NORTHERN GERMANY, 1977
Hans-Eberhard Hoffmann Juni 1979 94 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-615)
(DFVLR-MITT-79-06) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 15

Measurements of the inherent contrast of a 1.5 ton truck and a minesweeper were carried out using a photometer mounted in a helicopter. The results of the measurements are presented in diagrams and tables as a function of the background, the illumination of the target region, the angle of elevation, the time of day, the angle of azimuth, and the degree of cloud cover. Author (ESA)

N80-22936# World Meteorological Organization, Geneva (Switzerland). Global Atmospheric Research Programme.
NUMERICAL METHODS USED IN ATMOSPHERIC MODELS, VOLUME 2
Sep. 1979 508 p refs Prepared in cooperation with International Council of Scientific Unions, Rome, Italy
(GARP-Publ-17-Vol-2) Avail: NTIS HC A22/MF A01

A description of numerical methods applicable to atmospheric models is presented, including vertical coordinates and related discretization, difference approximations for fluid flow on a sphere, the spectral method, the pseudospectral method, the finite element method, difference approximations to quasi-geostrophic models, computational problems related to limited-area modeling, the semi-implicit method, phase speed errors due to various time differencing schemes, and nonlinear stability. Author (ESA)

N80-22937# World Meteorological Organization, Geneva (Switzerland).
BASIC SYNOPTIC NETWORKS OF OBSERVING STATIONS
1979 500 p In ENGLISH and FRENCH
(WMO-217) Avail: NTIS HC A21/MF A01

A directory is presented of the regional basic synoptic networks for each of the six WMO regions with a separate section devoted to the basic network for the Antarctic. Each section describes the state of implementation of the basic network and plans for elimination of deficiencies for each country. The stations in each country within a region are identified by an index number, and the surface and upper air observations made by each station given. Author (ESA)

N80-22938# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: GLOBAL OBSERVING SYSTEM-SATELLITE SUB-SYSTEM. INFORMATION ON THE APPLICATION OF METEOROLOGICAL SATELLITE DATA IN ROUTINE OPERATIONS AND RESEARCH: ABSTRACTS, ANNUAL SUMMARIES AND BIBLIOGRAPHIES
1979 158 p refs
(WMO-475) Avail: NTIS HC A08/MF A01

The titles, abstracts and other relevant information for 59 papers contributed by 14 nations to the World Weather Watch-Global observing system program are presented, in relation to meteorological satellite data applications. Author (ESA)

N80-22939# National Technical Information Service, Springfield, Va.
WIND SHEAR, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Nov. 1979
Guy E. Habercom, Jr. Dec. 1979 196 p Supersedes NTIS/PS-78/1315; NTIS/PS-77/-1172; NTIS/PS-76/1040; NTIS/PS-75/874
(PB80-802986; NTIS/PS-78/1315) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

The phenomena of wind shear effects in various environments are investigated. Aircraft, spacecraft launchings, atmospheric turbulence, and air water interactions are among the areas reviewed. This updated bibliography contains 189 abstracts, 44 of which are new entries to the previous edition. GRA

N80-22940# National Technical Information Service, Springfield, Va.
WIND SHEAR. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979
Guy E. Habercom, Jr. Dec. 1979 168 p Supersedes NTIS/PS-78/1316; NTIS/PS-77/1173; NTIS/PS-76/1041
(PB80-802994; NTIS/PS-78/1316; NTIS/PS-77/1173; NTIS/PS-76/1041) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

The phenomena of wind shear effects on aircraft, spacecraft launchings, atmospheric turbulence, and air/water interactions are reviewed. This updated bibliography contains 162 abstracts, 21 of which are new entries to the previous edition. GRA

N80-22941# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
NUMERICAL MODELING OF BUOYANT PLUMES IN A TURBULENT, STRATIFIED ATMOSPHERE
Ralph G. Bennett and Michael W. Golay Jan. 1979 236 p refs Sponsored in part by Consolidated Edison Co. of New York, Inc., and Northeast Utilities Service Corp.
(PB80-118953; MIT-EL-79-002) Avail: NTIS HC A11/MF A01 CSCL 04B

A computational model of buoyant, bent plumes in realistic atmospheres is presented. The model, constructed using numerically integrated two dimensional, time dependent fluid mechanics equations and a number of physical approximations is described. The ability of the model to reproduce the solutions to problems that are known is demonstrated. GRA

N80-22942# Colorado State Univ. Fort Collins. Dept. of Atmospheric Science.
SATELLITE STUDIES DURING THE 1976 - 1977, 1977 - 1978 SIERRA COOPERATIVE PILOT PROJECT Final Report, 2 Dec. 1975 - 30 Sep. 1978
K. Robert Morris, David W. Reynolds, and Thomas H. VonderHaar Feb. 1979 97 p refs
(Contract DI-6-07-DR-20020)
(PB80-126303) Avail: NTIS HC A05/MF A01 CSCL 04B

Digital satellite data from the SMS-2 geostationary satellite were analyzed for the 1976-77 and 1977-78 seasons of the Sierra cooperative pilot project. Temporal variations in cloud top temperatures for five case storms are presented. Three storms types and associated synoptic conditions defined by the satellite viewed cloud types are discussed. Mesoscale features and their precipitation effects are examined. GRA

N80-22943# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
DATA REPORT ON MEASUREMENTS OF PRECIPITABLE WATER VAPOR AND CLOUD LIQUID AT FORT SILL, OKLAHOMA, SESAME 1979
F. O. Guiraud, J. Howard, and D. C. Hogg Oct. 1979 87 p ref
(PB80-133762; NOAA-DR-ERL-WPL-2; NOAA-79121207) Avail: NTIS HC A05/MF A01 CSCL 04B

A two channel microwave radiometer was operated from March 29, 1979 to June 8, 1979 for the measurement of precipitable water vapor as part of the 1979 Severe Environmental Storms and Mesoscale Experiment (SESAME) program. The radiometers were located on the Fort Sill military base at Lawton, OK, approximately 140 miles southwest of Norman, OK, to provide a continuous monitor of total precipitable water vapor as it flows from the Gulf of Mexico into the SESAME monitoring area. The summaries of the measurements of precipitable water vapor, and condensed water (cloud liquid and rain), along with vapor measurements obtained from radiosonde measurements at Fort Sill and Oklahoma City, OK are presented. Rainfall summaries obtained toward the end of the measurement period when a rain gauge was installed at the radiometer site are included. GRA

N80-22944# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
MEASURES OF INHOMOGENEITY OF AEROSOLS
V. E. Derr, G. M. Lerfald, and M. J. Post Sep. 1979 101 p refs
(PB80-133770; NOAA-TM-ERL-WPL-38; NOAA-79121206) Avail: NTIS HC A06/MF A01 CSCL 04B

The use of laser illuminators which reflect from aerosol inhomogeneities and measure their time of passage over a known distance is considered. The configuration is also called transit time lidar. The principal potential advantage of the eddy correlation technique is obtaining transverse wind velocity measurements, i.e., the velocity perpendicular to the beam, contrary to Doppler techniques which can measure only velocity components lying in the direction of the radiation beam. GRA

N80-22945# National Center for Atmospheric Research, Boulder, Colo. Convective Storms Div.
A PROGRAM PROSPECTUS FOR A COOPERATIVE HIGH PLAINS EXPERIMENT ON CONVECTIVE PRECIPITATION
Oct. 1979 45 p Prepared in cooperation with the Bureau of Reclamation, Washington, D.C.
(Grant NSF ATM-77-23757)
(PB80-122302; NCAR/TN-145/PPR) Avail: NTIS HC A03/MF A01 CSCL 04B

The program prospectus for cooperative 1981 field season in Montana is discussed. The scientific objectives, the equipment used, and the organizational aspects of the program are described. GRA

N80-22946# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
A SUMMARY OF RECENT ATMOSPHERIC DIFFUSION EXPERIMENTS
Roland Draxler Apr. 1979 39 p refs
(PB80-111396; NOAA-TM-ERL-ARL-78; NOAA-79092603) Avail: NTIS HC A03/MF A01 CSCL 04B

Diffusion experiments conducted in areas with complex topography or meteorology such as near shoreline environments, over rough and complex terrain, above and within forest canopies, and over urban areas are described. Experiments designed to investigate dispersion under low wind speed conditions, and the processes of transport and dispersion over long distances are discussed. The results in each category are discussed and the dispersion data are illustrated in a summary diagram. The

dispersion data are compared to calculated values from predictive methods developed for homogeneous terrain. GRA

N80-22947# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
AN OCEAN CLIMATE RESEARCH PLAN
J. O. Fletcher Aug. 1979 58 p refs
(PB80-112873; NOAA-79092106) Avail: NTIS
HC A04/MF A01 CSCL 04B

The rational and a recommended plan for a research program on the oceanic processes that underlie the dynamics of the global climate and its variability are presented. The role of the program in identifying the processes responsible for year to year climate change is discussed. The application of the program's results towards developing conceptual and numerical models for use in the simulation and prediction of climate is outlined. A.W.H.

N80-22948# National Hurricane and Experimental Meteorology Lab., Boulder, Colo.
SATELLITE ESTIMATED RAINFALL IN GATE
William L. Woodley, Cecilia G. Griffith, Joseph S. Griffin, and Scott C. Tromatt Sep. 1979 63 p refs
(PB80-131402; NOAA-TM-ERL-NHEML-8; NOAA-79121204)
Avail: NTIS HC A04/MF A01 CSCL 04B

Quantitative precipitation estimates were made for the GARP Atlantic tropical experiment from geosynchronous, infrared satellite imagery and a computer automated technique which is described. The satellite generated 8 scale rainfall patterning is similar to, and the rain volumes are within 10% of those provided by radar. Superposition of the satellite generated rainfall maps and sea surface temperature maps by phase is discussed. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-22949*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH ENERGY BENTHIC BOUNDARY LAYER EXPERIMENT (HEBBLE): PRELIMINARY PROGRAM PLAN AND CONCEPTUAL DESIGN
Kent Frewing 15 Feb. 1980 94 p refs Sponsored in part by ONR
(Contract NAS7-100)
(NASA-CR-163003; JPL-Pub-80-2) Avail: NTIS
HC A05/MF A01 CSCL 08C

Deep sea processes of flow-sediment interaction, particularly the role of high energy ocean bottom current events in forming the seafloor topography, transporting material, and mixing the bottom of the water column are examined. A series of observations at and near the sea bottom, in water depths of 4 to 5 km, in areas of the western North Atlantic where high energy current events occur, include site surveys and physical reconnaissance to identify suitable areas and positions, and one or more six month experiments to investigate temporal and spatial variations of high energy events within the boundary layer and their interaction with the seabed. Descriptions of proposed HEBBLE activities are included, with emphasis on technology transfer to the oceanographic community through design, fabrication, testing, and operation of an instrumented ocean bottom lander. E.D.K.

N80-22950# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Numerical Modeling Div.
THE NORDA/FLENUMOCEANCEN THERMODYNAMICAL OCEAN PREDICTION SYSTEM (TOPS): A TECHNICAL DESCRIPTION
R. Michael Clancy and Paul J. Martin Nov. 1979 34 p refs
(AD-A080248; NORDA-TN-54) Avail: NTIS
HC A03/MF A01 CSCL 08/10

The Thermodynamical Ocean Prediction System (TOPS) is a general and flexible software framework for operational implementation of upper ocean forecast models at Fleet Numerical Oceanography Center (FLENUMOCEANCEN), Monterey, California. It was developed by NORDA Code 322 as a part of the Navy's Automated Environmental Prediction System (AEPS). TOPS is fully interfaced with the FLENUMOCEANCEN operational data base and meets all FLENUMOCEANCEN programming standards for operational programs. This technical note discusses the uses for TOPS, provides documentation of the physics currently represented in the system, indicates probable future developments, and briefly addresses the problem of forecast verification. GRA

N80-22951# Metallgesellschaft, A.G., Frankfurt am Main (West Germany). Chemisches Lab./Analytik.
ANALYTICAL INVESTIGATION OF THE GROWTH LAYERS OF PACIFIC OCEAN MANGANESE NODULES ON A SEMI-MICRO SCALE Final Report
Hans-Martin Lueschow Dec. 1978 44 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-M-78-04) Avail: NTIS HC A03/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 9.25

X-ray fluorescence analysis was used to examine the chemical composition of manganese nodules from the Pacific Ocean floor. Nodules found close to each other were significantly different in the structure of their various layers. Conclusions pertaining to the origin of the nodules are discussed. Author (ESA)

N80-22952# National Geodetic Survey, Rockville, Md.
GRAVIMETRIC TIDAL LOADING COMPUTED FROM INTEGRATED GREEN'S FUNCTIONS
Clyde C. Goad Oct. 1979 23 p refs
(PB80-128903; NOAA-TM-NOS-NGS-22; NOAA-79113002)
Avail: NTIS HC A02/MF A01 CSCL 08E

A method of predicting the effects of ocean tides on geodetic measurements using integrals of Green's functions with the desired ocean tide model is presented. Predictions are presented to the loading effects on Earth tide gravimeter measurements using a global M2 ocean tide model. Calculations for loading effects on tidal gravity data available for western Europe are confirmed to an accuracy of plus or minus 0.2 microgal for most sites. GRA

N80-22953# National Geodetic Survey, Rockville, Md.
GEODETIC LEVELING AND THE SEA LEVEL SLOPE ALONG THE CALIFORNIA COAST
Emery I. Balazs and Bruce C. Douglas Sep. 1979 27 p refs
(PB80-120611; NOAA-TM-NOS-NGS-20; NOAA-79102402)
Avail: NTIS HC A03/MF A01 CSCL 08F

Leveling surveys performed between the San Francisco and San Pedro tide stations for the epochs 1968-69, 1968-71, 1971-72 1973-75, and 1977-78 are discussed. The observed elevations at these tide stations are compared to mean sea levels of the 1941-59 epoch. The data indicates that San Pedro is rising with respect to San Francisco or that San Francisco is subsiding with respect to San Pedro at an average rate of about 70 mm/yr. A large discrepancy between relative movement rates from repeat leveling and tidal observations is examined. Computations of elevation difference are presented. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-22954 Illinois Univ. at Urbana-Champaign.
INACTIVATION OF ENTEROVIRUSES BY OZONE Ph.D. Thesis
Dipak Roy 1979 137 p
Avail: Univ. Microfilms Order No. 8009151

The kinetics of inactivation of enteroviruses was studied to a continuous flow, constant temperature reactor. Poliovirus 1 (Mahoney) was used as a model enteroviruses to study the mechanism of inactivation and to evaluate the effects of different environmental parameters on the kinetics of inactivation. Virus survival curves under all experimental conditions were observed to follow a similar pattern; a rapid rate of inactivation for the initial period followed by a slow rate of inactivation. The all or none effect, previously associated with ozone disinfection, was markedly absent. The survival curves did not follow single order

kinetics; it is believed that the inherent nature of the virus may be responsible for this observation. Dissert. Abstr.

N80-22955*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF AUDIO-VISUAL STIMULATION ON THE INCIDENCE OF RESTRAINT ULCERS ON THE WISTAR RAT
M. S. Martin, F. Martin, and R. Lambert Dec. 1979 7 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol., v. 164, no. 8/9, 1970 p 1748-1750 Original document announced as N80-19748 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75950) Avail: NTIS HC A02/MF A01 CSCL 06C

The role of sensory simulation in restrained rats was investigated. Both mixed audio-visual and pure sound stimuli, ineffective in themselves, were found to cause a significant increase in the incidence of restraint ulcers in the Wistar Rat. R.E.S.

N80-22956*# National Aeronautics and Space Administration, Washington, D. C.
ROLE OF ADRENALS IN THE MOBILIZATION OF CARBOHYDRATE AND FAT RESOURCES AFTER OVERSTIMULATION OF RATS
G. G. Khechninashvili Jan. 1980 13 p refs Transl. into ENGLISH FROM Farmakol. Toksikol. (USSR), v. 35, no. 5, 1972 p 575-580 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Acad. of Med. Sci., Leningrad
(Contract NASw-3198)
(NASA-TM-75974) Avail: NTIS HC A02/MF A01 CSCL 06C

The role of the cortical and cerebral layers of the adrenal glands in mobilizing carbohydrate and fatty resources in response to the effect of an extreme stimulant was investigated. It is shown that following adrenodemedullation and adrenalectomy, the leading role is played by the secretion of the adrenal medullary layer, whereas the role of suprarenals in the mobilization of fats is only slightly pronounced. R.C.T.

N80-22957*# National Aeronautics and Space Administration, Washington, D. C.
STATE OF THE MITRAL VALVE IN RABBITS WITH HYPOKINESIA
V. Ye. Strelkovska Dec. 1979 7 p refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr. RSR, Ser. Geol., Khim. Biol. Nauky, V. 36, no. 1, 1974 p 72-75 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76003) Avail: NTIS HC A02/MF A01 CSCL 06C

In hypokinesia, edema of all the layers of the mitral value was observed, which resulted in morphological changes of the cellular and noncellular components. An increase in ratio of elastic and collagenic fibers in the value was also observed along with and changes in their structural and staining properties. The observed changes can limit valve mobility and can result in manifestations of cardiac valve insufficiency, which is found clinically. R.E.S.

N80-22958*# National Aeronautics and Space Administration, Washington, D. C.
ANIMAL EXPERIMENTAL RESEARCH ON MICROSTRUCTURAL BEHAVIOR ON THE HYALINE ARTHROIDAL CARTILAGE AFTER IMMOBILIZATION AND REMOBILIZATION
H. J. Refior 3 Feb. 1980 6 p refs Transl. into ENGLISH from Langenbecks Archmany Fuer Chirugie (West Germany), 1976 p 296-298 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76050) Avail: NTIS HC A02/MF A01 CSCL 06C

The degeneration of the articular cartilage after a period of immobilization was investigated. The experiment was carried out by the immobilization of the knee joints of rabbits. Even after remobilization there was an increase in the alterations. These changes did not prove to be reversible. R.C.T.

N80-22959*# National Aeronautics and Space Administration, Washington, D. C.
INCORPORATION OF GLYCINE-2-C-14 IN ACID-INSOLUBLE PROTEINS OF RAT BONES AND TEETH DURING HYPOKINESIA AND ADMINISTRATION OF THYROCALCITONINE
A. I. Volozhin, L. I. Stekolnikov, N. N. Uglova, and V. Ye. Potkin Dec. 1979 8 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 37, no. 2, 1974, p 223-226 Original language document was announced as A72-40432 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75981) Avail: NTIS HC A02/MF A01

A forced limitation of the motor activity in rats (from 5 to 60 days) results in reduced incorporation of glycine 2-C14 in the total acid insoluble proteins of limb bones and its increase in the teeth and mandibular-maxillary bones. Daily administration of five micrograms of thyrocalcitonine together with polyvinylpyrrolidone normalizes the protein metabolism in the bone tissues during the 40 days of experimentation. E.D.K.

N80-22960*# National Aeronautics and Space Administration, Washington, D. C.
THE ULCEROGENIC EFFECT OF BILE AND BILE ACID IN RATS DURING IMMOBILIZATION STRESS
J. Weisener Feb. 1980 14 p refs Transl. into ENGLISH from Z. Gastroenterol. (West Germany), v. 12, no. 7, 1974 p 539-546 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76054) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of different concentrations of oxen bile and individual bile acids or their sodium salts on the gastric mucosa of rats was investigated in combination with immobilization stress. A statistically significant higher frequency of ulcers was only determined in the application of 10% oxen bile. Dosages on 10% sodium glycocholic acid demonstrated strong toxic damage with atonic dilation of the stomach and extensive mucosal bleeding. R.E.S.

N80-22961*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF PROLONGED HYPODYNAMIA ON CERTAIN PHYSIOLOGICAL FUNCTIONS IN DOGS
B. R. Yaremenko Dec. 1979 8 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), v. 14, no. 6, Nov. - Dec. 1970 p 10-13 Translation was announced as N74-19752 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75979) Avail: NTIS HC A02/MF A01

The behavior of 20 dogs whose mobility was restricted was experimentally investigated. Their reactions to hypodynamia were either active behavior or progressive general depression and increased muscular weakness. Arterial pressure, pressor sinocarotid reflex valve, body weight, pulse rate, body temperature, and plasma cholinesterase activity were monitered for 28 days. Results are reported. E.D.K.

N80-22962*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF RESTRAINING ON THE HEART RATE IN GUINEA PIGS
H. Mikiskova Jan. 1980 12 p refs Transl. into ENGLISH from Activ. Nerv Super/ (Czech.), v. 10, no. 4, 1968 p 382-388 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76006) Avail: NTIS HC A02/MF A01 CSCL 06C

The emotional effect of different applications of electrodes and the fixation for cariographic examination was investigated using guinea pigs. The effect of the stress is discussed in terms of heart rhythm and behavior. R.E.S.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-22963* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 205
Apr. 1980 68 p
(NASA-SP-7011(205)) Avail: NTIS HC$7.00 CSCL 06E

This bibliography lists 212 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1980. Author

N80-22964 State Univ. of New York at Stony Brook.
MULTIVARIATE ANALYSIS OF PHYSIOLOGICAL RESPONSE TO ENVIRONMENTAL STRESS Ph.D. Thesis
Edith Alker Zang 1979 396 p
Avail: Univ. Microfilms Order No. 8007325

Forty-five physiological response variables were recorded at various time intervals on three volunteers during each of one hundred experimental sessions conducted in a controlled environmental chamber. Besides the physiological measurements, fourteen environmental variables were also recorded to examine their influence on the subjects during the tests. The data was analyzed using multivariate techniques including factor analysis nonmetric multidimensional scale analysis and regression analysis to determine the relationship among the variables under varying environmental combinations, and also to evaluate the effectiveness of these techniques when applied to physiological data. The results of the analyses indicate that multivariate techniques, particularly factor analysis, can accurately summarize the complex highly interactive physiological reactions recorded in the study. Dissert. Abstr.

N80-22965 Columbia Univ., New York.
MATHEMATICAL MODELING, SIMULATION, AND STABILITY OF THE RESPIRATORY CONTROL SYSTEM Ph.D. Thesis
Edward Firouztale 1979 288 p
Avail: Univ. Microfilms Order No. 8008722

A mathematical model of the respiratory control system was developed. This model consisted of a sub-model of the oxygen and carbon dioxide stores and a second sub-model of the controlling system. The models together with the reference parameter values, were used to simulate the effects of various periods of apnea (periods of nonbreathing) and recovery from apnea. The results are of interest in connection with studies of sudden infant death syndrome. Simulation and linear stability analysis were used to determine the stability of the system and, in particular, the gain that will render the respiratory control system unstable. It was found that limit cycles exist and that the cardiac output has a major effect on stability of the respiratory control system. Finally, the effect of O_2-CO_2 interactions at the controller level, on stability, was studied. Dissert. Abstr.

N80-22966 Michigan Univ., Ann Arbor.
INVESTIGATION OF CIRCADIAN RHYTHMS ON SELECT PSYCHOMOTOR AND NEUROLOGICAL FUNCTIONS Ph.D. Thesis
Andris Freivalds 1979 280 p
Avail: Univ. Microfilms Order No. 8007740

The existence of circadian rhythms in response variables that relate most meaningfully to the physiological and neurological state of the body throughout the day and which may be indices of performance was investigated. Various models, including a 2-parameter, 3-parameter and 6-parameter cosine model and an autoregressive model were fit to the data. For the variables with data pooled across subjects and days, the averaging effect tended to minimize the better fit of higher order models. The 2-parameter cosine model is sufficient to explain a (normal) average rhythm. On the other hand, the individual subject data of resting heart rate was more variable and yielded significantly better fits with the higher order models for all three subjects. Dissert. Abstr.

N80-22967*# National Aeronautics and Space Administration, Washington, D. C.
REACTIVITY OF ORGANISM IN PROLONGED SPACE FLIGHTS
P. V. Vasilyev Jan. 1980 14 p refs Transl. into ENGLISH from Astronaut. Acta (Austria), v. 17, 1972 p 107-112 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(NASA-TM-75975) Avail: NTIS HC A02/MF A01 CSCL 06S

An analysis of published data are presented as well as the results of experiments which show that the state of weightlessness and hypodynamia result in a reduced orthostatic and vestibular resistance, increased sensitivity to infections, decreased endurance of accelerations and physical exercises, and altered reactivity of the organism to drugs. Various consequences of weightlessness on the human body, especially weightlessness combined with other factors linked to long space flights are also considered. R.C.T.

N80-22968*# National Aeronautics and Space Administration, Washington, D. C.
DYNAMICS OF CHANGE OF LIPID AND MONOAMINE METABOLISMS AND THE BLOOD COAGULATION SYSTEM DURING EXPERIMENTAL ATHEROSCLEROSIS CAUSED BY RESTRICTION OF MOVEMENT
G. S. Gvishiani and N. G. Kobakhidze Apr. 1980 5 p Transl. into ENGLISH from Soobshch. Akad. Nauk. Gruz. SSR (USSR), v. 60, no. 2, 1970 p 445-447 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Georgian SSR Acad. of Sci., Tbilisi, USSR
(Contract NASw-3199)
(NASA-TM-76033) Avail: NTIS HC A02/MF A01 CSCL 06S

Shifts in lipid, catecholamine, and blood coagulation systems following various periods (1, 2, 3, and 4 months) of experimentally induced atherosclerosis were studied. The same indices were studied in the tissues of the myocardium, liver, and brain stem-reticular formation after decapitation of the animals at the end of the experiment. Periodic motion restriction caused an increase in blood beta-lipoproteins in the rabbits at the beginning of the experiment. An increase in general cholesterol content and a decrease in the lecithincholesterol index were established at the end of the experiment. Myocardial beta-lipoprotein and brain stem reticular formation general cholesterol contents were elevated; catecholamine content was increased at the end of the experiment. In the initial months, free adrenaline basically increased, while in later months blood adrenaline decreased and blood noradrenaline increased. R.E.S.

N80-22969*# National Aeronautics and Space Administration, Washington, D. C.
STATE OF THE BODY IN DISORDERS OF DIURNAL PHYSIOLOGICAL RHYTHMS AND LONG-TERM HYPOKINESIA
S. N. Razin and A. V. Rychko Mar. 1980 7 p Transl. into ENGLISH from Vrach. Delo, no. 5, 1976 p 104-106 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76051) Avail: NTIS HC A02/MF A01 CSCL 06S

In order to study the effects of hypokinesia and circadian rhythm restructuring on the morphological and functional status of the hypothalamo-hypophysic-adrenal system, young male Wistar rats were placed in small cages for varying periods. The animals were decapitated and preparations were made from sections of the brain and adrenals and numerous destructive changes were noted in the investigated regions of the brain, indicating that the condition of these areas is directly affected by disruption of established rhythms in physiological processes. Author

N80-22970*# National Aeronautics and Space Administration, Washington, D. C.
CATECHOLAMINES OF THE ADRENAL MEDULA AND THEIR MORPHOLOGICAL CHANGES DURING ADAPTATION TO REPEATED IMMOBILIZATION STRESS
R. Kvetnansky, A. Mitro, L. Mikulaj, and G. Hocman Mar. 1980 14 p refs Transl. into ENGLISH from Bratislav. Lek. Listy (Czechoslovakia), V. 46, no. 1, Jan. 1966 p 35-41 Transl. by

Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76068) Avail: NTIS HC A02/MF A01 CSCL 06S

Changes of the adrenal medulla of rats were studied in the course of adaptation to repeated immobilization stress. An increase in the number of cells in the adrenal medulla was found in the adapted animals; this increase was confirmed by weight indices of the medulla and by cell counts per surface unit. Simultaneous karyometric measurements of the nuclei of adrenal medulla cells and an analysis of the catecholamine contents in the adrenals explain the increased activity of the adrenal medulla in the course of adaptation. R.C.T.

N80-22971*# National Aeronautics and Space Administration, Washington, D. C.
VESTIBULAR RECRUITMENT
S. G. Tsemakhov Mar. 1980 16 p refs Transl. into ENGLISH from Vestn. Otorino-Laringologii (USSR), no. 4, Jul. - Aug. 1979 p 75-83 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76088) Avail: NTIS HC A02/MF A01 CSCL 06P

Vestibular recruitment is defined through the analysis of several references. It is concluded that vestibular recruitment is an objective phenomenon which manifests itself during the affection of the vestibular receptor and thus serves as a diagnostic tool during affection of the vestibular system. R.C.T.

N80-22972*# National Aeronautics and Space Administration, Washington, D. C.
AUTOMATED SYSTEM FOR DIAGNOSING CRANIOCEREBRAL INJURY
N. I. Moiseyeva, G. D. Luchko, R. V. Kremleva, A. V. Morozov, L. I. Nikitina, K. K. Rodionov, A. F. Gurchin, and E. M. Shmatov Mar. 1980 10 p refs Transl. into ENGLISH from Sov. Med. (USSR), no. 10, Oct. 1979 p 94-98 Transl. by SCITTRAN, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76097) Avail: NTIS HC A02/MF A01 CSCL 06B

A Russian national computing and communication system designed to assist non-specialized physicians in the diagnosis and treatment of craniocerebral injury is described. R.E.S.

N80-22973# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
LOW FREQUENCY ACOUSTIC DETECTION IN SUPPORT OF HUMAN DETECTION RANGE PREDICTION Final Report, Sep. 1978 - Sep. 1979
S. A. Fidell, R. D. Horonjeff, and D. M. Green Oct. 1979 88 p refs
(Contract DAAK51-78-C-00133; DA Proj. 1L1-62209-AH-76)
(AD-A080579; BBN-4006; USARTL-TR-79-25) Avail: NTIS HC A05/MF A01 CSCL 06/16

This project resulted in modifications to the acoustic range prediction software that were intended to increase the accuracy with which the program predicts detection ranges for targets that are audible primarily at low frequencies. These modifications were based on interpretations of the findings of a psychoacoustic experiment that sought to determine the effective masking bandwidth for human observers at frequencies as low as 40 Hz. The rationale for this experimentation was based on an extensive search of the masking literature. The possibility that acoustic detection ranges of unaided human observers are affected by infrasonic emissions of helicopters was considered both analytically and empirically. It was concluded from a literature review that the prospects for 'infrasonic cueing' of conventional acoustic detection were doubtful. A two-alternative forced choice task in which infrasound was available as a cue to detection produced results consistent with that conclusion. GRA

N80-22974# Research Inst. of National Defence, Stockholm (Sweden).
PERFORMANCE IN TASKS DIFFERING IN MEMORY LOAD AND ITS RELATIONSHIP WITH HABITUAL ACTIVITY PHASE AND BODY TEMPERATURE
Jan E. Froeberg Apr. 1979 28 p refs
(FOA-C-52002-H6) Avail: NTIS HC A03/MF A01

Twenty-four hour patterns in tasks differing in memory load were studied during a 75 hour vigil. Differences in performance were also studied between morning and evening active subjects, and between body temperature and performance rhythms. The task with a high memory load showed a 24 hr rhythm which was in inverse phase with the less memory loaded task and with body temperature. This was true only for the first 24 hr cycle, after that the memory loaded task tended to follow the other two variables, except in the case of the most extreme morning types for whom the inverse relationship continued to exist. Author (ESA)

N80-22975# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fuer Flugmedizin.
EVALUATION OF THYROID HORMONES BY GAS CHROMATOGRAPHY
Wolfgang Raabe Jan. 1979 26 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-620)
(DFVLR-FB-79-07) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 7.20

Gas chromatography is discussed as a method to allow routine measurements of thyroid hormone concentration in human serum. It is shown that current methods using this technique are not sufficiently sensitive. A proposal is made to improve the sensitivity of the method by the use of vacuum techniques. A factor of 1000 in sensitivity gain is expected. Author (ESA)

N80-22976# Flying Personnel Research Committee, London (England).
COCKPIT THERMAL STRESS AND AIRCREW THERMAL STRAIN DURING ROUTINE JAGUAR OPERATIONS
T. M. Gibson, L. A. Cochrane, M. H. Harrison, and P. W. Rigden HMSO Mar. 1979 22 p refs
(FPRC/Rept-1376; BR70502) Avail: NTIS HC A02/MF A01

Thermal data were obtained using Jaguar aircraft flying routine, warm weather operations in Sardinia. The data were analyzed in terms of the ambient and cockpit wet bulb, globe temperatures (WBGT), and the mean body temperature (Tb) of the pilot. Relationships described by equations of negative slope, were obtained between Tb and sortie time and between cockpit WBGT and sortie time. MODEL WAS developed for predicting aircrew thermal strain in the Jaguar from cockpit temperature and sortie time. Author (ESA)

N80-22977# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Sound, Light and Indoor Climate Div.
NOISE EFFECTS. EFFECTS OF NOISE EXPOSURE ON BLOOD CIRCULATION AND RESPIRATION OF MAN. PART 1: RESULTS OF A TWO-HOUR NOISE EXPOSURE ON GROUPS OF YOUNGER AND OLDER PEOPLE
A. J. M. Roevekamp and W. Passchier-Vermeer Jun. 1978 123 p refs
(IG-TNO-B-373-E) Avail: NTIS HC A06/MF A01

The influence of noise exposure on blood circulation and respiration was studied. The effects of such noise on the following parameters were examined: heartbeat frequency; absolute impedance plethysmogram: the total alternating current resistance of an extremity (arm, finger); relative impedance plethysmogram: the amplitude of that part of the alternating current resistance of an extremity, which varies with the heartbeat frequency; diastolic and systolic blood pressure and pulse pressure; and respiratory frequency. The results are compared to the effects caused by exposure to traffic noise and by exposure to a constant high sound level. Author (ESA)

N80-22978# National Technical Information Service, Springfield, Va.
EFFECTS OF FATIGUE ON HUMAN BEHAVIOR AND PERFORMANCE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1980
Mary E. Young Feb. 1980 205 p Supersedes NTIS/PS-79/0071; NTIS/PS-78/0126; NTIS/PS-77/0064
(PB80-804263; NTIS/PS-79-0071; NTIS/PS-78/0126; NTIS/PS-77/0064) Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

The bibliography cites references on the psychological and physiological effects of mental and physical fatigue. Reports on circadian rhythm, work - rest schedules, sleep deprivation, and physical endurance are included. This updated bibliography contains 198 abstracts, 10 of which are new entries to the previous edition. GRA

N80-22979# National Technical Information Service, Springfield, Va.
BEHAVIOR AND PHYSIOLOGICAL EFFECTS OF NOISE, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jan. 1980
Mary E. Young Jan. 1980 190 p Supersedes NTIS/PS-79/1014; NTIS/PS-78/0038; NTIS/PS-77/0031; NTIS/PS-76/0014; NTIS/PS-75/103
(PB80-803869; NTIS/PS-79/1014; NTIS/PS-78/0038; NTIS/PS-77/0031; NTIS/PS-76/0014; NTIS/PS-75/103) Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

Research reports are cited on the medical, psychological and physiological problems of noise pollution. Human tolerances to noise from aircraft, community traffic, industry, and military weapons are discussed. Reports on protective measures, noise control and abatement are also included. This updated bibliography contains 183 abstracts, 34 of which are new entries to the previous edition. GRA

N80-22980# National Technical Information Service, Springfield, Va.
BIOLOGICAL EFFECTS OF LASER RADIATION, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jan. 1978 - Jan. 1980
Elizabeth A. Harrison Jan. 1980 46 p Supersedes NTIS/PS-79/0020; NTIS/PS-78/0036; NTIS/PS-77/0028
(PB80-803935; NTIS/PS-79/0020; NTIS/PS-78/0036; NTIS/PS-77/0028) Avail: NTIS HC $30.00/MF $30.00 CSCL 06R

The bibliography cites reports on radiation injuries, permissible dosage, protective devices, and safety measures. Included are references on the pathology of eye lesions caused by lasers. This updated bibliography contains 39 abstracts, 17 of which are new entries to the previous edition. GRA

N80-22981# National Technical Information Service, Springfield, Va.
COLOR VISION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1980
Elizabeth A. Harrison Jan. 1980 202 p Supersedes NTIS/PS-79/0049; NTIS/PS-78/0047; NTIS/PS-77/0039
(PB80-803992; NTIS/PS-79/0049; NTIS/PS-78/0047; NTIS/PS-77/0039) Avail: NTIS HC $30.00/MF $30.00 CSCL 06P

Selected references are presented on defective color vision, genetic characteristics, tests for color blindness, and the use of optical filters in enhancing color images. Reports are included on human engineering for military personnel, pilots, and other operators. Color vision requirements for various occupations are discussed. This updated bibliography contains 195 abstracts, 14 of which are new entries to the previous edition. GRA

N80-22982# Health Effects Research Lab., Research Triangle Park, N. C. Clinical Studies Div.
BIOCHEMICAL CHANGES IN HUMANS UPON EXPOSURE TO OZONE AND EXERCISE
Suzanne Chaney, Paulette DeWitt, Wendy Blowquist, Keith Muller, Robert Bruce, and George Goldstein Aug. 1979 53 p refs
(PB80-105554; EPA-600/1-79-026) Avail: NTIS HC A04/MF A01 CSCL 06S

A total of 44 human subjects were exposed to 784 micrograms/cu m (0.4 ppm) ozone and 30 human subjects were exposed to air as controls. A four hour exposure was given on each of five consecutive days. Half of each group received a higher level of treadmill exercise than the other half. Nine biochemical blood parameters were measured pre and post exposure, red blood cell glutathione reductase, vitamin E, red blood cell cholinesterase, red blood cell glucose-6-phosphate dehydrogenase, lactic acid dehydrogenase, alpha sub I antitrypsin, haptoglobin, complement C3, and igM. Of these variables only vitamin E, red blood cell glucose-6-phosphate dehydrogenase, and complement C3 showed significant changes due to treatment. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-22983 Illinois Univ. at Urbana-Champaign.
MODELS OF HUMAN DECISION MAKING IN MULTI-TASK SITUATIONS: EVENT DETECTION, ATTENTION ALLOCATION, AND IMPLICATIONS FOR COMPUTER AIDING Ph.D. Thesis
Joel Sandor Greenstein 1979 120 p
Avail: Univ. Microfilms Order No. 8009048

Human decision making in multi-task situations is discussed. Mathematical models of human event detection and attention allocation performance in multi-task situations were developed and validated in a specific multiple process monitoring situation. The implications these models have for the design and implementation of computer aided decision making systems are also discussed. Dissert. Abstr.

N80-22984*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THEORY OF THE DECISION/PROBLEM STATE
Duncan L. Dieterly Apr. 1980 21 p refs
(NASA-TM-81192; AFHRL/H80-104; A-8161) Avail: NTIS HC A02/MF A01 CSCL 05J

A theory of the decision-problem state was introduced and elaborated. Starting with the basic model of a decision-problem condition, an attempt was made to explain how a major decision-problem may consist of subsets of decision-problem conditions composing different condition sequences. In addition, the basic classical decision-tree model was modified to allow for the introduction of a series of characteristics that may be encountered in an analysis of a decision-problem state. The resulting hierarchical model reflects the unique attributes of the decision-problem state. The basic model of a decision-problem condition was used as a base to evolve a more complex model that is more representative of the decision-problem state and may be used to initiate research on decision-problem states. R.E.S.

N80-22985*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROBLEM SOLVING AND DECISIONMAKING: AN INTEGRATION
Duncan L. Dieterly Apr. 1980 20 p refs Prepared in cooperation with Air Force Human Resources Lab., Moffett Field, Calif.
(NASA-TM-81191; AFHRL/H80-103; A-8160) Avail: NTIS HC A02/MF A01 CSCL 05J

An attempt was made to redress a critical fault of decisionmaking and problem solving research-a lack of a standard method to classify problem or decision states or conditions. A basic model was identified and expanded to indicate a possible taxonomy of conditions which may be used in reviewing previous research or for systematically pursuing new research designs. A generalization of the basic conditions was then made to indicate that the conditions are essentially the same for both concepts, problem solving and decisionmaking. R.E.S.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-22986 Illinois Univ. at Urbana-Champaign.
MODELING THE HUMAN AS A CONTROLLER IN A MULTI-TASK ENVIRONMENT Ph.D. Thesis

Thiruvenkatasamy Govindaraj 1979 139 p
Avail: Univ. Microfilms Order No. 8009046

Two models were developed for the human controller in multitask situations with preview. In the simpler heuristic model, control actions are performed when projected weighted error from the previewed reference exceeds a threshold. The second is a more rigorous analytical model based on optimal control theory. Performance of the model and the subjects are compared in terms of various remote manipulator systems (RMS) measures. For a good match, the RMS lateral error of the model is close to that of the experimental runs. The discrete task performance is compared in terms of RMS differences between the times the subject initiated the discrete tasks and the times the model initiated the corresponding tasks. Results for various experimental conditions are given, and the model match is discussed.

Dissert. Abstr.

N80-22987*# Life Systems, Inc., Cleveland, Ohio.
PERFORMANCE CHARACTERIZATION OF A BOSCH CO SUB 2 REDUCTION SUBSYSTEM Final Report
D. B. Heppner, T. M. Hallick, and F. H. Schubert Feb. 1980 40 p refs
(Contract NAS2-10204)
(NASA-CR-152342; LST-TR-379-11) Avail: NTIS HC A03/MF A01 CSCL 06K

The performance of Bosch hardware at the subsystem level (up to five-person capacity) in terms of five operating parameters was investigated. The five parameters were: (1) reactor temperature, (2) recycle loop mass flow rate, (3) recycle loop gas composition (percent hydrogen), (4) recycle loop dew point and (5) catalyst density. Experiments were designed and conducted in which the five operating parameters were varied and Bosch performance recorded. A total of 12 carbon collection cartridges provided over approximately 250 hours of operating time. Generally, one cartridge was used for each parameter that was varied. The Bosch hardware was found to perform reliably and reproducibly. No startup, reaction initiation or carbon containment problems were observed. Optimum performance points/ranges were identified for the five parameters investigated. The performance curves agreed with theoretical projections. R.E.S.

N80-22988# Bunker-Ramo Corp., Westlake Village, Calif. Electronic Systems Div.
TOTAL AIRCREW WORKLOAD STUDY FOR THE AMST. VOLUME 1: RESULTS Final Report, Mar. 1976 - Nov. 1977
Ralph P. Madero, George A. Sexton, David Gunning, and Richard Moss Wright-Patterson AFB, Ohio AFFDL Feb. 1979 67 p refs 2 Vol.
(Contract F33615-78-C-3614; AF Proj. 2403)
(AD-A076422; AFFDL-TR-79-3080-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 01/3

There is a growing realization within the USAF that state-of-the-art crew systems may allow cost effective reductions in crew complements. The present study, titled the Total Aircrew Workload Study (TAWS) addresses the minimum crew complement required and conceptually, the crew systems required to support the minimum crew of an Advanced Medium STOL Transport (AMST) in the accomplishment of the tactical transport mission. The study involved the simulation of a total tactical airlift mission which was flown by operational (C-130) tactical airlift aircrews in order to further refine crew complement and crew system concepts established in earlier mockup studies. The results of this study indicate that two pilots, a loadmaster and a crew chief type additional crew member can fly the total AMST mission if provided with adequate state-of-the-art crew system capabilities, as identified in this report. The report is presented in two volumes. Volume 1 describes the TAWS program and presents the results. Volume 2 presents a detailed description of the navigation and communication system used during the TAWS evaluation. GRA

N80-22989# Bunker-Ramo Corp., Westlake Village, Calif. Electronic Systems Div.
TOTAL AIRCREW WORKLOAD STUDY FOR THE AMST. VOLUME 2: COMMUNICATION NAVIGATION DESCRIPTION Final Report, Mar. 1976 - Nov. 1977
Ralph P. Madero, George A. Sexton, David Gunning, and Richard Moss Wright-Patterson AFB, Ohio AFFDL Feb. 1979 36 p 2 Vol.
(Contract F33615-78-C-3614; AF Proj. 2403; AF Proj. 6190)
(AD-A076498; AFFDL-TR-79-3080-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 01/3

There is a growing realization within the USAF that state-of-the-art crew systems may allow cost effective reductions in crew complements. The present study, titled the Total Aircrew Workload Study (TAWS) addresses the minimum crew complement required and conceptually, the crew systems required to support the minimum crew of an Advanced Medium STOL Transport (AMST) in the accomplishment of the tactical transport mission. The study involved the simulation of a total tactical airlift mission which was flown by operational (C-130) tactical airlift aircrews in order to further refine crew complement and crew system concepts established in earlier mockup studies. The results of this study indicate that two pilots, a loadmaster and a crew chief type additional crew member can fly the total AMST mission if provided with adequate state-of-the-art crew system capabilities, as identified in this report. GRA

N80-22990# Payne, Inc., Annapolis, Md.
PRELIMINARY ANALYSIS OF WIND TUNNEL TEST OF A 1/2 SCALE MODEL OF AN EJECTING CREWMAN AND EJECTION SEAT Final Report, 15 Sep. 1976 - 30 Sep. 1978
Alastair Anthony May 1979 46 p ref
(Contract F33615-76-C-0530; AF Proj. 7231)
(AD-A069229; AMRL-TR-78-107; Working-Paper-210-8) Avail: NTIS HC A03/MF A01 CSCL 01/3

Doubts were raised as to the integrity of the rest of the structure when the neck member of a model crewman failed during tunnel measurements of the limb forces during ejection. The accuracy of the load estimates used in the pretest stress analysis clearly needed to be checked. Meanwhile, testing was resumed at restricted pressure values with a non-load-measuring replacement for the neck member. From a sampling of the test data, the distribution of bending and torsional moments along the limbs is clearly revealed and with its variation with attitude and Mach number, presents no great surprises. Values critical to the stress analysis confirm the estimated values. The neck pillar, designed by a subcontractor, had been designed for sensitivity in bending under the head loads without catering for torsion in the member if these loads should in the event be appreciably offset from its axis. Although there is little confirmation of the magnitude of the head loads, there is some indication the offsets in excess of one inch in these loads are to be expected in the real situation, and that the resulting torsion was the cause of the failure. GRA

N80-22991# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 75: C-141A AIRCRAFT, NEAR AND FAR-FIELD NOISE
Robert G. Powell Jul. 1979 85 p refs
(AF Proj. 7231)
(AD-A079865; AMRL-TR-75-50-Vol-75) Avail: NTIS HC A05/MF A01 CSCL 01/2

The USAF C-141A is a transport aircraft powered by four TF33-P-7 turbofan engines. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for three power conditions. Near-field data are reported for ten locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-22992# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK.

VOLUME 120. C-5A AIRCRAFT, NEAR AND FAR-FIELD NOISE
Robert G. Powell Jul. 1979 145 p refs
(AF Proj. 7231)
(AD-A079866; AMRL-TR-75-50-Vol-120) Avail: NTIS
HC A07/MF A01 CSCL 01/2

The USAF C-5A is a global, strategic airlift aircraft powered by [illegible] TF39-GE-1 turbofan engines. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for five engine/power configurations. Near-field data are reported for forty-five locations in a wide variety of physical and psychoacoustic measures: overall and band sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-22993# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 121: F-4C AIRCRAFT, NEAR AND FAR-FIELD NOISE
Robert G. Powell Apr. 1979 153 p refs
(AF Proj. 7231)
(AD-A079867; AMRL-TR-75-50-Vol-121) Avail: NTIS
HC A08/MF A01 CSCL 01/2

The USAF F-4C is an all-weather, supersonic, fighter-bomber aircraft powered by two J79-GE-15 turbojet engines. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for six engine/power configurations. Near-field data are reported for six locations in a wide variety of physical and phychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-Field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distances from the s GRA

N80-22994# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 128: T-38 AIRCRAFT IN THE AF32A-18 NOISE SUPPRESSOR, NEAR AND FAR-FIELD NOISE
Robert A. Lee Jul. 1979 105 p refs
(AF Proj. 7231)
(AD-A079868; AMRL-TR-75-50-Vol-128) Avail: NTIS
HC A06/MF A01 CSCL 01/2

The AF32A-18 noise suppressor is made by General Acoustics Corporation for acoustical suppression of the T-38 aircraft. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating in this suppressor for five engine power configurations. Near-field data are reported for four locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-22995# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 131: F-4 AIRCRAFT IN THE AF32A-14 NOISE SUPPRESSOR, NEAR AND FAR-FIELD NOISE
Robert A. Lee Feb. 1979 69 p refs
(AF Proj. 7231)
(AD-A079869; AMRL-TR-75-50-Vol-131) Avail: NTIS
HC A04/MF A01 CSCL 01/2

The AF32A-14 noise suppressor is made by Koppers Environmental Elements Corporation for acoustical suppression of the F-4 aircraft. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating in this suppressor for three engine power configurations. Near-field data are reported for two locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-22996# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 132: F-5 AIRCRAFT IN THE AF32A-16 NOISE SUPPRESSOR, NEAR AND FAR-FIELD NOISE
Robert A. Lee Mar. 1979 69 p refs
(AF Proj. 7231)
(AD-A079870; AMRL-TR-75-50-Vol-132) Avail: NTIS
HC A04/MF A01 CSCL 01/2

The AF32A-18 noise suppressor is made by the General Acoustics Corporation for acoustical suppression of the F-5 aircraft. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating in this suppressor for three engine power configurations. Near-field data are reported for two locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-22997# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 133: F-15 AIRCRAFT IN THE AF32A-23 NOISE SUPPRESSOR, NEAR AND FAR-FIELD NOISE
Robert A. Lee Jul. 1979 89 p refs
(AF Proj. 7231)
(AD-A079871; AMRL-TR-75-50-Vol-133) Avail: NTIS
HC A05/MF A01 CSCL 01/2

The AF32A-23 noise suppressor is made by the Jetway Equipment Corporation for acoustical suppression of the F-15 aircraft. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating in this suppressor for four engine power configurations. Near-field data are reported for locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interferences level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 16 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-22998# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 134. KC-135A AIRCRAFT IN THE MODIFIED AF32A-52A NOISE SUPPRESSOR, FAR-FIELD NOISE
Robert A. Lee Mar. 1979 75 p refs
(AF Proj. 7231)
(AD-A079872; AMRL-TR-75-50-Vol-134) Avail: NTIS

HC A04/MF A01 CSCL 01/2

The AF32A-52A noise suppressor was made by Industrial Acoustics Corporation and modified by the Air Force for acoustical suppression of the KC-135A aircraft. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating in an AF32A-52A suppressor for three engine power configurations. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for seven acoustic measures as functions of angle and distance from the source. GRA

N80-22999# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 135: F-106 AIRCRAFT IN THE AF32A-17 NOISE SUPPRESSOR, NEAR AND FAR-FIELD NOISE

Robert A. Lee Nov. 1978 104 p refs

(AF Proj. 7231)

(AD-A079873; AMRL-TR-75-50-Vol-135) Avail: NTIS HC A06/MF A01 CSCL 01/2

The AF32A-17 noise suppressor is made by Jetway Equipment Corporation for acoustical suppression of the F-106 aircraft. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating in this suppressor for five engine power configurations. Near-field data are reported for two locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derived sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-23000# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 136: F-111A AIRCRAFT IN THE AF32A-13 NOISE SUPPRESSOR, FAR-FIELD NOISE

Robert A. Lee Mar. 1979 100 p

(AF Proj. 7231)

(AD-A079874; AMRL-TR-75-50-VOl-136) Avail: NTIS HC A05/MF A01 CSCL 01/2

The AF32A-13 noise suppressor is made by the Industrial Acoustics Corporation for acoustical suppression of the F-111A aircraft. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating in the AF32A-13 noise suppressor for five power conditions. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for seven acoustic measures as functions of angle and distance from the source. GRA

N80-23001# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 140: F-16 AIRCRAFT IN THE AF32A-25 NOISE SUPPRESSOR, NEAR AND FAR-FIELD NOISE

Robert A. Lee Aug. 1979 87 p

(AF Proj. 7231)

(AD-A079875; AMRL-TR-75-50-Vol-140) Avail: NTIS HC A05/MF A01 CSCL 01/2

The AF-32A-25 noise suppressor is made by the Jetway Equipment Corporation for acoustical suppression of the F-16 aircraft. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating in this suppressor for four engine power configurations. Near-field data are reported for three locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N80-23002# Defence Research Establishment, Ottawa. (Ontario). Research and Development Branch.

ADDITIONAL STUDIES OF CHEMICALLY TREATED CLOTHING FOR PERSONNEL PROTECTION FROM BITING FLIES

I. S. Lindsay, B. Farnworth, and R. J. Osczenski Nov. 1979 19 p refs

(AD-A080612; DREO-TN-79-28) Avail: NTIS HC A02/MF A01 CSCL 06/17

Combat clothing and wide-mesh hoods treated with the insecticide permethrin have been evaluated for protection against biting flies. Experiments on human subjects indicate excellent protection against mosquitoes from both the clothing and the hoods. Experiments on plastic heads baited with dry-ice indicate moderate protection against blackflies from the hoods whereas the diethyltoluanide (deet) treated hoods gave excellent protection to the uncovered face. GRA

N80-23003# Clemson Univ., S.C. Coll. of Engineering.

EXPERIMENTAL EVALUATIONS OF SELECTED IMMERSION HYPOTHERMIA PROTECTION EQUIPMENT Final Report, 5 Jun. 1978 - 30 Jun. 1979

R. Michael Harnett, Edward M. OBrien, Fred R. Sias, and James R. Pruitt 12 Oct. 1979 172 p refs

(Contract DOT-CG-72074-A)

(AD-A080470; USCG-D-79-79) Avail: NTIS HC A08/MF A01 CSCL 06/17

This report summarizes an experimental test program conducted with state-of-the-art hypothermia protection equipment. Tests included the following attributes: cold-protection effectiveness, mobility reduction, fatigue induction, ease of donning, buoyancy, aesthetic appeal/wearer confidence, flame resistance and reliability. Cold-protection effectiveness is expressed in terms of survival-time estimates for individuals, with selected body structures, wearing the test articles in 1.7 C (35 F) water. The data from these investigations is intended to collectively support the selection of equipment best suited for use by recreational boaters, Coast Guard crewmen and merchant mariners. GRA

N80-23004# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

PROCEEDINGS OF THE FIFTEENTH ANNUAL CONFERENCE ON MANUAL CONTROL Interim Report, Apr. 1978 - Mar. 1979

Frank L. George, ed. Nov. 1979 809 p refs Conf. held at Wright State Univ., Ohio, 20-22 Mar. 1979

(AF Proj. 9994)

(AD-A080563; AFFDL-TR-79-3134) Avail: NTIS HC A99/MF A01 CSCL 05/8

Fifty-six papers were presented during this conference on Manual Control and all are represented, either as complete papers on as abstracts provided by the authors. Topics of the papers include higher order manual tasks involving attention allocation and decision-making, human dynamic modeling and identification, and design methodology for human operator controlled systems. Also covered were aspects of control manipulators and displays, as well as considerations for simulation of human operator-controlled systems. GRA

N80-23005# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

A METHOD FOR SEMI-AUTOMATIC ANALYSIS OF EYE MOVEMENTS

Hans Radke Dec. 1978 33 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-475)

(DFVLR-MITT-79-02) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 7.80

The measurement and analysis of the operator's visual behavior is described in terms of its importance as a tool for human factor research on the layout of displays and controls. However, the analysis of eye-point-of-regard data is difficult and

time consuming. A semi-automatic computer aided procedure is described, which reduces the time needed for data analysis.
Author (ESA)

N80-23006# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
CALIBRATION AND TEST PROCEDURES FOR THREE YEAR OLD CHILD DUMMY Final Report, 1 Feb. 1977 - 1 Nov. 1978
Joseph B. Benson and John W. Melvin 7 Feb. 1979 70 p
(Contract DOT-HS-6-01367)
(PB80-112246; UMICH-HSRI-79-4; DOT-HS-805-070) Avail: NTIS HC A04/MF A01 CSCL 13L

Four three year old child dummies, SA 103C models, were tested to determine the ranges of responses of these dummies in calibration type tests and to refine testing fixtures and techniques. The dummy head accelerometer mounting was revised to reduce ringing, and the ribcage structure attachment modified to eliminate bottoming. A revised loading fixture was designed to facilitate the lumbar spine calibration. The modified dummies produced consistent calibration response data within the proposed limits.
GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N80-23007*# Stanford Univ., Calif. Inst. for Plasma Research.
UNCERTAINTY IN ESTIMATES OF THE NUMBER OF EXTRATERRESTRIAL CIVILIZATIONS
P. A. Sturrock Mar. 1980 16 p refs
(Contract NGR-05-020-668)
(NASA-CR-162637; SUIPR-808) Avail: NTIS HC A02/MF A01 CSCL 03B

An estimation of the number N of communicative civilizations is made by means of Drake's formula which involves the combination of several quantities, each of which is to some extent uncertain. It is shown that the uncertainty in any quantity may be represented by a probability distribution function, even if that quantity is itself a probability. The uncertainty of current estimates of N is derived principally from uncertainty in estimates of the lifetime of advanced civilizations. It is argued that this is due primarily to uncertainty concerning the existence of a Galactic Federation which is in turn contingent upon uncertainty about whether the limitations of present-day physics are absolute or (in the event that there exists a yet undiscovered hyperphysics) transient. It is further argued that it is advantageous to consider explicitly these underlying assumptions in order to compare the probable numbers of civilizations operating radio beacons, permitting radio leakage, dispatching probes for radio surveillance for dispatching vehicles for manned surveillance.
R.C.T.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N80-23008*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VALIDATION METHODS RESEARCH FOR FAULT-TOLERANT AVIONICS AND CONTROL SYSTEMS: WORKING GROUP MEETING, 2
James W. Gault, ed., Kishor S. Trivedi, ed., and James B. Clary, ed. 1980 105 p Meeting held at Hampton, Va. 3-4 Oct. 1979
(NASA-CP-2130; L-13716) Avail: NTIS HC A06/MF A01 CSCL 12A

The validation process comprises the activities required to insure the agreement of system realization with system specification. A preliminary validation methodology for fault tolerant systems documented. A general framework for a validation methodology is presented along with a set of specific tasks intended for the validation of two specimen system, SIFT and FTMP. Two major areas of research are identified. First, are those activities required to support the ongoing development of the validation process itself, and second, are those activities required to support the design, development, and understanding of fault tolerant systems.
E.D.K.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-23009 California Univ., Los Angeles.
AN ARCHITECTURE FOR AUDITABLE ADVANCED TRANSACTION ORIENTED EDP SYSTEMS Ph.D. Thesis
Roger Dean Schultz 1979 466 p
Avail: Univ. Microfilms Order No. 8008526

Mechanisms for enhancing the auditability of advanced information systems are described. Vendors supply basic hooks to support such mechanisms as a part of the transaction processing operating systems which are used by enterprises as a basis for their advanced systems. The mechanism is composed of two parts: a programmable evidence capsule mechanism called the audit probe, and an interactive programmable evidence analysis part called the auditor's assistant. The audit probe borrows from the concepts of software probes used in performance monitoring, and is defined using a high level language. The evidence analysis portion of the mechanism provides planning and evidence evaluation support. It also documents the audit process, providing automatic working papers for the auditor, as well as many of the features currently provided by generalized audit software. Various implementation and performance issues concerning the audit probe approach are investigated.
Dissert. Abstr.

N80-23010 Duke Univ., Durham, N. C.
PERFORMANCE-ORIENTED DESIGN MODELS FOR COMPUTER SYSTEMS Ph.D. Thesis
Timothy Miller Sigmon 1979 152 p
Avail: Univ. Microfilms Order No. 8008194

Several performance-oriented design models are presented which can be used to aid computer system designers by generating intial system design for an iterative design process or by allowing the investigation of many different system configurations quickly and inexpensively. The design models are based on an exponential queueing network model of the desired system configuration upon which an optimization problem has been superimposed. For each design model, it is shown that the optimization problem is a convex programming problem and therefore any locally optimal solution is a global optimum. Numerical examples are provided for each design model which demonstrate how these models might be used. The examples also show that not only are these design models computationally tractable but they also quite efficient.
Dissert. Abstr.

N80-23011 California Univ., Los Angeles.
A STUDY OF PARALLEL PROCESSING ARCHITECTURE FOR COMPUTER SIMULATION OF PLASMAS Ph.D. Thesis
Li-Ping-Thomas Wang 1979 537 p
Avail: Univ. Microfilms Order No. 8008550

A candidate methodology which is intended to help model suitable computer architectures for a target system, and is particularly beneficial for the design of parallel processing systems is discussed. A particular example is examined that of plasma particle simulation of synchrotron radiation. Results from the computer simulation of a two-and-one-half dimensional relativistic electromagnetic particle model for a plasma are obtained and checked against those from mathematical computation. Several large scale computer configurations are presented and their

performance comparison is made on the base of a one-million particle simulation run of the simulation model. Dissert. Abstr.

N80-23012# Ohio State Univ. Research Foundation, Columbus.
EPITAXIAL MAGNETIC FILM EVALUATION TECHNIQUES Interim Report, 1 Nov. 1977 - 31 Oct. 1978
Philip E. Wigen and Kenneth J. Breeding Wright-Patterson AFB, Ohio AFAL Nov. 1979 113 p refs
(Contract F33615-77-C-1002; AF Proj. 2305)
(AD-A080390; OSURF-764596/710525; AFAL-TR-79-1145)
Avail: NTIS HC A06/MF A01 CSCL 09/2

This annual report reviews the progress of the second year of work on magnetic bubble materials and the testing of bubble memory devices. At the Avionics Laboratory, an M-H looper device was built for use in characterizing bubble materials. The device is fully automated (employing a Hewlett-Packard calculator system) and for use with whole wafers of bubble material. Details of the looper along with samples of data taken are included in the report. At the OSU Physics department, two types of domain wall phenomena were investigated. Propagation of spin waves through domain walls at microwave frequencies were investigated both theoretically and experimentally. Secondly domain wall motion excited with a radio frequency magnetic field oriented parallel to the film plane was studied. GRA

N80-23013# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DATA FLOW TECHNIQUES IN SINGLE-USER MULTIPROCESSOR SYSTEMS M.S. Thesis
Brian P. Boesch Dec. 1979 103 p refs
(AD-A080174; AFIT/GE/EE/79-7) Avail: NTIS
HC A06/MF A01

Problems associated with performing computation tasks in single-user microprocessor environments are discussed. Data flow methods are investigated as a means of applying multiprocessors to this environment. An event driven simulation of a variable architecture data flow processor is developed, using UCSD PASCAL (TM). A trial data flow multiprocessor using 8080 based microprocessors is developed and tested. Using the simulator and information gathered from the trial multiprocessor, several situations typical to single user systems were tested. Maximal levels of parallel processing are presented for a variety of situations. GRA

N80-23014# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A SYSTEM DESIGN TOOL FOR AUTOMATICALLY GENERATING FLOWCHARTS AND PREPROCESSING PASCAL M.S. Thesis
James Howard Keller Dec. 1979 116 p refs
(AD-A080418; AFIT/GCS/EE/79-7) Avail: NTIS
HC A06/MF A01 CSCL 09/2

The portion of overall system costs attributable to software development and maintenance is presently near 50 percent and is continually increasing. Programmers and analysts are diligently searching for tools to assist them by automating the analysis, design, and documentation of software systems. Flowcharting has lost some of its support as a powerful design tool due to the need for discipline, patience, and to some degree artistic talent. Automatic flowcharting, designed for specific languages and machines, provides automatic documentation only. No attempt has been made to link the automatic flowcharting to the compiler-ready code. This study begins the development of an automatic program design tool to grapically display and update flowcharts and provide this link between the flowchart and the system it represents. A method of detailed, automatic design of programs, down to the elemental source language level, is proposed which displays graphical flowchart constructs and provides for iterative, stepwise refinements of the flowcharts. The final system, is maintained in a data structure that allows for subsequent refinement and for optionally producing a compiler-ready source listing. GRA

N80-23015# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A GRAPH MODEL REPRESENTATION OF A DISTRIBUTED PROCESSOR COMPUTER SYSTEM M.S. Thesis
Leslie A. Palmer Dec. 1979 150 p refs
(AD-A080410; AFIT/GCS/EE/79-12) Avail: NTIS
HC A07/MF A01 CSCL 09/2

Every computer system is designed to perform a certain function or set of functions. The most accurate way to evaluate a system's performance is to measure the system under its real workload (Ref 32:19). Very often, though, it is not feasible or practical to measure an existing system (Ref 5:12). When the system to be analyzed is not available for direct analysis, a model of the system can serve as the subject of analysis. This investigation focuses on the use of a particular class of graph models, known as Evaluation-Nets, to model a distributed processor computer system in support of a performance analysis effort GRA

N80-23016# Iowa Univ., Iowa City. Dept. of Electrical and Computer Engineering.
TEST PROCEDURES FOR SEMICONDUCTOR RANDOM ACCESS MEMORIES Final Technical Report, Jul. 1978 - Apr. 1979
Sudhakar M. Reddy and D. S. Suk Griffiss AFB, N. Y. RADC Nov. 1979 105 p refs
(Contract F30602-78-C-0083; AF Proj. 2338)
(AD-A080450; RADC-TR-79-269) Avail: NTIS
HC A06/MF A01 CSCL 09/2

Currently available memory testing algorithms were reviewed and evaluated to assess their inadequacies in testing large scale integrated circuit random access memories (RAMs). Categories of functional faults were proposed to include several types of coupling faults. A neighborhood for pattern sensitive faults was defined. A fault model for stuck-at failures in dynamic RAMs was derived, as were requirements to detect abnormal timing parameters. Procedures to detect the following classes of faults were then developed: (1) functional faults, (2) neighborhood pattern sensitive faults, (3) stuck-at faults in dynamic RAMs, and (4) abnormal access times. GRA

N80-23017# Rome Air Development Center, Griffiss AFB, N.Y.
A PLAN FOR AN AUTOMATED MANAGEMENT INFORMATION SYSTEM Final Report
Donald I. Zulch, Frank Rehm, Stephen Gross, Sharon Keplesky, Dennis Maynard, Richard Gaudino, and G. Lamperti Dec. 1979 84 p
(AF proj. 9991)
(AD-A080137; RADC-TR-79-271) Avail: NTIS
HC A05/MF A01 CSCL 09/2

This report documents the results of an in-depth analysis of the management data bases that presently exist at RADC and defines a plan for achieving a fully automated management information system (MIS). A concept of a principal task is proposed and is defined. A method of achieving a smooth transition from the current data base structure to an automated MIS with on-line data entry and retrieval is suggested and finally a management structure supporting the MIS implementation is suggested. GRA

N80-23018# Ohio State Univ., Columbus. Computer and Information Science Research Center.
THE POST PROCESSING FUNCTIONS OF A DATABASE COMPUTER
David K. Hsiad and Jaishankar Menon Jul. 1979 38 p refs
(Contract N00014-75-C-0573)
(AD-A080128; OSU-CISRC-TR-79-6) Avail: NTIS
HC A03/MF A01 CSCL 09/2

DBC is a specialized back-end computer which is capable of managing database of 10 to the 10th power bytes in size and supporting known data models such as relational, network, hierarchical and attribute-based. This report deals with the post processing functions of DBC. A description of some known methods for performing natural and implicit joins is first given. It then goes on to show how both natural and implicit joins are performed by the post processor (PP) of DBC utilizing the parallelism of PP. This report show that the algorithm for performing joins is of O(N) time, where N is the number of records to be joined. Algorithms necessary for performing set functions such as maxima, minima, average, sum and count are given. The time complexities of these algorithms are also calculated. Finally, it is shown how to implement the set inclusion operator. Given a set of values for a particular attribute and a number of retrieved records, this operator can select those

records whose values for the attribute are the values in the set. GRA

N80-23019# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MIME: MICROPROGRAMMABLE MINICOMPUTER EMULATOR, PHASE 2, VOLUME 2 M.S. Thesis
Thomas R. Hoyt and Dean A. Myers Dec. 1979 252 p refs Revised 2 Vol.
(AD-A080420; AFIT/GCS/EE/79-11-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 09/2
Contents: MIME User's Manual; MIL-STD-1750 Emulation Reference Manual; MIME Translator Reference Manual; and MIME Modest Monitor (MIME/MM) User Manual. GRA

N80-23020# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MIME: MICROPROGRAMMABLE MINICOMPUTER EMULATOR, PHASE 2, VOLUME 1 M.S. Thesis
Thomas R. Hoyt and Dean A. Myers Dec. 1979 94 p refs 1 Vol.
(AD-A080360; AFIT/GCS/EE/79-11-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 09/2
This report describes software and hardware enhancements made to an existing educationally oriented microprogrammable minicomputer (MIME) that was implemented using the Am2900 series of integrated circuits. Hardware changes included extensions of the machine architecture by incorporation of user-definable fields in the microword, corresponding to user-definable capabilities in the hardware. A microprogramming language was developed for the machine, as well as a translator. The instruction set of MIL-STD-1750, Airborne Computer Instruction Set Architecture was microprogrammed to demonstrate the utility of the translator and the computer. MIL-STD-1750 peculiar hardware was interfaced through the user-definable portion of the architecture. The results showed that a minicomputer instruction set could be successfully emulated using MIME. The final system of hardware, software, and documentation provides a valuable educational tool for studies of microprogramming, emulation, and computer control. GRA

N80-23021# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EMITTER DATA MAINTENANCE AND RETRIEVAL SYSTEM M.S. Thesis
Clifford C. Gardner Dec. 1979 152 p refs
(AD-A080416; AFIT/GCS/EE/79-5) Avail: NTIS HC A08/MF A01 CSCL 05/2
The purpose of this thesis was to design and implement a system which maintained and processed electronic emitter data. The successful completion of this project resulted in a product which accomplishes the required tasks. The initial phase of the project was the requirements analysis. The technique used for this phase (Structured Analysis) proved to be only partially successful. It was only used at a very high level. For larger projects where more communication is necessary among designers and with users, it would be more beneficial. It was useful as a means of organizing the ideas of the designer, but the user/designer interaction was accomplished without the data flow diagrams. Familiarizing the user with the technique would be more productive on a larger project. The Structured Design technique used during the design specification stage was of greater value. It proved to be a very organized and effective method of taking a general task and breaking it into modules which could be easily coded and maintained. Even small software projects such as this can benefit from this or similar techniques. The choice of a programming language which encourages structured coding proved a wise decision. PASCAL is a highly readable language. While only an outside observer can determine how readable the resulting product is, the designer found debugging to be much simpler than expected. GRA

N80-23022# Naval Postgraduate School, Monterey, Calif.
MICROCOMPUTER DESIGN FOR ELECTRIC EMITTER INDENTIFICATION M.S. Thesis
Gary Lew Bush Sep. 1979 66 p refs
(AD-A081063) Avail: NTIS HC A04/MF A01 CSCL 17/4
New technological advances in weapons and electronics has increased the fighting capabilities of small ships. The increases are seen in better and lighter offensive weapons, along with increases in self-defensive weapons through the addition of electronic suites. The electronic warfare suites currently used on small ships are limited in size, weight, and response time because of the environment in which these ships are employed. It is the purpose of this paper to propose a system which will allow the currently very limited data bases to be expanded while at the same time not degrading the system. The feasibility of this approach is based upon using a microcomputer to aid in the identification of emitters off-line while leaving the current system to identify high threat emitters. GRA

N80-23023# European Space Agency, Paris (France).
THE USE OF DIGITAL INTEGRATORS, PARTICULARLY DIGITAL DIFFERENTIAL ANALYZERS, IN PROCESS CONTROL COMPUTERS
Rudolf Freilung Jul. 1979 79 p refs Transl. into ENGLISH of "Einsatz von Digitalen Integrierern in Prozessrechnern unter Besonderer Beruecksichtigung von Inkrementerechenschaltungen (DDA)", Rept. DLR-FB-77-71 DFVLR, Brunswick, Jan. 1978 Original report in GERMAN previously announced as X79-72229
(ESA-TT-533; DLR-FB-77-71) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 38.90
The principle of digital integrators is explained using a practical example, and the fundamentals of digital differential analyzers are treated. Several simple integration algorithms which take only a few program steps in digital computation and which are useful for digital differential analysers are reviewed. The error due to the integration algorithm chosen is shown in some applications to feedback systems. Some realizations of digital integrators for the simulation of dynamic systems are given for use in a programmable digital computer, as well as for use in hardware computing elements. Author (ESA)

N80-23024# National Technical Information Service, Springfield, Va.
PARALLEL PROCESSORS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1980
Brian Carrigan Feb. 1980 290 p Supersedes NTIS/PS-79/0012; NTIS/PS-78/0016; NTIS/PS-77/0024
(PB80-804313; NTIS/PS-79/0012; NTIS/PS-78/0016; NTIS/PS-77/0024) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B
Two hundred and eighty-three citations from federally funded research on the design, development, and application of parallel processors are presented. The development of numerical technqiues for parallel processing, scheduling parallel processors, and parallel processing of various kinds of scientific data are included. The development of algorithms and computer programs is also covered, as are specific studies on ILLIAC computers. GRA

N80-23025# National Technical Information Service, Springfield, Va.
PARALLEL PROCESSORS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Jan. 1980
Brian Carrigan Feb. 1980 273 p Supersedes NTIS/PS-79/0013, NTIS/PS-78/0018 and NTIS/PS-77/0025
(PB80-804321; NTIS/PS-79/0013; NTIS/PS-78/0018; NTIS/PS-77/0025) Avail. NTIS HC $30.00/MF $30.00 CSCL 09B
The bibliography cites worldwide research on the design, development, and application of parallel processors. Studies are included on the development of numerical techniques for parallel processing, scheduling parallel processors, and parallel processing of various kinds of scientific data. The development is also included, as are specific studies on ILLIAC computers. This updated bibliography contains 269 abstracts, 105 of which are new entries to the previous edition. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-23026 Wisconsin Univ. - Madison.
COMPLEMENTARITY IN MATHEMATICAL PROGRAMMING Ph.D. Thesis
Wayne Phillip Hallman 1979 147 p
Avail: Univ. Microfilms Order No. 8004721

The two mathematical programming problems are considered where the complementarity condition arises. The first problem studied is the complementary programming problem which is obtained by adding the complementarity condition into the constraints of a linear programming problem. Some applications of the complementary programming problem are presented, and the relationship between this problem and the mixed integer programming problem is discussed. The other problem studied is the linear complementarity problem. A method is proposed for solving a general linear complementarity problem where no assumptions are required on the problem data. The algorithm is based on the branch-and-exclude principle and is a modification of the branch-and-bound algorithm for the complementary programming problem. Dissert. Abstr.

N80-23027 Alabama Univ. in Birmingham.
SIMULATION STRATEGIES: A THEORETICAL AND PRACTICAL INVESTIGATION Ph.D. Thesis
James William Hooper 1979 305 p
Avail: Univ. Microfilms Order No. 8007879

An approach to alleviating the dual problems of simulation language inadequacy and simulation language proliferation is investigated. The approach is to merge two popular languages, providing the means to process models written in either language alone, or containing features of both languages. In order to devise a means to merge the languages, an in depth investigation of discrete event simulation strategies was conducted. Three recognized simulation strategies are described: event scheduling, activity scanning, and process interaction. Algorithms are formulated for each strategy and a detailed comparison of the strategies is given, based on the algorithms. To provide an approach to merging the two languages, the algorithms for the respective strategies (process interaction and event scheduling) are merged into one algorithm. A prototype processor is evaluated. Dissert. Abstr.

N80-23028 Northwestern Univ., Evanston, Ill.
A SYSTEMS APPROACH TO SOFTWARE DESIGN REPRESENTATION Ph.D. Thesis
Leon John Mekly 1979 214 p
Avail: Univ. Microfilms Order No. 8007395

The software engineering problem is approached recognizing that any design is the process of building a representation of an object to be created, and therefore, the right form of design representation is considered to be the main instrument necessary for the integration of essential mathematical and engineering concepts into the software design process. The main goal of this work is the development of a particular scheme of software design representation which is similar to the blueprint concept of the mature engineering professions. Special attention is given to the important notion that a design representation is not just a form of specification, description, or documentation, but a formal engineering model of the system's functional and structural aspects. The graphical-analytical simplicity of a representation scheme is considered to be the key feature for the effective construction and analysis of system models. Dissert. Abstr.

N80-23029 State Univ. of New York at Stony Brook.
TOWARD A THEORY OF PROGRAM SYNTHESIS: AUTOMATING IMPLEMENTATIONS OF ABSTRACT DATA TYPES Ph.D. Thesis
Pasupathi Ananta Subrahmanyam 1979 326 p
Avail: Univ. Microfilms Order No. 8009594

The development of a basis for a theory of program synthesis, proceeding from formal specifications of problems in the form of abstract (algebraic) data types. The problem considered is that of automating the implementation of a formally specified type of interest in terms of a target type (or a set of target types) for which the implementations are presumed to be available. The task of program synthesis is approached in a general algebraic framework, and has adequate flexibility to allow for various forms of optimizations to be applied at different stages of the synthesis process. The main tools used to obtain implementations are type composition, syntactic pattern-matching, and the semantic specifications of the functions defined on the type. Syntactically guided synthesis strategies are also investigated; these consist of hypothesizing implementations based purely on the syntactic specifications of functions. Dissert. Abstr.

N80-23030# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
A T = O(2N/2), S = O(2/4) ALGORITHM FOR CERTAIN NP-COMPLETE PROBLEMS
R. Schroeppel and Adi Shamir Jan. 1980 26 p refs
(Contract N00014-76-C-0366)
(AD-A080385; MIT/LCS/TM-147) Avail: NTIS
HC A03/MF A01 CSCL 09/4

A general purpose algorithm that can solve a number of NP-complete problems in time T=o (2 to the n/2 power) and space S=(2 to the n/4 power) is presented. The algorithm can be generalized to a family of algorithms whose time and space complexities are related by T times S squared =o (2 to the nth power). The problems it can handle are characterized by few decomposition axioms, and they include knapsack problems, exact satisfiability problems, set covering problems, etc. The new algorithm has a considerable significance, since it can break knapsack-based cryptosystem with up to n= 100 generators. R.C.T.

N80-23031# Naval Research Lab., Washington, D. C.
FLEX: A FLEXIBLE, AUTOMATED PROCESS DESIGN SYSTEM Final Report
Stephen A. Sutton and Victor R. Basil Nov. 1979 30 p refs
(RR0230345)
(AD-A079312; AD-E000345; NRL-8349) Avail: NTIS
HC A03/MF A01 CSCL 09/2

The FLEX Design System is a software design language and its processor that together form a tool for use in computer software development activities. The system combines features originating in earlier Process Design Languages (PDLs) with many features found in modern programming languages. The system is quite flexible and can be adapted to different programming environments; in effect the language can be configured to produce a family of less flexible PDLs. Among the features offered by the FLEX language are: a modular design structure, type abstraction, definable operators, generic routines, strong type checking, consistency checking of all functional interfaces, and protection of selected data from alteration in certain environments. GRA

N80-23032# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering
THE GENERATION OF INPUT DATA USING INTERACTIVE COMPUTER GRAPHICS M.S. Thesis
Alan R. Miller Dec. 1979 136 p refs
(AD-A080171; AFIT/GCS/MA/79D-2) Avail: NTIS
HC A07/MF A01 CSCL 09/2

The Air Force Avionics Laboratory utilizes a digital computer model of an air defense command and control system in its analysis programs. The model is quite large and requires an extensive input data set, of which approximately 80 percent is used to define the ground defense environment. Current techniques for preparation of the input data are totally manual, requiring many hours of tedious site preparation, data transcription, and keypunching. This paper presents a completely new approach to the preparation of the ground defense environment data. A system of three computer programs is identified that provides an automated process for converting basic site parameterization data into the required format for input to the model. An interactive computer graphics program is the core of the system and the principal vehicle through which all data modification and assignment actions occur. State-of-the-art concepts in software engineering, data storage and retrieval, and man-machine communication techniques are incorproated which enable early detection of erroneously defined data, increase the quality and

timeliness of the final product, and improve overall system maintainability. GRA

N80-23033# Utah Univ., Salt Lake City. Dept. of Electrical Engineering.
SOFTWARE RELIABILITY ESTIMATION UNDER CONDITIONS OF INCOMPLETE INFORMATION Final Technical Report, 1 Apr. 1978 - 1 Apr. 1979
C. K. Rushforth, F. L. Staffanson, and A. E. Crawford. Griffiss AFB, N. Y. RADC. Oct. 1979. 92 p. refs.
(Contract F30602-78-C-0025; AF Proj. 2528)
(AD-A080432; UTEC-79-063; RADC-TR-79-230) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes a computer program for the estimation of the reliability of large software packages. A model is developed which incorporates additional features found in realistic testing environments. The model is analyzed for deterministic data. Performance on simulated random test data is presented. The algorithm estimates the parameters of the model from software error data, and computes therefrom running estimates of the mean-time-to-failure and the number of software errors remaining. GRA

N80-23034# Ohio State Univ. Research Foundation, Columbus. Dept. of Computer and Information Science.
TRANSLATION OF PHRASE STRUCTURED PROGRAMMING LANGUAGES Final Report, 1 May 1975 - 30 Jun. 1979
William Buttelmann. Dec. 1979. 15 p. refs.
(Grant AF-AFOSR-2811-75; AF Proj. 2304)
(AD-A080100; OSURF-760242/784151; AFOSR-80-0088TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

An integrated formal theory of phrase structure linguistic descriptions has been developed, based on classical phrase linguistic theory and on a new formal theory of phrase structure semantics developed by this research project. The theory provides for both context-sensitive syntax and semantic structure, interpretations, the meaning of certain linguistic entities such as morphemes, phrases, sentences, and statements, and specifies the nature of and relationship between syntactic and semantic ambiguity. The theorectical model of syntax and semantics was developed in order to study the computational aspects of semantic interpreters and language translators. Based on the model, a theory of interpretation and translation was constructed, and a number of results in these two areas have been developed. It was shown how linguistic properties can be treated either as context-sensitive or context-free and either as semantic or syntactic information. This theory establishes the basis for further research into the computational complexity of semantic interpreters and especially into the problem of minimizing the complexity of interpreters by proper trade-offs between syntax and semantics and/or 'context-sensitive'-ness and 'context-free'. GRA

N80-23035# Pattern Analysis and Recognition Corp., Rome, N. Y. Pattern Analysis and Recognition Corp.
MULTICS REMOTE DATA ENTRY SYSTEM, VOLUME 1
David Bimbaum, John J. Cupak, Jr., Janet D. Dyar, and Richard Jackson. Griffiss AFB, N.Y. RADC. Oct. 1979. 260 p. refs.
(Contract F30602-77-C-0174; AF Proj. 5597)
(AD-A080625; PAR-79-59-Vol-1; RADC-TR-79-265-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 09/2

This report contains the user's manuals and software documentation for the Remote Data Entry System which is the front-end to the MULTICS Pattern Recognition Facility and the Cluster Analysis package which was added to MULTICS OLPARS. The Remote Data Entry System was designed to allow users of the MULTICS Pattern Recognition Facility the ability to input their data over the ARPANENT from a Tektronix remote storage device. Once the data is input into the MULTICS System, routines are provided so that the user can easily restructure or cluster his database to perform different classification experiments. Author (GRA)

N80-23036# Pattern Analysis and Recognition Corp., Rome, N. Y. Pattern Analysis and Recognition Corp.
MULTICS REMOTE DATA ENTRY SYSTEM. VOLUME 2: CLUSTERING ADDITIONS TO MOOS
Janet D. Dyar. Griffis AFB, N.Y. RADC. Oct. 1979. 98 p.
(Contract F30602-77-C-0174; AF Proj. 5597)
(AD-A080626; PAR-79-53-Vol-2; RADC-TR-79-265-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes the clustering algorithms added to the MULTICS OLPARS Operating System under this effort. GRA

N80-23037# California Univ., Livermore. Lawrence Livermore Lab.
DISCUSSION OF MACRO CAPABILITIES IN FORTRAN
Jeanne T. Martin. Sep. 1979. 17 p. refs. Presented at the FORTRAN Experts Meeting ISO/TC97/SC5, Turin, 12-16 Nov. 1979
(Contract W-7405-eng-48)
(UCRL-83306; CONF-791111-1) Avail: NTIS HC A02/MF A01

The advantages of adding a macro capability to FORTRAN are propounded. The necessary syntactic features are discussed and the utility of such a capability is illustrated through the use of examples. A particular syntactic mechanism is employed for illustrative purposes. It permits a programmer to define syntax appropriate to an application. DOE

N80-23038# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE EVALUATION OF LINEAR ALGEBRA SOFTWARE IN PARALLEL ARCHITECTURES
Thomas L. Jordan. Oct. 1979. 30 p. refs.
(Contract W-7405-eng-36)
(LA-8078-MS) Avail: NTIS HC A03/MF A01

Performance data of parallel computers on several of the problems of linear algebra using direct methods are provided. The computers considered include software pipeline, hardware pipeline, single-instruction multiple-data, and multiple-instruction multiple-data. Special features of each architecture are considered. Factors such as start-up time, scalar-vector break-even points, consistency in operation count, parallel steps required, and speed-up and efficiency of the hardware are discussed. A reasonably broad comparison is given for LU factorization without pivoting. A less extensive comparison is given for LU factorization with pivoting. Also various intracomputer comparisons are presented to show the performance of different implementations of a particular algorithm as well as the performance of different algorithms for solving the same problem. Data were collected for the linear algebraic problems of matrix multiplication, regular sparse systems (including tridiagonal systems and dissection techniques), and random sparse systems. DOE

N80-23039# Royal Aircraft Establishment, Farnborough (England).
A FREE-FORMAT DATA INPUT SCHEME WRITTEN IN FORTRAN 4
G. F. Butler and J. Pike. London. HMSO. May 1979. 43 p.
(RAE-TM-Aero-1804; BR69582) Avail: NTIS HC A03/MF A01

A data input scheme which uses FORTRAN 4 and which makes the minimum amount of demands on the data structure is described. The scheme allows input variables to retain their previous values, identical consecutive data to be input in a simplified form, and alphanumeric comments to appear among the data. Details of the data input scheme and the computer programs are discussed. Author (ESA)

N80-23040# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
COST ESTIMATION AND MANAGEMENT CONTROL OF SOFTWARE DEVELOPMENT IN SCIENTIFIC/TECHNICAL PROJECTS
U. Posthuma deBoer. 31 May 1979. 150 p. refs.
(Contract NIVR-1831)
(NLR-TR-78056-U) Avail: NTIS HC A07/MF A01

Cost estimation of software development and the monitoring and control of factors which affect the development cost is considered. The lack of uniformity in the development approach, the lack of a standard terminology and the limited, difficult to access, cost data bases are included. A cost estimation approach is presented together with a survey of factors affecting the cost of software development, illustrated with figures. To keep these cost factors manageable, a configuration management system is

proposed, partly based on procedures and tools already in use for hardware development. Procedures and tools for software configuration management and for related aspects as software testing are described and illustrated with examples from software development projects. Author (ESA)

N80-23041# Research Inst. of National Defence, Stockholm (Sweden).
DESIGN SPECIFICATION FOR DATALAB: A SYSTEM FOR DATA ANALYSIS BASED ON RELATIONAL MODEL OF DATA
Stefan Amborg, Eva Elvers, and Per Svensson. Nov. 1979. 232 p. refs.
(FOA-C-20326-DB). Avail: NTIS. HC A11/MF A01.

The design documentation for a proposed interactive program system, Datalab, intended for data analysis applications in science, technology, and management is presented. The kernel of the system is a relational database subsystem permitting the evaluation of queries expressed in a relational algebra query language. Onto this kernel are added several subsystems which serve to enhance the analytic power of the system, to simplify its use, and to ensure the security of its database. The system is functionally extensible, in the sense that additions to the standard set of application programs can be made by a programmer user. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N80-23042 California Univ., Los Angeles.
SEGMENTATION OF THE DOMAIN OF DISTRIBUTED PARAMETER SYSTEMS. Ph.D. Thesis.
Kofi Apenyo. 1979. 242 p.
Avail: Univ. Microfilms. Order No. 8008455.

A method based on pattern recognition principles is presented for the segmentation of the domain of distributed parameter systems. The proposed methodology involves the design of a region growing system. An important assumption is that a relationship between system observations and the underlying regions exists. Thus a theoretical formulation for the property of a pattern in the form of numerical measurements of the dynamic model response is considered. The decision phase of the pattern recognition system design consists of a threshold element which determines the membership of a pattern in one of the underlying regions. The segmentation ability of the system design is investigated by computer simulation of a water quality system. Quantitative measures which estimate the performance of the region grower are developed and used to demonstrate the feasibility of applying the methodology to realistic distributed parameter systems. Dissert. Abstr.

N80-23043 Princeton Univ., N. J.
MODELING OF MULTI-MICROCOMPUTER NETWORKS. Ph.D. Thesis.
Hikyu Lee. 1979. 160 p.
Avail: Univ. Microfilms. Order No. 8008943.

The network geometry for multi-microcomputer interconnection is described by an undirected graph. The nodes represent microcomputers with associated local memory and the edges are bi-directional communication links. Network geometries represented by a family of regular graphs, called chordal ring, high level chordal ring and multi tree structured graphs are described and analyzed. Analytic and computational results on these graphs are obtained. A specialized multichain, multiclass, network of queues model is developed. Statistics on the performance measures, such as processor utilization, mean response time, and concurrency are obtained for an example model of a 10 node system. Dissert. Abstr.

N80-23044# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PROTOTYPE UNIVERSAL NETWORK INTERFACE DEVICE. M.S. Thesis.
Eric Frederick Brown. Dec. 1979. 88 p. refs.
(AD-A080173; AFIT/GE/EE/79-8). Avail: NTIS. HC A05/MF A01. CSCL 17/2.

The thesis describes a prototype version of a flexible message processor designed for computer communications network applications. This message processor is microcomputer based and is called a Universal Network Interface Device. The thesis describes the operational features and construction details of the three cards, which were developed in the construction of the prototype device. These three cards are used with two microcomputer boards and a memory board to provide the capability to interface local users to a computer communications network. The device also provides the capability to act as the node connecting two networks operating under dissimilar protocols. GRA

N80-23045# California Univ., Livermore. Lawrence Livermore Lab.
LIMITING THE LIFETIME OF PACKETS IN COMPUTER NETWORKS.
Lansing J. Sloan. 16 Aug. 1979. 7 p. refs. Proceedings of the 4th Conf. on Local Computer Networks, Minneapolis, 22-23 Oct. 1979; sponsored by IEEE Computer Soc.
(Contract W-7405-eng-48).
(UCRL-82825; CONF-791023-1). Avail: NTIS. HC A02/MF A01.

The assurance mechanisms of protocols used in packet switching computer networks, the maximum lifetime of packets being transported from source to destination and subsequent reliability problems are discussed. A method is presented that ensures that a packet is delivered only if its age does not exceed a guaranteeable maximum packet lifetime. The method requires knowledge of the time a packet spends on a logical link; a mechanism to measure this time can be, and should be, added to existing link-level protocols. Such a mechanism is presented and its addition to a standard link-level protocol is shown. DOE

N80-23046# California Univ., Livermore. Lawrence Livermore Lab. Biomedical Sciences Div.
PLANNING THE EVOLUTION OF A LABORATORY COMPUTER NETWORK.
Tom Slezak. 28 Aug. 1979. 19 p. Presented at MODCOM Users Sec. Conf. Miami, 3-6 Dec. 1979.
(Contract W-7405-eng-48).
(UCRL-83061; CONF-791206-1). Avail: NTIS. HC A02/MF A01.

One consequence of the rapid decline of computer prices is the growth of loosely connected, relatively unplanned computer networks. In research installations, independently funded groups often acquire their own minicomputers and interconnect them as the need arises. If there are several groups working on problems in proximity, similar networks usually result. An unstructured network is examined, and a long-range growth plan that can be used at various levels of management is presented. The situation is illustrated by the example of the LLL Biomedical Sciences Division's computer network. DOE

N80-23047# European Space Agency, Paris (France).
LINK INVARIANT LINE PROGRAMS IN COMMUNICATION SYSTEMS.
Franz Josef Buchberger. Mar. 1979. 101 p. refs. Transl. into ENGLISH of "Anschlussinvariante Leitungsprogramme in Kommunikationssystemen", Rept. DLR-FB-77-38. DFVLR, Oberpfaffenhofen, West Germany Feb. 1977. Original report in GERMAN previously announced as X79-71675.
(ESA-TT-501-Rev.; DLR-FB-77-38). Avail: NTIS. HC A06/MF A01; DFVLR, Cologne DM 42.30.

Starting with the term 'communications system' a general introduction to the field of communications operating systems is given. By two examples, the operational program of the Interface Message Processors (IMPs) and TIPS, (Terminal IMPS) in the ARPA computer network and the operating system SOHO, it is shown in detail how communications operating systems can be constructed. The line programs are the object of particular consideration. The terms 'simple', 'copied', and 'link invariant' line programs are defined, and the advantages and disadvantages of these types of line programs are discussed. The implementation of link invariant line programs in the operating system SOHO is described. Their memory space and computing time requirements are evaluated. The effect of these requirements on the overall

system performance is investigated. The investigation shows that link invariant line programs are preferable to copied line programs in most cases. Author (ESA)

N80-23048# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)
DIGITAL COMPENSATORS FOR SAMPLED DATA SYSTEMS AND MINIMUM TIME COMMAND
Alain Bernard 1979 27 p refs In FRENCH; ENGLISH summary
Report will be also announced as translation (ESA-TT-607)
(ONERA-NT-1979-3) Avail: NTIS HC A03/MF A01

The minimum time command for a sampled system is that which allows a given change of state within a minimum number of sampling periods. The calculation of successive commands from the transition equations is presented and a method for determining and initializing numerical correctors is proposed. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-23049 Michigan Univ., Ann Arbor
THE M/G/1 QUEUE WITH DELAYED FEEDBACK Ph.D. Thesis
Robert Doyle Foley 1979 74 p
Avail: Univ. Microfilms Order No. 8007738

The M/G/1 queue with delayed feedback is a two node queueing network. External arrivals to node one from a Poisson process. Node one has a general server with an unlimited queue capacity and a first come, first serve queue discipline. After completing service a customer either departs from the network or feeds back to node two. Node two delays customers before allowing them to reenter node one. The delay is modelled as a /M/1 queue. After completing service at node two a customer reenters node one. Thus the total input process to node one consists of exogenous arrivals and endogenous reentries from node two. The probability of a customer feeding back is allowed to depend on the queue length at nodes one and two and on the service time of the customer at node one. Dissert. Abstr.

N80-23050# Stanford Univ., Calif. Dept. of Engineering-Economic Systems
DYNAMIC SYSTEMS Interim Report
David G. Luenberger Dec. 1979 6 p
(Grant AF-AFOSR-3141-77; AF Proj. 2304)
(AD-A080206; AFOSR-80-0051TR) Avail: NTIS
HC A02/MF A01 CSCL 12/2

During the past year of this grant, substantial progress was made in two major areas of research. The first, which was the original focus of the grant in earlier years, is that of positive dynamic systems. This work has reached the point where it is useful for certain design problems. The second area of research, which has been a new focus for the past two years, is that of descriptor variable systems. Our efforts continue on the basic theory and application for the nonlinear case. GRA

N80-23051# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems
A UNIFIED THEORY OF FLOW CONTROL AND ROUTING IN DATA COMMUNICATION NETWORKS Ph.D. Thesis
Seyyed Jamaloddin Golestaani Jan. 1980 100 p refs
(Contract N00014-75-C-1183; ARPA Order 3045; Grant NSF ENG-77-19971)
(AD-A080358; LIDS-TH-963) Avail: NTIS HC A05/MF A01
CSCL 17/2

A joint flow control and routing (JFCR) strategy is proposed for store and forward communication networks. The strategy is based on a convex optimization problem in terms of the average input rates and multi-commodity flows and is shown to have the following properties: first the average load of each buffer stays below some arbitrarily chosen level for the input rate and routing assignments of the strategy. This level can be chosen so as to upper bound the probability of buffer overflow arbitrarily. Secondly, by proper selection of the cost function, it is possible to utilize the network fully and to achieve a variety of different types of priorities in the services offered to the users. Finally, the routing assignments of the strategy correspond to a routing strategy/which tends to minimize the total delay when the network is lightly loaded and tends to prevent congestion when it is heavily loaded. Furthermore, the proposed JFCR problem is shown to be equivalent to a minimum delay routing problem corresponding to a bigger network. Accordingly, any minimum delay routing algorithm can be converted into a JFCR algorithm. Using this approach, a class of JFCR algorithms with distributed computations at the nodes are developed. Under certain conditions, a one to one correspondence is shown to exist in a store and forward network between the set of average input rates and the set of average number of outstanding packets of commodities. This unique correspondence is used to show that in practice the average input rates can be adjusted as desired by restricting the number of outstanding packets on each commodity (window strategy. GRA

N80-23052# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
GRAPHICAL INPUT METHODOLOGY FOR COMPUTER AIDED ANALYSIS OF CONTROL SYSTEMS M.S. Thesis
Donald E. Troxel Dec. 1979 169 p refs
(AD-A080362; AFIT/GE/MA/79D-1) Avail: NTIS
HC A08/MF A01 CSCL 09/2

This report describes the design of a graphical input language and CAD system for specifying control system block diagrams. The goal to develop a graphical means of defining block diagrams that avoided the need to create the textual descriptions required by most existing traditional analysis packages was accomplished. Generalized requirements for a successful human interface were developed. A graphical input methodology was developed that meets these human constraints. The CAD system designed allows graphical definition of linear systems and translation of these systems into forms acceptable by traditional analysis programs. GRA

N80-23053# Brown Univ., Providence, R. I. Center for Dynamical Systems.
PRACTICAL METHODS FOR THE COMPENSATION AND CONTROL OF MULTIVARIABLE SYSTEMS Interim Report
William A. Wolovich and Peter L. Falb 1979 14 p refs
(Contract AF-AFOSR-3182-77; AF Proj. 2304)
(AD-A080265; AFOSR-80-0036TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A new method for obtaining simple, low order models for higher order stable systems was developed and tested on a sixteenth order model of the F-100 jet engine. A scalar adaptive control procedure was extended to the multivariable case. A polynomial matrix characterization of the maximal (A,B)-invariant and controllability subspace in the kernel of C was determined together with an algorithm for the state feedback controllers which yield such maximal subspaces. This work should have significant impact in the study of systems with imprecisely known parameters. A complete resolution to the problems of determining state feedback invariants and canonical forms for linear systems characterized by proper rational transfer matrices was obtained. A number of results have been obtained illustrating the richness of the linkage between system theory and algebraic-geometry. For example, it has been shown that any symmetric transfer matrix over reals has a symmetric realization (answering an old question in network theory). Finally, a new, general purpose compensator for multivariable systems has been developed. This compensator insures simultaneous regulation, tracking, decoupling, stability, and robustness for a large class of linear multivariable systems. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-23054 Illinois Univ. at Urbana-Champaign.
THE MARTINGALE PROBLEM FOR THE DYNAMIC GAS

MODEL Ph.D. Thesis
Robert Wayne Bonvallet 1979 88 p
Avail: Univ. Microfilms Order No. 8008983

In the dynamic gas model, particles move to different sites in a lattice and no more than one particle can be at any site in the lattice at any one time. The probability of a particle at site k jumping to an unoccuped site 1 in time t is c sub k (x)P(k,1)delta t + sigma (delta t) when c sub k (x) is a nonnegative function of site k and configuration x, which tells the location of all particles, and P(k,1) is an irreducible transition kernel. Liggett has shown that under certain conditions on the functions c sub k (x) and P(k,1) there exists a unique semigroup T sub t which describes the motion of the system. It is shown here that under the same conditions, there exists a unique solution to the Martingale problem, which means that for each configuration x there exists a unique probability measure on the path space.
Dissert. Abstr.

N80-23055 Duke Univ., Durham, N. C.
A MONOTONE METHOD FOR A SYSTEM OF NONLINEAR PARABOLIC DIFFERENTIAL EQUATIONS Ph.D. Thesis
Paul Dennis Norman 1979 38 p
Avail: Univ. Microfilms Order No. 8008190

A monotone method for a system of semi-linear parabolic partial differential equations is presented. The principal tool used for obtaining this method is the maximum principle or a related comparison technique. Starting with properly defined upper and lower solutions of the system, sequences of upper and lower solutions are inductively defined and are shown to converge monotonically to the solution of the system. This is a generalization of a monotone method for a single equation of parabolic type. In the past, it has often been necessary to make the restriction of quasi-monotonicity on the non-linearities when applying the maximum principle to systems. It is shown that this restriction is not necessary here. A mathematical model describing a simple combustion process in which the nonlinearities do not satisfy the quasi-monotonicity property is discussed and the techniques developed are illustrated through this specific example.
Dissert. Abstr.

N80-23056 California Univ., Los Angeles.
THE HAMILTONIAN OF THE QUANTIZED NON-LINEAR SCHROEDINGER EQUATION Ph.D. Thesis
Stephen Charles Oxford 1979 208 p
Avail: Univ. Microfilms Order No. 8008510

As a classical equation, the nonlinear Schrodinger equation was studied successfully by means of inverse scattering. A complete family of conserved quantities was exhibited using this technique; however, in the absence of a quantum inverse scattering transform, the quantized field equations must be handled differently. The Lagrangian formalism permits the construction of a Hamiltonian associated to the NLSE, which has been explicitly spectrally decomposed by Gaudin in the repulsive case $c > 0$. Both the attractive, $c < 0$, and repulsive cases have been studied when the field is restricted to a finite interval with periodic boundary conditions, and some properties of the thermodynamic limit have been exhibited. The attractive case is treated in the quantized system strictly in the thermodynamic limit, explicitly exhibiting all bound states in the course of finding an explicit unitary transformation of the physical Hilbert space to a certain momentum space, which reduces the Hamiltonian to a multiplication operator.
Dissert. Abstr.

N80-23057 Alabama Univ., University.
ALMOST CONTINUOUS FUNCTIONS Ph.D. Thesis
Donald Lee Alexander 1979 42 p
Avail: Univ. Microfilms Order No. 8007584

The topological (or correctedness) properties of certain types of discontinuous functions are described. Particular emphasis is placed on Darboux.
Dissert. Abstr.

N80-23058 Yeshiva Univ., New York, N. Y.
THE FOURIER ANALYSIS THEORY OF UNSOLVABILITY IN PARTIAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
Ronald Stuart Levin 1979 111 p
Avail: Univ. Microfilms Order No. 8007268

A Fourier analysis technique for proving unsolvability in partial differential equations is presented. An operator D is onto if it possesses solutions for every function in a given space. If, for some function, no solution exists, D is not onto. The Fourier transform of the adjoint of D is an operator on a Fourier transform space of entire functions. By a well known theorem, D is onto if and only if the inverse of the Fourier transform of the adjoint of D is continuous. The Fourier analysis proof of the unsolvability of Lewy's equation is developed, followed by the use of the technique to show unsolvability for a more general class of operators. One result is the unsolvability of a simple two variable equation, the proof of which is almost identical to proof of Lewy's theorem. Finally, Lewy's proof is viewed in terms of topological vector space and the Fourier analysis proof is constructed from it.
Dissert. Abstr.

N80-23059 University of Western Michigan, Kalamazoo.
UNIFORM FACTORIZATIONS OF GRAPHS Ph.D. Thesis
David Peter Burns 1979 132 p
Avail: Univ. Microfilms Order No. 8007684

Problems involving the factorization of a given graph with each factor possessing a given graph theoretical property are investigated. The first such common property to be considered is line-symmetry, and a study of line-symmetric graphs themselves is made. A three part categorization of line-symmetric graphs containing no isolated vertices is provided as are characterizations of line-symmetric graphs in terms of the addition or deletion of edges. The vertex analogs of these results are considered, and point-symmetric graphs are characterized in terms of vertex deletion. It is shown that with some restrictions, a graph is line-symmetric if and only if its line graph is point-symmetric. Several structural characterizations of line-symmetric graphs that fall into particular categories are then presented, where the categories are specified by various connectivity properties of either the graphs themselves or their complements. It is shown that line-symmetric graphs containing no isolated vertices are either regular or biregular, this latter term describing graphs whose degree set has cardinality two. Characterizations of biregular line-symmetric graphs are established and examples are provided to show that these results are best possible.
Dissert. Abstr.

N80-23060*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MULTI-LEVEL ADAPTIVE FINITE ELEMENT METHODS. 1: VARIATION PROBLEMS
Achi Brandt 2 Mar. 1979 74 p refs
(Contract NAS1-14101)
(NASA-TM-80985; ICASE-79-8) Avail: NTIS HC A04/MF A01 CSCL 12A

A general numerical strategy for solving partial differential equations and other functional problems by cycling between coarser and finer levels of discretization is described. Optimal discretization schemes are provided together with very fast general solvers. It is described in terms of finite element discretizations of general nonlinear minimization problems. The basic processes (relaxation sweeps, fine-grid-to-coarse-grid transfers of residuals, coarse-to-fine interpolations of corrections) are directly and naturally determined by the objective functional and the sequence of approximation spaces. The natural processes, however, are not always optimal. Concrete examples are given and some new techniques are reviewed. Including the local truncation extrapolation and a multilevel procedure for inexpensively solving chains of many boundary value problems, such as those arising in the solution of time-dependent problems.
M.G.

N80-23061# Texas Univ. at Austin. Center for Cybernetic Studies.
A DUAL METHOD FOR DISCRETE CHEBYCHEV CURVE FITTING WITH LINEAR RESTRICTIONS ON THE PARAMETERS
Ronald D. Armstrong and Michael G. Sklar (St. Edward's Univ., Austin, Tex.) Sep. 1979 49 p refs
(Contract N00014-75-C-0569; NR Proj. 047-021)
(AD-A078623; CCS-352) Avail: NTIS HC A03/MF A01 CSCL 12/1

The L at infinity norm has been widely studied as a criterion for curve fitting problems. This paper presents an algorithm to solve discrete approximation problems in the L at infinity norm when the parameters are restricted by linear constraints. The

algorithm is a special-purpose linear programming dual method which employs a reduced bases and multiple pivots. Results of the computational experience with a computer code version of the algorithm are presented. GRA

N80-23062# Wisconsin Univ. - Madison. Mathematics Research Center.
AN ADAPTIVE NONLINEAR LEAST-SQUARES ALGORITHM Summary Report
John E. Dennis (Rice Univ., Houston, Tex.), David M. Gay (MIT, Cambridge), and Roy E. Welsch (MIT, Cambridge) Oct. 1979 46 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-76-00324; Grants NSF DCR-75-10143; NSF MCS-78-09525)
(AD-A079716; MRC-TSR-2010) Avail: NTIS HC A03/MF A01 CSCL 09/2

NL2SOL is a modular program for solving nonlinear least-squares problems that incorporates a number of novel features. It maintains a secant approximation S to the second-order part of the least-squares Hessian and adaptively decides when to use this approximation. S is 'sized' before updating, something which is similar to Oren-Luenberger scaling. The step choice algorithm is based on minimizing a local quadratic model of the sum of squares function constrained to an elliptical trust region centered at the current approximate minimizer. This is accomplished using ideas discussed by More, together with a special module for assessing the quality of the step thus computed. These and other ideas behind NL2SOL are discussed and its evolution and current implementation are also described briefly. GRA

N80-23063# Wisconsin Univ. - Madison. Dept. of Statistics.
TRANSFORMATION OF GROUPED OR CENSORED DATA TO NEAR NORMALITY
Victor M. Guerrero and Richard A. Johnson Nov. 1979 11 p refs Sponsored in cooperation with ARO
(Contract N00014-78-C-0722)
(AD-A080601; UWIS-DS-79-542; ARO-15660.27M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Box and Cox (1964) an analysis of transformations proposed a power transformation which has proven utility for tranforming ungrouped data to near normality. In this paper, we extend its applicability to two frequently encountered situations: (1) grouped data and (2) Type I censored data. The asymptotic properties of the estimators are derived and illustrative examples are presented. GRA

N80-23064# Rice Univ., Houston, Tex. Aero-Astronautics Group.
NEW TECHNIQUES IN NUMERICAL ANALYSIS AND THEIR APPLICATION TO AEROSPACE SYSTEMS Final Report, 1 1 Sep. 1976 - 31 Dec. 1979
Angelo Miele 1979 72 p
(Grant AF-AFOSR-3075-76; AF Proj. 2304)
(AD-A080445; AAR-146; AFOSR-80-0050TR) Avail: NTIS HC A04/MF A01 CSCL 22/3

This document summarizes the research performed at Rice University during the period 1976-79 under AFOSR 76-3075 in several areas of numerical analysis of interest in aerospace systems theory, namely solution of nonlinear equations, solution of differential equations, mathematical programming problems, and optimal control problems. The work summarized here is applicable to these areas of aerospace engineering optimum atmospheric flight trajectories, optimum extra-atmospheric flight trajectories, optimum aerodynamic shapes, and optimum structures. GRA

N80-23065# California Univ., Los Angeles. Dept. of System Science.
A COMPARISON OF THE OPTICAL ORDERING LEVELS OF BAYESIAN AND NON-BAYESIAN INVENTORY MODEL
Katy S. Azoury and Bruce L. Miller (Ill. Univ. at Chicago Circle) Dec. 1979 29 p refs
(Contract N00014-78-C-0428)
(AD-A080599) Avail: NTIS HC A03/MF A01 CSCL 15/5

Although it is often the case that the parameters of the distribution of demand are not known with certainty and that a Bayesian formulation would be appropriate, such an approach is generally not used in inventory calculations for computational reasons. Since one often resorts to a non-Bayesian formulation, it is of interest to compare Bayesian policies with a comparable non-Bayesian policy. It was anticipated that the non-Bayesian policy (quantity ordered) would be an upper bound to the Bayesian policy. This result is established for a two-period standard inventory model and for the n-period non-depletive inventory model. However, a counterexample is given in the standard inventory model for an alternative comparable non-Bayesian formulation. GRA

N80-23066# Army Research Office, Research Triangle Park, N. C.
TRANSACTIONS OF THE 25TH CONFERENCE OF ARMY MATHEMATICIANS
Jan. 1980 801 p refs Conf. held in Baltimore, 6-8 Jun. 1979; sponsored by the Army Mathematics Steering Comm.
(AD-A080736; ARO-80-1) Avail: NTIS HC A99/MF A01 CSCL 20/4

The Silver Anniversary of the Conferences of Army Mathematicians was conducted on the dates 6-8 June 1979. The U.S. Army Ballistic Research Laboratory and the Johns Hopkins University served as its hosts. It was held on the Homewood Campus of the Johns Hopkins University in Baltimore, Maryland. 'Continuum Mechanics' was the theme selected for the Silver Jubilee. To celebrate this occasion the number of guest speakers were increased, and those individuals who were invited to talk were selected because they are effective researchers who are in the frontiers of their fields. Another important reason for their appearance on the program is that they are interested in current and envisioned U.S. Army material research and development problems. As in previous conferences there were a large number of papers contributed by Army scientists. These, on the whole, addressed problems of immediate interest to scientists in the various Army laboratories. GRA

N80-23067# Applied Decision Analysis, Inc., Menlo Park, Calif.
ALGEBRAIC MODELING SYSTEM
Allen C. Miller Jul. 1979 15 p Prepared for Lawrence Livermore Lab., Calif.
(Contract W-7405-eng-48)
(UCRL-15074) Avail: NTIS HC A02/MF A01

The design of an algebraic modeling system is summarized. The purpose and capabilities of the algebraic modeling system are discussed and the set of commands used to instruct the system to construct and analyze models is specified. DOE

N80-23068# Argonne National Lab., Ill.
SOME RECENT MATHEMATICAL DEVELOPMENTS IN BOUNDING AND APPROXIMATING TRANSIENT CREEP SOLUTIONS
Richard A. Valentin 1979 8 p refs Presented at the 2nd Intern. Seminar on Inelastic Analysis and Life Prediction in High Temperature Environ., Berlin, 20-21 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790874-1) Avail: NTIS HC A02/MF A01

Current practice in the elevated temperature design of reactor components and structures places major emphasis on the development of constitutive laws, their application in detailed finite element analyses, and comparison of the resulting field quantities with limits specified by various design codes. While this design philosophy is of proven practical value, its success has resulted in reduced emphasis on the development of general mathematical results applicable to wide classes of creep problems. This lecture argues for a reexamination of the emphasis being placed on detailed analysis of specific geometries as opposed to the use of approximate analysis and bounding calculations. The main objective is to introduce the designer to certain classes of a priority estimates of creep response and to explore their potential in justifying the broad generalization often required to apply code rules in specific cases. DOE

N80-23069# California Univ., Livermore. Lawrence Livermore Lab.
SOLUTION OF THE TIME-DEPENDENT INCOMPRESSIBLE NAVIER-STOKES AND BOUSSINESQ EQUATIONS USING THE GALERKIN FINITE ELEMENT METHOD
Philip M. Gresho, Robert L. Lee, Stevens T. Chan, and Robert

L. Sani. Aug. 1979. 21 p. refs. Presented at the IUTAM Symp. on Approximation Methods for Navier-Stokes Probl., Paderborn, West Germany, 9-15 Sep. 1979.
(Contract W-7405-eng-48)
(UCRL-82899; CONF-790939-1) Avail: NTIS HC A02/MF A01

The generation of a time dependent, three-dimensional model of the atmospheric boundary layer using the Galerkin finite element method (GFEM) is described. Capabilities were developed for solving the two dimensional Navier-Stokes and Boussinesq equations, both steady and time-dependent. The GFEM is applied to the primitive variable (u,P,T) equations, thus generating, in the conventional manner, a coupled system of ordinary differential equations in time. A time integration method which gives very accurate, and reasonably efficient solutions to these time-dependent problems is discussed. It is stable for any grid spacing and Reynolds number, is nondissipative, and incorporates an automatic time step selection strategy. The techniques are then demonstrated by means of two numerical examples - both starting with a motionless system: (1) a thermally driven square cavity which goes to a steady-state and (2) isothermal flow around a circular cylinder which leads to periodic vortex shedding. DOE

N80-23070# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL SOLUTION OF NONLINEAR PROBLEMS
Homer T. Walker (Univ. of Houston, Texas). Sep. 1979. 228 p.
(Contract W-7405-eng-48)
(UCID-18285) Avail: NTIS HC A11/MF A01

A reproduction of the visuals that were used in the videotaped LLL Continuing Education Course CE1715 Numerical Solution of Nonlinear Problems is presented. The course surveyed aspects of the derivation, implementation, and application of algorithms for the iterative solution of multivariable nonlinear equations and unconstrained optimization problems. Topics included nonlinear problems in one variable Newton's method for systems of nonlinear equations, globally convergent modifications of Newton's method, and secant-update methods. DOE

N80-23071# Sandia Labs., Albuquerque, N. Mex. Ground Motion and Seismic Div.
NONRECURSIVE WEINER FILTER DESIGN
Samuel D. Stearns. Sep. 1979. 46 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-1319) Avail: NTIS HC A03/MF A01

This is a tutorial report on the design of nonrecursive filters using the least-mean-squared (LMS) error criterion. A version of Levinson's algorithm for solving the LMS equations is described. The emphasis is on applying LMS-design theory to cases such as system identifications, noise cancellation, prediction, inverse filtering, and deconvolution. Examples are included. DOE

N80-23072# Brookhaven National Lab., Upton, N. Y. Applied Mathematics Dept.
REDUCTION OF A DISCRETE EVENT SIMULATION TO A MARKOV CHAIN
A. S. Noetzel and E. J. Weyuker. 1979. 7 p. refs. Presented at the Winter Simulation Conf., San Diego, Calif., 3 Dec. 1979. Prepared in cooperation with New York Univ., and Sperry Univac, St. Paul, Minn.
(Contract EY-76-C-02-0016)
(BNL-26707; CONF-791207-2) Avail: NTIS HC A02/MF A01

An event driven, time based, stochastic simulation model was modified in a straight forward manner to satisfy the axioms of a discrete state, continuous time Markov chain. The method required casting the probability distribution of each random variable representing a time interval of the process into the form of a series of exponentially distributed stages. An algorithm for this transformation was developed. The technique demonstrated by means of a simple example of a computer system simulation. The Markov chain representation of the simulation can be solved numerically; this solution provides an independent verification of the logic of the simulation. DOE

N80-23073# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THEORY AND NUMERICAL METHODS OF RESOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
Pierre Laval. 1979. 174 p. refs. In FRENCH; ENGLISH summary. Report will also be announced as translation (ESA-TT-606)
(ONERA-NT-1979-2) Avail: NTIS HC A08/MF A01

The general properties of second order partial differential equations and of systems of higher order are discussed. The various classical boundary problems, whether hyperbolic, parabolic or elliptic, are presented in the simple case of the wave, heat, and Laplace equations with two independent variables. The numerical methods available to solve these equations are examined. The finite element method is presented within the framework of two dimensional elliptic or three dimensional parabolic problems. The finite difference methods of pseudo viscosity are presented and studied for problems of unsteady compressible flows with shock waves. Author (ESA)

N80-23074# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
A HIERARCHIAL CLUSTERING SCHEME FOR ASYMMETRIC MATRICES
D. S. Bree (Technische Hogeschool, Delft), B. J. Lageweg, J. K. Lenstra, A. H. G. Rinnooy (Erasmus Univ.), and G. vanBezouwen (Technische Hogeschool, Delft). May 1979. 29 p. refs. Submitted for publication.
(MC-BW-88/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3.

The problem of grouping elements, given asymmetric relationships between them, is studied. Two criteria for distinguishing between arrangements are developed: the distortion, based on the eigenvalues of the interaction matrix, and the composition, based on the amount of information lost by combining groups. The goal is to locate those arrangements in the space of the two criteria that lie close to the Pareto-optimal points. A heuristic search procedure is proposed, which allocates each element to a separate group and then combines groups is reached. The method is applied to illustrative examples and compared to other approaches. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-23075 Illinois Univ. at Urbana-Champaign.
A NON-STANDARD APPROACH TO BROWNIAN LOCAL TIME Ph.D. Thesis
Edwin Arend Perkins. 1979. 205 p.
Avail: Univ. Microfilms Order No. 8009129

Nonstandard analysis may be used to represent a standard stochastic process by means of a discrete and more intuitive internal stochastic process. Such a representation often leads to new insights into the original standard process. A representation of this type is given for the local time of a Brownian motion. This new formulation of local time allows us to show that Levy's characterization of local time as the mesure du voisinage of the Brownian path holds uniformly in x and not just for a single value of x. A similar result is obtained for the characterization of the local time as a limit of the number of upcrossings of the Brownian motion. In addition, a nonstandard description of weak convergence is used to establish some weak invariance principles for local time in which local time is realized as the weak limit of the normalized sums of the overshoots of a random walk. Dissert. Abstr.

N80-23076 Illinois Univ. at Urbana-Champaign.
ROBUSTNESS IN BAYESIAN INFERENCE Ph.D. Thesis
Thomas Grant Menten. 1979. 99 p.
Avail: Univ. Microfilms Order No. 8009105

It is postulated that one reason for the scarcity of robustness studies is a lack of agreement on what should characterize a robustness study. This lack of agreement results in part from the fact that the subjective interpretation of probability used in Bayesian inference differs from the relative frequency interpretation used in sampling theory. Thus Bayesians have tended to avoid studies directed at procedures in favor of studies restricted to a particular data analysis. The characteristics of these two

approaches are examined in detail. Neither the approach of Bayesian inference nor the use of subjective probabilities requires, the avoidance of procedure directed studies. It is argued that procedure directed studies are both possible and desirable within the framework of Bayesian inference. Specific strategies are suggested for studying the robustness of Bayesian procedures, and these methods are developed in exemplary robustness investigations. Author

N80-23077 Michigan Univ., Ann Arbor.
STATISTICAL ANALYSIS OF SHAPE WITH CONIC SECTIONS AND ELLIPTICAL DISTRIBUTIONS ON A HYPERSPHERE Ph.D. Thesis
Paul David Sampson 1979 156 p
Avail: Univ. Microfilms Order No. 8007824

The failings of previous statistical approaches to shape are resolved in three ways. First, arcs of conic sections are used to model the outlines of shapes idealized as convex, twice-differentiable curves. Second, elliptical distributions on a four dimensional unit hypersphere are used to model populations of shapes represented by arcs of conic sections. Then, geometric envelopes of arcs of equal probability density are defined to examine, in the Euclidean plane, the variation in shape. The theory and methods are applied to the study of the shape of the human dental arch form. Conic arcs are fit to data describing the shapes of a sample of 66 dental arches, and the Bingham distribution is used to model the fitted conic arcs. Envelopes demonstrate the precision of the estimation of the modal shape and the range of variation in dental arch shapes. Dissert. Abstr.

N80-23078 Princeton Univ., N. J.
STATISTICAL MODELS Q-PERMUTATIONS Ph.D. Thesis
Arthur Richard Silverberg 1979 159 p
Avail: Univ. Microfilms Order No. 8008568

A person's preferences for m objects are often expressed as a ranking or permutation of all these an objects. Sometimes just some, say the top q objects are listed -- this will be called a q-permutation. If people are indifferent to the objects, all permutations have the same probability. This leads to the uniform distribution on permutations. However, people usually have preferences, and they may differ from group to group. Hence, two new statistical models for q-permutations were developed. The first model is defined by successive sampling from q vases that may have different proportions of balls labeled 1,...,m. A vase is an urn where the number of balls maybe infinite. The second is the Log-Linear model. It may be obtained by modifying the sampling scheme on these vases. The sufficient statistics of the Log-Linear models are the numbers of rankers who rank the ith object jth. Dissert. Abstr.

N80-23079 Maryland Univ., College Park.
THE EFFECT OF PARAMETER CHANGES ON ESTIMATES USING RANDOMIZED RESPONSE Ph.D. Thesis
Karen Lynne Gienapp Soeken 1979 108 p
Avail: Univ. Microfilms Order No. 8008244

The main and joint effects of two parameters in the randomized response design are discussed: the probability of selecting the sensitive question in a randomized response design and the proportion of individuals possessing the nonsensitive characteristic. The effects upon three variables are assessed: (1) the estimated proportion of individual possessing the sensitive characteristic, (2) the protection perceived by the subject, and (3) the willingness to use randomized response. A 2 x 4 factorial design was employed with two strategies for selection of the nonsensitive question and four levels of random selection of the sensitive question. Results indicate that probability level does interact significantly with response for low and moderately sensitive items. Probability level is significant in respondent perception of protection. However, neither variable shows significant effect on respondent attitude toward responding to survey questions under randomized response. Dissert. Abstr.

N80-23080 Connecticut Univ., Storrs.
A GENERAL CLASS OF ONE-SAMPLE NONPARAMETRIC TEST STATISTICS BASED ON SUBSAMPLES Ph.D. Thesis
William Robert Stephenson 1979 110 p
Avail: Univ. Microfilms Order No. 8008691

A general class of one-sample non-parametric test statistics based on the sign of the most extreme value in subsamples of size m are proposed. General formulas for the mean and variance are given. By means of a Monte Carlo study, the small sample power was compared to that of the sign test, Wilcoxon signed-rank test, and the t-test statistics. The power of the proposed test statistics compared favorably in magnitude to the power of competing test statistics. Dissert. Abstr.

N80-23081 Rochester Univ., N. Y.
P-VALUES: ASYMPTOTICS AND ROBUSTNESS Ph.D. Thesis
Diane Marie Lambert 1978 224 p
Avail: Univ. Microfilms Order No. 7815288

Various properties of P-values that are useful for the comparison of test procedures at, or close to, a specified alternative distribution are determined. Asymptotic lognormality, influence curves, and continuity or qualitative robustness of P-values are investigated. The literature on P-values is reviewed from their somewhat vague thirteenth century origins to current perspectives on their use. Various previously proposed measures of their behavior, such as the exponential rate, termed the half-slope, at which they approach zero under the alternative hypothesis are described. Dissert. Abstr.

N80-23082# American Univ., Washington, D. C.
A STUDY OF THE SINGLY TRUNCATED NORMAL DISTRIBUTION Final Report, 1 Sep. 1977 - 31 Jul. 1979
David S. Crosby 31 Jul. 1979 42 p refs
(Contract N00014-77-C-0624)
(AD-A080198) Avail: NTIS HC A03/MF A01 CSCL 08/10

Procedures which use standard and new statistical techniques to estimate radiances for a high spacial resolution, multiple field-of-view instrument are developed. The theory of the truncated normal distribution is applied to obtain the estimate of the radiance. A sequential procedure for determining an optimal truncation point for the single parameter truncated normal is developed. Examples of the application of these techniques to real data are provided. GRA

N80-23083# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
A STOCHASTIC REPRESENTATION FOR THE PRINCIPAL EIGENVALUE OF A SECOND-ORDER DIFFERENTIAL EQUATION Interim Report
Ioannis Karatzas Nov. 1979 25 p refs
(Grant AF-AFOSR-3063-76; AF Proj. 2304)
(AD-A080212; AFOSR-80-0048TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Using ideas from stochastic control a stochastic representation for the smallest eigenvalue of a second-order differential equation has been devised. As a side-result an associated stationary control problem in a very general setting has been solved. GRA

N80-23084# Princeton Univ., N. J. Plasma Physics Lab.
SELF-CONSISTENT KINETIC THEORY OF STOCHASTICITY
John Krommes, A. Aug. 1979 15 p refs Presented at the Intern. Workshop on Intrinsic Stochasticity in Plasmas, Corsica, 18-23 Jun. 1979
(Contract EY-76-C-02-3073)
(PPPL-AF-89; CONF-7906106-2) Avail: NTIS HC A02/MF A01

It is argued that renormalized kinetic theory is the appropriate tool with which to study macroscopic properties of stochastic systems. Functional technique are described which afford a self-consistent describing of nonlinear excitation, propagation, and dielectric response of fluctuations in the stochastic regime. DOE

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-23085 New Mexico Univ., Albuquerque.
STOCHASTIC STABILITY OF INTERCONNECTED SYSTEMS

Ph.D. Thesis
Dhemetrios Boussalis 1980 175 p
Avail: Univ. Microfilms Order No. 8008073

The operation of the interconnected system in a noisy environment introduces additional difficulty to the stability studies of such dynamical systems. Specifically, the mathemtical models describing the subsystems as well as the interconnecting structure become dependent on random parameters or random functions, thus making the techniques used to manipulate systems described by ordinary differential equations inapplicable. This dissertation considers several classes of interconnected systems described by Ito stochastic differential equations and consisting of multiterminal, nonlinear, time-varying components. Stochastic Lyapunov functions are constructed, in scalar and vector form for the interconnected system in terms of the Lyapunov functions associated with the individual components, the system structure, and a parameter vector determined in some prescribed optimal manner. Dissert. Abstr.

N80-23086 New Mexico State Univ., University Park.
STABILITY OF LARGE-SCALE SYSTEMS Ph.D. Thesis
Helen Alexandra Ryaciotaki-Boussalis 1980 159 p
Avail: Univ. Microfilms Order No. 8007674

The stability of classes of large scale systems, consisting of multiterminal, nonlinear, time varying components is examined. Both continuous and discrete time systems are considered. The stability analysis of the interconnected system is determined in terms of the properties of the individual components and their interconnection patterns. Scalar and vector Lyapunov functions are constructed for the composite systems in terms of Lyapunov functions of the subsystems, the system structure, and a parameter vector. The stability criteria derived guarantee the stability of the interconnected system and are given in forms which are well suited for digital computation and design. Several examples are given for illustration. Dissert. Abstr.

N80-23087# Desmatics, Inc., State College, Pa.
OPTIMAL DESIGNS FOR ESTIMATION OF THE TWO-PARAMETER LOGISTIC FUNCTION
Leslie A. Kalish and Dennis E. Smith Jan. 1980 26 p refs
(Contracts N00014-79-C-0128; N00014-75-C-1054; NR Proj. 207-037; NR Proj. 042-334)
(AD-A080572; TR-112-4) Avail: NTIS HC A03/MF A01 CSCL 12/2

In this report, optimal designs for weighted least squares and maximum likelihood estimation of the two parameter logistic function are constructed. In particular, four criteria for optimality are considered: D, A, E and G-optimality. The D and G optimality criteria are found to be invariant to changes in scale while the A and E optimality criteria are not. Practical problems which arise in the implementation of the optimal designs are discussed. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-23088 Illinois Univ. at Urbana-Champaign.
RECURSIVE FUNCTION THEORY IN GROUPS AND SEMIGROUPS Ph.D. Thesis
Vardeman Griffith Moore 1979 120 p
Avail: Univ. Microfilms Order No. 8009113

The connections between notions of recursive function theory and the theory of groups and semigroups are considered. It is shown that a finitely generated, recursively presented semigroup can be embedded in a finitely presented semigroup whose word problem has the same Turing degree of unsolvability as that of the original semigroup. This result is proved using a construction involving Turing machines. Other results give algebraic characterizations of recursively enumerable sets, recursive sets, and partial recursive functions. For example, a set S of elements of a finitely generated, recursively presented group G is recursively enumerable if and only if G can be embedded in a finitely presented group H and S is the solution set of an equation f(x) = 1 in H. It is also shown that a group G has solvable word problem if and only if an analog of the enumeration theorem of recursive function theory holds for G. Most of these results are proved both for groups and semigroups. Algebraic techniques are used for the proofs of the results for groups, while both algebraic techniques and techniques based on Turing machines are used to prove the results for semigroups. Dissert. Abstr.

N80-23089 California Univ., Berkeley.
PRODUCT AND COMMUTATION PROPERTIES OF HILBERT SPACE OPERATORS Ph.D. Thesis
Michael John Hoffman 1979 202 p
Avail: Univ. Microfilms Order No. 8008429

This research concerns the set D(K,J) of operators commuting modulo a two-sided *-ideal J with each element of a subset K of the algebra L(H) of all bounded linear operators on a Hilbert space H. The set D(K,J) is an algebra, a *-algebra if K is closed under taking adjoints, and a C*-algebra if J is closed. Let M(K,J) = I epsilon L(h): TS epsilon J for every S epsilon K. If K and J are both two sided ideals, then M(K,J) is also an ideal studied by several authors, for example Norberto Salinas, who calls it a relative conjugate ideal. Ideals of operators on possibly nonseparable Hilbert spaces are classified by the dimensions of the ranges of operators in them and are determined by the diagonal operators they contain. These ideas are used to show that D(K,J) consists of perturbations of scalar multiples of the identity by elements. Dissert. Abstr.

N80-23090# Florida State Univ., Tallahassee. Dept. of Statistics.
A MINIMAX AND ADMISSIBLE SUBSET SELECTION RULE FOR THE LEAST PROBABLE MULTINOMIAL CELL
Roger L. Berger Sep. 1979 16 p refs
(Contract DAAG29-79-C-0158)
(AD-A080582; FSU-STATISTICS-M522; ARO-16713.4-M)
Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper a new subset selection rule for selecting a subset containing the least probable multinomial cell is defined. The rule is shown to be minimax and admissible in the class of rules which have a preassigned probability of at least P^* of selecting the least probable cell provided that P^* is sufficiently large. The loss used is the number of non-best cells selected. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-23091 California Univ., Davis.
CURVATURE THEORY OF POINT TRAJECTORIES IN THREE-DIMENSIONAL KINEMATICS Ph.D. Thesis
Lih-Min Hsia 1979 155 p
Avail: Univ. Microfilms Order No. 8009502

The curvature theory of point trajectories in constrained three dimensional motion of rigid bodies is investigated via instantaneous invariants. Two independent methods were used to obtain the kinematic characteristics i.e., the instantaneous invariants of the motion. The first method, is used to establish the correspondence between the instantaneous invariants and the dual instantaneous invariants. The second method applies systematic coordinate transformations via well-known vector calculus. The instantaneous invariants were used to derive expressions for curvature and torsion of point path trajectories in analytical forms. A FORTRAN code for the complete kinematic and curvature analyses of point trajectories of the RCCC mechanism is presented to demonstrate the advantages of using dual subroutines. Dissert. Abstr.

N80-23092 California Univ., Los Angeles.
THERMAL CONVECTION AND MAGNETIC FIELD GENERATION IN ROTATING SPHERICAL SHELLS Ph.D. Thesis
Pham Giem Cuong 1979 153 p
Avail: Univ. Microfilms Order No. 8008468

The generation of planetary magnetic fields is discussed. The nonlinear magnetohydrodynamic problem of thermal convection driven dynamo is formulated and solved numerically. The analysis proceeds in three steps: (1) the problem of nonmagnetic finite amplitude convection is solved; (2) the velocity

field is used to solve the induction equation for the magnetic field with vanishing growth rate; and (3) the resulting magnetic field is used as the starting point of an iterative approach to the solution of the full magnetohydrodynamic problem.
Dissert. Abstr.

N80-23093 Princeton Univ., N. J.
ASPECTS OF THE STATISTICAL THEORY OF STOCHASTIC MAGNETIC FIELDS: TEST PARTICLE TRANSPORT AND TURBULENT COLLISIONLESS TEARING MODE Ph.D. Thesis
Robert George Kleva 1980 202 p
Avail: Univ. Microfilms Order No. 8008564

Test particle transport in a stochastic magnetic field is examined. In the absence of collisions, the test particle self-diffusion coefficient is given by D = D sub M V (in the zero gyroradius limit), where D sub M is the magnetic diffusion coefficient due to a given spectrum of magnetic fluctuations and V is the particle velocity along a field line. The effect of collisions, either classical or turbulent, on this result is considered. The evolution of the collisionless tearing mode in the presence of a stochastic magnetic field is also considered. A statistical closure approximation, obtained from the direct interaction approximation by neglecting a mode-coupling term, is used to derive a nonlinear dispersion relation. Dissert. Abstr.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-23094 Illinois Univ. at Urbana-Champaign.
THEORY OF GUIDED ACOUSTIC WAVES IN PIEZOELECTRIC SOLIDS Ph.D. Thesis
Supriyo Datta 1979 78 p
Avail: Univ. Microfilms Order No. 8009012

A non-iterative variational technique for solving the acoustic field equations is described and applied to three different boundary conditions, namely, a free surface, an edge, and a surface with periodic discontinuities. A perturbation approach to surface wave scattering by periodic discontinuities is also developed and used to obtain both the elastic and the piezoelectric scatter matrix of a single electrode in a periodic array directly from the material parameters of the substrate and the electrodes. This scatter matrix accurately predicts the response of surface wave filters, transducers, and reflectors. Dissert. Abstr.

N80-23095 Virginia Polytechnic Inst. and State Univ., Blacksburg
NONLINEAR INTERACTIONS OF ACOUSTIC FIELDS WITH BODIES UNDER HARMONIC EXCITATIONS Ph.D. Thesis
Samuel Graham Kelly 1979 158 p
Avail: Univ. Microfilms Order No. 8007337

The multidimensional finite amplitude waves produced in a lossless fluid by the harmonic pulsations of a body in the flow field are examined. The pulsations are assumed to be such that they are expandable in a Fourier series in time and the independent coordinates describing the surface of the body. The analysis is applicable to isentropic gases and nondissipative liquids. The equations describing the dimensionless velocity potential and the fluid pressure are derived along with the boundary conditions at the surface of the body. The first problem considered is the interaction of an acoustic field with a plate undergoing near resonant flexations. The method of renormalization is used to obtain uniformly valid expansions for the velocity components and the pressure by coordinate strainings in two dimensions. The technique is applied to the finite amplitude waves produced by the pulsations of an infinite circular cylinder, a finite circular cylinder, and a sphere. Dissert. Abstr.

N80-23096*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TIME DEPENDENT DIFFERENCE THEORY FOR SOUND PROPAGATION IN AXISYMMETRIC DUCTS WITH PLUG FLOW
K. J. Baumeister 1980 12 p refs Presented at 6th Aeroacoustics Conf., Hartford, Conn. 4-6 Jun. 1980; sponsored by AIAA
(NASA-TM-81501; E-438) Avail: NTIS HC A02/MF A01 CSCL 20A

The time dependent governing acoustic-difference equations and boundary conditions are developed and solved for sound propagation in an axisymmetric (cylindrical) hard wall duct with a plug mean flow and spinning acoustic modes. The analysis begins with a harmonic sound source radiating into a quiescent duct. This explicit iteration method then calculates stepwise in real time to obtain the transient as well as the 'steady' state solutions of the acoustic field. The time dependent finite difference analysis has two advantages over the steady state finite difference and finite element techniques: (1)the elimination of large matrix storage requirements, and (2)shorter solution times under most conditions. Author

N80-23097*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRESSURE SPECTRA AND CROSS SPECTRA AT AN AREA CONTRACTION IN A DUCTED COMBUSTION SYSTEM
J. H. Miles and D. D. Raftopoulos 1980 12 p refs Presented at 1980 ASME Aerospace Conf., San Francisco, 13-15 Aug. 1980
(NASA-TM-81477; E-411) Avail: NTIS HC A02/MF A01 CSCL 20A

Pressure spectra and cross-spectra at an area contraction in a liquid fuel, ducted, combustion noise test facility are analyzed. Measurements made over a range of air and fuel flows are discussed. Measured spectra are compared with spectra calculated using a simple analytical model. Author

N80-23098*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF INFLOW CONTROL ON INLET NOISE OF A CUT-ON FAN
Richard P. Woodward and Frederick W. Glaser 1980 13 p refs Presented at 6th Aeroacoustics Conf., Hartford, Conn., 4-6 Jun. 1980; sponsored by AIAA
(NASA-TM-81487) Avail: NTIS HC A02/MF A01 CSCL 20A

The control of turbulence and other inflow disturbances in anechoic chambers for static turbofan noise studies was studied. A cut-on, high tip speed fan stage was acoustically tested with three configurations of an inflow control device in an anechoic chamber. Although this was a cut-on design, rotor inflow interaction appeared to be a much stronger source of blade passing tone radiated from the inlet than rotor stator interaction for the 1.6 mean rotor chord separation. Aft external suction applied to the area where the inflow control device joined the inlet produced a further reduction in blade passing tone, suggesting that disturbances in the forward flow on the outside of the inlet were superimposed on the inlet boundary layer and were a significant source of tone noise. M.G.

N80-23099*# General Electric Co., Cincinnati, Ohio.
ANALYTICAL STUDY OF THE EFFECTS OF WIND TUNNEL TURBULENCE ON TURBOFAN ROTOR NOISE Final Report
P. R. Gliebe and E. J. Kerschen Dec. 1979 126 p
(Contract NAS2-10002)
(NASA-CR-152359) Avail: NTIS HC A06/MF A01 CSCL 20A

The influence of tunnel turbulence on turbofan rotor noise was carried out to evaluate the effectiveness of the NASA Ames 40 by 80 foot tunnel in simulating flight levels of fan noise. A previously developed theory for predicting rotor/turbulence interaction noise was refined and extended to include first-order effects of inlet turbulence anisotropy. This theory was then verified by carrying out extensive data/theory comparisons. The resulting model computer program was then employed to carry out a parametric study of the effects of fan size, blade number, and operating line on rotor/turbulence noise for outdoor test stand, NASA Ames wind tunnel, and flight inlet turbulence conditions. A major result of this study is that although wind tunnel rotor/turbulence noise levels are not as low as flight levels they are substantially lower than the outdoor test stand levels and do not mask other sources of fan noise. A.R.H.

N80-23100*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORWARD ACOUSTIC PERFORMANCE OF A SHOCK-SWALLOWING HIGH-TIP-SPEED FAN (QF-13)
James G. Lucas, Richard P. Woodward, and Michael J. MacKinnon May 1980 20 p refs
(NASA-TP-1668; E-202) Avail: NTIS HC A02/MF A01 CSCL 20A

Forward noise and overall aerodynamic performance data are presented for a high-tip-speed fan having rotor blade airfoils designed to alter the conventional leading-edge bow shocks to weak, oblique shocks which are swallowed within the interblade channels. It was anticipated that the swallowed shocks would minimize the generation of multiple-pure-tone noise. In the speed range where the shocks presumably were swallowed, the multiple-tone noise was lowered only about 3 decibels. Comparison with several high-speed fans on a thrust-corrected basis indicates that the present fan was the quietest in total forward noise at low speeds but offered no advantage at high speeds. Author

N80-23101*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGHER ORDER MODE PROPAGATION IN NONUNIFORM CIRCULAR DUCTS
Y. C. Cho and K. U. Ingard 1980 11 p refs Presented at the 6th Aeroacoustics Conf., Hartford, 4-6 Jun. 1980; sponsored by AIAA Prepared in cooperation with MIT, Cambridge
(NASA-TM-81481; E-418) Avail: NTIS HC A02/MF A01 CSCL 20A

Higher order mode propagation in a nonuniform circular duct without mean flow was investigated. An approximate wave equation is derived on the assumptions that the duct cross section varies slowly and that mode conversion is negligible. Exact closed form solutions are obtained for a particular class of converging-diverging circular duct which referred to as 'circular cosh duct.' Numerical results are presented in terms of the transmission loss for the various duct shapes and frequencies. The results are applicable to multimodal propagation, single mode propagation, and sound radiation from certain types of contoured inlet ducts, or of sound propagation in a converging-diverging duct of somewhat different shape from a cosh duct. F.O.S.

N80-23102*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPLORATORY SURVEY OF NOISE LEVELS ASSOCIATED WITH A 100kW WIND TURBINE
J. R. Balombin 1980 20 p refs Presented at the 99th Meeting of the Acoustical Soc. of Am., Atlanta, 21-25 Apr. 1980
(NASA-TM-81486; E-424) Avail: NTIS HC A02/MF A01 CSCL 20A

Noise measurements of a 125-foot diameter, 100 kW wind turbine are presented. The data include measurements as functions of distance from the turbine and directivity angle and cover a frequency range from 1 Hz to several kHz. Potential community impact is discussed in terms of A-weighted noise levels relative to background levels, and the intrasonic spectral content. Finally, the change in the sound power spectrum associated with a change in the rotor speed in described. The acoustic impact of this size wind turbine is judged to be minimal. M.G.

N80-23103# Oak Ridge Y-12 Plant, Tenn. Instrumentation and Characterization Dept.
ITERATIVE CALCULATION OF IMPULSE RESPONSES FROM ULTRASONIC SIGNALS
R. C. McClung and M. W. Moyer 6 Sep. 1979 20 p ref
(Contract W-7405-eng-48)
(Y/DW-23) Avail: NTIS HC A02/MF A01

Iterative techniques were developed to calculate the impulse response of a medium under ultrasonic interrogation. This permits the identification and separation of reflected signals with pulse widths greater than the distance between two adjacent reflecting surfaces. The results may provide significant new information with respect to the spatial distribution and geometry of material discontinuities. DOE

N80-23104# European Space Agency, Paris (France).
NOISE GENERATION BY JET-ENGINE EXHAUST DEFLECTION
Burkhard Gehlar, Werner Dobrzynski, and Bernhard Fuhrken Jul. 1979 50 p refs Transl into ENGLISH of "Schallerzung durch Triebwerksstrahl-Deflexion", Rept. DFVLR-FB-78-21, DFVLR, Brunswick, Sep. 1978 Original report in GERMAN previously announced as X79-76750
(ESA-TT-553; DFVLR-FB-78-21) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 23,30

Noise radiation by jet engine exhaust-flow-interaction with blast deflectors is investigated by means of model-experiments of scale 0.1. The investigations pertain to a specific deflector configuration. Noise spectra and directivity characteristics for various power-settings and configuration changes are determined and used for the prediction of noise generation by the full-scale configuration. The investigation shows that the particular deflector gives rise to higher noise levels than those of the corresponding engine noise alone when the distance between exhaust nozzle and deflector is less than 10 nozzle-diameters. Author (ESA)

N80-23105# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.
SHEAR LAYER EFFECTS ON THE PERFORMANCE OF AN ACOUSTIC MIRROR MICROPHONE SYSTEM
Friedrich-Reinhard Grosche and Gianfranco Chiocchia (Politecnico di Torino) Mar. 1979 102 p refs
(DFVLR-FB-79-30) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 15,20

The waves travelling from a sound source within the open test section of a wind tunnel to an acoustic mirror-microphone system outside the test section were refracted and scattered by the free shear layer surrounding the wind tunnel flow. The effects of refraction on the performance of the mirror system were determined by calculating numerically the diffraction images of a point source of sound with and without flow. The computed data were then compared to the results of a corresponding set of experiments in a low speed windtunnel. Author (ESA)

N80-23106# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
ON THE SOUND FIELD GENERATED BY A FAN IN A HARD-WALLED BAFFLED DUCT WITH UNIFORM FLOW
J. N. Laan and J. B. H. M. Schulten 22 Feb. 1978 67 p refs
(Contracts NIVR-1773; NIVR-1821)
(NLR-TR-78024-U) Avail: NTIS HC A04/MF A01

A method to calculate the generation, transmission and radiation of fan noise is described. A steady uniform flow is assumed in the whole field. A hard walled circular duct is considered which is terminated at the open end by an infinite baffle. It is shown that the source mechanism is the impingement of wakes from an upstream row giving rise to fluctuating blade forces: this force field drives the sound field. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-23107 California Univ., Los Angeles.
MULTIPHOTON IONIZATION IN POLYATOMIC MOLECULES Ph.D. Thesis
David Hubert Parker 1979 174 p
Avail: Univ. Microfilms Order No. 8008512

Multiphoton ionization (MPI) processes were experimentally investigated and utilized to study highly excited states in polyatomic molecules. The systems examined all deal with three- or four-photon ionization enhanced by an allowed two-photon transition from the ground state. The MPI polarization method is described and applied to a number of spectroscopic problems such as the the location of A(g) symmetry-forbidden states, the mechanism of spatially separated molecular orbital interactions,

the energy of the pion and non-bonding orbitals in the ground state, and the UV absorption spectrum of methyl iodide. Experiments were carried out with a single laser, thus the same energy photons which caused the two-photon transition also ionize the molecule. A two-laser MPI technique is introduced where the exciting and ionizing photons are independent. Excited state lifetimes and ionization potentials can be measured with this simple method. Other improvements and future applications of MPI in polyatomic molecules are also discussed.

Dissert. Abstr.

N80-23108 Illinois Univ. at Urbana-Champaign.
STUDIES IN MOLECULAR COLLISION DYNAMICS: TUNNELING IN CHEMICAL REACTIONS AND VIBRATIONAL ENERGY TRANSFER IN HYDROGEN FLUORIDE SYSTEMS Ph.D. Thesis
Michael Elliott Coltrin 1979 123 p
Avail: Univ. Microfilms Order No. 8009006

Tunneling in molecular collisions and in vibrational energy transfer were studied. Both classical and semiclassical methods were used and compared with quantum mechanical results. The path corresponding to the line of inner turning points of the vibrational coordinate was proposed as the tunneling path. It is shown to be much nearer the dynamical path, i.e., it numerically satisfies Hamilton's principle of least action. The vibrational energy transfer in hydrogen fluoride-hydrogen fluoride systems is discussed. A moment method, together with quasiclassical trajectories, was used to relate the moments of the change in vibrational states to probabilities and rate constants.

Dissert. Abstr.

N80-23109 Northwestern Univ., Evanston, Ill.
VIBRATIONAL ENERGY TRANSFER IN TRIATOMIC MOLECULES: CO2 AND N2O Ph.D. Thesis
Rodney Kurt Huddleston 1979 200 p
Avail: Univ. Microfilms Order No. 8007385

Vibrational energy transfer in small molecules in the gas phase was investigated with emphasis on the triatomic molecules CO2 and N2O. General considerations relating to vibrational energy transfer processes and the laser induced infrared fluorescence technique are presented. The factors controlling the efficiency of vibrational energy transfer in triatomics are discussed with reference to theory and previous experimental studies. An information theory formalism of nonequilibrium statistical mechanics was used to derive population distributions in vibrationally excited gases where rapid vibration to vibration energy transfer occurs. The theoretical distribution is compared to published experimental results on CO. Calculated distributions for CO2 and CH3F are presented, and the results are discussed with respect to temperatures of different modes, decay of vibrational populations, and the possibility of vibrationally induced reactions.

Dissert. Abstr.

N80-23110*# California Inst. of Tech., Pasadena. Space Radiation Lab.
RESEARCH IN PARTICLES AND FIELDS Semiannual Status Report, 1 Apr. 1979 - 31 Mar. 1980
Rochus E. Vogt, A. Buffington, L. Davis, Jr., and E. C. Stone 1980 44 p refs
(Grant NGR-05-002-160)
(NASA-CR-162994) Avail: NTIS HC A03/MF A01 CSCL 20H

The astrophysical aspects of cosmic and gamma rays and the radiation environment of the Earth and other planets investigated by means of energetic particle detector systems flown on spacecraft and balloons are discussed. The theory of particles and fields in space is also addressed with particular emphasis on models of Saturn's magnetic field.

M.G.

N80-23111*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO-PHOTON EXCITATION CROSS-SECTION IN LIGHT AND INTERMEDIATE ATOMS
Kazem Omidvar Mar. 1980 49 p refs Revised Submitted for publication
(NASA-TM-80661) Avail: NTIS HC A03/MF A01 CSCL 20H

The method of explicit summation over the intermediate states is used along with LS coupling to derive an expression for two-photon absorption cross section in light and intermediate atoms in terms of integrals over radial wave functions. Two selection rules, one exact and one approximate, are also derived. In evaluating the radial integrals, for low-lying levels, the Hartree-Fock wave functions, and for high-lying levels, hydrogenic wave functions obtained by the quantum defect method are used. A relationship between the cross section and the oscillator strengths is derived. Cross sections due to selected transitions in nitrogen, oxygen, and chlorine are given. The expression for the cross section is useful in calculating the two-photon absorption in light and intermediate atoms.

J.M.S.

N80-23112*# California Inst. of Tech., Pasadena. W. K. Kellogg Radiation Lab.
A THERMALIZED ION EXPLOSION MODEL FOR HIGH ENERGY SPUTTERING AND TRACK REGISTRATION
L. E. Seiberling, J. E. Griffith, and T. A. Tombrello Apr. 1980 28 p refs
(Grant NGR-05-002-333; Contract EX-76-G-03-1305; Grant NSF PHY-79-23638)
(NASA-CR-162926; BAP-21) Avail: NTIS HC A03/MF A01 CSCL 20H

A velocity spectrum of neutral sputtered particles as well as a low resolution mass spectrum of sputtered molecular ions was measured for 4.74 MeV F-19(+2) incident of UF4. The velocity spectrum is dramatically different from spectra taken with low energy (keV) bombarding ions, and is shown to be consistent with a hot plasma of atoms in thermal equilibrium inside the target. A thermalized ion explosion model is proposed for high energy sputtering which is expected to describe track formation in dielectric materials. The model is shown to be consistent with the observed total sputtering yield and the dependence of the yield on the primary ionization rate of the incident ion.

E.O.K.

N80-23113# Rice Univ., Houston, Tex. Dept. of Chemistry.
REACTIONS AND ENERGY TRANSFER OF EXCITED MOLECULES Final Report, 1 May 1978 - 31 Oct. 1979
Philip R. Brooks, Scott L. Anderson, James D. Fite, and On Van Nguyen 1979 40 p refs
(Grant AF-AFOSR-3643-78; AF Proj. 2302)
(AD-A080121; AFOSR-80-0059TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

The effect of reagent rotation is investigated for the reaction K + HCl = KCl + H and found to be more important than a similar amount of translational energy. Rotation decreases reactivity. Electronic excitation of NO in the reaction NO + O3 = NO2 + O2 was shown to roughly be equivalent to ground state reactivity. Reaction is apparently enhanced by rotation of the NO molecule. The origin of these effects is not yet understood.

GRA

N80-23114# McElroy (Ralph) Co., Austin, Tex.
ON THE THEORY OF COLLISIONS BETWEEN ELECTRONS AND HYDROGEN ATOMS
G. F. Drukarev 1979 16 p refs Transl. into ENGLISH from Zh. Eksp. Teor. Fiz. (USSR), v. 25, no. 2, 1953 p 129-138 Prepared for LASL
(Contract W-7405-eng-36)
(LA-TR-79-38) Avail: NTIS HC A02/MF A01

It is shown that the method for the calculation of exchange effects in the collision electrons with atoms which was developed previously is based on an erroneous hypothesis. The collision of an electron with a hydrogen atom is described with the aid of a wave function for a two-electron system, the function having appropriate symmetry in an implicit form. A finite system of integro-differential equations is deduced for functions which describe the state of an incident electron.

DOE

N80-23115# California Univ., Livermore. Lawrence Livermore Lab. Neutral Beam Group.
NEGATIVE ION PRODUCTION FOR NEUTRAL BEAM SYSTEMS
E. B. Hopper, Jr., comp. 15 Feb. 1979 34 p refs
(Contract W-7405-eng-48)
(SAND-18067) Avail: NTIS HC A03/MF A01

The production of negative ions for neutral beam systems

is discussed. Methods which have either been used in experiments or proposed for experiments are described and compared in terms of current, gas efficiency, and so forth. DOE

N80-23116# Florida State Univ., Tallahassee. Dept. of Physics.
ION CURRENT DENSITIES PRODUCED BY ENERGETIC ELECTRONS IN ELECTROSTATIC PRECIPITATOR GEOMETRIES
W. C. Finney, L. C. Thanh, and R. H. Davis 1979 7 p refs Presented at the 2nd Symp. on the Transfer and Utilization of Particulate Control Technol., Denver, 23-27 Jul. 1979
(Contract ET-78-S-01-3199)
(CONF-790740-2) Avail: NTIS HC A02/MF A01

A new laboratory test system for electron beam ionization in electrostatic precipitator geometries was constructed to measure ion current densities as a function of voltage differences for clean (bare) plate conditions. The new system incorporates improved electrodes, which withstand a driving voltage of + or - 55 kV, a factor of 5 increase over the previous test system. A 3 MeV Van de Graaff accelerator produced ionizing electron beams of 1.2 and 2 MeV and currents of 10.5 and 21 micro Amps in place of corona wire ionization. Current densities of up to 130 mA/sq m were measured before breakdown between the plates, and no current saturation was observed. A comparison of I-V curves and sparkover voltages for various beam energies, currents, and collimation are discussed and the need for measurements with good beam geometry is reviewed. DOE

N80-23117# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Physics.
THEORY OF HEAVY ION COLLISIONS Annual Progress Report
Daniel Sperber Aug. 1979 22 p refs
(Contract EY-76-S-02-3463)
(COO-3463-52) Avail: NTIS HC A02/MF A01

Theoretical work was focused on heavy ion collisions. A classical model was developed in order to study heavy ion reactions in different energy regimes. In the low energy regime, the analysis dealt with fusion excitation functions and strongly damped collisions. In the intermediate range, the transport coefficients were studied. In the high energy regime, pion emission in relativistic heavy ion induced reactions was studied. DOE

N80-23118# Iowa Univ., Iowa City. Dept. of Chemistry.
DISTRIBUTION OF ENERGY IN BIMOLECULAR CHEMILUMINESCENT REACTIONS INVOLVING HYDROGEN ATOMS Final Report, 1 May 1978 - 30 Apr. 1979
William C. Stwalley 1979 18 p
(Contract EY-76-S-02-2326)
(COO-2326-38) Avail: NTIS HC A02/MF A01

Spectroscopic observations of the production of visible and ultraviolet photons from the collision of 5 e H atoms with a Li/Li2 crossed beam and with 02 and H2O crossed beams are analyzed. Complementary theoretical and nonbeam spectroscopic work related to the Li2H system is considered. DOE

N80-23119# Argonne National Lab., Ill.
COLLISION INDUCED FRAGMENTATION OF FAST MOLECULAR IONS IN SOLIDS AND GASES
Donald S. Gemmell 1979 51 p refs Presented at the 8th Intern. Conf. on Atomic Collisions in Solids, Hamilton, Canada, 13-17 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790843-9) Avail: NTIS HC A04/MF A01

A brief review is given of recent high resolution measurements on fragments arising from the collision induced dissociation of fast (MeV) molecular ions. For solid targets, strong wake effects are observed. For gaseous targets, excited electronic states of the projectile ions play an important role. Measurements of this type provide useful information on the charge states of fast ions traversing matter. The experimental techniques show promise as a unique method for determining the geometrical structures of the molecular-ion projectiles. DOE

N80-23120# Stanford Linear Accelerator Center, Calif.
FURTHER MEASUREMENTS OF PARITY NONCONSERVATION IN INELASTIC ELECTRON SCATTERING
C. Y. Prescott 1979 12 p refs Presented at the 9th Intern. Symp. on Lepton and Photon Interactions at High Energy, Batavia, Ill., 23-29 Aug. 1979
(Contract EY-76-C-03-0515)
(SLAC-PUB-2401; CONF-790885-1) Avail: NTIS HC A02/MF A01

The y-dependence of the parity nonconserving asymmetries for inelastic electron scattering from deuterium was measured. The measurements cover a range of y values from 0.15 to 0.36 and show only a small y-dependence. The results are in good agreement with the Weinberg-Salam model for sq sin theta/sub W/ = 0.224 +-0.020. DOE

N80-23121# Temple Univ., Philadelphia, Pa. Dept. of Physics.
EXPERIMENTAL INVESTIGATIONS IN PARTICLE PHYSICS AT INTERMEDIATE ENERGIES Progress Report, 1 Dec. 1978 - 30 Nov. 1979
L. B. Auerbach, V. L. Highland, and W. K. McFarlane Aug. 1979 14 p
(Contract EY-76-S-02-3539)
(COO-3539-11) Avail: NTIS HC A02/MF A01

The second run to search for the three gamma and four gamma decay modes of the neutral pion is completed. (Irvine) is data-taking on the proton-antiproton bound states experiment at the Brookhaven AGS and on the proton-antiproton experiment with Rutgers and BNL was completed. The analysis of the nucleon-nucleon experiments in collaboration with UNM and LASL is nearly finished with the np elastic differential cross-section published. DOE

N80-23122# Illinois Univ. at Urbana-Champaign.
PHOTOCONDUCTIVITY STUDIES OF FERROCYANIDE ION UNDER HIGH PRESSURE Ph.D. Thesis
Martin I. Finston 1979 94 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1275) Avail: NTIS HC A05/MF A01

The photoaquation of the ferrocyanide ion was studied using a high-pressure photoconductivity apparatus and a steady-state high-pressure mercury lamp. The first-order photocurrent rise-time could be related to the relative quantum efficiency of the photoaquation process, while the dark decay of the photocurrent yielded a relative value of the bimolecular rate-constant for the reverse reaction. Kinetic measurements were carried out on dilute solutions of potassium ferrocyanide in pure water, and in 20% ethanol. In both aqueous and alcoholic solution the photoaquation quantum efficiency decreased exponentially with pressure, as did the biomolecular rate-for the dark reaction in aqueous solution. The pressure dependence of the bimolecular rate-constant in the alcoholic solution indicated a diffusion-limited process. The pressure dependence of the photoaquation quantum yield, and of the bimolecular rate-constant in aqueous solution, was interpreted in terms of an activation volume model. DOE

N80-23123# California Univ., Berkeley. Dept. of physics.
OBSERVATION OF SHORT-LIVED PARTICLES PRODUCED IN HIGH ENERGY NEUTRINO INTERACTIONS
H. C. Ballagh, H. H. Bingham, W. B. Fretter, T. Lawry, G. R. Lynch, J. Lys, J. P. Marriner, J. Orthel, M. L. Stevenson, M. D. Sokoloff et al 1979 12 p refs Presented at the Neutrino 1979 Conf., Bergen, Norway, 8-12 Jun. 1979 Sponsored in part by NFS. Accelerator Lab., Univ. of Hawaii at Manoa; Univ. of Washington, Seattle; Univ. of Wisconsin, Madison
(Contract EY-76-C-03-0511)
(UH-511-345-79; CONF-790648-8) Avail: NTIS HC A02/MF A01

A sample of 89 high energy, neutrino induced dilepton events obtained in a 15 foot bubble chamber was examined which resulted in the direct observation of the production and semileptonic decay of 4 short lived particles. One charged decay, two neutral decays, and one decay of undetermined charge are found. The most likely explanation is that events represent decay of the charmed D meson. DOE

N80-23124# British Columbia Univ., Vancouver.
PION PHOTOPRODUCTION
J. M. Laget Aug. 1979 21 p refs Presented at the 8th Intern. Conf. on High-Energy Phys. and Nucl. Struct., Vancouver,

British Columbia, 13-17 Aug. 1979
(TRI-PP-79-27; CONF-790847-12) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The pion photoproduction reactions induced in the few body systems in the delta resonance energy range are examined. The multiple scattering series are summarized and relevant experiments carried out to study the corresponding singularities are described. A possible description of the N delta interaction is presented. The extensions to the threshold region, as well as to the heavier nuclei, are discussed. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-23125 Illinois Univ. at Urbana-Champaign.
ION-DYNAMICS IN A SPHERICAL REFLEX DIODE Ph.D. Thesis
Brian Ernest Edwards 1979 71 p
Avail: Univ. Microfilms Order No. 8009023

The electronic space charge fields created in a spherical diode are discussed for use in extracting and accelerating ions from a background plasma. Bunching of these ions was observed and space charge neutralization was accomplished by low energy electrons. The ion angular energy was found to be less than 0.1% of its radial energy, a condition allowing the excellent focusing at the center of the sphere. Dissert. Abstr.

N80-23126# Naval Research Lab., Washington, D. C.
INTENSE ION BEAM GENERATION WITH AN INVERSE REFLEX TETRODE (IRT)
J. A. Pasour, R. A. Mahaffey, J. Golden, and C. A. Kapetanakos 18 Oct. 1979 13 p refs
(NRL Proj. H02-28)
(AD-A075747; NRL-MR-4103) Avail: NTIS HC A02/MF A01 CSCL 09/1

A new reflexing electron ion source is described. The device produces a unidirectional ion beam with relatively high efficiency even when the applied magnetic field exceeds the self field. This new source operates at a low, constant impedance during much of the applied voltage pulse and is better matched to available high-power, low impedance generators than previous reflexing electron devices. GRA

N80-23127# Los Alamos Scientific Lab., N. Mex.
RF QUADRUPOLE BEAM DYNAMICS
R. H. Stokes, Kenneth R. Crandall, James E. Stovall, and Donald A. Swenson 1979 4 p ref Presented at the 1979 Particle Accelerator Conf., San Francisco, 12 Mar. 1979
(Contract W-7405-eng-36)
(LA-UR-79-657; CONF-790327-25) Avail: NTIS HC A02/MF A01

A method was developed to analyze the beam dynamics of the radiofrequency quadrupole accelerating structure. Calculations show that this structure can accept a dc beam at low velocity, bunch it with high capture efficiency, and accelerate it to a velocity suitable for injection into a drift tube linac. DOE

N80-23128# California Univ., Livermore. Lawrence Livermore Lab.
DETERMINATION OF PERFORMANCE CRITERIA FOR HIGH-LEVEL SOLIDIFIED NUCLEAR WASTE
Richard A. Heckman and Thomas Holdsworth 7 May 1979 281 p refs Prepared for the US Nuclear Regulatory Comm.
(Contract W-7405-eng-48)
(UCID-18121) Avail: NTIS HC A13/MF A01

To minimize radiological risk from the operation of a waste management system, performance limits on volatilization, particulate dispersion, and dissolution characteristics of solidified high level waste must be specified. The results show clearly that the preemplacement environs are more limiting in establishing the waste form performance criteria than the post-emplacement environs. Absolute values of expected risk are very sensitive to modeling assumptions. The transportation and interim storage operations appear to be most limiting in determining the performance characteristics required. The expected values of risk do not rely upon the repositories remaining intact over the potentially hazardous lifetime of the waste. DOE

N80-23129# California Univ., Berkeley. Lawrence Berkeley Lab. Div. of Earth Sciences.
GEOHYDROLOGICAL STUDIES FOR NUCLEAR WASTE ISOLATION AT THE HANFORD RESERVATION. VOLUME 1: EXECUTIVE SUMMARY
J. Apps, T. Doe, B. Doty, R. Galbraith, A. Kearns, B. Kohrt, J. Long, A. Monroe, T. N. Narasimhan, and P. Nelson Aug. 1979 31 p refs
(Contract W-7405-eng-48)
(LBL-8764-Vol-1) Avail: NTIS HC A03/MF A01

The hydrology of the Pasco Basin near Richland, Washington was studied as part of a long-term study on the feasibility of nuclear waste disposal in the Columbia River basalt underlying the Hanford Reservation. The hydrology field program, Pasco Basin modeling, and groundwater chemistry program are summarized. Hanford well logs are also reviewed. DOE

N80-23130# State Univ. of New York, Stony Brook. Dept. of Physics.
NUCLEAR THEORY GROUP Progress Report, 1 Dec. 1979 - 30 Nov. 1980
Gerald E. Brown, Andrew D. Jackson, and Thomas T. S. Kuo 1979 94 p refs
(Contract EY-76-S-02-3001)
(COO-3001-T1) Avail: NTIS HC A05/MF A01

A broad range of topics in theoretical nuclear and intermediate-energy physics and nuclear astrophysics are covered. Primary emphasis is placed on understanding the underlying nucleon-nucleon and meson-nucleon interactions. Catagory headings include: fundamental interactions; intermediate-energy physics; effective interactions, nuclear models and many body theory; structure of finite nuclei; nuclear astrophysics; heavy-ion physics; and numerical analysis. DOE

N80-23131# Battelle Pacific Northwest Labs., Richland, Wash.
HIGH-LEVEL WASTE IMMOBILIZATION PROGRAM: AN OVERVIEW
W. R. Bonner Sep. 1979 46 p refs
(Contract EY-76-C-06-1830)
(PNL-3094) Avail: NTIS HC A03/MF A01

Technology to allow safe, affordable immobilization and disposal of nuclear waste is reviewed. Waste forms and processes are being developed on a schedule consistent with national needs for immobilization of high-level wastes stored at Savannah River, Hanford, Idaho National Engineering Laboratory, and West Valley, New York. This technology is directly applicable to high-level wastes from potential reprocessing of spent nuclear fuel. Topics covered include: (1) waste form development and characterization; (2) process development; and (3) radioactive process demonstration. DOE

N80-23132# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report, Sep. 1979
W. J. Maraman, comp. Nov. 1979 42 p
(Contract W-7405-eng-36)
(LA-8150-PR) Avail: NTIS HC A03/MF A01

The use of Pu-238 O2 in radioisotopic power systems was studied. Three programs involved in the study: (1) general purpose heat source development; (2) space nuclear safety; and (3) radioisotopic terrestrial safety are discussed. DOE

N80-23133# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report, Aug. 1979
W. J. Maraman, comp. Nov. 1979 37 p
(Contract W-7405-eng-36)

(LA-8142-PR) Avail: NTIS HC A03/MF A01

The formal monthly report covers the studies related to the use of Pu(-238)O2 in radioisotopic power systems. General purpose heat source developments, space nuclear safety, and radioisotopic terrestrial safety are among the topics discussed. DOE

N80-23134# International Engineering Co., Inc., San Francisco, Calif.

REVIEW OF GEOTECHNICAL MEASUREMENT TECHNIQUES FOR A NUCLEAR WASTE REPOSITORY IN BEDDED SALT

Dec. 1979 282 p refs

(Contract W-7405-eng-48)

(UCRL-15141) Avail: NTIS HC A13/MF A01

Geotechnical measurement techniques that can provide the data necessary for safe development of a radioactive waste repository in bedded salt are described. Geotechnical data obtained by a diversity of measurement techniques are required during all phases of respository evolution. The techniques are grouped in the following categories: geologic, geophysical and geodetic; rock mechanics; hydrologic, hydrogeologic and water quality; and thermal. Extensive tables providing a review of available measurement techniques for each category are presented. The techniques are discussed, describing the measurements and associated instruments and evaluating the applicability or limitations of the method. Detailed discussions of thermal phenomena, creep laws, and geophysical methods are contained in the appendices; references to detailed explanations of measurement techniques and instrumentation are included. DOE

N80-23135# Oak Ridge National Lab., Tenn.

RADIOACTIVE WASTE DISPOSAL AREAS AND ASSOCIATED ENVIRONMENTAL SURVEILLANCE DATA AT OAK RIDGE NATIONAL LABORATORY

T. W. Oakes and K. E. Shank Dec. 1979 34 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6893) Avail: NTIS HC A03/MF A01

The solid waste burial grounds are described along with the environmental monitoring data. The various monitoring systems are reviewed, and the liquid discharge trends are discussed. Presently, a network of five environmental monitoring stations is in operation to monitor the radionuclide content of surface waters in the White Oak Creek watershed. Facts observed during the lifetime of the disposal sites include: (1) large amounts of Ru-106 were released during 1959 to 1964 due to the fact that Conasauga shale did not retain this element as well as it retained other radionuclides. (2) Large quantities of of tritiated water were released to the Clinch River in recent years, but, from a practical standpoint, little can be done to inhibit or control these releases. (3) A general downward trend in the number of curies released was observed for all other radionuclides. A number of corrective measures that have been initiated at ORNL to reduce the radioactive liquid discharges are outlined. DOE

N80-23136# Minnesota Univ., Minneapolis. School of Physics and Astronomy.

EXPERIMENTAL AND THEORETICAL HIGH ENERGY PHYSICS Progress Report, 1 Oct. 1978 - 30 Sep. 1979

1979 34 p

(Contract EY-76-C-02-1764)

(COO-1764-367) Avail: NTIS HC A03/MF A01

Theoretical and experimental high energy physics is summarized. A list of publications is included. DOE

74 OPTICS

Includes light phenomena.

N80-23137 Virginia Polytechnic Inst. and State Univ., Blacksburg.

REAL-TIME RECOGNITION OF MICROSCOPIC PHASE OBJECTS USING AN INTERFERENCE CONTRAST MICROSCOPE Ph.D. Thesis

Judy Kaye Partin 1979 120 p

Avail: Univ. Microfilms Order No. 8007339

A method of supplying real time input to a coherent optical processor is described and demonstrated. The method consists of directing a laser beam into an interference contrast microscope to produce enlarged, coherent images of the specimens. The system has the advantage of presenting high contrast, dark field images to the correlator without the need of additional preprocessing for image enhancement. In addition, the system does not require an expensive incoherent-to-coherent light transducer and is capable of utilizing both amplitude and phase information from three dimensional objects. Applications to diatom recognition are shown. Dissert. Abstr.

N80-23138 Northwestern Univ., Evanston, Ill.

OPTICAL WAVE PROPAGATION IN THE TURBULENT ATMOSPHERE Ph.D. Thesis

Samuel Chih-Hung Wang 1979 148 p

Avail: Univ. Microfilms Order No. 8007419

Optical wave propagation in random media was studied based on the theory of atmospheric turbulence and the extended Huygens-Fresnel principle. Temporal and spatial characteristics of optical waves, optical beam propagation for a finite partially coherent source in the turbulent atmosphere, pulsed plane wave propagation, and the effects of turbulence on the optical atmospheric transmittance were considered. Optical coherence, in both space and time, was studied by separating the effects which arise from the finite spatial extent of the source (spatial coherence) from those which arise from the nonmonochromaticity of radiation (temporal coherence). Pulsed wave propagation in a random medium was characterized by a two frequency mutual coherence function. The effects of turbulence on the optical atmospheric transmittance were investigated. Dissert. Abstr.

N80-23139*# North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Mechanical Engineering.

STUDY OF COMPOSITES AS SUBSTRATE MATERIALS IN LARGE SPACE TELESCOPES Final Report

Avva V. Sharma 1979 21 p refs

(Grant NsG-8045)

(NASA-CR-163008) Avail: NTIS HC A02/MF A01 CSCL 20F

Nonmetallic composites such as the graphite/epoxy system were investigated as possible substrates for the primary mirror of the large space telescope. The possible use of fiber reinforced metal matrix composites was reviewed in the literature. Problems arising out of the use of composites as substrate materials such as grinding, polishing, adherence of reflective coatings, rigidity of substrate, hygroscopic tendency of the composites, thermal and temporal stability and other related problems were examined. A.R.H.

N80-23140# Defence Research Establishment Valcartier (Quebec).

AN INFRARED THERMAL IMAGING SYSTEM WITH A DIGITAL SCAN CONVERTER

B. Montminy, P. Cote, and R. Carbonneau Jan. 1979 20 p refs in ENGLISH; FRENCH summary

(AD-A065465; DREV-R-4133/79) Avail: NTIS HC A02/MF A01 CSCL 17/5

This report describes a thermal imaging system consisting of an IR camera, a digital scan converter, an X-Y display monitor and a digital tape recorder. The system can be used for recording and study IR images in the 3- to 5-micrometer and 8- to 14-micrometer wavelength bands. It can also be used as an interface system for computer processing of images. GRA

N80-23141# Sperry Research Center, Sudbury, Mass.

INVESTIGATION INTO THE FEASIBILITY OF DESIGNING A FAIL SAFE OPTICAL DATA LINK Final Technical Report, 1 Jan. - 31 Dec. 1977

D. H. McMahon and W. Spillman Griffiss AFB, N.Y. RADC Dec. 1979 149 p refs

(Contract F19628-77-C-0055; AF Proj. 4600)

(AD-A080302; SCRC-CR-78-11; RADC-TR-79-284) Avail: NTIS HC A07/MF A01 CSCL 17/2

The development of a fail safe optical data link terminal and the construction of a serial fiber optic data bus system which uses several of these terminals is described. The system consists of a master terminal containing a CPU, an LED source, a photodiode detector, and several remote send/receive terminals, each containing an electro-optic modulator and a photodiode

detector. Multimode monofibers are the transmission media, and data can be impressed or tapped off at each remote terminal. After consideration of several types of terminals, an angle collimation terminal and a mirror terminal were constructed. The two terminals and a master terminal were assembled into a complete system and tested. Overall performance met or approached system objectives and the fail safe nature of the system was clearly shown. M.G.

N80-23142# Human Engineering Labs., Aberdeen Proving Ground, Md.
THE VERIFICATION OF A COMPUTER MODEL OF INTERNAL LIGHT REFLECTIONS FOR HELICOPTER CANOPY DESIGN Final Report
Christopher C. Smyth and Harry R. Stowell Oct. 1979 58 p refs
(AD-A080473; HEL-TM-21-79) Avail: NTIS HC A04/MF A01 CSCL 01/3

The U.S. Army Human Engineering Laboratory (USAHEL) has experimentally verified a computer model for internal light reflections on the transparent surfaces of helicopter canopies. The model was verified using a mockup of the Model 209 AH-1S Helicopter with the flat plate canopy design. The transmittance and coordinates of the light images on the canopy surfaces were measured at various light source positions. A matched sample was computed for the source positions using the computer model. Pearson's correlation coefficients for a linear regression analysis of the matched measured and computed values are greater than 0.98, and the results are statistically significant at the .01 level. GRA

N80-23143# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PERFORMANCE OF OPTICAL RECEIVERS IN DETECTION OF VARIABLE DUTY CYCLE MANCHESTER CODED DATA M.S. Thesis
Robert Andrew Cilley Dec. 1979 78 p refs
(AD-A080422; AFIT/GEO/EE/79-1) Avail: NTIS HC A05/MF A01 CSCL 17/8

The goal of this paper is to determine whether the probability of error in bit detection by optical receivers can be improved through the use of a variable duty cycle Manchester modulation format and proper receiver design. It has been speculated that a short source duty cycle would improve receiver performance, particularly when the source average power is constant. The parameters assumed to affect the probability of error include optical power, temperature, pulse width, amplifier gain, signal shot noise, thermal noise, and the circuit parameters of resistance and capacitance. Performance predictions are made for the optimum receiver of signals in additive white noise, the matched-filter receiver, and two suboptimum receivers. The first suboptimum receiver is nothing more than a detector and an FET amplifier. The second consists of the same components with an equalizing filter added. Graphical data showing performance under extreme variations of the parameters listed above indicate that the matched-filter receiver is far superior to the suboptimum receivers. The equalized receiver performs better than the basic detector/amplifier receiver only under the most favorable operating conditions. The performance variation with source duty cycle varies with operating conditions. Under worst conditions the maximum duty cycle is recommended. GRA

N80-23144# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
OPTICAL RECEIVER DESIGN USING PYROELECTRIC DETECTORS M.S. Thesis
Michael James Goodman Dec. 1979 82 p refs
(AD-A080423; AFIT/GEO/EE/79-2) Avail: NTIS HC A05/MF A01 CSCL 17/5

An optical receiver operable over a broad spectral range of the infrared region is possible using a pyroelectric point detector. The pyroelectric detector is modeled as a transducer of thermal radiation to an electrical signal cascaded with an R-C network. The pyroelectric signal is amplified by a preamplifier network. The sensor is, therefore, modeled as a linear bandpass filter. The preamplifier is configured in two modes, the voltage mode which limits the response to a narrow electrical bandwidth, and the current mode which broadens the response over a wide electrical bandwidth. The responsivity bandwidth product is dependent upon the preamplifier components determined by the mode of operation. However, pulse widths and pulse repetition rates can be calculated without regard to mode of operation. The detector performance is theoretically limited by fluctuations of the incident radiation and is practically constrained by the thermally generated noise within the preamplifier components. The optical receiver signal processing consists of a whitening filter cascaded with a matched filter. The filter network is used to optimally process the sensor output. The processing scheme provides a signal-to-noise improvement of 1 million over straight detection. GRA

N80-23145# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FAR INFRARED AND SUBMILLIMETER TECHNOLOGY Final Report, 1 Jan. 1977 - 31 Dec. 1979
P. E. Tannenwald Jan. 1980 49 p refs
(AD-A080710; AROD-13987.3-PX) Avail: NTIS HC A03/MF A01 CSCL 17/5

A submillimeter heterodyne receiver/radiometer has been developed that covers the spectral range from 100 micrometers to 1 mm with NEPs of 10 to the -19th power W/Hz or noise temperatures of 7000 K. It uses GaAs Schottky diodes as mixers in quasi-optical configurations. Tunable far IR radiation has been generated and used to carry out double resonance spectrocopy experiments in CH3F. Planar mixer diodes have been used to analyze the spectral properties of far IR lasers. Various applications of this newly developed near mm technology have been explored. GRA

N80-23146# Naval Ocean Systems Center, San Diego, Calif.
EMP HARDENING OF AIRBORNE SYSTEMS THROUGH ELECTRO-OPTICAL TECHNIQUES DESIGN GUIDELINES Technical Report, Apr. - Aug. 1979
R. A. Greenwell 15 Dec. 1979 55 p refs Sponsored by Defense Nuclear Agency
(AD-A080650; NOSC/TR-469) Avail: NTIS HC A04/MF A01 CSCL 18/6

This report examines the utilization of fiber optics technology as an alternative to system EMP hardening and provides design guidelines for airborne system applications. It also examines potential EMP vulnerabilities of the overall fiber optic data subsystems, defines and quantifies methods of protection against the EMP threat, and compares vulnerabilities with those of hard-wired data systems. GRA

N80-23147# Rochester Univ., N. Y.
DEVELOPMENT OF FERROMAGNETIC SPINELS FOR OPTICAL ISOLATION AT 10.6 MUONm Progress Report, 1 Dec. 1977 - 28 Feb. 1978
K. J. Teegarden Feb. 1978 7 p
(Contract EY-76-S-02-4056)
(COO-4056-6) Avail: NTIS HC A02/MF A01

The preparation of pure powders of CdCr2Se4 and the parameters necessary to hot press these into windows with low absorption at 10.6 microns are discussed. Two methods of preparation, namely growth of small single crystals from a liquid phase and a technique of coprecipitation of hydroxides and subsequent treatment with H2Se yielded samples which have an absorption coefficient of approximately 100/cm at 10.6 microns. The samples contain Cr2O3 as a major impurity. Scattering due to either pores or a second phase also limits transmission. Procedures for removing Cr2O3 and decreasing porosity are discussed. DOE

N80-23148# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereicht Halbleiter.
OPTOELECTRONIC DEVICES FOR SHORT RANGE COMMUNICATION Final Report
Werner Schairer Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1979 58 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-11) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 11.75

Glass fiber optics systems for signal transmission over short (30 m) and medium (300 m) range distances are described. Particular emphasis is placed on optical coupling efficiency and

frequency behavior. The incorporation of small plastic lenses between the fiber end and LED is shown to increase the optical coupling efficiency by up to a factor of 5. There are two complete systems described: the short range V300P system with a frequency limit of 10 MHz; and the medium range V350P system with a frequency limit of 100 MHz. Ge-doped GaAs diodes are developed with cutoff frequencies of up to 140 MHz. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-23149 Michigan Univ., Ann Arbor.
TENSOR PRESSURE TOKAMAK EQUILIBRIUM AND STABILITY Ph.D. Thesis
Anthony Cooper 1979 222 p
Avail: Univ. Microfilms Order No. 8007723

The equilibrium and MHD stability of tokamak with tensor pressure were investigated and the effects of anisotropies induced by neutral beam injections were examined. Perpendicular and parallel beam pressure components were evaluated by taking moments of a distribution function obtained from the solution of a Fokker-Planck equation that models the injection of high energy neutral beams into a tokamak. A double adiabatic energy principle was derived from a modified version of the guiding centre plasma energy principle. The asymptotic expansion (in large toroidal mode number n) and subsequent minimization of the energy principle yields an Euler equation from which a necessary stability criterion was obtained for the guiding centre plasma to oscillations of large toroidal mode number. The tensor pressure ballooning mode equation was applied computed equilibria that model experimentally determined ISX-B discharge profiles with high power neutral beam injection. Dissert. Abstr.

N80-23150 California Univ., Los Angeles.
DEVELOPMENT OF A FAR INFRARED SCATTERING SYSTEM AS A TOKAMAK DIAGNOSTIC TOOL Ph.D. Thesis
Alain Semet 1979 145 p
Avail: Univ. Microfilms Order No. 8008532

The development of a CW far infrared scattering apparatus suitable for both fusion and laboratory plasma wave scattering applications is discussed. The system consists of an optically pumped far infrared laser which is operated with CH3I or C(13) H3F, an optical scattering system based on a homodyne detection scheme, and the attendant signal processing instrumentation. Particular emphasis was placed on both the far infrared laser and its CO2 laser pump. Dissert. Abstr.

N80-23151 Illinois Univ. at Urbana-Champaign.
STABILITY OF THE FIELD-REVERSED MIRROR Ph.D. Thesis
Edward Clemens Morse 1979 108 p
Avail: Univ. Microfilms Order No. 8009115

Because of finite orbit effects, the stability properties of a field-reversed mirror are different from the stability properties of similar magnetohydrodynamic equilibria. The Vlasov energy principle is applied to a computer simulation of an axisymmetric field-reversed mirror state. It was possible to prove that the lambda = 0 modes, called tearing modes, satisfy a sufficient condition for stability. Precessional modes, with lambda = 1, 2, are found to be unstable at low growth rate. This suggests possible turbulent behavior (Bohm confinement) in the experimental devices aiming at field reversal. Techniques for suppressing these instabilities are outlined, and the applicability of the Vlasov energy principle to more complicated equilibrium models is shown. Dissert. Abstr.

N80-23152 Wisconsin Univ. - Madison.
AXISYMMETRIC INSTABILITY IN A NONCIRCULAR TOKAMAK Ph.D. Thesis
Bruce Lipschultz 1979 114 p
Avail: Univ. Microfilms Order No. 8004726

The stability of dee, inverse dee, and square cross section plasmas to axisymmetric modes, investigated experimentally in a Tokamak with a four-null poloidal divertor is discussed. Experimental results are closely compared with predictions of two numerical stability codes: the PEST code (ideal magnetohydrodynamics, linear stability) adapted to tokapole geometry and a code which follows the nonlinear evolution of shapes similar to tokapole equilibria. The experiment and code agree that the square is the most stable shape, but experiment indicates that passive feedback is partially defeated by finite plasma resistivity. In both code and experiment square-like equilibria exhibit a relatively harmless horizontal instability. Dissert. Abstr.

N80-23153# Los Alamos Scientific Lab., N. Mex.
RECENT DEVELOPMENTS IN LINEAR THETA-PINCH AND LASER-HEATED SOLENOID RESEARCH
K. F. McKenna, R. R. Bartsch, R. J. Commisso, C. A. Ekdahl, K. B. Freese, R. F. Gribble, F. C. Jahoda, G. Miller, R. E. Siemon, J. U. Brackbill et al 1978 28 p refs Presented at the 7th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Innsbruck, 23-30 Aug. 1978 Prepared jointly with Mathematical Sci. Northwest, Inc., Bellevue, Wash. and Wash. Univ., Seattle
(Contract W-7405-eng-36)
(LA-UR-78-1910; CONF-780811-9) Avail: NTIS HC A03/MF A01

High energy thermonuclear plasmas generated in linear theta pinches are examined. The end loss, end stoppering, stability, and heating in linear theta pinches were studied. The particle and thermal losses, the plasma flow and magnetic field interaction processes near the coil ends, the end loss suppression using solid material end plugs, and the plasma stability characteristics were investigated. The driving mechanisms of the observed m = 1 wobble instability, mathematical models of particle end loss, instability effects on radial diffusion, and magnetoacoustic heating methods are discussed. The interaction of CO2 laser radiation with theta pinch like plasma columns is reported. A.W.H.

N80-23154# Oak Ridge National Lab., Tenn.
MULTICHANNEL SUBMILLIMETER INTERFEROMETER FOR TOKAMAK DENSITY MEASUREMENTS
D. P. Hutchinson, P. A. Staats, K. L. Vanderslust, and J. B. Wilgen Sep. 1979 18 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7015) Avail: NTIS HC A02/MF A01

A two channel submillimeter (SMM) laser, electron density interferometer was operated successfully on the ISX Tokamak. The interferometer is the first phase of a diagnostic system to measure the Tokamak plasma current density using the Faraday rotation of the polarization vector of SMM laser beams. The deuterated formic acid lasers produced CW power of 10 mW. The interferometer performed successfully for line averaged electron densities as high as 8 x 10 to the 13th power/cu cm. DOE

N80-23155# Naval Research Lab., Washington, D. C.
THEORY OF ELECTRON CYCLOTRON RESONANCE HEATING OF TOKAMAK PLASMAS
Edward Ott, Bertram Hui, and K. R. Chu 1979 70 p refs
(Contract EY-76-A-34-1006)
(NRL-MR-4028) Avail: NTIS HC A04/MF A01

Tokamak plasma heating by the electron cyclotron resonance was studied. The density limitations imposed by accessibility are reviewed. The predictions of linear theory (including relativistic effects on the wave absorption) are examined via solutions of the ray equations in a toroidal Tokamak equilibrium. The possibilities of scattering heating wave by existing drift wave type fluctuations and of parametric instability are examined. DOE

N80-23156# California Univ., Livermore. Lawrence Livermore Lab.
THE TANDEM MIRROR HYBRID DESIGN STUDY
R. W. Moir, B. M. Boghosian, R. S. Devoto, J. L. Erickson, J. H. Fink, J. D. Lee, J. O. Myall, W. S. Neef, Jr., G. R. Pfirsterer (GE Co., Schenectady, N.Y.), A. E. Dubberley (GE Co., Schenetady, N.Y.) et al 1 Aug. 1979 496 p refs
(Contract W-7405-eng-48)
(UCID-18078) Avail: NTIS HC A21/MF A01

The initial phase of a design study of a tandem mirror fusion reactor is presented. The mechanical design of the plant, plasma

physics, blanket design, magnet design, injector design, direct convertor design, balance of plant design, fission burner reactor, and environment and safety of of the reactor are examined. DOE

N80-23157# California Univ., Livermore. Lawrence Livermore Lab.
LINEAR AND NON-LINEAR CALCULATION OF RESISTIVE MAGNETOHYDRODYNAMIC INSTABILITIES
J. Killeen Sep. 1979 21 p refs Presented at the 4th IRIA Intern. Symp. on Computing Methods in Applied Sciences and Engineering, Versailles, 10-14 Dec. 1979
(Contract W-7405-eng-48)
(UCRL-83332; CONF-791201-1) Avail: NTIS
HC A02/MF A01

Time dependent, linear and nonlinear, resistive magnetohydrodynamic, numerical models are reviewed. The codes compute growth rates, mode structure and saturation of tearing, rippling, and interchange modes in fusion experiments. Cartesian, cylindrical, helical, and toroidal geometries are used in the applications. The numerical methods are described and applications to reversed field configurations are presented. DOE

N80-23158# Oak Ridge National Lab., Tenn.
STABILITY OF BEAM-INDUCED TENSOR PRESSURE TOKAMAKS
W. A. Cooper (Univ. of Michigan, Ann Arbor), D. B. Nelson (DOE Washington, D.C.), G. B. Bateman, and T. Kammash (Univ. of Michigan, Ann Arbor) Oct. 1979 18 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7019) Avail: NTIS HC A02/MF A01

Necessary and sufficient criteria obtained for the high toroidal mode number stability of a guiding center plasma in low aspect ratio, D shaped, beam induced tensor pressure tokamak are presented. The difference between the two criteria for interchange stability and for ballooning stability is discussed. The critical beta value imposed by stability to ballooning modes is reported. DOE

N80-23159# Arizona Univ., Tucson. Dept. of Nuclear Engineering.
PROGRESS IN APPLICATION OF HYBRID NUMERICAL SIMULATION METHODS TO MAGNETIC CONFINEMENT SYSTEMS Annual Report
R. L. Morse Jun. 1979 27 p refs
(Contract EG-77-S-02-4259)
(COO-4259-T1) Avail: NTIS HC A03/MF A01

Hybrid codes, developed to simulate high density, high beta confined plasmas are described. The major areas of application were end plugging and heating of linear confinement systems. The role of line and recombination radiation in experiments which showed large increases in energy confinement times from the use of solid end plugs is discussed. The conception and theoretical analysis of an efficient, low frequency, axial heating method is discussed. DOE

N80-23160# Los Alamos Scientific Lab., N. Mex.
INTERFEROMETRIC EVALUATION OF DIAMOND-TURNED MIRRORS FOR CO2 LASER FUSION
J. L. Munroe 1979 8 p Presented at the Ann. Meeting of the Optical Soc. of America, Rochester, N.Y., 8 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3198; CONF-791055-2) Avail: NTIS
HC A02/MF A01

The development of the short pulse, high energy CO2 laser for application in a fusion reactor system is reported. The technique for single point diamond turning is described and its application to the fabrication of mirrors for the laser is examined. Data which can be used to improve the manufacturing process are evaluated including the average radial profile, astigmatism, and the optical power in flats. A.W.H.

N80-23161# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER SIMULATION OF SUPERTHERMAL TRANSPORT FOR LASER FUSION
David S. Kershaw 19 Oct. 1979 20 p refs Presented at the 21st Ann. Meeting of the Am. Phys. Soc., Boston, 12-16 Nov. 1979
(Contract W-7405-eng-48)
(UCRL-83494; CONF-791135-1) Avail: NTIS
HC A02/MF A01

The relativistic multigroup diffusion equations describing superthermal electron transport in laser fusion plasmas are the basis for the numerical scheme presented which is used to model laser fusion experiments. DOE

N80-23162# Naval Research Lab., Washington, D. C.
ANOMALOUS TRANSPORT FROM PLASMA WAVES
W. M. Manheimer 18 Oct. 1979 34 p refs Presented at 14th Conf. Intern. sur les Phenomenes d'Ionisation dans les Gaz, Grenoble, France, 9 Jul. 1979
(Contract EX-76-A-34-1006)
(NRL-MR-4066; CONF-790708-6) Avail: NTIS
HC A03/MF A01

An investigation is made as to whether one can derive, from first principles, simple scaling laws for complicated plasma devices such as a Tokamak. The approach uses phenomenological transport coefficients to describe the anomalous transport. DOE

N80-23163# Oak Ridge National Lab., Tenn.
CLASSICAL THEORY OF BEAM-INDUCED PLASMA CURRENTS
S. P. Hirshman Dec. 1979 31 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7079) Avail: NTIS HC A03/MF A01

A variational calculation of the current induced in a plasma by fast beam particles is presented. A new energy polynomial expansion of the classical Spitzer function is obtained and used to derive an accurate expression for the beam-induced current j/sub parallel which includes the effects of electron-electron collisions and is valid for all values of anti v/sub b/ = v/sub b/v sub e and effective charge anti Z. This analytic results is in excellent agreement with previous numerical calculations. An accurate rational form for the beam-induced current as a function of beam velocity is obtained by patching the large and small anti v/sub b/asymptotic expansions of j/sub parallel. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-23164 Illinois Inst. of Tech., Chicago.
CONTINUUM THEORY OF GRANULAR MEDIA Ph.D. Thesis
Mostafa Rassaian 1979 123 p
Avail: Univ. Microfilms Order No. 8003659

The mechanics of granular materials are analyzed using the balance laws associated with microscopic and macroscopic continua. The notion of microscopic rotation and dilation was introduced into the continuum structure as a means for describing the local arrangement of granules at a material point. The differential equations and boundary conditions governing the microscopic behavior of granular media undergoing small deformations in equilibrium field and describing very small velocity effects in nonequilibrium field were derived by means of a systematic and consistent application of the laws of continuum physics to a defined macroscopic model. The application of the equation of the conservation of energy, the second law of thermodynamics, and the principle of material objectivity enable the determination of the constitutive equations of the nonlinear theory for both the equilibrium and the nonequilibrium fields. Dissert. Abstr.

N80-23165 Pennsylvania State Univ., University Park.
ON THE STRUCTURE AND PROPERTIES OF POLYETHYLENE SINGLE CRYSTALS Ph.D. Thesis
James Patrick Runt 1979 237 p
Avail: Univ. Microfilms Order No. 8006051

A characterization of polyethylene (PE) single crystals in supension in a liquid is given and compared to the that of dried-down samples. The x-ray line broadening and infrared spectroscopy experiments on both dried and suspended PE crystals indicate that crystals maintained in suspension possess a greater

degree of lateral order that the corresponding dried sample. This difference in order is quantified using Differential Scanning Calorimetry. The weight fraction crystallinity of suspension samples is found to be approximately 90 percent. This is in contract to the usual values of 80 to 85 percent associated with dried PE lamellae. Melting point experiments and further analysis of heat of fusion data for suspension samples suggest that PE crystals possess folds containing 10 methylene units. Considering the evidence available at this time, it seems likely that PE single crystals posses predominately 'tight' adjacent reentry folds.
Dissert. Abstr.

N80-23166 Michigan Univ., Ann Arbor.
RADIATION DAMAGE ENHANCED HYDROGEN TRAPPING IN A SINGLE CRYSTAL MOLYBDENUM Ph.D. Thesis
Albert Leroy Hanson 1979 207 p
Avail: Univ. Microfilms Order No. 8007754

Hydrogen was implanted in samples of single crystal molybdenum, many of which were previously damaged with helium at 18 or 150 keV. The hydrogen implantations were at low energies, usually 10 keV. The enhanced retention, or trapping, of the hydrogen in the presence of this radiation damage was studied with a nuclear reaction technique. The conclusions that are drawn from the experimental results are divided into three components and disscussed.
Dissert. Abstr.

N80-23167 Nebraska Univ. - Lincoln.
RAMAN SCATTERING FROM MIXED-CRYSTAL LAYERED COMPOUNDS Ph.D. Thesis
George Anton Freund, Jr. 1979 204 p
Avail: Univ. Microfilms Order No. 8009585

The results of Raman scattering experiments on mixed crystals related to the transition metal dichalcogenide TiSe2 are reported. Pure TiSe2 is of interest because it undergoes a displacive structural phase transition to a superlattice. The mechanism for this phase transition is discussed. Two main aspects of the results are highlighted: (1) the mixed crystal lattice dynamics, and (2) the mechanism for the superlattice formation in TiSe2, including the effect of doping upon the transition.
Dissert. Abstr.

N80-23168 Illinois Univ. at Urbana-Champaign.
CORRELATED HARTREE-FOCK BAND STRUCTURES FOR TRANSITION METALS Ph.D. Thesis
Clint Bruce Geller 1979 171 p
Avail: Univ. Microfilms Order No. 8009039

The method of local orbitals was applied to the calculation of electronic properties of transition metal systems with good metallic behavior. Hartree-Fock energy band structures employing nonlocal exchange are reported for paramagnetic and ferromagnetic nickel, palladium, and palladium hydride, and an approximate correlation correction scheme is shown to yield encouraging results. The resulting nickel band structures are found to be in excellent agreement with recent optical experiments, while available information indicates the calculated energy bands for palladium to be somewhat too narrow. Stoichiometric palladium hydride exhibits a strong dependence of the resulting electronic structure on the degree of charge transfer between palladium and hydrogen sites.
Dissert. Abstr.

N80-23169 Illinois Univ. at Urbana-Champaign.
SURFACE REFLECTANCE STUDIES OF RARE GASES ADSORBED ON METAL AND OXIDE SURFACES Ph.D. Thesis
David Kimball Greenlaw 1979 257 p
Avail: Univ. Microfilms Order No. 8009047

The electronic structure of rare gas adsorbates was examined using differential reflectance spectroscopy in the vacuum ultraviolet range of photon energies. The spectral show that charge transfer processes occur when rare gas atoms adsorbed on certain metals are optically excited. The observed spectra do not permit direct determination of dielectric response of the adsorbed surface layer. A semi-quantitative correspondence between structure in the spectra and the dielectric response of the surface layer is established by fitting the data to a classical theory of the differential reflectance of surface layers. A simple and highly effective model is developed to predict whether the bonding of the excited rare gas state to the metal surface is ionic or metallic. The spectra of Xe adsorbed on Al2O3 are more complicated than that on pure metal surfaces. Features in the spectra that resemble crystal field splittings are shown to be incompatible with a simple model in which the surface crystal field has axial symmetry, perpendicular to the surface plane.
Dissert. Abstr.

N80-23170 Illinois Univ. at Urbana-Champaign.
STUDIES IN THE THEORY OF SOLIDS Ph.D. Thesis
Harold Paul Hjalmarson 1979 262 p
Avail: Univ. Microfilms Order No. 8009059

The surface arrangement of atoms was studied in terms of the energetically slowly varying features of a LEED spectrum. The surface sandwich reflectivity was directly compared with the slowly varying, surface dependent features. The method was used to determine that the surface of TiS2 is ideal whereas the surface sandwich of Ti Se2 expands outward slightly. The energies of deep straps associated with impurities in semiconductors were also examined. Using band structure at symmetry points to define the impurity potential, predictions of energies of deep traps caused by impurities were made for fourteen different semiconductors. The theory is compared with the data for GaP and the alloy GaAs1-xPx before developing a phenomenological model which depends mainly on the energy centers of the valence and conduction band density of states as well as atomic energies of impurities.
Dissert. Abstr.

N80-23171 Utah State Univ., Logan.
STUDIES OF ELECTRODE RESISTANCE AND HALL EFFECT IN ELECTROCHEMICAL PROCESSES Ph.D. Thesis
David Lee Rath 1979 210 p
Avail: Univ. Microfilms Order No. 8005116

The dependence of resistance and the Hall effect of thin gold film electrodes in an electrochemical cell was studied with simple charging (field effect), halide adsorption, and underpotential deposition. The in situ monitoring of the resistance and its time derivative in periodic linear sweep voltammetry along with voltammetric measurements provided a detailed and sensitive means to study the electrode-electrolyte interphase. Schemes for the statistical correlation of the derivative-resistance curves with the cyclic voltammagrams taken at several potential rates of scan were developed and found to enable precise calculations for the electrode resistance responses to adsorption and deposition processes. An integration scheme is described that uses the resistance measurements to enable a precise determination of the maximum obtainable adsorption coverage for the potential range of scans. The validity of the resistance results was checked with a comparison test where these measurements are made by the DC method and by the AC method at several frequencies. Changes in the Hall effect were investigated for simple charging and for bromide and iodide adsorption using the immersion-emersion technique.
Dissert. Abstr.

N80-23172 Illinois Univ. at Urbana-Champaign.
OXIDE CHARGE TRAPS AND INTERFACE STATES AT THE SILICON - SILICON DIOXIDE INTERFACE Ph.D. Thesis
Alan Randolph Stivers 1979 157 p
Avail: Univ. Microfilms Order No. 8009184

Metal oxide semiconductor capacitors were fabricated with 2800 A thick dry grown thermal oxides under various conditions to determine the effects of oxidation parameters on oxide charge trapping. Electrons and holes were injected into the oxides by the VUV bias method. The charge trapped at the interface was measured by the capacitance voltage method and located by the photocurrent voltage method. The annealing behavior of the oxide traps are discussed. An analysis of the annealing kinetics is given.
Dissert. Abstr.

N80-23173 Illinois Univ. at Urbana-Champaign.
NITROGEN ISOELECTRONIC TRAPS IN GALLIUM ARSENIDE PHOSPHIDE AND ALUMINUM GALLIUM ARSENIDE Ph.D. Thesis
Donald James Wolford, Jr. 1979 399 p
Avail: Univ. Microfilms Order No. 8009215

N trap luminescence in GaAsP and AlGaAs was examined. The photoluminescence properties of the N sub x state in GaAsP and AlGaAs are investigated at 5 K over a wide range of alloy compositions and N concentrations derived from ion implantation and annealing. Alloy diagrams for the N sub x state in these systems are presented. The N sub x emission lineshapes

interpreted at both 5 K and higher temperatures by a linear configuration coordinate coupling to both optic and acoustic phonons are discussed. Dissert. Abstr.

N80-23174 Connecticut Univ., Storrs.
DISLOCATION MOTION AND ITS EFFECT ON MAGNETIC FLUX PINNING IN TYPE-2 SUPERCONDUCTORS Ph.D. Thesis
Chan-Sui Pang 1979 91 p
Avail: Univ. Microfilms Order No. 8008690

The difference in the stress for plastic deformation between the mixed state and the superconducting state, measured in a series of lead-indium crystals is examined. These measurements showed a strong dependence of the drag stress on applied fields. The data indicate that the change in drag stress between the two states varies in the same manner as does the ultrasonic attenuation in a type 2 superconductor. Results show that dislocation motion in these alloys can be treated as an underdamped oscillator at low temperatures. Based upon the interactions between dislocation and the flux line lattice, a technique is developed which allows an in situ measurement of the mobile dislocation density in crystals. The measurements show the mobile dislocation density changes linearly with strain-rates. Futhermore, in studying the stress-strain characteristics, substantial difference in mobile dislocation density is found between various stages of the plastic deformation. Dissert. Abstr.

N80-23175 California Univ., Los Angeles.
CHARACTERIZATION OF HOMOEPITAXIAL SILICON FILMS PRODUCED BY ELECTRON BEAM DEPOSITION Ph.D. Thesis
Gracie Esther Davis 1979 143 p
Avail: Univ. Microfilms Order No. 8008469

Silicon films were deposited onto silicon (100) single crystal substrates using electron beam evaporation under moderate vacuum with low substrate heating (450 C to 650 C). A low temperature (700 - 850 C) cleaning method using anhydrous HCL etch and a low pressure heating was developed to investigate the electrical and structural properties of the evaporated films. The film's microstructure was investigated by scanning electron microscope and a transmission electron microscope in the electron diffraction mode. The electrical properties were investigated using spreading resistance, Hall measurements, Schottky and MOS C-V response and p-n junction characteristics. The boron doped source materials were found to produce films which were approximately one order of magnitude larger than the source material resistivity. The Schottky diodes were found to exhibit a C-V variation which was dependent on the deposition parameters. Dissert. Abstr.

N80-23176 Pennsylvania Univ., Philadelphia.
MAGNETOCRYSTALLINE ANISOTROPY, MAGNETOSTRICTION AND SATURATION MAGNETIZATION OF SmCo5 SINGLE CRYSTALS Ph.D. Thesis
Stanley Richard Trout 1979 93 p
Avail: Univ. Microfilms Order No. 8009472

To obtain a complete set of data on the intrinsic properties of SmCo5, the saturation magnetization, magnetocrystalline anisotropy, and magnetostriction of single crystal samples were measured from 4.2 K to room temperature and above. Magnetostriction constants were measured using strain gages at maximum fields of 110 kOe and at temperatures from 4.2 K to 300 K. The saturation magnetization was measured up to 890 K, using a vibrating sample magnetometer. Dissert. Abstr.

N80-23177 Princeton Univ., N. J.
STUDY OF THE GENERATION OF INTERFACE STATES IN THE Si-SiO2 SYSTEM AFTER HIGH-FIELD STRESS AND AFTER X-IRRADIATION Ph.D. Thesis
Genda James Hu 1979 115 p
Avail: Univ. Microfilms Order No. 8008942

Metal oxide silicon (MOS) capacitors subjected to high fields or ionizing radiation were examined. The high field stressing was done with the field plate positive in polarity, and the average fields in the oxide were 7.1 to 7.7 MV/cm. The irradiations were done with soft X-rays produced by 5 kV electrons striking a molybdenum target. A positive field plate bias providing an average field of about 1 MV/cm was used during the X-irradiation. The energy distributions within the Si bandgap of the generated interface states are discussed. The internal photoemission and photocurrent voltage techniques used to study the charge distributions in the SiO2 are described. Dissert. Abstr.

N80-23178 Michigan Univ., Ann Arbor.
HYPERFINE INTERACTION IN HYDROGEN AND NUCLEAR SPIN-SPIN COUPLING IN HYDROGEN DEUTERIDE Ph.D. Thesis
Thorsteinn Hannesson 1979 61 p
Avail: Univ. Microfilms Order No. 8007753

A model for the Fermi contact interaction is proposed, in which the charge and the magnetic moment of the nucleus are uniformly distributed within a sphere of radius R sub o. This leads to Schroedinger equation which is solvable without perturbation theory. The Schroedinger equation was solved in terms of an external solution and an internal solution. The eigenvalues were determined by a transcendental equation following from the requirement that the wave function and its derivative be continuous across r = ro. The results were used to calculate the contribution from the Fermi contact interaction to the nuclear spin - spin coupling constant of HD. Dissert. Abstr.

N80-23179 Columbia Univ., New York.
OPTOELECTRONIC AND PHOTOVOLTAIC PROPERTIES OF METAL-SiO2-SILICON TUNNELING STRUCTURES Ph.D. Thesis
Kwok Ng 1979 117 p
Avail: Univ. Microfilms Order No. 8009362

The short wave length (lambda) response of near-ideal silicon Schottky barrier photodetectors was studied. It is shown that the major cause of reduced quantum efficiency in this range of lambda is the collection by the metal of majority carriers photogenerated within the image force maximum. The potential barriers of ultrathin SiO2 layers to electrons and holes tunneling between the semiconductor and the metal were measured independently on the same MOS samples. The results show that the tunnelling barriers for holes are consisently much larger than those for electrons. Metal-SiO2-silicon (MIS) solar cells were investigated as a function of SiO2 thickness d. Both majority carrier and minority carrier structures were studied and their performance compared for SiO2 layers prepared under identical oxidation conditions and with identical silicon surface treatments. The short circuit current densities and the optimum conversion efficiencies for the majority carrier cells and for the minority carrier cells are given. Dissert. Abstr.

N80-23180*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATION DAMAGE IN HIGH VOLTAGE SILICON SOLAR CELLS
Irving Weinberg, Henry Brandhorst, Jr., Clifford K. Swartz, and Victor G. Weizer 1980 11 p refs Presented at 2nd European Symp. on Photovoltaic Generators in Space, Heidelberg, 15-17 Apr. 1980
(NASA-TM-81478; E-412) Avail: NTIS HC A02/MF A01 CSCL 20L

Three high open-circuit voltage cell designs based on 0.1 ohm-cm p-type silicon were irradiated with 1 MeV electrons and their performance determined to fluences as high as 10 to the 15th power/sq cm. Of the three cell designs, radiation induced degradation was greatest in the high-low emitter (HLE cell). The diffused and ion implanted cells degraded approximately equally but less than the HLE cell. Degradation was greatest in an HLE cell exposed to X-rays before electron irradiation. The cell regions controlling both short-circuit current and open-circuit voltage degradation were defined in all three cell types. An increase in front surface recombination velocity accompanied time dependent degradation of an HLE cell after X-irradiation. It was speculated that this was indirectly due to a decrease in positive charge at the silicon-oxide interface. Modifications aimed at reducing radiation induced degradation are proposed for all three cell types. Author

N80-23181*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF SILICATE IONS ON ELECTRODE OVERVOLTAGE

Jean-Marie Gras and Claude Serte Dec. 1979 14 p refs Transl. into ENGLISH of Effet des Ions Silicate sur les Surtensions d'Electrodes (Paris), Rept-P/539/77/24, Jun. 1977 10 p Translation was announced as N79-27413 Transl. by Sci. Transl. Serv., Santa Barbara, Calif. Original doc. prep. by Elec. de France, Paris
(Contract NASw-2791)
(NASA-TM-75760) Avail: NTIS HC A02/MF A01 CSCL 20L

The influence of the addition of a silicate to a caustic solution (KOH) is studied in order to determine the degree to which silicates inhibit the corrosion of chrysotile under conditions of electrolysis at working temperatures of 100 C and above. In an alkaline solution containing various silicate concentrations, current density was increased and electrode overvoltage was measured. Results show that silicate ion concentrations in the electrolyte increase with temperature without effecting electrochemical performance up to 115 C at 700 MA/sqcm. At this point the concentration is about 0.5 g Si/100 g KOH. Beyond this limit, electrolytic performance rapidly degenerates due to severe oxidation of the electrodes. Author

N80-23182# Fairchild Camera and Instrument Corp., Palo Alto, Calif. Research and Development Lab.
PROCESS VARIABLE DEPENDENCE AND INTERRELATIONSHIP BETWEEN AVALANCHE INJECTED AND RADIATION INDUCED CARRIER TRAPPING IN THERMAL OXIDES Quarterly Status Report, 1 Apr. - 30 Jun. 1979
Bruce E. Deal Jul. 1979 7 p
(Contract N00014-79-C-0297)
(AD-A079281; QSR-1; PR-1) Avail: NTIS HC A02/MF A01 CSCL 20/12

This is the first quarterly report on the ARPA sponsored project titled 'Process Variable Dependence and Interrelationship Between Avalanche Injected and Radiation Induced Carrier Trapping in Thermal Oxides.' This program is carried out in cooperation with the Naval Research Laboratory in Washington, DC. Progress to date includes the modification of our present computerized C-V analysis system to allow for automated avalanche carrier injection measurements and data reduction as well as the preparation of the first group of samples to be used in the program. The modifications proposed for our computerized C-V quasi-static system to convert it to an automated avalanche carrier injection trapping system have been carried out. N-type (111) silicon wafers, resistivity 0.2-0.3 ohm-cm, and p-type (111) wafers resistivity 0.4-0.7 ohm-cm were oxidized in dry O2 at 900, 1000, and 1100 C to an oxide thickness of approximately 800 A. GRA

N80-23183# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering.
PHOTOLUMINESCENCE OF UNDOPED, SEMI-INSULATING, AND Mg-IMPLANTED INDIUM PHOSPHIDE M.S. Thesis
Gernot Siefried Pomrenke Dec. 1979 199 p refs
(AF Proj. 2306)
(AD-A080366; AFIT/GEP/PH/79D-8) Avail: NTIS HC A09/MF A01 CSCL 20/12

A photoluminescent investigation was made of undoped, semi-insulating, unannealed and annealed Mg-ion implanted, indium phosphide which originated from Czochralski, vapor, and liquid grown crystals. Ion implantation was performed at fluences of 5 x 10 to the 12th power ions/sq cm to 1 x 10 to the 15 power ions/sq cm with an energy of 120 keV at room temperature, followed by annealing at 700 degrees C and 750 degrees C for fifteen minutes using a Si3N4 encapsulant. Luminescence of undoped InP was studied with respect to temperature, emission intensity, and excitation intensity; results included the possible identification of the following radiative recombinations: free exciton, bound exciton, donor-to-valence, and donor-to-acceptor. Broad, low intensity peaks were identified at 1.0541 eV, 0.9374 eV, and 1.15 eV. Spectral results of the less intense semi-insulating InP:Fe were identical to undoped InP aside from a 1.38 eV high energy shoulder and low intensity peak at 1.31 eV. Photoluminescence of unannealed, implanted samples resulted in a 0.9643 eV peak with a long, low energy shoulder. Emission intensity and peak energy of annealed, implanted samples were studied as a function of dosage and anneal temperature. The post-implantation annealing at 750 degree C was sufficient to obtain efficient luminescence. Analysis of the 750 degree C annealed samples indicates that the peak due to recombinations involving implanted Mg acceptors is located between 1.384 eV at 50 degrees K. Superior spectral results from VPE InP places the Mg peak position at 1.3801 eV. Full width at half maximum for the 1.41 eV peak at 77.3 degrees K was 10.32 meV for Czochralski grown InP, 5.67 meV for LPE grown InP, and 4.99 meV for VPE grown InP. GRA

N80-23184# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering.
AUTOMATED HALL EFFECT EXPERIMENT DATA ACQUISITION SYSTEM (AHEEDAS) M.S. Thesis
Edgar Alphonse Verchot Dec. 1979 208 p refs
(AD-A080175; AFIT/GEO/EE/79-D5) Avail: NTIS HC A10/MF A01 CSCL 09/2

The Air Force Materials Laboratory conducts experiments using the Hall effect to characterize the electrical properties and impurity levels of silicon samples. Both the van der Pauw and the classical Hall bar methods are used. The purpose of this study was the development of an Automated Hall Effect Experiment Data Acquisition System (AHEEDAS) to control the conduct of the experiment and to reduce all of the necessary data. The designed system is capable of controlling all aspects of the experiment except the temperature. The AHEEDAS produces as output, sample resistivity, Hall mobility, carrier concentration, and the Hall coefficient as a function of temperature. These are stored in data files on floppy disk storage along with all of the raw data from the experiment. The output is also printed on the computer terminal as the experiment is done. An LSI-11 microcomputer with 28K words of memory is used to control the experiment. Software was developed to allow this system to handle the acquisition and processing of data. The AHEEDAS was successfully implemented and tested. All functions other than the temperature control are fully operational. GRA

N80-23185# National Bureau of Standards, Washington, D.C. Surface Science Div.
THE ROLE OF STEPS AND DEFECTS IN ELECTRON STIMULATED DESORPTION: OXYGEN ON STEPPED W (110) SURFACES
Theodore E. Madey 20 Jan. 1980 51 p refs Submitted for publication
(Contract N00014-80-F-0002)
(AD-A080906; TR-10) Avail: NTIS HC A04/MF A01 CSCL 20/2

In order to examine the role of atomic steps and defects on electron stimulated desorption (ESD) phenomena, we have studied the adsorption of oxygen on a polyhedral tungsten crystal containing a W(110) flat and 4 flats having orientations 6 deg and 10 deg off the (110) plane with rows of steps parallel to the (100) and (110) directions. Upon adsorption at 300K, there is little or no ESD O(-) emission from the oxygen-covered (110) plane. In contrast, the stepped surfaces yield intense O(-) emission normal to the terraces and in 'downstep' directions, as seen using electron stimulated desorption ion angular distributions (ESDIAD). The presence of atomic steps has a major influence on sticking probability, saturation oxygen coverage and the ESDIAD patterns at all adsorption temperatures in the range 100K to greater than or approximately 1400K. Adsorption at low coordination sites appears to be a key factor in producing high ESD ion yields. GRA

N80-23186# California Inst. of Tech., Pasadena.
STEADY STATE AND RF PROPERTIES OF PROXIMITY EFFECT WEAK LINKS Final Technical Report, 1 Apr. 1978 - 31 Mar. 1979
R. P. McNamara and J. E. Mercereau 20 Dec. 1979 22 p refs Prepared in cooperation with Bell Labs., Naperville, Ill.
(Contract N00014-75-C-0913)
(AD-A081046) Avail: NTIS HC A02/MF A01 CSCL 20/3

A detailed experimental examination of the dc critical supercurrent density, j sub c, and the microwave (nonzero voltage) supercurrent, j sub mu, has been made in proximity effect thin film weak links at temperatures above the transition temperature of the link material. These results were correlated with measured

dimensional and superconducting parameters of the thin films and the link via a Ginzberg-Landau (GL) formalism. In the steady state, j sub c, was found to be adequately described by a one dimensional GL formalism similar to that of Likharev and Yakobson but with De Gennes boundary conditions on the order parameter applied at each interface. However, j sub mu decreases exponentially with increasing voltage and can be interpreted in terms of an interference modulation of the induced pair density within the link at the Josephson frequency. GRA

N80-23187# California Univ., Livermore. Lawrence Livermore Lab.
TUNABLE COHERENT UV TO NEAR IR GENERATION USING HIGH ORDER STIMULATED RAMAN SCATTERING
J. A. Paisner and R. S. Hargrove 27 Aug. 1979 20 p refs Presented at the 11th Ann. Electro Opt./Laser Conf. and Exposition, Anaheim, Calif., 23-25 Oct. 1979
(Contract W-31-109-eng-38)
(UCRL-83343; CONF-791047-1) Avail: NTIS HC A02/MF A01

A remarkably simple method to generate coherent vuv radiation is described. The technique is based on stimulated high order Raman scattering in H2 under tight focusing conditions. Using this method with tunable dye and rare gas halide pump lasers pulsed light output to 1238 A was produced. The important features of this process are discussed as well as its applications and extensions to the infrared region. DOE

N80-23188# Bell Telephone Labs., Inc., Murray Hill, N. J.
DEVELOPMENT OF MAGNETIC ORDER IN SUPERCONDUCTING SYSTEMS
D. E. Moncton, G. Shirane (Brookhaven National Lab., Upton, N.Y.), and W. Thomlinson (Brookhaven National Lab., Upton, N.Y.) Aug. 1979 23 p refs Presented at the Intern. Conf. on Neutron Scattering and Magnetism, Julich, West Germany, 29 Aug. 1979
(Contract EY-76-C-02-0016)
(BNL-26655; CONF-790877-2) Avail: NTIS HC A02/MF A01

Two different classes of rare earth ternary superconductors (RERh4B4 and REMo6S8, X = S, Se) provided the first instances in which chemically ordered sublattices of magnetic ions exist in superconductors. Neutron scattering showed that simple, conventional antiferromagnetism coexists with superconductivity in a number of systems, while destruction of superconductivity occurs with the onset of ferromagnetism. The magnetic structural details are summarized for the coexistent antiferromagnets, and review measurements on the superconducting to ferromagnetic transition in ErRh4B4 are presented. DOE

N80-23189# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
ELECTRONS ON THE SURFACE OF LIQUID HELIUM Ph.D. Thesis
David Kay Lambert May 1979 121 p refs
(Contract W-7405-eng-48)
(LBL-9553) Avail: NTIS HC A06/MF A01

Spectroscopic techniques were used to study transitions of electrons between bound states in the potential well near a helium surface. The charge density distribution of electrons on the surface was independently obtained from electrical measurements. From these measurements information was obtained about the interaction of the bound state electrons with the surface of liquid helium and about local disorder in the positions of electrons on the surface. DOE

N80-23190# Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands).
CALCULATIONS OF THE LONGITUDINAL AND LATERAL DISTRIBUTIONS OF THE ENERGY DEPOSITION OF 100-500 MeV ELECTRONS IN SOME MATERIALS
R. Maas and A. Hurkmans Oct. 1979 31 p refs
(INTERIKO-79/3) Avail: NTIS HC A03/MF A01

The electromagnetic energy distribution of electron induced cascade showers was studied. Primary electron energies were between 100 and 500 MeV. The longitudinal distribution of the showers was calculated analytically and Monte Carlo methods are used to obtain the lateral distribution. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-23191 Illinois Univ. at Urbana-Champaign.
VARIATIONAL THEORY OF QUANTUM FLUIDS Ph.D. Thesis
Kevin Edward Schmidt 1979 163 p
Avail: Univ. Microfilms Order No. 8009163

A theory is developed to allow the systematic calculation of the properties of quantum fluids given the microscopic two body potential. Physical arguments are used to construct a correlation operator that approximately transforms the states of a noninteracting system into the corresponding states of the interacting system. The theory is regarded as a microscopic realization of Landau's assumption of a one to one correspondence between the noninteracting and interacting states. A survey of various other many body theories are discussed. The Fermi hypernetted chain integral equations are generalized to allow the calculation of E (pi) in Fermi systems, using the correlation operator wave function. The method is applied to liquid He-3 and the v sub 2 model of nuclear matter. Dissert. Abstr.

N80-23192 Pennsylvania Univ., Philadelphia.
REPRESENTATIONS OF THE ROTATIONALLY INVARIANT ALGEBRA OF QUANTUM SPIN SYSTEMS Ph.D. Thesis
Makoto Saito 1979 101 p
Avail: Univ. Microfilms Order No. 8009455

An algebra of all observables associated with quantum spin systems is investigated as the simplest nontrivial model of a nonabelian gauge invariant discrete quantum field theory. The quantum spin systems considered are restricted to systems which consist of particles of spin 1/2 situated at each lattice site. The observables at each lattice site are composed of the spin operators which are represented by Pauli spin matrices. The rotationally invariant (RINV) algebra is highlighted. The RINV algebra is obtained as the restriction to the subalgebra of the lattice algebra which is invariant under the rotation of the lattice as a whole. The structure of the RINV algebra is presented and its connection with the symmetric group is stated. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N80-23193# Admiralty Marine Technology Establishment, Teddington (England).
PERSONALIZED TASK REPRESENTATION
R. Gregory Jul. 1979 35 p refs
(AMTE(E)-TM-79103; BR69898) Avail: NTIS HC A03/MF A01

A system of task analysis, personalized task representation (PTR) is described. An example of the current PTR system is presented and its rationale and relationship to the more traditional forms of task analysis are discussed. The most important difference between PTR and these other forms of analysis is that it provides the means to take into account the reasons for, and the contexts of task activities as well as the task activities themselves. The PTR thus emphasizes the experiential as well as the behavioral components of the task. It is suggested that PTR has the potential to cope with tasks having a high non-procedural content (e.g., tactical decision making), where other forms of task analysis break down. Author (ESA)

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-23194* National Aeronautics and Space Administration, Washington, D. C.
MANAGEMENT. A CONTINUING BIBLIOGRAPHY WITH INDEXES
Mar. 1980 175 p
(NASA-SP-7500(14)) Avail: NTIS HC $12.00 CSCL 05A

This bibliography cites 604 reports, articles, and other documents introduced into the NASA scientific and technical information system in 1979 covering the management of research and development, contracts, production, logistics, personnel, safety, reliability and quality control. Program, project, and systems management; management policy, philosophy, tools, and techniques; decision making processes for managers; technology assessment; management of urban problems; and information for managers on Federal resources, expenditures, financing, and budgeting are also covered. Abstracts are provided as well as subject, personal author, and corporate source indexes. A.R.H.

N80-23195 Pennsylvania Univ., Philadelphia.
AN INTERACTIVE PROCESS FOR HIERARCHICAL DECISION MAKING INCORPORATING THE MULTIPLE OBJECTIVES OF EACH PARTICIPANT Ph.D. Thesis
Robert Lee Banker 1979 215 p
Avail: Univ. Microfilms Order No. 8009383

A process which extends the concept of multiple criteria decision making to include the multiple objective used perspective of more than a single decision making entity is described. First, the identities of the decision makers are established, objectives with respect to the problem are determined, and how those objectives are related to decision variables is investigated. Next, each decision maker brings implicit preferences to bear on the problem by the use of an interactive satisficing procedure within the set of pareto-optimal alternatives. A final compromise solution to the problem is made by the top level decision makers in light of this information. An algorithm is developed to generate the set of Pareto-optimal alternatives for multiple objective linear programming problems with integer valued variables.
Dissert. Abstr.

N80-23196 George Washington Univ., Washington, D. C.
SYNTHESIS OF A THEORETICAL APPROACH FOR EMPLOYING ADAPTIVE CONFIGURATION MANAGEMENT IN AERONAUTICAL WEAPON SYSTEM PROGRAMS Ph.D. Thesis
Angelo John DiMascio 1979 426 p
Avail: Univ. Microfilms Order No. 8008364

A unified systems approach for managing aeronautical weapon system acquisition and life cycle support is discussed. The proposed holistic model provides a structured framework for integration of all of the technical and administrative elements associated with effective life cycle management. The primary integrative mechanism, which is used as the foundation module, is an expanded configuration management discipline. An adaptive configuration baseline management concept, when logically combined with basic integrated logistics management and research and development processes by a tailored system engineering methodology, is required to mitigrate the acquisition and support problems attendant to technology turnover. The adaptive characteristics and the tailoring emphasis are required not only to deal with the volatile state of technology but also to accommodate the continuously decreasing influence of the military markets on the components industries. Dissert. Abstr.

N80-23197# Oak Ridge Gaseous Diffusion Plant, Tenn. Operations Analysis and Planning Div.
UTILIZATION OF PROBABILISTIC NETWORK ANALYSES IN PLANNING LONG-RANGE ENGINEERING PROJECTS
D. W. Swindle, Jr., E. H. Gift, and F. M. Bustamante 6 Sep. 1979 10 p refs Presented at the Winter Simulation Conf., San Diego, Calif., 3-5 Dec. 1979
(Contract W-7405-eng-26)
(K/OP-268; CONF-791207-1) Avail: NTIS HC A02/MF A01

The application of the GERT (Graphical Evaluation and Review Technique) probabilistic network analysis technique and the results obtained from a program analysis using GERT is discussed. A historical summary of decision analysis techniques leading to the development and application of GERT is included. Discussion is provided on the GERT methodology, study rationale, and results of an analysis examining the receiving and storage task at the Oak Ridge National Laboratory. Long-range program planning advantages using GERT are identified and discussed as relates to the methodology's decision analysis capability. DOE

N80-23198# Economic Associates, Inc., Washington, D.C.
PROBLEMS FACING SMALL COMPANIES PERFORMING RESEARCH AND DEVELOPMENT
Frank Piovia May 1979 81 p Sponsored in part by NSF
(PB80-126337) Avail: NTIS HC A05/MF A01 CSCL 05A

The results of a 1977 survey on problems faced by small companies performing research and development are presented. The problems are ranked according to importance. Characteristics of the survey participants are included. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-23199 Michigan Univ., Ann Arbor.
ABSTRACT DATA STRUCTURES AND QUERIES: TOWARD MATHEMATICAL ANALYSIS IN LOGICAL-LEVEL DATABASE DESIGN Ph.D. Thesis
Donald Eugene Swartwout 1979 271 p
Avail: Univ. Microfilms Order No. 8007845

A mathematical theory is presented which is based in large part on the premise that bodies of data are broken down into pieces for storage on electronic media and then reassembled in order to construct response to users' requests for retrieval of data. An axiomatic characterization of this reassembly operation is given and an abstract data structure (ads) is defined to be any set equipped with a binary operation which satisfies the axioms. Three aspects of adses are investigated in detail: their algebraic properties, their relationship to real-world data management, and their role in the definition and analysis of data retrieval operations. Organizations for adses are used in the study of data retrieval operations. The language of the first-order predicate calculus is used to construct definitions for queries to organized adses. Query definitions are classified into a hierarchy patterned after the arithmetical hierarchy of ordinary recursion theory.
Dissert. Abstr.

N80-23200 Duke Univ., Durham, N. C.
ON THE COMPUTATIONAL COMPLEXITY OF BRANCH AND BOUND SEARCH STRATEGIES Ph.D. Thesis
Douglas Robert Smith 1979 108 p
Avail: Univ. Microfilms Order No. 8008195

The branch and bound search method is discussed and a probabilistic model of its domain is given, namely a class of trees with an associated probability measure. The best bound first and depth-first search strategies are discussed and results on the expected time and space complexity of these strategies are presented and compared. The best bound search strategy is shown to be optimal in both time and space. These results are illustrated by data from random traveling salesman problems. Evidence is presented which suggests that the asymmetric traveling salesman problem can be solved exactly in time O(n cubed ln squared (n)) on the average. Dissert. Abstr.

N80-23201 Michigan Univ., Ann Arbor.
DESIGN OF DBMS-PROCESSABLE LOGICAL DATABASE STRUCTURES Ph.D. Thesis
Subir Purkayastha 1979 331 p
Avail: Univ. Microfilms Order No. 8007814

A computer-aided design tool for the logical data base

structure design process is developed. The inputs to the methodology are a set of data items and a set of associations or relationships between pairs of data items. Other input include the volume of data items (number of occurrences of each data item type), data item access frequencies to satisfy known processing requirements, constraints for security and storage space considerations, and relevant characteristics of a specific data base management system (DBMS). The output of the methodology is a prototype DBMS-processable logical data base structure (schema) consisting of record definitions and relationships between record types storage, and access costs for the proposed logical data base structure. The design problem is formulated as an integral programming problem and the branch and bound method is used to generate an optimum solution for the parameters specified. Dissert. Abstr.

N80-23202 Michigan Univ., Ann Arbor.
PHYSICAL DESIGN OF DATABASE STRUCTURES Ph.D. Thesis
Lewis Benjamin Oberlander 1979 336 p
Avail: Univ. Microfilms Order No. 8007795

The physical data base structure design problem is analyzed as a collection of sub-problems, each of which is separately modeled and solved by appropriate techniques. The CODASYL data model is assumed. The input to the physical design process is a logical data base structure (essentially a Bachman Diagram) and data volume and access statistics. Technqiues are proposed for the record placement problem, the SET design problem, and the area design problem. Each design technique proposed requires as input results from the application of several of the other techniques, leading to circular dependencies among the techniques. An iterative scheme for integrating the technqiues is proposed. The operation of this integration scheme and the individual techniques are illustrated by an example. Dissert. Abstr.

N80-23203 Michigan Univ., Ann Arbor.
TOWARDS A THEORY FOR BEHAVIOR STUDIES OF DATA STRUCTURES Ph.D. Thesis
Siroos Afshar-Khajevand 1979 204 p
Avail: Univ. Microfilms Order No. 8007700

In order to identify those general structures which correspond to data structures, five restrictive axioms are presented, discussed, and justified. Three axioms are to be satisfied by dynamic parts, one axiom is to be satisfied by both dynamic and static parts, and one axiom is to be satisfied by the dynamic and the static parts considered as pairs. Dynamic and static parts are studied both as abstract mathematical objects and as parts of real life data structures. Several notions are defined and their real life counterparts and/or interpretations are given. Applications of the theory are presented and discussed. Examples are given as to how to employ the theory in studies concerning the power of data structures, the behavioral optimization of data structures, and the specification of abstract data structures. Dissert. Abstr.

N80-23204 Northwestern Univ., Evanston, Ill.
A SIMULATION STUDY OF ATTRIBUTE BASED LOCKING MECHANISMS FOR RELATIONAL DATABASES Ph.D. Thesis
Charles Coryell Devor 1979 149 p
Avail: Univ. Microfilms Order No. 8008158

A locking mechanism for relational databases wherein lockable resources are defined as a static two level hierarchy of database attributes and instances is proposed. In addition to this definition of resources, the concept of subset mode access is defined as an efficient vehicle for protection from phantom tuples. In this environment three separate attribute concurrency levels are definable. Each level defines more potential concurrency in exchange for more system overhead for locking. The concurrency levels are defined in terms of access to a single database attribute. To investigate the possibility of realizing such improvements in a real environment, discrete event simulation modeling is used. Studies were conducted on the performance of the three attribute concurrency levels, for different user environments. Dissert. Abstr.

N80-23205 Illinois Univ. at Urbana-Champaign.
A METHODOLOGY FOR MACHINE REPRESENTATION OF MEDICAL KNOWLEDGE Ph.D. Thesis
Arthur Bayard Baskin, III 1979 144 p
Avail: Univ. Microfilms Order No. 8008969

A formalism for the construction of knowledge bases is presented, and some of the advantages of using a knowledge base interactively during its own construction are explored. The formalism is used to evolve a metric for knowledge which measures the quality of access to information. In addition, a system of computer programs for the interactive acquisition of medical knowledge (MEDIKAS) is described. The preliminary use of the MEDIKAS system was to represent and enforce a model of gneeral knowledge base before any medical knowledge is added. The resulting meta-knowledge provides the acquisition portions of MEDIKAS with a certain amount of self-awareness. The nature of the meta-knowledge and the results of preliminary medical knowledge input are described. Dissert. Abstr.

N80-23206 Ohio State Univ., Columbus.
A METHODOLOGY FOR THE DEFINITION OF DATA BASE WORKLOADS: AN EXTENSION TO THE IPSS METHODOLOGY Ph.D. Thesis
Patrick Man-Kwong Wong 1979 281 p
Avail: Univ. Microfilms Order No. 8008797

A methodology for characterizing the data base workload for performance accessment purpose was developed. Procedures were developed for characterizing the distribution of data base attributes within the information system's data base in an implementation independent manner, and the structure of the user generated queries which constitute the system's input workload. An algorithm transforms the general prepositional based user query into one or more normalized Boolean expressions. The second algorithm transforms the Boolean expressions into data base responses. Discrete event simulation constructs were developed based on methodological model and were incorporated into the Information Processing System Simulator's Modeling and Executional Facilities. The IPSS language extensions were implemented, tested, and verified. It was found that the methodology is applicable to both conventional information storage and retrieval systems and relational data base management systems. Dissert. Abstr.

N80-23207# Forecasting International Ltd., Arlington, Va.
INITIAL CONCEPTUALIZATION AND CHARACTERIZATION OF A NAVY AUTOMATED PUBLISHING SYSTEM. VOLUME 1: EXECUTIVE SUMMARY Final Report, 15 Feb. - 15 Nov. 1979
Norman Nisenoff and Audrey Clayton Jan. 1980 35 p refs (Contract N60921-79-C-0106)
(AD-A080375) Avail: NTIS HC A03/MF A01 CSCL 05/2

There are many inadequacies in current Navy printing and publishing capabilities, and potential for improvement is offered by rapidly advancing computer and communications technologies. This report details the findings of a research and development program conducted by Forecasting International Ltd. to provide the Navy Publications and Printing Service with an automated system concept to address these shortcomings. The Navy Automated Publishing System (NAPS) concept here described is intended to be introduced initially in the early 1980s, and evolve incrementally to meet, by the year 2000, the Navy's needs with regard to the publication of all non-tactical information. This 3 volume report presents a description of the methodology employed; a review of Navy needs in this time frame; a detailed discussion of the state-of-the-art in pertinent technologies and a forecast through the period of concern; and a broad conceptualization of both the year 2000 system and the incremental steps for its achievement. Recommendations for Navy actions to develop and test further the concept of such a system are also included. GRA

N80-23208# European Space Agency, Frascati (Italy).
THE INFORMATION RETRIEVAL SERVICE OF THE EUROPEAN SPACE AGENCY
Dec. 1979 12 p
Avail: NTIS HC A02/MF A01

The on-line retrieval system and specialized off-line services for the bibliographic data bases and factual data banks are described. Subscription information for European users is given. Author (ESA)

N80-23209# Instituut TNO voor Wiskunde, Informatieverwerking en Statistiek, The Hague (Netherlands).
EXPERIMENTS WITH MULTILINGUAL QUERIES IN A MULTILINGUAL DATA BASE
T. deHeer Jul. 1978 29 p refs
(IWIS-MEDEDEL-22) Avail: NTIS HC A03/MF A01

Information retrieval programs are described which allow for the ambiguities of natural language in searching. Information records consisting of pieces of various natural languages are attached to each other, leaving fuzzy semantic traces behind in the form of sets of three-letter-strings which were derived from the original texts. The system calculates an importance value for each possible answer to a user query. Queries are given in the form of a simple piece of language. Answers are communicated to the user, in descending order of importance value as calculated by the system. Author (ESA)

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-23210*# Scientific Systems, Inc., Cambridge, Mass.
WHEAT FORECAST ECONOMICS EFFECT STUDY Final Report
R. K. Mehra, R. Rouhani, S. Jones, and I. Schick Washington NASA May 1980 117 p refs
(Contract NAS5-25463)
(NASA-CR-3286) Avail: NTIS HC A06/MF A01 CSCL 05C

A model to assess the value of improved information regarding the inventories, productions, exports, and imports of crop on a worldwide basis is discussed. A previously proposed model is interpreted in a stochastic control setting and the underlying assumptions of the model are revealed. In solving the stochastic optimization problem, the Markov programming approach is much more powerful and exact as compared to the dynamic programming-simulation approach of the original model. The convergence of a dual variable Markov programming algorithm is shown to be fast and efficient. A computer program for the general model of multicountry-multiperiod is developed. As an example, the case of one country-two periods is treated and the results are presented in detail. A comparison with the original model results reveals certain interesting aspects of the algorithms and the dependence of the value of information on the incremental cost function. M.G.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-23211# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1980 7 p Rept. to accompany H.R. 6412 presented by the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., 22 Apr 1980
(H-Rept-96-898; GPO-60-493) Avail: Comm. on Sci. and Technol.

The supplemental federal budget appropriations to the Space Shuttle Program for the fiscal year 1980 are explained with regard to current and projected cost data, its impact on program schedules and employment, and the effect of the legislation on inflation. A brief description of project activities is included. M.G.

N80-23212# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA SUPPLEMENTAL AUTHORIZATION FOR FISCAL YEAR, 1980
Howard W. Cannon Washington GPO 1980 10 p Rept. to accompany S. 2238 presented by the Comm. on Com., Sci., and Transportation at the 96th Congr., 2nd Sess., 12 May 1980
(S-Rept-96-694; GPO-62-346) Avail: US Capitol, Senate Document Room

The supplemental budget appropriations to sustain the space shuttle development efforts for the FY 1980 are discussed. Cost estimates, cost estimate comparisons, and a summary of program progress are given. The impacts of underfunding and program delays are briefly examined. M.G.

N80-23213# Committee on Science and Technology (U. S. House).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1981
Washington GPO 1980 11 p A bill on H.R. 6413 presented to the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., 5 Feb. 1980
(H-Rept-96-899) Avail: US Capitol, House Document Room

The NASA authorization for five R and D programs are listed. Stipulations for grants to research institutions are given along with those for consultations, and construction of facilities. F.O.S.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-23214*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TRACTION STUDIES OF NORTHEAST CORRIDOR RAIL PASSENGER SERVICE: EXECUTIVE SUMMARY
T. W. Macie and J. A. Stallkamp 15 Mar. 1980 64 p refs
Sponsored in part by DOE
(Contract NAS7-100)
(NASA-CR-162997; JPL-Pub-80-3) Avail: NTIS HC A04/MF A01 CSCL 13F

The enabling legislation of 1976 for improvement of service in the Northeast corridor (NEC) requires a schedule of 2 h 40 min between Washington and New York City by 1981 and 3 h 40 min between NYC and Boston, when the electrification is completed. Various options of the NEC operation that may satisfy the legislation were investigated, particularly in terms of travel time and energy consumption. NEC operations were compared with overseas systems and practices. The emerging new technology of AC traction was also evaluated. A.R.H.

N80-23215*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ASSESSMENT OF THE POTENTIAL OF HYBRID VEHICLES: SUMMARY
F. T. Surber et al 15 Mar. 1980 70 p refs
(Contracts NAS7-100; EM-78-I-01-4290; JPL Proj. 5030-345)
(NASA-CR-163059; JPL-Pub-80-13) Avail: NTIS HC A04/MF A01 CSCL 13F

The potential of hybrid vehicles as a replacement of the conventional gasoline or diesel fueled internal combustion engine vehicle within the next 20 to 30 years, was assessed. Hybrid vehicle designs and applications which are technically and economically viable were studied to determine if reductions in petroleum usage were large enough to warrant major expenditures of research and development funds. Critical technical areas where research and development can be most usefully concentrated were indentified. E.D.K.

N80-23216*# Honeywell, Inc., St. Paul, Minn. Technology Strategy Center.
ASSESSMENT AND PRELIMINARY DESIGN OF AN ENERGY BUFFER FOR REGENERATIVE BRAKING IN ELECTRIC VEHICLES Final Report
R. Buchholz and Anoop K. Mathur Dec. 1979 138 p

(Contracts DEN3-48; EC-77-C-31-1044)
(NASA-CR-159756; DOE/NASA/0048-79/1; TSCI0082-FR)
Avail: NTIS HC A07/MF A01 CSCL 13F

Energy buffer systems, capable of storing the vehicle energy during braking and reusing this stored energy during acceleration, were examined. Some of these buffer systems when incorporated in an electric vehicle would result in an improvement in the performance and range under stop and go driving conditions. Buffer systems considered included flywheels, hydropneumatic, pneumatic, spring, and regenerative braking. Buffer ranking and rating criteria were established. Buffer systems were rated based on predicted range improvements, consumer acceptance, driveability, safety, reliability and durability, and initial and life cycle costs. A hydropneumatic buffer system was selected.
Author

N80-23217*# MGA Research Corp., Buffalo, N.Y.
AN ANALYTICAL STUDY OF ELECTRIC VEHICLE HANDLING DYNAMICS Final Report
J. E. Greene and D. J. Segal May 1979 223 p
(Contracts NAS7-100)
(NASA-CR-162870; JPL-9950-297) Avail: NTIS HC A10/MF A01 CSCL 13F

Hypothetical electric vehicle configurations were studied by applying available analytical methods. Elementary linearized models were used in addition to a highly sophisticated vehicle dynamics computer simulation technique. Physical properties of specific EV's were defined for various battery and powertrain packaging approaches applied to a range of weight distribution and inertial properties which characterize a generic class of EV's. Computer simulations of structured maneuvers were performed for predicting handling qualities in the normal driving range and during various extreme conditions related to accident avoidance. Results indicate that an EV with forward weight bias will possess handling qualities superior to a comparable EV that is rear-heavy or equally balanced. The importance of properly matching tires, suspension systems, and brake system front/rear torque proportioning to a given EV configuration during the design stage is demonstrated.
E.D.K.

N80-23218# Army Mobility Equipment Research and Development Command, Fort Belvoir, Va. Electrical Equipment Div.
EVA METRO SEDAN ELECTRIC PROPULSION SYSTEM TEST AND EVALUATION Technical Report, Jan. 1978 - Sep. 1979
Eberhart Reimers Sep. 1979 291 p refs
(Contract EC-77-A-31-1042)
(AD-A080655) Avail: NTIS HC A13/MF A01 CSCL 13/6

This report provides the procedure and results of the performance evaluation of an EVA Metro Sedan propulsion system. Data is provided for the automatic transmission, solid state dc motor controller and the dc motor as well as the entire propulsion system. Algorithms used on the automatic data acquisition system are included.
GRA

N80-23219# Netherlands Organization for Applied Scientific Research TNO, Delft. Planologisch Studiecentrum TNO.
TWO ESTIMATION METHODS FOR SINGLY CONSTRAINED SPATIAL DISTRIBUTION MODELS
Jan vanEst and Jan vanSettin Feb. 1978 23 p refs
(TNO-78/PS/41) Avail: NTIS HC A02/MF A01

Distribution models used the description of spatial phenomena like residential and shopping interactions are examined. A singly constrained distribution model is considered which can be used for the description of several relationships, such as home-shop interactions. Those interactions are influenced by several factors, e.g., attraction and distance variables. The influence of explanatory variables finds expression in the accessory parameters. The estimation of the values of these parameters, and the testing of their significance is called calibration. The two best known estimation procedures, i.e., the maximum likelihood and the least squares method are considered. For the singly constrained trip distribution model the linear least squares method is used directly after a special logarithmic transformation without taking into account additivity constraints and without an iterative procedure. The maximum likelihood method is also shown from a statistical point of view, to have useful properties.
Author (ESA)

N80-23220# Otis Elevator Co., Denver, Colo. Transportation Technology Div.
VEHICLE LONGITUDINAL CONTROL AND RELIABILITY PROJECT. A REVIEW OF AGT (AUTOMATED GUIDEWAY TRANSIT) CONTROL AND MEASUREMENT SYSTEM TECHNOLOGY, VOLUME 2, PART A Final Report
E. Petrino, ed. Jun. 1979 58 p refs
(Contract DOT-UT-70048)
(PB80-114036; OTIS/TTD/VLCR-066;
UMTA-IT-06-0148-79-4) Avail: NTIS HC A04/MF A01 CSCL 13B

Theoretical and implemented longitudinal control concepts as they apply to AGT vehicles are discussed. Shuttle-loop transit, large and small group rapid transit, and personal rapid transit vehicles are included. Vehicle follower point follower, and fixed block systems are reviewed along with the control of merging vehicles. The opinions available for measuring vehicle states are considered. Sensors for measuring vehicle velocity, position, and separator between vehicles are described.
GRA

N80-23221# Federal Highway Administration, Washington, D.C. Urban Planning Div.
URBAN TRANSPORTATION PLANNING SYSTEM (UTPS), THE COMMUNITY AGGREGATE PLANNING MODEL (CAPM) USER'S GUIDE. HIGHWAY SKETCH PLANNING Final Report
James M. Ryan 2 Apr. 1979 146 p refs
(PB80-131923; UMTA-UPM-20-79-2) Avail: NTIS HC A07/MF A01 CSCL 13B

The community aggregate planning model (CAPM) was recently incorporated as a module of the urban transportation planning system (UTPS) package of computer programs, and is a computerized transportation sketch planning model, which permits fast and inexpensive preliminary screening of highway improvement alternatives. It is useful in a number of sketch planning applications, such as the analysis of urban development patterns, alternative system investments, air quality, and energy consumption. The CAPM users guide and the CAPM program writeup are presented. Together, these documents provide information of the program's capabilities, limitations, data needs, potential applications, and computer requirements. Both are now available on the UTPS tape.
GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-23222 Florida Univ., Gainesville.
A DETAILED INVESTIGATION OF THE Mg2 k LINE IN BETA PERSEI Ph.D. Thesis
Ronald Anthony Parise 1979 142 p
Avail: Univ. Microfilms Order No. 8005485

Observations of beta Persei were obtained during the eclipses of December 31, 1976, January 3, 1977, and February 3, 1977, from the Copernicus spacecraft. The spectrophotometric scans which covered the bottom of the Mg2 k line at various phases in the primary eclipse are discussed. Model absorption lines are computed for Algol A and for a differentially rotating disk of material around Algol A. The Algol A profile is removed from the data and the residuals analyzed for evidence of a circumstellar disk. The observational problems inherent in the data are discussed, and suggestions are made for future research.
Dissert. Abstr.

N80-23223 Illinois Univ. at Urbana-Champaign.
THE EVOLUTION OF INTERMEDIATE MASS STARS AS A

FUNCTION OF MASS AND COMPOSITION Ph.D. Thesis
Stephen Allan Becker 1979 338 p
Avail: Univ. Microfilms Order No. 8008972

The evolution of intermediate mass stars was modeled from the main sequence phase, through the core helium burning phase, and into the thermal pulse phase or to near the point of nondegenerate carbon ignition. For a given initial mass the behavior of a model was found to be extremely sensitive to the initial composition. Each evolutionary phase was studied in order to understand how the initial composition affects a model's behavior. Dissert. Abstr.

N80-23224 Rutgers - The State Univ., New Brunswick, N. J.
A RELATIVISTIC TREATMENT OF OPTICALLY THICK STEADY STATE SPHERICAL ACCRETION ONTO BLACK HOLES Ph.D. Thesis
Arthur Wayne Gillman 1979 86 p
Avail: Univ. Microfilms Order No. 8008879

The process of steady state spherical accretion onto black holes was studied for the condition when the infalling gas is optically thick to the outgoing radiation. The transfer of radiation is treated in the diffusion approximation and the calculation is done relativistically. It is found that the accretion rate may take on arbitrarily high values while the luminosity is held below the Eddington limit. The gas in cases of high accretion rates, however, approaches zero velocity at the Schwarzschild radius so that the solution is unphysical. The luminosity is thereby limited to a low value depending on the efficiency. The conclusion is that no steady flow may exist near the Eddington limit for the case of spherical symmetry. Dissert. Abstr.

N80-23225 Arizona Univ., Tucson.
SMOOTH-ARM SPIRAL GALAXIES: THEIR PROPERTIES AND SIGNIFICANCE TO CLUSTER-GALAXY EVOLUTION Ph.D. Thesis
Mary Susan Wilkerson 1979 121 p
Avail: Univ. Microfilms Order No. 8008059

A number of galaxies with optical appearances between those of normal, actively star-forming spirals and S0 galaxies were examined. Tests made to find if these smooth arm spirals could have, at one time, been normal, actively star-forming spirals whose gas was somehow removed, and that are currently transforming into 80 galaxies are discussed and the results are evaluated. Dissert. Abstr.

N80-23226 Indiana Univ., Bloomington.
THE OLD DISK CLUSTER TRUMPLER 5 Ph.D. Thesis
J. Keith Kalinowski 1979 480 p
Avail: Univ. Microfilms Order No. 8008217

Photoelectric and photographic observations on the UBV system and photoelectric DDO system data were analyzed in a study of the star cluster Trumpler 5. This material provides information about the cluster's age, distance, luminosity function, chemical composition, morphological structure, and possible kinematics. Within a standard framework of interpretation it was found that the UBV and DDO system data are contradictory. It was hypothesized that UBV-implied and DDO-implied cluster properties can be reconciled if a low Y in Trumpler 5 produces anomalously red color indices for any given triad of stellar surface gravity, effective temperature and metallicity. Qualitative arguments based on the expected difference in the continuum opacities of the atmospheres of giant stars having different Y are made to this effect. Color corrections are proposed which permit the derivation of reasonable physical parameters for Trumpler 5's giants. Dissert. Abstr.

N80-23227*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
STUDIES IN OCCULTATION ASTRONOMY Final Report, 1 Feb. 1975 - 31 Mar. 1979
Joseph Veverka May 1980 46 p refs
(Grant NsG-7126)
(NASA-CR-163006) Avail: NTIS HC A03/MF A01 CSCL 03A

Major scientific results are summarized for the following studies: (1) observations of the 8 April 1976 occultation of epsilon Geminorum by Mars; (2) studies in occultation techniques; and (3) the March 1974 occultation of Saturn by the Moon. A re-analysis of the 1974 lunar occultation of the Titan indicates that Titan is strongly limb darkened, with D approximately greater than 5800km; there is internal evidence in the data that Titan's atmosphere is inhomogeneous; and that observations are inconsistent with any sample homogeneous model atmosphere which matches the P (lambda) and Beta (lambda) observations of Titan. A.R.H.

N80-23228*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY AND UV SPECTROSCOPY OF CYGNUS X-1 - HDE226868
S. H. Pravdo, N. E. White, Y. Kondo, R. H. Becker, E. A. Boldt, S. S. Holt, P. J. Serlemitsos, and B. G. McCluskey Feb. 1980 18 p refs Submitted for publication
(NASA-TM-80646) Avail: NTIS HC A02/MF A01 CSCL 03A

Observations are presented of Cygnus X-1 with the solid-state spectrometer on the Einstein Observatory. The X-ray spectra of two intensity dips viewed near superior conjunction did not exhibit increased photoelectric absorption. Rather the data support a model in which an increase in the electron scattering optical depth modifies both the observed spectrum and the intensity. The characteristic temperature of the intervening material is greater than 5 x 10 to the 7th power K. These measurements were in part simultaneous with observations by IUE. The ultra violet spectrum and intensity remained relatively constant during an X-ray intensity dip. Author

N80-23229*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY OBSERVATIONS OF ALGOL
N. E. White, S. S. Holt, R. H. Becker, E. A. Boldt, and P. J. Serlemitsos Mar. 1980 14 p refs Submitted for publication
(NASA-TM-80670) Avail: NTIS HC A02/MF A01 CSCL 03A

Observations of Algol using a solid state spectrometer onboard the Einstein Observatory are discussed. Two observations six months apart were made, both during a primary optical eclipse. No corresponding X-ray eclipses were seen. During the second observation the source was flaring and was on average a factor three brighter. The spectrum on both occasions was consistent with a two-component thermal equilibrium model with temperatures of approximately 7.5 and 40 million degrees. Attempts to insert a third component indicate the temperature distribution to be bimodal. Models for the X-ray emission are discussed and it is suggested that the emission most likely originates from an active corona surrounding the K star. M.G.

N80-23230# European Space Agency, Paris (France).
EXTREME ULTRAVIOLET/X-RAY SKY SURVEY MISSION: REPORT ON THE PHASE A STUDY
Dec. 1979 91 p refs
(ESA-SCI(79)9) Avail: NTIS HC A05/MF A01

The program objectives, and implementation of the mission are analyzed. The satellite and its subsystems and the telescopes are described. The survey operations include the capability to search for EUV point and nebular sources in the pass band 100 to 1000 Angstroms, and to map with high resolution the diffuse emission known to exist in the band 10 to 250 Angstroms. Author (ESA)

N80-23231# European Space Agency, Paris (France).
HIPPARCOS SPACE ASTROMETRY: REPORT ON THE PHASE A STUDY
Dec. 1979 95 p refs
(ESA-SCI(79)10) Avail: NTIS HC A05/MF A01

The HIPPARCOS mission is compared with other astrometric techniques. The payload, the spacecraft and the mission are described. Scientific data processing and the management and time schedule is presented. The mission aims at the accurate measurement of the trigonometric parallaxes, proper motions, and positions of about 100,000 selected stars. The expected average mean error is about 0.002 arc second for all angular measurements. The total scheduled time from project approval to launching is approximately 6 years. Author (ESA)

N80-23232# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
NASA SHOULD PROVIDE THE CONGRESS COMPLETE COST INFORMATION ON THE SPACE TELESCOPE PROGRAM
3 Jan. 1980 38 p
(PB80-123433; PSAD-80-15) Avail: NTIS HC A03/MF A01 CSCL 03B

NASA's space telescope project is described and an analysis of the program reserves, contract costs, development costs, and life cycle costs is presented. The program's progress and outlook are discussed. A.W.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-23233 Ohio State Univ., Columbus.
CALCULATIONS OF RESONANCE FLUORESCENCE EXCITATION OF IRON 2 IN SEYFERT 1 GALAXIES Ph.D. Thesis
Craig Billig Foltz 1979 162 p
Avail: Univ. Microfilms Order No. 8009275

The source of excitation of permitted visible radiation from singly ionized iron in Seyfert 1 galaxies and related active galactic nuclei is discussed. Based upon the conditions expected in such objects, it is deduced that resonance fluorescence by continuum radiation in the wavelength region lambda lambda 2100 to 2750 A is the most probable excitation mechanism. The photoionization equilibrium equations for the conditions expected in such a cool filament were solved to determine the ionization structure of iron. The molecular equilibrium equations for the major hydrogen containing species were solved concurrently with the photoionization equilibrium with the result that virtually all of the hydrogen becomes molecular on a time scale short with respect to the crossing time of the broad line emitting region. Statistical equilibrium equations were developed for 74 energy levels of the Fe 2 ion, and radiative pumping rates were calculated for each of 406 transitions. Dissert. Abstr.

N80-23234 Columbia Univ., New York.
THERMAL CONDUCTION AND COOLING OF YOUNG NEUTRON STARS. EVOLUTION OF PULSAR MAGNETIC FIELDS Ph.D. Thesis
Alak Ray 1979 170 p
Avail: Univ. Mcrofilms Order No. 8009535

Thermal conductivity of matter in different regions of a neutron star is calculated. In the crust the electron conductivity is limited by electron-phonon collisions and is calculated in the Wiedermann-Franz approximation by using the standard solution of the coupled electron-phonon Boltzmann equation in the relaxation time approximation. In the core with normal nucleons, the electron and neutron conductivities are calculated in the theory of Fermi liquids. Stability and evolution of dipole and strong toroidal internal magnetic fields are considered. The problem of stability of the dipole magnetic field of a newly born pulsar is presented terms of a two dimensional model solution of the nonlinear equations of magnetohydrodynamics. A variational principle to test the linear stability of the solution is formulated. Dissert. Abstr.

N80-23235 Columbia Univ., New York.
THE FLUID DYNAMICS OF RADIATIVELY DRIVEN ELEMENT SEPARATION IN STARS Ph.D. Thesis
John Lin 1979 183 p
Avail: Univ. Microfilms Order No. 8009354

The dynamics of the element separation process in stars is treated on a fundamental level. The dynamical system under consideration consists of 3 components: 2 level active atoms, background atoms, and the radiation field. The active gas interacts with the radiation through resonance scattering. Both the active gas and the background gas are treated as dilute gases. Kinetic equations for the active gas and for photons are obtained from one single quantum Liouville equation, using the correlation approach and a perturbative treatment. Macroscopic equations governing the coupled system of radiation and fluid are set up by employing the moment method. These equations form the basis of photohydrodynamics in studying the element separation process. The linear stability problem is studied in a Boussinesq treatment and the stabilizing effect of rotation or magnetic fields is considered. Dissert. Abstr.

N80-23236 State Univ. of New York at Stony Brook.
INTERSTELLAR DIATOMIC CARBON AND THE CYGNUS OB2 ASSOCIATION Ph.D. Thesis
Steven Peter Souza 1979 163 p
Avail: Univ. Microfilms Order No. 8009602

Diatomic carbon in interstellar clouds were investigated through reddened stars. The interstellar medium toward and stellar properties of the Cygnus OB2 association were studied through high and medium dispersion spectroscopy. The H-R diagram for Cygnus OB2 represented by mass losing evolutionary models is discussed. Dissert. Abstr.

N80-23237# Los Alamos Scientific Lab., N. Mex.
NEUTRON CROSS SECTIONS OF IMPORTANCE TO ASTROPHYSICS
John C. Browne 1979 8 p refs Presented at the Intern. Conf. on Nucl. Cross Sect. for Technol., Knoxville, Tenn., 22-26 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2900; CONF-791058-10) Avail: NTIS HC A02/MF A01

Neutron reactions of importance to the various stellar burning cycles are discussed. The role of isomeric states in the branched s-process is considered. Neutron cross section needs for the Re-187 Os-187, Rb-87 Sr-87 clocks for nuclear cosmochronology are discussed. DOE

N80-23238# European Space Agency, Paris (France).
THE FLUX GATE MAGNETIC FIELD EXPERIMENT E2 IN HELIOS A AND B: TECHNICAL DESCRIPTION
Guenter Musmann Jul. 1979 67 p refs Transl. into ENGLISH of "Das Foerstersonden-Magnetfeldexperiment E2 in Helios A und B: Technische Beschreibung". Rept. BMFT-FB-W-77-09 DFVLR, Cologne and Technische Univ., Brunswick, Dec. 1977 Original report in GERMAN previously announced as X79-72253
(ESA-TT-540; BMFT-FB-W-77-09) Avail: NTIS HC A04/MF A01; DI, Munich DM 16.40

The basic features of the three axis vector magnetometer used on HELIOS space probes for the E2 experiment are described with emphasis on the sensor and electronic system. The experiment includes not only continuously observing the interplanetary magnetic field, but also measuring its spiral structure and discontinuous appearance. The analog-digital conversion of the measured voltages, the flipper, the time average computer, the shock identification computer, and data processing techniques are discussed. A.R.H.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-23239*# Planetary Science Inst., Tucson, Ariz.
PHOBOS AND DEIMOS: ANALYSIS OF SURFACE FEATURES, EJECTA DYNAMICS AND A VOLATILE LOSS MECHANISM Final Report
Donald R. Davis, Clark R. Chapman, Richard Greenberg, and Stuart J. Weidenschilling Mar. 1980 26 p refs
(Contract NASw-3272)
(NASA-CR-163005) Avail: NTIS HC A03/MF A01 CSCL 03B

The question of whether the crater population on Phobos represents a production population or an equilibrium population

is considered. The absolute ages of cratered surfaces are interpreted and analyzed. A computer program was developed to study the dynamics of material ejected from Martian satellites and to investigate the hypothesis that at least some of the extensive set of linear features discovered on the surface of Phobos could be the result of secondary cratering from the Stickney impact. The possibility that Deimos was catastrophically disrupted by a large impact but subsequently reaccreted is considered as well as the probability the Phobos had an impact nearly large enough to disrupt it are also discussed. A.R.H.

N80-23240*# National Aeronautics and Space Administration, Washington, D. C.
VENERA-11 AND VENERA 12: PRELIMINARY ESTIMATES FOR THE WIND SPEED AND TURBULENCE IN THE ATMOSPHERE OF VENUS
V. V. Kerzhanovich, M. Ya. Makarov, F. Marov, M. K. Roshdestvensky, and V. P. Sorokin. Aug. 1979. 20 p. refs. Transl. into ENGLISH of "Venera-11 i Venera-12: Predvaritelnyye Otsenki Skorosti Vetra i Turbulentosti v Atmosfere Venery" Rept. Acad. of Sci. USSR, Moscow, 1979, p 1-21. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-75726) Avail: NTIS HC A02/MF A01 CSCL 03B

The methods and results of measurements for wind speed and atmospheric turbulence in the clouds of Venus are described, and compared with earlier results. The distribution of wind speed obtained from the data of Venera 12 is in good conformity with the data of the preceding Venera and Pioneer probes, indicating the existence of a constant and powerful zonal movement of the troposphere. M.G.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-23241*# California Inst. of Tech., Pasadena.
ELEMENTAL COMPOSITION OF SOLAR ENERGETIC PARTICLES IN 1977 AND 1978
W. R. Cook, E. C. Stone, R. E. Vogt, J. H. Trainor (NASA Goddard Space Flight Center), and W. R. Webber (Univ. of New Hampshire). 1979. 7 p. refs. Presented at 16th Intern. Cosmic Ray Conf., Kyoto, Japan, 6-18 Aug. 1979.
(Contract NAS7-100; Grant NGR-05-002-169)
(NASA-CR-162927; SRL-79-8; Paper-SP-2-2) Avail: NTIS HC A02/MF A01 CSCL 03B

The elemental composition of energetic nuclei from seven major solar flare events were measured wit the cosmic ray detector systems aboard the Voyager 1 and 2 spacecraft. The energetic nuclei abundances differ significantly from those of photospheric material. They are enhanced relative to the photonsphere by a factor which is the ratio of abundance of an energetic nuclei species (relative to oxygen) over the corresponding abundance of photospheric material. This factor is common to all events and has a nonmonochromatic characteristic dependence on nuclear charge. This factor is roughly ordered by first ionization potential into two groups of elements, metallics and volatiles. A.R.H.

N80-23242# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.
SOLAR INSOLATION RECORDING SYSTEM (SIRS) REFERENCE MANUAL. Interim Report, Jan. 1977 - Dec. 1978
Edward E. Stapleton and Michael R. Mantz. Dec. 1979. 57 p. refs.
(AF Proj. 2054)
(AD-A080404; AFESC/ESL-TR-79-34) Avail: NTIS HC A04/MF A01 CSCL 03/2

This manual provides the installation procedures, theory of operation, and maintenance procedures necessary to install, operate, calibrate, maintain and understand the Solar Insolation Recording System (SIRS) which is a microcomputer-based data acquisition system used to collect solar insolation data. Traditionally, solar data has been collected in an analog format (strip chart). Large quantities of data were particularly difficult to manipulate. Therefore, to simplify the processing of data, a data acquisition system was designed and built which produced a computer compatible data medium. In the case of SIRS, the data media is digital cassette tapes. These tapes can be read into a larger computer where complex data manipulation/processing can be accomplished. This document strictly addresses the data acquisition system. Data reduction and manipulation will be covered in the final technical report on Solar Radiation Measuring. GRA

N80-23243# Tri-Con Associates, Inc., Cambridge, Mass.
ELECTRONICS SUBSYSTEM FOR A SOLAR EUV SPECTROMETER. Final Report, 4 Nov. 1976 - 30 Sep. 1979
Robert S. Hills. Hanscom AFB, Mass. AFGL. Oct. 1979. 14 p.
(Contract F19628-77-C-0048; AF Proj. 6688)
(AD-A080560; C-160; AFGL-TR-79-0258) Avail: NTIS HC A02/MF A01 CSCL 03/2

This report describes the design, fabrication, and launch of an electronics sub-system for a grazing incidence solar spectrometer for sounding rockets. GRA

N80-23244# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 421. PART 1: PROMPT REPORTS. DATA FOR JULY AND AUGUST 1979
Helen E. Coffey. Sep. 1979. 169 p.
(PB80-128747; SGD-421-Pt-1; NOAA-79101902) Avail: NTIS HC A08/MF A01 CSCL 03B

This prompt report provides data for August 1979 on alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, coronal holes, inferred interplanetary magnetic field polarities, mean solar magnetic field, and Boulder Geomagnetic Substorm Log. It also provides data for July 1979 on daily solar activity center, sudden ionospheric disturbances, solar x-ray radiation, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N80-23245# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 421. PART 2: COMPREHENSIVE REPORTS. DATA FOR MARCH 1979
Helen E. Coffey. Sep. 1979. 57 p.
(PB80-128754; SGD-421-Pt-2; NOAA-79101903) Avail: NTIS HC A04/MF A01 CSCL 03B

This comprehensive report provides data for March 1979 on: active regions, synoptic solar maps, solar radio emission, energetic solar particles and plasma, and solar x-ray radiation. The miscellaneous data includes geomagnetic indices for June 1979, energetic solar particles for January 1979, and solar-terrestrial activity for 1978. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-23246*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
COSMIC RAY STUDIES WITH A GAS CHERENKOV COUNTER IN ASSOCIATION WITH AN IONIZATION SPECTROMETER
V. K. Balasubrahmanyan, J. F. Ormes, J. F. Arens, F. Siohan, G. B. Yodh, M. Simon, and H. Spiegelhauer. Jan. 1980. 24 p. refs. Submitted for publication.
(NASA-TM-80639) Avail: NTIS HC A02/MF A01 CSCL 03B

The results from a balloon-borne gas Cherenkov counter (threshold 16.5 GeV/nucleon) and an ionization spectrometer are presented. The gas Cherenkov counter provides an absolute energy distribution for the response of the calorimeter for 5- or - Z 26 nuclei of cosmic rays. The contribution of scintillation to the gas Cherenkov pulse height was obtained by independently

selecting particles below the gas Cherenkov threshold using the ionization spectrometer. Energy spectra were derived by minimizing the chi squared between Monte Carlo simulted data and flight data. Best fit power laws, dN/dE = AE-gamma, were determined for C, N, O, Ne, Mg, and Si. The power laws, all consistent with E (-2.7) are not good fits to the data. A better fit is obtained using the spectrum derived from the spectrometer. The data from the ionization calorimeter and the gas Cherenkov are thus completely self-consistent. M.G.

N80-23247*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE COSMIC X-RAY BACKGROUND
Elihu A. Boldt. Mar. 1980. 42 p. refs. Presented at the 155th Meeting, Am. Astron. Soc., San Francisco, 15 Jan. 1980
(NASA-TM-80659) Avail: NTIS HC A03/MF A01 CSCL 03B

The cosmic X-ray experiment carried out with the A2 Instrument on HEAO-1 made systematics-free measurements of the extra-galactic X-ray sky and yielded the broadband spectral characteristics for two extreme aspects of this radiation. For the apparently isotropic radiation of cosmological origin that dominates the extragalactic X-ray flux (> 3 keV), the spectrum over the energy band of maximum intensity is remarkably well described by a thermal model with a temperature of a half-billion degrees. At the other extreme, broadband observations of individual extragalactic X-ray sources with HEAO-1 are restricted to objects within the present epoch. While the non-thermal hard spectral components associated with unevolved X-ray emitting active galaxies could account for most of the gamma-ray background, the contribution of such sources to the X-ray background must be relatively small. In contrast, the 'deep-space' sources detected in soft X-rays with the HEAO-2 telescope probably represent a major portion of the extragalactic soft X-ray (< 3 keV) backgoround. A.R.H.

N80-23248*# California Inst. of Tech., Pasadena.
SATELLITE MEASUREMENTS OF THE ISOTOPIC COMPOSITION OF GALACTIC COSMIC RAYS
R. A. Mewaldt, J. D. Spalding, E. C. Stone, and R. E. Vogt. 1979. 7 p. refs. Presented at the 16th Intern. Cosmic Ray Conf., Kyoto, Japan, 6-18 Aug. 1979
(Grant NGR-05-002-160)
(NASA-CR-162923; Paper-OG-7-2; SRL-79-9) Avail: NTIS HC A02/MF A01 CSCL 03B

The individual isotopes of galactic cosmic ray Ne, Mg, and Si at 100 MeV/nucleon were clearly resolved with an rms mass resolution of 0.20 amu. The results suggest the cosmic ray source is enriched in Ne-22, Mg-25, and Mg-26 when compared to the solar system. The ratio of (Mg-25) + (Mg-26) to Mg-24, which is approximately 0.49 compared to the solar system value of 0.27, suggest that the cosmic ray source and solar system material were synthesized under different conditions. E.D.K.

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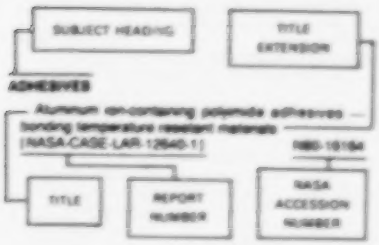

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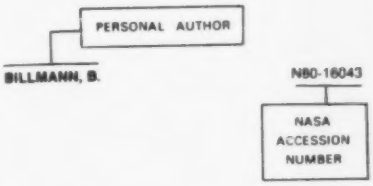

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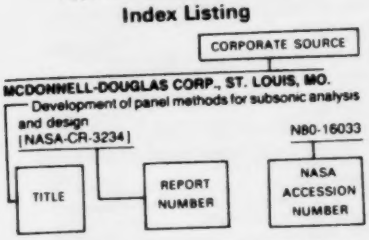

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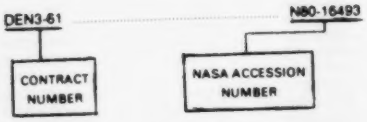

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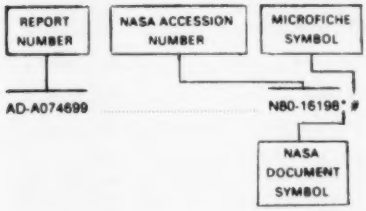

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LA-8101-M ..... N80-22650 #
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NASA-CASE-LAR-12468-1 ..... N80-22359* #
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NTIS/PS-76/0992 ..... N80-22480 #
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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1793

02 AERODYNAMICS 1793

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1797

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1798

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1799

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1800

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1801

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1803

Includes aircraft handling qualities; piloting; flight controls, and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1804

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1806

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 1806

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1807

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1808

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1809

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 1809

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1810

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 1810

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1811

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1813

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1818

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 1822

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 1825

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1827

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 1832

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 1837

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 1841

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 1845

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 1847

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 1850

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 1852

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 1853

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) 1858

43 EARTH RESOURCES 1858

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 1865

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 1878

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 1883

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 1886

Includes weather forecasting and modification.

48 OCEANOGRAPHY 1890

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 1891

Includes genetics.

52 AEROSPACE MEDICINE 1891

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 1893

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 1894

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 1894

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 1896

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS N.A.

Includes computer networks.

63 CYBERNETICS 1900

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 1901

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 1908

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 1910

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 1911

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

70 PHYSICS (GENERAL) 1911

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 1911
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 1913
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 1914
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 1915
Includes light phenomena.

75 PLASMA PHYSICS 1916
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 1919
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1921
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1921
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1922
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1923
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1923
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1924
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1925
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1925
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1926
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1927
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 1927

Note: N.A. means that no abstracts were assigned to this category for this issue.

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NASA ACCESSION NUMBER → N80-10198*# Teledyne Ryan Aeronautical Co., San Diego, Calif. ← CORPORATE SOURCE

TITLE → STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

AUTHOR → D. J. Mourey 3 Sep 1979 409 p refs

PUBLICATION DATE

CONTRACT OR GRANT → (Contract NAS1-15624)

AVAILABILITY SOURCE

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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, CRASHWORTHY PASSENGER (MILITARY) SEAT
B. Mazelsky, A R A Co., *2017 W. Garvey Ave., West Covina, California* 91791 (DN081084; N62269-78-C-0251)

To develop a military passenger seat offering the safety, comfort, and protective features which 'state-of-the-art' crashworthy seat technology has to offer. This contract supports work unit ZA601, Agency Accession No. DN 681080.

Development will involve three tasks: Task I will comprise the design phase; Task II will include the fabrication of prototypes and the static and dynamic test and evaluation phase; Task III will evaluate advanced prototypes under dynamic crash simulation tests.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0002, CALIFORNIA POLYTECHNIC GRADUATE STUDENT PROGRAM
D.R. Sandlin, California State University & Colleges, California Polytechnic State University, School of Engineering & Technology, Dept. of Aeronautical Engineering, *San Luis Obispo, California* 93407 (NCC 4-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

1.0003, COMPUTER CIRCLED OPTIMIZATION IN SELECTION OF OPTIMAL DESIGN PARAMETERS OF HELICOPTER ROTORS
A.G. Liniecki, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Mechanical Engineering, *Washington Sq., San Jose, California* 95192 (NCA 2-675001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0004, FLOW ANALYSIS OVER AN ADVANCING ROTOR BLADE
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0005, THE RESEARCH AND TRAINING ACTIVITIES FOR THE JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0006, JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS - STUDY OF TRAILING EDGE FLOWS AT HIGH REYNOLDS NUMBER
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-59)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0007, BASIC STUDIES OF MULTIPLE JETS AND WALL JETS
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DF056190; F49620-79-C-0189)

AF function - advanced aerospace vehicles. Deficiency -insufficient understanding exists of the physical features of complex flow fields associated with free and unconfined multiple jets and wall jets. Objective - to advance the state of knowledge regarding multiple interacting jets and wall jets. Detailed flow field surveys will be performed, and a determination will be made of the dependence of these flows on key flow and geometric parameters. How work contributes - the successful design and development of future powered lift aircraft will require increased knowledge regarding the interactive flow fields of multiple jets and of wall jets, which are usually present in such vehicles. Basic knowledge of relevant jet flow fields will be acquired, which is necessary for devising suitable prediction techniques.

For a range of geometric configurations and initial flow field conditions, detailed experimental investigations will be conducted into the mean, periodic, and random structure of the flow fields of multiple jets and wall jets. Consideration will be given to spacial and temporal variations of flow quantities, spectral and correlation characteristics, and mean and fluctuating pressures on the solid surfaces present.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0008, DIGITAL CONTROL SYSTEM SYNTHESIS USING MULTIPLE ORDER SAMPLING
R.F. Whitbeck, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF143430; F33615-79-C-3601)

This work unit supports TP03, Flight Control Technology, and specific goal FG02B, Flight Control System Design Technique. Many current digital design procedures attempt only to approach the characteristics of existing analog designs. The present practice is to first develop a good analog design and then emulate it digitally using single-rate sampling. No explicit methodology exists which can exploit the unique characteristics of multi-rate or multiple order digital computation/filtering. The

overall objective of the research effort is to develop a multi-rate/multiple order theory for the design of closed-loop digital control systems with characteristics and attributes that are either difficult or impossible to attain with analog or single-rate controllers. The key idea in this new multi-rate/multiple order design methodology is to use the logic of the computer to take a scalar continuous output signal, sample it at a relatively high rate, and then sort out the various samples into a vector of pseudo-measurements. The potential of such a scheme is significant, since it offers, among other things, the possibility of using fewer sensors, the potential for providing gracefully degrading system performance in the face of sensor failure, and the possibility of being able to do away with aliasing filters. This research effort will provide an explicit design methodology for future military aircraft flight controls that will insure optimum use of digital techniques, considering both cost and performance, and thus lead to the best practical flight control system.

An important facet of this effort is to develop simple and effective descriptions for multi-rate and multiple order sampling in the vector switch decomposition format. The vector switch decomposition model provides a straightforward way to generate a vector of pseudo-measurements from a scalar signal. The continuous frequency response theory for digitally controlled systems will be applied to the multi-rate/multiple order sampling architectures in order to investigate their spectral characteristics and to catalog their useful filtering properties. Extension of the frequency domain analysis techniques will be accomplished to accomodate multi-rate/multiple order sampling. This will bring the characteristics of new design methodology into better focus and integrate it with existing control system design knowledge.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, RESEARCH PROGRAM IN FLIGHT DYNAMICS IN THE JOINT INSTITUTE FOR ADVANCEMENT OF FLIGHT SCIENCES AT THE NASA LANGLEY RESEARCH CENTER

H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NCC 1-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0010, THE INVESTIGATION OF THE FLOW ABOUT GENERAL FUSELAGE SHAPES AT HIGH ANGLES OF ATTACK

M.H. Clarkson, State University System of Florida, University of Florida, School of Engineering, Dept. of Engineering Sciences, *220 Black Hall, Gainesville, Florida* 32611 (NCC 2-23)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0011, RESEARCH IN ENGINE NOZZLE DESIGN FOR A HYPERSONIC FLIGHT VEHICLE

G.W. Zumwalt, Wichita State University, School of Engineering, Dept. of Aeronautical Engineering, *1845 Fairmont N., Wichita, Kansas* 67208 (NCC 1-31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, IDENTIFICATION AND ADAPTIVE CONTROL OF HELICOPTER SYSTEMS

P.E. Caines, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Mathematics, *Cambridge Station, Cambridge, Massachusetts* 02138 (NCC 2-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0013, TURBULENT BOUNDARY LAYER STRUCTURE AND DRAG REDUCTION

M.T. Landahl, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF053960; AFOSR-79-0006)

AF function - advanced aerospace vehicles. Opportunity - gain further understanding of unsteady boundary layers. Objective -investigate the unsteady boundary layer phenomena induced on a fixed, stationary, two-dimensional airfoil. How work contributes - better knowledge of the unsteady mechanisms of a turbulent boundary layer will contribute understanding of flutter, buffeting and stall flutter, all common problems for airfoils used for helicopter blades, rotating machinery blades and fixed wing aircraft lifting surfaces. The data obtained from this effort will be directly applicable to the design of future aerospace vehicles.

The unsteady local flow around a well documented airfoil (NACA 0012) will be obtained in a steady flow field using a rotating elliptical cylinder near the airfoil trailing edge. Unsteady pressure measurements, unsteady local skin friction, tangential velocity components and other boundary layer parameter measurements will be taken and analyzed with respect to the phase angles of the unsteady velocities relative to that of the excitation. The airfoil will be held stationary at all times.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0014, THE EFFECT OF TURBULENT BOUNDARY LAYER ON TRANSONIC FLOWS

S.C. Lee, University of Missouri, Rolla Campus, School of Engineering, Dept. of Aerospace Engineering, *Rolla, Missouri* 65401 (NCA 2-450001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0015, AIRBORNE SIMULATION AND RESEARCH INVESTIGATIONS

P.A. Reynolds, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF142120; F33615-78-C-3602)

Engineering simulation is a cost-effective design tool for supporting advanced weapon systems development. In-flight simulation using variable stability airplanes provides the advantages of actual flight, visual, and motion cues in evaluating design trade-offs. The NT-33 and NC-131H variable stability airplanes will be used to conduct research programs to investigate flight control system problems and the integration of other subsystems with flight control. The systematic integration of the control function with other weapon systems functions such as fire control and control displays will result in new airplanes which can provide greater flexibility and mission effectiveness.

The NT33A and the TIFS NC-131H variable stability aircraft will be used to look at riding and flying qualities, simulated control systems, actual displays, cockpit controllers, actual control system hardware and the interaction between these factors and other airplane subsystems. Flight training will also be included for pre-first flights of new aircraft as well as test pilot schools indoctrinations. Details of each investigation or training program will be outlined at a planning meeting between the contractor, AF Flight Dynamics Laboratory and the requiring agency personnel prior to each investigation. These details will be documented by a test plan prior to flight testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, DIGITAL FLIGHT CONTROL CRITERIA DEVELOPMENT

W. Muller, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN081107; N62269-79-C-0430)

To update, combine, coordinate, and develop criteria applicable to advanced flight control systems and new flight modes for new aircraft development. This contract supports work unit ZA601, Agency Accession No. DN681080.

Survey advanced aircraft requirements; evaluate integration aspects; evaluate new flight modes criteria; and identify unique criteria for V/STOL aircraft.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0017, AN INTRODUCTORY STUDY OF THE H-FORCE ROTOR
H.R. Velkoff, Ohio State University, Columbus Campus, School of Engineering, Dept. of Mechanical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NCA 2-565001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0018, SYMBOLOGY VERIFICATION
J.M. Reising, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141720)

The inability of pilots to distinguish certain display symbols in selected symbology sets has become a matter of growing concern to USAF control display designers. As a part of the Digital Avionics Information System (DAIS) Experiment, this problem will be addressed by determining through objective analysis the error rates, search times and flying performance of subject pilots in a cockpit similar to the Digital Flight Control System (DFCS) cockpit. Display symbols which confuse pilot subjects will be modified using an algorithm to determine pilots' useability/acceptability of various display options.

A literature search will be conducted on the displays chosen for investigation. Possible alternatives will be programmed and objective performance and subjective attitude of pilot subjects will be evaluated. This evaluation will allow FGR to select the best display and symbol set. The results of this experiment will be documented in a technical report. Recommendation for an improved symbol set will be submitted to MIL-STD-884C.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, BASIC STUDIES OF A RECTANGULAR JET IMPINGEMENT ON THE SURFACE
A. Krothapalli, University of Oklahoma, Norman Campus, Graduate School, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (NCA 2-580001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0020, INVESTIGATION OF BUOYANT AIR VEHICLES FOR STRATEGIC AND TACTICAL PLATFORM MISSIONS
T.E. Bebout, Delex Systems Inc., *8150 Leesburg Pike, Suite 700, Vienna, Virginia* 22180 (DN081130; N62269-79-C-0269)

To investigate the potential application of buoyant and semi-buoyant air vehicles for future strategic high value targets and tactical platform mission requirements. The contract supports work unit DH828, Agency Accession No. DN081061.

A systems approach will be undertaken to achieve the above objective. Principal areas of the study will be the performance of mission analysis, including trade-offs and operational effectiveness, the generation of vehicle parametrics, vulnerability, environmental effects, and various scenarios of operations will be analyzed.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0021, HEAD-UP DISPLAY FOR C-130 LAPES OPERATIONS
F.K. Brem, Sundstrand Data Control Inc., *Overlake Industrial Park, Redmond, Washington* 98052 (DF142990; F33615-78-C-3618)

This work assists the Military Airlift Command in attaining a safe and effective cargo delivery capability. In recent years the experience level of C-130 pilots has decreased causing safety problems in low altitude parachute extraction system (LAPES) operations. The objective is to evaluate a Head-Up display as a solution to the problem of safely carrying out LAPES operations in the C-130 aircraft. It is believed that a Head-Up display will aid inexperienced pilots in precisely controlling the C-130 in the vertical approach pattern of the LAPES operation. If a Head-Up display can aid the C-130 pilot in precisely controlling his aircraft, the Air Force can save resources in the training of LAPES pilots (now in critical supply), and in reducing the number of accidents attributed to inexperienced pilots.

The LAPES HUD developed by SUNDSTRAND Data Control will be installed in an operational C-130 LAPES-configured aircraft. It will be evaluated during operational training missions to determine its potential usefulness as a pilot's aid.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, REDUCTION OF AERODYNAMIC DRAG
J.E. Field, University of Cambridge, *Hills Rd., Cambridge, England, United Kingdom* (DF054520; AFOSR-79-0057)

AF function - advanced aerospace vehicles. Opportunity - to provide understanding of the effect of small amounts of radiation on the molecular structure of air and other gases. Objective - to study the mechanisms of viscosity by reduction at the molecular level of air and various other gases when bombarded with low level radioactive emissions. How work contributes - this effort will research the control of viscosity by radiation. If successful, it could provide an effective method for control of aerodynamic drag and a possible method for retarding the transition to turbulence. The author postulates that this method is similar to the effect of long-chain polymers in liquids.

A flow channel will be used to determine the effect of alpha and beta bombardment of a surface on its skin friction drag. First a friction gauge will be constructed on the channel wall, later the drag on suspended shapes will be attempted. Gaseous systems of air, nitrogen and oxygen with varying amounts of humidity will be used. In addition to the friction balance, hot wire and magnetic probe measurements will be taken.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, NASA-AMES/STANFORD JOINT INSTITUTE FOR AERONAUTICS & ACOUSTICS - SHUTTLE INFRARED TELESCOPE POINTING CONTROL SYSTEM
J.D. Powell, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

2.0002, TECHNOLOGY RESEARCH FOR STRAP-DOWN INERTIAL EXPERIMENTS
R.B. Jenkins, University of Southern Colorado, School of Applied Science & Engineering Technology, Dept. of Electrical Engineering Technology, *2200 Bonforte Blvd., Pueblo, Colorado* 81001 (NCC 2-41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

2.0003, APPLICATION OF PHOTO-ORTHOTROPIC ELASTICITY TO PLANE PROBLEMS IN COMPOSITES
R. Prabhakaran, Old Dominion University, Graduate School, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NCC 1-26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, PLASMA SYNTHESIS OF MODEL METEORITIC ORGANIC MATTER
K.G. Donohoe, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0002, CHARACTERIZATION AND DEGRADATION STUDIES ON AROMATIC POLYAMIDES, POLYESTERS AND COMPOSITE RESINS
A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-28)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0003, HEAT RELEASE STUDIES FOR AIRCRAFT MATERIALS
A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-56)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0004, NEW ELASTOMERS FOR IMPROVED AIRCRAFT TIRES
A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0005, MINERAL SEPARATION SYSTEMS
L.A. Spitze, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-53)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0006, SEMICLASSICAL APPROACHES TO DYNAMICS OF MOLECULES
E.J. Heller, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Chemistry, *405 Hilgard Ave., Los Angeles, California* 90024 (CHE77-13305 A01)

This project will carry out a systematic investigation of new semiclassical techniques for certain molecular processes and properties. The previous form of Miller-Marcus semiclassical theory will be generalized to include wave pocket amplitudes, with the benefit that many of the well-known and otherwise unavoidable numerical difficulties and inaccuracies of that approach are eliminated or mitigated. The benefits of this extended approach include elimination of root or stationary trajectory searches, increased accuracy for 'primitive' semiclassical results, convenient numerical uniformization at various levels up to the ab initio, and a practical way of obtaining bound states (for multidimensional non-separable systems), suitable for use in spectroscopy or in other semiclassical calculations. The investigators will develop a coherent, unified attack on the problem of semiclassical methods of interest to chemical dynamics. A series of numerical tests and applications of increasing complexity will be carried out.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0007, SYNTHESIS OF ORGANIC COMPOUNDS UNDER PRIMITIVE EARTH CONDITIONS
S.L. Miller, University of California, San Diego Campus, Graduate School, Dept. of Chemistry, *P.O. Box 109, La Jolla, California* 92037 (CHE76-16779 A02)

Amino acids can be synthesized by the action of electric discharges and other sources of energy on a mixture of methane, ammonia, water and hydrogen. These gases were probably the components of the atmosphere of the primitive earth. Purines can be synthesized from hydrogen cyanide, and similar types of reactions can synthesize other components of present living organisms. Prebiotic reactions will be studied for the synthesis of the basic amino acids, tryptophan, diaminopimelic acid, water soluble vitamins, porphyrins, and diamines such as ethylene diamine and putrescine. The additions of ammonia and cyanide to acrylonitrile and acrolein will be investigated since these are major prebiotic compounds. Polymers of hydroxyacids, which could have been produced on the primitive earth, will be investigated for their ability to polymerize amino acids, nucleosides and activate phosphate. The prebiological synthetic reactions will be investigated paying particular attention to the plausibility of such reactions on the primitive earth. This work is a continuation of that currently supported by Foundation grant GP-36294.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, CLAY CATALYSIS OF PREBIOTIC POLYMERIZATIONS - POSSIBLE ROLES AND MECHANISMS OF ACTION OF METAL IONS
M.A. Sweeney, University of Santa Clara, School of Science, Dept. of Chemistry, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685005)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0009, PEPTIDE CATALYSIS OF POLYNUCLEOTIDE-TEMPLATED AMINO ACID CONDENSATION OF FLUCTUATING CLAY SURFACES
D.H. White, University of Santa Clara, School of Science, Dept. of Chemistry, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685006)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0010, AN INVESTIGATION OF ATMOSPHERIC S, N, AND CL COMPOUNDS IN THE TROPOSPHERE
B.J. Huebert, Colorado College, Graduate School, Dept. of Chemistry, *Colorado Springs, Colorado* 80903 (ATM77-11877 A02)

The objective of this research is to continue measurements of the tropospheric concentrations of HCl, HNO3, SO2, and particulate Cl ion, SO4 ions, and NH4 ions. The study will be conducted over the Pacific and North Atlantic oceans and many areas of an integrated measurement program aimed at determining atmospheric concentrations of trace gases and aerosols from a Lockheed Electra research aircraft. The data gathered will be used to: (1) improve understanding of the global budgets of S, N, and Cl compounds; (2) permit a computation of the exchange rates of trace gases and particles between the troposphere and stratosphere; (3) provide a basis for calculations of the extent to which HCl, HNO3, and SO2 contribute to atmospheric acidity; and (4) provide information on reaction mechanisms in clean and polluted air. Measurement techniques include collection of particles and acidic gases from large-volume air

samples followed with chemical analysis by fluorescence quenching, autoanalyzer, and ion chromatographic techniques.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

3.0011, MAGNETIC CIRCULAR DICHROISM STUDIES OF MATRIX ISOLATED DIATOMIC OXIDES

M.T. Vala, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Chemistry, *208 Tigert Hall, Gainesville, Florida* 32601 (CHE77-00988 A01)

Experimental research on the spectroscopy of selected diatomic oxides will be performed by Professor Martin Vala. In particular, he will investigate the alkaline earth oxides (MgO, CaO, SrO, and BaO), the Group IV B transition metal oxides (TiO, ZrO, and HfO), and the rare earth oxides (CeO, NdO, and SmO). The matrix-isolated magnetic circular dichroism and absorption spectroscopy of these diatomics will be investigated to confirm, where assigned, and to establish, where unknown, the excited electronic state assignments; additional information on excited and ground state magnetic moments and spin-orbit interactions will be sought. The study of dye laser-induced emission and magnetic-induced circularly polarized emission spectroscopy, lifetimes, and relative quantum yields of these species will also be studied by Professor Vala in order to gain information on the pathways of radiative and nonradiative decay between excited electronic, vibrational, and ground electronic states.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0012, THE RELATIONSHIP BETWEEN STRUCTURAL AND SUPERCONDUCTING TRANSITIONS IN VANADIUM 3 GALLIUM AND VANADIUM 3 SILICON

I.L. Spain, University of Maryland, College Park Campus, School of Engineering, Dept. of Chemical Engineering, *College Park, Maryland* 20742 (DMR76-09065)

The compounds vanadium 3 silicon and vanadium 3 gallium are superconductors with high superconducting transition temperatures (17.1 and 16.5 degrees K, respectively). These and other materials of the same type, known as A-15 superconductors, have great potential in technological applications such as windings for motors and generators, and lossless transmission lines. Their superconducting properties are believed to be associated with lattice instabilities as well as electronic anomalies. The lattice instability manifests itself as a reduction in an elastic constant as the temperature is lowered (mode-softening behavior), and as it tends to a zero-value the lattice distorts from its cubic form to a tetragonal form by a martensitic transformation.

The present research will study the properties of the mode-softening behavior, the martensitic transformation and other structural anomalies and attempt to relate them to the superconducting behavior. High pressure techniques will be used to vary the interatomic behavior and high magnetic fields to modify the electronic characteristics. In order to study the above problems, unique facilities will be used. Small, low temperature versions of the diamond-anvil high pressure cell will be employed, allowing structural information to be gained on both polycrystalline and single crystal specimens. In addition, information about electrical and magnetic properties will be obtained.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0013, LITHIUM INORGANIC ELECTROLYTE BATTERY INVESTIGATION

M. Slavin, GTE Sylvania Inc., *Needham Heights, Massachusetts* 02194 (DF461350; F33615-77-C-2021)

Provide technology for safe, lithium inorganic electrolyte batteries which meet the performance requirements of life support, spacecraft, and missile silo applications.

Define the conditions and causes of lithium inorganic electrolyte battery explosions. Eliminate the above causes or establish a range of parameters under which safe operation can be achieved. Establish shelf life for both anode and cathode limited cells. Investigate sulfuryl chloride in addition to thionyl chloride as an electrolyte solvent/reactant.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0014, ROLE OF COUPLING AGENTS IN METAL-POLYMER ADHESION

C.S. Sung, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF055160; F49620-79-C-0085)

AF function - the incorporation of composite materials into AF aircraft has been increasingly desirable due to their lightweight and reduced manufacturing costs. Deficiency - the adhesive interface in a compositely bonded structure is susceptible to failure under environmental attack. Objective - to better understand the role of coupling agents in promoting environmentally resistant metal-polymer adhesive bonds. How work contributes - by obtaining a basic understanding of the role of coupling agents on adhesion promotion and wet strength improvement of the metal-polymer adhesive joints, the reliability and durability of composite material bonds may be optimized.

The chemical interaction of various thicknesses of two silane coupling agents on the surface of single crystals of aluminum oxide (sapphire) will be studied using FTIR transmission spectroscopy, internal reflectance spectroscopy, and ESCA. Clarification of the coupling agent-adhesive polymer interaction will be determined by internal reflectance spectroscopy. Correlation of the silane film structure with adhesive joint strength will be determined by peel and sheer lap tests. Durability of joints in wet environments will be related to possible structural changes in the silane films with aging.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0015, BERLINITE CRYSTAL GROWTH

R.F. Belt, Litton Systems Inc., *200 E. Hanover Ave., Morris Plains, New Jersey* 07950 (DF903140; F19628-77-C-0213)

Air Force function - navigation, communication, surveillance. Deficiency - presently available resonator materials cause long term frequency drifting. Objective - to develop superior material for both timing and acoustic surface wave devices. How research contributes -development of new, possibly superior material may result in improved timing and acoustic surface wave devices.

The approach will be the study and growth of berlinite (aluminum phosphate) of sufficient size and quality for evaluation as timing and acoustic surface wave material. The hydrothermal crystal growth technique will be used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0016, THEORETICAL STUDIES OF INELASTIC AND REACTIVE GAS/SOLID-SURFACE PHENOMENA

J.D. Doll, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Chemistry, *Stony Brook, New York* 11790 (CHE77-16070 A01)

Theoretical studies of inelastic and reactive gas/solid-surface processes will be carried out. Motivated by recent experimental results involving vibrationally inhibited heterogeneous condensation, Doll will consider general internal mode effects for polyatomic/surface collisions. These studies, in addition to examining direct vibrational energy transfer, will explore the implications of resonant vibrational-vibrational processes between gas and previously adsorbed species. The experimentally studied system CO (gas) plus O (adsorbed) yields CO_2 (gas) will be studied theoretically. This reaction is of particular importance since essentially all aspects of gas/surface events are involved (e.g. inelastic processes, adsorption, diffusion, reaction, and desorption). The theoretical framework for the studies is the recently developed generalized Langevin theory of gas/solid-surface collisions. This method allows the treatment of general classes of gas/surface phenomena (inherently many-particle

processes) with only minor extensions of currently available 'few-particle' dynamical techniques.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0017, FATIGUE CRACK GROWTH UNDER VARIABLE-AMPLITUDE FATIGUE LOADING (JOINT ARMY/AF GRANT TO THE UNIV. OF PISA, ITALY)

A. Salvetti, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Research & Standardization Group, *Box 65, FPO, New York, New York* 09510 (DF289800)

The primary objective is to develop a reliable procedure for predicting crack growth under variable amplitude loading in built-up structure.

Crack growth prediction methods will be developed and verified by experiments using aluminum stiffened and unstiffened panels. The payoff will be an improved crack growth method for predicting the life of structure typical of aircraft construction. (AFFDL/FBE will plan to provide funding for FY 80-81.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

3.0018, SHEAR BANDS IN FORGED PRODUCTS

A.L. Hoffmanner, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF054440; AFOSR-79-0048)

AF function - observations of shear bands have been frequent in conventional titanium alloys used for gas turbine engine compressor blades and aircraft structures, and in nickel alloys used for jet engine components. Opportunity - metal-working processes are designed to produce parts to specified shapes with certain microstructures, and to do so without production of defects which may detract from service performance. These defects run the gamut from internal void formation, inhomogeneous phase distribution, and strain localization, to internal and external fracture. Often, process variables such as working speed and lubrication interact with material properties in the generation of these defects. One example of such an interaction may be cited in the occurrence of shear bands (regions of highly localized deformation crossing many grains) in forged products. Objective - this investigation is to document experimentally the occurrence of shear bands in forged products and to validate analytical techniques for their prediction. In addition, the effect of shear bands on subsequent mechanical behavior before and after typical post-forging heat treatments will be established. How work contributes - the results of this program will lead to much needed understanding of effects and control of a common forging defect which is of vital interest to the Air Force.

The research program will be performed over a 3-year period. In the first year, the mechanical properties of the program material will be determined, the applicability of heat transfer and combined heat transfer-deformation models established, and instability criteria evaluated in a simple deformation mode. During the second year, a simple and a more complex forging will be done to establish the validity of the heat transfer-deformation analysis and instability analysis to simulate more general deformation modes and to determine how these analyses should be used to predict process variables which lead to shear band development. Finally, the third year program will consist of mechanical testing to determine the effect of shear bands on in-service properties. In view of the on-going program on the development of a science base for manufacture of a dual property compressor disk of Ti-6Al-2Sn-4Zr-2Mo, this alloy will be utilized. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0019, HALOGENATION REACTIONS OF GROUP IB ATOMS USING MOLECULAR BEAMS AND SPECTROSCOPIC DETECTION

J.M. Parson, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Chemistry, *164 W. 17th Ave., Columbus, Ohio* 43210 (CHE76-11641 A02)

Dr. Parson will use a crossed molecular beam to study reactions of IB atoms with halogens and hydrogen halides. The methods of chemiluminescence and laser-induced fluorescence of product molecules will be used for detection. Quantities to be measured are translational energy dependence of cross-sections, internal energy distributions of products, angular distributions of products, and absolute cross-sections. Special features in the experimental approach include using metastable atomic beams, a secondary beam nozzle source, rotation of the laser light path about the collision center, background light correction by beam modulation, and high-repetition-rate laser pulses for enhanced signal. Emphasis will be on A plus BC reaction types where there are good opportunities for comparison of experimental results with theoretical predictions from potential energy surfaces. Other more immediate objectives involve identification of types of reactants which lead to inverted populations in vibrational or electronic degrees of freedom.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0020, STATISTICAL ANALYSIS OF SOLID PROPELLANT COMBUSTION

R.L. Glick, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF054120; AFOSR-79-0022)

AF function - nearly all future Air Force rocket propulsion systems will use solid propellants. Deficiency - current analytical and experimental techniques are inadequate for accurate prediction and assessment of steady and nonsteady combustion characteristics of these propellants. Objective - the purpose of this research is to further develop statistical methods for modeling propellant burning and develop new techniques for analysis of experimental data. How work contributes -when successful, this work will provide a low cost means of accurately selecting propellant formulations that meet mission requirements.

A statistical model has previously been developed for treating the steady state combustion of polydisperse heterogeneous propellants based on the assumption that the macroscopic flame structure of a fuel plain, dotted with concave and/or convex oxidizer surfaces, is an ensemble of non-interacting one-dimensional flames. In the present work, this model will be improved to account for flame interactions by including a binder in the process employed to compute mean rate. The model will also be extended to treat nonsteady combustion as a time-mean phenomenon rather than as the instantaneous response of a real-mean phenomenon. Methods will be developed and coded to extract both multifrequency response function data and statistical parameters defining data quality and reproducibility from pressure-coupled rotating valve burners.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0021, ELEVATED TEMPERATURE BEHAVIOR OF METAL-MATRIX COMPOSITES

B.W. Rosen, Material Sciences Corp., *Blue Bell, Pennsylvania* 19422 (DF054790; F49620-79-C-0059)

AF function - aerospaceframe, spaceframe and engine structure. Deficiency/opportunity - aerospaceframe performance and durability, spaceframe performance and thermal load stability, engine weight, cost and durability all require improvement. Metal matrix composites, with their potential for high temperature stiffness, strength, durability, low weight and low thermal expansion, promise to meet this need. Objective - to develop sufficient understanding of metal matrix composites to be able to use them routinely in Air Force weapons system applications. How work contributes - by increasing understanding of the response of metal matrix composite materials to loads and temperature changes, and by developing models for this behavior which can be incorporated into engineering analysis/design procedures.

Evolutionary, founded on experimentally significant behavior. The material is complex, as is its behavior. Present knowledge of such systems indicates that neither classical analysis nor pure experiment can adequately and frugally characterize their behavior. This work will initially investigate those deformation modes of a unidirectional fiber lamina for which the matrix con-

stitutive nonlinearity and fiber anisotropy is significant, develop one-dimensional lamina constitutive relations which appropriately incorporate load temperature interaction effects, and explore approaches to modeling the three-dimensional behavior of a lamina using the developed 1-D laws.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, SUPERSATURATED ALUMINIUM ALLOY POWDERS

D. Schechtman, Technion, *Haifa, Israel* (DF289740; AFOSR-78-3696)

AF function - research and development in structural metals for airframe application. Deficiency - present alloy theory is insufficient to develop new aluminum alloys of higher modulus and higher operating temperature. Contribution - improved alloy theory will allow further development and utilization of aluminum alloys.

The work involves a development and study of supersaturated aluminum alloys based on relatively high content of iron (Fe) and chromium (Cr). Two strengthening mechanisms will be employed; namely, solid solution strengthening and precipitates which are stable at relatively high temperatures. It has been demonstrated in the past that aluminum alloys, fast frozen from the melt, are capable of retaining high concentrations of alloying elements, and form a high density of stable precipitates if given adequate heat treatment. Alloys thus prepared show improvements in mechanical properties at various temperatures both under monotonic and cyclic loading. It is believed that other properties, such as specific modulus elasticity and specific strength at high temperature, can be improved. The aim of this study is to systematically investigate the microstructures and the nature of the precipitates, following various heat treatments, and some mechanical properties obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, CONTRIBUTIVE RESEARCH/RESIDENT SCIENTIST PROGRAM

C. Carroll, Auburn University, School of Engineering, Dept. of Electrical Engineering, *Auburn, Alabama* 36830 (DF684190; F33615-77-C-5003)

Research and development. Research - basic research in the physical and engineering sciences. How research contributes - utilizes unique AFWAL equipment for thorough investigations and knowledgeable evaluations. Offers the opportunity for basic research in the areas of chemistry, solid-state physics, plasma physics, applied mathematics, metallurgy and ceramics, hypersonics, energetics and fluid dynamics within the directed AFWAL approved mission projects.

The broad scope of the AFWAL program and the number of disciplines involved frequently make it desirable to obtain independent studies in specific subjects to extend or amplify various aspects of the program within these laboratories. As specific objectives within each of the laboratories are established, a series of technical goals are devised which lead to the attainment of various AFWAL objectives. These goals are further defined in terms of scientific studies, some of which will be carried out and directed by the AFWAL staff while others will be more effectively performed by contractors with highly specialized skills.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Materials Lab.

4.0002, OPTIMIZATION OF AN INTERACTIVE DISTRIBUTIVE COMPUTER NETWORK FOR PLANETARY AND INFRARED SCIENTIFIC RESEARCH APPLICATIONS

V. Frederick, Foothill De Anza Community College District, De Anza College, Undergraduate School, Dept. of Data Processing, *21250 Stevens Creek Blvd., Cupertino, California* 95014 (NCC 2-31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0003, ADVANCED TREND ANALYSIS PROCEDURES

Unknown, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DF462930; F33615-78-C-2062)

To develop advanced engine deterioration trend analysis procedures for improved aircraft engine condition monitoring.

To apply advanced mathematical techniques such as system identification theory in the development of fault isolation and detection software for improved modeling, estimation, and prediction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0004, NON-RADIATIVE RECOMBINATION IN GALLIUM ARSENIDE PHOSPHIDE

L. Forbes, University of California, Davis Campus, School of Engineering, Dept. of Electrical Engineering, *Davis, California* 95616 (ENG76-80128)

This program will continue an investigation of the effects of copper, iron, and other acceptor impurities on non-radiative recombination in gallium-arsenide-phosphide light emitting diodes. The importance of lattice relaxation and multiple phonon emission at impurity centers will be examined. This work will be compared with previous studies of impurity effects in gallium-phosphide diodes to ascertain if similar mechanisms are responsible for the behavior of the two materials. Energy levels, thermal emission rates, and ionization and capture cross-sections will also be determined for oxygen impurities in GaAsP.

This is a continuation of research previously supported under NSF grant ENG-7419430.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0005, PROPOSED UNIVERSITIES REGIONAL APPLICATIONS PROGRAM WORK PLAN - FY 1980

J.E. Estes, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NCC 2-43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0006, HIGH SPEED CYLINDRICAL ROLLER BEARING DEVELOPMENT

L. Dobek, United Technologies Corp., *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF461730; F33615-77-C-3114)

Extend the state-of-the-art of turbine engine cylindrical roller bearing technology to 3 million DN capability.

Roller bearings will be designed using bearing parameters that have been identified as most important in an existing Navy/Air Force cooperative program with United Technologies, Pratt-Whitney Aircraft Div. Bearings will be fabricated and tested up to 3 million DN. Parameters will be modified and analytical programs will be changed as required to assure a 3 million DN design capability for turbine engine mainshaft roller bearings.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0007, DIGITAL ELECTRONIC CONTROL SYSTEM RELIABILITY (FULL AUTHORITY, FAULT-TOLERANT EEC)

M. McGlone, United Technologies Corp., *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF464440; F33615-79-C-2082)

This is a dual award contract to evolve design guidance with respect to one facet of the reliability/availability/integrity issue associated with the future development of digital electronic engine control systems - that of providing for very high reliability through the use of redundancy/fault-tolerance, tailored to the needs of variable cycle engine control and optimized with respect to the reliability of the system (and of its components) and to cost of ownership.

Employ the services of two contractors - one skilled in the synthesis of very high reliability, fault-tolerant digital computer systems, and the other skilled in the synthesis of control systems for the engines of high-performance military combat aircraft. Require that they work together closely in a program of study and analysis to produce design guidance needed for the future development of full authority, fault-tolerant (digital) electronic engine control systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0008, A PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL PRODUCED FROM WHOLE CRUDE SHALE OIL

A.O. Braun, Signal Co. Inc., UOP Incorporated, *10 U O P Plaza, Des Plaines, Illinois* 60016 (DF463880; F33615-78-C-2079)

The objectives of this program are to optimize new procedures for the efficient and economic processing of whole crude shale oil into high yields of military fuels while maximizing the yield of aviation turbine fuel and to determine the trade-offs between jet fuel yield, jet fuel properties, and processing costs.

The proposed program will be a 28-month effort incorporating all of the following aspects: (1) process variable analysis, (2) analysis of laboratory samples, (3) production of component test samples, and (4) overall economic optimization by computer model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0009, NEW TECHNIQUES IN DIGITAL SIGNAL PROCESSING FOR SYNTHETIC APERTURE RADAR

W.K. Jenkins, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DF054230; AFOSR-79-0029)

AF function - to advance the technology of radar digital signal processing. Deficiency - in synthetic aperture radar (SAR), in which the data from a side-looking radar on an aircraft is processed by digital techniques, resolution errors for certain target regions are unacceptably high. Objective - to investigate and develop improved processing algorithms to achieve better imagery. How work contributes -success in this research would result in significant radar performance enhancement.

The research will be divided into three parts - 1) digital processing algorithms, 2) architectures for SAR digital processors, and 3) investigations of new techniques for post-processing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, ENERGY CONVERSION - STAGNATION REGION GAS FILM COOLING FOR TURBINE COOLING APPLICATIONS

B.A. Reese, Purdue University, School of Aeronautics & Astronautics, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DN475466; N00014-75-C-0873)

The objective is to obtain accurate data on the local rate of convective heat transfer to a highly cooled surface exposed to an accelerated, highly turbulent hot gas flow, with particular emphasis on the influence of turbulence scale and intensity and unsteady effects on stagnation region film cooling. The effort is primarily experimental, with analytical modeling backup, and is aimed at optimizing engine performance while utilizing higher turbine inlet temperatures with necessary cooling schemes. The research contributes to increasing the performance of aircraft and marine gas turbine engines.

A two-dimensional rectangular flow channel, with heated air from a gas turbine combustor supplied to a cylindrical film cooled test surface is used to model the turbine vane leading edge. Test equipment has ben modified to permit study of stagnation region film cooling using multiple rows of coolant holes. The cylindrical test surface has been scaled up, with a larger heat transfer surface to permit heat flux gauge installation between holes and rows of holes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0011, DETECTION AND ESTIMATION OF SINGLE EVENT-RELATED POTENTIALS

C.D. McGillem, Purdue University, School of Electrical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (DF055280; F49620-79-C-0084)

AF function - workload measures which incorporate reliable/valid electrophysiological techniques will be extremely useful for assessing and predicting human operator performance and requirements in the design and operation of advanced and more complex Air Force systems. Deficiency - little research has been reported that relates directly to the characterization of the transient waveform associated with a single event-related potential. Objective - the proposed research will develop and apply techniques for investigating the characteristics of the single event-related potential. How research contributes - techniques aimed directly at the single evoked brain potential have only recently advanced and require further development and specific characterization in Air Force mission-related contexts for consideration as part of an on-line workload measurement technology which incorporates the best available measures of physiological and neuropsychological processes.

The research will be accomplished through the techniques capable of providing quantitative estimates of parameters associated with individual responses and components of individual response as opposed to the averaging techniques widely employed at the present time.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, METAL-OXIDE-SEMICONDUCTOR SOLAR CELL

H.C. Lin, University of Maryland, College Park Campus, School of Engineering, Dept. of Electrical Engineering, *College Park, Maryland* 20742 (ENG76-09933)

An investigation will continue into the use of metal-insulator-semiconductor structures in the fabrication of solar cells. The effort will be directed towards demonstrating experimentally that the performance of such structures can approach that of conventional P-N junction-type cells. One area to be emphasized in the study is the use of transparent conductive electrodes to reduce optical reflection and surface-resistive losses. Also to be investigated is the effect on cell performance of increasing surface state densities and varying processing procedures for insulator growth.

This is a continuation of research previously supported under NSF grant ENG-7419310.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0013, RESEARCH ON THE DALTON-SILKOLENE PROCESS FOR RECLAIMING SYNTHETIC TURBINE ENGINE LUBRICANTS

A.T. Squires, Dalto Electronics Corp., *Norwood, New Jersey* 07648 (DF463540)

Establish the feasibility of developing the dalton-silkolene refining process for reclaiming mixtures of used Air Force synthetic turbine engine lubricants.

(1) Analysis of used lubricants, (2) identification of contaminants, (3) research on contaminant removal, (4) demonstration of processing techniques on USAF turbine engine lubricants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0014, MULTIFREQUENCY RADAR CROSS-SECTION MEASUREMENTS
R.B. Mack, Syracuse University, Graduate School, *Steele Hall, Syracuse, New York* 13210 (DF905610; F30602-78-C-0083)

AF function - all weather detection and identification. Deficiency - effective techniques for detection and identification require information on scattering properties of targets. Objective - this program will provide a newly designed facility for multifrequency scattering measurements of radar cross-sections. The installation is to be a part of the new facilities at the IPSWICH, MA field site planned for completion by the end of fiscal year 1979. How research contributes - the range will provide a modern, versatile facility for conducting radar experiments at l to X-band frequencies.

Task description - the task is to design a facility to serve as a multifrequency radar scattering measurement range. The range includes an anechoic room and will be used for both scattering and reflection measurements. The frequency range to be covered is l to X-band. As well as the design of the range, a list of desired auxiliary equipment is to be specified. Dr. Mack's experience in the field of radar scattering measurements - he is presently teaching a course on the subject - will assure a modern, versatile range representative of the most modern technology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0015, CRACK GROWTH INITIATION AND PROPAGATION UNDER DYNAMIC LOADING
M.F. Kanninen, Battelle Memorial Inst., Columbus Laboratories, *505 King Ave., Columbus, Ohio* 43201 (DN775733; N00014-77-C-0576)

Naval structures such as aircraft, missiles, submarines, and surface ships are exposed under service conditions to various forms of dynamic loading which can cause fracture and failure of key portions of these systems. Under this task improvements should be effected in dynamic fracture analysis and experimental techniques which should eventually impact on improved design approaches.

Existing dynamic and elastic plastic analysis procedures will be combined for application to the dynamic tear test specimen. Calculations will be compared with instrumented dynamic tear tests that measure time variations of applied loads, certain displacements, and crack life. Initial studies will be confined to relatively low toughness values and specimens that approximate linear elastic behavior. Work will then proceed to tough materials in elastic plastic behavior. Fracture resistance values will be extracted first from instantaneous loads and crack length measurements. Ways will then be sought to evaluate the resistance from the dynamic tear energy which is simpler to measure.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0016, ADVANCED DIAGNOSTIC ENGINE MONITORING SYSTEM APPLICATION ASSESSMENT - ADEMS II
W.R. Peters, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF455480; F33615-76-C-2025)

The objectives of this program are to design, develop, and evaluate advanced state-of-the-art in-flight computative and sensing techniques incorporated in an advanced diagnostic engine monitoring system (ADEMS II). This system is specifically designed and developed for istallation in selected operational C-5A aircraft for the flight evaluation of capabilities to monitor the condition of one of the TF39-GE-1A engines. This program will provide valuable information on the operational effectiveness of the system incorporated techniques for reducing field maintenance work through correct and timely maintenance actions based upon improved fault isolation and trending capabilities, provide data for effecting cost saving logistic management improvements, and establish engineering guidelines for diagnostic engine monitoring applications for future military aircraft.

The airborne system shall incorporate on-board fault detection pre-and post-failure event recording, selected airborne limit exceedance displays, self-check capability, and provide data for ground processing to develop and define the methodology for in-depth fault isolation, trending for the prediction of maintenance requirements, and history/statistical data for tracking life limited parts for logistic management purposes. Limited engine modifications for the installation of IR pyrometer, internal vibration (externally removable), oil system monitoring and other advanced sensors are required. This work is to be accomplished in six phases: design and definition of ADEMS system and hardware, procurement fabrication and assembly, total system and engine assurance testing, installation and flight evaluation, technical reporting, and low cycle fatigue damage analysis.

SUPPORTED BY U.S. Dept. of Defense Air Force, Aero Propulsion Lab.

4.0017, DYNAMIC BEHAVIOR OF SPLITTERS AND DUCTS
W. Steenken, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF459120; F33615-77-C-2081)

To define the dynamic interactions which occur at interfaces between engine ducts and other engine components. The effect of these dynamic interactions on engine stability will also be defined.

The program will combine test effort and analytical effort. The test effort will provide dynamic data at the interface to compare with dynamic simulations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0018, SM CO GENERATOR/ENGINE INTEGRATION STUDIES
D.E. Uehling, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF460900; F33615-77-C-2018)

To establish and demonstrate the feasibility of integrating a Sm Co starter generator into an aircraft jet engine.

The generator/engine interface will be defined based upon a specific application, the design and performance requirements will be established and a model device fabricated to demonstrate performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0019, POTENTIAL-COMPLEX LAMELLAR DECOMPOSITION OF FLUID FLOWS
R.L. Panton, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712 (DF054700; AFOSR-79-0081)

AF function - aerospace vehicle design. Deficiency - modeling of turbulent flow is almost entirely empirical. Objective - application of a reformulation of the fluid flow equations in a form more natural to the study of vorticity. How work contributes - better turbulence modeling should lead to better aircraft design.

The classical mathematical decomposition of the velocity field in turbulent flow due to CLEBSCH or MONGE separate out that part of the velocity field that is non-zero only in the vorticity-containing regions of the flow. The research will attempt to pick a unique transformation and apply the decomposition to selected problems where there is a strong interaction between potential and viscous flow components. Possible problem areas include three-dimensional boundary layers, wall turbulence, aerodynamic generation of sound and flows with strong interactions. A primary goal is to explore the general characteristics of the decomposition whose literature is both sparse and sketchy in an attempt to understand aspects such as the various restrictions employed to make the decomposition unique, the differing physical interpretations, (should vortex lines be fixed in the fluid, or in steady flow, fixed in space?) and the selection of coordinate surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, POWER SYSTEM CONTROL STUDY
J. Perkins, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DF462270; F33615-78-C-2018)

The purpose of this program is to define, design, and analyze an advanced, integrated aircraft electrical generation and control system which will provide the high quality, reliable, no gap power required by next generation Air Force weapon systems. A primary objective of the system design and study, therefore, encompasses the development and application of state-of-the-art technology for yielding a cost-effective electrical generation-control system which will not sustain first or second order faults or failures that result in complete loss of power.

In this study advanced system concepts will be examined. Such concepts include use of (1) solid-state switching in areas of power generation and control, bus and load switching and signal sensing, (2) samarium cobalt permanent magnet VSCF generator/starter implementation, (3) smart terminal (microprocessor controllers) applications in areas of the generator control unit, universal multiplex terminal, and integrated load management center designs, (4) dynamic load management and generator control via the EMUX sensory and data processing capabilities, (5) distributed load management, (6) automated and continuous built-in test and MIL-STD-1553 compatible multiplexing using TSPC (twisted shielded par) and F/O (fiber optic) data busing techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0021, RADIATION PRODUCTION BY CHARGED PARTICLE BEAMS EJECTED FROM A PLASMA FOCUS
G.M. Molen, Old Dominion University, School of Engineering, Dept. of Electrical Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (DF055950; F49620-79-C-0151)

AF function - the AF must be able to assure that its systems are hardened to withstand certain radiation levels from nuclear weapons. Deficiency - no laboratory radiation source can produce high enough intensities to simulate nuclear weapons effects over system size volumes. Objective - this research program is aimed at understanding a new X-ray source which the PI has developed. This new X-ray source is based upon a focused electron beam produced by a plasma focus device. Dr. Molen intends to measure the characteristics of both the electron beam and the X-rays it produces. Contribution - this research program will contribute to the development of laboratory radiation sources to simulate nuclear weapons effects.

The Mark IV plasma focus system will be transferred from the Aerospace Corporation to the Electrical Engineering Department at Old Dominion University and will be assembled and made operational. The system will be configured so as to produce a focused electron beam directed into the anode. Extensive diagnostics will be made on the ejected electron beam current that is transported through the drift tube. A high frequency Faraday cup will be modified to measure contributions to the electron current from lower energy electrons. Qualitative estimates of the electron energy of the beam will be made by the use of various thicknesses of dielectric films for which the forward electron range is known. The temporal current profile measured with the Faraday cup will be compared with X-ray emission from the converter region as well as the softer bremsstrahlung radiation produced at the plasma pinch.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, GLOBAL ATMOSPHERIC ENERGY INPUT DUE TO ELECTRONS PRECIPITATED BY MAN-MADE VLF EMISSIONS
A.L. Vampola, Aerospace Corp., Space Sciences Laboratory, *P.O. Box 92957, Los Angeles, California* 90009 (ATM77-28187)

This grant provides partial support for data processing and analysis for a study of energy input into the upper atmosphere due to electrons precipitated by interaction with man-made electromagnetic waves. The study covers a new area of investigation: the modification of the magnetospheric energetic electron population by very low frequency (VLF) waves from ground-based transmitters and power-line harmonics. The data involved were obtained by a magnetic electron spectrometer on the S3-2 satellite during the period December 1975 to present. As part of the tasks, the data will be reduced, processed to provide ephemeris and magnetic aspect, and furnished to the National Space Science Data Center for use by other investigators.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0002, EVOLUTION OF THE ATMOSPHERE OF VENUS
Y.L. Yung, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sciences, *1201 E. California Blvd., Pasadena, California* 91109 (NCC 2-61)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0003, SEASAT PROGRAM - EVALUATION OF OPEN OCEAN MEASUREMENTS BY THE SEASAT-A SYNTHETIC APERTURE RADAR DURING THE 1978 JOINT AIR-SEA INTERACTION
A.M. Peterson, Stanford University, Center for Radar Astronomy, *Stanford, California* 94305 (7-922; MO-AO1-78-00-4318)

OBJECTIVE: The extensive wind and wave measurement to be made during the Joint Air-Sea Interaction (JASIN) experiment will be utilized to evaluate the measurement of ocean wave directional spectra by the SEASAT-A SAR. Information will be obtained concerning the range of ocean wavelengths and observational parameters over which reliable measurements of directional spectra can be made using SAR images, the dominant radar wave/ocean wave interaction mechanism(s) which allow SAR to image long wavelength ocean waves and then effects of local winds on SAR images.

APPROACH: The SEASAT-A/JASIN collaborative research effort will include SAR data collection for the JASIN area; SAR images formation, including geometric and focussing corrections; SAR image processing; comparison of SAR and surface measurements sigma (k, Omega); and evaluation of SEASAT-SAR measurements of sigma. The principal conclusion to be drawn from the data comparison is over what range of observational parameters, and wind and wave conditions, can SEASAT SAR images be used to provide meaningful estimates of the ocean wave directional spectrum.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0004, IRRIGATED LANDS ASSESSMENTS FOR WATER MANAGEMENT
R.N. Colwell, University of California, Berkeley Campus, School of Natural Resources, Dept. of Forestry & Resource Management, *Berkeley, California* 94720 (NCC 2-54)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0005, RE-FORMAT AND DOCUMENTATION OF A SURVEY PLANNING MODEL
I.C. Wensel, University of California, Berkeley Campus, School of Natural Resources, Dept. of Forestry & Resource Management, *Berkeley, California* 94720 (NAS 9-15987)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0006, DEVELOPMENT OF A PLAN FOR FUNDAMENTAL RESEARCH IN ELECTROMAGNETIC RADIATION CHARACTERISTICS FOR RENEWABLE RESOURCES AND FEATURES

J.A. Smith, Colorado State University, School of Natural Sciences, Dept. of Earth Resources, *Fort Collins, Colorado* 80523 (NAS 9-16016)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0007, DOMESTIC HOT WATER SYSTEM TEST SUPPORT

Unknown, State University System of Florida, University of Florida, Graduate School, *Gainesville, Florida* 32601 (NAS 8-33761)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0008, COMPREHENSIVE STUDY OF POSSIBLE SOLAR ACTIVITY INFLUENCES ON THE UPPER STRATOSPHERE AND MESOSPHERE

C.G. Justus, Georgia Inst. of Technology, School of Engineering, Dept. of Aerospace Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (ATM77-05967)

This grant funds a study of possible influences of solar activity on the upper stratosphere and mesosphere (25-90 km). The indices of solar activity whose possible influences will be studied are: 1) the AE index, a measure of global electrojet activity, 2) the magnetic storm index Dst, 3) the solar radio noise flux at 10.7 cm wavelength F 10.7, 4) the 1000 A to 3500 A UV flux as measured by satellite, 5) the 1 A to 20 A X-ray flux as measured by satellite, 6) solar proton flux as measured by satellite, 7) solar magnetic sector boundary crossings, 8) solar magnetic sector intensities, 9) the Zurich sunspot number, and 10) and the satellite measured near-earth cosmic-ray flux (to investigate potential effects of solar magnetic field modulations on cosmic-ray flux and resultant influence on ionization). The meteorological parameters of the 25-90 km altitude region whose possible influence by solar activity is to be studied are: 1) departures of measured temperature, density, pressure, zonal wind, and meridional wind from 'climatological' monthly means, 2) the magnitude of gravity waves and planetary waves, as deduced by the daily difference analysis method, 3) weekly stratospheric circulation index and thickness values for the 30 degrees to 70 degrees latitude area between pressure heights to 5 mb and 0.4 mb.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0009, FIELD-ALIGNED CURRENTS IN THE POLAR REGIONS

T.A. Potemra, Johns Hopkins University, Applied Physics Lab., *Johns Hopkins Rd., Laurel, Maryland* 20810 (ATM76-81211 A01)

This grant will support a program of acquisition, analysis and interpretation of the data obtained from the Navy/Applied Physics Laboratory satellite TRIAD. The TRIAD magnetometer experiment remains the only means of studying field-aligned currents at relatively low satellite altitudes on a continuous basis. The program would establish an automatic data acquisition ground station at Resolute, Canada, and continue the operation of the station at McMurdo, Antarctica. Selected passes of TRIAD magnetometer data from College, Alaska, will be collected for correlation with the radars located at Chatanika and Homer, Alaska, and from Fort Churchill, Canada, and Prince Albert, Canada, for correlation with various ground-based magnetometer chains and radar observations scheduled for the IMS (International Magnetospheric Study). The primary objectives of this study are: (1) To determine the distributions and characteristics of magnetic disturbances (and the related field-aligned currents) in the polar cap and cusp region. (2) To correlate the characteristic field-aligned currents in the polar cap, cusp and auroral region with ionospheric current systems determined from the extensive ground-based observations scheduled for the IMS. (3) To determine the relationship of field-aligned currents with ionospheric scintillations observed to the VHF transmissions from TRIAD. (4) To continue the correlation of the TRIAD magnetometer data with measurements of low-energy electron fluxes from the Atmosphere Explorer C and D satellites.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0010, SYNOPTIC ANALYSIS

Unknown, Systems & Applied Sciences Corp., *6811 Kenilworth Ave., Riverdale, Maryland* 20840 (DF581710; F19628-78-C-0138)

AF function - strategic offense and defense. Deficiency - lack of quantitative data to define atmospheric hydrometeor distributions associated with synoptic scale meteorological patterns.

Perform analyses of synoptic meteorological patterns associated with flight track of specially instrumented cloud physics research aircraft. How development contributes - analyses developed permit climatological correlation of synoptic scale meteorological patterns with particle distributions, liquid water content, and other pertinent cloud physics parameters for quantitative assessment of environmental effect on aerospace operations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011, VIBRATIONAL NITRIC OXIDE ION STUDY

M. Camac, Aerodyne Research Inc., *Bedford Research Pk., Bedford, Massachusetts* 01730 (DF243580; F19628-76-C-0178)

AF function - detection and surveillance. Deficiency - inadequate knowledge of the upper atmosphere during disturbed conditions, e.g., nuclear explosions and auroras. Research - the vibrational transfer rate to molecular nitrogen and molecular oxygen are measured for nitric oxide ions. How research contributes - nitric oxide ions are important SWIR emitters in the disturbed ionosphere. The proposed measurements will lead to improved ability to predict the expected SWIR emission intensities.

Laboratory measurements of vibrationally excited nitric oxide ions are undertaken in order to determine the rate of transfer of vibrational energy to molecular nitrogen and molecular oxygen. Relative photoionization cross-sections will also be measured for the 0 through 4 vibrational level of the ion. If possible, the relative recombination coefficient will be measured for ions in levels 1 through 4. Two new items are being added to the approach. First, F-numbers for nitric oxide ions as measured on subject contract will be used to reanalyze previous U.S. nuclear test data in the IR. Secondly, IR absorption data concerning UO and its ion will be measured with the use of a commercially available infrared tunable diode laser whose output is passed through a white cell integrated with the flow reactor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, DEVELOP STRATOSPHERIC COMPOSITION IDENTIFICATION INSTRUMENT

H.A. Miranda, Epsilon Lab. Inc., *Bedford, Massachusetts* 01730 (DF582070; F19628-78-C-0168)

AF function - environmental impact of stratospheric aircraft and missile operations. Deficiency - inadequate understanding of the role of aerosol particles in the removal of pollutants deposited in the stratosphere. Objective - develop an instrument to make in-situ measurements of aerosol particle number density and particle composition. How research contributes - completion of effort will provide an instrument design which can be fabricated and used to measure aerosol particles in the stratosphere, thus providing better inputs on the role of aerosols in stratospheric processes and allow more accurate impact statements.

Develop an instrument design for in-situ measurement of stratospheric aerosols. The instrument would be designed for balloon flight at various stratospheric altitudes. The instrument

is envisioned to measure particle composition by vaporizing the particle with a laser beam and measuring the vaporized material with spectral techniques. This work effort is devoted to a theoretical and laboratory study to determine the feasibility of the concept and to demonstrate that feasibility through the use of a breadboard hardware model. The results will be a set of design specifications from which a flight instrument could be fabricated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, GEOPHYSICAL STUDY OF THE STRUCTURES AND PROCESSES OF THE CONTINENTAL CONVERGENCE ZONES

P. Molnar, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NCC 5-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0014, WIND AND TURBULENCE MEASUREMENTS AND THEORETICAL APPLICATION

I.L. Kofsky, Photometrics Inc., *Lexington, Massachusetts* 02173 (DF580500; F19628-78-C-0171)

AF function - low altitude operational satellites and ballistic nuclear weapon delivery. Deficiency - trajectory of missiles and satellites cannot be precisely calculated. Research - utilization of measured turbulent transport parameters in model atmospheres. How research contributes - permits more accurate calculations of dynamic model atmospheres. The results can be used to predict missile reentry and satellite orbit calculations.

The upper atmospheric turbulent motions will be determined from the fine detailed wind measurements (with a discrimination length of approximately 50 m) by the use of a Richardson number filter. These determined values of turbulent kinetic energy will then allow us to accurately estimate the rate of turbulent dissipation in the chemical release trail. Spectral analysis permits us to determine directly the turbulent rate of dissipation, from which the turbulent diffusion coefficients may be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, R AND D OF MATH AND PHYSICS MODELS

J. McCann, R D P Inc., *Waltham, Massachusetts* 02154 (DF249940; F19628-76-C-0212)

Research - infrared radiation pattern studies. How research contributes - performance of mathematical and statistical analysis of infrared background data obtained from rocket probes will improve means of detection.

Using mathematical and statistical techniques, models will be developed for the determination of multi-channel cross-talk matrices. Methods of numerical analysis, Fourier and optimization techniques will be applied for the (1) calibration of sensor and payload instrumentation, (2) processing of two-dimensional IR imagery data, and (3) infrared probe data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, AEROSPACE PAYLOAD R AND D

J.M. Otis, Wentworth Inst. of Technology, Undergraduate School, *550 Huntington Ave., Boston, Massachusetts* 02115 (DF247640; F19628-76-C-0211)

AF function - reconnaissance, surveillance, communication and advanced weapon systems. Deficiency or opportunity - inability to forecast atmospheric interactions affecting the design and operation of military systems such as re-entry vehicles, over-the-horizon radar and satellite operations. Objectives - (a) to perform research and engineering as required in the design, fabrication and test of aerospace payloads and G S E sensors; (b) to redesign, fabricate, test and evaluate component assemblies of existing aerospace vehicles for the purpose of improving reliability and/or cost-effectiveness. How research contributes - the complexities of upper atmosphere and near-space in situ measurements demand state-of-the-art expertise if meaningful data are to be retrieved. Improved construction techniques and designs can only enhance reliability of experiments directly related to AFGL projects 2310, 6688, 6690, 7659, 7661, 7670, 8658 and SAMSO program 2127.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, MEASUREMENTS OF ATMOSPHERIC CHLOROFLUOROCARBONS AND NITROUS OXIDE AND INTERPRETIVE AND THEORETICAL STUDIES IN ATMOSPHERIC CHEMISTRY

R.J. Cicerone, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM78-26728)

This research involves both theoretical and experimental studies of atmospheric chemistry. Numerical modeling investigations of the chemistry and physics of the stratospheric ozone layer and of the non-urban troposphere will be conducted.

Measurements of tropospheric chlorocarbons, chlorofluorocarbons and of nitrous oxide by electron-capture gas chromatography will also be performed. In general, the compounds to be measured are gases that are capable of influencing stratospheric photochemistry and/or the outgoing planetary infrared radiation and they are partly or mostly anthropogenic. To assure proper identificaiion of certain species and to detect several others, a limited amount of cryogenic pre-enrichment mass spectrometric work will be undertaken.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0018, EFFECT OF BEAM-PLASMA INTERACTIONS IN HIGH LATITUDE IONOSPHERE

E.G. Fontheim, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM77-24960)

This grant funds studies of precipitating particles and of the causes and effects of plasma turbulence in the high latitude ionosphere. It allows: 1) The analysis of electron precipitation spectra aimed at learning more about their origins as well as about their effects on the background plasma. This study involves extensive use of data from AE-C and D, INJUN5, Hawkeye 1, and the IMP series. 2) Investigation of whether downstreaming energetic protons may transfer their energy to electrons on auroral field lines in regions of plasma turbulence, thereby giving rise to intense inverted-V precipitation. 3) Study of the mechanisms which could give rise to plasma turbulence and anomalous transport effects at lower altitudes (h less than or equal to 500 km) and solution of the coupled set of conservation equations with anomalous transport coefficients. This study involves extensive use of Chatanika Incoherent scatter radar data and satellite data from AE-C and D and S3-3.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0019, EXPERIMENTAL AND THEORETICAL AIRGLOW STUDIES

P.B. Hays, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM77-26889)

The principal goal of the research to be funded by this grant will be to continue the development of techniques to remotely sense the state of the atmosphere. Emphasis is placed on the use of optical methods involving high resolution spectroscopy to infer the physical condition of the high atmosphere from the shape and position of emission lines in the airglow spectrum. The scope of measurements will be extended to include the stratosphere and mesosphere by using absorption features in the scattered sunlight spectrum. The approach used combines the experimental and theoretical work in the area of atmospheric optical emissions and related physical processes

into a unified endeavor. In addition to this general ongoing program of upper atmospheric research, a notable piece of new equipment is to be designed and constructed. The ability to significantly extend the general usefulness of multiple stacked Fabry-Perots (PEPSIOS) to atmospheric physics is promised by the technological achievement of slaving three Fabry-Perot etalons externally using computer controlled scans of each of the independent etalon systems. We can select any wavelength region without mechanical adjustment of the system. The use of widely separated free spectral ranges in the instrument allows basic wavelength stability high resolution systems using modest lower resolution scanning techniques.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0020, STUDY TO IMPROVE PARAMETERS FOR A WINTER WHEAT MODEL

J.M. Caprio, Montana State University, School of Agriculture, Dept. of Plant & Soil Science, *Bozeman, Montana* 59715 (NAS 9-16007)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

5.0021, A PHYSICAL INVESTIGATION OF AREA OF EFFECT OF CLOUD-SEEDING IN SIERRA NEVADA

J.A. Warburton, University of Nevada, System Office, Desert Research Inst., *Reno, Nevada* 89507 (ATM78-12215)

Increasing precipitation through cloud seeding has been demonstrated for certain orographic cloud systems in the Rocky Mountains. The total area affected by such modification has not been ascertained and represents an important societal as well as scientific issue.

This research seeks to determine whether cloud seeding on the (California) western slopes of the Sierra Nevada affects the cloud systems sufficiently to provide detectable changes in the precipitation falling on the (Nevada) eastern slopes of the Sierra. An advanced aircraft measurement and sampling system is being used to study changes in the physics of the precipitation process. There are three specific elements of the precipitation physics research: (1) To measure the content of the silver iodide and other ice nucleating aerosol tracers in the liquid and ice phases within the cloud systems. (2) To investigate the occurrence and persistence of supercooled liquid water passing over the mountain during various stability conditions. (3) To measure the spatial distribution of ice crystal concentrations and habits in relation to vertical mixing and the distribution of liquid water. New equipment has been constructed and installed in the aircraft for the airborne collection of supercooled liquid water and bulk ice crystals needed for the chemical analysis. The field research is being conducted over and on the downwind slopes of the Sierra Nevada and is closely coordinated with the operations of the Sierra Cooperative Pilot Project.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0022, GAS-SURFACE INTERACTIONS IN CRYOGENIC WHOLE AIR SAMPLING

J.M. Calo, Princeton University, School of Engineering & Applied Sciences, Dept. of Chemical Engineering, *Box 430, Princeton, New Jersey* 08540 (DF248590; F19628-77-C-0071)

AF function - stratospheric trace gas measurements are conducted to establish if Air Force flight operations are altering the composition of the stratosphere in any way which might produce a harmful environmental change. Deficiency or opportunity - there exist physico-chemical problems related to the collection, storage, manipulation, transfer and analysis of these gases by cryogenic techniques. Objective - under the contractual effort, theoretical and laboratory experimental investigations are intended to determine sticking and flaking of the gas species on cryogenic surfaces composed of various materials and to study potential chemical conversions on such surfaces.

A vacuum chamber/gas sampling system employing mass spectrometry for diagnostics will be designed and constructed. Gas samples, chosen for their applicability to stratospheric composition studies, will be introduced to the system and chemical conversions and sticking and flaking on cryogenic surfaces of different materials will be investigated. Also, the effects of sampling rates and modes as well as sample warmup will be studied. NO-to-NO sub-X conversion and determination of sticking coefficients for freons 11 and 12 on cryogenic surfaces will receive special attention.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0023, DOMESTIC HOT WATER SYSTEM TEST SUPPORT

Unknown, New Mexico State University, Las Cruces Campus, Graduate School, *University Park, Las Cruces, New Mexico* 88003 (NAS 8-33764)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Headquarters

5.0024, APPLICATION OF DIGITAL ANALYSIS OF MULTI-SPECTRAL SCANNER TO AGRO-ENVIRONMENTAL STUDIES

R.A. Lewis, Columbia University, Graduate School, *109 Low Memorial Library, New York, New York* 10027 (NCC 5-20)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

5.0025, WAVES AND WAVE COUPLING IN THE ATMOSPHERE

S.H. Gross, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Engineering, *333 Jay St., Brooklyn, New York* 11201 (ATM78-09509)

This grant funds research on the transport of energy and momentum by wave processes in the upper atmosphere and on the source regions for these waves. The data base utilized for this purpose will include data from the Atmospheric Explorer satellite. The effort will accentuate those waves that may originate in auroral regions or in lower layers of the atmosphere, as, for example, the troposphere. The research is concerned with the mechanisms for the propagation of these waves through the layers of the atmosphere and the deposition of their energy and momentum in these regions.

It is planned to select and analyze density data for individual species and the total medium, as well as temperature and species velocity data to seek correlative behavior between species and evidence of their wave amplitude and phase responses. Modeling analysis will enable the determination of important wave parameters from the data and will indicate the direction to the energy source region. Correlative studies with other geophysical data, with meteorological data, with data from incoherent backscatter radar, with Doppler sounder and ionosonde data will also be utilized to infer source locations and characteristics. The deduced wave parameters will enable the determination of momentum and energy transport fluxes as well.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0026, ELASTICITY OF POLYCRYSTAL AND SINGLE CRYSTAL SPECIMENS OF MINERALS SYNTHESIZED AT HIGH PRESSURES

R.C. Liebermann, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (EAR76-84066)

No unique interpretation of the seismic velocity and density models of the Earth's mantle in terms of composition and mineralogy is yet possible. Part of this ambiguity is due to an insufficient knowledge and understanding of the variation of elasticity with pressure, temperature, composition and phase. This is a project to address the effects of these variables on the elastic properties of minerals. Specifically, polycrystals (dimensions 1

mm or greater) will be hotpressed and single crystals (dimensions 10 mm or greater) will be grown at pressures up to 60 kilobars in solid-media apparatuses and their elastic properties measured on recovery by ultrasonic and Brillouin scattering techniques. The choice of sample composition will be dictated by the need to exhibit potential mantle crystal structures within the pressure range of synthesis. Such studies should enhance our ability to interpret more exactly the compositional and mineralogical nature of the transition zone of the Earth's mantle as delineated by seismological observations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0027, AN INVESTIGATION OF LABORATORY-PRODUCED SOLIDS AND LIQUIDS AS CANDIDATES FOR THE SCATTERING AEROSOLS IN OUTER PLANET ATMOSPHERES

T. Owens, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Science, *Stony Brook, New York* 11790 (NCA 2-760001)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

5.0028, STUDIES OF ROCKET-BORNE PROBES USED IN MEASUREMENTS OF THE MIDDLE ATMOSPHERE

T.M. York, Pennsylvania State University, University Park Campus, Ionosphere Research Lab., *201 Shields Bldg., University Park, Pennsylvania* 16802 (ATM76-81004 A01)

This grant funds a theoretical and laboratory study of rocket-borne ion mobility probes, to help understand the results obtained by these probes.

The three specific problems that will be addressed are: 1. Theoretical studies of electron collection by blunt probes. A new approximate theory has been developed for continuum collection but further detailed studies are needed to complete the analysis and perform comprehensive evaluation of probe data. 2. Theoretical studies of ion collection by a Gerdien condenser probe with an attached UV lamp. The creation, diffusion, and convection of ions from an axial beam must be studied to determine the details of the particle transport in this mobility spectrometer device. 3. Laboratory experimental studies of scaled probe flows. A new type of facility has been developed for testing scaled probes in laboratory flows. This study will consider collisional flows with blunt probes and the ion collection processes in the Gerdien with UV lamp device.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0029, SCIENCE AND APPLICATION TEAM FOR THE LIGHTNING OBSERVATION FROM SPACE DEVELOPMENT PROGRAM

A.A. Few, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (NAS 8-33715)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

5.0030, BASIC RESEARCH PLANNING IN PATTERN RECOGNITION IMAGE PROCESSING

L.F. Guseman, Texas A & M University, College Station Campus, School of Science, Dept. of Mathematics, *College Station, Texas* 77843 (NAS 9-15964)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

5.0031, ALASKAN INCOHERENT SCATTER RADAR INVESTIGATIONS OF THE HIGH-LATITUDE IONOSPHERE

J.R. Doupnik, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (ATM78-05747)

This grant funds over a two-year period the continuation of Utah State University's investigations of the high-latitude ionosphere. These investigations are carried out with the Incoherent Scatter Radar Facility operated in Chatanika, Alaska, by the Stanford Research Institute.

The incoherent scatter radar bounces radio signals off the charged particles (electrons and ions) in the ionosphere, a region located from about 80 to 600 kilometers above the earth's surface. From the characteristics of the radio echoes the density and the velocity of the charged particles may be immediately determined. Additional analysis yields information on the temperatures of the particle species, the magnitude and direction of ionospheric electric fields and currents, and the motion of the neutral atmosphere.

These measurements will be used in studies of related phenomena that range from relatively local to interplanetary in size. At the small end of the scale the fields and currents associated with auroras and the production and effects of precipitating energetic particles will be studied. On a larger scale the structure of the high-latitude ionosphere and the role of electric fields in determining that structure will be examined. Finally, the processes by which the solar wind is linked to the earth's magnetic field will be investigated. Each of these investigations is important in itself; each will also contribute significantly to our understanding of the possible mechanisms through which the sun influences our weather and climate.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0032, COUPLED RADIOACTIVE-CHEMICAL STUDIES OF THE EARTH'S TROPOSPHERE

S.N. Tiwari, Old Dominion University, School of Engineering, Dept. of Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NCC 1-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

5.0033, APPLICATION OF ADVANCED LIDAR TECHNIQUES FOR ATMOSPHERIC REMOTE SENSING

E.C. Kindle, Old Dominion University, School of Sciences & Health Professions, Dept. of Physics & Geophysical Science, *P.O. Box 6173, Norfolk, Virginia* 23508 (NCC 1-28)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

5.0034, ENVIRONMENTAL EFFECTS ON ADVANCED COMPOSITES

J. Unnam, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Metallurgical Engineering, *Blacksburg, Virginia* 24061 (NCC 1-10)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

5.0035, AN EVALUATION OF ENVIRONMENTAL DATA HANDLING IN GEOGRAPHIC INFORMATION SYSTEMS

J.W. Scott, Western Washington University, School of Arts & Sciences, Dept. of Geography, *516 High St., Bellingham, Washington* 98225 (NCA 2-862001)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

5.0036, THE ARCTIC STRATUS EXPERIMENT
G.F. Herma, University of Wisconsin, Madison Campus, Graduate School, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DPP77-23882)

During the summer of 1979, the radiative properties of summer stratus clouds in the Arctic will be measured using an instrumented aircraft (the NCAR Electra) flying out of Point Barrow, Alaska. These data, along with dynamical and cloud microphysical data collected by other researchers cooperating in this study, will be used to determine the role of summer stratus clouds in the Arctic heat balance.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, REGULATION OF NUTRIENT AVAILABILITY AND PLANT NUTRIENT UPTAKE IN CONTROLLED ENVIRONMENTS
A.J. Bloom, University of Alaska, Fairbanks Campus, Graduate School, *Fairbanks, Alaska* 99701 (NCA 2-20902)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0002, STUDIES IN ORIGIN-OF-LIFE RESEARCH SEARCH FOR EXTRA-TERRESTRIAL INTELLIGENCE
C.L. Seeger, California State University & Colleges, San Francisco State University, Graduate School, *1600 Holloway Ave., San Francisco, California* 94132 (NCC 2-32)

SUPPORTED BY U.S National Aeronautics & Space Admin., Ames Research Center

6.0003, EFFECTS OF CENTRIFUGATION ON GONADAL AND ADRENOCORTICAL STEROID IN RATS
R. Kakihana, California State University & Colleges, San Francisco State University, School of Science, Dept. of Biology, *1600 Holloway Ave., San Francisco, California* 94132 (NCC 2-25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, COOPERATIVE RESEARCH ON FLIGHT MANAGEMENT
B. Clark, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCC 2-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, SIMULATION TECHNOLOGY - HUMAN PERFORMANCE IN IN-FLIGHT SIMULATION (ABSTRACT)
B. Clark, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCC 2-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0006, HELICOPTER HUMAN FACTORS
B. Clark, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCC 2-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, A SELF-REPORT METHOD FOR MOTION SICKNESS ASSESSMENT IN THE SQUIRREL MONKEY - ITS USE IN HABITUATION AND SENSORY CONFLICT STUDIES
R. Ginsberg, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCA 2-675002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, PERCEPTUAL PROBLEMS IN AERONAUTICS
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0009, IMPLANTABLE INSTRUMENTATION FOR STUDIES OF BLOOD FLOW DISTRIBUTION
J.D. Meindl, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (NCC 2-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, CARDIOVASCULAR MAGNETIC MEASUREMENTS
D.C. Harrison, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NCC 2-51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0011, BIOMEDICAL TECHNOLOGY TRANSFER
D.C. Harrison, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NCC 2-52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0012, PRIMITIVE PHOTOBIOLOGICAL MECHANISMS OF SALT TRANSPORT
L. Packer, University of California, Berkeley Campus, Graduate School, *2200 University Ave., Berkeley, California* 94720 (NCA 2-50002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0013, AN ANALYSIS OF ANTICIPATED PSYCHOSOCIAL REQUIREMENTS FOR FUTURE SPACE FLIGHT
A.A. Harrison, University of California, Davis Campus, School of Letters & Science, Dept. of Psychology, *Davis, California* 95616 (NCC 2-48)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0014, CHARACTERIZATION OF ESTEROPEPTIDASES IN RAT TISSUES BY GEL ELECTROPHORESIS
A. Parlow, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NCA 2-390001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0015, STUDIES ON THE LOCALIZATION AND INTERCONNECTIONS OF EMETIC TRIGGER ZONES IN THE CENTRAL NERVOUS SYSTEM
R.L. Snyder, University of California, San Francisco Campus, Graduate School, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665003)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0016, ULTRASTRUCTURAL STUDIES OF IONIC TRANSFER THROUGH BONE CELL SHEETS IN ISOLATED PERFUSION CULTURE
C.D. Arnaud, University of California, San Francisco Campus, School of Medicine, Dept. of Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665906)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0017, MECHANISMS OF HORMONE-TISSUE INTERACTIONS IN ALTERED GRAVITY STATES
I. Goldfine, University of California, San Francisco Campus, School of Medicine, Dept. of Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0018, HISTOPATHOLOGICAL CHANGES IN RODENTS CAUSED BY HZE PARTICLE IRRADIATION
E.V. Benton, University of San Francisco, School of Science, Dept. of Physics, *2130 Fulton, San Francisco, California* 94117 (NCC 2-47)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0019, AN ANALYSIS OF ANTICIPATED PSYCHOSOCIAL REQUIREMENTS FOR FUTURE SPACE FLIGHT
F. Rakins, University of Santa Clara, Graduate School, *Santa Clara, California* 95053 (NCC 2-49)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0020, ENZYME-LINKED IMMUNOSORBENT ASSAY (ELISA) FOR DETECTING UPPER RESPIRATORY TRACT INFECTION
L.D. Caren, University of Santa Clara, School of Science, Dept. of Biology, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0021, BIOASSAYABLE GROWTH HORMONE - ISOLATION DEVELOPMENT OF A RADIOIMMUNOASSAY AND VALIDATION OF THE ASSAY
T. Fast, University of Santa Clara, School of Science, Dept. of Biology, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685003)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0022, THE DISTRIBUTION OF OXYGEN SENSITIVITY AMONG BACTERIAL DENITRIFIERS WITH PARTICULAR EMPHASIS ON ITS ECOLOGICAL SIGNIFICANCE
G.A. Tomlinson, University of Santa Clara, School of Science, Dept. of Biology, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685004)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0023, LIFE SCIENCES SHUTTLE INSTRUMENTATION DEVELOPMENT
R.E. Sturm, University of Denver, Graduate School, *2115 S. University Blvd., Denver, Colorado* 80210 (NAS 9-15991)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0024, INVESTIGATION OF THE MECHANICAL PRINCIPLES OF THE BALLISTIC MOTION OF THE LEFT VENTRICLE
G. Ray, Southern University Agricultural & Mechanical College, Baton Rouge Campus, School of Engineering, Dept. of Mechanical Engineering, *Baton Rouge, Louisiana* 70813 (NCC 2-33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0025, BIAXIAL FINITE DEFORMATIONS OF ARTERIAL AND VENOUS SEGMENTS UNDER PLUS OR MINUS GZ ACCELERATION STRESS
X.J. Avula, University of Missouri, Rolla Campus, School of Engineering, Dept. of Engineering Mechanics, *Rolla, Missouri* 65401 (DF055030; AFOSR-79-0107)

AF function - aircrew members operating high performance aircraft such as the F-15 and F-16 are exposed to increasing levels of rapid onset, long duration, repetitive g-forces. Data from USAFSAM and other research facilities indicate that the effects on the cardiopulmonary system may be the limiting factor in pilots' performance in air combat. A good physiological model of the cardiopulmonary system under g-stress is needed to provide human performance modelers the means to optimize combat tactics. Deficiency - the risk of actually exposing humans to high g-stresses to gain some knowledge of the cardiovascular system's response is prohibitive. The alternative is to develop a mathematical model and investigate its response to external excitations that are representative of various aircraft and spacecraft maneuvers. Objective - the objective of the proposed research is to determine radial and axial deformations of arterial and venous segments under dynamic fluid loads caused by blood pooling during GZ acceleration stresses of the aerospace environment. In an earlier model proposed by the investigator, only radial deformations were considered. Although it is reasonable to assume that only radial deformations are significant as a result of blood vessels being tethered to surrounding tissue, it is valid in the femoral-tibial region of the body where the blood vessels are embedded in a stiff muscular mass and under moderate accelerations. In the thoracic region, where the tissues surrounding the major vessels are relatively soft and accommodating, axial deformations of blood vessels can be significant. Also, under very high GZ stresses, even lower body blood vessels will deform in the axial direction. How research contributes - in designing a mathematical model of the cardiovascular system under acceleration stress, consideration of the large biaxial deformations of the blood vessels would contribute to the accuracy of the model.

In the proposed research, both radial and axial deformations of the arterial and venous segments under dynamic fluid loads will be treated from the standpoint of the large elastic deformation theory. The governing, nonlinear, partial differential equations will be solved numerically, and the blood pooling capacity of the arteries and veins will be determined for various realistic acceleration profiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0026, ASPECTS OF VISUAL SEARCH ACTIVITY RELATED TO ATTENTIONAL PROCESSES AND SKILL DEVELOPMENT
J.A. Stern, Washington University, School of Arts & Sciences, Dept. of Psychology, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF055400; F49620-79-C-0089)

AF function - flying an aircraft involves critical decision-making based on visual information. Inasmuch as the eye is the sensing system for visual information, it would be profitable to analyze eye movements recorded in operational settings. Defi-

ciency - adequate data sources are not yet available which allow making inferences about the adequacy of a pilot's visual search activity and about state-dependent changes in a pilot's ability to take in and process visual information. Both adequacy of visual search in the alert pilot and change in the state of alertness affect performance. Objective - the research will identify momentary (phasic) and tonic changes in alertness and lapses of attention using eye movement parameters and relate periods of altered state to changes in performance, both decision-making and motor response. How research contributes - since operation of complex instrumentation involves periods of scanning and anticipation, measures like parameters of eye movements, which can be used to assess change of state during these periods, are more useful in operational conditions than measures of the outcome of performance. Defining periods during which performance decrements can be expected on the basis of the proposed ocular measures including eye blinks may be a more sensitive and useful approach since such measures can be obtained under operational conditions rather than being restricted to the laboratory, and allow corrective action to be taken before performance decrements significantly impair performance.

Three experiments will be conducted: (1) Determine the relationship between change in oculomotor indicants of fatigue and change in performance measures such as whether increased eye blink closure duration during one period is predictive of performance decrements in a subsequent period; (2) based on results in experiment I, determine the precise procedure using eye movement parameters to predict and reduce drop-outs in performance; and (3) further examine the test-retest reliability of the resulting ocular measures as indicants of fatigue in order to increase the generalizability of results. In experiments I and II a complex divided attention task simulating demands made on Air Force personnel will be performed. Experiment III will use a reading task, which is a well-practiced task allowing comparison of the test-retest reliability of the oculomotor indices. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0027, CONTROLLED ECOLOGY LIFE SUPPORT SYSTEM WORKSHOPS - THE BIOLOGICAL PROBLEMS AND EXPERIMENTAL PROGRAMS

B. Moore, University System of New Hampshire, University of New Hampshire, School of Technology, Dept. of Mathematical & Computer Science, *James Hall, Durham, New Hampshire* 03824 (NCC 2-27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0028, TO DETERMINE THE RHYTHMICITY OF CIRCULATING CATECHOLAMINES IN NORMAL AND CHRONICALLY BED-RESTED SUBJECTS

B.H. Natelson, College of Medicine & Dentistry of New Jersey, New Jersey Medical School, School of Medicine, Dept. of Neurosciences, *100 Bergen St., Newark, New Jersey* 07103 (NCC 2-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0029, DETECTION, RECOGNITION, AND IDENTIFICATION OF TARGETS IN CIG DISPLAYS

M. Lemay, Montclair State College, School of Science & Mathematics, Dept. of Psychology, *Upper Montclair, New Jersey* 07043 (DF054920; AFOSR-79-0103)

AF function - this research supports the Air Force Flying Training Program, particularly simulator design efforts for electro-optical display training. Deficiency - new generation flight simulators are being equipped with computer image generation (CIG) displays designed to simulate electro-optical cockpit displays (infrared and low light level TV). Because CIG systems lack adequate capacity to reproduce all real world cues, it is necessary to know what to simulate to achieve effective training. The amount of display complexity needed to achieve this result is unknown. Objective - this research will attempt to determine the amount of display complexity needed to train three basic tasks using electro-optical displays - detection, recognition and identification of objects on the ground. How research contributes - the results of this research will add information to the knowledge base concerned with CIG simulation of electro-optical displays. It will impact the design of such simulations.

Three experiments will be conducted to estimate the minimum amount of display complexity necessary to perform detection, recognition, and identification of ground targets. Targets will be imbedded in a CIG scene created by scientists at AFHRL/AS, Wright-Patterson AFB, Ohio. The main independent variable will be the complexity of the scene. Targets will include a hangar, storage tank, water tower, house, office building and aircraft on the ground.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0030, THE INTERACTION OF METAL IONS AND NUCLEOTIDES - POSSIBLE MECHANISMS FOR THE ADSORPTION OF NUCLEOTIDES ON HOMOIONIC BENTONITE CLAYS

G.H. Loew, Rockefeller University, Lab. of Genetics, *66th & York Ave., New York, New York* 10021 (NCA 2-630901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0031, CHARACTERIZATION OF NON-BONDING MOLECULAR COMPLEXES BY EMPIRICAL ENERGY METHODS COUPLED TO THE AMES GRAPHICS SYSTEM

G.H. Loew, Rockefeller University, Lab. of Genetics, *66th & York Ave., New York, New York* 10021 (NCA 2-630902)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0032, NEUROSPORA EXPERIMENT

F.M. Sulzman, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (NAS 9-15975)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0033, MOTION SICKNESS IN THE CAT - CHEMICAL ASPECTS

G.H. Crampton, Wright State University, School of Science & Engineering, Dept. of Psychology, *Dayton, Ohio* 45431 (NCA 2-875002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0034, INVESTIGATION OF INHIBITION BY CAMP OF LYMPHOCYTE PLASMA MEMBRANE ENDOGENOUS PHOSPHORYLATION

R.E. Nordquist, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Anatomical Sciences, *Box 26901, Oklahoma City, Oklahoma* 73190 (NAS 9-15994)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0035, CENTRAL AND PERIPHERAL MECHANISMS UNDERLYING CARDIOVASCULAR DECONDITIONING IN THE UNANESTHETIZED PRIMATE

H.L. Stone, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Physiological & Biophysics, *Box 26901, Oklahoma City, Oklahoma* 73190 (NCC 2-24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0036, COUNTER-CURRENT DISTRIBUTION OF BIOLOGIC CELLS

D.E. Brooks, Oregon State Higher Education System, University of Oregon Health Sciences Center, School of Medicine, Dept. of Neurology, *3181 S.W. Sam Jackson Park Rd., Portland, Oregon* 97201 (NAS 8-33575)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

6.0037, ITEM DEVELOPMENT FOR AF READING ABILITIES TEST

D.A. Frucher, Educational Development Corp., *Austin, Texas* (DF233450; F33615-78-C-0038)

To develop items for additional forms of two levels of a reading test designed for use in classification of AF personnel.

360 items each of two subtest types and 600 items of a third type will be produced by the contractor in order to obtain 440 acceptable items, half for one level of the test and half for the other. The contractor will prepare a specimen set of 10 items of each subtype which will be reviewed and approved before preparation of remaining items. Subsequent groups of items will be placed in experimental booklets. Booklets will be administered to AF personnel, and AFHRL will also accomplish item analyses. Acceptable items will be placed on index cards as final products.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0038, INSTRUCTOR/SIMULATOR INTERFACE DESIGN STUDY

A. Lippay, Canadian Commercial Corp., *Ottawa, Ontario, Canada* (DF228520; F33615-78-C-0006)

To develop and evaluate new design concepts for instructor interface in a flight simulator. The purpose is to provide a method of delineating instructional tasks to support analytic design and evaluation of interface methods, identify advanced methods as candidates for future systems, develop objective techniques for evaluating these methods, and apply the techniques to derive new design concepts for the instructor interface portion of future simulators.

A technique will be developed to delineate instructional tasks in a way which facilitates the design of interface concepts and equipment. Within the delineation framework so developed, a representative instructional task will be defined. A survey of interface methods will be conducted, and methods of promise will be matched with the instructional tasks for which they are best suited. Techniques will be derived for objectively evaluating interface methods and will be applied to several methods identified as best candidates. Results will be applied to develop advanced design concepts for instructor interface. Major milestones - delineation of instructor tasks (4 MAC), survey of interface methods (6 MAC), develop objective evaluation methods (10 MAC) and develop advanced design concepts (13 MAC).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NUMERICAL SOLUTION OF STEADY NAVIER-STOKES EQUATIONS

R.S. Schreiber, Stanford University, Graduate School, *Stanford, California* 94305 (NCA 2-745002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0002, NUMERICAL SOLUTION OF TRANSONIC FLOW PROBLEMS

S. Osher, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NCA 2-390002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0003, INTERCOMMUNICATIONS IN REAL-TIME, REDUNDANT, DISTRIBUTED COMPUTING SYSTEMS

H. Zanger, City University of New York, Queensborough Community College, Undergraduate School, Dept. of Electrical Technology, *56th & Springfield Aves., Bayside, New York* 11364 (NCA 2-625001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THEORETICAL ASTROPHYSICS RESEARCH

P. Goldreich, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST78-21453)

Investigations related to a variety of outstanding astrophysical problems will be pursued. These include the excitation of density waves in galaxies by the potential of a central bar, the evolution of satellite orbits due to resonant tides raised in circumplanetary disks, the dynamics of supersonic turbulence in molecular clouds, the relation between quasar absorption lines and the clustering of galaxies, and the origin of the Kirkwood gaps in the asteroid belt.

This is a continuation of work being done under AST-7624281A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0002, NUCLEAR PHYSICS AND RELATED RESEARCH IN ASTROPHYSICS, GEOPHYSICS AND TECHNOLOGY

T.A. Tombrello, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (PHY76-83685 A01)

The research to be supported by this grant is in nuclear physics and related fields. It will be carried out in the Kellogg Radiation Laboratory, which has a history of significant contributions in these areas of research. The program covers many aspects of nuclear phenomena, particularly as they relate to stellar processes and how the geological and astronomical record of elemental and isotopic abundances can be analyzed to elucidate their production mechanisms. The research activities involve nuclear physics and experimental nuclear astrophysics, theoretical nuclear astrophysics, nuclear geophysics and planetary science, atomic physics, and applied nuclear physics. These areas are closely related, and there is considerable interaction between the projects.

This research is a continuation of that currently supported by Foundation grant PHY76-02724 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0003, HIGH RESOLUTION TRANSMISSION ELECTRON MICROSCOPE STUDIES OF SMALL METAL CRYSTALLITES AND SURFACES

K.H. Heinemann, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (NCC 2-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0004, AN INVESTIGATION OF THE PERFORMANCE, APPLICATION POTENTIAL, AND INHERENT LIMITATIONS OF THE NEW MICROANALYTICAL INSTRUMENT

K.H. Heinemann, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (NCC 2-46)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0005, ULTRA-HIGH RESOLUTION MOLECULAR BEAM CARS SPECTROSCOPY WITH APPLICATIONS TO PLANETARY ATMOSPHERIC MOLECULES

R.L. Byer, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (NCC 2-50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0006, THEORETICAL HIGH ENERGY PHYSICS

J.M. Cornwall, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY7821502)

Research will be done in theoretical physics to further our understanding of the elementary particles, of quantum field theory, and of many-body theory. Topics will include: 1) Broken chiral invariance; 2) Confinement and quantum chromodynamics; 3) Dynamical symmetry breaking; 4) Gauge theory, applied especially to the strong interactions; 5) Relativistic many-body theory; 6) Descriptions of the weak interactions alternative to the Salam-Weinberg-GIM model; 7) Neutral currents; 8) Phenomenology; 9) Supersymmetry.

This work is a continuation of that currently supported under NSF Grant PHY76-23467 A02, and this award will be the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0007, THE ELECTRIC CURRENT STRUCTURE OF THE MAGNETOSPHERE AND HELIOSPHERE

H. Alfven, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (ATM77-12866 A01)

This grant continues studies of the current system in natural plasmas, paying attention to those effects which produce nonideal plasma behavior, examination of the conditions for the production of charge double layers, and the collapse of volume currents into sheets and filaments. These phenomena will be related to magnetospheric observations.

A separate but related study of filamentation in the solar corona and chromosphere, in the solar wind, and in the tails of comets will be undertaken. The overall aim is to seek the consequences of these effects on solar-terrestrial relations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0008, SPECTROSCOPY OF CONDENSED MATTER SYSTEMS

S. Schultz, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR77-14659 A01)

This research program is a continuation and extension of work initiated under grant DMR-7424361. The relatively new tool of fluctuation spectroscopy will be used to aid in a determination of the dynamical properties of a variety of condensed matter systems which are extremely difficult to measure by alternative techniques. Applications range from the rate constants in simple chemical kinetics to the conformational chemisorption, and to 1/f noise. Another topic of this research program will be the investigation of crystallization processes. Experiments relating to the EPR and ENDOR of biomolecules will be carried out also.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, INNER-SHELL EXCITATIONS IN HEAVY ION-ATOM COLLISIONS

Q.C. Kessel, University of Connecticut, Storrs Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Storrs, Connecticut* 06268 (PHY78-06723)

A comprehensive experimental study of the excitation of inner electron shells in heavy atoms during high-energy ion-atom collisions will continue. This investigation will shed light on the quasi-molecular processes (in particular, curve crossing phenomena) which occur at small internuclear separations. These small internuclear separations can only be achieved by high-energy collision processes. The techniques which have been applied in the investigations include both coincidence and scattered particle measurements of the inelastic energy loss, the determination of scattered charge states and the measurement of relative cross-sections for X-ray emission. New experiments will provide detailed information on the couplings which give rise to diabetic molecular orbitals in very heavy ion-atom collisions. The results will be compared with the model of Fano and Lichten, with extensions of this model by Barat, Lichten, Eichler and co-workers, and with predictions of recent theoretical work by Schmid and Garcia.

This is a continuation of work currently supported by NSF Grant PHY76-10352 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0010, SELECTIVE PHOTOEXCITATION OF MOLECULES

W.C. Rhodes, State University System of Florida, Florida State University, Inst. of Molecular Biophysics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (CHE76-80292 A01)

These studies deal with the nature of time-dependent radiative and radiationless processes in molecules, which are associated with absorption of light having various spectral properties (in particular those of laser pulses). There are two major areas. The first deals with the excitation of molecules having dense manifolds of excited states, as for aromatic hydrocarbons. Specific topics to be studied are (1) the composition of the prepared excited state in terms of both molecular eigenstates and the more conventional Born-Oppenheimer state; (2) the extent to which the light acts as a projector on regions of the absorption spectrum; (3) the analysis of the absorption spectrum in terms of the interaction density (effective density of states) function and the associated excited state coupling schemes; and (4) spectroscopic criteria for oscillatory versus dissipative time-dependent behavior of excited states. The second major area is concerned with the coherent, nonlinear response of molecules to laser light. Particular focus will be placed on the coherent nature of vibrational excitation associated with infrared laser photochemistry being studied in other laboratories.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0011, MOLECULAR PHYSICS AND CHEMISTRY BASIC TO ENVIRONMENTAL RESEARCH

J.L. Dehmer, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (ANL 67102; ERDA RK-02-04-01)

The underlying concept of this theoretical program is to elucidate the fundamental electronic properties of pollutant molecules (and related molecules) and thereby to contribute to the sound understanding of their physical and chemical interactions in man's environment.

SUPPORTED BY U.S. Dept. of Energy

8.0012, ELECTRONIC STRUCTURE AND TRANSPORT PROPERTIES OF SEMICONDUCTING POLYMERS

A.B. Kunz, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DF056370; F49620-79-C-0215)

AF function - this proposed research primarily falls in the 7.4 research objectives which deal with the theoretical and experimental investigations of electronic, optical, acoustic, thermal, magnetic and conducting properties of materials to evolve new and improved device concepts. In particular, the theoretical investigations of excitonic superconductors which have high temperature transitions will lead to a quantum jump forward in the development of electronic devices. Deficiency - a wide range of basic research efforts that support the development of devices and device concepts are needed for the application of contemporary electronic electromagnetic technology in the operational Air Force. Most studies of superconductors have investigated low transition temperature systems. Objective - the major emphasis is to investigate the excitonic mechanism in the most likely systems to be useful to AF needs. The logical candidates would include the semiconducting polymers. Contribution - this research is a part of a comprehensive program in statistical mechanics to study phase transitions.

The main goal of this research is to produce a series of electronic band studies for silicon-based polymers and if time permits carbon-based polymers. These investigations will be studied to identify these polymers or classes of polymers most likely to favor the establishment of excitonic mechanisms for superconductivity. Investigations of donor levels caused by replacing polymer subgroups with alternate ones and mechanisms of ionizing these donors into the conduction band will be done. The coupling of these donor electrons to the exciton field of the polymer is to be computed and estimates of possible superconducting transition temperatures obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0013, X-RAY STUDIES OF SOLID-STATE PROBE TIES - VALENCE CHARGE DENSITIES - ACOUSTOELECTRICALLY AMPLIFIED PHONONS

R. Colella, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (PRF 0228)

X-ray diffraction techniques are being applied for investigating nonequilibrium phonons in crystals produced by AcoustoElectric (A.E.) amplification. Intense phonon beams of one well defined branch (Fast Transverse) can be generated in crystals by means of the A.E. effect, with frequencies of the order of 10 to the 9th power Hz. The time evolution of the acoustic flux generated by the A.E. effect has been investigated. An elaborate technique for recording diffraction patterns in the time-resolved mode with a resolution of 0.5 micron per second has been recently implemented. Experiments are in progress for investigating lifetimes of A.E. phonons and nonlinear interaction processes during their decay. Our data clearly show the effect of frequency down-shift when phonon domains bounce off the walls and reverse their direction of propagation. Work is in progress to repeat in the time-resolved mode some previous experiments on anomalous transmission of X-rays in which forbidden modes were observed. The idea is to see whether or not these forbidden modes arise from bouncing off the walls, or whether they are present in the primary propagating domain.

SUPPORTED BY Purdue Research Foundation

8.0014, THEORIES OF QUARKS AND LEPTONS

T. Cheng, University of Missouri, St. Louis Campus, School of Arts & Sciences, Dept. of Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (PHY78-08427)

The proposed work is in the area of theoretical physics, and suggests study of various problems in elementary particle interactions. It is becoming increasingly plausible that modern gauge theories provide the correct theoretical framework in which to describe such elementary particle reactions. The present work will study the possibility of a natural link between dynamics and various approximate symmetries observed in nature using some particular features of the fermion mass matrices-Majorana mass terms which violate lepton number conservation; non-diagonal terms which bring about fermion- and lepton-mixing, etc. The possibilities of massive neutrinos and massless u-quarks will also be examined.

This is a continuation of research currently supported under NSF grant PHY76-09798 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0015, AURORAL ELECTRON INTERACTIONS

R.L. Kaufmann, University System of New Hampshire, University of New Hampshire, School of Technology, Dept. of Physics, *James Hall, Durham, New Hampshire* 03824 (ATM77-01014)

This grant will extend the use of magnetometer and energetic particle data to investigate several problems associated with auroral electron acceleration and magnetohydrodynamic wave generation. A number of university groups will be working on various aspects of these topics, particularly during the International Magnetospheric Study period. The effort supported here will make a significant contribution to this worldwide effort. First priority is to fully utilize Dr. Arnoldy's rocket measurements of the auroral electron distribution function. These data will allow a study of the stability properties of the auroral plasma at rocket altitudes. When the plasma is unstable, it is possible to determine which wave mode should grow most rapidly. More frequently the plasma is just barely stable. At such times, a similar analysis will show which wave modes were unstable at higher altitudes. The waves presumably modified the electron distribution function through nonlinear processes until it reached the observed marginally stable state. These calculations should provide a good test of several aspects of plasma stability theory. In this sense, the work will represent one important step in attaining the goal of utilizing the magnetosphere as a plasma physics laboratory. The overall aim is to understand auroral precipitation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0016, PROBLEMS IN RENORMALIZATION

E.R. Speer, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Mathematics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (PHY77-02277 A01)

Research will be done in theoretical physics to further our understanding of the elementary particles. Work will focus on several problems connected with renormalization in quantum field theory. Quantum field theory is the theoretical framework which is the basis for practically all our efforts to understand elementary particles. Renormalization is a mathematical technique which greatly enhances our ability to use theory. The problems to be addressed here include definition of distributions in complex dimension, light cone expansions, the application of analytic renormalization methods to constructive quantum field theory, and the characterization of those renormalizations which alter minimally the structure of the field theory to which they are applied.

This work is a continuation of that currently supported under NSF grant PHY77-02277.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0017, ENERGY TRANSFER MECHANISMS IN MATERIALS STUDIED BY ULTRAFAST LASER TECHNIQUES

R.R. Alfano, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (ENG76-80212)

A research program will investigate intermolecular energy transfer between donor and acceptor molecules in liquids and solids using ultrafast laser spectroscopy. The program encompasses a systematic study of measuring the fluorescence and absorption kinetics from the different molecular components after optical excitation of one molecular component by picosecond laser pulses. Fluorescence kinetics from upper singlet states will be studied. Organic dyes mixtures in solvent and doped organic crystals at different concentration of donors and acceptor molecules will be investigated to determine the mechanisms for energy migration between donor molecules and between donor and acceptor molecules. The temperature and viscosity dependence will be studied to yield this information. The energy transfer along long donor molecule chains will be studied. The characterization of energy migration of excited states in solids and liquids is important in the understanding on how to transfer optical energy to different spectral regions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Chemical & Process Engineering

8.0018, RESONANCES UTILIZING MULTIPARTICLE SPECTROMETERS

S.J. Lindenbaum, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (PHY77-20225)

Investigations of the production of resonance states in hadron-proton collisions will be conducted in collaboration with research groups from Brookhaven National Laboratory, Brandeis, Massachusetts, and Cincinnati using the multiparticle spectrometer at the Brookhaven Alternating Gradient Synchrotron.

The program consists of two parts: 1. Search for charm particle production. This experiment, if successful, would demonstrate associated charm particle production and would show that selection rules for charm and strangeness quantum numbers are similar. Fifteen to 20 GeV pi meson interactions in hydrogen are studied. 2. Search for additional conventional resonances in the 1 to 3 GeV mass range. This experiment explores with high statistics the many particle final states in the energy range of 1 to 3 GeV produced in 6 GeV K-interactions in hydrogen.

This work represents a continuation of that currently supported by Foundation grant PHY73-04384 A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, ELECTRON SPECTROSCOPY OF NEGATIVE IONS

J.S. Risley, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (PHY78-02384)

This study in atomic physics is concerned with the fundamental structure of autodetaching, excited states of negative ions, using the ion-atom collisional technique of exciting the negative ion state and electron spectroscopy to detect the decay. A new experimental apparatus is planned which will allow us to measure, with higher accuracy than any previous attempt, the positions and widths for many autodetaching states of negative ions (most importantly H) and autoionizing states of atoms and positive ions through the use of high-resolution spectrometers whose surfaces will be coated with polycrystalline molybdenum coupled with a calibration scheme using ultraviolet laser-produced photoelectrons. Intensity measurements of some lines will yield new information about the branching ratios or relative transition probabilities for the excited states.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0020, THEORETICAL ELEMENTARY PARTICLE PHYSICS

R.W. Brown, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (PHY78-08883)

Of paramount importance in element particle theory is the question of the existence of the intermediate vector bosons, the carriers of the weak interaction force. Whether or not interactions other than quantum electrodynamics can be described via a field theory is at the heart of the new gauge theories. The success and self-consistency of these gauge theories in turn promises that weak bosons ought to exist and that they should have masses in the 30 to 100 GeV/c2 range, a range which can be explored with the next generation of high-energy accelerators.

The updating and extension of theoretical predictions for the production rates relevant to the very high energies of the future is thus quite important at this time and is the subject of the proposed research.

This work is a continuation of that currently supported under NSF grant PHY76-12245 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, THEORETICAL STUDIES ON VARIOUS COMPOSITE PARTICLE SYSTEMS

L.L. Foldy, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (PHY78-11629)

The work is in the field of theoretical physics, with emphasis on attempting to understand the interactions of elementary particles with nuclei. Particular projects which will be studied are in the areas of: A) Multiple Scattering Theory - 1) target particle binding effects; 2) intrinsic multiple scattering. B) Separable and Non-local Potentials. C) Coulomb Lattices. D) Relativistic Particle Systems. E) Miscellaneous Problems. 1) Gauge variance of observables; 2) Phenomenology of exchange currents in nuclei; 3) Ramsauer effect; 4) Quantum mechanics on various manifolds; 5) Properties of special classes of random matrices.

This work is a continuation of that currently supported under NSF grant PHY76-00299 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0022, INVERSE SCATTERING - IONOSPHERIC STRUCTURE DETERMINATION

J.M. Cohen, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DF055770; F49620-79-C-0127)

AF function - radio communication and control. Opportunity - a newly developed method for data processing seems applicable to ionospheric probing. Objective - real-time measurement of F layer irregularities. How work contributes - layering characteristics of ionosphere will aid development of optimized modulation and diversity schemes for propagating radio waves.

Present ray-based algorithms for ionospheric probing give approximate information only about the near side of peaks in index of refraction. Newly developed wave-based inverse scattering techniques seem capable of determining the far side of the peak as well. Amplitude and phase data versus frequency for vertical propagation will be obtained on a quiet day near the magnetic equator. A definite variational principle for the Gelfand Levitan equation will be used to construct and obtain error bounds for the variation of index refraction in the F layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0023, MULTICOLOR LIDAR SYSTEM RESEARCH

G.E. Copeland, Old Dominion University, School of Sciences & Health Professions, Dept. of Physics & Geophysical Science, *P.O. Box 6173, Norfolk, Virginia* 23508 (NCC 1-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0024, PROPERTIES OF LIQUID HELIUM FOUR

G.B. Hess, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR78-10778)

By studying the amplitude dependence of the resonant frequency of a Helmholtz resonator in the regime of vortex-free superfluid flow, the experimental observation has been made of the dependence of the superfluid density on the difference between the superfluid and normal fluid velocity. A systematic study of this dependence will be made, with emphasis on the region near the transition temperature where there are problems with the theory of the superfluid density. This work is important for understanding the hydrodynamics of quantum fluids.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, QUANTUM THEORY OF REACTIVE, DISSOCIATIVE AND INELASTIC MOLECULAR SCATTERING

K. Tang, Pacific Lutheran University, School of Arts & Sciences, Dept. of Physics, *P.O. Box 2068, Tacoma, Washington* 98447 (CHE78-09808)

Professor Tang's grant is for research in the quantum chemical area of atom-molecule scattering. The fundamental process occurring in chemical reactions is the collision between atoms and/or molecules of reagents, with subsequent rearrangement of chemical bonds to form products. Tang's group will seek to develop a polarized target coupling method for three-dimensional reactive, dissociative, and inelastic molecular scattering. This work will be an extension of the adiabatic distorted wave model already developed by Tang and others. By relaxing the adiabatic assumption, it will become possible to treat reactive scattering processes with small or no activation barriers. Convergence of results will be tested in a systematic way, and formal aspects of the theory will be studied. Attention will be focussed on reactions involving hydrogen isotopes, because of their fundamental theoretical interest, and on reactions involving hydrogen halides, because of their importance in laser applications. Calculations on cross-sections of ion-molecule collisions will be carried out in order to shed light on the process of vibrational enhancement of reaction rates. Similar techniques will be used to investigate ways to predict the outcome of dissociative scattering processes, as well as to develop efficient quantum methods for calculating inelastic cross-sections for vibrational-translational-rotational energy transfer.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0026, STUDIES ON BIOLOGICAL SYSTEMS WITH EXTENDED X-RAY ABSORPTION FINE STRUCTURE

E.A. Stern, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (OCE77-02872 A01)

The atomic structure of several biological systems will be studied using the extended X-ray absorption fine structure (EXAFS) technique. The systems chosen are ones which have current biological interest and are particularly suited for analysis by EXAFS. By such analysis it is hoped to answer questions concerning these systems that would be difficult if not impossible to answer otherwise. EXAFS can determine the atomic arrangement in the vicinity of a given type of atom, and can do so whether the sample has long range order or not. EXAFS will be applied to metalloproteins to study the environment of the metal as a function of the state of the protein. Such EXAFS studies can be made in configurations more closely approximating the natural state than can be done with conventional crystallography. Among the proposed proteins to be studied are rubredoxin, cytochrome-c, photosynthetic reaction center, carboxypeptidase A, and blood coagulation factors.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Physiology Cellular & Molecular Biology

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, ANALYSIS OF LAND USE PRACTICES AND POLICIES FROM LANDSAT DATA

C.W. Pannell, University of Georgia, School of Liberal Arts, Dept. of Geography, *Athens, Georgia* 30601 (SOC77-27701)

Information related to land use/land development projects of modern China is largely limited to government and visitor reports which seldom indicate spatial distributions or provide solid data by which the success (or failure) of planning policies can be measured. This research will employ recent LANDSAT-1 and -2 satellite image data in conjunction with supplementary information to map, analyze and compare the urban and rural land use patterns in seven selected regions of China known to have undergone significant change since 1949. Specifically, the study areas include: (a) Northeast and Borderlands; (b) North China Plain; (c) Huang Ho Basin; (d) Central Yangtze and Lakes Basin; (e) Pearl River Delta; (f) Sinkiang; and (g) Tibet. LANDSAT data and supplementary maps, photographs and reports are available for these study areas and previous investigations by the authors have demonstrated the feasibility of conducting regional land use studies of China from satellite data. It is anticipated that the regional studies and interregional comparisons will permit an objective assessment of Chinese planning goals and achievements.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Social & Economic Science

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, DIRECT DETERMINATIONS OF THE DYNAMICAL STRUCTURE AND CHEMICAL COMPOSITIONS OF LOCAL GROUP ELLIPTICAL GALAXIES

H.C. Ford, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (AST76-21312 A01)

The isolation and study of planetary nebulae are the only present means of directly determining the characteristics of the old stellar populations in galaxies of the Local Group. These characteristics include chemical composition (which gives data on nucleosynthesis in sequential generations of stars) and kinematics (which allows a detailed investigation of the dynamical structure of the galaxies in which the planetaries are found). Precision coordinates for 370 planetary nebulae in the Andromeda galaxy and its companions have been determined. Radial velocities of planetaries in M31 will be used to investigate the dynamical structure of its nuclear bulge. Reduction and analysis of radial velocities already obtained in M32, NGC 205, and M31 will be carried out. A novel technique of using a temperature and tilt controlled 1.5 angstrom bandpass interference filter to take velocity modulated photographs will be used to determine the radial velocities of large numbers of planetaries near and to within 15 parsecs of the nucleus of M31. The Kitt Peak National Observatory (KPNO) Image Tube Image Dissector Scanner on the Mayall 4-m telescope will be used to make spectrophotometric observations of planetary nebulae in NGC 147, M32, and NGC 205. The observations will allow the first direct chemical composition determinations in these galaxies and the data on the abundances will be fundamental for understanding metal enrichment during the formation of galaxies.

This is a continuation of research done under grant AST 76-21312.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, COMPARISON OF CALCULATED AND OBSERVED PROPERTIES OF COLLAPSING PROTOSTELLAR GAS CLOUDS

P.H. Bodenheimer, University of California, Santa Cruz Campus, Graduate School, Dept. of Astronomy & Astrophysics, *Santa Cruz, California* 95060 (NCA 2-690001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0003, AN OBSERVATIONAL INVESTIGATION OF THE NATURE AND EVOLUTIONARY STATUS OF THE RS CANUM VENATICORUM ECLIPSING BINARY STARS

F.B. Wood, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Astronomy, *208 Tigert Hall, Gainesville, Florida* 32601 (AST76-17591 A01)

The RS Canum Venaticorum eclipsing binary stars present many interesting problems relative both to stellar structure and to stellar and binary evolution. A program of continued systematic observation of the light curves of these stars will be carried out. Emphasis will be placed on understanding the structure and evolutionary status of these stars by carefully analyzing light curves and the changes in these light curves. Photoelectric photometry will be carried out using the 18- and 30-inch telescopes of Rosemary Hill Observatory (University of Florida) and the 24-inch telescopes of Mount John University Observatory (Universities of Canterbury, Pennsylvania, and Florida) in New Zealand. A spectroscopic survey for new examples of the class in the southern hemisphere will be undertaken at Mount John.

Prior support was under NSF Grant AST 76-17591.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0004, MAUNA KEA OBSERVATORY 2.25M TELESCOPE CONTROL SYSTEM

T.B. McCord, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (AST76-81951 A02)

This grant will provide funds for completion of a new control system for the Mauna Kea Observatory of the University of Hawaii. The 88-inch telescope was designed and built in the 1960's and was delivered to the Institute of Astronomy of the University of Hawaii in 1970. The telescope has been in constant use since installation and is mechanically and optically sound. There have, however, been continuing problems with the telescope's electrical and electronic systems. Observing techniques and technology have advanced considerably since the telescope was designed, and the original design is now obsolete. It is now time to rebuild the telescope's electrical and electronic systems in order to make efficient use of this facility.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0005, STUDIES OF NEARBY LUMINOUS STARS IN GALAXIES

R.M. Humphreys, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Depts. of Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (AST78-18398)

In recent years, the most luminous supergiants have become important steps in the determination of the extragalactic distance scale. However, very little fundamental information is available for these important stars, particularly outside our own galaxy. The primary purpose of this research is to obtain basic data, including spectra, for classification and photometry of individual stars in the Local Group galaxies. These observations have application to a number of current problems, including the cosmic distance scale and the progress of stellar evolution in different galaxies. These and other questions will be studied. In addition to observations of individual stars in the nearest galaxies, some aspects of the properties of the Population I stars such as the blue to red supergiant ratio can be studied in more distant spirals.

This research program is a continuation of AST76-09082A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0006, ANALYSIS OF SOLAR WIND VELOCITY - INTERNATIONAL SOLAR POLAR MISSION

E.P. Moore, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (NCA 5-81)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0007, STUDIES OF MAGNETIC PECULIAR A STARS

S.J. Adelman, Citadel Military College of South Carolina, Graduate School, *Charleston, South Carolina* 29409 (AST78-25395)

This research will be concerned with observational and theoretical studies of the sharp-lined magnetic Ap stars. These stars are known to have large surface magnetic fields and peculiar chemical abundances. Spectroscopic and spectrophotometric observations of these stars will be used for line identifications and abundance analysis studies. A study will be made of how magnetic fields in these stars affect the observed properties of the stars. Models of chemically inhomogenous atmospheres will be computed and the observational predictions of such models will be compared with actual observations. The evolution of an Ap star will be computed in order to determine the physical parameters that affect the atmospheres of these stars.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0008, RAPID OPTICAL VARIATIONS FROM COMPACT STARS

R.E. Nather, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-23882 A01)

A program of observations of rapid periodic luminosity variations in white dwarfs will be extended to include other aspects of rapid optical variations from compact objects. Photometric observations will be made of non-periodic variations (with time scales between a few milliseconds and a few minutes) of white dwarf stars and their accretion disks in nova and novalike variables. Observations will also be made of the periodic optical variations produced by neutron stars in radio pulsars and binary X-ray pulsars. The observational techniques will be extended to include high-speed spectroscopy as well as high-speed photometry. These observations will be carried out in order to obtain information on the observational characteristics of the rapid optical variations of these objects, on the physical mechanism producing the rapid variations, and on the structure of the compact objects.

This is a continuation of work previously supported under NSF Grant AST 76-23882.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0009, INFRARED STUDIES OF INTERSTELLAR AND CIRCUMSTELLAR MATERIALS

J.A. Hackwell, University of Wyoming, School of Arts & Sciences, Dept. of Astronomy, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (AST77-07505 A01)

The composition and distribution of dust in space and the effect on the dust of its environment, for example, the radiation field, the gas density and the degree of ionization, will be studied using infrared astronomy techniques. The goal is to determine to what extent the dust observed in ionized hydrogen

best copy available

(HII) regions, in 'cold' interstellar space, and around late-type stars is related.

Dust in HII regions will be studied by making maps in the 8-13 micron and 16-25 micron spectral regions using array spectrometer systems developed at Wyoming and mounted on the University of Wyoming's 2.3-meter (92-inch) infrared telescope. Infrared line observations of HII regions will be made, particularly in heavily observed regions, to determine excitation conditions in the nebula. An indium-antimonide (InSb) system will be used to make sensitive 1-5 micron observations of line strengths and free-free emission in selected regions. The observations of dust in HII regions will be compared with measurements of infrared interstellar absorption bands and with spectral features observed in late-type stars and other heavily obscured objects.

The scheduling flexibility of the 2.3-m telescope will allow the study of dust formation in such transient events as novae when they occur. These studies will help us to understand dust formation mechanisms in other objects.

This is a continuation of work previously supported by NSF grant AST77-07505.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

GENERAL

11.0001, SUPPORT OF CONFERENCE PLANNING FOR INTERNATIONAL SOCIETY FOR SPACE BIOLOGY

J.O. Kessler, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (NAS 9-16015)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

11.0002, JOINT USE OF RESOURCES FOR OPERATION OF NASA-AMES CONSORTIUM OFFICE

L. Eisenberg, California State University & Colleges, San Francisco State University, Graduate School, *1600 Holloway Ave., San Francisco, California* 94132 (NCA 2-660001)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

11.0003, TARGET SEARCH FOR EXTRA-TERRESTRIAL INTELLIGENCE OBSERVATIONS USING VERY LONG BASE INTERFEROMETRY TECHNIQUES & PATTERN RECOGNITION STUDIES

W.J. Welch, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering, *Berkeley, California* 94720 (NCC 2-36)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

11.0004, WIND TUNNEL SIMULATIONS OF MARTIAN SAND STORMS

R. Greeley, University of Santa Clara, School of Science, *El Camino Rd., Santa Clara, California* 95053 (NCC 2-60)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

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01 AERONAUTICS (GENERAL)

N80-23249* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONCEPTUAL STUDIES OF A LONG-RANGE TRANSPORT WITH AN UPPER SURFACE BLOWING PROPULSIVE LIFT SYSTEM
John A. Cochrane. May 1980. 24 p.
(NASA-TM-81196; A-8169) Avail: NASA. Ames Res. Center, Moffett Field, Calif. 94035. CSCL 01C

The application of propulsive lift technology to the long range, heavy lift transport mission was studied. The level of propulsive lift technology studied was that which is represented by the Quiet Short-Haul Research Aircraft (QSRA). This technology uses the upper surface blowing technique (USB) to develop high lift coefficients. Results indicate that field lengths of less than 3000 ft are feasible at landing gross weights and that even at maximum takeoff gross weight, a reduction in field length is available as compared to a conventional aircraft. Further study of the concept is recommended. J.M.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-23250*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LEEWARD FLOW OVER DELTA WINGS AT SUPERSONIC SPEEDS
Joachim G. Szodruch. Apr. 1980. 49 p. refs.
(NASA-TM-81187; A-8117) Avail: NTIS. HC A03/MF A01. CSCL 01A

A survey was made of the parameters affecting the development of the leeward symmetric separated flow over slender delta wings immersed in a supersonic stream. The parameters included Mach number, Reynolds number, angle of attack, leading-edge sweep angle, and body cross-sectional shape, such that subsonic and supersonic leading-edge flows are encountered. It was seen that the boundaries between the various flow regimes existing about the leeward surface may conveniently be represented on a diagram with the components of angle of attack and Mach number normal to the leading edge as governing parameters. R.E.S.

N80-23251*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STUDY OF PANEL LOADS AND CENTERS OF PRESSURE OF THREE DIFFERENT CRUCIFORM AFT-TAIL CONTROL SURFACES OF A WINGLESS MISSILE FROM MACH 1.60 TO 3.70
Milton Lamb and Charles D. Trescot, Jr. May 1980. 112 p. refs.
(NASA-TM-81787; L-13501) Avail: NTIS. HC A06/MF A01. CSCL 01A

An investigation was made of the forces and moments on the cruciform aft-tail control surfaces of a wingless missile model to determine the variation of panel load and center of pressure with angle of attack, tail deflection, model roll angle, and Mach number. Also, a limited force-moment and surface-pressure investigation was made on a noncircular aft end. These investigations were made in a unitary plan wind tunnel at Mach numbers of 1.60, 2.36, and 3.70 and at a Reynolds number per meter of 6,600,000. The cruciform aft-tail results indicate very little variation in the center of pressure for the highly loaded windward tail. The noncircular aft-end test results indicate no significant effect of the fin unporting on the fin loads. R.E.S.

N80-23252*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
SURFACE PRESSURE MEASUREMENTS AT TWO TIPS OF A MODEL HELICOPTER ROTOR IN HOVER. Final Report
R. B. Gray, H. M. McMahon, K. R. Shenoy, and M. L. Hammer. May 1980. 46 p. refs.
(Contract NAS1-15158; DA Proj. 1L1-61102-AH-45A)
(NASA-CR-3281) Avail: NTIS. HC A03/MF A01. CSCL 01A

Surface pressures were measured near the tip of a hovering single-bladed model helicopter rotor with two tip shapes. The rotor had a constant-chord, untwisted blade with a square, flat tip which could be modified to a body-of-revolution tip. Pressure measurements were made on the blade surface along the chordwise direction at six radial stations outboard of the 94 percent blade radius. Data for each blade tip configuration were taken at blade collective pitch angles of 0, 6.18 and 11.4 degrees at a Reynolds number of 736,000 and a Mach number of 0.25 both based on tip speed. Chordwise pressure distributions and constant surface pressure contours are presented and discussed. Author

N80-23253*# National Aeronautics and Space Administration, Washington, D. C.
LEE SIDE FLOW FOR SLENDER DELTA WINGS OF FINITE THICKNESS
Joachim G. Szodruch. Mar. 1980. 161 p. refs. Transl. into ENGLISH of "Leeseiten-Stroemung Bei Schlanken DeltaFluegeln endlicher Dicke" Rept. ILR-23. Tech. Univ., Berlin, Inst. fuer Luft und Raumfahrt, 1977. 150 p. Trans. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75753; ILR-23) Avail: NTIS. HC A08/MF A01. CSCL 01A

An experimental and theoretical investigation carried out to determine the lee side flow field over delta wings at supersonic speeds is presented. A theoretical method to described the flow field is described, where boundary conditions as a result of the experimental study are needed. The computed flow field with shock induced separation is satisfactory. M.G.

N80-23254# Nielsen Engineering and Research, Inc., Mountain View, Calif.
ACTIVE CONTROL OF ASYMMETRIC VORTEX EFFECTS Final Technical Report, 20 Apr. 1978 - 20 Dec. 1979
John E. Fiddler Dec. 1979 55 p refs
(Contract N60921-78-C-0073; WR02303003)
(AD-A081648; NEAR-TR-212) Avail: NTIS HC A04/MF A01 CSCL 20/4

Active control of asymmetric vortex effects on a pointed, slender body at high angles of attack has been achieved by rotating portions of the body about the axis. The lee side asymmetric vortex patterns and their associated yaw-plane forces and moments have been varied in cyclic, repeatable fashion at rates up to 100 cycles per second. The variations occurred to rapidly that the average yaw-plane quantities were brought to small, steady values, or nulled out. The effect was obtained by rotating the nose, the nosetip and a band of the body surface just aft of the nose. GRA

N80-23255# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
NUMERICAL FLOW FIELD PROGRAM FOR AERODYNAMIC HEATING ANALYSIS. VOLUME 1: EQUATIONS AND RESULTS Final Technical Report, Jun. 1977 - Sep. 1979
H. J. Fivel Wright-Patterson AFB, Ohio AFFDL Dec. 1979 125 p refs
(Contract F33165-77-C-3003; AF Proj. 2404)
(AD-A081471; AFFDL-TR-79-3128-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 20/4

This report documents a study to modify an existing computer program which provides an economical and easy to use analytic tool for aerodynamic heating to a wide variety of 3 dimensional vehicle configurations. This report also serves as a user's manual for the computer program plus two auxiliary programs written to analyze vehicle geometry, and presents program capabilities, input/output characteristics, and example problems. Core requirements have been minimized by the use of overlays. User oriented features of the program include minimized input requirements and various options for application flexibility. GRA

N80-23256# Kaman Avidyne, Burlington, Mass.
THE VIBRA-8 SUBSONIC AERODYNAMIC NUCLEAR GUST VULNERABILITY CODE Final Report, Jul. 1978 - Feb. 1979
Garabed Zartarian 1 May 1979 23 p refs
(Contract DNA001-78-C-0317)
(AD-A081722; AD-E300674; KA-TR-164; DNA-4966F) Avail: NTIS HC A02/MF A01 CSCL 20/4

This report describes certain modifications to the subsonic aerodynamic subroutine in the earlier versions of VIBRA to extend the applicability of the nuclear vulnerability code over broader ranges of Mach number, aspect ratio, and sweep angles. This modified version, designated as VIBRA-8, was developed in conjunction with a study of the nuclear vulnerability of an aeronautical system. A separate classified report has been issued to cover that study. GRA

N80-23257# Avco Systems Div., Wilmington, Mass.
HYPERSONIC HEAT TRANSFER TEST PROGRAM IN THE VKI LONGSHOT FACILITY Final Report, 1 Dec. 1978 - 30 Nov. 1979
Victor Dicristina 18 Dec. 1979 26 p
(Contract F49620-79-C-0013; AF Proj. 2307)
(AD-A081467; AVSD-0335-79-CR; K500-79-VD-32; AFOSR-80-0124TR) Avail: NTIS HC A03/MF A01 CSCL 20/13

A summary of test results is presented for local pressure and heat transfer distributions on a biconic body for a range of hypersonic Mach numbers, Reynolds number, and angle-of-attack. The model configuration approximated nosetip contours typical of low altitude turbulent ablated shapes. Instrumentation included a longitudinal row of ten pressure taps and, 180 degrees apart, a row of eleven smooth calorimeter discs. The tests were performed in the Longshot Facility of the von Karman Institute for Fluid Dynamics. GRA

N80-23258# Boeing Military Airplane Development, Seattle, Wash.
EASY-ACIS DYNAMIC ANALYSIS. USER'S MANUAL Final Report, 15 Apr. 1977 - 1 Jun. 1979
M. K. Wahi, G. S. Duleba, and P. R. Perkins Wright-Patterson AFB, Ohio AFFDL Sep. 1979 291 p refs
(Contract F33615-77-C-3054; AF Proj. 2402)
(AD-A081160; AFFDL-TR-79-3106) Avail: NTIS HC A13/MF A01 CSCL 09/2

This report contains a summary description of the command language used in the EASY dynamic analysis program. In addition, a description of the inputs and outputs for each standard component in the ACLS library is given. GRA

N80-23259# Calspan Advanced Technology Center, Buffalo, N.Y. Aerodynamic Research Dept.
ANALYSIS OF EXPERIMENTS ON THE EFFECTS OF JET PLUMES ON PRESSURE DISTRIBUTION OVER A CYLINDRICAL AFTERBODY AT TRANSONIC SPEEDS Final Report
Joseph P. Nenni Feb. 1980 51 p refs
(Grant DAAG29-77-C-0008)
(AD-A081647; CALSPAN-AA-4017-W-16; ARO-13797.1-E) Avail: NTIS HC A04/MF A01 CSCL 21/8

The objective of the present investigation was to obtain experimentally, the effects of various jet plume parameters on afterbody pressure distributions and to partially validate the Korst modeling procedure. Analysis of the experimental results and supplemental calculations made by the method of characteristics show that the approximate theory used by Korst gives a good estimate of the plume shape for nozzle exit Mach number of 2.0 and below. For nozzle exit Mach numbers much in excess of 2.0, it appears desirable to include the effect of the nozzle wall boundary layer on plume shape. In addition, afterbody pressure distributions produced by a series of nozzles designed to produce the same plume shape, but with different values of the plume pliability parameter, have been compared with results from a solid plume simulator. In general, the solid plume simulator produces results that agree with the nozzles with the higher values of the plume pliability parameter at zero degrees angle of attack. The correlation deteriorates significantly, however, at five degrees angle of attack. Also, afterbody pressure distributions from model tests on the ZAP rocket motor are presented for future correlation with prototype results. GRA

N80-23260# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
NUMERICAL FLOW FIELD PROGRAM FOR AERODYNAMIC HEATING ANALYSIS. VOLUME 2: USER'S MANUAL Final Technical Report, Jun. 1977 - Sep. 1979
H. J. Fivel Wright-Patterson AFB, Ohio AFFDL Dec. 1979 113 p refs Supersedes AFFDL-TR-79-3025 2 Vol.
(Contract F33615-77-C-3003; AF Proj. 2404)
(AD-A081472; AFFDL-TR-79-3128-Vol-2; AFFDL-TR-79-3025) Avail: NTIS HC A06/MF A01 CSCL 20/4

This report documents a study to modify an existing computer program which provides an economical and easy to use analytic tool for aerodynamic heating to a wide variety of 3 dimensional vehicle configurations. This report also serves as a user's manual for the computer program plus two auxiliary programs written to analyze vehicle geometry, and presents program capabilities, input/output characteristics, and example problems. Core requirements have been minimized by the use of overlays. User oriented features of the program include minimized input requirements and various options for application flexibility. GRA

N80-23261# Alabama Univ. in Huntsville. Dept. of Mechanical Engineering.
FINITE ELEMENT ANALYSIS OF SUBSONIC, TRANSONIC AND SUPERSONIC FLOWS AROUND MISSILES Final Report, 1976 - 1979
T. J. Chung Oct. 1979 73 p refs
(Grant DAAG29-76-G-0033)
(AD-A077375; UAH-RR-228; ARO-1913098.3-E) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report examines the Galerkin finite element method for solving aerodynamics problems with emphasis on transonic flows. A shock element concept was proposed and computations were carried out. In this process, a quadratic isoparametric element is divided into quadrants with each quadrant having independent

trial functions. This idea allows discontinuities at the center of an element and shocks are allowed to develop freely. Rankin-Hugoniot conditions are satisfied accurately. Although this method is efficient until freestream Mach number reaches approximately 0.95, the solution seems to deteriorate significantly for M = 0.95. Toward the end of the reporting period, the author proposed a new approach - optimal control penalty finite elements. This method is suited ideally for problems of discontinuity and shock waves as a consequence of changes in the type of partial differential equations. The resulting equations are symmetric and positive-definite, their solution being type-independent. Numerous examples indicate that both stability and accuracy are maintained very satisfactorily for Tricomi and small perturbation equations. Detailed calculations applied to the full potential equations using this approach are beyond the scope of the present study. GRA

N80-23262# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

MORPHOLOGICAL-PHENOMENOLOGICAL EXAMINATION OF THE INTERACTION OF TWO RING VORTICES WITH THE SAME TRANSLATION AXIS AND DIRECTION [MORPHOLOGISCH - PHAENOMENOLOGISCHE UNTERSUCHUNG DER WECHSELWIRKUNG ZWEIER RINGWIRBEL GLEICHER TRANSLATIONSACHSE UND TRANSLATIONSRICHTUNG]

Peter E. M. Schneider. Nov. 1978. 110 p. refs. In GERMAN.
(MPIS-20/1978) Avail: NTIS. HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25.65

With free jets and in the merging layer of two currents of different speeds, an interaction of succeeding ring and rectilinear vortices may be observed. This interaction may lead to a fusion of the proximate vortex systems. The morphological phenomena which have been observed when two ring vortices interact are described. Results are presented based upon observations as well as on the literature. Author (ESA)

N80-23263# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

OSCILLATIONS OF THE SUPERSONIC FLOW AT AN AREA OF ABRUPT INCREASE IN DUCT CROSS-SECTION [SCHWINGUNGEN DER UEBERSCHALLSTROEMUNG IN EINEM KANAL MIT QUERSCHNITTSSPRUNG]

A. P. Szumowski and G. E. A. Meier. Dec. 1978. 58 p. refs. In GERMAN.
(MPIS-23/1978) Avail: NTIS. HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13.50

The complex unsteady flow configurations occurring as a result of the interaction between shock waves and boundary layers is described, and experiments with flow in a duct performed. The mechanics of flow oscillations are considered, and stationary flow with perpendicular shock commented upon. Author (ESA)

N80-23264# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Antriebstechnik.

INVESTIGATION OF THREE-DIMENSIONAL SUBSONIC FLOW IN STRAIGHT CASCADES BY MEANS OF POTENTIAL FLOW CALCULATIONS AND EXPERIMENTS Ph.D. Thesis - Technische Univ.

Juergen Renken. Oct. 1979. 183 p. refs. In GERMAN; ENGLISH summary. Report will also be announced as translation (ESA-TT-622)
(DFVLR-FB-79-09) Avail: NTIS. HC A09/MF A01; DFVLR, Cologne DM 33.30

Two models for the calculation of incompressible potential flow are developed. One model calculates the influence of blade height and end wall shape on the velocity distribution in the cascade center section and requires only limited computer capacity. The second model, an extention of the first one, enables the calculation of the three dimensional aerodynamic blade end wall interaction. An outline of the problem of interaction between potential flow and secondary flow is presented. Author (ESA)

N80-23265# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.

LIFT, DRAG AND PITCHING MOMENT MEASUREMENTS ON A MISSILE BODY HAVING VARIOUS BOATTAILS AT SUBSONIC AND TRANSONIC VELOCITIES

Mauri Tanner. Mar. 1979. 86 p. refs. In GERMAN; ENGLISH summary. Report will also be announced as translation (ESA-TT-628)
(DFVLR-FB-79-15) Avail: NTIS. HC A05/MF A01; DFVLR, Cologne DM 13.60

The lift, drag, and pitching moment of a missile body with boattailing were measured at Mach numbers from 0.5 to 1.0 at a Reynolds number of 340,000 in a transonic wind tunnel. Lift, drag, and longitudinal stability of the body was found to decrease when the relative base diameter decreased. Author (ESA)

N80-23266# Rolls-Royce Ltd., Derby (England).

UNSTEADY AERODYNAMIC FORCES ON A SUBSONIC RECTILINEAR CASCADE OF BLADES

H. Loiseau and J. Nicolas. 1979. 28 p. refs. Transl. into ENGLISH of conf. paper "Forces Aerodynamiques Instationnaires en Grille Rectiligne d'Aubes Subsonique". ONERA, Paris, Oct. 1976. In ENGLISH and FRENCH. Presented at the RFM Symp., Paris, Oct. 1976. p. 105-114
(PNR-90007; Trans-14737) Avail: NTIS. HC A03/MF A01

Tests performed on Pfenniger-Sulzer airfoils and NACA 65 A 006 airfoils, singly and in cascades in a subsonic wind tunnel to investigate aeroelastic phenomena in gas turbines are discussed. The simultaneous use of two measurement methods (forces extended from the variation in natural frequency and the damping of the rotating blade, and from pressures) is a certain means of checking the quality of the measurements. The choice of a vibrating configuration, where only one blade is subjected to an oscillating movement, is found to be particularly effective in minimizing the effects of the horizontal walls. Agreement between the theoretical and experimental results is comparable to that obtained from a wing or an aircraft model between the results of flutter calculations and flutter measurements in a wind tunnel. However, although phases coincide well, the test amplitude are approximately 20 percent lower overall than the theoretical amplitudes. Author (ESA)

N80-23267# European Space Agency, Paris (France).

PRESSURE DISTRIBUTION MEASUREMENTS ON WEDGES AT SUBSONIC AND TRANSONIC VELOCITIES

Mauri Tanner. Nov. 1979. 44 p. refs. Transl. into ENGLISH of "Druckverteilungsmessungen an Keilen bei Unterschall- und Transschallgeschwindigkeiten". Rept. DFVLR-FB-78-22. DFVLR, Cologne, Oct. 1978. Original report in GERMAN previously announced as N79-30156
(ESA-TT-554; DFVLR-FB-78-22) Avail: NTIS. HC A03/MF A01; ZLDI, Munich 19.70

Measurements were performed in a wind tunnel on three wedges (apex angle of 8, 15, and 30 deg). Formulas are given for calculating pressure distributions and other characteristics associated with the wedge. Some comparisons are made with theoretically expected results. The pressure distribution on the wedge flank, the base pressure and the pressure drag vary considerably with Mach number and wedge angle. Author (ESA)

N80-23268# European Space Agency, Paris (France).

AFTERBODY DRAG AND BASE PRESSURE MEASUREMENTS ON A BODY OF REVOLUTION AT ANGLES OF INCIDENCE UP TO ALPHA = 25 DEG AT SUBSONIC AND TRANSONIC MACH NUMBERS

Mauri Tanner. Nov. 1979. 70 p. refs. Transl. into ENGLISH of "Heckwiderstands- und Basisdruckmessungen an einem fluckoerperrumpf bei Anstellwinkeln bis Alphas = 25 deg im Unterschallund Transschallbereicht". Rept. DFVLR-FB-78-14. DFVLR, Goettingen, West Germany, Jun. 1978. Original report in GERMAN previously announced as N79-30157
(ESA-TT-569; DFVLR-FB-78-14) Avail: NTIS. HC A04/MF A01; ZLDI, Munich DM 26.90

Base pressure and afterbody drag measurements were performed in a wind tunnel. The Mach number had values from 0.5 to 1.0, the Reynolds number based on the model diameter was 340,000. Results show the influence of the boattail angle, the boattail length, and the relative base diameter on the base pressure and the afterbody drag at various angles of incidence. Author (ESA)

N80-23269# European Space Agency, Paris (France).
ON DISTURBANCE FIELDS OF MOVING SINGULARITIES IN AERODYNAMICS AND AEROACOUSTICS
Arabino Das Dec. 1979 90 p refs Transl. into ENGLISH of "Ueber Stoerfelder Bewegter Singularitaeten in der Aerodynamische und Aeroakustik". Rept. DFVLR-FB-78-16 DFVLR, Brunswick, May 1978 Original report in GERMAN previously announced as N79-30158
(ESA-TT-570; DFVLR-FB-78-16) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 38.10

A unified method is presented in which arbitrary translatory motions of the disturbance sources, of the medium, and of the field point are admitted. The influence factors which arise from the kinematics of the disturbance field are derived and the physical processes involved are elucidated. The significance of the Lorentz transformation in problems of disturbance propagation from moving singularities is discussed. An evaluation of energy density and energy flux in disturbance fields is presented.
Author (ESA)

N80-23270# European Space Agency, Paris (France).
THE HARMONICALLY OSCILLATING BODY IN SUBSONIC FLOW: EFFECT OF COMPRESSIBILITY
Wolfgang Geissler Nov. 1979 42 p refs Transl. into ENGLISH of "Der Harmonisch Schwingende Rumpf in Unterschallstroemung: Einfluss der Kompressibilitaet". Rept. DFVLR-FB-78-24 DFVLR, Goettingen, West Germany, Nov. 1978 Original report in GERMAN previously announced as N79-30160
(ESA-TT-584; DFVLR-FB-78-24) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 20.20

The calculation of steady and unsteady airloads on harmonically oscillation bodies can be done by means of source and sink distributions on the real body surface. It is useful to do the calculation in a body fixed frame of reference. Pressures and forces on oscillating bodies were obtained for incompressible flow. The extension of this method to compressible subsonic flow is discussed. Numerical results are compared with other available methods for steady and unsteady flow about bodies.
Author (ESA)

N80-23271# European Space Agency, Paris (France).
FLUTTER STABILITIES IN AN ANNULAR CASCADE WITH SUPERSONIC RELATIVE FLOW
Pierre Salaun (ONERA, Paris, France) Feb. 1980 34 p refs Transl. into ENGLISH of "Instabilities de Flottement dans une Grille Annulaire en Ecoulement Relatif Supersonique". Rept. ONERA-P-1979-3 ONERA, Paris, 1979 Original report in FRENCH previously announced as N80-22277
(ESA-TT-610; ONERA-P-1979-3) Avail: NTIS HC A03/MF A01

A linearized three dimensional theory of the flow around a circular cascade of helical blades placed between two concentric cylinders is used; the relative flow is supersonic over the whole blade length, but the axial flow is subsonic. The influence of stagger angle, frequency, Mach number and number of blades on the stability of the first bending mode and the first torsion mode is studied. The first bending mode is always stable; the first torsion mode is usually unstable, but it is possible to suppress flutter by reducing the number of blades, at least in the example considered.
Author (ESA)

N80-23272# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Dept.
A WAKE BOUNDARY LAYER MIXING EXPERIMENT
P. J. Pot 2 Apr. 1979 8 p refs Presented at 2nd Symp. on Turbulent Shear Flows, London, 2-4 Jul. 1979
(NLR-MP-79012-U) Avail: NTIS HC A02/MF A01

The mixing of a boundary layer was investigated under zero pressure gradient with a two dimensional wake shed from a plate. Measurements of mean and fluctuating quantities were carried out for this flow in particular, as well as for one of the component flows, the isolated wake. Mean velocity, shear stress, turbulence intensities and mixing length development over a relatively large downstream region were surveyed for the mixed flow and comparisons were made with the corresponding isolated flows.
Author (ESA)

N80-23273# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
SUMMARY OF DATA REQUIRED FOR THE AGARD SMP ACTIVITY STANDARD AEROELASTIC CONFIGURATIONS - TWO-DIMENSIONAL CONFIGURATIONS
R. J. Zwaan 30 Apr. 1979 26 p refs
(NLR-MP-79015-U) Avail: NTIS HC A03/MF A01

For the current AGARD structures and material panel (SMP) activity Standard Aeroelastic Configurations two airfoils were proposed for use in comparative calculations, one of which is the NLR 7301 airfoil. To facilitate reference to definitions of airfoil geometry and aerodynamic conditions and to experimental values, all relevant data are presented.
Author (ESA)

N80-23274# Bristol Univ. (England).
AN AEROELASTIC ANALYSIS OF THE SHERIFF WING B.S. Thesis
A. K. Fuan Jun. 1979 40 p refs
(BU-234) Avail: NTIS HC A03/MF A01

The aeroelastic behavior of the Sheriff wing, particularly the aileron dependent flutter characteristics was analyzed with the intention of minimizing the mass balance weight. Results are presented for wind divergence speed and control surface reversal. The mass and stiffness matrices and the associated eigenvalues and eigenvectors are discussed.
Author (ESA)

N80-23275# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN INVESTIGATION OF LOADS ON WEDGES PLACED IN SUPERSONIC JETS B.S. Thesis
B. Monk and K. Weatherill Jun. 1979 58 p refs
(BU-235) Avail: NTIS HC A04/MF A01

Load measurements and base pressure distributions were investigated for several wedges placed in an axisymmetric supersonic jet. The wedges, of base width equal to the nozzle exit diameter, were positioned symmetrically at various nozzle to wedge separations with the jet operated over a range of pressure ratios. The sensitivity of the overall loads to wedge floor separation was investigated. A set of measurements obtained for the overall loads and for the floor interference investigation is presented.
Author (ESA)

N80-23276# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN ASSESSMENT OF THE STABILITY AND OPENING CHARACTERISTICS OF CRUCIFORM PARACHUTES B.S. Thesis
M. D. Copcutt and P. L. Denner Jun. 1979 53 p ref
(BU-238) Avail: NTIS HC A04/MF A01

The stability of cruciform parachutes and the measurement of the forces which occurred during the inflationary phase were investigated. A number of cruciform parachutes, with arm ratios varying from 2 : 1 to 5 : 1, were constructed. Stability tests were performed by attaching the parachutes to a fixed point and observing their behavior in a wind tunnel. Force measurements were obtained by the horizontal deployment of the parachutes on a restraining cable. Cruciform parachutes were found to be more laterally stable than flat circular parachutes but they exhibit a spinning instability. Results indicate that the most promising arm ratios for parachute design are between two and a half to one and four to one.
Author (ESA)

N80-23277# Bristol Univ. (England). Dept. of Aeronautical Engineering.
WIND TUNNEL TESTS ON THE SHERIFF TWIN-ENGINED LIGHT AIRCRAFT B.S. Thesis
K. M. R. Walsh and S. Watkins Jun. 1979 76 p refs
(BU-241) Avail: NTIS HC A05/MF A01

The aerodynamics of the Sheriff twin-engined light aircraft were examined. Flow visualization experiments which gave evidence of a premature stall arising on the wing section between the nacelle and fuselage are described. A search for improvement was made using various high lift leading edge devices, fillets, and changes of nacelle geometry. Improved aerodynamic performance in the Sheriff by adopting pointed tail nacelles, leading edge cusps on the wing inboard of the nacelles, and fairings on the wing/fuselage junctions is discussed. Pressure readings taken

to assess the forces likely to be encountered on the canopy hatches are reported. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-23278# Crew Systems Consultants, Yellow Springs, Ohio.
CARBURETOR ICE: A REVIEW
Richard L. Newman 1980 97 p refs Backup document for AIAA Synoptic, 'Carburetor ice flight testing: The use of an anti-icing fuel additive', scheduled for publication in Journal of Aircraft in Oct. or Nov. 1980
Avail: NTIS HC A05/MF A01

Carburetor ice formation, a cause of engine failure and resultant aircraft accidents, is investigated. Prevention techniques include antiicing fuel additives, such as ethylene glycol monomethyl ether, deicing procedures, pilot education, and engine design. For individual titles, see N80-23279 through N80-23280.

N80-23279# Crew Systems Consultants, Yellow Springs, Ohio.
CARBURETOR ICE: A REVIEW
Richard L. Newman *In its* Carburetor Ice 1980 56 p refs (For primary document see N80-23278 14-03)
(TR-79-9) Avail: NTIS HC A05/MF A01

The effectiveness of 0.15 percent by volume of ethylene glycol monomethyl ether as an antiicing fuel additive was investigated in-flight using a PA-23 airplane equipped with 0-320-A engines. Topics addressed include establishment of environmental conditions over which the carburetor is likely to form ice, rate of ice formation, and effectiveness of procedures for deicing a carburetor. The maximum amount of icing that can be safely tolerated was estimated. E.D.K.

N80-23280# Crew Systems Consultants, Yellow Springs, Ohio.
CARBURETOR ICE: A REVIEW
Richard L. Newman *In its* Carburetor Ice 1980 41 p refs (For primary document see N80-23278 14-03)
(TR-77-19) Avail: NTIS HC A05/MF A01

Records of aviation accidents due to carburetor icing are reviewed. Carburetor ice research, including formation and prevention techniques, is discussed. Possible solutions are presented with emphasis on fuel additives and a pilot education program. E.D.K.

N80-23281# Mitre Corp., McLean, Va.
OPPORTUNITIES ANALYSIS OF POTENTIAL ADVANCED VORTEX SYSTEMS SEPARATION STANDARDS
Dana L. Hall and Frank A. Amodeo Jul. 1979 73 p refs (Contract DOT-FA79WA-4184)
(AD-A081479; MTR-79W00073; FAA-EM-79-17) Avail: NTIS HC A04/MF A01 CSCL 01/2

The benefits associated with conceptual Advanced Vortex Systems (AVS) are quantified from a delay reduction viewpoint. The findings are equally applicable to airborne vortex alleviation technology or to ground or air-based vortex avoidance systems. The delay consequences of three sets of successively closer interarrival standards are compared against the option of maintaining today's rules or a combination of today's and 3 nmi separations. The analysis was performed for only IFR weather conditions, since minimum required separation standards were selected as representative of possible AVS capabilities. Substantial delay savings are shown to be possible even with demand growth below that projected to occur across the 1985 through 1995 analysis time period. The benefits are sufficiently large as to warrant a substantial research and development investment into an AVS program. A.R.H.

N80-23282*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STORM HAZARDS '79: F-106B OPERATIONS SUMMARY
Bruce D. Fisher, Gerald L. Keyser, Jr., Perry L. Deal, Mitchel E. Thomas, and Felix L. Pitts Mar. 1980 64 p refs
(NASA-TM-81779) Avail: NTIS HC A04/MF A01 CSCL 01C

Preliminary flight tests with a F-106B aircraft were made on the periphery of isolated thunder cells using weather radar support. In addition to storm hazards correlation research, a direct-strike lightning measurement experiment and an atmospheric chemistry experiment were conducted. Two flights were made to close proximity to lightning generating cumulonimbus clouds; however, no direct lightning strikes were experienced. Although no discernible lightning transients were recorded, many operational techniques were identified and established. R.E.S.

N80-23283*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OUTLOOK FOR ADVANCED CONCEPTS IN TRANSPORT AIRCRAFT
D. William Conner Apr. 1980 21 p refs Presented at the 1980 Intern. Air Transportation Meeting, Cincinnati, 20-22 May 1980
(NASA-TM-81810; SAE-TP-800744) Avail: NTIS HC A02/MF A01 CSCL 01C

Air transportation demand trends, air transportation system goals, and air transportation system trends well into the 21st century were examined in detail. The outlook is for continued growth in both air passenger travel and air freight movements. The present system, with some improvements, is expected to continue to the turn of the century and to utilize technologically upgraded, derivative versions of today's aircraft, plus possibly some new aircraft for supersonic long haul, short haul, and high density commuter service. Severe constraints of the system, expected by early in the 21st century, should lead to innovations at the airport, away from the airport, and in the air. The innovations are illustrated by descriptions of three candidate systems involving advanced aircraft concepts. Advanced technologies and vehicles expected to impact the airport are illustrated by descriptions of laminar flow control aircraft, very large air freighters and cryogenically fueled transports. R.E.S.

N80-23284# National Aerospace Lab., Amsterdam (Netherlands). Structures Materials Dept.
FAILURE ANALYSIS IN AVIATION
E. A. B. deGraaf 14 Aug. 1978 48 p refs In DUTCH; ENGLISH summary
(NLR-MP-78028-U) Avail: NTIS HC A03/MF A01

The role of service failure analysis in defining new inspection procedures and the adoption of existing ones is illustrated. Examples include failures detected during inspections prescribed by the manufacturer, failures discovered after having learned of problems experienced by other operators of the same type of aircraft, and those found after an accident or by chance. Author (ESA)

N80-23285# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Dept.
THE FAILURE OF AIRCRAFT STRUCTURES
E. A. B. deGraaf 6 Dec. 1978 36 p refs In DUTCH; ENGLISH summary Presented at Bondsdag-Bond van Materialenkennis, Wageningen, Netherlands, 10 Nov. 1978
(NLR-MP-78040-U) Avail: NTIS HC A03/MF A01

A general discussion of aircraft structural failures and the design measures taken to prevent them are presented. Methods for determining static strength and stiffness, loads, and fatigue strength are surveyed. Modern design philosophies which take into account the possibility of initial defects, from which fatigue damage could originate are considered. Examples of structural failure are given and discussed. Author (ESA)

N80-23499*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER EMERGENCY CREW ESCAPE SYSTEM
William W. Lofland *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 33-46 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

N80-23511*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EMERGENCY IN-FLIGHT EGRESS OPENING FOR GENERAL AVIATION AIRCRAFT
Laurence J. Bement *In its* Proc. of the 14th Aerospace Mech. Symp. May 1980 p 173-194 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 01C

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-23286# Logicon, Inc., San Pedro, Calif.
SOFTWARE IMPACT OF SELECTED EN ROUTE ATC COMPUTER REPLACEMENT STRATEGIES Final Report
W. D. Kandler, D. Weeton, and W. B. Cushing Dec. 1979 98 p refs
(Contract DOT-FA79WA-4313)
(AD-A081478; FAA-EM-79-15; Rept-7941-03) Avail: NTIS HC A05/MF A01 CSCL 17/7

The impacts and software constraints associated with transitioning to an en route air traffic control system are examined. The functional splitting of existing major system functions (flight data processing and radar data processing) and the implementation of system enhancements (en route minimum safe altitude warning and flight plan conflict probe) in a new computer system attached to the existing IBM 9020 system via a selector channel are described. The replacement of the IBM 9020 computer with an instruction-compatible computer system is also discussed. The required changes and predicted central processing unit and intersystem channel loading for each functional split are presented and implementation cost estimates provided. M.G.

N80-23287# Mitre Corp., McLean, Va. Metrek Div.
PROCEDURAL FEASIBILITY OF REDUCED SPACING UNDER WVAS OPERATION WITH APPLICATIONS TO ATLANTA AND O'HARE
Ronald G. Gados and Frank A. Amodeo Washington, D.C. FAA Aug. 1979 64 p refs
(Contract DOT-FA79WA-4184)
(AD-A081480; MTR-79W00243; FAA-EM-79-18) Avail: NTIS HC A04/MF A01 CSCL 01/2

A Wake Vortex Avoidance System (WVAS) may provide increased airport capacity by allowing for reduced aircraft separation standards on final approach under certain meteorological conditions. Three sets of reduced separation standards were hypothesized in order to describe the operational characteristics of potential WVAS systems. The analyses developed several operational schemes which allow aircraft to transition to reduced separation standards when under WVAS coverage, while maintaining larger terminal area standards prior to intercepting that coverage. Specific applications of these schemes to Atlanta Hartsfield and Chicago O'Hare International Airports are described. Procedures for and dynamics of transitioning between different sets of separation standards were investigated. Capacity benefits corresponding to the utilization of the different sets of separation standards under various operational procedures are estimated for Chicago and Atlanta. R.E.S.

N80-23288# National Aviation Facilities Experimental Center, Atlantic City, N. J.
A FLIGHT INVESTIGATION OF SYSTEM ACCURACIES AND OPERATIONAL CAPABILITIES OF A GENERAL AVIATION/AIR TRANSPORT AREA NAVIGATION SYSTEM (RNAV) Final Report, Nov. 1977 - Mar. 1979
Jack Edmonds, John Gallagher, and Robert Pursel Feb. 1980 104 p
(FAA Proj. 975-310-001)
(AD-A081646; FAA-NA-79-25) Avail: NTIS HC A06/MF A01 CSCL 17/7

Flight tests were conducted using a general aviation/air transport type area navigation system (RNAV) to investigation area navigation system accuracies and resultant airspace requirements. The system used very high frequency omnidirectional radio/distance measuring equipment (VOR/DME) radio data for position determination. Data and operational capabilities were also investigated, and graphical data are presented for parallel offsets, delay fans, and turn anticipation. Author

N80-23289# Texas Instruments, Inc., Dallas. Equipment Group.
GLOBAL POSITIONING SYSTEMS (GPS). MANPACK/VEHICULAR USER EQUIPMENT (MVUE), VOLUME 1 Final Report, Jun. 1975 - Aug. 1979
15 Aug. 1979 28 p
(Contract F04701-75-C-0181)
(AD-A076482; SAMSO-SD-TR-79-13-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/7

Texas Instrument's efforts to design and develop an alternate Manpack/Vehicular User Equipment (MVUE) set for use in the concept validation phase of GPS are described. Volume 1 summarizes design-to-cost goals and results; production engineering program, and field test reliability information. Maintainability analysis and fault isolation to achieve mean-time-to-repair goals are included. GRA

N80-23290# Texas Instruments, Inc., Dallas. Equipment Group.
GLOBAL POSITIONING SYSTEMS (GPS) HIGH DYNAMIC USER EQUIPMENT (HDUE). VOLUME 2: SET DESCRIPTION Final Report, Jun. 1975 - Aug. 1979
1 Aug. 1979 245 p 3 Vol.
(Contract F04701-75-C-0180)
(AD-A076480; SAMSO-SD-TR-79-12-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 17/7

Describes Texas Instruments design of the HDUE set as implemented during phase 1 of the GPS program, including system description; HDUE receiver control, Master Control, Navigation and Executive Subsystems; and Hardware System Description. GRA

N80-23291# Texas Instruments, Inc., Dallas. Equipment Group.
GLOBAL POSITIONING SYSTEM (GPS) HIGH DYNAMIC USER EQUIPMENT (HDUE). VOLUME 3: SET DESCRIPTION Final Report, Jun. 1975 - Aug. 1979
1 Aug. 1979 373 p
(Contract F04701-75-C-0180)
(AD-A076481; SAMSO-SD-TR-79-12-Vol-3) Avail: NTIS HC A16/MF A01 CSCL 17/7

This volume contains descriptions of both software/hardware modules in the HDUE system, which includes receiver software, master state control, navigation software, executive software, receiver LRU and navigation LRU descriptions. GRA

N80-23292# Mission Research Corp., Santa Barbara, Calif.
PREDICTIONS OF GPS X-SET PERFORMANCE DURING THE PLACES EXPERIMENT Progress Report, Jul. 1978 - Jun. 1979
D. L. Kneepp and R. L. Bogusch 1 Jul. 1979 123 p refs
(Contract DNA001-78-C-0364; DNA Proj. NWET-I25AAXHX642)
(AD-A081552; AD-E300664; MRC-R-514; DNA-5038T) Avail: NTIS HC A06/MF A01 CSCL 18/3

Preexperimental predictions of GPS X-set receiver performance during the PLACES barium release experiment are presented for carrier frequencies from 150 to 250 MHz. Detailed examples of the X-set phase, frequency and code tracking performance are shown. For mean carrier power-to-noise density ratios of 35 db-Hz and less, erroneous Doppler aiding from the AFC/Costas loop can cause degradations to the otherwise adequate code tracking loop. All receiver performance results presented are obtained using numerical multiple phase screen calculations of frequency-selective signal propagation through simulated barium clouds. These calculations are based upon a statistical model of a striated barium cloud developed from Fourier

analysis of back propagation data taken during the STRESS barium release series. This model includes representation of the important barium striation parameters derived from measured power spectral density (PSD) properties including phase standard deviation, spectral index, and outer scale. GRA

N80-23293# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
IMPROVED PACKAGING FOR THE LN-31 INERTIAL MEASUREMENT UNIT (F-15 AIRCRAFT)
Frank C. Jarvis Mar. 1980 14 p
(AD-A081745; PTPT-80-2) Avail: NTIS HC A02/MF A01 CSCL 17/7

The investigation of the current packaging for the F-15 Inertial Measurement Unit (LN-31 IMU) revealed that the pack will provide adequate shock and vibration protection for the item; however, it was anticipated that a less expensive pack could be developed at a cost savings of approximately 25% (PTPT Report 79-3, Packaging and Handling Analysis of the LN-31, 683420-14, Inertial Measurement Unit). A new improved pack was developed and evaluated. The estimated cost savings is 20% and the potential implementation date is scheduled for June 1980. GRA

N80-23294# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE IMPACT OF GLOBAL POSITIONING SYSTEM ON GUIDANCE AND CONTROLS SYSTEMS DESIGN OF MILITARY AIRCRAFT. VOLUME 2D: SPECIFIC STUDY NO. 4, GYRO ACCURACY REQUIREMENTS IN A STRAP DOWN INERTIAL NAVIGATION SYSTEM WITH GPS AIDING FOR RPV MISSIONS
K. Hurrass, ed. (Inst. fuer Flugfuehrung, Flughafen, Germany) and H. Winter, ed. (Inst. fuer Flugfuehrung, Flughafen, Germany) Feb. 1980 15 p
(AGARD-AR-147-Vol-2D) Avail: NTIS HC A02/MF A01

The influence of the NAVSTAR Global Positioning System aiding of a strap-down system on the accuracy requirements for the gyros was investigated for a remotely piloted vehicle. R.E.S.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-23295* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPERATIONS MANUAL: VERTICAL MOTION SIMULATOR (VMS) S.08
A. David Jones May 1980 70 p
(NASA-TM-81180; A-8095) Avail: Issuing Activity CSCL 14B

The Ames Research Center Vertical Motion Simulator (VMS) is described in terms useful to the researcher who intends to use it. A description of the VMS and its performance are presented together with the administrative policies governing its operation. The management controls over its use are detailed, including data requirements, user responsibilities, and scheduling procedures. This information is given in a form that should facilitate communication with the NASA operations group during initial simulator use. J.M.S.

N80-23296 Stanford Univ., Calif.
ESTIMATION OF WIND SHEAR AND THRUST LOSS DURING STOL AIRCRAFT LANDING APPROACH Ph.D. Thesis
Joseph Andrew Bossi 1980 125 p
Avail: Univ. Microfilms Order No. 8011611

Techniques for designing constant gain estimators when uncertainties are present in the dynamic model were investigated. Modification of the steady state Kalman filter are described which provides a satisfactory estimator in such cases. Also, methods for predicting the performance sensitivity of estimator designs are described. The results of applying these techniques to the design of an estimator for wind shear and thrust loss on a STOL aircraft are presented. Estimator performance was verified using a digital flight simulation of the aircraft on final approach. Dissert. Abstr.

N80-23297 Princeton Univ., N. J.
AN ANALYTICAL STUDY OF TILT PROPROTOR AIRCRAFT DYNAMICS IN AIRPLANE CRUISE CONFIGURATION INCLUDING THE EFFECTS OF FUSELAGE LONGITUDINAL RIGID BODY MOTION Ph.D. Thesis
Tatsuo Komatsuzaki 1980 430 p
Avail: Univ. Microfilms Order No. 8011032

The dynamics of tilt proprotor aircraft in symmetric motion in airplane cruise configuration were examined with the effects of the fuselage longitudinal rigid body motion included. The reference values of the physical parameters were mainly based on those of the Bell XV-15, a tilt rotor research aircraft. The influence of the fuselage motion on the aeroelastic stability of the proprotor/wing system was investigated, as well as the influence of the proprotor/wing system dynamics on the stability and control characteristics of the vehicle. In addition, the effects of various feedbacks were examined with particular emphasis placed upon the feasibility of using relatively simple feedbacks to improve the dynamic stability characteristics of the proprotor/wing system. Prior to investigating the dynamics of the complete system, the dynamics of simplified models with reduced number of motion degrees of freedom was examined in some detail in order to obtain physical insights into the dynamics of the more complex system. Dissert. Abstr.

N80-23298# Decisions and Designs, Inc., McLean, Va.
DECISION ANALYSIS OF ADVANCED SCOUT HELICOPTER CANDIDATES Final Technical Report
Michael L. Donnell and Jacob W. Ulvila Jan. 1980 98 p ref
(Contract DAAK50-79-C-0035)
(AD-A081483; PR-80-1-307) Avail: NTIS HC A05/MF A01 CSCL 01/3

An analysis is described for thirteen Advanced Scout Helicopter (ASH) candidates and mixtures of those candidates. The analysis evaluates the candidates on the basis of their military worth; life cycle costs; attainability; force structure personnel impact; and rationalization, standardization and interoperability impact. The major portion of the report describes and explains the methodology used to evaluate the candidates, presents the results of the analysis, and illustrates several of the sensitivity analyses that were performed. Detailed assessments used in the analysis are reported in the appendices. GRA

N80-23299# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
INVESTIGATION OF LANDING FLARE IN PRESENCE OF WIND SHEAR
Knut Wilhelm and Martin Marchand Jun. 1979 55 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-631)
(DFVLR-FB-79-20) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 11,50

The effects of wind shear on the arrested landing of conventional and short take off aircraft were calculated. The aircraft trajectory during the landing maneuver is given in analytical form as a function of wind speed and pilot aircraft controls. Various examples are used to illustrate the effect, resulting in specific recommendations for pilot control during the aircraft landing. Author (ESA)

N80-23300# European Space Agency, Paris (France).
INVESTIGATIONS OF THE DESIGN OF ACTIVE VIBRATION ISOLATION SYSTEMS FOR HELICOPTERS WITH RIGID AND ELASTIC MODELING OF THE FUSELAGE
Gerd Schulz Nov. 1979 66 p refs Transl. into ENGLISH of "Untersuchungen zur Auslegung von Vollaktiven Schwingungsisolationssystemen fuer Hubschrauber bei Starrer und Elastischer Zellenmodellierung", Rept. DFVLR-FB-78-04 DFVLR, Oberpfaffenhofen, West Germany Original report in GERMAN previously announced as N79-30183
(ESA-TT-556; DFVLR-FB-78-04) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 25,70

Different methods for the design of controllers for active vibration isolation on helicopters are investigated. Based on the special structure of the controller, compensation for the rotor blade harmonic disturbance vibrations is achieved, guaranteeing good trim behavior during maneuvers. For the first controller design, done for a rigid helicopter fuselage with a modified Riccati design, different sensor configurations are investigated. A possibility for sensitivity reduction for rotor speed variations is shown. For the second controller design for an elastic helicopter fuselage the modified Riccati design, the design by means of Nyquist plots and pole assignment are investigated, especially with respect to the applicability for higher order systems.
Author (ESA)

N80-23301# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
FLIGHT SAFETY OF ROGALLO HANG GLIDERS. THEORETICAL AND EXPERIMENTAL STUDY OF THE FLIGHT ENVELOPE
Claudius LaBurthe and Simone Walden. 1979. 227 p. refs. In FRENCH; ENGLISH summary. Report will also be announced as translation (ESA-TT-634)
(ONERA-NT-1979-8) Avail: NTIS HC A11/MF A01
Two series of full scale wind tunnel tests were completed on 15 hang gliders. The results were used to calculate the basic performance and stability characteristics and to analyze the critical limitations. The problem of pitching stability is highlighted in the analysis. Implications of the results in areas such as take off, stall, dives, and settings are discussed. Author (ESA)

N80-23302# Bristol Univ. (England). Dept. of Aeronautical Engineering.
INVESTIGATION OF A FOAM SUPPORTED GLASS FIBER D-BOX FOR A RIGID WING HANG GLIDER B.S. Thesis
N. A. Ruddick. Jun. 1979. 22 p. refs.
(BU-240) Avail: NTIS HC A02/MF A01
A proposed design for a foam supported, glass fiber covered D-box for use as a wing primary structure in a rigid wing hang glider is investigated. An arrangement for bracing the wing was analyzed and the performance of the structure in bending was verified. The stability of the D-box walls in torsion was investigated. Author (ESA)

N80-23303# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE IMPACT OF GLOBAL POSITIONING SYSTEM ON GUIDANCE AND CONTROLS SYSTEMS DESIGN OF MILITARY AIRCRAFT. VOLUME 2A: SPECIFIC APPLICATION STUDY NO. 1, CLOSE AIR SUPPORT
Louis J. Urban, ed. (ASD). Feb. 1980. 70 p.
(AGARD-AR-147-Vol-2A; ISBN-92-835-1349-5) Avail: NTIS HC A04/MF A01
The application of NAVSTAR/Global Positioning System to Close Air Support is described. A currently available 'model' was selected, namely the F-4E aircraft equipped with the ARN-101 weapon delivery system. This was selected since it represents the current state-of-the-art for externally aided (LORAN) digital avionics system integrated into a reasonably modern fighter aircraft which is currently in the operational inventory of several NATO countries. R.E.S.

N80-23514*# Boeing Commercial Airplane Co., Seattle, Wash.
AIRPLANE WING LEADING EDGE VARIABLE CAMBER FLAP
James B. Cole. *In* NASA. Langley Res. Center. Proc. of the 14th Aerospace Mech. Symp. May 1980. p 225-235 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-23304*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
WIND TUNNEL INVESTIGATION OF AN ALL FLUSH ORIFICE AIR DATA SYSTEM FOR A LARGE SUBSONIC AIRCRAFT
Terry J. Larson, Stuart G. Flechner, and Paul M. Siemers, III. May 1980. 97 p. refs.
(NASA-TP-1642; H-1085) Avail: NTIS HC A05/MF A01 CSCL 01D
The results of a wind tunnel investigation on an all flush orifice air data system for use on a KC-135A aircraft are presented. The investigation was performed to determine the applicability of fixed all flush orifice air data systems that use only aircraft surfaces for orifices on the nose of the model (in a configuration similar to that of the shuttle entry air data system) provided the measurements required for the determination of stagnation pressure, angle of attack, and angle of sideslip. For the measurement of static pressure, additional flush orifices in positions on the sides of the fuselage corresponding to those in a standard pitot-static system were required. An acceptable but less accurate system, consisting of orifices only on the nose of the model, is defined and discussed. R.E.S.

N80-23305# Douglas Aircraft Co., Inc., Long Beach, Calif.
FLIGHT TEST EVALUATION OF AIRBORNE TIRE PRESSURE INDICATING SYSTEMS Final Report, Oct. 1978 - Aug. 1979
Ronald L. Suiter and Wilson W. Kwong. Sep. 1979. 114 p.
(Contract DOT-FA77WA-4070)
(AD-A081598; FAA-RD-78-134-2) Avail: NTIS HC A06/MF A01
Six different cockpit tire pressure indicating systems were flight tested on two DC-10 aircraft; a seventh was tested on a DC-9. The systems evaluated include three analog tire pressure system concepts displaying actual tire pressure in the cockpit, two weight and balance systems measuring tire pressure indirectly via tire load and axle tilt, a go-no-go discrete pressure sensing system, and a wheel speed system that uses change in rolling radius to detect a low tire. A test evaluation for each of the systems and comments on the general merits of each system type are included. A recommendation is made that each system be subjected to airline service tests before entering fleet service. A.R.H.

N80-23306# McDonnell-Douglas Electronics Co., St. Charles, Mo.
VISUALLY COUPLED SYSTEM: COMPUTER GENERATED IMAGERY (VCS-CGI) ENGINEERING INTERFACE Final Report, Aug. 1977 - Mar. 1979
Shelton MacLeod and David B. Coblitz. Wright-Patterson AFB, Ohio. AMRL. Nov. 1979. 71 p. refs.
(Contract F33615-77-C-0524; AF Proj. 7184)
(AD-A080931; AMRL-TR-79-32) Avail: NTIS HC A04/MF A01 CSCL 14/2
The Visually-Coupled System Computer-Generated Imagery (VCS-CGI) Interface program had two main phases. The objective for the first phase was to successfully interface the various subcomponents (helmet-mounted sight, helmet-mounted displays, and advanced computer-generated image system) and demonstrate their compatibility and feasibility for use in wide field of view, air-to-ground visual simulation. The objective for the second phase was to conduct a systematic exploration and evaluation of various system parameters that could affect display quality.
GRA

N80-23307# Sandia Labs., Albuquerque, N. Mex. Exploratory Systems Div.
STUDY OF HIGH-ALTITUDE RADAR ALTIMETER MODEL ACCURACY AND SITAN PERFORMANCE USING HAAFT DATA
Thomas C. Shieves and Michael W. Callahan. Jul. 1979. 161 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-1380) Avail: NTIS HC A08/MF A01
Radar altimetry data, inertial navigation data, and scoring data are used in conjunction with topographic data to evaluate the accuracy of a high-altitude pulsed-radar altimeter model and

the resulting performance of an inertial terrain-aided guidance concept. The high-altitude flight test data analyzed show a system CEP of 120 m. The radar altimeter model that was required to achieve this performance includes the effects of the internal track loop, automatic gain control loop, antenna beamwidth, and the terrain radar cross section and provided a factor of six improvement over simple nadir ground clearance for rough terrain. It is postulated that high-altitude CEP could be reduced to 50 m or less if an altimeter were designed specifically for high-altitude terrain sensing. DOE

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-23308 Pennsylvania State Univ., University Park.
AXIAL FLOW ROTOR UNSTEADY PERFORMANCE Ph.D. Thesis
Edgar Perrin Bruce 1979 250 p
Avail: Univ. Microfilms Order No. 8010028

An existing two dimensional, nonviscous theory which employed a simplified vortex model in conjunction with the assumptions of thin airfoil theory to define cascade unsteady lift was modified and extended to include an expression for unsteady pitching moment. Computed theoretical results were compared with measured values of unsteady lift force and pitching moment coefficients and their phase angles and with the unsteady center-of-pressure position. In a large axial flow fan test facility, specially designed screens were employed to produce a variety of rotor inlet flows having a sinusoidally varying axial velocity component. Uncambered rotor response during operation in these harmonically varying inflows was determined by employing a strain-gaged sensing element on one rotor blade. The results show that, in general, the theory tends to overpredict the magnitude of the force and moment coefficients, that good agreement exists between the majority of the measured and predicted phase angle data, and that the validity of the theory in its present form should be restricted to values of reduced frequency greater than 0.8. Dissert. Abstr.

N80-23309*# General Electric Co., Cincinnati, Ohio.
CF6 JET ENGINE PERFORMANCE IMPROVEMENT: NEW FAN
W. A. Fasching May 1980 202 p
(Contract NAS3-20629)
(NASA-CR-159699; R79AEG413) Avail: NTIS HC A10/MF A01 CSCL 21E

As part of the NASA sponsored engine component improvement program, and fan package was developed to reduce fuel consumption in current CF6 turbofan aircraft engine. The new fan package consist of an improved fan blade, reduced fan tip clearance due to a fan case stiffener, and a smooth fan casing tip shroud. CF6 engine performance and acoustic tests demonstrated the predicted 1.8% improvement in cruise sfc without an increase in engine noise. Power management thrust/fan speed characteristics were defined. Mechanical and structural integrity was demonstrated in model fan rotor photoelastic stress tests, full-size fan blade bench fatigue tests, and CF6 engine bird ingestion, crosswind, and cyclic endurance tests. The fan was certified in the CF6-500c2/E2 engines and is in commerical service on the Boeing 747-200, Douglas DC-10-30, and Atrbus industrie A300B aircraft. A.R.H.

N80-23310*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIGNIFICANCE OF THERMAL CONTACT RESISTANCE IN TWO-LAYER THERMAL-BARRIER-COATED TURBINE VANES
Curt H. Liebert and Raymond E. Gaugler 1980 11 p refs
Presented at the Intern Conf. on Met. Coatings, San Diego, Calif., 21-25 Apr. 1980; sponsored by the Am. Vacuum Soc.
(NASA-TM-81483; E-420) Avail: NTIS HC A02/MF A01 CSCL 21E

The importance of thermal contact resistance between layers in heat transfer through two layer, plasma sprayed, thermal barrier coatings applied to turbine vanes was investigated. Results obtained with a system of NiCrAlY bond and yttria stabilized zirconia ceramic show that thermal contact resistance between layers is negligible. These results also verfied other studies which showed that thermal contact resistance is negligible for a different coating system of NiCr bond calcia stabilized zirconia ceramic. The zirconia stabilized ceramic thermal conductivity data scatter presented in the literature is ±20 to -10 percent about a curve fit of the data. More accurate predictions of heat transfer and metal wall temperatures are obtained when the thermal conductivity values are used at the ±20 percent level. E.D.K.

N80-23311*# Hamilton Standard, Windsor Locks, Conn.
ACOUSTIC TEST AND ANALYSES OF THREE ADVANCED TURBOPROP MODELS Final Report
Bennett M. Brooks and F. B. Metzger Jan. 1980 245 p refs
(Contract NAS3-20614)
(NASA-CR-159667) Avail: NTIS HC A11/MF A01 CSCL 21E

Results of acoustic tests of theree 62.2 cm (24.5 inch) diameter models of the prop-fan (a small diameter, highly loaded. Multi-bladed variable pitch advanced turboprop) are presented. Results show that there is little difference in the noise produced by unswept and slightly swept designs. However, the model designed for noise reduction produces substantially less noise at test conditions simulating 0.8 Mach number cruise speed or at conditions simulating takeoff and landing. In the near field at cruise conditions the acoustically designed. In the far field at takeoff and landing conditions the acoustically designed model is 5 db quieter than unswept or slightly swept designs. Correlation between noise measurement and theoretical predictions as well as comparisons between measured and predicted acoustic pressure pulses generated by the prop-fan blades are discussed. The general characteristics of the pulses are predicted. Shadowgraph measurements were obtained which showed the location of bow and trailing waves. R.C.T.

N80-23312*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
CORE COMPRESSOR EXIT STAGE STUDY, 2 Final Report
R. F. Behlke, E. A. Burdsall, E. Canal, Jr., and N. D. Korn Oct. 1979 90 p refs
(Contract NAS3-20578)
(NASA-CR-159812; PWA-5561-66) Avail: NTIS HC A05/MF A01 CSCL 21E

A total of two three-stage compressors were designed and tested to determine the effects of aspect ratio on compressor performance. The first compressor was designed with an aspect ratio of 0.81; the other, with an aspect ratio of 1.22. Both compressors had a hub-tip ratio of 0.915, representative of the rear stages of a core compressor, and both were designed to achieve a 15.0% surge margin at design pressure ratios of 1.357 and 1.324, respectively, at a mean wheel speed of 167 m/sec. At design speed the 0.81 aspect ratio compressor achieved a pressure ratio of 1.346 at a corrected flow of 4.28 kg/sec and an adiabatic efficiency of 86.1%. The 1.22 aspect ratio design achieved a pressure ratio of 1.314 at 4.35 kg/sec flow and 87.0% adiabatic efficiency. Surge margin to peak efficiency was 24.0% with the lower aspect ratio blading, compared with 12.4% with the higher aspect ratio blading. R.C.T.

N80-23313*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF IMPROVED-DURABILITY PLASMA SPRAYED CERAMIC COATINGS FOR GAS TURBINE ENGINES
Irving E. Sumner and Duane L. Ruckle (Pratt and Whitney Aircraft, East Hartford, Conn.) 1980 25 p refs Proposed for presentation at the 16th Joint Propulsion Conf., Hartford, 30 Jun. - 2 Jul. 1980; sponsored by AIAA, ASME and SAE
(NASA-TM-81512; E-451) Avail: NTIS HC A02/MF A01 CSCL 21E

As part of a NASA program to reduce fuel consumption of current commercial aircraft engines, methods were investigated for improving the durability of plasma sprayed ceramic coatings for use on vane platforms in the JT9D turbofan engine. Increased durability concepts under evaluation include use of improved strain tolerant microstructures and control of the substrate temperature during coating application. Initial burner rig tests conducted at temperatures of 1010 C (1850 F) indicate that improvements in cyclic life greater than 20:1 over previous ceramic coating systems were achieved. Three plasma sprayed coating systems applied to first stage vane platforms in the high pressure turbine were subjected to a 100-cycle JT9D engine endurance test with only minor damage occurring to the coatings. A.R.H.

N80-23314*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
OSCEE FAN EXHAUST BULK ABSORBER TREATMENT EVALUATION
H. E. Bloomer and Nick E. Samanich. 1980. 20 p. refs. Presented at 6th Aeroacoustics Conf., 4-6 June 1980; sponsored by AIAA.
(NASA-TM-81498; E-435) Avail: NTIS HC A02/MF A01 CSCL 21E

The acoustic suppression capability of bulk absorber material designed for use in the fan exhaust duct walls of the quiet clean short haul experiment engine (OCSEE UTW) was evaluated. The acoustic suppression to the original design for the engine fan duct which consisted of phased single degree-of-freedom wall treatment was tested with a splitter and also with the splitter removed. Peak suppression was about as predicted with the bulk absorber configuration, however, the broadband characteristics were not attained. Post test inspection revealed surface oil contamination on the bulk material which could have caused the loss in bandwidth suppression. R.C.T.

N80-23315*# Williams Research Corp., Walled Lake, Mich.
CONCEPTUAL DESIGN STUDY OF AN IMPROVED GAS TURBINE POWERTRAIN Final Report
W. I. Chapman. Mar. 1980. 294 p. refs.
(Contracts DEN3-12; EC-77-A-31-1040)
(NASA-CR-159852; DOE/NASA/0013-80/1; WRC 78-182) Avail: NTIS HC A13/MF A01 CSCL 21E

The conceptual design for an improved gas turbine (IGT) powertrain and vehicle was investigated. Cycle parameters, rotor systems, and component technology were reviewed and a dual rotor gas turbine concept was selected and optimized for best vehicle fuel economy. The engine had a two stage centrifugal compressor with a design pressure ratio of 5.28, two axial turbine stages with advanced high temperature alloy integral wheels, variable power turbine nozzle for turbine temperature and output torque control, catalytic combustor, and annular ceramic recuperator. The engine was rated at 54.81 kW, using water injection on hot days to maintain vehicle acceleration. The estimated vehicle fuel economy was 11.9 km/l in the combined driving cycle, 43 percent over the 1976 compact automobile. The estimated IGT production vehicle selling price was 10 percent over the comparable piston engine vehicle, but the improved fuel economy and reduced maintenance and repair resulted in a 9 percent reduction in life cycle cost. R.C.T.

N80-23316*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CF6-6D ENGINE SHORT-TERM PERFORMANCE DETERIORATION
W. H. Kramer, J. E. Paas, J. J. Smith, and R. H. Wulf. Apr. 1980. 154 p.
(Contract NAS3-20631)
(NASA-CR-159830; R80AEG374) Avail: NTIS HC A08/MF A01

Studies conducted as part of the NASA-Lewis CF6 jet engine diagnostics program are summarized. An 82-engine sample of DC-10-10 aircraft engine checkout data that were gathered to define the extent and magnitude of CF6-6D short term performance deterioration were analyzed. These data are substantiated by the performance testing and analytical teardown of CF6-6D short term deterioration engine serial number (ESN) 451507. R.C.T.

N80-23317*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
STATIC CALIBRATION OF A TWO-DIMENSIONAL WEDGE NOZZLE WITH THRUST VECTORING AND SPANWISE BLOWING
Michael J. Harris (Naval Ship Research and Development Center, Bethesda, Md.) and Michael D. Falarski. Apr. 1980. 38 p. refs.
(NASA-TM-81161; A-8043) Avail: NTIS HC A03/MF A01 CSCL 21E

The results of a static calibration of the two dimensional wedge nozzles on a STOL configuration of a large-scale fighter model are reported. These nozzles internally turn the efflux produced by two turbojets down 25 degrees and exhaust it over the deflected trailing edge of the wing. This arrangement provides direct thrust lift, enhances wing lift by producting supercirculation, and provides thrust vectoring by varying the deflection of the wing's trailing edge. The thrust is vectored from 10 deg to 38 deg. This system was calibrated with spanwise blowing for augmentation of the leading-edge vortex. When 16% of the turbojet efflux is blown spanwise, the thrust recovered is 92% of the thrust produced when the total efflux is exhausted longitudinally. E.D.K.

N80-23318# Pennsylvania State Univ., University Park. Applied Research Lab.
AXIAL FLOW ROTOR UNSTEADY PERFORMANCE
E. P. Bruce. 14 Aug. 1979. 256 p. refs.
(Contract N00024-79-C-6043)
(AD-A081107; ARL/PSU-TM-79-149) Avail: NTIS HC A12/MF A01 CSCL 20/4

Two problems facing designers of axial flow turbomachines at present are requirements for operation with increased efficiency and reduced radiated noise. To meet these requirements, it is necessary to have detailed information on the influence of geometrical and operating characteristics of blade rows on their unsteady response to distortions in the inflow velocity field. Unsteady response as defined here refers to the unsteady lift force and pitching moment generated on a rigid (i.e., nonvibrating) blade operating in a nonuniform, inviscid, incompressible flow. The unsteady pressure upon which the unsteady force and moment depends is also responsible for generation of part of the radiated acoustic or noise field. In this study, the objective was to investigate unsteady response. Thus, the acoustic problem was not treated in detail. However, a brief discussion is presented which shows how the results can be applied to define the related acoustic source field. In this study, an existing two dimensional, nonviscous theory which employed a simplified vortex model in conjunction with the assumptions of thin airfoil theory to define cascade unsteady lift was modified and extended to include an expression for unsteady pitching moment. Computed theoretical results were compared with measured values of unsteady lift force and pitching moment coefficients and their phase angles and with the unsteady center-of-pressure position. GRA

N80-23319# Naval Postgraduate School, Monterey, Calif.
A PRIMITIVE VARIABLE COMPUTER MODEL FOR COMBUSTION WITHIN SOLID FUEL RAMJETS Final Report
Charles A. Stevenson and David W. Netzer. Oct. 1979. 45 p. refs. Prepared for Naval Weapons Center, China Lake, Calif.
(AD-A081081; NPS67-79-010) Avail: NTIS HC A03/MF A01 CSCL 21/5

An adaptation of a primitive variable, finite-difference computer program was accomplished in order to predict the reacting flow field in a solid fuel ramjet. The study compares the predictions of the primitive variable computer model with an earlier computer model and empirical data. It was found that the new model reasonably predicted the flow field and permitted calculations within the aft mixing chamber. GRA

N80-23320# Solar Turbines International, San Diego, Calif.
APPLICATION OF CERAMIC NOZZLES TO 10 KW ENGINE Final Report
James C. Napier and A. G. Metcalfe. Dec. 1978. 263 p. refs.

(Contract DAAK02-75-C-0138)
(AD-A081184; SR80-R-4375-43; SO-6-4375-7) Avail: NTIS HC A12/MF A01 CSCL 21/5

Work on application of ceramics to the nozzle section of the small radial MERADCOM 10 KW gas turbine engine for meeting the two separate goals of improved erosion resistance and increased turbine inlet temperature is reported. Engine demonstrations of each of the two ceramic nozzle designs were completed. Efforts leading to engine demonstrations are documented and included; ceramic materials properties studies; design studies; engine simulator experiments for high temperature erosion, corrosion and thermal shock; and development of specialized relaxing glass adhesives for joining of ceramics. It was demonstrated that ceramics can offer from 10 to 100 times the erosion resistance at 1700 F to superalloys and have excellent corrosion and thermal shock properties. GRA

N80-23321# Naval Postgraduate School, Monterey, Calif.
ATMOSPHERIC DISPERSION OF HIGH VELOCITY JETS Final Report
Jack V. Brendmoen and David W. Netzer Nov. 1979 84 p refs
(ZF57572002)
(AD-A081612; NPS67-76-012) Avail: NTIS HC A05/MF A01 CSCL 21/5

A neutrally stable atmospheric surface layer was simulated in a low speed wind tunnel by tripping the boundary layer with a fence and letting the turbulent flow develop over a length of roughness elements. Turbojet exhaust dispersion characteristics, simulated by a burner/nozzle system, were investigated by measuring the horizontal and vertical temperature profiles at axial stations downwind from the nozzle exit. Dispersion sensitivity to different nozzle exit conditions, angles of incidence to the wind, and nozzle surface blockage were investigated. The results were compared to dispersion methods used in the Air Quality Assessment Model (AQAM). It was found that (1) the experimental jet penetration length was much shorter than that assumed in AQAM; (2) the horizontal jet exhibited plume rise; (3) the initial dispersion coefficients were a function of wind direction; and (4) the plume spreading rate was more rapid than for the low velocity, elevated sources in neutrally stable atmospheric conditions. GRA

N80-23322# IIT Research Inst., Chicago, Ill.
PROPERTY SCREENING AND EVALUATION OF CERAMIC TURBINE ENGINE MATERIALS Final Report, 1 Jul. 1975 - 1 Aug. 1979
D. C. Larsen Wright-Patterson AFB, Ohio AFML Oct. 1979 152 p refs
(Contract F33615-75-C-519616)
(AD-A080963; AFML-TR-79-4188) Avail: NTIS HC A08/MF A01 CSCL 11/2

An overview is presented of the pertinent thermal and mechanical properties of 26 structural silicon-base non-oxide ceramics that are candidates for advanced heat engine applications. Included are hot pressed, sintered and reaction sintered Si_3N_4 and SiC, and Sialon. Data are presented for flexure strength, elastic properties, strength degradation at long times due to subcritical crack growth, long term oxidation effects, creep resistance, fracture toughness, thermal expansion, thermal diffusivity, and thermal shock resistance. All materials are evaluated using the same test equipment so that valid comparisons can be made between materials. Emphasis is placed on predominant behavioral trends as related to material microstructure and purity, as determined by processing method. Structure-property relations are developed. GRA

N80-23323# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Turbine Engine Div.
TURBOPROPULSION COMBUSTION TECHNOLOGY ASSESSMENT Technology Summary Report, Mar. 1978 - Oct. 1979
Robert E. Henderson, ed. and A. M. Mellor, ed. (Purdue Univ.) Dec. 1979 31 p refs
(AF Proj. 3066)
(AD-A080748; AFAPL-TR-79-2115) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report summarizes the finding of an assessment. Section 1 provides a general introductory overview of the state-of-combustion-technology today and highlights some general projections and trends for the future. Section 2 gives a state-of-the-art review of the five special topic areas of interest covered during the assessment - main burners, afterburners, combustion modeling, structural and mechanical design, and alternative fuels. Sections 3 and 4 examine the advanced technology trends and projected technology needs, respectively, as related to each of the topic areas cited above. A five-year technology plan is outlined in section 5. Future aircraft propulsion requirements call for combustion systems capable of (1) accepting greater variations in compressor discharge pressure temperature and airflow; (2) producing heat release rates and temperature rises which will ultimately approach stoichiometric levels; and (3) providing high operational reliability and improved component durability, maintainability and repairability. In addition, the new requirements associated with exhaust emissions and fuel flexibility must be addressed. Consequently, as the combustor designer is confroneted with the new requirements of the future, especially exhaust emissions and fuel flexibility, new design concepts may be required to provide an acceptable solution. GRA

N80-23324# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
DEVELOPMENT OF HIGH TEMPERATURE RESISTANT CERAMIC PARTS FOR GAS TURBINES Final Report
Wolfgang Krueger, Bernd Kugenbuch, Walter-Hans Peschel, and Wilhelm Siebmanns Bonn Bundesmin. fuer Forsch. u. Technol. Jul. 1979 54 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NTS-19)
(BMFT-FB-T-79-09) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 10.90

Ceramic materials were used to produce an automobile gas turbine engine which is capable of operating at temperatures of up to 1400 C. The flame tube, turbine inlet cone, and turbine nozzle assembly were fabricated entirely of ceramics. The turbine rotor consisted of ceramic blades and a metal disc. Extensive tests were performed under conditions similar to those expected in automobile applications. Author (ESA)

N80-23325# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THREE DIMENSIONAL FLOW INVESTIGATION WITH A METHOD OF CHARACTERISTICS IN THE INLET REGION AND THE BLADE-TO-BLADE CHANNELS OF SUPERSONIC AXIAL COMPRESSORS Thesis - Paris VI Univ.
Jean Martinon 1979 205 p refs In FRENCH; ENGLISH summary Report will also be announced as translation
(ESA-TT-637)
(ONERA-NT-1979-1; ISSN-0078-379X) Avail: NTIS HC A10/MF A01

A three dimensional method of characteristics was developed for the calculation of the supersonic flow in the inlet region and the blade to blade channels of blade cascades and high transonic axial flow compressors with subsonic or supersonic axial velocity. The numerical scheme is described and example calculations on several linear or annular cascades and rotating blade rows are presented. Author (ESA)

N80-23513*# Pratt and Whitney Aircraft, East Hartford, Conn. Government Products Div.
F100 EXHAUST NOZZLE AREA CONTROL
Joseph R. Kozlin *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 211-223 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-23326*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va.

NAVIGATION, GUIDANCE, AND CONTROL FOR HELICOPTER AUTOMATIC LANDINGS
James R. Kelly and Frank R. Niessen May 1980 58 p refs (NASA-TP-1649; L-13454) HC A04/MF A01 CSCL 01C

A navigation, guidance and control concept was developed for helicopter automatic approach and landings. The algorithms employed were implemented in an airborne digital computer installed on a CH-47B research helicopter. Data are presented to illustrate system performance during fully automatic approach and landings in a variety of wind conditions. A.W.H.

N80-23327*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
PRECISION CONTROLLABILITY OF THE YF-17 AIRPLANE
Thomas R. Sisk and Neil W. Mataeny May 1980 34 p refs (NASA-TP-1677; H-1089) Avail: NTIS HC A03/MF A01 CSCL 01C

A flying qualities evaluation conducted on the YF-17 airplane permitted assessment of its precision controllability in the transonic flight regime over the allowable angle of attack range. The precision controllability (tailchase tracking) study was conducted in constant-g and windup turn tracking maneuvers with the command augmentation system (CAS) on, automatic maneuver flaps, and the caged pipper gunsight depressed 70 mils. This study showed that the YF-17 airplane tracks essentially as well at 7 g's to 8 g's as earlier fighters did at 4 g's to 5 g's before they encountered wing rock. The pilots considered the YF-17 airplane one of the best tracking airplanes they had flown. Wing rock at the higher angles of attack degraded tracking precision, and lack of control harmony made precision controllability more difficult. The revised automatic maneuver flap schedule incorporated in the airplane at the time of the tests did not appear to be optimum. The largest tracking errors and greatest pilot workload occurred at high normal load factors at low angles of attack. The pilots reported that the high-g maneuvers caused some tunnel vision and that they found it difficult to think clearly after repeated maneuvers. Author

N80-23328*# Systems Technology, Inc., Hawthorne, Calif.
PRACTICAL OPTIMAL FLIGHT CONTROL SYSTEM DESIGN FOR HELICOPTER AIRCRAFT. VOLUME 1: TECHNICAL REPORT
L. G. Hofmann, Susan A. Riedel, and Duane McRuer May 1980 273 p refs
(Contract NAS2-9946)
(NASA-CR-3275; TR-1127-1-I) Avail: NTIS HC A12/MF A01 CSCL 01C

A method by which modern and classical theory techniques may be integrated in a synergistic fashion and used in the design of practical flight control systems is presented. A general procedure is developed, and several illustrative examples are included. Emphasis is placed not only on the synthesis of the design, but on the assessment of the results as well. R.C.T.

N80-23329# Army Missile and Munitions Center and School, Redstone Arsenal, Ala. Guidance and Control Directorate.
THEORY OF DISTURBANCE-UTILIZING CONTROL WITH APPLICATION TO MISSILE INTERCEPT PROBLEMS
William C. Kelly 12 Dec. 1979 327 p refs
(AD-A081110; DRSMI/RG-80-11) Avail: NTIS HC A17/MF A01 CSCL 12/1

Control problems with disturbances which have waveform structure may be addressed by considering the maximum utilization mode of disturbance-accomodating control theory. It is shown in this work that the optimal utilization of disturbances can lead to significantly better performance than that of the 'optimal' linear-quadratic regulator. The conditions for the existence of a steady-state disturbance-utilizing control law are derived. It is shown that the steady-state control gains when they exist, are solutions of certain matric algebraic equations. Steady-state gain expressions are derived for several first and second order plants. Results are presented for the cases of optimal disturbance-utilizing control of an air-defense interceptor missile and of a missile homing on a fixed target, which demonstrate performance superior to that obtained by a conventional 'optimal' linear-quadratic missile controller. GRA

N80-23330# European Space Agency, Paris (France).
DEFINITION OF A TWO-LEVEL CONTROL SYSTEM FOR NONLINEAR MOTION OF AN AIRCRAFT
Albert Kirszenblat (Technion - Israel Inst. of Tech.) Feb. 1980 36 p refs Transl. into ENGLISH of "Calcul d'un Systeme de Commande a Deux Niveaux du Movement non Lineaire d'un Avion", Rept. ONERA-P-1979-7 ONERA, Paris, 1979 Original report in FRENCH previously announced as N80-22364
(ESA-TT-614; ONERA-P-1979-7) Avail: NTIS HC A03/MF A01

An approach to the problem of defining a control law well adapted to the whole flight envelope is presented. This system has a two level structure alloWing a task-oriented control and an augmentation of the aircraft stability. A nonlinear model of the aircraft dynamics incorporating the inertial coupling terms and the nonlinear aerodynamic effects constitute the first control level. The model generates a trajectory, a reference control law vector, and an output vector which follows a vector, representing the maneuvering objectives assigned by the pilot at any time. At the second level, a servo compensation subordinates the aircraft motion to the model. The control law is obtained by applying optimal linear control theory to local models of the aircraft. Direct force control surfaces may be easily incorporated into the computation of the control system. This system ensures an automatic and smooth coordination of the aircraft motions and of the deflection of the aerodynamic control surfaces along the pitch, roll and yaw axes, even under extreme flight conditions; it is particularly adapted to the case of high-performance fighter aircraft. Author (ESA)

N80-23331# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
DESIGN, DEVELOPMENT AND IMPLEMENTATION OF AN ACTIVE CONTROL SYSTEM FOR LOAD ALLEVIATION FOR A COMMERCIAL TRANSPORT AIRPLANE
R. F. OConnell (Lockheed-California Co., Burbank) Feb. 1980 21 p refs Presented at the 49th Struct. and Mater. Panel Meetings, Porz-Wahnm, West Germany, Oct. 1979
(AGARD-AR-683; ISBN92-835-1348-7) Avail: NTIS HC A02/MF A01

An active control system for load alleviation was developed for a long range version of the Lockheed L-1011. This system which permits the use of an extended wing span for fuel conservation with minimum structural change, will be introduced into commercial service in early 1980. The system is described and the criteria to which it is of the system installed on the flight test data obtained from a prototype version of the system installed on the flight airplane are presented, and comparsions of these results with analytical predictions are shown. A basis for certification of such systems is presented, assuring a level of safety equivalent to that of a conventional design. R.E.S.

N80-23512*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SPIN-RECOVERY PARACHUTE SYSTEM FOR LIGHT GENERAL-AVIATION AIRPLANES
Charles F. Bradshaw *In its* Proc. of the 14th Aerospace Mech. Symp. May 1980 p 195-209 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-23332*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TWINTAN: A PROGRAM FOR TRANSONIC WALL INTERFERENCE ASSESSMENT IN TWO-DIMENSIONAL WIND TUNNELS
William B. Kemp, Jr. May 1980 40 p refs
(NASA-TM-81819) Avail: NTIS HC A03/MF A01 CSCL 14B

A method for assessing the wall interference in transonic two dimensional wind tunnel test was developed and implemented in a computer program. The method involves three successive solutions of the transonic small disturbance potential equation to define the wind tunnel flow, the perturbation attributable to the model, and the equivalent free air flow around the model. Input includes pressure distributions on the model and along the top and bottom tunnel walls which are used as boundary conditions for the wind tunnel flow. The wall induced perturbation fields is determined as the difference between the perturbation in the tunnel flow solution and the perturbation attributable to the model. The methodology used in the program is described and detailed descriptions of the computer program input and output are presented. Input and output for a sample case are given. J.M.S.

N80-23333*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
CRYOGENIC WIND TUNNELS: A SELECTED, ANNOTATED BIBLIOGRAPHY
Marie H. Tuttle and Robert A. Kilgore May 1980 15 p
(NASA-TM-80168) Avail: NTIS HC A02/MF A01 CSCL 14B

This annotated supplement updates the cryogenic wind tunnel bibliography. The entries continue the numbering begun in the first publication and run from 125 through 167. R.E.S.

N80-23334# Air Force Human Resources Lab., Brooks AFB, Tex. Flying Training Div.
PLATFORM MOTION CONTRIBUTIONS TO SIMULATOR TRAINING EFFECTIVENESS. STUDY 3: INTERACTION OF MOTION WITH FIELD-OF-VIEW Final Report
Mark Nataupsky, Wayne L. Waag, Douglas C. Weyer, Robert W. McFadden, and Edward McDowell Nov. 1979 31 p refs (AF Proj. 1123)
(AD-A078426; AFHRL-TR-79-25) Avail: NTIS HC A03/MF A01 CSCL 05/9

The objective was to determine the effects of platform motion cueing, visual field of view (FOV), and their interaction upon learning in the simulator and as subsequent transfer of training to the aircraft for basic contact maneuvers in the T-37 aircraft. A transfer of training study design was used in which student pilots were initially trained in the Advanced Simulator for Pilot Training (ASPT) and subsequently evaluated on their first sortie in the T-37 aircraft. Each student received training under one of four simulator configurations: (1) full platform motion (six degrees-of-freedom), full FOV (300 degrees horizontal by 150 degrees vertical); (2) full platform motion, limited FOV (48 degrees by 36 degrees vertical); (3) no platform motion, full FOV; and (4) no platform motion, limited FOV. For the ASPT pretraining phase, scores from the automated performance measuring system and overall instructor pilot ratings were used for analysis. For the T-37 evaluation sorties, the overall instructor pilot ratings, as well as individually recorded flight parameters, were analyzed. These data provided no conclusive evidence of differential transfer effects resulting from platform motion cueing, size of the visual FOV, or their interaction. As such, these data provide support for previous findings that platform motion cueing does not significantly enhance the transfer of learning for basic contact tasks in the T-37 aircraft. It would seem that the impact of peripheral visual cues for initial acquisition is not critical. Furthermore, no convincing evidence was found indicating increased transfer using platform motion in conjunction with a narrow FOV visual scene. GRA

N80-23335# Naval Air Development Center, Warminster, Pa. Software and Computer Directorate.
NAVAIRDEVCEN DYNAMIC FLIGHT SIMULATOR DESIGN AND MULTIPURPOSE CREW STATION CONCEPT DESIGN AND DEVELOPMENT PLAN Final Report
G. Terry Thomas 1 Nov. 1979 68 p refs
(AD-A081982; NADC-80019-50) Avail: NTIS HC A04/MF A01 CSCL 14/2

Chemical reactions important in molecular lasers were studied with a special emphasis on atomic recombinations and on dissociation of diatomic molecules. The experiments involved flash photolysis and shock wave techniques. The results were explained in terms of 3-D trajectory calculations. GRA

N80-23336# Canyon Research Group, Inc., Westlake Village, Calif.
AIR COMBAT MANEUVERING PERFORMANCE MEASUREMENT
Michael J. Kelly, Lee Wooldridge, Robert T. Hennessy, Donald Vreula, and Steve F. Barnebey Sep. 1979 140 p refs
(Contract F33615-77-C-0079; AF Proj. 1123)
(AD-A077429; NAVTRAEQUIPC-IH-315; AFHRL-TR-79-3) Avail: NTIS HC A07/MF A01 CSCL 05/9

A study was conducted to define measures of Air Combat Maneuvering (ACM) for one-versus-one (lvl) free engagements on the Simulator for Air-to-Air Combat (SAAC). The study found a small set of measures which were (1) sensitive to differences in pilot ACM skill level; (2) diagnostic of performance proficiencies and deficiencies; (3) usable by instructor pilots and compatible with their judgments; (4) capable of providing results immediately after the end of the engagement; and (5) compatible with current projected training measurement hardware. The study was conducted in three phases. Phase 1 was an analytical study of ACM tasks using information from training material and instructor pilots; 28 measures reflected subject matter experts opinion on the important elements of ACM. Pilot control, aircraft performance and engagement outcome variables were measured in phase 2 during 405 free engagements on the SAAC at Luke AFB using a total of 30 pilots with three different levels of experience. A computer analysis of the engagement data was conducted in phase 3 to (1) check methodological assumptions that the three pilot experience levels represented different ACM skill levels and (2) develop the smallest comprehensive measure set. GRA

N80-23337# Rolls-Royce Ltd., Derby (England).
INVESTIGATION INTO COMPRESSOR AEROELASTIC INSTABILITIES IN A WIND TUNNEL FOR A RECTILINEAR CASCADE OF BLADES
Edmond Szechenyi (ONERA, Paris), Henri Loiseau (ONERA, Paris), and Brigitte Maquennehan (ONERA, Paris) 1979 14 p refs
Transl. into ENGLISH of conf. paper "Etude des Instabilites Aeroelastiques des Compresseurs en Soufflerie de Grille Rectiligne d'Aubes", Rept. AGARD-CP-248 AGARD In ENGLISH and FRENCH Presented at AGARD/PEP Symp. Stresses, Vibration, Engine Integration and Engine Integrity, Cleveland, 23-27 Oct. 1978
(PNR-90011; Trans-14190; AGARD-CP-248) Avail: NTIS HC A02/MF A01

The nature of the problems of aeroelastic stability in compressors is reviewed, and the wind tunnel for rectilinear cascades at ONERA is described. The installation simulates as closely as possible the conditions in the actual engines studied: compression ratio (or incidence), Mach number, and corrected frequency. The measurement methods are discussed, and test results presented which show the character of the aeroelastic instabilities in a subsonic and transonic flow. Author (ESA)

N80-23338# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
COMPARATIVE MEASUREMENTS IN FOUR EUROPEAN WIND TUNNELS OF THE UNSTEADY PRESSURES ON AN OSCILLATING MODEL
N. Lambourne (Royal Aircraft Establishment, Bedford, England), R. Destuynder (ONERA, Paris), K. Kienappel, and R. Roos Feb. 1980 50 p refs Presented at the 49th Struct. and Mater. Panel Meeting, Porz-Wahn, West Germany, Oct. 1979
(AGARD-R-673; ISBN-92-835-1346-0) Avail: NTIS HC A03/MF A01

The effects of the walls of a wind tunnel on the behavior of dynamic models used for flutter certification of aircraft were investigated. Tests were completed in four European wind tunnels

and the results were analyzed. The results and conclusions are summarized. R.E.S.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

N80-23339*# Georgetown Univ., Washington, D.C. Space Utilization Team.
A STUDY OF THE POTENTIAL IMPACTS OF SPACE UTILIZATION Final Report
T. Stephen Cheston, Charles M. Chafer, Sallie B. Chafer, David C. Webb, and Courtney A. Stadd. Sep. 1979. 144 p. refs.
(Contract NASw-3152)
(NASA-CR-163131) Avail: NTIS HC A07/MF A01 CSCL 22A

Because the demand for comprehensive impact analysis of space technologies will increase with the use of space shuttles, the academic social sciences/humanities community was surveyed in order to determine their interests in space utilization, to develop a list of current and planned courses, and to generate a preliminary matrix of relevant social sciences. The academic scope/focus of a proposed social science space-related journal was identified including the disciplines which should be represented in the editorial board/reviewer system. The time and funding necessary to develop a self-sustaining journal were assessed. Cost income, general organizational structure, marking/distribution and funding sources were analyzed. Recommendations based on the survey are included. A.R.H.

N80-23340*# National Aeronautics and Space Administration, Washington, D. C.
PRELAUNCH SUMMARY: NOAA-B LAUNCH
13 May 1980. 6 p.
(NASA-TM-81060; Summ-E-615-80-02) Avail: NTIS HC A02/MF A01 CSCL 22A

The NOAA-B satellite will launch from the Western Test Range into Sun-synchronous orbit to replace the TIROSN-satellite as part of the national operational environmental satellite system in support of the Global Atmospheric Research Program and the World Weather Watch. The mission objectives, primary environmental sensors, launch particulars, flight sequence of events, mission support, and project costs for NOAA-A through NOAA-G are discussed. NASA's responsibilities include launch, in-orbit evaluation and spacecraft checkout. A.R.H.

N80-23341*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM STANDARD MANEUVER SEQUENCES FOR ORBITER/UPPER-STAGE SEPARATION SSUS-A, SSUS-D, AND IUS
S. W. Wilson. Apr. 1980. 187 p. refs. Prepared in cooperation with TRW Systems, Houston, Tex.
(NASA-TM-81058; JSC-16508; Rept-80-FM-22) Avail: NTIS HC A09/MF A01 CSCL 22A

Descriptions of standard post-ejection maneuver sequences for the deployment of IUS, SSUS-A, and SSUS-D upper stages from the space shuttle orbiter are presented. The sequences were designed to satisfy requirements for limiting the damage inflicted on the orbiter by upper-stage exhaust particles, subject to a further requirement for minimizing the impingement of orbiter thruster plumes on the deployed payload. In all cases it was assumed that the orbital maneuvering system engines would be used to apply the orbiter's major separation velocity increment. R.E.S.

N80-23342# Technische Universitaet, Munich (West Germany). Lehrstual fuer Raumfahrttechnik.
THE MATHEMATICIAN GAUSS, SEEN FROM THE POINT OF VIEW OF A SPACE TECHNOLOGIST [GAUSS UNTER DEM BLICKWINKEL EINES RAUMFAHRTTECHNIKERS]
Harry O. Ruppe. Mar. 1977. 16 p. refs. In GERMAN
(TUM-LRT-KB-14/77) Avail: NTIS HC A02/MF A01

A biography of Carl Friedrich Gauss is presented, emphasizing his influence on modern science. His contributions to measuring techniques, planetary theory, celestial mechanics, orbit determination, differential geometry, relativity theory and the least squares method are discussed. Author (ESA)

N80-23343# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Preprojects and Studies Dept.
AUTOMATIC SPACE PROCESSING EQUIPMENT (ASPE), PRE-PHASE A STUDY. VOLUME 1: TECHNICAL SUMMARY
H. D. Bruhn, J. Geisel, R. Krieger, U. Laux, I. Meyer, T. Miski, H. Stolze, and H. Stegen. 10 Oct. 1979. 93 p. 3 Vol.
(Contract ESA-3910/79-F-FC(SC))
(PRV-3-6/79-Vol-1; ESA-CR(P)-1293-Vol-1) Avail: NTIS HC A05/MF A01

The initial automatic SL-Pallet concepts for material sciences (Automatic Space Processing Pallet Equipment - ASPE) were studied. Typical experiments and available equipment from which the performance limits and the basic equipment are derived were investigated. One reference payload for a shuttle flight was investigated for accomodation. For this payload, a preferred overall concept was established. Planning and cost estimation for development, manufacturing and integration of the experiment facilities, and a cost estimation (total and proportionate) for a reference mission were performed. Author (ESA)

N80-23344# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Preprojects and Studies Dept.
AUTOMATIC SPACE PROCESSING EQUIPMENT (ASPE), PRE-PHASE A STUDY. VOLUME 2: TECHNICAL APPENDIX
H. D. Bruhn, J. Geisel, R. Krieger, U. Laux, I. Meyer, T. Miski, H. Stolze, and H. Stegen. 10 Oct. 1979. 373 p. 3 Vol.
(Contract ESA-3910/79-F-FC(SC))
(PRV-3-6/79-Vol-2; ESA-CR(P)-1292-Vol-2) Avail: NTIS HC A15/MF A01

The initial automatic SL-Pallet concepts for material sciences (Automatic Space Processing Pallet Equipment - ASPE) were studied. Typical equipment and available equipment from which the performance limits and the basic equipment are derived were investigated. Several experiment facilities and the necessary support equipment were defined. One reference payload for a shuttle flight was investigated for accommodation. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-23345 Texas Univ. at Austin.
STATE AND PARAMETER ESTIMATION FOR REENTRY VEHICLE LATERAL MOTION Ph.D. Thesis
Jerry Louis McDowell. 1979. 174 p.
Avail: Univ. Microfilms Order No. 8009895

A four state dynamical model of reentry vehicle motion was used in a weighted least squares batch estimation algorithm to determine the angular motion and aerodynamic coefficients for a trajectory of known velocity, dynamic pressure, and roll rate. A model was proposed for the time variation of the aerodynamic coefficients. Simulated accelerometer and gyro measurements were processed to estimate the unknown states and coefficients. A second order measurement model was developed to account for the dynamic response characteristics of onboard measurement sensors in the presence of reentry vehicle oscillatory behavior. Examples are provided which illustrate the feasibility of the four state dynamical model and second order measurement model in reentry vehicle estimation problems.
Dissert. Abstr.

N80-23346*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
EARTH ORBITAL EXPERIMENT PROGRAM AND REQUIREMENTS STUDY Summary Report, 2 Sep. 1969 - 9 Apr. 1971
Apr. 1971. 112 p.
(Contract NAS1-9464)
(NASA-CR-162132; MDC-G0788) Avail: NTIS

HC A06/MF A01 CSCL 22A

A compilation of Earth orbital experiments and their required support technological developments is given. Six disciplines including manned spaceflight capability, space biology, spce astronomy, space physics, communications and navigation, and Earth observations were subjected to an overview analysis that resulted in the identifying of 3,800 critical issues. Of these critical issues, 1,983 that were deemed suitable for near-term manned space research were grouped into 136 research clusters in accordance with commonality of instrumentation and measurements. These clusters are described at a level of detail that identifies the important aspects of the research and establishes the principal requirements that will be placed on the missions in accomplishing the research and on the space research facilities for these missions. Summaries of the space facility requirements and guidelines for mission planning are given. The supporting technology developments required to pursue the research are identified and grouped into 233 work packages. M.G.

N80-23347# Aerospace Defense Command, Peterson AFB, Colo. Office of Astrodynamics.

GENERAL PERTURBATIONS THEORIES DERIVED FROM THE 1965 LANE DRAG THEORY

Max H. Lane and Felix R. Hoots Dec. 1979 64 p refs
(AD-A081264; ASTRODYNAMIC-2) Avail: NTIS
HC A04/MF A01 CSCL 22/3

The Air Force General Perturbation theory (AFGP4) based on the analytic satellite theory of Lane (1965) and Lane and Cranford (1969) which models the gravitational zonal harmonics through J5 and models the atmosphere with a spherically symmetric power density function is given here in its complete form. All equations needed for satellite prediction are given and the reader is referred to the original publications for theoretical background. Two simplified equation subsets (IGP4 and SGP4) of AFGP4 are also given and the procedure by which they were obtained is outlined. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters, manned orbital laboratories; reusable vehicles; and space stations.

N80-23348*# Rice Univ., Houston, Tex.

ELECTROSTATIC PROTECTION OF THE SOLAR POWER SATELLITE AND RECTENNA

John W. Freeman, Arthur A. Few, Jr., Patricia H. Reiff, David Cooke, Jerry Bohannon, and Bob Haymes May 1979 157 p
(Contract NAS8-33023)
(NASA-CR-161438) Avail: NTIS HC A08/MF A01 CSCL 22B

Several features of the interactions of the solar power satellite (SPS) with its space environment were examined theoretically. The voltages produced at various surfaces due to space plasmas and the plasma leakage currents through the kapton and sapphire solar cell blankets were calculated. At geosynchronous orbit, this parasitic power loss is only 0.7%, and is easily compensated by oversizing. At low-Earth orbit, the power loss is potentially much larger (3%), and anomalous arcing is expected for the EOTV high voltage negative surfaces. Preliminary results of a three dimensional self-consistent plasma and electric field computer program are presented, confirming the validity of the predictions made from the one dimensional models. Magnetic shielding of the satellite, to reduce the power drain and to protect the solar cells from energetic electron and plasma ion bombardment is considered. It is concluded that minor modifications can allow the SPS to operate safely and efficiently in its space environment. The SPS design employed in this study is the 1978 MSFC baseline design utilizing GaAs solar cells at CR-2 and an aluminum structure. A.R.H.

N80-23349# Logicon, Inc., Lexington, Mass.

FUNCTIONAL AND OPERATIONAL ADVANCES IN THE AFGL ROCKET TRAJECTORY SYSTEM-I Interim Report

Krishin H. Bhavnani and Edward C. Robinson Hanscom AFB, Mass. AFGL 15 Jul. 1979 67 p refs
(Contract F19628-78-C-0209; AF Proj. 9993)
(AD-A081447; AFGL-TR-79-0183; SR-1) Avail: NTIS
HC A04/MF A01

The present AFGL Rocket Trajectory System consists of an editor-preprocessor of radar data, a comprehensive multi-functional filtering and trajectory estimation program, a multi-radar estimation program, and a report generator. Several analytical and organizational procedures have been developed to enhance the capabilities of this system. A usage guide, a program guide and appendices describe these advances. GRA

N80-23350# Emmanuel Coll., Boston, Mass.

ENERGETIC PARTICLE STUDIES: INSTRUMENTATION AND ANALYSIS Final Report, 1 Apr. 1976 - 31 Mar. 1979

W. Bellew, A. Davis, M. P. Hagan, E. Holeman, A. Huber, J. Pantazis, D. Parsignault, Y. V. Rao, and R. Vesprini Hanscom AFB, Mass. AFGL Sep. 1979 164 p refs
(Contract F19628-76-C-0039; AF Proj. 2311)
(AD-A081714; AFGL-TR-79-0223) Avail: NTIS
HC A08/MF A01 CSCL 22/2

The general objectives of the program reported in this document were the implementation and support of research directed toward measurements of the energetic charged particle environment in near-Earth space. Specific objectives were the design, construction and calibration of instrument packages for the U.S. Air Force Satellites dmsp Flights Number 2, 3, 4 and 5 and P78-1, and field support for the same missions the study of the response, through computer and laboratory simulations, of existing proton-telescopes to the natural radiation environment the data analysis of proton data obtained from previous satellite missions finally, the preliminary study and design of a charged particle telescope. GRA

N80-23351# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

AERODYNAMIC COMPUTER CODE FOR COMPUTING PRESSURE LOADS ON A MISSILE AT HIGH SUPERSONIC SPEEDS AND GENERALIZED ALTITUDES Final Report, 1 Oct. 1978 - 31 Nov. 1979

Kenneth K. Wang Dec. 1979 225 p refs
(Contract N60921-78-C-0203)
(AD-A081596; MDC-G8223) Avail: NTIS HC A10/MF A01
CSCL 09/2

An aerodynamic computer code was developed for calculating the pressure distribution on a missile or its components, e.g., body and wings and subsequently interpolating the results by surface fit at locations as specified for structural analysis using the NASTRAN computer code. The code is valid for high supersonic speeds and generalized attitudes of the missile. GRA

N80-23352# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany) Inst. fuer Dynamik der Flugsysteme.

FEASIBILITY STUDY OF A SPACELAB-SUBSATELLITE

Juergen Puls Dec. 1977 206 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(ESA-TT-559)
(DLR-FB-77-67) Avail: NTIS HC A10/MF A01; DFVLR, Cologne DM 87.20

The feasibility of constructing a small inexpensive subsatellite for use in connection with the space shuttle program is

discussed. The satellite is designed to carry out various scientific experiments in orbits that are independent of the main space laboratory. A modular concept characterizes the design. Special emphasis is placed on the investigation of orbital mechanics.
Author (ESA)

N80-23353# Societe Nationale Industrielle Aerospatiale, Cannes (France).
COSMOS. METEOSAT: METEOROLOGICAL DATA DISTRIBUTION (MDD) ON METEOSAT Final Report [COSMOS. METEOSAT: MDD SUR METEOSAT]
R. Verdin 25 Jun. 1979 202 p refs In FRENCH
(Contract ESA-3828/79-F-CG(SC))
(Rept-2786/85-TEA; ESA-CR(P)-1283) Avail: NTIS HC A10/MF A01

The possibility of implementing meteorological data distribution (MDD) on a future Meteosat was examined. Three options were studied, a linear repeater, a regenerative repeater with separate power amplifier, and a regenerative repeater using the power amplifier of the Meteosat. Reasons for the choice of the second are elaborated. Methods for increasing the output of the solar generator on Meteosat and the power of the S band amplifier are reviewed. A study of the MDD regenerative transmitter is presented, along with a discussion of perturbations caused by a mechanically despun antenna on Meteosat. An evaluation was made of the electronic despun antenna in Rx mode relative to the performance of the Meteosat EDA. Author (ESA)

N80-23354# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
DETERMINATION OF BOUNDARIES FOR KINEMATIC INTERCEPT REGIONS AND EVALUATION OF THE MISS DISTANCE FOR LINE-OF-SIGHT (LOS)-GUIDED MISSILES
Winfried Hofmann Mar. 1979 79 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-626)
(DFVLR-FB-79-13) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 15,40

The kinematic and dynamic behavior of a guided missile is calculated in terms relating to initial and feedback correction. Requirements on the angle between visual sight line and trajectory as well as on the lateral acceleration of the missile are deduced from the kinematics of motion. The boundaries of kinematic intercept regions are presented. A linearized time dependent dynamic deviation model is used to evaluate the miss distance in terms of missile dynamics and initial errors. Author (ESA)

N80-23355# British Aerospace Dynamics Group, Stevenage (England).
ON THE ADVANCED POWER SYSTEM CONFIGURATION STUDY
J. E. Haines, comp. (British Aerospace Dyn. Group, Stevenage, England) Jun. 1979 231 p refs
(Contract ESA-3387/77-NL-HP(SC))
(TP-7753; ESA-CR(P)-1290) Avail: NTIS HC A11/MF A01

Payload power requirements were reviewed for four applications satellite missions: aircraft communications; maritime communications; commercial communications; and TV broadcast; in order to define power subsystem configurations and identify areas where the maximum reuse of hardware can be achieved. A modular design approach was directed at these areas and the conceptual modular designs interpreted into circuit schematics. Author (ESA)

N80-23356# General Technology Systems Ltd., London (England).
A STUDY OF INCREASED RELIABILITY AND LIFETIMES FOR FUTURE COMMUNICATIONS SATELLITES, VOLUME 1 Summary Report
G. E. Hall, comp. and A. I. Naylor, comp. Oct. 1979 23 p 2 Vol.
(Contract ESA-3925/79-NL-AB(SC))
(GTS-790174-Vol-1; ESA-CR(P)-1291-Vol-1) Avail: NTIS HC A02/MF A01

An analysis of the orbital life performance of 150 communications satellites was undertaken and supplemented by a literature search, an independent investigation of life limiting spacecraft elements, and visits to North American and European organizations, with the aim of improving cost effectiveness and service availability of communications satellites by extending design lifetimes to 10-15 years. It is shown that 20% of satellites failed to achieve full operational status in orbit. Satellites display a nonconstant failure rate consistent with extensive redundancy. Production expertise has matched the steady increase in design lifetimes which are, on an average, attained. A nine to ten year life is the present state of the art. Major satellites life limiters are: NiCd batteries (problems unsolved); TWTAs, radiation degradation, microwave transistors, inadequate parts screening, fuel depletion (requiring individual trade off decisions); design faults, command disabling, poor reduncancy, repeater electronics, power distribution, motors/bearings, bladders, thrusters, thermal cycle stresses, static discharging, microprocessor applications (requiring design/production control and further research).
Author (ESA)

N80-23357# General Technology Systems Ltd., London (England).
A STUDY OF INCREASED RELIABILITY AND LIFETIMES FOR FUTURE COMMUNICATIONS SATELLITES, VOLUME 2 Final Report
G. E. Hall, comp. and A. I. Naylor, comp. Oct. 1979 387 p refs 2 Vol.
(Contract ESA-3925/79-NL-AB(SC))
(GTS-790173-Vol-2; ESA-CR(P)-1291-Vol-2) Avail: NTIS HC A17/MF A01

An effort was undertaken to improve the cost effectness and service availability of communications satellites by extending design lifetimes to ten to fifteen years. A literature search containing over 200 references was directed primarily at the orbital performance of satellites. Appendices are presented covering the following areas: satellite orbital histories; confidence bounds for constant failure rates demonstrated by parts; and EEE part failure mechanisms. R.C.T.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-23358# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
SPACE TRANSPORTATION SYSTEM WESTERN LAUNCH SITE CONSTRUCTION MANAGEMENT INFORMATION SYSTEM: A CASE STUDY M.S. Thesis
G. Scott Griffin and James M. Mardis Sep. 1979 97 p refs
(AD-A077675; AFIT-LSSR-4-79B) Avail: NTIS HC A05/MF A01

The Corps of Engineers Management Information System (COEMIS) is used by the Corps of Engineers in their role as construction agents on Air Force projects built under the Military Construction Program. This research investigates the ability of COEMIS to meet Air Force informational needs by examining the construction management effort in progress on the Western Launch Site Space Transportation System Facilities at Vandenberg Air Force Base, California. The research concluded that the Corps of Engineers Management Information System can be an effective, efficient management tool which has the capability to meet Air Force needs provided: (1) implementation of real time computer interfaces, (2) Air Force participation in COEMIS, and (3) establishment of a split data base. The results of this study should be applicable to all major Air Force construction projects managed by the Army Corps of Engineers. GRA

N80-23359# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
LONG DURATION EXPOSURE FACILITY (LDEF): A NEW MULTIPURPOSE FREE-FLYING EXPERIMENT CARRIER
Eduard Igenbergs 1977 27 p refs In GERMAN Presented at Ann. DGLR Meeting, Berlin, 13-15 Sep. 1977
(TUM-LRT-KB-77/17) Avail: NTIS HC A03/MF A01

The construction, launch, and return environment of the long

duration exposure facility (LDEF) are described. Possible long-term experiments are discussed. Author (ESA)

N80-23360# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
SUGGESTED EXPERIMENTS FOR MOMENTUM-FREE G-SIMULATION USING THE LONG DURATION EXPOSURE FACILITY (LDEF) [EXPERIMENTEN VORSCHLAG EINER MOMENTENFREIEN G-SIMULATION FUER DEN EINSATZ IM DDEF]
D. Hayn and H. Steinberger Oct. 1978 18 p refs In GERMAN
(TUM-LRT-KB-77/18) Avail: NTIS HC A02/MF A01

An experiment is proposed which represents a torque-free simulation of the acceleration values 1 g, 1/3 g and 0 g. These are generated by two contrarotating cylindrical disks. The apparatus will fit in an experiment tray, and will be activated after the unloading of the carrier from the space shuttle. Author (ESA)

N80-23361# European Space Agency, Paris (France).
MODELING OF COUPLED HEAT TRANSFER BY RADIATION AND CONVECTION: APPLICATION TO SPACELAB SHORT MODULE [MODELISATION DES TRANSFERT THERMIQUES COUPLES PAR RAYONNEMENT ET CONVECTION: APPLICATION A LA CABINE DU SPACELAB]
J. B. Saulnier (Ecole Natl. Super. de Mecan. et d'Aerotech.), A. Alexandre (Ecole Natl. Super. de Mecan. et d'Aerotech.), and J. Martinet (Ecole Natl. Super. de Mecan. et d'Aerotech.) Oct. 1979 39 p refs In FRENCH
(ESA-STM-214; ISSN-0379-4075) Avail: NTIS HC A03/MF A01

A model of coupled heat transfer by radiation and forced convection was developed and applied to the Spacelab short module. The fundamental laws concerning emission and absorption of radiation in gases and gaseous mixtures are discussed. The Spacelab cabin was modelled using a cylindrical pipe in which a mixture of air, carbon dioxide, and water vapor flows at uniform velocity. The influence of zoning is demonstrated and the equations of combined heat transfer are solved for a step change in the input fluid temperature. Author (ESA)

N80-23498*# Boeing Aerospace Co., Seattle, Wash.
MECHANISMS TO DEPLOY THE TWO-STAGE IUS FROM THE SHUTTLE CARGO BAY
H. Theron Haynie *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 1-8 ref (For primary document see N80-23495 14-31)
(Contract F04701-78-C-0040)
Avail: NTIS HC A15/MF A01 CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-23362*# Vought Corp., Dallas, Tex.
SPACECRAFT RADIATORS FOR ADVANCED MISSION REQUIREMENTS Final Report
J. W. Leach 23 Apr. 1980 134 p refs
(Contract NAS9-14776)
(NASA-CR-160589; Rept-2-30320/9R-52212) Avail: NTIS HC A07/MF A01 CSCL 22B

Design requirements for spacecraft heat rejection systems are indentified, and their impact on the construction of conventional pumped fluid and hybrid heat pipe/pumped fluid radiators is evaluated. Heat rejection systems to improve the performance or reduce the cost of the spacecraft are proposed. Heat rejection requirements which are large compared to those of existing systems and mission durations which are relatively long, are discussed. E.D.K.

N80-23363# SRI International Corp., Menlo Park, Calif.
CHEMICAL PHYSICS OF CHARGE MECHANISMS IN NONMETALLIC SPACECRAFT MATERIALS Final Report
Richard C. Adamo and Joseph E. Nanevicz May 1979 37 p refs
(Contract F49620-77-C-0113; AF Proj. 2303; SRI Proj. 6402)
(AD-A081487; AFOSR-80-0125TR) Avail: NTIS HC A03/MF A01 CSCL 22/2

The interactions of spacecraft and space systems with the changing solar illumination and charged-particle environments in the vacuum of space result in the occurrence of a number of electrostatic and electromagnetic phenomena. These phenomena, commonly referred to collectively as spacecraft charging effects, can produce undesirable and sometimes serious problems with the performance and operation of military, commercial and NASA spacecraft. This report explores the behavior of typical polymeric spacecraft surface materials under simulated orbital conditions to provide a better understanding of the electrostatic and electromagnetic charging and discharging processes associated with spacecraft charging phenomena. The results of the materials charging behavior studies provide an empirical measure of some of the complexities of materials behavior under dynamic conditions more typical of those encountered in space than are normally used in ground based simulations and indicate that many present laboratory simulation and measurement techniques may not provide data truly representative of actual in-orbit spacecraft charging effects. The results of the discharge characterization experiments indicate that electromagnetic transients caused by sample discharges produced signals in external sensors indicative of transient electric field changes of tens of kV/m at locations several inches from the sample boundaries. These transient electromagnetic signals can therefore be considered as extremely energetic sources of possible electromagnetic interference on spacecraft. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-23364*# Illinois Univ., Urbana. Aeronomy Lab.
A ROCKET-BORNE ENERGY SPECTROMETER USING MULTIPLE SOLID-STATE DETECTORS FOR PARTICLE IDENTIFICATION
K. L. Fries, L. G. Smith, and H. D. Voss 1 Dec. 1979 167 p refs

(Grant NGR-14-005-181)
(NASA-CR-153183; UILU-ENG-79-2510; Aeronomy-91;
ISSN-0568-0581) Avail: NTIS HC A08/MF A01 CSCL 14B

A rocket-borne experiment using energy spectrometers that allows particle identification by the use of multiple solid-state detectors is described. The instrumentation provides information regarding the energy spectrum, pitch-angle distribution, and the type of energetic particles present in the ionosphere. Particle identification was accomplished by considering detector loss mechanisms and their effects on various types of particles. Solid state detectors with gold and aluminum surfaces of several thicknesses were used. The ratios of measured energies for the various detectors were compared against known relationships during ground-based analysis. Pitch-angle information was obtained by using detectors with small geometrical factors mounted with several look angles. Particle flux was recorded as a function of rocket azimuth angle. By considering the rocket azimuth, the rocket precession, and the location of the detectors on the rocket, the pitched angle of the incident particles was derived. R.E.S.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-23365*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COOLING OF HIGH PRESSURE ROCKET THRUST CHAMBERS WITH LIQUID OXYGEN
H. G. Price 1980 15 p refs Proposed for presentation at the 16th Joint Propulsion Conf., Hartford, 30 Jun. - 2 Jul. 1980; cosponsored by AIAA, ASME and SAE
(NASA-TM-81503; E-441) Avail: NTIS HC A02/MF A01 CSCL 21H

An experimental program using hydrogen and oxygen as the propellants and supercritical liquid oxygen (LOX) as the coolant was conducted at 4.14 and 8.274 MN/square meters (600 and 1200 psia) chamber pressure. Data on the following are presented: the effect of LOX leaking into the combustion region through small cracks in the chamber wall; and verification of the supercritical oxygen heat transfer correlation developed from heated tube experiments. A total of four thrust chambers with throat diameters of 0.066 m were tested. Of these, three were cyclically tested to 4.14 MN/square meters (600 psia) chamber pressure until a crack developed. One had 23 additional hot cycles accumulated with no apparent metal burning or distress. The fourth chamber was operated at 8.274 MN/square meters (1200 psia) pressure to obtain steady state heat transfer data. Wall temperature measurements confirmed the heat transfer correlation. R.C.T.

N80-23366# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab Section.
SURVEILLANCE REPORT. STAGE 1, DISSECTED MOTORS, PHASE 11: PROPELLANT COMPONENT TESTING Semiannual Report
John A. Thompson Nov. 1979 96 p
(AD-A081535; MANCP-427(79)) Avail: NTIS HC A05/MF A01 CSCL 21/9

Testing was performed to determine the useful shelf/service life for LGM-30 Stage 1 Rocket Motors. A three year storage program for propellant and components was started in May 1961. This program was then extended to a ten year study and later continued indefinitely to assure that a deterioration in motor physical characteristics could be detected in time to take some corrective actions before the weapon system performance deteriorated below an acceptable level. This report covers only propellant data and limited case bond data. The malfunction of an environmental chamber destroyed component samples that had originally been part of this testing program (and the inadvertent burning of some motors during dissection reduced the material available for testing). Planned dissection of selected motors in the future will provide samples for continued component testing. The data from this test period was combined with data from previous testing and entered into the G085 computer for storage, analysis, and regression analysis. From the statistical analysis of all data tested to date, significant degradation of the propellant does not appear likely for at least two years past the oldest data point. GRA

N80-23367# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF A MICROPROCESSOR-BASED INSTRUMENT FOR STATIC TESTING SMALL ROCKET ENGINES M.S. Thesis
Arthur Houghton Barber, III Sep. 1979 105 p refs
(AD-A081083) Avail: NTIS HC A06/MF A01 CSCL 14/2

A microprocessor-based instrument was developed for static testing solid-fuel rocket engines having peak thrusts of 130 Newtons or less and total impulses of up to 100 Newton-seconds. It measured peak thrust, total impulse, burn time, pyrotechnic delay time, and maximum casing external temperature, all to relative accuracies of two percent of the smallest expected values. This corresponds to better than 0.1 percent of full scale. The instrument was designed for minimum parts cost and for portable operation from two twelve-volt batteries. It may be easily modified to test engines with five to ten times greater thrusts and total impulses. GRA

N80-23368# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
COST ANALYSIS OF THE PROPULSION OF A PAYLOAD TRANSFER MODULE FOR SHUTTLE/SPACELAB APPLICATIONS ON THE BASIS OF HYBRID ROCKET ENGINES [UNTERSUCHUNGEN UEBER DIE KOSTEN DES ANTRIEBS EINES NUTZLASTTRANSFERMODULS FUER RAUMTRANSPORTER/RAUMLABORATORIUM-ANWENDUNGEN AUF BASIS VON ZWEISTOFFTRIEBWERKEN]
Robert H. Schmucker 28 Sep. 1977 25 p refs In GERMAN
(TUM-LRT-KB-77/19) Avail: NTIS HC A02/MF A01

Design alternatives are considered for an autonomous three axis stabilized propulsion platform for use with space shuttle/Spacelab. An optimal configuration is presented, based on subsystem choices. Author (ESA)

N80-23507*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN AND DEVELOPMENT OF THE QUAD REDUNDANT SERVOACTUATOR FOR THE SPACE SHUTTLE SOLID ROCKET BOOSTER THRUST VECTOR CONTROL
James M. Lominick *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 125-141 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 21H

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-23369# National Materials Advisory Board, Washington, D. C.
SCIENCE BASE FOR MATERIALS PROCESSING: SELECTED TOPICS Final Report
Nov. 1979 143 p refs
(Contract MDA903-78-C-0038)
(PB80-122948; NMAB-355) Avail: NTIS HC A07/MF A01 CSCL 05A

The highlights of a workshop on four selected topics, namely, high speed metal removal, metal deformation processing, advanced composites, and high modulus polymers are presented. Areas of materials processing are identified that could benefit from an improved science base. Scientific information to be obtained for each process are defined to achieve technological and economic improvements. Institutional problems are explored that must be overcome to achieve greater academic participa-

tion in processing science and more effective industry-university interaction. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-23370*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENGINE ENVIRONMENTAL EFFECTS ON COMPOSITE BEHAVIOR
C. C. Chamis and G. T. Smith 1980 20 p refs Presented at the 21st Struct., Structural Dyn. and Mater. Conf., Seattle, 12-14 May 1980; sponsored by AIAA, ASME, ASCE, and AHS (NASA-TM-81508; E-446) Avail: NTIS HC A02/MF A01 CSCL 11D

A series of programs were conducted to investigate and develop the application of composite materials to turbojet engines. A significant part of that effort was directed to establishing the impact resistance and defect growth chracteristics of composite materials over the wide range of environmental conditions found in commercial turbojet engine operations. Both analytical and empirical efforts were involved. The experimental programs and the analytical methodology development as well as an evaluation program for the use of composite materials as fan exit guide vanes are summarized. R.C.T.

N80-23371*# Lockheed-California Co., Burbank.
FLIGHT SERVICE EVALUATION OF KEVLAR-49 EPOXY COMPOSITE PANELS IN WIDE-BODIED COMMERCIAL TRANSPORT AIRCRAFT Annual Flight Service Report, Jan. - Dec. 1979
R. H. Stone Mar. 1980 43 p refs
(Contract NAS1-11621)
(NASA-CR-159231; AFSR-6) Avail: NTIS HC A03/MF A01 CSCL 11D

Kevlar-49 fairing panels, installed as flight service components on three L-1011s, were inspected after 6 years' service. The Kevlar-49 components were found to be performing satisfactorily in service with no major problems, or any condition requiring corrective action. The only defects noted were minor impact damage, and a minor degree of fastener hole fraying and elongation. These are for the most part comparable to damage noted on fiberglass fairings. R.C.T.

N80-23372# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
FATIGUE CHARACTERIZATION OF COMPOSITE MATERIALS Final Report, 1 Oct. 1978 - 15 Apr. 1979
James M. Whitney Oct. 1979 38 p refs
(AF Proj. 2419)
(AD-A081320; AFML-TR-79-4111) Avail: NTIS HC A03/MF A01 CSCL 11/4

A procedure is outlined which allows the generation of an S-N curve with some statistical value without resorting to an extremely large data base. The procedure is based on a power law representation of the S-N curve and a two-parameter Weibull Distribution for time-to-failure at a specific stress level. A data pooling scheme is also discussed which allows the determination of a fatigue shape parameter which is independent of stress level. GRA

N80-23373# Northrop Corp., Hawthorne, Calif. Aircraft Group.
ROOM TEMPERATURE CURING RESIN SYSTEMS FOR GRAPHITE/EPOXY COMPOSITE REPAIR Final Report, Jan. - Dec. 1979
D. J. Crabtree Dec. 1979 83 p
(Contract N62269-79-C-0224)
(AD-A081738; NOR-80-46; NADC-78101-60) Avail: NTIS HC A05/MF A01 CSCL 11/4

Adhesive formulations were developed for the repair of damaged graphite/epoxy structures on board ship. These adhesives cure at 24 C (75 F) or in the moderate temperature range of 67 to 121 C (150 to 250 F). The formulations which gave the best results in lap shear testing were formulated from high molecular weight and high functionality epoxy resins and a polyamine curing agent. A typical formulation is composed of a cresol novalac epoxy, (Ciba-Geigy ECN 1299), the triglycidyl ether of p-aminophenol, (Ciba-Geigy 0510), and diethylenetriamine, a polyamine curing agent. After a 72 hour cure at 24 C (75 F) an adhesive compounded from this formulation had much higher lap shear strength at 121 C (250 F) than did commercially available epoxy, acrylic, and anaerobic adhesives. Aluminum/aluminum bonds tested in a rapid heat-up to 121 C (250 F) (at 150 F/min) and immediate application of load at 121 C (250 F) had lap shear strength of 1400 psi whereas the commercial adhesives had 500-700 psi strength in the same test. The formulation when cured at 121 C (250 F) had lap shear strength at 121 C (250 F) of 2700 psi. Another promising system is the vinyl ester resin system as a moderate temperature, 66 C to 121 C (150 F to 250 F), curing adhesive. It has good environmental durability and methodological research. GRA

N80-23374# Effects Technology, Inc., Santa Barbara, Calif.
RESPONSE OF INFRARED-TRANSPARENT MATERIALS TO RAINDROP IMPACTS Final Report, Aug. 1978 - Aug. 1979
William F. Adler, John C. Botke, and Timothy W. James Wright-Patterson AFB, Ohio AFML Oct. 1979 175 p refs
(Contract F33615-78-C-5143; AF Proj. 2423)
(AD-A081542; ETI-CR79-60; AFML-TR-79-4151) Avail: NTIS HC A08/MF A01 CSCL 13/8

This investigation concentrates on the damage produced in chemically vapor deposited (CVD) zinc sulfide (ZnS) by water drop impacts on the order of 1 mm in diameter impinging over a velocity range from 222 to 684/ms (730 to 2240 fps). A combined experimental and analytical approach was pursued to determine the relationships between water drop impact damage and the material properties of CVD ZnS in order to evaluate and guide efforts to develop erosion resistant window materials for use at 8-12 micrometer wavelengths. Microscopic observations of the damage produced in three formulations of CVD ZnS representing variations in grain size, grain shape, and inclusion content indicated the fracture trajectories and penetration depths were essentially insensitive to the range of microstructural features which were investigated. The quality of the surface finish was found to be the dominant contribution to the fracture response of CVD ZnS. Further modification of the bulk material properties does not appear warranted; the present production material is satisfactory. Considerably greater latitude for increased resistance to rain erosion can be gained from improved polishing procedures and subsequent maintenance of the initial surface finish. GRA

N80-23375# AiResearch Mfg. Co., Torrance, Calif. Materials Engineering Group.
HIGH-TEMPERATURE MECHANICAL PROPERTIES OF SINTERED ALPHA SILICON CARBIDE (13 OCTOBER 1978 - 13 OCTOBER 1979)
David M. Kotchick 19 Feb. 1980 94 p refs
(Contract N00014-76-C-0249)
(AD-A081824; AiResearch-80-16772) Avail: NTIS HC A05/MF A01 CSCL 07/1

Failures on tensile-stressed, as-fired samples were caused primarily by processing defects and did not appear to be associated with compositional changes (amount of sintering agent) in the material. At high testing temperatures (above 1340 C), the occurrence of processing defects appears to control strength, making it impossible to speculate on the effect of salt and oxidation during slow crack growth in these specimens. Over the variety of conditions tested such as salt, oxidation, and their combinations, strength did not vary greatly. Therefore, the defects from processing represents the reasonable lower limit of strength under the imposed testing conditions. The determined strength values probably represent reasonable design data for components with as-fired, as-formed surfaces of similarly processed SASC. Since these strength values represent a reasonable lower limit for as-fired, as-formed surfaces of SASC, the potential is good for improvement by processing improvements to eliminate defects. SASC continues to show promise as a viable engineering material. It will become more attractive for heat exchanger applications in aggressive environments as processing becomes more sophisticated. GRA

N80-23376# Materials Sciences Corp., Blue Bell, Pa.
DEFINITION AND MODELING OF CRITICAL FLAWS IN GRAPHITE FIBER REINFORCED RESIN MATRIX COMPOSITE MATERIALS Final Report, 28 Jul. 1978 - 28 Aug. 1979
S. N. Chatterjee, Z. Hashin, and R. B. Pipes 28 Aug. 1979 121 p refs
(Contract N62269-78-C-0111)
(AD-A080893: MSC/TFR/1105/1008) Avail: NTIS HC A06/MF A01 CSCL 11/4

An analytical and experimental study was conducted to determine criticality of interlaminar disbonds by NDE methods. Criticality of such flaws in a shear environment (action of shear near support) was defined in terms of crack propagation and was analyzed by principles and methods of fracture mechanics. Growth of disbonds under cylic loading was also studied. Failure under compressive loading in presence of a disbond was defined in terms of buckling and an elastic stability analysis was utilized for assessing criticality. Analytical predictions were compared with experimental results in both cases. Utrasonic 'C' scans were used for detection and tracking of the flaws. Preliminary wave propagation studies were conducted for estimating changes in storage and loss moduli induced by moisture conditioning to examine the possibility of using such measurements as NDT techniques for damage assessment. GRA

N80-23377# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
RAPID PROPAGATION OF INTERFACE-FLAWS IN COMPOSITE BODIES Final Report, 1975 - 1979
J. D. Achenbach Nov. 1979 9 p refs
(Grants DAHC04-75-G-0200; DAAG29-78-G-0031)
(AD-A078813; NU-SML-TR-79-9; ARO-12791.7-E) Avail: NTIS HC A02/MF A01 CSCL 11/4

A summary and a bibliography are presented of the investigations on the rapid propagation of interface flaws in composite bodies, which were carried out at Northwestern University under the sponsorship of the U.S. Army Research Office during the period July 1, 1975 - September 30, 1979. GRA

N80-23378# New York Univ., N. Y.
EFFECTIVE BEHAVIOR OF COMPOSITE MATERIALS Final Technical Report, 1 Aug. 1978 - 31 Jul. 1979
George C. Papanicolaou Jul. 1979 8 p
(Grant AF-AFOSR-3668-78; AF Proj. 2304)
(AD-A078466; AFOSR-79-1157TR) Avail: NTIS HC A02/MF A01 CSCL 11/4

The following four problems have been analyzed in detail. First, the effective heat removal rate for a conducting material perforated with many small holes is computed. Second, for a conducting material impregnated with nonconductors occupying a large fraction of the medium and randomly dispersed the effective conductivity is obtained. Third, for a material with a random rough boundary, a theory of effective boundary impedance has been developed. Fourth, the effects of random structural imperfections on buckling loads of beams have been computed. GRA

N80-23379# United Technologies Research Center, East Hartford, Conn.
PROGRAM TO STUDY SIC FIBER REINFORCED GLASS MATRIX COMPOSITES Annual Report, Jul. 1978 - Jul. 1979
J. J. Brennan Aug. 1979 36 p refs
(Contract N00014-78-C-0503; NR Proj. 032-589)
(AD-A077638; UTRC/R79-914401-2) Avail: NTIS HC A03/MF A01 CSCL 11/4

Glass-ceramic composites reinforced with SiC fibers have been fabricated that exhibit good strength properties from RT to 1000 C. In particular, a lithium-aluminum-silicate (LAS) matrix reinforced with SiC yarn has been shown to possess bend strengths of over 690 MPa (100 ksi) from RT to 800 C. However, the TiO_2 nucleating agent present in the usual LAS materials can cause matrix crystallization during hot-pressing and fiber-matrix interactions, making the fabrication of consistently high strength composites extremely difficult. The substitution of ZrO_2 for the TiO_2 appears to have eliminated this problem. Composites fabricated from SiC monofilament with a magnesium-aluminum-silicate (MAS) matrix have also exhibited high strengths from RT to 1000 C. Again, however, consistent fabrication of reproducibly high strength composites has been difficult due to lack of wetting and bonding between the SiC fibers and the matrix. GRA

N80-23380# General Dynamics Corp., San Diego, Calif. Convair Div.
APPLICATION OF GRAPHITE/EPOXY COMPOSITES FOR THE SPS-10 RADAR REFLECTOR Final Report, Jan. 1978 - Oct. 1979
Gary A. Tremblay Oct. 1979 82 p
(Contract N00024-78-C-5332; SF12141404)
(AD-A077530; GDC-SPS-79-001) Avail: NTIS HC A05/MF A01 CSCL 11/4

The General Dynamics Convair Division was contracted to evaluate the applicability of graphite/epoxy on the SPS-10 reflector. This task was a result of the Navy's study to reduce life cycle costs, acquisition costs, and structural weight of Naval antenna systems. The Convair effort began with a study of the RF performance of a graphite/epoxy grating panel, which proved to perform as well as its metal counterpart. We designed, fabricated, and tested a composite prototype unit of the reflector unit for performance approval. The graphite/epoxy reflector was mounted on a Navy-furnished SPS-10 spider and pedestal for structural (wind and vibration) and RF pattern range testing. All performance test results met or exceeded Navy specifications. Following testing at General Dynamics, the antenna was sent to the Naval Ocean Systems Center (NOSC), San Diego, California, for extended RF and environmental testing prior to shipboard evaluation. The Convair prototype SPS-10 reflector weighs 66.9 pounds (a 14% weight reduction compared to the metal SPS-10). An applications evaluation study during the program showed that a significantly greater weight savings, i.e., a 20.1-pound weight reduction for a 26% weight savings, and reduced fabrication costs could be realized for a production design of the SPS-10 reflector. GRA

N80-23381# Fiat Research Center, Orbassano (Italy).
FABRICATION AND PROPERTIES OF A PRESSURELESS SINTERED SILICON NITRIDE BASED ON Y2O3 AS SINTERING AID
A. Giachello, P. C. Martinengo, G. Tommasini, and P. Popper (British Ceram. Res. Assoc.) 1979 17 p refs Submitted for publication
Avail: NTIS HC A02/MF A01

A powder mixture 91% Si_3N_4 + 8% Y_2O_3 + 1% MgO was sintered at 1800 C in nitrogen at atmospheric pressure to a density of 3.25 Mg/cu m. The strength at room temperature was 585 MPa and at 950 C it was 560 MPa. Devitrification of an amorphous phase increased the strength at 1125 C by 44%. The linear shrinkage during sintering was 16%; thus it should be possible to fabricate complex shapes to high dimensional accuracy. The proposed sintering process overcame some of the disadvantages of the reaction-sintering and hot pressing processes. Various mechanical and thermal properties were determined. Author (ESA)

N80-23382# Fiat Research Center, Orbassano (Italy).
SINTERING OF SILICON NITRIDE IN A POWDER BED
A. Giachello, P. C. Martinengo, G. Tommasini, and P. Popper (British Ceram. Res. Assoc.) 1979 8 p refs Submitted for publication
Avail: NTIS HC A02/MF A01

Silicon nitride with the addition of MgO as a sintering aid can be sintered at atmospheric pressure by embedding the powder compacts in a loose powder mixture. By choosing a suitable composition of the powder in the bed, it is possible to control both the decomposition of the silicon nitride and the loss by volatilization of the MgO. In this way one can obtain homogeneously sintered articles of complex shapes of density greater than 3.0 Megagrams per cu m. Author (ESA)

N80-24251 Idaho Univ., Moscow.
DYNAMIC MECHANICAL PROPERTIES OF FIBER-REINFORCED COMPOSITE MATERIALS
R. F. Gibson and D. G. Wilson *In* the Shock and Vibration

Inform. Center, The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 3-12 refs (For primary document see N80-24250 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-23383* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CHELATE-MODIFIED POLYMERS FOR ATMOSPHERIC GAS CHROMATOGRAPHY Patent
Warren W. Christensen (San Jose State Univ.), Ludwig A. Mayer (San Jose State Univ.), and Fritz H. Woeller, inventors (to NASA) (San Jose State Univ.) Issued 22 Apr. 1980 9 p Filed 30 Jun. 1978 Supersedes N78-27275 (16 - 18, p 2375) Sponsored by NASA
(NASA-Case-ARC-11154-1; US-Patent-4,198,792; US-Patent-Appl-SN-921626; US-Patent-Class-521-55; US-Patent-Class-55-66; US-Patent-Class-55-67; US-Patent-Class-55-68; US-Patent-Class-55-72; US-Patent-Class-521-146; US-Patent-Class-521-918; US-Patent-Class-525-4) Avail: US Patent and Trademark Office CSCL 07D

Chromatographic materials were developed to serve as the stationary phase of columns used in the separation of atmospheric gases. These materials consist of a crosslinked porous polymer matrix, e.g., a divinylbenzene polymer, into which has been embedded an inorganic complexed ion such as N,N'-ethylene-bis-(acetylacetoniminato)-cobalt (2). Organic nitrogenous bases, such as pyridine, may be incorporated into the chelate polymer complexes to increase their chromatographic utility. With such materials, the process of gas chromatography is greatly simplified, especially in terms of time and quantity of material needed for a gas separation.

Official Gazette of the U.S. Patent and Trademark Office

N80-23384 Yale Univ., New Haven, Conn.
DEVELOPMENT OF DYNAMIC NMR PULSE TECHNIQUES AND APPLICATIONS TO MEMBRANE PERMEATION AND PEPTIDE BOND ROTATION KINETICS Ph.D. Thesis
Jeffry Roy Alger 1979 311 p
Avail: Univ. Microfilms Order No. 8011521

Nuclear magnetic resonance (NMR) techniques were developed for the measurement of phospholipid membrane permeation by small molecules. A magnetization transfer NMR pulse technique termed selective population transfer (SPT) was developed for this purpose. Membrane permeation was studied when the NMR signal arising from a solute entrapped within a limiting membrane was resolved from the signal arising from excluded solute permeation exchanges entrapped and excluded solute and introduced exchange effects into the NMR spectrum. When the permeation rate was similar to the nuclear relaxation rate, permeation was measured with SPT. Faster permeation rates were measured with classical techniques involving lineshape analysis. The longitudinal relaxation of the exchanging nuclear resonances was observed after one resonance was selectively inverted. Iterative nonlinear least squares curve fitting of the observed relaxation to the theoretical relaxation curves was employed to determine the exchange rates. Initially the SPT technique was tested by measuring the interconversion rate between the cis and trans peptide bond conformations for the dipeptide, glycylsarcosine. Dissert. Abstr.

N80-23385 Wisconsin Univ. - Milwaukee.
A STUDY OF THE HYDROGEN ASSOCIATED WITH SUPPORTED AND UNSUPPORTED MOLYBDENUM OXIDE. 1: MOLYBDENA-ALUMINA CATALYSTS. 2: HYDROGEN MOLYBDENUM BRONZES Ph.D. Thesis
Alexander Carl Cirillo, Jr. 1979 268 p
Avail: Univ. Microfilms Order No. 8009232

Nuclear magnetic resonance (NMR) techniques were used to investigate the dehydroxylation of alumina and molybdena-alumina catalysts. The decrease in the percentage of hydroxyls observed by NMR with increasing temperature of dehydroxylation suggested a strong interaction between the unobservable hydroxyls, shown to be present by D2 exchange, and the Al(+3) ions exposed on the surface. The hydroxyls were restored to detection by NMR upon adsorption of D2O. The hydrogen spillover technique was used to form hydrogen molybdenum bronzes at 60 C by exposing platinized MoO3 to H2. Attempts to form lower bronzes, viz. H0.5MoO3, resulted in heterogeneous samples. The NMR lineshape observed at room temperature exhibited a total anisotropy of -23 ppm and was postulated to result from the extensive proton mobility in the irregularly shaped particles of the conducting oxide. Below 200 K, the proton mobility deceased and the homonuclear dipolar interaction became important; the lineshape became Lorentzian suggesting residual rotational motion. Dissert. Abstr.

N80-23386 Texas Univ. at Austin.
AN ELECTRON SPECTROSCOPIC INVESTIGATION OF THE INTERACTION OF METHANOL AND AMMONIA WITH CLEAN AND PARTIALLY OXIDIZED ALUMINUM SURFACES Ph.D. Thesis
James William Rogers, Jr. 1979 281 p
Avail: Univ. Microfilms Order No. 8009920

The oxidation of clean polycrystalline Al and the interaction of CH3OH and NH3 with clean and oxidized Al surfaces were studied using both ultraviolet and X-ray photoelectron spectroscopy as well as X-ray excited Auger electron spectroscopy. Ultrahigh vacuum conditions in the temperature range 106-673 K were used. Low exposure of O2 at 128 K caused dissociation and subsequent incorporation of oxygen below the surface leaving a depletion layer rich in Al(delta +). Sorption at intermediate exposures led to the formation of amorphous Al2O3 islands while high exposures formed a thin layer of amorphous Al2O3 which covered the entire surface. The D2O initially dissociated and oxidized clean Al at 128 K followed by condensation at higher exposures. An increase in surface temperature led to the desorption of the condensed multilayer beginning near 180 K, leaving the surface partially hydroxylated at 200-270 K. Further increases in temperature converted the hydroxide to surface oxide (Al2O3) as did D2O adsorption at 300 K. Dissert. Abstr.

N80-23387 Ohio Univ., Athens.
THE IDENTIFICATION OF CHROMATOGRAPHICALLY SEPARATED FRACTIONS BY FOURIER TRANSFORM INFRARED SPECTROSCOPY Ph.D. Thesis
Donald Kuehl 1979 184 p
Avail: Univ. Microfilms Order No. 8010855

Improvements in the sensitivity and versatility of both a gas chromatography-Fourier transform infrared (GC/FT-IR) interface and a high performance liquid chromatography-Fourier transform infrared spectroscopy (HPLC/FT-IR) interface to aid in the identification of chromatographically separated fractions are described. The sensitivity of the FT-IR spectrometer was improved by using a dual beam optical subtraction technique which decreased the signal-to-noise ratio of the interferogram about zero retardation. This allowed a more sensitive mercury cadmium detector to be substituted for the conventional triglycine sulfate detector. This system was applied to support coated open tubular column GC/FT-IR measurements using a lightpipe which was optimum for these columns. This system was used to measure spectra of low nanogram quantities of sample, separated by SCOT columns. To lower the detection for compounds separated by HPLC below the microgram range, a microprocessor controlled HPLC/FT-IR interface was designed and constructed which used a diffuse reflectance sampling technique and automated solvent elimination. Dissert. Abstr.

N80-23388 Utah Univ., Salt Lake City.
NUMERICAL STUDIES OF PHYSICAL VAPOR TRANSPORT Ph.D. Thesis
David William Greenwell 1980 199 p

Avail: Univ. Microfilms Order No. 8011589

The viscous and gravitational influences on the mass transport formulations for vapor are studied. The treatment is limited to binary physical vapor transport in vertical right circular cylinders. Numerical solutions were obtained for the coupled mass momentum, and chemical species (diffusion) transport equations. Since gravitational influences were of interest, calculations were made with the assumption that the two components differed in molecular weight. The relation between the Reynolds number and the aspect ratio is discussed and the effect of the convective component of mass flow on the concentration gradients is described. Dissert. Abstr.

N80-23389 Pennsylvania State Univ., University Park.
THEORETICAL AND EXPERIMENTAL STUDIES ON THE DIELECTRIC AND OPTICAL PROPERTIES OF FLUIDS UNDER HIGH PRESSURE Ph.D. Thesis
Chung Chih Chen 1979 231 p
Avail: Univ. Microfilms Order No. 8010037

The variation of the refractive index of liquid with pressure to 14 kbar was determined by an optical interferometric method. The liquids studied were chloroform, carbon disulfide, o-xylene, n-xylene, 1-3-5 trimethyl benzene, cumene, methyl cyclohexane, ethyl bromide, ethyl iodide, i-butyl alcohol, ethyl alcohol, and deuterium oxide at room temperature. Since some of these liquids freeze at room temperature even before 14 kbar is reached, the measurements were carried out up to the freezing point or 14 kbar, whichever pressure is lower. In every case the refractive index increased with pressure with pronounced nonlinearity, particularly at high pressure. This nonlinearity was reduced considerably when the same data on delta n were considered as a function of the volume strain indicating that the nonlinear piezo-optic behavior of liquids was just a manifestation of nonlinear P-V relationship. Further, it is found that the slight nonlinearity noticed in the delta N-delta V/V sub o relationship could be still further reduced when the variation in refractive index is treated as a function of the Lagrangian and Eulerian strains. Other significant results are reported. Dissert. Abstr.

N80-23390 Iowa State Univ. of Science and Technology, Ames.
OXYGEN REDUCTION OF A GRAPHITE PASTE AND A CATALYST LOADED GRAPHITE PASTE ELECTRODE Ph.D. Thesis
Dennis Michael DiMarco 1979 164 p
Avail: Univ. Microfilms Order No. 8010226

Oxygen reduction was studied in basic solution at graphite paste electrode (GPE). The GPE was used as the disk of a rotating ring disk electrode (RRDE) and experiments were done using the voltage scan technique. The enhancements afforded by catalysts applied to the GPE were also studied. Oxygen reduction on a GPE was shown to be a two electron process resulting in the formation of peroxide. The Tafel slope was 180 mV. The presence of gold, silver, or platinum on the GPE shifted the oxygen reduction wave approximately 800 mV in the anodic direction. Comparison of the data on a metal catalyzed GPE to the solid metal electrode showed that the former electrode produced a greater fraction of peroxide as product than did the latter. Silver and gold catalyzed GPEs gave Tagel slopes of about 120 mV. The intermediate catalysis of iron and cobalt porphyrin was also examined. While the cobalt porphyrin catalyzed oxygen reduction at a more anodic potential than the iron porphyrin, the latter appeared more active in reacting the peroxide formed as the product of the disk reaction. Dissert. Abstr.

N80-23391 Georgia Inst. of Tech., Atlanta.
IMPROVEMENTS IN DETECTION CAPABILITIES IN ATOMIC SPECTROSCOPY Ph.D. Thesis
John William Novak, Jr. 1979 175 p
Avail: Univ. Microfilms Order No. 8010004

High powered pulsed, ratio frequency (RF) - excited, electrodeless discharge lamps (EDLs) were characterized as possible sources for atomic spectroscopy. Novel behavior of the lamps was observed when they were operated in a pulsed mode. The radiant output of the EDLs was found to increase rapidly when short pulses were used, at incident powers where continuous wave (CW) operation of the lamps often resulted in decreased radiant output, thus indicating different excitation processes in the two modes of operation. The behavior of RF-excited Ar, Hg, Cd and Zn EDLs were compared with microwave excited lamps for the same elements. The process of liquid sample introduction into flames and plasmas was evaluated. An aerosol monitoring system was developed capable of measuring size distributions of spray droplets produced from common nebulizers used for analytical atomic spectrometry. The system provided a means for the systematic characterization of droplet sizes of the various sprays in the diameter range 0.10 to 10 micrometers. Droplet distributions were obtained using a cascade impactor operated in series with an electrical aerosol analyzer. Results are presented. Dissert. Abstr.

N80-23392 American Univ., Washington, D. C.
ELECTRO-OXIDATION OF HYDROGEN AND PROPANE IN STRONG ORGANIC ACID ELECTROLYTES Ph.D. Thesis
Jalil Ahmad 1980 128 p
Avail: Univ. Microfilms Order No. 8010687

The electrochemical behavior of methane sulfonic acid, ethane sulfonic acid, and sulfoacetic acid as fuel cell electrolytes was studied in a half cell at various temperatures. The methane sulfonic acid and ethane sulfonic acid have shown no promise with propane and therefore cannot be used as potential electrolytes for the hydrocarbon-air fuel cell. Adsorption on the platinum electrode surface and decomposition during electrolysis of these acids was also observed. Sulfoacetic acid with H2 supported about two times higher current density than trifluoromethane sulfonic acid monohydrate. It is concluded that the sulfonic acids containing unprotected C-H bonds are strongly adsorbed on the platinum surface, and decompose easily during the electrolysis; thus, a preferred electrolyte should be substituted sulfonic acid. Dissert. Abstr.

N80-23393*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RATE CONSTANT FOR THE REACTION OF HYDROXYL RADICAL WITH FORMALDEHYDE OVER THE TEMPERATURE RANGE 228-362 K
L. J. Stief, D. F. Nava, W. A. Payne, and J. V. Michael Mar. 1980 17 p refs
(NASA-TM-80666) Avail: NTIS HC A02/MF A01 CSCL 07D

Absolute rate constants for the reaction OH + H2CO measured over the temperature range 228-362 K using the flash photolysis-resonance fluorescence technique are given. The results are independent of variations in H2CO concentration total pressure Ar concentration, and flash intensity (i.e., initial OH concentration. The rate constant is found to be invariant with temperature in this range, the best representation being k sub 1 = (1.05 + or - 0.11) x 10 to the 11th power cc molecule (-1) s (-1) where the error is two standard deviations. This result is compared with previous absolute and relative determinations of k sub 1. The reaction is also discussed from a theoretical point of view. M.G.

N80-23394*# National Aeronautics and Space Administration. Pasadena Office, Calif.
POTENTIAL HEAT EXCHANGE FLUIDS FOR USE IN SULFURIC ACID VAPORIZERS Patent Application
D. D. Lawson (JPL) and G. R. Petersen, inventors (to NASA) (JPL) Filed 30 Apr. 1980 17 p
(Contract NAS7-100)
(NASA-Case-NPO-15015-1; US-Patent-Appl-SN-145207) Avail: NTIS HC A02/MF A01 CSCL 07A

The testing of several candidate perfluorocarbon liquids for the direct fluid contact heat exchange with H2SO4 at about 330 C prior to high temperature decomposition in the oxygen release step of several thermochemical cycles for splitting water into hydrogen and oxygen is described. Among the several liquids tested, only perfluoropropylene oxide polymers having a degree of polymerization from about 10 to 60 were chemically stable and had low miscibility and vapor pressure when tested with sulfuric acid at temperatures from 300 C to 400 C. The thermochemical cycle is outlined. NASA

N80-23395# Extranuclear Labs., Pittsburgh, Pa.
METAL ION REACTIONS WITH OZONE AND ATOMIC OXYGEN Final Report, 1 Sep. 1977 - 31 Dec. 1978
W. L. Fite, M. W. Siegel, and H. H. Lo Hanscom AFB, Mass.

AFGL Apr. 1979 71 p refs
(Contract F19628-77-C-0236; DNA Proj. S99-QAXHD411)
(AD-A081516; AFGL-TR-79-0092) Avail: NTIS HC A04/MF A01 CSCL 11/6

An experiment attempting to measure the thermal and near-thermal rate coefficients for reactions of metal ions with O and O3 is summarized. The method involves a new type of drift tube made of a fully oxidized leaky dielectric material (Cerramag C-11) which permits placing of the drift field without metallic electrodes which could degrade O and O3 into O2 in surface reactions. In the experiments Al(-) from an external surface ionization source was used, the drift gas was argon to which the reactant gas was added, and ions emerging from the drift tube were mass spectrometically detected. It was found by modulated beam mass spectrometry that ozone was not degraded in the drift tube; the atom content in partially dissociated oxygen admitted to the tube was too low to get unequivocal data on the integrity of O in the tube. GRA

N80-23396# Pennsylvania Univ., Philadelphia. Dept. of Physics.
RAMAN SPECTROSCOPY OF SOLIDS Final Report, 19 Jun. 1974 - 30 Sep. 1979
Elias Burstein Feb. 1980 11 p refs
(Grants DAHC04-74-G-0181; DAAG29-76-G-0325)
(AD-A081517; ARO-11716.6-P; ARO-14332.7-P) Avail: NTIS HC A02/MF A01 CSCL 07/4

Research on the inelastic scattering of light by elementary excitations in solids has provided information about the nature of the excitations, the relevant microscopic light scattering mechanisms and the electronic energy band structure of the solids. Results of work on the following problems are summarized: (1) resonance Raman scattering as a probe of space charge fields at semiconductor surfaces; (2) Raman scattering and light diffraction by surface poloritons; (3) surface-electromagnetic wave enhancement of Raman scattering and nonlinear optical phenomena; (4) giant Raman scattering molecules adsorbed metal surfaces; and (5) inelastic light scattering by charge carriers in two dimensional plasmas. GRA

N80-23397# Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
CHARACTERIZATION OF PASSIVE FILMS USING INFRARED AND RAMAN SPECTROSCOPY Final Report
J. Keiser, P. Fabis, C. Brown, and R. Heidersbach Jan. 1980 104 p refs
(Contract N00014-76-C-0889)
(AD-A081240; TR-8) Avail: NTIS HC A06/MF A01 CSCL 07/4

This report summarizes current research into the application of infrared and Raman spectroscopy to the study of passive films on metals. One section of the report discusses the results of computer interfacing of the Raman spectrometer with a minicomputer to produce signal averaged spectra. The signal-averaged Raman spectra reveal spectral details undistinguishable in a single spectrum. A parallel study involved exposure of iron, chromium, and two commercial iron-chromium alloys. GRA

N80-23398# Yale Univ., New Haven, Conn. School of Medicine.
METHODS FOR THE ISOLATION AND IDENTIFICATION OF POLYCYCLIC AROMATIC HYDROCARBONS FOUND IN COMPLEX MIXTURES AND THEIR POSSIBLE TOXICITY BY MEANS OF BIOASSAY TECHNIQUES Progress Report, 1 Aug. 1978 - Aug. 1979
S. R. Lipsky and W. J. McMurray Aug. 1979 24 p refs
(Contract EY-76-S-02-2958)
Avail: NTIS HC A02/MF A01

A computer controlled gas chromatography mass spectrometer is described. Materials under consideration include shale oil extracts, their dimethyl sulfoxide extracts and product waters. A chart of individual identified polycyclic aromatic hydrocarbons is given. DOE

N80-23399# California Univ., Berkeley. Lawrence Berkeley Lab. National Geothermal Information Resource.
AQUEOUS SOLUTIONS DATABASE TO HIGH TEMPERATURES AND PRESSURES: NaCl SOLUTIONS
S. L. Phillips, Roland J. Otto, Huseyin Ozbek, and Mehdi Tavana Aug. 1979 30 p refs Presented at the Workshop on Tech. for Meas. of Thermodyn. Properties, Albany, Oreg. 21-23 Aug. 1979
(Contract W-7405-eng-48)
(LBL-9621; CONF-790896-1) Avail: NTIS HC A03/MF A01

Available experimental data on sodium chloride solutions which are used in geothermal energy exploration and development for electrical power production and direct use were surveyed. The data are classified as thermodynamic, transport and physical; they are useful in the design and development of a geothermal area from brine production through utilization, to brine disposal. An ideal data system for geothermal energy is described. DOE

N80-23400# Oak Ridge National Lab., Tenn.
MASS TRANSPORT IN MOLTEN-SALT ELECTROCHEMICAL SYSTEMS
J. U. Nwalor and A. R. Manner 24 Mar. 1979 25 p refs
(Contract W-7405-eng-26)
(ORNL/MIT-290) Avail: NTIS HC A02/MF A01

Early time behavior of the open cell potential of a Li_2CO_3/K_2CO_3 electrolysis system was investigated to identify the various regimes involved. The regimes that were identified include the IR drop, anodic and cathodic double layer decays, and the themoelectric effects. The presence of a gaseous diffusion process was also inferred. DOE

N80-23401# Sandia Labs., Livermore, Calif. Applied Physics Div.
COHERENT RAMAN COMBUSTION DIAGNOSTICS
P. L. Mattern and L. A. Rahn 1980 19 p refs Presented at the 179th Natl. Meeting of the Am. Chem. Soc., Houston, Tex., 23 Mar. 1980
(Contract EY-76-C-04-0789)
(SAND-79-8807; CONF-800303-2) Avail: NTIS HC A02/MF A01

The use of background free coherent anti-Stokes Raman scattering and inverse Raman scattering to detect small concentrations of CO in a methane-air flame is discussed. Calculated detectivities for these techniques, as compared with spontaneous Raman scattering, for a broad range of temperature, pressure, and background luminosities are presented. DOE

N80-23402# Massachusetts Univ., Amherst. Dept. of Chemistry.
ANALYTICAL CHEMICAL SYSTEM FOR THE DETERMINATION OF HEAVY METALS AND ORGANIC COMPOUNDS Annual Progress Report, 1 Dec. 1978 - 30 Nov. 1979
Sidney Siggia and Ramon M. Barnes 24 Oct. 1979 49 p refs
(Contract EE-77-S-02-4320)
(COO-4320-2) Avail: NTIS HC A03/MF A01

Progress was made in the synthesis and characterization of resins for sequestering inorganic and organic compounds. The capabilities of the poly(dithiocarbamate) resin were extended, a poly(acrylamidoxime) resin prepared and characterized, and a series of resins for organic compounds prepared and tested. Limited actual sample analyses were performed with these resins. An inductively coupled plasma source, spectrometer and computer system were received and tested. DOE

N80-23403# California Univ., Berkeley. Lawrence Berkeley Lab.
MICROWAVE SPECTROMETER FOR THE DETECTION OF TRANSIENT GASEOUS SPECIES
W. F. Kolbe, Wolf-Dieter Zoellner, and B. Leskovar 1 Jun. 1979 30 p refs
(Contract W-7405-eng-48)
(LBL-7293) Avail: NTIS HC A03/MF A01

A microwave spectrometer and the associated apparatus used to detect unstable free radical species is described. The spectrometer, which operates over a frequency range from 66 to 73 GHz consists of a tunable Fabry-Perot resonator followed by superhetrodyne detection for high sensitivity at low power levels. The resonator tuning is accomplished by means of a computer controlled stepping motor and by a piezoelectric transducer which also permits the use of source modulation and phase sensitive detection at 100 Hz. The operations of the spectrometer is

demonstrated by the detection of the two free radical species OH and SO. In the case of OH, a number of lambda doubling transitions, previously unobserved, are reported. DOE

N80-23404# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COHERENT ANTI-STOKES RAMAN SCATTERING AT ELECTRONIC RESONANCE: APPLICATION TO IODINE Thesis - Paris-Sud Univ.
Brigitte Attal 1979 91 p refs IN FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-608)
(ONERA-NT-1979-4) Avail: NTIS HC A05/MF A01

The main properties and application of Coherent Anti-Stokes Raman scattering (CARS) are first detailed and the advantages of resonant excitation pointed out. In particular, the intensities of the Raman lines must be enhanced by several orders of magnitude. Specificity is thus improved and detection of trace pollutants in mixtures becomes possible. Results of experiments with NO2 and I2 are presented, and a study of iodine (partial pressure of 1 mb) in air in normal conditions is made. Two spectra were plotted for two distinct values of the laser frequency omega L in the proximity of the B-X transition absorption lines. Enhancement of the intensities of the CARS lines by one photon resonance is experimentally confirmed in iodine. Author (ESA)

N80-23405# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EXAMINATION OF THE REACTIONS OF O+ WITH CH4, C2H4, C2H6, C3H8 AND N+ WITH CO BY MEASUREMENT OF THE LUMINESCENCE AND THE TRANSLATIONAL ENERGY OF THE PRODUCT IONS Thesis - Georg-August Univ. [UNTERSUCHUNG DER REAKTIONEN VON O+ MIT CH4, C2H4, C2H6, C3H8 UND N+ MIT CO DURCH MESSUNG DER LUMINESZENZ UND DER TRANSLATIONSENERGIE DER PRODUKT-IONEN]
Stefan Zimmermann Jun. 1979 143 p refs In GERMAN
(MPIS-9/1979) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 24

Luminescent atom exchange reactions of O+ ions with hydrogen and different hydrocarbons are examined. The optical and translational spectra of the N+ - CO system are presented. Author (ESA)

N80-23406# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
APPLICATION OF LASER-INDUCED FLUORESCENCE FOR MEASURING REACTION RATE CONSTANTS IN H-N-C-O SYSTEMS [ANWENDUNG VON LASERINDUZIERTER FLUORESZENZ ZUR MESSUNG VON REAKTIONSGESCHWINDIGKEITSKONSTANTEN IM H-N-C-O-SYSTEM]
W. Hack, M. R. Schroeter, and H. G. Wagner Jul. 1979 69 p refs In GERMAN
(MPIS-13/1979) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12.60

Reactions of NH2 radicals with nitrogen-oxygen compounds and hydrocarbons were investigated in a flow reactor at temperatures between 203 K and 505 K and pressures between 0.8 mbar and 21 mbar. In [illegible] ases, reaction products were detected using mass spectroscopy. NH2 radicals were produced in the reaction F + NH3 yields NH2 + NF and were monitored by laser induced fluorescence. Temperature dependencies at 1.3 mbar were determined for the reactions of NH2 with NO, NO2 and C2H2. The rate constant of the reaction NH2 + C2H4 was independent of temperature within experimental error. Author (ESA)

N80-23407# Rolls-Royce Ltd., Derby (England).
GRAVIMETRIC DETERMINATION OF GAS SORPTION BY MEANS OF AN ELECTRONIC MICRO-BALANCE
G. Sandstede (Battelle Inst.) and E. Robens (Battelle Inst.) 1979 15 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (West Germany), no. 6, 1960 p 413-417 In ENGLISH and GERMAN
(PNR-90009; Trans-14483) Avail: NTIS HC A02/MF A01

A vacuum apparatus for the gravimetric measurement of sorption, in which pressure and quantity of sorbate are determined independently of each other (the quantity of sorbate by weighing), is described. Using a electronic microbalance, the apparatus enables the sorption of gases and vapors at pressures between .000005 Torr and 1 at m to be measured, and the shape of complete sorption isotherms to be recorded with a constant degree of accuracy. The lower limit of the surface of a weighed sorption sample for surface determination by the BET method is approximately 100 sq cm. Measurements were made of the adsorption of nitrogen and krypton on aluminum foil and aluminum powder, as well as on aluminum oxide and glass spheres, in order to compare the results of the BET surface determination with measured geometric surface values, as well as to determine the surface loading of a krypton atom and the pore radius distribution from description isotherms. In addition, the effect of various surface finishes on the shape of the isotherms was investigated for aluminum. Author (ESA)

N80-23408# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdeling Buitenlucht.
THE USE OF INDIGODISODIUMDISULFONATE TO COMBAT MOLDS IN OZONE REAGENTS [DE BESTRIJDING VAN SCHIMMELS IN HET OZONREAGENS OP BASIS VAN INDIGODINATRIUMDISULFONAAT]
L. F. Heidema May 1978 8 p In DUTCH
(IG-TNO-G-861) Avail: NTIS HC A02/MF A01

Measures taken to suppress the growth of molds in reagents is described. The influence of NO2 and SO2 on the results are given. Studies were made with sulfanilamide and streptomycin, formaldehyde, tris (hydroxy methyl) aminomethane, and indigodisodiumdisulfonate. Author (ESA)

N80-23409# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Groep Analytische Chemie.
C2-C6 HYDROCARBONS IN AIR: GAS CHROMATOGRAPHIC ANALYSIS OF C2-C6 HYDROCARBONS IN AIR USING A CONCENTRATING TECHNIQUE [C2-C6 KOOLWATERSTOFFEN IN LUCHT. GASCHROMATOGRAFISCHE BEPALING VAN C2-C6 KOOLWATERSTOFFEN IN LUCHT MET BEHULP VAN EEN CONCENTRERINGSTECHNIEK]
E. Burghardt Jul. 1978 13 p ref In DUTCH
(IG-TNO-H-393) Avail: NTIS HC A02/MF A01

A concentrating and chemical analysis technique for hydrocarbons in the air is described. The hydrocarbon components are concentrated in a cold trap cooled with liquid nitrogen. After thermic desorption with the aid of a carrying gas, they are transported to the chromatographic column. Concentrations in the sub-ppb region can then be measured. Author (ESA)

N80-23410# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands).
GC ANALYSIS ALDEHYDES: GAS CHROMATOGRAPHIC ANALYSIS OF C2-C5 ALKANES IN AIR USING AN ISOLATION AND CONCENTRATION METHOD BASED ON BISULPHATE ADDUCTION FORMATION [GC-BEPALING ALDEHYDEN. DE GASCHROMATOGRAFISCHE BEPALING VAN C2-C5 ALKANALEN IN LUCHT MET GEBRUIKMAKING VAN EEN ISOLATIE- EN CONCENTRERINGSMETHODE OP BASIS VAN BISULFIETADDUCTVORMING]
C. vanWaas 29 May 1979 31 p refs In DUTCH
(IG-TNO-H-399) Avail: NTIS HC A03/MF A01

A gas chromatography method capable of detecting concentrations of alkanes as low as 1 ppb in air is described. After the collection of alkanes in bisulphite reagents, they are respectively freed, expelled and concentrated on sorbant and deabsorbed again thermically for gas chromatographic analysis. The process is only efficient if the columm is kept below -15 C. Author (ESA)

N80-23411# European Space Agency, Paris (France).
FORMATION OF PROMPT NITROGEN OXIDES DURING COMBUSTION OF HYDROCARBONS Thesis - Paris VI Univ., 3 Nov. 1978
Nicole Avezard (ONERA, Paris) Feb. 1980 97 p refs Transl. into ENGLISH of "Formation Precoce d'Oxydes d'Azote au Cours de la Combustion d'Hydrocarbures", Rept. ONERA-NT-1978-4 ONERA, Paris Original report in FRENCH previously announced as N79-32314
(ESA-TT-579; ONERA-NT-1978-4) Avail: NTIS HC A05/MF A01

The theoretical schemes determining the early NO concentrations were verified by comparison with experimental results obtained in a stirred combustor. The influence of water vapor on early NO formation, from both the experiment and theoretical viewpoints, is also emphasized. The experimental early NO concentration, obtained in a Longwell type combustor, was determined to be the difference between the experimental NO and the thermal NO calculated using the Zeldovich mechanism, while taking into account an over-equilibrium of O. A process involving HCN is suggested as a explanation of the phenomenon. The Miyauchi model, complemented by the Jachimowski reactions, accounts exactly for the experimental early NO with a residence time on the order of 1 ms; for higher residence times, the calculation is much more complex. Results on the influence of water on nitrogen oxides are presented. Calculations made it possible to determine this effect, which is essentially thermal for lean mixtures; it is more complex for rich mixtures.
Author (ESA)

N80-23412# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CHEMICAL REACTIONS IN A TURBULENT MEDIUM Thesis - Paris VI Univ.
Roland Borghi 1979 99 p refs In FRENCH; ENGLISH summary
Report will also be announced as translation (ESA-TT-638)
(ONERA-NT-1979-2; ISSN-0078-379X) Avail: NTIS HC A05/MF A01

Different aspects of reactive turbulent flows are discussed including: the turbulent diffusion of possibly reactive species in a medium with variable density, the analysis of fluctuations of species concentrations, and the calculation of the mean reaction rate. Using partial differential equations for the moments of fluctuations together with particular closure assumptions, solutions for these problems are proposed. Two applications are highlighted. The first deals with the development of a high velocity premixed flame in a constant area duct. The second is devoted to the combustion in a fixed volume burner. The influence of such small scale disturbances on the rate of energy release and on the production of pollutant species NOx is discussed.
Author (ESA)

N80-23413# Oxford Univ. (England). Cryogenics Lab.
HEROP: A COMPUTER PROGRAM FOR THE THERMODYNAMIC AND THERMOPHYSICAL PROPERTIES OF HELIUM, THIRD EDITION
B. A. Hands Apr. 1979 69 p refs
(OUEL-1289/79) Avail: NTIS HC A04/MF A01

A set of FORTRAN subprograms called HEPROP used to calculate the thermophysical properties of helium are presented. The thermodynamic properties are derived from the equation of state which is valid from about 2 K to 1700 K, and up to about 100 MPa. By analytical differentiation and integration, pressure (P), enthalpy (h), entropy (s), (delta P/delta T) sub rho, (delta P/delta rho) sub T and C sub v are calculated as a function of density (rho) and temperature (T). Equations are provided for pressure, liquid density and vapor density at saturation. In addition, programs are given for C sub p, h sub fg, s sub fg, the velocity of sound and the Joule-Thomson coefficient. Programs are also devised to calculate T as a function of (rho, P), (P, h), (rho, h), (rho, s) and (P, s); and rho as a function of (P, T) (T, s), (P, h) and (R, s). Subprograms for calculating rho as a function of (P, H), H as a function of (P, S), S as a function of (P, H), and T as a function of (P, H) and for saturation enthalpy are also included. Equations for surface tension, viscosity, refractive index thermal conductivity and dielectric constant are included in HEPROP.
Author (ESA)

N80-23414# Envirogenics Systems Co., El Monte, Calif.
DEVELOPMENT OF A COMPOSITE REVERSE OSMOSIS MEMBRANE FOR SINGLE PASS SEAWATER DESALINATION Final Report
A. F. Graefe Feb. 1979 41 p refs
(Contract DI-14-34-0001-7541)
(PB80-124852; W80-02295; OWRT-7541(1)) Avail: NTIS HC A03/MF A01 CSCL 07D

An improved reverse osmosis composite noncellulosic membrane for the single pass desalination of seawater was developed and its performance in the form of four inch diameter spiral elements was demonstrated. A total of three membranes was investigated.
GRA

N80-23415# Envirogenics Systems Co., El Monte, Calif.
DEVELOPMENT OF LOW PRESSURE BRACKISH WATER REVERSE OSMOSIS MEMBRANES Final Report
A. F. Graefe and W. J. Schell May 1979 42 p refs
(Contract DI-14-34-0001-7510)
(PB80-126204; W80-02296; OWRT-7510(1); Rept-1093-25)
Avail: NTIS HC A03/MF A01 CSCL 07D

Chemcially stable noncellulosic desalination membranes were developed with reverse osmosis properties at pressures of 250 psi or less that are equivalent to those of currently available cellulosic membranes operating at 400 psi. Several membranes were investigated. One membrane consisted of a thin layer of sulfonated polyfurfuryl alcohol on a microporous polysulfone as a support (SPFA). This membrane exhibited water flux values up to 50 gfd at 98% salt rejection when tested at 250 psi with 0.5% sodium chloride. Subsequent long term testing of the membrane in element form at 100 to 300 psi showed that it was unstable to simulated Yuma feedwater. Another membrane of interest was asymmetric and was fabricated from a sulfonated polysulfone.
GRA

N80-23416# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
DETERMINATION AND ESTIMATION OF IONIC ACTIVITIES OF METAL SALTS IN WATER
N. A. Gokcen 1979 29 p refs
(PB80-112212; BM-RI-8372) Avail: NTIS HC A03/MF A01 CSCL 07D

Appropriate equations correlating the activity of water with the activities of electrolytes in binary and multicomponent solutions were derived for computer calculation. It was found that the half-integer power series are far superior to the integer power series, for both types of series having the same number of terms. The proposed method of calculation is capable of accurately yielding the activities of all components from the measurements of the activity of a single component at various concentrations. This method replaces the cumbersome and objectionable method of graphical integration of the Gibbs-Duhem equation.
GRA

N80-23417# Research Triangle Inst., Research Triangle Park, N. C.
COMPUTER PROGRAMS FOR REDUCING MASS SPECTRA DATA FROM GC/MS SYSTEMS Final Report, Sep. 1977 - Mar. 1979
David Rosenthal Oct. 1979 171 p refs
(Contract EPA-68-02-2745)
(PB80-133119; EPA-600/2-79-194) Avail: NTIS HC A08/MF A01 CSCL 07D

Existing computer programs for deconvoluting mass spectrometry data derived from gas chromatography, mass spectrometry, computer systems were evaluated, and the most efficient method was introduced into UNIVAC computer. The accompanying program listing is included. The program was tested with both standard runs and environmental samples. Sample components were sucessfully identified by an independent computer search program with an accuracy approaching 80%.
GRA

N80-23418# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: CHLORINATED HYDROCARBONS MANUFACTURE Final Report, Jan. 1976 - Aug. 1978
Z. S. Khan and T. W. Hughes Aug. 1979 191 p refs
(Contract EPA-68-02-1874)
(PB80-138209; MRC-DA-913; EPA-600/2-79-019-G) Avail: NTIS HC A09/MF A01 CSCL 07A

A study of air pollutants released during the manufacture of chlorinated hydrocarbon is described. The potential environmental effect of the source was evaluated using source severity, S, defined as the ratio of the maximum ground level concentration of a emission to the ambient air quality standard for criteria pollutants or to modified noncriteria pollutants. A representative plant was defined for each manufacturing process type and the environmental effects were determined on the basis of capacity instead of production.
GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-23419* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PREPARATION OF MONOTECTIC ALLOYS HAVING A CONTROLLED MICROSTRUCTURE BY DIRECTIONAL SOLIDIFICATION UNDER DOPANT-INDUCED INTERFACE BREAKDOWN Patent
Richard A. Parr, Mary H. Johnston, and John C. McClure, inventors (to NASA) Issued 15 Apr. 1980 8 p Filed 29 Dec. 1978 Supersedes N79-16943 (17 - 08, p 0953)
(NASA-Case-MFS-23816-1; US-Patent-4,198,232; US-Patent-Appl-SN-974292; US-Patent-Class-75-135; US-Patent-Class-75-138; US-Patent-Class-75-178R; US-Patent-Class-148-32) Avail: US Patent and Trademark Office CSCL 11F

Monotectic alloys having aligned spherical particles of rods of the minor component dispersed in a matrix of the major component are prepared by forming a melt containing predetermined amounts of the major and minor components of a chosen monotectic system, providing in the melt a dopant capable of breaking down the liquid solid interface for the chosen alloy, and directionally solidfying the melt at a selected temperature gradient and a selected rate of movement of the liquid-solid interface (growth rate). Shaping of the minor component into spheres or rods and the spacing between them are controlled by the amount of dopant and the temperature gradient and growth rate values. Specific alloy systems include Al Bi, Al Pb and Zn Bi, using a transition element such as iron.
Official Gazette of the U.S. Patent and Trademark Office

N80-23420 Pennsylvania State Univ., University Park.
INVESTIGATIONS INTO THE GRAIN REFINEMENT OF COPPER Ph.D. Thesis
Bruce Lee Tuttle 1979 174 p
Avail: Univ. Microfilms Order No. 8010106

Special melting procedures were established to control the as-melted constitution of copper. A series of criteria were developed to characterize those compounds that would be suitable inoculants for copper. A model was designed to characterize the growth restricting potential of individual element in copper. A thermal analysis testing procedure was developed to instantaneously evaluate the degree of grain refinment in castings. A testing system was also developed utilizing a commercially available thermal analysis mold and a customized potentiometric recorder to produce a temperature vs time curve. Dissert. Abstr.

N80-23421 Georgia Inst. of Tech., Atlanta.
STRESS CORROSION CHARACTERISTICS OF AL-Zn-Mg ALLOYS WITH COPPER ADDITIONS Ph.D. Thesis
Bhaskar Sarkar 1979 123 p
Avail: Univ. Microfilms Order No. 8010006

Four Al-6Zn2Mg-xCu alloys with similar microstructures but different copper contents were chosen to investigate the effect of copper in the stress corrosion cracking characteristics in an aqueous solution of 3.5% NaCl. The nominal copper contents were 0%, 1%, 1.6% and 2.1%. Stress corrosion cracking in this alloy system is intergranular and both anodic dissolution of grain boundary precipitates and hydrogen embrittlement are possible mechanisms. Precracked double cantilever beam specimens, loaded to constant crack opening displacements were used to determine the stress corrosion crack growth kinetics as a function of stress intensity. Increasing the copper content of the Al-Zn-Mg alloys in the -T651 condition was found to improve the SCC resistance. An overaging treatment improves the SCC characteristics of the copper-free alloy by increasing the homogeneity of deformation. The improvement in the copper-containing alloys is attributed to the eta phase becoming still less anodic (as compared to that in -T651 condition) because more copper enters the eta phase from solid solution during overaging. This further reduces the rates of electrochemical dissolution and/or hydrogen embrittlement. Dissert. Abstr.

N80-23422 Clarkson Coll. of Technology, Potsdam, N.Y.
DIRECTIONAL SOLIDIFICATION OF MANGANESE-BISMUTH/BISMUTH ALLOYS Ph.D. Thesis
P. S. Ravishankar 1980 227 p
Avail: Univ. Microfilms Order No. 8011197

Eutectic and off-eutectic alloy of MnBi/Bi were directionally solidified in a Bridgman-Stockbarger apparatus to determine the dependence of the fiber spacing on the growth parameters growth rate and interfacial temperature gradient. The growth rate was varied from 0.6 cm/hr to 30 cm/hr. Techniques were developed to measure the temperature profile in the melt and hence obtain the interfacial temperature gradient. Transverse sections of the solidified alloys were examined in a optical or scanning electron microscope and the fiber spacing measured. Fiber spacing varied as the inverse square root of growth rate as predicted by theory. The temperature gradient did not influence fiber spacing. This contradicts those claims that all faceted/non-faceted class of eutectics should show a temperature gradient influence. For the cases where such an influence was observed in the literature, a new hypothesis is proposed. The actual fiber spacing adjustment mechanism is not clear. Interface position measurements resulted in good agreement with the existing one dimensional heat transfer models. Dissert. Abstr.

N80-23423 Georgia Inst. of Tech., Atlanta.
THE EFFECTS OF DEFORMATION MODE ON THE BEHAVIOR OF Ti-28%V AND Ti-32%V ALLOYS Ph.D. Thesis
Tapas Kumar Mukhopadhyay 1979 99 p
Avail: Univ. Microfilms Order No. 8010566

Low cycle and high cycle fatigue tests were performed to determine the fatigue performance of Ti-28%V and Ti-32%V alloys in the metastable b.c.c. states under total strain and total load control modes. Effects of strain rate variation and spiked loading were also monitored. The planar slip Ti-32%V exhibited fatigue softening at low strain amplitudes and fatigue hardening at high strain amplitudes. The multiple (wavy) slip Ti-28%V alloy exhibited fatigue hardening at all strain amplitudes tested. A break in the Coffin Manson plot was observed at a strain amplitude of -0.0035 for both of the alloys. A similar break was also observed in the cyclic stress-strain plot. A reduction in the strain rate by an order of magnitude affected the two alloys differently. The Ti-32%V planar slip material exhibited increased hardening with decreased strain rate, whereas Ti-28%V alloy with its higher twin fault probability exhibited a typical b.c.c. behavior. The multiple (wavy) slip Ti-28%V alloy exhibited a diminished fatigue life at all strain amplitudes as compared to that of the planar slip Ti-32%V alloy. Within the scatter-band, the high cycle fatigue life for the planar slip material and the multiple (wavy) ship material was found to be similar. This suggests that the macroscopic deformation mechanism does not dictate the high cycle fatigue life. Dissert. Abstr.

N80-23424 Georgia Inst. of Tech., Atlanta.
THE EFFECT OF MICROSTRUCTURE ON THE FATIGUE BEHAVIOR OF AN ALUMINUM-LITHIUM ALLOY Ph.D. Thesis
Edward James Coyne, Jr. 1979 145 p
Avail: Univ. Microfilms Order No. 8010565

The monotonic and fatigue behavior of an aluminum-lithium-manganese alloy was investigated. The properties of an aluminum-copper-lithium alloy, were examined in order to have a lithium alloy as a base for comparison. The Al-Li-Mn material was studied in an underaged, peak aged and overaged condition. The grain structure of the three heat treatments were the same while the different size precipitates were responsible for differences in deformation characteristics. The underaged and peak aged alloys deformed by planar slip. The larger particle size and interparticle spacing of the overaged condition resulted in a combination of planar slip and Orowan looping. The Al-Cu-Li alloy deformed primarily by planar slip. The fatigue crack propagation data show that the crack propagation rates of Al-Li-X alloys are less than those of other aluminum alloys at low stress intensity factors due to the high modulus and low crack opening displacement of these alloys. Dissert. Abstr.

N80-23425 Kentucky Univ., Lexington.
A SURFACE ANALYSIS STUDY OF CARBON MONOXIDE AND HYDROGEN ABSORPTION AND DESORPTION OF

Ni(3) CRYSTALS Ph.D. Thesis
James Lih-Ren Chao 1979 194 p
Avail: Univ. Microfilms Order No. 8011118

Low energy electron diffraction and Auger electron spectroscopy were used to analyze nickel single crystal surfaces in order to understand nickel catalytic reactivity. The adsorption and desorption of CO and H2 were investigated. An additional nickel sample with small angle boundaries was used to examine the effect on the reactivity of the discontinuity caused by the boundary lines. The sulfur poisoning problem was also investigated. Results discussed include desorption states, activation energy, and temperature and pressure effects. Dissert. Abstr.

N80-23426 Rensselaer Polytechnic Inst., Troy, N. Y.
FATIGUE CRACK PROPAGATION IN A DIRECTIONALLY SOLIDIFIED COBALT-BASE EUTECTIC Ph.D. Thesis
Curtiss Mitchell Austin 1979 153 p
Avail: Univ. Microfilms Order No. 8011496

Fatigue crack propagation (FCP) in a Co-base aligned eutectic, Cotac (Co-10Ni-10Cr-15TaC), was investigated extensively, with temperature, environment, frequency and load waveform and load waveform as experimental variables. Emphasis was directed toward the determination of the role of fibers, using interfiber spacing, fiber orientation, fiber integrity, and the absence of fibers as material variables. The FCP rates at high delta K are affected by most of these material variables, but are not affected by pre-existing fiber failure produced by prestraining. The FCP rates at low delta K are not affected by any of the material variables. Results indicate that fatigue crack propagation in Cotac is generally matrix controlled, provided that it is understood that at high delta K the matrix is influenced by the presence of fiber segments. At high delta K, the critical crack advance event occurs within a plastic zone containing only segmented fibers.
Dissert. Abstr.

N80-23427 Stanford Univ., Calif.
DIFFUSIONLESS TRANSFORMATIONS IN TITANIUM-NICKEL Ph.D. Thesis
Gary Max Michal 1980 295 p
Avail: Univ. Microfilms Order No. 8011682

Various techniques of high resolution transmission electron microscopy to obtain a more thorough characterization of the premartensitic and martensitic transformations in TiNi than previously obtainable. Using an electron microscope equipped with a LaB6 filament detailed aspects of the structure were obtained through structure and high resolution dark field imaging, in situ heating and cooling experiments and 2 1/2 D microscopy. The technique of 2 1/2 D electron microscopy is shown to have a much greater potential than previously thought in determining the orientation changes or difference in lattice plane spacings in crystalline solids. A theoretical model and experimental evidence are presented to determine the limit of how closely spaced diffraction vectors are and still be correlated with their microstructural features. The results indicate that diffraction spot separations of 0.5nm-1 can be measured and unambiguously correlated with features in the dark field stereo pair while maintaining an image resolution of lnm.Dissert. Abstr.

N80-23428 Stanford Univ., Calif.
KINETIC AND THERMODYNAMIC STUDIES OF LIQUID METAL-OXYGEN SYSTEMS USING SOLID STATE ELECTROCHEMICAL TECHNIQUES Ph.D. Thesis
Bahman Heshmatpour 1980 333 p
Avail: Univ. Microfilms Order No. 8011647

The influence of small additions of the solutes tin, lead, copper, silver and titanium on the diffusivity, the solubility, the activity and the activity coefficient of oxygen in liquid indium was studied for the temperature range 750 to 950 C using solid state electrochemical techniques. Sharp increases in oxygen diffusivity and decrease in oxygen solubility were observed in all cases when these solutes were added to indium. Modest increases in oxygen diffusivity were observed for higher solute concentrations. Oxygen showed Henrian behavior up to the maximum oxygen solubility for all the temperatures and solute concentrations. The results indicated that the addition of a less reactive metal to a more reactive metal increases the oxygen diffusivity and decreases the oxygen solubility in the more reactive metal. A solubility diffusivity correlation proved to be valid for all the indium-solute-oxygen systems. The thermodynamics of liquid binaries of indium-solutes were also studied using a solid oxide electrochemical method up to 10 atomic percent of these solutes. Dissert. Abstr.

N80-23429 Rensselaer Polytechnic Inst., Troy, N. Y.
CRYSTALLOGRAPHY IN FUSION-WELD-METAL SOLIDIFICATION MECHANICS Ph.D. Thesis
Jay Morris Samuel 1979 186 p
Avail: Univ. Microfilms Order No. 8011510

Extensive X-ray diffraction work and metallographic examination of bead-on-plate fusion welds in cube-on-face oriented silicon iron revealed the the substructure characteristics were controlled to a large extent by crystallographic considerations. It was observed that the substructure width increased with increasing angular deviation between the direction of G sub L and the nearest < 100 > crystallographic direction in the solid. Furthermore, it was also noted that the substructure growth mode gradually changed in appearance from a cellular to a cellular dendritic geometry as the angular deviation increased. These changes in substructure characteristics were attributed to a modification of the effective constitutional supercooling experienced at the growing cell tips as a result of the orientation of the cell axes with respect to the direction of G sub L.
Dissert. Abstr.

N80-23430*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PRACTICAL APPLICATIONS OF SURFACE ANALYTIC TOOLS IN TRIBOLOGY
John Ferrante 1980 45 p refs Presented at the Intern. Lubrication Conf., San Francisco, 18-21 Aug. 1980; sponsored by ASME and ASLE
(NASA-TM-81484; E-422) Avail: NTIS HC A03/MF A01 CSCL 20K

A brief description of many of the widely used tools is presented. Of this list, those which have the highest applicability for giving elemental and/or compound analysis for problems of interest in tribology along with being truly surface sensitive (that is less than 10 atomic layers) are presented. The latter group is critiqued in detail in terms of strengths and weaknesses. Emphasis is placed on post facto analysis of experiments performed under real conditions (e.g., in air with lubricants). It is further indicated that such equipment could be used for screening and quality control. R.C.T.

N80-23431# Georgia Inst. of Tech., Atlanta. Fracture and Fatigue Research Lab.
QUANTITATIVE FRACTOGRAPHY OF A FATIGUED TI-28 W/O V ALLOY
Ervin E. Underwood and Saghana B. Chakrabortty 27 Nov. 1979 35 p refs
(Contract N00014-75-C-0349)
(AD-A079813; GIT-TR-79-1) Avail: NTIS HC A03/MF A01 CSCL 11/6

A quantitative fractographic analysis was undertaken to study the microstructural features important in the understanding of the mechanisms of fatigue crack growth and in the prediction of fatigue crack propagation rates. Special emphasis in this work is placed on the facet characteristics and sub-surface cracking. The stereological treatment of this problem develops methodologies and relationships based primarily on vertical sections through the fracture surface and parallel to the crack propagation direction. The evaluation of fracture profiles (in terms of true length, roughness, and degree of orientation) permits calculation of fracture surface characteristics (such as true surface area, roughness, and type of surface - the latter through an upper-lower bound approach). GRA

N80-23432# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
ADHESIVE BONDING EXPERIMENTS FOR TITANIUM 6 ALUMINUM 4 VANADIUM (Ti6Al4V). PART 1: ANODIZATION TREATMENTS Final Report, Jul. 1978 - Aug. 1979
William L. Baun Dec. 1979 42 p refs
(AF Proj. 2419)
(AD-A081538; AFML-TR-79-4172-Pt-1) Avail: NTIS HC A03/MF A01

Evaluations of surface treatments for adhesive bonding of Ti6Al4V were carried out using lap shear, peel and thick-thin wedge tests. Anodization to form dense oxides from 100-3000 A in thickness had little effect on bond strength or durability. Properties were governed by chemical pretreatments. Fluorine present in the anodization bath can cause oxide/alloy failures and should be avoided. GRA

N80-23433# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
AIRCRAFT CARRIER EXPOSURE TESTS OF ALUMINUM ALLOYS Progress Report
E. J. Jankowsky, S. J. Ketcham, and V. S. Agarwala 1 Nov. 1979 36 p refs
(ZF61542001)
(AD-A081060; NADC-79251-60) Avail: NTIS HC A03/MF A01 CSCL 11/6

An effort is underway to correlate results of accelerated laboratory corrosion tests with actual shipboard exposure of aircraft materials. This report describes the first of the series in which aluminum alloys with varying susceptibilities to exfoliation and stress corrosion were exposed on the flight deck of an aircraft carrier. Use of an electrochemical corrosion monitor to measure corrosivity of the environment is also described. GRA

N80-23434# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
MATERIALS EVALUATION. PART 2: DEVELOPMENT OF CORROSION INHIBITORS Final Report, Aug. 1978 - Jul. 1978
M. Khobaib Sep. 1979 65 p refs
(Contract F33615-76-C-5191; AF Proj. 7351)
(AD-A080905; SRL-6909-02-Pt-2; AFML-TR-79-4127-Pt-2)
Avail: NTIS HC A04/MF A01 CSCL 11/6

A borax-nitrite based inhibitor has been developed for incorporation into the Air Force Rinse Facility at MacDill Air Force Base. Chromate-based products, in combination with polyphosphates, have been reasonably effective against corrosion of ferrous and nonferrous metals and alloys and are presently the most widely used inhibitors. However, the use of chromates has been the subject of ecological concern, and the investigation discussed herein involves alternatives to chromates. The performance of nonchromate commercial inhibitors has been tested and a borax-nitrite based formulation developed which inhibits the corrosion of several ferrous and nonferrous metals and alloys. This mixture contains no chromates and offers important advantages over the chromate-polyphosphate combination. Corrosion-fatigue and crack-growth studies on aluminum alloys have shown a reduction of more than one order of magnitude in crack-growth rate in the presence of this inhibitor. In fact, the crack growth decelerates to the air-sample level with the use of the inhibitor, even in an aqueous environment of 0.1M NaCl solution. GRA

N80-23435# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
INHOMOGENEOUS BROADENING EFFECTS IN CW CHEMICAL LASERS Interim Report
Harold Mirels Los Angeles SAMSO Sep. 1979 66 p refs
(Contract F04701-78-C-0079; DARPA Order 2843)
(AD-A077319; TR-0079(4764)-1; SAMSO-TR-79-85) Avail: NTIS HC A04/MF A01 CSCL 20/5

The effects inhomogeneous broadening on the performance of CW chemical lasers were investigated. A simple two level vibrational model and a Fabry-Perot resonator were assumed. Laser performance was found to depend on certain parameters. The numerical results are given for a CW chemical laser with laminar diffusion and with a single longitudinal optical mode. The variation of differential number density with local lasing intensity and streamwise distance and the variation of net laser output power with tuning frequency are presented. The latter exibits a lamp dip near line center. Other significant results are presented. R.C.T.

N80-23436# Argonne National Lab., Ill. Materials Science Div.
SUPERPOSITION OF ALLOY HARDENING, STRAIN HARDENING, AND DYNAMIC RECOVERY
U. F. Kocks 1979 22 p refs Presented at the 5th Intern. Conf. on Strength of Metals and Alloys, Aachen, West Germany, Aug. 1979 Sponsored in part by Federal Republic of Germany
(Contract W-31-109-eng-38)
(CONF-790801-6) Avail: NTIS HC A02/MF A01

The principles and heuristics of flow stress superposition are illustrated for the case that one of the components is due to dislocation/dislocation interactions and is the only one that changes with strain. A simultaneous investigation of the flow stress and its rate sensitivity as a function of strain is described. It is shown that the slope of the observed stress strain curve depends on the form of the superposition law even if there is no physical influence of alloying on the dislocation storage rate; the frequently observed low initial strain hardening associated with a higher yield stress may in some cases be merely a consequence of a nonlinear superposition. It is also shown that higher strains, the influence of alloying a dynamic recovery becomes the predominant effect; it also controls the high temperature creep strength. When dynamic recovery plays an important role, it provides a further straining mechanism which, however, is not additive to the low temperature strain rate; a form of the superposition law for long range slip and this dynamic recovery strain is proposed. An application of these principles has demonstrated that dynamic strain aging is due to an effect of mobile solute atoms on the strain hardening component of the flow stress, not on the friction stress. DOE

N80-23437# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL PROPERTIES OF COLD-WORKED 5083 ALUMINUM
M. E. Prado and J. J. Scott 6 Mar. 1979 16 p refs
(Contract W-7405-eng-48)
(UCID-18179) Avail: NTIS HC A02/MF A01

Tensile and fracture toughness tests of 25% cold worked 5083 aluminum and weld material were conducted. The tests showed that the aluminum is highly nonhomogeneous; its fracture toughness, elongation, and percent reduction in area varied greatly from point to point. This characteristic could significantly affect the design of 5083 applications. The weld material exhibited more uniform mechanical properties throughout the weld. However, its fracture toughness varied from 19 to 43 ksi in./sup 1/2/. The weld-joint geometry affects the fracture characteristics of the joint. DOE

N80-23438# Pennsylvania Univ., Philadelphia. Dept. of Metallurgy and Material Science.
METASTABLE PHENOMENA IN HYDROGEN DEGRADATION OF LOW CARBON ALLOY STEELS Interim Report, Dec. 1977 - Nov. 1978
L. S. Darken and E. R. Ryba EPRI Palto Alto, Calif. Sep. 1979 39 p refs
(EPRI-AF-1176) Avail: NTIS HC A03/MF A01

According to thermodynamic calculations, The inclusion of chromium and other strong carbide-forming elements in steels should significantly lower the activity of carbon so that methane does not form in hydrogen atmospheres at moderate temperatures. However, degradation of low alloy steels does occur, and it is suggested that a metastable equilibrium condition exists in which the carbon atoms cluster around the atoms of the alloying elements in the ferrite phase and assume a higher activity. This suggestion has now been substaniated by the results of carbonization experiments in which pure iron and iron-chronium alloys have been exposed to atmospheres of varying carbon activities at 600 C and 700 C. Measurement of weight changes by thermogravimetry clearly shows that the solubility of carbon in the alloy ferrite is in excess of that in pure iron. DOE

N80-23439# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
HYDROGEN ATTACK OF STEEL Progress Report, 1 Apr. 1979 - 31 Mar. 1980
Paul G. Shewmon 2 Jan. 1980 9 p refs
(Contract EY-76-S-02-2872)
(COO-2872-04) Avail: NTIS HC A02/MF A01

The atomic processes by which the hydrogen attack of pressure vessel steel occurs were investigated by the following: the growth kinetics using an exceptionally sensitive dilatometer.

These data were compared with the predictions of models based on the postulated mechanisms. Scanning electron microscope studies were conducted to establish the geometry and location of the growing methane bubbles. The steels used were various commercial alloys because of the new confirmed suspicion that trace impurities, e.g., from dioxidation practice, play a central role in determining the nucleation and growth geometry of the bubbles or fissures. DOE

N80-23440# General Atomic Co., San Diego, Calif.
CREEP-RUPTURE BEHAVIOR OF 2-1/4Cr-1 Mo STEEL, ALLOY 800H AND HASTELLOY ALLOY X IN A SIMULATED HTGR HELIUM ENVIRONMENT
G. Y. Lai and R. J. Wolowowicz Dec. 1979 75 p refs
(Contract DE-AT03-76ET-35300)
(GA-A-15572) Avail: NTIS HC A04/MF A01

Testing was conducted in flowing helium containing nominal concentration of following gases: 1500 micron atm H2, 450 micronatm CO, 50 micronatm H2O and 5 micronatm CO2 to represent maximum permissible levels of impurities in the primary coolant for the steam-cycle system of a high-temperature gas-cooled reactor (HTGR) when it is operating continuously with a water and/or steam leak at technical specification limits. Two or three heats of material for each alloy were investigated. Tests were conducted a 482 C and 760 C (1200 F and 1400 F) for Alloy 800H, and at 760 C and 871 C (1400 F and 1600 F) for Hastelloy Alloy X for times up to 10,000 h. Selected tests were performed on same heat of material in both air and helium environment to make a direct comparison of creep-rupture behaviors between two environments. Metallurgical evaluation was performed on selected post test specimens with respect to gas-metal interactions which included oxidation, carburization and/or decarburization. Correlation between gaseous corrosion and creep-rupture behavior was attempted. Limited tests were also performed to investigate the specimen size effects on creep-rupture behavior in the helium environment. DOE

N80-23441# Ames Lab., Iowa.
HYDROGEN EMBRITTLEMENT IN VANADIUM SINGLE CRYSTALS
Shen-Ann Shei and Tom E. Scott 1979 4 p refs Presented at the 2nd Intern Symp. on Hydrogen in Metals, Minakami Spa, Japan, 26-29 Nov. 1979
(Contract W-7405-eng-82)
(ISM-249; CONF-791132-2) Avail: NTIS HC A02/MF A01

Mechanical properties of < 149 > oriented single crystals of high purity vanadium and hydrogen-charged vanadium were investigated in the temperature range from 77 K to 296 K. Cleavage fracture occurred in hydrogen-charged crystals tested at temperatures above and below the stress-free hydrogen solvus temperature. Fractographic studies show small whiskers along edges of cleavage steps. The effect of hydrogen on fracture behaviors and strengthening of vanadium is discussed. DOE

N80-23442# Hanford Engineering Development Lab., Richland, Wash.
CHEMICAL DECONTAMINATION OF METALS
Jerry A. Partridge and Ronald E. Larch Oct. 1979 22 p refs Presented at the Am. Nucl. Soc. Meeting, San Francisco, 11-15 Nov. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1880; CONF-791103-66) Avail: NTIS HC A02/MF A01

A metal decontamination process based upon removal of contamination by treatment with a cerium (4) nitric acid solution (or other redox agent in nitric acid) is feasible and highly promising. The technique is effective in dissolving the surface layer of stainless steel. Dissolution rates of approximately 1.5 mils/h were demonstrated with cerium (4) nitric acid solutions. Removal of plutonium contamination from stainless steel was demonstrated in laboratory tests, in which activity levels were reduced from greater than 500,000 counts per minute to nondetectable levels in approximately one hour at 90C. Removal of paint from stainless steel surfaces was also demonstrated. Advantages of this process include: (1) There is potentially less waste generated; (2) cerium 4 in nitric acid is a good dissolution agent for plutonium oxide; (3) regeneration of Ce4 during the decontamination is accomplished by electrolysis; (4) the process should be effective for irregularly shaped equipment; (5) it could be effective as a spray or a flow-through system. DOE

N80-23443# Vacuumschmelze G.m.b.H., Hanau (West Germany).
DEVELOPMENT OF PERMANENT MAGNET ALLOYS Final Report
Robert Cremer, Christian Radeloff, and Irmtraud Pfeiffer Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1979 183 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-23) Avail: NTIS HC A09/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 38

The influence of phase transformations and precipitations on the mechanical and magnetic properties of magnetic alloys was investigated. A group of semihard magnetic alloys with rectangular hysteresis loop was developed for use in permanent reed switch applications. Production studies were made of magnetic alloys containing titanium. Author (ESA)

N80-23444# Kloeckner-Humboldt-Deutz A.G., Oberursel (West Germany).
FATIGUE AT HIGH TEMPERATURES: EXAMINATION OF THE BEHAVIOR OF GASTURBINE CASTING MATERIALS ALSO IN SIMULTANEOUS TEMPERATURE AND STRAIN CYCLES Final Report
Arnold Witt and Manfred Pucher Bonn Bundesmin. fuer Forsch. u. Technol. Jul. 1979 102 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-26) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 21

Test equipment that allows an examination of the effects of low cycle fatigue of nickel based cast alloys is described. It is possible to simultaneously vary temperature and compression-tension strain cycles of precision cast alloy samples. A hollow cylindrical sample was investigated in terms of the number of cracks as a function of temperature, dwell times for tension and compression, cycle period, strain rate, and alteration of temperature and strain. Author (ESA)

N80-23445# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MECHANICAL MODELIZATION OF MICROSTRUCTURAL INSTABILITIES IN CYCLIC VISCOPLASTICITY AT VARIABLE TEMPERATURE Thesis - Paris VI Univ.
Georges Cailletaud 1979 76 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-611)
(ONERA-NT-1979-6; ISSN-0078-3781) Avail: NTIS HC A05/MF A01

The time dependent temperature variations modifying the mechanical properties of the nickel alloy IN100 were studied along with the microstructural instabilities producing the modifications. In the framework of thermodynamics, with internal variables and using phenomenological remarks, a mathematical model was developed. The model is described. Author (ESA)

N80-23446# Vereinigte Aluminium-Werke A.G., Bonn (West Germany). Leichtmetall-Forschungsinst.
ELECTRON BEAM MELT-HARDENING OF ALUMINUM ALLOYS Final Report
Barbara Grzemba, Gerhard Ibe, and Walther Hiller Bundesmin. fuer Forsch. u. Technol. Aug. 1979 92 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. Prepared in cooperation with Steigerwald-Strahltechnik G.m.b.H., Munich
(BMFT-FB-T-79-20) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany. DM 18,90

Several binary aluminum alloys were subjected to melting and solidification. Subsequently, the mechanical properties of these alloys were studied. After surface melting and rapid solidification, aluminum-iron alloys showed tensile strengths which, in the temperature range of 200 C to 300 C, exceeded the tensile strengths of their known heat resistant aluminum alloys. Electron beam techniques were used to melt a surface layer of other

aluminum alloys resulting in aluminum materials of high wear resistance. Author (ESA)

N80-23447# European Space Agency, Paris (France).
ANALYSIS OF POSSIBLE IMPROVEMENTS OF ALLOYS DUE TO DIRECTIONAL EUTECTIC SOLIDIFICATION IN ZERO GRAVITY CONDITIONS
Hans Ahlborn and Ruediger Rothe Nov. 1979 57 p refs Transl. into ENGLISH of "Analyse der Erreichbaren Verbesserungen bei Legierungen Aufgrund Gerichteter Eutektischer Erstarrung unter Weltraumbedingungen", Rept. BMFT-FB-W-77-15 BMFT and Hamburg Univ., Bonn., Dec. 1977 Original report in GERMAN previously announced as N79-30371
(ESA-TT-575; BMFT-FB-W-77-15) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 13.50

Eutectic alloys having undergone directional solidification in a temperature gradient already in use, being developed, and/or known from the literature were analyzed for their mechanical, electrical, magnetic, and optical properties. These characteristics were evaluated with respect to possible improvement through production in space. Results show that with the absence of thermal convection which affects the formation of structures on Earth, an improvement in the microstructure and hence in the properties of the alloys can be expected from zero gravity manufacture. It is anticipated that space processing will in particular bring advantages for eutectics whose properties are substantially influenced by the regularity of the structure, e.g., eutectics intended for optical applications. Author (ESA)

N80-23448# National Physical Lab., Teddington (England). Quantum Metrology Div.
LOW TEMPERATURE DATA HANDBOOK TITANIUM AND TITANIUM ALLOYS
D. R. Salmon May 1979 266 p refs
(NPL-QU-53) Avail: NTIS HC A12/MF A01

Values for tensile properties, elastic modulus, impact strength, fatigue strength, fracture properties, creep, electrical resistivity, specific heat, thermal conductivity, thermal expansion, and magnetic properties are presented for titanium and the following alloys: Ti6Al4V, Ti5Al2.5Sn, Ti8Al1Mo1V, and Ti13V-11Cr3Al. Author (ESA)

N80-23449# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
GUST SEVERITY EFFECTS ON FATIGUE CRACK PROPAGATION IN ALUMINUM ALLOY SHEET MATERIALS
R. J. H. Wanhill Dec. 1978 21 p refs Submitted for publication Sponsored by Netherlands Agency for Aerospace Programs and Dutch Civil Aviation Board
(NLR-MP-78041-U) Avail: NTIS HC A02/MF A01

Flight simulation fatigue tests were conducted to investigate the effect of differing gust load experiences on fatigue crack propagation in 7075-T6 and the effect of gust load alleviation on 2024-T3. Two gust spectra were used: the Fokker F-27 spectrum and the reference spectrum TWIST. A large systematic effect of gust severity on crack propagation rates in 7075-T6 was correlated by the stress intensity factor for the rms of the gust amplitudes. Author (ESA)

N80-23450# National Technical Information Service, Springfield, Va.
POWER METALLURGY OF TITANIUM AND TITANIUM ALLOYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jan. 1980
William E. Reed Feb. 1980 288 p Supersedes NTIS/PS-79/0126; NTIS/PS-78/0130 and NTIS/PS-77/0002
(PB80-805161; NTIS/PS-79/0126; NTIS/PS-78-0130; NTIS/PS-77/0002) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Citations of worldwide research on powder pressing, sintering, forging, compacting, and extruding are covered. Studies on properties and structure of powdered metal products, TiC-containing alloys, tools and aircraft parts are included. This updated bibliography contains 281 abstracts, 27 of which are new entries to the previous edition. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-23451 Wisconsin Univ. - Madison.
STRESS-BIREFRINGENCE-STRAIN RELATIONS IN POLYMER NETWORKS WITH SPECIALLY DESIGNED STRUCTURES Ph.D. Thesis
Hsin-Chia Kan 1979 344 p
Avail: Univ. Microfilms Order No. 8004724

Strips of linear 1,2-polybutadiene were cross-linked near its glass transition temperature by gamma irradiation while strained in uniaxial extension with a stretch ratio gamma sub o, with very little relaxation at gamma sub o before cross-linking. After release and warming, the sample retracts to a state of ease gamma sub s. The stress-strain relation in uniaxial extension from the state of ease is accurately represented by a two network model with cross-links and trapped entanglements; the first with neo-Hookean elasticity and the second with a Mooney-Rivlin stress-strain relation. The corresponding birefringence-strain relation is also accurately described by the two network model with respective stress-optical coefficients for the two individual networks. Dissert. Abstr.

N80-23452* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REVERSE OSMOSIS MEMBRANE OF HIGH UREA REJECTION PROPERTIES Patent
Catherine C. Johnson and Theodore J. Wydeven, inventors (to NASA) Issued 22 Apr. 1980 6 p Filed 9 Jun. 1976 Supersedes N77-18265 (15 - 09, p1152)
(NASA-Case-ARC-10980-1; US-Patent-4,199,448; US-Patent-Appl-SN-694407; US-Patent-Class-210-23H; US-Patent-Class-204-171; US-Patent-Class-210-500M; US-Patent-Class-427-41; US-Patent-Class-427-245) Avail: US Patent and Trademark Office CSCL 11G

Polymeric membranes suitable for use in reverse osmosis water purification because of their high urea and salt rejection properties are prepared by generating a plasma of an unsaturated hydrocarbon monomer and nitrogen gas from an electrical source. A polymeric membrane is formed by depositing a polymer of the unsaturated monomer from the plasma onto a substrate, so that nitrogen from the nitrogen gas is incorporated within the polymer in a chemically combined form.

Official Gazette of the U.S. Patent and Trademark Office

N80-23453*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF METHODS FOR PROVIDING THERMAL SHOCK RESISTANCE TO PLASMA-SPRAYED CERAMIC GAS-PATH SEALS
Robert C. Bill (AVRADCOM Res. and Technol. Labs.), Donald W. Wisander, and David E. Brewe (AVRADCOM Res. and Technol. Labs.) May 1980 24 p refs
(NASA-TP-1561; E-9941; AVRADCOM-TR-79-28) Avail: NTIS HC A02/MF A01 CSCL 11G

The cyclic thermal shock resistance of several outer air, gas path seal systems for high pressure turbines was evaluated. In all these systems, plasma sprayed, yttria stabilized ZrO2 was the ceramic constituent. The most promising approaches were those that had a porous-metal, low modulus pad as a strain isolator between the ceramic layer and the dense metal substrate. Cooling pins extending into the low modulus pad significantly reduced the oxidation rate of the porous metal and the extended seal life. The thermal shock resistance of ceramic layer was improved by increasing its porosity and by precracking it before thermal shock testing. Microstructural and probe studies suggested that the long term durability of the high-pressure turbine seal systems would be adversely affected if the metal ceramic interfaces exceeded about 800 C because some metallic species would rapidly diffuse. Author

N80-23454*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADJUSTABLE HIGH EMITTANCE GAP FILLER Patent Application

Howard E. Goldstein, Carlos Estrella, Marnell Smith, David A. Stewart, and Daniel B. Leiser (Stanford Univ.) Filed 7 May 1980 17 p
(NASA-Case-ARC-11310-1; US-Patent-Appl-SN-147700) Avail: NTIS HC A02/MF A01 CSCL 11G

A flexible, adjustable refractory filler is disclosed for filling gaps between ceramic tiles forming the heat shield of a space shuttle vehicle, to protect its aluminum skin during atmospheric re-entry. The easily installed and replaced filler consists essentially of a strip of ceramic cloth coated, at least along both its longitudinal edges with a room temperature vulcanizable silicone rubber compound with a high emittance colored pigment. The filler may have one or more layers as the gap width requires. Preferred materials are basket-weave aluminoborosilicate cloth, and a rubber compounded with silicon tetraboride as the emittance agent and finely divided borosilicate glass containing about 7.5% B203 as highly temperature binder. The filler cloth strip or tape is cut to proper width and length, inserted into the gap, and fastened with previously applied drops of silicone rubber adhesive. NASA

N80-23455*# Pennwalt Corp., King of Prussia, Pa. Central Research and Development.
DEVELOPMENT OF A SPECIAL PURPOSE SPACECRAFT COATING, PHASE 4 Technical Report, 30 May 1978 - 30 May 1979
H. D. Gillman May 1980 14 p refs
(Contract NAS9-14403)
(NASA-CR-160586) Avail: NTIS HC A02/MF A01 CSCL 11G

Coating formulations based on a fluorocarbon resin were evaluated for use on spacecraft exteriors. Formulations modified with an acrylic resin were found to have excellent offgassing properties. A much less expensive process for increasing to solid content of the fluorocarbon latex was developed. R.C.T.

N80-23456*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORMATION OF POROUS SURFACE LAYERS IN REACTION BONDED SILICON NITRIDE DURING PROCESSING
N. J. Shaw and T. K. Glasgow 1979 24 p refs Presented at the Fall Meeting of the Basic Sci. and Nucl. Div. of the Am. Ceramic Soc., New Orleans, 14-17 Oct. 1979
(NASA-TM-81493; E-431) Avail: NTIS HC A02/MF A01

An effort was undertaken to determine if the formation of the generally observed layer of large porosity adjacent to the as-nitride surfaces of reaction bonded silicon nitrides could be prevented during processing. Isostatically pressed test bars were prepared from wet vibratory milled Si powder. Sintering and nitriding were each done under three different conditions:(1) bars directly exposed to the furnance atmosphere; (2) bars packed in Si powder; (3) bars packed in Si3N4 powder. Packing the bars in either Si of Si3N4 powder during sintering retarded formation of the layer of large porosity. Only packing the bars in Si prevented formation of the layer during nitridation. The strongest bars (316 MPa) were those sintered in Si and nitrided in Si3N4 despite their having a layer of large surface porosity; failure initiated at very large pores and inclusions. The alpha/beta ratio was found to be directly proportional to the oxygen content; a possible explanation for this relationship is discussed. R.C.T.

N80-23457# Celanese Research Co., Summit, N.J.
PROCESSING MECHANISMS, STRUCTURE AND MORPHOLOGY OF HIGH TEMPERATURE POLYMERIC ALLOYS, PART 2 Final Technical Report, 1 Feb. 1977 - 31 Jan. 1979
Ian L. Hay, Jay R. Shaner, Peter Sullivan, Ted T. L. Chang, and Richard R. Kemmerer Mar. 1979 64 p refs
(Contract F49620-77-C-0046; AF Proj. 2303)
(AD-A080068; AFOSR-78-0954TR-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 11/9

The processing conditions expected to optimize interactions at a molecular level between poly (bisbenzimidazobenzophenanthroline) (BBB) and polybenzimidazole (PBI) have been investigated and the reaction products evolved under these conditions examined. Studies of the mechanical properties and the morphology indicate that binary interactions between BBB-BBB, PBI-PBI and BBB-PBI may all be occurring. The BBB-BBB interactions occur at temperatures greater than 500 C but PBI-PBI and BBB-PBI interactions arise at temperatures more than 100 C lower. Mass spectroscopic studies indicate that the principal reaction products in the presence of PBI are water and phenol whereas with BBB alone only water is evolved. Moreover in the mixture of BBB-PBI, phenol is evolved at lower temperatures than is the case with PBI alone. Possible end group reactions and reactions with partially cyclized rings, consistent with the observed evolution of water and phenol, are proposed for the improved processability of BBB in the presence of PBI. Further work to confirm the proposed reactions and the use of other additives to enhance these reactions is recommended. GRA

N80-23458# Columbia Univ., New York. Dept. of Chemistry.
PREPARATION OF POLYMERS USING METAL-CARBENES Technical Report, 1 Aug. 1979 - 7 Feb. 1980
Thomas J. Katz, Steven J. Lee, and Michael A. Shippey 7 Feb. 1980 22 p refs Submitted for publication
(Contract N00014-79-C-0683; Grant NSF CHE-77-22726; NR Proj. 356-726)
(AD-A080891; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/3

Metal-carbenes initiate the polymerizations of cycloalkenes to polyalkenamers that are stereoselectively cis, cyclic trisubstituted olefins to polymers that are translationally invariant, and acetylenes to polyacetylenes. Some implications are described. GRA

N80-23459# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
DEVELOPMENT OF HIGH TEMPERATURE SILICONE BASE FIRE-RESISTANT HYDRAULIC FLUID Final Report
Alfeo A. Conte, Jr. and J. Lee Hammond 5 Feb. 1980 75 p refs
(WF41451208)
(AD-A081597; NADC-79248-60) Avail: NTIS HC A04/MF A01 CSCL 11/8

A candidate silicone-base fire-resistant hydraulic fluid designated Nadraul MS-6 has been developed for future military aircraft hydraulic system design. The lubricating ability of this fluid has been demonstrated in hydraulic pump-loop circuit evaluations at 20.7 MPa (3000 PSI) and 55.2 MPa (8000 PSI) fluid pressures and at a fluid temperature as high as 163C (325F). Chemical and physical properties have been determined to establish both specification and hydraulic system design criteria and are reported herein. GRA

N80-23460# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
SINTERABLE POWERS FROM LASER DRIVEN REACTIONS Annual Report, 1 Jul. 1978 - 30 Jun. 1979
John S. Haggerty and W. Roger Cannon Jul. 1979 126 p refs
(Contract N00014-77-C-0581; ARPA Order 3449)
(AD-A081709; MIT-EL-79-047; AR-2) Avail: NTIS HC A07/MF A01 CSCL 11/2

Extremely fine, uniform ceramic powders were synthesized from laser heated gas phase reactions. Resulting Si, Si3N4 and SiC powders have been characterized in terms of parameters which are important for densification processes. They are virtually ideal. The spherical particles typically have mean diameters from 120 to 1000 angstrom. The standard deviation is typically 25-45% and the diameter of the largest observed particle is typically less than twice that of the smallest particle. Purities are extremely high. The laser heated process has been modeled in terms of fluid flow and heat transfer criteria. Many fundamental property measurements were made to provide data for these calculations. The process is extremely efficient; approximately 95% of the SiH4 is reacted in a single pass through the laser beam and approximately 2 kwhr. of energy are required per kilo of Si3N4. GRA

N80-23461# Dayton Univ. Research Inst., Ohio.
SURFACE CONTAMINATION OF ADHESIVE BONDING MATERIALS Final Report, Jan. 1978 - Sep. 1979
W. L. Baun (AFML) and J. S. Solomon Wright-Patterson AFB,

Ohio AFML Dec. 1979 57 p refs Presented at Symp. on Contamination, Washington, D.C., Sep. 1978
(Contract F33615-76-C-5185; AF Proj. 2419)
(AD-A081316; AFML-TR-79-4165) Avail: NTIS HC A04/MF A01 CSCL 11/1

The surface composition of adherend materials, as received, is usually entirely different from the bulk and generally unsuitable for adhesive bonding. Consequently, prebonding treatments of adherend surfaces are usually necessary to remove unwanted chemical species and to modify the surface chemistry and topography in order to produce a strong and durable bond. Auger electron spectroscopy, ion scattering spectroscopy, and secondary ion mass spectroscopy were used to characterize adhesive bonding materials as received and at various prebonding stages. The presence of contaminants or undesirable materials has been traced to manufacturing processes, prebonding treatments, and environment. In many instances the presence of contaminants or unwanted materials has been directly related to poor bond performance. GRA

N80-23462# Akron Univ., Ohio. Inst. of Polymer Science.
THE ROLE OF CHEMICAL BONDING IN ADHESION Annual Report
A. N. Gent and P. Dreyfuss Feb. 1980 34 p refs
(Contract N00014-76-C-0408; NR Proj. 092-555)
(AD-A081661; TR-4) Avail: NTIS HC A03/MF A01 CSCL 13/8

Progress in three different phases of our study of the role of chemical bonding in adhesion is summarized in this report. Phase one consisted of an experimental study of the self-adhesion of thin layers of three crosslinked elastomers: namely, cispolyisoprene (natural rubber) and two polybutadienes. For the polybutadienes, the strength of self-adhesion was found to be strongly dependent upon the time of exposure of the two surfaces to air before they were brought into contact. The same phenomenon did not take place on exposure to nitrogen nor for samples of cispolyisoprene and it was reduced or delayed in samples containing antioxidant. It was therefore attributed to surface oxidation reactions that can lead to interfacial covalent bonds with polybutadiene but not with polyisoprene. Phase two consisted of a study of the effect of the number of chemical bonds at an interface between glass and polybutadiene on the joint strength of the adhesive bond formed between them. GRA

N80-23463# Brown Univ., Providence, R. I. Dept. of Chemistry.
COMPARATIVE RAMAN STUDY OF MIXED-ALKALI AND SIMILAR ION EXCHANGED GLASSES
Charles Windisch and William M. Risen, Jr. 10 Dec. 1979 39 p refs Submitted for publication
(Contract N00014-75-C-0883; NR Proj. 051-539)
(AD-A080840; TR-79-02) Avail: NTIS HC A03/MF A01 CSCL 11/2

The Raman spectra of analogous ion exchanged and mixed alkali disilicate and aluminodisilicate glasses of the same relative composition of dissimilar cations have been determined and employed to investigate the origin of the similarity of the mechanical loss features exhibited by them. Ion exchange of Na- for Lin Li_2O-Al_2O_3-$2SiO_2$ glasses is shown to yield glasses whose network structure is different from that of the mixed alkali glasses of the same stoichiometry, but to attain that structure upon annealing. The network structure of ion exchanged and conventionally mixed alkali disilicate glasses are apparently identical. These results are interpreted in light of the mechanical loss spectra of the analogous glasses prepared in the two ways. GRA

N80-23464# Brown Univ., Providence, R. I. Dept. of Chemistry.
TOWARD AN UNDERSTANDING OF THE MECHANICAL MIXED ALKALI EFFECT IN GLASSES
Costas H. Tzinis 10 Dec. 1979 24 p refs Submitted for publication
(Contract N00014-78-C-0883; NR Proj. 051-539)
(AD-A080751; TR-79-04) Avail: NTIS HC A02/MF A01 CSCL 11/2

The mechanical properties of mixed alkali glasses have been analyzed in order to determine their common features, including systematic variations with composition, and to define clearly the phenomena that must be explained. New assignments of the mechanical loss peaks are made, and approaches to developing a cooperative theory for the phenomena, especially the compositional variation of the peak temperatures and loss tangents, are presented and discussed. GRA

N80-23465# Montana Energy and MHB Research and Development Inst., Inc., Butte.
THERMAL CONDUCTIVITY AND DIFFUSIVITY OF ENGINEERING CERAMICS Final Report, 15 Sep. 1978 - 14 Sep. 1979
G. E. Youngblood and Larry D. Bentsen Nov. 1979 139 p refs
(Contract N00014-78-C-0726)
(AD-A078540; Rept-4TC-NAVY-F/79) Avail: NTIS HC A07/MF A01

This report summarizes the results of a one year research program devoted to an investigation of the effect of compositional and microstructural variables on the thermal conductivity/diffusivity of engineering ceramics. Particular emphasis was placed on studies of thermal transport phenomena in composite materials. A total of six completed studies have resulted during this program, with another four in progress, as follows: (1) Effect of Crystallization on the Thermal Diffusivity of a Cordierite Glass-Ceramic; (2) Thermal Diffusivity of Ba/Mica/Alumina Composites; (3) Thermal Diffusivity of Al_2O_3 with Dispersed Monoclinic and Tetragonal ZrO_2 particles; (4) Effect of thermal Expansion Mismatch on the Thermal Diffusivity of Glass-Ni Composites; (5) Simple Laser Pulse Calorimeter; (6) Thermal Diffusivity/Conductivity of Dense Magnesia/Magnesia-Alumina Spinel Ceramic; (7) Thermal Diffusivity of Al_2O_3/SiC Composites; (8) Thermal Diffusivity of MgO/SiC Composites; (9) Thermal Diffusivity of Al_2O_3/TiC Composites; (10) Thermal Diffusivity of a Partially Electronic Conducting Ceramic: Yttrium Chromites. GRA

N80-23466# Dayton Univ. Research Inst., Ohio.
STRUCTURE MODIFICATION OF FLUOROCARBON ETHER BIBENZOXAZOLE POLYMERS TO IMPROVE HYDROLYTIC STABILITY Final Report, Jun. 1975 - May 1978
R. C. Evers, G. J. Moore, and J. L. Burkett Wright-Patterson AFB, Ohio AFML Oct. 1979 37 p refs
(Contract F33615-75-C-5095; AF Proj. 2419)
(AD-A078954; AFML-TR-79-4149) Avail: NTIS HC A03/MF A01

Hydrolytically and thermooxidatively stable fluorocarbon ether bibenzoxazole (FEB) polymers were synthesized by the acetic acid-promoted polycyclocondensation of fluorocarbon ether bis (o-aminophenol) monomers with novel fluorocarbon ether dithioimidate ester monomers. The dithioimidate esters were derived from hexafluoropropylene oxide (HFPO) or, preferably, from a combination of tetrafluoroethylene oxide (TFEO) and HFPO. The latter class of TFEO:HFPO-derived dithioimidate esters was tailored to impart improved hydrolytic stability to the resultant FEB polymers while minimizing undesirable, concomitant increases in polymer glass transition temperatures (Tg). The polymers were obtained in moderate-to-high molecular weight and exhibited inherent viscosities in the range of 0.20 to 0.41 dl/g. Polymer structures were verified by elemental and infrared spectral analysis. Lower polymer Tg's were obtained with increased fluorocarbon ether content, a minimum value of -48 C (-55 F) being achieved. High thermooxidative stability of the HFPO- and TFEO:HFPO-based FEB polymers was substantiated by thermogravimetric analysis and isothermal aging studies in air. After isothermal aging in air for 200 hours at 288 C (550 F) and 260 C (500 F), respresentative polymers exhibited weight losses of 17 and 7 percent, respectively. Hydrolytic stability of the polymers was evaluated by exposure to a 95 percent relative humidity, 93 C (200 F) environment for prolonged periods of time. Based on comparative polymer Tg, inherent viscosity and infrared spectral data, the HFPO- and TFEO:HFPO-based FEB polymers exhibited vastly improved hydrolytic stability over analogous TFEO-based FEB polmers. GRA

N80-23467# Dayton Univ. Research Inst., Ohio.
DYNAMIC MECHANICAL MEASUREMENT OF POLYPHENYLSULFONE (RADEL) Interim Report, Jul. - Dec. 1978

C. Ying-Cheung Lee, Jacque D. Henes, and Thomas E. Grossman Wright-Patterson AFB, Ohio AFML Jun. 1979 37 p refs (Contract F33615-78-C-5126; AF Proj. 2419)
(AD-A077281; UDR-NM-TR-79-07; AFML-TR-79-4062) Avail: NTIS HC A03/MF A01 CSCL 11/9

The dynamic response of Polyphenylsulfone (Radel) was measured with the Rheometrics Mechanical Spectrometer in different modes: Torsional Bar, Tensile, 3 Point-Bending, and Parallel Plates. The measurements cover a temperature range from -150 C to 380 C. Two secondary transitions below the glass transition have been identified and their relaxation activation energies are evaluated. The region above the glass transition temperature was characterized by Parallel Plates measurement and a maximum similar to the liquid-liquid transition was observed. Viscosity in this region was also measured as a function of frequencies. A Master Curve was constructed from the Torsion and Parallel Plates data, and the frequency shift parameters were fitted to the WLF equation. GRA

N80-23468# Naval Research Lab., Washington, D. C. Applied Mechanics Branch.
SHOCK AND VIBRATION PERFORMANCE OF AN EPOXY CHOCKING COMPOUND Final Report, Oct. 1977 - Sep. 1979
E. W. Clements Dec. 1979 47 p refs
(AD-A078496; NRL-MR-4128) Avail: NTIS HC A03/MF A01 CSCL 11/9

For some years, various epoxy compounds have been used to form machinery/equipment chocks on merchant ships. In application, the item to be mounted is located and aligned, and supported in place by some temporary means while the chocking compound is mixed and poured in place. The advantages are speed, economy and intimacy of fit compared to conventional methods. More recently, these compounds have been used to a limited extent on Navy combatants, where shock and vibration environments are much more severe than those encountered in the mercantile fleet. In order to evaluate the ability of poured epoxy chocks to withstand these environments, two structures have been constructed which resemble equipment items which have been so mounted on combatants in terms of mounting footprint, weight and overturning moment. These have been subjected to shock and vibration tests similar to those required by the Navy for acceptance of shipboard equipment. The epoxy chocks were unaffected by the vibration test, while under shock test they sustained minor cracking and spalling, but without significant reduction of load-bearing area and no impairment of alignment function. It was concluded that their performance was satisfactory for the test situations employed. It should be cautioned, however, that other environmental factors (temperature, humidity, contaminants, etc.) than those considered here may also be effective, and that other mechanical situations might modify the results observed. Such factors should be evaluated for any contemplated installation. GRA

N80-23469# National Technical Information Service, Springfield, Va.
THE CHEMISTRY OF SILICONE RESINS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1976
Diane M. Cavagnaro Feb. 1980 184 p
(PB80-804362) Avail: NTIS HC $30.00/MF $30.00 CSCL 07C

This bibliography pertains to the synthesis, polymerization, and chemical reactions of silicone and silicon-containing polymers and copolymers. The citations discuss grafting and crosslinking reactions, radiation polymerization, and spectra and molecular structure as they relate to their properties. This updated bibliography contains 177 abstracts, none of which are new entries to the previous edition. GRA

N80-23470# National Materials Advisory Board, Washington, D. C.
FIRE-RESISTANT HYDRAULIC FLUIDS IN ENCLOSED MARINE ENVIRONMENTS Final Report
1979 72 p refs
(Contract MDA903-78-C-0038)
(PB80-125545; NMAB-345) Avail: NTIS HC A04/MF A01 CSCL 11H

The status of research directed toward the reduction of fire hazards associated with hydraulic systems was reviewed. Particular attention was given to the problems associated with the search of less flammable hydraulic fluids. The nature and significance of tests to evaluate the flammability of candidate fluids and such practical considerations as toxicity and corrosivity, which affect the selection and use of hydraulic fluids, were emphasized. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-23471* National Aeronautics and Space Administration. Pasadena Office, Calif.
PROCESS FOR THE LEACHING OF AP FROM PROPELLANT Patent
Graham C. Shaw (Thiokol Corp., Brigham City, Utah) and Meldon J. McIntosh, inventors (to NASA) (Thiokol Corp., Brigham City, Utah) Issued 15 Apr. 1980 7 p Filed 29 Sep. 1978 Supersedes N79-10227 (17 - 01, p 0031) Sponsored by NASA
(NASA-Case-NPO-14109-1; US-Patent-4,198,209; US-Patent-Appl-SN-946990; US-Patent-Class-23-302R; US-Patent-Class-149-108.4; US-Patent-Class-23-302T; US-Patent-Class-23-300; US-Patent-Class-23-302A) Avail: US Patent and Trademark Office CSCL 21I

A method for the recovery of ammonium perchlorate from waste solid rocket propellant is described wherein shredded particles of the propellant are leached with an aqueous leach solution containing a low concentration of surface active agent while stirring the suspension.

Official Gazette of the U.S. Patent and Trademark Office

N80-23472*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE IMPACT OF FUELS ON AIRCRAFT TECHNOLOGY THROUGH THE YEAR 2000
Jack Grobman and Gregory M. Reck 1980 26 p refs Presented at the Intern. Meeting and Tech. Display: Global Technol. 2000, Baltimore, 5-11 May 1980; sponsored by AIAA
(NASA-TM-81492; E-429) Avail: NTIS HC A03/MF A01 CSCL 21D

The impact that the supply, quality, and processing costs of future fuels may have on aircraft technology is assessed. The potential range of properties for future jet fuels is discussed along with the establishment of a data base of fuel property effects on propulsion system components. Also, the evolution and evaluation of advanced component technology that would permit the use of broader property fuels and the identification of technical and economic trade-offs within the overall fuel production-air transportation system associated with variations in fuel properties are examined. M.G.

N80-23473# Arizona Univ., Tucson. Dept. of Chemistry.
EXPLORING NEW CONCEPTS FOR ELUCIDATING PROCESSES OCCURRING IN PYROTECHNIC FLARES AND FOR GENERATING AEROSOL DISPERSIONS Final Report
M. Bonner Denton Sep. 1979 33 p refs
(Contract N00019-78-C-0512)
(AD-A080731) Avail: NTIS HC A03/MF A01 CSCL 19/1

Efforts leading to the development of successful techniques for mapping burning pyrotechnic flares are described. An experimental system capable of studying a variety of combustion processes under 'noisy' and 'smoky' conditions on a time scale appropriate for combusting flare candles is presented. Fundamental investigations designed to elucidate critical design parameters in Babington Nebulizers for application as high density aerosol generators are described. GRA

N80-23474# Suntech, Inc., Marcus Hook, Pa.
RESEARCH ON DIAMANTANE AND OTHER HIGH DENSITY HYDROCARBON FUELS
Final Report, 1 Jun. 1978 - 30 Jun. 1979

A. Schneider and H. K. Myers Wright-Patterson AFB, Ohio AFAPL Oct. 1979 93 p refs
(Contract F33615-78-C-2037; AF Proj. 3048)
(AD-A080749; AFAPL-TR-79-2080) Avail: NTIS HC A05/MF A01 CSCL 21/4

This report describes the preparation of (a) diamantane, (b) exo-tetrahydro-tricyclopentadiene, (c) the hydrogenated product of isomerized endo, endo-di(norbornadiene), and (d) some precursors of polyalkyldiamantanes. GRA

N80-23475# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab Section.
PROPELLANT SURVEILLANCE REPORT LGM-30 A AND B STAGE 1, TP-H1011
John A. Thompson Nov. 1979 110 p
(AD-A081493; MANCP-425(79)) Avail: NTIS HC A06/MF A01 CSCL 21/9

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 A and B First Stage Minuteman Motors. Testing was accomplished in accordance with MMWRM Project M82934C-WNL17514. The purpose of testing was to determine and provide early warning of any serious degradation trends in the propellant for service life predictions. An analysis of all parameters indicates that no potential problems are expected in the propellant for at least two years past the oldest data point. Data stored in the GO85 System were plotted utilizing the IBM 360-65 Computer and CAL-COMP Plotter. The data range at any age can be found by suitable inquiry of the GO85 System. Each point on the regression plot represents the mean of all samples at that particular age. The number of specimens at each point is indicated on the sample size summary sheet accompanying each regression plot or group of regression plots. GRA

N80-23476# Institute for Industrial Research and Standards, Dublin (Ireland). Information Technology Group.
RETROSPECTIVE SEARCH ON THE BIOCHEMICAL PRODUCTION OF ALCOHOL FUELS
Jul. 1979 233 p Prepared in cooperation with National Board for Science and Technology, Dublin
(NP-24137) Avail: NTIS (US Sales Only) HC A11/MF A01; DOE Depository Libraries

The production of alcohol from a wide variety of carbohydrate and cellulose sources from 1957 to 1979 is discussed. Some general information relating to the bioconversion process and alcohol fuels is also included. DOE

N80-23477# Argonne National Lab., Ill.
ENVIRONMENTAL ASSESSMENT OF THE UTILIZATION OF ALCOHOL FUELS IN HIGHWAY VEHICLE APPLICATIONS
Oreste M. Bevilacqua and Martin J. Bernard, III 1979 11 p refs Presented at 2d Intern. Conf. on Energy Use Management, Los Angeles, 22-26 Oct. 1979
(Contract W-31-109-eng-38)
(CONF-791009-19) Avail: NTIS HC A02/MF A01

Four alternative alcohol fuel utilization scenarios are described. The development of the utilization scenarios was based on an evaluation of a broad range of implementation constraints and considerations. The final set of utilization scenarios will be used in the environmental assessment to bracket the probable environmental impacts and implications during the foreseeable future. DOE

N80-23478# Brookhaven National Lab., Upton, N. Y.
HYDROGEN STORAGE MATERIALS RESEARCH AND DEVELOPMENT WORK AT BROOKHAVEN NATIONAL LABORATORY
John R. Johnson 1979 4 p refs Presented at the DOE Chem. Energy Storage and Hydrogen Energy Systems Contracts Rev. Meeting, Reston, Va., 12 Nov. 1979
(Contract EY-76-C-02-0016)
(BNL-26813; CONF-791127-2) Avail: NTIS HC A02/MF QA01

The utilization of TiCr2 intermetallics (parent compounds or substituted systems) as energy storage media or for nonmechanical compression/liquefaction applications is discussed. Preliminary research into the feasibility of hydrogen separation from mixed gas streams, using intermetallic compounds, is briefly reported. DOE

N80-23479# California Univ., Livermore. Lawrence Livermore Lab.
PERFORMANCE AND PROPERTIES OF EXTRUSION CAST EXPLOSIVES COMPOSED OF HMX, FEFO AND AFNOL
John S. Hallam Oct. 1979 38 p refs
(Contract W-7405-eng-48)
(UCID-18333) Avail: NTIS HC A03/MF A01

The results of a comprehensive program to develop a series of extrusion cast explosives (ECX) are developed composed of HMX and AFNOL, an energetic, cast curable binder that is plasticized with FEFO. Results indicate that an ECX can be extruded into containers of almost any configuration and then cured in place without any shrinkage or loss of homogeneity. The results also show that in the cured state ECXs are extremely insensitive to impact, and their composition can be adjusted to give different energies; a formulation containing 80 wt % HMX has the equivalent energy of PBX 9404. DOE

N80-23480# Sandia Labs., Albuquerque, N. Mex.
INITIATION OF GRANULAR EXPLOSIVES BY RAMP WAVES
R. E. Setchell 1979 22 p refs Presented at the CPIA-JANNAF Combust. Conf., Monterey, Calif., 10 Sep. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1169C; CONF-790975-5) Avail: NTIS HC A02/MF A01

Initiation processes in granular explosives experiencing finite-risetime loading, in contrast to shock loading were investigated. Ramp waves having a risetime or either 0.3 microseconds or 0.8 microseconds were transmitted into the explosive PBX-9404, resulting in initial waves having a peak axial stress of 5.1 GPa. The incident waves were generated in discs of a glass-ceramic, pyroceram, by planar impact of copper-faced projectiles using a gas-fired gun facility. Velocity interferometry (VISAR) was used to measure particle velocity histories after the initial wave had propagated through explosive samples having different thicknesses. For comparison, similar measurements were made for the case of shock loading to the same initial peak stress. The slower-rising ramp wave initially loads the explosive at an average rate of 7 GPa microseconds. The VISAR measurements show that initiation processes leading to detonation are strongly inhibited at such a rate of compression. DOE

N80-23481# Battelle Columbus Labs., Ohio.
CARBOHYDRATE CROPS AS A RENEWABLE RESOURCE FOR FUELS PRODUCTION. VOLUME 1: AGRICULTURAL RESEARCH
E. S. Lipinsky, D. R. Jackson, S. Kresovich, M. F. Arthur, and W. T. Lawhon 15 May 1979 94 p refs
(Contract W-7405-eng-92)
(BMI-2031-Vol-1) Avail: NTIS HC A05/MF A01

Narrow row spacing of sweet sorghum and sugarcane as a means of reducing costs and increasing availability in selected geographical areas was emphasized. The influence of row spacing, cultivar selection, and planting date on yield and composition of sweet sorghum were evaluated in a typical corn belt state (Ohio). Similar data were obtained for Texas, Louisiana, Mississippi, and Florida for sweet sorghum and sugarcane. DOE

N80-23482# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.
METHANOL AND METHYL FUEL CATALYSTS Quarterly Report, Mar. - May 1979
Kamil Klier and Richard G. Herman Jun. 1979 14 p
(Contract ET-78-S-01-3177)
(FE-3177-3) Avail: NTIS HC A02/MF A01

Additional preparations of CuO/ZnO catalysts were made, and the materials were examined by X-ray powder diffractions. A series of cerium(IV) containing catalysts was prepared, and it was shown that the CuO/ZnO/CeO2 = 25/65/10 wt percent catalyst precursor contained the copper in the form of (Cu,Zn)2(OH)2CO3, analogous to the binary Cu/Zn = 30/70 sample. Calcination of this material, as well as of a binary ZnO/CeO2 = 87/13 sample, yielded oxides having small

crystallite sizes (< 135 A). The reduced binary Cu/Zn catalysts were examined by diffuse reflectance spectroscopy and by X-ray powder diffraction. It was observed that the amount of noncrystalline copper assayed by X-ray diffraction correlated well with that found dissolved in the zinc oxide phase by an earlier scanning transmission electron microscopy study. The relationship between the optical parameters, such as the emergence of the high intensity visible absorption and the loss of the fundamental absorption edge of the zinc oxide, and the existence of the copper-zinc oxide solid solution were established. DOE

N80-23483# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF THE STEAM-IRON PROCESS FOR HYDROGEN PRODUCTION Quarterly Report, 1 Jul. - 30 Sep. 1978
Aug. 1979 95 p
(Contract EX-76-C-01-2435)
(FE-2435-39; QR-9) Avail: NTIS HC A05/MF A01

The data necessary for determining the effects of the major variables on hydrogen production in the steam-iron process were obtained. A number of significant milestones were achieved which furthered the development of the steam-iron process. A total of three highly successful hydrogen producing tests and data analysis for another test were completed. DOE

N80-23484# Bituminous Coal Research, Inc., Monroeville, Pa.
TEST AND EVALUATE THE TRI-GAS LOW-Btu COAL GASIFICATION PROCESS Quarterly Report, Apr. - Jun. 1979
Jul. 1979 38 p
(Contract ET-78-C-01-2798)
(FE-2798-66; BCR-L-1001) Avail: NTIS HC A03/MF A01

A total of three tests were conducted in the TRI-GAS PEDU. In the last two tests, the system was operated with the char and gas flows integrated in the process design mode. Smooth transfer of both char and gas between reactors was accomplished. Several minor equipment problems were encountered, but these will be alleviated through modifications. Work on the bench-scale equipment continued. DOE

N80-23485# Badger Plants, Inc., Cambridge, Mass.
CONCEPTUAL DESIGN OF A COAL-TO-METHANOL-TO-GASOLINE COMMERCIAL PLANT. VOLUME 3: ENVIRONMENTAL Interim Final Report, 31 Aug. 1977 - 1 Mar. 1979
Mar. 1979 216 p
(Contract EX-76-C-01-2416)
(FE-2416-43-Vol-3; IFR-2) Avail: NTIS HC A10/MF A01

The environmental considerations associated with an industrial manufacturing complex are addressed with specific reference to a coal-to-gasoline manufacturing facility. The environmental laws and regulations affecting the design of the coal-to-gasoline facility are summarized. Environmental control methods and equipment are outlined that will yield a zero plant discharge of all process waste water streams. Gaseous emissions are tabulated and methods of treatment and control are also described. Waste disposal by landfill methods are also considered. DOE

N80-23486# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS (MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL) Quarterly Progress Report, 1 Aug. - 31 Oct. 1979
Y. K. Ahn, Y. C. Chen, H. C. Chen, E. T. Nelson, R. P. Stringer, and Richard C. Bailie 1979 35 p refs Prepared in cooperation with West Virginia Univ., Morgantown, and Environmental Energy Engineering, Inc., Morgantown, W. Va.
(Contract ET-78-C-02-5022)
(COO-5022-9) Avail: NTIS HC A03/MF A01

Biomass characterization procedures were developed to characterize approximately 100 biomass species. Thermal gravimetric analyses were supplemented with a pyrogram and a pyrochromatogram to further characterize each biomass. Tests were run on the PDU in the fluidized bed mode to determine the effects of particle size on reaction time. Thirteen tests were run during this quarter to verify the results from previous testing. The process development unit was modified to accommodate future sustained runs. A mathematical model developed by modifying the Texaco entrained bed pilot plant gasifier model to simulate biomass gasification in an entrained bed. Results were evaluated. A biomass economic program was developed to provide average product fuel costs using 15 thermochemical processes. DOE

N80-23487# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS (MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL)
R. P. Stringer and R. C. Bailie 1979 17 p Prepared in cooperation with West Virginia Univ., Morgantown, and Environmental Energy Engineering, Inc., Morgantown, W. Va.
(Contract ET-78-C-02-5022)
(COO-5022-8) Avail: NTIS HC A02/MF A01

A market analysis of the need for biomass derived fuels presented and the regional availability of biomass resources on seasonal bases are discussed. Biomass conversion profiles were developed for 100 biomass materials including wood species, bagasse, sugar cane, wheat and rice straw, corn stover, and others. Conversion profiles were developed from thermal gravimetric analyses runs under various conditions of temperature and pressure and in the presence of catalysts. Gasification, pyrolysis, and direct combustion were the modes of conversion. An attempt was made to develop biomass-to-fuel process models and to verify them using process development unit runs. Finally, a linear programming model was developed for selecting the most profitable combination of feedstocks and the conversion processes required to satisfy fuels need under given market conditions. The data banks of market conditions for biomass resources and biomass derived fuels, biomass conversion profiles, and commercial scale process economics were used as input to the model. DOE

N80-23488# Los Alamos Scientific Lab., N. Mex.
EXPLOSIVES RESEARCH AND DEVELOPMENT: RECOMMENDATIONS AND COMMENTS ON UNSOLVED PROBLEMS
Louis C. Smith Nov. 1979 46 p refs
(Contract W-7405-eng-36)
(LA-8124-MS) Avail: NTIS HC A03/MF A01

Historical highlights and the current status of the science of high explosives are briefly reviewed, and recommendations and comments on areas deserving special attention during the next decade or so are offered. DOE

N80-23489# SRI International Corp., Menlo Park, Calif.
FRACTURE AND FRAGMENTATION OF HIGH ENERGY PROPELLANT Annual Report
W. J. Murri, Y. M. Gupta, and D. R. Curran Apr. 1979 48 p refs
(Contracts W-7405-eng-48; E(04-3)-115; SRI Proj. PYU-5532)
(UCRL-15160) Avail: NTIS HC A03/MF A01

Dynamic fracture and fragmentation of VRA high energy propellant were investigated. A predictive model for fracture, and fragmentation and associated formation of surface area during dynamic loading was developed. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-23490 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 9
Judith Nagle-Eshleman, ed. Sep. 1979 113 p refs
(AD-A074320) Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Techniques and applications of mechanical signature analysis are examined with a specific emphasis on monitoring the condition of rotating machinery. Also, the frictional damping

mechanisms that can occur in structural joints are discussed. An abstract bibliography of current literature is included. For individual titles, see N80-23491 through N80-23492.

N80-23491 Shock and Vibration Information Center (Defense), Washington, D. C.
TECHNIQUES AND APPLICATIONS OF MECHANICAL SIGNATURE ANALYSIS **c37**
R. H. Volin *In its* The Shock and Vibration Digest, Vol. 11, No. 9 Sep. 1979 p 17-33 refs (For primary document see N80-23490 14-31)
Avail: NRL, Code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Techniques and applications of mechanical signature analysis are examined with a particular emphasis on monitoring the condition of rotating machinery. Vibration signature standard and comparative criteria, measurement and instrumentation, and data analysis are addressed. Condition assessment of gears, pumps, values, and ground vehicles are also specifically discussed. M.G.

N80-23492 Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering
DAMPING IN STRUCTURAL JOINTS **c39**
C. F. Beards *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 9 Sep. 1979 p 35-41 refs (For primary document see N80-23490 14-31)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

The frictional damping mechanisms that can occur in structural joints are discussed. Linearized theories appear adequate for describing the macroslip range. Optimum joint clamping forces exist for maximum energy dissipation and for minimum structural response and have been experimentally confirmed. Fretting corrosion can be controlled by hardening joint interfaces or using EDM joints. It is suggested that some joints in any structure could allow slight slip without affecting the integrity of the structure, thereby increasing inherent damping and improving vibrational performance. Author

N80-23493 Toledo Univ., Ohio.
BAYESIAN CONCEPTS FOR RELIABILITY AND STATISTICAL DECISION THEORY FOR STRUCTURAL DESIGN Ph.D. Thesis
Hikmat F. Mahmood 1977 163 p
Avail: Univ. Microfilms Order No. 8010799

A design procedure based on subjective analysis is developed to overcome the lack of information in the design practice. Methods of prediction are presented which are based on information collected about the specific structure to be designed or similar structures. These predictions are described by a likelihood measure. Bayes' theorem provides a formal method of revising probability measures as new information becomes available. The application of Bayesian methods to structural design problems, where there are limited experimental data, is described. Also, theoretical models are developed for structural designs based on the information available about the design variables. An a priori distribution is used to present prior knowledge or relative ignorance. Earthquake data of ground accelerations is presented and a method for predicting future earthquake accelerations is discussed as an application of this technique. Then, based on this information, a frame structure is analyzed and the probability of occurrence of such earthquakes is included. Dissert. Abstr.

N80-23494 Akron Univ., Ohio.
PROGRESSIVE SETTLEMENTS OF FOUNDATIONS ON COHESIONLESS SOILS SUBJECTED TO VERTICAL VIBRATORY LOADINGS Ph.D. Thesis
Sompetch Leelanitkul 1980 121 p
Avail: Univ. Microfilms Order No. 8010682

A governing equation was developed to relate with existing dynamic soil constitutive relationships. A method for progressive settlement analysis was then developed in which the shearing strain amplitude and number of loading cycles was related to the progressive strain. Comparisons of progressive strains observed from different types of dynamic tests at the same shearing strain amplitude show consistency of the method. The procedure and relationships can be used for predicting the progressive settlement of dynamically loaded foundations. An examination of a model test reported in the literature demonstrates the applicability of the developed method. Dissert. Abstr.

N80-23495*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
PROCEEDINGS OF THE 14TH AEROSPACE MECHANISMS SYMPOSIUM
May 1980 327 p refs Symp. held at Hampton, Va., 1-2 May 1980; sponsored in part by Calif. Inst. of Tech. and Lockheed Missiles and Space Co.
(NASA-CP-2127; L-13610) Avail: NTIS HC A15/MF A01 CSCL 20K

Technological areas covered include aviation propulsion, aerodynamic devices, and crew safety; space vehicle propulsion, guidance and control; spacecraft deployment, positioning, and pointing; spacecraft bearings, gimbals, and lubricants; and large space structures. Devices for payload deployment, payload retention, and crew extravehicular activity on the space shuttle orbiter are also described. For individual titles, see N80-10248 through N80-10274. For individual titles, see N80-23496 through N80-23522.

N80-23496*# Boeing Aerospace Co., Seattle, Wash.
MECHANISMS TO DEPLOY THE TWO-STAGE IUS FROM THE SHUTTLE CARGO BAY **c16**
H. Theron Haynie *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 1-8 ref (For primary document see N80-23495 14-31)
(Contract F04701-78-C-0040)
Avail: NTIS HC A15/MF A01 CSCL 22B

The Inertial Upper Stage (IUS) is a two-stage or three-stage booster used to transport spacecraft from the space shuttle orbit to synchronous orbit or on an interplanetary trajectory. The mechanisms which were designed specifically to perform the two-stage IUS required functions while contained within the cargo bay of the space shuttle during the boost phase and while in a low Earth orbit are discussed. The requirements, configuration, and operation of the mechanisms are described, with particular emphasis on the tilt actuator and the mechanism for decoupling the actuators during boost to eliminate redundant load paths. R.E.S.

N80-23497*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
MANNED MANEUVERING UNIT LATCHING MECHANISM **c54**
Charles S. Ailton *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 9-18 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 05H

The astronaut/Manned Maneuvering Unit interface, which presented a challenging set of requirements for a latching mechanism, is described. A spring loaded cam segment with variable ratio pulley release actuator was developed to meet the requirements. To preclude jamming of the mechanism, special precautions were taken such as spring loaded bearing points and careful selection of materials to resist cold welding. The mechanism successfully passed a number of tests which partially simulated orbital conditions. R.E.S.

N80-23498*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER DOOR CLOSURE TOOLS **c37**
William R. Acres *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 19-31 ref (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

Safe reentry of the shuttle orbiter requires that the payload bay doors be closed and securely latched. Since a malfunction in the door drive or bulkhead latch systems could make safe reentry impossible, the requirement to provide tools to manually close and secure the doors was implemented. The tools would disconnect a disabled door or latch closure system and close and secure the doors if the normal system failed. The tools required to perform these tasks have evolved into a set that consists of a tubing cutter, a winch, a latching tool, and a bolt extractor. The design, fabrication, and performance tests of each tool are described. R.E.S.

N80-23499*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER EMERGENCY CREW ESCAPE SYSTEM c03
William W. Lofland *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 33-46 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

Two conventional ejection seats were incorporated into the first two orbiter vehicles to provide the crew with emergency ejection capability during the flight test programs. To avoid extensive development and test costs, existing ejection seats were selected and minimum modifications were made to accommodate the orbiter application. The new components and modifications were qualified at the component level, and a minimum sled test program was conducted to verify the orbiter installation and validate the six degree-of-freedom analysis. The system performance was certified and the orbital flight test capability was established by analysis. R.E.S.

N80-23500*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FLUID CIRCULATING PUMP OPERATED BY SAME INCIDENT SOLAR ENERGY WHICH HEATS ENERGY COLLECTION FLUID c37
Earl R. Collins *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 47-56 refs (For primary document see N80-23495 14-31)
(Contract NAS7-100)
Avail: NTIS HC A15/MF A01 CSCL 13K

The application of using a spacecraft solar powered pump terrestrially to reduce or eliminate the need for fossil fuel generated electricity for domestic solar hot water systems was investigated. A breadboard prototype model was constructed utilizing bimetals to convert thermal energy into mechanical motion by means of a toggle operated shutter mechanism. Although it did not meet expected thermal efficiency, the prototype model was sufficient to demonstrate the mechanical concept. R.E.S.

N80-23501*# Vought Corp., Dallas, Tex.
THE ECCENTUATOR: A NEW CONCEPT IN ACTUATION c37
Robert G. Musgrove *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 57-67 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A new concept in actuation for aerospace mechanisms is presented. This actuator, called an 'eccentuator', features unique output characteristics, installation and envelope efficiencies, and relative simplicity. The actuator can be powered by either hydraulic or mechanical inputs. Potential applications of the 'eccentuator' and development efforts are discussed. R.E.S.

N80-23502*# Institute for Industrial Research and Standards, Dublin (Ireland).
THE ACTUATED LATCH PIN AND ITS DEVELOPMENT c37
Patrick J. Lawlor *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 69-78 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

An actuated latch pin developed to meet the need for a reusable locking device is described. The unit can function as a pin puller or as a pin pusher latch. Initial prototype testing demonstrated the feasibility of the device with the unit being driven from a 28 V dc supply and using 15 W to drive a 12 mm diameter pin through a stroke of 10 mm with a side load of 100 N in 120 ms. High wear rates with a MOS2 lubrication on the ballscrew and angular contact bearings have necessitated the reduction in the duty cycle from 1000 cycles in air and vacuum to 100 in air and 1000 in vacuum. M.G.

N80-23503*# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
BALL BEARING VERSUS MAGNETIC BEARING REACTION AND MOMENTUM WHEELS AS MOMENTUM ACTUATORS c37
W. Auer *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 79-91 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

Different bearing technologies of momentum actuators for the attitude control of satellites are compared and a guideline for the selection of the suitable momentum actuators or momentum actuator configurations to meet given mission goals with high reliability and low cost is developed. The comparison between ball bearing and magnetic bearing momentum actuators shows that given mission requirements can be economically met by employing the ball bearing technology without decreasing reliability and lifetime. However, for some special mission requirements, such as 'zero friction at zero speed,' fine pointing (met by vernier gimballing), and/or active damping, magnetic bearings may be advantageous. This makes it evident that magnetic bearing technology will not replace ball bearing technology for momentum actuators, but will supplement it for some special mission requirements. M.G.

N80-23504*# Societe Nationale Industrielle Aerospatiale, Paris (France).
CENTRIFUGAL REGULATOR FOR CONTROL OF DEPLOYMENT RATES OF DEPLOYABLE ELEMENTS c37
J. C. Vermalle *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 93-99 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

The requirements, design, and performance of a centrifugal regulator aimed at limiting deployment rates of deployable elements are discussed. The overall mechanism is comprised of four distinct functional parts in a machined housing: (1) the centrifugal brake device, which checks the payout of a deployment cable; (2) the reducing gear, which produces the spin rate necesary for the braking device; (3) the payout device, which allows the unwinding of the cable; and (4) the locking device, which prevents untimely unwinding. The centrifugal regulator is set into operation by a threshold tension of the cable which unlocks the mechanism and allows unwinding. The pulley of the windout device drives the centrifugal brake with the help of the reducing gear. The centrifugal force pushes aside weights that produce friction of the studs in a cylindrical housing. The mechanism behaved well at qualification temperature and vibrations. M.G.

N80-23505*# Science Research Council, Chilton (England).
MECHANISMS OF UK RADIOMETERS FLOWN ON NIMBUS 5 AND 6 WITH PARTICULAR REFERENCE TO BEARINGS, PIVOTS AND LUBRICATION c37
H. Hadley *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 101-110 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

The mechanisms incorporated in the vertical sounding infrared radiometry experiments which were launched on Nimbus 5 in 1972 and on Nimbus 6 in 1975 are discussed. Both use dry lubricants. The Nimbus 5 radiometer includes a rotating chopper driven via a carbon fiber-acetal resin gearwheel. The driving motor runs at 2000 rpm and has completed over 7 x 10 to the 9th power revolutions. Four gear driven filter wheels powered by stepper motors have each completed 2 x 10 to the 8th power changes. The input calibration mirror mechanism and its field of view compensation mechanisms are also described. All 25 ball races used in the experiment are of the film transfer type. The Nimbus 6 radiometer includes two cells. Each contains a piston supported on diaphragm springs and driven electromagnetically. The pistons are 6 cm in diameter with a stroke of 1 cm and are driven at their mechanical resonant frequency of approx. 15 Hz. The calibrating mirrors rotate periodically to view a target. The support pivots are synthetic sapphire ring stones with separate end thrust stones. The problems of mounting these stones to withstand vibration loads is described. M.G.

N80-23506*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRIPLE-AXIS COMMON-PIVOT ARM WRIST DEVICE FOR MANIPULATIVE APPLICATIONS c37
Leendert Kersten and J. Dwight Johnston *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 111-124 ref Prepared in cooperation with Nebraska Univ.-Lincoln (For primary document see N80-23495 14-31)

Avail: NTIS HC A15/MF A01 CSCL 13I

A concept in manipulator development to overcome the 'weak wrist syndrome', a triple-axis common-pivot arm wrist (TACPAW), is presented. It contains torque motors for actuation, tachometers for measuring rate, and resolvers for position measurements. Furthermore, it provides three degrees of freedom, i.e., pitch, yaw, and roll, in a single manipulator joint. The advantages of this development are increased strength, compactness, and simplification of controls. Designed to be compatible with the protoflight manipulator arm, the joints of TACPAW are back-driveable with + or - 45 deg rotation in pitch, + or - 45 deg in yaw and continuous roll in either direction while delivering 20.5 N-m (15 ft-lb) torque in each of the three movements. M.G.

N80-23507*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

DESIGN AND DEVELOPMENT OF THE QUAD REDUNDANT SERVOACTUATOR FOR THE SPACE SHUTTLE SOLID ROCKET BOOSTER THRUST VECTOR CONTROL c20

James M. Lominick *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 125-141 (For primary document see N80-23495 14-31)

Avail: NTIS HC A15/MF A01 CSCL 21H

The design and theory of operation of the servoactuator used for thrust vector control of the space shuttle solid rocket booster is described accompanied by highlights from the development and qualification test programs. Specific details are presented concerning major anomalies that occurred during the test programs and the corrective courses of action pursued. M.G.

N80-23508*# Rockwell International Corp., Seal Beach, Calif. Space Systems Group.

A PRECISION BEARING GIMBAL SYSTEM FOR THE TEAL RUBY PROGRAM c37

Charles H. Lowry *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 143-153 (For primary document see N80-23495 14-31)

Avail: NTIS HC A15/MF A01 CSCL 13I

A precision bearing gimbal system designed to allow a spaceborne infrared sensor to stare at points on the Earth while in orbit is described. The problems encountered, analytical tools and test methods used, and data applicable to users of similar systems are presented. Assembly procedures, bearing preload effects, moisture control, structural analysis, and noise control are specifically examined. M.G.

N80-23509*# General Dynamics/Convair, San Diego, Calif.

FUEL/HYDRAULIC TRANSFER VALVE IMPROVES RELIABILITY OF ATLAS SPACE LAUNCH VEHICLE c37

M. Ogman *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 155-161 (For primary document see N80-23495 14-31)

Avail: NTIS HC A15/MF A01 CSCL 13K

The Atlas fuel hydraulic transfer valve design is described. The design satisfies primary goals such as fuel and oil isolation before launch in order to use existing ground support and airborne hardware and procedures. The valve operates only after the vehicle has been committed to launch. Hydraulic system function is maintained if the valve fails to function. Valve operation is mechanical and interfaces only with the propulsion system. R.C.T.

N80-23510*# Hughes Aircraft Co., Culver City, Calif.

KU BAND DEPLOYED ASSEMBLY AND GIMBAL c37

T. E. Deal *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 163-172 Sponsored in part by Rockwell International Corp. (For primary document see N80-23495 14-31)

Avail: NTIS HC A15/MF A01 CSCL 13I

Requirements for shuttle orbiter missions to locate satellites for servicing and to communicate when out of touch with a direct ground link were established. A Ku Band deployed antenna system providing an integrated radar and communications function was designed to meet these requirements. The unique features of the gimbal assembly are described with emphasis on the following: edge mounted antenna to minimize stowage volume in shuttle and maximize gain; unique two axis housing and shaft arrangement to accommodate two runs of waveguide and 55 electrical conductors without requiring slip rings; maximum use of aluminum in gimbal structure to reduce costs; and lubricant chosen to survive Earth and space environments. R.C.T.

N80-23511*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EMERGENCY IN-FLIGHT EGRESS OPENING FOR GENERAL AVIATION AIRCRAFT c03

Laurence J. Bement *In its* Proc. of the 14th Aerospace Mech. Symp. May 1980 p 173-194 refs (For primary document see N80-23495 14-31)

Avail: NTIS HC A15/MF A01 CSCL 01C

An emergency in-flight egress system was installed in a light general aviation airplane. The airplane had no provision for egress on the left side. To avoid a major structural redesign for a mechanical door, an add on 11.2 kg (24.6 lb) pyrotechnic-actuated system was developed to create an opening in the existing structure. The skin of the airplane was explosively severed around the side window, across a central stringer, and down to the floor, creating an opening of approximately 76 by 76 cm. The severed panel was jettisoned at an initial velocity of approximately 13.7 m/sec. System development included a total of 68 explosive severance tests on aluminum material using small samples, small and full scale flat panel aircraft structural mockups, and an actual aircraft fuselage. These tests proved explosive sizing/severance margins, explosive initiation, explosive product containment, and system dynamics. This technology is applicable to any aircraft of similar construction. R.C.T.

N80-23512*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A SPIN-RECOVERY PARACHUTE SYSTEM FOR LIGHT GENERAL-AVIATION AIRPLANES c08

Charles F. Bradshaw *In its* Proc. of the 14th Aerospace Mech. Symp. May 1980 p 195-209 refs (For primary document see N80-23495 14-31)

Avail: NTIS HC A15/MF A01 CSCL 01C

A tail mounted spin recovery parachute system was designed and developed for use on light general aviation airplanes. The system was designed for use on typical airplane configurations, including low wing, high wing, single engine and twin engine designs. A mechanically triggered pyrotechnic slug gun is used to forcibly deploy a pilot parachute which extracts a bag that deploys a ring slot spin recovery parachute. The total system weighs 8.2 kg. System design factors included airplane wake effects on parachute deployment, prevention of premature parachute deployment, positive parachute jettison, compact size, low weight, system reliability, and pilot and ground crew safety. Extensive ground tests were conducted to qualify the system. The recovery parachute was used successfully in flight 17 times. R.C.T.

N80-23513*# Pratt and Whitney Aircraft, East Hartford, Conn. Government Products Div.

F100 EXHAUST NOZZLE AREA CONTROL c07

Joseph R. Kozlin *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 211-223 (For primary document see N80-23495 14-31)

Avail: NTIS HC A15/MF A01 CSCL 21E

The details of the F100 nozzle mechanism design are highlighted, placing particular emphasis upon the evolution of design constraints or drivers from initial concept through current operational deployment. A kinematic description of the area control mechanism is given, and several environmental constraints which complicate the normal mechanism design process are discussed. R.C.T.

N80-23514*# Boeing Commercial Airplane Co., Seattle, Wash.

AIRPLANE WING LEADING EDGE VARIABLE CAMBER FLAP c05

James B. Cole *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 225-235 (For primary document see N80-23495 14-31)

Avail: NTIS HC A15/MF A01 CSCL 01C

The invention and design of an aerodynamic high lift device which provided a solution to an aircraft performance problem are described. The performance problem of converting a high

speed cruise airfoil into a low speed aerodynamic shape that would provide landing and take-off characteristics superior to those available with contemporary high lift devices are addressed. The need for an improved wing leading edge device that would complement the high lift performance of a triple slotted trailing edge flap is examined. The mechanical and structural aspects of the variable camber flap are discussed and the aerodynamic performance aspects only as they relate to the invention and design of the device are presented. R.C.T.

N80-23515*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
A MECHANICAL ADAPTER FOR INSTALLING MISSION EQUIPMENT ON LARGE SPACE STRUCTURES c37
A. LeFever and R. S. Totah *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 237-245 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A mechanical attachment adapter was designed, constructed, and tested. The adapter was was included in a simulation program that investigated techniques for assembling erectable structures under simulated zero-g conditions by pressure-suited subjects in a simulated EVA mode. The adapter was utilized as an interface attachment between a simulated equipment module and one node point of a tetrahedral structural cell. The mating performance of the adapter, a self-energized mechanism, was easily and quickly demonstrated and required little effort on the part of the test subjects. R.C.T.

N80-23516*# Grumman Aerospace Corp., Bethpage, N.Y.
AUTOMATED BEAM BUILDER c37
Walter K. Muench *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 247-265 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

Requirements for the space fabrication of large space structures are considered with emphasis on the design, development, manufacture, and testing of a machine which automatically produces a basic building block aluminum beam. Particular problems discussed include those associated with beam cap forming; brace storage, dispensing, and transporting; beam component fastening; and beam cut-off. Various critical process tests conducted to develop technology for a machine to produce composite beams are also discussed. A.R.H.

N80-23517*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE MAGSAT MAGNETOMETER BOOM c37
James F. Smola, Wade E. Radford, and Marcus H. Reitz *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 267-278 ref (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A lightweight extendable structure that can precisely position magnetically sensitive instruments safe distances from magnetic sources in a spacecraft is described as well as the major areas of concern that played dominant roles in its development. Weight, packaging volume, thermal distortion, mechanical misalignments, dimensional instability, launch environments, and low temperature functioning were areas that presented some formidable obstacles. The ways in which these obstacles were dealt with are examined for those involving the development of similar aerospace mechanisms with equally restrictive requirements. A.R.H.

N80-23518*# General Electric Co., Philadelphia, Pa. Reentry Systems Div.
DRAWER DRIVE FOR SPACE SHUTTLE VACUUM CANISTER c37
Kenneth E. Werner *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 279-288 (For primary document see N80-23495 14-31)
(Contract NAS1-14375)
Avail: NTIS HC A15/MF A01 CSCL 13I

A sliding drawer type canister was designed to contain long duration exposure facility experiments which require vacuum storage before and after space exposure. The elastomeric seals require high closing loads which are generated through camming levers and transmitted through a spring loaded pressure plate. Lubrication was provided by various dry surface coatings. Higher than expected friction required some redesign after which the assembly functioned well and provided good sealing. Author

N80-23519*# Santa Barbara Research Center, Goleta, Calif.
DESIGN OF AN ATMOSPHERIC SOUNDING RADIOMETER FOR THE GOES METEOROLOGICAL SATELLITE SYSTEM c47
Robert G. Jensen *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 289-301 (For primary document see N80-23495 14-31)
(Contracts NAS5-21139; NAS5-20769)
Avail: NTIS HC A15/MF A01 CSCL 04B

An advanced version of the visible infrared spin scan radiometer onboard U.S. geostationary operational environmental satellites was developed to add a vertical dimension to the instrument's infrared atmospheric images. Through the addition of twelve selectable narrow band filters and more precise in-flight calibration of the infrared detectors, the VISSR atmospheric sounder (VAS) will provide increased data to help determine the Earth's atmospheric temperature and water vapor distribution. The radiometer design, filter wheel, calibration shutter mechanisms, and their preflight test performance are discussed. A.R.H.

N80-23520*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A POLARIMETER FOR THE HIGH RESOLUTION ULTRAVIOLET SPECTROMETER/POLARIMETER c35
John A. Calvert *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 303-310 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 14B

The design requirements of the polarimeter were established by the scientific optical objectives of the experiment to be launched aboard the Solar Max Mission which will study active solar regions. The polarization of the light is accomplished by a rotating magnesium fluoride quarter wave plate. The quarter wave plates are rotated in 22 1/2 degree steps about an axis coincidental with the light beam. As the light beam passes through the wave plate, the transformation that occurs can be expressed by mathematical equations. By having the wave plates calibrated, the data obtained from solar flares can be analyzed and meaningful information provided to the investigators. The polarimeter has two wave plates with different optical characteristics to provide both redundancy and versatility. A four mirror polarizer was added behind one wave plate to provide additional polarization. The mechanical design, testing, and operation of the polarimeter for the high resolution ultraviolet spectrometer/polarimeter are described. A.R.H.

N80-23521*# Ford Aerospace and Communications Corp., Newport Beach, Calif.
THE DESIGN AND APPLICATION OF AN ANTENNA POSITIONER MECHANISM FOR INTELSAT-5 SERIES COMMUNICATION SATELLITE c37
Big Szeto *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 311-322 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

In opertion, the East/West spot beam reflectors on the Intelsat-5 series communication satellite are required to satisfy initial precise-pointing to particular Earth locations; and repositioning and pointing to different Earth locations as traffic changes dictate during the seven year mission. Two 2 axis antenna positioner mechanisms (APM) are utiltized in fulfilling these requirements. Each APM is comprised of three components which consist of one center pivot and two linear actuators rather than an integral two axis gimbal design. The step resolution of the APM can be adjusted as required with the present design, at a step resolution of 0.002865 degrees. The design philosophy and considerations, test program, and test results are discussed as well as some major problems encountered during the course of testing and their resolution. A.R.H.

N80-23522*# Science Research Council, Chilton (England).
THE MECHANISMS OF THE SAMS EXPERIMENT FLOWN

ON NIMBUS 7 WITH PARTICULAR REFERENCE TO THE 2 AXIS SCANNING MIRROR c37
H. Hadley *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 323-333 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

The stratospheric and mesospheric sounder (SAMS) experiment on Nimbus 7 includes a 2 axis scanning mirror and 7 pressure modulator cells. The SAMS experiment is a limb sounding instrument to measure the temperature profile and minor constituents of the atmosphere. The limb scan requires small mirror steps over a 3 deg range, while the scan in azimuth is in larger steps over a 15 deg range. The mirror is plane, 20 cm in diameter, and of zero expansion glass-ceramic. It is supported on two tilt tables, fitted one on the other, with the axes at right angles. The angle of tilt is adjusted by means of recirculating ball screws which are ion plated with lead for lubrication and driven by stepper motors. The seven gas filled cells are each pressure modulated by a 3 cm diameter, 0.3 cm stroke piston which is supported by diaphragm springs and driven electromagnetically at the system's mechanical resonant frequency. The mean pressure of the filling gas, which is the atmospheric constituent being measured, is changed by varying the temperature of a suitable molecular sieve. Author

N80-23523# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NEW METHOD OF ROUNDNESS MEASUREMENT BY CAPACITIVE DETECTORS Thesis - Paris VI Univ.
Bernard Foulon 1979 86 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-635)
(ONERA-NT-1979-9; ISSN-0078-3781) Avail: NTIS HC A05/MF A01

A high precision technique for roundness measurements of nearly cylindrical mechanical parts by the use of capacitive detectors was developed. The general problems encountered in roundness measurements and the limitations of existing systems are presented. The apparatus and test results are described. A 3 mm radius cylinder was measured with a relative accuracy of 0.0001. Theoretically the method makes it possible to determine the exact roundness of an unknown section. Author (ESA)

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-23524* National Aeronautics and Space Administration. Pasadena Office, Calif.
DUAL BAND COMBINER FOR HORN ANTENNA Patent
William F. Williams (JPL) and Seymour B. Cohn, inventors (to NASA) (JPL) Issued 22 Apr. 1980 5 p Filed 31 Jan. 1979 Supersedes N79-17068 (17 - 08, p 0968) Sponsored by NASA
(NASA-Case-NPO-14519-1; US-Patent-4,199,764; US-Patent-Appl-SN-008207; US-Patent-Class-343-786; US-Patent-Class-343-895) Avail: US Patent and Trademark Office CSCL 17B

A corrugated horn antenna, adapted to be coupled to a waveguide at its apex for X-band excitation is further adapted to be connected to waveguides through a circumferential slot for S-band excitation at four distinct phases selected for the desired S-band polarization. The circumferential slot is positioned along the axial length of the horn for good impedance matching and is provided with an X-band choke in the form of two concentric choke slots. For further improvement in impedance matching, the second (outer) choke slot is divided by plugs into four segments that coincide with waveguide ports for the four distinct phases of the S-band.

Official Gazette of the U.S. Patent and Trademark Office

N80-23525 Rensselaer Polytechnic Inst., Troy, N. Y.
SIGNAL PROCESSING USING SURFACE ACOUSTIC WAVE DEVICES Ph.D. Thesis
Duane Roger Arsenault 1979 596 p
Avail: Univ. Microfilms Order No. 8011495

Three surface acoustic wave (SAW) devices, the separated medium convolver, the memory correlator, and the chirp filter are analyzed for signal processing applications. Emphasis is placed on convolution/correlation and Fourier transformation processes. The chirp filter theory is more general and applies equally well to chirp filters fabricated by alternate techniques. Dissert. Abstr.

N80-23526 Mississippi Univ., University.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF PLANAR DISCONTINUITIES IN COAXIAL WAVEGUIDES Ph.D. Thesis
Michael George Harrison 1979 233 p
Avail: Univ. Microfilms Order No. 8011143

An integral equation approach is developed for treating a large class of planar discontinuities in coaxial waveguides. The technique can effectively treat single and multiple discontinuities with no constraints on frequency or relative location. The integral equations are formulated with the transverse component of electric field in the aperture of each discontinuity as the unknown quantity. A numerical solution procedure is described which allows a choice of both the number of sub-sectional expansion pulses employed in each aperture and the number of terms evaluated in the modified higher-order-mode series. Once a solution for the electric field in each aperature is obtained, straight-forward procedures may be employed to compute the admittance of any discontinuity or the field anywhere in the wavefuige. Two sets of coaxial waveguide/cavity structures were constructed and an extensive program of experimental measurements of cavity admittance and field components at cavity wall was pursued. The measured results are compared to integral equation calculations of the same quantities to verify the accuracy of the approach. Dissert. Abstr.

N80-23527 Mississippi Univ., University.
ELECTROMAGNETIC PENETRATION THROUGH A SLOT IN A SCREEN COVERED BY A DIELECTRIC SLAB Ph.D. Thesis
Robert Dudley Nevels, Jr. 1979 181 p
Avail: Univ. Microfilms Order No. 8011149

The problem of scattering from a slot in a screen covered by a dielectric slab is discussed in terms of its applications in the study of electromagnetic pulse effects as well as the analysis of transmission and reception through apertures located on the surfaces of aircraft. Integral equations are derived in terms of the tangential electric field in the slot for an electromagnetic wave incident upon a simple slot, coupled slots and a notch in a ground screen covered by a dielectric slab. The method of moments is used to solve the various coupled integral equations derived. Results are presented for the electric field in a slot lying in a dielectric covered ground screen as a function of slot width and dielectric thickness. For the problem of multiple slots in a ground screen covered by a pielectric slab, results are given for the electric field in the slot as function of slot width, dielectric thickness and spacing between the slots. The electric field in the aperture of a notch in a ground screen covered by a dielectric slab is presented as a function of the width, dielectric thickness and notch depth. Other pertinent results are reported.

Dissert. Abstr.

N80-23528 California Univ., San Diego.
PROBE SIGNALING ON FADING MULTIPATH COMMUNICATION CHANNELS Ph.D. Thesis
Lawrence Elvin Hoff 1979 259 p
Avail: Univ. Microfilms Order No. 8009753

The application of forward probe signaling to unknown, randomly fading multipath communication channels is explained. The essence of the probe concept is that by dedicating part of the transmitted energy to channel probing, the receiver can measure the channel response and then construct an optimum detection scheme for the information waveform. It is shown that the detection efficiency is improved more than enough to compensate for the energy required by the probe measurements. For highly dispersed channels, the probed signaling technique

can reduce the required signal to noise ratio by 10 to 20 dB over unprobed schemes at 0.0001 bit error rate. A mathematical model of the communication problem is given. Dissert. Abstr.

N80-23529 Texas Univ. at Dallas, Richardson.
ATTENUATION OF TELESEISMIC P-WAVES WITHIN GEOTHERMAL SYSTEMS Ph.D. Thesis
Chi-Yuh Young 1979 202 p
Avail: Univ. Microfilms Order No. 8010854

A technique was developed to quantitatively construct a crystal Q model. The reduced spectral ratio method was used to compare the power density spectra of the teleseismic P-wave seismograms and calculated the lateral variation of the differential attenuation factor delta t for each station deployed across the surface of a geothermal area. These data were inverted using a generalized discrete linear inversion technique to construct a quality factor, Q, model of the crust for the geothermal system. The inaccuracies of the inversion result were due to the effect of the observational errors and necessary simplification in applying the method. An empirical relationship was determined between the error involved in the observed differential attenuation factor and the inversion results. It indicated that when the signal to error ratio is above 5, the original model is reproducible, between 5 and 1, there is a dramatic degradation of fidelity and at 1 or below, numerous low Q cells are indentified as high Q and vice versa. Dissert. Abstr.

N80-23530# National Aviation Facilities Experimental Center, Atlantic City, N. J.
MEASUREMENT OF INTERFERENCE-TO-NAVIGATION/COMMUNICATION AVIONICS FROM CABLE TELEVISION (CATV) SYSTEMS Final Report, Jan. - Sep. 1978
Edward M. Sawtelle and James G. Dong Dec. 1979 52 p refs
(FAA Proj. 213-662-810)
(AD-A081430; FAA-NA-79-7; FAA-RD-79-104) Avail: NTIS HC A04/MF A01 CSCL 20/14

Airborne measurements of cable television (CATV) leakage, made at selected cities to compile a representative sampling of interference effects are presented and discussed. Different altitudes were used in the flight-grid-type pattern. Ground measurements were also accomplished by the Federal Communications Commission (FCC) at the sites tested to determine any correlation between the ground and air measurements. The cities selected for discussion in this report were chosen to show various CATV effects detected by the data collection systems. A statistical analysis was performed on the data upon finding that direct airborne position correlation to strong ground leak points was not possible. The analysis provided the mean for each run of a grid and a comparison to determine if significant differences existed between runs. Where no significant differences were found, the condition was due to ambient noise exceeding signal level. Laboratory measurements were also made. Recommendations include maximum signal level for CATV leakage that may be tolerated in the communication and navigation bands. A further recommendation is made that the CATV industry use frequencies in the navigation band which are separated from Federal Aviation Administration navigation frequencies by 25 kilohertz. M.G.

N80-23531*# Illinois Univ., Urbana. Aeronomy Lab.
THE URBANA COHERENT-SCATTER RADAR: SYNTHESIS AND FIRST RESULTS
K. P. Gibbs and S. A. Bowhill 1 Dec. 1979 98 p refs
(Grants NsG-7506; NSF ATM-78-15224)
(NASA-CR-153186; UILU-ENG-79-2509; Aeronomy-90; ISSN-0568-0581) Avail: NTIS HC A05/MF A01 CSCL 17I

A coherent scatter radar system was synthesized and several hundred hours of echo power and line of sight velocity data obtained. The coherent scatter radar utilizes a diode array and components from meteor radar. The receiving system permits a time resolution of one minute in the data. Echo power from the D region shows a high degree of variability from day to day. Examples of changes in power level at shorter time scales are observed. Velocity data show the existence of gravity waves and occasionally exhibit vertical standing wave characteristics. E.D.K.

N80-23532# Naval Ocean Systems Center, San Diego, Calif.
AEGIS SPY-1 RADAR 5-V/60-A SWITCHING-MODE POWER SUPPLY STABILITY ANALYSIS: A STABILITY ANALYSIS EMPLOYING STATE-SPACE AVERAGING TECHNIQUES FOR CONVERTER MODELING
R. E. Hammond Jan. 1979 47 p refs
(XF54582093)
(AD-A080449; NOSC/TR-363) Avail: NTIS HC A03/MF A01 CSCL 10/2

State of the art techniques for modeling switching regulator power supplies are applied to the AEGIS SPY-1 Radar 5-volt/60-ampere power supply. The results of the modeling and subsequent analysis are used to predict the power supply's basic stability and performance characteristics. GRA

N80-23533# Defence Research Establishment, Ottawa (Ontario). Defense Electronics Div.
RADAR VIDEO PULSE RECORDING SYSTEM
Pierre B. Richer Sep. 1979 51 p
(AD-A081156; DREO-TN-79-19) Avail: NTIS HC A04/MF A01 CSCL 17/9

This technical note covers the design and development of an interface unit which was developed to enable a Sony TC-158SD audio cassette recorder to record and playback the pulse repetition frequency (PRF) of a video radar signal within the range of 100 to 5000 pps. GRA

N80-23534# Harry Diamond Labs., Adelphi, Md.
MODIFICATION OF THE AURORA ELECTROMAGNETIC ENVIRONMENT EXPERIMENT AND INTERPRETATION Progress Report
Roland P. Manriquez, George Merkel, and Daniel J. Spohn Oct. 1979 39 p
(DNA Proj. R99-QAXEB088)
(AD-A080804; HDL-PR-79-5) Avail: NTIS HC A03/MF A01 CSCL 20/14

In a series of experiments, it has been determined that a simple parallel plate transmission line would behave in a predictable manner when subjected to the 13-MeV-thick target bremsstrahlung produced by the AURORA flash X-ray machine. During the experiment, the following parameters were measured: current into the transmission line, current through the matched termination of the transmission line, the electric field at the bottom plate along the center of the transmission line, and a component of the magnetic field at the center of the transmission line. The experimental results were interpreted with a simple lumped parameter model of the transmission line. GRA

N80-23535# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
THE ZOG APPROACH TO MAN-MACHINE COMMUNICATION Interim Report
G. Robertson, D. McCracken, and A. Newell Oct. 1979 55 p refs
(Contracts N00014-76-C-0874; F33615-78-C-1551)
(AD-A081088; CMU-CS-79-148) Avail: NTIS HC A04/MF A01 CSCL 05/8

ZOG is a rapid response, large network, menu selection system used for man-machine communication. The philosophy behind this style of communication was first developed by the PROMIS (Problem Oriented Medical Information System) Laboratory of the University of Vermont. ZOG has been used in a number of task domains to help explore the limits and potential benefits of the communication philosophy. This paper discusses the basic ideas in ZOG, describes the architecture of a system implemented to carry out that exploration, and discusses our initial experience. GRA

N80-23536# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N. Mex.
E-3A EMP EVALUATION PROGRAM Final Report, Nov. 1977 - Feb. 1979
J. R. Anderson Kirtland AFB, N. Mex. AFWL Oct. 1980 104 p
(Contract F29601-78-C-0013; AF Proj. 3763)
(AD-A081725; AD-E200458; EG/AG-1394; AFWL-TR-79-115)
Avail: NTIS HC A06/MF A01 CSCL 20/14

This document is the final report of the E-3A EMP Evaluation

Test Program conducted for the AFWL, at Kirtland Air Force Base. The report is divided into four sections: Test Planning, Test Procedures, Data Management and Test Activities. The Test Planning section emphasizes the importance of pretest activities, demonstrates what can happen if critical items (such as connectors) are not identified early, and makes recommendations for future tests. The Test Procedures section gives a step-by-step detailed explanation for performing an EMP test on a large test object. A great number of the problems the test crew encountered on this program are pointed out and solutions are recommended. A brief discussion on power-on testing and breakout box qualification tests are included at the end of the section. The most detailed section in the report is section 4, Data Management. Virtually every function of Data Management is covered in this section; examples of typical response data, 284 calibration data, Daset log sheets and Adset log sheets are given and explained. The final section, Test Activities, explains to the reader the mechanics of performing a test at the HPD facility. GRA

N80-23537# Atlantic Research Corp., Alexandria, Va.
COMMUNICATIONS-ELECTRONIC INTRASYSTEM ELECTROMAGNETIC INTERFERENCE MEASUREMENT TECHNIQUE AND INSTRUMENTATION Quarterly Report, 21 Sep. - 21 Dec. 1979
Lester E. Polisky, Thomas E. Baldwin, Jr., and John Savage
Fort Monmouth, N.J. Army Commun. Res. and Develop. Command Feb. 1980 75 p
(Contract DAAK80-79-C-0786; DA Proj. 1L1-62701-AH-92)
(AD-A081830; CORADCOM-79-0786-2; QR-2) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report presents the results obtained during the second quarter of the communications-electronics intrasystem electromagnetic interference measurement techniques and instrumentation project. The period covered was 21 Sep. 1979 to 21 Dec 1979. The major efforts in the second quarter consisted of completing the IEMCAP feasibility study and developing a broadband measurement system for conducting EMC measurements. GRA

N80-23538# Naval Postgraduate School, Monterey, Calif.
CHANNELS THAT COOPERATIVELY SERVICE A DATA STREAM AND VOICE MESSAGES. 1
D. P. Gaver and P. J. Lehoczky (Carnegie-Mellon Univ.) Nov. 1979 46 p refs 2 Vol.
(Contract N00014-80-WR-00067; Grant NSF ENG-79-05526; R0000110)
(AD-A081616; NPS55-79-027-1) Avail: NTIS HC A03/MF A01 CSCL 17/2

A system of channels cooperatively services both voice and data messages arriving at one node of a communications network. This paper is devoted to the analysis of a particular channel-sharing strategy, in which voice traffic always occupies its channels when available, but data service is allowed to occur on empty voice channels. Voice traffic is taken to be of high priority; voice arrivals that find all voice channels busy are treated as losses. Note that voice traffic will be relatively infrequent as compared to data, and will also exhibit relatively long holding (service) times. Data traffic is taken to be heavy, and exhibits very short holding times (per word unit); compared to voice, data appears to arrive nearly continuously; when all data (and empty voice) channels are filled, queueing occurs. GRA

N80-23539# Varian Associates, Palo Alto, Calif. Solid State Lab.
A 3-5 HETEROSTRUCTURE AVALANCHE PHOTODIODE MODULES FOR FIBER OPTIC COMMUNICATION LINKS IN THE 1.0 TO 1.3 MICROMETER SPECTRAL RANGE Interim Report, Feb. - Jul. 1979
R. Yeats Sep. 1979 29 p refs Prepared for Army Communication Research and Development Command, Fort Monmouth, N.J.
(Contract DAAB07-78-C-2402)
(AD-A081185; IR-3) Avail: NTIS HC A03/MF A01 CSCL 09/5

The increased leakage current in InGaAsP APDs near breakdown is found to be a rather uniform bulk property, not associated with conventional microplasmas, dislocations, or surface effects. Surface effects were eliminated by the fabrication of guard ring APDs, but the increased leakage current persisted. Surface effects were further ruled out by a statistical study of a large sample of APDs, which showed conclusively that the APD leakage current is proportional to diode area, not perimeter. Attempts to overcome the leakage current problem are still being made. GRA

N80-23540# Naval Postgraduate School, Monterey, Calif.
CHANNELS THAT COOPERATIVELY SERVICE A DATA STREAM AND VOICE MESSAGES. PART 2: DIFFUSION APPROXIMATIONS
J. P. Lehoczky (Carnegie Mellon Univ.) and D. P. Gaver Nov. 1979 46 p refs
(Contract N00014-80-WR-0054; Grant NSF ENG-79-05526)
(AD-A081617; NPS55-79-028) Avail: NTIS HC A03/MF A01 CSCL 17/2

A system of channels mutually accommodate both data and voice messages, voice having preemptive priority but being a loss system, and data being allowed to queue. Approximations to the data queue properties are derived. GRA

N80-23541# Naval Research Lab., Washington, D.C. Microwave Technology Branch.
MEASURED PERFORMANCE CHARACTERISTICS OF REFLECTIVE BUTLER MATRICES Final Report
B. Sheleg and H. E. Heddings 9 Jan. 1980 32 p refs
(RR0210346)
(AD-A081002; AD-E000362; NRL-8361) Avail: NTIS HC A03/MF A01 CSCL 09/5

A reflective Butler matrix is described which has the full electrical performance of a conventional Butler matrix while requiring only 1/2 the usual size and number of circuit components and ports. Reflective networks having eight and 16 ports were built, tested, and evaluated at 1060 MHz. Details of the circuit design and fabrication are included. The measured performance characteristics of the reflective Butler matrix are shown to compare well with those of conventional Butler matrix. GRA

N80-23542# Varian Associates, Palo Alto, Calif. Solid State Lab.
THE 3-V HETEROSTRUCTURE AVALANCHE PHOTODIODE MODULES FOR FIBER OPTIC COMMUNICATION LINKS IN THE 1.0 TO 1.3 MICROMETER SPECTRAL RANGE Interim Technical Report, Aug. 1978 - Feb. 1979
R. Yeats and S. H. Chiao Apr 1979 51 p refs
(Contract DAAB07-78-C-2402)
(AD-A081747; ITR-2) Avail: NTIS HC A04/MF A01 CSCL 17/2

InGaAsP APDs have been fabricated with uniform high-speed gains up to 42 and quantum efficiencies up to 70% at 1.28 micrometers. At high gains increased leakage current leads to excessive shot noise and gain saturation. Noise measurements indicate that the increased leakage current arises from a uniformly multiplied but increasing value of the primary (i.e., premultiplication) leakage current. To try to reduce this leakage current, various procedures for fabricating guard ring APDs have been studied. Preliminary guard ring structures have demonstrated guard ring isolation by exhibiting avalanche gain in the central region only. However, these initial guard ring APDs need further development before a meaningful comparison can be made to APDs without guard rings. GRA

N80-23543# Defence Research Establishment, Ottawa, (Ontario). Energy Conversion Div.
TEST AND EVALUATION OF MK 37 TORPEDO BATTERIES
G. J. Donaldson and William D. Barnes Dec. 1979 27 p refs
(AD-A081642; DREO-TN-79-34) Avail: NTIS HC A03/MF A01 CSCL 10/3

The exercise and warshot batteries for the MK 37 torpedo were tested against the electrical specifications of the manufacturer. Both battery types fail to meet the minimum power requirements during the three second, high rate (130A) portion of the discharge test. The warshot batteries performed as specified for the main part of the discharge test. Due to the limited number of test batteries examined it was not possible to estimate the cycle life expectancy for the rechargeable exercise battery. Electrolyte levels within some cells of the exercise battery were found to decrease over a time interval of several months. Additional

electrolyte should be provided as a routine servicing procedure. Some indication of imminent cell failure is provided by the open circuit voltage after at least a one day stand. It is indicated that low open circuit voltage may be taken as sufficient reason for the replacement of the 4 cell monoblock in the exercise battery. R.C.T.

N80-23544# Regis Coll., Weston, Mass.
DEVELOPMENT AND EVALUATION OF ADAPTIVE TECHNIQUES FOR REDUCING IONOSPHERIC-INDUCED RADAR TRACKING ERRORS IN REAL TIME Final Report, 1 Oct. 1978 - 30 Sep. 1979
D. E. Donatelli-DuLong 30 Sep. 1979 52 p refs
(Contract F19628-78-C-0255; AF Proj. 4643)
(AD-A081460; AFGL-TR-79-0256) Avail: NTIS HC A04/MF A01 CSCL 17/9

Adaptive procedures, using real time measurements of ionospheric parameters to reduce r.m.s. errors in predictions, are analyzed, addressing both additive and multiplicative processes as contributors to ionospheric variability. A particular procedure is tested using total electron content data from four stations at solar maximum and three stations at solar minimum. Its impact on radar, navigation and communication systems is evaluated, considering diurnal, seasonal and solar cycle effects. A space-time correlation cell is defined and cell limits established on the basis of temporal and spatial growth rate of r.m.s. residual error. Results indicate that an adapted prediction can significantly improve system performance, particularly in daytime at solar maximum when ionospheric refraction effects are most severe. GRA

N80-23545# Technology Service Corp., Silver Spring, Md.
A REVIEW OF REPRESENTATION FUNCTIONS FOR PROBABILITY OF DETECTION
Wayne Rivers, J. N. Bucknam, E. N. Khoury, and R. E. Blase 11 Jan. 1980 120 p refs
(Contracts N00921-79-C-A306; N00024-78-C-7065)
(AD-A081734; TSC-W25-180) Avail: NTIS HC A06/MF A01 CSCL 17/9

Simple representation functions that interrelate the primary signal detection variables for the receiver structure of Marcum and Swerling are reviewed in regard to accuracy, complexity and inversion. Functions reviewed include those of Brooks, Neuvy, and Khoury-Bucknam. The first two of these are simple algorithms for computing minimum ratio of signal energy to noise power density as functions of number of samples integrated, the target distribution case, and required probabilities of detection and false alarm. The Khoury-Bucknam functions are analytic and invertable, and they relate probability of detection and signal-to-noise ratio using parameters chosen uniquely for each case, number of samples, and probability of false alarm. The procedures and software that support determination of the coefficients of the Khoury-Bucknam function are documented. GRA

N80-23546# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
LASER COMMUNICATION CLIMATOLOGY STUDY Interim Report
May 1979 23 p refs
(Contract N00014-78-C-0539)
(AD-A081656) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report summarizes the progress made during the first half of the climatology study contract period. It presents preliminary results which are useful in estimating the availability of space-to-Earth optical communication systems. GRA

N80-23547# Atmospheric Sciences Office, White Sands Missile Range, N. Mex.
ATMOSPHERIC EFFECTS ON MILLIMETER RADIO WAVES
H. K. Kobayashi Jan. 1980 56 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A081414; ERADCOM/ASL-TR-0049) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report is a short survey intended to present the atmosphere's effect on millimeter waves. The emphasis is on rain and raindrop-size distributions. This emphasis is appropriate because rain (the most common nongaseous constituent of the lower atmosphere) also has the greatest effect on millimeter waves, and raindrop-size distribution is needed to compute the theoretical and measured extinction of radio waves. The pressing need to acquire short-time data on raindrop-size distribution, particularly in the smallest size classes, is emphasized. Likewise, the acquisition of data on atmospheric fluctuations will determine how well millimeter-wave propagation through turbulence will be understood. GRA

N80-23548# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
MAXIMUM ENTROPY SPECTRAL ANALYSIS AND RADAR SIGNAL PROCESSING
R. W. Herring Jan. 1980 49 p refs Sponsored by Dept. of Natlional Defence, Ottawa
(AD-A081343; CRC-1330) Avail: NTIS HC A03/MF A01 CSCL 17/9

The theory and derivation of the maximum-entropy method of spectral analysis and the Burg algorithm, and the potential applicability of these techniques to radar signal processing, are reviewed. This material is presented in a readily comprehensible form for assessment by the practicing radar engineer. Topics such as computational complexity, statistical properties, adaptive clutter suppression and angular spectrum estimation are discussed. It is concluded that, at least at present, maximum-entropy spectral analysis is not a panacea for radar signal processing, due to its substantial computational requirements, and the relatively unknown and potentially unfavorable statistical properties of data analyzed using the Burg algorithm. A promising area of applicability appears to be that of adaptive Doppler filtering. GRA

N80-23549# Brookhaven National Lab., Upton, N. Y.
ELECTROMAGNETIC INTERACTION OF COLLIDING BEAMS ON STORAGE RINGS
J. C. Herrera 1979 13 p ref Presented at Symp. on Nonlinear Dyn. and the Beam-Beam Interaction, Upton, N.Y., 19-21 Mar. 1979
(Contract EY-76-C-02-0016)
(BNL-27035; CONF-790318-8) Avail: NTIS HC A02/MF A01

When the beams cross each other in the intersection region of a storage ring, two distinct effects occur. A particle of one beam may undergo a fundamental interaction with a particle of the other beam. The average number of such events is equal to the product of the machine luminosity and the particle-particle total cross section. In contrast to what happens for these fundamental interactions, a particle of one beam passing through the interaction region will always be influenced by the electric and magnetic fields produced by the entire other beam. Clearly, this classical electromagnetic interaction between the two beams will perturb the motion of the particles circulating in the machine. The basic aspects of this beam-particle force are presented. The effect of this electrical force is quite different in the case of continuous (unbunched) proton beams which cross each other at the angle (as in the ISR at CERN and in ISABELLE at Brookhaven), as compared to the case of electron-positron bunches which collide head on (as in the SPEAR 2 ring and in PETRA and PEP). DOE

N80-23550# AEG-Telefunken, Ulm (West Germany). Research Inst.
VIDEO TELEPHONE SYSTEM WITH DATA COMPRESSION FOR INCREASED COMMERCIAL REQUIREMENTS Final Report
Georg Kummerfeldt and Franz May Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1979 196 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-79-01) Avail: NTIS HC A09/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 40.75

The design of an improved version of a video telephone system for commercial applications was investigated. Problems that were studied in detail include picture quality, channel coding, data compression techniques for continuous gray scale and facsimile signals, and compatibility with already existing systems. Author (ESA)

N80-23551# AEG-Telefunken, Ulm (West Germany). Research Inst.

BASIC STUDIES FOR A NEW COMMUNICATION NETWORK. PART A: AN INTEGRATED COMMUNICATION SYSTEM WITH DECENTRALIZED SWITCHING Final Report

Wolfgang Herzig, Rupert Hildenbrand, and Max Proegler Bonn Bundesmin. fuer Forsch. und Technol. Jul. 1979 179 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. 2 Vol.

(BMFT-FB-T-79-07-Pt-A) Avail: NTIS HC A09/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 37,20

A digital communication system with decentralized switching and integration of broadcasting services and dialed connections at different bandwidths is described. The subscribers are connected to wideband twin lines in a branched, multiple access network. The network is synchronized both with respect to the bit rate and the frame phase. A hardware model is also presented.

Author (ESA)

N80-23552# AEG-Telefunken, Ulm (West Germany). Research Inst.

BASIC STUDIES FOR A NEW COMMUNICATION NETWORK. PART B: MOBILE RADIO TELEPHONE Final Report

Michael Aldinger, Horst Maly, and Karl Neumann Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 207 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-08) Avail: NTIS HC A10/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 43,05

A mobile radio telephone system with digitally encoded access and transmission was developed and tested. The system consists of a fixed relay station and a maximum of five mobile stations. It has a range of about 1 km radius and operates at data rates of 19,200 bits/sec.

Author (ESA)

N80-23553# AEG-Telefunken, Heilbronn (West Germany). Serienprodukte Aktienges.

TECHNOLOGY FOR THE MONOLITHIC INTEGRATION OF UHF DEVICES Final Report

Klaus Woerner Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 85 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-13) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 17,45

The development of a technology for monolithic integration of ultrahigh frequency devices is described. Transistors with cut-off frequencies of up to 6 GHz were produced using ion implantation for the base and arsenic diffusion for the emitter. Methods for the simulating and optimizing of UHF devices were developed. A monolithic integrated wideband amplifier with 1 GHz bandwidth was produced.

Author (ESA)

N80-23554# Fraunhofer Institut, Freiburg (West Germany). Angewandte Festkoerperphysik.

TECHNOLOGIES OF IMAGING FOR COMMUNICATION TERMINALS Final Report

Guenter Baur, Manfred Schiekel, and Karl Walter Bonn Aug. 1979 220 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-38) Avail: NTIS HC A10/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 45,80

A review of technologies for imaging and a discussion of their possible spinoff on prospective terminal equipment in telecommunication system is presented, including a survey of human factors and their influence on display systems. The present state and future trends in the development of components and subsystems for imaging are also analyzed. The consequences for the development of improved and novel equipment are discussed, especially in the field of television and telephone.

Author (ESA)

N80-23555# TICRA ApS, Copenhagen (Denmark).

STUDY AND DEVELOPMENT OF A COMPUTER PROGRAM FOR ANALYSIS OF SAR PLANAR ARRAY ANTENNAS Final Report

N. C. Albertsen and P. Balling May 1979 100 p refs (Contract ESA-3693/78-NL-AK(SC))

(S-110-02; ESA-CR(P)-1297) Avail: NTIS HC A05/MF A01

The development of a computer program TOPAS for analysis of planar array antennas, in particular synthetic aperture radar (SAR) antennas, is described. The program is divided into a number of modules, each of which can be used to analyze the antenna at a certain level. It was developed on a PRIME 300 minicomputer. The first calculates the realized element excitations; taking into account mutual coupling; the second module calculates the radiation pattern, taking into account possible degradations of the array. The third module presents the data in user oriented formats such as: theta-phi plots, u-v plots, isogain curves on the ground, along track and across track curves, and integrated side-lobe level.

Author (ESA)

N80-23556# GEC-Marconi Electronics Ltd., Chelmsford (England).

A STUDY OF SPECTRUM EFFICIENT MODULATION TECHNIQUES FOR DIGITAL SATELLITE COMMUNICATIONS Final Report

P. N. Sargeaunt, ed., M. J. D. Staniforth, B. G. West, G. G. Windus, J. K. Potts, R. J. Millard, and G. R. Brooks Jun. 1979 515 p refs

(Contract ESTEC-3397/77-NL-AK(SC))

(Y/212/5086; ESA-CR(P)-1298) Copyright. Avail: NTIS HC A22/MF A01

The feasibility of achieving an information rate to an occupied bandwidth ratio of 3 bits per Hz in digital satellite systems was studied as a solution to the problem of saturation of the frequency band allocated to satellite communications. Taking the 4 level PSK method as reference, multilevel phase shift keying, hybrid amplitude/phase shift keying, and partial response signaling techniques are discussed. Principles, implementation, the effect of circuit and system imperfections, are discussed, as well as compatibility with typical satellite communication applications. Satellite utilization with 16 PSK, 16 QASK, and 8 DPSK is studied, and consideration is given to the possible use of error correcting codes in signal-to-noise ratio limited situations.

Author (ESA)

N80-23557# Institute for Telecommunication Sciences, Boulder, Colo.

SIGNAL LEVEL DISTRIBUTIONS AND FADE EVENT ANALYSES FOR A 5 GHz MICROWAVE LINK ACROSS THE ENGLISH CHANNEL

D. R. Wortendyke, A. P. Barsis, and R. R. Larsen (Electronics Engineering Group (1842nd), Scott AFB, Ill.) Oct. 1979 29 p refs

(PB80-129398; NTIA/REPT-79/30) Avail: NTIS HC A03/MF A01 CSCL 17B

This report describes instrumentation for fading studies and measurement results over an 88 km multiple-diversity line-of-sight microwave link across the English Channel operating in the 4 to 5 GHz frequency range. Signal level and fade duration statistics derived from the measurments are compared with CCIR models. It is found that median fade duration tends to be less than estimates from the CCIR models.

GRA

N80-23558# Institute for Telecommunication Sciences, Boulder, Colo.

PERFORMANCE OF A VERY LONG 8 GHz MICROWAVE LINK

Nov. 1979 106 p refs Sponsored in part by Electronic Systems Div., Hanscom AFB, Mass.

(PB80-129380; NTIA/REP-79/31) Avail: NTIS HC A06/MF A01 CSCL 17B

Measurement of signals received over a 160 km (100 mile) line-of-sight microwave radio link operating at 8.4 GHz is discussed. The effects of macro-scale meteorological conditions are discussed particularly those which are peculiar to the central European location of the path. The data obtained from this measurement effort are presented both in terms of radio link availability and in terms of long-term propagation performance.

The data were also analyzed to obtain distributions of fade duration for single receivers and for both receivers in a diversity configuration. It is shown that it is possible to achieve reliable propagation at 8 GHz on a link as long as 160 km and with less than normal diversity spacing. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-23559* National Aeronautics and Space Administration. Pasadena Office, Calif.

PASSIVE INTRUSION DETECTION SYSTEM Patent

Eric G. Laue, inventor (to NASA) (JPL) Issued 8 Apr. 1980 5 p Filed 9 Feb. 1977 Supersedes N77-19390 (15 - 10, p 1311) Sponsored by NASA

(NASA-Case-NPO-13804-1; US-Patent-4,197,530; US-Patent-Appl-SN-766999; US-Patent-Class-340-602; US-Patent-Class-310-319; US-Patent-Class-331-65; US-Patent-Class-340-604) Avail: US Patent and Trademark Office CSCL 09C

An intrusion detection system is described in which crystal oscillators are used to provide a frequency which varies as a function of fluctuations of a particular environmental property of the atmosphere, e.g., humidity, in the protected volume. The system is based on the discovery that the frequency of an oscillator whose crystal is humidity sensitive, varies at a frequency or rate which is within a known frequency band, due to the entry of an intruder into the protected volume. The variable frequency is converted into a voltage which is then filtered by a filtering arrangement which permits only voltage variations at frequencies within the known frequency band to activate an alarm, while inhibiting the alarm activation when the voltage frequency is below or above the known frequency band.

Official Gazette of the U.S. Patent and Trademark Office

N80-23560 Stanford Univ., Calif.

AN INSULATED-GATE THYRISTOR STRUCTURE: PRINCIPLES OF OPERATION AND DESIGN Ph.D. Thesis

Brad Whitney Scarf 1980 258 p

Avail: Univ. Microfilms Order No. 8011706

A thyristor configuration, developed for high power semiconductor switching functions, with a metal-oxide-semiconductor (MOS) gate that greatly reduces control-circuit power consumption, improves isolation and simplifies the interfacing of low- and high-power segments is discussed. This is not achieved by circuit techniques but by a single merged device that incorporates mechanisms found in both MCS and bipolar transistors. Although the insulated configuration is suitable for many types of thyristors and voltage and current levels, it has been repeatedly fabricated and extensively analyzed in the form of a planar 150 V bilateral switch called TRIMOS which is fully integrable and is based on a double-diffused MOS (DMOS) fabrication process. The overall current-voltage characteristics are described in terms of a simple equivalent circuit of MOS and bipolar transistors that are directly related to the physical structure. Computer analysis of the circuit leads to accurate simulation of TRIMOS characteristics in the nonregenerative region. Finally, a description of TRIMOS fabrication and design relates performance limitations to the present structure and to fundamental material properties.

Dissert. Abstr.

N80-23561 Minnesota Univ., Minneapolis.

TWO-DIMENSIONAL KALMAN FILTERING AND ITS APPLICATION TO IMAGE RESTORATION Ph.D. Thesis

Bindinganavle Raghavan Suresh 1979 162 p

Avail: Univ. Microfilms Order No. 8011892

The problem of image restoration was investigated. Image restoration techniques were defined in terms of their capability to mathematically model degrading phenomena and attempt to reverse the corrupting influences. An estimate of the original image was obtained through the use of a two dimensional Kalman filter. The filter was implemented by using the strip filtering technique. Strip filtering provided excellent results. Results indicate that the technique is also capable of handling nonstationary images. Dissert. Abstr.

N80-23562 Georgia Inst. of Tech., Atlanta.

DESIGN, STABILITY AND PERFORMANCE OF TWO-DIMENSIONAL RECURSIVE DIGITAL FILTERS Ph.D. Thesis

Gary Alan Shaw 1979 293 p

Avail: Univ. Microfilms Order No. 8010008

Solution methods and algorithms for problems associated with two dimensional recursive digital filter design are developed. Stability testing, stabilization, and space domain design are specifically addressed. Two aspects of recursive filter performance, their efficiency and susceptibility to instability are also investigated by means of a computer study. The major contribution in the area of stability is an efficient algorithm for testing stability of any recursive filter by phase unwrapping. The algorithm is shown to be reliable and computationally efficient. In the area of stabilization, an algorithm is proposed for stabilizing recursive filters with any type of support while approximately preserving the magnitude response. Two algorithms for space domain approximation of a desired response by a recursive filter are proposed and applied to design numerous filters. The algorithms minimize the sum-of-square error between the desired unit-pulse response and the unit-pulse response of the recursive filter over a finite area of the response plane. Performance of the two algorithms is compared. Dissert. Abstr.

N80-23563*# Old Dominion Univ. Research Foundation, Norfolk, Va.

DIGITAL SIMULATION OF DYNAMIC PROCESSES IN RADIOMETER SYSTEMS Contractor Report, 1 Jan. - 31 Dec. 1978

William D. Stanley May 1980 48 p refs

(Contract NAS1-14193)

(NASA-CR-159266) Avail: NTIS HC A03/MF A01 CSCL 09C

The development and application of several computer programs for simulating different classes of microwave radiometers are described. The programs are dynamic in nature, and they may be used to determine the instantaneous behavior of system variables as a function of time. Some of the programs employ random variable models in the simulations so that the statistical nature of the results may be investigated. The programs have been developed to utilize either the Continuous System Modeling Program or the Advanced Continuous System Language. The validity of most of the programs was investigated using statistical tests, and the results show excellent correlation with theoretical predictions. The programs are currently being used in the investigation of new design techniques for microwave radiometers. A.R.H.

N80-23564# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.

A DYNAMIC PROGRAMMING ALGORITHM FOR PHASE ESTIMATION AND DATA DECODING ON RANDOM PHASE CHANNELS

Odile Macchi and Louis L. Sharf Dec. 1979 62 p refs

(Contract N00014-75-C-0518)

(AD-A081314; CSU-TR-DEC79-3) Avail: NTIS HC A04/MF A01 CSCL 09/4

The problem of simultaneously estimating phase and decoding data symbols from baseband data is posed. The phase sequence is assumed to be a random sequence on the circle and the symbols are assumed to be equally-likely symbols transmitted over a perfectly equalized channel. A dynamic programming algorithm (Viterbi algorithm) is derived for decoding a maximum a posteriori (MAP) phase-symbol sequence on a finite dimensional phase-symbol trellis. A new and interesting principle of optimality for simultaneously estimating phase and decoding phase-amplitude coded symbols leads to an efficient two step decoding procedure for decoding phase-symbol sequences. Simulation results for binary, 8-ARY PM, and 16-QASK symbol sets transmitted over random walk and sinusoidal jitter channels are presented, and

compared with results one may obtain with a decision-directed algorithm, or with the binary Viterbi algorithm introduced by Ungerboeck. When phase fluctuations are severe, and the symbol set is rich (as in 16-QASK), MAP phase-symbol sequence decoding on circles is superior to Ungerboeck's technique, which in turn is superior to decision-directed techniques. GRA

N80-23565/# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
AN/TPQ-37 TRANSMITTER TUBE IMPROVEMENTS Interim Report, 28 Sep. 1978 - 28 Mar. 1979
S. L. Bosma 27 Apr. 1979 28 p
(Contract DAAB07-78-C-3008)
(AD-A081393; EDD-W-081401; ERADCOM-78-C-3008-1; IR-1) Avail: NTIS HC A03/MF A01 CSCL 17/9

The purpose of this program is to improve the performance and reliability of the AN/TPQ-37 transmitter tube. The task is to build and test two high power, PPM focused, grid pulsed Traveling Wave Tubes TWT that meet the requirements of Technical Guidelines MW-119 B. The TWT will employ a M-type cathode for reduced temperature operation and extended live. Gain variations will be minimized by use of in-band loss techniques and weight will be reduced by using samarium cobalt magnets. Author (GRA)

N80-23566/# Massachusetts Inst. of Tech., Cambridge. Lab for Information and Decision Systems.
NEW RESULTS ON THE INNOVATIONS PROBLEM FOR NON-LINEAR FILTERING Interim Report
Deborah F. Allinger and Sanjoy K. Mitter Jan. 1980 16 p refs
(Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A081574; LIDS-R-964; AFOSR-80-0131TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

This report considers an observed stochastic process consisting of a signal with additive noise. It assumes that the signal has finite energy and that the signal and noise are independent. In this paper it is also shown, that under the above assumptions the innovations and observations algebra are equal, and thereby it provides a long-standing conjecture of Kailath. GRA

N80-23567/# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
DESIGN OF SPECIAL-PURPOSE VLSI CHIPS: EXAMPLE AND OPINIONS Interim Report
M. J. Foster and H. T. Kung Sep. 1979 35 p refs
(Contracts N00014-76-C-0370; F33615-78-C-1551; Grant NSF MSC-78-23676)
(AD-A081451; CMU-CS-79-147) Avail: NTIS HC A03/MF A01 CSCL 09/3

This paper identifies important steps in the design of a special purpose VLSI chip, and argues that the most crucial step is the design of the underlying algorithm. Because the algorithm determines the degree of parallelism and pipelining that is possible, it largely determines the performance of the chip. Furthermore, if the underlying algorithm has the right properties such as modularity and regularity, then the rest of the design should be routine and thus takes little effort. These claims are supported by a concrete example--the design of an efficient pattern matching chip, which has been fabricated for testing. GRA

N80-23568/# Martin Marietta Labs., Baltimore, Md.
INTERFACE PROPERTIES AND SURFACE LEAKAGE OF HgCdTe PHOTODIODES Interim Report, 30 Aug. 1979 - 9 Jan. 1980
T. S. Sun, S. P. Buchner, and N. E. Byer Jan. 1980 39 p refs
(Contract DAAK70-79-C-0134)
(AD-A081530; MML-TR-80-3C) Avail: NTIS HC A03/MF A01 CSCL 09/1

A program was undertaken to determine the origin of surface leakage associated with Hg sub 1-x Cd sub x TE photodiodes and to seek improved surface passivation techniques. To attain this goal, emphasis was placed on surface spectroscopic analyses and metal-insulator-semiconductor (MIS) characteristics of candidate passivants. During the initial four months of the program, the insulating and interfacial properties of anodic oxides and ZnS on Hg0.8Cd0.2Te were investigated. X-ray photoelectron spectroscopy (XPS) techniques were developed for determining depth profiles of compositional variations in the semiconductor with a minimum materials damage. Using these techniques, we found that (a) the composition of a 1200 angstrom anodic film is 68% TeO2, 27% CdO, and 8% HgO, and (b) the cations, especially the Hg ions in the semiconductor, are significantly depleted near the interface. The capacitance-voltage curves from MIS measurements of the same specimen exhibited a large hysteresis and a characteristic indicative of a high density of surface states. The consequence of these chemical and electrical properties to diode passivation is discussed. GRA

N80-23569/# Ohio State Univ., Columbus. ElectroScience Lab.
THE PERFORMANCE OF A SAMPLED DATA DELAY LOCK LOOP IMPLEMENTED WITH A KALMAN LOOP FILTER M.S. Thesis. Interim Report, Dec. 1978 - Mar. 1979
H. S. Eilts Griffiss AFB, N.Y. RADC Jan. 1980 99 p refs
(Contract F30602-79-C-0068; AF Proj. 4519)
(AD-A081822; ESL-711679-1; RADC-TR-79-333) Avail: NTIS HC A05/MF A01 CSCL 09/5

The purpose of this study is to evaluate the steady-state and transient (lock-up) performance of a tracking loop implemented with a Kalman filter. Steady-state performance criteria are errors due to measurement noise (jitter) and Doppler errors due to motion of the tracking loop. Trade-offs exist between the two criteria such that increasing performance with respect to either one will cause performance decrease with respect to the other. It is shown that by carefully selecting filter parameters reasonable performance can be obtained for both criteria simultaneously. It is also shown that lock-up performance for the loop is acceptable when these parameters are used. GRA

N80-23570/# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
AUTOCLAVE TESTING OF PLASTIC ENCAPSULATED 4001 CMOS INTEGRATED CIRCUITS
Richard Holecinski Jan. 1980 30 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A081555; DELET-TR-80-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

Samples from 10 vendors of CMOS 4001 plastic encapsulated integrated circuits were tested in an autoclave at 121 C, 100% RH and 15 psig with and without electrical bias. Twenty-nine test groups of 16 circuits each accumulated over 200,000 device hours. Failure analyses were performed to verify moisture related electrochemical aluminum metal corrosion on the die. Weibull failure distributions showed large differences in moisture resistance reliability among the various vendor products. Test devices with newer data coded packages had longer median life times. There was no correlation of median life time between groups with and without electrical bias. GRA

N80-23571/# Hughes Aircraft Co., Fullerton, Calif.
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE SAW DEVICES. VOLUME 4: TECHNICAL AND OPERATIONAL PARTS 4 AND 5 Final Report, 1 Jul. 1975 - 31 Dec. 1978
A. W. Dozier Fort Monmouth, N.J. Army Electronics Research and Development Command Dec. 1978 232 p
(Contract DAAB07-75-C-0044)
(AD-A081126; HAC-FR-79-12-40-Vol-4; DELET-TR-75-0044-F-Vol-9) Avail: NTIS HC A10/MF A01 CSCL 09/5

The object of the program was the establishment of a production capability for surface acoustic wave devices of varied design and material for the purpose of meeting estimated military needs and to establish a base and plans which may be used to meet expanded requirements. The primary requirement was the pilot line production of devices that are reliable, reproducible, and low cost. Phase 3 involved fabrication of a large quantity of confirmatory devices which were sampled at a high rate and subjected to rigorous life and environmental testing. Phase 3 was successfully completed with delivery and acceptance of the confirmatory samples. The device configuration is detailed as it existed for Phase 3 along with assembly details, results and conclusions from the Confirmatory Sample production run. The

Fourth Engineering Phase (Phase 4) of the program was pilot line production effort of 150 each of the devices scheduled to be delivered. Solder sealing was identified as a problem area during Phase 4 for SAW devices in semiconductor pin packages. New solder seal screening and processing procedures were investigated. In addition, alternative sealing approaches were evaluated. These procedures, Tungsten Inert Gas (TIG) and projection and seam welding were demonstrated to be more compatible with SAW processing. They are especially suitable for high volume production. GRA

N80-23572# Bendix Corp., Baltimore, Md. Communications Div.
TACTICAL MINIATURE CRYSTAL OSILLATOR Semiannual Report, 1 Oct. 1978 - 1 Apr. 1979
D. L. Harton and D. Brown Dec. 1979 95 p refs
(Contract DAAB07-78-C-2990; DA Proj. 1L1-62705-AH-94)
(AD-A080769; DELET-TR-78-2990-1) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report describes the advanced development of a fast warmup Tactical Miniature Crystal Oscillator (TMXO). The intended use of this TMXO is as a precision frequency/time reference in advanced communications, navigation and position location systems. The present effort is a continuation of work based on the demonstrated feasibility on previous contracts. The TMXO is an evacuated enclosure containing an evacuated inner electronics container. The electronics assembly consisting of two hybrid substances and the crystal resonator is suspended by its lead from the header of the evacuated inner container. The inner container is in turn supported by a system of Kovar wires (which also provide electrical connections) that feed through the header of the outer container. Both the inner and outer containers are hermetically sealed and the space between the containers is evacuated. Removal of the gas between the two containers eliminates heat transfer due to gas conduction and convection. This leaves only conduction through the Kovar wires and radiation as thermal coupling mechanisms between the inner container and the outer environment. GRA

N80-23573# Naval Ship Research and Development Center, Annapolis, Md. Propulsion and Auxiliary Systems Dept.
THE EFFECT OF A SATURATED SHIELD DESIGN ON THE DESIGN, WEIGHT, AND PERFORMANCE OF SUPERCONDUCTIVE ACYCLIC MACHINERY Interim Report
Geoffrey Green 29 Jun. 1979 36 p
(AD-A080919; DTNSRDC-PAS-79-29) Avail: NTIS HC A03/MF A01 CSCL 09/5

The estimated weight advantage of designing a superconducting homopolar acyclic machine with a saturated magnetic shield is presente d the possible power or flux loss due to the saturation of iron is reported. A method of estimating the magnetic field at 15.23 centimeters from the saturated magnetic shield is shown in addition to indicating how the fields at large distances vary for hexapole and quadrupole designs. GRA

N80-23574# Texas Instruments, Inc., Dallas. Central Research Labs.
MONOLITHIC INTEGRATION OF MICROWAVE GaAs POWER FETs Annual Technical Report, 1 Oct. 1978 - 30 Sep. 1978
V. Sokolov and R. E. Williams Nov. 1979 48 p refs Prepared for ONR
(Contract N00014-77-C-0657; NR Proj. 251-026)
(AD-A080793) Avail: NTIS HC A03/MF A01 CSCL 09/1

Efforts during the second year of this contract have included investigations of monolithic integration of GaAs power field effect transistors (FETs) at X-band microwave frequencies and incorporation of on-chip matching using lumped elements and coplanar ground metallization for monolithic FET circuit design. Two monolithic circuits have been investigated - a push-pull two-stage amplifier on a 2.0 x 2.0 mm chip, and a three-transistor paraphase amplifier on a 2.0 x 2.4 mm chip. Results for the two-stage push-pull amplifier include 1.4 W with 12.4 dB gain at 9.0 GHz. To provide the necessary 180 deg. out-of-phase signals for the push-pull devices, 180 deg. hybrid rings fabricated on alumina substrates are used. Fabrication of the paraphase amplifier, which is intended to replace the input 180 deg. hybrid ring, and preliminary evaluation of these chips have also been done. GRA

N80-23575# Varian Associates, Palo Alto, Calif. Microwave Tube Div.
EFFICIENCY IMPROVEMENTS IN COUPLED CAVITY TRAVELING WAVE TUBES Final Report, 10 Mar. 1978 - 10 Jun. 1979
W. R. Ayers and F. Ruth Walker Griffiss AFB, N.Y. RADC, Oct. 1979 253 p refs
(Contract F30602-78-C-0117; AF Proj. 4506)
(AD-A080961; RADC-TR-79-264) Avail: NTIS HC A10/MF A01 CSCL 09/1

This report describes an analytical study of schemes for maximizing the conversion efficiency in high power coupled-cavity traveling-wave tubes. The procedures developed in this study were used to design a 100 KW, S-band coupled-cavity TWT with a predicted 40 percent conversion efficiency. GRA

N80-23576# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
AN/TPQ-37 TRANSMITTER TEST BED Interim Report, Feb. - Jul. 1979
W. L. McPeak and E. J. Bonem Feb. 1980 22 p
(Contract DAAB07-78-C-3010)
(AD-A081591; HAC-FR-80-14-239; DELET-TR-78-3010-2; IR-2) Avail: NTIS HC A02/MF A01 CSCL 17/9

The AN/TPQ-37 Transmitter Test Bed will provide a vehicle for evaluating techniques for improving the reliability and maintainability of the AN/TPQ-37 Transmitter. Work includes design and fabrication of a major portion of the microprocessor based fault isolation subsystem. Support has been provided to ERADCOM in monitoring procurement of Advanced Design Traveling Wave Tubes. During a later phase of the program these TWTs will be evaluated in the AN/TPQ-37 transmitter. GRA

N80-23577# TRW Defense and Space Systems Group, Redondo Beach, Calif. Power Conversion Electronics Dept.
THE ac-dc POWER PROCESSOR, TYPE 1 Final Report, Mar. 1976 - Mar. 1978
John J. Biess Fort Monmouth, N.J. Army Electron. Technol. and Devices Lab. Nov. 1979 101 p refs
(Contract DAAB07-76-C-1336; DA Proj. 1F2-63702-DG-11)
(AD-A081545; TRW-29518-6001-RU-00; DELET-TR-76-1336-F) Avail: NTIS HC A06/MF A01 CSCL 10/2

The ac-dc power processor type 1 power module furnishes 0-100Adc over an output voltage range of 24 to 32Vdc from a 120/208 30 50/60/400Hz power source. Remote output voltage sensing at the load circuit is provided to eliminate the IR drop of the power distribution cabling between the power module and the load. The power module can also be used for battery charging from 5 to 100A. A thyristor series LC resonant inverter power stage is used to provide the output power control and regulation, input/output ground isolation and protection of the power thyristor. The power supply is constructed in accordance with the shelter-installed, mobile GE equipment for shelter or van use without the use of fans for cooling. The internal electronics are modularized according to circuit function with provisions for easy removal and repair. GRA

N80-23578# Electrochemical Technology Corp., Seattle, Wash.
DETERMINATION OF THE EFFECT OF COMPOSITION, STRUCTURE AND ELECTROCHEMICAL MASS TRANSPORT PROPERTIES ON ADHESION AND CORROSION INHIBITION OF PAINT FILMS Annual Progress Report, Oct. 1978 - Oct. 1979
Theodore R. Beck Dec. 1979 174 p refs
(Contract N00014-79-C-0021)
(AD-A080960; APR-1) Avail: NTIS HC A09/MF A01 CSCL 11/3

Seven different paint systems were formulated to meet military specifications of paints used by the Navy. These included three vinyl resins, two polyurethanes, and two epoxy resin systems. Unpigmented free films of all of these systems were prepared for various physical and chemical measurements. Chemical formulas, molecular weights, and structures of these resins are

known. Three characterization tests were used, infrared and ultraviolet spectroscopy and dynamic mechanical properties measured on a Rheovibron instrument. The loss tangent for all of the systems rapidly increased around or slightly above room temperature. The nonlinear changes in mechanical properties around and above room temperature are indicative of structural changes that would certainly influence mass transport properties of the films. GRA

N80-23579# Stanford Univ., Calif. Edward L. Ginzton Lab.
TRANSDUCER ARRAYS SUITABLE FOR ACOUSTIC IMAGING Ph.D. Thesis
Charles S. DeSilets Jun. 1978 190 p refs
(Contracts N00014-75-C-0632)
(AD-A080970; GL-2833) Avail: NTIS HC A09/MF A01 CSCL 20/1

The design and development of piezoelectric transducer arrays sutiable for use in electronically scanned and focused acousitc imaging systems is described. These arrays are designed to operate in the frequency range 2-5 MHz within 45% to 80% fractional bandwidths. Linear arrays of up to 180 elements have been built and used extensively in acoustic imaging systems. Particular attention is placed on achieving high transduction efficiency and angular beam-widths of at least + or - 15 deg. Design techniques based on the tranmission line model of the transducer of Krimholtz, Leedom, and Matthaei are formulated for achieving efficient, broadband operation. These techniques involve the use of quarter-wave matching layers between a high impedance ceramic and a low impedance load. Broadband matching criteria are generated, and a novel technique for selecting the quarter-wave matching layer impedances is described. The theoretical transient response of the transducer is obtained by taking the Fourier transform of the transfer function of the transducer. An experimental transducer built using the formulated design techniques is described and its characteristics compared to theory. Slotted transducer arrays employing tall, narrow elements are described. A one dimensional model of this kind of element is formulated, and the effects of coupling between element resonant modes are examined. GRA

N80-23580# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.
LOW-NOISE WIDE-BAND AMPLIFIER SYSTEM FOR STOCHASTIC BEAM COOLING EXPERIMENTS
Branko Leskovar and C. C. Lo Oct. 1979 11 p refs Presented at the IEEE Nucl. Sci. Symp., San Francisco, 17 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9841; CONF-791037-15) Avail: NTIS HC A02/MF A01

A low noise wideband power amplifier system was developed for stochastic beam cooling experiments. The system incorporated a low noise preamplifier with a noise figure of 1.9 dB over a bandwidth range of 20 to 300 MHz, wideband driver and buffer stages, a frequency characteristics shaping network, a remotely controlled wideband attenuator with 0.1 dB resolution, a remotely controlled high resolution adjustable delay line, and a wideband solid state output power amplifier. The amplifier system had a maximum voltage gain of 140 dB over a bandwidth from 1.5 to 310 MHz, a signal group delay of 55.5 ns, and a c.w. output power level of 75 W. Particular attention was given to minimizing the signal propagation time delay of the amplifier system, the propagation time delay change as a function of the system gain, and harmonic and intermodulation distortion. DOE

N80-23581# Princeton Univ., N. J. Plasma Physics Lab.
CURRENT GENERATION WITH LOW-FREQUENCY WAVES
N. J. Fisch and C. F. F. Karney Dec. 1979 58 p refs
(Contract EY-76-C-02-3073)
(PPPL-1624) Avail: NTIS HC A04/MF A01

The low frequency waves most suitable for operating tokamak reactors in the steady are identified in terms of the power cost for deployment in a reactor. Means of exciting these waves and tradeoffs with design critieria are discussed. A comparison is made with the alternative attractive regime of high-frequency waves. Conclusions are based, in part, on the numerical solution of the two dimensional Fokker-Planck equation with an added quasi-linear term due to the waves. DOE

N80-23582# Sandia Labs., Albuquerque, N. Mex. Telemetry Components and Transducers Div.
CHARACTERIZATION OF DIGITAL FILTERS USED IN SANDIA LABORATORIES TEST DATA ANALYSIS DIVISION
Patrick L. Walter and Ronald Rodeman Dec. 1979 56 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1230) Avail: NTIS HC A04/MF A01

Characteristics of computer synthesized digital filters are presented. Difficulties with such filters discussed include deviation from both flat amplitude and linear phase response, time delay, pulse stretching, periodicity of and nonuniqueness of the transfer function, and zero phase filters. E.D.K.

N80-23583# Sandia Labs., Albuquerque, N. Mex.
LATCH-UP CONTROL IN CMOS INTEGRATED CIRCUITS
A. Ochoa, W. Dawes, and H. Packard 13 Jul. 1979 13 p refs Presented at the 1979 IEEE Ann. Conf. on Nucl. and Space Radiation Effects, Santa Cruz, Calif., 17 Jul. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1479C; CONF-790706-7) Avail: NTIS HC A02/MF A01

The potential for latch-up, a p-n-p-n self-sustaining low impedance state, in standard bulk complementary metal oxide semiconductor (CMOS)-integrated circuit structures is discussed. Latch-up control methods presently employed for weapons and space applications on present (approx. 9 microns p-well) CMOS are surveyed and the extent of their applicability to increased packing density designs is examined. DOE

N80-23584# Sandia Labs., Livermore, Calif. Combustion Applications Div.
CRITICAL COMPARISON OF HOT-WIRE ANEMOMETRY AND LASER DOPPLER VELOCIMETRY FOR I.C. ENGINE APPLICATIONS
O. P. Witze Sep. 1979 30 p refs Presented at SAE Automotive Eng. Congr., Detroit, 25 Feb. 1980 Sponsored in part by Motor Vehicle Manufacturers Association of America
(Contract EY-76-C-04-0789)
(SAND-79-8685; CONF-800202-1) Avail: NTIS HC A03/MF A01

Hot-wire anemometer and laser Doppler velocimeter measurements taken in a motored reciprocating engine are compared to access the validity of hot-wire measurements. The procedure used to account for the sensitivity of the hot wire to changes in the gas temperature is extensively investigated. For the optimum conditions of known flow direction, low turbulence level, and low compression ratio, the hot-wire anemometer can provide useful mean velocity results. Accurate hot-wire turbulence intensity measurements appear to be possible only for the intake and exhaust strokes. DOE

N80-23585# AEG-Telefunken, Berlin (West Germany). Forschungsinst.
DEVELOPMENT OF CURRENT CONVERTERS FOR SWITCHING AND REGULATING TASKS IN ENERGY TECHNOLOGY Final Report
Hans-Peter Beck, Peter Heinmeyer, Detlef Knuth, Werner Lukanz, and Monika Steinwegs Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 350 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-79-12) Avail: NTIS HC A15/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 73,10

The design and production of semiconductor switching devices are described. The devices serve as semiconductor power switches in current converting and current regulating applications. Two prototypes were developed, a power switch for 10 MW with a water cooling system and a power switch for 3 MW with an evaporative cooling system. Author (ESA)

N80-23586# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
THERMAL AND CRYOTECHNICAL DEFINITION STUDY ON MINICRYOGENERATOR SYSTEM FOR SPACE APPLICATION (SQUID MAGNETOMETER) Final Report
Guenter Musmann, Reinhardt Geisler, Peter Burkert (Kayser Threde G.m.b.H.), Reinhard Katterloher (Firma Reinhard Katterloher), and

Martin Pfeil (Firma Martin Pfeil) Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1979 134 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. (BMFT-FB-W-79-01) Avail: NTIS HC A07/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 27,75

The cryogenic cooling requirements for a superconducting quantum interference device (SQUID) to measure magnetic fields under space laboratory conditions are studied. The necessary cooling capacity is calculated and different technical concepts for the cryogenerator system and its components are developed. Some critical results of the study were verified by tests. Author (ESA)

N80-23587# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereicht Halbleiter.

TECHNIQUES FOR LOW NOISE AND HIGH POWER TRANSISTORS IN INTEGRATED CIRCUITS Final Report

Kurt Dieter Hintzman Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 110 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. (BMFT-FB-T-79-15) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 22,70

The development of low noise transistors and high power transistors in integrated circuits is described. The optimized production process and an additional gettering step are described. The application of polycrystalline regions as collector contacts is discussed. Author (ESA)

N80-23588# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

RESEARCH ON THE PERTINENT PARAMETERS OF A QUARTZ OSCILLATOR Thesis - Univ. Pierre et Marie Curie

Francois Tardivel 1979 131 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-636)
(ONERA-NT-1979-10; ISSN-0078-3781) Avail: NTIS HC A07/MF A01

A quartz operational cascade type oscillator is considered. A diode limiter device and a feed back loop made of a band filter that selects the desired quartz overtone are included. A computing method is described which allows the elaboration of a mathematical model simulating the working of the oscillator. The model accounts for a number of non linearities introduced by the transistors, the diodes, and the quartz resonator. This model permits the determination of the sensitivity to a score of parameters of the frequency of the oscillator and proves the important part played by the band filter of the feedback loop, the electric coupling of the filter, and the diode limiter device in the instability of the oscillator frequency. In order to minimize the contribution of electronics in this instability at medium and long term, a modification of the structure of the feedback loop is proposed. Author (ESA)

N80-23589# Oxford Univ. (England). Dept. of Engineering Science.

DESIGN OF STOCHASTIC DISCRETE-TIME LINEAR OPTIMAL REGULATOR

K. P. Lam 1979 53 p refs
(OUEL-1288/79) Avail: NTIS HC A04/MF A01

Methods of designing optimal digital regulators for randomly distributed single input/single output linear systems with time delay are presented. The approach forms an extension to minimum variance and single stage cost function design and provides a link between them using state-space theory. Two state-space models, referred as implicit and explicit delay forms, are considered and their relationships with the standard single stage cost function design are established. Computational procedures and comparison between the state-space designs are provided. Author (ESA)

N80-23590# Oxford Univ. (England). Dept. of Engineering Science.

A SURVEY OF THE HIGH FREQUENCY EFFECTS ASSOCIATED WITH THE LIGHTNING DISCHARGE

N. S. J. Braithwaite and M. J. Cooke 1979 47 p refs
(OUEL-1290/79) Avail: NTIS HC A03/MF A01

The literature on high frequency effects associated with the lightning discharge is reviewed, with emphasis on the possible hazards to aircraft from electromagnetic fields. Sources of fast field changes in the cloud discharge and in the discharge to ground are considered in detail, from experimental observations of the far radiation field. Radiation from the return stroke and from K changes is most important up to 10 MHz, and breakdown processes become important at higher frequencies. An overall amplitude frequency spectrum is given. Models of the return stroke are briefly reviewed. Measurements at lightning current at ground are discussed, with the airborne survey of lightning fields conducted as part of TRIP-76. Author (ESA)

N80-23591# Bureau of Reclamation, Denver, Colo. Electric Power Branch.

FIELD TESTS OF THE LIBERTY-MEAD TRANSMISSION SYSTEM

L. E. Eilts Aug. 1979 61 p refs
(PB80-125610; REC-ERC-79-9) Avail: NTIS HC A04/MF A01 CSCL 09C

Results of field tests of a 383 km (238 mi), 345 kV, series-capacitor-compensated transmission line are summarized. The test series included routine capacitor bypass and insertion tests, line switching tests, and staged fault tests. The tests demonstrated that routine capacitor bypass and insertion do not adversely affect the power system; line switching surges are modest, but reclosing, using the existing switchgear, is precluded by trapped charge; high-speed capacitor bypass was achieved but reinsertion proceeded slower than permitted by the specifications; breaker interrupting performance was acceptable; and, excepting some minor problems that were identified, the line relaying schemes generally performed satisfactorily. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-23592 Stanford Univ., Calif.

THE THERMAL AND HYDRODYNAMIC BEHAVIOR OF THICK, ROUGH-WALL, TURBULENT BOUNDARY LAYERS Ph.D. Thesis

Phillip Meredith Ligrani 1980 251 p
Avail: Univ. Microfilms Order No. 8011664

Thick, fully rough, and transitionally rough turbulent boundary layers were studied in order to investigate the differences between fully rough and transitionally rough behavior and to observe how downstream development affects these flows as the boundary layers become very thick. Measurements included Stanton numbers, skin friction coefficients, mean temperature and velocity profiles, Reynolds stress tensor component profiles, and spectra of the longitudinal velocity fluctuations. Predictions of wall heat transfer, wall shear, and mean profiles were made using a mixing-length and turbulent Prandtl number closure scheme which accounted for the effects of wall roughness in the boundary layer equations. Dissert. Abstr.

N80-23593 Brown Univ., Providence, R. I.

ON THE ORGANIZED LARGE-SCALE STRUCTURE IN A TURBULENT ROUND JET AND ITS FAR-FIELD SOUND Ph.D. Thesis

Reda Rushdi-El Mankbadi 1979 325 p
Avail: Univ. Microfilms Order No. 8007040

The large scale organized structure observed in the initial region of a round jet is investigated. Phase averaging, in addition to the usual time averaging, decomposes each flow quantity into three flow components: a mean one, a wavelike large scale structure one, and a fine grained turbulent one. After making certain assumptions concerning the shape of each flow component, the integrated energy equations are solved, yielding the wave amplitude, the fine-grained turbulence energy, and the mean flow

momentum thickness. Considering the organized structure to be more efficient than the random turbulence in emitting sound, the noise of a subsonic cold turbulent round jet is investigated. The organized structure was found to generate noise of comparable magnitude to the measured values of the full noise. The spectra of the organized structure noise were found to peak at the same Strouhal number at which the measured sound intensity peaks. The far field sound of a turbulent plane mixing layer is investigated by taking the organized fluctuations of the turbulent flow to be the dominant sound source. Lighthill's stress tensor is determined and the volume integral involved in Lighthill's equation is evaluated to yield the far field sound produced by the large scale organized structure. Results show that the organized structure radiates shear noise of considerable magnitude.
Dissert. Abstr.

N80-23594 Stanford Univ., Calif.
FINITE ELEMENT SIMULATION OF SIMPLE THREE-DIMENSIONAL FULLY CAVITATING FLOWS Ph.D. Thesis
Peter Yuk-Lam Ko 1980 123 p
Avail: Univ. Microfilms Order No. 8011660

A formulation is given for three dimensional fully cavitating flow with a Riabouchinsky model based on potential flow theory. The model is nonlinear and the location of the free surface of the cavity is not known priori. Therefore, an iterative procedure is used to locate the free surface boundary. The employment of a trial-free-boundary approach effectively reduces the fully nonlinear model to a linear one, and the solution at each iteration is obtained by means of the finite element method (FEM). Examples studied were fully cavitating flow past flat plates in a water tunnel. Results are given for pure drag flows past circular and elliptic plates and a lifting flow past a circular plate. Because of the change in flow boundary conditions at the separation edge and the failure of the FEM to resolve these conditions accurately, the ability of the numerical solution to maintain a constant pressure over the entire cavity decreases as the three dimensionality of the free surface increases. However, the present procedure produces absolutely stable iterations and shows no sign of drifting of the free surface. Dissert. Abstr.

N80-23595 Wayne State Univ., Detroit, Mich.
STABILITY OF MODULATED ROTATING FLUIDS Ph.D. Thesis
Jerry Ihor Tustaniwskyj 1979 183 p
Avail: Univ. Microfilms Order No. 8010180

The linear and energy stabilities of an extensively modulated cylindrical Couette flow were investigated in the finite gap range. A closed form analytic solution is obtained for the basic unsteady flow, with the modulation introduced through the boundary conditions. In the linear analysis, perturbation equations are derived and subsequently solved via the Galerkin method with the stability analyzed using the Floquet theory. Instabilities due to two dimensional axisymmetric disturbances are thoroughly investigated and results are found to compare favorably with experimental ones. Some arbitrary three dimensional non-axisymmetric disturbances are also studied and are found to be of importance especially at higher frequencies. In the energy analysis, the Euler-Lagrange equations are derived using variational techniques and are solved using the Galerkin method again. The strong energy results, where two dimensional axisymmetric disturbances are found to be the most crucial ones, are quite conservative, thus creating a rather large region where subcritical instabilities are possible. Dissert. Abstr.

N80-23596 Iowa State Univ. of Science and Technology, Ames.
THE SPLIT COEFFICIENT MATRIX METHOD FOR HYPERBOLIC SYSTEMS OF GASDYNAMIC EQUATIONS Ph.D. Thesis
Sukumar Raman Chakravarthy 1979 111 p
Avail: Univ. Microfilms Order No. 8010220

A finite difference method, the split coefficient matrix (SCM) method, for the numerical solution of hyperbolic systems of gasdynamic equations is presented. The method retains the ease of application of conventional finite difference schemes while exploiting the mathematical theory of characteristics and thus proves to be a superior method. The development of the method from characteristics theory is presented in detail. Boundary point calculation procedures along the lines of and consequently consistent with the SCM method used at interior points are explained. The split coefficient matrices that define the method are given for unsteady and steady supersonic flows, for several choices of dependent variables and for the Cartesian and cylindrical base coordinates systems. Dissert. Abstr.

N80-23597 New York Univ., N. Y.
A CLASS OF COMPRESSIBLE PARTIAL DIFFERENTIAL EQUATIONS RELATED TO THE INCOMPRESSIBLE NAVIER-STOKES EQUATION Ph.D. Thesis
John Edward Weiss 1979 189 p
Avail: Univ. Microfilms Order No. 8010412

A class of compressible extensions of the Navier Stokes equation were defined that depend on a linear operator which is required to posses a formal inverse and is otherwise arbitrary that the solutions of the compressible extension are continuous functions of a parameter and converge uniformly to the solution of the Navier Stokes equation when this parameter converges to zero. Compressible and incompressible components of the velocity field, the Markov random coupling model (MRCM) for this compressible extension was constructed to determine the quantitative nature of the interactions between the compressible and incompressible components of the velocity field. The MRCM equations were examined analytically. Results indicate that it is possible to apply closure methods with a compressible extension to study the interaction of a near incompressible flow with a compressible component. Dissert. Abstr.

N80-23598 Stanford Univ., Calif.
THE EFFECTS OF PHONON DYNAMICS ON THE SINGULAR BEHAVIOR OF A ONE-DIMENSIONAL FERMI GAS Ph.D. Thesis
Edward Hovsepian Rezayi 3 May 1980 134 p
Avail: Univ. Microfilms Order No. 8011698

Phonon dynamical effects are investigated for two model systems of fermion-phonon interactions. The first model is a Tomonaga-Luttinger model generalized to include forward scattering fermion-phonon interactions. For a certain range of the coupling constants, the model is solved exactly. The method of solution is a direct diagonalization of the Hamiltonian in the space of the Tomonaga bosons. Bosonization of Fermi fields is used to obtain the single-particle propagator, and the charge-density wave (CDW) and superconducting (SUP) response functions. A CDW occurs for regions of repulsive direct fermion-fermions interactions. The bulk of phase space for which the SUP instability occurs lies within the region of attractive fermion-fermion interactions. The second model studied is the Frohlich Hamiltonian which includes backscattering of fermions by phonons. This model is investigated by employing a low-type renormalization group. The scaling equations are obtained in the parquet (one-loop) approximation, and are found to be identical to that of the nonretarded model. The phonon dynamics, however, affect the correlation functions, which are also obtained in the parquet approximation. Dissert. Abstr.

N80-23599*# Sigma Research, Inc., Richland, Wash.
TWO-PHASE WORKING FLUIDS FOR THE TEMPERATURE RANGE OF 50 TO 350 DEG, PHASE 2 Final Report
E. W. Saaski and J. H. Hartl Mar. 1980 57 p refs
(Contract NAS3-21202)
(NASA-CR-159847) Avail: NTIS HC A04/MF A01 CSCL 20D

Several two phase heat transfer fluids were tested in aluminum and carbon steel reflux capsules for over 25,000 hours at temperatures up to 300 C. Several fluids showed very good stability and would be useful for long duration heat transfer applications over the range 100 to 350 C. Instrumentation for the measurement of surface tension and viscosity were constructed for use with heat transfer fluids over the temperature range 0 to 300 C and with pressures from 0 to 10 atmospheres. The surface tension measuring device constructed requires less than a 1.0 cc sample and displays an accuracy of about 5 percent in preliminary tests, while the viscometer constructed for this program requires a 0.05 cc sample and shows an accuracy of about 5 percent in initial tests. E.D.K.

N80-23600*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MEASURED AND PREDICTED SHOCK SHAPES AND AERODYNAMIC COEFFICIENTS FOR BLUNTED CONES AT INCIDENCE IN AIR AT MACH 5.9
Robert L. Calloway and Nancy H. White May 1980 70 p refs
(NASA-TP-1652; L-13429) Avail: NTIS HC A04/MF A01 CSCL 20D

Experimental values of shock shapes (angles of attack of 0 deg and 10 deg) and static aerodynamic coefficients (angles of attack of -4 deg to 12 deg for sharp and spherically blunted cones having cone half angles of 30 deg, 45 deg, 60 deg, and 70 deg, and nose bluntness ratios of 0, 0.25, and 0.50 are presented. Shock shapes were measured at 0 deg angle of attack by using a flat faced cylinder (90 deg cone) and a hemispherically blunted cylinder (sphere). All tests were conducted in air at a free stream Mach number of 5.9 and a unit free stream Reynolds number of 2,800,000 per meter. Comparisons between measured values and predicted values were made by using several numerical and simple engineering methods. Author

N80-23601# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
SHOCK-BOUNDARY LAYER INTERACTION EFFECTS IN TRANSONIC FLOW FIELDS Final Report, 1972 - 1979
G. R. Inger 25 Jan. 1980 30 p refs
(Contract N00014-75-C-0456)
(AD-A080889; VPI-SU-Aero-105) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report summarizes the results of a five-year basic theoretical study of non-separating transonic shock-turbulent boundary layer interactions. Both local and downstream boundary layer distortion effects have been studied including extensive comparisons with available experimental data. GRA

N80-23602# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ON GOERTLER INSTABILITY
Saad Aly Ragab and Ali Hasan Nayfeh Dec. 1979 81 p refs
(Contract N00014-75-C-0381)
(AD-A081255; VPI-E-79-41) Avail: NTIS HC A05/MF A01 CSCL 20/4

Goertler instability for boundary-layer flows over generally curved walls is considered. The full linearized disturbance equations are obtained in an orthogonal curvilinear coordinate system. A perturbation procedure to account for second-order effects is used to determine the effects of the displacement thickness and the variation of the streamline curvature on the neutral stability of the Blasius flow. The pressure gradient in the mean flow is accounted for by solving the non-similar boundary-layer equations. Growth rates are obtained for the actual mean flow and compared with those for the Blasius flow and the Falkner-Skan flows. The results demonstrate the strong influence of the pressure gradient and the nonsimilarity of the basic flow on the stability characteristics. GRA

N80-23603# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
APPLICATIONS OF RANDOM-CHOICE METHOD TO PROBLEMS IN SHOCK AND DETONATION-WAVE DYNAMICS Interim Report
T. Saito and I. I. Glass Oct. 1979 78 p refs
(Grant AF-AFOSR-3303-77; AF Proj. 2307)
(AD-A081304; UTIAS-240; AFOSR-80-0144TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

Eight applications of the Random-Choice Method (RCM) to the solution of problems in shock and detonation-wave dynamics are presented. It is shown that unlike other numerical methods, the RCM yields sharp-fronted shocks and contact surfaces without resorting to artificial and perhaps erroneous means of predicting their locations. It has been shown by examples that the RCM provides exceptionally high computational accuracy for flows involving planar and spherical shock waves, rarefaction waves and contact surfaces, as well as their interactions. In addition, the RCM can handle flows with detonations and chemical reactions involving the above transition fronts. GRA

N80-23604# Pennsylvania State Univ., University Park. Applied Research Lab.
A HIGHER ORDER SURFACE SINGULARITY METHOD FOR THE AXISYMMETRIC INVERSE PROBLEM
J. Fernandez 25 Jun. 1979 45 p refs
(Contract N00024-79-C-6043)
(AD-A081797; ARL/PSU-TM-79-125) HC A03/MF A01 CSCL 20/4

The hydrodynamic design of the axisymmetric body with certain performance characteristics requires the solution to the inverse problem wherein the pressure distribution on the body is specified and the corresponding body profile must be determined. This paper presents an efficient inverse method for incompressible, axisymmetric potential flows employing a higher order surface singularity technique with parabolic surface elements and linearly varying sources. The body shape is obtained through an iterative scheme using the stream function to predict the body profile. The method is rapidly convergent and shows excellent agreement in cases where solutions are known. GRA

N80-23605# Nielsen Engineering and Research, Inc., Mountain View, Calif.
DEVELOPMENT OF PERTURBATION PROCEDURES FOR NONLINEAR INVISCID AND VISCOUS FLOWS Interim Report, 1 Apr. - 30 Sep. 1979
David Nixon Jan. 1980 105 p refs
(Contract F49620-79-C-0054; AF Proj. 2307)
(AD-A081531; NEAR-TR-214; AFOSR-80-0129TR) Avail: NTIS HC A06/MF A01 CSCL 20/4

The perturbation theory for transonic flow is further developed for two and three dimensional problems. The physical perturbation theory, in which the perturbation parameter is a physical quantity, is applied to solutions of the Navier-Stokes equations in two dimensions. The mathematical perturbation theory, in which the perturbation parameter is a measure of the difference between approximate and exact solutions, is applied both to the three dimensional potential flow problems and to the two dimensional Navier-Stokes equations. The strained coordinate technique is used to treat changes in location of any shock waves or large gradients. GRA

N80-23606# Naval Postgraduate School, Monterey, Calif.
HYDROELASTIC OSCILLATIONS OF SMOOTH AND ROUGH CYLINDERS IN HARMONIC FLOW Ph.D. Thesis
Farhad Rajabi Dec. 1979 297 p refs
(AD-A081760) Avail: NTIS HC A13/MF A01 CSCL 20/4

A comprehensive experimental and analytical investigation has been undertaken to determine the hydroelastic response of elastically-mounted smooth and rough cylinders in harmonically-oscillating flow. The forces acting on the cylinder and the cylinder response have been measured together with the characteristics of the flow and analyzed through the use of the Fourier analysis, spectral analysis, Duhamel's integral, and the wake-oscillator model. In addition, the in-line force has been analyzed through the use of Morison's equation. The results have shown that hydroelastic oscillation occur in a narrow range of the reduced velocity and give rise to significant amplification of the exciting force. The use of the Fourier and spectral analysis together with the governing equations of motion was shown to predict the hydroelastic response of the cylinders in the synchronous region. The investigation shed considerable light on the interaction between the harmonic fluid motion and the hydroelastic response of cylinders and provided definitive information for the prediction of the force and response characteristics of the type of oscillations considered herein. GRA

N80-23607# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
ON THE INTERACTION OF WALL JETS AND FOUNTAIN FORMATION Final Report
K. T. Yen 30 Sep. 1979 25 p refs
(AD-A081540; NADC-79275-60) Avail: NTIS HC A02/MF A01 CSCL 20/4

An analysis of the fountain formation produced by the vertical impingement of two jets on a flat-ground surface is presented. A method has been developed for the determination of the upwash angle of the fountain in the plans of symmetry and the ground stagnation line. Comparison of the calculated results from the present analysis with tests data obtained by the Grumman Aerospace Corporation shows generally good agreement. The different methods of approach and results in some recent works

regarding the upwash angle are discussed, and it is shown that the fountain should leave the ground surface in direction perpendicular to it, and approach the upwash angle asymptotically. GRA

N80-23608# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.

PREDICTION OF SEPARATING TURBULENT BOUNDARY LAYERS INCLUDING REGIONS OF REVERSED FLOW Final Report

R. H. Pletcher, O. K. Kwon, and R. Chilukuri Feb. 1980 71 p refs

(Grant DAAG29-76-G-0155)

(AD-A081592; ISU-ERI-AMES-80112; HTL-22; ARO-13376.4-E) Avail: NTIS HC A04/MF A01 CSCL 20/4

The results of a research program to develop and evaluate improved prediction methods for turbulent separating flows are summarized. The predictions of several turbulence models have been compared with experimental data for flows containing regions of recirculation using an inverse finite-difference method to solve the boundary layer equations. A new turbulence model which employs a one-dimensional transport equation for the outer-layer length scale was seen to provide the best agreement with the experimental data beyond separation. A viscous-inviscid interaction calculation procedure was developed to predict airfoil flows containing leading edge or midchord separation bubbles. The procedure utilized the inverse finite-difference method to predict the viscous flow and a small disturbance Cauchy integral formulation for the inviscid flow. Three models for laminar-turbulent transition were evaluated. Generally good agreement between predictions of the best model and measurements was observed in the several comparisons made. Some early results from a finite-difference scheme to solve the partially parabolized Navier-Stokes equations in primitive variables were also reported. The method was developed to predict viscous flows in which normal pressure gradients cannot be neglected. GRA

N80-23609# Defence Research Establishment Suffield, Ralston (Alberta).

A CALCULATION METHOD FOR CONVECTIVE HEAT AND MASS TRANSFER IN MULTIPLY-SLOTTED FILM-COOLING APPLICATIONS

S. B. Murray Jan. 1980 91 p refs

(AD-A081641; DRES-TP-507) Avail: NTIS HC A05/MF A01 CSCL 20/4

A computer model to calculate the development of wall jet boundary layers downstream of multiple film-cooling slots is described. The differential equations for the conservation of mass, momentum and energy in an incompressible two-dimensional for axisymmetric flow are solved using a downstream-marching, iterative, implicit, finite-difference scheme. The turbulent transport of mass in a conventional wall boundary layer is described by means of inner outer two layer eddy viscosity model based on the Prandtl mixing-length hypothesis with Van Driest's modification in the near-wall region. Further alterations to include the effects of pressure gradients, heat and mass transfer are due to Cebeci and Smith. This basic model is extended to include cases with tangential fluid injection. Computed velocity profiles indicate that the law of the wall is obeyed in the inner layer and that the outer wake-like layer strives to resume the velocity-defect relationship that existed upstream of the point of fluid injection in zero pressure-gradient flow with no heat or mass transfer. Comparison between computed and experimental adiabatic wall temperature distributions in flows with heat transfer shows that the eddy viscosity model is deficient in the near-slot region and tends to overestimate film-cooling efficiency. The absence of an eddy term to account for turbulence due to finite slot lip thickness is partly responsible for this overestimation. Recommendations are made to validate the model in pressure-gradient flows and to improve the predictive capability in the near-slot region. GRA

N80-23610# Tetra Tech, Inc., Pasadena, Calif.

COMPUTER PROGRAMS FOR CALCULATING PARTIALLY CAVITATING BLUNT TRAILING EDGED CASCADE FLOWS IN NONLINEAR THEORY Technical Manual, 15 Feb. - 31 Oct. 1979

Shin Maekawa and Okitsugu Furuya Jan. 1980 207 p

(Contract N00014-79-C-0234)

(AD-A081832; TETRAT-TC-3284-02) Avail: NTIS HC A10/MF A01 CSCL 09/2

In addition to the previously developed partially cavitating cascade theory, two new flow models were constructed in search of a better flow model for determining accurate force coefficients. Effort has been made for obtaining (1) physically acceptable flows, particularly the location of cavity boundary and (2) smooth matching of the flow characteristics between the partially cavitating and super-cavitating flow regimes. Based on the numerical results made with these flow models for practical blade profiles taken after a supercavitating propeller, it was found that no single flow model developed could handle the complete set of cascade geometries and incidence angles. One theory was supplemental to the other and no definite guideline was discovered for selection of an appropriate flow model for a specified flow condition to be solved except for a few weak evidences. This report is a users' manual for the computer programs developed above, describing the structure of program, input data set-up, typical output data and listing. GRA

N80-23611# Naval Postgraduate School, Monterey, Calif.

A PRIMITIVE VARIABLE MATHEMATICAL MODEL FOR PREDICTING THE FLOWS IN TURBOJET TEST CELLS Final Report

Charles Stevenson and David W. Netzer Oct. 1979 71 p refs

(AD-A081539; NPS-67-79-009) Avail: NTIS HC A04/MF A01 CSCL 21/4

An adaptation of a primitive variable, finite-difference computer program was made in order to predict the non-reacting flow fields in turbojet test cells. The study compares the predictions of the primitive variable computer model with an earlier stream function-vorticity computer model and empirical data. It was found that the model reasonably predicted the flow fields and allowed simulation of test cell flows up to full engine throttle conditions. GRA

N80-23612# Sandia Labs., Livermore, Calif. Thermal Sciences Div.

NATURAL CONVECTION HEAT TRANSFER FROM AN EXTERNAL RECEIVER

Dennis Siebers Dec. 1979 41 p refs

(Contract EY-76-C-04-0789)

(SAND-78-8276) Avail: NTIS HC A03/MF A01

A numerical solution of turbulent, two dimensional, natural convection heat transfer for a high temperature, vertical surface is presented. This is relevant to heat transfer from the receiver power plant on a calm day (no wind). It is the lower bound of convective loss from an external receiver. Application of wall suction to the receiver surface is also examined as a means of reducing convective loss. An analysis of the economic impact of energy loss from a receiver is also presented. DOE

N80-23613# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.

LAMINAR FLOW CYCLONE DEVELOPMENT PROGRAM Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1978

W. B. Giles and K. L. Bekofske Jan. 1979 9 p

(Contract ET-78-C-01-3242)

(FE-3242-2) Avail: NTIS HC A02/MF A01

The deleterious effects of turbulent mixing in the cyclone separation process were investigated. Transition from laminar to turbulent flow can be delayed to higher velocities and large scale by suppressing inlet turbulence and preventing boundary layer tripping. Extended laminarization can be obtained by techniques such as wall suction and wall cooling (in the case of gaseous flows). In cyclone separators, the flow must be set into a swirling motion to provide the separative g-field. The implications are that the flow entering the cyclone is unstable and that the swirl vane wake turbulence is the most probable trigger. The design of a model with greater contraction to suppress vane wake turbulence and a shorter radial inflow region to inhibit the development of the wall jet is proposed. An analysis of the boundary layer situation is suggested. DOE

N80-23614# California Univ., Berkeley. Lawrence Berkeley Lab.

MEASUREMENT OF THE THICKNESS OF LIQUID FILM BY MEANS OF CAPACITANCE METHOD
B. Leskovar, R. K. Sun, W. F. Kolbe, and B. Turko Nov. 1979 68 p refs
(Contract W-7405-eng-48; EPRI Proj. 1379-1)
(EPRI-NP-1212) Avail: NTIS HC A04/MF A01

A technique was developed for measuring water film thickness in a two phase annular flow system by means of the capacitance method. Theoretical considerations are applied to estimate the capacitance value as a function of the film thickness. An experimental model of the flow system with two types of electrodes mounted on the inner wall of a cylindrical tube was constructed and evaluated. The ability of the apparatus to observe fluctuations of the water film passing over the electrodes is described. DOE

N80-23615# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
INTERACTION OF TWO RING VORTICES WITH DIFFERENT TRANSLATION AXIS AND FORMATION OF NEW RING VORTICES FROM AN OSCILLATING RING VORTEX [DIE WECHSELWIRKUNG ZWEIER RINGWIRBEL VERSCHNEIDER TRANSLATIONSACHSEN UND DIE NEUBILDUNG VON RINGWIRBELN AUS EINEM SCHWINGENDEN RINGWIRBEL]
Peter E. M. Schneider Jun. 1978 108 p refs In GERMAN
(MPIS-2/1979) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 26.55

The merging, overtaking, and diffusion of two interacting ring vortices, successively formed at the same circular nozzle where the initial translational axis breaks down, is described. The same processes are studied for vortices meeting obliquely. The formation of new ring vortices from one vortex originating from nozzles of various shapes is explained. Photographic techniques using dyes in water were utilized. Author (ESA)

N80-23616# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EXPERIMENTS WITH ROTATIONAL SYMMETRIC SUPERSONIC FREE JETS WITH LASER-INDUCED J2 FLUORESCENCE [UNTERSUCHUNGEN AN ROTATIONSSYMMETRISCHEN UEBERSCHALLFREISTRAHLEN MITTELS LASERINDUZIERTER J2-FLUORESZENZ]
Joachim Haegle Feb. 1979 78 p refs In GERMAN Original contains color illustrations
(MPIS-7/1979) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 28.05

Using the J2 fluorescence process, supersonic free jets of low density were examined, including dissociation phenomena in the expansion region of the stream. Dissociation processes were also studied in the shocks. An argon laser was used. Author (ESA)

N80-23617# National Physical Lab., Teddington (England). Numerical Analysis and Computer Science Div.
DATA STRUCTURES FOR CALCULATING FLOWS IN STORM SEWER SYSTEMS
R. A. Pitfield Aug. 1979 12 p refs
(NPL-NACS-20/79) Avail: NTIS HC A02/MF A01

A mathematical model is presented which was used to calculate flows in storm sewer systems. The model is represented by a simple data structure. The operations on the data structure are described. Author (ESA)

N80-23618# Bristol Univ. (England). Dept. of Aeronautical Engineering.
DEVELOPMENT OF THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS IN INCOMPRESSIBLE FLOW WITH SEPARATION B.S. Thesis
M. I. Nissiriou and N. Pilatis Jun. 1979 58 p refs
(BU-239) Avail: NTIS HC A04/MF A01

The development of a three dimensional turbulent boundary layer was investigated in a non symmetrical diffuser. A yawmeter was calibrated and used to measure total pressures and angles of yaw over the twisted floor of the diffuser. Longitudinal pressure distributions, velocity profiles and viscous layer parameters were analyzed and compared with the results of an earlier two dimensional experiment. Lateral variables and parameters are presented and discussed. A swept separation front was defined and the flow beyond it is described. The establishment of equilibrium profiles in various parts of the flow is shown. Author (ESA)

N80-23619# Illinois Univ. at Urbana-Champaign. Water Resources Center.
JET INJECTIONS FOR OPTIMUM MIXING IN PIPE FLOW Final Research Report
S. D. Fitzgerald and E. R. Holley Dec. 1979 97 p refs
Prepared for the Office of Water Research and Technol., Washington, D.C.
(PB80-128960; UILU-WRC-79-0144; W80-02470; OWRT-A-091-ILL(1)) Avail: NTIS HC A05/MF A01 CSCL 20D

Laboratory experiments were conducted to determine the rates of mixing with a single jet injection made at the pipe wall at various angles relative to the pipe wall and with two diametrically opposed jets. For uniform pipe flow, it was possible to identify an optimum momentum for each angle of injection. A few experiments with induced swirl in the pipe flow showed that the swirl had a significant effect on the jet mixing, especially when two jets were used. GRA

N80-23620# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Propulsion and Energetics Panel.
TURBULENT TRANSPORT PHENOMENA
Marcel L. Barrere (ONERA, Paris) Feb. 1980 51 p refs
(AGARD-AR-150; ISBN-92-835-0259-0) Avail: NTIS HC A04/MF A01

Methods of making scalar measurements in hot turbulent flow and in combustion flow are examined. The advantages and drawbacks of employing either optical or probe methods for temperature measurements are outlined; for nonconstant concentration and density, spontaneous Raman scattering, methods making use of fluorescence perturbation phenomenon, and coherent anti-Stokes Raman scattering techniques are described. Finally, probe and indirect methods for pressure fluctuation measurements are suggested. M.G.

N80-24249 Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
UPDATE ON THE LOW WAVE NUMBER CONTENT OF TBL PRESSURE FIELDS
L. D. Pope *In* the Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 8 Aug. 1979 p 15-22 refs (For primary document see N80-24247 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washinton, D.C. 20375. Annual rate $100.00

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-23621*# Hughes Aircraft Co., Culver City, Calif.
CRYOGENIC COOLING STUDY FOR THE ADVANCED LIMB SCANNER
S. C. Russo May 1980 110 p
(Contract NAS1-16029)
(NASA-CR-159250) Avail: NTIS HC A06/MF A01 CSCL 14B

The cryogenic operating requirements for a VM refrigerator to be used for detector cooling of the advanced limb scanner (ALS) instrument are defined. Determination of these requirements include consideration of mission and environmental constraints. Based on the operating requirements a detailed refrigerator design and performance analysis is conducted resulting in an optimized VM refrigerator conceptual design. The cooler-instrument-

spacecraft interfaces are evaluated resulting in recommendations as to the best approach and most effective concepts resulting in simple and satisfactory interfaces. A preliminary implementation plan and schedule describing the general tasks required to develop, design, manufacture, test, and deliver three VM coolers and required support equipment to support an ALS flight experiment are presented. The result of this effort shows that existing VM cooler technology is sufficient to satisfy ALS mission requirements and schedules. M.G.

N80-23622# Defence Research Establishment, Ottawa. (Ontario). Defense Electronics Div.

VIDEO TAPE RECORDING TECHNIQUES FOR SEASAT RADAR DATA

L. G. Rowlandson and J. J. Renaud Dec. 1979 15 p
(AD-A081152; DREO-TN-79-32) Avail: NTIS
HC A02/MF A01 CSCL 17/9

A dual channel ARVIN/ECHO WRR-441 video tape recorder was used in a system to record SEASAT radar data. The video recorder channels were limited to 6 MHz bandwidth whereas the radar data covered 20 MHz. By designing a phase quadrature recording/play back system an effective bandwidth of 12 MHz was realized which covered the main lobe of the sin X/X radar signal spectrum. GRA

N80-23623# Arizona Univ., Tucson. Inst. of Atmospheric Physics.

DUAL-FREQUENCY DOPPLER-LIDAR METHOD OF WIND MEASUREMENT Final Report, 1 Dec. 1975 - 30 Nov. 1979

Wynn L. Eberhard and Richard M. Schotland 22 Jan. 1980 37 p refs
(Grants DAAG29-76-G-0115; DAAG29-79-G-0026)
(AD-A080849; ARO-13343.1-GS) Avail: NTIS
HC A03/MF A01 CSCL 14/2

In this new method (DFDL) of remote wind sensing, two optical beams of unlike frequency are superimposed in the sensed volume. The velocity information is obtained from the difference in the Doppler shifts of light scattered from the two beams by aerosols moving with the air. The DFDL signal spectrum and expressions for signal-to-noise ratio are derived. Attractive characteristics of DFDL include resilience to optical imperfections of the turbulent atmosphere and a potential for simultaneous measurement of the three components of wind velocity. GRA

N80-23624# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.

A THERMOPLASTIC DEVICE FOR REAL-TIME IN SITU RECORDING OF ACOUSTICAL HOLOGRAMS

Hua-Kuang Liu (Alabama Univ., University) 1 Oct. 1979 54 p refs
(AD-A081011; DRSMI/RL-80-4) Avail: NTIS
HC A04/MF A01 CSCL 20/1

Theory and experimental results of a thermoplastic device for real-time in situ acoustical holographic recording are presented. The theoretical analysis takes the possible existence of an in-line reference beam and its influence on the real-time coherent optical image reconstruction into consideration. A new technique has been used for fabricating the thermoplastic devices. The preliminary experimental data have demonstrated the feasibility of the application of the device for recordings of acoustical holograms. GRA

N80-23625# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.

IMPROVING A REAL TIME ACOUSTICAL HOLOGRAPHIC SYSTEM FOR FLAW DETECTION

W. F. Swinson 1 Oct. 1979 35 p ref
(AD-A080918; DRSMI/RL-80-3) Avail: NTIS
HC A03/MF A01 CSCL 20/1

This report documents work performed to improve the acoustical imaging capability of an acoustical holographic system for flaw detection. Included in the report is a mathematical model of the acoustical system and the results of the experimental effort to improve it. Added improvements include new plexiglas acoustical lenses, a lens gymbal mount, object gymbal mount, and acoustical thermoplastic memory. An attempt to use glycerine as a new acoustical couplant media is also reported. Work is also reported about the generation of acoustical real time speckle interferograms using the system. GRA

N80-23626# Litton Systems, Inc., Woodland Hills, Calif.

MULTIOSCILLATOR LASER GYRO STUDY Final Report, Sep. 1978 - Sep. 1979

V. E. Sanders Wright-Patterson AFB, Ohio AFAL Jan. 1980 64 p refs
(Contract F33615-78-C-1524; AF Proj. 2305)
(AD-A081421; AFAL-TR-79-1214) Avail: NTIS
HC A04/MF A01 CSCL 17/7

Parameter variation experiments were conducted and results are reported on the Litton IR and D developed LG2432 multioscillator laser gyro. The purpose of this collection of data is in its intended use as an aid in the advancement of a developing multioscillator theoretical model. The model predicts both the output intensities and oscillation frequencies of the various ring laser modes in this device. Therefore, the parameter variation experiments are concerned with the intensities and frequencies of the laser modes as a function of several laser gyro environmental parameters. Results from the refined theory and the correlation with the experimental data are discussed. GRA

N80-23627# Massachusetts Inst. of Tech., Cambridge. Research Lab of Electronics.

PASSIVE RING RESONATOR LASER GYROSCOPE Final Report, 1 Jun. 1977 - 31 May 1979

Shaoul Ezekiel 3 Jan. 1980 17 p refs
(Grant AF-AFOSR-3042-76; AF Proj. 2305)
(AD-A081649; AFOSR-80-0134TR) Avail: NTIS
HC A02/MF A01 CSCL 17/7

This report studies the behavior of a passive cavity optical gyroscope using (1) a small, 17 cm on a side, aluminum block and (2) a large, 70 cm on a side, cavity having discretely mounted components. In both cases, short-noise-limited performance has been reached for short periods of time, on the order of 20 minutes. Long term behavior has not been studied in much detail, but several factors that can influence the long term performance have been identified. GRA

N80-23628# Honeywell Electro-Optics Center, Lexington, Mass.

SPATIAL RADIOMETER, VOLUME 1 Final Report, 10 Nov. 1977 - 7 Sep. 1979

Richard Sullivan Mar. 1979 241 p
(Contract F19628-75-C-0179; AF Proj. 2123)
(AD-A081584; HONEYWELL-79024-Vol-1;
AFGL-TR-80-0061-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 17/5

This final report describes the Spatial Radiometer System, analysis, operational parameters and data results of the Head No. 1 system launch on 10 November 1977 at White Sands Missile Range, New Mexico. In addition, this final report contains the operational parameters and data on Head No. 2, thru 31 December 1978. Head No. 2 was not launched on 7 September 1978 due to pre-separation on the launch pad and is rescheduled for an early 1979 flight. GRA

N80-23629# California Univ., Livermore. Lawrence Livermore Lab.

BATTERY-POWERED, DIFFERENTIAL INFRARED ABSORPTION SENSOR FOR METHANE, ETHANE, AND OTHER HYDROCARBONS

G. E. Bingham, C. H. Gillespie, and J. H. McQuaid 8 Oct. 1979 21 p refs Presented at the Gas Res. Inst. Symp. on Methane Detection and Measurement, Chicago, 27 Aug. 1979
(Contract W-7405-eng-48; Grant NSF DEB-77-16327)
(UCRL-83317; CONF-790887-1) Avail: NTIS
HC A02/MF A01

The performance goals, design considerations and physical details of the miniature infrared absorption sensor developed for the liquefied natural gas spill safety program are presented. The sensor is lightweight, battery-powered, portable, self-contained, and able to interface readily to large array data systems. Essentially a precision infrared differential spectrometer capable of operating over the full range of gas concentrations expected in the spill diffusion tests, the sensor is expected to cost less than $7000 per unit. The present design of this open-cell fast response sensor

allows it to measure two components, but it can be modified to measure additional components at a reduced sampling frequency. To minimize temperature effects and power consumption, the sensor has a single source, single detectors design which includes a rotating chopper-filter wheel. A CMOS microprocessor interfaced with a arithmetic chip is used to linearize sensor output and correct for component interference. DOE

N80-23630# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
ORNL 10-m SMALL-ANGLE X-RAY SCATTERING CAMERA
R. W. Hendricks Dec. 1979 162 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6342) Avail: NTIS HC A08/MF A01

A new small angle X-ray scattering camera utilizing a rotating anode X-ray source, crystal monochromatization of the incident beam, pinhole collimation, and a two dimensional position sensitive proportional counter was developed. The design criteria for the instrument are outlined and an overview of the various components is given. A quantitative description of the performance of the system, and its use is illustrated with several examples taken from current research in materials and polymer science and biophysics. E.D.K.

N80-23631# Oak Ridge Y-12 Plant, Tenn. Fabrication Systems Dept.
NONCONTACT, LASER INTERFEROMETER SWEEP GAGE
W. E. Barkman 19 Nov. 1979 16 p ref
(Contract W-7405-eng-26)
(Y-2190) Avail: NTIS HC A02/MF A01

A noncontract rotary inspection machine was developed which utilizes a focused beam from a laser interferometer to measure variations in the surfaces of the reflective, spherical test parts used to characterize precision machines. Digital output data from the laser display is converted to an analog signal which is available for additional processing to provide contour and/or surface texture information. DOE

N80-23632# Oak Ridge National Lab., Tenn. Engineering Technology Div.
ASSESSMENT OF CURRENT HIGH-TEMPERATURE STRAIN GAGES
J. E. Smith Dec. 1979 59 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7025) Avail: NTIS HC A04/MF A01

Long term stability tests for systematic drift and strain sensitivity (gage factor) were conducted on two types of capacitive strain (gage) - the Boeing differential-capacitance gage and the CERL-Planer variable gap capacitive strain transducer and on the Ailtech SG-425 resistance gage. Results for tests of durations up to 12,000 hr are presented and compared with similar tests reported by others. The stability and repeatability of the capacitive systems were verified. In addition, two short term investigations were made on Ailtech weldable-resistance gages to address areas of uncertainty related to special applications. Data from these tests are also presented and interpreted. Advantages and limitations of the various systems are identified, and conclusions and recommendations are presented. Descriptions of the gage systems and problems encountered in the use of capacitive gages are given. DOE

N80-23633# California Univ., Livermore. Lawrence Livermore Lab.
STREAKCAMERA APERTURE FUNCTION
D. Dunbar 12 Dec. 1979 14 p
(Contract W-7405-eng-48)
(UCID-18520) Avail: NTIS HC A02/MF A01

The aperture function of a streaktube is derived. It defines the input spectrum as a function of time and space. The zeros of the aperture function depend inversely on aperture size and sweep time. DOE

N80-23634# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SIMPLE CAMERA SYSTEM FOR PHOTOGRAPHY OF PROJECTILES IN FLIGHT UNDER DAYLIGHT CONDITIONS
A. W. M. vanderVoort Nov. 1978 97 p refs In DUTCH; ENGLISH summary
(PHL-1978-51; TDCK-71693) Avail: NTIS HC A05/MF A01

A modified Linhof camera with a two msec electromechanical shutter using a point light source with a flash interval of one microsecond was developed. Photography of projectiles in flight with a length of up to one meter and a velocity up to 1700 meters per second is possible. A retro reflector and high gain reflective sheeting were used. Silhouette and shockwave photographs are also possible. The use of a second flash unit permits photographs of the projectile body. Author (ESA)

N80-23635# National Aerospace Lab., Amsterdam (Netherlands). Spaceflight Div.
GYRO NOISE MEASUREMENT AND ANALYSIS
J. A. Bosgra, J. J. M. Reumers, A. D. King (Ferranti Ltd., Edinburgh), G. Dickson (Ferranti Ltd., Edinburgh), and G. S. Gordon (Ferranti Ltd., Edinburgh) 12 Sep. 1979 177 p refs
(Contract ESA-3423)
(NLR-TR-79077-U; ESA-CR(P)-1295) Avail: NTIS HC A09/MF A01

Noise measurements were performed on two identical space qualified gyroscopes of the floated rate integrating type (Ferranti Type 125) in an analog rebalance loop configuration of selectable loop bandwidth, running under space representative conditions. The noise frequency range of interest was 0.005 Hz to 50 Hz. The noise results were processed into a number of statistical parameters (mean, standard deviation, range, slope, histogram). In addition, through a fast Fourier transform, auto and cross power spectra were determined together with auto and cross covariance functions. By making use of transfer function polynomials, equivalent gyro open-loop power spectra were computed from the closed-loop results and compared with directly measured open-loop spectra. A selection of the results is presented as graphs. Author (ESA)

N80-23636# Defence Research Information Centre, Orpington (England).
TORQUE RHEOMETERS, APPLICATION OF THE METHOD. PART 1: UNPLASTICIZED PVC
O. Laguna Castellanos, R. Arganza, and V. M. Arroyo London HMSO Nov. 1979 21 p refs Transl. into ENGLISH of Rev. de Plasticos Moderne, v. 29, no. 262, 1978 p 468-479 and 486
(DRIC-Trans-5585-Pt-1; BR71174-Pt-1) Avail: NTIS HC A02/MF A01

Parameters of a viscous material measured by a torque rheometer are correlated with shear stress and viscosity. The processing of an unplasticized polyvinyl chloride and the influence of external and internal lubricants was analyzed from the rheometer curves obtained on the material. Author (ESA)

N80-23520*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A POLARIMETER FOR THE HIGH RESOLUTION ULTRAVIOLET SPECTROMETER/POLARIMETER
John A. Calvert *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 303-310 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-23637# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
LASER ANNEALING OF GaAs Final Technical Report, 5 Jan. 1978 - 30 Sep. 1979
F. H. Eisen, J. L. Tandon, and C. G. Kirkpatrick Jan. 1980 58 p refs
(Contracts MDA903-78-C-0285; MDA903-78-C-0463; ARPA Order 3595)
(AD-A081466; ERC-41008.11FR) Avail: NTIS HC A04/MF A01 CSCL 20/5

Irradiations of appropriate energy densities from a pulsed ruby laser lambda = 0.69 microns, tp approx. 15 or 59 ns) or

a pulsed electron beam (energy approx. 20 keV, t(p) approx. 100 ns) were found to anneal implanted amorphous layers in GaAs successfully without using an encapsulant. This was confirmed by backscattering/channeling and TEM measurements. Good electrical activation of high dose (greater than 10 to the 15th power sq. cm) implanted donor ions, with peak electron concentrations higher than 10 to the 19th power cc, was achieved after both pulsed ruby laser and pulsed electron beam irradiations. Low dose (less than 10 to the 13th power sq. cm) donor ion implanted samples irradiated with ruby laser or electron beam pulses did not show any measurable electrical activity. Possible reasons for this apparent inactivity were explored but the exact reasons are not clear at present. Au-Ge/Pt ohmic contacts with specific contact resistance as low as 10 to the -7th power omega/sq.cm were fabricated on n-type GaAs by pulsed electron beam alloying. This value of the specific contact resistance is one of the lowest values reported so far. GRA

N80-23638# Naval Postgraduate School, Monterey, Calif.
INDUCED EVAPORATION OF METAL FROM AN ALUMINUM SURFACE BY A NORMAL PULSE NEODYMIUM LASER M.S. Thesis
Christopher Brinton Johnson Sep. 1979 77 p refs
(AD-A081601) Avail: NTIS HC A05/MF A01 CSCL 20/5

Laser induced evaporation of material from the surface of an aluminum target in a vacuum was studied. Based on a literature examination, material removal using a normal pulse laser was judged to be more efficient than for a Q-switched laser. The experiment was conducted using a neodymium glass laser modified for normal pulse operation. The energy density was varied from 850 J/sq cm where no breakdown occurred to 5000 J/sq.cm where the threshold for breakdown was exceeded. The normal pulse duration was 600 microsec. Analysis of the ejected material was achieved by using a Hughes Ionization Gauge placed in the path of the ejected material. Oscilloscope traces of the ionization gauge output show that the gauge 'sees' what is flying past it. There is good correlation between laser radiation, plasma radiation and ionization gauge fluctuations. The ionization gauge gave distinguishable signals for ions, electrons, and neutral particles ejected from the target surface. Signal sequence was dependent on the particle velocity. By measuring the elapsed time after ejection from the surface and the target to collector distance, the first arriving neutral particle velocity was determined to be 5.2 times ten to the 4th power cm/s. GRA

N80-23639# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF VELOCITY FIELD ABOUT A TWO DIMENSIONAL PLEXIGLASS OGIVAL FOIL USING THE LASER DOPPLER ANEMOMETER M.S. Thesis
Gary J. Tettelbach Jun. 1978 135 p refs
(AD-A081765) Avail: NTIS HC A07/MF A01 CSCL 20/4

Until recently measuring the velocity of a fluid required the insertion of some instrument into the flow which would disturb the flow. The development of the laser doppler anemometer has created a means of measuring flow velocity using two intersecting monochromatic light beams, one of which has been shifted in frequency a prescribed amount. In order to use the type of laser doppler anemometer owned by M.I.T. the light beams must be able to traverse the test section and the scattered light be collected by the receiving optics. This requires a transparent model in order to measure the flow around the entire model. This thesis demonstrates the feasibility of such a method and is an account of the special techniques used to obtain the data. GRA

N80-23640# Boston Univ., Mass. Dept. of Chemistry.
MEDIUM EFFECTS OF FLUORESCENCE QUANTUM YIELDS AND LIFETIMES FOR COUMARIN LASER DYES Technical Report, 1 Nov. 1978 - 31 Oct. 1979
Guilford Jones, II, William R. Jackson, and Arthur M. Halpern (Northeastern Univ.) 1 Jan. 1980 13 p refs Submitted for publication
(Contract N00014-79-C-0054; NR Proj. 395-609)
(AD-A081748; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Fluorescence quantum yields and lifetimes for a series of aminocoumarin laser dyes have been measured. The characteristics red shift of fluorescence in polar solvents is accompanied by a marked decrease in emission yield and lifetime for coumarins in which the substituted amine group at the 7 position is free to rotate. Strong emission is maintained in structurally rigid dyes. The non-radiative decay rates for non-rigid dyes which increase in polar solvents are associated with relaxation of emissive planar dye conformations to twisted zwitterionic species. GRA

N80-23641# Boston Univ., Mass. Dept. of Chemistry.
SOLVENT EFFECTS ON PHOTOPHYSICAL PARAMETERS FOR COUMARIN LASER DYES Technical Report, 1 Nov. 1978 - 31 Oct. 1979
Guilford Jones, II, William R. Jackson, Santhi Kanoktanaporn, and Arthur M. Halpern (Northeastern Univ.) 1 Jan. 1980 20 p refs Submitted for publication
(Contract N00014-79-C-0054; NR Proj. 395-609)
(AD-A081749; TR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

The red shifts of absorption and emission bands of coumarin laser dyes were studied as a function of solvent polarity and hydrogen bonding. Spectra were correlated with solvent parameters, pi and alpha, and those solvents resulting in the largest Stokes shifts of dye emission were identified. Solvent effects on emission yield and lifetime revealed a major non-radiative decay path for dyes in which the 7 amine function is free to adopt a non-planar conformation. GRA

N80-23642# Naval Postgraduate School, Monterey, Calif.
DESIGN CONSIDERATIONS OF A FLOW SYSTEM FOR TRANSIENT LASER DISCHARGE EXPERIMENTS
Josef Stricker Aug. 1979 37 p refs
(RR0000101)
(AD-A080942; NPS67-79-008) Avail: NTIS HC A03/MF A01 CSCL 20/5

Design considerations were examined for a flow system for transient electrical laser experiments. After a brief review of corona discharge gas flow interaction phenomena, the choice of the size and operating conditions of the discharge cell are discussed. Once those parameters are established, the flow system, which consists essentially of a Ludwieg tube, is designed. Attention is paid to flow starting times, to the available time of steady state flow, and to the effects of the boundary layer on the core flow. Suggested experiments and instrumentation are given in this report. GRA

N80-23643# Columbia Univ., New York.
HIGH PRESSURE NOBLE GAS ALKALI VAPOR MIXTURES AND THEIR VISIBLE AND INFRARED EXCIMER BANDS Final Report, 15 Nov. 1976 - 14 Nov. 1979
William Harper Feb. 1980 23 p refs
(Grant DAAG29-77-G-0015; DA Proj. 1L1-61102-BH-57)
(AD-A081808; ARO-1914223.8-P) Avail: NTIS HC A02/MF A01 CSCL 20/5

The infrared absorption of saturated alkali vapors has been measured for the first time. New absorption bands are tentatively assigned to triplet dimer molecules and also to trimer molecules. GRA

N80-23644# North Texas State Univ., Denton. Dept. of Physics.
INVESTIGATION OF LASER OPTICAL BIASING ON THE QUANTUM TRANSPORT PROPERTIES OF n-InSb Annual Summary Report, 1 Oct. 1978 - 30 Sep. 1979
David G. Seiler Oct. 1979 50 p refs
(Contract N00014-76-C-0319; NR Proj. 318-039)
(AD-A081578) Avail: NTIS HC A03/MF A01 CSCL 20/2

The interaction of CO2 and CO laser radiation with the semiconductor InSb has been studied at liquid helium temperatures with a highly sensitive photoconductive technique. Two distinct sets of resonant magnetophotoconductivity structure have been observed and identified as arising from multiphonon assisted cyclotron harmonic transitions and impurity level transitions. The first observation of a laser induced cooling process of the conduction electrons in n-InSb has been made using a CO laser and an applied dc electric field. GRA

N80-23645# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Sciences.
EXTENSION FOR INCREASED DATA COLLECTION OF

QUASI-HOMOGENEOUS SOURCES. ADDENDUM Progress Report, 1 Jul. - 30 Sep. 1979
Lorenzo M. Narducci 1 Feb. 1980 16 p
(Grant DAAG29-78-G-0098)
(AD-A081557; ARO-16054.2-A-P-ADD) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report summarizes our experimental findings. It is divided into 3 sections: the first provides a general introduction to the main problem of quasi-homogeneous sources. The second section contains the important experimental findings from far field measurements. The third summarizes our efforts to perform near field coherence measurements. GRA

N80-23648# United Technologies Research Center, East Hartford, Conn.
PROGRAM TO INVESTIGATE ADVANCED LASER PROCESSING OF MATERIALS Annual Report, 1 Jun. 1978 - 31 Jul. 1978
E. M. Breinan, C. O. Brown, and D. B. Snow Aug. 1979 93 p refs
(Contract N00014-78-C-0387; ARPA Order 3542)
(AD-A077573; UTRC/R79-914346-4; AR-1) Avail: NTIS HC A05/MF A01 CSCL 20/5

During the course of the initial program year, UTRC's program to produce and spin test a 12.7 cm diameter turbine disk using the LAYERGLAZE (TM) process fabrication technique has seen major milestones met in both the processing and alloy Design areas. Specifically, in the processing area, a powder feed LAYERGLAZE apparatus has been designed, constructed, and used to produce LAYERGLAZE parts for mechanical test, and a 13.2 cm diameter, 3 cm thick scale model disk preform. Mechanical testing and microstructural analysis showed the LAYERGLAZED material to have excellent microstructure, along with good structural integrity and freedom from serious fabrication flaws. It thus appears that the process and the apparatus will be capable of producing test disks which will meet the program's major objective of a spin test in late 1980. In the alloy design area, a technique for effective, rapid screening of alloys for LAYERGLAZE fabricability has been devised. Early experience showed that all but the weakest of conventional superalloys crack under LAYERGLAZE fabrication conditions. Therefore, the alloy development task assumed the challenging role of identifying strong ductile alloys which are also fabricable by the LAYERGLAZE process. To date, a preliminary series of alloys based on the Ni-Al-Mo system has been identified, and one composition, Ni-8Al-12Mo-3Ta (at %) has been LAYERGLAZE fabricated and mechanically tested. GRA

N80-23647# State Univ. of New York, Buffalo. Dept. of Physics and Astronomy.
INTRACAVITY ABSORBER EFFECTS IN A CW DYE LASER Progress Report, 1 Jun. 1978 - 31 May 1979
G. O. Brink Feb. 1979 8 p refs
(Contract EG-77-S-02-4448)
(COO-4448-2) Avail: NTIS HC A02/MF A01

The technique of dye laser intracavity absorption was studied as a possible method of detecting small densities of atoms and molecules in combustion systems. Two types of phenomena were observed. Absorption signals, which, although of complex line shape, result in a decrease in laser intensity at the absorption wavelength are observed over a wide range of absorber densities. At values of the pump laser power above a certain threshold an enhancement effect is observed in which the dye laser spectrally condenses at the absorber wavelength. The enhancement effect allows the detection of very low densities of sodium with good signal to noise ratio. The data obtained to date are discussed. DOE

N80-23648# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL DESIGN FOR A LARGE FUSION LASER SYSTEM
C. A. Hurley 1 Nov. 1979 14 p refs Presented at the 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract W-7405-eng-48)
(UCRL-82928; CONF-791102-11) Avail: NTIS HC A02/MF A01

Progress is reported in the design, fabrication, and installation of laser chain components, the stable support structure that holds them, and the beam lines that transport the laser beam to the target system. Topics covered relating to the Nova laser system include configuration, spaceframe, beam line components, amplifiers, spatial filters, and cleanliness of the glass, mirrors and other surfaces. DOE

N80-23649# California Univ., Livermore. Lawrence Livermore Lab.
LASER-DRIVEN SHOCKWAVE EXPERIMENTS AT EXTREME HIGH PRESSURES
R. M. More 21 Sep. 1979 29 p refs Presented at the 5th Workshop on Laser Interactions with Matter, Rochester, N.Y., Nov. 1979
(Contract W-7405-eng-48)
(UCRL-83372) Avail: NTIS HC A03/MF A01

A quantitative analysis of the prospects for using laser-driven shockwave experiments to accurately determine equation of state data in the multimegabar pressure range is presented. In order to unambiguously interpret shockwave data, that is, a planar, steady shock wave entering cold material (without significant preheat perturbation) is required. The problems of attaining sufficiently clean shocks at high pressure are examined and scaling relations which relate the pressure achieved to laser intensity, pulse energy, etc. are developed. It is shown that significantly higher pressures can be achieved when structured (layered) targets are used. DOE

N80-23650# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A LASER INTERFEROMETRIC DILATOMETER
W. D. Drotning 1979 32 p refs Presented at the 16th Intern. Thermal Conductivity Conf., Chicago, 7 Nov. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1714C; CONF-791134-6) Avail: NTIS HC A03/MF A01

The development of a high precision dilatometer using laser interferometry is described. Design criteria require operation over a temperature range from ambient to 900 K with a length change sensitivity of ten microinches (0.25 microns) or less. The dilatometer is designed to achieve rapid sample turnaround for quality control measurements in a production environment. The length change measurement is based on a modified Michelson interferometer using a two-frequency HeNe laser and ac detection of fringes. The final critical alignment of the interferometer during sample installation is achieved by automatic computer control. The furnance system incorporates a low thermal mass heating chamber to achieve rapid thermal response with minimal thermal disturbance to the interferometer system. Flexibility and reproductivity in heating schedules are achieved through digital control. Dilatometer control and data acquisition functions are accomplished by a minicomputer using a standard interface bus. DOE

N80-23651# Los Alamos Scientific Lab., N. Mex.
DIRECT SOLAR PUMPED LASER
Howard C. Volkin Jul. 1979 33 p refs
(Contract W-7405-eng-36)
(LA-7982-MS) Avail: NTIS HC A03/MF A01

The development of a direct solar pumped laser is described. Laser operation on the phosphorescence transition T reacts with S, with a suitable dye/solvent system is described. The set of coupled rate equations that governs the solar pumping kinetics are formulated. The compatability of the laser system with useful CW laser operation is discussed. DOE

N80-23652# Bureau of Radiological Health, Rockville, Md.
ANALYSIS OF SOME LASER LIGHT SHOW EFFECTS FOR CLASSIFICATION PURPOSES Final Report, Nov. 1979
David D. Royston Nov. 1979 25 p refs
(PB80-131576; FDA-80-8103; FDA/BRH-80/35) Avail: NTIS HC A02/MF A01 CSCL 20F

Some laser effects in laser lights shows irradiate audiences directly with laser radiation. This laser radiation must be below class 1 accessible emission limits. If actual radiometric measurements cannot be performed, a numerical analysis of the laser effect can be made to determine if the accessible laser

radiation is below acceptable limits. An analysis is presented of the following laser light show effects: a sawtooth wave scan, a triangular wave scan, a sine wave scan, a circular Lissalous pattern, a stationary laser beam on a rotating mirror ball, and a scanning laser beam on a mirror ball. The level of laser radiation of the effect is computed as well as the length of time the effect remains below class 1 levels. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-23653* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLOATING NUT RETENTION SYSTEM Patent
James F. Charles (Rockwell International Corp., Downey, Calif.) and Harry A. Theakston, inventors (to NASA) (Rockwell International Corp., Downey, Calif.) Issued 18 Mar. 1980 5 p Filed 31 Aug. 1978 Supersedes N78-32931 (16 - 23, p 3085) Sponsored by NASA
(NASA-Case-MSC-16938-1; US-Patent-4,193,435; US-Patent-Appl-SN-938582; US-Patent-Class-151-41.76) Avail: US Patent and Trademark Office CSCL 13I

A floating nut retention system includes a nut with a central aperture. An inner retainer plate has an opening which is fixedly aligned with the nut aperture. An outer retainer member is formed of a base plate having an opening and a surface adjacent to a surface of the inner retainer plate. The outer retainer member includes a securing mechanism for retaining the inner retainer plate adjacent to the outer retainer member. The securing mechanism enables the inner retainer plate to float with respect to the outer retainer number, while simultaneously forming a bearing surface for inner retainer plate.

Official Gazette of the U.S. Patent and Trademark Office

N80-23654* National Aeronautics and Space Administration. Pasadena Office, Calif.
QUARTZ BALL VALUE Patent
Carl Goetz (Motorola, Inc., Phoenix, Ariz.) and William M. Ingle, inventors (to NASA) (Motorola, Inc., Phoenix, Ariz.) Issued 1 Apr. 1980 6 p Filed 31 Aug. 1978 Supersedes N79-10427 (17 - 01, p 0057) Sponsored by NASA
(NASA-Case-NPO-14473-1; US-Patent-4,195,666; US-Patent-Appl-SN-938300; US-Patent-Class-137-625.4; US-Patent-Class-251-86; US-Patent-Class-137-375; US-Patent-Class-251-138) Avail: US Patent and Trademark Office CSCL 13K

A ball valve particularly suited for use in the handling of highly corrosive fluids is described. It is characterized by a valve housing formed of communicating segments of quartz tubing, a pair of communicating sockets disposed in coaxial alignment with selected segments of tubing for establishing a pair of inlet ports communicating with a common outlet port, a ball formed of quartz material supported for displacement between the sockets and configured to be received alternately thereby, and a valve actuator including a rod attached to the ball for selectively displacing the ball relative to each of the sockets for controlling fluid flow through the inlet ports.

Official Gazette of the U.S. Patent and Trademark Office

N80-23655* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR HOLDING TWO SEPARATE METAL PIECES TOGETHER FOR WELDING Patent
Sidney R. McClure, inventor (to NASA) Issued 8 Apr. 1980 9 p Filed 6 Apr. 1978 Supersedes N78-23434 (16 - 14, p 1851)
(NASA-Case-GSC-12318-1; US-Patent-4,196,840; US-Patent-Appl-SN-894213; US-Patent-Class-228-212; US-Patent-Class-228-44.1R; US-Patent-Class-228-222; US-Patent-Class-269-287; US-Patent-Class-219-160; US-Patent-Class-219-161) Avail: US Patent and Trademark Office CSCL 13H

A method of holding two separate metal pieces together for welding is described including the steps of overlapping a portion of one of the metal pieces on a portion of the other metal piece, encasing the overlapping metal piece in a compressible device, drawing the compressible device into an enclosure, and compressing a portion of the compressible device around the overlapping portions of the metal pieces for holding the metal pieces under constant and equal pressure during welding. The preferred apparatus for performing the method utilizes a support mechanism to support the two separate metal pieces in an overlapping configuration; a compressible device surrounding the support mechanism and at least one of the metal pieces, and a compressing device surrounding the compressible device for compressing the compressible device around the overlapping portions of the metal pieces, thus providing constant and equal pressure at all points on the overlapping portions of the metal pieces. Official Gazette of the U.S. Patent and Trademark Office

N80-23656*# National Aeronautics and Space Administration, Washington, D. C.
ECONOMICAL DRIVE FOR LARGE TUBE MILLS BY MEANS OF PLANETARY GEARS
W. Ackle Mar. 1980 28 p Transl. into ENGLISH from Zem. -Kalk-Gips (West Germany), no. 1, 1975 p 43-50 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75808) Avail: NTIS HC A03/MF A01 CSCL 13I

The performance of heavy-duty planetary gear drives for ball mills used in the cement industry since 1967 is described. These gear drives transmit up to 8500 HP per installation. A reliable method for establishing gear drive efficiency is described and possible savings due to higher efficiency are indicated. A.R.H.

N80-23657# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Power Systems Branch.
AN ANALYTICAL MEANS FOR DETERMINATION OF SCORING LIMITED LOAD CAPACITY IN SLIDING/ROLLING CONTACT Final Report, 1 Mar. 1977 - 27 Sep. 1979
Everett A. Lake Dec. 1979 23 p refs
(AF Proj. 3145)
(AD-A080984; AFAPL-TR-79-2128) Avail: NTIS HC A02/MF A01 CSCL 20/11

Scoring limited load capacity of paired discs in sliding/rolling lubricated contact is addressed. The approach used previously acquired data in a multiple regression analysis. The resulting mathematical expression for load capacity at failure has a correlation coefficient greater than 99%. GRA

N80-23658# Catholic Univ. of America, Washington, D. C. Vitreous State Lab.
EVALUATION OF THE TRACTION CHARACTERISTICS OF THREE LUBRICANTS Final Report, 1 Jan. - 31 Dec. 1978
C. J. Montrose, R. Moeller, D. Czaplak, B. Houston, R. R. Meiste, and P. Schoen (NRL, Washington, D.C.) Wright-Patterson AFB, Ohio AFML Mar. 1979 35 p refs
(Contract N00014-75-C-0585; AF Proj. 2421)
(AD-A080968; AFML-TR-79-4055) Avail: NTIS HC A03/MF A01 CSCL 11B

A combination of experimental techniques is used to characterize the viscoelastic properties of three lubricant candidates. These data were used as inputs in a model calculation to evaluate the traction characteristics of the candidate fluids for application to rolling element bearing analysis. All are found to have lower traction coefficients than the best traction fluids currently available. The major cause of this stems from the relatively slow variation of the shear viscosity with pressure in all three fluids and in one case a rather broad relaxation time spectrum. The other viscoelastic factors that are important in determining traction are found to be in a quite normal range. GRA

N80-23659# United Technologies Research Center, East Hartford, Conn.
EVALUATION OF BASIC LASER WELDING CAPABILITIES Final Report, 1 Jun. 1974 - 31 May 1979
D. B. Snow, M. J. Kaufman, C. M. Banas, and E. M. Breinan Jul. 1979 44 p refs
(Contract N00014-74-C-0423)
(AD-A077575; UTRC/R79-911989-17) Avail: NTIS HC A03/MF A01 CSCL 20/5

5456 and 5086 aluminum alloys were welded with a continuous, cross-beam CO2 laser operated in the master oscillator/power amplifier mode (Gaussian beam). Extensive experimental parameter modifications were made to the welding apparatus in an attempt to improve weld quality, in particular the reproducibility and uniformity of fusion zone penetration. The effects of laser (power, mode, optics), process (welding speed, beam rotation, shielding design) and other (weld prep, wire feed, flux, backup, etc.) parameters on weld performance were evaluated. Although some progress was demonstrated, the capability for generation of sound autogenous laser weldments in these alloys on a reproducible basis was not established within the scope of this program. Areas of endeavor which might be expected to produce further significant improvement in the ability to laser weld 5000 series aluminum alloys are not evident at this time. GRA

N80-23660# Northern Research and Engineering Corp., Cambridge, Mass. Applied Sciences Group.
ELECTRIC FUEL NOZZLES FOR COMBUSTORS
W. Jansen, I. P. Krepchin, M. J. Paradise, R. Cignoni, R. D. Grzybinski, E. P. Demetri, M. Platt, E. R. Norster, and W. H. Robinson 7 Mar. 1979 65 p refs
(Contract EY-76-C-03-1442)
(SAN/1442-79/T1) Avail: NTIS HC A04/MF A01

The feasibility of electrically charging the fuel droplets from a conventional atomizer by means of high-voltage electrodes was investigated. This method of fuel injection was proposed to improve the uniformity of the fuel/air distribution in the combustion zone and, at the same time, reduce power requirements by eliminating the need to introduce turbulent air flows and the accompanying large pressure drops. Two nozzle configurations, both utilizing the principle of corona discharge, were designed and fabricated. The initial tests were performed but the results did not warrant further testing. The fuel was not sufficiently charged to affect distribution. The conclusion was that droplets were moving too fast and their conductivity was too low for adequate charging to take place. Another effect observed, however holds the promise of eventually applicable to an electric nozzle. This is the phenomenon in which a thin film of jets shooting off the surface. DOE

N80-23661# Mechanical Technology, Inc., Latham, N. Y.
MAGNETIC BEARING SUPPORT STUDY FOR A 10 kW-hr ENERGY STORAGE FLYWHEEL
M. W. Eusepi and D. F. Wilcock Nov. 1979 180 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7025; MTI-75TR59) Avail: NTIS HC A09/MF A01

The design of a magnetic suspension system which fully supports a 10 kW-hr energy storage flywheel is presented. Discussions leading to the selection of the design to other storage levels ranging from a 1 kW-hr vehicular size to a large 100 kW-hr stationary system are included. DOE

N80-23662# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH-TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Quarterly Report, Apr. - Jun. 1978
A. Caruvana, E. D. Alderson, N. R. Antrim, H. V. Doering, R. P. Dubois, M. Dreedman, and R. Frishmuth Jul. 1978 185 p refs
(Contract EX-76-C-01-1806)
(FE-1806-48) Avail: NTIS HC A09/MF A01

Progress is reported in a program design to bring to technology readiness, over a six- to ten year duration, a coal-derived fuel at a firing temperature of 2600 F with growth capability 3000 F. The objectives of phase 2 are to: perform component design and trade-off analyses in sufficient depth to support the component design and test tasks; and update the phase 1 combined cycle studies to evaluate the commercial viability of a GE-TRV turbine system. Information is included on hot gas path development test facilities, low BTU gas cleanup system, motorized rig test air turbine tests, liquid- and gas-fueled combined cycle power plants, turbine subsystem design, update of verification tests system definition and technology readiness vehicle design. DOE

N80-23663# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
DEVELOPMENT OF A ROTARY HIGH PRESSURE DISPLACEMENT PUMP FOR REVERSED OSMOSIS SYSTEMS FOR SEAWATER DESALINATION Final Report
Gerhard Bardewyck (Bornemann (J. H.) Company) Dec. 1978 40 p In GERMAN; ENGLISH summary
(BMFT-FB-M-78-08) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 8.40

A rotary screw pump was developed for use in plants accomplishing sea water desalination through reverse osmosis. The pump operates at pressures of up to 100 bar, has better than average efficiency, and is free of pulsation. Studies were performed to optimize the rotor profiles of the pump. Author (ESA)

N80-23664# Eidgenoessisches Flugzeugwerk, Emmen (Switzerland). Research and Testing Dept.
STUDY AND DETAIL DESIGN OF THE ENGINEERING MODEL OF A VAPOR COMPRESSOR TO BE USED IN SPACE Final Report
F. Berner, H. Oesch, and O. Joeri Dec. 1979 85 p refs
(Contract ESA-3770/78-NL-PP)
(F/W-FO-1498; ESA-CR(P)-1277) Avail: NTIS HC A05/MF A01

An engineering model of a vapor compressor was designed for a refrigeration unit to be used in Spacelab. The piston compressor which, when incorporated in an optimally controlled refrigeration unit using freon 12 as the working fluid, allowed cooling of a payload down to about -27 C at heat removal rates of about 70 W under conditions where the heat sink fluid enters the condenser with a temperature of 40 C. Alternately, the heat removal rate at the source was increased to about 3 W. The shaft power required by the compressor under these conditions was expected to be about 12 W. The compressor was designed to operate under normal atmospheric conditions along with its drive unit even if placed in a vacuum. Author (ESA)

N80-23491 Shock and Vibration Information Center (Defense), Washington, D. C.
TECHNIQUES AND APPLICATIONS OF MECHANICAL SIGNATURE ANALYSIS
R. H. Volin *In its* The Shock and Vibration Digest, Vol. 11, No. 9 Sep. 1979 p 17-33 refs (For primary document see N80-23490 14-31)
Avail: NRL, Code 8404, Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

N80-23498*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER DOOR CLOSURE TOOLS
William R. Acres *In* NASA, Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 19-31 ref (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23500*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FLUID CIRCULATING PUMP OPERATED BY SAME INCIDENT SOLAR ENERGY WHICH HEATS ENERGY COLLECTION FLUID
Earl R. Collins *In* NASA, Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 47-56 refs (For primary document see N80-23495 14-31)
(Contract NAS7-100)
Avail: NTIS HC A15/MF A01 CSCL 13K

N80-23501*# Vought Corp., Dallas, Tex.
THE ECCENTUATOR: A NEW CONCEPT IN ACTUATION
Robert G. Musgrove *In* NASA, Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 57-67 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23502*# Institute for Industrial Research and Standards, Dublin (Ireland).

THE ACTUATED LATCH PIN AND ITS DEVELOPMENT
Patrick J. Lawlor *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 69-78 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23503*# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
BALL BEARING VERSUS MAGNETIC BEARING REACTION AND MOMENTUM WHEELS AS MOMENTUM ACTUATORS
W. Auer *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 79-91 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23504*# Societe Nationale Industrielle Aerospatiale, Paris (France).
CENTRIFUGAL REGULATOR FOR CONTROL OF DEPLOYMENT RATES OF DEPLOYABLE ELEMENTS
J. C. Vermalle *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 93-99 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23505*# Science Research Council, Chilton (England).
MECHANISMS OF UK RADIOMETERS FLOWN ON NIMBUS 5 AND 6 WITH PARTICULAR REFERENCE TO BEARINGS, PIVOTS AND LUBRICATION
H. Hadley *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 101-110 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23506*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRIPLE-AXIS COMMON-PIVOT ARM WRIST DEVICE FOR MANIPULATIVE APPLICATIONS
Leendert Kersten and J. Dwight Johnston *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 111-124 ref Prepared in cooperation with Nebraska Univ.-Lincoln (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23508*# Rockwell International Corp., Seal Beach, Calif. Space Systems Group.
A PRECISION BEARING GIMBAL SYSTEM FOR THE TEAL RUBY PROGRAM
Charles H. Lowry *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 143-153 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23509*# General Dynamics/Convair, San Diego, Calif.
FUEL/HYDRAULIC TRANSFER VALVE IMPROVES RELIABILITY OF ATLAS SPACE LAUNCH VEHICLE
M. Ogman *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 155-161 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13K

N80-23510*# Hughes Aircraft Co., Culver City, Calif.
KU BAND DEPLOYED ASSEMBLY AND GIMBAL
T. E. Deal *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 163-172 Sponsored in part by Rockwell International Corp. (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23515*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
A MECHANICAL ADAPTER FOR INSTALLING MISSION EQUIPMENT ON LARGE SPACE STRUCTURES
A. LaFever and R. S. Totah *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 237-245 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23516*# Grumman Aerospace Corp., Bethpage, N.Y.
AUTOMATED BEAM BUILDER
Walter K. Muench *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 247-265 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23517*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE MAGSAT MAGNETOMETER BOOM
James F. Smola, Wade E. Radford, and Marcus H. Reitz *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 267-278 ref (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23518*# General Electric Co., Philadelphia, Pa. Reentry Systems Div.
DRAWER DRIVE FOR SPACE SHUTTLE VACUUM CANISTER
Kenneth E. Werner *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 279-288 (For primary document see N80-23495 14-31)
(Contract NAS1-14375)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23521*# Ford Aerospace and Communications Corp., Newport Beach, Calif.
THE DESIGN AND APPLICATION OF AN ANTENNA POSITIONER MECHANISM FOR INTELSAT-5 SERIES COMMUNICATION SATELLITE
Big Szeto *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 311-322 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23522*# Science Research Council, Chilton (England).
THE MECHANISMS OF THE SAMS EXPERIMENT FLOWN ON NIMBUS 7 WITH PARTICULAR REFERENCE TO THE 2 AXIS SCANNING MIRROR
H. Hadley *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 323-333 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-23665# Naval Research Lab., Washington, D. C.
NON-DESTRUCTIVE EVALUATION OF DEFECTS IN STRUCTURAL MATERIALS USING LONG-WAVELENGTH NEUTRONS
M. Fatemi and B. B. Rath Jan. 1980 22 p refs
(RR0220601)
(AD-A081097; NRL-TR-1) Avail: NTIS HC A02/MF A01 CSCL 14/2

Small-angle scattering profiles from HSLA steels (Fe-0.05C-1.0Mn-0.12Nb-0.06Al) annealed at various temperatures ranging between 660 C and 1000 C were obtained. The values obtained from Guinier analysis and size distribution calculations were compared with those obtained from electron micrographic observations, and were shown to agree satisfactorily. Similar data were obtained from samples of Ni-P amorphous glasses annealed at 295 C, 400 C, and 500 C. No crystallization effects were observed from 295 C sample. The Guinier plots of the 400 C and 500 C samples indicate good agreement with the expected behavior due to annealing of the amorphous state; namely, the higher annealing temperatures correspond to larger microcrystallite sizes. GRA

N80-23666# Mantech of New Jersey, Rockville, Md. Engineering Support Div.

DECISION PATH APPROACH TO GUIDANCE FOR CLIMATIC ENVIRONMENTAL TEST PLANNING (MIL-STD-810C) Technical Progress Report, 1 Oct. 1978 - May 1979
J. W. Hamilton and S. Cohen 12 Apr. 1979 133 p refs
(Contract DAAK70-78-C-0026)
(AD-A080909; ETL-0183) Avail: NTIS HC A07/MF A01 CSCL 14/2

The decision path method developed in this report provides a step-by-step logical approach to guidance for users of MIL-STD-810C. The method comprises systematic procedures for characterizing items of materiel and defining environments prior to designing tests. It is equally applicable as a general approach to all climatic environmental tests and as a specific approach to each climatic environmental test method in the Standard. Use of this approach should contribute to a better understanding of the MIL-STD's purpose, enhance its utility, and promote better correlation of test results. GRA

N80-23667# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
ULTRASONIC NONDESTRUCTIVE TESTING OF MATERIALS Annual Report, 1 Aug. 1978 - 31 Jul. 1979
Yih-Hsing Pao and Wolfgang Sachse Oct. 1979 31 p refs
(Contract F49620-78-C-0100; AF Proj. 2307)
(AD-A078370; AFOSR-79-1174TR) Avail: NTIS HC A03/MF A01 CSCL 11/4

The method of phase spectroscopy was applied to measure dispersions of longitudinal and transverse waves in graphite-epoxy and boron-epoxy composite materials over a wide frequency range. A method to determine the attenuation from the dispersion based on the Kramers-Kronig relations was developed. To separate the attenuation due to scattering, and that due to viscosity, dispersion and attenuation of waves in a laminated viscoelastic composite material was analyzed using a statistical theory of multiple scattering. GRA

N80-23668# Los Alamos Scientific Lab., N. Mex.
THE LASL NONDESTRUCTIVE TESTING GROUP Interim Report
R. A. Morris and Larry Bryant 1979 8 p Presented at the WANTO Proc., Oak Ridge, Tenn., 9-11 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3071; CONF-791098-1) Avail: NTIS HC A02/MF A01

Topics discussed include: high-pressure diamond cell work; X-ray fluorescence analysis; shroud of Turin; laser fusion target inspection; and scanning electron microscope. Organization charts for the M-1 group are included. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-23669 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 11
Judith Nagle-Eshleman, ed. Nov. 1979 93 p refs
(AD-A078375) Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Substructuring methods for analysis of vibrating systems and computer program literature concerning shock and vibration isolation are presented. An abstract bibliography of current literature is given. For individual titles, see N80-23670 through N80-23671.

N80-23670 Tufts Univ., Medford, Mass. Dept. of Mechanical Engineering.
A REVIEW OF SUBSTRUCTURE ANALYSIS OF VIBRATING SYSTEMS
F. C. Nelson *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 11 Nov. 1979 p 3-9 refs
(For primary document see N80-23669 14-39)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual Rate $100.00

A general review of substructuring is presented, with emphasis placed on the method of component mode synthesis. Static substructuring is described as are dynamic substructuring by component mode synthesis and substructure truncation. Other substructuring methods are summarized. E.D.K.

N80-23671 Barry Controls, Inc., Watertown, Mass.
COMPUTER PROGRAMS: SHOCK AND VIBRATION ISOLATION
T. F. Derby *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 11 Nov. 1979 p 23-28 refs (For primary document see N80-23669 14-39)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Literature pertaining to computer programs useful in the analysis of shock and vibration isolation is reviewed. Topics included are the design of isolators, determination of required or optimum isolator parameters, and computational techniques. E.D.K.

N80-23672 Stanford Univ., Calif.
ELASTIC-PLASTIC DEFORMATION AT FINITE STRAIN Ph.D. Thesis
Vlado A. Lubarda 1980 45 p
Avail: Univ. Microfilms Order No. 8011672

Almost all current elastic-plastic theory is based on the total strain-rate being expressed as the sum of elastic and plastic strain-rates. This assumption and the kinematic model on which it is based are invalid and lead to erroneous conclusions. By defining plastic deformation as the residual deformation after unloading to zero macroscopic stress, the careful separation of elastic and plastic strain-rates is correctly achieved. On this basis the rate (incremental) type constitutive law for time independent material is rigorouly established. The law is not restricted to infinitesimal elastic strains, and Prandtl-Reuss equations follow as a special case of this general theory. The established constitutive law is then incorporated into the structure of the finite deformation variational principle by deriving the expression for the rate potential function. This is oriented toward the direct use in the finite element evaluation of boundary-value problems. The presentation and the development of the whole theory is given at the level of modern continuum mechanics. Dissert. Abstr.

N80-23673 Minnesota Univ., Minneapolis.
STUDIES IN THE SMALL MOTIONS OF VISCOELASTIC SOLIDS Ph.D. Thesis
Prakash Mahadeo Dixit 1979 187 p
Avail: Univ. Microfilms Order No. 8011794

The reduced canonical forms of the stress and equations of motion governing the motions which perturb the natural state of viscoelastic solids are derived. For simplicity only homogeneous, isotropic, incompressible solids are considered. The questions of uniqueness and stability are considered. It is shown that if the elastic constant and the viscoelastic function associated with the operator satisfy certain mild and physically natural conditions, then the limiting form of the solution as t approaches infinity is unique. This is equivalent to saying that under the above conditions the natural state of an incompressible solid is stable in linear approximation. Uniqueness of solutions of the initial-history-boundary-value problem is also considered. Also two free surface problems are considered. These problems involve computing the distortion of cylindrical or plane surfaces of solids in the natural state. In the problem of the sheared block the distortion occurs at first order while in the torsion of a viscoelastic cylinder arises at second order. In both the problems the motion is governed by fourth order partial differential equations. Dissert. Abstr.

N80-23674# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
MATHEMATICAL MODEL FOR THE SEPARATION OF GUST AND MANOEUVRE LOADS OF CIVIL AIRCRAFT
J. Taylor 1979 28 p refs
(FB-141(1979); ICAF-1135) Avail: NTIS HC A03/MF A01

Ignoring the unsteady lift functions, the normal acceleration response of an aircraft at its centre of gravity to a simplified

turbulence spectrum varying as frequency to the power -5/3 were studying. It is shown that the pitching influence usually reduces the response at long wavelengths from that produced by heaving alone. This influence was relatively small in piston-engined aircraft but has generally become greater as aircraft have developed. The increased response at long wavelengths in modern aircraft makes the problem of separating maneuvres from gust response more difficult but it is attenuated somewhat by the pitching contributions to the response. Experimental studies on a T33, on a Concorde and on a Transall indicate that a band frequency exists where the manoeuvres and turbulence responses are both small so that a filter within this band should separate one type of response from the other. Author

N80-23675# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
SHEAR LIPS ON FATIGUE FRACTURES IN ALUMINUM ALLOY SHEET MATERIAL
J. Schijve Sep. 1979 26 p refs
(LR-287; ICAF-1112) Avail: NTIS HC A03/MF A01

Shear lip width measurements and the transition of tensile mode fatigue cracks to shear mode fatigue cracks, as observed on fatigue crack surfaces of aluminum alloy sheet material are analyzed. It is shown that these phenomena were controlled by delta K sub eff rather than K sub max or delta K. For crack growth in air the shear lip width was approximately proportional to the square of delta K sub eff, but is was significantly larger than the estimated size of the reversed plastic zone. The initiation of shear lips, the transition from plane stress to plane strain along the crack front, and the environmental effect on shear lips are briefly considered in the discussion. M.G.

N80-23676# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
THE SIGNIFICANCE OF THE FATIGUE STRENGTH IN THE POWDER METALLURGY
Cetin Morris Sonsino and Gottfried Hoffman 1979 7 p refs
Repr. from Arch. Eisenhuettenw. (West Germany), v. 50, no. 12, 1979 p 533-538 In GERMAN; ENGLISH summary
(ICAF-1134) Avail: NTIS HC A02/MF A01

The importance of fracture mechanical parameters, cyclic stress-strain curve, S/N curve, fatigue life curve, scatter, probability of survival and failure and significance analysis in powder metallurgy is discussed as well as the possible influences of homogenizing and pore shape on fracture mechanical parameters, of porosity on the cyclic stress-strain behavior, on the fatigue strength and on notch sensitivity. Differences between S/N and fatigue life curves are discussed. A.R.H.

N80-23677*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ELASTIC CONSTANTS FOR SUPERPLASTICALLY FORMED/DIFFUSION-BONDED CORRUGATED SANDWICH CORE
William L. Ko May 1980 82 p refs
(NASA-TP-1562; H-1094) Avail: NTIS HC A05/MF A01 CSCL 20K

Formulas and associated graphs for evaluating the effective elastic constants for a superplastically formed/diffusion bonded (SPF/DB) corrugated sandwich core, are presented. A comparison of structural stiffnesses of the sandwich core and a honeycomb core under conditions of equal sandwich core density was made. The stiffness in the thickness direction of the optimum SPF/DB corrugated core (that is, triangular truss core) is lower than that of the honeycomb core, and that the former has higher transverse shear stiffness than the latter. E.D.K.

N80-23678*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF NASA FULL-SCALE ENGINE AEROELASTICITY RESEARCH
Joseph F. Lubomski 1980 21 p refs Presented at the 21st Struct., Structural Dyn., and Mater. Conf., Seattle, 12-14 May 1980; sponsored by AIAA, ASME, ASCE and AHS
(NASA-TM-81500; E-437) Avail: NTIS HC A02/MF A01 CSCL 20K

Data relevant to several types of aeroelastic instabilities were obtained using several types of turbojet and turbofan engines. In particular, data relative to separated flow (stall) flutter, choke flutter, and system mode instabilities are presented. The unique characteristics of these instabilities are discussed, and a number of correlations are presented that help identify the nature of the phenomena. R.E.S.

N80-23679*# California Inst. of Tech., Pasadena.
VISUALIZATION OF IMPACT DAMAGE OF COMPOSITE PLATES BY MEANS OF THE MOIRE TECHNIQUE
W. G. Knauss, C. D. Babcock, and H. Chai Apr. 1980 53 p refs
(Grant NsG-1483)
(NASA-CR-159261; SM-79-9) Avail: NTIS HC A04/MF A01 CSCL 11D

The phenomenological aspects of propagation damage due to low velocity impact on heavily loaded graphite-epoxy composite laminates were investigated using high speed photography coupled with the moire fringe technique. High speed moire motion records of the impacted specimens are presented. The results provide information on the time scale and sequence of the failure process. While the generation of the initial damage cannot always be separated temporally from the spreading of the damage, the latter takes place on the average with a speed on the order of 200 m/sec. R.E.S.

N80-23680*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
USER'S MANUAL TO THE ACTION COMPUTER CODE
Monohar P. Kamat Apr. 1980 78 p
(Contract NAS1-15080)
(NASA-CR-144973) Avail: NTIS HC A05/MF A01 CSCL 20K

The form and interpretation of input and output data are defined. The Analysis of Crash Transients in Inelastic and Geometrically Nonlinear structures program (ACTION) performs nonlinear transient response analysis of structures subjected to time varying loads, allowing for nonlinear, time independent material properties and large geometry changes. Author

N80-23681# Chi Associates, Inc., Arlington, Va.
STATE-OF-THE-ART REPORT ON NUMERICAL INTEGRATION METHODS FOR ANALYSIS OF STIFF STRUCTURAL ANALYSIS SYSTEMS
John Tucker and Michael Chi [1980] 60 p refs
(Contract DOT-HS-7-10620)
Avail: NTIS HC A04/MF A01

The state-of-the-art of integration methods suitable for stiff, nonlinear systems were assessed to improve the computational efficiency of vehicle structural dynamics simulation programs. Applicable methodologies were analyzed and their strengths and weaknesses cited. Criteria were developed for their applicability to stiff, nonlinear systems. R.E.S.

N80-23682*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ROOM TEMPERATURE MECHANICAL PROPERTIES OF SHUTTLE THERMAL PROTECTION SYSTEM MATERIALS
James Wayne Sawyer and Donald R. Rummler Apr. 1980 39 p ref
(NASA-TM-81786) Avail: NTIS HC A03/MF A01 CSCL 20K

Tests were conducted at room temperature to determine the mechanical properties and behavior of materials used for the thermal protection system of the space shuttle. The materials investigated include the LI-900 RSI tiles, the RTV-560 adhesive and the .41 cm (.16 thick) strain isolator pad (SIP). Tensile and compression cyclic loading tests were conducted on the SIP material and stress-strain curves obtained for various proof loads and load cyclic conditioning. Ultimate tensile and shear tests were conducted on the RSI, RTV, and SIP materials. The SIP material exhibits highly nonlinear stress-strain behavior, increased tangent modulus and ultimate tensile strength with increased loading rate, and large short time load relaxation and moderate creep behavior. Proof and cyclic load conditioning of the SIP results in permanent deformation of the material, hysteresis effects, and much higher tensile tangent modulus values at large strains. R.E.S.

N80-23683*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MINIMUM MASS SIZING OF A LARGE LOW-ASPECT RATIO AIRFRAME FOR FLUTTER-FREE PERFORMANCE
William H. Greene and Jaroslaw Sobieszczanski-Sobieski May 1980 40 p refs Presented at the 21st Struct., Structural Dyn., and Mater. Conf., Seattle, 12-14 May 1980; sponsored by AIAA, ASME, ASCE and AHS
(NASA-TM-81818; AIAA-80-0724CP) Avail: NTIS HC A03/MF A01 CSCL 20K

A procedure for sizing an airframe for flutter-free performance is demonstrated on a large, flexible supersonic transport aircraft. The procedure is based on using a two level reduced basis or modal technique for reducing the computational cost of performing the repetitive flutter analyses. The supersonic transport aircraft exhibits complex dynamic behavior, has a well-known flutter problem and requires a large finite element model to predict the vibratory and flutter response. Flutter-free designs were produced with small mass increases relative to the wing structural weight and aircraft payload. R.E.S.

N80-23684*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRACTICAL IMPLEMENTATION OF THE DOUBLE LINEAR DAMAGE RULE AND DAMAGE CURVE APPROACH FOR TREATING CUMULATIVE FATIGUE DAMAGE
S. S. Manson (Case Western Reserve Univ.) and G. R. Halford Apr. 1980 50 p refs
(NASA-TM-81517; E-387) Avail: NTIS HC A03/MF A01 CSCL 20K

Simple procedures are presented for treating cumulative fatigue damage under complex loading history using either the damage curve concept or the double linear damage rule. A single equation is provided for use with the damage curve approach; each loading event providing a fraction of damage until failure is presumed to occur when the damage sum becomes unity. For the double linear damage rule, analytical expressions are provided for determining the two phases of life. The procedure involves two steps, each similar to the conventional application of the commonly used linear damage rule. When the sum of cycle ratios based on phase 1 lives reaches unity, phase 1 is presumed complete, and further loadings are summed as cycle ratios on phase 2 lives. When the phase 2 sum reaches unity, failure is presumed to occur. No other physical properties or material constants than those normally used in a conventional linear damage rule analysis are required for application of either of the two cumulative damage methods described. Illustrations and comparisons of both methods are discussed. Author

N80-23685*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
COMPARISON OF STRUCTURAL BEHAVIOR OF SUPER-PLASTICALLY FORMED/DIFFUSION-BONDED SANDWICH STRUCTURES AND HONEYCOMB CORE SANDWICH STRUCTURES
William L. Ko Jun. 1980 35 p refs
(NASA-TM-81348) Avail: NTIS HC A03/MF A01 CSCL 20K

A superplasticity formed/diffusion-bonded (SPF/DB) orthogonally corrugated core sandwich structure is discussed and its structural behavior is compared to that of a conventional honeycomb core sandwich structure. The stiffness and buckling characteristics of the two types of sandwich structures are compared under conditions of equal structural density. It is shown that under certain conditions, the SPF/DB orthogonally corrugated core sandwich structure is slightly more efficient than the optimum honeycomb core (square-cell core) sandwich structure. However, under different conditions, this effect can be reversed. R.C.T.

N80-23686# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
APPLICATIONS OF GENERALIZED DERIVATIVES TO VISCOELASTICITY
Ronald L. Bagley Nov. 1979 119 p refs
(AF Proj. 2418)
(AD-A081131; AFML-TR-79-4103) Avail: NTIS HC A06/MF A01 CSCL 20/11

Generalized derivatives of fractional order are used to construct stress-strain constitutive relations for viscoelastic materials, based on the observed sinusoidal behavior of the materials. The non-periodic behavior of one material is observed in the laboratory and compares favorably with the non-periodic behavior of the material predicted by its generalized derivative constitutive relation. Having established that the generalized derivative constitutive relation is an appropriate mathematical model for the general motion of at least one viscoelastic material, the tools for the analysis of structures of engineering interest are put forward. In particular, attention is focused on a finite element formulation of and solutions to the equations of motion for structures containing elastic and viscoelastic components. GRA

N80-23687# Naval Ocean Systems Center, San Diego, Calif.
DYNAMICS OF A MOVING MASS BEING ABRUPTLY STOPPED BY A CABLE Final Report
R. W. Buecher Dec. 1979 13 p
(R0118OS)
(AD-A081158; NOSC/TR-489) Avail: NTIS HC A02/MF A01 CSCL 20/11

The one dimensional wave equation is used to determine the propagation of tension in a cable that abruptly stops a moving mass. A simple simulation is used to determine tension propagation when the end of the cable opposite the moving mass is fixed and tension reflections occur. Predicted tensions compare favorably with those determined by experiment. GRA

N80-23688# Northwestern Univ., Evanston, Ill. Technological Inst.
CRITICAL DAMPING IN LINEAR DISCRETE DYNAMIC SYSTEMS
D. E. Beskos and B. A. Boley Nov. 1979 23 p refs Prepared in cooperation with Minnesota Univ., Minneapolis
(Contract N00014-75-C-1042)
(AD-A081085; TR-1979-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

Free viscously damped vibrations of linear discrete structural systems are studied. The amount of damping varies among the various structural elements of the system resulting in several critical damping possibilities. A general method is developed for determining the critical damping surfaces of a system. These surfaces represent the loci of combinations of damping values corresponding to critically damped motions, and thus separate regions of partial or complete underdamping for those of overdamping. The dimension of a critical damping surface is equal to the number of independent amounts of damping present in the system. The determination of the surface point corresponding to equal amounts of damping is considerably simplified for systems which, on the assumption that all amounts of damping are equal, possess a damping matrix of the Rayleigh type. Three examples presented in detail illustrate the proposed technique and some of the important characteristics of critical damping surfaces. GRA

N80-23689# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
SOME COMMENTS ON THE ENDOCHRONIC THEORY OF PLASTICITY
R. S. Rivlin Oct. 1979 47 p refs
(Contract N00014-76-C-0235)
(AD-A081825; CAM-100-33) Avail: NTIS HC A03/MF A01 CSCL 20/13

Two endochronic theories of plasticity advanced by Valanis in 1971 and 1978 are discussed critically. It is concluded that the first of these theories, which does not involve a yield surface or a separation of strain into plastic and elastic components, cannot form an appropriate basis for the mechanics of metals. The second theory is a more conventional theory involving a yield surface with kinematic and isotropic hardening. However, there is no evidence that the particular laws employed by Valanis accord with experiment. GRA

N80-23690# Lockheed Missiles and Space Co., Palo Alto, Calif.
COMPUTER ANALYSIS OF SHELLS AND COMPOSITES Final Report, Oct. 1977 - Dec. 1979
David Bushnell and Frank W. Crossman Dec. 1979 28 p
(Contract F49620-77-C-0122; AF Proj. 2307)

(AD-A081469; LMSC-D684018; AFOSR-80-0136TR) Avail: NTIS HC A03/MF A01 CSCL 11/4

Task 1 hygrothermal, viscoelastic plane stress and generalized plane strain analysis codes were developed and employed to determine the influence of hygrothermal history on laminate inplane and free edge stresses and dimensional stability. Task 2 monographs were written on plastic buckling, stability and optimization of panels, and buckling of shells. The surveys include many examples of nonlinear collapse and bifurcation buckling in which moderately large deflections, nonlinear material effects, and imperfections are accounted for. Their purpose is to give the reader a physical feel for thin shell behavior that will help him to design appropriate tests and perform efficient numerical analyses with existing computer programs for the treatemnt of structures composed of thin sections. GRA

N80-23691# Lehigh Univ., Bethlehem, Pa. Center for Application of Mathematics.

INTERACTION OF LARGE AMPLITUDE STRESS WAVES IN LAYERED ELASTIC-PLASTIC MATERIALS Final Report, Aug. 1976 - Sep. 1979

Eric Varley Feb. 1980 12 p refs

(Grant DAAG29-76-G-0319)

(AD-A081429; ARO-14110.2-E) Avail: NTIS HC A02/MF A01 CSCL 11/9

Mathematical techniques are developed to analyze the nonlinear wave interactions that occur when a uni-directional wave traveling through an hysteretic material arrives at an interface with some other hysteretic material. Also, mathematical techniques are developed to describe the deformations of finitely strained materials surrounding cracks, notches, and inclusions. GRA

N80-23692# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Structures Lab.

TENSILE CRACK EXPOSURE TESTS. REPORT 3: LABORATORY EVALUATION OF SERIES A BEAMS WITH RESULTS FROM 1951 TO 1975

Edward F. ONeil Jan. 1980 73 p refs

(AD-A081302; WES-TM-6-412-3; Rept-3) Avail: NTIS HC A04/MF A01 CSCL 13/13

A study was begun in 1950 to determine the effects of severe natural weathering to stressed, reinforced concrete beams of various compositions and degrees of stress. The objectives of the study were to obtain information on the long-term weathering of air-entrained and nonair-entrained concrete beams containing steels of different compositions, types of deformation, and having different levels of stress in the steel that caused varying degrees of cracking of the concrete. The beams were fabricated, cured, and loaded at the U.S. Army Engineer Waterways Experiment Station (WES) in 1951, then shipped to Eastport, Maine, and placed on the beach at the natural weathering exposure station on the south side of Treat Island, Cobscock Bay, Eastport, and Lubec. The beams were subjected to twice daily tidal cycles exposing them to wetting under considerable head, and drying to surface dry conditions. The beams were inspected annually during the exposure period and evaluated by a team of inspectors rating the degree of deterioration. Each year, maximum crack widths were measured beginning in 1956 and continuing until 1975 when the exposure period was concluded after 25 years of weathering. The results of the exposure study and the laboratory investigation indicated, among other findings, that stressing the steel to varying levels of stress over the exposure period did not reduce the ultimate moment carrying capacity of the beams; the maximum areas of corrosion occurred at spalled areas; corrosion to the steel could not be located at any flexural crack smaller than 0.015 in. (0.38 mm); and no area of maximum reduction of cross-sectional are due to corrosion occurred at the flexural cracks. GRA

N80-23693# Naval Postgraduate School, Monterey, Calif.

AN INVESTIGATION OF RESIDUAL STRESSES IN SIMULATED WING PANELS OF 7075-T6 ALUMINUM M.S. Thesis

Edward C. Engle Dec. 1979 46 p refs

(AD-A080863) Avail: NTIS HC A03/MF A01 CSCL 11/6

The advent of onboard aircraft microprocessor fatigue monitoring systems will establish the opportunity to fully exploit residual stresses at stress-critical areas, including their effects on fatigue predictions. An experimental investigation was undertaken to more fully understand them by making photoelastic measurements of residual stresses at notches in simulated wing panels of 7075-T6 aluminum and to establish the relationships between local stresses, residual stresses, and the far-field or applied stress. The stress concentration factors were found to decrease with increased plastic deformation while the strain concentration factors were found to remain constant. The residual stress levels were found to be immutable despite changes in fatigue loading conditions, notch geometry, or test duration.GRA

N80-23694# Oakland Univ., Rochester, Mich. School of Engineering.

LIGHTER AND STRONGER

A. J. Durelli and K. Rajaiah Feb. 1980 54 p refs

(Contract N00014-76-C-0487; Grant NSF ENG-77-07974)

(AD-A081317; Rept-53) Avail: NTIS HC A04/MF A01 CSCL 20/11

A new method has been developed that permits the direct design of shapes of two dimensional structures ad structural components, loaded in their plane, within specified design constraints and exhibiting optimum distribution of stresses. The method uses photoelasticity and requires a large field diffused light polariscope. Several problems of optimization related to the presence of holes in finite and infinite plates, subjected to uniaxial and biaxial loadings, are solved parametrically. Some unexpected results have been found: (1) the optimum shape of a large hole in a bar of finite width, subjected to uniaxial load, is 'quasi' square, but the transverse boundary has the configuration of a 'hat'; (2) for the small hole in the large plate, a 'barrel' shape has a lower s.c.f. than the circular hole and appreciably higher coefficient of efficiency; and (3) the optimum shape of a tube, subjected to diametral compression, has small 'hinges' and is much lighter and stronger than the circular tube. Applications are also shown to the design of dove-tails and slots in turbine blades and rotors, and to the design of star-shaped solid propellant grains for rockets. GRA

N80-23695# Brown Univ., Providence, R. I. Center for Dynamical Systems.

THE EQUATIONS OF ELASTICITY ARE SPECIAL

C. M. Dafermos Oct. 1979 15 p refs

(Contract N00014-76-C-0278; Grants DAAG29-76-G-0294; NSF MCS-79-05774)

(AD-A081668) Avail: NTIS HC A02/MF A01 CSCL 20/1

In dynamics, the goal is to relate the Second Law of thermodynamics with 'stability'. The work of Ericksen reveals that the Second Law induces stability of an equilibrium state of a thermoelastic material in the range of convexity of internal energy (e.g., at points where energy attains a minimum.) Similarly, it has been shown that smooth adiabatic processes in thermoelasticity, residing in the range of convexity of internal energy, depend continuously upon the initial state, even within the class of processes that develop shock waves. Actually, in certain circumstances, the same result can be established under a mere strong ellipticity assumption. GRA

N80-23696# California Univ., Berkeley. Dept. of Mechanical Engineering.

ANALYTICAL STRESS ANALYSIS OF ELASTIC COMPOSITES WITH CRACKS Final Report

D. B. Bogy Aug. 1979 74 p refs

(Contract W-7405-eng-48)

(UCRL-15109) Avail: NTIS HC A04/MF A01

The elastostatic axisymmetric problem of a sphere, containing a centrally located penny-shaped crack, embedded in a dissimilar matrix subject to far field loads is solved. First the problem of a cracked sphere is solved by using Boussinesq stress-functions. Two coordinate systems - oblate spheroidal for representing the crack surface and spherical polars for the spherical surface - are used to satisfy boundary conditions. Integral representations and transformations of harmonic functions are used to relate stress-functions in the two coordinate systems. This procedure leads to a system of algebraic equations which are solved, for axisymmetric tractions on both the surfaces. This solution is then used to obtain the solution of the original problem. A representation of the solution for the axisymmetric problem of a crack in an infinite medium is also presented. DOE

N80-23697# Oak Ridge National Lab., Tenn.
BEHAVIOR OF DEEP FLAWS IN A THICK-WALL CYLINDER UNDER THERMAL SHOCK LOADING
R. D. Cheverton 1979 24 p refs Presented at the Water Reactor Safety Meeting, Washington, D.C., 5 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791123-3) Avail: NTIS HC A02/MF A01

Behavior of inner-surface flaws in thick-walled vessels was studied in a 991-mm OD x 152 mm wall x 1220 mm length cylinder with toughness properties similar to those for HSST Plate. The initial temperature of 93 C and a thermal shock medium of liquid nitrogen (.197 C) were employed. The initial flaw selected was a sharp, 16 mm deep, long (1220 mm) axial crack. Crack arrest methodology was shown to be valid for deep flaws under severe thermal shock. DOE

N80-23698# Sandia Labs., Livermore, Calif. Data Processing Div.
TECHNICAL MANUAL: PRIMARY DATA REDUCTION PROGRAMS FOR THE ECLIPSE S-200/230 SHOCK AND VIBRATION MEASUREMENT SYSTEMS
H. W. Swan Nov. 1979 41 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8054) Avail: NTIS HC A03/MF A01

The internal workings and computational algorithms for the quick-look plotting programs and primary data reduction programs for the Eclipse computer-based shock and vibration test centers are described. DOE

N80-23699# Hanford Engineering Development Lab., Richland, Wash.
EVALUATION OF THE ROUND COMPACT SPECIMEN FOR FATIGUE-CRACK GROWTH RATE TESTING
L. A. James and W. J. Mills Apr. 1979 18 p refs Presented at the ASTM Symp. on Fatigue Crack Growth Meas. and Data Anal., Pittsburgh, 29 Oct. - 2 Nov. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1810; CONF-7910102-2) Avail: NTIS HC A02/MF A01

A proposed round compact specimen was evaluated for its suitability for fatigue crack growth rate testing. The results were compared to results from standard compact specimens, and the two sepcimens were found to yield equivalent results. A number of K solutions were proposed for the round compact specimens, and these are reviewed. The agreement between the various solutions was good, and the Newman Equation was used to evaluate the present results. DOE

N80-23700# General Atomic Co., San Diego, Calif.
THERMAL STRESS ANALYSIS AND THE EFFECT OF TEMPERATURE DEPENDENCE OF MATERIAL PROPERTIES ON DOUBLET 3 LIMITER DESIGN
T. E. McKelvey, A. E. Koniges, F. Marcus, M. Sabado, and R. Smith Oct. 1979 8 p refs Presented at the 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract DE-AT03-76ET-51011)
(GA-A-15626; CONF-791102-48) Avail: NTIS HC A02/MF A01

Temperature and thermal stress parametric design curves are presented for two materials selected for Doublet 3 primary limiter applications. INC X-750 is a candidate for the medium Z limiter design and ATJ graphite for the low Z design. The dependence of significant material properties on temperature is shown and the impact of this behavior on the decision to actively or passively cool the limiter is discussed. DOE

N80-23701# General Atomic Co., San Diego, Calif.
BOUNDARY VALUE PROBLEMS OF THE CIRCULAR CYLINDERS IN THE STRAIN-GRADIENT THEORY OF LINEAR ELASTICITY
B. G. Kao Nov. 1979 43 p refs
(Contract DE-AT03-76ET-35300)
(GA-A-15142) Avail: NTIS HC A03/MF A01

Three boundary value problems in the strain-gradient theory of linear elasticity are solved for circular cylinders: the twisting of circular cylinders, uniformly pressuring of concentric circular cylinders, and pure-bending of simply connected cylinders. The comparisons of these solutions with the solutions in classical elasticity and in couple-stress theory reveal the differences in the stress fields as well as the apparent stress fields due to the influences of the strain-gradient. These aspects of the strain-gradient theory could be important in modeling the failure behavior of structural materials. DOE

N80-23702# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.
IMPLICIT STRAIN-HARDENING FORMULATION FOR CREEP ANALYSIS
B. R. Bass, W. G. Johnson, and S. V. McGrath May 1979 29 p refs
(Contract W-7405-eng-26)
(K/CSD/TM-30) Avail: NTIS HC A03/MF A01

A variable stiffness method for creep analysis is presented which utilizes a strain hardening theory of creep and an implicit time marching scheme. The formulation uses the change in stress and accumulated creep strain during a time interval to determine the corresponding creep strain increment. The method is suited for use in formulations of elastic plastic creep and large displacement, small strain analysis. Applications presented demonstrate that this implicit method offers numerical stability using relatively large time steps for which the conventional explicit scheme fails to function. DOE

N80-23703# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
THE INDENTATION OF AN ELASTIC LAYER BY A RIGID STAMP UNDER CONDITIONS OF COMPLETE ADHESION
J. P. Pauwelussen and J. B. Albias (Technische. Univ., Eindhoven, Netherlands) Aug. 1978 25 p refs Submitted for publication
(MC-TW-181/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The indentation of an elastic layer by a rigid stamp is treated under conditions of complete adhesion beneath the stamp, where the ratio of the half-width of the contact region and the thickness of the layer is assumed to be small. The cases of a flat stamp and a polynomial shaped one are considered successively and two applications are treated. Author (ESA)

N80-23704# Laboratoire Central des Ponts et Chaussees, Paris (France). Dept. des Betons et Metaux.
FATIGUE IN WELDED METAL STRUCTURES: AN INTRODUCTORY REPORT TO A RESEARCH PROGRAM
Pierre Brevet, Dominique Francois, Jean-Paul Gourmelon, and Andre Raharinaivo Nov. 1978 64 p refs In FRENCH; ENGLISH summary
(LPC-85) Avail: NTIS HC A04/MF A01

The problem of fatigue in welded metal structures is discussed using a review of the mathematical and physical theories of damage. The notions of lifetime and endurance of the parts subjected to fatigue are examined and the characteristic Woehler's and Goodman-Smith's diagrams are presented. The points in a metal structure carrying traffic which are most liable to the risks of fatigue damage are indicated. The influence of the characteristics of welded joints on the behavior of assemblies under fatigue is examined. The characteristics are either of a geometric nature, including porosity, blisters, and defects such as lack of fusion, or of a metallurgical origin. Ways of improving the behavior of welded joints under fatigue are indicated. Author (ESA)

N80-23705# European Space Agency, Paris (France).
CHANCES AND HANDICAPS OF ROD-BEAM THEORIES
Dieter Peterson Nov. 1979 39 p refs Transl. into ENGLISH of "Moeglichkeiten und. Grenzen der Stabtheorien", Rept. DFVLR-FB-78-13 DFVLR, Brunswick, Jul. 1978 Original report in GERMAN previously announced as N79-30583
(ESA-TT-568; DFVLR-FB-78-13) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 17,50

The assumptions inherent in the hypotheses of rod-beam theories, such as the one of Bernoulli suggesting even cross-sections under deformation, limit the accuracy of analysis. It is shown that for higher order terms geometrically nonlinear deformations are in contradiction with rod-beam hypotheses. The consistent use of differential calculus uncovers simultaneously geometric differences between current rod-beam theories of higher order. These differences are examined using simple examples. Author (ESA)

N80-23706# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
INTERACTIVE SIMULATION OF THE PROGRESSIVE COLLAPSE OF A BUILDING REVISITED
Per Loetstadt 1979 31 p refs Sponsored by Swedish Inst. of Applied Mathematics
(TRITA-NA-7921) Avail: NTIS HC A03/MF A01

A computer program is described which simulates the large scale behavior of a collapsing building. A two dimensional model is developed, where the walls and floors are regarded as rigid bodies. The numerical algorithm for solving the contact forces, accelerations, velocities and positions is discussed and its deficiencies are pointed out. A literature survey of the simulation of rigid body mechanical systems is included. Author (ESA)

N80-23707# Bristol Univ. (England). Dept. of Aeronautical Engineering.
THE EFFECT OF FOAMED HARD PLASTIC STIFFENERS ON ALUMINUM SHEAR WEBS B.S. Thesis
A. Breeze-Stringfellow and A. C. Duthie Jun. 1979 52 p refs
(BU-237) Avail: NTIS HC A04/MF A01

The effect of foamed hard plastic stiffeners on aluminum shear webs was investigated. Shear webs of varying gauges were tested with varying depths of stiffener, the stiffener width and spacing being kept constant. The foam used was Rohacell 31 and the aluminum was L72. The addition of foam stiffeners increased the workable stress and shear stiffness of the shear web. Above a certain depth of stiffener, no further increase of workable stress and web stiffness was found; it was this depth that was taken as the optimum value. Author (ESA)

N80-23708# Oxford Univ. (England). Dept. of Engineering Science.
PEAK WIND LOADS ON CLADDING PANELS AND THEIR DEPENDENCE UPON PANEL SIZE
M. E. Greenway 1979 45 p refs
(OUEL-1286/79) Avail: NTIS HC A03/MF A01

Peak wind induced loads on cladding panels fixed to the windward face of a building are considered. A total of two gust factor equations are derived which describe the ratio of the peak load on a cladding panel to the mean load. The equations do not apply if the panel is in a region of separated flow. The first equation is based on a linearized theory for the pressure developed on the windward face of a tall building; the second is a nonlinear form of the same equation. The equations are used to calculate peak loads on cladding panels positioned at various heights on a tall building. An explanation is offered for the observed relatively frequent failure of cladding panels at low levels on some tall buildings. Author (ESA)

N80-23709# Oxford Univ. (England). Dept. of Engineering Science.
AN ANALYSIS OF THE STATIC AND DYNAMIC INSTABILITY OF THICK CYLINDERS
John D. Renton 1979 20 p refs
(OUEL-1292/79) Avail: NTIS HC A02/MF A01

A general solution of Bolotin's differential equations for the dynamic stability of a homogenous isotropic medium is given. This takes the form of displacement functions, which express the solution as a sum of dilatational and distortional effects. Solutions are found for the vibration of cylinders of finite thickness when initial axial stresses are present. It is shown that simple vibration and simple buckling are cases of the general solution. The results are compared with approximate formulas for the buckling of thin cylinders and it is shown that the known solution for the natural frequency of unloaded cylinders is a particular case. Author (ESA)

N80-23492 Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
DAMPING IN STRUCTURAL JOINTS
C. F. Beards *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 9 Sep. 1979 p 35-41 refs (For primary document see N80-23490 14-31)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

N80-24252 Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
RECENT RESEARCH IN COMPOSITE AND SANDWICH PLATE DYNAMICS
C. W. Bert *In* Shock and Vibration Inform. Center. The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 13-23 refs (For primary document see N80-24250 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

N80-24253 State Univ. of New York at Buffalo. Dept. of Mechanical Engineering.
OPTIMIZATION TECHNIQUES FOR SHOCK AND VIBRATION ISOLATOR DEVELOPMENT
R. W. Mayne *In* Shock and Vibration Inform. Center. The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 25-33 refs (For primary document see N80-24250 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

N80-24256 Birla Inst. of Technology and Science, Pilani (India).
A SURVEY OF STRUCTURAL OPTIMIZATION UNDER DYNAMIC CONSTRAINTS
M. A. V. Rangacharyulu and G. T. S. Done (City Univ., London) *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 12 Dec. 1979 p 15-25 refs (For primary document see N80-24254 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

42 GEOSCIENCES (GENERAL)

N80-23710# Oak Ridge National Lab., Tenn. Environmental Science Div.
MODELING THE CIRCULATION OF CARBON IN THE WORLD'S TERRESTRIAL ECOSYSTEMS
W. R. Emanuel, G. G. Killough, and J. S. Olson 1979 40 p refs
(Contract W-7405-eng-26; Grant NSF DEB-77-26722)
(DOE/TIC-10293) Avail: NTIS HC A03/MF A01

A mathematical model for the circulation of carbon in the world terrestrial ecosystems is proposed. A five compartment representation is developed which corresponds to the functional components studied by field ecologists. Rate coefficients for this linear dynamic model are calculated from estimates of the 1970 standing crop and compartment exchanges of carbon. The model is analyzed in terms of response to a unit impulse, thereby displaying a transient time distribution. The response to a hypothetical pulse input through gross primary production is also simulated, illustrating the efficiency of the terrestrial carbon system in transferring carbon into longer storage components. The concept of CO_2 fertilization is examined by allowing gross primary production to increase in response to higher atmosphere concentrations. DOE

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-23711* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COAL-SHALE INTERFACE DETECTOR Patent
Harry Reid, Jr., inventor (to NASA) Issued 1 Apr. 1980 8 p Filed 3 Nov. 1977
(NASA-Case-MFS-23720-1; US-Patent-4,195,512; US-Patent-Appl-SN-848419; US-Patent-Class-73-12; US-Patent-Class-73-82) Avail: US Patent and Trademark Office CSCL 08I

A coal-shale interface detector for use with coal cutting equipment is described. The detector consists of a reciprocating hammer with an accelerometer to measure the impact of the hammer as it penetrates the ceiling or floor surface of a mine. Additionally, a pair of reflectometers simultaneously view the same surface, and the outputs from the accelerometer and reflectometers are detected and jointly registered to determine when an interface between coal and shale is being cut through.
Official Gazette of the U.S. Patent and Trademark Office

N80-23712 Utah Univ., Salt Lake City.
CATEGORIZATION OF WATERSHED LAND COVER UNITS WITH LANDSAT DATA Ph.D. Thesis
Thomas Delane Frank 1979 187 p
Avail: Univ. Microfilms Order No. 8010660

Unsupervised training procedures were used to statistically and spatially analyze spectral variation in LANDSAT-2 MSS data for a semiarid watershed in east-central Utah. Categorization of the signatures was accomplished with a factor analysis procedure. Interclass distances among all signatures were computed, and a standardization distance matrix entered into an oblique factor analysis. Factors derived from the reduction of interclass similarities among signatures were interpreted as core land cover categories. Each of the land cover categories is an integrated terrain unit, consisting of similar vegetation and surface geology. The optimum number of integrated terrain units is readily determined. Categorization of signatures with this methodology allows a researcher to evaluate the adequacy of the signatures generated in an unsupervised training approach to actually represent land cover variation. If the optimum number of land cover categories is not known prior to classification of LANDSAT data, the basic number as represented in the LANDSAT signatures, is identified by this method which contributes to the labelling and categorization of individual signatures to the core land cover categories.
Dissert. Abstr.

N80-23713 Pennsylvania State Univ., University Park.
HYDROLOGIC EVALUATION OF THE STORMFLOW GENERATION PROCESS ON A FORESTED WATERSHED Ph.D. Thesis
Edward Sisk Corbett 1979 149 p
Avail: Univ. Microfilms Order No. 8010041

An irrigation system was designed to apply a uniform amount of simulated rainfall to parts or all of a 19.59 acre experimental watershed in central Pennsylvania. To delineate the stormflow contributing areas and to evaluate their relative efficiency in converting rainfall into stormflow, a series of simulated rainfall applications were made, starting with the channel area and progressively increasing the application areas up the side slopes. The applications were made at both dry and wet antecedent soil moisture conditions and at three primary application amounts, 0.96, 1.50, and 1.92 inches. All rainfall applications were made at the rate of 0.24 inches per hour. There was a rapid reduction in the efficiency with which rainfall is converted to stormflow as distance from the perennial stream channel increases under dry antecedent soil moisture conditions. Under wet antecedent soil moisture conditions the watershed contributes to stormflow in a more uniform manner and the stormflow components becomes highly correlated with storm amount. There was large increase in the efficiency with which the middle and upper slope soil zones converted rainfall into quickflow as positive hydraulic gradients became established in these areas of the watershed.
Dissert. Abstr.

N80-23714 Colorado Univ. at Boulder.
LAND USE INTENSITY AND WATER QUALITY Ph.D. Thesis
Donald William Duckson, Jr. 1979 181 p
Avail: Univ. Microfilms Order No. 8011272

The relationship between land use and water quality in three watersheds tributary to the Potomac is as examined. Specfically concomitant changes in water quality which result from land use alterations were determined. A predictive device for estimating the rate and direction fo water quality changes brought about by a mosaic of land uses which themselves, are in flux, was developed. Mosaics of land uses were evaluated using and empirically-derived index of land use intensity. Index values were used as the independent varible in a series of regression equations which dissolved oxygen, pH, total dissolved solids, total iron, and total hardness (EDTA) were dependent varibles. Regressions provided statistically significant: results only for TDS, iron, and hardness and indicate a predictable rate of change for selected water quality parameters with changes in the intensity of land use. No distinction between classes of land use was possible.
Dissert. Abstr.

N80-23715*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): USER'S GUIDE
A. M. Fails, Principal Investigator Dec. 1979 77 p ERTS
(Contract NAS9-15800)
(E80-10088; NASA-CR-160531; LEC-14286; JSC-16436)
Avail: NTIS HC A04/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-23716*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
A METHOD FOR CLASSIFYING MULTISPECTRAL REMOTE SENSING DATA USING CONTEXT
Philip H. Swain, Howard J. Siegel, and Bradley W. Smith, Principal Investigators 1979 11 p refs Presented at the Machine Process of Remotely Sensed Data Symp., 1979 ERTS
(Contract NAS9-15466)
(E80-10089; NASA-CR-160477; Rept-062379) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23717*# Lockheed Electronics Co., Houston, Tex.
OPERATIONS MANUAL FOR THE LANDSAT IMAGERY, VERIFICATION AND EXTRACTION SYSTEM (LIVES)
L. E. Giddings, Principal Investigator Aug. 1979 83 p ERTS
(Contract NAS9-15800)
(E80-10090; NASA-CR-160475; LEC-12903; JSC-14633)
Avail: NTIS HC A05/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23718*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
USERS MANUAL FOR THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)
L. E. Giddings, Principal Investigator Aug. 1979 52 p ERTS
(Contract NAS9-15800)
(E80-10091; NASA-CR-160474; LEC-12902; JSC-14632)
Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23719*# National Governors Association/Council of State Planning Agencies, Washington, D. C.
EARTH RESOURCES DATA PROJECT Final Report, 1 Aug. - 30 Sep. 1979
Feb. 1980 96 p ERTS
(Contract NASw-3140)
(E80-10092; NASA-CR-162802) Avail: NTIS HC A05/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23720*# Lockheed Electronics Co., Houston, Tex.
CROP PHENOLOGY LITERATURE REVIEW FOR CORN, SOYBEAN, WHEAT, BARLEY, SORGHUM, RICE, COTTON, AND SUNFLOWER
T. Hodges and P. C. Doraiswamy, Principal Investigators Nov. 1979 90 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for Intern. Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10093; NASA-CR-160469; SR-L9-00409; LEC-13722; JSC-16088) Avail: NTIS HC A05/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-23721*# Fort Lewis A&M Coll., Durango, Colo.
DEVELOPMENT OF A WINTER WHEAT ADJUSTABLE CROP CALENDAR MODEL Final Report
James R. Baker, Principal Investigator 31 Dec. 1979 83 p refs ERTS
(Contract NAS9-15276)
(E80-10094; NASA-CR-160447) Avail: NTIS HC A05/MF A01 CSCL 02C

The author has identified the following significant results. Least squares techniques were applied for parameter estimation of functions to predict winter wheat phenological stage with daily maximum temperature, minimum temperature, daylength, and precipitation as independent variables. After parameter estimation, tests were conducted using independent data. It may generally be concluded that exponential functions have little advantage over polynomials. Precipitation was not found to significantly affect the fits. The Robertson triquadratic form, in general use for spring wheat, yielded good results, but special techniques and care are required. In most instances, equations with nonlinear effects were found to yield erratic results when utilized with averaged daily environmental values as independent variables.

N80-23722*# Council of State Governments, Lexington, Ky.
INTEGRATED USE OF LANDSAT DATA FOR STATE RESOURCE MANAGEMENT
William G. Schneider, Jr., Principal Investigator 1979 41 p refs ERTS
(Contract NASw-3140)
(E80-10095; NASA-CR-162809) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23723*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): UNIVAL SOFTWARE USER'S GUIDE
A. S. Story and M. V. Martin, Principal Investigators Dec. 1979 55 p ERTS
(Contract NAS9-15800)
(E80-10096; NASA-CR-160532; LEC-14287; JSC-16437) Avail: NTIS HC A04/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-23724*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): ACCEPTANCE TEST PROCEDURES
M. L. Brown, M. V. Martin, and A. S. Story, Principal Investigators Dec. 1979 52 p ERTS
(Contract NAS9-15800)
(E80-10097; NASA-CR-160533; LEC-14288; JSC-16438) Avail: NTIS HC A04/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-23725*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AGRICULTURAL SOIL MOISTURE EXPERIMENT: 1978 COLBY (KANSAS) DATA CATALOG AND DOCUMENTATION
B. W. Milstead, Principal Investigator Sep. 1979 176 p refs ERTS
(Contract NAS9-15800)
(E80-10098; NASA-CR-160473; LEC-13226; JSC-16229) Avail: NTIS HC A09/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-23726*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
VARIABILITY OF CROP CALENDAR STAGE DATES
M. L. Sestak, T. Hodges, and J. A. Artley, Principal Investigators Jan. 1980 23 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10099; NASA-CR-160468; LEMSCO-14070; SR-L0-00416; JSC-16309) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-23727*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM: CORRECTIONS TO FOREST REFLECTANCE AS A FUNCTION OF LOW SUN ANGLE AND SLOPE
W. H. Echert and C. E. Campbell, Principal Investigators Jun. 1979 36 p refs Sponsored in part by USDA ERTS
(Contract NAS9-15800)
(E80-10100; NASA-CR-160470; LEC-13188) Avail: NTIS HC A03/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-23728*# National Governors Association/Council of State Planning Agencies, Washington, D. C.
LANDSAT'S ROLE IN STATE COASTAL MANAGEMENT PROGRAMS
Oct. 1979 18 p Sponsored by NASA ERTS
(E80-10101; NASA-CR-162810) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23729*# National Governors Association/Council of State Planning Agencies, Washington, D. C.
LANDSAT'S ROLE IN HUD 701 PROGRAMS
Oct. 1979 15 p Sponsored by NASA ERTS
(E80-10102; NASA-CR-162811) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-indentified significant results in this report.

N80-23730*# Instituto de Pesquisas Especiais, Sao Jose dos Campos (Brazil).
LANDSAT RECONNAISSANCE IMAGES OF THE GREAT SOIL REGION IN THE WESTERN PART OF THE PARAIBA BASIN [RECONHECIMENTO DOS GRANDES DOMINIOS PEDOLOGICOS DA BACIA DO PARAIBA (PARTE OCIDENTAL) ATRAVES DE IMAGENS LANDSAT]
Nelson DeJesusParada, Principal Investigator, Mario Valerio Filho, Jose Pereira deQueirozNeto, Natalio Felipe Koffler, Paulo Nakashima, Juercio Tavares deMattos, Nilton Tocicazu Higa, and Vitor Celso deCarvalho Nov. 1979 55 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E80-10103; NASA-CR-162812; INPE-1623-RPE/088) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23731*# Purdue Univ., Lafayette, Ind.
SAMPLING FOR AREA ESTIMATION: A COMPARISON OF FULL-FRAME SAMPLING WITH THE SAMPLE SEGMENT APPROACH
Marilyn Hixson, Marvin E. Bauer, and Barbara J. Davis, Principal Investigators (Bell Telephone Co., Indianapolis) 1979 8 p refs Presented at the Machine Process. of Remotely Sensed Data Symp., 1979 ERTS
(Contract NAS9-14970)
(E80-10104; NASA-CR-160479; Rept-06277) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. Full-frame classifications of wheat and non-wheat for eighty counties in Kansas were repetitively sampled to simulate alternative sampling plans. Evaluation of four sampling schemes involving different numbers of samples and different size sampling units shows that the precision of the wheat estimates increased as the segment size decreased and the number of segments

was increased. Although the average bias associated with the various sampling schemes was not significantly different, the maximum absolute bias was directly related to sampling size unit.

N80-23732*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
EVALUATION OF SEVERAL SCHEMES FOR CLASSIFICATION OF REMOTELY SENSED DATA: THEIR PARAMETERS AND PERFORMANCE
Donna Scholz, Nancy Fuhs, Marilyn Hixson, and Tsuyoshi Akiyama, Principal Investigators. 1979. 14 p. refs. ERTS.
(Contract NAS9-15466)
(E80-10105; NASA-CR-160478; LARS-TR-041279) Avail: NTIS. HC A02/MF A01. CSCL 05B.

The author has identified the following significant results. Data sets for corn, soybeans, winter wheat, and spring wheat were used to evaluate the following schemes for crop identification: (1) per point Gaussian maximum classifier; (2) per point sum of normal densities classifiers; (3) per point linear classifier; (4) per point Gaussian maximum likelihood decision tree classifiers; and (5) texture sensitive per field Gaussian maximum likelihood classifier. Test site location and classifier both had significant effects on classification accuracy of small grains; classifiers did not differ significantly in overall accuracy, with the majority of the difference among classifiers being attributed to training method rather than to the classification algorithm applied. The complexity of use and computer costs for the classifiers varied significantly. A linear classification rule which assigns each pixel to the class whose mean is closest in Euclidean distance was the easiest for the analyst and cost the least per classification.

N80-23733*# Department of Agriculture, Weslaco, Tex. Science and Education Administration.
PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Dec. 1979 - 1 Mar. 1980
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators. Mar. 1980. 9 p. HCMM.
(Contract NASA Order S-40198-B)
(E80-10106; NASA-CR-162817) Avail: NTIS. HC A02/MF A01. CSCL 08B.

The author has identified the following significant results. HCMM day/night coverage 12 hours apart cannot be obtained at 26 deg N latitude; nor have any pairs 36 hours apart been obtained. A day-IR scene and a night scene for two different dates were analyzed. A profile across the test site for the same latitude shows that the two profiles are near mirror images of each other over land surfaces and that the temperature of two large water bodies, Falcon Reservoir and the Gulf of Mexico, are nearly identical on two dates. During the time interval between overpasses, the vegetative cover remained static due to winter dormancy. The data suggest that day/night temperature differences measured weeks apart may yield meaningful information about the contrast between daytime maximum and nighttime minimum temperatures for a given site.

N80-23734*# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
APPLICATION EXPLORER MISSION A: HEAT CAPACITY MAPPING MISSION
R. Haydn, Principal Investigator. [1979] 3 p. Sponsored by NASA. HCMM.
(E80-10107; NASA-CR-162818) Avail: NTIS. HC A02/MF A01. CSCL 08B.

There are no author-identified significant results in this report.

N80-23735*# Consiglio Nazionale delle Ricerche, Milan (Italy). Istituto per la Geofisica della Litosfera.
STUDY OF GEOLOGICAL STRUCTURE OF SICILY AND OTHER ITALIAN AREAS Progress Report
Robert Cassinis, Giovanni Maria Lechi, Principal Investigators, Pietro Alessandro Brivio, Renzo Moretti, and Eugenio Zilioli. Jan. 1980. 9 p. Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM.
(E80-10108; NASA-CR-162819; RN-304; PR-2) Avail: NTIS. HC A02/MF A01. CSCL 08B.

There are no author-identified significant results in this report.

N80-23736*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INTEGRATED SURVEYS OF THE NATURAL RESOURCES IN THE AMAZONIA NATIONAL PARK (TOPAJOS) BASED ON LANDSAT IMAGES [LEVANTAMENTO INTEGRADO DOS RECURSOS NATURAIS DA AREA DO PARQUE NACIONAL DA AMAZONIA (TAPAJOS), BASEADO NAS IMAGENS MSS DO LANDSAT]
Nelson deJesusParada, Principal Investigator, Joaquim Henrique Duran Pinto, Joao Roberto dosSantos, Liu Chan Chiang, Madalena Niero, Sergio dosAnjos Ferreira Pinto, and Vitor Celso deCarvalho. Sep. 1979. 59 p. refs. In PORTUGUESE; ENGLISH summary. Sponsored by NASA. Original contains color illustrations. ERTS.
(E80-10109; NASA-CR-162820; INPE-1577-RPE/074) Avail: NTIS. HC A04/MF A01. CSCL 08F.

There are no author-identified significant results in this report.

N80-23737*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AUTOMATIC INTERPRETATION OF LANDSAT DATA TO CHARACTERIZE THE DISPERSION OF SUSPENDED SEDIMENTS IN ARTIFICIAL RESERVOIRS [ANALISE AUTOMATICA DE DADOS LANDSAT NO ESTUDO DA DISPERSAO DE SEDIMENTOS EM SUSPENSAO EM RESERVATORIOUS ARTIFICIAIS]
Nelson deJesusParada, Tania Maria Sausen, and Vitor Celso deCarvalho, Principal Investigators. Sep. 1979. 40 p. refs. In PORTUGUESE; ENGLISH summary. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS.
(E80-10110; NASA-CR-162821; INPE-1572-RPE/071) Avail: NTIS. HC A03/MF A01. CSCL 05B.

There are no author-identified significant results in this report.

N80-23738*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE SOLUTION OF PROBLEMS IN THE MANAGEMENT OF RESOURCES IN INDIANA Semiannual Status Report, 1 Dec. 1978 - 31 May 1979
R. A. Weismiller and R. P. Mroczinski, Principal Investigators. 31 May 1979. 32 p. refs. ERTS.
(Grant NGL-15-005-186)
(E80-10111; NASA-CR-162853; LARS-053079) Avail: NTIS. HC A03/MF A01. CSCL 05A.

There are no author-identified significant results in this report.

N80-23739*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
APPLICABILITY OF SELECTED WHEAT REMOTE SENSING TECHNOLOGY TO CORN AND SOYBEANS Final Report, 1 Nov. 1978 - 30 Nov. 1979
Quentin A. Holmes, William A. Malila, Principal Investigators, D. P. Rice, and E. P. Crist. Jan. 1980. 38 p. refs. ERTS.
(Contract NAS9-15082)
(E80-10112; NASA-CR-160546; ERIM 124000-9-F) Avail: NTIS. HC A03/MF A01. CSCL 02C.

There are no author-identified significant results in this report.

N80-23740*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AGRICULTURAL SCENE UNDERSTANDING AND SUPPORTING FIELD RESEARCH, VOLUME 1 Final Report, 1 Dec. 1978 - 30 Nov. 1979
D. A. Landgrebe, Principal Investigator, M. E. Bauer, L. L. Biehl, C. S. T. Daughtry, B. F. Robinson, and E. R. Stover. Nov. 1979.

140 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior and Agency for International Development. ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10113; NASA-CR-160547; SR-P9-00410;
LARS-112879) Avail: NTIS HC A07/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23741*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
PROCESSING TECHNIQUES DEVELOPMENT, VOLUME 2. PART 1: CROP INVENTORY TECHNIQUES Final Report, 1 Dec. 1978 - 30 Nov. 1979
D. A. Landgrebe, Principal Investigator, C. S. T. Daughtry, and M. M. Hixson Nov. 1979 78 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10114; NASA-CR-160548; SR-P9-00411;
LARS-112979) Avail: NTIS HC A05/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23742*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
PROCESSING TECHNIQUES DEVELOPMENT, VOLUME 3. PART 2: DATA PREPROCESSING AND INFORMATION EXTRACTION TECHNIQUES Final Report, 1 Dec. 1978 - 30 Nov. 1979
D. A. Landgrebe, Principal Investigator, P. H. Swain, P. E. Anuta, and H. J. Siegel Nov. 1979 155 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior and Agency for International Development Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10115; NASA-CR-160549; SR-P9-00412;
LARS-113079) Avail: NTIS HC A08/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-23743*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
COMPUTER PROCESSING SUPPORT, VOLUME 4 Final Report, 1 Dec. 1978 - 30 Nov. 1979
D. A. Landgrebe, Principal Investigator, J. L. Kast, L. A. Kraemer, B. M. Shelley, S. K. Schwingendorf, and T. L. Phillips Nov. 1979 136 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for Intern. Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10116; NASA-CR-160550; SR-P9-00413;
LARJ-120179) Avail: NTIS HC A07/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23744*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
CORN/SOYBEAN DECISION LOGIC: IMPROVEMENTS AND NEW CROPS
C. L. Dailey, K. M. Abotteen, and J. D. Nichols, Principal Investigators Jan. 1980 91 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10118; NASA-CR-160543; FC-Lo-00420;
LEMSCO-14084; JSC-16301) Avail: NTIS HC A05/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23745*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
INTERPRETATION OF LANDSAT DIGITAL DATA USING A CUBIC COLOR MODEL BASED ON RELATIVE ENERGIES
R. B. Cate, D. E. Phinney, M. C. Kinsler, M. L. Seetak, T. Hodges, and J. J. Dishler, Principal Investigators Feb. 1980 31 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10119; NASA-CR-160541; SR-LO-00418;
LEMSCO-13499) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-23746*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
NEUTRON-METER CALIBRATION FOR THE 1979 COLBY SOIL MOISTURE EXPERIMENT
Lalit M. Arya, Principal Investigator Feb. 1980 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10120; NASA-CR-160553; SR-LO-00415;
LEMSCO-14082; JSC-13775) Avail: NTIS HC A03/MF A01 CSCL 08M
There are no author-identified significant results in this report.

N80-23747*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
COMPOSITION AND ASSEMBLY OF A SPECTRAL DATA BASE FOR TRANSITION YEAR SPRING WHEAT BLIND SITES
M. H. Trenchard, M. L. Seetak, and M. C. Kinsler, Principal Investigators Jan. 1980 114 p ref Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10121; NASA-CR-160544; SR-LO-00417;
LEMSCO-14069; JSC-16273) Avail: NTIS HC A06/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23748*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
CROP YIELD LITERATURE REVIEW FOR AGRISTARS CROPS: CORN, SOYBEANS, WHEAT, BARLEY, SORGHUM, RICE, COTTON, AND SUNFLOWERS
P. C. Doraiswamy, T. Hodges, and D. E. Phinney, Principal Investigators Dec. 1979 106 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10122; NASA-CR-160542; SR-LS-00406; LEC-13791;
JSC-16320) Avail: NTIS HC A06/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23749# Army Engineer Topographic Labs., Fort Belvoir, Va.
RESEARCH FOR INFORMATION EXTRACTION FROM AERIAL IMAGERY
Robert D. Leighty Oct. 1979 14 p refs Presented at the Remote Sensing Symp., Ft. Belvoir, Va., 29-31 Oct. 1979
(AD-A080744; ETL-R001) Avail: NTIS HC A02/MF A01 CSCL 05/8
The U.S. Army Engineer Topographic Laboratories is investigating a number of approaches to information extraction from aerial imagery. Two approaches will be discussed in this paper: automated feature extraction research and computer-assisted photo interpretation research. The discussion of automated information extraction indicates present day capabilities of automated systems, problems facing automated information extraction, and directions which basic research must take to achieve automated 'smart analysis systems' in the distant future. The discussion of computer-assisted photo interpretation will describe the research system now being developed and experiments for research which is expected to have value in the near future for increasing the quality and efficiency of the total information extraction processes. GRA

N80-23755# Defense Mapping Agency, Washington, D.C.
AUTOMATION IN PHOTOGRAMMETRY
James B. Case 25 Jul. 1980 14 p refs
(AD-A081562) Avail: NTIS HC A02/MF A01 CSCL 08/2

All functional aspects of photogrammetry, i.e., triangulation mensuration, elevation data extraction, planimetric data extraction, and rectification and orthorectification, are now being automated to some degree. Automation extends from computer control of comparators and analog stereo plotters, through the analytical stereoplotters, to orthophoto printers and fully automated correlation equipment. The drive towards automation has been triggered not only by the continuing necessity to reduce costs, but also by the need to generate new products (e.g., DTM, land use, etc.) and to utilize other than conventional mapping photography. These have led, in turn, to the necessity for data editing and data management systems. The trend in the future will be towards the ever-increasing use of digital image processing technology. Examples of several levels of automation in photogrammetry are described. GRA

N80-23751# Army Engineer Studies Center, Washington, D. C. Computer Sciences Lab.
APPLICATIONS OF DIGITAL DISPLAY IN PHOTOINTERPRETATION AND DIGITAL MAPPING
Bryce L. Schrock Jan. 1980 15 p refs
(AD-A081091; ETL-R004) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Digital Image Analysis Laboratory (DIAL) at USAETL is a large-scale interactive system designed for research and development activities in digital image processing. The system has been successfully applied to a variety of investigations in both digital mapping and photointerpretation as described in this presentation. Recently a Demonstration Image Processing System (DEMONS) has been added to the DIAL system to serve as a high-speed work station for processing very large digital images. Although DEMONS has been reasonably successful in manipulating large images, its limitations indicate that future such systems might be hybrid systems combining the best features of both hardcopy (film) and softcopy (cathode ray tube) exploitation systems. GRA

N80-23752# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
OCEANOGRAPHIC REMOTE SENSING: A POSITION PAPER
R. Goodman, J. Bailey, J. Gallagher, R. Kurk, R. Nagle, V. Moble, A. Pressman, and K. VanSickle 26 Jan. 1979 26 p
(AD-A081494) Avail: NTIS HC A03/MF A01 CSCL 22/2

The purpose of a Navy R D remote sensing plan should be to set forth the requirements and direction of basic and exploratory research in satellite remote sensing which supports the overall Navy oceanographic research and operational programs. The aim of the plan would be to outline the established requirements, objectives, current and planned research programs necessary to achieve the ultimate goals of improved environmental support to the fleet. While the plan will be primarily directed toward 6.1 and 6.2 programs, appropriate consideration for coordination of 6.3 - 6.6 requirements should be addressed. The plan should help serve as a single technology and program reference for implementation and planning of Navy related satellite remote sensing programs. Fundamentally, the plan would: (1) set forth the manner and rate with which the Navy research program should proceed in order to successfully exploit environmental satellite systems supporting Navy and DOD oceanographic requirements, (2) provide guidance to the Assistant Secretary of the Navy for Research, Engineering and Systems (ASNRES) and the Chief of Naval Research in overall program planning, (3) provide research programs which will support the objective of the Naval Oceanographic and Meteorological Support System (NOMSS) Environmental Satellite Plan for predictions for Naval operations. GRA

N80-23753# Army Engineer Topographic Labs., Fort Belvoir, Va.
DIGITAL SCREENING AND HALFTONE TECHNIQUES FOR RASTER PROCESSING
Richard L. Rosenthal 14 Jan. 1980 13 p refs
(AD-A081090; ETL-R003) Avail: NTIS HC A02/MF A01 CSCL 14/5

The development of raster processing programs at USAETL has included programs for the generation of raster plot data containing cartographically symbolized features as well as the more widely investigated raster-to-vector software. Raster plot data may be used to generate film negatives with open window areas over which mechanical screens can be placed by conventional contact printing techniques. These areas can also be filled with digitally generated screens, a capability unique with the raster approach. Further, since most available raster plotting hardware does not permit the modulation of each pixel for intensity, it is desirable to control groups of pixels in order to approximate a halftone dot for color or density control. A study was made to determine the suitability of the 25 micron pixel raster on the Digital Laser Platemaker for the generation of digital screens for absolute color and process color printing. Tests will be conducted to establish screen pattern and angle criteria to achieve desired results without moire. An associated literature search resulted in a fairly comprehensive bibliography of work published in the digital screening field. GRA

N80-23754# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
REMOTE SENSING OF AQUATIC PLANTS Final Report, Sep. 1975 - Sep. 1977
Katherine S. Long Oct. 1979 103 p refs
(AD-A081737; WES-TR-A-79-2) Avail: NTIS HC A06/MF A01 CSCL 14/5

This report summarizes a 3 year effort in evaluating the various available remote sensing methods for identification and assessment of expanses of aquatic plants. Both materials and techniques are examined for cost effectiveness and capability to sense aquatic plants on both the local and regional scales. Computer simulation of photographic responses was employed; LANDSAT, high-altitude photography, side-looking airborne radar, and low-altitude photography were examined to determine the capabilities of each for identifying and assessing aquatic plants. Results of the study revealed LANDSAT to be the most cost effective for regional surveys, although its coarse resolution would be limiting in some cases. High-quality, high-altitude false-color infrared film showed great potential for species identification. Model studies borne out by field demonstrations showed black-and-white infrared photography to have a strong potential for discriminating infested from uninfested areas, with less associated cost than when false-color infrared is used. False-color infrared does show the greatest potential for discriminating among species. Ground-truth information concerning a specific area aids materially in the mapping. Examples of photographs, maps, and cost analyses of two demonstration projects conducted at Lake Marion, South Carolina, and Lake Seminole Florida, are included. GRA

N80-23755# Geokinetics, Inc., Concord, Calif.
GEOKINETICS IN SITU SHALE OIL RECOVERY PROJECT Annual Report, Mar. 1979
Mar. 1979 61 p
(Contracts ET-78-F-03-1787; DE-FC20-78LC-0787)
(LETC-10787-25; AR-2) Avail: NTIS HC A04/MF A01

Eighteen in situ retorts were constructed, ranging in size from 330 tons to 46,000 tons. Eleven of these retorts were burned, and a total of 5400 barrels of shale oil were recovered. Oil shale thicknesses of 30 feet, and cross-sectional areas of 3800 square feet were successfully blasted. The results are encouraging, and the project will continue to scale up its size of the operation in 1979. DOE

N80-23756# University of Southern California, Marina del Rey. Medical Imaging Sciences Group.
REMOTE SENSING FOR GEOTHERMAL ENVIRONMENTAL ASSESSMENTS Final Report
W. Frei, T. Shibata, and G. C. Huth 30 Jun. 1979 35 p refs
Sponsored in part by California Univ., Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15108) Avail: NTIS HC A03/MF A01

The role of remote sensing is examined in the context of the DOE Environmental Assessment Studies. Particular attention is paid to the exploitation by computer analysis, of low altitude aerial photographs, which were made available for this project.

One technique, change detection, developed during this project, was found to be particularly useful because it permits the detection of environmental changes at a very early stage where it might escape detection on the ground. This technique, which was perfected for use on a routine basis, can thus provide a very effective environmental early warning capability. Several examples are shown in known Geothermal Resource Areas (KGRA's) in the Imperial Valley and the Geysers, California, which lead to the conclusion that remote sensing become an essential tool for the Environmental Assessment Studies. DOE

N80-23757# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
DEVELOPMENT AND TESTING OF A MICROWAVE SYSTEM TO MEASURE COAL LAYER THICKNESS UP TO 25 cm
K. C. Roe and D. A. Ellerbruch Jan. 1979 27 p refs
(Contract ET-77-I-01-8881)
(FE-8881-1; SR-723-8-79) Avail: NTIS HC A03/MF A01

The design, construction and testing of a microwave coal thickness indicator built to demonstrate the hypothesis that an electromagnetic coal interface detector (EMCID) corrected for surface admittance variation can measure coal thickness up to 25 cm within + or - 10 percent accuracy is described. The design is based upon the FM-CW radar technique where reflections from layered strata are detected in time relationship to propagation path lengths. Relative depths to layered strata are displayed in numerical digits. Determining the thickness of the coal layer left on mine-haulageway roofs is important for both mine safety and maximum coal recovery. A specified thickness is required in many mines to maintain roof strength and to prevent exposure of the overlying slate or shale to air, which deteriorates slate and shale. DOE

N80-23758# California Univ., Livermore. Lawrence Livermore Lab.
CHABOT OBSERVATORY REMOTE SENSING EXPERIMENTS (CORSE) Progress Report, 1978 - 1979
W. M. Porch, T. R. Galloway, T. J. Greens, J. O. Waidl, and P. T. Futshcer Jan. 1980 30 p refs
(Contract W-7405-eng-48)
(UCID-18504) Avail: NTIS HC A03/MF A01

A cooperative effort yielded several important results and new techniques for remote sensing of atmospheric parameters. An electro-optical system was developed which simultaneously analyzes regional scale atmospheric constituents such as aerosols H2O, O2, NO2, and O3 while measuring long path averaged wind and atmospheric turbulence in the San Francisco Bay Area. Improvement of these techniques will permit the remote determination of vertical temperature profiles inversion heights, heat fluxes and vertical gradient wind speeds. DOE

N80-23759# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
REMOTE SENSING METHODS FOR DETERMINATION OF SLANT RANGE VISIBILITY
Christian Werner Mar. 1979 49 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-627)
(DFVLR-FB-79-14) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8.70

The various known methods for the determination of the slant visual range are reviewed and compared. Emphasis is placed on a discussion of laser radar systems for use in aircraft landing operations. Based on considerations related to accuracy and technical complexity, a measurement method is proposed for visibility distances of up to 1500 m and altitudes of 100 m. Author (ESA)

N80-23760# Amsterdam Univ. (Netherlands). Lab. of Physical Geography.
POINTBARS: A COMPARATIVE EXAMINATION ALONG THE LARGE DUTCH RIVERS [POINTBARS: EEN VERGELIJKEND ONDERZOEK LANGS DE NEDERLANDSE GROTE RIVIEREN]
N. Boekhorst, H. Duimelaar, K. Jurrians, J. vanderMeer, B. Meijer, R. Smit, L. Taekema, and H. vanVeen 1977 67 p refs In DUTCH
(Rept-2) Avail: NTIS HC A04/MF A01

Pointbars were studied in the vicinity of the rivers Yssel, Waal, and Maas. The method of study is described, including field work and data processing. The genesis of pointbars is treated in the form of a literature study. The three regions are compared, and the age of the pointbars discussed. Author (ESA)

N80-23761# Amsterdam Univ. (Netherlands). Lab. of Physical Geography.
VOORNE-PUTTEN: A LANDSCAPE-ECOLOGICAL SURVEY [VOORNE-PUTTEN: EEN LANDSCHAPSECOLOGISCH ONDERZOEK]
T. W. M. Levelt, A. J. J. Bolt, C. Kwakernaak, and A. P. A. Vink 1978 123 p refs In DUTCH
(Rept-4) Avail: NTIS HC A06/MF A01

A land-use plan for part of the Rhine delta is presented. The methodology of the surveys is described. Changes in land utilization are shown, as determined by natural causes, as well as man-made incursions. Beaches and dunes are evaluated for their potential as recreation areas and bird sanctuaries, and a study made of the impact of urbanization. Author (ESA)

N80-23762# European Space Agency, Paris (France).
CLASSIFICATION OF MULTISPECTRAL REMOTE SENSING DATA
Peter Haberaecker Nov. 1979 64 p refs Transl. into ENGLISH of "Untersuchungen zur Klassifizierung Multispektraler Bilddaten aus der Fernerkundung", Rept. DLR-FB-77-72, Oberpfaffenhofen, West Germany, Jul. 1978 Original report in GERMAN previously announced as N79-30697 Original German report available from ZLDI, Munich DM 108.10 Original contains color illustrations
(ESA-TT-571; DLR-FB-77-72) Avail: NTIS HC A04/MF A01

Different concepts pertinent to classification are defined and a mathematical model, subsequently derived, is described. Various classifiers are theoretically considered. A synthetic and a natural scene, taken from a multispectral aerial photograph, are used to test and illustrate the efficiency of the various classifiers. Results are compared and performance criteria is evolved. Further algorithms are evaluated for feature selection and computation of indexes showing the a priori quality of classification. Finally, an example within the context of regional planning is examined using the classification of multitemporal image data. Author (ESA)

N80-23763# Department of the Army, Washington, D. C.
UNIVERSAL TRANSVERSE MERCATOR GRID TABLES FOR LATITUDES 0-80 DEGREES CLARKE 1866 SPHEROID (METERS). VOLUME 2: TRANSFORMATION OF COORDINATES FROM GRID TO GEOGRAPHIC
Jun. 1958 258 p Sponsored by NOAA
(PB80-140411; DA-TM-5-241-4/2; NOAA-80011603) Avail: NTIS HC A12/MF A01 CSCL 08B

Tables are presented to facilitate the transformation of coordinates, as well as the computation of scale factors and convergence of the meridians. All such computations consist essentially of the algebraic summation of the products of north-south factors by powers of east-west factors. The north-south factors are obtained by interpolation; the east-west factors are expressions of the distance from the central meridian. Certain factors of small and slow changing numerical value are expressed by graphs from which the desired term may be interpolated, using both the north-south and east-west factors as arguments. The tables give the following precisions: Grid coordinates to geographic coordinates + or - 0.001 second; convergence of the meridians; + or - 0.01 second; and reduction of lengths by scale factor; + or - in the seventh significant figure. GRA

N80-23764# Economics, Statistics and Cooperatives Service, Washington, D. C. Natural Resources Economics Div.
INTERPRETING LAND USE CHANGE THROUGH SATELLITE IMAGERY
Linda K. Lee Dec. 1979 24 p refs
(PB80-127277; AER-442) Avail: NTIS HC A02/MF A01 CSCL 08B

Employing a multiperiod approach to monitor land use change may compound the problems associated with interpretation of satellite imagery. Data from satellite imagery were used to

inventory new cropland development in the Great Plains and 85 counties in the Southeastern Alluvium Coast and Tidewater region between 1972 and 1976. Cloud cover problems, intensified by the two-period approach used, made data more difficult to interpret. Field checks were also more difficult because of the scattered and irregularly shaped land use change sites. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-23765 Southern Methodist Univ., Dallas, Tex.
AMPHOTERIC GALLIUM ARSENIDE HETEROFACE SOLAR CELLS Ph.D. Thesis
Samuel Walter Beal 1979 124 p
Avail: Univ. Microfilms Order No. 8010704

The fabrication of a heteroface AlGaAs/GaAs solar cell by liquid phase epitaxy is presented. An amphoteric pn junction produced from a single GaAs:Si melt forms the base. A subsequent Al.85Ga.15As:Ge layer was deposited to provide an optical 'window' to the cell. The three layer structure was produced, then, from only two growth melts. The benefits of the window layer are demonstrated by spectral response comparisons. The efficiency is reported to be > 14 percent (1 AM1 sun). This is without an anti-reflection coating and does not account for the loss due to the contact area. The main advantage to this system is the improved minority carrier diffusion lengths obtained as compared to typical diffused-junction GaAs solar cell devices. The minority carrier properties were observed experimentally. The impurity profile was determined by capacitance measurements to be approximately linear and extending beyond the nominal depletion region boundary. The built-in electric field resulting from the grading in the quasi-neutral region was applied, for the first time, to the current mechanisms of a solar cell device. Dissert. Abstr.

N80-23766 Brown Univ., Providence, R. I.
SOLAR CELL HETEROJUNCTIONS INVOLVING N-CADMIUM SULFIDE AND CERTAIN P-TYPE SEMICONDUCTOR SINGLE CRYSTALS Ph.D. Thesis
Arienzo Maurizio 1979 214 p
Avail: Univ. Microfilms Order No. 8006969

The fabrication and testing of heterojunction photovoltaic solar cells of the type n-CdS/p-Ge, n-CdS/p-InP, n-CdS/p-GaAs and n-CdS/p-CdTe is described. The CdS layer was found to be single crystalline when it was grown on substrates whose lattice mismatch with CdS was less than 4%, i.e., in the case of growth on InP, GaAs and Ge. Analysis of the dark current characteristics revealed that in all of these heterojunction devices, there exists a low temperature, low bias voltage tunneling current. Analysis of the photovoltaic responses showed that they generally had respectable collection efficiencies; i.e., that the interface states did not act as recombination sites of photogenerated carries crossing the junction. The solar energy conversion efficiency is, however, strongly influenced by interface states through the open circuit voltage and the fill factor. A maximum conversion efficency without antireflection coating of 6.5% for n-CdS/p-InP under natural sunlight having an intensity of 74 mW/cm was observed. Dissert. Abstr.

N80-23767 Stanford Univ., Calif.
PROPERTIES OF SPUTTERED ITO/CdTe SOLAR CELLS Ph.D. Thesis
Francis Georges Courreges 1980 135 p
Avail: Univ. Microfilms Order No. 8011619

The properties of indium tin oxide/cadmium telluride (ITO/CdTe) solar cells prepared by RF sputtering of ITO on phosphorus-doped CdTe single crystals is investigated through measurements of dark and light current-voltage characteristics of ITO/CdTe heterojunctions and In/CdTe junctions and of surface photovoltage and photoluminescence of CdTe surfaces. An observed reduction in solar efficiency of ITO/CdTe solar cells with time and/or heat treatment is describable in terms of the change from a n(+)-ITO/n-CdTe/p-CdTe homojunction structure to a n(+)-ITO/p-CdTe heterojunction, characterized by high collection efficiency and poor rectifying properties. Dissert. Abstr.

N80-23768*# Westinghouse Research and Development Center, Pittsburgh, Pa.
CELL MODULE AND FUEL CONDITIONER DEVELOPMENT
D. Q. Hoover, Jr. Jan. 1980 58 p
(Contracts DEN3-161; DE-AI03-79ET-1272)
(NASA-CR-159828; DOE/NASA/0161-79/3; QR-1; Rept-80-9E6-MARED-R1) Avail: NTIS HC A04/MF A01

Components for the first 5 cell stack (no cooling plates) of the MK-2 design were fabricated. Preliminary specfications and designs for the components of a 23 cell MK-1 stack with four DIGAS cooling plates were developed. The MK-2 was selected as a bench mark design and a preliminary design of the facilities required for high rate manufacture of fuel cell modules was developed. Two stands for testing 5 cell stacks were built and design work for modifying existing stands and building new stands for 23 and 80 cell stacks was initiated. Design and procurement of components and materials for the catalyst test stand were completed and construction initiated. Work on the specifications of pipeline gas, tap water and recovered water and definition of equipment required for treatment was initiated. An innovative geometry for the reformer was conceived and modifications of the computer program to be used in its design were stated. R.E.S.

N80-23769*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CELL MODULE AND FUEL CONDITIONER Quarterly Report, Jan. - Mar. 1980
D. Q. Hoover, Jr. Apr. 1980 87 p
(Contracts DEN3-161; DE-AI03-79ET-11272)
(NASA-CR-159875; DOE/NASA/0161-2; QR-2) Avail: NTIS HC A05/MF A01 CSCL 10A

Stack tests indicate that the discrepancies between calculated and measured temperature profiles are due to reactant cross-over and a lower than expected thermal conductivity of cells. Preliminary results indicate that acceptable contact resistance between cooling plane halves can be achieved without the use of paper. The preliminary design of the enclosure, definition of required labor and equipment for manufacturing repeating components, and the assembly procedures for the benchwork design were developed. Fabrication of components for a second 5-cell stack of the MK-2 design and a second 23-cell stack of the MK-1 design was started. The definition of water and fuel for the reforming subsystem was developed along with a preliminary definition of the control system for the subsystem. The construction and shakedown of the differential catalytic reactor was completed and testing of the first catalyst initiated. R.E.S.

N80-23770*# Texas Instruments, Inc., Dallas.
AUTOMATED ARRAY ASSEMBLY, PHASE 2 Final Report
Bernard G. Carbajal Nov. 1979 43 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954881)
(NASA-CR-153191; DOE/JPL-954881-79-8; JPL-9950-319; Rept-03-79-58) Avail: NTIS HC A03/MF A01 CSCL 10A

Tasks of scaling up the tandem junction cell (TJC) from 2 cm x 2 cm to 6.2 cm and the assembly of several modules using these large area TJC's are described. The scale-up of the TJC was based on using the existing process and doing the necessary design activities to increase the cell area to an acceptably large area. The design was carried out using available device models. The design was verified and sample large area TJCs were fabricated. Mechanical and process problems occurred causing a schedule slippage that resulted in contract expiration before enough large-area TJCs were fabricated to populate the sample tandem junction modules (TJM). A TJM design was carried out in which the module interconnects served to augment the

current collecting buses on the cell. No sample TJMs were assembled due to a shortage of large-area TJCs. R.E.S.

N80-23771*# Spire Corp., Bedford, Mass.
DEVELOPMENT OF PULSED PROCESSES FOR THE MANUFACTURE OF SOLAR CELLS Final Report, Apr. 1979
J. A. Minnucci Apr. 1979 238 p refs Sponsored in part by DOE
(Contract JPL-954786)
(NASA-CR-153188; DOE/JPL-954786-79/02; JPL-9950-324; FR-79-10052) Avail: NTIS HC A11/MF A01 CSCL 10A

Low-energy ion implantation processes for the automated production of silicon solar cells were investigated. Phosphorus ions at an energy of 10 keV and dose of 2 x 10 to the 15th power/sq cm were implanted in silicon solar cells to produce junctions, while boron ions at 25 keV and 5 x 10 to the 15th power were implanted in the cells to produce effective back surface fields. An ion implantation facility with a beam current up to 4 mA and a production throughput of 300 wafers per hour was designed and installed. A design was prepared for a 100 mA, automated implanter with a production capacity of 100 MW sub e/sq cm per year. Two process sequences were developed which employ ion implantation and furnace or pulse annealing. A computer program was used to determine costs for junction formation by ion implantation and various furnace annealing cycles to demonstrate cost effectiveness of these methods. R.E.S.

N80-23772*# Solarex Corp., Rockville, Md.
ANALYSIS OF THE EFFECTS OF IMPURITIES IN SILICON Final Report, 19 Jan. 1979 - 31 Jan. 1980
J. H. Wohlgemuth and M. N. Giuliano 1980 95 p refs Sponsored in part by DOE
(Contract JPL-955307)
(NASA-CR-163133; DOE/JPL-955307; JPL-9950-325) Avail: NTIS HC A05/MF A01 CSCL 10A

A solar cell fabrication and analysis program was conducted to determine the effects on the resultant solar cell efficiency of impurities intentionally incorporated into silicon. It was found that certain impurities such as titanium, tantalum, and vanadium were bad, even in very small concentrations. Cell performance appeared relatively tolerable to impurities such as copper, carbon, calcium, chromium, iron and nickel (in the concentration levels which were considered). R.E.S.

N80-23773*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEVELOPMENT AND FABRICATION OF A SOLAR CELL JUNCTION PROCESSING SYSTEM Quarterly Progress Report
Ward Halvason Apr. 1980 18 p Sponsored in part by DOE
(Contracts NAS7-100; JPL-955640)
(NASA-CR-153194; DOE/JPL-955640-80/1; JPL-9950-329; QPR-10073-01; QR-1) Avail: NTIS HC A02/MF A01 CSCL 10A

Experiments were completed which indicate that single-pulse, liquid-phase epitaxial regrowth is the optimum technique for pulsed electron beam annealing of ion implantation damage in silicon wafers. An electron beam which covers the entire area of the wafer was chosen for the solar cell processor. Beam control experiments to improve beam propagation and to test the concept of partial space charge and current neutralization were initiated. The electrical parameters of the pulsed electron beam subsystem were chosen on the basis of computer calculations and past experience in pulsed electron accelerator design and operation. The pulder, designated SPI-PULSE 7000, is designed to anneal 10 cm diameter silicon wafers at a rate of 30 per minute. The preliminary design of the major elements of the SPI-PULSE 7000 was completed, and the detailed design of many of the components begun. These elements include a capacitive energy store and charging system, an electron accelerator, a beam control system, a wafer handling system and pressure and vacuum assemblies. R.E.S.

N80-23774*# Quality Inn of Key West, Miami Beach, Fla.
SOLAR HOT WATER SYSTEM INSTALLED AT QUALITY INN, KEY WEST, FLORIDA Final Report
Apr. 1980 25 p Sponsored in part by NASA
(Grant EG-77-G-01-1633)
(NASA-CR-161434) Avail: NTIS HC A02/MF A01 CSCL 10A

The solar energy hot water system installed in the Quality Inn, Key West, Florida, which consists of four buildings is described. Three buildings are low-rise, two-story buildings containing 100 rooms. The fourth is a four-story building with 48 rooms. The solar system was designed to provide approximately 50 percent of the energy required for the domestic hot water system. The solar system consists of approximately 1400 square feet of flat plate collector, two 500 gallon storage tanks, a circulating pump, and a controller. Operation of the system was begun in April 1978, and has continued to date with only three minor interruptions for pump repair. In the first year of operation, it was determined that the use of the solar facility resulted in forty percent fuel savings. R.E.S.

N80-23775*# General Electric Co., Philadelphia, Pa. Space Div.
MOD-1 WIND TURBINE GENERATOR ANALYSIS AND DESIGN REPORT, VOLUME 1 Final Report
Mar. 1979 320 p
(Contracts NAS3-20058; EX-77-A-29-1010)
(NASA-CR-159495; DOE/NASA/0058-79/2-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 10A

The activities leading to the completion of detail design of the MOD-1 wind turbine generator are described. Emphasis is placed on the description of the design as it finally evolved. However, the steps through which the design progressed are also traced in order to understand the major design decisions. R.E.S.

N80-23776*# Gilbert (W. E.) and Associates, Inc., Greenwood, S.C.
SOLAR HEATING SYSTEM INSTALLED AT BLAKEDALE PROFESSIONAL CENTER, GREENWOOD, SOUTH CAROLINA Final Report
Mar. 1980 33 p Sponsored in part by NASA
(Contract EX-76-C-01-2389)
(NASA-CR-161435) Avail: NTIS HC A03/MF A01 CSCL 10B

Information on the solar heating system installed at the Blakedale Professional Center, in Greenwood, South Carolina is presented. The information consists of site and building description, solar system description, performance evaluation, system problems and installation drawings. The solar system was designed to provide approximately 85 percent of the building's heating requirements. The system was installed concurrently with building construction and heats 4,440 square feet of the building. There are 954 square feet of liquid flat plate collectors that are proof-mounted and have a drain-down system to protect the collectors from freezing. A 5,000 gallon steel, polyurethane insulated tank buried underground provides storage. The system was fully instrumented for performance evaluation and integrated into the National Solar Data Network. R.E.S.

N80-23777*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
REDOX STORAGE SYSTEMS FOR SOLAR APPLICATIONS
Norman H. Hagedorn and Lawrence H. Thaller 1980 28 p refs Proposed for presentation at Power Sources Conf., Brighton, England, 15-18 Sep. 1980
(Contract EF-77-A-31-1002)
(NASA-TM-81464; DOE/NASA/1002-80/5; E-383) Avail: NTIS HC A03/MF A01 CSCL 10A

The NASA Redox energy storage system is described. The system is based on soluble aqueous iron and chromium chloride redox couples. The needed technology advances in the two elements (electrodes and membranes) that are key to its technological feasibility have been achieved and system development has begun. The design, construction, and test of a 1 kilowatt system integrated with a solar photovoltaic array is discussed. R.E.S.

N80-23778*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
THE OPTIMIZATION AIR SEPARATION PLANTS FOR

COMBINED CYCLE MHD-POWER PLANT APPLICATIONS
Albert J. Juhasz, Helmut Springmann, and Ralph Greenberg 1980 11 p refs Presented at the 7th Intern. Conf. on MHD Elec. Power Generation, Cambridge, Mass., 16-20 Jun. 1980
(Contracts DEN3-165; EF-77-A-01-2674)
(NASA-TM-81510; DOE/NASA/2674-80/10) Avail: NTIS HC A02/MF A01 CSCL 10B

Some of the design approaches being employed during a current supported study directed at developing an improved air separation process for the production of oxygen enriched air for magnetohydrodynamics (MHD) combustion are outlined. The ultimate objective is to arrive at conceptual designs of air separation plants, optimized for minimum specific power consumption and capital investment costs, for integration with MHD combined cycle power plants. R.E.S.

N80-23779*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF CATALYST LENGTH AND DOWNSTREAM REACTOR DISTANCE ON CATALYTIC COMBUSTOR PERFORMANCE
David Anderson 1980 24 p refs Presented at the 4th Workshop on Catalytic Combust., Cincinnati, 14-15 May 1980; sponsored by EPA
(Contract EC-77-A-31-1040)
(NASA-TM-81475; DOE/NASA/1040-80/14; E-409) Avail: NTIS HC A02/MF A01 CSCL 10B

A study was made to determine the effects on catalytic combustor performance which resulted from independently varying the length of a catalytic reactor and the length available for gas-phase reactions downstream of the catalyst. Monolithic combustion catalysts from three manufacturers were tested in a combustion test rig with no. 2 diesel fuel. Catalytic reactor lengths of 2.5 and 5.4 cm, and downstream gas-phase reaction distances of 7.3, 12.4, 17.5, and 22.5 cm were evaluated. Measurements of carbon monoxide, unburned hydrocarbons, nitrogen oxides, and pressure drop were made. The catalytic-reactor pressure drop was less than 1 percent of the upstream total pressure for all test configurations and test conditions. Nitrogen oxides and unburned hydrocarbons emissions were less than 0.25 g NO2/kg fuel and 0.6 g HC/kg fuel, respectively. The minimum operating temperature (defined as the adiabatic combustion temperature required to obtain carbon monoxide emissions below a reference level of 13.6 g CO/kg fuel) ranged from 1230 K to 1500 K for the various conditions and configurations tested. The minimum operating temperature decreased with increasing total (catalytic-reactor-plus-downstream-gas-phase-reactor-zone) residence time but was independent of the relative times spent in each region when the catalytic-reactor residence time was greater than or equal to 1.4 ms. R.E.S.

N80-23780*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY AND EVALUATION OF THE PARAMETRIC STUDY OF POTENTIAL EARLY COMMERCIAL MHD POWER PLANTS (PSPEC)
Peter J. Staigner and John M. Abbott 1980 11 p refs Presented at the 7th Intern. Conf. on Magnetohydrodyn. Elec. Generation, Cambridge, Mass., 16-20 Jun. 1980; sponsored by the Symp. on the Eng. Aspects of Magnetohydrodynam., Inc.
(Contract EF-77-A-31-2674)
(NASA-TM-81497; DOE/NASA/2674-80/9; E-434) Avail: NTIS HC A02/MF A01 CSCL 10B

Two parallel contracted studies were conducted. Each contractor investigated three base cases and parametric variations about these base cases. Each contractor concluded that two of the base cases (a plant using separate firing of an advanced high temperature regenerative air heater with fuel from an advanced coal gasifier and a plant using an intermediate temperature metallic recuperative heat exchanger to heat oxygen enriched combustion air) were comparable in both performance and cost of electricity. The contractors differed in the level of their cost estimates with the capital cost estimates for the MHD topping cycle and the magnet subsystem in particular accounting for a significant part of the difference. The impact of the study on the decision to pursue a course which leads to an oxygen enriched plant as the first commercial MHD plant is described. R.E.S.

N80-23781# National Mechanical Engineering Research Inst., Pretoria (South Africa). Aeromechanics Div.
THE AERODYNAMICS OF AXIAL FLOW WIND POWER TURBINES
W. J. VanderElst Jun. 1979 37 p refs
(CSIR-ME-1619; ISBN-0-7988-1463-2) Avail: NTIS HC A03/MF A01

A general analysis of the aerodynamics of wind power turbines of the axial flow type is presented. The design parameters appear in nondimensional form and are presented graphically. The theory is applicable to any type of wind power generator, including slow running windmills normally used for powering water pumps as well as fast running machines which are suitable for the generation of electric power. Author

N80-23782# Delta Electronic Control Corp., Irvine, Calif.
DESIGN, CONSTRUCTION AND TESTING OF A 60 kW SOLAR ARRAY AND POWER CONVERSION SYSTEM Final Report, Jan. 1978 - Aug. 1979
J. S. Suelzle Aug. 1979 138 p
(Contract DAAK70-78-C-0018)
(AD-A080877; DECC-61211-003) Avail: NTIS HC A07/MF A01 CSCL 10/1

A 60 kW photovoltaic array and power conversion system was designed, constructed, tested and installed by Delta Electronic Control Corporation. The system is currently operative, augmenting a remote diesel power generating station at Mt. Laguna Air Force Station. The system, which operates without on-site energy storage, operates unattended, extracting the maximum available power from the solar array. GRA

N80-23783# SRI International Corp., Menlo Park, Calif.
NAVAL FACILITY ENERGY CONVERSION PLANTS AS RESOURCE RECOVERY SYSTEM COMPONENTS Interim Report, period ending Oct. 1979
Arlie G. Capps Port Hueneme, Calif. Civil Engineering Lab. Jan. 1980 68 p
(Contract N00123-78-C-0868)
(AD-A081232; CEL-CR-80-002) Avail: NTIS HC A04/MF A01 CSCL 21/4

This interim report addresses concepts for recovering energy from solid waste by using Naval facilities steam plants as principle building blocks of candidate solid waste/resource recovery systems at Navy installations. The major conclusions of this portion of the project are: although it is technically feasible to adapt Navy energy conversion systems to fire Waste Derived Fuels (WDF) in one or more of its forms, the optimal form selected should be a site-specific total system; near- to intermediate-term programs should probably continue to give first consideration to waterwall incinerators and to the cofiring of solid WDF in coal-capable plants; package incinerators and conversions of oil burning plants to fire a fluff form of solid waste fuel may be the options with the greatest potential for the intermediate term because waterwalls would be uneconomical in many small plants and because the majority of medium-sized oil-burning plants will not be converted to burn coal; and pyrolytic processes to produce gaseous and liquid fuels have not been sufficiently developed as yet to be specified for commerical operation. GRA

N80-23784# Air Force Academy, Colo.
LiSi AND LiB AS ANODES IN CHLOROALUMINATE THERMAL BATTERIES
Robert L. Vaughn Jan. 1980 22 p refs
(AF Proj. 2303)
(AD-A081300; FJSRL-TR-80-0002) Avail: NTIS HC A02/MF A01 CSCL 10/3

Lithium silicon (40 weight percent Li) and lithium boron were studied as anode materials in chloroaluminate thermal cells and were compared with lithium aluminum. Lithium boron anodes were tested only at a single temperature (200 C) because of low availability whereas lithium silicon was studied over the temperature range 175 to 275 C. The current density range was 15 to 150 mA/sq cm. The results showed that lithium silicon behaved like lithium aluminum, with linear polarization over the current densities studied. The internal resistances were

the same at all temperatures. On the other hand, lithium boron displayed an activation overpotential at current densities less than 50 mA/sq cm. At higher current densities, an internal resistance of less than 0.19 omega was indicated for the lithium boron-anode cells. This study shows that LiSi offers no advantage over lithium aluminum as an anode for chloroaluminate thermal cells. However, LiB promises to be a superior anode material at high current densities. GRA

N80-23785# California Univ., Berkeley. Lawrence Berkeley Lab. Chemical Biodynamics Div.
PHOTOVOLTAIC PROPERTIES OF METAL-MEROCYANINE-TiO2 SANDWICH CELLS Ph.D. Thesis
T. A. Skotheim Aug. 1979 150 p refs
(Contract W-7405-eng-48)
(LBL-9916) Avail: NTIS HC A07/MF A01

Photocurrent generation in thin films of merocyanine photosensitizing dyes sandwiched between an n-type semiconductor and a metal overlayer was studied using photovoltaic techniques. Titanium dioxide single crystal, doped n-type, was used as the semiconductor and a semitransparent Au film as a metal overlayer. A theoretical model was developed to explain the photovoltaic properties. The model assumes that the principal route for the formation of charge carriers is via singlet excitons diffusing to the merocyanine-TiO2 interface followed by dissociation of the excitons into electron-hole pairs, the electrons being injected into the TiO2 conduction band and the holes into the merocyanine. The model also incorporates field dependence of the quantum efficiency for charge generation and is strongly supported by a variety of steady state and kinetic measurements. DOE

N80-23786# Woodard-Clyde Consultants, San Francisco, Calif. Fossil Fuel and Advanced Systems Div.
ENVIRONMENTAL ASSESSMENT METHODOLOGY: SOLAR POWER PLANT APPLICATIONS. VOLUME 2: INDUSTRIAL IMPLICATIONS AND SECONDARY-IMPACT METHODOLOGY
K. Nair and A. Sicherman Apr. 1979 123 p refs Sponsored by the Elec. Power Res. Inst.
(EPRI Proj. 551)
(EPRI-ER-1070-Vol-2) Avail: NTIS HC A06/MF A01

A methodology for assessing industrial implication and secondary impacts of central solar electric stations was developed using an input output formulation, and a computer model was developed to help estimate these impacts. An independent assessment of the market penetration of solar energy to the year 2000 was made using Bayesian statistical techniques to evaluate different future scenarios. Techniques for assessing the likelihood of these scenarios were also developed. DOE

N80-23787# Georgia Univ., Athens. Dept. of Biochemistry.
MECHANISM OF ENERGY CONVERSION AND TRANSFER IN BIOLUMINESCENCE Final Report
Milton J. Cormier 1979 20 p refs
(Contract EY-76-S-09-0635)
(SRO-635-7) Avail: NTIS HC A02/MF A01

Bioluminescence in the sea pansy, Renilla reniformis, a marine anthozoan coelenterate, is a complex process involving the participation of three proteins specfic to anthozoan coelenterate-type systems. These are: (1) the luciferin binding protein, (2) the enzyme luciferase, and (3) the green-fluorescent protein. Each of these were purified and characterized and the structure of luciferin confirmed by synthesis. The Renilla bioluminescence system is the first radiationless energy transfer system the individual components of which have been purified to homogeneity, characterized, and then reassembled in vitro with restoration of the energy transfer function. DOE

N80-23788# Lincoln Lab., Mass. Inst. of Tech., Lexington.
APPLICATION AND DESIGN STUDIES OF COMPRESSED-AIR ENERGY STORAGE FOR SOLAR APPLICATIONS Final Report
G. T. Flynn and J. L. Nash-Webber 28 Sep. 1979 118 p refs
(Contract EX-76-A-01-2295-029)
(CAES-7) Avail: NTIS HC A06/MF A01

Adiabatic compressed air energy storage (CAES), in which both the heat of compression and the compressed air stored separately, was studied. The applicability of this technology to solar power systems was examined. The basic thermodynamics of ideal single and two stage adiabatic CAES is reviewed. Generic single stage and two stage types are discussed, and the efficiency and mass flow rate as a function of storage pressure and stage pressure ratios were investigated. The performance and cost of available turbomachinery for the single and two stage adiabatic systems are examined. DOE

N80-23789# Argonne National Lab., Ill.
OPTIMAL DESIGN OF COMPRESSED AIR ENERGY STORAGE SYSTEMS
F. W. Ahrens, A. Sharma, and K. M. Ragsdell 1979 13 p refs Presented at the 6th Annual Conf. on Energy, Rolla, Mo., Oct. 1979 Prepared in cooperation with Illinois Univ., Chicago and Purdue Univ., Lafayette, Ind.
(Contract W-31-109-eng-38)
(CONF-791069-3) Avail: NTIS HC A02/MF A01

Compressed air energy storage (CAES) power systems considered by various electric utilities for load leveling applications are discussed. Models of CAES systems which employ natural underground aquifier formations, and present an optimal design methodology which demonstrates their economic viability are developed. The approach is based upon a decomposition of the CAES plant and utility grid system into three partially-decoupled subsystems. Numerical results are given for a plant employing the Media, Illinois Galesville aquifier formation. DOE

N80-23790# Argonne National Lab., Ill. Office of Program Management Support.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 6: INTERNATIONAL AGREEMENT PROFILES
Jun. 1979 202 p
(Contract W-31-109-eng-38)
(ANL-PMS-79-2-Vol-6) Avail: NTIS HC A10/MF A01

The World Energy Data System contains organized data on those countries and international organizations that may have critical impact on world energy. The international agreement profiled in WENDS are all energy related and are organized by energy technology. These are: coal; conservation; fusion; geothermal; nuclear fission; oil, gas, and shale; solar, wind, and ocean thermal; and other (cooperation in electrical power equipment acquisition, energy, energy research, etc.). The agreement profiles are accessible by energy technology and alphabetically by country. DOE

N80-23791# Hittman Associates, Inc., Columbia, Md.
SOLAR APPLICATIONS OF THERMAL ENERGY STORAGE Final Report
C. Lee, L. Taylor, A. J. DeVries, and S. Heibein Jan. 1979 158 p refs
(Contract EM-78-C-01-4275)
(TID-29430) Avail: NTIS HC A08/MF A01

The preparation technology assessment on solar energy systems which use thermal energy storage was studied. The characterization of the current state-of-the-art of thermal energy storage, an assessment of the energy storage needs of solar energy systems, and the synthesis of this information into preliminary design criteria which would from the basis for detailed designs of thermal energy storage are included. Since the goal of the solar thermal energy storage program is to provide optimum storage units for solar thermal energy systems, the focus was on storage concepts that are either commercially available or will be commercially available by 1979. DOE

N80-23792# Department of Energy, Washington, D. C. Office of Energy Technology.
NOAA'S ROLE IN THE SOLAR ENERGY PROGRAM Annual Report, 1978
Aug. 1979 244 p refs
(DOE/ET-0110) Avail: NTIS HC A11/MF A01

The efforts of the National Oceanic and Atmospheric Administration toward monitoring and documenting the USA solar radiation and related weather data are reported. A format to be used for transfer and processing of related solar data sets is presented. Solar radiation maps of the U.S. for total and direct radiation on a monthly and annual basis are presented and

discussed. A section on solar and climatic data applied to subdivisions of the U.S. that are quasi-homogeneous in solar radiation heating demand and topography is included. A listing of the periods of record of all available wind observations in the National Climatic Center's meteorological archives is given. The computational of extra-terrestrial solar radiation, solar evaluation angle, and true solar time of sunrise and sunset is described. Also, research on the effects of aerosols and clouds on solar radiation is described. DOE

N80-23793# Battelle Pacific Northwest Labs., Richland, Wash.
THERMAL ENERGY STORAGE IN AQUIFIERS: PRELIMINARY INFORMATION
R. D. Allen Dec. 1979 86 p refs
(Contract EY-76-C-06-1830)
(PNL-3062) Avail: NTIS HC A05/MF A01

Topics discussed include conceptual design; numerical modelling; field experiments; relevant technical information, feasibility studies; preliminary aquifer selection considerations; and preliminary design and operating considerations. DOE

N80-23794# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
BASIC RESEARCH NEEDS IN ENERGY CONSERVATION
Jack M. Hollander Oct. 1979 28 p refs
(Contract W-7405-eng-48)
(LBL-9939) Avail: NTIS HC A03/MF A01

The role of research in energy conservation, the role of government in conservation research and the role of basic research in conservation are discussed with information on the need for research on the physical, environmental, social, and economic aspects of energy conservation in the residential, industrial, and transportation sectors, and the outlook for U.S. energy supply and demand. DOE

N80-23795# Los Alamos Scientific Lab., N. Mex.
THERMAL FRACTURE EFFECTS IN GEOTHERMAL ENERGY EXTRACTION
Ruth B. Demuth and Francis H. Harlow Nov. 1979 148 p refs
(Contract W-7405-eng-36)
(LA-7963) Avail: NTIS HC A07/MF A01

Heat and water exchange between the primary crack and a lateral thermal fracture are analyzed by means of numerical modeling on a high-speed computer. Three dimensional heat flow in the rock is coupled to a two dimensional approximation for the time-varying convective patterns that result from both forced flow and buoyancy. The physical and mathematical bases for the study are described together with the numerical technique for solution. Three versions of the computer code are listed and some results of representative calculations are included. DOE

N80-23796# United Technologies Research Center, East Hartford, Conn.
PARAMETRIC PERFORMANCE EVALUATION AND TECHNICAL ASSESSMENT OF ADIABATIC COMPRESSED AIR ENERGY STORAGE SYSTEMS Final Report
R. D. Lessard and W. A. Blecher Oct. 1979 157 p refs
Sponsored by Elec. Power Res. Inst.
(EPRI Proj. 1199-1)
(EPRI-EM-1188) Avail: NTIS HC A08/MF A01

An adiabatic compressed air energy storage (ACAES) system, an advanced compressed air energy storage system concept which features thermal energy storage (TES) is discussed. The intermediate pressure hybrid ACAES system (an ACAES system wherein the heat of compression is transferred to the TES at a pressure level substantially below the cavern air storage pressure and which utilizes combustion of some fossil fuel prior to expansion to raise the turbine inlet temperature) was examined for near term commercialization. The level of performance and the level of turbomachinery technology required of an intermediate-pressure hybrid ACAES system are evaluated. DOE

N80-23797# Sandia Labs., Livermore, Calif. Energy Systems Study Div.
FIXED SITE HYDROGEN STORAGE. 1: APPLICATIONS IMPACT
J. J. Iannucci and S. L. Robinson 1979 11 p refs Presented at the 2nd Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10 Dec. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8647; CONF-791204-10) Avail: NTIS HC A02/MF A01

The potential applications and requirements for fixed site storage in a scenario of wide spread hydrogen use are examined and quantified. An envisioned hydrogen production/distribution/end-use cycle is scrutinized to identify the storage needs for both continuous and intermittent sources including solar. The most pressing need for storage is found to be at the distribution point, in concurrence with current natural gas practice. Caverns and similar underground storage techniques are shown to be the most promising modes due to their low cost relative to all other options examined. Since a large volume of natural gas storage is presently in service, a pressing need to develop fixed site hydrogen storage technology (beyond the conversion of this underground storage to hydrogen) has not been identified. DOE

N80-23798# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SOLAR ENERGY PROGRAM EVALUATION: AN INTRODUCTION
Peter deLeon Sep. 1979 112 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-51-294) Avail: NTIS HC A06/MF A01

An overview of the practice and methodology of program evaluation is presented which defines more precisely the evaluation techniques and methodologies that are the most appropiate to government organizations which are actively involved in the research, development, and commercialization of solar energy systems. There are four basic types of evalution designs: the pre-experimental design; the quasi-experimental design based of time series; the quasi-experimental design based on comparision groups; and the true experimental design. DOE

N80-23799# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
CONVERSION SYSTEM OVERVIEW ASSESSMENT. VOLUME 2: SOLAR-WIND HYBRID SYSTEMS
T. S. Jayadev, J. Henderson, and C. Bingham Aug. 1979 34 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-35-078-Vol-2) Avail: NTIS HC A03/MF A01

Solar-wind hybrid systems are discussed. It is shown that there are large areas in the United States where solar and wind resources are comparable in magnitude and there are diurnal and seasonal complementarities which offer the potential for cost-effective hybrid systems. There are also distinct engineering features of the two conversion technologies. Electric power generation from wind is straightforward and cost-effective, whereas solar thermal conversion to generate heat is more cost-effective than to generate electricity. Examples of hybrid systems utilizing these features on total energy application are presented. DOE

N80-23800# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
DEVELOPMENT OF A SOLAR THERMAL RECEIVER FOR HIGH TEMPERATURE APPLICATIONS
M. Bohn and G. Bessler Nov. 1979 7 p refs Presented at the Semiann. Conf. for Adv. Solar Thermal Tech., Phoenix, Ariz., 11 Dec. 1979
(Contract EG-77-C-02-4042)
(SERI/TP-333-485; CONF-791221-1) Avail: NTIS HC A02/MF A01

A thermal receiver for point focus collectors is described. The receiver uses as a buffer between the cavity surface and the heat transfer fluid a thermal mass, which with a very small temperature drop penalty smooths the flux distribution to eliminate hot spots. The design of the receiver enables significant spillage flux at the receiver to be used. Thus, lower quality optics can be employed in applications not requiring very high temperatures. Design and construction features of the receiver are presented and the testing program is described. DOE

N80-23801# Los Alamos Scientific Lab., N. Mex.
ENERGY STORAGE TECHNOLOGY-ENVIRONMENTAL

IMPLICATIONS OF LARGE SCALE UTILIZATION
M. C. Krupka, J. E. Moore, W. E. Keller, G. A. Baca (Los Alamos Tech. Assoc., Inc., N. Mex.), R. I. Brasier (Los Alamos Tech. Assoc., Inc., N. Mex.), and W. S. Benneth (Los Alamos Tech. Assoc., Inc., N. Mex.) 1979 20 p refs Presented at the 2d Intern. Alternative Energy Sources Conf., Miami Beach, Fla., 10-13 Dec. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3098; CONF-791204-4) Avail: NTIS HC A02/MF A01

Environmental impacts for several energy storage technologies have been identified. State-of-the-art control technology options were similarly identified. Recommendations for research and development on new control technology were made where present controls were either deemed inadequate or non-existent. Specifically, the energy storage technologies under study included: advanced lead-acid battery, compressed air, underground pumped hydroelectric, flywheel, superconducting magnet and various thermal systems (sensible, latent heat and reversible chemical reaction). In addition, a preliminary study was conducted on fuel cell technology. Although not strictly classified as an energy storage system, fuel cells in conjunction with product recycling units can serve an energy storage function. A very large number of potential environmental impacts can be identified for all o. these technologies. However, not all are of primary importance. Detailed discussions of a number of environmental impacts from the latest LASL study as they relate to primarily operational situations are emphasized. In addition, a brief discussion on new application for energy storage technologies and the additional costs of controls to be used for mitigation of specific impacts are also presented. DOE

N80-23802# Los Alamos Scientific Lab., N. Mex.
ENERGY FROM HOT DRY ROCK
Robert H. Hendron 1979 22 p refs Presented at the Conf. on Long-Term Energy Resources, 3 Dec. 1979; sponsored by UNITAR
(Contract W-7405-eng-36)
(LA-UR-79-3256; CONF-791216-1) Avail: NTIS HC A02/MF A01

The Hot Dry Rock Geothermal Energy Program is described. The system, operation, results, development program, environmental implications, resource, economics, and future plans are discussed. DOE

N80-23803# New Zealand Energy Research and Development Committee, Auckland.
ELECTRICITY FROM REFUSE
M. White 1979 51 p refs
(NZERDC-44; ISSN-0110-1692) Avail: NTIS HC A04/MF A01

The conversion of refuse to electricity for Auckland involves the combustion of refuse directly or as a refuse-derived fuel to release heat energy, which in turn is converted to high-pressure steam for driving steam turbogenerators. Domestic/commercial collected refuse, privately deposited domestic refuse and industrial/commercial refuse are used. Only those technologies are considered that have been basically proven by commercial operation and systems designed to make use, whenever possible, of existing plant and equipment. The following options are examined for close technical and economic assessment: mass burning in sloping grate boiler plant, semi-suspension combustion boiler plant, supplementary firing of a refuse-derived fuel and refuse-fueled power station using semi-suspension combustion boiler plant. Extensive data are compiled on: refuse from the Auckland urban area; design of systems; environmental and technical aspects. DOE

N80-23804# Los Alamos Scientific Lab., N. Mex.
USE OF ADAPTIVE OPTIMAL CONTROL TO PROVIDE ENERGY CONSERVATION IN LARGE BUILDINGS
Donald R. Ferris and Dennis E. Miller (Johnson Controls, Inc., Milwaukee, Wis.) 1979 9 p refs Presented at 18th IEEE Conf. on Decision and Control, Fort Lauderdale, Fla., 12 Dec. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3354; CONF-791227-1) Avail: NTIS HC A02/MF A01

The use of an adaptive linear regulator approach for controlling heating, ventilating, and air conditioning systems in large buildings is discussed. The control manifestations of this approach are compared with those found in conventional applications. The salient features of the approach are discussed, and simulation results are presented. Implementation is discussed, and economic estimates for commercial use of this approach also presented. DOE

N80-23805# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PROPOSITION ON ENERGY ANALYSIS AND ECONOMIC EFFICIENCY
Donald I. Hertzmark Oct. 1979 22 p refs
(Contract EG-77-C-01-4042)
(SERI/RR-51-332) Avail: NTIS HC A02/MF A01

Analytical results of an attempt to simultaneously optimize economic and thermodynamic efficiency are presented and discussed. The attempt to impose complete mathematical rationality and consistency on the pricing of energy commodities failed since it was not possible to consistently weigh purely physical efficiency measures, much less social factors. Nevertheless, the use of both material balance and entropy analysis is valuable for evaluating nonmarket decisions, as well as identifying opportunities for process improvements. DOE

N80-23806# Sandia Labs., Livermore, Calif.
HELIOSTAT DESIGN COST/PERFORMANCE TRADEOFFS
Miriam J. Fish and T. A. Dellin Nov. 1979 50 p refs
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-8248) Avail: NTIS HC A03/MF A01

The heliostat field comprisbs the most expensive subsystem of a solar central receiver power plant. Cost reductions might be achieved by either total heliostat redesign or component substitution in existing design. The value of changing any of several design specifications, in the current baseline glass/metal heliostat is discussed. Results are quantified in terms of the breakeven cost; i.e., the cost of a new design which will yield the same total system energy cost as the baseline system. Changes in mirror reflectivity, pointing accuracy, surface quality, canting and focusing strategy, heliostat size, and stow requirements were evaluated. DOE

N80-23807# Los Alamos Scientific Lab., N. Mex.
RESIDENTIAL PASSIVE SOLAR SYSTEMS: REGIONAL SENSITIVITY TO SYSTEM PERFORMANCE COSTS, AND ALTERNATIVE PRICES
C. Kirschner, S. Ben-David, and F. Roach 1979 32 p Presented at the 2nd Miami Intern. Conf. on Alternatives Energy Sources, Miami Beach, Fla., 10-13 Dec. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3390; CONF-791204-12) Avail: NTIS HC A03/MF A01

The economic potential of two passive space heating configurations were analyzed. These were a masonary thermal storage wall (trombe) and a direct gain system - both with night insulation. A standard tract home design for each of the two passive systems was used throughout the analysis to allow interregional comparisons. The economic performance of these two systems was evaluated on a regional basis (223 locations) throughout the United States. A sensitive analysis was conducted on two conventional energy types (electricity and natural gas) to determine the impact of alternative fuel price escalation rates and solar costs upon feasibility of the two solar systems. Cost goals for solar system prices were established under one set of future fuel prices and stated economic conditions. DOE

N80-23808# Dow Chemical Co., Midland, Mich. Process Development Dept.
ENERGY FROM IN SITU PROCESSING OF ANTRIM OIL SHADE Quarterly Technical Progress Report, Apr. - Jun. 1979
Lawrence J. Washington 20 Jul. 1979 43 p ref
(Contract EX-76-C-01-2346)
(FE-2346-49) Avail: NTIS HC A03/MF A01

Four wells were drilled and cored in the 100 series for use in evaluating the fracturing in Wells No. 101-106 and for possible use in subsequent extraction trails. Extensive logging, liquid

permeability, air permeability and well communication tests were carried out for fracture assessment at both the hydraulic/explosive fracture site and the explosive underream site. Although these evaluations are still incomplete and no decision can yet be made as to which would be preferred for an extraction trail, both site have much greater permeability and better interwell communications than was present in the first extraction trails on the existing site. DOE

N80-23809# Schumacher and Associates, Inc., Sacramento, Calif.
PRELIMINARY DESIGN REPORT: NEW IDEAS FOR HELIOSTAT REFLECTOR CLEANING SYSTEMS
J. Schumacher, J. Hansen, and J. Nevenzel Dec. 1979 135 p refs Prepared for Sandia Labs., Albuquerque
(Contract EY-76-C-04-0789)
(SAND-79-8181) Avail: NTIS HC A07/MF A01
The feasibility of two concepts for cleaning heliostat reflectors are investigated and the results are itemized. In addition, the design and construction of a reflectometer and wind tunnel, and the performance of some dust accumulation studies are also discussed. DOE

N80-23810# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
METAL FOILS FOR DIRECT APPLICATION OF ABSORBER COATINGS ON SOLAR COLLECTORS
Carl M. Lampert Aug. 1979 19 p refs Presented at the 2nd Am. Electroplaters Soc. Symp. on Coatings for Solar Collectors, St. Louis, 16-17 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9324-Rev; CONF-791021-1-Rev) Avail: NTIS HC A02/MF A01
The basic materials and processing associated with the production of coated metal foils for solar collector absorber surfaces are discussed. Also covered are details of heavier metal strips for direct fabrication of solar collectors. Techniques including bonding methods and the use of adhesive are surveyed. Commercial solar foil manufacturers are covered along with the research efforts in this area. In conclusion, advantages and disadvantages are outlined, with specific recommendations. DOE

N80-23811# Monsanto Research Corp., Dayton, Ohio.
LOW-COST MIRROR CONCENTRATOR BASED ON DOUBLE-WALLED METALLIZED, TUBULAR FILMS Semiannual Technical Progress Report, 20 Aug. 1978 - 19 Feb. 1979
J. W. Leffingwell, G. L. Ball, III, J. L. Schuendeman, and T. A. Orofino 30 Mar. 1979 44 p refs
(Contract EM-78-C-04-4227)
(ALO-4227-12; SAPR-2) Avail: NTIS HC A03/MF A01
The development of a potentially, low cost, air inflatable, tubular plastic, nontracking 3X solar collector is described. The design employs joined truncated cylindrical sections which reduce both cover and mirror material requirements by 40% compared with a conventional cylindrical design. Aluminum foil-plastic laminates were selected as an alternative to aluminized polyester films because of their low cost, ease of fabrication, good durability, high strength, and acceptable reflectivity. Specially UV-stabilized and polyester scrim reinforced flexible polyvinyl chloride film was selected for use as the outer transparent cover material because of its mechanical and optical durability, acceptable transmission characteristics and its potential low cost. DOE

N80-23812# Foster Wheeler Corp., Livingston, N.J.
SOLAR PRODUCTION OF INDUSTRIAL PROCESS STEAM RANGING IN TEMPERATURE FROM 300 DEG F TO 550 DEG F, PHASE 1. VOLUME 3: APPENDICES (CONT) Final Report, 30 Sep. - 30 Jun. 1979
30 Jun. 1979 243 p refs
(Contract ET-78-C-03-2199)
(DOE/CS-32199-3) Avail: NTIS HC A11/MF A01
The following appendices are included: (1) instruments, (2) electrical specifications, (3) protective coverings, (4) welding requirements, (5) engineering specifications, and (6) administrative. DOE

N80-23813# Foster Wheeler Corp., Livingston, N.J.
SOLAR PRODUCTION OF INDUSTRIAL PROCESS STEAM RANGING IN TEMPERATURE FROM 300 DEGREES F TO 550 DEGREES F, PHASE 1. VOLUME 2: APPENDICES Final Report
30 Jun. 1979 232 p
(Contract ET-78-C-03-2199)
(DOE/CS-32199-2) Avail: NTIS HC A11/MF A01
The following appendices are presented: (1) equipment requisitions, (2) instrument list, (3) mechanical subcontract requisition, (4) electrical subcontract requisition, (5) site preparation and subcontract requisition, (6) building subcontract requisition, and (7) job specifications. DOE

N80-23814# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SOLAR THERMAL REPOWERING UTILITY VALUE ANALYSIS Final Report
Roger Taylor, John Day (Westinghouse Electric Corp., Pittsburgh), Brian Reed (Westinghouse Electric Corp., Pittsburgh), and Mike Malone (Westinghouse Electric Corp., Pittsburgh) Dec. 1979 225 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-8016-1) Avail: NTIS HC A10/MF A01
The value of a retrofitting central receiver energy supply systems to existing steam-electric generating stations (repowering) is assessed. The modeling tools and assumption used are described and the results are presented and interpreted. DOE

N80-23815# Alabama Univ., Huntsville. Environmental and Energy Center.
DATA HANDBOOK FOR THE NATIONAL SOLAR ENERGY DEMONSTRATION PROGRAM
David L. Christensen May 1979 97 p
(Contract EM-78-S-01-5216)
(DSE/5216-T3) Avail: NTIS HC A05/MF A01
Information is presented in a matrix format listing the technical and programmatic data concerning the various project sites selected for the National Solar Energy Demonstration Program. It incorporates the commercial, residential, and other demonstration projects which are now a part of the national program. DOE

N80-23816# Mega Analytical Research Services, Inc., Silver Spring, Md. Mega Engineering Div.
STUDY AND ANALYSIS OF A LOW COST CEMENT BONDED FLAT PLATE SOLAR COLLECTOR Final Report
Jan. 1979 136 p refs
(Contract EG-77-04-4122)
(ALO-4122-T1) Avail: NTIS HC A07/MF A01
A flat plate collector was designed and tested using low cost materials. This collector absorber plate included copper circulating tubes bonded to a flat sheet of conductive material using high service temperature, low outgassing, high conductivity adhesives. A series of candidate adhesive were evaluated. Structural and thermal tests were performed using galvanized sheet steel collector plates and aluminum collector plates with copper tubes to determine the conductivity of bond joints. The structural integrity of bond joints was evaluated under relative thermal expansion forces at various temperatures (ranging from 35 C to 300 C). Thermal cycling tests were conducted to evaluate fatigue of bond joints and to evaluate the degradation of thermal conductivity of these bond joints. A cost/performance summary was made (using F-chart) to determine the potential cost sevings realized compared with conventional systems. DOE

N80-23817# Monsanto Research Corp., Dayton, Ohio.
NON-CONCENTRATING COLLECTORS FOR SOLAR HEATING APPLICATIONS (MEDIUM TEMPERATURE AIR HEATERS BASED ON DURABLE TRANSPARENT FILMS) Final Report, 30 Sep. 1977 - 31 Oct. 1978
J. W. Leffingwell, J. L. Schwendeman, G. L. Ball, and T. A. Orofino Mar. 1979 143 p refs
(Contract EG-77-C-04-4147)
(ALO-4147-T1; MRC-DA-867) Avail: NTIS HC A07/MF A01
A special UV-stablized and scrim-reinforced flexible photovoltaic conversion film was developed, characterized, and tested on an air solar heater. Solar energy transmission of early

precontract 20/mil thick film was determined to be about 83% after two months outdoor Florida exposure, dropping to 78% after two years. Outdoor exposure and artificial UV aging tests indicate that a 10 year lifetime could be possible. The fabricated solar heater had a lower efficiency than predicted from computer modeling (43% for 129 F output with 62 F temperature rise at an ambient temperature of 60 F) suggesting design problems which could most easily be overcome by changing from a double-glazed non-selective absorber collector to a single-glazed-selective absorber heater. DOE

N80-23818*# Thermo Electron Corp., Waltham, Mass.
DOE/JPL ADVANCED THERMIONIC TECHNOLOGY PROGRAM Progress Report, Apr. - Jun. 1979
1979 73 p refs
(Contracts JPL-95509; EY-76-C-02-3056)
(NASA-CR-163134; COO-3056-41; PR-39) Avail: NTIS HC A04/MF A01 CSCL 10A

Progress made in different tasks of the advanced thermionic technology program is described. The tasks include surface and plasma investigations (surface characterization, spectroscopic plasma experiments, and converter theory); low temperature converter development (tungsten emitter, tungsten oxide collector and tungsten emitter, nickel collector); component hardware development (hot shell development); flame-fired silicon carbide converters; high temperature and advanced converter studies; postoperational diagnostics; and correlation of design interfaces. DOE

N80-23819# Sandia Labs., Albuquerque, N. Mex.
NON-INVERTING HELIOSTAT STUDY
J. B. Blackmon Jul. 1979 101 p refs Prepared in cooperation with McDonnell-Douglas Corp.
(Contract EY-76-C-04-0789)
(SAND-78-8190; MDC-G7876) Avail: NTIS HC A06/MF A01

Implications of employing a non-inverting heliostat design with a lower capital cost relative to an inverting design are considered from three standpoints: (1) effects of dust buildup, corresponding cleaning frequencies, and resultant cleaning costs; (2) effects of hail impact; and (3) reflected beam safety issues. It is concluded that elimination of the inverting stow hardware and addition of reflector provides a direct subsystem cost savings. DOE

N80-23820# Los Alamos Scientific Lab., N. Mex.
PRELIMINARY DEFINITION AND CHARACTERIZATIONS OF SOLAR INDUSTRIAL PROCESS HEAT TECHNOLOGY AND MANUFACTURING PLANT FOR THE YEAR 2000
Richard T. Meyer and Ted Prythero 1979 7 p Presented at the Solar Ind. Process Heat Conf., Oakland, Calif., 31 Oct. - 2 Nov. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2812; CONF-791024-4) Avail: NTIS HC A02/MF A01

The findings and projections of this preliminary definition and characterization of a solar industrial process heat technology and manufacturing plant for the year 2000 indicate that the technology and the manufacturing would be significantly more sophisticated and expanded than exists in the solar industry today. The solar process heat technology is defined to be a parabolic trough collector system and to utilize a combustion of the more advanced materials and components under current development. The manufacturing operations are projected to include glass-making, silvering, electroplating and plastic-forming, which, while standard industrial procedures, will be additions to or expansions of existing solar manufacturing plants. These integrated operations for the year 2000 solar facility will introduce important environmental residuals which will need to be managed and controlled to satisfy local, state, and federal environmental standards. DOE

N80-23821# Oak Ridge National Lab., Tenn. Engineering Technology Div.
SUMMARY OF THE RESEARCH AND DEVELOPMENT EFFORT ON OPEN-CYCLE COAL-FIRED GAS TURBINES
M. E. Lackey Oct. 1979 126 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6253) HC A07/MF A01

Extensive experience gained with gas turbines operating not only with coal as fuel but also with dusty inlet air and with dirty fuels (such as heavy oils and blast furnace gas) as well as petroleum catalytic cracking units was reviewed. All this experience indicates that the particulate content of the hot gases fed to the turbine must be kept to less than approximately 1 ppM to keep turbine bucket erosion to an acceptable level for turbine inlet temperatures of 1500 F or more. It is shown that cyclone separators can be used to reduce the particulate content to as low as 100 ppM under the best conditions. The only effective was found to reduce the particulate content of blast furnace gas and gas from coal gasification units to the 1 ppM required for a high temperature gas turbines is to cool the gas and pass it through a two-stage water scrubber or equivalent before burning it. DOE

N80-23822# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF SHALLOW SOLAR PONDS FOR INDUSTRIAL PROCESS HEAT: CASE HISTORIES
Alan B. Casamajor 4 May 1979 13 p refs Presented at the Intern. Solar Energy Soc., Atlanta, 28 May - 1 Jun. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-82367; CONF-790541-57) Avail: NTIS HC A02/MF A01

The shallow solar pond collector system is approaching commercialization. Three prototype or demonstration projects, Sohio Petroleum Company, Sweet Sue Kitchens, and Fort Benning, are described. A critique of each project points out the significant factors that affect the individual projects and shallow-solar pond technology in general. Particular attention is drawn to problems encountered and solutions proposed. Finally, possible marketing organization and strategies are discussed. DOE

N80-23823# Battelle Pacific Northwest Labs., Richland, Wash.
NUMERICAL ANALYSIS OF TEMPERATURE AND FLOW EFFECTS IN A DRY, TWO-DIMENSIONAL, POROUS-MEDIA RESERVOIR USED FOR COMPRESSED AIR ENERGY STORAGE
L. E. Wiles Oct. 1979 87 p refs
(Contract EY-76-C-06-1830)
(PNL-3047) Avail: NTIS HC A05/MF A01

The hydrodynamics and thermodynamic responses of a compressed air energy storage dry porous media reservoir subjected to simulated air mass cycling were investigated to develop design guidelines for the efficient and stable operation of the air storage reservoir. The analysis and results obtained by two dimensional modeling of dry reservoirs are presented. While the fluid/thermal response of the underground system is dependent on many parameters, the two-dimensional model was applied only to those parameters that entered the analysis by virtue of inclusion of the vertical dimension. In particular, the parameters or responses that were quantified or characterized include well bore heat transfer, heat losses to the vertical boundaries of the porous zone, gravitationally induced flows, producing length of the wellbore, and the effects of nonuniform permeability. The analysis of the wellbore heat tranfer included consideration of insulation, preheating (bubble development with heated air), and air mass flow rate. DOE

N80-23824# Mechanical Technology, Inc., Latham, N. Y.
APPLICATION OF MAGNETIC SUSPENSIONS AND FLUID FILM BEARINGS TO ENERGY STORAGE FLYWHEELS
M. Eusepi, L. Martin, and A. Ray Mar. 1979 168 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7007) Avail: NTIS HC A08/MF A01

The design of a suspension system for the support of a 10 kWh energy storage flywheel, with scaling equations and curves suitable for extending the 10 kWh design to other flywheel sizes up to 100 kWh is presented. The design of a test vehicle suitable for evaluating the final suspension design is included. The first phase of this effort was a concept study in which fluid film bearings for both radial and axial load support and magnet suspensions were examined in several combinations to determine suitability. The concept study is described and includes discussions on flywheel sizing, journal and thrust bearing sizing, magnetic suspension sizing and geometric arrangements. DOE

N80-23825# Sandia Labs., Livermore, Calif. Solar Components Div.
THERMOCHEMICAL ENERGY STORAGE AND TRANSPORT PROGRAM Progress Report, Oct. 1977 - Dec. 1978
T. T. Bramlette Sep. 1979 109 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8208) Avail: NTIS HC A06/MF A01

To exploit the potential advantages and quantify the disadvantages of thermochemical reactions for energy storage and transport applications, the program was structured initially to explore a wide range of chemical reactions and applications. In general, the development procedure consists of: (1) identification and evaluation of preferred current and future users of reversible chemical reactions for energy storage and transport; (2) identification of specification requirements and evaluation of available technology and technology needs for selected storage and transport systems; (3) formulation and evaluation of energy storage and transport concepts which meet the requirements established above; (4) definition and development of the required technology; (5) comparison of thermochemical storage and transport concept with competing technologies, and assessment of their conservation potential; and (6) development of the most promising concepts and systems to the point of demonstration on a scale commensurate with commercial applications. Progress made during the reporting period is summarized. DOE

N80-23826# Northeast Solar Energy Center, Cambridge, Mass.
STATUS OF INSOLATION RESOURCE ASSESSMENT IN THE NORTHEAST
Susan L. Kannenberg Dec. 1979 35 p refs
(Contract EM-78-C-01-4274)
(NESEC-6) Avail: NTIS HC A03/MF A01

The status of insolation resource assessment is described. Activities performed, services offered, and general features of solar radiation which are significant to the application of solar energy in the Northeast are summarized. DOE

N80-23827# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
OFF-PEAK ELECTRIC AUXILIARY HEAT FOR SOLAR AIR-HEATING SYSTEMS Final Report, 1 Jun. 1977 - 31 Dec. 1978
Thomas B. Jones and Paul J. Wilbur Jan. 1979 51 p refs
(Contract EG-77-S-02-4516)
(COO-4516-1) Avail: NTIS HC A04/MF A01

The performance of various solar auxiliary heating system options was examined by means of computer simulation. A storage reservoir which is separate from the solar reservoir was found to be preferable. Performance was generally not found to be sensitive to the time at which off-peak energy is available. Control schemes that predict energy requirements for a forthcoming on-peak period and account for energy in solar storage are preferable and a reservoir heater that can be staged so heating can be accomplished over the full duration of the on-peak period to supply different levels of energy is desirable. The system installed in a solar house for testing is described. DOE

N80-23828# Oak Ridge National Lab., Tenn.
FOSSIL ENERGY PROGRAM Progress Report, Oct. 1979
L. E. McNeese Dec. 1979 79 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7144) Avail: NTIS HC A05/MF A01

The utilization of coal and other fossil fuel alternatives to oil and gas as sources of clean energy is addressed. Coal conversion development, materials engineering, a coal equipment test program, an atmospheric fluid bed combustor for cogeneration, engineering studies and technical support, process and program analysis, environmental assessment studies, magnetic beneficiation of dry pulverized coal, technical support to a fluid bed combustion program, coal cogeneration/district heating plant assessment, chemical research and development, and technical support to major liquefaction projects are specifically discussed. DOE

N80-23829# Teledyne Energy Systems, Timonium, Md.
SELENIDE ISOTOPE GENERATOR FOR THE GALILEO MISSION: COPPER/WATER AXIALLY-GROOVED HEAT PIPE TOPICAL REPORT
N. P. Strazza 30 Jun. 1979 136 p refs
(Contracts ET-78-C-01-2865; DE-AC01-78ET-33009)
(TES-33009-44) Avail: NTIS HC A07/MF A01

A summary of the major accomplishments for the development, fabrication, and testing of axially-grooved copper/water heat pipes for selenide isotopic generator (SIG) applications is presented. The early development consisted of chemical, physical, and analytical studies to define an axially-grooved tube geometry that could be successfully fabricated to provide the desired long term (up to seven years) performance. Heat pipe fabrication procedures, measured performance and accelerated life testing of heat pipes S/Ns AL-5 and LT-57 are discussed. DOE

N80-23830# Systems Consultants, Inc., Washington, D. C.
REGIONAL APPLICATION OF FOSSIL ENERGY TECHNOLOGIES: AN ANALYTICAL APPROACH Final Report
W. Rebello, D. Canete, H. Phipps, and R. Smith Sep. 1979 312 p refs
(Contract EX-76-C-01-2442)
(DOE/ET-2442-1) Avail: NTIS HC A14/MF A01

Energy supply/demand profiles are presented for the 50 states and the nine US census regions using 1974 statistics. These profiles include quality and type of energy reserves, annual primary resource production, and consumption by end-use sector. A method for use by energy planners in assessing the effects of policy decision on energy profiles was developed. A series of energy indices was derived for each census region. The indices are defined to include the effect of consumption of relatively scarce fuels (oil and gas) versus plentiful fuels (coal). A number of fossil energy technologies under development are described. The potential impact of the maturation of these technologies on each census region's energy posture is discussed in conjunction with any regional constraints that may exist. Finally, a number of sample what if scenarios are discussed and the impact of fossil fuel replacements on national, regional, and sector energy consumption quantitatively is assessed. DOE

N80-23831# Rockwell International Corp., Golden, Colo. Energy Systems Group.
MILLVILLE WIND TURBINE GENERATOR: FAILURE ANALYSIS AND CORRECTIVE DESIGN MODIFICATION
C. A. Waldon, M. J. Carr, and V. K. Grotzky Jul. 1979 25 p refs
(Contract EY-76-C-04-3533)
(RFP-2992/3533/79-3) Avail: NTIS HC A02/MF A01

Fatigue cracks in the blade skins of the Millville Wind Turbine Generator were fractographically analyzed. It is beleived they were caused by large flapwise deflections during a wind storm on December 4, 1978. The deflections caused the skin to buckle, which initiated rapidly growing fatigue cracks. Propagation continued to the leading edge, moving radially inward and outward along the leading edge radius. A modified blade design which incorporates several corrective techniques was then developed. DOE

N80-23832# Oak Ridge Y-12 Plant, Tenn. Fabrication Systems Dept.
OAK RIDGE FLYWHEEL EVALUATION LABORATORY Annual Report, 1 Apr. - 30 Sep. 1979
R. S. Steele, Jr., J. M. Casstevens, and B. J. Sutton Dec. 1979 29 p refs
(Contracts W-7405-eng-48; W-7405-eng-26)
(Y-2210) Avail: NTIS HC A03/MF A01

The Oak Ridge Flywheel Evaluation Laboratory (ORFEL) was assembled, and the initial stages of proof testing were completed. The significant accomplishments for the past year included the establishment of adequate full-time personnel; facility modification to reflect the emphasis on flywheel evaluation over simple testing; and the facility proof test involving two aluminum disk flywheels and one composite flywheel. DOE

N80-23833# IBM Federal Systems Div., Huntsville, Ala.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
May 1979 266 p
(Contract EG-77-C-01-4049)
(Solar/0010-79/05) Avail: NTIS HC A12/MF A01

A major goal of the National Solar Heating and Cooling Demonstration Program is to collect and analyze data which will be used to determine the thermal performance of selected solar energy systems. To meet the goals and objectives of the Demonstration Program, the National Solar Data Network was developed. The network consists of sensors which measure key performance parameters at a selected site, a site data acquistion system, telephone transmission circuits and a central data processing system which collects data and performs the computations required for system performance analysis. The output of the National Solar Data Network is a monthly performance report which defines the energy contribution of the solar energy system and resultant fossil fuel savings. The performance data for homes throughout the US is included. DOE

N80-23834# Hughes Research Labs., Malibu, Calif.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THINS-FILM SOLAR CELLS Quarterly Progress Report, 27 Sep. - 27 Dec. 1978
K. Zanio. Jun. 1979. 26 p. refs
(Contract ET-78-C-01-3412)
(DSE/3412-T1; QPR-1) Avail: NTIS HC A03/MF A01

Preliminary studies were initiated to examine and alleviate the deleterious effect of grain boundaries in solar cells fabricated from InP. The planar reactive deposition system was modified so that the InP substrate temperature could be reduced below the single crystalline to polycrystalline transition temperature and effects of grain boundaries on p-n junctions can be more readily and reproducibly separated out. A model for grain boundaries intersecting a p-n junction was introduced. In the model, the grain boundary is treated as a two dimensional array of lower bandgap material which enhances the leakage current at the p-n junction. The effect of various etchants on grain boundaries in InP was also examined as a preliminary step toward passivating the grain boundaries. An anodic oxide and InGaP, both candidates as passivation layers, were deposited on single-crystal InP. DOE

N80-23835# Fluidyne Engineering Corp., Minneapolis, Minn.
MHD AIR HEATER DEVELOPMENT TECHNOLOGY Progress Report, Oct. - Dec. 1978
Apr. 1979. 25 p. refs
(Contract ET-78-C-01-3005)
(CONS-3005-T2) Avail: NTIS HC A02/MF A01

Work on different tasks of the magnetohydrodynamic air heater development technology is described. The influence of heater system layout, duct dimensions, and heater sequencing on flow distribution was studied. One result was that localizing the bulk of the pressure drop in the heaters tends to minimize heater-toheater flow differences. An analysis of current flow back up the air duct from the combustor was done. Results showed that the voltage gradient and power loss back up the air duct depend on the ratio of electrical conductivities of air and duct wall insulation. Heat 201 was run with a Corhart X-317 matrix in the rig. Matrix test 7 (Heat 201) ran for over four hundred hours but was terminated early because of a restriction in the bed. This was caused by failure of the insulating lining in the hot gas duct between the burner and the matrix. DOE

N80-23836# CCB/CUMALI Associates, Oakland, Calif.
PASSIVE SOLAR CALCULATION METHODS Interim Report
15 Apr. 1979. 70 p. refs
(Contract EM-78-C-01-5221)
(DSE/5221-T1) Avail: NTIS HC A04/MF A01

The results accomplished under the following tasks: (1) evaluation of existing passive solar calculation methods, (2) BLAST/DOE-1 program interface and comparison with BR-202, and (3) development of analytic relationships between the thermal balance and weighting factor techniques are detailed. The various methods available for use in thermal load analysis are presented with detailed information on algorithm used in the thermal balance and weighting factor techniques. DOE

N80-23837# Bechtel National, Inc., San Francisco, Calif. Research and Engineering Operation.
DESIGN OF LOW-COST STRUCTURES FOR PHOTOVOLTAIC ARRAYS. VOLUME 2: TECHNICAL STUDIES AND APPENDICES Final Report
Nov. 1979. 238 p. refs
(Contract EY-76-C-04-0789)
(SAND-79-7002-Vol-2) Avail: NTIS HC A11/MF A01

A study of low cost support structures for flat photovoltaic panels set at a fixed angle to the ground was conducted. The work began with a survey of solar system manufacturers. The results showed a diverse approach to the design of support structures and a lack of systematic design criteria. Therefore, a series of conceptual designs of support structures and their foundations were developed based on the use of concrete, steel or aluminum, and timber. A 6 MWe peak baseline photovoltaic power plant was conceptualized in order to bring a practical perspective to cost estimating for the designs. Detailed civil-structural design criteria were developed. These criteria identified loadings for normal operating conditions and extreme environmental conditions. The study results include detailed designs for eight array support structures and foundations for flat plate arrays using 8 foot wide panels with foundations spaced 20 feet apart along the rows in the east-west direction. Cost estimates for supports and foundations were shown to vary between $2 to $3 per square foot of supported panels (deflated to 1975 dollars). DOE

N80-23838# Department of Energy, Washington, D.C. Office of Fusion Energy.
MAGNETIC FUSION ENERGY AND COMPUTERS: THE ROLE OF COMPUTING IN MAGNETIC FUSION ENERGY RESEARCH AND DEVELOPMENT
Washington, D.C. DOE. Oct. 1979. 57 p.
(DOE/ER-0033) Avail: NTIS HC A04/MF A01

The role of computing in the magnetic confinement fusion program is examined. The present status of the magnetic fusion energy computer center and its associated network is described. The role of computer models in the main elements of the fusion program is also examined and their dependence on the most advanced scientific computer is discussed. A study of computer requirements for the magnetic fusion energy program was conducted and the results of this analysis are presented. DOE

N80-23839# Oak Ridge National Lab., Tenn. Chemistry Div.
MOLTEN CARBONATE FUEL CELL PROGRAM. COMPOSITION GRADIENTS INDUCED BY CURRENT FLOW IN Li_2CO_3-K_2CO_3 MIXTURES Progress Report, 1 Jul. - 31 Dec. 1978
J. Braunstein, H. R. Bronstein, S. Cantor, D. E. Heatherly, J. I. Padova, T. M. Thomas, and C. E. Vallet. Dec. 1979. 15 p. refs
(Contract W-7405-eng-26)
(ORNL/TM-7061) Avail: NTIS HC A02/MF A01

Gradients in the Li/K ratio of a $LiKCO_3$ electrolyte caused by current flow in a molten carbonate fuel cell is the cation mobilities are unequal were examined. Composition gradients were predicted from estimated values of mobility, activity, and diffusivity utilizing a one dimensional model. Predictions from a similar model for a system of known properties were confirmed experimentally by electrolysis-relaxation experiments. The model calculations for carbonates are consistent with electrolysis-relaxation measurements on fuel cell tiles, but clearly indicate the need for additional specific physical property data, especially the tranference number. DOE

N80-23840# Puerto Rico Univ., Rio Piedras. Agricultural Experiment Station.
PRODUCTION OF SUGARCANE AND TROPICAL GRASSES AS A RENEWABLE ENERGY SOURCE Quarterly Report, 1 Dec. 1978 - 28 Feb. 1979
Alex G. Alexander, W. Allison, and M. Garcia. 1979. 45 p. refs
(Contract ET-78-S-05-5912; AES-UPR Proj. C-481)
(ORO-5912-T1; QR-3) Avail: NTIS HC A03/MF A01

Research on candidate screening, water and nitrogen regimes, and ratoon-crop performance for row-spacing, harvest frequency, and varietal variables is discussed. Greenhouse tests revealed several grasses having growth and drouth-tolerance characteristics superior to Sordan 70A, the project's outstanding short-rotation candidate up to this time. Johnson grass (Sorghum halepense), regarded as a weed by farmers, gave very favorable growth performances under simulated arid and semi-arid conditions. At six months into year 2, first ratoon data for sugarcane and

napier grass indicate yield increases of 33% and 4%, respectively, over plant crop yields. The NCo 310 is emerging as the outstanding sugarcane variety tested to date. There are no consistent responses to narrow row spacing. Frequent recutting (at 2 month intervals) is gradually destroying sugarcane but is not appreciably affecting napier grass. DOE

N80-23841# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
FEDERAL REPUBLIC OF GERMANY: ESTIMATES OF FUTURE ENERGY/GDP RELATIONSHIPS
R. Bruce Williamson and Edward L. Allen Dec. 1979 64 p refs
(Contracts EY-76-C-05-0033; DE-AC05-76OR-00033)
(ORAU/IEA(M)-79-22) Avail: NTIS HC A04/MF A01

Postwar trends in the West German economy, demography, and energy use were analyzed. The base year is 1976, and projections are made up to the yesr 2000 for gross domestic product (GDP) and sectoral energy demand. West Germany's 2.8 percent average annual GDP growth rate for the 1970s contrasts sharply with the 5.4 percent rate achieved in the 1960s. Future GDP growth is projected to level off at 2.9 percent a year, on the average, between now and 2000. This projection places German economic growth below that of Japan, Canada, and France but ahead of that projected for Italy and the United Kingdom. The relationship between West Germany energy demand and economic growth was stable in the postwar period. In 1976, total energy consumption stood at 9.8 quads and is projected to increase to 12.7 quads in 2000, an average annual 1.1 percent increase. The E/GDP ratio is expected to improve substantially by the year 2000, with the residential sector leading the way in energy efficiency. DOE

N80-23842*# General Electric Co., Schenectady, N. Y.
CONCEPTUAL DESIGN OF THERMAL ENERGY STORAGE SYSTEMS FOR NEAR-TERM ELECTRIC UTILITY APPLICATIONS Final Report
E. W. Hall, W. Hausz, R. Anand, N. LaMarche, J. Oplinger, and M. Katzer Nov. 1979 524 p refs Sponsored by NASA and EPRI
(Contract EC-77-A-31-1034; EPRI Proj. 1082-1)
(NASA-CR-159577; EPRI-EM-1218) Avail: NTIS HC A22/MF A01 CSCL 10A

Over forty concepts were examined for storage media, forms of containment, and cycle configurations for conversion to electricity. An extensive analysis and screening process resulted in selecting two coal-fired and two nuclear plants for detail conceptual design. The coal plants utilized peaking turbines and the nuclear plants varied the feedwater extraction to change power output. It was shown that the performance and costs of even the best of these systems could not compete in near-term utility applications with cycling coal plants and typical gas turbines available for peaking power. Lower electricity costs, greater flexibility of operation, and other benefits can be provided by cycling coal plants for greater than 1500 hours of peaking or by gas turbines for less than 1500 hours if oil is available and its cost does not increase significantly. DOE

N80-23843# General Electric Co., Schenectady, N. Y. Materials and Processes Lab.
LAMINATED COMPOSITE DISC FLYWHEEL DEVELOPMENT Interim Report, Jan. - 30 Jun. 1979
R. P. Nimmer, K. A. Toroosian, and J. S. Hickey Jul. 1979 75 p refs
(Contract W-7405-eng-48)
(UCRL-15154; IR-2) Avail: NTIS HC A04/MF A01

A flywheel with high energy density potential is considered. The actual testing of fabricated composite discs is reported with emphasis on spin tests to destruction on laminated S2-glass discs of various stacking sequences. The tests were designed to investigate the effect of alpha-number upon flywheel energy density. Progress in testing and interpreting results of these initial laminated disc flywheels is reported. J.M.S.

N80-23844# Argonne National Lab., Ill.
OPEN-CYCLE COAL-FIRED LIQUID-METAL MHD
E. S. Pierson, M. Petrick, F. Schreiner, and D. Cohen 1979 12 p refs Presented at the 18th Symp. on Eng. Aspects of Magnetohydrodyn., Butte, Mont., 18-20 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-790640-7) Avail: NTIS HC A02/MF A01

An open-cycle, coal fired, liquid magnetohydrodynamics (MHD) concept is described and compared with the open-cycle plasma MHD cycle, and it is shown that, in the former, temperatures are much lower and the air preheater and radiant boiler are eliminated. The constraints on the electrodynamic working fluid and the choice of copper are discussed. Recent experiments with liquid copper and coal combustion gas are described, and the indicated implications for environmental impact, i.e., SO/sub x/ and NO/sub x/ control, are discussed. Initial efficiency calculations yield values comparable to those for open-cycle plasma MHD at combustor temperatures as much as 1000 K lower and MHD generator temperatures more than 1000 K lower than is the case for open-cycle plasma MHD. Significantly, the liquid metal MHD system uses components that, except for the generator, are close to or within present-day technology, and it appears that readily available containment materials are compatible with the fluids. DOE

N80-23845# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
VERTICAL AXIS WIND TURBINE DEVELOPMENT: EXECUTIVE SUMMARY Final Report, 1 Mar. 1976 - 30 Jun. 1977
R. E. Walters, J. B. Fanucci, P. W. Hill, and P. G. Migliore Jul. 1979 26 p
(Contract EY-76-C-05-5135)
(ORO-5135-77-5-Summ) Avail: NTIS HC A03/MF A01

Information is presented concerning (1) the numerical solution of the aerodynamics of cross-flow wind turbines; (2) boundary layer considerations for a vertical axis wind turbine (VAWT); (3) VAWT outdoor test model; (4) low solidity blade tests; (5) high solidity blade design; (6) cost analysis of the VAWT test model; (7) structural parametric analysis of VAWT blades; and (8) cost study of current wind energy conversion systems. DOE

N80-23846# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
VERTICAL AXIS WIND TURBINE DEVELOPMENT Final Report, 1 Mar. 1976 - 30 Jun. 1977
R. E. Walters, J. B. Fanucci, P. W. Hill, and P. G. Migliore Jul. 1979 243 p refs
(Contract EY-76-C-05-5135)
(ORO-5135-77-5) Avail: NTIS HC A11/MF A01

Theoretical and experimental research accomplished in evaluating an innovative concept for vertical axis wind turbines (VAWT) is described. The concept is that of using straight blades composed of circulation controlled airfoil sections. The theoretical analysis was developed to determine the unsteady lift and moment characteristics of multiple-blade cross-flow wind turbines. To determine the drag data needed as input to the theoretical analysis, an outdoor test model VAWT was constructed; design details, instrumentation, calibration results, and initial test results are reported. Initial testing was with fixed pitch blades having cross-sections of conventional symmetrical airfoils. Costs of building the test model are included, as well as cost estimates for blades constructed with composite materials. These costs are compared with those of other types of wind turbines. DOE

N80-23847# Urban Systems Research and Engineering, Inc., Cambridge, Mass.
DIRECT REGIONAL ENERGY/ECONOMIC MODELING (DREEM) DESIGN Final Report
P. D. Hall and C. J. Pleatsikas Oct. 1979 146 p refs
(Contract EI-78-C-01-6345)
(DOE/EIA/6345-1) Avail: NTIS HC A07/MF A01

The use of regional and multiregional economic models for estimating the indirect and induced impacts of Federally-mandated energy policies was investigated. Alternative types of energy policies that can impact regional economics and the available analytical frameworks for measuring the magnitudes and spatial extents of these impacts were examined. The models capabilities for addressing various energy policy issues are summarized. Then the applicability of the model in specified contexts is demonstrated by developing appropriate input data for three scenarios. These scenarios concern the multi-state impacts of

alternative coal mining development decisions, multi-regional impacts of macroeconomic change, and the comprehensive effects of an alternative national energy supply trajectory. DOE

N80-23848# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
UNITED KINGDOM: ESTIMATES OF FUTURE ENERGY/GDP RELATIONSHIP
J. C. Gehman and Edward L. Allen. Dec. 1979. 106 p. refs.
(Contracts EY-76-C-05-0033; DE-AC05-76OR-00033)
(ORAU/IEA(M)-79-25) Avail: NTIS. HC A06/MF A01

The UK economy is expected to grow in real terms due, for the most part, to advances in productivity. With productivity increasing, but at a declining rate, real GDP is projected at 50 percent above the 1976 level. The historical shift from goods production to services is expected to continue, but at a slower pace; by the year 2000 service output is expected to reach 55 percent of GDP. In the transport sector, the historical shift toward the passenger car is expected to saturate at about 70 percent of total ton-miles, while the shift toward truck freight is expected to continue and reach 76 percent of total ton-miles. Goods production is expected to stagnate and could fall to 33 percent of GDP by 2000. Historically, E/GDP has fallen steadily in the United Kingdom due almost exclusively to industrial conservation (investment in new and more efficient plant and equipment). Conservation should spread to all other sectors of the economy as a result of government policy. The E/GDP ratio is expected to fall by another 28 percent by the year 2000. This implies total energy consumption of 8.7 quads. DOE

N80-23849# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
CANADA: ESTIMATES OF FUTURE ENERGY/GNP RELATIONSHIPS
E. L. Allen, James A. Edmonds, and R. Bruce Williamson. Dec. 1979. 61 p. refs.
(Contracts EY-76-C-05-0033; DE-AC05-76OR-00033)
(ORAU/IEA(M)-79-24) Avail: NTIS. HC A04/MF A01

The Canadian economy expanded at an annual rate of 4.6 percent in the 1970s (GNP growth), second only to the remarkable record of Japan. In the future, Canadian economic development is expected to fall below past rates of achievement, primarily because of declining numbers of new entrants in the labor force. However, other factors affecting growth remain favorable. Canada, in particular, is virtually self-sufficient in energy. Government policy is to carry out a vigorous program of conservation, and to parallel this effort with domestic energy price increases which will move up to world levels over the next few years. As to economic growth, GNP expansion is expected to remain well above 3 percent a year for the balance of this century. Energy consumption is expected to grow from 7.51 Btu x 10 to the 15th power (quads) in 1976 to 13.3 quads by 2000. This means that energy growth, as a consequence of determined conservation, is expected to be about half as rapid as economic growth to 1990. DOE

N80-23850# Foster-Miller Associates, Inc., Waltham, Mass.
RESEARCH AND DEVELOPMENT OF AN AIR-CYCLE HEAT-PUMP WATER HEATER. Final Report
John T. Dieckmann, Alve J. Erickson, Andrew C. Harvey, and William M. Toscano. 1 Oct. 1979. 343 p. refs.
(Contract W-7405-eng-26)
(ORNL/SUB-7226/1) Avail: NTIS. HC A15/MF A01

A prototype reverse Brayton air cycle heat pump water heater was designed and built for residential applications. The system consists of a compressor/expander, an air-water heat exchanger, an electric motor, a water circulation pump, a thermostat, and fluid management controls. A potential residential market for the new high-efficiency water heater of approximately 480,000 units/y was identified. The retail and installation cost of this water heater is estimated to be between $500 and $600 which is approximately $300 more than a conventional electric water heater. As part of the design effort, a thermodynamic parametric analysis was performed on the water heater system. It was determined that to obtain a coefficient of performance of 1.7, the isentropic efficiency of both the compressor and the expander must be at least 85 percent. The selected mechanical configuration is described. DOE

N80-23851# BDM Corp., Albuquerque, N. Mex.
INVESTIGATION OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF USING PUMPED WELL-WATER ENERGY STORAGE SYSTEMS. Final Report
Dec. 1979. 92 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-7096; BDM/TAC-79-518-TR-R1) Avail: NTIS. HC A05/MF A01

Work completed on the three technical tasks of the project is summarized. The first task included a conceptual/preliminary system design, a selection of potential geographic locations in New Mexico for this system, and a study of relating institutional issues. The second task included a design of the baseline energy storage system with the identification of major components (off the shelf) and their associated performance estimates and a proposed site location within New Mexico. The third task area included an estimate of the capital cost for the storage system (e.g., cost of major components and processes, O and M costs) and an estimate of the potential annual fossil fuel savings. DOE

N80-23852# Toledo Univ., Ohio. College of Engineering.
PERFORMANCE IMPROVEMENT OF A SOLAR HEATING SYSTEM UTILIZING OFF-PEAK ELECTRIC AUXILIARY. Semiannual Progress Report, 18 Jun. - 31 Dec. 1979
A. H. Eltimsahy. Dec. 1979. 10 p.
(Contract DE-FG02-79R5-10140)
(DOE/R5/10140-1) Avail: NTIS. HC A02/MF A01

A solar-assisted heat pump system, which was designed, installed, and operated in an experimental solar house, is described. The heat pump system is capable of operating in a wide range of temperatures which is needed in a solar house utilizing off-peak storage from the electric utility. The complete system consists of 584.1 square feet of flat plate solar collectors, a 5 horsepower compressor, an evaporator, a condenser, thermal storage units, and associated equipment. During the installation and initial operation of the system, numerous aspects of the feasibility of the system design were evaluated. Many of these aspects point to the potentially improved operating performance of a solar heating system utilizing off-peak storage from the electric utility. DOE

N80-23853# Sandia Labs., Albuquerque, N. Mex.
LOW COST STRUCTURES FOR PHOTOVOLTAIC ARRAYS
H. Post. 1980. 6 p. refs. Presented at the 14th Photovoltaics Specialists Conf., San Diego, Calif., 7 Jan. 1980
(Contract EY-76-C-04-0789)
(SAND-80-0142C; CONF-800108-9) Avail: NTIS. HC A02/MF A01

The design and analysis of low cost, ground-mounted flat plate non-tracking array structures for use in large intermediate and central power station applications are described. Design requirements for the array structure, especially wind loading criteria, are discussed and problem areas associated with the integration of the module panel and support structure are identified. Support system costs which include site preparation, foundation and support structure, and installation costs are summarized. Wind effects data derived from comprehensive wind tunnel tests of flat plate array field models are presented and compared with wind loading estimates based on existing design standards. DOE

N80-23854# Massachusetts Inst. of Tech., Cambridge.
PROCESS APPLICATIONS FOR GEOTHERMAL ENERGY RESOURCES. Progress Report
1 Oct. 1979. 9 p.
(Contract ET-78-S-02-4896)
(COO-4896-T1) Avail: NTIS. HC A02/MF A01

Energy use characteristics of the major energy using industries in the US were examined. Using the pulp and paper industry, two analyses were performed of the potential for substituting geothermal energy for fossil fuel in specific plants. The lack of industry interest is discussed. DOE

N80-23855# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLAR PHOTOVOLTAIC PROJECT: MATERIALS, AND TESTING ACTIVITIES. Quarterly Report, 1 Apr. - 1 Jun. 1979

B. E. Foreman and M. P. Themelis 31 Oct. 1979 36 p refs
(Contract EY-76-C-02-4094)
(COO-4094-80) Avail: NTIS HC A03/MF A01

Terrestrial photovoltaic modules were tested in the field to determine the extent of physical and electrical degradation which had taken place since previous inspections. Several modules were removed from the sites for more detailed laboratory analysis. In addition degradation analyses of modules from the rooftop of the Chicago Museum of Science and Industry, and failure analysis of modules from the Lincoln Laboratory Rooftop Test Bed and Residential Test Beds was performed. The results of both field testing and the laboratory analyses are reported. DOE

N80-23858# Midwest Research Inst., Kansas City, Mo. Solar Energy Research Inst.
SOLPOND: A SIMULATION PROGRAM FOR SALINITY GRADIENT SOLAR PONDS
Jon Henderson and Cecile M. Lebeau Jan. 1980 7 p refs
Presented at the 2nd Ann. Systems Simulation and Econ. Analysis Conf., San Diego, Calif., 23-25 Jan. 1980
(Contract EG-77-C-01-4042)
(SERI/TP-351-589; CONF-800101-4) Avail: NTIS
HC A02/MF A01

A computer simulation design tool was developed to simulate dynamic thermal performance for salinity gradient solar ponds. Dynamic programming techniques allow the user significant flexibility in analyzing pond performance under realistic load and weather conditions. Finite element techniques describe conduction heat transfer through the pond, earth, and edges. Results illustrate typical thermal performance of salinity gradient ponds. Sensitivity studies of salty pond thermal performance with respect to geometry, load, and optical transmission are included. Experimental validation of the program with an operating pond is also presented. DOE

N80-23857# Brookhaven National Lab., Upton, N. Y.
SERIES SOLAR HEAT PUMP AND ENERGY CONSERVATION
Edward A. Kush 1979 24 p refs Presented at the 2nd Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10-13 Dec. 1979
(Contract EY-76-C-02-0016)
(BNL-27012; CONF-791204-13) Avail: NTIS
HC A02/MF A01

An overview is given of the series solar heat pump concepts and the reasons why it can serve an important role in energy conservation in space heating. These are highlighted by elevated coefficients of performance (COP's) and the use of low temperature potentially inexpensive solar collectors. The characteristics required of the subsystems and integrated system are detailed. Particular emphasis is given to the performance of the heat pump itself at high temperature source conditions corresponding to those of solar input, and recent laboratory results which demonstrate very high COP's using practical components are shown. The reasons why the high COP's are a necessary but not sufficient condition for competitive overall system performance are detailed and methods for applying the high COP's to an effective solar assisted heat pump system are discussed. Ongoing development work in the field is summarized. DOE

N80-23856# Boeing Computer Services, Inc., Seattle, Wash. Energy Technology Applications Div.
DEVELOPING AND UPGRADING OF SOLAR SYSTEM THERMAL ENERGY STORAGE SIMULATION MODELS Technical Progress Report, 1 Sep. 1979 - 28 Feb. 1979
J. K. Kuhn, G. F. vonFuchs, and A. P. Zob May 1979 70 p refs
(Contract EG-77-C-02-4482)
(BCS-40252) Avail: NTIS HC A04/MF A01

The rock bed solar energy storage model selected for validation was further explored and compared to test data. Correlation with data from different experiments is showing improvement over the correlations reported earlier. Two more water tank models were obtained. Work is continuing with model testing, validation and evaluation. Additional laboratory test data on water tank performance was obtained. Some significant improvements were made in the SOLSYS algorithm resulting in a more powerful simulation tool referred to as the extended SOLSYS model. DOE

N80-23859# Battelle Pacific Northwest Labs., Richland, Wash.
SOLAR REFLECTOR MATERIALS
M. A. Lind 1979 23 p Presented at the USPE Seminar on High-Level Solar Energy, Seattle, 18 May 1979
(Contract EY-76-C-06-1830)
(PNL-SA-7698; CONF-7905134-1) Avail: NTIS
HC A02/MF A01

A overview is given of the current state-of-the-art in solar reflector materials which outlines the uses of reflectors in the solar industry and presents some insights into the operational and materials considerations that must be incorporated into the solar reflector design. Current problem areas and research goals are also emphasized. DOE

N80-23860# Battelle Columbus Labs., Ohio.
ANALYSIS AND DESIGN OF A 100-KILOWATT SOLAR PHOTOVOLTAIC FLAT-PANEL POWER SYSTEM FOR A MACHINING AND METALWORKING FACILITY IN COLUMBUS, OHIO. PHASE 1: PHOTOVOLTAIC FLAT PANEL APPLICATION EXPERIMENT Final Report, 1 Oct. 1978 - 28 Feb. 1979
G. T. Noel, G. Alexander, L. H. Stember, G. H. Stickford, J. H. Broehl, and D. C. Carmichael Albuquerque, N. Mex. DOE Mar. 1979 163 p
(Contracts ET-78-C-04-5395; DE-AC04-78ET-23055)
(DOE/ET/23055-1) Avail: NTIS HC A08/MF A01

A 100kW peak flat panel photovoltaic power system to supply power to a machine shop load in Columbus, Ohio was designed. The system will provide three-phase, 240 volt ac power to a machining and metal-working facility which has 100 pieces of machinery and employs 50 machinists and other craftsmen. The system will operate in parallel with the utility which will supply the backup power. Due to the close match of the array power output to the workday shop load, only a small amount of the power generated is excess to the concurrent shop demand. When there is any excess, it will be fed to alternate loads at the site, rather than into the utility grid. A system performance analysis indicates that the system will supply approximately 115,000 kWh/ year of electrical energy after all losses. The system uses high energy-density flat panel photovoltaic modules in a roof-mounted installation, and employs a microprocessor controlled power conditioning unit. DOE

N80-23861# Yardney Electric Corp., Pawcatuck, Conn.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF NICKEL-ZINC BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1978
Oct. 1979 64 p
(Contract W-31-109-eng-38)
(ANL/OEPM-78-12) Avail: NTIS HC A04/MF A01

The work carried on nickel zinc batteries over the past year was directed in three major areas: (1) elucidating the failure modes of the nickel-zinc battery system; (2) improving performance of the system; and (3) effecting a cost reduction program. Progress on the three areas is reported. DOE

N80-23862# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
DYNAMICS OF A FLEXIBLE ROTOR-TOWER SYSTEM
Lennart S. Hultgren and John Dugundji Stockholm Aeronautical Research Inst. of Sweden Aug. 1979 99 p refs
(Contract SWEDBESD-5061.012)
(ASRL-TR-194-1; FFA-AU-1499) Avail: NTIS
HC A05/MF A01

The dynamics of a horizontal axis wind turbine were analyzed. Both the blades and the tower are taken to be flexible. The analysis is linear and modal. For a three bladed rotor, numerical results were obtained for free vibrations and forced oscillations due to static unbalance. Analytical solutions were constructed for forced vibrations due to gravity and wind shear. Author (ESA)

N80-23863# Rolls-Royce Ltd., Derby (England).
IDENTIFICATION SYSTEM FOR APPARATUS AND PLANT USED IN THERMAL POWER STATIONS

Horst Anders (Brown, Boverie and Co.), Philipp Freymeyer (Siemans AG), and Helmut Hotes (AEG Telefunken) 1979 30 p Transl. into ENGLISH of 'System zur Kennzeichnung von Geraeten u. Anlagen in Waermekraftwerken', Elektrizitaetswirtschaft (Frankfurt), v. 6, 17 Mar. 1969 p 181-192 In ENGLISH and GERMAN
(PNR-90008; Trans-14884) Avail: NTIS HC A03/MF A01

The advantages of using a standard nomenclature for all equipment and apparatus used in thermal power stations are given, along with a list of the requirements which such a system would have to meet. A system covering both electrical and mechanical engineering is presented along with possible extensions. Experience gained in the use of the system is discussed. Author (ESA)

N80-23864# Metallgesellschaft, A.G., Frankfurt am Main (West Germany). Metall-Lab.
GRIDS FOR MAINTENANCE-FREE STORAGE BATTERIES MADE FROM LEAD-AKALINE EARTH METAL-ALLOYS Final Report
Ulrich Heubner, Gert Friedham, and Eberhard Nann Bonn Bundesmin. fuer Forsch und Technol. Sep. 1979 95 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-79-21) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 19.55

The production of lead-alkaline earth metal grids for use in acid-based batteries was investigated. Rolled strips of the alloy were processed into expanded metal grids showing sufficient mechanical strength, high electrical conductivity, and corrosion resistance. Batteries using these electrodes are maintenance-free and exhibit good cold cranking ability. Author (ESA)

N80-23865# European Space Agency, Paris (France).
PHOTOLYTIC DECOMPOSITION OF WATER INTO OXYGEN AND HYDROGEN AS AN ALTERNATIVE ENERGY UTILIZATION OF HOUSEHOLDS AND SMALL CONSUMERS
Wolfgang U. Wendekamm Nov. 1979 54 p refs Transl. into ENGLISH of "Photolytisches Zersetzung von Wasser zu Wauerstoff und Wasserstoff als Alternative Energieversorgung von Haushalten und Kleinverbrauchern", Rept. DFVLR-FB-78-77 DFVLR, Trauen, West Germany, Jan. 1978 Original report in GERMAN previously announced as N79-30836 Original German report available from ZLDI, Munich DM 19.90
(ESA-TT-582; DFVLR-FB-78-17) Avail: NTIS HC A04/MF A01

The photolytic decomposition of water into oxygen and hydrogen is one of the possible alternatives for the transformation of solar energy into storable secondary energy for practical utilization by households and small consumers. After a survey of the possible cycles of water decomposition, the chemical and physical fundamentals of the photolytic decomposition of water using inorganic catalysts and sensitizers are described. Finally, a total house energy supply system is presented as one illustration of the application possibilities. Author (ESA)

N80-23866# Transportation Research Board, Washington, D.C. Commission on Sociotechnical Systems.
ENERGY POLICY IMPACT EVALUATION
Susan Singer-bart, ed., Raisin K. Mufti (Princeton Univ.), Michael J. Munson (Princeton Univ.), Kenneth Chomitz (California Univ., Irvine), Richard A. Margiotta (Tennessee Univ., Knoxville), Lawrence J. Reilly (Harvard Univ., Cambridge Mass.), David T. Hartgen (New York State Dept. of Transportation, Albany), Leon Rudman (DOE, Cambridge, Mass.), Robin Dubin (Johns Hopkins Univ., Baltimore), David L. Greene (ORNL, Tenn.) et al 1979 44 p refs Sponsored in part by DOE
(PB80-137953; TRB/TRR-726; ISBN-0-309-02979-1; LC-79-607912; ISSN-0361-1981) Avail: NTIS HC A03/MF A01; Paper copy also available from Transportation Res. Board, 2101 Constitution Ave., Washington, D. C. 20418 CSCL 10A

Five papers are presented which deal with the following areas: approach to assessing the impact of energy conservation policies on transportation demand; survey and analysis of energy intensity estimates for urban transportation modes; foreign oil dependence; state-level analysis; vehicle kilometers traveled; evaluation of existing data sources; and multivariate classification of automobiles by use of an automobile characteristics data base. GRA

N80-23867# National Bureau of Standards, Washington, D.C.
SOLAR ENERGY SYSTEMS: TEST METHODS FOR COLLECTOR INSULATIONS
McClure Godette, Jack Lee, and James Fearn Oct. 1979 40 p Sponsored in part by DOE
(PB80-132038; NBSIR-79-1908) Avail: NTIS HC A03/MF A01 CSCL 10A

A preliminary study was performed to evaluate potential procedures for screening the insulation used in collectors. Both standard test methods and newly developed non-standard procedures were used to evaluate twenty-one insulation materials. The insulation parameters measured were selected on the basis of how and to what extent they were affected by the unique environmental conditions within solar collectors. Results of the laboratory tests are discussed and those procedures which offer a potential for screening insulations used in solar collectors are presented. GRA

N80-23868# National Bureau of Standards, Washington, D. C. Structures and Materials Div.
SOLAR ENERGY SYSTEMS: STANDARDS FOR RUBBER HOSE
Robert D. Stiehler and John L. Michalak Nov. 1979 38 p Sponsored in part by DOE
(PB80-129828; NBSIR-79-1917) Avail: NTIS HC A03/MF A01 CSCL 10A

A study of commercial rubber hose was made to develop standards for hoses used in solar energy systems. Twelve hoses were evaluated by cycling between temperatures of about 100 C and temperatures as low as -40 C during a period of about seven months. Laboratory tests for bursting strength, compatibility with metals, compression set, ozone resistance, and water vapor transmission were also made. The results of the tests are presented. Based on these findings a standard for rubber hose used in solar energy systems is proposed. GRA

N80-23869# National Bureau of Standards, Washington, D.C.
SOLAR COLLECTOR FLUID PARAMETER STUDY Final Report, Nov. 1978 - Jun. 1979
Wallace W. Youngblood, William Schultz, and Ralph Barber Oct. 1979 130 p
(Contract EG-77-C-01-4050)
(PB80-125891; NBS-GCR-79-184) Avail: NTIS HC A07/MF A01 CSCL 10A

A series of instantaneous thermal performance tests were performed on four differently constructed, commercially available flat plate solar collectors with each of four commonly used heat transfer fluids. The tests were designed to illustrate the magnitude of fluid parameter effects on the thermal performance of flat plate solar collectors. The configurations were selected to provide a broad variety of flow conditions. The heat transfer fluids used were as follows: (1) water; (2) an ethylene glycol (Prestone 11) water solution (50 percent by weight); (3) a silicone based heat transfer fluid (SLYTHERM 444); and (4) a synthetic hydrocarbon (Therminol 44). GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-23870 Stanford Univ., Calif.
PROBABILITY MODELING AND ESTIMATION FOR HOURLY VARIATION OF AIR POLLUTION CONCENTRATIONS Ph.D. Thesis
Chen-Hui Lisa Foo 1980 57 p
Avail: Univ. Microfilms Order No. 8011635

A probability model is presented which describes the behavior of high pollutant concentrations. The model characterizes the variation of hourly average concentration, after a suitable normalization, as the superposition of a daily random effect and an hourly random effect. Without the daily random effect this model becomes one for repeated measurements on the

autoregressive process of order one. Without the hourly random effect, it becomes a variance components problem. The maximum likelihood estimates of the model parameters are derived. A particular set of mid-day oxidant data were chosen from San Jose Piedmont monitoring station. The maximum likelihood estimates are obtained for the data in which the estimated daily random effect is very small. The estimation of the probabilities of threshold exceedances of mid-day oxidant concentrations is also studied. Sensitivity analysis was done on the estimation of the above probabilities by varying the model parameters.
Dissert. Abstr.

N80-23871 Kentucky Univ., Lexington.
DEVELOPMENT OF A REGIONAL TRANSPORT/TRANSFORMATION/REMOVAL MODEL FOR SO2 AND SULFATE IN THE EASTERN UNITED STATES Ph.D. Thesis
Gregory Richard Carmichael 1979 358 p
Avail: Univ. Microfilms Order No. 8010494

A combined transport-chemistry model that describes the regional distribution of SO2 and sulfate within the lower troposphere is developed. The mathematical analysis is based on the coupled three dimensional advection-diffusion equations for SO2 and sulfate and incorporates chemical transformations as well as the physical phenomena of dry deposition at the surface and wet deposition. The analysis also considers spatial variations in topography and spatial and temporal variations in both the mixing layer heights and the wind field. The dynamic model employs a Galerkin method for the numerical solution of the partial differential equations. Results from a series of numerical experiments show the Galerkin method to be superior, in terms of accuracy and computation time, to the finite difference methods tested. Numerical results studying the interactions of convection, diffusion, chemical reaction, pollutant removal, and the effects of contaminant emission source strength, source location and multiple sources are also presented.
Dissert. Abstr.

N80-23872 Texas Univ. Health Science Center, Houston.
SEASONAL AND GEOGRAPHICAL DISTRIBUTION OF PRIMARY AMINES IN HOUSTON ATMOSPHERE Ph.D. Thesis
Chi-Ping Jack Peng 1979 129 p
Avail: Univ. Microfilms Order No. 8010902

The seasonal and geographical distribution pattern of airborne primary amines in the Houston atmosphere is examined. Free primary amines, amine salts, and pollens in the air were collected on glass fiber filters by means of a high volume sampler. Acid digestion dissolved the free amines, their salts, and pollens from the filter paper into solution. Fluorescamine was used as the fluorescent reagent. Fluorophor was quantified with a spectrophotofluorometer with high specificity and sensitivity. A total of 15 sets of samples were collected. Each set of samples consisted of 25 to 29 specimens which were collected at 29 different stations around the Houston area. Multiple regression analysis was applied to assess the role of different meteorological factors on the variation of amines. The SYMAP technique was used to show amine variations across the city and thus suggested possible sources for amines.
Dissert. Abstr.

N80-23873 Pennsylvania State Univ., University Park.
THE CHEMICAL TRANSFORMATION OF SULFUR DIOXIDE TO SULFATE IN THE PLUME OF THE COAL-BURNING KEYSTONE POWER PLANT Ph.D. Thesis
Allen Conrad Dittenhoefer 1979 137 p
Avail: Univ. Microfilms Order No. 8010048

Measurements of the oxidation rate of sulfur dioxide to sulfate particles were made in the plume of the coal-fired Keystone power plant using instrumented aircraft. Aerosol number concentrations in nine distinct size intervals spanning the range 0.01-2.0 micrometer diameter were obtained using a condensation nucleus counter, an optical particle counter, and an electrical aerosol analyzer. These measurements were combined with cascade impactor sampling and quantitative sulfate analysis of individual plume and background particles using a transmission electron microscope to determine the mass concentration of sulfate at various positions in and out of the plume. From cross sectional plume mappings of the horizontal and vertical concentration profiles of SO2 and sulfate mass it was possible to calculate the SO2 conversion rate in the plume. It was found that although plume sulfate particle size distributions were highly dependent on both ambient relative humidity and solar radiative flux, relative humidity was the predominant parameter governing the SO2 transformation rate within the initial one to two hours of plume transport.
Dissert. Abstr.

N80-23874*# Virginia Univ., Charlottesville. Engineering Sceinces Research Labs.
EVALUATING AND MINIMIZING NOISE IMPACT DUE TO AIRCRAFT FLYOVER Final Report
Ira D. Jacobson May 1980 78 p refs
(Grant NsG-1509)
(NASA-CR-153187; UVA/528166/MAE80/102) Avail: NTIS HC A05/MF A01

The results of a study on the evaluation and reduction of noise impact to a community due to aircraft landing and takeoff operations are presented. The case of multiple aircrafts flying on several trajectories, for either approach/landings or takeoffs was examined. An extremely realistic model of the flight path was developed. The annoyance criterion used was the noise impact index (NII). The algorithm was applied to Patrick Henry International Airport.
R.E.S.

N80-23875*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ASSESSMENT OF POTENTIAL EXPOSURE TO FRIABLE INSULATION MATERIALS CONTAINING ASBESTOS
Walter S. Kim and David E. Kuivinen Apr. 1980 41 p refs
(NASA-TM-81435; E-359) Avail: NTIS HC A03/MF A01 CSCL 13B

Asbestos and the procedures for assessing potential exposure hazards are discussed. Assessment includes testing a bulk sample of the suspected material for the presence of asbestos, and monitoring the air, if necessary. Based on field inspections and laboratory analyses, the health hazard is evaluated, and abatement measures are taken if a potential hazard exists. Throughout the assessment and abatement program, all applicable regulations are administered as specified by the Environmental Protection Agency and the Occupational Safety and Health Administration.
R.E.S.

N80-23876# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN FOR BIOMASS ENERGY SYSTEMS
Sep. 1979 56 p refs
(DOE/EDP-0032) Avail: NTIS HC A04/MF A01

Key elements of the Biomass Energy Systems Program are briefly described. Significant environmental concerns and requirements are identified. These include effects on soil erosion, soil quality, water quality, ecosystems, and air quality.
J.M.S.

N80-23877# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: GEOTHERMAL ENERGY SYSTEMS
Aug. 1979 77 p refs
(DOE/EDP-0036) Avail: NTIS HC A05/MF A01

All current and planned activities of the DOE Geothermal Energy Systems Program are covered. Major elements of this program include exploration of resources, confirmation of reservoirs, development of energy extraction systems, demonstration of utilization systems, identification and removal of institutional barriers, and a loan guaranty program. Environmental concerns and requirements for resolution of these concerns are discussed in detail. In terms of immediate need and importance in getting power online, the emission of H2S is the most important concern and the demonstration of an effective abatement system is the most significant requirement. Other significant concerns are the management or disposal of spent geothermal fluids, the potential of land subsidence, questions of water availability for heat rejection systems, land use conflicts, and socio-economic and cultural problems. The requirements to appropriately research and mitigate these and other concerns in time to permit orderly and timely development of geothermal energy systems are presented.
J.M.S.

N80-23878# California Univ., Livermore. Lawrence Livermore Lab.

POTENTIAL AIR QUALITY IMPACT OF GEOTHERMAL POWER PRODUCTION IN THE IMPERIAL VALLEY
P. H. Gudiksen, D. L. Ermak, K. C. Lamson, M. C. Axelrod, and R. A. Nyholm Oct. 1979 42 p refs
(Contract W-7405-eng-48)
(UCRL-52797) Avail: NTIS HC A03/MF A01

A regional assessment of the potential impact on air quality of developing the Imperial Valley's geothermal resources for power production is presented. A network of six stations was installed to characterize the air quality and atmospheric transport properties for the valley before development. These measured the ambient air concentrations of H2S, SO2, O3, NO, NO/x, CO2, Hg, Rn, and particulates. The geothermal fluids were analyzed chemically to estimate potential emission rates from future power plants. Using these data and advanced air quality modeling led to the prediction of the potential valley-wide impact of a 3000 MW development scenario. The impact analysis reveals that H2S is the principal gaseous pollutant of concern. The ambient H2S concentrations that would result from generating 3000 MW without emission controls exceed the California air quality standard (30 ppb) at least 1% of the time for an area in the northern part of the valley that is roughly 1500 sq km in size. DOE

N80-23879# Battelle Pacific Northwest Labs., Richland, Wash. Atmospheric Sciences Dept.
EVALUATION OF EMPIRICAL ATMOSPHERIC DIFFUSION DATA
T. W. Horst, J. C. Doran, and P. W. Nickole Oct. 1979 151 p refs
(Contract EY-76-C-06-1830)
(NUREG-CR-0789; PNL-2599) Avail: NTIS HC A08/MF A01

A study was made of atmospheric diffusion over level, homogeneous terrain of contaminants released from non-buoyant point sources up to 100 m in height. Current theories of diffusion are compared to empirical diffusion data, and specific dispersion estimation techniques are recommended which can be implemented with the on-site meteorological instrumentation required by the Nuclear Regulatory Commission (NRC). A comparison of both the recommended diffusion model and the NRC diffusion model with the empirical data demonstrates that the predictions of the recommended model have both smaller scatter and less bias, particularly for groundlevel sources. DOE

N80-23880# Battelle Pacific Northwest Labs., Richland, Wash.
MATHEMATICAL MODELS FOR ATMOSPHERIC POLLUTANTS. APPENDIX C: GOVERNING EQUATIONS FOR ATMOSPHERIC TRACE CONSTITUENTS AND SOLUTION TECHNIQUES Final Report
R. L. Drake Aug. 1979 252 p refs Sponsored in part by Electric Power Research Inst.
(Contract EY-76-C-06-1830)
(EPRI-EA-1131-App-C) Avail: NTIS HC A08/MF A01

The governing equations for the evolution and fate of airborne gases and particles are described, and exact and approximate solution techniques are presented. Among the systems of equations are: the conservation of mass, momentum and energy and the equations of state for defining the motion, pressure, density and temperature fields of the atmosphere; the conservation of liquid water and water vapor; the radiation equations for the solar and terrestrial radiation intensities; the conservation equations for non-reactive and reactive gases and aerosols. The techniques for obtaining exact solutions of diffusion and aerosol equations are: series methods, integral transforms, similarity techniques, principle of superposition and Green's functions. Among the approximate solution techniques described in this document are: the classical techniques, such as successive approximations, asymptotic techniques, perturbation methods, the method of moments and integral methods, random walk and Monte Carlo techniques; finite difference methods and spectral and variational methods, including finite element techniques. DOE

N80-23881# Department of Energy, Washington, D. C. Div. of Technology Assessments.
ENVIRONMENTAL DEVELOPMENT PLANS FOR ENERGY TECHNOLOGY PROGRAMS Summary Report
Oct. 1979 110 p
(DOE/EDP-0062) Avail: NTIS HC A06/MF A01

A review of 30 environmental development plans prepared in 1979 covering the Department of Energy's programs in the solar geothermal conservation, fossil, and nuclear energy technology areas is presented. For each area, the key environmental, health and safety concerns are identified, and the research required to resolve the concerns is discussed. Abbreviated milestones for technology and environmental activities are presented, and the completion dates for mandated environmental documents are summarized. DOE

N80-23882# Battelle Pacific Northwest Labs., Richland, Wash.
AEROSOL, TRACE ELEMENTS AND VISIBILITY MEASUREMENTS IN MOUNTAINOUS TERRAIN
M. M. Orgill, N. S. Laulainen, D. R. Drawes, and R. N. Lee Jan. 1979 10 p refs Presented at the 19th Ann. Meeting of the Inst. of Environ. Sci., Seattle, 30 Apr. - 2 May 1979 Submitted for publication
(Contract EY-76-C-06-1830)
(PNL-SA-7576; CONF-790445-7) Avail: NTIS HC A02/MF A01

Data on the relationships between aerosols, trace elements, and visibility in mountainous terrain and air pollutants from existing industrial, urban, agricultural and transportation sources in the Pacific Northwest states of Washington, Oregon, and Idaho were analyzed. Data were obtained by airborne instruments. Twelve sampling flights provided data on scattering extinction coefficient, trace elements, sulfate, and ozone during relatively good prevailing visibility conditions. Over 80 percent of the sample flights indicated that the meteorological range was 20 km or more. Four or five of the sampling flights indicated the presence of visibility reducing haze. Relatively higher concentrations of certain crustal and anthropogenic trace elements and sulfate (associated with high relative humidities) resulted in degradation of meteorological range in the foothills of Cascades, Snoqualmie Pass and Kittitas Valley and Columbia River Gorge. DOE

N80-23883# Institute of Ecology, Indianapolis, Ind.
ROLE OF TEMPERATE ZONE FORESTS IN THE WORLD CARBON CYCLE: PROBLEM DEFINITION AND RESEARCH NEEDS
Thomas V. Armentano, ed. and J. Hett, ed. Jul. 1979 69 p refs Workshop held in Indianapolis, 21-22 Mar. 1979
(Contract DE-AC02-79EV-10040)
(DOE/ET/10040-1) Avail: NTIS HC A04/MF A01

Carbon uptake and losses from temperate zone forests are reported. The forest inventory data reviewed suggest the temperate zone forests could have functioned for the past several decades as a net sink for 10 to the 9th power tons of carbon annually. However, due to the limited data on noncommercial timberlands, nonmerchantable tree components, and soil organic matter changes, the precision of this estimate of temperate zone C retention may be only within one-quarter to one-half of the true value. Despite this limitation, the data suggest strongly that temperate zone forests probably are not a source of carbon. The principal areas for which new information would reduce uncertainties in estimates of carbon uptake and losses from temperate zone forests are discussed, and recommendations are made for a series of research initiatives to increase resolution of the problem areas. DOE

N80-23884# Battelle Pacific Northwest Labs., Richland, Wash.
MATHEMATICAL MODELS FOR ATMOSPHERIC POLLUTANTS. APPENDIX D: AVAILABLE AIR QUALITY MODELS Final Report
R. L. Drake, D. J. McNaughton, and C. Wang Aug. 1979 140 p refs Sponsored in part by DOE
(EPRI Proj. 805)
(EPRI-EA-1131-App-D) Avail: NTIS HC A07/MF A01

Models that are available for the analysis of airborne pollutants are summarized. In addition, recommendations are given concerning the use of particular models to aid in particular air quality decision making processes. The air quality models are characterized in terms of time and space scales, steady state or time dependent processes, reference frames, reaction mechanisms, treatment of turbulence and topography, and model uncertainty. Using these characteristics, the models are classified in the following manner: simple deterministic models, such as air pollution indices, simple area source models and rollback models;

statistical models; such as averaging time models, time series analysis and multivariate analysis; local plume and puff models; box and multibox models; finite difference or grid models; particle models; physical models, such as wind tunnels and liquid flumes; regional models; and global models. DOE

N80-23885# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands).
INVESTIGATING THE NOISE POLLUTION PROBLEM. A THEORETICAL MODEL [ONDERZOEK NAAR GELUIDHINDER. EEN THEORETISCH MODEL]
R. G. deJong Jan. 1978 19 p In DUTCH
(IG-Publ-663) Avail: NTIS HC A02/MF A01

The methodology of the social scientist is explained as applied to the study of noise pollution. Through use of a model, psychological concepts are introduced showing how noise is perceived and assimilated. The role of social science research in the Institute is elaborated, and its integration into the technical, physical, legal, economic and medical approaches to noise pollution is described. Author (ESA)

N80-23886# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands).
MONITORING DUST CONCENTRATIONS. MODIFICATIONS TO THE DUST MONITOR FH62A [REGISTRERENDE STOFCONCENTRATIEMETINGEN. VOORZIENING AAN DE STAUBMONITOR FH62A (NR. 268) VOOR HET ONDERDRUKKEN VAN STORINGEN TIJDENS HET REGISTREREN VAN GROTERE AANTALLEN MEETGEGEVENS]
W. C. Duba Apr. 1978 6 p In DUTCH
(IG-TNO-F-1468) Avail: NTIS HC A02/MF A01

Modifications to the Staubmonitor FHG2A commercial monitor to decrease the cycle time, improve precision, and allow quick look determinations of concentrations are described. A method is proposed for attaching the instrument to a data recorder to facilitate data processing with a computer. Author (ESA)

N80-23887# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
PROJECT FILTER HOLDER. TESTS ON 25 mm DUST FILTER HOLDERS [ONTWERP FILTERHOUDER. ONTWERP VAN NIEUWE FILTERHOUDER 25 mm EN HET TESTEN VAN DRIE TYPEN FILTERHOUDERS 25 mm]
W. C. Duba Apr. 1978 19 p In DUTCH
(IG-TNO-F-1638) Avail: NTIS HC A02/MF A01

Designs are presented for dust filter holders suitable for use in air pollution monitoring equipment. Design principles were determined which overcome problems such as lateral filtration and leaks. Interchangeable parts permit different methods of sampling using the same basic equipment. Author (ESA)

N80-23888# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Binnenlucht.
COMPARATIVE INVESTIGATION INTO THE RELIABILITY OF VARIOUS ANALYSIS METHODS FOR FORMALDEHYDE IN AIR [ONDERZOEK BEPALINGSMETHODEN FORMALDEHYDE. VERGELIJKEND ONDERZOEK NAAR DE BETROUWBAARHEID VAN VERSCHILLENDE BEPALINGSMETHODEN VOOR FORMALDEHYDE IN LUCHT]
I. J. F. vanderWal Oct. 1978 10 p In DUTCH
(IG-TNO-F-1643) Avail: NTIS HC A02/MF A01

Three spectrophotometric methods are being studied for determining concentrations of formaldehyde in air for routine use in pollution monitoring systems. Sensitivity test results from four laboratories are presented. Author (ESA)

N80-23889# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
NOx AND O3, FLUSHING: AIR POLLUTION IN 1976 [NOx EN O3. VLISSINGEN. HET ONDERZOEK NAAR DE VERONTREINIGING VAN DE BUITENLUCHT IN VLISSINGEN IN 1976]
E. J. G. Goudena Mar. 1978 53 p In DUTCH
(IG-TNO-G-675) Avail: NTIS HC A04/MF A01

Reduced data for nitrogen oxides and ozone taken at Flushing, the Netherlands, show that the American limit for average NO2 concentration over a one year period was not exceeded. The Japanese limit was exceeded on 130 days. The Japanese limit and EPA limit for hourly average ozone concentrations were exceeded 100 days and 50 days, respectively. Author (ESA)

N80-23890# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
NOx AND O3, VLAARDINGEN: AIR POLLUTION IN 1976 [NOx EN O3. VLAARDINGEN. ONDERZOEK NAAR DE VERONTREINIGIN DE BUITENLUCHT TE VLAARDINGEN IN 1976]
E. J. G. Goudena Mar. 1978 49 p In DUTCH
(IG-TNO-G-678) Avail: NTIS HC A03/MF A01

Reduced data for nitric acid and ozone taken at Vlaardingen, Netherlands, show that the American limit for average NO2 concentration over a one year period was not exceeded. The Japanese limit was exceeded on 214 days. The Japanese limit and EPA limit for hourly average ozone concentrations were exceeded 95 and 48 days, respectively. Author (ESA)

N80-23891# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
AIR POLLUTION AT SCHOUWEN-DUIVELAND, 1976 [LUCHTVERONTREINIGING SCHOUWEN - DUIVELAND LUCHTVERONTREINIGINGSMETINGEN IN 1976 OP HET PILOTSTATION HAAMSTEDE OP SCHOUWEN-DUIVELAND]
J. A. F. deVreede Apr. 1978 98 p refs In DUTCH
(IG-TNO-G-679) Avail: NTIS HC A05/MF A01

Data are presented for NO, NO2, and O3 for the year, with incomplete readings for PAN, C1 - C5, and THC. Correlations by month, by day of week, and time of day are shown. A good correlation exists between increased ozone and PAN. Author (ESA)

N80-23892# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
AIR POLLUTION IN DELFT, 1977 [LUCHTVERONTREINIGING IN DELFT. ONDERZOEK NAAR DE BUITENLUCHTVERONTREINIGING IN DELFT IN 1977]
E. J. G. Goudena Dec. 1978 108 p In DUTCH
(IG-TNO-G-764) Avail: NTIS HC A06/MF A01

Data are presented for NO, NO2, O3, PAN, and CO. Measurements were also made of UV intensity. The American limit for average NO2 concentration level over one year was not exceeded, while the Japanese limit was exceeded on 185 days. The Japanese limit and the EPA limit for hourly average ozone concentration were exceeded on 25 and 6 days, respectively. Author (ESA)

N80-23893# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
NOx AND O3, FLUSHING: AIR POLLUTION IN 1977 [NOX EN O3. VLISSINGEN. HET ONDERZOEK NAAR DE VERONTREINIGING VAN DE BUITENLUCHT IN VLISSINGEN IN 1977]
E. J. G. Goudena Sep. 1978 46 p In DUTCH
(IG-TNO-G-765) Avail: NTIS HC A03/MF A01

Reduced data for NOx and O3 concentrations taken at Flushing, the Netherlands are presented. The American limit for average NO2 concentration over a one year period was not exceeded. The Japanese limit was exceeded in 64 days. The Japanese limit and Environmental Protection Agency limit for hourly average ozone concentrations were exceeded in 10 days and 4 days respectively. Author (ESA)

N80-23894# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
NOx AND O3, VLAARDINGEN: AIR POLLUTION IN 1977 [NOx EN O3. VLAARDINGEN. ONDERZOEK NAAR DE VERONTREINIGING VAN DE BUITENLUCHT TE VLAARDINGEN IN 1977]
E. J. G. Goudena Sep. 1978 48 p In DUTCH
(IG-TNO-G-766) Avail: NTIS HC A03/MF A01

Reduced data for nitrogen oxide and ozone taken at Vlaardingen, Netherlands, show that the American limit for average NO2 concentration over a one year period was not exceeded. The Japanese limit was exceeded on 183 days. The Japanese limit and EPA limit for hourly average ozone concentration were exceeded 19 days and 5 days, respectively. Author (ESA)

N80-23895# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
AIR POLLUTION IN DELFT. MEASUREMENTS OF SMOKE DURING 1977 IN DELFT AND NAALDWIJK [VERONTREINIGING BUITENLUCHT DELFT. ONDERZOEK NAAR HET STANDAARDROOKGEHALTE VAN DE BUITENLUCHT TE DELFT EN NAALDWIJK IN 1977]
J. J. vanGiezen and H. J. Geevers Feb. 1978 29 p In DUTCH
(IG-TNO-G-768) Avail: NTIS HC A03/MF A01

Smoke concentration measurements for the two cities were combined for the first time in 1977. A 70 percent reduction was noted over previous years. Highest concentrations appear between 6 and 10 hours on work days, with a peak occurring Wednesday. Author (ESA)

N80-23896# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
FLUORIDE MEASUREMENTS IN SOUTHERN NETHERLANDS. MEASUREMENTS AT DELFT, NAALDWIJK AND MAASLAND DURING 1977 [FLUORMETINGEN IN ZUID-HOLLAND. METINGEN MET 10-VOUDIGE MONSTERNEMINGSAPPARATEN TE DELFT, NAALDWIJK EN MAASLAND GEDURENDE HET JAAR 1977]
J. J. vanGiezen Mar. 1978 22 p In DUTCH
(IG-TNO-G-769) Avail: NTIS HC A02/MF A01

Measurements were made with semiautomatic sampling instruments. Frequency distributions and cumulative distributions are given. Little change was noted from concentrations measured in previous years. No instance of concentrations higher than 3.3 micrograms F per cu m in a 24 hour period was found. Author (ESA)

N80-23897# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
AIR POLLUTION STUDIES IN THE NIEUWE-WATERWEG REGION USING DEPOSIT GAGES, 1977 DATA [VERONTREINIGING BUITENLUCHT NIEUWE WATERWEG HET ONDERZOEK NAAR DE VERONTREINIGING VAN DE BUITENLUCHT IN HET NIEUWEWATERWEG-GEBEIDMET OMGEVING M.B.V. NEERSLAGVANGERS EN LUIKSE BOLLEN IN 1977]
J. J. vanGiezen Feb. 1978 40 p refs In DUTCH
(IG-TNO-G-771) Avail: NTIS HC A03/MF A01

The location of sampling stations are given, and some comparisons made with data from the previous year. Large variations in weight of precipitation dust and ash were observed. The percentage of iron increased somewhat, in one case 100 percent. The percentage of fluorides has remained constant. Measurements were made with liege bulbs and the British Standard Deposit Gauge. Some computations of the possibility of corrosion occurrence were made. Author (ESA)

N80-23898# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
SO2 MEASUREMENTS IN ROTTERDAM: VOLUMETRIC SO2 DETERMINATIONS, APRIL 1977 TO MARCH 1978 [SO2-METINGEN. DE METINGEN MET EEN VOLUMETRISCH SO2-APPARAAT IN ROTTERDAM VAN APRIL 1, 1977 TOT MARCH 31, 1978]
J. J. vanGiezen Oct. 1978 40 p refs In DUTCH
(IG-TNO-G-794) Avail: NTIS HC A03/MF A01

Monitoring and analysis procedures are described for SO2 and standard smoke measurements. Variations of concentration by season, and as a function of temperature and wind direction are given. Increases in both smoke and SO2 values over the previous year were observed. Maxima were noted Sundays and Mondays. Author (ESA)

N80-23899# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
MEASURING TECHNIQUES FOR NO2 [IJKMETHIDEN NO2. EEN INLEIDEND ONDERZOEK NAAR AFWIJKINGEN IN DE AFGIFTE VAN NO2-PERMEATIEBUIZEN]
L. F. Heidema Mar. 1978 12 p In DUTCH
(IG-TNO-G-852) Avail: NTIS HC A02/MF A01

Experiments were performed showing that differences exist between gravimetrically determined amounts of NO2 from a reference source, and the actual emission. The deviation was greater at concentrations of 800 micrograms NO2 per cu m than with lower concentrations. Explanations for the phenomenon include contamination of the NO2 and incorrect weighing methods. Author (ESA)

N80-23900# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
PAN: MEASUREMENTS AT DELFT IN 1974 [PAN-METINGEN TE DELFT IN 1974]
R. Bos Sep. 1978 20 p In DUTCH
(IG-TNO-G-866) Avail: NTIS HC A02/MF A01

Concentration data for PAN (peroxyacetylnitrate) taken at Delft, the Netherlands, are given. Variations by month, time of day, and day of the week are presented. The highest concentration measured was 3.8 ppb. Author (ESA)

N80-23901# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
NOx AND O3. AIR POLLUTION IN 1973 [NOx EN O3. VLAARDINGEN. ONDERZOEK NAAR DE VERONTREINIGING VAN DE BUITENLUCHT TE VLAARDINGEN IN 1973]
E. J. G. Goudena Oct. 1978 48 p In DUTCH
(IG-TNO-G-867) Avail: NTIS HC A03/MF A01

Reduced data for NOx and O3 taken at Vlaardingen, Netherlands show that the American limit for average NO2 concentration over a one year period was not exceeded, but the Japanese limit was exceeded on 16 days. The number of days on which the Japanese standard and the EPA standard for hourly average ozone concentrations have been exceeded were respectively 12 and 7 days. Author (ESA)

N80-23902# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN INVESTIGATION INTO THE INITIAL MIXING AND DILUTION OF IDENTICAL PLUMES FROM MULTIPLE STACK CONFIGURATIONS B.S. Thesis
G. R. Burton and A. J. R. Hope Jun. 1979 65 p refs
(BU-233) Avail: NTIS HC A04/MF A01

The interaction between nonbuoyant plumes was studied using a flow visualization technique to examine the initial mixing and a mass spectrometer to investigate the development and dilution of the plumes. The wind tunnel and compressed air system used during the study are described along with the experimental procedures. The variation of resultant plume due to stack configuration changes is discussed. Author (ESA)

N80-23903# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
SAROAD (STORAGE AND RETRIEVAL OF AEROMETRIC DATA) INFORMATION Final Report
Jacob G. Summers Feb. 1979 71 p refs
(PB80-133838; EPA-450/4-79-005) Avail: NTIS HC A04/MF A01 CSCL 13B

The storage and retrieval of aerometric data (SAROAD) system is described for an individual who is unfamiliar with SAROAD. The booklet includes: (1) an overview of the data contained in SAROAD, (2) an explanation of available air quality publications, (3) a description of procedures for requesting data, and (4) a description and example of the most important computerized reports. GRA

N80-23904# Pullman Kellogg, Houston, Tex.
ENVIRONMENTAL STANDARDS FOR COAL CONVERSION PROCESSES. VOLUME 1: MOST STRINGENT, FEDERAL, AND SELECTED STATE REGULATIONS Final Report, Feb. 1977 - Jan. 1979
D. K. Webber and D. E. Whittaker Oct. 1979 268 p refs
(Contract EPA-68-02-2198)
(PB80-126980; EPA-600/7-79-231-A) Avail: NTIS HC A12/MF A01 CSCL 13B

Existing and proposed environmental standards are synopsized as a guide for evaluating the efficiency of available and developing technology for controlling liquid, gaseous, and solid wastes from coal conversion processes. Within the U.S., the Federal (including EPA) standards and guidelines for air, water, and solid wastes were gathered together with standards for 22 states selected

for their potential in installing coal conversion facilities) and two regional commissions. Because environmental effects can cross national borders, standards and guidelines for Mexico, the Dominion of Canada, two Canadian provinces, and the international Joint Commission of U.S. and Canada were synopsized and added to the U.S. standards. All standards and guidelines are compared; from them the most stringent standards are summarized. GRA

N80-23905# Environmental Protection Agency, Research Triangle Park, N.C. Environmental Criteria and Assessment Office.
AIR QUALITY CRITERIA FOR OZONE AND OTHER PHOTOCHEMICAL OXIDANTS
Apr. 1978 372 p refs
(PB80-124753; EPA-600/8-78-004) Avail: NTIS HC A16/MF A01 CSCL 13B

Current knowledge regarding the origin of ozone and other photochemical oxidants is presented and assessed. Data on the effects of oxidant/ozone in the ambient air on man, vegetation, and ecosystems are summarized. The effects that have been observed will form the scientific basis for supporting the present National Ambient Air Quality Standard of 160 micrograms/cu m (0.08 ppm) or a revised standard. In this document, toxic organics are considered only with respect to eye irritation. The studies and data cited constitute the best available basis for specific standards aimed at protecting human health and the environment from photochemical oxidants in ambient air. GRA

N80-23906# Environmental Sciences Research Lab., Research Triangle Park, N.C.
ANALYSIS OF HIGH SULFATE CONCENTRATIONS IN GREATER NEW YORK CITY AIR Technical Report, Dec. 1978 - Aug. 1979
Gerard A. DeMarrais and Dale H. Coventry Dec. 1979 43 p refs
(PB80-128515; EPA-600/4-79-074) Avail: NTIS HC A03/MF A01 CSCL 04B

The meteorological phenomena which occurred during April 15 to 21, 1976, when high sulfate concentrations were measured in the New York City area, are summarized. Relationships between meteorological phenomena and high sulfate concentrations are compared to these findings. Since ozone readily occurs with the same meteorological conditions that are associated with sulfate episodes, the ozone concentrations are also discussed. Results show that the current procedure for sampling sulfate every sixth day does not provide sufficient data for determining how sulfate concentrations relate to meteorological phenomena. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-23907 Colorado Univ. at Boulder.
THE FREQUENCY DEPENDENCE OF Q Ph.D. Thesis
Gary Michael Lundquist 1979 281 p
Avail: Univ. Microfilms Order No. 8011290

That the fractional energy loss per cycle of an harmonic wave,Q(-1), is a function of the frequency, w, of the cycle is demonstrated and models of Q(-1) (w)-vs-depth which meet all available constraints are presented. Empirical observations on the value and depth dependence of the relaxation time (tau sub 2)are made in the frequency domain. The average position of tau sub 2 over teleseismic raypaths is found by fitting observed body-wave source spectra to a range of theoretical models. The results show that Q must be frequency dependent and that, on the average over the upper 1500 km in the mantle, tau sub 2 is approximately 0.07 to 0.16 sec, corresponding to about 1.0 to 2.4 Hz. First order models of tau sub 2-vs-depth are estimated from the ratio of Q(-1) defined by body-wave inversion to the Q(-1) defined by free oscillation inversion. The first order models are tested in the domain. Synthetic seismograms generated for an absorption band rheology are compared to observed seismograms of nuclear explosion sources in both Nevada and Novaya Zemlya. Dissert. Abstr.

N80-23908*# Department of Energy, Mines and Resources, Ottawa (Ontario). Gravity and Geodynamics Div.
INVESTIGATION OF TIDAL DISPLACEMENTS OF THE EARTH'S SURFACE BY LASER RANGING TO GEOS-3
D. R. Bower, J. Halpenny, M. K. Paul, and A. Lambert Apr. 1980 32 p refs
(NASA-CR-156863) Avail: NTIS HC A03/MF A01 CSCL 08F

An analysis of laser ranging data from three stations was carried out in an attempt to measure the geometric Earth tide. Two different approaches to the problem were investigated. The dynamic method computes pass to pass apparent movements in stations height relative to short arcs fitted to several passes of data from the same station by the program GEODYNE. The quasi-geometric method reduces the dependence on unmodelled satellite dynamics to a knowledge of only the radial position of the satellite by considering two station simultaneous ranging at the precise time that the satellite passes through the plane defined by two stations and the center of mass of the Earth. E.D.K.

N80-23909*# Texas Univ. at El Paso. Dept. of Geological Sciences.
OCCURRENCE AND MINERAL CHEMISTRY OF HIGH PRESSURE PHASES, PORTRILLO BASALT, SOUTHCENTRAL NEW MEXICO M.S. Thesis. Final Technical Report, 1 Jun. 1978 - 31 May 1980
J. M. Hoffer and Terri Smith Ortiz 31 May 1980 102 p refs
Original contains color illustrations
(Grant NsG-9062)
(NASA-CR-153192) Avail: NTIS HC A06/MF A01 CSCL 08G

Inclusions of clinopyroxenite, kaersutiteclinopyroxenite, kaersutite-rich inclusions, wehrlite and olivine-clinopyroxenite together with megacrysts of feldspar, kaersutite and spinel are found loose on the flanks of cinder cones, as inclusions within lava flows and within the cores of volcanic bombs in the Quaternary alkali-olivine basalt of the West Potrillo Mountains, southcentral New Mexico. Based on petrological and geochemical evidence the megacysts are interpreted to be phenocrysts which formed at great depth rather that xenocrysts of larger crystal aggregates. These large crystals are believed to have formed as stable phases at high temperature and pressure and have partially reacted with the basalt to produce subhedral to anhedral crystal boundaries. It can be demonstrated that the mafic and ultramafic crystal aggregates were derived from an alkali-basalt source rock generated in the mantle. The inclusions are believed to represent a cumulus body or bodies injected within the lower crust or upper mantle. A.R.H.

N80-23910*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
APPLICATION OF LASER RANGING AND VLBI DATA TO A STUDY OF PLATE TECTONIC DRIVING FORCES Final Technical Report, 1 Apr. 1978 - 31 Mar. 1979
Sean C. Solomon 30 May 1980 175 p refs
(Grants NsG-7329; NSF EAR-74-21894; NSF EAR-78-12936)
Avail: NTIS HC A08/MF A01 CSCL 08G

The measurability of changes in plate driving or resistive forces associated with plate boundary earthquakes by laser rangefinding or VLBI is considered with emphasis on those aspects of plate forces that can be characterized by such measurements. Topics covered include: (1) analytic solutions for two dimensional stress diffusion in a plate following earthquake faulting on a finite fault; (2) two dimensional finite-element solutions for the global state of stress at the Earth's surface for possible plate driving forces; and (3) finite-element solutions for three dimensional stress diffusion in a viscoelastic Earth following earthquake faulting. A.R.H.

N80-23911*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM: COMPUTING ATMOSPHERIC SCALE HEIGHT FOR REFRACTION CORRECTIONS
William M. Lear Mar. 1980 281 p Prepared in cooperation

with TRW Systems, Houston, Tex.
(NASA-TM-81059; JSC-16462; Rept-80-FM-16) Avail: NTIS HC A13/MF A01 CSCL 04A

Methods for computing the atmospheric scale height to determine radio wave refraction were investigated for different atmospheres, and different angles of elevation. Tables of refractivity versus altitude are included. The equations used to compute the refraction corrections are given. It is concluded that very accurate corrections are determined with the assumption of an exponential atmosphere. F.O.S.

N80-23912*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VOLCANIC FEATURES OF HAWAII. A BASIS FOR COMPARISON WITH MARS
M. H. Carr (U.S. Geological Survey, Menlo Park, Calif.) and R. Greeley Washington 1980 216 p refs Original contains color illustrations
(NASA-SP-403; LC-80-600024) Avail: NTIS MF A01; SOD HC $14.00 CSCL 08K

Despite the difference in size Martian and Hawaiian volcanoes have numerous characteristics in common. Specific features such as lava channels, collapsed lava tubes, levees and flow fronts, all very common in Hawaii, are also abundant on the flanks of some of the Martian volcanoes. Striking differences also exist, such as the apparent lack of radial rift zones on some Martian volcanoes and the paucity of cinder and spatter cones. Some of the best photographs of Martian and Hawaiian volcanic features are presented. Descriptive legends are provided for each picture. An overview of the geological processes and structures depicted is included. A.R.H.

N80-23913# RDP, Inc., Waltham, Mass.
DATA PROCESSING SYSTEMS FOR ACCELEROMETER EXPERIMENTS ON AIR FORCE SATELLITES Final Report, 7 Jun. 1976 - 30 Apr. 1979
Robert W. Fioretti, Edwin Barry, and Shirley Cieszka May 1979 37 p refs
(Contract F19628-76-C-0244; AF Proj. 6690)
(AD-A080460; AFGL-TR-79-0237) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report summarizes the data processing required to systematically extract meaningful data from accelerometer experiments flown aboard Air Force satellites. Drag data are extracted from the accelerometer output. These drag measurements are converted to atmospheric density. GRA

N80-23914# Wyoming Univ., Laramie. Dept. of Atmospheric Science.
CONDUCT OF CLOUD SPECTRA MEASUREMENTS Progress Report, 1 Dec. 1978 - 30 Sep. 1979
Gabor Vali, Marcia K. Politovich, Darrel G. Baumgardner, and William A. Cooper Oct. 1979 61 p refs
(Contract F19628-79-C-0029; AF Proj. 6670)
(AD-A081127; AFGL-TR-79-0251; SR-1) Avail: NTIS HC A04/MF A01

The work addressed the following objectives: Compare bench determinations of Axially Scattering Spectrometer Probe (ASSP) and Forward Scattering Spectrometer Probe (FSSP) sample areas with determinations during actual cloud sampling; evaluate the accuracy of the overlap in size range between FSSP and 1D-C probes; evaluate the response of the ASSP and FSSP probes to ice crystals; check the statistical correction schemes used to deal with 1D-C counts in the lowest and highest size categories. The information needed to accomplish these objectives was collected by performing special tests with the probes in question. These tests were conducted, for the most part, at the Elk Mountain Laboratory, during times when the Observatory was enveloped by clouds. Bench and wind-tunnel tests were utilized. In addition, data were derived from aircraft penetrations of clouds, with identical probes as those used at the observatory. GRA

N80-23915# Air Force Geophysics Lab., Hanscom AFB, Mass.
KWAJALEIN REFERENCE ATMOSPHERES, 1979 Interim Scientific Report
Allen E. Cole, Arthur J. Kantor, and C. Russell Philbrick 9 Oct. 1979 109 p refs
(AF Proj. 6670; AF Proj. 6690)
(AD-A081780; AFGL-TR-79-0241; AFGL-ERP-677) Avail: NTIS HC A06/MF A01 CSCL 04/1

Measurements of atmospheric temperature, density, and wind have been used to derive consistent hydrostatic models representative of the atmospheric properties at Kwajalein Atoll, Marshall Islands. A mean annual model and 12 monthly models of thermodynamic properties have been constructed between altitudes of 0 and 120 km, using data available up to 1979. Below an altitude of 60 km, the models are based on a data base that is large enough for the monthly variations to be statistically significant. Above 60 km the significance of the monthly models progressively decreases with altitude because of the small number of high-altitude measurements. The statistical properties of winds have been calculated for altitudes up to 60 km for the midseason months. Although the information used to prepare these models is based primarily on observations made at Kwajalein, some data from other tropical locations have been considered, particularly for such items as the estimates of time and space variations. The Kwajalein Missile Range (KMR) Reference Atmospheres contains information on the following parameters: temperature, pressure, density, speed of sound, dynamic viscosity, wind speed and direction, relative humidity, optical and radar indices of refraction, mean molecular weight, interlevel correlations of temperature, density, and wind, acceleration of gravity, and magnitudes of diurnal and semidiurnal tidal components of temperature, density, and wind. GRA

N80-23916# Naval Research Lab., Washington, D. C. Plasma Physics Div.
THE PHYSICS OF THE PHOTODEPOSITION PHASE OF THE NRL MASTER CODE FOR THE DISTURBED E AND F REGIONS
A. W. Ali 24 Jan. 1980 47 p refs
(AD-A081776; AD-E000376; NRL-MR-4152) Avail: NTIS HC A03/MF A01 CSCL 04/1

The physics of the revised photoionization phase for the NRL Master Code for the Disturbed E and F Region of the ionosphere is presented. The revision utilizes current total and partial photoionization cross sections. GRA

N80-23917# National Academy of Sciences - National Research Council, Washington, D. C. Panel on Gravity Field and Sea Level.
APPLICATIONS OF A DEDICATED GRAVITATIONAL SATELLITE MISSION
1979 64 p refs Presented at the Workshop on a Dedicated Gravitational Satellite Mission, Washington, D.C., 28-30 Nov. 1978
(Contract N00014-76-C-0411)
(AD-A076438) Avail: NTIS HC A04/MF A01 CSCL 08/5

In the late 1960's, it became clear that satellite-determined gravity field data contained a large amount of geophysical and geodetic information. Today, it appears that satellite technology may be capable of resolving the short- and intermediate-wavelength components (100-1000 km) in the Earth's gravity field, thereby contributing even more significantly to the solution of geophysical and geodetic problems and opening up important oceanic applications. A previous NRC report recommended a dedicated gravitational satellite mission (low-altitude satellite or satellites to be launched specifically for the purpose of accurately determining the details of the Earth's gravity field) subject to the analysis of accuracy requirements and feasibilities. This report is the product of a Workshop held in Washington, D.C., from November 28 to November 30, 1978, under the auspices of the NRC's Committee on Geodesy and its Panel on Gravity Field and Sea Level, to ascertain the applications of a dedicated gravitational satellite mission. Topics include: Technology Assessment; Solid-Earth Geophysics--Continents and Oceans; Oceanic Circulation; and Ephemeris and Geodetic Applications. GRA

N80-23918# Battelle Pacific Northwest Labs., Richland, Wash.
SEISMIC DATA CATALOG AND ASSOCIATED GRAPHICAL CAPABILITIES
T. N. Bishop, H. P. Foote, and S. C. Blair Nov. 1979 55 p refs
(Contract EY-76-C-06-1830)

(PNL-2893) Avail: NTIS HC A04/MF A01

An extensive data base of compiled seismic data is described along with useful and unique computer techniques for analysis and display of the data. Software associated with the data base include programs for editing earthquake files, sorting files with respect to time, location, or magnitude, selecting data by use of various parameters and merging files. The desired file may then be listed or displayed graphically. From the data analysis software, an accurate and comprehensive earthquake catalog for the Pacific Northwest was created. Graphic displays can plot two and three dimensional epicenter or hypocenter information. Magnitude and/or depth information can be represented on two-dimensional plots by using color of symbol size. Plots can be produced using a variety of map projections and at a specified scale. The capability allows the use of any desired map as a base map for the display of earthquake data. Dissert. Abstr.

N80-23919# Columbia Univ., Palisades, N.Y. Geological Observatory.

COMPREHENSIVE STUDY OF THE SEISMOTECTONICS OF THE EASTERN ALEUTIAN ARC AND ASSOCIATED VOLCANIC SYSTEMS Annual Progress Report, 1 Mar. 1979 - 29 Feb. 1980

K. H. Jacob, J. N. Davies, and K. R. Sykes 1979 111 p refs

(Contract EY-76-S-02-3134)

(COO-3134-20) Avail: NTIS HC A06/MF A01

The modern and historic seismicity of the eastern Aleutian arc was thoroughly researched and shows clear evidence that the Shumagin Islands region of the arc has been ruptured at least partly by previous large or great earthquakes; has recurrence times for large earthquakes between 50 and 115 years; has precently the properites of a seismic gap, i.e., was pot ruptured by a large or great earthquake for a least 76 years; and shows a donut configuraton of modest seismicity including high-stress-drop events around the rim combined evidenc it is concluded that the likelihood for a large or great earthquake to occur within the Shumagin Island gap is high within the next three decades. Stress, stress-drop, and other source parameters of moderate earthquakes in the Shumagin islands gap were alturmined along with similar results for the St. Elaias earthquakes neat the Takatage gap in the eastern Gulf of Alaska. DOE

N80-23920# Los Alamos Scientific Lab., N. Mex.

GRAVITY STUDY OF THE LOS ALAMOS AREA, NEW MEXICO

Laurel M. Williams Nov. 1979 21 p refs

(Contract W-7405-eng-36)

(LA-8154-MS) Avail: NTIS HC A02/MF A01

Profiles of gravity readings were observed along two CXC seismic reflection lines recently recorded in Los Alamos County, one in Los Alamos Canyon, the other in Mortandad Canyon and on Sigma Mesa. These data were merged with available gravity data in the Los Alamos area and a density profile across Los Alamos Canyon was modeled to find the proper reduction density. The resulting Bouguer map of the Pajarito Plateau suggests the basement deepens to the northeast. Two dimensional computer modeling of the gravity profiles indicates that subsurface lenses of Tschicoma Formation along the west edge of the Pajarito Plateau may act as an effective basement, obscuring actual basement structures in that area. Thus, an alternative to the graben interpretation of the prominent gravity low in the area is that this low is due to density contrasts within the thick sequences of Quaternary volcanics present. DOE

N80-23921# Preussag A.G., Erdoel und Erdgas, Hannover (West Germany)

DEVELOPMENT OF A THREE-DIMENSIONAL SEISMIC DATA ACQUISITION AND PROCESSING SYSTEM Final Report

Johann Wolfgang Sattlegger Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 115 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-22) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 23.75

Algorithms were developed to allow three dimensional seismic surveys in densely populated areas using a flexible recording geometry. These algorithms are based on ray theory. A computer program is discussed that allows the prediction of effective irregular recording geometries and to compute three dimensional seismic surveys from data obtained from irregular recording geometries. Two test surveys have been carried out. Author (ESA)

N80-23922# Bonn Univ. (West Germany). Inst. fuer Physik.

SOUNDING ROCKET PROGRAM AERONOMY: NEUTRAL COMPOSITION OF THE MESOSPHERE AND LOWER THERMOSPHERE DURING WINTER-ANOMALY CONDITIONS Final Report

Volkmar Friedrich and Ulf vonZahn Bundesmin. fuer Forsch. und Technol. Jun. 1979 84 p refs In GERMAN; ENGLISH summary

(Contract BMFT-WRK-RV-14-B106/73)

(BMFT-FB-W-79-02) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 17.25

During two rocket flights in January 1976, a mass spectrometer with a helium-cooled ion source measured the number densities of N2, O2, O, Ar, and CO2 at altitudes between 80 km and 117 km. The altitude profiles of these constituents show strong, regular wave-like structures except those for atomic oxygen which seem less regular. Moreover, the absolute number densities of O differed considerably from flight to flight. Possible causes for this difference are discussed. Author (ESA)

N80-23923# Physics Lab. RVO-TNO, The Hague (Netherlands).

THE MEASUREMENT OF THE TRANSMISSION AND THE EMISSION OF THE ATMOSPHERE BY AN INFRARED TELERADIANCE METER

A. C. vanBochove Nov. 1978 86 p refs In DUTCH; ENGLISH summary

(PHL-1978-50; TDCK-71541) Avail: NTIS HC A05/MF A01

Experiments measuring transmissivity, emissivity and contrast transmissivity of the atmosphere at four distances (max 935 m) in 16 different spectral regions are described. An infrared radiance meter was used to perform experiments in the intervals of 3-6 micrometers and 8-4 micrometers. Instrument design, data processing routines, and some results are discussed. Author (ESA)

N80-23924# Prakla-Seismos G.m.b.H., Hannover (West Germany).

FURTHER DEVELOPMENT OF SEISMIC METHODS. THREE-DIMENSIONAL MIGRATION/APPROXIMATION PROCEDURE Final Report

Wolfgang Houba Bonn Bundesmin. fuer Forsch. und Technol. Sep. 1979 141 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-18; ISSN-0340-7608) Avail: NTIS HC A07/MF A01; Fachinformationsznetrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 29.40

Approximate methods for the calculation of geological profiles from seismic measurements along straight lines are discussed. By applying geometrical corrections to the velocities, two dimensional migration methods were found to provide adequate three dimensional images of local subsurface layering, provided the strike does not vary too rapidly in the vicinity of the seismic line. Author (ESA)

N80-23925# Prakla-Seismos G.m.b.H., Hannover (West Germany).

FURTHER DEVELOPMENT OF SEISMIC METHODS: THREE-DIMENSIONAL VELOCITY DETERMINATIONS Final Report

Erich Meixner Bonn Bundesmin. fuer Forsch. und Technol. Sep. 1979 128 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-19) Avail: NTIS HC A07/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 26.45

A survey of current methods to determine the velocity of seismic waves in geological formations is presented. An iterative computer method is described to calculate seismic interval velocities. A field test example is used to illustrate the method. Author (ESA)

N80-23926# European Space Agency, Paris (France).
ATMOSPHERIC RAYLEIGH SCATTERING IN THE ULTRAVIOLET AND VISIBLE SPECTRAL REGION
Dieter Beran Nov. 1979 43 p refs Transl. into ENGLISH of "Atmosphaerische Rayleigh-Streung im Ultraviolc..en und Sichtbaren Spektralkber.", Rept. DLR-Mitt-78-03 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1977 Original report in GERMAN previously announced as N79-30888 Original German report available from DFVLR, Cologne DM 17.90
(ESA-TT-588; DLR-Mitt-78-03) Avail: NTIS HC A03/MF A01

Attenuation by scattering and absorption of solar radiation entering the Earth's atmosphere was studied in order to determine the role of Rayleigh scattering. It is shown that Rayleigh scattering is a function of the solar flux and the scattering cross section. Generally, Rayleigh scattering is single scattering because the small cross section and with it, the low optical depth, do not permit multiple scattering. Rayleigh intensity however depends on direction and is polarized. For the anisotropic air molecules a depolariztion factor must be involved. The absorption of solar radiation in the wavelength region under consideration is discussed as being caused by ozone and by molecular oxygen.
Author (ESA)

N80-23927# Oxford Univ. (England). Dept. of Engineering Science.
DYNAMIC FRACTURE STRENGTH OF OIL SHALE AND COAL
W. E. Jahsman (Colorado Univ., Boulder) 1919 30 p refs Sponsored by Colorado Univ.
(OUEL-1295/79) Avail: NTIS HC A03/MF A01

Measurements were carried out on tubular specimens of oil shale and coal using the torsional Kolsky apparatus (split Hopkinson bar) to show that these materials exhibit strain rate dependent fracture strengths. At shear strain rates of 500 s, typical fracture strengths were found to be 80 MPa for oil shale and 12 MPa for coal. A stress redistribution occured in the specimen after initial fracturing along planes perpendicular to the maximum tensile stress. The fracture strength reported for coal, was accompanied by a compressive stress of equal magnitude. The final mode of failure in this case was compressive rather than tensile.
Author (ESA)

N80-23928# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
TELEPHOTOMETRIC STUDY OF BASELINE VISUAL RANGE AT CEDAR MOUNTAIN, UTAH, 21 APRIL TO 16 MAY 1978
Paul A. Allee, William F. Roberts, L. Gwen Lowery, and Gary M. Williams Aug. 1979 46 p refs
(PB80-137383; NOAA-DR-ERL-APCL-4; NOAA-79121209) Avail: NTIS HC A03/MF A01 CSCL 04A

Visual range values derived from telephotometric measurements are presented for four views. Supplementary visual ranges of two distant mountain ranges, the Henry Mountains at 72 miles and the Abajo Mountains at 110 miles, are also given. GRA

N80-23929# Meteorology Research, Inc., Altadena, Calif.
CHARACTERIZATION OF VISIBILITY-REDUCING AEROSOLS IN THE SOUTHWEST. PROJECT VISTA Final Report, 1-10 Oct. 1977
Edward S. Macias, Donald L. Blumenthal, Jerry A. Anderson, and Bruce K. Cantrell Nov. 1979 68 p refs
(Contract EPA-68-02-2713)
(PB80-139041; MRI-78-IR-1585; EPA-600/7-79-243) Avail: NTIS HC A04/MF A01 CSCL 04A

The atmospheric visibility-reducing aerosol in the Southwest was experimentally characterized with respect to particle size composition, and contribution to light scattering. Measurements were taken within the mixing layer using the instrumented Beechcraft Queen Air aircraft. The aircraft was equipped to measure and record on magnetic tape the light-scattering coefficient, Aitken nuclei count, size distribution, ozone, sulfur dioxide, nitrogen oxides, temperature, dew point, turbulence, pressure (altitude), and navigational parameters. Multistage impactor and size-fractionated filter samples were also collected in order to determine aerosol elemental composition as a function of size. Visual range estimates were obtained by viewing distant landmarks and verified by optical photography. GRA

N80-23930# Environmental Sciences Research Lab., Research Triangle Park, N.C. Meteorology and Assessment Div.
SPATIAL VARIABILITY OF OZONE AND OTHER POLLUTANTS AT ST. LOUIS, MISSOURI
Thomas R. Karl Oct. 1979 42 p refs
(PB80-132830; EPA-600/4-79-063) Avail: NTIS HC A03/MF A01 CSCL 04A

At a network of 25 aerometric stations, ozone (O3) and various other photochemical pollutants, as well as carbon monoxide, were analyzed with respect to their spatial variability. Data were analyzed for April, through October of 1975 and 1976, periods during which high O3 concentrations are common. Topics addressed include the representativeness of pollutant concentrations spatially averaged over some grid scale with respect to the actual concentrations observed in the atmosphere, variations of stationary point measurements in space in and around metropolitan areas, and the number of fixed point measurements necessary to designate the area of highest O3 concentrations.
E.D.K.

N80-23931# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
TELEPHOTOMETRIC STUDY OF BASELINE VISUAL RANGE AT CEDAR MOUNTAIN, UTAH, 19 JANUARY TO 6 MARCH 1979
Gary M. Williams and Paul A. Allee Sep. 1979 50 p refs
(PB80-142227; NOAA-DR-ERL-APCL-6; NOAA-79122601) Avail: NTIS HC A03/MF A01 CSCL 04A

Visual range values derived from telephotometric measurements at Cedar Mountain, Emery County, Utah, from January 19 to March 6, 1979 are presented for the visual ranges of four views and two supplementary views. The air during the winter study was cleaner than it was during the summer study, probably because of the passage of several winter storms. Also, the wind at both lower and upper levels was predominantly from the north and northwest, while summertime flow was from the south, and it is believed that southerly air brings in more light scattering particles than northerly air flow. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-23932*# Parker (Lee W.), Inc., Concord, Mass.
THUNDERCLOUD ELECTRIFICATION MODELS IN ATMOSPHERIC ELECTRICITY AND METEOROLOGY
Lee W. Parker Mar. 1980 37 p refs
(Contract NAS8-33467)
(NASA-CR-161441) Avail: NTIS HC A03/MF A01 CSCL 04B

A survey is presented of presently-available theoretical models. The models are classified into three main groups: (1) convection models, (2) precipitation models, and (3) general models. The strengths and weaknesses of the models, their dimensionalities and degrees of sophistication, the nature of their inputs and outputs, and the various specific charging mechanisms treated by them, are considered. In results obtained to date, the convection models predict no significant electrification enhancement based on conductivity gradients and convection alone, with the assumed air circulation patterns. Results of the precipitation models show that the initial electrification can occur rapidly and stably through noninductive collision mechanisms involving ice, and breakdown-strength electric fields can relatively easily be achieved subsequently through the collisional-inductive mechanism. A critical difficulty of the collision mechanisms is imprecise knowledge of relaxation times versus contact times, which can easily lead to overestimates of electrification. The general model results tend to support those of the precipitation models in emphasizing the high potential effectiveness of the collisional-inductive mechanism.
F.O.S.

N80-23933*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
RATE STATISTICS FOR RADIO NOISE FROM LIGHTNING

D. M. LeVine, R. Meneghini (Maryland Univ., College Park), and S. A. Tretter May 1980 34 p refs
(NASA-TP-1665; G80F5117) Avail: NTIS HC A03/MF A01 CSCL 04B

Radio frequency noise from lightning was measured at several frequencies in the HF - VHF range at the Kennedy Space Center, Florida. The data were examined to determine flashing rate statistics during periods of strong activity from nearby storms. It was found that the time between flashes is modeled reasonably well by a random variable with a lognormal distribution. R.E.S.

N80-23934*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Space Sciences Lab.

ICE CRYSTAL GROWTH IN A DYNAMIC THERMAL DIFFUSION CHAMBER

Vernon W. Keller May 1980 216 p refs
(Grants NSF ATM-75-10935; NSF ATM-77-07995)
(NASA-TP-1651) Avail: NTIS HC A10/MF A01 CSCL 04B

Ice crystals were grown in a supersaturated environment produced by a dynamic thermal diffusion chamber, which employed two horizontal plates separated by a distance of 2.5 cm. Air was circulated between and along the 1.2 m length of the plates past ice crystals which nucleated and grew from a fiber suspended vertically between the two plates. A zoom stereo microscope with a magnification which ranged from 3X to 80X and both 35 mm still photographs and 16 mm time lapse cine films taken through the microscope were used to study the variation of the shape and linear growth rate of ice crystals as a function of the ambient temperature, the ambient supersaturation, and the forced ventilation velocity. The ambient growth conditions were varied over the range of temperature 0 to -40 C, over the range of supersaturation 4% to 50% with respect to ice, and over the range of forced ventilation velocities 0 cm/s to 20 cm/s. E.D.K.

N80-23935*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.

A TIME VARIABLE MODEL OF EARTH'S ALBEDO Final Report

Fred L. Bartman Mar. 1980 123 p
(Grant NsG-1482)
(NASA-CR-159259) Avail: NTIS HC A06/MF A01 CSCL 04B

A time variable model of Earth's albedo was prepared for use in climate studies and as an aid to the interpretation of satellite Earth radiation budget data. The features of the model include: a 10 deg latitude 10 deg longitude grid for numerical integration, surface albedo specified at 1 month intervals, calculation of zenith angle effect for surface albedo and of the additional effect of the atmosphere on the albedo. Percent cloud cover is specified for 29 different climatological cloud type regions at 8 times of the day for 12 months of the year. Cloud albedos were specified for each of the cloud climatological types. Diurnal and monthly variations of this model are described and results are compared with a model which is based on satellite measurements. A computer program was also written for use in studying the sampling effects in satellite radiation budget measurements. An example of the results of calculations with this program are compared with a previous study of the sampling effects. This program for satellite orbit characteristics is to be combined with the time-variable albedo model for further study of the sampling problem. J.M.S.

N80-23936# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).

NUMERICAL METHODS FOR SOLUTION OF THE SHALLOW-WATER EQUATIONS IN METEOROLOGY Ph.D. Thesis

I. M. Navon Jun. 1979 249 p refs
(CSIR-SR-WISK-10) Avail: NTIS HC A11/MF A01

The system of partial differential equations representing motion in a homogeneous, incompressible and nonviscous fluid in hydrostatic equilibrium with a free surface is dealt with. This system, referred to in meteorology as the shallow water equations system or the primitive barotropic equations system, provides an approximation to large scale weather prediction equations having the same numerical characteristics. Methods for solving this system with improved accuracy or high computational efficiency are studied. Several numerical aspects of this system quasilinear hyperbolic partial differential equations, viewed as a mixed initial boundary value problem, are highlighted. The long term behavior of the shallow water equations systems in the inviscid limit is related to the conservation of a number of integral invariants, in particular conservation of potential enstrophy. The paramount importance of well posed numerical boundary conditions as a prerequisite for the success of limited area integrations of the shallow water equations systems is shown. E.D.K.

N80-23937# Cincinnati Electronics Corp., Ohio.

RADIOMETRIC MEASUREMENTS BY THE MIDAS 3 SYSTEM AT KEY WEST. VOLUME 1: CLOUD BACKGROUNDS Final Report

Al Geiser and Charlie Dippel Sep. 1979 143 p refs
(Contract N60530-79-C-0031; ZF32392002)
(AD-A081052; TR-79-001215) Avail: NTIS HC A07/MF A01 CSCL 17/5

This report describes the test equipment, test procedures, test site and test results for a program to measure the infrared signatures of a representative sample of cloud backgrounds and aircraft at Key West, Florida. Data on various clouds were gathered between April 26 and May 10, 1979, and data on F-4 and F-14 aircraft were gathered between June 4 and June 19, 1979. The MIDAS 3 radiometer was used to measure the infrared signatures of the aircraft during the day and a number of different types of cloud backgrounds at various times of the day and night and at various angles with respect to the sun. The MIDAS 3 System is a small-field scanning radiometer that makes simultaneous measurement of infrared sources in the 3-5 and 8-13 micrometer spectral regions. The 3-5 spectral region is further sub-divided into smaller spectral bands by inserting various spectral filters in front of the 3-5 detector.GRA

N80-23938# Woods Hole Oceanographic Institution, Mass.

ATLANTIS 2 CRUISE 102 MOORED AND SHIPBOARD SURFACE METEOROLOGICAL MEASUREMENTS DURING JASIN 1978

Melbourne G. Briscoe, Carol A. Mills, Richard F. Payne, and Kenneth R. Peal Dec. 1979 93 p refs
(Contract N00014-76-C-0197; Grants NSF OCE-77-25803; NSF OCE-76-80174; NR Proj. 083-400)
(AD-A080732; WHOI-79-43) Avail: NTIS HC A05/MF A01 CSCL 04/2

During cruise 102 of the R/V Atlantis-II in the Joint Air-Sea Interaction Project (JASIN), surface meteorological data were gathered by Woods Hole Oceanographic Institution personnel from two moored buoys and from the ship. One buoy (JASIN W2/WHOI 651) carried a Vector Averaging Wind Recorder (VAWR) and a Vector Measuring Wind Recorder (VMWR); these instruments provided 18 days of intercomparison data and 38 days of meteorological data from 30 July to 6 September 1978. The other buoy (JASIN H2) carried a VMWR and gave 25 total days of data from 16 July to 10 August, and from 26 August to 1 September. A PET computer, hardwired to sensors positioned on the ship, displayed data that were logged during both legs of the cruise. Manual data were gathered by the science watches. This report describes the PET system, and displays and compares all the data. VAWR hourly meteorological data are listed for the 38 day period. Scientific interpretation of these data, such as calculations of heat fluxes, will be published separately. GRA

N80-23939# Pacific Missile Test Center, Point Mugu, Calif. Geophysics Div.

DIURNAL VARIATIONS OF COASTAL STRATUS

Thomas Frederick Lee Jun. 1979 60 p refs
(AD-A080951; PMTC-TP-80-02) Avail: NTIS HC A04/MF A01 CSCL 04/2

Diurnal dissipation of stratus over and off the southern California and Baja California coasts during two months of July is measured using GOES visual imagery. Morning inland penetration of the eastern stratus margin is favored in coastal valleys and restricted by hills. Afternoon dissipation of the margin away from land usually occurs the length of the coast, with the breadth of clearing being large off southern California, but limited

both north of Point Arguello and south of San Diego. Decreased frequency of stratus ceilings in the southern California bight seems to be related to subsidence in the lee of the Santa Ynez Mountains to the north. With 850 mb wind flow from north and east (340-159 deg), which favors lee subsidence, this region was more often stratus free than for flow from south and west (160-339 deg). GRA

N80-23940# Calspan Advanced Technology Center, Buffalo, N.Y.

DEFORMATION OF THE MARINE INVERSION AND THE DEVELOPMENT OF MARINE FOG AND STRATUS RESULTING FROM WARM WATER PATCHES, NUMERICAL MODELING AND VERIFICATION WITH SATELLITE IMAGERY

C. William Roger and James T. Hanley. Nov. 1979. 32 p. refs.
(Contract N00014-79-C-0459)
(AD-A081089; CALSPAN-6512-M-1) Avail: NTIS
HC A03/MF A01 CSCL 04/2

The results presented here represent the initial application of a numerical model, designed originally to study snow storms occurring downwind of a warm lake, to stratus/fog systems occurring downwind of the warm water patches in the ocean. Major differences between the two applications include: (1) an order of magnitude difference in inversion heights, with the base of the marine layer inversion being typically a few hundred meters above the surface and (2) air-water temperature differences of a couple of degrees centigrade over the ocean compared to 5-15 C over the lake. Using observed sea surface temperature patterns and meteorological conditions as input, Lavoie model simulations reproduce quite well the location and orientation of the major axis of the cloud field and predict a maximum in liquid water content near the bright core of the observed cloud. The location of the seaward edge of the cloud pattern is reproduced but with somewhat less skill than for the other cloud field features. This limited feasibility study has demonstrated that a significant potential exists for developing a stratus cloud-fog forecasting method based on a suitably modified version of the Lavoie model which uses satellite imagery as the basic input. GRA

N80-23941# Control Data Corp., Minneapolis, Minn.

STATISTICAL RETRIEVAL OF TEMPERATURES FROM SCR-B, AT 10 TO 0.4 MB. Final Report, 1 Jan. 1978 - 31 Jan. 1979

D. N. Hovland and R. W. Wilcox. Mar. 1979. 46 p. refs.
(Contract F49620-78-C-0036; AF Proj. 2310)
(AD-A077359; AFOSR-79-1091TR) Avail: NTIS
HC A03/MF A01 CSCL 04/2

The purpose of this first phase of a study on the morphology of planetary waves was to estimate global temperatures for the upper stratosphere and lower mesophere from the radiances of the SCR-B experiment on Nimbus 5. This has been successfully achieved using a regression of the radiances on meteorological rocket data. In general, the accuracy of the retrieved temperatures, i.e., standard deviation of the error, varies from about 3 K at 10 mb to about 5.5 K at 0.4 mb as compared to meteorological rocket values. Layer mean temperatures are about one-half degree more accurate than temperatures at the bordering levels. Details of the procedure, which included extensive prior preparation of the radiances, are given here. Global temperatures at 10, 5, 2, 1 and 0.4 mb along the orbit, and the mean temperatures (thicknesses) between the levels, are now ready to apply to the next phase of this study, which will obtain heights of those surfaces at latitude-longitude gridpoints. The planetary waves will be computed from these gridpoint values. GRA

N80-23942# Purdue Univ., Lafayette, Ind. Dept. of Statistics.

SOME STATISTICAL TECHNIQUES FOR CLIMATOLOGICAL DATA

Shanti S. Gupta and S. Panchapakesan. Jan. 1980. 14 p. refs.
Prepared in cooperation with Univ. of Southern Illinois, Carbondale
(Contract N00014-75-C-0455)
(AD-A081490;) Avail: NTIS HC A02/MF A01 CSCL 12/1

Statistical methods are increasingly being applied in the analysis of climatological data. A brief introduction to subset selection approach in multiple decision theory is given to illustrate the potential applications in climatology. GRA

N80-23943# British Columbia Univ., Vancouver. Inst. of Oceanography.

THE TURBULENT FLUXES OF MOMENTUM AND SENSIBLE HEAT OVER THE OPEN SEA DURING MODERATE TO STRONG WINDS. Ph.D. Thesis

William George Large. Aug. 1979. 195 p. refs.
(Contracts N00014-76-C-0446; N00014-66-C-0447; NR Proj. 083-207)
(AD-A081392) Avail: NTIS HC A09/MF A01 CSCL 04/2

Two systems for remote measurements of the air-sea fluxes of momentum, sensible heat and moisture during moderate to strong winds are described. One employs the dissipation method and the other the Reynolds flux or eddy correlation method. A modified Gill propeller-vane anemometer is the velocity sensor and a method of resolving the vertical velocity component that accounts for the propeller's non-cosine behavior and avoids its non-linear operating region is derived. The dynamic responses of the sensors are found from measurements in the actual turbulent conditions of the flux measurements. The results of an experiment on the Bedford tower, a stable platform moored in 59m of water 10 km offshore, are presented. Spectra, cospectra, turbulence statistics and transfer coefficients are calculated from the Reynolds flux velocity and temperature data and found to be comparable to previously reported values. Simultaneous dissipation and Reynolds flux estimates of both the momentum and sensible heat fluxes in up to 20 m/s winds are shown to be in excellent agreement. Also presented are the results of a second experiment where the systems were deployed on the weathership CCGS Quadra. A comparison of ship and tower drag coefficients from the dissipation system, demonstrates that the Bedford tower is essentially an open ocean site. GRA

N80-23944# Texas A&M Univ., College Station. Dept. of Meteorology.

A STUDY OF THE VARIABILITY OF THUNDERSTORM ELECTRICAL EVENTS BASED ON VERY-LOW-FREQUENCY ELECTROMAGNETIC DATA. Ph.D. Thesis. Final Report, 1 Oct. 1978 - 30 Sep. 1979

William Burns Freeman, Jr. Aug. 1979. 183 p. refs.
(Grant AF-AFOSR-0003-79; AF Proj. 2310)
(AD-A081305; AFOSR-80-0115TR) Avail: NTIS
HC A09/MF A01 CSCL 04/1

Sferics counts were used to estimate the incidence of lightning discharges; study the relationship of lightning-flash density to thunderstorm days; and explore the variability to cloud-to-ground discharges. Areal and global discharge incidence estimates were generated from sferics, yielding a global estimate of 1.3 times ten to the minus 5th power /Sq km/s. Gridded monthly values are given for much of the Eastern Hemisphere. The Southern Hemisphere tropics were found to have a average incidence of discharge than the Northern Hemisphere tropics. The linear regression relationship between flash density and thunder storm days indicated lower estimates of flash density when based on data stratifications compared to previous studies. Selected data from the Eastern Hemisphere were studied by linear regression techniques for causes of large-scale variability of cloud-to-ground discharges. In order of importance the regressors were the height of freezing level, the planetary geomagnetic index, a parameterization of the height of the freezing level, precipitable water in 1000-850 mb layer, the dew-point depression at 850 mb, the K index of stability, and the departure of the H-component of the magnetic force vector from its mean. GRA

N80-23945# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

EXPERIMENTAL INVESTIGATION OF AN INEXPENSIVE SKY TEMPERATURE MEASURING DEVICE. Final Report, 1 Jun. 1977 - 30 Jun. 1979

S. Karaki and P. Brothers. Aug. 1979. 23 p. refs.
(Contract EG-77-S-02-4522)
(COO-4522-1) Avail: NTIS HC A02/MF A01

Efforts were made to develop a simple approach for determining clear sky temperature from ground air temperature and absolute humidity and to develop an inexpensive device for direct measurement of sky temperature. The analytical approach

taken was similar to that developed by Bliss. A model to estimate sky temperature to acceptable accuracy, however, was not achieved. A simple device to measure sky temperature was designed and tested but development efforts within the means of the project were unsuccessful. It was concluded that a device that could include measurement or knowledge of the convective heat transfer coefficient rather than control or elimination of it would be an alternative approach in the development of a sky temperature measurement device. DOE

N80-23946# Brookhaven National Lab., Upton, N. Y.
RECOMMENDED CHANGES IN METEOROLOGICAL MEASUREMENT AND PREDICTION METHODS FOR COASTAL SITES
Gilbert S. Raynor, Paul Michael, and S. SethuRaman. 1980. 5 p. refs. Presented at the 2nd Conf. on Coastal Meteorology (AMS), Los Angeles, 31 Jan. - 1 Feb. 1980.
(Contract EY-76-C-02-0016)
(BNL-26840; CONF-800107-2) Avail: NTIS HC A02/MF A01

Meteorological measurement programs and atmospheric transport and diffusion prediction models for nuclear power plants were evaluated to determine their adequacy for plants located in coastal zones for changes to improve current procedures. Recommendations for changes to improve current procedures, based on an extensive literature review and on studies of coastal meteorology and diffusion are discussed. The following areas were highlighted in the evaluation: coastal internal boundary layers; tower location; instrument heights; atmospheric stability classification; plume meander and diffusion calculations. DOE

N80-23947# Battelle Pacific Northwest Labs., Richland, Wash.
WIND CHARACTERISTICS FOR AGRICULTURAL WIND ENERGY APPLICATIONS
David S. Renne. Jan. 1979. 5 p. refs. Presented at the 14th Conf. on Agr. and Forest Meteorology, Minneapolis, 24 Apr. 1979.
(Contract EY-76-C-06-1830)
(PNL-SA-7270; CONF-7904120-1) Avail: NTIS HC A02/MF A01

The development of economically viable wind energy conversion systems (WECS) is discussed. The use of the WECS in farm and rural applications is examined. Potential applications for WECS include irrigation pumping, residential heat, control of livestock environment, crop drying, and water heating and pumping. A map outlining the wind energy resource in the United States is presented at the various wind characteristics important to WECS are delineated. A.W.H.

N80-23948# Hawaii Univ., Honolulu. Dept. of Meteorology.
HAWAII WIND POWER SURVEY: FIXED STATION DATA
C. S. Ramage, N. E. Oshiro, and S. T. Yokogawa. Dec. 1979. 66 p. refs. Sponsored in part by Kauai County Council, Maui County, Hawaii.
(Grant EG-77-G-03-1617)
(UHMET-79-15) Avail: NTIS HC A04/MF A01

Winds were measured at windy locations in the Hawaiian Islands for periods ranging from 9 to 40 months. Careful calibration and comparison with the nearest airport measurements allow for correction of elimination of bad data. The differences were sufficiently small to justify computing speed and power density, and diurnal variations of wind speed and power density for each station. A significant area on each island possesses high annual wind power (power density at 50 m (164) AGL exceeding 400 W/sqm). The monitoring of the strong wind area of northwest Molokai, until now sampled only during a mobile survey, is outlined. Plans include making detailed measurements of the turbulence characteristics and the vertical profile of the wind in each of the major strong wind areas. DOE

N80-23949# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
FILTERING METEOROLOGICAL FLIGHT DATA
Charles Edward Wallington. Jun. 1979. 104 p. refs.
(DFVLR-Mitt-79-19) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 17.50

Filtering techniques are discussed which can be used to smooth out short period noise and to attempt to extract data on intermediate scales. Difficulties and pitfalls of designing and applying filters are described and the steps to be taken in choosing filter types and parameters are listed. Author (ESA)

N80-23950# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
PROJECT SEVERE ENVIRONMENTAL STORMS AND MESOSCALE EXPERIMENT. Summary Report
Ronnie L. Alberty, Donald W. Burgess, Carl E. Hane, and John F. Weaver. Aug. 1979. 278 p.
(PB80-119902; NOAA-79102303) Avail: NTIS HC A13/MF A01 CSCL 04B

Various aspects of smaller scale circulations were measured and observed and are discussed. Existing observational resources which provided the necessary data base for improved analytical, conceptual, and numerical efforts to understand and project mesoscale convection are described. The severe thunderstorm problem along with attendant important circulations on adjacent spatial scales are discussed. The meteorological settings for various data collection efforts are examined. G.R.A.

N80-23951# National Environmental Satellite Service, Washington, D. C.
ENVIRONMENTAL SATELLITE IMAGERY, APRIL 1979
Oct. 1979. 100 p.
(PB80-130214; NOAA-79113001) Avail: NTIS HC A05/MF A01 CSCL 04B

Photographs from the TIROS N satellite which show cloud cover for the northern and southern hemispheres during the April of 1979 are presented. The TIROS N instrument system, including the advanced very high resolution radiometer, the TIROS operational vertical sounder, the data collection system, and the space environment monitor, is discussed. A.W.H.

N80-23952# Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Atmospheric Physics.
DETECTION OF CLEAR-AIR TURBULENCE BY WATER VAPOUR EMISSION VARIATIONS: TRANSMITTANCES AND WEIGHTING FUNCTIONS. Final Report
Aug. 1979. 32 p.
(Grant NOAA-04-78-1301-20)
(PB80-130339; NOAA-79110204) Avail: NTIS HC A03/MF A01 CSCL 04B

A model of a water vapor disturbance (assumed to be caused by clear air turbulence) in the stratosphere or upper troposphere was used to investigate the changes in emission along a slant path which an aircraft detector would view when encountering such a disturbance ahead of the aircraft. Transmittances for the 260/cm to 500/cm spectral region were calculated along slant paths assuming detector viewing angles above the horizon of from 0.5 degrees to 10 degrees. Weighting functions in terms of the transmissance rate of change with eater path and the radiance rate of change with time were investigated for water vapor increases in a disturbance of 10 ppm. The predicted radiance changes were compred with known radiometer sensitivities and with actual observed changes. GRA

N80-23953# National Technical Information Service, Springfield, Va.
CLIMATIC CHANGES FROM INCREASED ATMOSPHERIC CARBON DIOXIDE. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1970 - Jan. 1980
George W. Reimherr. Feb. 1980. 46 p.
(PB80-805427) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

The cited reports amine the relationship between climatic changes and an increase in atmospheric carbon dioxide. Topics considered include the Greenhouse effect, global climatic models, and climatic effects, from increased combustion of fossil fuels. Thirty nine abstracts are presented. GRA

N80-23954# National Weather Service, Wallops Island, Va. Techniques Development Lab.
COMPARISON AND VERIFICATION OF DYNAMICAL AND STATISTICAL LAKE ERIE STORM SURGE FORECASTS
William S. Richardson and David J. Schwab (NOAA, Ann Arbor,

best copy available

Mich.) Nov. 1979 25 p. refs
(PB80-137797; NOAA-TM-NWS-TDL-69; NOAA-79121201)
Avail: NTIS HC A02/MF A01 CSCL 04B

Lake Erie storm surge forecasts produced by a dynamical and a statistical method for several months in 1977 and 1978 are compared. The dynamical method yields much better forecasts at Buffalo and slightly better forecasts at Toledo. GRA

N80-23955# National Oceanographic Data Center, Washington, D. C.
REPORT OF THE CLIMATE DATA MANAGEMENT WORKSHOP
1979 311 p. refs. Workshop held at Harpers Ferry, West Va., 8-11 May 1979
(PB80-128226; NOAA-79112101) Avail: NTIS
HC A14/MF A01 CSCL 04B

The development of an integrated inventory of climate data is discussed. The status of the various types of climate data are assessed in relation to their requirements. The topics addressed included: hydrology, precipitation, snow and ice; ocean data; atmospheric data; climate inventory; and land use. A.W.H.

N80-23619*# Santa Barbara Research Center, Goleta, Calif.
DESIGN OF AN ATMOSPHERIC SOUNDING RADIOMETER FOR THE GOES METEOROLOGICAL SATELLITE SYSTEM
Robert G. Jensen. *In* NASA. Langley Res. Center. Proc. of the 14th Aerospace Mech. Symp. May 1980 p. 289-301 (For primary document see N80-23495 14-31)
(Contracts NAS5-21139; NAS5-20769)
Avail: NTIS HC A15/MF A01 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography, and marine resources.

N80-23956*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REMOTE SENSING AND PROBLEMS OF THE HYDROSPHERE. A FOCUS FOR FUTURE RESEARCH
Edward D. Goldberg, ed. (Scripps Inst. of Oceanography, La Jolla, Calif.) Apr. 1980 35 p. refs. Meeting held at New Orleans, 9-11 May 1979
(NASA-CP-2132; L-13645) Avail: NTIS HC A03/MF A01
CSCL 08C

The underly problems of water quality which are addressable with remote sensors are considered. The chemical, biological, geological, and physical dynamics of natural ecosystems are examined. For individual titles, see N80-23957 through N80-23960.

N80-23957*# Manhattan Coll., New York.
BIOPROCESSES
Dominic M. DiToro, Richard L. Iverson (Florida State Univ., Tallahassee), and James J. McCarthy (Harvard Univ., Cambridge) *In* NASA. Langley Res. Center. Remote Sensing and Probl. of the Hydrosphere. Apr. 1980 p. 3-8 (For primary document see N80-23956 14-48)
Avail: NTIS HC A03/MF A01 CSCL 08A

The application of remote sensing techniques to the study of eutrophication in natural waters and the location and characterization of fronts is considered. The specific problem to be studied is examined along with the feasibility and capabability of remote sensing techniques for each application. J.M.S.

N80-23958*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GLOBAL GEOCHEMICAL PROBLEMS
Robert C. Harriss. *In its* Remote Sensing and Probl. of the Hydrosphere. Apr. 1980 p. 9-11 (For primary document see N80-23956 14-48)
Avail: NTIS HC A03/MF A01 CSCL 08C

Application of remote sensing techniques to the solution of geochemical problems is considered with emphasis on the 'carbon-cycle'. The problem of carbon dioxide sinks and the areal extent of coral reefs are treated. In order to assess the problems cited it is suggested that remote sensing techniques be utilized to: (1)monitor globally the carbonate and bicarbonate concentrations in surface waters of the world ocean; (2)monitor the freshwate and oceanic biomass and associated dissolved organic carbon; (3) inventory the coral reef areas and types and the associated oceanographic climatic conditions; and (4)measure the heavy metal fluxes from forested and vegetated areas, from volcanos, from different types of crustal rocks, from soils, and from sea surfaces. J.M.S.

N80-23959*# North Carolina Univ., Chapel Hill.
GAS AND AEROSOL FLUXES
Christopher S. Martens. *In* NASA. Langley Res. Center. Remote Sensing and Probl. of the Hydrosphere. Apr. 1980 p. 12-22 refs. (For primary document see N80-23956 14-48)
Avail: NTIS HC A03/MF A01 CSCL 08J

The development of remote sensing techniques to address the global need for accurate distribution and flux determinations of both man made and natural materials which affect the chemical composition of the atmosphere, the heat budget of the Earth, and the depletion, of stratospheric ozone is considered. Specifically, trace gas fluxes, sea salt aerosol production, and the effect of sea surface microlayer on gas and aerosol fluxes are examined. Volatile sulfur, carbon, nitrogen, and halocarbon compounds are discussed including a statement of the problem associated with each compound or group of compounds, a brief summary of current understanding, and suggestions for needed research. J.M.S.

N80-23960*# State Univ. of New York, Stony Brook.
COASTAL SEDIMENTATION
Jerry R. Schubel. *In* NASA. Langley Res. Center. Remote Sensing and Probl. of the Hydrosphere. Apr. 1980 p. 23-29 refs. (For primary document see N80-23956 14-48)
Avail: NTIS HC A03/MF A01 CSCL 08J

Several important coastal sedimentation problems are identified. Application of existing or anticipated remote sensing techniques to examine these problems is considered. Specifically, coastal fine particle sediment systems, floods and by hurricanes and sedimentation f of coastal systems, routes and rates of sediment transport on continental shelves, and dredging and dredged material disposal are discussed. J.M.S.

N80-23961# Phoenix Corp., McLean, Va.
VALIDATION OF OCEAN TIDE MODELS FROM SATELLITE ALTIMETRY. Interim Progress Report, May - Oct. 1978
R. D. Brown. 15 Oct. 1979 36 p. refs.
(Contract N00014-79-C-0409)
(AD-A078294) Avail: NTIS HC A03/MF A01 CSCL 08/3

Tides in the deep ocean can be determined directly from satellite altimetry, completely independent of assumptions about earth tides, bottom topography and coastal geometry and thus free of the uncertainties which plague numerical tide models. Existing tide models differ by 1 meter or more in the value of sea surface height in the deep ocean at a given place and time. This uncertainty is a formidable obstacle to determination of a precise marine geoids from satellite altimetry. By harmonic analysis of the temporal changes in altimeter measurements at satellite subtrack crossover points, it is possible to solve for the amplitude and phase of harmonic tidal components. However, care must be exercised in the removal of satellite orbit errors, and in the selection of crossovers for sufficient observability of the phase angle of the harmonic tidal component. Preliminary tidal solutions in the Gulf of Alaska using the relatively sparse GEOS-3 altimeter data distribution show generally good agreement (20 cm in amplitude and 25 degrees in phase) with deep ocean bottom pressure gauge measurements and establish the feasibility of this technique. SEASAT altimeter data yields a much greater density of crossovers (400 plus per 1/2 deg by 1/2 deg areal, making possible much better separation of individual harmonic components within the semi-diurnal and diurnal families. GRA

N80-23962# Dynalysis of Princeton, N.J.
WHOLE BASIN MODEL OF THE GULF OF MEXICO
A. F. Blumberg and G. L. Mellor (Princeton Univ.) 1979 11 p. refs. Presented at the 6th OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract ET-78-C-02-5028)
(CONF-790631-12) Avail: NTIS HC A02/MF A01

An ocean model which is advanced beyond the current state of the art was developed. Characteristics of the model include: a second moment turbulence closure model capable of accurate prediction of small scale turbulent mixing and derivative ocean features such as mixed layer temperature and depth; an algorithm which calculates the external (tidal) mode separately from the internal mode; a sigma coordinate system with 20 levels in the vertical independent of depth; and coding deliberately designed for modern array processing computers. Some preliminary tests of the model as applied to the Gulf of Mexico are described.
DOE

N80-23963# Rheinische Braunkohlenwerke A.G., Cologne (West Germany). Abt. Rohstoffe.
SOIL MECHANICAL TESTS ON PACIFIC DEEP SEA SEDIMENTS Final Report
Olaf Lettau. Bonn: Bundesmin. fuer Forsch. u. Technol. Dec. 1978. 34 p. refs. In GERMAN; ENGLISH summary. Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-78-02) Avail: NTIS HC A03/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 7.35
The results of soil mechanical studies of the Pacific Ocean flow are described. The properties of deep sea sediments were studied in order to design deep sea collecting machines for manganese modules. Sediment depth profiles of the vane shear strength are presented graphically.
Author (ESA)

N80-23964# California Univ., San Diego, La Jolla. Inst. of Marine Resources.
CALIFORNIA SEA GRANT COLLEGE PROGRAM: AN OVERVIEW 1977 - 1978
1979. 29 p.
(Grant NOAA-04-7-158-44121)
(PB80-127988; IMR-79-102; SG-68; NOAA-79112109) Avail: NTIS HC A03/MF A01 CSCL 05I
An overview of the 1977-78 California Sea Grant Program is presented. The report addresses three themes that are among the foremost issues facing society today: ecology, technology, and cooperation. The scientific investigations reported range from the broadly fundamental to the sharply practical. The educational and advisory efforts described are critical to developing a common understanding of the potential of the ocean and the implications of developing that potential.
GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-23965# Martin Marietta Labs., Baltimore, Md.
PHOTOCHEMISTRY AND ENZYMOLOGY OF PHOTOSYNTHESIS Progress Report
Richard Redmer. 30 Jul. 1979. 100 p. refs.
(Contract EY-76-C-02-3326)
(COO-3326-82) Avail: NTIS HC A05/MF A01
Three basic problems are addressed: (1) the effect of different preparative procedures on various photosynthetic reactions, with particular emphasis on photosystem II reactions in corn bundle sheath chloroplasts; (2) the development and testing of photosystem II assays; and (3) studies of the stoichiometry of electron carriers in bundle sheath chloroplasts, and whether cyclic phosphorylation could be a major pathway in this tissue. The instruments and techniques to be used in investigating the problems are discussed.
DOE

N80-23966# California Univ., Berkeley. Lawrence Berkeley Lab. Chemical Biodynamics Div.
STUDIES OF PHOTOSYNTHETIC MEMBRANES USING CHLOROPHYLL FLUORESCENCE LIFETIMES Ph.D. Thesis
Grace Toy Brewington. Sep. 1979. 189 p. refs.
(Contract W-7405-eng-48)
(LBL-9795) Avail: NTIS HC A09/MF A01
Using a single photon counting system with spark discharge excitation, the in vivo fluorescence kinetics in samples that had been treated with DCMU/NH2OH, ferricyanide, dithionite, background actinic illumination, and different cations in the buffer were investigated. From the studies it was concluded that: (1) fluoresence at the F sub o level does not arise from pigments that are not connected to the PS II reaction center; (2) a puddle model is inadequate to explain these data; (3) these data can be accommodated by a model in which tau sub 1 arises from the chlorophyll a of the chlorophyll a/b light harvesting complexes, and tau sub 2 arises from chlorophylls more directly affected by the PS II reaction center, such as the PS II chlorophyll a antenna; and (4) the fluorescence lifetime data for samples treated with sodium or magnesium ion are consistent with the models of spillover and alpha change. The fluorescence lifetime behavior in chloroplasts as a function of the redox state of the primary acceptor of PS II was also studied.
DOE

N80-23967# Unilever Research, Vlaardingen (Netherlands).
EFFECT OF HYDROGEN CHLORIDE ON THE MORPHOLOGY OF BACILLUS SUBTILIS SPORES
H. L. M. Lelieveld. 1979. 10 p. refs. Submitted for publication.
Avail: NTIS HC A02/MF A01
Gaseous hydrogen chloride, in the presence of a minute amount of water vapor, rapidly inactivates bacterial spores. Scanning electron microscopy showed that the treatment caused spores of Bacillus subtilis to collapse. Based on modern theories of spore structure and resistance, it is likely that hydrogen chloride inactivates, and causes the collapse of spores by breaking disulphide bonds in coat protein and neutralizing, by protonation, peptidoglycan carboxyl groups in the underlying cortex.
Author (ESA)

N80-23968# Unilever Research, Vlaardingen (Netherlands).
STERILIZATION BY MEANS OF HYDROGEN CHLORIDE: INFLUENCE OF PROCESS PARAMETERS ON THE BIOCIDAL ACTIVITY
H. L. M. Lelieveld and H. M. J. vanEijk. 1979. 40 p. refs. Submitted for publication.
Avail: NTIS HC A03/MF A01
At ambient temperatures, hydrogen chloride is a strong bactericide. At a partial hydrogen chloride pressure of 30 mmHg, the number of spore bearing colony forming units present in straw-dust particles of 0-32 micrometers was reduced by a factor of more than 50,000 within 60 sec. Naked spores of Bacillus subtilis were reduced in viability by a factor of 100,000 within only 10 sec. Viability of vegetative cells of various kinds of bacteria was reduced by a factor of more than 10 to the 7th power within 10 sec. The manner of administration of the gas influenced the sterilization and must be adapted to the geometry of the surfaces to be sterilized. Increases in treatment time and concentration of hydrogen chloride enhanced the sterilizing effect to a lesser extent when large dust particles were involved. The partial water vapor pressure did not influence the sterilization between 0.3 and 6 mmHg. An increase in temperature decreased the sterilizing effect.
Author (ESA)

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N80-23969* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
PULSE TRANSDUCER WITH ARTIFACT SIGNAL ATTENUATOR Patent
Wilbur H. Cash, Jr. (Martin Marietta Aerospace, Denver) and John T. Polhemus, inventors (to NASA) (Martin Marietta Aerospace, Denver). Issued 22 Apr. 1980. 4 p. Filed 26 Jul. 1978. Supersedes N78-28339 (16 - 19, p. 2520). Sponsored by NASA
(NASA-Case-FRC-11012-1; US-Patent-4,198,988; US-Patent-Appl-SN-928137; US-Patent-Class-128-666; US-Patent-Class-128-690) Avail: US Patent and Trademark Office CSCL 06B
An artifact signal attenuator for a pulse rate sensor is described. The circuit for attenuating background noise signals is connected with a pulse rate transducer which has a light source and a detector for light reflected from blood vessels of a living body. The heart signal provided consists of a modulated

dc signal voltage indicative of pulse rate. The artifact signal resulting from light reflected from the skin of the body comprises both a constant dc signal voltage and a modulated dc signal voltage. The amplitude of the artifact signal is greater and the frequency less than that of the heart signal. The signal attenuator circuit includes an operational amplifier for canceling the artifact signal from the output signal of the transducer and has the capability of meeting packaging requirements for wrist-watch-size packages. A.R.H.

N80-23970 University of Northern Colorado, Greeley.
TIME FOR RECOVERY FROM SUCCESSIVE BOUTS OF EXERCISE AS MEASURED BY CHANGES IN THE ANAEROBIC THRESHOLD: A COMPARISON OF RECOVERY INTERVALS OF 24 AND 48 HOURS Ph.D. Thesis
Jeffrey Mark Broida 1979 194 p
Avail: Univ. Microfilms Order No. 8010467

The time course for recovery from successive bouts of prolonged and fatiguing exercise was examined to determine if a measure of anaerobic threshold (AT) could be used to differentiate the degree of recovery from exercise frequencies of 3.5 and 7 days per week in which the recovery times were 48 hours and 24 hours respectively. It was concluded that the AT level will decrease if an individual exercises too often with insufficient time for recovery to be complete. Twenty-four hours of recovery time is not sufficient during the first few weeks of prolonged exercise training if the activity consists of running for 45 minutes. Twenty-four hours of recovery time may be sufficient for the 'trained' individual whose physiological mechanisms have had time to adapt. This adaptation period may take from 3 to 6 weeks. Training at the AT either 3.5 or 7 days per week for 45 minutes each session will not increase the AT in a period of 9 weeks. The results of this study indicated that the AT holds potential for being a sensitive indicator of underlying physiological changes resulting from exercise. Dissert. Abstr.

N80-23971 Wayne State Univ., Detroit, Mich.
CORONARY PLEXUS IN MAN AND MONKEY Ph.D. Thesis
Arthur James Jackson 1979 116 p
Avail: Univ. Microfilms Order No. 8010147

The distribution of autonomic nerve fibers in relation to the coronary arteries and their branches is examined, and axon terminals in the region of arterioles and capillaries are identified. The left and right coronary plexuses were studied, macroscopically, in seven human hearts and three monkey (Macaca Mulatta) hearts with the aid of a binocular dissecting microscope. In addition, the coronary arteries and their branches with the adjacent myocardium, from a stump-tail (Macaca Arctoides) and Rhesus monkey, were studied by transmission electron microscopy with and without the 'false neurotransmitter, 5-hydroxydopamine. The results suggest that if the coronary arteries are subject to autonomic control, it may be at the level of the capillary bed. Dissert. Abstr.

N80-23972 Pennsylvania State Univ., University Park.
RELATIONSHIP BETWEEN URINARY 3-METHYLHISTIDINE EXCRETION AND COMPONENTS OF BODY COMPOSITION IN MAN Ph.D. Thesis
Henry Charles Lukaski 1979 124 p
Avail: Univ. Microfilms Order No. 8010079

The relationship between urinary 3-methylhistidine (3-Mehis) excretion and components of body composition was studied in 14 men (mean age 25.2 years). Based on energy and protein intakes derived from seven day dietary records, the subjects were given a meat diet for the first four days and a meat-free diet for the next seven days. Body weight was measured daily and all urine was collected daily and analyzed for creatinine, urea nitrogen, and 3-Mehis. Densitometry and skinfold measurements were performed and total body potassium (TBK), nitrogen (TBN), and water (TBW) were determined. During the meat-free diet, urea nitrogen output was constant, indicating no increase in protein catabolism, creatinine excretion was variable, and 3-Mehis reached its lowest level, endogenous output, on day three. 3-Mehis was more closely related to muscle weight ($r = 0.91$; p less than 0.001) calculated from measurements of TBK and TBN than to free fat ($r = 0.81$; p less than 0.001) calculated from densitometry. It is concluded that because endogenous 3-Mehis is closely and significantly related to muscle weight in man, it can be used to study skeletal muscle protein degradation provided that the necessary dietary restrictions are observed. Dissert. Abstr.

N80-23973*# National Aeronautics and Space Administration, Washington, D. C.
IDEAS OF I. M. SECHENOV IN AVIATION AND SPACE MEDICINE
Oleg Georgiyevich Gazenko and Yevgeniy Aleksandrovich Kovalenko Jan. 1980 18 p refs Transl. into ENGLISH from Priroda (USSR), no. 9, 1979 p 30-37 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75976) Avail: NTIS HC A02/MF A01 CSCL 06E

The contributions I. M. Sechenov (19th century) made to modern physiology are described, including his studies on gases in the blood (O_2 and CO_2), and how these studies were the basic building blocks of current efforts in aviation and space medicine. Sechenov also studied hypokinesia, which is becoming important in long duration space flights. R.E.S.

N80-23974*# National Aeronautics and Space Administration, Washington, D. C.
INFLUENCE OF EXPERIMENTAL HYPOKINESIA ON GASTRIC SECRETORY FUNCTION
O. O. Markova, V. I. Vavryshchuk, V. I. Rozvodovskyy, and V. A. Proshcheruk Apr. 1980 8 p refs Transl. into ENGLISH from Fiziol. Zh. (Kiev), v. 23, no. 5, 1977 p 653-656 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76034) Avail: NTIS HC A02/MF A01 CSCL 06S

The gastric secretory function of rats was studied in 4, 8, 16 and 30 day hypokinesia. Inhibition of both the gastric juice secretory and acid producing functions was found. The greatest inhibition was observed on day 8 of limited mobility. By days 16 and 30 of the experiment, a tendency of the gastric secretory activity to return to normal was observed, although it remained reduced. R.E.S.

N80-23975*# National Aeronautics and Space Administration, Washington, D. C.
POSSIBILITIES OF FORECASTING HYPERCHOLESTERINEMIA IN PILOTS
P. Vivilov Mar. 1980 9 p Transl. into ENGLISH from Kazanskiy Meditsinskiy Zh. (USSR), v. 60, no. 3, May-Jun. 1979 p 18-20 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76087) Avail: NTIS HC A02/MF A01 CSCL 06P

The dependence of the frequency of hypercholesterinemia on the age, average annual flying time, functional category, qualification class, and flying specialty of 300 pilots was investigated. The risk probability coefficient of hypercholesterinemia was computed. An evaluation table was developed which gives an 84% probability of forecasting risk of hypercholesterinemia. R.E.S.

N80-23976*# National Aeronautics and Space Administration, Washington, D. C.
PROCEDURE OF PRACTICAL EXERCISE WITH STUDENTS ON THE PATHOGENIC EFFECT OF ACCELERATIONS ON THE ORGANISM
I. M. Tyrtyshnikov and L. M. Tarasenko Apr. 1980 5 p refs Transl. into ENGLISH from Patol. Fiziol. Eksperim. Terapiya (USSR), no. 4, Jul-Aug. 1978 p 81-82 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Poltava Med. Stomatological Inst., USSR
(Contract NASw-3198)
(NASA-TM-76120) Avail: NTIS HC A02/MF A01 CSCL 06S

The effects of acceleration alone and coupled with administration of either aminazine (chlorpromazine- a sedative) or caffeine (a stimulant) on the development of kinetoses in mice were studied. The problem is presented as a method to teach students and to demonstrate the role of the nervous factor in the development of kinetosis. R.E.S.

N80-23977*# National Aeronautics and Space Administration, Washington, D. C.
ON THE PRESERVATION OF EQUILIBRIUM IN THE ORTHOGRADE AND INVERTED POSITIONS OF THE BODY
L. P. Semenov and N. A. Rebyakova Apr. 1980 7 p Transl. into ENGLISH from Teor. i Prakt. Fiz. Kul't. (USSR), no. 5, 1979 p 29-30 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76141) Avail: NTIS HC A02/MF A01 CSCL 06P
The mechanism which regulates the vertical posture when maintaining equilibrium in an inverted position of the body is discussed. R.E.S.

N80-23978# Clemson Univ., S.C. College of Engineering.
AN EXPERIMENTAL EVALUATION OF SELECTED REWARMING THERAPIES FOR THE TREATMENT OF PROFOUND ACCIDENTAL HYPOTHERMIA, PART 2 Final Report, 5 Jun. 1978 - 30 Jun. 1979
R. Michael Harnett, Edward M. OBrien, Fred R. Sias, and James R. Pruitt 27 Aug. 1979 60 p refs
(Contract DOT-CG-72074-A)
(AD-A078292; USCG-D-65-79-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 06/5
This report summarizes the results of rewarming experiments performed with mildly cooled volunteers. Rewarming therapies are studied which can be used for treatment of hypothermia at the rescue site. Other therapies are included in the study to serve as standards of comparison for the (portable) ones. The results are analyzed in the context of expected human responses to arrive at comparative evaluations of the therapies for use in the treatment of (profound) hypothermia. GRA

N80-23979# Battelle Pacific Northwest Labs., Richland, Wash.
PROCEEDINGS OF THE WORKSHOP ON ELECTRICAL AND BIOLOGICAL EFFECTS RELATED TO HVDC TRANSMISSION
T. D. Bracken, ed (Bonneville Power Administration, Vancouver, Wash.) Aug. 1979 209 p refs Conf. held at Richland, Wash., 19-20 Oct. 1978
(Contract EY-76-C-06-1830)
(PNL-3121) Avail: NTIS HC A10/MF A01
Six papers are presented on various aspects of electrical and biological effects related to high voltage direct current transmission. R.E.S.

N80-23980# California Univ., Los Angeles. Nuclear Medicine and Radiation Biology Lab.
POSITRON EMISSION TOMOGRAPHY OF THE HEART
Heinrich R. Schelbert, Michael E. Phelps, and D. E. Kuhl 1979 34 p refs
(Contracts EY-76-C-03-0012; DE-AM03-76SF-00012)
(UCLA-12-1232) Avail: NTIS HC A03/MF A01
Positron emission computed tomography (PCT) represents an important new tool for the noninvasive evaluation and, more importantly, quantification of myocardial performance. Most currently available techniques permit assessment of only one aspect of cardiac function, i.e., myocardial perfusion by gamma scintillation camera imaging with Thallium-201 or left ventricular function by echocardiography or radionuclide angiocardiography. With PCT it may become possible to study all three major segments of myocardial performance, i.e., regional blood flow, mechanical function, and most importantly, myocardial metabolism. Each of these segments can either be evaluated separately or in combination. The principles and technological advantages of the imaging device are described. Currently available radioactive tracers and how they can be employed for the assessment of flow, function and metabolism are reviewed. Possible applications of PCT for the study of cardiac physiology of its potential role in the diagnosis of cardiac disease are discussed. DOE

N80-23981# IIT Research Inst., Chicago, Ill. Physics Div.
STUDY OF THE POSSIBLE EFFECTS OF 110 kHz ELECTROMAGNETIC FIELDS ON HUMANS
Sep. 1979 71 p refs
(Contract EY-76-C-04-0789)
(SAND-77-7028) Avail: NTIS HC A04/MF A01
The effects of the magnetic field on humans, in particular those wearing pacemakers, was investigated using pacemakers inserted in a simulated (phantom) human being. The tests performed were on a worst case basis. That is, for one set of tests the most sensitive of the several cardiac pacemakers tested was used in the simulated human being (phantom) tests. Furthermore, the largest observed pacemaker lead pickup area was used with the most sensitive pacemaker, and in some of the tests the pacemaker lead was oriented for maximum pickup with the phantom being placed in the strongest magnetic field. A discussion of the types of the tests as well as the electrical pickup mechanism is given. The results are presented and discussed in relation to the development of an electronic, remotely detected credential for personnel identification within security areas. R.E.S.

N80-23982# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
RHYTHMIC VORTEX CURRENTS AND THEIR SIGNIFICANCE IN HUMAN PHYSIOLOGY [RHYTHMISCHE WIRBELSTROEMUNGEN UND IHRE BEDEUTUNG FUER DEN PHYSIOLOGISCHEN HAUSHALT DES MENSCHEN]
Peter E. M. Schneider Mar. 1979 189 p refs In GERMAN (MPIS-1/1979) Avail: NTIS HC A09/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 31.20
The consequences of interactive fluid flows in the human body are discussed. The Marangoni instability is described, along with some cellular and ring vortex currents. A system thoery is presented, and the functional and morphological processes in the human digestive tract examined. Author (ESA)

N80-23983# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
SUMMARIES OF SOME REPORTS OF 1978 CONCERNING RESULTS OF FIELD EXPERIMENTS FOR VISIBILITY
Hans-Eberhard Hoffmann, Ruedigger Buell, and Werner Kuehnemann Sep. 1979 38 p refs
(DFVLR-Mitt-79-11) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 6.60
The Results of field tests for determining the visibility ranges, maximum detection range, maximum recognition range, and maximum identification range when observing air-to-land and air-to-sea are presented. The influence of the following parameters on the visibility ranges are emphasized: location, size, manner of illumination, movement and non-movement of ground targets, meteorological visibility; adaptation luminance; flight altitude and observation devices. Author (ESA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-23984 Clemson Univ., S.C.
A DISCRIMINANT ANALYSIS OF PILOT PERFORMANCE PREDICTION AND SELECTION FOR AIR-TO-AIR COMBAT Ph.D. Thesis
Dwight Wilson Polk 1979 108 p
Avail: Univ. Microfilms Order No. 8010554
Data from Southeast Asian conflict were partitioned into five epochs. Four sets of discriminant functions based on training and experience factors were derived. Each set of functions was obtained from the data of a particular epoch and was used to predict the results of a subsequent epoch. Predicted and actual results provided the basis for determining the effectiveness of computed discriminant functions in predicting successes and failures in decisive engagements. For the majority of the cases studied discriminant functions predicted results correctly in approximately the same proportions as a random classification process. However, when air combat maneuvering training of tactical flying experience were used to predict results in an early period of the conflict, the discriminant function predictions exceeded random classifications in accuracy by better than ten percent. In the last period of the conflict, flight position which

is actually a pseudo training and experience factor because of the confounding of training and experience information within it was an effective indicator of engagement outcomes. These results are consistent with a tactical analysis of the conflict.

Dissert. Abstr.

N80-23985*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CLARIFICATION PROCESS: RESOLUTION OF DECISION-PROBLEM CONDITIONS
Duncan L. Dieterly. May 1980. 24 p. refs.
(NASA-TM-81193; AFHRL-H-80-101; A-8162) Avail: NTIS HC A02/MF A01 CSCL 05J

A model of a general process which occurs in both decisionmaking and problem-solving tasks is presented. It is called the clarification model and is highly dependent on information flow. The model addresses the possible constraints of individual indifferences and experience in achieving success in resolving decision-problem conditions. As indicated, the application of the clarification process model is only necessary for certain classes of the basic decision-problem condition. With less complex decision problem conditions, certain phases of the model may be omitted. The model may be applied across a wide range of decision problem conditions. The model consists of two major components: (1) the five-phase prescriptive sequence (based on previous approaches to both concepts) and (2) the information manipulation function (which draws upon current ideas in the areas of information processing, computer programming, memory, and thinking). The two components are linked together to provide a structure that assists in understanding the process of resolving problems and making decisions.

R.E.S.

N80-23986# Oregon Univ., Eugene. Dept. of Psychology.
PREPARATION COST AND DUAL-TASK PERFORMANCE: FURTHER EVIDENCE AGAINST A GENERAL TIME-SHARING FACTOR
Harold L. Hawkins, Elizabeth Ollich-Rodriquez, Thomas O. Halloran, R. Daniel Ketchum, David B. Bachmann, and Gerald M. Reicher. Aug. 1979. 38 p. ref.
(Contract N00014-77-C-0643; NR Proj. 150-407)
(AD-A080857; TR-5) Avail: NTIS HC A03/MF A01 CSCL 05/8

The time-sharing performance of 12 pilot trainees and 12 subjects with no pilot training was evaluated on 8 dual-task and 4 single-task conditions. Three task characteristics-input modality (auditory or visual), output modality (vocal or manual), and task difficulty (easy or difficult)--were systematically manipulated across conditions in an effort to vary the nature of the specific time-sharing demands imposed. To assess their generality, time-sharing factors were correlated across task conditions. A factor was considered general if it correlated across conditions imposing dissimilar time-sharing demands. The result suggest that (a) neither an ability to time-share efficiently nor an ability to effectively prepare for multiple tasks is a general factor in dual-task performance, and (b) effective preparation for multiple tasks is a skill that increases with piloting experience.

GRA

N80-23987# European Space Agency, Paris (France).
PSYCHOLOGICAL SELECTION OF SPACELAB PAYLOAD SPECIALISTS. THE EVALUATION OF GERMAN APPLICANTS
Klaus-Martin Goeters, E. Schwartz, C. Budczinski, M. Nordhausen, and B. Repp. Nov. 1979. 26 p. refs. Transl. into ENGLISH of "Psychologische Auswahl von Spacelab-Nutzlastexperten: Die Eignungsuntersuchung Deutscher Bewerber", Rept. DFVLR-FB-78-29. DFVLR, Godesberg, West Germany, Oct. 1978. Original report in GERMAN previously announced as N79-30936. Original German report available from ZLDI, Munich DM 13.20.
(ESA-TT-586; DFVLR-FB-78-29) Avail: NTIS HC A03/MF A01

Criteria and methods used for the psychological selection of scientific astronauts (payload specialists) are described. The evaluation of 103 German Spacelab applicants is reported.

Author (ESA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-23988*# Essex Corp., Huntsville, Ala.
EVA MANIPULATION AND ASSEMBLY OF SPACE STRUCTURE COLUMNS
Tomas E. Loughead and Edwin C. Pruett. May 1980. 58 p.
(Contract NAS8-32989)
(NASA-CR-3285; M-299) Avail: NTIS HC A04/MF A01 CSCL 05H

Assembly techniques and hardware configurations used in assembly of the basic tetrahedral cell by A7LB pressure-suited subjects in a neutral bouyancy simulator were studied. Eleven subjects participated in assembly procedures which investigated two types of structural members and two configurations of attachment hardware. The assembly was accomplished through extra-vehicular activity (EVA) only, EVA with simulated manned maneuvering unit (MMU), and EVA with simulated MMU and simulated remote manipulator system (RMS). Assembly times as low as 10.20 minutes per tetrahedron were achieved. Task element data, as well as assembly procedures, are included.

R.E.S.

N80-23497*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MANNED MANEUVERING UNIT LATCHING MECHANISM
Charles S. Allton. *In* NASA. Langley Res. Center. Proc. of the 14th Aerospace Mech. Symp. May 1980. p 9-18 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 05H

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-23959 Auburn Univ., Ala.
A DYNAMICALLY RECONFIGURABLE DISTRIBUTED COMPUTING SYSTEM. Ph.D. Thesis
Charles Ralph Vick. 1979. 245 p.
Avail: Univ. Microfilms Order No. 8008385

A distributed architecture is described which integrates the fundamental concepts and qualities of pipelining and parallel processing into the basic structure. The architecture is a network of processors where each node in the network is called a

computing station (CS) and executes a well defined single entry - single exit procedure. It may be considered a type of data flow architecture in that packets of data called data item state vectors (DI SV's), trigger a given CS that not only operates on the data to produce a transformation but routes it to the next appropriate CS in the network. The routing function is not necessarily deterministic at design time, but may depend on the content of the given DI SV and the procedure within the CS that operates on it. Dissert. Abstr.

N80-23990# General Electric Co., Utica, N. Y.
NONLINEAR SYSTEM IDENTIFICATION STUDY. PART 1: IMPLEMENTATION FEASIBILITY STUDY Final Technical Report, Jan. - Sep. 1979
E. J. Ewen Griffiss AFB, N.Y. RADC Dec. 1979 189 p refs
(Contract F30602-79-C-0046; AF Proj. 2338)
(AD-A081464; RADC-TR-79-199-Pt-1) Avail: NTIS
HC A09/MF A01 CSCL 09/2

The implementation feasibility of a nonlinear system identification technique is evaluated in this report. The identification technique uses a 'black box' approach requiring measurements only at system input and output terminals and is applicable to weakly nonlinear systems whose behavior is adequately characterized by a finite Volterra series. Three hardware implementations of the identification technique are postulated and their respective performances are evaluated. The impact of A/D converter quantization error, non-ideal amplifiers, multipliers and integrators on performance of the identification process is assessed. Performance requirements for each of the three implementations are derived via simulation and analysis. The feasibility of implementing the technique using commercially available state of the art components and measurement equipment in each implementation is assessed. RADC-TR-79-199, Part 2, A computational complexity study of the identification technique processing to determine the class of nonlinear systems to which the technique can be practically applied will be published at a later date. GRA

N80-23991*# Maryland Univ., College Park. Dept. of Computer Science.
ZMOB: A MOB OF 256 COOPERATIVE Z80A-BASED MICROCOMPUTERS
Chuck Rieger Nov. 1979 20 p refs
(Grant NsG-7253; Contract N00014-76-C-0477)
(NASA-CR-163129; AD-A081346; TR-825) Avail: NTIS
HC A02/MF A01 CSCL 09/2

Current directions of computer science and computing in general are toward more parallel machine architectures and distributed models of computing based upon these new architectures. Recently, there has been considerable interest in highly parallel architectures capable of supporting complex distributed computation via a large number of autonomous processors. ZMOB is such a machine, currently under design and simulation. Architecturally, ZMOB is a collection of 256 identical but autonomous Z80A-based microcomputers (processors). Each processor comprises 32K bytes of 375 ns read/write central memory (expandable to 48K bytes), up to 4K bytes of resident operating system on 450ns EPROM, an 8-bit hardware multiplier, and interface logic for communications functions. GRA

N80-23992# South Carolina Univ., Columbia. Dept. of Electrical and Computer Engineering.
MULTIPLE MICROCOMPUTER CONTROL ALGORITHM Final Report, Sep. 1978 - Sep. 1979
Robert O. Pettus, Ronald D. Bonnell, Michael N. Huhns, Larry M. Stephens, and Gregory M. Wierzba Sep. 1979 203 p refs
(Contract N61338-78-C-0157)
(AD-A080735; NAVTRAEQUIPC-78-C-0157-1) Avail: NTIS
HC A10/MF A01 CSCL 09/2

The design, analysis and performance evaluation of the architecture of a mutiprocessor is presented. The architecture is a hierarchically structured, functionally distributed, multiple microcomputer system. Its operating system is a multi-level structure implemented in an optimal combination of hardware, firmware, and software. This architecture is suited to any application, such as process control or real-time system simulation, in which the basic computational tasks do not change in time. Control functions are distributed among the microcomputer; however, the scheduling and execution of these tasks is governed at each microcomputer level by a local, real-time operating system. This local operating system is implemented primarily in firmware to minimize overhead. However, the control structure is designed to be independent of implementation so that a variety of microcomputers can be utilized together. Moreover, it is possible to add to each local processor an additional subprocessor which implements the operating system. GRA

N80-23993# Wayne State Univ., Detroit, Mich.
INTERCONNECTION NETWORK IN MULTIPLE-PROCESSOR SYSTEMS Final Technical Report, May 1976 - Jun. 1979
Tse-Yun Feng and Chuan-Lin Wu Griffiss AFB, N.Y. RADC Dec. 1979 244 p refs
(Contract F30602-76-C-0282; AF Proj. 5597)
(AD-A080959; RADC-TR-79-304) Avail: NTIS
HC A11/MF A01 CSCL 09/2

The class of multistage interconnection networks with the configuration is introduced as a reverse-exchange interconnection network which is shown to be a powerful interconnection network for the parallel processing system. A recursive formula is derived to calculate the control pattern of the network for each of four realizable permutation classes. The recursive formulas can provide superior operating speed over the existing routing algorithms. It is proven that all permutations can be realized by the reverse-exchange network in two passes. Both the construction and routing algorithms are provided. Our results compares favorably with those of other networks. GRA

N80-23994# Army Engineer Topographic Labs., Wright-Patterson AFB, Ohio. Hydraulics Lab.
PLANNING OF AUTOMATED DATA ACQUISITION AND PROCESS CONTROL SYSTEMS (ADACS) Final Report
Roger H. Multer Jan. 1980 43 p
(AD-A081043; WES-MP-HL-80-1) Avail: NTIS
HC A03/MF A01

This report deals with the planning of Automated Data Acquisition and Control Systems (ADACS) and is written to introduce the general engineering and management audience to the types of considerations which must be addressed for successful implementation of such systems. Brief discussions are presented on such topics as basic system requirements, minicomputer components, systems implementation, programming of minicomputers, data acquisition, process control, and data transmission. The ADACS developed for use at the Chesapeake Bay model, a large hydraulic model of the Chesapeake Bay, is discussed as an example of WES experience. GRA

N80-23995# Naval Academy, Annapolis, Md. Engineering and Weapons Div.
SYNTHESIS OF OPTIMAL FILTERS USING MICROCOMPUTERS Progress Report, Jan. - May 1979
Tian S. Lim Aug. 1979 21 p refs
(AD-A081045; USNA-EW-8-79) Avail: NTIS
HC A02/MF A01

This project deals with optimal synthesis of an RC high-pass ladder network. It shows how to obtain a network with the maximum possible gain and minimum total series capacitance. The current transfer function, source and load conductances are specified. Lagrange multipliers method is used to obtain optimization. The entire process is completed using a microcomputer which can handle a large number of poles and can perform the optimization in a very short time. GRA

N80-23996# Pacific Missile Test Center, Point Mugu, Calif. Weapons Instrumentation Div.
OPTIMUM DIGITAL DATA STORAGE ON MAGNETIC TAPE
E. L. Law and W. R. Hedeman, Jr. Washington Naval Air Systems Command Dec. 1979 15 p
(AD-A081049; PMTC-TP-80-03) Avail: NTIS
HC A02/MF A01 CSCL 09/2

In recent years considerable effort has been expended on high density digital recording. The goal has been to increase the data storage per unit length of tape, usually focused on a fixed track width. The present investigation advances the thesis

that optimum data storage per square of tape is achieved by increasing the number of tracks, rather than the storage per track. An experimental method for the determination of the best operating point is described, and data is presented for Non-Return-to-Zero-Level (NRZ-L), Manchester and Miller codes for an ideal tape recorder, and also for an actual tape recorder. GRA

N80-23997# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
SIMPLE MICROCOMPUTER INTERFACE TO INSTRUMENTS WITH PARALLEL DECIMAL (BCD) OUTPUTS
P. E. Ridgeway 1979 7 p ref
(Contract EY-76-C-04-0656)
(GEPP-397) Avail: NTIS HC A02/MF A01

A simple interface to couple a microcomputer to almost any parallel BCD output device using the 8255 Programmable Peripheral Interface I.C. is described. A typical connection is shown, and a flow chart and program illustrate the software required. DOE

N80-23998# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: SELECTION OF DATA ENTRY EQUIPMENT
Steve A. Recicar Nov. 1979 80 p
(PB80-144322; NBS-SP-500-55; LC-79-600173) Avail: NTIS HC A05/MF A01 CSCL 09B

Economic and general operational considerations, steps to be followed in acquisition and training, and other factors pertinent to data entry equipment selection are presented. Equipment profiles for the different data entry methods are also provided. GRA

N80-23999# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
RECOVERY FROM SOFT ERRORS IN TRIPLICATED COMPUTER SYSTEMS OPERATING IN LOCK-STEP
A. L. Koenig and A. W. Holt Nov. 1979 30 p Sponsored in part by DNA
(PB80-126931; NBSIR-79-1927) Avail: NTIS HC A03/MF A01 CSCL 09B

A triply modular redundant (TMR) computer system operating in clocked lock-step was investigated for an application requiring a mean time between failure of five years. No mechanical memoreies were used; this allowed comparison of the outputs of the three computers to be made each clock period. The most novel contribution was the method of recovery from soft errors, such as those produced by lightning strokes or alpha particles. Data are provided on the uptime history of an experimental system which uses three commercial microcomputers. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-24000 Stanford Univ., Calif.
GLOBAL PROGRAM ANALYSIS IN AN INTERACTIVE ENVIRONMENT Ph.D. Thesis
Larry Melvin Masinter 1980 113 p
Avail: Univ. Microfilms Order No. 8011678

The implementation and characteristics of a programming tool, called SCOPE. The program which aids programmers in dealing with large programs is described. SCOPE analyzes a user's programs, remembers what it sees, answers questions based on the facts it remembers, and incrementally updates its data base when a piece of the program changes. A variety of program analysis techniques are used within SCOPE to extract different kinds of information from programs. Examples include cross reference information, flow analysis, and data type inference. At the foundation, SCOPE embodies a representation system, in which properties of pieces of programs can be expressed. Representation systems are characterized by the entities they describe, the kind of facts they can contain and the manner in which the facts are derived. The basic entity which SCOPE deals with is the definition of a symbol, e.g., the definition of a procedure, record type, or macro. In particular, the facts SCOPE stores are not about individual statements of a program but rather about the definitions of symbols. Dissert. Abstr.

N80-24001 Stanford Univ., Calif.
TECHNIQUES FOR PROGRAM VERIFICATION Ph.D. Thesis
Charles Gregory Nelson 1980 122 p
Avail: Univ. Microfilms Order No. 8011683

Two problems related to program verification are examined: choosing algorithms and data structures for the 'low-level' parts of a mechanical theorem prover that reason about important primitive operations such as equality, linear inequalities, and functions for operating on arrays and ordered pairs; and choosing a formal system that is suitable for reasoning about programs that manipulate pointers. The main result on the first problem is a method for combining 'satisfiability procedures' for two logical theories into a single satisfiability procedure for the combination of the theories. A satisfiability procedure is a program that determines the satisfiability of conjunctions of literals (signed atomic formulas). Implementation of the method in a theorem prover is described. The suggested solution to the second problem is that the specification language of the verification system be extended to allow nondeterministic partial recursive function definitions. A formal system is described for coding, specifying, and verifying programs that manipulate pointers. Dissert. Abstr.

N80-24002*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INTERACTIVE COMPUTER PROGRAM FOR SIZING SPACECRAFT MOMENTUM STORAGE DEVICES
F. J. Wilcox, Jr. Mar. 1980 40 p refs
(NASA-TM-81798) Avail: NTIS HC A03/MF A01 CSCL 09B

An interactive computer program was developed which computes the sizing requirements for nongimbled reaction wheels, control moment gyros (CMG), and dual momentum control devices (DMCD) used in Earth-orbiting spacecraft. The program accepts as inputs the spacecraft's environmental disturbance torques, rotational inertias, maneuver rates, and orbital data. From these inputs, wheel weights are calculated for a range of radii and rotational speeds. The shape of the momentum wheel may be chosen to be either a hoop, solid cylinder, or annular cylinder. The program provides graphic output illustrating the trade-off potential between the weight, radius, and wheel speed. A number of the intermediate calculations such as the X-, Y-, and Z-axis total momentum, the momentum absorption requirements for reaction wheels, CMG's, DMCD's, and basic orbit analysis information are also provided as program output. Author

N80-24003# Stanford Univ., Calif. Systems Optimization Lab.
SOLVING STAIRCASE LINEAR PROGRAMS BY THE SIMPLEX METHOD. 2. PRICING
Robert Fourer Nov. 1979 70 p refs
(Contract N00014-75-C-0267; DE-AS03-76SF-00326; Grants NSF MCS-76-20019; NSF ENG-77-0671)
(AD-A080838; SU-SOL-79-19) Avail: NTIS HC A01 CSCL 12/2

This and a companion paper share one goal: to solve staircase-structured linear programs faster through adaptation of the algorithms of the modern simplex method. Their means are quite different however, whereas the preceding paper concentrated on 'inversion' algorithms that factorize the basis and solve linear systems, the present paper looks are 'pricing' algorithms that select a variable to enter the basis at each iteration. Pricing involves two sets of algorithms: computation algorithm that determine reduced costs of the nonbasic variables, and selection algorithms that choose among variables whose reduced costs are favorable. This paper develops staircase adaptations of both sorts of algorithms, and reports extensive (although preliminary) computational experience. Staircase computation algorithms appear to offer modest but consistent savings; staircase selection algorithms, properly chosen, may offer substantial savings in number of iterations, time per iteration, or sometimes both. GRA

N80-24004# Stanford Univ., Calif. Systems Optimization Lab.
COMMENTS ON KHACHIAN'S ALGORITHM FOR LINEAR PROGRAMMING
George B. Dantzig Nov. 1979 7 p refs
(Contract N00014-75-C-0267; DE-AS03-76SF-00326; Grants NSF MCS-76-81259; NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A080837; SU-SOL-79-22) Avail: NTIS HC A02/MF A01 CSCL 12/2

Khachian's polynomial bound for finding a feasible solution to a relaxed linear program is an important theoretical result. Unfortunately, a polynomial bound does not imply a good algorithm because such a bound could be too large for problems of practical interest. For example, using the formulae in the original paper, practical problems with 3000 non-negative variables and 1000 equations (which are solved under one-half hour on IBM 370-168 using the simplex method) would involve over 10 to 15th power iterations and would take 50,000,000 years to solve using Khachian's method. GRA

N80-24005# George Washington Univ., Washington, D. C. Inst. for Management Science and Engineering.
FINDING THE GLOBAL MINIMUM OF A FUNCTION OF ONE VARIABLE USING THE METHOD OF CONSTANT SIGNED HIGHER ORDER DERIVATIVES
Garth P. McCormick 9 Nov. 1979 20 p refs
(Contracts DAAG29-79-C-0062; N00014-75-C-0729)
(AD-A081491; SERIAL-T-411) Avail: NTIS HC A02/MF A01 CSCL 12/2

A method for obtaining a global minimizer of the problem: minimize f(x) s.t. L equal to or less than X equal to or greater than U is presented when f(x) has kth order continuous derivatives. Subintervals are found on which certain derivatives have constant sign. An upward process then finds all the zeros of the first derivative in the interval. GRA

N80-24006# Naval Postgraduate School, Monterey, Calif.
AUTOMATIC FACTORIZATION OF GENERALIZED UPPER BOUNDS IN LARGE SCALE OPTIMIZATION PROBLEMS M.S. Thesis
David Samuel Thomen Sep. 1979 45 p refs
(AD-A081761) Avail: NTIS HC A03/MF A01 CSCL 12/1

To solve contemporary large scale linear, integer and mixed integer programming problems, it is often necessary to exploit intrinsic special structure in the model at hand. One commonly used technique is to identify and then to exploit in a basis factorization algorithm a generalized upper bound (GUB) structure (also called a static signed identity basis factorization). This report compares several existing methods for identifying GUB structure. Computer programs have been written to permit comparison of computational efficiency. The GUB programs have been incorporated in an existing optimization system of advanced design and have been tested on a variety of large scale real life optimization problems. The identification of GUB sets of maximum size is shown to be among the class of NP-complete problems; these problems are widely conjectured to be intractable in that no polynomial-time algorithm has been demonstrated for solving them. All the methods discussed in this report are polynomial-time heuristic algorithms that attempt to find, but do not guarantee, GUB sets of maximum size. Bounds for the maximum size of GUB sets are developed, in order to evaluate the effectiveness of the heuristic algorithms. GRA

N80-24007# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
A RANDOM SAMPLER OF DYNAMIC PROGRAMMING APPLICATIONS IN SIGNAL PROCESSING AND CONTROL
Louis L. Scharf and Howard Elliott Dec. 1979 8 p refs
Presented at the 13th Ann. Asilomar Conf. on Circuits, Systems and Computers, 5-7 Nov. 1979 Sponsored in part by the Army Research Office and the Office of Naval Research
(AD-A081485; CSU-TR-DEC79-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

Three classical problems, discrete Fourier analysis, linear prediction, and nonlinear phase and frequency demodulation are used to illustrate the use of dynamic programming in control and signal processing. The first two problems illustrate the use of dynamic programming in the (re-) derivation of the FFT and Levinson algorithms, two of the best known and most widely used fast algorithms. The last problem illustrates how dynamic programming can provide comfort in those applications where recursively computable, finite dimensional sufficient statistics are nowhere to be found. GRA

N80-24008# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
TRANSFORMING STATIC DATA STRUCTURES TO DYNAMIC STRUCTURES Interim Report
James B. Saxe and Jon Louis Bentley 3 Sep. 1979 70 p refs
(Contract N00014-76-C-0370)
(AD-A081438; CMU-CS-79-141) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this paper we will investigate transformations that serve as tools in the design of new data structures. Specifically, we study general methods for converting static structures (in which all elements are known before any searches are performed) to dynamic structures (in which insertions of new elements can be mixed with searches). We will exhibit three classes of such transformations, each based on a different counting scheme for representing the integers, and then use a combinatorial model to show the optimality of many of the transformations. Issues such as online data structures and deletion of elements are also examined. To demonstrate the applicability of these tools, we will study six new data structures that have been developed by applying the transformations. GRA

N80-24009# Naval Postgraduate School, Monterey, Calif.
NON-NUMERICAL APPLICATIONS OF COMPUTER PROGRAMMING IN THE CONSTRUCTION OF PROBLEM ORIENTED LANGUAGES M.S. Thesis
Lawrence Bruce Elliott Dec. 1979 139 p refs
(AD-A081673) Avail: NTIS HC A07/MF A01 CSCL 09/2

A discussion of several non-numerical techniques that are useful in FORTRAN programming is presented. The use of these techniques is then illustrated with a problem oriented language called CAL-NPS. This last program is a derivation of a code named CAL written by Professor E. L. Wilson of the University of California, Berkeley, California. GRA

N80-24010# Naval Postgraduate School, Monterey, Calif.
COMPLEXITY AS A FACTOR OF QUALITY AND COST IN LARGE SCALE SOFTWARE DEVELOPMENT M.S. Thesis
Joe Newton Harris Dec. 1979 98 p refs
(AD-A081604) Avail: NTIS HC A05/MF A01 CSCL 09/2

The impact of complexity on software quality and costs is examined. Historic and current issues relating to complexity in the software development and software cost estimation processes are reviewed. Select complexity models and metrics are described and briefly analyzed. Finally, an argument is presented in support of McCabe's Directed Graph Model as a useful software management tool in controlling complexity, formulating a test strategy and allocating resources. GRA

N80-24011# General Research Corp., Santa Barbara, Calif.
USING EXECUTIVE ASSERTIONS FOR TESTING
D. M. Andrews and J. P. Benson Nov. 1979 8 p refs
(Contract F49620-79-C-0115; AF Proj. 2304)
(AD-A081488; GRC-TM-2282; AFOSR-80-0127TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

One of the ways of assuring greater reliability of software is to improve testing techniques. Three of the key problems associated with software testing are: choosing adequate test cases, assuring correctness of the results, and reducing, the high cost of testing. Some degree of automation is required to help solve these problems. By combining the automated capability of adaptive testing with the use of executable assertions, it is possible to execute a program with a large number of test cases over a wide range of input values. The usual goal of adaptive testing is to maximize some performance value (objective function) for the software by automated perturbation of the input parameters. This technique only indirectly leads to locating errors, because of the time-consuming tasks of examining the usual output from the program. In software testing, the primary goal is to locate the maximum number of errors rather than maximize the

performance value. Since software errors can be detected by executable assertions, these assertions can be used to define an objective function for the Adaptive Tester so that a program can be tested automatically and a mapping made of its 'error space.' A search algorithm is used to generate new test cases based on past performance data about the number of assertion violations. Software testing can become much more efficient and effective through the use of adaptive testing with assertions, because such extensive testing increases the possibility of finding any existing errors and of improving software reliability. GRA

N80-24012# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

CONCURRENT MANIPULATION OF BINARY TREES, REVISION Interim Report

H. T. Kung and Philip L. Lehman Sep. 1979 46 p refs Revised

(Contract N00014-76-C-0370; Grant NSF MCS-78-23676)

(AD-A081443; CMU-CS-79-145-Rev) Avail: NTIS HC A03/MF A01 CSCL 09/2

The concurrent manipulation of a binary search tree is considered in this paper. The systems presented can support any number of concurrent processes which perform searching, insertion, deletion, and rotation(reorganization) on the tree, but allow any process to lock only a constant number of nodes at any time. Also, in the systems, searches are essentially never blocked. The concurrency control techniques introduced in the paper include the use of special nodes and pointers to redirect searches, and the use of copies of sections of the tree to introduce many changes simultaneously and therefore avoid unpredictable interleaving. Methods developed in this paper may provide new insights to other problems in the area of concurrent database manipulation. GRA

N80-24013# Science Applications, Inc., Englewood, Colo.

AN ANALYSIS OF SOFTWARE DESIGN METHODOLOGIES Technical Progress Report, 3 Oct. 1977 - 3 Dec. 1978

H. Rudy Ramsey, Michael E. Atwood, and Gary D. Campbell Aug. 1979 124 p refs

(Contract DAHC19-78-C-0005; DA Proj. 2Q7-62725-A-778)

(AD-A081319; SAI-79-104-DEN; ARI-TR-401) Avail: NTIS HC A06/MF A01 CSCL 09/2

Four formal software design methodologies were described and briefly analyzed: (1) Structured Design, (2) Jackson's Methodology, (3) Integrated Software Development System (Higher Order Software), and (4) Warnier's: Logical Construction of Programs; strengths, weaknesses, and commonalities among the methods were identified and human factors problem areas were analyzed. Several major human factors deficiencies and problems were identified. Formal software design methods differ in terms of: Applicability to problems of different types, size or complexity; susceptibility to design errors; and constraints and limitations imposed on the software designer. Various methods limit the designer's ability to select an appropriate problem representation, prevent the designer from utilizing relevant knowledge and experience, or impose potentially significant information loads on the designer. Improvements in design methodologies require a better understanding of the problem-solving behavior of software designers; potential research topics in this area were identified. GRA

N80-24014# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

LOW-COST COMPUTER-AIDED INSTRUCTION/ COMPUTER-MANAGED INSTRUCTION CAI/CMI SYSTEM: FEASIBILITY STUDY Final Report

Larry M. Lintz and Thompson Tate Brooks AFB, Tex. AFSC Dec. 1979 152 p refs

(Contract F33615-78-C-0031; AF Proj. 1121)

(AD-A081072; AFHRL-TR-79-42) Avail: NTIS HC A08/MF A01

This study investigated the feasibility of a low-cost computer-aided instruction/computer-managed instruction (CAI/CMI) system. Air Force instructors and training supervisors were surveyed, to determine the potential payoffs of various CAI and CMI functions. Results indicated that a wide range of capabilities had potential for resident technical training. Surveys of selected computers, terminals, communications, and support software identified candidates for the low cost system. GRA

N80-24015# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

COMPUTER-ASSISTED INSTRUCTION IN THE CONTEXT OF THE ADVANCED INSTRUCTIONAL SYSTEM. PART 1: AUTHORING SUPPORT SOFTWARE Final Report

Ann D. Montgomery and Wilson A. Judd Brooks AFB, Tex. AFSC Dec. 1979 88 p refs

(Contract F33615-78-C-0022; AF Proj. 1121)

(AD-A081071; AFHRL-TR-79-12) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report details the design, development and implementation of computer software to support the cost-effective production of Computer-Assisted Instruction (CAI) within the context of the Advanced Instructional System (AIS) located at Lowry AFB. This report supplements the computer managed Air Force technical training that is currently supported by AIS, giving the Air Force a full function Computer Based Instructional system. The interactive Authoring Editor, Presentation Program, Data Collection, and Data Print software components of the CAI system are detailed. The Editor simplifies the authoring task by (a) eliminating the need for the author to use a computer language, (b) structuring the task, (c) providing computer aided input, and (d) extensive formating and editing capabilities. The software also provides conditional and unconditional branching that can be specified from the Editor. GRA

N80-24016# Stanford Univ., Calif. Dept. of Operations Research.

EQUIVALENCE OF LCP AND PLS

B. C. Eaves and C. E. Lemke Dec. 1979 28 p refs

(Grants DAAG29-78-G-0026; NSF MCS-79-0563; NSF MCS-78-0296)

(AD-A080890; ARO-1915254.7-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

The linear complementarity problem and the piecewise linear system are the two principal models in complementary pivot and fixed point theory. It is shown that the path following methods for solving each are conceptually equivalent. GRA

N80-24017# Naval Postgraduate School, Monterey, Calif.

AUTOMATIC FACTORIZATION OF GENERALIZED UPPER BOUNDS IN LARGE SCALE OPTIMIZATION MODELS

Gerald G. Brown and David S. Thomen Jan. 1980 53 p refs

(AD-A081614; NPS55-80-003) Avail: NTIS HC A04/MF A01 CSCL 12/1

To solve contemporary large scale linear, integer and mixed integer programming problems, it is often necessary to exploit intrinsic special structure in the model at hand. One commonly used technique is to identify and then to exploit in a basis factorization algorithm a generalized upper bound (GUB) structure. This report compares several existing methods for identifying GUB structure. Computer programs have been written to permit comparison of computational efficiency. The GUB programs have been incorporated in an existing optimization system of advanced design and have been tested on a variety of large scale real life optimization problems. The identification of GUB sets of maximum size is shown to be among the class of NP-complete problems; these problems are widely conjectured to be intractable in that no polynomial-time algorithm has been demonstrated for solving them. All the methods discussed in this report are polynomial-time heuristic algorithms that attempt to find, but do not guarantee, GUB sets of maximum size. Bounds for the maximum size of GUB sets are developed, in order to evaluate the effectiveness of the heuristic algorithms. GRA

N80-24018# Stanford Univ., Calif. Systems Optimization Lab.

A PROJECTED LAGRANGIAN ALGORITHM FOR NONLINEAR MINIMAX OPTIMIZATION

Walter Murray and Michael L. Overton Nov. 1979 74 p refs

(Contracts DAAG29-79-C-0110; DE-AS03-76SF-00326; DE-AT03-76ER-72018; Grant NSF MCS-76-20019)

(AD-A081069; SU-SOL-79-2115; ARO-16470.5-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

The minimax problem is an unconstrained optimization

problem whose objective functions is not differentiable everywhere, and hence cannot be solved efficiently by standard techniques for unconstrained optimization. It is well known that the problem can be transformed into a nonlinearly constrained optimization problem with one extra variable, where the objective and constraint functions are continuously differentiable. This equivalent problem has special properties which are ignored if solved by a general-purpose constrained optimization method. The algorithm we present exploits the special structure of the equivalent problem. A direction of search is obtained at each iteration of the algorithm by solving a equality-constrained quadratic programming problem, related to one a projected Lagrangian method might use to solve the equivalent constrained optimization problem. Special Lagrangian multiplier estimates are used to form an approximation to the Hessian of the Lagrangian function, which appears in the quadratic program. Analytical Hessians, finite-differencing or quasi-Newton updating may be used in the approximation of this matrix. The resulting direction of search is guaranteed to be a descent direction for the minimax objective function. Under mild conditions the algorithms are locally quadratically convergent if analytical Hessians are used. GRA

N80-24019# Stanford Univ., Calif. Systems Optimization Lab.

A GLOBALLY CONVERGENT CONDENSATION METHOD FOR GEOMETRIC PROGRAMMING

Eric Rosenberg Oct. 1979 28 p refs

(Contracts DAAG29-79-C-0110; DE-AS03-76SF-00326; DE-AT03-76ER-72018; Grant NSF MCS-76-20019)

(AD-A081067; SU-SOL-79-11; ARO-16470.2-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

To solve a posynomial geometric program, rather than solve its dual directly, one solves the duals of a sequence of approximating geometric programs. Each approximating program, obtained by condensing certain terms of the given problem, has fewer degrees of difficulty than the given problem. Therefore, this method is to solve a sequence of problems, each posed in the same low dimensional space, rather than solve one problem in a higher dimensional space. The method requires a special sub-matrix of the matrix of exponents, and procedures to find such a sub-matrix are presented. A line search on an exact penalty function is employed. Under mild conditions, from any arbitrary starting solution estimate the method generates a sequence of estimates converging to a solution. The method also generates a sequence of lower bounds, thus providing an effective stopping criterion. A numerical example is presented. GRA

N80-24020# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

TASK REDUCTION SYSTEMS

H. J. Boom Mar. 1978 15 p refs Submitted for publication

(MC-IW-95/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The essential computational dependencies in a problem to be programmed can be expressed as a 'task replacement system' which indicates how tasks can be accomplished if other tasks are first accomplished. Associating good order with a suitable task replacement system can provide a constructive proof that an algorithm exists for solving a problem, without actually requiring the effort of writing a program. The method is demonstrated with simple examples. Author (ESA)

N80-24021# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

A FRAMEWORK FOR THE INTEGRATION OF GRAPHICS AND PATTERN RECOGNITION

Paul Klint and Marleen Sint May 1978 25 p refs Submitted for publication

(MC-IW-96/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A model is presented that describes a symmetric input/output function in a computer graphics system. This model is based on the construction of a symmetric input function by means of pattern recognition. Both theoretical and implementational aspects of this model are discussed. Author (ESA)

N80-24022# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

A SOUND AND COMPLETE HOARE-LIKE SYSTEM FOR A FRAGMENT OF PASCAL

K. R. Apt Jul. 1978 64 p refs Submitted for publication

(MC-IW-97/78) Avail: NTIS HC A04/MF A01; Stichting Math. Centrum, Amsterdam FL 7

A fragment of PASCAL is considered in which local declarations of simple variables, of array variables and of systems of mutually recursive parameterless procedures are allowed. A Hoare-like proof system for the fragment is presented which is proved to be both sound and complete in the sense of Cook. Author (ESA)

N80-24023# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

A FINITE STATE LEXICAL ANALYZER FOR THE STANDARD HARDWARE REPRESENTATION OF ALGOL 68

H. B. M. Jonkers Sep. 1978 40 p refs Submitted for publication

(MC-IW-98/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5

A finite state lexical analyzer for ALGOL 68 programs written in the standard hardware representation is described. The analyzer is written in a very simple language, allowing semi-mechanical translation to an arbitrary language. The whole language, including format-texts, is dealt with. Author (ESA)

N80-24024# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

AN ALGORITHM WITH ALGOL 60 PROGRAM FOR THE COMPUTATION OF THE ZEROS OF ORDINARY BESSEL FUNCTIONS AND OF THEIR DERIVATIVES

N. M. Temme Jun. 1978 15 p refs Submitted for publication

(MC-TW-179/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

An algorithm is described for the computation of the zeros of the Bessel functions J sub a (x), Y sub a (x), J prime sub a (x), and Y prime sub a (x). The algorithm is given as an ALGOL 60 procedure. Author (ESA)

N80-24025# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.

LOGICAL INVESTIGATIONS ON PTQ ARISING FROM PROGRAMMING REQUIREMENTS

T. M. V. Janssen Nov. 1978 34 p refs Submitted for publication

(MC-ZW-117/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

Investigations on intensional logic which were stimulated by the development of a computer program for Montague's 'The Proper Treatment of Quantification in Ordinary English' are dealt with. Some problems which arose during the design of the algorithm of the program are considered and special attention is paid to the logical reduction rules which are used to simplify the expressions of intensional logic. An explicit list of these rules is presented with a strategy for their application. The correctness of these rules is proved together with some related results. Finally, several illustrative examples of generated sentences are considered and some inaccuracies and omissions in Montague's article are indicated. Author (ESA)

N80-24026# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.

A COMPARISON OF BOUNDS OF DELSARTE AND LOVASZ

A. Schrijver Oct. 1978 17 p refs Submitted for publication

(MC-ZW-118/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Two upper bound functions are compared: Delsarte's linear programming bound (an upper bound for the cardinality of cliques in association schemes) and Lovasz's theta-function (an upper bound for the Shannon capacity of a graph). It is shown that the two bounds can be treated in a unified fashion. Delsarte's linear programming bound can be generalized to a bound theta prime (G) for the independence number alpha (G) of arbitrary graphs G, such theta prime that (G) is less than or equal to

theta (G). On the other hand, if the edge set of G is the union of some classes of a symmetric association scheme, theta (G) may be calculated by means of linear programming. It is shown that for such graphs G the product theta (G) dot theta (bar G) is equal to the number of vertices of G. Author (ESA)

N80-24027# ERIA/ECA Automation, St. Cloud (France).
THE STUDY OF REAL-TIME SOFTWARE ON SPACE MISSIONS, VOLUME 1 Final Report
Apr. 1979 34 p refs In FRENCH; ENGLISH summary 3 Vol.
(Contract ESOC-3326/77-D-JS(SC))
(Rept-7T40423/MEG/JCR-Vol-1; ESA-CR(P)-1270-Vol-1) Avail: NTIS HC A03/MF A01

Four facets of software reliability were studied: techniques for quantitative assessment and prediction of software reliability, impact of programming languages on program reliability, parallelism and synchronization issues in real-time software, and fault-tolerance techniques. Several recommendations are made including the pratical use of several techniques for quantitatively assessing software reliability and the actual implementation of an integrated set of tools for software quality control. Author (ESA)

N80-24028# ERIA/ECA Automation, St. Cloud (France).
THE STUDY OF RELIABILITY OF REAL-TIME SOFTWARE FOR SPACE MISSIONS, VOLUME 2 Final Report [ETUDE SUR LA FIABILITE DES LOGICIELS TEMPS REEL DES MISSIONS SPATIALES]
Gerard Memmi and Jean-Claude Rault Jan. 1979 182 p refs In FRENCH 3 Vol.
(Contract ESOC-3326/77-D-JS(SC))
(ESA-CR(P)-1270-Vol-2; Rept-7T40423/MEG/JCR-Vol-2) Avail: NTIS HC A09/MF A01

Several techniques were examined for the quantitative measurement of software reliability. They include: the mathematical theory of reliability or assessment and prediction methods, and a method based on the complexity of software (structure complexity, text complexity, execution behaviour complexity). Author (ESA)

N80-24029# ERIA/ECA Automation, St. Cloud (France).
THE STUDY OF RELIABILITY OF REAL-TIME SOFTWARE FOR SPACE MISSIONS, VOLUME 3 Final Report [ETUDE SUR LA FIABILITE DES LOGICIELS TEMPS REEL DES MISSIONS SPATIALES]
Jan. 1979 126 p refs In FRENCH 3 Vol.
(Contract ESOC-3326/77-D-JS(SC))
(Rept-7T40423/MEG/JCR-Vol-3; ESA-CR(P)-1270-Vol-3) Avail: NTIS HC A07/MF A01

The impact of programming languages on program reliability is discussed. Parallelism and synchronization issues in real time software are analyzed. Fault tolerance techniques are presented. Mathematical theories of reliability are reviewed, and an example of a reliable system is provided. Author (ESA)

N80-24030# National Physical Lab., Teddington (England). Div. of Numeric Analysis and Computer Science.
A COMPARISON OF FOUR FORTRAN ROUTINES FOR DENSE LINEAR PROGRAMS
E. R. Brocklehurst and K. Dennis Oct. 1979 26 p refs
(NPL-NACS-19/79) Avail: NTIS HC A03/MF A01

Four algorithms for solving dense linear programs are compared in terms of speed and accuracy. From these comparisons inferences are drawn as to how the various tolerances can be determined automatically and how accuracy can be improved. Some of the conclusions reached apply also to algorithms for sparse linear programs. Author (ESA)

N80-24031# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computer Science.
COMPLEX ARITHMETIC IN FORTRAN
S. J. Hammarling, P. D. Kenward, and Hilary J. Symm Dec. 1979 12 p refs
(NPL-NACS-23/79) Avail: NTIS HC A02/MF A01

The use of FORTRAN to implement complex algorithms in portable software is discussed. The method is compared to implenting the complex algorithm in real arithmetic and allocating two real type values to represent each complex value. The advantages and disadvantages of the two approaches are described and suggestions are provided on means to interface them. Author (ESA)

N80-24032# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science
SOME STATISTICS ON ALGOL 68 PROGRAMS
D. Grune May 1979 12 p refs Submitted for publication
(MC-IW-109/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2.88

An attempt is made to assess some static and dynamic properties of ALGOL 68 programs, which are useful for optimization decisions. The results indicate that slicing and assignation are the most important candidates for optimization. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-24033 Pennsylvania State Univ., University Park.
CONTROL OF ENTRY TO A QUEUEING SYSTEM Ph.D. Thesis
Robert Charles Rue 1979 237 p
Avail: Univ. Microfilms Order No. 8010094

A semi-Markov approach is used to formulate an expanded M/M/1 model with several classes of customers, each with its own reward and holding cost rate. Socially optimal control of this model is shown to be provided by establishing a balking point for each class that is no greater than the balking point a member of the class would determine if he acted to maximize his own expected net benefit. A semi-Markov approach is also used to extend the several class model to include service times. A heuristic solution technique based on policy iteration and a solution technique using mixed integer programming are presented. The several class models are applied to the problem of determining an optimal policy for controlling the entry of commerical aircraft to the landing queue at an international airport. A socially optimal control policy is found and analyzed. Finally, the semi-Markov approach is used to formulate three other models: (1) a nonpreemptive priority model; (2) a class dependent service rate model; (3) a nonpreemptive priority model with class dependent service rates. Dissert. Abstr.

N80-24034# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
SYSTEM OPTIMIZATION BY PERIODIC CONTROL Interim Report
Elmer G. Gilbert Sep. 1979 11 p refs
(Grant AF-AFOSR-3158-77; AF Proj. 2304)
(AD-A080295; AFOSR-80-0045TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Four new papers were published or in preparation during the past year. The results are in four main areas: (1) frequency domain tests for optimality in problems of periodic control, (2) infinite-horizon problems as natural extension of traditional problems in periodic control, (3) applications of periodic control to aircraft cruise, and (4) minimal realization of nonlinear (functional 2 power) input/output maps. GRA

N80-24035# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.

QUEUEING NETWORKS
Ralph L. Disney Dec. 1979 35 p refs
(Contract N00014-77-C-0743; Grant NSF ENG-77-22757; NR Proj. 042-296)
(AD-A081257; VTR-79-23) Avail: NTIS MF A03/MF A01 CSCL 12/1

The study of queueing networks is a rather recent addition to queueing theory. In this paper we will review about the last 20 years of developments in the area. Primary emphasis is placed on Jackson networks and the major contribution of Kelly. We discuss queue length processes, waiting time processes, busy period processes and departure processes. We will also note a few new studies that have appeared in the area of network flows. Topics that are not discussed in detail in the paper are briefly noted in the final section. The bibliography can serve as an introduction for further reading in the area. GRA

N80-24036# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.
SOME RESULTS ON SOJOURN TIMES IN ACYCLIC JACKSON NETWORKS, REVISION
Burton Simon and Robert D. Foley Dec. 1978 16 p refs Revised
(Contract N00014-77-C-0743; Grant NSF ENG-77-22757)
(AD-A080737; VTR-79-01-Rev) Avail: NTIS HC A02/MF A01 CSCL 12/1

Studies are made on sojourn times in acyclic, Jackson networks as part of a survey of equilibrium results. Argument is made that a particular customer has a sojorun time at node i that is independent of his remaining sojourn time in the network given that the customer transfer from node i to node j. This assumption is then used to derive a set of equations involving the Laplace-Stieltjes transform of the sojourn times at each node from which several properties of sojourn times are determined. GRA

N80-24037# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
ON OPTIMISTIC METHODS FOR CONCURRENCY CONTROL Interim Report
H. T. Kung and John T. Robinson Oct. 1979 21 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-78-23676)
(AD-A081452; CMU-CS-79-149) Avail: NTIS HC A02/MF A01 CSCL 09/2

Most current approaches to concurrency control in database systems rely on locking of a data objects as a control mechanism. In this paper, two families of non-locking concurrency controls are presented. The methods used are ('optimistic' in the sense that rely mainly on transaction backup as a control mechanism, 'hoping' that conflicts between transactions will not occur. Applications where these methods should be more efficient than locking are discussed. GRA

N80-24038# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.
THE M/G/1 QUEUE WITH INSTANTANEOUS BERNOULLI FEEDBACK Technical Progress Report, period ending 1979
Ralph L. Disney, Donald C. McNickle (Univ. of Canterbury, New Zealand), and Burton Simon Dec. 1979 22 p refs
(Contract N00014-75-C-0492)
(AD-A081256; VTR-79-22) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report concerns with several random processes that occur in M/G/1 queues with instantaneous feedback in which the feedback decision process is a Bernoulli process. Queue length processes embedded at various times are studied. It is shown that these do not all have the same asymptotic distribution, and that in general none of the output, input, or feedback processes is renewal. These results have implications in the application of certain decomposition results to queueing networks. GRA

N80-24039# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Systems.
AN ALGORITHM FOR AVERAGE COSTS DENUMERABLE STATE SEMI-MARKOV DECISION PROBLEMS WITH APPLICATIONS TO CONTROLLED PRODUCTION AND QUEUEING SYSTEMS
H. C. Tijms Oct. 1978 36 p refs Submitted for publication
(MC-BW-94/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

A computational approach is presented for typical applications of average costs denumerable state semi-Markov decision problems as arising in controlled production and queueing systems. This approach combines policy-iteration and embedding techniques to develop, by exploiting the structure of the application considered, a tailor-made algorithm for computing an optimal policy within a given class of intuitively reasonable policies having a simple form. An M/G/1 queueing system with controllable service time distribution, a discrete production problem in which the inventory is controlled by turning on or off the production, and an M/M/c queueing system in which the number of servers operating can be controlled are considered as applications. Author (ESA)

N80-24040# Fondazione Ugo Bordoni, Rome (Italy).
A SIMULA PROGRAM FOR INVESTIGATING A CLASS OF QUEUEING NETWORKS
Mauro Brizzi and Davide Grillo Oct. 1978 22 p refs
(FUB-40-1978) Avail: NTIS HC A02/MF A01

A queueing network model is described that may be applied to the analysis of real time distributed control systems. The model combines the main features of the BCMP class with others more common in real time systems. A simulation program for investigating the network model is discussed with reference to making use of the SIMULA programming language. The mechanism through which SIMULA manages discrete-state-continuous-time systems is described, and some broad indications are given concerning mapping procedures. Author (ESA)

N80-24041# European Space Agency, Paris (France).
DIGITAL COMPENSATORS FOR SAMPLED SYSTEMS AND MINIMUM TIME CONTROL
Alain Bernard Apr. 1980 44 p refs Transl. into ENGLISH of "Correcteurs Numeriques pour Systemes Echantillonnes et Commande en Temps Minimum", Rept. ONERA-NT-1979-3 Onera, Paris, 1979 Original report in FRENCH previously announced as N80-13038
(ESA-TT-607; ONERA-NT-1979-3) Avail: NTIS HC A03/MF A01

A method for determining and initializing numerical correctors is proposed. The optimal command is obtained in the case where the sampled transfer function of the open loop system presents only poles at the origin. The use of this method makes it possible to improve the response of any system presenting a number of poles at the origin. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-24042 Wayne State Univ., Detroit, Mich.
THE STRUCTURE OF MINIMAL GRAPHS WITH GIVEN ABELIAN AUTOMORPHISM GROUP Ph.D. Thesis
William Charles Arlinghaus 1979 216 p
Avail: Univ. Microfilms Order No. 8010117

The cycle structure of permutation groups is investigated, and necessary conditions are established for a permutation to represent an automorphism in a graph with abelian group. Candidates are constructed for minimal graphs with given cyclic group, and the above conditions are utilized to show that these candidates are indeed minimal. These methods are then used to find minimal graphs for abelian p-groups, first with two generators, and then (using induction) with an arbitrary number of generators. In general, these are suggested by the minimal graphs of the cyclic groups associated with the generators. The one class of exceptions is thoroughly developed. Finally, the results are extended to all abelian groups. Thus a complete classification is provided for minimal graphs with given finite abelian automorphism group. Dissert. Abstr.

N80-24043# Orange Free State Univ., Bloemfontein (South Africa).

PREDICTION, ESTIMATION AND MODEL SELECTION FOR MULTIVARIATE NORMAL POPULATIONS

D. J. deWaal, P. C. N. Groenewald, C. J. Lombard, D. G. Nel, and A. J. VanderMerwe May 1979 18 p refs

(TR-44) Avail: NTIS HC A02/MF A01

The prediction of future observations from multivariate normal populations is considered using Bayesian techniques and a predictive sample reuse method. Simulations comparing different estimators are made. Selecting the model that yields the best prediction is also considered. M.G.

N80-24044*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

BOUNDARY CONDITIONS FOR THE NUMERICAL SOLUTION OF ELLIPTIC EQUATIONS IN EXTERIOR REGIONS

Alvin Bayliss, Max Gunzburger (Tennessee Univ.), and Eli Turkel (New York Univ.) [1980] 47 p refs

(Contracts NAS1-14101; Contracts DAAG29-78-C-0024; EY-76-C-02-3077)

(NASA-CR-153185; Rept-80-1) Avail: NTIS HC A03/MF A01 CSCL 12A

Elliptic equations in exterior regions frequently require a boundary condition at infinity to ensure the well-posedness of the problem. Examples of practical applications include the Helmholtz equation and Laplace's equation. Computational procedures based on a direct discretization of the elliptic problem require the replacement of the condition on a finite artificial surface. Direct imposition of the condition at infinity along the finite boundary results in large errors. A sequence of boundary conditions is developed which provides increasingly accurate approximations to the problem in the infinite domain. Estimates of the error due to the finite boundary are obtained for several cases. Computations are presented which demonstrate the increased accuracy that can be obtained by the use of the higher order boundary conditions. The examples are based on a finite element formulation but finite difference methods can also be used. Author

N80-24045# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).

FINITE CRITERIA FOR CONDITIONAL DEFINITENESS OF QUADRATIC FORMS

D. H. Martin Aug. 1979 20 p refs Sponsored in part by Control Data Corp.

(CSIR-TWISK-115) Avail: NTIS HC A02/MF A01

Finite criteria, involving the solution of sets of linear equations constructed from the matrices Q.A (Q symmetric and n x n, A is m x n), for testing two types of conditional definiteness are presented. The real symmetric n x n matrix Q is A-conditionally positive semidefinite, where A is a given m x n real matrix, if x prime Q x > or = 0 whenever Ax > or = 0, and is A-conditionally positive definite if strict inequality holds except when x = 0. When A is the identity matrix these notions reduce to the well studied notions of copositivity and strict copositivity respectively. The criteria developed generalize known facts about copositive matrices, and, when Q is invertible and all rowsubmatrices of A have maximal rank, can be very elegantly stated in terms of Schur complements of the matrix AQ (-1) A prime. M.G.

N80-24046# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).

UNIFORM LINEAR APPROXIMATION IN NORMED LINEAR SPACES

M. Brannigan Aug. 1979 17 p refs

(CSIR-TWISK-114) Avail: NTIS HC A02/MF A01

It was shown that the theory of H-sets is important in the characterization of best uniform approximation of continuous real- or complex-valued functions. The theory of H-sets is extended to the more general setting of functions with compact domain and with range contained in a Banach space. Using the definitions of H-sets, a maximal linear functional is constructed and inclusion theorems analogous to the classical case are obtained. It is then a simple matter to deduce a characterization of best approximation and show when uniqueness and strong uniqueness are achieved. F.O.S.

N80-24047# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).

COPOSITIVE MATRICES AND DEFINITENESS OF QUADRATIC FORMS SUBJECT TO HOMOGENEOUS LINEAR INEQUALITY CONSTRAINTS

D. H. Martin and D. H. Jacobson May 1979 43 p refs

(CSIR-TWISK-89) Avail: NTIS HC A03/MF A01

A symmetric matrix C is called copositive if the quadratic form x prime C x is nonnegative for all nonnegative values of the variables (x sub 1, x sub 2,..., x sub n) = x prime o. A known sufficient condition for a quadratic from x prime Qx to be positive unless x = 0, subject to the linear inequality constraints Ax equal to or greater than 0, is that there should exist a copositive matrix C such that Q - A prime CA is positive definite. The main result establishes the necessity of this condition. For x prime Qx to be merely nonnegative subject to Ax equal to or greater than 0, the situation is less straight-forward. The necessity of the existence of a copositive matrix C such that Q - A prime CA is positive semi-definite is proved only under various additional hypotheses regarding the size or rank of A, and counter examples are given to show that, in general, no such matrix may exist, even when Slater's constraint qualification holds. Our approach to these existence questions also furnishes certain tests for positivity or mere nonnegativity in which specific symmetric matrices, constructed by rational operations from A and Q and depending upon a single real parameter nu, must be tested for positive definiteness or strict copositivity for large values of nu. This technique is illustrated by several examples. F.O.S.

N80-24048# North Carolina Univ. at Chapel Hill. Inst. of Statistics.

EXPECTED NUMBER OF VERTICES OF A RANDOM CONVEX POLYTOPE. I: INTEGRAL FORMULA AND ASYMPTOTIC BOUNDS

D. G. Kelly and J. M. Tolle Jan. 1980 15 p refs

(Contract N00014-75-C-0550; Grant DAAG29-79-G-0014)

(AD-A080191; MIMEO-SER-1261) Avail: NTIS HC A02/MF A01 CSCL 12/1

Given m points on the unit sphere in n-sphere, the hyperplanes tangent to the sphere at the given points bound a convex polytope with m facets. If the points are chosen independently at random from the uniform distribution on the sphere, the number V sub mn of the vertices of the polytope is a random variable. An integral expression for EV sub mn and asymptotic bounds are obtained. GRA

N80-24049# Systems Technology, Inc., Hawthorne, Calif.

WIENER-HOPF APPROACHES TO REGULATOR, FILTER/OBSERVER, AND OPTICAL COUPLER PROBLEMS Final Report

Richard F. Whitbeck Jan. 1980 77 p refs

(Contract N00014-78-C-0391)

(AD-A081489; STI-TR-1125-1; ONR-CR215-260-1) Avail: NTIS HC A05/MF A01 CSCL 12/1

Most approaches to optimal linear stochastic control problems depend on time domain techniques for both their theoretical foundations and for computational algorithms. In contrast, this paper discusses innovations based on classical transform domain Wiener-Hopf theory. These innovations avoid several difficulties occurring in time domain solutions (e.g., those which arise in connection with singular regulator and filter problems). Emphasis will be placed upon solution techniques and properties in distinction to derivations. The following points will be demonstrated: linear regulator, filter/observer problems can be solved using linear algebraic equations (in distinction to solving nonlinear Riccati equations); the R weighting matrix need not be positive definite nor is it necessary that 1/R exists; singular regulator and filter/observer problems (e.g., the cheap control problem) can be handled neatly; the weighting matrices, R and Q, can be explicit functions of frequency; and there are some advantages in using non-diagonal Q and R matrices. GRA

N80-24050# Stanford Univ., Calif. Systems Optimization Lab.

SOLVING STAIRCASE LINEAR PROGRAMS BY THE SIMPLEX METHOD. 1: INVERSION

Robert Fourer Nov. 1979 84 p refs

(Contracts N00014-75-C-0267; DE-AS03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A081713; SU-SOL-79-18) Avail: NTIS
HC A05/MF A01 CSCL 12/1

Problems of economic planning, production scheduling, inventory, transportation, control and multi-stage structural design have been modeled as linear programs that have a 'staircase' structure: their activities fall into a sequence of disjoint stages or periods, while their constraints relate only successive periods. At one time it was hoped that staircase linear programs would be particularly easy to solve, owing to their special structure, but experience with the most common solution technique, the general simplex method, has shown otherwise. Over the years many alternatives to the simplex method have also been proposed, but as yet none of these has been proved superior in solving a wide variety of staircase problems. This and a companion paper consider how the modern simplex method, as implemented for large computers, may be adapted to solve staircase linear programs more efficiently. Each paper looks at a set of algorithms within the simplex method: this one deals with 'inversion' of the basis - more accurately, solution of linear systems by Gaussian elimination and its successor considers the task of pricing. GRA

N80-24051# Naval Postgraduate School, Monterey, Calif.
ON THE COMPUTATIONAL COMPLEXITY OF BRANCH AND BOUND SEARCH STRATEGIES M.S. Thesis
Douglas R. Smith Nov. 1979 111 p refs
(Grant NSF MCS-74-14445)
(AD-A081608; NPS52-79-004) Avail: NTIS
HC A06/MF A01 CSCL 12/1

Many important problems in operations research, artificial intelligence, and other areas of computer science seem to require search in order to find an optimal solution. A branch and bound procedure, which imposes a tree structure on the search, is often the most efficient known means for solving these problems. While for some branch and bound algorithms a worst case complexity bound is known, the average case complexity is usually unknown despite the fact that it gives more information about the performance of the algorithm. In this dissertation the branch and bound method is discussed and a probabilistic model of its domain is given, namely a class of trees with an associated probability measure. The best-bound-first search strategy and depth-first search strategy are discussed and results on the expected time and space complexity of these strategies are presented and discussed. The best-bound-first search strategy is shown to be optimal in both time and space. These results are illustrated by data from randomly generated traveling salesman problems. GRA

N80-24052# Dayton Univ. Research Inst., Ohio.
EIGENVALUE AND NEAR EIGENVALUE PROBLEMS SOLVED BY BRANDT'S MULTIGRID METHOD Interim Report, May - Jun. 1979
K. G. Guderley and Donald S. Clemm (AFFDL, Wright-Patterson AFB, Ohio) Sep. 1979 29 p ref
(Grant AF-AFOSR-3524-78; AF Proj. 2304)
(AD-A081318; AFFDL-TR-79-3147) Avail: NTIS
HC A03/MF A01 CSCL 12/1

To illustrate Brandt's multigrid method this report considers the Helmholtz equation in cases where the frequency is close to an eigenfrequency. In a second part the eigenvalue problem is discussed. The basic idea for the treatment of the inhomogeneous problem is contained in Brandt's publications. Difficulties are encountered because the coarse grid eigenvalues differ from those of the finer grid. As a consequence, approximations to a solution in the coarse grid may differ widely from the corresponding approximation in a finer grid, if the frequency defined by the inhomogeneous problem is close to one of the eigenfrequencies. This may be detrimental to the aim of the coarse grid step; namely to remove from an approximation in a fine grid long waves which cause divergence of fine grid iterations. This is remedied by eliminating long wave contributions to the residual directly in the next finer grid. The success of this procedure still depends upon the choice of the subspace from which the long wave corrections in the finer grid are taken. Even this modified method fails if the frequency pertaining to the inhomogeneous term is too close to an eigenvalue, unless the subspace contains the pertinent eigenfunction. GRA

N80-24053# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
IMPLEMENTATION, INTERPRETATION AND ANALYSIS OF A SUBOPTIMAL BOUNDARY FINDING ALGORITHM
H. Cooper Elliott, D. B. Cooper, F. Cohen, and P. Symosek Jan. 1980 52 p refs
(Contract N00014-75-C-0518; Grants DAAG29-78-G-0124; NSF ENG-77-26788)
(AD-A081484; CSU-TR-JA80-DELENG-1) Avail: NTIS
HC A04/MF A01 CSCL 12/1

This report presents a suboptimal boundary estimation algorithm for noisy images which is based upon an optimal maximum likelihood problem formulation. Both the maximum likelihood formulation and the resulting algorithm are described in detail, and computational results are given. In addition, the potential power of the likelihood formulation is demonstrated through the presentation of three simple but insightful analyses algorithm performance. GRA

N80-24054# Colorado Univ. at Boulder. Dept. of Computer Science.
DETERMINING FEASIBILITY OF A SET OF NONLINEAR INEQUALITY CONSTRAINTS Interim Technical Report
Robert B. Schnabel Aug. 1979 54 p refs Presented at the 10th Intern. Symp. on Math. Programming, Montreal, Aug. 1979 and at the Fall ORSA-TIMS Meeting, Milwaukee, Oct. 1979
(Contract DAAG29-79-C-0023; Grants DAAG29-78-G-0046; NSF MCS-77-02194)
(AD-A081802; CU-CS-172-80; ARO-15074.11-M; ARO-15809.1-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

Contents: Introduction, the new class of algorithms: a weighting function-penalty approach; termination properties of the new class of algorithms; choice of the weighting function; Computational results; summary and directions for further work. GRA

N80-24055# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
GEOMETRIC TRANSFORMS FOR FAST GEOMETRIC ALGORITHMS Ph.D. Thesis. Interim Report
Kevin Q. Brown Dec. 1979 161 p refs
(Contract N00014-76-C-0370)
(AD-A081448; CMU-CS-80-101) Avail: NTIS
HC A08/MF A01 CSCL 12/1

Many computational problems are inherently geometrical in nature. For example, cluster analysis involves construction of convex hulls of sets of points, LSI artwork analysis requires a test for intersection of sets of line segments, computer graphics involves hidden line elimination, and even linear programming can be expressed in terms of intersection of half-spaces. As larger geometric problems are solved on the computer, the need grows for faster algorithms to solve them. The topic of this thesis is the use of geometric transforms as algorithmic tools for constructing fast geometric algorithms. We describe several geometric problems whose solutions illustrate the use of geometric transforms. These include fast algorithms for intersecting half-spaces, constructing Voronoi diagrams, and computing the Euclidean diameter of a set of points. For each of the major transforms we include a set of heuristics to enable the reader to use geometric transforms to solve his own problems. GRA

N80-24056# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. for Computer Science.
TWO PAPERS ON GRAPH EMBEDDING PROBLEMS Interim Report
James B. Saxe Jan. 1980 40 p refs
(Contract N00014-76-C-0370)
(AD-A081449; CMU-CS-80-102) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This report contains two independent papers on problems concerned with graph embedding, i.e., assignment of the vertices of a graph to points in a metric space subject to specified constraints. The first paper in this report, 'Embeddability of weighted graphs in k-space is strongly NP-hard,' examines the problem of assigning the vertices of a weighted graph to points

in a k-dimensional Euclidean space subject to the constraint that any two vertices connected by an edge must be assigned to points whose distance is the weight of that edge. We prove (by reduction from 3-satisfiability) that it is NP-hard to determine whether such an assignment exists, even when k=1 and the edge weights are restricted to take on the values 1 and 2. The same reduction used in this proof forms the basis of proofs of the NP-completeness of several variants of the original problem. The second paper, 'Dynamic-programming algorithms for recognizing small-bandwidth graphs in polynomial time,' deals with the problem of bandwidth minimization, in which we are given a graph, G, and a positive integer, k, and whether it is possible to assign the vertices of G to distinct integers subject to the constraint that no edge of G may have its endpoints mapped to integers which differ by more than k. Although the general problem has been proven (by C. H. Papadimitriou) to be NP-complete, we show that it can be solved in polynomial time for any fixed value of k. As in the first paper, the methods used to achieve the principal result are extended to a number of related problems. GRA

N80-24057# Maryland Univ., College Park. Computer Vision Lab.

ALGORITHMS FOR TESTING CONVEXITY OF DIGITAL POLYGONS. Interim Report

Reinhard Klette and E. V. Krishnamurthy. Dec. 1979. 22 p. refs

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A081476; TR-841; AFOSR-80-0138TR) Avail: NTIS HC A02/MF A01 CSCL 12A

A simple approach based on Shoenberg's theorem is described to test whether a set of border points of a simply 4 connected digital picture is convex. The sequential implementation of this method is linear in the number of points; the parallel algorithm needs constant time only, using bitwise parallel Boolean operations and shifts on binary matrices. Suitable modifications of this approach can be used for decomposing two dimensional objects into convex sets and for filling concavities. GRA

N80-24058# Texas A&M Univ., College Station. Inst. of Statistics.

MODERN METHODS OF MULTIPLE SPECTRAL DENSITY ESTIMATION

H. Joseph Newton. Mar. 1979. 17 p. refs

(Contract N00014-78-C-0599)

(AD-A081172; TR-N-8) Avail: NTIS HC A02/MF A01 CSCL 12/1

Methodology for estimating the spectral density of a multiple time series is presented. The windowed and autoregressive methods are described and a new estimator called the periodic autoregressive estimator is proposed. A worked example is given and a Fortran program written by the author is described. GRA

N80-24059# Texas A&M Univ., College Station. Inst. of Statistics.

EFFICIENT ESTIMATION OF MULTIVARIATE MOVING AVERAGE AUTOCOVARIANCES

H. Joseph Newton. May 1979. 5 p. refs

(Contract N00014-78-C-0599)

(AD-A081173; TR-N-9) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method is proposed for estimating the autocovariances of a d-dimensional moving average process of order q. The estimators have the same asymptotic covariance matrix as those obtained by maximizing a Gaussian likelihood, and are obtained by performing a generalized least squares regression of the periodogram on the autocovariance, thus extending Parson's estimators for d=1. J.M.S.

N80-24060# Texas A&M Univ., College Station. Inst. of Statistics.

TIME SERIES ANALYSIS METHODS AND APPLICATIONS INCREASED INTERDISCIPLINARY INTERACTION COULD STIMULATE RESEARCH BREAKTHROUGHS

Emmanuel Parzen. Nov. 1979. 11 p. refs

(Contract N00014-78-C-0599)

(AD-A081174; TR-N-10) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper consists of three parts: (1) Classification of Researchers Applying and Developing Methods of Time Series Analysis; (2) Theory of Time Series Analysis; and (3) Current Fields of Application of Time Series Analysis. GRA

N80-24061# Stanford Univ., Calif. Systems Optimization Lab.

A NESTED PARTITIONING PROCEDURE FOR NUMERICAL MULTIPLE INTEGRATION

Jerome H. Friedman and Margaret H. Wright. Nov. 1979. 38 p. refs

(Contracts DAAG29-C-0110; EY-76-C-03-0515; DE-AS03-76SF-00326; Grant NSF MSC-76-20019)

(AD-A081070; SU-SOL-79-23; ARO-16470.5-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

An algorithm is presented for adaptively partitioning a multidimensional coordinate space based on optimization of a scalar function of the coordinates. The goal is to construct a set of hyperrectangular regions, such that the variation of function values within each region is small. These regions are then used as the basis for a stratified sampling estimate of the definite integral of the function. GRA

N80-24062# Stanford Univ., Calif. Systems Optimization Lab.

A NOTE ON SPARSE QUASI-NEWTON METHODS

Mukund Thapa. Sep. 1979. 18 p. refs

(Contracts DAAG29-79-C-0110; DE-AS03-76SF-00034; Grants NSF MCS-76-20019; NSF ENG-77-06761)

(AD-A081068; SU-SOL-79-13; ARO-16470.3-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Shanno's derivation of the sparse analog of any symmetric Quasi-Newton update is obtained as a simple extension of Toint's derivation of a sparse update. Furthermore, it is shown how to compute an intermediate quantity efficiently. GRA

N80-24063# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A NUMERICAL METHOD TO INTEGRATE STIFF SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS

T. P. Coffee, J. M. Heimerl, and M. D. Kregel. Jan. 1980. 53 p. refs

(DA Proj. 1L1-61102-AH-43)

(AD-A080998; AD-E430374; ARBRL-TR-02206) Avail: NTIS HC A04/MF A01 CSCL 12/1

A method is described for the efficient integration of stiff systems of ordinary differential equations. The method, based on a predictor-corrector formulation, uses the Jacobian in a non-standard fashion. The resulting program is compared with EPISODE, a standard stiff integrator, for a number of systems of ordinary differential equations. The results show that the procedure is usually competitive with EPISODE and is more efficient for some problems. GRA

N80-24064# California Univ., Livermore. Lawrence Livermore Lab.

LINEAR LEAST-SQUARES ANALYSIS AND EFFECTIVE INTERACTIONS

S. D. Bloom, R. F. Hausman, Jr. (LASL), and J. Larsen. Mar. 1979. 11 p. Presented at the (P,N) Reaction and Nucleon-Nucleon Force Conf., Telluride, Colo., 29-31 Mar. 1979

(Contract W-7405-eng-48)

(UCRL-82587; CONF-790348-6) Avail: NTIS HC A02/MF A01

Some results are shown from the application of the method of singular value analysis (SVA), a particular form of linear squares analysis, to two sets of experimental two body matrix elements, the 63 Chung-Wildenthal matrix elements for the 1d5/2, 1d3/2 shells (A approx. equal to 20 to 40) and the best 84 matrix elements from previous work. The latter cover the atomic weight range of A approx. equal to 40 to 200 and nine shells from 1d3/2 to 1f3/2. The purpose is the extraction of a first-order set of strength parameters for an effective interaction of minimum rank and simple form for each set or both sets of data. The ranges, being nonlinear in their effects are investigated separately. Mainly considered are local potential forms, which is not a limitation of the approach. DOE

N80-24065# Sandia Labs., Albuquerque, N. Mex. Numerical Mathematics Div.
GLOBAL ERROR ESTIMATION FOR STIFF ODEs
L. F. Shampine Oct. 1979 20 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1587) Avail: NTIS HC A02/MF A01

A method is presented which in some generality, provides a rough estimate of the global error arising in the numerical solution of the initial-value problem for a stiff set of ordinary differential equations (ODEs). The procedure is not rigorously correct like global extrapolation, nor is its justification comparable to that of Stetter's scheme for Adams codes. There is a close relationship between the method and more specialized ones proposed by Robinson and Prothero, and Dew and West. A careful discussion of the most important approximations made in the present paper illuminates the accuracy and reliability of these other methods. DOE

N80-24066# Princeton Univ., N. J. Plasma Physics Lab.
SEPARATING VARIABLES IN TWO-WAY DIFFUSION EQUATIONS
N. J. Fisch and M. D. Kruskal Oct. 1979 43 p refs
(Contract EY-76-C-02-3073)
(PPPL-1596) Avail: NTIS HC A03/MF A01

It is shown that solutions to a class of diffusion equations of the two-way type may be found by a method akin to separation of variables. The difficulty with such equations is that the boundary data must be specified partly as initial and partly as final conditions. In contrast to the one way diffusion equation, where the solution separates only into decaying eigenfunctions, the two way equations seperate into both decaying and growing eigenfunctions. Criteria are set forth for the existence of linear eigenfunctions, which may not be found directly by separating variables. A speculation with interesting ramifications is that the growing and decaying eigenfunctions are separately complete in an appropriate half of the problem domain. DOE

N80-24067# Sandia Labs., Albuquerque, N. Mex. Numerical Mathematics Div.
QUADRATURE SUBROUTINES FOR SPLINES AND B-SPLINES
Donald E. Amos Dec. 1979 12 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1825) Avail: NTIS HC A02/MF A01

Four subroutines (BSQUAD, PPQUAD, BFQUAD, and PFQUAD) for integrating splines and B-splines are described. The subroutine BSQUAD accepts the B-representation in terms of the knot array T(*), the coefficient array BCOEF(*) the number of coefficients N, and the order K to compute integrals on subintervals of T(K) < or = X < or = T (N+1). Distinct knot partition the interval of integration so that polynomial integration by a Gauss quadrature formula can be implemented. The piecewise polynomial form is accepted by PPQUAD which sums polynomial evaluation of integrals on the partition. More general integrals for the product of a function f(x) and a B-spline are computed similarly in subroutines BFQUAD and PFQUAD using a quadrature routine with error control and code structure similar to that in BSQUAD and PPQUAD. DOE

N80-24068# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
GENERATING ALL MAXIMAL INDEPENDENT SETS: NP-HARDNESS AND POLYNOMIAL-TIME ALGORITHMS
E. L. Lawler (California Univ., Berkeley), J. K. Lenstra, and A. H. G. Rinnooykan (Erasmus Univ.) Apr. 1978 18 p refs Sponsored in cooperation with Netherlands Organization for Advancement of Pure Research (ZWO) Submitted for publication
(Grant NSF MCS-76-17605)
(MC-BW-87/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2,88

Suppose that an independence system (E,I) is characterized by a subroutine which indicates in unit time whether or not a given subset of E is independent. It is shown that there is no algorithm for generating all the K maximal independent sets of such an independence system in time polynomial in the absolute value of E and K, unless P = NP. However, it is possible to apply ideas of Paull and Unger and of Tsukiyama et al. to obtain polynomial-time algorithms for a number of special cases, e.g., the efficient generation of all maximal feasible solutions to a knapsack problem. The algorithmic techniques bear an interesting relationship with those of Read for the enumeration of graphs and other combinatorial configurations. Author (ESA)

N80-24069# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
A NONLINEAR VECTOR FINITE DIFFERENCE SCHEME
Paul J. Schweitzer Jun. 1978 10 p refs Submitted for publication
(MC-BW-89/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A nonlinear vector iterative scheme of linear fractional form is investigated. Explicit expressions are given for each vector iterate and for the limiting vector. These equations arise in the bottleneck analysis of closed networks of queues. Author (ESA)

N80-24070# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
NON-STATIONARY MARKOV DECISION PROBLEMS WITH CONVERGING PARAMETERS
A. Federgruen (Rochester Univ.) and P. J. Schweitzer (Rochester Univ.) Aug. 1978 31 p refs Submitted for publication
(MC-BW-90/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The solution of Markov decision problems is discussed. Various models are presented in which this situation occurs. It is shown that a modified value-iteration method may be employed in order to solve the optimality equation and to find optimal policies. In both cases the convergence rate is shown to be geometric. The asymptotic behavior of backward products of a geometrically convergent sequence of Markov matrices is characterized. Author (ESA)

N80-24071# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
DENUMERABLES STATE SEMI-MARKOV DECISION PROCESSES WITH UNBOUNDED COSTS, AVERAGE COST CRITERION
A. Federgruen (Leiden Univ.), A. Hordijk, and H. C. Tijms (Vrije Univ.) Sep. 1978 24 p refs Submitted for publication
(MC-BW-92/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

An undiscounted semi-Markov decision model with a denumerable state space and compact metric action sets, where the one step expected costs and transition times are allowed to be unbounded, is discussed. The existence of a finite solution to the average costs optimality equation is verified as well as the existence of an average cost optimal stationary policy. Author (ESA)

N80-24072# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
ANALYSIS OF HEURISTICS FOR SEQUENCING JOBS ON ONE MACHINE WITH RELEASE DATES AND DELIVERY TIMES
C. N. Potts (Keele Univ.) Nov. 1978 13 p refs Submitted for publication
(MC-BW-95/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 6

The single machine sequencing problem is considered in which each job has a release date, a processing time, and a delivery time. The objective is to find a sequence of jobs which minimizes the time by which all jobs are delivered. A heuristic is presented which never deviates by more than 50 percent from the optimum. Author (ESA)

N80-24073# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ONE-STEP SPLITTING METHODS FORMULATED FOR SEMI-DISCRETE PARABOLIC EQUATIONS
P. J. vanderHouwen and J. G. Verwer Apr. 1978 34 p refs Submitted for publication
(MC-NW-55/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3,85

Splitting methods for parabolic equations via the method of lines are discussed, starting with the formulation of these methods for semi-discrete equations such as dy/dt = f(y), f non-linear,

and f satisfying a linear splitting relation f(y) = sum of f sub i(y). A class of one-step integration formulas is defined, which is shown to contain all known splitting methods, provided the functions F sub i are defined appropriately. For a number of methods stability results are given. Secondly, attention is paid to alternating direction methods for problems with an arbitrary nonlinear coupling between space derivatives. Numerical results of those methods are compared with results obtained by a hopscotch method. Author (ESA)

N80-24074# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
SEMI-DISCRETIZATION METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS ON NONRECTANGULAR GRIDS
K. Dekker May 1978 26 p refs Submitted for publication
(MC-NW-56/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A semi-discretization method for two dimensional partial differential equations is presented, applicable to curvilinear meshes. The method yields nine-point approximation formulas for the first and second derivatives of a function. Error estimates for another discretization method are given, and both methods are compared in numerical examples. The new method turns out to be more accurate, whereas the calculation of the weights of the formulas is more time-consuming. Author (ESA)

N80-24075# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
THE APPLICATION OF ITERATED DEFECT CORRECTION TO THE LOD METHOD FOR PARABOLIC EQUATIONS
J. G. Verwer Aug. 1978 33 p refs Submitted for publication
(MC-NW-58/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

The numerical solution of the initial boundary value problem for a class of multi-dimensional parabolic partial differential equations is studied. In particular the time-integration of semi-discrete equations is investigated. An attempt is made to develop integration formulas which are computationally attractive and of high accuracy, while possessing unconditional stability properties. To that end iterated defect correction is applied to the LOD method. The convergence properties of this process are investigated. Numerical experiments are reported. Author (ESA)

N80-24076# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE STABILITY OF MULTISTEP FORMULAS FOR VOLTERRA INTEGRAL EQUATIONS OF THE SECOND KIND
P. J. vanderHouwen and P. H. M. Wolkenfelt Aug. 1978 21 p refs Submitted for publication
(MC-NW-59/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The stability properties of a class of multistep methods for second kind Volterra integral equations are analyzed. The usual analysis in which the kernel function is a priori restricted to a special class of test functions is followed. In most stability investigations these test functions depend only on the unknown function. In this case it is only required that the kernel function can be separated with respect to its first argument. Stability conditions are derived. It turns out that in the case of linear convolution kernels, the trapezoidal rule may become unstable. Author (ESA)

N80-24077# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ERROR BOUNDS FOR EXPONENTIALLY FITTED GALERKIN METHODS APPLIED TO STIFF TWO-POINT BOUNDARY VALUE PROBLEMS
P. P. N. deGroen and P. W. Hemker Sep. 1978 35 p refs Submitted for publication
(MC-NW-62/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

A linear second order singularly perturbed two point boundary-value problem is considered. Discretization by means of Petrov-Galerkin methods of finite element type, where the trial spaces contain piecewise exponentials, is studied. Error bounds, both pointwise and in the energy norm, are derived. The relation with other special difference schemes is shown and the error bounds obtained are compared with numerical results. Author (ESA)

N80-24078# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE STABILITY OF MULTISTEP FORMULAS FOR SYSTEMS OF VOLTERRA INTEGRO-DIFFERENTIAL EQUATIONS
P. J. vanderHouwen, H. J. J. teRiele, and P. H. M. Wolkenfelt Oct. 1978 44 p refs Submitted for publication
(MC-NW-63/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5

The stability behavior of linear multistep methods is analyzed for systems of integro-differential equations of Volterra type which are only restricted by the condition that the kernel function is finitely decomposable. Stability regions are derived for backward differentiation type schemes of orders 2 up to 6 and for the trapezoidal rule. In particular, attention is paid to these schemes when applied to the special integro-differential equation, which arises from differentiating a Volterra integral equation of the second kind. Numerical experiments are reported which confirm the theoretical stability results. Author (ESA)

N80-24079# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
COMPUTATIONS CONCERNING THE CONJECTURE OF MERTENS
H. J. J. teRiele Dec. 1978 9 p refs Submitted for publication
(MC-NW-64/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

In 1897, F. Mertens conjectured that the absolute value of M (x) is less than the square root of x, for all real x greater than 1, where M (x) = Sigma sub n less than or = x mu(n), and mu is the Moebius function. Several hundred hours of CPU time of a CDC Cyber 73/173 computer system were used to prove that the absolute value of M (x) greater than 0.860 square root of x, for some real x greater than 1. Author (ESA)

N80-24080# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
INEQUALITIES IN DISCRETE DISTRIBUTIONS
J. M. Buhrman Apr. 1978 12 p Submitted for publication
(MC-SW-56/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2,88

Sufficient conditions were derived for the implication F sub 1 (x) less than or = F sub 2 implies F sub 1 (x-j) less than or = F sub 2 (x-j) for all j greater than zero where F sub 1 and F sub 2 are discrete distribution functions with jumps on Z. Results are given for pairs of possibly shifted - distribution functions of binomial, Poisson, hypergeometric and negative binomial type. Author (ESA)

N80-24081# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
A NOTE ON THE MEDIAN OF THE BINOMIAL DISTRIBUTION
R. Kaas and J. M. Buhrman Jul. 1978 11 p refs Submitted for publication
(MC-SW-59/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The location of the median of the binomial distribution is studied. An integer k is shown to be a median of the binomial-(n,p) distribution if it does not differ from np by more than min (p,1-p). Neither the inequality 'mean less than median less than mode' nor its reverse holds if median and mode differ. Author (ESA)

N80-24082# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
NONUNIFORMITY OF THE CONVERGENCE OF LOCATION ESTIMATORS
C. A. J. Klaassen Oct. 1978 11 p refs Submitted for publication
(MC-SW-60/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The pointwise supremum is considered of the distribution

functions of properly normed translation equivariant antisymmetric location estimators based on observations from a distribution with a symmetric density. For positive values of the argument this function converges to the standard normal distribution function as the number of observation increases. Sets of symmetric densities are given over which this convergence, and consequently the convergence of adaptive location estimators, is not uniform.
Author (ESA)

N80-24083# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
REGRESSION ANALYSIS FOR MIXED CROSS-SECTION AND TIME-SERIES DATA WITH REFERENCES TO SOME INCOMPLETE OBSERVATIONS TECHNIQUES
R. D. Gill Nov. 1978 28 p refs Submitted for publication
(MC-SW-61/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

An iterative method is proposed for estimating a certain regression model with mixed cross section and time series data, where each observational unit is not necessarily available at each time point of the time series. Consistency and asymptotic normality of the estimators of the regression coefficients is proved as the size of the cross section increases while the length of the time series remains bounded. Both other models and the connection between this method and various incomplete data techniques from the literature are discussed. Author (ESA)

N80-24084# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
THE EFFICIENCY OF THREE TESTS FOR LINEAR HYPOTHESES CONCERNING TWO PROBABILITIES
J. M. Buhrman Nov. 1978 12 p refs Submitted for publication
(MC-SW-62/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Two experiments have probabilities of success; p sub 1 and p sub 2 respectively. Three methods are described to test hypotheses with the form p sub 1 - cp sub 2 = d, and their Pitman-efficiencies are given. Author (ESA)

N80-24085# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
JACOBI FUNCTIONS: THE ADDITION FORMULA AND THE POSITIVITY OF THE DUAL CONVOLUTION STRUCTURE
M. Flensted-Jensen (Copenhagen Univ.) and T. H. Koornwinder May 1978 21 p refs Sponsored in part by Dan. Nat. Sci. Res. Council Submitted for publication
(MC-TW-177/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum Amsterdam FL 3

An addition formula for Jacobi functions phi sub lambda (alpha, beta) (alpha greater or = beta greater or = -1/2) analogous to the known addition formula for Jacobi polynomials is proven. The positivity of the coefficients in the addition formula is exploited by giving the following application. It is proven that the product of two Jacobi functions of the same argument has a nonnegative Fourier-Jacobi transform. This implies that the convolution structure associated to the inverse Fourier-Jacobi transform is positive. Author (ESA)

N80-24086# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
A FRACTIONAL INTEGRAL OPERATOR CORRESPONDING TO NEGATIVE POWERS OF A CERTAIN SECOND ORDER DIFFERENTIAL OPERATOR
I. G. Sprinkhuizen-Kuijper Aug. 1978 40 p refs Submitted for publication
(MC-TW-182/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5

A class of integral operators is defined which contains negative fractional powers of both D squared/DX squared + (V/X x D/DX) and (I/X x D/DX). These operators are intimately connected with an integral formula for hypergeometric functions due to Erd elyi. A result of Wimp on hypergeometric integral equations is also contained in the theory of these fractional integral operators. Author (ESA)

N80-24087# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
ON A CLASS OF ELLIPTIC SINGULAR PERTURBATIONS WITH APPLICATIONS IN POPULATION GENETICS
J. Grasman Oct. 1978 15 p refs Submitted for publication
(MC-TW-184/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

With the maximum principle for differential equations asymptotic estimates are made for a class of linear elliptic singular perturbation problems with resonant turning point behavior in some of the independent variables. The method is applied to stationary solutions of the Kolmogorov backward equation from population genetics. Author (ESA)

N80-24088# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
ON THE EDGE-COLORING PROPERTY FOR THE HEREDITARY CLOSURE OF A COMPLETE UNIFORM HYPERGRAPH 2
R. Tijdeman Apr. 1978 8 p ref Submitted for publication
(MC-ZW-106/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 6

It is shown that the collection of subsets of cardinality at most h of a fixed set of cardinality n possesses a parallelism (1-factorization) if n = kh-1, h is odd, and 1/2 (h+1) less than or = k less than or = h-4 thereby completing results of A.E. Brouwer. Author (ESA)

N80-24089# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
VERTEX-CRITICAL SUBGRAPHS OF KNESER-GRAPHS
A. Schrijver Feb. 1978 11 p refs Submitted for publication
(MC-ZW-108/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

It is shown that if the stable (independent) n-subsets of a circuit with 2n+k vertices are split into k+1 classes, one of the classes contains two disjoint n-subsets; this yields a (k+2)-vertex-critical subgraph of Lovasz' Kneser-graph KG sub n,k. Author (ESA)

N80-24090# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
A LOWER BOUND FOR THE LENGTH OF PARTIAL TRANSVERSALS IN A LATIN SQUARE
A. E. Brouwer, A. J. deVries (Eindhoven Univ., Netherlands), and R. M. A. Wieringa (Eindhoven Univ., Netherlands) Feb. 1978 8 p refs Submitted for publication
(MC-ZW-109/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

It is proven that any Latin square of order n has a partial transversal or order at least n-square root of N. Author (ESA)

N80-24091# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
SOLUTION OF TWO FRACTIONAL PACKING PROBLEMS OF LOVASZ
A. Schrijver and P. D. Seymour (Merton Coll.) Apr. 1978 12 p refs Submitted for publication
(MC-ZW-110/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Lovasz asked whether the following is true for each hypergraph H and natural number k: if epsilon sub k (H prime) = k. Epsilon * (H prime) holds for each hypergraph H prime arising from H by multiplication of points, then epsilon sub k (H) = tau sub k (H); and if tau sub k (H prime) = k. tau * (H prime) holds for each hypergraph H prime arising from H by removing edges, then tau sub k (H) = epsilon sub k (H). A proof and generalization are given for the former, and a counter example is provided for the latter. Author (ESA)

N80-24092# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
A LOWER BOUND FOR THE PERMANENTS OF CERTAIN (0,1)-MATRICES
M. Voorhoeve Apr. 1978 8 p refs
(MC-ZW-111/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

It is proven that the permanent of a nxn (0,1)-matrix with

exactly three ones in each row and column is at least 6 (4/3) to the n-3 power for n > or = 3. Author (ESA)

N80-24093# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
BINARY CODES WITH MINIMUM DISTANCE FOUR
M. R. Best Aug. 1978 30 p refs Submitted for publication
(MC-ZW-112/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

A binary code with length ten and minimum Hamming distance four is presented. It contains forty words, and is therefore optimal. It gives rise to a new sphere packing in ten dimensions. It is proven that a binary code of length eleven and minimum distance four cannot contain eighty words. All seventeen optimal codes with length twelve, constant weight four and minimum distance four are listed. Author (ESA)

N80-24094# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
ON THE DIOPHANTINE EQUATION 1k + 2k + ... + xk + R(x) = yz
M. Voorhoeve, K. Gyoery, and R. Tijdeman Aug. 1978 14 p refs Submitted for publication
(MC-ZW-113/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The following theorem is proven: let R(x) be a fixed polynomial with rational integer coefficients; let b not = o and k > or = 2 be fixed rational integers such that k does not belong to the interval (3,5); then the equation 1k + 2k + ... + xk + R (x) = byz in integers x, y, > or = to 1 and 2 > 1 has only finitely many solutions. Author (ESA)

N80-24095# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
A GENERALIZATION OF DECARTES' RULE
M. Voorhoeve Oct. 1978 15 p refs Submitted for publication
(MC-ZW-115/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A generalization of Descartes' rule is presented and analyzed. The generalization is not limited to exponential sums and integrals. An example using the Dirichlet series is presented to show this. Author (ESA)

N80-24096# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
INTERPOLATION FOR FRAGMENTS OF THE PROPOSITIONAL CALCULUS
J. I. Zucker Nov. 1978 21 p refs Submitted for publication
(MC-ZW-116/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The problem of whether the interpolation theorem holds for arbitrary fragments of classical and intuitionistic propositional calculus, is considered. Author (ESA)

N80-24097# European Space Agency, Paris (France).
THE ROBERSON/WITTENBURG FORMALISM AND THE PACKAGE MULTIBODY FOR COMPUTER SIMULATIONS OF MULTIBODY SYSTEMS
Richard Schwertassek Nov. 1979 145 p refs Transl. into ENGLISH of "Der Roberson/Wittenburg-Formalismus und das Programmsystem MULTIBODY zur Rechnersimulation von Mehrkoerpersystemen", Rept. DFVLR-FB-78-08 DFVLR, Obserpfaffenhofen, West Germany, May 1978 Original report in GERMAN previously announced as N79-30979
(ESA-TT-557; DFVLR-FB-78-08) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 49.70

The prediction of the dynamic behavior of multibody systems (MBS) is based on computer oriented multibody formalisms. The corresponding computer programs prove to be an efficient tool for treating a great variety of problems. Their broad field of application results from consistent use of the capacity of modern computers. The equations of motion are established by the computer itself, starting from input data, which may be derived easily by the user. The kinematic and dynamic equations of MBS are presented in scalar, computer oriented form. These equations are implemented in the multipurpose computer package MULTIBODY. Its characteristics are demonstrated by considering an example from a typical field of application, such as the simulated deployment of the solar arrays of a geostationary communication satellite. Author (ESA)

N80-24098# European Space Agency, Paris (France).
THEORY AND NUMERICAL METHODS OF RESOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
Pierre Laval Apr. 1980 206 p refs Transl. into ENGLISH of "Theorie et Methodes Numeriques de Resolution des Equations aux Derivees Partielles", Rept. ONERA-NT-1979-2 ONERA, Paris, 1979 Original report in FRENCH previously announced as N80-23073
(ESA-TT-606; ONERA-NT-1979-2) Avail: NTIS HC A10/MF A01

The general properties and the classification of second order partial differential equations are presented as well as systems of higher order. The various classical boundary problems, whether hyperbolic, parabolic or elliptic, are then given in the simple case of the wave, heat and Laplace equations with two independent variables. The finite element method is discussed in terms of two dimensional elliptic or three dimensional parabolic problems. The finite difference methods of pseudo viscosity are evaluated for problems of unsteady compressible flows with shock waves. The implicit splitting up methods (of stabilization, predictor-corrector and desintegration) are formulated for evolution problems. The stabilization method is described for elliptic problems after a review of some iterative methods. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-24099*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
BIVARIATE NORMAL, CONDITIONAL AND RECTANGULAR PROBABILITIES: A COMPUTER PROGRAM WITH APPLICATIONS
Ram Swaroop, James D. Brownlow, George R. Ashwworth, and William R. Winter May 1980 39 p Prepared jointly with Systems Development Corp., Edwards, Calif.
(NASA-TM-81350) Avail: NTIS HC A03/MF A01 CSCL 12A

Some results for the bivariate normal distribution analysis are presented. Computer programs for conditional normal probabilities, marginal probabilities, as well as joint probabilities for rectangular regions are given: routines for computing fractile points and distribution functions are also presented. Some examples from a closed circuit television experiment are included. M.G.

N80-24100# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
THE METHOD OF n RANKINGS WHEN THE UNDERLYING DISTRIBUTIONS ARE DISCRETE Ph.D. Thesis
R. Markham Jul. 1979 245 p refs
(CSIR-TWISK-108) Avail: NTIS HC A11/MF A01

The problem of testing the null hypothesis of equal treatment effects, H sub O, in a block design, is studied. Three classes of rank tests are considered, the class of average scores tests, of midrank scores tests, and of randomized ranks tests. The randomized block design, and the balanced incomplete randomized block design are considered as special cases. Special cases of the rank tests are compared with the parametric test by means of their asymptotic relative efficiencies. An asymptotic comparison is also made of the three classes of rank tests. A method is provided for the calculation of the exact powers of the rank tests and several relative efficiency curves are calculated. E.D.K.

N80-24101# Florida State Univ., Tallahassee. Dept. of Statistics.
ON THE CHOICE OF VARIANCE FOR THE LOG RANK TEST Interim Report
Mark Brown Nov. 1979 26 p refs
(Contract F49620-79-C-0157; AF Proj. 2304)
(AD-A080296; FSU-STATISTICS-M528; TR-79-83-AFOSR;

AFOSR-80-0068TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The log rank test is widely used for comparison of survival curves. This paper examines various estimators for the variance of the log rank test statistic. These include the Mantel-Haenszel variance, the permutation variance of Peto and Peto and several newly proposed estimators. The results generalize to a wide class of test statistics for the two sample problems with censored data. GRA

N80-24102# North Carolina Univ. at Chapel Hill. Inst. of Statistics.

SAMPLING REPRESENTATIONS AND APPROXIMATIONS FOR CERTAIN FUNCTIONS AND STOCHASTIC PROCESSES Interim Report

Muhammad Kamel Habib Jan. 1980 102 p refs

(Grant AF-AFOSR-2796-75; AF Proj. 2304)

(AD-A081533; MMS-1260; AFOSR-80-0141TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

Sampling representations and approximations of deterministic and random signals are important in communication and information theory. Finite sampling approximations are derived for certain functions and processes which are not bandlimited, as well as bounds on the approximation errors. Also derived are sampling representations for bounded linear operators acting on certain classes of bandlimited functions and processes; these representations enable one to reconstruct the image of a function (or a process) under a bounded linear operator using the samples of the image. Finally, sampling representations for distributions and random distributions are obtained. GRA

N80-24103# Wisconsin Univ. - Madison. Dept. of Statistics.

ON THE PERFORMANCE OF LEAST SQUARES ESTIMATORS IN TYPE TWO CENSORED ACCELERATED LIFE TESTS

G. K. Bhattacharyya and Z. Soejoeti Aug. 1979 13 p refs

(Contract N00014-78-C-0722)

(AD-A080912; UWIS-DS-79-576) Avail: NTIS HC A02/MF A01 CSCL 14/4

In context of the analysis of accelerated life testing experiments where items are tested under more severe stress conditions than those arising in normal use, the least squares approach is noted for its simplicity. Expressions are derived for the asymptotic efficiency of the least squares estimators when the failure time data are type II censored. Applications of the general results are made to the Weibull and exponential models and the loss of efficiency is investigated in relation to the severity of censoring and the nature of spread of the design points. GRA

N80-24104# Wisconsin Univ. - Madison. Dept. of Statistics.

TRANSFORMATION OF A DISCRETE DISTRIBUTION TO NEAR NORMALITY

Fabian Hernandez and Richard A. Johnson Nov. 1979 12 p refs

(Contract N00014-78-C-0722)

(AD-A080886; UWIS-DS-79-546) Avail: NTIS HC A02/MF A01 CSCL 12/1

Utilizing an information number approach, we propose an objective method for the normalization of either discrete distributions, or sample counts, by means of a power transformation. Approximations are also given to the original known probabilities. Next, we derive the large sample distribution of our estimate of the power transformation. We compare our methods with the Box-Cox procedure, applied to observed counts, and conclude that their technique often provides good approximations even though their underlying assumption of normality is clearly violated. Two examples illustrate our methods. GRA

N80-24105# Wisconsin Univ. - Madison. Dept. of Statistics.

THE SELECTION OF AN EXTREME-VALUE DISTRIBUTION

Fabian Hernandez and Richard A. Johnson Apr. 1979 16 p refs

(Contract N00014-78-C-0722)

(AD-A080884; UWIS-DS-79-544) Avail: NTIS HC A02/MF A01 CSCL 12/1

We consider the problem of transforming a known distribution (or a random sample) to distributions other than the normal. Transformations to the negative exponential distribution are considered but the most interesting version is the extension concerning the selection of a best fitting extreme value distribution. By creating a suitable three parameter family of transformations all three types of extreme value distributions may be considered as candidates. Our sample approach to the selection is based on the marginal posterior distribution of the shape parameter. GRA

N80-24106# Wisconsin Univ. - Madison. Dept. of Statistics.

THE LARGE SAMPLE BEHAVIOR OF TRANSFORMATIONS TO NORMALITY

Fabian Hernandez and Richard A. Johnson Jan. 1979 22 p refs

(Contract N00014-78-C-0722)

(AD-A080885; UWIS-DS-79-545) Avail: NTIS HC A02/MF A01 CSCL 12/1

We investigate the large sample behavior of both the classical and Bayesian procedures for selecting a transformation to normality. The study of the large sample behavior clearly reveals the role played by the assumptions leading to the Box and Cox procedures. Based on our large sample results, we introduce an information number approach for transforming a known distribution to near normality. This latter procedure provides bench marks for the maximum possible amount of improvement through power transformations. We illustrate our procedure with three examples. Finally, we generalize our procedure to random vectors and linear models situations. GRA

N80-24107# Pittsburgh Univ., Pa. Dept. of Mathematics and Statistics.

MAXIMUM LIKELIHOOD ESTIMATION FOR AN AUTOREGRESSIVE PROCESS WITH MISSING OBSERVATIONS

Suan-Boon Tan Aug. 1979 13 p refs

(Contract N00014-76-C-0839)

(AD-A081251) Avail: NTIS HC A02/MF A01 CSCL 12/1

Three methods are proposed for estimation of the parameters of an autogressive process of order p with missing observations. These methods are based on the maximum likelihood approach and use the EM algorithm, the Newton-Raphson method and the method of scoring, which are applied to the likelihood equations. Finally, comparison on those methods is also discussed. GRA

N80-24108# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.

COMBINATORIAL GRAPH EMBEDDING Final Report

R. A. Demillo, S. C. Eisenstat, and R. J. Lipton Jan. 1980 85 p refs

(Grant DAAG29-76-G-0338)

(AD-A081247; GIT-ICS-79/12; ARO-14690.10-EL) Avail: NTIS HC A05/MF A01 CSCL 12/1

Let G, G' be directed graphs. A combinatorial embedding of G into G' is an identification of each x an element of V(G) with a set of vertices S a subset of V(G') such that each S is bounded in size by a constant independent of -V(G)= and each arc in G is carried into a directed path of length bounded by a constant independent of -V(G)=. This concept has formed the basis for a number of theoretical studies and the papers collected here are representative of - with one major exception - the state-of-the-art with regard to graph embedding. GRA

N80-24109# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.

STOCHASTIC FILTERING THEORY: A DISCUSSION OF CONCEPTS, METHODS, AND RESULTS

J. H. vanSchuppen Dec. 1978 21 p refs Submitted for publication

(MC-BW-96/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The stochastic filtering problem is examined and a definition proposed for a stochastic dynamical system in terms of the conditional independence relation. The stochastic filtering problem is then defined as the determination of the conditional distribution of the state given past observations. Two methods to solve this problem are sketched. A list with stochastic dynamical systems for which the stochastic filtering problem has been resolved is given, and some examples are presented. Author (ESA)

N80-24110# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
TESTING WITH REPLACEMENT AND THE PRODUCT LIMIT ESTIMATOR
R. D. Gill May 1978 26 p refs Submitted for publication
(MC-SW-57/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Let X1, X2,... be a sequence of i.i.d. strictly positive random variables with distribution function F. Define N tilde (t) = the number of j with X sub 1 +...+ X sub j < or = to t. In testing with replacement, n independent copies of N tilde are observed each over the time interval (o,T) and the interest lies in nonparametric estimation of F based on these observations. Consistency is proven of the product limit estimator as n goes to infinity for arbitrary F, and weak convergence for two cases: integer valued X sub i and X sub i with a continuous distribution function. The theory of stochastic integrals is used to do this, and the similarity of the results is explained with those for the product limit estimators in the model of random censorship.
Author (ESA)

N80-24111# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
BOUNDS FOR THE MEAN AND STANDARD DEVIATION OF LINEAR COMBINATIONS OF ORDER STATISTICS
Charles H. Kraft and Constance vanEeden Jun. 1978 20 p Submitted for publication Sponsored in part by Quebec Min. of Educ.
(Grants NRC-A-3038; NRC-A-3114)
(MC-SW-58/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Bounds are given for E sub theta Sigma from s = 1 to s = N alpha sub s o sub s and sigma sub theta (Sigma from s = 1 to s = N alpha sub s o sub s), where o sub 1,..., o sub N are the order statistics of X sub 1,..., X sub N, a random vector with density p sub o (x sub 1 - theta sub 1,..., x sub N - theta sub N) for some theta = (theta sub 1,..., theta sub N) and p sub o (x sub 1,..., x sub N) a completely arbitrary density with respect to Lebesgue measure in R sub N. If the X sub i are exchangeable under p sub o the bounds depend only on E sub o Sigma from s = 1 to s = N alpha sub s o sub s and sigma sub o (Sigma from s = 1 to s = N alpha sub s o sub s plus quantities that can be computed without knowledge of p sub o. The bounds are attainable for some distributions and nearly attainable for some others.
Author (ESA)

N80-24112# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
LARGE DEVIATIONS OF MULTIVARIATE-L-ESTIMATORS WITH MONOTONE WEIGHT FUNCTIONS
J. Oosterhoff Dec. 1978 15 p refs Submitted for publication
(MC-SW-63/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A large deviation theorem for p-variate (p greater than or = 1) linear combinations of order statistics with monotone weight functions is derived. The proof is based on a Sanov-type large deviation results for empirical common distribution functions.
Author (ESA)

N80-24113# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
NONPARAMETRIC ESTIMATION BASED ON CENSORED OBSERVATIONS OF A MARKOV RENEWAL PROCESS
R. D. Gill Dec. 1978 30 p refs Submitted for publication
(MC-SW-64/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Uniform consistency and weak convergence is proved for estimators of the transition probabilities of an arbitrary finite state space Markov renewal process, based on n independent and identically distributed right censored realizations of the process. The approach uses the theory of stochastic integrals and counting processes. It is shown how the results may be extended to the non-identically distributed case and to general censorship under suitable conditions.
Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-24114*# Johns Hopkins Univ., Baltimore, Md. Dept. of Electrical Engineering.
INTERMITTENT/TRANSIENT FAULTS IN COMPUTER SYSTEMS: EXECUTIVE SUMMARY
Gerald M. Masson Apr. 1980 39 p refs
(Grant NsG-1442)
(NASA-CR-159229) Avail: NTIS HC A03/MF A01 CSCL 09B

An overview of an approach for diagnosing intermittent/transient (I/T) faults is presented. The development of an interrelated theory and experimental methodology to be used in a laboratory situation to measure the capability of a fault tolerant computing system to diagnose I/T faults, is discussed. To the extent that such diagnosing capability is important to reliability in fault tolerant computing systems, this theory and supporting methodology serves as a foundation for validation efforts.
E.D.K.

N80-24115# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
AN ADAPTIVE BRANCHING RULE FOR THE PERMUTATION FLOW-SHOP PROBLEM
C. N. Potts (Keele Univ.) Sep. 1978 16 p refs Submitted for publication
(MC-BW-91/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A branch and bound algorithm is presented for the permutation flow-shop problem in which the objective is to minimize the maximum completion time. A branching procedure is used in which jobs both at the beginning and at the end of the schedule are fixed. Dominance rules are included in the algorithm. During the initial stages of the algorithm, upper bounds are computed at certain nodes of the search tree. Computational results indicate that the proposed algorithm is superior to previously published algorithms.
Author (ESA)

N80-24116# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
DETERMINISTIC PRODUCTION PLANNING: ALGORITHMS AND COMPLEXITY
M. Florian (Montreal Univ.), J. K. Lenstra, and Rinnooy A. H. G. Kan (Erasmus Univ.) Oct. 1978 16 p refs Co-sponsored by Netherlands Organ. for Advan. of Pure Res. (ZWO) and Natl. Res. Council of Canada Submitted for publication
(MC-BW-93/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A class of production planning problems is considered in which known demands have to be satisfied over a finite interval at minimum total costs. For each period, production and storage cost functions are specified. The production costs may include setup costs and the production levels may be subject to capacity limits. The computational complexity of the problems in this class is investigated. Several algorithms proposed for their solution are described and analyzed. It is also shown that some special cases are NP-hard and hence unlikely to be solvable in polynomial time.
Author (ESA)

N80-24117# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
RUN FOR YOUR LIFE. A NOTE ON THE ASYMPTOTIC SPEED OF PROPAGATION OF AN EPIDEMIC
O. Diekmann May 1978 24 p refs Submitted for publication
(MC-TW-176/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The large-time behavior of the solution of a nonlinear integral equation of mixed Volterra-Fredholm type describing the spatio-temporal development of an epidemic is studied. For this model it is known that there exists a minimal wave speed c sub o (i.e., traveling wave solutions with speed c exist if the absolute value of c is greater than c sub o and do not exist if the absolute value of c is less than c sub o). It is shown that c sub o is the asymptotic speed of propagation (i.e., for any c

sub 1, c sub 2 with o less than c sub i less than c sub o less than c sub 2 the solution tends to zero uniformly in the region absolute value of x greater than or = to c sub 2 t, whereas it is bounded away from zero uniformly in the region absolute value of x less than or = to c sub 1 t for t sufficiently large).
Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-24118# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
REGULARIZATION AND GENERALIZED INVERSE SOLUTIONS OF INTEGRAL EQUATIONS OF THE FIRST KIND IN REPRODUCING KERNEL HILBERT SPACES
M. L. Baart Jun. 1979 15 p refs
(CSIR-TWISK-88) Avail: NTIS HC A02/MF A01

An assessment is made of possible ways of presenting ill-posed problems, in this case typified by Fredholm integral equations of the first kind, in a reproducing kernel Hilbert space setting. Advantages of this kind of representation are discussed.
Author

N80-24119# George Washington Univ., Washington, D. C.
LOCATING AN ISOLATED GLOBAL MINIMIZER OF A CONSTRAINED NONCONVEX PROGRAM
Garth P. McCormick Sep. 1979 23 p refs
(Contract N00014-75-C-0729; Grant AF-AFOSR-2504-73)
(AD-A080180; SERIAL-T-409) Avail: NTIS HC A02/MF A01 CSCL 12/1

Conditions are given which verify the existence and determine the location of an isolated local constrained minimizer in a convex compact set. An exact formula is given for the amount by which the value of the objective function at some point differs from the value at that isolated point. Further conditions are given which ensure that the local minimizer is a global minimizer in the given convex compact set. GRA

N80-24120# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
THE STRENGTH OF NONSTATIONARY INERATION Interim Report
G. W. Wasilkowski Aug. 1979 30 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-22255; NR Proj. 044-422)
(AD-A081450; CMU-CS-79-138) Avail: NTIS HC A03/MF A01 CSCL 12/1

This is the second of three papers in which we study global convergence of iterations using linear information for the solution of nonlinear equations. In Wasilkowski we proved that for the class of all analytic scalar complex functions having only simple zeros there exists no globally convergent stationary iteration using linear information. Here we exhibit a nonstationary iteration using linear information which is globally convergent even for the multivariate and abstract cases. This demonstrates the strength of nonstationary iteration. In Wasilkowski we shall prove that any globally convergent iteration using linear information has infinite complexity even for the class of scalar complex polynomials having only simple zeros. GRA

N80-24121# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
DISJOINTNESS AND QUASIFACTORS IN TOPOLOGICAL DYNAMICS
J. C. S. P. vanderWoude Nov. 1978 24 p refs Submitted for publication
(MC-ZW-119/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Some results are presented about the disjointness relations between factors, extensions and quasifactors of minimal topological transformation groups (ttg's) with arbitrary phase group and compact Hausdorff phase space. Some families of minimal ttg's are characterized whose members are disjoint from a certain collection of minimal ttg's. For instance it is proven that if the phase group is strongly amenable, then the minimal ttg's, which are disjoint from every PI-ttg, are just the weakly mixing ones.
Author (ESA)

N80-24122# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
ON A SUFFICIENT CONDITION FOR THE EXISTENCE OF G-COMPACTIFICATIONS
H. Ludescher (Polytech. Inst. Timisoara, Romania) and A. J. deVries Dec. 1978 11 p refs Submitted for publication
(MC-ZW-120/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

It is shown that if a topological transformation group is pointwise equicontinuous with respect to some uniformity of the phase space, then it can equivariantly be embedded in a topological transformation group with a compact phase space and the same acting group. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-24123# Air Force Geophysics Lab., Hanscom AFB, Mass.
EMISSION OF PARTICLES FROM A CHARGED SPHERE INTO A MAGNETIC FIELD Interim Report
Christopher Sherman 20 Sep. 1979 14 p refs
(AF Proj. 7661)
(AD-A081781; AFGL-TR-79-0211; AFGL-ERP-674) Avail: NTIS HC A02/MF A01 CSCL 04/1

Trajectories of particles emitted normally from a charged sphere into a constant magnetic field are examined. Calculations are made which separate such trajectories into two classes: those that return to the sphere and those that do not. GRA

N80-24124*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF INTERCONTINENTAL CLOCK SYNCHRONIZATION BY VLBI AND THE NTS SATELLITE Final Report
James A. Buisson (NRL), O. Jay Oaks, Jr. (NRL), Thomas B. McCaskill (NRL), William J. Hurd (JPL), Schulyer C. Wardrip, Hugh E. Warren (Bendix Field Eng. Corp., Columbia, Md.), and Gary G. Whitworth (APL) 4 Jan. 1980 9 p refs
(NRL Proj. R04-16)
(NASA-TM-81063; AD-A081001; AD-E000360; NRL-8366)
Avail: NTIS HC A02/MF A01 CSCL 14/2

The intercontinental clock synchronization capabilities of Very Long Baseline Interferometry (VLBI) and the Navigation Technology Satellite (NTS) have been compared at the NASA Deep Space Net complexes at Madrid, Spain and Goldstone, California. The VLBI experiments used the Wideband VLBI Data Acquisition System developed at the NASA Jet Propulsion Laboratory. The Naval Research Laboratory NTS Satellites were used with NTS Time Transfer Receivers developed by the Goddard Space Flight Center. The two methods agreed to within about 0.5 microseconds. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-24125 Stanford Univ., Calif.
SIGNAL PROCESSING FOR HIGHER FREQUENCY ULTRASONIC IMAGING Ph.D. Thesis
Douglas Baxter Boyle 1980 118 p
Avail: Univ. Microfilms Order No. 8011612

The use of signal processing methods in medical ultrasonic imagery is discussed. A high speed data acquisition system is used to record signals for subsequent computer analysis. A model of the normal heart is developed. The emphasis is on the frequency dependence of the scattering properties. The reflection coefficient,

acoustic velocity, and thickness of the epicardium are studied. The scattering cross section of the myocardium is also measured. A phantom which has the acoustic properties of th epicardium is described. A set of design equations is developed and used to predict scanner performance. Imaging systems with adjustable frequency and pulse length provide higher performance in varied anatomical environments than conventional fixed frequency, shock excited systems. A combination of higher frequency and longer pulses increases lateral resolution with little cost in volemetric resolution. The use of signal processing methods to increase system sensitivity was studied. Pulse to pulse coherence measurements indicated that coherent processing could be used during certain parts of the cardiac cycle for images of the liver. Dissert. Abstr.

N80-24126 Brown Univ., Providence, R. I.
A GENERAL THEORY FOR THE SCATTERING OF SOUND BY SOUND WITH PARAMETRIC ARRAY APPLICATIONS Ph.D. Thesis
Harvey Charles Woodsum 1979 62 p
Avail: Univ. Microfilms Order No. 8007077

A general theory of the scattering of sound by sound, which is exact to second order, was derived in terms of plane wave expansions. The solution involves an extension for the second order scattering of two plane acoustic waves to include the effects of viscosity. The plane wave expansions for the sum and difference frequency components of the second order scattered field were obtained in terms of the fundamanetal solution for the scattering of two plane waves, and the plane wave expansion coefficients for the primary fields. Applications to parametric transmitting and receiving arrays are presented, with advantages being noted in that quite general field geometries can be treated with the plane wave expansion technique. Dissert. Abstr.

N80-24127 Catholic Univ. of America, Washington, D. C.
NORMAL MODE ACOUSTIC SCATTERING FROM ELASTIC CYLINDRICAL SHELLS Ph.D. Thesis
Edward Darwin Breitenbach 1980 150 p
Avail: Univ. Microfilms Order No. 8010934

Acoustic scattering from a fluid loaded air backed infinite elastic cylindrical shell was examined using partial wave analysis. The partial wave technique was applied to a thick shell, from which dispersion curves are derived for the identified circumferential Rayleigh transverse, and longitudinal modes. The validity of the partial wave analysis was confirmed. A response enhancement method was developed to isolate the elastic resonances excited by the circumferential modes on thick intermediate and thin shells. Specific mode responses were traced through the transition to a thin shell. Mode responses were examined for the continuous order representation at discrete value of ka. Dissert. Abstr.

N80-24128 Brown Univ., Providence, R. I.
THE INTERACTION OF SOUND WITH NOISE IN WATER Ph.D. Thesis
Timothy Kevin Stanton 1979 126 p
Avail: Univ. Microfilms Order No. 8007070

The nonlinear interaction of a monochromatic ultrasonic signal with audio frequency noise was measured in water. The scattered signal lies in sidebands corresponding to the sum and difference components of the frequencies involved. The intensity of the scattered signal increases linearly with interaction distance and quadratically with the signal frequency in the range 1-4 MHz. An estimation of the scattered intensity was made by characterizing the 2.28 kHz component of the noise field in terms of its complex intensity. In each interaction measurement, a continuous wave signal of amplitude less than 0.2 atm was generated in water by a ceramic transducer. After passage through distances up to 90 cm, the beam was detected by a second transducer and fed to a spectrum analyzer. The noise in the medium was provided by a mechanical noise generator striking the metallic wall of the water-filled tank. The noise spectrum lay between 2.8 kHz, with component amplitudes up to 0.005 atm. A wattmeter is described which is capable of measuring separately the real and imaginary parts of the complex acoustic intensity in water. A general expression for the complex intensity is derived and used to provide a basis for the measurements. Dissert. Abstr.

N80-24129*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FAR-FIELD RADIATION OF AFT TURBOFAN NOISE
Edward J. Rice and Arthur V. Saule 1980 25 p refs Presented at 99th Meeting of the Acoust. Soc. of Am., Atlanta, 21-25 Apr. 1980
(NASA-TM-81506; e-444) Avail: NTIS HC A02/MF A01 CSCL 20A

Approximate expressions were developed for the noise radiation from the aft duct. The results of approximate aft radiation equation compare favorably to more exact Wiener-Hopf radiation results. Refraction as well as convective effects in the multiple flow streams is considered. The peak in the radiation pattern, which occurs nearly at engine sideline, is composed of modes with relatively large cut-off ratios. This implies that aft fan radiation will be inherently more difficult to suppress that the fan inlet noise. The theoretical multimodal radiation pattern is compared to experimental data for the first two harmonics of blade passage frequency for three full scale fans at two speeds. The agreement between theory and experiment is quite good. A.R.H.

N80-24130# New Mexico State Univ., Las Cruces. Physical Science Lab.
HYPERBOLIC FITS TO TIME-OF-ARRIVAL SOUND RANGING MEASUREMENTS
Don Hoock and Mike Marotta Dec. 1979 31 p
(Contract DAAD07-79-C-0008; DA Proj. 1L1-62111-AH-71) (AD-A080746; ERADCOM/ASL-CR-79-0008-3) Avail: NTIS HC A03/MF A01 CSCL 17/1

A simple algorithm is presented for fitting a hyperbola to the times of arrival of sounds at each of several microphone locations along a linear array. Timing points, taken in groups of three, are tested for causality to determine that they can be associated with a physically realizable source location. The resulting parameters defining the fit or averaged hyperbola are themselves an initial estimate of source location and sound emission time. After transformation to field coordinates, these estimates are capable of being used as input to existing sound ranging algorithms which correct for wind and temperature. If displayed with raw data, the hyperbola may be used in future to aid personnel in identifying related signals from among background clutter and for initial visual assessment of data quality. The algorithm is expected to be a useful tool in supporting advanced ranging techniques. GRA

N80-24131# Oregon State Univ., Corvallis. School of Oceanography.
BACKSCATTERING PROGRAMS FOR SPHERICAL TARGETS
Richard K. Johnson, Lawrence Flax (NRL, Washington, D. C.), and David Standley Apr. 1979 34 p refs
(Contract N00014-76-C-0067; NR Proj. 038-102)
(AD-A081094; REF-79-7) Avail: NTIS HC A03/MF A01 CSCL 20/1

These programs compute the acoustical reflectivity of a sphere in a fluid medium. The programs differ in the allowed physical properties of the spheres. The principal outputs of the programs are plots of reflectivity, R-squared, as a function of size-frequency, ka. The reflectivity is defined as R-squared = (sigma sub b)/(a-squared/4) where sigma sub b is the backscattering cross-section of the sphere, and a-squared/4 is the backscattering cross-section of a completely reflecting sphere of radius a. The variable k is the wavenumber in the medium. These plots may be considered as dimensionless representations of target strength vs. frequency. The conversions are TS = 10 log (R-squared times a-squared/4) and f = cKa/2pia with a in meters, c in meters per second and f in kHz. This relation for frequency is such that the product of frequency in kHz and radius in mm is 240 when ka = 1. These programs have been used primarily for low contrast cases (with g and h near one) at relatively low values of ka (less than 10). GRA

N80-24132# Harry Diamond Labs., Adelphi, Md.
ANALYSIS OF ULTRASONIC FLOWMETERS FOR LEAK DETECTION IN LIQUID HYDROCARBON PIPELINES
Stacy E. Gehman and Allen B. Holmes Dec. 1979 26 p ref
(AD-A081791; HDL-TR-1907) Avail: NTIS HC A03/MF CSCL 03/11

A program was conducted to determine repeatability and linearity of the ultrasonic time-delay types of flowmeters, so that their applicability to leak detection on underwater pipelines could be assessed. Field tests using merchantable crude oil were conducted on two off-the-shelf, commercially available flowmeters at a refinery meter proving station. These tests showed a short-term repeatability of 0.2 percent for both meters. Long-term (7 hours) repeatability was 0.6 percent for one meter and 2.5 percent for the other. For a leak detection system in which line balance is continually computed and line packing is compensated for, slow drifts in line balance due to drifts of meter factors can be compensated for by periodically adjusting meter factors. For a meter with drift characteristics similar to those measured, a computerized simulation indicates that the probability of detecting a leak greater than 0.6 of the total flow in 10 minutes is greater than 99 percent. The probability of a false alarm for the same conditions is about once per week. GRA

N80-24133# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF AN EXPERIMENTAL PROBE FOR THE MEASUREMENT OF THE ACOUSTIC PRESSURE INSIDE AN AIRFLOW Thesis - Paris VI Univ.
Herve Huguenin 1979 63 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-633)
(ONERA-NT-1979-5) Avail: NTIS HC A04/MF A01

The turbulence generated by the presence of a microphone, placed to study the origin of noise of an aircraft in motion, and the effect it has upon the measurements of acoustic pressure within the fluids in motion are discussed. An acoustic probe, designed to reduce the influence of the instrument during such measurements is described. The principle of the probe is reported and performance tests on the probe and their results are evaluated. Author (ESA)

N80-24134# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SPECTRAL ANALYSIS OF NON-STATIONARY RANDOM PROCESSES. APPLICATION TO NOISE OF FLYOVER TYPE Thesis - Paris-Sud Univ.
Max Ernoult 1979 180 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-639)
(ONERA-NT-1979-4) Avail: NTIS HC A09/MF A01

Nonstationary noise detected by fixed microphones was studied during the passage of a moving acoustic source (e.g., aircraft flyover noise), with the objectives of measuring the noise radiation pattern and characterizing the spatial distribution of the noise. A time frequency representation of the energy of nonstationary random processes and a series of charts which allows the adaptation of the spectral analysis processes to the treatment of nonstationary signals are presented. The characteristics pertaining to the nonstationarity of an aircraft noise determined in the far field, are discussed. Author (ESA)

N80-24248 Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
RECENT DEVELOPMENT FOR THE NONLINEAR DISTORTION OF NON-DISPERSIVE ACOUSTIC WAVES. PART 2: MULTIDIMENSIONAL SYSTEMS
J. H. Ginsberg *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 8 Aug. 1979 p 3-12 refs (For primary document see N80-24247 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-24135 Stanford Univ., Calif.
MULTIQUANTUM ULTRAVIOLET EXCITATION OF ATOMS AND MOLECULES Ph.D. Thesis
Jeffrey Bokor 1980 174 p
Avail: Univ. Microfilms Order No. 8011610

Properties of a variety of atoms and molecules prepared in high lying electronically excited states were studied by multiphoton absorption of rare gas halide ultraviolet laser radiation. The basic technique used involved the observation of laser induced fluorescence from gaseous samples irradiated by an argon fluoride (193 nm) or krypton fluoride (248 nm) laser. A specially constructed tunable laser source was used in some of the experiments. Following a review of the theory of multiphoton absorption processes, and the fundamental properties of high power ultraviolet lasers, the experimental results are described. Dissert. Abstr.

N80-24136 Texas Univ. at Austin.
MEASUREMENTS OF THE TOTAL ELASTIC SCATTERING CROSS SECTION FOR ARGON ON ARGON AT COLLISION ENERGIES BELOW FOUR MILLIVOLTS Ph.D. Thesis
Georges Edward Jamieson 1979 75 p
Avail: Univ. Microfilms Order No. 8009878

Total elastic scattering cross sections for argon on argon were measured over the energy range of two to four millivolts. Identical particle symmetry oscillations were clearly resolved, with two maxima and three minima observed. Comparisons were made with computed cross sections. Relative positions of the sharp minima were more accurately determined than absolute positions, with the locations of the maxima and the shapes of the peaks being the less accurately measured quantities. Dissert. Abstr.

N80-24137 New York Univ., N. Y.
SCATTERING OF LOW-ENERGY ELECTRONS BY LASER EXCITED SODIUM ATOMS IN THE 3 2P 3/2 STATE Ph.D. Thesis
Richard Kaoyu Dang 1979 124 p
Avail: Univ. Microfilms Order No. 8010334

The atomic beam double-recoil technique was used to measure total cross sections for the scattering of electrons by sodium atoms. The electron energy ranges from 0.85 to 6 eV. A single mode, tunable dye laser is projected into the interaction region to raise some of the atoms from the ground state to a higher state. The fraction of atoms that are in the excited state was determined by observing the net atomic beam recoil due to resonant photon interaction in the direction of the laser beam. The mixture of the ground and the excited state of the sodium atoms was then cross-fired by a modulated electron beam. Dissert. Abstr.

N80-24138# Toronto Univ. (Ontario).
STUDIES OF LASER SELECTIVE EXCITATION OF ATOMS
Norbert Drewell Dec. 1979 151 p refs
(Grant AF-AFOSR-2902-76)
(UTIAS-229; ISSN-0082-5255) Avail: NTIS HC A08/MF A01

Sample preparation through laser ablation of a solid target under vacuum was combined with short-pulsed laser selective excitation to create a technique for measuring atomic radiative lifetimes. The lifetimes of the three resonance states of chromium compare very favorably with those found through other experimental means. The technique was extended to demonstrate the potential for plasma dianostics using two-wavelength selective excitation with short laser pulses. The ratio of population densities of two energy states of chromium atoms was measured as a function of time during the expansion of the ablation plasma. Extended saturation pumping of the resonance transition in sodium vapor was also investigated. Rate equations for 20 energy levels in the sodium atom, and the rate equations for the free electrons were integrated numerically. It was found that multiphoton ionization, combined with superelastic heating of free electrons can account for the rapid and complete ionization of an un-ionized vapor. The theoretical results led to the development of a simple model which accurately predicts the temporal variation of electron density. A.R.H.

N80-24139# Texas Univ. at El Paso.
COMPUTERIZED METHOD FOR THE GENERATION OF MOLECULAR TRANSMITTANCE FUNCTIONS IN THE INFRARED REGION Final Report
Joseph H. Pierluissi and Ken Tomiyama 31 Dec. 1979 195 p refs

(Contract DAAG29-79-C-0067)
(AD-A081789; FR1-79-UA-72; ARO-16641.1-GS) Avail: NTIS HC A09/MF A01 CSCL 07/4

A study is made of two basically distinct methods normally used in the development of band models for the calculation of gaseous molecular transmittance in the infrared region. The first method consists of the determination of the 'empirical' transmittance function and the associated absorber and spectral parameters from measured or calculated transmittance spectra. The second method consists of the determination of the absorber and spectral parameters with an assumed 'analytical' transmittance function, using the same type of data. Computerized numerical techniques are presented in connection with the first method and a generalized transmittance function is adopted for the second method. Although the methodology is generally applicable to other gaseous species, it is specifically discussed in connection with the trace gases SO2, NO, NO2, and NH3. As a secondary effort a structural breakdown of the Lowtran code is presented for the purpose of incorporating the band models for the trace gases. GRA

N80-24140# Arizona Univ., Tucson. Optical Sciences Center.
COHERENT TRANSIENT EFFECT STUDIES OF RYDBERG ATOMS Interim Report, 16 Jun. 1979 - 1 Mar. 1980
Richard L. Shoemaker and William H. Wing 27 Feb. 1980 8 p refs
(Contract N00014-79-C-0488; NR Proj. 393-041; RR0110301)
(AD-A081746) Avail: NTIS HC A02/MF A01 CSCL 07/4

New techniques for making time-resolved studies of atoms in highly excited (Rydberg) states will be developed. In particular, the absorption or emission of radiation by Rydberg-state atoms will be monitored on a nanosecond time scale during and after irradiation by various laser pulse sequences. The signals thus produced (known as coherent transient effects), will be studied in order to provide both information about collisional relaxation processes in Rydberg atoms and other spectroscopic data. GRA

N80-24141# Duke Univ., Durham, N. C. Dept. of Physics.
MICROWAVE INVESTIGATIONS OF MATTER Final Report, 3 Nov. 1973 - 30 Oct. 1976
Walter Gordy 22 Feb. 1980 19 p refs
(Grant DAHC04-74-G-0034)
(AD-A081708; ARO-11803.23-P) Avail: NTIS HC A02/MF A01 CSCL 07/4

This report contains a bibliography of nineteen published papers. These results fall into two broad classifications: (a) Millimeter and Submillimeter Wave Studies; and (b) Solid State Studies with ESR and ENDOR. GRA

N80-24142# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
CROSSED BEAM REACTIVE SCATTERING OF OXYGEN ATOMS AND SURFACE SCATTERING STUDIES OF GASEOUS CONDENSATION Ph.D. Thesis
Steven Jay Sibener Sep. 1979 243 p refs
(Contract W-7405-eng-48)
(LBL-9811) Avail: NTIS HC A11/MF A01

A high pressure, radio frequency discharge nozzle beam source was developed for the production of very intense supersonic beams of oxygen atoms. This source is capable of producing seeded beams of ground state atoms when dilute oxygen-argon mixtures are used, with molecular dissociation levels exceeding 80% being realized for operation at pressures up to 350 torr. When dilute oxygen-helium mixtures are employed, both ground state and excited state atoms are present in the terminal beam, with molecular dissociation levels typically exceeding 60% being achieved for operation at pressures up to 200 torr. Atomic oxygen mean translational energies from 0.14 to 0.50 eV were obtained using the seeded beams technique, with Mach numbers as high as 10 (FWHM delta v/v approximately 20%) being realized. The ICl, CF3I, C6H6, and C6D6 reactions are discussed. A series of beam-surface scattering experiments is also described which examined the internal and translational energy dependence of molecular condensation probabilities for collisions involving either CCl4 or SF6 and their respective condensed phases. DOE

N80-24143# Wright State Univ., Dayton, Ohio. Dept. of Chemistry.
ABSORPTION OF H AND D LYMAN-ALPHA RADIATION BY O2 MOLECULES AT HIGH TEMPERATURES
C. C. Chiang and Gordon B. Skinner 1979 12 p refs
(Contract EY-76-S-02-2944)
(COO-2944-T2) Avail: NTIS HC A02/MF A01

Absorption cross sections of molecular oxygen were measured at the H and D Lyman alpha wavelengths (1215.67 and 1215.34A) between 800 and 1700 K. Vibrational relaxation times were in agreement with literature data over the range of common temperatures. DOE

N80-24144# California Univ., Berkeley. Lawrence Berkeley Lab.
NEGATIVE-HYDROGEN-ION PRODUCTION BY BACKSCATTERING FROM ALKALI-METAL TARGETS
P. J. Schneider, K. H. Berkner, W. G. Graham, R. V. Pyle, and J. W. Stearns Nov. 1979 12 p refs Presented at the Workshop on Hydrogen Recycling, Dublin, Calif., 17-18 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9992; CONF-791057-2) Avail: NTIS HC A02/MF A01

Measurements were made of the total backscattering D(-) and H(-) yields from Cs, Rb, K, Na, and Li surfaces bombarded with D2(+), D3(+), H2(+), andH3(+) in the energy range 0.15 to 4 keV/nucleus. All measurements were made at a background pressure less than 10 to the minus 9th power Torr and the alkali metal surfaces were evaporated onto a substrate in situ to minimize contamination of surfaces. Measurements of the H(-) yield were also made for H(+) bombarding a W substrate, as a function of the work function of the target, as Li was deposited on the W. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-24145# California State Univ., Los Angeles. Plasma Physics Group.
COLLECTIVE DRAG EXPERIENCED BY AN ELECTRON BEAM IN THE PURE RUNAWAY REGIME
G. J. Morales Oct. 1979 10 p refs
(Contract N00014-75-C-0476)
(AD-A081116; PPG-436) Avail: NTIS HC A02/MF A01 CSCL 20/9

A calculation is presented of the drag experienced by a continuously accelerated cold electron beam due to the swept excitation of the finite bandwidth two-stream instability. GRA

N80-24146# Canadian Industries Ltd., Kingston (Ontario). Environmental Improvement Business Area.
SWARU: SOLID WASTE DISPOSAL RESOURCE SYSTEM
[1979] 13 p
(NP-24196) Avail: NTIS HC A02/MF A01

The SWARU solid waste disposal resource recovery process a comprehensive system which can accept garbage and wastes of all kinds and converts the constituents to their highest and best economic use, is described. The incineration and materials handling technology, which facilitates resource recovery and ensures high thermal efficiency is evaluated and emissions from the plant are analyzed. DOE

N80-24147# Texas Univ., Austin. Center for Particle Theory.
SYNTHESIS OF BARYONS FROM UNCONFINED QUARKS
D. Dicus, J. Pati, and V. Teplitz Sep. 1979 21 p refs Prepared in cooperation with Maryland Univ., College Park and Arms Control and Disarmament Agency, Washington, D.C.
(Contract EY-76-S-05-3992)
(ORO-3992-371) Avail: NTI HC A02/MF A01

The cosmic temperature at which primordial quarks condense into baryons is calculated for a number of cases within a field theory of partially confined quarks that enjoys temporary

asymptotic freedom. It is assumed that the mass of a quark in a dense quark antiquark medium is a monotonic function of the medium, that is, that the so-called Archimedes effect is valid. It is shown that, within such models, unbound quark lifetimes are larger than the age of the universe at the time of the transition and that the Archimedes effect implies that the change of the medium from free to bound quarks is a phase transition. DOE

N80-24148# Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands).
RADIATION AND SHIELDING AROUND BEAM ABSORBERS
A. Hurkmans and R. Maas Dec. 1978 48 p refs
(INTERIKO-78/7) Avail: NTIS HC A03/MF A01

Radiation levels found in the vicinity of particle accelerators are reviewed. Shielding requirements, radiation under no beam conditions and under operational conditions (gamma, low energy and high energy neutrons), and contributions from various metal components (i.e., copper collimeters) are shown. Tables of radiation susceptibility for selected materials and electronic equipment are provided, as well as some relations concerning dose rates.
Author (ESA)

74 OPTICS

Includes light phenomena.

N80-24149* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF FORMING A SHARP EDGE ON AN OPTICAL DEVICE Patent
Charles M. Fleetwood and Stephen H. Rice Issued 22 Apr. 1980 8 p Filed 28 Jul. 1978 Supersedes N78-29902 (16 - 23, p 2729)
(NASA-Case-GSC-12348-1; US-Patent-4,198,788; US-Patent-Appl-SN-929088; US-Patent-Class-51-283R; US-Patent-Class-51-277; US-Patent-Class-65-61) Avail: US Patent and Trademark Office CSCL 20F

A sharp edge is formed on an optical device by placing the optical device in a holding mechanism; grinding one surface so that it and a surface of the holding mechanism are co-planar; and polishing both the surface of the optical device and the surface of the holding mechanism with felt until an edge on the surface of the optical device adjacent to the surface of the holding mechanism obtains a desired sharpness.
Official Gazette of the U.S. Patent and Trademark Office

N80-24150 Stanford Univ., Calif.
HIGH RESOLUTION OPTICAL RANGING SYSTEM Ph.D. Thesis
Heungsup Park 1980 108 p
Avail: Univ. Microfilms Order No. 8011690

Reflection from a viewed object can be detected with a high signal to noise ratio, by sending short pulses into a scattering and absorbing medium, and opening an optical gate only during the time when the light reflected from a specified range returns. By using picosecond pulses and a picosecond optical gate 0.3 mm spatial resolution can be achieved. A pulsed (picosecond) local oscillator for heterodyne detection of the reflected picosecond pulses constitutes the fast optical gate. The pulses from a mode locked dye laser at some optical frequency are incident upon an acoustic wave to provide a frequency shifted wave, by Bragg diffraction. The reference signal at the shifted frequency passes through a variable delay element and goes to the photocathode of a photomultiplier. The direct beam at the original frequency, in passing through an absorbing and scattering medium, is reflected and backscattered continuously. The reflected signal is consequently dispersed in time. Dissert. Abstr.

N80-24151*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GLADSTONE-DALE CONSTANT FOR CF4
Alpheus W. Burner, Jr. and William K. Goad May 1980 18 p refs
(NASA-TM-80228; L-13551) Avail: NTIS HC A02/MF A01 CSCL 20F

The Gladstone-Dale constant, which relates the refractive index to density, was measured for CF4 by counting fringes of a two-beam interferometer, one beam of which passes through a cell containing the test gas. The experimental approach and sources of systematic and imprecision errors are discussed. The constant for CF4 was measured at several wavelengths in the visible region of the spectrum. A value of 0.122 cu cm/g with an uncertainty of plus or minus 0.001 cu cm/g was determined for use in the visible region. A procedure for noting the departure of the gas density from the ideal-gas law is discussed. A.R.H.

N80-24152*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CONSTANT MAGNIFICATION OPTICAL TRACKING SYSTEM Patent Application
Robert E. Frazer, inventor (to NASA) (JPL) Filed 30 Apr. 1980 14 p
(Contract NAS7-100)
(NASA-Case-NPO-14813-1; US-Patent-Appl-SN-145282) Avail: NTIS HC A02/MF A01 CSCL 20F

A constant magnification optical tracking system is disclosed wherein a traveling objective lens maintains a fixed relationship to an object to be optically tracked. The objective lens is chosen to provide a collimated light beam oriented in the direction of travel of the moving object. A reflective surface is attached to the traveling objective lens for reflecting an image of the moving object to the lens. The moving object is maintained at the focal point of the traveling objective lens. A motor and control means is provided for maintaining the traveling objective lens in a fixed relationship relative to a free falling object, thereby keeping said object at the focal point and centered on the axis of the traveling objective lens throughout its entire free fall path. NASA

N80-24153# Harry Diamond Labs., Adelphi, Md.
THE OPTICAL PROCESSOR AS AN ARRAY ANTENNA CONTROLLER
James S. Shreve Nov. 1979 40 p ref
(DA Proj. 1L4-63737-D-181)
(AD-A081790; HDL-TR-1905) Avail: NTIS HC A03/MF A01 CSCL 20/6

Presented here are the results of an investigation into the feasibility of employing a coherent optical processor as a real time computer for controlling a phased-array antenna. Specifically, the role of the processor was to determine the appropriate phase and amplitude distributions across the array antenna aperture. The desired antenna control included the dynamic control of antenna beam shape and position, the independent control of simultaneous multiple beams, and the independent control of antenna-pattern nulls. GRA

N80-24154# EMTEC Engineering, Inc., Los Angeles, Calif.
ANALYSIS OF MULTIMODE FIBER COUPLERS, TAPERS AND MODE CONVERTERS Final Technical Report, 4 Aug. 1978 - 31 Jul. 1979
C. Yeh Griffiss AFB, N.Y. RADC Jan. 1980 115 p refs
(Contract F19628-78-C-0206; AF Proj. 2306)
(AD-A081669; EM-F-01; RADC-TR-79-341) Avail: NTIS HC A06/MF A01 CSCL 20/6

This is a final report on the analysis of multimode fiber couplers, tapers and mode converters. A method based on the fast Fourier transform technique of scalar wave equation has been successfully developed to yield numerical results on a number of practical multimode fiber components. Included in this report are listings of the computer programs. GRA

N80-24155# Owens-Illinois, Inc., Toledo, Ohio.
EVALUATION OF NRL GLASS FOR FIBER OPTICS, PHASE 1 Interim Report, Oct. 1978 - 15 Jun. 1979
14 Sep. 1979 36 p refs
(Contract N00173-78-C-0242)
(AD-A081582) Avail: NTIS HC A03/MF A01 CSCL 11/2

This interim report covers a Phase 1 activity to develop glasses for medium loss fiber optic waveguides. The requirements of the final fiber are that it should have: (1) a diameter of 75 to 125 micrometers with a 50 to 75 micrometers core; (2) a numerical aperture of 0.4 to 0.6; (3) losses of approximately 100 dB/km; and (4) radiation resistance. The Phase 1 activities included the evaluation of a special NRL core glass composition, development of several promising clad glasses and fabricating

a test fiber utilizing one of the clad glasses over the NRL core. Meeting the loss requirement was not an objective in Phase 1. GRA

N80-24156# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
FIELD MANUAL TO DETERMINE DETECTION OR RECOGNITION RANGE OF A FLIR SENSOR Final Report
Lynne N. Seekamp Sep. 1979 32 p refs
(Contract MDA903-79-C-0202)
(AD-A081324; AD-E500112; IDA-P-1419; IDA/HQ-79-21390) Avail: NTIS HC A03/MF A01 CSCL 17/5

Forward-looking infrared (FLIR) sensor performance range estimates over a horizontal path can be made by using a rapid estimation procedure. These estimates can be calculated while in the field by using a hand calculator for several different FLIR systems, atmospheric transmission conditions, and levels of difficulty of the visual task. GRA

N80-24157# Arizona Univ., Tucson. Optical Sciences Center.
OPTIMUM OPTICAL STRUCTURES FOR ACTIVE CONTROL Final Report
R. R. Shannon, R. M. Richard, and J. G. R. Hansen 21 Jan. 1980 67 p refs Sponsored in part by DARPA
(Contract N00014-78-C-0282)
(AD-A080934) Avail: NTIS HC A04/MF A01 CSCL 20/6

A NASTRAN structural analysis of a lightweight mirror structure has been completed and is compared with previous experimental measurements. A preliminary design for a 4 meter aperture, 6 meter focal length primary mirror is presented. GRA

N80-24158# Naval Postgraduate School, Monterey, Calif.
EFFICIENT ADAPTIVE FIR AND IIR FILTERS Ph.D. Thesis
Uzi Ben-Yakov Dec. 1979 149 p refs
(AD-A081605) Avail: NTIS HC A07/MF A01 CSCL 17/5

Self adaptive filters adjust their parameters to perform an almost optimal filtering operation without a prior knowledge of the input signal statistics. Two approaches to the design of efficient self adaptive discrete filtering algorithms are considered. For non-recursive (FIR) adaptive filters, simplified estimations of the gradient of the performance function to be minimized are considered. These algorithms result in reduced complexity of implementation, improved dynamic operating range with about the same misadjustment errors and convergence time as the classic LMS (Least Means Squared) algorithm. An analysis of the simplified gradient approach is presented and confirmed experimentally for the specific example of an adaptive line enhancer (ALE). The results are used to compare the simplified gradient approaches with each other and the LMS algorithm. This comparison is done using a new graphic presentation of adaptive filter operating characteristics and a complexity index. This comparison indicates that the simplified gradient estimators are superior to the LMS algorithm for filters of equal complexity. GRA

N80-24159# Naval Research Lab., Washington, D. C. Electro-Optical Technology Program Office.
PASSIVE INFRARED SURVEILLANCE. PART 2: THRESHOLD-CROSSING RECEIVERS Interim Report
Richard A. Steinberg 24 Jan. 1980 61 p refs
(ZF32391003)
(AD-A081723; AD-E000373; NRL-8367; EOTPO-57) Avail: NTIS HC A04/MF A01 CSCL 17/5

A number of infrared passive surveillance receivers are analyzed with the theory developed in Part 1 (NRL Report 8320). The specific problem of interest is the detection of low-contrast point-source targets against high-contrast structured backgrounds. A new and promising approach to signal processing is proposed for minimizing background-induced false alarms while retaining maximum target-detection sensitivity. It is shown that improvements in focal-plane-array (FPA) technology employing time delay and integration (TDI) may afford 'excess' detector sensitivity that can be intentionally sacrificed in the interest of enhanced performance against structured scenes. GRA

N80-24160# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Hauptabteilung Vorprojekte und Studien.
ANALYSIS OF SPECIAL COMPONENTS OF THE EUV-VERY WIDE ANGLE CAMERA Final Report
Rainer Krieger, Irmin Meyer, Fritz Fischer, Heinz Stolze, and Peter Vits Bonn Bundesmin. fuer Forsch. und Technol. Jul. 1979 118 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. Prepared in cooperation with Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Freiburg, West Germany
(BMFT-FB-W-79-04) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldschafen, West Germany DM 24,35

The development of special components for a wide angle camera is described. The description included are: the design principles of the detector transportation mechanism; the measurement of the optical constants of LiF; the measurement of the reflectivity of mirror surfaces; and the layout of a LiF Schmidt plate. Author (ESA)

N80-24161# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
MODEL OF A STARFIELD IDENTIFIER Final Report
Lothar Schmieder and Siegbert Graf vomHagen (Kyberna G.m.b.H.) Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 126 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-W-79-05) Avail: NTIS HC A07/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 26,05

An optical scanning device with the capability of identifying the brightest stars in its field of view is discussed. Highly sensitive single diodes with a field of view of 2 deg are used allowing a positional accuracy for the entire device of 2 min. Data on 1400 stars were collected and stored on magnetic tape, for simulating and testing. Author (ESA)

N80-24162# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE BEHAVIOR OF OPTICAL GLASS FIBERS AT EXTREME TEMPERATURES
G. J. Kunz Oct. 1978 25 p refs In DUTCH; ENGLISH summary
(PHL-1978-37; TDCK-71759) Avail: NTIS HC A02/MF A01

Several parameters of glass fibers were determined at temperatures between -60 and +80 C, for fibers 50 m long. The problem of fiber end preparation is discussed. Pulse dispersion at .5 ns was measured. Author (ESA)

N80-24163# Zeiss (Carl), Oberkochen (West Germany).
DEVELOPMENT OF NEW TECHNOLOGIES FOR ULTRA-PRECISE LARGE-SCALE ASTRONOMICAL INSTRUMENTS, IN PARTICULAR MIRROR TELESCOPES Final Report
Christophe Kuehne Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 53 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-79-10) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 10.30

The development of an industrial production facility for the manufacturing of mirror telescopes in sizes of up to 4 m in diameter is described. The production facility was tested by making a psuedo mirror of granite ground stock and cement. The development of a mirror mount is described, together with the drive, the associated electronics, and the computer. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-24164 Colorado Univ. at Boulder.
EFFECTS OF IMPURITY RADIATION ON REVERSED-FIELD PINCH EVOLUTION Ph.D. Thesis
Edward James Caramana 1979 145 p
Avail: Univ. Microfilms Order No. 8011266

A one dimensional MHD simulation code that includes both plasma transport and impurity effects and follows the plasma through a series of equilibrium states was used. The equations are split into two sets, one that contains plasma transport and another that contains atomic physics effects. Two codes were developed and linked together to solve the full problem. Results are presented for the ZT-S, ZT-40, and RFX experiments with a fixed set of parameters, typical or envisioned, and various concentrations of impurities. Radiation barriers are encountered and limits are found on the acceptable level of low Z impurities that may be present in these devices. A criterion for radiation barrier burn-through is derived in terms of appropriate nondimensional parameters and calibrated by comparison to the numerical simulations for the case of oxygen. Thermal instability in the reversed-field pinch is explored. For the case of a reversed-field pinch in a nearly force-free equilibrium, after the formation phase, as the plasma attempts to ohmically heat to a significant beta.
Dissert. Abstr.

N80-24165# California Univ., Livermore. Lawrence Livermore Lab.
ELIMINATION OF DEFECTS IN PLASMA POLYMERIZED FILMS USED IN LASER FUSION TARGETS
S. A. Letts, W. L. Johnson, D. W. Myers, J. D. Illige, L. E. Lorenson, and C. W. Hatcher 11 Apr. 1979 10 p refs
(Contract W-7405-eng-48)
(UCID-18324) Avail: NTIS HC A02/MF A01

The identification and control of the parameters which govern the formation of defects in plasma polymerized surfaces are discussed. The process variables (power dissipated in the discharge, pressure and rate of monomer flow) which control the nature of the plasma were studied using an inductively coupled discharge. Preexisting irregularities on the polymerized surfaces were examined using flourocarbon coated glass slides. The relationship between the size of a substrate irregularity and the defect it generates is discussed and the effect of the substrate irregularities upon the coating smoothness is described. A.R.H.

N80-24166# Arizona Univ., Tucson. Dept. Of Chemistry.
A HIGH POWER INDUCTIVELY COUPLED PLASMA TORCH AND IMPEDANCE MATCHING NETWORK Interim Report
D. L. Windsor, D. R. Heine, and M. B. Denton 13 Apr. 1979 15 p refs
(Contract N00014-75-C-0513; NR Proj. 051-549)
(AD-A080906; TR-22) Avail: NTIS HC A02/MF A01 CSCL 20/9

The relative ease of operation, power handling capabilities and overall performance of an inductively coupled- plasma-optical emission spectrometer (ICP-OES) depends upon numerous factors, not the least important of which is the design of the torch. A variety of such designs has appeared in the literature. Most workers have employed three concentric fused silica and/or pyrex tubes, referred to as an inner sample gas tube, a 'flaired mouth' plasma gas tube, and an outer coolant tube. These tubes are either fused into one or two-piece units through glass blowing techniques or mounted in some type of dismantleable base assembly. Precise alignment of the glass-blown torch can be achieved during construction through the use of an assembly jig. However, this type of torch is not easily repaired should problems be encountered. The dismantleable base approach can be difficult to align if the three tubes are held only near the bottom. This problem is aggravated by the fact that rarely is commercial quartz and pyrex glass tubing perfectly straight or cylindrical. A torch design which is both dismantleable and self-aligning has been successfully used in this laboratory for several years. A unique feature is the use of nylon or teflon slip fit spacers between the sample and plasma gas tubes and the plasma and coolant gas tubes. GRA

N80-24167# California State Univ., Los Angeles. Center for Plasma Physics and Fusing Engineering.
PLASMA BOUNDARY COLLISIONLESS ABSORPTION EFFECTS IN THE LOADING OF RF CONDUCTORS
G. J. Morales Oct. 1979 28 p refs
(Contract N00014-75-C-0476)
(AD-A081115; PPG-435) Avail: NTIS HC A03/MF A01 CSCL 20/9

This study considers the role of collisionless absorption at the boundary between an unmagnetized plasma and a conductor to which an RF potential is applied. The Landau half-space problem is examined from the energetic viewpoint to calculate the surface power absorption due to longitudinal fields. The transverse field absorption is evaluated and the connection with the anomalous skin effect is indicated. The corresponding loading resistance is found to be significant for typical surface plasma parameters. A numerical study of pure bounce absorption heating demonstrates the physical reality of the process and uncovers the existence of a time asymptotic equilibrium between the kinetic energy of the plasma and the externally applied RF potential, independent of initial conditions or parameters. GRA

N80-24168# California Univ., Berkeley. Electronics Research Lab.
ERGODIC ORBITS IN PARTICLE SIMULATIONS OF STRONG ION RINGS
Alex Friedman 28 Jun. 1979 43 p refs
(Contract DE-AS03-76SF-00034)
(AD-A081391; UCB/ERL-M79/41) Avail: NTIS HC A03/MF A01 CSCL 20/9

The existence of ergodic orbits in magnetostatic simulations of strong ion rings is demonstrated. For nonlinear 2 D3 V simulations with axisymmetry the principal manifestation of such orbits is an eventual violation of left-right mirror symmetry in cases where such symmetry would normally be expected, due to the exponential divergence of neighboring mirror image trajectories. Linearized simulations, in effect, compute the first order separation of orbits which are displaced from each other by an infinitesimal vector for all time. When a linearized code is applied to a problem involving ergodic orbits, the single-particle growth can be faster than that associated with the collective modes of interest, rendering the simulation invalid. This may severely limit the class of problems for which linearized simulation is applicable. Similar effects are expected in simulations of other systems, including field-reversed mirror equilibria with large nominal gyroradii. GRA

N80-24169# Naval Research Lab., Washington, D. C. Experimental Plasma Physics Branch.
TRANSIENT FIELD REVERSAL WITH A PROTON LAYER
C. A. Kapetanakos, J. Golden, J. A. Pasour, S. J. Marsh (Sachs-Freeman Associates, Inc., Bladensburg, Md.), and R. A. Mahaffey (Sachs-Freeman Associates, Inc., Bladensburg, Md.) 27 Dec. 1979 38 p refs
(RR0110941)
(AD-A081724; AD-E000371; NRL-MR-4135) Avail: NTIS HC A03/MF A01 CSCL 20/9

This report describes a series of experiments that led to the transient field reversal of the applied magnetic field with a proton pulse. The 400-500 KA, 50 nsec duration, 1.7 MeV peak energy hollow proton pulse is generated by an Inverse Reflex Tetrode. After passing through the cusp, the pulse propagates in a uniform field with 1.15 cm/nsec axial velocity, when the applied voltage on the anode is 1MV. GRA

N80-24170# Illinois Univ., Urbana. Dept. of Electrical Engineering.
FABRICATION AND CHARACTERIZATION OF CRYOGENIC TARGETS FOR INERTIAL CONFINEMENT FUSION
H. Rieger and Kyekyoon Kim Aug. 1979 63 p refs Prepared for California Univ., Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15113) Avail: NTIS HC A04/MF A01

A technique was developed which is capable of fabricating uniform cryogenic targets for use in inertial confinement fusion. The essence of the technique is to directly wet a target with a cold helium gas jet, which results in freezing of the DT mixture contained in the target. A controlled amount of current is pulsed through a heater wire surrounding the target, giving rise to fast evaporation and refreezing of the DT condensate into a uniform layer. Experiments, which were performed with D2 filled glass microshells are described. A set of data illustrating the technique is presented and analyzed. DOE

N80-24171# Los Alamos Scientific Lab., N. Mex.
CECAM WORKSHOP ON TRANSPORT OF FAST ELECTRONS IN LASER FUSION PLASMAS Progress Report

R. J. Mason 1979 6 p refs Conf. held at Orsay, France, 20 Aug. - 14 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3308) Avail: NTIS HC A02/MF A01

Three problem areas in laser driven electron transport are discussed. They include: ion-acoustic turbulence as a source of inhibition; the effects of anti E times and anti j heating of the thermals; and the possibility of thermal inhibition by thermal electron runaway or trapping. DOE

N80-24172# Los Alamos Scientific Lab., N. Mex.
NUMERICAL TREATMENT OF LINEARIZED EQUATIONS DESCRIBING INHOMOGENEOUS COLLISIONLESS PLASMAS
H. R. Lewis 1979 11 p refs Presented at the 4th IRIA Intern. Symp. on Computing Methods in Appl. Sci. and Eng., Versailles, France, 10 Dec. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2755; CONF-791201-2) Avail: NTIS HC A02/MF A01

The equations governing the small signal response of spatially inhomogeneous collisionless plasmas were examined and their significance in controlled thermonuclear fusion research is discussed. The development of methods to solve the equation, which are applicable when the equilibrium involves only one nonignorable coordinate is highlighted. DOE

N80-24173# Oak Ridge National Lab., Tenn. Solid State Div.
REMARKS ON THE USE OF DEPOSITION PROBES FOR ANALYSIS OF TOKAMAK BOUNDARY-LAYER PLASMAS
H. Vernickel (Max-Planck-Institut fur Plasmaphysik, Munich, West Germany) Oct. 1979 30 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7034) Avail: NTIS HC A03/MF A01

The deposition of impurities and plasma ions on probes exposed in plasma devices, is discussed as a diagnostic method for characterizing boundary layer plasmas. Quantitative measurements of impurity and plasma particle profiles obtained from ion scattering and nuclear reaction analysis of samples exposed in the plasma edge are described. An analytic model of the boundary layer plasma is utilized to explore the relationship between the deposition profile on such probes and the particle confinement time and ionization probability of wall originated impurities in the boundary layer. DOE

N80-24174# Wisconsin Univ. - Madison. Plasma Physics Lab.
EXPERIMENTAL OBSERVATION OF PLASMA PARAMAGNETISM IN A TOKAMAK
D. J. Holly, S. C. Prager, M. W. Phillips, and J. C. Sprott Sep. 1979 11 p refs
(Contract EY-76-S-02-2387)
(COO-2387-115) Avail: NTIS HC A02/MF A01

The increase in the toroidal magnetic field of a Tokamak due to plasma presence was measured. The measurements are discussed and compared with predictions of an equilibrium code. DOE

N80-24175# Wisconsin Univ. - Madison. Plasma Physics Lab.
AXISYMMETRIC INSTABILITY IN A NONCIRCULAR TOKAMAK: EXPERIMENT AND THEORY
B. Lipschultz, S. C. Prager, A. M. M. Todd (Princeton Plasma Physics Lab., N.J.), and J. Delucia (Princeton Plasma Physics Lab., N.J.) Sep. 1979 49 p refs Submitted for publication
(Contract EY-76-S-02-2387)
(COO-2387-116) Avail: NTIS HC A03/MF A01

The stability of dee, inverse dee, and square cross section plasmas to axisymmetric modes was investigated in Tokapole 2, a tokamak with a four null poloidal divertor. The results are compared with predictions of two numerical stability codes: the PEST code (ideal MHD, linear stability) adapted to tokapole geometry, and a code which follows the nonlinear evolution of shapes similar to tokapole equilibria. DOE

N80-24176# Cornell Univ., Ithaca, N. Y. Lab. of Plasma Studies.
INTENSE ION BEAM APPLICATIONS TO MAGNETIC CONFINEMENT FUSION
R. N. Sudan 24 Sep. 1979 62 p refs
(Contract EG-77-S-02-4460)
(COO-4460-2) Avail: NTIS HC A04/MF A01

The ion ring experiment is described in relation to its trapping effectiveness and continued research proposed is discussed. The long-pulse experimental program is also considered. DOE

N80-24177# California Univ., Livermore. Lawrence Livermore Lab.
VELOCITY DISTRIBUTION IN A PINCHED BEAM
E. P. Lee 17 Sep. 1979 21 p refs
(Contract W-7405-eng-48; ARPA Order 3718)
(UCID-18303) Avail: NTIS HC A02/MF A01

A procedure for distributing transverse velocities to simulate a self pinched beam of specified density profile is described. Examples of the procedures are presented using the flat top, Bennett, and Gaussian Profiles. DOE

N80-24178# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
STUDY OF THE GENERAL PLASMA CHARACTERISTICS OF A HIGH POWER MULTIFILAMENT ION SOURCE Ph.D. Thesis
K. F. Schoenberg Sep. 1979 139 p refs
(Contract W-7405-eng-48)
(LBL-8940) Avail: NTIS HC A07/MF A01

The steady state and time dependent plasma properties which characterize a high power multifilament ion source are discussed. Steady state measurements, obtained via a pulsed electrostatic probe data acquisition system, are described. Fluctuation measurements, obtained via a broadband digital spectral analysis system, are reported. DOE

N80-24179# General Dynamics/Convair, San Diego, Calif.
STRUCTURAL ANALYSIS OF THE MAGNET SYSTEM FOR MIRROR FUSION TEST FACILITY (MFTF), ADDENDUM 1
K. R. Loss and J. W. Wohlwend Sep. 1979 31 p refs
(Contract W-7405-eng-48)
(UCRL-15112; CASD-LLL-78-003) Avail: NTIS HC A03/MF A01

The stress analysis refinement of the MFTF magnet system using GDSAP (general dynamics structural analysis program) and NASTRAN finite element computer models is described. The calculation of a more refined case and jacket stress distribution was the focus of the study. The GDSAP model was refined in the minor radius area to yield a more detailed prediction of the stress distributions in critical areas identified by the previous analysis. Modifications in the case plate thickness and in the conductor pack load distribution and stiffness were included. The GDSAP model was converted to an identical NASTRAN model to determine the influence on stress results using higher order elements. DOE

N80-24180# Science Applications, Inc., La Jolla, Calif. Applied Plasma Studies Lab.
ANTIC: A CODE FOR CALCULATION OF NEUTRAL TRANSPORT IN CYLINDRICAL PLASMAS
S. Tamor Dec. 1979 40 p refs
(Contracts EY-76-C-03-1018; DE-AC03-79ET-53057)
(SAI-79-1056-LJ; LAPS-50) Avail: NTIS HC A03/MF A01

A scheme for computing the steady state transport of neutral atoms in cylindrical plasmas is described. The physical model used represents atoms emerging from charge exchange collisions by an isotropic source of neutrals with energy equal to 3/2 times the local ion temperature. The processes of charge exchange and impact ionization by electrons andions are included. The transport can be described by an integral equation for the charge exchange collision density, and this equation approximated by a set of algebraic equations for the zone average collision densities. A derivation of the appropriate kernel and a technique for computing it are presented. Comparisonof computed results with predictions of other, more exact, codes exhibit quite satisfactory agreement for temperatures as high as 10 keV DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see *also 33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-24181 State Univ. of New York at Stony Brook.
LASER ANNEALING: SURFACE EPITAXIAL CRYSTALLIZATION, SPATIAL VARIATIONS MEASUREMENT, DYNAMICS OF ANNEALING AND OTHER APPLICATIONS Ph.D. Thesis
Lakkur Parthasarathy 1979 152 p
Avail: Univ. Microfilms Order No. 8011077

Annealing and recrystalization of implanted or amorphous layers of semiconductor material through the rapid heating produced by the absorption of laser light is considered. An electrical circuit equivalent to the physical model is described to simulate the laser annealing process. The nonlinear heat equation is numerically solved to give the time evolution of temperature and melting as a function of pulse energy and its duration. The structure, temperature, and frequency dependence of the absorption coefficient and thermal conductivities are taken into consideration. Phase changes involved are explicitly considered. The model is used for explaining recrystalization as well as depths and thresholds for annealing. The results are in good agreement with the experimental data. The model can be used to account for processes that occur both below and after melting, enables the study of special annealing techniques like frequency mixing, pulsing the beam, and assess the spatial variations in annealing. Dissert. Abstr.

N80-24182 Iowa State Univ. of Science and Technology, Ames.
THE EFFECTS OF HYDROGEN CONTENT ON REACTIVELY SPUTTERED AMORPHOUS SILICON FILMS Ph.D. Thesis
Jeffrey Frank Rumer 1979 94 p
Avail: Univ. Microfilms Order No. 8010235

A set of parameters were determined for r.f. reactive sputtering which allow simultaneous control of monohydride and dihydride bond densities in hydrogenated amorphous Si. It is proposed that the predominant effect of dihydride bonds is to reduce the carrier mobility in a-Si while the dominant effect of monohydride bonds is a reduction in the carrier recombination rate. Dissert. Abstr.

N80-24183 Brown Univ., Providence, R. I.
ELECTRONIC STRUCTURE OF SEMICONDUCTING SURFACE INVERSION LAYERS Ph.D. Thesis
Sankar DasSarma 1979 98 p
Avail: Univ. Microfilms Order No. 8006990

The electronic subband structure of semiconducting surface inversion layers is studied using the Green's function approach and many body perturbation theory. Hartree variational functions are used as the basis states in the theory. At finite temperature self energies and quasi-particle energies of low lying subbands are calculated for various inversion layer concentrations. A finite temperature plasmon-pole approximation is employed to evaluate the self-energies in the first order screened interaction. At low concentrations, the magnitudes of self-energies are found to decrease with temperature for all the subbands. However, at high concentrations, the magnitudes of self-energies of the excited subbands increase with temperature, while that of the ground subband continues to decrease. The subband separations including exchange-correlation effects are found to be much less temperature dependent than the Hartree values. Results are also presented for the effect of a uniaxial stress on the self-energies, quasi-particle energies, energy separations and occupancies in different subbands. Dissert. Abstr.

N80-24184 Wayne State Univ., Detroit, Mich.
DYNAMIC PROPERTIES OF VORTICES IN JOSEPHSON TUNNEL JUNCTIONS Ph.D. Thesis
T. V. Rajeevakumar 1979 66 p
Avail: Univ. Microfilms Order No. 8010165

By means of electron tunneling techniques, some of the dynamic properties of vortices in Josephson tunnel junctions were investigated. In particular, two types of vortex motion were studied. The first one involves the nonresonant propagation of isolated vortices and antivortices with reflection from the junction edges. The second type of vortex motion is the simple flux flow which appears as a single ohmic branch in the I-V characteristic. Dissert. Abstr.

N80-24185*# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Technology.
CRYSTAL GROWTH OF DEVICE QUALITY GaAs IN SPACE Annual Report, 1 Apr. 1979 - 31 Mar. 1980
Harry C. Gatos and Jacek Lagowski May 1980 136 p refs
(Grant NsG-7331)
(NASA-CR-153190) Avail: NTIS HC A07/MF A01 CSCL 20L

The apparatus and techniques used in effort to determine the relationships between crystal growth and electronic properties are described with emphasis on electroepitaxy and melt-grown gallium aresenide crystal. Applications of deep level transient spectroscopy, derivative photocapitance spectroscopy, and SEM-cathodoluminescene in characterizing wide bandgap semiconductors; determining photoionization in MOS, Schottky barriers, and p-n junctions; and for identifying inhomogeneities are examined, as well as the compensation of indium phosphide. A.R.H.

N80-24186# Princeton Univ., N. J. Dept. of Electrical Engineering and Computer Science.
STUDY OF ELECTRONIC TRANSPORT AND BREAKDOWN IN THIN INSULATING FILMS
Walter C. Johnson 1 Jun. 1979 74 p refs
(Contract DAAG53-76-C-0059; DARPA Order 3466)
(AD-A081135; NVL-0059-010; STR-7) Avail: NTIS HC A04/MF A01 CSCL 20/12

Recent progress is reported in an ongoing program of studies of high-field effects in thin insulating films on semiconducting substrated. The investigations include further studies of the high-field generation of interface states in the Si-SiO2 system, description of a method for measuring interface state densities at low temperatures, a preliminary report of Auger observations of interface states in the Si-SiO2 system, and the results of further studies of high-field effects in the metal-aluminum oxide-silicon system. GRA

N80-24187# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
InGaAsP QUARTERNARY MATERIALS FOR NEAR INFRARED DETECTOR AND LASER APPLICATIONS Quarterly Report, 1 Apr. - 30 Jun. 1979
N. Holonyak, Jr. and G. E. Stillman Jul. 1979 8 p refs
(Contract N00014-77-C-0086; ARPA Order 3316)
(AD-A078320; QTR-8) Avail: NTIS HC A02/MF A01 CSCL 20/12

The study of the influence of different parameters on the growth of InP using the hydride growth technique has been continued. This work is to be presented at the 156th Electrochemical Society Meeting, Los Angeles, 1979, and an abstract is included with the reprints/preprints at the end of this report. Because of moisture damage and contamination sustained during a flood this summer, it was decided to implement the new automatic gas flow control system described in the last report as soon as possible. The old system has been disassembled and heliarc welding on the new system is progressing rapidly. Included at the end of this report are some reprints of papers that have been received since the last report and some preprints and abstracts of more recent work. GRA

N80-24188# Hughes Research Labs., Malibu, Calif.
ELECTRONIC PROCESSES IN InP AND RELATED COMPOUNDS Quarterly Progress Report, 13 Aug. - 12 Dec. 1979
K. V. Vaidyanathan, C. L. Anderson, H. L. Dunlap, D. E. Holmes, and G. S. Kamath Jan. 1980 8 p
(Contract N00019-79-C-0533)
(AD-A080802; QPR-1) Avail: NTIS HC A02/MF A01 CSCL 20/12

An experimental system to measure ionization coefficients in InP and related compounds is described. The growth of high purity liquid phase epitaxial InP is described and the properties of such layers discussed. GRA

N80-24189# Advanced Research and Applications Corp., Sunnyvale, Calif.
IMPROVEMENT IN GaAs DEVICE YIELD AND PERFORMANCE THROUGH SUBSTRATE DEFECT GETTERING Interim Technical Report
T. J. Magee, J. Peng, J. Hong, and R. A. Armistead Jan. 1980 43 p refs
(Contract N00014-78-C-0065; ARPA Order 3516)
(AD-A081344; ARACOR-TR-19-2) Avail: NTIS HC A03/MF A01 CSCL 07/2

The gettering of Cr and front-surfaces defects by mechanically produced back-surface damage in semi-insulating GaAs wafers has been investigated. It has been shown that improved VPE layers can be grown on pre-gettered substrates. Also, the level of Cr outdiffusing from the substrate during epilayer growth and subsequent annealing is substantially reduced when pre-gettered substrates are used. Thermal stability times of back-surface damage at an anneal temperature of 800 C is typically on the order of 2 - 3 hours, corresponding to the point at which major back-surface microstructural damage is largely annealed. Increases in the thermal stability period were attained by encapsulating the back surface with an As-doped SiO2 layer. Subsequent investigations of Au contacts on GaAs showed that Cr was mobile during 350 C alloying, resulting in gettering within alloy damage regions and subsequent outdiffusion into the Au film. Device structures (FET) fabricated on VPE layers on pre-gettered GaAs wafers showed considerable improvements in both yield/wafer, noise figures at higher frequencies and input capacitance values. GRA

N80-24190# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
PIEZOELECTRICITY IN POLYACRYLONITRILE Interim Report
H. Ueda and S. H. Carr 4 Jan. 1980 30 p refs Submitted for publication
(Contract N00014-75-C-0963; Grant NSF DMR-76-80847; NR Proj. 051-599)
(AD-A081250; TR-8) Avail: NTIS HC A03/MF A01 CSCL 11/9

The piezoelectricity and related properties in ion-doped (NH4NO3, NaNO3) and undoped films of polyacrylonitrile have been measured as a function of temperature. The piezoelectric constants of both ion-doped and undoped films show a maximum around 80 C and thereafter decrease markedly with temperature. A maximum of thermally stimulated discharge current (TSDC) around 90 C is observed in both ion-doped and undoped films. An abrupt decrease of piezoelectric constant around 90 C and TSDC maximum around 90 C are ascribed to randomization of nitrile dipoles in ordered regions. The piezoelectric constant of stretched films has a tendency to increase with stretching. The piezoelectric constant, d sub 31, changes from positive to negative when temperature rises above 110 C. GRA

N80-24191# Electronics Research Lab., Adelaide (Australia).
LIQUID PHASE EPITAXIAL GROWTH OF GALLIUM ARSENIDE
M. Folkard Aug. 1979 42 p refs
(AD-A081835; ERL-0078-TR) Avail: NTIS HC A03/MF A01 CSCL 20/12

This report discusses two methods of liquid phase epitaxial (LPE) growth applied to the compound semi-conductor gallium arsenide, and develops a mathematical description for each using a diffusion-limited model. The properties of the epitaxial layers grown under various experimental conditions are discussed, and the observed growth rates compared with those predicted by the mathematical models. From the differences observed, it is concluded that processes additional to simple diffusion of solute through the melt are occurring. Convective mixing caused by horizontal temperature gradients within the melt is suggested as an explanation for these differences. GRA

N80-24192# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
DENSITY VARIATION IN THE ELECTRON-HOLE LIQUID IN STRESSED GERMANIUM AND SILICON Ph.D. Thesis
Susan Mary Kelso Aug. 1979 385 p refs
(Contract W-7405-eng-48)
(LBL-8786) Avail: NTIS HC A17/MF A01

The variation in electron hole pair density in the electron hole liquid (EHL) in stressed Ge and Si was studied using two procedures. One method involved studying the variation of the density and other properties of the EHL as a function of uniaxial stress in both Ge and Si. The other method involved studying, the variation of the density with position in the strain confined electron hole liquid (SCEHL) in Ge. DOE

N80-24193# Lincoln Lab., Mass. Inst. of Tech., Lexington.
HgCdTe AVALANCHE PHOTODIODE DEVELOPMENT Final Report, 1 Aug. 1978 - 30 Sep. 1979
Theodore C. Harman 30 Sep. 1979 29 p refs
(Contract F19628-78-C-0002)
(AD-A081595; ESD-TR-79-309; ARO-15682.1-P) Avail: NTIS HC A03/MF A01 CSCL 09/1

This report covers in detail the mercury cadmium telluride research work carried out on avalanche photodiode development at Lincoln Laboratory for the period 1 August 1978 through 30 September 1979. The topics covered are the liquid phase epitaxial growth of HgCdTe, liquidus isotherm determination by differential thermal analysis, optical and electrical characterization of various epitaxially grown layers on CdTe and CdTeSe substrates. GRA

N80-24194# Illinois Univ., Urbana. Dept. of Physics.
STUDIES IN THE THEORY OF SOLIDS Ph.D. Thesis
H. P. Hjalmarson 1979 263 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1283) Avail: NTIS HC A12/MF A01

The surface sandwich reflectivity, computed by using a method which considers only single reflections of the electron by sheets of atoms in the solid, was directly compared with the slowly varying, surface dependent features in the data. The method was used to determine that the surface of TiS2 is ideal whereas the surface sandwich of TiSe2 expands outward slightly. For the final determinations, the smoothing method was used on both the data and a theory which includes multiple scattering to confine the comparison to just the slowly varying surface dependent features. Energies of deep traps associated with impurities in semiconductors are shown to be controlled by the S and P orbital energies of the impurity atoms. Predictions of energies of deep traps caused by impurities are made for fourteen different semiconductors. The theory is compared with the data for GaP and the alloy GaAs(1-x)Px. A phenomenological model which depends mainly on the energy centers of the valence and conduction band density of states as well as atomic energies of impurities is used to make predictions of deep trap energies in Si. DOE

N80-24195# Ames Lab., Iowa. Dept. of Physics.
VORTICES IN SUPERCONDUCTING FILMS
John R. Clem 1979 7 p refs Presented at the Inhomogeneous Superconductors Conf., Berkeley Springs, W. Va., 1 Nov. 1979
(Contract W-7405-eng-82)
(ISM-258; CONF-791151-1) Avail: NTIS HC A02/MF A01

The local magnetic flux density and electrical current density generated by a vortex in a superconducting film is calculated approximately using an extension of Pearl's method. The results apply to arbitrary ratios of the film thickness to the penetration depth and reduce to Pearl's thin-film and semi-infinite results in the appropriate limits. In addition, the vanishing of the order parameter on the vortex axis is accounted for by a simple model which removes the London-model divergences of the flux density and supercurrent density and leads to a physically correct description in the vortex core. The results are then applied to a calculation of the interaction energy of vortex-vortex and vortex-antivortex pairs. DOE

N80-24196# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
MODEL OF THE RECRYSTALLIZATION MECHANISM OF AMORPHOUS SILICON LAYERS CREATED BY ION IMPLANTATION Ph.D. Thesis
Robert M. Drosd Nov. 1979 96 p refs
(Contract W-7405-eng-48)
(LBL-9990) Avail: NTIS HC A05/MF A01

The recrystallization behavior during annealing of thin films

of amorphous silicon, in contact with a single crystal silicon substrate (referred to as C), was studied in the transmission electron microscope (TEM). The amorphous film is created during high dose phosphorus ion implantation at 100 keV. It was found that the crystal substrate orientation and the implantation temperature have dramatic effects on the recrystallization rate, and the defect microstructure produced during annealing. Specifically, (100) wafers implanted at 77 K contain only a low density of dislocation loops, but when the same wafer is implanted at room temperature the dislocation density is increased drastically. When implanted at 77 K (111) wafers show a high density of microtwins, but as the implantation temperature is increased a gradual increase in the density of dislocation loops is observed along with a reduction of the microtwins. At an implantation temperature of about 100 C both orientations give an identical defect microstructure when annealed, which is a dense tangle of dislocations. DOE

N80-24197# Siemens A.G., Munich (West Germany). Unternehmensbereicht Bauelemente.
LIQUID CRYSTAL DISPLAYS OF HIGH RELIABILITY Final Report
Martin Bechteler Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 106 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-79-17) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 21,85

The development of high reliability liquid crystal displays is discussed. The displays feature glass frit sealing, a silicon dioxide protective layer to avoid contamination of the liquid crystal, and a conductive layer bearing. The lifetime of the displays are determined. Author (ESA)

N80-24198# Electronics Research Lab., Adelaide (Australia).
THIN FILM ANNEALING BY ION BOMBARDMENT
E. H. Hirsch and I. K. Varga Aug. 1979 18 p refs
(PB80-125677; ERL-0092-TR; AR-001-701) Avail: NTIS HC A02/MF A01 CSCL 20L

The enhancement of film adherence resulting from argon ion bombardment during the evaporation procedure was studied experimentally. The observations point to the existence of an annealing effect caused by atomic rearrangement in bombardment induced temperature spikes. This mechanism begins to be effective at a critical minimum bombardment intensity, which is sufficient to ensure that practically all the deposited material is subjected to rearrangement soon after it has condensed. The small amount of argon incorporated into the film by the bombardment is shown to have no significant influence on the process. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-24199 Rensselaer Polytechnic Inst., Troy, N. Y.
ON VACUUM FLUCTUATIONS OF A SCALAR FIELD IN A LOCALIZED REGION OF SPACETIME Ph.D. Thesis
Richard T. Hammond 1979 88 p
Avail: Univ. Microfilms Order No. 8011504

It is shown that the wavenumber of a scalar field is reduced due to curvature of space. This effect is shown to occur in an Einstein metric, de Sitter space, and the Schwarzchild geometry. Furthermore, it is shown that this effect is more pronounced for higher frequencies and larger curvature. A particle the mass (energy), was modeled by the vacuum energy of a quantized scalar field. The vacuum expectation value of the time-time component of the energy momentum tensor of the scalar field is used in the Einstein field equations. It is then shown that the zero-point energy is not infinite as it appears in flat space but, due to the natural gravitational cutoff, is actually finite. The resulting particle has a mass to radius ratio of that of a black hole. The model is extended by considering a charged particle. If the charge is assumed to be one electronic charage then the resulting particle is a black hole the radius of which is one Planck length and the mass is equal to the Planck mass. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-24200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATRIX MANAGEMENT FOR AEROSPACE 2000
John F. McCarthy, Jr. May 1980 16 p refs Presented at the Intern. Meeting and Techn. Display: Global Technol. 2000, Baltimore, 5-11 May 1980
(NASA-TM-81509; E-447) Avail: NTIS HC A02/MF A01 CSCL 05A

The matrix management approach to program management is an organized effort for attaining program objectives by defining and structuring all elements so as to form a single system whose parts are united by interaction. The objective of the systems approach is uncompromisingly complete coverage of the program management endeavor. Starting with an analysis of the functions necessary to carry out a given program, a model must be defined; a matrix of responsibility assignment must be prepared; and each operational process must be examined to establish how it is to be carried out and how it relates to all other processes. A.R.H.

N80-24201# Naval Postgraduate School, Monterey, Calif.
A MANAGEMENT PERSPECTIVE ON THE ROLE OF INFORMATION PRODUCTION IN THE ORGANIZATION M.S. Thesis
Richard L. Wooten Sep. 1979 53 p refs
(AD-A081058) Avail: NTIS HC A04/MF A01 CSCL 05/1

The explosive growth of information technology in the last decade has caused a demand for experienced information system managers far beyond the present supply. Consequently, many of these positions are filled by personnel who may lack a comprehensive understanding of the role of information production in the organization. This paper addresses organization processes and interactions of which the information system manager must be made aware in order to perform his job effectively. Discussion includes organization purpose, structure, decision processes, and information production. When appropriate, descriptive models were developed in order to better understand the synergistic relationships which exist. Particular attention was given to the need for systematic valuation of organization information products, and development of the 'product-worth function' is proposed as a possible approach to this problem. GRA

N80-24202# Naval Postgraduate School, Monterey, Calif.
A COMPUTER SIMULATION OF ORGANIZATIONAL DECISION-MAKING M.S. Thesis
Vincent John Andrews Dec. 1979 85 p refs
(AD-A081600) Avail: NTIS HC A05/MF A01 CSCL 09/2

A computer simulation of organizational decision-making is developed based on the Complete Cycle of Choice. The interrelationships between attitudes, individual behaviors, organization choices, and the environment are represented in terms of matrices and mathematical equations. Statistical analysis of the data generated by the simulation program is performed to discern

significant variables and decision-making patterns. Refinements to the basic model are proposed to increase its usefulness as a managerial tool. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-24203# Forecasting International Ltd., Arlington, Va.
INITIAL CONCEPTUALIZATION AND CHARACTERIZATION OF A NAVY AUTOMATED PUBLISHING, VOLUME 2 Final Report, 15 Feb. - 15 Nov. 1979
Norman Nisenoff and Audrey Clayton Jan. 1980 185 p refs
(Contract N60921-79-C-0106)
(AD-A080479) Avail: NTIS HC A09/MF A01 CSCL 05/2

This report describes an R and D study whose objective was the characterization of an automated publishing system for the Navy which could be introduced during the early 1980s and evolve incrementally to meet by the year 2000 the Navy's needs with regard to the publication of all non-tactical information. Both the methodology and the conclusions of the project are included in the 3 volume report, together with recommendations for Navy actions to develop and test further the concept of such a system. GRA

N80-24204# Defense Technical Information Center, Alexandria, Va.
DTIC CATALOGING GUIDELINES
Barbara P. Gladd Jan. 1980 86 p refs Supersedes DDC/TR-78/3
(AD-A080800; DTIC-TR-80/1; DDC/TR-78/3) Avail: NTIS HC A05/MF A01 CSCL 05/2

Defense Technical Information Center (DTIC) rules for cataloging of reports for computer entry are arranged in numeric order by the number designations of the computer fields described. Data regarding space limitations for each field are provided. Additional fields have been added to previous edition to include regrading of classified reports to implement EO 12065 effective 1 December 1978. These rules are an adaptation of Guidelines for Descriptive Cataloging of Reports, A Revision of COSATI Standard for Descriptive Cataloging of Government Scientific and Technical Reports, published in March 1978 as AD-A050900. Subject fields and groups, abstracts, posting terms and candidate posting terms are discussed briefly. Included is an appendix from COSATI of personal author surnames with separately written prefixes, as well as several appendices designed for use by trainee catalogers. GRA

N80-24205# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
TECHNICAL INFORMATION DISSEMINATION PLAN FOR THE US DEPARTMENT OF ENERGY, ETS/SOLAR DIVISIONS
Pete Mourning, Barbara Glenn, Stephen A. Rubin, F. Floyd Shoemaker, and Rob Soto Jan. 1979 74 p
(Contract EG-77-C-01-4042)
(SERI/SP-69-071) Avail: NTIS HC A04/MF A01

A plan for a technical information dissemination (TID) program is presented, the purpose of which is to build the most effective information transfer mechanisms possible to support the earliest appropriate commercialization of solar research and development (R&D) results in five technologies: photovoltaics, solar thermal power, biomass, ocean thermal energy conversion, and wind energy conversion. Coordination, evaluation, and maximum use of ongoing information support services, information activities where the leverage effect appears reasonably high in meeting the goals of the TID program, and involvement of in house and contractor personnel in planning, evaluating, and implementing these technical information dissemination activities are described. Users of solar R&D results are to be involved in external evaluation of technical information activities in each of the five solar technologies. DOE

N80-24206# Rolls-Royce Ltd., Derby (England).
THE MANAGEMENT OF INFORMATION FLOW IN A HIGH TECHNOLOGY DEVELOPMENT ENVIRONMENT
D. S. Pearson 1979 28 p refs
(PNR-90002) Avail: NTIS HC A03/MF A01

Methods for planning, motivating, and managing applied to the activities of technical personnel engaged in a gas turbine development program are described. Average value for numbers of projects begun, the fraction finally reported on, and manhours available for each project were gathered from records of instrumentation tests conducted during a period of 25 years. The data were for modeling anticipated situations, permitting effective assignment of resources. Author (ESA)

N80-24207# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
SYSTEM REQUIREMENTS ANALYSIS FOR THE CHEMICAL STRUCTURE AND NOMENCLATURE SYSTEM (CSNS) Final Report
David Lefkovitz, Helen N. Hill, and Carol S. Kulp 28 Sep. 1979 234 p refs
(PB80-105218) Avail: NTIS HC A11/MF A01 CSCL 05B

The Chemical Structure and Nomenclature System (CSNS) which will enable Chemical Substances Information Network (CSIN) users to determine whether a particular chemical substance exists in the network is presented. A plan for CSNS development, including functional and operational requirements, design alternatives, existing systems, and a developmental approach, is presented. GRA

N80-24208# General Services Administration, Washington, D.C.
HONEYWELL INFORMATION SYSTEMS MULTICS VERSION 4.1
18 Jan. 1980 79 p
(PB80-126071; CCVS74-VSR470) Avail: NTIS HC A05/MF A01

This validation summary report (VSR) for the HIS LEVEL 68 MULTICS COBOL compiler Version 4.1 (MULTICS Version MR7.0B) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X323-1974/FIPS PUB 21-1). The compiler was validated at the high level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies be level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N80-24209# Hotline International, New York, N.Y.
HOW TO GAIN ACCESS TO INFORMATION ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT FROM DATA BASES VIA COMPUTER TELECOMMUNICATIONS
Glen Leet Aug. 1979 47 p refs Presented at the UN Conf. on Sci. and Technol. for Develop., Vienna, Aug. 1979
(PB80-133143) Avail: NTIS HC A03/MF A01 CSCL 05B

The use of computers and the telecommunications systems to improve access to information in developing countries are considered. Computer access to data banks is demonstrated. A plan for practical demonstrations of the transfer of information on Science and Technology for development via computer telecommunications is given. The augmentation of international conferences through computer communications is discussed. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-24210# Committee on Commerce, Science, and Transportation (U. S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1981
15 May 1980 20 p A bill referred to the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., 30 Jan. 1980
(S-96-719) Avail: US Capitol, Senate Document Room

An ammendment is presented to the text of a bill authorizing appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, and research and program development. A.R.H.

N80-24211# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1981
Washington, D.C. GPO 1980 316 p refs Hearings before the Subcomm. on Transportation, Aviation and Commun. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 95, v. 3, 6-7 Feb. 1980
(GPO-59-528) Avail: Subcommittee on Transportation, Aviation and Communications

Specifics of NASA'S proposed aeronautics program are discussed with emphasis on research and technology development in aerodynamics, materials and structures propulsion, avionics, and human factors engineering. Benefits accrued from the ACEE program are examined and activities related to the defense program are summarized. A.R.H.

N80-24212# Comision Nacional de Investigacion del Espacio, Madrid.
[SPACE RESEARCH ACTIVITIES IN SPAIN]
1979 50 p Presented at 22nd COSPAR Plenary Meeting, Bangalore, India, 29 May - 9 Jun. 1979 Original contains color illustrations
Avail: NTIS HC A02/MF A01

The following activities of the Commission are described: research in meteorology; the ionosphere; astrophysics and radioastronomy; cosmic rays; remote sensing; the Spacelab experiment and operation of the rocket launching station El Aronosillo. Developments in sounding rockets, hydrazine thrusters, spectra of fluorescence of gases, as well as the operation of the Madrid Space station are outlined. Author (ESA)

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-24213*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
RESEARCH ON THE APPLICATIONS OF SPACE TECHNOLOGY Final Report
Oct. 1979 343 p refs
(Grant NASw-3204)
(NASA-CR-153184) Avail: NTIS HC A15/MF A01 CSCL 05A

Communication satellites and technology transfer are discussed in seven individual reports. Topics cover: (1) NASA'S technological alternatives assuming that the orbit-spectrum resource will continue to be allocated to communication satellite service providers at zero price; (2) the economic aspects of orbit-spectrum allocation; (3) the cost structure of local distribution systems for satellite communication; (4) the economic basis for national science and technology policy; (5) the economics of the household economy; (6) government patent policy; and (7) screening and evaluation in information dissemination. A.R.H.

N80-24214# Los Alamos Scientific Lab., N. Mex.
FUEL CELL SYSTEMS FOR VEHICULAR APPLICATIONS
D. K. Lynn, J. B. McCormick, R. E. Bobbett (Arizona Univ., Tuscon), W. J. Kerwin, and C. Derouin 1980 30 p refs Presented at SAE Automotive Eng. Congr. and Exposition, Detroit, 25 Feb. 1980
(Contract W-7405-eng-36)
(LA-UR-79-2826; CONF-800202-2) Avail: NTIS HC A02/MF A01

The phosphoric acid fuel cell was used as the base line in these evaluations. Two cell sizes (15 and 60 kW) and two fuel options (methanol and propane) were included. Four vehicle types, the city bus, highway bus, delivery van, and general-purpose consumer car were selected for evaluation. Typical drive cycles and economics for these vehicles are compiled, and the fuel cell vehicle and current internal combustion and diesel engine vehicles are compared. The initial results of detailed computer simulations to illustrate a number of the important system-design considerations in configuring a fuel cell/battery electric vehicle are presented and a fuel-cell-powered golf cart currently being used as an engineering test bed is described. DOE

N80-24215# Energy Research Corp., Danbury, Conn.
RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF NICKEL-ZINC BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report
Oct. 1979 139 p
(Contract W-31-109-eng-38)
(ANL/OEPM-78-10) Avail: NTIS HC A07/MF A01

Progress in the nickel electrode development program directed at the optimization of the electrical performance, specifically, in terms of increased cycle life is reported. Pilot plant facilities to produce nickel hydroxide, manufacturing processes to produce nickel hydroxide and the effect of additives upon shape change, cycle performance and on the mechanistic processes involved in the shape change are covered along with a low cost separator which exhibits stability in the electrolyte, has uniform pores which are of a sufficiently small size to impede the growth of zinc dendrites, and exhibits low electrical resistance and good flexibility. The feasibility of sealed cell operation is also examined. Results of accelerated testing are presented. DOE

N80-24216# Department of Energy, Washington, D. C. Office of Transportation Programs.
ELECTRIC AND HYBRID VEHICLE PROGRAM Quarterly Report, Jul. - Sep. 1979
Nov. 1979 27 p
(Contract EC-77-A-31-1044)
(DOE/CS-0026) Avail: NTIS HC A03/MF A01

Progress in U.S. programs on the design, development, production, performance testing, and commercializing of electric and hybrid electric powered vehicles is briefly summarized. DOE

N80-24217# Argonne National Lab., Ill.
ELECTRIC AND HYBRID VEHICLES IN THE URBAN FUTURE
Margaret K. Singh and Martin J. Bernard, III 1979 11 p refs Presented at the 2nd Intern. Conf. on Energy Use Management, Los Angeles, 22-26 Oct. 1979
(Contract W-31-109-eng-38)
(CONF-791009-23) Avail: NTIS HC A02/MF A01

Basic electric and hybrid vehicle (EHV) information is outlined for transportation energy planners and engineers. Topics covered include: (1) the market potential for EHVs (trucks, buses, and automobiles) based on the work of several research groups and on expected technological characteristics of EHVs; (2) an assessment of the impact of EHVs on the urban structure and transport systems as well as urban environmental systems; and (3) current programs designed to accelerate the utilization of EHVs. In the assessment, 61 types of vehicles are characterized and set in five distinct market scenarios. It is concluded that the potential for significant EHV markets by the year 2000 is high and an overall net benefit to urban areas will result. DOE

N80-24218# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
FUEL CONSUMPTION MEASUREMENTS-CARBON BALANCE VERSUS FLOW METER
Dale Turton Jul. 1979 10 p ref
(PB80-128549; EPA-AA-SDSB-79-28) Avail: NTIS HC A02/MF A01 CSCL 13F

Fuel consumption data obtained by both the carbon balance method and the fuel flow method is described and compared. A recent EPA program which investigated the accuracy of the dynamometer simulation of the speed of a vehicle consisted of numerous repetitive steady, state dynamometer tests, providing sufficient fuel consumption measurements by both methods for the statistical analysis necessary to detect any difference between the methods. GRA

N80-24255 Purdue Univ., Lafayette, Ind. Dept. of Mechanical Engineering.
VEHICLE-GUIDEWAY INTERACTION PROBLEMS
J. Genin and E. C. Ting *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 12 Dec. 1979 p 3-10 refs (For primary document see N80-24254 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington D.C. 20375. Annual rate $100.00

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-24219 Clemson Univ., S.C.
OBSERVATIONS AND ANALYSIS OF FOUR ECLIPSING BINARY SYSTEMS Ph.D. Thesis
William Clarence Maddox 1979 123 p
Avail: Univ. Microfilms Order No. 8010560

Four eclipsing binary systems were observed in order to determine times of minimum light and conduct period studies. Three of these, in the constellation Ophiuchus, are W Ursae Majoris-type eclipsing binaries. The fourth, R W Tauri, is an Algol-type system. V502 Oph was analyzed using the Russell-Merrill and Wilson-Devinney methods. R W Tauri was analyzed using the Wilson-Devinney method. Dissert. Abstr.

N80-24220 Texas Univ. at Austin.
VACUUM BLACK HOLE GRAVITATIONAL WAVE CROSS SECTIONS Ph.D. Thesis
Francis Albert Handler 1979 145 p
Avail: Univ. Microfilms Order No. 8009864

The problem of scattering of plane gravitational waves incident along the z axis of a Kerr black hole was solved numerically. Analogies between the problem and several simplified problems are exploited to provide intuitive understanding of the features seen in the scattering cross sections. Partial wave absorption as a function of lambda provided a measure of marginally trapped null trajectories characterized by an asymptotic impact parameter. The parameter was found to be larger for the case of corotation between the incoming wave and hole than for the counter rotating case. Interpretation of the differential cross section was further achieved using a semiclassical viewpoint borrowed from quantum scattering. Dissert. Abstr.

N80-24221 Colorado Univ. at Boulder.
THE SHELL EPISODE OF 59 CYGNI (1974-1975): ROTATING MAGNETIC WINDS? Ph.D. Thesis
Paul Kenneth Barker 1979 236 p
Avail: Univ. Microfilms Order No. 8011263

High quality spectroscopic observation obtained of the early Be star 59 Cygni during an active phase characterized by mass ejection and a 160-day shell episode are examined. Shell absorption lines are shown to display variations in strength and velocity which have a form radically different from the variations seen in Pleione. The nonlinear hydrodynamic equations governing a radiatively driven rotating magnetic stellar wind are solved numerically. An extensive grid of quasi-static subcritical model winds is calculated for both a hard force law and a new semi-soft force law, for a variety of mass loss rates and magnetic field strengths, with and without rotation. The terminal velocities of both hard and semi-soft winds are sensitive to changes in the wind parameters. Semi-soft winds are more sensitive than hard winds: such a wind from a rapidly rotating star with a photospheric field of 20 gauss can have a terminal velocity a factor of four lower that the wind from an identical nonrotating nonmagnetic star. Variability in either the mass loss rate or the magnetic field can explain the large wind velocity changes observed in 59 Cygni. Dissert. Abstr.

N80-24222# California Univ., San Diego, La Jolla. Dept. of Physics.
GROUND-BASED MEASUREMENTS OF SOURCES IN THE AFGL INFRARED SKY SURVEY Final Report, 1 Aug. 1976 - 15 Nov. 1979
Richard J. Rudy, Timothy R. Gosnell, and S. P. Willner 15 Nov. 1979 73 p refs
(Contract F19628-76-C-0252; AF Proj. 7670)
(AD-A081381; AFGL-TR-79-0172) Avail: NTIS HC A04/MF A01 CSCL 03/1

This report contains ground-based observations of 271 objects detected in the AFGL infrared sky survey, falling between 40 min. and 60 min. of each hour of right ascension and -60 deg and -30 deg of declination. Photometric magnitudes are presented for those sources which could be located from the ground and are compared to those reported by the Air Force. Conclusions are drawn concerning the identification of AFGL sources with IRC sources. A rough classification is made of the catalogue objects within our area of the sky. Limits for completeness of the survey are approximately -1.0 mag at 4 micrometers and -1.0 mag at 11 micrometers. GRA

N80-24223# Los Alamos Scientific Lab., N. Mex.
PULSATION OF HIGH LUMINOSITY HELIUM STARS
D. S. King, J. C. Wheeler (NBS, Boulder, Colo.), J. P. Cox (NBS, Boulder, Colo.), A. N. Cox, and S. W. Hodson 1979 12 p refs Presented at the Nonradial and Nonlinear Stellar Pulsation Workshop, Tucson, Ariz., 12 Mar. 1979 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-79-2785; CONF-790364-4) Avail: NTIS HC A02/MF A01

Preliminary calculations are made on a systematic restudy of the linear and nonlinear pulsations of helium stars allowing for more recent and higher estimates of the effective temperature and for the high carbon abundance. Linear and nonlinear models are used. Results show qualitative agreement with earlier ones, models with sufficiently large L/M have a very hot blue edge for their instability strip, very large L/M values lead to dynamically unstable models which would appear to eject mass and therefore may not be realistic models for the pulsating RCrB stars, for the sequence studied a reasonable mass could be > or = 1.5 M sub solar. DOE

N80-24224# Los Alamos Scientific Lab., N. Mex.
LASL GAMMA-RAY BURST ASTRONOMY PROGRAM
R. W. Klebesadel, W. D. Evans, and J. R. Laros 1979 13 p refs Presented at the Conf. on Cosmic Gamma Ray Bursts, Toulouse, 25-30 Nov. 1979
(Contract W-7405-eng-36)
(LA-UR-80-80; CONF-791164-1) Avail: NTIS HC A02/MF A01

Satellite observation of cosmic gamma burstss are reviewed. The vela, Pioneer Venus, and ISEE-3 instruments observation are discussed. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-24225 Pennsylvania State Univ., University Park.
THEORETICAL INVESTIGATION OF STATIONARY STELLAR SYSTEMS IN THE BRANS-DICKE THEORY OF GRAVITATION, WITH APPLICATIONS TO PERFECT FLUID INTERIORS Ph.D. Thesis
William Fred Bruckman 1979 276 p
Avail: Univ. Microfilms Order No. 8008083

Stationary stars in the Brans-Dicke-Jordan theory of gravitation were modeled and studied. Cold, superdense, perfect fluid configurations were investigated and exact and approximate solutions were found which suggest that there is a maximum mass for cold matter beyond which equilibrium cannot be achieved. Methods for generating Brans-Dicke-Jordan solutions from known solutions of general relativistic perfect fluids and from Einstein-Maxwell equations, are presented. The stability of equilibrium configurations was studied using a critical based on energy considerations alone and the case of radial perturbations of spherically symmetric perfect fluids in general relativity is discussed. Dissert. Abstr.

N80-24226 Ohio State Univ., Columbus.
EVOLUTION OF A SUPERMASSIVE OBJECT ACCRETING MASS Ph.D. Thesis
Robert Charles Reynolds 1979 289 p
Avail: Univ. Microfilms Order No. 8009333

The evolution of a supermassive star accreting mass is studied. The range of masses considered is 100,000 to 1,000,000 M with an accretion rate of 10 to the 27th power gm/sec and an infall velocity for the accreting material of 100,000,000 cm/sec. The dynamical behavior of nonvacuum and vacuum models were analyzed in three short time step sequences. Dissert. Abstr.

N80-24227 State Univ. of New York at Stony Brook.
HELIUM ABUNDANCES IN YOUNG CLUSTERS AND ASSOCIATIONS Ph.D. Thesis
Gail Yanchak Patton 1979 179 p
Avail: Univ. Microfilms Order No. 8011072

Helium abundances derived from high dispersion spectrograms of 80 early B stars are discussed. These objects are members of seven young clusters and two associations which span a range of galactocentric radius of nearly four kiloparsecs. It is assumed that each cluster is characterized by a unique helium abundance which reflects that of the interstellar medium from which the cluster condensed. An estimate of this abundance can be obtained from the mean of the helium abundance determined from the individual B stars in a cluster. Comparison of the cluster means shows a range in abundances of 086 < or = N(He) < or = .107. However, the inclusion of undetected spectroscopic binaries may have a substantial effect on the cluster mean helium abundance. A method of indentifying suspected systems in the observed clusters is proposed. A strong upper limit is placed on a possible helium abundance gradient in the Galaxy indicating a mean abundance of N(He) = 097 + or - .002 for B stars. Assuming helium enhancement by nuclear processing of an amount similar to the observed metal enhancement in Population I objects yields Y sub P = .24, within the predicted range of Big Bang cosmology. Dissert. Abstr.

N80-24228 Texas Univ. at Austin.
RAPID OSCILLATIONS IN CATACLYSMIC VARIABLES Ph.D. Thesis
Joseph Otis Patterson 1979 239 p
Avail: Univ. Microfilms Order No. 8009910

The rapid oscillations seen in the optical light curves of cataclysmic variables are examined. The discovery of a class of rapid periodic variable is noted of which DQ Herculis is the prototype. There are four members of this class: two classical novae, one nova-like variable, and one dwarf nova. Their periods range from 28 to 71 seconds, and their oscillations are essentially permanent features of the light curves. The oscillations are extraordinarily stable in period and phase, showing measurable changes only on time scales of years. A comprehensive study of the coherent oscillations seen in the eruption light curves of dwarf novae is also presented. The oscillations are typically seen for a few days near the peak of each dwarf nova eruption. The periods are in the range 8 to 39 seconds, with each star showing a characteristic, and much smaller, range of variation. Finally, a unified model is proposed in which both the DQ Her-type and the dwarf nova oscillations can be produced by the same basic mechanism in rapidly rotating white dwarfs with magnetic fields of 10 to the 5th to 10 to the 8th power gauss, and with time varying accretion rates. Dissert. Abstr.

N80-24229 California Inst. of Tech., Pasadena.
STUDIES ON GRAVITATIONAL WAVES AND STARS WITH NEUTRON CORES Ph.D. Thesis
Mark Edward Zimmerman 1980 180 p
Avail: Univ. Microfilms Order No. 8010968

Estimates of the astrophysically likely amplitude of gravitational radiation emitted by the Crab and Vela pulsars are presented. The pulsars are modeled as rapidly rotating, freely precessing, rigid or elastic solid bodies. The gravitational radiation produced by an idealized rotating and freely precessing rigid body were studied in the weak field, slow motion, small stresses, quadrupole moment formalism. A natural coordinate system which might be set up by a rotating and accelerating observer is presented and the results in studying nucleosynthesis in stars with neutron star cores are discussed. Dissert. Abstr.

N80-24230 Harvard Univ., Cambridge, Mass.
CHARGE TRANSFER PROCESSES IN ASTROPHYSICAL PLASMAS Ph.D. Thesis
Scott Edward Butler 1979 180 p
Avail: Univ. Microfilms Order No. 8011105

Charge transfer recombination and ionization processes which occur in astrophysical plasmas are investigated. The electronic structure and the couplings which describe the reactions quantum mechanically are studied via the methods of quantum chemistry. Calculations are presented for most astrophysically important charge transfer processes. The significance of each of the couplings which can induce charge transfer is discussed. Rate coefficients calculated by a variety of means are presented, and simple methods based upon the full quantal results are developed to allow the estimation of other rate coefficients. The significance of the process for a wide variety of astronomical objects is pointed out, and the specific effects of charge transfer upon the determination of the neon abundance in planetary nebulae, astrophysical shocks, and the interpretation of the spectral lines of silicon ions are discussed. Dissert. Abstr.

N80-24231# National Technical Information Service, Springfield, Va.
COSMOLOGY: CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1980
Brian Carrigan Feb. 1980 151 p Supersedes NTIS/PS-79/0118; NTIS/PS-78/0089; NTIS/PS-77/0116 (PB80-804818; NTIS/PS-79/0118; NTIS/PS-78/0089; NTIS/PS-77/0116) Avail: NTIS HC $30.00/MF $30.00 CSCL 03B

Studies of cosmology and cosmological models are cited. The origin of the universe is studied by the aid of nuclear reactions, relativity, and astrophysical research. This updated bibliography contains 144 abstracts, 16 of which are new entries to the previous edition. GRA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-24232 Texas Univ. at Dallas.
ANALYSIS OF LUNAR SEISMIC SIGNALS: DETERMINATION OF INSTRUMENTAL PARAMETERS AND SEISMIC

VELOCITY DISTRIBUTION Ph.D. Thesis
Peter Horvath 1979 346 p
Avail: Univ. Microfilms Order No. 8010640

Inverse filters, designed to correct for the instrumental response and for near surface effects to facilitate the comparison of the ground motion at the various sites on the lunar surface are described. The constants of the long period lunar seismographs were determined from a least squares inversion of the observed calibration pulses. The noise, especially the digitizing noise, was reduced by using two postive and two negative calibration pulses. The seismograph parameters allowed calculation of the transfer functions for each seismograph and accurate correction of the seismograms for the instrumental response. The seismograms were corrected for both instrumental response and near surface effect and were found to be comparable at the various sites and were used to obtain readings for the direct shear and secondary wave arrivals. Dissert. Abstr.

N80-24233 Brown Univ., Providence, R. I.
STUDIES OF IMPACT CRATERING PROCESSES Ph.D. Thesis
Mark Frederick Patrick Settle 1979 189 p
Avail: Univ. Microfilms Order No. 8007061

Impact cratering processes on the Moon and the terrestrial planets are examined. The effects of various modification processes that occur during the terminal stages of an impact cratering event are assessed. The distribution characteristics and mode of emplacement of impact crater ejecta are discussed. Dissert. Abstr.

N80-24234 Brown Univ., Providence, R. I.
EVOLUTION OF THE EARLY LUNAR CRUST: THE ROLE OF IMPACT MELTING, SECONDARY CRATERING, AND HIGHLAND VOLCANISM Ph.D. Thesis
Bernard Ray Hawke 1979 108 p
Avail: Univ. Microfilms Order No. 8007017

The processes associated with impact melting, secondary cratering and highland volcanism are examined and their implications for the evolution of the early lunar crust are discussed. Investigations of lunar impact melt deposits have yielded results concerning melt distribution and modes of occurence as well as the processes responsible for melt emplacement. Criteria for the identification of melt deposits were formulated and an origin as the product of shock melting was confirmed. The modes of occurence, distribution, and amounts of melt were analyzed and found to vary as a function of crater size. A model for the emplacement of large amounts of impact melt on crater rims, which places emphasis on events occuring during the modification stage of the cratering process is presented. Dissert. Abstr.

N80-24235 California Inst. of Tech., Pasadena.
Sm-Nd AND Rb-Sr CHRONOLOGY OF CRUSTAL FORMATION. PART 1: Ba, Nd AND Sm ISOTOPIC ANOMALIES IN THE ALLENDE METEORITE, PART 2 Ph.D. Thesis
Malcolm Thomas McCulloch 1980 400 p
Avail: Univ. Microfilms Order No. 8010964

The times at which new segments of crust were formed ascertained by using Sm-Nd and Rb-Sr isotopic systematics, together with plausible assumptions regarding the geochemical evolution of the crust and mantle. The general approach used is to assume that the differentiation process which produce magmatic rocks occur with a marked chemical fractionation of the Sm/Nd and Rb/Sr ratios relative to the source region. It is then the time of this chemical fraction which has been dated. This approach is valid insofar as the dominant contribution to the crust comes from emplacement of magmatic rocks derived from a 'uniform' mantle reservoir. Isotopic anomalies are reported for Ba, Nd, and Sm in two inclusions from the Allende meteorite. These inclusions are typical Ca-Alrich objects associated with early condensates from the solar nebula but have distinctive O and Mg isotopic anomalies of FUN type. Dissert. Abstr.

N80-24236*# RAND Corp., Santa Monica, Calif.
IMPROVED COORDINATES OF FEATURES IN THE VICINITY OF THE VIKING LANDER SITE ON MARS
Merton E. Davies and Stephen H. Dole Mar. 1980 21 p refs
(Contract NASw-3264)
(NASA-CR-153193; RAND/R-2600-NASA) Avail: NTIS HC A02/MF A01 CSCL 03B

The measurement of longitude of the Viking 1 landing site and the accuracy of the coordinates of features in the area around the landing site are discussed. The longitude must be measured photogrammatically from the small crater, Airy 0, which defines the 0 deg meridian on Mars. The computer program, GIANT, which was used to perform the analytical triangulations, and the photogrammetric computation of the longitude of the Viking 1 lander site are described. Improved coordinates of features in the vicinity of the Viking 1 lander site are presented. E.D.K.

N80-24237# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
MARS
Harry O. Ruppe Jan. 1977 32 p refs In GERMAN
(TUM-LRT-KB-13/77) Avail: NTIS HC A03/MF A01

A historical review of the study of Mars is presented. The surface features of the planet and its moons are described. The exploration of the solar system with space probes is discussed, with emphasis on Mars. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-24238 Colorado Univ. at Boulder.
INTERNAL GRAVITY WAVES IN THE SOLAR ATMOSPHERE Ph.D. Thesis
Barbara Ruth Mihalas 1979 322 p
Avail: Univ. Microfilms Order No. 8011292

Three aspects of the behavior of gravity waves in the solar atmosphere are considered adiabatic propagation in the photosphere and chromosphere; photospheric radiative damping of waves generated by convection; and the effects of waves on spectral line profiles. The wave propagation studies are carried out with linearized fluid equations in a standard solar model. The fluid equations are reduced to a single Schroedinger-type equation in the vertical velocity, which is solved as a two-point boundary-value problem. Wave perturbations derived from this solution are used in a line transfer code to study effects of waves with varying parameters on spectra line profiles. Dissert. Abstr.

N80-24239 Colorado Univ. at Boulder.
THE EFFECT OF TRANSPORT PHENOMENA ON ELECTRON VELOCITY DISTRIBUTION FUNCTIONS AND ION ABUNDANCES IN THE SOLAR CHROMOSPHERE-CORONA TRANSITION REGION Ph.D. Thesis
Robert Antoine Roussel-Dupre 1979 293 p
Avail: Univ. Microfilms Order No. 8011301

The effect of non Maxwellian electron distribution functions on ionization equilibrium calculations for ions found in the solar atmosphere and the effects of diffusion on ion abundances in the chromosphere-corona transition region were studied. The electron distribution functions were estimated as a function of height for Dupree's model of the transition region. The results were used to compute ionization rates for ions of carbon nitrogen and oxygen. The effect of thermal diffusion on ion abundances in the solar transition region is discussed. Diffusion coefficients for ions of helium, carbon, nitrogen and oxygen were computed. Dissert. Abstr.

N80-24240*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
APPLICATION OF ADVANCED COMPUTATIONAL PROCEDURES FOR MODELING SOLAR-WIND INTERACTIONS WITH VENUS: THEORY AND COMPUTER CODE Progress Report, Jul. 1978 - Sep. 1979
Stephen S. Stahara, Daniel Klenke, Barbara C. Trudinger, and John R. Spreiter May 1980 318 p refs
(Contract NASw-3182)
(NASA-CR-3267; NEAR-TR-202) Avail: NTIS HC A14/MF A01 CSCL 03B

Computational procedures are developed and applied to the

prediction of solar wind interaction with nonmagnetic terrestrial planet atmospheres, with particular emphasis to Venus. The theoretical method is based on a single fluid, steady, dissipationless, magnetohydrodynamic continuum model, and is appropriate for the calculation of axisymmetric, supersonic, super-Alfvenic solar wind flow past terrestrial planets. The procedures, which consist of finite difference codes to determine the gasdynamic properties and a variety of special purpose codes to determine the frozen magnetic field, streamlines, contours, plots, etc. of the flow, are organized into one computational program. Theoretical results based upon these procedures are reported for a wide variety of solar wind conditions and ionopause obstacle shapes. Plasma and magnetic field comparisons in the ionosheath are also provided with actual spacecraft data obtained by the Pioneer Venus Orbiter. E.D.K.

N80-24241# Manila Observatory (Philippines).
SOLAR MICROWAVE BURSTS ACCOMPANYING PROTON EVENTS Final Report, 1 Jul. 1977 - 30 Jun. 1979
Victor L. Badillo 31 Jul. 1979 22 p ref
(Contract F19628-77-C-0200; AF Proj. 4643)
(AD-A081461; AFGL-TR-79-0171) Avail: NTIS
HC A02/MF A01 CSCL 03/2

A daily radio patrol was maintained at Manila Observatory. The cm sun was monitored at discrete frequencies: 8800, 4995, 2695, 1415 and 606 MHz, while the dekameter sun was monitored by a sweep frequency interferometer in the band 24-48 MHz. Microwave bursts accompanying six proton events are shown. GRA

N80-24242# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.
THE LATITUDINAL STRUCTURE OF SOLAR WIND STREAMS FROM RADIO SCINTILLATION OBSERVATIONS
S. Ananthakrishnan, W. A. Coles, J. J. Kaufman, and B. J. Rickett Hanscom AFB, Mass. AFGL Sep. 1979 37 p refs
(Contract F19628-77-C-0161; AF Proj. 2311)
(AD-A081462; AFGL-TR-79-0234; SR-2) Avail: NTIS
HC A03/MF A01 CSCL 03/2

A comparison of spacecraft and IPS(Interplanetary Scintillations) measurements of the solar wind velocity for 1973-75 are presented, when the large scale velocity structure was very stable. From this comparison we infer a prototype distribution across a high speed stream for the electron density fluctuations, delta n sub e, in the spatial frequency range 1/10,000 - 1/100/km. The 'microturbulence' is more closely related to the velocity structure in a stream than to the bulk density; enhancements in delta n sub e occur wherever high speed wind overtakes low speed wind. The distribution of delta n sub e is closely matched by the distribution of magnetic field fluctuations approx. 1/1,000,000 km. GRA

N80-24243# Los Alamos Scientific Lab., N. Mex.
SOLAR PHOTO RATE COEFFICIENTS
W. F. Huebner and C. W. Carpenter Oct. 1979 97 p refs
(Contract W-7405-eng-36)
(LA-8085-MS) Avail: NTIS HC A05/MF A01

Photo rate coefficients based on wavelength dependent solar photon flux at 1 AU heliocentric distance were determined for atomic hydrogen, carbon, nitrogen, and oxygen, and for some molecules formed from these elements. Branching ratios are considered for the various modes of decay of these molecules. Rates for some metastable states were estimated. DOE

N80-24244# California Univ., Livermore. Lawrence Livermore Lab.
HISTORY OF THE SUN'S LUMINOSITY, 0 TO 460,000 BP, BASED ON THE GEOLOGIC RECORD IN LIGHT OF RECENT CLIMATE THEORY
J. A. Viecelli Jan. 1980 17 p refs Presented at the 17th Gen. Assembly of the Intern. Union of Geodesy and Geophys., Canberra, Australia, Dec. 1979 Revised
(Contract W-7405-eng-48)
(UCRL-80972-Rev-2; CONF-791231-1) Avail: NTIS
HC A02/MF A02

A solar luminosity index extending 460,000 years into the past is computed from ocean surface temperatures derived from the geologic record. It is estimated that the Sun's luminosity fluctuated between 2% above to 5% below the current value over this period. The index shows pulses occurring at intervals of 75,000 to 120,000 years. DOE

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-24245 California Univ., San Diego.
THE SOLAR IMPULSIVE HARD X-RAY SPECTRUM Ph.D. Thesis
Michael John Elcan 1979 195 p
Avail: Univ. Microfilms Order No. 8009750

The solar impulsive hard X-ray spectrum is described using both the power law and the exponential forms and presents a high temperature thermal flare model to account for the data. The data set consists of 219 10.24 sec samples in 38 small to medium size flares. Systematic data reduction error was minimized by using a complete detector model appropriate to both the spectral form and the parameters for each individual sample. The exponential results is compared to previous uses of a power law. Mechanisms for rapidly and efficiently producing a Maxwellian plasma are examined. Adiabatic compression expansion is dicussed. Dissert. Abstr.

N80-24246# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR).
THE COLLECTIVE ACCELERATION MECHANISM OF SOLAR COSMIC RAYS
S. S. Gershtein 1978 21 p refs Submitted for publication (IFVE-OTF-78-112) Avail: International Atomic Energy Agency, Karntner, Ring 11, P.O. Box 590, A-1011 Vienna, Austria

The collective acceleration mechanism of protons and nuclei in solar flares, which lies in the fact that nuclei are trapped by electron bunches moving along the opened lines of force of the decreasing magnetic field of spots, is discussed. The proposed mechanism explains in a natural way the electron and nucleus energy ratio observed during flares. Electron acceleration in the current layers up to energies of the order of a MeV is discussed as a mechanism of electron pulsed injection. The collective acceleration mechanism can be realized at a comparatively small density of the accelerated electrons. Author

99 GENERAL

N80-24247 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 8
Judith Nagle-Eshleman, ed. Aug. 1979 83 p refs
(AD-A073239) Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Current sound, and vibration literature is critiqued and summarized. Review articles concerning acoustic waves and low wavenumber content of turbulent boundary layer pressure fields are presented. An abstract bibliography of current literature in included. For individual titles, see N80-24248 through N80-24249.

N80-24248 Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
RECENT DEVELOPMENT FOR THE NONLINEAR DISTORTION OF NON-DISPERSIVE ACOUSTIC WAVES. PART 2: MULTIDIMENSIONAL SYSTEMS c71
J. H. Ginsberg *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 8 Aug. 1979 p 3-12

refs (For primary document see N80-24247 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

A perturbation procedure for investigating finite amplitude acoustic waves that depend on more than one spatial coordinate is described. Wave motions that are nondispersive in the linear approximation are emphasized. The results of applying the procedure to a variety of systems are presented. R.E.S.

N80-24249 Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
UPDATE ON THE LOW WAVE NUMBER CONTENT OF TBL PRESSURE FIELDS **c34**
L. D. Pope *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 8 Aug. 1979 p 15-22 refs (For primary document see N80-24247 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washinton, D.C. 20375. Annual rate $100.00

Measurements directed at the low wavenumber component of turbulent boundary layer (TBL) pressure fluctuations for the case of low subsonic flow are summarized. Knowledge to predict marine-structure response to TBL pressure fields. R.E.S.

N80-24250 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 10
Judith Nagle-Eshleman, ed. Oct. 1979 89 p refs
(AD-A078374) Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Shock and vibration modes are examined with reference to their effects on various structural elements. The major emphasis is placed on the optimization of dynamic response. An abstract bibliography of current literature is included. For individual titles, see N80-24251 through N80-24253.

N80-24251 Idaho Univ., Moscow.
DYNAMIC MECHANICAL PROPERTIES OF FIBER-REINFORCED COMPOSITE MATERIALS **c24**
R. F. Gibson and D. G. Wilson *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 3-12 refs (For primary document see N80-24250 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Efforts to characterize the internal damping and dynamic stiffness of fiber-reinforced composite materials under vibratory loading are reviewed. Several trends are noted, and suggestions are offered regarding directions of future research. R.C.T.

N80-24252 Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
RECENT RESEARCH IN COMPOSITE AND SANDWICH PLATE DYNAMICS **c39**
C. W. Bert *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 13-23 refs (For primary document see N80-24250 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Literature concerning dynamics of plate type structural elements of either composite material or sandwich construction is surveyed. Special attention is given to rectangularly orthotropic, cylindrically orthotropic, and anisotropic plates; laminated plates; thick and sandwich plates; and nonlinearities. Free vibration, harmonic and random forced vibration, thermally and flow induced vibration (flutter), and impact are also treated. R.C.T.

N80-24253 State Univ. of New York at Buffalo. Dept. of Mechanical Engineering.
OPTIMIZATION TECHNIQUES FOR SHOCK AND VIBRATION ISOLATOR DEVELOPMENT **c39**
R. W. Mayne *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 25-33 refs (For primary document see N80-24250 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C 20375. Annual rate $100.00

Optimization methods with application to shock and vibration isolation are summarized. Included are: nonlinear programming methods that are basic tools for engineering optimization problems of all types, time domain methods of isolator optimization as evolved from optimal control theory; and cases where isolation systems are considered in the frequency domain. R.C.T.

N80-24254 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 12
Judith Nagle-Eshleman, ed. Dec. 1979 151 p refs
(AD-A079549) Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Methods for studying vehicle-guideway interaction problems are reviewed along with methods for structural analysis under dynamic constraints. An annual index of feature articles, literature, reviews, and book reviews, an author index, and a subject index are included. An abstract bibliography of current literature is included. For individual titles, see N80-24255 through N80-24256.

N80-24255 Purdue Univ., Lafayette, Ind. Dept. of Mechanical Engineering.
VEHICLE-GUIDEWAY INTERACTION PROBLEMS **c85**
J. Genin and E. C. Ting *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 12 Dec. 1979 p 3-10 refs (For primary document see N80-24254 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington D.C. 20375. Annual rate $100.00

Three general methods for studying vehicle-guideway interaction problems are discussed. These include: moving force approximation; massless guideway approximation; and moving mass approximation. The trolley problem at the Sandia Laboratories is also summarized. J.M.S.

N80-24256 Birla Inst. of Technology and Science, Pilani (India).
A SURVEY OF STRUCTURAL OPTIMIZATION UNDER DYNAMIC CONSTRAINTS **c39**
M. A. V Rangacharyulu and G. T. S. Done (City Univ., London) *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 12 Dec. 1979 p 15-25 refs (For primary document see N80-24254 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Methods used with continous and discrete models are described for free vibration problems. Methods for forced vibration problems and nonconservative problems are also discussed. J.M.S.

N80-24257*# Illinois Univ., Urbana. Aeronomy Lab.
RESEARCH IN AERONOMY Progress Report, 1 Apr. - 30 Sep. 1979
Belva Edwards, ed. 1979 88 p refs
(Grants NGR-14-005-181; NsG-5213; NsG-7506; NSF ATM-76-01773; NSF ATM-78-21765; NSF ATM-78-15224; Grant NSF ATM-78-12308)
(NASA-CR-153189; PR-79-2) Avail: NTIS HC A05/MF A01 CSCL 05B

Several theoretical, experimental, and instrumentational developments in the field of aeronomy are presented. The forcing and propagation characteristics of planetary waves in the troposhere and middle atmosphere are addressed. Instrument payloads and launch objectives are explained for a number of rocket experiments including radio propagation and energetic particle experiments. The development of rocket-borne microprocessors, a lunar aspect sensor, and a rocket-borne energy spectrometer with solid state detectors are also discussed. The use of partial reflection techniques (to study the D region of the ionosphere), a meteor-radar system (to investigate the dynamics of the meteor region), and coherent and incoherent scatter radars (to study ionized regions) are examined. Finally, a laser radar system designed and constructed to measure the latitude distribution of atmospheric sodium in the 80 to 100 km altitude region is discussed. M.G.

N80-24258# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

RETROSPECTIVE STUDY OF SELECTED DOD MATERIALS AND STRUCTURES RESEARCH AND DEVELOPMENT PROGRAMS. PHASE 1: CASE HISTORY DATA COLLECTION Interim Report, Feb. 1978 - Feb. 1979

John E. Hove and Leo F. Gowen Mar. 1979 294 p refs

(Contract DAHC15-73-C-0200)

(AD-A080547; AD-E500116; IDA-P-1391; IDA/HQ-79-21258) Avail: NTIS HC A13/MF A01 CSCL 05/1

The DOD recognizes a continuing need to examine and, if possible, improve its investment strategy rationale in all of its R and D. Based on a request of USDR and E(R and AT/ET), the Institute for Defense Analyses undertook a study of R and D planning in the limited area of materials and structures. The objective of the study is to determine if the current R and D planning procedures in materials and structures can be improved. This phase I report is an orderly compilation of pertinent case histories. Evaluation and analysis will be the subject of a future Phase II paper. Pertinent studies of the past, such as HINDSIGHT and TRACES, are reviewed along with the IR and D programs of DOD. Funding histories in materials and structures technology are presented. Some outstanding research programs (6.1 category) sponsored by the Navy, Army, and Air Force are traced from their initial concept to their eventual contribution to the technology base. Selected case histories include the Navy's C4 Missile System program, which exemplifies the careful utilization of materials and structures technology advances by the designers. Other case histories discussed include the history and user acceptance of advanced fibers and composites as primary structural components; the development history of titanium and its uses; the Navy's development and sustained utilization of high-yield strength steels; the development of special aluminum alloys for aircraft and ships, and the growth of the graphitic (graphite and carbon-carbon) materials technology and their high temperature applications. The disappointing results of refractory metals for military applications are also discussed. GRA

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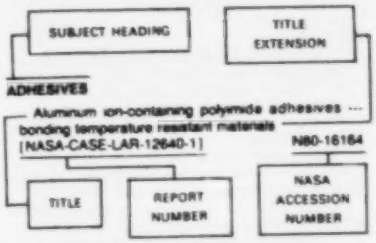

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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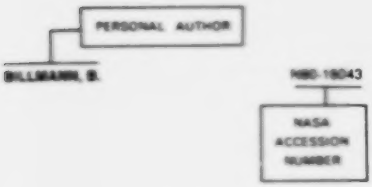

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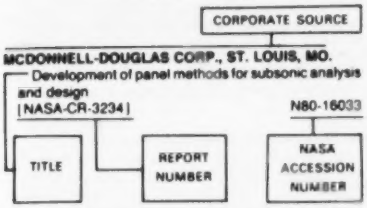

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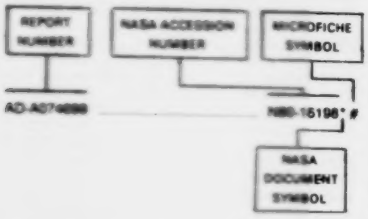

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NASA-TM-81509 N80-24200* #
NASA-TM-81510 N80-23778* #
NASA-TM-81512 N80-23313* #
NASA-TM-81517 N80-23684* #
NASA-TM-81779 N80-23282* #
NASA-TM-81786 N80-23662* #
NASA-TM-81787 N80-23251* #
NASA-TM-81798 N80-24002* #
NASA-TM-81810 N80-23283* #
NASA-TM-81818 N80-23683* #
NASA-TM-81819 N80-23332* #

NASA-TP-1561 N80-23453* #
NASA-TP-1562 N80-23677* #
NASA-TP-1642 N80-23304* #
NASA-TP-1649 N80-23326* #
NASA-TP-1651 N80-23934* #
NASA-TP-1652 N80-23600* #
NASA-TP-1665 N80-23933* #
NASA-TP-1677 N80-23327* #

NAVTRAEQUIPC-IH-315 N80-23336 #

NAVTRAEQUIPC-78-C-0157-1 N80-23992 #

NBS-GCR-79-184 N80-23869 #

NBS-SP-500-55 N80-23998 #

NBSIR-79-1908 N80-23867 #
NBSIR-79-1917 N80-23868 #
NBSIR-79-1927 N80-23999 #

NEAR-TR-202 N80-24240* #
NEAR-TR-212 N80-23254 #
NEAR-TR-214 N80-23605 #

NESEC-6 N80-23826 #

NLR-MP-79028-U N80-23284 #
NLR-MP-78040-U N80-23285 #
NLR-MP-78041-U N80-23449 #
NLR-MP-79012-U N80-23272 #
NLR-MP-79015-U N80-23273 #

NLR-TR-79077-U N80-23635 #

NMAB-345 N80-23470 #
NMAB-355 N80-23369 #

NOAA-DR-ERL-APCL-4 N80-23928 #
NOAA-DR-ERL-APCL-6 N80-23931 #

NOAA-TM-NWS-TDL-69 N80-23954 #

NOAA-79102303 N80-23950 #
NOAA-79110204 N80-23952 #
NOAA-79112101 N80-23955 #
NOAA-79112109 N80-23964 #
NOAA-79113001 N80-23951 #
NOAA-79121201 N80-23954 #
NOAA-79121209 N80-23928 #
NOAA-79122601 N80-23931 #
NOAA-80011603 N80-23763 #

NOR-80-46 N80-23373 #

NOSC/TR-363 N80-23532 #
NOSC/TR-489 N80-23687 #

NP-24137 N80-23476 #
NP-24196 N80-24146 #

NPL-NACS-19/79 N80-24030 #
NPL-NACS-20/79 N80-23617 #
NPL-NACS-23/79 N80-24031 #

NPL-QU-53 N80-23448 #

NPS-67-79-009 N80-23611 #

NPS52-79-004 N80-24051 #
NPS55-79-027-1 N80-23538 #
NPS55-79-028 N80-23540 #
NPS55-80-003 N80-24017 #
NPS67-76-012 N80-23321 #
NPS67-79-008 N80-23642 #
NPS67-79-010 N80-23319 #

NRL-MR-4128 N80-23468 #
NRL-MR-4135 N80-24169 #
NRL-MR-4152 N80-23916 #

NRL-TR-1 N80-23665 #

NRL-8361 N80-23541 #
NRL-8366 N80-24124* #
NRL-8367 N80-24159 #

NTIA/REP-79/31 N80-23558 #

NTIA/REPT-79/30 N80-23557 #

NTIS/PS-77/0002 N80-23450 #
NTIS/PS-77/0116 N80-24231 #
NTIS/PS-78-0130 N80-23450 #
NTIS/PS-78/0089 N80-24231 #
NTIS/PS-79/0118 N80-24231 #
NTIS/PS-79/0126 N80-23450 #

NU-SML-TR-79-9 N80-23377 #

NUREG-CR-0789 N80-23879 #

NVL-0059-010 N80-24186 #

NZERDC-44 N80-23603 #

ONERA-NT-1978-4 N80-23411 #
ONERA-NT-1979-1 N80-23325 #
ONERA-NT-1979-2 N80-23412 #
ONERA-NT-1979-2 N80-24098 #
ONERA-NT-1979-3 N80-24041 #
ONERA-NT-1979-4 N80-23404 #
ONERA-NT-1979-4 N80-24134 #
ONERA-NT-1979-5 N80-24133 #
ONERA-NT-1979-6 N80-23445 #

ONERA-NT-1979-8 N80-23301 #
ONERA-NT-1979-9 N80-23523 #
ONERA-NT-1979-10 N80-23588 #

ONERA-P-1979-3 N80-2327[illegible] #
ONERA-P-1979-7 N80-23[illegible]0 #

ONR-CR215-260-1 N80-24049 #

ORAU/IEA(M)-79-22 N80-23841 #
ORAU/IEA(M)-79-24 N80-23849 #
ORAU/IEA(M)-79-25 N80-23848 #

ORNL/MIT-290 N80-23400 #

ORNL/SUB-7226/1 N80-23850 #

ORNL/TM-6253 N80-23821 #
ORNL/TM-6342 N80-23630 #
ORNL/TM-7025 N80-23632 #
ORNL/TM-7034 N80-24173 #
ORNL/TM-7061 N80-23839 #
ORNL/TM-7144 N80-23828 #

ORO-3992-371 N80-24147 #
ORO-5135-77-5 N80-23846 #
ORO-5135-77-5-SUMM N80-23845 #
ORO-5912-T1 N80-23840 #

OUEL-1286/79 N80-23708 #
OUEL-1288/79 N80-23589 #
OUEL-1289/79 N80-23413 #
OUEL-1290/79 N80-23590 #
OUEL-1292/79 N80-23709 #
OUEL-1295/79 N80-23927 #

OWRT-A-091-ILL(1) N80-23619 #

OWRT-7510(1) N80-23415 #
OWRT-7541(1) N80-23414 #

PB80-105216 N80-24207 #
PB80-112212 N80-23416 #
PB80-119902 N80-23950 #
PB80-122948 N80-23369 #
PB80-124753 N80-23905 #
PB80-124852 N80-23414 #
PB80-125545 N80-23470 #
PB80-125610 N80-23591 #
PB80-125677 N80-24198 #
PB80-125891 N80-23869 #
PB80-126071 N80-24208 #
PB80-126204 N80-23415 #
PB80-126931 N80-23999 #
PB80-126980 N80-23904 #
PB80-127277 N80-23764 #
PB80-127988 N80-23964 #
PB80-128226 N80-23955 #
PB80-128515 N80-23906 #
PB80-128549 N80-24218 #
PB80-128960 N80-23619 #
PB80-129380 N80-23558 #
PB80-129398 N80-23557 #
PB80-129828 N80-23868 #
PB80-130214 N80-23951 #
PB80-130339 N80-23952 #
PB80-131576 N80-23852 #
PB80-132038 N80-23867 #
PB80-132830 N80-23930 #
PB80-133119 N80-23417 #
PB80-133143 N80-24209 #
PB80-133838 N80-23903 #
PB80-137383 N80-23928 #
PB80-137797 N80-23954 #
PB80-137953 N80-23866 #
PB80-138209 N80-23418 #
PB80-139041 N80-23929 #
PB80-140411 N80-23763 #
PB80-142227 N80-23931 #
PB80-144322 N80-23998 #
PB80-804362 N80-23469 #
PB80-804818 N80-24231 #
PB80-805161 N80-23450 #
PB80-805427 N80-23953 #

PHL-1978-37 N80-24162 #
PHL-1978-50 N80-23923 #
PHL-1978-51 N80-23634 #

PMTC-TP-80-02 N80-23939 #

PMTC-TP-80-03 ..... N80-23996 #

PNL-SA-7270 ..... N80-23947 #
PNL-SA-7576 ..... N80-23882 #
PNL-SA-7898 ..... N80-23859 #

PNL-2599 ..... N80-23879 #
PNL-2893 ..... N80-23918 #
PNL-3047 ..... N80-23823 #
PNL-3062 ..... N80-23793 #
PNL-3121 ..... N80-23979 #

PNR-90002 ..... N80-24206 #
PNR-90007 ..... N80-23266 #
PNR-90008 ..... N80-23863 #
PNR-90009 ..... N80-23407 #
PNR-90011 ..... N80-23337 #

PPG-435 ..... N80-24167 #
PPG-436 ..... N80-24145 #

PPPL-1596 ..... N80-24066 #
PPPL-1624 ..... N80-23581 #

PR-2 ..... N80-23735* #
PR-39 ..... N80-23818* #
PR-79-2 ..... N80-24257* #
PR-80-1-307 ..... N80-23298 #

PRV-3-6/79-VOL-1 ..... N80-23343 #
PRV-3-6/79-VOL-2 ..... N80-23344 #

PTPT-80-2 ..... N80-23293 #

PWA-5561-66 ..... N80-23312* #

QPR-1 ..... N80-23834 #
QPR-1 ..... N80-24188 #
QPR-10073-01 ..... N80-23773* #

QR-1 ..... N80-23768* #
QR-1 ..... N80-23773* #
QR-2 ..... N80-23537 #
QR-2 ..... N80-23769* #
QR-3 ..... N80-23840 #
QR-9 ..... N80-23483 #

QTR-8 ..... N80-24187 #

RADC-TR-79-199-PT-1 ..... N80-23990 #
RADC-TR-79-264 ..... N80-23575 #
RADC-TR-79-304 ..... N80-23993 #
RADC-TR-79-333 ..... N80-23569 #
RADC-TR-79-341 ..... N80-24154 #

RAND/R-2600-NASA ..... N80-24236* #

REC-ERC-79-9 ..... N80-23591 #

REF-79-7 ..... N80-24131 #

REPT-2 ..... N80-23760 #
REPT-2-30320/9R-52212 ..... N80-23362* #
REPT-3 ..... N80-23692 #
REPT-4 ..... N80-23761 #
REPT-4TC-NAVY-F/79 ..... N80-23465 #
REPT-7T40423/MEG/JCR-VOL-1 ..... N80-24027 #
REPT-7T40423/MEG/JCR-VOL-2 ..... N80-24028 #
REPT-7T40423/MEG/JCR-VOL-3 ..... N80-24029 #
REPT-03-79-58 ..... N80-23770* #
REPT-53 ..... N80-23694 #
REPT-80-FM-16 ..... N80-23911* #
REPT-80-FM-22 ..... N80-23341* #
REPT-80-1 ..... N80-24044* #
REPT-80-9E6-MARED-R1 ..... N80-23768* #
REPT-1093-25 ..... N80-23415 #
REPT-2786/85-TEA ..... N80-23353 #
REPT-7941-03 ..... N80-23286 #
REPT-06277 ..... N80-23731* #
REPT-062379 ..... N80-23716* #

RFP-2992/3533/79-3 ..... N80-23831 #

RN-304 ..... N80-23735* #

R79AEG413 ..... N80-23309* #
R80AEG374 ..... N80-23316* #

S-96-719 ..... N80-24210 #
S-110-02 ..... N80-23555 #

SAE-TP-800744 ..... N80-23283* #

SAI-79-104-DEN ..... N80-24013 #
SAI-79-1056-LJ ..... N80-24180 #

SAMSO-SD-TR-79-12-VOL-2 ..... N80-23290 #
SAMSO-SD-TR-79-12-VOL-3 ..... N80-23291 #
SAMSO-SD-TR-79-13-VOL-1 ..... N80-23289 #

SAMSO-TR-79-65 ..... N80-23435 #

SAN/1442-79/T1 ..... N80-23660 #

SAND-77-7028 ..... N80-23981 #
SAND-78-8190 ..... N80-23819 #
SAND-78-8276 ..... N80-23612 #
SAND-79-1169C ..... N80-23480 #
SAND-79-1230 ..... N80-23582 #
SAND-79-1380 ..... N80-23307 #
SAND-79-1479C ..... N80-23583 #
SAND-79-1587 ..... N80-24065 #
SAND-79-1714C ..... N80-23650 #
SAND-79-1825 ..... N80-24067 #
SAND-79-7002-VOL-2 ..... N80-23837 #
SAND-79-7007 ..... N80-23824 #
SAND-79-7025 ..... N80-23661 #
SAND-79-7096 ..... N80-23851 #
SAND-79-8054 ..... N80-23698 #
SAND-79-8181 ..... N80-23809 #
SAND-79-8208 ..... N80-23825 #
SAND-79-8248 ..... N80-23806 #
SAND-79-8647 ..... N80-23797 #
SAND-79-8685 ..... N80-23584 #
SAND-79-8807 ..... N80-23401 #
SAND-80-0142C ..... N80-23853 #

SAPR-2 ..... N80-23811 #

SERI/RR-51-332 ..... N80-23805 #

SERI/SP-69-071 ..... N80-24205 #

SERI/TP-333-485 ..... N80-23800 #
SERI/TP-351-559 ..... N80-23856 #

SERI/TR-35-078-VOL-2 ..... N80-23799 #
SERI/TR-51-294 ..... N80-23798 #
SERI/TR-8016-1 ..... N80-23814 #

SERIAL-T-409 ..... N80-24119 #
SERIAL-T-411 ..... N80-24005 #

SG-68 ..... N80-23954 #

SM-79-9 ..... N80-23679* #

SO-6-4375-7 ..... N80-23320 #

SOLAR/0010-79/05 ..... N80-23833 #

SR-L0-00415 ..... N80-23746* #
SR-L0-00416 ..... N80-23726* #
SR-L0-00417 ..... N80-23747* #
SR-L0-00418 ..... N80-23745* #
SR-L9-00405 ..... N80-23748* #
SR-L9-00409 ..... N80-23720* #

SR-P9-00410 ..... N80-23740* #
SR-P9-00411 ..... N80-23741* #
SR-P9-00412 ..... N80-23742* #
SR-P9-00413 ..... N80-23743* #

SR-1 ..... N80-23349 #
SR-1 ..... N80-23914 #
SR-2 ..... N80-24242 #
SR-723-8-79 ..... N80-23757 #

SRL-6909-02-PT-2 ..... N80-23434 #

SRO-635-7 ..... N80-23787 #

SR80-R-4375-43 ..... N80-23320 #

STI-TR-1125-1 ..... N80-24049 #

STR-7 ..... N80-24186 #

SU-SOL-79-11 ..... N80-24019 #
SU-SOL-79-13 ..... N80-24062 #
SU-SOL-79-18 ..... N80-24050 #
SU-SOL-79-19 ..... N80-24003 #
SU-SOL-79-22 ..... N80-24004 #
SU-SOL-79-23 ..... N80-24061 #
SU-SOL-79-2115 ..... N80-24018 #

SUMM-E-615-80-02 ..... N80-23340* #

TDCK-71541 ..... N80-23923 #
TDCK-71693 ..... N80-23634 #
TDCK-71759 ..... N80-24162 #

TES-33009-44 ..... N80-23829 #

TETRAT-TC-3284-02 ..... N80-23610 #

TID-28430 ..... N80-23791 #

TP-7753 ..... N80-23355 #

TR-N-8 ..... N80-24058 #
TR-N-9 ..... N80-24059 #
TR-N-10 ..... N80-24060 #

TR-1 ..... N80-23458 #
TR-1 ..... N80-23640 #
TR-2 ..... N80-23641 #
TR-4 ..... N80-23462 #
TR-5 ..... N80-23986 #
TR-8 ..... N80-23397 #
TR-8 ..... N80-24190 #
TR-22 ..... N80-24166 #
TR-44 ..... N80-24043 #
TR-77-19 ..... N80-23280 #
TR-79-B3-AFOSR ..... N80-24101 #
TR-79-9 ..... N80-23279 #
TR-79-02 ..... N80-23483 #
TR-79-04 ..... N80-23464 #
TR-79-001215 ..... N80-23937 #
TR-825 ..... N80-23991* #
TR-841 ..... N80-24057 #
TR-0079(4764)-1 ..... N80-23435 #
TR-1127-1-I ..... N80-23328* #
TR-1979-2 ..... N80-23688 #

TRANS-14190 ..... N80-23337 #
TRANS-14483 ..... N80-23407 #
TRANS-14737 ..... N80-23266 #
TRANS-14884 ..... N80-23863 #

TRB/TRR-726 ..... N80-23866 #

TRITA-NA-7921 ..... N80-23706 #

TRW-29518-6001-RU-00 ..... N80-23577 #

TSC-W25-160 ..... N80-23545 #

TUM-LRT-KB-13/77 ..... N80-24237 #
TUM-LRT-KB-14/77 ..... N80-23342 #
TUM-LRT-KB-77/17 ..... N80-23359 #
TUM-LRT-KB-77/18 ..... N80-23360 #
TUM-LRT-KB-77/19 ..... N80-23368 #

UAH-RR-228 ..... N80-23261 #

UCB/ERL-M79/41 ..... N80-24168 #

UCID-18179 ..... N80-23437 #
UCID-18303 ..... N80-24177 #
UCID-18324 ..... N80-24165 #
UCID-18333 ..... N80-23479 #
UCID-18504 ..... N80-23758 #
UCID-18520 ..... N80-23633 #

UCLA-12-1232 ..... N80-23960 #

UCRL-15108 ..... N80-23756 #
UCRL-15109 ..... N80-23696 #
UCRL-15112 ..... N80-24179 #
UCRL-15113 ..... N80-24170 #
UCRL-15154 ..... N80-23843 #
UCRL-15160 ..... N80-23489 #
UCRL-52797 ..... N80-23878 #
UCRL-80972-REV-2 ..... N80-24244 #
UCRL-82367 ..... N80-23822 #
UCRL-82587 ..... N80-24064 #
UCRL-82928 ..... N80-23648 #
UCRL-83317 ..... N80-23629 #
UCRL-83372 ..... N80-23649 #

UDR-NM-TR-79-07 ..... N80-23467 #

UHMET-79-15 ..... N80-23948 #

UILU-ENG-79-2509 ..... N80-23531* #
UILU-ENG-79-2510 ..... N80-23364* #

UILU-WRC-79-0144 ..... N80-23619 #

US-PATENT-APPL-SN-008207 ..... N80-23524*
US-PATENT-APPL-SN-145207 ..... N80-23394* #
US-PATENT-APPL-SN-145282 ..... N80-24152* #
US-PATENT-APPL-SN-147700 ..... N80-23454* #
US-PATENT-APPL-SN-694407 ..... N80-23452*
US-PATENT-APPL-SN-766999 ..... N80-23559*
US-PATENT-APPL-SN-848419 ..... N80-23711*
US-PATENT-APPL-SN-894213 ..... N80-23655*
US-PATENT-APPL-SN-921626 ..... N80-23383*
US-PATENT-APPL-SN-928137 ..... N80-23969*
US-PATENT-APPL-SN-929088 ..... N80-24149*
US-PATENT-APPL-SN-938300 ..... N80-23654*
US-PATENT-APPL-SN-938582 ..... N80-23653*
US-PATENT-APPL-SN-946990 ..... N80-23471*
US-PATENT-APPL-SN-974292 ..... N80-23419*

US-PATENT-CLASS-23-300 ..... N80-23471*
US-PATENT-CLASS-23-302A N80-23471*
US-PATENT-CLASS-23-302R N80-23471*
US-PATENT-CLASS-23-302T N80-23471*
US-PATENT-CLASS-51-277 ..... N80-24149*
US-PATENT-CLASS-51-283R N80-24149*
US-PATENT-CLASS-55-66 ..... N80-23383*
US-PATENT-CLASS-55-67 ..... N80-23383*
US-PATENT-CLASS-55-68 ..... N80-23383*
US-PATENT-CLASS-55-72 ..... N80-23383*
US-PATENT-CLASS-65-61 ..... N80-24149*
US-PATENT-CLASS-73-12 ..... N80-23711*
US-PATENT-CLASS-73-82 ..... N80-23711*
US-PATENT-CLASS-75-135 ..... N80-23419*
US-PATENT-CLASS-75-138 ..... N80-23419*
US-PATENT-CLASS-75-178R N80-23419*
US-PATENT-CLASS-128-666 ..... N80-23969*
US-PATENT-CLASS-128-690 ..... N80-23969*
US-PATENT-CLASS-137-375 ..... N80-23654*
US-PATENT-CLASS-137-625.4 ..... N80-23654*
US-PATENT-CLASS-148-32 ..... N80-23419*
US-PATENT-CLASS-149-108.4 ..... N80-23471*
US-PATENT-CLASS-151-41.76 ..... N80-23653*
US-PATENT-CLASS-204-171 ..... N80-23452*
US-PATENT-CLASS-210-23H N80-23452*
US-PATENT-CLASS-210-500M N80-23452*
US-PATENT-CLASS-219-160 ..... N80-23655*
US-PATENT-CLASS-219-161 ..... N80-23655*
US-PATENT-CLASS-228-44.1R N80-23655*
US-PATENT-CLASS-228-212 ..... N80-23655*
US-PATENT-CLASS-228-222 ..... N80-23655*
US-PATENT-CLASS-251-86 ..... N80-23654*
US-PATENT-CLASS-251-138 ..... N80-23654*
US-PATENT-CLASS-269-287 ..... N80-23655*
US-PATENT-CLASS-310-319 ..... N80-23559*
US-PATENT-CLASS-331-65 ..... N80-23559*
US-PATENT-CLASS-340-602 ..... N80-23559*
US-PATENT-CLASS-340-604 ..... N80-23559*
US-PATENT-CLASS-343-786 ..... N80-23524*
US-PATENT-CLASS-343-895 ..... N80-23524*
US-PATENT-CLASS-427-41 ..... N80-23452*
US-PATENT-CLASS-427-245 ..... N80-23452*
US-PATENT-CLASS-521-55 ..... N80-23383*
US-PATENT-CLASS-521-146 ..... N80-23383*
US-PATENT-CLASS-521-918 ..... N80-23383*
US-PATENT-CLASS-525-4 ..... N80-23383*

US-PATENT-4,193,435 ..... N80-23653*
US-PATENT-4,195,512 ..... N80-23711*
US-PATENT-4,195,666 ..... N80-23654*
US-PATENT-4,196,840 ..... N80-23655*
US-PATENT-4,197,530 ..... N80-23559*
US-PATENT-4,198,209 ..... N80-23471*
US-PATENT-4,198,232 ..... N80-23419*
US-PATENT-4,198,788 ..... N80-24149*
US-PATENT-4,198,792 ..... N80-23383*
US-PATENT-4,198,988 ..... N80-23969*
US-PATENT-4,199,448 ..... N80-23452*
US-PATENT-4,199,764 ..... N80-23524*

USCG-D-65-79-PT-2 ..... N80-23978 #

USNA-EW-8-79 ..... N80-23995 #

UTIAS-229 ..... N80-24138 #

UTIAS-240 ..... N80-23603 #

UTRC/R79-911989-17 ..... N80-23659 #
UTRC/R79-914346-4 ..... N80-23646 #
UTRC/R79-914401-2 ..... N80-23379 #

UVA/528166/MAE80/102 ..... N80-23874* #

UWIS-DS-79-544 ..... N80-24105 #
UWIS-DS-79-545 ..... N80-24106 #
UWIS-DS-79-546 ..... N80-24104 #
UWIS-DS-79-576 ..... N80-24103 #

VPI-E-79-41 ..... N80-23602 #

VPI-SU-AERO-105 ..... N80-23601 #

VTR-79-01-REV ..... N80-24036 #
VTR-79-22 ..... N80-24038 #
VTR-79-23 ..... N80-24035 #

WES-MP-HL-80-1 ..... N80-23994 #

WES-TM-6-412-3 ..... N80-23692 #

WES-TR-A-79-2 ..... N80-23754 #

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WRC-78-182 ..... N80-23315* #

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03 AIR TRANSPORTATION AND SAFETY 1934
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04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1935
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13 ASTRODYNAMICS 1944
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18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE N.A.
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For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 1947
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47 METEOROLOGY AND CLIMATOLOGY 2031

Includes weather forecasting and modification.

48 OCEANOGRAPHY 2036

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 2036

Includes genetics.

52 AEROSPACE MEDICINE 2037

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 2039

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 2040

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 2041

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 2042

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 2044

Includes computer networks.

63 CYBERNETICS 2044

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 2046

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 2050

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 2051

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 2052

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

70 PHYSICS (GENERAL) 2052

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 2052
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 2054
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 2056
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 2057
Includes light phenomena.

75 PLASMA PHYSICS 2059
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 2063
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 2065
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2066
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2066
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 2067
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2068
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2069
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2070
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION N.A.
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2075
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2077
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2077

Note: N.A. means that no abstracts were assigned to this category for this issue.

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REPORT/ACCESSION NUMBER INDEX I-83

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NASA ACCESSION NUMBER → N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif. ← CORPORATE SOURCE

TITLE → STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

PUBLICATION DATE

AUTHOR → D. J. Mourey 3 Sep. 1979 409 p refs

CONTRACT OR GRANT → (Contract NAS1-15624)

AVAILABILITY SOURCE

REPORT NUMBER → (NASA-CR-159149) Avail: NTIS HC A18/MF A01

CSCL 01C

COSATI CODE

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, VARIABLE LOAD E/A CONCEPT

S.P. Desjarding, Simula Inc., *2223 S. 48th St., Tempe, Arizona* 85282 (DN081113; N62269-79-C-0241)

To investigate the feasibility of improving the operational performance of energy attenuator systems in crashworthy seats by incorporating a passively controlled variable limit load concept in their design. This contract supports work unit ZA601, Agency Accession No. DN681080.

A prototype variable limit load energy attenuator device will be designed, fabricated, tested and evaluated. Various load control mechanisms will be included in the evaluation.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0002, EFFECT OF FREE-STREAM TURBULENCE AND SURFACE ROUGHNESS ON BOUNDARY-LAYER TRANSITION

J.M. Kendall, U.S. National Aeronautics & Space Admin., Jet Propulsion Lab., *4800 Oak Grove Dr., Pasadena, California* 91103 (DF144080)

Designs of advanced aerospace vehicles require a better understanding of boundary-layer transition. Although many transition experiments have been conducted in past years, the phenomenon of boundary-layer transition remains poorly understood. The objective of this work is to provide experimental information which will enable application of stability theory to the prediction and interpretation of boundary-layer transition. Fundamental experiments such as these will provide new knowledge on the nature of transition and a more reliable means of predicting boundary-layer transition.

Through wind tunnel experiments the turbulence interaction efficiency throughout the important range of wave number and obliquity angle will be measured directly, using a new approach. The interaction results will be represented analytically and combined with stability theory to form a transition prediction method. Mean velocity profiles on a model with distributed roughness will be measured and represented analytically for the computation of stability results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, ADVANCED ELECTRONIC FLIGHT CONTROL SYSTEMS DEVELOPMENT (INTEGRATED SENSORY SUBSYSTEM)

W.D. Weinstein, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN081106; N62269-79-C-0206)

To develop an integrated and survivable configuration of inertial and air data flight control sensors suitable for digital flight control systems. This contract supports work unit ZA601, Agency Accession No. DN681080.

Synthesize and evaluate the operational capabilities of ISS integrated sensory subsystems and develop the asset advanced skewed sensory electronic triad accelerometer configurations.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0004, BICONIC AERODYNAMICS

D.S. Gillies, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142900)

This work unit supports a SAMSO technology need for updated information on biconic reentry vehicles as well as tests planned at the AEDC wind tunnels on biconic designs. Biconic reentry vehicles would provide significant packaging and weight advantages over present sphere-cone designs. Technology on stability of biconics at reentry conditions will be advanced with completion of this study. The objective of this effort is to determine the aerodynamic properties of biconic configurations as a function of geometry for various angles of attack for reentry Mach and Reynolds number environments. This reentry environment simulation will improve ICBM capabilities and performance with the new design data and criteria obtained and will allow prediction of aerodynamic centers to within one percent of the vehicle length at reentry conditions.

Comprehensive experimental test program in the AFFDL 20-inch hypersonic wind tunnel varying biconic geometry and angles of attack over ICBM reentry Mach and Reynolds number conditions. Accompanying analysis to establish methods for accurate prediction of aerodynamic coefficients.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, DEPLOYABLE STABILIZATION AND RESTRAINT DEVICES FOR EJECTION SEATS

S.R. Mehaffie, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144090)

This work unit will support the emergency escape and recovery of Air Force crew members from fighter aircraft. Current ejection seats are aerodynamically unstable, resulting in crew member injuries due to unrestrained limb flail and uncontrolled aerodynamic forces. The objective of this work effort is to determine the feasibility of deploying stabilizing surfaces on the ejection seat such as a nose and tail fairing. Additionally, an advanced crew member restraint system will be examined in order to control the limb flail problem. Successful demonstration of this concept will result in a capability for rapidly deploying pre-shaped crew escape system appendages which have potential for achieving the ejection seat stabilization and crew member restraint necessary to prevent serious injury or loss of life of the crew member during emergency escape.

The seat geometry is to be altered by the deployment of pre-shaped, foam-filled bags to act as nose, tail and advanced crew member restraint. This approach requires the development of a foam deployment technique capable of attaining fifty-millisecond operating time.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, PRELIMINARY DESIGN OF AIRCRAFT STRUCTURES
R.S. Sandhu, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143760)

To reduce the acquisition and maintenance costs and to insure a high degree of structural integrity and reliability of future Air Force weapon systems, it is imperative to develop reliable lightweight and low-cost airframe structures. The objective of this program is to develop new, low-cost structural concepts for Air Force weapons systems, and to enhance the capability of the preliminary design group in the areas of design-analysis techniques for the design and the evaluation of these concepts using advanced materials.

New structural concepts and arrangements using metallic, composites and hybrid materials will be designed, fabricated, and validated by tests resulting in an improved structural technology base.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, IMPROVED DATA MANAGEMENT SYSTEM
R.B. Philbrick, Bell Helicopter Textron, *Hwy. 183, P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3867; DAAJ51 79 C 0015)

Develop an improved data analysis and management system known as DATA-MAP (data from aeromechanics' tests and analytics-management and analysis package, formerly known as OLS-DMS) to be used for interactive analysis and display of data resulting from flight, wind tunnel, or whirl tower tests, and for validation and evaluation of analytical methods. An end-result will be the capacity to analyze and display data for improving performance, stability and control, loads and vibrations, acoustics and aeroelastic stability.

Improve DATA-MAP (OLS-DMS version 2.01) by expanding and enhancing its graphics, analysis and operational capabilities in order to increase its versatility and usefulness as an engineering tool. A data file will be defined to simplify conversion of data formats and structures for input to DATA-MAP, thus facilitating direct comparison of test and simulation results and also providing for C-81 data display and analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0008, INTEGRAL THEORY OF IMPACT ANALYSIS
T. McDonough, U.S. Dept. of Defense, Defense Advanced Research Projects Agency, *1400 Wilson Blvd., Arlington, Virginia* 22209 (DF142980)

In the performance of many military missions the crew compartment transparent enclosure is exposed to various different threats. It is imperative that the crew compartment enclosure (windshield, canopy) provides maximum protection against ballistic threats. This program will analytically analyze transparencies for resistance to ballistic impacts and will determine design methodology to maximize transparencies for survivability against ballistic threats while minimizing the associated costs, weights, thicknesses, etc. By obtaining a capability to analytically determine an optimum windshield design, instead of the current cut and try techniques, the assets required to arrive at a final windshield design should be substantially reduced.

Aeronautical Research Associates of Princeton (ARAP) has developed an integral theory of impact which offers the potential capability to predict material response to ballistic threats. ARAP will predict the ballistic limit of an existing multi-laminate aircraft windshield. If the theory proves successful, ARAP will then design a windshield specimen optimized for performance against a ballistic threat while remaining within specified weight, cost and thickness parameters. That windshield specimen will then be fabricated and tested and if acceptable levels of correlation are obtained, remaining funds will be used to develop the theory to handle additional variables (yaw, obliquity and projectile shapes).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, AN ADAPTIVE CONTROLLER FOR AN AIRCRAFT GAS TURBINE PROPULSION SYSTEM
R.G. Leonard, Virginia Polytechnic Inst. & State University, Graduate School, *Blacksburg, Virginia* 24061 (NSG 3275)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, INVESTIGATION OF THE CNTD MECHANISM AND PROPERTIES OF SIC AND ALN DEPOSITION
R.A. Holzl, Chemetel Corp., *Pacoima, California* 91331 (DF054420; F49620-79-C-0041)

AF function - ceramic materials are being developed for a variety of components (e.g., blades, vanes, combustors, bearings and seals) in future gas turbine engines and for a variety of electronic and optical components in aircraft. Opportunity - a new CVD-like process known as CNTD (controlled nucleation thermochemical deposition) has been developed for producing very fine-grained materials having superior mechanical properties. Objective - the objective of this research is to study the mechanism and deposition parameters of CNTD for fine-grained high strength silicon carbide and aluminum nitride. How work contributes - silicon carbide deposits will be further evaluated by the Air Force for strength, toughness and corrosion resistance for possible impact on the Ceramic Turbine Engine Program. Silicon nitride samples will be further characterized for optical, dielectric and thermal properties under concurrent AFOSR research contracts.

The optimum deposition parameters for CNTD will be established to produce fine-grain, high strength SiC and AlN. Microstructure and mechanical testing data will be used in an iterative development cycle for optimizing the process. Variables to be studied include gas chemistry, gas pre-heat, gas flow, partial and total pressure, substrate temperature, methods of heating and geometry of the sample and deposition system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, ENERGY TRANSFER PROCESSES AND COHERENCE IN CONDENSED PHASE
C.B. Harris, University of California, Berkeley Campus, School of Letters & Science, Dept. of Chemistry, *Berkeley, California* 94720 (CHE77-14667 A01)

Dr. Harris will investigate the properties of solids and liquids which are important and responsible for rapid electronic and vibrational energy transfer in condensed phases. He will develop new experimental approaches to the field utilizing the coherent properties of applied magnetic (microwave) and electric (laser) fields. In addition, he will develop the theoretical basis for the investigations. This theory is applicable in a general way to many different types of spectroscopy. Finally, he will investigate the interrelationships between kinetic and statistical descriptions of energy transfer in condensed phases. This research represents a continuation of that currently supported by Foundation grant CHE-7420707.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0003, TITANIUM COATING IGNITION TEST
Unknown, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF463340; F33615-79-C-2005)

To verify the effectiveness of titanium fire suppressant coatings developed in a materials technology program.

Test coated samples of titanium in a flow field of varying temperature, pressure and velocity. Samples will be ignited by melt impingement and/or high energy laser.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0004, WEAPONRY - COMBUSTION OF NON-ALUMINIZED HETEROGENEOUS SOLID PROPELLANTS
W.C. Strahle, Georgia Inst. of Technology, School of Aerospace Engineering, Dept. of Aerospace Engineering, *Atlanta, Georgia* 30332 (DN223680; N00014-75-C-0332)

The objective of this work is to obtain quantitative understanding of the combustion of ammonium perchlorate–binder–ammonium perchlorate (AP) sandwich models in an effort to establish a predictive capability for the burn rate behavior of composite propellants. The research, hopefully, will contribute fundamental kinetic data on binder and oxidizer decomposition, and gas-phase, catalytic, and interface reactions all pertinent to cost-reduction aspects of propellant formulation and development for Navy missiles.

The investigation is aimed at acquisition of experimental data relevant to combustion of AP-binder sandwiches incorporating catalysts within the binder, oxidizer, or at the interface and extension of an analytical model to include several effects of importance. A combustion bomb, with burning up to 3200 psi, will be utilized with deflagration characteristics inferred through cinephotomicrography and quenched sample photomicrography.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0005, HIGH DOSE ION IMPLANTATION OF ALUMINUM AND TITANIUM ALLOYS
J.R. Stevenson, Georgia Inst. of Technology, School of Physics, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF054110; AFOSR-79-0011)

AF function - corrosion due to the formation of oxides and nitrides limits the life-span of equipment and is both economically and militarily expensive. Deficiency - unexpected and catastrophic failure of metal components can occur where corrosion damage is undetected. Objective - to make beneficial changes to the surface chemical and physical properties by the use of ion implantation techniques. How work contributes - ion implantation is expected to improve such surface properties as hardness, friction, resistance to oxidation and corrosion without changing the bulk properties of structural metal alloys.

Ion implantation is a technique which has evolved from electronic device fabrication. This research project will explore the possibilities of improving the mechanical, chemical and metallurgical surface properties by utilizing high doses (up to 10 to the 19th power ions incident per sq. cm of target area).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0006, CHEMICAL APPLICATIONS OF RESONANCE RAMAN SPECTROSCOPY WITH TUNABLE LASERS
R.P. Van Duyne, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Chemistry, *633 Clark St., Evanston, Illinois* 60201 (CHE78-00877)

Dr. Van Duyne is studying the electronic structure of the ground and the excited states of radical ions as well as the nature of highly exothermic, nonadiabatic electron transfer reactions. In addition he is pursuing a series of investigations into the development of highly specific molecular probes for the monitoring of electrochemical processes and for the analytical characterization of low dimensionality, organic solids possessing unusual electronic properties. The main experimental technique being employed is resonance Raman spectroscopy (RRS). Tunable continuous wave (CW) as well as pulsed dye lasers are being used as the primary excitation sources. This work is a continuation of that currently supported by Foundation Grant, CHE-7412573.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0007, LONG RANGE MOLECULES
W.C. Stwalley, University of Iowa, School of Liberal Arts, Dept. of Chemistry, *Jessup Hall, Iowa City, Iowa* 52240 (CHE77-14681 A02)

Dr. Stwalley will investigate long range molecules, i.e., molecules (mainly diatomic) in their highest closely spaced vibrational-rotational levels near dissociation. These molecules have unique and exotic properties which, however, are often simply related to the long range behavior of the interaction potential (e.g., -C6R-6). The existence of such molecules has been conclusively established by electronic spectroscopy and independently by theoretical calculation. This research will involve spectroscopic studies (e.g., using a high-resolution tunable laser) principally of diatomic Li-containing molecules (e.g., the A1 sigma plus u state of Li2 where nearly half the vibrational states are predicted to be long range) with complementary theoretical studies as appropriate.

This research represents a continuation of that currently supported by Foundation grant CHE-74-13019.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, HIGH TEMPERATURE TURBINE ROTOR MATERIAL
Unknown, General Electric Co., *1000 Western Ave., West Lynn, Massachusetts* 01910 (DF463780; F33615-79-C-2043)

Investigate the use of carbon/carbon material in the turbine rotor of a small (500 to 1000 pounds thrust), 50-hour-life turbofan engine. The rotor will operate at 2500 degrees F and will not require any cooling air.

The basic contract will be a design study of a turbine rotor in a 2500 degrees F tit of a small turbofan and will also include a carbon/carbon material definition effort. Possible follow-on efforts include design, fabrication and test of a carbon/carbon turbine rotor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0009, SURFACE EFFECTS IN THE PLASTICITY OF CRYSTALLINE SOLIDS
R.M. Latanision, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgy & Materials Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-05935)

It is known that the mechanical behavior of a solid may be affected by conditions at its surface. In the case of semiconductors and insulators, the influence of variations in the space charge distribution on the mobility of dislocations has been proposed as an explanation for mechanical effects. The principal objective of the present program is to study the effect of changes in the space charge distribution on dislocation mobility about hardness impressions in cadmium sulfide surfaces exposed to sub-band-gap illumination in order to achieve the flat-band condition as determined by surface photovoltage spectroscopy. A singular feature of this program, particularly with respect to the role of surface charge, is the introduction of a surface analytical approach into an area that has been studied historically by essentially metallurgical methods. The microhardness and dislocation mobility (by etch putting techniques) will be determined for a variety of surface conditions. In addition the effect of adsorbed gases on surface mechanical behavior will be studied. Theoretical calculations of the forces between adjacent, like-charged dislocations will be performed to aid in the interpretation of experimental results.

This is a continuation of studies initiated under NSF grant DMR76-06854.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0010, ENERGY PARTITIONING AND FLOW IN METAL-OXIDANT FLAMES
R.W. Field, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (CHE78-18427)

This research is in the area of quantum chemistry. Dr. Field plans to carry out a three-faceted investigation of energy flow in alkaline earth plus oxidant flames. Its purpose is to de-

lineate and explain the most important channels for transfer of internal energy between electronic and chemical species. Particular attention will be focussed on the role of isolated-molecule spin-orbit and rotation-electronic perturbations in facilitating transfer of population between electron states. The three parts of this study are: (1) complete characterization of all so-called 'reservoir levels', as well as several high lying radiating states, by the technique of Optical-Optical Double Resonance (OODR) Spectroscopy; (2) detailed experimental and computer analysis of perturbations with the dual purpose of mapping the possible perturbation channels into, between, and out of the reservoir levels and establishment of quantitative relationships between populations and laser-induced fluorescence intensities; (3) selective pulsed preparation of individual reservoir levels by the technique of Stimulated Emission Pumping, combined with fluorescence and excitation spectroscopic population monitoring, to obtain state-to-state transfer rates and quantum efficiencies. This research represents a continuation of that currently supported by Foundation grant CHE7505959.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0011, EFFECT OF MOLECULAR STRUCTURE ON MESOMORPHIC BEHAVIOR

A.C. Griffin, University of Southern Mississippi, School of Science & Technology, Dept. of Chemistry, *Hattiesburg, Mississippi* 39401 (DMR7805284)

Liquid crystals can flow like liquids, but have some of the molecular ordering of solids. The changes of this ordering and of the optical properties with temperature or applied field are the basis of using liquid crystals in, say, the familiar digital thermometers or display devices. The goal of Professor Griffin's work is to examine how the tendency of the liquid crystal phases to undergo transitions is affected by such chemical attributes of the constituent molecules as dipole interactions, polarity, size, and ability to hydrogen bond. The long range goal of this work is to enable the synthetic chemist to tailor make a system with desired transition temperature and optical properties. A correlation between molecular structure (electronic and steric factors) and smectic properties is to be established by preparing and examining binary mesophase systems. New smectic materials are synthesized as required. Experimental studies include (1) microscopic measurements of transition temperatures and phase identification; (2) thermal measurements of heats and temperatures of transition for selected pure compounds and binary systems using differential scanning calorimetry; (3) X-ray studies of structure when required by the uniqueness of the binary behavior.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0012, LIGHT SCATTERING EFFECTS FOR AEROSOLS AND OTHER PARTICLE SYSTEMS

M. Kerker, Clarkson College of Technology, School of Science, Dept. of Chemistry, *51 Main St., Potsdam, New York* 13676 (CHE77-13102)

This project will study a number of new light scattering effects, and the application of these effects to study the size, composition and internal structure of particulate systems. Examples are aerosols, hydrosols, and biological cells.

When Raman or fluorescent scattering signals are used to probe for molecular species in aerosols or biological cells, significant errors will occur unless the effect of particle size and shape is considered. Numerical and experimental studies will be carried out to elucidate the effect quantitatively.

When light is absorbed by a particle, the particle may be heated. The effect of this heating on particle motion will be studied. Configurations of particles which have abnormally low scattering cross-sections (nearly invisible particles) have been discovered. Similar effects for absorbing particles will be investigated.

An integral equation formulation to permit effective calculation of scattering from particles with internal structure will be developed.

This research is a continuation of that currently supported by Foundation Grant, CHE-7403910.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0013, PHASE RELATIONS AND ELECTRON-ELECTRON INTERACTIONS IN THE SYSTEM LITHIUM-METHYLAMINE

M.J. Sienko, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Chemistry, *Ithaca, New York* 14850 (CHE78-12238)

This research project is in the area of chemical thermodynamics, in the subfield of phase equilibria. The system lithium-methylamine will be examined for its electric, magnetic, and magnetic resonance behavior over the concentration range from 0 to 30 moles percent metal, and over the temperature range from 4 degrees K to 300 degrees K. Special attention will be given to the region of the metal-nonmetal transition, and its relation to liquid-liquid coexistence, and 'expanded-metal' compound formation. Electron spin resonance, electrical conductivity, nuclear magnetic resonance, and X-ray and neutron diffraction are among the experimental methods which will be applied. The results will be of interest for the analysis of electron-electron interactions and the metal-insulator transition, especially for disordered systems.

This research is a continuation of that currently supported by Foundation Grant, CHE-7421480.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0014, STABILIZED SKIN STUDIES

M. Plummer, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF142070; F33615-78-C-3215)

Performance requirements of advanced military aircraft indicate the desirability of using titanium as a major structural material to achieve the necessary strength-to-weight fraction, thermal capability, or both. The high cost of both the material and conventional primary production processes makes acquisition costs for titanium structural hardware non-competitive with more conventional materials. The objective of this effort is to define design options utilizing advanced titanium construction methods which allow more efficient use of material and production innovations. A goal of 25 percent or more acquisition cost-reduction with no sacrifice of structural weight, integrity, or life is required.

A number of stabilized skin panels utilizing superplastic forming and diffusion bonding will be designed to satisfy realistic type design criteria. They will be fabricated and tested. The results will be analyzed, tabulated, and compared with the best existing design technologies presently in production use.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0015, INTERACTIVE EFFECTS BETWEEN TRANSITION METAL IONS IN OXIDE GLASSES

R.K. MacCrone, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Materials Engineering, *110 8th St., Troy, New York* 12181 (DMR77-11322 A01)

Previous work using electric and magnetic susceptibility has estabished that in dilute concentrations (0-10 moles percent), transition metal ions form ordered complexes in oxide glasses. Further investigation into these complexes will be accomplished using the techniques of mixed valence charge transfer optical absorption and electron paramagnetic resonance. The objectives will be to understand how the chemical composition of the host glass and the valence concentration ratio of the contained transition metal ions affect the glass structures.

Mixed valance charge transfer optical absorption will be used as a tool to study the formation of transition metal ion complexes as a function of transition metal ion concentration, transition metal ion type, valence concentration ratio, host glass composition and thermal history. At the same time the physics

of the absorption bands will be studied to investigate the phonon and exchange interaction.

Electron paramagnetic resonance measurements will be used on selected glasses as complementary techniques to study the transition metal ion complex structure through the antiferromagnetic coupling effects of the exchange integral. The temperature dependence of the resonance in selected glasses, subjected to the experimental variables above, will be measured and compared to the behavior expected of specific structural models.

This is a continuation of NSF Grant DMR77-11322.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0016, PREBIOTIC SYNTHESIS - BIOMOLECULES FROM HCN

J.P. Ferris, Rensselaer Polytechnic Inst., School of Science, Dept. of Chemistry, *110 8th, Troy, New York* 12181 (CHE76-11000 A02)

The isolation of orotic acid by the hydrolysis of the HCN oligomers suggests that pyrimidines and pyrimidine derivatives may have been formed from HCN on the primitive earth. The conversion of orotic acid to uracil and orotidine as part of the further investigation of this prebiotic pathway to pyrimidine nucleosides is being investigated. The decarboxylation of orotic acid is being attempted in the presence of anions which may have existed on the primitive earth. The investigation of the synthesis of orotodine starts with a study of the reactions of alkali metal and transition metal salts or orotic acid with a bromoribose derivative. When the factors which control orotidine synthesis are more clearly understood the reaction will be studied using a prebiotic ribose derivative. The investigation of the products formed by the hydrolysis of the HCN oligomers to see if other classes of biomolecules besides purines, pyrimidines and amino acids are formed is being continued. The pathway for the oligomerization is being probed using carbon-14 labelled and N-alkyl derivatives of diaminomaleonitrile. The effect of clay on the oligomerization of HCN and peptide bond formation mediated by HCN oligomers is being investigated. This work is a continuation of that currently supported by Foundation grant, GP-40080X.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0017, CHARACTERIZATION OF STRUCTURE OF A POLYMER WITH A MAGNETIC RESONANCE SPECTROSCOPY

W.M. Ritchey, Case Western Reserve University, Case Inst. of Technology, Dept. of Chemistry, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NSG 3241)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0018, PLASTIC DEFORMATION BEHAVIOR OF SINGLE-CRYSTAL ALUMINA (NON-BASAL SLIP)

R.E. Tressler, Pennsylvania State University, University Park Campus, School of Liberal Arts, Dept. of Materials Science, *110 Sparks Bldg., University Park, Pennsylvania* 16802 (DMR76-83412 A01)

Research will be continued on the study of the plastic deformation dynamics and dislocation substructures of C- and A-axis sapphire deformed by pyramidal and prismatic slip, respectively. The results of differential strain-rate and differential temperature tests and detailed substructure evaluation as a function of the deformation parameters (strain, strain rate, and temperature) will be used to determine the rate-controlling mechanism(s) of deformation via these non-basal slip systems in undoped sapphire. The investigation of solute (Cr3 ion, Ti3 ion, Ti4 ion, and Mg2 ion) effects and precipitate effects (Ti4 ion-rich precipitates) on the yielding and flow behavior and the dislocation substructures will be continued. The results of this program will add to the fundamental understanding of the non-basal dislocation behavior in sapphire and elucidate the reason for the insensitivity of the deformation behavior to solutes and precipitates in these non-basal slip modes.

Ultimately, with the fund of published knowledge on basal slip and the information from this program, the plastic flow behavior of sapphire in uniaxial stress states can be mapped out as a function of orientation, strain rate, and temperature.

This is a continuation of research initiated under NSF Grant DMR-74-14118.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0019, RESEARCH ON HIGH DENSITY DIAMANTANE FUELS

A. Schneider, Suntech Inc., *P.O. Box 1135, Marcus Hook, Pennsylvania* 19061 (DF462920; F33615-78-C-2037)

The objective of this program is to develop high energy density liquid and solid hydrocarbon propellants based on the structures of diamantane and triamantane.

This program involves the laboratory syntheses of potential high energy density hydrocarbon propellants based on the structures of diamantane and triamantane. The contractor will measure and report the physical properties of all new compounds, and will supply experimental samples to the government.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0020, SIGMA-PI REARRANGEMENT IN TRANSITION METAL COMPLEXES

M. Tsutsui, Texas A & M University, College Station Campus, School of Science, Dept. of Chemistry, *College Station, Texas* 77843 (A-420)

The results obtained by the studies on 'Sigma-pi Equilibria in Transition Metal Complexes' during recent few years have led us to explore broader and more general fundamental areas of transition metal complexes such as the nature of bonding and 4f and 5f elements. The X-ray diffraction analysis and X-ray photo-electron spectroscopy (ESCA) of organic derivatives of 5f elements (uranium and thorium) have revealed strong evidence of covalency in their bonding.

The two 'shake-up' satellite photopeaks observed in the U(4f) spectra probably arise from electron charge-transfer from molecular orbitals of both metal and ligand character to the corresponding anti-bonding molecular orbitals.

Satellite structures of Ln 3d5/2 photoelectron lines have been investigated for a number of diphthalocyaninatolanthanide (III) and -actinide (IV) complexes. Ligand yields shake-up satellites were not observed in Pr, Nd, and Gd complexes, while La, Ce, Th, and U complexes showed strong shake-up peaks. A new interpretation is put forward to explain the sharp variation in intensity observed throughout the lanthanide and actinide series.

SUPPORTED BY Robert A. Welch Foundation

3.0021, COMBUSTION MODELING OF SOLID PROPELLANTS

M.W. Beckstead, Brigham Young University, School of Engineering Science & Technology, Dept. of Chemical Engineering, *B-166 A S B, Provo, Utah* 84601 (DF054900; AFOSR-79-0100)

AF function - nearly all future Air Force rocket propulsion systems will use solid propellants. Deficiency - current analytical and experimental techniques are inadequate for accurate prediction and assessment of the combustion characteristics of these propellants. Objective - the objective of this research is to advance knowledge in four areas needed to understand the combustion of solid rocket propellants. These areas include diffusion flame analysis, aluminum combustion effects in double base propellants, catalyst effects in composite propellants and distributed combustion effects on propellant response function calculations. How work contributes - the results of this work will provide information needed to improve current analytical and experimental tools for predicting propellant steady and nonsteady combustion behavior and rocket motor performance.

An oxygen-methane diffusion flame burner will be built and used to collect data to assess various assumptions currently em-

ployed in application of the Burke-Schumann flame analysis to solid propellant combustion. A version of the BDP model, modified to account for double base binders, will be extended to treat aluminized propellants by incorporating a model for aluminum agglomeration. The resulting combustion model will be evaluated by examining predicted effects on burn rate, exponent, temperature sensitivity and combustion response. A version of the BDP model, modified to treat the effects of catalysts, will be evaluated against data currently available on catalyst effects on propellant combustion behavior. An aluminum agglomeration model will also be coupled to an acoustic calculation to examine distributed combustion effects on propellant response characteristics by comparing predictions with T-burner data. A steady-state model will also be evaluated in terms of its capability to predict propellant nonsteady response characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, MATERIALS SUPPORT TECHNOLOGY - CHARACTERIZATION OF ORGANIC MATERIALS

C.H. Wang, Utah Higher Education System, University of Utah, School of Science, Dept. of Chemistry, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DN323116; N00014-75-C-0908)

Organic materials, such as polymeric coatings and lubricants, are in wide Navy use, and in order to predict their reliability under a variety of conditions, it is essential to understand their characteristics, and especially their breakdown mechanisms. It is proposed in this research to study the changes of physical properties of organic materials in the vicinity of transition points, such as glass transition temperatures, and to correlate changes in these materials with their molecular properties.

Low frequency intra- and intermolecular motions of molecules in solids, liquids, and liquid crystals will be studied, using an electric field-induced Raman scattering, Brillouin scattering and other techniques. These studies will be carried out under varying conditions of temperature to observe changes near transition points.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0023, SOME ASPECTS OF FATIGUE CRACK CLOSURE IN ALPHA-BETA TITANIUM ALLOYS

C.J. Beevers, University of Birmingham, *P.O. Box 363, Birmingham, England, United Kingdom* (DF289790; AFOSR-79-0045)

AF function - research in improved, more reliable, lighter and longer lifetime air frame components. Deficiency - present methods of predicting the performance of titanium components are hindered by a lack of understanding of fatigue crack growth. Research - the aim of the proposed research is to understand the mechanics of fatigue crack growth, particularly the effects of fatigue crack closure in an alpha-beta titanium alloy. The work will consist of preparing, testing and analyzing the data from a series of one-inch-thick compact tension specimens tested over the growth rate range 10-4 to 10-2 mm/cycle and at an r ratio of 0.1. The crack extension will be monitored by optical, potential drop and compliance measurements simultaneously.

It is expected to answer the following questions: (1) What are the conditions under which fatigue crack closure occurs and what is the effect of load interaction on crack closure? (2) What is the magnitude of closure effect in terms of applied and effective stress intensity factors? (3) What is the crack growth rate relationship to both applied and effective stress intensity factors?

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, IR MINI-SCANNER MISSION EFFECTIVENESS INVESTIGATION

J.V. Weaver, Lockheed California Co., *Burbank, California* 91503 (DN081062; N62269-79-C-0348)

To establish, on a preliminary basis, the mission effectiveness of the infrared mini-scanner concept for air ASW application against current and projected threats. This work supports work unit ZU701, Agency Accession No. DN681083.

Formulate modifications to existing ASW system analysis models to include infrared line scanning sensors. Generate preliminary operational performance data for a limited scope of aircraft type, tactical system configuration and mission scenarios. Generate preliminary concepts for the integration of the mini-scanner into P-3 and S-3 aircraft and estimate the associated recurring and non-recurring costs.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

4.0002, SEARCH FOR STABLE ONE-DIMENSIONALLY CONFINED PLASMA CONFIGURATIONS

O. Buneman, Stanford University, School of Engineering, Dept of Electrical Engineering, *Stanford, California* 94305 (ENG78-01559)

The equilibrium properties of planar plasma configurations will be investigated from a theoretical and numerical point of view with the objective of determining those characteristics that result in stable configurations. Interest will focus on 'plywood' models in which current filaments in the plasma flow in different directions as one progresses through successive layers of the structure. Particular attention will be placed on the numerical methods. An effort will be made to reduce the computations needed to analyze particular structures. The analysis will include considerations of the effects of magnetic fields other than those arising from the current distribution and the effects of particles whose motion remains undetermined in the formulation.

This is a continuation of research previously supported under NSF grant ENG-7602402.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0003, RESONANT ABSORPTION AND PARAMETRIC DECAY INSTABILITIES IN LASER-GENERATED PLASMAS

P.W. Chan, Colorado State University, School of Engineering, Dept. of Electrical Engineering, *Fort Collins, Colorado* 80523 (ENG78-05894)

This program is an experimental investigation of anomalous heating of plasmas produced by irradiation of polysterene targets with carbon dioxide laser radiation. Plasma heating due to resonant absorption at oblique incidence and to the parametric decay instability are being investigated in detail. For the study of resonant absorption, the CO2 laser is split into two beams - one is used for plasma production and the other is used for plasma heating at different angles of incidence. The diagnostics include measurements of absorbed CO2 laser energy using an integrating sphere, measurement of electron and ion energy using a retarding potential energy analyzer, and determination of the spectra of resonant oscillation by incoherent scattering using a probing ruby laser beam. For the study of plasma heating via parametric decay instability, a single CO2 laser beam is used for plasma generation and heating. A probing ruby laser beam is used for scattering to observe the spectra of the electron-plasma and ion-acoustic lines. The frequency shifts of these lines can be used for positive identification of parametric decay instability. The line-widths give the damping rate and the line intensities (corresponding to growth rates), which are studied as functions of the incident laser power density. The absorbed laser energy, electron and ion energy are monitored as in the case of resonant absorption. In addition, temporal and spatial resolved holographic interferometry, Schlieren and shadowgram are employed to measure density, density scale length and electron temperature.

This is a continuation of research previously supported under NSF grant ENG-7418623.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0004, TWO-DIMENSIONAL HOLOGRAPHIC SCANNER INVESTIGATION

C.S. Ih, University of Delaware, School of Engineering, Dept. of Electrical Engineering, *Newark, Delaware* 19711 (ENG76-17987)

This research relates to the use of a single rotating multi-hologram system to provide a required two-dimensional scan automatically, and a simple means to dynamically stabilize the scanning beam. Analysis indicates that very high resolution (10 to the 7th power total resolution elements) could be achieved with scanners of moderate size and operating speed.

The program consists of analytical investigations and experimental demonstrations in the optical (visible) region. The main areas to be investigated include configurations and resolution, dynamic beam stabilization, multiplexing techniques, different wavelength operations, replication techniques, and static and dynamic demonstrations of hologram scanners. The results have application in infrared, millimeter, microwave, and ultrasonic imaging systems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0005, FUEL DUMPING BY USAF A/C

H.J. Clewell, U.S. Dept. of Defense, Air Force, Engineering & Services Center, Engineering & Services Lab., *Tyndall Air Force Base, Panama City, Florida* 32403 (DF407170)

To assess the extent and environmental impact of fuel dumping by USAF aircraft, and to determine optimal procedures for minimizing any negative impact.

Extent of AF fuel dumping will be assessed by establishment of an AF-wide fuel dump reporting system and tabulation of reports. Physical behavior of the dumped fuel will be determined through wind tunnel modeling, computer simulation, and studies of actual dumps.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0006, CODING FOR MEMORY-LESS MULTIPLE-ACCESS CHANNELS

S. Lin, University of Hawaii System, Manoa Campus, School of Engineering, Dept. of Electrical Engineering, *Bachman Hall, Honolulu, Hawaii* 96822 (ENG78-05151)

Recent developments in satellite communication systems, computer communication networks and other communication systems involving multiple users require the investigation of the problem of the simultaneous transmission of information amongst several terminals over a common communication channel. Recent research results indicate that multiple users can communicate data with arbitrarily small probability-of-error over a common memory-less channel provided that the rates for the individual data streams lie within the capacity region for the channel.

This research program is concerned with coding for a special multiple user communication channel called the memory-less multiple access communication channel. The objectives of the research are: (1) to construct good (block or trellis) codes for the memory-less multiple access communication channel; and (2) to find practical methods for encoding and decoding these codes.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0007, DESIGN AND ANALYSIS OF PERIODIC SEQUENCES

M.B. Pursley, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (ENG78-06630)

There are a number of important electronic systems engineering problems which require sets of periodic sequences with good correlation properties. Examples include multiple-access communications, synchronization, ranging, tracking, multiple-terminal system identification, and communication via multipath channels. New techniques for the selection of sets of sequences with pre-specified correlation properties are needed to solve the signal design problems associated with such applications. In addition, new methods for the analysis of sequences and the evaluation of their key correlation parameters are required for system performance analysis. The analysis and design of sequences is the subject of this research investigation.

This action renews the research project presently supported under NSF Grant ENG75-22621.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0008, UNSTEADY TRANSONIC FLOW WITH HEAT ADDITION

M. Sichel, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (ENG76-23982)

Two problems in unsteady transonic flow will be analyzed: 1) to explore the possibility of using similarity series to solve the transonic equations with heating accounting for the existence of shock waves or exothermic discontinuities; 2) to develop a dynamic model of oscillatory condensation for flow where the characteristic reaction or condensation time is much smaller than the characteristic unsteady flow time.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0009, CARRIER TRANSPORT IN HETEROJUNCTION DEVICES

E.S. Yang, Columbia University, School of Engineering & Applied Science, Dept. of Electrical Engineering, *Broadway & W. 116th St., New York, New York* 10027 (ENG78-19426)

Electronic properties of heterojunctions and heterostructure semiconductor devices are being investigated as part of an electronic device program. The special areas of research include (1) carrier transport in p-N and p-P heterojunctions, (2) carrier confinement and leakage, and (3) current-voltage characteristics of double-heterostructure devices. The work centers on device operating conditions dominated by radiative recombination effects and provides calculations and/or experimental observations of current-threshold and current-voltage properties of heterojunction structures. Experimental and theoretical work is being performed with devices fabricated in the Columbia University laboratory and with developmental devices available from industrial research organizations.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0010, MAGNETOELASTIC RAYLEIGH WAVES

G.L. Thomas, State University of New York, Stony Brook Campus, School of Engineering & Applied Science, Dept. of Electrical Engineering, *Stony Brook, New York* 11794 (ENG77-12151)

An experimental and theoretical study of magnetoelastic surface waves will be undertaken. The specific areas to be investigated include: (1) propagation characteristics of magnetoelastic Rayleigh waves (MERWs) for varying cuts of yttrium iron garnet (YIG) discs and films and varying propagative and bias field directions for frequencies extending to above one gigahertz; (2) the role played by magnetic domains in observed propagation and excitation properties of MERWs; (3) characteristics of recently observed magneto-acoustic volume-like modes in YIG discs and films; (4) tunability properties of MERW reso-

nators; and (5) design of MERWs on bulk substrates and thin films of strongly magnetostrictive rare earth-iron compounds.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0011, BACK-SCATTER/FORWARD-SCATTER/TERRAIN SCATTER RELATIONS

R.J. Papa, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF904630)

AF function - surveillance. Deficiency/opportunity - existing surveillance radar systems have difficulty in estimating the height of low flying aircraft and do not optimize the overall performance capability of the radar. Objective - to predict radar multipath returns over a real earth from a causal relation between back scatter and forward scatter returns and other site-dependent data. Also, to improve existing multipath models for specular and diffuse scattering. How research contributes - improved multipath models will yield more accurate determination of the positions of aircraft and improve a radar system's performance in a more cost-effective fashion. The results of these investigations will be applied to several radar sites along the DEW line (project Seek Frost).

Utilize existing models of scattering from random, rough surfaces and correlate theoretical and computer models with experimental data. Types of terrain and sea states will be delineated for which an accurate theoretical model exists, capable of giving a causal relationship between the forward scattering (multipath) and back scatter (clutter). Theoretical and computer models will be extended to include the effects of terrain screening, shadowing and multiple scattering, and these models will be compared with experimental data taken under contract. The types of terrain to be investigated will be selected from several sites along the DEW line.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0012, SUMMER FACULTY FELLOWSHIP PROGRAM IN ENGINEERING SYSTEMS DESIGN

E.G. Abu Saba, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Architectural Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NGT 34-012-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0013, DISTRIBUTED DIGITAL CONTROL OF MANIPULATOR SYSTEMS

W.E. Snyder, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Electrical Engineering, *Raleigh, North Carolina* 27607 (ENG77-06771 A01)

This research examines the problem of controlling a coordinated system of mechanical actuators by means of a distributed network of digital processors, one processor for each actuator. In order to realize such a system, two problems, the control theory problem and the networking problem, will be investigated. To have independent, identical processors, control algorithms will be designed that are capable of estimating load parameters in real-time. Second, in order to achieve coordinated motion, techniques will be devised to permit the various controllers to communicate. This is a distributed processing problem seeking to use microprocessors to control a general purpose manipulator.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0014, TURBINE ENGINE COMBUSTION TECHNOLOGY

R.P. Bradley, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF462060)

Quantify the effects of fuel character variation on current combustion systems and examine methods of reducing these effects. Determine the benefits of main burner and after-burner catalytic combustion. Evaluate non-perturbing instrumentation to measure temperature and specie concentration within practical combustion devices.

Conduct combustor rig tests in RM 20 using the F101, catalytic combustor, and combustion tunnel and conduct afterburner tests in C-stand using the J85. Vary fuel properties, test conditions, and hardware configurations while measuring emissions, temperatures, pattern factors and performance parameters using conventional and in-situ techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0015, HIGH SPEED INSTRUMENTATION FOR GENERATOR TEST FACILITY

E.J. Caputo, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458970)

Complete the AFAPL generator test facility by providing a data acquisition and control system with the following capabilities: (1) sufficient acquisition speed to characterize aircraft electrical system transient performance, (2) storage of all performance-related test data, (3) short time playback and analysis capability, (4) complete automation, and (5) engine-start simulation.

Design system and procure and integrate all necessary components to accomplish objective. System will be composed at a MODCOMP II computer, a high density digital tape drive, 18 10-microsecond conversion A/D converters, and necessary interfacing and control circuitry. The MODCOMP II will be a satellite in the AFAPL computer network.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0016, TURBOMACHINERY FLUID MECHANICS

Wennerstrom, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458780)

The objective of this task is to contribute to the aerodynamic technology required to design turbomachinery of low aspect ratio and high stage loading. This is fundamental to reducing the manufacturing and maintenance costs and improving the mechanical integrity of aircraft turbine engines.

The approach involves three parallel lines of effort: (a) analytical methods are being upgraded to include three-dimensional and time-unsteady effects, (b) data are being obtained through controlled experiments and advanced instrumentation, better defining three-dimensional and time-unsteady features of the turbomachinery gas path, and (c) design innovations such as splitter vanes, vortex generators for boundary-layer control, etc. are being experimentally evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0017, CATHODOLUMINESCENCE STUDIES OF AMPHOTERIC DOPANTS IN GAAS

Y.S. Park, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF117470)

The objective of this program is to attain a knowledge of the behavior of amphoteric dopants in epitaxial and semi-insulating GaAs with the goal of obtaining a better understanding of the thermal conversion of semi-insulating GaAs.

The work will utilize cathodoluminescence and Hall measurements as the principal techniques to analyze the characteristics of ion-implanted epitaxial and semi-insulating GaAs substrates. The behavior of amphoteric dopants such as Si or C will be studied by implantation into GaAs in order to elucidate the in- or out-diffusion mechanism and changes in the lattice location of amphoteric impurities. The effect of fabrication parameters on dopant type will be assessed. Samples will be prepared under differing implantation conditions in both semi-insulating GaAs and GaAs epi-layers. Parameters such as dose rate, target temperature, surface-encapsulants, and annealing conditions will be varied in preparation of the samples. Dual implantation will also be performed to determine conditions which produce N- or

P-type activity in GaAs. Comparison of luminescence results with Hall results should provide considerable insight into the effect of implant and annealing conditions on the behavior of amphoteric dopants implanted in GaAs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0018, TURBULENT FLOW RESEARCH
J.H. Lee, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143170)

Turbulence is an unsolved problem in fluid mechanics, yet one confronts it in many types of aerodynamic work. For this reason, a long-range research program has been instituted to understand the basic mechanics of turbulence and thereby develop new techniques that can be implemented to effectively solve the engineering type of shear flows such as turbulent jets and boundary-layer flows. A particular emphasis is placed on the aerodynamic/structural interaction problems in which the turbulent fluid motion brings about random excitation to part of the aircraft structure or the entire aircraft, thereby affecting the flight dynamics.

The rigorous treatment of turbulence involves analysis of the Navier-Stokes equations using statistical mechanics, random process techniques, stochastic simulation, and model approaches of constructing dynamic equations which share certain features of the Navier-Stokes equations. Probabilistic techniques are used to deal with the structural response excited by random aerodynamic fields. Important parameters are the statistical mean and variance, and power spectral density of the random variables.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0019, ESTIMATION OF AERODYNAMIC FORCES AND MOMENTS FOR MISSILES
F.M. Sawyer, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144530)

This work unit supports TP03, Flight Control, and specific goal FG04A2, Flight Control System Design Techniques. The problem area is the accurate determination of aerodynamic stability and control characteristics for missiles during the design phase. The objective is to systematically compare the results obtained from current missile computer programs with wind tunnel data for selected missile configurations. Results of this study will enable assessment of the accuracy of the various existing methods and will provide a basis for selection of the most promising approach for future program development.

Several existing computer programs will be used to predict the aerodynamic characteristics for circular and elliptical cross-section missile configurations. These results will be systematically compared with wind tunnel data to assess numerical accuracy. The computational techniques will also be compared to identify relative strengths and weaknesses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0020, INTERFACE HARDWARE DESIGN CONSTRUCTION AND MAINTENANCE
R. Trapani, Trapani Engineering Inc., *Berwyn, Pennsylvania* 19312 (DN081318; N62269-79-C-0059)

To design and construct various items of interface hardware for the Basic Configuration No. 1 laboratory effort. To provide maintenance support for various items of interface hardware.

To procure from the original manufacturer of several of GFE interface hardware the services and material necessary to perform above objective.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0021, PHOTOREFRACTIVE PROCESSES FOR OPTICAL STORAGE AND DISPLAY
C.M. Kim, Rice University, School of Engineering, Dept. of Electrical Engineering, *6100 Main St., Houston, Texas* 77001 (ENG76-15006)

This program will examine holographic data storage and display in photorefractive materials. The thrust will be two-fold: (1) theoretical and experimental investigation of the physical processes and relevant crystal properties responsible for the photorefractive effect and the limitations imposed by them on desired device parameters, and (2) preparation of crystals with optimal properties and investigation of convenient techniques for the development of optical memory devices with predictable and desired characteristics. The crystals to be investigated include several transition metal-doped ferroelectrics. Characteristics of drift and photogenerated space charge fields in the crystals will be examined using holographic, photoelectronic, and chemical measurement techniques.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0022, SUMMER FACULTY FELLOWSHIP PROGRAM IN ENGINEERING SYSTEMS DESIGN
D.J. Norton, Texas A & M University, College Station Campus, School of Engineering, Dept. of Aerospace Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NGT 44-001-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0023, ION AND ELECTRON CYCLOTRON PLASMA WAVE STUDIES
J.E. Scharer, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Electrical Engineering, *Madison, Wisconsin* 53706 (ENG75-19259 A01)

Theoretical and experimental studies of wave effects in magnetoplasmas will be conducted. The program will emphasize wave propagation and heating in the ion cyclotron range of frequencies and nonlinear processes excited by electron cyclotron waves. The objectives of the research are: 1) To obtain a solution to the fast Alfven wave mode conversion problem for multiple ion species plasmas and to assess potential advantages and disadvantages of this process for plasma heating. 2) To determine propagation characteristics and absorption processes for the mode-converted slow wave. 3) To examine the fast wave heating problem for larger Tokamaks where many eigenmodes exist within the absorption Q for a single eigenmode. 4) To conduct experiments to observe and model mode conversion and nonlinear electron cyclotron wave processes in a two-ion plasma.

This is a continuation of research previously supported under NSF grant ENG-7519259.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, SEASAT PROGRAM - USE OF SEASAT DATA TO INVESTIGATE CONNECTIONS BETWEEN SEA-SURFACE TEMPERATURES AND METEOROLOGICAL FACTORS
S.A. Bowling, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (7-925; MO-A01-78-00-4321)

OBJECTIVE: The use of SEASAT-A SMMR sea-surface temperature and wind speed data to examine the immediate effect of meteorological events, especially cyclone passages on sea-surface temperatures in the Gulf of Alaska/Aleutian area.

APPROACH: The SMMR data will be processed by differencing of temperatures obtained at different times to obtain

maps of cooling/heating rates, which will then be compared both with SMMR-derived wind speeds and with conventional meteorological data. Conventional meteorologial data will be used to select three periods during winter 1978-79, during fall, mid-winter and early spring. SMMR geophysical data tapes will be obtained during these periods, as well as IR imagery, if available. Major emphasis will be on patterns of temperature change relative to the positions of major meteorological features, and identification of those which are consistent enough to have a high probability of being real.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0002, CARBON-14 FLUCTUATIONS IN THE ENVIRONMENT OF EARTH AND ATMOSPHERE
P.E. Damon, University of Arizona, School of Earth Sciences, Dept. of Geochemistry, *Tucson, Arizona* 85721 (EAR78-21813)

This is a continuation of NSF grant EAR74-13362 to continue investigations of 14C fluctuations and their causes. Long-term fluctuations in 14C production will be examined by analysis of the oldest bristlecone wood and other suitable material. Short-term 14C fluctuations of dated material from the Medieval Warm Epoch (AD 1150 to AD 1250) will be investigated to determine 14C atmospheric variations related to climate change. Previous analyses of bristlecone material that were significantly discordant with respect to adjacent material will be repeated. A model of the relationship between geomagnetic excursions, reversals plus other changes in the Earth's dipole moment, and 14C variations will be constructed. This will be used to calculate the effect of industrial additions of CO2 to the atmosphere. In addition, the work will evaluate relationships between 14C, climate and solar constant by study of the bristlecone data.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0003, MEASUREMENTS OF CONTINUOUS ABSORPTION BY ATMOSPHERIC TRANSMISSION CODES
D.E. Burch, Ford Aerospace & Communications Corp., *Ford Rd., Newport Beach, California* 92663 (DF582430; F19628-79-C-0041)

AF function - surveillance satellite, meteorological satellite. Deficiency - lack of knowledge of infrared absorption properties of the atmosphere. Objective - conduct laboratory measurements of water vapor and other atmospheric gases in the 20-30 micrometers, 2.7 micrometers, 6.3 micrometers and in the 3-5 micrometers and 10 micrometers window regions. How research contributes - atmospheric molecular absorption primarily by water vapor is being studied in order to provide fundamental spectroscopic data for inclusion in atmospheric transmission codes.

Laboratory measurements of absorption by various atmospheric gases with emphasis on the continuum or line wing component will be made in order to provide direct input data in the AFGL standard atmospheric transmission codes. Emphasis will be placed on the measurements and analysis in the spectral regions containing significant contributions from line wings or continuum absorption.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0004, DESIGN FABRICATION AND ENGINEERING SUPPORT OF ATTITUDE-CONTROL SYSTEMS
S.D. Lyon, Space Vector Corp., *Northridge, California* (DF248830; F19628-77-C-0251)

AF function - direct support of SAMSO infrared measurements program. Deficiency - lack of knowledge of rocket attitude-control and behavior. Objective - to provide the Air Force with a reliable, accurate, and low-cost attitude-control system (ACS) for ARIES sounding rockets. How research contributes - provides rocket-borne payloads with sufficiently accurate attitude-control for probing the infrared aerospace environment.

Develop and fabricate a state-of-the-art, highly accurate attitude-control system for the ARIES rocket.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0005, DEVELOPMENT OF INSTRUMENTATION FOR MONITORING CARBON FIBER EMISSIONS
S. Pollack, Thompson Ramo Wooldridge Inc., Defense & Space Systems Group, *1 Space Park, Redondo Beach, California* 90278 (68-02-3273; G712B-BE-021)

OBJECTIVE: The objective of the work is to develop prototype instrumentation for monitoring carbon fiber emissions.

APPROACH: Existing carbon fiber measuring equipment will be evaluated for application to continuous monitoring of carbon fiber emissions. Equipment(s) and modifications will be recommended for the monitor, and a prototype system will be fabricated and evaluated.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0006, SIERRA CLOUD LIQUID
J. Snider, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (RAA7 72 47)

PROJECT OBJECTIVE: To participate in sponsor's winter 1979-80 cloud seeding program. To obtain data to help assess ability of microwave radiometry to measure liquid water content in clouds.

CURRENT YEAR PLAN: Operate 28 GHz satellite receiver-radiometer during the December-February 1979-80 Sierra Cooperative Pilot Program at a location near Auburn, CA, to measure cloud liquid water content. Compare liquid measured by receiver-radiometer with data taken by probe-carrying aircraft.

SUPPORTED BY U.S. Dept. of the Interior, Water & Power Resources Service

5.0007, SEISMIC OBSERVATORIES
H. Whitcomb, U.S. Dept. of the Interior, Geological Survey, Branch of Global Seismology, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9920-01193)

STATES/COUNTRIES TO WHICH PROJECT PERTAINS: Washington, Guam, Puerto Rico, Alaska.

The GS operates and maintains a national and world-wide network of observing and reporting systems. Included are facilities and systems for describing, mapping and charting the earth, utilizing seismological and geomagnetic science and technology, and conducting related research and development. Observatories supported by this project are located at Newport, Washington; Cayey, Puerto Rico; Agana, Guam; and Adak, Alaska. These observatories provide seismological data which are used to describe the occurrence of earthquakes and their effects on lives and property, and to monitor and record vibrations in the earth caused by earthquakes and large man-made disturbances. Also, observatories at Guam and Newport, Washington provide input on a 24-hour standby basis to the Tsunami Warning Service operated by NOAA in Honolulu. The data produced contribute to a better understanding of the earth's crust, mantle, and core, and of the nature of seismic hazards and risk. Magnetic data are used to update periodically regional and world magnetic charts, and to determine correction factors applicable to magnetic field measurements made by land, marine, and airborne magnetic survey parties. Additionally, this information supports studies in ionospheric physics, radio propagation phenomena, electrical conductivity, the composition of the core and mantle of the earth, and interplanetary space. Knowledge of magnetic declination and its secular change is required as input to the compilation of all sea and air navigation charts for use by marine and aircraft navigators and by public and private surveyors.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0008, ION MICROPROBE ANALYSES OF FELDSPARS AND UPPER-MANTLE MINERALS

J.V. Smith, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (EAR77-27100)

This project concerns the continued development of ion microprobe trace element analyses and the application of these techniques to the analysis of peridotite nodules from kimberlites, kimberlite groundmass, and the analysis of lithium, beryllium and boron in feldspars.

The peridotites to be studied are the MARID (mica-amphibole-rutile-ilmenite-diopside) suites which have already been characterized in detail petrographically and analytically by electron microprobe for major elements and certain trace elements. This part of the study is of particular interest to the development of models for mag generation in the upper mantle.

Light element analysis will be performed on feldspars from a wide range of environments (authigenic, pegmatitic, granitic, and anorthositic) to determine elemental fractionation under varying conditions. Li, Be, and B are of particular interest because they cannot be determined by electron microprobe methods.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0009, REMOTE SENSING FOR SOIL SURVEY AND EROSION STUDIES

M.F. Baumgardner, Purdue University, Agricultural Experiment Station, Dept. of Agronomy, *Executive Bldg., West Lafayette, Indiana* 47907 (0008923; IND050020)

OBJECTIVE: Determine quantitatively the relationships between soil radiance and the physico-chemical properties of soils; delineate and map soil differences by digital analysis of multispectral data from air and spacecraft scanners; use digital analysis of multispectral data to prepare soil erosion maps.

APPROACH: The relationships between the radiance (-.48-2.40Mum) characteristics and numerous physical/chemical properties of a broad range of soils will be studied. Computer-implemented pattern recognition techniques, supplemented with field observations, will be used to analyze multispectral data from air and spacecraft scanners to delineate soil boundaries and map meaningful soil differences, including severity of erosion.

PROGRESS: The major long range goal of this research is the development of an advanced global information system for agriculture which integrates the new technologies of data acquisition, data analysis, and communications, or information dissemination. During the project period exploration of the information requirements of a global information system has continued. Specific research has been concentrated on defining quantitatively the relationships between soil reflectance and other physical/chemical properties of soils. This SCS-LARS cooperative research includes the study of duplicate samples of 250 major soil series selected to provide adequate statistical sampling from seventeen climatic regions of the U.S. Results of this study will make a significant contribution to the body of knowledge related to the contributions which different soil constituents make to soil spectral characteristics. With SCS participation, digital analysis of LANDSAT data has provided the principal data base for a detailed soil survey of Jasper County, Indiana. A false color image at a scale of 1:125,000 was used as a base map on which to delineate parent material boundaries. With these digitized boundaries overlaid onto LANDSAT spectral data, a soil map was produced spectrally at a scale of 1:15,840. A detailed description of each map unit has been prepared for publication with the spectral maps. This constitutes the first county to be mapped in detail using digital analysis of LANDSAT data.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Indiana

5.0010, OCEANOGRAPHIC INSTRUMENTATION - TESTING

E.M. Russin, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey, Office of Marine Technology, *Rockville, Maryland* 20852

TECHNICAL OBJECTIVE: To improve marine measurements made by NOAA and all sectors of the oceanographic community (private, academic, government) through a continuing research and development program of testing and evaluation of marine instrumentation. The program results are available through NOAA to the entire marine community.

APPROACH: Test and evaluate instruments used for the collection of physical, chemical, and biological data used for research and survey of the deep ocean, coastal waters, and estuaries. Maintain a laboratory to simulate the ocean environment. Analyze instrument failure modes for reliability assessment. Encourage the development of new sensors and testing techniques/methods unique to marine instruments and provide analysis of the quality for instrumental measurements. Disseminate results in comprehensive technical reports.

CURRENT PLANS: The FY '79 program includes providing lab/field performance and data quality information on marine instrumentation to measure water level, current speed and direction, conductivity, temperature, wave height and direction, water bottom depth, dissolved oxygen and nutrient-concentration to support NOS' involvement in the Tides and Tidal Currents Program, DOE's Strategic Petroleum Reserve Program, Wave Monitoring Project, Hydrographic Survey Systems, Ocean Dumping Program, and EPA's Pass-Thru Program. T&EL support is also planned for NOAA/NASA's Laser Hydrography experiments and OCEANAV/NORDA's T&E Program.

SUPPORTED BY U.S. Dept. of Commerce, National Ocean Survey, Office of Marine Technology

5.0011, ENERGETIC PROTON DELAY FROM SOLAR RADIO BURSTS

P.M. Bakshi, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Physics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF583490; F19628-79-C-0084)

AF function - communication and surveillance. Deficiency -capability of accurately predicting time of arrival of solar flare emitted particles does not exist. Objective - to investigate the delay of solar flare energetic particles by means of associated solar radio burst observations. How research contributes - will provide a knowledge of the delay characteristics of energetic solar flare particles to establish prediction techniques for the incidence of solar-related disruptive influences on HF communications, OTH radars, and satellite communication systems.

The correlation between solar radio bursts and the propagation of energetic particles from the sun to the earth will be studied by consideration of such parameters as the burst peak radio flux spectral width (W3/W2), the time development of the radio burst spectral shape, the flare/burst position on the sun, the flare/burst flash phase rise time, and the particle pitch angle distribution.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, INTERFEROGRAM DATA ACQUISITION SYSTEM FOR BALLOON-BORNE CRYOGENIC INTERFEROMETER

J.L. Pritchard, Idealab Inc., *Union St., Franklin, Massachusetts* 02038 (DF248480; F19628-77-C-0039)

AF function - surveillance, advanced infrared detection system. Deficiency - lack of high-resolution data of stratospheric emittance in infrared. Objective - to acquire and handle interferogram signal from cryogenically operated interferometer in balloon-borne environment. How research contributes - an instrument sensitive enough to measure stratospheric emission will be made ready for a balloon-borne operation.

A system for acquiring and handling an interferogram signal from a cryogenically operated high-resolution IR interferometer will be designed and fabricated. Tests for interfacing will be conducted to see whether the full sensitivity of the instrument will be achieved to insure a detection of the stratospheric emission for a proposed balloon-borne experiment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, SCATHA INSTRUMENTS

B.F. Sellers, Panametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DF242880; F19628-74-C-0217)

AF function - communications and reconnaissance. Deficiency -unknown cause of erratic system performance. Research - develop instrument to measure electron and proton fluxes in .05-300 keV energy range. How research contributes - this instrument will be used in the SCATHA satellite as one of a number of sensors intended to define the particle and field environment at synchronous orbit and its effect on satellite performance. It involves the design and testing of feasibility models and the fabrication of flight instruments and associated GSE. Instrument will feature maximization of information and minimization of weight, power requirements and telemetry demands.

The rapid-scan instruments designed for the SCATHA satellite must be shielded against energetic electrons. Appropriate electronic components are to be shielded as well as experimental testing of the detector response to background.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, RAPID SCAN PARTICLE DETECTOR DATA INTERPRETATION

B.F. Sellers, Panametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DF582720; F19628-79-C-0099)

AF function - communication, navigation and command. Deficiency -the data base of the high energy plasma present at synchronous orbit is inadequate to accurately describe observed charging events or to properly relate them to their ultimate cause. Objective - to operate the rapid scan spectrometer at synchronous altitudes and interpret the data returned. How research contributes - data from the rapid scan spectrometer once analyzed and interpreted will provide increased understanding of the geosynchronous plasma environment and its role in spacecraft charging.

The rapid scan particle spectrometer will be operated at the geosynchronous orbit in conjunction with the other instruments on board the SCATHA satellite. The returned data will be analyzed and interpreted to provide definitive answers as to the plasma environment at the geosynchronous orbit as a function of geomagnetic activity, the effect of the plasma on spacecraft charging, and the response of the plasma to beam operations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, SATELLITE DATA PROCESSING AND ANALYSIS

R.W. Fioretti, R D P Inc., *Waltham, Massachusetts* 02154 (DF247630; F19628-76-C-0244)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be accurately predicted. Research - direct density measurements with satellite-borne accelerometers. Results are correlated with solar-geophysical parameters and other experiments. How research contributes -permits accurate determination of Air Force satellite ephemerides.

A SETA accelerometer is to be flown on Air Force satellites. This instrument permits high accuracy, high resolution atmospheric density measurements. Telemetry data from all the experiments will be provided on tape. The raw SETA data will consist mainly of drag accelerations which are proportional to density and accelerations due to vehicle motions caused by thrusting. Digital filtering methods are used to determine those accelerations due to drag. Density is calculated directly from the drag data. These results are used to accurately determine the orbit of the satellite. In addition, the density results are used to develop accurate atmospheric models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, DEVELOP INSTRUMENTATION AND TECHNIQUES FOR STRATOSPHERIC ION COMPOSITION MEASUREMENTS

A.D. Bailey, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581130)

AF function - military operations of supersonic aircraft and other vehicles in the stratosphere. Deficiency - the environmental effects of AF stratospheric operations cannot be accurately predicted for lack of knowledge of normal species concentrations and their spatial and temporal variations. Further, the mixing properties and chemical interactions of jet engines or missile effluents are only poorly defined. Objective - develop and flight-test a viable balloon-borne mass spectrometer system and techniques to determine the ionic composition and electrochemistry of the stratosphere, and conduct an initial measurements effect. How research contributes - ions may be effective sinks for pollutants by serving as condensation nuclei which could aglomerate stratospheric pollutants, forming aerosols which subsequently fall from the stratosphere into the troposphere to be washed out. Payoff could lessen restrictions on Air Force operations.

A cryo-pumped ion mass spectrometer will be designed and developed for balloon-borne measurements of positive and negative ions under both ambient and artificially excited conditions. Extensive laboratory evaluation testing will be conducted, including laboratory experiments with cluster ions to identify charge transfer reactions that alter the ion composition of the stratosphere. A theoretical study of ambient ion masses will be made to guide programming of the ion mass spectrometer measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, LIDAR MEASUREMENTS OF ATMOSPHERIC DENSITY

D.E. Bedo, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582840)

AF function - vehicle tracking, RV trajectory prediction, interception. Deficiency - insufficient information on a timely basis of the atmospheric density and variations in density at altitudes below 30 kilometers as is required for advanced reentry systems. Objective - the design, development and fabrication of a satellite-borne laser radar (LIDAR) system capable of providing near real-time remote density measurements at stratospheric altitudes and below. How research contributes - the satellite LIDAR system will probe the lower atmosphere and provide near real-time measurements of the atmospheric density at altitudes below 30 kilometers. Such data are of value to the Air Weather Service in support of strategic missile systems and in the development of low altitude density and weather prediction techniques.

The LIDAR system to be developed will be based on the detection of Rayleigh scattered laser light using a satellite-based transmitter and receiver. The hardened laser will be operated in a pulsed mode with power and repetition frequency determined by mission requirements and specific spacecraft capabilities. The LIDAR design will be compatible with an altitude resolution of one kilometer and absolute accuracy of better than 15 percent in the determination of density. Gating and timing circuitry will restrict the observations to altitudes below 30 kilometers. In addition to density determinations, the scattered signal will provide information on aerosol distributions within the probed regions and will allow deduction of the atmospheric transmission from the satellite to the ground.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, SHAPE AND STRESS ANALYSIS OF NATURAL SHAPE BALLOONS

J.F. Dwyer, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582770)

AF function - advanced balloon system (surveillance, delivery, operations, environmental research support and space equipment test). Deficiency - procedures, adequate for the design of natural shape balloons and the analysis of critical off-

design load/altitude conditions, do not exist. Objective - a general computer code for the generation of natural shape balloon designs and the analysis of such balloons under representative flight conditions will be written and demonstrated for selected practical problems. How research contributes -this computer code will enable rapid evaluation of balloon requirements for proposed efforts including the advantages and disadvantages of system options. Further it will provide a means to evaluate proposed balloon design criteria changes.

A computer code written for the design of natural shape balloons, and using the Runge-Kutta numerical technique, will be modified to provide natural shape balloon designs based upon payload altitude and duration requirements. Rigging weight, recovery parachute weight, and ballast weight modelling codes will be included. The partially inflated ascent deployment configuration of natural shape balloon envelopes will be modelled using the Runge-Kutta or a finite difference method and the entire program tested on existing design shapes and a representative number of selected cases related to known operational problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, INSTRUMENTATION FOR DEKAMETRIC SOLAR-BURST-DISK LOCATION

D.N. Gaunt, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580850)

AF function - communications and surveillance. Deficiency - at present, burst disk location, an essential element of geophysical prediction, is obtained solely from optical observations, which are sometimes obscured by weather. Objective - to develop the techniques and instrumentation for determining burst disk position from interferometric observations. How research contributes - determination of burst disk position and motion will be helpful in understanding the phenomena and in predicting the travel path of solar energetic particles toward the earth.

Produce a data processing system which will generate a continuous, real-time (seconds) measurement of the position of a radioactive area from data presently available from an existing sweep frequency interferometer. The technique used will measure the displacement of the phase difference of signals (received from the two antennas of the interferometer) from that of a theoretical signal from the center of the sun and convert this to angular displacement which will determine position.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, RAPID SCAN PARTICLE SPECTROMETER DATA ANALYSIS

D.A. Hardy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583220)

AF function - AF satellite systems operate at synchronous altitudes where charging can occur due to natural causes and may give rise to effects deleterious to the systems. Deficiency - the data base of the high energy plasma present at synchronous orbit is inadequate to accurately describe observed charging events or to properly relate them to their ultimate cause. Objective - to analyze and interpret data from the rapid scan particle spectrometer in conjunction with data from other experiments on the SCATHA satellite. How research contributes - data from the rapid scan particle spectrometer will provide specification of the geosynchronous plasma environment and its relationship to spacecraft charging.

The data from the rapid scan particle spectrometer will be analyzed to provide specification of the electron and ion characteristics at the orbit of the SCATHA satellite, to determine the relationship between the plasma characteristic and the degree of satellite charging, to provide input for the verification of spacecraft charging codes and to aid in the determination of active control methods for spacecraft charging.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, AUTOMATED AVIATION WEATHER PREDICTION

B.A. Kunkel, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582990)

AF function - launch and recovery of military aircraft. Deficiency - lack of timely, automated methods of short range prediction of aviation-critical weather parameters. Objective - to investigate the characteristics of aviation-critical weather parameters such as slant range visibility, low-level wind shear and cloud base height, and to develop and evaluate statistically-based objective techniques which predict their behavior over periods ranging from 0 to 3 hours. How development contributes - the launch and recovery of military aircraft will be less hazardous and more effective, given improved predictions of aviation-critical weather parameters.

Weather data being gathered at the Otis AFB weather test facility (WTF) will be subjected to an extended analysis to determine the temporal and spatial characteristics of slant range visibility, as defined by a multiple sensor array of forward scatter meters (FSM) and transmissometers in a simulated landing zone and from remote towers. Using multivariate statistical methods, such as regression estimation of event probabilities, short range prediction experiments, initially carried out under task 667010, will be extended to consider the additive contribution of multiple FSM and transmissometer measurements. Consider the additive contribution of multiple FSM and transmissometer measurements. Cloud-base height observations will be gathered for a period of one year from an array of three automated rotating beam ceilometers (RBCs) located at the WTF and near an active runway at Otis AFB. An assessment of the representativeness of closely-spaced RBCs observations to automatically specify the required cloud parameters of total sky cover, cloud layer amounts and ceiling will be made. The development and testing of techniques of forecasting baseline cloud base height (or ceiling if appropriate) will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, TOP-SIDE IONOSPHERE MEASUREMENTS OF LOW ENERGY

R.C. Sagalyn, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580770)

AF function - surveillance, communications, navigation and ionospheric modelling. Objective - develop instrument for monitoring ion and electron densities, temperature and scale height in the top-side ionosphere to be used as inputs for ionospheric models. How research contributes - permits improved space communications, frequency management and surveillance at HF and UHF frequencies.

The satellite experiments will be designed, fabricated, tested and integrated in the DMSP satellite. Software programs will be developed to operate on GWC UNIVAC for rapid transmittal to AWS Ionosphere Predictions Program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, EVALUATION OF DMSP WATER VAPOR RADIANCES

F.R. Valovcin, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583100)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - inability to determine meteorological variables over inaccessible or unfriendly territory. Objective - to recommend operational techniques to derive moisture parameters from DMSP radiance measurements. How research contributes - water vapor obtained from satellite radiance measurements as input into AFGWC's Objective Analysis Program, cloud model, 3DNEPH and numerical forecasting model should provide an improvement in the analysis and forecasting of meteorological variables for AF tactical and strategic operations, weapons and surveillance systems.

DMSP water vapor radiances (emissions) will be correlated with ground truth measurements from polar to equatorial re-

gions and for different seasons. In addition, comparisons of calculations with observed water vapor radiances will be made. Progress - new in-house work unit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, UV ELECTRON AND PROTON FLUX MEASUREMENTS IN THE AURORAL E LAYER

R.A. Van Tassel, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584090)

AF function - trans-ionospheric ranging and communications, remote ionospheric monitoring. Deficiency - present state-of-the-art in relating natural optical emission to the electron density profile is not understood well enough to permit remote satellite monitoring of the auroral oval. Objective - in situ measurements with rockets of UV, electron and proton fluxes. How research contributes - provides direct measurements of atmospheric parameters to correlate with other measurements and computer codes being generated in the auroral E program.

The approach is to use sounding rockets to measure the following parameters in the auroral E layer - 1) electron flux and differential energy distributions from 1 eV to 20 keV, 2) proton flux and differential energy distributions from 5 keV to 60 keV, and 3) volume emission rates and total column emission rates from atomic oxygen at 5577 angstroms, 2972 angstroms and 1356 angstroms, from neutral nitrogen in the LBH bands and 2nd positive bands, from ionized nitrogen at 3914 angstroms, from hydrogen beta at 4861 angstroms, and from the nitrogen dioxide continuum around 5070 angstroms. All of the measurements will be made from a single rocket payload in the altitude range between 90 and 180 km.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, ALTITUDE PROFILE OF NEUTRAL THERMOSPHERIC COMPOSITION AND DYNAMICS

W.K. Vickery, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF248950)

AF function - operate missiles and satellites in and through the upper atmosphere. Opportunity - the DMSP supplementary sensor density package (SSD) requires calibration in order to assure accurate global measurements of atmospheric density. Objective - measure the density profile of major neutral atmospheric species with near-simultaneous measurements of the dynamical structure of the region between 90 and 180 kilometers. How research contributes - provides profile of major neutral species, turbopause altitude and thermospheric temperature profile needed as inputs for the calibration of the DMSP(SSD) package.

Each set of measurements involves two rocket payloads. One payload contains a specially designed neutral mass spectrometer to measure the density of each of the major atmospheric species. The other will dispense a vapor trail for dynamics measurements (including eddy diffusion coefficients, molecular diffusion and turbopause altitude data and temperature measurements). These measurements are combined with measurements of solar UV absorption, electron energy distribution and airglow radiation for a set of essential inputs to support the SSD calibration. The data are collected from the mass spectrometer by telemetry and reduced in terms of the neutral species distribution. Atmospheric dynamics parameters are determined from analysis of time-lapse photographs of vapor trails yielding wind, wind shear and temperature profiles, diffusion coefficients, and indirectly, total neutral density. Two sets of measurements are planned, one in FY79, a second in FY80.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, SIGNAL STATISTICS OF INTENSE SCINTILLATIONS

H.E. Whitney, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580930)

AF function - satellite communications. Deficiency - inadequate knowledge of the effects of ionospheric scintillations on trans-ionospheric radio propagation. Objective - study the signal characteristics of intense scintillation and relate the effects of the propagation path to the performance of satellite communication systems. How research contributes - with a better knowledge of the degradation that can be expected on the communications path from scintillations, mitigating techniques can be implemented to improve the reliability of satellite communications.

The data recorded in Peru during October 1976 and March 1977 on intense scintillations will be computer-processed to provide the required signal statistics. Additional testing will be done in March 1978 to expand the data base on equatorial scintillations. Data from three closely spaced receiving sites will be used to determine the spatial correlation and the feasibility of space diversity for AFSATCOM. Power spectra from ground station data will be compared to aircraft data to determine the effects of the planes' velocity on the scintillation rate. The basic analysis for signal statistics was developed under in-house work unit 46430103 and the work unit is an extension of that effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, SATELLITE INSTRUMENTATION FOR HIGH ENERGY PARTICLES

G.K. Yates, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580070)

AF function - navigation, communication and surveillance. Deficiency - inaccurate environmental specification for hardness of microelectronic components will result in insufficient criteria for military satellite systems. Objective - to design, test and calibrate high energy particle and magnetic flux detectors for satellite observations. How research contributes - direct measurement of the energetic particle environment in space will lead to a useful model resolving uncertainties in calculations of radiation hardening requirements.

Designs of state-of-the-art instruments for measuring high energy particles and magnetic flux will be completed. Fabricated instruments acquired under contractual work units supporting this task will be tested and calibrated in preparation for satellite integration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, AEROSPACE PAYLOAD R & D

J.M. Otis, Wentworth Inst. of Technology, Undergraduate School, *550 Huntington Ave., Boston, Massachusetts* 02115 (DF583330; F19628-79-C-0103)

AF function - reconnaissance, surveillance, communication and advanced weapon systems. Deficiency or opportunity - inability to forecast atmospheric interactions affecting the design and operation of military systems such as re-entry vehicles, over-the-horizon radar and satellite operations. Objectives - (a) to perform research and engineering as required in the design, fabrication and test of aerospace payloads and sensors. (b) to redesign, fabricate, test and evaluate component assemblies of existing aerospace vehicles for the purpose of improving reliability and/or cost-effectiveness. How research contributes - the complexities of upper atmosphere and near-space in situ measurements demand state-of-the-art expertise if meaningful data are retrieved. Improved construction techniques and designs can only enhance reliability of experiments directly related to AFGL projects 2310, 6687, 6690, 7659, 7670, and SAMSO program 2123.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, ECOLOGICAL STUDIES AND MATHEMATICAL MODELING FOR THE CONTROL OF CLADOPHORA IN THE GREAT LAKES

R.P. Canale, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Civil Engineering, *Ann Arbor, Michigan* 48104 (R806600; N769 -0049)

OBJECTIVE: Control the Cladophora problem in Lake Huron along the United States shoreline.

APPROACH: Determine effectiveness of alternate control strategies using mathematical models. Develop models using field and lab experiments. Obtain verification data under varying environmental conditions.

PROGRESS: Project is still in initiation phase. Field station established at Harbor Beach. Coordination achieved with NASA for over-flights.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Research Lab.

5.0030, ANTARCTIC SEA ICE

S.F. Ackley, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (DPP77-24528)

The proposed work is a three-year project to describe sea ice conditions in Antarctica and their relationship to oceanic and atmospheric processes. Sea ice studies are incomplete without an accounting for their mechanics, thermodynamics, and structural and material properties, which form the bases of the proposed study. The Weddell Sea area has been chosen because of its unique role as a sea ice source and the impact of sea ice problems on other disciplines in this region, including meteorology, physical oceanography and biology.

The four objectives of this project are: (1) To obtain a drift-strain record from drifting buoys. These buoys will also provide meteorological information during the First GARP Global Experiment (FGGE). (2) To use the drift-strain record as a data source for the ice thickness distribution, and as a verification of energy flux estimates from satellite imagery. (3) To provide structural and material property information through a ship and helicopter-based ice drilling, coring, and remote sensing program. (4) To numerically model the sea ice circulation based on the results of the drifting buoy and ice structural experiments.

First-year activities will concentrate on preparations for deploying the buoy array during the 1978-79 field season.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0031, MEASUREMENT OF PHYSICAL AND INSTITUTIONAL FACTORS FOR MANAGING ENVIRONMENTS ON RURAL LANDS

R.S. Freeburg, New Mexico State University, Las Cruces Campus, Agricultural Experiment Station, Dept. of Agricultural Engineering, *University Park, Las Cruces, New Mexico* 88003 (0072329; NM00609)

OBJECTIVE: Measure rates at which watershed characteristics change with development rates during the course of development of rural lands for recreation. Measure changes in water quality resulting from watershed characteristic changes. Assess patterns of development, considering institutional restraints, as to the expected effects on watershed characteristics.

APPROACH: Aerial photographs, in conjunction with information from the county assessor, city and county zoning, and county clerk offices, will be used to determine change in amount and distribution of impervious surfaces within several types of recreational developments. From among developments studied, at least one of each type will be studied in more detail, measuring runoff in major watercourses within developed area, Coliform counts in perennial streams and/or wells where these exist, sediment concentrations in perennial and ephemeral streams which are being influenced by construction activity, water table levels in those areas where water table is near the surface, precipitation. Several construction designs will be computer-simulated for the developments studied and tested, considering institutional restraints, to predict a range of effects to be expected from each development. It will also take into account physical restraints such as topography of land, soil, access, vegetation, etc.

PROGRESS: Monitoring of research sites is continuing. Measurements being made include: 1) inflow to developing sites, 2) outflow from developing sites, 3) rate of build-out on sites, 4) precipitation on sites. Preliminary evaluations of flood-routing patterns are being made to determine changes caused by land development. Results to date reveal rapid amelioration of runoff production in the developed areas in which road building and utility installation have been completed. Build-out rates have diminished in most developments. Land-use history of the development sites has been reviewed. Some of the environmental change due to development have been predicted on the basis of the site histories.

SUPPORTED BY New Mexico State Government

5.0032, MULTI-EXPERIMENTAL STUDIES OF THE WIND AND WAVE PATTERNS IN THE UPPER ATMOSPHERE AND IONOSPHERE

M.C. Kelley, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (ATM77-04518 A01)

This award provides continued funding for research under NSF grant ATM77-04518 and extends the duration by one year. The scientific objectives remain the same, with a modest shift in emphasis to take advantage of the Millstone Hill facility recently upgraded with NSF funds.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0033, GAS CORRELATION FOR CARBON MONOXIDE

L.W. Chaney, U.S. Environmental Protection Agency, *Research Triangle Park, North Carolina* 27709 (DF336440)

To evaluate the capability of gas correlation spectroscopy for the remote (non-contact) sensing of carbon monoxide. Presently available point monitoring sensors have proven unreliable or inappropriate for determining the contribution of airfield operations to local environmental quality. A remote system would provide an integrated pollutant load.

Joint funding with EPA. Two existing systems will be evaluated by an independent party to determine their sensitivity, specificity, accuracy and reliability, and to recommend improvements.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

5.0034, ELECTRO-OPTICAL TECHNIQUES FOR THE SAMPLING AND ANALYSIS OF AIR POLLUTANTS

W.F. Herget, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab., *Research Triangle Park, North Carolina* 27711 (G712B-BA-006)

OBJECTIVE: Manage, administer, and conduct research on the application of electro-optical and electron optical instruments and systems for the measurement of pollutants emitted from stationary and mobile sources.

APPROACH: Remote sensing and extended-path techniques are applied for the identification of emitted gaseous pollutants. An electron microscope facility is maintained and applied for the characterization of particulate emission.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0035, OHIO SOIL SURVEY

G. Hall, Ohio Agricultural Research & Development Center, *Wooster, Ohio* 44691 (0065341; OHO00450-S)

OBJECTIVE: Participate in Ohio Soil Survey program; explore and test new soil survey techniques; map soils on representative landscapes and characterize soil mapping limits; update soil survey on field research areas.

APPROACH: The cooperative program will be continued in the conduct of medium intensity soil surveys of new counties and old surveys will be evaluated as to their suitability for land use planning. Panchromatic and multispectral remote sensing techniques with surface mapping procedures will be tested as to

their feasibility for generalized and detailed mapping of soils in areas of different soil landscapes. Composition of soil mapping units and landscape features will be investigated. Soil surveys on field research areas will be reviewed and updated where needed.

PROGRESS: The Ohio Cooperative Soil Survey under the joint direction of the OARDC, ODNR Div. of Lands and Soils and USDA SCS has completed a modern land inventory of 4.5 of the 10.6 million hectares in the state (71%). During 1978 a total of slightly more than 0.4 million hectares of the state was mapped by field parties of the DLS and SCS. Soil survey field mapping has been completed in 51 of the 88 counties. Mapping is now in progress in 21 counties and a priority list established for the remaining 16 counties. Four counties in SE Ohio started progressive field mapping during the year: Perry, Scioto, Pike and Hocking. Cooperative soil survey reports for Greene, Miami and Portage counties were published during the year by USDA. Soil description and sampling for a soil drainability study to evaluate the effects of tile drainage on selected soils in NW and SW Ohio were completed during the year. This study, in cooperation with the OSU Dept. of Agricultural Engineering and the SCS, involved sampling the Clermont, Avonburg, Paulding, Latty and Roselms soils. Field studies in the Teays Valley area of Jackson Co. are being conducted by a graduate student in order to elucidate the origin of parent materials in the area.

SUPPORTED BY Ohio State Government

5.0036, PRECISE ESTIMATE OF THE EARTH'S GRAVITY FIELD

R. Rapp, Ohio State University Research Foundation, *1314 Kinnear Rd., Columbus, Ohio* 43212 (DF582570; F19628-79-C-0027)

AF function - study factors affecting precise determination of earth's gravity field. Deficiency - lack of suitable technical data for aerospace systems requiring precise gravity input. Objective - improved position determination and inertial alignment. How research contributes - provides technology to collect and interpret improved gravity data derived from currently inaccessible terrestrial areas.

Study global height reference systems by examining the unification of the various leveling networks that exist in the world today in order to see if it is feasible to develop a common gravity anomaly basis. Additionally, satellite altimetry data taken over land masses will be investigated to determine if it is practical to interpret such data for gravitational field improvement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0037, LOWER THERMOSPHERE WINDS

W.B. Hanson, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (DF583600; F19628-79-C-0113)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be predicted with sufficient accuracy. Objective - direct measurement of neutral wind motions by satellite-borne accelerometers. Correlation of these results is made with other satellite data, including accelerometer density measurements, to develop improved atmospheric models. How research contributes - permits accurate determination of Air Force satellite ephemerides and development of accurate density forecasting techniques.

A satellite triaxial accelerometer system was flown on the Atmosphere Explorer-C satellite. Atmospheric density measurements have been derived from the two axes oriented to see large components of the force due to air drag. The third accelerometer axis was always nearly perpendicular to the air drag direction. Forces due to atmospheric winds along this axis may be determined. Separation of wind data from other forces acting on this axis is required. The other forces include those due to vehicle dynamics, motions of other instruments on the satellite and a small component of air drag if the accelerometer axis is not exactly orthogonal to the drag vector. This study will determine the accuracy with which neutral winds can be measured as a function of satellite altitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, STRESS AND PERFORMANCE IN THE FLYING TRAINING ENVIRONMENT

Kvahenbaul, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (DF224200; F33615-78-C-0053)

To investigate stress in the flying training environment with particular interest directed to stress of simulated flight and subsequent stress of airborne events. Experiments have been planned which (1) allow for quantification of stress experienced in various modes and phases of surface attack training, (2) help determine the interaction of instructor techniques and student stress, and (3) provide a clearer picture of the relationship between stress, learning and performance in surface attack training.

Three studies will examine: (1) physiological indices of stress in A-10 surface attack training, (2) the effect of IP teaching style on student stress, and (3) the effect of combat experience on stress response to simulated A-10 scenarios.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, ADVANCED FIGHTER RESEARCH PLANNING

W.L. Waag, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224280)

To define critical research issues which impact the design of advanced fighter training systems and to develop a plan which addresses these research issues using the modified capabilities of the ASPT. It is anticipated that the research program will focus on training syllabus development, performance measurement development, visual and force cue requirements, and instructor-operator station design requirements with emphasis on those features unique to the F16 aircraft.

A research team within FT shall be formed for the development of the research plan and shall take into consideration status of the F16 training system, projected ASPT capabilities and engineering development schedules, and user organizations requiring information which might be provided as a result of the research effort. Following formation of the research team and its orientation to the weapons system, user organizations shall be contacted for the purpose of identifying a potential set of research issues. From these data, a preliminary research plan shall be drafted and a planning conference hosted for their revision. Based on these revisions, the draft plan shall be forwarded to participating organizations for final review. The final plan shall become the basis of the research program to be accomplished using the ASPT.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, TACTICAL PERFORMANCE CHARACTERIZATION

L.J. Fogel, Decision Science Inc., *4901 Morena Blvd., San Diego, California* 92117 (DF228490; F33615-78-C-0011)

To develop advanced techniques for characterizing important aspects of tactical performance in flight simulators for display at the instructor/operator station (IOS). The work will include development and testing of methods for quantifying the value of importance assigned by students to various performance criteria and to the acquisition of various vantage points in the maneuvering envelope. This type of information, when displayed at the IOS, will provide valuable training data not otherwise available through conventional displays.

An adaptive maneuvering logic (AML) program has been developed to emulate the opponent in one-on-one tactical combat. The approach is to develop a modification of this pro-

gram which can compute the subjective weights assigned by a student to various short- and long-term performance goals or tactical objectives. The first phase of the study will be to develop and demonstrate the mechanics of the necessary computations - 9 MAC. The second phase, to be conducted only upon successful completion of the first phase, will include demonstration/refinement of the method using real pilot data recorded on the air combat maneuvering range - 15 MAC.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, AIRCRAFT OXYGEN GENERATION BY MEMBRANE PERMEATION

D. Johnson, Garrett Corp., *2525 W. 190th St., Torrance, California* 90509 (DF324890; F33615-79-C-0609)

This effort is to design, construct and test a staged gas permeation system to demonstrate the technical feasibility of producing aviator's breathing oxygen from aircraft engine bleed air.

The use of membrane gas permeators offers an alternative technology for on-board generation of breathing oxygen, which may offer the advantage of 100 percent contaminant-free oxygen coupled with a low aircraft power penalty. Various types of membranes will be investigated for oxygen permeation. Based on these data, a model system is to be constructed capable of delivering 20 liters/minute of 90 percent oxygen and to determine the effect of operating parameters such as feed pressure, temperature, and flow on oxygen concentrations. In addition, recommendations are to be included for up-grading the oxygen system to a prototype configuration which must provide 95 to 99 percent oxygen at flow rates up to 40 liters/minute.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0005, WIND-BLAST PROTECTION CONCEPTS DEMONSTRATION

W. Adams, Rockwell International Corp., *International Airport, Los Angeles, California* (DF325420; F33615-79-C-0528)

Injury statistics from combat and non-combat emergency escape experience with USAF and USN ejection seats indicate that wind-blast injuries greatly degrade the effectiveness of these systems to provide safe recovery of aircrew. Injuries to the legs and arms present the most frequent serious problem. The objective of this research effort is to develop and demonstrate by limited testing the feasibility of limb protection concepts that are suitable for use with current in-service ejection seats. Resulting aeromedical design criteria and data will be provided to the Aeronautical Systems Division for further development and testing, and introduction of the final wind-blast protection equipment into operational usage.

This research effort encompasses: 1. exploratory development of new wind-blast protection techniques and equipment configurations, 2. demonstration of protective equipment concepts by laboratory tests, and 3. the development of aeromedical design criteria for wind-blast protection systems. To assure applicability of the research effort, the ACES II ejection seat will be used as the baseline seat design for this study. The protective system design will be compatible with the general installation requirements of the A-10, F-15, F-16 and their two-seat configurations. Consideration of designs from Air Force contract F33615-78-C-0514 will be given greatest emphasis. The research effort will be coordinated with the ASD Life Support Systems program office and aircraft program offices to assure that the design data and criteria that are developed can be successfully transitioned into protective equipment hardware development programs that will meet operational user needs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0006, DYNAMICS OF AIRCRAFT ACCIDENT VICTIMS - COMPUTER SIMULATION

J.M. Ballo, U.S. Dept. of Defense, Armed Forces Inst. of Pathology, *c/o Walter Reed Medical Ctr., Washington, District of Columbia* 20306 (DAOB6608)

Computer simulation of the kinematics of occupants in selected aircraft accidents in order to recreate the sequences of injuries and to determine their specific cause(s). This will lead to an increased understanding of the pathogenesis of such injuries and lead to more effective means of preventing them. Examine feasibility of running concurrently the KRASH vehicle impact simulation code so as to enhance the realism of occupant-vehicle interaction.

APPROACH: Operate the CALSPAN three-dimensional program as a model using selected Aerospace Pathology Division cases as sources of input data. Correlate the actual injuries observed at autopsy with the injuries predicted from the occupant kinematics of the computer simulation. Use the optimal output features of the CALSPAN code, using subroutines to calculate injury severity indices and time points of maximum injury.

PROGRESS: The usefulness of the CALSPAN three-dimensional program model has been demonstrated for three primary situations. These are: (1) low-velocity fixed-wing aircraft accidents; (2) rotary winged aircraft accidents; (3) out-of-envelope ejections with partial man-seat separation. The need for improvement of the program centers about three areas: (1) the need for a simplified input deck with greater flexibility in selection of altitude; (2) the need for post-processing for analysis of injury data; and (3) the need for a programmable deformation of the 'vehicle' during a crash pulse. The CALSPAN three-dimensional program model, in its present form, is more useful as a research and development tool rather than a day-to-day tool for the investigation of routine accidents.

SUPPORTED BY U.S. Dept. of Defense, Armed Forces Inst. of Pathology

6.0007, ASSESSING PEER RATINGS

Dunnette, Personnel Decisions Research Inst. Inc., *821 Marquette Ave., Minneapolis, Minnesota* 55402 (DF233440; F33615-78-C-0041)

To assess the relationship between peer ratings of new enlistees and their relative success in the Air Force.

The peer ratings, biographic and aptitudinal information on about 20,000 basic trainees will be codified into a tape file. From this tape file, the contractor will perform statistical analyses to assess the ability of peer ratings to predict success in basic military training (BMT). It is estimated that this effort will take 12 months. The final product will be a technical report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0008, AN EXPERIENCE-JUDGMENT APPROACH TO TACTICAL FLIGHT TRAINING

R.P. Meyer, Design Plus, *St. Louis, Missouri* (DF054660; F49620-79-C-0052)

AF function - this research supports AF programs in aircrew training, particularly the training of critical combat skills in the tactical arena, and supports the AF Simulator Procurement Program. Deficiency - the basic principles of learning which are needed to design effective visual simulators for training tactical flying skills are only partly known. Without research in this area, visual scene modeling for tactical simulation will fall short of its potential training effectiveness. Objective - the objective of this research is to discover visual simulations which are highly effective for teaching critical tactical flying skills. How research contributes - this research will uncover new concepts in visual simulation which can be used by instructional theorists and systems designers for creating tactical training materials.

The principal investigator will catalog old visual training materials currently used for tactical training. A taxonomy of tactical flying skills will be employed to determine whether these materials are adequate for all of the required tasks. A second inventory will determine what critical combat skills are not being taught in on-going flying programs due to risk. Then, existing visual materials which could train these tasks will be indexed. Tasks for which visual materials are needed, or current materials need improving, will be identified, and innovative scene modeling concepts will be used to build candidate scenes for training these tasks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, ADVANCED TRAINING TECHNIQUES USING COMPUTER-GENERATED IMAGERY
D.B. Coblitz, McDonnell Douglas Electronics Co., *St. Charles, Missouri* (DF055000; F49620-79-C-0067)

AF function - this research supports Air Force programs in flight and technical training. Deficiency - the Air Force is making significant investments in computer-generated imagery systems for use in training environments, such as flight simulator visual systems. To make optimum use of these systems, more must be known about different types of scene modeling which can result in effective training for complex skill learning. Objective - the objective of this research is to investigate new concepts of computer-generated imagery which can be used effectively in training. How research contributes - this research will expand the use of computer-generated imagery systems in flight and technical training. It could significantly increase the number of skill categories which are now practiced using such systems.

Several training tasks from advanced flying programs will be studied, especially those involving combat skills, and tasks which might benefit from innovative scene modeling will be dissected into meaningful segments. Concepts using unique visual models will be investigated in the context of these task segments to see if training methods can be developed which provide cues that may not be available in the real world but which may add significantly to the speed, quality, or scope of the training transfer. These concepts will be refined and tested in an aircrew training environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0010, TRAINING EFFICIENT MULTIPLE-TASK PROCESSING STRATEGIES
D.L. Damos, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (DF053800; AFOSR-79-0014)

AF function - this research supports aircrew training programs, particularly the learning and performance of the types of skills characteristic of combat. Deficiency - modern weapon systems performing in combat-intensive environments place high demands on the aircrew. While some details of how the pilot learns to process information under stress are known, our knowledge of how to train information-processing skills remains deficient. Objective - this research will study ways to train pilots to resist information-processing stress. How research contributes - the results of this effort will feed into aircrew training technology, with potential impact on the structure and context of training programs.

The proposed effort covers a four-year period of investigation. The initial year will involve two experiments, both using a dual short-term memory and classification task. If individual strategy preferences can be detected, then operators will be trained to see if they can learn a non-preferred strategy, i.e., to determine their capability to learn new strategies. If operators can change their strategies, the second experiment will study efficient methods for training these new strategies. These methods will include adaptive training, pre-training, feedback manipulation, and instruction-demonstration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0011, ASSESSMENT OF SCENE COMPLEXITY AND CUE VALIDITY IN VISUAL FLIGHT SIMULATION
H.G. Shulman, Ohio State University, Columbus Campus, School of Arts & Sciences, Dept. of Psychology, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF055140; F49620-79-C-0070)

AF function - this research supports Air Force programs in aircrew training, especially flight simulator technology. Deficiency -computer-generated image systems allow many different visual scenes to be presented to pilots flying in sophisticated simulators. Little is known about which scene features are most important to achieve high levels of training transfer. Furthermore, there is no adequate measure of scene complexity to use to describe different scenes. Objective -this research has two objectives. It will study earlier attempts to measure scene complexity and develop a valid metric for use by training researchers and it will develop the methodology for assessing the importance of different scene features for training various flying tasks. How research contributes - this research will provide useful methodological tools which researchers in training simulation can use to develop optimum visual simulations for aircrews.

Two research tasks will be pursued. 1. The human visual system will be assumed to analyze information about the distribution of spatial frequencies in a scene by using autocorrelations. A method will be developed for calculating autocorrelations for a given scene and relating them to human performance on tasks which are relevant to simulated and actual flight. If a strong relationship is established between this metric and performance, then it can be used to establish training efficiency, along a continuum anchored by simplified schematic images on one end and high detail, realistic images on the other. 2. The principal task of a pilot using terrain features in controlling his vehicle is assumed to be the use of key transformations in the visual scene for determining depth, altitude, speed, vertical velocity, etc. Using an interactive visual flight simulator, the research team will try to isolate these transformations and develop custom-tailored visual scenes which speed the learning of transformations for students learning specific tasks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0012, LDF-3, APPLICATION OF OPTIMAL ESTIMATION TECHNIQUES TO BIODYNAMIC IMPACT DATA
J.H. Raddin, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325470)

Recent requirements for biodynamic testing have placed more stringent demands on test instrumentation and data analysis in order to provide accurate, non-ambiguous descriptions of body part motion to allow useful mathematical model formulations. Current experimental technique involves the use of inertial sensors and photographic instrumentation in order to provide data on body part motion. However, since the inertial instruments generally measure rate or acceleration, and the photographic instrumentation provides measurements of position, these data outputs have classically been analyzed separately with poor correspondence when compared. This deficiency has led to difficulties in relating data from experiments to mathematical models. The objective of this effort, therefore, will be to develop a technique to utilize all available information sources in order to derive the statistically optimum estimate of body part motion in both the translational and angular sense.

This effort will take advantage of well developed technology in the field of inertial guidance and adapt techniques for use in the biodynamic application, thus assuring a high potential return on investment. The basic technology of the optimal estimator or Kalman filter will be adapted to function as a data analysis tool for impact experiments using inertial and film-derived data. Equations will be developed to produce the optimal estimate of body position, velocity, and acceleration (both in a translational and angular sense) using data derived from biodynamic impact experiments carried out within AMRL. Independent sensors located at other points on the structure being measured will be utilized to assess the accuracy of the estimation technique. Information will also be gained from this effort to assess the relative advantages and disadvantages of the various approaches to angular and translational motion sensing. This information will be an inherent product of this effort since those information sources contributing most directly to an optimum estimate will be more heavily weighted in the mathematical model than will sensors which contribute relatively little information or contribute information which is provided more accurately by other information sources available in the experiment. The money will be put on contract F33615-76-C-0520 with Dynalectron Corporation, work unit 72311607 as an expansion of effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, SUBJECTIVE EFFECTS OF MULTI-AXIS OSCILLATING INERTIAL FORCE ENVIRONMENTS
R.W. Shoemberger, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321240)

To investigate the subjective effects of whole-body vibration in the pitch, roll, and yaw axes and in multi-axis environments. Subjective response data are available for the three translational axes (x, y and z) and this effort will extend that knowledge to rotational vibrations and to environments with simultaneous oscillations in (or around) more than one axis. The information obtained will result in improved and expanded vibration criteria for evaluating aircrew exposure to operational multi-axis oscillating inertial force environments, and provide data for improved crew station design to alleviate adverse vibration effects.

Psychophysical measurement techniques (e.g., psychophysical matching and magnitude estimation) will be used to evaluate the severity of vibration inputs. Subjects will be exposed to single axis angular vibrations (pitch, roll and yaw) as well as combined multi-axis inputs in both translational and angular modes. Subjective intensity comparisons will be made using single axis translational vibrations (for which there are existing criteria) as comparison standards. Data analysis will provide assessment of the subjective effects of angular vibrations in relation to translational motion and techniques for evaluating the subjective intensity of multi-axis vibrations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0014, DEVELOPMENT AND EVALUATION OF CIG TECHNIQUES

W.L. Foley, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF228920)

The objective is to develop, implement and perform engineering tests of various potential improvements to CIG. This will include evaluation of non-linear terrain generation methods, circular features techniques, new texturing methods, and new CIG concepts based on application of human perceptual characteristics. The effort will include informal but structured engineering evaluations and the development of refinements necessary to resolve problems.

For each of the four study areas listed in the objective, several tasks will be accomplished. First, evaluation techniques and criteria will be developed. Then the method under study will be implemented on the advanced CIG techniques evaluation (ACTE) system and subjects will be selected based on their CIG expertise and their familiarity with the real world cues being simulated. The ACTE system will be used to generate static and dynamic scenes which will be used in this effort, as well as in another study designed to examine in more detail the impact of the method on human performance. Finally, the scenes will be evaluated by the subjects using the selected criteria. As required, refinements and re-test will be accomplished prior to documentation of results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0015, EFFECTS OF PROLONGED NOISE EXPOSURE - A LONGITUDINAL STUDY

S. Cohen, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Psychology, *1472 Kincaid St., Eugene, Oregon* 97401 (BNS77-08576)

Laboratory research indicates that short-term exposure to environmental stress can be detrimental to task performance, and result in motivational and cognitive deficits. That research emphasizes acute rather than long-term effects. The present research deals with long-term effects of exposure to noise over long periods of time. The Principal Investigator investigates the effect of noise on the students in three schools near a busy airport. All three schools will be modified to reduce noise levels, but not all will be modified at the same time. The research examines the effect of noise and the noise reduction on attentional focusing, ability to tune out distracting noise, verbal ability, expectancy of control, and health.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Behavioral & Neural Sciences

6.0016, EYE MOVEMENT AS AN INDICATOR OF VISUAL WORK OVERLOAD IN AIRCREW PERSONNEL

G.T. Chisum, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN081176)

Virtual image devices are being developed to provide a means of displaying information to aircrew members under a head-out-of-the-cockpit attitude. The amount and type of information to be displayed and the specific schemes for presentation of the information are currently in the process of being proposed and investigated. A method of evaluating the alternatives is required. The objective of this work is to evaluate the use of eye movements as an objective, non-intrusive, non-interfering method of assessing the effect on performance of the alternatives regarding virtual image display information amounts and design. The method can then be used to provide the information which will give guidance in selecting the most suitable alternative for display of information. The method will also be useful for the evaluation of the complexity and optential efficiency of any visual environment.

Visual tasks which are complicated enough to permit demonstration of performance levels, but simple enough to be readily quantified for use in the validation of an objective measure of efficiency, will be selected. Eye movements during the peformance of the tasks will be monitored. The difficulty of the tasks will be varied. Number of detections, indentifications or tracking scores, depending on the task selected, will be recorded as a function of task difficulty. Eye movements will be recorded and correlated with the task difficulty and performance scores. The correlation score will provide an indication of the validity of the eye movement measure as a means of objectively measuring visual efficiency. Eye movements can then be used to assess other tasks, and to predict effect on performance of various task or display designs.

SUPPORTED BY U.S. Dept. of Defense, Navy

6.0017, SELECTION FOR PILOT TRAINING

H.E. Jensen, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234200)

1. Norming of AFOQT. 2. Investigation of new measures to be used in pilot selection. 3. Validation of AFOQT, PAPAMS, and experimental measures against UPT, CCTS, and operational performance. 4. Identification of characteristics of superior pilots. 5. Evaluation of the effect of the Flight Screening Program on UPT performance.

AFOQT will be normed on AFA, AFROTC, and OTS samples. New perceptual and psychomotor measures including the portable automated pilot aptitude measurement system (PAPAMS) will be investigated to determine their relationship to performance in UPT, CCTS, and operational settings. Phase I - AFOQT-N and APD norming study evaluation of flight screening program. Phase II - experimental testing program. Phase III - collection of criterion performance data through UPT, CCTS, and after one year in an operational setting.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0018, PERSONNEL TECHNOLOGY - EFFECTS OF LIFE STRESS AND COPING SKILLS ON PERFORMANCE AND ORGANIZATIONAL EFFECTIVENESS

I.G. Sarason, University of Washington, School of Arts & Sciences, Dept. of Psychology, *Seattle, Washington* 98105 (DN575416; N00014-75-C-0905)

In developing personnel who will later be exposed to high levels of stress (e.g., aviators, submariners, UDT personnel), the Navy and MARCORPS are limited by gaps in our knowledge of the fundamental relationships among situational stressors, life stress, individuals' coping skills, and organizational effectiveness. This work unit is designed to clarify these relationships and experiment with various individual and organizational procedures for improving the ability to cope with stress in organizational contexts.

Earlier research has demonstrated that stress is associated with morbidity and with decreased performance in certain kinds of situations. This research is producing new measures designed

to assess organizational stress. The investigator is experimenting with various techniques for altering cognitive responses since these are hypothesized to be involved in mediating the deleterious effects of stress on performance. The initial experiments in civilian groups exposed to high levels of job stress (e.g., firemen), will, if successful, be extended to certain military groups working under high stress conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, ANALYSIS AND MODELING OF INFORMATION HANDLING TASKS IN SUPERVISORY CONTROL OF ADVANCED AIRCRAFT

R. Steeb, Perceptronics Inc., *6271 Variel Ave., Woodland Hills, California* 91364 (DF055730; F49620-79-C-0130)

AF function - increasing supervisory loads are being imposed on the pilot in advanced aircraft operations. Future aircraft will be characterized by high information loads, severe time constraints, and complex decisions regarding allocation of display resources. Deficiency - the information costs and the limited processing capabilities of the human operator make it necessary to optimize the information selected, processed and displayed. Objective - the research will establish new techniques for the selection of essential information in airborne tactical operations. How research contributes - the program will result in aids for the real-time analysis and management of information selection in advanced aircraft.

The techniques will center on the use of multi-attribute utility models, adaptive estimation methods, and queuing theory formulation to model individual supervisory control behavior. Specifically, the research will: (1) formulate a working taxonomy of supervisory control functions in advanced aircraft operations, (2) investigate the behavioral issues of operator acceptance of and confidence with the possible levels of model-based aiding, (3) generalize the model form to include continuous monitoring and control functions, and (4) produce guidelines for field applications of the information evaluation and management programs in operational airborne systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, APPLIED PARTIAL DIFFERENTIAL EQUATIONS AND NUMERICAL ANALYSIS

S.J. Osher, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Mathematics, *405 Hilgard Ave., Los Angeles, California* 90024 (MCS78-01252)

Renewal of MCS-7604412.

This research concerns partial differential equations of hyperbolic type and of mixed type, with strong emphasis on their numerical solution. For hyperbolic problems the investigator will study non-linear instability, propagation of error, and the effects of boundaries. For mixed type problems he will deal with a method effectively of splitting the problem into separate elliptic and hyperbolic problems. Along the line of non-numerical work, the investigator will continue study of well-posedness and regularity for hyperbolic differential equations. He may also extend his recent analysis of certain equations of mixed type to those of transonic flow.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0003, RESEARCH IN ALGEBRAIC MANIPULATION

J. Moses, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF056340; F49620-79-C-0200)

AF function - design of aerospace vehicles. Deficiency - algebraic manipulation is still primarily done with pencil and paper. Objective -to improve capabilities for algebraic type manipulation on a computer. How work contributes - by reducing computer time and memory requirements.

Often the final answer is a short expression while intermediate expressions are long, as for example in obtaining the multivariate polynomial greatest common divisor used in simplifying rational functions. The proposed research builds on the idea that the information required may be a particular term or the polynomial may be sparse. For example, random values inserted for all but one of the variables map a difficult problem into a simpler one which however retains features of the full problem unless accidental cancellations occur. The probability of this occurring can be estimated and reduced. By solving a hierarchy of such simpler equations, using the information obtained along the way, much more effective algorithms can be obtained. Computer time is a polynomial function of the number of terms of the solution polynomial instead of exponential in the order of the solution polynomial. Intermediate expression swell is also reduced.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, DATCOM UTILIZATION AND IMPROVEMENT

J.E. Williams, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF141500; F33615-78-C-3610)

A continuing effort is required to improve DATCOM coverage by refining existing methods and adding new techniques in concert with rapidly advancing technology. The objective of this effort is to determine the major shortcomings of DATCOM as it applies to modern design trends and to investigate potential means of overcoming these weaknesses. A uniformly valid and complete set of prediction methods which could be used with confidence in early design would eliminate much of the uncertainty and consequent expense now associated with this phase of design.

The digital DATCOM will be used to conduct parametric studies of modern configurations, thereby assessing the value of existing DATCOM methods and the relative value of various factors involved in the calculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, ELECTRON MICROSCOPY OF ATOM CONFIGURATIONS IN FAULTED CRYSTALS

S. Iijima, Arizona State University, School of Liberal Arts, Dept. of Physics, *Tempe, Arizona* 85281 (DMR78-09291)

This research will be a study of defects in complex inorganic crystals using high resolution electron microscopy (HREM). Results of this work will be of importance to a number of areas of ceramic science, since many fundamental properties depend on the detailed nature of lattice defects. The research objectives will be two-fold: (a) to determine the nature of extended defects, such as planar faults, in complex oxides and other compounds, and (b) to continue improving the performance of present electron microscopes by refining the resolution capability even further. Theoretical interpretation of HREM images that are recorded under precisely controlled operating conditions will allow detailed comparisons to be made between experimental image contrast and contrast determined by computer simulation.

Additional research will include attempts to examine extremely small clusters of metal atoms which are prepared on thin graphite films, and to initiate studies using HREM to examine the structure of amorphous solids.

This program is a continuation of research initiated under NSF Grant DMR76-06108 A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, ORGANIC AND ORGANO-METALLIC CONDUCTORS AND SUPERCONDUCTORS

W.A. Little, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (DMR76-82087 A02)

The overall goal of this project is to advance our knowledge of the solid-state physics and chemistry of compounds containing strongly interacting substructures so their physical properties can be understood, designed and predicted. Part of this work is concerned with the broad question of the attainability of high-temperature superconductivity through systematic study of linear chain compounds. This includes the synthesis of polarizable ligand systems, plus model studies of stacked arrays of square planar complexes and the effects of oxidation upon them. Physical properties are measured and studies made of theoretical problems bearing on high Tc (critical temperature) materials.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0003, SPECTROSCOPY AND QUANTUM ELECTRONICS

A.L. Schawlow, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (PHY77-09687 A02)

The application of modern optical devices, such as advanced kinds of lasers, is proposed for basic studies in physics. In the course of these studies, the laser techniques will be refined and extended, and new sensitive methods of laser spectroscopy will be explored and developed. The extremely high resolution permitted by the techniques of Doppler-free nonlinear spectroscopy (saturation, polarization, two-photon) will be used to study fine and hyperfine structures in spectra of atoms and simple molecules. Use of short laser pulses in new ways for high-resolution spectroscopy and the extension of high-resolution methods to shorter ultraviolet wavelengths are planned. The spectrum of simple one-electron atoms will be studied in high resolution, to probe the limits of quantum electrodynamics, and to improve the values of fundamental constants. Saturation and polarization labeling techniques will be used and extended to simplify the analysis of complex atomic and molecular spectra. New techniques for measuring wavelengths and frequency intervals will be developed and studied. Laser methods for the ultrasensitive and highly selective detection of atoms and molecules will be explored. The development of a dye-laser-like tunable ultraviolet laser, pumped by a molecular hydrogen laser, which would be a valuable tool for laser studies of atoms and molecules, is also planned.

This work is a continuation of that currently supported under NSF grant PHY74-14786A03.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0004, PLASMA COLLECTIVE ION ACCELERATION

A. Fisher, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (DN975487; N00014-79-C-0560)

The Navy needs quantitative information on methods to generate intense ion beams with energies up to 1 geV for directed energy applications, sources of intense radiation through impact with targets, new sources of energy via interaction with pellets, etc. The electron beam front collective acceleration of ions to be carried out in this contract has the scaling characteristics which are necessary to fulfill the requirement stated above.

The beam front of a high current relativistic electron beam creates a very strong electric field capable of accelerating ions to geV energies over short distances. Controlling the motion of the electron beam front over distances of 10's of meters has been a major problem in the area of collective acceleration. In this contract, two novel concepts are utilized to accomplish this: (a) the use of a strong longitudinal magnetic field to maximize the length of propagation, and (b) the use of a programmed, externally generated plasma to provide the charge neutralization needed to propagate the space charge limited intense beam current front.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0005, ENGINEERING RESEARCH INITIATION - THEORETICAL INVESTIGATIONS OF RECOMBINATION CENTERS IN SEMICONDUCTORS

D. Pan, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Electrical Sciences & Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR78-05783)

This research will be a detailed theoretical investigation of two important problems about recombination centers in semiconductors. The first system which will be investigated is the hole recombination center of the two-electron impurity state of oxygen in gallium phosphide. The role of a complex structure, formed after the capture of the hole and before the recombination, will be studied in detail. The ground and excited states of this complex are of importance to determine various recombination mechanisms of quite different physical origin. Those states will be first studied in detail. The Auger recombination rates for those states will then be calculated. The recombination cross-section will be calculated in a cascade model. The result may shed new light about the mechanism of recombination centers which has many important technical applications. The second system to be investigated is the zinc-oxygen center in gallium phosphide light-emitting diodes (GaP LEDs). Various electronic states bound to Zn-O center will first be investigated. The potential energy as a function of the positions of Zn and O will be calculated in a simple model for various electronic states. The rate of 'dissociation' of the Zn-O pair will be estimated in a way similar to the theory of pre-dissociation of molecules.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0006, SOME THEORETICAL STUDIES OF THE PROPERTIES OF CONDENSED MATTER

P.A. Pincus, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR78-10312)

Research previously supported by DMR7519544.

Theoretical research in condensed matter physics will be carried out. Some of the topics to be studied will include: quantal adiabatic hopping; hopping in the ultra-weak dispersion regime; hopping in a molecular crystal with Morse-type intramolecular vibrational potentials; higher-order multiphonon calculations; the mechanism of self-trapping of electrons, holes and excitons; excitation transfer in disordered systems; spin flip scattering near the glass transition in spin-glasses; magnetic anisotropy of strongly mixed magnetic moments in dilute magnetic alloys; fluctuations in superconductors near the critical temperature; macromolecular physics; polyelectrolytes; deformed entangled polymer solutions; and nematic polymers.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, THE ELECTRIC CURRENT STRUCTURE OF THE MAGNETOSPHERE AND HELIOSPHERE

H. Alfven, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (ATM79-17859)

This grant will continue studies of the current system in natural plasmas, paying attention to those effects which produce non-ideal plasma behavior, and examining the conditions for production of charge double layers and the collapse of volume

currents into sheets and filaments. A new initiative will be an effort relating these phenomena to observations of planetary and cometary magnetospheres and the heliosphere, while noting in each case the topological constraints set by the continuity relations for current and field lines. The overall aim is to provide a theoretical framework for space plasma physics which will be both accurate and realistic.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0008, IR BACKGROUND MEASUREMENTS

D. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (DF582060; F19628-78-C-0164)

AF function - surveillance, target detection, discrimination and acquisition. Deficiency - lack of high-resolution spectral data of atmospheric background emission which reduces target to background contrast. Objertive - obtain high-resolution IR spectral data of atmospheric background emission as a function of altitude, time of day and season - data which is needed for enhanced performance of present and future sensor systems used for target detection.

A 0.1 cm to the minus 1st power resolution LIN cooled interferometer and gondola package will be modified, such that the whole system will have elevation and azimuth pointing capability for down-looking as well as up-looking balloon measurements. This instrumentation will then be used to perform IR background emission measurements as indicated in objective.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

8.0009, THEORETICAL STUDIES ON SPIN GLASSES, ELECTRONS IN DISORDERED SYSTEMS, AND TWO-DIMENSIONAL PHASE TRANSITIONS

D.J. Thouless, Yale University, Graduate School, *206 Elm, New Haven, Connecticut* 06520 (DMR79-08329)

Theoretical research will be carried out on three topics: (1) Spin glasses, in which the nature of electron localization will be explored, and the details of phase transitions will be investigated - of particular interest will be the effect of an external field on the critical properties. (2) Electrons in disordered systems - the general problem of localization will be studied, in reference to the properties of disordered solids, such as maximum resistance, the Hall effect and the behavior of the conductivity in an external magnetic field. (3) Two-dimensional phase transitions - the consequences of the vortex driven transition (Kosterlitz-Thouless model) will be worked out. In particular, an explanation of the properties of helium films will be developed.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0010, HIGH-FIELD STUDIES OF SUPERCONDUCTING LAYERED COMPOUNDS

D.E. Prober, Yale University, School of Science, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DMR78-17957)

This is a continuation of the work sponsored under DMR76-09591 and entails an experimental study of the high magnetic field properties of superconducting transition-metal dichalcogenides layer compounds. A miniaturized high frequency resonant circuit has been designed and constructed which will allow one to measure Tc and Hc(T) of oriented microcrystallites (mass less than 1 microgram) of compounds of interest. These include TaS2 intercalated with long-chain amines, metallocene intercalated complexes and the unintercalated alloy series Nb1-xTaxSe2. This work is important for our understanding of the basic microscopic nature of the super-conducting state in these layered systems and has potential for impacting upon technologically important high-field superconductors in general.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0011, COMPUTER SIMULATIONS OF MAGNETIC SYSTEMS

D.P. Landau, University of Georgia, Franklin College of Arts & Sciences, Dept. of Physics & Astronomy, *Athens, Georgia* 30601 (DMR76-11329 A01)

Research previously supported by DMR76-11329.

Theoretical research in condensed matter physics will be carried out. The main thrust of the investigations will be to study the thermal and magnetic properties of magnetic systems using importance sampling Monte Carlo methods. Emphasis will be placed on the examination of models exhibiting multicritical phenomena in two and three dimensions. These studies will include the location of phase boundaries and multicritical points and an examination of the associated critical and multicritical behavior. More detailed studies of 'impure' and 'random' systems will be pursued and investigations of models with long-range interactions will continue. The low temperature behavior of these models will be studied using the new 'n-fold way' algorithm.

This research will help to illuminate the behavior of a material which is changing phase and will be particularly useful in circumstances where the more analytical theories do not apply.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0012, EXCHANGE PROPERTIES OF SOLID 3HE, ACOUSTIC AND NMR STUDIES OF THE 3HE SUPERFLUIDS

W.P. Halperin, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *633 Clark St., Evanston, Illinois* 60201 (DMR78-11660)

Measurements of the susceptibility, phase diagram, pressure effects, antiferromagnetic resonance and specific heat of solid helium-3 will be performed in order to explore the exchange magnetism in the BCC phase. Acoustic impedance measurements will be made in the A and B phase of superfluid helium-3. Longitudinal magnetic resonance frequencies will also be measured over a wide range of temperature and pressure. The g-shift in the B phase and relaxation in both phases will be studied. This work is important to understanding the behavior of quantum solids.

This is the first year of a three-year continuing grant. Research previously supported under DMR-7605181.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0013, THE EFFECT OF A ZERO G ENVIRONMENT ON FLAMMABILITY LIMITS AS DETERMINED USING A STANDARD FLAMMABILITY TUBE APPARATUS

R.A. Strehlow, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (NSG 3293)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lewis Research Center

8.0014, INTERDISCIPLINARY PROGRAM OF MATERIALS RESEARCH

C.P. Flynn, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR77-23999)

Major interdisciplinary programs are being pursued in three areas. The effects of structure modulation are studied in Microscopically Modulated Materials, where theoretical and experimental investigations of property variation are being carried out. Of special interest are the effects on the fluctuations, on mor-

phology and dynamics of phase transitions, and on the control of the resulting properties.

The program on Optical Semiconductors emphasizes the quaternary system In-Ga-As-P, in which materials exhibiting a large range of band gap width can be prepared. Such materials can be used in optical devices tuned to selected wavelength.

The program on Compound Catalysts emphasizes non-metallic catalysts, and is currently primarily concerned with the theory of surfaces. The development of instrumentation for proving the properties of clean and of doped surfaces is the initial objective.

Significant support is provided for the operation of central facilities and for additional research on liquids, on disordered solids, and on structural alloys. Close coordination with a research program co-supported by the Department of Energy is maintained locally.

This award is a continuation of DMR76-01058 A01 and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, RESEARCH IN NUCLEAR ASTROPHYSICS

J.W. Truran, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (AST78-20123)

The research to be carried out in this grant will be primarily concerned with two broad topics in nuclear astrophysics: (1) the mechanisms by which heavy nuclei are formed in stellar interiors, novae, and supernovae, and (2) the consequences of mass accretion onto white dwarf stars in aging binary systems. Detailed calculations have shown that the composition of matter ejected in nova and supernova explosions is consistent with the abundances of material in the solar system. It has also been demonstrated that luminous and rapidly evolving red giant stars are also the formation site of a class of heavy nuclei ranging from the heaviest isotopes of iron through mercury and lead. Nova explosions have been shown to result from the accretion of hydrogen-rich material onto the surfaces of white dwarf stars in binary systems.

Studies which will be carried out include: (1) studies of the hydrodynamics of nova explosions; (2) the accretion of matter onto white dwarf stars; (3) the synthesis of elements in the outer atmosphere of a supernova; (4) the synthesis of elements in the interiors of red giant stars; (5) the formation of dust grains in novae and supernovae; and (6) the behavior of neutron star matter at high temperatures and densities.

This is a continuation of research previously supported under NSF grant AST77-21563.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0016, HISTORY OF PLANETARY PHYSICS

S.G. Brush, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (SOC77-26749)

Dr. Brush is conducting historical research in the area of nineteenth and twentieth century geophysics and astrophysics, with special emphasis on the connections of these sciences with the so-called 'fundamental' parts of physical science (atomic theory, thermodynamics, electromagnetism, relativity). In addition to publications on the history of planetary physics, he expects that the project will ultimately lead to a book on the history of modern physical science in which the development of planetary physics and its relations to other disciplines are included.

Dr. Brush is currently concentrating on a detailed study of changes in ideas about the early development and internal constitution of the earth since 1830, and on the development of astrophysical, geological and chemical sciences relating to theories of the origin of the solar system in the twentieth century. He is examining aspects such as the impact of discoveries in celestial mechanics, radioactivity, and seismology, reasons for the rejection and later revival of ideas such as nebular origin of the solar system, planetesimal hypothesis, fluid regions inside the earth, and continental drift; and the interactions of scientific disciplines such as astronomy, physics, geology, chemistry and applied mathematics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral & Social Sciences, Div. of Social & Economic Science

8.0017, MAGNETIC RESONANCE IN IONIC SOLIDS

I.Y. Chan, Brandeis University, School of Arts & Sciences, Dept. of Chemistry, *415 South St., Waltham, Massachusetts* 02154 (DMR74-18095 A01)

Electron nuclear double resonance (ENDOR) of 19F is used to investigate the behavior of Jahn-Teller active ions in fluorite crystals. Vibronic interaction in such species leads to characteristic modification of hyperfine interaction of the F nuclei with the electronic system of the center ions. Precise measurements of the hyperfine interaction constants by ENDOR in turn provide information of the Jahn-Teller active system. Specific objectives are to: 1. Continue and complete ENDOR studies of the Cu2 ion:CdF2 system. ENDOR frequencies as a function of magnet angle are measured along three independent planes. Hyperfine coupling constants are extracted by least squares methods. The distorted geometry of this static Jahn-Teller system will be deduced from the dipole model. The nature of the Jahn-Teller active vibrational mode will be elucidated. 2. Test the feasibility of an ENDOR experiment on the Fe2 ion:KMgF3 system based on the double quantum EPR transition. A measurement of the hyperfine constants in this dynamic Jahn-Teller system will provide information on orbital reduction.

This is a continuation of research supported under DMR 74-18095.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, ANALYTICAL METHODS IN MANY-BODY PHYSICS

E.P. Gross, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR76-02048 A01)

Research previously supported by DMR76-02048.

Theoretical research in condensed matter physics will be performed which is designed to develop and improve mathematical approximations in the physics of many-body systems and in the study of particle field and random potential interactions. Techniques which have been developed in the theory of the dynamics of classical dense gases, liquids and plasmas will be extended to apply to general many-body systems. The theory of particle field and random potential interactions will be developed, with the aim of finding a systematic theory for the strong and intermediate coupling domains comparable to the existing theory for weak coupling.

The aim of this research is to increase our understanding of the fundamental interactions which determine the behavior of condensed matter.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, FUNDAMENTALS OF MAGNETIC INTERACTIONS - NEW APPROACHES TO THEORY AND EXPERIMENT

A. Lempicki, General Telephone & Electronics Corp., G T E Laboratories Inc, *40 Sylvan Rd., Waltham, Massachusetts* 02154 (DF056180; F49620-79-C-0182)

AF function - this proposed research primarily falls in the 7.4 research objectives which deal with the theoretical and experimental investigations of electronic, optical, acoustic, thermal, magnetic and conducting properties of materials to evolve new and improved device concepts. In particular, this is an extensive experimental and theoretical investigation directed at elucidating the fundamentals of magnetic interactions and light-

induced magnetic phase transitions. Deficiency - a wide range of basic research efforts that support the development of devices and device concepts are needed for the application of contemporary electronic electromagnetic technology in the operational Air Force. Most studies of magnetic properties utilize model Hamiltonians, and model potentials which are incorrect on first principles considerations. Objective - the major emphasis will be on achieving a light-induced magnetic phase change and an extensive fundamental calculation aimed at a complete qualitative prediction of the magnetic structure. Contribution - this research is part of a comprehensive program in statistical mechanics to study phase transitions.

The main goal of this research is a complete understanding of the nature of the coupling of the electronic spins, both orbital and intrinsic angular momenta, which give rise to the phenomena of cooperative magnetism. This does not exist at this time for any material. Light offers a sharp probe of magnetic interactions in certain magnetic semiconductors, insulators and certain rare-earth metals that have magnetism highly sensitive to external influences. It can alter electronic spins directly, and alter populations of electronic states responsible for the coupling which is called opto-magnetism. It is proposed to combine a team of physicists, from industry and universities, to obtain just the aforementioned understanding of magnetism.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0020, PROPERTIES OF AMORPHOUS SEMICONDUCTORS

W. Paul, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Engineering & Applied Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DMR78-10014)

This a continuation of research previously supported by NSF grant DMR-7615325.

Samples of amorphous group 4 and group 3-5 semiconductors with incorporated hydrogen and other dopants will be prepared and characterized chemically and structurally. Appropriate property measurements, among them photoluminescence, electron spin resonance, optical and transport, will be carried out and correlated in order to gain a comprehensive, self-consistent model of the behavior of the substance. Special attention will be paid to the possibility that strong electron-phonon interactions affect the optical properties through developing Stokes shifts and the transport properties through the creation of small polarons. Measurements made as functions of the hydrogen content of the films will be done in order to try to separate out the intrinsic properties of the disordered element or compound from those of the alloy with hydrogen. In the case of the binary compounds, special attention will be paid to the effects of like-atom bonds in determining the properties.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, ELECTRONIC STATES IN DISORDERED MATERIALS

A. Bansil, Northeastern University, College of Arts & Sciences, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR79-02600)

The research to be performed will focus on the equilibrium electronic properties of disordered metals. The materials to be studied include noble and transition metal alloys and metallic glasses.

The disordered alloys will be investigated within the framework of the coherent potential (CPA) and the average t-matrix approximations (ATA), utilizing realistic muffin-tin potentials to represent the atoms. The question of calculating self-consistently charge densities and atomic potentials in transition and noble metal alloys will be studied. The extentions of the theory to obtain average momentum densities, measured by a Compton scattering or a positron annihilation experiment, will be taken up.

The theory will also be used to study the electronic spectrum of liquid metals and metallic glasses. The latter materials have many potential technological applications. In recent years a substantial body of experimental optical, photoemission, specific heat, magnetic susceptibility, Hall effect and residual resistivity data on liquid and amorphous metals has become available. The extent to which these data can be correlated within the present scheme will be investigated. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, DEVIATIONS FROM MATTHIESSEN'S RULE IN THE ELECTRICAL RESISTIVITY AND ATTENDANT EFFECTS IN OTHER TRANSPORT PROPERTIES (ABBREV)

R.I. Boughton, Northeastern University, School of Liberal Arts, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR77-24023)

This is a continuation of the research previously supported by DMR-7513090.

The experimental research program consists of two parts. The first and major portion involves a series of measurements of the electrical resistivity in a specific group of polyvalent metals which exhibit large and systematic deviations from Matthiessen's rule which are not at present adequately described by theory. Definitive experimental tests of the 'Non-conservation of Momentum' theory will be carried out by studying the correlations between impurity scattering-induced deviations in the electrical resistivity with boundary scattering-induced deviations and deviations in the thermal resistivity, respectively. The second part of the research program entails a continuation of the investigation of the possibility of observing flux quantization in a normal metal through measurement of the Aharonov-Bohm effect.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0023, COHERENT FAR INFRARED SOURCES AND NONLINEAR PROCESSES

F. Brown, Williams College, Graduate School, Dept. of Physics, *Williamstown, Massachusetts* 01267 (ENG77-20145)

This program consists of the development of a deuterium water vapor and the application of the laser to the investigation of nonlinear processes in crystals at far infrared wavelengths. Laser powers in the range between 25 and 40 megawatts will be sought for discrete wavelengths lying between 50 and 150 micrometers. The nonlinear processes to be investigated include Raman scattering by electronic states associated with impurities in germanium and the generation of intense terrahertz acoustic signals in gallium arsenide. The acoustic studies will also deal with the determination of damage thresholds at far infrared wavelengths.

This is a continuation of research previously supported under NSF grant ENG-7503222.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

8.0024, FUNDAMENTAL INVESTIGATIONS USING POSITRONS AND POSITRONIUM

A. Rich, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY77-28139)

Recent studies of the decay rate of ortho-positronium have shown a serious discrepancy with calculations based on current atomic theory. Further studies will be made of this decay rate in various environments (powder, gas, and vacuum). In addition, research will be initiated on the decay rate of para-positronium, on the allowed four-photon decay of positronium, and on the polarization of slow positron beams.

This is a continuation of work supported by NSF Grant PHY76-02398 A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0025, JOSEPHSON VORTEX PROPERTIES AND NONEQUILIBRIUM SUPERCONDUCTIVITY

J. Chen, Wayne State University, School of Liberal Arts, Dept. of Physics, *4841 Cass Ave., Detroit, Michigan* 48202 (DMR78-17813)

Research previously supported by DMR7402616.

A comprehensive experimental and theoretical investigation of nonequilibrium superconductivity in thin tin films as well as the electrodynamic properties of long Josephson tunnel junctions containing vortices will be made; techniques to be used include electron tunneling spectroscopy employing double junctions and ultrasonic attenuation measurements on thin films. Initial studies will concentrate on tin films and tin-tin oxide junctions. This work is important as the results will impact on emerging technologies such as ultrafast superconducting computers.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, NEUTRON SCATTERING STUDIES OF THE TRANSITION METAL SESQUIOXIDES

S.A. Werner, University of Missouri, Columbia Campus, Graduate School, *205 Jesse Hall, Columbia, Missouri* 65201 (DMR77-27247)

Neutron scattering experiments will be carried out at the University of Missouri Research Reactor to investigate the highly unusual magnetic and electronic properties of the vanadium and titanium oxides. Large single crystals suitable for neutron scattering experiments have been obtained and will be used in the following experiments: 1) Measurement of the phonon dispersion in V2O3 above and below the semiconductor-to-metal transition (170 degrees K). 2) Measurement of the magnon dispersion in V2O3 below the Neel temperature. 3) Measurement of the phonon dispersion in Ti2O3 as a function of temperature. 4) Measurements on chromium-doped V2O3 at temperatures where the speculated Mott transition occurs. 5) Measurements of the magnetic ordering in titanium-doped V2O3 as a function of temperature.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, COINCIDENCE AUGMENTED DIFFERENTIAL ION ENERGY-LOSS SPECTROMETRY

J.T. Park, University of Missouri, Rolla Campus, School of Science, Dept. of Physics, *Rolla, Missouri* 65401 (PHY78-07907)

This project in atomic physics studies the fundamental properties of the collisions of atoms at energies (up to 200 keV) well in excess of the atomic binding energies. A unique ion energy-loss spectrometer is used to measure the details of the collision process with a resolution of one part per million and better in energy, and simultaneously measure the scattering angles. It will be possible to measure the excitation of specific excited states in atomic hydrogen by incident protons, as well as the details of differential charge transfer scattering. In parallel, the collision products (including the photons emitted by excited atoms) will be detected. These studies will be extended to more complex atoms.

This is a continuation of work supported by NSF Grant PHY74-09671 A04.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0028, THEORETICAL STUDIES OF THE ELECTRON STRUCTURE OF SOLID SURFACES

J.C. Hermanson, Montana State University, School of Letters & Sciences, Dept. of Physics, *Bozeman, Montana* 59715 (DMR77-11862)

A theoretical model will be developed to examine the electronic structure of solid surfaces. The technique to be used will be an extension of the resolvent method which has been modified to treat a tight-binding model of solid surfaces. This method will be used to compute densities of states for the interpretation of the results of angle-resolved photoemission experiments on oriented single crystals. The initial aim of this work is to consider clean surfaces of solids, but a later objective will be the calculation of chemisorption behavior. This approach utilizes the best available band structure information and emphasizes the role of geometrical factors in determining surface quantum structure. Relaxation and reconstruction will be treated by modifying atomic interactions near the surface.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0029, ELECTRON CORRELATIONS AND PROPERTIES OF METALS AND INSULATORS

D.C. Langreth, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR77-08694 A01)

Theoretical investigations of many-electron systems in condensed matter previously supported by NSF grant DMR-7509804 will be continued.

Specific topics to be addressed include: the effect of electron correlations near surfaces of metals, surface energy of metals, and related structural properties; exchange and correlation in non-uniform systems and the approximate methods used in them; real metal properties including magnetic effects; and high-energy excitations in solids, including the theory of high-energy probes of solids such as photon, photoelectron, and electron spectroscopies. These will be studied both with respect to bulk and surface properties.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, LOW TEMPERATURE THERMAL PROPERTIES OF AMORPHOUS SOLIDS AND NITRATE GLASSES

R.O. Pohl, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR78-01560)

A systematic study of the thermal and dielectric properties of nitrate glasses at low temperatures will be carried out. This will include experimental measurements of the low temperature thermal conductivity and specific heat as well as of the optical and dielectric properties. Other amorphous and disordered solids exhibit anomalous behavior in their low temperature thermal and dielectric properties which may be characteristic of the disordered state. The goal of this research is to seek control of the anomalies in well prepared and well characterized nitrate glasses in order to identify those properties intrinsic to the amorphous state. A specific aim is to search for impurity modes in glasses associated with rotational or translational motion of impurity ions.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, THEORY OF CHARGE TRANSFER AT SEMICONDUCTOR-ELECTROLYTE INTERFACES

D. Mattis, Polytechnic Inst. of New York, Brooklyn Campus, School of Arts & Sciences, Dept. of Physics, *333 Jay St., Brooklyn, New York* 11201 (DN875508; N00014-78-C-0594)

Electrochemical processes at the semiconductor-electrolyte interface are important in many Navy areas of interest, includ-

ing photolysis of water, photovoltaic devices, corrosion and techniques for surface passivation of semiconductors. Improved devices and better control of many problems associated with electrochemical processes of surfaces will result from better understanding of the mechanisms associated with charge transfer and current flow at these interfaces.

The investigator is developing theoretical techniques to describe the charge exchange between semiconductor surfaces and adsorbed atoms. These will be applied to the charge transfer process occurring at the interface between a semiconductor and a liquid electrolyte while under illumination. Electronic eigenstates will be determined as will normal vibrational modes of the adatom. Other areas of application will be the interface between oxides and silicon and the compound semiconductors. Defect levels and resonant levels for tunneling mechanisms will be considered. Particular attention will be directed to the breakup of excitons impinging on the interface and its electron-ion analog in the photoelectrochemical cell problem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0032, MULTIPLE X-RAY DIFFRACTION EFFECTS IN SINGLE CRYSTALS

B. Post, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Physics, *333 Jay St., Brooklyn, New York* 11201 (DMR77-02532 A01)

This investigation will be a study of the nature and techniques of multiple diffraction of X-rays by crystals, and the application to selected problems in materials science and solid-state science. The study will include highly precise lattice constants of crystals such as gallium arsenide, gadolinium gallium garnet, and magnetic oxides.

In addition, the experimental determination of phase relationships among X-ray reflections from single crystals will be made. This will be done by analyses of the intensity distributions in the X-ray fine structure of reflections recorded under conditions of multiple diffraction. The research will be broadened from the study of perfect crystals to less perfect crystals.

This is a continuation of research initiated under NSF Grant DMR75-23680.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, COMPUTATIONAL STUDY OF NONADIABATIC EFFECTS IN ATOM-MOLECULE REACTIVE SCATTERING

M. Redmon, Battelle Memorial Inst., Battelle Columbus Laboratories, *505 King Ave., Columbus, Ohio* 43201 (DF054510; F49620-79-C-0050)

AF function - Air Force operations in detection, surveillance, and other areas require knowledge of gas phase energy exchange mechanisms. Deficiency - there is a lack of detailed understanding of how energy transfer occurs between species in the atmosphere and in lasers. Objective - the goal of this research is to develop quantum mechanical computational techniques to study nonadiabatic effects in three-dimensional atom-diatom collisions. How work contributes - the results of this effort will lead to a fundamental understanding of energy exchange processes in atmospheric chemistry, combustion and lasers.

The first phase of this program will be devoted to obtaining a computationally feasible basis for representing the scattering wave function for rearrangement collisions involving ground and excited state carbon and oxygen with singlet sigma and doublet pi molecules. Then, couplings responsible for non-adiabatic transitions will be obtained, initially from diatomics-in-molecules theory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0034, PHASE TRANSITION IN SOLID HYDROGEN ALLOYS AND OTHER DISORDERED SYSTEMS

J.R. Gaines, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DMR78-07527)

Experimental studies will be made of phase transitions in solid hydrogen below 0.5K. Nuclear magnetic resonance techniques will be used to study single crystals containing very low concentrations of orthohydrogen. Measurements of the heat capacity of small samples of solid hydrogen will be made above and below the transition temperature. This work is important to understanding the behavior of quantum solids.

This is a continuation of work supported under DMR76-11427. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, ADVANCED CONCEPTS IN CLOSED-CYCLE ELECTRICAL DISCHARGE LASER TECHNOLOGY

R.A. Olson, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF460890; F33615-76-C-2177)

AF function - electrical discharge gas lasers. Deficiency - presently there are no coherent long-life light sources to simultaneously cover all transmission windows from 1 to 5 microns. Research - an existing research system will be improved in aerodynamics, power conditioning and excitation, including photoionization to meet AF requirements. A significant decrease in size and weight will be achieved by development of a compact configuration. The closed-cycle laser technology developed will be applied to other electrical discharge lasers of AF interest. How research contributes - this research supports several AF requirements for multiple wavelength medium power high rep rate sources in the visible-to-infrared spectral range for electro-optical countermeasures.

The state-of-the-art of closed-cycle laser technology will be improved further by developing and incorporating new aerodynamic configuration concepts, by improvements in the laser geometry, by further development of the fast pulse-high repetition rate power conditioning system and by improving the laser parameter range (wavelength, power, rep-rate), for example, with improved photo-preionization. A new coaxial-flow system will be developed and tested. The closed cycle-high purity technology will be applied to other selected electrical discharge lasers of AF interest.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

8.0036, MAGNETIC IMPURITIES AND RADIATION DAMAGE IN PEROVSKITE AND RUTILE STRUCTURED MATERIALS

W.A. Sibley, Oklahoma State University, School of Arts & Sciences, Dept. of Physics, *Agricultural Hall, Stillwater, Oklahoma* 74075 (DMR77-12594)

This research was previously supported under DMR-7302349 A01. This research will involve the growth, preparation and optical characterization of previously little studied fluoride materials. In particular, studies of the optical and radiation damage of 3-D and rare-earth impurities will be made in crystals such as MgF_2, MnF_2, $RbMgF_3$ and $RbMnF_3$. From past research in this program, it has been possible to assign optical transitions, both absorption and emission, to particular energy levels for transition metal ions such as Mn ions, Co ions and Ni ions, and to study the effect of radiation-induced defects on the optical properties of these impurities. This research will attempt to understand how energy transfer occurs in these materials and whether the lifetimes of the optical transitions are reduced greatly by the presence of defects. Also, it will be determined whether in $RbMnF_3$ and MnF_2 radiation damage affects the optical oscillator strength of the Mn ions. In general this research will continue the work of understanding up-conversion and energy transfer in these materials.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, RELATIVISTIC CALCULATIONS OF ENERGIES, AUGER RATES AND LIFETIMES

B. Crasemann, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DF054220; AFOSR-79-0026)

AF function - this research contributes to RO 6.3, electromagnetic weaponry. Deficiency - energy levels and transition rates are needed in laser design. Objective - to develop and use methods of calculation of properties of atoms. Contributions - the availability of the results of this work will make it easier to develop new kinds of lasers since an accurate guide of atomic energy levels and transition rates will exist.

Atomic transition rates and configuration interaction energies are being calculated using a relaxed-orbital relativistic Hartree-Fock-Stater method. The total wave function is assumed to be a single Slater determinant of orbital functions, each of which is a solution of the DIRAC Hamiltonian.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0038, THE STRUCTURE AND LATTICE DYNAMICS OF MONOLAYERS ON CRYSTALLINE SUBSTRATES

A.D. Novaco, Lafayette College, Undergraduate School, Dept. of Physics, *Easton, Pennsylvania* 18042 (DMR75-15630 A01)

A theoretical study will be made of the structure and lattice dynamics of monolayer films on crystalline substrates. These systems are examples of two-dimensional displacive incommensurate solids, with the incommensurate structure in the monolayer being driven by the substrate. A variety of systems will be examined, some being treated with perturbation theory and some with an extended version of the self-consistent phonon approximation.

Research previously supported by DMR75-15630.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0039, STATISTICAL MECHANICS AND THEORY OF SOLIDS

H.B. Callen, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DMR76-21703 A02)

Research on the statistical mechanical properties of condensed matter carried out under NSF grant DMR72-03146 will be continued. Common to several aspects of this program is the use of renormalization-group techniques in phenomena other than thermodynamic phase transitions. In particular, such techniques will be used for studies of percolation, the theory of random systems, and the problem of turbulence. The latter, and the study of systems far from thermodynamic equilibrium, represents a new area of interest to be pursued during this grant period.

Further investigations using the renormalization group on the various liquid crystal phase transitions, and on phase transitions of surfaces, will be carried out.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0040, INELASTIC ELECTRON SCATTERING FROM SURFACE ADSORBATES

E.W. Plummer, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DMR78-08520)

This is an extension of research previously supported by NSF grant DMR-7302656 A01.

Vibrational modes of atoms and molecules on solid surfaces will be studied using high resolution inelastic electron scattering. The mechanisms for the scattering of low-energy electrons from adsorbed complexes will be investigated in an attempt to observe short range molecular scattering. In this scattering mode all of the fundamental modes of the surface complexes can be observed. The identification of the fundamental vibrational modes will enable one to identify the bonding configurations of a surface atom or molecule. This information is important in understanding bonding and reactions at solid surfaces.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0041, MECHANISMS OF PORE, DISLOCATION AND PRECIPITATE NUCLEATION AND GROWTH DURING HIGH TEMPERATURE ION BOMBARDMENT

W.J. Choyke, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DMR78-02598)

Many metals subjected to atomic displacement damage exhibit complex microstructural changes not seen under normal thermal equilibrium conditions. In all cases the evolution of the microstructure involves competitive nucleation and growth processes which proceed by the diffusion and aggregation of point defects and impurities. While there is a large body of experimental data and theory which has been identified and examined in detail, the mechanisms of point defect diffusion and clustering at low temperatures and damage levels in many metals and alloys, the mechanisms at temperatures and atomic displacement levels of interest to the new fields of implantation metallurgy and simulation of fast neutron effects remain largely unexplored. The purpose of this program is to identify the mechanisms of diffusion and aggregation of point defects and impurities involved in the nucleation and growth of voids, dislocation loops and precipitates under ion bombardment at temperatures high enough for self-diffusion to occur. Two co-impinging beams of helium ions and silicon ions are used to simultaneously produce lattice damage and introduce an isoluble impurity. In single crystals of copper, molybdenum and polycrystalline type 304 stainless steel, ion channeling, anelastic relaxation and transmission electron microscopy measurements will be used to determine impurity site occupancy, nature of the impurity-point defect aggregates, and the kinetics of diffusion and precipitation. The mechanisms of diffusion and aggregation of point defects and impurities will be identified by reconciling the measured properties with nucleation and growth reaction rate theories. This is a continuation of research previously funded under NSF Grant DMR75-01032 A02. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0042, RADIATION PROBLEMS IN GENERAL RELATIVITY

A.I. Janis, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY78-13926)

Theoretical physics research will be done in the area of general relativity. The following is a brief summary of the main topics to be emphasized. 1) There will be continued study of the geometric properties of the four-complex dimensional space (H-space) of asymptotically shear-free null surfaces in asymptotically flat space-times and its relationship to twistor theory. Particular points to be worked on are: a) Generalization of the techniques to include Yang-Mills theory. b) To further explore the unusual theory of equations of motion (ponderomotive force laws) that seems to be emerging. c) To understand, more precisely, how to find the physical space which produced a given H-space. d) To find more explicit H-spaces. e) To study the wide class of two-dimensional real H-spaces. f) To generalize the Penrose twistor particle classification scheme to deformed twistor space. g) To study the use of hyperfunction theory and sheaf theory in the case of non-analytic solutions to field equations. 2) It is planned to study several aspects of angular momentum in general relativity. In particular these include the removal of the ambiguities in the definition of angular momentum and the difficult question of finding the relationship between the rotational motion of sources and the total angular momentum.

This work is a continuation of that currently supported under NSF grant PHY76-17253 AO1.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0043, TRANSIENT NUCLEAR MAGNETIC RESONANCE STUDY OF SOLIDS

I.J. Lowe, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DMR78-15441)

Several solid-state physics experiments will be carried out using nuclear magnetic resonance (NMR). These include: (1) a continuation of the measurements of hydrogen diffusion in solids; (2) a continuation of line shape measurements in motionally narrowed solids such as NH4Cl and ice to better understand diffusive motion in solids; (3) a study of superionic conductors such as PbF2 to understand how the motion of the fluorine atoms is influenced by dopants. Measurements of various high pressure phases of ice will also be carried out.

This research was previously supported DMR-7622655.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0044, CHARGE TRANSFER BETWEEN HYDROGEN BEAMS AND NOBLE GASES

H.R. Dawson, Angelo State University, School of Science, Dept. of Physics, *San Angelo, Texas* 76901 (AJ-497)

Absolute cross-sections for the transfer of electrons into the 3S, 3D and 3P states of atomic hydrogen produced by proton and deuteron impact on gaseous targets of N2O and CO have been measured over the energy range between 2.2 and 8.2 keV. Over this energy range the N2O exhibits cross-section of 8 times 10 to the minus 18th power/cm for both 3D and 3S state capture. Capture into the 3P state is too small to measure by this technique. These measurements are almost the same as those made in this laboratory for a CO2 target. For the same energy range the CO target exhibits cross-sections of 4.5 times 10 to the minus 18th power/cm, 3 times 10 to the minus 18th power/cm and 11 times 10 to the minus 18th power/cm for the 3S, 3D and 3P states, respectively. These results compare in magnitude with those measured in this laboratory for O2, H2 and N2 targets.

SUPPORTED BY Robert A. Welch Foundation

8.0045, GAS-SOLID INTERACTIONS AT SEMICONDUCTOR SURFACES

J.H. Lunsford, Texas A & M University, College Station Campus, School of Science, Dept. of Chemistry, *College Station, Texas* 77843 (CHE78-09811)

This project is in the Structural Chemistry and Thermodynamics program, in the subfield of surface chemistry and heterogeneous catalysis. Reactions of the oxygen ions, O, O2, O3, with adsorbed species on various substrates, both non-catalytic and catalytic, will be studied by electron paramagnetic resonance spectroscopy (EPR). The catalytic oxidation of hydrocarbons by N2O will be investigated. It is thought that these reactions may proceed via oxygen ion intermediates. Other experiments will be devoted to the formation of O ions from lattice oxide ions, and to the generation of O ions in supported niobium. The research will progress from known oxygen species to surface reactions, and finally, the catalytic processes. The EPR technique limits the range of surfaces which may be studied, but a number of metal oxide systems are suitable; these include some supported transition metal oxides.

This research is a continuation of that currently supported by Foundation Grant, CHE-7515456.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0046, AN EXPERIMENTAL STUDY OF SURFACE INTERFACES IN SOLIDS

D.G. Naugle, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (A-514)

Measurements of the specific heat of thin foils of amorphous LaGa and LaAu alloys have been completed and provide a wealth of information. Values of the Debye temperature, electron-phonon coupling constant and the electronic density of states have been determined. Our measurements indicate that unlike most amorphous non-transition metals the electronic structure is not free electron-like and the strength of the electron-phonon interaction is intermediate. Variations in these properties with Ga or Au concentration suggest a change in the short range order at a concentration of about 24 in agreement with computer calculations based on the dense random packing model of the amorphous structure.

The specific heat of a bulk-like NiO powder with an average particle size of 1300 A and surface area of 7 sq. meters/gm land stated purity of 99.995% has been measured in the temperature range from 18K-300K. The results are in reasonably good agreement with and exhibit considerably less scatter than the high temperature measurements of Selz, et al. At lower temperatures the measured values are appreciably higher than those calculated by Thompson, et al., from inelastic neutron scattering. Estimates indicate that the discrepancy cannot be explained by size or surface effects.

SUPPORTED BY Robert A. Welch Foundation

8.0047, ENERGY GAP STUDIES IN THIN FILM SUPERCONDUCTORS

B.J. Marshall, Texas Tech University, School of Arts & Sciences, Dept. of Physics, *P.O. Box 4340, Lubbock, Texas* 79409 (D-170)

The interaction of surface acoustic waves with conduction electrons in thin film superconductors provides a method of determining the superconducting energy gaps in these thin films. A comparison of these energy gaps with the values previously obtained for the same materials in the bulk state provides one means of understanding the transition temperature enhancement in thin film superconductors.

The ultrasonic surface acoustic waves are generated by interdigital gratings plated onto both quartz and lithium niobate substrates. Thin films ranging from 100 A up to 10,000 A for Zn, Nb and Cd are presently being investigated. The material being studied is plated onto the substrate in the region between the sending and receiving interdigital gratings. This requires the surface wave to travel through the thin film resulting in energy being removed from the surface wave due to the electron-phonon interactions. By measuring the temperature dependence of this energy loss the superconducting energy gap can be calculated.

SUPPORTED BY Robert A. Welch Foundation

8.0048, STUDIES OF WHISTLER MODE SIGNALS FROM SIPLE STATION AND RELATED GEOPHYSICAL PHENOMENA

W.R. Sheldon, University of Houston, School of Arts & Sciences, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DPP75-13566 A03)

This is a supplement to Grant Number DPP 7513566. Previous award number is DPP 7513566 AO2 (proposal No. DPP 7623981).

This research on very-low-frequency wave particle interactions, orginally scheduled for the austral summer of 1977/78, has been delayed one year, and a pre-Siple rocket flight to test the research payload has been scheduled for January 1978 at Andeness, Norway.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

8.0049, TRANSITIONS AND ELECTRONIC PROPERTIES OF NON-CRYSTALLINE MATERIALS

J.C. Thompson, University of Texas, Austin Campus, School of Arts & Sciences, Dept. of Physics, *200 W. 21st, Austin, Texas* 78712 (F-145)

Studies of optical properties of molten alloys of Ga, In or Tl with Te are being extended to higher photon energies. The optical system is being rebuilt to permit the study of chemically reactive systems at higher temperatures. Data already obtained confirm the central role of the non-bonding pi electrons from Te in the semiconducting properties. Molecular clusters such as Ga2Te3, In2Te3, Tl2Te form with Ga-Te, In-Te, Tl-Te bonds and associated sigma bands.

A new, electrodeless Hall effect apparatus has been used to confirm the existence of mobility maximum in Na-NH3 solutions near 4 mole percent metal. While this excess mobility is associated with the phase separation and metal-nonmetal transition, no mechanism has yet been found. Li, K and Cs solutions do not show the excess.

Electrons have been photo-injected into NH3 from p-type Si and GaAs electrodes. The es level has therefore to be lower with respect to the vacuum in NH3 than in H2O. This suggests that the electron may enter the e8 bands level instead.

SUPPORTED BY Robert A. Welch Foundation

8.0050, ELECTRONIC STATES AT SURFACES OF SOLIDS

L. Kleinman, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR77-21559)

Theoretical calculations of the electronic structure of transition metal surfaces will be performed. First, ab initio calculations of the energy bands of a thin film of paramagnetic iron will be carried to self-consistency. Secondly, parameterized LCAO calculations on thicker films will be done.

Also to be calculated is the photocurrent of each spin due to a single-step process involving the excitation of the electrons near the surface into time-reversed LEED states. The surface resonance in tungsten will be examined in order to settle the question of whether this experimental feature is due to a spin-orbit induced resonance or an ordinary surface state. Finally, using techniques developed for electron calculations, the phonon densities of states on stepped surfaces will be calculated.

Continuation of research supported by DMR73-02449 A02. This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0051, PHASE TRANSFORMATIONS IN THE SOLID STATE

W.D. McCormick, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (F-610)

We have measured, in separate experiments, the heat capacity of six single crystals of K2SnCl6, in the temperature range 250 K to 265 K. The masses of the samples varied from 9 to 147 mg. We found evidence for two structural phase transformations at 260.5 plus or minus 0.5 K and 253.5 plus or minus 1.0 K. The temperature variability indicated was from sample to sample. Both transitions were found to be first order: the upper transition having a substantial latent heat, and the lower transition being nearly second order with a very small latent heat. We were able to confirm the presence of the lower of these two phase transitions, the existence of which has been somewhat controversial, even though the total height of the heat capacity anomaly associated with it was only about 2%. This was because, with the 'microcalorimetric' heat capacity technique developed under this grant, we were able to achieve a resolution of about plus or minus 0.1%, even with these very small samples.

SUPPORTED BY Robert A. Welch Foundation

8.0052, PROPERTIES OF DILUTE MAGNETIC ALLOYS AT VERY LOW TEMPERATURES AND NUCLEAR COOLING

O.G. Symko, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR76-21702 A01)

Experimental studies of dilute magnetic impurities at very low temperatures previously supported by NSF grant DMR71-01802 will be continued. The interest is in the behavior of transition-metal impurities in a non-magnetic metal host. Such impurities will interact strongly with their surroundings, and in particular they will interact with the crystalline field produced by the surrounding ions and conduction electrons, with the conduction electrons, and with the other impurities; also, hyperfine interactions and a spin-compensated Kondo state can exist. These effects will be studied by measuring the magnetization as a function of temperature in the following alloys: Zn-Cr, Mg-Mn, Au-Mn, and Cu-Cr. As impurity-impurity interactions are quite strong, it will be necessary to go to very low impurity concentrations to observe some of the above mentioned single-impurity effects. The latter tend to be weak and hence low temperatures are necessary to reduce the thermal energy kT. A nuclear cooling apparatus together with a SQUID magnetometer will be used to study the ground-state behavior of some of the above alloys and nuclear quadrupole interactions in metals.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0053, MAGNETIC RESONANCE STUDY OF ATOMIC AND MOLECULAR MOTIONS

D.C. Ailion, Utah Higher Education System, University of Utah, School of Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR76-18966 A01)

This research was previously supported under NSF grant DMR-7618966.

Recently developed techniques will make use of nuclear magnetic resonance (NMR) to obtain a microscopic understanding of atomic and molecular motions in solids. NMR relaxation time techniques will be applied to the study of ionic diffusion in solid electrolytes such as sodium B'-alumina. Because of the very high conductivity of sodium ions in B and B'-alumina, these substances have a variety of practical applications in problems where energy storage and conversion are important.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0054, THE RESPONSE OF THE HIGH LATITUDE IONOSPHERE TO CONVECTION ELECTRIC FIELDS

W.J. Raitt, Utah Higher Education System, Utah State University, School of Science, Dept. of Physics, *Main Bldg., Office 104, Logan, Utah* 84321 (DF582300; F19628-79-C-0025)

AF function - surveillance, communication, navigation. Deficiency - inadequate knowledge of plasma flows, charge distributions, electric fields for the design needs of AF systems. Objective - study high latitude ionospheric dynamics in three areas - 1. High latitude f region dynamics. 2. Convection electrodynamics. 3. Polar cap plasma chemistry and dynamics. How research contributes - provides data essential to HF and UHF propagation predictions, provides data required for the design and utilization of communication guidance and surveillance systems and provides understanding of the dynamical processes in the ionosphere.

Develop theoretical procedures and computer codes to determine plasma flow, particle distributions and effects of electric fields on the high latitude ionosphere. Satellite data will be utilized to test the theoretical methods and to develop a prediction capability for the high latitude ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

8.0055, INELASTIC ELECTRON AND SOFT X-RAY SPECTROSCOPY

S.E. Schnatterly, University of Virginia, School of Engineering & Applied Science, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR78-16753)

Experimental studies of the electronic structure and excitations in solids which previously were supported by NSF grant DMR-7721709 will be continued. Two research areas will be addressed. The first area is concerned with electron energy loss phenomena in solids. The inelastic electron scattering spectrometer previously built with NSF support will be reassembled with improvements in design at the University of Virginia. Experimental studies of X-ray thresholds, absorption edge fine structure, atomic plasmons and core excitons will be carried out using this technique. An improved understanding of these effects will provide a basis for testing the validity of current theories for single particle and collective excitations in solids. The second area of research is concerned with soft X-ray spectroscopy. An emission spectrometer is being designed and constructed which should have a significant increase in sensitivity over equipment currently available. Experiments using this technique will be carried out to complement the electron scattering experiments. Also, the application of this technique to experimental studies of surface phenomena will be investigated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0056, STUDY OF PULSE-EXCITED NITROGEN

C.C. Lin, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF580220; F19628-78-C-0042)

AF function - infrared optical detection system. Deficiency - lack of knowledge of the optical and infrared emission induced by the detonation of a high altitude nuclear weapon. Objective - to investigate time-dependent radiation intensity of excited N2 at various wave lengths. How research contributes - a complete understanding of how the excited states of nitrogen are populated and their subsequent decay will contribute to the accuracy of prediction of radiation intensity from ultraviolet to infrared frequencies.

Use double laser-pulsed excitation technique to examine the first positive band of nitrogen and other bands.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

8.0057, SURFACE STRUCTURES, LATTICE DYNAMICS AND ADATOM INTERACTIONS

M.B. Webb, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DMR78-16650)

Research on the atomic arrangements, thermal vibrations, thermodynamics and kinetic properties of surfaces and adsorbed atoms, previously supported by NSF grant No. DMR76-21576, will be continued. Experiments using the low energy electron diffraction technique will be performed on Si (100) and (111) surfaces, both clean and with adsorbed gases, and Ag (111) surfaces with adsorbed Xe and other noble gases. The information obtained will contribute significantly to the understanding of the electronic and chemical processes of semiconductor surfaces, and of the interactions of adsorbed gas atoms with the substrate surface and with each other.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, MICROMETRIC MEASURES OF VISUAL DOUBLE STARS

F. Holden, (No Performing Organization Reported), *California* (AST77-00249 A01)

Support for an additional year will allow continuation of measures, with bifilar micrometers, of visual double stars in California, Chile, and Venezuela. The 36-inch refractor of Lick Observatory will be again available and, in the northern winter when California does not have its best seeing, measures will be made in Chile and Venezuela. The southern observatories of Cerro Tololo and Las Campanas will be visited and also the C.I.D.A. Observatory near Merida, Venezuela, to extend the observations through both hemispheres of the sky.

Double stars are important because they are more numerous than single stars in our galaxy and from their orbital motions information about stellar masses is obtained.

Previous support was by NSF grant AST 77-00249.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, AIRBORNE OBSERVATIONS OF PASCHEN ALPHA EMISSION IN SEYFERT GALAXIES

B.T. Soifer, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 2413)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

10.0003, DETECTION, SPECTROSCOPY AND PHYSICAL STUDY OF RADIO GALAXIES AT LARGE RED SHIFTS

H. Spinrad, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST77-26897)

The main research objective is to study the evolution of galaxies at large red shifts (and long look-back times), and to constrain current cosmological models by means of optical observations of distant radio and cluster galaxies. The procedures require detection of limiting (V greater than or equal to 23) galaxies (radio sources or cluster members), followed up by (presently) lengthy and difficult spectrophotometry. This research then yields a red shift and color-evolution data. In a few cases, galaxy surface-brightnesses and isophotal diameters will be measured; such data will be utilized for an evaluation of galaxian luminosity evolution, if qo (the deceleration parameter) can be independently fixed. Finally the probable content of a sample of faint field galaxies will be discussed.

This is a continuation of research done under grant AST 72-05061 A04.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0004, MEASUREMENT OF ATMOSPHERIC CONSTITUENT PROFILES USING THE SOLAR SPECTRUM AND THE ATMOSPHERIC EMISSION SPECTRUM IN THE INFRARED

D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM77-27633)

One of the major problems of the chemistry of the stratospheric ozone layer is the lack of data on the altitude distribution of many chemical species of interest. A significant number of molecules predicted to be present in the stratosphere and to play key roles in ozone chemistry have not been directly detected at all. Many such molecules have infrared absorption bands. The objective of this research is to detect and to determine altitude distributions of trace chemical species in the stratosphere in a series of balloon-borne experiments that utilize infrared absorption and emission as the basis for detection.

Two different types of instruments will be flown under this program: (1) a solar tracking system coupled to an infrared in-

terferometer to obtain solar absorption spectra at a resolution of 0.01/cm as a function of altitude and from float altitude at sunset, and (2) an ultrasensitive spectrometer system to measure radiation emitted by the atmosphere at various altitudes up to the balloon float altitude. Absorption studies offer superior spectral resolution for sensitive and accurate identification of the molecules present in the atmosphere. Emission experiments offer increased dynamic range and the ability to detect atmospheric species at any time of day and thereby measure important diurnal variation.

Previous balloon-borne infrared experiments have been highly successful in detecting many important stratospheric species for the first time. The substantially improved infrared absorption instrumentation to be flown under this grant shows considerable promise of achieving detection and measurement of several key species for which only upper limits on concentrations have been determined previously, thereby achieving a major improvement in chemical understanding of the stratosphere. The emission experiment should achieve significant results on the concentrations of important species, such as N2O5, that are believed to reach maximum concentration at night.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0005, OBSERVATIONAL STUDIES OF MASS EXCHANGE BETWEEN STARS AND DIFFUSE MATTER IN GALAXIES AND ACTIVE BINARY SYSTEMS

J.S. Gallagher, University of Illinois, Urbana Champaign Campus, School of Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST77-18270)

Observational studies concerning interrelationships between stars and diffuse matter is presented. The research will primarily be divided between two major areas: 1. Cataclysmic Variable Stars. An emphasis will be placed on classical novae and on variable stars which share physical characteristics with novae. Specific problems will include evolution of the ejecta, abundances, and mass exchange in active binaries. 2. Optical structural characteristics of E, SO, and IO galaxies. Detailed information on internal structure and dynamics as well as the distribution of stellar populations will be needed for representative sample galaxies in order to properly assess variable atom hydrogen (HI) content in early-type galaxies. A program of optical spectrophotometry and direct broad-band and image intensifier H alpha photography has been chosen for the initial stages of this work.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, IONIZATION MODELS OF HIGH EXCITATION PLANETARY NEBULAE

J.P. Harrington, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (AST78-07490)

This research will involve the construction of detailed ionization models of high-excitation planetary nebulae, with particular emphasis upon the interpretation of satellite ultraviolet observations. The purpose of this work will be to obtain estimates of the abundances of carbon, nitrogen and oxygen in these objects. This is important to our understanding of the carbon-nitrogen-oxygen cycle and helium-burning nucleosynthesis taking place in stars which become planetary nebulae.

In addition to the requirement of high-quality visual data, the nebulae chosen for modelling will be selected among those scheduled for early observation by the International Ultraviolet Explorer spacecraft. The modelling approach to be adopted is the only good method available for the analysis of the ultraviolet lines of carbon and other elements.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, IONOSPHERIC VARIABILITY

M.J. Mendillo, Boston University, School of Liberal Arts, Dept. of Astronomy, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (DF249900; F19628-77-C-0270)

AF function - radio frequency ranging systems for navigation and satellite detection and tracking. Deficiency - monthly average models are available for correcting for the effects of the earth's ionosphere on the velocity of radio waves. However, on a day-to-day basis, the models have errors of up to 25 percent rms. The effect on the ionosphere of large magnetic storms has been studied, and can be corrected for to first order. Other variations occur which are not yet understood yet cause large errors from average conditions. Objective - study the day-to-day variability of the ionospheric f region to develop algorithms to improve models of ionospheric time delay. How research contributes -results will improve existing models of the time delay to operational radar and navigation systems, and will require the use of fewer monitoring stations to update ionospheric conditions.

The ionosphere has an approximate 25 percent variability from monthly average conditions. The contractual approach to study this variability will be to find relationships with other geophysical parameters which correlate with ionospheric parameters such as total electron content and NMAX after the effects of magnetic storms have been carefully removed from the data. Also, power spectral analyses will be done to determine the predominant spectral features of the temporal behavior and its repeatability. Some model studies will be undertaken to determine the effects of changes in neutral winds, electric fields and auroral heating on the day-to-day variability of the f region.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

10.0008, BLACK HOLES, GRAVITATIONAL COLLAPSE OF DENSE STELLAR SYSTEMS, COSMOLOGY

A.P. Lightman, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (AST78-08428)

The research to be carried out under this grant involves studies of cosmology, the gravitational collapse of dense stellar systems, and the interactions of black holes with their environments. Specific problems to be considered include: massive black holes in globular clusters and galactic nuclei, detailed time-dependent analysis of energy conduction processes and rates in two-species gravitating systems, the nature of the active nucleus of the Seyfert galaxy NGC 4151, the possibility of dissolution of globular clusters, and relaxation effects in cosmological mass condensations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, STUDIES IN THE MATHEMATICAL THEORY OF GLOBAL CLIMATE

G.R. North, University of Missouri, St. Louis Campus, School of Arts & Sciences, Dept. of Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (ATM78-07962)

This project is a two-year continuation of the analytical study of simple climate models. Certain features of these models have been established such as multiple branch solutions, stability theory and estimates of sensitivity under specific assumptions. Further work needs to be done to provide a guide or reference line for larger model studies. Proposed work includes: the extension of a stationary perturbation theory which predicts the change in large-scale climate due to infinitesimal external changes (such as CO2 concentration); the extension of a variational principle to larger classes of models; the extension of a simple seasonal model to include climate change with ice feedback; the study of fluctuations in model solutions due to various stochastic inputs; and the extension of the simple terrestrial models to the example of the planet Mars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0010, ULTRAVIOLET AND X-RAY BOMBARDMENT OF PLANETARY ATMOSPHERES

J.A. Samson, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (ATM78-05702)

The interaction of solar radiation with a planet's atmosphere depends critically upon the wavelength of the incident radiation. The energetic radiation below 2000 A causes dissociation, ionization, and dissociative ionization of atmospheric molecules. The resulting molecular fragments react with ambient species to form a source of new molecules in the atmosphere, while the ionic fragments are the starting species in ionospheric chemistry. The objective of this research is to investigate the interaction of solar ultraviolet radiation with planetary atmospheres and to provide cross-sections for specific interactions as functions of wavelength in the interval 100-1400 A. The techniques used in the study include measurement of kinetic energies of ejected photoelectrons (photoelectron spectroscopy) and of ionic species with a mass spectrometer.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0011, COSMIC RAY ANISOTROPY, SOLAR MAGNETISM AND HELIOMAGNETOSPHERE

H.S. Ahluwakia, University of New Mexico, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Hill N.E., Albuquerque, New Mexico* 87106 (ATM78-10727)

This award will support an attempt to understand the observed day-to-day and the long-term changes in the parameters of the diurnal, the semidiurnal and the tridiurnal components of the solar daily variation of cosmic rays, in an attempt to arrive at a unified theory of the anisotropies of solar origin which contribute to these ordered interplanetary magnetic fields, far away from the plane of the ecliptic. This study might make it possible to draw certain inferences regarding the broad scale ordering of the interplanetary magnetic field and the time variations in it, over a solar cycle. One can compare these inferences with the predictions of theoretical models.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0012, MOLECULAR SPECTROSCOPY FROM THE KUIPER AIRBORNE OBSERVATORY

S. Beckwith, Cornell University, Ithaca Campus, Graduate School, *101 Sage Graduate Ctr., Ithaca, New York* 14850 (NSG 2412)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

10.0013, THEORY OF GRAVITATION

J.W. York, University of North Carolina, Chapel Hill Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Chapel Hill, North Carolina* 27514 (PHY76-83252)

Research initiated under NSF grant PHY74-14191 A04 will be continued. This project deals primarily with the dynamics of gravitational fields according to the general theory of relativity. The principal feature of the analysis is that it is based on the conclusions that have been reached from a comprehensive analysis, using conformal methods, of the initial-value equations, which form the foundation of the dynamical structure. In particular, the following topics will be investigated: 1. The space of degrees of freedom of asymptotically flat gravitational fields. 2. The natural kinematical gauge conditions that are suggested by the conformal analysis of the initial-value problem. The 'minimal coordinate shear' condition is of particular interest in regard to the evolution of Cauchy data, and the explicit characterization of gravity waves on space-like slices. 3. Incorporation of the constraint equations and the above gauge conditions into the Hamiltonian form of classical general relativity. 4. Implications of the above results for a quantum theory of gravity. 5. Continuation of work on numerical construction of initial data for calculation of astrophysical interest.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

10.0014, CONSTRUCTION AND INSTALLATION OF A REMOTELY CONTROLLED CASSEGRAIN SPECTROGRAPH SYSTEM FOR THE MCDONALD OBSERVATORY 2.7-METER TELESCOPE

H.J. Smith, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-23326)

A Cassegrain spectrograph system will be constructed and installed at the 2.7-meter (107-inch) telescope of the McDonald Observatory of the University of Texas. The design of this system will be modelled on the automated Miller spectrograph at the Lick Observatory of the University of California. The system will consist of four major parts: (1) the telescope utility bench, which will support the spectrograph, detector calibration lamps and the television guiding system; (2) the Cassegrain spectrograph; (3) the detector system, and (4) the read-out and data handling system.

Actual construction of most of the parts of the system will be carried out at the McDonald Observatory Shop, located at the Bee Caves Research Center and Observatory. Construction should take approximately one year. Installation and operation will begin in the second year.

Scientific projects that will make use of the new spectrograph will cover many areas of astrophysics: radio galaxies, galaxies in clusters, quasi-stellar objects, time-resolved spectroscopy of rapidly varying stellar sources such as cataclysmic binaries, variable white dwarf stars, dwarf cepheids, and flare stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0015, A STUDY OF STRATOSPHERIC AEROSOL SOURCES, FORMATION PROCESSES AND ROLE AS A SINK FOR TRACE GASES

D.J. Hofmann, University of Wyoming, School of Arts & Sciences, Dept. of Physics & Astronomy, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (ATM77-27552)

This action funds the study of the nature and importance of the stratospheric sulfate aerosol layer in terms of defining the source, investigating aerosol formation processes and investigating the importance of transport processes. These research goals will be sought by conducting stratospheric balloon soundings of ozone, r greater than or equal to 0.15 micron, aerosol r greater than or equal to 0.01 micron condensation nuclei and by observing the vaporization point of the volatile aerosol in the sulfate layer over Laramie, Wyoming. Major emphasis will be placed on continuing monthly aerosol soundings at Laramie as have been done in the past year, to attempt to sort out volcanic and transport effects. In studying transport phenomena, ozone measurements are important as another tracer of equatorial air. Laboratory studies of ozone sensors will continue in hopes that a chemiluminescent detector can be suitably calibrated prior to balloon launch so the absolute as well as relative ozone data can be obtained. Continued research on the condensation nuclei counter is necessary to improve its high-altitude response. Some of this work should be done this summer along with additional aerosol vaporization measurements. To increase the versatility of balloon platforms for stratospheric research, work will proceed on developing small multi-balloon systems wherein the number of balloons is varied to obtain different float altitudes and developing radio command capabilities so that the experimenter can control his experiment from the ground. Related work funded by the Office of Naval Research and the Army Research Office will be coordinated with this effort.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-24259* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING. A CONTINUING BIBLIOGRAPHY WITH INDEXES. SUPPLEMENT 121, APRIL 1980
Apr. 1980 128 p
(NASA-SP-7037(121)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 411 reports, articles, and other documents introduced into the NASA Scientific and Technical Information system in March 1980. Author

N80-24260*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
DEVELOPMENT OF TEST METHODS FOR SCALE MODEL SIMULATION OF AERIAL APPLICATIONS IN THE NASA LANGLEY VORTEX RESEARCH FACILITY
Frank L. Jordan, Jr. Apr. 1980 17 p refs Presented at the AIAA 11th Aerodyn. Testing Conf., Colorado Springs, Colo., 18-20 Mar. 1980
(NASA-TM-81805) Avail: NTIS HC A02/MF A01 CSCL 01B

As part of basic research to improve aerial applications technology, methods were developed at the Langley Vortex Research Facility to simulate and measure deposition patterns of aerially-applied sprays and granular materials by means of tests with small-scale models of agricultural aircraft and dynamically-scaled test particles. Interactions between the aircraft wake and the dispersed particles are being studied with the objective of modifying wake characteristics and dispersal techniques to increase swath width, improve deposition pattern uniformity, and minimize drift. The particle scaling analysis, test methods for particle dispersal from the model aircraft, visualization of particle trajectories, and measurement and computer analysis of test deposition patterns are described. An experimental validation of the scaling analysis and test results that indicate improved control of chemical drift by use of winglets are presented to demonstrate test methods. A.R.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-24261*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
THEORY FOR COMPUTING THE SIZE AND SHAPE OF A REGION OF INFLUENCE ASSOCIATED WITH A MANEUVERING VEHICLE
Raymond L. Barger May 1980 22 p refs
(NASA-TP-1648; L-13419) Avail: NTIS HC A02/MF A01 CSCL 01A

A general procedure for computing the region of influence of a maneuvering vehicle is described. Basic differential geometric relations, including the use of a general trajectory parameter and the introduction of auxiliary variables in the envelope theory are presented. To illustrate the application of the method, the destruct region for a maneuvering fighter firing missiles is computed. Author

N80-24262*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
COMPARISON OF CALCULATED AND MEASURED MODEL ROTOR LOADING AND WAKE GEOMETRY
Wayne Johnson Apr. 1980 34 p refs Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif.
(NASA-TM-81189; AVRADCOM-TR-80-A-4; A-8149) Avail: NTIS HC A03/MF A01 CSCL 01A

The calculated blade bound circulation and wake geometry are compared with measured results for a model helicopter rotor in hover and forward flight. Hover results are presented for rectangular tip and ogee tip planform blades. The correlation is quite good when the measured wake geometry characteristics are used in the analysis. Available prescribed wake geometry models are found to give fair predictions of the loading, but they do not produce a reasonable prediction of the induced power. Forward flight results are presented for twisted and untwisted blades. Fair correlation between measurements and calculations is found for the bound circulation distribution on the advancing side. The tip vortex geometry in the vicinity of the advancing blade in forward flight was predicted well by the free wake calculation used, although the wake geometry did not have a significant influence on the calculated loading and performance for the cases considered. Author

N80-24263*# General Dynamics/Fort Worth, Tex.
EXPERIMENTAL INVESTIGATION OF A 0.15 SCALE MODEL OF A CONFORMAL VARIABLE-RAMP INLET FOR THE F-16 AIRPLANE Final Report
J. E. Hawkins Mar. 1980 219 p refs Sponsored by NASA
(NASA-CR-159640; ERR-FW-2014) Avail: NTIS HC A10/MF A01 CSCL 01A

A 0.15 scale model of a proposed conformal variable-ramp inlet for the Multirole Fighter was tested from Mach 0.8 to 2.2 at a wide range of angles of attack and sideslip. Inlet ramp angle was varied to optimize ramp angle as a function of engine airflow, Mach number, angle of attack, and angle of sideslip. Several inlet configuration options were investigated to study their effects on inlet operation and to establish the final flight configuration. These variations were cowl sidewall cutback, cowl lip bluntness, boundary layer bleed, and first-ramp leading edge shape. Diagnostic and engine face instrumentation were used to evaluate inlet operation at various inlet stations and at the inlet/engine interface. Pressure recovery and stability of the inlet were satisfactory for the proposed application. On the basis of an engine stability audit of the worst-case instantaneous distortion patterns, no inlet/engine compatibility problems are expected for normal operations. Author

N80-24264*# California Polytechnic State Univ., San Luis Obispo. Dept. of Aeronautical Engineering.
EFFECTS OF FREE-STREAM TURBULENCE ON DIFFUSER PERFORMANCE
Jon A. Hoffmann. Jun. 1980. 51 p. refs.
(Grant NsG-2391)
(NASA-CR-163194) Avail: NTIS. HC A04/MF A01. CSCL 01A

An experimental evaluation of the effects of free stream turbulence on the performance of a subsonic two dimensional diffuser was made. The diffuser's static pressure recovery coefficient was increased 11.4 and 21.1 percent at total. Divergence angles of 12 and 20 degrees respectively were obtained when the value of the inlet integral free stream scale of turbulence in the flow direction was at least 7.5 times larger than the inlet boundary layer displacement thickness, and when the inlet total free stream turbulence intensity was at least 3.5 percent. It is hypothesized that a larger scale of turbulence transmits the free stream energy to the wall more effectively and when coupled with large turbulence intensities, acts to decrease the distortion and delay separation within the diffuser. J.M.S.

N80-24265*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INSTRUMENTATION FOR CALIBRATION AND CONTROL OF A CONTINUOUS-FLOW CRYOGENIC TUNNEL
Charles L. Ladson and Robert A. Kilgore. May 1980. 13 p. refs. Presented at AGARD-VKI Lecture Ser. 3 on Cryogenic Wind Tunnels, May 1980.
(NASA-TM-81825) Avail: NTIS. HC A02/MF A01. CSCL 01A

Those aspects of selection and application of calibration and control instrumentation that are influenced by the extremes in the temperature environment to be found in cryogenic tunnels are described with emphasis on the instrumentation and data acquisition system used in the Langley 0.3 m transonic cryogenic tunnel. Typical calibration results obtained in a 20 by 60 cm two dimensional test section are included. A.R.H.

N80-24266*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF CONVENTIONAL AND SQUARE STORES ON THE LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A FIGHTER AIRCRAFT MODEL AT SUPERSONIC SPEEDS
William J. Monta. Jun. 1980. 59 p. refs.
(NASA-TM-81791; L-13402) Avail: NTIS. HC A04/MF A01. CSCL 01A

The effects of conventional and square stores on the longitudinal aerodynamic characteristics of a fighter aircraft configuration at Mach numbers of 1.6, 1.8, and 2.0 was investigated. Five conventional store configurations and six arrangements of a square store configuration were studied. All configurations of the stores produced small, positive increments in the pitching moment throughout the angle-of-attack range, but the configuration with area ruled wing tanks also had a slight decrease on stability at the higher angles of attack. There were some small changes in lift coefficient because of the addition of the stores, causing the drag increment to vary with the lift coefficient. As a result, there were corresponding changes in the increments of the maximum lift drag ratios. The store drag coefficient based on the cross sectional area of the stores ranged from a maximum of 1.1 for the configuration with three Maverick missiles to a minimum of about .040 for the two MK-84 bombs and the arrangements with four square stores touching or two square stores in tandem. Square stores located side by side yielded about 0.50 in the aft position compared to 0.74 in the forward position. R.E.S.

N80-24267*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF AXISYMMETRIC AND NONAXISYMMETRIC NOZZLES INSTALLED ON A 0.10 SCALE F-18 PROTOTYPE AIRPLANE MODEL
Francis J. Capone and Bobby L. Berrier. Jun. 1980. 304 p. refs.
(NASA-TP-1638; L-13401) Avail: NTIS. HC A14/MF A01. CSCL 01A

The Langley 16 foot transonic tunnel was used to investigate the afterbody/nozzle longitudinal aerodynamic characteristics of three different two dimensional nozzles and a base-line axisymmetric nozzle installed on a 0.10 scale model of the F-18 airplane. The effects of thrust vectoring and in-flight thrust reversing were also studied. Horizontal-tail deflections of 0 deg, -2 deg, and -5 deg were tested. Test data were obtained at static conditions and at Mach numbers from 0.60 to 1.20 over an angle-of-attack range from -2 deg to 10 deg. Nozzle pressure ratio was varied from jet off to about 10. A.R.H.

N80-24268*# Boeing Commercial Airplane Co., Seattle, Wash.
A GENERAL PANEL METHOD FOR THE ANALYSIS AND DESIGN OF ARBITRARY CONFIGURATIONS IN INCOMPRESSIBLE FLOWS Final Report
Forrester T. Johnson. Washington: NASA. May 1980. 200 p. refs.
(Contract NAS2-7729)
(NASA-CR-3079; D6-43808) Avail: NTIS. HC A09/MF A01. CSCL 01A

A method for solving the linear integral equations of incompressible potential flow in three dimensions is presented. Both analysis (Neumann) and design (Dirichlet) boundary conditions are treated in a unified approach to the general flow problem. The method is an influence coefficient scheme which employs source and doublet panels as boundary surfaces. Curved panels possessing singularity strengths, which vary as polynomials are used, and all influence coefficients are derived in closed form. These and other features combine to produce an efficient scheme which is not only versatile but eminently suited to the practical realities of a user-oriented environment. A wide variety of numerical results demonstrating the method is presented. Author

N80-24269*# Beam Engineering, Inc., Sunnyvale, Calif.
SIMPLE TURBULENCE MODELS AND THEIR APPLICATION TO BOUNDARY LAYER SEPARATION Final Report
Alan J. Wadcock. Washington: NASA. May 1980. 71 p. refs.
(Contract NAS2-10093)
(NASA-CR-3283) Avail: NTIS. HC A04/MF A01. CSCL 01A

Measurements in the boundary layer and wake of a stalled airfoil are presented in two coordinate systems, one aligned with the airfoil chord, the other being conventional boundary layer coordinates. The NACA 4412 airfoil is studied at a single angle of attack corresponding to maximum lift, the Reynolds number based on chord being 1.5 x 10 to the 6th power. Turbulent boundary layer separation occurred at the 85 percent chord position. The two-dimensionality of the flow was documented and the momentum integral equation studied to illustrate the importance of turbulence contributions as separation is approached. The assumptions of simple eddy-viscosity and mixing-length turbulence models are checked directly against experiment. Curvature effects are found to be important as separation is approached. Author

N80-24270*# Computer Sciences Corp., Hampton, Va.
THE INCORPORATION OF PLOTTING CAPABILITY INTO THE UNIFIED SUBSONIC SUPERSONIC AERODYNAMIC ANALYSIS PROGRAM, VERSION B Progress Report, 1973 - 1980
Octavio A. Winter. Washington: NASA. May 1980. 141 p. refs.
(Contract NAS1-14900)
(NASA-CR-3228) Avail: NTIS. HC A07/MF A01. CSCL 01A

The B01 version of the United Subsonic Supersonic Aerodynamic Analysis program is the result of numerous modifications and additions made to the B00 version. These modifications and additions affect the program input, its computational options, the code readability, and the overlay structure. The following are described: (1) the revised input; (2) the plotting overlay programs which were also modified, and their associated subroutines; (3) the auxiliary files used by the program, the revised output data; and (4) the program overlay structure. R.E.S.

N80-24271*# Boeing Commercial Airplane Co., Seattle, Wash.
FURTHER INVESTIGATION OF A FINITE DIFFERENCE PROCEDURE FOR ANALYZING THE TRANSONIC FLOW

ABOUT HARMONICALLY OSCILLATING AIRFOILS AND WINGS Final Report
W. H. Weatherill, F. E. Ehlers, E. Yip, and J. D. Sebastian. Washington NASA May 1980 83 p refs
(Contract NAS1-15128)
(NASA-CR-3195; D-48851) Avail: NTIS HC A05/MF A01 CSCL 01A

Analytical and empirical studies of a finite difference method for the solution of the transonic flow about harmonically oscillating wings and airfoils are presented. The procedure is based on separating the velocity potential into steady and unsteady parts and linearizing the resulting unsteady equations for small disturbances. The steady velocity potential is obtained first from the well-known nonlinear equation for steady transonic flow. The unsteady velocity potential is then obtained from a linear differential equation in complex form with spatially varying coefficients. Since sinusoidal motion is assumed, the unsteady equation is independent of time. An out-of-core direct solution procedure was developed and applied to two-dimensional sections. Results are presented for a section of vanishing thickness in subsonic flow and an NACA 64A006 airfoil in supersonic flow. Good correlation is obtained in the first case at values of Mach number and reduced frequency of direct interest in flutter analyses. Reasonable results are obtained in the second case. Comparisons of two-dimensional finite difference solutions with exact analytic solutions indicate that the accuracy of the difference solution is dependent on the boundary conditions used on the outer boundaries. Homogeneous boundary conditions on the mesh edges that yield complex eigenvalues give the most accurate finite difference solutions. The plane outgoing wave boundary conditions meet these requirements. Author

N80-24272*# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
COHERENT SUBSTRUCTURE OF TURBULENCE NEAR THE STAGNATION ZONE OF A BLUFF BODY
Willy Z. Sadeh and Herbert J. Brauer. 1980 13 p refs Presented at the 4th Colloq. on Ind. Aerodyn., Aachen, West Germany, 18-20 Jun. 1980
(Grant NsG-3127)
(NASA-CR-163191) Avail: NTIS HC A02/MF A01 CSCL 01A

The evolution of freestream turbulence in crossflow about a circular cylinder was studied in order to indentify the existence of a coherent substructure which is the outcome of the amplification of freestream turbulence by the stretching mechanism in diverging flow about a bluff body. Visualization of the flow events revealed the selective stretching of cross-vortex tubes and the emergence of an organized turbulent flow pattern near the cylinder stagnation zone. Significant amplification of the total turbulent energy of the streamwise fluctuating velocity was consistently monitored. Realization of selective amplification at scales larger than the neutral scale of the stagnation flow was indicated by the variation of the discrete streamwise turbulent energy. A most amplified scale, characteristic of the energy containing eddies within the coherent substracture and commensurate with the boundary-layer thickness, was detected. Penetration of the amplified turbulence into the cylinder boundary layer led to the retardation of separation and to a concurrent decrease in the drag coefficient at subcritical cylinder-diameter Reynolds numbers. A.R.H.

N80-24273*# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
A DRY-SURFACE COATING METHOD FOR VISUALIZATION OF SEPARATION
W. Z. Sadeh, H. J. Brauer, and J. R. Durgin. 1980 6 p refs Presented at the Intern. Symp. on Flow Visualization, Bochum, West Germany, 9-12 Sep. 1980
(Grant NsG-3127)
(NASA-CR-163192) Avail: NTIS HC A02/MF A01 CSCL 01A

A relatively simple and reasonably accurate dry-surface coating method for visualization of the separation line on a bluff body was devised and successfully tested. This technique is based on the color reaction of a dry film containing a pH indicator with an appropriate gas released in the body wake. The dry-surface coating method is effective at any Reynolds number and for both incident laminar and turbulent flows. It further supplies a colorful permanent of consistently good photographic quality of the separation line. The effectiveness and accuracy of this technique were tested in visualizing the separation angle on a circular cylinder in both laminar and turbulent crossflows at subcritical Reynolds numbers. Separation angles revealed by the visualization were within + or - 4 percent of their counterparts deduced from the mean wall pressure distribution. Author

N80-24274# Raytheon Co., Bedford, Mass. Missile Systems Div.
GUIDANCE SUBSYSTEMS WITH POSITION MEASUREMENT FOR GLIDING AIRDROP SYSTEMS Final Report, 13 Jan. - 25 Aug. 1978
C. F. Olenberger. Natick, Mass. Army Natick Res. and Develop. Command Aug. 1978 173 p refs
(Contract DAAK60-78-C-0022; DA Proj. 1L1-62210-D-283)
(AD-A080730; BR-10606; NATICK/TR-79/016) Avail: NTIS HC A08/MF A01 CSCL 01/3

The objective of this work has been to assess guidance techniques and available hardware which are suitable for gliding airdrop systems. Information presented indicates the suitability of available hardware for measuring required flight data, processing these data according to one of several alternative guidance schemes and activating control lines as required to guide a gliding airdrop system. GRA

N80-24275# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A DIAGNOSTIC STUDY OF FLOW IN THE WAKE OF A CIRCULAR DISK USING A PHOTON CORRELATION LASER VELOCIMETER M.S. Thesis
Steven L. Morris. Mar. 1980 200 p refs
(AD-A082167; AFIT/GAE/AA/79D-12) Avail: NTIS HC A09/MF A01 CSCL 20/5

The present investigation involves a diagnostic study of flow in the wake of a circular disk utilizing schlieren photography and a photon correlation laser velocimeter system (LDV). The schlieren system was used to examine the basic flow pattern over a 2.0 inch diameter disk and to establish the bounds of the recirculation zone. In all tests, the flow originated from a 1.5 inch diameter axially symmetric free jet with an exit Mach number of 0.35. The disk was positioned in the flow 12 jet diameters downstream of the exit. Mean velocity and turbulence intensity profiles were measured at selected locations in the near wake region of the 2.0 and a 1.5 inch diameter disk with the LDV system. This was accomplished without particle seeding of the flow. A free jet survey was conducted for comparison with theoretical predictions to analyze the quality of the LDV data. The schlieren system produced high quality photographs from which the dimensions of the recirculation zone were obtained. Mean velocity and turbulence intensity profiles were acquired at the varied stream-wise locations behind each disk with the LDV system. The laser velocimeter system, when used in conjunction with a phase modulator, clearly indentified the flow direction. Bounds of the recirculation zone found from the LDV study agreed with the results of the schlieren study. GRA

N80-24276# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
CAPTURE OF AN AXISYMMETRIC FREE JET IN A PIPE WITH APPLICATION TO POWER-AUGMENTED-RAM WING THEORY
Harvey R. Chaplin, Earl F. McCabe, Jr., Harry A. Berman, and William J. H. Smithey. Dec. 1979 18 p refs
(ZF43411210)
(AD-A082241; DTNSRDC/ASED-79/12) Avail: NTIS HC A02/MF A01 CSCL 20/4

A theory of the two dimensional power augmented ram wing with turbulent jets was previously validated over a range of experimental conditions which did not include very small ratios of jet nozzle area to capture area. In the present investigation a simple axisymmetric experiment was conducted to evaluate this condition. Results indicate that the original theory should provide useful predictions regardless of nozzle area ratio. GRA

N80-24277# Bristol Univ. (England). Dept. of Aeronautical Engineering.

AN INVESTIGATION OF THE PERFORMANCE OF A MOTORCYCLE FAIRING B.S. Thesis
P. E. Freathy and J. D. Potter Jun. 1979 43 p refs
(BU-231) Avail: NTIS HC A03/MF A01

The addition of strakes to the fairing of a racing motorcycle to improve handling and stability by decreasing front wheel lift was studied. A full size Suzuki 500 motorcycle was adapted to accept a Yamaha racing fairing and a 1/9th scale model of the Yamaha motorcycle was used in the wind tunnel for force measurements. Flow visualization was used to compare the full scale flow to that over the model. A theoretical analysis of stability was also performed. It was found that the strakes could greatly reduce the lift with no consequent drag penalty. There were no unexpected disturbances in the flow, although one separation line, emanating from the handlebars on the model was not found on the full scale machine. Problems encountered during the course of this project are in included. Author (ESA)

N80-24278# Royal Aircraft Establishment, Farnborough (England).
WIND TUNNEL MEASUREMENTS OF THE MEAN FLOW IN THE TURBULENT BOUNDARY LAYER AND WAKE IN THE REGION OF THE TRAILING EDGE OF A SWEPT WING AT SUBSONIC SPEEDS
P. H. Cook, M. A. McDonald, and M. C. P. Firmin London HMSO Jun. 1979 185 p refs
(RAE-TR-79062; RAE-Aero-3457; BR71526) Avail: NTIS HC A09/MF A01

Measurements were made of the distributions of local Mach number, flow direction, and static pressure coefficient through the wake and boundary layers of a wing of constant chord (0.61 m normal to the leading edge) and RAE 101 section at sweep angles of 20 deg and 28 deg. The model spanned the 1.8 m (6 ft) dimension of the wind tunnel working section and was set at incidences in the range of + or - 1.88 deg. Tests were made at free stream Mach numbers in the range 0.43 to 0.76 and Reynolds numbers of 7 to 11 x 1,000,000. The technique of measurements, using calibrated minature three-hole yawmeters, is described and the experimental results are compared with an integral boundary layer calculation method. Some comparisons are also made with previous tests at zero sweepback. Results indicate that useful data on the behavior of three-dimensional layers and wakes can be obtained by this technique.
Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-24279# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: THURMAN L. MUNSON, CESSNA CITATION 501, N15NY, NEAR CANTON, OHIO, AUGUST 2, 1979
16 Apr. 1980 29 p
(NTSB-AAR-80-2) Avail: NTIS HC A03/MF A01

The findings of an investigation of the Cessna Citation 501 accident are presented and analyzed. The probable cause of the accident was the pilot's failure to recognize the need for, and to take action to maintain sufficient airspeed to prevent a stall into the ground during an attempted landing. The pilot also failed to recognize the need for timely and sufficient power application to prevent the stall during an approach conducted inadvertently without flaps extended. Contributing to the pilot's inability to recognize the problem and to take proper action was his failure to use the appropriate checklist and his nonstandard pattern procedures which resulted in an abnormal approach profile. M.G.

N80-24280# National Aviation Facilities Experimental Center, Atlantic City, N. J.
POSTCRASH FUEL FIRE HAZARD MEASUREMENTS IN A WIDE-BODY AIRCRAFT CABIN Final Report, Mar. 1977 - Dec. 1978
Richard G. Hill, George R. Johnson, and Constantine P. Sarkos Dec. 1979 92 p refs Original contains color illustrations
(FAA Proj. 181-521-100)
(AD-A079548; FAA-NA-79-42) Avail: NTIS HC A05/MF A01 CSCL 01/3

Results obtained utilizing a full-scale, wide-body test article for studying postcrash cabin hazards produced by an external fuel fire adjacent to a cabin door opening are described. Seventy-two tests were conducted at various ambient wind conditions and fire sizes in a fire-hardened cabin devoid of interior materials. Temporal data, taken at a large number of cabin locations, are presented and discussed pertaining to the effect of ambient wind on the rate of hazard accumulation inside of the cabin; stratification of heat, smoke, and toxic gases; the effect of fire size of thermal radiation through the opening; and the relative importance of heat, smoke, and carbon monoxide in a fuel-dominant fire. It is concluded that major stratification of hazards occurs in the cabin when the hazards are created by an external fuel fire, and that ambient wind determines the amount of hazards entering a cabin due to a given fuel fire. M.G.

N80-24281# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ADVANCED CONCEPT IN AIRCRAFT CRASH FIREFIGHTING USING CARBON TETRAFLUORIDE Final Report, Oct. 1977 - Jan. 1979
George B. Geyer, Lawrence M. Nen, and Charles H. Urban Mar. 1980 100 p refs Sponsored in part by Air Force
(AD-A082936; FAA-NA-79-43; ESL-TR-79-40) Avail: NTIS HC A05/MF A01 CSCL 13/12

The feasibility of replacing a potentially lethal aircraft cabin environment with a cool habitable atmosphere which is nonsupportive of combustion during passenger evacuation in fire emergencies was investigated. Carbon tetrafluoride (CF4) was chosen as the fire extinguishant because of its very low toxicity and high molecular stability under thermal insult. Four large-scale experiments were performed in a completely instrumented cabin of a DC7 aircraft employing both Class A and B combustable materials. Three experiments were performed using the habitable inert atmosphere (27 volume percent CF4) discharging at the rate of 3,300 cubic feet per minute into the aircraft cabin through a window exit. For comparative purposes, the fourth experiment was performed using neat CF4 discharged from two simulated points of fuselage penetration by a ballistically-powered aircraft slug penetrator nozzle. The CF4-air atmosphere was capable of extinguishing nonsurvivable Class A and B cabin fires within 125 seconds or less during which time the cabin temperature was rapidly reduced and visual acuity slowly improved by smoke dilution during the Class A fire tests. Fire extinguishment by means of neat CF4 at the same discharge rate required approximately twice as long, and visibility within the cabin did not improve during the duration of the experiment. R.E.S.

N80-24282# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
DEVELOPMENT AND TESTING OF AN AUTOMATIC LAP BELT RETRACTION AND RELEASE SYSTEM Interim Report
Marcus Schwartz 25 Jan. 1980 41 p refs
(WF4140000)
(AD-A080950; NADC-79270-60) Avail: NTIS HC A03/MF A01 CSCL 01/3

The consequences of a poor or loosely adjusted restraint system have been well documented and have been shown to cause various crewmember injuries and also to degrade ejection seat performance. An automatic lap belt retraction and seat-man release system has been developed for use with the Navy's Maximum Performance Escape System ejection seat. The lap belt cinch-up device works simultaneously with the action of the inertia reel from independent gas generators, while the lap belt release device work simultaneously with the strap cutter from a common gas generator. In-house testing of improved cinch and release prototype devices is continuing. GRA

N80-24283# Army Natick Research and Development Command, Mass. Clothing Equipment and Materials Engineering Lab.
US ARMY SURVEY OF AIRCREW SURVIVAL KITS/VESTS Final Report
Thomas H. Judge Jan. 1980 101 p
(AD-A081153; CE/MEL-210; NATICK/TR-80/012) Avail: NTIS HC A06/MF A01 CSCL 06/7

For a number of years air crew members have complained of problems with survival kits, vests, and components. These complaints have been debated time and again with no resolution forthcoming to meet the comprehensive crash survival needs of the aircrew members. In an effort to resolve these complaints, a survey was initiated throughout the U.S. Army Aviation Community to identify the problem areas and develop rationale for correction action. This report discusses results of the survey and conferences held following completion of the survey. Medical, Crash, Search and Rescue and Aviation Community Data provided rationale for new approaches to survival kits and vests. These approaches to reduce the amount of present day survival components were modified by each conference and upgraded to improve the aircraft crash survival environment. The reductions in helicopter crash fires and the ability of rescue teams to recover crash survivors in six hours or less has contributed to the need to replace present day nonessential items with only essential, absolute need, survival components. GRA

N80-24284# Textron Bell Helicopter, Fort Worth, Tex.
LATERAL ROLLOVER PROTECTION CONCEPTS Final Report, Oct. 1977 - Aug. 1979
Roy G. Fox Jan. 1980 107 p refs
(Contract DAAJ02-77-C-0078; DA Proj. 1L2-62209-AH-76)
(AD-A081420; USAAVRADCOM-TR-80-D-1) Avail: NTIS HC A06/MF A01 CSCL 01/3

Helicopter accidents in which the aircraft rolled over laterally are costly in aircraft damage. U.S. Army helicopter accident reports involving lateral rollover for a 6 1/2 year period were analyzed to determine their significant characteristics such that design concepts for rollover protection could be identified. The results of the accident analysis were applied to portions of crash survival specifications and design concepts for rollover protection. Dynamic rollover, when the aircraft is light on its landing gear, was investigated using computer simulation to identify pertinent parameters. A quick response from the pilot to reduce main rotor thrust is the primary means available for recovery. A preliminary evaluation of the KRASH computer simulation program was done for the rollover environment. Design concepts that either prevented the occurrence of a rollover accident or minimized the dangers to the occupants as the aircraft rolled over were investigated. An automatic rollover sensing and correction system was investigated. Wing and wide landing gear concepts can provide increased rollover resistance. Means of preventing hazardous main rotor pylon motion during a rollover accident were also investigated. GRA

N80-24285# University of Northern Illinois, De Kalb. Dept. of Biological Sciences.
DEVELOPMENT OF COMPUTER-GENERATED PHENOGRAMS TO FORECAST REGIONAL CONDITIONS HAZARDOUS TO LOW-FLYING AIRCRAFT Final Report, 30 Sep. 1977 - 30 Dec. 1979
William E. Southern Dec. 1979 102 p refs
(Grant AF-AFOSR-3431-77; AF Proj. 2312)
(AD-A081869; AFOSR-80-0175TR) Avail: NTIS HC A06/MF A01 CSCL 01/2

Collisions or strikes between birds and aircraft that occur annually across the United States result in damages amounting to millions of dollars and considerable risk to crew members. Gulls are involved in more strikes than any other group of avian species. USAF aircraft are vulnerable to birdstrikes during take-off, while landing, and during low-altitude missions. This report describes monthly patterns of gull distribution across the United States and provides a statistical model for predicting the probability of one or more birdstrikes occurring. The accuracy of such predictions is dependent upon the input data for the model being as complete as possible. In addition, the data should be for the specific geographical area for which the prediction is desired. The following types of data are needed: (1) an estimate of the number of birds present in the area; (2) the number of missions flown in the area; and (3) the number of strikes previously recorded in the area. With this information at hand, it is possible to determine how a change either in the number of missions flown or in the concentration of birds present will affect the probability of a birdstrike occurring. GRA

N80-24286# Interaction Research Corp., Stanton, Calif.
AN INVESTIGATION OF FACTORS AFFECTING AIRCRAFT PASSENGER ATTENTION TO SAFETY INFORMATION PRESENTATIONS Final Report, Nov. 1978 - Apr. 1979
Daniel A. Johnson Aug. 1979 32 p refs
(Contract DOT-FA78WA-4095)
(AD-A082358; IRC-79-1) Avail: NTIS HC A03/MF A01 CSCL 01/2

Many commercial aircraft passengers do not appear to attend to the safety information presentation given prior to takeoff. This presentation, in the form of the oral briefing given by the flight attendant and the safety information cards, supplies information the passenger may need to increase the probability of safely surviving an aircraft emergency. A questionnaire was administered to 255 respondents who had flown at least twice in the previous two years. A number of factors associated with the way the information is presented, the apparent response of other passengers to the presentation, perceived accident probability, relative adequacy of the oral briefing, and situational and demographic variables are related to whether the passenger reports attending or not attending to the safety presentation. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-24287# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: EN ROUTE CONTROL, PROGRAM 12
Nov. 1979 57 p
(AD-A082471; FAA-ED-12-2B) Avail: NTIS HC A04/MF A01 CSCL 17/7

Implementation of the third generation en route air traffic control system, model A3d2, provides basic automation capability for processing flight data and surveillance functions. Substantial upgrading of this basic capability is needed to meet the demand forecast for the en route system through the 1980's. The development plan to build the features and functions necessary for upgrading the present third generation en route system is described. Program objectives, development activities, implementation considerations, and resource estimates are set forth. R.E.S.

N80-24288# Mitre Corp., McLean, Va. Metrek Div.
PRELIMINARY COMPUTER SIZING ESTIMATES FOR AUTOMATED EN ROUTE ATC (AERA)
H. Gilbert Miller Oct. 1979 38 p
(Contract DOT-FA80WA-4370)
(AD-A082628; MTR-79W00263; FAA-EM-79-21) Avail: NTIS HC A03/MF A01 CSCL 17/7

An analysis that estimates the computer sizing requirements imposed by the Automated En Route Air Traffic Control (AERA) system, a possible long-term enhancement to National Aviation System, is presented. In order to establish preliminary AERA processor and memory requirements, two models are presented. A simulation model of the higher level AERA functions, such as initial processing and progress monitoring, is applied to the Washington Center to show typical AERA imposed processor loading. A previously developed linear model of required memory is also applied to show typical memory requirements resulting from AERA. The models presented reflect a version of AERA did not include the recently developed concepts of strategic and tactical planning/control. Additionally, since AERA will continue to evolve during the development stage, requirements enumerated

must be considered preliminary in nature and significant changes on the estimates may be expected. R.E.S.

N80-24289# Electronics Engineering Group (1842nd), Scott AFB, Ill. Support Engineering Branch.
RADAR APPROACH CONTROL (RAPCON) PRIMARY INPUT POWER SUPPLY STUDY
Robert L. Boyce 15 Aug. 1979 25 p
(AD-A074080; Rept-1842EEG/EEISG-TR-79-15) Avail: NTIS HC A02/MF A01 CSCL 17/7

Equipment failure data was collected from 52 representative sites (with and without voltage regulators) for a period of 12 months to determine whether or not equipment failures were less while using voltage regulators on RAPCON ac power supplies. No correlation could be found between reduced failures and the use of voltage regulators. The equipment failure rates at sites with regulated power supplies, compared to those sites with unregulated power supplies were approximately the same, except that indicator scopes located at sites with unregulated power supply systems had a lower failure rate. It was also found that seven of the ten highest failure incidence sites had regulated input power. Failure rates were found to be at, or below, the specified MTBF of the equipment. Recommendations are included. A.R.H.

N80-24290# Royal Aircraft Establishment, Farnborough (England).
PERFORMANCE OF OMEGA H-FIELD ANTENNAS RECESSED INTO AIRFOILS
E. A. Blake and I. D. Birch London HMSO May 1979 121 p refs
(RAE-TR-79048; RAE-RAD-NAV-78; BR70238) Avail: NTIS HC A06/MF A01

The use of an H-field Omega antenna recessed below an airfoil surface was investigated. Theoretical and experimental aspects are discussed together with ground and flight test results of a practical installation. The mounting configuration is shown to be fully viable and is thought to have wide application to both civil and military aircraft. Author (ESA)

N80-24291# Royal Aircraft Establishment, Farnborough (England).
WIND-SHEAR ENCOUNTERS DURING VISUAL APPROACHES AT NIGHT. A PILOTED SIMULATOR STUDY
P. L. Bisgood, J. W. Britton, and H. Y. Ratcliffe (Cranfield Inst. of Tech.) London HMSO Sep. 1979 64 p refs
(RAE-TR-79126; RAE-FS-112; BR71911) Avail: NTIS HC A04/MF A01

A study was made in a fixed-base simulator of encounters with a variety of idealized wind shears under conditions simulating a two-pilot approach, partly on instruments and partly visual, made at night were studied in a fixed-bed simulator. Twenty-five pilots, airline and service, participated completing a total of 62 sorties, each of ten approaches. There were four shear encounters per sortie. The data comprized time-histories of each approach together with the pilots responses to a datailed questionnaire and their spontaneous observation. Results show that pilots are successful in recognizing the absence of shear or the presence of severe shear. They are less successful in recognizing shears of moderate intensity or in identifying the velocity components. To cope effectively with the shears, pilot action must be both prompt and appropriate and it is clear that pilots were quick to seek clues that might offer 'early warning' of impending shear. It seems likely that the inclusion of shear encounters during routine simulator training can prove beneficial. Author (ESA)

N80-24292# Royal Signals and Radar Establishment, Malvern (England).
PRECISION NAVIGATION FOR AIR TRAFFIC MANAGEMENT
S. Ratcliffe London HMSO Oct. 1978 9 p refs Presented at 29th AGARD/GCP Symp., Copenhagen, Oct. 1979
(RSRE-Memo-3220; BR72506) Avail: NTIS HC A02/MF A01

The problems that would arise if airspace users had the use of NAVSTAR, or some other position-fixing aid, and the uses that Air Traffic Control (ATC) could, or could not, make of this capability are discussed. There would be formidable transitional problems in the vertical plane, because NAVSTAR measures height from the Earth's center whereas current altimeters measure atmospheric pressure. In either vertical or horizontal planes much work is necessary to prove that the separation standards can be reduced at all. Changes that might be possible in the ATC system should appreciable reductions in separation standards prove possible are suggested. A collision avoidance system based on either the broadcast coordinates of each aircraft, or on a time-frequency basis using NAVSTAR as the time reference is proposed. The latter scheme would offer protection to a fully-equipped aircraft against another that could not afford the expense of a NAVSTAR fit. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-24293*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
A CANDIDATE V/STOL RESEARCH AIRCRAFT DESIGN CONCEPT USING AN S-3A AIRCRAFT AND 2 PEGASUS 11 ENGINES
Bedford A. Lampkin May 1980 24 p refs
(NASA-TM-81204; A-8197) Avail: NTIS HC A02/MF A01 CSCL 01C

A candidate V/STOL research aircraft concept which uses an S-3A airframe and two Pegasus 11 engines was studied to identify a feasible V/STOL national flight facility that could be obtained at the lowest possible cost for the demonstration of V/STOL technology, inflight simulation, and flight research. The rationale for choosing the configuration, a description of the configuration, and the capability of a fully developed aircraft are discussed. R.E.S.

N80-24294*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
WIND-TUNNEL TESTS OF THE XV-15 TILT ROTOR AIRCRAFT
James A. Weiberg and Martin D. Maisel Apr. 1980 133 p refs Prepared in cooperation with Army Research and Technology Labs., Moffett field, Calif.
(NASA-TM-81177; AVRADCOM-TR-80-A-3; A-8089) Avail: NTIS HC A07/MF A01 CSCL 01C

The XV-15 aircraft was tested in the Ames 40 by 80 Foot Wind Tunnel for preliminary evaluation of aerodynamic and aeroelastic characteristics prior to flight. The tests were undertaken to investigate the aircraft performance, stability, control and structural loads for flight modes from helicopter through transition and airplane mode up to the tunnel capability of 170 knots. Results from these tests are presented. Author

N80-24295*# Kansas Univ. Center for Research, Inc., Lawrence.
COMPARISON OF THEORETICALLY PREDICTED LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS WITH FULL-SCALE WIND TUNNEL DATA ON THE ATLIT AIRPLANE
Michael Griswold and J. Roskam May 1980 213 p refs (Grant NsG-1574)
(NASA-CR-163189; KU-FRL-399-2) Avail: NTIS HC A10/MF A01 CSCL 01C

An analytical method is presented for predicting lateral-directional aerodynamic characteristics of light twin engine propeller-driven airplanes. This method is applied to the Advanced Technology Light Twin Engine airplane. The calculated characteristics are correlated against full-scale wind tunnel data. The method predicts the sideslip derivatives fairly well, although angle of attack variations are not well predicted. Spoiler performance was predicted somewhat high but was still reasonable. The rudder derivatives were not well predicted, in particular the effect of angle of attack. The predicted dynamic derivatives could not be correlated due to lack of experimental data. R.E.S.

N80-24296*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENT OF AIRCRAFT SPEED AND ALTITUDE
William Gracey May 1980 311 p refs
(NASA-RP-1046; L-12610) Avail: NTIS HC A14/MF A01 CSCL 01C

Problems involved in measuring speed and altitude with pressure-actuated instruments (altimeter, airspeed indicator, true-airspeed indicator, Machmeter, and vertical-speed indicator) are examined. Equations relating total pressure and static pressure to the five flight quantities are presented, and criteria for the design of total and static pressure tubes are given. Calibrations of typical static pressure installations (fuselage nose, wing tip, vertical fin, and fuselage vent) are presented, various methods for flight calibration of these installations are described, and the calibration of a particular installation by two of the methods is described in detail. Equations are given for estimating the effects of pressure lag and leaks. Test procedures for the laboratory calibration of the five instruments are described, and accuracies of mechanical and electrical instruments are presented. Operational use of the altimeter for terrain clearance and vertical separation of aircraft is discussed, along with flight technical errors and overall altitude errors of aircraft in cruise operations. Altitude-measuring techniques based on a variety of properties of the Earth and the atmosphere are included. Two appendixes present airspeed and altitude tables and sample calculations for determining the various flight parameters from measured total and static pressures. R.E.S.

N80-24297# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
ICING NOZZLE ELEMENT OPTIMIZATION TEST, JANUARY 1979 Final Report
Leandro V. Delgado 20 Aug. 1979 370 p refs
(AD-A081175; AFGL-TR-79-0193) Avail: NTIS HC A12/MF A01 CSCL 14/2

An MC-130E instrumented by AFGL for cloud physics research flew a series of tests behind a KC-135 specially modified with a multi-element spray nozzle. The tests, for Air Force Flight Test Center, were to sample and define the spray plume produced by the nozzle at specified values of water flow rate, distance from nozzle, and temperature. PMS spectrometers were used to sample the artificial cloud. Data were analyzed to produce sample average and instantaneous 1 sec particle size spectra with liquid water content values. Comparison of values of liquid water content, water flow rate, and distance from nozzle to instrument indicate well defined linear relationships. Instantaneous 1 sec liquid water content values indicate a variance in the uniformity across the spray. Maximum, minimum, mean, and standard deviation values are provided for each sample to charactarize the variance. Although many of the particles had round shapes, it was not possible to tell from the instrumentation whether the particles were ice or water drops. GRA

N80-24298# Sikorsky Aircraft, Stratford, Conn.
MM&T FIBER REINFORCED PLASTIC HELICOPTER TAIL ROTOR ASSEMBLY (PULTRUDED SPAR) Final Report, 29 Aug. 1975 - 30 Oct. 1978
Maron J. Bonassar and John J. Lucas Jan. 1980 181 p ref
(Contract DAAJ02-76-C-0001)
(AD-A082352; SER-70286; USAAVRADCOM-TR-79-45) Avail: NTIS HC A09/MF A01 CSCL 01/3

This program was directed at establishing the pultrusion process for the manufacture of helicopter tail rotor spars as a means of lowering manufacturing cost without sacrificing structural performance and keeping design changes to a minimum. The pultrusion process capability was successfully demonstrated by designing, fabricating, and testing a full-size tail rotor spar assembly for the YUH-60A prototype helicopters. Although the pultrusion process was determined to be a viable manufacturing fabrication method, the program was terminated prior to completion because the cost effectiveness and producibility of the pultrusion process as compared with present UH-60A BLACK HAWK production techniques are not sufficiently significant to warrant a change in manufacturing fabrication method at this time. GRA

N80-24299# Douglas Aircraft Co., Inc., Long Beach, Calif.
PRIMARY ADHESIVELY BONDED STRUCTURE TECHNOLOGY (PABST). DESIGN HANDBOOK FOR ADHESIVE BONDING Final Report, 15 Mar. 1977 - Jan. 1979
D. L. Potter Wright-Patterson AFB, Ohio AFFDL Nov. 1979 192 p refs
(Contract F33615-75-C-3016; AF Proj. 486U)
(AD-A082078; MDC-J6076; AFFDL-TR-79-3129) Avail: NTIS HC A09/MF A01 CSCL 11/1

The Air Force Primary Adhesively Bonded Structure Technology (PABST) Program was started in February 1975 for the purpose of validating the concept of adhesive bonding primary fuselage structural members together in lieu of the use of rivets. The goal of the program was to provide a cost saving of 20 percent of the acquisition and maintenance cost of ownership. It was further desired to show a 15 percent weight saving for the bonded assemblies. The program is now complete and the damage tolerance and durability of bonded structure has been shown to exceed, by far, that of riveted structure. Also the cost and weight savings goals appear to be obtainable for a production article. The design guidelines for a bonded primary structure are presented. The complete design criteria are identified for successfully developing bonded primary structure. It includes the fatigue, damage tolerance, and fail-safe criteria for both the metallic structure and adhesive bond area. A section discusses the material selection requirements, and another one presents the manufacturing considerations required to properly bond the primary structure. A review of the inspection needs is presented followed by a discussion of the repairability of the bonded structure. The cost and weight analysis reviews the methods used to determine results obtained on the program. A complete section covers the loads, load transfer, and failure modes of bonded joints and this is followed by an analysis section which describes numerical methods for analyzing all manner of bonded joints with and without adjacent metal flaws. The final section in the report discusses the types of tests and associated specimens needed to properly select an adhesive for use in a bonded primary structure. GRA

N80-24300# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
A CASE FOR VATOL FLIGHT DEMONSTRATION
C. Joseph Martin Jan. 1980 33 p refs Presented at the V/STOL Aircraft Aerodyn. Meeting, Monterey, Calif, 16-18 May 1979
(ZF66421001)
(AD-A082179; DTNSRDC/AERO-1264; DTNSRDC-80/018) Avail: NTIS HC A03/MF A01 CSCL 01/3

This paper reviews the work on the Vertical Attitude Takeoff and Landing (VATOL) technology development. Studies of vertical and short takeoff and landing aircraft have shown a significant advantage in payload or performance for the vertical attitude concept. The additional payoff from the incorporation of Post-Stall Combat Maneuvering is identified. The VATOL post-stall control system that requires control at high angle-of-attack, provides a decisive combat advantage over a conventional fighter. The planning for post-stall aerodynamic studies at DTNSRDC and NASA Ames is presented. This includes a large powered model to be tested in the NASA 40 x 80 foot wind tunnel. Progress toward a moving base simulation of the vertical attitude landing is reviewed. Results of design studies indicating the feasibility of a VATOL research aircraft, using an existing propulsion system are outlined along with a possible configuration for an advanced VATOL fighter that incorporates a novel control system. GRA

N80-24301# RAND Corp., Santa Monica, Calif.
FUTURE V/STOL AIRPLANES: GUIDELINES AND TECHNIQUES FOR ACQUISITION PROGRAM ANALYSIS AND EVALUATION, EXECUTIVE SUMMARY
J. R. Nelson, J. R. Gebman, J. L. Birkler, R. W. Hess, P. Konoske-Dey, and W. H. Krase Feb. 1980 44 p refs
(Contract MDA903-77-C-0107)
(AD-A081922; RAND/R-2397-PA/E; ISBN-0-8330-0166-3; LC-79-22274) Avail: NTIS HC A03/MF A01 CSCL 01/3

The purpose of this summary report and a companion technical document (AD-B044 537) is to assist the Department of Defense in making critical evaluations of proposed vertical/short takeoff and landing (V/STOL) airplane program characteristics, including

airplane performance, acquisition schedule, and acquisition cost. The guidelines and techniques described in these two documents take the form of analytical tools, data, and lessons drawn from previous V/STOL airplane research, development and acquisition experience. The documents focus exclusively on the acquisition phase for the airframe and the propulsion subsystems; avionics is not considered. The operational utility of V/STOL airplanes and the possible new missions to which V/STOL airplanes might be uniquely suited are not addressed. GRA

N80-24302# Sikorsky Aircraft, Stratford, Conn.
ADVANCED COMPOSITE ROTOR HUB PRELIMINARY DESIGN Final Report, Oct. 1977 - Jul. 1979
Elliot F. Olster Jan. 1980 193 p refs
(Contract DAAJ02-77-C-0056; DA Proj. 1L2-62209-AH-76)
(AD-A081951; USARTL-TR-78-53) Avail: NTIS
HC A09/MF A01 CSCL 01/3

The design requirements for a UH-60A (BLACK HAWK) main rotor hub are presented. A series of six composite hub configurations were evaluated. The evaluation included a comparison to the design requirements as well as additional goals such as reduced weight, cost, radar cross section, use of existing rotor head components, etc. The best of these hub concepts was subsequently refined and reanalyzed. The results of this study indicated the following: (1) A composite rotor hub can reduce the weight of an equivalent metal hub by up to 15%, (2) The production and acquisition costs of a composite hub are 20% less than its metal counterpart, (3) The life-cycle cost analysis indicated that $690K could be saved if the hub were in production by January 1983. The life-cycle cost savings are significantly affected by the 'introduction time', and a 6-month delay would negate the cost savings, and (4) For other benefits, such as an alternate source in case of a shortage of titanium, or to generate limited, in-service, maintenance and repair data on a composite hub, a continued effort was recommended. GRA

N80-24303# Grumman Aerospace Corp., Bethpage, N.Y.
INTEGRATED RACK CONCEPT STUDY FOR V/STOL TYPE AIRCRAFT Final Report, 1 Oct. 1978 - 1 Dec. 1979
E. V. Ramirez, B. Borgenson, A. Caserta, V. Cirrito, and R. Dahl Jan. 1980 205 p
(Contract N62269-78-R-0294)
(AD-A081864; NADC-78113-60) Avail: NTIS
HC A10/MF A01 CSCL 01/3

Six different rack concepts were investigated for determining the most optimum configuration of packaging the avionic equipment on A and B type V/STOL aircraft. The two basic approaches of cooling the rack considered were air impingement and conduction cooled. As a baseline, two module configurations were used; an Improved Standard Electronic Module-2A, and Hollow Core Design with an ISEM-2A form factor. The modules, utilizing chip carrier semiconductor devices, were assumed to dissipate 5 to 10 watts. The rack power system makes use of Solid State Electric Logic (SOSTEL) power management elements. A parametric thermal analysis with junction temperatures from 60 to 125 C was performed. Each of the following disciplines, Mechanical, EMI, ECS, Reliability, Maintainability and Life Cycle Costs were also considered in the design of the racks. A Sensitivity Evaluation Program was used to select the most viable approaches. GRA

N80-24304# Foster-Miller Associates, Inc., Waltham, Mass.
ANALYSIS OF TRUNK FLUTTER IN AN AIR CUSHION LANDING SYSTEM: USER'S MANUAL Final Report, May 1978 - Jul. 1979
Roger B. Fish Wright-Patterson AFB, Ohio AFFDL Nov. 1979 179 p
(Contract F33615-78-C-3412; AF Proj. 2307)
(AD-A082087; AFFDL-TR-79-3121) Avail: NTIS
HC A09/MF A01 CSCL 01/3

This User's Manual (Computer Program) describes the computer programs for trunk flutter analysis. It includes descriptions, user instructions, and a sample run for the trunk flutter dynamic simulation program, and an eigenvalue calculation program for a linearized static trunk model. GRA

N80-24305# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
ARTIFICIAL ICING TEST CH-47C HELICOPTER WITH FIBERGLASS ROTOR BLADES Final Report, Jan. - Mar. 1979
John R. Niemann, Frame J. Bowers, III, and Sherwood C. Spring Jul. 1979 56 p
(AD-A081860; USAAEFA-78-18) Avail: NTIS
HC A04/MF A01 CSCL 01/3

The United States Army Aviation Engineering Flight Activity, in conjunction with the Boeing Vertol Company, conducted an evaluation of the CH-47C helicopter with fiberglass rotor blades and a prototype blade de-ice system. The rotor blades were tested under natural and artificial icing conditions at St. Paul, Minnesota from 24 January to 2 March 1979, and required 30.1 flight hours of which 17.7 hours were in an icing environment. Testing was conducted in two phases: (1) protected, where the blade de-ice system was allowed to operate automatically and (2) unprotected, where the blade de-ice system was held in standby status. The fiberglass rotor blade system was evaluated at conditions varying from 0.1 gm cu m liquid water content (LWC) to 0.8 gm cu m LWC and temperatures varying from -4 C to -16 C. Time in the icing environment varied from a minimum of 28 minutes to a maximum of 2 hours and 25 minutes. The protected rotor blade de-ice system operated satisfactorily. The unprotected rotor blades operated satisfactorily under the limited conditions tested. Minimal ice accretion and minimal asymmetric shed characteristics were observed. Two deficiencies for flight under icing conditions unrelated to the fiberglass rotor blades were noted. The deficiencies are: (1) failure of the droopstops to engage after flight in icing conditions; and (2) ice accretion and subsequent blockage of the fuel vents. GRA

N80-24306# General Dynamics Corp. Fort Worth, Tex.
V/STOL PROPULSION-INDUCED AERODYNAMICS HOVER CALCULATION METHOD Final Technical Report, 19 Jan. 1979 - 19 Jan. 1980
W. H. Foley and J. A. Sansone Feb. 1980 133 p refs
(Contract N62269-79-C-0212)
(AD-A082688; NADC-78242-80) Avail: NTIS
HC A07/MF A01 CSCL 20/4

An empirical method has been developed to predict the propulsive-induced forces on a V/STOL aircraft hovering in proximity of the ground. This method is applicable to configurations employing two, three, or four circular exhausts. Planform contour, nozzle pressure ratio, and lift improvement devices are considered. Accuracies on the order of one percent of propulsive thrust are demonstrated. GRA

N80-24307# Northrop Corp., Hawthorne, Calif.
HYBRID COMPUTER ERRORS IN ENGINEERING FLIGHT SIMULATION Final Report, 15 May 1978 - 15 Aug. 1979
Richard A. Weeks Wright-Patterson AFB, Ohio AFFDL Aug. 1979 128 p refs
(Contract F33615-78-C-3608; AF Proj. 2307)
(AD-A081953; NOR-79-89; AFFDL-TR-79-3091) Avail: NTIS
HC A07/ MF A01 CSCL 20/4

A real-time airframe simulation was constructed with an all analog, hybrid-single Central Processing Unit (CPU), hybrid-dual CPUs with shared common memory, hybrid-dual CPUs with an Input/Output serial link, and all digital computer configurations so as to investigate the effects of various computer error sources on solution accuracy. The airframe simulation represented three degrees-of-freedom of longitudinal motion such that effects of error sources on both short period and phugoid motion could be observed. The error analysis utilized Fast Fourier Transforms which showed how the Power Spectra of the transient airframe response distorted (relative to a theoretical response) when contaminated with error sources. GRA

N80-24308# Neilsen Engineering and Research, Inc., Mountain View, Calif.
THE RAPID PREDICTION OF AIRCRAFT STORE LOADING DISTRIBUTION AT TRANSONIC SPEEDS, PART 2 Final Report, 1 Jan. 1975 - 30 Sep. 1979
Anthony J. Crisalli, Stephen S. Stahara, and Michael J. Hemsch Oct. 1979 82 p refs
(Contract F44620-75-C-0047; AF Proj. 2307)
(AD-A082005; NEAR-TR-204-Pt-2; AFOSR-79-1282TR-Pt-2)
Avail: NTIS HC A05/MF A01 CSCL 20/4

An account is provided for the progress made in the development of an engineering predictive method for determining loading distributions on external stores located in the three dimensional transonic flow field of a parent aircraft. Attention has been directed toward developing accurate but rapid methods for predicting store loadings in transonic flow fields generated by wing-body/pylon combinations representative of modern fighter-bomber aircraft. Detailed evaluations, based on extensive comparisons with experimental data obtained from a parallel wind-tunnel test phase of the program, are presented for two store loading prediction methods. Results are provided for various wing-body/pylon/store configurations for flow conditions throughout the transonic regime. GRA

N80-24309# Boeing Military Airplane Development, Seattle, Wash.
DESIGN OPTIONS STUDY Final Report
E. A. Barber, D. G. Blattner, R. J. Marhefka, M. Fligstein, and E. J. LaKous 29 Feb. 1980 161 p refs
(Contract F33615-78-C-0114)
(AD-A082941; D180-24258-3) Avail: NTIS HC A08/MF A01 CSCL 01/3

This study considered a number of desired military features applied to a new commercial freighter and examined the commercial operating cost penalties and military life cycle costs. An I.O.C. of 1990 is projected for the new commercial freighter aircraft and the military design options, based upon a 1985 technology maturity date for the key technologies. The baseline aircraft incorporates graphite epoxy primary structure, active flight controls, advanced engines and aircraft systems. It appears that use of the dedicated commercial freighter uncompromised, but with selective military loading preprogrammed to optimize unit payloads, can provide a major portion of the airlift with only a minor increase in the organic fleet. One of the most pervasive influences in the study was the cost of the Enhanced CRAF provisions on the Design Options airplanes. Commercial pricing was used for both the baseline airplane and the provisions. However, because the CRAF provisions were developed and procured on a small unit buy relative to the baseline airplane the relative cost of the CRAF provisions are high, and significantly influence the results. GRA

N80-24310# Royal Aircraft Establishment, Farnborough (England).
MEASUREMENT OF MOMENTS OF INERTIA AND PRINCIPAL INERTIA AXIS OF A GNAT AIRCRAFT Final Report
R. L. Poulter London HMSO Jul. 1979 27 p refs
(RAE-TR-79090; RAE-FS-106; BR70939) Avail: NTIS HC A03/MF A01

The modifications made to a ground rig used to measure moments of inertia and the technique developed to minimize errors in the moment of inertia in roll are described. Calibration of the rig shows that acceptable accuracies are obtained while results for the moments of inertia in roll and pitch as well as the inclination of the principal inertia axis of the Gnat aircraft are given. Three fuel states, empty, external tanks full, and internal tanks full, were tested, comparisons being made with estimated values where possible. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-24311# Human Engineering Labs., Aberdeen Proving Ground, Md.
A DYNAMIC EVALUATION OF THE INTEGRATED AVIONICS CONTROL SYSTEM (IACS) Final Report
William B. DeBellis Feb. 1980 54 p
(AD-A082203; HEL-TM-2-80) Avail: NTIS HC A04/MF A01 CSCL 01/4

The Integrated Avionics Control System (IACS) was developed to reduce crew member workload and save cockpit space by controlling all airborne communication systems from a single control panel. This investigation compares the IACS with a suite of standard communication radios through the use of computer graphics, mockups, and hardware. It was concluded (1) that there is a definite savings in cockpit space, (2) the crew workload is reduced, and (3) cockpit 'bookkeeping' related to communications is a significant portion of the workload. GRA

N80-24312# Arinc Research Corp., Annapolis, Md.
STANDARD AVIONICS PACKAGING, MOUNTING, AND COOLING BASELINE STUDY Final Report, Jun. 1979 - Jan. 1980
S. Baily, A. Jackson, J. Russell, C. N. D. Smith, and N. Sullivan Jan. 1980 219 p
(Contract F33657-79-C-0717; AF Proj. 2257)
(AD-A082166; Rept-1753-01-1-2124) Avail: NTIS HC A10/MF A01 CSCL 01/3

This is the final report on a study concerning the development of an avionics packaging, mounting, and environmental (PME) standard and an associated cost-benefit analysis. The report compares military and commercial airlines avionics generic standards to determine their technical and procedural differences and identifies the changes and waivers required when equipment built to the commercial airlines standards are procured by the USAF. It also compares the functional and physical characteristics of certain military and commercial avionics equipments and assesses the degree of utility of current commercial equipments for use in USAF aircraft. The opinions of aircraft and avionics manufacturers concerning a military avionics PME standard and their suggestions as to what the standard's scope an applicability should be, are reponed. Alternative avionics cooling procedures and technologies and the concept of employing a separate environmental control system dedicated to avionics cooling are reviewed. A life-cycle cost payback model that addresses the impact of PME standardization on the cost of avionics systems in USAF aircraft is described. The results of exercising the model are reported. The significant tasks and scheduling for the next phases of avionics PME development, leading to the definition and acceptance of a military avionics PME standard, are presented. GRA

N80-24313# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
HELICOPTER REMOTE WIND SENSOR FLIGHT TEST
David H. Dickson and Jon E. Ottesen Feb. 1980 54 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A082770; ERADCOM/ASL-TR-0051) Avail: NTIS HC A04/MF A01 CSCL 14/2

A flight test program has been completed in which the Helicopter Remote Wind Sensor was mounted on a UH-1 testbed aircraft. Wind measurements were made and recorded under a variety of flight hover conditions. Data from the flight test program are presented as wind profiles as a function of range, and data reduction and analysis approaches are discussed. The point-pair method was applied for comparison to theoretical and wind tunnel results. The data are applied to a baseline ballistics study sufficient to estimate the quantity of data needed for free-flight aerial armaments. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-24314*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COMPARISON OF SEVERAL INFLOW CONTROL DEVICES FOR FLIGHT SIMULATION OF FAN TONE NOISE USING A JT15D-1 ENGINE
J. G. McArdle, W. L. Jones, L. J. Heidelberg, and L. Homyak

1980 45 p refs Presented at the 6th Aeroacoustics Conf., Hartford, 4-6 Jun. 1980; sponsored by AIAA
(NASA-TM-81505; E-443) Avail: NTIS HC A02/MF A01 CSCL 21E

To enable accurate simulation of in-flight fan tone noise during ground static tests, four devices intended to reduce inflow disturbances and turbulence were tested with a JT15D-1 turbofan engine. These inflow control devices (ICD's) consisted of honeycomb/screen structures mounted over the engine inlet. The ICD's ranged from 1.6 to 4 fan diameters in size, and differed in shape and fabrication method. All the ICD's significantly reduced the BPF tone in the far-field directivity patterns, but the smallest ICD's apparently introduced propagating modes which could be recognized by additional lobes in the speeds; at supersonic fan tip speed the smallest ICD's had some measurable loss, but the largest had no loss. Data from a typical transducer show that the unsteady inflow distortion modes (turbulence) were eliminated or significantly reduced when either of the ICD's was installed. However, some steady inflow distortion modes remained. A.R.H.

N80-24315*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QCSEE UTW ENGINE POWERED-LIFT ACOUSTIC PERFORMANCE
I. J. Loeffler, N. E. Samanich, and H. E. Bloomer 1980 35 p refs Presented at the 6th Aeroacoustics Conf., Hartford, 4-6 Jun. 1980; sponsored by the AIAA
(NASA-TM-81504; E-442) Avail: NTIS HC A03/MF A01 CSCL 21E

Powered-lift acoustic test of the Quiet Clean Short Haul Experimental Engine (QCSEE) under the wing (UTW) engine are reported. Propulsion systems for two powered-lift concepts were designed, fabricated, and tested. In addition to low noise features, the designs included composite structures, gear-driven fans, digital control, and a variable pitch fan (UTW). The UTW engine was tested in a static ground test facility with wing and flap segments to simulate installation on a short haul transport aircraft of the future. Powered-lift acoustic performance of the UTW engine is compared with that of the previously tested and reported QCSEE over-the-wing (OTW) engine. Both engines were slightly above the noise goal but were significantly below current FAA and modern wide-body jet transport levels. The UTW system in the powered-lift mode was penalized by reflected engine noise from the wing and flap system, while the OTW system was benefitted by a wing noise shielding effect. J.M.S.

N80-24316*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED COMPONENT TECHNOLOGIES FOR ENERGY-EFFICIENT TURBOFAN ENGINES
Neal T. Saunders 1980 19 p refs Presented at the 16th Joint Propulsion Conf., Hartford, 30 Jun. - 2 Jul. 1980; cosponsored by AIAA, ASME and SAE
(NASA-TM-81507; E-445) Avail: NTIS HC A02/MF A01 CSCL 21E

A cooperative government-industry effort, the Energy Efficient Engine Project, to develop the advanced technology base for future commercial development of a new generation of more fuel conservative turbofan engines for airline use is described. Engine configurations that are dependent upon technology advances in each major engine component are defined and current design and development of the advanced components are included. J.M.S.

N80-24317*# Alabama Univ., University. Engineering Experiment Station.
DEVELOPMENT OF BASIC THEORIES AND TECHNIQUES FOR DETERMINING STRESSES IN ROTATING TURBINE OR COMPRESSOR BLADES Final Report
C. H. Chien, W. F. Swinson, J. L. Turner, F. A. Moslehy, and W. F. Ranson May 1980 158 p refs
(Grant NsG-3233)
(NASA-CR-163190) Avail: NTIS HC A08/MF A01 CSCL 21E

A method for measuring in-plane displacement of a rotating structure by using two laser speckle photographs is described. From the displacement measurements one can calculate strains and stresses due to a centrifugal load. This technique involves making separate speckle photographs of a test model. One photograph is made with the model loaded (model is rotating); the second photograph is made with no load on the model (model is stationary). A sandwich is constructed from the two speckle photographs and data are recovered in a manner similar to that used with conventional speckle photography. The basic theory, experimental procedures of this method, and data analysis of a simple rotating specimen are described. In addition the measurement of in-plane surface displacement components of a deformed solid, and the application of the coupled laser speckle interferometry and boundary-integral solution technique to two dimensional elasticity problems are addressed. M.G.

N80-24318# RAND Corp., Santa Monica, Calif.
AN APPROACH TO THE LIFE-CYCLE ANALYSIS OF AIRCRAFT TURBINE ENGINES Interim Report
J. R. Nelson Dec. 1979 62 p refs
(AD-A080930; RAND/N-1337-AF) Avail: NTIS HC A04/MF A01 CSCL 21/5

A paper prepared for the AGARD/NATO Lecture Series, 'The Application of Design to Cost and Life-Cycle Cost to Aircraft Engines,' is scheduled for May 1980. A methodology is described for life-cycle analysis of aircraft turbine engines from historical data. The methodology enables the weapon-system planner to acquire early visibility of cost magnitudes, proportions, and trends associated with a new military engine's life cycle, and to identify 'drivers' that increase cost and can lower capability. The methodology is applied at the engine subsystem and aircraft system levels for a military fighter aircraft to demonstrate that decisions about engine performance/schedule/cost must be made at the system level. Commercial considerations are discussed, as is limited historical experience in engine monitoring, an approach to obtaining the necessary information and procedures for performance and cost feedback to the engine designer. This note presents portions of previously published Rand work on life-cycle analysis of aircraft turbine engines and engine monitoring systems, together with some recent unpublished work applying the earlier efforts at the aircraft system level. GRA

N80-24319# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
SHOCK WAVE THERMOMECHANICAL PROCESSING OF AIRCRAFT GAS TURBINE DISK ALLOYS Final Technical Report, Jul. 1978 - Jul. 1979
John M. Robertson, James W. Simon, and Thomas D. Tillman Aug. 1979 54 p refs
(Contract N00019-78-C-0270)
(AD-A082080; FR-11992) Avail: NTIS HC A04/MF A01 CSCL 11/6

This program was conducted to assess the effects of shock wave thermomechanical processing on nickel-base (Ni) gas turbine disks. In particular, the peak pressure limit on shaped subscale turbine disks was determined based on allowable permanent deformation and fracture. Using maximum pressure and selected shock/heat-treat schedules, the effect on mechanical properties was determined with results indicating an enhancement of strength, particularly the yield strength, with only a slight decrease in ductility. In general, low-cycle fatigue (LCF) life was not significantly affected, however, two samples tested showed a 3X improvement in life. In addition, two shock/heat-treat schedules were found to be extremely beneficial and will be investigated further. GRA

N80-24320# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
THERMAL RESPONSE TURBINE SHROUD Final Report, 26 Sep. 1978 - 28 Sep. 1979
C. H. Gay Wright-Patterson AFB, Ohio AFAPL Nov. 1979 149 p refs
(Contract F33615-78-C-2071; AF Proj. 3066)
(AD-A082754; AFAPL-TR-79-2108) Avail: NTIS HC A07/MF A01 CSCL 21/5

The Thermal Response Turbine Shroud program studied and evaluated overall engine active clearance control designs and payoffs for a broad range of engine/aircraft combinations. Both turbine and compressor active clearance control systems were considered for gas turbine engines that encompassed high and low fan bypass ratios, single and two stage turbines, and

commercial and military missions. The study of active clearance control included detailed material, heat transfer and thermal and mechanical growth analyses. The study effort looked at the active control of clearance at transient as well as steady state engine operation. The evaluation included an overall assessment of active clearance control benefits and penalties in both performance and cost for the particular aircraft/engine system studied. GRA

N80-24321# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
MATERIAL EVALUATION. PART 1: MECHANICAL PROPERTY TESTING AND MATERIALS EVALUATION AND MODELING Final Report, Apr. 1976 - Jun. 1979
Noel E. Ashbaugh Wright-Patterson AFB, Ohio AFML Sep. 1979 91 p refs
(Contract F33615-76-C-5191; AF Proj. 7351)
(AD-A081871; SRL-6909-01; AFML-TR-79-4127-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 21/5

To accomplish the assessment of the characteristics of materials which are currently being used or which may be used in airframes and in gas-turbine engines, the following three tasks were performed--development and implementation of mechanical test methods, research on the application of solid mechanics to failure prediction, and investigation of environmental effects upon mechanical behavior. Some of the test methods which were developed in the first task were a low-cycle-fatigue (LCF) test capability, an experimental set-up to evaluate crack growth under sustained load, and a capability to conduct crack-growth tests under spectrum loads. In these tests the temperature range was normally between 538 C (1000 F) and 760 C (1400 F), and the specimen geometries were uniform gage specimens for the LCF tests, compact-type (CT) specimens for the sustained-load crack-growth tests, and CT and wedge-opening-loaded (WOL) specimens for crack-growth tests under spectrum loads. The tests which were conducted on material behavior provided data for at least 30 reports and journal articles. These tests, in addition to the previously developed tests, included uniaxial tension and compression tests, creep tests, fatigue-life tests, and single and multiple overload and underload tests. The temperature range for these tests was between room temperature and 760 C (1400 F). Equipment and instrumentation which were designed and fabricated for these tests included resistant furnaces, induction coils, dc conditioners, and power controllers. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-24322*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
AN ANALYTICAL STUDY OF EFFECTS ON AEROELASTICITY ON CONTROL EFFECTIVENESS Final Report, Jun. 1974 - Mar. 1980
Sudhir C. Mehrotra Mar. 1980 14 p refs
(Grant NsG-1046)
(NASA-CR-163197) Avail: NTIS HC A02/MF A01 CSCL 01C

Various uses of the Elastic Stability Derivative (ELASRAD) program are described. Topics include structural influence coefficient matrices of wings, arrow wing structural analysis, and graphic display of wing structures. The rigid and elastic stability derivatives were calculated for Transonic Aircraft Technology Project aircraft. E.D.K.

N80-24323*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAXIMUM LIKELIHOOD METHOD FOR ESTIMATING AIRPLANE STABILITY AND CONTROL PARAMETERS FROM FLIGHT DATA IN FREQUENCY DOMAIN
Vladislav Klein May 1980 60 p refs Prepared in cooperation with Joint Institutes for Advancement of Flight Sciences, Hampton, Va.
(NASA-TP-1637; L-13383) Avail: NTIS HC A04/MF A01 CSCL 01C

A frequency domain maximum likelihood method is developed for the estimation of airplane stability and control parameters from measured data. The model of an airplane is represented by a discrete-type steady state Kalman filter with time variables replaced by their Fourier series expansions. The likelihood function of innovations is formulated, and by its maximization with respect to unknown parameters the estimation algorithm is obtained. This algorithm is then simplified to the output error estimation method with the data in the form of transformed time histories, frequency response curves, or spectral and cross-spectral densities. The development is followed by a discussion on the equivalence of the cost function in the time and frequency domains, and on advantages and disadvantages of the frequency domain approach. The algorithm developed is applied in four examples to the estimation of longitudinal parameters of a general aviation airplane using computer generated and measured data in turbulent and still air. The cost functions in the time and frequency domains are shown to be equivalent; therefore, both approaches are complementary and not contradictory. Despite some computational advantages of parameter estimation in the frequency domain, this approach is limited to linear equations of motion with constant coefficients. Author

N80-24324*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLUTTER ANALYSIS OF AN AIRPLANE WITH MULTIPLE STRUCTURAL NONLINEARITIES IN THE CONTROL SYSTEM
Elmar J. Breitbach Mar. 1980 39 p refs
(NASA-TP-1620; L-13356) Avail: NTIS HC A03/MF A01 CSCL 01C

Experience has shown that the flutter prediction process for airplanes can be greatly affected by strong concentrated nonlinearities which may be localized in the linking elements of the control mechanism, in the pivot joints of variable-sweep-wing systems, and in the connecting points between wing and pylon-mounted external stores. The principle of equivalent linearization offers an efficent possibility for solving the related nonlinear flutter equations in the frequency domain as a complement to the well-known time domain procedures. Taking as an example an airplane with nonlinear control characteristics, it is demonstrated how the equivalent linearization approach can be extended to rather complicated systems with multiple sets of strongly interacting, concentrated nonlinearities. Author

N80-24325# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INITIAL DEVELOPMENT FOR A FLUTTER ANALYSIS OF DAMAGED T-38 HORIZONTAL STABILATORS USING NASTRAN M.S. Thesis
John O. Lassiter Mar. 1980 125 p refs
(AD-A082168; AFIT/GAE/AA/80M-2) Avail: NTIS HC A06/MF A01 CSCL 20/4

This thesis demonstrates the development and response of a finite element model of the T-38 horizontal stabilator using NASTRAN. The finite element model is to be used in a flutter analysis of damaged or repaired stabilators. The objective of the flutter analysis is to determine absolute values and degradations of the flutter speed due to different types of damages and repairs. Development of a finite element model with two dimensional quadrilateral and bar elements is described. For verification, a static analysis of the finite element model yielded for the most part qualitatively agreeable values in comparison to an influence coefficient study. For showing the dynamic response of the finite element model, a model analysis using both rigid and flexible root boundary conditions is used. The rigid root analysis shows agreement between the first two modes and the flexible root compares favorably up to three and possibly four modes. With these results, it is decided to use the finite element model in an initial flutter analysis. In the flutter analysis a doublet lattice aerodynamic model is combined with the finite element model for an undamaged stabilator. Poor agreement of the NASTRAN flutter speed with other available data indicates possible camber effects and the need for a verification aerodynamic model using steady and unsteady airloads. A brief description of a method

of simulating repairs and damages of a horizontal stabilator is included. GRA

N80-24326# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Applied Mathematics.
RESEARCH IN ADVANCED FLIGHT CONTROL DESIGN Final Scientific Report, 1 Jun. 1977 - 31 May 1979
Isaac Horowitz, B. Golurev, T. Kopelman, and S. Britman. Jan. 1980. 125 p. refs.
(Grant AF-AFOSR-3355-77; AF Proj. 2307)
(AD-A082424; AFFDL-TR-79-3120) Avail: NTIS HC A06/MF A01 CSCL 01/3

The flight control problem is one of regulation and control of a nonlinear, highly uncertain multiple input-output system, to achieve desired performance bounds. Feedback control theory has not been able to cope with even its approximate linear time-invariant version, because of its neglect of synthesis techniques in which uncertainty and performance bounds appear quantitatively. However, there have been two recent breakthroughs, giving precise, rigorous, quantitative synthesis techniques for both linear and nonlinear time-varying, single and multiple input-output systems containing plants with large uncertainties. In these techniques, quantitative performance bounds can be assigned in the time and/or frequency domain. For a large problem class, it is guaranteed that the design satisfies the specifications over the entire range of plant uncertainty. One of the breakthroughs was applied to a significantly nonlinear model of the short-period, longitudinal flight control problem. Uncertainty was included in the model by allowing for a large range in velocity and air-density, without any provision for their measurement. The output $c^*(t)$, was to lie within specified bounds in response to a range of step commands. The design was simulated with excellent results. GRA

N80-24327# Rockwell International Corp., Columbus, Ohio. North American Aircraft Div.
FLIGHT VERIFICATION OF DIRECT DIGITAL DRIVE FOR AN ADVANCED FLIGHT CONTROL ACTUATION SYSTEM (AFCAS) IN THE T-2C AIRCRAFT Final Report, Oct. 1978 - Nov. 1979
Lloyd K. Kohnhorst and Domenic A. Magnacca. Nov. 1979. 143 p. refs.
(Contract N62269-76-C-0201)
(AD-A081925; NR79H-97; NAVAIRDEVCEN-78207-60) Avail: NTIS HC A07/MF A01 CSCL 01/4

The feasibility of Direct Digital Drive for an Advanced Flight Control Actuation System (AFCAS) was successfully demonstrated in a T-2C aircraft. The test installation contained a digitally-controlled direct-drive rudder actuator, microcomputer, electronic drive unit, force transducers, and a localized 8000 PSI (55 MPa) hydraulic power supply. The system met all laboratory and flight test objectives and demonstrated direct microcomputer control of primary flight control surfaces. This program has demonstrated an approach that will improve performance and reliability of fly-by-wire control systems by reducing the system complexity. GRA

N80-24328# Bihrle Applied Research, Inc., Jericho, N. Y.
INFLUENCE OF PITCHING MOMENT CHARACTERISTICS ON DEPARTURE AND UNCOORDINATED ROLL REVERSAL BOUNDARIES FOR FIGHTER CONFIGURATIONS Final Report, May 1978 - Jun. 1979
William Birhle, Jr. Wright-Patterson AFB, Ohio AFFDL. Feb. 1980. 130 p. refs.
(Contract F33615-78-C-3600; AF Proj. 2403)
(AD-A082335; AFFDL-TR-79-3157) Avail: NTIS HC A07/MF A01 CSCL 01/3

A study is reported which generated design charts and developed associated boundaries for identifying departure and uncoordinated roll-reversal flight characteristics as a function of aerodynamic rolling and yawing moment coefficients typical of fighter airplanes for various pitching moment characteristics. This information should be valuable for specification, design and evaluation purposes. The investigation utilized a large angle, six-degree-of-freedom digital computer program to simulate the motions of a fighter performing a severe air combat maneuver. The results showed that the developed uncoordinated roll reversal boundaries may be applied to any fighter configuration and that the developed departure boundaries are applicable to fighter configurations exhibiting static pitch stability. Unaugmented airframes having pitch instability impose more stringent requirements on the rolling and yawing moment coefficients to avoid departure susceptibility. A simple angle-of-attack feedback augmentation system can markedly improve the departure resistance of both stable and unstable airframes given sufficient control authority. GRA

N80-24329# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
FLIGHT EVALUATION OF NONDIMENSIONAL STATIC LONGITUDINAL STABILITY TEST METHODS Final Report, Nov. 1974 - Feb. 1975
Kenneth R. Ferrell, Barclay H. Boirun, and James E. Jenks, Jr. Jul. 1979. 66 p. refs.
(AD-A082831; USAAEFA-74-87) Avail: NTIS HC A04/MF A01 CSCL 20/4

Stability and control testing of helicopters at this activity has included performing discrete tests at representative mission conditions, as well as extremes of altitude, airspeed, vertical speed, rotor speed, gross weight, and center of gravity location. Special studies and tests concluded that the use of nondimensional parameters commonly used in performance analysis such as the thrust coefficient, advance ratio, and advancing tip Mach number could be used to reduce the number of independent test variables in stability and control testing. These studies also indicated that constant referred rotor speed might be better for isolation of compressibility effects than the conventional constant rotor speed method for obtaining nondimensional test data. This test investigated the relative advantage of obtaining static longitudinal stability and trim control data as a function of the nondimensional parameters using both the constant referred and constant rotor speed methods on a UH-1M helicopter. Within the accuracy of the test instrumentation, the static longitudinal trim control position data were found to be a function of thrust coefficient and advance ratio. The collective fixed static longitudinal stability was primarily a function of advance ratio only. The advancing tip Mach number did not have a significant effect on the longitudinal stability data on this test helicopter. Static longitudinal stability and control trim position can be defined by obtaining data over the full range of the thrust coefficient and advance ratio envelope and then using the nondimensional method to calculate intermediate value. GRA

N80-24330# Sandia Labs., Albuquerque, N. Mex. Exploratory Systems Div.
ROLL CONTROL OF AN ATTITUDE-CONTROLLED AERODYNAMIC VEHICLE WHICH HAS STRONG ROLL-YAW COUPLING
Farrell J. Perdreauville. Oct. 1979. 41 p.
(Contract EY-76-C-04-0789)
(SAND-79-1940) Avail: NTIS HC A03/MF A01

Plant equations, autopilot structure and control philosophy are described for the roll control of a vehicle that has destabilizing roll-yaw coupling. Computer-implemented stability analyses and transient responses for two autopilot designs are presented and discussed. DOE

N80-24331# Royal Aircraft Establishment, Farnborough (England).
WIND TUNNEL/FLIGHT COMPARISON OF THE LEVELS OF BUFFETING RESPONSE INTENSITY FOR THE TACT F-111
G. F. Butler and G. R. Spavins. London HMSO. May 1979. 28 p. refs. Presented at USAF/NASA Symp. on Transonic Aircraft Technol. Lancaster, Calif., Aug. 1978.
(RAE-TM-Aero-1806; BR69201) Avail: NTIS HC A03/MF A01

A wind-tunnel/flight correlation has been made of the levels of buffeting response intensity of the TACT F-111 aircraft. Wind-tunnel measurements of the buffeting response of a 1/8 scale half-model of conventional construction have been used to predict the response of the TACT aircraft under full-scale flight conditions. Comparison with flight measurements shows good agreement. Author (ESA)

N80-24332# Royal Aircraft Establishment, Farnborough (England).

THE DESIGN OF AIRCRAFT AUTOMATIC RIDE-SMOOTHING SYSTEMS USING DIRECT-LIFT CONTROL
D. E. Fry and J. S. Winter. London: HMSO, May 1979. 93 p. refs.
(RAE-TR-79045; RAE-FS-98; BR70063) Avail: NTIS HC A05/MF A01

How a direct-lift motivator can be used to alleviate the response to vertical turbulence of a rigid, combat-type aircraft is shown. Optimal-control and parameter-optimization techniques are used to design both 'open' and 'closed' loop control systems. Alternative criteria other than simply reducing the normal acceleration response are discussed. The effects of system nonlinearities such as position and rate limits are explored. Both discrete and continuous models of turbulence are used in the analysis. Some nonlinear control solutions are discussed.
Author (ESA)

N80-24333# Royal Aircraft Establishment, Farnborough (England).
ON THE USE IN STABILITY ANALYSIS OF THE RELATIONSHIPS BETWEEN THE COEFFICIENTS OF A QUARTIC EQUATION AND THOSE OF QUADRATIC FACTOR
H. H. B. M. Thomas. London: HMSO, Jun. 1979. 63 p. refs.
(RAE-TR-79065; RAE-Aero-3456; BR70237) Avail: NTIS HC A04/MF A01

The stability of the perturbed longitudinal motion of an unaugmented aircraft about a given trimmed flight condition was determined by the well-known stability quartic. It is shown that two basic relationship exist between the coefficients of the quartic and those of a quadratic factor. Results show that examination of the position of the locus traced out by the point defined by the coefficients of the quadratic in relation to the axes and the parabolic boundary (separating real and complex roots) enables the trends in the nature of and the degree of stability of the mode or modes represented by the quadratic factor to be determined. Expressions are given which enable the value of the parameter being varied, and associated with a given point of the locus, to be calculated. The use of this method of analyzing aircraft stability is illustrated by a number of examples.
Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-24334*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
METRIC HALF-SPAN MODEL SUPPORT SYSTEM. Patent Application
Charlie M. Jackson, Jr., Samuel M. Dollyhigh, and David S. Shaw, inventors (to NASA). Filed 30 Apr. 1980. 11 p.
(NASA-Case-LAR-12441-1; US-Patent-Appl-SN-145210) Avail: NTIS HC A02/MF A01 CSCL 01E

A model support system used to support a model in a wind tunnel test section is described. The model comprises a metric, or measured, half-span supported by a nonmetric, or nonmeasured, half-span which is connected to a sting support. Moments and forces acting on the metric half-span are measured without interference from the support system during a wind tunnel test.
NASA

N80-24335# Pennsylvania Transportation Inst., University Park.
ACCEPTANCE CRITERIA FOR BITUMINOUS SURFACE COURSE ON CIVIL AIRPORT PAVEMENTS. Final Report
J. L. Burati and J. H. Willenbrock. Oct. 1979. 196 p. refs.
(Contract DOT-FA78WA-4185)
(AD-A080430; PTI-7915; FAA-RD-79-89) Avail: NTIS HC A09/MF A01 CSCL 01/5

The development of a statistically based price adjustment acceptance plan for a bituminous surface course is discussed. Data on the physical characteristics of pavement materials were collected from thirteen airport pavement construction projects. A statistical analysis of this data permitted the determination of the parameters (mean and standard deviation) on existing airport construction projects, and these parameters were then used to develop acceptance plans and price adjustment factors. Operating Characteristics (OC) curves and curves of expected payment were used to determine the appropriate acceptance plans, which were based on the percentage of material falling within specification limits (PWL). By using a continuous rather than a discrete price adjustment schedule, it was possible to avoid the problem of large differences in payment associated with relatively small differences in quality (as measured by PWL). A computer program was developed to approximate the expected payment curves associated with different continuous price adjustment systems. This program is applicable to one-sided specification limits such as density. For properties such as air voids, which require both an upper and lower specification limit, the OC curves were determined by computer simulation of 10,000 randomly drawn samples.
M.G.

N80-24336# General Accounting Office, Washington, D. C. Logistics and Communications Div.
INCREASED STANDARDIZATION WOULD REDUCE COSTS OF GROUND SUPPORT EQUIPMENT FOR MILITARY AIRCRAFT
7 Feb. 1980. 65 p.
(PB80-139546; LCD-80-30) Avail: NTIS HC A04/MF A01 CSCL 05A

An analysis of ground support equipment standardization is presented. Substantial savings could be realized if military aircraft ground support equipment could service more than one aircraft. It is suggested that the Department of Defense needs to emphasize standardization of this equipment and improve systems for reducing duplication of equipment. The Department should seek to provide incentives to contractors to use existing aircraft support equipment in the design of new weapon systems.
GRA

N80-24337# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Environmental Control Branch.
A COMBINED ENVIRONMENTS RELIABILITY TEST (CERT) FACILITY FOR TESTING OF AIRBORNE EQUIPMENT. Final Report, Jun. 1976 - Oct. 1978
Harriman E. Reynolds. Sep. 1979. 32 p. refs.
(AF Proj. 2402)
(AD-A080974; AFFDL-TR-79-3079) Avail: NTIS HC A03/MF A01 CSCL 01/3

A third combined environment reliability test facility has been developed with improved capability to simulate the dynamic combined environments that internally carried aircraft equipment is exposed to in modern high performance military aircraft. An electro-pneumatic control system individually controls compartment temperature, humidity, air mass flow and altitude, and equipment cooling air temperature, humidity, and mass flow from a tape deck according to aircraft ground and flight profiles programmed on magnetic tape. Random mechanical vibration control is semi-automatic. The design, engineering development, and partial performance capabilities are documented.
GRA

N80-24338# New Mexico Univ., Albuquerque. Civil Engineering Research Facility.
PREDICTING THE FATIGUE LIFE OF FLEXIBLE AIRFIELD PAVEMENTS: A RECOMMENDED APPROACH. Final Report, Jul. 1978 - Jun. 1979
Dale S. Decker. Tyndall AFB, Fla.: AFESC, Jul. 1979. 123 p. refs.
(Contract F29601-76-C-0015; AF Proj. 2104)
(AD-A079747; AFESC/ESL-TR-79-26) Avail: NTIS HC A06/MF A01 CSCL 01/5

The pavement engineer currently has no realistic means of predicting the fatigue life of an existing asphalt pavement or the service of a new asphalt pavement surface. The development of information that would enable engineers to make realistic fatigue life predictions, and thereby to make the best use of the increasingly scarce pavement maintenance dollar, is critically needed. This report reviews current fatigue and routine design

best copy available

test methods and examines the effects of materials and environmental conditions on fatigue life. The extensive literature review indicates a possibility that fatigue life may be estimated by correlating known fatigue parameters with results of routine design tests. The repeated-load indirect tensile (fatigue) test and the resilient modulus indirect tensile (routine design) test are recommended for use in U.S. Air Force investigations. GRA

N80-24339# Defence Research Information Centre, Orpington (England)
THE FRICTION CLASSIFICATION OF RUNWAYS
R. W. Sugg (Mech. Eng. Res. and Develop.), I. Beaty (Cranfield Inst. of Tech.), and R. J. Nicholls (Cranfield Inst. of Tech.) London HMSO Dec. 1979 43 p. refs
(S/T-Memo-6-79; BR70258) Avail: NTIS HC A03/MF A01

With the development of the continuous recording runway friction meter (Mu-Meter) and a runway self wetting system contained in the tow vehicle, it is possible to obtain a permanent record showing the friction reading along the entire length of a runway. The method developed to carry out such a trial together with its associated Standard Friction Classification Table is described. Use of the Mu-Meter under natural rain conditions demonstrates that aircraft aquaplaning can sometimes occur in local areas. A method for indentifying these areas is explained and how results can be combined with the self wetting trial to give a proper friction evaluation of a runway is hown. The relationship in Mu-Meter readings to the US Federal Aviation Administration and UK Ministry of Defence methods runway friction classification is determined and reported. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-24679*# Aerospace Corp., Los Angeles, Calif.
USER REQUIREMENTS OF SOLAR-TERRESTRIAL PREDICTIONS FOR SPACECRAFT APPLICATIONS
A. L. Vampola, R. Altrock, W. Atwell, R. C. Backstrom, H. B. Garrett, David R. Hickman, R. G. Johnson, N. H. Pereyaslova, D. Robbins, and J. Slowey. *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p. 1-20 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 22A

N80-24683*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR-INDUCED VARIATIONS OF ENVIRONMENT AFFECTING MANNED SPACE FLIGHT AND SPACECRAFT OPERATIONS
William G. Johnson, Thomas A. Parnell, and William W. Vaughan. *In its* Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p. 89-103 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 22A

13 ASTRODYNAMICS

Includes powered and free-flight trajectories, and orbit and launching dynamics.

N80-24340# Aerospace Defense Command, Peterson AFB, Colo. Office of Astrodynamics.
A RESTRICTED FOUR BODY SOLUTION FOR RESONATING SATELLITES WITHOUT DRAG
Richard S. Hujsak Nov. 1979 72 p. refs
(AD-A081263; Astrodynamic-1) Avail: NTIS
HC A04/MF A01 CSCL 03/3

A generalized method of averaging is used to study two general problems for drag free motion of an artificial Earth satellite. The first development includes perturbations due to the point masses of the Earth, Moon and Sun as well as zonal variations. The second development extends the first to include tesseral and sectoral harmonics as resonance perturbations for two specific classes of orbits. GRA

N80-24341# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
DRAG ESTIMATION AND SATELLITE ORBIT DETERMINATION
A. Eisner Mar. 1980 45 p. refs
(Contract N00024-78-C-5384)
(AD-A082888; JHU/APL/TG-1327) Avail: NTIS
HC A03/MF A01 CSCL 22/3

Like the weather, upper atmospheric density often behaves unpredictably. Even the best models of the upper atmosphere cannot consistently predict atmospheric density for Transit System satellites (1000 km) to the desired high precision. A comprehensive evaluation is presented of the drag estimation concept as a tool in routinely determining the orbit of the Transit System, the benefits to the Transit System are also examined. The resulting data (fitted along-track bias force) can be used subsequently to study upper atmospheric density variations at Transit satellite altitudes that will lead ultimately to improved upper atmospheric density models. Drag estimation in satellite orbit determination yields higher precision-tracked (determined) ephemerides and significantly improves the prediction (extrapolated satellite position) accuracy of the Transit System. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities, ground support equipment, mobile transporters, and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-24342*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BIOCENTRIFUGE SYSTEM CAPABLE OF EXCHANGING SPECIMEN CAGES WHILE IN OPERATIONAL MODE Patent Application
Robert R. Below, inventor (to NASA) Filed 30 Apr. 1980 20 p.
(NASA-Case-MFS-23825-1; US-Patent-APPL-SN-145273)
Avail: NTIS HC A02/MF A01 CSCL 06B

A bioresearch centrifuge system for subjecting caged animals to long term centrifugal forces that create gravity conditions aboard orbiting spacecraft is disclosed. The biocentrifuge system is comprised of a centrifuge carrying a plurality of removable and replaceable cages for the animal specimens. Pairs of opposing cages may be removed from the frame while it is rotating, by means of a cage exchanger which rotates concentrically within the centrifuge and the speed of which is controlled independently of the frame speed. An image rotator is provided for selective observation of the rotating animals. The system further includes a waste conveyor system, a food supply system, and a water supply system for each cage for creating a life sustaining environment so that the animals can live in the rotating centrifuge for extended periods. The rotating cage exchanger can also be used to selectively remove containers from various other centrifuges or other rotatable frame structures. NASA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters, manned orbital laboratories, reusable vehicles, and space stations.

N80-24343*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE OPERATIONS CENTER: A CONCEPT ANALYSIS
Louis E. Livingston 29 Nov. 1979 150 p.
(NASA-TM-81062; JSC-16277) Avail: NTIS

HC A09/MF A01 CSCL 22B

The Space Operations Center is a concept for a shuttle-service, permanent, manned facility in low Earth orbit. An analysis of this concept was conducted and the results are reported. It is noted that there are no NASA plans at present to implement such a concept. The results are intended for consideration in future planning. J.M.S.

N80-24344*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

STUDY OF MULTI-kW SOLAR ARRAYS FOR EARTH ORBIT APPLICATION

30 Apr. 1980 334 p.

(Contract NAS8-32981)

(NASA-CR-161453; LMSC-D715841) Avail: NTIS

HC A14/MF A01 CSCL 22B

Low cost low Earth orbit (LOW) and geosynchronous Earth orbit (GEO) Solar Array concepts in the 300 to 1000 kW range which could be reduced to hardware in the mid 1980's, are identified. Size scaling factors and longer life demands are recognized as the prime drivers for the designs if low life cycle costs for energy are to be achieved. Technology is identified which requires further development in order to assure component readiness and availability. Use of the low concentration ratio (CR) concentrator, which uses gallium arsenide solar cells for both LEO and GEO applications, is recommended. E.D.K.

N80-24345*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

STUDY OF MULTI-kW SOLAR ARRAYS FOR EARTH ORBIT APPLICATION Progress Report, 15 Mar. 1979 - 1 Mar. 1980

21 Mar. 1980 202 p.

(Contract NAS8-32981)

(NASA-CR-161452; LMSC-D715827) Avail: NTIS

HC A10/MF A01 CSCL 22B

Planar and concentrator solar array configurations based on silicon and gallium arsenide solar cells were conceptualized and on-orbit maintainability was addressed. Four basic categories emerged: (1) planar (non concentrated) with silicon cells, (2) low-CR (concentration ratio = 3.4) with silicon cells, (3) low-CR with GaAs, and (4) high-CR (concentration ratio = 62.5) with GaAs. A very high-CR (concentration ratio = 200) was investigated but rejected on thermal grounds. Nonrecurring and recurring cost elements for each of the four concepts selected were compared over a 15 year life cycle. Under conditions where the gallium arsenide cells can be produced for less than $25 per 2 x 2 cm, the low CR concentrator emerges as the most cost effective configuration. However, the producibility risk remains higher on the gallium arsenide cell. R.E.S.

N80-24348*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

VIKING MARS MISSION SUPPORT INVESTIGATIONS IN THE LANGLEY TRANSONIC DYNAMICS TUNNEL

Jerome T. Foughner, Jr. May 1980 23 p. refs.

(NASA-TM-80234; L-13405) Avail: NTIS HC A02/MF A01 CSCL 22A

Six experimental investigations conducted in the transonic dynamics tunnel, which supported elements of the entry and the landed phases of the Viking mission, are described. The objective of each investigation and selected experimental results are presented. How these particular wind tunnel results contributed to spacecraft development and ultimately to the success of the Viking mission is indicated. Experimental studies applicable to the entry phase of the mission included parachute environment and performance definition, aerodynamic characteristics exhibited by two separating bodies, and pressure measurements in the transonic range to optimize the location and orientation of a stagnation-pressure sensor on the Lander. The experimental investigations which supported the landed phase of the mission included a convective heat transfer test to establish the requirements for wind covers for the radioisotope thermoelectric generators and two tests which supported the development and calibration of the meteorological science experiment. M.G.

N80-24347# Lincoln Lab., Mass. Inst. of Tech., Lexington.

GEODSS ORBIT DISPLAY PROGRAM (GEOD)

Andrew J. Wardrop 19 Nov. 1979 28 p.

(Contract F19628-80-C-0002; AF Proj. 2128; AF Proj. 2295)

(AD-A081498; ETS-1; ESD-TR-79-270) Avail: NTIS

HC A03/MF A01 CSCL 22/3

An interactive computer program has been developed for plotting world maps, satellite ground tracks, and orbit coverage by a system of ground sensors. All plotting is done by an HP7221A four color pen plotter attached to the MODCOMP IV. This report is a users manual for this program, and contains several examples of plots. GRA

N80-24348# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.

OPTICAL PATTERN RECOGNITION FOR MISSILE GUIDANCE Final Report, 1 Oct. 1978 - 30 Sep. 1979

David Casasent 1 Jan. 1979 80 p. refs.

(Grant AF-AFOSR-2851-75; AF Proj. 2305)

(AD-A082134; AFOSR-80-0158TR) Avail: NTIS

HC A05/MF A01 CSCL 17/7

Research on optical pattern recognition (OPR) for missile guidance has addressed three general areas: new OPR techniques, OPR experiments on specific missile guidance problems and scenarios, and component evaluation and testing. In the area of component evaluation and testing, research has been concentrated on 2-D spatial light modulators (SLM) with specific attention to the photo-DKDP, prom, and the liquid crystal light valve and to a general test and evaluation procedure for these devices. A general SLM test and evaluation procedure has been developed. In the area of new OPR techniques, a coherence measure correlator, an equalization correlator, moment invariant hybrid correlator and an averaged filter correlator have been developed. Specific missile guidance scenarios persued were OPR of multi-sensor and infrared imagery. The former has laid initial ground work for a future program in optical statistical and deterministic pattern recognition. The latter has initiated a generalized approach to OPR using hyperspace formulations and linear combinations of orthonormal basis functions. GRA

N80-24349# Ohio State Univ., Columbus.

ACCURACY ESTIMATES OF 1 DEG X 1 DEG MEAN ANOMALY DETERMINATIONS FROM A HIGHLOW SST MISSION Interim Report

Richard H. Rapp and D. P. Hajela Hanscom AFB, Mass. AFGL Sep. 1979 18 p. refs.

(Contract F19628-79-C-0027; AF Proj. 2309)

(AD-A083035; DGS-295; AFGL-TR-79-0269; SR-3) Avail: NTIS HC A02/MF A01 CSCL 08/5

The method of least squares collocation is used to estimate the accuracy and correlation of 1 degree x 1 degree anomalies that could be determined from a high-low satellite to satellite tracking mission. The observed data is taken to be the line of sight acceleration which can be computed from the range rate data. Variables considered in this study were: (a) the spherical distance from the center of the 1 degree x 1 degree block within which data is selected for use; (b) the accuracy of the 'observed' accelerations; (c) the height of the low satellite; and (d) the data density or interval. Typical results indicate that a low satellite height of 200 km, a data noise corresponding to a range accuracy of + or - 0.015 cm/sec, would yield a 1 degree x 1 degree anomaly to an accuracy of about + or - 8 mgals with an average error correlation coefficient between adjacent blocks of -0.6. Lowering the satellite to 150 km reduces the accuracy to about + or - 5 mgals but increases the correlaton to about -0.9. This study does not consider the effects of orbit error, nor errors in the degree 12 reference field. In addition, some results could not be obtained when stable matrix inversions could not be obtained. This occured when dense data and/or low data noise was being used. GRA

N80-24350# Wentworth Inst., Boston, Mass.

PAYLOAD INSTRUMENTATION FOR PROBING ROCKETS Final Report, Apr. - Mar. 1979

R. W. Ebacher Hanscom AFB, Mass. AFGL Dec. 1979 17 p.

(Contract F19628-76-C-0211; AF Proj. 7659)

(AD-A083023; AFGL-TR-80-0027) Avail: NTIS

HC A02/MF A01 CSCL 03/2

Personnel, facilities, services and materials were provided

for the design, development, fabrication, assembly, installation and testing of electro-mechanical instrumentation comprising the payloads utilized in aerospace vehicles as a part of the upper atmosphere and astronomical research program being conducted by the U.S. Air Force. Special devices such as a field programmable digital timer and low cost vibration recorder suitable for general use in sounding rocketborne sensing payloads were developed. Also developed was a control system to focus a cryogenically cooled infrared sensing instrument on a particular star. This contract also entailed the design, fabrication, assembly and testing of instruments for the remote operation and monitoring of the rocketborne apparatus from a blockhouse along with recovery and retesting of certain instruments. Provision was made for the preparation and reproduction of all necessary mechanical detail and assembly drawings and circuitry schematics, as well as for participation in the pre-flight, flight and post-flight field operations associated with the assembly, preparation and launching of the probing vehicles at the various launch sites selected by the Air Force Geophysics Laboratory for the conducting of rocket-borne experiments. GRA

N80-24351# Royal Aircraft Establishment, Farnborough (England).
SECOND-ORDER PERTURBATIONS DUE TO J2 FOR A LOW-ECCENTRICITY EARTH-SATELLITE ORBIT
R. H. Gooding. London. ESA. Aug. 1979. 74 p. refs.
(RAE-TR-79100; RAE-Space-566; BR71411). Avail: NTIS. HC A04/MF A01.

The perturbations of order J (2) sub 2 in the orbital elements of an Earth satellite are analyzed by an elementary treatment that neglects terms of order J (2) sub 2 e. The resulting expressions are combined into a triad of cylindrical polar coordinates, defined by a plane of fixed inclination and uniform rotation rate. Mean orbital elements are required and are introduced in a general manner involving arbitrary constants. Both first order and second order perturbation formulas are made as compact as possible for the cylindrical coordinates. The second order results are expressed in terms of the Earth's equatorial radius, the satellite's mean semimajor axis, its inclination, and its argument of latitude. Other aspects of the J sub Z main problem are also considered. Author (ESA)

N80-24352# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
NAVSTAR SHOULD IMPROVE THE EFFECTIVENESS OF MILITARY MISSIONS: COST HAS INCREASED. Report to the Congress
15 Feb. 1980. 31 p.
(PB80-143126; PSAD-80-21). Avail: NTIS. HC A03/MF A01. CSCL 22B.

The program, which is being developed for precise worldwide navigation and position capability, has increased in cost from about $1.7 billion to $8.6 billion. This is due largely to estimates not previously included for replenishment satellites, launches, and user equipment. Extensive testing proved that NAVSTAR may provide accurate navigation and position information. However, its potential problems relating primarily to Soviet threat, satellite reliability, and launch capability could have serious cost schedule or performance implications. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-24353*# Little (Arthur D.), Inc., Cambridge, Mass.
SPACE TRANSPORTATION SYSTEM THERMAL ENVIRONMENTAL FLUX REFERENCE BOOK
Oct. 1979. 466 p.
(NASA Order C-79393-07)
(NASA-CR-159968). Avail: NTIS. HC A20/MF A01. CSCL 22B.

The information necessary to estimate the thermal environment in which proposed instruments will be expected to operate is presented in curves and tables which indicate the magnitude of the environmental fluxes which can be expected for various space transportation system missions. A.R.H.

N80-24354*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A DESIGN ASSESSMENT OF MULTIWALL, METALLIC STAND-OFF, AND RSI REUSABLE THERMAL PROTECTION SYSTEMS INCLUDING SPACE SHUTTLE APPLICATION
L. Robert Jackson and Sidney C. Dixon. Apr. 1980. 96 p. refs.
(NASA-TM-81780). Avail: NTIS. HC A05/MF A01. CSCL 22B.

The design and assessment of reusable surface insulation (RSI), metallic stand off and multiwall thermal protection systems (TPS) is discussed. Multiwall TPS is described in some detail, and analyses useful for design of multiwall are included. Results indicate that multiwall has the potential to satisy the TPS design goals better than the other systems. The total mass of the stand-off TPS and of the metallic systems require less primary structure mass than the RSI system, since the nonbuckling skin criteria required for RSI may be removed. Continued development of multiwall TPS is required to verify its potential and to provide the necessary data base for design. M.G.

N80-24355*# Northrop Services, Inc., Huntsville, Ala.
IUS GUIDANCE ALGORITHM GAMMA GUIDE ASSESSMENT
R. E. Bray and V. A. Dauro. Apr. 1980. 54 p. refs.
(Contract NAS8-33197)
(NASA-CR-161448; TR-230-1995). Avail: NTIS. HC A04/MF A01. CSCL 22B.

The Gamma Guidance Algorithm which controls the inertial upper stage is described. The results of an independent assessment of the algorithm's performance in satisfying the NASA missions' targeting objectives are presented. The results of a launch window analysis for a Galileo mission, and suggested improvements are included. J.M.S.

N80-24356*# ARO, Inc., Arnold Air Force Station, Tenn.
AEROTHERMAL TESTS OF THE THERMAL PROTECTION SYSTEM MATERIALS FOR THE SPACE SHUTTLE SOLID ROCKET BOOSTERS AND SOLID ROCKET MOTORS. Final Report, 17 Jan. - 2 Apr. 1979
John O. Ievalts. May 1979. 45 p. refs. Sponsored by NASA.
(NASA-CR-163157; AD-A081970; AEDC-TSR-79-V27). Avail: NTIS. HC A03/MF A01. CSCL 21/9.

Samples of insulation materials under consideration for use on the various protuberances of the Space Shuttle Solid Rocket Boosters and Solid Rocket Motors were tested to evaluate their survivability at simulated flight heating levels. Heat transfer calibration data were obtained by the use of the thin-skin technique on several protuberance configurations. All tests were conducted in the VKF Tunnel C. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-24357*# Texas Technological Univ., Lubbock. Biomedical Systems Lab.
A MINIATURIZED DIGITAL TELEMETRY SYSTEM FOR PHYSIOLOGICAL DATA TRANSMISSION
William M. Portnoy and Larry J. Stotts. 31 Mar. 1978. 56 p. refs.
(Contract NAS9-11162)
(NASA-CR-160660). Avail: NTIS. HC A04/MF A01. CSCL 09F.

A physiological date telemetry system, consisting basically of a portable unit and a ground base station was designed,

built, and tested. The portable unit to be worn by the subject is composed of a single crystal controlled transmitter with AM transmission of digital data and narrowband FM transmission of voice; a crystal controlled FM receiver; thirteen input channels follwed by a PCM encoder (three of these channels are designed for ECG data); a calibration unit; and a transponder control system. The ground base station consists of a standard telemetry reciever, a decoder, and an FM transmitter for transmission of voice and transponder signals to the portable unit. The ground base station has complete control of power to all subsystems in the portable unit. The phase-locked loop circuit which is used to decode the data, remains in operation even when the signal from the portable unit is interrupted. A.R.H.

N80-24358# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.
TELEMETRY ANTENNAS FOR LARGE DIAMETER SOUNDING ROCKETS Instrumentation Papers, 1 Oct. 1977 - 31 Jan. 1979
Raymond E. Wilton and Alexander Waterman. Sep. 1979. 23 p. refs.
(AF Proj. 7659)
(AD-A082383; AFGL-TR-79-0205; AFGL-IP-280) Avail: NTIS HC A02/MF A01 CSCL 09/1

The telemetry antenna systems developed for use on large diameter research sounding rockets have been investigated and test flights have been conducted. Three antenna concepts were studied: a flush-mounted antenna system, a surface-mounted system, and a directional system for attitude-controlled vehicles. Several successful designs have been completed and are now standard with Air Force research payloads. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control, and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-24684*# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
PREDICTION OF SPACECRAFT POTENTIALS AT GEOSYNCHRONOUS ORBIT
H. B. Garrett, A. G. Rubin, and C. P. Pike. *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 104-118 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-24359# Air Force Geophysics Lab., Hanscom AFB, Mass.
CALIBRATION OF THE RAPID SCAN PARTICLE DETECTOR MOUNTED IN THE SCATHA SATELLITE Final Report
Frederick A. Hanser, David A. Hardy, and Bach Sellers. 18 Jul. 1979. 41 p. refs.
(AF Proj. 7661)
(AD-A082382; AFGL-TR-79-0167; AFGL-IP-278) Avail: NTIS HC A03/MF A01 CSCL 22/2

A rapid scan particle detector (RSPD) for electrons and protons in the range of 0.05 keV to greater than a few MeV has been designed, constructed, and calibrated. The RSPD uses electrostatic analyzers (ESA's) with Spiraltron electron multipliers (SEM's) for 0.05 to 60 keV particles, and solid-state detector telescopes for the higher energy particles. The ESA's have been extensively calibrated at the Rice University Calibration Facility, using 0.04 to 45 keV electrons and 0.1 to 30 keV ions, and the results are given in this report. The calibration procedure for the SSS's is also described, and the results are tabulated. The RSPD was launched in the SCATHA satellite on 30 January 1979 and is known as the SC5 instrument. Orbit operations have been excellent, with the SSS's operating nearly 100 percent of the time and the ESA's operating about 50 percent time operation at a higher bias level is achieving a sufficiently stable operation that should allow reliable data-taking for at least the one year design life. GRA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines, and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-24360*# Rocketdyne, Canoga Park, Calif.
ORBITAL TRANSFER VEHICLE (OTV) ENGINE STUDY. PHASE A: EXTENSION Bimonthly Progress Report
A. J. Sobin. 11 Jan. 1980. 22 p.
(Contract NAS8-32996)
(NASA-CR-161374; ASR80-80; BMR-3) Avail: NTIS HC A02/MF A01 CSCL 21H

The current Phase A-Extension of the OTV engine study program aims to provide additional expander and staged combustion cycle data that will lead to design definition of the OTV engine. The proposed program effort seeks to optimize the expander cycle engine concept (consistent with identified OTV engine requirements), investigate the feasibility of kitting the staged combustion cycle engine to provide extended thrust operation, and conduct in-depth analysis of development risk, crew safety, and reliability for both cycles. Additional tasks address the costing of a 10/K thrust expander cycle engine and support of OTV systems study contractors. A.R.H.

N80-24361*# Lockheed Missiles and Space Co., Huntsville, Ala.
SUMMARY OF SOLID ROCKET MOTOR PLUME FLOW FIELD AND RADIATION ANALYSES Final Report
Beverly J. Audeh, Robert E. Carter, and Sheldon D. Smith. Apr. 1980. 28 p. refs.
(Contract NAS8-28609)
(NASA-CR-161456; LMSC-HREC-TR-D697900) Avail: NTIS HC A03/MF A01 CSCL 21H

The inclusion of solid propellant plume flow field effects in analyses and design of the space vehicle was investigated. Results of these analyses are summarized. J.M.S.

N80-24362*# Colorado State Univ., Fort Collins. Dept. Of Mechanical Engineering.
INERT GAS THRUSTERS Annual Report
Harold R. Kaufman and Raymond S. Robinson. Nov. 1979. 113 p. refs.
(Grant NsG-3011)
(NASA-CR-159813) Avail: NTIS HC A06/MF A01 CSCL 21C

Inert gas thrusters considered for space propulsion systems were investigated. Electron diffusion across a magnetic field was examined utilizing a basic model. The production of doubly charged ions was correlated using only overall performance parameters. The use of this correlation is therefore possible in the design stage of large gas thrusters, where detailed plasma properties are not available. Argon hollow cathode performance was investigated over a range of emission currents, with the positions of the inert, keeper, and anode varied. A general trend observed was that the maximum ratio of emission to flow rate increased at higher propellant flow rates. It was also found that an enclosed keeper enhances maximum cathode emission at high flow rates. The maximum cathode emission at a given flow rate was associated with a noisy high voltage mode. Although this

mode has some similarities to the plume mode found at low flows and emissions, it is encountered by being initially in the spot mode and increasing emission. A detailed analysis of large, inert-gas thruster performance was carried out. For maximum thruster efficiency, the optimum beam diameter increases from less than a meter at under 2000 sec specific impulse to several meters at 10,000 sec. The corresponding range in input power ranges from several kilowatts to megawatts. J.M.S.

N80-24363# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DETECTABILITY OF COLD ROCKET PLUMES
Gerald F. Dionne, Marvin M. Litvak, Jerald A. Weiss, and William D. Fitzgerald. 11 Oct. 1979. 63 p. refs.
(Contract F19628-80-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A081858; TN-1979-48; ESD-TR-79-264) Avail: NTIS
HC A04/MF A01 CSCL 21/2

The problem of detecting high altitude rocket plumes with satellite-borne submillimeter-wave radiometers is examined from both theoretical and experimental points of view. To estimate the sizes of plume signatures contrasted against a 250-K earth background or in self-emission against the cold sky, a computer program has been developed to predict plume brightness temperatures and optical depths of rotational lines of plume molecular constituents (e.g., H2O) as a function of distance from the nozzle. The methods employed in the computations are described in general terms, and examples are presented to indicate that detectable H2O signatures extending to several thousand nozzle diameters should exist at plume altitudes above 250 km. Details of a laboratory water vapor jet operating in a high vacuum environment designed to simulate a rocket plume at high altitude are outlined. Sensitivity considerations relevant to the plume detection problem are discussed for Fourier transform spectrometers and heterodyne receivers designed to study spectral lines in the submillimeter-wave region. Finally, a technique for converting the heterodyne radiometer into a spectrometer is described as a means of obtaining line shape details of the 752-GHz H2O line. GRA

N80-24364# Naval Air Development Center, Warminster, Pa.
ROCKET PLUME BURN HAZARD. Final Report
A. M. Stoll, J. R. Piergallini, and M. A. Chinata. 3 Jan. 1980. 23 p. refs.
(WF51523000)
(AD-A081965; NADC-80008-60) Avail: NTIS
HC A02/MF A01 CSCL 21/9

By use of miniature rocket engines, the burn hazard posed by exposure to ejection seat rocket plume flames was determined in the anaesthetized rat. A reference chart is provided for predicting equivalent effects in human skin based on extrapolation of earlier direct measurements of heat input for rat and human burns. The chart is intended to be used in conjunction with thermocouple temperature measurements of the plume environment for design and modification of escape seat systems to avoid thermal injury on ejection from multiplace aircraft. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-24365# National Bureau of Standards, Washington, D.C. National Engineering Lab.
AN INTERLABORATORY EVALUATION OF THE ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS) E84-77a TUNNEL TEST MODIFIED BY THE CONSUMER PRODUCT SAFETY COMMISSION FOR CELLULOSIC LOOSE FILL INSULATION. Final Report
J. Randall Lawson. Nov. 1979. 37 p. ref.
(PB80-128317; NBSIR-79-1922) Avail: NTIS
HC A03/MF A01 CSCL 13C

An interlaboratory evaluation was conducted to determine precision estimates for repeatability and reproducibility of the American Society for Testing and Materials (ASTM) E 84-77a tunnel test as modified by the Consumer Product Safety Commission for cellulosic loose fill insulation. Six laboratories participated by running tunnel tests on eight cellulosic loose fill materials. Each laboratory was surveyed during the project to examine its conformance with the critical details of the test apparatus and procedure. The results of the survey showed that none of the tunnels completely conformed with the specifications of the modified ASTM 84-77a standard. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-24366 Washington Univ., Seattle.
DYNAMIC TORSIONAL BEHAVIOR OF SOME CARBON FIBERS. Ph.D. Thesis
Seshadri Srinivasagopalan. 1979. 149 p.
Avail: Univ. Microfilms. Order No. 8013597

The torsional modulus G and damping infinity of carbon fibers were investigated using a double torsion pendulum operated in vacuum (2-4x 10 to the minus 5th power torr) at low frequencies (0.5 to 1.5 Hz). The dynamic torsion behavior was studied with respect to the heat treatment temperature, measurement temperature, applied tensile stress and static torsional bias strain for selected fibers made from pitch, rayon, poly-acrylo-nitrile, and pitch mesophase precursors. The intrinsic torsional moduli G sub zero (extrapolated to zero tensile stress) were found to range from 9 to 35 GPa and were correlated with variations in the microstructure. Dissert. Abstr.

N80-24367*# Lockheed-California Co., Burbank.
STUDY OF THE INFLUENCE OF HOLE QUALITY ON COMPOSITE MATERIALS
J. J. Pengra. Feb. 1980. 81 p. refs.
(Contract NAS1-15599)
(NASA-CR-159257) Avail: NTIS HC A05/MF A01 CSCL 11D

The influence of hole quality on the structural behavior of composite materials was investigated. From an industry survey it was determined that the most frequent imperfections encountered during hole fabrication are chipout, delamination, and oversize conditions. These hole flaw types were generated in critical areas of static, compression, and fatigue specimens fabricated from T300/5208 graphite/epoxy system. The specimens were tested in static and cyclic pin bearing modes in addition to compression loading. Results of these tests are presented and discussed. The hole chipout defect reduced the static and cyclic endurance characteristics. Oversize holes also lowered the cyclic pin bearing endurance, but had no influence of the static pin bearing characteristics. Delamination had no insignificant influence on the static tension and cyclic pin bearing characteristics. Compression tests demonstrated a deleterious effect for chipout of delamination defects. Hole quality requirements proposed are discussed. J.M.S.

N80-24368*# Michigan Univ., Ann Arbor.
MANUFACTURE OF FIBER-EPOXY TEST SPECIMENS: INCLUDING ASSOCIATED JIGS AND INSTRUMENTATION
S. B. Mathur and D. K. Felbeck. May 1980. 20 p.
(Grant NGR-23-005-528)
(NASA-CR-163198) Avail: NTIS HC A02/MF A01 CSCL 11D

Experimental work on the manufacture and strength of graphite-epoxy composites is considered. The correct data and thus a true assessment of the strength properties based on a proper and scientifically modeled test specimen with engineered design, construction, and manufacture has led to claims of a very broad spread in optimized values. Such behavior is in the main due to inadequate control during manufacture of test specimen, improper curing, and uneven scatter in the fiber orientation. The graphite fibers are strong but brittle. Even with various epoxy matrices and volume fraction, the fracture toughness is still relatively low. Graphite-epoxy prepreg tape was investigated as a sandwich construction with intermittent interlaminar bonding between the laminates in order to produce high strength, high fracture toughness composites. The quality and control of manufacture of the multilaminate test specimen blanks was

emphasized. The dimensions, orientation and cure must be meticulous in order to produce the desired mix. J.M.S.

N80-24369*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
THE VISCOELASTIC BEHAVIOR OF A COMPOSITE IN A THERMAL ENVIRONMENT
D. H. Morris, H. F. Brinson, W. I. Griffith, and Y. T. Yeow (Allied Chemical Corp., Morristown, N. J.) Dec. 1979 28 p refs
(Grant NsG-2038)
(NASA-CR-163187; VPI-E-79-40) Avail: NTIS HC A03/MF A01 CSCL 11D

A proposed method for the accelerated predictions of modulus and life times for time dependent polymer matrix composite laminates is presented. The method, based on the time temperature superposition principle and lamination theory, is described in detail. Unidirectional reciprocal of compliance master curves and the shift functions needed are presented and discussed. Master curves for arbitrarily oriented unidirectional laminates are predicted and compared with experimantal results obtained from master curves generated from 15 minute tests and with 25 hour tests. Good agreement is shown. Predicted 30 deg and 60 deg unidirectional strength master curves are presented and compared to results of creep rupture tests. Reasonable agreement is demonstrated. In addition, creep rupture results for a (90 deg ± or - 60 deg/90 deg) sub 2s laminate are presented. Author

N80-24370*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
THE ACCELERATED CHARACTERIZATION OF VISCOELASTIC COMPOSITE MATERIALS Ph.D. Thesis
W. I. Griffith, D. H. Morris, and H. F. Brinson Apr. 1980 167 p refs
(Grant NsG-2038)
(NASA-CR-163188; VPI-E-80-15) Avail: NTIS HC A08/MF A01 CSCL 11D

Necessary fundamentals relative to composite materials and viscoelasticity are reviewed. The accelerated characterization techniques of time temperature superposition and time temperature stress superposition are described. An experimental procedure for applying the latter to composites is given along with results obtained on a particular T300/934 graphite/epoxy. The accelerated characterization predictions are found in good agreement with actual long term tests. A postcuring phenomenon is discussed that necessitates thermal conditioning of the specimen prior to testing. A closely related phenomenon of physical aging is described as well as the effect of each on the glass transition temperature and strength. Creep rupture results are provided for a variety of geometries and temperatures for T300/934 graphite/epoxy. The results are found to compare reasonably with a modified kinetic rate theory. A.R.H.

N80-24371*# Naval Surface Weapons Center, Dahlgren, Va.
BURN/BLAST TESTS OF MISCELLANEOUS GRAPHITE COMPOSITE PARTS Final Report
T. C. Babinsky and K. A. Musselman Nov. 1979 37 p refs Sponsored by NASA. Langley Research Center
(W0852000)
(NASA-CR-163310; AD-A081712; NSWC/TR-79-390) Avail: NTIS HC A03/MF A01 CSCL 11/4

This report describes the work performed by the Naval Surface Weapons Center on tests conducted for NASA, Langley Research Center for a series of burn/blast tests with various graphite-reinforced composite materials and aircraft components. These tests were a continuation of a series requested by NASA, and, as in previous tests, information concerning the effects of fire and/or explosion upon aircraft structural composite materials and size distribution and dissemination patterns of released fiber materials for risk analyses was obtained. Electrical hazards associated with the released fibers should be the same with these materials as with previously tested materials, but final risk assessment is dependent also on other factors being investigated under the overall NASA program. GRA

N80-24372# Rockwell International Corp., El Segundo, Calif.
THE NUCLEAR THERMAL EFFECTS ON HUMIDITY SATURATED COMPOSITE MATERIALS Final Report, Dec. 1977 - Feb. 1979
Craig Sparling Feb. 1979 83 p
(Contract DNA001-78-C-0062)
(AD-A077195; AD-E300616; DNA-4860F) Avail: NTIS HC A05/MF A01 CSCL 11/4

The primary objective of this program was the development of composite design data in the area of nuclear hardness after humidity saturation. Over 4,000 specimens were fabricated and tested during this program. It was demonstrated that humidity saturation substantially lowers the nuclear thermal flash damage threshold of organic composites. GRA

N80-24373# Texas Univ. at Austin. Dept. of Mechanical Engineering.
INTERFACE CHARACTER OF ALUMINUM/GRAPHITE METAL MATRIX COMPOSITES Technical Progress Report, 1 Dec. 1977 - 30 Nov. 1979
Harris L. Marcus and Daniel Laser Dec. 1979 86 p refs
(Contract N00014-78-C-0094)
(AD-A078828) Avail: NTIS HC A05/MF A01 CSCL 11/4

One of the problems limiting the application of the aluminum/graphite composites to structural applications is the poor transverse properties. This research program has as a primary purpose the understanding of the contributing factors that govern the transverse strength and methods to improve it. In order to develop a better understanding of the character of the aluminum/graphite interface, a series of experimental approaches have been used. The key approaches taken are: (1) Scanning Auger Electron Spectroscopy (SAM) of the fractured surface; (2) Auger Spectrum deconvolution techniques to evaluate bonding state; (3) X-ray Residual Stress Measurements; (4) TEM - Interface Phase Identification; and (5) Electronic characterization of the interface. The combined approaches are being used to separate out the many factors that may influence the interface strength. GRA

N80-24374# Hercules, Inc., Cumberland, Md. Allegany Ballistics Lab.
DESIGN, PROTOTYPE FABRICATION AND MANUFACTURING TECHNIQUES FOR A COMPOSITE BOX BEAM Final Report, Oct. 1977 - Jun. 1979
W. E. Stewart Nov. 1979 128 p refs
(Contract DAAG46-77-C-0069; DA Proj. 1L2-63102-D-071)
(AD-A082231; A0296-610-03-009; AMMRC-TR-79-55) Avail: NTIS HC A07/MF A01 CSCL 11/4

Several composite systems were evaluated and the most appropriate was selected to fabricate two geometric half-scale versions of a full scale traversing launch beam. One beam was subsequently tested in four-point-bending. GRA

N80-24375# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Materials Engineering.
THERMAL-MECHANICAL AND THERMAL BEHAVIOR OF HIGH-TEMPERATURE STRUCTURAL MATERIALS Interim Report, 1 Jan. - 31 Dec. 1979
D. P. H. Hasselman, P. F. Becher, L. D. Bentsen, M. P. Kamat, K. Mazdiyasni, R. J. Palicka, B. R. Powell, J. A. Rubin, K. Satyamurthy, J. P. Singh et al. 31 Dec. 1979 215 p refs
(Contract N00014-78-C-0431)
(AD-A081915) Avail: NTIS HC A10/MF A01 CSCL 11/4

Topics covered include (1) effect of heat transfer variables on thermal stress resistance of brittle ceramics measured by quenching experiments; (2) effect of spatially varying thermal conductivity on thermal stress in brittle ceramics subjected to convective heating; (3) effect of data scatter on apparent thermal stress failure mode of brittle ceramics; (4) effect of spatially varying porosity on magnitude of thermal stress during steady state heat flow; (5) The thermal diffusivity of glass Ni composites; (6) the resistance of high E, low E brittle composites to failure by thermal shock; (7) thermal stress analysis of brittle ceramics with density gradients; (8) thermal stress resistance of partially absorbing ceramic plate subjected to asymmetric radiation; (9) micro-cracking in brittle composites; (10) transient thermal stresses in cylinders with square cross section; (11) effect of microcracking on thermal conductivity analysis and experiments; and (12) The Role of Thermal Expansion in the Thermal-Stress Resistance of Semi-absorbing Brittle Materials Subject to Severe Thermal Radiation. GRA

N80-24376# Michigan Univ., Ann Arbor. Dept of Mechanical Engineering.
MOISTURE ABSORPTION OF EPOXY MATRIX COMPOSITES IMMERSED IN LIQUIDS AND IN HUMID AIR Final Report, Mar. - Sep. 1979
George S. Springer and Alfred C. Loos. Wright-Patterson AFB, Ohio. AFML. Oct. 1979. 63 p. refs.
(Contract F33615-75-C-5165)
(AD-A082159; AFML-TR-79-4175) Avail: NTIS HC A04/MF A01 CSCL 11/4

Moisture absorption of graphite-epoxy composites immersed in liquids and in humid air were investigated. The moisture content as a function of time and temperature was measured for three materials: Fiberite T300/1034, Hercules AS/3501-5 and Narmco T300/5208. Tests were performed (1) with the materials immersed in No. 2 diesel fuel, in jet A fuel, in aviation oil, in saturated salt water, and in distilled water (in the range 300 to 322 K) and (2) with the materials exposed to humid air (in the range 322 to 366 K). The results obtained were compared to available composite and neat resin data. Moisture absorption of a boron-epoxy, graphite-epoxy hybrid composite immersed in humid air and in saturated steam was also measured. GRA

N80-24377# Lockheed-California Co., Burbank.
THE EFFECT OF COMPRESSIVE LOADING ON THE FATIGUE LIFETIME OF GRAPHITE/EPOXY LAMINATES Final Technical Report, 31 May 1977 - 2 Aug. 1979
J. T. Ryder and E. K. Walker. Wright-Patterson AFB, Ohio. AFML. Jan. 1979. 378 p. refs.
(Contract F33615-77-C-5045; AF Proj. 2419)
(AD-A082150; LR-29168; AFML-TR-79-4128) Avail: NTIS HC A17/MF A01 CSCL 11/4

The main objective of this research investigation was the effect of compressive loading on the fatigue response of graphite epoxy laminates as influenced by a circular hole and an aggressive environment. The investigation was undertaken in order to further characterize the behavior of graphite/epoxy laminates under fatigue loading. The primary emphasis of the program was on the accumulation of a statistically significant data base. Unnotched coupon properties of a quasi-isotropic and a 67% 0 degrees fiber laminate were investigated in a 82.2 degrees C (180 degrees F), 90% R.H. environment after prior conditioning in that environment. The interactional effects of absorbed moisture and fatigue loading on the fatigue lifetime of coupons containing a circular hole was investigated at room temperature and at 82.2 degrees C (180 degrees F), 90% R.H. using the quasi-isotropic laminate. The test program consisted of static tension and compression tests; tension-tension and tension-compression fatigue tests; and static tension and compression residual strength tests of coupons prior tested either under tension-tension or tension-compression fatigue loading. GRA

N80-24378# General Dynamics Corp. Fort Worth, Tex.
IN-SERVICE INSPECTION OF ADVANCED COMPOSITE AIRCRAFT STRUCTURE Final Report, 1 Mar. - 31 Dec. 1978
Francis H. Chang, Jerry R. Bell, Alvis H. Gardner, Gerald P. Handley, and C. Patrick Fischer. Wright-Patterson AFB, Ohio. AFML. Feb. 1979. 118 p. refs.
(Contract F33615-77-C-5206; AF Proj. 2418)
(AD-A082331; FZM-6816; AFML-TR-79-4087) Avail: NTIS HC A06/MF A01 CSCL 11/4

This report describes the work accomplished under a 12 month program conducted for the purpose of developing a reliable and practical inspection and data recording capability for service induced, or propagated flaws in composite aircraft structure. The basis of the developmental work was a portable C-scan recording system developed by General Dynamics to be used in hand-scan ultrasonic inspection on F-16 production line. In that system, a unique sonic microphone digitizing system was used to receive low-frequency ultrasound generated by a cursor attached to the ultrasonic transducer for position indication. In this program, a laboratory mock-up system was assembled to detect and record implanted flaws and impact damages in fabricated specimens, using modified and improved ultrasonic techniques. Preliminary design of a prototype system incorporating improvements from the laboratory mock-up system was completed. A cost analysis was conducted to allow an evaluation of the performance of the prototype system in the preliminary design against its cost. GRA

N80-24379# Boeing Aerospace Co., Seattle, Wash.
ADVANCED THERMOPLASTIC COMPOSITE DEVELOPMENT Final Report, 4 Nov. 1977 - 4 Feb. 1979
S. G. Hill, E. E. House, and J. T. Hoggatt. May 1979. 68 p. refs.
(Contract N00019-71-C-0561)
(AD-A081978; D180-25734-1) Avail: NTIS HC A04/MF A01 CSCL 11/4

The objective of this program was to evaluate recently developed thermoplastic resins as matrix materials for graphite reinforced composites. Thermoplastic polymers (PKXA Polysulfone, Radel 5010 polyphenylsulfone, P-300, and KM-1 polyethersulfones, and CM-1 fluorocarbon based resin) having high temperature capability (-350 F) were evaluated as matrix materials for graphite reinforced composites. Resin characterization studies were performed. Prepreg processing and laminate molding parameters were optimized. Mechanical properties evaluations conducted consisted of flexure, tension, compression, shear, bearing, and impact strength. A study was conducted to determine resistance of the graphite fabric/thermoplastic composites to fluids likely to be encountered in aircraft flight and maintenance operations. Thin (0.01 in.) titanium sheet was bonded to the laminate faces and these 'clad' specimens immersed in fluids to determine if the clad specimens were more fluid resistant than unclad specimens. Postforming and thermal cycling studies were performed on the clad specimens. The feasibility of using two joining methods, spot fusion and use of a glue gun, for attaching graphite reinforced composite repairs patches to graphite reinforced composite structure was demonstrated. GRA

N80-24380# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Nonmetallic Materials Div.
PROCEEDINGS OF THE FIFTH ANNUAL MECHANICS OF COMPOSITES REVIEW
Karyn T. Knoll, ed. Jan. 1980. 237 p. refs. Review held 30 Oct. - 1 Nov. 1979; sponsored by AFML.
(AF Proj. 2419)
(AD-A082846; AFWAL-TR-80-4020) Avail: NTIS HC A11/MF A01 CSCL 11/4

Unedited papers presented by representatives of NASA and of various DOD agencies discuss the mechanical properties, fracture mechanics, fatigue life, weathering, and interferometric testing of fiber composites, metal matrix composites, epoxy matrix composites, and composite structures. An interactive program for the optimum design of stiffened cylindrical panels, and methods for modeling critical flaws in graphite fiber reinforced resin matrix composites are described and the effects of engine environment on composite are also considered. A listing of both the inhouse and contractual activities of each participating organization is included. A.R.H.

N80-24381# Illinois Univ. at Urbana-Champaign. Dept. of Ceramic Engineering.
DENSIFICATION OF ZIRCONIA WITH BORATES Interim Research Report, 1 Mar. 1979 - 28 Feb. 1980
A. Sircar and R. C. Buchanan. 24 Jan. 1980. 49 p. refs.
(Contract N00014-78-C-0279)
(AD-A082760; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/2

Sintering studies carried out on submicron CaO (6.5 percent by weight) stabilized ZrO powders, showed borate additions (1-10 percent by weight) to be effective densification aids. Densities greater than 99% estimated theoretical were obtained at 1200 degrees C/4 hours, with 2 percent by weight B2O3 or 5 percent by weight CaO borate (CaO.2B2O3; (CaO.B2O3)) additions to these powders. GRA

N80-24382# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev. Energy Measurements Group.
CORNER BURN TEST OF COMPOSITE MATERIALS
A. D. Adamitis and F. M. Bowman. Nov. 1979. 72 p.
(Contract EY-76-C-08-1183)
(EGG-1183-1717-Rev-1) Avail: NTIS HC A04/MF A01

The data obtained from igniting and burning a specimen structure representing an instrumentation trailer are discussed.

The test shows that the combination of the fire retardant materials did withstand the type of fire anticipated in a typical trailer, minimizing damage and losses to the facility. The possibility of a total loss due to fire in a structure built of these materials would be reduced significantly if fuel loading does not exceed 14 pounds. Also, the combination of fire retardant materials did not create dangerous outgassing or the possibility of explosion due to vapor mixture. Additionally, the test establishes a base of information that can be used for comparison, if other labeled materials were chosen for construction. DOE

N80-24383# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.
THE INFLUENCE OF PROCESSING CONDITIONS ON THE MICROSTRUCTURE AND THE MECHANICAL PROPERTIES OF REACTION SINTERED SILICON NITRIDE Ph.D. Thesis - Technische Univ., Berlin
Juergen Heinrich. Sep. 1979. 103 p. refs. In GERMAN; ENGLISH summary. Report will also be announced as translation (ESA-TT-650)
(DFVLR-FB-79-32) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 19.40

The microstructure of reaction sintered silicon nitride was changed by varying green density, grain size of the silicon powder, nitriding conditions, and by introducing artificial pores. The influence of single microstructural parameters on mechanical properties such as room temperature strength, creep behavior, and resistance to thermal shock was investigated. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-24384 Georgia Univ., Athens.
FUNDAMENTAL STUDIES IN HIGH TEMPERATURE AND REVERSED PHASE LIQUID CHROMATOGRAPHY Ph.D. Thesis
Jeffrey Alan Graham. 1979. 138 p.
Avail: Univ. Microfilms Order No. 8010588

Pressure programmed supercritical fluid chromatography was investigated. Under optimized conditions, particle diameters in the range of 122 micrometers to 205 micrometers were found to yield maximum resolution of ohgomers of 800 molecular weight polystyrene when 5% isopropanol in pentane was employed as a mobile phase at 240 C. The ability of a given column to achieve maximum resolution was found to be dependent on the ratio of the pressure programming rate to the average mobile phase flow rate. The effects of addition of surfactants to aqueous mobile phases of a reversed phase liquid chromatographic system on the capacity factors of six nonionic solutes were also investigated. Capacity factors were generally observed to decrease upon addition 5.0 x 10 to the minus 5 power M and 5.0 x 10 to the minus 3 power M sodium dodecylsulfate. The magnitude of the observed reduction was found to be a function of the mobile phase composition, the concentration of the surfactant in the mobile phase the hydrophobicity of the surfactant and the hydrophobicity of the solute. Dissert. Abstr.

N80-24385 Kent State Univ., Ohio.
CHEMICAL ANALYSIS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY WITH ELECTROCHEMICAL DETECTION Ph.D. Thesis
William John Mayer. 1979. 131 p.
Avail: Univ. Microfilms Order No. 8011563

The electrochemical detector takes advantage of the difference in the voltammetric characteristics between the sample and the background solvents/electrolyte used as the mobile phase. If the electrochemical detector is set at a potential characteristic peak of the oxidation or reduction potential of the sample, it is possible to observe a normal Gaussian chromatographic peak as the sample is oxidized or reduced as it is eluted from the HPLC column. Interferences can be eliminated by either choosing the cell potential low enough so that the interferences will not be observed, or choosing an electrochemical mode of operation that will selectively identify the desired sample. The separation and quantification of theophylline from related molecules of theobromine and caffeine in blood serum are described as well as the determination of oxalic acid concentration in urine and the separation of carbamate pesticides. Dissert. Abstr.

N80-24386*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN INTERACTIVE MODULAR DESIGN FOR COMPUTERIZED PHOTOMETRY IN SPECTROCHEMICAL ANALYSIS
Virginia L. Bair. 1980. 17 p. Presented at the Pittsburgh Conf. on Anal. Chem. and Appl. Spectry., Atlantic City, 10-14 Mar. 1980; cosponsored by the Soc. for Anal. Chemists of Pittsburgh and the Spectry. Soc. of Pittsburgh
(NASA-TM-81521; E-465) Avail: NTIS HC A02/MF A01 CSCL 07D

A general functional description of totally automatic photometry of emission spectra is not available for an operating environment in which the sample compositions and analysis procedures are low-volume and non-routine. The advantages of using an interactive approach to computer control in such an operating environment are demonstrated. This approach includes modular subroutines selected at multiple-option, menu-style decision points. This style of programming is used to trace elemental determinations, including the automated reading of spectrographic plates produced by a 3.4 m Ebert mount spectrograph using a dc-arc in an argon atmosphere. The simplified control logic and modular subroutine approach facilitates innovative research and program development, yet is easily adapted to routine tasks. Operator confidence and control are increased by the built-in options including degree of automation, amount of intermediate data printed out, amount of user prompting, and multidirectional decision points. A.R.H.

N80-24387*# Purdue Univ., Lafayette, Ind. Dept. of Physics.
ATOMIC EMISSION SPECTROSCOPY Final Technical Report, 1 Feb. 1969 - 31 Jan. 1975
Kenneth H. Andrew. 31 Jan. 1975. 10 p. refs
(Grant NGL-15-005-003)
(NASA-CR-163184) Avail: NTIS HC A02/MF A01 CSCL 07D

The relationship between the Slater-Condon theory and the conditions within the atom as revealed by experimental data was investigated. The first spectrum of Si, Rb, Cl, Br, I, Ne, Ar, and Xe-136 and the second spectrum of As, Cu, and P were determined. Methods for assessing the phase stability of fringe counting interferometers and the design of an autoranging scanning system for digitizing the output of an infrared spectrometer and recording it on magnetic tape are described. A.R.H.

N80-24388# Rome Air Development Center, Griffiss AFB, N.Y.
SWEEPING AND Q MEASUREMENTS AT ELEVATED TEMPERATURES IN QUARTZ
R. N. Brown, J. J. OConnor, and A. F. Armington. May 1979. 33 p. refs
(AF Proj. 2306)
(AD-A081463; RADC-TR-79-175) Avail: NTIS HC A03/MF A01 CSCL 07/4

Results of sweeping experiments on synthetic quartz are presented. Sweeping was performed with an inert gas atmosphere below the transition temperature. An electric field of 1000 V/cm was employed. Alkali ions were observed to deposit on both electrodes. Doping was performed by sweeping alkali ions into the quartz. A Q-measuring technique was developed to evaluate the effects of sweeping and doping. GRA

N80-24389# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
THEORY AND EXPERIMENTS ON CHEMICAL DYNAMICS AND INSTABILITIES Final Scientific Report, 1 Dec. 1976 - 30 Nov. 1979
John Ross. Jan. 1980. 16 p. refs

(Grant AF-AFOSR-0169-80; AF Proj. 2303)
(AD-A082147; AFOSR-80-0169TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

We have used the Franck Condon theory to calculate planar and three dimensional angular distributions for the reaction products of atom-diatom chemical reactions. After applying the Franck Condon approximation we consider the limits of weak and strong potential coupling in the limits of weak and strong kinematic coupling. For H + H2 we find our results in the strong potential limit to be in qualitative agreement with exact quantum mechanical calculations. We have used some results from the theory of propagation of discontinuities in systems with chemical instabilities for the purpose of an analysis of the motion of domain walls in ferrodistortive materials. When a fluid, gas or liquid, is subjected to a temperature gradient in the gravitational field, then convective instabilities, called Rayleigh-Bernard instabilities, may occur. We have re-investigated this much studied problem since previous work did not consider the inclusion of cross transport coefficients such as thermal diffusion (Soret effect) and the reciprocal phenomena known as the Dufour effect. We used the hydrodynamic equations in the Boussinesq approximation and studied their stability to the onset of both stationary and oscillatory convection. We find a variation principle for the critical Rayleigh number at the onset of stationary convection which depends on a single dimensionless parameter, a function of the thermo-dynamic coefficients. GRA

N80-24390# New York Univ., N. Y. Dept. of Chemistry.
VACUUM ULTRAVIOLET PHOTOELECTRON EMISSION SPECTROSCOPY OF WATER AND AQUEOUS SOLUTIONS
Iwao Watanabe, James B. Flanagan, and Paul Delahay Feb. 1980 34 p refs
(Contract N00014-75-C-0397)
(AD-A081980; TR-11) Avail: NTIS HC A03/MF A01 CSCL 07/4

Experimental methods are developed for the photoelectron emission spectroscopy of water and aqueous solutions (halides, hydroxyl ion, phosphoric acid and phosphates) up to 10.5 eV. The yield for emission of photoelectrons by the liquid into water vapor is measured as a function of photon energy. Threshold energies are determined by extrapolation from emission spectra. Photoelectron emission by liquid water obeys Urbach's rule and has a threshold energy of 9.3 + or - 0.3 eV. This threshold is compared with the literature value of 8.7 + or - 0.1 eV for the threshold energy for amorphous ice. Threshold energies for halide and hydroxyl ions are obtained by application of the Brodsky-Tsarevsky theory of photoelectron emission by solutions: 8.7, 7.9, 7.2, 8.4 eV, respectively, for Cl-, Br-, I-, OH- ions. The emission spectrum for Br is deconvoluted for spin-orbit coupling. The threshold energies of these ions are higher by 1.6 to 1.8 eV than the energies at the maxima of the corresponding charge-transfer-to-solvent absorption spectra. The difference of 1.6 to 1.8 eV agrees with a theoretical prediction. Preliminary results are reported on the effect of ionic charge on the emission of phosphoric acid and phosphate ions. GRA

N80-24391# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A METHOD FOR COMPUTING THE FLAME SPEED OR A LAMINAR, PREMIXED, ONE DIMENSIONAL FLAME
T. P. Coffee and J. M. Heimerl Jan. 1980 151 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A082803; AD-B430386; ARBRL-TR-02212) Avail: NTIS HC A08/MF A01 CSCL 21/2

A method of numerically solving the equations for a one dimensional, premixed, laminar, steady state flame that propagates into an unbounded medium is described. Particular attention is given to the description of an adaptive grid, which concentrates gridpoints within the flame front. GRA

N80-24392# California Univ., Livermore. Lawrence Livermore Lab.
MEASUREMENT OF SULFUR CONTENT OF FLUIDS BY X-RAY FLUORESCENCE
R. W. Ryon Dec. 1979 7 p
(Contract W-7405-eng-48)
(UCID-18508) Avail: NTIS HC A02/MF A01

A nondestructive method is described for the quantitative measurement of sulfur in oils and water. The method is rapid, sensitive, and accurate. A wavelength dispersive x-ray spectrometer is used. Excitation is produced by a rhodium target, grounded cathode, 0.005 inch Be end window x-ray tube. When a 35 mm diam. specimen cell is used, 1% sulfur in oil yields 19,000 c/s. The detection limit for sulfur is estimated to be less than 5 ppM. DOE

N80-24393# Electrochemical Technology Corp., Seattle, Wash.
SURVEY OF ORGANIC ELECTROLYTIC PROCESSES Final Report
T. R. Beck, R. T. Ruggeri, R. C. Alkirk (Illinois Univ., Urbana), M. A. Stadherr (Illinois Univ., Urbana), and N. L. Weinberg Nov. 1979 272 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-79-5) Avail: NTIS HC A12/MF A01

The commercial status of electroorganic processes and whether there would be significant possible energy savings by introduction of electroorganic processes to replace conventional chemical processes for production of certain large-tonnage organic chemicals were determined. A list was compiled of the 220 organic chemicals that were produced at greater than 10,000 tons per year in 1975 in the United States. Search of the Swann and of the Fichter Bibliographies of electroorganic literature yielded references on 95 of these compounds. By application of selection rules to obtain promising candidates, nine chemicals with diverse electrochemical processes were chosen for detailed process energy calculations. Parallel calculations were made for presently-used commercial chemical routes to these products. Two of the nine electrochemical processes, adiponitrile and methyl ethyl ketone, had energy savings in comparison to the corresponding chemical processes. DOE

N80-24394# Argonne National Lab., Ill. Chemical Engineering Div.
WETTING BEHAVIOR OF MOLTEN-CHLORIDE ELECTROLYTES: CAPILLARITY EFFECTS IN LITHIUM-ALUMINUM/METAL SULFIDE BATTERIES
J. G. Eberhart (Aurora Coll., Ill.) Aug. 1979 41 p refs
(Contract W-31-109-eng-38)
(ANL-79-34) Avail: NTIS HC A03/MF A01

A lithium-aluminum/iron sulfide battery which uses a molten LiCl-KCl electrolyte is described. The performance and lifetime of this electrochemical system depend, in part, on the ability of the electrolyte to wet the materials used as electrodes, separators, and particle retainers. For this reason contact-angle measurements were made on smooth, 100%-dense surfaces of the cell materials. In addition, electrolyte penetrability determinations were made on the porous materials actually used as cell separators and particle retainers. The results of these measurements led to techniques for completely filling porous cell components with electrolyte, suggestions for dealing with the problem of electrolyte creeping, estimates of the likelihood of electrolyte transfer from one porous component to another, and estimation of the maximum allowable vertical cell dimensions. DOE

N80-24395# Oak Ridge Y-12 Plant, Tenn. Plant Lab. Dept.
DETERMINATION OF HYDROGEN IN URANIUM-NIOBIUM-ZIRCONIUM ALLOY BY INERT-GAS FUSION
W. F. Carden Dec. 1979 18 p ref
(Contract W-7405-eng-26)
(Y-2194) Avail: NTIS HC A02/MF A01

A method using inert-gas fusion for determining the hydrogen content in uranium-niobium-zirconium (U-7.5Nb-2.5Zr) alloy is described. The method is applicable to concentrations of hydrogen ranging from 1 to 250 micrograms per gram and may be adjusted for analysis of greater hydrogen concentrations. Hydrogen is determined using a hydrogen determinator. The limit of error for a single determination at a 95 percent-confidence level (at the 3.7 microgram/gram hydrogen level) is + or - 1.4 micrograms per gram hydrogen. DOE

N80-24396# Oak Ridge Y-12 Plant, Tenn. Plant Lab. Dept.
DETERMINATION OF NITROGEN AND OXYGEN IN URANIUM METAL BY INERT-GAS FUSION
W. F. Carden 31 Dec. 1979 19 p
(Contract W-7405-eng-26)
(Y-2193) Avail: NTIS HC A02/MF A01

An analytical method using inert-gas fusion for determining the nitrogen and the oxygen contents of uranium metal is described. The analytical method is applicable to concentrations of nitrogen and oxygen ranging fron 1 microgram per gram to 1000 micrograms per gram for each gas. In uranium metal, the limit of error for a single determinaiton at the 95%-confidence level, at the 12 micrograms per-gram-nitrogen level, is +-3 micrograms per gram nitrogen and, at the 20 micrograms-per-gram-oxygen level, is +-3 micrograms per gram oxygen. Nitrogen and oxygen concentrations are determined by using a nitrogen-oxygen determinator. DOE

N80-24397 Sandia Labs., Livermore, Calif.
LASER ABSORPTION MEASUREMENTS OF OH IN A METHANE-AIR FLAT FLAME
Robert J. Cattolica Dec. 1979 79 p refs Presented at the 1979 Fall Combustion Meeting, Berkeley, Calif., 15-16 Oct. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-8717; CONF-791048-5) Avail: NTIS HC A04/MF A01

The OH radical concentration and rotational temperature were measured in atmospheric pressure methane-air flat flames using absorption spectra obtained with a tunable dye laser. The OH radical nonequilibrium and the associated recombination in the post flame gases were observed for fuel-air equivalence ratios of .8, .9, 1.0, 1.1, 1.2. The predicted peak OH concentrations from one dimensional laminar flame models were found to be in good agreement with the measured values. The OH decay profiles were consistent with a second-order dependence of the decay on the OH concentration. Although this dependence is associated with the recombination chemistry for the fuel rich flames, it appears that for the lean flames diffusional transport is responsible. The OH decay rate constant was nearly the same for the stoichiometric and lean conditions, but was found to increase substantially for the fuel-rich conditions. DOE

N80-24398# Bendix Field Engineering Corp., Grand Junction, Colo.
HIGH RESOLUTION GAMMA-RAY SPECTROSCOPY APPLIED TO BULK SAMPLE ANALYSIS
K. L. Kosanke, Chuck D. Koch, and Robert D. Wilson Jan. 1980 62 p refs
(Contract EY-76-C-13-1664)
(GJBX-4(80)) Avail: NTIS HC A04/MF A01

A high resolution Ge(Li) gamma-ray spectrometer was installed and made operational for use in routine bulk sample analysis. The Ge(Li) spectrometer provides bulk sample analyses for potassium, uranium, and thorium that are superior to those obtained by the sodium iodide spectrometer. The near term analysis scheme permits a direct assay for uranium that corrects for bulk sample self-absorption effects and is independent of the uranium/radium disequilibrium condition of the sample. A more complete analysis scheme was developed that fully utilizes the gamma-ray data provided by the Ge(Li) spectrometer and that more properly accounts for the sample self-absorption effect. This new analysis scheme should be implemented on the Ge(Li) spectrometer at the earliest date. DOE

N80-24399# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
LIQUID SCINTILLATION ALPHA PARTICLE SPECTROMETRY Progress Report
L. L. Bell, S. A. Hakooz, L. O. Johnson, E. B. Nieschmidt, and D. H. Meikrantz (Exxon Nuclear Idaho Corp.) Dec. 1979 72 p refs
(Contract EY-76-C-07-1570)
(EGG-phys-5058) Avail: NTIS HC A04/MF A01

A technique is developed whereby plutonium may be put into solution, extracted by solvent, extracted into a suitable extractive scintillant, and subsequently counted. Separation of beta and alpha activities through pulse shape discrimination is attempted. A qualitative discussion is given which yields alpha particle peak widths, resolution, and response. The detection efficiency for alpha particles in a liquid scintillant is 100%. The detectability of a particular alpha emitting species is strongly dependent upon the population of other species. The ability to discriminate depends upon the system resolution. DOE

N80-24400# Department of Energy, Washington, D. C.
COMPUTERS IN ACTIVATION ANALYSIS AND GAMMA RAY SPECTROSCOPY. PROCEEDINGS OF THE AMERICAN NUCLEAR SOCIETY TOPICAL CONFERENCE
B. S. Carpenter, ed. (NBS, Washington, D.C.), Michael D. DAgostino, ed. (Grumman Aerospace Corp., Bethpage, N.Y.), and Herbert P. Yule, ed. (Nuclear Utility Services Inc., Washington, D.C.) 1979 905 p refs Conf. held at Mayaguez, Puerto Rico, 30 Apr. - 4 May 1978; sponsored by Am. Nucl. Soc., Am. Chem. Soc., NBS, Puerto Rico Univ., Center for Energy and Environ. Res., and DOE
(CONF-780421) Avail: NTIS HC A99/MF A01

Seventy-three papers are included under the following session headings: analytical and mathematical methods for data analysis; software systems for gamma ray and X-ray spectrometry; gamma-ray spectra treatment, peak evaluation; least squares; IAEA intercomparison of method for processing spectra; computer and calculator utilization in spectrometer systems; and applications in safeguards, fuel scanning, and environmental monitoring. Separate abstracts were prepared for 72 of those papers. DOE

N80-24401# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
STUDIES IN CHEMICAL REACTIVITY Progress Report, 1 Jan. - 31 Dec. 1979
R. W. Carr, Jr. Dec. 1979 15 p refs
(Contract EY-76-S-02-2026)
(COO-2026-39) Avail: NTIS HC A02/MF A01

Data on the collisional deactivation of chemically activated polyatomic molecules show a trend of decreasing Delta E, the average energy removal per gas kinetic collision, with increasing size of activated molecule when polyatomic collider species of similar molecular structure and nearly constant number of atoms are used. Calculations of Delta E by a quasistatistical transition modes model give quantitative agreement with the experimental data. Measurements of photoionization cross sections and yields of some organic molecules were made in a double ionization chamber. Work is proceeding on an experiment to detect chemically activated molecules by photoionization. Observation were made of the production of CF2 in the flash photolysis of 1, 3 dichlorotetrafluoroacetone, and the rate of removal of CF2 by reaction. Observation have also been made on the production and removal of C10 when O2 is present in the reaction. Analysis of reaction products from steady illumination photolysis of 1, 3 dichlorotetrafluoroacetone and oxygen mixtures at 313 nm were done by gas chromatography, infrared spectrometry and mass spectrometry. Continued efforts to observe CH2(B1) yields CH2(A1) luminescence from photolysis of ketene, diazomethane and diazirine were unsuccessful. DOE

N80-24402# Argonne National Lab., Ill.
PULSED NEURON ACTIVATION CALIBRATION TECHNIQUE
Paul Kehler 1979 13 p refs Presented at the 7th Water Reactor Safety Res. Inform. Meeting, Gaithersburg, Md., 5-9 Nov. 1979
(Contract W-31-109-eng-38)
(CONF-791118-7) Avail: NTIS HC A02/MF A01

A pulsed neutron activation for measurement of two-phase flow is described. Flow was measured downstream by an NaI detector. Measured counts were sorted by a multisealer into different time channels. A counts vs. time distribution typical for two phase flow with slip between the two phases was obtained. Proper evaluation for the counts/time distribution lead to flow regime independent equations for the average of the inverse transil time and the average density. After calculation of the average mass flow velocity, the true mass flow was derived. DOE

N80-24403# Los Alamos Scientific Lab., N. Mex.
FLOWING AFTERGLOW SPECTROSCOPY: AN ULTRASENSITIVE PROBE INTO SOLID-PHASE DECOMPOSITION KINETICS
George W. Taylor and George H. Andrews, Jr. 1979 30 p refs Presented at the 7th Ann. DOE Compatibility Conf., Aiken, S.C., 16 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-80-56; CONF-791079-3) Avail: NTIS

HC A03/MF A01

The thermal decomposition kinetics of high explosives are discussed with respect to the processing and storage of these dangerous materials. Two broad temperature regions are of particular importance, i.e., the high (greater than or equal to 200 C) temperature region associated with fire hazard and the low (approximately 20 to 200 C) region associated with storage and processing environments. The technique is described in detail and efforts to elucidate the low temperature kinetics of trinitrotriaminobenzene and nitroguanidine are summarized. DOE

N80-24404# California Univ., Berkeley. Lawrence Berkeley Lab. Nuclear Science Div.

NEW DEVELOPMENTS IN GAMMA-RAY CONTINUUM SPECTROSCOPY

R. M. Diamond. Dec. 1979. 16 p. refs. Presented at the Intern. Symp. on Continuum Spectra, San Antonio, Tex., 3 Dec. 1979

(Contract W-7405-eng-48)

(LBL-10137; CONF-791219-3) Avail: NTIS HC A02/MF A01

The development of gamma ray spectroscopy for the investigation of high spin states is discussed. In such studies, selection of particular (high) spin regions are made through use of multiplicity filters and total-energy spectrometers. The nuclei investigated so far, whether initially near-spherical or deformed, all appear to become deformed rotors at high spin, and effective moments of inertia can be obtained. A new technique of determining energy correlations among coincident transitions in the cascade offers great promise for the future. DOE

N80-24405# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Information Processing Computer Science.

KINRATE AND KINBOX: TWO PROGRAM PACKAGES FOR INTERACTIVE SIMULATION OF CHEMICAL SYSTEMS

Mathias Uhlen. 1979. 69 p. refs.

(TRITA-NA-7912) Avail: NTIS HC A04/MF A01

Two interactive program packages for simulation of chemical reaction systems, KINRATE a program package for simulations of homogenous reaction systems and KINBOX a program package for heterogenous systems, are described. These programs are a further development of a program package, KEMPEX, used in numerical analysis. Each program package contains four different programs. In the first, the chemical system is defined by the user and the kinetics are automatically translated into ordinary differential equations. In the second program, chemical and physical parameters are given, while in the third, the simulation takes place. The fourth program is used to interpret the result, using graphical units. The chemical, physical, and mathematical background which is needed for the computational simulations is also discussed. Two test runs are included, one illustrating an oscillating chemical system (Belousov-Zhabotinsky), and the other illustrating kinetics and diffusion of some components of the atmosphere. Author (ESA)

N80-24406# European Space Agency, Paris (France).

COHERENT ANTI-STOKES RAMAN SCATTERING AT ELECTRONIC RESONANCE: APPLICATION TO IODINE

Brigitte Attal. Apr. 1980. 143 p. refs. Transl. into ENGLISH of "Diffusion Raman Anti-Stokes Coherente a la Resonance electronique: Application a l'Iode", Rept. ONERA-1979-4 ONERA, Paris, 1979. Original report in FRENCH previously announced as N80-23404

(ESA-TT-608; ONERA-NT-1979-4) Avail: NTIS HC A07/MF A01

The main properties and application of Coherent Anti-Stokes Raman Scattering (CARS) are recalled and the advantages of resonant excitation pointed out. In particular the intensities of the Raman lines must be enhanced by several orders of magnitude. Specificity is thus improved and detection of traces of polluants in mixtures becomes possible. Results of experiments with NO2 and I2 are presented, and a study of iodine (partial pressure of 1 mb) in air in normal conditions is made. Two spectra were plotted for two distinct values of the laser frequency omega L in the proximity of the b - x transition absorption lines. Enhancement of the intensities of the CARS lines by one-photon resonance is experimentally confirmed in iodine. Author (ESA)

N80-24407# National Bureau of Standards, Washington, D.C.

JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS, VOLUME 84, NUMBER 6 Bimonthly Report, Nov. - Dec. 1979

1979. 89 p. refs.

(PB80-131766) Avail: NTIS HC A05/MF A01 CSCL 07D

Research papers of the NBS are reported. The topics include: molecular dynamics of liquid rubidiums; room temperature poly (venylidene fluoride) with deposited metal electordes; generator for discrete polynomial Li; and coloring algorithm for large scheduling problems. Citations of all recent publication of the National Bureau of Standards are presented. F.O.S.

N80-24408# Ohio State Univ., Columbus. Water Resources Center.

ADSORPTION OF FREE AND COMPLEXED METALS FROM SOLUTION BY ACTIVATED CARBON

Alan J. Rubin and Danny L. Mercer. Aug. 1979. 76 p. refs. Sponsored by Dept. of Interior

(PB80-127244; W80-02406; OWRT-A-044-OHIO(1)) Avail: NTIS HC A05/MF A01 CSCL 07D

The effect of two complexing agents of different solubilities on the adsorption of cadmium(II), zinc(II) and lead(II) by activated carbon was investigated. Studies were run to compare carbons of different isoelectric points, particle size, and dosage. The Freundlich and Langmuir isotherms were compared as were curve fitting techniques for evaluating the adsorption parameters. Results indicate that at very low surface coverage, as with an excess of adsorbent, EDTA appears to enhance the sorption of cadmium. Under more realistic conditions, that is, at high surface coverages, the effect of this soluble chelating agent is to suppress adsorption of metal ion. Results also indicate that the use of EDTA is detrimental to metals removal. GRA

N80-24409# Midwest Research Inst., Kansas City, Mo.

SAMPLING AND ANALYSIS OF SELECTED TOXIC SUBSTANCES. TASK 1: ACRYLAMIDE Final Report, Sep. 1978 - Sep. 1979

John E. Going and Ken Thomas. Dec. 1979. 39 p. refs.

(Contract EPA-68-01-5017)

(PB80-128150; EPA-560/13-79-013) Avail: NTIS HC A03/MF A01 CSCL 07D

A sampling and analysis program was conducted to determine the level of residual acrylamide monomer in selected polymers and to determine if the use of those polymers in water treatment leads to measurable levels of acrylamide in the water. Methods for the determination of acrylamide in water and in polyacrylamide were validated. Water samples were reduced in volume by evaporation and analyzed by GC using a nitrogen selective thermionic detector. The detection limit was determined to be about 1 microgram/liter. Polyacrylamide samples were extracted with 80 percent methanol/20 percent pH 3.75 water for 3 hr. The extracts were analyzed by HPLC with a UV detector set at 200 nm. The monomer limit of detection was about 0.5 microgram/g. One potable water treatment plant was sampled at pre- and post-flocculation points. MRI tap water was analyzed for comparison. No acrylamide above the detection limit was found in any of the samples. Thirty-two polymers were analyzed for residual acrylamide. When not obscured by interferences, the observed acrylamide ranged from 0.5 to 600 microgram/g. GRA

N80-24410# FilmTec Corp., Minnetonka, Minn.

ADVANCED POLY(PIPERAZINEAMIDE) REVERSE OSMOSIS MEMBRANES Final Report, 27 Sep. 1978 - 26 Sep. 1979

John E. Cadotte, Rita S. King, and Nancy A. Newkumet. 1979. 54 p. refs.

(Contract DI-14-34-0001-8512)

(PB80-127574; W80-02401; OWRT-C-80011-S(8512)(1)) Avail: NTIS HC A04/MF A01 CSCL 07C

Poly(piperazineamide) thin-film composite reverse osmosis membranes were prepared by interfacially reacting piperazine compounds with a mixture of isophthaloyl and trimesoyl acid chlorides. Reaction of piperazine itself with these acylhalides gave membranes with high flux and excellent salt rejections towards salts with divalent anions, but relatively poor salt rejections toward salts with monovalent anions. About 95%

seawater rejections were possible. A variety of water-soluble, amine-terminated piperazine oligomers were prepared by reaction of an excess of piperazine with poly-functional acyl halides. These were then used in the above interfacial reaction step. Cyanuric chloride-piperazine adducts showed performance advantages over other in preparation of reverse osmosis membranes interfacially. In seawater tests at 1000 psi and 25C, fluxes of 15 to 20 gfd at 97 percent salt rejection were attainable for poly (piperazineamides) containing cyanuric amide segments. These latter membranes were not chlorine-resistant. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-24411# Aeronautical Research Labs., Melbourne (Australia).
FATIGUE-CRACK GROWTH IN D6AC STEEL HEAT-TREATED TO DIFFERENT VALUES OF FRACTURE TOUGHNESS
N. E. Ryan Apr. 1979 15 p refs
(ARL/MAT-REPT-110; AR-001-734) Avail: NTIS
HC A02/MF A01

Measurements of fatigue-crack growth in D6AC steel, heat-treated to various fracture-toughness levels, show that, under conditions where the growth mechanism produces striation markings and the crack extension per cycle is a linear function of a power of the stress intensity range, the rate of fatigue-crack growth is independent of fracture-toughness. At peak stress intensity values greater than 0.7 K sub 1c, the rate of growth accelerates as the critical stress intensity is approached and tensile modes of crack extension occur. At peak stress intensity values less than 18 MPa m to the 1/2 power, fractographic examination indicates a change in mechanism as the crack extension per cycle decreases more rapidly with decreasing peak stress intensity, approaching a threshold value of stress intensity dependent upon heat-treatment. The implications of these results for the choice of materials for service applications are discussed. Author

N80-24412# Washington State Univ., Pullman. Dept. of Physics.
TRIBOSTIMULATED EXOEMISSION FROM OXIDE COVERED METALS Final Report, 1 Jun. 1973 - 31 Oct. 1979
J. T. Dickinson and P. F. Braeunlich Jan. 1980 56 p refs
(Grant AF-AFOSR-3650-78; AF Proj. 2306)
(AD-A081477; AFOSR-80-0137TR) Avail: NTIS
HC A04/MF A01 CSCL 07/4

This report presents a summary of the work performed by Washington State University under Grant No. 78-3650 during June 1978 to October 1979. This report covers a number of experiments concerning emission phenomena accompanying plastic deformation of anodized aluminum. The sensitivity of this tribostimulated exoemission to anodization parameters and the relation of this emission to oxide cracking is briefly discussed. The emission of neutral species during deformation is presented. The comparison of acoustic emission due to cracking of the anodized oxide layer with the accompanying electron emission shows the intimate link between fracture of the oxide layer and electron emission. We have also studied a model exoemission system (NaCl) to examine the details of the emission mechanisms of neutral species and electrons following perturbations due to electron bombardment. Finally we examine briefly the chemiluminescence that occurs during H3PO4 anodization of Al. GRA

N80-24413# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Nonmetallic Materials Div.
FAILURE MECHANISMS AND INTERPHASE CHEMISTRY OF GOLD FILMS ON Ti6Al4V. PART 1: SURFACE CHEMISTRY OF FAILURE SURFACES Final Report, Jul. 1978 - Oct. 1979
W. L. Baun Jan. 1980 53 p refs
(AF Proj. 2419)
(AD-A081727; AFML-TR-79-4178-Pt-1) Avail: NTIS
HC A04/MF A01 CSCL 11/6

This work is part of a program which looks at the effects of surface treatments on surface chemistry and morphology of titanium alloys with reference to adhesive bonding. Here gold is vapor deposited on Ti6Al4V which was prepared to simulate conditions of etching and aging which might be encountered during processing and use. Although this model system of gold on Ti6Al4V is not a direct analogy to adhesive bonding, certain similarities do exist and the system provides interesting information on bond failure mechanisms. Surface chemical analysis using ISS/SIMS showed that the gold on titanium alloy could model the failure mechanisms on surfaces prepared by methods similar to that in adhesive bonding. ISS/SIMS was found to be a sensitive chemical method to determine locus of failure and the change of composition at interfaces following humid aging and bond testing. Several types of failures appeared to be observed. Fractures which appeared to have occurred by interfacial failure were actually found to be mixed mode failures or failures in a weak boundary layer. GRA

N80-24414# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Nonmetallic Materials Div.
FAILURE MECHANISMS AND INTERPHASE CHEMISTRY OF GOLD FILMS ON Ti6Al4V. PART 2: ETCHING OF Ti6Al4V AND ITS EFFECT ON EVAPORATED GOLD AND CHEMICAL ADHESIVE ADHESION Final Report, Jul. 1978 - Oct. 1979
W. L. Baun Jan. 1980 39 p refs
(AF Proj. 2419)
(AD-A081728; AFML-TR-79-4178-Pt-2) Avail: NTIS
HC A03/MF A01 CSCL 11/6

This work is part of a program which looks at the effects of surface treatments on surface chemistry and morphology of titanium alloys with reference to adhesive bonding. Here gold is vapor deposited on Ti6Al4V which was prepared to simulate conditions of etching and aging which might be encountered during processing and use. Although this model system of gold on Ti6Al4V is not a direct analogy to adhesive bonding, certain similarities do exist and the system provides interesting information on bond failure mechanisms. Surface chemistry changes suggest selective etching of the alpha phase and subsequently larger influence of the alpha phase in bonding. Heating of the gold on Ti6Al4V resulted in improved adhesion, probably by diffusion mechanisms. Exposure to steam resulted in bond degradation in both gold/Ti6Al4V and in adhesive/Ti6Al4V systems. The adhesive bonding results for the etched specimens were compared to expected performance based on 'attachment site' theory. Excellent agreement for both gold on Ti6Al4V and commercial adhesive on Ti6Al4V was observed. Degradation of the bond due to steam followed the same form in both systems. GRA

N80-24415# Polytechnic Inst. of New York. Microwave Research Inst.
MICROWAVE REFLECTIONS FROM VIBRATING IN HOMOGENEOUS CONDUCTING SURFACES Final Report, Jun. 1976 - May 1979
Hellmut J. Juretschke 1980 6 p refs
(Grant AF-AFOSR-3030-76; AF Proj. 2305)
(AD-A081534; AFOSR-80-0133TR) Avail: NTIS
HC A02/MF A01 CSCL 11/6

Homogeneously oxidized iron surfaces show modulated microwave reflections under strain. The effects are too small to account for the modulation found from actual vibrating systems, but are large compared to the response expected from clean metal surfaces. Tunneling junctions of Fe-Oxide-Fe have been investigated as a possible origin of the observed enhancement of strain sensitivity. Su h tunneling junctions have been found to exist, at room temperature, but the effect found in model MOM junctions is not large enough to account for the observations. GRA

N80-24416# Georgia Inst. of Tech., Atlanta. School of Physics.
ELECTRONIC EXCITATION STRUCTURE, CORRELATION, AND RELAXATION AND THEIR EFFECTS ON THE OPTICAL PROPERTIES AND ELECTRON EMISSION OF TRANSITION METAL OXIDES Final Report, 1 Oct. 1976 - 30 Sep. 1979
M. W. Ribarsky 30 Nov. 1979 63 p refs
(Grant AF-AFOSR-3108-76; AF Proj. 2301)
(AD-A081946; AFOSR-80-0202TR) Avail: NTIS

HC A04/MF A01 CSCL 07/4

Studies of the electronic excitation structure of transition metal oxides and the effect of the structure on the optical properties, electron correlations, and photoemission spectra of these materials have been made. Techniques have been developed which for the first time allow precise and general calculations of the excitation structure so that in addition to the above properties several other properties can be obtained. These techniques have been applied in particular to calculations on TiO. The calculations allow comparison with experiment and identification of the structure in the optical spectra of oxidized surfaces. They also show that significant correlation and relaxation effects occur in the band structure. GRA

N80-24417# Materials Research Labs., Ascot Vale (Australia).
FRACTURE TOUGHNESS OF FATIGUE-DAMAGED STEEL SPECIMENS
Graham Clark. Jun. 1979. 20 p. refs.
(AD-A081841; MRL-R-749) Avail: NTIS. HC A02/MF A01 CSCL 11/6

The plane strain fracture toughness K sub Ic of a material is used to describe the crack tip conditions required for unstable growth of a crack, and is used extensively in designing metallic components and in assessing the severity of pre-existing defects. There are many situations in service, however, where the crack tip stress conditions immediately prior to unstable crack growth are not identical to those in a standard fracture toughness test specimen. This report examines the fracture toughness of high-quality gun steel, and describes conditions under which the fatigue pre-cracking levels specified for K sub Ic tests may produce unreasonably high values of K sub Ic, leading to an increased possibility of in-service fracture of components designed using these values. GRA

N80-24418# Air Force Systems Command, Wright-Patterson AFB, Ohio.
HARDENING OF STEEL WITH HIGH-SPEED DEFORMATION IN WIDE TEMPERATURE RANGE
L. I. Mirkin. 28 Feb. 1980. 27 p. refs. Transl. into ENGLISH from Fiz. Khim. Obrab. Mater., USSR, no. 1, 1967, p. 105-113
(AD-A082325; FTD-ID(RS)T-0231-80) Avail: NTIS
HC A03/MF A01 CSCL 11/6

Massive specimens of low-carbon steel 10 (0.1 o/c C) and technical iron (0.06o/o C) were subjected to impact with an indentor at relative speeds in a range of from 1200 to 4000 m/s. Prior to impact, the specimens were heated in a temperature range of up to +700 C and cooled in a temperature as low as -180 C. A number of experiments were also undertaken with specimens at room temperature. Low-temperature (-180 C) deformation of low-carbon steel at impact speeds of 1200 m/s leads to the development of a spherical twin-structure and grain deformation. High-temperature pulsed deformation provides additional recrystallization effects. Increasing the impact speed up to 4000 m/s at room temperature results qualitatively in the same pattern as high-temperature deforming at low speed. The results of X-ray structural analysis and metallographic study of the deformed zone coincide with the dislocation models of shock wave effects on metal. A.R.H.

N80-24419# Battelle Columbus Labs., Ohio.
RESEARCH TO DEVELOP PROCESS MODELS FOR PRODUCING A DUAL PROPERTY TITANIUM ALLOY COMPRESSOR DISK. Interim Annual Report, 1 Aug. 1978 - 31 Jul. 1979
G. D. Lahoti and T. Altan. Dec. 1979. 400 p. refs. Prepared in cooperation with Wyman-Gordon Co., Worcester, Mass.; Wright State Univ., Dayton, Ohio; Pittsburgh Univ., Pa.; Calif. Univ., Berkeley; and Los Alamos Scientific Labs., N. Mex.
(Contract F33615-78-C-5025; AF Proj. 2306)
(AD-A082207; AFML-TR-79-4156) Avail: NTIS
HC A17/MF A01

This program is aimed at developing a science-based methodology for analyzing, optimizing, and designing metal-deformation processes to control microstructure and properties in a finished part. The validity and application of this approach will be demonstrated by developing forging process for a compressor disk from Ti-6242 alloy, as an example. GRA

N80-24420# Washington State Univ., Pullman. Dept. of Physics.
SHOCK-INDUCED MARTENSITE REVERSAL IN Fe/30%Ni. Final Report, 18 Sep. 1977 - 15 Sep. 1979
George E. Duvall, Paul M. Bellamy, and Ronald J. Livak. 14 Feb. 1980. 107 p. refs.
(Grant DAAG29-77-C-0030)
(AD-A082003; ARO-14619.1-MS) Avail: NTIS
HC A06/MF A01 CSCL 11/6

It is pointed out that variations of shear stress in a solid undergoing transition may have an important effect on the conditions under which transitions occur. Such variations are not calculable from present knowledge, and for practical reasons, description of the state of shear during the transition must be made part of the constitutive relations. The difficulty of defining a Gibbs energy in a solid is pointed out and the thermodynamic problems are indicated in some details. Experiments are described which promise to reveal the state of shear in the alpha-gamma transition in Fe/30%Ni at high temperatures using shock wave methods. Attempts to carry out these experiments are described, and numerical calculations of phase transitions with and without shear stress show that characteristic shock wave structures do indeed result from various shear conditions during transformation. Transformation experiments at various initial temperatures suggest that there may be a third phase, perhaps epsilon, which is reached in shock experiments for modest driving pressures and for initial temperatures less than 200 C. A description of the metallographic state after shock transition is given. There is minimal evidence that the shear stresses were sharply reduced for initial temperatures of 400 C. GRA

N80-24421# Sussex Univ., Brighton (England). School of Engineering and Applied Sciences.
SUPERPLASTICITY IN SPLAT-QUENCHED Pb Sn EUTECTIC
R. Cheese and B. Cantor. 1 Jan. 1980. 28 p. refs.
(Grant N00014-78-G-0048)
(AD-A082046; TR-5) Avail: NTIS. HC A03/MF A01 CSCL 11/6

Lead-tin eutectic alloy tapes have been prepared by melt-spinning over a wide range of solidification conditions. In all cases, the rapid solidification produces a microstructure consisting of equiaxed lead-rich and tin-rich grains, approximately 4 micron in size. This microstructure could result from a divorced eutectic solidification process, or, more likely, from post-solidification, coarsening. Under tensile loading, the melt-spun lead-tin eutectic tapes exhibit superplastic deformation with large failure strains, a sigmoidal variation of log flow stress with log flow strain, a strain rate sensitivity of approximately 0.42, and an activation energy for superplastic flow of approx. 54KJ mole. GRA

N80-24422# Aluminum Co. of America, Alcoa Center, Pa. Alcoa Technical Center.
FATIGUE RESISTANT ALUMINUM P/M ALLOY DEVELOPMENT. Final Technical Report, Sep. 1977 - Sep. 1979
R. E. Sanders, Jr., W. L. Otto, Jr., and R. J. Bucci. Wright-Patterson AFB, Ohio. AFML. Sep. 1979. 177 p. refs.
(Contract F33615-77-C-5174; AF Proj. 2418)
(AD-A081949; Rept-56-79-AF11; AFML-TR-79-4131) Avail: NTIS. HC A08/MF A01 CSCL 11/6

An investigation was undertaken to study the effects of fabrication practice, alloy chemistry, aging treatment, and residual stress relief on the fatigue crack growth (FCG) resistance of 7XXX P/M hand forgings and extrusions. Testing was performed in both humid air (R.H.=90%) and salt fog atmosphere. FCG rates of the P/M extrusions were slightly higher than those of a 7050-T76511 control material at delta k values below 4 MPa-square root of m. From 4-10 MPa-square root of M, FCG resistance of the P/M extrusions were approximately equivalent to those of the 7050 control. Overaging was beneficial to the FCG resistance of the P/M extrusions. Scatter in the FCG data for the hand forgings prevented any definite conclusions regarding effects of chemistry of aging treatment on crack growth in these materials. FCG testing of stress-relieved and nonstress-relieved forgings showed that compressive residual stresses can markedly affect effective delta K levels and measured FCG rates. The introduction of crack closure concepts to the data analysis

allowed for a computation of effective delta K values to correct for the presence of residual stresses in FCG specimens. GRA

N80-24423# Sussex Univ., Brighton (England). School of Engineering and Applied Sciences.
MELT SPINNING OF CRYSTALLINE ALLOYS
S. J. B. Charter, D. R. Mooney, R. Cheese, and B. Cantor. 1 Jan. 1980. 13 p. refs.
(Contract N00014-78-C-0048)
(AD-A082052; TR-4) Avail: NTIS. HC A02/MF A01. CSCL 11/6.

This paper describes the effect of melt-spinning process parameters such as orifice diameter, ejection pressure, and wheel speed, in determining the ribbon dimensions of Pb-Sn eutectic and low content Al alloys. Rapid solidification techniques have been studied ever since the early experiments of Duwez et al. In recent years, the melt-spinning process (sometimes known as chill block casting) has been of particular interest because of the possibility of manufacturing iron-based amorphous alloys for magnetic applications. Liebermann and Graham and Kavesh have discussed the effect of melt spinning process parameters on the dimensions of melt-spun ribbons of amorphous Fe(40)Ni(40)B(20). This note describes the results of an investigation into the effect of melt spinning process parameters on the ribbon dimensions of two other materials, namely Pb-Sn eutectic and Al containing small quantities of Fe and Mn. The main objective was to determine whether the conclusions of Liebermann and Graham and Kavesh can be applied over a wide range of materials. Thus, Pb-Sn and Al-(Fe,Mn) were chosen because they have very different melting points from Fe(40)Ni(40)B(20), and because they solidify in a crystalline rather than amorphous form. GRA

N80-24424# Polytechnic Inst. of New York, Brooklyn. Dept. of Physical and Engineering Metallurgy.
CALCULATIONS OF STRESS-STRAIN RELATIONS IN ALPHA-BETA Ti-Mn ALLOYS. Annual Technical Report, 1 Apr. 1979 - 5 Feb. 1980
Sreeramamurthy Ankem. 5 Feb. 1980. 72 p. refs.
(Contract N00014-75-C-0793; NR Proj. 031-779)
(AD-A082346; TR-2) Avail: NTIS. HC A04/MF A01. CSCL 11/6.

Elastic interactions at the Widmanstatten alpha-beta titanium alloy interfaces that arise due to compatibility requirements have been calculated for various orientations of the interface with respect to the stress axis. It is shown that maximum interactions are found when the stress axis lies in or close to the interface and 40 degrees away from (0001) alpha beta aids the elastic deformation of alpha much more strongly on the basal slip systems than on either prism or pyramidal slip systems. The significance of these interactions stresses on the initiation of plastic flow is considered. The effect of the interface phase on the elastic interaction stresses has been considered and a possible role of interface stresses on elevated temperature creep of alpha-beta alloys has been suggested. GRA

N80-24425# Itek Corp., Lexington, Mass.
SPUTTER DEPOSITION OF DIELECTRIC THIN FILMS. Final Report
Ralph E. Aldrich, Salvatore C. Moreno, and Walter J. Faccenda. Feb. 1980. 24 p.
(Contract DAAG29-77-C-0027)
(AD-A082389; ARO-15216.3-P) Avail: NTIS. HC A02/MF A01. CSCL 20/3.

The work described herein is the outgrowth of a Phase I study completed in August 1978. The objective of the effort is to develop new, high dielectric strength, high optical quality coatings which may ultimately find application in improving the resolution and signal-to-noise ratio of the Pockels Readout Optical Modulator (PROM). During this phase of the program, techniques for rf sputtering SiO2 and Ta2O5 dielectrics and indium tin oxide (ITO) transparent conductors were investigated. These materials were selected as most promising, based on the Phase I study. Test samples were sent to Dr. Armand Tanguay of the University of Southern California for detailed characterization on a parallel program. GRA

N80-24426# Naval Research Lab., Washington, D. C. Advanced Materials Technology Branch.
FRACTOGRAPHIC AND MICROSTRUCTURAL ANALYSIS OF SCC SPECIMENS OF HY-100, HY-130, AND HY-180 STEEL WELDMENTS. Final Report
Frances W. Fraser and Edward A. Metzbower. 10 Jan. 1980. 34 p. refs.
(SF54591500)
(AD-A082301; AD-E000380; NRL-8370) Avail: NTIS. HC A03/MF A01. CSCL 13/5.

This report summarizes an investigation of the microstructures and fracture morphologies of selected double-V weldments of HY-100, HY-130, and HY-180 steels fractured under stress in an aqueous environment. The specimens, which were prepared using substantially different welding practices and filler materials, displayed similar K sub Iscc values. Optical examination of the microstructures showed that repeated thermal cycling, which occurs during fabrication of GTA (gas-tungsten-arc) fine-bead as-welded specimens, resulted in a uniform, fine-grained, tempered microstructure that offered the greatest resistance to stress-corrosion (SCC). Microvoid coalescence (MVC) was the dominant fracture mode. Coarse-bead, as-welded, GMA (gas-metal-arc) specimens contained substantial amounts of high-temperature-transformation products which fractured by cleavage. Heat treating these specimens, to a lower yield strength, refined the microstructure and improved the SCC resistance. The dominant fracture mode of the heat-treated specimens was MVC. Microbranching of the advancing crack front occurred in the cross-bead, as-welded specimens and may be responsible for the relatively high K sub Iscc values reported. GRA

N80-24427# Texas Univ. at Austin. Dept. of Mechanical Engineering and Materials Science and Engineering.
THE INFLUENCE OF HOLD TIMES ON FATIGUE CRACK GROWTH OF ALUMINUM ALLOYS. Final Report, 1 Jan. 1976 - Dec. 1979
H. L. Marcus. 21 Feb. 1980. 107 p. refs.
(Grant AF-AFOSR-2955-76)
(AD-A082526; AFOSR-80-0233TR) Avail: NTIS. HC A06/MF A01. CSCL 11/6.

The results of the research on fatigue crack growth in aluminum alloys are described in three general areas. The first relates the influence of hold time at an underload that follows an overload on the fatigue crack growth retardation behavior of the 7075 and 2219 aluminum alloys. A very distinct effect on retardation with hold time is observed. The effect is microstructure dependent with the time dependence behavior extending over a longer period for the high strength materials. This well-defined time dependence clearly shows that lifetime predictions based on accelerated short hold time tests could be very non-conservative. The influence of humidity was also determined using vacuum as a reference environment. The second aspect of the research investigated the nature of the residual displacement, d, that leads to the crack closure phenomena. The last major emphasis was to investigate how gaseous environments interact with fatigue crack growth in aluminum alloys. Combined AES/SIMS studies were made of fracture surfaces taken from fatigue crack growth specimens fatigued in vacuum and subsequently exposed to and fatigued in a range of environments. GRA

N80-24428# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
MECHANICAL PROPERTIES AND MICROSTRUCTURES OF DUAL PHASE STEELS CONTAINING SILICON, ALUMINUM AND MOLYBDENUM. M.S. Thesis
T. J. O'Neill, Jr. Mar. 1979. 107 p. refs.
(Contract W-7405-eng-48)
(LBL-9047) Avail: NTIS. HC A06/MF A01.

The heat treatment of duplex ferritic-martensitic low carbon steels containing silicon, aluminum and molybdenum was carried out. Tensile properties of intermediately quenched and directly annealed specimens were characterized and microstructural correlations established. The two-phase mixture rule was used as a fairly good approximation of the mechanical behavior of the duplex system, but it recognized that the properties of both the ferrite and martensite depend on the volume fraction of martensite produced in the final morphology. Thus, although the volume fraction of martensite appears to be the most influential factor in controlling the behavior of the duplex steel, ferrite

strengthening may occur by precipitation hardening and the strength of martensite may increase due to carbon enrichment as its volume fraction is decreased. Utilization of both of these factors results in a composite whose properties do not depend upon the martensite volume fraction (up to about .4). DOE

N80-24429# Sandia Labs., Albuquerque, N. Mex.
THERMAL EXPANSION OF NICKEL TO 2300 K
W. D. Drotning 1979 20 p refs Presented at the 18th Intern. Thermal Conductivity Conf., Chicago, 7 Nov. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1717C; CONF-791134-5) Avail: NTIS HC A02/MF A01

The thermal expansion of nickel was measured from ambient to 2300 K using the gamma attenuation technique. The high temperature measurement system used a high vacuum tungsten mesh furnace designed for passage of a collimated gamma beam through the sample region. The gamma counting system incorporated a thermostatically controlled detector and automatic gain control to achieve count rate stability. A precision analysis is given for the use of the technique to measure changes in molten density as a function of temperature, and a discussion of possible systematic errors in the use of the measurement technique is presented. The linear thermal expansion of solid nickel from ambient to the melting point (1728 K) was observed to be slightly larger than provisional values suggested in the literature. The thermal expansion of molten nickel was measured from melt to 2300 K. DOE

N80-24430# California Univ., Livermore. Lawrence Livermore Lab.
ELECTRICAL DISCHARGE IN GASES: A TECHNIQUE FOR DETECTING METAL ANOMALIES
David E. Lord 6 Jun. 1979 23 p refs
(Contract W-7405-eng-48)
(UCRL-52828) Avail: NTIS HC A02/MF A01

A general technique for inspection of critical parts is presented that is fast, inexpensive, nondestructive, and not limited by size or geometry. Ionization effects that reveal nonuniformities and were recorded with standard photographic equipment are also shown. DOE

N80-24431# Brookhaven National Lab., Upton, N. Y.
SPECIAL ABOUT TRANSITION METALS IN ALLOY PHASE FORMATION
R. E. Watson and L. H. Bennett (NBS, Washington, D.C.) 1979 26 p refs Presented at the AIME Ann. Meeting, New Orleans, 18 Feb. 1979
(Contract EY-76-C-02-0016)
(BNL-27113; CONF-790219-13) Avail: NTIS HC A03/MF A01

Although the bonding properties of d-electrons remain to be completely understood, it is recognized that d band broadening is the dominant term contributing to transition metal cohesion. Less generally realized is that d-band hybridization leads to changes in d-electron counts at a transition metal site which are opposite in sign to the net charge transfer on or off the site. The renormalized atom picture of cohesion of the pure transition metals, the experimental evidence, and the theoretical understanding of d charge transfer going the wrong way are reviewed. A picture of the electronegativity of transition metals based on this trend is developed. Charge transfer associated with equalizing the local chemical potentials in alloys is estimated. Friedel type model alloy calculations are reviewed. The implications of the experimental charge transfer information from Moessbauer isomer shifts to such model alloy calculations and to the strength of the Coulomb energy associated with charge transfer is considered. DOE

N80-24432# National Bureau of Standards, Washington, D.C.
PARAMETERS IN SEMI-EMPIRICAL THEORIES OF ALLOY PHASE FORMATION
L. H. Bennett and R. E. Watson 1979 35 p refs Presented at the AIME Ann. Meeting, New Orleans, 18 Feb. 1979 Prepared in cooperation with Brookhaven National Lab., Upton, NY
(Contract EY-76-C-02-0016)
(BNL-2714; CONF-790219-12) Avail: NTIS HC A03/MF A01

Many theories of alloy solubility, structural stability of compounds, and heats of formation in alloying rely on parameters such as valence, size or electronegativity for their predictions. Nature requires only one parameter, the nuclear charge to completely specify all the electronic properties of the elements. Thus, the atomic parameters are, intimately connected with one another. The physical origins of some of the more popular parameters used are reviewed. The relationship of the different electronegativity scales to each other, and the relationship of electronegativity to other parameters such as atomic size are emphasized. Structural stability maps employing electronegativity and some other parameters are shown for intermetallic compounds formed from different classes of elements: main group-main group, transition metal-main group, and transition metal-transition metal. DOE

N80-24433# Bendix Corp., Kansas City, Mo.
ELECTROMECHANICAL POLISHING OF METAL SPHERES
N. E. Miller and D. E. Engelhaupt Dec. 1979 9 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2311) Avail: NTIS HC A02/MF A01

Equipment was developed to electromechanically polish metal spheres. Mechanical polishing accomplished by the action of three cup-shaped laps which rotate against the sphere. An abrasive slurry containing an electrolyte is continuously applied to the sphere and laps. Electrochemical etching is accomplished by applying a positive potential to two of the laps and a negative potential to the third. DOE

N80-24434# Northwestern Univ., Evanston, Ill.
EFFECT OF POINT DEFECTS ON MECHANICAL PROPERTIES OF METALS Technical Progress Report, 1 Dec. 1979 - 31 Jan. 1980
M. Meshii Jan. 1980 7 p refs
(Contract EY-76-S-02-1367)
(COO-1367-109) Avail: NTIS HC A02/MF A01

The importance of morphological study in conjunction with mechanical tests is emphasized and is explained in niobium, the surface effect on crystal plasticity of niobium, surface film softening in Ni-plated iron, and the hydrogen charging effect in iron. DOE

N80-24435# Westinghouse Research and Development Center, Pittsburgh, Pa.
STUDY TO OPTIMIZE Cr-Mo STEELS TO RESIST HYDROGEN AND TEMPER EMBRITTLEMENT Quarterly Report
B. J. Shaw 7 May 1979 44 p refs
(Contract ET-78-C-01-3050)
(FE-3050-T1; QR-1; QR-2) Avail: NTIS HC A03/MF A01

Two groups of 2-1/4 Cr-1 Mo steel are described with respect to their resistance to temper and hydrogen embrittlement. These include: (1) commercial steels; and (2) laboratory heats with compositions arranged according to a statistical design. This design and the reasoning for the selected compositions is discussed. The test matrix includes two strength levels: that of normal ASTM A387 pressure vessel steel and that representative of the heat affected zone (HAZ) adjacent to a weldment. The characterization of the peak hardness in the HAZ is presented. The test requirements for measuring K/sub Iscc/ in H2S are also included. DOE

N80-24436# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.
CORRELATION OF PROCESSING PARAMETERS, MICROSTRUCTURE, AND MECHANICAL PROPERTIES OF HIGH STRENGTH POWDER METALLURGICALLY PRODUCED ALUMINUM ALLOYS Ph.D. Thesis - Technische Hochschule, Aachen
David Voss Nov. 1979 289 p refs
(DFVLR-FB-79-34) Avail: NTIS HC A13/MF A01; DFVLR, Cologne DM 49,70

Two high strength commercial aluminum alloys (2024 and 7075) were produced by powder metallurgy processing. The interrelationship among processing, microstructure, and mechanical properties of these alloys was investigated. Powder metallurgy processing reduces the grain size and the constituent particle size as well as refining the constituent particle distribution. These microstructural changes result in a reduced scattering of the

data and a significant improvement of S-N fatigue properties. These results are discussed in terms of existing knowledge concerning fatigue research, fracture mechanics, and the correlation of mechanical properties and microstructure, particularly the influence of constituent particles and grain size.
Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-24437* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODIFICATION OF THE ELECTRICAL AND OPTICAL PROPERTIES OF POLYMERS Patent
Michael J. Mirtich and James S. Sovey, inventors (to NASA) Issued 22 Apr. 1980 4 p Filed 7 Nov. 1978 Supersedes N70-11216 (17 - 02, p 0164)
(NASA-Case-LEW-13027-1; US-Patent-4,199,650; US-Patent-Appl-SN-958575; US-Patent-Class-428-421; US-Patent-Class-427-38; US-Patent-Class-427-40; US-Patent-Class-427-164; US-Patent-Class-428-474) Avail: US Patent and Trademark Office CSCL 11G
An electron bombardment argon ion source is used to form textured surfaces on polymide and fluorinated ethylene propylene polymers. This treatment improves the optical and electrical properties so that these polymers may be used in industrial and space applications.
Official Gazette of the U.S. Patent and Trademark Office

N80-24438* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HEAT RESISTANT POLYMERS OF OXIDIZED STYRYLPHOSPHINE Patent
Kazimiera J. L. Paciorek, inventor (to NASA) (Ultrasystems, Inc., Irvine, Calif.) Issued 29 Apr. 1980 14 p Filed 19 May 1978 Supersedes N7825217 (16 - 16 p 2094) Division of US Patent Appl. SN-706424, filed 19 Jul. 1976, US Patent 4, 092, 466 Sponsored by NASA
(NASA-Case-MSC-14903-3; US-Patent-4,200,721; US-Patent-Appl-SN-907479; US-Patent-Class-526-261; US-Patent-Class-525-326; US-Patent-Class-525-336; US-Patent-Class-525-340; US-Patent-Class-525-374; US-Patent-Class-525-375; US-Patent-Class-526-275; US-Patent-Class-526-276; US-Patent-Class-526-278; US-Patent-Class-260-DIG.29; US-Patent-Class-528-481; US-Patent-Appl-SN-706424) Avail: US Patent and Trademark Office CSCL 07C
A flame resistant, nontoxic polymer which may be used safely in confined locations where there is inadequate ventilation is prepared either by polymerizing compounds having the formula R-N=P(C6H5)2(C6H4)CH=CH2 where R is an organic moeity selected from the group of (C6H5)2P(O)-, (C6H5O)2P(O)-, (C6H5)2 C3N3-, or their mixtures, or by reacting a polymer with an organic azide such as diphenylphosphinylazide, diphenylphosphonylazide, 2-azido-4,6-diphenyl-5-triazine, 2,4-diazido-6-phenyl-s-triazine, trimethylsilyoazide, triphenylsilylazine, and phenylazine. The reaction of the styrylphosphine with the organoazide results in the oxidation of the trivalent phosphorus atom to the pentavalent state in the form of an unsaturated P=N linkage known as a phosphazene group.
Official Gazette of the U.S. Patent and Trademark Office

N80-24439# Old Dominion Univ., Norfolk, Va.
THE SIGNIFICANCE OF PEEL STRESSES IN CYCLIC DEBONDING M.S. Thesis
Richard A. Everett, Jr. May 1980 116 p refs
Avail: NTIS HC A06/MF A01
Cyclic debonding in an adhesively bonded crack-lap shear specimen is investigated by means of a linear elastic finite element analysis and a series of constant-amplitude axial fatigue tests. The hypothesis that cyclic debonding is due largely to tensile peel stresses in the adhesive is considered. The results indicate that not all of the tensile peel stresses in the adhesive have to be overcome in order to stop cyclic debonding, i.e., a threshold value of the peel stress exists.
M.G.

N80-24440*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HEAT SEALABLE, FLAME AND ABRASION RESISTANT COATED FABRIC Patent Application
Richard P. Tschirch (Little (Arthur D.), Inc., Cambridge, Mass.) and Kenneth R. Sioman, inventors (to NASA) (Little (Arthur D.), Inc., Cambridge, Mass.) Filed 30 Apr. 1980 17 p
(Contract NAS9-13979)
(NASA-Case-MSC-18382-1; US-Patent-Appl-SN-145107) Avail: NTIS HC A02/MF A01 CSCL 11E
A flexible, lightweight air impermeable coated fabric was developed to replace the flame retardant neoprene coated nylon fabric used as the micrometeorite protection layer in the intravehicular thermomicrometeorite garment. The elastometric compositions are comprised of thermoplastic polyurethane polymer and flame retarding amounts of a filler selected from decabromodiphenlyoxide and antimony oxide in a 3:1 weight ratio, and decabromodiphenyloxide, antimony oxide, and ammonium polyphosphate in as 3:1:3 weight ratio. The compounds were dissolved at about 40% solids in tetrahydrofuran. Films cast from the solution were dried and bonded to the fabric under heat and pressure at 400 F, 30 psi with 10 sec dwell time. Either heat or dielectric sealing procedures can be used.
NASA

N80-24441*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MICROSTRUCTURAL CHARACTERIZATION OF THE HRSI THERMAL PROTECTION SYSTEM FOR SPACE SHUTTLE
Philip O. Ransone and Donald R. Rummler May 1980 21 p ref
(NASA-TM-81821) Avail: NTIS HC A02/MF A01 CSCL 11B
Components of the space shuttle high temperature reusable surface insulation (HRSI) system were microscopically characterized, both separately and as a system, to obtain information needed for stress analysis models of the thermal protection system. A tension specimen of the HRSI system was loaded in steps and was microscopically observed at each load condition to demonstrate the tension failure mode associated with strain isolation pad (SIP) behavior. A local failure occurred which should be associated with transfer of load through transverse fibers in the SIP. Stress concentrations attributed to the SIP behavior necessitated strengthening of the HRSI by densification of the RSI at the bondline. An HRSI tile was microscopically characterized after the densification process. The densified surface layer blended into the RSI which caused a gradual change in density. The gradation in density does not appear to represent a sharp discontinuity in elastic modulus between the densified layer and the parent material.
J.M.S.

N80-24442# Council for Scientific and Industrial Research, Pretoria (South Africa).
THE CHEMICAL BASIS OF HOTSEALING ADHESIVES FOR INTERFACING
K. H. Stukenbrock 1979 19 p refs Transl. into ENGLISH from Textilveredlung (Switzerland) v. 6, no. 7, 1971 p 459-468
(CSIR-Trans-1452) Avail: NTIS HC A02/MF A01
The process by which hotsealing adhesives are applied to the substrate is briefly described. The methods of application have a certain effect on the selection and quality of the adhesives, at least as far as their external appearance is concerned. The chemical basis of these adhesives is examined.
J.M.S.

N80-24443# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
QUALIFICATION OF A NEW MAPO SOURCE AND ERL-510 CURING AGENT FOR MINUTEMAN STAGE 1 UF-2121 LINER Semiannual Report
John A. Thompson Jul. 1979 28 p
(AD-A078530; MANCP-419(79)) Avail: NTIS HC A03/MF A01 CSCL 11/4
Thiokol Chemical Corporation/Wasatch Division uses MAPO in the production of UF-2121 liner. Thiokol changed MAPO

vendors and, therefore, qualification of the new source MAPO was required. Thiokol prepared specimens from the new source and also specimens from the original source which are to be used as the control material in the 10 year surveillance testing program. The specimens were transferred to Ogden ALC for testing and reporting of the data obtained. This report includes the test results for the first, second, third, fourth, and fifth time testing of the control and special specimens at Ogden ALC. In all instances, the mean data for the control and special specimens are well above the minimum requirements found in TWR-7857 A. Thiokol specimen data. Therefore, the capability of the liner from the new source material is expected to perform satisfactorily. GRA

N80-24444# Tennessee Univ., Knoxville. Dept. of Polymer Engineering.

RHEO-OPTICS OF SHEAR AND ELONGATIONAL FLOW OF LIQUID CRYSTALLINE POLYMER SOLUTIONS: HYDROXYPROPYL CELLULOSE/WATER AND POLY-P-PHENYLENE TEREPHTHALAMID/SULFURIC ACID Technical Progress Report, 30 Oct. 1978 - 28 Sep. 1979

Yoshihiko Onogi, James L. White, and John F. Fellers Oct. 1979 63 p refs Submitted for publication

(Contract N00014-77-C-0236; NR Proj. 356-639)

(AD-A077455; PSE-133; TR-05) Avail: NTIS HC A04/MF A01 CSCL 11/9

An experimental study is reported of the quiescent and flow birefringent characteristics of two liquid crystalline polymer solution systems, poly-p-phenylene terephthalamide (PPD-T) in sulfuric acid and hydroxypropyl cellulose (HPC) in water over a range of concentrations. It is shown that, for the quiescent state, the dilute solutions are optically isotropic while the concentrated solutions consist of negatively birefringent domains. During flow at low deformation rates, moving domains are still seen. At higher deformation rates a homogenous highly birefringent fluid is obtained. The birefringence increases with concentration at constant deformation rate and exhibits a major increase as the liquid crystalline state is formed. The source of the birefringence is due to: (1) anisotropy of polarizability of oriented macromolecules, and (2) difference in refractive index of solvent and oriented macromolecules (form birefringence). The results are interpreted in terms of the level of polymer orientation which may be developed in flow for liquid crystalline polymer solutions as compared to solutions of flexible macromolecules. GRA

N80-24445# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.

TOXICITY OF THE DEGRADATION PRODUCTS FROM POLYPHOSPHAZENE COPOLYMERS, PART 4 Interim Report

P. J. Lieu, J. H. Magill, and Y. C. Alarie Dec. 1979 31 p refs Submitted for publication

(Contract N00014-77-C-0310; NR Proj. 356-644)

(AD-A078585; SETEC-MME-79-62; TR-4) Avail: NTIS HC A03/MF A01 CSCL 11/9

Polyphosphazene copolymers have been degraded under dynamic air flow up to temperatures of 700 degrees C at a heating rate of 35 degrees per minute. A few experiments were also conducted up to 1000 C. Animal inhalation screening tests with mice (Swiss Webster) were made under these test conditions. An air flow rate of 20 L/min was employed in the toxicological studies where the temperature in the animal chamber was always held below 45 C, a condition which did not adversely affect the animals under test. Simultaneously, thermogravimetric measurements were made on decomposing polyphosphazenes in order to assess the rate of sample decomposition at different temperatures. Quantitative analytical measurements of the evolution of HCN and CO gases from the polymers (some without fillers) were made under identical thermal and environmental conditions. The results clearly show that there is not a significant correlation between CO-evolved and the induced toxicity in these animals. A similar conclusion follows for the evolution of HCN gas. Correlation with both these gaseous products indicates that other more lethal products may be responsible for the observed LC50 results. The complexity of the decomposition products has not yet been elucidated, but it has been demonstrated clearly that an animal test model properly applied can be used to screen complex polymeric systems. GRA

N80-24446# Pennsylvania State Univ., University Park. Applied Research Lab.

TURBULENCE IN DRAG REDUCING POLYMER SOLUTIONS

I. Kubo Apr. 1979 35 p refs Presented at the Biennial Symp. on Turbulence, Rolla, Mo., 8-10 Oct. 1979

(Contract N00024-79-C-6043)

(AD-A077523; ARL/PSU/TM-79-66) Avail: NTIS HC A03/MF A01 CSCL 11/9

Measurements were made of the mean and fluctuating velocity profile with a Laser Doppler Velocimeter in a fully developed turbulent pipe flow of a polymer drag reducing solution. A one-equation turbulence model has been developed by using a damping factor similar to that of Mizushima and Usui. Predictions by the model agree well with experimental data for the mean velocity profile and for the increase of the length scale in polymer solutions. Predictions are also compatible with the streamwise turbulent intensity measurements and show similar trends to the measured intensity distributions in Newtonian fluids and polymer solutions. In highly reduced drag region, predictions, together with the measurements, indicate considerable effect of Reynolds number below Re = 40,000 on the turbulent intensity profile. GRA

N80-24447# Southwest Research Inst., San Antonio, Tex.

COMPRESSIVE STRENGTH AND DAMAGE MECHANISMS IN CERAMIC MATERIALS Interim Technical Report, 1 Jul. 1979 - 31 Jan. 1980

James Lankford Feb. 1980 23 p refs

(Contract N00014-75-C-0668; NR Proj. 032-553)

(AD-A081657) Avail: NTIS HC A02/MF A01 CSCL 11/2

Compressive strength measurements as a function of temperature and loading rate, and microhardness measurements as a function of temperature, have been carried out for Al2O3, SiC, and Si3N4. Results are correlated in terms of current theories connecting compressive strength, hardness, fracture toughness, and indentation microfracture. It is found that while high loading rates can suppress high temperature intergranular compressive fracture in SiC, this is not true in Al2O3. The threshold crack size for indentation microfracture as a function of temperature seems to correlate at least as well (if not better) with compressive strength as with hardness, and temperature-controlled compressive fracture mechanisms seem to operate during indentation fracture at corresponding temperatures. GRA

N80-24448# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.

THE FEASIBILITY OF ELECTRICAL MONITORING OF RESIN CURE WITH THE CHARGE-FLOW TRANSISTOR Technical Report, Apr. 1978 - Sep. 1979

Stephen D. Senturia, Norman F. Sheppard, Soon Y. Poh, and Howard R. Appelman Dec. 1979 36 p refs Submitted for publication

(Contract N00014-78-C-0591; Grant NSF DMP-76-80895; NR Proj. 356-691)

(AD-A081977; TR-1) Avail: NTIS HC A03/MF A01 CSCL 09/1

A new technique for the electrical monitoring of polymerization reactions such as resin cure is described. The technique is based on the charge-flow transistor, which resembles a conventional MOSFET, but with a portion of the metal gate replaced by the resin under study. Electrical signals obtained from several resins undergoing cure are presented, along with an electrical circuit model that can account for the principal features of these signals. The dramatic change in signal shape during cure can be related to corresponding changes in both the real and imaginary parts of the dielectric constant. GRA

N80-24449# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Nonmetallic Materials Div.

TORSION IMPREGNATED CLOTH ANALYSIS (TICA) OF EPOXY CURE Final Report, Apr. 1977 - Apr. 1978

C. Y. Lee, J. D. Henes, T. E. Grossman, and I. J. Goldfarb Jan. 1980 39 p refs

(AF Proj. 2303)

(AD-A082361; AFML-TR-79-4185) Avail: NTIS HC A03/MF A01 CSCL 11/9

The technique of Torsion Impregnated Cloth Analysis (TICA)

has been developed to allow continuous monitoring of the cure behavior of thermoset systems. Epoxy 3501-A has been used as the material in the feasibility study. The thermal scan of an incompletely cured epoxy specimen has shown that further curing effect during experimentation cannot always be ignored. The cure phase diagram and an isocure state curve have been constructed from the experimental results. Combining both results, it is concluded that an epoxy sample cured at 135 C for 5 hours will have an intrinsic cured glass transition of 158 C. GRA

N80-24450# Southeastern Center for Electrical Education, Inc., Auburn, Ala.
PARTICLE-SIZE ANALYSIS OF ENGINE OILS: A SUPPLEMENT TO SPECTROMETRIC ANALYSIS Final Report, Feb. 1977 - Sep. 1979
James A. Bierlein Wright-Patterson AFB, Ohio AFML Jan. 1980 55 p
(Contract F33615-77-C-5003; AF Proj. 2303)
(AD-A082230; AFML-TR-79-4215) Avail: NTIS HC A04/MF A01 CSCL 11/8

The Spectrometric Oil Analysis Program (SOAP) is a maintenance system used by the Air Force for continuous monitoring of engine oil samples. Total mass concentrations of various metals are measured to provide an indication of engine wear and to warn of impending malfunction; such data provide a basis for scheduling maintenance action in advance of failure. Supplementary methods of analysis are sought with the objective of characterizing oil samples more completely so as to sharpen SOAP decision criteria and achieve improvements in reliability and cost effectiveness. One such technique is particle counting, which defines the size distribution of wear-metal particles and other debris if present. This report describes exploratory work which establishes a methodology for particle-size analysis of authentic engine oils and shows how the data can be applied for practical decision making. Indications are that the engine failure rate can be reduced to about 16% of its current level by supplementing each spectrometric analysis with a particle count. Instrumentation and technique are susceptible to automation which would permit the necessary particle size analysis to be made routinely in a SOAP laboratory within three minutes per sample. An approach to the problems of realizing and exploiting this potential is outlined. GRA

N80-24451# Massachusetts Univ., Amherst. Dept. of Chemistry.
SYNTHESIS AND CHARACTERIZATION OF HIGH ENERGY POLYMERS Final Report, 1 Mar. 1979 - 31 Mar. 1980
James W. Chien and C. Peter Lillya 31 Mar. 1980 16 p refs
(Contract N00014-79-C-0265)
(AD-A082544) Avail: NTIS HC A02/MF A01 CSCL 11/9

Synthetic procedures for selective nitromercuration via phase transfer catalysis have been developed for usage with water insoluble poly(butadiene), poly(isoprene), and carboxyl terminated butadiene acrylonitrile copolymers. GRA

N80-24452# Pennwalt Corp., King of Prussia, Pa. Central Research and Development Dept.
PIEZOELECTRIC POLYMERS Final Report, 1 Jan. 1977 - 31 Dec. 1979
Harry Stefanou Apr. 1980 11 p
(Contract N00014-77-C-0130)
(AD-A083002) Avail: NTIS HC A02/MF A01 CSCL 11/9

The objective of this program was the development of improved fluoropolymer resins for transducer applications. The effort involved synthesis, characterization, and processing of new resins with emphasis on those obtained by copolymerizing vinylidene fluoride (VF2) with monomers such as tetrafluoroethylene (TFE), vinyl fluoride (VF), trifluoroethylene (VF3), and hexafluoropropene (HFP). Variations on the PVF2 homopolymer synthesis were also investigated. In a number of cases, the piezoelectric activity of the copolymers was found to be as good or better than that of the PVF2 homopolymer; however, a distinct advantage of the copolymer vs homopolymer is the fact that, in general, the copolymers are considerably easier to fabricate into thick, oriented film configurations, as needed for underwater use. GRA

N80-24453# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
CHEMICAL DURABILITY IMPROVEMENT AND STATIC FATIGUE OF GLASSES Annual Report, 31 Mar. 1979 - 25 Feb. 1980
Minoru Tomozowa 25 Feb. 1980 22 p refs
(Contract N00014-78-C-0315)
(AD-A083007; AR-2) Avail: NTIS HC A02/MF A01 CSCL 11/2

Chemical durability of glass can be improved by applying a coating on the surface. It was also found that an addition of a minor quantity of calcium to the alkaline solution drastically improves the durability of glass. It was confirmed that calcium is deposited on the glass surface and protects the glass. It is suggested that this phenomenon of sorption is playing an important role in the chemical durability of glasses. The strength of glass is strongly influenced by the environment in which it is measured, but the exact cause of the phenomenon is not clear. Mechanical strength of high silica glass was measured in various liquids, as a function of strain rate. At a constant strain rate, the strength of glass measured in various liquid correlated well with the volume change of a high silica porous glass immersed in various liquids. These phenomena in turn showed a good correlation with the surface energy reduction of glass in liquids. These experiments suggest that the surface energy produces the mechanical stress which causes the volume change of porous glass and this stress influences the mechanical strength of glass. GRA

N80-24454# Channel Products Inc., Chesterland, Ohio.
DEVELOPMENT OF SPECIALIZED EQUIPMENT TO MEASURE PEIZOELECTRIC COEFFICIENTS OF POLYMER PIEZOELECTRIC MATERIALS
C. P. Germano 22 Feb. 1980 23 p refs
(Contract N00014-78-C-0383)
(AD-A083013) Avail: NTIS HC A02/MF A01 CSCL 11/4

Specialized equipment has been developed to measure piezoelectric g and d coefficients of polymer piezoelectric materials. It is likely that the same equipment will allow the evaluation of these properties for composite flexible lead titanate zirconates as well. However; samples of these were not made available and thus not tested. By means of a special adaptor, the same equipment may be used as a standard Berlincourt d(33) Meter Channel Prod. Model Number CPDT 3300. GRA

N80-24455# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.
DEVELOPMENT OF THE FULL SCALE T63 TEST FOR SPECIFICATION MIL-L-23699 AND XAS-2354 GAS TURBINE LUBRICANTS Final Report
John T. Shimski Feb. 1980 71 p refs
(W45430000; W0598000)
(AD-A082919; NAPC-PE-31) Avail: NTIS HC A04/MF A01 CSCL 11/8

The T56 engine had been utilized for the full scale engine test required under the qualification process for lubricants Specifications MIL-L-23699 and XAS-2354. As advanced engine operating environments become more severe, and the quality of new lubricants improved, the T56 engine became marginal in its ability to thoroughly test gas turbine lubricants. As a result, a new engine was selected through an evaluation of engines in service. The T63-A-5A engine was chosen because of its present level of severity on the turbine section tube wetted parts and its potential for increased severity testing through engine/lube system modification. This report presents the results of engine modifications and operating procedures developed in establishing the T63 engine test for gas turbine lube oil qualification. GRA

N80-24456# California Univ., Livermore. Lawrence Livermore Lab.
STUDY OF THE AGING PROCESSES IN POLYURETHANE ADHESIVES USING THERMAL TREATMENT AND DIFFERENTIAL CALORIMETRIC, DIELECTRIC, AND MECHANICAL TECHNIQUES. 1: IDENTIFYING THE AGING PROCESSES. 2: QUANTIFYING THE AGING EFFECT
L. P. Althouse and N. W. Hetherington 1 Nov. 1979 22 p refs
(Contract W-7405-eng-48)
(UCRL-52849) Avail: NTIS HC A02/MF A01

The thermal aging of polyurethane adhesives was investigated. It is shown that competitive mechanisms are involved that occur simultaneously as a function of time and temperature. These mechanisms involve chain scission and formation of pseudocrystalline domains. DOE

N80-24457# Royal Aircraft Establishment, Farnborough (England).
EFFECT OF TEMPERATURE AND DURATION OF CURE ON THE HEAT DISTORTION TEMPERATURE, JOINT STRENGTH AND DURABILITY OF SOME STRUCTURAL ADHESIVES BONDED TO ALUMINUM
M. H. Stone London HMSO Jul. 1979 23 p refs
(RAE-TM-Mat-318; BR71038) Avail: NTIS HC A02/MF A01

Heat distortion temperatures (Td) were measured for a range of structural adhesives as a function of cure cycle. One-part epoxy adhesives when cured at 120 C gave Td in the range 76 C - 120 C, but could be cured at 90 C to give similar Td. Two-part cold setting epoxies were post-cured in stages at increasing temperature and exhibited Td between 44 C and 100 C. Two acrylate adhesives cured at room temperature gave an apparent Td at about 100 C. Aluminum alloy joints bonded with one-part epoxies could be cured at 90 C, rather than the usual 120 C, without serious loss of strength or durability. Modified cure cycles are proposed as a means of reducing differential thermal contraction stresses in adhesively bonded CERP-metal joints. Author (ESA)

N80-24458# National Technical Information Service, Springfield, Va.
MAGNESIUM OXIDE CERAMICS AND REFRACTORIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1980
William E. Reed Mar. 1980 262 p Supersedes NTIS/PS-79/0217; NTIS/PS-78/0248; NTIS/PS-77/0207
(PB80-805864; NTIS/PS-79/0217; NTIS/PS-78/0248; NTIS/PS-77/0207) Avail: NTIS HC $30.00/MF $30.00 CSCL 11B

Federally-funded research is cited on the structure, deformation, mechanical properties fabrication, radiation effects tests, and thermodynamic properties. Studies on phase diagrams, diffusion, and electrical, high temperature, and nuclear reactor applications are also presented. This updated bibliography contains 255 abstracts, 20 of which are new entires to the previous edition. GRA

N80-24459# National Technical Information Service, Springfield, Va.
MAGNESIUM OXIDE CERAMICS AND REFRACTORIES, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Jan 1980
William E. Reed Mar. 1980 156 p Supersedes NTIS/PS-79/0219; NTIS/PS-78/0249; NTIS/PS-77/0208
(PB80-805872; NTIS/PS-79/0219; NTIS/PS-78/0249; NTIS/PS-77/0208) Avail: NTIS HC $30.00/MF $30.00 CSCL 11B

Worldwide research is cited on sintering, structure, mechanical properties, stength, degradation, phase studies, additives, and use of these materials. This updated bibliography contains 149 abstracts, 67 of which are new entries to the previous edition. GRA

N80-24460# Southern Services, Inc., Birmingham, Ala.
RESIDUAL MONOMERS IN ACRYLIC AND MODACRYLIC FIBERS AND FABRICS Final Report
Joe M. Finkel, Ruby H. James, and Herbert C. Miller Jul. 1979 14 p refs
(Contract EPA-68-01-4746)
(PB80-129166; SORI-EAS-79-504; EPA-560/11-80-003) Avail: NTIS HC A02/MF A01 CSCL 06J

The detection and quantitation of acrylonitrile, vinylidene chloride, and vinyl bromide, which are used as monomers in the production of acrylic and modacrylic fibers were surveyed. The amounts of monomers evolved from samples of carpets, fibers, and fabrics at 50 C and 50% relative humidity were determined by gas chromatography with a flame ionization detector and by direct insertion probe mass spectroscopy. The results of the gas chromatographic studies indicate that detectable amounts of residual acrylonitrile, vinylidene chloride, and vinyl bromide are not released from the carpet, fiber, and fiber samples under the conditions selected for analysis. Direct insertion mass spectrometry indicated that methyl bromide evolves from all of the fiber samples and from two of the three carpet samples. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-24461 Minnesota Univ., Minneapolis.
A ONE-STEP EFFUSIONAL PROCESS FOR PRODUCING HYDROGEN AND OXYGEN FROM WATER USING SOLAR ENERGY Ph.D. Thesis
Richard Boyer Diver 1979 196 p
Avail: Univ. Microfilms Order No. 8011793

A process for producing hydrogen and oxygen from water involves heating water to high temperatures (2400 - 3000 K)by a concentrating solar collector. At those temperatures water dissociates into a mixture which contains primarily six species. The lighter species, H and H2 are to be separated from the mixture by a one-step effusional separation technique. In principle the limiting thermal efficiency of such a thermochemical process is the Carnot efficiency. In practice, thermal efficiency is also limited by the irreversibilities associated with the various internal processes. To determine the magnitudes and sources of irreversibilities, an analytical model of an archetypal device for using solar energy in a one-step thermochemical process for producing hydrogen and oxygen from water is presented and analyzed. The rate of entropy production associated with each of the major components is calculated and related to the operating variables. On the basis of that analysis, improvements in the model are suggested and evaluated. In addition irreversibilities which are a consequence of economic or other compromises are anticipated and also evaluated. Dissert. Abstr.

N80-24462# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
NONISOTHERMAL EXPERIMENTS ON THE HYDRODESULPHURIZATION OF COAL
H. Baumann, J. Klein, and H. Juentgen 1980 22 p refs Transl. into ENGLISH from Erdoel Kohle, Petrochem. (West Germany), v. 30, no. 4, 1977 p 159-164
(NRC/CNR-TT-1963; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The hydrodesulfurization of bituminous coal by nonisothermal pyrolysis in an atmosphere of hydrogen was investigated. The rate of formation of hydrogen sulfide when samples were heated at a constant rate was plotted as a function of temperature. The curves divide into three regions: one to about 500 C, and the HS formed results from organically bound sulfur; the second is between 500 and 600 C, and the HS is due to the decomposition of pyrites into FeS; the third region extends from 600 to 1000 C, and the HS is due to organically bound sulfur, and the reduction of FeS. It is concluded that for low rank coals, moderate temperatures are sufficient for removal of most of the organic sulfur. F.O.S.

N80-24463# Southwest Research Inst., San Antonio, Tex.
RESTORING ESSENTIAL FLOW AND IGNITION PROPERTIES TO ANTIMISTING KEROSINE (AMK) FOR TURBINE AIRCRAFT OPERATIONS Final Report, 26 Apr. 1978 - 31 Jan. 1979
R. J. Mannheimer Feb. 1979 32 p refs Sponsored in part by DOT
(Contract DAAK70-78-C-0001)
(AD-A081684; MED105; FAA-RD-79-62) Avail: NTIS HC A03/MF A01 CSCL 21/4

A small scale test was used to measure the resistance of a fuel to form a mist that will support flame propagation. Preliminary results indicate that this measurement is in good agreement with other large scale fire safety tests. The ignition resistance

of antimisting kerosine (AMK) was found to depend on fuel properties such as aromatic content and the presence of polar additives. The most controversial result is that in addition to improving filterability, surfactants increase the ignition resistance of AMK. While the rheological mechanism for this was established, several factors suggest that it is associated with improved solubility of the polymer. R.C.T.

N80-24464*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COAL DESULFURIZATION BY LOW TEMPERATURE CHLORINOLYSIS, PHASE 2 Final Report
J. J. Kalvinskas, Karel Grohmann, Naresh Rohatgi, John Ernest, and Don Feller 15 Jan. 1980 146 p
(Contracts NAS7-100; ET-N-I-019060)
(NASA-CR-163152; JPL-Pub-80-15) Avail: NTIS HC A07/MF A01 CSCL 21D

An engineering scale reactor system was constructed and operated for the evaluation of five high sulfur bituminous coals obtained from Kentucky, Ohio, and Illinois. Forty-four test runs were conducted under conditions of 100 by 200 mesh coal, solvents - methlychloroform and water, 60 to 130 C, 0 to 60 psig, 45 to 90 minutes, and gaseous chlorine flow rate of up to 24 SCFH. Sulfur removals demonstrated for the five coals were: maximum total sulfur removal of 46 to 89% (4 of 5 coals with methylchloroform) and 0 to 24% with water. In addition, an integrated continuous flow mini-pilot plant was designed and constructed for a nominal coal rate of 2 kilograms/hour which will be operated as part of the follow-on program. Equipment flow sheets and design drawings are included for both the batch and continuous flow mini-pilot plants. J.M.S.

N80-24465*# Technology Development Corp., Huntsville, Ala.
COAL CONVERSION PRODUCTS INDUSTRIAL APPLICATIONS
Joseph H. Dunkin and Dennis Warren 28 Feb. 1980 213 p
(Contract NAS8-33759)
(NASA-CR-161469; TDC-80-005) Avail: NTIS HC A10/MF A01 CSCL 21D

Coal-based synthetic fuels complexes under development consideration by NASA/MSFC will produce large quantities of synthetic fuels, primarily medium BTU gas, which could be sold commercially to industries located in South Central Tennessee and Northern Alabama. The complexes would be modular in construction, and subsequent modules may produce liquid fuels or fuels for electric power production. Current and projected industries in the two states which have a propensity for utilizing coal-based synthetic fuels were identified, and a data base was compiled to support MFSC activities. A.R.H.

N80-24466# Politecnico di Milano (Italy). Inst. di Macchine.
THE DYNAMICS OF SOLID PROPELLANT COMBUSTION Annual Technical Report, 31 Dec. 1977 - 30 Nov. 1979
Luigi DeLuca, Aldo Coghe, and Aldolfo Reggiori Sep. 1979 199 p refs
(Grant DA-ERO-78-G-029; DA Proj. 1T1-61102-BH-57)
(AD-A082881; ATR-2) Avail: NTIS HC A09/MF A01 CSCL 21/9

A nonlinear stability analysis of solid rocket propellant burning was carried out, within the framework of a thermal theory for thin (quasi-steady gas phase) heterogeneous flames. This required an integral method in reducing the partial differential equation for the condensed phase heat conduction to an approximate ordinary differential equation. A nonlinear algebraic function, called static restoring function, was found that contains all basic properties of equilibrium and stability of burning solid propellants. GRA

N80-24467# Badger Plants, Inc., Cambridge, Mass.
CONCEPTUAL DESIGN OF A COAL-TO-METHANOL-TO-GASOLINE COMMERCIAL PLANT, VOLUME 1 Final Report, 31 Aug. 1977 - 1 Mar. 1979
Mar. 1979 311 p refs
(Contract EX-76-C-01-2416)
(FE-2416-43-Vol-1) Avail: NTIS HC A14/MF A01

An engineering and economic assessment of the conceptual design for an integrated commercial facility to convert coal-to-methanol-to-gasoline was investigated. The process steps involved an oxygen blown, high pressure coal gasification technique, followed by a chemical shift reaction, acid gas removal, sulfur recovery, methanol synthesis, methanol conversion, gas fractionation, and HF alkylation. DOE

N80-24468# Badger Plants, Inc., Cambridge, Mass.
CONCEPTUAL DESIGN OF A COAL-TO-METHANOL-TO-GASOLINE COMMERCIAL PLANT. VOLUME 2: COMMERCIAL PLANT ECONOMIC ANALYSIS Final Report, 31 Aug. 1977 - 1 Mar. 1979
Mar. 1979 322 p refs
(Contract EX-76-C-01-2416)
(FE-2416-43-Vol-2) Avail: NTIS HC A14/MF A01

The economic aspects of the coal-to-methanol-to-gasoline project are presented. Capital and product costs are specifically addressed. DOE

N80-24469# Badger Plants, Inc., Cambridge, Mass.
CONCEPTUAL DESIGN OF A COAL-TO-METHANOL-TO-GASOLINE COMMERCIAL PLANT. VOLUME 4A: DRAWINGS, SPECIFICATIONS, AND ALTERNATE DESIGNS Final Report, 31 Aug. 1977 - 1 Mar. 1979
Mar. 1979 504 p
(Contract EX-76-C-01-2416)
(FE-2416-43-Vol-4A) Avail: NTIS HC A22/MF A01

Block flow diagrams, utility flow diagrams, and the one line electrical diagrams pertaining to the base case coal-to-gasoline commercial plant are presented. Mass balance figures for the main process units are tabulated. Components and totals are shown for major process streams. The duty specifications and sketches for the major equipment items and buildings comprising the facility are presented. The conceptual and mechanical design features of the slag gasifier are also presented. R.C.T.

N80-24470# Badger Plants, Inc., Cambridge, Mass.
CONCEPTUAL DESIGN OF A COAL-TO-METHANOL-TO-GASOLINE COMMERCIAL PLANT. VOLUME 4B: DRAWINGS, SPECIFICATIONS, AND ALTERNATE DESIGNS Final Report, 31 Aug. 1977 - 1 Mar. 1979
Mar. 1979 459 p
(Contract EX-76-C-01-2416)
(FE-2416-43-Vol-4B) Avail: NTIS HC A24/MF A01

The conceptual designs for a coal gasifier are discussed. The following alternating coal gasifier concepts are described: slag bath; gas velocity in gasifier; carbon gasifier per pass; carbon gasifier overall; gasifier diameter; and number of gasifiers. R.C.T.

N80-24471# Oak Ridge National Lab., Tenn. Chemical Technology Div.
EVALUATION OF AN IN SITU COAL GASIFICATION FACILITY FOR PRODUCING M-GASOLINE VIA METHANOL
W. C. Ulrich, M. S. Edwards, and R. Salmon Dec 1979 250 p refs
(Contract W-7405-eng-26)
(ORNL-5439) Avail: NTIS HC A11/MF A01

A conceptual process design and cost estimate was formulated for a facility producing approximately 15,000 barrels of M-gasoline per day via methanol from synthesis gas generated by gasification of coal in situ. The design was based on experimental data and mathematical predictions on the linked vertical well in situ coal gasification process. In place coal consumption is 20,000 tons/day, based on a subbituminous Wyoming coal. The capital investment was estimated to $535 million in first-quarter 1978 dollars. M-gasoline product price was calculated as a function of the debt/equity ratio, annual earning rates on debt and equity, inplace coal cost, and plant factor (onstream efficiency). Using a debt/equity ratio of 70/30, and interest rate on debt of 9%, an after tax earning rate on equity of 15%, an inplace coal cost of $5/ton, an LPG (propane) by-product credit of $410 to the 6th power Btu, and a plant factor of 90%, the product price of M-gasoline is approximately $0.90/gal at the plant gate. Calculated overall efficiency for the facility was 22%, based on inplace coal. DOE

N80-24472# Argonne National Lab., Ill.
METHANE FROM LANDFILLS
R. E. Zimmerman and M. L. Wilkey 1979 13 p refs Presented

at the 2nd Ann. Conf. of Appl. Res. and Practice on Municipal and Ind. Waste, Madison, Wis., 18 Sep. 1979
(Contract W-31-109-eng-38)
(CONF-790999-1) Avail: NTIS HC A02/MF A01

The recovery, processing, and utilization technology operational in the landfill methane recovery field are described. The status of the US Department of Energy's Landfill Gas Utilization research and development program are also described. DOE

N80-24473# Midwest Research Inst., Golden, Colo.
THE 3RD ANNUAL BIOMASS ENERGY SYSTEMS CONFERENCE PROCEEDINGS
John T. Pfeffer Oct. 1979 625 p refs Conf. held at Golden, Colo., 5-7 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-33-285) Avail: NTIS HC A99/MF A01

The latest research finding from federally funded and other selected projects in the clean fuels for biomass field were reviewed. The engineering and economic status of the biomass energy system was summarized. Problems related to ongoing research are identified and discussed and opportunities for on future research are explored. R.C.T.

N80-24474# Illinois Univ., Urbana. Dept. of Civil Engineering.
BIOLOGICAL CONVERSION OF BIOMASS TO METHANE CORN STOVER STUDIES Progress Report, 1 Dec. 1977 - 1 Aug. 1978
John T. Pfeffer and Gerald E. Quindry Jun. 1979 171 p refs
(Contract EY-76-S-02-2917)
(COO-2917-13: UILU-ENG-79-2004) Avail: NTIS HC A08/MF A01

A series of experiments was conducted to determine the performance characteristics of the methane fermentation process using corn stover processed through four parallel fermenters each having a capacity of 775 liters. A continuous feed system was employed to determine the conversion efficiency. The dewatering characteristics of the effluents and the quality of the liquid and solid residues were determined. The biodegradability of corn stover is low. Data obtained at a fermentation temperature of 59 + -1 C show that only 36 percent of the volatile solids are biodegradable. Pretreatment with caustic (NaOH) concentration of 0.30 molar and a temperature of 115 C for one hour increased the biodegradable fraction to 71 percent of the volatile solids. The reactor slurries were easily dewatered by both vacuum filtration and centrifugation. Corn stover does not appear to be attractive economically at the present energy prices. DOE

N80-24475# Battelle Columbus Labs., Ohio.
CARBOHYDRATE CROPS AS A RENEWABLE RESOURCE FOR FUELS PRODUCTION. VOLUME 2: IDENTIFICATION OF KEY POLICY ISSUES, ALTERNATIVES, AND IMPLICATIONS RELATING ENERGY FROM BIOMASS
D. A. Scantland, T. A. McClure, and E. S. Lipinsky 30 May 1979 75 p refs
(Contract W-7405-eng-92)
(BMI-2031-Vol-2) Avail: NTIS HC A04/MF A01

Significant quantities of ethanol from carbohydrate crops could be produced from the equivalent number of dollars currently diverted and expected to be spent under the Food and Agriculture Act of 1977; however the the production of ethanol from sugar crops or corn would mean that significant changes in the prices of agricultural products could be expected (all other things being equal). In the initial development of ethanol fuels, ethanol from corn appears to be the least expensive as compared to sugarcane, sugar beets, and sweet sorghum. This is primarily because of high by-product credits. The crop with the greatest long term potential is sweet sorghum. Various policy incentive programs will continue to be directed towards stimulating biomass energy production. Four policy incentive programs are described. DOE

N80-24476# Pennsylvania State Univ., University Park. Coal Research Station.
CHARACTERISTICS OF AMERICAN COALS IN RELATION TO THEIR CONVERSION INTO CLEAN ENERGY FUELS Quarterly Technical Progress Report, Jul. - Sep. 1978
W. Spackman, A. Davis, P. L. Walker, H. L. Lovell, F. J. Vastola, P. H. Given, N. H. Suhr, and R. G. Jenkins May 1979 83 p refs
(Contract EX-76-C-01-2030)
(FE-2030-13) Avail: NTIS HC A05/MF A01

Certain important aspects of the chemical and physical composition of American lignite coals were characterized. Differential scanning calorimetry and thermogravimetric analysis were used to study the interaction between oxygen and seventeen coal chars (40 x 100 mesh) at 100 C. The same techniques were used to investigate briefly the interaction between air and a highly caking coal at selected isothermal temperatures in the range 100 to 275 C. DOE

N80-24477# Midwest Research Inst., Golden, Colo.
PHOTOBIOLOGICAL HYDROGEN PRODUCTION
M. Seibert, S. Lien, and P. F. Weaver 1979 20 p refs Presented at the US/USSR Joint Working Group in Microbiol., Riga, 2-5 Oct. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-33-410) Avail: NTIS HC A02/MF A01

Hydrogen production by phototrophic organisms, which has been known since the 1930's, occurs at the expense of light energy and electron-donating substrates. Three classes of organisms, namely, photosynthetic bacteria cyanobacteria, and algae carry out this function. The primary hydrogen-producing enzyme systems, hydrogenase and nitrogenase, are discussed along with the manner in which they couple to light-driven electron transport. In addition, the feasibility of using in vivo and in vitro photobiological hydrogen producing systems in future solar energy conversion applications are examined. DOE

N80-24478# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
FUEL FROM FARMS: A GUIDE TO SMALL-SCALE ETHANOL PRODUCTION
Feb. 1980 165 p refs
(Contract EG-77-C-01-4042)
(SERI/SP-451-519) Avail: NTIS HC A08/MF A01

A guide on fermentation processes with emphasis on small-scale production of ethanol using farm crops as a source of raw material is published. The status of on-farm ethanol production as well as an overview of some of the technical and economic factors is presented. Decision and planning worksheets and a sample business plan for use in decision making are included. Specifics in production including information on the raw materials, systems components, and operational requirements are also provided. Diagrams of fermentors and distilling apparatus are included. DOE

N80-24479# Department of Energy, Washington, D. C.
COAL CONVERSION COMPARISONS, TASK 002 Final Report
K. A. Rogers and R. F. Hill Jul. 1979 99 p refs
(Contract EF-77-C-01-2468)
(FE-2468-51) Avail: NTIS HC A05/MF A01

Technologies for producing synthetic fuels from coal are examined. The conclusion is made that many processes are ready for commercial demonstration but synthetic fuel will cost more than conventional petroleum fuels. An economic comparison method was developed to reflect the value differences of the different fuel products. The value method assigns relative values to all producing from a multiproduct synfuel process. This method incorporates the preferences of the marketplace to arrive at the necessary selling prices for each product. Two methods of financing, using typical utility and private venture returns on investment, are included for all products. The fourteen conversion processes studied are divided into six groups: solid clean fuel, direct liquefaction, indirect liquefaction, synthetic natural gas, industrial gas, and electric power from a combined cycle-integrated gasifier system. Three of the processes are shown in an alternate mode of operations giving a total of seventeen sets of energy costs. The prediction is made that no major technological advances are expected which will significantly decrease synfuel costs. DOE

N80-24480# Department of Energy, Washington, D. C. Coal Conversion Div.
COAL LIQUEFACTION Quarterly Report, Oct. - Dec. 1978
Sep. 1979 61 p refs
(Contract EX-76-C-01-2297)

(DOE/ET-0068/4) Avail: NTIS HC A04/MF A01

The conversion of coal to liquid fuels is discussed with emphasis on improved process configurations for both catalytic processes. The advantage of coal liquefication is assessed with respect to its high yield of a wide range of liquid products, especially boiler fuels, distillate fuel oil, and gasoline. The development of several conversion processes are briefly described. DOE

N80-24481# Department of Energy, Washington, D. C. Fossil Fuel Processing Div.

COAL CONVERSION Technical Report, 1978

Sep. 1979 188 p refs

(Contract EX-76-C-01-2297)

(DOE/ET-0061/2) Avail: NTIS HC A09/MF A01

Development of processes for converting coal into products that substitute for those derived from oil and natural gas is considered with emphasis on rapid commercialization. These substitute fuels include crude oil, fuel oil and distillates, chemical feedstocks, pipeline quality and fuel gas, and other products such as char that may be useful in energy production. J.M.S.

N80-24482# Chevron Research Co., Richmond, Calif.

REFINING AND UPGRADING OF SYNFUELS FROM COAL AND OIL SHALES BY ADVANCED CATALYTIC PROCESSES Quarterly Report, Jul. - Sep. 1979

R. F. Sullivan and D. J. ORear Oct. 1979 44 p

(Contract EX-76-C-01-2315)

(FE-2315-43) Avail: NTIS HC A03/MF A01

The denitrification fouling rate of ICR 106 catalyst was measured in an accelerated fouling rate test. At comparable conditions, the H-coal whole process product is denitrified to a greater extent than the solvent-refined coal 2 whole process product. Deposits were formed in the preheater of the whole oil hydrotreater, which appear to be from either asphaltenes of soluble iron compounds in the feed. An alumina guard bed ahead of the catalyst sucessfully removed these contaminants. A large batch of low aromatic, denitrified H-coal whole process product was prepared for downstream hydrocracking. In this preparation hydrogen was consumed by the oil at roughly 2100 SCF/bbl. The whole product from this hydrotreater was then cracked in an extinction recycle hydrocracker to make a 350 F product. In this hydrocracking step, hydrogen was consumed by the oil 800 SCF/bbl. DOE

N80-24483# Brookhaven National Lab., Upton, N. Y. Energy Storage and Conversion Div.

BULK HYDROGEN STORAGE USING METAL HYDRIDES

G. Strickland and M. J. Russo, Jr. Dec. 1979 10 p refs Presented at the 2nd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10-13 Dec. 1979

(Contract EY-76-C-02-0016)

(BNL-27093; CONF-791204-14) Avail: NTIS HC A02/MF A01

The considerations involved in design and use of a process unit, or reservoir, for storing bulk quantities of hydrogen via solid particles of titanium-iron-maganese are described along with several applications. One style of reservoir having improved design features, and the service system in which it was installed for testing are discussed. The reservoir has a nominal storage capacity of 50 lb (23 kg) of hydrogen and is rated for hydrogen charging and discharging times in the 5 to 10 hour range. DOE

N80-24484# Argonne National Lab., Ill. Materials Science Div.

MATERIALS TECHNOLOGY FOR COAL-CONVERSION PROCESSES Quarterly Report, Apr. - Jun. 1979

Nov. 1979 70 p refs

(Contract W-31-109-eng-38)

(ANL-79-93; QR-18) Avail: NTIS HC A04/MF A01

A 500-h test run, exposing 11 water-cooled refractions to basic slag (B/A = 1.5), was completed. High chromia content and high density again appeared to be significant factors contributing to the corrosion resistance of refractories used for slag containment. A literature review on high temperature ultrasonic coupling was completed and suggest that studies on long term (month to years) pressure-coupling stability are needed. Flow-induced acoustic energy studies (relevant to acoustic leak detection) suggest that a 20% coal-water slurry flowing through an orifice under pressure produces acoustic-energy excitation mainly at frequencies < 65 kHz and that a better correlation between acoustic runs levels and flow rate is obtained as the differential pressure is increased. Corrosion studies of type 310 stainless steel at 1000 C with various P/sub O2/ and P/sub/S2/ suggested that titanium addition increases the corrosion rate relative to that of commercially available steels. DOE

N80-24485# Argonne National Lab., Ill.

METHANE RECOVERY FROM URBAN REFUSE

M. L. Wilkey and R. Eric Zimmerman 1979 8 p Presented at the 2nd World Energy Eng. Conf., Atlanta, 28 Oct. 1979

(Contract W-31-109-eng-38)

(CONF-7910105-2) Avail: NTIS HC A02/MF A01

The goals of the methane recovery program are discussed. Major emphasis is placed on the develop, evaluation and implementation of the technologies necessary for recovery, processing, and utilization of combustible gases generated in landfills. To achieve these goals, a research program that examined the feasibility of landfill gas recovery and use, as well as future optimization techniques and methods, has been undertaken. DOE

N80-24486# Argonne National Lab., Ill.

REFUSE CONVERSION TO METHANE (REFCOM): A PROOF-OF-CONCEPT ANAEROBIC DIGESTION FACILITY

D. K. Walter and Caroline Brooks 1979 7 p refs Presented at the Joint Power Generation Conf., Charlotte, N.C., 7 Oct. 1979 Prepared in cooperation with DOE, Washington, D.C. and Mittelhauser Corp., Downers Grove, Ill.

(Contract W-31-109-eng-38)

(CONF-791006-2) Avail: NTIS HC A02/MF A01

A process for the anaerobic digestion of solid waste and sewage sludge into methane is described. Known as RefCOM (Refuse Conversion to Methane), the DOE experimental facility in Florida can process 100 tons of raw refuse per day with an output as high as 700,000 cubic feet of gas (CH4 and CO2) per day. Based on an average home gas consumption of one million cubic feet per year, a 1,000 tons-per-day plant has the potential to meet the gas needs of over 7,000 homes. The objectives of the RefCOM experiment are to: establish information on the quality and quantity of gas produced; ascertain optimum operating parameters for both mesophilic and thermophilic modes; and evaluate the reliability of the techniques. DOE

N80-24487# Los Alamos Scientific Lab., N. Mex.

CATALYTIC COAL CONVERSION SUPPORT: USE OF LASER FLASH-PYROLYSIS FOR STRUCTURAL ANALYSIS Progress Report, 1 May - 31 Aug. 1979

N. E. Vanderborgh, W. J. Verzino, Jr., and B. A. Nichols Nov. 1979 47 p refs

(Contract W-7405-eng-36)

(LA-8133-PR) Avail: NTIS HC A03/MF A01

The project plan for determining the structural changes occurring in coal, using laser pyrolysis are delineated. The pertinent, computer generated references are appended. The determination of trial heating regimes and the selection and collection of appropriate catalysts are reported. DOE

N80-24488# Montana State Univ., Bozeman.

CATALYTIC HYDROGENATION FOR COAL-DERIVED LIQUIDS Interim Report, Jun. - Aug., 1979

L. Berg and F. P. McCandless Sep. 1979 43 p

(Contract EY-76-C-01-2034)

(FE-2034-16) Avail: NTIS HC A03/MF A01

The catalysts specifically designed to hydrodenitrogenate solvent refined coal continue. Using catalyst bases of specific surface area, pore volume and pore diameter and impregnating them with tungsten, nickel, cobalt and/or molybdenum yielded denitrogenation of SRC from 1.17% nitrogen to as low as 0.01% nitrogen after 45 minutes use and 0.1% nitrogen after 90 minutes, and desulfurization of SRC from 0.73% to as low as 0.2% sulfur after three hours. The catalysts appear to be a cross between hydrotreating and hydrocracking catalysts and will require a burn-off and resulfiding after four to six hours of operation. Five additional catalysts were discovered which appear to offer the possibility of an economically attractive process for converting

solvent-refined coal into a feedstock suitable for a conventional petroleum refinery. DOE

N80-24489# California Univ., Livermore. Lawrence Livermore Lab.
MATERIALS PROBLEMS IN PRODUCTION, TRANSPORT, AND STORAGE OF HYDROGEN
O. H. Krikorian 2 Jan. 1980 13 p refs Presented to the Energy-Sources Technol. Conf. and Exhibition, New Orleans, 3-7 Feb. 1980
(Contract W-7405-eng-48)
(UCRL-83771) Avail: NTIS HC A02/MF A01

Materials problems in three hydrogen production methods and in the transport and storage of hydrogen are identified. In hydrogen production by thermochemical cycles, materials problems center primarily around an H2SO1 boiler, and H2SO4 vapor decomposer, and an HI decomposer. In advanced electrolytic hydrogen production, the main thrust has been to raise cell efficiencies by raising operating temperatures and pressures using two approaches: (1) an alkaline electrolyte cell; and (2) a solid polymer electrolyte cell. In high temperature stream electrolysis, materials problems include development of solid state electrolytes for oxide ion conduction, and electrically conductive anode, cathode and interconnecting materials for cells. Problems dealing with pipeline steels for transport of gaseous hydrogen are also considered. Long term storage of hydrogen on a large scale is anticipated to be in underground repositories. However for short term or small scale uses, hydrogen storage in hydrides, or storage in glass microballons offer certain operational advantages. DOE

N80-24490# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
LBL CONTINUOUS BIOMASS LIQUEFACTION PROCESS ENGINEERING UNIT (PEU)
Carlos Figueroa, Jim Wrathall, and Sabri Ergun Nov. 1979 6 p ref Presented at the Thermochem. Conversion Contractors' Meeting, Rolla, Mo., 7 Nov. 1979
(Contract W-7405-eng-48)
(LBL-10092; CONF-791166-2) Avail: NTIS HC A02/MF A01

Project goals and preliminary tests of a biomass liquefaction process engineering unit are briefly described. Findings from slurry pumping capability tests indicate that hydrolyzed slurries of 20 percent can be pumped without any difficulties. A schematic for the process engineering unit is given. M.G.

N80-24491# Los Alamos Scientific Lab., N. Mex.
LASL THERMOCHEMICAL HYDROGEN Status Report, 20 Sep. 1979
K. E. Cox 1979 5 p Presented at the DOE Chem. Energy Storage and Hydrogen Energy Systems Contracts Rev. Meeting, Reston, Va., 12 Nov. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2799; CONF-791127-1) Avail: NTIS HC A02/MF A01

A conceptual design of the hybrid bismuth sulfate cycle and experimental work to verify the design conditions were examined. Key findings were a 50.8% efficiency was obtained when an improved cycle design was coupled to a fusion energy source at 1500 K; experimental results showed an endothermic heat requirement of +172 kJ/mol for the decomposition of Bi2O3.2SO3 to Bi2O3.SO3, and SO3; reaction times for bismuth sulfate decomposition were determined as a function of temperature. At 1240 K, < 1.5 min were required for the first two stages of decomposition from Bi2O3.3SO3 to Bi2O3; tests made to determine the feasibility of decomposing Bi2O3.2SO3 in a 1 inch diameter rotary kiln showed that Bi2O3.2SO3 could be decomposed continuously. DOE

N80-24492# Louisiana State Univ. and A&M Coll., Baton Rouge. Agricultural Experiment Station.
POTENTIAL OF PRODUCING AND HARVESTING SUGARCANE AND SWEET SORGHUM AS A RENEWABLE BIOMASS ENERGY RESOURCE Annual Report
B. J. Cochran and Ray Ricaud 31 Jul. 1979 64 p
(Grant EG-77-G-05-5373)
(ORO-5373-T1) Avail: NTIS HC A04/MF A01

Manufacturers of land clearing equipment, land leveling, ditching machinery, mold board plows, and lister plows are listed as well as manufacturers of sugar cane tillage equipment. Suppliers are also listed for the following types of equipment: planting, irrigation, spraying equipment, aerial application spraying and dusting equipment, power units, harvesting, loaders, and transport units. Methods of mechanical harvesting sugarcane and sweet sorghum grown from improved planting and production treatments are evaluated. Commercial mechanical systems available for harvesting maximum sugarcane biomass in the sugar production areas of the United States are described. DOE

N80-24493# Midwest Research Inst., Golden, Colo.
ENVIRONMENTAL AND INSTITUTIONAL CONSIDERATIONS IN THE DEVELOPMENT AND IMPLEMENTATION OF BIOMASS ENERGY TECHNOLOGIES
Charlotte Schwab Sep. 1979 46 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-62-264) Avail: NTIS HC A03/MF A01

The photosynthetic energy stored in plant and organic waste materials in the United States amounts to approximately 40% of the nation's total energy consumption. The conversion of the biomass energy source, in the form of biomass residues and wastes, can create problems. Environmental impacts may be significant, and legal responses to these impacts are a key determinant to the widespread adoption of biomass technologies. The major legal areas which will impact on biomass energy conversion include (1) the effect of existing state and federal legislation; (2) the role of regulatory agencies in the development of biomass energy; (3) governmental incentives to biomass development; and (4) legal issues surrounding the functioning of the technologies themselves. Emphasis is placed on the near-term technologies whose environmental impacts and institutional limitations are more readily identified. If biomass energy is to begin to achieve its apparently great potential, these questions must receive immediate attention. DOE

N80-24494# Garrett Energy Research and Engineering Co., Ojai, Calif.
INVESTIGATION OF WOODY BIOMASS SPECIES FOR FUEL PRODUCTION IN WARM CLIMATE, NON-AGRICULTURAL LAND IRRIGATED BY BRACKISH OR SALINE WATER Final Report, 24 Apr. 1978 - 24 Apr. 1979
D. E. Garrett 24 Apr. 1979 209 p refs
(Contract ET-78-C-01-3077)
(DSE-3077-T1) Avail: NTIS HC A10/MF A01

Over 17,000 Tamarisk plants were grown in an approximately 1.5 acre plot of very poor soil in the San Joaquin Valley at Hanford, California. Tamarix aphylla (Athel Tree) cuttings were tested in a variable fertilization and water salinity statistically designed standard agronomic program. Other variables were studied with potted T. aphylla, T. pentandra (Salt Cedar), T. hispida and T. africana on a semi-quantitative basis. The plants averaged about 0.4 inches of growth per day from planting in May until growth stopped in November, and produced a dry weight yield for this short season of about 7.4 dry tons/acre/year assuming an 18 inch spacing. The average yield for the better plots was 14 DTE/acre/yr. Nitrogen fertilizer increased growth by about 38% at a level of 300 Kg/ha. Water containing 600 to 35,000 ppM salts did not change the growth rate apprecialby. DOE

N80-24495# Sandia Labs., Livermore, Calif. Solar Programs Dept.
OVERALL EFFICIENCIES FOR CONVERSION OF SOLAR ENERGY TO A CHEMICAL FUEL
J. D. Fish 1979 22 p refs Presented at the 2nd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10 Dec. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-8636; CONF-791204-9) Avail: NTIS HC A02/MF A01

A complete and consistent schema for determining the overall efficiency of a generalized process for the conversion of solar energy into a chemical fuel was developed and applied to seven conversion processes. The overall efficiency of each of these processes is determined by ten common factors: maximum theoretical efficiency; inherent absorption losses; inherent internal losses; rate limiting effects; reflection losses; transmission losses;

coverage losses; system construction requirements; parasitic losses; and harvesting and conversion losses. DOE

N80-24496# Sandia Labs., Livermore, Calif. Materials Development Div.
TECHNOLOGIES AND ECONOMICS OF SMALL-SCALE HYDROGEN STORAGE
S. L. Robinson and J. J. Iannucci Dec. 1979 51 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8646) Avail: NTIS HC A04/MF A01

Presently available fixed-site hydrogen storage technologies are examined, to identify the minimum cost storage technique for various combinations of quantity, cycling frequency and parasitic energy costs. Pressurized gas, cryogenic liquid, hydride, and microballoon storage are studied. For each form, installed capital cost, filling and emptying equipment costs and parasitic energy costs are developed and parameterized by electric rates. The energy intensive systems are economical for long term cycling (seasonal storage) but unfavorable for short term (daily cycling). Low pressure gas storage is favored for short term and intermediate term storage. Development of microballoon storage is recommended as a possible low cost long term storage option. DOE

N80-24497# California Univ., Livermore. Lawrence Livermore Lab.
HYDROGEN ENCAPSULATION IN A CS-EXCHANGED TYPE 4A ZEOLITE
P. L. Turi and J. F. Lakner 24 Sep. 1979 12 p refs
(Contract W-7405-eng-48)
(UCRL-52865) Avail: NTIS HC A02/MF A01

Hydrogen encapsulation in a Cs-exchanged synthetic type 4A zeolite was observed. Hydrogen storage capacity was measured in samples in which Na(+) yields Cs(+) exchange was from 19 to 61%. The samples were loaded with H2 at temperatures from 350 to 420 C, at pressures up to 20,000 psi. Results are reported. DOE

N80-24498# TRW, Inc., McLean, Va. Energy Systems Planning Div.
COAL DERIVED FUEL GASES FOR MOLTEN CARBONATE FUEL CELLS
Nov. 1979 91 p
(Contract EY-77-C-21-8085)
(METC-8085-T2) Avail: NTIS HC A05/MF A01

The range of raw gas compositions available from the major classes of coal gasifiers, the degree of gas clean-up achievable with state-of-the-art and future gas clean-up systems, and the energy penalties associated with gas clean-up are described. The results indicate that gasifer product raw-gas compositions are influenced by the gasifer type, operating conditions and coal type. Fixed-bed gasifers, that do not subject the coal pyrolysis products to temperatures above approximately 1600 F, contain significant quantities of tars, oils, organic sulfur compounds and organic nitrogen compounds in the product raw gas. Fluid-bed, entrained-bed, and molten salt gasifers that operate at higher temperature, produce less of these materials. Increasing operating temperature also favors the formation of H2 and CO as compared to CO2, H20 and CH4. Since the presence of H2 and CO is preferred over CH4 for a molten carbonate fuel cell feed, high operating temperature seem to be indicated for gasifiers operating with molten carbonate fuel cells. DOE

N80-24499# Johns-Manville Sales Corp., Denver, Colo.
FILTRATION PROCESS AND EQUIPMENT STUDIES FOR COAL LIQUEFACTION PROCESSES Final Report
I. Bastidas, R. C. Himes, F. B. Hutto, and P. Martin May 1979 217 p refs
(Contract EX-76-C-01-2007)
(FE-2007-T1) Avail: NTIS HC A10/MF A01

A rotary pressure precoat filter test leaf was designed and constructed which makes it possible to simulate the operation of a full scale rotary pressure precoat filter. Variables affecting the operation of the rotary pressure precoat filter were investigated in detail. Precoat filtration principles were also reviewed. The effect of filtration variables as determined by studies with the rotary pressure precoat filter test leaf is discussed. DOE

N80-24500# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
MARINE BIOMASS SYSTEM: ANAEROBIC DIGESTION AND PRODUCTION OF METHANE
K. F. Haven, Mark Henriquez, and Ronald L. Ritschard Apr. 1979 84 p refs
(Contract W-7405-eng-48)
(LBL-8460) Avail: NTIS HC A05/MF A01

Two approaches to kelp conversion to methane are described. First, a large (10.56 sq mi) oceanic farm using an artificial substrate and an upwelling system to deliver nutrient-rich deep ocean water to the kelp bed is described. This system can yield as much as 50 tons of kelp (dry ash free - DAF) per acre-year. Kelp are harvested by a specially designed 30,000 DWT ship and delivered to an onshore processing plant as a ground kelp slurry. The second system involves the use of a natural coastal kelp bed. Growth rates in this bed are stimulated by a nutrient rich sewer outfall. A conceptual model is presented for calculations of the growth rate of kelp in this natural bed which can reach 15 tons (DAF) per acre-year. The harvest activity and processing plant are similar to those for oceanic farm system. The overall concept of kelp production and conversion to methane is discussed. The general design of the ocean farm system is presented. DOE

N80-24501# Eyring Research Inst., Provo, Utah.
EXPERIMENTAL AND PROCESS DESIGN STUDY OF A HIGH RATE ENTRAINED COAL GASIFICATION PROCESS Final Report, Jan. 1974 - Nov. 1978
M. J. McIntosh and Ralph L. Caotes 1978 415 p refs
(Contract EX-76-C-01-1548)
(FE-1548-T2) Avail: NTIS HC A18/MF A01

Work began in January 1974. The original experimental equipment was designed, fabricated and installed during the first eight months of the project. A total of 296 test runs were made for a total of 800 operating hours. Cold gas efficiencies of 73 percent at specific gasification rates of 115 pounds coal/hour cu ft atmospheres were achieved. Extensive equipment modifications were made to overcome problems encountered. An extended series of runs on a range of feed coals and char were conducted. Using the results a semi-emperical mathematical model was developed. This model incorporated material and energy balances, assumption of frozen water gas shift equilibrium and Arrhenius correlations of carbon gasification and methane formation. The Arrhenius constants were found to depend directly on the carbon percentages and the percent volatile matter for the four coals tested. Mathematical models of the entrained gasifier integrated in various ways with a combined cycle system were developed and used to study the effect of mode of integration, coal type, gasifier heat loss and gasifier steam feed rate on combined cycle performance. DOE

N80-24502# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
BIOTECHNOLOGY FOR PRODUCING FUELS AND CHEMICALS FROM BIOMASS: RECOMMENDATIONS FOR RESEARCH AND DEVELOPMENT VOLUME 1. SYNOPSIS AND EXECUTIVE SUMMARY
Ruxton Villet Dec. 1979 29 p 2 Vol.
(Contract EG-77-C-01-4042)
(SERI/TR-332-360-Vol-1) Avail: NTIS HC A03/MF A01

Areas of research and development judged to be crucial for establishing a biotechnology of biomass processing are identified. Two general avenues are recommended for R and D: (1) in the near term, revival of the older fermentation technology and improvement of processing efficiencies; and (2) in the longer term, the development of novel biotechnological processes, such as for the conversion of lignocellulosic biomass to fuels and chemicals. Recommended R and D ranges from work in molecular genetics to biochemical engineering aspects of plant design. It is recommended that the R and D strategy be designed as an integration of three disciplines: biochemical engineering, microbial genetics, and biochemistry. Applications of gene-transfer methodology and developments in continuous fermentation should be pursued. Currently, economic incentive for the use of biological conversion processes is marginal. However, as the imported fraction of US oil supply grows and hydrocarbon costs mount, the market is beginning to motivate a quest for substitutes. DOE

N80-24503# National Transportation Policy Study Commission, Washington, D. C.
UTILIZATION CONCERNS OF POTENTIAL TRANSPORTATION FUELS
Gretchen Coar Apr. 1979 43 p refs
(PB80-138498; NTPSC/WP-79-37) Avail: NTIS HC A03/MF A01 CSCL 10A

The known utilization problems for fuels which were identified as likely near and midterm alternatives to petroleum (synthetics from oil shale and coal, and alcohols from various sources) are identified and discussed. The focus is on distribution and handling, material compatibility, vehicle performance, fuel economy, environmental effects, safety and toxicity, and potential utilization in alternative engines. GRA

N80-24504# NEUS, Inc., Santa Monica, Calif.
BIOSOURCES DIGEST. A JOURNAL ON BIOMASS UTILIZATION, VOLUME 1, NUMBER 3
Harry Sobel Jul. 1979 65 p refs
(Grant NSF PFR-77-12500)
(PB80-139306; NSF/RA-790296) Avail: NTIS HC A04/MF A01 CSCL 10A

A rubber analysis procedure is described which publicizes laboratory instructions and details for pilot plant operations along with a discussion on gasohol production. Four eggshaped digesters being constructed by the City of Los Angeles are also discribed. Multi-use oil and hydrocarbon-producing crops in adaptive systems for food, material and energy production are briefly examined. Patents pertinent to biomass utilizattion, sources of new available information, are listed. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-24505# Naval Civil Engineering Lab., Port Hueneme, Calif.
PERFORMANCE OF UNCOATED AND COATED NONFERROUS HEAT EXCHANGERS IN A TEMPERATE MARINE ENVIRONMENT FOR TWO YEARS Final Report, Jul. 1975 - Aug. 1978
T. Roe, Jr., J. F. Jenkins, and R. L. Alumbaugh Aug. 1979 64 p refs
(YF53534006)
(AD-A081154; CEL-TN-1560) Avail: NTIS HC A04/MF A01 CSCL 13/1

Twelve finned tube heat exchangers - four pieces of three different materials or material combinations were operated in a marine environment: (1) uncoated; (2) coated with an electrostatically applied polyester enamel; (3) coated with a specification alkyd system; or (4) coated with a zinc inorganic silicate material. Temperature drops across each exchanger were monitored for 24 months and heat transfer capacities were calculated for selected periods. Copper tube/copperfin exchangers coated with any of the three different coating systems were superior in thermal efficiency to the uncoated units. The opposite was true for the all aluminum units and for the copper tube/aluminum fin units. Based on 1978 prices, coating of copper tube/copper fin exchangers increases their cost from 48 to 60%. It is believed this can be justified on the basis of increased life expectancy alone. GRA

N80-24506# Fondazione Ugo Bordoni, Rome (Italy).
A REFLECTOMETER FOR THE CONTROL OF THE DEPOSITION OF THIN FILMS [RIFLETTOMETRO DI CONTROLLO PER DEPOSIZIONI DI STRATI SOTTILI]
Ludovico Muzii Dec. 1978 18 p In ITALIAN
(FUB-34-1978) Avail: NTIS HC A02/MF A01

A reflectometric device for the control of thickness of metallic or dielectric thin layer deposits is described. The apparatus can measure the reflectance at several wave lengths and has high sensitivity even for low reflectance films. The implementation of the optical detector, the control and measuring circuits and the design of the optical system are discussed. The effect of secondary reflection is analyzed. Author (ESA)

N80-24507# National Bureau of Standards, Washington, D.C. Electrosystems Div.
MEASUREMENTS ON INSULATING MATERIALS AT CRYOGENIC TEMPERATURES Final Report
William E. Anderson and Richard S. Davis Jan. 1980 165 p refs Prepared for Brookhaven National Lab., Upton, N.Y.
(Contract EA-77-A-01-6010)
(PB80-134596; NBSIR-79-1950) Avail: NTIS HC A08/MF A01 CSCL 09A

Results of a four-year effort to study the high voltage dielectric behavior of various materials at cryogenic temperatures are described. Dissipation factors at 60 Hz were measured for polymer tapes and epoxy samples at 4.2 K, atmospheric pressure. Multi-layer polymer samples in coaxial geometries at temperatures from 7 K to 10 K and helium pressures up to 1.5 megapascals were also studied. The measurements were performed at stresses up to 40 MV/m. Since partial discharges were major source of losses at the higher stresses and their presence was possibly detrimental to the integrity of the insulation, instrumentation was developed and implemented to study these discharges under conditions found in proposed ac superconducting power-transmission lines. GRA

N80-24508# Southwest Research Inst., San Antonio, Tex.
SURFACE PREPARATION OF PAVEMENTS PRIOR TO APPLICATION OF PAVEMENT MARKINGS Final Report
John M. Dale Jan. 1980 23 p
(Contract DOT-FH-11-9298)
(PB80-137326; FHWA-TS-80-207) Avail: NTIS HC A02/MF A01 CSCL 13B

A brush assembly was designed, fabricated and installed on a Texas Department of Highways and Public Transportation striping truck and run over a variety of roads. It was found that brushing did not significantly extend the service life of the traffic marking paint. There was not sufficient improvement to consider mounting brush assemblies ahead of the spray guns on striping trucks for use on a daily basis. GRA

N80-24509# Office of Personnel Management, Washington, D.C. Personnel Research and Development Center.
THE NEED FOR A COMMON METRIC IN ITEM BIAS STUDIES Final Report
Neil J. Dorans Sep. 1979 18 p refs
(PB80-128671; TM-79/20) Avail: NTIS HC A02/MF A01 CSCL 12A

A common metric is essential for valid comparisons in any investigations of subpopulation differences and similarities. Item bias studies are one type of investigation that focuses on testing for subpopulation differences. The techniques of latent trait theory, with its powerful property of item parameter invariance are applied to the item bias question. The property of item parameter invariance is examined, with primary consideration given to the importance of metric in studies that test for item bias by testing for item parameter invariance. Neutral, hypothetical examples illustrate some consequences of ignoring the importance of metric. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-24510* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND APPARATUS FOR DOPPLER FREQUENCY MODULATION OF RADIATION Patent
Jack S. Margolis (JPL), Daniel J. McCleese (JPL), Michael S. Shumate (JPL), and Clay H. Seaman, inventors (to NASA) (JPL) Issued 6 May 1980 6 p Filed 3 Nov. 1978 Supersedes N80-21141 (18 - 11 p 1493) Sponsored by NASA
(NASA-Case-NPO-14524-1; NASA-Case-NPO-14527-1; US-Patent-4,201,468; US-Patent-Appl-SN-957452; US-Patent-Class-356-28.5; US-Patent-Class-350-6.5;

US-Patent-Class-350-6.6; US-Patent-Class-350-294) Avail: US Patent and Trademark Office CSCL 20N

A method and apparatus are described for frequency modulating radiation, such as from a laser, for optoacoustic detectors, interferometers, heterodyne spectrometers, and similar devices. Two oppositely reciprocating cats-eye retroreflectors are used to Doppler modulate the radiation. By reciprocally moving both retroreflectors, the center of mass is maintained constant to permit smooth operation at many Hertz. By slightly offsetting the axis of one retroreflector relative to the other, multiple passes of a light beam may be achieved for greater Doppler shifts with the same reciprocating motion of the retroreflectors.

Official Gazette of the U.S. Patent and Trademark Office

N80-24511*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

CAVITY-BACKED, MICRO-STRIP DIPOLE ANTENNA ARRAY Patent Application

Haynes Ellis, Jr., inventor (to NASA) (Rockwell Intern. Corp., Downey, Calif.) Filed 30 Apr. 1980 15 p

(Contract NAS9-14000)

(NASA-Case-MSC-18606-1; US-Patent-Appl-SN-145206) Avail: NTIS HC A02/MF A01 CSCL 09E

A flush mounted, microwave band antenna for high performance aircraft and space vehicles is disclosed. Features of the cavity-backed microstrip antenna include: (1) low cost construction; (2) microstrip elements in orthogonal dipole arrangement; and (3) circular polarized sum and difference radiation patterns. The microstrip antenna elements are fed through quadrature hybrids proceeded by a comparator hybrid. J.M.S.

N80-24512*# Texas Univ. at Austin. Electrical Engineering Research Lab.

ATS-6 ASCENDING: NEAR HORIZON MEASUREMENTS OVER WATER AT 30 GHz

W. J. Vogel, A. W. Straiton, and B. M. Fannin Apr. 1977 30 p refs Presented at URSI Comm. of Open Symp. on Propagation in Nonionized Media, LaBaule, France, 28 Apr. - 6 May 1977

(Contract NAS5-22576)

(NASA-CR-159966) Avail: NTIS HC A03/MF A01 CSCL 20N

The return of the ATS 6 satellite to a western longitude during the fall of 1976 presented a unique opportunity to perform low angle of elevation measurements at 30 GHz. For this purpose a receiver using a 1.5 m antenna was set up at Port Aransas, Texas, resulting in a propagation path entirely over water. The 30 GHz beacon was monitored daily for at least one hour from 8 September 1976 to 21 September 1976. During the time the elevation angle changed from 1.5 deg to 17.3 deg, the mean attenuation decreased from 20 dB to 2 dB and the standard deviation from over 6 dB to less than .2 dB. The deep fades at angles below 4 deg show significantly sharper nulls than peaks on a log scale. Spectra of the log amplitude fluctuations vary as the (-8/3) power of the spectral frequency in the limit. A flattening is noticeable at the low frequencies. A precipitation event at 8.5 deg elevation produced a 16 dB fade and significantly increased the variance. Author

N80-24513*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

RADIO PROPAGATION THROUGH SOLAR AND OTHER EXTRATERRESTRIAL IONIZED MEDIA

Ernest K. Smith and Robert E. Edelson 15 Jan. 1980 66 p refs

(Contract NAS7-100)

(NASA-CR-163153; JPL-Pub-79-117) Avail: NTIS HC A04/MF A01 CSCL 20N

The present S- and X-band communications needs in deep space are addressed to illustrate the aspects which are affected by propagation through extraterrestrial plasmas. The magnitude, critical threshold, and frequency dependence of some eight propagation effects for an S-band propagation path passing within 4 solar radii of the Sun are described. The theory and observation of propagation in extraterrestrial plasmas are discussed and the various plasma states along a near solar propagation path are illustrated. Classical magnetoionic theory (cold anisotropic plasma) is examined for its applicability to the path in question. The characteristics of the plasma states found along the path are summarized and the errors in some of the standard approximations are indicated. Models of extraterrestrial plasmas are included. Modeling the electron density in the solar corona and solar wind, is emphasized but some cursory information on the terrestrial planets plus Jupiters is included. J.M.S.

N80-24514*# Mitre Corp., Bedford, Mass.

ON-BOARD PROCESSING CONCEPTS FOR FUTURE SATELLITE COMMUNICATIONS SYSTEMS

William T. Brandon, ed. and Brian E. White, ed. May 1980 39 p refs

(Contract F19628-80-C-0001)

(NASA-CR-159683; MTR-3943) Avail: NTIS HC A03/MF A01 CSCL 17B

The initial definition of on-board processing for an advanced satellite communications system to service domestic markets in the 1990's is discussed. An exemplar system with both RF on-board switching and demodulation/remodulation baseband processing is used to identify important issues related to system implementation, cost, and technology development. Analyses of spectrum-efficient modulation, coding, and system control techniques are summarized. Implementations for an RF switch and baseband processor are described. Among the major conclusions listed is the need for high gain satellites capable of handling tens of simultaneous beams for the efficient reuse of the 2.5 GHz 30/20 frequency band. Several scanning beams are recommended in addition to the fixed beams. Low power solid state 20 GHz GaAs FET power amplifiers in the 5W range and a general purpose digital baseband processor with gigahertz logic speeds and megabits of memory are also recommended. A.R.H.

N80-24515*# Tennessee Univ., Knoxville. Systems and Radar Lab.

SPS ANTENNA POINTING CONTROL

James C. Hung 29 Feb. 1980 84 p refs

(Contract NAS8-33604)

(NASA-CR-161446) Avail: NTIS HC A05/MF A01 CSCL 13I

The pointing control of a microwave antenna of the Satellite Power System was investigated emphasizing: (1) the SPS antenna pointing error sensing method; (2) a rigid body pointing control design; and (3) approaches for modeling the flexible body characteristics of the solar collector. Accuracy requirements for the antenna pointing control consist of a mechanical pointing control accuracy of three arc-minutes and an electronic phased array pointing accuracy of three arc-seconds. Results based on the factors considered in current analysis, show that the three arc-minute overall pointing control accuracy can be achieved in practice. J.M.S.

N80-24516# Communications Research Centre, Ottawa (Ontario). Radio and Radar Research Branch.

RANGE ESTIMATION FROM WAVE-FRONT CURVATURE

R. V. Webber Mar. 1979 32 p refs

(AD-A081640; CRC-1322) Avail: NTIS HC A03/MF A01 CSCL 20/14

The computation of the range of a signal from its wavefront curvature has been investigated. Some success was obtained by fitting a truncated power series to phase data which was taken by a linear array of antenna. In simulated experiments the effect of noise in the data was investigated extensively. For typical data obtained with the Communications Research Centre HFDF 1.2 km array, one should be able to make useful estimates of range for distances up to about 100 kilometers. In a field experiment the ground wave was used to estimate ranges of up to 111 kilometers. The bias and the rms deviation from the mean range were low for the near transmission sites but were up to 33% and 45% respectively, for the more remote sites. An unsuccessful attempt was made to compute the range of a signal which had been reflected by the E layer of the ionosphere. In this case the range was about twice the useful limit for the present system and the received signal may well have consisted of two or more interfering rays. Because of distorted wavefronts resulting from wave interference the range cannot be computed for a resultant signal which is made up of two or more signals which come from almost the same direction. GRA

N80-24517# Raytheon Co., Sudbury, Mass. Equipment Development Labs.
DIGITAL TRANSMISSION SYSTEM Final Technical Report, 10 Mar. 1976 - Feb. 1978
Manfred Unkaut, Paul Danis, and Carl Alsmeyer Griffiss AFB, N.Y. RADC Oct. 1979 212 p refs
(Contract F30602-76-C-0217; AF Proj. 2157)
(AD-A080894; RADC-TR-79-250) Avail: NTIS HC A10/MF A01 CSCL 09/2

The objective of this program was to improve the performance of an earlier experimental model by replacing existing circuit card assemblies with new circuits that would enhance the performance of the DAR-IV technique. Therefore, emphasis of the DTS program was to implement improvements in the basic design which included increased memory of the demodulator coherent filter, modification of the clock recovery loop for increased stability, improvement in bit count integrity and modification of the adaptive equalizer associated with increasing demodulator coherent filter memory. Digital transmission was accomplished at data rates of 1.75, 3.5 and 7.0 Mbps by using the Distortion Adaptive Receiver (DAR-IV) modulation/demodulation (modem) technique. Testing of the DAR-IV was performed using the RADC troposcatter media simulator and the actual over-the-air tests on the AN/TRC-97 and AN/TRC-132 on the RADC Troposcatter Experimental Range in Rome, New York and on NATO Strategic Troposcatter (ACE-HIGH) links between Dosso Dei Galli, Italy and Feldberg and Kinsbach, Germany as part of the combined US/NATO digital troposcatter Test Program. The test results show that the DAR-IV technique has the potential to provide quality digital data transmission on both tactical and strategic troposcatter links. The DAR-IV was shown to typically operate within 2 dB of theoretical in back-to-back tests. GRA

N80-24518# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PREDICTION AND BUFFERING OF DIGITAL SPEECH STREAMS FOR IMPROVED TASI PERFORMANCE ON A DEMAND-ASSIGNED SATELLITE CHANNEL
William Kantrowitz, Clifford J. Weinstein, and Edward M. Horstetter 15 Nov. 1979 46 p refs
(Contract F19628-80-C-0002)
(AD-A081593; TN-1979-75; ESD-TR-79-249) Avail: NTIS HC A03/MF A01 CSCL 17/2

An approach for achieving efficient TASI-like multiplexing of speech on a demand-assigned satellite channel, where a number of ground stations each support a small number of off-hook callers, is proposed and evaluated. The approach presupposes a demand-assignment scheme which allows rapid changes in channel capacity assignments, and includes channel reservation requests based on speaker activity prediction, and buffering of speech at the nodes to increase multiplexing efficiency. System performance results obtained by computer simulation indicate potentially significant reductions in speech cutout fraction and accompanying increases in system TASI advantage. GRA

N80-24519# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE TERRAIN SHIELDING ALGORITHM USED IN THE MASR AIRBORNE SURVEILLANCE RADAR PROGRAM
Philip L. Fleck 3 Dec. 1979 32 p refs
(Contract F19628-80-C-0002; AF Proj. 2217)
(AD-A081409; TN-1979-69; ESD-TR-79-276) Avail: NTIS HC A03/MF A01 CSCL 17/9

The algorithm described herein quickly determines if a point on the surface of the earth is visible or not from a remote aircraft due to masking by nearby terrain features. It was designed to work in an airborne radar surveillance system, updating a 16 x 16 km area every 4 seconds with a resolution of 250 x 250 m. GRA

N80-24520# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FACTORS AFFECTING THE PERFORMANCE OF ADAPTIVE ANTENNA SYSTEMS AND SOME EVALUATION TECHNIQUES
Joseph T. Mayhan and Franklin W. Floyd 9 Aug. 1979 107 p refs
(Contract F19628-78-C-0002; AF Proj. 2029)
(AD-A081711; TN-1979-14; ESD-TR-79-197) Avail: NTIS HC A06/MF A01 CSCL 09/5

The basic performance of an adaptive antenna system is influenced somewhat independently by two sub-systems: the antenna and the adaptive processor. Choice of the antenna type (multiple beam antenna or phased array) and the design of the adaptive processor (which is used to control the weighting at each antenna feed port) depends strongly on the specific requirement of a particular system. To date, much has been published on the ideal performance characteristics of adaptive nulling antenna systems. However, little has been published on the effects of hardware component imperfections on system performance. To characterize these effects is the purpose of this note. We present methods for categorizing, analyzing and measuring the effects of a few of the key components which are common to the majority of adaptive systems implemented to date. Some examples we will discuss are those effects due to antenna type, antenna tolerance errors, channel tracking errors, weighting circuits, hard-limiters, correlators and base-band components. We analyze these from the viewpoint of the degree of cancellation achievable by the adaptive processor and also their impact on loop dynamics (where appropriate). In order to illustrate the various effects, measured performance results obtained using an experimental Applebaum-Howell type adaptive processor will be presented. GRA

N80-24521# Stanford Univ., Calif.
RESEARCH ON LARGE ADAPTIVE ARRAYS Final Technical Report, Aug. 1978 - Jun. 1979
B. Widrow, R. Chestek, H. Mesiwala, and K. Duvall Griffiss AFB, N.Y. RADC Dec. 1979 111 p refs
(Contracts F30602-78-C-0083; N00019-78-C-0276; AF Proj. 2305)
(AD-A081388; RADC-TR-79-308) Avail: NTIS HC A06/MF A01 CSCL 09/5

Most adaptive filters are designed to achieve minimization of estimation error. Other design goals could include satisfaction of constraints as well as minimization of mean square error. The paper proposes a particular set of performance criteria, involving 'soft constraints'. A 'soft-constraint lms algorithm' is derived from a performance function which is the sum of mean square error and weighted squared constraint violation errors. The soft constraint algorithm is applied to adpative antenna arrays as an example, which includes a demonstration of the effects of varying the softness of the constraints. Also, convergence properties of the algorithm are presented. A relation between the output power of a signal from a converged soft constraint lms adaptive filter and the signal's input power is derived, which demonstrates some unexpected behavior. GRA

N80-24522# Technology Service Corp., Santa Monica, Calif.
ADAPTIVE ARRAYS IN AN ADVANCED INTERFERENCE ENVIRONMENT Final Progress report
L. E. Brennan and I. S. Reed Oct. 1979 30 p refs
(Contract N00019-78-C-0497)
(AD-A081913; TSC-PD-A211-4) Avail: NTIS HC A03/MF A01 CSCL 09/3

When an adaptive array is implemented digitally, the sample covariance matrix algorithm provides a direct method of computing the adaptive weights and rapid convergence independent of the eigenvalues of the covariance matrix. Previous analyses of this algorithm have assumed that the weights are computed using one set of array element outputs and these weights are applied to later array outputs. This report considers the case where the adaptive weights are tested against the same set of data used in the weight computation. For many applications, the multiple channel sidelobe canceller is the preferred adaptive configuration. It can be shown that the sidelobe canceller is a special case of the more general adaptive array. In the next section it is shown that the general adaptive array problem can be transformed to an equivalent sidelobe canceller problem, a form which is more convenient for some analyses. It is also shown that the array performance is independent of this transformation, and that the effective weights, output S/N, etc., can be computed in any convenient coordinate system provided the transformation of coordinates is non-singular. GRA

N80-24523# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
PARAMETRIC INVESTIGATION OF RADOME ANALYSIS METHODS Annual Technical Report, 1 Oct. 1978 - 30 Sep. 1979

G. K. Huddleston, H. L. Bassett, and J. M. Newton Feb. 1980 41 p refs
(Grant AF-AFOSR-3469-77; AF Proj. 2301)
(AD-A082214; AFOSR-80-0218TR) Avail: NTIS HC A03/MF A01 CSCL 20/14

The status is described of a research program whose objective is to determine the accuracies of various methods of radome analysis as functions of antenna size and placement, radome size and shape, and wavelength. The analytical methods used and the experimental program to establish true data are described concisely. GRA

N80-24524# Stanford Univ., Calif. Stanford Electronics Labs.
COMPENDIUM OF THE ULF/ELF ELECTROMAGNETIC FIELDS GENERATED ABOVE A SEA OF FINITE DEPTH BY SUBMERGED HARMONIC DIPOLES Technical Report, 1 Jul. 1978 - 30 Jun. 1979
A. C. Fraser-Smith and D. M. Bubenik (SRI International, Menlo Park, Calif.) Jan. 1980 106 p
(Contract N00014-77-C-0292; NR Proj. 089-121)
(AD-A081954; SU-SEL-79-025; SU-TR-E715-1) Avail: NTIS HC A06/MF A01 CSCL 20/14

This report extends earlier computations of the amplitudes of the quasi-static electromagnetic fields produced on and above the surface of a sea of finite depth by a submerged vertically directed harmonic magnetic dipole (VMD) to other dipoles. Specifically, it now presents data for the fields produced by a submerged vertically directed harmonic electric dipole (VED) and by submerged horizontally directed magnetic and electric dipoles (HMD and HED, respectively). The primary purpose of these computations is to determine the conditions under which an electrically conducting sea floor can produce significant changes in the fields, as compared with the fields produced on and above an infinitely deep sea, for frequencies in the ULF/ELF bands (frequencies less than 3 kHz). As in the earlier work, this report finds that even a comparatively highly conducting sea floor (conductivity of approximately 0.4S/m) can produce substantial changes in the field amplitudes for some source-receiver configurations, and, in the case of the horizontal dipoles (as previously found for the VMD), alterations of two orders of magnitude or more can occur in the amplitudes on the sea surface for smaller values of sigma. GRA

N80-24525# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
FILTER RECEIVER DEVELOPMENT STUDY Final Report
J. E. Jackson, R. Anderson, and J. D. Kelley 15 May 1979 210 p refs
(Contract N00014-78-C-0717)
(AD-A082149) Avail: NTIS HC A10/MF A01 CSCL 17/2

An atomic resonance absorption and fluorescence (ARAF) filter is a viable filter concept providing background discrimination for blue-green laser communication to a submerged receiver. A detailed design has been accomplished which provides realistic performance parameters that are compared with other filter concepts. GRA

N80-24526# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
AN INVESTIGATION OF ATMOSPHERIC OPTICALLY SCATTERED NON-LINE-OF-SIGHT COMMUNICATION LINKS Final Report, Sep. 1978 - Sep. 1979
Warren S. Ross and Robert S. Kennedy 5 Jan. 1980 66 p refs
(Contract DAAG29-77-C-0048)
(AD-A082004; ARO-15365.2-A-el) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report discusses the work performed in the second year of a two year program to investigate short-haul non-line-of-sight optical scatter communication links. The wavelength region considered for this study is the middle ultraviolet (uv) (2000 A - 3000 A). This region is attractive for communication purposes because the absence of solar background radiation makes wide-angle receivers practical. Futhermore, the short wavelengths result in significant scatter from molecular atmospheric constituents (Rayleigh scatter), so that the availability of a non-line-of-sight link is extended into clear weather. The goal of the investigation has been to obtain a fundamental understanding of scatter propagation in low visibility atmospheric environments. In particular, the work has focused on the determination of parameters needed for optical communication system design, such as angular spread and multipath time spread. GRA

N80-24527# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
A DIGITAL IF SIMULATOR FOR FM RANGING SYSTEMS
Marion C. Bartlett and Raymond C. Johnson Adelphi, Md. HDL Mar. 1980 25 p refs
(Contract DAAG39-78-C-0074; DA Proj. 1L6-62616-AH-77)
(AD-A082353; HDL-CR-80-074-1) Avail: NTIS HC A02/MF A01 CSCL 17/9

A digital intermediate frequency signal simulator (DIFSS) which is useful for testing many periodically modulated FM ranging systems is described. The DIFSS digitally computes the IF signal angle using angle tables stored in EPROM's and generates the cosine of the angle with a cosine PROM and D/A converter. Target delay time tau and doppler frequency can be varied as desired for static tests or dynamic target trajectories. The simulator is useful for testing real-time hardware or for testing ambiguous ranging system responses in a scaled-time mode. GRA

N80-24528# Electronics Research Lab., Adelaide (Australia).
TABLES OF RADAR CROSS SECTIONS OF HEMISPHERES ON PERFECTLY CONDUCTING GROUND PLANES
J. L. Whitrow Jul. 1979 142 p refs
(AD-A082050; ERL-0086-TR) Avail: NTIS HC A07/MF A01 CSCL 17/9

It is proposed that a hemisphere be used as the standard target when radar cross section measurements must be made of a target on or near a ground plane. These tables enable the radar cross section of any hemisphere whose radius is in the range 0.1 to 10.0 wavelengths to be determined for angles of observation up to 30 from the horizontal. Asymptotic expressions are presented for hemispheres outside the size range of the tables. A sphere is commonly used as the standard target in the calibration of radar cross section measurements because its backscatter cross section is invariant with aspect angle and is readily calculable to any desired order of accuracy. If however, the target undergoing measurement is located on or near a ground plane, complications arise if a sphere is to be used as the standard target because of the additional ray paths introduced between the radar and the sphere by reflections from the ground plane, and because the sphere can couple to itself, thus modifying its scattering characteristics, by other reflections from the ground plane. In general therefore the radar cross section of a sphere above a ground plane is not readily predictable, and will be strongly dependent upon the height of the sphere above the ground plane and the aspect angle. Thus the generally desirable properties of the sphere in isolation are no longer evident. GRA

N80-24529# Polytechnic Inst. of New York, Brooklyn. Microwave Research Inst.
APPLICATION OF SURFACE ACOUSTIC WAVE DEVICES TO COMMUNICATION RECEIVERS Final Technical Report, 1 Jul. 1977 - 30 Oct. 1979
Wen-Chung Wang, Harry Schachter, and Frank A. Cassara 14 Nov. 1979 51 p refs
(Grant AF-AFOSR-3353-77; AF Proj. 2305)
(AD-A082525; POLY-MRI-1403-79; AFOSR-80-0250TR) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report relates to a study of acoustoelectric surface acoustic wave (SAW) devices for the detection of analog and digital communication signals. More specifically, a general SAW structure is shown to exhibit capabilities in demodulating amplitude, phase, and frequency modulated signals including those used in spread spectrum communication systems. The principle of operation for each device described is based upon acoustoelectric nonlinear interactions. The devices studied include the acoustoelectric phase-locked loop (PLL), SAW FM discriminator, differential phase shift-keyed (DPSK) demodulator, monolithic integrated SAW structures for the detection of spread spectrum communication signals, and an acoustoelectric voltage controlled oscillator (VCO). In addition, recognizing the importance of thin-film technology in fabricating monolithic integrated structures, we initiated a thin-film technology program. The capabilities and

limitations of each of these devices were examined theoretically and experimentally. Theoretical models which provide physical insight into each demodulator's performance and design rules were advanced. Comparisons were made with known electronic structures. GRA

N80-24530# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MILLIMETER WAVE APPLICATIONS OF LARGE APERATURE SYSTEMS Final Technical Report, 30 Jun. 1978 - 31 Mar. 1979
Francois Ayer Griffiss AFB, N.Y. RADC Feb. 1980 163 p refs
(Contract F30602-78-C-0128; ARPA Order 3537; AF Proj. C537)
(AD-A082990; R-1301; RADC-TR-79-277) Avail: NTIS HC A08/MF A01 CSCL 17/9

This study proposes a structural design for the millimeter wave (MMW) antenna concept offered by Aerojet/NTL. It performs an assessment of the structural behavior of the satellite as it proceeds along its 500 km orbit. This effort concentrated on the definition and quantification of critical disturbances expected in the orbital environment. The design of a thermal blanket is arrived at through a number of thermal model analyses. The modeling of structural components and substructuring approaches are presented. The responses are evaluated for thermal loadings and dynamic disturbances. Based on the antenna deformational state, the performance is evaluated in term of point-spread functions (antenna loss of gain) and line-of-sight errors. A packaging and deployment technique is suggested for the surface panels, the back-up trusses and the feed tower to fit into the cargo bay of a single shuttle. Although the satellite is relatively heavy at 8800 kg, it is expected to perform satisfactorily in an almost completely passive manner. The evaluation of orbital dynamics shows the need for substantial propellant (2000 kg) to maintain the 500 km orbit. GRA

N80-24531# Naval Underwater Systems Center, New London, Conn. Special Projects Dept.
EFFECTS OF RANDOM SHADINGS, PHASING ERRORS, AND ELEMENT FAILURES ON THE BEAM PATTERNS OF LINEAR AND PLANAR ARRAYS
Albert H. Nuttall 14 Mar. 1980 57 p refs
(ZR0000101)
(AD-A082694; NUSC-TR-6191) Avail: NTIS HC A04/MF A01 CSCL 17/1

The moments of a sum of independent complex random variables are derived, up through fourth order, in complete generality, with no Gaussian assumptions. Applications of these results are made to linear and planar arrays, where the beamforming is subject to random shadings, phasing errors, and element failures. Expressions for the mean and variance of the random power transfer function of the array are presented. Programs and examples of their use are given for all of these results. GRA

N80-24532# Naval Ocean Systems Center, San Diego, Calif.
SIMPLIFIED VLF/LF MODE CONVERSION COMPUTER PROGRAMS; GRNDMC AND ARBNMC Interim Report, 1 Jan. - 31 Dec. 1979
D. G. Morfitt Jan. 1980 182 p refs Sponsored in part by DNA
(Contract MIPR-80-563)
(AD-A082695; NOSC/TR-514) Avail: NTIS HC A09/MF A01 CSCL 20/14

The computer programs GRNDMC and ARBNMC numerically determine vlf/lf mode conversion coefficients and mode sums for an earth-ionosphere waveguide which is inhomogeneous along the direction of propagation. GRNDMC generates values of the vertical electric field, Ez, at the ground as produced by a ground based vertical dipole source. ARBNMC calculates at an arbitrary height within the guide, all three electric field components (Ez, Ex and Ey) generated by an electric dipole of arbitrary orientation and height within the guide. The ARBNMC program treats air-to-air, ground-to-air or air-to-ground vlf/lf problems. It will also handle ground-to-ground propagation but is much less economical to run than GRNDMC. GRA

N80-24533# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
STUDIES OF SOME BASIC PROBLEMS RELATED TO SATELLITE ANTENNA SYSTEMS Final Report, 1 Jul. 1977 - 30 Jun. 1979
S. W. Lee and R. Mittra Aug. 1979 11 p refs
(Grant AF-AFOSR-3375-77; AF Proj. 2305)
(AD-A081313; UIEM79-13; UILU-ENG-79-2557; AFOSR-80-0130TR) Avail: NTIS HC A02/MF A01 CSCL 09/5

This final report summarizes the technical effort in the past years on reflector and lens antennas. In particular, this report studied the computation of dual-reflector patterns by series expansion method and by GTD, synthesis of shaped dual reflectors, and mutual coupling effect in lenses. GRA

N80-24534# SRI International Corp., Menlo Park, Calif.
ANALYSIS OF UHF RADAR DATA - STRESS SERIES Final Report, May 1977 - Sep. 1978
Victor H. Gonzalez 1 Dec. 1978 103 p refs
(Contract DNA001-76-C-0341; DNA Proj. NWET-L25AAXHX635)
(AD-A082193; AD-E300689; DNA-4823F) Avail: NTIS HC A06/MF A01 CSCL 17/9

The data acquired by the UHF radar AN/FPS 85 while tracking the ion clouds resulting from the STRESS series of barium releases have been analyzed and the results presented. The calibration of the radar, and the motion and evolution of the ion clouds are described. The special problems of (1) correlation between optical features and radar measurements; (2) total ion inventory; and (3) early deposition of ions, have also been studied and the results are included in this report. GRA

N80-24535# Rome Air Development Center, Griffiss AFB, N.Y.
STUDY OF THE RADIATION PROPERTIES OF OVERLAPPED, SUBARRAYED SCANNING ANTENNAS
Ronald L. Fante Nov. 1979 42 p refs
(AF Proj. 2305)
(AD-A082401; RADC-TR-79-293) Avail: NTIS HC A03/MF A01 CSCL 17/9

Radar systems of the future will require wideband electronically steered antennas, with sidelobes below -40 dB. Because the cost of a fully time-delay steered array is excessive, the concept of overlapped subarray (with time delay controlled at the subarray feed input) is attractive. This concept seems to have originated with Rudge and Whithers, and Tang, and recently studied for limited scan by Borgiotti. In this paper we will study the sidelobe and bandwidth properties of this system for large scan angles. The basic configuration uses a circular lens fed by a hybrid matrix (with fixed time delays at the matrix output for subarray beam collimation). When an input port on the feed is excited, a distinct subarray distribution is produced on the output face of the lens. Therefore different time delays can be applied to each subarray simply by applying different time delays to each input port. The main array has phase shifters to produce a phase tilt that scans the subarray patterns. GRA

N80-24536# Ohio State Univ., Columbus. ElectroScience Lab.
COMMUNICATION APPLICATIONS OF ADAPTIVE ARRAYS Quarterly Report
R. T. Compton, Jr. Dec. 1979 8 p refs
(Contract N00019-79-C-0291)
(AD-A082350; ESL-711847-5) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report describes progress on three areas of work. The first involves studies on weight jitter and dynamic range for the improved LMS loop. The second is a continuation of research on a reference signal generation technique for FSK signals. The third area involves the preparation of a monograph on adaptive arrays. GRA

N80-24537# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A UHF TEST SIMULATOR FOR AN ANTENNA NULLING SYSTEM
William C. Cummings, Thomas P. Robbio, William C. Provencher, John E. Drower, and Madhu Singhal 7 Jun. 1979 85 p refs
(Contract F19628-78-C-0002; AF Proj. 2029)

(AD-A082853; TN-1979-8; ESD-TR-79-157) Avail: NTIS HC A05/MF A01 CSCL 09/5

A UHF Test Simulator designed for use in testing adaptive antenna array nulling systems is described. The simulator consists of two major components: a Jammer Simulator and an Antenna Array Simulator. The Jammer Simulator can simulate up to eight independent jammers. The Array Simulator can simulate an array of eight elements in a four jammer environment. Operating details of both these simulators is discussed. GRA

N80-24538# Naval Research Lab., Washington, D. C.
A PATTERN-SYNTHESIS PROCEDURE FOR REGULAR PLANAR ARRAYS
J. Paul Shelton 14 Feb. 1980 19 p refs
(SF12141491)
(AD-A082798; AD-E000386; NRL-8388) Avail: NTIS HC A02/MF A01 CSCL 20/14

The synthesis of radiation pattern functions for symmetric hexagonal arrays is considered. The concept of number of degrees of freedom in the array illumination is introduced, and the pattern characteristics of the seven element array are developed. The relationship between multiplication of pattern functions and convolution of array illuminations is established. Synthesis techniques with zero and one degree of freedom are presented and demonstrated with examples. The technique with zero degrees of freedom generates hexagonal arrays which are analogous to linear arrays with binomial-coefficient illumination. GRA

N80-24539# Ohio State Univ., Columbus. ElectroScience Lab.
AN APERTURE-MATCHED HORN DESIGN
W. D. Burnside and C. W. Chuang Jan. 1980 39 p refs
(Contract N00014-78-C-0049)
(AD-A083003; ESL-710816-5) Avail: NTIS HC A03/MF A01 CSCL 09/5

A novel horn design is presented in this report which provides significantly better performance in terms of the pattern, impedance and frequency characteristics than normally obtainable. The modification necessary to accomplish these improvements is achieved with a moderate increase in the size and weight; yet, the overall cost of design ad construction need not significantly increase. The basic concept utilizes an ordinary horn except that curved surface sections are attached to the outside of the aperture edges. Although all of the original studies associated with this new antennas were made using elliptic cylinder sections, they can be arbitrary smooth convex shapes which are attached to the horn such that the junction forms a smooth surface to the touch. GRA

N80-24540# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A NEW ALGORITHM FOR ADAPTIVE RADAR SIGNAL PROCESSING
Darrol F. DeLong 31 Dec. 1979 49 p refs
(Contract F19628-80-C-0002; AF Proj. 2217)
(AD-A082856; TN-1979-72; ESD-TR-79-312) Avail: NTIS HC A03/MF A01 CSCL 17/9

A new adaptive processing algorithm, called Weighted Covariance Estimation (WCE), for the detection of signals in interference of unknown character is presented. Its main advantage over present techniques, such as Sample MAtrix Inversion (SMI), is its tendency not to suppress desired signals present in the learning data. WCE and SMI are compared for a radar problem of practical interest, adaptive MTI from a moving platform, using both simulated and actual radar data. GRA

N80-24541# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN EXTREMELY LIGHT-WEIGHT UHF DIPOLE ARRAY FOR SATELLITE APPLICATIONS
Charles A. Lindberg 11 Dec. 1979 30 p refs
(Contract F19628-80-C-002; AF Proj. 2029)
(AD-A082855; TN-1979-80; ESD-TR-79-282) Avail: NTIS HC A03/MF A01 CSCL 09/5

The development of an extremely light-weight, circularly-polarized crossed-dipole UHF antenna array is described. Performance characteristics of the array measured on a full-scale model including gain and VSWR curves are provided. Weighing only four pounds, the array provides a nominal 13 dB gain in the 290-400 MHz band. The unit is light weight and its durability makes it very attractive for use in satellite application. GRA

N80-24542# Fondazione Ugo Bordoni, Rome (Italy).
CALCULATION OF THE PARAMETERS OF THE RELATIONSHIP BETWEEN SPECIFIC ATTENUATION AND RAIN INTENSITY [CALCOLO DEI PARAMETRI DELLA RELAZIONE TRA ATTENUAZIONE SPECIFICA ED INTENSITA' DI PRECIPITAZIONE]
Francesco Fedi and Dario Maggiori Jul. 1978 17 p refs In ITALIAN
(FUB-35-1978) Avail: NTIS HC A02/MF A01

Starting from an ellipsoidal raindrop model, the parameters of the exponential relationship attenuation-rain intensity for vertical and horizontal polarizations are calculated for frequencies between 10 and 100 GHz. Author (ESA)

N80-24543# Fondazione Ugo Bordoni, Rome (Italy).
THE RELATIONSHIP OF ATTENUATION DIFFERENCES AND SPECIFIC PHASE DIFFERENCES TO RAINFALL INTENSITY [RELAZIONI TRA ATTENUAZIONI E FASI DIFFERENZIALI SPECIFICHE ED INTENSITA' DI PRECIPITAZIONE]
Francesco Fedi and Dario Maggiori Dec. 1978 19 p refs In ITALIAN
(FUB-36-1978) Avail: NTIS HC A02/MF A01

The parameters of the relationship between transmitting media anisotropy and rain intensity were studied to facilitate the calculation of cross polarization phenomena during microwave transmission using two orthogonally polarized carriers. Tables relating the specific attenuation and the specific phase difference to the rain intensity in both planes are presented. It is shown that the simple exponential approximation for the specific phase differences is not sufficient accurate in the region 30 to 40 GHz. Author (ESA)

N80-24544# Fondazione Ugo Bordoni, Rome (Italy).
STUDY OF A MEASURING SYSTEM FOR THE CHARACTERIZATION OF THE PHYSICAL MECHANISMS CAUSING DISCRIMINATION LOSS BETWEEN TWO ORTHOGONALLY POLARIZED TRANSMISSION CARRIERS [STUDIO DI UN SISTEMA DI MISURA PER LA CARATTERIZZAZIONE DEI MECCANISMI FISICI CAUSANTI DEGRADAZIONE DI DISCRIMINAZIONE TRA POLARIZZAZIONE ORTOGONALI]
Dario Maggiori, Piergiorgia Migliorini, and Aldo Paraboni (Politec. di Milan) Dec. 1978 50 p refs In ITALIAN
(FUB-37-1978) Avail: NTIS HC A03/MF A01

A study of a measuring system to characterize depolarization of millimetric waves at 30 GHz is presented. The theoretical accuracy limits required for measuring the interactions between non-spherical raindrops and coherent waves are discussed. The performance of measuring instruments is analyzed and the limits imposed by the existing research facilities are examined. It is concluded that such a measuring system is feasible in reference to the signal to noise ratio, while the effects due to the antenna polarization discrimination impose severe limitations. Author (ESA)

N80-24545# Aalborg Univ. (Denmark). Inst. of Electronic Systems.
DIFFRACTION OF AN ELECTRIC POLARIZED WAVE BY A RIGHT-ANGLED DIELECTRIC WEDGE
Svend Bernsten Oct. 1978 37 p refs
(R-78-1) Avail: NTIS HC A03/MF A01

The problem of diffraction of an electromagnetic wave by a dielectric wedge is formulated as a singular integral equation. When the index of refraction is near unity the solution of this equation is constructed as a power series. A simple, general way to find an approximate solution is described. The error inherent in the method is shown to be very small; for a typical case considered the relative error of the edge source is calculated to be 10 to the minus 4 power. Author (ESA)

N80-24546# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
SWITCH ELEMENT CAPACITIES IN ACCESS AREA DIGITAL SWITCHING SYSTEMS

R. F. Linfield and M. Nesenbergs Sep. 1979 192 p refs Prepared for Army Communication Systems Agency, Ft. Monmouth, N.J.
(PB80-126139; NTIA-79/26) Avail: NTIS HC A09/MF A01 CSCL 17B

The capacity of a digital circuit switching system is defined in terms of its four major elements: the traffic offered by the interface element, the maximum traffic carried by the switch matrix, the maximum number of call attempts handled by the control processor, and the maximum number of calls handled by the signaling elements. These element capacities may be engineered for the expected traffic, the performance objectives, the processor capabilities, and the signaling techniques. In a properly engineered system, the interrelations between the capacity of all elements should be considered. Such interrelationships are discussed and representative switch configurations are characterized on the basis of the four major elements. GRA

N80-24547# National Telecommunication Information Administration, Annapolis, Md.
SPECTRUM RESOURCE ASSESSMENT IN THE 2.7-2.9 GHz BAND PHASE 2: RADAR SIGNAL PROCESSING
Robert L. Hinkle, Robert M. Pratt, and Jay S. Levy Aug. 1979 363 p refs
(PB80-129323; NTIA-79/25; Rept-2) Avail: NTIS HC A16/MF A01 CSCL 17G

The signal processing properties of the primary radars in the 2.7 to 2.9 GHz band, and the Automated Radar Terminal System (ARTS-IIIA) post processor planned for use by the Federal Aviation Administration on the Airport Surveillance Radars (ASRs) were investigated. The degree of congestion in the band in designated areas in the United States was assessed. It was concluded that some spectrum conservation techniques can be used by the radiodetermination services in the 2.7 to 2.9 GHz band to obtain more efficient utilization of the spectrum. Also, the current hardware in the later model primary radars and the ARTS-IIIA will suppress asynchronous interference with tradeoffs to the desired signal performance. GRA

N80-24694*# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERE-REFLECTED PROPAGATION
B. M. Reddy *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 203-216 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 17B

N80-24695*# Air Force Geophysics Lab., Hanscom AFB, Mass.
TRANSIONOSPHERIC PROPAGATION PREDICTIONS
J. A. Klobucher, Santimay Basu (Emmanuel Coll.), Sunanda Basu (Emmanuel Coll.), P. A. Bernhardt (Stanford Univ.), K. Davies (NOAA, Boulder, Colo.), D. E. Donatelli (Regis Coll.), E. J. Fremouw (Phys. Dyn., Inc., Bellevue, Wash.), J. M. Goodman (NRL, Washington, D.C.), G. K. Hartmann (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), R. Leitinger (Graz Univ.) et al *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 217-245 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 20N

N80-24721*# Norwegian Defence Research Establishment, Kjeller.
EFFECTS OF D REGION IONIZATION ON RADIO WAVE PROPAGATION
T. R. Larsen *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 617-654 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 20N

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-24548* Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
DYNAMICS EXPLORER POWER SUBSYSTEM STUDY, PHASE B
R. C. Wong, H. A. Owen, Jr., and T. G. Wilson 16 Oct. 1979 58 p refs
(Contract NAS5-25351)
(NASA-CR-159983) Avail: Issuing Activity CSCL 09C

Modifications to the Atmospheric Explorer power system required to meet the Dynamics Explorer mission requirements are described. These include raising the switching of the 24.5 V switching regulator to 21 kHz and inserting a solar array filter between the solar array and the shunt bus. Small signal analysis is used to characterize the 24.5 V switching regualtor in order to investigate the possibility of instability and/or undesired system oscillation due to such modifications. The rest of the system is modeled as an equivalent source impedance as seen by the regulator. The stability of the 24.5 V switching regulator in the presence of the equivalent source impedance as well as the stability of the system bus voltage are analyzed extensiveley. J.M.S.

N80-24549*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTRICALLY CONDUCTIVE PALLADIUM CONTAINING POLYIMIDE FILMS Patent Application
Larry T. Taylor (Virginia Polytech. Inst. and State Univ.), Anne K. StClair (Virginia Polytech. Inst. and State Univ.), Vicki C. Carver (Virginia Polytech. Inst. and State Univ.), and Thomas A. Furtsch, inventors (to NASA) (Virginia Polytech. Inst. and State Univ.) Filed 28 Mar. 1980 16 p Sponsored by NASA
(NASA-Case-LAR-12705-1; US-Patent-Appl-SN-135058) Avail: NTIS HC A02/MF A01 CSCL 09A

A method is described for preparing lightweight, high temperature resistant, electrically conductive, palladium containing, polyimide films for use on aerodynamic and space applications. A palladium (2) ion-containing polymamic acid solution is prepared by reacting an aromatic dianhydride with an equimolar quantity of a palladium 2 ion-containing salt or complex. The reactant product is cast as a thin film onto a surface and cured at approximately 300 C to produce a flexible electrically conductive cyclic palladium containing polyimide. The source of palladium ions is selected from the gruop of palladium 2 compounds consisting of LiPdC14, Pd[S(CH3)2]2Cl2, Na2PdC14, and PdC14. NASA

N80-24550*# Three E Vehicles, San Diego, Calif.
THE PERFORMANCE AND EFFICIENCY OF FOUR MOTOR/CONTROLLER/BATTERY SYSTEMS FOR THE SIMPLER ELECTRIC VEHICLES Final Report
Paul R. Shipps May 1980 88 p refs
(Contracts DEN3-130; EC-77-A-31-1044)
(NASA-CR-159776; DOE/NASA/0130-80/1) Avail: NTIS HC A05/MF A01 CSCL 09C

A test and analysis program performed on four complete propulsion systems for an urban electric vehicle (EV) is described and results given. A dc series motor and a permanent magnet (PM) motor were tested, each powered by an EV battery pack and controlled by (1) a series/parallel voltage-switching (V-switch) system; and (2) a system using a pulse width modulation, 400 Hz transistorized chopper. Dynamometer tests were first performed, followed by eV performance predictions and data correlating road tests. During dynamometer tests using chopper control; current, voltage, and power were measured on both the battery and motor sides of the chopper, using three types of instrumentation. Conventional dc instruments provided adequate accuracy for eV power and energy measurements, when used on the battery side of the controller. When using the chopper

controller, the addition of a small choke inductor improved system efficiency in the lower duty cycle range (some 8% increase at 50% duty cycle) with both types of motors. Overall system efficiency rankings during road tests were: (1) series motor with V-switch; (2) PM motor with V-switch; (3) series motor with chopper; and (4) PM motor with chopper. Chopper control of the eV was smoother and required less driver skill than V-switch control. M.G.

N80-24551*# Sperry Flight Systems, Phoenix, Ariz.
MAGNETIC SUSPENSION SYSTEM FOR AN ANNULAR MOMENTUM CONTROL DEVICE (AMCD)
Dec. 1979 114 p
(Contract NAS1-14502)
(NASA-CR-159255) Avail: NTIS HC A06/MF A01 CSCL 09C

A technique to control a rim suspended in a magnetic field was developed. A complete system was developed, incorporating a support structure, magnetic actuators, a rim drive mechanism, an emergency fail-safe system, servo control system, and control electronics. Open loop and closed loop response of the system at zero speed and at 500 revolutions per minute (r/min) of the rim was obtained and analyzed. The rim was then dynamically balanced and a rim speed of 725 r/min was achieved. An analog simulation of the hardware was developed and tested with the actual control electronics connected to the analog computer. The system under development is stable at rim speeds below 700 r/min. Test results indicate that the rim under test is not rigid. The rim has a warp and a number of binding modes which prevented achievement of higher speeds. Further development efforts are required to achieve higher rim speeds. J.M.S.

N80-24552*# Raytheon Co., Waltham, Mass.
SURFACE ACOUSTIC WAVE STABILIZED OSCILLATORS Final Report, 15 Aug. 1978 - 14 Aug. 1979
T. E. Parker, D. L. Lee, and I. Leja Sep. 1979 79 p
(Contract NAS5-25117)
(NASA-CR-159980; S-2604) Avail: NTIS HC A05/MF A01 CSCL 09A

Four areas of surface acoustic wave (SAW) controlled oscillators were investigated and a number of 401.2 MHz oscillators were constructed that showed improved performance. Aging studies on SAW devices packaged in HC36/U cold weld enclosures produced frequency drifts as low as 0.4 ppm in 35 weeks and drift rates well under 0.5 ppm/year. Temperature compensation circuits have substantially improved oscillator temperature stability, with a deviation of + or - 4 ppm observed over the range -45 C to + 40 C. High efficiency amplifiers were constructed for SAW oscillators and a dc to RF efficiency of 44 percent was obtained for an RF output of 25 mW. Shock and vibration tests were made on four oscillators and all survived 500 G shock pulses unchanged. Only when white noise vibration (20 Hz to 2000 Hz) levels of 20 G's rms were applied did some of the devices fail. J.M.S.

N80-24553# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
MANUFACTURING METHODS AND TECHNOLOGY FOR DIGITAL FAULT ISOLATION FOR PRINTED CIRCUIT BOARDS Interim Report, Sep. 1978 - Aug. 1979
25 Aug. 1979 734 p refs
(Contract DAAK40-78-C-0290; Proj. R783242)
(AD-A080839; HAC-FR79-12-669A) Avail: NTIS HC A99/MF A01 CSCL 09/5

This report describes the manufacturing technology that will enable detection, identification, and location of digital faults in advanced digital missile electronic systems. Emphasis is placed on the fault diagnosis of large printed circuit boards containing complex digital hybrid microelectronic circuits to be used in the 1980's. The identified technology provides the capability to isolate digital faults to the minimum size component level, using state-of-the-art automatic test equipment. The effort included an industry survey for digital printed circuit board test requirements and available test system capabilities, the development of digital fault isolation methodology, and the identification of the corresponding optimum available automatic test hardware. The subsequent contract option phase of this project involves the purchase, setup, and demonstration of the selected fault isolation hardware/software system, using the developed techniques.GRA

N80-24554# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TRANSCONDUCTANCE MULTIPLIERS FOR WEIGHT CIRCUITS
J. Nelson Wright 1 Jun. 1979 47 p refs
(Contract F19628-78-C-0002; AF Proj. 2029)
(AD-A081796; TN-1979-11; ESD-TR-79-99) Avail: NTIS HC A03/MF A01 CSCL 09/3

The design, construction, and measurement of weight circuits utilizing four quadrant transconductance multiplication is described. The weights operate over a 10 MHz band centered at 121.4 MHz. GRA

N80-24555# Texas Instruments, Inc., Dallas.
IC FABRICATION USING ELECTRON-BEAM TECHNOLOGY Final Report, 1 Jul. 1976 - 30 Jun. 1979
Gilbert L. Varnell, John Bartelt, and Jack Reynolds Feb. 1980 70 p refs
(Contract DAAB07-76-C-8105; DA Proj. 1L1-62705-AH-94)
(AD-A082237; TI-03-79-57; DELET-TR-76-8105-F) Avail: NTIS HC A04/MF A01 CSCL 09/3

The development of a manufacturing capability for standard bipolar circuits of conventional design using existing e-beam direct writing equipment is described. In particular, a pilot-line demonstration of significant yields of conventional 4 to 5 micrometer design rule integrated circuits which were fully tested to military specifications for performance, quality and reliability is discussed. The vehicle used for this demonstration was a standard TTL 256 bit bipolar RAM using a single level metal, junction isolated, Schottky clamped bipolar process. Emphasis was placed on utilizing a new class of high-speed electron resist in combination with selective plasma etching techniques in order to establish economical next generation very large scale integration processes. A vector scan, laser controlled e-beam direct writing system, developed with fully automatic slice alignment, was used for patterning of these devices. To determine that e-beam direct writing yields devices with no degradation in performance or reliability, optically patterned split lot controls were fabricated in parallel and used for comparative testing. M.G.

N80-24556# Maine Univ., Orono. Dept. of Electrical Engineering.
MICROWAVE SURFACE ACOUSTIC WAVE MATERIALS Final Scientific Report, 15 Feb. 1975 - 1 Jun. 1979
John F. Vetelino Feb. 1980 102 p refs
(Grant AF-AFOSR-2816-75; AF Proj. 2306)
(AD-A082079; AFOSR-80-0135TR) Avail: NTIS HC A06/MF A01 CSCL 09/3

The acoustic wave properties of several piezoelectric crystals and a layered structure have been theoretically and experimentally investigated for possible application in microwave acoustic devices. A search was made for crystals and layered structures having one or more of the following properties: (1) temperature compensation; (2) high piezoelectric coupling; (3) low power flow angle; (4) low loss; and (5) low or high acoustic wave velocities. The acoustic waves studied were the bulk acoustic waves (BAW), the surface acoustic waves (SAW), the pseudo SAW (PSAW), the plate modes and the surface skimming bulk waves (SSBW). The wave properties studied were the velocity, piezoelectric coupling, the temperature coefficient of delay, diffraction and attenuation. The layered geometries examined studied included fused silica on LiNbO3 and gold, aluminum and copper layers on quartz. The overlay structures were found to be more temperature stable than the single crystals. A theory describing the spectrum of acoustic waves emanating from an interdigital transducer was developed. Several promising cuts for SSBW in quartz were identified and studied both theoretically and experimentally. Finally, various prototype SSBW devices were fabricated and tested. GRA

N80-24557# University Coll., Cork (Ireland). Microelectronics Research Center.
SUBMILLIMETER SCHOTTKY DIODES WITH ELECTRON BEAM LITHOGRAPHY Annual Technical Report, Jul. 1978 - Nov. 1979
John B. Langley, II and G. T. Wrixon Dec. 1979 58 p refs

(Grant DA-ERO-78-G-076; DA Proj. 1T1-61102-BH-57)
(AD-A082356) Avail: NTIS HC A04/MF A01 CSCL 09/5

A microprocessor based electron beam lithography system has been developed for production of Schottky barrier diodes with submicron geometric features. The electron beam lithography system is described along with details of the fabrication procedure. Complete logic diagrams and listings of the microprocessor operating software are included. GRA

N80-24558# Northrop Corp., Des Plaines, Ill. Defense Systems Div.

I/J BAND LOW COST CROSSED-FIELD AMPLIFIER Interim Technical Report, 31 Mar. - 30 Sep. 1979

Robert R. Moats Feb. 1980 40 p refs
(Contract DAAB07-78-C-2981; DA Proj. 1L1-62705-AH-94)
(AD-A081861; Rept-094-009246; ITR-2; DELET-TR-78-2981-2) Avail: NTIS HC A03/MF 01 CSCL 09/5

This program is directed toward development of an I/J band, linear format, injected-beam crossed-field amplifier (IBCFA) for electronic warfare. The IBCFA should be capable of power output of 1000 W peak, 200 W average, between 8.5 and 17 GHz with 20 dB gain. A laser-cut shaped-substrate meander line is used. The performance objectives for E/F band CFA's include 3 kW peak pulse power output and 1 kW average power output, 20 dB gain, 2-4 GHz, for electronic warfare; and 2 kW peak pulse power output at 10-15% duty, 25 dB gain, 3.0 to 3.6 GHz, for phased-array radar. One E/F band tube has been built. Preliminary tests at 10% duty directed toward electronic warfare applications showed 3 kW peak power at midband, 1.5 kW at 2 GHz, and 2.4 kW at 4 GHz. Increased drive power leads to greater power output at the low end of the band, indicating the need for greater circuit length. This tube will be tested further for its characteristics in the phased array mode and for full rated duty in the electronic warfare mode. Another E/F band tube is under construction, this one with increased circuit length. GRA

N80-24559# Air Force Systems Command, Wright-Patterson AFB, Ohio.

ANALYSIS OF TRAVELING WAVES IN UNDERGROUND CABLES

Eduard Hoefler Feb. 1980 15 p refs Transl. into ENGLISH from Elektroprivreda (Yugoslavia), v. 30, no. 7-8, 1977 p 215-219
(AD-A082326; FTD-ID(RS)T-1864-79) Avail: NTIS HC A02/MF A01 CSCL 20/14

The form of overvoltage in underground cables for a wave with a vertical front and a falling crest is analyzed. The derived expression enables an estimate of the voltage in the cable as a function of time for any length of cable and duration of the overvoltage wave. The shorter the cable the more accurate the calculation. Figures show overvoltages in cables between two power lines and between a power line and a transformer (assuming certain wave resistances). J.M.S.

N80-24560# Kaman Sciences Corp., Colorado Springs, Colo.

NOISE CANCELLATION TRANSDUCER DEVELOPMENT PROGRAM Final Report, Jan. 1977 - May 1979

Vurnon D. Peckham and Robert T. Winnicki 31 May 1979 75 p refs
(Contract DNA001-77-C-0110)
(AD-A082801; AD-E300700; K-79-38; DNA-195048) Avail: NTIS HC A04/MF A01 CSCL 17/1

This report describes the development and ground testing of an acoustic sensor to detect boundary layer transition on models in high acoustic noise wind tunnel facilities. The noise cancellation transducer utilizes the Boundary Layer Acoustic Monitor (BLAM) detection concept to monitor the flow and employs a subtractive technique to cancel out coherent noise components to improve the signal to noise ratio. GRA

N80-24561# Yeshiva Univ., New York, N. Y.

SYSTEMATIC STUDY OF PYROELECTRICITY. APPLICATIONS OF PYROELECTRIC MATERIALS Final Technical Report, 1 Oct. 1976 - 31 Mar. 1977

M. I. Bell and Y. H. Tsuo Ft. Monmouth, N.J. Army Electronics Research and Development Command Jul. 1979 79 p refs
(Contracts DAAB07-76-C-1342; DAAB07-74-C-0470)
(AD-A082435; DELET-TR-76-1342-F) Avail: NTIS HC A05/MF A01 CSCL 20/3

Full accounts are given of theoretical and experimental studies of ferroelectric phase transitions begun under a previous contract and completed under the present one. The findings of these studies are applied to the analysis of several applications of pyroelectric materials and to the evaluation of the suitability of various ferroelectrics for these uses. A major result is that improper ferroelectrics, in which the polarization is not the order parameter, are predicted to have performance superior to that of proper ferroelectrics in both infrared imaging and thermal-to-electrical energy conversion applications. Experimental evidence is presented supporting this conclusion in the case of the pyroelectric vidicon. GRA

N80-24562# Syracuse Univ., N. Y.

NONLINEAR SYSTEM ANALYSIS IN BIPOLAR INTEGRATED CIRCUITS Progress Report, Sep. 1977 - Oct. 1979

Ta-Fang Fang and James J. Whalen Griffiss AFB, N.Y. RADC Jan. 1980 268 p refs Prepared in cooperation with State Univ. of New York at Buffalo
(Contracts F30602-79-C-0011; F30602-75-C-0122)
(AD-A082527; RADC-TR-79-324) Avail: NTIS HC A12/MF A01 CSCL 09/5

Since analog bipolar integrated circuits (IC's) have become important components in modern communication systems, the study of the Radio Frequency Interference (RFI) effects in bipolar IC amplifiers is an important subject for electromagnetic compatibility (EMC) engineering. The investigation has focused on using the nonlinear circuit analysis program (NCAP) to predict RF demodulation effects in broadband bipolar IC amplifiers. The audio frequency (AF) voltage at the IC amplifier output terminal caused by an amplitude modulated (AM) RF signal at the IC amplifier input terminal was calculated and compared to measured values. Two broadband IC amplifiers were investigated: (1) a cascode circuit using a CA3026 dual differential pair; (2) a unity gain voltage follower circuit using a micro A741 operational amplifier (op amp). Before using NCAP for RFI analysis, the model parameters for each bipolar junction transistor (BJT) in the integrated circuit were determined. Probe measurement techniques, manufacturer's data, and other researcher's data were used to obtain the required NCAP BJT model parameter values. An important contribution included in this effort is a complete set of NCAP BJT model parameters for most of the transistor types used in linear IC's. GRA

N80-24563# Raytheon Co., Bedford, Mass. Missile Systems Div.

RELIABILITY EVALUATION OF LOW POWER SCHOTTKY CLAMPED MICROCIRCUITS Final Technical Report, Sep. 1977 - Oct. 1979

K. B. Lasch, D. Bartels, J. J. Spinale, and P. H. Ackroyd Griffiss AFB, N.Y. RADC Feb. 1980 364 p refs
(Contract F30602-77-C-0186; AF Proj. 2338)
(AD-A082926; RADC-TR-80-5) Avail: NTIS HC A16/MF A01 CSCL 09/5

An evaluation study has been completed on T2L Schottky integrated circuits of medium to large scale integration. The study consisted of electrical and physical characterization, step stress and accelerated long term testing, failure analysis and failure rate determination. The objective of this study was to verify the suitability of these devices for incorporation in advanced digital military systems. Five device types were selected and each was procured from two manufacturers. Device selection was based upon the availability of the MIL-M-38510 slash sheet at the time of selection, and manufacturer selection was based upon his offering the greatest number of the devices selected. In all, in excess of 1000 devices from four different manufacturers were included in the study. Electrical characterization was accomplished on computer-based test systems augmented by bench testing of transfer characteristics and thermal resistance. GRA

N80-24564# Oak Ridge National Lab., Tenn. Atomic Molecular and High Voltage Physics Group.

HIGH VOLTAGE RESEARCH (BREAKDOWN STRENGTHS

OF GASEOUS AND LIQUID INSULATORS) AND ENVIRONMENTAL EFFECTS OF DIELECTRIC GASES Semiannual Report, 1 Apr. - 30 Sep. 1979
L. G. Christophorou, D. R. James, R. Y. Pai, R. A. Mathis, I. Sauers, L. Frees, M. O. Pace, D. W. Bouldin, and C. C. Chan Jan. 1980 128 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7173) Avail: NTIS HC A07/MF A01

Electron attachment rates were measured and unfolded to give attachment cross section junctions for CCl3F, CCl2F, and CClF3 each in N2, and for CCl3F in Ar. Electron attachment rates were measured also for n-C6F14 in both Ar and N2. The effects of molecular structure on energy cross section, and lifetime of negative ion states of organic molecules were considered. The potential role of electron detachment in breakdown and the role of dipolar scattering of electrons in inhibiting breakdown was investigated. The nature of synergisms among constituents of a gas dielectric mixture is discussed. Examples are cited from recent breakdown measurements. The initial fragmentation of 1,1,2-C2Cl3F2 under electron impact was studied. Final decomposition products of sparked SF6/2-C4F6 mixtures were identified and quantified. The breakdown products of SF6 were studied. In the study of liquid dielectrics n-hexane and perfluoro-n-hexane were tested. DOE

N80-24565# Brookhaven National Lab., Upton, N. Y.
ANALYSIS OF CRITICAL-BEND STRAIN RELATIONSHIPS IN COMPOSITE Nb3Sn SUPERCONDUCTING WIRES
Thomas Luhman and D. O. Welch 1979 5 p refs Presented at the 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract EY-76-C-02-0016)
(BNL-26989; CONF-791102-86) Avail: NTIS HC A02/MF A01

Nb3Sn conductors must meet several mechanical strain criteria including tolerance to bending strains encountered during fusion magnet construction. The dependence of critical current on bending strains in monofilamentary Nb3Sn wires is calculated and compared with experimental data. The calculation takes into account a shift in the composite's neutral axis which occurs during bending. The analysis correctly predicts the observed dependence of the critical current on bending strains. DOE

N80-24566# Sandia Labs., Albuquerque, N. Mex.
RESEARCH AND APPLICATION OF PULSED-POWER TECHNOLOGY
Gerald Yonas 12 Jan. 1980 19 p
(Contract EY-76-C094-0789)
(SAND-80-0177C) Avail: NTIS HC A02/MF A01

Pulsed power technology relating to that branch which was simulated by military applications in the 1960's is addressed. A history of the development and characteristics of some devices producing intense electron and ion beams which resulted in Sandia's particle beam fusion program is presented. These include Hermes II, Aurora, Hydra, and Proto II. Research on inertial confinement fusion ignition (ICF) is described, and the most critical issue in ICF today still is the demonstration of ignition and efficient burnup of a small amount of thermonuclear fuel. Progress on particle beam fusion accelerators is reported. DOE

N80-24567# Royal Aircraft Establishment, Farnborough (England).
COMPUTER PROGRAMS FOR THE DESIGN OF ACTIVE RC FILTERS
L. J. Richards London HMSO Mar. 1979 92 p refs
(RAE-TR-79038; RAE-RAD-NAV-76; BR70157) Avail: NTIS HC A05/MF A01

Three ALGOL 68-R programs which can be used as aids to the design of active RC filters are described. Two programs calculated the performance of standard all-pole filter types; the first program calculating the attenuation and the second the group delay. The third program calculates component values needed to implement the filter as a cascade connection of first or second order sections. Sensitivity and gain performance can also be calculated. Algorithms are described which ensure that where possible component values lie within specified bounds and take standard values. Specifications of the programs are given, together with examples of their use. Author (ESA)

N80-24568# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
A PARAMETRIC TRANSDUCER FOR THE DETECTION OF SMALL DISPLACEMENTS [TRASDUTTORE PARAMETRICO PER LA RIVELAZIONE DI PICCOLI SPOSTAMENTI]
F. Bordoni Mar. 1979 17 p refs In ITALIAN
(LPS-79-3) Avail: NTIS HC A02/MF A01

A parametric transducer used for the detection of vibrations in a gravitational antenna is described. Several noise sources were examined in detail, comparing the noise sensitivity of the described transducer with previously described transducers. Performance comparable to that of a microwave detector is attainable operating at much lower frequencies without using very high Q resonant circuits. Author (ESA)

N80-24569# Royal Aircraft Establishment, Farnborough (England).
A THICK FILM MICROSTRIP BUTLER MATRIX FOR THE FREQUENCY RANGE 1.5 TO 1.7 GHz
A. G. Tabb London HMSO Sep. 1979 96 p refs
(RAE-TR-79118; RAE-Space-568; BR72772) Avail: NTIS HC A05/MF A01

The design, construction, and electrical measurement of a 4 by 4 Butler Matrix for the 1.5 to 1.7 GHz frequency range are described. The Matrix was constructed in thick film technology on an alumina substrate. A computer aided design package was used for the circuit synthesis. As an application example, the use of this Matrix as a submatrix for a 16 by 16 Matrix which could be part of the feed system of a satellite borne steerable beam phased array of radiators allowing complete Earth coverage is discussed. Author (ESA)

N80-24570# National Bureau of Standards, Washington, D.C. Electron Devices Div.
ZINC OXIDE VARISTORS FOR LIGHTNING ARRESTER SERVICE Final Report, Oct. 1978 - Sep. 1979
Robert I. Scace Jan. 1980 25 p refs Sponsored in part by DOE
(PB80-144645; NBSIR-79-1939) Avail: NTIS HC A02/MF A01 CSCL 09A

The application of zinc oxide varistors to high power surge arresters for electrical transmission lines is considered, with particular attention to the special measurement problems posed by the application and by the unique properties of these varistors. The development of ZnO varistors and the present theory of ZnO varistor action are discussed. The need for further elaboration of the theory is considered. GRA

N80-24687*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
MAGNETIC STORM EFFECTS IN ELECTRIC POWER SYSTEMS AND PREDICTION NEEDS
Vernon D. Albertson and John G. Kappenman (Minnesota Power and Light Co.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 137-148 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 09C

N80-24688*# British Columbia Univ., Vancouver. Dept of Geophysics and Astronomy.
THE PROBLEM OF SOLAR INDUCED CURRENTS
D. H. Boteler *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 149-161 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 09C

N80-24689*# Manitoba Univ., Winnipeg. Dept. of Electrical Engineering.
PREDICTION OF SOLAR INDUCED CURRENTS AND EFFECTS ON POWER TRANSMISSION SYSTEMS IN CENTRAL CANADA
W. R. Goddard and W.-M. Boerner (Illinois Univ. at Chicago Circle) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 162-171 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 09C

N80-24690*# British Columbia Univ., Vancouver. Dept. of Geophysics and Astronomy.
HARMONICS OF 60 Hz IN POWER SYSTEMS CAUSED BY GEOMAGNETIC DISTURBANCES
K. Hayashi, T. Oguti, T. Watanabe, K. Tsuruda, S. Kokubun, and R. E. Horita (Victoria Univ., British Columbia) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 172-181 refs Prepared in cooperation with Tokyo Univ., Japan (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 09C

N80-24691*# Geological Survey, Denver, Colo.
INDUCED ELECTRIC CURRENTS IN THE ALASKA OIL PIPELINE MEASURED BY GRADIENT, FLUXGATE, AND SQUID MAGNETOMETERS
Wallace H. Campbell and James E. Zimmerman (NBS, Boulder, Colo.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 182-192 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-24571 State Univ. of New York at Stony Brook.
INTERFEROMETRIC STUDIES OF NATURAL CONVECTIVE HEAT TRANSFER IN VARIOUS AIR SPACE GEOMETRIES Ph.D. Thesis
Yih-Jung Yeh 1980 201 p
Avail: Univ. Microfilms Order No. 8011337

Mach-Zehnder interferometric methods were employed to identify, modify, and improve the thermal performance of various air spaces. Horizontal balsa wood dividers were employed as separators in a vertical rectangular air space where an imposed temperature gradient is maintained across the short dimension. The balsa wood separators were employed to create a multiplicity of subspaces of the original rectangular space. Experimental results show that free convection was suppressed by the introduction of the balsa wood dividers in the studied air spaces. It is found that the overall Nusselt number is decreased where the free convective heat transfer dominates. The Nusselt number is increased where the conductive heat transfer dominates. The effects of air leaks on the boundaries, which allowed air mass exchange among the divided air spaces, were investigated. Results show that contiguous air spaces which are coupled by small air leaks provide heat transfer rates which are approximately the same as for the uncoupled air space systems. Cellularization of large air spaces is shown to be a useful tool for suspression of convective heat transfer. Dissert. Abstr.

N80-24572 Texas Univ. at Austin.
DETERMINATION OF FRICTION FACTORS AND HEAT TRANSFER COEFFICIENTS FOR FLOW PAST ARTIFICIALLY ROUGHENED SURFACES Ph.D. Thesis
Stephen Andrew Hodge 1979 224 p
Avail: Univ. Microfilms Order No. 8009873

A critical review of the underlying assumptions, theoretical foundations, and supporting experimental evidence for the analytical procedures in current use for the evaluation of roughness effects of heat transfer surfaces of gas cooled reactors are discussed. A method is demonstrated for determination of the slope and intercept of the universal logarithmic dimensionless velocity distribution law for past roughened surfaces without the need for experimental measurement of the velocity profile. The slope is shown to vary with the nature of the roughened surface and to deviate considerably from the slope for turbulent flow past smooth walls in some cases. It is further shown that the intercept, which is a boundary condition equivalent to the roughness parameter for friction, is independent of the width of the velocity profile. The dependence noted by previous investigators was due to their assumption that the slope of the dimensionless velocity profile for flow past rough surfaces has a value equal to that of the slope of this profile in flow past smooth surfaces. A similar method is developed for determination of the slope and intercept of the dimensionless temperature distribution law, but additional experimental investigation is required before the efficacy of this application can be conclusively established. Dissert. Abstr.

N80-24573* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT EXCHANGER AND METHOD OF MAKING Patent
Anthony Fortini and John M. Kazaroff, inventors (to NASA) Issued 29 Apr. 1980 6 p Filed 30 Nov. 1977 Supersedes N79-21313 (17 - 02, p 0164) Div. of US Patent Appl. SN-559846, filed 19 Mar. 1975, US Patent No-4,108,241
(NASA-Case-LEW-12441-2; US-Patent-4,199,937; US-Patent-Appl-SN-856462; US-Patent-Class-60-267; US-Patent-Class-239-127.1; US-Patent-Appl-SN-559846) Avail: US Patent and Trademak Office CSCL 20D

A heat exchange of increased effectiveness is disclosed. A porous metal matrix is disposed in a metal chamber or between walls through which a heat-transfer fluid is directed. The porous metal matrix has internal bonds and is bonded to the chamber in order to remove all thermal contact resistance within the composite structure. Utilization of the invention in a rocket chamber is disclosed as a specific use. Also disclosed is a method of constructing the heat exchanger.
Official Gazette of the U.S. Patent and Trademark Office

N80-24574*# Mississippi State Univ., State College. Dept. of Aerospace Engineering.
NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR HIGH REYNOLDS NUMBER INCOMPRESSIBLE TURBULENT FLOW M.S. Thesis
David S. Thompson May 1980 68 p refs
(Grant NGR-25-001-055)
(NASA-CR-163154) Avail: NTIS HC A04/MF A01 CSCL 20D

The full Navier-Stokes equations for incompressible turbulent flow must be solved to accurately represent all flow phenomena which occur in a high Reynolds number incompressible flow. A two layer algebraic eddy viscosity turbulence model is used to represent the Reynolds stress in the primitive variable formulation. The development of the boundary-fitted coordinate systems makes the numerical solution of these equations feasible for arbitrarily shaped bodies. The nondimensional time averaged Navier-Stokes equations, including the turbulence mode, are represented by finite difference approximations in the transformed plane. The resulting coupled system of nonlinear algebraic equations is solved using a point successive over relaxation iteration. The test case considered was a NACA 64A010 airfoil section at an angle of attack of two degrees and a Reynolds number of 2,000,000. A.R.H.

N80-24575*# Tennessee State Univ., Nashville. Dept. of Mechanical Engineering.
AN INVESTIGATION OF THE MOTION OF SMALL PARTICLES AS RELATED TO THE FORMULATION OF ZERO GRAVITY EXPERIMENTS Final Report
V. S. Sastry May 1980 17 p refs
(Grant NsG-8032)
(NASA-CR-163146) Avail: NTIS HC A02/MF A01 CSCL 20D

The nature of Brownian motion and historical theoretical investigations of the phenomemon are reviewed. The feasibility of using a laser anemometer to perform small particle experiments in an orbiting space laboratory was investigated using latex particles suspended in water in a plastic container. The optical equipment and the particle Doppler analysis processor are described. The values of the standard deviation obtained for the latex particle motion experiment were significantly large compared to corresponding velocity, therefore, their accuracy was suspect and no attempt was made to draw meaningful conclusions from the results. A.R.H.

N80-24576*# Old Dominion Univ. Research Foundation, Norfolk, Va.

TAP 2: A FINITE ELEMENT PROGRAM FOR THERMAL ANALYSIS OF CONVECTIVELY COOLED STRUCTURES Contractor Report, Oct. 1976 - Jan. 1980
Earl A. Thornton May 1980 88 p refs
(NASA-CR-159038) Avail: NTIS HC A05/MF A01 CSCL 20D

A finite element computer program (TAP 2) for steady-state and transient thermal analyses of convectively cooled structures is presented. The program has a finite element library of six elements: two conduction/convection elements to model heat transfer in a solid, two convection elements to model heat transfer in a fluid, and two integrated conduction/convection elements to represent combined heat transfer in tubular and plate/fin fluid passages. Nonlinear thermal analysis due to temperature-dependent thermal parameters is performed using the Newton-Raphson iteration method. Transient analyses are performed using an implicit Crank-Nicolson time integration scheme with consistent or lumped capacitance matrices as an option. Program output includes nodal temperatures and element heat fluxes. Pressure drops in fluid passages may be computed as an option. User instructions and sample problems are presented in appendixes. Author

N80-24577*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXTENSION OF SIMILARITY TEST PROCEDURES TO COOLED ENGINE COMPONENTS WITH INSULATING CERAMIC COATINGS
Herbert J. Gladden May 1980 16 p refs
(NASA-TP-1615; E-337) Avail: NTIS HC A02/MF A01 CSCL 20D

Material thermal conductivity was analyzed for its effect on the thermal performance of air cooled gas turbine components, both with and without a ceramic thermal-barrier material, tested at reduced temperatures and pressures. The analysis shows that neglecting the material thermal conductivity can contribute significant errors when metal-wall-temperature test data taken on a turbine vane are extrapolated to engine conditions. This error in metal temperature for an uncoated vane is of opposite sign from that for a ceramic-coated vane. A correction technique is developed for both ceramic-coated and uncoated components. Author

N80-24578*# Aeronautical Research Associates of Princeton, Inc., N. J.
COMPUTATIONAL MODELS FOR THE VISCOUS/INVISCID ANALYSIS OF JET AIRCRAFT EXHAUST PLUMES Final Report
Sanford M. Dash, Harold S. Pergament, and Roger D. Thorpe May 1980 78 p refs
(Contract NAS1-14794)
(NASA-CR-3289; ARAP-408) Avail: NTIS HC A05/MF A01 CSCL 20D

Computational models which analyze viscous/inviscid flow processes in jet aircraft exhaust plumes are discussed. These models are component parts of an NASA-LaRC method for the prediction of nozzle afterbody drag. Inviscid/shock processes are analyzed by the SCIPAC code which is a compact version of a generalized shock capturing, inviscid plume code (SCIPPY). The SCIPAC code analyzes underexpanded jet exhaust gas mixtures with a self-contained thermodynamic package for hydrocarbon exhaust products and air. A detailed and automated treatment of the embedded subsonic zones behind Mach discs is provided in this analysis. Mixing processes along the plume interface are analyzed by two upgraded versions of an overlaid, turbulent mixing code (BOAT) developed previously for calculating nearfield jet entrainment. The BOATAC program is a frozen chemistry version of BOAT containing the aircraft thermodynamic package as SCIPAC; BOATAB is an afterburning version with a self-contained aircraft (hydrocarbon/air) finite-rate chemistry package. The coupling of viscous and inviscid flow processes is achieved by an overlaid procedure with interactive effects accounted for by a displacement thickness type correction to the inviscid plume interface. J.M.S.

N80-24579# Naval Postgraduate School, Monterey, Calif.
HEAT TRANSFER PERFORMANCE OF A ROTATING HEAT PIPE USING DIFFERENT CONDENSERS AND WORKING FLUIDS M.S. Thesis
Hans-Joachim Weigel Dec. 1979 57 p refs
(AD-A081805) Avail: NTIS HC A04/MF A01 CSCL 13/1

A rotating heat pipe was tested using five different copper condensers (a smooth cylinder, a spiral Noranda tube, two Hitachi tubes and a Turbotec tube) and three different working fluids (distilled water, ethanol and Freon 113). All condensers were tested with filmwise condensation at rotational speeds of 700, 1400, 2800 rpm. The heat transfer rate of each run was measured and plotted against the temperature difference between the vapor and the cooling water inlet. The main objective was to compare the different condenser configurations and working fluids with respect to the heat transfer achieved. The best heat transfer performance was achieved by using the spiral Noranda tube and distilled water as working fluid. With this tube rotating at 2800 rpm the heat pipe was capable of transferring 6.5 KW at a vapor temperature of 90 C. The maximum increase in performance of 300% over the smooth cylinder occurred when using the Turbotec tube and Freon 113 as working fluid. GRA

N80-24580# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL STUDY OF FILMWISE CONDENSATION ON HORIZONTAL ENHANCED CONDENSER TUBING M.S. Thesis
Huseyin Ciftci Dec. 1979 171 p refs
(AD-A081603; NPS69-79-014) Avail: NTIS HC A08/MF A01 CSCL 13/1

Heat transfer and hydrodynamic performance of eight different geometrically enhanced tubes of different metals was determined. Results were compared to a 25.4 mm (1.0 in.) OD, smooth stainless steel tube. Steam at about 21 kPa (3 psia) was condensed on the outside surface of each enhanced tube, horizontally mounted in the center of a dummy tube Bank. Each tube was cooled on the inside by water. The overall heat transfer coefficient was determined directly from experimental data. The inside and outside heat transfer coefficients were determined using the Wilson plot technique. The cooling water pressure drop was measured inside the tube and converted to the friction factor in the enhanced section. The overall heat transfer coefficients of the enhanced tubes were increased as much as 1.9 times, and the corrected pressure drops of the enhanced tubes were as large as 4 times the corresponding smooth tube value for the same cooling water velocity. The helix angle should be 45 deg to 60 deg on the inside surface and 90 deg on the outside surface of the tube to obtain maximum inside and outside heat transfer coefficients. GRA

N80-24581# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
THE INFLUENCE OF BLADE PROFILE AND SLOTS ON THE PERFORMANCE OF A CENTRIFUGAL IMPELLER [INFLUENCE DU PROFIL DE PALES ET FENTES SUR LA PERFORMANCE D'UN VENTILATEUR CENTRIFUGE]
H. S. Fowler Jan. 1980 44 p refs In ENGLISH; FRENCH summary
(AD-A082728; DME-ME-248) Avail: NTIS HC A03/MF A01 CSCL 20/4

As part of the program of studies on centrifugal impellers, the problem of instability at low flows was investigated. The major cause was found to be flow detachment from the impeller vanes. Slotted blades were found to be the most effective means of delaying this detachment, and extending the working range of the blower. Low speed studies were confirmed by a test program on a high speed machine, where it was demonstrated that the improved flow range was accompanied by a general increase of efficiency. The design and placement of the slots is discussed. GRA

N80-24582# United Technologies Research Center, East Hartford, Conn.
EXPERIMENTAL INVESTIGATION OF COMPRESSOR ROTOR WAKES Final Report, 1 Sep. 1977 - 30 Sep. 1979
Robert P. Dring, H. D. Joslyn, and L. W. Hardin Wright-Patterson AFB, Ohio AFAPL Jan. 1980 51 p refs
(Contract F33615-77-C-2083; AF Proj. 2307)
(AD-A081911; UTRC/R79-914183-15; AFAPL-TR-79-2107)
Avail: NTIS HC A04/MF A01 CSCL 13/7

The detailed nature of the three dimensional flow downstream

of an isolated compressor rotor has been studied experimentally in a large scale rotating rig. Radial-circumferential arrays of pneumatic data have been acquired in the rotating frame for reference at values of (C sub x/U sub m) of 0.65, 0.75, 0.85 and 0.95 at planes 10, 30, 50 and 110% of blade axial chord aft of the rotor. The data consists of the total and static pressures and the yaw and pitch angles. From this data the relative velocity vector has been completely defined. From the data it can be seen that the radial flow in the wake increases dramatically as the rotor loading is increased (by going to lower values of (C sub x/U sub m)). At high values of (C sub x/U sub m) low total pressure fluid accumulates at the hub causing corner stall. As (C sub x/U sub m) is reduced, the radial flow carries the low total pressure fluid out to the tip, causing the hub corner stall to be inhibited, i.e. reduced in its streamwise extent aft of the blade trailing edge. By this process non-strip theory effects are seen to have a strong impact on the nature of rotor performance. GRA

N80-24583# Physical Sciences, Inc., Woburn, Mass.
ROUGH WALL REENTRY HEATING ANALYSIS. EFFECT OF SURFACE ROUGHNESS CHARACTER ON TURBULENT BOUNDARY LAYER HEATING Final Report, 1 Dec. 1977 - 30 Sep. 1979
M. L. Finson, A. S. Clarke, and P. K. S. Wu Feb. 1980 58 p refs Sponsored in part by Space and Missile Systems Organ. (Contract F49620-78-C-0028; AF Proj. 2307)
(AD-A082438; PSI-TR-204; AFOSR-80-0251TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

A Reynolds stress model is used to evaluate the effect of surface roughness on turbulent boundary layers. Roughness is represented by distributed source or sink terms in the various governing equations, the most important term being a sink term in the mean momentum equation describing firm drag on the roughness elements. The blockage effect of closely spaced elements is treated by accounting for the volume fraction occupied by the solid material. Calculations based on the theory have been compared with the available data on the influence of roughness character, where the roughness shape and spacing were varied. Reasonable agreement was obtained against most of Schlichting's low speed data with spherical, spherical segment, and conical roughness elements at various spacings. The cone measurements imply a somewhat higher effective drag coefficient than observed on the other shapes. The second set of experiments that were analyzed in detail were performed by Acurex under supersonic conditions, with a number of roughnesses created by grit or chemical etching processes. The heat transfer data and the present theory indicate spacing to be more important than height under the conditions tested. GRA

N80-24584# Pennsylvania State Univ., University Park. Applied Research Lab.
A THEORY FOR CAVITATION INCEPTION IN A FLOW HAVING LAMINAR SEPARATION
B. R. Parkin 19 Nov. 1979 187 p refs
(Contract N00024-79-C-6043)
(AD-A082851; ARL/PSU/TM-79-198) Avail: NTIS HC A09/MF A01 CSCL 20/4

An approximate theory is developed to predict onset of cavitation on hemispherical head forms for Reynolds numbers at which laminar separation is known to occur. Fairly good agreement is obtained between cavitation inception (or desinence) trends recently measured and the present theory which is based upon first principles as far as possible. Moreover, the observed occurrence of a lowest speed for 'bubble-ring' cavitation, which is the only cavitation form considered, and the range of (cutoff) speeds predicted by the present asymptotic theory show very encouraging agreement. Like the experiments, this theory suggests that the cutoff speed and its accompanying cutoff cavitation number can also depend on water temperature, provided that the initial size attributed to a 'typical' spherical free-stream air bubble nucleus also varies with temperature. At 80 F (26.6 C) it is found that the typical nucleus from which bubble-ring cavitation originates has a radius of about seven microns. At higher temperatures the nucleus radius decreases from this value while at lower temperatures the initial radius exceeds the value noted. It is also found that the onset cavitation number should be less than the magnitude of the pressure coefficient at the laminar separation point; and that the cavitation number increases with free-stream velocity. As long as there is an appreciable concentration of dissolved air in the water, it is also found that in agreement with experiment, the onset of bubble-ring cavitation is practically independent of air content. GRA

N80-24585# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
ON THE VERTICAL MOMENTUM OF THE FOUNTAIN PRODUCED BY MULTI-JET VERTICAL IMPINGEMENT ON A FLAT GROUND PLANE Final Report
K. T. Yen 1 Nov. 1979 27 p refs
(WR02302000)
(AD-A082765; NADC-79273-60) Avail: NTIS HC A03/MF A01 CSCL 20/4

An analysis of the vertical momentum flux for the fountain produced by multi-jet vertical impingement on a flat ground plane is presented. The jets are considered to have equal thrust and the same exit diameter, and to be equally-spaced on a bolt circle. Analytical formulas for both the core and arms of the fountain have been derived, and show the dependence on the height, planform size, and number of jets. Preliminary numerical comparison with some experimental data indicates the formulas to be capable to produce acceptable predictions. Comparison has also been made with Kuhn's empirical formulas, revealing some similarity as well as differences between the two sets of formulas. Additional work needed for the development of prediction methods for lift losses is suggested. GRA

N80-24586# State Univ. of New York at Buffalo. Fluid and Thermal Science Lab.
STABILITY AND TRANSITION OF WALL BOUNDARY LAYERS INDUCED BY MOVING WAVES Final Report, 15 May 1974 - 14 May 1979
J. Gordon Hall and Yehia Mamoud Amr Jul. 1979 160 p refs
(Grant AF-AFOSR-2719-74; AF Proj. 2307)
(AD-A082534; AFOSR-80-0231TR) Avail: NTIS HC A08/MF A01 CSCL 20/4

The present study concerns a theoretical investigation of stability and an experimental investigation of transition for wall boundary layers developed within unsteady plane expansion waves and behind shock waves traveling into a gas at rest. The theoretical investigation involved three tasks: the use of approximate methods for the prediction of critical Reynolds numbers, a numerical integration of the ORR-Sommerfeld equation for the incompressible boundary layer flow at the expansion wave head, and the development of a multiple scales technique for nearly quasi-steady, quasi-parallel boundary layer flows. The boundary layer flow at expansion wave head has the same velocity profile as a semi-infinite flat plate given a sudden constant acceleration after being at rest. Expansion wave boundary layer transition times observed after the time of wave head arrival, are five to eight times larger than those previously reported and most of the transition Reynolds numbers observed are above or near the critical Reynolds numbers calculated by the approximate method. Shock wave boundary layer transition times observed are also larger than those previously reported and some of the transition Reynolds numbers observed based on distance to the shock wave front are above the critical values previously calculated. GRA

N80-24587# Clemson Univ., S.C. Dept. of Mechanical Engineering.
THREE-DIMENSIONAL TRANSIENT NATURAL CONVECTION IN A HORIZONTAL CYLINDER: A NUMERICAL ANALYSIS Final Report 16 May - 31 Dec. 1979
James A. Liburdy Feb. 1980 38 p refs
(Contract F49620-79-C-0168; AF Proj. 2307)
(AD-A082858; AFOSR-80-0262TR) Avail: NTIS HC A03/MF A01 CSCL 20/13

A mathematical formulation of the governing equations for transient natural convection in a finite length horizontal cylinder is developed and constructed in finite difference form. The boundary conditions consist of radial heat flux for a specified thermal resistance, axial heat flux from one closed end and three different conditions at the other end to represent exposure to a hot convecting gas environment. The formulation is expressed

in terms of the vorticity equations, energy equation and a set of vector potential equations. Solution is by the alternating direction implicit method for the vorticity and energy equations and the successive over relaxation method for the vector potential equations. Numerical experiments were run using the model to determine the local wall heat flux and the local wall temperatures. A heat transfer correlation is presented in terms of the Nusselt and Rayleigh numbers. Steady state conditions are obtained for the nondimensional time approximately equal to .005. Circumferential heat transfer coefficient variations are shown with larger values occurring near the top of the cylinder. Axial coefficients vary within approximately 10 percent with the largest values occurring near the center of the cylinder. With respect to test conditions at the AEDC facility, the convective components appear to be less than 10 percent of the radiative heat flux to the cylinder walls when a high temperature gas (air) is enclosed in the cylinder. GRA

N80-24588# AiResearch Mfg. Co., Torrance, Calif.
HIGH-TEMPERATURE CERAMIC HEAT EXCHANGER Final Report
M. Coombs, D. Kotchick, and H. Warren Jul. 1979 366 p refs Sponsored by Elec. Power Res. Inst.
(EPRI-FP-1127) Avail: NTIS HC A16/MF A01

A ceramic heat exchanger for operation with a small, closed Brayton cycle engine was developed which operates with 3000 F combustion products on one side and heats high pressure Argon gas, which subsequently is delivered to the turbine, to 1800 F. A materials test program encompassing strength tests, cyclic fatigue tests, and stress rupture tests from room temperature to a maximum of 2950 F was conducted on various silicon carbide test specimens. Complete heat exchanger modules were produced and tested under simulated engine operating conditions up to 2300 F tube wall temperatures. The design consisting of an array of siliconized silicon carbide U tube modules employing 180, 1 inch diameter finned tubes was selected. DOE

N80-24589# Oak Ridge National Lab., Tenn. Chemistry Div.
THERMAL MOTION ANALYSIS
C. K. Johnson 1980 16 p refs
(Contract W-7405-eng-26)
(DOE/TIC-11068) Avail: NTIS HC A02/MF A01

The items selected for coverage reflect what can be determined from thermal motion studies using Bragg diffraction data. The emphasis is on rigid body and segmented body thermal motion analysis, the effects of internal molecular vibration on vibration ellipsoids, and a practical model for anharmonic vibration analysis. A quasi-orthogonal model for higher order atomic thermal motion is described. A least squares program incorporating that model has been in use since 1971 and has a history of successful application to difficult problems such as ionic conductors. DOE

N80-24590# Sandia Labs., Albuquerque, N. Mex.
CORRELATION OF NOSETIP BOUNDARY-LAYER TRANSITION DATA MEASURED IN BALLISTICS-RANGE EXPERIMENTS
D. C. Reda Nov. 1979 61 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0649) Avail: NTIS HC A04/MF A01

Preablated nosetips of various carbonaceous materials were tested in a ballistics range. Surface-temperature contours, measured with image-converter cameras were used to define boundary-layer transition-front contours. Measurements of surface roughness, surface temperature, average transition-front location, and freestream environment were combined with calculations of nosetip flowfields, and with calculations of laminar boundary-layer development in these flowfields, to transform all data into various dimensionless parameters. These parameters were defined by previous attempts to correlate existing wind-tunnel data for transition on rough/blunt bodies. Of the available correlating techniques, only one, based on the concept of a constant (critical) roughness Reynolds number for transition, was found to successfully describe both the wind-tunnel and ballistics-range data. DOE

N80-24591# Royal Aircraft Establishment, Farnborough (England).
THE STRUCTURE OF THE DOPPLER-DIFFERENCE SIGNAL AND THE ANALYSIS OF ITS AUTOCORRELATION FUNCTION
J. B. Abbiss London HMSO Jul. 1979 25 p refs Repr. from Phys. Scripta (Sweden), v. 19, 1979 p 388-395
(RAE-TR-79089; RAE-IT-165; BR71041) Avail: NTIS HC A02/MF A01

The essential characteristics of the Doppler-difference signal and of the associated autocorrelation function are considered for both laminar and turbulent flows. Experimental conditions under which it is known that the autocorrelation function can be analyzed to yield reliable estimates of mean velocity and turbulence intensity are specified. The various data reduction methods which are proposed are classified and briefly reviewed. It is shown that unknown flows having relatively high levels of turbulence can only be treated successfully is there are very many fringes within a beam diameter, or if frequency-shifting techniques are used to achieve an equivalent effect. The estimation of turbulence intensity in low turbulence flows also presents special difficulties and a procedure which uses information already available in the transform plane is described. Author (ESA)

N80-24592# Royal Aircraft Establishment, Farnborough (England).
MEASUREMENTS OF THE TURBULENCE AHEAD OF 45 DEG SWEPT STEP USING A DOUBLE SPLIT-FILM PROBE
L. F. East and W. G. Sawyer London HMSO Nov. 1979 39 p refs
(RAE-TR-79136; RAE-Aero-3466; BR71441) Avail: NTIS HC A03/MF A01

Initial data obtained with a special double split-film probe in the boundary layer flow ahead of a 45 deg swept step show that the probe offers a convenient means of measuring the three velocity components of turbulence. It is also shown, that the measurements are not reliable within about 15 mm of the surface. The measurements indicate that the rotation of the shear stress vector as the flow develops lags considerably behind the rotation of the velocity gradient. Author (ESA)

N80-24593# Geological Survey, Menlo Park, Calif. Water Resources Div.
DOCUMENTATION OF A FINITE-ELEMENT TWO-LAYER MODEL FOR SIMULATION OF GROUNDWATER FLOW Final Report
Michael J. Mallory Aug. 1979 353 p refs Prepared in cooperation with San Bernardino Valley Municipal Water District, Calif.
(PB80-140932; USGS/WRI-79-18; USGS/WRD/WRI-80/006) Avail: NTIS HC A16/MF A01 CSCL 08H

A finite element model is documented for simulation of ground water flow in a two-aquifer system where the two aquifers are coupled by a leakage term that represents flow through a confining layer separating the two aquifers. The computer program, FORTRAN 4 computer language, is described in detail. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-24594*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SCANNING LASER-VELOCIMETER TECHNIQUE FOR MEASURING TWO-DIMENSIONAL WAKE-VORTEX VELOCITY DISTRIBUTIONS
Luther R. Gartrell and David B. Rhodes 23 May 1980 43 p refs
(NASA-TP-1661; L-13426) Avail: NTIS HC A03/MF A01 CSCL 14B

A rapid scanning two dimensional laser velocimeter (LV)

has been used to measure simultaneously the vortex vertical and axial velocity distributions in the Langley Vortex Research Facility. This system utilized a two dimensional Bragg cell for removing flow direction ambiguity by translating the optical frequency for each velocity component, which was separated by band-pass filters. A rotational scan mechanism provided an incremental rapid scan to compensate for the large displacement of the vortex with time. The data were processed with a digital counter and an on-line minicomputer. Vaporized kerosene (0.5 micron to 5 micron particle sizes) was used for flow visualization and LV scattering centers. The overall measured mean-velocity uncertainity is less than 2 percent. These measurements were obtained from ensemble averaging of individual realizations. Author

N80-24595*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC BEHAVIOR OF A BEAM DRAG-FORCE ANEMOMETER
Gustave C. Fralick Washington May 1980 16 p refs
(NASA-TP-1687; E-340) Avail: NTIS HC A02/MF A01 CSCL 14B

A cantilevered beam with strain gages attached to the fixed ends and the minimax technique were used in an experiment conducted to determine the dynamic behavior of a drag-force anemometer in high frequency, unsteady flow. In steady flow the output of the anemometer is proportional to stream velocity head and flow angle. Fluid mechanics suggests that, in unsteady flow, the output would also be proportional to the rate of change of fluid velocity. It was determined that effects due to the rate of change of fluid velocity are negligible for the probe geometry and frequencies involved. A.R.H.

N80-24596# Defence Research Establishment Suffield, Ralston (Alberta).
DYNAMIC SIMULATION OF A CANTILEVER BEAM TYPE FORCE TRANSDUCER
D. A. Bayly Feb. 1980 60 p refs
(AD-A082314; DRES-TN-440) Avail: NTIS HC A04/MF A01 CSCL 02/1

A cantilever beam force transducer was modelled as a massless elastic section at the base with the remaining section of the beam rigid and having mass. Computer programs were written to simulate free or forced, damped or undamped vibrations of the beam. Good agreement was found between predicted and experimental frequencies of undamped free vibration for two different beams. After further verification, the computer programs can be used to determine beam configurations, viscous damping factors, and loading rates which will reduce unwanted oscillations of the transducer element. GRA

N80-24597# Weizmann Inst. of Science, Rehovoth (Israel).
DEVELOPMENT OF RECORDING MATERIALS FOR HOLOGRAPHIC NON-DESTRUCTIVE TESTING Final Report, 1 Jun. 1976 - 30 Aug. 1978
A. A. Friesem and S. Reich Aug. 1979 68 p refs
(Grants AF-AFOSR-3421-77; AF-AFOSR-3004-76; AF Proj. 2307)
(AD-A082030; AFFDL-TR-79-3089) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report describes a two year effort on investigating two recording materials for in-situ, real-time holographic nondestructive field testing application, namely, photodielectrics and photoconductor thermoplastic devices (PC-TP). The holographic parameters as well as the recording mechanism of photo-dielectric materials were thoroughly studied. The recording mechanism is attributed to photochemically induced cross links of macromolecules. Resolution on excess of 2500 1/mm and diffraction efficiency approaching 100% were measured. Due to the low exposure sensitivity, about 1 J/sq cm, this recording material could only be incorporated into systems for testing relatively small objects. A number of ways for operating the PC-TP devices more reliably and for improving the spatial bandwidth to over 1800 1/mm were established. Furthermore, the frost formation mechanism was investigated, and means for supressing the frost were determined, thereby leading to improved signal-to-noise ratio. These results together with the high exposure sensitivity (50 erg/sq cm and the improvements in sample fabrication, have led to an operable device which may be incorporated into most holographic non-destructive systems. GRA

N80-24598# Stanford Univ., Calif. Dept. of Physics.
MODELING AND ERROR ANALYSIS OF A SUPERCONDUCTING DUCTING GRAVITY GRADIOMETER Final Report
Kai Yuen Wang Aug. 1979 264 p refs
(Grant AF-AFOSR-2913-76; AF Proj. 2309)
(AD-A082535; AFOSR-80-0219TR) Avail: NTIS HC A12/MF A01 CSCL 17/7

The demand for higher accuracy in inertial navigation systems has pushed the development of more accurate accelerometers and gyroscopes. Inertial navigation systems (INS) can now be built with error stemming mainly from the uncertainty of the vertical along the flight path (Savet, 1970). The deflection of the vertical is produced by mass anomalies on the surface of the earth. The error can be corrected by measuring the gravity gradient and using it in the navigation equations. This possibility has generated intensive interest and research in the field of gravity gradiometry. The lower bound of the resolution of room temperature gravity gradiometers is thermal (Brownian) noise. By lowering the temperature to 4 K, the noise level is smaller by an order of magnitude. A comparatively simple gravity gradiometer can be built using some newly developed superconducting technology. GRA

N80-24599# United Nuclear Industries, Inc., Richland, Wash.
ULTRASONIC FLOWMETERS Progress Report
W. D. Wittekind 12 Nov. 1979 58 p refs
(Contract EY-76-C-06-1857)
(UNI-1405) Avail: NTIS HC A04/MF A01

A prototype ultrasonic flowmeter was assembled and tested. The theoretical basis of this prototype ultrasonic flowmeter is reviewed. The equipment requirements for a portable unit, the individual electronic modules contained in the prototype, and the operating procedures and configuration are explained. The data from preliminary calibrations are presented. The calibration data confirm that the prototype operates according to theoretical prediction and provides nonintrusive flow measurements to predicted accuracies for pipes larger than two inches, under single phase stable flow conditions. DOE

N80-24600# United Nuclear Industries, Inc., Richland, Wash.
ULTRASONIC FLOWMETERS Interim Progress Report
W. D. Wittekind and H. Toffer 31 Jan. 1979 28 p refs
(Contract EY-76-C-06-1857)
(UNI-1318) Avail: NTIS HC A03/MF A01

Ultrasonic flow measuring and flow characterization methods for use in flows of primary coolant, secondary water, and auxiliary water systems are examined. The major advantage of these methods is that they do not require penetration or alteration of the fluid containment structure. An evaluation of commercially available equipment is given and testing of the equipment is described. DOE

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-24601 Columbia Univ., New York.
A COLLECTIVE FREE ELECTRON LASER Ph.D. Thesis
David Bruce McDermott 1979 146 p
Avail: Univ. Microfilms Order No. 8009686

A tunable, free electron laser operated in the stimulated Raman scattering regime is discussed. An intense relativistic electron beam (1.2MV,25kA) propagating in a rippled magnetic field scattered megawatt level radiation at sub-millimeter wavelengths (400 microns). The performance of the device is determined by the pulse length of the accelerator and its voltage fluctuation. With high fluctuation disruption of the three-wave resonance can occur, and the radiation is absorbed by the electrons. The general scattering processes of a cold e-beam are discussed in the theoretical section. The model not only describes the immediate experiment, but also has ramifications for the earlier experiments which collective effects were assumed

negligible. The oscillating two-stream instability contributed to their observed gain. A reformulation of three-wave scattering where the space charge wave has assumed the role of the idler is also presented, and an original derivation of the parametric growth rate for scattering with the electromagnetic cyclotron wave as idler. Dissert. Abstr.

N80-24602*# National Aeronautics and Space Administration. Pasadena Office, Calif.
COHERENTLY PULSED LASER SOURCE Patent Application
Jack S. Margolis, inventor (to NASA) (JPL) Filed 15 May 1980 12 p
(Contract NAS7-100)
(NASA-Case-NPO-15111-1; US-Patent-Appl-SN-150040) Avail: NTIS HC A02/MF A01 CSCL 20E

An electronically controllable apparatus is described which modulates a continuous wave laser beam so as to produce an output beam consisting of coherent 'pulses' that are electronically controllable as to both pulse repetition rate and pulse width. The apparatus includes two acoustic devices positioned so that the laser beam passes through them in sequence, and an apparatus for passing sound waves through the devices to frequency shift the laser radiation as well as to diffract it. Each acoustic device generates sound waves containing a group of frequencies which result in spaced pulses. The spreading of a laser beam which emanates from the first acoustic device is countered by the second acoustic device to produce a collimated, coherently pulses, laser beam. NASA

N80-24603*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Science.
ANALYSIS OF LUNAR LASER RANGING DATA FOR EARTH DYNAMICS APPLICATIONS Final Report
Charles C. Counselman, III 31 Jan. 1980 9 p
(Grant NsG-7428)
(NASA-CR-163145) Avail: NTIS HC A02/MF A01 CSCL 20E

The effects of elasticity and of tidal friction within the Moon were incorporated into the numerical model of the Moon's rotation which was used in an effort to determine the axial rotation of the Earth, as measured by Universal Time. Some 2,651 normal points representing ranges measured to Lunokhod 2, and to the Apollo 11, 14, and 15 retroflectors were analyzed. Smoothed estimates derived from the lunar rangefinding were compared with smoothed values published by the International Bureau of Time, in the 1968 and 1969 systems. The derived values at the observation sight were connected to corresponding values at the Conventional International Origin, using the BIH data for polar motion. Differences are discussed. A.R.H.

N80-24604*# Stanford Univ., Calif. Labs. of Physics.
STUDIES OF LASER AND LASER DEVICES Final Report, 1 Apr. 1979 - 31 Mar. 1980
S. E. Harris, A. E. Siegman, and J. F. Young May 1980 34 p refs
(Grant NsG-7619)
(NASA-CR-163144; SU-GL-3132) Avail: NTIS HC A03/MF A01 CSCL 20E

The generation of tunable, infrared, and ultraviolet light, and the control of this light by mode-locking and modulation techniques are discussed. Particular emphasis is given to energy storage and extraction using atomic levels, the development of a tunable narrowband vacuum ultraviolet light source, and to the generation and applications of ultrashort optical pulses. A.R.H.

N80-24605# Textron Bell Aerospace Co., Buffalo, N. Y.
NUMERICAL MODEL DEVELOPMENT FOR LASER CAVITY FLOWFIELDS Interim Report, 31 May 1978 - 31 May 1979
J. T. Schimke 1979 64 p refs
(Contract F49620-77-C-0070; AF Proj. 2304)
(AD-A078297; Rept-9278-950002; AFOSR-79-1239TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

A recently developed subroutine package for the integration of systems of ordinary differential equations by implicit methods is tested on a variety of gas dynamic problems. These problems include one dimensional unsteady gas flow with chemistry and radiation and two and three dimensional parabolic (steady) Navier-Stokes problems. The governing partial differential equations were converted to systems of ordinary differential equations using either finite differences or finite elements, and then integrated by the implicit integration package. GRA

N80-24606# United Technologies Research Center, East Hartford, Conn.
ELECTRON-BEAM-SUSTAINED BLUE/GREEN LASER PUMP Final Technical Report
R. T. Brown and W. L. Nighan Feb. 1980 46 p refs
(Contract N00014-78-C-0830)
(AD-A081423; UTRC/R80-924428-1) Avail: NTIS HC A03/MF A01 CSCL 07/4

Techniques are described for prolonging the duration of stable E-beam controlled excimer laser discharges, including: temporal tailoring of either the discharge voltage or the ionization source, and kinetics modification by way of additives. Theoretical and experimental results are presented for Kr F* discharges. The Xe Cl (B) formation processes are examined for conditions typical of a discharge excited laser using HCl as the chlorine donor. It is shown that vibrational excitation of HCl followed by dissociative attachment is a primary step in the reaction sequence resulting in Cl(-). Formation of XeCl(B) is the result of a three body Xe(+) - Cl(-) recombination reaction. Experimental results are presented which demonstrate (approx. 2%) Xe Cl laser operation in an e-beam assisted discharge in which over 75% of the energy was deposited by the discharge. GRA

N80-24607# General Electric Co., Philadelphia, Pa. Space Div.
DESIGN STUDY OF A LASER RADAR SYSTEM FOR SPACEFLIGHT APPLICATION Final Report, 7 Sep. 1978 - 7 Dec. 1979
W. F. Brehm and J. L. Buckley Dec. 1979 249 p refs
(Contract F19628-78-C-0204; AF Proj. 6690)
(AD-A082332; AFGL-TR-79-0264) Avail: NTIS HC A11/MF A01 CSCL 04/1

This report provides the analyses of several laser measurement techniques for the determination of the density of the neutral atmosphere from space. Several operational concepts of a laser radar system for spaceflight applications were investigated, including also, a proof-of-concept balloon-based experiment. The recommended baseline density measurement technique uses two wavelengths and the wavelength dependence of Rayleigh scattering (1/lambda to the 4th power) and Mie scattering (about 1/lambda) to separate the neutral atmosphere returns from those of aerosols and particulates. GRA

N80-24608# Calspan Advanced Technology Center, Buffalo, N.Y. Aerodynamic Research Dept.
MEASUREMENT OF KINETIC RATES FOR CARBON MONOXIDE LASER SYSTEMS Final Scientific Report, Oct. 1978 - 30 Oct. 1979
J. W. Rich, R. C. Bergman, and M. J. Williams Nov. 1979 111 p refs
(Contract F49620-77-C-0020; AF Proj. 2301)
(AD-A082345; CALSPAN-WG-6021-A-3; AFOSR-80-0207TR) Avail: NTIS HC A06/MF A01 CSCL 20/10

A continuous wave carbon monoxide laser is used to excite the vibrational mode of CO in gas mixtures flowing through an absorption cell. High steadystate excitation of the CO vibrational mode (0.3 eV/molecule) is achieved, while a translational-rotational temperature near 300 K is maintained by the steady flow of cold gas into the cell. These non-equilibrium conditions result in extreme vibration - vibration pumping populating high-lying vibrational quantum levels (to V = 42) of CO. N2 can also be pumped by vibrational energy transfer from CO. Using the experimantal technique, the vibration-translation (V-T) deactivation rates for high vibrational quantum levels of carbon monoxide have been measured for collisions of carbon monoxide with argon at room temperature. The rates are quantum-state-resolved and have been measured for quantum levels from V = 10 up 10 v = 42. GRA

N80-24609# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
HEL PHASE CONTROL
Kenneth W. Kaiser Sep. 1979 90 p refs

(Contract DAAK40-78-C-0117)
(AD-A081917; R-1303) Avail: NTIS HC A05/MF A01 CSCL 20/5

This report summarizes progress toward a solution to the problem of HEL control-loop instability in the presence of thermal blooming. Current phase-control-loop structure is analyzed, and a dual-loop structure is proposed. A corresponding closed-loop phase-compensation control algorithm is also proposed, and its fundamental requirements identified. Because the key subsystem impacted by the control algorithm is the HEL deformable mirror, considerable attention is paid to adaptive-optics deformable-mirror requirements for both continuous-wave and pulsed lasers. GRA

N80-24610# Colorado State Univ., Fort Collins. Dept. of Chemistry.
LASER SPECTROSCOPIC STUDIES OF MOLECULAR CRYSTALS Final Report, 1 Jun. 1975 - 30 Nov. 1979
Elliot R. Bernstein Mar. 1980 7 p
(Contract N00014-75-C-1179; NR Proj. 056-607)
(AD-A082334) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report summarizes the work performed under the contract from 1 June 1975 to 30 November 1979. It includes a summary of new results, a list of all technical reports generated during the life of the contract, and a listing of personnel associated with the project. GRA

N80-24611# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
STUDY OF LASER CREATED METAL VAPOR PLASMAS Final Technical Report, 1 Oct. 1978 - 30 Sep. 1979
R. M. Measures 16 Nov. 1979 71 p refs
(Grant AF-AFOSR-2902-76; AF Proj. 2301)
(AD-A082215; AFOSR-80-0193TR) Avail: NTIS HC A04/MF A01 CSCL 20/9

During the past year the 'Laser Ablation and Selective Excitation Spectroscopy' facility has been extended to provide a dual wavelength excitation and monitoring capability. Work on an experiment, that is directed at making the first direct spatially and temporally resolved measurements of the ion to neutral ground state population ratio in a laser ablation plasma, has recently been commenced. The preliminary results attained to date have been encouraging. GRA

N80-24612# Toronto Univ. (Ontario). Dept. of Chemistry.
STUDY IN MOLECULAR LASERS Final Technical Report, 1 Jun. 1975 - 15 Dec. 1979
George Burns 11 Feb. 1980 14 p refs
(Grant AF-AFOSR-2856-75)
(AD-A081982; AFOSR-80-0181TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

Chemical reactions important in molecular lasers were studied with a special emphasis on atomic recombinations and on dissociation of diatomic molecules. The experiments involved flash photolysis and shock wave techniques. The results were explained in terms of 3-D trajectory calculations. GRA

N80-24613# Army Missile Command, Redstone Arsenal, Ala. High Energy Research Lab.
CUMULATIVE REACTANT SPECIES INDEX FOR VOLUMES 1-5 OF THE COMPILATION OF DATA RELEVANT TO GAS LASERS, VOLUME 6
E. W. McDaniel, M. R. Flannery, E. W. Thomas, H. W. Ellis, K. J. McCann, S. T. Manson, J. W. Gallagher, S. R. Rumble, E. C. Beaty, and T. G. Roberts Sep. 1979 143 p Prepared in cooperation with Georgia Inst. of Technol., Atlanta, Georgia State Univ., Atlanta, and Colorado Univ., Boulder
(AD-A082665; DRSMI-H-78-1-Vol-6) Avail: NTIS HC A07/MF A01 CSCL 20/5

This volume contains a cumulative reactant species index for MIRADCOM Technical Report H-78-1. Volumes 1 and 2 covered data relevant to rare gas monohalide excimer lasers. Volumes 3-5 covered data relevant to nuclear pumped lasers. GRA

N80-24614# Memphis State Univ., Tenn. Inst. for Engineering Research.
INVESTIGATION OF THE PULSE-TO-PULSE PHASE COHERENCE OF CARBON DIOXIDE LASERS Final Report, 15 Jan. 1979 - 14 Jan. 1980
Carl E. Halford Jan. 1980 28 p refs
(Grant DAAG29-79-C-0018)
(AD-A082613; ARO-16279.2-R-P) Avail: NTIS HC A03/MF A01 CSCL 20/5

The phase coherence properties of pulsed carbon dioxide lasers are analyzed. Experimental results for a self-pulsing helium neon ring laser are presented and used to calculate the average phase coherence time for that system. Experimental factors are the primary limitations for phase coherence. These factors influence the phase by altering the resonant cavity by mirror motion or by index of refraction changes. The importance of these two factors are assessed for high power TEA lasers using the experimental results of others. A novel technique of active phase correction for correcting the phase of pulsed lasers is presented. GRA

N80-24615# Harry Diamond Labs., Adelphi, Md.
ASSESSMENT OF Pr(3+):KY3F10 AS A BLUE-GREEN LASER
Clyde A. Morrison, Donald F. Wortman, Richard P. Leavitt, and Hans P. Jenssen Feb. 1980 28 p refs
(Contract MIPR-78-MP-80020)
(AD-A082982; HDL-TR-1897) Avail: NTIS HC A03/MF A01 CSCL 20/5

The reported energy levels of praseodymium and europium in the host material KY3F10 have been analyzed. Using the X-ray data, lattice sums have been done, and odd crystal-field parameters have been calculated. Using these results, the transition probabilities for both magnetic and electric dipoles have been calculated for the rare earth ions. Discussions are given of the application of the results to a blue-green laser using praseodymium. GRA

N80-24616# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A STUDY OF CRYOGENIC TECHNIQUES FOR OPERATING HYDROGEN MASERS Interim Report, 1 Jul. 1979 - 31 Jan. 1980
Robert F. C. Nessot Feb. 1980 7 p
(Contract N00014-77-C-0777)
(AD-A082937) Avail: NTIS HC A02/MF A01 CSCL 20/13

Cryogenic Techniques are applied to the Atomic Hydrogen Maser Frequency Standard to extend the storage time of the atoms and reduce the thermal noise accompanying the signal and within the resonance linewidth. Oscillation has been achieved below 25 K using wall coatings of frozen CF4. A pair of new masers is under construction so that frequency stability improvement can be measured. Stability at the 10 to the -18th power level in Delta f/f for averaging time intervals of 1,000 seconds is expected at temperatures below 30 K. GRA

N80-24617# California Univ., Livermore. Lawrence Livermore Lab.
EXPERIMENTS WITH POLYMER COATED MICROSPHERES IRRADIATED BY THE SHIVA LASER SYSTEM
J. M. Auerbach, K. R. Manes, D. L. Matthews, L. N. Koppel, S. M. Lane, E. M. Campbell, N. Ceglio, D. Phillion, P. H. Y. Lee, V. Rupert et al 10 Nov. 1979 18 p refs Presented at the 21st Ann. Meeting of the Am. Phys. Soc., Boston, 12-16 Nov. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83057; CONF-791135-2) Avail: NTIS HC A02/MF A01

Polymer coated spherical targets were irradiated by the Shiva laser system in an effort to compress the contained 10 mg/cc DT fuel to super liquid densities. Glass microspheres of 140 micron ID and 5 micron wall thickness with polymer coatings 15 micron to 100 micron thick were irradiated with laser pulses of 4 kilojoules in 200 psec FWHM. Target performance was diagnosed with neutron yield measurements, radiochemistry, Argon line imaging, and X-ray imaging techniques. Ball in plate targets achieved greater implosion symmetry than free standing ball targets. With yields of ten million to one hundred million neutrons, targets reached DT fuel compressions of several times liquid density. DOE

N80-24618# Los Alamos Scientific Lab., N. Mex.
PLANAR STREAK CAMERA LASER-DRIVEN SHOCKWAVE STUDIES
L. R. Veeser, A. J. Lieber, and J. C. Solem 1979 6 p refs
Presented at the Intern. Conf. on Lasers, Orlando, Fla., 17-21 Dec. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3509; CONF-791220-3) Avail: NTIS HC A02/MF A01

High pressure equation-of-state parameter determination is now possible using a high-energy laser to drive shock waves into a multiple foil target. Progress in the design of streak cameras and targets has reduced the errors and uncertainties in impedance-match measurements to about 5 to 10%, and further improvements are expected in the near future. Initial measurements are reported for pressures in the few-megabar region for gold and aluminum. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-24619*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FULLY PLASMA-SPRAYED COMPLIANT BACKED CERAMIC TURBINE SEAL Patent Application
R. C. Bill, inventor (to NASA) Filed 30 Apr. 1980 7 p
(NASA-Case-LEW-13268-1; US-Patent-Appl-SN-145209) Avail: NTIS HC A02/MF A01 CSCL 11A

To maintain the minimum operating clearances between the blade tips and the lining of a high pressure turbine, a low temperature easily decomposable material, such as a polymer, in powder form is blended with a high temperature oxidation resistant metal powder. The two materials are simultaneously deposited on a substrate formed by the turbine casing. Alternately, the polymer powder may be added to the metal powder during plasma spraying. A ceramic layer is then deposited directly onto the metal-polymer composite. The polymer additive mixed with the metal is then completely volatilized to provide a porous layer between the ceramic layer and the substrate. Thermal stresses are reduced by virtue of the resulting porous structure which affords a cushion effect. By using plasma spraying for depositing both the powders of the metal and polymer material, as well as the ceramic powder, no brazing is required. NASA

N80-24620*# Chrysler Corp., Detroit, Mich.
BASELINE AUTOMOTIVE GAS TURBINE ENGINE DEVELOPMENT PROGRAM Final Report
C. E. Wagner, ed. and R. C. Pampreen, ed. Apr. 1979 182 p refs Sponsored by NASA
(Contracts EY-76-C-02-2749; EC-77-A-31-1040)
(NASA-CR-159670; DOE/NASA/2749-79/1-Vol-1; COO-2749-42) Avail: NTIS HC A09/MF A01 CSCL 21A

Tests results on a baseline engine are presented to document the automotive gas turbine state-of-the-art at the start of the program. The performance characteristics of the engine and of a vehicle powered by this engine are defined. Component improvement concepts in the baseline engine were evaluated on engine dynamometer tests in the complete vehicle on a chassis dynamometer and on road tests. The concepts included advanced combustors, ceramic regenerators, an integrated control system, low cost turbine material, a continuously variable transmission, power-turbine-driven accessories, power augmentation, and linerless insulation in the engine housing. R.E.S.

N80-24621*# Chrysler Corp., Detroit, Mich.
CONCEPTUAL DESIGN STUDY OF AN IMPROVED AUTOMOTIVE GAS TURBINE POWERTRAIN Final Report
C. E. Wagner, ed. and R. C. Pampreen, ed. Jun. 1979 196 p refs
(Contracts DE-AC02-76CS-52749)
(NASA-CR-159672; DOE/NASA/2749-79/3-Vol-3; COO-2749-40) Avail: NTIS HC A09/MF A01 CSCL 21A

Automotive gas turbine concepts with significant technological advantages over the spark ignition (SI) engine were assessed. Possible design concepts were rated with respect to fuel economy and near-term application. A program plan which outlines the development of the improved gas turbine (IGT) concept that best met the goals and objectives of the study identifies the research and development work needed to meet the goal of entering a production engineering phase by 1983. The fuel economy goal is to show at least a 20% improvement over a conventional 1976 SI engine/vehicle system. On the basis of achieving the fuel economy goal, of overall suitability to mechanical design, and of automotive mass production cost, the powertrain selected was a single-shaft engine with a radial turbine and a continuously variable transmission (CVT). Design turbine inlet temperature was 1150 C. Reflecting near-term technology, the turbine rotor would be made of an advanced superalloy, and the transmission would be a hydromechanical CVT. With successful progress in long-lead R&D in ceramic technology and the belt-drive CVT, the turbine inlet temperature would be 1350 C to achieve near-maximum fuel economy. A.R.H.

N80-24622*# California State Univ., Northridge. School of Engineering and Computer Science.
STUDY OF ROLLING ELEMENT DYNAMIC INTERACTIONS WITH SEPARATOR AND RACEWAY PATHS. ROLLER SKEWING MEASUREMENTS IN ROLLER BEARINGS Final Report
Lester J. Nypan 21 May 1980 108 p refs
(Grant NsG-3065)
(NASA-CR-163186) Avail: NTIS HC A06/MF A01 CSCL 13I

Measurements of roller skewing in a 118 mm bore roller bearing operating at shaft speeds to 12000 rpm are reported. High speed motion pictures of a modified roller were taken through a derotation prism to record skewing as the roller moved through loaded and unloaded regions of the bearing. Subsequent frame by frame measurement of the photographic film provided information on roller skewing. Radial and tangential skew amplitudes of .4 to .5 degrees were observed with .5 degree misalignment. Author

N80-24623# Norton Co., Worcester, Mass. Industrial Ceramics Div.
SEVERE ENVIRONMENT TESTING OF SILICON NITRIDE ROLLING ELEMENTS Final Report, 30 Dec. 1977 - 2 Mar. 1979
John W. Lucek, L. B. Sibley, and J. W. Rosenlieb Nov. 1979 82 p refs Prepared in cooperation with SKF Industries, Inc., King of Prussia, Pa.
(Contract N00019-77-C-0551)
(AD-A080801) Avail: NTIS HC A05/MF A01 CSCL 13/8

Wear rates for dry film lubricated rolling-spinning contacts of silicon nitride surfaces were studied to 540 C wear rate was essentially constant to 315 C. Surface stress modifications in hot pressed silicon nitride have been shown to improve tensile stress behavior under high magnitude Hertzian stress fields.GRA

N80-24624# Aerodyne Dallas, Tex.
TURBOCHARGING OF SMALL INTERNAL COMBUSTION ENGINES AS A MEANS OF IMPROVING ENGINE/APPLICATION SYSTEM FUEL ECONOMY Final Report
1979 202 p refs
(Contract DAAK07-78-C-0031)
(AD-A081442) Avail: NTIS HC A10/MF A01 CSCL 21/4

This report presents the results of prototype manufacturing, rig testing, application, and engine testing of a small advanced technology turbocharger. The turbocharger features variable turbine nozzles, ball bearings supported rotor system, self contained lube system and a broad operating range compressor. The purpose of the work was to show the potential benefits of the subject turbocharger in enhancing specific fuel consumption, emissions, and transient response of a diesel engine. The work was accomplished through laboratory testing of hardware and subsequent mathematical duty cycle simulation using the acquired data. The proposed turbocharger was manufactured and successfully run on a turbocharger test rig. Compressor maps were generated for several compressor trims with vaned and vaneless diffusers. A turbocharger was successfully run for 53 hours on a John Deere, 239 cubic inch, four cylinder, diesel engine. Fuel consumption and emissions data were obtained for

this engine as well as the 'as received' turbocharged engine and the engine with no turbocharger. GRA

N80-24625# Naval Air Development Center, Warminster, Pa. Aircraft and Crew systems Technology Directorate.
SOLID FILM LUBRICATED CUTTING TOOLS Final Report
Alfeo A. Conte, Jr. and Vincent Novielli 15 Jan. 1980 51 p refs
(AD-A081541; NADC-79249-60) Avail: NTIS HC A04/MF A01 CSCL 13/9

The effect of solid film lubricants on tool life was investigated under the Navy Manufacturing Technology (MT) Program. Various solid lubricant formulations were evaluated in tapping and drilling operations on a laboratory device designed to measure the tapping efficiency of cutting fluids. The metallurgy of the workpieces studied included AISi 1020 and 4130 steels, 7075-T6 aluminum, 17-4 PH stainless steel, L-605 cobalt base alloy and Ti-6Al-4V alloy. The solid film lubricant was applied to high speed steel taps and drills and evaluated by measuring the torque developed or the number of holes the cutting tool could produce. Base line studies on uncoated cutting tools with and without the use of cutting fluid were also performed. Under the experimental conditions of this program no substantial benefit could be achieved. GRA

N80-24626# TriTec, Inc., Columbia, Md.
THE DESIGN, FABRICATION, AND TEST OF AN ELECTROFLUIDIC SERVOVALVE Final Report, Sep. 1978 - Oct. 1979
Maurice F. Funke and Lester K. Pacan Feb. 1980 58 p
(Contract DAAK51-78-C-0022; DA Proj. 1L1-62120-AH-25)
(AD-A082443; USAAVRADCOM-TR-80-D-2) Avail: NTIS HC A03/MF A01 CSCL 13/7

This report covers the design, fabrication, and testing of a dual input (hydraulic and electric) servovalve using fluidic amplifiers and positive derivative feedback. The design utilized a two-stage gain block to drive a hydraulic actuator. Electrical input signals were converted by a torque motor into mechanical motion of the first-stage flow splitter. Actuator position was fed back to a movable splitter in the second-stage amplifier. Flow to the actuator was augmented in a positive feedback sense by a spool valve whose flow was proportional to actuator velocity. Performance tests showed that the servovalve accepted and summed combinations of pressure and electrical inputs. Frequency response objectives were met without the high leakage flow penalty usually associated with this application of fluid amplifiers. GRA

N80-24627# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN OF A HIGH SPEED ROTATING MECHANICAL SHUTTER
I. F. Stowers, B. T. Merritt, and C. B. McFann 6 Nov. 1979 19 p refs Presented at the 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13-16 Nov. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83570; CONF-791102-7) Avail: NTIS HC A02/MF A01

A high-speed rotating shutter was designed to operate in a 10 to the minus 6 power Torr vacuum at the optical focus of a laser spatial filter. The shutter is basically a wheel, with a single 3 x 10 mm slot at the perimeter, which rotates with a peripheral speed of 1 km/s. The motor to drive the rotating wheel is magnetically suspended and synchronously wound. The wheel achieves a 4 microns opening time and a timing accuracy of better than 0.2 microns. DOE

N80-24628# Argonne National Lab., Ill.
ASSESSMENT OF HIGH-HEAD TURBOMACHINERY FOR UNDERGROUND PUMPED HYDROELECTRIC STORAGE PLANTS
S. W. Tam, A. A. Frigo, and C. A. Blomquist 1979 18 p refs Presented at the 2nd Miami Intern. Conf. on Alternative Energy Sources, Coral Gables, Fla., 10-13 Dec. 1979
(Contract W-31-109-eng-38)
(CONF-791204-11) Avail: NTIS HC A02/MF A01

The costs for underground pumped hydroelectric storage (UPHS) plants equipped with advanced single and two stage reversible pumped turbines for operating heads from 500 to 1500 m are considered. The effects of machinery costs, operating heads, plant configurations and sizes are included. The results indicate that the use of advanced machinery seems to push the minimum UPHS plant cost to heads greater than 1500 m. The employment of advanced reversible pump turbines seems to be economically attractive. It is shown that pump-turbine efficiencies and the so-called charge/discharge ratio are very important design parameters for UPHS applications and the interactive effects of these parameters have been analyzed. Under certain conditions a pump-turbine option with a higher charge/discharge ratio at the expense of somewhat lower operating efficiency can be desirable. DOE

N80-24629# California Univ., Berkeley. Lawrence Berkeley Lab.
FEASIBILITY STUDY FOR DUCTILE MACHINING OF GLASS Final Report, 1 Jan. - 30 Sep. 1979
I. Finnie, J. Giovanola, A. Misra, and R. Glardon Dec. 1979 93 p refs
(Contract W-7405-eng-48)
(UCRL-15124) Avail: NTIS HC A05/MF A01

Practical ideas about the plasticity of glass, and thermal and cutting fluid effects are presented. The mechanism of chip formation and brittle failure was investigated using commercial microscope slides and especially prepared samples of lead-silicate glass and diffused silica. Results, presented in the form of SEM photographs are discussed. It is shown that lead-silicate glass is readily amenable to ductile cutting using heptanol cutting fluid. Fused silica displayed no sign of ductile behavior. DOE

N80-24630# Biomass Energy Inst., Inc., Winnipeg (Manitoba).
PROCEEDINGS FOREST AND FIELD FUELS SYMPOSIUM
1977 336 p refs Symp. held at Winnipeg, Canada, 12 Oct. 1977
(CONF-7710158) Avail: NTIS (US Sales Only) HC A15/MF A01; DOE Depository Libraries CSCL 20/3

Forest and field fuels are examined areas where RD and D funding would be effective in expanding their marketability and use as substitutes for oil are identified. The present uses and immediate constraints on the wider uses of these renewable resources, compaction of field residues, and gasification and liquefaction of biomass are discussed. DOE

N80-24631# Wisconsin Univ. - Madison.
HETEROGENEOUS ENGINE IN-CYLINDER MIXING MEASUREMENTS USING A TRACER TECHNIQUE. PART 1 Final Report
S. R. Turns and G. L. Borman Mar. 1979 327 p refs
(Contract EC-77-S-02-4492)
(COO-4492-1) Avail: NTIS HC A15/MF A01

Gas-sampling characteristics of engine sampling probes were determined to assist in interpretation of engine sampling data. Of the many sources of sampling error, three were chosen for investigation: the flow disturbance associated with a probe's sink action, the flow disturbance associated with a probe's presence, and the bulk-gas sample bias caused by flame quenching at the probe's surface. Flow disturbance errors were determined by conducting experiments in a steady-flow rig, while estimates of quench-gas bias were determined principally by mathematical modeling. DOE

N80-24632# Wisconsin Univ. - Madison.
HETEROGENEOUS ENGINE IN-CYLINDER MIXING MEASUREMENTS USING A TRACER TECHNIQUE. PART 2 Final Report
A. J. Jessel and G. L. Borman Mar. 1979 131 p refs
(Contract EC-77-S-02-4492)
(COO-4492-2) Avail: NTIS HC A07/MF A01

A diagnostic technique for determining fluid motion and mixing in heterogeneous internal combustion engines involves injecting a small, discrete quantity of a gaseous tracer directly into the combustion chamber using a rapid-acting valve. Following tracer injection, a similar valve extracted a small quantity of cylinder gas which was analyzed for cycle averaged tracer concentration. For motored engine tests, an ethane/nitrogen mixture was used as the tracer with a flame ionization detector for gas analysis. Radioactive argon was employed as the tracer for fired engine

tests with a sodium iodide scintillation counter as a detector. The test engine was an open-chambered single-cylinder diesel. Data taken just prior to top center of the compression stroke indicated that the tracer puff remained largely unmixed with air over the short distance between injection and sampling valves. A swirl rate of 2.5 was calculated from motoring data. Firing results showed the tracer pulse higher in peak concentration and more compact than for the motored case. DOE

N80-24633# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
CONCEPTION OF MARS ROVING VEHICLE
J. Kotnik and D. Heyn Jul. 1978 14 p refs
(TUM-LRT-KB-78/3) Avail: NTIS HC A02/MF A01

A vehicle with a minimal propulsion and fuel system is proposed to investigate a large area of the Martian surface as well as its atmosphere with one, or a few independent systems. This simple method, using the Martian winds and weather conditions for long range operation, consists of a helium filled balloon containing an automatic integrated payload. Different configurations, including combination with a Marsochod vehicle, are discussed. Feasibility in each case is argued while areas for further study, depending on the configuration chosen, are considered. Author (ESA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-24634*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONCEPTS AND TECHNIQUES FOR ULTRASONIC EVALUATION OF MATERIAL MECHANICAL PROPERTIES
Alex Vary 1980 21 p refs To be presented at the Conf. on Mech. of Nondestructive Testing, Blacksburg, Va., 10-12 Sep. 1980
(NASA-TM-81523; E-467) Avail: NTIS HC A02/MF A01 CSCL 14D

Ultrasonic methods that can be used for material strength are reviewed. Emergency technology involving advanced ultrasonic techniques and associated measurements is described. It is shown that ultrasonic NDE is particularly useful in this area because it involves mechanical elastic waves that are strongly modulated by morphological factors that govern mechanical strength and also dynamic failure modes. These aspects of ultrasonic NDE are described in conjunction with advanced approaches and theoretical concepts for signal acquisition and analysis for materials characterization. It is emphasized that the technology is in its infancy and that much effort is still required before the techniques and concepts can be transferred from laboratory to field conditions. A.R.H.

N80-24635*# Massachusetts Inst. of Tech., Cambridge.
ULTRASONIC NONDESTRUCTIVE EVALUATION OF IMPACT-DAMAGED GRAPHITE FIBER COMPOSITE
James H. Williams, Jr. and Norman R. Lompert May 1980 23 p refs
(Grant NsG-3210)
(NASA-CR-3293) Avail: NTIS HC A02/MF A01 CSCL 14D

Unidirectional Hercules AS/3501-6 graphite fiber epoxy composites were subjected to repeated controlled low-velocity drop weight impacts in the laminate direction. The degradation was ultrasonically monitored using through-thickness attenuation and a modified stress wave factor (SWF). There appears to be strong correlations between the number of drop-weight impacts, the residual tensile strength, the through-thickness attenuation, and the SWF. The results are very encouraging with respect to the NDE potential of both of these ultrasonic parameters to provide strength characterizations in virgin as well as impact-damaged fiber composite structures. R.E.S.

N80-24636# Vought Corp., Dallas, Tex.
NDI SURVEY OF COMPOSITE STRUCTURES Final Report, 5 May 1978 - 1 May 1979
Sharon A. McGovern 31 Jan. 1980 79 p refs
(Contract N62269-78-M-6391)
(AD-A081801; NADC-80032-60; Rept-2-53500/9R52131)
Avail: NTIS HC A05/MF A01 CSCL 11/4

As part of the Naval Air Systems Command Maintenance Technology Program, a survey was made of DoD, NASA, NBS, Industry and the R D Community reviewing and analyzing the current status of current nondestruction inspection (NDI) technology for composites. The survey is aimed at contributing information which will assist in defining NDI requirements for the organizational, intermediate, and depot levels of maintenance. The investigation reported herein covers a survey to determine the state of NDI technology for composite materials and an analysis of the survey results in terms of maintenance requirements for naval aircraft. This review and analysis of the status of current NDI technology covers the experience of DoD, NASA, NBS, Industry, and the R D community. A range of composite materials and constructions, damage classification, repair procedures, and NDI techniques were included in the survey. Twenty-one different NDI methods were examined and ranked in terms of effectiveness. Twelve types of composited damage and five different repairs were considered during the investigation. Conclusions included definitions of the most frequently encountered types of construction, the five NDI techniques considered essential, specific technique recommendations for specified damage to specified configurations, and technique recommendations for verifying specific types of repairs. GRA

N80-24637# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
ASSESSMENT OF CRUDE OIL AND REFINED PETROLEUM PRODUCT QUALITY DURING LONG-TERM STORAGE Final Interim Report, Jun. 1978 - Dec. 1979
L. L. Stavinoha, J. N. Bowden, S. R. Westbrook, and H. N. Giles (DOE, Washington, D.C.) Dec. 1979 70 p refs
(Contracts DAAK70-78-C-0001; DAAK70-80-C-0001; EL-78-A-01-2815)
(AD-A082365; AFLRL-121) Avail: NTIS HC A04/MF A01 CSCL 15/3

It is national policy to develop a strategic petroleum reserve of up to one billion barrels of crude oil and refined petroleum products to lessen U.S. vulnerability to the effects of a severe petroleum supply interruption. A four task program was undertaken to assist in ensuring that products being considered for long term storage would remain of a quality immediately usable and to identify likely quality assurance procedures. This report summarizes the results of this work. The first task reviewed and assessed the state-of-the-art in crude and petroleum product storage. The second task investigated the effect of storage on the quality of finished products. The third task developed a DOE/SPRO computer based search capability for crude oil characterization data. The fourth and final program task consisted of an overall assessment of long term fuel storage, including recommendations for product specifications intended for storage, and test methodology for monitoring selecting product quality. GRA

N80-24638# Los Alamos Scientific Lab., N. Mex.
EVALUATION OF IN-LINE NONDESTRUCTIVE ASSAY SYSTEMS Progress Report, 1 Jul. - 30 Sep. 1979
D. F. Bowersox, N. Ensslin, S. T. Hsue, S. S. Johnson, L. G. Speir, C. A. Spirio, J. W. Tape, G. Walton, and R. B. Walton Jan. 1980 17 p refs
(Contract W-7405-eng-36)
(LA-8202-PR) Avail: NTIS HC A02/MF A01

Progress is reported in a project to design, construct, and operate nondestructive assay systems for characterizing solids and liquids containing plutonium so that automated real-time analysis of nuclear materials could be conducted in-line and at-line in processing facilities with available instruments. The two systems to be evaluated are for solids and solutions characterizations are housed in two glove boxes in the LASL Plutonium Facility. Isotopic analyses, weighing, neutron counting and optional heat treatment are planned for the solids system. Isotopic analysis, rate of flow, neutron counting, X-ray fluorescence, and absorption densitometry are designed into the liquids loop. Results will be calculated and reported by a minicomputer. DOE

N80-24639# Royal Aircraft Establishment, Farnborough (England).
FIRST REPORT OF THE MOD AEROSPACE NON-DESTRUCTIVE TESTING (NDT) SUB-COMMITTEE
D. E. W. Stone, ed. London HMSO Oct. 1979 21 p refs (RAE-TM-Struct-960; BR70938) Avail: NTIS HC A02/MF A01

Non-destructive test methods of inspecting defects in structural components of fixed and rotary wing aircraft, together with some related problems pertinent to aero-engines, are considered. Problem areas included are detection and sizing of small cracks beneath installed fasteners and in multilaminate constructions, characterization of surface breaking cracks, detection of corrosion, non-destructive measurement of residual stress, and inspection of bonded joints. Test techniques reviewed cover optical methods, ultrasonics, radiography, eddy current techniques, and the acoustic emission method. State of the art is outlined and recommendations for development based on cost effectiveness are made. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-24640 Utah Univ., Salt Lake City.
APPLICATIONS OF A GENERAL VARIATIONAL METHOD TO THE SOLUTIONS OF BOUNDARY VALUE PROBLEMS IN ELASTICITY Ph.D. Thesis
Danton Gutierrez-Lemini 1979 112 p
Avail: Univ. Microfilms Order No. 8009810

A comprehensive formulation of a general variational method is given in connection to boundary value problems of mathematical physics. The generality of the variational procedure is discussed, showing that it includes as special cases the established techniques in the Calculus of Variations, by Rayleigh-Ritz, Galerkin, and Trefftz. To handle problems of body force-free elastostatics, a displacement formulation of the method is also provided. A stress-function formulation of the method is subsequently derived; whereby a straightforward use of it leads to a novel and direct way of solving displacement boundary value problems in terms of stress functions. The generation of harmonic and biharmonic vectors in polar and general curvilinear coordinates is also addressed; and methods developed to cope with it. Finally, the solutions to the vector harmonic and biharmonic equations in polar coordinates are obtained; and some applications are presented to illustrate their usage. In particular, several exact solutions are arrived at for boundary value problems with traction, mixed, and dual conditions, involving multiply-and simply-connected bodies. Dissert. Abstr.

N80-24641 Brown Univ., Providence, R. I.
NUMERICAL SOLUTIONS IN DYNAMIC LINEAR ELASTIC FRACTURE MECHANICS Ph.D. Thesis
Pierre Burgers 1979 114 p
Avail: Univ. Microfilms Order No. 8006973

The dynamic propagation of a crack in an anti-plane shear deformation field was analyzed by second-order-accurate finite differences. The finite difference equations were obtained by integrating the dynamic linear elastic equations of motion along the bicharacteristic strips in four perpendicular directions and the time axis to (delta to the third power). The singularity in stresses around the crack was calculated by performing a global energy balance on a small region containing the crack tip and approximating the stresses and velocity in this region by a one term asymptotic expansion about the crack tip. Results for stresses and stress intensity factor are presented for a semi-infinite crack propagating steadily in an infinite strip, from which errors in the numerical calculations are identified. Four cases of typical non-steady crack propagation in an infinite strip following steady propagation are also considered. Dissert. Abstr.

N80-24642 Brown Univ., Providence, R. I.
SOME NOVEL PROBLEMS IN DYNAMIC CRACK PROPAGATION Ph.D. Thesis
Ibrahim Said I. Abou-Sayed 1979 107 p
Avail: Univ. Microfilms Order No. 8006965

The stress intensity factor is calculated for the problem of an infinite body containing a semi-infinite crack propagating with velocity faster than the Rayleigh wave speed but slower than the shear wave speed. The propagation of a separation zone at the cohesionless interface of two similar half-planes is considered. The stress intensity factor due to impact loading of edges of a semi-infinite crack, stationary as well as propagating, is solved. The loads are applied parallel to the crack edges and pointing in the same direction. The M-integral is derived for steadily propagating cracks and then used to calculate the energy release rate and the stress intensity factor for a crack propagating with constant velocity and subjected to a moving load. Dissert. Abstr.

N80-24643# Technische Hogeschool, Delft (Netherlands).
THE STRESS RATIO EFFECT ON FATIGUE CRACK GROWTH IN 2024-T3 ALCLAD AND THE RELATION TO CRACK CLOSURE
J. Schijve Aug. 1979 30 p refs
(M-336; ICAF-1113) Avail: NTIS HC A03/MF A01

The Elber equation for the stress ratio effect on the crack opening stress level in 2024-T3 material is unsatisfactory for negative stress ratios. A new equation is proposed and checked for crack growth data from the literature. A good agreement was obtained. Author

N80-24644# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
THE EFFECT OF AN IRREGULAR CRACK FRONT ON FATIGUE CRACK GROWTH
J. Schijve Jan. 1980 18 p refs
(Memorandum-358; ICAF-1137) Avail: NTIS HC A02/MF A01

Crack growth was initiated in 7075-T6 specimens from slits of different shapes in order to produce irregular and wavy crack fronts. Lower crack rates were found for more wavy crack fronts. Crack opening was also lower then, indicating that longer crack fronts produced lower K-values. Part of the environmental effect on crack growth is due to irregular crack fronts. The significance of fatigue fracture morphology for understanding certain influences is emphasized. Author

N80-24645# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
ENVIRONMENTAL EFFECTS OF FATIGUE FRACTURE MODE TRANSITIONS OBSERVED IN ALUMINUM ALLOYS
L. B. Vogelesang and J. Schijve Nov. 1979 27 p refs
(LR-289; ICAF-1138) Avail: NTIS HC A03/MF A01

Fatigue crack propagation tests were carried out in different environments on 7075-T6 and 2024-T3 center-cracked sheet specimens. Observations were made on the macroscopic transition from tensile mode to shear mode. The transition is suppressed by an aggressive environment, whereas it is promoted by an inert environment. As a consequence, there is no unique correlation between the state of stress and the mode of cracking. Both the state of stress and the environment have a significant effect on the mode of cracking. A simple model for the effect of environment on fatigue crack growth is presented. The implications for crack growth under corrosion fatigue conditions are discussed. Author

N80-24646# Pisa Univ. (Italy). Instituto di Aeronautica.
THE FATIGUE CRACK GROWTH UNDER VARIABLE AMPLITUDE LOADING IN BUILTUP STRUCTURES Annual Report, Sep. 1978 - Oct. 1979
A. Salvetti, G. Cavallini, and L. Lazzeri Nov. 1979 87 p refs
(Grant DA-ERO-78-G-107)
(ICAF-1139; ATR-1) Avail: NTIS HC A05/MF A01

Test were conducted on stiffened and unstiffened panels to monitor the growth of a crack both under constant and variable amplitude loads. Significant results were reached concerning: influence of the fastener flexibility and stringer-sheet friction forces on fatigue crack propagation in stiffened panels; and (2) the reliability of existing methods for predicting the growth of a crack under loading conditions in plain sheets. A reliable procedure

for evaluating the growth of a crack in built-up structure under realistic loading conditions was the developed. R.E.S.

N80-24647*# Houston Univ., Tex. Dept. of Electrical Engineering.
RESEARCH ON THE APPLICATION OF A DECOUPLING ALGORITHM FOR STRUCTURE ANALYSIS Final Report, 15 Mar. 1979 - 14 Mar. 1980
Eugene D. Denman Mar. 1980 78 p refs
(Grant NsG-1603)
(NASA-CR-163195) Avail: NTIS HC A05/MF A01 CSCL 20K

The mathematical theory for decoupling mth-order matrix differential equations is presented. It is shown that the decoupling precedure can be developed from the algebraic theory of matrix polynomials. The role of eigenprojectors and latent projectors in the decoupling process is discussed and the mathematical relationships between eigenvalues, eigenvectors, latent roots, and latent vectors are developed. It is shown that the eigenvectors of the companion form of a matrix contains the latent vectors as a subset. The spectral decomposition of a matrix and the application to differential equations is given. M.G.

N80-24648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EIGHTH NASTRAN USER'S COLLOQUIUM
May 1980 242 p refs Colloq. held at Greenbelt, Md., 30-31 Oct. 1979
(NASA-CP-2131) Avail: NTIS HC A11/MF A01 CSCL 20K

The general application of finite element methodology and the specific application of NASTRAN to a wide variety of static and dynamic structural problems are discussed. For individual titles, see N80-24649 through N80-24661.

N80-24649*# Computer Sciences Corp., Silver Spring, Md.
ON THE CONGRUENT FEATURE IN NASTRAN
P. R. Pamidi *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 1-10 refs (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The congruent feature, which is a capability in NASTRAN that can contribute to significant increases in computational efficiencies, is discussed. The usage of the capability and the software design characteristics affecting it are explained. The factors affecting the efficiency of the feature are pointed out. The details pertaining to the software design of the congruent feature are presented; in particular, the congruent element table is described. Serveral examples employing the congruent feature are considered and comparisons of Element Matrix Generator module computer program update times with and without this feature are presented. The results clearly demonstrate the role of the congruent feature in increasing computational efficiencies and its applicability to large-size problems. R.E.S.

N80-24650*# Gates Learjet Corp., Wichita, Kans.
DEVELOPMENT OF THE LEARJET 28/29 WING USING NASTRAN ANALYSIS
Robert R. Boroughs *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 11-32 refs (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The structural development work performed on the Learjet 28/29 wing using NASTRAN analysis is discussed. The work included the basic sizing of primary structural members such as wing skins, wing skin splices, and spar caps, as well as the calculation of preliminary weight estimates utilizing the weight computation routine in NASTRAN. The eight spar redundancy of the Learjet wing made this task somewhat more complex than for more determinate type wing structures. Some of the problems that were encountered and the solutions and methods that were used are described. R.E.S.

N80-24651*# Goodrich (B. F.) Co., Akron, Ohio.
TENSIONING OF A BELT AROUND A DRUM USING MEMBRANE ELEMENT
C. H. S. Chen *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 33-39 refs (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

An application of the membrane element to the problem of the tensioning of a conveyer belt which wraps around a drum is presented. Two cases were investigated: (1) belt tension increase due to drum edge wear; and (2) material trapped between the drum and the belt. In both cases it was found that the increase in belt tension was due to the additional stretching of the belt resulting from the drum radius change rather than from the transverse deflection of the belt. R.E.S.

N80-24652*# Anamet Labs., Inc., Berkeley, Calif.
THERMAL STRESS ANALYSIS OF SYMMETRIC SHELLS SUBJECTED TO ASYMMETRIC THERMAL LOADS
Gordon R. Negaard *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 41-63 refs (For primary document see N80-24648 15-39)
(Contract F33615-77-C-3046)
Avail: NTIS HC A11/MF A01 CSCL 20K

The performance of the NASTRAN level 16.0 axisymmetric solid elements when subjected to both symmetric and asymmetric thermal loading was investigated. A ceramic radome was modeled using both the CTRAPRG and the CTRAPAX elements. The thermal loading applied contained severe gradients through the thickness of the shell. Both elements were found to be more sensitive to the effect of the thermal gradient than to the aspect ratio of the elements. Analysis using the CTRAPAX element predicted much higher thermal stresses than the analysis using the CTRAPRG element, prompting studies of models for which theoretical solutions could be calulated. It was found that the CTRAPRG element solutions were satisfactory, but that the CTRAPAX element was very geometry dependent. This element produced erroneous results if the geometry was allowed to vary from a rectangular cross-section. The most satisfactory solution found for this type of problem was to model a small segment of a symmetric structure with isoparametric solid elements and apply the cyclic symmetry option in NASTRAN. R.E.S.

N80-24653*# Army Armament Research and Development Command, Watervliet, N. Y. Benet Weapons Lab.
STRESS CONCENTRATIONS IN SCREW THREADS
G. Peter OHara *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 65-77 refs (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The concept of stress concentration in screw threads was defined using the sheer transfer rate as the fundamental quantity. The stress concentration is plotted for a fixed geometry. The Heywood equation was used to generate the basic plots and NASTRAN was used to extend the analysis to the case both where flanks of an individual thread tooth are in contact. The case where a finite axial stress is superimposed is discussed. R.E.S.

N80-24654*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONDENSING LOADED POINTS FOR TRANSIENTS BY SUBSTRUCTURING
Thomas G. Butler (Butler Analysis) *In its* Eighth NASTRAN User's Colloq. May 1980 p 79-100 (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

A technique for condensing dynamic loading points is described. The method was applied to substructure transient solutions and was found to be very effective. R.E.S.

N80-24655*# Army Armament Research and Development Command, Watervliet, N. Y. Benet Weapons Lab.
IMPLEMENTATION OF A TRAPEZOIDAL RING ELEMENT IN NASTRAN FOR ELASTIC-PLASTIC ANALYSIS
P. C. T. Chen and G. P. OHara *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 101-112 refs (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The explicit expressions for an elastic-plastic trapezoidal ring element are presented and implemented in NASTRAN computer program. The material is assumed to obey the von Mises' yield criterion, isotropic hardening rule and the Prandtl-Reuss flow relations. For the purpose of demonstration,

two elastic-plastic problems are solved and compared with previous results. The first is a plane-strain tube under uniform internal pressure and the second, a finite-length tube loaded over part of its inner surface. A very good agreement was found in both test problems. R.E.S.

N80-24658*# Planning Research Corp., Kennedy Space Center, Fla.
NORMAL MODE ANALYSIS OF THE IUS/TDRS PAYLOAD IN A PAYLOAD CANISTER/TRANSPORTER ENVIRONMENT
Karl A. Meyer *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 113-129 refs (For primary document see N80-24648 15-39)
(Contract NAS10-8525)
Avail: NTIS HC A11/MF A01 CSCL 20K

Special modeling techniques were developed to simulate an accurate mathematical model of the transporter/canister/payload system during ground transport of the Inertial Upper Stage/Tracking and Data Relay Satellite (IUS/TDRS) payload. The three finite element models - the transporter, the canister, and the IUS/TDRS payload - were merged into one model and used along with the NASTRAN normal mode analysis. Deficiencies were found in the NASTRAN program that make a total analysis using modal transient response impractical. It was also discovered that inaccuracies may exist for NASTRAN rigid body modes on large models when Given's method for eigenvalue extraction is employed. The deficiencies as well as recommendations for improving the NASTRAN program are discussed. R.E.S.

N80-24657*# Naval Underwater Systems Center, New London, Conn.
STEADY STATE SOLUTIONS TO DYNAMICALLY LOADED PERIODIC STRUCTURES
Anthony J. Kalinowski *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 131-164 refs (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The general problem of solving for the steady state (time domain) dynamic response (i.e., NASTRAN rigid format-8) of a general elastic periodic structure subject to a phase difference loading of the type encountered in traveling wave propagation problems was studied. Two types of structural configurations were considered; in the first type, the structure has a repeating pattern over a span that is long enough to be considered, for all practical purposes, as infinite; in the second type, the structure has structural rotational symmetry in the circumferential direction. The theory and a corresponding set of DMAP instructions which permits the NASTRAN user to automatically alter the rigid format-8 sequence to solve the intended class of problems are presented. Final results are recovered as with any ordinary rigid format-8 solution, except that the results are only printed for the typical periodic segment of the structure. A simple demonstration problem having a known exact solution is used to illustrate the implementation of the procedure. R.E.S.

N80-24658*# Northrop Corp., Los Angeles, Calif.
APPLICATIONS OF NASTRAN IN GUST RESPONSE ANALYSIS AT NORTHROP
Ashok K. Singh *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 165-188 refs (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

A comprehensive gust response analysis was performed on a complete model of an airplane using the NASTRAN aeroelastic package. The analysis investigated random response to atmospheric turbulence and transient response to a discrete gust, including control system dynamics in both cases. It is shown that NASTRAN is an effective tool for aeroelastic analysis and active control system design. R.E.S.

N80-24659*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
IMPLEMENTATION OF NASTRAN ON THE IBM/370 CMS OPERATING SYSTEM
Stephen S. Britten and Betsy Schumacker *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 189-203 refs Sponsored in part by the Air Force (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The NASA Structural Analysis (NASTRAN) computer program is operational on the IBM 360/370 series computers. While execution of NASTRAN has been described and implemented under the virtual storage operating systems of the IBM 370 models, the IBM 370/168 computer can also operate in a time-sharing mode under the virtual machine operating system using the Conversational Monitor System (CMS) subset. The changes required to make NASTRAN operational under the CMS operating system are described. R.E.S.

N80-24660*# Sikorsky Aircraft, Stratford, Conn.
IFEMS, AN INTERACTIVE FINITE ELEMENT MODELING SYSTEM USING A CAD/CAM SYSTEM
Spencer McKellip, Todd Schuman, and Spencer Lauer *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 205-221 (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

A method of coupling a CAD/CAM system with a general purpose finite element mesh generator is described. The three computer programs which make up the interactive finite element graphics system are discussed. R.E.S.

N80-24661*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF A DATA BASE MANAGEMENT SYSTEM TO A FINITE ELEMENT MODEL
James L. Rogers, Jr. *In* NASA. Goddard Space Flight Center Eighth NASTRAN User's Colloq. May 1980 p 223-234 (For primary document see N80-24648 15-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

In today's software market, much effort is being expended on the development of data base management systems (DBMS). Most commercially available DBMS were designed for business use. However, the need for such systems within the engineering and scientific communities is becoming apparent. A potential DBMS application that appears attractive is the handling of data for finite element engineering models. The applications of a commercially available, business-oriented DBMS to a structural engineering, finite element model is explored. The model, DBMS, an approach to using the DBMS, advantages and disadvantages are described. Plans for research on a scientific and engineering DBMS are discussed. R.E.S.

N80-24662# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
FINITE ELEMENT ANALYSIS OF PIPE ELBOWS Final Report, Oct. 1978 - Sep. 1979
Melvyn S. Marcus and Gordon C. Everstine Feb. 1980 95 p refs
(AD-A081077; DTNSRDC/CMLD-79/15) Avail: NTIS HC A05/MF A01 CSCL 13/11

NASTRAN analyses were performed with three different finite element models on a 90 degree pipe elbow to determine principal stresses due to internal pressure, inplane bending, out-of-plane bending, and torsion moment loadings. Comparison with stresses experimentally obtained under the four loading conditions demonstrates the adequacy of a finite element model with ideal geometry assumptions and an economical mesh spacing. Implementation of the NASTRAN modeling is described in detail. Deck set-ups for a sequence of computer runs to automatically generate NASTRAN input data, execute NASTRAN, and postprocess NASTRAN output are included. A sample NASTRAN data input file is also listed. GRA

N80-24663# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
EFFECTS OF MATERIAL BEHAVIOR ON THE RESPONSE OF RAPIDLY HEATED STRUCTURES Technical Report, Feb. 1978 - Dec. 1979
S. F. Stone Jan. 1980 112 p refs
(Contract N00014-75-C-0648; NR Proj. 064-588)
(AD-A082148; MDC-G8432) Avail: NTIS HC A06/MF A01 CSCL 20/11

An investigation into the theoretical requirements for short time elevated temperature material property data to be used in a structural analysis to predict the response and failure of

structures subject to the combined effects of mechanical and thermal loads due to rapid heating was undertaken. An assessment of the ability of the MARC and ANSYS finite-element computer codes to perform the required analysis was made. An evaluation of the suitability of existing mechanical material property data for 6061-T6 aluminum was made in light of the theoretical requirements. Uniaxial simulation experiments were performed in which load and temperature were varied as a function of time in order to simulate the loading and unloading behavior that occurs in locally heated structures. Basic uniaxial material property tests were conducted. These data were used to obtain time independent ('zero' time) temperature dependent elastic-plastic stress/strain curves and time dependent creep curves. A one dimensional direct integration code 'CREEPARHS' was written to perform the required analysis and to check the results from the finite elements codes. Analysis using the newly generated material property data and currently available 10 second isochronous and handbook data was performed. GRA

N80-24664# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.

DUCTILE FRACTURE UNDER MULTIAXIAL STRESS STATES BETWEEN PAIRS OF HOLES

R. J. Bourcier and D. A. Koss Nov. 1979 21 p refs
(Contract N00014-76-C-0037)
(AD-A081976; TR-11) Avail: NTIS HC A02/MF A01 CSCL 20/11

As a means of examining ductile fracture under multiaxial stress and strain states, the deformation and fracture between pairs of holes has been studied in a 7075 Al alloy. The test technique, which is unique, utilizes tensile samples each with a pair of holes through the thickness. The holes are sufficiently close (two hole diameters apart) so as to concentrate slip between them, and the local states of stress and strain can be controlled by the orientation of the holes to the stress axis. The influence of hole orientation on the strain at fracture has been determined in the 7075 Al alloy in the T6 as well as TO tempers. Fracture occurs by flow localization between the holes and very little hole growth occurs, especially in the T6 condition. Fractography indicates a transition in fracture appearance with hole orientation with dimpled fracture predominating, but the degree of shear fracture increases as the pair of holes become more inclined to the stress axis. A modification of the Bridgeman analysis is used as a description of the approximate state of stress between the holes as a function of the hole orientation. The results indicated that the criterion for ductile fracture depends on both the state of stress and the strain state, but the functional dependence could not be determined. The results are also discussed as a crude model for void coalescence in ductile fracture. GRA

N80-24665# California Univ., Los Angeles. Dept. of Materials.

MAGNETOMECHANICAL ACOUSTIC EMISSION FOR RESIDUAL STRESS AND PRIOR STRAIN DETERMINATION

Kanju Ono and M. Shibata Oct. 1979 36 p refs Presented at the Intern. Conf. on Acoustic Emission, Anaheim, Calif., 10-13 Sep. 1979
(Contract N00014-75-C-0419)
(AD-A081912; TR-79-04) Avail: NTIS HC A03/MF A01 CSCL 20/1

This study evaluated magnetomechanical acoustic emission (MAE) in iron, nickel, steels and an iron-nickel alloy. The intensity of MAE increased with an increasing level of magnetization at 60 Hz and was also dependent on chemical composition, microstructure, applied stress, and prior cold work. Nickel was the highest emitter and the iron-31% nickel alloy was the lowest. Martensitic transformation and cold-working reduced MAE. Applied stress also suppressed MAE, although some enhancements were observed in nickel and A533B steel. A model based on displacement step generation is proposed. The displacement is a consequence of domain boundary motion that alters magnetostrictive strain. The model satisfactorily explains a variety of experimental observations at least qualitatively. However, independent experiments will be needed to confirm some of the assumptions. Results presented amply demonstrate that MAE provides the basis for a new class of nondestructive testing of residual stress and other material parameters of practical interest. GRA

N80-24666# Cincinnati Univ., Ohio. Dept. of Engineering Science.

MULTI-BODY DYNAMIC INCLUDING THE EFFECTS OF FLEXIBILITY AND COMPLIANCE Technical Report, 30 Sep. 1978 - 29 Feb. 1980

Ronald L. Huston 1 Apr. 1980 61 p refs
(Contract N00014-76-C-0139)
(AD-A082762; UC-ES-040180-8-ONR) Avail: NTIS HC A04/MF A01 CSCL 20/11

New and recently developed concepts and ideas useful in obtaining efficient computer algorithms for solving the equations of motion of multi-body mechanical systems with flexible links are presented and discussed. These ideas include the use of Euler parameters, Lagrange's form of d'Alembert's principle, generalized speeds, quasi-coordinates, relative coordinates, structural analysis techniques and body connection arrays. The mechanical systems considered are linked bodies forming a tree structure, but with no closed loops permitted. An explicit formulation of the equations of motion is presented. GRA

N80-24667# Naval Surface Weapons Center, White Oak, Md.

DYNAMIC BUCKLING OF CYLINDRICAL SHELLS: A LITERATURE SURVEY Final Report

David B. Grenier 23 Oct. 1979 83 p refs
(SR0230300)
(AD-A082049; NSWC/TR-79-447) Avail: NTIS HC A05/MF A01 CSCL 20/11

A literature survey was conducted in order to ascertain the current theoretical methods available for predicting dynamic buckling behavior of cylindrical shells. Existing theories which give consideration to advanced shell wall geometries and materials are examined. Emphasis is placed on theories which lend themselves either to a closed form solution or to an iterative solution which does not require finite difference or finite element modeling. The task of developing such theories appears to be so overwhelming that few investigators stepped further than the bounds of a simple monocoque shell subjected to end or side-pulse loading. A brief summary and critique of each significant article is included. Further work is directed in the modification of existing programs to create general dynamic shell design criteria. GRA

N80-24668# Naval Ship Research and Development Center, Bethesda, Md. Computation, Mathematics, and Logistics Dept.

CONSTRAINED OPTIMIZATION OF HOLE SHAPES IN PLATE STRUCTURES Interim Report, Jun. 1979 - Jan. 1980

S. K. Dhir Feb. 1980 22 p refs
(SR0140301)
(AD-A082518; DTNSRDC/CMLD-80/02) Avail: NTIS HC A02/MF A01 CSCL 20/11

An analytical/numerical procedure has been developed which yields the optimum geometry for a constrained hole shape in a large plate under prescribed boundary stresses at infinity. The optimality criterion is based on the minimization of a certain stress integral taken around the hole boundary. Muskhelishvili's method is used to first obtain the symbolic stress expressions for a given mapping function with unknown coefficients. These stress expressions are then squared and integrated around the hole boundary to obtain the stress integral. The squaring prevents any cancellation of compressive and tensile stresses during the integration process and thus produces a more meaningful integral. A sample problem is worked out in detail to demonstrate this procedure. The optimum shape of a square-like (double barrel shape) hole with rounded corners was determined by restricting the mapping function to only one specific unknown coefficient. Modification of this shape by introduction of an additional term is also discussed. Numerical stress concentration values for this case are compared with those from other sources. GRA

N80-24669# Naval Ship Research and Development Center, Bethesda, Md.

PIEZOELECTRIC FINITE ELEMENTS FOR NASTRAN Final Report, Jun. - Sep. 1979

Robert R. Lipman and Myles M. Hurwitz Apr. 1980 34 p refs

(RR0310301)
(AD-A082965; DTNSRDC-80/045) Avail: NTIS HC A03/MF A01 CSCL 17/1

The NASTRAN structural analysis program has been modified so that its TRAPAX and TRIAAX finite elements may handle piezoelectric material properties. These elements are solid, axisymmetric ring elements capable of handling nonaxisymmetric loads. The natural frequencies of a piezoelectric hollow cylinder and a piezoelectric disk with electroded surfaces were computed with this modified version of NASTRAN and were found to be in excellent agreement with experimental and other numerical results. GRA

N80-24670# California Univ., Livermore. Lawrence Livermore Lab.

STRESS-RUPTURE LIFETIMES OF ORGANIC FIBER-EPOXY STRANDS AND PRESSURE VESSELS

H. T. Hahn, I. L. Chiu, and T. L. Gates 21 Aug. 1979 25 p refs Presented at the 35th Ann. Conf. of the SPI Reinforced Plastics/Composites Inst., New Orleans, 4-8 Feb. 1980
(Contract W-7405-eng-48)
(UCRL-82862; CONF-800203-1) Avail: NTIS HC A02/MF A01

In an effort to determine the long-term behavior of filament-wound pressure vessels, Kevlar 49 epoxy strands were studied in stress-rupture for more than a year at five different stress levels. At each stress level, approximately one-hundred strands were hung in a room maintained at 22 C to 24 C and below 20% relative humidity. Failure times were automatically recorded by a data acquistion system. The shape parameter increased with decreasing stress level. Less scatter and increasing failure rates were observed at lower stresses. There was no sign of an endurance limit down to 68% UTS (ultimate tensile strength). At 50% UTS no failure had yet occured after 9000 h. The strand data were compared with data on lifetimes of pressure vessels wound with the same fiber and epoxy. The strands had slightly longer characteristic lifetimes, except at 86% UTS, and slightly less scatter, except at 68% UTS. DOE

N80-24671# Royal Aircraft Establishment, Farnborough (England).

DATA GENERATION COMPUTER PROGRAMS FOR SHELL FINITE ELEMENTS

Susan M. Ford London HMSO Jul. 1979 55 p refs
(RAE-TM-Struct-954; BR70226) Avail: NTIS HC A04/MF A01

A series of computer programs written in ICL 1900 series FORTRAN is presented to generate data for the finite element analysis of shells, with particular reference to spherical surfaces. The programs are appropriate either to a finite element program containing the RAE SEMILOOF thin shell element, of for a NASTRAN package containing the TRIA 3 and QUAD 4 facet shell elements. The two types of program are described. The programs generate data specifically for meshes on the surface of a sphere. They are used to generate all the data for the hemispherical cap and patch test problems considered by Morley and Norris. Results are shown. Author (ESA)

N80-24672# Royal Aircraft Establishment, Farnborough (England).

OPENING-MODE STRESS INTENSITY FACTORS FOR TWO UNEQUAL CRACKS AT A HOLE

D. P. Rooke (Old Dominion Univ.) and J. Tweed London HMSO Aug. 1979 31 p refs
(RAE-TR-79105; RAE-Mat-386; BR71448) Avail: NTIS HC A03/MF A01

An integral-transform method is used to solve the elastic problem of two collinear cracks at the edge of a hole in a sheet. Both uniform loadings on the sheet remote from the crack and loadings on the perimeter of the hole are considered. Since in all cases the loadings are symmetrical about the crackline, only the opening-mode stress intensity factors are nonzero; these factors are calculated. An approximation procedure is examined for obtaining stress intensity factors for two cracks at a hole from that for one crack. Results show that the errors in the approximation used are small. The possibility of extending this approximation technique to other configurations for which only single crack results are known is considered. Author (ESA)

N80-24673# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.

ANALYSIS OF SOME DIFFICULTIES ENCOUNTERED IN THE SIMULATION OF MECHANICAL SYSTEMS WITH CONSTRAINTS

Per Loetstedt 1979 76 p refs Sponsored in part by Swedish Inst. of Appl. Math.
(TRITA-NA-7914) Avail: NTIS HC A05/MF A01

Mathematical properties of mechanical systems of rigid bodies with constraints are investigated. In particular, properties of interest for the digital simulation of such systems are studied. Much attention is paid to normal and friction forces in planar systems. The main mathematical tool is the theory of linear complementarity problems. Problems where the constraints give rise to normal forces only are found to be much simpler than those with Coulomb friction. For systems exposed to friction, solutions may fail to exist and if they do exist, they need not be unique. The related question of how to compute impulses, e.g., after a collision, is treated briefly. Author (ESA)

N80-24674# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.

FINITE ELEMENT ANALYSIS OF CONCRETE CRACKING

J. H. Argyris, G. Faust, and K. J. Willam Jan. 1979 28 p refs Presented at IASS Symp., Darmstadt, West Germany, 3-7 Jul. 1978
(Contract BMFT-RK-SBB4)
(ISD-254) Avail: NTIS HC A03/MF A01

Critical factors which determine the predictive quality of the finite element analysis of tensile concrete cracking are identified. In particular, two popular methods are explored. These are the smeared crack approach (strength model) and the discrete crack approach (fracture mechanics model). The limitations of these widely accepted strategies are illustrated using the example of a thick walled concrete ring. Extensive strength and deformation data results are obtained. Author (ESA)

N80-24675# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.

EULERIAN AND LAGRANGIAN TECHNIQUES FOR ELASTIC AND INELASTIC LARGE DEFORMATION PROCESSES

J. H. Argyris, J. S. Doltsinis, W. C. Knudson, J. Szimmat, H. Wuestenberg, and K. J. Willam May 1979 63 p refs Presented at TICOM 2, Austin, Tex., 26-29 Mar. 1979
(ISD-256) Avail: NTIS HC A04/MF A01

Two fundamentally different methods for solving elastic and inelastic large deformation problems are examined. These are the viscous flow approach with a Eulerian description of the velocity field using a finite element mesh fixed in space, and the solid mechanics approach with a Lagrangian description of the displacement field using an update material mesh for tracing the motion of each particle. The two techniques are assessed and evaluated for analysis of combined elastic and inelastic material processes of the rigid plastic and elasto-plastic type. Both formulations are illustrated on two forming problems: the extrusion of an aluminum billet through a curved nozzle and the heat forming of a steel bolt. Results are reported and compared. Author (ESA)

N80-24676# Royal Aircraft Establishment, Farnborough (England).

METHODS FOR DETERMINING UNDAMPED NORMAL MODES AND TRANSFER FUNCTIONS FROM RECEPTANCE MEASUREMENTS

D. R. Gaukroger and J. C. Copley London HMSO Jun. 1979 35 p refs
(RAE-TR-79071; RAE-Struct-BF/B/0793; BR70158) Avail: NTIS HC A03/MF A01

Possible approaches to the determination of the dynamic characteristics of a system from receptance measurements are considered. The particular characteristics of interest are transfer functions for which no direct measurements are available and their undamped normal modes. A simple example using calculated receptances which are degraded with random errors indicates the degree of accuracy which might be expected from various methods of analysis. Author (ESA)

N80-24677# Texas Univ. at Austin. Structures Research Lab.
SHEAR BEHAVIOR OF REINFORCED CONCRETE MEMBERS UNDER BIDIRECTIONAL REVERSED LATERAL LOADING Ph.D. Thesis
K. Maruyama and James O. Jirsa Aug. 1979 133 p refs
(Grant NSF ENV-77-20816)
(PB80-140395; CESRL-79-1; NSF/RA-79-270) Avail: NTIS HC A07/MF A01 CSCL 13M

The influence of lateral load of deformation history on shear behavior was examined. Each load path of load sequence was imposed on the specimens using a specially fabricated servo-controlled loading system which applied lateral translations perpendicular to the longitudinal axis of the specimen. Rotation of the ends of the specimens was controlled to simulate a column between stiff floors. The influence on load and deformation history was examined by comparing performance in terms of shear atrength deterioration stiffness reduction, strain distribution in transverse reinforcement, and crack patterns. A conceptual model was developed for analyzing the shear behavior of members under multi directional loading. GRA

42 GEOSCIENCES (GENERAL)

N80-24678*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR-TERRESTRIAL PREDICTIONS PROCEEDINGS. VOLUME 2: WORKING GROUP REPORTS AND REVIEWS
Richard F. Donnelly, ed. (NOAA, Boulder, Colo.) Dec. 1979 744 p refs Workshop held in Boulder, Colo., 23-27 Apr. 1979; sponsored by NOAA Sponsored in part by AFGL, AFOSR, DOE, NSF and NOAA 4 Vol.
(NASA-TM-81061) Avail: NTIS HC A99/MF A01 CSCL 04A

Accurate models are needed to support research in the following areas: spacecraft charging, radiation dosage, transionospheric radio propagation, long and short term solar activity, magnetospheric disturbances, ionospheric interactions, solar weather/climate effects, and geomagnetic applications such as electric power transmission and oil and gas pipeline problems. For individual titles, see N80-24679 through N80-24726.

N80-24679*# Aerospace Corp., Los Angeles, Calif.
USER REQUIREMENTS OF SOLAR-TERRESTRIAL PREDICTIONS FOR SPACECRAFT APPLICATIONS c12
A. L. Vampola, R. Altrock, W. Atwell, R. C. Backstrom, H. B. Garrett, David R. Hickman, R. G. Johnson, N. H. Pereyaslova, D. Robbins, and J. Slowey *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 1-20 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 22A

Areas which are influenced by solar-terrestrial coupling effects and which are internal to the Earth's magnetosphere are of interest to mission planners, spacecraft hardware designers, and those engaged in the operation of already orbiting manned or unmanned spacecraft. Accurate models are needed to predict energetic particle flux density, interactions between low energy (10 eV to 100 eV) near-Earth plasma and space systems, and neutral atmospheres. Parameters required for each of these areas are discussed. A.R.H.

N80-24680*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODELING THE EARTH'S RADIATION BELTS. A REVIEW OF QUANTITATIVE DATA BASED ELECTRON AND PROTON MODELS c46
J. I. Vette, M. J. Teague, D. M. Sawyer, and K. W. Chan *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 21-35 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

The evolution of quantitative models of the trapped radiation belts is traced to show how the knowledge of the various features has developed, or been clarified, by performing the required analysis and synthesis. The Starfish electron injection introduced problems in the time behavior of the inner zone, but this residue decayed away, and a good model of this depletion now exists. The outer zone electrons were handled statistically by a log normal distribution such that above 5 Earth radii there are no long term changes over the solar cycle. The transition region between the two zones presents the most difficulty, therefore the behavior of individual substorms as well as long term changes must be studied. The latest corrections to the electron environment based on new data are outlined. The proton models have evolved to the point where the solar cycle effect at low altitudes is included. Trends for new models are discussed; the feasibility of predicting substorm injections and solar wind high-speed streams make the modeling of individual events a topical activity. Author

N80-24681*# Air Force Geophysics Lab., Hanscom AFB, Mass.
LOW ENERGY MAGNETOSPHERIC PLASMA INTERACTIONS WITH SPACE SYSTEMS: THE ROLE OF PREDICTIONS c46
H. B. Garrett *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 36-70 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

The present status of low energy magnetospheric plasma interactions with space systems is reviewed. The role of predictions in meeting user needs in assessing the impact of such interactions is described. In light of the perceived needs of the user community and of the current status of modeling and prediction efforts, it is suggested that for most user needs more detailed statistical models of the low energy environment are required. In order to meet current prediction requirements, real-time in situ measurements are proposed as a near-term solution. Author

N80-24682*# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.
PREDICTABILITY OF UPPER-ATMOSPHERIC DENSITY AND COMPOSITION c46
Joe M. Straus and David R. Hickman *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 71-88 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

Empirical models of upper-atmospheric density and composition are employed in a number of areas, ranging from basic research in atmospheric and ionospheric physics to practical applications in satellite ephemeris prediction. Such models are based on various kinds of data sets and have varying levels of complexity, strengths, and weaknesses. The characteristics of several of the widely used models are described and studies in which the predictions of these models were compared with observational data are reviewed. The relative advantages and limitations of the models in current use are discussed as well as ways in which the models might be improved. A.R.H.

N80-24683*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR-INDUCED VARIATIONS OF ENVIRONMENT AFFECTING MANNED SPACE FLIGHT AND SPACECRAFT OPERATIONS c12
William G. Johnson, Thomas A. Parnell, and William W. Vaughan *In its* Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 89-103 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 22A

Estimates of short and long term solar activity are required for calculating variations in the environment with regard to spacecraft charging, radiation effects, and orbital lifetime. Correlations appear to exist between the time of solar activity and the time of operational anomalies due to electrical discharges when the dielectric surfaces of geosynchronous spacecraft are charged by interaction with the ambient plasma to levels above breakdown voltage. An ability to predict the solar induced variation variability of the plasmas could permit refinement of design criteria. The influence of the radiation on spacecraft materials, systems, and manned operations is summarized. Solar radition effects on the orbital altitude atmospheric density environment and spacecraft lifetimes are also considered. A.R.H.

N80-24684*# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
PREDICTION OF SPACECRAFT POTENTIALS AT GEOSYNCHRONOUS ORBIT c18
H. B. Garrett, A. G. Rubin, and C. P. Pike *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 104-118 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 22B

Two relatively straightforward techniques are outlined for determining spacecraft potentials in the limit of a 'thick sheath' surrounding the spacecraft. A statistical model of the various features of the geosynchronous environment based on ATS-5 and ATS-6 data and an analytic model capable of detailed simulation of the low energy geosynchronous environment are also discussed. The results from these two environmental models are then combined with the charging models in order to provide estimates of the relationships between the geomagnetic index and spacecraft potential. The results are compared with actual potential measurements from ATS-5 and ATS-6. Author

N80-24685*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TERRESTRIAL RADIATION ENVIRONMENT AND EVA'S: PREDICTION REQUIREMENTS, MODEL IMPROVEMENTS, AND WARNING SYSTEMS c54
E. G. Stassinopoulos *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 119-120 (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 05H

The total medical-biological impact of the Earth's space radiation environment on humans is a function of combined EVA and non-EVA exposure. In either case, the correct assessment of the eventual health risk to crew members is crucial to the success and viability of a project or mission. Aside from the medical-biological aspect itself, the validity of any assessment depends entirely on the existence of good and reliable models providing the high quality data that is needed for such evaluations, which should contain time histories of storm and substorm events, their intensities, their frequency of occurrence, and their duration. Prediction requirements, advantageous and desirable model developments and improvements, and systems that need to be designed and tested, which would alert space crews and maintenance personnel about impending radiation danger are outlined. A.R.H.

N80-24686*# Rockwell International Corp., Houston, Tex.
DOSIMETRY IN THE MANNED SPACE PROGRAM c46
William Atwell *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 121-132 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

Dosimetric results of the various U.S. manned spaceflight programs are presented along with a description of the instrumentation, trapped radiation environments, and spacecraft shielding models. Analytical dose calculations are included and composed with actual measurements. Future requirements of the solar-terrestrial data user who will support manned spaceflight operations during the space shuttle era are outlined. A.R.H.

N80-24687*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
MAGNETIC STORM EFFECTS IN ELECTRIC POWER SYSTEMS AND PREDICTION NEEDS c33
Vernon D. Albertson and John G. Kappenman (Minnesota Power and Light Co.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 137-148 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 09C

Geomagnetic field fluctuations produce spurious currents in electric power systems. These currents enter and exit through points remote from each other. The fundamental period of these currents is on the order of several minutes which is quasi-dc compared to the normal 60 Hz or 50 Hz power system frequency. Nearly all of the power systems problems caused by the geomagnetically induced currents result from the half-cycle saturation of power transformers due to simultaneous ac and dc excitation. The effects produced in power systems are presented, current research activity is discussed, and magnetic storm prediction needs of the power industry are listed. Author

N80-24688*# British Columbia Univ., Vancouver. Dept. of Geophysics and Astronomy.
THE PROBLEM OF SOLAR INDUCED CURRENTS c33
D. H. Boteler *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 149-161 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 09C

The production of surface electric fields by geomagnetic variations is discussed with reference to magnetotelluric theory; and evidence is presented to show that the severity of solar-induced currents (SIC) at Cornerbrook, Newfoundland is due to channeling of currents induced in the sea through a region adjacent to the power line. An 'isolated loop' approximation is proposed for calculating the quasi-dc currents produced in the power system by the surface electric fields. Identification of the processes causing the geomagnetic perturbations responsible for SIC would be aided by investigation of the local time dependence of SIC occurrence. Such knowledge could potentially be used to provide several hours warning of SIC. A.R.H.

N80-24689*# Manitoba Univ., Winnipeg. Dept. of Electrical Engineering.
PREDICTION OF SOLAR INDUCED CURRENTS AND EFFECTS ON POWER TRANSMISSION SYSTEMS IN CENTRAL CANADA c33
W. R. Goddard and W.-M. Boerner (Illinois Univ. at Chicago Circle) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 162-171 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 09C

The auroral-electrojet zone covers three quarters of Manitoba and consequently, solar storms strongly affect transmission lines. Harmonics are generated at transformers due to the saturation of their cores by induced currents, and the level of harmonics produced may cause malfunction of control relays, and yield unacceptable distortions in normal ac waveforms. The expected effects of long ac transmission systems were studied with emphasis on a 500 kv line to be built from Winnipeg to Minneapolis-St. Paul. Spectral analysis of induced current records from Manitoba Hydro's LaVerendrye station and magnetograms from IMS stations in Manitoba were used along with results of Campbell's work on the Alaskan pipeline induction problem (1978) in order to predict periodic and surge currents. It is concluded that the surge currents will produce significant levels of harmonics and corresponding operating problems during magnetic storms. A.R.H.

N80-24690*# British Columbia Univ., Vancouver. Dept. of Geophysics and Astronomy.
HARMONICS OF 60 Hz IN POWER SYSTEMS CAUSED BY GEOMAGNETIC DISTURBANCES c33
K. Hayashi, T. Oguti, T. Watanabe, K. Tsuruda, S. Kokubun, and R. E. Horita (Victoria Univ., British Columbia) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 172-181 refs Prepared in cooperation with Tokyo Univ., Japan (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 09C

Simultaneous VLF/ULF observations carried out near Winnipeg, Manitoba show that geomagnetic disturbances control the behavior of harmonics of 60 Hz man-made electric power. The harmonics of 60 Hz detected by the VLF receiver are at multiples of 180 Hz, indicating that they originated from a 3 phase ac power system. Under geomagnetically quiet conditions, only odd harmonics of 70 Hz were detected. In disturbed conditions, both odd and even harmonics were excited. The strength of each harmonic changed concurrently with geomagnetic pulsation (ULF) activity. These findings seem to indicate that a portion of telluric currents shunted into the power line system through the neutrals of the Y-connected transformers give rise to a dc bias to the transformer core materials and that it distorts their hysteresis loops, activating harmonics of 60 Hz power. A mathematical proof is given that a hysteresis loop having a point of symmetry generates odd harmonics only, whereas loops lacking in point-symmetry generally give rise to both odd and even harmonics. A general formula was obtained to calculate the

strength of each harmonic based on the shape of the hysteresis loop. A.R.H.

N80-24691*# Geological Survey, Denver, Colo.
INDUCED ELECTRIC CURRENTS IN THE ALASKA OIL PIPELINE MEASURED BY GRADIENT, FLUXGATE, AND SQUID MAGNETOMETERS c33
Wallace H. Campbell and James E. Zimmerman (NBS, Boulder, Colo.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 182-192 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 09C

The field gradient method for observing the electric currents in the Alaska pipeline provided consistent values for both the fluxgate and SQUID method of observation. These currents were linearly related to the regularly measured electric and magnetic field changes. Determinations of pipeline current were consistent with values obtained by a direct connection, current shunt technique at a pipeline site about 9.6 km away. The gradient method has the distinct advantage of portability and buried-pipe capability. Field gradients due to the pipe magnetization, geological features, or ionospheric source currents do not seem to contribute a measurable error to such pipe current determination. The SQUID gradiometer is inherently sensitive enough to detect very small currents in a linear conductor at 10 meters, or conversely, to detect small currents of one amphere or more at relatively great distances. It is fairly straightforward to achieve imbalance less than one part in ten thousand, and with extreme care, one part in one million or better. A.R.H.

N80-24692*# Space Environment Services Center, Boulder, Colo.
VERY LARGE GEOMAGNETIC DISTURBANCE DURING SUNSPOT CYCLE 21: A PREDICTION c92
H. H. Sargent, III *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 193-197 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

Evidence is presented which suggests that very large geomagnetic disturbances (350 gammas or greater at an invariant magnetic latitude of 50 degrees) occur once or twice per sunspot cycle, on the average. There is also some tendency for these disturbances to group in large odd numbered sunspot cycles similar to the current cycle, cycle 21. No such disturbance was noted during the past cycle although a series of major solar flares was observed in August 1972. At least one very large geomagnetic disturbance is expected during the current cycle; a prediction with perhaps serious consequences for electric power companies. Author

N80-24693*# Los Alamos Scientific Lab., N. Mex.
POTENTIAL PREDICTION NEEDS IN SUPPORT OF ENERGY SYSTEMS c44
Richard L. Blake *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 198-202 ref Sponsored in part by DOE (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 10B

The relationship between emerging energy systems and the natural environment is discussed, including selected examples to show that energy systems are tied to global solar terrestrial processess. The interdependence of resources, technology, and environmental impact is considered in terms of needed geophysical, atmospheric, and solar terrestrial data inputs. The need for long term basic research on the solar terrestrial system is emphasized. J.M.S.

N80-24694*# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERE-REFLECTED PROPAGATION c32
B. M. Reddy *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 203-216 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 17B

The predictability of those ionospheric parameters relevant to ionosphere-reflected communications is considered along with their optimum utilization. Several excellent original articles and review papers which have been published from time to time dealing with the long term and short term forecasting of ionospheric parameters, radio systems, and modelling needs for ionospheric communications, are covered. J.M.S.

N80-24695*# Air Force Geophysics Lab., Hanscom AFB, Mass.
TRANSIONOSPHERIC PROPAGATION PREDICTIONS c32
J. A. Klobucher, Santimay Basu (Emmanuel Coll.), Sunanda Basu (Emmanuel Coll.), P. A. Bernbardt (Stanford Univ.), K. Davies (NOAA, Boulder, Colo.), D. E. Donatelli (Regis Coll.), E. J. Fremouw (Phys. Dyn., Inc., Bellevue, Wash.), J. M. Goodman (NRL, Washington, D.C.), G. K. Hartmann (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), R. Leitinger (Graz Univ.) et al *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 217-245 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 20N

The current status and future prospects of the capability to make transionospheric propagation predictions are addressed, highlighting the effects of the ionized media, which dominate for frequencies below 1 to 3 GHz, depending upon the state of the ionosphere and the elevation angle through the Earth-space path. The primary concerns are the predictions of time delay of signal modulation (group path delay) and of radio wave scintillation. Progress in these areas is strongly tied to knowledge of variable structures in the ionosphere ranging from the large scale (thousands of kilometers in horizontal extent) to the fine scale (kilometer size). Ionospheric variability and the relative importance of various mechanisms responsible for the time histories observed in total electron content (TEC), proportional to signal group delay, and in irregularity formation are discussed in terms of capability to make both short and long term predictions. The data base upon which predictions are made is examined for its adequacy, and the prospects for prediction improvements by more theoretical studies as well as by increasing the available statistical data base are examined. J.M.S.

N80-24696*# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
LONG-TERM SOLAR ACTIVITY PREDICTIONS c92
P. S. McIntosh, G. M. Brown, R. Buhmann, T. Clark, P. F. Fougere, H. Hunter, J. V. Lincoln, H. H. Sargent, III, J. G. Timothy, and Y. Z. Lin *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 246-257 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

The need for long term solar activity predictions is addressed. The spatial organization of solar activity is described including applications for predictions, and ancient evidence for solar variability. Methods of predicting sunspot numbers are discussed. The inherent accuracy of the methods varies considerably, but a typical error bar 20%. The accuracy of sunspot cycle predictions is considered along with long term predictions of great solar events. J.M.S.

N80-24697*# Main Astronomical Observatory, Pulkovo (USSR).
A NEW METHOD OF VERY LONG-TERM PREDICTION OF SOLAR ACTIVITY c92
A. I. Ohl and G. I. Ohl (Arkticheskii i Antarkticheskii Nauchno-Issled. Inst.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 258-263 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

A method of solar activity prediction based on the statistical relationship between the minimum value of geomagnetic activity in each 11 year cycle and the height of the next sunspot cycle is proposed. The method is applied to predict sunspot cycle 21. J.M.S.

N80-24698*# University Coll. of Wales, Aberystwyth. Dept. of Physics.
NEW METHODS FOR PREDICTING THE MAGNITUDE OF SUNSPOT MAXIMUM c92
G. M. Brown *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 264-279 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

Three new and independent methods of predicting the magnitude of a forthcoming sunspot maximum are suggested.

The longest lead time is given by the first method, which is based on a terrestrial parameter measured during the declining phase of the preceding cycle. The second method, with only a slightly shorter foreknowledge, is based on an interplanetary parameter derived around the commencement of the cycle in question (sunspot minimum). The third method, giving the shortest prediction lead-time, is based entirely on solar parameters measured during the initial progress of the cycle in question. Application of all three methods to forecast the magnitude of the next maximum (Cycle 21) agree in predicting that it is likely to be very similar to that of Cycle 18. Author

N80-24699*# Colorado Univ., Boulder. Atmospheric and Space Physics Lab.

THE VARIABILITY OF THE SOLAR ULTRAVIOLET SPECTRAL IRRADIANCES **c92**

J. Gethyn Timothy *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 280-321 refs (For primary document see N80-24678 15-42)

Avail: NTIS HC A99/MF A01 CSCL 03B

Available data on the solar spectral irradiances at wavelengths below 3100 A are extremely limited and there are major uncertainties in many of the measurements. In particular, there is major disagreement on the magnitude of the variability of the spectral irradiances over the solar cycle. The effects of different solar features on the ultraviolet spectral irradiances over both the 28 day solar rotation period and over the solar cycle are discussed. It is proposed that any attempt to predict the magnitudes of the ultraviolet spectral irradiances must take into account a long term variability of emission from quiet regions of the solar disk over the solar cycle. The need for direct long term monitoring of the ultraviolet spectral irradiances is emphasized. J.M.S.

N80-24700*# Astronomical Inst., Utrecht (Netherlands). Space Research Lab.

THE NEEDS FOR PREDICTION AND REAL-TIME MONITORING FOR THE FLARE BUILD-UP STUDY **c92**

Zdenek Svestka *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 322-330 refs (For primary document see N80-24678 15-42)

Avail: NTIS HC A99/MF A01 CSCL 03B

Similarities between plasma instabilities occurring in the magnetospheric tail and in active regions on the Sun are discussed. Intense observations of the flare build-up processes on the Sun planned for May and June 1980 as a part of the Solar Maximum Year are described. J.M.S.

N80-24701*# American Science and Engineering, Inc., Cambridge, Mass.

SOLAR FORECAST AND REAL-TIME MONITORING NEEDS OF THE STUDY OF ENERGY RELEASE IN FLARES (SERF) **c92**

David M. Rust *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 331-339 refs (For primary document see N80-24678 15-42)

Avail. NTIS HC A99/MF A01 CSCL 03B

Complementary, simultaneous observations of flares from as many observatories, both ground based and orbiting, as possible planned for the Solar Maximum Year are considered. The need for forecasts of solar activity on long term, one week, and two day intervals is described. Real time reporting is not needed, but daily summaries of activity and permanent records are important. J.M.S.

N80-24702*# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

REQUIREMENTS FOR PREDICTIONS AND REAL-TIME MONITORING FOR THE STUDY OF TRAVELLING INTERPLANETARY PHENOMENA **c90**

Murray Dryer and M. A. Shea (AFGL, Hanscom AFB, Mass.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 340-345 refs (For primary document see N80-24678 15-42)

Avail: NTIS HC A99/MF A01 CSCL 03B

Physical processes within quiescent as well as disturbed flows of solar wind plasma, energetic particles, and magnetic and electric fields from the Sun are considered. Specifically, travelling interplanetary phenomena to be studied during the years of the solar maximum of solar cycle 21 are covered. It is noted that predictions, while needed for long range, logistical planning, is secondary to the requirements of synoptic real time monitoring over a wide range of particle energies and spectral bandwidths. J.M.S.

N80-24703*# National Aeronautics and Space Administration, Washington, D. C.

SOLAR WIND AND MAGNETOSPHERE INTERACTIONS **c92**

C. T. Russell (California Univ., Los Angeles), J. H. Allen (Environmental Data Serv., Boulder, Colo.), D. P. Cauffman, J. Feynman (Boston Coll.), E. W. Greenstadt (TRW Systems Group, Redondo Beach, Calif.), R. E. Holzer (California Univ., Los Angeles), S. M. Kaye (California Univ., Los Angeles), J. A. Slavin (California Univ., Los Angeles), R. H. Manka (NSF), G. Rostoker (Alberta Univ., Edmonton) et al *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 346-364 refs (For primary document see N80-24678 15-42)

Avail: NTIS HC A99/MF A01 CSCL 03B

The relationship between the magnetosphere and the solar wind is addressed. It is noted that this interface determines how much of the solar plasma and field energy is transferred to the Earth's environment, and that this coupling not only varies in time, responding to major solar disturbances, but also to small changes in solar wind conditions and interplanetary field directions. It is recommended that the conditions of the solar wind and interplanetary medium be continuously monitored, as well as the state of the magnetosphere. Other recommendations include further study of the geomagnetic tail, tests of Pc 3,4 magnetic pulsations as diagnostics of the solar wind, and tests of kilometric radiation as a remote monitor of the auroral electrojet. J.M.S.

N80-24704*# California Univ., Los Angeles. Dept. of Earth and Space Sciences.

ON THE PREDICTION OF MAGNETOSPHERIC CONFIGURATION **c46**

James A. Slavin and Robert E. Holzer *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 365-374 refs (For primary document see N80-24678 15-42)

(Grants NGR-05-007-276; NSF ATM-75-01431)

Avail: NTIS HC A99/MF A01 CSCL 04A

A simple model of magnetic flux transfer is reviewed along with empirical expressions for flux transfer rates based upon the auroral AL index and the eastward component of the interplanetary electric field. It is shown that the magnitude of the time integral of the AL index over isolated intervals of geomagnetic disturbance can be predicted from the the observed flux of southward interplanetary magnetic field lines incident on the front of the magnetosphere. Difficulties in the quantitative prediction of substorm onset time and intensity are discussed and magnetospheric stress index on both solar wind and ground based observations is proposed for this purpose. Finally, caveats concerning the use of both the AL index and interplanetary medium data in predicting the response of the magnetosphere to solar wind conditions are considered. J.M.S.

N80-24705*# California Univ., Los Angeles. Dept. of Earth and Space Sciences.

THE MAGNETOSPHERIC ELECTRIC FIELD AND CONVECTIVE PROCESSES AS DIAGNOSTICS OF THE IMF AND SOLAR WIND **c92**

Stanley M. Kaye *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 375-384 refs (For primary document see N80-24678 15-42)

(Grants NsG-7295; NGL-05-007-004; NSF DES-74-23464)

Avail: NTIS HC A99/MF A01 CSCL 03B

Indirect measurements of the convection field as well as direct of the ionospheric electric field provide a means to at least monitor quanitatively solar wind processes. For instance, asymmetries in the ionospheric electric field and ionospheric Hall currents over the polar cap reflect the solar wind sector polarity. A stronger electric field, and thus convective flow, is found on the side of the polar cap where the y component of the IMF is parallel to the y component of the geomagnetic field. Additionally, the magnitude of the electric field and convective southward B

sub Z and/or solar wind velocity, and thus may indicate the arrival at Earth of an interaction region in the solar wind. It is apparent that processes associated with the convention electric field may be used to predict large scale features in the solar wind; however, with present empirical knowledge it is not possible to make quantitative predictions of individual solar wind or IMF parameters. J.M.S.

N80-24706*# National Oceanic and Atmospheric Administration, Boulder, Colo.
REVIEW OF SELECTED GEOMAGNETIC ACTIVITY INDICES **c46**
Joe H. Allen and J. Feynman (Boston Coll.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 385-398 refs (For primary document see N80-24678 15-42)
(Contract F19628-79-C-0031)
Avail: NTIS HC A99/MF A01 CSCL 04A

Magnetic activity indexes are reviewed. Classifications of magnetograms from single observatories and the global range of potential associated with the equivalent currents which could have produced the variations monitored at a large array of recording sides are addressed. Principal magnetic activity indexes discussed include: the auroral electrojet index and its associated indexes (AU, AL and AO) useful for auroral zone studies; the Kp, ap, aa and am indexes which are measures of midlatitude geomagnetic activity; and the Dst index of magnetic activity recorded at low latitudes. It is concluded that geomagnetic activity indexes are useful in studies of the interaction between solar activity, the interplanetary magnetic field and solar wind, the magnetosphere, ring current, field aligned currents, and ionospheric currents. J.M.S.

N80-24707*# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE PREDICTION OF AE, ap, AND Dst AT TIME LAGS BETWEEN 0 AND 30 HOURS **c46**
D. F. Smart, H. B. Garrett, and M. A. Shea *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 399-414 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

The magnetic activity indexes AE, ap, and Dst are correlated with approximately 35,000 hours of interplanetary plasma and magnetic field measurements acquired near the Earth (assembled by NASA/NSSDC into a composite data sat). Lag times between the indexes and solar wind parameters ranged from 0 to 30 hours. Correlations at lags less than 6 hours yield results in agreement with previous studies. At greater lags, the correlation coefficients between the solar wind parameters and AE and ap approach these parameters' autocorrelation (persistence) values. For Dst the correlation with solar wind parameters is lower than that with AE and ap in the 3 to 4 hour lag range whereas the autocorrelation of Dst is significiantly higher over the entire 0 to 30 hour lag range. The implications of these differences between AE, ap, and Dst are discussed in terms of persistence of solar wind structure. J.M.S.

N80-24708*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREDICTION OF ENERGETIC PARTICLE DISTURBANCES **c93**
G. A. Paulikas (Aerospace Corp., Los Angles, Calif.), D. N. Baker (LASL), W. R. Barron (AFGL), V. Domingo (European Space Technol. Center, Noordwijk, Netherlands), P. R. Higbie (LASL), W. L. Imhof (LMSC, Palo Alto, Calif.), L. R. Lyons, R. L. McPherron, E. C. Roelof (APL/JHU, Laurel, Md.), M. Scholer (Max-Planck-Inst. fuer Phys. und Astrophys., Munich, West Germany) et al *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 415-432 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

The prediction of fluxes of energetic particles of solar or magnetospheric origin is addressed. Topics include the prediction of the properties of the particle populations generated by magnetospheric storms and substorms, and the prediction of long term variations in the populations of magnetospheric particles. E.D.K.

N80-24709*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SHORT TERM MAGNETOSPHERIC PARTICLE VARIATIONS (1 MINUTE > T > 1 DAY), APPENDIX 1 **c46**
P. R. Higbie (LASL), D. N. Baker (LASL), V. Domingo (European Space Technol. Center., Noordwijk, Netherlands), W. L. Imhof (LMSC, Palo Alto, Calif.), R. L. McPherron (California Univ., Los Angeles), W. N. Srjeldvik (NOAA, Boulder, Colo.), D. J. Williams (NOAA, Boulder, Colo.), J. R. Burrows (Herzberg Inst. of Astrophysics), M. Hayakawa (Nagoya Univ.) et al *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 433-440 (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

A schematic representation of the generation and propagation processes for energetic particles of concern in solar terrestrial predictions is given. Particle precipitation at low, mid, and high altitudes is discussed with emphasis on prediction techniques. Methods given for testing of such techniques include traditional collaborations, enhanced collaborations, simulated prediction schemes, and field tests. E.D.K.

N80-24710*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG TERM MAGNETOSPHERIC PARTICLE VARIATIONS (1 DAY > T > INFINITY), APPENDIX 2 **c46**
J. I. Vette, H. K. Hills, G. A. Paulikas (Aerospace Corp., Los Angeles, Calif.), D. A. Sawyer, E. G. Stassinopoulos, M. J. Teague et al *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 441-445 (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

Effects of solar variations on energetic particle propagation are discussed, as well as prediction techniques for such particles within the magnetosphere. Magnetic field models, magnetic energy stored in the tail, magnetic monitoring measurements in the geostationary orbit and at certain ground based stations are important elements concerning improving such techniques.E.D.K.

N80-24711*# Max-Planck-Institut fuer Extraterrestrische Physik, Munich (West Germany).
ENERGETIC SOLAR PARTICLE BEHAVIOUR IN THE MAGNETOSPHERE **c46**
M. Scholer *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 446-463 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

The behavior of energetic solar flare particles in the magnetosphere is discussed. In the absence of magnetospheric motion, the problem of particle transport can be treated as simple propagation of charged particles in a stationary magnetic field configuration using, for instance, trajectory calculations in model fields. This single particle approach is the basis for the determination of intensity and anisotropy structures over the polar caps and in the geomagnetic tail from different interplanetary conditions. Particle transport on closed field lines is in addition strongly affected by resonant interaction processes as pitch angle scattering and radial diffusion. Author

N80-24712*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A REAL-TIME ISEE DATA SYSTEM **c46**
Bruce T. Tsurutani and Daniel N. Baker (LASL) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 464-475 refs Sponsored in part by DOE (For primary document see N80-24678 15-42)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 04A

A real time International Sun Earth Explorer (ISEE) data system directed toward the prediction of geomagnetic substorms and storms is discussed in detail. Such a system may allow up to 60 minutes or more, advance warning of magnetospheric substorms and up to 30 minute warnings of geomagnetic storms induced by high speed streams and solar flares. The proposed system utilizes existing capabilities of several agencies thereby minimizing costs. E.D.K.

N80-24713*# SRI International Corp., Menlo Park, Calif.
MAGNETOSPHERE-IONOSPHERE INTERACTIONS c46
R. R. Vondrak, Y. T. Chiu (Aerospace Corp., Los Angeles, Calif.), D. S. Evans (NOAA, Boulder, Colo.), V. G. Patterson (AF Global Weather Central), G. J. Romick (Alaska Univ., College), and K. Stasiewicz (Polish Acad. of Science, Warsaw) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 476-493 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

The present understanding of magnetosphere ionosphere interactions is described, and present and future predictive capabilities are assessed. Ionospheric features directly coupled to the magnetosphere to a significant degree are considered, with emphasis given to those phenomena of major interest to forecasters and users. E.D.K.

N80-24714*# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.
AURORAL MAGNETOSPHERE-IONOSPHERE COUPLING: A BRIEF TOPICAL REVIEW c46
Y. T. Chiu, J. M. Cornwall (California Univ., Los Angeles), and Michael Schulz *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 494-512 refs (For primary document see N80-24678 15-42)
(Contract NASw-3120)
Avail: NTIS HC A99/MF A01 CSCL 04A

Auroral arcs result from the acceleration and precipitation of magnetospheric plasma in narrow regions characterized by strong electric fields both perpendicular and parallel to the Earth's magnetic field. The various mechanisms proposed for the origin of such strong electric fields include electrostatic double layers, double reverse shocks, anomalous resistivity, magnetic mirroring of hot plasma, mapping of the magnetospheric convection electric field through an auroral discontinuity. E.D.K.

N80-24715*# Alaska Univ., College. Geophysical Inst.
HIGH-LATITUDE E AND F REGION IONOSPHERIC PREDICTIONS c46
Robert D. Hunsucker, R. Allen, P. Argo, R. Babcock, P. Bakshi, D. Lund, S. Matsushita, G. Smith, A. V. Shirochkov, and G. Wortham *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 513-527 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

The physical processes and morphology of the high latitude E and F layers are discussed. The existence and adequacy of models, and features to be included are examined, as well as reliability of ionospheric predictions. E.D.K.

N80-24716*# Articheskii i Antarkticheskii Nauchno- Issledovatelskii Institut, Leningrad (USSR).
ON THE APPROACH TO FORECASTING POLAR IONOSPHERIC CONDITIONS c46
A. S. Besprozvannaya, A. V. Shirochkov, and T. I. Shchuka *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 528-542 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

The major properties of polar ionospheric main anomalous events are summarized. The monitoring of large scale features of the ionization distribution that are the projections of large scale structural characteristics of magnetospheric plasma on the upper ionosphere is suggested as a basic principle of polar ionospheric condition forecasting. It is concluded that the processes of the magnetosphere/ionosphere interaction appear to play a predominant role in the creation of the polar ionosphere. Author

N80-24717*# Alaska Univ., Fairbanks. Geophysical Inst.
MORPHOLOGY AND PHENOMENOLOGY OF THE HIGH-LATITUDE E AND F REGIONS c46
Robert D. Hunsucker *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 543-561 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

Results obtained at high latitude observatories on the behavior of E and F region ionization are presented including a bibliography. Behavior of E and F region ionization during day and night for quiet and disturbed conditions in the auroral and polar regions is described. Daily, seasonal and sunspot variations are also outlined. J.M.S.

N80-24718*# National Telecommunication Information Administration, Boulder, Colo. Inst. of Telecommunications Sciences.
REPORT OF THE MID- AND LOW-LATITUDE E AND F REGION WORKING GROUP c46
Charles M. Rush *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 562-572 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

The formation and variation of the ionosphere is addressed with regard to the ability to understand, specify, and predict the low and mid latitude E and F regions. A brief survey of prediction methods and techniques is given for long and short term variability in the E and F regions. It is indicated that the usefulness of theoretical models to predict electron density distribution in the low and mid latitude ionospheric E and F regions is limited by the ability to predict the parameters which enter the relevant equations; i.e., neutral atmospheric constituents, neutral and charged particle temperatures, neutral wind, electric fields, and ionizing sources such as solar (E sub uv) radiation and energetic particles. It is recommended that areas for research include improving knowledge of the input parameters and how they respond to changing solar and geophysical conditions. J.M.S.

N80-24719*# Norwegian Defence Research Establishment, Kjeller. Electronics Div.
D REGION PREDICTIONS c46
E. V. Thrane, D. K. Chakrabarty (Phys. Res. Lab.), S. D. Deshpande (Dept. of Appl. Phys., Coll. of Eng., India), R. H. Doherty (Colo. Res. and Prediction Lab.), J. B. Gregory (Saskatchewan Univ.), J. K. Hargreaves (Lancaster Univ.), J. Lastovicka, Peter Morris (Coast Guard, Washington, D.C.), W. R. Piggott (British Antarctic Surv.), and J. B. Reagan (LMSC, Palo Alto, Calif.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 573-598 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

Present knowledge of D region phenomena is briefly reviewed and the status of current methods of predicting their effects on radio propagation considered. The ELF, VLF and LF navigational and timing systems depend on the stability of the lower part of the D layer where these waves are reflected, whereas MF and HF waves are absorbed as they penetrate the region, in most cases mainly in the upper part of the layer. Possible methods of improving predictions, warnings, and real time operations are considered with particular stress on those which can be implemented in the near future. J.M.S.

N80-24720*# Air Force Geophysics Lab., Hanscom AFB, Mass.
ION PRODUCTION IN THE D REGION c46
William Swider *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 599-616 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

Ionization processes for the D region are reviewed. Levels of ionization range from the fairly steady rates produced through galactic cosmic rays to the large rates generated during solar flares and associated geomagnetic storms. The normal quiescent daytime D region is ionized by solar UV radiation available because of certain windows and solar X-rays, although this later source is generally weak. Cosmic rays are important roughly below 65 km. At night, stellar X-ray sources may be important along with precipitating electrons at high latitudes from the quiet magnetosphere. Solar flares can result in ionization rates due to X-rays, electrons, or nuclei which are greatly enhanced over quiet conditions. Typical ionization production rates from these various sources are illustrated. Author

N80-24721*# Norwegian Defence Research Establishment, Kjeller.
EFFECTS OF D REGION IONIZATION ON RADIO WAVE PROPAGATION c32
T. R. Larsen *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 617-654 refs (For

primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 20N

The effects of anomalous D region ionization upon radio wave propagation are described for the main types of disturbances: sudden ionospheric disturbances, relativistic electron events, magnetic storms, auroral disturbances, polar cap events, and stratospheric warmings. Examples of radio wave characteristics for such conditions are given for the frequencies between the extremely low (3-3000 Hz) and high (3-30 MHz) frequency domains. Statistics on the disturbance effects and radio wave data are given in order to contribute towards the evaluation of possibilities for predicting the radio effects. Author

N80-24722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR WEATHER/CLIMATE PREDICTIONS c47
K. Schatten (Boston Univ.), Richard A. Goldberg, J. M. Mitchell (NOAA, Silver Spring, Md.), R. Olson (Aspen Inst. for Humanistic Studies, Boulder, Colo.), J. Schaefer (Bonn Univ.), S. Silverman (AFGL), J. Wilcox (Stanford Univ.), and G. Williams (Southampton Univ.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 655-668 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04B

Solar variability influences upon terrestrial weather and climate are addressed. Both the positive and negative findings are included and specific predictions, areas of further study, and recommendations listed. J.M.S.

N80-24723*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COUPLING PROCESSES RELATED TO THE SUN-WEATHER PROBLEM c47
Richard A. Goldberg and John R. Herman (Radio Sci. Co., Melbourne, Fla.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 669-688 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04B

Physical mechanisms for coupling the energetics of solar activity to meteorological responses are reviewed. Although several hypotheses have been advanced, none can be said to be sufficiently complete to be applied to weather or climate prediction. Solar activity indicators potentially useful for forecasting are identified, including sunspots, solar flares, and magnetic sector boundary crossings. Additional experiments, studies, and analyses are required before Sun-weather concepts can be utilized for predicting meteorological responses. Author

N80-24724*# Cornell Univ., Ithaca, N. Y. Atmospheric Sciences Div.
THE IMPACT OF SUN-WEATHER RESEARCH ON FORECASTING c47
Miguel F. Larsen *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 689-702 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04B

The possible impact of Sun-weather research on forecasting is examined. The type of knowledge of the effect is evaluated to determine if it is in a form that can be used for forecasting purposes. It is concluded that the present understanding of the effect does not lend itself readily to applications for forecast purposes. The limits of present predictive skill are examined and it is found that skill is most lacking for prediction of the smallest scales of atmospheric motion. However, it is not expected that Sun-weather research will have any significant impact on forecasting the smaller scales since predictability at these scales is limited by the finite grid size resolution and the time scales of turbulent diffusion. The predictability limits for the largest scales are on the order of several weeks although presently only a one week forecast is achievable. J.M.S.

N80-24725*# Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
PLANETARY WAVES AND SUN-WEATHER EFFECTS c47
H. Volland and J. Schaefer (Bonn Univ.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 703-721 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04B

A brief outline about the theory of planetary waves is given and a review of space-time analysis, mainly at the 500 mbar pressure level, is presented. This analysis gives evidence that broad spectral bands of two types of waves exist within the troposphere: ultralong waves with zonal wave numbers M < or approximately equal to 4 and periods tau > or approximately equal to 5 days, propagating mainly to the west, and synoptic scale waves with M > or approximately equal to 3 and tau < or approximately equal to 10 days, propagating mainly to the east. These waves are generated by internal turbulent processes within the atmosphere and are quasi-persistent with lifetimes of several periods. It is shown that solar activity cannot generate planetary waves of significant amplitudes, and that the observed 'Sun-weather effects' can be interpreted within the framework of these internally generated planetary waves without any trigger mechanism from outside the atmosphere. It is suggested that a better knowledge of these persistent ultralong waves may help to improve long range weather forecasts. J.M.S.

N80-24726*# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE CLOUDED CRYSTAL BALL: COMMENTS ON GEOPHYSICAL PREDICTION
S. M. Silverman *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 722-733 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

The concepts of prediction in the geophysical domain are considered with emphasis on the areas of difficulties and the nature of these difficulties. Differences in defining and determining the validity and significance of hypotheses and observational correlations are covered. J.M.S.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-24727* National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES. A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 25, APRIL 1980
Apr. 1980 109 p
(NASA-SP-7041(25)) Avail: NTIS HC $10.50 CSCL 05B

The bibliography lists 380 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1, 1980 and March 31, 1980. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N80-24728*# Energy and Environmental Analysis, Inc., Arlington, Va.
FORECAST OF LONG TERM COAL SUPPLY AND MINING CONDITIONS: MODEL DOCUMENTATION AND RESULTS
Final Report
7 Mar. 1980 240 p refs Sponsored by NASA and DOE
Prepared for JPL
(Contract JPL-955552)
(NASA-CR-163141; JPL-9950-310) Avail: NTIS HC A11/MF A01 CSCL 08I

A coal industry model was developed to support the Jet Propulsion Laboratory in its investigation of advanced underground coal extraction systems. The model documentation includes the programming for the coal mining cost models and an accompanying users' manual, and a guide to reading model output. The methodology used in assembling the transportation, demand, and coal reserve components of the model are also described. Results presented for 1986 and 2000, include projections of coal

production patterns and marginal prices, differentiated by coal sulfur content. A.R.H.

N80-24729# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DISTRIBUTED SENSOR NETWORKS Semiannual Technical Summary Report, 1 Oct. 1978 - 31 Mar. 1979
Richard T. Lacross 31 Mar. 1979 56 p refs
(Contract F19628-78-C-0002; ARPA Order 3345)
(AD-A082395; ESD-TR-79-211) Avail: NTIS HC A04/MF A01 CSCL 15/4

Progress on the Distributed Sensor Networks program is reported. Further design and analysis of strawman sensor and report circuit communications for a low flying aircraft DSN are presented. System studies dealing with sensor redundancy, adaptive communications nonuniform node distribution, and alternative DSN applications are summarized. Overall designs for DSN node software, for a software development DSN simulation test bed, and acoustic node front-end simulation software are reviewed. Progress on development of a digital acoustic data collection system is reported. GRA

N80-24730# Army Engineer Topographic Labs., Fort Belvoir, Va.
DETECTION OF SIGNAL SIGNATURES OF CARTOGRAPHIC FEATURES
Pi-Fuay Chen and William Seemuller 17 Jan. 1980 19 p refs
(AD-A082235; ETL-R006) Avail: NTIS HC A02/MF A01 CSCL 08/2

A semi-automated technique was developed for extracting and recognizing cartographic features, such as, road intersections, straight line roads, and rectangular objects from aerial photographs. The method uses the Walsh transform processing technique, and was implemented with an electronic experimental system consisting of a solid-state sensor array, a minicomputer, and a computer-controlled translational stage as the imagery holder. Successful experimental results were obtained for a selected set of cartographic features of the types described above. This feature extractor will be integrated in parallel with other feature extractors, which are to be developed in the future, to become a total automated feature extraction system. A method for detecting the decomposed signal signatures representing cartographic features using analog processors is described. Finally, conclusions are given. GRA

N80-24731# Army Engineer Topographic Labs., Fort Belvoir, Va.
CARTOGRAPHIC RASTER PROCESSING PROGRAMS AT USAETL
Richard A. Clark 8 Jan. 1980 19 p
(AD-A082236; ETL-R005) Avail: NTIS HC A02/MF A01 CSCL 08/2

The raster processing activities at USAETL have been concerned with both hardware and software development aimed at high-speed generation of topographic data base information and graphic map production. Early work with raster digitizing techniques resulted in the development of the Cartographic Scanner/Plotter which provides a multi-resolution, rapid capability of digitizing or film plotting. Software to process these raster data has been developed for sequential computers as well as for the STARAN: associative array processor. Recently completed programs for the STARAN permit the processing of raster-scanned contour sheets, the semi-automatic determination and tagging of elevations for the contours, and interpolation of these tagged contours into a uniform grid of elevations. Work has also been started on algorithm development for automatic detection of cartographically symbolized raster scan data. STRAPS programming improvements are under way which will provide expanded capabilities in the vector-to-raster and raster symbolization areas. The soon to be delivered Digital Laser Platemaker will provide a totally new capability to go directly from raster formatted data to press plates, eliminating the film preparation stages entirely. An inherent capability also exists in the laser platemaker to produce quick, self-developing proof plots and conventional film plots for back-up purposes, as well as to receive data via satellite for remote operations. GRA

N80-24732# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
CHART MODIFICATION AND REPRODUCTION WITH A RASTER SYSTEM
Jan S. Schneier Jan. 1980 23 p refs Presented at the Am. Congr. on Surveying and Mapping/ASP Conf., St. Louis, 9-14 Mar. 1980
(AD-A082103) Avail: NTIS HC A02/MF A01 CSCL 14/5

The Defense Mapping Agency Hydrographic/Topographic Center (DMAHTC) acquired the SCI-TEX Response 250 Mapping System (R250/MS) to facilitate the production of modified facsimile charts. Currently, a preliminary evaluation indicates that the system is capable of producing the modified color-separated reproducibles required for the production of modified facsimile charts. Editing of a raster file remains the most time-consuming phase of the production flow. Standard operating procedures to reduce edit time and scanning procedures to reduce the amount of spurious data are currently being established. The addition of font, symbol, and text libraries will further increase the capabilities of the R250/MS. Following the establishment of the system in the modified facsimile reproduction process, other avenues of cartographic applications will be explored. GRA

N80-24733# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
AUTOMATED CARTOGRAPHIC PRODUCTS
Mary G. Clawson Jan. 1980 17 p Presented at the Am. Congr. on Surveying and Mapping/ASP Conf., St. Louis, 9-14 Mar. 1980
(AD-A082107) Avail: NTIS HC A02/MF A01 CSCL 08/2

The Defense Mapping Agency Hydrographic/Topographic Center (DMAHTC) is engaged in researching, planning, compiling, and constructing charts, digital graphics and data bases, and plotter-derived support products through the use of the Advanced Cartographic Production System (ACPS). This presentation highlights the cartographic products generated in support of the military and civil mapping requirements. GRA

N80-24734# Naval Surface Weapons Center, Dahlgren, Va. Science and Mathematics Research Group.
TERRESTRIAL AND CELESTIAL CARTOGRAPHY
A. V. Hershey May 1979 89 p refs
(AD-A082663; NSWC/DL-TR-3789) Avail: NTIS HC A05/MF A01 CSCL 08/2

World Data Bank 1 has been reordered in such a way that the latitudes where coastlines cross meridians are sorted in order of latitude for each minute of longitude. Whether a satellite position is over sea or over land is determined by the parity of the next lower crossing. Stellar data on distance and velocity as well as direction are given in a small catalog. Boundary data for Moon mare, constellations, and the Milky Way are given in a set of files. GRA

N80-24735# Department of Energy, Washington, D. C.
UNCONVENTIONAL GAS RECOVERY - ENHANCED GAS RECOVERY
Oct. 1979 71 p refs
(DOE/EDP-0049) Avail: NTIS HC A04/MF A01

The development of gas recovery methods that will make it economically possible to produce gas resources that are currently uneconomic is examined including resource targets for future development. Processes developed and tested to assist conventional gas extraction processes in the recovery of unconventional gas resources include advanced hydraulic fracturing, chemical explosive fracturing, and directionally deviated wells. The technology program, commercialization plan for unconventional gas recovery, environmental concerns and requirements, and environmental strategy are among the topics discussed. DOE

N80-24736# Department of Energy, Washington, D. C. Office of Leasing Policy Development.
ANALYSIS OF EXPLORATION, DEVELOPMENT AND PRODUCTION ACTIVITY ON FEDERAL OUTER CONTINENTAL SHELF LEASES
J. A. Gribbin, G. M. Kaitz, S. W. Edwards, and K. W. Erickson Dec. 1979 152 p refs
(DOE/RA-0044) Avail: NTIS HC A08/MF A01

Because the Outer Continental Shelf Lands Act Amendments

of 1978 reconfirmed Congress' desire to ensure that persons holding Federal Outer Continental Shelf (OCS)leases act in a diligent manner to explore and develop the resources on these leases. The actual history of operations on all Federal OCS leases was examined. The primary objective of the analysis was to determine and to describe the actual record of exploration, development, and production activity on Federal OCS leases. The analysis was designed also to identify factors that influence the rate of this activity. DOE

N80-24737# LKB Resources, Inc., Huntingdon Valley, Pa.
NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY, COLORADO-ARIZONA AREA: SALTON SEA NI 2-9, PHOENIX NI 12-7, EL CENTRO NI 2-12, AJO NI 12-10, LUKEVILLE NH 12-1 QUADRANGLES. VOLUME 1: NARRATIVE REPORT
Nov. 1979 258 p refs
(Contract EY-76-C-12-1664)
(GJBX-12(80)-Vol-1) Avail: NTIS HC A12/MF A01

A rotary-wing reconnaissance high sensitivity radiometric and magnetic survey, encompassing several 1:250,000 quadrangles in southwestern Arizona and southeastern California, was performed. The surveyed area consisted of approximately 9300 line miles. The radiometric data were corrected and normalized to 400 feet terrain clearance. The data were identified as to rock type by correlating the data samples with existing geologic maps. Statistics defining the mean and standard deviation of each rock type are presented as listings in volume 1 of this report. The departure of the data from its corresponding mean rock type is computed in terms of standard deviation units and is presented as computer listings in microfiche form. The local geology is described, and the magnetic and radiometric data is discussed and selected uranium anomalies are evaluated. DOE

N80-24738# Royal Aircraft Establishment, Farnborough (England).
GEOMETRIC CORRECTION OF SATELLITE IMAGERY
J. M. Williams London HMSO Sep. 1979 31 p refs
(RAE-TR-79121; RAE-Space-569; BR72781) Avail: NTIS HC A03/MF A01

Imagery from LANDSAT and other remote sensing satellites suffers geometric distortion which requires correction. How ground control points can be used to determine the transformation between image coordinates and some known projection is described. These ground control points were located in the image and on a standard map, here a 1:50,000 ordnance survey map. Suitable models for performing the transformation and various interpolation techniques for resampling the transformed image are examined. As results, a set of photographic images is included to show the effects of the processing methods described.
Author (ESA)

N80-24739# South Dakota State Univ., Brookings. Water Resources Research Inst.
MODEL DEVELOPMENT FOR PREDICTING SOIL MOISTURE BY THERMOGRAPHY
Jerald A. Tunheim Jan. 1980 64 p refs
(Contract DI-14-34-0001-7088)
(PB80-140569; WB0-03007; OWRT-A-063-SDAK(1)) Avail: NTIS HC A04/MF A01 CSCL 08K

Experimental and theoretical investigations were carried out relating to the detection and mapping of soil moisture by the use of remote sensed thermal emittance data (thermography). Soil temperature profiles, thermal emittance, soil moisture and other pertinent data were collected for test plots under fallow and crop cover conditions. Data were always collected simultaneously for two plots with indentical surface conditions but one of the plots irrigated to create different soil moisture profiles. Calculations of surface temperature difference as a function of time for these soil moisture conditions were made utilizing a theoretical model. The functional form of the theoretical temperture difference with time were shown to be very close to the experimental apparent temperature difference for both crop cover and bare soil conditions. The general nature of additional parameters needed for the present model are also described.
GRA

N80-24740# Bureau of Mines, Pittsburgh, Pa.
CORRECTION FACTORS FOR LOW VELOCITY AIRFLOW MEASUREMENTS IN MINES
Edward D. Thimons, Slavoljub D. Maksimovic, and Fred N. Kissell 1979 20 p refs
(PB80-137862; BM-RI-8400) Avail: NTIS HC A02/MF A01 CSCL 08I

The Bureau of Mines conducted in-mine tests to determine correction factors applicable to low velocity airflows (below 150 fpm) measured by the smoke cloud, vane anemometer, and oil of wintergreen tracer gas techniques. The average correction factors found for these methods of measurement were lower than those reported in the literature for use with higher velocity measurements. All tests measured airflows with controlled average velocities ranging from 50 to 100 fpm. Correction factors averaged about 0.75 for readings taken by the centerline smoke cloud method, remotely controlled and stickheld centerline anemometer, and split traverse stick-held anemometer. For handheld centerline anemometer and oil of wintergreen tracer gas readings, correction factors averaged about 0.67. Since special anemometers are needed to measure airflows in this low velocity range, and since proper calibration of these anemometers is difficult and expensive, the use of anemometers for low velocity measurement is impractical. On the other hand, smoke and oil of wintergreen give results as consistent as those obtained with specially calibrated, low velocity anemometers. Furthermore, they are easy to use and inexpensive. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *85 Urban Technology and Transportation*.

N80-24741* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF MITIGATING TITANIUM IMPURITIES EFFECTS IN P-TYPE SILICON MATERIAL FOR SOLAR CELLS Patent
Amal M. Salama, inventor (to NASA) (JPL) Issued 6 May 1980 7 p Filed 31 Jan. 1979 Supersedes N79-17315 (17 - 08, p 1001) Sponsored by NASA
(NASA-Case-NPO-14635-1; US-Patent-4,210,622; US-Patent-Appl-SN-008212; US-Patent-Class-156-605; US-Patent-Class-156-617SP; US-Patent-Class-156-DIG.64; US-Patent-Class-136-89SG; US-Patent-Class-252-62.3E) Avail: US Patent and Trademark Office CSCL 10A

An economical way to reduce the deleterious effects of titanium, one of the impurities present in metallurgical grade silicon material, is disclosed. By adding copper to approximately the same concentration level of the titanium during the melting process, the conversion efficiency will be restored to about 99.3% of what it would have been if the single crystal silicon had been grown free of titanium impurities.
Official Gazette of the U.S. Patent and Trademark Office

N80-24742*# PRC Systems Services Co., Huntsville, Ala.
SOLAR ARRAY SUBSYSTEMS STUDY Final Report, Mar. 1979 - May 1980
P. W. Richardson, F. Q. Miller, and M. B. Badgley 6 Jun. 1980 284 p
(Contract NAS3-21926)
(NASA-CR-159857) Avail: NTIS HC A13/MF A01 CSCL 10A

The effects on life cycle costs of a number of technology areas are examined for a LEO, 500 kW solar array. A baseline system conceptual design is developed and the life cycle costs estimated in detail. The baseline system requirements and design technologies are then varied and their relationships to life cycle

costs quantified. For example, the thermal characteristics of the baseline design are determined by the array materials and masses. The thermal characteristics in turn determine configuration, performance and hence life cycle cost. Author

N80-24743*# Materials Research, Inc., Centerville, Utah.
QUANTITATIVE ANALYSIS OF DEFECTS IN SILICON. SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE ARE SILICON SHEET TASK OF THE LOW-COST SOLAR ARRAY PROJECT Final Report
R. Natesh, J. M. Smith, T. Bruce, and H. A. Oidwai Apr. 1980 100 p refs Sponsored by NASA and DOE Prepared for JPL (Contract JPL-954977)
(NASA-CR-163140; MRI-276; DOE/JPL-954977-79/9) Avail: NTIS HC A05/MF A01 CSCL 10A

One hundred and seventy four silicon sheet samples were analyzed for twin boundary density, dislocation pit density, and grain boundary length. Procedures were developed for the quantitative analysis of the twin boundary and dislocation pit densities using a QTM-720 Quantitative Image Analyzing system. The QTM-720 system was upgraded with the addition of a PDP 11/03 mini-computer with dual floppy disc drive, a digital equipment writer high speed printer, and a field-image feature interface module. Three versions of a computer program that controls the data acquisition and analysis on the QTM-720 were written. Procedures for the chemical polishing and etching were also developed. R.E.S.

N80-24744*# Tao (William) and Associates, St. Louis, Mo.
SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT SAINT LOUIS, MISSOURI Final Report
Apr. 1980 68 p refs Sponsored by NASA
(Grant EG-77-G-01-4085)
(NASA-CR-161420) Avail: NTIS HC A04/MF A01 CSCL 10A

The solar heating and hot water system installed at the William Tao & Associates, Inc., office building in St. Louis, Missouri is described, including maintenance and construction problems, final drawings, system requirements, and manufacturer's component data. The solar system was designed to provide 50 percent of the hot water requirements and 45 percent of the space heating needs for a 900 sq ft office space and drafting room. The solar facility has 252 sq ft of glass tube concentrator collectors and a 1000 gallon steel storage tank buried below a concrete slab floor. Freeze protection is provided by a propylene glycol/water mixture in the collector loop. The collectors are roof mounted on a variable tilt array which is adjusted seasonally and is connected to the solar thermal storage tank by a tube-in-shell heat exchanger. Incoming city water is preheated through the solar energy thermal storage tank. R.E.S.

N80-24745*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
COMPARISON OF INDOOR-OUTDOOR THERMAL PERFORMANCE FOR THE SUNPAK EVACUATED TUBE LIQUID COLLECTOR
Mar. 1980 48 p Sponsored by NASA
(Contract DEN-000006)
(NASA-CR-161421; Wyle-TR-531-40-R) Avail: NTIS HC A03/MF A01 CSCL 10A

Performance data for current Sunpak production collectors is presented. The effects of an improved manifold are seen from the test results. The test results show excellent correlation between the solar simulator derived test results and outdoor test results. Also, because of different incident angle modifiers, the all-day efficiency of this collector with a diffuse reflector is comparable to the performance with the standard shaped specular reflector. R.E.S.

N80-24746*# General Electric Co., Philadelphia, Pa. Space Div.
SOLAR HEATING AND COOLING SYSTEM DESIGN AND DEVELOPMENT Final Report
Oct. 1979 106 p ref Sponsored in part by DOE
(Contract NAS8-32092)
(NASA-CR-161422) Avail: NTIS HC A06/MF A01 CSCL 10A

The design and development of marketable solar heating and cooling systems for single family and commercial applications is described. The delivery, installation, and monitoring of the prototype systems are discussed. Seven operational test sites are discussed in terms of system performance. Problems encountered with equipment and installation were usually due to lack of skills required for solar system installation. R.E.S.

N80-24747*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLAR-HEATED FLUIDIZED BED GASIFICATION SYSTEM Patent Application
Shaik A. Qader, inventor (to NASA) (JPL) Filed 15 May 1980 13 p
(Contract NAS7-100)
(NASA-Case-NPO-15071-1; US-Patent-Appl-SN-150115) Avail: NTIS HC A02/MF A01 CSCL 10A

A solar-powered fluidized bed gasification system for gasifying carbonaceous material is disclosed. The system includes a solar gasifier which is heated by fluidizing gas and steam. Energy to heat the gas and steam is supplied by a high heat capacity refractory honeycomb which surrounds the fluid bed reactor zone. The high heat capacity refractory honeycomb is heated by solar energy focused on the honeycomb by solar concentrator through solar window. The fluid bed reaction zone is also heated directly by thermal contact to the high heat capacity ceramic honeycomb with the walls of the fluidized bed reactor. Provisions are also made for recovering and recycling catalysts used in the gasification process. A back-up furnace is provided for start-up procedures and for supplying heat to the fluid bed reaction zone when adequate supplies of solar energy are not available. NASA

N80-24748*# Engelhard Minerals and Chemicals Corp., Edison, N. J.
DURABILITY TESTING AT 5 ATMOSPHERES OF ADVANCED CATALYSTS AND CATALYST SUPPORTS FOR GAS TURBINE ENGINE COMBUSTORS Final Report
B. A. Olson, H. C. Lee, I. T. Osgerby, R. M. Heck, and H. Hess Apr. 1980 95 p refs
(Contracts NAS3-19416; Contract EF-77-A-01-2593)
(NASA-CR-159839; DOE/NASA/9416-80/2) Avail: NTIS HC A05/MF A01 CSCL 10A

The durability of CATCOM catalysts and catalyst supports was experimentally demonstrated in a combustion environment under simulated gas turbine engine combustor operating conditions. A test of 1000 hours duration was completed with one catalyst using no. 2 diesel fuel and operating at catalytically-supported thermal combustion conditions. The performance of the catalyst was determined by monitoring emissions throughout the test, and by examining the physical condition of the catalyst core at the conclusion of the test. Tests were performed periodically to determine changes in catalytic activity of the catalyst core. Detailed parametric studies were also run at the beginning and end of the durability test, using no. 2 fuel oil. Initial and final emissions for the 1000 hours test respectively were: unburned hydrocarbons (C3 vppm):0, 146, carbon monoxide (vppm):30, 2420; nitrogen oxides (vppm):5.7, 5.6. R.E.S.

N80-24749*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CHARACTERIZATION OF THREE TYPES OF SILICON SOLAR CELLS FOR SEPS DEEP-SPACE MISSIONS. VOLUME 2: CURRENT VOLTAGE CHARACTERISTICS OF SOLAREX TEXTURED P(+)8 TO 10 MIL, PLANAR P(+)8 TO 10 MIL AND PLANAR P(+)2 MIL CELLS AS A FUNCTION OF TEMPERATURE AND INTENSITY
A. F. Whitaker, S. A. Little, and V. A. Wooden Mar. 1980 91 p refs
(NASA-TM-78272) Avail: NTIS HC A05/MF A01 CSCL 10A

Three types of high performance silicon solar cells, textured P(+)8 to 10 mil, planar P(+)8 to 10 mil and planar P(+)2 mil were evaluated for their low temperature and low intensity (LTLI) performance. Sixteen cells of each type were subjected to 11 temperatures and 9 intensities. The textured P(+)8 to 10 mil cells provided the best performance both at 1 astronomical unit and at LTLI conditions. The average efficiencies of this cell were

14.5 percent at 1 solar constant/+25 C and 18.7 percent at 0.086 solar constant/-100 C. R.E.S.

N80-24750*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SOLAR THERMAL POWER SYSTEMS POINT-FOCUSING THERMAL AND ELECTRIC APPLICATIONS PROJECTS. VOLUME 1: EXECUTIVE SUMMARY Annual Technical Report, fiscal year 1979
A. Marriott 15 Jan. 1980 36 p 2 Vol.
(Contracts NAS7-100; DE-AI01-79ET-20307; JPL Proj. 5103-93)
(NASA-CR-163147; DOE/JPL-1060-31-Vol-1; JPL-Pub-79-118-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 10A

The activities of the Point-Focusing Thermal and Electric Applications (PETEA) project for the fiscal year 1979 are summarized. The main thrust of the PFTEA Project, the small community solar thermal power experiment, was completed. Concept definition studies included a small central receiver approach, a point-focusing distributed receiver system with central power generation, and a point-focusing distributed receiver concept with distributed power generation. The first experiment in the Isolated Application Series was initiated. Planning for the third engineering experiment series, which addresses the industrial market sector, was also initiated. In addition to the experiment-related activities, several contracts to industry were let and studies were conducted to explore the market potential for point-focusing distributed receiver (PFDR) systems. System analysis studies were completed that looked at PFDR technology relative to other small power system technology candidates for the utility market sector. R.E.S.

N80-24751*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SOLAR THERMAL POWER SYSTEMS POINT-FOCUSING DISTRIBUTED RECEIVER TECHNOLOGY PROJECT. VOLUME 2: DETAILED REPORT Annual Technical Report, fiscal year 1979
1 Apr. 1980 134 p refs Prepared in part by NASA. Lewis Res. Center, Cleveland, Ohio 2 Vol.
(Contracts NAS7-100; DE-AI01-79ET-20307; JPL Proj. 5104-61)
(NASA-CR-159715; DOE/JPL-1060-30-Vol-2; JPL-Pub-79-112-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 10A

The accomplishments of the Point-Focusing Distributed Receiver Technology Project during fiscal year 1979 are detailed. Present studies involve designs of modular units that collect and concentrate solar energy via highly reflective, parabolic-shaped dishes. The concentrated energy is then converted to heat in a working fluid, such as hot gas. In modules designed to produce heat for industrial applications, a flexible line conveys the heated fluid from the module to a heat transfer network. In modules designed to produce electricity the fluid carries the heat directly to an engine in a power conversion unit located at the focus of the concentrator. The engine is mechanically linked to an electric generator. A Brayton-cycle engine is currently being developed as the most promising electrical energy converter to meet near-future needs. R.E.S.

N80-24752*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RESULTS OF THE 1979 NASA/JPL BALLOON FLIGHT SOLAR CELL CALIBRATION PROGRAM
C. H. Seaman and R. S. Weiss 1 May 1980 17 p refs
(Contract NAS7-100)
(NASA-CR-163013; JPL-Pub-80-31) Avail: NTIS HC A02/MF A01 CSCL 10A

Calibration of solar cells to be used as reference standards in simulator testing of cells and arrays was accomplished. Thirty-eight modules were carried to an altitude of about 36 kilometers during the solar cell calibration balloon flight. E.D.K.

N80-24753*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE APPLICABILITY OF DOE SOLAR CELL AND ARRAY TECHNOLOGY TO SPACE POWER
John A. Scott-Monck, Paul M. Stella, and Paul A. Berman 1 May 1980 27 p refs
(Contract NAS7-100)
(NASA-CR-163143; JPL-Pub-80-29) Avail: NTIS HC A03/MF A01 CSCL 10B

An evaluation of the main terrestrial photovoltaic development projects was performed. Technologies that may have applicability to space power are identified. Where appropriate, recommendations are made for programs to capitalize on developed technology. It is concluded that while the funding expended by DOE is considerably greater than the space (NASA and DOD) budget for photovoltaics, the terrestrial goals and the means for satisfying them are sufficiently different from space needs that little direct benefit currently exists for space applications. R.E.S.

N80-24754*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FEDERAL POLICIES TO PROMOTE THE WIDESPREAD UTILIZATION OF PHOTOVOLTAIC SYSTEMS. SUPPLEMENT: REVIEW AND CRITIQUE
J. L. Smith 15 Apr. 1980 115 p
(Contracts NAS7-100; EX-76-A-29-1012)
(NASA-CR-163148; DOE/JPL-1012-45; JPL-80-32) Avail: NTIS HC A06/MF A01 CSCL 10A

Review comments of the Congressional report entitled 'Federal Policies to Promote the Widespread Utilization of Photovoltaic Systems' are presented. Responses to the review comments by the Jet Propulsion Laboratory, preparer of the Congressional report, are also presented. The Congressional report discussed various issues related to promoting the deployment of photovoltaic systems through the Federal Photovoltaic Program. Various program strategies and funding levels were examined. R.E.S.

N80-24755*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROPOSED METHOD FOR DETERMINING THE THICKNESS OF GLASS IN SOLAR COLLECTOR PANELS
Donald M. Moore 1 Mar. 1980 74 p refs
(Contracts NAS7-100; EX-76-A-29-1012)
(NASA-CR-163151; DOE/JPL-1012-41; JPL-Pub-80-34) Avail: NTIS HC A04/MF A01 CSCL 10A

An analytical method was developed for determining the minimum thickness for simply supported, rectangular glass plates subjected to uniform normal pressure environmental loads such as wind, earthquake, snow, and deadweight. The method consists of comparing an analytical prediction of the stress in the glass panel to a glass breakage stress determined from fracture mechanics considerations. Based on extensive analysis using the nonlinear finite element structural analysis program ARGUS, design curves for the structural analysis of simply supported rectangular plates were developed. These curves yield the center deflection, center stress and corner stress as a function of a dimensionless parameter describing the load intensity. A method of estimating the glass breakage stress as a function of a specified failure rate, degree of glass temper, design life, load duration time, and panel size is also presented. R.E.S.

N80-24756*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ELECTRIC VEHICLE PROPULSION SYSTEM'S IMPACT ON BATTERY PERFORMANCE: AN OVERVIEW
John M. Bozek, John J. Smithrick, Robert C. Cataldo, and John G. Ewashinka 1980 10 p refs Presented at the 3d Intern. Elec. Vehicle Exposition and Conf., St. Louis, 20-22 May 1980
(Contract EC-77-A-31-1044)
(NASA-TM-81515; DOE/NASA/1044-7; E-459) Avail: NTIS HC A02/MF A01 CSCL 10B

The performance of two types of batteries, lead-acid and nickel-zinc, was measured as a function of the charging and discharging demands anticipated from electric vehicle propulsion systems. The benefits of rapid high current charging were mixed: although it allowed quick charges, the energy efficiency was reduced. For low power (overnight) charging the current wave shapes delivered by the charger to the battery tended to have no effect on the battery cycle life. The use of chopper speed controllers with series traction motors resulted in a significant

reduction in the energy available from a battery whenever the motor operates at part load. The demand placed on a battery by an electric vehicle propulsion system containing electrical regenerative braking confirmed significant improvment in short term performance of the battery. R.E.S.

N80-24757*# Honeywell, Inc., Minneapolis, Minn.
SPECTROPHOTOVOLTAIC ORBITAL POWER GENERATION Final Report, Aug. 1979 - Feb. 1980
Joan R. Onffroy Feb. 1980 195 p refs
(Contract NAS8-33511)
(NASA-CR-161451; HONEYWELL-80SRC8) Avail: NTIS HC A09/MF A01 CSCL 10A

The feasibilty of a spectrophotovoltaic orbital power generation system that optically concentrates solar energy is demonstrated. A dichroic beam-splitting mirror is used to divide the solar spectrum into two wavebands. Absorption of these wavebands by GaAs and Si solar cell arrays with matched energy bandgaps increases the cell efficiency while decreasing the amount of heat that must be rejected. The projected cost per peak watt if this system is $2.50/W sub p. R.E.S.

N80-24758*# Boeing Engineering and Construction, Seattle, Wash.
MOD-2 WIND TURBINE SYSTEM CONCEPT AND PRELIMINARY DESIGN REPORT. VOLUME 1: EXECUTIVE SUMMARY
Jul. 1979 31 p
(Contracts DEN3-2; DE-AI01-793T-20305)
(NASA-CR-159609; DOE/NASA/0002-80/2) Avail: NTIS HC A03/MF A01 CSCL 10A

The configuration development of the MOD-2 wind turbine system is presented. The MOD-2 is design optimized for commercial production rates which, in multi-unit installations, will be integrated into a utility power grid and achieve a cost of electricity at less than 4 cents per kilowatt hour. R.E.S.

N80-24759*# Delaware Univ., Newark. Dept. of Chemical Engineering.
HEAT STORAGE IN ALLOY TRANSFORMATIONS
C. Ernest Birchenall Apr. 1980 29 p refs
(Grant NsG-3184; Contract EC-77-A-31-1034)
(NASA-CR-159787; DOE/NASA/3194-1) Avail: NTIS HC A03/MF A01 CSCL 10C

The feasibility of using metal alloys as thermal energy storage media was investigated. The elements selected as candidate media were limited to aluminum, copper, magnesium, silicon, zinc, calcium, and phosphorus on the basis of low cost and latent heat of transformation. Several new eutectic alloys and ternary intermetallic phases were determined. A new method employing X-ray absorption techniques was developed to determine the coefficients of thermal expansion of both the solid and liquid phases and the volume change during phase transformation. The method and apparatus are discussed and the experimental results are presented for aluminum and two aluminum-eutectic alloys. Candidate materials were evaluated to determine suitable materials for containment of the metal alloys. Graphite was used to contain the alloys during the volume change measurements. Silicon carbide was identified as a promising containment material and surface-coated iron alloys were also evaluated. System considerations that are pertinent if alloy eutectics are used as thermal energy storage media are discussed. Potential applications to solar receivers and industrial furnaces are illustrated schematically. R.E.S.

N80-24760*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROCEEDINGS OF THE FIRST SEMIANNUAL DISTRIBUTED RECEIVER PROGRAM REVIEW
15 May 1980 241 p refs Proc. held at Lubbock, Tex., 22-24 Jan. 1980; sponsored in part by Texas Tech. Univ.
(Contracts NAS7-100; DE-AI01-79ET-20307)
(NASA-CR-163135; DOE/JPL-1060-33; JPL-Pub-80-10) Avail: NTIS HC A11/MF A01 CSCL 10B

Point focus and line focus distributed receiver solar thermal technology for the production of electric power and of industrial process heat is addressed. Concentrator, receiver, and power conversion development are covered along with hardware tests and evaluation. Mass production costing, parabolic dish applications, and trough and bowl systems are included. For individual titles, see N80-24761 through N80-24798.

N80-24761*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HEAT AND ELECTRICITY FROM THE SUN USING PARABOLIC DISH COLLECTOR SYSTEMS
Vincent C. Truscello and A. Nash Williams *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 19-26 refs (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

Point focus distributed receiver solar thermal technology for the production of electric power and of industrial process heat is addressed. The thermal power systems project which emphasizes the development of cost effective systems which will accelerate the commercialization and industrialization of plants up to 10 MWe, using parabolic dish collectors is described. The projected size of the isolated load market in the 1990-2000 time period is 300 to 1000 MW/year. Although this market is small in comparison to the grid connected utility market, it is indicated that by assuming only a 20 percent market penetration, up to 10,000 power modules per year would be required to meet this need. At a production rate of 25,000 units/year and assuming no energy storage, levelized bus bar energy costs of 75 mills/kWeh are projected. These numbers are based on what is believed to be a conservative estimate regarding engine-generator conversion efficiency (40 percent) for the 1990 time period. With a more optimistic estimate of efficiency (i.e., 45 percent), the bus bar cost decreases to about 67 mills/kWeh. At very large production rates (400,000 modules/years), the costs decrease to 58 mills/kWeh. Finally, the present status of the technology development effort is discussed. J.M.S.

N80-24762*# Sandia Labs., Albuquerque, N. Mex. Solar Energy Projects Dept.
LINE-FOCUS CONCENTRATING COLLECTOR PROGRAM
Virgil L. Dugan *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 27-33 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

The Line-Focus Concentrating Collector Program has emphasized the development and dissemination of concentrating solar technology in which the reflected sunlight is focused onto a linear or line receiver. Although a number of different types of line-focus concentrators were developed, the parabolic trough has gained the widest acceptance and utilization within the industrial and applications sectors. The trough is best applied for application scenarios which require temperatures between 140 and 600 F. Another concept, the bowl, is investigated for applications which may require temperatures in the range between 600 and 1200 F. Current technology emphases are upon the reduction of system installation cost and the implementation of production oriented engineering. J.M.S.

N80-24763*# E-Systems, Inc., Dallas, Tex. Energy Technology Center.
TEST BED CONCENTRATOR (TBC)
Vernon R. Goldberg *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 35-39 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

A point focussing concentrator design adapted from an existing communications antenna for use in a solar test bed application is described. The structure design, configured for use with JPL's spherical radius mirror panels, made no attempt toward optimization. The key objectives of stiffness, pointing accuracy, and timely delivery were exceeded. The system weight is approximately 16,000 Kg (36,000 lbs) and has a calculated 1 sigma system error of 0.03 degrees. J.M.S.

N80-24764*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TEST BED CONCENTRATOR MIRRORS
M. J. Argoud *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 41-46 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

The test bed concentrator (TBC) was des point focusing distributed receiver (PFDR) systems. The reflective surface of the concentrator was fabricated using mirror facet designs and techniques. The facets are made by bonding mirrored glass to spherically-conducted substrates. Several aspects of earlier work were reevaluated for application to the TBC: optimum glass block size, material selection, environmental test, optical characteristics, and reliability. A detailed explanation of tooling, substrate preparation, testing techniques, and mirror assembly is presented. J.M.S.

N80-24765*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INITIAL TEST BED CONCENTRATOR CHARACTERIZATION
D. J. Starkey *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 47-51 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

The operational characteristics and the mirror alignment technique of the test bed concentrator control system are highlighted. The final design of the TBC control system provided one axis of fast slew capability so that either the Sun acquisition or emergency off-Sun mode could be obtained in a minimum time. The procedure for getting on and off Sun is to run the elevation axis up to the approximate elevation of the Sun for the particular time of acquisition and then slew the concentrator on Sun in azimuth. The automatic Sun-acquisition system is controlled by two Sun sensors, one for each axis: each has a 2 deg acquisition cone angle within which the concentrators are programmed to point. The mirror alignment technique chosen utilized a semi-distant incandescent light source which produced a reflected image on the focal point target. The concentrator was boresighted to the light by moving the concentrator while sighting along the cross hairs and through the apertures in the disks to the light source resulting in a maximum point error of 0.11 deg. Test plans to install a solar flux mapper to characterize the solar spot and to measure the size, shape, and intensity of the Sun's image are outlined. J.M.S.

N80-24766*# OMNIUM-G Co., Anaheim, Calif.
THE OMNIUM-G HTC-25 TRACKING CONCENTRATOR
S. Zelinger *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 53-57 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

A point focusing, two axis tracking, high concentration ratio parabolic reflector is described. Field experience coupled with engineering improvements are shown to have manifested a design that is economic in the areas of manufacturing, packaging, delivering, installing, and commissioning the system into operation. The initial problems specifically with the OMNIUM-G model HTC-25 tracking concentrator are addressed. J.M.S.

N80-24767*# General Electric Co., Philadelphia, Pa. Advanced Energy Dept.
THE SHENANDOAH CONCENTRATOR
A. J. Poche *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 59-61 refs (For primary document see N80-24760 15-44)
(Contracts DE-AC04-77ET-2D260; EG-77-C-04-3985)
Avail: NTIS HC A11/MF A01 CSCL 10A

A 7 meter diameter, parabolic dish solar collector was designed and developed for first application at Shenandoah, Georgia. Key features and requirements for the collector are outlined. Performance test results for collector testing at Sandia Laboratories in Albuquerque are summarized. The key features, requirements and performance of the solar collector subassemblies/subsystems are discussed: mount and drives, reflector, receiver, and collector control unit. Problems experienced during collector testing in Albuquerque are identified and solutions described. J.M.S.

N80-24768*# General Electric Co., Philadelphia, Pa.
THE 1ST GENERATION LOW COST POINT FOCUS SOLAR CONCENTRATOR
J. Zimmerman *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 63-67 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

A point focus solar concentrator that, given a high volume of production, will optimize the ratio of performance to cost is considered. The concentrator design approach has evolved by a systematic process of examining the operating requirements particular to the solar application, minimizing material content through detail structural design and structurally efficient subsystem features, and utilizing materials and processes compatible with high volume production techniques. The design approach, the rationale for the configuration and subsystem selections, and the development status are described. J.M.S.

N80-24769*# Acurex Corp., Mountain View, Calif.
A CELLULAR GLASS SUBSTRATE SOLAR CONCENTRATOR
Roger Bedard and D. Bell *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 69-73 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

The design of a second generation point focusing solar concentration is discussed. The design is based on reflective gores fabricated of thin glass mirror bonded continuously to a contoured substrate of cellular glass. The concentrator aperture and structural stiffness was optimized for minimum concentrator cost given the performance requirement of delivering 56 kWth to a 22 cm diameter receiver aperture with a direct normal insolation of 845 watts sq m and an operating wind of 50 kmph. The reflective panel, support structure, drives, foundation and instrumentation and control subsystem designs, optimized for minimum cost, are summarized. The use of cellular glass as a reflective panel substrate material is shown to offer significant weight and cost advantages compared to existing technology materials. R.E.S.

N80-24770*# AiResearch Mfg. Co., Torrance, Calif.
THE DEVELOPMENT OF AN AIR BRAYTON AND A STEAM RANKINE SOLAR RECEIVER
Max V. Greeven *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 75-85 refs (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

An air Brayton and a steam Rankine solar receiver now under development are described. These cavity receivers accept concentrated insolation from a single point focus, parabolic concentrator, and use this energy to heat the working fluid. Both receivers were designed for a solar input of 85 kw. The air Brayton receiver heats the air to 816 C. A metallic plate-fin heat transfer surface is used in this unit to effect the energy transfer. The steam Rankine receiver was designed as a once-through boiler with reheat. The receiver heats the water to 704 C to produce steam at 17.22 MPa in the boiler section. The reheat section operates at 1.2 MPA, reheating the steam to 704 C. R.E.S.

N80-24771*# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeronutronic Div.
AN ORGANIC RANKINE RECEIVER FOR THE SCSTPE PROGRAM
D. B. Osborn *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 87-93 refs (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

The organic Rankine cycle receiver which is presently being developed is described. The receiver employs an integrated cavity/pool boiler which permits the design of a small, lightweight, low cost and efficient moderate temperature receiver for use in a dish-Rankine solar thermal system. R.E.S.

N80-24772*# Fairchild Stratos Corp., Manhattan Beach, Calif.
NON-HEAT PIPE/P-40 STIRLING ENGINE
R. A. Haglund *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 95-97 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

The non-heat-pipe receiver/P-40 Stirling engine system design is described. A 25 kW direct-driven induction-type

alternator will be mounted directly to the P-40 engine to produce to a 60 Hz, 115/230 volt output. R.E.S.

N80-24773*# Ford Aerospace and Communications Corp., Newport Beach, Calif.
THE SCSTPE ORGANIC RANKINE ENGINE
Frank P. Boda *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 99-105 refs (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

The organic Rankine cycle engine under consideration for a solar thermal system being developed is described. Design parameters, method of control, performance and cost data are provided for engine power levels up to 80 kWe; efficiency is shown as a function of turbine inlet temperature in the range of 149 C to 427 C. R.E.S.

N80-24774*# AiResearch Mfg. Co., Phoenix, Ariz.
A HYBRID BRAYTON ENGINE CONCEPT
Lyle D. Six and R. Elkins *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 107-112 ref (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

A first generation open cycle Brayton engine concept for use in full scale solar module testing was defined. The concept extended to include solar/fossil hybrid capability. The combustion system defined for hybrid operation consists of a wide range combustor liner, a single airblast atomizer, an ignitor and a high-voltage ignition unit. Wide range combustor operation would be achieved through combining pilot and primary zones. The hybrid control mode and the solar only control mode are both based on the concept of maintaining constant turbine inlet temperature and varying the engine speed for part-power operation. In addition, the hybrid control concept will allow the operator to set a minimum thermal power input to the engine by setting a corresponding minimum engine speed. When the solar thermal power input falls below this minimum, fossil fuel would be utilized to augment the solar thermal power input. R.E.S.

N80-24775*# United Sterling, Inc. Alexandria, Va.
THE UNITED STIRLING P40 ENGINE FOR SOLAR DISH CONCENTRATOR APPLICATION
Lars Ortegren and Lars E. Sjostedt (United Stirling A.B., Malmo, Sweden) *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 113-117 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

The United Stirling P40 engine is a key component in a solar concentration based energy conversion system, to be demonstrated and tested during 1980-81. The inherent characteristics of modern Stirling engines is reviewed focusing on the baseline P40 double-acting engine. The extent of modifications required for the solar application is reviewed and performance data are predicted. Finally, the potential of an advanced solar Stirling engine is briefly considered. R.E.S.

N80-24776*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
JPL'S PARABOLIC DISH TEST SITE
Terry L. Hagen *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 119-123 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

A parabolic dish test site (PDTS) was established in the California Mojave Desert to carry out work in testing solar point focusing concentrator systems and related hardware. The site was chosen because of its high solar insolation level and year around clear sky conditions. The various facilities and equipment at the PDTS, and the concentrator experiments being performed are described. R.E.S.

N80-24777*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OMNIUM-G CONCENTRATOR TEST RESULTS
Jack D. Patzold *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 125-131 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

A performance evaluation was conducted on a commercially available point-focus solar concentrator, the Heliodyne model HTC-25s tracker/concentrator. Thermal power test results indicate that slightly more than six kilowatts of thermal energy is available from a system of this configuration using a 10 cm aperture. R.E.S.

N80-24778*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE JPL FLUX MAPPER
William A. Owen *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 133-137 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

The flux mapper is a device that can map the intensity distribution in three dimensions of concentrated solar energy at the focus of a concentrator. Intensities to 10,000 solar constants can be measured. Constructed to assist in concentrator and receiver development, it consists of a radiometer which is moved through the concentrated sunlight in a series of planes perpendicular to the optical axis by means of a mechanical rastering device. Various radiometer probes can be utilized depending on the time and accuracy requirements of the program. Energy levels are recorded as a function of location. Reduction of this data can be in various formats, e.g., contour maps, digital arrays, isometric visualizations and other displays as the user requires. R.E.S.

N80-24779*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COSTING THE OMNIUM-G SYSTEM 7500
H. R. Fortgang *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 139-144 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 05C

A complete OMNIUM-G System 7500 was cost analyzed for annual production quantities ranging from 25 to 10,000 units per year. Parts and components were subjected to in-depth scrutiny to determine optimum manufacturing processes, coupled with make or buy decisions on materials and small parts. When production quantities increase both labor and material costs reduce substantially. A redesign of the system that was analyzed could result in lower costs when annual production runs approach 100,000 units/year. Material and labor costs for producing 25, 100, 25,000 and 100,00 units are given for 17 subassembly units. A.R.H.

N80-24780*# Pioneer Engineering and Mfg. Co., Inc., Warren, Mich.
TBC COSTING
Henry L. Kaminski *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 145-152 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 05C

Procedures to be used in determining the cost of producing and installing a parabolic dish collector in annual production volumes of 10,000, 50,000, 100,000, and 1,000,000 units include (1) evaluating each individual part for material cost and for the type and number of operations required to work the raw material into the finished part; (2) costing labor, burden, tooling, gaging, machinery, and equipment; (3) estimating facilities requirements for each production volume; and (4) considering suggestions for design and material alterations that could result in cost reduction. A.R.H.

N80-24781*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COST ESTIMATING BRAYTON AND STIRLING ENGINES
Herbert R. Fortgang *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 153-158 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 05C

Brayton and Stirling engines were analyzed for cost and selling price for production quantities ranging from 1000 to 400,000 units per year. Parts and components were subjected to indepth scrutiny to determine optimum manufacturing processes coupled with make or buy decisions on materials and small

parts. Tooling and capital equipment costs were estimated for each detail and/or assembly. For low annual production volumes, the Brayton engine appears to have a lower cost and selling price than the Stirling Engine. As annual production quantities increase, the Stirling becomes a lower cost engine than the Brayton. Both engines could benefit cost wise if changes were made in materials, design and manufacturing process as annual production quantities increase. Author

N80-24782*# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeronutronic Div.
THE DISH-RANKINE SCSTPE PROGRAM (ENGINEERING EXPERIMENT NO. 1)
Robert L. Pons and Carl E. Grigsby *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 159-167 ref (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

Activities planned for phase 2 of the Small Community Solar Thermal Power Experiment (PFDR) program are summarized with emphasis on a dish-Rankine point focusing distributed receiver solar thermal electric system. Major design efforts include: (1) development of an advanced concept indirect-heated receiver;(2) development of hardware and software for a totally unmanned power plant control system; (3) implementation of a hybrid digital simulator which will validate plant operation prior to field testing; and (4) the acquisition of an efficient organic Rankine cycle power conversion unit. Preliminary performance analyses indicate that a mass-produced dish-Rankine PFDR system is potentially capable of producing electricity at a levelized busbar energy cost of 60 to 70 mills per KWh and with a capital cost of about $1300 per KW. A.R.H.

N80-24783*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SITING SOLAR THERMAL POWER EXPERIMENTS
Herbert J. Holbeck *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 169-173 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

The Small Community Solar Thermal Power Experiment will test a point-focusing, distributed receiver system in a small community, electric utility application. Site planning is becoming increasingly important for solar experiments as well as all kinds of development due to increased competition for desirable sites and increased complexity of regulatory requirements. Siting issues can be categorized as: (1) resources and physical environmental at this site; (2) acquisition, permits and regulations; and (3) development requirements and costs. These issues are addressed with respect to the unique requirements of solar thermal power experiments. A.R.H.

N80-24784*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE JPL ISOLATED APPLICATION EXPERIMENT SERIES
Richard R. Levin *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 175-179 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

A set of small (approximately 60-150 kWe) solar thermal power experiments, each of which is meant to address a separate isolated load application, will employ point focusing distributed receiver technology with emphasis on electric and possibly some thermal power applications. The program will be closely integrated with the technology development element of the thermal power systems project with the objective of utilizing the technologies being developed under that program. A.R.H.

N80-24785*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INDUSTRIAL APPLICATION EXPERIMENT SERIES
Steven A. Bluhm *In its* Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 181-184 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

The deployment of parabolic dish systems into the industrial sector for the purpose of providing users, suppliers, sponsors, and developers with a realistic assessment of system feasibility in selected near-term industrial applications will be accomplished initially through the industrial module experiment and later through additional experiments involving thermal, electric, and combined thermal and electrical systems. The approach is to progress through steps, from single module to multi-module systems, from thermal-only applications to more complex combined thermal and electric applications. The experience of other solar thermal experiments, particularly those involving parabolic dish hardware, will be utilized to the fullest extent possible in experiment planning and implementation. A.R.H.

N80-24786*# General Electric Co., Philadelphia, Pa.
SPS MARKET ANALYSIS
Hugh C. Goff *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 185-189 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 05C

A market analysis task included personal interviews by GE personnel and supplemental mail surveys to acquire statistical data and to identify and measure attitudes, reactions and intentions of prospective small solar thermal power systems (SPS) users. Over 500 firms were contacted, including three ownership classes of electric utilities, industrial firms in the top SIC codes for energy consumption, and design engineering firms. A market demand model was developed which utilizes the data base developed by personal interviews and surveys, and projected energy price and consumption data to perform sensitivity analyses and estimate potential markets for SPS. A.R.H.

N80-24787*# BDM Corp., McLean, Va.
MILITARY MARKETS FOR SOLAR THERMAL ELECTRIC POWER SYSTEMS
James S. Hauger *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 191-195 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

The Department of Defense maintains an inventory of over 1,800 MW of engine-generators 15 KW and larger, with an estimated procurement rate of over 140 MW/year. Nearly the entire requirement could be met by advanced heat engines of the types being developed as point-focussing, distributed receiver power plants. A conceptual system consisting of a heat engine which efficiently burns liquid fossil or synthetic fuels, with a 'solarization kit' for conversion to hybrid solar operation could meet existing DOD requirements for new systems which are quieter, lighter, and multi-fueled. An estimated 24 percent (33 MW/year) or more could operationally benefit from the solar option. Baseline cost projections indicate levelized energy cost goals of 210 to 120 mills/KWh (15 to 1000 KW systems). Fuel cost escalation is the major factor affecting the value of the solar option. A baseline calculation for fuel at $0.59/gal in spring, 1979, escalating at 8 percent above general inflation indicates a value of $2700/KWe for a solarization kit. A.R.H.

N80-24788*# Science Applications, Inc., McLean, Va.
SOLAR THERMAL PLANT IMPACT ANALYSIS AND REQUIREMENTS DEFINITION
Yudi P. Gupta *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 197-209 (For primary document see N80-24760 15-44)
(Contract JPL-955238)
Avail: NTIS HC A11/MF A01 CSCL 10B

Progress on a continuing study comprising of ten tasks directed at defining impact and requirements for solar thermal power systems (SPS), 1 to 10 MWe each in capacity, installed during 1985 through year 2000 in a utility or a nonutility load in the United States is summarized. The point focus distributed receiver (PFDR) solar power systems are emphasized. Tasks 1 through 4, completed to date, include the development of a comprehensive data base on SPS configurations, their performance, cost, availability, and potential applications; user loads, regional characteristics, and an analytic methodology that incorporates the generally accepted utility financial planning methods and several unique modifications to treat the significant and specific characteristics of solar power systems deployed in either central or distributed power generation modes, are discussed. E.D.K.

N80-24789*# Little (Arthur D.), Inc., San Francisco, Calif.
A STUDY OF MASS PRODUCTION AND INSTALLATION OF SMALL SOLAR THERMAL ELECTRIC POWER SYSTEMS
John F. Butterfield *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 211-215 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

Technological constraints, materials availability, production capacity, and manufacturing and installations plans and costs at different production levels are included in a study of concentrating collector industrialization. As cobalt for the engine and receiver is supply limited, alternative lower temperature alloys and higher temperature materials such as ceramics are discussed. Economics and production efficiency favor co-location of cellular and thin glass production for reflectors. Assembly and installation are expensive for small sites and few alternatives exist to apply mass production techniques to lower those costs for the selected design. Stepping motors in the size and quantities required are not commercially available today but could be in the future.
E.D.K.

N80-24790*# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
THE CROSSBYTON PROJECT
John D. Reichert *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 217-220 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

The Analog Design Verification System (ADVS), the largest single solar collector built, was tested. Referred to as the Solar Gridiron or Bowl Concept, it employs a stationary mirror, with tracking accomplished by the mirror.
E.D.K.

N80-24791*# Acurex Corp., Mountain View, Calif.
IEA/SPS 500 kW DISTRIBUTED COLLECTOR SYSTEM
Temple W. Neumann and Creighton D. Hartman *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 221-227 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

Engineering studies for an International Energy Agency project for the design and construction of a 500 kW solar thermal electric power generation system of the distributed collector system (DCS) type are reviewed. The DCS system design consists of a mixed field of parabolic trough type solar collectors which are used to heat a thermal heat transfer oil. Heated oil is delivered to a thermocline storage tank from which heat is extracted and delivered to a boiler by a second heat transfer loop using the same heat transfer oil. Steam is generated in the boiler, expanded through a steam turbine, and recirculated through a condenser system cooled by a wet cooling tower.
E.D.K.

N80-24792*# Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
COOLIDGE SOLAR POWERED IRRIGATION PUMPING PROJECT
Dennis L. Larson *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 229-233 refs (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

A 150 kW solar thermal electric power plant which includes over 2100 square meters of parabolic trough type collectors and an organic Rankine cycle turbine engine was constructed on an irrigated farm. The plant is interconnected with the electrical utility grid. Operation is providing an evaluation of equipment performance and operating and maintenance requirements as well as the desirability of an on farm location.
E.D.K.

N80-24793*# Battelle Columbus Labs., Ohio.
THE 50-HORSEPOWER SOLAR-POWERED IRRIGATION FACILITY LOCATED NEAR GILA BEND, ARIZONA
Wilbur A. Smith, G. Alexander, and D. F. Busch *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 235-239 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

The 50 horsepower solar powered irrigation facility near Gila Bend, Arizona which includes a Rankine cycle demonstrates the technical feasibility of solar powered pumping. The design of a facility specifically for the irrigation farmer using the technology that has been developed over the last four years is proposed.
E.D.K.

N80-24794*# New Mexico State Univ., Las Cruces.
PRELIMINARY OPERATIONAL RESULTS FROM THE WILLARD SOLAR POWER SYSTEM
Donald L. Fenton, G. H. Abernathy, G. Krivokapich, D. E. Ellibee, and V. Chilton *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 241-246 refs (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10B

The solar powered system located near Willard, New Mexico, generates mechanical or electrical power at a capacity of 19 kW (25 HP). The solar collection system incorporates east/west tracking parabolic trough collectors with a total aperture area of 1275 sq m (13,720 sq ft). The hot oil type thermal energy storage is sufficient for approximately 20 hours of power system operation. The system utilizes a reaction type turbine in conjunction with an organic Rankine cycle engine. Total collector field efficiency reaches a maximum of 20 percent near the winter solstice and about 50 percent during the summer. During the month of July, 1979, the system pumped 60 percent of the 35,300 cu m (28.6 acre-feet) of water delivered. Operating efficiencies for the turbine component, organic Rankine cycle engine and the complete power system are respectively 65 to 75 percent, 12 to 15 percent and 5 to 6 percent. Significant maintenance time was expended on both the collector and power systems throughout the operational period.
Author

N80-24795*# Georgia Power Co., Atlanta.
SOLAR TOTAL ENERGY-LARGE SCALE EXPERIMENT, SHENANDOAH, GEORGIA
Walter R. Hensley *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 247-249 (For primary document see N80-24760 15-44)
Avail: NTIS HC A11/MF A01 CSCL 10A

The design and development of a 7 meter diameter parabolic dish solar collector are discussed. Each of the four main subsystems of the collector: (1) reflector, (2) mount and drives, (3) receiver and (4) the controls, is discussed briefly with the major emphasis on the receiver design. To minimize development risks and production costs, a dish design based on use of stamped aluminum petals (sectors) was chosen. This design is similar to the design of a communication antenna already commercially produced. The reflective surface of the petals has a total reflectance of .86 and a specularity (dispersion) of 8 mrd. This performance is obtained by mechanical polishing and chemical brightening of the petal surface, followed by application of a clear RTV silicone protective coating. Selection of the material and weather proofing coated are discussed. Results from performance tests on an engineering development dish collector are presented and compared with pretest predictions.
J.M.S.

N80-24796*# General Electric Co., Philadelphia, Pa.
SOLAR TOTAL ENERGY PROJECT AT SHENANDOAH, GEORGIA SYSTEM DESIGN
A. J. Poche *In* JPL Proc. of the First Semiann. Distributed Receiver Program Rev. 15 May 1980 p 251-255 (For primary document see N80-24760 15-44)
(Contracts EG-77-C-04-3985; DE-AC04-77ET-20260)
Avail: NTIS HC A11/MF A01 CSCL 10B

The solar total energy system (STES) was to provide 50% of the total electrical and thermal energy requirements of the 25,000 sq ft Bleyle of America knitwear plant located at the Shenandoah Site. The system will provide 400 kilowatts electrical and 3 megawatts of thermal energy. The STES has a classical, cascaded total energy system configuration. It utilizes one hundred twenty (120), parabolic dish collectors, high temperature (750 F) trickle oil thermal energy storage and a steam turbine generator. The electrical load shaving system was designed for interconnected operation with the Georgia Power system and for operation in a stand alone mode.
J.M.S.

N80-24797*# General Electric Co., Schenectady, N. Y. Energy Technology Operation.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 1: SUMMARY REPORT Final Report

H. E. Gerlaugh, E. W. Hall, D. H. Brown, R. R. Priestley, and W. F. Knightly Jan. 1980 154 p
(Contract DEN3-31)
(NASA-CR-159765; GE79ET0102; DOE/NASA/0031-80/1) Avail: NTIS HC A08/MF A01 CSCL 10B

Large savings can be made in industry by cogenerating electric power and process heat in single energy conversion systems rather than separately in utility plants and in process boilers. About fifty industrial processes from the largest energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidates which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed-cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum-based residual and distillate liquid fuels, and low Btu gas obtained through the on-site gasification of coal. An attempt was made to use consistent assumptions and a consistent set of ground rules for determining performance and cost in individual plants and on a national level. It was found that: (1) atmospheric and pressurized fluidized bed steam turbine systems were the most attractive of the direct coal-fired systems; and (2) open-cycle gas turbines with heat recovery steam generators and combined-cycles with NO(x) emission reduction and moderately increased firing temperatures were the most attractive of the coal-derived liquid-fired systems. R.E.S.

N80-24798*# Rockwell International Corp., Huntsville, Ala.
STUDY OF MULTI-kW SOLAR ARRAYS FOR EARTH ORBIT APPLICATIONS: MIDTERM PERFORMANCE REVIEW
26 Jul. 1979 98 p
(Contract NAS8-32988)
(NASA-CR-161467) Avail: NTIS HC A05/MF A01 CSCL 10A

Planar and concentrator solar array concepts capable of providing 300 kW to 1000 kW in low Earth orbit applications in the 1987 time period at an array recurring cost less than or equal to thirty dollars per watt are examined. Silicon and gallium arsenide solar cell applicability are evaluated. On-orbit maintenance by space shuttle is also investigated. Design configurations for the solar arrays and solar cells are recommended. R.E.S.

N80-24799# Naval Weapons Center, China Lake, Calif.
GEOTHERMAL ENERGY RESOURCES OF NAVY/MARINE CORPS INSTALLATIONS ON THE ATLANTIC AND GULF COASTAL PLAIN Interim Report, Jun. - Sep. 1978
Douglas W. Edsall (Naval Academy) Mar. 1980 43 p refs
(AD-A082400; NWC-TP-6062) Avail: NTIS HC A03/MF A01 CSCL 10/1

The search for alternative energy sources is of great importance to the U.S. Navy. Preliminary examination of data from the literature, bottom hole temperatures from existing deep wells, and heat flow measurements in wells drilled at selected sites as part of a current research program sponsored by the Department of Energy have demonstrated that low temperature waters (-212 F or 100 C) may be available at moderate depths in the major sedimentary basins along the Atlantic and east Gulf Coastal Plain. Although the possible geothermal energy resources present here are not sufficient for electrical power generation, they appear adequate for space heating and cooling. The Navy should take a leading role in planning and executing exploratory drilling and resource evaluation programs, especially at the following installations, all of which are major energy users: Norfolk, Portsmouth, and Virginia Beach, Virginia; Charleston, South Carolina; and Pensacola, Milton, and Panama City, Florida. GRA

N80-24800# EIC, Inc., Newton, Mass.
INVESTIGATIONS OF THE SAFETY OF Li/SOCl2 BATTERIES Final Report, 30 Sep. 1978 - 29 Sep. 1979
Kuzhikalail M. Abraham, Richard M. Mank, and Gerhard L. Holleck Fort Monmouth, N. J. Army Electronics Research and Development Command Feb. 1980 105 p refs
(Contract DAAB07-78-C-0564; DA Proj. 1L1-62705-AH-94)
(AD-A081998; C-536; DELET-TR-78-0564-F) Avail: NTIS HC A06/MF A01 CSCL 10/3

Forced overdischarge behavior of Li/SOCl2 cells was studied using spirally wound C-size and small prismatic cells. Cathode and anode limited cells were tested. Cathode limited cells could be forcibly overdischarged for long periods of time without explosions. Anode limited cells, on the other hand, were found to be potentially hazardous. Our data suggest that anode limited cells are likely to explode during forced overdischarge. The behavior of Li/SOCl2 cells during application of a (charge) current was investigated using C-size cells. It was possible to subject either new or partially discharged cells to a (charging) current without apparent hazard. The charging reactions involve a sequence of regenerative processes so that only small amounts of chemicals accumulate in the cells. On the basis of materials characterized from IR spectral and cyclic voltammetry data, a mechanism is proposed for the oxidation reactions in SOCl2/LiAlCl4 solutions. Preliminary studies indicated that Li2S/AlCl3 based electrolytes may be useful as alternatives to LiAlCl4 in Li/SOCl2 batteries. GRA

N80-24801# Brookhaven National Lab., Upton, N. Y.
LOW-COST GENERAL ENERGY/ANALYTIC INFORMATION SYSTEM
Ann W. Reisman and Jack Allentuck 1979 7 p Presented at the Intern. Conf. on Energy Use Management, Los Angeles, 22 Oct. 1979
(Contract EY-76-C-02-0016)
(BNL-26398; CONF-791009-6) Avail: NTIS HC A02/MF A01

Energy planning is frequently complicated by the fact that many countries should not be viewed as single entities, but rather as assemblies of regions. Sub-national regional differences arise from variations in terrain and climate, and demographic and historical patterns as well as combinations of these and other factors. Planners must consider sub-national regional needs and opportunities in formulating national energy plans. The structure and data requirements for a low cost energy/analytic information system having a regional capability is outlined. The kinds of planning decisions that require energy-information-system support are examined. The information content of an energy information system is summarized and its basic analytic capabilities are described. DOE

N80-24802# Logistics Management Inst., Washington, D. C.
THE PROJECT INDEPENDENCE EVALUATION SYSTEM (PIES). VOLUME 1: DESCRIPTION OF THE SYSTEM, EXECUTIVE SUMMARY
Oct. 1978 51 p
(Contract EA-78-X-01-1321)
(HCP/I-1321-01/1) Avail: NTIS HC A04/MF A01

The project independence evaluation system (PIES) a national energy forecasting system used to provide baseline forecasts of energy prices, supplies, demand, and conversion activities is described. It is an analytical tool that can be used to examine the potential impact of changes in Federal policies by the specification of alternate scenarios. An overview which described the main features of the PIES; a discussion of the regional representation within the system; descriptions of the major supply and conversion submodels; a description of available documentation; and appendices that describe the modeling of refineries and utilities are provided. DOE

N80-24803# Sandia Labs., Albuquerque, N. Mex.
BATTERIES FOR SPECIFIC SOLAR APPLICATIONS: PROJECT DESCRIPTION
1979 47 p Presented at the Photovoltaic/Battery Storage Meeting, Albuquerque, N. Mex., 26-27 Jul. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1782C; CONF-790768-1) Avail: NTIS HC A03/MF A01

The Sandia Laboratories electrochemical power sources program is outlined. The project is divided into five tasks: (1) battery requirements analysis; (2) laboratory evaluation; (3) photovoltaic advanced systems tests; (4) photovoltaic application experiments; and (5) battery research and development. The status of each task is reviewed. DOE

N80-24804# Argonne National Lab., Ill.
INSTITUTIONAL TOTAL ENERGY CASE STUDIES

D. Wulfinghoff Jul. 1979 51 p
(Contract W-31-109-eng-38)
(ANL/CNSV-TM-15) Avail: NTIS HC A04/MF A01

Profiles of three total energy systems in institutional settings are presented. The plants are those of Franciscan Hospital, a 384 bed facility in Rock Island, Illinois; Franklin Foundation Hospital, a 100 bed hospital in Franklin, Louisiana; and the North American Air Defense Command Cheyenne Mountain Complex, a military installation near Colorado Springs, Colorado. The case studies include descriptions of plant components and configurations, operation and maintenance procedures, reliability, relationships to public utilities, staffing, economic efficiency, and factors contributing to success. DOE

N80-24805# Midwest Research Inst., Kansas City, Mo.
SOLAR REFLECTANCE, TRANSMITTANCE AND ABSORPTANCE OF COMMON MATERIALS
B. C. Butler, P. J. Call, G. L. Jorgensen, and R. B. Pettit (Sandia Labs., Albuquerque, N.M.) Oct. 1979 8 p refs Presented at the Solar Industrial Process Heat Conf., San Francisco, 31 Oct. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-334-457; CONF-791024-9) Avail: NTIS HC A02/MF A01

The solar reflectance, transmittance, and absorptance of common materials used for solar collector fabrication were compiled for easy reference. The data are derived from solar weighted averaging techniques and can be used for initial calculations of collector performance. DOE

N80-24806# California Univ., Livermore. Lawrence Livermore Lab.
STATUS OF TANDEM MIRROR THEORY
D. E. Baldwin 12 Dec. 1979 45 p Proceedings of 21st Ann. Meeting of the Am. Phys. Soc., Boston, 12-16 Nov. 1979
(Contract W-7405-eng-48)
(UCRL-83213; CONF-791135-4) Avail: NTIS HC A03/MF A01

The text and slides used for the review talk on tandem mirror theory presented at the meeting of the Division of Plasma Physics, A.P.S., Boston, MA, November 12-16, 1979 are included. Topics covered include classical confinement, equilibria, MHD- and micro-stability, radial transport, and thermal barriers. DOE

N80-24807# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
RESIDENTIAL SOLAR HEATING AND COOLING USING EVACUATED TUBE SOLAR COLLECTORS: CSU SOLAR HOUSE 3 Final Report, Management Summary, 1 Feb. 1976 - 30 Sep. 1978
Dan S. Ward, John C. Ward, and H. S. Oberoi Mar. 1979 11 p
(Contract EY-76-S-02-2858)
(COO-2858-24-Summ) Avail: NTIS HC A02/MF A01

An integrated evacuated tube solar collector and absorption space cooling system installed in a solar house was designed, tested, and evaluated. The seasonal performance was compared with two other solar heating and cooling systems installed in adjacent buildings with virtually identical thermal characteristics. The two comparison system consist of conventional solar water heating and air heating flat plate collectors. DOE

N80-24808# Badger Plants, Inc., Cambridge, Mass.
CONCEPTUAL DESIGN OF A COAL-TO-METHANOL-TO-GASOLINE COMMERCIAL PLANT. VOLUME 5: ALTERNATE DESIGN STUDIES Interim Final Report, 31 Aug. 1977 - 1 Mar. 1979
Mar. 1979 209 p
(Contract EX-76-C-01-2416)
(FE-2416-43-Vol-5; IFR-2) Avail: NTIS HC A10/MF A01

Three design cases were investigated for converting methanol to gasoline using the Mobil process. These are defined as Case A, which produces gasoline and byproduct Liquid Propane Gas (LPG); Case B, which produces gasoline, high Btu gas, and byproduct LPG; and Case C, which produces gasoline only. The LPG includes propane LPG and high purity isobutane. Alternate Cases A and C are described. Additional process studies, including economy of scale evaluations, studies of Lurgi methanol synthesis recommendations, integration of Methanol-to-Gasoline facilities with a refinery, and recovery of aromatics from stabilized synthetic gasoline, are discussed. DOE

N80-24809# Galaxy, Inc., Washington, D.C.
ORGANIC RANKINE CYCLE ENGINE TECHNOLOGY IN JAPAN, A PRELIMINARY SURVEY
Oct. 1979 132 p refs
(Contract DE-AC03-79SF-10538)
(DOE/SF/10538-1) Avail: NTIS HC A07/MF A01

The state-of-the-art of the development of organic Rankine cycle engines in Japan is reviewed. With the first oil crisis as a momentum, general volition to research and development and commercialization efforts of the Rankine cycle has rapidly developed. However, practical applications by industries will be the matter of future. Recovery systems of waste heat should be designed based on availability of waste heat sources. The Rankine cycle, as one of the electric power generators, has a wider range of application and thus, especially in Japan, the development of Rankine cycle technology is going forward. Although the presently attained thermal utilization rate is only 20%, future improvement of the rate will be considerably dependent on the contribution of the developments on specific various units, for example, the heat exchanger. R.E.S.

N80-24810# Battelle Pacific Northwest Labs., Richland, Wash.
COMPRESSED AIR ENERGY STORAGE TECHNOLOGY PROGRAM IN THE UNITED STATES
W. V. Loscutoff 1979 8 p Presented at the Intern. Assembly on Energy Storage, Dubrovnik, Yugoslavia, 26 May - 1 Jun. 1979
(Contract EY-76-C-06-1830)
(PNL-SA-7669; CONF-790515-6) Avail: NTIS HC A02/MF A01

The development of compressed air energy storage (CAES) technology is a recognized objective of the United States Department of Energy. The specific objectives are to develop the technology to a level that will permit early commercialization of the concept and to develop advanced CAES systems that will not require any petroleum fuels for operation. The CAES technology research and development program is summarized and a brief set of recommendations on the developments required for the commercialization of the concept is provided. DOE

N80-24811# Dayton Univ. Research Inst., Ohio.
ELECTROFLUID DYNAMIC WIND GENERATOR Final Annual Progress Report, 15 Sep. 1977 - 30 Sep. 1978
John E. Minardi, Maurice O. Lawson, and Frank L. Wattendorf May 1979 76 p refs
(Contract EY-76-S-02-4130)
(COO-4130-2; APR-3) Avail: NTIS HC A05/MF A01

The objective of the program is to conduct research leading to the development of EFD wind driven generators. In such generators, the wind blows through suitably oriented arrays of electrodes, transports charged particles against an electrical potential gradient, and thereby generates electrical power directly without moving parts. Significant progress has been made in accomplishing major research objectives. During the year, the effort was directed toward the achievement of three milestones; namely: development of a laboratory method for the production of an adequate supply of suitably low mobility charged droplets for the testing of generator performance; experimental verification of generator performance theory; and development of methods for practical production of charged droplets. DOE

N80-24812*# Rasor Associates, Inc., Sunnyvale, Calif.
ADVANCED THERMIONIC ENERGY CONVERSION Joint Highlights and Status Report, Apr. - Jun. 1979
1979 81 p refs
(Contracts JPL-955033; EY-76-C-02-2263)
(NASA-CR-163061; COO-2263-15; NSR-2-15) Avail: NTIS CSCL 10A

Developments towards space and terrestrial applications of thermionic energy conversion are presented. Significant accomplishments for the three month period include: (1) devised a blade-type distributed lead design with many advantages compared to the stud-type distributed lead; (2) completed design of Marchuk tube test apparatus; (3) concluded, based on current understanding, that residual hydrogen should not contribute to a

negative space charge barrier at the collector; (4) modified THX design program to include series-coupled designs as well as inductively-coupled designs; (5) initiated work on the heat transfer technology, THX test module, output power transfer system, heat transfer system, and conceptual plant design tasks; and (6) reached 2200 hours of operation in JPL-5 cylindrical converter envelope test. DOE

N80-24813# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
HEAT-PUMP-CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS Final Report
Nov. 1979 214 p refs Supersedes ANL/ICES-TM-31 Prepared for Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(ANL/CNSV-TM-18; ANL/ICES-TM-31) Avail: NTIS HC A10/MF A01

A Heat Pump Centered-Integrated Community Energy System (HP-ICES) concept was explored and developed that is based on use of privately owned ice-making heat pumps in each building or complex within a community. These heat pumps will provide all of the space heating, space cooling and domestic hot water needs. All of the community input energy required is provided by electrical power, thereby eliminating a community's dependence on gas or oil supplies. The heat pumps will operate in both air and water source modes, deriving performance advantages of both. The possible forms of an HP-ICES system, the technical and economic limitations, environmental impacts and other factors are discussed from a general viewpoint. The concept is applied to a specific planned community and its performance and economic features are examined in detail. It is concluded that the HP-ICES concept is technically viable, but that its economical desirability as compared with conventional heat pump systems is hampered by much higher initial costs, and that the economic feasibility of HP-ICES systems will depend on future fuel source costs and supply and on electric power rates. DOE

N80-24814# General Accounting Office, Washington, D. C.
FEDERAL GOVERNMENT NEEDS A COMPREHENSIVE PROGRAM TO CURB ITS ENERGY USE
E. B. Staats 12 Dec. 1979 66 p refs
(EMD-80-11) Avail: NTIS HC A04/MF A01

According to this GAO analysis, the Federal Government is not making a sufficient commitment to curbing its energy use. Its program to conserve energy is in disarray. Although the Congress and the President have enacted and issued legislative and executive guidance, a comprehensive and aggressive energy conservation program for the Federal sector has not been developed. The Department of Energy's efforts have been minimal and Federal agencies have resisted Energy's attempts to establish a meaningful program. The Federal Government - the Nation's largest consumer of energy needs a comprehensive, centrally directed program to curb energy use. Recommendations to the Congress, The President, and the Department of Energy to establish such a program are presented. DOE

N80-24815# Ames Lab., Iowa.
PRELIMINARY STUDY OF PASSIVE SOLAR HEATING PERFORMANCE AND VISUAL CLARITY FOR A TRANS-WALL STRUCTURE
J. F. McClelland and R. Fuchs 1979 7 p refs Presented at the 3rd Natl. Passive Solar Conf., San Jose, Calif., 11 Jan. 1979
(Contract W-7405-eng-82)
(ISM-206; CONF-790118-7) Avail: NTIS HC A02/MF A01

The thermal performance of a new passive solar heating system called Transwall has been compared to that of Trombe wall and direct gain systems using thermal network models. The Transwall system is a visually transparent modular water wall which thermalizes a high percentage of incident solar radiation within a water based storage medium by absorption of the radiation in both the water and in a semitransparent plate positioned between the light transmitting walls of the water filled modules. The Transwall structure allows vision to the exterior through the solar gain fenestration and provides a direct gain contribution to the building heating requirements. Because of the strong light attenuation by the Transwall, the direct gain operation of the system does not suffer from severe glare and photodegradation problems which occur in some direct gain interiors. DOE

N80-24816# California Univ., Berkeley. Lawrence Berkeley Lab.
SENSIBLE HEAT STORAGE FOR A SOLAR THERMAL POWER PLANT M.S. Thesis
Thomas F. Baldwin, Scott Lynn, and Alan S. Foss Jul. 1979 195 p refs
(Contract W-7405-eng-48)
(LBL-9321) Avail: NTIS HC A09/MF A01

One possible configuration for a solar power plant with a sensible-heat storage unit was investigated. The proposed flowsheet allows thermal energy storage between the heat collection unit and the power generation unit without a reduction in the thermodynamic availability of the energy supplied to the power turbines. Energy is stored by heating a checkerwork of magnesia bricks. A gas that is circulated from the solar collector through the storage unit and the power plant boiler serves as the heat-transfer medium. Nitrogen was found to be preferable to helium for this purpose. A computer model was used to predict the behavior of the sensible-heat storage unit and to aid in sizing the storage unit. Procedures were developed to estimate the cost of electricity generated by the solar power plant. The effects on the storage unit and on the total plant design of changing several processes and design parameters were then evaluated. Two alternative process configurations for solar power plants with sensible-heat storage were developed. DOE

N80-24817# Aerospace Corp., Los Angeles, Calif. Energy and Resources Div.
SOLAR THERMAL SMALL POWER SYSTEMS STUDY. INVENTORY OF US INDUSTRIAL SMALL ELECTRIC POWER GENERATING SYSTEMS
1 Jun. 1979 59 p ref
(Contract ET-78-C-03-2226)
(ATR-79(7780)-1) Avail: NTIS HC A04/MF A01

This inventory of small industrial electric generating systems was assembled to provide a data base for analyses being conducted to estimate the potential for displacement of these fossil fueled systems by solar thermal electric systems no larger than 10 MW in rated capacity. The approximately 2100 megawatts generating capacity of systems in this category constitutes a potential market for small solar thermal and other solar electric power systems. The sources of data for this inventory were the (former) Federal Power Commission (FPC) Form 4 Industrial Ledger and Form 12-C Ledger for 1976. Alphabetical lists are presented of generating systems located at industrial plants and at Federal government installations in each of the 50 states. These systems are differentiated by type of power plant: steam turbine, diesel generator, or gas turbine. Each listing is designed as a power system rather than a power unit because the GPC Ledgers do not provide a means of determining whether more than one unit is associated with each industrial installation. The user should consider each listing to be a system capacity rating wherein the system may consist of one or more generating units with less than 10 MW/sub e/ combined rating. DOE

N80-24818# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
COMPOSITION PROFILING OF SOLAR COATING MATERIALS Final Report, 16 Apr. 1976 - 15 Apr. 1979
G. K. Wehner Sep. 1979 39 p refs
(Contract EY-76-S-02-2953)
(COO-2953-4) Avail: NTIS HC A03/MF A01

Auger electron composition vs. depth and optical analysis revealed that a very inexpensive-to-produce (15 min. 900 C heat treatment in air) Cr_2O_3 layer on stainless steels provides an excellent diffusion barrier for preventing stainless steel constitutents from entering into an IR reflective Mo coating. It was shown that with sputter deposition of Mo at high rate in a clean noble gas plasma, one can obtain Mo coatings of excellent IR reflectance. The optical properties of various other absorber surfaces such as stacked razor blades, cone or whisker-covered metal surfaces, plasma-sprayed chromic oxide coatings etc. were measured and explored. DOE

N80-24819# California Univ., Berkeley. Lawrence Berkeley Lab. Materials Science and Mineral Engineering.
CHEMICAL, STRUCTURAL AND OPTICAL CHARACTERIZATION OF A BLACK CHROME SOLAR SELECTIVE ABSORBER Ph.D. Thesis
C. M. Lampert Jul. 1979 173 p refs
(Contract W-7405-eng-48)
(LBL-9123) Avail: NTIS HC A08/MF A01

The very popular black chrome coating, Harshaw Chemical's Chromonyx was analyzed in terms of materials science to determine the nature of its microstructure and relationship to wavelength selectivity. This coating serves as an efficient solar thermal conversion coating for both concentrating and flat plate solar collectors. General properties of solar energy and selective absorbers are discussed to give a firm footing for analysis. Also, the properties and degradation modes were revealed for samples heat treated at high temperatures for short times. Several electrodeposited black chrome-substrate combinations were investigated including the favored black chrome with a dull nickel underlayer. It was found that black chrome coating thickness and surface roughness greatly influence spectral hemispherical reflectance. To a minor extent, underlayer material also altered infrared reflectance: nickel, copper and steel were evaluated. Principally, energy dispersive X-ray analysis as well as scanning and transmission electron microscopy were employed for thin film analysis. DOE

N80-24820# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
MEAN MONTHLY PERFORMANCE OF PASSIVE SOLAR WATER HEATERS
W. Place, M. Daneshyar (Univ. of Technology, Esfahan, Iran), and R. Kammerud Oct. 1979 8 p ref Presented at the 4th Natl. Passive Solar Energy Conf., Kansas City, Kas., 3 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9295; CONF-791022-11) Avail: NTIS HC A02/MF A01

A simplified analysis was used to compare the average monthly performance of a compact heater (having combined collection and storage) and a thermosiphon heater (using natural convective transfer from a collector to an insulated tank). The comparison which was made for a range of climates and a variety of load profiles indicates that the performance of the thermosiphon is substantially superior to that of the compact heater. DOE

N80-24821# Springborn Labs., Inc., Enfield, Conn.
SOLAR COLLECTORS Technical Progress Report, 5 Sep. 1978 - 5 Mar. 1979
B. Baum and Michael Gage 27 Apr. 1979 54 p
(Contract EM-78-C-04-5359)
(ALO-5359-T1; TPR-1) Avail: NTIS HC A04/MF A01

A broad information search was carried out in four areas: glazings, housing materials, acrylic coatings, etching processes and AR coatings. An extensive list of all (known) US transparent polymers was developed as well as tables of plastic, ceramic and metallic materials that could conceivably function as a housing. In addition, a compilation was made of commercially available solvent and water base acrylic coatings for use as a uv protective coating for the glazing. Eighteen transparent polymers were chosen as possible glazings and twelve materials (plastic and wood) as possible housings and exposed in the Weather-Ometer as tensile bars and for the glazings as disks for optical transmission. These same materials were also exposed on our roof to monitor soiling. A variety of solvent and water base acrylics were selected as protective coatings and ordered. Two commercial films, Tedlar 20 and Halar 500, with strong absorption in the uv and two commercial films containing uv absorbers, Tedlar UT and Korad 201R, were laminated by several different processes to four promising glazing materials: polyvinyl fluoride (Tedlar), polymethyl methacrylate (Plexiglass), crosslinked ethylene/vinyl acetate and thermoplastic polyester (Llumar). A variety of etching processes were briefly explored and AR coating studies started on the above four glazing films. DOE

N80-24822# Rocket Research Corp., Redmond, Wash. System Development.
HEAT-PUMP-CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS Final Report
Nov. 1979 69 p refs
(Contract W-31-109-eng-38)
(ANL/CNSV-TM-20) Avail: NTIS HC A04/MF A01

Heat-pump-centered integrated community energy systems (HP-ICES) are energy systems for communities which provide heating, cooling and/or other thermal energy services through the use of heat pumps. Since heat pumps primarily transfer energy from existing and otherwise probably unused sources, rather than convert it from electrical or chemical to thermal form, HP-ICES offer significant potential for energy savings. Secondary benefits of HP-ICES include reduction of adverse environmental effects as compared to conventional systems, reliable production of services in contrast to the increasingly frequent utility curtailments and interruptions, and delivery of services to consumers at costs lower than those for conventional systems (including acquisition, operation, and maintenance costs). The objective of this multiphase project is development and demonstration of HP-ICES concepts leading to one or more operational systems by the end of 1984. The results of the system development phase of the HP-ICES Project are reported. Information is presented on: central heat pump and distributed heat pump ICES; potential application; waste heat availability; system performance and economics; environmental impacts; site requirements; component testing requirements; mathematical analysis of heat balance and cost relations; and performance and economic analyses of HP-ICES located near Seattle, Washington and San Antonio, Texas. DOE

N80-24823# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
HETEROSTRUCTURE SINGLE CRYSTAL SILICON PHOTOVOLTAIC SOLAR CELLS Final Report, 27 Sep. 1978 - 31 Jul. 1979
J. R. Szedon, T. A. Temofonte, T. W. OKeeffe, H. C. Dickey, S. J. Fonash, and T. E. Sullivan 31 Jul. 1979 209 p refs Prepared in cooperation with Pennsylvania State Univ., Univ. Park
(Contract EY-76-C-03-1282)
(DOE/ET/20408-1) Avail: NTIS HC A10/MF A01

Technical and commercial practicability (specifically, conversion efficiency of 10 percent or greater at a module selling price below $0.50/peak watt in 1975 dollars) for power generation of metal-heterojunction silicon solar cell of the metal-insulator semiconductor (MIS) variety is assessed. Empirical and theoretical studies were made of cells using both single crystal (n- and p-type) and polycrystalline (p-type) silicon with a variety of metals (Al, Au, Ag, Pd) and silicon dioxide layers of various thicknesses. Performance limitations were identified. Means to improve cell performance were evaluated, including material modifications, layer thickness control and changes in device structure. It is concluded that the program goals can be met. Encouraging results in analysis of cells made with polycrystalline material provide a good basis for proceeding with future work to assess the prospects of even lower cost cells. DOE

N80-24824# Midwest Research Inst., Golden, Colo. Thermal Conversion Branch.
FEASIBILITY EVALUATION FOR SOLAR INDUSTRIAL PROCESS HEAT APPLICATIONS
S. A. Stadjuhar Jan. 1980 7 p refs Presented at the Systems Simulation and Econ. Analysis Conf., San Diego, Calif., 23 Jan. 1980
(Contract EG-77-C-01-4042)
(SERI/TP-333-538; CONF-800101-3) Avail: NTIS HC A02/MF A01

An analytical method for assessing the feasibility of Solar Industrial Process Heat applications was developed and implemented in a flexible, fast-calculating computer code, PROSYS/ECONMAT. The performance model PROSYS predicts long-term annual energy output for several collector types, including flat-plate, nontracking concentrator, one-axis tracking concentrator, and two-axis tracking concentrator. Solar equipment cost estimates, annual energy capacity cost, and optional net present worth analysis are provided by ECONMAT. User input consists of detailed industrial process information and optional economic parameters. Internal program data includes meteorological information for 248 US sites, characteristics of more than

20 commercially available collectors representing several generic collector types, and defaults the economic parameters. Because a fullscale conventional back-up fuel system is assumed, storage is not essential and is not included in the model. DOE

N80-24825# Massachusetts Inst. of Tech., Cambridge.
PHOTOCHEMICAL ENERGY STORAGE: STUDIES OF INORGANIC PHOTOASSISTANCE AGENTS Progress Report, 11 Dec. 1978 - 31 Mar. 1980
M. S. Wrighton Dec. 1979 23 p refs
(Contract EY-76-S-02-4178)
(COO-4178-3) Avail: NTIS HC A02/MF A01

Research was focused on the study of chemically derived photoelectrodes for conversion of light to electricity or fuels. Examples of completed research are given in the list of publications. Highlights of the period include (1) study of the derivatized n-type Si photoanode for oxidation of water soluble species such as I(-) Fe(CN)6(4-), and Ru(NH3)6(2+); (2) demonstration that heterogeneous electron transfer rates between a surface-confined, photogenerated reagent and a solution reagent can be measured; (3) demonstration that Fermi level pinning obtains for p-type semiconductors such as Si, GaAs, and InP; (4) strained Si-C bonds can be used to functionalize surfaces; and (5) study of catalysis of H2 evolution from illuminated p-type semiconductors. DOE

N80-24826# Foster Wheeler Corp., Livingston, N.J.
SOLAR PRODUCTION OF INDUSTRIAL PROCESS STEAM RANGING IN TEMPERATURE FROM 300 F TO 550 F (PHASE 1), VOLUME 1 Final Report, 30 Sep. 1978 - 30 Jun. 1979
30 Jun. 1979 176 p refs
(Contract ET-78-C-03-2199)
(DOE/CS/32199-1; FWDC-9-41-4010) Avail: NTIS HC A09/MF A01

This section summarizes the Phase 1 solar industrial process steam system and includes a system schematic, a brief system description, general specifications of the major system components, expected system performance, and a cost estimate summary for Phases 2 and 3. The objectives of Phase 1 are: (1) design a cost-effective solar steam generating system using state-of-the-art components and technology to supply steam for Dow Chemical Company's Dalton, Georgia, plant; (2) predict the performance of the solar process steam plant; (3) conduct a safety evaluation and an environmental impact assessment of the solar steam system; (4) conduct an economic analysis to determine the potential economic benefits of a solar-augmented process steam production system compared with an existing fossil-fuel-fired steam generator; and (5) promote the project extensively to make it visible to industry and the general public. DOE

N80-24827# Duke Univ., Durham, N. C. Dept. of Mechanical Engineering and Materials Science.
PREPARATION AND CHARACTERIZATION OF HYDROGENATED AMORPHOUS SILICON THIN FILMS AND THIN FILM SOLAR CELLS PRODUCED BY ION PLATING TECHNIQUES Quarterly Progress Report, 1 Apr. - 30 Jun. 1979
Franklin H. Cocks, Phillip L. Jones, and Louis Dimmey Sep. 1979 23 p refs
(Contract DE-AC03-79ET-23041)
(DOE/ET/23035-2) Avail: NTIS HC A02/MF A01

Using quartz substrates, hydrogenated a-Si thin films were produced both by glow discharge decomposition of silane and by the controlled ion plating of high purity through glow discharges composed of silane, hydrogen, and argon using a modified Takagi apparatus. Thus far, thin films produced by both glow discharge decomposition of silane with and without magnetic confinement and by ion plating have been characterized and compared using X-ray defractometry, infrared spectroscopy, optical absorption spectroscopy and by their temperature dependence of resistivity. Based on these results, the ion plating technique of producing a-Si thin films looks extremely encouraging. Films were produced at approximately ten times the deposition rate obtained using glow discharge decomposition of silane, even with magnetic field containment. In addition the resulting thin film properties measured to date compared favorably with those obtained from our glow discharge produced films and the properties of glow discharge produced films reported in the literature. DOE

N80-24828# American Science and Engineering, Inc., Cambridge, Mass.
DEVELOPMENT OF A SECOND-GENERATION CONCENTRATING TRACKING SOLAR COLLECTOR Technical Progress Report, 20 Jun. - 27 Dec. 1978
Roy W. Miller 16 Jan. 1979 58 p refs
(Contract EM-78-C-04-4375)
(ASE-4371) Avail: NTIS HC A04/MF A01

The objective is to develop a second generation parabolic mirror concentrator with a variation of the cylindrical blackbody receiver to provide a minimum concentration ratio of ten. Performance characteristics are to be determined by tests using a prototype unit. Probable mass production costs for the collector will be generated. Work performed during the first six months of the effort is described. The design of the prototype collector was completed. The collector design is described in detail. The performance analysis for the second generation collector was also completed during the first six months of the contract. The work consists of collector tradeoff studies together with optical and thermal analysis of detailed configurations. The analysis is described in detail with computer programs included and results given for conditions of interest. The performance analysis was conducted in concert with the collector design effort. Thus, the collector design features were driven by performance considerations and design details are optimum with respect to performance. The result is a collector design capable of producing outlet field of high enough temperature to drive air conditioning equipment. Concentration ratio is 12 and predicted efficiency is 60% at fluid outlet temperature of 200 F. DOE

N80-24829# Aerospace Corp., Los Angeles, Calif. Energy Systems Directorate.
NEW APPLICATIONS OF HIGH-TEMPERATURE SOLAR ENERGY FOR THE PRODUCTION OF TRANSPORTABLE FUELS AND CHEMICALS AND FOR ENERGY STORAGE
19 Jan. 1979 178 p refs
(Contract EY-76-C-03-1101)
(ATR-78(7691-04)-1) Avail: NTIS HC A09/MF A01

The solar fuels and chemicals study was limited to the examination of processes requiring temperatures in excess of 1000 K since lower temperature processes had already been examined in studies concerned with the application of waste heat from nuclear power plants to industrial processes. In developing the carbon cycle processes, the primary activity included an extensive literature search and the thermodynamic evaluation of a number of candidate chemical cycles. Although both hydrogen and carbon closed- and open-loop chemical cycles were studied, it was concluded that the carbon cycles offered sufficient additional potential to warrant concentrating on them in subsequent work. The section on new ideas for transportable fuels presents the elements of a new concept for a carbon cycle recovery technique to produce transportable fuels. The elements discussed are sources of carbon dioxide, solar energy reduction of CO2, potential carbon cycles, and use of carbon monoxide as fuel and feedstocks. Another section presents some new concepts for the use of high temperature solar energy in the production of essential materials and for closed-loop chemical storage, as well as for the production of hydrogen as a fuel and open-loop applications. Potential problem areas pertinent to solar derived fuels and chemicals have been identified. These problems are primarily associated with the limited high temperature experience in industry and include materials compatibility, separation of reaction products, development of solid electrolytes and high temperature electrodes, selective emission of receiver coatings at high temperature, and a lack of chemical kinetics data, and high temperature thermodynamic data. DOE

N80-24830# Lockheed Missiles and Space Co., Palo Alto, Calif.
CADMIUM SULFIDE/COOPER SULFIDE HETEROJUNCTION CELL RESEARCH Technical Progress Report, 26 Feb. - 31 May 1979
W. W. Anderson Jun. 1979 21 p refs
(Contract EG-77-C-03-1459)
(DSE-1459-T1; LMSC-D-676741) Avail: NTIS

HC A02/MF A01

All vacuum deposition process AuCu2SCd(1-x)Zn(x)S/Nb photovoltaic cells were fabricated by sequentially sputtering (1) Nb in Ar, (2) Cd(1-x)Zn(x), and then (3) Cu in H2S and Ar gas mixtures, and finally, in a separate operation, (4) Au in Ar. Photovoltaic response of As-deposited junctions (i.e., without subsequent heat treatment) was obtained with appropriate deposition parameters. Resistivity of CdS or Cd(o)(9)Zn(o)(1)S films was controlled by sputtering from In-doped metal cathodes. Junction characteristics were strongly influenced by deep trap levels on the Cd(1-x)Zn(x)S side of the heterojunction. A trap level at E(t) approx. = 0.37 eV below the conduction band edge was identified in sputter deposited CdS by admittance spectroscopy. DOE

N80-24831# Midwest Research Inst., Golden, Colo.
BIOLOGICAL SOLAR CELLS
M. Seibert and A. F. Janzen Nov. 1979 7 p refs Presented at the 2nd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10 Dec. 1979 Prepared in cooperation with Photochemical Research Associates, Inc., London (Canada)
(Contract EG-77-C-01-4042)
(SERI/TP-332-476; CONF-791204-7) Avail: NTIS HC A02/MF A01

The bacterial photosynthetic reaction center isolated from Rhodopseudomonas sphaeroides was attached directly onto an SnO2 electrode. The light-induced primary charge separation processes which occur across the reaction center macromolecule were then coupled to the electrode. In a two-electrode configuration, photovoltages as high as 70 mV and photocurrents as high as 0.5 micron A/sq cm are observed in an external circuit. Such reaction center electrodes may be the forerunner of future biological solar cells or may serve as model systems for future organic photovoltaic devices. DOE

N80-24832# Sandia Labs., Albuquerque, N. Mex.
PHOTOVOLTAIC CONCENTRATORS
E. C. Boes 1980 10 p refs Presented at the 14th Photovoltaics Specialist Conf., San Diego, Calif., 7 Jan. 1980
(Contract EY-76-C-04-0789)
(SAND-80-0143C; CONF-800106-7) Avail: NTIS HC A02/MF A01

A status report on photovoltaic (PV) concentrators technology is presented. The major topics covered are as follows: (1) current PV concentrator arrays: designs, performances, and costs; (2) current PV concentrator array components: cells and cell assemblies, optical concentrators, support structures, tracking, and drive; (3) design of PV concentrator arrays; and (4) array manufacturing technology. DOE

N80-24833# Sandia Labs., Albuquerque, N. Mex. Large Power Systems Div.
SOLAR CENTRAL RECEIVER SYSTEMS PROGRAMS
J. D. Fish 1979 5 p refs Presented at the Solar Ind. Process Heat Conf., San Francisco, 31 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8777; CONF-791024-5) Avail: NTIS HC A02/MF A01

Major elements of the Solar Central Receiver Systems program include: (1) development of storage-coupled and hybrid system concepts; (2) the Central Receiver Test Facility in Albuquerque, NM; (3) the pilot plant under construction at Barstow, CA; (4) proposed repowering/industrial retrofit plants; and (5) heliostat, receiver, and storage subsystems development work. Current and proposed activities within each element are discussed. DOE

N80-24834# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering
OCEAN THERMAL ENERGY CONVERSION: A STATE-OF-THE-ART STUDY
A. Douglas Carmichael Jul. 1979 84 p Sponsored by EPRI
(EPRI-ER-1113-SR) Avail: NTIS HC A05/MF A01

A baseline ocean thermal energy conversion unit composed of eight 50 MW power modules was studied and defined. It was concluded that OTEC system is technically feasible and could operate year round in some regions of the Gulf of Mexico, off Hawaii, and off Puerto Rico. The closed Rankine cycle using ammonia as the working fluids is probably the best power plant system to utilize the small temperature differences of about 40 F between the warm surface water and the cold water taken from a depth of about 3280 ft. The most important components in the power plant are the large heat exchanges and the major technical problems are anticipated with these components. The platform will probably have a ship or barge configuration with the long cold water pipe supported from the midships region. The estimated costs of the baseline system were established from recent design studies. The total capital investment (excluding the cables to shore) was estimated to be about $3000 per kW. DOE

N80-24835# Argonne National Lab., Ill. Energy and Environmental Systems Div.
OTEC PERFORMANCE TESTS OF THE CARNEGIE-MELON UNIVERSITY VERTICAL FLUTED-TUBE CONDENSER
L. G. Lewis and N. F. Sather May 1979 45 p refs
(Contract W-31-109-eng-38)
(ANL/OTEC-PS-4) Avail: NTIS HC A03/MF A01

Performance tests results on a vertical fluted-tube condenser are reported. The condenser was free of operational problems and performed in a stable and repeatable manner. At nominal design conditions (a heat duty of 3.2 million Btu/hr and a water flow rate of 3200 gpm), the overall heat transfer coefficient (U sub zero) was 1040 Btu/hr sq ft F and the water-side pressure drop was 3.3 psi. Varying the quality of the ammonia vapor feed to the condenser (in the range of 90 to 100 percent) did not affect performance. On the other hand, when the heat duty was increased from 2.3 million to 4.0 million Btu/hr U sub zero rose from 1024 to 105 Btu/hr sq ft F. This trend resulted from an increase in the amonnia-side coefficient over this range of heat duties. Finally, the water side coefficient was about 2.45 times greater than that calculated from the Sieder-Tate equation for smooth circular tubes of the same cross-sectional area. This enhancement ratio of 2.45 was some 20 percent greater than the enhancement factor of 2.07 expected from the increase in surface area alone. DOE

N80-24836# Mitre Corp., McLean, Va. METREK Div.
SOLAR THERMAL REPOWERING: UTILITY/INDUSTRY MARKET POTENTIAL IN THE SOUTHWEST
N. Lord, P. Curto, and S. True Dec. 1978 177 p refs
(Contract ET-78-C-01-2854)
(MTR-7919) Avail: NTIS HC A09/MF A01

An analysis of the utility and industrial solar thermal repowering market potential in the Southwest is presented. Repowering involves adding the solar thermal central receiver (power tower) system as a retrofit power source for existing utilities and industries. It would provide steam to drive utility turbogenerator or supply process heat for industry. The potential for repowering oil and gas using steam turbine utility sites with a capacity greater than 25 MWe and sufficient land adjacent to the plant for a minimum 25 MWe addition is analyzed. Industry projections based on an analysis of the energy requirements for the chemicals and petroleum industries in Texas and estimates of land availability are included. It is estimated that the potential solar thermal repowering market for utilities and industries in the Southwest is approximately one quad. DOE

N80-24837# Massachusetts Inst. of Tech., Cambridge.
BATTERY CHARGE/SOLAR CONTROLLER FOR A RESIDENTIAL SIZE PHOTOVOLTAIC POWER SYSTEM
R. N. Cadieux 31 Oct. 1979 20 p refs
(Contract EY-76-C-02-4094)
(COO-4094-62) Avail: NTIS HC A02/MF A01

A controller was designed to meet the initial requirements of an off-peak, utility-interactive solar photovoltaic power system now undergoing tests. A physical description of the controller, an explanation of the control algorithm, a circuit description and the theory of operation are presented. DOE

N80-24838# Georgetown Univ., Washington, D.C.
GEORGETOWN UNIVERSITY GENERIC INTEGRATED COMMUNITY ENERGY SYSTEM GU ICES DEMONSTRATION PROJECT. MODIFIED WORK MANAGEMENT PLAN Final Report
Apr. 1979 330 p refs
(Contract EC-77-C-02-4488)

(CDO-4499-2) Avail: NTIS HC A14/MF A01

This Phase 2 Modified Work Management Plan reflects the change from a Coal Using ICES to a Generic ICES Program. Book 2 deals with an energy audit conducted at the campus in the fall of 1978 to establish a gross baseline from which to measure and evaluate the contributions of selected alternative energy subsystems both from an energy and cost standpoint. Book 1 proceeds from a discussion of an ICES through an explanation of the scope of effort — each phase expanded into detailed task descriptions by phase together with schedules, PERT and GANTT charts, milestones and levels of effort by task for the Feasibility Analysis, and schedules for the overall program. A description of examples of alternative subsystems to be considered is also included. A detailed Management Plan for the conduct of the effort by General Electric completes the plan. Appendices related to cogeneration, life cycle costing, GE energy subsystems, the GU Master Energy Plan, and typical regulatory processes to be encountered are included. Book 2 treats the Energy Audit under the three committed task areas of System Description, Analysis and Survey, and Criteria for Energy Usage. The five major energy systems utilized at Georgetown are considered: electrical, chilled water, steam, gas and fuel oil, and city water. A top level analysis yields significant results and recommendations for further action with respect to a detailed measurements program, particularly of steam and electric power usage, over a one year period. DOE

N80-24839# Delaware Univ., Newark. Inst. of Energy Conversion.

AMORPHOUS Si SOLAR CELLS Quarterly Report, 1 Apr. - 30 Jun. 1979

V. L. Dalal Aug. 1979 58 p refs

(Contract DE-AC03-79ET-23034)

(DOE/ET/23034-T1; QR-2) Avail: NTIS HC A04/MF A01

An analysis of a-Si devices was completed. The analysis shows that even with limited diffusion length and high defect density, a-Si devices can achieve J/sub sc/ approximately = to 15 mA/sq cm, V/sub oc/ approximately = to 1V and FF approximately = to 0.72. Novel a-Si devices were also designed and analyzed. The analysis shows that the flexibility in material properties offered by a-Si can be used advantageously to design high quality devices. DOE

N80-24840# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

APPLICATION OF CIRCUMSOLAR MEASUREMENTS TO CONCENTRATING COLLECTORS

D. F. Grether, D. Evans, A. Hunt, and M. Wahlig Jun. 1979 6 p refs Presented at the Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979

(Contract W-7405-eng-48)

(LBL-9412; CONF-790541-56) Avail: NTIS HC A02/MF A01

A systematic measurement program is being carried out to assess the effects of circumsolar radiation (the solar aureole) on the performance of solar conversion systems using concentrating collectors. Four instrument systems were constructed and are providing detailed intensity vs. angle profiles of the solar and circumsolar (out to 3 deg from the center of the Sun) as well as other solar measurements. The instruments are briefly described. Results are presented of the average effect of the circumsolar radiation on the solar energy available to an idealized point focusing system. Results are also presented for an analysis of two specific central receiver designs. DOE

N80-24841# EIC, Inc., Newton, Mass.

SYNTHESIS, EVALUATION, AND DEFECT COMPENSATION OF TETRAHEDRAL GLASSES AS POSSIBLE SOLAR CELL MATERIALS Quarterly Technical Progress Report, 1 May - 31 Jul. 1979

R. D. Rauh Sep. 1979 19 p refs

(Contract DE-AC03-79ET-23039)

(DOE/ET/23039-2) Avail: NTIS HC A02/MF A01

Work performed on the project to synthesize A/sup II/B/sup IV/C2/su V/ glasses and evaluate their potential use as solar cell materials is described. The major effort was directed towards preparation of these films by thermal evaporation of compounds synthesized during the first quarter. Films were produced from CdAs2, CdSnAs2, CdSiAs2, ZnSiAs2 and ZnAs2. Only films from the last compound had a stoichiometry comparable to the starting material. The ternary films were deficient in the group IV element and films produced from CdAs2 indicated the sample had undergone extensive decomposition. In addition to having good stoichiometries, the X-ray analysis of the ZnAs2 films indicated they were amorphous. The work thus represents the first reported results of preparation of amorphous films of ZnAs2. DOE

N80-24842# Sandia Labs., Albuquerque, N. Mex.

EXTRINSIC LOSSES IN SOLAR CELLS FOR LINEAR FOCUS SYSTEMS 4

C. Michael Garner Dec. 1979 42 p refs

(Contract EY-76-C-04-0789)

(SAND-79-1781) Avail: NTIS HC A03/MF A01

Solar cell efficiency is dependent on the intrinsic one dimensional diode efficiency and on the extrinsic losses (i.e., contact shadowing, series resistance and losses arising from nonuniform illumination). These extrinsic losses can depend on cell size and should be considered in the design of concentrator systems. The carrier transport and junction phenomena are arbitarily called intrinsic effects, and the efficiency resulting from the one dimensional transport equations will be called the intrinsic efficiency. The under consideration will be called extrinsic effects. The I sq R and shadowing losses have been calculated as a function of cell size, contact thickness and number of buses. In addition, losses resulting from nonuniform illumination and temperature have been calculated. These results should give clear guidelines for the design of receivers for linear focus systems. DOE

N80-24843# Argonne National Lab., Ill. Energy and Environmental Systems.

PROCEDURES FOR SAFE HANDLING OF OFF-GASES FROM ELECTRIC VEHICLE LEAD-ACID BATTERIES DURING OVERCHARGE

S. J. LaBelle, M. H. Bhattacharyya, R. O. Loutfy, and R. Varma 25 Jan. 1980 20 p refs

(Contract W-31-109-eng-38)

(ANL/CNSV-TM-28) Avail: NTIS HC A02/MF A01

The potential for generation of toxic gases from lead-acid batteries has long been recognized. Prior to the current interest in electric vehicles, there were no studies specifically oriented to toxic gas release from traction batteries, however. As the Department of Energy Demonstration Project (in the Electric and Hybrid Vehicle Program) progresses, available data from past studies and parallel health effects programs must be digested into guidance to the drivers and maintenance personnel, tailored to their contact with electric vehicles. The basic aspects of lead-acid battery operation, vehicle use, and health effects of stibine and arsine to provide electric vehicle users with the information behind the judgment that vehicle operation and testing may proceed are presented. Specifically, it is concluded that stibine generation or arsine generation at rapid enough rates to induce acute toxic response is not at all likely. Procedures to guard against low-level exposure until more definitive data on ambient concentrations of the gases are collected are presented for both charging the batteries and driving the vehicles. A research plan to collect additional quantitative data from electric traction batteries is presented. DOE

N80-24844# Battelle Pacific Northwest Labs., Richland, Wash.

HELIOSTAT MANUFACTURING COST ANALYSIS, VOLUME 1 Final Report

K. Drumheller, Steven C. Schulte, Ron A. Dilbeck, and Lloyd W. Long Oct. 1979 83 p refs Prepared for Midwest Research Inst., Golden, Colo.

(Contracts EG-77-C-01-4042; EY-76-C-06-1830)

(SERI/TR-8043-Vol-1) Avail: NTIS HC A05/MF A01

This study has two primary objectives. The first is to provide a detailed cost evaluation of the second generation of DOE heliostats, from which repowering heliostat designs are likely to be derived. A second objective is to provide an analytical foundation for the evaluation of future heliostat designs. The approach taken was to produce a cost estimate for the production of the prototype design by generating estimates of the materials, labor, overhead, and facilities costs for two different production scenarios, 25,000 heliostats per year and 250,000 heliostats

per year. The primary conclusion is that the second generation of heliostat designs should cost approximately $100/sq m at volumes of 25,000 units/year. This price falls to approximately $80/sq m at volumes of 250,000 units/year. A second conclusion is that cost reduction begins at relatively low production volumes and that many production benefits can be obtained at production rates of 5,000 to 15,000 units/year. A third conclusion is that the SAMICS model and the SAMIS III program can be useful tools in heliostat manufacturing costing, and economic studies. DOE

N80-24845# Pennsylvania State Univ., University Park. Materials Research Labs.
CONTROLLED CADMIUM TELLURIDE THIN FILMS FOR SOLAR CELL APPLICATIONS (EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS) Quarterly Progress Report, 9 Apr. - 8 Jul. 1979
K. Vedam Aug. 1979 12 p refs
(Contract DE-AC02-79ET-23013)
(DOE/ET/23013-T2; QPR-1) Avail: NTIS HC A02/MF A01

Preparation and properties of cadmium telluride thin films for use in solar cells are studied. CdTe sputter deposition, crystal doping, and carrier typing are discussed. Future experimental plans are described. DOE

N80-24846# California Univ., Livermore. Lawrence Livermore Lab.
WEIGHT AND VOLUME ESTIMATES FOR ALUMINUM-AIR BATTERIES DESIGNED FOR ELECTRIC VEHICLE APPLICATIONS
J. F. Cooper Jan. 1980 19 p refs Presented at the 1st Intern. Workshop on Reactive Metal-Air Batteries, Bonn, 9-11 Jul. 1979
(Contract W-7405-eng-48)
(UCRL-83881; CONF-790759-3) Avail: NTIS HC A02/MF A01

The weights and volumes of reactants, electrolyte, and hardware components are estimated for an aluminum-air battery designed for a 40-kW (peak), 70-kWh aluminum-air battery. Generalized equations are derived which express battery power and energy content as functions of total anode area, aluminum-anode weight, and discharge current density. Equations are also presented which express total battery weight and volume as linear combinations of the variables, anode area and anode weight. The sizing and placement of battery components within the engine compartment of typical five-passenger vehicles is briefly discussed. DOE

N80-24847# Westinghouse Research and Development Center, Pittsburgh, Pa.
CADMIUM SULFIDE/COPPER SULFIDE HETEROJUNCTION CELL RESEARCH Final Report, 30 Sep. 1977 - 31 Jul. 1979
J. R. Szedon, F. A. Shirland, W. J. Biter, T. W. OKeeffe, J. A. Stoll, and S. J. Fonash (Pennsylvania State Univ., University Park) 31 Jul. 1979 186 p refs
(Contract EG-77-C-03-1577)
(DOE/ET/20429-1) Avail: NTIS HC A09/MF A01

The objective of this program is to conduct research on solar cells of the copper sulfide/cadmium sulfide (and cadmium sulfide-zinc sulfide alloy) type with the goal of producing thin film cells capable of 10% AM1 conversion efficiency with less than 5% degradation in performance over a period of 20 years. New evaluation methods reveal cell microstructure details (grain size, Cu2S penetration into grain boundaries, etch pit depth and density) whose modification and control should allow reproducible achievement of at least 9% conversion efficiency. Cell degradation primarily involves changes in heterojunction collection efficiency, not minority carrier transport in the thin CU2S, light absorbing layer. Analysis of current technology predicts a selling price of $0.53/peak watt(1975 dollars) for glass encapsulated, 8% efficient modules. More conservative material use, especially gold grid electrode, should allow a selling price of $0.38/peak watt. DOE

N80-24848# United Engineers and Constructors, Inc., Philadelphia, Pa.
ENERGY ECONOMIC DATA BASE (EEDB) PROGRAM: PHASE 1: INITIAL UPDATE Final Report
Dec. 1979 210 p refs
(Contract EN-78-C-02-4954)
(COO-4954-1-Vol-3) Avail: NTIS HC A10/MF A01

Volume 1 describes the EEDB and presents some pertinent update material. The initial appendices make up Volume 2 in which descriptions of the Standard Hypothetical Middletown Sites for nuclear power plants and coal-fired power plants are presented. Additional data in appendices in Volume 2 include information on fuel-cycle work; inflation-free fixed charge rates; capital cost update procedure; and nuclear steam supply system. This Volume 3, contains additional appendices entitled: Practical Target Economics for the Liquid Metal Fast Breeder Reactor Nuclear Power Generating Station; Air-Quality Impact Analysis for determination of the Acceptability of Qualified High and Low-sulfur Coal-fired Facility Designs for the Hypothetical Middletown Site; Synthetic Power Plant Fuels by the Solvent Refined Coal Process; Inflation Free Fuel Cycle Costs for Throwaway and Recycle Cases; Inflated (6%) Fuel Cycle cost for Throwaway and Recycle cases; Inflated (7%) Fuel cost for Throwaway and Recycle Cases; Inflated (8%) Fuel Cycle Costs for Throwaway and Recycle Cases; Fuel Costing Methodology; and Bred-Fuel Scenarios. DOE

N80-24849# Science Applications, Inc., La Jolla, Calif.
CALIFORNIA THERMAL OIL UTILIZATION. VOLUME 1: EXECUTIVE SUMMARY Final Report
R. Colman and E. W. Standley Dec. 1979 385 p refs
(Contract ET-78-C-03-1864)
(SAN-1864-1) Avail: NTIS HC A17/MF A01

The potential for significant increases in California thermally produced crude oil (CTO) production and utilization by 1985 was studied. The DOE goal of 900,000 barrels/day of total CTO production by 1985 was evaluated. The constraints to increased CTO production were discussed. Incentives for increasing production were recommended. Physical and chemical properties, conventional refining processes, and alternate technologies for CTO were also discussed. DOE

N80-24850# RCA Labs., Princeton, N. J.
AMORPHOUS THIN FILMS FOR SOLAR CELL APPLICATIONS Quarterly Report, 12 Apr. - 11 Jul. 1979
D. E. Carlson, I. Balberg, R. S. Crandall, B. Goldstein, J Hanak, J., J. I. Pankove, and D.L. Staebler Jul. 1979 109 p refs
(Contract ET-78-C-03-2219)
(SAN-2219-3; QR-3) Avail: NTIS HC A06/MF A01

A theory for the capture of electrons by deep centers in hydrogenerated amorphous silicon (a-Si:H) is presented. Some recent results obtained with the RF magnetron deposition system are described. Other results show that additions of Ar to dc or ac SiH4 discharges cause the dark conductivity and photoconductivity to increase. Other data show that the addition of SiF4 to SiH4 discharges cause the photolumainescence intensity to decrease. Recent work involving photoconductivity spectra, the photoelectromagnetic effect, and the Hall effect in undoped a-Si:H is briefly described. Measurements of the surface photovoltage were used to estimate the distribution of surface states on a-Si:H. Tunneling measurements were used to characterize the surface and bulk states in MIS junctions. A new technique for determining the optical absorption in the band-tail states in a-Si:H is described. Information on stacked on multiple junction a-Si:H solar cells and on large area, series-connected cells is given. The influence of photoconductive gain on the fill factor of a-Si:H cells is discussed and an upper limit of approximately 380 A is established for the hole diffusion length in a-Si:H films made in an RF capacitive discharge. DOE

N80-24851# Radiation Monitoring Devices, Inc., Watertown, Mass.
HIGH EFFICIENCY THIN FILM CdTe SOLAR CELLS Quarterly Progress Report, 19 Mar. - 18 Jun. 1979
H. B. Serreze, G. Entine, and R. B. Goldner Jul. 1979 17 p refs
(Contract DE-AC04-79ET-23012)
(DOE/ET/23012-T1; QPR-1) Avail: NTIS HC A02/MF A01

Facilities for the high vacuum evaporation of thin film CdTe were prepared. A number of evaporations were performed of both p-type (phosphorus doped) and n-type (halogen doped) CdTe on both conductive and nonconductive substrates. Optical,

physical, and electrical evaluations were made. Initial results indicate that the films are predominantly cubic, but that film resistivity is generally still too high and that an anomalous barrier exists at the ITO/n-CdTe interface. DOE

N80-24852# Institute for Energy Analysis, Washington, D.C.
FRANCE: ESTIMATES OF FUTURE ENERGY/GDP RELATIONSHIPS
Edward L. Allen Dec. 1979 67 p refs
(Contracts EY-76-C-05-0033; DE-AC05-76OR-00033)
(ORAU/IEA-79-23(M)) Avail: NTIS HC A04/MF A01

Compared with other OECD nations, France's postwar economic growth has been above average. Gross domestic product (GDP) grew at an annual rate of 4.1% in the 1970s. A high rate of new investment (fixed, nonresidential investment) was achieved during these years to bolster productivity gains. Since France depends primarily on imports for its energy supplies, energy use has become relatively efficient. Government policy emphasizes energy saving in all sectors; the E/GDP ratio increased only slightly to 1973 and thereafter fell sharply. As to the future, economic growth, as measured by GDP, is expected to moderate over the balance of this century, to a level of 2.8% annually by the 1995-2000 period. Labor force growth will decline because of decreased domestic fertility and the more restrictive immigration policy. In addition, the length of the workweek, which has remained relatively high, is expected to follow the declining trend already evident in other OECD countries. DOE

N80-24853# FMC Corp., Santa Clara, Calif. Engineered Systems Div.
LINE FOCUS SOLAR THERMAL CENTRAL RECEIVER RESEARCH STUDY Final Report, 30 Apr. 1977 - 31 Mar. 1979
D. G. DiCanio, William J. Treytl, Frank A. Jur, and C. Don Watson Apr. 1979 314 p refs
(Contract EY-76-C-03-1246)
(DOE/ET/20426-1) Avail: NTIS HC A14/MF A01

The results of a study to examine the line focus central receiver alternative for solar thermal generation of electric power on a commercial scale are presented. The baseline concept consists of the following elements: (1) A solar collector (heliostat) whose geometry is the equivalent of a focused parabolic cylinder. The heliostat reflecting surface is composed of an array of flexible rectangular mirror panels supported along their long edges by a framework which rotates about an axis parallel to the ground plane. (2) A linear cavity receiver, composed of 61 meter (200-foot) sections supported by towers at an elevation of 61 meters (200 feet). Each section receives feedwater and produces turbine-rated steam. (3) Heliostat control, consisting of a local controller at each heliostat module which communicates with a master control computer to perform elevation tracking and focal length adjustment. The control logic is open-loop, with sun position computer by the master computer with an algorithm. DOE

N80-24854# Exxon Research and Engineering Co., Linden, N.J. Advanced Energy Systems Labs.
THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS Quarterly Report, 1 Apr. - 30 Jun. 1979
A. K. Ghosh, Tom Feng, H. Paul Maruska, and Charles Fishman 1979 45 p refs
(Contract DE-AC02-79ET-23047)
(DOE/ET/23047-T1; QR-2) Avail: NTIS HC A03/MF A01

The theory of polycrystalline solar cells was entended by introducing effects due to the reduction of grain boundary states. The results show that a large improvement in efficiency can be attained either by increasing the grain size or by passivating the grain boundary states to reduce the number of recombination centers. Experimental results are presented to show grain size distribution in Wacker polycrystalline silicon. Preliminary Hall mobility measurements are presented as a function of temperature. Experimental results and analysis of diffused p on n cells are reported. Preliminary studies of grain boundary passivation and stability of SnO2/n-Si solar cells are presented. DOE

N80-24855# Aerospace Corp., Los Angeles, Calif. Energy and Resources Div.
SOLAR THERMAL SMALL POWER SYSTEMS STUDY. PHASE 2: STUDY RESULTS
D. E. Lapedes, P. K. Munjal, and L. R. Sitney 12 Jul. 1979 239 p refs
(Contract ET-78-C-03-2226)
(DOE/ET/20516-2) Avail: NTIS HC A11/MF A01

This study of small solar power systems (SSPS) was structured to determine conditions under which SSPS can be cost-effective sources of electric power in the US in the period 1985 to 2015. An extensive data base, which provides a discrete identification of all utility and industrial electric generating units up to ans including 10 MW/sub e/ in rated capacity, was prepared. This data base defines the market for which comparative evaluations are made of SSPS and alternative fossil-fueled power plants. The market penetration of SSPS is determined and the effect of economic incentives on accelerating the penetration is evaluated. The solar electric power system is evaluated as either a complete replacement for existing conventional electric power systems or as a repowering installation for boilers supplying steam to turbine-driven generators. The cost data used in the market penetration analysis are for a central receiver-type of small solar thermal power system. While the market penetration discussed is for this type of SSPS, the sensitivity data in the report can be used to determine the market penetration of other types of solar thermal power systems (e.g., point focus distributed receiver) with different system costs. DOE

N80-24856# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
VACUUM DEPOSITED POLYCRYSTALLINE SILICON FILMS FOR SOLAR CELL APPLICATIONS Quarterly Report, 1 Apr. - 30 Jun. 1979
Charles Feldman and Frank G. Satkiewicz Aug. 1979 55 p refs
(Contract ET-78-C-02-3208)
(DOE/ET/32208-3) Avail: NTIS HC A04/MF A01

Research was conducted on grain growth phenomena and interface interactions pertaining to an all-vacuum deposition technique for fabricating thin-film polycrystalline silicon solar cells. Investigations dealt primarily with the structure silicon/TiB2/alumina substrate, which seems to be the most satisfactory from the standpoint of stability and potential applicability to low-cost solar cells. Deposition of silicon in the presence of hydrogen resulted in devices inferior to those fabricated in high vacuum. Silicon growth from the TiB2 coated substrates was observed to start from larger seeds than was observed on bare alumina substrates. The larger silicon crystallites observed on the TiB2/alumina are believed to arise from growth on an intermediate Ti-Si phase. A series of experiments on top electrode preparation indicates that Ti/Ag electrodes heated for 30 min at 500 C in air gives the best results for the polycrystalline devices as they are presently constructed. DOE

N80-24857# Sandia Labs., Albuquerque, N. Mex.
QUALIFICATION TESTING OF PHOTOVOLTAIC CONCENTRATOR MODULES FOR SYSTEM APPLICATION EXPERIMENTS
J. F. McDowell, D. A. Pritchard, and A. E. Verardo 1980 14 p Presented at the 14th Photovoltaics Specialists Conf., San Diego, Calif., 7 Jan. 1980
(Contract EY-76-C-04-0789)
(SAND-80-0112C; CONF-800106-12) Avail: NTIS HC A02/MF A01

Concentrator module performance qualification testing is described. The nature of the qualification tests, the control and data acquisition systems used and typical performance data on representative modules are discussed. Qualification testing is to be performed on modules assembled by final production processes and is designed to identify design/construction weaknesses rather than measure life expectancy. Three trackers will be used as will three independent computer-controlled data acquisition systems. The basic elements are the computer, control equipment, data acquisition instruments, a portable thermal loop, and programmable electronic load. DOE

N80-24858# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
PERFORMANCE EVALUATION OF A SOLAR AIR-HEATING AND NOCTURNAL COOLING SYSTEM IN CSU SOLAR

HOUSE 2 Final Report, 1 Jun. 1977 - 30 Sep. 1978
Susumu Karaki Apr. 1979 173 p refs
(Contract EY-76-S-02-2868)
(COO-2868-5) Avail: NTIS HC A08/MF A01

The solar heating system in Colorado solar house No.2 consists of 67.1 sq m of double glazed air-heating collectors with flat-black absorbers, 10.3 cu m of pebble bed storage, air-to-water heat exchanger for preheating domestic water, and one blower to circulate the air through the system. The nocturnal cooling system consists of an evaporative cooler and utilizes the pebble bed for cool storage. A schematic diagram of the system is presented. DOE

N80-24858/ California Univ., Livermore. Lawrence Livermore Lab.
PROSPECTS FOR USING IMPROVED CLIMATE INFORMATION TO BETTER MANAGE ENERGY SYSTEMS
William J. Quirk and John E. Moriarty (Federal Energy Regulatory Commission, Washington, D.C.) Jan. 1980 12 p refs Presented at the Intern. Workshop on Energy/Climate Interactions, Munster, W. Germany, 3-7 Mar. 1980
(Contract W-7405-eng-48)
(UCRL-83813; CONF-800309-2) Avail: NTIS HC A02/MF A01

The impacts that climate anomalies have had on energy systems in the United States, and the resulting impacts on society are described. It is pointed out that better use of climate information could alleviate some of the adverse consequences of these anomalies. The possibility of international cooperation in using climate information to avoid potentially worsening conditions during a global energy shortage is also examined. DOE

N80-24860/ Alabama Univ., University. Bureau of Engineering Research.
HEAT-PUMP-CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS Final Report
Walter J. Schaetzle, C. Everett Brett, and Marvin S. Seppanen Dec. 1979 283 p refs Supersedes ANL/ICES-TM-30
(Contract W-31-109-eng-38)
(ANL/CNSV-TM-25; ANL/ICES-TM-30) Avail: NTIS HC A13/MF A01

The heat-pump-centered integrated community energy system supplies district heating and cooling using heat pumps and a thermal energy storage which is provided by nature in underground porous formations filled with water, i.e., aquifers. The proposed system was analyzed as demonstration projects for a downtown portion of Louisville, Kentucky, and a section of Fort Rucker, Alabama. The downtown Louisville demonstration project is tied directly to major buildings while the Fort Rucker demonstration project is tied to a dispersed subdivision of homes. The Louisville project shows a payback of approximately 3 y, while Fort Rucker is approximately 30 y. The primary difference is that at Fort Rucker new heat pumps are charged to the system. In Louisville, either new construction requiring heating and cooling systems or existing chillers are utilized. DOE

N80-24861/ South Dakota School of Mines and Technology, Rapid City.
ENERGY FROM HUMID AIR Final Report
T. K. Oliver, W. N. Groves, C. L. Gruber, and A. Cheung Feb. 1979 99 p refs
(Contract EX-76-C-01-2553)
(DSE-2553-79/1) Avail: NTIS HC A05/MF A01

A cost effective process to convert the energy in humid air into mechanical work to drive an electrical generator was investigated using computer modeling. Results for a natural draft tower show that it is not a cost effective way to get energy from humid air. Parametric studies are presented for expansion-compression cycles. With suitable conditions, including large amounts of cooling during compression, this cycle has an attractive network output. To avoid using all the output power to overcome machine losses, it appears necessary to use a one-machine mechanization. The most promising uses vortex flow to achieve the necessary expansion and subsequent compression with cooling. Power output and costs were estimated for a vortex plant located in Puerto Rico. DOE

N80-24862/ Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
STANDARD ASSUMPTIONS AND METHODS FOR SOLAR HEATING AND COOLING SYSTEMS ANALYSIS
Cecile M. Leboeuf Jan. 1980 7 p refs Presented at the 2nd Ann. Systems Simulation and Econ. Anal. Conf., San Diego, Calif., 23-25 Jan. 1980
(Contract EG-77-C-01-4042)
(SERI/TP-351-548; CONF-800101-9) Avail: NTIS HC A02/MF A01

A set of inputs, assumptions, analytical methods, and a reporting format is presented to help compare the results of residential and commercial solar system analyses being performed by different investigators. For residential heating and cooling systems, three locations were selected. The weather data chosen to characterize these cities are the Typical Meteorological Year (TMY). A house for each location was defined that is typical of new construction in that locale. Hourly loads for each location were calculated using a computerized load model that interacts with the system specified inputs characterizing each house. Four locations for commercial cooling analyses were selected from among the existing sites for which TMYs were available. A light commercial (nominal 25 ton cooling load) office building was defined and is used in all four locations. Hourly cooling and heating loads were computed for each city. DOE

N80-24863/ Franklin Research Center, Philadelphia, Pa.
HEAT-PUMP-CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS Final Report
Richard E. Crane and Robert G. Werden (Werden (R.G.) and Assoc., Philadelphia) Dec. 1979 223 p refs Supersedes ANL/ICES-TM-26
(Contract W-31-109-eng-38)
(ANL/CNSV-TM-24; ANL/ICES-TM-26-Rev) Avail: NTIS HC A10/MF A01

Heat-pumps-centered integrated community energy systems (HP-ICES) are energy systems for communities which provide heating, cooling and/or other thermal energy services through the use of heat pumps. Since heat pumps primarily transfer energy from existing and otherwise probably unused sources, rather than convert it from electrical or chemical to thermal form, HP-ICES offer significant potential for energy savings. Information is presented on the following: the HP-ICES concept; its application potential; variations in the basic HP-ICES concept which could lead to improved performance; applications of the concept to specific communities; design; economics; environmental impacts; and component testing requirements. DOE

N80-24864/ Grumman Aerospace Corp., Bethpage, N.Y.
FURTHER INVESTIGATIONS OF DIFFUSER AUGMENTED WIND TURBINES. PART 1: EXECUTIVE SUMMARY Final Report
K. M. Foreman and B. L. Gilbert Jul. 1979 11 p
(Contract EY-76-C-02-2616)
(COO-2616-2-Pt-1-Rev-1) Avail: NTIS HC A02/MF A01

A multiphased experimental program is described which involves wind tunnel test facilities and models of several compact diffuser configurations. Screens to simulate a wind turbine and a three-bladed, fixed-pitch turbine were used with the diffuser models. A candidate baseline design is described, and some of the key technical and economic issues which can lead to future full scale implementation are discussed. DOE

N80-24865/ Georgetown Univ., Washington, D.C. School of Engineering and Applied Science.
UTILITY RATE STRUCTURES AND DISTRIBUTED THERMAL ENERGY STORAGE: A COST/BENEFIT ANALYSIS Basic Research Report, Oct. 1978 - Feb. 1979
Evan F. Koening Feb. 1979 44 p refs
(Contract ET-78-S-01-3411)
(DSE-3411-T1) Avail: NTIS HC A03/MF A01

Three alternative methods by which electric utilities might take advantage of distributed thermal energy storage to smooth out their load profiles are examined. The three methods are: time-specific rates, time-invariant rates with subsidized storage, and direct load controls. The optimal form of each of these policies was determined, and formulas indicating the relative desirability of each policy were developed. DOE

N80-24866# General Electric Co., Schenectady, N. Y. Chemical, Systems and Technology Lab.
THERMAL ENERGY STORAGE SUBSYSTEMS FOR SOLAR HEATING AND COOLING APPLICATIONS: ROLLING CYLINDER THERMAL STORAGE Interim Report
R. F. Thornton and C. S. Herrick Jun. 1979 119 p refs
(Contract EM-78-C-05-5759)
(ORO-5759-T1) Avail: NTIS HC A06/MF A01

The rolling cylinder provides a means for utilizing the latent heat of fusion of salt hydrates for thermal energy storage. Calorimetric tests of laboratory scale rolling cylinders using Glauber's salt have confirmed the technical feasibility of the concept. Several concepts for large scale, one million Btu units were evaluated for heat rate capability, blower and rolling power requirements, and relative cost and manufacturability. Large scale units seem technically and economically viable. The recommended size of the prototype is a two foot diameter, nine foot long cylinder of about 250,000 Btu theoretical capacity. DOE

N80-24867# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
SOLAR-POWERED ENVIRONMENTAL DATA COLLECTION SYSTEM
H. W. Randolph Feb. 1980 18 p
(Contract EY-76-C-09-0001)
(DP-1529) Avail: NTIS HC A02/MF A01

A solar powered system consisting of a multipurpose remote data collector, a radio data link, and a data receiving station was designed to acquire data from various remote areas at the Savannah River Plant. A prototype system was built to monitor gamma radiation at the plant perimeter. It is operating satisfactorily and will be installed to monitor gamma radiation or other environmental parameters at many remote locations on the plant. DOE

N80-24868# Oak Ridge National Lab., Tenn. Energy Div.
ENERGY AVAILABILITIES FOR STATE AND LOCAL DEVELOPMENT: 1975 DATA VOLUME
J. B. Mills, P. L. Rice, and D. P. Vogt Jan. 1980 285 p
(Contract W-7405-eng-26)
(ORNL/TM-6951) Avail: NTIS HC A13/MF A01

The supply, demand, and net imports of seven fuel types of four final consuming sectors for Bureau of Economic Analysis Areas (BEAs), states, census regions, and the nation in 1975 are presented. The data are formatted to present regional energy availability from primary extraction as well as from regional transformation processes. Extensive tables depict energy balances between availability and use for each specific fuel. A consistent base of historic and projected energy information is presented within a standard format. Such a framework should aid regional policy makers in their consideration of regional-growth issues that may be influenced by the regional energy system. For analysis of specific regions, however, this basic data should be supplemented by additional information which only the local policy analyst can bring to bear in his assessment of the energy conditions that characterize his region. DOE

N80-24869# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
JAPAN: ESTIMATES OF FUTURE ENERGY/GNP RELATIONSHIPS IN ENERGY USE
J. A. Edmonds and Edward L. Allen Dec. 1979 95 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-79-21(M)) Avail: NTIS HC A05/MF A01

As a consequence of continued rapid economic expansion, Japan's energy consumption is projected to more than double between 1976 and 2000. At the same time GNP is projected to triple, accompanied by lowering of the Japanese energy/GNP ratio by 30%. Industrial and transportation sector energy efficiency gains are expected to lead the way, with residential and commercial sector consumption growing almost abreast with GNP. The delayed home appliance revolution is expected to offset much of the gains from slow population growth. On the other hand, the Japanese automobile population explosion is expected to proliferate more energy-efficient automobiles throughout the economy, rapidly raising overall fleet performance. A significant shift toward water transport of freight also improves the overall performance of the transport sector. DOE

N80-24870# Department of Energy, Washington, D. C. Office of Analytical Sciences.
NATIONAL ENERGY PLAN 2, MAY 1979. APPENDIX A: WORLD OIL PRICES
1979 65 p refs
(DOE/TIC-10203-App-A) Avail: NTIS HC A04/MF A01

The detailed assumptions and projections used to develop the Second National Energy Plan (NEP-2) world oil price cases are presented in three major sections. The first section presents assumptions about potential world demand and production of oil, assuming constant real future world oil prices. Included is a discussion of alternative theories of OPEC behavior. The second section presents world oil price paths generated by mathematical models of world oil supply and demand. The models calculate oil prices that act through price elasticities to change the assumed constant-price oil demand and supply conditions to achieve a balanced oil market. The final section synthesizes the various model projections into the range of world oil price cases used in NEP-2 and reports major conclusions resulting from the world oil price analysis. DOE

N80-24871# Department of Energy, Washington, D. C. Office of Building and Community Systems.
ENERGY PERFORMANCE STANDARDS FOR NEW BUILDINGS: ECONOMIC ANALYSIS
Jan. 1980 402 p
(DOE/CS-0129) Avail: NTIS HC A18/MF A01

The major economic impacts of the implementations of the standards on affected groups were assessed and the effectiveness of the standards as an investment in energy conservation was evaluated. The methodology used to evaluate the standards for the various building types and perspectives is described. The net economic effect of changes in building cost and energy use are discussed for three categories of buildings: single family residential, commercial and multifamily residential, and mobile homes. Forecasts of energy savings and national costs and benefits both with and without implementation of the standards are presented. The effects of changes in energy consumption and construction of new buildings on the national economy, including such factors as national income, investment, employment, and balance of trade are assessed. DOE

N80-24872# Royal Aircraft Establishment, Farnborough (England).
PROTON/ELECTRON DAMAGE RATIOS FOR SOME VIOLET, BLACK, AND THIN SILICON SOLAR CELLS
M. W. Walkden London HMSO Nov. 1979 72 p refs
(Contract ESTEC-3301/NL-77(HP))
(RAE-TR-79133; RAE-Space-571; BR71903) Avail: NTIS HC A04/MF A01

Proton damage ratios which relate the damage caused by protons of different energies to that caused by 1 MeV electrons were used to study radiation environment and other factors may affect solar cell output power. Four different types of modern silicon solar cells were subjected to 1 MeV electrons and protons in the energy range from 2 to 50 MeV followed at each irradiation stage by an exposure to photon irradiation. It was found that the proton damage ratio of one type of cell was approximately one half of that of the other three types and that the proton damage ratio for this type of cell was independent of temperature. One cause of these differences is attributed to photon induced changes in solar cell performance following electron and proton irradiation for the particular material from which this type of cell is made. Author (ESA)

N80-24873# National Bureau of Standards, Washington, D.C. National Engineering Lab.
EVALUATION OF ENERGY CONSERVING MODIFICATIONS FOR WATER HEATERS Final Report
Robert L. Palla, Jr. Jul. 1979 53 p refs
(PB80-133853; NBSIR-79-1783) Avail: NTIS HC A04/MF A01 CSCL 10A

The effects of various energy-conserving modifications on water heating energy consumption were evaluated based on laboratory tests. Nine storage-type residential water heaters, representative of standard and energy-saving electric gas, and oil fueled models currently on the market, were obtained for testing. Federally-promulgated water heat test procedures were

used to measure the energy consumption of each unit before and after modifications. GRA

N80-24874# New Mexico Energy Inst., Albuquerque.
PREPARATION OF HIGHLY EFFICIENT SOLAR CELLS AND CORROSION STUDIES ON SOLAR CELL MATERIALS Final Report, 1 Jul. 1978 - 30 Jun. 1979
Su-Moon Park Jul. 1979 69 p refs Sponsored by New Mexico Energy and Minerals Dept.
(PB80-141294; NMEI-46) Avail: NTIS HC A04/MF A01 CSCL 10B

The Pourbaix diagram was applied to the prediction and understanding of corrosion properties of semiconductor materials. With the aid of flat band potential information, the thermodynamic stability of semiconductor materials under various operating conditions, types of electrodes (n- or p-), conversion efficiencies, types of redox couples, and the proper operating pH-region can be determined. Electrolyte and pH dependencies of flat band potentials were studied to be able to design more efficient semiconductor-liquid junction solar cells. Various effects of electrolytes on flat band potentials were also studied. GRA

N80-24875# New Mexico Energy Inst., Albuquerque.
VARIABLE SPEED CONSTANT FREQUENCY VOLTAGE GENERATOR (ALTERNATOR) Final Report
W. W. Grannemann Jul. 1979 46 p refs Sponsored by New Mexico Energy and Minerals Dept.
(PB80-141286; NMEI-44) Avail: NTIS HC A03/MF A01 CSCL 10B

The objective achieved was constucting the first prorotype alternator with digital control of its output frequency for a variable shaft speed, such as a wind machine would have. The first machine is a two-pole alternator with power removed from the rotor through slip rings. The rotating field in the stationary coils of the stator is controlled by the microcircuits. Later alternators may well have the control circuits and rotating field in the rotor which would be a significant improvement since power would not need to be removed through slip rings. Except for the power amplifers which drive the stator windings, the control and the comparison circuitry is constructed with available low cost, low power integrated circuits (IC's). Test results from the first prototype demonstrate that the alternator can successfully convert available wind power directly to usable a-c 60 hertz power to supplement line power. The power generated by the alternator can have constant frequency as determined by the local power system and the control circuitry. Variations in the mechanical speed of rotation of the alternator rotor, which are caused by changes in wind velocity, will change the power output of the alternator while the voltage and the frequency remain constant. GRA

N80-24876# Bechtel National, Inc., San Francisco, Calif. Research and Engineering Dept.
PROJECTED ANNUAL RESOURCE REQUIREMENTS AT THE NATIONAL AND REGIONAL LEVEL FOR THE DEPARTMENT OF COMMERCE ENERGY FORECAST 1985 AND 2000
Andrea L. Watson and Ralph G. J. Zimmerman Mar. 1979 205 p Sponsored by Dept. of Commerce
(PB80-126956) Avail: NTIS HC A10/MF A01 CSCL 10A

An analysis is presented of the national and regional resource requirements (capital, material, manpower, etc.) associated with future energy development in the U.S. The analysis, using Bechtels Energy Supply Planning Model (ESPM) indicates projected cumulative capital requirements of $1.6 trillion (January 1978 dollars) during the 1977 - 2000 forecast period. The largest requirements by energy sector are for electric power generation facilities (53%) coal-fired plants in particular. Although the U.S. is projected to become more and more dependent upon western energy resources, both capital and labor requirements are projected to move from Western to Eastern regions - by the year 2000 - again primarily because of electrical generation requirements. GRA

N80-24877# National Bureau of Standards, Washington, D.C.
FIRE EXPERIMENTS AND FLASH POINT CRITERIA FOR SOLAR HEAT TRANSFER LIQUIDS Final Report
B. T. Lee and W. D. Walton Nov. 1979 42 p refs Sponsored in part by DOE
(PB80-140536; NBSIR-79-1931) Avail: NTIS HC A03/MF A01 CSCL 13A

To help provide a rational basis for developing flammability criteria for heat transfer fluids used in solar energy collection systems, fire tests were performed using simulated accident scenarios involving spills, flowing leaks, spray leaks, and soaked insulation. These experiments indicated that the flash point temperatures, as measured with the Pensky-Martens closed cup apparatus, are close to the minimum temperatures at which pools of the fluids will support a flame when they are exposed to a small pilot igniting flame in a room. The heat release from moderate sized burning pools of these liquids is sufficient to cause flashover in a room. Interim flash point critera of at least 28 deg C (50 deg F) greater than the maximum operating temperature and not more than 111 deg C (200 deg F) below the maximum no-flow temperature are proposed to reduce the risk of fire in the use of solar heat transfer liquids. GRA

N80-24878# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Civil Engineering.
SNOW AND ICE ACCUMULATION AROUND SOLAR COLLECTOR INSTALLATIONS Final Report
Michael J. ORourke Aug. 1979 75 p refs Sponsored in part by DOE
(Contract NB79-NAAA-6099)
(PB80-127053; NBS-GCR-79-180) Avail: NTIS HC A04/MF A01 CSCL 13A

Half the installations had the collectors mounted flush with the roof surface, while the remainder had collectors mounted on racks at an angle to the roof. Contours of snow depth on the roof, snow densities, measurements of snow on the ground adjacent to the building, sketches, and photographs of the roofs, and comments of the owners of the installations are included in addition to a discussion of the state of the art of predicting snow accumulation on roofs of buildings. The effect of solar collectors on the design of roof structures for the support of snow loads is discussed and recommendations for future research are made. GRA

N80-24879# Versar, Inc., Springfield, Va.
COMPARISON OF MODEL PREDICTIONS AND CONSUMPTIVE WATER USE OF CLOSED CYCLE COOLING SYSTEM Final Report, Mar. - Jul. 1978
Jerome B. Strauss Nov. 1978 207 p refs
(Contract EPA-68-02-2618)
(PB80-148273; EPA-600/7-78-206) Avail: NTIS MF A01 CSCL 13A

Results are presented of a comparison of field data-derived water evaporation rates with predictive model values for cooling towers and cooling ponds at steam-electric generating plants. The Leung Moore coolingtower model and five cooling pond models (Harbeck and Marciano; Harbeck; Harbeck, Koberg, and Hughes; Myer; and Brady et al.) were used in the study. Plant data from 13 utilities (16 cooling tower systems and 7 cooling ponds) and for 5 water resource regions were utilized. For the water resource regions included in the study, ponds generally exhibited higher consumptive water use than towers. GRA

N80-24693°# Los Alamos Scientific Lab., N. Mex.
POTENTIAL PREDICTION NEEDS IN SUPPORT OF ENERGY SYSTEMS
Richard L. Blake *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 198-202 ref Sponsored in part by DOE (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 10B

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-24880°# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
A STUDY OF POULTRY PROCESSING PLANT NOISE CHARACTERISTICS AND POTENTIAL NOISE CONTROL

TECHNIQUES Final Report
J. C. Wyvill, A. D. Jape, L. J. Moriarity, and R. D. Atkins 1980 170 p refs Sponsored in part by Georgia Dept. of Agr.
(Grant NsG-3228)
(NASA-CR-163139) Avail: NTIS HC A08/MF A01 CSCL 13B

The noise environment in a typical poultry processing plant was characterized by developing noise contours for two representative plants: Central Soya of Athens, Inc., Athens, Georgia, and Tip Top Poultry, Inc., Marietta, Georgia. Contour information was restricted to the evisceration are of both plants because nearly 60 percent of all process employees are stationed in this area during a normal work shift. Both plant evisceration areas were composed of tile walls, sheet metal ceilings, and concrete floors. Processing was performed in an assembly-line fashion in which the birds travel through the area on overhead shackles while personnel remain at fixed stations. Processing machinery was present throughout the area. In general, the poultry processing noise problem is the result of loud sources and reflective surfaces. Within the evisceration area, it can be concluded that only a few major sources (lung guns, a chiller component, and hock cutters) are responsible for essentially all direct and reverberant sound pressure levels currently observed during normal operations. Consequently, any effort to reduce the noise problem must first address the sound power output of these sources and/or the absorptive qualities of the room. R.E.S.

N80-24881*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIATION OF AIRCRAFT NOISE ANNOYANCE
Thomas K. Dempsey Apr. 1980 11 p refs Presented at the 99th Acoust. Soc. of Am. Meeting, Atlanta, 21-25 Apr. 1980
(NASA-TM-81804) Avail: NTIS HC A02/MF A01 CSCL 13B

Laboratory and field studies were conducted to determine the basis for increased sensitivity of people to noise during aircraft noise studies. This change in sensitivity could be attributed to either a physiological time-of-day effect (i.e., a circadian rhythm) or simply to the total number of aircraft noise events experienced during a laboratory test period. In order to investigate the time-of-day factor, noise sensitivity measures were obtained from subjects at home with cassette tape recorders/headsets over a 24 hour period. The effect of number of aircraft noise events on noise sensitivity was investigated within a laboratory. In these tests, measures of sensitivity to noise were obtained from subjects before and after their exposure to varying numbers of aircraft noise events. The 24 hour data showed no evidence that noise sensitivity is physiologically cyclical. Consequently, these data can not explain annoyance response variation to aircraft noise tests conducted during the daytime. However, the number of aircraft noise events did influence the subject's noise sensitivity. This effect completely accounts for the systematic increase in noise sensitivity during a laboratory test period. Author

N80-24882# Naval Postgraduate School, Monterey, Calif.
VALIDATION OF AN AMBIENT AIR QUALITY MODEL FOR NAVAL AIR OPERATIONS M.S. Thesis
Terry Scott Douglas Dec. 1979 133 p refs
(AD-A081768) Avail: NTIS HC A07/MF A01 CSCL 13/2

An initial validation of an Air Quality Assessment Model for Naval air operations was conducted at NAS Miramar, Calif. A previously developed model was updated to appropriately represent 1978-1979 operations and then evaluated for prediction sensitivity to variations in meteorological and dispersion model parameters. A joint effort with the Naval Air Propulsion Center, the Environmental Protection Agency/Northrup Services, Inc. and PMTC, Point Mugu was conducted to obtain detailed data over a one week period. Comparison of model predictions with the limited initial measured concentration data indicated that: (1) predicted CO concentrations were in good agreement with measurement; (2) predicted NOx concentrations from aircraft idle/taxi operations were too low; and (3) predicted total hydrocarbons and particulate concentrations were too high for aircraft idle/taxi operations and too low for environ sources. GRA

N80-24883# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 124: F104D AIRCRAFT, NEAR AND FAR-FIELD NOISE
Robert G. Powell Aug. 1979 88 p
(AF Proj. 7231)
(AD-A081845: AMRL-TR-75-50-Vol-124) Avail: NTIS HC A04/MF A01 CSCL 01/2

This volume provides measured and extrapolated data defining bioacoustic environments produced by this aircraft during ground runup operations. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with ground runups of the F-104D aircraft. This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and ground support equipment. The far-field, community-type, noise data in the handbook describe the noise produced during ground operations of aircraft, ground support equipment, and other ground-based equipment or facilities. Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Volume 2 provides a method and data for adjusting the handbooks:s far-field noise data, which are for standard meteorological conditions (15 C temperature, 70% rel humidity, 0.760 meters Hg barometric pressure), to derive comparable data for other meteorological conditions. Refer to Volumes 1 and 2 (references 1 and 2) for such information because it is not repeated in other handbook volumes. GRA

N80-24884# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
ENVIRONMENTAL CONTROL TECHNOLOGY FOR THE FLASH HYDROPYROLYSIS OF COAL Progress Report, 1 Apr. - 31 Dec. 1978
Feb. 1979 81 p refs
(Contract EY-76-C-02-0016)
(BNL-50983; PR-3) Avail: NTIS HC A05/MF A01

Based on experimental results and analytical studies, preliminary environmental and economic assessments of a conceptual, industrial scale FHP-Refinery Complex were made. Three cases were considered, one for the production of pipeline gas, the second for the production of liquid hydrocarbons such as motor gasoline and liquid prepared gas LPG, and the third for the production of both liquid and gaseous effluents for each case gaseous products. Solid, liquid and gaseous products. Solid, liquid and gaseous effluents for each case were evaluated, and required effluent treatment facilities and potential problem areas identified. Thermal efficiency range from 50% to 72%, depending upon the mode of operation of the Complex, and investment costs from 834 to 936 million dollars. The installed cost of environmental equipment is estimated at about 5% of total plant investment for all three cases. DOE

N80-24885# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
ANALYSIS OF ENVIRONMENTAL IMPACTS OF WATER LEVEL FLUCTUATION IN RESERVOIRS AT HYDROELECTRIC SITES
A. T. Szluha, J. M. Loar, R. R. Turner, and S. G. Hildebrand 1979 8 p refs Presented at the Waterpower 79 Intern. Conf.: Small Scale Hydropower, Washington, D.C., 1 Oct. 1979
(Contract W-7405-eng-26)
(CONF-791056-2) Avail: NTIS HC A02/MF A01

Potential significance, on a site-specific basis, of water-level-fluctuation impacts ranges from begin (run-of-the river plants) to possibly significant enough to require mitigation. It is emphasized that efforts to develop small hydroelectric sites that entail water level fluctuation should include a careful analysis of the types of impacts. The potential significance of these impacts should be evaluated as an integral part of initial studies of site feasbility. DOE

N80-24886# Niagra Univ., New York, N.Y.
ENVIRONMENTAL CONSEQUENCES OF ATMOSPHERIC

KRYPTON-85 Final Report, 1 Jan. 1977 - 30 Sep. 1979
W. L. Boeck 1979 17 p refs
(Contract EE-77-S-02-4364)
(COO-4364-2) Avail: NTIS HC A02/MF A01

Krypton-85 is a radioactive inert gas produced during normal operations of the nuclear fuel cycle. The quantities of krypton-85, that will be produced in the next century, are sufficient, if released to alter the electrical state of the atmosphere. The principal hypothesis is that an anthropogenic alteration of the electric state of the atmosphere could alter other meterological phenomena and lead to significant environmental impacts. The goal was to explore some areas of basic science related to the evaluation of that hypothesis. The approach was primarily theoretical. The following topics were addressed: a first approximation model to estimate the effects of krypton-85 on the electrical state of the atmosphere; an analysis of the pathways between krypton-85 production and the atmosphere; an analytical model for fair weather atmospheric electricity; and a dipole model for atmospheric electricity. The results will provide a framework on which detailed models can be built. The results should provide better understanding of some topics in atmospheric electricity. DOE

N80-24887# California Univ., Livermore. Lawrence Livermore Lab.
POTENTIAL ENVIRONMENTAL EFFECTS OF AIRCRAFT EMISSIONS
F. M. Luther, J. S. Chang, W. H. Duewer, J. E. Penner, R. L. Tarp, and D. J. Wuebbles 15 Oct. 1979 233 p refs
(Contract W-7405-eng-48)
(UCRL-52861) Avail: NTIS HC A11/MF A01

An assessment is provided of the potential environmental effects of fleets of subsonic, supersonic, and hypersonic aircraft. A general discussion of photochemical and transport modeling techniques is included along with a description of the LLL one dimensional transport-kinetics model that was used in the assessment. Model simulations of the natural and perturbed stratosphere are used to compare theory with observations as a means of verification of model processes. A review is provided of engine emission indexes and 1990 fleet projections. Assessments of the potential effects of subsonic and supersonic aircraft fleets indicate a small increase in total ozone. However, the change in total ozone is the net difference between regions of ozone increase (in the lower stratosphere and upper troposphere) and ozone decrease (in the upper stratosphere). The percent change in the local ozone concentration is much larger than the change in total ozone. The effect of a proposed hydrogen fueled hypersonic transport fleet is a small reduction in total ozone. A study is made of the effect on these results of uncertainties in chemical rate coefficients, speculative chemical reactions, temperature feedback, hydrostatic adjustment, and various model parameters. The potential effect on ozone of aircraft emissions is compared with potential changes due to other anthropogenic perturbations. DOE

N80-24888# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.
ENVIRONMENTAL CONTROL TECHNOLOGY FOR ATMOSPHERIC CARBON DIOXIDE
Meyer Steinberg and Anthony S. Albanese 1980 31 p refs
Presented at the Intern. Workshop on the Energy/Climate Interactions, Munster, West Germany, 3-7 Mar. 1980
(Contract EY-76-C-02-0016)
(BNL-27164; CONF-800309-1) Avail: NTIS HC A03/MF A01

The impact of fossil fuel use in the United States on worldwide CO_2 emissions and the impact of increased coal utilization on CO_2 emission rates are assessed. The aspects of CO_2 control are discussed as well as the available CO_2 control points (CO_2 removal sites). Two control scenarios are evaluated, one based on the absorption of CO_2 contained in power plant flue gas by seawater; the other, based on absorption of CO_2 by (mono ethanol amine-MEA). Captured CO_2 is injected into the deep ocean in both cases. The analyses indicate that capture and disposal by seawater is energetically not feasible, whereas capture and disposal using MEA is a possibility. However, the economic penalties of CO_2 control are significant. The use of nonfossil energy sources, such as hydroelectric, nuclear or solar energy is considered as an alternative for limiting and controlling CO_2 emissions resulting from fossil energy usage. DOE

N80-24889# North American Weather Consultants, Goleta, Calif.
WORKSHOP ON ATMOSPHERIC DISPERSION MODELS IN COMPLEX TERRAIN Final Report, Mar. - Oct. 1979
Einar L. Hovind, Max W. Edelstein, and Victoria C. Sutherland Nov. 1979 215 p refs Workshop held in Raleigh, N.C., 16-20 Jul. 1979
(Contract EPA-68-02-3223)
(PB80-138571; EPA-600/9-79-041) Avail: NTIS HC A10/MF A01 CSCL 13B

Problems associated with plume dispersion modeling in complex terrain are addressed. Aspects of the topic discussed include environmental and control pollution technology, and industrial and scientific viewpoints. Model development, analysis, evaluation, and application are covered along with experimental design, measurement techniques, and data management and quality assurance. Recommendations are summarized. J.M.S.

N80-24890# Environmental Protection Agency, Research Triangle Park, N.C. Emission Standards and Engineering Div.
CONTROL TECHNIQUES FOR CARBON MONOXIDE EMISSIONS Final Report
Jun. 1979 410 p refs
(PB80-140510; EPA-450/3-79-006) Avail: NTIS HC A18/MF A01 CSCL 13B

This document characterizes carbon monoxide emission sources and controls for use by states in revising state implementation plans. It is intended for use by state and local air pollution control engineers to provide basic available information on carbon monoxide emissions from mobile sources, stationary combustion sources, and industrial process sources. Both demonstrated and feasible control strategies are presented for each source. Information is also provided on emission reduction benefits, energy requirements of controls, and annualized and operating costs of controls. GRA

N80-24891# Rhode Island Univ., Kingston. Dept. of Chemistry.
A RESONANCE RAMAN METHOD FOR THE RAPID DETECTION, IDENTIFICATION AND QUANTITATION OF BACTERIA IN SEWAGE AND NATURAL WATERS Completion Report, 1 Oct. 1977 - 30 Sep. 1979
Wilfred H. Nelson 1979 21 p refs Sponsored by Dept. of Interior
(PB80-138522; W80-03087; OWRT-B-078-RI(1)) Avail: NTIS HC A02/MF A01 CSCL 06M

Resonance Raman spectroscopy was used to rapidly identify and quantify chromogenic bacteria in water. A series of carotene-containing bacteria were studied using a standard Spex model 1401 spectrometer with a photon counting detection system. Line intensities and energies are presented. Two intense bands were found for each bacterial spectrum. A substantial number of the microorganisms produced specific, interpretable resonance Raman spectra. The spectra were simply obtained, of high quality, and are reproducible. The method will allow for the rapid identification of microorganisms in the presence of 'contaminants' such as sewage and water. GRA

N80-24892# Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
POLLUTION ASSESSMENT AND POTENTIAL MOBILITY OF HEAVY METALS IN GREAT LAKES SEDIMENTS Report, 1 Oct. 1978 - 30 Sep. 1979
Richard M. Owen Oct. 1979 29 p refs
(Contract DI-14-34-0001-9024)
(PB80-133580; W80-02704; OWRT-A-101-MICH(1)) Avail: NTIS HC A03/MF A01 CSCL 07D

A sequential extraction scheme was used to determine the geochemical fractionation of Fe, Mn, Cr, Cu, and Zn in different grain size classes for sediment samples collected from within and around Little Traverse Bay, Lake Michigan. The partitioning of Fe, Cr, and Cu in both sediment and presently eroding coastal bluff samples are similar. Also the concentrations of these metals in fine grained particles are not proportional to the increased surface area of these grains compared with larger grain sizes. Both of these results indicate that these metals have undergone little authigenic change since entering the lacustrine environment.

However, sediment Zn concentrations are significantly higher than in coastal bluff samples, and also have a different geochemical fractionation. In general, Mn shows relatively little mobility in the bay's oxizing environment, except in areas where Mn nodules are forming. GRA

N80-24893# California Univ., Riverside. Statewide Air Pollution Research Center.
CHEMICAL CONSEQUENCES OF AIR QUALITY STANDARDS AND OF CONTROL IMPLEMENTATION PROGRAMS: ROLES OF HYDROCARBONS, OXIDES OF NITROGEN, OXIDES OF SULFUR AND AGED SMOG IN THE PRODUCTION OF PHOTOCHEMICAL OXIDANT AND AEROSOL Final Report, 24 May 1977 - 30 Sep. 1978
James N. Pitts, Jr. Jun. 1979 167 p refs Sponsored by California Air Resources Board
(PB80-126840; ARB-R-A6-172-30-79-104) Avail: NTIS HC A08/MF A01 CSCL 97D

Using an environmental chamber, the reactivity scale of the reaction of organic compounds with the OH radical was studied. Investigations were carried out in order: (1) to establish correlations between ozone formation and hydroxyl radical rate constraints and hydrocarbon reactivity scales; (2) to determine rate constants for the reactions of hydroxyl radicals with selected organic compounds including alkanes, alkenes and alkene oxides; (3) to obtain data concerning the rates of conversion of sulfur dioxide to sulfate aerosol under simulated atmospheric conditions; (4) to extend the previous oxidant-HC-NO(x) data base by generating data for 12 hour irradiation experiments employing both constant light intensity and quasi-diurnal light intensity; and (5) to apply both computer kinetic modeling and an emperical mathematical approach to assessments of oxidant-precursor relationships. GRA

N80-24894# Battelle Columbus Labs., Ohio.
ASSESSMENT OF DIESEL PARTICULATE CONTROL: DIRECT AND CATALYTIC OXIDATION Final Report, Mar. - Jul. 1979
M. J. Murphy, L. J. Hillenbrand, and D. A. Trayser Oct. 1978 33 p refs
(Contract EPA-68-02-2629)
(PB80-128697; EPA-600/7-79-232B) Avail: NTIS HC A03/MF A01 CSCL 13B

The technology and potential for disposal of diesel particulate by oxidation are discussed. Relevant properties of typical diesel particulate are given; note is taken of the small size (on the order of 0.1 micrometer diameter) and the presence of a portion extractable with an organic solvent. Available reaction rate data is used to derive particle lifetimes at various temperatures; these exceed likely exhaust system residence times. The use of catalysts to increase oxidation rates and lower ignition temperatures is discussed. Small amounts of many metals are effective in increasing the rate of oxidation by 2 to 5 orders of magnitude. Chemical reactor theory is used to derive ignition and operational characteristics of trap/oxidizers. Note is also taken of the tendency of these devices to go rapidly from a cold unignited state to an ignited state close to the adiabatic flame temperature of the fuel. Design techniques to ameliorate undesirable temperature excursions are presented. GRA

N80-24895# Maine Univ., Orono. Land and Water Resources Center.
A SIMPLE POLLUTION VULNERABILITY INDEX FOR PRELIMINARY COASTAL WATER QUALITY MANAGEMENT PLANNING
Bruce J. Edwards and Franklin E. Woodard Oct. 1979 32 p refs Sponsored by Office of Water Res. and Technol.
(PB80-134323; W80-02768; OWRT-A-047-ME(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

A quantitative pollution vulnerability index was developed for locating future coastal discharge in Maine so that deleterious effects are minimized. The index is designed to serve as a planning tool for agencies in coastal zone management. The vulnerability of a coastal zone is determined by its capacity to accept a particular pollutant which is a function of dispersion, background pollutant levels, and allowable limits. The Weyl 'pollution susceptibility index' is used because it is mathematically simple and requires minimal input data. Because levels of critical use are not well defined for a wide range of pollutants, fecal coliform is used for an example. GRA

N80-24896# Tennessee Valley Authority, Chattanooga. Power Research Staff.
DESIGN OF A MONITORING PROGRAM FOR ASH POND EFFLUENTS Final Report, May 1975 - Apr. 1979
F. A. Miller, III, T. V. J. Chu, and R. J. Ruane Nov. 1979 207 p refs Sponsored by EPA
(PB80-128457; PRS-41; EPA-600/7-79-236) Avail: NTIS HC A10/MF A01 CSCL 13B

A procedure is described for designing an effective monitoring program for fossil-fueled power plant ash pond effluents. Factors that influence effluent characteristics and are important in designing such a monitoring program were determined following a review of plant operating characteristics and ash pond effluent characteristics of TVA's fossil-fueled power plant system. A statistical procedure for determining the sampling frequency of chemical characteristics in ash pond effluents precision are described: method 1 involves selecting a precision value to estimate the population mean within a given percentage; method 2 involves calculating a precision value by subtracting an estimate of the population mean from either the ash pond effluent limitation established by EPA or a desirable water quality criterion. Method 2 gives the number of samples required to show that the effluent is in compliance with the effluent limitation or below the water quality criteria. The method chosen to compute the precision depends on the purpose of the monitoring program. The procedure was demonstrated for two TVA ash pond systems. GRA

N80-24897# Southern Research Inst., Birmingham, Ala.
ASSESSMENT OF DIESEL PARTICULATE CONTROL: FILTERS, SCRUBBERS, AND PRECIPITATORS Final Report, Mar. - Jul. 1979
M. G. Faulkner, E. B. Dismukes, J. R. Donald, D. H. Pontius, and A. H. Dean Oct. 1979 177 p refs
(Contract EPA-68-02-2610)
(PB80-128655; SORI-EAS-79-564; EPA-600/7-79-232A; Rept-3858-14-FR) Avail: NTIS HC A09/MF A01 CSCL 13B

An investigation is reported of three types of devices that might be used for the after-treatment of diesel exhaust to lower particulate emmissions forn light-duty vehicles. The devices are filters, electrostatic precipitators (ESPS), and wet scrubbers. The conclusions reached are that filters and ESPs merit further consideration but wet scrubbers do not. Wet scrubbers were eliminated from further consideration on the basis of excessive size, low efficiency, and excessive fluid loss by evaporation (assuming that water is the fluid of choice). Filters and ESPs, although appearing to offer significant potential, have possible disadvantages that can only be assessed experimentally. Prototype filters and electrostatic devices that appear worthy of experimental study are described. GRA

N80-24898# Rockwell International Corp., Newbury Park, Calif. Air Monitoring Center.
QUALITY ASSURANCE IN SUPPORT OF ENERGY RELATED MONITORING ACTIVITIES Annual Report
Mark Cher Jun. 1979 69 p refs
(Contract EPA-68-02-2412)
(PB80-135270; AMC-8303.135-AR-2; EPA-600/7-79-136; AR-2) Avail: NTIS HC A04/MF A01 CSCL 13B

A program to establish a quality assurance data base for ambient air monitoring around present and proposed energy development projects, and to provide technical assistance to enable existing monitoring networks to achieve a high level of data quality is described. Results from laboratory performance surveys carried out for the analysis of sulfate, nitrate, SO2, NO2, and CO and for weight measurements and high volume flow rate are given. GRA

N80-24899# Rockwell International Corp., Creve Couer, Mo. Environment Monitoring and Services Center.
DOCUMENTATION OF THE REGIONAL AIR POLLUTION STUDY (RAPS) AND RELATED INVESTIGATIONS IN THE SAINT LOUIS AIR QUALITY CONTROL REGION Final Report
Joseph A. Strothmann and Francis A. Schiermeier Dec. 1979

717 p refs
(Contract EPA-68-02-2093)
(PB80-138241; EPA-600/4-79-076) Avail: NTIS
HC A99/MF A01 CSCL 13B

During the period of 1974 to 1977, the regional air pollution study (RAPS) was conducted in the St. Louis, Missouri/Illinois metropolitan area. Because of the availability of extensive monitoring data, additional independent research studies were conducted in the St. Louis area during this time frame. This report is an attempt to document nearly all the RAPS and related investigations conducted in the St. Louis air quality control region during the period of 1973 to 1978. Descriptions of locally operated air quality and meteorological networks are also included. Such a report will serve as a summary of data available to the EPA modelers in pursuit of the RAPS objectives and will be used by RAPS researchers to locate supplementary data sources to augment their own measurements. GRA

N80-24900# Radian Corp., Austin, Tex.
CALCIUM SULFITE CRYSTAL SIZING STUDIES Final Report
Larry O. Edwards Aug. 1979 97 p refs Prepared for EPA, Washington, D.C.
(Contract EPA-68-02-2608)
(PB80-128689; EPA-600/7-79-192) Avail: NTIS
HC A05/MF A01 CSCL 13B

A reliable experimental method is described that can be used routinely to determine the crystal size distribution function, a measure that is required for a mathematical representation of the nucleation and growth processes involved in the settling, dewatering, and disposal of calcium sulfite sludge from lime/limestone or dual alkali scrubbers, a major problem associated with coal burning. Optical and instrumental crystal sizing methods were compared and the merits of each discussed; Coulter counting is recommended. GRA

N80-24901# National Transportation Policy Study Commission, Washington, D. C.
TRANSPORTATION AND THE ENVIRONMENT
Elaine M. Conley May 1979 63 p refs
(PB80-133812; NTPSC/WP-79-14) Avail: NTIS
HC A04/MF A01 CSCL 13B

Major issues and concerns of transportation as they relate to environmental and safety goals were studied. A number of particularly important or timely issues in the context of transportation, the environment, and safety over the next 25 years are treated. Eight issues were selected according to several qualitative criteria, in consultation with experts in the field, Commission regional public hearings, and current literature. They were selected to represent a sampling of acute and chronic problems in the provision of transportation supply affecting all the modes. GRA

N80-24902# IIT Research Inst., Chicago, Ill.
HOUSTON URBAN PLUME STUDY, 1974. MICROSCOPICAL IDENTIFICATION OF COLLECTED AEROSOLS Interim Report, Jul. 1974 - Oct. 1977
Ronald G. Draftz and Jean Graf Sep. 1979 62 p refs
(Grant EPA-R-803078)
(PB80-139074; EPA-600/3-79-090) Avail: NTIS
HC A04/MF A01 CSCL 13B

An urban plume study was conducted in Houston during July 1974 to gain preliminary data on the concentration and composition of primary and secondary aerosols contributing to Houston's air pollution problem. Selected membrane filter samples containing urban aerosols were analyzed by polarized light and scanning electron microscopy to identify the aerosols and their possible sources. The aerosol samples, collected by aircraft at elevations from 1,000 to 4,000 feet above sea level, consisted principally (more than 95 percent by number) of mineral silicate fragments. A trace to minor quantity of carbonaceous particles (resembling diesel exhaust), lead bromide compounds (from vehicle exhausts), and sea salt were also found in most samples. No discrete particles of ammonium sulfate were present. GRA

N80-24903# Environmental Sciences Research Lab., Research Triangle Park, N.C.
PHOTOCHEMISTRY OF SOME NATURALLY EMITTED HYDROCARBONS
Robert R. Arnts and Bruce W. Gay, Jr. Sep. 1979 140 p refs
(PB80-131980; EPA-600/3-79-081) Avail: NTIS
HC A07/MF A01 CSCL 04A

Six C10H16 monoterpenes, p-cymene, and isoprene, all known or thought to be emitted to the atmosphere by vegetation, were irradiated in the presence of NOx. The terpenes studied included one acyclic triolefin (myrcene), two monocyclic diolefins (d-limonene, terpinolene), and three bicyclic monolefins (alpha-pinene, beta-pinene, and delta-carene). Propylene was also studied since this olefin serves as a point of reference with other chamber studies. Results show that monoterpenes and isoprene promoted the oxidation of NO to NO2 and were themselves consumed at rates comparable to or greater than propylene; p-cymene was decidedly slow in these respects. The monoterpenes however did not permit the buildup of ozone due to their rapid reaction with ozone. The ozone suppression was particularly noticeable at high carbon/NOx ratios. Deciduous forests, isoprene emitters, are coniferous forests. Coniferous forests may in fact function as a sink for ozone. Reported ambient concentrations of isoprene and terpenic hydrocarbons in forested areas are too low to account for more than a few ppb of ozone even if NOx is available. GRA

N80-24904# Environmental Monitoring and Support Lab., Las Vegas, Nev.
A BATTERY-OPERATED AIR SAMPLER FOR REMOTE AREAS Final Report
K. W. Brown, G. B. Wiersma, and C. W. Frank Nov. 1979 16 p refs
(PB80-128978; EPA-600/4-79-071) Avail: NTIS
HC A02/MF A01 CSCL 14B

An air sampling system developed to evaluate air quality in biosphere reserves or in other remote areas is described. The equipment consists of a Dupont P-4000 pump and a specially designed battery pack containing Gates batteries. This air sampling system was tested in southern Utah and at 10 remote sampling sites in the Great Smoky Mountains National Park. The equipment was backpacked to the remote sampling sites, and was operated continuously at full capacity for a maximum 8 day period. Except for tampering by curious hikers at one site, the equipment operated satisfactorily. GRA

N80-24905# San Jose State Univ., Calif. Dept. of Meteorology.
OBSERVATIONAL PROGRAM FOR AIR POLLUTION MODELS Final Report
Peter F. Lester Apr. 1979 27 p ref
(Contract ARB-A7-180-30)
(PB80-139298; ARB-R/79-101) Avail: NTIS
HC A03/MF A01 CSCL 04B

PIBAL winds and aircraft soundings of temperature, moisture, oxidant, and particulates were gathered at several locations in the San Francisco Bay area and in the Northern Salinas Valley during the period July 31 through August 17, 1978. The observational program was conducted during MABLES WC, an extensive field study of the marine boundary layer. The design of the experiment, schedule of observations and resulting data are described. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-24906* National Aeronautics and Space Administration. Pasadena Office, Calif.
GEOLOGICAL ASSESSMENT PROBE Patent
Earl R. Collins, inventor (to NASA) (JPL) Issued 8 Apr. 1980 8 p Filed 25 Sep. 1978 Supersedes N80-12642 (18 - 3, p 0365) Sponsored by NASA
(NASA-Case-NPO-14558-1; US-Patent-4,196,619; US-Patent-Appl-SN-945436; US-Patent-Class-73-155) Avail: US Patent and Trademark Office CSCL 08G

A probe is described which can be installed in a side hole

that extends from a bore hole in the Earth, to assess the permeability of the strata surrounding the borehole. The probe is elongated and has a plurality of seals spaced therealong and sealed to the walls of the side hole to form a plurality of chambers sealed from one another. A tracer fluid injector on the probe can inject a tracer fluid into one of the chambers, while a tracer fluid detector located in another chamber can detect the tracer fluid, to thereby sense the permeability of the strata surrounding the side hole. The probe can include a train of modules, with each module having an inflatable packer which is inflated by the difference between the borehole pressure and the strata pressure. Official Gazette of the U.S. Patent and Trademark Office

N80-24907 Pennsylvania State Univ., University Park.
EFFECT OF TRANSFORMATION OF SUPERPLASTIC PROPERTIES WITHIN THE OLIVINE-SPINEL TRANSITION ZONE OF THE EARTH'S MANTLE Ph.D. Thesis
James Lindall Dein 1979 200 p
Avail: Univ. Microfilms Order No. 8010045

A theory for transformational superplasticity (TSP) is derived and applied to geophysical situations involving the olivine-spinel transformation. An internal stress mechanism is assumed, in which internal stresses resulting from transformational volume change interact with an applied stress to trigger pseudo-Newtonian behavior in an intrinsically non-Newtonian material. Theoretical analysis shows that the internal stress TSP can probably occur in the 400 km transition zone under appropriate circumstances. The pressure-change rates used in conjunction with published data on the olivine-spinel transformation give transformation rates ranging from 10 to the - 13th power s (-1) to 10 to the -15th power s (-1). Assuming a strain rate of 10 to the -15th power s (-1) consistent with plate tectonics, the theory predicts that the high transformation rate probably can, and the low transformation rate probably cannot, induce TSP. Application of the theory to a simple model of transformation in subducted lithosphere indicates the possibility that the seismicity gaps found over broad depth ranges centered on a depth of 400 km may be related to TSP stress relaxation. Dissert. Abstr.

N80-24908 State Univ. of New York at Stony Brook.
CARIBBEAN TECTONIC PROCESSES: SEISMIC SURFACE WAVE SOURCE AND PATH PROPERTY ANALYSIS Ph.D. Thesis
Alan Louis Kafka 1980 294 p
Avail: Univ. Microfilms Order No. 8011075

The magnitude threshold for earthquake focal mechanism and depth studies was lowered as far as mb = 4.7 by exploiting the surface wave portion of seismograms recorded at Worldwide Standardized Seismic Station Network stations. The initial phase was calculated and the Rayleigh wave phase velocities between the events and the observing stations were determined. A plane layered, laterally homogeneous, oceanic Earth model for the source region in the theoretical Rayleigh wave calculations was assumed, as well as the introduction of a subducting lithospheric slab. The tectonic implications of these focal mechanisms results remain independent of the Earth model chosen for the source region. The focal mechanisms determined for the northeastern Caribbean plate boundary indicate that this displacement is at present accommodated along this boundary by a complex oblique subduction process. The mechanisms determined for the southern Caribbean plate boundary and the intra-Caribbean plate region indicate this displacement is being accommodated over a broad zone of internal deformation which extends from northern South America into the interior of the Caribbean plate. Dissert. Abstr.

N80-24909 Stanford Univ., Calif.
ATTENUATION OF SEISMIC WAVES IN ROCKS AND APPLICATIONS IN ENERGY EXPLORATION Ph.D. Thesis
Einar Kjartansson 1980 160 p
Avail: Univ. Microfilms Order No. 8011658

The absorption and dissipation of seismic wave energy into heat is examined. A mathematical description for the general elastic response and wave propagation in materials where the specific loss or Q factor is exactly independent of frequency is developed. One particular mechanism for the dissipation of energy, thermal relaxation, is examined. This mechanism, which affects compressional waves more than shear waves, is highly sensitive to the state and the nature of the pore fluids. Wave propagation in media where attenuation and velocity are spatially heterogeneous is also discussed. Finite difference solutions to the wave equation are developed to include the effects of absorption, as well as arbitrary spatial heterogeneities. Finally, methods are developed to extract information about spatial variations of attenuation and velocities from seismic reflection data. The application of the inversions to amplitude and traveltime data from unstacked common-midpoint reflection data yield detailed pictures of the subsurface. Dissert. Abstr.

N80-24910 Stanford Univ., Calif.
DETAILED SEISMIC STUDIES OF SIX MODERATE CALIFORNIA EARTHQUAKES Ph.D. Thesis
Allan Goddard Lindh 1980 185 p
Avail: Univ. Microfilms Order No. 8011665

Material velocity changes, reported to precede the last two magnitude-5 earthquakes along the San Andreas fault in central California, are shown to be caused by differences in the depth and magnitude of the source earthquakes during the anomalous periods and unrelated to any premonitory material property changes. Additional data show that travel times before the two magnitude-5 earthquakes were in fact stable to within a few hundredths of a second for rays that passed within a few kilometers of the hypocenters. The ratio of the amplitudes of P and S waves from fore- and aftershocks to three recent California earthquakes show a characteristic change at the time of the main events, inferring a small systematic change in stress or fault configuration in the source region. An approach to the recognition of foreshocks based on simple measurements of the amplitudes of seismic waves is suggested. Correlations with regional geology suggest that fault discontinuities, determined through examination of data pertaining to the 1966 Parkfield, California earthquake, are controlled by changes in material properties along the fault. Dissert. Abstr.

N80-24911 Colorado Univ. at Boulder.
THE DIURNAL EVOLUTION OF THE EAST AFRICAN JET STREAM Ph.D. Thesis
David Marc Rubenstein 1979 201 p
Avail: Univ. Microfilms Order No. 8011302

The diurnal evolution of the equatorial east African low level jet stream is examined theoretically and observationally. Using measurements taken aboard a research aircraft, the turbulent fluxes of heat and momentum are computed. Profiles of these fluxes are used to descriptively analyze the diurnal behavior of the mesoscale jet structure. During the daytime, as the flow advects from a suppressed marine environment to an actively convective continental environment, a mixed layer grows in depth. A nonlinear entrainment model is developed to describe the evolution of the mixed layer in both time and space. During the evening a stable layer builds up and causes the pre-existing mixed layer to erode. Frictional restraint falls dramatically, allowing a strong jet to develop during the night. A linear analysis suggests that the development is the result of an imbalance between the pressure gradient force and friction. A diurnally periodic circulation transverse to the mean jet axis responds to the heating cycle over the land. This transverse circulation results from a combination of a slope-induced breeze and a sea breeze. These effects are simulated by a linear, buoyancy driven diffusion model. Dissert. Abstr.

N80-24912 Brown Univ., Providence, R. I.
MORPHOMETRIC STUDIES OF PLANETARY LANDFORMS: IMPACT CRATERS AND VOLCANOES Ph.D. Thesis
Charles Arthur Wood 1979 230 p
Avail: Univ. Microfilms Order No. 8007089

Impact craters and basins on Mars, Mercury, and the Moon are comparatively examined and the morphometry of three types of volcanoes (composite, nonbasaltic shield volcanoes, and cinder cones) are investigated. Cinder cone growth rates vary from cone to cone with time for a single cone. Cinder/spatter cones on Reunion and Etna grow slowly, whereas the Tolbachik cones and Vulcan grew to hundreds of meters in a few days. For 16 cones there is a statistically significant relation between average cone growth rate and ultimate cone volume. There is a strong positive correlation between cone volume and flow volume. Cinder cones have smaller volumes than their association flows, and commonly a lesser volume than associated mantle ash deposits.

The effects of degradation on cone morphometry were investigated in detail. Cinder cones on the Moon and Mars have W sub CR/W sub CO ratios nearly identical to terrestrial values, but are only 25% to 35% as tall as Earth cones. Extraterrestrial cinder cones are roughly 25% the volume of terrestrial cones, suggesting shallower magma source areas than typical on Earth. Dissert. Abstr.

N80-24913 Institut d'Aeronomie Spatiale de Belgique, Brussels.
OPEN ION-EXOSPHERE WITH AN ASYMMETRIC ANISOTROPIC VELOCITY DISTRIBUTION
M. Scherer 1979 36 p refs Presented at 7th Roy. Acad. of Belgium Session, Brussels, Oct. 1978 Submitted for publication
(Aeronomica-Acta-A-205-1979) Avail: Issuing Activity

Expressions for the number density, the escape flux, the parallel and perpendicular momentum fluxes, and the energy flux in an open ion-exosphere, are set up under the following assumptions: (1) the velocity distribution function at the exobase is given by an an asymmetric bimaxwellian depending on four parameters; and (2) along a magnetic field line the potential energy of a charged particle is a monotonic function while the magnetic field strength monotonically decreases to a constant value. A method which allows for calculating the four parameters of the velocity distribution for a given set of values of the state variables is outlined. Finally, the analytic formulas for the state variables are explicitely given for the special case that the velocity distribution at the exobase is a bimaxwellian. Author (ESA)

N80-24914*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
COMPARISON OF THE NIMBUS-4 BUV OZONE DATA WITH THE AMES TWO-DIMENSIONAL MODEL
W. J. Borucki and I. J. Eberstein May 1980 46 p refs Prepared in cooperation with NASA, Goddard Space Flight Center
(NASA-TM-81207; A-8139) Avail: NTIS HC A03/MF A01 CSCL 04A

A comparison is made of the first two years of Nimbus 4 backscattered ultraviolet (BUV) ozone measurements with the predictions of the Ames two dimensional model. The ozone observations used consist of the mixing ratio on the 1, 2, 5, and 10 mb pressure surfaces. The data are zone and time averaged to obtain seasonal means for 1970 and 1971 and are found to show strong and repeatable meridional and seasonal dependencies. The model used for comparison with the observations extends from 80 N to 80 S latitude and from altitudes of 0 to 60 km with 5 deg horizontal grid spacing and 2.5 km vertical grid spacing. Chemical reaction and photolysis rates are diurnally averaged and the photodissociation rates are corrected for the effects of scattering. The large altitude, latitude, and seasonal changes in the ozone data agree with the model predictions. Model predictions of the sensitivity of the comparisons to changes in the assumed mixing ratios of water vapor, odd nitrogen, and odd chlorine, as well as to changes in the ambient temperature and transport parameters are also shown. E.D.K.

N80-24915*# Minnesota Univ., Minneapolis. Cosmic Physics Group.
A STUDY OF PARTICLE ACCELERATION MECHANISMS AND DYNAMICS OF THE OUTER TRAPPING REGION BY OBSERVATIONS AT SYNCHRONOUS ORBIT: A SUMMARY OF SCIENTIFIC RESULTS
K. N. Erickson Feb. 1980 69 p refs
(Contract NAS5-11687; NAS5-23703)
(NASA-CR-159979; Cosmic-Phys-TR-184) Avail: NTIS HC A04/MF A01 CSCL 04A

The research concerning the ATS-6 synchronous orbit satellite is reported. The completed research and results are discussed along with the research in progress. Abstracts of published papers are included. F.O.S.

N80-24916# Lowell Univ. Research Foundation, Mass. Center for Atmospheric Research.
MEASUREMENT OF NEUTRAL TEMPERATURE IN THE 120-180 KM REGION OF THE ATMOSPHERE FOLLOWING TMA RELEASES FROM A ROCKET Final Technical Report, 17 Jan. 1977 - 17 Aug. 1978
David F. Kitrosser Hanscom AFB, Mass. AFGL May 1979 75 p refs
(Contract F19628-77-C-0090; AF Proj. 2310)
(AD-A081445; ULRF-403/CAR; AFGL-TR-79-0120) Avail: NTIS HC A04/MF A01 CSCL 07/4

Atmospheric temperature measurement at approximately 160 km altitude over White Sands Missile Range on 24 September 1977 were made by the AlO sunlit resonance fluorescence technique. A rocket borne payload released trimethyl aluminum (TMA) in one large cloud at morning twilight. Twelve minutes of data were used to calculate temperatures at the top of the cloud averaging 628 K and at bottom averaging 578 K. The standard deviation of any one measurement involving typically 40 seconds of data was generally between 5 and 11 K. Included in this report is the most detailed description to date of the procedures and statistical background underlying the 'AlO Temperature' technique developed by the author over the last eleven years. GRA

N80-24917# Air Force Geophysics Lab., Hanscom AFB, Mass.
LINEAR FILTERING ON THE SURFACE OF A SPHERE Environmental Research Papers
Ralph Shapiro 29 Oct. 1979 33 p refs
(AF Proj. 2310)
(AD-A082386; AFGL-TR-79-0263; AFGL-ERP-683) Avail: NTIS HC A03/MF A01 CSCL 04/1

Although methods of filtering have been developed for representing on a planar surface the sub-grid scale process of diffusion in numerical modeling of the atmosphere, the proper form of filtering for a spherical domain remains to be selected. In this study, the characteristics of several different forms of a highly scale dependent low pass filter are examined and compared for the case where the filter is applied to a scalar field on the surface of a sphere. The phase and amplitude response functions of the various forms of the filter indicate that the simplest form, although it does not preserve area-weighted mean values, approaches most closely the criteria established for the ideal filter. This indication is verified by the test computations in which each form of the filter is applied up to 10,000 times to a noisy scalar field. GRA

N80-24918# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
PROCEEDINGS OF THE AIR FORCE GEOPHYSICS LABORATORY WORKSHOP ON GEOMAGNETISM
Rita C. Sagalyn, Robert O. Hutchinson, and Susan Gussenhoven 20 Aug. 1979 128 p refs Workshop held at Hanscom AFB, Mass., 6-7 Apr. 1979
(AF Proj. 7601)
(AD-A082308; AFGL-TR-79-0192; AFGL-SR-223) Avail: NTIS HC A07/MF A01 CSCL 04/1

On 6-7 April 1979 a two-day workshop on geomagnetism was held at the Air Force Geophysics Laboratory (AFGL). Proceedings of the workshop presented here include: reports on tutorial sessions concerning magnetospheric and geomagnetic pulsations, summaries of contributed papers, descriptions of active magnetometer networks, conclusions of workshop-discussion groups. Special emphasis is given to the use and future potential of the AFGL midlatitude magnetometer chain. GRA

N80-24919# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Meteorology Office.
AUTOMATED MODEL ATMOSPHERE GENERATOR PROGRAM (AMAG) Final Report, 10 Oct. 1977 - 31 Oct. 1979
Edward H. Blish Feb. 1980 71 p refs
(AD-A082088; ASD-TR-79-5056) Avail: NTIS HC A04/MF A01

This paper documents a computer program for generating internally consistent model atmosphere data based on a terrain following five layer temperature model derived from the 1976 U.S. Standard Atmosphere and the 1966 U.S. Standard Atmosphere Supplements. For any given geometric altitude, terrain height, ground level temperature and altimeter setting, the Automated Model Atmosphere Generator (AMAG) program will calculate corresponding temperature and pressure altitude values. From these two output parameters the user can compute additional

environmental parameters needed to solve particular engineering problems. GRA

N80-24920# Florida Inst. of Tech., Melbourne. Dept. of Physics and Space Sciences.
SATELLITE PARTICLE OBSERVATIONS AND COINCIDENT AURORAL-E IONIZATION Final Report, 1 Jun. 1978 - 31 Aug. 1979
James R. Sharber 31 Oct. 1979 70 p refs
(Grant AF-AFOSR-3625-78; AF Proj. 2311)
(AD-A082121; AFOSR-80-0173TR) Avail: NTIS
HC A04/MF A01 CSCL 04/1

Using data taken during coordinated flights of the AFGL Airborne Ionospheric Observatory and the ISIS-2 Satellite, a comparison has been made between the particle spectrum of the continuous (diffuse) aurora and the properties of the auroral-E region with the following results: Most electron differential number spectra of the diffuse aurora may be represented as Maxwellians with characteristic energy between a few hundred eV to a few keV; this characteristic energy increases with the pitch angle to a maximum value of 90. Over the diffuse aurora, the angular distribution of electron energy flux is isotropic only near the peak of precipitation. At latitudes above and below the peak, the energy flux at the edge of the loss cone may exceed that near the local field line by as much as a factor of two. Integration of individual spectra over the loss cone produces a composite Maxwellian distribution which may be used to estimate the electron energy deposited in the E-region. The procedure underestimates the energy by about 20%. Although the continuous (diffuse) aurora is a relatively stable phenomenon, enhancements in intensity of the incident electrons occur on a time scale of a few seconds. It has not been determined whether these variations represent temporal or spatial changes. Within the energy range 10 eV to 15 keV the electron population accounts for 80 - 90% of the particle energy deposited into the E-region. GRA

N80-24921# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.
STUDY OF CHARACTERISTICS OF POLAR CAP AURORAS IN DMSP IMAGES Final Report, 1 Oct. 1978 - 31 Dec. 1979
M. S. Gussenhoven 29 Feb. 1980 56 p refs
(Grant AF-AFOSR-0012-79; AF Proj. 2311)
(AD-A082184; AFOSR-80-0214TR) Avail: NTIS
HC A04/MF A01 CSCL 04/1

Energetic electron measurements from a particle detector on the DMSP/F2 satellite have been used to determine the corrected geomagnetic latitude (Lambda sub CGM) of the equatorward boundary of the auroral oval. The satellite was launched into a nearly sun-synchronous, polar orbit centered on the 0700-1900 MLT meridian. Due to the wobble of the dipole and a very slow precessional motion of the orbit more than 6000 boundary crossings could be studied in the 1600-2300 and 0400-1000 MLT sectors. The detectors, which have large geometric factors, look radially away from the earth and detect precipitating electrons with energies between 50eV and 20keV. In the evening sector the equatorward boundaries are precisely determined from the rise in the total electron flux. The morningside boundary cannot always be clearly delineated. Data were divided into one hour magnetic local time bins with about 400 samples per bin. In each of the MLT bins Lambda sub CGM was found to be linearly correlated to the Kp index. Regression values of Lambda sub CGM were projected to the magnetic equatorial plane using the Mead-Fairfield magnetic field model. The projected boundaries are not in good agreement with the injection boundaries of Mauk and McIlwain. GRA

N80-24922# Texas A&M Univ., College Station. Dept. of Meteorology.
NONLINEAR TRANSFER OF KINETIC ENERGY IN THE ATMOSPHERE USING ONE AND TWO DIMENSIONAL SPECTRAL REPRESENTATION Final Report
Dusan Djuric 18 Feb. 1980 18 p refs
(Grant AF-AFOSR-3492-78; AF Proj. 2310)
(AD-A082069; AFOSR-80-0159TR) Avail: NTIS
HC A02/MF A01 CSCL 04/1

A review of the literature on nonlinear transfer of kinetic energy in the atmosphere using one and two dimensional spectral techniques is presented. The numerical programs for the conversion of energy have been written and tested. It was found that the hemispheric meteorological data from the AFGWC and from ETAC have serious gaps that hinder the progress of nonlinear kinetic energy transfer calculations. It is suggested to introduce an interpolation technique which will formally fill the data gaps, or, alternatively, to acquire new data sets without such gaps. Energy transfer calculations can then be successfully completed. GRA

N80-24923# SRI International Corp., Menlo Park, Calif.
ON THE SPATIAL RELATIONSHIP OF 1-METER EQUATORIAL IRREGULARITIES AND DEPLETIONS IN TOTAL ELECTRON CONTENTS Topical Report, 1 Nov. 1978 - 31 Jan. 1979
Roland T. Tsunoda 1 Feb. 1980 27 p refs
(Contract DNA001-79-C-0153)
(AD-A082185; AD-E000684; DNA-4897T; Rept-1) Avail: NTIS HC A03/MF A01 CSCL 04/1

A radar experiment was conducted at Kwajalein Atoll, Marshall Islands to investigate the spatial relationship of 1 m equatorial spread-F irregularities to total electron content (TEC) depletion. A high-power radar was operated (1) in a backscatter scan mode to spatially map the distribution of 1 m irregularities, and (2) in a dual-frequency, satellite-track mode to obtain the longitudinal TEC variations. Using the radar data, we show that radar backscatter 'plumes' found in the disturbed, nighttime equatorial ionosphere are longitudinally coincident with TEC depletions. We suggest that the TEC depletions are probably due to the presence of plasma bubbles in the equatorial F layer. GRA

N80-24924# Scripps Institution of Oceanography, La Jolla, Calif. Visibility Lab.
AIRBORNE MEASUREMENTS OF ATMOSPHERIC VOLUME SCATTERING COEFFICIENTS IN NORTHERN EUROPE, WINTER 1978 Interim Report
Richard W. Johnson and Jacqueline I. Gordon Jun. 1979 298 p refs
(Contract F19628-78-C-0200; AF Proj. 7670)
(AD-A082044; SIO-REF-79-25; AFGL-TR-79-0159; SR-10)
Avail: NTIS HC A13/MF A01 CSCL 04/1

This report presents daytime atmospheric optical data collected chiefly with airborne instruments during a field expedition to northern Europe in the Winter of 1978. Results from 26 flights are presented. The data include the natural irradiance upon horizontal plane surfaces, total volume scattering coefficients, and derived values of atmospheric beam transmittance and equivalent attenuation length. Data for daytime conditions ranging from relatively clear and cloud free to completely overcast are presented. Data were measured in four spectral regions, as follows: Three narrow band optical filters with mean wavelengths of 478, 664, and 765 nanometers; and one broad band representing a pseudo-photopic response with a mean wavelength of 557 nanometers. Selected meteorological properties, measured concurrently with the radiometric data are also included. GRA

N80-24925# Naval Research Lab., Washington, D. C. Geophysical and Plasma Dynamics Branch.
NONLINEAR STABILIZATION OF THE CURRENT CONVECTIVE INSTABILITY IN THE DIFFUSE AURORA
P. K. Chaturvedi (Maryland Univ., College Park) and S. L. Ossakow 7 Jan. 1980 18 p refs Sponsored in part by DNA
(AD-A082300; AD-E000378; NRL-MR-4118) Avail: NTIS
HC A02/MF A01 CSCL 04/1

The current convective instability has recently been proposed as a possible mechanism for generating large scale irregularities in the auroral F region, driven by weak field-aligned currents associated with the diffuse aurora and a plasma density gradient (Ossakow and Chaturvedi, 1979). In this report, we show that this instability can stabilize nonlinearly by generating linearly damped harmonics. An estimate of the saturated amplitudes show good agreement with the available experimental data. In addition, with a northward plasma density gradient, the dominant nonlinear harmonic is in the northward direction, in agreement with DNA Wideband satellite observations. GRA

N80-24926# Meteorology International, Inc., Monterey, Calif.
THE APPLICATION OF MEASURES OF SYNOPTIC SIMILARITY TO THE EVALUATION AND DEVELOPMENT OF ATMOSPHERIC PREDICTION MODELS: TASK 2
Manfred M. Holl, Michael J. Corning, and Barbara A. Hawkins. Feb. 1980 46 p refs
(Contract N00228-78-C-3258)
(AD-A082031; MII-M-247; NEPRF-CR-79-01-Supp) Avail: NTIS HC A03/MF A01 CSCL 04/1

This Report, the final report for Task 2 of the overall development of the MOSS (Measures of Synoptic Similarity) system, has been written as a Supplement to the final report for Task 1. Familiarity with and access to that report is assumed. The expanded MOSS system resulting from performance of Task 2 is known as MOSS2. Task 2 objectives were to extend the MOSS1 system to provide the MOSS2 system by incorporating the following additional features and capabilities: A capability for producing MOSS scores for the southern hemisphere; A capability for utilizing User-specified range-level values; A capability for matching, in ranges-of-scale, either 1000 mb fields only or 500 mb fields only, and for matching fields which have been pattern-separated prior to input to the MOSS2 system; A capability for producing an areal distribution of match coefficients for the SV, SL and SD ranges-of-scale at 500 mb, 1000 mb, and/or the 500-1000 mb thickness; A capability for producing an areal distribution of match coefficients which are a User-weighted combination of the SV, SL and SD ranges-of-scale; A capability for displaying the results of the MOSS2 system in tabulated form. GRA

N80-24927# Pennsylvania State Univ., University Park. Dept. of Meteorology.
THE ROLE OF DIABATIC HEATING IN GENERATING LOWER TROPOSPHERIC MESOSCALE CIRCULATIONS Final Report, 23 Feb. 1976 - 31 Dec. 1979
Thomas T. Warner, Richard A. Anthes, and Nelson L. Seaman. Dec. 1979 105 p refs
(Contract DAAG29-76-C-0157; Grant EPA-R-805659)
(AD-A082129; ARO-13817.1-GS) Avail: NTIS HC A06/MF A01 CSCL 04/2

A two dimensional, multilevel primitive equation model is used to investigate various characteristics of thermally driven circulations. The sensitivity of the mesoscale circulations to the magnitude of the surface sensible heat flux is established through examination of various quantifiable circulation features such as the planetary boundary layer depth and the horizontal and vertical wind maxima. The simulations fall into two groups; one deals with circulations over flat terrain in the vicinity of a coastline and the other deals with circulations induced by heating of the irregular terrain in the vicinity of the Tennessee Valley. The results establish a surprisingly linear relationship between forecast errors and errors in the specification of the surface sensible heat flux. The results of the Tennessee Valley simulations are verified using satellite visible imagery. The model-predicted subsidence over the valley corresponds very closely in location to anomalous cloud free regions observed in numerous satellite photographs. GRA

N80-24928# Utah Univ., Salt Lake City. Center for Atmospheric and Space Sciences.
ENERGY INPUT TO THE AURORAL IONOSPHERE Final Report, 1 Sep. 1977 - 31 Aug. 1978
J. R. Doupnik. 29 Feb. 1980 69 p refs
(Grant AF-AFOSR-3435-77)
(AD-A083038; AFOSR-80-0261TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

This effort was to aid studies of the high latitude ionosphere particularly with regard to Joule heating processes. For energy input to the atmosphere by Joule heating the dominant physical factor has been found to be the strength of the electric field, the motions of the ionospheric plasma through the nearly stationary neutral gas. Both the conductivity and electric field change by large factors but the dependence of the Joule heating rate on the square of the electric field strength makes the electric field the most critical factor. In the design of the experiments with a steerable dish antenna the conductivities are obtained from electron densities in the E region of the ionosphere while the electric fields are obtained from the F region. In this work, to cover a wide range of latitudes with acceptable time resolution, the E region measurements were curtailed. A suggestion from model studies is that the offset of the geomagnetic pole from the geographic pole and a further offset of the center of the oval to be several degrees antisunward of the geomagnetic pole introduces a strong longitudinal variation in the magnetic latitude of the oval. So, some longitude sectors, such as Chatanika, penetrate more deeply into the oval than other locations with the same magnetic latitude. GRA

N80-24929# Smithsonian Astrophysical Observatory, Cambridge, Mass.
CALCULATIONS PERTAINING TO THE ENERGY BALANCE AND PLASMA MOTIONS IN THE IONOSPHERE Final Report, 1 Jan. - 30 Sep. 1978
Alexander Dalgarno and Eustratios Constantinides. Hanscom AFB, Mass. AFGL Nov. 1979 143 p refs
(Contract F19628-78-C-0047; AFGL-TR-79-0270)
(AD-A083010; AFGL-TR-79-0270) Avail: NTIS HC A07/MF A01 CSCL 04/1

Plasma motions in the upper atmosphere have been investigated with the aid of satellite data. It is shown that the major ion, O(+), moves in response to the sum of the forces on itself and on electrons. Major ions follow the motion of the major ion. The observed plasma velocity in the vertical direction is in harmony with the assumption of an eastward electric field of between 3 and 5 millivolts per meter. The present investigation demonstrates clearly the need for measurements of electric fields and plasma drifts. Author (GRA)

N80-24930# Cincinnati Univ., Ohio. Dept. of Physics.
THEORETICAL INVESTIGATION OF THE EFFECTS OF ATMOSPHERIC GRAVITY WAVES ON THE HYDROXYL EMISSIONS OF THE ATMOSPHERE Final Report, 15 Jul. 1978 - 30 Nov. 1979
Tai-Fu Tuan. Hanscom AFB, Mass. AFGL 31 Dec. 1979 44 p refs
(Contract F19628-78-C-0208)
(AD-A083025; AFGL-TR-80-0007) Avail: NTIS HC A03/MF A01 CSCL 04/1

The effect of gravity waves on OH emission is investigated using a gravity-wave model valid for an inhomogeneous atmosphere and computed as well as semi-empirical data for the 'undisturbed' ozone and hydrogen profiles. The results show that (1) the magnitude of the response depends on the relative magnitudes and signatures of the vertical and horizontal wave-induced diffusion. Since in some regions the horizontal velocity field of the gravity wave can increase much more rapidly with height than the vertical field, horizontal diffusion even when there is a relatively sharp layer gradient; and (2) the structures in the OH profile produced by the gravity wave are in general but not always more pronounced below the intensity peak than above. The observed dark areas in OH emission can be produced by gravity waves with vertical wave length small compared with the half width of the intensity profile. GRA

N80-24931# Science Applications, Inc., La Jolla, Calif. Environmental Systems Div.
PROCEEDINGS OF THE HEAVY LIFT LAUNCH VEHICLE TROPOSPHERIC EFFECTS WORKSHOP
Arnold I. Goldford. Dec. 1979 115 p refs Workshop held at Rosemont, Ill., 12-14 Sep. 1979
(Contract W-31-109-eng-38)
(CONF-7809192) Avail: NTIS HC A06/MF A01

A workshop on Heavy Lift Launch Vehicle (HLLV) tropospheric effects was held in Chicago, Illinois, on September 12, 13, and 14, 1978. Briefings were conducted on the latest HLLV configurations, launch schedules, and proposed fuels. The geographical, environmental, and ecological background of three proposed launch sites were presented in brief. The sites discussed were launch pads near the Kennedy Space Center (KSC), a site in the southwestern United States near Animas, New Mexico, and an ocean site just north of the equator off the coast of Ecuador. A review of past efforts in atmospheric dynamics modeling, source term prediction, atmospheric effects, cloud rise modeling, and rainout/washout effects for the space shuttle tropospheric effects indicated that much of the progress made in these areas has direct applicability to the HLLV. A list of

specific recommendations for short and long term research to investigate, understand, and possibly mitigate the HLLV environmental impacts was developed. DOE

N80-24932# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
APPLICATION OF THE ADJOINT METHOD IN ATMOSPHERIC RADIATIVE TRANSFER CALCULATIONS
S. A. W. Gerstl 1979 20 p refs Presented at the Workshop on Atmospheric Aerosols: Their Formation, Optical Properties and Effects, Baltimore, 6-8 Nov. 1979
(Contract W-7405-eng-36)
(LA-UR-80-17; CONF-791161-1) Avail: NTIS HC A02/MF A01

The transfer of solar radiation through a standard mid-latitude summer atmosphere including different amounts of aerosols (from clear to hazy) has been computed. The discrete-ordinates (S/sub N/) method is employed in a forward as well as adjoint mode. In the adjoint mode the result of a transfer calculation is an important function (adjoint intensity) which allows the calculation of transmitted fluxes or other radiative responses, for any arbitrary source distribution. The theory of the adjoint method is outlined in detail and physical interpretations are developed for the adjoint intensity. If, for example, the downward directed solar flux at ground level, F/sub lambda/ (z = 0), is desired for N different solar zenith angles, a regular (forward) radiative transfer calculation must be repeated for each solar zenith angle. In contrast, only 1 adjoint transfer calculation gives F/sub lambda/ (z = 0) for all solar zenith angles in a hazy aerosol atmosphere, for 1 wavelength interval, in 2.3 seconds on a CDC-7600 computer. DOE

N80-24933# Hawaii Univ., Honolulu. Inst. of Geophysics.
HYDROLOGY AND GEOCHEMISTRY OF A HAWAIIAN GEOTHERMAL SYSTEM: HGP-A Geothermal Resources Exploration in Hawaii no. 4
P. M. Kroopnick, R. W. Buddemeier, D. Thomas, L. S. Lau, and D. Bills Aug. 1979 69 p refs Revised
(Contract EY-76-C-03-1093; Grant NSF GI-38319)
(MIG-78-6-Rev) Avail: NTIS HC A04/MF A01

A water quality monitoring program of the Hawaii Geothermal Project well A (HGP-A) was conducted for downhole depth samples and continuous discharge samples in 1976 to 1977. The well water was slightly saline (about 5 to 10 percent ocean water) and nearly depleted of magnesium, but contained high concentrations of silica and sulfide. The chemical composition of the well water did not vary much with depth even though the sampling reached the well bottom (approximately 1768 m below sea level. The well fluid temperature was higher than that of any Hawaii ground water; a maximum of 358 C was recorded at the bottom of the well. The water was low in tritium but unexpectedly high in carbon-14 when compared with the surrounding ground water (sampled as close as approximately 1609 km away). Mass balance calculations involving carbon and its isotopes are consistent with a model proposing that 13 per cent of recharge is from sea water. During continuous flow tests, the total well yield was 83,400 lb of steam per hour, equivalent to approximately 150 gpm with 70 per cent steam and the rest water. For most constituents measured, there was a one to three day buildup period before approach to a steady state concentration. Water quality data, coupled with other measurements, indicate that the well is either poorly developed or located in a formation of low transmissivity. The moderately high rainfall and high surficial permeability allow substantial rain water infiltration. Actual subsurface water circulation is open to interpretation because of our uncertainty about geologic formations. Geophysical evidence suggests that deep dikes or intrusive bodies may be located on the ocean side of the well, such barriers would retard the encroachment of sea water into the well. DOE

N80-24934# Royal Aircraft Establishment, Farnborough (England).
UPPER-ATMOSPHERE ROTATION RATE DETERMINED FROM THE ORBIT OF CHINA 6 ROCKET (1976-67B)
R. Hiller London HMSO Sep. 1979 24 p refs
(RAE-TR-79115; RAE-Space-567; BR71447) Avail: NTIS HC A02/MF A01

The orbit of China 6 rocket, 1976-67B, was determined at 51 epochs during its 17 month life using the Royal Aircraft Establishment orbit refinement computer program, PROP 6, with over 4,000 radar and optical observations from 49 stations. On the average, the orbital accuracy was about 100 meters, radial and cross track. The rotation rate of the upper atmosphere and lambda rev/day, for the height-band 200 to 230 km, was calculated from the decrease in orbital inclination (after being cleared of perturbations) and the results are given. Values of density scale height were obtained from the variation in perigee height, including several values during the final 16 days to decay. Comparison with CIRA 1972 values shows agreement, mostly within 10 percent. Author (ESA)

N80-24935# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
RESULTS FROM MAGNETOSPHERIC ELECTRIC FIELD OBSERVATIONS
Ulf Fahleson Mar. 1979 18 p refs Presented at Intern. Workshop on Selected Topics of Magnetospheric Phys., Tokyo, 12-16 Mar. 1979
(TRITA-EPP-79-04; ISSN-0348-7539) Avail: NTIS HC A02/MF A01

The results of magnetospheric dc and low frequency electric field measurements obtained to date by the GEOS, ISEE and S3 satellites are given. These cover the morning, noon, evening, and midnight sectors inside the magnetosphere both during quiet and disturbed (substorm) conditions. Indications are that near the dayside magnetopause large fluctuations occur even during relatively quiet times. Author (ESA)

N80-24936# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ON THE CONSEQUENCES OF THE INTERACTION BETWEEN THE AURORAL PLASMA AND THE GEOMAGNETIC FIELD
Walter Lennartsson May 1979 35 p refs Submitted for publication Sponsored in part by Swedish Board for Space Activities
(Contract N00014-78-C-0479)
(TRITA-EPP-79-16) Avail: NTIS HC A03/MF A01

An attempt to find a unified description of auroral electric fields based on the interaction between a hot plasma and the Earth's magnetic field is extended. It is shown that a large electrostatic potential difference must exist along the magnetic field lines under very general conditions as a direct consequence of this interaction. This does not require anomalous resistivity and is not a consequence of anisotropic pitch-angle distributions, but the electric field always produces anisotropy. In general, the electric field has a time-varying (unstable) spatial structure. An important source of temporal fluctuations is charge trapping in the combined electric and magnetic fields which is an inevitable effect of scattering. A necessary condition for a stable electric field structure to form is that this trapping saturates. The conditions for this are most favorable in a thin double layer structure, in particular one that is aligned along the magnetic field. A secondary effect of charge trapping is a collimation of the electron precipitation flux. Another effect consists of increasing the transverse energy of cold ions. This effect is particularly strong for oxygen, resulting in a conical pitch-angle distribution. Author (ESA)

N80-24937# Research Inst. of National Defence, Stockholm (Sweden).
A SEISMIC ACTIVITY DETECTOR
Paul Mitlid Nov. 1979 18 p
(FOA-C-20327-E4) Avail: NTIS HC A02/MF A01

A seismic activity detector is described. It is specially adapted to gainranging seismometer amplifiers. To facilitate long time constants, the reference voltage generating circuit employs a digital potentiometer. The reference voltage is linearly related to the background noise over the detector's entire working range. The bandpass filter has plug-in frequency determining units for easy change of cut-off frequencies. A method for identifying interesting seismic signals is discussed in relation to this equipment. Author (ESA)

N80-24938# Research Inst. of National Defence, Stockholm (Sweden).
INTERNATIONAL SEISMOLOGICAL DATACENTER: DEMONSTRATION FACILITIES IN SWEDEN
Ola Dahlman Jan. 1980 28 p refs
(FOA-C-20333-T1) Avail: NTIS HC A03/MF A01

To facilitate the establishment of an international global seismological monitoring system for the verification of a comprehensive Test Ban Treaty, Sweden offered to establish and operate an International Seismological Data Center. Temporary data center facilities were set up at the Hagfors Observatory of the National Defence Research Institute in Stockholm to demonstrate the feasibility of such a center. These facilities were demonstrated in July, 1979, to representatives and experts from 26 countries and the World Meteorological Organization. A general description of the demonstration facilities and a summary of the experience gained so far from these facilities are given.
Author (ESA)

N80-24680*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODELING THE EARTH'S RADIATION BELTS. A REVIEW OF QUANTITATIVE DATA BASED ELECTRON AND PROTON MODELS
J. I. Vette, M. J. Teague, D. M. Sawyer, and K. W. Chan *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 21-35 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24681*# Air Force Geophysics Lab., Hanscom AFB, Mass.
LOW ENERGY MAGNETOSPHERIC PLASMA INTERACTIONS WITH SPACE SYSTEMS: THE ROLE OF PREDICTIONS
H. B. Garrett *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 36-70 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24682*# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.
PREDICTABILITY OF UPPER-ATMOSPHERIC DENSITY AND COMPOSITION
Joe M. Straus and David R. Hickman *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 71-88 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24686*# Rockwell International Corp., Houston, Tex.
DOSIMETRY IN THE MANNED SPACE PROGRAM
William Atwell *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 121-132 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

N80-24704*# California Univ., Los Angeles. Dept. of Earth and Space Sciences.
ON THE PREDICTION OF MAGNETOSPHERIC CONFIGURATION
James A. Slavin and Robert E. Holzer *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 365-374 refs (For primary document see N80-24678 15-42)
(Grants NGR-05-007-276; NSF ATM-75-01431)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24706*# National Oceanic and Atmospheric Administration, Boulder, Colo.
REVIEW OF SELECTED GEOMAGNETIC ACTIVITY INDICES
Joe H. Allen and J. Feynman (Boston Coll.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 385-398 refs (For primary document see N80-24678 15-42)
(Contract F19628-79-C-0031)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24707*# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE PREDICTION OF AE, ap, AND Dst AT TIME LAGS BETWEEN 0 AND 30 HOURS
D. F. Smart, H. B. Garrett, and M. A. Shea *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 399-414 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24709*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SHORT TERM MAGNETOSPHERIC PARTICLE VARIATIONS (1 MINUTE > T > 1 DAY), APPENDIX 1
P. R. Higbie (LASL), D. N. Baker (LASL), V. Domingo (European Space Technol. Center., Noordwijk, Netherlands), W. L. Imhof (LMSC, Palo Alto, Calif.), R. L. McPherron (California Univ., Los Angeles), W. N. Srjeldvik (NOAA, Boulder, Colo.), D. J. Williams (NOAA, Boulder, Colo.), J. R. Burrows (Herzberg Inst. of Astrophysics), M. Hayakawa (Nagoya Univ.) et al *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 433-440 (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24710*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG TERM MAGNETOSPHERIC PARTICLE VARIATIONS (1 DAY > T > INFINITY), APPENDIX 2
J. I. Vette, H. K. Hills, G. A. Paulikas (Aerospace Corp., Los Angeles, Calif.), D. A. Sawyer, E. G. Stassinopoulos, M. J. Teague et al *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 441-445 (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24711*# Max-Planck-Institut fuer Extraterrestrische Physik, Munich (West Germany).
ENERGETIC SOLAR PARTICLE BEHAVIOUR IN THE MAGNETOSPHERE
M. Scholer *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 446-463 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24712*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A REAL-TIME ISEE DATA SYSTEM
Bruce T. Tsurutani and Daniel N. Baker (LASL) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 464-475 refs Sponsored in part by DOE (For primary document see N80-24678 15-42)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24713*# SRI International Corp., Menlo Park, Calif.
MAGNETOSPHERE-IONOSPHERE INTERACTIONS
R. R. Vondrak, Y. T. Chiu (Aerospace Corp., Los Angeles, Calif.), D. S. Evans (NOAA, Boulder, Colo.), V. G. Patterson (AF Global Weather Central), G. J. Romick (Alaska Univ., College), and K. Stasiewicz (Polish Acad. of Science, Warsaw) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 476-493 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24714*# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.
AURORAL MAGNETOSPHERE-IONOSPHERE COUPLING: A BRIEF TOPICAL REVIEW
Y. T. Chiu, J. M. Cornwall (California Univ., Los Angeles), and Michael Schulz *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 494-512 refs (For primary document see N80-24678 15-42)
(Contract NASw-3120)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24715*# Alaska Univ., College. Geophysical Inst.
HIGH-LATITUDE E AND F REGION IONOSPHERIC PREDICTIONS

Robert D. Hunsucker, R. Allen, P. Argo, R. Babcock, P. Bakshi, D. Lund, S. Matsushita, G. Smith, A. V. Shirochkov, and G. Wortham *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 513-527 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24716*# Articheskii i Antarkticheskii Nauchno- Issledovatelskii Institut, Leningrad (USSR).
ON THE APPROACH TO FORECASTING POLAR IONOSPHERIC CONDITIONS
A. S. Besprozvannaya, A. V. Shirochkov, and T. I. Shchuka *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 528-542 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24717*# Alaska Univ., Fairbanks. Geophysical Inst.
MORPHOLOGY AND PHENOMENOLOGY OF THE HIGH-LATITUDE E AND F REGIONS
Robert D. Hunsucker *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 543-561 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24718*# National Telecommunication Information Administration, Boulder, Colo. Inst. of Telecommunications Sciences.
REPORT OF THE MID- AND LOW-LATITUDE E AND F REGION WORKING GROUP
Charles M. Rush *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 562-572 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24719*# Norwegian Defence Research Establishment, Kjeller. Electronics Div.
D REGION PREDICTIONS
E. V. Thrane, D. K. Chakrabarty (Phys. Res. Lab.), S. D. Deshpande (Dept. of Appl. Phys., Coll. of Eng., India), R. H. Doherty (Colo. Res. and Prediction Lab.), J. B. Gregory (Saskatchewan Univ.), J. K. Hargreaves (Lancaster Univ.), J. Lastovicka, Peter Morris (Coast Guard, Washington, D.C.), W. R. Piggott (British Antarctic Surv.), and J. B. Reagan (LMSC, Palo Alto, Calif.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 573-598 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

N80-24720*# Air Force Geophysics Lab., Hanscom AFB, Mass.
ION PRODUCTION IN THE D REGION
William Swider *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 599-616 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-24939 Colorado State Univ., Fort Collins.
INTERNAL STORM MOTIONS FROM A SINGLE NON-DOPPLER WEATHER RADAR Ph.D. Thesis
Ronald Earl Rinehart 1979 281 p
Avail: Univ. Microfilms Order No. 8010834

A correlation analysis pattern recognition technique called TREC (Tracking Radar Echoes by Correlation) with developed which is capable of determining motions within storms. The success of TREC depends upon the interrelationships between the flow and reflectivity field characteristics as well as the parameters of TREC processing such as the array size and spacing and the data resolution. A comparison of TREC results with data from a triple Doppler radar system collection data at the same time on the same storm shows that TREC vectors are apparently generated either above or below the level being examined. While the average difference between the height of TREC vectors and Doppler data of best agreement was only 550 m, the standard deviation of this difference was 1.8 km. This is likely the most severe restriction on the use of TREC in deep convective storms. Dissert. Abstr.

N80-24940*# Arizona State Univ., Tempe. Coll. of Engineering and Applied Science.
WAKE CHARACTERISTICS OF BUILDINGS IN DISTURBED BOUNDARY LAYERS Final Report
Earl Logan, Jr. and Jingfa Chang May 1980 52 p refs
(Contract NAS8-32357)
(NASA-CR-3284; M-298) Avail: NTIS HC A04/MF A01 CSCL 04B

Measurements relevant to the effect of buildings on the low level atmospheric boundary layer are presented. Field measurements of velocity and turbulence in the wake of a block building 3.2 m high and 26.8 m long are presented which show an apparent increase in momentum flow above the upwind value. Velocity-deficit and turbulence-excess decay characteristics of the disturbed or nonequilibrium layer are correlated with power law exponents and apparent roughness length at various distances downstream of the disturbance. Model wake profiles from the simulated building are compared at various stations for equilibrium and nonequilibrium upstream profiles. Empirical correlations relating building wake profiles to upstream nonequilibrium parameters are presented. The relationship of the data to the smooth-rough transition is discussed, and a flow model is presented. R.E.S.

N80-24941# National Research Inst. for Oceanology, Stellenbosch (South Africa). Physical Oceanography Div.
USE OF METEOSAT IN SOUTHERN OCEAN OCEANOLOGY AND SOUTHERN HEMISPHERE METEOROLOGY
Jre Lutjeharms Jun. 1979 30 p refs Presented at the ESA Conf. on Meteosat Usage, Darmstadt, West Germany, Jun. 1979
(CSIR-SEA-7918; ISBN-0-7988-1557-4) Avail: NTIS HC A03/MF A01

The use of Meteosat data in the refinement of weather prediction, determination of wind vectors, investigations on thunderstorms, the tracking of pollution plumes as well as in studies on the flooding of river mouths, on the water flux in and out of large lakes, and on the behaviour of ocean currents and ocean upwelling phenomena is briefly discussed. The placement of a drifting buoy in the south Atlantic Ocean using hourly thermal infrared images is also described. Some of the advantages and shortcomings of the data for oceanologic research are pointed out. M.G.

N80-24942# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
SMOOTHING AND FILTERING IN NUMERICAL WEATHER PREDICTION
H. A. Riphagen Jun. 1979 27 p refs
(CSIR-TWISK-87) Avail: NTIS HC A03/MF A01

A review is presented of various filtering and smoothing operators that may be used to control the spurious growth of high frequency components introduced by roundoff, truncation, observational errors, etc. The effects of these operators are discussed and illustrated by showing the result of their application in a three level simplified linear balanced weather prediction model. M.G.

N80-24943*# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
INTERACTIONS BETWEEN CONVECTIVE STORMS AND THEIR ENVIRONMENT Final Report
R. A. Maddox, L. R. Hoxit, and C. F. Chappell May 1979 104 p refs
(NASA Order S-40336-B)
(NASA-CR-159981) Avail: NTIS HC A06/MF A01 CSCL 04B

The ways in which intense convective storms interact with their environment are considered for a number of specific severe storm situations. A physical model of subcloud wind fields and vertical wind profiles was developed to explain the often observed

intensification of convective storms that move along or across thermal boundaries. A number of special, unusually dense, data sets were used to substantiate features of the model. GOES imagery was used in conjunction with objectively analyzed surface wind data to develop a nowcast technique that might be used to identify specific storm cells likely to become tornadic. It was shown that circulations associated with organized meso-alpha and meso-beta scale storm complexes may, on occasion, strongly modify tropospheric thermodynamic patterns and flow fields. R.E.S.

N80-24944*# Systems and Applied Sciences Corp., Hampton, Va.
SEVERE STORMS FORECAST SYSTEMS Final Report
M. Kaplan and J. Zack May 1980 8 p
(Contract NAS1-15660)
(NASA-CR-159282) Avail: NTIS HC A02/MF A01 CSCL 04B

Two research tasks are described: (1) the improvement and enhancement of an existing mesoscale numerical simulation system, and (2) numerical diagnostic studies associated with an individual case of severe storm development (April 10, 1979 in the Red River Valley of Texas and Oklahoma). R.E.S.

N80-24945# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DESIGN OF AN IMPROVED WEATHER CONTOURING DEVICE Final Report, Nov. 1977 - Sep. 1978
Robert G. Oliver Mar. 1979 71 p
(FAA Proj. 021-241-820)
(AD-A082750; FAA-RD-80-6) Avail: NTIS HC A04/MF A01 CSCL 17/9

A prototype weather contouring device is described which uses the concept of contour symbol generation to produce lines, shaded areas, or other symbols necessary to generate contours of weather intensity. Unlike former techniques, this device generates homogenous lines and is easily programmable for other formats. The device can provide dots or other symbols to the more intense side of a weather contour line clearly aiding the interpretation of the weather display. The device is designed to take advantage of digital signal transmission techniques for the transmission of up to six levels of weather intensity. Any two of these six levels can be simultaneously displayed. The device was designed for those applications where plan position indicator (rho-theta) format is desired or necessary. Tests indicate that the device can generate contours which are exceptionally smooth and stable and are well suited to use in the air traffic control system. M.G.

N80-24946*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
DETERMINATION OF THE SOLAR ENERGY MICROCLIMATE OF THE UNITED STATES USING SATELLITE DATA Final Report, 12 May 1975 - 11 Nov. 1976
Thomas H. VonderHarr and James S. Ellis Jul. 1978 72 p refs
(Contract NAS5-22372)
(NASA-CR-159987) Avail: NTIS HC A04/MF A01 CSCL 04B

The determination of total solar energy reaching the ground over the United States using measurements from meteorological satellites as the basic data set is examined. The methods of satellite data processing are described. Uncertainty analysis and comparison of results with well calibrated surface pyranometers are used to estimate the probable error in the satellite-based determination of ground insolation. It is 10 to 15 percent for daily information, and about 5 percent for monthly values. However, the natural space and time variability of insolation is much greater than the uncertainty in the method. The most important aspect of the satellite-based technique is the ability to determine the solar energy reaching the ground over small areas where no other measurements are available. Thus, it complements the widely spaced solar radiation measurement network of ground stations. M.G.

N80-24947# Rochester Univ., N. Y. The Graduate School of Management.
GAUSSIAN MARKOV RELATED VARIATES FOR METEOROLOGICAL PLANNING Final Report, 1 Jul. 1978 - 30 Sep. 1979
J. Keilson and H. F. Ross Hanscom AFB, Mass. AFGL 14 Nov. 1979 81 p refs
(Contract F19628-78-C-0158; AF Proj. 6670)
(AD-A081382; AFGL-TR-79-0282) Avail: NTIS HC A04/MF A01 CSCL 04/2

The Gaussian-Markov process or Ornstein-Uhlenbeck (O-U) process successfully models fluctuations in upper level wind velocity, rainfall, temperatures, etc. On-line predictions for longrange operational planning require the distribution of the maximum value of X(t), the stationary O-U process over an interval of specified duration. The required distribution and its basic properties are presented with accompanying tables and graphs. Algorithmic techniques required for on-line predictions are indicated. GRA

N80-24948# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
AIR WEATHER SERVICE (AWS) CLIMATIC BRIEFS: AFRICA Data Summary Report
Dec. 1979 14 p
(AD-A082097; USAFETAC/DS-79/083) Avail: NTIS HC A02/MF A01 CSCL 04/2

Monthly and annual climate data for Africa are presented. Meteorological elements included are: temperature, precipitation, relative humidity, vapor pressure, dew point, pressure altitude, surface wind, mean cloud cover, thunderstorm and fog days, flying weather, and typhoon and hurricane data. R.E.S.

N80-24949# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
AIR WEATHER SERVICE (AWS) CLIMATIC BRIEFS: ASIA Data Summary Report
Dec. 1979 187 p
(AD-A082096; USAFETAC/DS-79/082) Avail: NTIS HC A09/MF A01 CSCL 04/2

Monthly and annual climatic data for Asia are presented. Meteorological elements included are: temperature, precipitation, relative humidity, vapor pressure, dew point, pressure altitude, surface wind, mean cloud cover, thunderstorm and fog days, flying weather, and typhoon and hurricane data. R.E.S.

N80-24950# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
AIR WEATHER SERVICE (AWS) CLIMATIC BRIEFS: USSR AND MONGOLIAN PR Data Summary Report
Dec. 1979 10 p Supersedes AWSP-105-4-Vol-5
(AD-A082095; USAFETAC/DS-79/081; AWSP-105-4-Vol-5)
Avail: NTIS HC A02/MF A01 CSCL 04/2

Monthly and annual climate data for U.S.S.R. and Mongolian PR are presented. Meteorological elements included are: temperature, precipitation, relative humidity, vapor pressure, dew point, pressure altitude, surface wind, mean cloud cover, thunderstorm and fog days, flying weather, and typhoon and hurricane data. R.E.S.

N80-24951# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
AIR WEATHER SERVICE (AWS) CLIMATIC BRIEFS: LATIN AMERICA Data Summary Report
Dec. 1979 18 p Supersedes AWSP-105-4-Vol-3
(AD-A082093; USAFETAC/DS-79/089; AWSP-105-4-Vol-3)
Avail: NTIS HC A02/MF A01 CSCL 04/2

Monthly and annual climate data for Latin America are presented. Meteorological elements included are: temperature, precipitation, relative humidity, vapor pressure, dew point, pressure altitude, surface wind, mean cloud cover, thunderstorm and fog days, flying weather, and typhoon and hurricane data. R.E.S.

N80-24952# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
AIR WEATHER SERVICE (AWS) CLIMATIC BRIEFS: EUROPE Data Summary Report
Dec. 1979 77 p Supersedes AWSP-105-4-Vol-4
(AD-A082094; USAFETAC/DS-79/080; AWSP-105-4--Vol-4)
Avail: NTIS HC A05/MF A01 CSCL 04/2

Monthly and annual climate data for Europe are presented.

Meteorological elements included are: temperature, precipitation, relative humidity, vapor pressure, dew point, pressure altitude, surface wind, mean cloud cover, thunderstorm and fog days, flying weather, and typhoon and hurricane data. R.E.S.

N80-24953# Air Force Geophysics Lab., Hanscom AFB, Mass.
DEVELOPMENT AND EVALUATION OF A TOWER SLANT VISUAL RANGE SYSTEM
Edward B. Geisler Sep. 1979 41 p refs
(AF Proj. 6670)
(AD-A082384; AFGL-TR-79-0209; AFGL-IP-281) Avail: NTIS HC A03/MF A01 CSCL 01/2

Analysis of remote tower forward scatter meter measurements of extinction coefficient collected at the Air Force Geophysics Laboratory Weather Test Facility at Otis AFB, Massachusetts demonstrated the accuracy of a remote tower slant visual range (SVR) system. This report describes the final phase of the development and evaluation of a tower SVR system in which the remote tower approach has been extended to include category 1 operations. Tests give additional evidence that the runway visual range (RVR) measurements are often not representative of pilot visibility during approach and touchdown. An examination of three short range prediction techniques for forecast times of 2, 5, 10, 30 and 60 minutes revealed that the equivalent Markov technique provides accurate and reliable forecasts of below-limit SVR conditions and yields slightly better results than the Markov and REEP techniques. GRA

N80-24954# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
AIR WEATHER SERVICE (AWS) CLIMATIC BRIEFS: ANTARCTICA, AUSTRALIA, AND OCEANIA Data Summary Report
Dec. 1979 47 p
(AD-A082098; USAFETAC/DS-79/094) Avail: NTIS HC A03/MF A01 CSCL 04/2

Monthly and annual climatic data for Antarctica, Australia, and Oceania are summarized. Meteorological elements included are: temperature, precipitation, relative humidity, vapor pressure, dew point, pressure altitude, surface wind, mean cloud cover, thunderstorm and fog days, flying weather, and typhoon and hurricane data. R.E.S.

N80-24955# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
AIR WEATHER SERVICE (AWS) CLIMATIC BRIEFS: NORTH AMERICA Data Summary Report
Dec. 1979 317 p Supersedes ASWP-105-4-Vol-2
(AD-A082092; USAFETAC/DS-79/088; AWSP-105-4-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 04/2

Monthly and annual climate data for North America are summarized. Meteorological elements included are: temperature, precipitation, relative humidity, vapor pressure, dew point, pressure altitude, surface wind, mean cloud cover, thunderstorm and fog days, flying weather, and typhoon and hurricane data. R.E.S.

N80-24956# Weather Wing (3rd), Offutt AFB, Nebr.
COMMA CLOUD DEVELOPMENT RELATED TO MAJOR WINTER STORMS: TWO EXAMPLES
Eugene M. Weber Mar. 1980 15 p refs
(AD-A082125; Rept-3WW/TN-80/002) Avail: NTIS HC A02/MF A01 CSCL 04/2

This technical note discusses the relationship of comma cloud development over the southern Rockies and plain states to the developing storm system. Emphasis is placed on the likelihood that the storm system will soon recurve northeast-ward when the comma cloud becomes well-defined. A brief look at the structure and the development of the comma cloud is included. Two case studies are presented. GRA

N80-24957# Colorado State Univ., Fort Collins. Dept. of Physics.
REMOTE ATMOSPHERIC WIND SPEED MEASUREMENTS BY INDIVIDUAL PARTICLE SCATTERING AND DIGITAL BURST CORRELATION Final Report, 1 Mar. 1978 - 31 Oct. 1978
C. Y. She and Richard F. Kelley Dec. 1979 55 p refs
(Contract N00014-78-C-0289)
(AD-A082347) Avail: NTIS HC A04/MF A01 CSCL 04/2

We have demonstrated that atmospheric wind speeds can indeed be measured with photon bursts scattered from single dust particles. If photon counting, electronics and clipped digital correlation are used for signal analysis, an unambiguous speed measurement can be made with a detected signal as low as ten counts under practical conditions, i.e., in the presence of noise. A microprocessor is used to run the LTV measurements automatically, and to analyze and compare data for both LTV and a conventional cup anemometer. Satisfactory agreement between the LTV and the cup anemometer were obtained. The potential of the LTV with its high speed data acquisition and its short measurement time has been thoroughly demonstrated. In the field test of this automated LTV system, we have conducted speed measurements with both natural aerosols and with seeding of water droplets from a humidifier. To our satisfaction, we obtained better performance without seeding. In short, with the research of this project, we have demonstrated beyond doubt the principle of single-particle scattering for remote speed measurements and also the practical uses of LTV under realistic field conditions. GRA

N80-24958# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19704A MLRS, MISSILE NO. 067, ROUND NO. B-77, 7 JANUARY 80 Meteorological Data Report
Jan. 1980 15 p
(DA Proj. 1F6-65702-D-127)
(AD-A082974; ERADCOM/ASL-DR-1112) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19704A MLRS, Missile Number 067, Round Number B-71 are presented in tabular form. GRA

N80-24959# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702B MLRS, MISSILE NUMBERS 028, 353, 027, 351, 352, ROUND NUMBERS B-62, B-63, B-64, B-65, B-66, B-67, 5 JANUARY 1980 Meteorological Data Report
Jan. 1980 21 p
(AD-A082972; ERADCOM/ASL-DR-1109) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702B MLRS, Missile Numbers 028, 005, 353, 027, 351 and 352, Round Numbers B-62, B-63, B-64, B-65, B-66 and B-67 are presented in tabular form. GRA

N80-24960# Institute for Storm Research, Inc., Houston, Tex.
THE DEVELOPMENT OF METHODS OF NUMERICAL DIAGNOSTIC ANALYSIS OF SERIES OF SATELLITE PHOTOGRAPHS Final Report, Nov. 1976 - Feb. 1980
John C. Freeman 28 Feb. 1980 81 p refs
(Grant DAAG29-77-G-0013)
(AD-A082549; ISR-6-13; ARO-13734.4-GS) Avail: NTIS HC A05/MF A01 CSCL 04/2

A research study to develop methods of predicting mesoscale wind and temperature fields is reported on. Two mesoscale weather patterns were studied by an adaptation of optimization principles. Hourly surface pressure and infrared satellite cloud measurements were used as input to the updating scheme. The results shown here illustrate mesoscale properties of the circulation and vertical temperature distribution. GRA

N80-24961# Chicago Univ., Ill. Dept. of Geophysical Sciences.
A QUASI-ONE-DIMENSIONAL CUMULUS CLOUD MODEL AND PARAMETERIZATION OF CUMULUS HEATING AND MIXING EFFECTS Final Report, Nov. 1976 - Sep. 1979
H. L. Kuo and W. H. Raymond Hanscom AFB, Mass. AFGL Nov. 1979 69 p refs
(Contract F19628-77-C-0044; AF Proj. 2310)
(AD-A083024; AFGL-TR-79-0272) Avail: NTIS HC A04/MF A01 CSCL 04/2

The characteristic properties of cumulus convection are investigated using a semi-one-dimensional axisymmetric quasi-Lagrangian steady state model which takes into consideration the influences of the pressure perturbation, density stratification and nearby moist downdraft under two different environmental

situations, namely, 1) a potentially more unstable tropical environment and 2) a less unstable middle latitude environment with prominent stable layers in middle troposphere. It is found that the compressional heating of the dry environment makes the cloud air warmer and reduces the updraft velocity slightly and moist downdraft cools the cloud air and reduces both the updraft and the cloud depth, while the influence of pressure perturbation is also to reduce the updraft but it is effective only for clouds of radii larger than 1000 m. The influence of density stratification is to reduce w sub c slightly at low levels and augment w sub c at high levels and to slightly increase the cloud depth. The calculated precipitation rates appear to be close to the representative values obtained from observations. One most interesting result given by the model is that, under the less unstable middle latitude environment, the precipitation rate jumps from lower than .7 cm/hr for cloud radii smaller than 1000 m to more than 5.4 cm/hr for cloud radii greater than 2000 m, reflecting the inhibiting effect of the mid-tropospheric stable layer on the penetrative power of the smaller clouds.GRA

N80-24962# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19308B MLRS, MISSILE NO. 1091, ROUND NO. V-96, 8 DECEMBER 1979 Meteorological Data Report
Dec. 1979 17 p
(DA Proj. 1F6-65702-D-127)
(AD-A082967; ERADCOM/ASL-DR-1101) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of the 19308B MLRS, Missile Number 1091, Round Number V-96 are presented in tabular form. GRA

N80-24963# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19308B MLRS, MISSILE NO. 1057, ROUND NO. 1057 V-97, 8 DECEMBER 1979 Meteorological Data Report
8 Dec. 1979 16 p
(DA Proj. 1F6-65702-D-127)
(AD-A082968; ERADCOM/ASL-DR-1102) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of the 19308B MLRS, Missile Number 1057, Round Number V-97 are presented in tabular form. GRA

N80-24964# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL WIND FIELD MODEL VALIDATION FOR A COMPLEX TERRAIN AREA IN THE VICINITY OF LAWRENCE LIVERMORE LABORATORY
W. M. Porch, H. Walker, C. R. Veith, and M. H. Dickerson 20 Sep. 1979 35 p refs
(Contract W-7405-eng-48)
(UCRL-52837) Avail: NTIS HC A03/MF A01

The computer program, MATHEW, a mass consistent wind field model including topography, was tested using statistically selected data stations in the region of Lawrence Livermore Laboratory (LLL). Predicted versus measured winds were compared for data taken across a windy pass in the hills 3 km east of LLL. The topographic scale and the number of selected stations were varied to assess their relative impact on the agreement the winds predicted by the model and those measured at Patterson Pass. The test results for a one hour data set show that the model underestimates the measured winds by 25% and the wind energy by a factor of 2.4, with little dependence on topographic scale and some dependence on which data stations were included in the model; however, high winds were predicted in high wind areas. DOE

N80-24965# Wyoming Univ., Laramie. Dept. of Atmospheric Science.
CATALOG OF AVAILABLE WIND DATA IN IDAHO, MONTANA AND WYOMING
J. D. Marwitz and K. B. Gilkey Feb. 1979 42 p
(Contract EY-76-S-06-2343)
(RLO-2343-79/1) Avail: NTIS HC A03/MF A01

A catalog of available wind data was assembled for the states of Idaho, Montana and Wyoming. Data collected by approximately 100 surface anemometers and 12 to 15 instrumented towers operated for various lengths of time are presented. Most of these data are available from areas of high wind and areas with significant numbers of eolian features. Only a minimum amount of these data are analyzed and then only for single station climatology. DOE

N80-24966# Battelle Pacific Northwest Labs., Richland, Wash.
WIND RESOURCE ASSESSMENT STATUS
L. L. Wendell 1979 13 p refs Presented at the EPRI Workshop on Econ. and Operational Requirements and Status of Large-Scale Wind Systems, Monterey, Calif., 28-30 Mar. 1979
(Contract EY-76-C-06-1830)
(PNL-SA-6918-Rev-1) Avail: NTIS HC A02/MF A01

Prototype techniques for the analysis of wind energy potential and distribution over a large area were developed. These techniques involve the utilization of a large data set, the application of meteorological and topographic factors in the analysis, and the use of indirect methods of wind power estimation in areas where no wind measurements exist. The techniques were tested in five Pacific Northwest states. DOE

N80-24967# Hawaii Univ., Honolulu. Water Resources Research Center.
PROJECT AHUPUAA: SOLAR METEOROLOGICAL FIELD MEASUREMENTS ON THE ISLAND OF HAWAII, SUMMER 1978. 2: EASTERN FLANK OF MAUNA LOA
P. C. Ekern and Alfred J. Garrett Aug. 1979 63 p refs
(Grant EG-77-G-03-1617)
(UHMET-79-04) Avail: NTIS HC A04/MF A01

During 1-11 June 1978, solar radiation and other meteorological data were gathered at eight stations in a nearly linear transect on the windward eastern slopes of Hawaii, extending from the coast of Hilo, Hawaii to Mauna Loa Observatory (MLO), 60 km inland and 3400 m higher. In general, synoptic conditions were representative of normal early summer trade wind weather with a frontal remnant to the north, and a small westward-moving depression to the south. Solar radiation distributions followed climatological rainfall patterns; the driest areas were sunniest. At the wettest sites, underneath the orographic cloud, measured global solar radiation was only 50 percent of clear-sky potential, and the diffuse component probably accounted for more than 50 percent of the global. Consequently, effective concentration of solar radiation for use as an alternate energy resource will be difficult in such areas. The orographic cloud developed during the day in anabatic/trade winds of 2 to 4 m/s, which sharply reduced afternoon solar radiation at sites, including MLO on 7 out of 11 days. Moist upslope flow penetrated the trade wind inversion by 0.5 to 1.5 km on weak inversion days. When the inversion was strong, MLO was dry and clear all day. Cloudiness, and hence insolation, varied greatly from day-to-day due to passage of trade wind cloud masses and jet stream cirrus. Even so, the island effect was always significant. This data and analyses can be used by mesoscale numerical modelers, particulary those attempting to simulate orographic cloud development. DOE

N80-24968# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
STATISTICAL MODELS FOR WIND CHARACTERISTICS AT POTENTIAL WIND ENERGY CONVERSION SITES Final Report, 15 Sep. 1977 - 14 Oct. 1978
R. B. Corotis Jan. 1979 86 p refs
(Contract EY-76-S-06-2342)
(DOE/ET/20283-1; RLO-2342-79/1) Avail: NTIS HC A05/MF A01

Simple models and guidelines are developed for wind energy site surveys. Probabilistic procedures are employed to assess survey duration, climatological adjustment, and run duration statistics. A climatological adjustment procedure is derived for the enhancement of candidate site data from a reference site with long term data, and the computation of confidence intervals is shown for existing data and for projected survey durations. The value of the enhancement procedure is diminished because of the sensitivity of the procedures to long term cross correlations. A simplified run duration model is developed for initial persistence assessment. The model is simply calibrated for each run level from the seasonal mean wind speed at a site. DOE

N80-24969# Danish Meteorological Inst., Copenhagen.
DANISH EXPERIENCE AND PLANS FOR ESTABLISHMENT OF ARCTIC WEATHER OBSERVING STATIONS
Joergen Taagholt and Niels Woetmann Boulder, Colo. Intern. Assoc. of Meteorol. and Atmospheric Phys. Feb. 1979 11 p refs Presented at Joint IAGA/IAMAP Assem., Seattle, 22 Aug. - 3 Sep. 1977
Avail: NTIS HC A02/MF A01

The design, location, and operation of Unmanned Geophysical Observatories (UGO-stations) as well as of Automatic Weather Stations (AWS) are reported on. Experience gained to date concerning the need for this kind of meteorological data, maintainability of the installations, and the benefits of various equipment innovations is cited. The data collection system is analyzed and several configurations are proposed based on cost effectiveness. Author (ESA)

N80-24970# Danish Meteorological Inst., Copenhagen.
ON THE GENERAL AND SPECIFIC NATIONAL AND INTERNATIONAL NEED FOR METEOROLOGICAL DATA FROM THE GREENLAND AREA
Niels Woetmann and Joergen Taagholt Boulder, Colo. Intern. Assoc. of Meteorol. and Atmospheric Phys. Feb. 1979 9 p refs Presented at Joint IAGA/IAMAP Assem., Seattle, 22 Aug. - 3 Sep. 1977
Avail: NTIS HC A02/MF A01

Arguments based on the needs of aviation, industry, and industrial fishing for better meteorological data are presented in support of the establishment of unmanned geophysical observatories. Climatological factors, such as katabatic wind, surface wind, pressure gradient, and temperature, important in the analysis and forecasting of weather conditions are discussed. Results obtained from those stations already in place are cited as evidence of the reliability of these installations. Author (ESA)

N80-24971# Illinois State Water Survey, Urbana.
SPATIAL AND TEMPORAL CORRELATION OF PRECIPITATION IN ILLINOIS
Floyd A. Huff 1979 19 p refs Sponsored in part by OWRT
(PB80-137706; ISWS/CIR-141/79; W80-02882) Avail: NTIS
HC A02/MF A01 CSCL 04B

Analyses were made of the correlation patterns of annual, seasonal, monthly, storm, and partial storm precipitation in Illinois, with major emphasis on the warm season months of May - September when convective rainfall dominates and spatial variability maximizes. Data were from the climatic network of the National Weather Service in the annual analyses, and that from dense raingage networks of the State Water Survey in the seasonal, monthly, and storm analyses. Results provide knowledge and basic information concerning the spatial and temporal distribution characteristics of precipitation. This is needed in various endeavors, such as hydrologic studies, weather modification experiments, and agricultural research. GRA

N80-24972# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
OBSERVATIONAL ANALYSIS OF TROPICAL CYCLONE FORMATION
John L. McBride and William M. Gray Apr. 1979 242 p refs
(Contract N00228-76-C-2129; Grants NSF ATM-78-18962; NOAA-NA79-RAD-00002)
(PB80-133614; AS-PAPER-308) Avail: NTIS
HC A11/MF A01 CSCL 04B

This study investigates the genesis of tropical cyclones through a combination of the compositing approach and the case study approach. Twelve composite data sets are analyzed from the tropical Northwest Pacific and tropical Northwest Atlantic Oceans. Each data set is a composite average of approximately 80 individual disturbances. Four different types of nondeveloping oceanic tropical disturbances are composited. They are compared with pre-hurricane and pre-typhoon disturbances in each ocean composited at four different stages of intensification. In total, 912 different tropical weather systems go into the composites and approximately 40,000 rawinsonde observations are used. Vertically integrated budgets of heat, momentum and kinetic energy are performed on the composite data sets and physical hypotheses are made on the mechanisms of tropical cyclone genesis and development. GRA

N80-24973# Systems Applications, Inc., San Rafael, Calif.
MODELING WIND DISTRIBUTIONS OVER COMPLEX TERRAIN
Mark A. Yocke and Mei-Kao Liu Oct. 1979 122 p refs
(Contract EPA-68-02-2446)
(PB80-140783; EPA-600/4-79-066) Avail: NTIS
HC A06/MF A01 CSCL 04B

Accurate determination of wind fields is a prerequisite for successful air quality modeling. Thus, there is an increasing demand for objective techniques for analyzing and predicting wind distribution, particularly over rugged terrain, where the wind patterns are not only more complex, but also more difficult to characterize experimentally. This report describes the development of a three dimensional wind model for rugged terrain based on mass continuity. The model is composed of several horizontal layers of variable thicknesses. For each layer, a Poisson equation is written with the wind convergence as the forcing function. Many types of wind perturbations over rugged terrain are considered in this model including diversion of the flow due to topographical effects, modification of wind profiles due to boundary layer frictional effects, convergence of the flow due to urban heat island effects, and mountain and valley winds due to thermal effects. Wind data collected during a comprehensive field measurement program at Phoenix, Arizona, were used to test the model. GRA

N80-24974# National Oceanic and Atmospheric Administration, Rockville, Md. Atmospheric Programs Office.
WEATHER MODIFICATION REPORTING PROGRAM, 1973-1978. PART 1: SUMMARY OF WEATHER MODIFICATION ACTIVITIES FOR CALENDAR YEARS 1976, 1977 AND 1978. PART 2: COMPARISON OF DATA REPORTED SINCE 1973
Mason T. Charak Jun. 1979 78 p refs
(PB80-145055; NOAA-79110702) Avail: NTIS
HC A05/MF A01 CSCL 04B

Part 1 is a summary of reported weather modification activities for calendar years 1976, 1977, and 1978. Information presented on the reported weather modification projects includes purposes, locations, sponsors, operators, equipment, techniques, target areas, seeding agents, seeding duration, operational considerations, and environmental factors. In Part 2, some adjusted data from published summaries of activities for 1973-1975 are compared with the data for Part 1. GRA

N80-24722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR WEATHER/CLIMATE PREDICTIONS
K. Schatten (Boston Univ.), Richard A. Goldberg, J. M. Mitchell (NOAA, Silver Spring, Md.), R. Olson (Aspen Inst. for Humanistic Studies, Boulder, Colo.), J. Schaefer (Bonn Univ.), S. Silverman (AFGL), J. Wilcox (Stanford Univ.), and G. Williams (Southampton Univ.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 655-668 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04B

N80-24723*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COUPLING PROCESSES RELATED TO THE SUN-WEATHER PROBLEM
Richard A. Goldberg and John R. Herman (Radio Sci. Co., Melbourne, Fla.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 669-688 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04B

N80-24724*# Cornell Univ., Ithaca, N. Y. Atmospheric Sciences Div.
THE IMPACT OF SUN-WEATHER RESEARCH ON FORECASTING
Miguel F. Larsen *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 689-702 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04B

N80-24725*# Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.

PLANETARY WAVES AND SUN-WEATHER EFFECTS
H. Volland and J. Schaefer (Bonn Univ.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 703-721 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-24975*# Business and Technological Systems, Inc., Seabrook, Md.
GLOBAL EARTH RESPONSE TO LOADING BY OCEAN TIDE MODELS Final Report
Ronald H. Estes and James M. Strayer Jun. 1979 64 p refs (Contract NAS5-25010)
(NASA-CR-159984) Avail: NTIS HC A04/MF A01 CSCL 08C

Mathematical and programming techniques to numerically calculate Earth response to global semidiurnal and diurnal ocean tide models were developed. Global vertical crustal deformations were evaluated for M sub 2, S sub 2, N sub 2, K sub 2, K sub 1, O sub 1, and P sub 1 ocean tide loading, while horizontal deformations were evaluated for the M sub 2 tidal load. Tidal gravity calculations were performed for M sub 2 tidal loads, and strain tensor elements were evaluated for M sub 2 loads. The M sub 2 solution used for the ocean tide included the effects of self-gravitation and crustal loading. R.E.S.

N80-24976# Naval Postgraduate School, Monterey, Calif.
PREPARATION OF OCEAN MODEL FORCING PARAMETERS FROM FNWC ATMOSPHERIC ANALYSIS AND MODEL PREDICTIONS Technical Report, Dec. 1978 - Sep. 1979
Patrick C. Gallacher Dec. 1979 29 p refs
(AD-A081611; NPS63-79-005) Avail: NTIS HC A03/MF A01 CSCL 08/3

A software system is described which produces atmospheric fields on the time scale necessary to force the Garwood (1977) mixed layer model. The fields required are the surface wind speed, solar radiation and total heat flux. These fields are obtained from the NORPAX data center and from FNWC. The winds are available at 6 hour intervals and the heat fluxes at 12 hour intervals. The software system edits, reformats and interpolates the fields to 1 hour intervals. The system also provides the capability to extract specific grid points for any time interval desired. GRA

N80-24977*# National Aeronautics and Space Administration, Washington, D. C.
CATALOG OF FEDERAL OCEAN POLLUTION RESEARCH, DEVELOPMENT AND MONITORING PROGRAMS, FISCAL YEARS 1978 - 1980
Aug. 1979 271 p Sponsored in cooperation with the Interagency Commission on Ocean Pollution Research, Development, and Monitoring Prepared in cooperation with NOAA, Washington, D.C.
(NASA-TM-81071; PB80-140171; NOAA-80011801; Working-Paper-1) Avail: NTIS HC A12/MF A01 CSCL 08J

The National Ocean Pollution Research and Development and Monitoring Planning Act of 1978 was signed as Public Law 95 273, in May 1978, to establish a comprehensive 5 year plan to provide planning for, coordination of, and dissemination of, information with respect to such programs within the Federal Government. A detailed inventory of Federal ocean pollution research, development, and monitoring programs is presented as the basis upon which all descriptions and analyses of Federal activities in this area are made. The overall program is analyzed from the perspectives of pollutants under study, specific geographic concerns, sources, or causes of pollution and control and mitigation. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-24978*# National Aeronautics and Space Administration, Washington, D. C.
GROWTH AND FORMATION OF THE FORELEG SKELETON IN INBRED MICE AND RATS UNDER CONDITIONS OF HYPO-, NORMO- AND HYPERDYNAMIA
B. I. Kogan and Yu. S. Antipov Jan. 1980 10 p refs Transl. into ENGLISH from Vestn. Zool. (USSR), no. 4, 1976 p 67-71 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Acad. of Pedagogical Sci.
(Contract NASw-3198)
(NASA-TM-75977) Avail: NTIS HC A02/MF A01 CSCL 06C

Inbred 1 month old males of C57B 1/6, CBA, CC57Br/Mw interlinear hybrid mice of the first generation and rats of the August and Wistar lines were subjected to conditions of hypo-, normo- and hyperdynamia for 2 months. The statistically reliable dependence is shown between mechanical underloadings and overloadings and macro microscopic changes in the hind limb skeleton of animals. Genetic determination of growth and formation of the forelimb skeleton is established. Hereditary susceptibility and the phenomenon of heterosis are preserved under all motor conditions. Author

N80-24979*# National Aeronautics and Space Administration, Washington, D. C.
PLANTS AND WEIGHTLESSNESS
V. Karminskiy and V. Tarkhanovskiy Jan. 1980 4 p Transl. into ENGLISH from Tekhn. i Nauka (Moscow), no. 11, 1978 p 10 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76025) Avail: NTIS HC A02/MF A01 CSCL 06C

The growth of two plants, wall cress and short-day red goosefoot, was traced for their entire lifetime in weightlessness. In the beginning both plants grew normally: the seeds sprouted in the normal periods, and the shoots did not differ in any way from the control plants. It is true that certain roots lost their normal orientation and did not go deeper into the nutrient medium, but rather crept over its surface. But then both the wall cress and the goosefoot slowed down their normal rate of growth, which became noticeable from the rate of formation of new leaves in the wall cress and stem development in the goosefoot. Although no disorders were successfully found in the morphology of the two plants, almost half of the experimental cress and goosefoot plants ceased growth completely, yellowed and died. The other part continued to develop normally and by the end of vegetation, differed from the control plants only in a lower height. Not all were fertile since certain experimental plants, after losing spatial orientation, became twisted and produced sterile flowers. R.E.S.

N80-24980*# National Aeronautics and Space Administration, Washington, D. C.
CHANGE IN RADIO SENSITIVITY OF MICE UNDER EFFECT OF ROTATION
N. I. Arlashchenko, V. M. Seraya, and G. P. Rodina Jan. 1980 12 p refs Transl. into ENGLISH from Radiobiol. (USSR), no. 2, 1979 p 251-256 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Med. and Biol. Probl. of the USSR Min. of Public Health
(Contract NASw-3198)
(NASA-TM-76026) Avail: NTIS HC A02/MF A01 CSCL 06C

Radiosensitivity of animals placed in slowly rotating chambers was investigated and was found to vary under the influence of the functional load on the vestibular analyzer. An increased radioresistance was registered in populations of the most radiosensitive mice. In populations of more radioresistant animals the gravitational load decreases the radioresistance. R.E.S.

N80-24981*# National Aeronautics and Space Administration, Washington, D. C.

CONTENT OF TOTAL IRON, COPPER AND MANGANESE IN LIVER OF ANIMALS DURING HYPOKINESIA, MUSCLE ACTIVITY AND PROCESS OF RECOVERY
G. M. Potapovich, G. V. Taneyeva, and A. B. Uteshev 30 May 1980 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk Kaz. SSR, Ser. Biol. (USSR), no. 4, Jul. - Aug. 1978 p 63-66 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by the Kazakh SSR Min. of Public Health, Alma-Ata
(Contract NASw-3198)
(NASA-TM-76130) Avail: NTIS HC A02/MF A01 CSCL 06C

It is shown that the content of total iron, copper and manganese in the liver of animals is altered depending on the intensity and duration of their swimming. Hypodynamia for 7 days does not alter the concentration of iron, but sufficiently increases the content of copper and manganese. The barometric factor effectively influences the maintenance of constancy in the content of microelements accumulated in the liver after intensive muscle activity. Author

N80-24982*# Hampton Inst., Va. Dept. of Physics.
A RADIATIVE TRANSFER MODEL FOR REMOTE SENSING OF LASER INDUCED FLUORESCENCE OF PHYTOPLANKTON IN NON-HOMOGENEOUS TURBID WATER Annual Report
D. D. Venable May 1980 57 p refs
(NASA-CR-163155) Avail: NTIS HC A04/MF A01 CSCL 06C

A radiative transfer computer model was developed to characterize the total flux of chlorophyll a fluoresced or backscattered photons when laser radiation is incident on turbid water that contains a non-homogeneous suspension of inorganic sediments and phytoplankton. The radiative transfer model is based on the Monte Carlo technique and assumes that: (1) the aquatic medium can be represented by a stratified concentration profile; and (2) that appropriate optical parameters can be defined for each layer. The model was designed to minimize the required computer resources and run time. Results are presented for an anacystis marinus culture. R.E.S.

N80-24983*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY RESULTS OF FAST NEUTRON TREATMENTS IN CARCINOMA OF THE PANCREAS
Reinhard Gahbauer, Kyee Y. Koh, Antonio Rodriguez-Antunez, Gwynn L. Jelden, Robert F. Turco, John Horton, Ronald Bukowski, Ronald Reimer, James Blue, William Roberts et al 1980 4 p Presented at the National Pancreatic Proj., New Orleans, 18 Apr. 1980 Prepared in cooperation with Cleveland Clinic Foundation, Ohio
(NASA-TM-81516; E-460) Avail: NTIS HC A02/MF A01 CSCL 06E

A group of 30 patients with adenocarcinoma of the pancreas including some patients with very advanced disease, were treated with the so-called mixed beam modality employing photon treatments three times per week and neutron treatments twice a week. Two hundred Rads or equivalent Rads (RBE 3.3) were given in daily fractions aiming at a total dose of 6000 Rads in 6 to 8 weeks. The treatments were well tolerated and significant palliation was achieved in 26 to 30 cases. Twelve months survival was 33 percent with a median survival of 7 months or 210 days. Treatment techniques and localization procedures are discussed. R.E.S.

N80-24984# Rancho Los Amigos Hospital, Inc., Downey, Calif.
STUDIES ON OXYGEN TOXICITY IN THE LUNGS Final Technical Report, 1 May 1970 - 29 Feb. 1980
Jack D. Hackney 29 Feb. 1980 51 p refs
(Contract N00014-78-C-0290)
(AD-A082546) Avail: NTIS HC A04/MF A01 CSCL 06/20

Work on two animal species has shown that during the first day of exposure to high concentrations of oxygen (O2), the normal rate of cell division in the lung is decreased. In animals that survive the initial exposure to O2 or in those exposed to a lower concentration, cell division resumes after about five days. In animals exposed to O2, it has been noted that they eat less and lose weight. Air-breathing mice deprived of food had weight loss and depression in DNA synthesis similar to that observed in mice exposed to 95 percent O2. These results indicate that indirect factors are associated with the depression of DNA synthesis observed in mice exposed to high O2. Lack of food or 40 percent O2 did not inhibit type 2 division associated with repair of ozone damaged alveolar epithelium. Oxygen concentrations of 61 percent or higher did inhibit reparative cell division in ozone damaged alveoli of mice. GRA

N80-24985# Rochester Univ., N. Y. School of Medicine and Dentistry.
BIOLOGICAL EFFECTS OF IONIZING RADIATION AT THE MOLECULAR, CELLULAR AND ORGANISMAL LEVELS Annual Progress Report, 15 Oct. 1978 - 14 Oct. 1979
C. S. Lange 1979 13 p refs
(Contract EY-76-S-02-3501)
(COO-3501-13) Avail: NTIS HC A02/MF A01

The Zimm theory of rotor speed dependent DNA sedimentation has been tested quantitatively and found to be correct as predicted by the equation of Zimm and Schumaker. The quantitative validity of the theory means that the size of a DNA sedimenting under speed-dependent conditions is not undefinable but rather can be uniquely obtained by the application of that theory to the data. The viscoelastic recoil or more accurately, the zero shear rate reduced recoil was shown to be a quantitative direct function of the number of intact DNA molecules present in solution. This demonstration made possible the measurement of a direct survival curve for intact DNA molecules after exposure to ionizing radiation. A D37 of 49.5 krads was obtained for the DNA of T4c coliphage irradiated as a solution of phage particles. It is noteworthy that this survival curve measures the number of intact DNA molecules, not the average number of breaks/molecule. DOE

N80-24986# National Academy of Sciences - National Research Council, Washington, D. C. Board on Science and Technology for International Development.
MICROBIAL PROCESSES: PROMISING TECHNOLOGIES FOR DEVELOPING COUNTRIES Final Report
Feb. 1980 215 p refs
(Contract AID/csd-2584)
(PB80-144686; CIR/BOSTID-80/28) Avail: NTIS HC A10/MF A01 CSCL 06K

Ten subpanels selected a number of microbial processes that met either of the following criteria: the process can be beneficially employed in developing countries, or the process has sufficient potential for developing countries to merit research and development for future use. Microbes can be marshaled to aid in solving many important global problems including food storages, resource recovery and reuse, energy shortages, and pollution. Microbiology is particularly suited to make important contributions to human needs in developing countries, yet it has received comparatively little attention. The range of possible applications covers uses by individuals and industries in rural settings, villages and cities. The ten subject areas covered include raw materials for microbial processes, food and animal feed, soil microbes in plant health and nutrition, nitrogen fixation, microbial insect control agents, fuel and energy, waste treatment and utilization, cellulose conversion, antibiotic and vaccines, and pure cultures for microbial processes. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-24987* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY. A CONTINUING BIBLIOGRAPHY WITH INDEXES. SUPPLEMENT 206, MAY 1980
May 1980 61 p
(NASA-SP-7011(206)) Avail: NTIS HC $7.00 CSCL 06E

This bibliography lists 169 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1980. Author

N80-24988*# National Aeronautics and Space Administration, Washington, D. C.
FREE AMINO ACIDS OF THE BLOOD AND SOME ORGANS IN HYPOKINESIA
B. M. Kurtser, L. N. Kobylyanskiy, S. A. Lysenko, and L. I. Tkachenko Jan. 1980 6 p refs Transl. into ENGLISH from Zdravookhraneniye (USSR), v. 18, no. 4, 1975 p 26-27 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by the Kishinev Med. Inst., USSR
(Contract NASw-3198)
(NASA-TM-75945) Avail: NTIS HC A02/MF A01 CSCL 06P

The metabolic fund of amino acids of the blood and tissues of rats under hypokinesia was investigated. The content of free amino acids was determined for the liver, kidney, brain, and the skeletal and cardiac muscles after established periods of hypokinesia. It was found that the total content of free amino acids in the experimental animals was, on the average 19 percent lower than in the controls. The results of the quantity of individual compounds indicate that the level of some were reduced while others were increased. It was also found that there was an unequal content of individual amino acids in the different tissues. R.E.S.

N80-24989*# National Aeronautics and Space Administration, Washington, D. C.
HYPODYNAMIC AND HYPOKINETIC CONDITION OF SKELETAL MUSCLES
G. S. Katinas, V. S. Oganov, and A. N. Potapov Feb. 1980 7 p refs Transl. into ENGLISH from Fiz. Zh. SSSR (USSR), v. 60, no. 10, 1974 p 1606-1608 Original language document was announced as A75-14852 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Min. Inst. for Medicobiol. Probl., Moscow, USSR
(Contract NASw-3199)
(NASA-TM-76009) Avail: NTIS HC A02/MF A01 CSCL 06P

Data are presented in regard to the effect of unilateral brachial amputation on the physiological characteristics of two functionally different muscles, the brachial muscle (flexor of the brachium) and the medial head of the brachial triceps muscle (extensor of the brachium), which in rats represents a separate muscle. Hypokinesia and hypodynamia were studied. Author

N80-24990*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF PRODUCTION MICROCLIMATE ON FEMALE THERMAL STATE WITH INCREASED TEMPERATURE AND AIR HUMIDITY
O. G. Machablishvili Mar. 1980 6 p refs Transl. into ENGLISH from Vrachebnoye Delo (Kiev), no. 6, Jun. 1979 p 96-98 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by the Georgian SSR Min. of Public Health, USSR
(Contract NASw-3198)
(NASA-TM-76082) Avail: NTIS HC A02/MF A01 CSCL 06S

The thermal state of women during the effect of high air temperature and relative humidity with a varying degree of physical loads was studied. Parameters for air temperature, relative humidity, and air movement were established. It was established that in women the thermo-regulatory stress occurs at lower air temperatures and with lower physical loads than in men. The accumulation of heat in women was revealed with lower air temperature than in men. It is concluded that to preserve the normal physiological state of the female organism it is necessary to create more favorable microclimate conditions and decrease the physical loads. R.E.S.

N80-24991*# National Aeronautics and Space Administration, Washington, D. C.
CARDIOLEADER USE IN ACYCLIC TYPES OF SPORTS
V. I. Bondin Mar. 1980 11 p refs Transl. into ENGLISH from Teor. Prakt. Fiz. Kultury (USSR), no. 6, June 1969 p 34-37 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Bostov State Pedagogical Inst., USSR
(Contract NASw-3199)
(NASA-TM-76085) Avail: NTIS HC A02/MF A01 CSCL 06A

The use of the cardioleader method in regulating training loads and tests for athletes in acyclic sports was investigated. It was found that the use of this method increases the effectiveness of the training process. R.E.S.

N80-24992*# Stanford Univ., Calif. School of Medicine.
NEURON ANALYSIS OF VISUAL PERCEPTION Final Report
Kao Liang Chow May 1980 13 p
(Grant NGR-05-020-435)
(NASA-CR-163137) Avail: NTIS HC A02/MF A01 CSCL 06P

The receptive fields of single cells in the visual system of cat and squirrel monkey were studied investigating the vestibular input affecting the cells, and the cell's responses during visual discrimination learning process. The receptive field characteristics of the rabbit visual system, its normal development, its abnormal development following visual deprivation, and on the structural and functional re-organization of the visual system following neo-natal and prenatal surgery were also studied. The results of each individual part of each investigation are detailed. R.E.S.

N80-24993*# Clarkson Coll. of Technology, Potsdam, N.Y.
LIGHT FLASH PHENOMENA INDUCED BY HzE PARTICLES Final Report
P. J. McNulty and V. P. Pease 31 Mar. 1980 51 p refs
(Grant NsG-9059; Contract F30602-78-C-0102)
(NASA-CR-163011) Avail: NTIS HC A04/MF A01 CSCL 06P

Astronauts and Apollo and Skylab missions have reported observing a variety of visual phenomena when their eyes are closed and adapted to darkness. These phenomena have been collectively labelled as light flashes. Visual phenomena which are similar in appearance to those observed in space have been demonstrated at the number of accelerator facilities by expressing the eyes of human subjects to beams of various types of radiation. In some laboratory experiments Cerenkov radiation was found to be the basis for the flashes observed while in other experiments Cerenkov radiation could apparently be ruled out. Experiments that differentiate between Cerenkov radiation and other possible mechanisms for inducing visual phenomena was then compared. The phenomena obtained in the presence and absence of Cerenkov radiation were designed and conducted. A new mechanism proposed to explain the visual phenomena observed by Skylab astronauts as they passed through the South Atlantic Anomaly, namely nuclear interactions in and near the sensitive layer of the retina, is covered. Also some studies to search for similar transient effects of space radiation on sensors and microcomputer memories are described. R.E.S.

N80-24994# Clemson Univ., S.C. Coll. of Engineering.
AN EVALUATION OF HUMAN THERMAL MODELS FOR THE STUDY OF IMMERSION HYPOTHERMIA PROTECTION EQUIPMENT Final Report, 17 Jan. 1978 - 21 Aug. 1979
R. Michael Harnett, IV Baker E. R., and Jeffrey L. Ringuest 12 Oct. 1979 107 p refs
(Contract DOT-CG-72074-A)
(AD-A081100; USCG-D-80-79) Avail: NTIS HC A06/MF A01 CSCL 06/19

This report presents an evaluation of mathematical models of a man in a cold environment. The models are evaluated for their ability to predict the effectiveness of anti-exposure equipment use during cold water immersion. The evaluation is done by comparison of model results to those observed during in vivo cold immersions with a wide range of anti-exposure equipment. The models evaluated are those, available in the literature, which employ a metabolic rate control submodel. Model results obtained with modified and experimental submodels are discussed. GRA

N80-24995# Army Research Inst. of Environmental Medicine, Natick, Mass.
PHYSIOLOGICAL RESPONSES OF MEN AND WOMEN TO HUMID AND DRY HEAT
Yair Shapiro, Kent B. Pandolf, Barbara A. Avellini, Nancy A. Pimental, and Ralph F. Goldman Nov. 1979 30 p refs
(DA Proj. 3E1-62777-A-845)
(AD-A079573) Avail: NTIS HC A03/MF A01 CSCL 06/19

The major objective of this study was to determine whether

sex-related differences in thermoregulation exist; and if so, whether there was any method to define these differences. A major methodological problem of the study was the inability to find groups of males and females matched in all their physical characteristics, namely: body weight, skin surface area, percentage of body fat and cardiorespiratory physical fitness. This problem was partially solved by dividing each sex into two subgroups and matching the subgroups as 'small' males vs. 'big' females, or more fit females vs. less fit males. The sex-related differences concluded from this investigation are summarized in Table 4. In comfortable climatic conditions (20 C, 40% rh) men and women reacted in a physiologically similar fashion. Under wet conditions, whether mild or hot, females tolerated the heat better than males. They displayed lower deep body and skin temperatures, and therefore lower heat storage, while demonstrating lower sweat rates and subsequently less dehydration than males. In contrast, under hot-dry conditions, males seemed to be at a physiological advantage. Compared to females, they showed lower deep body and skin temperatures, lower HR, lower heat storage, and similar sweat rates. GRA

N80-24996# Undersea Medical Society, Bethesda, Md.
MONITORING VITAL SIGNS IN THE DIVER Special Report
Claes E. G. Lundgren 1979 121 p refs
(Contract N00014-74-C-0319)
(AD-A071920; WS-78-2) Avail: NTIS HC A06/MF A01 CSCL 06/5

Various aspects of monitoring vital signs in the diver are discussed. Special consideration is given to monitoring heat loss, temperature, and eye movement. Performance measures and voice monitoring were considered extremely important. It is concluded that monitoring is highly desirable and is within the capability of present equipment. It was recognized however that monitoring in-sea divers is difficult and complicated because of unwillingness on the part of divers and tenders to cooperate. R.E.S.

N80-24997# Saint Louis Univ., Mo. Dept. of Physiology.
HEMATOLOGICAL ASPECTS OF HEAT STRESS IN TRAINED AND UNTRAINED MEN WITH SPECIAL EMPHASIS ON ERYTHROCYTE VOLUME, ACID-BASE BALANCE AND FLUID-ELECTROLYTE SHIFTS Final Report, 1 May 1976 - 31 Aug. 1978
W. vanBeaumont, S. Underkofler, and S. vanBeaumont 15 Jun. 1979 46 p refs
(Contract N00014-76-C-0795)
(AD-A071757) Avail. NTIS HC A03/MF A01 CSCL 06/19

The results of the present study indicate that with 30 min of continuous sub-maximal exercise in a cool environment (24 C) or a warm environment (40 C), the plasma volume rates of decrease and restoration are virtually identical. At all levels of sub-maximal performance, restoration of plasma volume was 80-90% complete in 30 min post-exercise and 100% complete in 60 min. The regression equation for calculating proportional changes in plasma volume, using changes in hematocrit and hemoglobin indicate that the changes in mean erythrocyte volume (MCV) were small. However, based on statistical analyses it is apparent that significant changes in the MCV do occur during sub-maximal exercise. Physical training decreased plasma complexity and increased the size of the human erythrocyte. Proportionally, the shift of plasma water during maximal exercise was similar before and after training. Acclimatization to heat induced increments in MCV which, however, were not statistically significant. In most acclimatized subjects there was a tendency for quicker restoration of plasma volume than in nonheat acclimatized subjects after exercise in the heat. These changes are discussed with reference to concomittant changes in plasma complexity and plasma protein. R.E.S.

N80-24998# Army Research Inst. of Environmental Medicine, Natick, Mass.
RESPIRATORY ADAPTATIONS IN ACID-BASE DISTURBANCES: ROLE OF CEREBRAL FLUIDS
V. Fencl and R. A. Gabel 19 Jun. 1979 14 p refs
(DA Proj. 3A1-61101-A-91C)
(AD-A073202) Avail: NTIS HC A02/MF A01 CSCL 06/16

The respiratory and metabolic components of acid-base homeostasis are defined. A quantitative empirical description of the (incomplete) mutal compensations in steady acid-base disturbances primarily occuring in either of the two components is presented, based upon data compiled from the literature. Respiratory adaptations in steady acid-base disturbances of metabolic origin (hyperventilation with hypocapnia in primary metabolic acidosis, and hypoventilation with hypercapnia in metabolic alkalosis) are analyzed as a function of the acidity of the cerebral fluids (cerebrospinal and cerebral interstitial fluid). R.E.S.

N80-24999# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
TREND PREDICTION AS A BASIS FOR OPTIMAL THERAPY: A SURVEY REPORT
J. E. Beneken, J. A. Blom, F. F. Jorritsma, A. Nandorff (Leiden Univ., Netherlands), and J. Spierdijk (Leiden Univ., Netherlands) Aug. 1978 71 p refs
(TH-78-E-86; ISBN-90-6144-086-6) Avail: NTIS HC A04/MF A01

A state-of-the-art survey in clinical trend prediction as a basis for optimizing therapy, with emphasis on research being done in the countries of the European Community, was conducted. Special areas of interest are quantitative prognosis (prognostic indices), the detection and use of trends in the patient's state, the use of models in prediction and their possible use for deciding which therapy is optimal for a specific patient. An extensive list of centers working in these fields as well as an extensive reference list is included. Author (ESA)

N80-25000# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
BIOLOGICAL EFFECTS OF ULTRAVIOLET RADIATION [EFFETTI BIOLOGICI DELLA RADIAZIONE ULTRAVIOLETTA]
M. Cremonese and M. Matzeu 9 Jul. 1979 54 p refs In ITALIAN
(ISS-R-79/5; ISSN-0390-6477) Avail: NTIS HC A04/MF A01

A review is presented of the most important effects produced by ultraviolet radiation with particular regard to the possible pathologic effects on man. A molecular interpretation of DNA alterations by the action of UV radiation is discussed, presenting experimental evidence of the effect upon cellular cultures and damages inflicted to human skin and eyes. The carcenogenic effects are related to this interpretation. Some statuory problems are discussed in connection with health protection against ultraviolet radiation. Author (ESA)

N80-25001# National Asthma Center, Denver, Colo. Dept. of Physiology.
LOW-LEVEL CARBON MONOXIDE EXPOSURE AND WORK CAPACITY AT 1600 METERS
Philip C. Weiser, Gerd J. A. Cropp, Callis G. Morrill, Thomas L. Kurt, and David W. Dickey Sep. 1979 35 p refs
(Contract EPA-68-02-2244)
(PB80-129083; EPA-600/1-79-037) Avail: NTIS HC A03/MF A01 CSCL 06T

At sea level low-level carbon monoxide (CO) exposure impairs exercise performance. To determine if altitude residence at 1600 m augments this CO effect, two studies of graded treadmill work capacity were done. In both studies, maximal cardiopulmonary responses were not different, but submaximal exercise changes were elevated breathing CO. Thus, in healthy young men residing near 1600 m, an increase in low-level CO exposure produced a linear decrement in maximal aerobic performance similar to that reported at sea level. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-25002*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DECISION-PROBLEM STATE ANALYSIS METHODOLOGY

Duncan L. Dieterly. May 1980. 21 p. refs. Prepared in cooperation with AFHRL, Moffett Field, Calif.
(NASA-TM-81194; AFHRL/H/80-102) Avail: NTIS
HC A02/MF A01 CSCL 05J

A methodology for analyzing a decision-problem state is presented. The methodology is based on the analysis of an incident in terms of the set of decision-problem conditions encountered. By decomposing the events that preceded an unwanted outcome, such as an accident, into the set of decision-problem conditions that were resolved, a more comprehensive understanding is possible. All human-error accidents are not caused by faulty decision-problem resolutions, but it appears to be one of the major areas of accidents cited in the literature. A three-phase methodology is presented which accommodates a wide spectrum of events. It allows for a systems content analysis of the available data to establish: (1) the resolutions made, (2) alternatives not considered, (3) resolutions missed, and (4) possible conditions not considered. The product is a map of the decision-problem conditions that were encountered as well as a projected, assumed set of conditions that should have been considered. The application of this methodology introduces a systematic approach to decomposing the events that transpired prior to the accident. The initial emphasis is on decision and problem resolution. The technique allows for a standardized method of accident into a scenario which may used for review or the development of a training simulation. R.E.S.

N80-25003*# SRI International Corp., Menlo Park, Calif. Artificial Intelligence Center.
RESEARCH IN INTERACTIVE SCENE ANALYSIS Final Report
Jay M. Tenenbaum. 30 May 1980. 49 p. refs.
(Contract NASw-2865)
(NASA-CR-163196) Avail: NTIS HC A03/MF A01 CSCL 05J

The recovery of information about the three dimensional structure and physical characteristics of surfaces depicted in an image was studied focusing on two complementary problems: (1) basic techniques for inferring three dimensional surface shape from two dimensional images and (2) means for integrating the results of different techniques to obtain a globally consistent surface description. A technique was developed for constraining surface orientation along image contours that correspond to surface boundaries. A means for interpolating surface orientation estimates from a variety of sources into smooth surfaces--a major integration problem--was also developed. A computational model, based on these techniques, was proposed for inferring the three dimensional surface structure depicted in a line drawing. R.E.S.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-25004# Grumman Aerospace Corp., Bethpage, N.Y.
INVESTIGATION OF MINIMUM SIZED LOW-PROFILE COCKPITS (MSLPC) AND CREW ESCAPE SYSTEM INTEGRATION Final Report, 15 Sep. 1978 - 17 Jul. 1979
William C. Tauby. Wright-Patterson AFB, Ohio AFFDL. 17 Sep. 1979. 239 p. refs.
(Contract F33615-78-C-3427; AF Proj. 2402)
(AD-A081055; AFFDL-TR-79-3104) Avail: NTIS
HC A11/MF A01 CSCL 01/3

Assessed are the potential benefits derived from the application to advanced fighter aircraft configurations and the integration of an effective crew escape capability. Alternate approaches and escape concepts were identified and subjected to analysis and tradeoff to permit the recommendation of preferred concepts. The computer simulation of escape system aerodynamic performance facilitated the evaluation leading to the selection of the supine concept as that preferred for further development as a preliminary design. GRA

N80-25005# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario). MLSD Div.
EVALUATION OF UK PQ OXYGEN MASK FOR USE IN CF AIRCRAFT
D. F. Leben. Sep. 1979. 27 p. refs.
(AD-A079476; DCIEM-79-R-39) Avail: NTIS
HC A03/MF A01 CSCL 06/11

As part of a project to develop adequate life support equipment for the New Fighter Aircraft (NFA), evaluation of the Royal Air Force (RAF) P/Q oxygen mask by DCIEM indicated that the RAF P/Q mask is the only mask capable of holding the necessary 70-80 mm of pressure of the 'get-me-down' requirement of the life support ensemble. Subsequently, DCIEM was asked to evaluate the suitability of the P/Q mask as a direct replacement for the A13A mask (also known as the MS22001) for general use with the present series of aircrew helmets (i.e., the DH 41-2 jet aircrew helmet). The A13A oxygen mask currently in use in the CAF Air Operations has a number of deficiencies (e.g., slippage under G). Additionally, the A13A is not suited for use in the NFA (i.e., it cannot seal against the requisite positive breathing pressures for high altitude). This report documents the result of this evaluation. The P/Q is superior to all other oxyen masks available in that it is the only mask which can hold the 70-80 mm of pressure deemed necessary for the 'get-me-down' capability of the New Fighter Aircraft. In comparison, the A13A mask with Pate suspension can hold only 30 mm. GRA

N80-25006# Naval Postgraduate School, Monterey, Calif.
A SIMULATOR EVALUATION OF PILOT RESPONSE TO AN AIRCRAFT COCKPIT SPIN INDICATOR SYSTEM M.S. Thesis
James Hunter Aldrich, Jr. Dec. 1979. 112 p. refs.
(AD-A081536) Avail: NTIS HC A06/MF A01 CSCL 01/3

A high-performance aircraft simulator facility employing a two-axis combat maneuvering simulation was used to investigate pilot response to an aircraft cockpit spin indicator system. The time required to correctly respond to departed flight, spin and engine stall indications was measured using F-14 NATOPS procedures. Incorrect and inadequate responses were also recorded. Quantitative and qualitative analysis of sixteen data items was performed for eighteen test subjects during twenty-seven test runs and compiled using eight category classifications. Favorable performance and opinion were obtained. Detailed conclusions and recommendations are presented. GRA

N80-25007# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
DYNAMICS OF MULTI-BODY SYSTEMS
I. H. Mufti. Nov. 1979. 31 p. refs.
(AD-A082436; DME-MK-29; NRC-18017) Avail: NTIS
HC A03/MF A01 CSCL 20/11

The dynamic equations of multi-body systems in the form of open chains are derived by applying the principles of linear and angular momentum to each individual member in the chain. This results in the appearance of constraint forces and torques in the dynamic equations. Using more or less classical approach these unknown forces and torques can be eliminated. Another approach is to approximate these forces by elastic and viscous forces by allowing small violations of the constraints. The well-known elimination procedure leads to a small densely coupled system of equations while the lesser-known procedure of approximating the constraint forces and torques yields a large but less densely coupled system. Both these procedures are first explained in the context of a single rigid body and then applied to a system of rigid bodies in an open chain where each body is coupled directly to at most two neighbors. GRA

N80-25008# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
LIVE SUBJECT EJECTION TOWER TESTING TO DETERMINE HUMAN TOLERANCE TO AN INCREASED ONSET RATE OF ACCELERATION Final Report, Jun. 1970 - Oct. 1972
W. C. Ward, Jr. 31 Oct. 1979. 24 p.
(WF41451402)
(AD-A082993; NADC-79244-60) Avail: NTIS
HC A02/MF A01 CSCL 01/3

The U.S. Navy development of an advanced Minimal

Envelope/Weight (MEW) ejection seat under the auspices of AIR-340, Naval Air System Command (NASC), had as one of its design goals the development of a pure rocket motor as the propulsion system. The finalized propulsion unit produced an acceleration onset of 500 G/sec which exceeded the specification maximum onset rate of 250 G/sec. As a consequence, this study was generated to determine whether the higher onset in combination with a 10 to 12 G acceleration was physiologically acceptable. This report describes the tests conducted in exploration of physiological acceptability of this particular acceleration envelope. The results indicate successful tolerance based on limited exposure of four volunteer subjects. GRA

N80-24685*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE TERRESTRIAL RADIATION ENVIRONMENT AND EVA'S: PREDICTION REQUIREMENTS, MODEL IMPROVEMENTS, AND WARNING SYSTEMS
E. G. Stassinopoulos. *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2. Dec. 1979. p 119-120 (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 05H

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-25009*# Hughes Aircraft Co., Fullerton, Calif.
DESIGN OF A MODULAR DIGITAL COMPUTER SYSTEM Final Summary Report
30 Jan. 1980. 48 p.
(Contract NAS8-27926)
(NASA-CR-161457) Avail: NTIS HC A03/MF A01 CSCL 09B

A Central Control Element (CCE) module which controls the Automatically Reconfigurable Modular System (ARMS) and allows both redundant processing and multi-computing in the same computer with real time mode switching, is discussed. The same hardware is used for either reliability enhancement, speed enhancement, or for a combination of both. E.D.K.

N80-25010*# Virginia Univ., Charlottesville. Dept. of Electrical Engineering.
A POLYMORPHIC RECONFIGURABLE EMULATOR FOR PARALLEL SIMULATION Annual Report
E. A. Parrish, Jr., E. S. McVey, and G. Cook. Apr. 1980. 89 p. refs.
(Grant NsG-1599)
(NASA-CR-163185; UVA/528173/EE80/102) Avail: NTIS HC A05/MF A01 CSCL 09B

Microprocessor and arithmetic support chip technology was applied to the design of a reconfigurable emulator for real time flight simulation. The system developed consists of master control system to perform all man machine interactions and to configure the hardware to emulate a given aircraft, and numerous slave compute modules (SCM) which comprise the parallel computational units. It is shown that all parts of the state equations can be worked on simultaneously but that the algebraic equations cannot (unless they are slowly varying). Attempts to obtain algorithms that will allow parellel updates are reported. The word length and step size to be used in the SCM's is determined and the architecture of the hardware and software is described. J.M.S.

N80-25011# Sperry Univac, Roseville, Minn.
DATA BASE COMPUTER RESEARCH Final Report, 1 Sep. 1978 - 31 Aug. 1979
Harvey A. Freeman, J. Banerjee, R. B. Batman, D. H. Bray, H. R. Johnson, J. R. Jordan, J. L. Larson, T. M. P. Lee, D. B. Russell, and T. B. Wilson. 30 Nov. 1979. 120 p. refs.
(Contract N00014-78-C-0487)
(AD-A082074; TMA-00789) Avail: NTIS HC A06/MF A01 CSCL 09/2

Data base computer research was undertaken by Sperry Univac to confirm the benefits of the DBC approach, and to determine the actual requirements of a data base computer from a computer manufacturer's point of view. Described in this report are an application investigation and analysis effort, a revised and extended data base computer design, the required software structure, a performance analysis, and some access control and security considerations. The result is a framework for a special purpose computer that will significantly improve the user's ability to manage the ever growing body of data characteristic of our modern technological society. GRA

N80-25012# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
JETS: ACHIEVING COMPLETENESS THROUGH COVERAGE AND CLOSURE
Tim Finin, Bradley Goodman, and Harry Tennant. 8 Feb. 1979. 27 p. refs.
(Contract N00014-75-C-0612)
(AD-A081957; WP-19) Avail: NTIS HC A03/MF A01 CSCL 05/8

Work in progress on JETS, the successor to PLANES, is described. JETS is a natural language question answering system that is intended to interface users to a large relational data base. The architecture is designed to extend the conceptual coverage of JETS to better meet the conversational and data base usage requirements of users. The implementation of JETS is designed to gain a high degree of closure over concept manipulation, contributing to a solution to the problems of perspicuity and scale. Specific examples are given of concept manipulation through the implied relationships of modification and of an approach to problem-solving through the use of frames. GRA

N80-25013# Ohio State Univ. Research Foundation, Columbus.
FINITE STATE MODELS OF MANNED SYSTEMS: VALIDATION, SIMPLIFICATION AND EXTENSION Annual Report, 1 Oct. 1978 - 30 Sep. 1979
Richard A. Miller. Nov. 1979. 139 p. ref.
(Grant AF-AFOSR-0015-79; AF Proj. 2312)
(AD-A082434; AFOSR-80-0216TR) Avail: NTIS HC A07/MF A01 CSCL 09/2

Three basic research objectives were pursued. An assessment of the robustness and validity of previously developed discrete control models resulted in a comprehensive examination of the conceptual and methodological issues associated with validity. This work is included in the report. Work on computer assisted discrete control analysis focused primarily on the problems associated with representing continuous data in a form suitable for use by existing analysis routines. Additional work on modelling discrete control tasks, including modelling coordination in small trams was also performed and resulted in two papers which are included as appendices to the report. GRA

N80-25014# California Univ., Livermore. Lawrence Livermore Lab.

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S-1 PROJECT: DEVELOPING HIGH-PERFORMANCE DIGITAL COMPUTERS
L. C. Widdoes, Jr. 11 Dec. 1979 12 p refs Presented at the COMPCON Spring 1980 Meeting, San Francisco, Feb. 1980; sponsored by the IEEE Computer Soc.
(Contract W-7405-eng-48)
(UCRL-83702; CONF-800201-5) Avail: NTIS HC A02/MF A01

The design and implementation of a multiprocessor (the S-1) with at least ten times the computational power of the Cray-1 is described. The multiprocessor is made up of 16 of these uniprocessors, sharing a main memory. The uniprocessors can be used together for large problems or separately for several smaller problems. To reduce average memory-access time, each uniprocessor has a private cache memory. A powerful design system (SCALD) that supports extremely efficient structured design of digital logic was also developed. Using advanced compiler and verification techniques, SCALD can complete the details of a computer design starting from a high-level specification. DOE

N80-25015# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
A DIGITAL LOW FREQUENCY SPECTRUM ANALYZER, USING A PROGRAMMABLE POCKET CALCULATOR
W. P. Spruit. Jun. 1978 37 p refs
(TH-78-E-85; ISBN-90-6144-085-8) Avail: NTIS HC A03/MF A01

A measuring instrument utilizing Texas Instruments calculators (SR 52 or SR 56) is described. An application as a digital noise measuring system is discussed in detail. The instrument makes use of an input-output processor for the SR 52/56, developed by Verkroost, for which the design and testing of print lay-outs are reported. Results concerning sine-wave and noisy input signals are presented. For this application, the system shows no significant differences in properties with respect to the analog filters normally used for audio frequencies. The frequency range is, however, restricted to about 0.1 Hz, upper limit. Author (ESA)

N80-25016# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
DATA ACQUISITION SYSTEM BASED ON THE RCA 1802 MICROCOMPUTER [SISTEMA DI ACQUISIZIONE DATI BASATO SUL MICROCALCOLATORE RCA 1802]
P. Carulli-Irelli. Jul. 1978 44 p refs Partly in ITALIAN and ENGLISH
(LPS-79-7) Avail: NTIS HC A03/MF A01

A data acquisition system is described. The system was implemented by adding to the RCA cosmac evaluation kit CDP 185020 an EPROM 2716 containing the BASIC interpreter, an EPROM 2716 with software for input-output management, an output gate of 8 bits in parallel, and an 8 bit A-D converter with 16 input channels. Author (ESA)

N80-25017# Royal Signals and Radar Establishment, Malvern (England).
MACHINE INDEPENDENT COMPILER FOR ATLAS (MICA)
D. P. Taylor. London HMSO Apr. 1979 16 p refs
(RSRE-Memo-3167; BR67746) Avail: NTIS HC A02/MF A01

A number of software modules and a software building technique, known as a Machine Independent Compiler for 'ATLAS' (MICA) are described. The Abbreviated Test Language for All Systems (ATLAS) is a high-level computer language convenient for writing test specifications. Some language handling software systems shown include a translator, compiler, cross-compiler, interpreter, and assembler. The concept of MICA as a collection of computer programs and fully developed manual as well as automatic techniques which potentially enable an ATLAS compiler to be constructed for any project is then presented. Author (ESA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-25018*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
COMPUTER PROGRAM DOCUMENTATION: RAW-TO-PROCESSED SINDA PROGRAM (RTOPHS) USER'S GUIDE
S. J. Damico. Apr. 1980 10 p
(Contract NAS9-15800)
(NASA-CR-160654; LEMSCO-14860; JSC-16673) Avail: NTIS HC A02/MF A01 CSCL 09B

Use of the Raw to Processed SINDA(System Improved Numerical Differencing Analyzer) Program, RTOPHS, which provides a means of making the temperature prediction data on binary HSTFLO and HISTRY units generated by SINDA available to engineers in an easy to use format, is discussed. The program accomplishes this by reading the HISTRY unit and according to user input instructions, the desired times and temperature prediction data are extracted and written to a word addressable drum file. E.D.K.

N80-25019*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
COMPUTER PROGRAM DOCUMENTATION: ODRC DEMAND PLOTTING PROGRAM USER'S GUIDE
S. J. Damico. Apr. 1980 39 p
(Contract NAS9-15800)
(NASA-CR-160653; JSC-16664; LEMSCO-14847) Avail: NTIS HC A03/MF A01 CSCL 09B

The Orbital Data Reduction Center (ODRC) Demand Plotting Program provides the user with three main options, each of which provides the additional option of generating a numerical summary and/or plots for the Measurement ID's (MID) on the Measurement Node Correlation (MNC) list. Option one reads MID data from word addressable ODRC files, stores the data on a temporary file, and uses it to build the numerical summary and/or plots, according to user input instructions. Options two and three read MID data from a word addressable ODRC file and component node data from a word addressable HSTFLO or HISTRY file. The component node data is used to calculate a predicted MID. Then, for option two, the MID and predicted MID data is used to generate a numerical summary and/or plots. For option three, the component node data itself is used in generating the numerical summary and/or plots. The numerical summary is sent to the BRKPT file, RELOCOK, and can be viewed after the execution of the program using the edit mode to find the desired section of the summary. E.D.K.

N80-25020*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
COMPUTER PROGRAM DOCUMENTATION D1FLTD TO DRIVE SINDA BOUNDARY NODES: USER'S GUIDE
S. J. Damico. Apr. 1980 8 p refs
(Contract NAS9-15800)
(NASA-CR-160652; LEMSCO-14846; JSC-16683) Avail: NTIS HC A02/MF A01 CSCL 09B

The thermal model correlation process begins when measured thermocouple data is available from the orbital flight tests of the shuttle. For this effort, it is necessary to convert some of the system improved numerical differencing analyzer (SINDA) diffusion or arithmetic nodes to boundary nodes and then drive these boundary nodes to the temperature profile of a flight measurement. An efficient way to provide this capability within the SINDA and OFT software systems is to provide a new SINDA routine, D1FLTD, for use in VARIABLES 1 of SINDA, to access the processed (word-addressable) orbital data reduction center flight data and store the appropriate measurement temperature in the desired SINDA temperature location. The ODRC flight data that is to be used for driving the boundary nodes must be assigned a logical unit number and must reside on a word-addressable file. The user must also provide two SINDA constants for the word positions of the first and last words of the temperature record for each measurement identifier (MID), i.e. each call to D1FLTD, used in the model. D1FLTD is then called from the VARIABLES 1 block to obtain the SINDA boundary node temperature for any MID on the file at any time point. A.R.H.

N80-25021*# Science Systems and Applications, Inc., Lanham, Md.
A COMPUTER ALGORITHM FOR PERFORMING INTERAC-

TIVE ALGEBRAIC COMPUTATION ON THE GE IMAGE-100 SYSTEM Final Report
William D. Hart and H. H. Kim 1979 32 p refs
(Contract NAS5-25113)
(NASA-CR-159985) Avail: NTIS HC A03/MF A01 CSCL 09B

A subroutine which performs specialized algebraic computations upon ocean color scanner multispectral data is presented. The computed results are displayed on a video display. The subroutine exists as a component of the aircraft sensor analysis package. The user specifies the parameters of the computations by directly interacting with the computer. A description of the conversational options is also given. M.G.

N80-25022# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AN ALTRAN PROGRAM FOR FINDING A RECURSION FORMULA FOR THE GEGENBAUER MOMENTS OF A FUNCTION
Neil Robertson Jul. 1979 62 p refs
(CSIR-SR-SWISK-12) Avail: NTIS HC A04/MF A01

An ALTRAN program is described that constructs a recurrence relation for the Gegenbaure moments of a function. The algorithm is expressed in terms of a certain type of linear operator. The implementation of the algorithm on to the ALTRAN language is described. M.G.

N80-25023# Naval Postgraduate School, Monterey, Calif.
A PORTABLE THREE-DIMENSIONAL COMPUTER GRAPHICS SOFTWARE PACKAGE M.S. Thesis
Homer John Rood, Sr. Sep. 1978 273 p refs
(AD-A081037) Avail: NTIS HC A12/MF A01 CSCL 09/2

A portable three-dimensional computer graphics software package was developed utilizing the FORTRAN language. The package included the capability of displaying any object as a wire-frame image, as a wire-frame image with hidden lines removed, or as a solid figure with hidden surfaces removed. This computer graphics package provides the user with the ability to rotate, scale, and translate any part of the displayable image. It was utilized to display images on four distinct display devices with only minor software alterations. Three totally different host computer supported the four display devices. GRA

N80-25024# Stanford Univ., Calif. Electronics Lab.
DESIGN AND VERIFICATION OF RELIABLE SOFTWARE Final Report, 1 Jan. 1977 - 31 Dec. 1979
Susan S. Owicki 29 Feb. 1980 13 p refs
(Contract F49620-77-C-0045; AF Proj. 2304)
(AD-A082545; AFOSR-80-0232TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This research project is concerned with methods for developing provably correct concurrent programs. Two complementary approaches have been pursued. The first is the development of basic tools for describing and verifying concurrent interactions between system components. Specification and proof methods have been developed for both invariant properties and service guarantees of modular programs. They allow independent verification of each module, and provide a basis for reasoning about a wide class of concurrent systems. Statemeogic, a logical system in which one can reason about the future states of a program computation. GRA

N80-25025# University of Southern California, Marina del Rey. Information Sciences Inst.
MICROCODE VERIFICATION PROJECT Interim Report
Stephen D. Crocker, Leo Marcus, and Dono Van-Mierop Jan. 1980 63 p refs
(Contract F30602-78-C-0008; AF Proj. 5581)
(AD-A082481; RADC-TR-79-353) Avail: NTIS HC A04/MF A01 CSCL 09/2

The goal of the microcode verification project at ISI is the development of both the theory and tools for verification of microcode. The strategy has been to push the development of a working system, letting the theoretical issues and the human engineering questions emerge during system development. The ISPS language is used for encoding our machine descriptions. The State Delta formalism is used for reasoning about the course of the computation. A system to check proofs of microcode validity is currently built. The system is composed of a data base and simplifier that perform some automatic deductions to make checking of the proofsteps manageable, as well as a proof language and a user interface. A particular computer (the FTSC) is used to establish a focus for the project and to provide a source of examples. This document reports the results of verifying the microcode of the square root instruction of the FTSC, and the results of verifying the complete microcode of a much smaller fictitious example machine. GRA

N80-25026# Oak Ridge National Lab., Tenn. Chemistry Div.
COMPUTER-GENERATED ILLUSTRATIONS
C. K. Johnson 1979 10 p refs
(Contract W-7405-eng-26)
(DOE/TIC-11057) Avail: NTIS HC A02/MF A01

The computer graphics technique is one of the best available methods for analyzing and communicating complex results revolving crystallographic structural information. The types of commercial equipment available for use in crystallographic computer graphics and the commitment needed from the user of typical operational configurations are discussed. The Oak Ridge Crystallographic Imaging and Graphics System is given as an example configuration for stepwise interactive graphics and image processing. The applications of computer graphics to crystallography described are density map representation, particularly by critical point networks, and the drawing of crystal structures. The various types of line drawings and surface illustrations currently in use are discussed, and two solutions of the hidden line problem for thermalellipsoid drawings are compared. DOE

N80-25027# Sandia Labs., Livermore, Calif. Computer Applications Div.
QPLOT: A LIBRARY OF FORTRAN SUBROUTINES FOR QUICK LOOK DATA GRAPHING
H. G. Short Nov. 1979 23 p
(Contract EY-76-C-04-0789)
(SAND-79-8278) Avail: NTIS HC A02/MF A01

A set of FORTRAN compatible data plotting subroutines, QPLOT, provides a simplified method of data representation for those applications that do not require presentation quality graphics. It is a stand alone plot package and does not require knowledge of any other graphics software system. DOE

N80-25028# Royal Aircraft Establishment, Farnborough (England).
A USER'S GUIDE TO THE RAE GRAPH PLOTTER LIBRARY
B. E. Taylor London HMSO Jul. 1979 192 p refs
(RAE-TR-79098; RAE-Math-Comp-234; BR71045) Avail: NTIS HC A09/MF A01

The graph plotter library written to meet Royal Aircraft Establishment requirements for the production of drawings, graphs, and charts is described. The library is intended for use with either the ICL 1934 range of incremental drum plotters or the Calcomp 905/936 incremental drum plotter. The utilization of the library is shown and specifications of the routines contained in the library are given. Author (ESA)

N80-25029# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
MICROPROGRAMMED FAST FOURIER TRANSFORM FOR THE VARIAN V73 AND ITS APPLICATION IN INTERACTIVE PICTURE PROCESSING
Magnus Persson 1979 31 p refs
(TRITA-NA-7915) Avail: NTIS HC A03/MF A01

A Fast Fourier Transform machine was designed and implemented on a Varian V73 minicomputer by means of microprogramming. The machine consists of eight transform instructions and five miscellaneous ones. The implementation is discussed and a detailed description of the Fast Fourier Transform machine itself is given. Some examples of use of the machine in digital picture processing are shown. Simple digitized pictures and their corresponding power spectra are displayed. A few filtering operations on a digitized picture indicate the capability of the machine. The utilization of the machine in an interactive environment is discussed and a computer architecture for digital picture processing, is suggested. Author (ESA)

N80-25030# Stichting Mathematisch Centrum, Amsterdam (Netherlands).
CHECKING LANDAU'S GRUNDLAGEN IN THE AUTOMATH SYSTEM
L. S. vanBenthemJutting 1979 133 p refs
(MCT-83; ISBN-90-6196-147-5) Avail: NTIS HC A07/MF A01; Stichting Math. Centrum, Amsterdam FL 15

An account of the translation of E. Landau's book Grundlagen der Analysis into AUTOMATH language is given. The version of this language used, AUT-QE, is formally defined and described in detail. Specific difficulties encountered in making the translation are discussed and the strategies applied to overcome them are shown. Results substantiate the claim that formalization and verification can really be carried out for substantial portions of mathematics with a language more closely resembling intuitive mathematics then other present day formalizations, and which is fit for describing a large variety of concepts and situations. Author (ESA)

N80-25031# Stichting Mathematisch Centrum, Amsterdam (Netherlands).
ALGOL 68 TRANSPUT. PART 2: AN IMPLEMENTATION MODEL
J. C. vanVliet 1979 230 p refs
(MCT-111; ISBN-90-6196-179-3) Avail: NTIS HC A11/MF A01; Stichting Math. Centrum, Amsterdam FL 27

An implementation model of the ALGOL 68 transput is reviewed. It is scrutinized to ensure that it correctly interprets the transput as defined. This model is shown to be an effective basis for actual implementation of the transput. Author (ESA)

N80-25032# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
EFFICIENT IMPLEMENTATION OF DYNAMIC PROGRAMMING ALGORITHMS FOR SEQUENCING PROBLEMS
E. L. Lawler (California Univ. Berkeley) May 1979 19 p refs
Submitted for publication Sponsored in part by NATO
(Grant NSF MCS-76-17605)
(MC-BW-106/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2,88

Dynamic programming is shown to be a fruitful approach for the solution of a variety of sequencing problems, including single machine sequencing problems and assembly line balancing problems. Certain technical difficulties experienced in fully exploiting the reduction in computational complexity which should result from the existence or precedence constraints in these problems are addressed. In particular, a satisfactory technique for generating 'feasible' sets of jobs, as determined by precedence constraints is considered. A simple computer implementation of the dynamic programming algorithms which overcase these difficulties is present. The implementation permits sequencing problems with precedence constraints to be solved in O (kn) time, where k is the number of feasible sets, and in O (n+k sub max) space, where k sub m is the number of feasible sets of size m and k sub max = max sub m k sub m. It is also shown how similar techniques can be applied to improve the efficiency of dynamic programming computations for the traveling salesman problem when the network is sparse or when there are precedence constraints. Author (ESA)

N80-25033# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
THE INSTALLATION OF ALICE ON THE PDP 11/45 UNDER UNIX
A. P. W. Boehm Jan. 1978 70 p refs
(MC-IW-94/78) Avail: NTIS HC A04/MF A01; Stichting Math. Centrum, Amsterdam FL 6,72

The implementation of ALICE on the PDP 11/45 under UNIX is discussed. The ALICE to assembly language translator and the run time system are described. The performance of the implementation is compared to C, the system implementation language of UNIX. Results show that the efficiency of the calling mechanism implementation is sufficient. Author (ESA)

N80-25034# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
A W-GRAMMAR OF ALEPH
R. Glandorf, D. Grune, and J. Verharen Nov. 1978 38 p refs
(MC-IW-100/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5,00

A VW-grammar (2 level grammar) of the programming language ALEPH is presented. It comprises a context-free grammar, plus all static restrictions. Some comments on the problems encountered in writing and debugging a W-grammar are given. This paper should be read in parallel with the ALEPH manual, since by itself it does not define or explain the language. Author (ESA)

N80-25035# Royal Aircraft Establishment, Farnborough (England).
CREATION AND MODIFICATION OF FLOW CHARTS USING AN INTERACTIVE GRAPHICS SYSTEM
G. Sharples London HMSO Sep. 1979 68 p refs
(RAE-TR-79113; RAE-Math-Comp-235; BR71907) Avail: NTIS HC A04/MF A01

A system for creating, storing, and modifying flow charts using a Vector General display linked to a PDP 11 minicomputer is described. On completion the flow charts can be directed to a plotter, the resulting output being suitable for inclusion in reports or documentation. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N80-25036# California Univ., Livermore. Lawrence Livermore Lab.
HIERARCHICALLY STRUCTURED DISTRIBUTED MICROPROCESSOR NETWORK FOR CONTROL
J. R. Greenwood, F. W. Holloway, P. R. Rupert, R. G. Ozarski, and G. J. Suski 6 Jul. 1979 13 p Presented at the 13th Rocky Mountain Symp., Fort Collins, Colo., 19-21 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-82936; CONF-7908104-1) Avail: NTIS HC A02/MF A01

To satisfy a broad range of control analysis, and data acquisition requirements for Shiva, a hierarchical, computer based, modular distributed control system was designed. This system handles the more than 3000 control elements and 1000 data acquisition units in a severe high voltage, high current environment. The control system design gives one a flexible and reliable configuration to meet the development milestone for Shiva within critical time limits. DOE

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-25037 Stanford Univ., Calif.
SIMULATING GENERALIZED SEMI-MARKOV PROCESSES
Ph.D. Thesis
Lawrence Duane Fossett 1980 105 p
Avail: Univ. Microfilms Order No. 8011636

The generalized semi-Markov process (GSMP) supplements the natural description of a system by adding information about the past history of the system. If a queueing network occupies a state where only one event can change the state of the system, the process behaves the same way each time it leaves this state. For GSMPs without such a state, stringent assumptions are required on the supplementary variables to develop a central limit theorem for the GSMP. By endowing the GSMP with a memory of a finite number of steps, an iterate of its transition function can be split into a state invariant measure and a state dependent remainder. These measures can be used to define a regenerative process which has a coordinate with the same marginal distribution as the original GSMP, however, it is not suitable for simulation applications because the remainder cannot be determined explicitly in most cases. A supplementary variables technique is developed which requires only a sequence of Bernoulli

random variables. The central limit theorem and variance estimation technique developed, provided a method of determining confidence intervals for functions of the equilibrium behavior of many complex stochastic systems. Dissert. Abstr.

N80-25038*# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
ROBUSTNESS PROPERTIES OF DISCRETE TIME REGULATORS, LOG REGULATORS AND HYBRID SYSTEMS Final Report
Gunter Stein and Michael Athans 31 Oct. 1979 69 p refs (Grant NsG-1312)
(LIDS-FR-960; NASA-CR-163313) Avail: NTIS HC A04/MF A01 CSCL 12A

Robustness properites of sample-data LQ regulators are derived which show that these regulators have fundamentally inferior uncertainty tolerances when compared to their continuous-time counterparts. Results are also presented in stability theory, multivariable frequency domain analysis, LQG robustness, and mathematical representations of hybrid systems. J.M.S.

N80-25039*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REALIZABLE OPTIMAL CONTROL FOR A REMOTELY PILOTED RESEARCH VEHICLE
H. J. Dunn May 1980 35 p refs
(NASA-TP-1654; L-13403) Avail: NTIS HC A03/MF A01 CSCL 01C

The design of a control system using the linear-quadratic regulator (LQR) control law theory for time invariant systems in conjunction with an incremental gradient procedure is presented. The incremental gradient technique reduces the full-state feedback controller design, generated by the LQR algorithm, to a realizable design. With a realizable controller, the feedback gains are based only on the available system outputs instead of being based on the full-state outputs. The design is for a remotely piloted research vehicle (RPRV) stability augmentation system. The design includes methods for accounting for noisy measurements, discrete controls with zero-order-hold outputs, and computational delay errors. Results from simulation studies of the response of the RPRV to a step in the elevator and frequency analysis techniques are included to illustrate these abnormalities and their influence on the controller design. Author

N80-25040# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
A COMPARISON OF NUMERICAL METHODS FOR IDENTIFICATION AND OPTIMIZATION PROBLEMS INVOLVING CONTROL SYSTEMS WITH DELAYS
H. T. Banks, J. A. Burns (Virginia Polytechnic Inst. and State Univ.) E. M. Cliff (Virginia Polytechnic Inst. and State Univ.). Nov. 1979 189 p refs Prepared in cooperation with Virginia Polytechnic Inst. and State Univ.
(Contract DAAG29-79-C-0161; Grants AF-AFOSR-3092-76; DAAG29-78-G-0125; NSF MCS-79-05774; AF Proj. 2304)
(AD-A082151; LCDS-TR-79-7; AFOSR-80-0146TR) Avail: NTIS HC A09/MF A01 CSCL 12/1

This report presents numerical results for two approximation techniques for functional differential control systems. One technique is based on an averaging scheme, the other on spline approximations. A number of examples are considered and the techniques are applied to parameter estimation problems and optimal control problems where the systems are given by differential equations with hereditary terms. GRA

N80-25041# Old Dominion Univ., Norfolk, Va. Dept. of Electrical Engineering.
RESULTS ON CUMULANT CONTROL AND ESTIMATING SYSTEMS. A SUMMARY Final Report, 16 May 1978 - 31 Dec. 1979
Stanley R. Liberty and Clifford R. Parten Mar. 1980 16 p refs
(Contract N00014-78-C-0443)
(AD-A082077) Avail: NTIS HC A02/MF A01 CSCL 12/1

A description of a previously unpublished linear stochastic control problem class called 'cumulant control' is presented. A summary of an 'accessible state' formulation of problems in this class is given. This result is key to the applicability of this generalized Linear-Quadratic-Gaussian theory. GRA

N80-25042# California Univ., Santa Barbara. Inst. of Algebra and Combinatorics.
BASIC RESEARCH IN THE MATHEMATICAL FOUNDATIONS OF STABILITY THEORY, CONTROL THEORY AND NUMERICAL LINEAR ALGEBRA Annual Scientific Report, 1 Oct. 1978 - 30 Sep. 1979
Marvin Marcus, Morris Newman, Robert C. Thompson, Roy B. Leipnik, and Henryk Minc Sep. 1979 25 p refs
(Contract F49620-78-C-0030; AF Proj. 2304)
(AD-A082067; AFOSR-80-0166TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Research under the following general headings was concluded: (1) Eigenvalue inequalities (Marcus, Thompson); (2) Numerical range calculations (Marcus); (3) Exact solutions of integral systems of linear equations (Newman); (4) Experiments on the ILLIAC IV, Sunnyvale, CA (Newman); (5) The Campbell Baker Hausdorff formula (Thompson); (6) Rearrangement inequalities and determinant bounds (Minc); (7) Non-linear control in 3 x 3 linear systems (Leipnik). GRA

N80-25043# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
RECENT DEVELOPMENTS IN THE ROBUSTNESS THEORY OF MULTIVARIABLE SYSTEMS. PROCEEDINGS OF THE ONR/MIT WORKSHOP Final Report
Nils R. Sandell, Jr., ed. 31 Aug. 1979 457 p refs Workshop held in Cambridge, Mass., 25-27 Apr. 1979
(Contract N00014-79-C-0377)
(AD-A082362; LIDS-R-954; ONR-CR-215-271-1F) Avail: NTIS HC A20/MF A01 CSCL 12/1

This report summarizes the recent developments in the Robustness Theory of Multivariable Systems. The motivation for the workshop was the dissemination and discussion of recent research results concerning the characterization of robust multivariable feedback systems, defined here as systems that perform satisfactorily despite differences between the mathematical model used for control synthesis and the actual dynamics, and the design of such systems. The report describes the motivation for the theoretical developments and the nature of the results that have been obtained. An introductory discussion of the papers presented at the workshop is provided; the papers themselves are included in an Appendix. Finally, the research directions identified in a roundtable discussion held at the end of the workshop are summarized. GRA

N80-25044# Stanford Univ., Calif. Dept. of Operations Research.
REGENERATIVE SIMULATION OF RESPONSE TIMES IN NETWORKS OF QUEUES
Donald L. Iglehart and Gerald S. Shedler Nov. 1979 211 p refs
(Contract N00014-76-C-0578; Grants NSF MCS-75-23607; NSF MCS-79-09139; NR Proj. 042-343)
(AD-A082736; SU-TR-52) Avail: NTIS HC A10/MF A01 CSCL 12/2

Networks of queues occur frequently in diverse applications. In particular, they are widely used in studies of computer and communication system performance as models for the interactions among system resources. This monograph deals with mathematical and statistical methods for discrete event simulation of networks of queues. The emphasis is on methods for the estimation of general characteristics of 'passage times' in closed networks. Informally, a passage time is the time for a job to traverse a portion of a network. Such quantities, calculated as random sums of queueing times, are important in computer and communication system models where they represent job response times. GRA

N80-25045# Los Alamos Scientific Lab., N. Mex.
ADAPTIVE OPTIMAL CONTROL: AN ALGORITHM FOR DIRECT DIGITAL CONTROL
Donald R. Farris and Thomas E. McDonald 1980 32 p refs Presented at the Semiann. Meeting of ASHRAE, Los Angeles, 3-7 Feb. 1980
(Contract W-7405-eng-36)
(LA-UR-79-1897; CONF-800206-1) Avail: NTIS

HC A03/MF A01

An algorithm developed for applying advanced control concepts in heating, ventilating, and air conditioning systems is described. The algorithm uses optimal control and is adaptive in nature. Simulations for a solar heated and cooled building indicate that use of this algorithm can accomplish a substantial savings in auxiliary energy consumption. Its application is illustrated with a simple example. Simulation results for a more complex system are presented. The hardware, including the digital computer, needed to implement this algorithm is briefly discussed. DOE

N80-25046# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Automatic Control.

EXPERIMENT DESIGN FOR MAXIMUM-POWER MODEL VALIDATION

Ludomir Rewo 1979 27 p refs

(TRITA-REG-7902) Avail: NTIS HC A03/MF A01

The problem of input signal selection for the testing of dynamic models is considered and the specific maximum power used is described. Some computational aspects are discussed and a simple example is given. Author (ESA)

N80-25047# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Automatic Control.

THE MULTILEVEL RANDOM WALK BETWEEN REFLECTING BARRIERS: A NEW TYPE OF TEST SIGNAL FOR THE IDENTIFICATION OF NONLINEAR PROCESSES

N. A. Lindberger 1979 45 p refs

(TRITA-REG-7903) Avail: NTIS HC A03/MF A01

The generalized multilevel random walk between symmetric reflecting barriers is defined as a random walk process which allows jumps between any pair of a finite number of discrete levels with probabilities specified by a Markov matrix, as distinguished from the simple random walk commonly described in the literature in which jumps are allowed only to adjoining levels. The simple, as well as the generalized processes, are analyzed with respect to their covariance and spectral properties. It is shown that, in this respect, in spite of their nonlinear feature of having a limited amplitude they are spectrally equivalent to the linear autoregressive moving-average stochastic process. The amplitude limitation gives them an advantage over the autoregressive moving-average process for use as test signals for dynamical systems. Concerning suitabilty for identification it turns out in case studies that almost any stable realization allows for linear parameter estimation with high accuracy, without any noticable trends of differences in quality between the different signal families that can be obtained by the choice of transition probabilities in the stochastic matrix. Author (ESA)

N80-25048# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.

COMPUTATION OF THE STATIONARY DISTRIBUTION OF THE QUEUE SIZE IN AN M/G/1 QUEUEING SYSTEM WITH VARIABLE SERVICE RATE

A. Federgruen and H. C. Tijms (Free Univ., Amsterdam) Jan. 1979 11 p refs Submitted for publication

(MC-BW-97/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 6

A simple and computationally tractable method which recursively computes the stationary probabilities of the queue size in an M/G/1 queueing system with variable service rate is presented. For each service two possible service types are available and the service rule is characterized by two switch-over levels. Results show that the computational approach discussed can be applied to a variety of queueing problems. Author (ESA)

N80-25049# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.

A UNIFIED STEADY-STATE ANALYSIS FOR CONTROLLED MARKOV DRIFT PROCESSES IN INVENTORY, QUEUEING AND REPLACEMENT PROBLEMS

H. C. Tijms Jan. 1979 13 p refs Submitted for publication

(MC-BW-98/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A simple and unified approach for the steady-state analysis of a class of controlled Markov drift processes involving compound Poisson processes and arising in various applications areas, such as inventory production, queueing, and replacement systems, is presented. Three specific problems are studied. These are a finite capacity queueing-storage problem with variable input and output rates, a finite capacity production-inventory problem with variable demand and production rates, and a replacement problem under additive damage with variable damaging rates. In these problems the drift parameters of the underlying stochastic processes can be controlled, while the control rule considered is characterized by two switchover levels. Results are used to find a formula for the long run average expected costs per unit time. This also leads to the definition of operating characteristics, the stationary probability distribution of the state of the system, and the average number of switchovers and overflows per unit time.

Author (ESA)

N80-25050# Stichting Mathematisch Centrum, Amsterdam (Netherlands).

PREEMPTIVE SCHEDULING OF UNIFORM PARALLEL MACHINES TO MINIMIZE THE WEIGHTED NUMBER OF LATE JOBS

E. L. Lawler (California Univ., Berkeley) May 1979 23 p refs Submitted for publication Sponsored in part by NATO

(Grant NSF MCS-76-17605)

(MC-BW-105/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2.88

The possibility of preemptively scheduling n jobs on m uniform parallel machines so as to minimize the weighted number of late jobs in time of O(W exp 2 N exp 2), for M = 2, and of O(W exp 2, n exp (3m-5), for M > or = 3, where W is the sum of the integer weights of the jobs is shown. For fixed m this constitutes a pseudopolynomial time bound, and for fixed m and unweighted jobs i.e., W = n, a strictly polynomial time bound. It is also shown that for fixed m there is a fully polynomial approximation scheme. Preemptive scheduling procedures are then derived to which dynamic programming techniques are applied. Run time results confirm the validity of the scheduling scheme.

Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-25051 Stanford Univ., Calif.

ALGORITHMIC EQUIVALENCE IN QUADRATIC PROGRAMMING Ph.D. Thesis

Arthur Diang 1980 213 p

Avail: Univ. Microfilms Order No. 8011626

Algorithms for solving the quadratic programming problem (QP) of minimizing a real valued quadratic function subject to linear inequality constraints is considered. The case of problem QP in which the objective function f(x) is strictly convex is examined. A method called the active set algorithm is described, and a number of procedures for solving QP are shown to be realizations of the method and are therefore equivalent. The case in which f(x) is a general quadratic function is also discussed. The relationship between active set methods and pivoting algorithms for general quadratic programming is discussed, and additional equivalence results are proved. A special case of QP known as the least distance programming problem is examined. For this problem relationships among active set, pivoting, and simplicial decomposition algorithms are demonstrated.

Dissert. Abstr.

N80-25052 Texas Univ. at Austin.

A PENALTY METHOD FOR THE FINITE ELEMENT ANALYSIS OF CERTAIN UNILATERAL PROBLEMS IN VON KARMAN PLATE THEORY Ph.D. Thesis

Kunihiko Ohtake 1979 169 p

Avail: Univ. Microfilms Order No. 8009906

Penalized variational equations governing a class of nonlinear plate problems with unilateral contact conditions are formulated using the von Karman theory of large deflections of elastic plates. Two classes of problems are considered, the plate with fixed edges, and the problem of simply supported plates with thrust. Existence, uniqueness and regularity of solutions to these problems are discussed based on pseudomonotone operator theory. A finite

element approximation scheme is proposed based on penalty arguments. The convergence of approximate solutions to solutions of the variational problems is proved. A computational method is introduced which employs Fraeijs de Veubeke's plate bending element, a Newton-Raphson iteration scheme, and a penalty method. The results of several numerical experiments are given which indicate that the methods developed are quite effective for problems of this type. Dissert. Abstr.

N80-25053 Catholic Univ. of America, Washington, D. C.
IMPROVEMENT OF THE CONSTRAINED VARIATIONAL METHOD Ph.D. Thesis
Frederick Albert Schumann 1980 76 p
Avail: Univ. Microfilms Order No. 8010941

A method for the approximate solution of boundary value differential equations and the extension of an existing variational method that provides a solution for secondary variables and derivatives in addition to the primary variable(s) is discussed. Both methods are categorized as constrained variational methods. The first method, Galerkin with constraints, utilizes Lagrangian multipliers as holonomic constraints to provide for all boundary conditions that are not satisfied by the selected trial function. The second method employs Lagrangian multipliers as non-holonomic constraints that introduce additional variables or derivatives of variables to the same formulation. The constrained Galerkin method is not limited to a conservative system. The applied differential operators of interest need not be either self adjoint or positive definite. The exact solution of a base problem is also not required. Thus the field of applicable problems is significantly enhanced. Dissert. Abstr.

N80-25054*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF A MULTI-LEVEL GRID METHOD TO TRANSONIC FLOW CALCULATIONS
Jerry C. South, Jr. and Achi Brandt (Weizmann Inst. of Science) 19 Mar. 1976 30 p refs
(Grant NGR-47-102-001)
(NASA-TM-81066; ICASE-76-8) Avail: NTIS HC A03/MF A01 CSCL 12A

A multi-level grid method was studied as a possible means of accelerating convergence in relaxation calculations for transonic flows. The method employs a hierarchy of grids, ranging from very coarse to fine. The coarser grids are used to diminish the magnitude of the smooth part of the residuals. The method was applied to the solution of the transonic small disturbance equation for the velocity potential in conservation form. Nonlifting transonic flow past a parabolic arc airfoil is studied with meshes of both constant and variable step size. E.D.K.

N80-25055*# Santa Clara Univ., Calif. Dept. of Mechanical Engineering.
ON ONE-DIMENSIONAL STRETCHING FUNCTIONS FOR FINITE-DIFFERENCE CALCULATIONS Final Technical Report, 1 Jul. 1978 - 30 Jun. 1979
Marcel Vinokur 1979 55 p refs
(Grant NsG-2086)
(NASA-CR-163136) Avail: NTIS HC A04/MF A01 CSCL 12A

The class of one-dimensional stretching functions used in finite-difference calculations is studied. For solutions containing a highly localized region of rapid variation, simple criteria for a stretching function are derived using a truncation error analysis. These criteria are used to investigate two types of stretching functions. One is an interior stretching function, for which the location and slope of an interior clustering region are specified. The simplest such function satisfying the criteria is found to be one based on the inverse hyperbolic sine. The other type of function is a two-sided stretching function, for which the arbitrary slopes at the two ends of the one-dimensional interval are specified. The simplest such general function is found to be one based on the inverse tangent. A.R.H.

N80-25056*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INVERSION AND APPROXIMATION OF LAPLACE TRANSFORMS
William M Lear (TRW) 19 May 1980 37 p
(NASA-TM-81064; JSC-16499; Rept-80-FM-20) Avail: NTIS HC A03/MF A01 CSCL 12A

A method of inverting Laplace transforms by using a set of orthonormal functions is reported. As a byproduct of the inversion, approximation of complicated Laplace transforms by a transform with a series of simple poles along the left half plane real axis is shown. The inversion and approximation process is simple enough to be put on a programmable hand calculator. E.D.K.

N80-25057*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DISCRETE TCHEBYCHEFF ORTHONORMAL POLYNOMIALS AND APPLICATIONS
W. M. Lear (TRW) Apr. 1980 59 p
(NASA-TM-81065; JSC-16484; Rept-80-FM-19) Avail: NTIS HC A05/MF A01 CSCL 12A

Discrete Tchebycheff orthonormal polynomials offer a convenient way to make least squares polynomial fits of uniformly spaced discrete data. Computer programs to do so are simple and fast, and appear to be less affected by computer roundoff error, for the higher order fits, than conventional least squares programs. They are useful for any application of polynomial least squares fits: approximation of mathematical functions, noise analysis of radar data, and real time smoothing of noisy data, to name a few. E.D.K.

N80-25058# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
ITERATIVE ELLIPSOIDAL TRIMMING
Laurence S. Gillick Feb. 1980 139 p Prepared in cooperation with Northeastern Univ., Boston, Mass.
(Contract N00014-75-C-0555)
(AD-A082238; TR-15) Avail: NTIS HC A07/MF A01 CSCL 12/1

The iterative ellipsoidal trimming algorithm is introduced as both a clustering method and an estimator of location and shape. Its power as a data analytic tool is investigated and the asymptotic distribution of its stationary point is derived. In addition, several scale estimators are proposed and studied. GRA

N80-25059# Wisconsin Univ. - Madison. Dept. of Statistics.
USE OF BOX-COX TRANSFORMATION WITH BINARY RESPONSE MODELS
V. M. Guerrero and Richard A. Johnson Aug. 1979 12 p refs
(Contract N00014-78-C-0722)
(AD-A080911; UWIS-DS-79-575) Avail: NTIS HC A02/MF A01 CSCL 12/1

The power transformation is applied to the odds ratio to generalize the logistic model and to parameterize a certain type of lack of fit. Transformation of the design variable within the context of the dose-response problem is also considered. GRA

N80-25060# Systems and Applied Sciences Corp., Riverdale, Md.
AN INVESTIGATION OF THREE METHODS OF COMPLETING A STAGGERED DATA FIELD ON A SQUARE GRID
Donald C. Norquist 24 Aug. 1979 26 p ref
(Contract F19628-79-C-0033; AF Proj. 6670; AF Proj. 2310)
(AD-A082330; SCIENTIFIC-1; AFGL-TR-79-0197) Avail: NTIS HC A03/MF A01 CSCL 12/1

Three methods are examined for estimating values for grid points without data, based on data values available at grid points distributed in a staggered manner on a square grid. One method uses the average of values at surrounding points. The other two involve interpolation formulas of greater sophistication: bicubic spline interpolation and Fourier transform interpolation. All three methods are applied to square grids on which values of transcendental functions of known wave numbers are placed in a staggered fashion. The completed fields from each method are spectrally analyzed to determine the effect of the completion method on the known spectrum of the incomplete field. It is determined that all three methods tend to alias high wave number components to lower wave number components. In addition, a spectral spreading is observed in the bicubic spline technique. The Fourier transform method results in the least amount of aliasing, especially when the incomplete field is made up primarily of low wave number components. GRA

N80-25061# Wisconsin Univ. - Madison. Dept. of Computer Sciences.
ANOTHER LOOK AT ITERATIVE METHODS FOR ELLIPTIC DIFFERENCE EQUATIONS
Seymour V. Parter and Michael Steuerwalt (LASL) Jul. 1979 29 p refs
(Contracts N00014-76-C-0341; W-7405-eng-36)
(AD-A082391; CSTR-358; LA-UR-80-202) Avail: NTIS HC A03/MF A01 CSCL 12/1

Iterative methods for solving elliptic difference equations have received new attention because of the recent advent of novel computer architectures and a growing interest in three dimensional problems. The fundamental characteristic of an iterative method is its rate of convergence. We present here, in the context of the model problem in two and three dimensions, a very simple theory for determining the rates of convergence of block iterative schemes. This theory is easily extended to general domains, general elliptic problems, and higher dimensions. GRA

N80-25062# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
NECESSARY AND SUFFICIENT CONDITIONS FOR OPTIMAL CONTROL OF QUASILINEAR PARTIAL DIFFERENTIAL SYSTEMS
N. A. Derzko (Toronto Univ.), S. P. Sethi (Toronto Univ.), and G. L. Thompson Nov. 1979 32 p refs
(Contracts N00014-75-C-0621; N00014-76-C-0932)
(AD-A082422; MSRR-453) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper studies the problem of optimal control of quasilinear partial differential systems. A maximum principle necessary condition is derived and shown to be sufficient when the Hamiltonian and boundary conditions satisfy a convexity condition. The derivation is made using Stokes theorem and a generalized version of Green's theorem. Management science applications are suggested to problems of cattle ranching, perishable inventories, manpower planning, and advertising. GRA

N80-25063# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
A SEMIGROUP APPROACH TO PARTIAL DIFFERENTIAL EQUATIONS WITH DELAY
Karl Kunisch Feb. 1980 20 p refs
(Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A082070; AFOSR-80-0145TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The objective of this investigation is to give sufficient conditions on f and g such that local semigroups can be associated with the equation (1). This will imply representation formulas for the solutions of (1), and secondly to discuss various notions of solutions which have arisen in the study of (1). Although only the autonomous equation is considered here, many of the results remain true if f and g depend on t. GRA

N80-25064# Claremont Mens Coll., Calif. Inst. of Decision Science
DELTA-EXACT LOWER CONFIDENCE BOUNDS FOR SERIES AND PSEUDO-SERIES SYSTEM RELIABILITY
Tim Baker, Renee Clift, Beth Karras, Austin Lee, Amanda McZeal, and Alexis Oliver Feb. 1980 31 p refs
(Contract N00014-78-C-0213)
(AD-A082133; Rept-80-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

Methods of computing lower confidence bounds are examined for applicability to actual data and systems. Improvements to a modification of the likelihood ratio method are shown for the series case and a variety of methods are studied for pseudo-series, which may model some missiles. GRA

N80-25065# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOME k-TH ORDER SOLUTIONS TO THE PROBLEM OF FINDING OPTIMAL DISCRIMINANT FUNCTIONS
Lee K. Jones 10 Jan. 1980 23 p refs
(Contract F19628-80-C-0002; AF Proj. 627A)
(AD-A082396; TN-1980-4; ESD-TR-79-305) Avail: NTIS HC A02/MF A01 CSCL 12/1

This article describes a general method for discriminating between two random variables when we are required to use a discriminant function belonging to a given class. GRA

N80-25066# Texas Univ. at Austin. Center for Cybernetic Studies.
POLYEXTREMAL PRINCIPLES AND SEPARABLY-INFINITE PROGRAMS
A. Charnes, P. Gribik (Pacific Gas and Electric Co., San Francisco), K. Kortanek (Carnegie-Mellon Univ.), and A. Levine Jan. 1980 46 p refs
(Contract N00014-75-C-0569; Grant NSF ENG-78-25488; NR Proj. 047-021)
(AD-A081943; CCS-RR-346) Avail: NTIS HC A03/MF A01 CSCL 12/1

As a direct extension of Charnes' characterization of two-person zero-sum constrained games by linear programming, it is shown how a general class of saddle value problems can be reduced to a pair of uniextremal dual separably-infinite programs. These programs have an infinite number of variables and an infinite number of constraints, but only a finite number of variables appear in a infinite number of constraints and only a finite number of constraints have an infinite number of variables. The conditions under which the characterization holds are among the more general ones appearing in the literature sufficient to guarantee the existence of a saddle point of concave-convex function. The key construction involves augmenting a given player's original set of variables by generalized finite sequences determined by the other player's constraint set and objective function. A duality theory is developed which includes complementarity conditions, thereby making contact with the numerical treatment of semi-infinite program. GRA

N80-25067# Texas Univ. at Austin. Center for Cybernetic Studies.
COMPREHENSIVE COMPUTER EVALUATION AND ENHANCEMENT OF MAXIMUM FLOW ALGORITHMS
Fred Glover (Colorado Univ., Boulder), Darwin Klingman, John Mote (Analysis, Research, and Computation, Inc., Austin, Texas), and David Whitman (Analysis, Research, and Computation, Inc., Austin, Texas) Oct. 1979 80 p refs
(Contracts N00014-78-C-0222; DOT-OS-70074)
(AD-A081941; CCS-RR-356) Avail: NTIS HC A05/MF A01 CSCL 12/2

The primary purpose of this study was to refine and streamline all major classes of maximum flow algorithms using the recent developments in network labeling and data organization techniques. To safeguard against being swayed too heavily by preliminary analyses (and past experience in other network settings), it has implemented more than one type of data structure and associated processing techniques for most of the algorithms. Additionally, the resulting codes on four distinct problem topologies has been tested. GRA

N80-25068# Naval Postgraduate School, Monterey, Calif.
FORMATION OF EFFICIENT FINITE ELEMENT PREDICTION MODELS Technical Report, Oct. 1978 - Dec. 1979
R. T. Williams and A. L. Schoenstadt Jan. 1980 37 p refs
(Contracts N66856-79-WR-79002; N63134-79-WR-90909)
(AD-A081945; NPS63-80-001) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report compares three finite element formulations of the linearized shallow-water equations which are applied to the geostrophic adjustment process. The three corresponding finite difference schemes are also included in the study. The development follows Schoenstadt (1980) wherein the spatially discretized equations are Fourier transformed in x, and then solved with arbitrary initial conditions. The six schemes are also compared by integrating them numerically from an initial state at rest with a height perturbation at a single point. The finite difference and finite element primitive equation schemes with unstaggered grid points give very poor results for the small scale features. The staggered scheme B gives much better results with both finite differences and finite elements. The vorticity-divergence system with unstaggered points also is very good with finite differences and finite elements. It is especially important to take into account these results when formulating efficient finite element prediction models. GRA

N80-25069# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
A COMPARISON OF NUMERICAL METHODS FOR IDENTIFICATION AND OPTIMIZATION PROBLEMS INVOLVING CONTROL SYSTEMS WITH DELAYS
H. T. Banks and J. A. Burns Nov. 1979 189 p refs
(Contract DAAG29-79-C-0161; Grants DAAG29-78-G-0125; AF-AFOSR-3092-76; NSF MCS-79-05774)
(AD-A081986; ARO-15561.6-M; ARO-16835.2-M) Avail: NTIS HC A09/MF A01 CSCL 12/1

Numerical results are presented for two approximation techniques for functional differential control systems. One technique is based on an averaging scheme, the other on spline approximations. A number of examples are considered and the techniques are applied to parameter estimation problems and optimal control problems where the systems are given by differential equations with hereditary terms. GRA

N80-25070*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF THE METHOD OF LINES TO THE SOLUTION OF ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS APPLICATION Aeronautical Report
D. J. Jones and J. C. South, Jr. Ottawa National Research Council of Canada Nov. 1979 82 p refs In ENGLISH; FRENCH summary Prepared in cooperation with National Aeronautical Establishment, Ottawa, Canada
(NASA-TM-80982; AD-A082729; NAE-LR-599; NRC-18021) Avail: NTIS HC A05/MF A01 CSCL 12/1

The method of lines is used in this report for solving one linear, two nonlinear elliptic boundary value problems and a linear eigenvalue problem. An analysis of the stability and convergence is made in the linear cases. GRA

N80-25071# Utah Univ., Salt Lake City. Dept. of Mathematics.
AN AUTOMATIC QUADRATURE ALGORITHM BASED ON THE TRAPEZOIDAL FORMULA
J. Schwing (Old Dominion Univ., Norfolk, Va.) and K. Sikorski 22 Feb. 1980 28 p refs
(Grant DAAG29-77-G-0139)
(AD-A082547; ARO-14864.7-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

The formulas that this subroutine (WNEW) is based on are most powerful when the integrand f does not have a singularity (a singularity is a point where df/dx does not exist) in the interior of the range of integration; however, singularities at end-points of intervals are allowed. Indeed, it is in the cases where f has singularities at the end-points of the range of integration that the subroutine WNEW is superior to other subroutines. GRA

N80-25072# Oak Ridge National Lab., Tenn. Engineering Physics Div.
GENERALIZED SENSITIVITY THEORY FOR SYSTEMS OF COUPLED NONLINEAR EQUATIONS
D. G. Cacuci, C. F. Weber, E. M. Oblow, and J. H. Marable Jan. 1980 105 p refs
(Contract W-7405-eng-26)
(NUREG-CR-1003; ORNL/NUREG/TM-349) Avail: NTIS HC A06/MF A01

A general sensitivity theory is presented for treating problems characterized by systems of nonlinear equations with nonlinear responses. Frechet derivatives are used in both differential and variational approaches to derive appropriate adjoint equations and expressions for sensitivity functions. The two approaches are unified to form a complete operator viewpoint of sensitivity theory. Also presented is an alternative sensitivity formalism for systems of nonlinear matrix equations such as those arising from the application of numerical methods to many practical problems. This approach significantly enlarges the scope and versatility of sensitivity theory as it allows direct treatment of parameters which are purely of numerical methods origin. To demonstrate the usefulness and practical applications of both operator and matrix formalisms, a significantly nonlinear transient problem in fast reactor thermal-hydraulics is considered. DOE

N80-25073# Stanford Univ., Calif. Dept. of Computer Science.
PROJECTED LAGRANGIAN ALGORITHMS FOR NONLINEAR MINIMAX AND 1-SUB-1 OPTIMIZATION Ph.D. Thesis
M. L. Overton Aug. 1979 172 p refs Sponsored in part by the National Research Council of Canada
(Contract EY-76-S-03-0326; Grants NSF MCS-75-13497; NSF MCS-78-11985)
(SU-326-P3067) Avail: NTIS HC A08/MF A01

Algorithms for solving the nonlinear minimax and L sub 1 optimization problems are presented. The minimax problem can be transformed into a nonlinearly constrained optimization problem with one extra variable, where the objective and constraint functions are continuously differentiable. A direction of search is obtained at each iteration of the algorithm by solving an equality constrained quadratic programming problem, related to one a projected Lagrangian method might use to solve the equivalent constrained optimization problem. The L sub 1 problem can also be transformed into a nonlinearly constrained optimization problem, but it involves extra variables. A method closely related to that for the minimax problem which requires successively solving quadratic programs in the same number of variables as that of the original problem is constructed. Several flexible steplength algorithms are presented, along with algorithms for univariate minimization of the minimax, L sub 1 and related functions. DOE

N80-25074# California Univ., Livermore. Lawrence Livermore Lab.
MULTIGRID METHODS: AN ALTERNATE VIEWPOINT
S. F. McCormick Oct. 1979 23 p refs
(Contract W-7405-eng-48)
(UCID-18487) Avail: NTIS HC A02/MF A01

An operator theoretic approach to the multigrid process is presented with the view that the technique is a combined Newton like method and relaxation scheme. Attention is focused upon the correction cycle of this process. A simplified view of the multigrid processes is provided and some of the nuances of the techniques used in the full multigrid scheme are clarified. DOE

N80-25075# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
SOME CONTRACTIVITY QUESTIONS FOR ONE-LEG AND LINEAR MULTISTEP METHODS
Germund Dahlquist 1979 14 p refs
(TRITA-NA-7905) Avail: NTIS HC A02/MF A01

The set of contractivity for a one leg method with respect to the norm generated by a positive definite k x k matrix is either a disk, a half plane, or the exterior of a disk. It can also degenerate into a point or be void. The result is a kind of converse to the main result of an analysis of the equivalence of G-stability to A-stability. Author (ESA)

N80-25076# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
A SEMI-DISCRETIZATION ALGORITHM FOR TWO-DIMENSIONAL PARTIAL DIFFERENTIAL EQUATIONS
J. Kok, P. J. vanderHouwen, and P. H. M. Wolkenfelt Dec. 1978 17 p refs
(MC-NW-54/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The semi-discretization method of a general class of nonlinear two dimensional time-dependent partial differential equations on a grid with nonuniform meshes is described. The documentation of the semi-discretization algorithm is then presented. Finally, the relation with other semi-discretization methods to be used together with different time-integrators for solving initial boundary value problems is indicated. Author (ESA)

N80-25077# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
BACKWARD DIFFERENTIATION FORMULAS FOR VOLTERRA INTEGRAL EQUATIONS OF THE SECOND KIND. PART 2: NUMERICAL EXPERIMENTS
H. J. J. TeRiele and P. J. vanderHouwen May 1978 25 p refs

(MC-NW-57/78-Pt-2) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Results of numerical experiments with backward differentiation formulas for linear and nonlinear Volterra integral equations of the second kind are given. In order to start these (multistep) formulas, a starting scheme is supplied based on extrapolation of the trapezoidal rule and combined with a block-implicit Runge-Kutta scheme. Convergence and stability tests were carried out and the efficiency is compared with that of a block-implicit Runge-Kutta scheme of de Hoog and Weiss. It is shown that the backward differentiation formulas are especially suitable for problems where the kernel has a large Lipschitz constant with respect to its last argument. Author (ESA)

N80-25078# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

A CLASS OF PROBLEMS IN HYDRODYNAMICS

H. A. Lauwerier Mar. 1978 12 p refs

(MC-TW-175/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A number of problems in hydrodynamics which lead to elliptic partial differential equations with oblique boundary conditions are surveyed. These included the initial value problem for a shallow sea with an arbitrary geometry as well as the consideration of a semi-infinite channel bounded by coasts and an ocean. Mathematical models were developed and equations were obtained for a stationary situation, for free oscillations, and for periodic motion under the influence of an external periodic force. Author (ESA)

N80-25079# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.

ON THE NONEXISTENCE OF CERTAIN PLANAR SPACES

A. E. Brouwer Aug. 1978 15 p

(MC-ZW-114/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Whether or not, in a nontrivial planar space in which all planes are isomorphic to a given linear space, all lines have the same cardinality (unless the given linear space is a degenerate projective plane) is discussed. The six smallest given linear spaces for which this might be true are defined. Next, the impossibility of five of these six cases is shown by various counting arguments. A rather strong result on the parameters, implying the previous results, and some miscellaneous results on special classes of linear spaces are also brought out. Author (ESA)

N80-25080# Office of Personnel Management, Washington, D.C. Personnel Research and Development Center.

ESTIMATORS OF THE SQUARED CROSS-VALIDITY COEFFICIENT: A MONTE CARLO INVESTIGATION Final Technical Study.

Fritz Drasgow, Neil J. Dorans, and Ledyard R. Tucker Oct. 1979 15 p refs Prepared in cooperation with Illinois Univ. at Urbana-Champaign

(PB80-138928; TS-79-3) Avail: NTIS HC A02/MF A01 CSCL 12A

A Monte Carlo experiment was used to evaluate four procedures for estimating the population squared cross-validity of a sample least squares regression equation. Four levels of population squared muliple correlation (R(p) squared) and three levels of number of predictors (n) were factorially crossed of produce twelve population covariance matrices. Random samples at four level of sample size (n) were drawn from each population. The level of R(p) squared, n, and N were carefully selected to ensure relevance of simulation results for much applied research. The least squares regression equation from each sample was applied in its respective population to obtain the actual population squared cross-validity (R(cv) squared). GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-25081# California Univ., Berkeley. Operations Research Center.

INFERENCE FOR THE EXPONENTIAL LIFE DISTRIBUTION

Richard E. Barlow and Frank Proschan Dec. 1979 46 p refs Prepared in cooperation with Florida State Univ., Tallahassee.

(Grant AF-AFOSR-3179-77; AF Proj. 2304)

(AD-A080899; ORC-79-16) Avail: NTIS HC A03/MF A01 CSCL 14/4

This paper constitutes chapter 1 of a book on 'Inference and Data Analysis for Reliability and Life Testing.' The purpose is to provide an elementary coherent Bayesian foundation for research in statistical reliability theory. The results in section 3 and the appendix concerning the role of failures and total time on test in statistical inference for the exponential model are new. GRA

N80-25082# Wisconsin Univ. - Madison. Dept. of Statistics.

ON TESTING EQUALITY OF TWO EXPONENTIAL DISTRIBUTIONS UNDER COMBINED TYPE 2 CENSORING Interim Report

G. K. Bhattacharyya and Kishan G. Mehrotra (Syracuse Univ.) Jan. 1980 19 p refs

(Contract N00014-78-C-0722)

(AD-A080913; UWIS-DS-80-601) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of testing equality of the scale parameters of two exponential distributions is considered under a combined sample type II censoring scheme that has been extensively treated in nonparametric inference. Sufficiency and invariance considerations lead to a pair of statistics, namely, the proportions of failure count and the total time on test of the first sample to those of the combined sample. Exact distribution and moment properties are discussed, and asymptotic joint normality under local alternatives is established in a general framework. The invariant test that maximizes the Pitman efficacy is seen to be based on the difference between these two proportions, and is asymptotically equivalent to the likelihood ratio test. GRA

N80-25083# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

A DISTRIBUTED ALGORITHM FOR MINIMUM WEIGHT SPANNING TREES. REVISION

R. G. Gallager, P. A. Humblet, and P. M. Spira (Apple Computer Co.) Oct. 1979 24 p refs

(Contract N00014-75-C-1183; Grant NSF ENG-77-19971; ARPA Order 3045)

(AD-A080902; LIDS-P-906-A) Avail: NTIS HC A02/MF A01 CSCL 12/1

A distributed algorithm is presented that constructs the minimum weight spanning tree in a connected undirected graph with distinct edge weights. A processor exists at each node of the graph, knowing initially only the weights of the adjacent edges. The processors obey the same algorithm and exchange messages with neighbors until the tree is constructed. The total number of messages required for a graph of N nodes and E edges is at most 5 N log of N to the base 2 & 2 E and a message contains at most one edge weight plus log of 8 N to the base 2 bits. The algorithm can be initiated spontaneously at any node or at any subset of nodes. Author (GRA)

N80-25084# Pittsburgh Univ., Pa. Dept. of Mathematics and Statistics.

SOME CONCEPTS OF MULTIVARIATE DEPENDENCE

Henry W. Block and Mei-Ling Ting 1980 14 p refs

(Contract N00014-76-C-0839)

(AD-A082065; RR-79-02) Avail: NTIS HC A02/MF A01 CSCL 12/1

Several types of positive dependence are shown to be equivalent to the concept of a distribution with a density which is TP2 in pairs. Among these is the concept of m^*-positive dependence of Alam and Wallenius. Using this result, all relationships among many of the most important concepts of positive dependence are determined. Furthermore, an application of the equivalences of these types of positive dependence yields a result of Ahmed, Langberg, Leon and Proschan. GRA

N80-25085# Ohio State Univ., Columbus. Dept. of Statistics.

A MULTIVARIATE SOLUTION OF THE MULTIVARIATE RANKING AND SELECTION PROBLEM

Edward J. Dudewicz and Vidya S. Taneja (Univ. of Western Ill.)

Feb. 1980 23 p refs
(Contract N00014-78-C-0543)
(AD-A082035; TR-163A) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of selection of the best multivariate population is given a new formulation which does not involve reducing the populations to univariate quantities. This formulation's solution is developed for known, and (using the Heteroscedastic Method) also for unknown, variance-covariance matrices. Preference reversals and arbitrary nonlinear preference functions are explicity allowed in this new theory. GRA

N80-25086# Florida State Univ., Tallahassee. Dept. of Statistics.
THE EXTREMAL LARGE DEVIATION RATE OF THE F-STATISTIC
L. Barker and J. Sethuraman Oct. 1979 19 p refs
(Grant DAAG29-79-G-0278)
(AD-A081960; FSU-STATISTICS-M529; TR-D-42-ARO; ARO-16713.7-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The extremal large deviation rate of the F-statistic over a large class is determined. It is shown that the Bahadur efficiency of the F-test relative to Moses' rank test for equality of variances is zero at every alternative when the distribution of the underlying observations is unspecified. GRA

N80-25087# Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE USE OF R AND S2 CHARTS UNDER NONSTANDARD CONDITIONS
D. R. Jensen and Y. V. Hui Mar. 1980 33 p refs
(Grant DAAG29-78-G-0172)
(AD-A083032; RR-Q-3; ARO-15194.3-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

R and S-squared charts for monitoring the variability of a process are studied when the control variance, (sigma sub 0) squared is unknown, when observations are non-Gaussian, and when the process drifts. Geometric bounds on run-length distributions for the R and S-squared charts are given for all underlying distributions when (sigma sub 0) squared is estimated in a base period. Similar bounds apply in the case of a drifting process, the notion of which is developed rigorously. It is shown that normal-theory properties of these charts hold exactly for every spherical process when a suitable estimate for (sigma sub 0) squared is used. Run-length distributions otherwise are shown to be ordered stochastically given a peakedness ordering on the underlying spherical processes. GRA

N80-25088# Rockwell International Science Center, Thousand Oaks, Calif.
EXTREME VALUE DISTRIBUTIONS Technical Report, 1 Feb. - 30 Jun. 1979
N. R. Mann and Nozer D. Singpurwalla Feb. 1980 25 p refs
Prepared in cooperation with George Washington Univ.
(Contracts N00014-76-C-0723; NRC-04-78-239; NR Proj. 047-204)
(AD-A082624; SC5065.4TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This is an expository survey of the univariate theory of extreme values and the estimation of the parameters of the related extreme-value distributions. This survey was written at the invitation of Professors N.L. Johnson and S. Kotz, editors of the forthcoming 'Encyclopedia of Statistical Sciences' to be published by John Wiley and Sons, Inc., New York. The theory of extreme values plays a fundamental role in several areas of applied statistics, such as the analysis of flood flows, the reliability of complex systems, the analysis of air pollution data, etc. In addition to surveying (without proofs) the basic results of extreme value theory and the estimators of the parameters of the extreme value distributions, this survey presents a brief discussion of the current research in these areas. GRA

N80-25089# Stanford Univ., Calif. Dept. of Statistics.
APPROXIMATING CONDITIONAL MOMENTS OF THE MULTIVARIATE NORMAL DISTRIBUTION
Joseph G. Deken Dec. 1979 30 p refs
(Contract N00014-75-C-0442)
(AD-A082921; SU-TR-41) Avail: NTIS HC A03/MF A01 CSCL 12/1

A practical method for computing the conditional expectation of a polynomial in the components of a multivariate normal random variable X, when X is restricted to a subset of R superscript p, is given. This method makes the application of certain missing data techniques possible in cases where repeated numerical integration is not feasible. GRA

N80-25090# Wisconsin Univ. - Madison. Dept. of Statistics.
ILL POSED PROBLEMS: NUMERICAL AND STATISTICAL METHODS FOR MILDLY, MODERATELY AND SEVERELY ILL POSED PROBLEMS WITH NOISY DATA
Grace Wahba Feb. 1980 75 p refs
(Contract N00014-77-C-0675)
(AD-A082925; UWIS-DS-80-595) Avail: NTIS HC A04/MF A01 CSCL 12/1

We discuss a number of topics related to the practical solution of ill posed problems given noisy data as it might arise in an experimental situation. The sensitivity of a regularized estimate of f to the noise is made explicit. After giving the intrinsic rank of the examples of first and second derivative, Abel's equation and Fujita's equation, it is argued that the first three are only mildly ill posed and f should be amendable to accurate estimation by the method of regularization. The method of Generalized Cross Validation (GCV) for choosing the regularization parameter is described and numerical results for the estimation of first and second derivative from noisy data are given. Two numerical algorithms for obtaining a regularized estimate with GCV are detailed. The second uses a B-spline basis to allow the handling of large data sets. This use of outside information in the estimation of f is discussed. We discuss the problem of checking the validity of the 'model' k, and provide a crude goodness-of-fit test. Finally we end by describing the (known) result that the number k of iterations in a Landweber iteration for solving large linear systems is a form of regularization parameter. We than show how GCV can feasibly be used to choose k in very large problems like those arising in computerized tomography. GRA

N80-25091# Stichting Mathematisch Centrum, Amsterdam (Netherlands).
A SURVEY OF ASYMPTOTIC VALUE-ITERATION FOR UNDISCOUNTED MARKOVIAN DECISION PROCESSES
A. Federgruen and P. J. Schweitzer May 1979 46 p refs
Submitted for publication
(MC-BW-104/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3.85

The asymptotic behavior of undiscounted value-iteration in Markov decision problems with finite state and action spaces is reviewed. The asymptotic results concern both the value functions and the sets of optimizing policies as the length of the planning period tends to infinity. The discussion includes Lyapunov functions and other techniques for bounding a solution pair to the optimality equations

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-25092# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
THE NONCANDIDATE CONSTRAINT METHOD FOR REDUCING THE SIZE OF A LINEAR PROGRAM
Awanti P. Sethi and Gerald L. Thompson Feb. 1980 17 p refs
(Contract N00014-75-C-0621; NR Proj. 047-048)
(AD-A082423; MSRR-455; WP-52-79-80) Avail: NTIS HC A02/MF A01 CSCL 12/2

A noncandidate constraint in a linear program is one which never contains a pivot element during the course of solving the problem. Discovering noncandidate constraints is computationally costly since their discovery, in general, depends on the actual sequence of pivots used. Knowing which constraints are noncandidate is of great computational benefit since they need not be kept in updated form. Our experience indicates that from 50 to 80 percent of the constraints in random problems are

noncandidates at least part of the time. In this paper we present a learning approach to the identification of noncandidate constraints. At each iteration we determine which constraints can potentially be pivotal; these are candidate constraints and all others are noncandidate constraints on that step. On proceeding with the simplex method we update only the candidate constraints. If a noncandidate constraint becomes candidate on a later step, we update it and add it to the candidate list. Although the constant checking of constraints to see whether they are changing from being candidate to noncandidate is computationally costly, we obtain the computational benefit of having to keep in updated form a much smaller tableau. The net benefit of using this strategy is positive and results in a 25 to 50 percent reduction in total computation time. This paper describes the method in detail and gives computational results of testing it on a series of randomly generated problems. GRA

N80-25093# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.
COMBINATIONAL ALGORITHMS IN OPERATIONS RESEARCH Final Report, 1 Sep. 1975 - 31 Dec. 1979
T. C. Hu 10 Mar. 1980 6 p refs
(Grant DAAG29-76-G-0031)
(AD-A082614; ARO-12945.3-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Nine technical papers and a manuscript of a book on 'Combinatorial Algorithms' were prepared. The most significant discoveries are two algorithms of constructing binary tree optimum under various criteria. The first algorithm constructs optimum binary trees which include Huffman's tree as a special case. The second algorithm constructs optimum alphabetic trees which include Hu-Tucker tree as a special case. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-25094# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
CONDITIONAL POSITIVITY OF QUADRATIC FORMS IN HILBERT SPACE
D. H. Martin Aug. 1979 25 p refs
(CSIR-TWISK-113) Avail: NTIS HC A02/MF A01

If X and Y are real Hilbert spaces (A : X approaches Y is a bounded linear operator, and gamma is contained in set Y is a closed convex cone) an immediate sufficient condition for a quadratic form Q on X to be positive subject to the constraint Ax is an element of gamma, is that Q be decomposable as a sum Q(x) = C(Ax) + S(x), where C is a quadratic form on Y which is positive on gamma, and S is positive definite on X. The necessity of such a decomposition is established for a class of quadratic forms which commonly occur in variational problems - the Legendre forms. The proof furnishes formulas for C and S which are explicit apart from the occurrence of an unkown scalar. The usefulness of the result is illustrated by the determination of the focal (conjugate) time of a linear-quadratic control problem with inequality constraints on the final state. M.G.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-25095 Texas Univ. at Austin.
RESONANT PERIODIC ORBITS IN THE PROBLEM OF THREE BODIES Ph.D. Thesis
Hoi-Ming Kwok 1979 181 p
Avail: Univ. Microfilms Order No. 8009882

The evolution of families of resonant periodic orbits in the circular and elliptic restricted problem into families of the general problem is studied. A systematic approach is introduced to generate resonant periodic orbits in the circular, elliptic restricted and the general three-body problem. The bifurcation phenomena in the restricted problem are studied, analyzed and compared with the bifurcation phenomena in the general problem. A new method to determine the linear stability of periodic orbits of the general three-body problem by surfaces of section is introduced. The method calculates the characteristic exponents of a periodic orbit by using a nonrotating heliocentric coordinate system rather than the usual rotating coordinate system. The stability characteristics of families of resonant periodic orbits of the asteroidal type, especially of the Hecuba, Hilda and Thule groups, are analyzed. Two new families of periodic orbits with a 5:2 resonance and having the mass ratio of the Sun-Jupiter-Saturn system are found, and their stability characteristics are studied. A new type of bifurcation phenomenon in periodic orbits of the general three-body problem is discovered. Dissert. Abstr.

N80-25096# California Univ., Livermore. Lawrence Livermore Lab.
NONLINEAR DYNAMICS
J. C. Garrison 19 Nov. 1979 25 p refs
(Contract W-7405-eng-48)
(UCID-18499) Avail: NTIS HC A02/MF A01

This cursory survey of nonlinear physical phenomena describes some important problems and identifies common qualitative properties and analytical techniques. Brief descriptions nonequilibrium thermodynamics, turbulence, plasma physics, nonlinear optics, and nonlinear mechanics are presented. Similarities that exist between such apparently unrelated fields are remarked upon. DOE

N80-25097# California Univ., Livermore. Lawrence Livermore Lab.
RADIATION EFFECTS ON SUPERCONDUCTORS AND MAGNET STABILIZER MATERIALS
R. A. VanKonynenburg and M. W. Guinan Jan. 1980 8 p refs
(Contract W-7405-eng-48)
(UCID-18523) Avail: NTIS HC A02/MF A01

Previously irradiated Nb3Sn wires were given additional irradiation at room temperature to reach the anticipated serious decline in critical current and to evaluate the fluence where it occurs. An experiment is in preparation to measure the magnetoresistance of copper and aluminum in fields up to 12 tesla after 14MeV neutron irradiation, as well as testing the effects of repeated irradiation and room temperature annealing on NbTi critical current. DOE

N80-25098# Brookhaven National Lab., Upton, N. Y.
MANY-BODY PROBLEM IN ONE-DIMENSION
V. J. Emery Nov. 1979 35 p refs Presented at the 2nd Summer Inst. on Phys. of Low Dimensional Systems, Kyoto, Japan, 7-14 Sep. 1979
(Contract EY-76-C-02-0016)
(BNL-26960; CONF-7909119-1) Avail: NTIS HC A03/MF A01

Many-body systems in one dimension are examined and a particular strong-coupling model is considered. The model provides description of the chains of mercury ions in Hg/sub 3-delta/AsF6; some of the predictions of the theory can be checked by X-ray and neutron diffraction. Much of the physics of nearly one dimensional materials is concerned with understanding the possible types of phase transition that may take place, and establishing the conditions in which one or another will be predominant. The most significant feature of purely one dimensional systems is dominant effect of fluctuations. Qualitative aspects of one dimensional systems (qualitative discussion of strong coupling - strong attractive U, strong repulsive U, large V); strong coupling between parallel spins (independent spin systems, coupling between opposite spins); mercury chains; electrons with arbitrary coupling; boson representation of operators; and classical Coulomb gas are addressed. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-25099 New York Univ., N. Y.
CONSTRUCTIVE SOLUTION AND CHARACTERIZATION OF

INVERSE SCATTERING PROBLEM FOR THE ONE-DIMENSIONAL ACOUSTIC WAVE EQUATION Ph.D. Thesis
Robert Rex Greene 1979 120 p
Avail: Univ. Microfilms Order No. 8010358

The inverse scattering problem for the one dimensional acoustic wave equation on the real line is solved. The class of reflection coefficients of the wave equation is completely characterized for a class of wave speeds. The problem is solved using 'trace methods' tailored to the wave equation. 'Trace formulas' are derived which express the wave speed c, and the logarithmic derivative of c in terms of solutions of the wave equation and of the reflection coefficient. When these expressions are coupled to the wave equation, it is possible to solve the coupled 'trace system' to recover the wave speed from the reflection coefficient. Existence and uniqueness theorems for a solution of the trace system are proved. The trace method provides a differential equation approach to the solution of the inverse problem. Marchenko equations are derived which can be used to give an integral equation approach to the inverse problem.
Dissert. Abstr.

N80-25100*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ANALYSIS OF VIBRATORY EXCITATION OF GEAR SYSTEMS AS A CONTRIBUTOR TO AIRCRAFT INTERIOR NOISE
William D. Mark Feb. 1979 97 p refs
(Contract NAS1-14611)
(NASA-CR-159088; TM-502) Avail: NTIS HC A05/MF A01 CSCL 20A

Application of the transfer function approach to predict the resulting interior noise contribution requires gearbox vibration sources and paths to be characterized in the frequency domain. Tooth-face deviations from perfect involute surfaces were represented in terms of Legendre polynomials which may be directly interpreted in terms of tooth-spacing errors, mean and random deviations associated with involute slope and fullness, lead mismatch and crowning, and analogous higher-order components. The contributions of these components to the spectrum of the static transmission error is discussed and illustrated using a set of measurements made on a pair of helicopter spur gears. The general methodology presented is applicable to both spur and helical gears. A.R.H.

N80-25101*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPARISON BETWEEN AN EXISTING PROPELLER NOISE THEORY AND WIND TUNNEL DATA
James H. Dittmar May 1980 41 p refs
(NASA-TM-81519; E-464) Avail: NTIS HC A03/MF A01 CSCL 20A

The noise of three supersonic helical tip speed propellers was compared with the noise predicted by an existing noise theory. Comparisons of the peak blade passage tones showed fairly good agreement beween theory and experiment at the lowest helical tip Mach numbers tested, 0.86 and 1.00, while at higher numbers, the theory predicted higher noise levels than measured. When the differences among the propellers were considered the theory and measurement showed fairly good agreement. Directivity measurements in general showed that the measured blade passage tone data peaked further downstream than the theory predicted. At the cruise design condition the harmonics appeared to fall off faster in the data than the theory indicated. E.D.K.

N80-25102*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
INTERIOR NOISE CONTROL PREDICTION STUDY FOR HIGH-SPEED PROPELLER-DRIVEN AIRCRAFT
D. C. Rennison, J. F. Wilby, A. H. Marsh (DyTec Eng., Inc., Long Beach, Calif.), and E. G. Wilby Sep. 1979 307 p refs
(Contract NAS1-15426)
(NASA-CR-159200; BBN-4026) Avail: NTIS HC A18/MF A01 CSCL 20A

An analytical model was developed to predict the noise levels inside propeller-driven aircraft during cruise at M = 0.8. The model was applied to three study aircraft with fuselages of different size (wide body, narrow body and small diameter) in order to determine the noise reductions required to achieve the goal of an A-weighted sound level which does not exceed 80 dB. The model was then used to determine noise control methods which could achieve the required noise reductions. Two classes of noise control treatments were investigated: add-on treatments which can be added to existing structures, and advanced concepts which would require changes to the fuselage primary structure. Only one treatment, a double wall with limp panel, provided the required noise reductions. Weight penalties associated with the treatment were estimated for the three study aircraft. J.M.S.

N80-25103*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SURFACE ACOUSTICAL INTENSITY MEASUREMENTS ON A DIESEL ENGINE
Michael C. McGary and Malcolm J. Crocker (Purdue Univ., West Lafayette, Ind.) Apr. 1980 18 p refs Presented at the 99th Acoust. Soc. of Am. Meeting, Atlanta, 21-25 Apr. 1980
(NASA-TM-81807) Avail: NTIS HC A02/MF A01 CSCL 20A

The use of surface intensity measurements as an alternative to the conventional selective wrapping technique of noise source identification and ranking on diesel engines was investigated. A six cylinder, in line turbocharged, 350 horsepower diesel engine was used. Sound power was measured under anechoic conditions for eight separate parts of the engine at steady state operating conditions using the conventional technique. Sound power measurements were repeated on five separate parts of the engine using the surface intensity at the same steady state operating conditions. The results were compared by plotting sound power level against frequency and noise source rankings for the two methods. Author

N80-25104*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME CALCULATED EFFECTS OF NON-UNIFORM INFLOW ON THE RADIATED NOISE OF A LARGE WIND TURBINE
George C. Greene and Harvey H. Hubbard May 1980 14 p refs
(NASA-TM-81813) Avail: NTIS HC A02/MF A01 CSCL 20A

Far field computations were performed for a large wind turbine to evaluate the effects of non-uniform aerodynamic loading over the rotor disk. A modified version of the Farassat/Nystrom propeller noise prediction program was applied to account for the variations in loading due to inflow interruption by the upstream support tower. The computations indicate that for the uniform inflow case, relatively low noise levels are generated and the first rotational harmonic dominated the spectrum. For cases representing wake flow deficiences due to the tower structure, subtantially increased noise levels for all harmonics are indicated, the greatest increases being associated with the higher order harmonics. Author

N80-25105*# Lockheed-California Co., Burbank.
ANALYTICAL STUDY OF INTERIOR NOISE CONTROL BY FUSELAGE DESIGN TECHNIQUES ON HIGH-SPEED, PROPELLER-DRIVEN AIRCRAFT Final Report, Jul. 1978 - Dec. 1979
J. D. Revell, F. J. Balena, and L. R. Koval 4 Apr. 1980 174 p refs Supersedes LR-29252
(Contract NAS1-15427)
(NASA-CR-159222; LR-29382; LR-29252) Avail: NTIS HC A08/MF A01 CSCL 20A

The acoustical treatment mass penalties required to achieve an interior noise level of 80 dBA for high speed, fuel efficient propfan-powered aircraft are determined. The prediction method used is based on theory developed for the outer shell dynamics, and a modified approach for add-on noise control element performance. The present synthesis of these methods is supported by experimental data. Three different sized aircraft are studied, including a widebody, a narrowbody and a business sized aircraft. Noise control penalties are calculated for each aircraft for two kinds of noise control designs: add-on designs, where the outer wall structure cannot be changed, and advanced designs where

the outer wall stiffness level and the materials usage can be altered. For the add-on designs, the mass penalties range from 1.7 to 2.4 percent of the takeoff gross weight (TOGW) of the various aircraft, similar to preliminary estimates. Results for advanced designs show significant reductions of the mass penalties. For the advanced aluminum designs the penalties are 1.5% of TOGW, and for an all composite aircraft the penalties range from 0.74 to 1.4% of TOGW. J.M.S.

N80-25106# Hamilton Standard, Windsor Locks, Conn. Systems Research and Development Service.
V/STOL ROTARY PROPULSOR NOISE PREDICTION MODEL UPDATE AND EVALUATION
B. Magliozzi Dec. 1979 237 p refs
(Contract DOT-FA77WA-4067)
(AD-A082616; FAA-RD-79-107) Avail: NTIS HC A11/MF A01 CSCL 20/1

A literature review was conducted to identify and evaluate high quality noise measurements of propeller, variable pitch fan, fixed pitch fan, helicopter, lift fan, core engine, and jet noise for the preparation of a data base with emphasis on recent measurements of in-flight propulsors. The effects of forward flight on V/STOL propulsor noise were evaluated and the noise prediction model was improved to give better agreement with current measurements. The performance of the noise prediction methodology was evaluated by comparison of calculations with measurements of propulsor noise from the data base. Although certain aspects of the measured propulsor noise, such as installation and ground reflection effects, caused discrepancies between measured and calculated levels (the calculations assume uninstalled propulsors under free-field conditions), the general correlation was good. Typical correlation between measured and calculated one third octave band levels was + or - 5 dB and between measured and calculated dB(A), PNL, PNLT, and EPNL was + or - 3 dB. A.R.H.

N80-25107# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
ULTRASONIC WAVE PROPAGATION IN MATERIALS WITH ORTHOTROPIC (ORTHORHOMBIC) SYMMETRY WITH AN EXAMPLE OF CENTRIFUGALLY CAST PIPE
D. W. Fitting, L. Adler, and K. V. Cook Feb. 1980 77 p ref
(Contract W-7405-eng-26)
(ORNL-5609) Avail: NTIS HC A05/MF A01

The propagation of elastic waves in orthotropic and hexagonal anisotropic material is examined mathematically showing that the elastic constants for these materials may be ascertained from ultrasonic longitudinal and transverse wave velocity measurements. Knowledge of the elastic constants of the material permits calculation of the velocities of longitudinal and transverse waves propagating in any direction. Experimental velocity measurements on samples of centrifugally cast austenitic stainless steel pipe are presented. They compare favorably with theoretical predictions, assuming an orthotropic model. DOE

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-25108*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODIFIED ITERATIVE EXTENDED HUECKEL. 1: THEORY
S. Aronowitz Apr. 1980 26 p refs 2 Vol.
(NASA-TM-81200; A-8183) Avail: NTIS HC A03/MF A01 CSCL 20H

Iterative Extended Huekel is modified by inclusion of explicit effective internuclear and electronic interactions. The one electron energies are shown to obey a variational principle because of the form of the effective electronic interactions. The modifications permit mimicking of aspects of valence bond theory with the additional feature that the energies associated with valence bond type structures are explicitly calculated. In turn, a hybrid molecular, orbital valence, bond scheme is introduced which incorporates variant total molecular electronic density distributions similar to the way that Iterative Extended Hueckel incorporates atoms. Author

N80-25109*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODIFIED ITERATIVE EXTENDED HUECKEL. 2: APPLICATION TO THE INTERACTION OF Na(+), Na(+)(aq.), Mg(+)-2(aq.) WITH ADENINE AND THYMINE
S. Aronowitz, R. MacElroy, and S. Chang Apr. 1980 28 p refs 2 Vol.
(NASA-TM-81201; A-8184) Avail: NTIS HC A03/MF A01 CSCL 20H

Modified Iterative Extended Hueckel, which includes explicit effective internuclear and electronic interactions, is applied to the study of the energetics of Na(+),Mg(+), Na(+) (aqueous), and Mg(+2) (aqueous) ions approaching various possible binding sites on adenine and thymine. Results for the adenine + ion and thymine + ion are in good qualitative agreement with ab initio work on analogous systems. Energy differences between competing sites are in excellent agreement. Hydration appears to be a critical factor in determining favorable binding sites. That the adenine N1 and N3 sites cannot displace a water molecule from the hydrated cation indicates that they are not favorable binding sites in aqueous media. Of those sites investigated, 04 was the most favorable binding site on the thymine for the bare Na(+). However, the 02 site was the most favorable binding site for either hydrated cation. Author

N80-25110*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
QUANTUM THEORY AND CHEMISTRY: TWO PROPOSITIONS
S. Aronowitz May 1980 13 p refs
(NASA-TM-81202) Avail: NTIS HC A02/MF A01 CSCL 20J

Two propositions concerning quantum chemistry are proposed. First, it is proposed that the nonrelativistic Schroedinger equation, where the Hamiltonian operator is associated with an assemblage of nuclei and electrons, can never be arranged to yield specific molecules in the chemists' sense. It is argued that this result is a necessary condition if the Schroedinger has relevancy to chemistry. Second, once a system is in a particular state with regard to interactions among its components (the assemblage of nuclei and electrons), it cannot spontaneously eliminate any of those interactions. This leads to a subtle form of irreversibility. J.M.S.

N80-25111# IBM Research Lab., San Jose, Calif.
THEORY OF ELECTRONIC, ATOMIC, AND MOLECULAR CALCULATIONS
Robert K. Nesbet Mar. 1980 7 p refs
(Contract N00014-79-C-0406)
(AD-A082891; TR-1) Avail: NTIS HC A02/MF A01 CSCL 09/2

The general approach is to develop computational methods that are quantitative in the sense of being based on the exact formal theory of the processes considered, and are practicable, in the sense of being capable of implementation on digital computers at the present level of technology. For atom-molecule scattering, a new method is being developed that extends a recent theory of the action constants of nonseparable dynamical systems to collision problems. For electron-molecule scattering, a new method for treating vibrational and rotational excitation has been developed, formal theoretical relations needed in detailed applications of this method are being derived, and a new variational approach to quantitative fixed-nuclei calculations is being planned for practical implementation. GRA

N80-25112# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
INTERMOLECULAR ENERGY EXCHANGE BY INFRARED RADIOMETRY Final Report, 1 Jun. - 31 Dec. 1979
J. Fenn, B., S. B. Ryali, and S. P. Venkateshan 31 Jan. 1980 48 p refs
(Contract F49620-79-C-0036; AF Proj. 2303)
(AD-A082540; AFOSR-80-0222TR) Avail: NTIS HC A03/MF A01 CSCL 20/10

Excitation by translational energy of the asymmetric stretch

vibrational mode of ground state carbon dioxide molecules in collision with nitrogen, oxygen and argon molecules has been studied, by intersecting two slightly collimated molecular beams in the field of view of an InSb photovoltaic detector which monitored resulting radiation in the 4.3 micrometer band. The excitation cross sections for all three combinations of partners were of similar magnitude and showed a strong dependence upon collision velocity. For nitrogen the measured cross sections ranged from about 0.0008 square Angstroms at 2 km/s to about 0.5 square Angstroms at 5 km/s. A similar but separate experiment determined an upper limit of 0.1 square Angstroms for the collisional excitation of hydrogen fluoride by krypton at energies up to 1.7 times the threshold requirement. Bulk relaxation rates for molecules in free jet expansion were also investigated. Results obtained from experimental data with the frequently used Sudden Freeze Model have been compared with those obtained by Numerical Integration. Success has been achieved in obtaining Method-of-Characteristics solutions for the free jet expansion with a varying specific heat ratio. This development provides the best description yet of relaxation in free jet expansion for any internal mode which can be characterized by a Boltzmann distribution of energy. GRA

N80-25113# Pennsylvania State Univ., University Park. Applied Research Lab.

SCATTERING OF LOW ENERGY HELIUM BEAMS FROM CLEAN SURFACES OF SODIUM FLUORIDE, LITHIUM FLUORIDE, AND GRAPHITE Ph.D. Thesis

Gregory Neil Derry 13 Dec. 1979 118 p refs

(Contract N00024-79-C-6043)

(AD-A082986; ARL/PSU/TM-79-220) Avail: NTIS HC A06/MF A01 CSCL 07/4

An examination of helium beam scattering from the basal plane of graphite and from (001) surfaces of two alkali halide crystals is presented. Results are given for both (4)He and (3)He. Incident beam energies used range from 2.9 meV to 17.3 meV, chosen to probe the physisorption regime. Bound state energy levels are measured for (4)He and (3)He adsorbed on graphite, NaF and LiF. Matrix elements of the atom-surface potential Fourier components are measured for (4)He on graphite and LiF. A brief discussion of how this information is used to determine the details of the gas-atom - solid surface interaction is given. In the case of (4)He and (3)He on graphite, comparison is made with thermodynamic adsorption data for submonolayer films and excellent agreement is found. Resonance lineshapes are studied for (4)He scattering from LiF and from graphite as the incident angles and energy are varied. The LiF results are seen to agree well with recent theoretical predictions. For graphite, some phenomena exhibit conformance to elastic theory while others appear to contradict it. Experimental evidence that the latter are due to inelastic scattering mechanisms is presented. GRA

N80-25114# Wright State Univ., Dayton, Ohio. Dept. of Chemistry.

COLLISIONAL EXCITATION AND IONIZATION Final Report, 1 Jul. 1975 - 30 Sep. 1979

T. O. Tiernan 30 Sep. 1979 216 p refs

(Contract F44620-76-C-0007; AF Proj. 2303)

(AD-A082884; AFOSR-80-0260TR) Avail: NTIS HC A10/MF A01 CSCL 07/4

Ion-scattering apparatuses were utilized to investigate the kinetics, dynamics and energy transfer characteristics of selected positive and negative ion neutral reactions. Thresholds for endothermic electron transfer reactions involving O3, N2O, CO2, and other atmospheric molecules were determined, and these data were used to determine electron affinities of these species. Similarly, thresholds for collision induced dissociation reactions of O3, CO3, NO3 ions, and other atmospheric negative ions were determined, and ionic bond dissociation energies, heats of formation and electron affinities were derived from these results. GRA

N80-25115# IRT Corp., San Diego, Calif.

MOLECULAR BEAM STUDIES OF LOW ENERGY REACTIONS Final Report, 1 Sep. 1973 - 31 Jan. 1980

R. H. Neynaber and S. Y. Tang 31 Mar. 1980 17 p refs

(Contract N00014-74-C-0011; NR Proj. 012-115; NR Proj. 393-004)

(AD-A082939; IRT-8103-010) Avail: NTIS HC A02/MF A01 CSCL 07/4

A summary of research performed under ONR Contract No. N00014-74-C-0011 is given. The contract covered the period 1 Sept. 1973-31 Jan. 1980. The report describes merging and crossed-beams studies of chemi-ionization and/or ion-molecule reactions. Included are investigations of the Ne(plus) -Ar, Ne(plus) -Kr, Ne(plus) -Xe, He(plus) -D, Ar(plus) -Na, He(plus) -He(plus), He(plus) -Ne(plus), Ar(plus) -Kr(plus), and He(plus) -Ne(plus) systems. GRA

N80-25116# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

VIBRATIONAL-ROTATIONAL EXCITATION: CHEMICAL VIBRATIONALLY EXCITED MOLECULES

C. Bradley Moore and Ian W. M. Smith (Univ. Chem. Labs., Cambridge, England) Mar. 1979 38 p refs Presented at Faraday Gen. Discussion no. 67 Kinetics of State-Selected Species, Birmingham, England, 9-11 Apr. 1979 Submitted for publication

(Contract W-7405-eng-48)

(LBL-9781; CONF-790411-2) Avail: NTIS HC A03/MF A01

A limited number of systems, particularly gas-phase processes are reviewed. Excited states and their preparation, direct bimolecular reactions, reactions of highly excited molecules, and reactions in condensed phases are discussed. Laser-induced isotope separation applications are mentioned briefly. DOE

N80-25117# California Univ., Berkeley. Lawrence Berkeley Lab.

ALGORITHMS AND COMPUTER CODES FOR ATOMIC AND MOLECULAR QUANTUM SCATTERING THEORY, VOLUME 1

Lowell Thomas, ed. 1979 417 p refs Proceedings of the workshop held at Argonne, Ill., 25-27 Jun. 1979; sponsored by the Natl. Resource for Computation in Chem.

(Contract W-7405-eng-48)

(LBL-9501; CONF-790696) Avail: NTIS HC A18/MF A01

The efficiency of existing computer codes for solving the coupled equations of quantum molecular scattering theory was determined for a variety of test problems. Many of the most active developers and users of these codes discuss the methods and solve a set of test problems using the LBL computers. DOE

N80-25118# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

MULTIPHOTON PROCESSES IN ISOLATED ATOMS AND MOLECULES Ph.D. Thesis

Aasmund Sveinung Sudbo Nov. 1979 132 p refs

(Contract W-7405-eng-48)

(LBL-9796) Avail: NTIS HC A07/MF A01

The theory of coherent excitation of a multilevel quantum mechanical system is developed. Damping of the system is taken into account by the use of a density matrix formalism. General properties of the wave function and/or the density matrix are discussed. The physical implications for the behavior of the system are described, together with possible applications of the formalism, including the infrared multiphoton excitation of molecules, and optical pumping in alkali atoms. Experimental results are presented on the infrared multiphoton dissociation of molecules, followed by a discussion of the general features of this process. The experimental results were obtained using a crossed laser and molecular beam method, and the emphasis is on determining the properties of the dissociating molecule and the dissociation products. The dissociation process is shown to be described very well by the standard statistical theory of unimolecular reactions. DOE

N80-25119# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

ELECTRON TEMPERATURE DETERMINATION FROM THE He1 3889A AND 5016A LINE INTENSITIES

Nils Brenning Mar. 1979 33 p refs

(TRITA-EPP-79-06) Avail: NTIS HC A03/MF A01

The possibility of determining electron temperature by helium spectroscopy in low density (N sub e < 10 exp 20/cu m) plasmas is discussed. It is concluded that most lines can only be used at very low densities (N sub e < 2 x 10 exp

16/cu m) because the line intensities are highly influenced by secondary processes, such as electron impact induced transitions between excited levels or excitations from metastable levels. The density range where measurements are possible can be extended if the influence of these secondary processes on the line intensities can be determined. For most helium 1 lines this is impossible for lack of atomic data. However, there are two exceptions, the 3889A (3 (3)P yields 2(3)S) and the 5016A (3 (1)P yields 2 (1)S) lines. The influence from secondary processes on these lines is calculated, and methods are developed which can be used for measurement of electron temperatures T sub e < 100 eV in plasmas of densities N sub e < 5 x 10 exp 19/cu m. The use of the methods is illustrated by a experiment where they use successfully applied. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-25120# SRI International Corp., Arlington, Va.
EMITTANCE OF TRANSPORT OF ELECTRON BEAM IN A FREE ELECTRON LASER
V. Kelvin Neil. Dec. 1979. 41 p. refs.
(Contract MDA903-78-C-0086; ARPA Order 2504)
(AD-A081064; SRI-JSR-79-10) Avail: NTIS HC A03/MF A01 CSCL 20/5

In this work we examine the consequences of finite beam emittance and discuss some of the requirements on the beam transport system in a free electron laser; we will not discuss the operation of the FEL. We concentrate on beams from linear accelerators, but the transport theory is quite general and may be applied to beams from (or in) a storage ring. We discuss a fundamental limitation placed on the beam current density by the finite emittance and the resulting spread in axial velocity, continuous solenoidal focusing, and the possibility of focusing the electron beam with the magnetic field of the wiggler. GRA

N80-25121# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM. Progress Report
W. J. Maraman, comp. Dec. 1979. 37 p.
(Contract W-7405-eng-36)
(LA-8184-PR) Avail: NTIS HC A03/MF A01

The formal monthly report covers the studies related to the use of 238PuO2 in radioisotopic power systems carried out for the Advanced Nuclear Systems and Projects Division of the Los Alamos Scientific Laboratory. The three programs involved are: General-Purpose Heat Source Development; Space Nuclear Safety; and Radioisotopic Terrestrial Safety. DOE

N80-25122# Battelle Pacific Northwest Labs., Richland, Wash.
ENVIRONMENTAL CONTROL ASPECTS FOR FABRICATION, REPROCESSING AND WASTE DISPOSAL OF ALTERNATIVE LWR AND LMFBR FUELS
A. M. Nolan, M. A. Lewallen, and G. W. McNair. Nov. 1979. 94 p. refs.
(Contract EY-76-C-06-1830)
(BNL-3129) Avail: NTIS HC A05/MF A01

Three different fabrication plants were analyzed using a 50 year dose commitment, a fuel fabrication plant (FFP) to produce low activity uranium and uranium thorium fuel rods, a plutonium fuel refabrication plant (PFRFP) to produce plutonium uranium and plutonium thorium fuel rods, and a uranium refabrication plant (UFRFP) to produce fuel rods containing the high activity isotopes U(-232) and U(-233). Bedded salt was chosen for the waste repository analysis. Wastes assumed to be stored in the repository include high level vitrified waste from the FRP, packaged fuel residue from the FRP, and transuranic contaminated wastes from the FFP, PFRFP, and UFRFP. The potential environmental significance was determined by estimating the ground water concentrations of the various nuclides over a time span of a million years. The maximum permissible concentrations for each nuclide was used along with the estimated ground water concentration to generate a biohazard index for the comparison among fuel compositions. DOE

N80-25123# Los Alamos Scientific Lab., N. Mex.
RESEARCH AND DEVELOPMENT RELATED TO THE NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS. Progress Report, 1 Jul. - 30 Sep. 1979
B. M. Crowe, comp. Nov. 1979. 14 p. refs.
(Contract W-7405-eng-36)
(LA-8152-PR) Avail: NTIS HC A02/MF A01

Sorption under anoxic conditions is reported for core samples of tuff from exploratory drill hole UE25a-1. Sorption for Sr, Cs, Ba, Ce, and Eu is somewhat lower in pure nitrogen than in ambient atmosphere, but generally by less than a factor of two. U and Tc sorb poorly in nitrogen; however, an increase over atmospheric conditions is noted for Tc. Final results for sorption of Pu and Am on core samples from drill hole J-13 are presented, and problems with Am are discussed. Ground water composition is found to be a major factor in sorption. Autoradiography indicates that Pu sorbs indiscriminately on rock thin sections and that Np deposits in aggregate form. Zeolite minerals are present within two distinct horizons of tuff. Prototype containment vessels for the hyorothermal soak tests have been assembled and tested. Revised volcanic disruption probability calculations for a 60-km radius circle around Yucca Mountain fall into the range of 10 to the 9th power/year. Petrographic and geochemical data for the basalts of Crater Flat show a strong control of basalt type with structural setting. DOE

N80-25124# Sandia Labs., Albuquerque, N. Mex. Transportation Technology Center.
DEFENSE HIGH-LEVEL WASTE AND SPENT FUEL CHARACTERIZATION FOR GEOLOGIC WASTE REPOSITORIES
S. H. Sutherland and D. E. Bennett. Sep. 1979. 32 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-0172) Avail: NTIS HC A03/MF A01

Results of calculations are given for the total thermal output and radionuclide content, up to 100,000 years decay time, for defense high-level waste expected from three defense industry sites, and for one pressurized water reactor and five boiling water reactor spent fuel types. DOE

N80-25125# Oak Ridge National Lab., Tenn. Energy Div.
PUBLIC INFORMATION ON RADIOACTIVE WASTE: A STUDY OF AN EMERGING ISSUE
L. M. Bronfman, B. H. Bronfman, and J. L. Regens. Oct. 1979. 59 p. refs.
(Contract W-7405-eng-26)
(ORNL/OIAPA-13) Avail: NTIS HC A04/MF A01

Through an analysis of information provided in the printed media on the topic of radioactive waste, the emergence of radioactive waste as a public issue in the press is analyzed. Discussions of radioactive waste have focused for all sources more frequently on themes not directly related to the technical problems of radioactive waste storage or isolation. A substantial amount of the information availabe to a variety of segments of the public is composed of discussions of real or perceived risk related to the existence of waste or to methods of disposing of it. In addition to risk, a substantial proportion of the discussions deal with institutional themes. Over time, the total amount of information on most dimensions of the radioactive waste problem has increased substantially. Institutional themes have gained relative to other issues. National and local press sources infrequently specify the form of waste being discussed thus providing evidence that the quality of technical information available to some members of the public is very low. DOE

N80-25126# Oak Ridge National Lab., Tenn.
MANAGEMENT OF RADIOACTIVE WASTES
J. O. Blomeke. Nov. 1979. 33 p. Presented at the Seminar on Nucl. Eng., College Station, Tex., 5-9 Nov. 1979.
(Contract W-7405-eng-26)
(DOE/TIC-10294) Avail: NTIS HC A03/MF A01

The nature and characteristics of radioactive wastes and present methods of handling are reviewed. Options available in

waste management and plans and expectations for the future are presented. DOE

N80-25127# Maryland Univ., College Park. Dept. of Physics and Astronomy.
NEW METHODS IN NUCLEAR REACTION THEORY
Edward F. Redish 1979 33 p refs Presented at the Meeting of the Am. Phys. Soc., Washington, D.C., 23-26 Apr. 1979
(Contract EY-76-S-05-5126)
(ORO-5126-97; CONF-790484-4) Avail: NTIS
HC A03/MF A01

Standard nuclear reaction methods are limited to treating problems that generalize two body scattering. These are problems with only one continuous (vector) degree of freedom (CDOF). The difficulty in extending these methods to cases with two or more CDOFs is not just the additional numerical complexity, it is hard to guarantee that the proper boundary conditions are satisfied. The physics of the problem in the context of coupled channel calculations is considered. A method for using techniques available for solving problems with two CDOFS in the nuclear N body problem is presented. A set of well posed equations for physical scattering operators is taken, and it is shown how approximation schemes can be developed for a wide range of reaction mechanisms. The resulting general framework for a reaction theory can be applied to a number of nuclear problems. DOE

N80-25128# California Univ., Berkeley. Lawrence Berkeley Lab. Nuclear Science Div.
GAMMA-RAYS FROM DEEP INELASTIC COLLISIONS
F. S. Stephens 1979 43 p refs Presented at the Varonna Conf., Italy, 9-25 Jul. 1979 Submitted for publication
(Contract W-7405-eng-48)
(LBL-10358; CONF-790751-3) Avail: NTIS
HC A03/MF A01

The gamma rays associated with deep inelastic collisions can give information about the magnitude and orientation of the angular momentum transferred in these events. Emphasis is placed on understanding the origin and nature of these gamma rays in order to avoid some of the ambiguities that can arise. The experimental information is reviewed, and compared briefly with that obtained by other methods and also with the expectations from current models for deep inelastic collisions. DOE

N80-25129# Brookhaven National Lab., Upton, N. Y.
HYPERNUCLEAR PHYSICS RESEARCH AT BROOKHAVEN
Morgan May 1979 15 p refs Presented at the 1979 Intern. Conf. on Hypernucl. and Low Energy Kaon Phys., Jablonna, Poland, 11-14 Sep. 1979
(Contract EY-76-C-02-0016)
(BNL-27154; CONF-7909118-1) Avail: NTIS
HC A02/MF A01

Experiments with the hypernucleus 12/sub lambda/C are described. The observed formation of hypernuclear states at large momentum is compared with theoretical expectations. DOE

N80-25130# Geological Survey, Albuquerque, N. Mex. Water Resources Div.
GEOHYDROLOGY OF THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEAST NEW MEXICO: INTERIM DATA REPORT Final Report
J. W. Mercer and B. R. Orr Jul. 1979 190 p refs Sponsored in part by DOE
(PB80-128762; USGS/WRI-79-98; USGS/WRD/WRI-80/001)
Avail: NTIS HC A09/MF A01 CSCL 08H

Hydrologic investigations were conducted to evaluate the feasibility of nuclear-waste storage within bedded salt of the Salado Formation of Permian age. Liquids in the rocks overlying the Salado Formation are found at the contact between the Permian-Rustler and Salado Formations, and in the Culebra and Magenta Dolomite Members of the Rustler Formation. The flow direction and transmissivity range for each formation are discussed. GRA

74 OPTICS

Includes light phenomena.

N80-25131 California Univ., San Diego.
APPLICATION OF INTEGRATED OPTICS TO OPTICAL SIGNAL PROCESSING Ph.D. Thesis
Lew Goldberg 1979 133 p
Avail: Univ. Microfilms Order No. 8009751

Integrated optical logic elements, which carry out digital logic operations between guided light input signals, were developed. Interaction between guided light beams was achieved with LiNbO3 electrooptic modulators, which operated by changing the cut-off condition of the lowest order guided mode in a channel waveguide, and CdS photodetectors. The photodetectors converted one of the input light signals into an electrical current. This current then changed the voltage bias on the electrooptic modulator, thereby changing the transmission state of a second input light signal, and the output of the logic gate. To demonstrate the flexibility of this approach to integrated optical logic, several elementary logic gates were combined on a single LiNbO3 substrate to produce a more complex information processing circuit, that of a half adder. A silicon photodiode for detecting digital signals propagating in optical channel waveguides was developed. The diode configuration was that of one side p-n junction formed in a preferentially etched mesa structure. The 7 micron wide mesas were placed in close proximity to the channel waveguide surface. Optical energy was transferred from waveguide to photodiode by evanescent field coupling. Dissert. Abstr.

N80-25132 Arizona Univ., Tucson.
IMAGE PARAMETERS FOR FAST EVALUATION OF ADAPTIVE OPTICAL SYSTEMS Ph.D. Thesis
Noah Bareket 1979 93 p
Avail: Univ. Microfilms Order No. 8009738

A set of image parameters in terms of the first and second moments of the irradiance distribution. The set includes the centroid, variance, eccentricity, and orientation of the principal axes. The relationship between the second moment of the point spread function (PSF) and the optical transfer function (OTF) is established through the moment theorem. The second moment is found to be the sum of a contribution of the pupil amplitude distribution, and a term that is directly related to the wavefront aberrations. One way to measure the image parameters is to sample the PSF by an array of detectors and use the digitized data to circulate the moments of the distribution. Sampling with small elements is shown to be more accurate than sampling with extended elements. An alternate way of measuring the parameters is by means of an analog measurement system based on chopping the images by a series of slits or knife edge apertures. Algorithms for performing the calculation are developed and functional block diagrams of electronic circuitry which perform these calculations are presented. Dissert. Abstr.

N80-25133 Utah Univ., Salt Lake City.
LIGHT SCATTERING BY NONSPHERICAL MULTILAYERED PARTICLES Ph.D. Thesis
Dau-Sing Y. Wang 1979 179 p
Avail: Univ. Microfilms Order No. 8008338

The light scattering characteristics of nonspherical, multilayered objects are theoretically studied using the Extended Boundary Condition Method, a technique capable of accurately evaluating the scattering functions for said objects having random orientations. Scattering calculations made for single layered, prolate spheroids indicate that a significant change in the differential scattering characteristics occurs as the internal structure changes. Angular scattering calculations made for a polydispersion of two layered, prolate, spheroidal particles using a quasi-Gaussian distribution as the density function of the size distribution, indicate changes in the average size of the distribution have a dominant effect on the scattering of such suspensions. Dissert. Abstr.

N80-25134*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PHOTOELECTRIC DETECTION SYSTEM Patent Application

James R. Currie, inventor (to NASA) Filed 30 Apr. 1980 14 p
(NASA-Case-MFS-23776-1; US-Patent-Appl-SN-145272) Avail: NTIS HC A02/MF A01 CSCL 20F

A photoelectric beam system for the detection of the arrival of an object at a discrete station wherein artificial light, natural light, or no light may be present is described. A signal generator turns a signal light on and off at a selected frequency. When the object in question arrives on station ambient light is blocked by the object and the signal light is reflected onto a photoelectric sensor having a delayed electrical output and of the same frequency as the signal light. Outputs from both the signal source and the photoelectric sensor are fed to inputs of an exclusively OR detector which provides as an output the difference between them. The difference signal is a small width pulse occurring at the frequency of the signal source. This signal is distinguished from those responsive to sunlight, darkness, or 120 Hz artificial light by filter means. In this fashion, An object presence is thereby established. NASA

N80-25135# Army Armament Research and Development Command, Dover, N. J. Fire Control and Small Caliber Weapon-System Command
APPLICATION OF THE HAAR TRANSFORM TO IR IMAGERY Final Report
Gary Sivak Mar. 1980 45 p refs
(DA Proj. 121-61101-A-011)
(AD-A082296; AD-E400408; ARSCD-TR-80001) Avail: NTIS HC A03/MF A01 CSCL 09/2

The author's fast Haar transform algorithm, referenced in a previous report, is analytically shown to elicit signal contrast improvement of digital imagery data. The development of a computer program to measure contrast improvement is explained, and tabular and graphical results of contrast increase are presented. A simulation is also developed to explore the algorithm's ability to improve the signal-to-noise ratio of digital imagery, and tabular results of the decrease of the RMS noise levels and increased signal-to-noise ratios are presented. Finally, the algorithm is run using real infrared imagery data, and picture plots before and after Haar processing are shown. GRA

N80-25136# ITT Electro-Optical Products Div., Roanoke, Va.
FIBER OPTIC COUPLERS Final Report, 17 Apr. 1978 - 16 May 1979
G. W. Bickel, Lawrence E. Foltzer, Glen A. Rines, and Art R. Nelson Wright-Patterson AFB, Ohio AFAL Jul. 1979 208 p refs
(Contract F33615-78-C-1448; AF Proj. 2001)
(AD-A082360; AFAL-TR-79-1149) Avail: NTIS HC A10/MF A01 CSCL 20/6

This report is the final report on a one-year technology development program for active and passive fiber optic coupler components. The passive coupler effort consisted primarily of the development of packaging method for coupler type developed previously under contract No. F33615-77-C-1058. The active coupler effort explored techniques of obtaining active switching and modulation for multimode data bus applications. GRA

N80-25137# Hampton Inst., Va. Dept. of Physics.
A STUDY OF TPF STRUCTURE FOR MULTIPLE OVERLAPPING OF PICOSECOND LASER LIGHT PULSES Final Technical Report, Dec. 1978 - Nov. 1979
D. D. Venable 1980 74 p refs
(Grant AF-AFOSR-0036-79; AF Proj. 2301)
(AD-A081939; AFOSR-80-0205TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

A systematic study has been conducted to characterize the multiple overlapping of closely spaced laser pulses in a two photon fluorescence (TPF) cell. Parametric analysis of the autocorrelation function for the amplitude of a closely spaced laser pulse train containing n-pulses has reproduced TPF spectra experimentally observed with a low light level electro-optics detecting system. The effects of one and two photon absorption has been analyzed. Theoretical predictions have been presented for peak to background ratios, number and spacings of TPF peaks, relative TPF peak intensities and fluorescent decay spectra. A design of an experimental system for generating closely spaced laser pulses has been presented. Closed form solutions have been obtained for cases in which two photon absorption is negligible. Finally, it can be concluded that laser pulses separated by distances on the order of one picosecond can be characterized with this system. GRA

N80-25138# Battelle Columbus Labs., Ohio.
OPTICAL WAVEGUIDE SCATTERING REDUCTION Final Report, 15 Apr. 1978 - 15 Apr. 1979
David W. Vahey Wright-Patterson AFB, Ohio AFAL Jun. 1979 76 p refs
(Contract F33615-78-C-1426; AF Proj. 2001)
(AD-A082357; AFAL-TR-79-1113) Avail: NTIS HC A05/MF A01 CSCL 20/6

The goal of this program was the reduction of scattering in optical waveguides to levels commensurate with the required performance characteristics of an integrated optical acoustooptic spectrum analyzer. Waveguides formed by thermal diffusion of Ti films into LiNb03 substrates were emphasized. The best waveguides were obtained by diffusing thin (+ or - 280 A) Ti films or by polishing waveguides made from thicker films to reduce surface contamination believed to be associated with Li-Ti-0 compound formation. Residual scattering in the best waveguides is found to be strongly anisotropic and polarization dependent. Additionally, it can be enhanced by an applied electric field, but not by the photorefractive generation of optical damage using a beam propagating parallel to the optical axis. Possible sources of residual scattering that were considered are antiphase microdomains, separated crystalline phases, and diffused-film imperfections. None of these could be definitely identified as the source of residual scattering in good Ti:LiNbO3 waveguides; however, only the micro-domains hypothesis appears to be ruled out on the basis of its conflicts with various data. Theoretical understanding of the scattering process was extended during the program to account for the two and three dimensional nature of waveguide scatters, and to account for volume as well as surface-roughness scattering centers. GRA

N80-25139# Ampex Corp., Redwood City, Calif. Advanced Technology Div.
OPTICAL CORRELATION STUDIES, CONTINUATION OF LENS PROGRAM Final Report, 1 Jun. 1977 - 28 Apr. 1979
Lawrence R. Weiner Oct. 1979 136 p refs
(Contract N00014-77-C-0447; NR Proj. 366-003)
(AD-A082073; RR-79-23) Avail: NTIS HC A07/MF A01 CSCL 20/6

The present program was provided information that is vital in the determination of the role that optical processing will play in acoustic data gathering systems. The program plan was designed to investigate whether a special purpose optical processor can truly interface with and augment the performance of digital processing equipment. The major accomplishments of this study were: (1) The development of an optical processing algorithm that would accept narrowbanded complex samples and form an ambiguity surface. (2) An optical system was designed and constructed to implement this algorithm. (3) The optical processor was tested by recording simulated acoustic data on film and using these masks as inputs. (4) Experiments were performed on this test bed that provided information on accuracy and detectability of the optical output. (5) Direct comparisons of the optically generated surfaces to surfaces calculated digitally with the same data were made. (6) It was ascertained that these optical techniques would be amenable to real-time implementation if spatial light modulators were substituted for the film. GRA

N80-25140# General Research Corp., Santa Barbara, Calif.
SPIRE: A COMPUTER MODEL OF ELECTRO-OPTICAL SENSORS Final Report, 9 Nov. 1978 - 30 Nov. 1979
H. F. Gilmore 30 Nov. 1979 91 p
(Contract DNA001-78-C-0002; DNA Proj. NWED-QAXHC301)
(AD-A082364; AD-E300694; GRC-RM-2212; DNA-3964F-21)
Avail: NTIS HC A05/MF A01 CSCL 17/5

SPIRE (Simulation of Passive Infrared Equipment) is a computer program designed to simulate a variety of electro-optical sensors by representing their various elements. These elements include the optics, the detector array, amplifiers, and other linear and non-linear signal processing stages. This report is a user's

introduction to the program: SPIRE is described, its use is discussed, and examples of applications are given. GRA

N80-25141# Lincoln Lab., Mass. Inst. of Tech., Lexington.
IRAR IMAGE PROCESSING TECHNIQUES
Dorothy R. Sullivan 7 Nov. 1979 45 p refs
(Contract F19628-80-C-0002; AF Proj. 649L)
(AD-A082727; TST-41; ESD-TR-79-271) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report examines the problems associated with the display of active (10.6 micron) infrared radar images. Issues addressed include degradations introduced by the imaging sensor, the effects of these degradations on image tracking and image enhancement, and evaluation of various tracking and enhancement techniques in view of their usefulness and potential hardware implementation. The performance of each algorithm is demonstrated using either simulated data or data collected by the Infrared Airborne Radar (IRAR) testbed system. GRA

N80-25142# Stanford Univ., Calif. Labs. of Physics.
ACOUSTICALLY SCANNED OPTICAL IMAGING DEVICES Semiannual Report, 1 Jul. - 31 Dec. 1979
G. S. Kino, J. Bowers, B. Khuri-Yakub, and R. Thornton Feb. 1980 81 p refs
(Contract N00014-76-C-0129; ARPA Order 2778)
(AD-A082029; SU-GL-3089; SAR-9) Avail: NTIS HC A05/MF A01 CSCL 17/1

Broadband ZnO on Si acoustic surface wave devices with a 40 MHz bandwidth has been demonstrated by making use of a new highly flexible iterative technique for the design of broadband matching networks. The first ZnO on Si Schottky diode correlator has also been demonstrated. Work proceeds on ZnO magnetron sputtering processes, with some problems due to badly oriented gold. These have been cured. GRA

N80-25143# Rockwell International Corp., Anaheim, Calif. Electronic Research Center.
FIBER RING INTERFEROMETER NOISE STUDY Final Technical Report, 1 Aug. 1979 - 31 Jan. 1980
Victor Vali and M. F. Berg 31 Jan. 1980 23 p refs
(Contract N00014-79-C-0675)
(AD-A081935; C80-102/501) Avail: NTIS HC A02/MF A01 CSCL 20/6

All the present fiber ring interferometer gyroscopes are sensitive to changes in environmental conditions. This noise background, which is equivalent to a fringe shift of about ten times the Earth rotation rate, is caused to a large extent by the polarization scrambling in the fiber and by the relative motion of the interferometer components. One of the environmental changes is the variation of the birefringent due to small twists. A way of quantifying this effect on the state of polarization is to introduce controlled twists in a straight, relatively short (about one meter) fiber and determine the output polarization. Another environmental change is the variation of birefringence with temperature changes. An experiment to obtain quantitative results on these effects is described. GRA

N80-25144# Hughes Research Labs., Malibu, Calif.
OPTICAL-MICROWAVE INTERACTIONS IN SEMICONDUCTOR DEVICES Quarterly Report, 1 Oct. - 31 Dec. 1979
L. Figueroa, C. Slayman, and H. W. Yen Feb. 1980 26 p refs
(Contract N00173-78-C-0192)
(AD-A082552; QR-6) Avail: NTIS HC A03/MF A01 CSCL 20/12

GaAs FETs with built-in optical waveguides are being developed. The purpose is to allow optical signals to be coupled into the active region of the devices efficiently. These FETs will be useful for optical mixing, optical injection locking, and optical detection purposes. GRA

N80-25145# Raytheon Co., Waltham, Mass. Research Div.
MANUFACTURING METHODS TECHNOLOGY PROGRAM, ZINC SELENIDE BLANKS FOR WINDOWS AND LENS ELEMENTS Final Technical Report, 17 Jul. 1978 - 17 Nov. 1979
R. N. Donadio, J. F. Connolly, and J. Pappis Feb. 1980 105 p
(Contract DAAB07-78-C-2038)
(AD-A083005; S-2689) Avail: NTIS HC A06/MF A01 CSCL 17/5

This program established a fully automated process for the chemical vapor deposition of zinc selenide blanks. Prior to the program Raytheon Company had an established production process for the fabrication of this material. Further, Raytheon Company had, on an experimental basis, determined that the process could be fully automated by replacing the internally housed zinc source system with an externally housed system that fed zinc into the furnace at a predetermined rate. This system was successfully used in the Pre-Engineering, Engineering, Confirmatory, and Pilot deposits to yield zinc selenide with good optical and mechanical properties. The program also demonstrated that this process significantly reduced the costs of standard type lens blanks. GRA

N80-25146# Stanford Univ., Calif. Physics Labs.
NEW APPROACHES TO OPTICAL SYSTEMS FOR INERTIAL ROTATION SENSING Final Report, 1 Oct. 1978 - 30 Sep. 1979
G. Pavlath, H. J. Shaw, and M. Chodorow 1980 80 p refs
(Grant AF-AFOSR-3070-76; AF Proj. 2305)
(AD-A082533; SU-GL-3094; AFOSR-80-0235TR) Avail: NTIS HC A05/MF A01 CSC 17/8

The objective of the program is to determine the potential of new fiber optic approaches to inertial rotation sensing. The system presently under investigation is a passive reentrant Sagnac system (PRS) in which light pulses from an external laser, propagating clockwise and counterclockwise around a multiturn sensing loop of single-mode optical fiber, are repetitively recirculated around the multiturn loop a multiplicity of times to increase the sensitivity of the system to inertial rotation. It is shown experimentally that five recirculations around a loop consisting of 600 meters of single mode fiber are possible using bulk optical components of standard precision, with behavior in accordance with theory. This has potential application to small rate-gyros. Work is proceeding on an all-fiber integrated version of the PRS system, which will circumvent serious optical alignment problems encountered with bulk components, and is designed to greatly increase performance as well as reducing size, weight and cost. An optical fiber amplifier being developed under a companion program will be introduced later into this system, to compensate for fiber propagation losses, forming an active reentrant Sagnac system (ARS), designed to permit a very large number of recirculations, forming an integrating-rate-gyro with potential for extreme sensitivity. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-25147 Columbia Univ., New York.
THERMONUCLEAR BURN IN WALL-CONFINED PLASMAS Ph.D. Thesis
Lubomyra Nadia Kmetyk 1979 151 p
Avail: Univ. Microfilms Order No. 8008746

The one dimensional initial value problem describing a hot, dense, thermonuclear reacting plasma which is magnetically insulated and contained between cold metal walls has been studied by means of computational simulation. The resulting time evolution of the plasma temperature, number density and magnetic field profiles includes the effects of thermal conduction and radiation energy losses from the plasma, convection, and a detailed treatment of alpha particle heating, as well as ohmic heating and magnetic field diffusion. The results are used to evaluate the net energy gains possible in a shock-heated, magnetically insulated, wall-confined fusion cycle. The energy multiplication is calculated for simple limiting cases and then in greater detail using one dimensional time-dependent physics. The effects on the energy gain of various two dimensional loss mechanisms, such as particle drifts and boundary layer instabilities, are estimated using modified forms of the general one dimensional model. Energy multiplications of between 10 and 20 are calculated

for a cylinder whose mean radius is less than one meter. Energy break-even is found for L = 20 cm, Ein = 1.9 MJ, at a power input of 8.8 TW. Dissert. Abstr.

N80-25148# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANOMALOUS VISCOSITY IN TURBULENT PLASMA DUE TO ELECTROMAGNETIC INSTABILITY, PART 1
T. Abe and K. Niu (Tokyo Inst. of Tech.) Feb. 1980 27 p refs
(IPPJ-442) Avail: NTIS HC A03/MF A01

The stability of electron plasma with body stress or shear stress is analyzed against the electromagnetic mode. There are two kinds of modes: one is purely transversal, having the electric field perpendicular to the plane of anisotropy, and another is transverse-longitudinal coupled mode, having the electric field in the plane of anisotropy. It is shown that Weibel-type instability occurs in the state where stresses exceed thresholds. Nonlinear theory is used to analyze the stationary turbulence and the viscosity in it. A.R.H.

N80-25149# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANOMALOUS VISCOSITY IN TURBULENT PLASMA DUE TO ELECTROMAGNETIC INSTABILITY, PART 2
T. Abe and K. Niu (Tokyo Inst. of Tech.) Feb. 1980 19 p refs
(IPPJ-443) Avail: NTIS HC A02/MF A01

It is shown that the electron plasma with stresses (body stress or shear stress) is unstable in the electromagnetic mode (the Weibel type instability) provided that stresses exceed thresholds. The stationary turbulence caused by this instability and the viscosity coefficient in it are analyzed by using the nonlinear theory. The resonance broadening has an important role in the saturation of fluctuations. Author

N80-25150# Nagoya Univ. (Japan). Inst. of Plasma Physics.
REVIEW ON RESONANCE CONE FIELDS
Toshiro Ohnuma (Tohoku Univ., Sendai) Feb. 1980 79 p refs
(IPPJ-446) Avail: NTIS HC A05/MF A01

The resonance cone fields and lower hybrid heating are historically reviewed including experiments and theories. F.O.S.

N80-25151# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONLINEAR TRANSVERSE VIBRATION OF ELASTIC BEAMS UNDER TENSION
Yoshi H. Ichikawa, Kimiaki Konno (Nihon Univ., Tokyo), and Miki Wadati (Tsukuba Univ., Sakura, Japan) Feb. 1980 10 p refs
(IPPJ-445) Avail: NTIS HC A02/MF A01

Nonlinear transverse vibrations of elastic beams under end-thrust were examined taking full account of the rigorous nonlinear relation of curvature and deformation of elastic beams. When the beams are subject to tension, the derived equation is shown to be reduced to one of the new integrable evolution equations through generalization of the inverse scattering method. Author

N80-25152# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CONTROL OF TOROIDAL EXPANSION OF HIGH BETA PLASMA COLUMN IN PINCH TOKAMAK BY PROGRAMMED PULSED VERTICAL FIELD
A. Nagata, S. Yamaguchi, and K. Hirano Feb. 1980 18 p refs
(IPPJ-444) Avail: NTIS HC A02/MF A01

Dynamics of high beta toroidal pinch plasmas in major radius plane is calculated after simple model and compared with experiments using STP-2 screw pinch under the conditions of T(e) = approximately 20eV and n(e) = approximately 1.2 x 10 to the 15th power cu cm. It is demonstrated that the theory agrees with the experimental results during the early phase of the discharge where the plasma keeps high beta value (poloidal Beta (p) = approximately 3) while discrepancy between the experiment and calculation begins to grow after 8 micron sec from the start of the main discharge because the Beta value decreases considerably. In order not to deviate the plasma column from the center of the discharge tube a concept of effective dissipative force generated by proper programming of the pulsed vertical field is introduced. This concept is shown to be useful in keeping the shock heated high beta plasma in the center of the discharge tube by damping out the unfavorable oscillation in a few oscillation periods. A.R.H.

N80-25153# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
PLASMA HEATING IN CORONAL LOOPS
J. G. Luhmann and R. M. Broussard 15 Feb. 1980 19 p refs
(ATR-80(9552)-1) Avail: NTIS HC A02/MF A01

In the lower corona, where plasma is constrained to flow in the direction of the local magnetic field, a loop field geometry connecting regions of opposite polarity will force plasma originating at the two foot points of the arch-like flux tube to interact. If the tube has a cross section that increases with distance from a foot point, the plasma evaporating at the foot point can be accelerated along the field in the same fashion as the solar wind is accelerated along open diverging flux tubes. If this acceleration occurs symmetrically with respect to the apex of the loop, Coulomb collisions between the ions of the resulting two streams from the opposite foot point convert this direct energy to thermal energy. Since the flux tube converges at both ends and the Coulomb collisions cause pitch angle scattering as well as thermalization, the heated plasma accumulates. The loop is destroyed when the pressure of the trapped plasma becomes greater than the confining pressure. The feasibility of this model of coronal loops is assessed using an example observed with the X-ray telescope on Skylab. A.R.H.

N80-25154# Texas Univ. at Austin. Dept. of Physics.
FORMATION AND DIAGNOSTICS OF A CYLINDRICAL SHELL PLASMA Final Technical Report
Roger D. Bengston, D. L. Honea, and D. Pease 1980 22 p refs
(Grant AF-AFOSR-3259-77; AF Proj. 2301)
(AD-A081983; AFOSR-80-0172TR) Avail: NTIS HC A02/MF A01 CSCL 20/9

An apparatus was developed which forms a hollow cylindrical plasma shell of 3 x 2 cm(2) cross section 40 cm diameter by injecting a neutral gas shell of argon via supersonic injection nozzles and ionizing this shell with a high voltage electrical discharge. GRA

N80-25155# California Univ., Davis. Dept. of Applied Science.
TURBULENT PLASMA HEATING Final Scientific Report, 1 Jul. 1978 - 30 Sep. 1979
John S. DeGroot Sep. 1979 18 p refs
(Contract F49620-76-C-0014; AF Proj. 2301)
(AD-A082228; AFOSR-80-0212TR) Avail: NTIS HC A02/MF A01 CSCL 20/9

This research involved measurements of plasma heating using electron beams, anomalous dc resistivity, and double layers. In addition, the development of a compact X-ray source is being investigated. An extensive set of measurements of the interactions of an electron beam with a collisionless plasma is summarized. It is found that the two stream electron wave decays into a large amplitude ion wave and an electron wave. The ion wave beats with the two stream electron wave and produces a short wavelength electron wave. This beat wave traps and heats the thermal electrons. The efficiency of conversion of beam energy to plasma energy is found to be less than one percent. Steady state anomalous dc resistivity has been investigated in a double plasma device. The spectra of the turbulence and the level of anomalous dc resistivity has been investigated in a double plasma device. The spectra of the turbulence and the level of anomalous dc resistivity are in fair agreement with theory. We have constructed another device which will be used to investigate anomalous dc resistivity at much higher currents and electric fields. We have made preliminary measurements of very large amplitude double layer formation in other experiments. Finally, we are constructing a very high power gas puff z pinch. We will measure the time history of X-ray emission from this device. GRA

N80-25156# California Univ., Livermore. Lawrence Livermore Lab.
RECENT PROGRESS IN INERTIAL CONFINEMENT FUSION AT THE LAWRENCE LIVERMORE LABORATORY

H. G. Ahlstrom and K. R. Manes 15 Oct. 1979 25 p refs
Presented at the 11th Ann. Electro Optics/Laser Conf., Anaheim, Calif., 23-25 Oct. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83312; CONF-791047-3) Avail: NTIS HC A02/MF A01

The Shiva and Argus laser systems at Livermore were developed to study the physics of inertial confinement fusion. Both laser system designs are predicated on the use of large aperture Nd-glass disk amplifiers and high power spatial filters. During the past year DT-filled microshell targets with and without polymer coatings were irradiated. Recently new instruments were developed to investigate implosion dynamics and to determine the maximum fuel density achieved by these imploded fusion pellets. A series of target irradiations with thin wall microshells at 15 to 20 TW, exploding pusher designs, resulted in a maximum neutron yield of 3 x 10 to the 10th power. Polymer coated microshells designed for high compression were subjected to 4 kJ for 0.2 ns and reached fuel densities of 2.0 to 3.0 gm/cu cm. Results of these and other recent experiments are reviewed. DOE

N80-25157# Los Alamos Scientific Lab., N. Mex.
ULTRA-SOFT X-RAY LIGHT PIPES FOR SPACE-, TIME- AND ENERGY-RESOLVED IMAGING OF HIGH-DENSITY PLASMAS
C. A. Ekdahl Nov. 1979 21 p refs
(Contract W-7405-eng-36)
(LA-8117-MS) Avail: NTIS HC A02/MF A01

By use of the ultra-soft X-ray (USXR) analog of 'light-pipes' space- and time-resolved measurements of plasma radiation in the high-energy region of the emission spectrum can be obtained. Using fast analog-to-digital converters, computerized data acquisition and processing, and the techniques of computer-aided tomography, it is possible to reconstruct from these data the time evolution of a spatially distributed X-ray source. A conceptual design of an apparatus using USXR pipes for obtaining spatially resolved data from the ZT-40 toroidal pinch is described. The pipes also have the property of acting as a dispersing element, and a means of using this feature to obtain information about the spectral properties of the plasma source is described. DOE

N80-25158# California Univ., Livermore. Lawrence Livermore Lab.
NOZZLE MODEL OF FLOWING PLASMA WITH FIELD REVERSAL
J. W. Shearer 7 Jan. 1980 23 p refs
(Contract W-7405-eng-48)
(UCID-18500) Avail: NTIS HC A02/MF A01

The flowing plasma outflow from a field reversed plasma gun is modeled by a one dimensional calculation based on the problem of fluid flow through a nozzle. A low plasma mass flow rate necessary for reconnection to be important. Comparison with 2D MHD calculations and with preliminary data from the BETA-II experiment are consistent with the model at this time. E.D.K.

N80-25159# Department of Energy, Washington, D. C. Office of Energy Technology.
GENERAL CHARACTERISTICS AND ASSESSMENT OF THE SCIENTIFIC/TECHNICAL FEASIBILITY OF THE NEXT MAJOR DEVICE IN THE TOKAMAK FUSION PROGRAM. SUMMARY OF THE US CONTRIBUTIONS TO THE INTOR WORKSHOP
W. M. Stacey, Jr. (Georgia Inst. of Technol., Atlanta), J. R. Gilleland (General Atomic Co., San Diego, Calif.), G. L. Kulcinski (Wisconsin Univ., Madison), and P. H. Rutherford (Princeton Plasma Physics Lab., N.J.) Sep. 1979 18 p Conf. held in Vienna, Austria, Dec. 1979
(DOE/ET-0117/1) Avail: NTIS HC A02/MF A01

A substantial physics and technology data base for INTOR exists today, and this data base will be expanded over the next few years by currently planned programs. However, certain crucial information will not be developed by currently planned programs. Much of this missing information could be developed on the INTOR time scale by the expansion and/or acceleration of existing R and D programs and by the establishment of new R and D programs. On this basis, it is concluded that it is scientifically and technologically feasible to undertake the construction of an INTOR-like device to operate in the early 1990s, provided that the supporting R and D effort is expanded immediately to provide an adequate data base within the next few years in a few critical areas. Furthermore, it is concluded that the construction of an INTOR-like device to operate in the early 1990s is the appropriate next major step in the development of fusion power. DOE

N80-25160# California Univ., Livermore. Lawrence Livermore Lab.
IMPROVED PERFORMANCE OF TANDEM MIRRORS WITH THERMAL BARRIERS
T. B. Kaiser Nov. 1979 21 p refs
(Contract W-7405-eng-48)
(UCID-18308) Avail: NTIS HC A02/MF A01

As originally conceived, tandem mirrors with thermal barriers are limited by MHD instabilities to values of central-cell Beta that are significantly lower than those attainable in tandems without barriers. Much of the degradation in performance is due to the introduction of a new region of unfavorable field line curvature in the central cell. From a variational calculation that maximizes central cell fusion power subject to constraints on the vacuum field energy and allowable interchange instability drive, an analytic expression is derived for a central cell magnetic field strength profile for which the new instability drive is greatly reduced. As a result, central cell performance is enhanced to a point approaching that of tandem mirrors without barriers. Formulas showing how Beta/sub c/ and fusion power scale with design parameters are also derived. DOE

N80-25161# California Univ., Livermore. Lawrence Livermore Lab.
TESTS OF HIGH-POWERED DIRECT CONVERSION ON BEAMS AND PLASMA
W. L. Barr, R. W. Moir, G. W. Hamilton, and A. F. Lietzke (Calif. Univ. Lawrence Berkeley Lab.) 6 Nov. 1979 6 p refs
Presented at the 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract W-7405-eng-48)
(UCRL-82852; CONF-791102-31) Avail: NTIS HC A02/MF A01

Two types of direct converters at up to 100 keV were tested. A beam direct converter was tested on a reduced area TFRT source at the Lawrence Berkeley Laboratory (LBL). After surface conditioning and outgassing, the efficiency was over 60% at the beginning of a pulse. During a pulse, the efficiency decreased as the gas density built up. A single-stage plasma direct converter with immersed grids is being tested on a steady-state ion beam with 6 kW of beam power. The power density at the grids can be varied by adjusting the beam focus. Recovery efficiencies over 70% are measured and we are now studying various loss mechanisms. DOE

N80-25162# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
MODE COUPLING IN A TOROIDAL SHARP-BOUNDARY PLASMA. 1: WEAK-COUPLING LIMIT
D. A. Dippolito and J. P. Goedbloed (Assoc. Euratom - FOM, Jutphaas, Netherlands) Dec. 1979 37 p refs
(Contracts EY-76-C-03-1018; DE-AC03-79ET-53057)
(SAI-254-79-933-LJ) Avail: NTIS HC A03/MF A01

The phenomenon of mode coupling in the discrete Alfven wave spectrum of ideal magnetohydrodynamics is studied using a simplified plasma model. The occurrence of mode coupling when a periodic modulation of the equilibrium magnetic field strength and curvature is introduced, either by toroidicity or by noncircularity of the cross section is shown. The existence of gaps in the frequency spectrum and the spatial localization of the eigenfunction as a result of mode coupling is analogous to the behavior of valence electrons in a one dimensional crystal lattice. DOE

N80-25163# Kansas State Univ., Manhattan. Dept. of Chemistry.
EXPERIMENTAL INVESTIGATION OF THE CHEMISTRY OF EXCITED STATES OF RARE GASES Quarterly Progress Report, 15 Jan. 1978 - 15 Apr. 1979

D. W. Setser May 1979 8 p refs
(Contract EY-76-S-02-2807)
(COO-2807-17; QPR-2) Avail: NTIS HC A02/MF A01

The reactions of Kr(P-3)1 and Xe(P-3)1 with halogen compounds, producing rare gas halides, were studied. Abstracts of two papers on excited rare gas states are included. DOE

N80-25164# Naval Research Lab., Washington, D. C. Plasma Theory Branch.

TRANSIENT TOKAMAK

W. M. Manheimer and N. K. Winsor 21 Dec. 1979 11 p refs
(Contract EX-76-A-34-1006)
(NRL-MR-4142) Avail: NTIS HC A02/MF A01

The generation of a Tokamak plasma, and its toroidal current, by an intense pulsed ion beam is described. The beam is injected into a target plasma or empty vacuum chamber and then builds the plasma around it. It is shown that ignition is theoretically possible for a dense, high field Tokamak. DOE

N80-25165# Department of Energy, Washington, D. C.

SURVEY OF THERMONUCLEAR INSTABILITIES IN A TOKAMAK

A. B. Mikhaylovskii (Gosudarstvennyj Komitet po Ispolzovaniyu Atomnoj Energit, Moscow, USSR) 1979 24 p refs Transl. into ENGLISH from Russian article
(DOE-TR-218) Avail: NTIS HC A02/MF A01

The results of the linear theory of the cyclotron instability of trapped alpha particles are discussed. The quasi-linear theory of this instability is described. Drift thermonuclear instabilities are then described along with Alfven instabilities caused by the peak on their energy distribution function. The cyclotron Alfven instability is then described. DOE

N80-25166# Naval Research Lab., Washington, D. C. Plasma Physics Div.

SHEAR STABILIZED CYLINDRICALLY SYMMETRIC MIRROR PLASMA Interim Report

W. M. Manheimer 21 Dec. 1979 7 p refs
(Contract EX-76-A-34-1006)
(NRL-MR-4144) Avail: NTIS HC A02/MF A01

A cylindrically symmetric MHD stable mirror plasma is proposed. Shear stabilization is used rather than minimum B. This essentially means running a current through the center of the mirror field. DOE

N80-25167# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

MAGNETIC TRAPS WITH A SPHERICAL SEPARATRIX: TORNADO TRAPS

B. P. Peregood (A. F. Ioffe Phys. Tech. Inst.) and B. Lehnert Nov. 1979 92 p refs
(TRITA-EPP-79-18; ISSN-0348-7539) Avail: NTIS HC A05/MF A01

The features of magnetic traps with a spherical separatrix are reviewed with special emphasis on Tornado spiral coil configurations. The confinement and heating of static plasmas in Tornado traps is treated, including the topology of the magnetic field structure, the magnetomechanical properties of the magnetic coil system, and the particle orbits as well as plasma behavior in these traps. In addition, the mode of rotating plasma operation by crossed electric and magnetic fields is described. The results of experiments on static and rotating plasmas are summarised. Conclusions are drawn about future possibilities of Tornado traps for the creation and containment of hot plasmas. Author (ESA)

N80-25168# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

A NEUTRON TELESCOPE AND SPECTROMETER FOR DIAGNOSTICS OF EXTENDED FUSION PLASMAS

T. Elevant and B. Holmqvist (Studsvik Sci. Res. Lab.) Sep. 1979 27 p refs Sponsored by EURATOM
(TRITA-PFU-79-09) Avail: NTIS HC A03/MF A01

A method for measurement of the energy spectra of thermonuclear neutrons from a fusion plasma and of the spatial distribution of the emitted neutrons is proposed. It is based on (n,p) scattering in a hydrogeneous specimen. The method provides simultaneous recording of the recoil proton energy and the energy of the corresponding scattered neutron by means of time of flight. Calculations show that an energy resolution less than 2% for D-D plasmas and about 3% for D-T plasmas is feasible. These figures correspond to ion temperatures, which cause a Doppler broadening in the neutron energy, of 0.4 and 7.0 keV, respectively. Results indicate that space resolution of 15 cm can be obtained. Author (ESA)

N80-25169# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

ON THE PLASMA BALANCE IN STRAIGHT EXTRAP GEOMETRY

B. Lehnert Oct. 1979 34 p refs
(TRITA-PFU-79-10) Avail: NTIS HC A03/MF A01

The parameter ranges and scaling laws of a small scale straight Extrap experiment were investigated in which a pinched plasma column was stabilized by an imposed inhomogeneous magnetic vacuum field. The relations between the characteristics plasma parameters and their possible ranges of stable and quasisteady equilibrium, as obtained from the results of earlier investigations on the momentum and heat balance, kink stability, and plasma-neutral gas interaction, are discussed. Scaling laws are obtained for the pinch radius, the plasma density, the temperature, and the electrode voltage as functions of the pinch current, the pinch length, and the neutral filling density. From these laws the achievable maximum plasma temperature can be calculated. Additional losses, such as from impurity radiation and Bohm diffusion, modify the scaling as well as the corresponding changes in the resistivity. Author (ESA)

N80-25170# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.

A MULTI-PULSE RUBY LASER RECORDING THE TEMPORAL EVOLUTION OF PLASMA PARAMETERS BY LIGHT SCATTERING

R. Behn 1979 11 p refs Submitted for publication
(IPF-79-4) Avail: NTIS HC A02/MF A01

A ruby laser which delivers about 30 equidistant pulses of MW peak power during each flashlamp discharge is described. The sequence of pulses is obtained by high repetition rate Q-switching with a KD*P Pockels cell. The laser system was developed for scattering diagnostics with the object of recording the temporal evolution of plasma parameters in the sub-millisecond time scale. A scattering experiment using a high current carbon arc plasma as a test object was carried out to demonstrate the capabilities of the system. Results show that for application to a Tokamak plasma a system with higher pulse energies and improved beam divergence is required. For this purpose investigations on oscillator-amplifier operation were carried out. Results demonstrate the validity of this approach. Author (ESA)

N80-25171# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.

WAVE PROPAGATION IN A TEMPERATURE n ION SPECIES PLASMA AROUND THE ION CYCLOTRON FREQUENCY RANGE

G. Janzen 1979 27 p refs Submitted for publication
(IPF-79-5) Avail: NTIS HC A03/MF A01

Plane wave propagation in temperate plasmas consisting of n ion species is calculated analytically for collisionless plasmas of arbitrary composition. Numerical results for the complex refractive index of plasmas, including collisions between particles of any kind and at arbitrary angles of propagation, are given. These results show that there are two waves propagating at all angles other than 90 deg, one wave showing resonances at each of the n cyclotron frequencies of the ions involved. High ion-ion collision frequencies combine the motions of the ions to give new mass and composition weighted hybrid ion cyclotron resonances. At right angles to the external magnetic field one wave will propagate in the ion cyclotron range showing n-1 ion-ion-hybrid resonances and n-1 hybrid cutoffs. The ion-ion-hybrid resonances can be traced down to propagation at angles smaller than 90 deg, disappearing for parallel propagation. The hybrid resonance frequencies are close to the cyclotron frequencies of the ions with small relative concentrations. Damping of the waves in the neighborhood of the ion-ion-hybrid resonances is strongly affected by ion-ion collisions. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-25172 Brown Univ., Providence, R. I.
ONE-DIMENSIONAL SYSTEMS: A NEW VARIATIONAL SOLUTION AND RELATIONS BETWEEN VARIOUS THEORIES Ph.D. Thesis
Ertugrul Berkcan 1978 162 p
Avail: Univ. Microfilms Order No. 8006972

A variational solution of the sine-Gordon theory and the Luther-Emery backward scattering model that is useful for the study of various quasi-one dimensional systems is presented. This yields a renormalized mass for the fundamental fermion of the massive Thirring model and the energy gap in the fermion spectrum of the backward scattering model. The solution is then generalized to a coupled chain problem and related to the SU(2) massive Thirring model. The normalization constants of the Mandelstam's representation for fermion operators are calculated and using the relation of the sine-Gordon theory to the massive thirring model, the renormalized mass of the massive Thirring model and the solitons are obtained in the range where there are no nonleading mass singularities. The one dimensional backward scattering model is related to the sine-Gordon theory by identifying the coupling constants and the cutoff procedures of the two theories. This yields the energy gap in the fermion spectrum for the backward scattering model in the corresponding range. This solution is then formulated in terms of Mandelstam operators. The results obtained are in good agreement with the nonweak coupling methods. Dissert. Abstr.

N80-25173 Georgia Inst. of Tech., Atlanta.
THE SCATTERING OF 5-30 keV HYDROGEN FROM METAL SURFACES Ph.D. Thesis
James Edward Harris 1979 141 p
Avail: Univ. Microfilms Order No. 8010002

The scattering of 5 to 15 keV protons and 30 keV H2(±) from surfaces of Au, Be, C, Cu, Nb, and stainless steel was investigated. Angular distributions of the total and neutral recoil flux were made from 21 degrees up to a 45 degree scattering angle. The flux was found to rise rapidly as the angle increased from the surface, reaching a peak midway between the surface and the specular angle, and declining at larger angles. Energy distributions recorded at a scattering angle theta of 30.4 degrees showed a peak in the intensity between 30% and 80% of the beam's initial energy. Larger angles had peaks at lower energies, and smaller angles showed maxima at larger energies. Numerical integration of the H(±) and H(-) energy distributions gave the ratio of H(-)/H(±). When the projectile's initial energy was reduced, the H(-)/H(±) ratio was found to rise. Absolute measurement of the current of ions scattered from a gold target allowed calibration of other measurements. Large changes in the intensity of the recoil particles and a shift toward lower energies in the energy distributions of scattered ion and in the total recoil flux occurred as the proton dose to the target increased. Dissert. Abstr.

N80-25174*# Guests Associates, Inc., Huntsville, Ala.
GROWTH OF SOLID SOLUTION SEMICONDUCTORS Final Report
Lawrence R. Holland 19 Jan. 1980 32 p refs
(Contract NAS8-33217)
(NASA-CR-161460; Rept-80-TR2) Avail: NTIS HC A03/MF A01 CSCL 20L

Laboratory investigation of tellurium solvent zone growth in which small ampoules were made to determine the rate of floatation separation of excess Te from a molten Hg(0.8)Cd(0.2)Te (1.0) charge is reported including tests performed on the solution grown crystals to determine product uniformity, and the segregation coefficient of HgTe and CdTe for this type of crystal growth. Specific areas covered include the following: (1) tests conducted on the growth of Hg(1-x)CdxTe single crystals by a solvent zone technique; (2) the distillation of ultrapure tellurium and cadmium directly into crystal growth ampoules; (3) Several attempts to grow single crystals in long ampoules by a modified Bridgman-Stockbarger technique, of which two were successful; (4) progress made toward the final definition of a growth ampoule for Bridgman-Stockbarger melt growth in space; and (5) series of tests conducted on fused silica ampoules to determine the safe limits of temperature and internal pressure. J.M.S.

N80-25175# Illinois Univ. at Chicago Circle, Chicago. Dept. of Physics.
STUDY OF THE PHASE TRANSITION IN NIOBIUM DIOXIDE Final Report, 1 Apr. 1977 - 30 Sep. 1979
P. M. Raccah 1 Feb. 1980 21 p refs
(Grant DAAG29-77-G-0084)
(AD-A081575; ARO-14998.3-P; Rept-3-46-32-59-3-60) Avail: NTIS HC A02/MF A01 CSCL 07/2

It is shown that it is indeed possible to use underdamped hard modes of high symmetry to determine quantitatively the temperature dependence of the order parameter in a structural phase transition (SPT). The example chosen is that of the SPT in Niobium dioxide. GRA

N80-25176# Rutgers - The State Univ., Piscataway, N. J. High Pressure Materials Research Lab.
THE POLING TIME DEPENDENCE OF THE FIELD INDUCED PHASE TRANSITION AND THE PIEZOELECTRIC RESPONSE OF POLY(VINYLIDENE FLUORIDE) FILMS
J. I. Scheinbeim, C. H. Yoon, K. D. Pae, and B. A. Newman 1 Mar. 1980 21 p refs Submitted for publication
(Contract N00014-75-C-0540; NR Proj. 356-564)
(AD-A081821; TR-16) Avail: NTIS HC A02/MF A01

The poling time dependence of the field induced phase transition (from phase 2 to polar phase 2) of biaxially oriented poly(vinylidene fluoride) films by X-ray methods have been examined. These results were compared with the poling time dependence of the piezoelectric response (d sub 31 and e sub 31) determined by using a Piezotron Model U (Toyo Seiki, Tokyo). The piezoelectric response shows an initial rapid increase with poling time followed by a slow increase as the poling time increases. The X-ray results show that the field induced phase transition is time dependent, and occurs first for those crystallites with their a axes perpendicular to the film surface. Crystallites with a in the plane of the film transform at a much slower rate. The data indicate that the poling time dependence of d sub 31 and e sub 31 (and, presumably, film polarization) are dependent on the transition rates. GRA

N80-25177# Honeywell, Inc., Minneapolis, Minn. Defense Electronics Div.
EFFECT OF ZrO2 SOURCE VARIATIONS ON PbZrO3-PbTiO3 PIEZOELECTRIC PROPERTIES Final Report, Mar. 1976 - 31 May 1979
W. B. Harrison and M. P. T. Murphy 15 Jan. 1980 51 p refs
(Contract N00014-76-C-0623)
(AD-A082138; HONEYWELL-47602; TR-2) Avail: NTIS HC A04/MF A01 CSCL 11/2

ZrO2, derived from three zircon source minerals and many process variations, was physically and chemically analyzed. The impact of the ZrO2 variations obtained was then evaluated in both dry and wet blended lead zirconate-lead titanate, high drive type piezoelectric compositions. Proper purification and blending of the ZrO2 was shown to yield PZ-PT material with uniform low and high drive piezoelectric behavior. Single precipitated ZrO2 and dry blending were shown to be highly variable processes. Also, solution ceramic approaches produced a higher density PZ-PT. GRA

N80-25178# RCA Labs., Princeton, N. J.
EPITAXIAL GROWTH OF SEMI-INSULATING GaAs Final Report, 1 Jul. 1977 - 31 Aug. 1979
S. T. Jolly, E. C. Douglas, S. G. Liu, C. P. Wu, and C. W. Magee Jan. 1980 101 p refs
(Contract N00014-77-C-0542; DARPA Order 3441)
(AD-A082163; PRRL-80-CR-3) Avail: NTIS HC A06/MF A01 CSCL 07/4

This program was aimed at the study of epitaxial growth of high-resistivity GaAs, high-energy implantation of donors into GaAs, and the use of high-power lasers for annealing implanted

GaAs layers. We have made significant progress in these three areas. We have grown high-resistivity Cr-doped GaAs layers with good surface morphology using both Ga/Hcl/AsH3/H2 and Ga/AsCl3/H2 processes. N-layers grown on epitaxial buffer layers have consistently shown lower compensation than direct growth on SI GaAs substrates. Cr doped layers have been grown on both SI GaAs and n or - GaAs substrates. Ion implantation into epitaxial buffer layers, in general, leads to higher electron mobility than direct implantation. GRA

N80-25179# North Carolina State Univ., Raleigh. Engineering Research Services Div.
SINGLE CRYSTAL EPITAXY AND CHARACTERIZATION OF BETA-SILICON CARBIDE Annual Report, 1 Jan. - 31 Dec. 1979
Robert F. Davis 25 Jan. 1980 33 p refs
(Contract N00014-79-C-0121; RR0210203)
(AD-A082036; ATR-243-027-001) Avail: NTIS HC A03/MF A01 CSCL 07/4

The project involves the development of low pressure chemical vapor deposition and r-f sputtering techniques for the synthesis of single crystal thin films of beta-SiC. The CVD apparatus is being produced in-house and a detailed description of the design is provided herein. Theoretical CVD phase diagrams of the Si-C-H system are also being produced as a function of Si/Si-C and total pressure. Both reactive sputtering of Si in CH4 and normal sputtering of a SiC target are being readied. GRA

N80-25180# Rensselaer Polytechnic Inst., Troy, N. Y.
ON THE TEMPERATURE DEPENDENCE OF THE VELOCITY OF SURFACE WAVES IN QUARTZ
B. K. Sinha and H. F. Tiersten Feb. 1980 31 p refs
(Contract N00014-76-C-0368; NR Proj. 318-009)
(AD-A082333; TR-30) Avail: NTIS HC A03/MF A01 CSCL 20/2

The first temperature derivatives of the fundamental elastic constants of quartz are employed along with the thermally-induced biasing strains in the equation for the first perturbation of the eigenvalue for the linear electroelastic equations for small fields superimposed on a bias to calculate the resulting change in surface wave velocity with temperature. Since the description employed is referred to a fixed reference state, the geometry does not change and the temperature coefficient of velocity is the negative of the temperature coefficient of delay. GRA

N80-25181# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
EPITAXIAL GARNETS AND HEXAGONAL FERRITES Final Scientific Report, 15 Jan. 1979 - 14 Jan. 1980
Howard L. Glass 28 Feb. 1980 8 p
(Contract F49620-79-C-0048; AF Proj. 2306)
(AD-A082539; C80-149/501) Avail: NTIS HC A02/MF A01 CSCL 07/4

The objective of this research is to develop new and improved epitaxial ferrite materials for use in microwave and millimeter-wave signal processing devices. The major emphasis has been on multiple layer epitaxial garnet structures for magnetostatic wave delay lines. Theoretical analysis was made for magnetostatic surface wave and magnetostatic forward volume wave propagation in structures containing two or three different magnetic garnet layers. Two-layer structures were prepared by liquid phase epitaxy using yttrium iron garnet as a high magnetization layer and lanthanum-gallium substituted yttrium iron garnet as a lower magnetization layer. Measurements of magnetostatic wave propagation at frequencies in the 1 GHz to 6 GHz range were generally in good agreement with the theory. For magnetostatic surface waves, non-dispersive delays of approximately 200 MHz bandwidth at a center frequency of 3 GHz are obtainable. Delay time can be varied from about 50 nsec/cm to 120 nsec/cm by choice of the layer thickness and magnetization. For magnetostatic forward volume waves, it appears to be possible to obtain 1 GHz bandwidths in linearly dispersive delay lines operating at X band. GRA

N80-25182# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.
LOW ENERGY ELECTRON DIFFRACTION. LEED-AUGER THIN-LAYER ELECTROCHEMICAL STUDIES OF THE UNDERPOTENTIAL DEPOSITION OF LEAD ONTO GOLD SINGLE CRYSTALS Ph.D. Thesis
Patrick Lee Hagans, A. Horna, W. OGrady, and E. Yeager 15 Dec. 1979 190 p refs
(Contract N00014-75-C-0953)
(AD-A082822; TR-51) Avail: NTIS HC A09/MF A01 CSCL 07/4

The underpotential deposition of lead onto very clean and well-ordered single crystal Au samples was studied with linear sweep voltammetry. The single crystal surfaces examined were (100), (110), (111) and (410). The (410) surface is a stepped surface with terraces of (100) orientation four atomic rows in width separated by steps of (100) orientation of monatomic height. The crystals were prepared in an ultra-high vacuum environment (equivalent to 10 to the minus 11th power Torr) by alternate cycles of argon-ion sputtering and annealing until the surfaces were clean within the limits of AES (Auger Electron Spectroscopy). GRA

N80-25183# Trinity Coll., Dublin (Ireland).
OPTICAL DETECTION OF MAGNETIC RESONANCE IN SEMICONDUCTORS Final Report, Mar. 1979 - Jan. 1980
Brian Henderson Jan. 1980 17 p
(Grant DA-ERO-79-G-0028; DA Proj. 1T1-61102-BH-57)
(AD-A082629) Avail: NTIS HC A02/MF A01 CSCL 20/12

Compound semiconductors were studied using spin sensitive optical polarization and photoconductivity. The spectrometer was redesigned to give greater versatility and sensitivity. Some of the design features were implemented and tested to show that theoretical advantages are indeed matched by experiment. The experiments so far attempted have been concerned with Cd Te and Ga As Cr. For Cd Te, recombination luminescence following band gap excitation is shown to be due to recombination processes involving donor states with g sub D = 1.61 and acceptors of g sub A = 1.35. The spectral dependence of these resonances show that the recombination is complex involving excitons trapped at neutral donors and neutral acceptors as well as holes trapped at neutral donors. The advantage of applying spin sensitive photoconductivity is apparent in experiments using band gap excitation in CdTe. GRA

N80-25184# Pennsylvania State Univ., University Park. Dept. of Chemistry.
SYNTHESIS AND SPECTROSCOPIC CHARACTERIZATION OF H3CoRu3(CO)12 CRYSTAL AND MOLECULAR STRUCTURE OF THE C3v ISOMER Interim Technical Report
W. L. Gladfelter, Gregory L. Geoffroy, and Joseph C. Calabrese 20 Mar. 1980 30 p refs Submitted for publication
(NR Proj. 053-645)
(AD-A082528; TR-6) Avail: NTIS HC A03/MF A01 CSCL 07/4

The reaction of HCoRu3(CO)13 with H2 in refluxing hexane gives the new cluster H3CoRu3(CO)12 in 75% yield. Infrared and H(1) NMR spectra indicate that the cluster exists in two isomeric forms. The structure of one isomer has determined by single crystal X-ray diffraction. The CoRu3 core of the molecule defines a distorted tetrahedron with three carbonyls terminally bound to each metal atom. The hydride ligands were located by difference Fourier techniques and bridge the three Ru-Ru bonds. The overall symmetry of the cluster is approximately C sub 3v. Spectral evidence indicates that the second isomer contains a bridging CO ligand and three non-equivalent hydrogens. The interconversion of the two isomers and the various hydrogen exchange processes have been monitored by H(1) NMR spectroscopy and the exchange mechanisms are discussed. GRA

N80-25185# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Physics.
EXPERIMENTAL STUDIES OF EXCITED METALLIC PHASES IN STRESSED GERMANIUM Ph.D. Thesis
J. E. Furneaux Sep. 1979 157 p refs
(Contract W-7405-eng-48)
(LBL-9334) Avail: NTIS HC A08/MF A01

The strain confined electron-hole liquid (SCEHL), a unique form of matter which forms when photoexcited carriers flow into a strain potential well created by suitably inhomogeneously stressing Ge was considered. Various experimental aspects of this SCEHL were studied. DOE

N80-25186# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
ANALYSIS OF TIN SUPERCONDUCTIVE FILM ELECTROMAGNETIC BEHAVIOR IN A PARALLEL MAGNETIC FIELD [ANALISI DEL COMPORTAMENTO ELETTROMAGNETICO DI FILM SUPERCONDUTTIVI DI STAGNO IN CAMPO MAGNETICO PARALLELO]
M. Flamini, S. Onori, and A. Rogani 20 Jul. 1979 26 p refs In ITALIAN
(ISS-P-79/9; ISSN-0390-6469) Avail: NTIS HC A03/MF A01

The validity of a proposed model for calculating the influence of temperature and thickness of a superconductive film upon the parallel critical magnetic field was experimentally verified for thickness in the order of the coherent length. Tests were made using 15 samples 1000 to 34,000 Angstrom thick. Experimental results are in good agreement with the Landau-Ginzburg model previsions either for thin thick films and the characteristic behavior changes in a continuous way from thin to thick films. The thickness dependence of the penetration depth was determined. Author (ESA)

N80-25187# European Space Agency, Paris (France).
CRYSTAL GROWTH OF 3-5 SEMICONDUCTORS. IMPROVEMENT OF CRYSTAL QUALITY WITH RESPECT TO MICROGRAVITY Final Report
Klaus-Werner Benz, Herbert Weiss (Erlangen-Nurenberg Univ.), and Georg Mueller (Erlangen-Nurenberg Univ.) Nov. 1979 68 p refs Transl. into ENGLISH of "Untersuchung der Moeglichkeiten zur Verbessereng der Kristallqualitaet von 3-5-Halbleintern im Hinblick auf Experimente unter O-g-Bedingungen", Rept. BMFT-FB-W-77-33 BMFT and Erlangen-Nurenberg Univ., Bonn. Original report in GERMAN previously announced as N80-12455
(ESA-TT-577; BMFT-FB-W-77-33) Avail: NTIS HC A04/MF A01

Gallium antimonide (GaSb) and indium antimonide (InSb) crystals were grown by the traveling-solvent-method (TSM) using both a vertical and a horizontal system. The maximum growth rates of GaSb crystals (solution temperature T = 500 C, vertical system) and InSb crystals (solution temperature T = 400 C, horizontal system) were estimated at .003 mm per min and .002 mm per min, respectively. A comparison was made between growth rates calculated by a diffusion limited transport model and the growth rates of the present experiments. It was concluded that the transport mechanism in the solution is governed by convection. The influence of various growth parameters on the crystal quality was studied. GaSb single crystals were grown with a diameter of 10 mm and a length of 30 mm. The dislocation density of these grown crystals was lower by a factor of 100 compared with the dislocation density of the seed crystal. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-25188 Texas Univ. at Austin.
THE UNSTABLE STATE AND ITS REPRESENTATION IN QUANTUM DECAY THEORY Ph.D. Thesis
Thomas Keith Bailey 1979 208 p
Avail: Univ. Microfilms Order No. 8009829

The problem of representing unstable quantum states is studied using superoperator quantum theory and complex energy solutions to the Schroedinger equation. The Hamiltonians studied are of the form H = H sub 0 + V, where H sub 0 has a bound state which is unstable with respect to the interaction V. Complex energy poles of the analytically continued resolvent (z - H) to the minus 1st power, are used to determine unstable state solutions to the Schroedinger equation and also the corresponding superoperator eigenvalue problem. The superoperator theory is based on the construction of a Hamiltonian with eigenvector elements as probabilities instead of amplitudes. The most general solution to this analytically continued superoperator eigenvalue problem contains terms which may be associated with the excitation of energy conserving continuous spectrum states. Normalization constants may be chosen so that probability is conserved in the time dependent decay process. Dissert. Abstr.

N80-25189 Stanford Univ., Calif.
QUANTUM THEORY OF COHERENT RAMAN AND COHERENT HYPER-RAMAN SCATTERING Ph.D. Thesis
Jon Orn Bjarnason 1980 156 p
Avail: Univ. Microfilms Order No. 8011605

The fully quantum mechanical theory of coherent Raman scattering in gases and liquids is developed where the electromagnetic radiation is described as a quantized field, and the quantum mechanical transition amplitude for the scattering process is calculated. The Doppler broadened lineshape for the ideal gas is calculated and found to be non-Gaussian with a width that is 1.2 times larger than the Doppler width for spontaneous Raman scattering in the forward direction. The rotational-vibrational bandshape is shown to be related to a correlation function for rotational-vibrational motion. The asymptotic behavior of the coherent Raman signal in the wings of a resonance is found, and the relation between the correlation function and the integrated intensity is derived. The fully quantum mechanical theory of the coherent hyper-Raman effect is treated. The selection rules for coherent hyper-Raman scattering are shown to be identical to those for the spontaneous hyper-Raman process. A relation between the coherent hyper-Raman spectrum and a correlation function of the hyperpolarizability is obtained. The coherent hyper-Raman process bears the same relation to spontaneous hyper-Raman scattering as a coherent Raman process does to spontaneous Raman scattering. Dissert. Abstr.

N80-25190# Arizona Univ., Tucson. Optical Sciences Center.
ELECTROMAGNETIC ANISOTROPY Final Report, 1 Oct. 1978 - 30 Sep. 1979
Peter A. Franken, J. G. Small, and E. Bogatin Dec. 1979 75 p refs
(Contract F49620-77-C-0021; AF Proj. 2301)
(AD-A082232; AFOSR-80-0221TR) Avail: NTIS HC A04/MF A01 CSCL 20/10

Two new precision laser interferometric tests of the postulates of special relativity are described. Two independent frequency stabilized lasers situated on the circumference of a rotatable platform beat together at the center. A variation in the beat frequency as the table rotates can be interpreted as a one way anisotropy in the speed of light. A test for a round trip anisotropy is made by monitoring the cavity length change as the laser orientation change. This can also be interpreted as a mass anisotropy in space. GRA

N80-25191# Texas Univ., Austin. Center for Particle Theory.
FIBER BUNDLES IN A NON-RELATIVISTIC QUANTUM MECHANICS
P. Moylan Nov. 1979 43 p refs
(Contract EY-76-S-05-3992)
(ORO-3992-375) Avail: NTIS HC A03/MF A01

The problem of describing a quantum mechanical system with symmetry by a fiber bundle is considered. The quantization of a fiber bundle is introduced. Fiber bundles for the Kepler problem and the rotator are constructed. The fiber bundle concept provides a model for a physical system: it provides a model for an elementary particle with extension having integral values of spin. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-25192 International Institute for Applied Systems Analysis, Laxenburg (Austria).
THE TENNESSEE VALLEY AUTHORITY: A FIELD STUDY
Hans Knop, ed. Jun. 1979 249 p refs
(IIASA-RR-79-2) Avail: Issuing Activity

The results of an international conference on the Tennessee Valley Authority (TVA) are given. They are divided into four main parts: the systems approach to regional industrial development programs; the managerial structure of the TVA, including specific management case studies of several major departments; the application of models and computer techniques to management; and the integration of environmental factors into the TVA management and planning processes, including a case study dealing with the environmental decision-making process in the siting of a nuclear power plant. Author (ESA)

N80-25193# Perceptronics, Inc., Woodland Hills, Calif.
AN INTERACTIVE COMPUTER AIDING SYSTEM FOR GROUP DECISION MAKING Quarterly Technical Report
Steven Johnston and Randall Steeb May 1979 33 p
(Contract MDA903-77-C-0184; ARPA Order 3344)
(AD-A082440; PQTR-1046-79-5) Avail: NTIS
HC A03/MF A01 CSCL 05/1

This report describes progress on work centered on the transfer of an interactive computer aid for group decision making to the DARPA/CTO Demonstration and Development Facility. The report includes: (1) implementation details of both the black and white version and the color version; (2) a description of software support modules required for system integration as a generalized demonstration program at the DDF; (3) the design description of the Group Aid/CACI Executive Aid integration; and (4) a progress report on the full scale experimental studies currently being administered. GRA

N80-25194# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
AN ALGORITHM FOR COMPUTERIZED ADAPTIVE DECISION ANALYSIS Final Report, Jan. - Sep. 1976
James L. Raney Sep. 1979 43 p refs
(DA Proj. 2T1-61101-A-91B)
(AD-A082924; ARI-TR-406) Avail: NTIS HC A03/MF A01 CSCL 12/1

This research investigated an application of recent results in conjoint measurement theory research with the aim of developing a new methodology for (1) modeling a decision process used to evaluate preferences for complex choice alternatives; and (2) producing measurement scales for choice component factors and composite choice alternatives based on the decision model. An algorithm for interactive conjoint measurement (ICM) was developed to minimize the problems of redundancy and random error in testing the additive-independence model (AIM) in pair-comparisons designs with fallible data. No provisions were made for handling the systematic error problem or for accommodating more than two choice component factors. The ICM algorithm was tested in error-free data and in data with random error. The results showed that this ICM algorithm performed rather poorly. GRA

N80-25195# National Bureau of Standards, Washington, D.C.
DIMENSIONS/NBS, VOLUME 63, NO. 11 Monthly Report
Nov. 1979 41 p refs
(PB80-141542; NBS/DIM-63/11) Avail: NTIS
HC A03/MF A02 CSCL 14B

Short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications are presented. Topics covered include: fire safety tips for wood burning appliances; computer interface standards; new photometric calibrator performs direct measurement; girth weld standards for Alaskan natural gas pipeline; and 'ultra-black' coating for high absorptance of solar energy. GRA

N80-25196# National Bureau of Standards Washington, D.C.
DIMENSIONS/NBS, VOLUME 63, NO. 12 Monthly Report
Dec. 1979 37 p refs
(PB80-130701; NBS/DIM-63/12) Avail: NTIS
HC A03/MF A01 CSCL 14B

Short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications are presented. Topics covered include: protecting citizens' rights; once is enough; guidelines for the use of modernized metric system; refractory concrete strength measured under simulated usage; chemical degradation of refractory liners in coal gasifier systems; data centers established to aid coal conversion industry; conferences; publications; index; and news briefs. GRA

N80-25197# George Washington Univ., Washington, D. C.
THE MEANING OF PATENT STATISTICS Final Report
L. James Harris, Mary A. Holman, Edmund W. Kitch, and Keith Pavitt Dec. 1979 107 p refs Sponsored by NSF Prepared in cooperation with Chicago Univ., Ill., and Sussex Univ., Brighton, England
(PB80-137664; NSF/SIU-79-1) Avail: NTIS
HC A06/MF A01 CSCL 05A

The strengths and weaknesses of patent counts as measures of levels of technical invention are discussed. Long range studies providing insight into the meaning of patent data are suggested. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-25198*# Herner and Co., Washington, D.C.
AN EVALUATION OF THE GODDARD SPACE FLIGHT CENTER LIBRARY
Saul Herner, F. W. Lancaster, Nancy Wright, Lynn Ockerman, Barbara Shearer, Susan Greenspan, Jule McCartney, and Matthew Vellucci Jul. 1979 68 p refs
(Contract NAS5-25140)
(NASA-CR-159969) Avail: NTIS HC A04/MF A01 CSCL 05B

The character and degree of coincidence between the current and future missions, programs, and projects of the Goddard Space Flight Center and the current and future collection, services, and facilities of its library were determined from structured interviews and discussions with various classes of facility personnel. In addition to the tabulation and interpretation of the data from the structured interview survey, five types of statistical analyses were performed to corroborate (or contradict) the survey results and to produce useful information not readily attainable through survey material. Conclusions reached regarding compatability between needs and holdings, services and buildings, library hours of operation, methods of early detection and anticipation of changing holdings requirements, and the impact of near future programs are presented along with a list of statistics needing collection, organization, and interpretation on a continuing or longitudinal basis. A.R.H.

N80-25199*# General Electric Co., Huntsville, Ala. Space Div.
DATA SYSTEM IMPLICATIONS DERIVED FROM USER APPLICATION REQUIREMENTS FOR SATELLITE DATA
James Neiers May 1979 79 p refs
(Contract NAS8-32491)
(NASA-CR-161468; Doc-79HV005) Avail: NTIS
HC A05/MF A01 CSCL 05B

An investigation of the data system needs as driven by users of space acquired Earth observation data is documented. Two major categories of users, operational and research, are identified. Limiting data acquisition alleviates some of the delays in processing thus improving timeliness of the delivered product.

Trade offs occur between timeliness and data distribution costs, and between data storage and reprocessing. The complexity of the data system requirements to apply space data to users' needs is such that no single analysis suffices to design and implement the optimum system. A series of iterations is required with analyses of the salient problems in a general way, followed by a limited implementation of benefit to some users with a continual upgrade in system capacity, functions, and applications served. The resulting most important requirement for the data system is flexibility to accommodate changing requirements as the system is implemented. E.D.K.

N80-25200*# National Aeronautics and Space Administration, Washington, D. C.
A BIBLIOGRAPHY OF SPACE BOOKS AND ARTICLES FROM NON-AEROSPACE JOURNALS, 1957-1977
John J. Looney 1979 258 p
(NASA-TM-81068; HHR-51) Avail: NTIS MF A01; SOD HC CSCL 05B

This bibliography cites over 3,600 articles and books from the nonspecialized secondary literature relating to NASA and to aerospace-related themes. Entries are arranged alphabetically by author in the following categories: (1) space activity; (2) spaceflight: earliest times to the creation of NASA; (3) organization, administration, and management of NASA; (4) aeronautics; (5) boosters and rockets; (6) technology of spaceflight; (7) manned spaceflight; (8) space science; (9) applications; (10) space law; (11) international implications; (12) foreign space programs; (13) domestic public policy and opinion; and (14) economics: impact of NASA, analyses of aerospace industry, and patent policy. A.R.H.

N80-25201# Battelle Pacific Northwest Labs., Richland, Wash.
STATUS OF SORPTION INFORMATION RETRIEVAL SYSTEM
D. D. Hostetler and A. Brandstetter Sep. 1979 64 p
(Contract EY-76-C-06-1830)
(PNL-3139) Avail: NTIS HC A04/MF A01

A sorption information retrieval system designed to provide an efficient, computerized, data base for information on radionuclide sorption in geologic media is described. The dark bank will include Kd values for a large number of radionuclides occurring in radioactive wastes originating from the commercial nuclear power industry. Kd values determined to date span several groundwater compositions and a wide variety of rock types and minerals. The data system will not only include Kd values, but also background information on the experiments themselves. This will allow the potential user to retrieve not only the Kd values of interest but also sufficient information to evaluate the accuracy and usefulness of the data. DOE

N80-25202# California Univ., Berkeley. Electronics Research Lab.
INGRES: A RELATIONAL DATA BASE SYSTEM Final Report, 1 Jun. 1976 - 30 Sep. 1979
M. Stonebraker and E. Wong Sep. 1979 10 p refs
(Grant DAAG29-76-G-0245)
(AD-A082548; ARO-13585.14-EL) Avail: NTIS HC A02/MF A01 CSCL 05/2

The report summarizes the progress made during a three year period on research in data base management. The primary effort has been the design development of a major data base management system of the relational type, INGRES. In addition, a number of new directions, such as distributed data bases and data base machines were initiated. GRA

N80-25203# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
ENERGY INFORMATION DATA BASE, SERIES TITLES: SUPPLEMENT 7, FEBRUARY 1978 - DECEMBER 1979
Dec. 1979 137 p
(DOE/TIC-4579-R10-Suppl-7) Avail: NTIS HC A07/MF A01

Changes and additions to the authority list for serial titles used by the DOE Technical Information Center are listed. Supplements are cumulative from February 1978 until another revision is issued. DOE

N80-25204# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
ENERGY INFORMATION DATA BASE, CORPORATE AUTHOR ENTRIES: SUPPLEMENT 4, JUNE 1978 - DECEMBER 1979
Dec. 1979 57 p
(DOE/TIC-4585-R1-Suppl-4) Avail: NTIS HC A04/MF A01

Additions to the authority list for corporate author names are given. Supplements are cumulative from June 1978 until another revision is issued. DOE

N80-25205# Royal Aircraft Establishment, Farnborough (England).
ACCEPTANCE TESTS FOR THE RAE SCIENTIFIC DATA BASE: THE SCHEMA AND SUBSCHEMA COMPILER TESTS
Irene M. Cummings London HMSO Aug. 1979 27 p refs
(RAE-TM-Math-Comp-7905; BR71363) Avail: NTIS HC A03/MF A01

A data base management system was designed consisting of a set of utility programs and a library of routines which can be incorporated in FORTRAN programs. The system was subjected to a set of rigorous acceptance tests. One set of acceptance tests, prepared for the schema and subschema compilers, are described in detail. These tests are shown to be sufficient to ensure confidence in the soundness of the software. Author (ESA)

N80-25206# General Electric Co., Arlington, Va.
SHIPPING OPERATIONS INFORMATION SYSTEM: EXECUTIVE OVERVIEW Progress Report, Jun. 1978 - Dec. 1979
Thomas Choate Dec. 1979 63 p
(Contract MA-6-38043)
(PB80-134778; MA-RD-930-80023) Avail: NTIS HC A04/MF A01 CSCL 09B

Computer software modules developed for a shipping operations information system are described. The description of each module includes a functional overview as well as highlights of the capabilities, benefits, and operational elements of the module. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-25207# Argonne National Lab., Ill.
MARKET PENETRATION OF NEW ENERGY SYSTEMS ESTIMATED BY ECONOMETRIC AND STOCHASTIC METHODOLOGY
Arvind P. S. Teotia, Chinmei Lee, and Allen S. Kennedy 1979 15 p refs Presented at the IGT Symp. on Energy Modeling 2: The Interface Between Model Builder and Decision Maker, Colorado Springs, Colo., 13-19 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790852-2) Avail: NTIS HC A02/MF a01

An econometric and stochastic model approach is used to analyze the technical, economic, and market factors influencing the possible market penetration of new energy systems. The market model methodology includes four phases: segment the new technology/end-use market; estimate the technical market; estimate the economic market; and estimate the market penetration. The market penetration of integrated community energy systems (ISCE) is estimated by this methodology. To illustrate the methodology, highlights of the ICES application are included. DOE

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-25208*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ALLEVIATION OF PRESSURE PULSE EFFECTS FOR TRAINS ENTERING TUNNELS. VOLUME 1: SUMMARY Final Report
Bain Dayman, Jr., Andrew G. Hammitt, Harold P. Holway, Curtis E. Tucker, Jr., and Alan E. Vardy Jun. 1979 51 p refs Presented at the 3rd Intern. Symp. on the Aerodyn. and Ventilation of Vehicle Tunnels, Sheffield, England, 12-21 Mar. 1979; sponsored by BHRA Fluid Engineering Sponsored in part by DOT
(Contract NAS7-100)
(NASA-CR-163012; JPL-Pub-78-73-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 13F

The degree to which it is possible to attenuate the effects of pressure pulses on the passengers in trains entering tunnels by modifying the normally abrupt portal of a constant-diameter single track tunnel was investigated. Although the suggested modifications to the tunnel entrance portal may not appreciably decrease the magnitude of the pressure rise, they are very effective in reducing the discomfort to the human ear by substantially decreasing the rate of pressure rise to that which the normal ear can accommodate. Qualitative comparison was made of this portal modification approach with other approaches: decreasing the train speed or sealing the cars. The optimum approach, which is dependent upon the conditions and requirements of each particular rail system, is likely to be the portal modification one for a rapid rail mass transit system. A.R.H.

N80-25209*# Ford Motor Co., Dearborn, Mich. Research Staff.
FEASIBILITY STUDY OF SILICON NITRIDE REGENERATORS
C. A. Fucinari and V. D. N. Rao Oct. 1979 58 p refs
(Contract DEN3-8)
(NASA-CR-159713; DOE/NASA/0008-79/10) Avail: NTIS HC A04/MF A01 CSCL 13F

The feasibility of silicon nitride as a regenerator matrix material for applications requiring inlet temperatures above 1000 C is examined. The present generation oxide ceramics are used as a reference to examine silicon nitride from a material characteristics, manufacturing, thermal stress and aerothermodynamic viewpoint. E.D.K.

N80-25210*# Defense Research Corp., Santa Barbara, Calif. Lunar Systems.
DESIGN AND MANUFACTURE OF WHEELS FOR A DUAL-MODE (MANNED - AUTOMATIC) LUNAR SURFACE ROVING VEHICLE. VOLUME 1: DETAILED TECHNICAL REPORT
May 1970 171 p
(Contract NAS8-25194)
(NASA-CR-163199; TR70-30-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13F

The concept development, testing, evaluation, and the selection of a final wheel design concept for a dual-mode lunar surface vehicle (DLRV) is detailed. Four wheel configurations were fabricated (one open wheel and three closed wheel) (and subjected to a series of soft soil, mechanical, and endurance tests. Results show that the open wheel has lower draw-bar pull (slope climbing) capability in loose soil due to its higher ground pressure and tendency to dig in at high wheel slip. Endurance tests indicate that a double mesh, fully enclosed wheel can be developed to meet DLRV life requirements. There is, however, a 1.0 to 1.8 lb/wheel weight penalty associated with the wheel enclosure. Also the button cleats used as grousers for the closed-type wheels result in local stress concentration and early fatigue failure of the wire mesh. Load deflection tests indicate that the stiffness of the covered wheel increased by up to 50% after soil bin testing, due to increased friction between the fabric and the wire mesh caused by the sand. No change in stiffness was found for the open wheel. The single woven mesh open wheel design with a chevron tread is recommended for continued development M.G.

N80-25211*# Defense Research Corp., Santa Barbara, Calif.
DESIGN AND MANUFACTURE OF WHEELS FOR A DUAL-MODE (MANNED - AUTOMATIC) LUNAR SURFACE ROVING VEHICLE. VOLUME 2: PROPOSED TEST PLAN
May 1970 40 p
(Contract NAS8-25194)
(NASA-CR-163200; TR70-30-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 13F

A developmental test plan for the wheel and wheel drive assembly of the dual-mode (manned/automated) lunar surface roving vehicle is presented. The tests cover performance, as well as critical environmental characteristics. Insofar as practical, the environmental conditions imposed will be in the sequence expected during the hardware's life from storage through the lunar mission. Test procedures are described for static load deflection and endurance tests. Soft soil tests to determine mobility characteristics including drawbar-pull and thrust vs slip, and motion resistance for various wheel loads are also discussed. Test designs for both ambient and thermal vacuum conditions are described. Facility, transducer, and instrumentation requirements are outlined. M.G.

N80-25212# Ford Motor Co., Dearborn, Mich.
FORD/DOE SODIUM-SULFUR BATTERY ELECTRIC VEHICLE DEVELOPMENT, PHASE 1A Final Report
Dec. 1979 193 p
(Contract EY-76-C-02-2566)
(DOE/CS/2566-1) Avail: NTIS HC A09/MF A01

An evaluation of a NaS battery design, developed for installation in an existing production vehicle, is presented. It is shown that a NaS battery powered two passenger vehicle can have adequate performance and range potential such that its use as a test bed could adequately evaluate the potential of the NaS battery as a power source for further electric vehicles. DOE

N80-25213# Science Applications, Inc., McLean, Va.
ASSESSMENT OF THE TECHNOLOGY TRANSFER POTENTIAL OF FEDERAL PHOTOVOLTAIC POWER SYSTEM APPLICATIONS TO COMMERCIAL MARKETS Final Report
T. F. Jaras, Michael McDonnell, and Richard A. Moyle Jun. 1979 153 p
(Contract EM-78-C-04-4261)
(ALO-4261-T8) Avail: NTIS HC A08/MF A01

An assessment of the market potential of photovoltaic power supplies is presented. Markets analyzed include the water pumping market, marine navigational aids, cathodic protection, remote general power sources, telecommunications, air navigational aids, mobile generator market, instrumentation, and utility connected applications. DOE

N80-25214# Department of Energy, Washington, D. C. Office of Transportation Programs.
ELECTRIC AND HYBRID VEHICLE PROGRAM Annual Report to Congress, FY 1979
Jan. 1980 93 p refs
(DOE/CS-0130; AR-3) Avail: NTIS HC A05/MF A01

The number of vehicles committed to market demonstrations increased from more than 200 in FY 1978 to almost 800 and demonstration sites rose from 16 to 57. There was a modest

increase of commercial interest and public awareness of the potential of electric and hybrid vehicles also was heightened. Market demonstrations, incentives, research and development, product engineering, commercialization activities, and legislative recommendations are reported. DOE

N80-25215# Westinghouse Electric Corp., Pittsburgh, Pa.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF NICKEL-IRON BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report
Oct. 1979 76 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-78-14) Avail: NTIS HC A05/MF A01

The fabrication and evaluation of cells are discussed. Electroprecipitation nickel electrodes were prepared of up to 24 Ah/plate (at C/3 drain rate) at design thickness (2.5 mm). Iron electrodes of the composite-type deliver 24 Ah/plate (at C/3) at target thickness (1.0 mm). Both plates display good capacity stability at 130 to 175 test cycles, respectively, in some of the three plate cell tests. Finished cells deliver up to 58 Wh/Kg at C/3, based on projected weight of the finsihed cell and in the actual designed cell volume. Reduction in cell resistance, reduction in nickel plate processing time, and swelling on cycling are areas of major effort to reach the final battery objectives. Thermal nickel electrodes show promise in full size plate tests (up to 22 Ah in a plate of only 2.3 mm thickness). DOE

N80-25216# Volunteers in Technical Assistance, Inc., Mount Rainier, Md.
APPROPRIATE TECHNOLOGY INFORMATION FOR DEVELOPING COUNTRIES. SELECTED ABSTRACTS FROM THE NTIS DATA FILE (SECOND EDITION)
Paul L. Bundick Nov. 1979 413 p Revised Sponsored by NTIS and Agency for International Development
(PB80-117666) Avail: NTIS HC $5.50/MF A01 CSCL 05B

The bibliography is an edited search of 'appropriate technology' citations from the NTIS bibliographic data file. Over 2000 citations with abstracts are included. Appropriate technology was defined, in the context of this publication, as information which can be adapted and applied to improve the quality of life of low-income groups. This does not refer to 'trickle-down' benefits but to direct benefits which foster self-reliance and a sense of dignity among the poor. The information, therefore, is broad in scope covering many fields but pertaining to one or more of the following categories: smaller-scale technologies, labor-intensive technologies, low-cost technologies, revived technologies, improved traditional technologies, alternative techniques, useful social and management technologies and selected modern technologies adapted to the local needs and environment. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-25217 Catholic Univ. of America, Washington, D. C.
A SEARCH FOR LONG AND SHORT TERM VARIATIONS IN THE SPECTRUM OF A CENTAURI Ph.D. Thesis
Richard Patrick Fahey 1980 142 p
Avail: Univ. Microfilms Order No. 8011099

Equivalent width and central depth measurements of the ultraviolet absorption lines from the spectrum of the He1 variable star a Cen are presented. The measurements are from short wavelength, and long wavelength, high resolution spectrographs taken with the International Ultraviolet Explorer (IUE) satellite. Central depth measurements were of lines of Cr3, Mn3, V3, C3, Si2, and S2 seen in the region between 1245 and 1255 A. Equivalent widths are of the three He1 2(3)s-n(3) P(0) transitions found at 2945, 2829 and 2764 A. The period for cyclic intensity variations in He1 is determined using a four parameter, least squares fit to a sinusoid. The IUE observations alone match both a period + or - of 8.8163 + or - 0.0003 days and a previously unreported period of 9.2532 + or - 0.0003 days with equal minima for the least squares fit. The phase of C3 maximum relative to He1 maximum is found to be 0.53 cycles for the IUE observations. Dissert. Abstr.

N80-25218 California Inst. of Tech., Pasadena.
THE PHOTOMETRIC PROPERTIES OF BRIGHTEST CLUSTER GALAXIES Ph.D. Thesis
John Greg Hoessel 1980 100 p
Avail: Univ. Microfilms Order No. 8010961

Photometry of a large sample of first ranked cluster galaxies, obtained with SIT and CCD area photometers, is discussed. The absolute photometric results anchor the bright end of the Hubble diagram; essentially the entire formal error for the method is now due to the distant clusters used. Determinations of the systematic trend of galaxy absolute magnitude with the cluster properties of richness and Bautz-Morgan type are derived. All the structure data support and are interpreted on the dynamical friction evolution model. Twenty-eight percent of the galaxies have multiple component nuclei; the short lifetimes of such systems provide the best available evidence that ongoing evolution actually occurs. Average magnitude and structure evolution rates are derived and used to estimate corrections to the value of q sub o derived from the Hubble diagram. When combined with the expected rate of evolution of the stellar population in the galaxies and accounting for known selection effects in the sample, a true value near the formal value of q sub o = -0.5 is indicated, suggesting an open universe. Dissert. Abstr.

N80-25219 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
THEORY OF NP0532 PULSAR RADIATION AND THE NATURE OF CRAB NEBULA ACTIVITY
G. Z. Machabeli and V. V. Usov 1979 44 p refs
(Pr-517) Avail: Issuing Activity

A self-consistent radiation model of the pulsar NP0532 and the Crab Nebula is presented. It is based on the consideration of cyclotron instability in relativistic electron-positron plasma in a strong magnetic field. This instability is found near the light cylinder of pulsar NP0532. The pitch angle and energy distribution of particles, caused by cyclotron instability development are calculated. It is shown that X-ray and gamma ray radiation of the pulsar are explained by the synchrotron radiation of beam particles. Scattering of cyclotron perturbations on plasma particles is responsible for nonzero pitch angles of gamma rays. As a result, the synchroton radiation originates within optical frequencies. As cyclotron waves corresponding to a ratio frequency region can form solitons which carry energy of those waves out of the pulsar magnetosphere, the energy flux due to cyclotron waves from NP0532 is sufficient to explain its radio luminosity. The spectrum of ultrarelativistic electron-positron pairs ejected from the NP0532 pulsar magnetosphere into the Crab Nebula is calculated. Author (ESA)

N80-25220# Astronomisches Inst., Bonn (West Germany)
PUBLICATIONS OF THE ASTRONOMY INSTITUTE OF BONN [VEROEFFENTLICHUNGEN DER ASTRONOMISCHEN INSTITUTE BONN]
1979 54 p refs In GERMAN; ENGLISH summary
Avail: NTIS HC A04/MF A01

Selected topics concerning astronomical photography including use of a double refracting telescope and techniques of hypersensitization of photographic plates are presented. The advantages and capabilities of the PDS 1010A microdensitometer is also discussed. For individual titles, see N80-25221 through N80-25223.

N80-25221# Astronomisches Inst., Bonn (West Germany)
PHOTOGRAPHIC ASTRONOMY AT THE HOHER LIST OBSERVATORY [PHOTOGRAPHISCHE ASTROMETRIE AM OBSERVATORIUM HOHER LIST]
M. Hoffmann and M. Geffert *In its* Publ. of the Astronomy

Inst. of Bonn 1979 p 3-12 refs In GERMAN; ENGLISH summary (For primary document see N80-25220 15-89)
(Rept-89) Avail: NTIS HC A04/MF A01

The operation of the double refractor at the Hoher List Observatory is presented emphasizing the influence of refraction and flexure. The handling of a coordinate measuring engine with an Objective image centering is described. E.D.K.

N80-25222# Astronomisches Inst., Bonn (West Germany).
THE USE OF MICRODENSITOMETER PDS 1010A IN SPECTROSCOPY [DER FINSATZ DES MIKRODENSITOMETERS PDS 1010A IN DER SPEKTROSKOPIE]
H. J. Becker and M. Becker *In its* Publ. of the Astronomy Inst. of Bonn 1979 p 15-40 refs In GERMAN; ENGLISH summary (For primary document see N80-25220 15-89)
(Rept-90) Avail: NTIS HC A04/MF A01

The capabilities of the PDS 1010A microdensitometer, including measurement collection at high speeds and digitalization of such data, are investigated. Results indicate a photometric accuracy of 0.1 to 0.4% at moderate scanning apertures and a positional accuracy of 0.1 micrometers. With these characteristics, spectrograms of standard stars gamma Pegasi and beta Leporis and of the W UMa system AE Phoenicis are reduced. Spectral line curvature, dispersion and characteristic curves, spectrophotometry and radial velocities, are studied. Conventional photometers and oscilloscope setting devices are outperformed in accuracy, objectivity, and speed. E.D.K.

N80-25223# Astronomisches Inst., Bonn (West Germany).
HYPERSENSITIZATION OF PHOTOGRAPHIC PLATES FOR ASTRONOMY PURPOSES [HYPERSENSIBILISIERUNG VON FOTOPLATTEN FUER ASTRONOMISCHE ZWECKE]
J.-D. Schumann *In its* Publ. of the Astronomy Inst. of Bonn 1979 p 43-53 refs In GERMAN; ENGLISH summary (For primary document see N80-25220 15-89)
(Rept-91) Avail: NTIS HC A04/MF A01

The selection of a suitable hypersensitization technique is discussed with emphasis on side effects. Additional fog and its homogeneity, change of gradation, duration of treatment, uniformity of sensitivity, and gain in exposure time, are examined. The selected process works ten times faster than nitrogen soaking and produces less fog than baking or hydrogenization. E.D.K.

N80-25224*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ASSESSMENT OF GROUND-BASED TECHNIQUES FOR DETECTING OTHER PLANETARY SYSTEMS. VOLUME 2: POSITION PAPERS
David C. Black and William E. Brunk Mar. 1980 253 p refs Prepared in cooperation with NASA, Washington, D.C.
(NASA-CP-2124; A-8114) Avail: NTIS HC A12/MF A01 CSCL 03A

The capabilities of several astronomical interferomenter system concepts are assessed and the effects of the Earth's atmosphere on astrometric precision are examined in detail. Included is an examination of the use of small aperture interferometry to detect planets in binary star systems. It is estimated that, for differential astrometric observation, an amplitude interferometer having two separate telescopes should permit observations of stars as faint as 14th magnitude and a positional accuracy of 0.00005 arc-sec. Instrumental, atmospheric, and photon noise errors that apply to interferometric observation are examined. It is suggested that the effects of atmospheric turbulence may be eliminated with the use of two color refractometer systems. Several sites for future telescopes dedicated to the search for planetary systems are identified. M.G.

N80-25225*# Arizona Univ., Tucson. Optical Sciences Center.
STUDY OF STRAY LIGHT SUPPRESSION FOR THE LARGE SPACE TELESCOPE
B. B. Fannin 5 Mar. 1980 26 p
(Contract NAS8-32127)
(NASA-CR-161455) Avail: NTIS HC A03/MF A01 CSCL 03A

Analysis of light scattering, using the APART computer program, begins at the image plane and progresses through the optical system to the front end of the telescope tube. The approach identifies all critical surfaces, computes the geometrical configuration factors (GCF) from each area of the system under study to all other areas of the system, and determines incident and reflected angles which are important for baffle surfaces which do not have Lambertian scattering characteristics. The power input into the optical surface from either point source objects or extended objects such as the bright Earth are computed. The surface scattering characteristics and the GCF values are combined so that the power transfer to the image plane is computed. Capabilities for handling light scattering from baffle surfaces, specular reflectance from black surfaces, scattering from mirror surfaces, diffraction, internal scattering from transmissive optics, and internal thermal emission are assessed. A.R.H.

N80-25226# Los Alamos Scientific Lab., N. Mex.
GROUND BASED AUTOMATED TELESCOPE
Stirling A. Colgate and William Thompson 1980 12 p refs Presented at the Optical and Infrared Program Conf., Tucson, Ariz., 7-12 Jan. 1980
(Contract W-7405-eng-36)
(LA-UR-80-278; CONF-800116-1) Avail: NTIS HC A02/MF A01

The building of a ground-based automated telescope of the 2 meter class for remote multiuser use as a natural facility is recommended. Experience dictates that a primary consideration is a time shared multitasking operating system with virtual memory overlayed with a real time priority interrupt. The primary user facility is a remote terminal networked to the single computer. The telescope should be rapid slewing, and hence a light weight construction. Automation allows for the closed loop pointing error correction independent of extreme accuracy of the mount. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-25227 Colorado Univ. at Boulder.
ASTROPHYSICAL GAS FLOWS WITH RADIATIVE ENERGY TRANSFER Ph.D. Thesis
Richard A. London 1979 198 p
Avail: Univ. Microfilms Order No. 8011289

Theoretical models for astrophysical shock waves and radiation heated expansion (deflagration-like)waves are presented. The first model described a region which is impulsively heated and accelerated by a shock wave. The gas cools thereafter, primarily by infrared line radiation of H2. The structure of the cooling region is calculated and the values of intial parameters required to match the calculated and observed line strengths are found. The second model is that of an H2 dissociation front caused by UV radiation from a star. The region of dissocation propagates out from a newborn star. The energy balance in the front is controlled by UV absorption and IR emission by the H2 molecules. The heating creates a pressure imbalance and a resulting flow. The emission expected from regions is calculated and the gas dynamical effects on the surrounding material are described. The third model is of a stellar atmosphere which is illuminated by X-rays from its compact companion in an X-ray binary system. Dissert. Abstr.

N80-25228 California Inst. of Tech., Pasadena.
INTERACTIONS BETWEEN GALAXIES AND A HOT MEDIUM IN RICH CLUSTERS Ph.D. Thesis
Stephen Matthews Kent 1979 186 p
Avail: Univ. Microfilms Order No. 8010963

The influence of a hot medium on the formation and evolution of galaxies in rich clusters is investigated. The two peculiar systems of emission line filaments around the galaxy NGC1275 in the Perseus cluster are studied. It is concluded that one system consists of condensations in an accretion flow from a surrounding medium onto an underlying elliptical galaxy while the second system arises in a superposed but unrelated spiral galaxy. The formation of SO galaxies by the ram pressure sweeping of spirals due to their motion through a hot intracluster medium is investigated and found to be too weak by a large factor to

produce the required numbers of SO's. Observations of emission lines from spiral galaxies in the X-ray cluster A1367 reveal a deficiency in gas content relative to field galaxies, and is strongest for galaxies closest to the region of X-ray emission. The systematic trends in morphological populations observed in clusters are explained as resulting from a truncation of disks in spirals and SO during their formation due to cluster collapse. Dissert. Abstr.

N80-25229*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CURRENT PROBLEMS IN STELLAR PULSATION INSTABILITIES
David Fischel, Janet Rountree Lesh, and Warren M. Sparks May 1980 687 p refs Conf. held at Greenbelt, Md., 1-2 Jun. 1978
Avail: NTIS HC A99/MF A01 CSCL 03B

Instabilities of pulsating variable stars, such as Cepheid variables, Cepheid masses, early-type variable stars, White Dwarfs, and Mira variables, are discussed. For individual titles, see N80-25230 through N80-25261.

N80-25230*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Astronomical Inst.
OBSERVATIONS OF CLASSICAL CEPHEIDS
J. W. Pel *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 1-23 refs (For primary document see N80-25229 15-90)
(NASA-TM-80625) Avail: NTIS HC A99/MF A01 CSCL 03B

The observations of classical Cepheids are reviewed. The main progress that has been made is summarized and some of the problems yet to be solved are discussed. The problems include color excesses, calibration of color, duplicity, ultraviolet colors, temperature-color relations, mass discrepancies, and radius determination. R.E.S.

N80-25231*# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
THE PERIODS AND AMPLITUDES OF TU CAS
Stephen W. Hodson and Arthur N. Cox *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 25-40 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

Light curve observations of the double-mode Cepheid TU Cas obtained by 10 different sets of observers on several photometric systems over a time span of 67 years were carefully studied to determine the fundamental and first overtone periods and their amplitudes on the V magnitude scale. The presence of a second overtone radial pulsation is discussed, and it is concluded that a previous detection of this mode was spurious due to the lack of a proper zero point correction for two groups of observations. The amplitudes of the two modes are shown to possibly vary during the entire observing period with the fundamental mode amplitude of 0.69 + or - 0.03 and the overtone amplitude decreasing about 0.2 or 0.3 magnitude. If this Cepheid displays the two pulsation modes because it is mode switching, this switching time scale might be less than a hundred years. R.E.S.

N80-25232*# Nebraska Univ., Lincoln. Behlen Observatory.
THE RADII OF SU CAS AND TU CAS
Gordon D. Niva and Edward G. Schmidt *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 41-54 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

It is possible to obtain the masses of Cepheid variables by several methods involving the pulsation theory. However, these masses are frequently smaller than those indicated by the theory of stellar evolution. The cause of this discrepancy is not fully understood. Since the pulsation theory indicates that there is a relation among the mass, the radius and the period, the discrepancy also manifests itself in the radii of these stars. With this in mind, radius determinations for two Cepheids, SU Cas and TU Cas, were undertaken. It is concluded that because of the agreement between the present radius and the beat radius of TU Cas, the pulsation theory is giving correct information about the radii of beat Cepheids. This implies that the luminosities of short period Cepheids have been overestimated. Thus, the solution to the mass discrepancy should perhaps be sought in the theory of stellar evolution or in the possibility of mass loss. R.E.S.

N80-25233*# Indiana Univ., Bloomington.
ZEEMAN OBSERVATIONS OF W SGR
H. John Wood, W. W. Weiss (University Observatory, Vienna), and H. Jenkner (University Observatory, Vienna) *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 57-67 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

A new precise method for measuring magnetic fields on Zeeman plates of the southern Cepheid 'W Sgr' is reviewed. Ten plates over the 7.6(d) period of pulsation show two extrema in the measured values of the effective magnetic field. The method has a precision of + or - 0.4 microns in the Zeeman shift corresponding to + or - 50 Gauss (g). A negative spike of -220 g occurred at the time of arrival of the compressional wave of pulsation at the stellar surface. A positive field of +270 g occurred at the phase of most rapid contraction near the temperature minimum of the pulsation cycle. R.E.S.

N80-25234*# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
A DISCUSSION OF CEPHEID MASSES
Arthur N. Cox *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 69-95 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

Masses and compositions of Cepheids are essential to map the places in the Hertzsprung-Russell diagram where various radial pulsation modes occur. Luminosity observations and stellar evolution theory give masses for Cepheids which range from 10 percent to a factor of four more than those given by pulsation theory. Combining the evolution and pulsation theories, a theoretical mass was determined using only the period and an approximate surface effective temperature. The ratio of the theoretical to evolutionary masses averaged 0.99 + or - 0.07 for 16 Cepheids. R.E.S.

N80-25235*# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.
TRIPLE MODE CEPHEID MASSES
David S. King, Arthur N. Cox, and Stephen W. Hodson *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 97-111 refs Sponsored in part by DOE Prepared in cooperation with LASL (For primary document see N80-25229 15-90)
(Grant NSF AST-76-15445)
Avail: NTIS HC A99/MF A01 CSCL 03B

Unconventional composition structures are proposed to explain the periods of the triple mode Cepheid AC And. A strong Cepheid wind appears to enrich helium in the convection zones down to about 60,000 K or 70,000 K. Then some downward partial mixing occurs to the bottom of a layer with about 1-q = .0005 of the stellar mass. It was found that AC And was not unlike anomalous Cepheids. However, masses of betwen one and two solar masses are suggested and the population is more likely a type two. R.E.S.

N80-25236*# Boston Univ., Mass.
DEPENDENCE OF RED EDGE ON EDDY VISCOSITY MODEL PARAMETERS
Robert G. Deupree and Peter W. Cole *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 113-120 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The dependence of the red edge location on the two fundamental free parameters in the eddy viscosity treatment was extensively studied. It is found that the convective flux is rather insensitive to any reasonable or allowed value of the two free parameters of the treatment. This must be due in part to the fact that the convective flux is determined more by the properties

of the hydrogen ionization region than by differences in convective structure. The changes in the effective temperature of the red edge of the RR Lyrae gap resulting from these parameter variations is quite small (approximately 150 K). This is true both because the parameter variation causes only small changes and because large changes in the convective flux are required to produce any significant change in red edge location. The possible changes found are substantially less than the approximately 600 K required to change the predicted helium abundance mass fraction from 0.3 to 0.2. Author

N80-25237*# Liege Univ. (Belgium). Inst. of Astrophysics.
THERMAL FLICKERS: A SEMIANALYTICAL APPROACH
J. Perdang and J. Robert Buchler *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 121-128 refs Prepared in cooperation with Florida Univ., Gainesville (For primary document see N80-25229 15-90) (Grants NSF AST-75-05012; NSF AST-77-17572)
Avail: NTIS HC A99/MF A01 CSCL 03B

In order to enhance physical insight into the nature of thermal oscillations arising from a thin helium burning shell, the behavior in its phase plane of a simple two zone model which, however, contains all the relevant physics is analyzed. This simple model very naturally reproduces thermal flickers and is relatively insensitive to all but two parameters. A.R.H.

N80-25238*# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
RECENT THEORETICAL WORK ON CEPHEIDS AND OTHER TYPES OF VARIABLES
John P. Cox *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 135-174 refs (For primary document see N80-25229 15-90) (Grant NSF AST-72-05039)
Avail: NTIS HC A99/MF A01 CSCL 03B

Some important problems in the theory of Cepheids and of other types of variables are pointed out. Three of these are: (1) large-amplitude mode behavior; (2) convection; and (3) Cepheid masses, which must essentially always be inferred indirectly. Of the several types of indirect mass which can be defined, the inferred masses of the 'beat (or double-mode) Cepheids,' seem to be smaller than one expects for this period range by factors of 2-3. For the nonbeat Cepheids, the indirect masses also appear to be low as compared with conventional stellar evolution theory, but by a smaller amount, say some 20-40 percent. Some conceivable ways of explaining these mass discrepancies are discussed. The question of whether the apparently predominantly radial pulsations of the beat Cepheids could be contaminated with a small admixture of nonradial pulsations, so that the use of purely radial pulsation theory may not be applicable to the beat Cepheids is addressed. Some other conjectures which may bear on ordinary or beat Cepheids are offered. A.R.H.

N80-25239*# Los Alamos Scientific Lab., N. Mex.
LIGHT CURVES FOR BUMP CEPHEIDS COMPUTED WITH A DYNAMICALLY ZONED PULSATION CODE
T. F. Adams, J. I. Castor, and C. G. Davis *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 175-186 refs Prepared in cooperation with Joint Inst. for Lab. Astrophysics, Boulder, Colo. (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The dynamically zoned pulsation code developed by Castor, Davis, and Davison was used to recalculate the Goddard model and to calculate three other Cepheid models with the same period (9.8 days). This family of models shows how the bumps and other features of the light and velocity curves change as the mass is varied at constant period. The use of a code that is capable of producing reliable light curves demonstrates that the light and velocity curves for 9.8 day Cepheid models with standard homogeneous compositions do not show bumps like those that are observed unless the mass is significantly lower than the 'evolutionary mass.' The light and velocity curves for the Goddard model presented here are similar to those computed independently by Fischel, Sparks, and Karp. They should be useful as standards for future investigators. A.R.H.

N80-25240*# Rutgers Univ., New Brunswick, N. J. Dept. of Physics and Astronomy.
TIME DOMAIN PERIOD DETERMINATION TECHNIQUES
R. F. Stellingwerf *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 187-198 refs (For primary document see N80-25229 15-90) (Grant NSF AST-77-26993)
(RU-78-82) Avail: NTIS HC A99/MF A01 CSCL 03B

Two simple period determination schemes are discussed. They are well suited to problems involving non-sinusoidal periodic phenomena sampled at a few irregularly spaced points. Statistical properties are discussed. The techniques are applied to the double mode Cepheids BK Cen and TU Cas as test cases. Author

N80-25241*# Science Applications, Inc., Palo Alto, Calif.
OPTICAL OBSERVABLES IN STARS WITH NON-STATIONARY ATMOSPHERES
R. W. Hillendahl *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 199-236 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

Experience gained by use of Cepheid modeling codes to predict the dimensional and photometric behavior of nuclear fireballs is used as a means of validating various computational techniques used in the Cepheid codes. Predicted results from Cepheid models are compared with observations of the continuum and lines in an effort to demonstrate that the atmospheric phenomena in Cepheids are quite complex but that they can be quantitatively modeled. A.R.H.

N80-25242*# Toronto Univ. (Ontario). Dept. of Astronomy.
MICROTURBULENCE AND WESSELINK RADII
Nancy Remage Evans *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 237-246 refs Sponsored in part by National Research Council of Canada (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

Using the calibration of Bell and Parsons (1974), the effects of changes in microturbulence and surface gravity throughout the cycles of delta Cephei and eta Aquilae are estimated. When the changes in microturbulence are considered, Wesselink radii for these stars are reduced 20%. A.R.H.

N80-25243*# Observatoire de Nice (France).
POPULATION OF THE LOWER PART OF THE INSTABILITY STRIP: DELTA SCUTI STARS AND DWARF CEPHEIDS (OR AI VELORUM)
M. Auvergne, A. Baglin, J. M. LeContel, and J.-C. Valtier *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 247-270 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

Some of the properties of the atmospheric variations in delta Scuti stars were investigated with emphasis on the amplitude and the shape of both light curves and radial velocity curves. It is shown that these curves are small and rapidly variable in the case of dwarf Scuti stars; for the evolved stars the situation is more complex. The relation between variables and nonvariables, and also the results on abundances in the atmospheres of these stars were surveyed with respect to the hydrodynamics of their envelopes. The abundance anomalies of Am stars were qualitatively examined. The coexistence of abundance anomalies and variability among giants were also studied. Attempts were made to relate the variability to the hydrogen ionization zone in an envelope deprived of helium. Specific results are reported. R.C.T.

N80-25244*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE ORIGIN OF PERIOD CHANGES IN RR LYRAE STARS
A. Renzini (Osservatorio Astronomico, Bologna) and A. V. Sweigart *In its* Current Probl. in Stellar Pulsation Instabilities May 1980 p 271-291 refs Submitted for publication (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The observed period changes are explained with respect to the behavior of the semiconductive zone (SCZ) within the core of an RR Lyrae star. General consideration are given which suggest

that the composition changes occuring within the SCZ during the horizontal-branch evolution result from many small mixing events, each of which slightly perturbs the pulsation period. Results indicate that small mixing events within the core of an RR Lyrae star can produce changes in the pulsation period comparable with those typically observed. It is further indicated that these mixing events together with the nuclear burning between them can produce period changes of both signs. R.C.T.

N80-25245*# Los Alamos Scientific Lab., N. Mex.
THEORETICAL MEAN COLORS FOR RR LYRAE VARIABLES
C. G. Davis and A. N. Cox *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 293-310 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

A hydrodynamically pulsating 0.6 solar mass model of a typical RR Lyrae variable was studied with a radiation transport-hydrodynamic computer program to predict theoretical T sub 3 and colors at many phases and to find the proper methods for getting mean colors and the consequent mean effective temperatures. The variable Eddington radiation approximation method was used with gray and with multifrequency absorption coefficients to represent the radiation flow in the outer optically thin layers. Comparison between observed and computed B-V colors indicate that these low Z population 2 models are reasonably accurate using King 1A composition opacities. The well known Oke, Giver, and Searle relation between B-V and T sub e reproduced. Mean colors were found by four different averaging methods. The method that gives a mean color and the mean T sub e closest to the nonpulsating model was the separate intensity means of B and V. R.C.T.

N80-25248*# Tohoku Univ., Sendai (Japan). Astronomical Inst.
THE EVOLUTIONARY STAGE OF AN RRS STAR SX PHE
Hideyuki Saio and Mine Takeuti *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 317-327 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The evolutionary stage for a short period variable SX Phe was investigated. It was assumed that SX Phe is a mixed star with low metal abundance in which the material was mixed after the star evolved off the main sequence, and is in the second hydrogen burning stage. The validity of this hypothesis was examined by constructing two evolutionary sequences with (X,Z,M/solar mass) = (0.5,0.004,0.75) and (0.5,0.001,0.70) in the hydrogen burning phase and computed the pulsation period. Agreement between theoretical results and observational data was sufficient to conclude that the mixed model is actually adequate for SX Phe. The applicability of this model to other RRs stars is briefly discussed. R.C.T.

N80-25247*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODE IDENTIFICATION IN BETA CEPHEI STARS
Morris L. Aizenmen and Janet Rountree Lesh *In its* Current Probl. in Stellar Pulsation Instabilities May 1980 p 331-361 refs Prepared in cooperation with NSF, Washington, D.C. (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The essential observational characteristics related to mode identification are summarized. Major emphasis is placed on the following: both light and velocity amplitudes; typical periods in both light and radial velocity; the light curve for Beta Cephei stars in comparison to the classical Cepheids and RR Lyrae stars; the van Hoof effect with respect to the radial velocity curves in many Beta Cephei stars; and the line profiles of many Beta Cephei stars. R.C.T.

N80-25248*# Calgary Univ. (Alberta). Dept. of Physics.
SOME EVOLUTIONARY CONSIDERATIONS OF BETA CEPHEI STARS
S. R. Sreennivasan and W. J. F. Wilson *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 363-380 refs Sponsored in part by National Research Council of Canada (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The evolutionary aspects of massive population 1 stars were investigated. Semiconvection was treated in two different ways, and included mass loss both in the early as well as later spectra stages. The effect of rotation was taken into account and the time evolution of angular momentum of these models was studied. The effect of differential rotation due to the faster rotating interiors and slowed down surface layers are briefly described. R.C.T.

N80-25249*# McDonald Observatory, Austin, Tex.
THE LINE PROFILE VARIABLE B STARS
Myron A. Smith *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 391-407 refs (For primary document see N80-25229 15-90)
(Grants NsG-5167; NSF AST-77-06965)
Avail: NTIS HC A99/MF A01 CSCL 03B

The observational status of the line profile variable B stars is summarized. The following areas are discussed: recent history; evolutionary status; line profile variations; line strength variations; and photometric variations. R.C.T.

N80-25250*# Allegheny Observatory, Pittsburgh, Pa.
PULSATION OF LATE B-TYPE STARS
W. R. Beardsley, T. F. Worek, and M. W. King *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 409-420 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

Radial velocity observations of three of the brightest stars in the Pleiades, Alcyone, Maia and Taygeta, made during the course of one night, 25 October 1976, are discussed. All three stars were discovered to be pulsating with periods of a few hours. Analysis of all published radial velocities for each star, covering more than 70 years and approximately 100,000 cycles, has established the value of the periods to eight decimal places, and demonstrated constancy of the periods. However, amplitudes of the radial velocity variations change over long time intervals, and changes in spectral line intensities are observed in phase with the pulsation. All three stars may also be members of binary systems. M.G.

N80-25251*# McDonald Observatory, Austin, Tex.
THE PULSATING WHITE DWARFS
Edward L. Robinson *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 423-451 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The characteristics of variable white dwarfs are presented through an examination of observational data. The variable white dwarfs are normal, single, DA white dwarfs. The variations are caused by pulsations, but the pulsations are nonradial rather than radial pulsations. The periods are all very long. Excluding harmonics and cross frequencies, the shortest period is 114 sec and the longest period is 1186 sec. Without exception every variable is multiperiodic. The stability of the periods varies from extremely high to very low; the low stability of many of the variables perhaps being due to incomplete data. Finally, there is a strong correlation between the amplitude of the variations and their remaining properties. The higher amplitude variables have more periods in their light curves and the periods are more unstable. M.G.

N80-25252*# Mees (C. E. Kenneth) Observatory, Rochester, N. Y.
THEORIES OF WHITE DWARF OSCILLATIONS
H. M. VanHorn *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 453-500 refs (For primary document see N80-25229 15-90)
(Grant NSF AST-76-80203)
Avail: NTIS HC A99/MF A01 CSCL 03B

The current status of theoretical understanding of the oscillations observed in the ZZ Ceti stars and cataclysmic variables is briefly reviewed. Nonradial g-mode oscillations appear to provide a satisfactory explanation for the low amplitude variables such as R548, with periods in the range of approximately 200 to 300 seconds, but for the longer period (800 to 1000 seconds)

oscillators, the situation is still unclear. Rotation may play an important role in this problem, and the effects of both slow and fast rotation upon the mode structure are discussed. In the cataclysmic variables, both accretion and thermonuclear burning may act to excite oscillations of the white dwarf. Author

N80-25253*# McDonald Observatory, Austin, Tex.
THE PERIOD STRUCTURE OF THE ZZ CETI VARIABLES
John T. McGraw. *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 501-512 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The current observational status of the period structure of ZZ Ceti stars is reviewed, and in particular those features which appear to be the most important for theory to explain, or which may be relevant to the directions of theoretical development are discussed. Mechanisms to explain the broad range of period structure are suggested. Multiple nonradial modes, probably corresponding to different radial overtones, may be simultaneously excited in each star. The excitation energy of individual stars is distributed among permitted modes by nonlinear resonant coupling. In addition, rotational splitting of the nonradial modes can produce closely spaced periods which results in modulation of the light curve. Amplitude/spectral complexity correlation results from the appearance in the power spectrum of harmonics and cross-frequencies which are the effects brought on by increasing nonlinearity of the pulsations. M.G.

N80-25254*# Pahlavi Univ., Shiraz (Iran). Biruni Observatory.
THE g-MODES OF WHITE DWARFS
Y. Sobouti, M. R. H. Khajehpour, and V. V. Dixit. *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 513-531 refs Sponsored in part by Min. of Sci. and Higher Educ. of Iran (For primary document see N80-25229 15-90)
(Contrib-4) Avail: NTIS HC A99/MF A01 CSCL 03B

The neutral g-modes of a degenerate fluid at zero temperature are analyzed. The g-modes of a degenerate fluid at finite but small temperatures are then expanded in terms of those of the zero temperature fluid. For nonrelativistic degenerate fluids it is found that (1) the g-eigenvalues are proportional to T mu(6)sub e mu(-1)sub i, where T is the internal temperature of the fluid, mu sub e and mu sub i are the mean molecular weights of electrons and ions, respectively; (2) the ion pressure is solely responsible for driving the g-modes. For white dwarfs of about a solar mass, the periods of the g-oscillations are in the range of a few hundredths of seconds. Author

N80-25255*# Ohio State Univ., Columbus. Dept. of Astronomy.
MIRA VARIABLES: AN INFORMAL REVIEW
Robert F. Wing. *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 533-566 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The structure of the Mira variables is discussed with particular emphasis on the extent of their observable atmospheres, the various methods for measuring the sizes of these atmospheres, and the manner in which the size changes through the cycle. The results obtained by direct, photometric and spectroscopic methods are compared, and the problems of interpretation are addressed. Also, a simple model for the atmospheric structure and motions of Miras based on recent observations of the doubling of infrared molecualr times is described. This model, consisting of two atmospheric layers plus a circumstellar shell, provides a physically plausible picture of the atmosphere which is consistent with the photometrically measured magnitude and temperature variations as well as the spectroscopic data. M.G.

N80-25256*# Washington Univ., Seattle.
VELOCITY STRUCTURE IN LONG PERIOD VARIABLE STAR ATMOSPHERES
C. Pilachowski, G. Wallerstein, and L. A. Willson. *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 577-609 refs Sponsored in part by NSF Prepared in cooperation with Iowa State Univ., Ames (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

A regression analysis of the dependence of absorption line velocities on wavelength, line strength, excitation potential, and ionization potential is presented. The method determines the region of formation of the absorption lines for a given data and wavelength region. It is concluded that the scatter which is frequently found in velocity measurements of absorption lines in long period variables is probably the result of a shock of moderate amplitude located in or near the reversing layer and that the frequently observed correlation of velocity with excitation and ionization are a result of the velocity gradients produced by this shock in the atmosphere. A simple interpretation of the signs of the coefficients of the regression analysis is presented in terms of preshock, post shock, or across the shock, together with criteria for evaluating the validity of the fit. The amplitude of the reversing layer shock is estimated from an analysis of a series of plates for four long period variable stars along with the most probable stellar velocity for these stars. J.M.S.

N80-25257*# Mount Stromlo and Siding Spring Observatory, Canberra (Australia).
PULSATION AND MASS LOSS IN MIRA VARIABLES
P. R. Wood. *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 611-628 refs (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The behavior of pulsation in the outer layers of a typical Mira variable was studied in the adiabatic and isothermal limits. A shock wave propagates outward once per period and the radial velocity obtained from observations of hydrogen emission lines is identified with the velocity of gas in the post shock region. In the adiabatic case, mass loss in the form of a steady stellar wind was produced. In the isothermal case, no continuous mass loss was produced but occasional ejection of shells occur. Pulsation introduced into a star undergoing steady mass loss as a result of radiation pressure acting on grains caused the mass loss rate to increase by a factor of approximately 40, while the terminal velocity of the flow was almost unaltered. E.D.K.

N80-25258*# Texas Univ. at Austin. Dept. of Astronomy.
AN INDEPENDENT CEPHEID DISTANCE SCALE: CURRENT STATUS
Thomas G. Barnes, III. *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 639-646 refs (For primary document see N80-25229 15-90) (Grant NSF AST-76-21316)
Avail: NTIS HC A99/MF A01 CSCL 03B

An independent distance scale for Cepheid variables is discussed. The apparent magnitude and the visual surface brightness, inferred from an appropriate color index, are used to determine the angular diameter variation of the Cepheid. When combined with the linear displacement curve obtained from the integrated radial velocity curve, the distance and linear radius are determined. The attractiveness of the method is its complete independence of all other stellar distance scales, even though a number of practical difficulties currently exist in implementing the technique. E.D.K.

N80-25259*# Delaware Univ., Newark.
THE BARNES-EVANS COLOR-SURFACE BRIGHTNESS RELATION: A PRELIMINARY THEORETICAL INTERPRETATION
Harry L. Shipman. *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 647-663 refs (For primary document see N80-25229 15-90) (Grants NsG-5144; NSF AST-76-20723)
Avail: NTIS HC A99/MF A01 CSCL 03B

Model atmosphere calculations are used to assess whether an empirically derived relation between V-R and surface brightness is independent of a variety of stellar paramters, including surface gravity. This relationship is used in a variety of applications, including the determination of the distances of Cepheid variables using a method based on the Beade-Wesselink method. It is concluded that the use of a main sequence relation between V-R color and surface brightness in determining radii of giant stars is subject to systematic errors that are smaller than 10% in the determination of a radius or distance for temperature cooler than 12,000 K. The error in white dwarf radii determined

from a main sequence color surface brightness relation is roughly 10%. E.D.K.

N80-25260*# Arizona Univ., Tucson. Dept. of Physics.
EVIDENCE FOR THE EXISTENCE OF NONRADIAL SOLAR OSCILLATIONS: SOLAR ROTATION
Thomas P. Caudell and Henry A. Hill *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 665-675 refs Sponsored in part by NSF and AFGL (For primary document see N80-25229 15-90)
Avail: NTIS HC A99/MF A01 CSCL 03B

The coherent properties of six oscillations over a two week period in which seven days of equatorial diameter measurements were analyzed, are confirmed by the addition of an extra day of data. The two large 1 (the principal order number in the spherical harmonic expansion of the eigenfunction) g-mode oscillations may be candidates for the slowly rotating mode locked structures. For the four low frequency p-modes, periodic nature is observed in the daily power levels, varying with periods of several days. This is attributed to beating between rotationally split m states for a given 1 value. Nonradial modes are a major contribution to the observed solar oscillations. The nonradial character of the observed modes allows the depth dependence of the internal solar rotation to be investigated. E.D.K.

N80-25261*# Lick Observatory, Santa Cruz, Calif.
A PRELIMINARY ATTEMPT TO INTERPRET THE POWER SPECTRUM OF THE SOLAR FIVE MINUTE OSCILLATIONS IN TERMS OF THE GLOBAL OSCILLATION MODEL
D. A. Kesley *In* NASA. Goddard Space Flight Center Current Probl. in Stellar Pulsation Instabilities May 1980 p 677-694 refs (For primary document see N80-25229 15-90)
(Grant NGL-05-002-003)
Avail: NTIS HC A99/MF A01 CSCL 03B

The observed power spectrum of the solar five minute oscillations is discussed from the viewpoint that the oscillations are excited by turbulent convection. The observations place significant constraints on the theory and suggest constraints on the solar model structure. It is shown that the steep low frequency side of the peak in the power spectrum is more readily explained if the mixing length is greater than one scale height. The high frequency end of the power spectrum is also discussed. J.M.S.

N80-24702*# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
REQUIREMENTS FOR PREDICTIONS AND REAL-TIME MONITORING FOR THE STUDY OF TRAVELLING INTERPLANETARY PHENOMENA
Murray Dryer and M. A. Shea (AFGL, Hanscom AFB, Mass.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 340-345 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

No abstracts in this category.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-25262*# Denver Univ., Colo. Dept. of Physics.
ANALYSIS OF SOLAR SPECTRA IN THE MIDDLE ULTRAVIOLET AND VISIBLE FOR ATMOSPHERIC TRACE CONSTITUENTS MEASUREMENTS Final Report, 15 Mar. 1977 - 15 May 1980
A. Goldman 20 May 1980 54 p refs
(Grant NsG-1405)
(NASA-CR-163150) Avail: NTIS HC A04/MF A01 CSCL 03B

Individual spectral line parameters including line positions, strengths, and intensities were generated for the sq Alpha Sigma - sq Chi Pi (0,0) band of OH, applicable to atmospheric and high temperatures. Energy levels and transition frequencies are calculated by numerically diagonalizing the Hamiltonian. Line strengths are calculated using the dipole matrix and eigenvectors derived from energy matrix diagonalization. The line strengths are compared to those calculated from previously published algebraic line strength formulas. Tables of line parameters are presented for 240 K and 4600 K. Author

N80-25263*# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
A STUDY OF ACOUSTIC HEATING AND FORCED CONVECTION IN THE SOLAR CORONA Final Report, 1 Jan. 1979 - 1 Apr. 1980
Peter V. Foukal 11 Apr. 1980 51 p refs
(Contract NAS8-32985)
(NASA-CR-161454) Avail: NTIS HC A04/MF A01 CSCL 03B

The S055 EUV spectra was used to perform emission measure and line intensity ratio analyses of loop plasma conditions in a study on the thermodynamics of magnetic loops in the solar corona. The evidence that loops contain plasma hotter than the background corona, and thus, require enhanced local dissipation of magnetic or mechanical energy is discussed. The S055 EUV raster pictures were used to study physical conditions in cool ultraviolet absorbing clouds in the solar corona, and optical data were used to derive constraints on the dimension, time scales and optical depths in dark opaque clouds not seen in H alpha and CaK as filaments or prominences. Theoretical modelling of propagation of magnetically guided acoustic shocks in the solar chromosphere finds it still unlikely that high frequency acoustic shocks could reach the solar corona. Dynamic modelling of spicules shows that such guided slow mode shocks can explain the acceleration of cool spicular material seen high in the corona. E.D.K.

N80-25264*# Alabama Univ. in Huntsville.
DYNAMIC SIMULATION OF CORONAL MASS EJECTIONS Final Report
R. S. Steinolfson and S. T. Wu Apr. 1980 141 p refs
(Contract NAS8-33216)
(NASA-CR-161461; UAH-RR-240) Avail: NTIS HC A07/MF A01 CSCL 03B

A model is developed for the formation and propagation through the lower corona of the loop-like coronal transients in which mass is ejected from near the solar surface to the outer corona. It is assumed that the initial state for the transient is a coronal streamer. The initial state for the streamer is a polytropic, hydrodynamic solution to the steady-state radial equation of motion coupled with a force-free dipole magnetic field. The numerical solution of the complete time-dependent equations then gradually approaches a stationary coronal streamer configuration. The streamer configuration becomes the initial state for the coronal transient. The streamer and transient simulations are performed completely independent of each other. The transient is created by a sudden increase in the pressure at the base of the closed-field region in the streamer configuration. Both coronal streamers and coronal transients are calculated for values of the plasma beta (the ratio of thermal to magnetic pressure) varying from 0.1 to 100. M.G.

N80-25265# California Univ., Berkeley. Lawrence Berkeley Lab.
MEASUREMENT AND ANALYSIS OF CIRCUMSOLAR RADIATION Summary Report, Apr. - Sep. 1979
D. F. Grether, D. Evans, A. Hunt, and M. Wahlig Oct. 1979

11 p refs Presented at the DOE Div. of Distributed Solar Technol. Insulation Assessment Constractor's Program Rev., Bethesda, Md., 31 Oct. - 1 Nov. 1979
(Contract W-7405-eng-48)
(LBL-10243) Avail: NTIS HC A02/MF A01

Four instrument systems called Circumsolar Telescopes, used to measure the solar and circumsolar radiation for application to solar energy systems, employ lenses or mirrors to concentrate the incident sunlight. Each measuring system has a scanning telescope mounted on a precision solar tracker. The telescope is mechanically scanned thru an arc of 6 deg with the sun at the center of the arc. A digitization of the brightness of the sun or circumsolar radiation is taken every 1.5 min. of arc, with a complete scan taking one minute of time. Auxiliary instruments include a pyroheliometer and two pyranometers, one mounted in the usual horizontal position and one tracking the sun. The telescope and pyroheliometer have batched ten position filter wheels: one open position, eight interference filters that divide the solar spectrum into eight intervals of roughly equal energy content, and one opaque filter to monitor detector noise. The data are recorded on magnetic tape, with one tape holding one week's worth of data per telescope. DOE

N80-25266# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ENERGY SOURCE OF THE SOLAR WIND
P. Carlqvist and H. Alfven Oct. 1979 14 p refs
(TRITA-EPP-79-17; ISSN-0348-7539) Avail: NTIS HC A02/MF A01

A direct transfer of energy from photospheric activity to the solar wind by means of electric currents is discussed. Currents are assumed to flow in quiescent prominences which occasionally erupt and give rise to expanding looplike structures in the corona as observed from Skylab. Due to the expansion the legs of the loops are transformed into coronal rays which carry currents from the photosphere to the outer parts of the corona or interplanetary medium and then back again to the photosphere. It is proposed that energy is transferred from photospheric activity to the solar wind (1) as kinetic energy of the ejected loop matter; (2) as electric power directly fed into the extended loops; and (3) as torsional waves produced by fluctuations in the loop currents. Author (ESA)

N80-25267# National Center for Atmospheric Research, Boulder, Colo.
SUNSPOT VECTOR MAGNETIC FIELDS AND MODEL UMBRAL ATMOSPHERES Final Report
Joseph Beurak Gurman Sep. 1979 205 p refs
(Grant NSF ATM-77-23757)
(PB80-135247; NCAR-CT-55) Avail: NTIS HC A10/MF A01 CSCL 03B

The Stokes polarimeter of the High Altitude Observatory was used to observe a round, unipolar sunspot in three absorption lines and the nearby continua. Observations in the weak Zeeman triplet at 6302.50A wavelength are used to derive the vector magnetic field across the spot. Stokes profiles are used to probe the depth variation of the magnetic field and to obtain a model atmosphere for the umbra. A linear anticorrelation is found between the continuum intensity and the magnetic field strength. Model atmospheres determined at four locations in the umbra represent a significant improvement over the few existing umbral models in fitting the observed D2 line wings. A method of determining the longitudinal component of the B field as a function of depth is derived and tested with synthetic Stokes profiles. GRA

N80-24692*# Space Environment Services Center, Boulder, Colo.
VERY LARGE GEOMAGNETIC DISTURBANCE DURING SUNSPOT CYCLE 21: A PREDICTION
H. H. Sargent, III *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 193-197 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

N80-24696*# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
LONG-TERM SOLAR ACTIVITY PREDICTIONS
P. S. McIntosh, G. M. Brown, R. Buhmann, T. Clark, P. F. Fougere, H. Hunter, J. V. Lincoln, H. H. Sargent, III, J. G. Timothy, and Y. Z. Lin *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 246-257 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

N80-24697*# Main Astronomical Observatory, Pulkovo (USSR).
A NEW METHOD OF VERY LONG-TERM PREDICTION OF SOLAR ACTIVITY
A. I. Ohl and G. I. Ohl (Arkticheskii i Antarkticheskii Nauchno-Issled. Inst.) *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 258-263 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

N80-24698*# University Coll. of Wales, Aberystwyth. Dept. of Physics.
NEW METHODS FOR PREDICTING THE MAGNITUDE OF SUNSPOT MAXIMUM
G. M. Brown *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 264-279 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

N80-24699*# Colorado Univ., Boulder. Atmospheric and Space Physics Lab.
THE VARIABILITY OF THE SOLAR ULTRAVIOLET SPECTRAL IRRADIANCES
J. Gethyn Timothy *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 280-321 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

N80-24700*# Astronomical Inst., Utrecht (Netherlands). Space Research Lab.
THE NEEDS FOR PREDICTION AND REAL-TIME MONITORING FOR THE FLARE BUILD-UP STUDY
Zdenek Svestka *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 322-330 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

N80-24701*# American Science and Engineering, Inc., Cambridge, Mass.
SOLAR FORECAST AND REAL-TIME MONITORING NEEDS OF THE STUDY OF ENERGY RELEASE IN FLARES (SERF)
David M. Rust *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 331-339 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

N80-24703*# National Aeronautics and Space Administration, Washington, D. C.
SOLAR WIND AND MAGNETOSPHERE INTERACTIONS
C. T. Russell (California Univ., Los Angeles), J. H. Allen (Environmental Data Serv., Boulder, Colo.), D. P. Cauffman, J. Feynman (Boston Coll.), E. W. Greenstadt (TRW Systems Group, Redondo Beach, Calif.), R. E. Holzer (California Univ., Los Angeles), S. M. Kaye (California Univ., Los Angeles), J. A. Slavin (California Univ., Los Angeles), R. H. Manka (NSF), G. Rostoker (Alberta Univ., Edmonton) et al *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 346-364 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

N80-24705*# California Univ., Los Angeles. Dept. of Earth and Space Sciences.
THE MAGNETOSPHERIC ELECTRIC FIELD AND CONVECTIVE PROCESSES AS DIAGNOSTICS OF THE IMF AND SOLAR WIND
Stanley M. Kaye *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 375-384 refs (For primary document see N80-24678 15-42)
(Grants NsG-7295; NGL-05-007-004; NSF DES-74-23464)
Avail: NTIS HC A99/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-25268*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HIGH TIME RESOLUTION OBSERVATION OF THE TRANSIENT EVENT OF 5 MARCH 1979
M. C. Weisskopf, W. Darbro, P. Ghosh, P. G. Sutherland (McMaster Univ.), and J. Grindlay (Center for Astrophysics) Mar. 1980 8 p refs
(NASA-TM-78273) Avail: NTIS HC A02/MF A01 CSCL 03B

The detection of an intense gamma ray burst with the monitor proportial counter on the HEAO 2 spacecraft is discussed with particular emphasis on the measurement of the time of onset of the event. Based on the mean observed counting rate in the burst and assuming a sharp rise, the uncertainty in the burst onset is found to be + or - 220 microseconds. The time of occurrence was 57124.826908 + or - 0.000220 s UT on March 5, 1979, and the location of the HEAO 2 satellite at this time was latitude 22.15 deg, longitude -27.60 deg at an altitude of 525.0 km. M.G.

N80-25269*# Alabama A & M Univ., Normal.
THE ELECTRIC POTENTIAL OF PARTICLES IN INTERSTELLAR SPACE RELEASED FROM A NUCLEAR WASTE PAYLOAD Progress Report, Jul. 1979 - Feb. 1980
Alton C. Williams Feb. 1980 45 p refs
(Grant NsG-8068)
(NASA-CR-163149; AM-PHY-201-01) Avail: NTIS HC A03/MF A01 CSCL 03B

Mechanisms for charging a grain in the interplanetary medium include: (1) capture of solar wind electrons; (2) capture of solar wind protons; (3) ejection of electrons through the photoelectric effect due to the solar radiation; (4) escape of beta particles from beta emitters in the grain; and (5) escape of alpha particles from alpha emitters in the grain. The potentials on both nonradioactive and radioactive grains are considered with relation to particle size and time, and the distance from the Sun. Numerical results are presented where the waste mix is assumed to be PW-4b. A.R.H.

N80-25270# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE ENERGY SPECTRUM OF COSMIC RAY IRON NUCLEI AND THE PREDICTED INTENSITY VARIATION DURING THE SOLAR CYCLE WITH APPLICATIONS FOR THE INTENSITY OBSERVED BY A MAGNETOSPHERIC SATELLITE Final Report, 1 May - 30 Sep. 1979
W. R. Webber and S. M. Yushak Nov. 1979 29 p refs
(AF Proj. 7601)
(AD-A082223; AFGL-TR-80-0056) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report surveys existing measurements of cosmic ray iron nuclei, combines these data and represents them as a function of modulation during a solar cycle. This composite cosmic ray iron nuclei spectrum is then applied to estimate the heavy nuclei flux exposure to a satellite orbiting at 3.5 Earth radii taking into account the effects of geomagnetic shielding. GRA

N80-24708*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREDICTION OF ENERGETIC PARTICLE DISTURBANCES
G. A. Paulikas (Aerospace Corp., Los Angles, Calif.), D. N. Baker (LASL), W. R. Barron (AFGL), V. Domingo (European Space Technol. Center, Noordwijk, Netherlands), P. R. Higbie (LASL), W. L. Imhof (LMSC, Palo Alto, Calif.), L. R. Lyons, R. L. McPherron, E. C. Roelof (APL/JHU, Laurel, Md.), M. Scholer (Max-Planck-Inst. fuer Phys. und Astrophys., Munich, West Germany) et al *In* NASA. Marshall Space Flight Center Solar-Terrest. Predictions Proc., Vol. 2 Dec. 1979 p 415-432 refs (For primary document see N80-24678 15-42)
Avail: NTIS HC A99/MF A01 CSCL 03B

99 GENERAL

N80-25271 Engineering Sciences Data Unit, London (England).
ENGINEERING SCIENCES DATA UNIT INDEX, 1979 - 1980
1979 440 p
(ESDU-INDEX-79-80; ESDU-INDEX-77-78) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $20.00

Contents: introduction and guide for use; current constitution of technical committees; complete sub-series and section list; index; table 1 - physical properties of pure compounds; table 2 - physical properties of elements; table 3 IDS(B): thermodynamic properties of aqueous organic systems. ESDU

N80-25272# Air Force Systems Command, Washington, D.C.
AIR FORCE SYSTEMS COMMAND RESEARCH PLANNING GUIDE (RESEARCH OBJECTIVES)
1 Feb. 1980 379 p Supersedes AFSC-TR-78-01
(AD-A082043; AFSC-TR-80-01; AFSC-TR-78-01) Avail: NTIS HC A17/MF A01 CSCL 15/3

The purpose of the Air Force Systems Command research planning guide (Research Objectives) is to identify research needed by the Air Force. The document provides a method of informing military and civilian research and development communities of mid-term requirements and of long-term requirements directed toward scientific opportunities which offer the greatest potential for impacting on future military operations. Research must also take advantage of new situations and new opportunities to open up wide areas of technology. One such opportunity is the tremendous potential for technology expansion resulting from the space shuttle development and operational deployment. Increased emphasis is being given to those research opportunities which exploit the unique space shuttle capabilities. In addition, new subareas have been added to the Life Sciences and Weaponry technical areas to add emphasis to an Air Force need for new efforts in environmental quality and civil engineering research. GRA

N80-25273# Finnish National Committee of COSPAR, Otaniem.
SPACE ACTIVITIES IN FINLAND IN 1978 Annual Report
M. Tiuri, ed. and S. Urpo, ed. 1978 11 p refs Prepared in cooperation with Helsinki Univ. of Technology, Espoo
Avail: NTIS HC A02/MF A01

Finnish space programs completed in 1978 or in progress are reviewed. These include soil mapping, land use mapping, and terrain analysis all from LANDSAT data as well as forest mapping, small scale mapping, and ore prospecting (aircraft scanner data). Finnish involvement in the Intelsat, Eutelsat, Sirio, and OTS satellite programs is also discussed. The work of Finnish satellite tracking, telemetry, and acquisition facilities is covered. Author (ESA)

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SUBJECT INDEX

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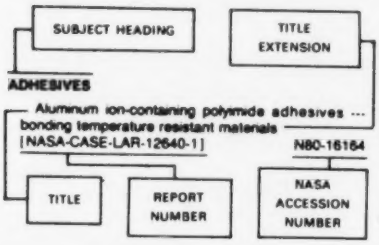

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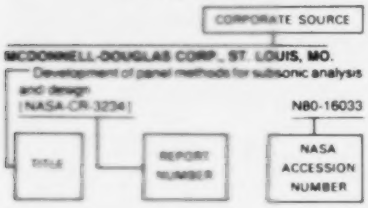

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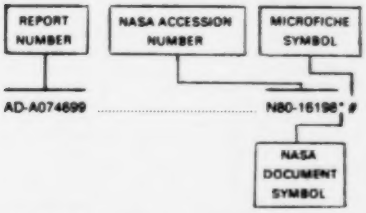

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NASA-CR-163184 ..... N80-24387* #
NASA-CR-163185 ..... N80-25010* #
NASA-CR-163186 ..... N80-24622* #
NASA-CR-163187 ..... N80-24369* #
NASA-CR-163188 ..... N80-24370* #
NASA-CR-163189 ..... N80-24295* #
NASA-CR-163190 ..... N80-24317* #
NASA-CR-163191 ..... N80-24272* #
NASA-CR-163192 ..... N80-24273* #
NASA-CR-163194 ..... N80-24264* #
NASA-CR-163195 ..... N80-24647* #
NASA-CR-163196 ..... N80-25003* #
NASA-CR-163197 ..... N80-24322* #
NASA-CR-163198 ..... N80-24368* #
NASA-CR-163199 ..... N80-25210* #
NASA-CR-163200 ..... N80-25211* #
NASA-CR-163310 ..... N80-24371* #
NASA-CR-163313 ..... N80-25038* #

NASA-RP-1046 ..... N80-24296* #

NASA-SP-7011(208) N80-24987*
NASA-SP-7037(121) N80-24259*
NASA-SP-7041(25) N80-24727*

NASA-TM-75945 ..... N80-24968* #
NASA-TM-75977 ..... N80-24978* #
NASA-TM-76009 ..... N80-24969* #
NASA-TM-76025 ..... N80-24979* #
NASA-TM-76026 ..... N80-24980* #
NASA-TM-76082 ..... N80-24990* #
NASA-TM-76085 ..... N80-24991* #
NASA-TM-76130 ..... N80-24981* #
NASA-TM-78272 ..... N80-24749* #
NASA-TM-78273 ..... N80-25268* #
NASA-TM-80234 ..... N80-24348* #
NASA-TM-80625 ..... N80-25230* #
NASA-TM-80982 ..... N80-25070* #
NASA-TM-81061 ..... N80-24678* #
NASA-TM-81062 ..... N80-24343* #
NASA-TM-81064 ..... N80-25056* #
NASA-TM-81065 ..... N80-25057* #
NASA-TM-81066 ..... N80-25054* #
NASA-TM-81068 ..... N80-25200* #
NASA-TM-81071 ..... N80-24977* #
NASA-TM-81177 ..... N80-24294* #
NASA-TM-81189 ..... N80-24262* #
NASA-TM-81194 ..... N80-25002* #
NASA-TM-81200 ..... N80-25108* #
NASA-TM-81201 ..... N80-25109* #
NASA-TM-81202 ..... N80-25110* #
NASA-TM-81204 ..... N80-24293* #
NASA-TM-81207 ..... N80-24914* #
NASA-TM-81504 ..... N80-24315* #
NASA-TM-81505 ..... N80-24314* #
NASA-TM-81507 ..... N80-24316* #
NASA-TM-81515 ..... N80-24756* #
NASA-TM-81516 ..... N80-24963* #
NASA-TM-81519 ..... N80-25101* #
NASA-TM-81521 ..... N80-24386* #
NASA-TM-81523 ..... N80-24634* #
NASA-TM-81780 ..... N80-24354* #
NASA-TM-81791 ..... N80-24266* #
NASA-TM-81804 ..... N80-24881* #
NASA-TM-81805 ..... N80-24260* #
NASA-TM-81807 ..... N80-25103* #
NASA-TM-81813 ..... N80-25104* #
NASA-TM-81821 ..... N80-24441* #
NASA-TM-81825 ..... N80-24265* #

NASA-TP-1615 ..... N80-24577* #
NASA-TP-1620 ..... N80-24324* #
NASA-TP-1637 ..... N80-24323* #
NASA-TP-1638 ..... N80-24267* #
NASA-TP-1648 ..... N80-24261* #
NASA-TP-1654 ..... N80-25039* #
NASA-TP-1661 ..... N80-24594* #
NASA-TP-1687 ..... N80-24595* #

NATICK/TR-79/016 ..... N80-24274 #
NATICK/TR-80/012 ..... N80-24283 #

NAVAIRDEVCEN-78207-60 ..... N80-24327 #

NBS-GCR-79-180 ..... N80-24878 #

NBS/DIM-63/11 ..... N80-25195 #
NBS/DIM-63/12 ..... N80-25196 #

NBSIR-79-1783 ..... N80-24873 #
NBSIR-79-1922 ..... N80-24365 #
NBSIR-79-1931 ..... N80-24877 #
NBSIR-79-1939 ..... N80-24570 #
NBSIR-79-1950 ..... N80-24507 #

NCAR-CT-55 ..... N80-25267 #

NEAR-TR-204-PT-2 ..... N80-24308 #

NEPRF-CR-79-01-SUPP ..... N80-24926 #

NMEI-44 ..... N80-24875 #
NMEI-46 ..... N80-24874 #

NOAA-79110702 ..... N80-24974 #
NOAA-80011801 ..... N80-24977* #

NOR-79-89 ..... N80-24307 #

NOSC/TR-514 ..... N80-24532 #

NPS63-79-005 ..... N80-24976 #
NPS63-80-001 ..... N80-25068 #
NPS69-79-014 ..... N80-24580 #

NRC-18017 ..... N80-25007 #
NRC-18021 ..... N80-25070* #

NRC/CNR-TT-1963 ..... N80-24462 #

NRL-MR-4118 ..... N80-24925 #
NRL-MR-4142 ..... N80-25164 #
NRL-MR-4144 ..... N80-25166 #

NRL-8368 ..... N80-24538 #
NRL-8370 ..... N80-24426 #

NR79H-97 ..... N80-24327 #

NSF/RA-79-270 ..... N80-24677 #
NSF/RA-790296 ..... N80-24504 #

NSF/SIU-79-1 ..... N80-25197 #

NSR-2-15 ..... N80-24812* #

NSWC/DL-TR-3789 ..... N80-24734 #

NSWC/TR-79-390 ..... N80-24371* #
NSWC/TR-79-447 ..... N80-24667 #

NTIA-79/25 ..... N80-24547 #
NTIA-79/26 ..... N80-24546 #

NTIS/PS-77/0207 ..... N80-24458 #
NTIS/PS-77/0208 ..... N80-24459 #
NTIS/PS-78/0248 ..... N80-24458 #
NTIS/PS-78/0249 ..... N80-24459 #
NTIS/PS-79/0217 ..... N80-24458 #
NTIS/PS-79/0219 ..... N80-24459 #

NTPSC/WP-79-14 ..... N80-24901 #
NTPSC/WP-79-37 ..... N80-24503 #

NTSB-AAR-80-2 ..... N80-24279 #

NUREG-CR-1003 ..... N80-25072 #

NUSC-TR-6191 ..... N80-24531 #

NWC-TP-6062 ..... N80-24799 #

ONERA-NT-1979-4 ..... N80-24406 #

ONR-CR-215-271-1F ..... N80-25043 #

ORAU/IEA-79-21(M) ..... N80-24869 #
ORAU/IEA-79-23(M) ..... N80-24852 #

ORC-79-16 ..... N80-25081 #

ORNL-5439 ..... N80-24471 #
ORNL-5609 ..... N80-25107 #

ORNL/NUREG/TM-349 ..... N80-25072 #

ORNL/OIAPA-13 ..... N80-25125 #

ORNL/TM-6951 ..... N80-24868 #
ORNL/TM-7173 ..... N80-24564 #

ORO-3992-375 ..... N80-25191 #
ORO-5126-97 ..... N80-25127 #
ORO-5373-T1 ..... N80-24492 #
ORO-5759-T1 ..... N80-24866 #

OWRT-A-044-OHIO(1) ..... N80-24408 #
OWRT-A-047-ME(1) ..... N80-24895 #
OWRT-A-063-SDAK(1) ..... N80-24739 #
OWRT-A-101-MICH(1) ..... N80-24892 #

OWRT-B-078-RI(1) ..... N80-24891 #

OWRT-C-80011-S(8512)(1) ..... N80-24410 #

PB80-117666 ..... N80-25216 #
PB80-126139 ..... N80-24546 #
PB80-126840 ..... N80-24893 #
PB80-126956 ..... N80-24876 #
PB80-127053 ..... N80-24878 #
PB80-127244 ..... N80-24408 #
PB80-127574 ..... N80-24410 #
PB80-128150 ..... N80-24409 #
PB80-128317 ..... N80-24365 #
PB80-128457 ..... N80-24896 #

PB80-128655 ..... N80-24897 #
PB80-128671 ..... N80-24509 #
PB80-128689 ..... N80-24900 #
PB80-128697 ..... N80-24894 #
PB80-128762 ..... N80-25130 #
PB80-128978 ..... N80-24904 #
PB80-129063 ..... N80-25001 #
PB80-129166 ..... N80-24460 #
PB80-129323 ..... N80-24547 #
PB80-130701 ..... N80-25196 #
PB80-131766 ..... N80-24407 #
PB80-131960 ..... N80-24903 #
PB80-133580 ..... N80-24892 #
PB80-133614 ..... N80-24972 #
PB80-133812 ..... N80-24901 #
PB80-134153 ..... N80-24873 #
PB80-134323 ..... N80-24895 #
PB80-134596 ..... N80-24507 #
PB80-134778 ..... N80-25206 #
PB80-135247 ..... N80-25267 #
PB80-135270 ..... N80-24898 #
PB80-137326 ..... N80-24508 #
PB80-137664 ..... N80-25197 #
PB80-137706 ..... N80-24971 #
PB80-137862 ..... N80-24740 #
PB80-138241 ..... N80-24899 #
PB80-138498 ..... N80-24503 #
PB80-138522 ..... N80-24891 #
PB80-138571 ..... N80-24889 #
PB80-138928 ..... N80-25060 #
PB80-139074 ..... N80-24902 #
PB80-139298 ..... N80-24905 #
PB80-139306 ..... N80-24504 #
PB80-139546 ..... N80-24336 #
PB80-140171 ..... N80-24977* #
PB80-140395 ..... N80-24677 #
PB80-140510 ..... N80-24890 #
PB80-140536 ..... N80-24877 #
PB80-140569 ..... N80-24739 #
PB80-140783 ..... N80-24973 #
PB80-140932 ..... N80-24593 #
PB80-141286 ..... N80-24875 #
PB80-141294 ..... N80-24874 #
PB80-141542 ..... N80-25195 #
PB80-143126 ..... N80-24352 #
PB80-144645 ..... N80-24570 #
PB80-144686 ..... N80-24966 #
PB80-145055 ..... N80-24974 #
PB80-148273 ..... N80-24879 #
PB80-80586[illegible] ..... N80-24458 #
PB80-805872 ..... N80-24459 #

PNL-SA-6918-REV-1 ..... N80-24966 #
PNL-SA-7669 ..... N80-24810 #

PNL-3139 ..... N80-25201 #

POLY-MRI-1403-79 ..... N80-24529 #

PQTR-1046-79-5 ..... N80-25193 #

PR-3 ..... N80-24884 #
PR-517 ..... N80-25219

PRRL-80-CR-3 ..... N80-25178 #

PRS-41 ..... N80-24896 #

PSAD-80-21 ..... N80-24352 #

PSE-133 ..... N80-24444 #

PSI-TR-204 ..... N80-24583 #

PTI-7915 ..... N80-24335 #

QPR-1 ..... N80-24845 #
QPR-1 ..... N80-24851 #
QPR-2 ..... N80-25163 #

QF-1 ..... N80-24435 #
QR-2 ..... N80-24435 #
QR-2 ..... N80-24839 #
QR-2 ..... N80-24854 #
QR-3 ..... N80-24850 #
QR-6 ..... N80-25144 #
QR-18 ..... N80-24484 #

R-78-1 ..... N80-24545 #
R-1301 ..... N80-24530 #

R-1303 ..... N80-24609 #

RADC-TR-79-175 ..... N80-24388 #
RADC-TR-79-250 ..... N80-24517 #
RADC-TR-79-277 ..... N80-24530 #
RADC-TR-79-293 ..... N80-24535 #
RADC-TR-79-308 ..... N80-24521 #
RADC-TR-79-324 ..... N80-24562 #
RADC-TR-79-353 ..... N80-25025 #
RADC-TR-80-5 ..... N80-24563 #

RAE-AERO-3456 ..... N80-24333 #
RAE-AERO-3457 ..... N80-24278 #
RAE-AERO-3466 ..... N80-24592 #

RAE-FS-98 ..... N80-24332 #
RAE-FS-106 ..... N80-24310 #
RAE-FS-112 ..... N80-24291 #

RAE-IT-165 ..... N80-24591 #

RAE-MAT-386 ..... N80-24672 #

RAE-MATH-COMP-234 ..... N80-25028 #
RAE-MATH-COMP-235 ..... N80-25035 #

RAE-RAD-NAV-76 ..... N80-24567 #
RAE-RAD-NAV-78 ..... N80-24290 #

RAE-SPACE-566 ..... N80-24351 #
RAE-SPACE-567 ..... N80-24934 #
RAE-SPACE-568 ..... N80-24569 #
RAE-SPACE-569 ..... N80-24738 #
RAE-SPACE-571 ..... N80-24872 #

RAE-STRUCT-BF/B/0793 ..... N80-24676 #

RAE-TM-AERO-1806 ..... N80-24331 #

RAE-TM-MAT-318 ..... N80-24457 #

RAE-TM-MATH-COMP-7905 ..... N80-25205 #

RAE-TM-STRUCT-954 ..... N80-24671 #
RAE-TM-STRUCT-960 ..... N80-24639 #

RAE-TR-79038 ..... N80-24567 #
RAE-TR-79045 ..... N80-24332 #
RAE-TR-79048 ..... N80-24290 #
RAE-TR-79062 ..... N80-24278 #
RAE-TR-79065 ..... N80-24333 #
RAE-TR-79071 ..... N80-24676 #
RAE-TR-79089 ..... N80-24591 #
RAE-TR-79090 ..... N80-24310 #
RAE-TR-79098 ..... N80-25028 #
RAE-TR-79100 ..... N80-24351 #
RAE-TR-79105 ..... N80-24872 #
RAE-TR-79113 ..... N80-25035 #
RAE-TR-79115 ..... N80-24934 #
RAE-TR-79118 ..... N80-24569 #
RAE-TR-79121 ..... N80-24738 #
RAE-TR-79126 ..... N80-24291 #
RAE-TR-79133 ..... N80-24872 #
RAE-TR-79136 ..... N80-24592 #

RAND/N-1337-AF ..... N80-24318 #

RAND/R-2397-PA/E ..... N80-24301 #

REPT-1 ..... N80-24923 #
REPT-2 ..... N80-24547 #
REPT-2-53500/9R52131 ..... N80-24636 #
REPT-3-46-32-59-3-60 ..... N80-25175 #
REPT-3WW/TN-80/002 ..... N80-24956 #
REPT-56-79-AF11 ..... N80-24422 #
REPT-80-FM-19 ..... N80-25057* #
REPT-80-FM-20 ..... N80-25056* #
REPT-80-TR2 ..... N80-25174* #
REPT-80-1 ..... N80-25064 #
REPT-89 ..... N80-25221 #
REPT-90 ..... N80-25222 #
REPT-91 ..... N80-25223 #
REPT-094-009246 ..... N80-24558 #
REPT-1753-01-1-2124 ..... N80-24312 #
REPT-1842EEG/EEISG-TR-79-15 ..... N80-24289 #
REPT-3858-14-FR ..... N80-24897 #
REPT-9278-950002 ..... N80-24605 #

RLO-2342-79/1 ..... N80-24968 #
RLO-2343-79/1 ..... N80-24965 #

RR-Q-3 ..... N80-25087 #

RR-79-02 ..... N80-25084 #
RR-79-23 ..... N80-25139 #

RSRE-MEMO-3167 ..... N80-25017 #
RSRE-MEMO-3220 ..... N80-24292 #

RU-78-82 ..... N80-25240* #

S-2604 ..... N80-24552* #
S-2689 ..... N80-25145 #

S/T-MEMO-6-79 ..... N80-24339 #

SAI-254-79-933-LJ ..... N80-25162 #

SAN-1864-1 ..... N80-24849 #
SAN-2219-3 ..... N80-24850 #

SAND-79-0172 ..... N80-25124 #
SAND-79-0649 ..... N80-24590 #
SAND-79-1717C ..... N80-24429 #
SAND-79-1781 ..... N80-24842 #
SAND-79-1782C ..... N80-24803 #
SAND-79-1940 ..... N80-24330 #
SAND-79-8278 ..... N80-25027 #
SAND-79-8636 ..... N80-24495 #
SAND-79-8646 ..... N80-24496 #
SAND-79-8717 ..... N80-24397
SAND-79-8777 ..... N80-24833 #
SAND-80-0112C ..... N80-24857 #
SAND-80-0143C ..... N80-24832 #
SAND-80-0177C ..... N80-24566 #

SAR-9 ..... N80-25142 #

SCIENTIFIC-1 ..... N80-25060 #

SC5065.4TR ..... N80-25088 #

SER-70286 ..... N80-24298 #

SERI/SP-451-519 ..... N80-24478 #

SERI/TP-33-285 ..... N80-24473 #
SERI/TP-33-410 ..... N80-24477 #
SERI/TP-332-476 ..... N80-24831 #
SERI/TP-333-538 ..... N80-24824 #
SERI/TP-334-457 ..... N80-24805 #
SERI/TP-351-548 ..... N80-24862 #

SERI/TR-62-264 ..... N80-24493 #
SERI/TR-332-360-VOL-1 ..... N80-24502 #
SERI/TR-8043-VOL-1 ..... N80-24844 #

SETEC-MME-79-62 ..... N80-24445 #

SIO-REF-79-25 ..... N80-24924 #

SORI-EAS-79-504 ..... N80-24480 #
SORI-EAS-79-564 ..... N80-24897 #

SR-3 ..... N80-24349 #
SR-10 ..... N80-24924 #

SRI-JSR-79-10 ..... N80-25120 #

SRL-6909-01 ..... N80-24321 #

SU-GL-3089 ..... N80-25142 #
SU-GL-3094 ..... N80-25146 #
SU-GL-3132 ..... N80-24804* #

SU-SEL-79-025 ..... N80-24524 #

SU-TR-E715-1 ..... N80-24524 #

SU-TR-41 ..... N80-25089 #
SU-TR-52 ..... N80-25044 #

SU-326-P3067 ..... N80-25073 #

TDC-80-005 ..... N80-24465* #

TH-78-E-85 ..... N80-25015 #
TH-78-E-86 ..... N80-24999 #

TI-03-79-57 ..... N80-24555 #

TM-79/20 ..... N80-24509 #
TM-502 ..... N80-25100* #

TMA-00789 ..... N80-25011 #

TN-1979-8 ..... N80-24537 #
TN-1979-11 ..... N80-24554 #
TN-1979-14 ..... N80-24520 #
TN-1979-48 ..... N80-24363 #
TN-1979-69 ..... N80-24519 #
TN-1979-72 ..... N80-24540 #
TN-1979-75 ..... N80-24518 #
TN-1979-80 ..... N80-24541 #
TN-1980-4 ..... N80-25065 #

TPR-1 ..... N80-24821 #

TR-D-42-ARO ..... N80-25086 #

TR-1 ..... N80-24448 #
TR-1 ..... N80-25111 #
TR-2 ..... N80-24424 #
TR-2 ..... N80-25177 #
TR-3 ..... N80-24381 #
TR-4 ..... N80-24423 #
TR-4 ..... N80-24445 #
TR-5 ..... N80-24421 #
TR-6 ..... N80-25184 #
TR-05 ..... N80-24444 #
TR-11 ..... N80-24390 #
TR-11 ..... N80-24664 #
TR-15 ..... N80-25058 #
TR-16 ..... N80-25176 #
TR-30 ..... N80-25180 #
TR-51 ..... N80-25182 #
TR-79-04 ..... N80-24665 #
TR-163A ..... N80-25085 #
TR-230-1995 ..... N80-24355* #

TRITA-EPP-79-04 ..... N80-24935 #
TRITA-EPP-79-06 ..... N80-25119 #
TRITA-EPP-79-16 ..... N80-24936 #
TRITA-EPP-79-17 ..... N80-25266 #
TRITA-EPP-79-18 ..... N80-25167 #

TRITA-NA-7905 ..... N80-25075 #
TRITA-NA-7912 ..... N80-24405 #
TRITA-NA-7914 ..... N80-24673 #
TRITA-NA-7915 ..... N80-25029 #

TRITA-PFU-79-09 ..... N80-25168 #
TRITA-PFU-79-10 ..... N80-25169 #

TRITA-REG-7902 ..... N80-25046 #
TRITA-REG-7903 ..... N80-25047 #

TR70-30-VOL-1 ..... N80-25210* #
TR70-30-VOL-2 ..... N80-25211* #

TS-79-3 ..... N80-25080 #

TSC-PD-A211-4 ..... N80-24522 #

TST-41 ..... N80-25141 #

TUM-LRT-KB-78/3 ..... N80-24833 #

UAH-RR-240 ..... N80-25264* #

UC-ES-040180-8-ONR ..... N80-24666 #

UCID-18308 ..... N80-25160 #
UCID-18487 ..... N80-25074 #
UCID-18499 ..... N80-25096 #
UCID-18500 ..... N80-25158 #
UCID-18506 ..... N80-24392 #
UCID-18523 ..... N80-25097 #

UCRL-15124 ..... N80-24629 #
UCRL-52628 ..... N80-24430 #
UCRL-52637 ..... N80-24964 #
UCRL-52649 ..... N80-24456 #
UCRL-52861 ..... N80-24887 #
UCRL-52865 ..... N80-24497 #
UCRL-82852 ..... N80-25161 #
UCRL-82862 ..... N80-24670 #
UCRL-82936 ..... N80-25036 #
UCRL-83057 ..... N80-24817 #
UCRL-83213 ..... N80-24806 #
UCRL-83312 ..... N80-25156 #

UCRL-83570 — N80-24627 #
UCRL-83702 — N80-25014 #
UCRL-83771 — N80-24489 #
UCRL-83813 — N80-24859 #
UCRL-83881 — N80-24846 #

UHMET-79-04 — N80-24967 #

UREM79-13 — N80-24533 #

UILU-ENG-79-2004 — N80-24474 #
UILU-ENG-79-2557 — N80-24533 #

ULRF-403/CAR — N80-24916 #

UNI-1318 — N80-24600 #
UNI-1406 — N80-24590 #

US-PATENT-APPL-SN-008212 — N80-24741*
US-PATENT-APPL-SN-135058 — N80-24549* #
US-PATENT-APPL-SN-145107 — N80-24440* #
US-PATENT-APPL-SN-145206 — N80-24511* #
US-PATENT-APPL-SN-145209 — N80-24619* #
US-PATENT-APPL-SN-145210 — N80-24334* #
US-PATENT-APPL-SN-145272 — N80-25134* #
US-PATENT-APPL-SN-145273 — N80-24342* #
US-PATENT-APPL-SN-150040 — N80-24602* #
US-PATENT-APPL-SN-150115 — N80-24747* #
US-PATENT-APPL-SN-559846 — N80-24573*
US-PATENT-APPL-SN-706424 — N80-24438*
US-PATENT-APPL-SN-856462 — N80-24573*
US-PATENT-APPL-SN-907479 — N80-24438*
US-PATENT-APPL-SN-945436 — N80-24906*
US-PATENT-APPL-SN-957452 — N80-24510*
US-PATENT-APPL-SN-958575 — N80-24437*

US-PATENT-CLASS-60-267 — N80-24573*
US-PATENT-CLASS-73-155 — N80-24906*
US-PATENT-CLASS-136-89SG — N80-24741*
US-PATENT-CLASS-156-DIG.64 — N80-24741*
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18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 2094

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION **N.A.**

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER **2094**

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) **2094**

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **2095**

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **2096**

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS **2098**

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **2103**

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **2105**

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) **2108**

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **2112**

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING **2115**

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER **2120**

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY **2130**

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS **2132**

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING **2133**

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **2136**

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **2137**

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) **N.A.**

43 EARTH RESOURCES 2142

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 2150

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 2168

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 2174

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 2178

Includes weather forecasting and modification.

48 OCEANOGRAPHY 2183

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 2184

Includes genetics.

52 AEROSPACE MEDICINE 2184

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES N.A.

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 2186

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 2186

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 2187

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS N.A.

Includes computer networks.

63 CYBERNETICS 2191

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 2192

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 2194

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 2195

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS N.A.

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

70 PHYSICS (GENERAL) 2195

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 2195
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 2196
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 2198
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 2199
Includes light phenomena.

75 PLASMA PHYSICS 2201
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 2204
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 2207
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT N.A.
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2207
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 2208
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2208
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2208
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2211
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2213
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2214
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2215
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2215
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2216

Note: N.A. means that no abstracts were assigned to this category for this issue.

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N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mousey 3 Sep. 1979 409 p refs
(Contract NAS1-15624)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01
CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, BOOST SUSTAIN INTEGRATION STUDY
T. Piercy, Marquardt Co., *16555 Saticoy St., Van Nuys, California* 91409 (DF462490; F33615-78-C-2034)

Study the possibility of combining the separate propulsion stages of boost and sustain into a single propulsion unit for ramjets (solid fuel, liquid fuel and ducted rocket). Eliminate booster ejectables during boost-to-sustain transition phase.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0002, FURTHER WIND TUNNEL INVESTIGATIONS OF A WING/STORE FLUTTER SUPPRESSION SYSTEM
C. Hwang, Northrop Corp., *3901 W. Broadway, Hawthorne, California* 90250 (DF142180; F33615-78-C-3221)

High performance fighter attack aircraft are required to carry many combinations of external wing mounted stores to obtain operational effectiveness in the combat role. However, some wing/store configurations are found to be critical from the standpoint of preventing flutter from occurring within the desired operational flight envelope. Speed placards are presently the only means of preventing this flutter, but this technique generally results in significant losses in aircraft performance. The objective of this program is to conduct wind tunnel tests on an aeroelastic model with external stores to further investigate critical parameters. The technology gained from this program will ultimately result in an expanded attack envelope, increased survivability (reduced cost per target kill), and improved operational flexibility on fighter attack aircraft with an air-to-ground mission.

The existing flutter model will be refurbished to include additional sensors, new control surface actuators, and new and improved control laws. In order to prevent severe damage to the model if flutter is unexpectedly encountered, a new store with a movable mass will be designed and fabricated, and will be controlled by an automatic flutter sensing unit. Additional analytical studies will be conducted to develop the new control laws which could possibly include AFFDL, French and British control laws. Two test entries will be performed with the cooperation of NASA Langley at the 16-foot transonic dynamics tunnel. These tests will be conducted to evaluate the control laws described earlier as well as adaptive control laws which will be developed under a separate AFFDL contract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, IMPROVED HIGH AOA DESIGN GUIDES AND FLYING QUALITIES CRITERIA
I.L. Ashkenas, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF137370; F33615-78-C-3604)

The mission to be supported is FG02, Development and Improvement of Flight Control Design Techniques. One problem area experienced by aircraft designers is their inability to adequately predict high-angle-of-attack characteristics. The objective of this effort is to improve the methods available to predict and quantitatively define aircraft flying qualities at high angles of attack. The results will be applicable to updating military specifications, as well as providing design guides for future high-performance military aircraft using either conventional or CCV control system concepts.

The effort consists of both gathering and analyzing existing data required to provide new and/or improved high-angle-of-attack (AOA) flying qualities requirements and design guides for all categories of aircraft. The effort will begin with an extensive literature survey of the technical area and a critical review of the high-AOA requirements of MIL-F-8785B. This will be followed by a comprehensive series of personal visits to various organizations within the USAF, Navy, NASA, industry, and the academic community to obtain ideas and data. From this data a revised high-AOA flying qualities specification will be formulated. The design guides effort consists of gathering high-AOA design guides from cognizant sources in the technical community and performing appropriate analysis for verification. Presently used guides as well as planned improvements or potential new guides shall be considered. The results will be presented in compendium form.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, F100 HPC AEROELASTIC ANALYSIS
J. Jeffers, United Technologies Corp., *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF461950; F33615-77-C-2105)

Improve understanding of blade flutter mechanisms by providing insight into parameters affecting blade instability.

Conduct a detailed aero/mechanical analysis of FX-208 and XD-11 test data generating a stall and choke flutter data bank for prediction system development, evaluate existing prediction system capabilities/limitations, and assess the use of 'core' engines for full-scale engine HPC flutter clearance testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0005, COOLED HOLLOW CERAMIC AIRFOIL EVALUATION PROGRAM
Unknown, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF463710; F33615-79-C-2024)

The objective of this program is demonstrate the feasibility of using ceramic materials for cooled airfoil applications.

This will be a single phase, four task study to design and evaluate ceramics for cooled airfoil applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0006, UNIFIED SYNTHESIS OF MANUAL AND AUTOMATIC FLIGHT CONTROL
D.K. Schmidt, Purdue University, School of Aeronautics & Astronautics, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DF054350; AFOSR-79-0042)

AF function - given adequate design specifications, or aircraft handling qualities criteria, and a valid system model, synthesis techniques, particularly modern control approaches, are available to the system designer for synthesizing even the most

complex flight systems. Deficiency - weaknesses, however, exist in the handling qualities specifications for non-conventional aircraft such as control configured vehicles (CCV's), and for aircraft with significant structural dynamics needs. Objective - the objective is to synthesize vehicle augmentation to aid the pilot in the air-to-air tracking (gunnery) task. How research contributes-the proposed research would consist of the further development and application of a synthesis methodology usable in the absence of quantitative vehicle handling qualities specifications, and yet explicitly include design objectives based on pilot acceptance by means of an analytic pilot model.

The procedure involves the unique approach of simultaneously solving for the stability augmentation system (SAS) gains and pilot model via optimal control techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0007, HELMET MOUNTED OCULOMETER DEVELOPMENT

J. Merchant, Honeywell Inc., Radiation Center, *2 Forbes Rd., Lexington, Massachusetts* 02173 (DF142950; F33615-77-C-2077)

The mission this work unit supports is the simulation of advanced aerospace vehicles. The engineering flight simulator is a modern tool for the analysis and evaluation of current and future Air Force systems. The opportunity exists with simulations to develop proposed flight control system schemes including cockpit controls and displays. This requires man-in-the-loop participation throughout the design evaluation. The objective of this work unit is to develop, install, demonstrate and maintain a system capable of both head and eye measurements of the test subject without any attachments to the subject and within the framework of moving base simulation. This program contributes to effective simulation of flight vehicles.

Studies will be conducted to establish the optimum location for equipment to be installed. The equipment will then be engineered to be compatible with installation requirements. All power and signal cables will be installed and the equipment will be installed and demonstrated. The demonstration will consist of 3 hours reliable data acquisition daily for a period of two weeks with no more than 30 minutes downtime per eight-hour shift.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, DEVELOPMENT OF IMPROVED FATIGUE LIFE TRACKING SYSTEMS FOR NAVY AIRCRAFT

R.E. Pinckert, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DN081258; N62269-79-C-0225)

To develop improved fatigue life tracking systems for Navy aircraft in order to achieve significant improvements in the accuracy of fatigue-life-expended estimates of fleet aircraft. This contract will support work unit ZA-601, Aircraft Technology, Agency Accession DN 681080.

Program will be done in two phases. Phase I will be a conceptual design, analytical assessment and cost optimization of candiate tracking systems. Phase II will be a flight test and laboratory evaluation of the function and accuracy of the improved systems.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0009, FUEL CHARACTER EFFECTS ON CURRENT LOW PRESSURE RATIO CAN-TYPE AIRCRAFT TURBINE COMBUSTION SYSTEMS

C. Gleason, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF460830; F33615-77-C-2042)

To determine the effects of fuel character changes on an existing low pressure ratio, can-type AF combustion system.

Single can combustor rig tests will be performed on a current AF combustion system such as the T56, J57, or J79. Fuel hydrogen content, types of aromatics, volatility, and fuel distillation end point are the parameters to be investigated. Close coordination with TBC will be maintained throughout this program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0010, TI/AL DESIGN/COST TRADE OFF ANALYSIS

D.O. Nash, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF461680; F33615-77-C-2066)

The primary objective of this program is to evaluate suitable applications for titanium aluminide alloys in gas turbine engines. It shall be determined if these alloys offer a viable alternative to nickel base superalloys. Studies of static and dynamic components, fabricated from various manufacturing processes, will be conducted to discern all potential areas of application from a structural, economic, and life-cycle cost viewpoint.

A design/cost trade-off analysis of titanium aluminides in the wrought cast, forged, rolled and powder metallurgical states shall be made for both static and dynamic component applications. Finite element analyses shall be conducted to determine stress/strain distributions of the various component configurations with loadings and boundary conditions that are commensurate with the actual operating environments of the components. The critical areas of all components will be identified as well as the limiting material properties for that application. Potential methods of optimizing the limiting properties will be discussed plus an overall assessment of practically applying the materials to this type of component. In addition, the optimum applications for wrought material, cast, forged, rolled and powder metal forming shall be specified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0011, THERMAL RESPONSE TURBINE SHROUD

Unknown, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF463290; F33615-78-C-2071)

Analyze the effects of thermal response technology on engine performance and determine the level of complexity required to obtain maximum payoff with minimum cost.

Perform an analysis of thermal response effectiveness in relation to engine cycles and various other design parameters. Describe a number of concept alternatives for further consideration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0012, THERMALLY CONTROLLED BOUNDARY LAYER TECHNOLOGY

J.D. Lee, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF143230; F33615-79-C-3008)

The Air Force function for this effort is the design of future large aircraft, transports and bombers. The problem this effort addresses is the need to reduce the drag on these aircraft so that either the range can be extended or fuel required for a given mission reduced. The objective is to demonstrate the ability of cryogenic cooling of an airfoil surface to delay transition of the boundary layer and thereby reduce drag. The results of this study will contribute to the Air Force's fuel conservation effort.

This effort will first involve the design and construction of a simple low-cost wind tunnel model to demonstrate the effect of boundary layer cooling on an airfoil. This model will then be tested in a wind tunnel and the results used to verify or modify existing theory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, APPLICATION OF COHERENT ANTI-STOKES RAMAN SCATTERING TO LASER & COMBUSTION MEDIA

B.R. Won, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF461250; F33615-77-C-2019)

Use coherent anti-Stokes Raman scattering (CARS) for measuring species concentrations and temperature as a function of position inside a jet engine combustor.

Use the CARS system already demonstrated to obtain spectra for organic compounds found in fuels and combustion products, use CARS to determine species concentrations vs position within a combustion system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0014, HYDRAULIC DYNAMIC ANALYSIS EXPERIMENTAL VERIFICATION

P.D. Lindquist, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF455370)

The purpose of this program will be to model the dynamic effects of an aircraft hydraulic system. Computer models will be developed and verified in the laboratory.

The approach will be to set up, beginning with a simple system, a hydraulic circuit in the laboratory and develop an analytic model which can be verified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0015, FUELS TECHNICAL SUPPORT

C.R. Martel, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF464140)

Solve problems related to the use of aviation turbine and ramjet fuels in airbreathing propulsion systems. Provide support to operational systems and new systems under development.

Prepare and update fuel specifications as required. Aid in the investigation of field problems where needed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0016, VIBRATION TEST LEVEL CRITERIA FOR AIRCRAFT EQUIPMENT

P.S. Hall, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143860)

The currently available methods for the formulation of vibration test criteria are not readily usable by all individuals associated with predicting the level and spectrum of vibration necessary for environmental and reliability testing of onboard equipments carried in modern high performance aircraft. Presently available vibration test level methods are either unrealistic, complicated for the non-vibration specialists, or require computer access and numerous input data. This work effort is to evaluate all existing vibration test level prediction methods, and construct criteria to determine vibration test levels to be used in MIL-STD-781, MIL-STD-810, or some other combined environment test specifications that are realistic, universally usable, and easily accessible.

Extract pertinent methodology from previous work unit efforts, contract studies, and military standards and specifications. Generate an analytical expression with proper validation through flight test data and other empirical data that results in an orderly and unified vibration test level prediction method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, ADVANCED AIRBORNE DIFFUSERS

S. Hasinger, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143660)

Airborne laser weapons systems depend on a high pressure recovery diffuser in order to discharge the laser exhaust gasses into the atmosphere. The effectiveness of the diffuser is crucial to the operation of these weapons systems. Present laser diffuser systems do not satisfy all the requirements established by AFWL, Kirkland A.F.B., N.M. It is the objective of this research to explore the potential of novel diffuser concepts for their eventual incorporation into an actual airborne laser weapon system. The general validity of these concepts has been proven in previous investigations at the AFFDL, Wright-Patterson A.F.B., Ohio. This research is conducted in direct coordination with AFWL, who is charged with the responsibility of developing various forms of airborne laser weapon systems.

Research will be carried out in the AFFDL Mach number six high Reynolds number wind tunnel on a single stage of the slanted cascade diffuser. The radial outflow diffuser will be tested in a Mach number two and three environment at a reynolds number of ten to the fifth power. In both cases the result will be a light, compact diffuser with a high pressure recovery and instant re-start capability. The slanted cascade diffuser is intended for use in the gas dynamic laser weapon system while the radial outflow diffuser is to be employed in the chemical laser system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, INTEGRATED FLIGHT PATH DISPLAY

C.J. Kopala, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144340)

This work unit will support the design of advanced fighter aircraft cockpits. The flight path display to be designed will combine two current displays, VSD and HSD, onto a single display surface. In addition, it will provide the pilot with perspective and closure cues which have heretofore been unavailable. The objective of the work unit is to develop a three-dimensional pictorial flight path display, and to compare flight performance of A-7 pilots using this display with their flight performance using the current DAIS VSD and HSD CRTs. Their performances will be measured across a number of different flight maneuvers. The new flight path display will increase combat effectiveness by improving pilot navigation through highly dense threat areas.

An extensive review of all studies applicable to this program has been performed and documented in a report. The 3-D display proposed for development will incorporate those features of earlier 3-D models that were found to enhance flight performance. Objective flight performance data will be used to compare pilots use of the 3-D display versus their use of the current DAIS displays. Subjective data will also be taken from the pilots as they use each display set and the data used to compare the display sets.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, EVALUATION OF STRUCTURAL FASTENERS FOR INTEGRAL AIRCRAFT FUEL TANKS

J.D. Oetting, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142870)

This work unit supports the requirement for enhanced fuel tightness in integral fuel tanks for USAF aircraft. MIL-A-8867B is directly supported in the area of fuel tank leak testing and MIL-T-5578 in the area of fuel tank sealing. This effort is directed toward solving the problems of fuel leakage at structural joints. The objective of this program is to screen various fastener systems and evaluate their ability to reduce fuel leaks. The reduction of fuel leak problems will significantly reduce the maintenance costs of USAF aircraft.

Candidate fastener systems will be obtained from vendors and installed in test coupons with recommended fuel sealants. Fuel pressurization chambers will be placed over the area of the fasteners while flight-by-flight loading is being applied to the test coupon. Fuel leak rates will be measured and compared with each candidate fastener system. Recommendations will be made for the procurement of the most qualified systems. The better rated fastener systems will be evaluated for fuel tightness with representative variations in hole preparation, hole size and fastener torque.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, INTEGRAL FUEL TANK TEST METHODS AND CRITERIA

M.D. Richardson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143150)

This effort will help to insure increased safety and more cost effective operation of future USAF aircraft. Current data retrieval systems have identified fuel leaks from aircraft integral fuel tanks as a high-cost item. These costs are incurred directly by the maintenance required to repair leaks and return the aircraft to flight status, and indirectly by the reduction in aircraft availability. The Air Force specification, MIL-S-8867, requires very little fuel tank testing and contractors do very little. The goal of this effort will be to develop a cost-effective method(s) of adequately certifying new aircraft with integral fuel tanks for fuel containment. As part of this goal a criteria defining adequate fuel containment will be established. The impact of effective test methods on such design parameters as cost, weight, materials and configuration can be significant. Accomplishment of this objective will permit economical and efficient operation of future USAF aircraft with respect to repairs necessitated by fuel system leaks.

Review current structural and dynamic test criteria. Determine scale and configuration of specimens needed. Develop test techniques to realistically simulate static and dynamic loads and related environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, OH-58 COMPOSITE MAIN ROTOR BLADE PRELIMINARY DESIGN INVESTIGATION

B. Brogden, Bell Helicopter Textron, *Hwy. 183, P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3798; DAAJ02-77-C-0073)

The OH-58 composite main rotor blade preliminary design investigation is a paper study to investigate the application of a composite main rotor blade to the OH-58 for replacement of its existing metal blade. The results from the program will be of significant benefit in establishing realistic requirements for a follow-on OH-58 product improvement program.

Each contract shall include two principal tasks. Task I shall include a trade-off of candidate blade concepts varying in design, configuration, method of fabrication and materials against design goals and objectives. The prime areas for consideration shall include ballistic survivability, radar reflectivity, R&M, life-cycle cost, and performance. From the trade-off analysis one concept shall be selected for Task II. Task II shall include in-depth preliminary design and analysis on the selected blade concept to optimize its characteristics. Each contractor shall be furnished technical reports on the OH-58. The program is now set up whereby the final reports shall be releasable to industry. Solicitation for the PIP program shall not be limited to the PD study contractors.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0022, NAVTOLAND (NAVY VERTICAL TAKEOFF AND LANDING) SYSTEM ERROR BUDGET

J. Wokkovitch, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN081105; N62269-78-C-0254)

To analyze and quantify the effects of landing guidance sensor noise, flight control sensor noise and environmental disturbances on V/STOL automatic approach and landing aboard small ships. The intent is to budget and identify disturbances that limit performance. This contract supports work unit ZA601, Agency Accession No DN681080.

Utilize non-linear covariance propagation analyses techniques to calculate autoland trajectory and touchdown error statistics.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0023, STRUCTURAL OPTIMIZATION METHODS

G. Sander, Universite de Liege, *7 Pl. du 20 Aout, Liege, Belgium* (DF143980; F33615-76-C-3145)

This effort supports the design and analysis of aerospace vehicle structures. The use of automated design methods for structural components contributes significantly to the effectiveness and efficiency of flight vehicles. The problem is to design the lightest weight and most efficient load carrying structure. The objective of this effort is to extend the development of the mixed method of structural optimization which retains the main advantages of the optimality criteria and mathematical programming approaches. This work will provide the basis for an analytical tool for minimum weight design of the structure thus improving the performance and cost effectiveness of the aerospace vehicle.

Determine the optimum value of the convergence control parameter, determine constraints that require exact linearization after each reanalysis and extend method to other types of constraints, i.e., dynamic, buckling, etc.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, ELASTIC AND INELASTIC ELECTRON-MOLECULE SCATTERING CROSS SECTIONS AND MOLECULAR PHOTOIONIZATION CROSS SECTIONS

V. McKoy, California Inst. of Technology, Graduate School, Dept. of Chemistry, *1201 E. California Blvd., Pasadena, California* 91109 (CHE76-05157 A02)

The principal objectives of the research are the development of theoretical approaches and practical computational schemes for calculating a) elastic and electronically inelastic cross sections for the scattering of low energy electrons by diatomic and polyatomic molecules and b) photoionization and photodetachment cross sections, including resonance contributions, for the ground and metastable states of molecules. The plan is to use two methods for calculating low-energy electron-molecule scattering cross sections which make use of discrete basis functions. The first method for calculating elastic and rotationally and electronically inelastic scattering of electrons by molecules involves the use of discrete basis functions. This feature has several important advantages for the electron-molecule scattering problem. The second method is a very simple and approximate procedure for computing cross sections for low-energy elastic electron scattering by diatomic and polyatomic molecules. Scattering information is extracted from a single diagonalization of the Hamiltonian in a discrete basis. The method for calculating photoionization cross sections completely avoids the need for obtaining molecular continuum eigenfunctions by taking advantage of certain analytic properties of the Hamiltonian expressions for these photoabsorption cross sections that can be evaluated using discrete square-integrable basis functions exclusively. This work is a continuation of that currently supported by Foundation grant CHE-7205038.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0002, STATE SELECTION AND STATE DETECTION OF MOLECULES WITH LASERS

R.N. Zare, Stanford University, School of Humanities & Sciences, Dept. of Chemistry, *Stanford, California* 94305 (CHE78-10019)

The objective of Dr. Zare's research program is to obtain state-specific (quantum) information on the dynamics of chemical reactions and of excited state formation and decay. This will be accomplished through the synthesis of molecular beam and of laser spectroscopic methods. Beam techniques permit the study of isolated molecules and the investigation of chemical reactions, one collision at a time. Laser techniques permit the preparation (state selection) of reagents and the interrogation (state detection) of the products. This quantum information will provide detailed state-to-state data that will answer these questions: How do chemical reactions occur? How do molecular scatter (desorb) from surfaces? How do photo-prepared molecules decompose or undergo other radiationless transitions?

This research represents a continuation of that currently supported by Foundation Grant CHE-7715938.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0003, INTERACTIONS AMONG EXCITED ELECTRONIC STATES IN ANIONS AND RELATED NEUTRAL MOLECULES

D.S. Tinti, University of California, Davis Campus, School of Letters & Science, Dept. of Chemistry, *Davis, California* 95616 (CHE77-11839 A01)

Dr. Tinti plans to investigate the interactions among the lower energy electronic states in closed-shell anions and related neutral molecules by low temperature optical spectroscopy in conjunction with ODMR (optically detected magnetic resonance) techniques. Covalent and ionic derivatives of oxalic acid will be examined to completely assign and characterize the lower energy electronic states in systems where several states of different orbital character are expected to occur in a narrow energy range. Thiocarbonyls, wherein the electronic states are widely separated, will be studied as examples of systems which violate Kasha's rule and to deduce the general consequences of thio-substitution on the excited state properties. The radiationless processes among excited electron states in the nitrite anion, which exhibits an uncommon excitation energy dependent total emission spectrum in a solid host, will be studied to determine the mechanisms and routes of electronic relaxation in a small molecule.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, GIANT INTRINSIC MAGNETIC HARDNESS

H. Oesterreicher, University of California, San Diego Campus, Inst. for Pure & Applied Physical Sciences, Dept. of Chemistry, *P.O. Box 109, La Jolla, California* 92037 (DMR76-10842 A02)

Recently materials have been identified in the Principal Investigator's laboratory and in Russia which exhibit the highest coercive forces ever measured; extrapolated values are in the megaoersted region. These materials are substituted rare earth (R) transition metal (T) compounds such as the series SmCo5-SmNi5. As outstanding values of coercive force are observed in single phase homogeneous bulk materials, this magnetic hardness is an intrinsic, fundamental solid state parameter. In fact, these materials appear to represent examples where the anisotropy field limits the coercive field. This study elucidates the physical and chemical origins of this effect; one expects to learn about a new mechanism leading to outstanding magnetic hardness. For this purpose anisotropy constants and coercive fields are measured, in part, in single crystals, as a function of temperature. Coercive fields are correlated with anisotropy fields and ordering temperature. The 'chemical' origins of the effect are elucidated by studying the effects of substitution for transition metals (T) in SmT5 or Sm2T7 and related compounds by elements which allow for a systematic change in spacial and electronic parameters. The relative contribution of T and R are established by working with compound series where either B or T is nonmagnetic. Giant intrinsic magnetic hardness will be sought in a wider range of compounds on the basis of R and T metals. In view of the outstanding strength of coercive forces part of this work shall be carred out in cooperation with the National Magnet Laboratory.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0005, SOLIDIFICATION OF METALLIC MELTS PRODUCED BY LASER IRRADIATION

S.M. Copley, University of Southern California, School of Engineering, Dept. of Materials Science, *3551 University Ave., Los Angeles, California* 90007 (DMR78-07532)

This is a continuation of a basic investigation on the solidification of metallic melts produced by laser irradiation. This program includes studies of: the processes that determine solute distribution; conditions under which the melt will solidify with the same orientation as the substrate; factors which influence the microstructure; and the magnitude of residual stress present in solidified layers. Experiments will be carried out on crystals of Ag-Cu, Ag-Ge and Au-Si. Surface compositions will be modified by plating or physical vapor deposition. The range of incident beam intensities and beam scan rates will be expanded over that previously used in irradiation treatments. The microstructures of irradiated specimens will be characterized by a variety of techniques including transmission electron micrscopy, scanning electron microscopy, energy dispersive X-ray analysis, and electronprobe microanalysis. It is expected the results of this research will contribute to a basic understanding of solidification phenomena under far-from-equilibrium conditions, and to a better understanding of processes of possible technological importance, such as laser glazing and surface alloying. This is a continuation of research previously funded under NSF Grant DMR76-08897. This is the first year of a two year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0006, HETEROGENEOUS RECOMBINATION OF OXYGEN AND CARBON MONOXIDE ON SOLID CARBON DIOXIDE AND ITS IMPORTANCE IN MARTIAN AERONOMY

D.S. Sethi, University of Bridgeport, School of Arts & Sciences, Dept. of Chemistry, *285 Park Ave., Bridgeport, Connecticut* 06602 (ATM77-27217)

The objective of this research is to determine the importance of the heterogeneous recombination of CO and O on solid CO2, in the chemistry of the atmosphere of Mars. The Martian atmosphere consists largely of CO2, which can be photodissociated by solar ultraviolet radiation. Because known homogeneous recombination processes are slow, the mechanism by which CO and O recombine to form CO2 is of great interest in attempts to understand the known stability of CO2 in the Martian atmosphere. In this research, the rate of the reaction of CO and O in solid CO2 will be obtained as a function of temperature in the range 77 degrees to 150 degrees K, and the experiments will be done at concentrations typical of those encountered in the Martian atmosphere. The mechanism of the recombination process will also be studied. In addition to providing data of considerable interest in Martian atmospheric chemistry, the experiments will provide the basis for future studies of heterogeneous chemistry in the Earth's atmosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

3.0007, PREPARATION AND PROPERTIES OF COMPLEX CARBIDES AND NITRIDES FOR ABRASIVES

H. Nowotny, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Metallurgy, *Box U-37, Storrs, Connecticut* 06268 (DMR77-20504)

This research will be a study of the synthesis and evaluation of new ceramic abrasives based on complex carbides and nitrides. The objective will be to study the phase equilibria and crystal chemistry of wear-resistant materials such as titanium-aluminum-carbon and titanium-aluminum-nitrogen combinations. Synthesis of the carbides and nitrides will be done by sintering and hot pressing.

The research will include studies aimed at preparing cemented carbides, materials important to the areas of cutting, drilling and grinding. The wettability and reactivity of complex carbides and nitrides with binder materials such as copper and copper solid solutions will be investigated. Diffusion couples of the ceramics and metal will be annealed at high temperatures, and the diffusion will be measured as a function of time and temperature.

Characterization of the materials will include phase analysis by x-ray diffraction and the electron microprobe, optical and microscopy, and measurement of physical and mechanical properties, in particular hardness.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0008, DISORDERED SEMICONDUCTORS

H. Fritzsche, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (DMR77-11683 A01)

The experimental program of research on the properties of defects and localized gap states in amorphous semiconductors previously supported by NSF grant DMR7515003 A01 will be continued. The role of valence alternation defects as luminescence or recombination centers will be studied by altering in a controlled manner their concentration by high-temperature doping and low-temperature drift diffusion of various addititves. Compensation of defects by the method of lithium drifting will be attempted in tetrahedrally coordinated semiconductors as well as in chalcogenide glasses. A new two-beam photoconductivity modulation technique using X-ray excitation together with infrared scanning will be employed to determine the energy distribution of recombination centers. Experiments will be performed to determine the nature of the reversible photostructural centers by means of photo-induced electron spin resonance and photo-induced infrared absorption.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0009, DELAYED FAILURE AND AGING OF MELT-SPRAYED CERAMIC-METAL BONDS IN PHYSIOLOGICAL MEDIA

S.D. Brown, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Ceramic Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DMR78-18084)

This biomaterials project will deal with delayed failure and aging of ceramic-metal bonds in physiological media. The objective will be to understand the mechanisms which underlie these processes, both in vitro and in vivo. Attention will be focused on the measurement of subcritical crack velocity in plasma-sprayed alumina-coated-metal systems. The effects of the character of the coating-substrate system and the composition of the physiological media on subcritical flaw propagation, aging and delayed failure will be ascertained. Stainless steel and a titanium alloy will be used as substrate materials, and the physiological media to be employed for in vitro experiments will include deionized water and various isotonic saline solutions. The results will be examined in terms of a multibarrier kinetics model of the subcritical crack velocity. Biocompatibility tests will be made in conjunction with in vivo aging experiments. These will involve evaluation of local changes in tissues surrounding the implants by examination of histological sections.

This is a continuation of NSF Grant DMR76-03893.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0010, SUPERCOOLED LIQUIDS AND GLASSES

C.A. Angell, Purdue University, School of Science, Dept. of Chemistry, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR77-04318 A01)

A diversified program of laboratory and computer simulation experiments, bound together by a common concern with the metastable supercooled liquid state, is being continued. Highlighted are (1) Extensions of the study of supercooled and pressurized water into the very low temperature region (T less than minus 50 degrees C) accessible above 1 kbar applied pressure. Expectations include broadened density maxima occurring as low minus 80 degrees C and interesting pressure and temperature dependencies of the mass transport properties. Structural studies (near IR spectra) may show that water can exist as a mobile liquid in the absence of identifiable 'broken' hydrogen bonds. (2) Optical studies of local structure relaxation processes in glasses in and above their transformation regions for comparison with total system responses such as enthalpy and volume relaxations. These studies are intended to throw light on the origin of the broad 'distributions' of relaxation times characteristic of liquid relaxation processes at low temperatures. (3) Spectroscopic studies of the variation in the electronic state of anions (chloride or oxide) with composition through a Lewis acid-base equivalence point. (The result will aid interpretation of the composition dependence of redox processes in oxide glasses.) (4) The extended study by molecular dynamics computer simulations of liquid and configurationally arrested (glassy) states of simple ionic and molecular systems, through which correlations of thermodynamic and dynamic behavior with structural features may be obtained. This is a continuation of research supported under DMR73-02632.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0011, MATERIAL SUPPORT TECHNOLOGY - STRUCTURE OF INSULATING FILMS

R.L. Park, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DN775707; N00014-77-C-0485)

Improvements in solid-state electron devices and development of new devices will require better understanding and control of the thin insulating films which are formed and deposited on the device surface. Many transistor devices used in Navy communications and surveillance systems use insulating films under device control electrodes or for surface passivation. Understanding and controlling the properties of the films is very important for future developments.

By analysis of the energies of electrons emitted from bulk solids following excitation of an atom by x rays it has been demonstrated that the local atomic structure around the atom can be deduced. Bombardment by fast electrons will excite atoms just as easily, except the electrons do not penetrate beyond a few atomic layers of the surface. The technique of extended appearance potential fine structure (EAPFS) has been developed to explore the properties of surface films, with the goal of deducing the local properties of a near surface atom excited by incident electrons. The emission of secondary electrons is influenced by the nearest neighbors thereby leading to data on local environments. These techniques are applied to insulators on silicon and III-V compound semiconductors. Correlation of structural and electrical properties of the films will be made.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0012, SOURCES AND DISTRIBUTION OF TRACE ELEMENTS IN THE ANTARCTIC ATMOSPHERE

W.H. Zoller, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Chemistry, *College Park, Maryland* 20742 (DPP76-23423 A01)

This is a continuation of NSF Grant Number DPP 7623423.

In this research project, the Principal Investigator seeks to identify and classify aerosols from different sources and to determine how these aerosols interact with and are removed from the Antarctic atmosphere.

Aerosols will be collected at the Clean Air Facility at the South Pole Station during the 1978 winter-over period and during the austral summer of 1978/79. The chemical composition of these aerosols will be determined. Their variation as a function of particle size and time will be investigated and these parameters will be related to the history of the air masses being sampled. The size distribution of the particulate material will also be determined, and the effect of ice crystals scavenging for the removal of the particulate material from the atmosphere will be investigated. Airborne studies using an instrumented LC-130 aircraft will be carried out to collect samples of atmospheric particulate material above and below the inversion layer over the Antarctic continent. Sampling of the volcanic emissions from Mt. Erebus will be attempted both from the crater rim and from the instrumented LC-130 aircraft.

Logistics support is required during austral summer of 1978/79 for two persons at South Pole station and for two persons on the instrumented LC-130.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral & Social Sciences, Div. of Physiology Cellular & Molecular Biology

3.0013, DEFECT AGGREGATION IN IRRADIATED MATERIALS

K.C. Russell, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgy & Materials Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR77-23402)

This is a continuation of basic studies on phase stability and void formation in irradiated metallic materials. The theoretical work will employ the nodal line/critical point formalism of Poincare. A recently developed theory for phase stability under irradiation conditions will be generalized to include the effects of displacement cascade-induced dissolution and solute drag. A combined theoretical/experimental program on irradiation altered precipitation in Al-Ge and Al-Si will be continued. Numerical evaluation of the rate equations for precipitate nucleation under irradiation will be done at M.I.T., the experimental work at Harwell, England. A theory for homogeneous void nucleation is to be extended to heterogeneous nucleation at interphase boundaries and dislocations. Nucleation kinetics will be analyzed in terms of helium and vacancy trapping and defect energetics; expressions for the nucleation rate and terminal void number density will be derived. This is a renewal of NSF Grant DMR73-07609 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0014, MOLECULAR COLLISIONS

J.L. Kinsey, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (CHE78-09807)

In this reseach in the general area of quantum chemistry, Dr. Kinsey will investigate the properties of binary collisions between molecules or atoms. Such collisions represent the most elementary kind of chemical event, whether the outcome be transfer of energy from one molecule to another or rearrangements of bonds to form new chemical species. The primary aim of these studies will be to determine the details of energy utilization and disposal for such processes. Part of the work will focus on testing and extending a number of new techniques, developed in Dr. Kinsey's laboratory and elsewhere, for taking advantage of the properties of tuneable lasers to probe molecular collisions. A substantial effort will also be directed towards preparation of molecules with large, well-characterized amounts of vibrational excitation for investigating the effects of such excitation on the collisional and reactive properties of the molecules.

This research represents a continuation of part of the work currently supported by Foundation grant CHE-75-12852.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0015, THE STRUCTURE OF DISPERSED LYOTROPIC LIQUID CRYSTALLINE PHASES

S. Friberg, University of Missouri, Rolla Campus, School of Arts & Sciences, Dept. of Chemistry, *103 Parker Hall, Rolla, Missouri* 65401 (DMR76-23569 A01)

Lyotropic liquid crystals have been shown to have a pronounced influence on the stability of disperse systems such as emulsions and foams. The first report on this effect was published less than ten years ago, but the phenomenon has already been applied in technical developments within different areas, such as the pharmaceutical and food technology industries and for the dispersion of essential components in a variety of commodities, such as those used in the production of concrete and the application of paper coatings.

The objective of the program is a basic understanding of those factors that determine the adherence of a dispersed liquid crystal to an interface. The determinations include: (1) size distribution by optical and electron microscopy, viscosity, and light scattering; (2) the electric surface potential of dispersed, liquid crystalline particles by zeta-potential measurements; (3) comparison between the microscopic structure of the liquid crystal in bulk and in a dispersed state by low-angle X-ray diffraction and electron microscopy; and (4) interfacial tension measurements using the sessile drop method. Results from 3 and 4 are used to evaluate the influence of the anisotropic conditions at an interface on the geometric dimensions of the liquid crystalline structure. The evaluation is made from calculations of the Van der Waals pressure by using methods developed by Parsegian and collaborators. The results of these investigations will form the basis for establishing rules for the adherence of liquid crystals to interfaces. The application of these rules to technical problems within different industrial activities will take place in collaboration with the engineering departments and with industry.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0016, VIBRATIONAL-ELECTRONIC INTERACTIONS IN MOLECULAR SPECTRA

L. Goodman, Rutgers the State University of New Jersey, New Brunswick Campus, School of Chemistry, Dept. of Chemistry, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (CHE76-23813 A01)

Dr. Goodman intends to investigate the effect of molecular vibrations on electronic spectra of small and medium-sized molecules (4-25 atoms). He will pursue experimental and theoretical studies in two limiting cases, the non-dynamical weak coupling case where the Born-Oppenheimer approach is accurate, and the strong coupling case where the electronic motion is dependent on nuclear kinetic energy. The experiments will involve narrow line laser studies of band intensities and vibronic structure observed in excitation, absorption, and emission spectra for both free molecules in the vapor and in low-temperature (to 1.5 degrees K) solid environments. The two cases are found in molecules with well-separated and closely-spaced states, respectively. The theoretical studies will involve developing a method for handling the strong coupling problems with similar accuracy to the Born-Oppenheimer approach so that there is smooth passage between the non-dynamical and dynamical cases. Application to potential surface distortion, anomalous vibronic intensity and energy level perturbation effects is planned.

This research is a continuation of that currently supported under Foundation Grant, GP-31496X.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0017, INFLUENCE OF PLASTIC AND ELASTIC STRAINS ON STRENGTH AND FRACTURE OF MATERIALS AND ON ELECTRICAL PROPERTIES OF SEMICONDUCTORS

S. Weissmann, Rutgers the State University of New Jersey, New Brunswick Campus, School of Engineering, Dept. of Materials Engineering, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR78-05930)

The project will be an x-ray topographic study of elastic and plastic deformation of semiconductor materials. The objectives will be to apply the topographic technique to determine: (a) the extent of microplastic zones in silicon induced by deformation and relaxation of plastic and elastic strains by subsequent annealing, and (b) the strains and defect structure in gallium arsenide metal-oxide-semiconductor (MOS) devices.

The experimental plastic zone measurements will be compared with predictions based on calculations of continuum mechanics. The x-ray diffraction topographic techniques will be augmented by transmission electron microscopy to examine the defect structure. The x-ray methods will include: imaging of plastic and elastic strain distribution by pendellosung fringe topography, precision measurements of lattice curvature by x-ray

scan with automatic Bragg angle control, assessment of the distribution of the defect structures in different crystallographic directions by the divergent beam method and rocking curve measurements, and magnitude of strain determination by quantitative intensity measurements.

This is a continuation of research initiated under NSF Grant DMR75-21763, is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0018, DEFECTS AND DEFECT MOBILITY IN IONIC CRYSTALS

A.S. Nowick, Columbia University, School of Engineering, Dept. of Metallurgy & Materials Science, *351 Engineering Ter., New York, New York* 10027 (DMR77-07141 A01)

Research on point defects in ionic crystals continues, employing measurements of ionic conductivity and relaxation phenomena. Of major interest is a study of diffusion of Li ion into MgF2 crystals, and the associated ionic conductivity, since Li ion has been found to be a fast diffusor in MgF2 (via interstitial migration). The discovery of a low-temperature internal friction peak due to Li2 pairs provides a useful auxiliary tool for this investigation. Previous studies utilizing both dielectric and anelastic relaxation in non-cubic crystals will be extended to the tetragonal crystal paratellurite (TeO2) containing appropriate dopants; this crystal will also allow a study of piezoelectric relaxation.

An investigation of protonic hydrogen (H ion) as a defect in ionic crystals is under way, with the initial investigation on NaNO3 and LiIO3 crystals. It is desired to introduce H ion and to determine its site occupancy, activation energy for migration, and interaction with other defects.

Finally, various extensions of the theory of relaxation phenomena continues.

This is a continuation of research supported under DMR 75-09603. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0019, ESTABLISHMENT OF A HIGH ENERGY X-RAY SYNCHROTRON RADIATION LABORATORY

B.W. Batterman, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR78-01267)

The Cornell High Energy Synchrotron Source (CHESS) will utilize the synchrotron radiation generated in the Cornell Electron Storage Ring (CESR) for a variety of experiments requiring high energy x-rays. Synchrotron radiation is emitted by the relativistic electrons used in colliding beam experiments in CESR. The radiation is extremely intense with energy varying continuously from the x-ray region through the ultraviolet, is highly polarized, well focussed and is pulsed on a nanosecond time scale. CHESS will extend the photon energy range available in the United States from about 35 kev to more than 150 kev, thus making many significant experiments possible. Instruments will be developed to exploit this unique source of high energy radiation for experiments in areas such as atomic physics, chemistry, crystallography, metallurgy and condensed matter science. These facilities will be available to qualified scientists who need the high energy radiation not available elsewhere. CHESS will include facilities for 1) absorption and fluorescence spectroscopy at high photon energies; 2) diffraction and crystallographic studies; 3) non-conventional experiments such as Compton scattering, x-ray interferometry, nuclear resonant scattering and diffuse scattering.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0020, CRACK PROPAGATION IN PRE-CRACKED SPECIMENS OF ALPHA, ALPHA-BETA AND BETA TI-MN ALLOYS

H. Margolin, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Metallurgy, *333 Jay St., Brooklyn, New York* 11201 (DF054100; AFOSR-79-0028)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. In fact, the fatigue properties of structural materials often limit their application. Opportunity - thus, it is important to understand the mechanisms of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Systematic studies of fatigue crack initiation and propagation in alpha-beta titanium alloys are of great interest to the Air Force and would make useful contribution to future development of engineering alloys. Objective -this research will determine the relationship between fatigue properties and microstructures of two-phase (alpha-beta) titanium alloys. Specifically, the Ti-Mn system will be used as a model system for alloys consisting of two ductile phases. How work contributes - alloy composition and heat treatment can be used to vary the volume fraction and morphology of the phases present, and thus, by this study, the most desired microstructures for fatigue resistance can be determined.

Fatigue crack initiation and propagation characteristics will be related to microstructural features such as phases present, particle size and distribution, and dislocation densities. Monotonic and cyclic stress-strain curves will be determined for each alloy composition to aid in interpretation of fatigue data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0021, HIGH-TEMPERATURE PLASTIC FLOW IN A15 SUPERCONDUCTING COMPOUNDS

R.N. Wright, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Materials Engineering, *110 8th St., Troy, New York* 12181 (DMR78-05726)

This is a continuation of research on the high-temperature plastic deformation of A15 superconducting compounds. Continued use will be made of hot isostatic pressing to produce low-porosity materials with maximal A15 matrix phase content. The effects of refined grain size on stress-strain rate-temperature (S-SR-T) response will be evaluated through study of Zr-doped Nb3Sn. A refined grain size should facilitate plastic deformation by abetting diffusional flow deformation mechanisms, and is required to achieve enhanced critical current values. The effects of variations from stoichiometry on S-SR-T response will be studied on a range of V3Ga specimens. Thorough microstructural characterization will be undertaken. Mechanical behavior will be evaluated through the use of deformation mechanism mapping techniques, in an effort to identify micromechanism of deformation, and to provide a basis for comparison with other materials. Critical temperature, critical current and low-temperature heat capacity measurements will be undertaken, and the results obtained correlated with microstructural observations and mechanical behavior in order to assess the effect of high-temperature deformation on superconducting properties. A detailed consideration of dislocation geometry and motion in A15 compounds will be done using electron transmission microscopy. An evaluation of the influence of hydrostatic pressure on high-temperature Nb3Sn fracture behavior will be performed using constrained plastic flow testing analogous to direct extrusion. The results of this study are expected to serve as a scientific basis from which it may be possible to control deformation processing parameters in order to achieve acceptable superconducting properties in A15 and related superconducting materials. This is a continuation of research, previously funded under NSF Grant DMR76-00554. This is the first year of a three year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0022, STARK SPECTROSCOPY OF MOLECULAR SOLIDS

D.M. Manson, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Chemistry, *Stony Brook, New York* 11790 (CHE78-06606)

Effects of external electric fields on electronic spectra of pure and doped molecular crystals, glasses, liquids, and vapors are to be used to locate and characterize charge transfer exciton states in crystals, to characterize the charge distribution in excited vibronic states of molecules, and to probe the microscopic electric field in anisotropic molecular systems. In the experiments, standard methods of high resolution optical spectroscopy are combined with modern techniques of laser excitation and computerized data acquisition and analysis. Supersonic molecular beams may be utilized, and the feasibility of using x-ray diffraction in the presence of an intense optical radiation field to probe the microscopic electric field is to be examined. The experiments will determine the energy of charge transfer exciton states, the validity of the Wannier or Frenkel ion-pair exciton models, the parameters of electron-phonon and exciton-exciton coupling, and the structure of the charge-transfer exciton band, and will document the variation of these properties with chemical composition and crystal structure. The excited vibronic state charge distributions will be characterized by measurements of the dipole moment parameter. The relationship between the macroscopic dielectric properties of molecules in condensed phases and the microscopic characteristics of the molecules is to be derived for various theoretical models, and data are to be obtained to test the validity or applicability of these results to specific real systems.

This research represents a continuation of that currently supported by Foundation Grant CHE-7509680.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0023, DEVELOPMENT AND TESTING OF A QUANTITATIVE INFRARED REMOTE SENSING METHOD

P.R. Griffiths, Ohio University, Athens Campus, School of Arts & Sciences, Dept. of Chemistry, *Athens, Ohio* 45701 (CHE77-01058 A01)

Dr. Griffiths is developing a method for the remote quantitative analysis of hot gases by infrared emission spectroscopy using a mid-infrared Fourier transform spectrometer. Computer programs have been written using which the temperature and composition of hot gases containing either Co or CO2 can be calculated assuming the variation of the width of each rotational line in the vibration-rotation spectrum with temperature is accurately known. These line-widths, both self-broadened and air-broadened, are being measured using a tunable diode laser spectrometer. It has also been found that current phase correction algorithms for interferograms measured using rapid-scanning Fourier transform spectrometers do not allow discrete work, and methods for improving this algorithm are being developed. All techniques are being tested using spectra measured both in the laboratory and in the field. The spectra obtained in the field are from stationary sources of pollution such as coal burning power plants, blast furnaces and turbines.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0024, ELECTROCHEMICAL IMPREGNATION FOR THE FABRICATION OF CADMIUM ELECTRODES

Y. Kao, University of Cincinnati, School of Engineering, Dept. of Chemical & Nuclear Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (DF054990; AFOSR-79-0104)

AF function - communications, flight operations, life-support systems depend on auxiliary battery sources for power. Deficiency -there is a continuous need to attain longer life, higher energy, lighter weight batteries to meet power requirements. Objective - to further the understanding of the kinetic process of electrochemical impregnation. How work contributes - this research will further the electrochemical method in achieving higher loading and utilization of the active cadmium electrode.

A cyclic voltammetric technique has been used in a helium atmosphere to study the cathodic deposition of cadmium on nickel. A unique reduction reaction occurs on the nickel electrode in the presence of the cadmium ion. It appears to be the electrodeposition of cadmium oxide which passivates the electrode surface. This may not be desirable. To improve the deposition process a potential controlled current program is to be carried out in which cadmium hydroxide is deposited at high current densities followed by conversion to fresh cadmium at lower current densities. The electrode is then subject to charge-discharge studies in alkaline solution to examine its behavior. Most electrodeposition processes are conducted at near boiling temperature of the solution. A study will be done on the temperature effect in the loading of cadmium electrode. The potential programmed deposition technique will be applied to porous electrode (which is the common form of the cadmium electrode) and its performance be determined. Preliminary modelling studies will be carried out if experimental results justify it.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0025, MECHANISMS OF ORDERING IN SOME NI-BASED BINARY ALLOYS

D.E. Laughlin, Carnegie Mellon University, Inst. of Technology, Dept. of Metallurgy & Materials Science, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DMR78-05723)

This is a study of several mechanisms to determine how a single phase solid solution decomposes into two phases, one of which is ordered. Ordering reactions will be investigated in several nickel-based binary alloys (Ni-V, Ni-Be, Ni-Mo and Ni-Ti) using transmission electron microscopy (TEM) and differential scanning calorimetry (OSC). The TEM studies will document the transformation microstructures, and the OSC studies will characterize important thermodynamic and kinetic parameters. Of special interest is an analysis of continuous transformations in these alloys. In an earlier phase of this study, the spinodal ordering reaction in the Ni-Mo system was investigated, using TEM. The DSC experiments will provide additional information on the temperature ranges of instability. The results obtained will be used to assess solid solution thermodynamic models for alloys which exhibit continuous transformations. Concomitantly, some important mechanical properties (including yield strength, tensile strength, work hardening coefficient and fracture mode) will be measured systematically for specimens which have undergone different modes of transformation. It is expected the results of this investigation will provide a better understanding of precipitation of ordered phases in solid solutions, and serve as a basis for the development of advanced theoretical models to describe clustering and ordering in metallic solid solutions. This research was previously supported under NSF Grant DMR76-22353. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0026, THEORY OF NONLINEAR OPTICAL SUSCEPTIBILITIES

H.F. Hameka, University of Pennsylvania, School of Arts & Sciences, Dept. of Chemistry, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (CHE77-22638)

In present and future lightwave communication systems there is an urgent need for a number of devices such as modulators, amplifiers, couplers, etc., which are capable of processing high intensity light beams. The operation of such devices depends on certain nonlinear optical and electrooptical effects. Professor Hameka will calculate various linear and nonlinear electric susceptibilities that represent the magnitudes of these nonlinear optical effects. In particular he will develop theories that relate the magnitudes of these susceptibility terms to chemical structure. Such calculations should lead to the identification of materials that have unusally large nonlinear electric susceptibilities. Particular attention will be paid to conjugated and aromatic molecules and to unsaturated polymers.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0027, PHOTOELECTRON SPECTROSCOPY OF TRANSITION METAL CARBONYLS

M.B. Hall, Texas A & M University, College Station Campus, School of Science, Dept. of Chemistry, *College Station, Texas* 77843 (A-648)

The ESCA spectra of (h5-C5H5Fe (CO))2-micron-Ph2P-(CH2)nPPh2m ion, (n equals 1, 2), (m equals 0, 1) have been measured and compared to the results of parameter-free Fenske-Hall molecular orbital calculations. The calculations are used both to calculate ESCA satellite intentions via the sudden approximation and to describe the valence electronic structure. The results of the sudden approximation, which predict no satellites of intensity greater than 10 percent of the main peak, are in good agreement with the ESCA spectra, where no satellites are discernable. However, using the same theoretical results, we find that the Hush model predicts a single intense satellite, which is in disagreement with the full MO sudden approximation and the ESCA spectra. The description of the valence electronic structre is in good agreement with previous results for the cyclic voltammetry, for the carbonyl streiching frequencies, and for the crystal structures. However, they suggest that oxidation of the neutral species involves removal of an Fe-Fe nonbonding electron, rather than removal of an electron from the Fe-Fe sigma bond.

SUPPORTED BY Robert A. Welch Foundation

3.0028, MOLECULAR SPECTROSCOPY AND MOLECULAR QUANTUM MECHANICS

R.M. Hedges, Texas A & M University, College Station Campus, School of Science, Dept. of Chemistry, *College Station, Texas* 77843 (A-106)

Work has continued on the investigation of excited electronic states of aromatic hydrocarbons by study of N2 pulsed laser excited fluorescence and the fluorescence decay of individual vibronic lines.

A reexamination of the fluorescence of coronene shows that its fluorescence is the S0 yields S1 emission. The half-lives of some twenty of the more prominent fluorescence lines of coronene from 4200A to 5070 were measured in n-alkane solvents at 77 degrees K and room temperature. At room temperature all lines have lifetimes of 225 plus or minus 5ns. At 77 degrees K all lines have lifetimes of 220 5ns and the 4200A line has a lifetime of 20 plus or minus 2ns. The 4200A line is interpreted to be emitted from an unrelaxed excited vibrational level of S1, a 'hot fluorescence'.

The quantum yield of S0 yields S2 is apparently too small for us to observe it under our experimental conditions. The S0 yields S2 emission should occur in a region in which there occurs some N2 fluorescence (noise from our laser source). This N2 fluorescence has caused us some bad moments.

We have observed the fluorescence spectrum of 1,12-benzperylene in n-heptane at 77 degrees K and measured the decay of many individual vibronic lines. Our analysis supports the assignment of the shortest wavelength line (highest energy) as a 'hot fluorescence' from S1 rather than an emission from S2.

SUPPORTED BY Robert A. Welch Foundation

3.0029, NEW EXPERIMENTS IN PULSED NUCLEAR MAGNETIC RESONANCE

C.G. Wade, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Chemistry, *200 W. 21st St., Austin, Texas* 78712 (F-370)

Pulsed nuclear magnetic resonance techniques have been used to study molecular dynamics in model membrane multilayers and in liquid crystals. The lateral diffusion coefficient of phospholipid molecules in oriented phospholipid/D2O model membranes has been measured using pulsed NMR spin echo techniqes. Oriented samples are used to minimize anisotropic dipolar interactions. Diffusion coefficients over a temperature range 28-70 degrees C were measured for the following lecithins: dipalmitoyl, dilauryl, dimyristoyl, and egg yolk. The diffusion coefficients are in the range 10 to the minus 7th power to 10 to the minus 8th power sq. cm/sec. The hydration dependence of lipid diffusion for dipalmitoyl was determined. The addition of cholesterol decreases diffusion. Calculations have been done which improve the accuracy of the D measurements; this approach includes the effects of image currents in the pole pieces for the usual orientation of the quadrupolar gradient coils. The theory of NMR relaxation in liquid crystals has been extended to include internal rotations and the axial symmetry of the molecules. The results have been quantitatively applied to proton, carbon-13, and deuteron relaxation data in liquid crystals.

SUPPORTED BY Robert A. Welch Foundation

3.0030, DEFECT INTERACTIONS IN METALS

R.A. Johnson, University of Virginia, School of Engineering & Applied Science, Dept. of Materials Science, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR78-07539)

This is a continuation of a study of the kinetics associated with the interactions between defects in irradiated metallic materials, using computer modeling techniques. A mathematical model has been developed to study nucleation of point defect clusters in solids, and applied to the case of homogeneous nucleation of interstitial clusters under uniform irradiation conditions. The current research is aimed at studying the subsequent vacancy cluster nucleation and at understanding the effects of trapping and of non-uniform defect production both spatially and in time. The effect of elastic point defect/dislocation interactions on point defect kinetics near dislocations will be investigated to determine the role of dislocations as sinks for point defects, and as nucleation sites for defect clustering. An interatomic potential has been developed for titanium, a hexagonal close packed metal. A collaborative effort is underway with Professor J. Beeler at North Carolina State University to better understand the primary defect parameters for interstitials and vacancies in titanium. This research was previously funded under NSF Grant DMR75-22462A01. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0031, INVESTIGATION OF STRUCTURAL, MAGNETIC, & SPECTROSCOPIC PROPERTIES OF POLYNUCLEAR & ONE- & TWO-DIMENSIONAL TRANSITION METAL HALIDE COMPLEXES

R.D. Willett, Washington State University, School of Arts & Sciences, Dept. of Chemistry, *Administration Bldg., Room 101, Pullman, Washington* 99163 (CHE77-08610 A01)

The research involves the synthesis and characterization of a number of magnetic materials of low dimensionality. The purpose is two-fold: to study structural-magnetic relationships and to provide experimental systems with which to test predictions of models for magnetic interactions. The major initial efforts will be centered on the two-dimensional canted antiferromagnetic (RNH3)2FeCl4 and (RNH3)2NiCl4 salts, on two-dimensional antiferromagnetic (RNH3)2CoCl4 salts, and on the one-dimensional XY antiferromagnetic ((CH3)3NH)3CdCoCl7 systems. Other systems under study include potential ferromagnetic spin 1/2 linear chain systems and catalytic cluster systems. The principal techniques which are utilized are single crystal X-ray diffraction studies, mutual inductance magnetic susceptibility and magnetic moment measurements, EPR linewidth studies, and fluorescent lifetime studies.

This project is a continuation of CHE74-23207-A04.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, SUPPORT SERVICES FOR USERS OF THE CHATANIKA INCOHERENT SCATTER RADAR DURING THE IMS PERIOD

R.D. Hunsucker, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-21460)

This grant funds Geophysical Institute personnel to provide operation, maintenance data collection, and some data reduction for instrumentation used in support of Chatanika incoherent scatter radar operations by users other than the University of Alaska during the IMS. The Geophysical Institute will endeavor to obtain good quality data, prepare copies of the data, and disseminate the data to Chatanika radar users by specific request. It will also provide technical assistance in operation of other support instrumentation provided by radar experimenters, as well as limited assistance in Chatanika radar operations. This will lead to a more fruitful set IMS effort than would be otherwise possible.

The Chatanika incoherent scatter radar near College Alaska provides a unique set of high-latitude time continuous profiles of charged particle temperatures and concentrations, neutral winds, electric fields and energy deposition rates: parameters leading to better understanding of upper atmospheric physical processes. Research scientists from over a dozen U.S. and foreign institutions travel to Chatanika each year to pursue their research efforts, and this pressure is enhanced during the present years of the International Magnetospheric Study. The efforts by the PI supported by this grant provide a more meaningful context of geophysical data within which this overall effort will now take place.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0002, FULL GROWTH AUXILIARY POWER SYSTEM

F. Swiggus, Garrett Corp., *402 S. 36th St., Phoenix, Arizona* 85034 (DF451280; F33615-75-C-2016)

The program objective is to develop advanced technology components for the auxiliary power unit (APU) resulting from contracts F33615-69-C-1100 and F33615-72-C-1936. As a goal, these components shall make possible an APU capable of 165 shaft horsepower, 150 hp/cu. ft and 1.65 hp/lb at 130 degrees F sea level static conditions. The program shall emphasize APU hot end component development.

The intent of this effort encompasses APU redesign, utilizing the basic APU configuration developed under contract F33615-72-C-1936 as the baseline, including hot end components development, as required to accomplish the stated objectives. To minimize program cost, a demonstrator APU shall not be developed. The program shall consist of the following two phases- (1) APU design - provide an APU conceptual design, design in detail hot end components to be developed, and define a detailed test plan and (2) component development - develop APU hot end components required to achieve program goals. During conceptual design, the baseline compressor is considered to be that configuration developed under contract F33615-72-C-1936. Adjustments of compressor mass flow and pressure ratio, attainable by minor changes in parameters such as speed, inlet guide vane (IGV) settings, or shroud contour of the baseline compressor stages, are permitted to achieve overall program goals. A critical design review shall be held at design phase completion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0003, DESIGN-FOR-REPAIR CONCEPT DEFINITION

R.G. Palomba, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DF111320; F33615-78-C-1461)

To investigate the capability for self-sufficient avionic systems with no external support equipment and elimination of the intermediate level of repair for modules.

The approach is to review automatic test/fault isolation techniques currently used, consider preflight, inflight, postflight test/fault isolation, module replacement, recertification, assess technologies which may impact current maintenance concepts such as built-in-testing, adaptive modules, fault tolerance, partitioning, standardization and packaging, define design features required for implementation of appropriate technologies, identify gaps in current technology which must be filled to permit implementation of desirable advanced maintenance concepts, develop a detailed plan for follow-on efforts to enhance avionics maintainability if new concepts prove promising.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0004, COMMUNICATIONS - LOW ENERGY PARTICLE EXPERIMENT

R.D. Sharp, Lockheed Missiles & Space Co. Inc., Lockheed Palo Alto Research Lab, *3251 Hanover St., Palo Alto, California* 94304 (DN223316; N00014-78-C-0479)

Ionospheric disturbances associated with geomagnetic substorms and particle precipitation degrade the performance of naval communication, navigation, and surveillance systems. This program is investigating the mechanism directly responsible for auroral precipitation, as well as the fundamental properties of ionospheric-magnetospheric coupling and its possible role in triggering substorms.

Measurements of ion mass, energy, and pitch angle distribution made by the ONR 118 experiment on the S3-3 satellite are used to investigate the physical mechanisms responsible for acceleration of the upstreaming ions that inflate the ring current and for energetic particle precipitation into the ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, PERTURBATION METHODS IN TRANSONIC FLOW

D. Nixon, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DF054770; F49620-79-C-0054)

AF function - advanced aerospace vehicles. Deficiency - a need exists for rapid and accurate design and analysis computational methods for transonic flows. Objective - to develop a computationally inexpensive method to obtain a range of nearly transonic two- and three-dimensional solutions based on standard solutions obtained with existing transonic codes. How work contributes - a fast, economical method will be provided which is suitable for use in finding the influence of changes in geometric and flow field parameters (preliminary design application) or to correct solutions obtained either on coarse computational grids or by satisfying lower order approximations of the governing conservation equations. Both areas of application of the method address the deficiency indicated above.

A transonic perturbation theory which allows a range of transonic flow solutions to be found by simple algebra provided that a base solution and a calibration solution are known will be investigated. The applicability of the method will be determined for correcting transonic solutions obtained on coarse computational grids based on particular fine grid solutions as well as for correcting Euler or small perturbation solutions for viscous effects based on particular Navier-Stokes solutions. The method will be extended both for physical perturbation problems in unsteady transonic flows and, if possible, for Navier-Stokes solutions in which separated regions occur.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, LABORATORY EXPERIMENTS ON SPACE PLASMAS

F.W. Crawford, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ATM78-08440)

This grant will support experimental and theoretical research aimed at three basic plasma physics problems, all of which have special significance to space plasma phenomena: First, a primarily laboratory study by spectral methods of the influence of collisions on the excitation and saturation characteristics of ion acoustic waves in a collisionless to moderately collisional plasma; next, extensions to realistic antenna geometry and warm plasma effects of the theory of ionospheric pulse propagation, with the aim of utilizing the results for planning a satellite

experiment; and finally, an experimental study of double-sheaths, with an emphasis on the magnetic field effects.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

4.0007, AN INTERNATIONAL MAGNETOSPHERIC STUDY (IMS) ANTARCTIC VLF DIRECTION-FINDER NETWORK

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ATM75-15852 A02)

As part of the International Magnetospheric Study (IMS), this grant will support establishment of a VLF direction finder near Siple Station in the Antarctic and the operation of a direction finder near Roberval, Canada, conjugate to the Siple, Antarctica, VLF transmitter. The purpose of the network will be to locate and track the field-aligned ducts along which whistlers and VLF noise propagate through the ionosphere and magnetosphere to ground stations. This information will be used to define the structure and convection patterns of the magnetospheric plasma. It will also be used to study VLF wave-particle interactions, including the mechanisms of wave growth and precipitation of energetic particles. The direction finders will be located at the Antarctic stations Siple (USA) and Argentine Islands (UK), and at Roberval, Canada. They will be part of an international four-station network in the Antarctic, which will include direction finders at Halley Bay (UK) and General Belgrano (Argentina and France). Cooperating groups are expected to operate direction finders at the higher latitude of Syowa Base (Japan) and will operate conventional broadband VLF receiving systems at other locations in both hemispheres.

The cooperative aspects of this work will make it an important part of the VLF studies to be continued during IMS.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

4.0008, VERY-LOW-FREQUENCY PROBING OF THE MAGNETOSPHERE FROM SIPLE STATION, ANTARCTICA

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DPP76-82646 A01)

This is a continuation of NSF Grant DPP7682646. This program will involve initial winter-over operations at Siple Station, Antarctica, including tests and coordinated use of a variety of experimental equipments. Major efforts will be devoted to initial operations of the Jupiter VLF transmitter, a new system which includes previously unavailable amplitude modulation of the radiated signal. Jupiter is essentially a high-gain audio amplifier. At low power, it can operate broadband over the range 1-30kHz, instead of within the 1 kHz steps of the present system. Transmitter operations will include further investigation of the magnetospheric response to changes in transmitter power and initial studies of the response of the magnetosphere to transmission at multiple frequencies. A major objective will be continued studies of wave-induced particle precipitation so as to better determine how the observed types of precipitation events contribute on a large scale to a loss of energetic particles from the magnetosphere. An improved monitoring system will be available for handling and displaying photometric and VLF wave information on precipitation activity. Passive VLF studied of magnetospheric thermal plasma particle dynamics will continue as part of international cooperative observing campaigns, and as a source of information on magnetospheric parameters for active probing experiments. Special VLF transmissions to satellites will continue as part of in situ studies of the details of magnetospheric wave-particle interactions. In the 1979-80 summer season, active and passive VLF probing will be carried out at Siple in support of a special rocket-balloon campaign to study wave-induced particle precipitation effects in the ionosphere and sub-ionosphere. Logistics support is required for both summer and winter-over operations at Siple Station.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

4.0009, FABRICATION TECHNIQUES AND SEMICONDUCTOR LASER DEVICE RESEARCH FOR USE IN GUIDED WAVE OPTICAL COMMUNICATION

S. Wang, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical & Computer Engineering, *Berkeley, California* 94720 (ENG76-08292 A01)

A program of research to study semiconductor lasers and laser performance for guided wave optical communications will be conducted. Continued work on new laser and waveguiding structures suitable for integrated optics and application of surface chemistry for improving and innovating device-fabrication technology will be pursued. Laser physics for understanding the operation and improving the performance of semiconductor lasers under high injection-current and high laser-power densities will be investigated. Specific laser structures that will be studied are: (1) the Distributed Bragg Reflector (DBR) injection laser with separate optical and carrier confinement, which promises single-mode operation with sufficient output power and can easily be integrated with other optical devices, and (2) the inverted-ridge waveguide (IRW) laser with current confinement for control of lateral modes, which opens the possibility of direct waveguide-fiber coupling. In the area of device fabrication, the role of surface energy and chemical bonding will be examined for possible new laser and waveguiding structures. In the area of laser physics, the effects of high injected carrier concentrations and high laser fields on the index of refraction will be explored along with the gain constant of the active region of the laser.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Engineering & Applied
Science

4.0010, FUNDAMENTAL INVESTIGATION OF SUPERPLASTIC FORMING PROCESS

A.K. Mukherjee, University of California, Davis Campus, School of Engineering, Dept. of Mechanical Engineering, *Davis, California* 95616 (DF054640; AFOSR-79-0069)

AF function - superplastic forming operations have found extensive use in the fabrication of airframes (monolithic, integrally-stiffened structures), and in the manufacture of gas turbine engines components using the newer generation superalloys. Opportunity - coupled with diffusion bonding, the superplastic forming-diffusing bonding operation has allowed manufacturing engineers a more cost effective design with significant savings in materials costs, labor-intensive machining costs, and the possibility of obtaining large geometrically complicated shapes in one step. Objective - this research will clarify the mechanical and microstructural properties of structural alloys in superplasticity and creep processes. How work contributes - a better understanding of the dependence of superplastic strain rate on temperature, flow stress, grainsize and other microstructural details will be of significant help in optimization of processing variables. Such optimization will enable the material to be deformed at the highest possible forming rates and still benefit from the remarkably large ductility associated with superplasticity.

Four areas are proposed for special study: 1) consideration of microstructural modifications induced by superplastic flow and their effect on the mechanical properties of the superplastically deformed material, 2) investigation of the nature of stress-strain data, activation energy, and threshold stress in low strain rate regions which correspond to the creep strain rates usually encountered in service of high temperature components, i.e., gas turbine engines, 3) delineation of ranges of operation of superplastic processes, and study of the criteria for the transition from superplasticity to creep. In addition, investigation of the factors that would allow extension to higher strain rates and optimization of the processing parameters for forming operations, 4) determination of the factors which lead to fracture during the

superplastic process in terms of microstructural modification, cavitation and geometrical instability. During the first year, the areas outlined above will be investigated using a well charactorized model system (Al-Zn eutectoid alloy). Subsequent effort will focus upon alloys with potentially important applications in the manufacture of airframes and engines (such as Ti-6Al-4V, a near-beta Ti alloy, In-100, and a high strength aluminum alloy).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, MOLECULAR BEAM STUDIES OF SURFACE STRUCTURE, SURFACE PHONON EXCITATIONS, AND THE DYNAMICS OF GAS-SURFACE INTERACTIONS

D.R. Miller, University of California, San Diego Campus, Graduate School, Dept. of Applied Mechanics & Engineering Sciences, *P.O. Box 109, La Jolla, California* 92037 (DMR78-17176)

Experimental and theoretical studies of low energy molecular beam scattering from solid surfaces previously supported by NSF grant DMR-7623009 will be continued. These studies include: (1) atomic beam spectroscopy of surface structure and phonon excitation, and (2) internal energy exchange in the scattering of polyatomics from surfaces. Experimental studies will be conducted in an ultra high vacuum molecular beam facility using both time-of-flight and fluorescence spectroscopy to measure translational and internal energy of scattered or desorbed species. Theoretical treatments will be quantum mechanical, utilizing several types of approximations: extended distorted wave Born, Rayleigh scattering, and impulsive approximations. The effects of attractive gas-surface potential and bound state resonances on both elastic and inelastic scattering will be examined. The surface spectroscopy will utilize low energy helium atom scattering. Inelastic studies will initially involve the simple diatomics H2, D2, N2. The internal rotational state of N2 will be examined spectroscopically. Surfaces to be investigated initially are Ag(111), W(100), and LiF(100). The scattering of molecular beams from solid surfaces provide a sensitive probe of surface structures, excitations and interactions with adsorbed atoms or molecules. The objective of this research is to develop an improved understanding of these processes as they affect the physics and chemistry of surfaces.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

4.0012, MULTIMODE OPTICAL SWITCHING AND BEAM EXPANSION

E. Garmire, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF903760; F19628-77-C-0221)

AF function - command and control. Deficiency/opportunity -communications links lack security and are inefficient. Objective - to develop integrated optic laser source optimally suited for coupling to optical fiber. How research contributes - provides improved source for optical communication links.

Integrated optics will be used to render the output of a CW GaAs double-heterostructure, stripe-geometry laser compatible with coupling to optical fibers. A distributed Bragg reflector will be used to achieve spectrally narrow output. A 100 micrometer-square beam will be produced by waveguide beam-expansion techniques for butt-coupling to a multimode optical fiber. First, the beam will be expanded in the plane of the waveguide by using a 90-degree grating beam expander. A grating output coupler will be used to produce a laser output normal to the waveguide surface having the desired near-field spot size and pattern. The effects of blazing the gratings on output coupling will be studied. Applications of waveguide beam expansion to optical signal processing will also be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0013, ELECTROMAGNETIC SCATTERING PROCESSES AT RESONANCE AND WITH INTENSE FIELDS

R.W. Hellwarth, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF054890; AFOSR-79-0098)

AF function - there is a critical need to find means to eliminate deleterious effects of phase distortion of laser beams being considered for weaponry, reconnaissance and other vital AF functions. Opportunity - nonlinear phase conjugation techniques offer a means to automatically correct phase distortion of optical beams caused by the atmosphere, imperfect optics or other phenomena. These techniques must be better understood, their limits explored and novel implementations considered before they can be applied to important AF problems. Objective - study nonlinear phase conjugation by Brillouin scattering including reduction of threshold using near resonant phenomena, effects of linear loss and geometric effects. Contribution - this work will supply understanding necessary to apply stimulated Brillouin scattering phase conjugation techniques to prevent distortion in AF optical systems.

The approach is mainly theoretical but will include some experimental verification. The effect of linear loss, especially in waveguides, on the stimulated Brillouin backscattered efficiency will be formulated and calculated. Ultimate limits imposed by such processes will be studied. Resonance enhancement of phase conjugation by stimulated Raman or Brillouin scattering will be theoretically studied and experiments using dye lasers to excite dyes in waveguides will be used to verify theory. Short pulse (transient) effects will be explored. Possibilities of using polarization effects for nonlinear spectroscopy, especially at low frequencies determined by the difference in input optical frequencies will be explored.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, DIAGNOSTIC TECHNIQUES FOR MOLECULAR MULTIPHOTON ABSORPTION OF IR LASER RADIATION

C. Wittig, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (ENG76-82560)

This research involves a series of diagnostic experiments to measure fundamental processes in molecular multiple photon IR absorption. This phenomenon, which can lead to dissociation of molecular species on a collisionless time scale, has been shown to be useful for laser isotope separation and offers the possibility of laser controlled chemistry. The proposed experiments address the following two questions. First, what is the distribution and fate of the vibrational energy that a molecule gains from the laser field in the absence of photodissociation? Second, what are the specific product channels for photodissociation and how can these product channels be monitored and controlled?

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0015, HIGH CAPACITY LASER HOLOGRAPHIC DATA STORAGE

T.K. Gaylord, Georgia Inst. of Technology, School of Electrical Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (ENG76-81707)

A research project will be undertaken to obtain detailed understanding of optically and electrically induced refractive index changes in electrooptic crystals. Particular emphasis will be directed toward the implementation of high capacity holographic information storage and retrieval and optical grating devices. A comparison will be made of the terminal characteristics of volume hologram gratings predicted by dynamic theory and experimental results in electrooptic crystals. Several holographic data storage experiments will be conducted including volume superposition of data, coherent selective erasure, digital logic operations, optical noise, and multiphoton recording.

This action renews the research that is being conducted under NSF Grant ENG75-14456.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0016, NEAR-EQUATORIAL PLASMASPHERE
T.H. Roelofs, University of Hawaii System, Manoa Campus, School of Engineering, Dept. of Electrical Engineering, *Bachman Hall, Honolulu, Hawaii* 96822 (DF580190; F19628-78-C-0050)

AF function - time delay errors produced in satellite navigation and detection systems. Deficiency - present models of ionospheric time delay do not include the contribution of electrons from heights above approximately 1000-3000 kilometers, a region called the plasmasphere. In the equatorial anomaly region where the ionospheric time delays are the world's highest the additional contribution to total time delay of the plasmasphere is unknown. Objective - measure the diurnal and seasonal plasmaspheric electron content during magnetically quiet and disturbed conditions. How research contributes - these results will be used to improve existing models and prediction techniques for time delay to operational satellite detection radar and navigation systems particularly when operating in the Pacific equatorial anomaly region.

The plasmaspheric electron content will be found by making simultaneous measurements from a ground station in Hawaii of the true group delay and the Faraday rotation of radio waves transmitted by an ionospheric beacon transmitter on board the geostationary satellite ATS-6. This satellite is located at 140 degrees west longitude, well suited for making these measurements from the Hawaiian equatorial anomaly location. The difference between the electron content as measured by the two techniques, after suitable corrections, is the plasmaspheric electron content. Measurements will be made for approximately 2 years to determine the diurnal and seasonal behavior of this parameter during magnetically quiet and disturbed conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0017, OPTICAL TECHNIQUES TO MEASURE DISPLACEMENTS AND STRAINS IN SOLIDS
C.A. Sciammarella, Illinois Inst. of Technology, School of Engineering & Physical Science, Dept. of Mechanics & Mechanical & Aerospace Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (ENG77-24302)

The objective of this research program is to develop optical techniques (holography, moire and speckle interferometry) for the measurement of stresses and strains in solids.

These developments include faster and more efficient data processing techniques, significant increase in the magnitude of resolution, easier and simpler methods of application, and possible new areas of utilization.

These advances will find application in a number of areas of technological importance, such as the study of complex structural and machine elements, in the study of material properties, as well as in nondestructive inspection techniques and fracture mechanics.

This action provides additional support for ENG 75-11160.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0018, UNSTEADY FREE CONVECTION
R.J. Adrian, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Theoretical & Applied Mechanics, *207 Engineering Hall, Urbana, Illinois* 61801 (ATM77-22936)

This project will perform investigations of unsteady turbulent free convection in horizontal layers of fluid that are heated from below and bounded above by either an insulating surface or a layer of stable fluid.

The purposes of this investigation are to provide detailed information of the structure of turbulence in turbulent flows, including joint higher order moments of temperature and velocity, and to use these data to evaluate and implement certain higher order models of buoyancy driven turbulence which have been proposed for modeling the planetary boundary layer. Measurements will be made of the fluctuating local temperatures, vertical velocities, and horizontal velocities along horizontal lines in the fluid layer by simultaneously scanning a temperature sensor and the measurement volume of a two component laser Doppler velocimeter through the fluid.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0019, HIGH-RESOLUTION METEOR WINDS RADAR OBSERVATIONS
S.A. Bowhill, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (ATM76-01773 A01)

This grant funds the continued operation of the University of Illinois' meteor wind radar, begun under National Science Foundation grant ATM-7601773. Data taken under this program will be analyzed for studies of the dynamics of the mesosphere and lower thermosphere, particularly to investigate vertical tides and their temporal variability in the 80-110 km region, internal gravity waves, and the relation between neutral winds and ionospheric motions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0020, LARGE SCALE SYSTEMS
J.B. Cruz, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (ENG74-20091 A01)

The general objective of this research is to develop a unified approach to the modeling and control of large scale systems with uncertainties.

The first part of the study will examine structural aspects, such as controllability and resulting related design possibilities, of interconnected systems. The principal aim is to obtain results in terms of subsystem and interconnection properties only, without having to examine the large composite system model.

The second part will develop methods for the simplification of large dynamic systems by the use of different time scales which model slow and fast phenomena (singularly perturbed models). This inherent time scale separation offers an interesting possibility for decomposition and decentralization of design, control and optimization problems for large scale systems.

The third part will investigate dynamic game structure where the control action is applied simultaneously by many decision-makers with different objectives. The Stackelberg strategy will be adapted to coordinate subsystems.

The final part will investigate parameter uncertaintity in large systems from both the sensitivity viewpoint (regarding the parameters as deterministic with fixed but unknown values) and the stochastic viewpoint. The goal is to develop methodologies for decentralized control which are robust to modeling uncertainties.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0021, COHERENCE BANDWIDTH STUDY
K.C. Yeh, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DF582040; F19628-78-C-0195)

AF function - satellite communications. Deficiency - inadequate knowledge of the effects of ionospheric scintillations on trans-ionospheric radio propagation. Objective - study the coherence bandwidth and pulse distortion through naturally occurring and artificially modified ionospheres. How research con-

tributes - with a greater understanding of the degradation that occurs on the propagation path due to intense scintillations, mitigating techniques can be implemented to improve the reliability of satellite communications.

The mutual coherence functions will be determined and applied to study the coherence bandwidth under various ionospheric and propagation conditions. Experimental data will be compared with theoretical results and used to evaluate the effects of the nuclear disturbed ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0022, PROGRAMMABLE SELF-CUEING KEYBOARD ASSEMBLY FOR INTEGRATED AVIONICS

T. McCreery, Bomar Instruments Corp., *Fort Wayne, Indiana* (DN081111; N62269-78-C-0151)

The Navy's advanced integrated display system AIDS program is to develop a totally new concept in modular cockpit instrumentation for naval air missions, requiring exploratory development of new display materials and techniques. A flat programmable self-cueing keyboard assembly is directly applicable to the type of display required by the AIDS programmable panel display. This contract supports work unit ZA601, Agency Accession No. 681080.

A 25 key station keyboard utilizing light emitting diode displays is to be developed and evaluated in the areas of cueing assembly, actuator plate concept, and optimum force level. A prototype keyboard is to be designed and developed for evaluation and demonstration.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0023, RESPONSE OF THE CARDIOVASCULAR SYSTEM TO VIBRATION AND COMBINED STRESSES

C.F. Knapp, University of Kentucky, School of Engineering, Dept. of Mechanical Engineering, *Limestone & Euclid, Lexington, Kentucky* 40506 (DF053900; F49620-79-C-0034)

AF function - environmental stresses such as acceleration and/or vibration may severely compromise aircrew performance. Circulation may be extended to critical limits since it is directly affected by these forces and is indirectly involved in all adjustments of the body to environmental stress. Deficiency - with the recent development and deployment of high speed terrain-following tactical aircraft, operational crews are exposed to a dynamic acceleration environment with a significant frequency content below 1.0 Hz for extended periods of time. There is an acute lack of information available concerning responses at frequencies below 1.0 Hz. The design of effective countermeasures to acceleration stress depends upon the understanding of the mechanisms responsible for cardiovascular regulation. Because of the invasive nature of the instrumentation required for assessing cardiovascular responses, studies will be performed using chronically instrumented canines. Objective - the proposed studies are designed to 1) yield needed quantitative information about the cardiovascular system's ability to function in, and adjust to, ultra low frequency acceleration environments, and allow a qualitative evaluation of the possible hazards of exposure to such acceleration stress, and 2) to provide a means of analyzing the frequency response of the cardiac and vascular control mechanisms, acting to maintain circulatory integrity, during exposure to these dynamic, total-circulatory (i.e. whole body) acceleration loadings. How research contributes - this effort will provide the background required for the design and implementation of human investigations which would lead to improved protective equipment and operational procedures for military personnel exposed to the acceleration environment resulting from the optimal utilization of advanced aerospace systems.

Emphasis will be placed on 1) the quantification of the frequency response characteristics of cardiovascular regulation, using Fourier analysis, with a shifting of focus toward specific receptors, i.e. carotid sinus pressure, venous volume and the vestibular apparatus with specific peripheral vascular effectors acting and 2) the identification of the source of the increase in mean arterial pressure associated with oscillatory acceleration loading, a pressure increase which appears to be independent of autonomic effector activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024, APPLICATIONS OF ENGINEERING METHODS IN PLASMA SCIENCE

H. Lashinsky, University of Maryland, College Park Campus, Inst. for Fluid Dynamics & Applied Mathematics, *College Park, Maryland* 20742 (ENG77-02128)

The objective of this program is to examine the supression of low-frequency instabilities in a plasma in a magnetic field by the application of high-frequency electric fields. Specific problems to be treated include: 1. Stabilization of the collisionless drift instability by the high-frequency transverse (to the magnetic field) electric fields associated with the lower-hybrid resonance. 2. Stabilization of the collisionless drift instability by the application of high-frequency parallel electric fields. 3. Development of noncontact methods for the introduction of a high-frequency electric field with known spatial distribution and amplitude into a plasma. 4. Coupling to the lower hybrid resonance in a bounded plasma of dimension comparable to the wavelength. Experimental aspects of the research will be performed on a Q machine.

This is a continuation of research previously supported under NSF grant ENG-7604635.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0025, PHOTOCONDUCTIVITY EFFECTS IN SEMICONDUCTORS FOR PICOSECOND OPTOELECTRONIC DEVICES

C.H. Lee, University of Maryland, College Park Campus, School of Engineering, Dept. of Electrical Engineering, *College Park, Maryland* 20742 (ENG78-06862)

This program is examining the photoconductivity effects in semiconductors which are induced by picosecond laser pulses. Since photo-induced carriers can be generated very rapidly, an optoelectronic switching device based on photo-conductivity effects can be built with picosecond response time and precision. This study focuses on methods for implementing switching devices and on measurements of device operation. The program includes an investigation of: (a) electronic recombination processes in semiconductors, (b) Ridley-Watkins-Hilsum inter-valley scattering effects and their relation to device characteristics, (c) generation of multi-kilovolt electric impulses, (d) microwave switching, (e) the use of the devices as ultrafast optical detectors, (f) two-photon photoconductivity laser intensity correlation with picosecond resolution, and (g) new materials suitable for bulk photoconductivity switching applications.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0026, ASTROMETRIC INTERFEROMETER

D.H. Staelin, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST77-06052 A01)

Optical stellar interferometry techniques show promise of being able to improve the measurement of stellar positions by a factor of 10 to 15 over conventional techniques. Such an advance greatly increases the chances for detecting neutron stars, black holes, and planets around nearby stars.

An existing pilot model interferometer with a 1.6 meter base line will be improved and the basic system concepts will be demonstrated with observations of bright stars. Basic data about the propagation of starlight through the atmosphere will be obtained. Such data will be necessary for the design of future high-resolution interferometric instruments.

This is a continuation of research previously funded under NSF grant AST 77-06052.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

4.0027, DESIGN & DEVELOP AEROSPACE RESEARCH INSTRUMENTS

S.J. Rochefort, Northeastern University, School of Engineering, Dept. of Electrical Engineering, *360 Huntington Ave., Boston, Massachusetts* 02115 (DF242400; F19628-78-C-0218)

AF function - nuclear weapons delivery, communications, detection, track and intercept stratospheric operations. Deficiency - inability to forecast atmospheric interactions affecting the design and operation of military systems such as reentry vehicle, over-the-horizon radar, polar communications and satellite ephemerides. Insufficient data to accurately predict environmental effects of stratospheric operations. Objective - to increase ability to forecast atmospheric variables requires measurements by sounding rocket and balloon experiments. How research contributes - provides instruments for conducting experiments measuring the composition and densities of ion and neutral species of importance to AF systems operations.

The contractor will design and operate electronic instruments for mass spectrometer and related experiments as required for a series of rocket- and balloon-borne ion and neutral atmospheric composition measurement programs. The design of each experiment will be coordinated with parallel laboratory and other related programs while being updated according to the results of the preceding experiments. Research, development and test of components and assemblies are undertaken to create reliable operating instruments for rocket and balloon experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0028, SATELLITE/SPACE PLASMA INTERACTION STUDY

U. Samir, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical & Computer Engineering, *Ann Arbor, Michigan* 48104 (DF582420; F19628-79-C-0060)

AF function - communication, navigation, command and control. Objective - to determine the structure of the plasma sheath and wake in the vicinity of a satellite and to perform a parameter study relating satellite velocity, altitude, ambient plasma density, temperature and energy. Examine effect of spacecraft induced plasma oscillations on the reliability of in-situ plasma measurements from spacecraft. Develop an empirical model of the sheath structure for the low altitude satellites DMSP, S3-2, S3-3, Space Shuttle (STS) and the synchronous orbit AF satellite, SCATHA. How research contributes - defines and quantifies spacecraft sheath and charging properties enabling the effects on communications equipment and electrical and optical sensing systems to be evaluated.

A parametric study of problems involved in spacecraft-space plasma interactions at low altitude utilizing in-situ measurements made aboard Air Force satellites including the S3-2, S3-3 and DMSP will be made. SCATHA sheath and wake studies will be undertaken utilizing the electron and ion plasma data for modelling synchronous orbit conditions. Use results from the study to set up a definite experiment using space shuttle which will study plasma interactions with experimental bodies under closely monitored conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0029, FRESNEL LENS AND BEAM CONTROL IN OPTICAL WAVEGUIDES

W.S. Chang, Washington University, School of Engineering & Applied Science, Dept. of Electrical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF055880; F49620-79-C-0145)

AF function - advanced Air Force weapon systems require the real-time processing of data obtained from a multitude of sensors at data rates which exceed current capabilities. This requirement necessitates the development of analog parallel processing techniques such as optical or acousto-optical processing. Opportunity - an integrated optical format must be found before such processing can be realizable onboard aircraft and missiles. Objective - this research will use Fresnel diffraction in an attempt to fabricate efficient and inexpensive waveguide lenses for integrated optical systems. How work contributes -the effort advances optical processors for avionics and command/control systems.

Fresnel lenses in high index of refraction waveguides such as lithium niobate will be analyzed, designed, fabricated, and experimentally evaluated. New phase reconstruction methods and volume holographic techniques will be investigated for their capability to improve Fresnel lens performance in such respects as side lobe reduction, better efficiency, and larger signal-to-noise ratios. Microfabrication techniques will be studied in an attempt to discover batch fabrication methods for the lenses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, TRANSITION TO TURBULENCE IN SHEAR FLOWS

A. Demetriades, Montana State University, Graduate School, *Bozeman, Montana* 59715 (DF055600; F49620-79-C-0210)

AF function - aerospace vehicles. Deficiency - methods for predicting the transition to turbulence of shear flows, i.e. free shear layers, boundary layers, wakes and jets, is not adequate at present for most design applications. Objective - development of a verified predictive method for the laminar-turbulent transition of all shear flows, including the effects of Mach number, heat transfer, surface roughness and pressure gradient. How work contributes - a criterion for establishing the transition distance of shear flows will aid the design of many systems of interest to the Air Force such as the prediction of boundary layer transition of blunted nose types on reentry vehicles, the change of the transition distance due tothe growth of roughness caused by ablative pitting and the transition of shear layers and wakes in gas flow lasers.

An analytical study of flow data in the published literature will be conducted to evaluate the concept of a threshold or minimum turbulence Reynolds number for all classes of shear layers and how it will vary depending on the flow parameters of Mach number, heat transfer rates, surface curvature, roughness, pressure gradient, etc. This approach appears to be profitable due to the early successes of the principal investigator in the predictions for wakes and boundary layers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, CHARACTERIZATION OF THE RADIATION DAMAGE TO ELECTROOPTIC COMPONENTS

B.H. Rose, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (DF196460)

The objective of this program is to provide detailed information on the effects of radiation - in particular solar radiation - on solid-state and electrooptic components. Ultimately, this information will be used not only to assess the vulnerability of these components, but also to develop techniques that can enhance the radiation hardness of satellite components.

DDC literature search No. ACR20F accomplished. Degradation of relevant device parameters will be measured as a function of proton beam energy desposition and gamma dose rate and total dose. Initial measurements will be of power output and minority carrier lifetime in LED's and of efficiency in solar cells. In addition, transient capacitance measurements will be made on the junctions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0032, ROTOR BEARING DYNAMICS DESIGN TECHNOLOGY

C.H. Pan, Shaker Research Corp., *Northway 10 Executive Pk., Ballston Lake, New York* 12019 (DF458690; F33615-76-C-2038)

Update current AFAPL-TR-65-45 series to reflect state-of-the-art advanced and to clarify certain sections.

Review current volumes, literature, and practice to establish areas for update, correction, and/or additions. Rewrite and restructure the guides to reflect and improve ease of use. Add volume on gas lubed foils and pneumomechanical critical speed control. Provide for systematic update.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0033, INTRASYSTEM EMC SUSCEPTIBILITY

D. Weiner, Syracuse University, L.C. Smith College of Engineering, Dept. of Electrical & Computer Engineering, *Link Hall, Syracuse, New York* 13210 (DF930410; F30602-78-C-0083)

The objective of this effort, entitled Intrasystem Electromagnetic Compatibility Susceptibility Study, is to examine the electromagnetic interference (EMI) behavior of devices such as fuel gauge indicators, electroexplosive devices, logic circuits, display units, etc.

The approach will be then to determine EMI performance curves for such devices. These performance curves will relate device degradation to various interference signal parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0034, ANTENNA RESEARCH

C.J. Drane, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF904550)

AF function - communication and surveillance. Deficiency - antennas that are rendered ineffective for practical applications by their great expense, immobility, high drag coefficient, susceptibility to jamming, high sidelobe levels, low gain, and narrowbandedness. Objective - to provide fundamental technical basis for antennas that are cost-effective with more precisely predictable sidelobes; have high gain and easy portability; are low profile with minimal aerodynamic drag; have wide angular scan capability; are significantly less vulnerable to enemy jamming; have sidelobes that can be selectively reduced; can operate on a dual frequency basis. How research contributes - provides antenna technology for OTH backscatter detection radars, emergency communications, high performance aircraft, aircraft-to-satellite communications, tactical surveillance, radiation defense of ground-based radar and communications systems, and broadband communications capability.

Judicious loading of array elements to significantly mitigate interelement mutual coupling; perturbative and iterative adjustment of dipole lengths and spacings along a transmission line whose characteristic and terminating impedances are also parameters in maximizing the gain; investigation of radiation mechanisms, basic element properties and bandwidth of microstrip antenna arrays, surface wave concepts combined with phased array principles for high gain and efficiency over wide angles. Integrated design of reflector and offset feed for very low sidelobes; spatial filtering screens in immediate foreground of antenna arrays for selective reduction of sidelobes; short-backfire antenna structure combined with concentric loop for dual frequency operation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0035, THERMAL ENERGY STORAGE AND HEAT TRANSFER INVESTIGATION

J.E. Beam, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458500)

To develop the required analytical and experimental heat transfer and metallurgical compatibility data necessary to optimize the design and usable life for surveillance spacecraft via cryocooler applications.

A two phase program is proposed. Phase I concerns analytical modeling of transient cycling of cylindrically encapsulated TES phase change materials, setting up an in-house test capability to allow thermal cycling of liquid metal heat pipes with integral TES, and initiating in vacuo metallurgical clad/TES compatibility tests. Phase II centers on calorimetric testing and cyclic performance mapping of subscale thermal trains and contractual end item hardware.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0036, PLASMA PROPERTIES OF GAS LASERS

P. Bletzinger, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458840)

AF function - electrical discharges applied to gas laser and high power technology. Deficiency - present electrical discharge lasers are limited in performance and lifetime by discharge instabilities, contamination and electrode or boundary effects. Research - the in-house experimental program uses sample discharges such as DC, RF or microwave, UV or electron-beam preionized plasmas as representative of those used in lasers or high power switches of current AF interest. The application of a wide variety of excitation methods and diagnostics will permit a detailed and accurate determination of the characteristics, limitations of and possible improvements to these discharges. How research contributes - this research supports several Air Force requirements in the area of medium and high power lasers in the infrared and visible wavelength range as well as switch technology. Research also supports data requirements of theoretical studies under work unit 12.

The research program uses small in-house experiments to generate and analyze accurately defined CW or pulsed discharges. Excitation methods include standard very high stability DC discharges, pulsed and DC RF and microwave discharges as well as pulsed and DC UV or electron-beam preionized discharges. The diagnostics are compatible with the well-defined discharges and include time resolved spectroscopy from the vacuum UV to medium infrared and electrical diagnostics. Presently, emphasis is on the analysis of population distributions in molecular gases under various excitation conditions, analysis of preionization mechanisms and seed characterization of UV preionized discharges and instability mechanisms in conventional and e-beam discharges. Future plans call for research on electronegative discharges relevant to lasers and switches.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0037, COMBUSTION MODELING STUDIES

R.P. Bradley, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF461200)

Design and run experiments to evaluate existing combustor models.

The experimental design will determine: (1) combustor configuration, (2) initial conditions, (3) fuel type, (4) spatial measurement locations, and (5) model predictions of temperature, species concentration, and velocity profiles. Advanced optical techniques will be used to make the desired profile measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0038, BEARING RESEARCH FOR PROPULSION AND POWER SYSTEMS

J.F. Dill, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451070)

Raise R. E. bearing capability to three plus mission DN, extend bearing fatigue life and increase steel fracture toughness through better materials, increase the understanding of the fundamentals of lubrication dynamics, increase the capability of computer modelling of bearing operation.

Document the result of existing R. E. bearing analyses, conduct full scale bearing tests to verify fatigue capability, perform dynamic measurements of lubricant film thickness and traction characteristics, investigate the physical properties of lubricants needed for dynamic modelling.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0039, CORRELATION VELOCITY SENSOR FLIGHT TEST

N.R. Banke, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF116760)

An inertial navigation system (INS) of the type required for accurate navigation of penetrating manned bombers, remotely piloted vehicles and cruise weapons, provides continuous estimates of vehicle position, velocity, and ground track angle. The accuracy of these estimates degrade with time unless the INS is periodically 'updated' by data derived from external sensors. Accurate velocity-updating, of the order of 10.5 ft/sec precision, can reduce the position estimate error-rate of a 6000 ft/hour ins to about 1500 ft/hour, a four to one performance improvement. A sensor concept for obtaining such accuracy, known as the correlation velocity sensor (CVS), combines an interferometer receiving antenna system with a pulsed radar altimeter to generate and process radar returns into estimates of flight speed and heading. Flight tests to two breadboard CVS units under a Navy/Air Force program have demonstrated CVS feasibility but the accuracy achieved was about an order of magnitude below Air Force. The prime objective of this program is to perform flight test evaluation of the brassboard CVS units in an AF fixed-wing A/C to demonstrate that performance requirements can be met.

A Program Introduction Document (PID) has been submitted to 6585TG and 4950TW stating the requirements of the CVS flight test, Proj 688G funds will be requested by 6585TG to perform the flight test program. The Navy will deliver the CVS equipment to the Air Force on 01 Oct 78.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0040, HARMONICS CANCELLATION SYSTEM

S. Harris, General Atronics Corp., *1200 E. Mermaid Ln., Philadelphia, Pennsylvania* 19118 (DF912600; F30602-78-C-0191)

The objective of this effort is to further investigate the generation of harmonics from high power HF transmitters aboard aircraft which interferes with the reception of weak VHF/UHF signals, and if necessary, to investigate nonlinear interference cancellation system (NICS) techniques to solve the problem. Our investigation to date has been chiefly concerned about HF harmonics into AFSATCOM and reconnaissance type receivers, however, it should have direct application to possible future problems such as a. HF/VHF harmonics into SEEK talk, b. VHF/UHF harmonics into JTIDs, and c. VHF/UHF harmonics into NAVSTAR (global positioning system).

The study phase shall include lab, ground and airborne testing on special mission aircrafts to determine the locations of the various harmonic generators. Once a specific nonlinearity has been located, then a solution considering the technical, economical and operational aspects should be investigated. (Example - if a simple filter will eliminate a particular harmonic generator, then that will be the recommendation.) Over the past year, six harmonic generators have been isolated and their effects minimized but there still exists an interference level 12 db above AFSATCOM receiver sensitivity. The number of remaining harmonic generators on these aircraft is unknown at this time. If a NICS appears to be the technical and economical solution to a specific harmonic generator, then the amplitude/phase characteristics of that nonlinearity has to be accurately determined. Consideration also has to be given to the nonlinearity location relative to the transmitting and receiving antennas, including the case of multiple nonlinearity locations. Thereafter, a variety of NICS techniques shall be examined by analysis, computer simulation and/or laboratory experiments to verify their applicability. The second phase is the actual design of the NICS. Techniques considered must apply both for AM and FM modulation on the offending transmitter without distorting the desired signal. The last phase is the fabrication and testing of a breadboard model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0041, DEVELOPMENT OF DISTRIBUTED PROCESSING SYSTEM GENERATOR PROGRAM

C. Czaplicki, U.S. Dept. of Defense, Navy, Naval Air Development Center, Software & Computer Directorate, *Warminster, Pennsylvania* 18974 (DN081147)

Distributed computer configurations have been projected as the next generation architecture for various avionics platforms. The system generation software provided to day only accommodates one loadable processor. The objective is to explore and develop new approaches for system generator which could provide coordinated loadable software for all the loadable devices within a distributed processing architectures. The goal is a system generator which will provide the load files for the processors within various platform configurations.

The approach of this effort is to review the currently available system generators and investigate new approaches which will expand their capability for more than one processor. There has been very little effort expended on a distributed computer system generator for the avionics application. Items to be investigated are configuration management, recovery, loader interfaces and multi-computer loader directives.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0042, RADIATION HARDENED MNS DEVICE RESEARCH

D.J. Dumin, Clemson University, School of Engineering, Dept. of Electrical & Computer Engineering, *Rhodes Research Bldg., Clemson, South Carolina* 29631 (DF905360; F19628-79-C-0094)

AF function - guidance, navigation, communication. Deficiency -metal-nitride-oxide-semiconductor (MNOS) technology is the only non-volatile microelectronic memory technology but is still a very immature technology. A variant on this structure, metal-nitride-semiconductor (MNS) with a thermally grown nitride layer, offers tremendous potential for reliability and radiation hardness, but has only been successfully accomplished recently in Japan. Objective is to develop a thermal nitride growth process for radiation hardened MNS memory. How research contributes - radiation hardened, reliable, non-volatile semiconductor memories are essential to Air Force satellite and missile systems. This research will advance the development of such memories and also advance the metal-insulator-semiconductor (MIS) technology in general.

Develop a reaction facility for the thermal nitridation of silicon. Characterize silicon-nitride films as a function of growth parameters to optimize growth process. Fabricate MNS test devices to determine the effects of nitride growth parameters on device function, reliability and radiation hardness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0043, TRAJECTORY OPTIMIZATION FOR A MIXED-MODE SINGLE STAGE NUCLEAR SURFACE-TO-ORBIT SHUTTLE

T.C. Powell, University of Tennessee, Central Office, Space Inst., Dept. of Mechanical Engineering, *Tullahoma, Tennessee* 37388 (DF055350; F49620-79-C-0166)

AF function - space defense. Opportunity - optimization of trajectory for a mixed mode single stage nuclear surface-to-orbit shuttle. Objective - research will be performed to obtain the characteristics of optimum trajectories of single stage orbiting vehicles launched from the equator. How work contributes - future surveillance satellites may use single stage nuclear shuttles. To place a given payload in orbit the optimum trajectories for minimum initial mass are desirable.

Performance calculations will be performed for a single stage shuttle operation. The engines will be designed to operate in two modes, a) low specific impulse propellants, and b) high specific impulse propellants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0044, DULLES INTERNATIONAL AIRPORT IMPROVED ACCESS IMMEDIATE ACTION PROGRAM
D.F. Erion, Northern Virginia Transportation Commission, *2030 16th N. Arlington, Arlington, Virginia* (193159 (HRB NO.))

The purpose of this demonstration project is to determine whether improved high speed bus service can shift some air passengers from the more accessible National Airport to the relatively less accessible Dulles Airport. A secondary purpose is to test the effectiveness of such an improved bus service to induce a modal shift from autos and taxis to a higher occupancy mode. The project seeks to improve ground access via mass transit to Dulles Airport through traffic engineering improvements, increased visibility of bus service, increased awareness of the services available and improved perception of the existing service.

SUPPORTED BY U.S. Dept. of Transportation, Urban Mass Transportation Admin.

4.0045, NIOBIUM BASED JOSEPHSON JUNCTIONS
J.E. Nordman, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Electrical Engineering, *Madison, Wisconsin* 53706 (ENG74-24227 A02)

The primary objective of this research is to understand and perfect the niobium (Nb) based Josephson tunnel junction. Specific goals include: 1) the determination of the mechanisms responsible for leakage current, the anomalous negative resistance, and the reduced maximum DC Josephson current - all now observed as functions of fabrication parameters in Nb-Nb oxide-lead (Pb) junctions; 2) the fabrication of junctions exhibiting repeatable behavior using semiconductor barriers which can be altered in a controlled way either by doping, optical injection or the field effect; 3) the determination of the limits to the efficiency of coupling of elecromagnetic radiation to Nb tunnel junctions through either the Nb or the Pb film.

The Nb based junction will be studied because of its great potential for use in practical Josephson devices. In that regard, effort will be directed toward achieving one or more of the following: a better circuit model for Nb junctions, development of a low leakage Nb-barrier-Nb junction, development of efficient high frequency emitters or detectors development of reliable high current density junctions.

This is a continuation of research previously supported under NSF Grant ENG-7424227.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0046, RESEARCH IN FLUID DYNAMICS
J. Sandford, Von Karman Inst. for Fluid Dynamics, *Rhode St. Genese, Belgium* (DF289780; AFOSR-79-0033)

AF function - research in aerodynamics. Deficiency - there exists a need to better understand the relationship between aircraft design parameters and noise. Aircraft noise contributes to detection, structural fatigue and associated maintenance problems. Research - the research will investigate wing-propeller interactions and their effect on aircraft noise. How research contributes - the research will contribute to the evolution of criteria which will aid in the design of low-noise propeller-driven aircraft. This program is part of a long range VKI effort and support of this low level will facilitate transfer of this data in the future.

A model will be constructed which will allow the location of a pusher propeller to be varied relative to the wing. Complete polars will be measured and simultaneously noise measurements will be recorded at various positions outside the test station. The effect of background windtunnel noise will be studied also. The tests will be conducted in the three-meter low-speed facility at VKI.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

4.0047, SEMICONDUCTOR LASER DEFECTS
B. Thomas, University of Wales, Inst. of Science & Technology, *King Edward V I I Ave., Cardiff, Wales, United Kingdom* (DF902680; AFOSR-77-3206)

AF function - airborne and ground communications. Deficiency/opportunity - existing wire systems deficient in terms of bandwidth, security susceptibility, electrical interference. Objective -investigate switching characteristics of light sources for fibers. How research contributes - establish limitations on pulse operation of various laser diodes.

Fast rise time pulse measurements will be undertaken on various laser structures. Delay, 'q' switching, etc. will be investigated and in certain instances deliberately induced through material defects from neutron irradiation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, QUANTITATIVE MAGNETOSPHERIC B-FIELD MODELS FOR THE INTERNATIONAL MAGNETOSPHERIC STUDY
J.G. Roederer, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM78-09459)

For many research purposes, both theoretical and experimental, it is necessary to have a mathematical model of the Earth's magnetic field. A model in this sense means a numerical algorithm (e.g., a computer program) that, given the coordinates of a point in space, will return the value of the vector magnetic field at that point. There currently exists a fair variety of such models with widely varying properties, accuracies, and features. This grant funds a program of systematic evaluation, testing, intercomparison, and updating of these models. The objective of this work is to establish a series of magnetospheric models with clearly defined properties, merits, and limitations. This will permit improved theoretical and experimental studies of effects of the interplanetary magnetic field on Earth's magnetic field, ring current configurations, and neutral sheet current distributions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0002, REFURBISHMENT AND ENGINEERING SUPPORT OF RECOVERED PAYLOAD RECOVERY SYSTEMS
E. Allen, Space Data Corp., *Tempe, Arizona* (DF249840; F19628-78-C-0015)

AF function - recovery of aerospace payloads. Deficiency - economical recovery of small diameter sounding rocket payloads. Objective - to provide the AF with reliable, accurate, and low cost recovery systems for small sounding rocket payloads. How research contributes - will result in an inventory of reliable recovery systems that will enable scientific payloads to be recovered, refurbished and reflown, thereby reducing the per mission cost of sounding rocket research projects.

The AF intends to contract for the refurbishment of recovered, recovery systems. It is intended that four GFE systems per year will require refurbishment in each of three years.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0003, EPHEMERIDES SYSTEM APPLICATIONS
J. Bass, Logicon Inc., *21535 Hawthorne Blvd., Torrance, California* 90503 (DF581670; F19628-77-C-0254)

AF function - ephemerides systems applications for research on physics of upper atmosphere. Deficiency - requirement for continual modification and maintenance at state-of-the-art level for current vehicles of interest and any future launches. Objective - advancement and improvement in orbital parameter accuracies as required by researchers investigating experimental results. How research contributes - determination of atmospheric effects, e.g., density of atmosphere, atmospheric drag on a vehicle, geomagnetic effects during periods of high, medium and

low solar activity, as well as improvements in earth modelling and continuing investigations of auroral zone data.

Provide analysis of experimental data from the upper atmosphere utilizing specialized methods of analysis to perform atmospheric modelling using spectral analysis, statistical analysis and other numerical methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0004, STUDY OF MONSOON DISTURBANCES IN THE VICINITY OF TAIWAN AND SOUTH CHINA SEA

C. Chang, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (INT78-14557)

This award provides travel support for Dr. Chih-Pei Chang, Associate Professor of Meteorology, Naval Postgraduate School, to collaborate with scientists of National Taiwan University on study of large-scale monsoon motions and the associated subtropical and tropical disturbances during the summer and winter seasons in Southeast Asia. The project has been approved under the United States - Republic of China Cooperative Science Program and support for National Taiwan University investigators will be provided by the National Science Council of the R. O. C. The cooperative research will include: (1) study of the Mei-Yu ('plum-rain') systems in the vicinity of southeastern China and Taiwan during the early summer monsoon, and (2) study of the cold air surges off the Asian continent and their relationship with the convective activities in the South China Sea and maritime continent during the winter monsoon. Chang and his associates will collect data from sources in Taiwan and the U.S. These will be analyzed to obtain the structures and properties of atmospheric systems, their dynamic and thermodynamical mechanisms, their possible relationships with the broad scale circulations, and the methods for improved forecasting of these systems. Chang will provide advice on the establishment of special meteorological stations in the South China Sea during the Winter Monsoon Experiment of the Global Atmospheric Research Program.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

5.0005, STUDENT RESEARCH

A. Smith, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8DJ41190)

Research effort directed towards processes for solar-terrestrial phenomena to aid in the prediction of time and spatial occurrence of solar disturbances and their effects on the solar-terrestrial and near-earth environment.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0006, CLIMATE PREDICTABILITY AND LONG RANGE PREDICTION

E.J. Pitcher, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (ATM76-80604)

At present the detailed prediction of the daily weather is limited for practical purposes to just a few days. However, recognizing that the atmosphere is also subject to forcing on many different time scales longer than those associated with daily weather fluctuations, it may be possible to predict dynamically the atmospheric response in some averaged sense. Under the present project the principal investigator will investigate whether extended ranges of predictability are possible whenever time-averaged quantities are considered, rather than instantaneous values associated with day-by-day weather. A long-range prediction model suitable for making time-averaged predictions of the tropospheric height fields will be developed and tested. The method also involves the prediction of the temporal covariance structure of these fields and it is expected that knowledge of the variances would permit statements of variability of conditions during the forecast period. The research consists of both empirical and theoretical approaches.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0007, ANALYSIS OF COHERENT POLARIZATION DIVERSITY RADAR LIDAR FOR METEOROLOGICAL APPLICATIONS

J.I. Metcalf, Georgia Tech Research Inst., *Atlanta, Georgia* 30332 (DF582290; F19628-79-C-0076)

AF function - radar detection and identification of aerospace operational hazards. Deficiency - hydrometeor characteristics adversely affect the performance of many Air Force systems. Objective - perform a detailed systems analysis on the most suitable combination of coherent polarization diversity optical and/or microwave techniques for the remote determination of hydrometeor size distribution and phase. How development contributes - provides technique and system for remotely identifying weather phenomena affecting missile trajectories, communications links, and fire control radar paths.

The results of a previous study will be utilized to determine the effectiveness of various combinations of coherent polarization diversity radar and lidar systems in the remote sensing of the size distribution and phase of precipitation particles. A detailed analysis, including hardware performance trade-offs and hydrometeor definition capabilities, will be performed on the radar/lidar system which offers the most promise in measuring these particle characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0008, INFRARED FLUX IN THE EARTH'S ATMOSPHERE

L.D. Kaplan, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (ATM76-81027 A01)

The purpose of this research is to continue to develop methods for determining the three-dimensional distribution of flux of infrared radiation in the earth's atmosphere and its relation to the temperature, pressure, composition, cloud and snow cover, and aerosol fields. Emphasis will be placed on obtaining maximum computational speed compatible with the accuracy requirements of general circulation and numerical weather prediction models. The role of absorption of radiation by ozone, clouds, and aerosols in the tropospheric circulation will be investigated with special attention given to radiative effects on the thermal structure and dynamics during periods of a few days to a few weeks. Continued work on the determination of the characteristics of a remote sensing system to obtain high vertical resolution in retrievals of temperature and water vapor distributions will also be performed under this grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0009, THE STRATOSPHERIC WATER VAPOR SINK IN THE WINTER ANTARCTIC

J.L. Stanford, Iowa State University of Science & Technology, College of Humanities & Sciences, Dept. of Physics, *Beardshear Hall, Ames, Iowa* 50010 (ATM76-15403 A02)

The processes by which water vapor is removed from the stratosphere are not well understood. The most promising candidate among these processes is a mechanism operating in the winter antarctic. However, the magnitude of this antarctic sink is in doubt by at least a factor of ten.

This research will utilize satellite-derived temperature information for the southern polar stratosphere in winter. These data will be used to calculate the maximum (saturation) amounts of water vapor which can be held by the cold stratospheric air, as a function of pressure (altitude), geographical position, and time. The difference between these amounts and the generally accept-

ed value for stratospheric water vapor content will be calculated and assumed to form precipitation particles. The stratospheric water mass removed is the total mass of these particles which are able to fall out of the stratosphere before evaporating in the warming air at the end of winter.

A second phase will refine the calculations by incorporating the effects of air circulation into and around the strong polar-night vortex and the effects of asymmetry of the cold air masses around the South Pole. A third phase of the research will utilize satellite radiance data from several years to determine the year-to-year variability of the stratospheric temperature structure in winter, allowing an estimate of the amount of water removed from the stratosphere during an 'average' year.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0010, THEORETICAL ANALYSIS OF HIGH RESOLUTION SPECTRA

W.S. Benedict, University of Maryland, College Park Campus, School of Arts & Sciences, Chemical Physics Program, *College Park, Maryland* 20742 (DF582540; F19628-79-C-0030)

AF function - target detection and backgrounds, satellite meteorology, surveillance satellite, detection of aircraft and missile plumes. Deficiency - limited knowledge of the high resolution spectral properties of atmospheric gases. Objective - provide improved molecular absorption parameters for computing atmospheric transmittance. How research contributes - provides analysis of available data and develops theoretical methods to compute atmospheric properties, transmittance and emission.

Laboratory measurements, solar spectral measurements, and planetary spectral measurements will be examined and analyzed in order to develop an improved compilation of atmospheric absorption line of methane and water vapor. Careful analysis of such data contributes to the mathematical techniques which allow extrapolations and interpolations to spectral line data not amenable to measurement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011, HIGH ALTITUDE DENSITOMETER PAYLOADS

D.H. Fryklund, Accumetrics Corp., *Cambridge, Massachusetts* (DF583310; F19628-79-C-0058)

AF function - airborne surveillance and weapons delivery. Deficiency - improved accuracy required for low altitude satellite ephemerides and impact prediction for AF operational RV's and weapons systems. Research - improved rocketborne accelerometers and telemetry systems for more accurate measurements in 50-150 km altitude range. How research contributes - density data in this altitude range can contribute significantly to improved impact prediction capability for ICBMs, RVs, increased computational accuracy for satellite ephemerides and improved model atmospheres that can result from an increase in the data base.

Work to be performed under this contract will consist of development, fabrication, testing, calibration, payload integration and technical field support of complete operational falling sphere payload systems ready for installation onboard a rocket vehicle. These instrumented payloads will enable atmospheric density to be determined with improved accuracy in the altitude region between 50 and 150 km. Also the work shall include post flight system analysis based upon flight results. This will enable an in-depth analysis to be made of flight performance so that subsequent units can be improved with regard to accuracy, reliability and survivability. Rocketborne density payloads developed under this contract will be launched at selected sites in response to AFGL and other AF programs and requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, EWER PROBE EFFICIENCY STUDY

H.G. Norment, Atmospheric Science Associates, *363 Great Rd., Bedford, Massachusetts* 01730 (DF583580; F19628-79-M-0005)

Air Force function - strategic offense and defense. Deficiency -inability to accurately measure the liquid (or ice) water content of the atmosphere. This can degrade weapon system performance and affect aircraft operation. Objective - to accurately measure the concentrations of liquid water and/or ice mass of cloud systems. How development contributes - this study will permit more accurate measurements of atmospheric ice or water contents with the ewer instrument thereby providing accurate liquid water content (LWC) computations for quantitative assessments of environmental effects on aerospace operations.

Study the airflow in and about ewer probes to determine the efficiency of collection of hydrometeors and ice crystals as a function of size and shape.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, MATH AND PHYSICS STUDIES

N. Grossbard, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF247420; F19628-76-C-0147)

Research - upper atmospheric studies and rocket attitude determination. How research contributes - studies of high resolution solar data. Emission intensity studies in the earth's ionosphere and determination of dynamical motion of rockets.

Using numerical analysis, Fourier methods and integral equation techniques, mathematical models will be developed to test and improve the performance of space vehicles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, CHARACTERISTICS OF POLAR CAP AURORA IN DMSP IMAGES FROM 1972-1976

M.S. Gussenhoven, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF053770; AFOSR-79-0012)

AF function - communication, surveillance, and detection systems operating in and through the high latitude ionosphere and magnetosphere are influenced by disturbances in the plasma medium resulting from energy disposition from the solar wind. Deficiency - there is no universally accepted theory of the reconnection process between the geomagnetic and interplanetary fields that occurs as the solar wind plasma is convected past the earth and of the attendant particle entry and acceleration mechanisms. Objective - the clarification of the nature, occurrence, and dynamics of polar cap aurora will provide an understanding of ionospheric and magnetospheric processes. Contribution - an understanding of the polar cap aurora will aid in monitoring and predicting magnetospheric substorm development.

The work proposed for FY79 is to analyze electric and magnetic field measurements made on the AF satellite S3-2. The S3-2 satellite complements the Air Force DMSP satellite SSJ/3 launched in June 1977, which in addition to the optical monitoring of the cap regions provides a 16 channel electrostatic analyzer to measure precipitating electrons from 50eV to 20 keV. The work is planned in three phases: the first phase will attend to the analysis of S3-2 electric and magnetic field data over the polar caps as it relates to polar cap auroral activity. The second phase will coordinate all results obtained in studying the polar cap environment to model polar cap conditions for a variety of solar wind and magnetospheric conditions. Finally, an attempt to order terms in a theoretical model of the polar cap will be made. This work is a continuation of work begun under F49620-77-C-0050.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0015, EARTHQUAKE SOURCE PARAMETERS AND TECTONICS IN ASIA

P. Molnar, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EAR77-23017)

Analysis of the tectonics of Asia using seismic data and LANDSAT photos will be continued. The seismic wave velocity structure of Tibet will be completed, fault plane solutions will be determined for events more recent than 1973, earth-

quakes in Asia will be relocated and a summary of the seismicity, including discussion of major events, will be completed. These data will be combined with detailed analyses of LANDSAT photos to determine the major active structures in Asia and their type and style of deformation. The areas of focus will first be the Tien Shan-Mongolia-Baikal region and then the Pamir and Burman regions. Some simple experiments will be carried out to try to understand the physical processes occurring in continents with layers of light, wet plaster overlying heavier, more fluid barite. These experiments will allow isostasy to hold and stress to be transmitted by the buoyancy of the thickened 'crust'. A series of simple numerical experiments will be carried out to explore the effects on the state of stress due to gravity acting on horizontal density gradients (mountains) and to explore further the slip line field analogy with Asian tectonics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0016, METEOROLOGICAL STUDIES

L. Burke, Regis College, Undergraduate School, Dept. of Mathematics, *235 Wellesley St., Weston, Massachusetts* 02193 (DF248460; F19628-77-C-0010)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of adequate information and techniques to meet military weather support requirements. Objective -improvement of dynamical theory and techniques for weather analysis and forecasting (task 2310G2)- acquire, process and analyze satellite imagery data to develop short range prediction techniques (task 667008), extend the modular automated weather system capabilities in weather observing and forecasting (task 667010). How research and development contribute - provide improved weather analysis, forecasting and observing techniques in the following areas - mathematical models of atmospheric processes (task 2310G2)- improvement of DMSP satellite imagery and techniques for using AFGL man computer interactive data access system (MCIDAS) (task 667008), development of real-time use of advanced weather observing systems and automated weather forecasts and warning techniques (task 667010).

Analytical and statistical techniques are applied to problems in atmospheric dynamics to select the most promising techniques and assessing their limitations (task 2310G2), acquire, navigate and archive selected samples of digitized satellite imagery data, correct data for various systems errors and analyze data in conjunction with other meteorological data (task 667008), test and improve a prototype modular automated weather system (MAWS) using data acquired at the AFGL Field Weather Test Facility (667010).

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0017, DATA ANALYSIS OF SCATHA BEAM OPERATIONS

H.A. Cohen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583210)

AF function - satellite communications and survivability. Deficiency - electrical charging of satellite at geosynchronous altitudes by ambient particles causes anomalous switching of electronic circuitry which reduces reliability and lifetime. Objective -determination of active charging and discharging characteristics of electron and ion charge ejection systems aboard the SCATHA satellite. How research contributes - will provide insight into the ability to control spacecraft charging using charge injection systems. This could lead to incorporation of active control systems on satellites which are potentially susceptible to severe degradation due to electrical charging.

Data from in-house testing and testing to be performed at the SCATHA satellite integrator's facility will be analyzed to determine checkout and initial modes of operation of the SCATHA charge ejection systems. Data from initial operations of the SCATHA charge ejection systems will be analyzed to determine subsequent operations which will maximize future data in terms of determining the optimal method of controlling spacecraft charging and providing maximum scientific information relating to the geosynchronous altitude plasma environment. All SCATHA data relating to charge ejection system operations will be analyzed in support of the SCATHA mission objectives of understanding causes and cures of spacecraft charging at geosyncronous orbit altitudes.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0018, LOWER ATMOSPHERE REMOTE SENSING ASSESSMENT

D. Fitzgerald, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582950)

AF function - low altitude aircraft operations. Deficiency - unexpected low level turbulence and wind shear effects can adversely affect flight safety and mission performance. Objective - to investigate methods for obtaining improved precision in measurement of low level wind parameters and temperature-humidity profile anomalies. How research contributes - advances in measurement will lead to better warnings of hazardous landing conditions and to improved support for near surface operations.

A detailed analysis will be made of the conditions of applicability of all identifiable low altitude remote sensing techniques. Inputs to the analysis will consist of published reports and engineering data combined with site visits to organizations actively engaged in the construction and use of equipment for remote sensing. Present operational experience regarding the utility and limitations of the various techniques will be determined. Approaches for further improvements in sensor performance will be identified and recommendations made for future lines of development of the most promising techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0019, MEASUREMENTS OF STRATOSPHERIC TURBULENCE OVER WATER

R.E. Good, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582820)

AF function - provide data to predict if there is a significant change in the environmental quality of the stratosphere as a result of flight of USAF aircraft and missiles. Deficiency - existing data on stratospheric transport is insufficient to accurately predict changes in stratospheric composition from small perturbations caused by aircraft and missile exhaust products. Objective - conduct and analyze balloon-borne observations of the characteristics of turbulence layers. How research contributes - measurements of the turbulence characteristics over level terrain, away from mountains will be compared to previous measurements over mountains. This data will then be used to derive representative mixing coefficients and stratospheric pollution residence times over the United States. This will result in more precise environmental impact assessment of AF flight operations.

A balloon platform is used to carry a corona turbulence sensor that measures the intensity and spectral characteristics of turbulence layers. The balloon will initially be allowed to rise to 90,000 ft. producing a vertical record of the location of turbulence layers. The balloon will then be forced to descend so to float in a turbulent layer for several hours to observe the time history of the turbulent layer. This will be repeated several times during the estimated ten hour mission. A total of two balloon flights are planned with launches from Florida flying across the Gulf to Texas and launch from Chico, CA, flying over the Pacific. Additional turbulence measurements will be performed using the recently developed smoke puff generator. These flights will be conducted at HAFB to thoroughly evaluate the new procedure.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0020, MM RADIOMETER IMPROVEMENT

D.A. Guidice, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580840)

AF function - communications and surveillance. Deficiency -techniques to forecast the proton energy spectra of solar flare-bursts require sensitive mm-wavelength observations. Present mm instrumentation (35 gHz) at Sagamore Hill is below state-of-the-art, a 35 gHz radiometer was not included in current RSTN equipment. Objective - to upgrade the Sagamore Hill mm-wavelength patrol equipment to improve sensitivity, this will then serve as the baseline for other RSTN units as needed. How research contributes - equipment upgrading and resulting improved sensitivity will lead to a more complete utilization of collected data for prediction.

The approach is to investigate the suitability, procure, test, and incorporate wide-band (greater than 100 mhz) intermediate-frequency components into the Sagamore Hill mm-wavelength radiometric instrumentation. Sensitivity will also be improved by incorporating suitable low-noise and/or low-loss waveguide components into the existing radiometer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, PRELIMINARY BEAM-PLASMA INTERACTION STUDIES

J.R. Jaspere, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583670)

AF function - satellite survivability, communications and surveillance. Deficiency - the characteristics of energetic charged-particle beams injected in the earth's ionosphere and magnetosphere are not understood well enough to assess the space-environmental effects produced by such beams. Objective - to develop knowledge of the injection, propagation, reflection and deposition of energetic electron beams in the earth's ionosphere and magnetosphere. How research contributes - will provide an understanding and review of the literature in the field and a recommendation of specific areas requiring further study.

The data and pertinent literature in the field will be surveyed. In an attempt to understand the data, preliminary calculations will be performed. Directions for future analytical work will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, NONLINEAR INVERSION ALGORITHM FOR SATELLITE-SENSED TEMPERATURE RETRIEVAL

J.I. King, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583090)

AF function - weather surveillance and forecasting, enhancement of probing techniques, weapons delivery. Deficiency - inability to exploit the full atmospheric sensing capability of Defense Meteorological Satellite Program (DMSP) over inaccessible or unfriendly territory. Objective - to develop data analysis and inversion techniques capable of extracting all the information regarding atmospheric structure inherent in the DMSP sounder data. How research contributes - nonlinear inversion accesses only valid atmospheric inferences by dealing solely with DMSP radiance data free from the contamination introduced by subjectively imposed constraints.

Nonlinear inversion has the attractive features of objectivity (no 'first-guess', prognosis, or climatological input is needed) and noise discrimination (data noise is inferred and isolated by the algorithm without smoothing requirements). The fast Laplace transform (FLT) technique will be programmed for real-time inversion of synthesized radiance data. Following that, a scaled transform theory will be developed capable of incorporating empirical atmospheric transmittance into the inversion algorithm.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, EQUATORIAL SCINTILLATION MODELLING STUDIES

J.P. Mullen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580920)

AF function - communications/navigation. Deficiency - signal fading range errors. Objective - to model the scintillation-producing structure of the equatorial ionosphere in order to predict communication satellite outages and errors. How research contributes - develops and tests predictive models of ionospheric scintillation.

Using actual data from Peru, Brazil and Ghana models are constructed and tested to predict SATCOM outages and error rates. Driving parameters are day number, local time, solar and geomagnetic activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, INCREASE CONTROL OF BALLOON VERTICAL MOTION

G. Nolan, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582760)

AF function - use of balloons to collect aerospace environment data. Deficiency - inability to control balloon descent rates to conform with experimental requirements. Objective - to obtain greater control of balloon descent rates by modification of the gas valve in present use and from flight tests acquire balloon response information. How research contributes - the development of a modified gas valve and information on its ability to program balloon descent rates will enable atmospheric sampling experiments to be conducted more efficiently by ensuring elimination of contamination and the acquisition of required descent rates.

The EV-13 gas valve has only two positions, full open and closed. Modification will provide a range of automatically controlled openings thus giving a higher degree of buoyancy control. This will allow one to counteract, to a degree not now attainable, the complex thermodynamic and aerodynamic effects on the vertical motion of balloons. If the goal of automatic control is not attainable the modification will provide incremental openings by command. Test flight data will determine the usefulness of these concepts and form the basis for new and improved flight procedures and capabilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, CATEGORIZATION OF SOLAR FLARE EVENTS DURING THE 20TH SOLAR CYCLE

M.A. Shea, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF248910)

AF function - survivability, solar effects on satellite and missile operation, detection, surveillance, and communications. Deficiency -inability to satisfactorily describe and accurately predict solar and precipitating particle events which affect the aerospace environment in which USAF systems operate. Objective - to identify and catalog solar particle events that occurred during the 20th solar cycle. How research contributes - a data base of comprehensive measurements of solar particle events must be acquired for future basic research necessary to improve the accuracy and reliability of the solar proton prediction technique. When the objective of this research is realized, a systematic and comprehensive solar particle event data base will exist from which phenomenology analyses can be undertaken to identify systematic difficulties in the current technique and areas where applied research may result in significant improvements. This research will contribute toward a data base on the solar particle portion of the energetic particle environment.

Energetic solar particle data acquired by both satellites and ground-based sensors for the 20th solar cycle are being acquired and examined for identification of discrete solar particle events detected at one astronomical unit. The primary satellite data from NASA sources are to be processed into standardized usable formats for systematic examination of the data. The following parameters are being identified for each event and for each sensor responding to the event, onset time, time of maximum intensity, magnitude of peak particle flux, and the duration

of the event. These events will be categorized in terms of their possible relationships with various solar phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, SHUTTLE INSTRUMENT DEVELOPMENT
M. Smiddy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580760)

AF function - surveillance, communications, and shuttle-plasma interaction. Deficiency - inadequate knowledge of the electrical properties of the ionosphere/magnetosphere system and of the interaction of the space shuttle with the environmental plasma. Objective - to design and fabricate instruments for: 1. Determining shuttle charging and current flow - wake and sheath properties. 2. To measure the flux, directional properties of ions and electrons in the energy range 0 to 50 eV. How research contributes - permits improved space vehicle design for communication and surveillance systems. Provides understanding of the dynamical processes in the ionosphere and magnetosphere and contributes to the understanding and solution of current flow problems on the shuttle.

Spacecraft charging monitors and low energy plasma monitors will be developed for flight on the space shuttle. Later, low energy plasma sensors will be designed for sub-satellite flight in the magnetosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, NITRIC OXIDE VARIABILITY IN THE MESOSPHERE AND LOWER THERMOSPHERE
W. Swider, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581120)

AF function - communications, surveillance and detection. Deficiency - inadequate knowledge of the nitric oxide concentration in the upper atmosphere. Objective - to provide better information on the distribution of nitric oxide at 80-200 km as a function of time, latitude and solar activity. How research contributes - nitric oxide is important to the ionic structure and is an IR emitter. Improved models of nitric oxide ionization variability at 90-200 km will help communication codes for computing transmission paths/absorption for LF-VHF. Improved models of nitric oxide variability will help also with Air Force IR surveillance and detection capabilities.

Ionic data measured by LKD and groups outside of AFGL will be compared with models developed in-house. Nitric oxide profiles will be derived from the requirement of reaching agreement between the model/models and data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, EXPERIMENTAL INVESTIGATION OF OPAQUE MINERAL OXIDES
S.E. Haggerty, University of Massachusetts, Amherst Campus, School of Natural Sciences & Mathematics, Dept. of Geology, *Amherst, Massachusetts* 01002 (EAR78-02539)

This project concerns an experimental investigation of the stability fields of opaque mineral oxides as a function of temperature and oxygen fugacity at a total pressure of one atmosphere. Experiments will be carried out in the system FeO-Fe2O3-TiO2. Experiments will also be carried out using natural mineral assemblages form kimberlites (opaques, silicates, and/or diamond), carbonatites (Mn-rich opaque minerals and carbonates), and Ca-Al-Ti-rich inclusions from the Allende meteorite.

These experiments will provide data that will allow a determination of oxygen fugacities extant during the crystallization of basaltic terrestrial magmas, oxygen fugacities necessary for the preservation of diamonds in kimberlites, and oxygen fugacities present during solar condensation - as represented by the Allende meteorite.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0029, INSTRUMENTATION FOR ACCELEROMETER DENSITY MEASUREMENTS
J.M. Ott, Wentworth Inst. of Technology, Undergraduate School, *550 Huntington Ave., Boston, Massachusetts* 02115 (DF278900; F19628-75-C-0051)

AF function - airborne surveillance and weapons delivery. Deficiency - accurate predictions cannot be made for ephemerides for low altitude operational satellites and missile targeting because of lack of adequate density data. Research - improved accelerometers and rocket instrumentation for accurate density measurements in the 35-140 km altitude range. How research contributes - density data in this altitude range can significantly improve the accuracy of satellite ephemeris and missile targeting calculations. Objective - the object of the proposed work is to upgrade the accuracy of rocketborne techniques and instrumentation used to determine mean model values and extremes of departure about mean values under varying atmospheric conditions. A major portion of the effort under this procurement will be directed toward optimizing sensors and sub-system performance for improved density measurements over the required range. Data from rocket launches will be utilized for progressive evaluation of contract objectives and accomplishments.

Work on this contract will provide a major transition in fabrication and payload integration of new rocket hardware for 10-inch falling spheres in addition to follow-on effort on accelerometers and specialized electronic sub-systems for the standard 7-inch sphere and the hi-ball densitometer. Instrumented rocketborne payloads will be used to determine neutral upper atmospheric density and temperature in accordance with Air Force requirements. Work will include- (a) applied engineering research and development with regard to related rocketborne sub-systems (b) fabrication, laboratory tests and calibration (c) environmental testing to insure payload integrity and (d) field support of rocketborne payloads launched at designated sites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, THE MORPHOLOGY OF STRATOSPHERIC PLANETARY WAVES
A.D. Belmont, Control Data Corp., *8100 34th Ave. S., Minneapolis, Minnesota* 55420 (DF056330; F49620-79-C-0160)

AF function - long range forecasting of meteorology and the state of the ionosphere are required to support flight and communications systems. Deficiency - little is understood of the dynamics of the upper stratosphere and mesosphere. Yet evidence is mounting that planetary wave patterns in that region are precursors of tropospheric changes. Ionospheric/tropospheric coupling, a popular topic, also suggests some interaction with that region of interest. Objective - to determine the planetary wave patterns in the stratosphere (16-55km) during the period 4/70 to 12/76 from satellite radiance data and to diagnose their spatial and temporal variations. Coupling with other layers is not within the scope. Contribution - improved understanding of the stratosphere, aid communications, possibly aid forecasting.

Satellite radiance data will be analyzed using regression techniques and available rocketsondes to determine average temperature in their stratospheric layers eq (3-13km). These spatial and temporarily distributed data will be spectrally analyzed to determine the contributions of wave numbers 1-6.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0031, AIRCRAFT MEASUREMENTS OF PLUME DISPERSION AND CHEMISTRY
W.M. Vaughan, Environmental Measurements Inc., *8506 Delmar Blvd., University City, Missouri* 63124 (68-02-2709; G603A-AA-178)

OBJECTIVE: To acquire the data base necessary for the development of control strategies for the reduction of ambient air concentrations of sulfates and nitrates, EPA will conduct a large scale program of discrete, intensive experimental field studies during the year FY 78-81; the proposed studies are identified by the acronym, STATE (Sulfur Transport and Transformation in the Environment). Air quality simulation models are the expected end product.

APPROACH: The contractor supplied two moving laboratory platforms for plume transport and transformation from the

Cumberland Power Plant in Tennessee. One platform was an instrumented aircraft and the other an instrumented van - Air Quality Moving Laboratory (AQML) - for measurements in the downwind plume.

PROGRESS: The aircraft has sampled and measured SO2, SO4 (continuous and integrated), B scat, NO, NO2, NH4, SF6 (continuous), hydrocarbons over 4 week period involving approximately 100 flight hours. Sampling and measurements were made for SO2 at the surface, SO2 and NO2 aloft by remote sensor (COSPEC), SF6 (continuous) and hydrocarbons. A data report on aircraft measurements was prepared with graphical representations of all continuous measurements, and tabulated values of filter sulfate and nitrate measurements. A report on the AQML results was also prepared, including analyses and discussions of results for selected sampling days. All data from both aircraft and AQML measurements are included in the STATE data bank.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0032, RELATIONSHIPS BETWEEN CERTAIN AIR POLLUTANTS AND VARIOUS METEOROLOGICAL FACTORS

N.M. Reiss, Rutgers the State University of New Jersey, New Brunswick Campus, Agricultural Experiment Station, Dept. of Meteorology, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (0005009; NJ00279)

OBJECTIVE: Examine: The feasibility of making quantitative determinations of average atmospheric concentrations of soluble salts using statistics derived from routine meteorological observations; the feasibility of making quantitative determinations of average oxidant concentrations, using statistics derived from routine meteorological observations.

APPROACH: Atmospheric concentrations of soluble salts will be determined by making use of the fact that these salts, because they change from solid particles to liquid droplets at discrete humidity values, affect the average visibility vs. relative humidity statistics for a given location. Oxidant concentrations will be determined by making use of the fact that days with high oxidants are known to have low visibilities as well. By isolating days of potentially high oxidant concentrations from an examination of historical weather maps, and examining the visibilities that occurred, one can estimate the oxidant concentrations.

PROGRESS: The results of our earlier research efforts, in which we found a highly predictable relationship between visibility and relative humidity, were used to reconstruct visibilities, and hence, particulate mass concentrations at Newark, N.J. back to 1948. Particulate measurements at Newark were begun only about 1966 and earlier data would be useful in establishing baseline values and in elucidating trends. It was interesting to note that, while visibilities at Newark have increased considerably over the years, much of this can be ascribed to humidity decreases caused by extensive nearby landfill operations, rather than to real improvements in air quality. Beginning in the late 1960s, however, there seems to have been some real improvements in air quality.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New Jersey

5.0033, NATURAL INFRASOUND COMPARED WITH ARECIBO INCOHERENT BACKSCATTER TO MONITOR THE LOWER THERMOSPHERE

D. Rind, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (ATM78-04587)

This grant funds the establishment of a microphone network near Arecibo, P.R. to record natural infrasound (long period sound waves). The infrasound recorded will be of about 5 sec period and is generated by interfering ocean waves in the seas surrounding the West Indies. Such low-frequency sound travels long horizontal ranges and vertical distances with little attenuation below about 110 km. It propagates beyond line of sight by one or more skips between the upper atmosphere (stratopause region or lower thermosphere) and the earth's surface, being 'reflected' from levels where the speed of sound equals or exceeds that at the surface. The horizontal trace velocity equals the acoustic speed at the reflection level. Because the latter speed is a function of temperature and wind, measurement of the trace velocity provides a useful measure of these atmospheric parameters. Furthermore, the sound amplitude provides information about the wind direction. This work will compare infrasound velocity determination with those computed from (Arecibo) incoherent backscatter observations of temperature and wind, as well as compare winds with those from a meteor wind radar (funded by NSF through a separate grant to Georgia Institute of Technology), thus calibrating such procedure against the others. It will also determine temperature and wind with the infrasound technique by combining its observations with those of backscatter observations of wind and temperature, respectively. From the continuous observation capacity of infrasound it will develop a climatology of lower thermosphere effects at this subtropical latitude.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0034, PHYSICAL AND METEOROLOGICAL CHARACTERISTICS ASSOCIATED WITH THE LIGHTNING DISCHARGE

R.E. Orville, State University of New York, Albany Campus, School of Science & Mathematics, Dept. of Atmospheric Science, *1400 Washington Ave., Albany, New York* 12222 (ATM78-05703)

The objectives of this research are: (1) Record the luminous component of the first lightning stroke during daytime. (2) Record the spectral emissions from lightning channel. (3) Development of a deep convection numerical cloud model for application to the Kennedy Space Center thunderstorms. (4) Analyses of DMSP satellite data to estimate global lightning frequency. (5) Investigate the polarity of cloud to ground lightning discharges.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0035, EVALUATION OF DIFFERENTIAL ABSORPTION LIDAR

R.J. Byer, U.S. Environmental Protection Agency, *Research Triangle Park, North Carolina* 27709 (DF336430)

To evaluate the capability of differential absorption lidar for remote (non-contact) sensing of environmental pollutants generated by Air Force operations. Presently available point monitoring sensors have proven unreliable/inappropriate for determining the contribution of airfield operations to local environmental quality. A DIAL system would provide an integrated pollutant map.

An existing differential absorption lidar (DIAL) system will be used on targets of opportunity to determine the suitability of DIAL measurements for mapping concentrations of pollutants including hydrocarbons and sulfur dioxide. Joint funding with EPA.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

5.0036, ELECTROOPTICAL TECHNIQUES FOR THE IDENTIFICATION AND CHARACTERIZATION OF AIR POLLUTANTS

W.F. Herget, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab., *Research Triangle Park, North Carolina* 27711 (G712B-BC-032)

OBJECTIVE: Manage, administer, and conduct research programs on the application of electrooptical instruments and systems for the identification and characterization of air pollutants from stationary and mobile sources.

APPROACH: The morphology and elemental composition of particles emitted from sources is determined by transmission

and scanning electron microscopy in conjunction with electron diffraction and microprobe measurements. High resolution infrared emission and long-path adsorption spectroscopy, laser-Doppler velocimeter and other remote sensing instruments are used.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0037, A COMPARISON OF SATELLITE IMAGERY AND CONVENTIONAL AERIAL PHOTOGRAPHY

W.A. Shain, Clemson University, College of Forestry & Recreational Resources, Dept. of Forestry, *Long Hall, Clemson, South Carolina* 29631 (0078326; SC-FR00-041)

OBJECTIVE: A comparison is being made of the effectiveness of satellite imagery and low-altitude color infrared aerial photographs in indicating negative recovery from a severe forest fire and the ability to detect these changes from remote sensing processes.

APPROACH: The subject area (approximately 40,000 acres) has been covered, mapped and analyzed by both aerial photographs and satellite imagery. The Com-Tal plotter was utilized for satellite imagery and standard photo-interpretation techniques were employed for the aerial photographs. When ground truth information is completed, the final analysis will be made.

PROGRESS:

SUPPORTED BY South Carolina State Government

5.0038, ALTITUDE DEPENDENCE OF SPACECRAFT CHARGING

A. Konradi, U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center, *Houston, Texas* 77058 (DF583480)

AF function - surveillance, communication utilizing satellites. Deficiency - satellites are degraded by electrical charge-up induced by the plasma environment. Objective - to determine the variation of spacecraft charging and space plasma as a function of altitude. How research contributes - knowledge of the altitude characteristics of charging will allow an assessment of the importance of spacecraft charging in affecting the overall AF mission in space. It will allow an extension of knowledge gained at geosynchronous orbit to other altitudes.

Data from various satellites available to the NASA Johnson Space Center will be analyzed in order to determine the level of spacecraft charging and corresponding plasma conditions as a function of satellite altitude. Statistics will be gathered on the percentage of occurrence of various potentials at different satellite locations and of the associated plasma conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0039, CONTINUING THEORETICAL INVESTIGATIONS OF PLASMA AND NEUTRAL GAS TRANSPORT PROCESSES IN THE IONOSPHERE

R.W. Schunk, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (ATM78-10501)

This grant funds theoretical investigations of the effects that plasma and neutral gas transport processes have on planetary ionospheres and atmospheres. Specifically, this work will: 1) derive diffusion and heat flow equations for a planetary ionosphere which are valid when there are large temperature differences between the interaction species, 2) derive a general system of transport equations which is based upon a bi-Maxwellian distribution function, 3) calculate time-dependent He ion density, temperature, and drift velocity profiles in the polar cap with allowance for heating due to convection electric fields, 4) study the dynamics of the high latitude F-layer with emphasis on understanding the composition changes that occur in the nightside electron density trough regions, 5) study plasma transport in the ionosphere above Stable Auroral Red arcs (SAR arcs) with the complete 13-moment system of transport equations, 6) obtain a numerical solution of the 13-moment of transport equations for the solar wind (H ion electrons) and the terrestrial polar wind (H ion, O ion electrons), and (7) obtain a numerical solution of the 13-moment system of transport equators for the neutral atmosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0040, A STUDY OF ION DYNAMICS AND RELATED EFFECTS AT MIDDLE AND HIGH LATITUDES

J. St. Maurice, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (ATM76-82323)

This grant funds a theoretical and data-analysis study of ion dynamics and related effects at middle and high latitudes. In particular, it funds: 1. Continuation of a study of non-Maxwellian ion velocity distributions in regions of fast ion convection at high latitudes, with emphasis on the effects of these non-Maxwellian distributions on measurements. Measurements to be analyzed include retarding potential analyzers and incoherent scatter radar. 2. A study of the dynamics and chemistry of fast convecting regions in the auroral ionosphere, using data from the Atmosphere Explorer satellites. 3. A study of chemical reaction rates, to determine how to interpret laboratory measurements of reaction rates for application to the ionosphere when non-Maxwellian velocity distributions are involved.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0041, DYNAMICS OF LARGE SCALE ATMOSPHERIC MOTIONS

J.R. Holton, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (ATM76-84633 A01)

It is proposed to develop numerical models to elucidate a number of features of the large scale circulation in the stratosphere and mesosphere. In particular it is proposed to use the semi-spectral primitive equation model which has been developed with support of NSF grant, ATM-74-21418, to investigate the following topics: (1) The minor warnings or stratospheric 'vaciliations' which occur on a quasi-periodic basis during the winter regime in both hemispheres, (2) The role of nonlinear wave interaction during major sudden warming events, (3) The response of the stratosphere to forcing at the tropopause using observed 200 mb geopotential heights as the boundary forcing, and (4) A three-dimensional simulation of the quasi-biennial oscillation including coupling with midlatitude circulations.

In addition, a separate study is planned in which a limited area primitive equation model will be developed to simulate the structure and energetics of tropospheric synoptic waves in the African region during GATE (GARP Atlantic Tropical Experiment).

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0042, STRATOSPHERIC RESIDENCE TIMES FROM CONTRAIL OBSERVATIONS BY SATELLITE

N. Rosenberg, Tel Aviv University, *155 Herzl St., Tel Aviv, Israel* (DF056130; F49620-79-C-0180)

AF function - all aircraft and rockets which operate in the stratosphere (approximately 10 to 50 kilometers altitude) deposit water and other combustion products which might adversely effect the natural composition and chemical balance of that region. Recently, there has been increased concern over the effects upon the stratospheric ozone which absorbs and protects the earth's biosphere from solar ultraviolet radiation. The Air Force is required to submit environmental impact assessment statements on all weapons systems which operate in the stratosphere. The public furor over the SST and B-1 was partially due to the concern over the possibility of zone depletion by engine exhaust gases. Deficiency-the turbulent mixing and larger

scale transport of the natural and man-made chemical species are important factors in modelling of the perturbed stratosphere. Several programs are underway to measure in-situ the concentrations and turbidity. However, little is known of regional values and few statistical models exist for total impact assessments. Objective - this research will investigate the possibility of using LANDSAT satellite images of aircraft contrails to determine stratospheric turbulence coefficients and evaluate the feasibility of using such data to develop a statistical model of eddy diffusivities and stratospheric residence times.

The contractor will search the LANDSAT archives for photos of aircraft contrails, estimate the number of photos required to locate sufficient such images for a second phase study, analyze the best six images located, and by digital analysis, determine radial growth characteristics, the altitude and relationship with known or estimated atmospheric parameters, and derive the eddy diffusivity for the six sample cases. The contractors results will be used to determine the feasibility of the follow-on study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, E-3A FLIGHT-SIMULATOR (FS) FOLLOW-ON TESTING & EVALUATION PHASE II

W.H. Nelson, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224270)

Assess the psychological fidelity of the FS. Assess the human factors engineering of the instructional features. Assess the capability of the FS to train the required tasks.

AFHRL/FTR will provide an on-site evaluation of the capability of the instructional features to provide a functional environment for training the flight crew - tasks including AFHRL collection, processing, and analysis of data. AFHRL report will include conclusions, recommendations, and deficiencies. AFHRL/SM support will process computer cards which will be mailed by the test team once per month and will provide tabulated summary descriptive statistics to USAFTAWC/TNX and AFHRL/FTR. AFHRL/FTR will provide quarterly and final analysis summaries to include, but not be limited to, deficiencies and conclusions/recommendations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, PULMONARY GAS FLOWMETER FOR ABNORMAL ENVIRONMENTS

L. Hall, Perkin Elmer Corp., *Pasadena, California* (DF320600; F33615-77-C-0607)

The purpose of this effort is to obtain a bi-directional respiratory flowmeter that will accurately monitor inspired and expired gas flow rates and volumes under dynamic conditions of increasing gravitational forces and varying altitude experienced by aircrew members. Currently available flow meters are either affected by dynamic variation in g forces, pressure, gas density, gaseous species, temperature or humidity. This produces large and unacceptable errors when evaluating environmental stressors on aircrew members. The present procurement contract seeks to overcome these errors by the use of new technology in this area. Use of the flowmeter will provide, more accurately, data on the effects of the stressors met in flight and for establishing biomedical criteria for the design and testing of life support systems.

The contractor shall furnish the necessary personnel, service, equipment and facilities to design, fabricate, test and deliver a pulmonary gas flowmeter for measuring pulmonary function under aircraft flight simulated conditions of changing pressure and gravity fields. The contractor will build a 'breadboard' model which will be tested and approved by USAFSAM before the final model is fabricated, tested and delivered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0003, AERODYNAMIC/INERTIAL RESPONSE ANALYSIS

P. Payne, Payne Inc., *Annapolis, Maryland* (DF325380; F33615-79-C-0527)

Seven percent of the major injuries that results from emergency escape from military aircraft under noncombat conditions are attributable to aerodynamic forces. Under combat conditions where the ejection velocities are higher, the windblast injury rate has been at least 26 percent. Solution of this problem requires that the escape system designer understand the characteristics of all of the forces that act simultaneously or sequentially on the crewmember during the escape process. The objectives of this research effort are to conduct an analysis of the aerodynamic and inertial forces acting on the human body during escape using available data to provide design criteria for protective equipment design and, where necessary, to improve the analytical methods and design future experimental efforts to substantiate these methods.

The research involves: 1. The consolidation and analysis of all available aerodynamic data on the human body with particular emphasis on extremity flail potential loads, 2. Adapting the consolidated data for use with the AMRL/articulated total body (ATB) model, computer model of an aircrewman's body, 3. Acquiring data on the inertial forces acting on the crewman due to the action of ejection catapults, rockets and aerodynamic decelerators, 4. Exercising the model using both inertial and aerodynamic data in comparison with actual USAF flail injury experience, and 5. Determining what additional experimental information is needed, and planning additional wind tunnel program (or programs) to obtain it.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0004, LDF 79-5, TARGET ACQUISITION UNDER VIBRATION AND HIGH GRAVITY FACTORS

A.P. Ginsburg, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325220)

The Air Force needs to understand target acquisition under the operationally important conditions of vibration and high gravity (g) forces. Vibration can cause a blurring of the perceived image and discomfort may interfere with observer attention and/or decision processes. High g-stress may also cause similar problems in addition to reduced peripheral vision. A series of experiments is proposed to determine the human spatial filtering properties and investigate the identification of simple and complex targets during vibration and high g-forces. Furthermore, detection and identification thresholds of targets of a stationary observer viewing vibrating targets, for example, on a vibrating display, will also be undertaken. Since the physics of the observer are different under those two conditions, then different results are expected for target detection and identification.

Devices capable of satisfying technical objectives are not commercially available. Presently available variable contrast devices capable of measuring contrast thresholds of objects will not withstand vibration. Thus, a variable contrast device capable of operation under sustained vibration and high g-stress will be created under contract. The initial design concept will be to use a cross Polaroid system that under operator, subject, or computer control, allows the change of contrast of any slide imagery without changing the mean luminance of the stimulus. Base line studies will determine the contrast sensitivity of sine wave gratings and the detection and identification of complex targets, e.g., aircraft, under static viewing conditions. The contrast sensitivity measurements will define the threshold contrast sensitivity of the subject. The data will be related to the detection and identification of complex objects. Next, studies will be made under conditions of vibration and induced high g-forces. The vibration platform and the centrifuge facility at AMRL will be used to create vibration and g-force conditions. The difference between the contrast sensitivity measurements under static and dynamic conditions will provide a quantitative description of visual sensitivity to certain spatial frequencies which in turn will be related to the differences between target detection and identification under those static and dynamic conditions. This

effort is supported by O & M contract documented under work unit No. 71840006.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0005, OPTICAL PROPERTIES OF WINDSCREENS

R.C. Seid, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321110)

To develop new measurement techniques for evaluating cockpit windscreen optical characteristics. To measure and quantify the optical characteristics exhibited by experimental and actual aircraft windscreens, using both existing and new optical measures. To analyze the optic performance of the design windscreens for the F-111 using computer ray-tracing techniques, assist in relating the optical characteristics of these, and similar, transparencies to specific functional effects on the human visual system (work unit 71841803). The ultimate product of this work unit will be to recommend a specific set of optical measures that will be used in acceptance testing of aircraft windscreens.

Historically, a number of optical tests have been devised in an effort to quantify the optical characteristics of windscreens. None of these measures has proven to be infallible. In the previous work unit (71841204) several new measures of windscreen optical quality were being explored. These included: multiple imaging, optical Fourier analysis, angular deviation, binocular disparity and birefringence coloration. By comparing optical measures made on the windscreens with pilot acceptance and/or visual performance (see work unit 7184-18-03) it will be possible to determine which of these optical tests correlates with vision. Predistorted panels have been fabricated to be used in relating optical measures to vision. Windscreens and new panels having different characteristics and geometrics will be used during the course of this work. The windscreen measurement lab and the image metrics facility will be used in accomplishing this work. Disciplines involved are optics, physics, and experimental psychology. Field data from F-111 windscreens will be obtained and compared with the optical measures developed for the previous work unit. Computer ray trace of the F-111 windscreen will be accomplished for determining design-inherent angular deviation, binocular disparity and multiple imaging. This will be compared with actual measures to determine how much of the problem is due to manufacturing and how much is inherent in the design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0006, USE OF THE C-5 A/C GROUND PROCESS SYSTEM FOR PROTOTYPING AUTOMATED MAINTENANCE SYSTEM APPLICATIONS (AMS) TEST PROGRAM

E.G. McFall, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF228320)

To modify the ground processing system (GPS), an advanced maintenance management system unique to C-5 aircraft, to incorporate twenty-two new maintenance management concepts, primarily in automation/distribution of existing maintenance forms and automated parts ordering. The changes will be incorporated incrementally into the GPS. An evaluation will be performed to determine the effectiveness of these changes in reducing administrative workloads, increasing visibility of management information and increasing overall operational effectiveness. Additionally, the modified system will be compared against a non-GPS maintenance system to enable evaluation for Air Force wide application. The specific objective of AFHRL's participation is to evaluate these concepts from a human factors standpoint (e.g., ease of use, confidence in system, training requirements) and to provide consultation in the design and execution of the overall evaluation.

New concepts will be implemented incrementally into the basic GPS and evaluated on the basis of operational impact and human factors. AFHRL will concentrate on the human factors investigation, to be accomplished by: (1) assisting in task analysis, (2) identifying human factors evaluation areas, (3) developing job tests and data collection forms, (4) monitoring data collection, (5) analyzing human factors data, and (6) reporting findings. Manpower engineering teams will be the primary data collectors for both the human factors data, and the operational system evaluation data. To insure a valid assessment of change impact (resulting from automation), to be projected for other GPS and non-GPS applications, it is necessary to measure the same tasks in a similar but non-GPS system. The McGuire AFB, C-141 maintenance organization has been selected for this purpose. This effort will begin in February 1977 with evaluation of present system. Analysis and development of the proposed system will be accomplished as implemented by MAC. Total evaluation will be completed by January 1980. More detailed milestones can not be specified at this time. They will be specified as the effort progresses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0007, EVOKED CORTICAL RESPONSES AS AN INDICATOR OF G TOLERANCE

M.M. Cohen, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881699)

To determine whether evoked cortical responses to visual stimuli can provide an objective, quantitative, reliable, and non-invasive indicator of human tolerance to g3 acceleration loads.

Changes of visual function such as decreased visual sensitivity, dimming of the visual field, peripheral light loss (PLL) and central light loss (CLL) have been shown to preceed the loss of consciousness (LOC) that can result when human subjects are exposed to excessive gz acceleration loads. Both the visual changes and the LOC are due to inadequate blood supply to the eyes and brain resulting from acceleration produced hydrostatic pressures in excess of cardiovascular capacities. Although Doppler flow techniques can provide objective indications of flow velocity, these techniques are sensitive to straining maneuvers on the part of the subject, and the resulting artifacts can make the interpretation of Doppler flow signals extremely difficult when the subject is not completely relaxed. In contrast, evoked cortical responses should reflect the integrity of the visual system, irrespective of straining maneuvers. In the proposed experiments, PLL, CLL, Doppler flow measures, and evoked cortical responses will be recorded and studied while volunteer human subjects are exposed to increased gz acceleration loads, both when the subjects are relaxed and when they perform L1 and M1 straining maneuvers. Changes in the evoked cortical responses will be correlated with the other physiological and behavioral parameters, and the efficacy of evoked cortical responses as an indicator of gz tolerance will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

6.0008, ANALYSIS OF CAREER MOTIVATION-CAREER POTENTIAL INDEX

E. Boyle, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Lackland Air Force Base, San Antonio, Texas* 78236 (DF233720)

The objectives of this effort are as follows: (1) to develop a data base for a longitudinal study of career motivation, (2) to determine changes in career motivation during first-term and the reasons for those changes, (3) to identify factors related to positive career motivation, and (4) to explore the feasibility of developing a career potential index.

A large sample (approx 30,000) of NPS airmen will be administered a biographical/attitudinal survey at the 12, 24 and 36 month points of their initial tour. Distribution and regression analyses, and chi square analyses will be accomplished to track career motivation and predictability of career intent/career decision.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0009, EVALUATION OF ITEM CHARACTERISTICS CURVE THEORY TO REDUCE BIAS AND INCREASE VALIDITY

H.E. Jensen, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234180)

Greater accuracy in estimating airmen ability levels through the use of an adaptive testing method and latent trait theory.

Approximately 1000 word knowledge and arithmetic operations items will be calibrated, obtaining the A, B, and C parameters. Items selected for inclusion in the adaptive test will demonstrate minimized racial bias. Tests will be administered to approximately 400 basic airmen who are designated for the 423, 426, and 431 career fields. Final school performance measures will be obtained and conventional and adaptive test scores will be correlated with these.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0010, PERIPHERAL CUES AND COLOR IN VISUAL SIMULATION

C.L. Kraft, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF054180; F49620-79-C-0030)

AF function - this research supports AF programs in aircrew training, particularly the flight simulator procurement program. Deficiency - the prudent procurement and use of expensive flight simulators requires knowledge about pilot visual processes, such as the types of peripheral cues needed to learn the landing task and the effect of color on this learning. Currently there is a deficiency in our knowledge about how these visual processes interact with learning complex tasks. Objective- this research will provide quantitive data on the effect of scene content complexity, color, and visual field on USAF pilot performance in the approach and landing phases of the operation of a very large aircraft. How research contributes - the results of this study should permit intelligent decisions to be made about the types of color and complexity needed in computer generated imagery visual scenes and the necessity of peripheral cueing displays (side windows) for student pilots.

A group of AF multi-engine pilots will be given a complete optometric examination and a series of special visual tests to evaluate stereo acuity, chromostereopsis, chromatic interval, and cyclophoria. They then will fly a number of approach and landings in a multi-engine aircraft simulator under various conditions of scene complexity, color and peripheral cueing. Performance ratings will be collected by expert judges as well as objective flight parameter algorithms. Data analyses will compare pilot performance under the different conditions of simulation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, HYDRODYNAMIC STUDIES OF THE NOVA OUTBURST AND RELATED OBJECTS

S.G. Starrfield, Arizona State University, School of Liberal Arts, Dept. of Physics, *Tempe, Arizona* 85281 (AST77-23190)

This research will be concerned with the cause and evolution of the nova outburst. Calculations will be made concerning the behavior of the material that is ejected from the star and the effect of accretion of material on the characteristics of the nova outburst. Thermonuclear reactions in the envelopes of neutron stars will be studied in an attempt to understand the transient X-ray sources that have been observed. Accretion of material onto neutron stars will be examined. There will be work concerned with the cause of the nova outburst and a study will be made of the effects of variations in the helium to hydrogen abundance ratio on the nova and dwarf nova phenomenon. An investigation of oscillations of novae will be made.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0002, SOLAR OSCILLATIONS

H.A. Hill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DF248760; F19628-77-C-0064)

AF function - communications, surveillance, detection, tracking. Deficiency - extremely limited knowledge of solar interior structure. Objective - determine the nature of possible solar oscillations and construct solar interior models based on these results. How research contributes - a detailed knowledge of solar interior structure is needed before accurate models capable of predicting the behavior of solar magnetic fields may be constructed.

Continue observations of solar oscillations with periods between ten and fifty minutes. Based on the derived amplitudes and frequencies of these oscillations solar interior models will be constructed. These models can then be used to investigate the origin of solar magnetic fields.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0003, CHATANIKA INCOHERENT-SCATTER FACILITY OPERATION AND COORDINATION

M.J. Baron, S R I International, Radio Physics Laboratory, *300 Ravenswood Ave., Menlo Park, California* 94025 (ATM72-01644 A06)

This grant funds the operation of the Chatanika Incoherent-Scatter Radar facility in Alaska for research into the quiet and disturbed auroral-zone atmosphere and ionosphere by the U.S. scientific community. Scientific questions to be explored include: 1. electron and ion densities and temperatures during quiet times and during times of auroral electron and proton bombardment, 2. behavior of the auroral-zone ionosphere during times of solar proton events, 3. winds and dynamical effects in the E- and F-regions, 4. relationships of observed phenomena in the auroral-zone ionosphere to geomagnetic variations, visible and infrared light emissions, and gravity and infrasonic wave activity.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0004, INHOMOGENEOUS AND ANISOTROPIC SYSTEMS

D.W. Hone, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DMR78-05926)

Research previously supported by DMR7302691.

Theoretical research in condensed matter physics will be carried out. The types of materials which will be studied will include lower dimensional magnetic crystals, pure and impure exchange coupled paramagnets, and surfaces. A major motivating factor will be the direct comparison with experiment, such as the interpretation of proton spin-lattice relaxation in tetramethylammonium manganese chloride in terms of a symmetry crossover phenomenon. The work on surfaces will be focussed on exploring charge exchange scattering and related problems on the charge states of protons driven through thin films of atoms sputtered from surfaces. Also, resistance fluctuations in thin metal films and inelastic electron tunneling will be studied. Continuing investigations of correlated atomic motion in high temperature paramagnets and superionic conductors will be pursued.

This research program is aimed at increasing our understanding of the behavior of a wide range of phenomena in a number of technologically interesting materials.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, THEORETICAL PARTICLE PHYSICS AND THEORY OF PHASE TRANSITIONS

M. Nauenberg, University of California, Santa Cruz Campus, Crown College, Dept. of Physics, *Santa Cruz, California* 95064 (PHY78-22253)

This work is in the field of theoretical physics, with emphasis on problems in statistical mechanics and elementary particle physics. In particle physics, the topics include the study of topological properties of the non-abelian gauge theories, models of quark confinement in both lattice and continuum approximations, and phenomenology of hard proton scattering. In statistical mechanics, the renormalization group will be applied to various phase transitions, such as spin glass transitions which have not yet been fully understood. Finally, problems in high-energy astrophysics relating quantum field theory and general relativity will be pursued.

This is the first year of a three-year continuing grant, previously supported under NSF grant PHY76-18598A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0006, THEORY OF STRONG CONFIGURATION INTERACTION IN ATOMIC TRANSITION

T. Chang, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (PHY78-09621)

A program of research in theoretical atomic physics will be initiated. This project is designed to develop a realistic theoretical approach for atomic transitions in metal atoms. The main effort will be concentrated on the study of autoionization processes which are dominated by the strong configuration interactions corresponding to the two-particle excitations. Special attention will also be given to the atomic transitions in ionic systems where accurate experimental measurements are either extremely difficult or practically inaccessible at the present time. The basic approach in this work is to extend and generalize Professor Chang's recently developed theoretical procedure which has already shown to be particularly effective in dealing with other important many-body interactions (or, equivalently, the configuration interactions) including the ground state configuration interactions, the intershell and interchannel interactions. The infinite number of configurations which contribute to the strong configuration interactions will be replaced by a finite number of configuration channels. The configuration interactions are then effectively taken into account by the coupling of these configuration channels in terms of a set of coupled differential equations similar to the ordinary Hartree-Fock equation which can be evaluated readily with existing computational techniques.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0007, HEAT PULSE STUDIES IN HELIUM AT LOW TEMPERATURE

J.U. Trefny, Colorado School of Mines, Graduate School, Dept. of Physics, *Golden, Colorado* 80401 (DMR77-25715)

Heat pulse experiments will be conducted in solid, liquid and gaseous helium at low temperature. An experimental study will be made of pulse-generated second-sound in solid helium-three and in helium-four rich mixture of helium-three and helium-four. Measurements, with improved temperature control, will be made of pulse driven first sound in gaseous helium-four, helium-three and helium-three and helium-four mixtures.

This is a continuation of research supported under DMR7202941 at Wesleyan University.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, LIGHT SCATTERING STUDIES OF SPIN-FLIP PROCESSES IN SEMICONDUCTORS AND OF ANOMALOUS PHASE TRANSITIONS IN INSULATORS

J.F. Scott, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (DMR78-02552)

Experimental studies of Raman scattering in solids previously supported by DMR76-04561 will be continued. Spin-flip scattering experiments will be carried out on the wide bandgap semiconductors ZnTe:As, ZnTe:Li, SiC:Al; and SiC:N. Emphasis will be given to measuring the dependences of the transition intensities and linewidths as a function of concentration near the Mott transition. Raman studies of dynamics of the second order phase transitions in BaMn1-xCoxF4 also will be done. Related structural studies will be carried out for TbP5O14 and Eu2SiO4. Three new effects will be emphasized in these studies: 1) ferroelectrically induced magnetism; 2) large dielectric anomalies proportional to sublattice magnetization near the critical temperature; and 3) anomalous acoustic phonon dispersion at incommensurate transition temperatures.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, RADIATION EFFECTS AND POINT DEFECTS IN INSULATING CRYSTALS

R.B. Murray, University of Delaware, School of Arts & Sciences, Dept. of Physics, *Newark, Delaware* 19711 (DMR76-08550 A01)

Experimental studies of the interaction of energetic charged particles with insulating crystals which were supported by NSF grant DMR-7608550 will continue. These studies are directed toward providing an understanding of radiation damage mechanisms, the processes by which defects recombine and the electronic processes that accompany defect formation in insulating crystals. Optical experiments will be used to study positive ion irradiation effects in potassium chloride and magnesium oxide. The effects to be investigated include ion track effects and defect recombination in potassium chloride. The damage dependence of the range for helium ion penetration also will be measured.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0010, CRYSTAL-FIELD EFFECTS IN MAGNETIC SYSTEMS

Y. Wang, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (DMR77-21539)

The advancement in experimental techniques in recent years have made the detailed measurement of crystal-field effects in a magnetic system possible which in turn demands a refined theoretical treatment. The development of accurate theoretical methods in treating magnetic systems where the crystal-field plays an essential role will be carried out. Examples of the physical systems are the rare earth compounds, especially the induced moment systems with singlet or nonmagnetic doublet ground states. Two methods will be used to study the crystal-field effects in these compounds. A Green's function theory which incorporates the correlations of fluctuations in a systematic procedure will be applied to the induced moment systems. The theory is expected to explain the line broadening in neutron scattering experiments, the behavior of the central mode, and the thermodynamic quantities such as magnetization, susceptibility, specific heat, and the critical temperature.

This is a continuation of research supported under DMR7302318.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, THEORY OF COMBINED SYNCHROTRON, CERENKOV, AND TRANSITION RADIATION

W. Tsai, University of Miami, School of Arts & Sciences, Dept. of Physics, *Miami, Florida* 33124 (PHY78-01305)

A program of research in theoretical physics will be initiated to improve our understanding of electromagnetic radiation processes. Even though synchrotron, Cerenkov, and transition radiations are well known and have been extensively studied in the past, the importance of their combined effects has not been recognized until recently by Tsai and his collaborators. The new features emerging from the interference among these radiation processes can be applied to the study of plasma physics, solid state physics, astrophysics, as well as to the design of new high energy counters. Theoretical effort is needed to provide guidance for the design of experiments to exploit these new efforts.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0012, PLASMA VORTEX STRUCTURES

D.R. Wells, University of Miami, School of Arts & Sciences, Dept. of Physics, *Miami, Florida* 33124 (PHY77-07106 A01)

The research project in plasma physics is concerned with the study of naturally occurring, self-ordering stable plasma structures. These structures are investigated theoretically and experimentally. The theory is concerned with an application of variational principle and the use of appropriate constraint integrals which correspond to the physics of the experiment. The total 'free' energy of the plasma structures is varied subject to these constraints in order to find the most stable plasma configurations. The determination of appropriate and complete sets of constraints for various situations is of current interest. The resulting equations of motion for the plasma are compared to experimental results.

The particular plasma structures currently under investigations are generated by conical theta pinch guns. The resulting plasma vortex structures are guided to the center of a primary magnetic mirror. They are then compressed and amplified by adiabatic compression, utilizing a secondary magnetic mirror system. Various plasma diagnostics are used to determine plasma temperature before and after compression. Secondary compression by magnetic vacuum fields as high as 120,000 Gauss is currently under investigation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0013, A COOPERATIVE RESEARCH PROGRAM IN ELECTRON SPECTROSCOPY OF ATOMIC COLLISIONS IN SOLIDS AND GASES - THEORY AND EXPERIMENT

M.G. Menendez, University of Georgia, Franklin College of Arts & Sciences, Dept. of Physics, *Athens, Georgia* 30601 (INT77-01314)

This award provides support for three U.S. scientists to visit Argentina to conduct research in cooperation with Argentinian scientists using the facilities of the Bariloche Atomic Center in San Carlos de Bariloche, Argentina. Under the U.S.-Argentina Cooperative Science Agreement the Argentinian Government is also providing funds for the purchase of equipment to be used in this cooperative effort and for a visit by Argentinian scientists to the U.S.

In this project the scientists will study doubly differential cross-sections of the secondary electrons emitted when beams of ions or atoms collide with solid and gaseous targets and the ionizations caused in the targets by the bombarding beams. Secondary electrons are emitted by the target when it is struck by a beam; they are important in vacuum tubes, cathode ray tubes, space probes and other devices. The ionizations caused in target by a bombarding beam are of importance in atmospheric models, particle detectors, and radiation damage in living tissue.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0014, DEVELOPMENT OF SCANNING PROTON MICROSCOPY

R. Levisetti, University of Chicago, Graduate School, Dept. of Physics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (PCM77-00464 A01)

A 65 keV, low resolution (approximately 1000 A) scanning transmission ion microscope (STIM) with a hydrogen ion beam from a field ionization source has been developed. Several of the anticipated new imaging methods based on ionic interaction have been qualitatively but successfully explored. We wish to pursue the development, in a balanced approach between technological advance and a systematic program of study of the ion beam-specimen interaction. Future plans include: a) A systematic program of measurement of qualities relevant to the understanding of the image contrast based on ionic interactions. Use of a magnetic spectrometer will enable the separate detection of the dark-field signals originating from proton-electron recombination (charge-exchange) and H2 ion dissociation used here as image contrast mechanisms. Emphasis in such studies will be on exploring the potential of the STIM in providing useful contrast related to chemical composition, of light elements in particular. b) To improve the resolution of the STIM. This will first be attempted using the gun-microscope presently available by reducing the beam aperture to the limit allowed by the field ion source brightness (resolution estimated at approximately 300 A). Secondly, a system already designed of einzel electrostatic lenses will be introduced in the optical column (resolution limit estimated at 50-100 A). The program endeavors to isolate those sources of image contrast which are unique to the interaction of a proton versus an electron probe. Significant application of the new instrument to biomedical and biological research is anticipated in particular to complement electron microscope observations with the anticipated unique sensitivity of the STIM to the hydrogen content in thin specimens.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral & Social Sciences, Div. of Physiology Cellular & Molecular Biology

8.0015, DEFECT INTERACTIONS IN CRYSTALS

A.V. Granato, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR77-10556 A01)

This research was previously supported under DMR 75-14726.

The main focus of this research is the investigation of dislocation-point defect interactions and the influence on these interactions of electrons, phonons and optical illumination. Ultrasonic attenuation will be studied in a variety of crystals in order to measure the nature of these interactions. Among the systems which will be investigated are (1) carbon in iron, (2) free interstitials in metals, (3) defects in irradiated metals and (4) impurity-interstitial complexes. The strength loss of superconductors and the strength increase of II-II compounds under optical illumination will be studied by means of ultrasonic measurements.

The development of theories to explain these effects will be continued. In particular, this will include the theory of long-range dislocation-point defect interactions and the effect of thermal fluctuations on amplitude-dependent internal friction.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, ULTRASONIC STUDIES OF MAGNETIC-FIELD DEPENDENT INTERACTIONS IN METALS

J.R. Franz, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DMR77-11160 A01)

An ongoing program of ultrasonic studies of magnetic-field dependent interactions in metals will be continued. New experimental techniques of very high sensitivity that have recently been developed will be used to investigate a wide variety of phenomena. Nuclear acoustic resonance experiments in dilute magnetic alloys will be carried out to detect and analyze satellite resonances caused by the interactions between the impurities and their near neighbors. Such experiments can be used to determine the electric field gradient and the net electron spin density at sites near the impurities. Small velocity shifts resulting from the nonresonant Alpher-Rubin interaction will be measured in Al over the temperature range 4-77 K and in magnetic fields up to at least 100 kG to investigate the onset of band structure effects, to look for effects of magnetic breakdown, and to try to understand anomalous phase reversals that have been observed in nuclear acoustic resonance experiments. Experiments will be carried out in tantalum to test the dependence of the Alpher-Rubin interaction on magnetoresistance. A nuclear acoustic resonance investigation of anisotropic Knight shifts in pure metals will also be done. Experiments are planned for both cubic and noncubic metals as well as studies of small velocity shifts in super-conductors.

This is a continuation of research supported by NSF grant No. DMR75-14355.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, THEORETICAL STUDY OF FUNDAMENTAL PROCESSES IN CONDENSED MATTER

W.L. Schaich, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DMR78-10235)

Research previously supported by DMR76-20034.

Theoretical research of fundamental processes in condensed matter will be carried out. Those areas to be investigated will include: (1) Electromigration. The theory will be extended in order to clarify questions of principle and to make it more quantitative. (2) Dispersion forces. The Lifschitz theory will be examined in the retardation regime in an effort to remove the current discrepancy between theory and experiment. (3) Surface reaction dynamics. The Brownian motion model will be used to further the understanding of desorption spectra. (4) Phonon transport. In order to understand the experiments in this field, theories will be developed to include the frequency-dependent effects of ballistic versus diffusive motion of phonons in crystals.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, NEW METHOD FOR INFRARED DETECTION

J. Weber, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (ENG77-28458)

A new method for detection of electromagnetic radiation in the far infrared portion of the spectrum is being investigated. Free electrons in the surface layers of a conductor are employed to coherently scatter infrared photons into the microwave region. The requirements for conservation of energy and momentum require the scattering to take place in a magnetic field inside of a superconducting shield at cryogenic temperatures. The new approach is promising for the wavelengths region from 1 millimeter to 100 microns. Detectors based upon this principle would prove useful in radio astronomy and communications.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Engineering & Applied Science

8.0019, AXISYMMETRIC SOLAR WIND THEORY

R.L. Carovillano, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Physics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (ATM77-11690 A01)

This grant will support a study of axisymmetric solar wind theory. The basis for the work is a new equation governing axisymmetric ideal magnetohydrodynamic (MHD) flow. The purpose of the work is to extend the analysis of the equation, to obtain analytical solutions, and to develop applications to the solar wind. Areas to be studied include: critical surfaces, mathematical properties of the equation and its solutions, analytical solutions, the variational principle from which the equation is derivable, perturbation theory, propagation of disturbances, the relativistic generalization of the equation, and applications to solar research such as coronal holes and the heliosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0020, SUPERGRAVITY, GENERAL RELATIVITY AND FIELD THEORY

S.J. Deser, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (PHY78-09644)

Research in theoretical gravitation and field theory currently supported under NSF grant PHY76-07299 A01 will be continued. A major effort will be directed toward a deeper understanding of the new subject of supergravity. This theory attempts to unify the treatment of space, time, and matter into a single entity. Among the topics to be investigated are: 1. Supergravity; 2. Vector gauge fields; 3. Solitons; 4. Quantum gravity; 5. Classical gravity.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, ENERGETIC PARTICLES AND MAGNETIC ACTIVITY

P.M. Hagan, Emmanuel College, Graduate School, Dept. of Physics, *400 the Fenway, Boston, Massachusetts* 02115 (DF582660; F19628-79-C-0102)

AF function - communications, surveillance and navigation. Deficiency - lack of understanding of magnetosphere and inability to predict solar particle effects on atmospheric and ionospheric conditions. Objective - define the charged particle population and magnetic field configuration in the interplanetary medium and the earth's magnetosphere developing models and characteristic indices.

Design, develop and fabricate hardware modifications for the AFGL magnetometer network interfacing hardware with system software and with the data processing programs to provide increased system reliability and ease of utilization. Design and fabricate hardware to measure energetic particle fluxes, to discriminate species and to perform energy analysis. Match instrumentation to available satellite rides performing integration and calibration as required. Analyze data returned or recovered emulsion packages and perform payload simulation studies to verify observed results.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

8.0022, TESTS OF THEORIES OF GRAVITATION

G.H. Pettengill, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (PHY78-07760)

Research in solar system observations about gravitational physics supported under NSF grant PHY72-05104 A05 will continue. Among the topics to be investigated are: 1) Perihelion advance of planetary orbits; 2) Principle of equivalence; 3) Test of possible time dependence of the gravitational constant; 4) Model of solar system - planetary topography, orbit of Jupiter, asteroids.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0023, PARTICLE THEORY

R. Arnowitt, Northeastern University, School of Liberal Arts, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (PHY78-09613)

The proposed research is in the field of the theoretical physics with emphasis on attempting to understand the interactions of elementary particles. Specific projects will be pursued in the areas of: Local Supersymmetry - The co-principal investigators propose to continue their investigation of unified gauge theories based on local supersymmetry. Research would involve the following topics: 1. An investigation of the particle content of gauge supersymmetry. 2. Examination of whether the Bianchi identities of the theory lead to a consistent treatment of higher spins. 3. Examination of particle phenomenology in the 'low' energy region (2 less than or approximately 10 to the 8th power GeV) arising from gauge supersymmetry. 4. Discussion of quantum loop corrections. 5. Examination of the k yields O limit of gauge supersymmetry and its relation to supergravity. 6. Discussion of non-perturbative methods for calculation of quantum corrections. Quantum chromodynamics - 1. Dynamical examination of instanton-meron phenomena and quark confinement. 2. Investigation of non-perturbative approximation to QCD (such as Hartree-Fock) which satisfies the non-Abelian Ward identities.

This work is a continuation of that currently supported under NSF grant PHY 76-11455 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0024, X-RAY SCATTERING FROM QUANTUM FLUIDS AND GASES

R.B. Hallock, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics, *Amherst, Massachusetts* 01002 (DMR77-07727 A01)

This research is a continuation of work done under DMR-7508630.

The static structure factor, S(K), of the quantum fluids helium-3 and helium-4 will be determined by X-ray scattering techniques. S(K) will be determined as a function of density at fixed temperature and as a function of temperature at fixed density. Specific goals are the testing of theoretical predictions for spatial ordering effects associated with the superfluid phase transition at T in helium-4. Work will be initiated for the gas phase of helium and accurate pair correlation functions will be determined for the first time.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, DESIGN, CONSTRUCTION, AND TESTING OF A SUPERCONDUCTING CYCLOTRON FOR HEAVY-ION RESEARCH

H.G. Blosser, Michigan State University, School of Natural Sciences, Dept. of Physics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (PHY76-83254 A02)

This work is the logical continuation of the work in progress under NSF grant PHY75-01080 A02 consisting of the design and construction of a superconducting magnet with an azimuthally varying field and very high field strength. The high field (5 Tesla) will be accomplished by using superconducting wire in the coils. The object of the project is to produce a high-field magnet of sufficiently high quality to serve as the main magnet of an isochronous cyclotron. The magnet was designed to be full scale, allowing it to serve as the basis for a complete cyclotron if the specifications were met.

This grant will extend the feasibility study to the design and construction of the necessary subsystems (RF acceleration voltage, ion source extraction system, etc.) to make a functioning cyclotron. Sufficient auxiliary equipment will be provided to allow for extensive studies of the use of beams provided by the accelerator as nuclear probes.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0026, POSITRON INTERACTIONS WITH ATOMS AND MOLECULES

W.E. Kauppila, Wayne State University, School of Liberal Arts, Dept. of Physics, *4841 Cass Ave., Detroit, Michigan* 48202 (PHY77-18760 A01)

A low-energy and highly monochromatic positron beam has been developed and used to initiate a complementary program of research involving the collisions of positrons with atoms and molecules.

The present measurements will be continued with increasing emphasis being placed on investigations of possible structural features in total scattering cross sections, such as Ramsauer-Townsend effects, resonances, and behavior near inelastic thresholds. The program will also be expanded into new areas of positron research, including positron collisions with atomic hydrogen and alkali atoms, and differential scattering of positrons. Comparison measurements between positrons and electrons in the same apparatus are an important part of this research program.

This work is a continuation of that currently supported under NSF grant number PHY75-07165 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0027, THEORY OF QUANTUM FLUIDS

C.E. Campbell, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Physics & Astronomy, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DMR78-09226)

Research previously supported by DMR7614777.

Theoretical research in condensed matter physics will be carried out. The emphasis will be on the study of quantum fluids, with the aim of understanding their properties from a fundamental point of view.

The research will include: the structure and dynamics of liquid helium-four; the normal and pair-condensed phases of liquid helium-three; the liquid phase and lattice gas phases of adsorbed quantum fluids; the energy and structure of neutron and nuclear matter; the phase separation and spinodal decomposition of helium-three/helium-four mixtures; and the frequency dependence of the Raman scattering and fourth order dynamic structure function of room temperature argon gas.

The predominant theoretical approach will be the method of correlated basis functions and generalizations of Jastrow theory. In the systems to be studied, the most reliable interparticle potentials will be used, with a heavy emphasis on short-range correlations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, SPECTROSCOPY OF ALKALI ATOMS TRAPPED IN RARE-GAS MATRICES

L.C. Balling, University System of New Hampshire, University of New Hampshire, School of Liberal Arts, Dept. of Physics, *Durham, New Hampshire* 03824 (PHY78-05369)

This investigation in atomic physics will study the interaction between specific types of atoms as the distance between them (which can be controlled) is held constant. The energy-level structure of alkali atoms trapped in various sites in rare-gas matrices at liquid-helium temperatures will be determined. Pulsed one- and two-step dye laser excitation will be used to locate the excited states; the lifetimes of these states and the wavelength distribution of the luminescence will be observed. Comparisons of the experimental results with theoretical calculations, carried on concurrently, will be made to determine the nature of the trapping sites. The effect of the rare-gas matrix on the energy-level structure of the alkali atoms will be calculated, using the same techniques employed to compute alkali-rare-gas diatomic potentials.

This is a continuation of work supported by NSF Grant PHY74-05548 A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0029, THEORY OF PHASE TRANSITIONS IN RANDOM SYSTEMS

M.J. Stephen, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR78-10276)

Research previously supported by DMR75-13350.

Theoretical research in condensed matter physics will be carried out. The main emphasis will be on the application of renormalization group methods to phase transitions in random systems. Of particular interest are those systems exhibiting strong randomness near the percolation threshold. Among the topics to be considered will be (a) pure percolation problems, (b) phase transitions in random magnets near the percolation threshold, and (c) the conductivity of random resistor networks and its relation to phonons in a random lattice and spin waves in random ferromagnets.

This research will enhance the understanding of the behavior of an important class of materials, i.e., disordered solids, under conditions near a phase transition.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, PIEZO-OPTICAL DETERMINATION OF DEFORMATION POTENTIALS IN MULTI-VALLEYED SEMICONDUCTORS

F. Pollak, City University of New York, Brooklyn College, New School of Liberal Arts, Dept. of Physics, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (DN875773; N00014-78-C-0890)

Calculations of the properties of new semiconductor materials for use in electronic devices that find application in naval systems rely upon a number of material constants, many of which are unknown and difficult to determine. This program will seed to ascertain various parameters that affect transport in semiconductors.

An investigation of the stress-dependence of the optical absorption will be carried out in several III-V semiconductors. Wavelength modulated transmission from valence to conduction band. From the transition rates and the scattering processes, the absolute values for the electron-phonon and hole-phonon deformation potentials for intervalley processes can be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0031, THEORETICAL NUCLEAR PHYSICS

C.M. Shakin, City University of New York, Brooklyn College School of Science, Dept. of Physics, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (PHY77-05016 A01)

Research in theoretical nuclear physics initiated under NSF grant PHY75-06932 A01 will be continued. Topics to be investigated include: 1. pion physics; a. pion-nucleus scattering; b. pion creation and absorption; 2. deuteron-nucleus collisions; 3. many-body theory; 4. heavy-ion physics; a. foundations of TDHF theory for heavy-ion collisions; b. heavy-ion collisions at medium and high energies; 5. three-body problem at medium and high energies; 6. general scattering theory; 7. scattering of electrons by nuclei.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0032, SUPERCONDUCTIVITY IN TRANSITION METAL SUBSTITUTED A-15 SYSTEMS

F.J. Cadieu, City University of New York, Queens College, School of Liberal Arts & Science, Dept. of Physics, *65-30 Kissena Blvd., Flushing, New York* 11367 (DMR78-03217)

This is a continuation of work sponsored under DMR74-18138.

The A-15 phase of compound systems of the form (Nb1-yTy)1-xGex), where T is the transition metal atom Mo, Ti or Zr, will be synthesized via RF sputtering techniques. Metallurgical characterization will be accomplished by the use of X-rays and X-ray fluorescence techniques. Superconducting state parameters such as Tc and dHc2/dT will be determined from AC inductance data. Such data will be correlated with composition and microstructure to delineate those physical parameters which maximize Tc. Auger and electron loss spectroscopy will be used to obtain information about the effect of T-atom substitution upon N(O), the electronic density of states evaluated at the Fermi level. This work is important to our basic understanding of high (greater than 18K) Tc superconductors and will impact on energy related problems via large scale applications of high Tc superconductors.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, EXPERIMENTAL INVESTIGATION OF ELECTRON LOCALIZATION PHENOMENA IN DISORDERED SYSTEMS

D.F. Holcomb, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR78-10728)

Materials of interest in this investigation are disordered substitutional impurity systems which undergo an insulator-to-metal transition as a function of composition. The ability to reliably predict properties of a given material depends, among other things, upon firmly known answers to two questions: (1) What is the mechanism for electron localization in these materials? and (2) What is the correct model to use to describe electron transport in the regime of strong scattering of electrons, just at the transition concentration? Concerning the first question, experiments will be carried out to test the relevance of the Anderson localization model to the metal-insulator transition in semiconductor impurity systems, in sodium tungstate crystals, and a new class of untested materials. Initial experiments will use multiple doped crystals, Si:B, Al, Ga and Si:Li, P, as, to study the effect which a spread in the value of impurity binding potentials has upon the value total impurity concentration at which electron delocalization occurs. This value will be monitored by measurements of electrical conductivity and Hall constant at low temperature. Concerning question (2), studies of NMR relaxation times will be used to measure electron jump times as a function of composition and temperature, in order to study the evolution of the strong-scattering regime as one moves from delocalized to localized electron states.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, ELECTRONIC STRUCTURE OF HIGH-TEMPERATURE SUPERCONDUCTORS

S.J. Williamson, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (DMR76-02043 A02)

This is a continuation of work performed under DMR76-02043. Studies will be made of thermal expansion and the response to applied uniaxial stress of various A-15 crystals. Band model calculations for the A-15 crystals, based on a k.p approximation for bands near the corner of the Brillouin zone, will be made to attempt to account for the anomalous temperature dependence of the electrical resistivity of some A-15 crystals. These calculations will be extended to specific heat and certain elastic constants. The thermal expansion of single crystals of V3Si will be studied above and below Tc to test the predictions of the above model.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, MATERIALS SUPPORT TECHNOLOGY - STATISTICAL MECHANICS OF TWO-DIMENSIONAL ELECTRON FLUIDS

A. Isihara, State University of New York, Buffalo Campus, School of Natural Sciences & Mathematics, Dept. of Physics,

3435 Main St., Buffalo, New York 14214 (DN975472; N00014-79-C-0451)

Inversion layers at semiconductors surfaces are important in many electronic devices used in naval systems for communication, surveillance, command and control. This research will contribute to understanding of the fundamental properties of electrons confined in two-dimensional layers.

The investigator will study the properties of the two-dimensional electron fluid, with particular attention to the formation of the Wigner lattice, using a simplifying transformation deduced from an electrostatic analog to the dielectric function. Treatment of the zero temperature 2-D dielectric function will be followed by extension to finite temperatures, the correlation function, and the 3-D system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0036, MAGNETIC AND ELECTRICAL STUDIES IN N-TYPE SEMICONDUCTORS

T.G. Castner, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (DMR77-20450)

Experimental studies of the dielectric behavior, frequency-dependent conductivity, and magnetic behavior of heavily doped N-type semiconductors doped near the critical concentration for the onset of metallic behavior, which were previously supported by NSF grant DMR-7612586 will be continued. These studies should give new information concentration for the onset of metallic behavior, which were previously supported by NSF grant DMR-7612586 will be continued. These studies should give new information concerning (1) the origin of the unsatisfactorily explained negative magnetoresistance of heavily doped semiconductors, (2) the components of the single valley donor polarizability tensor, (3) the frequency dependence of the conductivity into the microwave region in the liquid-helium temperature range, and (4) the very low-temperature spin ordering and exchange interactions as a function of donor concentration. Capacitance measurements, magnetocapacitance measurements, piezocapacitance measurements using uniaxial stress, low frequency and microwave conductivity measurements, and magnetization studies yielding information on magnetic susceptibilities will be made. In addition to measurements in the 4 K to 1.1 K range, certain measurements will be made to 0.01 K in a dilution refrigerator. Magnetic fields up to 115 kilogauss will be employed. These studies will aid in understanding how donor wave functions behave in zero and large magnetic fields at concentrations close to the metallic transition and the nature of the conductivity processes involving these donor electrons.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, OPTICAL STUDIES OF SUPERCONDUCTING TUNGSTEN BRONZES

E.M. Brody, University of Rochester, School of Engineering & Applied Science, Dept. of Aerospace & Mechanical Science, *260 Crittenden Blvd., Rochester, New York* 14627 (DMR78-12993)

Raman and Brillouin inelastic light scattering and photoelastic modulation ellipsometry will be used to study the electron and phonon properties affecting superconductivity in the hexagonal tungsten bronze system AxWO3 (A equals K, Rb, Cs, Tl) as a function of composition and temperature. The Brillouin studies will probe for acoustic phonon softening and permit the determination of the single crystal elastic moduli. Ellipsometry will be used to determine the optical constants necessary to interpret the Brillouin spectra. This work is important for determining the properties of materials which govern their macroscopic superconducting behavior.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0038, POINT DEFECTS IN IONIC CRYSTALS - ROLE OF THE SURFACE CHARGE

L.M. Slifkin, University of North Carolina, Chapel Hill Campus, Graduate School, Dept. of Physics, *Chapel Hill, North Carolina* 27514 (DMR78-09198)

Surfaces of ionic crystals generally are electrically charged because of an excess of surface kinks of one sign. The compensating ionic space charge has a depth of about 0.1 micron, across which there is a potential difference often of about 0.2 volt. Very large perturbations of concentrations of point defects in this region give rise to a number of interesting and important effects. This phenomenon is being studied in the silver halides, which are attractive media because of the firm groundwork already established (a result of the importance of these effects to the photographic process) and also because the very high ionic conductivity of the space charge layer makes possible experiments not feasible with other materials. The following experiments are performed: (1) Space charge is studied by measuring the conductivity as a function of thickness of evaporated films, and of various adsorbed species. (2) Equilibrium concentrations, at various temperatures, of divalent dopants, are determined as a function of depth below the surfaces of single crystals. (3) An experiment not involving surface charge phenomena is suggested by the diverse ways in which iodide addition affects the properties of AgCl and AgBr photographic emulsions: elastically bound complexes between I and point defects are to be sought.

This is the first year of a three-year continuing grant.

It is a continuation of work supported by DMR 76-18862.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0039, HIGH RESOLUTION STUDY OF TWO-ELECTRON ONE-PHOTON INNER-SHELL TRANSITIONS

J.R. Mowat, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (PHY77-27526)

This project in atomic physics will study further the recent discovery of two-electron transitions within atomic inner shells. The principal observation is the detection of a high energy x-ray emitted when two electron simultaneously jump into pre-existing vacancies in the innermost electronic shell. The double vacancy can be produced by any one of several processes, the most efficient being a high speed ion-atom collision.

The initial objective of this research is to make-high-resolution spectral measurements of the x-ray accompanying two-electron transitions between atomic inner shells. A newly developed technique (Doppler-tuned spectroscopy), that is 100 times more precise than (but just as sensitive as) previous methods, will accurately test transition-energy calculations, and will, for the first time, clearly determine the electronic configurations from which these transitions originate. A second objective is to measure the intensities of the resolved features as a probe of the importance of the electron-electron repulsive force for inner-shell atomic structure.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0040, ELECTRONIC STRUCTURE OF CRYSTALS AND ALLOYS

B.S. Segall, Case Western Reserve University, Graduate School, Dept. of Physics, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (DMR76-21550 A01)

Research previously supported by DMR76-21550.

Theoretical condensed matter research will be carried out. The main areas of research will be the calculation of the electronic structure and some associated (e.g., optical and x-ray) properties of pure metals crystals and random alloys. Accurate electronic structure and useful wave functions will be obtained by the Chen-Segall parameterization scheme which utilizes a few pieces of empirical data. The coherent potential approximation approach will be implemented for the study of random alloys. The first alloys to be studied will be those of the CuAu and CuZn systems. It is also planned to study the ordered

Cu3Au and Beta prime CuZn phases of these systems. X-ray spectra of the alloys will be obtained. A study of the dependence of the surface electronic structure of one-dimensional semi-infinite crystals and films on the parameters of the problem (e.g., strengths and shapes of the 'atomic' and barrier potentials, film thickness) will be completed.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0041, MINORITY CARRIER INJECTION INTO MATERIALS CONTAINING TRAPS

H.K. Henisch, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR76-80619)

Experiments will be conducted on the voltage-current characteristics of metal-semiconductor and semiconductor-semiconductor contacts in two distinct operational regimes as regards trapping of injected minority carriers. The two regimes will be established by varying (a) the ambient temperature, and (b) the trap concentration, the latter through neutron bombardment and/or heat shock. Recently published theoretical treatments lead to the conclusion that trapping should play a major role in determining the voltage-current relationship in the forward direction, so much so that resistance increases have been predicted as a result of injection when the trap density is high enough. There are indications (from the published and unpublished results of other workers) that this is indeed the case, and the present project is intended as a designed experimental test under ideal conditions. Though effects related to surface states and effects related to bulk trapping cannot be unambiguously resolved by the measurement of a single voltage-current relationship, there should be no difficulty in resolving them by comparative experiments under distinctly different trapping probabilities, and by the in situ introduction of traps into a completed system. Germanium will receive principal attention, though it is also planned to perform comparative measurements on other single-crystal semiconductors.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0042, STATISTICAL MECHANICAL STUDIES OF PHASE TRANSITIONS

M.S. Green, Temple University, Graduate School, Dept. of Physics, *1821 N. Broad St., Philadelphia, Pennsylvania* 19122 (DMR78-07201)

Research previously supported under DMR74-01951. Theoretical research in condensed matter physics will be carried out. Statistical mechanics will be used to investigate the dynamics of first and second order phase transitions, the foundations of the equations of hydrodynamics, the nature of the critical point in a Van der Waals fluid and the mathematical properties of the renormalization group.

This research is focused on understanding the fundamental behavior of condensed matter near a critical point or phase transition.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0043, GENERAL RELATIVITY AND ASTROPHYSICS

P. Havas, Temple University, School of Liberal Arts, Dept. of Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (PHY77-28356)

A research program in theoretical gravitation will be initiated. Among the topics to be investigated are: A. General Relativistic Dynamics; 1. Test particles; 2. Approximate equations of motion. B. Relativistic Thermodynamics; C. Electromagnetic and Gravitational Waves in Curved Space; 1. Radiation from pulsating neutron stars; 2. Radiation from rotating neutron stars; 3. Gravitational and neutrino waves.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0044, NUCLEAR RESEARCH WITH TANDEM ACCELERATOR

R. Middleton, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (PHY78-01396)

This is a continuation of research presently supported under PHY77-03852 AO1. A program of Nuclear Science studies will be carried out using an upgraded FN Tandem Van de Graaff accelerator. Work will continue using a tritium source developed at the University of Pennsylvania to study a variety of (t, beta) and (t, alpha) reactions on nuclei ranging from 9Be to 209Bi. However emphasis will be on light nuclei. Also (t, p gamma) studies using coincidence methods will be carried out. Lifetimes for beta-decay of nuclei produced by the (t,p) reaction will be studied using a beam chopper. Spin assignments of levels in 20 He and 24 Mg will be carried out using 12C(12C, alpha) and 17C(16O alpha) reactions. Work in heavy ion reactions using silicon and calcium targets and beams will study high spin states. Angular correlations using (d, p gamma) reactions will give information on the details of nuclear reaction mechanisms. Some applications of nuclear techniques to astrophysics and archeology will be pursued.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0045, QUASI-ONE-DIMENSIONAL STUDIES - SPIN-PEIERLS TRANSITIONS AND NEW MAGNETIC COOLING SYSTEMS

J.C. Bonner, University of Rhode Island, School of Arts & Sciences, Dept. of Physics, *Kingston, Rhode Island* 02881 (DMR77-24136)

Theoretical research will be carried out on quasi-one-dimensional systems. These investigations will be directed towards the spin-Peierls transition, which has been observed experimentally in a new class of metallo-organic complexes with TTF (tetrathiafulvalene). A second focus of this research will be magnetic cooling studies on quasi-one-dimensional insulators. Previous theoretical studies have treated the magnetic inter-ionic interactions rather crudely, using approximate theories which frequently violate the third law. The models to be studied here do not have this undesirable feature, and will make feasible quantitative comparisons of theory and experiment.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0046, SOFT X-RAY APPEARANCE POTENTIAL STUDY OF ERBIUM

D.R. Chopra, East Texas State University, School of Science & Technology, Dept. of Physics, *E. Texas Station, Commerce, Texas* 75428 (T-643)

The soft X-ray appearance potential spectrum (SXAPS) of the M levels of erbium (Er) has been obtained in the 1400-1500 eV energy range with a nondispersive spectrometer which measures the derivative of the total x-ray fluorescence of an electron-bombarded sample as a function of bombarding electron energy. The spectrum represents the self-convolution of the density of unoccupied 4f orbitals in Er. The data supplement the information derived from photoabsorption spectroscopy but is applicable to the surface region. The M5 spectrum selectively arising from the M5 yields N7 transition has the appearance of a line absorption preceded by two shoulder-like peaks at about 2.3 and 1.3 eV lower energies and a step-like onset. The M4 peak lacks prominent structure and is rather weak, in agreement with the forbidden M4 yields N7 transition. The spectral features correlate well with photoabsorption spectrum and the density of states calculations. The results are interpreted in terms of the

relatively weak exchange interaction between the 4f electrons and 3d vacancies where the spin-orbit interval is prominent.

SUPPORTED BY Robert A. Welch Foundation

8.0047, ANISOTROPY IN ION COLLISION EXCITATION

D.A. Church, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (PHY78-26616)

An investigation of the production of anisotropically excited states in fast ions and atoms by collisions with gas molecules, and with solid and liquid surfaces, will be initiated. Controlled and analyzed surfaces and ion beams will be used to ascertain the effects of adsorbed gases, surface fields, scattering, and charge exchange on the excitation process. Coherence and coincidence measurements will be used.

This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0048, ELECTRON SCATTERING FROM ALKALI VAPORS

M. Fink, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (F-534)

Electron diffraction is a well established method to study molecular structures. Today with the development of more advanced techniques more accurate data are collected, and more precise structure parameters derived. Before one can take advantage of these new results, several peripheral questions have to be studied. Our attention was focused lately to the problem of intramolecular multiple scattering and its influence on the structure parameters.

This spring the multiple scattering theory, based on the Glauber approximation, was extended with the cooperation of Drs. Bartell and Kohl and applied to SF6 New diffraction cross sections with 30, 40, and 50 KeV electrons were recorded and analyzed. All internuclear distances were found to be energy independent and to be in very good agreement with properly corrected spectroscopic values. However, the mean amplitudes of vibrations varied with the electron energy. After the data were corrected for multiple scattering, the amplitudes agreed for all energies with one of the spectroscopic value. A second value based on optical results could be eliminated. New work is underway to study the temperature dependence of the mean amplitudes of vibrations and to compare our results with the calculations of Cyvin which are based on harmonic force fields.

SUPPORTED BY Robert A. Welch Foundation

8.0049, LOW ENERGY ELECTRON SCATTERING AND NUCLEAR CHEMICAL STUDIES

C.F. Moore, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (F-261)

Pion-induced single-nucleon removal to discrete final states has been measured. Gamma radiation from targets of 7Li, 9Be, 12C, and 16O bombarded by positive pion and negative pion at energies between 60 and 300 MeV was uniquely associated with states formed by removing a single nucleon by the (pi,piN) reaction. All yields were found to reflect the 3-3 resonance in the proton-nucleon system. Ratios of yields for negative pion and positive pion beams were measured for 7Li, 9Be, and 13C. These ratios were very similar to one another and to previous results on 12C, 14N, and 16O for neutron removal. The ratios of negative pion to positive pion induced neutron removal (or of positive pion to negative pion induced proton removal) is about half that predicted by a quasi-free scattering mechanism, and displays an energy dependence unlike these predictions. High resolution Ar-LMM and Kr-MNN Auger spectra produced by oxygen and chlorine ions incident on argon and krypton at several MeV have been measured and comparisons are made with spectra from lighter ion impact. The increase of the probability from light to heavy ion impact for MNn multiple ionization in Kr is found to be comparably lower than for the MNn multiple ionization in Ar. The heavy ion induced spectra show in both cases a satellite line structure which is assumed to result from initial states consisting of highly ionized outer shells and additional electrons being excited into high bound levels.

SUPPORTED BY Robert A. Welch Foundation

8.0050, FUNDAMENTAL PROPERTIES OF NONTHERMAL EMISSION MECHANISMS IN RADIO SOURCES

J.J. Broderick, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Physics, *Blacksburg, Virginia* 24061 (AST77-08013 A01)

The fundamental properties of nonthermal emission will be studied by radio astronomical techniques. The conditions required for the production of detectable nonthermal radio emission by stars, and the mechanisms by which it is produced, will be investigated by a series of complete radio surveys of 400 stars within 20 pc of the Sun. Sensitive surveys at 13 and 6 cm of several thousand galaxies brighter than mp equals 14.5 have been made and will be used to test current hypotheses relating radio structures and intensities to optical morphology, luminosities, and line spectra. Confusion-limited scans at 21 and 13 cm made in association with these surveys will be used to obtain statistical (P(D)) extragalactic source number counts and to detect possible anisotropy at the 1 mJy level. Very long baseline (VLB) interferometric observations of complete samples of extragalactic sources will be continued to isolate the effects of self-absorption and electron energy distributions on compact source spectra, and to relate source optical luminosity and morphology to radio core flux. Very long baseline pulsar data will be analyzed to yield unresolved calibration sources and information about the interstellar medium through a comparison of scattering sizes with dispersion measures. Interstellar scintillation observations will be made at low frequencies to find, or at least set strict limits on, possible high-brightness coherent emission mechanisms in extragalactic sources. The current research on optical identifications and spectroscopy of compact extragalactic sources will be continued. The nature of the hydrogen absorbing clouds in front of the quasi-stellar object 3C 286 and the BLLac object AO 0235 equals 164 will be investigated using spectral-line VLB techniques.

This is a continuation of work previously supported by NSF grant AST 77-08013.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0051, PARITY TESTS IN ATOMS

E.N. Fortson, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (PHY78-05897)

This is an experimental program in atomic physics. Experiments designed to look for a breakdown of parity conservation in free atoms can provide information about the neutral weak current interaction between electrons and nucleons. The present research is searching for optical rotation in atomic bismuth. Failure thus far to observe any such parity non-conservation in bismuth at the level predicted on the basis of Weinberg-Salem Theory of Neutral Currents indicates that the theory likely needs to be modified. To establish this important result more firmly and to test predictions of other weak interaction models, further optical rotation experiments with bismuth and with other elements will be carried out. These experiments should provide information that will complement neutrino studies of neutral current interactions at high energy.

This is a continuation of work currently supported under NSF Grant PHY74-17319 A05.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0052, SPATIAL ORDERING TRANSITIONS IN TWO-DIMENSIONS WITH APPLICATIONS TO ADSORBED SYSTEMS

M. Schick, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR77-21842)

The research program supported by NSF grant DMR 73-02582 will be continued and extended. Transitions in adsorbed systems to states in which the adsorbate is found in a spatially ordered array will be studied theoretically. Many of these transitions are in universality classes of current interests in the theory of phase transitions and critical phenomena. Theoretical methods previously developed will be applied to other classes of transitions. Investigation of systems with greater internal symmetries than those of adsorbed atoms will be conducted.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0053, ELECTRICAL CHARACTERIZATION OF GERMANIUM AND MAGNESIUM IMPLANTED GALLIUM ARSENIDE

F.L. Pedrotti, Marquette University, School of Liberal Arts, Dept. of Physics, *604 N. 16th St., Milwaukee, Wisconsin* 53233 (DF055130; AFOSR-79-0113)

AF function - microwave solid state devices are essential components of Air Force surveillance, electronic countermeasures and communication systems. The ability to tailor GaAs to device applications is greatly improved when we know the properties which result from the use of various ion species in the ion implantation process. Opportunity - increase the possibility of consistently producing N-type layers in GaAs with high free electron concentrations. Objective - the objective of this research is to perform characterization measurements on ion implanted specimens now being produced at AFDL/DHR. How work contributes - this work will provide feedback to establish ion implantation conditions to improve semiconductor materials for devices.

Hall/resistivity measurements and chemical etching will be used to determine electrical activation and mobility as a function implantation depth. Low temperature anneals will be used in the effort to determine the diffusion coefficients of the implanted ions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, THEORETICAL ASTROPHYSICS

R.D. Blandford, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST78-05484)

Theoretical and interpretative studies in topics of current astronomical interest will be carried out. Research that relates to radio astronomical observations will be emphasized. Specific areas that will be investigated include: (1) Models of superluminally expanding compact radio sources involving the propagation of shock waves; (2) Black-hole models of quasars; (3) Radio emission from Jupiter's magnetosphere; (4) Statistics of pulsars.

This is a continuation of research previously supported by grant AST 76-20375.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scin., Div. of Astronomical Sciences

10.0002, A STUDY OF PRE-FLARE POLARIZATION CHANGES IN SOLAR ACTIVE REGIONS AT 2.8 CM

R.N. Bracewell, Stanford University, Stanford Electronics Lab., *Stanford, California* 94305 (ATM77-09072 A01)

The Stanford radio interferometer has been used to map solar active regions at 2.8 cm wavelength. On one series of maps of an active region, the peak of the circularly polarized emission appears to be shifted towards the central meridian relative to the peak of the total intensity.

This study is to test the existence of this effect using the Stanford interferometer to map several active regions as they travel from limb to limb. The maps will show both the total intensity and the polarized emission. A comparison with photospheric magnetograms will contribute to elucidation of the structure of magnetic fields in the chromosphere and corona. Should a region flare during a mapping observation, which is likely, the flare pre-history will have been automatically recorded and changes in the polarization before, during and after the flare will be documented. If systematic pre-flare changes are observed a valuable clue to flare prediction may have been found.

The overall objective is to use radio observations to improve our understanding of solar flares.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scin., Div. of Atmospheric Sciences

10.0003, OPTICAL OBSERVATIONS OF CELESTIAL X-RAY SOURCES

C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST78-06873)

The research to be carried out on this grant will be concerned with ground-based optical observations of celestial X-ray sources. Observations will be made of the source Aquila X-1 in order to obtain information on the long-term optical and X-ray behavior of this source. There will be observations of the X-ray pulsar AO535 plus 26 in order to determine if it and other transient X-ray stars are binary systems. The X-ray source Sco X-1, which is the brightest X-ray source in the sky, will be studied. Observations at optical wavelengths will be obtained at the same time as observations are made at other wavelengths. High galactic latitude X-ray sources will also be examined. There will be simultaneous optical observations on X-ray sources as they are being scanned by the HEAO-1 X-ray satellite. A search will be made for the optical counterparts of Southern Hemisphere galactic X-ray sources. Finally, there will be optical studies of low-luminosity stars associated with Southern Hemisphere galactic X-ray sources.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scin., Div. of Astronomical Sciences

10.0004, INVESTIGATION OF THE 1-0 QUADRUPOLE SPECTRUM OF HYDROGEN IN ASTRONOMICAL OBJECTS

J.E. Gaustad, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST78-06715)

A study of the 1-0 rotation-vibration band of molecular hydrogen (H2) in astronomical objects will be continued. The goals of this study are: 1. to study the radial velocity and profile of the S(1) line in known H2 sources in order to understand the dynamics of the emitting regions; 2. to search for H2 in other astronomical objects and to map its distribution in them; in particular to study the relation of H2O maser sources and H2 emission; 3. to measure the intensity of different quadrupole lines in order to study their excitation.

A Fabry-Perot spectrometer will be used for the observations.

This is a continuation of grant AST76-80198.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scin., Div. of Astronomical Sciences

10.0005, STUDIES OF THE INTERSTELLAR GAS AND MAGNETIC FIELD

C. Heiles, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST78-06713)

Studies of the angular structure and kinematics of the interstellar gas, and of the interstellar magnetic field as revealed by Zeeman splitting of spectral lines will be continued. The combination of the Northern hemisphere Hat Creek Radio Observatory survey and Southern hemisphere surveys of the 21-cm wavelength line of interstellar atomic hydrogen will be continued and completed. The numerous shells of interstellar gas recently discovered by the University of California, Berkeley, radio astronomers will be observed in atomic emission lines in the optical, molecular emission lines in the radio, and the 21-cm wavelength line in both absorption and emission. The studies of the interstellar magnetic field will be continued and intensified by performing Zeeman splitting observations of the 21-cm line and the 18-cm hydroxyl (OH) molecular lines in both emission and absorption, and of ionized hydrogen recombination lines in emission. The Hat Creek 85-foot telescope will be used to start an intensive effort to detect the 3.5-cm wavelength line of the cosmologically significant helium isotope 3He ion by using high-quality electronics and long integration times. The Hat Creek telescope will also be used to begin in what is envisioned as a long-term program to locate dense regions within nearby dark clouds and with carbon monoxide (CO) concentrations in the galactic plane and the galactic interior, using the 3.3-cm J equals 1 yields O transition of cyanoacetylene (HC3N).

This is a continuation of grant AST74-17362 AO3.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, CHEMICAL FRACTIONATION IN THE SOLAR NEBULA AND THE FORMATION LOCATIONS OF CHONDRITIC METEORITES

J.T. Wasson, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Planetary & Space Science, *405 Hilgard Ave., Los Angeles, California* 90024 (EAR78-03336)

This project concerns a chemical investigation of chondritic meteorites which will define better what have been interpreted as chemical fractionation in the solar nebula and as fractionation that took place during the formation of planetesimals. The 'volatile' elements Au, Mn, Na, Ga, Ge, Zn, Cd, and In will be determined in CI, CM, CO and CV chondrites to establish apparent temperature-dependent fractionation trends in this group of meteorites. In addition, preliminary data indicate that systematic variations occur in the abundance of certain siderophile elements in ordinary chondrites. About 20 ordinary chondrites will be analyzed by INAA techniques for Ir, Ni, Au, and Ge, in order to test these trends.

The analytical results of this study will lend themselves to a more precise definition of the condensation history of the solar nebula and to the processes involved in the formation of planetesimals.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

10.0007, STUDY OF SOLAR AND ATMOSPHERIC NEUTRONS OF 2 TO 100 MEV AND GAMMA RAYS OF 0.5 TO 30 MEV

R.S. White, University of California, Riverside Campus, Inst. of Geophysics & Planetary Physics, *Riverside, California* 92502 (ATM77-08483 A01)

This grant will provide partial support for a search for solar neutrons of 2-100 MeV and gamma rays of 0.5 to 30 MeV and gamma rays of 0.5 to 30 MeV during solar flares and quiet times. It will extend the measurements of the earth's albedo neutron and gamma ray fluxes in latitude, angle and energy. These observations will be carried out on a four-day flight. The instrument to be used has high efficiency, excellent directionality, wide aperture, good energy resolution, and excellent background rejection. Additional calibrations will be carried out with gamma rays produced by protons bombarding targets at the Van de Graaff accelerator at California State University, Los Angeles. Data analysis on a previous flight from Palestine, Texas will be carried out. The data from two previous flights are being searched for gamma rays and solar neutrons.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0008, INVESTIGATIONS OF THE COSMOLOGICAL CONSEQUENCES OF ANTIMATTER

H. Alfven, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (AST76-15521)

The theoretical investigation of the consequences of Klein's hypothesis that the universe contains large amounts of antimatter will be carried out. The role of antimatter in cosmogony, including methods whereby it can be separated, and the scale of that separation will be explored. The observable consequences having matter and antimatter interacting and the relation of the cosmic X-ray background and recently observed sporadic cosmic X-rays will be considered. The cosmic X-ray background may arise from interpenetrating gas, and the sporadic X-rays may be caused by the collision between condensed normal and antimatter.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, STUDIES OF SOLAR AND MAGNETOSPHERIC PARTICLES

S.M. Krimigis, Johns Hopkins University, Applied Physics Lab., *Johns Hopkins Rd., Laurel, Maryland* 20810 (ATM76-81099)

This grant is for scientific studies of data on charged particle intensities, angular distributions, energy spectra, and compositions obtained with the Charged Particle Measurement Experiment built by The Johns Hopkins University Applied Physics Laboratory and carried aboard the NASA satellites IMP-7 and 8. Similar data from JHU/APL experiment on IMP-6 will be examined in conjunction with that from IMP-7 and 8. Data from other experiments on the same spacecraft will also be used on a cooperative basis with other investigators.

In general terms, the objectives of this study are to obtain new information and understanding of the electrodynamics and plasma physics of the terrestrial magnetosphere, interplanetary medium and the Sun. The specific studies will concern themselves with two areas: (a) The study of particle acceleration phenomena in the earth's magnetotail, with emphasis on plasma sheet and neutral sheet measurements of particle pitch angle distribution, charge, and energy spectra. Particular emphasis will be devoted to analysis of events from two or more closely spaced spacecraft. (b) A statistical and case-by-case study of the charge composition of solar particle emissions, particularly during active periods, and delineation of the dependence of composition on energy, flux level, location on the solar disk, spatial structure in the interplanetary medium, and interaction with the earth's magnetosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0010, ASTRONOMICAL RESEARCH - TO COMPILE AND PUBLISH A CATALOGUE OF STELLAR MOTIONS LARGER THAN 0.2 ANNUALLY IN ARC SECONDS

W.J. Luyten, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Physics & Astronomy, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (AST76-80612 A01)

Preparation of a catalog of stars with proper motions in the range 0.2 to 0.5 arc second per year will be continued. Under support of this award, the second and third part, covering the

sky between declination 30 degrees North and 30 degrees South, will be prepared and published. The survey for these stars of large motion has been carried out on pairs of plates taken with an interval of 10 to 15 years at Palomar Mountain Observatory using the 48-inch Schmidt telescope. Measurement was carried out with the automated measuring machine furnished by NASA.

Publication of the catalog will make available to the astronomical community material useful for kinematic studies of the sun's neighborhood, for selection of candidates for distance measurement, for studies of the luminosity function of the stars to faint limits, and for astrophysical studies of selected individual stars.

Prior support was by NSF grant AST 76-80612.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, THE STRUCTURE OF SYSTEMS OF GALAXIES

H.J. Rood, (No Performing Organization Reported), *New Jersey* (AST77-17958)

Research on the structure of systems of galaxies contributes to our knowledge of cosmology and the evolution of galaxies. This proposal is concerned primarily with investigations into problems related to groups of galaxies and groups of galaxy clusters.

Twenty-one centimeter hydrogen line profiles of galaxies in groups obtained at the National Radio Astronomy Observatory will be used in an extensive virial analysis of nearby groups of galaxies to establish their characteristic mass-to-light ratio, the origin of various correlations among virial parameters, and whether the groups are mostly bound or expanding in the Hubble flow.

As an extension of a previously published study on groups of clusters, large samples of Abell clusters will be used to determine if groups of clusters are randomly distributed in space, if properties of clusters depend significantly on whether they are group members, and if the dominant motion of clusters in groups is the Hubble flow.

This is a continuation of work done under grant AST 75-18667.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0012, FIELD-DEPENDENT COSMIC-RAY ANISOTROPIES IN INTERPLANETARY SPACE AT HIGH RIGIDITIES

V.H. Regener, University of New Mexico, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Hill N.E., Albuquerque, New Mexico* 87106 (ATM76-11743 A01)

This grant will continue studies of cosmic-ray anisotropies in interplanetary space surrounding the Earth, and of their dependence on the characteristics of the interplanetary magnetic field, using an expanded network of large underground cosmic-ray telescopes. This work is expected to yield information on cosmic-ray modulation at high energies, which can only be reached with underground detectors, as a function of the parameters of the interplanetary magnetic field, and of the solar magnetic field. The field-dependent anisotropies being investigated are particularly amenable to study in the forthcoming period of solar maximum. Support is being requested for the continued data acquisition, reduction and interpretation, as well as for the continued operation, for two years, of two currently operating large multi-directional meson telescope recorders (4 square meters each) at Embudo Cave, and Socorro, New Mexico; also for the installation and operation of a giant telescope (18 square meters) at a greater depth underground in Arizona.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0013, OBSERVATION AND THEORY IN THE DEVELOPMENT OF ASTRONOMY

B.R. Goldstein, University of Pittsburgh, School of Arts & Sciences, Dept. of History & Philosophy of Science, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (SOC77-23594 A01)

Dr. Goldstein is collecting and analyzing reports of medieval observations of the planets, the moon, and eclipses that survive in Hebrew and Arabic manuscripts for the elucidation of medieval observational techniques and for their potential use by modern astronomers. A search of these manuscripts for additional data on total solar eclipses and other celestial phenomena is also being undertaken.

This research will help to clarify the relationship between theory and observation as well as the way in which instruments were modified on the basis of observational experience in the history of astronomy. Furthermore, the historical records, particularly of eclipses, will help contemporary astronomers in their study of the secular acceleration of the earth and the moon.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral &
Social Sciences, Div. of Social &
Economic Science

10.0014, EMPIRICAL DETERMINATION OF THE CEPHEID AND RR-LYRAI DISTANCE SCALES (ABBREV)

T.G. Barnes, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-21316 A01)

A new method will be used to calibrate the classical Cepheid distance scale and the period-luminosity relation. Simultaneous photometric and spectroscopic observations will be made of these variable stars. The photometry will be used to determine the variation in angular diameter with phase. The spectroscopic and photometric measurements will be used to give the distance and the mean linear radius of each variable. A similar program will be crried out on the RR-Lyrae variable stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0015, A MAGNETIC-TAPE CATALOG OF SPECTROSCOPIC AND BIBLIOGRAPHIC STELLAR DATA

S.B. Parsons, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-20254)

The Bidelman file of spectroscopic information and references for about 50,000 stars will be put into machine-readable form at the University of Texas. The file covers much of the astronomical literature and contains much unpublished material not available in other major catalogs.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

GENERAL

11.0001, SCIENCE AND CIVILIZATION IN CHINA

J. Needham, East Asian History of Science Inc., *11 S. LaSalle St., Chicago, Illinois* 60603 (SOC79-06589)

This project will assist Professor Needham to complete, with the assistance of a number of collaborators, his monumental study of Science and Civilization in China. Four of the projected 7 volumes have already been completed. The first volume is essentially introductory. The next volume deals with Chinese philosophy and the development of scientific thought. The third volume begins the study of the scientific sciences, mathematics, astronomy, meteorology and the earth sciences. In the fourth volume physics and the engineering sciences are surveyed. The fifth is devoted to chemistry together with its many industrial and artistic applications. The biological sciences occupy the whole of the sixth volume. In volume 7 there follows a collective account of the special characteristics of sci-

ence in classical Chinese culture. Throughout the work the Chinese contributions are considered in relation to the achievements of other civilizations. Two questions are raised in this process: Why did modern science, the mathematization of hypotheses about Nature, with all its implications for contemporary technology, take its meteroric rise in the West only, at the time of Galileo? Why was it that between the first and the fifteenth century of our era East Asian culture was much more efficient than the European West in applying human knowledge of nature to useful purposes? Only an analysis of the social and economic structures of Eastern and Western cultures, not forgetting the great role of systems of ideas, will in the end suggest an explanation of both these things.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-25274* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 122
May 1980 96 p
(NASA-SP-7037(122)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 303 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1980. Author

N80-25275# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
AIRCRAFT INTEGRATED DATA SYSTEMS
Feb. 1979 363 p refs Partly in GERMAN and ENGLISH Presented at 9th Symp. on Aircraft Integrated Data Systems, Friedrichshafen, West Germany, 26-27 Sep. 1978
(DFVLR-Mitt-79-03) Avail: NTIS HC A16/MF A01

The following topics are covered: experiences with a flying data recording system, LEADS 200 engine parameter trend analysis, local fault detection on turbojet engines, localization of faults in jet engines through calculation of component characteristics, engine usage monitoring system, classification of operating conditions of turbomachines from solid-borne sound, reduction of measured data, the British civil aviation airworthiness data recording program, SYDAS flight data processing system, use of AIDS data at KLM, Navaid calibration evaluation, reconstruction of flight path, automatic fault identification system, processing of flight recorder data. For individual titles, see N80-25276 through N80-25290.

N80-25276# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
EXPERIENCES WITH A FLYING DATA RECORDING SYSTEM (FDRS) IN A GERMAN AIRFORCE FIGHTER BOMBER WING AFTER A TROOP TAIL c06
H. Harsch *In its* Aircraft Integrated Data Systems Feb. 1979 p 11-26 In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

A one year test of the LEADS-200 digital flight data recording and processing system was carried out. A description of both hardware and software aspects of the system is given. The test data are described and discussed in some detail. Emphasis is placed on accident and maintenance aspects and on the influence of flight safety and operational management. Author (ESA)

N80-25277# Technische Hochschule, Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
ENGINE PARAMETER TREND ANALYSIS BY LEADS 200: POSSIBILITIES AND LIMITATIONS c07
W. Koschel *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 29-55 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

Causes of fighter aircraft engine damage were analyzed with a view toward identifying engine components that should be monitored over the long term in order to ensure aircraft safety. The possibility of recognizing deterioration of these components using data from the LEADS 200 flight recorder system is discussed and illustrated by examples. Author (ESA)

N80-25278# Technische Hochschule, Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
INVESTIGATIONS ON LOCAL FAULT DETECTION AT TURBOJET ENGINES c07
H. Toenskoetter *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 57-83 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

Some results of experiments that simulated faults in a single spool turbojet engine are presented. The effect of small disturbances such as low compressor air bleed, a single removed turbine guide vane, or one plugged fuel nozzle are described as a function of local and averaged aerothermodynamic parameters. Author (ESA)

N80-25279# Technische Universitaet, Brunswick (West Germany). Inst. fuer Maschinenelemente und Foerdertechnik.
LOCALIZATION OF FAULTS IN JET ENGINES BY CALCULATION OF COMPONENT CHARACTERISTICS c07
G. Dahl *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 85-112 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

A method to calculate the component characteristics of single spool jet engines was developed using measured engine data. The method was tested by simulating a large number of different faults on a J-65 engine, recording measured engine data, and performing a fault diagnosis on the basis of the measured data. The method is capable of localizing single and multiple faults of arbitrary nature and magnitude. Author (ESA)

N80-25280# Rolls-Royce Ltd., Bristol (England). Aero Div.
THE ENGINE USAGE MONITORING SYSTEM (EUMS): AN HEURISTIC APPROACH TO COST EFFECTIVE FLIGHT DATA MONITORING AND ANALYSIS c07
F. Robinson *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 113-138 refs (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

An engine monitoring system is described that is capable of accurately measuring low cycle fatigue usage during service operations. Up to 16 parameters relating to engine reliability can be recorded at intervals of one half second. Author (ESA)

N80-25281# Technische Universitaet, Munich (West Germany). Inst. fuer Flugmechanik und Flugregelun.
RELATIONS FOR A FLIGHT PERFORMANCE COMPUTER c06
M. Kloster *In* DFVLR Aircraft Integrated Data Systems Feb.

1979 p 139-150 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

Formulas are discussed to approximate drag, thrust and fuel consumption as functions of altitude and Mach number. The flight performance in the case of steepest climb and greatest acceleration is derived. It is shown that the resulting equations can be numerically solved by a small onboard computer. The formulas are simplified in order to obtain analytic relations.
Author (ESA)

N80-25282# Karlsruhe Univ. (West Germany). Inst. fuer Thermische Stroemungsmaschinen.
CLASSIFICATION OF OPERATING CONDITIONS OF TURBOMACHINES FROM SOLID BORNE SOUND c07
D. Barschdorf, B. Stuehlen, and W. Mach *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 151-168 refs (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

A method is presented for continuously monitoring turbine engine conditions using acoustic signature procedures. Rotor synchronous measurement of accelerometer values and formal pattern recognition methods are used. Correlation between measured data and certain working or fault machine conditions is accomplished by data collection during a learning phase. Only small computers are needed to implement the method.
Author (ESA)

N80-25283# Technische Universitaet, Brunswick (West Germany). Inst. fuer Maschinenelemente und Foerdertechnik.
REDUCTION OF MEASURED DATA AND A METHOD OF EARLY DETECTION OF SENSOR BREAKDOWN c06
G. Dahl *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 169-185 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

Procedures were developed to prepare and reduce automatically recorded data in order to assess the reliability of sensors. The data were divided into blocks of constant levels and statistical methods were used to determine their mean value, standard deviation, and regression line. A strong increase in the variation coefficient is found to indicate sensor faults. Author (ESA)

N80-25284# Civil Aviation Authority, Redhill (England).
DESCRIPTION OF THE BRITISH CIVIL AVIATION AIRWORTHINESS DATA RECORDING PROGRAM c06
H. D. Ruben *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 187-214 (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

The application of routine operational flight recorder data to airworthiness problems and the maintenance of safety standards is described. The various ways in which the data have been analyzed is illustrated with examples. A brief history of airworthiness data recording is presented as well. Author (ESA)

N80-25285# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
THE SYDAS FLIGHT DATA PROCESSING SYSTEM c06
C. Dupuy (ENERTEC Schlumberger) *In its* Aircraft Integrated Data Systems Feb. 1979 p 215-235 (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

The use of the SYDAS system for the maintenance and safety of aircraft is described. Data from a variety of aircraft types is processed automatically and completely. Unique features of the system include both bit and frame synchronizers. A detailed description of the functions of the system during the data acquisition and reduction phase is given. Author (ESA)

N80-25286# KLM Royal Dutch Airlines, Amsterdam (Netherlands).
THE USE OF AIDS DATA AT KLM c06
R. A. Hartman *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 237-268 (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

A description is given of an aircraft integrated data system that is able to interrogate up to 350 parameters of some 40 aircraft systems. Sampled flight data is recorded and subsequently analyzed by special ground based computer programs. The use of the output of these programs by the engineering and operational departments to investigate incidents, aircraft and flight crew performance, and flight safety is described. Author (ESA)

N80-25287# National Aerospace Lab., Amsterdam (Netherlands).
NAVAIDS CALIBRATION EVALUATION WITH A COMPUTER-CONTROLLED AVIONICS-DATA ACQUISITION SYSTEM c06
F. J. Abbink and R. Krijn *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 269-311 refs (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

A computer system is described that allows the acquisition of aircraft flight data and their use to evaluate the applicability and accuracy of multi-distance measuring equipment positioning. The system was also used as a reference for the calibration of both Doppler and standard VOR stations in the Netherlands and for the calibration of an inertial sensor system. Finally, the system was used for the measurement of air traffic control radar signals. Author (ESA)

N80-25288# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfehrung.
THE RECONSTRUCTION OF FLIGHT PATHS FROM AIDS-DATA WITH THE AID OF MODERN FILTERING METHODS c04
U. Benecke and K. Hurrass *In its* Aircraft Integrated Data Systems Feb. 1979 p 313-326 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

A method is described that allows the reconstruction of the flight path of an aircraft in cases when a modern, airborne, autonomous navigation system is unavailable. The method uses the true airspeed, the heading, the VOR bearing, and the DME distance and applies optimum smoothing techniques. Data from a test flight are used to illustrate the method. Author (ESA)

N80-25289# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
AN AUTOMATIC FAULT INDENTIFICATION SYSTEM (AFIS) ON BOARD c06
H. Kalbe and F. Hildebrandt *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 327-344 In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

A device to monitor aircraft systems performance is described. Operation modes include the continuous monitoring of A/C systems, automatic fault identification, trend data sampling, and single signal interrogations. The system is operated onboard and results in improved maintenance activity, reduces the crew workload and leads to increased dispatch reliability.
Author (ESA)

N80-25290# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Rechenzentrum.
PROCESSING OF AIDS FLIGHT RECORDER DATA FOR A QUICK-LOOK WITH THE AID OF A HYBRID SYSTEM c35
H. Hoffmann *In its* Aircraft Integrated Data Systems Feb. 1979 p 34-362 In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

The translation of flight data recorder information into data which are stored in 12 bit words on IBM compatible magnetic tape is described. The translation makes use of a hybrid computer and passes through the following steps: active filtering, use of a one bit analog to digital converter, and change from serial to parallel data. Author (ESA)

N80-25291# General Accounting Office, Washington, D. C.
A DECISION BY THE SECRETARY OF DEFENSE IS NEEDED ON THE AV-8B AIRCRAFT PROG[illegible]
8 Feb. 1980 25 p

(PB80-143209) Avail: NTIS HC A02/MF A01 CSCL 01C

The estimated cost of the AV-8B aircraft program has increased greatly although little progress has been made in completing its development. Intense competition for Navy aircraft procurement funds between the AV-8B and the F/A-18 aircraft program has created an element of controversy that has caused proponents and opponents to develop strong arguments for and against the capabilities of the AV-8B. The Congress wants it, the Secretary of Defense is undecided, and the Marine Corps remains convinced that the AV-8B will provide it with the most effective close air support through the end of this century. A decision is needed by the Secretary of Defense. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-25292 Case Western Reserve Univ., Cleveland, Ohio.
STABILITY OF THE LAMINAR BOUNDARY LAYER ON A BLUNTED PLATE IN SUPERSONIC FLOW Ph.D. Thesis
Mohammad Mehboob Sartaj Khan 1980 251 p
Avail: Univ. Microfilms Order No. 8013846

The method of multiple scales is used to analyze the effects of bluntness on the spatial stability of a laminar supersonic flow over a blunt plate. The mean flow is formed as a composite of the boundary layer flow and the external inviscid flow over the blunted plate using the method of matched asymptotic expansions. The composite is modified to consider swallowing of the streamlines of the entropy layer by the developing boundary layer. Two length scales are identified to describe the nonuniformity associated with the flow normal to the body. One is related to the boundary layer thickness and the other to the thickness of the entropy layer which results from the rotational inviscid flow field produced by the bow shock ahead of the plate. The ratio of the two scales, epsilon, used as the perturbation parameter, is an index of the bluntness effects on the flow field at each streamwise location of the body. The value epsion $<<$ 1 indicates a boundary epsilon $>>$ 1, the boundary layer thickness greatly exceeds the thickness of the entropy layer. Dissert. Abstr.

N80-25293 Iowa State Univ. of Science and Technology, Ames.
A TWO-DIMENSIONAL UNSTEADY EULER EQUATION SOLVER FOR FLOWS IN ARBITRARILY SHAPED REGIONS USING A MODULAR CONCEPT Ph.D. Thesis
Richard Glenn Hindman 1980 84 p
Avail: Univ. Microfilms Order No. 8012966

A technique is described for solving supersonic fluid dynamics problems containing multiple regions of continuous flow, each bounded by a permeable or impermeable surface. Region boundaries are, in general, arbitrarily shaped and time dependent. Discretization of such a region for solution by conventional finite-difference procedures is accomplished using an elliptic solver which alleviates the dependence on a particular base coordinate system. Multiple regions are coupled together through the boundary conditions. The technique has been applied to a variety of problems including the shock diffraction and pointed wedge with detached bow shock. Dissert. Abstr.

N80-25294*# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
STUDY OF EXPERIMENTS ON CONDENSATION OF NITROGEN BY HOMOGENEOUS NUCLEATION AT STATES MODELLING THOSE ON THE NATIONAL TRANSONIC FACILITY Final Report
Peter P. Wegener May 1980 58 p refs
(Grant NsG-1612)
(NASA-CR-163217) Avail: NTIS HC A04/MF A01 CSCL 01A

A cryogenic wind tunnel is based on the twofold idea of lowering drive power and increasing Reynolds number by operating with nitrogen near its boiling point. There are two possible types of condensation problems involved in this mode of wind tunnel operation. They concern the expansion from the nozzle supply to the test section at relatively low cooling rates, and secondly the expansion around models in the test section. This secondary expansion involves higher cooling rates and shorter time scales. In addition to these two condensation problems it is not certain what purity of nitrogen can be achieved in a large facility. Therefore, one cannot rule out condensation processes other than those of homogeneous nucleation. E.D.K.

N80-25295*# Grumman Aerospace Corp., Bethpage, N.Y.
TRANSONIC FLOW FIELD ANALYSIS FOR WING-FUSELAGE CONFIGURATIONS Final Report
Charles W. Boppe May 1980 160 p refs
(Contract NAS1-14732)
(NASA-CR-3243) Avail: NTIS HC A08/MF A01 CSCL 01A

A computational method for simulating the aerodynamics of wing-fuselage configurations at transonic speeds is developed. The finite difference scheme is characterized by a multiple embedded mesh system coupled with a modified or extended small disturbance flow equation. This approach permits a high degree of computational resolution in addition to coordinate system flexibility for treating complex realistic aircraft shapes. To augment the analysis method and permit applications to a wide range of practical engineering design problems, an arbitrary fuselage geometry modeling system is incorporated as well as methodology for computing wing viscous effects. Configuration drag is broken down into its friction, wave, and lift induced components. Typical computed results for isolated bodies, isolated wings, and wing-body combinations are presented. The results are correlated with experimental data. A computer code which employs this methodology is described. E.D.K.

N80-25296*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
DEVELOPMENT AND VALIDATION OF A COMBINED ROTOR FUSELAGE INDUCED FLOW FIELD COMPUTATIONAL METHOD
Carl E. Freeman Jun. 1980 61 p refs Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
(NASA-TP-1656; AVRADCOM-TR-80-B-3; L-13363) Avail: NTIS HC A04/MF A01 CSCL 01A

A potential-flow panel method was modified to calculate the effects of a rotor wake on the time-averaged surface pressure and velocity distributions on a helicopter fuselage. The rotor-induced velocities are calculated by using a vortex-tube wake model. The calculated pressure distributions are found to compare well with experimental data obtained from tests of a wind-tunnel model. Author

N80-25297*# Lockheed-Georgia Co., Marietta.
EXPLORATORY STUDIES OF THE CRUISE PERFORMANCE OF UPPER SURFACE BLOWN CONFIGURATIONS. EXPERIMENTAL PROGRAM: TEST FACILITIES, MODEL DESIGN INSTRUMENTATION, AND LOWSPEED, HIGH-LIFT TESTS
J. A. Braden, J. P. Hancock, K. P. Burdges, and J. E. Hackett
Washington NASA Jun. 1980 111 p refs
(Contract NAS1-13871)
(NASA-CR-3192; LG77FR0028) Avail: NTIS HC A06/MF A01 CSCL 01A

The model hardware, test faciliteis and instrumentation utilized in an experimental study of upper surface blown configurations at cruise is described. The high speed (subsonic) experimental work, studying the aerodynamic effects of wing nacelle geometric variations, was conducted around semispan model configurations composed of diversified, interchangeable components. Power simulation was provided by high pressure air ducted through closed forebody nacelles. Nozzle geometry was varied across size, exit aspect ratio, exit position and boattail angle. Three dimensional force and two dimensional pressure measurements were obtained at cruise Mach numbers from 0.5 to 0.8 and at nozzle pressure ratios up to about 3.0. The experimental investigation was supported by an analytical synthesis of the system using a vortex lattice representation with first order power effects. Results are also presented from a compatibility study in which a short haul transport is designed on the basis of the aerodynamic findings in the experimental study as well as

acoustical data obtained in a concurrent program. High lift test data are used to substantiate the projected performance of the selected transport design. E.J.R.

N80-25298*# Computational Mechanics Consultants, Knoxville, Tenn.

AN INTERACTION ALGORITHM FOR PREDICTION OF MEAN AND FLUCTUATING VELOCITIES IN TWO-DIMENSIONAL AERODYNAMIC WAKE FLOWS Final Report

A. J. Baker and J. A. Orzechowski Washington NASA Jul. 1980 70 p refs

(Contract NAS1-14855)

(NASA-CR-3301; CoMCo-80-TR-1.0) Avail: NTIS HC A04/MF A01 CSCL 01A

A theoretical analysis is presented yielding sets of partial differential equations for determination of turbulent aerodynamic flowfields in the vicinity of an airfoil trailing edge. A four phase interaction algorithm is derived to complete the analysis. Following input, the first computational phase is an elementary viscous corrected two dimensional potential flow solution yielding an estimate of the inviscid-flow induced pressure distribution. Phase C involves solution of the turbulent two dimensional boundary layer equations over the trailing edge, with transition to a two dimensional parabolic Navier-Stokes equation system describing the near-wake merging of the upper and lower surface boundary layers. An iteration provides refinement of the potential flow induced pressure coupling to the viscous flow solutions. The final phase is a complete two dimensional Navier-Stokes analysis of the wake flow in the vicinity of a blunt-bases airfoil. A finite element numerical algorithm is presented which is applicable to solution of all partial differential equation sets of inviscid-viscous aerodynamic interaction algorithm. Numerical results are discussed. Author

N80-25299*# Aeronautical Research Associates of Princeton, Inc., N. J.

VISCOUS THIN AIRFOIL THEORY Final Report, 1977 - 1980

John E. Yates Feb. 1980 65 p refs

(Contracts NAS1-15936; N00014-77-C-0616)

(NASA-CR-163069; AD-A082744; ARAP-413) Avail: NTIS HC A04/MF A01 CSCL 20/4

The theory of oscillating thin airfoils in incompressible viscous flow is formulated and applied to the calculation of steady and unsteady loads on the family of symmetric Joukowski airfoils. The theory is reduced to the form of an integral equation with kernel function whose solution is obtained with a modal expansion technique familiar from flat plate thin airfoil theory. The effect of viscosity is to change the order of the singularity in the kernel function such that a unique solution is obtained for any cross sectional geometry without using an auxiliary uniqueness criteria like the Kutta condition or principle of minimum singularity. Viscous thin airfoil calculations for an airfoil with sharp trailing edge are in agreement with the results of potential theory with Kutta condition. Viscous thin airfoil steady and unsteady calculations for an airfoil with elliptic cross section are in much better agreement with experimental results. It is concluded that viscous thin airfoil theory is a practical tool for introducing simultaneously the effects of viscosity and geometric thickness in two dimensional unsteady aerodynamic theory. GRA

N80-25300# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

UNSTEADY PRESSURE MEASUREMENTS AT STALL AND BUFFETING

Peter Bublitz Apr. 1979 52 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-641)

(DFVLR-Mitt-79-09; ESA-TT-641) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 11,60

The fluid dynamics of stall and buffeting and their effects on elastic structures are described. Using a generalized form of the equations of motion and applying Fourier transformation techniques, the dynamical solution and the quantities that govern it are briefly discussed. The experimental apparatus and the measurement method are described in some detail and a few results relating to the measurement of stall on a trapezoidal stalled wing with and without strakes are presented. Author (ESA)

N80-25301# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.

HYPERSONIC SLIP-FLOW AROUND SLENDER ELLIPTIC CONES AT A SLIGHT ANGLE OF ATTACK Ph.D. Thesis - Technische Univ., Aachen

Panajotis Evangelou May 1979 126 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-644)

(DFVLR-FB-79-21; ESA-TT-644) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 19,20

A method is developed for calculating the hypersonic flow around slender elliptic cones at a slight angle of attack. The main equations are derived from the Navier-Stokes equations and energy conservation. The resulting system of partial parabolic differential equations is solved using an explicit finite difference scheme. A comparison is made with experimental data and other theoretical investigations. Author (ESA)

N80-25302# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.

DRAG MEASUREMENTS OF CONICAL AFTERBODIES AT SUBSONIC AND TRANSONIC SPEEDS

Helmut Esch 22 May 1979 65 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-646))

(DFVLR-FB-79-27; ESA-TT-646) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 10,40

The drag of open conical afterbodies of missile bodies was measured at angles of incidence up to 20 deg. The speeds were in the subsonic and lower transonic Mach range at Reynolds numbers, based on body diameter, between 500,000 and 1,300,000. At zero incidence, the results allow a drag optimization for constant afterbody lengths and for constant base diameters. Author (ESA)

N80-25303# National Technical Information Service, Springfield, Va.

AIRCRAFT WAKE VORTICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1980

Guy E. Habercom, Jr. Mar. 1980 288 p Supersedes NTIS/PS-79/0166; NTIS/PS-78/0122; NTIS/PS-77/0067

(PB80-805666; NTIS/PS-79/0166; NTIS/PS-78/0122; NTIS/PS-77/0067) Avail: NTIS HC $30.00/MF $30.00 CSCL 01A

Wake vortices and turbulent flow across aircraft lifting surfaces are investigated in the Government-sponsored research documents. Aerodynamic characteristics of vortices are reviewed with special attention made to trailing aircraft and aviation safety. This updated bibliography contains 281 abstracts, 23 of which are new entries to the previous edition. GRA

N80-25304# National Technical Information Service, Springfield, Va.

AIRCRAFT SONIC BOOM: EFFECTS ON BUILDINGS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1980

Guy E. Habercom, Jr. Mar. 1980 82 p Supersedes NTIS/PS-79/0265; NTIS/PS-78/0239; NTIS/PS-77/0219

(PB80-806334; NTIS/PS-79/0265; NTIS/PS-78/0239; NTIS/PS-77/0219) Avail: NTIS HC $30.00/MF $30.00 CSCL 01C

Research findings are cited on the effects of sonic booms on buildings, structural components, forms, windows, and walls. Test house investigations are included, along with damage analysis and vibration response. Documentation is made on residential buildings. Other topics contained in the volume range from theory to failure analysis. Sonic boom propagation and effects on biological forms, including human responses, are cited in separate bibliographies. This updated bibliography contains 75 abstracts, 1 of which is a new entry to the previous edition. GRA

N80-25305# National Technical Information Service, Springfield, Va.
PARACHUTES AND DECELERATORS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1974 - Feb. 1980
Guy E. Habercom, Jr. Apr. 1980 338 p Supersedes NTIS/PS-79/0368; NTIS/PS-78/0320
(PB80-806946; NTIS/PS-79/0368; NTIS/PS-78/0320) Avail: NTIS HC $30.00/MF $30.00 CSCL 01C

Citations describe devices such as towplates, balutes, servoactuators, patented mechanisms, semiautomatic openers, and release systems. Discussions are made of inflatable, supersonic, autorotor, retrorocket, and other structures. Descent characteristics, trajectories, aerodynamic reefing, shroud line and snatch forces, and flare engineering are included. Also presented are materials on flight testing, models, wind tunnel tests, and computer aided design. Applications are to target drone retrieval, air drop and delivery, coastal upwelling, sewage water tracking, and mine ventilation. This updated bibliography contains 332 abstracts, 24 of which are new entries to the previous edition. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-25306*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
EQUATIONS FOR DETERMINING AIRCRAFT MOTIONS FOR ACCIDENT DATA
Ralph E. Bach, Jr. and Rodney C. Wingrove Jun. 1980 24 p refs
(NASA-TM-78609; A-7913) Avail: NTIS HC A02/MF A01 CSCL 01C

Procedures for determining a comprehensive accident scenario from a limited data set are reported. The analysis techniques accept and process data from either an Air Traffic Control radar tracking system or a foil flight data recorder. Local meteorological information at the time of the accident and aircraft performance data are also utilized. Equations for the desired aircraft motions and forces are given in terms of elements of the measurement set and certain of their time derivatives. The principal assumption made is that aircraft side force and side-slip angle are negligible. An estimation procedure is outlined for use with each data source. For the foil case, a discussion of exploiting measurement redundancy is given. Since either formulation requires estimates of measurement time derivatives, an algorithm for least squares smoothing is provided. E.D.K.

N80-25307# Simula, Inc., Tempe, Ariz.
AIRCRAFT CRASH SURVIVAL DESIGN GUIDE. VOLUME 2: AIRCRAFT CRASH ENVIRONMENT AND HUMAN TOLERANCE Final Report, Sep. 1977 - Aug. 1979
D. H. Laananen Jan. 1980 11225 p refs Supersedes USAAMRDL-TR-71-22
(Contract DAAJ02-77-C-0021; DA Proj. 1L1-62209-AH-76)
(AD-A082512; TR-7820-Vol-2; USARTL-TR-79-22B-Vol-2; USAAMRDL-TR-71-22) Avail: NTIS HC A06/MF A01 CSCL 01/2

Background information is presented to assist designers in developing crashworthy U.S. Army aircraft. Aspects covered include the aircraft crash environment, human tolerance to impact, occupant motion during a crash, anthropometry, and crash test dummies. A.R.H.

N80-25308# Simula, Inc., Tempe, Ariz.
AIRCRAFT SURVIVAL DESIGN GUIDE. VOLUME 5: AIRCRAFT POSTCRASH SURVIVAL Final Report, Sep. 1977 - Sep. 1979
N. B. Johnson and S. H. Robertson Jan. 1980 228 p refs Supersedes USAAMRDL-TR-71-22
(Contract DAAJ02-77-C-0021; DA Proj. 1L1-62209-AH-76)
(AD-A082513; TR-7823-Vol-5; USARTL-TR-79-22E-Vol-5; USAMRDL-TR-71-22) Avail: NTIS HC A11/MF A01 CSCL 01/2

The aircraft environment following a crash is described as well as design techniques that can be used to reduce hazards. Topics covered include fires, crashworthy fuel systems, ignition source control, the fire behavior of interior materials, ditching survival, emergency escape, and crash locator beacons. A.R.H.

N80-25309# Civil Aeronautics Board, Washington, D.C. Office of Comptroller.
HANDBOOK OF AIRLINE STATISTICS: SUPPLEMENT Final Report, 1977 - 1978
Paul Gavel, ed. Dec. 1979 195 p
(PB80-138407; CAB-OC-79-01) Avail: NTIS HC A09/MF A01 CSCL 01B

A wide variety of annual traffic, profit and loss, and balance sheet data for each United States Certificated Air Carrier for 1977 and 1978 is presented. Other sections include chronologies of significant events effecting aviation, growth of the airline industry, miscellaneous air transport data, comparisons of air with other modes of transportation as well as carrier group data. It also contains information involving classes of air carriers other than the Certificated Air Carriers. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-25310 Radio Technical Commission for Aeronautics, Washington, D. C.
MINIMUM PERFORMANCE STANDARDS: AIRBORNE OMEGA RECEIVING EQUIPMENT
21 Sep. 1979 103 p Supersedes DO-164
(RTCA/DO-164A; DO-164) Avail: Radio Technical Commission for Aeronautics, Suite 655, 1717 H Street, N.W., Washington, D.C. 20006

Minimum performance standards for airborne omega receiving equipment are set forth. Incorporated within these standards are system characteristics that are felt to be useful to users of the system as well as designers and manufacturers. Compliance with these standards by manufacturers and users is recommended as a means of assuring that the equipment will satisfactorily perform its intended function under all conditions normally encountered in routine aeronautical operations. In any application of these minimum performance standards due allowance should be made where necessary for equipment in current use which does not fully meet these standards. Inasmuch as the measured values of radio equipment performance characteristics may be a function of the method of measurement, standard test conditions and methods of testing are recommended. E.D.K.

N80-25311 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
GRAVITY MODEL EVALUATION FOR PRECISE TERRESTRIAL INERTIAL NAVIGATION: A SYSTEM ACCURACY APPROACH Ph.D. Thesis
Robert Miles Edwards 1979 291 p
Avail: Univ. Microfilms Order No. 8010664

A statistical analysis technique based on a double integral expression of the navigation system error covariance is developed. Numerical algorithms were formulated to approximate the covariance, and the accuracy and efficiency of these algorithms were compared using a simple Schuler loop example analysis. An algorithm based on a pair of nested, single integrals (nested integrals) was shown to be more efficient than direct approximation of the covariance double integral and was selected for further

development. This nested integrals method was verified against linear state space covariance analysis results on a great circle trajectory and against Monte Carlo results on a hypothetical trajectory for an air-launched strategic missile. A 30:1 computational efficiency advantage over Monte Carlo was demonstrated. The error of linear state space analysis were demonstrated by violating the trajectory restriction. In a final development, the nested integrals algorithm was modified for Kalman filter updates of navigational estimates based on external measurements.
Dissert. Abstr.

N80-25312# Aeronautical Research Labs., Melbourne (Australia).
VISUAL PROBLEMS AND NIGHT LANDING GUIDANCE OF THE CH-47 (CHINOOK) HELICOPTER
B. A. J. Clark Nov. 1979 16 p refs
(ARL/SYS-TM-50; AR-001-781) Avail: NTIS HC A02/MF A01

Improvements and solutions are suggested in the aspects of reflections in transparencies and instrument cover glasses, cockpit lighting, instrument panel layout, and overhead transparencies. The requirements, history, and some brief trials of tactical night landing guidance systems are discussed and possible improvements to present devices and characteristics required of new devices are suggested. Further trials of night landing guidance systems should avoid unnecessary repetition of earlier trials. Improvements to the devices currently in use are necessary to improve operational effectiveness and flight safety. E.D.K.

N80-25313# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
GRAVITY MODEL EVALUATION FOR PRECISE TERRESTRIAL INERTIAL NAVIGATION: A SYSTEM ACCURACY APPROACH Ph.D. Thesis. Final Report, 17 Dec. 1976 - 15 Dec. 1979
Robert M. Edwards Dec. 1979 272 p refs
(AF Proj. 6095)
(AD-A082494; AFAL-TR-79-1231) Avail: NTIS HC A12/MF A01 CSCL 17/7

Inertial navigation has evolved to the point that the traditional gravity model is a principle error source in precise systems. Since future systems may require a more accurate gravity model, a statistical performance evaluation is needed to compare candidate models on realistic scenarios. The present methods of model evaluation are Monte Carlo, which is computationally costly, and linear state space covariance analysis, which has troublesome trajectory and statistical model restrictions. This research developed a new statistical analysis technique based on a double integral expression of the navigation system error covariance. Numerical algorithms were formulated to approximate the covariance, and the accuracy and efficiency of these algorithms were compared using a simple Schuler Loop example analysis.
GRA

N80-25314# Bendix Corp., Baltimore, Md. Communications Div.
MICROWAVE LANDING SYSTEM (MLS), PHASE 3. BASIC NARROW SMALL COMMUNITY CONFIGURATIONS, VOLUME 1 Final Report
Jun. 1978 357 p
(Contract DOT-FA72WA-2801)
(AD-A081233; MLS-BCD-R-2801-1-Vol-1) Avail: NTIS HC A16/MF A01 CSCL 17/7

This report describes the design, fabrication, and testing of a Basic (Narrow) and a Small Community configuration for the Microwave Landing System (MLS). A detailed description of the ground and airborne subsystems and equipments, and a summary of flight test data taken at the National Aviation Facilities Experimental Center (NAFEC) are presented. The sitings of the two configurations at NAFEC are described. A summary of the reliability and maintainability analysis is given; the detailed R M analysis is presented in Volume 2, Appendices B thru E. GRA

N80-25315# Bendix Corp., Baltimore, Md. Communications Div.
MICROWAVE LANDING SYSTEM (MLS), PHASE 3. BASIC NARROW SMALL COMMUNITY CONFIGURATIONS, VOLUME 2: APPENDICES Final Report
Jan. 1978 232 p
(Contract DOT-FA72WA-2801)
(AD-A081133; MLS-BCD-R-2801-1-Vol-2-App) Avail: NTIS HC A11/MF A01 CSCL 17/7

Appendix A describes the design considerations that were applied to the Rotman lenses used in a Basic (Narrow) and a Small Community configuration for the Microwave Landing System. Appendices B thru E contain a detailed reliability and maintainability analysis of the two configurations including the airborne equipments. GRA

N80-25316# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
COLORED MEASUREMENT NOISE DIGITAL PREFILTERING BY AVERAGING
Ranier Froriep Jul. 1979 40 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-640)
(DFVLR-Mitt-79-08; ESA-TT-640) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8

A digital prefilter is described which is used to increase the alignment speed of an inertial platform with a Kalman filter. The prefilter averages sampled measurement data with correlated noise data. The system operates with minimal storage requirements and only small computational effort. The choice of filter parameters is discussed using simulation techniques.
Author (ESA)

N80-25288# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfehrung.
THE RECONSTRUCTION OF FLIGHT PATHS FROM AIDS-DATA WITH THE AID OF MODERN FILTERING METHODS
U. Benecke and K. Hurrass *In its* Aircraft Integrated Data Systems Feb. 1979 p 313-326 refs In GERMAN; ENGLISH summary
(For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-25317 Southern Methodist Univ., Dallas, Tex.
A STUDY OF THE REINFORCEMENT REQUIRED FOR CUTOUTS IN AIRCRAFT SEMI-MONOCOQUE STRUCTURE Ph.D. Thesis
George Ronald Motley 1980 280 p
Avail: Univ. Microfilms Order No. 8012578

An automated solution procedure was developed which results in substantial savings in time and cost required for static, ultimate strength analysis of cutouts in aircraft monocoque structures. A specialized preprocessor was developed to use with existing software which automatically generates the bulk of the input data. A postprocessor was also developed which evaluates the results, revises member properties, and iterates until a near optimal solution is obtained. A fatigue analysis is also required for most cutout installations. Data to support fatigue analysis were extended by use of finite element methods to cover most common cutout reinforcement configurations. General fatigue design guidelines available in the literature were summarized. A third item to consider in development of any cutout reinforcement is the method of fabrication to be used for individual elements. Decisions should be based on relative costs of the various techniques available. A series of studies based in part on the cost of an actual cutout installation were completed and the results summarized to support future design efforts. Dissert. Abstr.

N80-25318*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LARGE-SCALE WIND-TUNNEL TESTS OF INVERTING FLAPS ON A STOL UTILITY AIRCRAFT MODEL

Terrell W. Feistel and Joseph P. Morelli Jun. 1980 56 p refs
(NASA-TP-1696; AVRADCOM-TM-80-A-1; A-7061) Avail: NTIS HC A04/MF A01 CSCL 01C

A unique inverting flap system was investigated on a large scale deflected slipstream model in the Ames 40 by 80 foot wind tunnel. The subject tests utilized 33% chord double-slotted flaps on a low aspect ratio wing that was fully immersed in the propeller slipstream. Evaluation of the flap effectiveness is aided by comparisons with the results of tests of other flap systems on the same twin propeller, twin tail boom STOL utility aircraft mode. No extreme or abrupt force or moment increments were encountered when the flaps were deflected through a wide range, corresponding to the complete retraction/extension spectrum. The lift and descent capability of the inverting flaps compared very favorably with that of the other flap systems that have been tested on this model, including some with much greater mechanical complexity. As expected, the flaps caused large nose down, pitching moment increments at the high lift settings; however, the trimmed characteristics are still competitive with those obtained from the more complicated flap systems. It is believed that these flaps may have promising potential application to the design of relatively simple STOL utility aircraft with improved performance capabilities. In addition, they may merit consideration as retrofits to existing aircraft with less effective flap systems. J.M.S.

N80-25319*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HIGH-SPEED T-38A LANDING GEAR EXTENSION LOADS
Arthur L. Schmitt Mar. 1980 17 p
(NASA-TM-58226; JSC-16497) Avail: NTIS HC A02/MF A01 CSCL 01C

Testing of T-38A landing gear extension at high speed and high altitude is described. The mechanisms are shown together with peak hydraulic pressure data during landing gear deployment with active and inactive strut door flaps. Results of strain gage measurements of stress on various structural members are included. Author

N80-25320*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT SERVICE EVALUATION OF AN ADVANCED COMPOSITE EMPENNAGE COMPONENT ON COMMERCIAL TRANSPORT AIRCRAFT Quarterly Technical Report, 1 Jan. 1976 - 31 Mar. 1976
15 Apr. 1976 180 p
(Contract NAS1-14000)
(NASA-CR-159286; QTR-3) Avail: NTIS HC A09/MF A01 CSCL 01C

The development and flight evaluation of an advanced composite empennage component is presented. The recommended concept for the covers is graphite-epoxy hats bonded to a graphite-epoxy skin. The hat flare-out has been eliminated, instead the hat is continuous into the joint. The recommended concept for the spars is graphite epoxy caps and a hybrid of Kevlar-49 and graphite-epoxy in the spar web. The spar cap, spar web stiffeners for attaching the ribs, and intermediate stiffeners are planned to be fabricated as a unit. Access hole in the web will be reinforced with a donut type, zero degree graphite-epoxy wound reinforcement. The miniwich design concept in the upper three ribs originally proposed is changed to a graphite-epoxy stiffened solid laminate design concept. The recommended configuration for the lower seven ribs remains as graphite-epoxy caps with aluminum cruciform diagonals. The indicated weight saving for the current advanced composite vertical fin configuration is 20.2% including a 24 lb growth allowance. The project production cost saving is approximately 1% based on a cumulative average of 250 aircraft and including only material, production labor, and quality assurance costs. E.D.K.

N80-25321*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL AND ANALYTICAL TRANSONIC FLUTTER CHARACTERISTICS OF A GEARED-ELEVATOR CONFIGURATION
Charles L. Ruhlin, Robert V. Doggett, Jr., and Richard A. Gregory (Boeing Commercial Airplane Co., Seattle) Jun. 1980 30 p refs Revised
(NASA-TP-1666; L-13544) Avail: NTIS HC A03/MF A01 CSCL 01C

The flutter model represented the aft fuselage and empennage of a proposed supersonic transport airplane and had an all movable horizontal tail with a geared elevator. It was tested mounted from a sting in the transonic dynamics tunnel. Symmetric flutter boundaries were determined experimentally at Mach numbers from 0.7 to 1.14 for a geared elevator configuration (gear ratio of 2.8 to 1.0) and an ungeared elevator configuration (gear ratio of 1.0 to 1.0). Gearing the elevator increased the experimental flutter dynamic pressures about 20 percent. Flutter calculations were made for the geared elevator configuration by using two analytical methods based on subsonic lifting surface theory. Both methods analyzed the stabilizer and elevator as a single, deforming surface, but one method also allowed the elevator to be analyzed as hinged from the stabilizer. All analyses predicted lower flutter dynamic pressures than experiment with best agreement (within 12 percent) for the hinged elevator method. Considering the model as mounted from a flexible rather than rigid sting in the analyses, had only a slight effect on the flutter results but was significant in that a sting related vibration mode was identified as a potentially flutter critical mode. Author

N80-25322# Texas Univ. at Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
THE INFLUENCE OF BALLISTIC DAMAGE ON THE AEROELASTIC CHARACTERISTICS OF LIFTING SURFACES Interim Report, 1 Feb. 1978 - 31 Jan. 1980
D. S. Scott, J. C. Westkaemper, A. Sigal, and R. O. Stearman Jul. 1979 201 p refs
(Grant AF-AFOSR-3569-78; AF Proj. 2301)
(AD-A082536; AFOSR-80-0220TR) Avail: NTIS HC A10/MF A01 CSCL 20/4

An investigation is carried out to determine whether ballistic damage can seriously degrade the aeroelastic integrity of lifting surfaces on aircraft. A promising aeroelastic failure mechanism is identified that results from the localized drag generated when a lifting surface encounters severe damage to its aerodynamic shape. This damage induced drag is shown to significantly decrease the divergence speed of a generic or statistical fighter wing for certain damage site locations while increasing the flutter speed of the wing. Consequently, a critical damage level exits where divergence becomes the critical aeroelastic instability for a wing which may still have adequate strength and flutter integrity. In view of the very limited information existing on the aerodynamic modeling of damaged lifting surfaces, a combined analytical and experimental modeling study was initiated to investigate the flow field in the vicinity of thru hole type damages on lifting surfaces. GRA

N80-25323*# National Materials Advisory Board, Washington, D. C. Commission on Sociotechnical Systems.
MATERIALS FOR HELICOPTER GEARS Final Report
Oct. 1979 100 p refs Sponsored in part by NASA and DOD
(Contract MDA903-78-C-0038)
(NASA-CR-163068; PB80-153463; NMAB-351) Avail: NTIS HC A05/MF A01 CSCL 01C

Some of the power train transmission gears in helicopter drive systems can become critical components as performance requirements are increased; accordingly, increasing attention must be paid to new alloys in order to obtain required performance reliability and survivability. Candidate advanced alloys, with improved high temperature properties, while increasing the resistance to scoring and scuffing, tend to have lower ductility and fracture toughness. An attempt is made to identify design materials, and process problems and requirements. In addition, it is recommended that the characterization of candidate steels be accelerated; preliminary investigation indicates that new alloys may provide improved capability against surface distress. GRA

N80-25324# General Accounting Office, Washington, D. C.
F/A-18 NAVAL STRIKE FIGHTER: ITS EFFECTIVENESS IS UNCERTAIN
14 Feb. 1980 37 p
(PB80-143225; PSAD-80-24) Avail: NTIS HC A03/MF A01 CSCL 01C

Preliminary tests indicate that the F/A-18 weapon system is superior in a number of areas to the aircraft it is to replace, the F-4, A-4, and A-7. However, until the F/A-18's deficiencies,

including those in its armament systems, are resolved, its effectiveness to perform its missions is uncertain. The General Accounting Office makes a number of recommendations to the Secretary of Defense, including delaying the production rate increase until performance problems are corrected and testing is completed, giving priority attention to the F/A-18's self protection and all-weather capability and reassessing the cost of the program and reporting it to the Congress. GRA

N80-25325# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AIRCRAFT DYNAMIC RESPONSE TO DAMAGED RUNWAYS
Mar. 1980 37 p refs Presented at the 49th Meeting of the Struct. and Mater. Panel, Porz-Wahn, West Germany, Oct. 1979
(AGARD-R-685; ISBN-92-835-1354-1) Avail: NTIS HC A03/MF A01

The potential problems of aircraft dynamic response to damaged and repaired runways were studied. For small aircraft with relatively simple landing gear, the operation over nominal repairs was dominated by rigid body motions of the aircraft. The prediction of those motions was possible and compared reasonably well with experimental data. For larger aircraft or aircraft with large external stores, the prediction of detailed loads in critical areas has met with limited success so far. Since landing gear equations are highly nonlinear, the prediction of aircraft dynamic response required time consuming numerical integrations. Also the behavior of large external stores can be affected by nonlinear effects (such as rigging loads), and both landing gear and external stores nonlinearities are affected by aircraft servicing procedures and by the ambient environment. For individual titles, see N80-25326 through N80-25328.

N80-25326# Air Force Engineering and Services Center, Tyndall AFB, Fla.
RUNWAY SURFACE ROUGHNESS
Lapsley R. Caldwell, Anthony G. Gerardi (AFFDL), and Richard Borowski (AFFTC) *In* AGARD Aircraft Dyn. Response to Damaged Runways Mar. 1980 p 1-18 refs (For primary document see N80-25325 16-05)
Avail: NTIS HC A03/MF A01

The techniques used for analysis of runway surface roughness on an f-4 aircraft are reported. Computer simulations and their results are discussed. These results are compared to test data measured from operation of an f-4 over simulated bomb damage repair. Surface roughness criteria to be used in repairing an airfield after an attack are presented. E.D.K.

N80-25327# British Aerospace Aircraft Group, Weybridge (England).
UK APPROACH TO AIRCRAFT DYNAMIC RESPONSE ON DAMAGED AND REPAIRED RUNWAYS
B. W. Payne, A. E. Dudman (British Aerospace Aircraft Group, Warton, England), B. R. Morris, M. Ormerod (Aeroplane and Armament Experimental Establishment), and C. Brain *In* AGARD Aircraft Dyn. Response to Damaged Runways Mar. 1980 p 19-24 (For primary document see N80-25325 16-05)
Avail: NTIS HC A03/MF A01

The operation of military aircraft from damaged and repaired runways was studied. Mathematical models and associated validation trials were successfully employed to predict the dynamic response of aircraft on damaged and repaired runways and together with engineering support trials allow the operational capability of the aircraft to be defined, provided proper consideration can be given to the variability of the environment and the aircraft. Clearance problems arise from rigid aircraft response in pitch and roll giving rise to high undercarriage loads and/or unacceptable handling problems for the pilot and from flexible structure response leading to high aircraft structure loads, especially for heavy external stores. Considerable simplifications were achieved on those aircraft studied as the critical features cams essentially from single degree of freedom responses. E.D.K.

N80-25328# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
PARAMETERS AFFECTING AIRCRAFT PERFORMANCE ON RUNWAYS IN BAD CONDITION
Arnulf Krauss, Otto Bartsch, and Gunther Kempe *In* AGARD Aircraft Dyn. Response to Damaged Runways Mar. 1980 p 25-31 refs (For primary document see N80-25325 16-05)
Avail: NTIS HC A03/MF A01

It is postulated that calculations of dynamic response to damaged runways must account for the nonlinearities of the undercarriage. Examples taken from simulations of the F-104G running across AM2 runway repair mats serve to identify the influence of some of these nonlinearities and to discuss possibilities to improve undercarriage performance. The subsequent considerations on structural response of the airframe deal with the validity of models and with cost effective ways of determining aircraft performance on runways in bad condition. E.D.K.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-25329 Radio Technical Commission for Aeronautics, Washington, D. C.
ENVIRONMENTAL CONDITIONS AND TEST PROCEDURES FOR AIRBORNE EQUIPMENT Final Draft
7 Dec. 1979 148 p Supersedes DO-160
(RTCA-309-79/SC135-41; DO-160) Avail: Issuing Activity

A series of standard environmental test conditions and applicable test procedures for airborne equipment is set forth. These tests are to provide a laboratory means of determining the performance characteristics of equipment under environmental conditions representative of those which may be encountered in operation of said equipment. The test conditions and test procedures may be used as a minimum performance specification under environmental conditions which can assure a sufficient degree of confidence in performance during operations. Some of the conditions and procedures are not necessarily applicable to all airborne equipment. The appropriate selection is the responsibility of the writers of the performance standards for the specific airborne equipment. E.D.K.

N80-25330*# Old Dominion Univ. Research Foundation, Norfolk, Va.
SENSOR FOR MEASURING INSTANTANEOUS ANGLE OF ATTACK OF HELICOPTER BLADES Final Report, 13 Jan. 1975 - 31 Jul. 1979
P. S. Barna Jun. 1980 84 p refs
(Grant NsG-1143)
(NASA-CR-3297) Avail: NTIS HC A04/MF A01 CSCL 01D

Systematic investigations were performed on a variety of probes to determine their potential for possible application as sensors attached to helicopter blades to measure both the instantaneous angle of attack as well as the dynamic head during actual flight operations. After some preliminary considerations a sensor of essentially spherical shape, about 30 mm in diameter, was designed. The sensor was provided with three pressure ports, and it housed two pressure transducers required for sensing the prevailing pressures acting outside on the surface. The sensors were subsequently tested in the laboratory under a variety of flow conditions to determine their aerodynamic characteristics. Two series of tests were performed: in the first series the sensor was fixed in space while exposed to steady uniform flow, while in the second series the sensor was made to oscillate, thus simulating the cyclic pitch change of the helicopter blades. While the cyclic pitch frequencies were of about the same magnitude as encountered in flight, the flow velocities during tests fell well below those experienced in a rotating blade. The tests showed that the sensors performed satisfactorily under low subsonic flow conditions with frequencies not exceeding five Hz. Author

N80-25276# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
EXPERIENCES WITH A FLYING DATA RECORDING SYSTEM (FDRS) IN A GERMAN AIRFORCE FIGHTER

BOMBER WING AFTER A TROOP TAIL
H. Harsch *In its* Aircraft Integrated Data Systems Feb. 1979 p 11-26 In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25281# Technische Universitaet, Munich (West Germany). Inst. fuer Flugmechanik und Flugregelun.
RELATIONS FOR A FLIGHT PERFORMANCE COMPUTER
M. Kloster *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 139-150 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25283# Technische Universitaet, Brunswick (West Germany). Inst. fuer Maschinenelemente und Foerdertechnik.
REDUCTION OF MEASURED DATA AND A METHOD OF EARLY DETECTION OF SENSOR BREAKDOWN
G. Dahl *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 169-185 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25284# Civil Aviation Authority, Redhill (England).
DESCRIPTION OF THE BRITISH CIVIL AVIATION AIRWORTHINESS DATA RECORDING PROGRAM
H. D. Ruben *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 187-214 (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25285# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
THE SYDAS FLIGHT DATA PROCESSING SYSTEM
C. Dupuy (ENERTEC Schlumberger) *In its* Aircraft Integrated Data Systems Feb. 1979 p 215-235 (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25286# KLM Royal Dutch Airlines, Amsterdam (Netherlands).
THE USE OF AIDS DATA AT KLM
R. A. Hartman *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 237-268 (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25287# National Aerospace Lab., Amsterdam (Netherlands).
NAVAIDS CALIBRATION EVALUATION WITH A COMPUTER-CONTROLLED AVIONICS-DATA ACQUISITION SYSTEM
F. J. Abbink and R. Krijn *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 269-311 refs (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25289# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
AN AUTOMATIC FAULT INDENTIFICATION SYSTEM (AFIS) ON BOARD
H. Kalbe and F. Hildebrandt *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 327-344 In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-25331 Cincinnati Univ., Ohio.
A NEW APPROACH IN TURBOMACHINERY FLOW ANALYSIS USING THE FINITE ELEMENT METHOD Ph.D. Thesis
Erian Aziz Baskharone 1979 95 p
Avail: Univ. Microfilms Order No. 8012218

A new approach in analyzing the potential flow in the complicated passages of a turbomachine is presented. The analysis is also generally applicable to a variety of similar problems involving multiply connected domains. The outlines of the solution procedure follow the weighted residual; Galerkin's method combined with different order finite elements. The finite element equations are derived in terms of the velocity potential discrete values as well as localized potential discontinuities associated with the domain multiconnectively. As a result, neither the flow exit angle nor the circulation around the lifting bodies need to be externally prescribed. Instead, they are determined, along with the velocity potential nodal values, in the finite element solution. The computed results are compared with available experimental data, and also with existing analytical solutions based on conformal transformations. The method was used to analyze single airfoil and cascade flows, and also the three dimensional flow field in a radial turbine scroll. Different finite element discretization models were used to obtain the solution, and to study the effects of the grid size and the order of elements on the solution accuracy, computer size and storage requirements. Dissert. Abstr.

N80-25332*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
ENGINE COMPONENT IMPROVEMENT: PERFORMANCE IMPROVEMENT, JT9D-7 3.8 AR FAN Progress Report, Jan. 1978 - Feb. 1979
W. O. Gaffin 12 Jun. 1980 57 p ref
(Contract NAS3-20630)
(NASA-CR-159806; PWA-5515-114) Avail: NTIS HC A04/MF A01 CSCL 21E

A redesigned, fuel efficient fan for the JT9D-7 engine was tested. Tests were conducted to determine the effect of the 3.8 AR fan on performance, stability, operational characteristics, and noise of the JT9D-7 engine relative to the current 4.6 AR Bill-of-Material fan. The 3.8 AR fan provides increased fan efficiency due to a more advanced blade airfoil with increased chord, eliminating one part span shroud and reducing the number of fan blades and fan exit guide vanes. Engine testing at simulated cruise conditions demonstrated the predicted 1.3 percent improvement in specific fuel consumption with the redesigned 3.8 AR fan. Flight testing and sea level stand engine testing demonstrated exhaust gas temperature margins, fan and low pressure compressor stability, operational suitability, and noise levels comparable to the Bill-of-Material fan. Author

N80-25333*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
STUDY OF BLADE ASPECT RATIO ON A COMPRESSOR FRONT STAGE Final Report, 28 Oct. 1977 - 28 May 1979
R. F. Behlke, J. D. Brooky, and E. Canal, Jr. Nov. 1980 261 p refs
(Contract NAS3-20809)
(NASA-CR-159556; PWA-5583-58) Avail: NTIS HC A12/MF A01 CSCL 21E

A single stage, low aspect ratio, compressor with a 442.0 m/sec (1450 ft/sec) tip speed and a 0.597 hub/tip ratio typical of an advanced core compressor front stage was tested. The test stage incorporated an inlet duct which was representative of an engine transition duct between fan and high pressure compressors. At design speed, the rotor stator stage achieved a peak adiabatic efficiency of 86.6 percent at a flow of 44.35 kg/sec (97.8 lbm/sec) and a pressure ratio of 1.8. Surge margin was 12.5 percent from the peak stage efficiency point. Author

N80-25334*# AiResearch Mfg. Co., Torrance, Calif.
THERMAL-STRUCTURAL DESIGN STUDY OF AN AIRFRAME-INTEGRATED SCRAMJET Final Report, Jun. 1975 - Dec. 1979
J. J. Killackey, E. A. Katinszky, S. Tepper, A. A. Vuigner, C. C. Wright, and G. G. Stockwell May 1980 228 p refs
(Contract NAS1-13984)

best copy available

(NASA-CR-159039; AiResearch-78-15442-2) Avail: NTIS HC A11/MF A01 CSCL 21E

The development and evaluation of a design concept for the cooled structures assembly for the Scramjet engine is discussed. Development concepts for engine subsystems and design concepts for the aircraft/engine interface are included. A thermal protection system was defined which makes it possible to attain a life of 100 hr and 1000 cycles, the specified goal. The coolant equivalence ratio at the Mach 10 maximum thermal loading condition is 0.6, indicating a capacity for airframe cooling. The mechanical design is feasible for manufacture using conventional materials. For the cooled structures in a six module engine, the mass per unit capture area is 1256 kg/sq m. The total mass of a six module engine assembly including the fuel system is 1502 kg. E.D.K.

N80-25335*# Detroit Diesel Allison, Indianapolis, Ind.
EXPERIMENTAL DETERMINATION OF UNSTEADY BLADE ELEMENT AERODYNAMICS IN CASCADES. VOLUME 1: TORSION MODE CASCADE Final Report
R. E. Riffel and M. D. Rothrock Jun. 1980 305 p
(Contract NAS3-20055)
(NASA-CR-159831; EDR-10119-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 21E

A two dimensional cascade of harmonically oscillating airfoils was designed to model a near tip section from a rotor which was known to have experienced supersonic torsional flutter. This five bladed cascade had a solidity of 1.17 and a setting angle of 1.07 rad. Graphite epoxy airfoils were fabricated to achieve the realistically high reduced frequency level of 0.44. The cascade was tested over a range of static pressure ratios approximating the blade element operating conditions of the rotor along a constant speed line which penetrated the flutter boundary. The time-steady and time-unsteady flow field surrounding the center cascade airfoil were investigated. The effects of reduced solidity and decreased setting angle on the flow field were also evaluated. Author

N80-25336# Detroit Diesel Allison, Indianapolis, Ind.
HIGH BYPASS TURBOFAN COMPONENT DEVELOPMENT. PHASE 1: FAN DETAIL DESIGN Final Report, Dec. 1978 - Oct. 1979
D. C. Chapman Wright-Patterson AFB, Ohio AFAPL Dec. 1979 70 p
(Contract F33615-78-C-2014; AF Proj. 3066)
(AD-A082821; DDA-EDR-100; AFAPL-TR-79-2103) Avail: NTIS HC A04/MF A01 CSCL 21/5

The objective of this program is to develop an advanced, small, high bypass turbofan component applicable to an advanced, fuel-efficient engine for a new Air Force primary trainer aircraft. The program consists of two phases. Phase 1 consisted of the preliminary design and life cycle cost analysis of candidate engines. This report documents Phase 2 which was the detail design of the selected fan configuration. Primary design point of the fan is 1.8 pressure ratio at 55.9 lbm/sec flow. At a lower speed, the fan will produce 1.65 pressure ratio at a flow compatible with the GMA500 advanced technology core engine. The resultant engine satisfies all requirements of the contract. The fan stage meets all requirements of Mil-E-5007D, including bird ingestion and predicted noise levels are below FAR Part 36 requirements. GRA

N80-25337*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
DESIGN AND COLD-AIR TEST OF SINGLE-STAGE UNCOOLED TURBINE WITH HIGH WORK OUTPUT
Thomas P. Moffitt, Edward M. Szanca, Warren J. Whitney, and Frank P. Behning Jun. 1980 18 p refs
(NASA-TP-1680; E-316) Avail: NTIS HC A02/MF A01 CSCL 21E

A solid version of a 50.8 cm single stage core turbine designed for high temperature was tested in cold air over a range of speed and pressure ratio. Design equivalent specific work was 76.84 J/g at an engine turbine tip speed of 579.1 m/sec. At design speed and pressure ratio, the total efficiency of the turbine was 88.6 percent, which is 0.6 point lower than the design value of 89.2 percent. The corresponding mass flow was 4.0 percent greater than design. Author

N80-25338*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COLD-AIR INVESTIGATION OF A 4 1/2 STAGE TURBINE WITH STAGE-LOADING FACTOR OF 4.66 AND HIGH SPECIFIC WORK OUTPUT. 2: STAGE GROUP PERFORMANCE
Warren J. Whitney, Frank P. Behning, Thomas P. Moffitt, and Glen M. Hotz Jun. 1980 16 p refs
(NASA-TP-1688; E-315) Avail: NTIS HC A02/MF A01 CSCL 21E

The stage group performance of a 4 1/2 stage turbine with an average stage loading factor of 4.66 and high specific work output was determined in cold air at design equivalent speed. The four stage turbine configuration produced design equivalent work output with an efficiency of 0.856; a barely discernible difference from the 0.855 obtained for the complete 4 1/2 stage turbine in a previous investigation. The turbine was designed and the procedure embodied the following design features: (1) controlled vortex flow, (2) tailored radial work distribution, and (3) control of the location of the boundary-layer transition point on the airfoil suction surface. The efficiency forecast for the 4 1/2 stage turbine was 0.886, and the value predicted using a reference method was 0.882. The stage group performance results were used to determine the individual stage efficiencies for the condition at which design 4 1/2 stage work output was obtained. The efficiencies of stages one and four were about 0.020 lower than the predicted value, that of stage two was 0.014 lower, and that of stage three was about equal to the predicted value. Thus all the stages operated reasonably close to their expected performance levels, and the overall (4 1/2 stage) performance was not degraded by any particularly inefficient component. E.R.

N80-25339*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
STATIC AND TRANSIENT PERFORMANCE OF YF-102 ENGINE WITH UP TO 14 PERCENT CORE AIRBLEED FOR THE QUIET SHORT-HAUL RESEARCH AIRCRAFT
Jack G. McArdle, Leonard Hornysk, and Allan S. Moore Jun. 1980 26 p refs
(NASA-TP-1692) Avail: NTIS HC A02/MF A01 CSCL 21E

An outdoor static test stand was used to measure the steady-state and transient performance of the YF-102 turbofan engine with core airbleed. The test configuration included a bellmouth inlet and a confluent-flow exhaust system similar in size to the quiet short-haul research aircraft (QSRA) exhaust system. For the steady-state tests, the engine operated satisfactorily with core bleed up to 14 percent of the core inlet flow. For the transient tests the engine accelerated and decelerated satisfactorily with no core bleed and with core bleed up to 11 percent of the core inlet flow (maximum tested). For some of the tests the core-bleed flow rate was scheduled to vary with fan discharge pressure, to simulate the QSRA bleed requirements. No stability, surge, stall, overtemperature, combustor flameout, or other operating problems were encountered in any of the tests. Steady-state and transient engine performance data are presented in graphs, and fuel-control trajectories for typical transient tests are shown. A.R.H.

N80-25340*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
PERFORMANCE DETERIORATION BASED ON IN-SERVICE ENGINE DATA: JT9D JET ENGINE DIAGNOSTICS PROGRAM
G. P. Sallee 27 Apr. 1979 185 p refs
(Contract NAS3-20632)
(NASA-CR-159525; PWA-5512-35) Avail: NTIS HC A09/MF A01 CSCL 21E

Results of analyses of engine performance deterioration trends and levels with respect to service usage are presented. Thirty-two JT9D-7A engines were selected for this purpose. The selection of this engine fleet provided the opportunity of obtaining engine performance data starting before the first flight through initial service such that the trend and levels of engine deterioration related to both short and long term deterioration could be more carefully defined. The performance data collected and analyzed included in-flight, on wing (ground) and test stand prerepair and postrepair performance calibrations with expanded instrumen-

tation where feasible. The results of the analyses of these data were used to: (1) close gaps in previously obtained historical data as well as augment the historical data with more carefully obtained data; (2) refine preliminary models of performance deterioration with respect to usage; (3) establish an understanding of the relationships between ground and altitude performance deterioration trends; (4) refine preliminary recommendations concerning means to reduce and control deterioration; and (5) identify areas where additional effort is required to develop an understanding of complex deterioration issues. E.R.

N80-25341# General Electric Co., Lynn, Mass. Aircraft Engine Group
HIGH BYPASS TURBOFAN COMPONENT DEVELOPMENT. PHASE 2: DETAILED DESIGN Interim Report, 4 Oct. 1978 - 25 May 1979
H. Mauch, T. Oldakowski, and D. Weldon. Wright-Patterson AFB, Ohio AFAPL Aug. 1979 139 p
(Contract F33615-78-C-2060; AF Proj. 3066)
(AD-A082753; AFAPL-TR-79-2064) Avail: NTIS
HC A07/MF A01 CSCL 21/5
A detailed aerodynamic, aeromechanical and mechanical design of the high bypass turbofan fan stage selected during Phase I of this program was satisfactorily completed. This fan design is the result of aero and aeromechanical iterations and trade-offs which achieved the objectives of meeting aerodynamic performance as well as the life and mechanical considerations of MIL-E-5007D. The resulting fan design compares very closely to the fan originally proposed. GRA

N80-25342# National Technical Information Service, Springfield, Va.
GAS AND STEAM TURBINES, GENERAL: CORROSION AND EROSION, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Feb. 1980
Guy E. Habercom, Jr. Mar. 1980 180 p Supersedes NTIS/PS-79/0248; NTIS/PS-78/0167 and NTIS/PS-77/0084
(PB80-806664; NTIS/PS-79/0248; NTIS/PS-78/0167; NTIS/PS-77/0084) Copyright. Avail: NTIS
HC $30.00/MF $30.00 CSCL 21E
Government sponsored research reports relating to the hot corrosion and erosion of gas/steam turbine components are cited in this updated bibliography. Of the 173 abstracts included, 54 are new to the previous edition. GRA

N80-25343# National Technical Information Service, Springfield, Va.
GAS AND STEAM TURBINES, GENERAL: CORROSION AND EROSION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Feb. 1980
Guy E. Habercom, Jr. Mar. 1980 313 p Supersedes NTIS/PS-79/0249; NTIS/PS-78/0168; and NTIS/PS-77/0085
(PB80-806672; NTIS/PS-79/0249; NTIS/PS-78/0168; NTIS/PS-77/0085) Copyright. Avail: NTIS
HC $30.00/MF $30.00 CSCL 21E
General components of gas/steam turbines exposed to corrosive and erosive environments are analyzed in these reports gathered in a worldwide literature survey. This updated bibliography contains 306 abstracts, 48 of which are new entries to the previous edition. GRA

N80-25277# Technische Hochschule, Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
ENGINE PARAMETER TREND ANALYSIS BY LEADS 200: POSSIBILITIES AND LIMITATIONS
W. Koschel *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 29-55 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25278# Technische Hochschule, Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
INVESTIGATIONS ON LOCAL FAULT DETECTION AT TURBOJET ENGINES
H. Toenskoetter *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 57-83 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25279# Technische Universitaet, Brunswick (West Germany). Inst. fuer Maschinenelemente und Foerdertechnik.
LOCALIZATION OF FAULTS IN JET ENGINES BY CALCULATION OF COMPONENT CHARACTERISTICS
G. Dahl *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 85-112 refs In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25280# Rolls-Royce Ltd., Bristol (England). Aero Div.
THE ENGINE USAGE MONITORING SYSTEM (EUMS): AN HEURISTIC APPROACH TO COST EFFECTIVE FLIGHT DATA MONITORING AND ANALYSIS
F. Robinson *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 113-138 refs (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

N80-25282# Karlsruhe Univ. (West Germany). Inst. fuer Thermische Stroemungsmaschinen.
CLASSIFICATION OF OPERATING CONDITIONS OF TURBOMACHINES FROM SOLID BORNE SOUND
D. Barschdorf, B. Stuehlen, and W. Mach *In* DFVLR Aircraft Integrated Data Systems Feb. 1979 p 151-168 refs (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-25344*# Oklahoma State Univ., Stillwater. Div. of Engineering, Technology and Architecture.
HANDLING QUALITIES OF LARGE FLEXIBLE CONTROL-CONFIGURED AIRCRAFT Final Technical Report, 1 Jan. 1979 - 30 Jun. 1980
Robert L. Swaim Jun. 1980 13 p refs
(Grant NsG-4018)
(NASA-CR-163206) Avail: NTIS HC A02/MF A01 CSCL 01C
The effects on handling qualities of low frequency symmetric elastic mode interaction with the rigid body dynamics of a large flexible aircraft was analyzed by use of a mathematical pilot modeling computer simulation. An extension of the optimal control model for a human pilot was made so that the mode interaction effects on the pilot's control task could be assessed. Pilot ratings were determined for a longitudinal tracking task with parametric variations in the undamped natural frequencies of the two lowest frequency symmetric elastic modes made to induce varying amounts of mode interaction. Relating numerical performance index values associated with the frequency variations used in several dynamic cases, to a numerical Cooper-Harper pilot rating has proved successful in discriminating when the mathematical pilot can or cannot separate rigid from elastic response in the tracking task. E.D.K.

N80-25345*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENT OF THE HANDLING CHARACTERISTICS OF TWO LIGHT AIRPLANES
Jun. 1980 80 p refs
(NASA-TP-1636; L-13054) Avail: NTIS HC A05/MF A01 CSCL 01C
A flight investigation of the handling characteristics of two single engine general aviation airplanes, one a high wing and the other a low wing, included a variety of measurements of different characteristics of the airplanes. The characteristics included those of the control systems, performance, longitudinal and lateral responses, and stall motions. Author

N80-25346# Missouri Univ. - Columbia. Coll. of Engineering.
INHERENT ERROR IN ASYNCHRONOUS DIGITAL FLIGHT CONTROLS Final Report, 1 Feb. 1978 - 31 Jul. 1979
Charles Slivinsky and Sudhiporn Patumtawapibal Feb. 1980 129 p refs
(Grant AF-AFOSR-2968-76; AF Proj. 2304)
(AD-A082622; AFOSR-80-0256TR) Avail: NTIS HC A07/MF A01 CSCL 17/7

The design of closed loop, digital flight control systems having dual redundant digital controllers is presented. The digital controllers have the same sample rate but there is a fixed time skew, or offset, between their respective sample times. The input to the plant is the difference between the external input (pilot input) and the output of the first controller. In an extended model the first channel computes two outputs. The first output of the second channel, is used to calculate the error due to the time skew between the two controllers. The second channel computes only one signal. The inherent errors depend on the difference of the second output of the first channel and the output of the second channel. An algorithm estimates the time skew between two asynchronous systems. The application of the extended model in asynchronous redundant digital flight control systems is described. General descriptions, flow charts, user instructions, and listings for all the software are shown. E.D.K.

N80-25347# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE 54TH(A) PROPULSION AND ENERGETICS PANEL MEETING ON ADVANCED CONTROL SYSTEMS FOR AIRCRAFT POWERPLANTS
J. David Powell (Stanford Univ., Calif.) Mar. 1980 10 p refs See also AGARD-CP-279
(AGARD-AR-152; ISBN-92-835-1353-3) Avail: NTIS HC A02/MF A01

A survey of the nineteen papers presented and of the discussions which followed each paper given at the meeting is presented as well as conclusions drawn at the Round Table Session. Topics covered include the use of analog electronics, hydromechanics, fluidics, and digital techniques with emphasis on sensors, actuators, redundancy and fault detection. A.R.H.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-25348# Committee on Science and Technology (U. S. House).
WATER IMMERSION FACILITY JOHNSON SPACE CENTER
Washington GPO 1979 47 p Hearing before the Subcomm. on Space Sci. and Appl. of the Comm. on Sci. and Technol., no. 73, 96th Congr., 1st Sess., 13 Sep. 1979
(GPO-54-508) Avail: Subcommittee on Space Science and Application

The proposed reprogramming of training facility construction funds needed to complete the construction of the Water Immersion Facility (WIF) is discussed. Details of a failure which occured in the shoring system for the excavation are reported. Results from the failure analysis are outlined and corrective actions are proposed. A number of options for completing the facility were analyzed and the utilization of the existing construction was determined to be the least costly and most expidious plan. Estimates are also given for WIF training costs and costs for training at alternative facilities. A discussion of training options is documented. M.G.

N80-25349# Sandia Labs., Albuquerque, N. Mex.
SIMULATED HAIL TEST FACILITY
D. W. Miller Feb. 1980 25 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1114) Avail: NTIS HC A02/MF A01

A low cost, simulated jail test facility for testing solar mirror and support materials was developed. The facility was designed to be mounted on an existing 54.8 m tower and consists of a 30.5 vertical steel tube, an ice ball transport mechanism, and a release mechanism. It is simple to control and maintain and is convenient for a one man operation. The facility was designed to operate in either a single ball drop mode or a salvo drop mode. Measured velocities of the simulated hail were within 10% of the calculated theoretical terminal velocities of hail in still air for diameters up to 1.9 cm. For larger diameter hail balls, the drop distance is too short to reach terminal velocity.Data generated at this facility aided in the characterization of hail resistant materials for solar applications. Test procedures and alternate methods of hail testing are discussed. DOE

N80-25350# Oak Ridge National Lab., Tenn.
DESIGN OF VIEWING WINDOWS FOR CONTROLLED-ATMOSPHERE CHAMBERS
James N. Robinson Mar. 1980 65 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6864) Avail: NTIS HC A04/MF A01

A guide to the design of safe viewing windows is presented. Design criteria, the properties of materials, the problems of structural design in unreliable materials such as glass, the mathematics of reliability and redundance, and problems associated with testing windows are discussed, and formulas are presented for the design of windows. Criteria adopted at ORNL for controlled atmosphere chambers are presented, a program for surveying and upgrading the safety of existing facilities is described, and the results of this program are reported. DOE

N80-25351# Oak Ridge National Lab., Tenn.
CRITERIA FOR CONTROLLED ATMOSPHERE CHAMBERS
James N. Robinson Mar. 1980 29 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6865) Avail: NTIS HC A03/MF A01

The criteria for design, construction, and operation of controlled atmosphere chambers intended for service at ORNL are presented. Classification of chambers, materials for construction, design criteria, design, controlled atmosphere chamber systems, and operating procedures are presented. DOE

N80-25352# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Entwurfs-Aerodynamik.
EXPERIMENTAL INVESTIGATION OF THE PARTICLE-NUMBER CONCENTRATION IN THE WIND TUNNEL FOR USE OF THE LASER ANEMOMETRY
Harry Bessling, Reinhard Kiock, Christoph Helsper (Gesamthochschule, Duisburg, West Germany), and Heinz Fissan (Gesamthochschule, Duisburg, West Germany) Jun. 1979 49 p refs In GERMAN; ENGLISH summary Report will also be also announced as translation (ESA-TT-647)
(DFVLR-FB-79-28; ESA-TT-647) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 9.30

The conditions under which it becomes possible to measure the velocity of particles in wind tunnels using laser anemometry were studied. Experiments, which were carried out in a high speed cascade wind tunnel, showed that the natural load of particles was insufficient and that the steady addition of an aerosol was necessary to use this method. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-25353*# New Mexico Univ., Albuquerque. Technology Applications Center.
SPACE COLONIES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Nov. 1979
Gerald F. Zollars Dec. 1979 55 p Sponsored by NASA and NTIS

(NASA-CR-163204; PB80-802960) Avail: NTIS HC $30.00/ MF $30.00 CSCL 22A

Approximately 204 citations to the international literature concerning various aspects of space colonies are presented. Topics include the design and construction of space colonies, the effects on humans of long term life in a variety of spaceborne environments, and the potential uses of orbital space stations and lunar bases. GRA

N80-25354*# Battelle Columbus Labs., Ohio.
SPAR 5 EXPERIMENT NO. 74-30 AGGLOMERATION IN IMMISCIBLE LIQUIDS Final Report
Stan Gelles and A. J. Markworth Jul. 1979 116 p refs
(Contract NAS8-31543)
(NASA-CR-161473) Avail: NTIS HC A06/MF A01 CSCL 22A

The influence of gravity, cooling rate, and composition on the macro-and microstructure of liquid phase immiscible alloys were researched. Aluminum indium alloys of compositions 30, 40, 70, and 90 weight percent indium were processed aboard two sounding rocket flights, SPAR 2 and SPAR 5. Radiographic and metallographic examination of the SPAR 2 flight and ground base samples showed the expected separation at lg of the ground base alloys into indium rich and aluminum rich layers. The flight alloys produced an aluminum rich core surrounding by indium rich metal. The results obtained from the SPAR 5 40 and 70 weight percent indium alloys were essentially identical to those from SPAR 2. The 30 and 90 weight percent indium alloys also showed massive separation into configuration similar to the 40 and 70 weight percent indium alloys. The 90 weight percent indium alloy showed additional evidence that surface tension induced droplet migration had occurred in this alloy which could at least in part account for the observed structures. E.D.K.

N80-25355*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
F-104 LOW-GRAVITY CALIBRATION TESTS FOR MATERIALS PROCESSING IN SPACE PRECURSORY EXPERIMENTS
R. M. Poorman 5 Mar. 1980 11 p
(NASA-TM-78278) Avail: NTIS HC A02/MF A01 CSCL 22A

A precursory low-gravity flight experiment in an F-104 aircraft was conducted to check out the vehicle as a suitable flight test carrier for microgravity experiments. Calibration experiment verification tests in the F-104 were completed. Three flight parabolas were flown. The test data shows all the test parameters recorded by telemetry to have reasonable values. Photographic records are clear and distinct.Solidification modes were the same as those observed in other low gravity environments. The F-104 has been proven to be a useful test bed for low gravity experiments which require less than 60 seconds of low g time. E.D.K.

N80-25356# RAND Corp., Santa Monica, Calif.
COST-EFFECTIVENESS MEASURES OF REPLENISHMENT STRATEGIES FOR SYSTEMS OF ORBITAL SPACECRAFT
Bruce E. Krell Dec. 1979 56 p refs
(Contract F49620-77-C-0023)
(AD-A081859; RAND/N-1295-AF) Avail: NTIS HC A04/MF A01 CSCL 22/1

For many years the U.S. Air Force has employed large-scale, discrete-event digital simulation models for evaluating the cost-effectiveness of various replenishment strategies for operating satellite systems. The extensive use of computer simulation presupposes a problem complexity intractable to closed form or analytical solutions. This statement is true if analysis requires a great amount of detailed information. This Note demonstrates that there is a level of aggregation of the data inputs at which closed form tractability may be attained. Moreover, given this input aggregation representing failure patterns and replenishment strategies, the exact closed forms for approximating cost-effectiveness are derived. The closed form expressions for the cost-effectiveness of satellite systems are not meant to replace the large-scale simulation programs. The aggregate level measures can be most effectively employed to check the computer programs for internal consistency and to narrow the focus of acceptable inputs into the large-scale simulation. Proper use of the analytical tools presented herein can reduce the computational effort by significantly reducing the number of simulation runs necessary to identify the most attractive replenishment methods. GRA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-25357*# General Electric Co., Philadelphia, Pa. Space Div.
STUDY OF ADVANCED COMMUNICATIONS SATELLITE SYSTEMS BASED ON SS-FDMA
John Kiesling May 1980 359 p
(Contract NAS3-21745)
(NASA-CR-159778; DOC-80SDS4217) Avail: NTIS HC A16/MF A01 CSCL 22B

A satellite communication system based on the use of a multiple, contiguous beam satellite antenna and frequency division multiple access (FDMA) is studied. Emphasis is on the evaluation of the feasibility of SS (satellite switching) FDMA technology, particularly the multiple, contiguous beam antenna, the onboard switch and channelization, and on methods to overcome the effects of severe Ka band fading caused by precipitation. This technology is evaluated and plans for technology development and evaluation are given. The application of SS-FDMA to domestic satellite communications is also evaluated. Due to the potentially low cost Earth stations, SS-FDMA is particularly attractive for thin route applications up to several hundred kilobits per second, and offers the potential for competing with terrestrial facilities at low data rates and over short routes. The onboard switch also provides added route flexibility for heavy route systems. The key beneficial SS-FDMA strategy is to simplify and thus reduce the cost of the direct access Earth station at the expense of increased satellite complexity. E.D.K.

N80-25358*# Aerospace Corp., Los Angeles, Calif.
COMMUNICATION SATELLITE TECHNOLOGY: STATE OF THE ART AND DEVELOPMENT OPPORTUNITIES
J. B. Woodford, comp. Jul. 1978 275 p refs
(Contract NAS5-24489)
(NASA-CR-159977; ATR-78(7735)-1) Avail: NTIS HC A12/MF A01 CSCL 22B

Opportunities in communication satellite technology are identified and defined. Factors that tend to limit the ready

availability of satellite communication to an increasingly wide group of users are evaluated. Current primary limitations on this wide utilization are the availability of frequency and/or synchronous equatorial satellite positions and the cost of individual user Earth terminals. The former could be ameliorated through the reuse of frequencies, the use of higher frequency bands, and the reduction of antenna side lobes. The latter limitation requires innovative hardware, design, careful system design, and large scale production. E.D.K.

N80-25359# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE ELECTROSTATIC POTENTIAL OF AN EQUATORIAL SATELLITE
Nellore S. Venkataraman May 1980 12 p refs Revised Submitted for publication
(INPE-1749-RPE/142-Rev) Avail: NTIS HC A02/MF A01

The surface electrostatic potential of a satellite moving with a constant velocity perpendicular to a constant magnetic field was calculated. The ion thermal motion and photoelectric currents were included. Nondimensional parameters were introduced. For large satellites, the nondimentsional potential varies linearly with the nondimensional maximum induced potential. The influence of ion thermal motion photoelectric effect on the satellite potential are of the same order. E.D.K.

N80-25360*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE SOLAR POWER SATELLITE CONCEPTS: THE PAST DECADE AND THE NEXT DECADE
Christopher C. Kraft, Jr. Jul. 1979 22 p Presented at the 15th AIAA Ann. Meeting and Tech. Display, Washington, D.C., 6-8 Feb. 1979 Original contains color illustrations
(NASA-TM-81000; JSC-14898) Avail: NTIS HC A02/MF A01 CSCL 22B

Results of studies on the solar power satellite concept are summarized. The basic advantages are near continuous access to sunlight and freedom from atmospheric effects and cloud cover. The systems definition studies consider photovoltaic and thermal energy conversion systems and find both to be technically feasible, with the photovoltaic approach preferred. A microwave test program is under way which will provide quantitative data on critical parameters, including beam forming and steering accuracy. Ballistic and winged launch vehicles are defined for the transportation of construction materials, with the shuttle expected to provide low cost transportation to and from space. A reference system is outlined for evaluating the concept in terms of environmental and other considerations. Preliminary estimates of natural resource requirements and energy payback intervals are encouraging. E.D.K.

N80-25361# Boston Coll., Chestnut Hill, Mass.
CHARACTERIZATION OF TITAN 3-D ACOUSTIC PRESSURE SPECTRA BY LEAST-SQUARES FIT TO THEORETICAL MODEL Interim Report
Eugene B. Hartnett and Eric Carleen Hanscom AFB, Mass. AFGL Jan. 1980 61 p refs
(Contract F19628-78-C-0008; AF Proj. 7600)
(AD-A083021; SR-2; AFGL-TR-80-0004) Avail: NTIS HC A04/MF A01 CSCL 22/4

A theoretical model for the acoustic spectra of undeflected rocket plumes is fitted to computed spectra of a Titan III-D at varying times after ignition, by a least-squares method. Tests for the goodness of the fit are made. GRA

N80-25362# Syracuse Univ., N. Y.
GEOMETRY OF ORBITING EARTH SATELLITES (GOES) Final Technical Report, Jan. 1978 - Jul. 1979
Jeffrey L. Posdamer Jan. 1980 69 p refs
(Contract F30602-75-C-0121; AF Proj. 0172)
(AD-A082381; RADC-TR-79-357) Avail: NTIS HC A04/MF A01 CSCL 17/8

This report describes the results of a study undertaken to determine if apparent satellite brightness as measured at Earth tracking stations could be used to determine the geometry of the specular reflectors on the orbiting Earth satellite. Specular peaks were identified in the data, sequences of peaks were traced, the maximum peak was identified, and the area and orientation of the maximum peaks were calculated. The output of the specular detection process can be interactively edited to allow translation and rotation of the polygons generated. The process cannot provide unique solutions to the reconstruction problem without some prior knowledge of the object's surface geometry, however. While the feasibility of this approach has been demonstrated, additional work in the areas of simulation, signal processing, and pattern recognition is required. GRA

N80-25363# Argonne National Lab., Ill.
PROCEEDINGS OF THE WORKSHOP ON STRATOSPHERIC AND MESOSPHERIC IMPACTS OF SATELLITE POWER SYSTEMS (SPS)
Dec. 1979 120 p refs Workshop held at Rosemont, Ill., 6-8 Sep. 1978
(Contract W-31-109-eng-38)
(CONF-7809197) Avail: NTIS HC A06/MF A01

Composition perturbations due to rocket exhaust emissions and reentry effects are considered. Climatic effects due to increased noctilucent cloud formation and composition perturbations are also discussed, as well as the effects of localized energy injection, including rocket exhaust thermal energy and microwave absorption. DOE

N80-25364# Battelle Columbus Labs., Ohio.
PRELIMINARY MATERIALS ASSESSMENT FOR THE SATELLITE POWER SYSTEM (SPS)
R. R. Tester and W. M. Jamieson Jan. 1980 131 p refs
(Contract W-7405-eng-92)
(DOE/ER-0038) Avail: NTIS HC A07/MF A01

Presently, there are two SPS reference design concepts (one using silicon solar cells, the other using gallium arsenide solar cells). A materials assessment of both systems was performed based on the materials lists set forth in the DOE/NASA SPS Reference System Report: Concept Development and Evaluation Program. This listing identified 22 materials used in the SPS. Tracing the production processes for these 22 materials, a total demand for over 20 different bulk materials and nearly 30 raw materials was revealed. Assessment of these SPS material requirements produced a number of potential material supply problems. The more serious problems are those associated with the solar cell materials, and the graphite fiber required for the satellite structure and space construction facilities. In general, the gallium arsenide SPS option exhibits more serious problems than the silicon option, possibly because gallium arsenide technology is not as well developed as that for silicon. DOE

N80-25365# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
EFFECTS OF CONSTRUCTION AND OPERATION OF A SATELLITE POWER SYSTEM UPON THE MAGNETOSPHERE Final Report
Y. T. Chiu, J. G. Luhmann, M. Schulz, and J. M. Cornwall (California Univ., Los Angeles) 1 Dec. 1979 80 p refs Prepared for Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(ATR-80(7824)-1) Avail: NTIS HC A05/MF A01

Exhaust emisions from propulsion and stationkeeping activities of SPS spacecraft induce substantial modifications of magnetospheric processes on both the local and the global scale. This is primarily because of the relatively large mass and energy contents of these emmisions when compared with the total mass and energy contents of the inner magnetosphere. The sources of these emmisions are the argon plasma jet from the solar electric propulsion modules of the cargo orbit transfer vehicle and the H2O neutral exhaust for LO2/LH main engines of the personnel orbit transfer vehicles. Assessment of the SPS scenario, based on presently known physical mechanisms operative in plasma and neutral injection in the magnetosphere, indicates that the major part of the exhaust emmissions are likely to be deposited inside the magnetosphere. DOE

N80-25366# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
A METHOD OF PRODUCING ANALYTICAL ORBIT MODELS FOR GEOSTATIONARY SATELLITES
Martin Eckstein Aug. 1979 31 p refs In GERMAN; ENGLISH

summary Report will also be announced as translation (ESA-TT-643)
(DFVLR-FB-79-16; ESA-TT-643) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 7,30

A simplified perturbation theory of nearly geostationary satellites is described. The analytical form of the perturbations is derived from geometrical considerations and the coefficients are determined using multiple Fourier analysis. The resulting single formula avoids singularities for zero eccentricity and inclination. A computer program is used to evaluate the formula.
Author (ESA)

N80-25367# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.
WINDTUNNEL TESTS OF A TUBULAR SUPERSONIC INLET FOR PROJECTILES
Berthold Schaefer Mar. 1979 33 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-645)
(DFVLR-FB-79-26; ESA-TT-645) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 6,30

Measurements were carried out in a trisonic wind tunnel to investigate the sudden increase of drag of a tubular projectile using models with different cowl angles and fineness ratios. The test results show the influence of Mach number, cowl angle, and fineness ratio on the drag coefficient. The Mach number at which the increase in drag occurs is estimated using a simple method.
Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-25368* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EPS ANALYSIS OF NOMINAL STS-1 FLIGHT
D. F. Wolfgram and M. D. Pipher May 1980 811 p
(NASA-TM-81001; JSC-16681) Avail: NTIS HC A99/MF A01 CSCL 22B

The results of electrical power system (EPS) analysis of the planned Shuttle Transportation System Flight 1 mission are presented. The capability of the orbiter EPS to support the planned flight and to provide program tape information and supplementary data specifically requested by the flight operations directorate was assessed. The analysis was accomplished using the orbiter version of the spacecraft electrical power simulator program, operating from a modified version of orbiter electrical equipment utilization baseline revision four. The results indicate that the nominal flight, as analyzed, is within the capabilities of the orbiter power generation system, but that a brief, and minimal, current overload may exist between main distributor 1 and mid power controlled 1, and that inverter 9 may the overloaded for extended periods of time. A comparison of results with launch commit criteria also indicated that some of the presently existing launch redlines may be violated during the terminal countdown. E.D.K.

N80-25369*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MCC LEVEL C FORMULATION REQUIREMENTS. ENTRY GUIDANCE AND ENTRY AUTOPILOT, OPTIONAL TAEM TARGETING
J. C. Harpold Apr. 1980 116 p Supersedes JSC-11746
(NASA-TM-81072; JSC-16516; Rept-80-FM-24; JSC-11746) Avail: NTIS HC A06/MF A01 CSCL 22B

The level C software formulations requirements for the entry guidance and the simplified autopilot to be used by the Mission Control Center (MCC) entry processor are presented. The modifications required to functionally simulate optional Terminal Area Energy Management (TAEM) targeting capability (OTT) are incorporated. Implementation of this logic in the MCC must be coordinated with flight software OTT implementation and MCC TAEM guidance OTT. The entry guidance logic is based on the orbiter avionics entry guidance software. Descriptions of the entry guidance detailed formulation requirements, the detailed autopilot formulation requirements, and the targeting routine are given. Also included are a definition of coordinate systems, a list of parameter definitions for the software formulations, and a set of formulation flow charts. E.D.K.

N80-25370*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MCC LEVEL C FORMULATION REQUIREMENTS. SHUTTLE TAEM TARGETING
Gilbert L. Carman and Moises N. Montez Apr. 1980 86 p
(NASA-TM-80796; JSC-16522; Rept-80-FM-29) Avail: NTIS HC A05/MF A01 CSCL 22B

The level C requirements for the shuttle orbiter terminal area energy management (TAEM) guidance and flight control functions to be incorporated into the Mission Control Center entry profile planning processor are described. This processor is used for preentry evaluation of the entry through landing maneuvers, and includes a simplified three degree-of-freedom model of the body rotational dynamics that is necessary to account for the effects of attitude response on the trajectory dynamics. This simulation terminates at TAEM-autoland interface. E.D.K.

N80-25371*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 5: DESCENT, CYCLE 3
Richard Moore, Allen Baker, Ralph Hite, Alan Hochstein, Jack Lyons, and Ken Strong May 1980 254 p refs Supersedes T79-12405
(NASA-TM-81077; JSC-14483; Rept-78-FM-51-Vol-5-Rev-1; T79-12405) Avail: NTIS HC A12/MF A01 CSCL 22A

The trajectory data presented are to be used for orbiter systems and subsystems evalation, flight and mission control center software verification, flight techniques and timeline development, crew training, and evaluation of operational mission suitability. The entry profile is very similar to cycle 2, however, elevon and body flap temperature margins have increased and the elevon schedule was changed. The terminal area energy management (TAEM) profile was completely reshaped to conform with new angle of attack constraints and left hand turn around the heading alignment cylinder. Also, the entry/TAEM interface was adjusted to minimize guidance induced angle of attack transients across the interface. The approach and landing phase was reshaped for a 20 deg glideslope and reduced velocity at touchdown. The definition of the runway threshold was standardized for all landing sites. This results in a shift at Edwards Air Force Base in aim points and touchdown relative to the threshold of 1000 feet. The rollout remains essentially unchanged with the exception of the speedbrake, which is now deployed to 50 percent at touchdown. E.D.K.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-25372*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER/SHUTTLE CARRIER AIRCRAFT SEPARATION: WIND TUNNEL, SIMULATION, AND FLIGHT TEST OVERVIEW AND RESULTS
D. J. Homan, D. E. Denison (Rockwell International Corp., Downey, Calif.), and K. C. Elchert (Rockwell International Corp., Downey, Calif.) May 1980 88 p ref
(NASA-TM-58223) Avail: NTIS HC A05/MF A01 CSCL 22B

A summary of the approach and landing test phase of the space shuttle program is given from the orbiter/shuttle carrier aircraft separation point of view. The data and analyses used during the wind tunnel testing, simulation, and flight test phases in preparation for the orbiter approach and landing tests are reported. E.D.K.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-25373 Princeton Univ., N. J.
NITRAMINE MONOPROPELLANT DEFLAGRATION AND GENERAL NONSTEADY REACTING ROCKET CHAMBER FLOWS Ph.D. Thesis
Moshe Ben-Reuven 1980 355 p
Avail: Univ. Microfilms Order No. 8011031

A steady state deflagration analysis of cyclic nitramines considered as highly energetic components of solid propellant formulations for rocket motors is conducted. An asymptotic theory is advanced for the gaseous deflagration wave, resting upon the difference between the two overall chemical relaxation scales involved. A burning rate formula showing increasing pressure dependence as pressure rises is shown. Linear dependence of the flame speed eigenvalue on pressure is demonstrated, as well as the highly nonlinear coupling between far field and near field processes in the gas and a quantitative measure for the role of condensed phase exothermicity upon the deflagration rate. An erosive burning model, based on coupling through turbulence heat feedback between the core fluid dynamic processes and the wall layer where most of the gaseous chemical reactions occur, is derived. When core wall layer interaction occurs, resulting in burning rate enhancement, residual exothermic reactions may extend to the core. Dynamic coupling of the Rayleigh type between the axial acoustic modes and the residual core exothermicity is demonstrated through natural evolution of oscillations from smooth initial data. Dissert. Abstr.

N80-25374# Los Alamos Scientific Lab., N. Mex.
MODEL OF BURNING AND DETONATION IN ROCKET MOTORS
Charles A. Forest Jan. 1980 29 p refs
(Contract W-7405-eng-36)
(LA-8141-MS) Avail: NTIS HC A03/MF A01

Rocket motor dome failure may produce a damaged porous bed of propellant adjacent to the motor case. This porous bed of propellant may burn and ultimately cause detonation of the motor. A numerical model is presented which examines detonation of the solid propellant grain from shocks induced by the burning porous bed. Calculations are made in one and two dimensional cylindrical geometry and employ the forest fire model of shock induced decomposition. DOE

N80-25375# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
PERFORMANCE PREDICTION OF POWER AUGMENTED ELECTROTHERMAL HYDRAZINE THRUSTERS
D. Hayn, M. Braitinger, and R. H. Schmucker (Bayern-Chem. GmbH, Ottobrun, West Germany) May 1978 10 p refs
(TUM-LRT-KB-78/1) Avail: NTIS HC A02/MF A01

Monopropellant hydrazine propulsion systems are almost exclusively used as auxiliary propulsion systems for satellite orbit and attitude control with large total impulse and long operational life. A detailed analysis of the nozzle flow and the losses including boundary layer, two dimensional flow, and kinetics is presented. The data derived are compared to experimental results. Results show that performance improvement can be achieved by increasing the enthalpy of the hydrazine decomposition productes via an electrical resistive heater so that the gas temperature significantly grows. The performance increase is limited by the maximum tolerable chamber temperature and the conversion of thermal energy into kinetic energy of the exhaust jet. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-25376# California Univ., Livermore. Lawrence Livermore Lab. Metals and Ceramics Div.
ADVANCES IN MATERIALS SCIENCE Quarterly Progress Report, Jul. - Sep. 1979
John J. Truhan, ed. and Forest N. Weid, ed. 25 Oct. 1979 64 p refs
(Contract W-7405-eng-48)
(UCRL-50058-79-3) Avail: NTIS HC A04/MF A01

Materials for magnetic fusion energy, laser fusion energy, and Al-air batteries are evaluated. Geothermal energy, oil shale, nuclear waste management, thermochemical cycles for hydrogen production, chemistry, and basic energy science are discussed with reference to the corrosion resistance of materials in the high temperature deg of a double stage flash steam electrical generation system. The corrosion performance of well-casting and piping materials are also discussed. DOE

N80-25377# National Bureau of Standards, Washington, D.C.
JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS, VOLUME 85, NO. 1 Bimonthly Report, Jan. - Feb. 1980
1980 75 p
(PB80-146566; LC-62-37059) Avail: NTIS HC A04/MF A01 CSCL 07D

Contents: absolute isotopic abundance and the atomic weight of a reference sample of thallium; enthalpies of dilution of aqueous electrolytes-sulfuric acid, hydrochloric acid, and lithium chloride; standardization of iridium-192 gamma-ray sources in terms of exposure; a practical test of the air density equation in standards laboratories at differing altitude; and publications of the National Bureau of Standards. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-25378 Case Western Reserve Univ., Cleveland, Ohio.
FOURIER TRANSFORM INFRARED INVESTIGATION OF THE STRUCTURE AND MOISTURE STABILITY OF THE EPOXY MATRIX IN GLASS-REINFORCED COMPOSITES Ph.D. Thesis
Mitchell Kelly Antoon, Jr. 1980 251 p
Avail: Univ. Microfilms Order No. 8013869

Fourier transform infrared spectroscopy is utilized to clarify both the matrix chemical composition and the physical and chemical effects of moisture exposure on an anhydride-crosslinked epoxy resin. Digital subtraction of spectra obtained during the epoxy/anhydride copolymerization indicate that several modifications of the currently accepted reaction mechanism are required. In addition, results show that the kinetics are diffusion controlled; steady-state concentrations of the active centers are never attained. The composition and extent of cure of the highly crosslinked matrix reinforced with glass cloth may be rapidly calculated regardless of the filler concentration. Such calculations are aided by a factor analysis procedure which determines the number of independently absorbing species in the composite system. The composition of any composite is then determined by fitting the spectra of those species to the composite spectrum by a least squares criterion. Dissert. Abstr.

N80-25379 Duke Univ., Durham, N. C.
CHARACTERIZATION OF FATIGUE DAMAGE MECHANISMS IN CONTINUOUS FIBER REINFORCED METAL MATRIX COMPOSITES Ph.D. Thesis
William Steven Johnson 1979 178 p
Avial: Univ. Microfilms Order No. 8012034

The fatigue damage mechanisms of continuous fiber reinforced metal matrix composites were examined by conducting a series of fatigue tests on various laminates of annealed boron-6061 aluminum. The mechanical stress-strain response of each specimen was recorded at various intervals during the cyclic life in order to determine the changes in various mechanical properties due to fatigue. Each specimen was inspected utilizing a C-scan ultrasonic nondestructive testing technique to screen those specimens with detectable defects such that only the better quality laminate specimens would be evaluated. After failure the specimens were studied microscopically in order to define and document the fatigue damage. Significant results are reported. Dissert. Abstr.

N80-25380*# Vought Corp., Dallas, Tex.
DESIGN AND DEVELOPMENT OF A HARD TUBE FLEXIBLE RADIATOR SYSTEM Final Report
C. W. Hixon 25 Apr. 1980 40 p refs
(Contract NAS9-14776)
(NASA-CR-160663; Rept-2-30320/OR-52416) Avail: NTIS
HC A03/MF A01 CSCL 11D

The construction and operational characteristics of an extended life flexible radiator panel is described. The radiator panel consists of a flexible fin laminate and stainless steel flow tubes designed for a 90 percent probability of surviving 5 years in an Earth orbit micrometeoroid environment. The radiator panel rejects 1.1 kW sub t of heat into an environmental sink temperature of 0 F. Total area is 170 square feet and the panel extends 25 feet in the fully deployed position. When retracted the panel rolls onto a 11.5 inch diameter by 52 inch long storage drum, for a final stored diameter of 22 inches. R.C.T.

N80-25381*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
SHORT BEAM SHEAR TESTS OF POLYMERIC LAMINATES AND UNIDIRECTIONAL COMPOSITES Final Report
W. W. Stinchcomb and E. G. Henneke Jun. 1980 33 p refs (Contract NsG-1254)
(NASA-CR-163239) Avail: NTIS HC A03/MF A01 CSCL 11D

The application of advanced composite materials in aerospace, ground transportation, and sporting industries are discussed. Failure theories for the design and mechanical behavior of composite materials are emphasized. Methods for detecting specific types of flaws are outlined. The effect of detected flaws on mechanical properties such as stiffness, strength, fatigue lifetime, or residual strength is described. R.C.T.

N80-25382*# Hamilton Standard, Windsor Locks, Conn.
DIFFUSION BONDED BORON/ALUMINUM SPAR-SHELL FAN BLADE Final Report, Jun. 1977 - May 1978
C. E. K. Carlson, J. L. Cutler, W. J. Fisher, and J. V. W. Memmott Jun. 1980 114 p refs
(Contract NAS3-20407)
(NASA-CR-159571; HSER-7968) Avail: NTIS
HC A06/MF A01 CSCL 11D

Design and process development tasks intended to demonstrate composite blade application in large high by-pass ratio turbofan engines are described. Studies on a 3.0 aspect radio space and shell construction fan blade indicate a potential weight savings for a first stage fan rotor of 39% when a hollow titanium spar is employed. An alternate design which featured substantial blade internal volume filled with titanium honeycomb inserts achieved a 14% potential weight savings over the B/M rotor system. This second configuration requires a smaller development effort and entails less risk to translate a design into a successful product. The feasibility of metal joining large subsonic spar and shell fan blades was demonstrated. Initial aluminum alloy screening indicates a distinct preference for AA6061 aluminum alloy for use as a joint material. The simulated airfoil pressings established the necessity of rigid air surfaces when joining materials of different compressive rigidities. The two aluminum alloy matrix choices both were successfully formed into blade shells. A.R.H.

N80-25383*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
SUDDEN STRETCHING OF A FOUR LAYERED COMPOSITE PLATE Interim Report
G. C. Sih and E. P. Chen Mar. 1980 42 p refs
(Grant NsG-3197)
(NASA-CR-159870; IFSM-80-102) Avail: NTIS
HC A03/MF A01 CSCL 11D

An approximate theory of laminated plates is developed by assuming that the extensional and thickness mode of vibration are coupled. The mixed boundary value crack problem of a four layered composite plate is solved. Dynamic stress intensity factors for a crack subjected to suddenly applied stress are found to vary as a function of time and depend on the material properties of the laminate. Stress intensification in the region near the crack front can be reduced by having the shear modulus of the inner layers to be larger than that of the outer layers. Author

N80-25384*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
SUDDEN BENDING OF CRACKED LAMINATES Interim Report
G. C. Sih and E. P. Chen Feb. 1980 53 p refs
(Contract NsG-3197)
(NASA-CR-159860; IFSM-80-103) Avail: NTIS
HC A04/MF A01 CSCL 11D

A dynamic approximate laminated plate theory is developed with emphasis placed on obtaining effective solution for the crack configuration where the 1/square root of r stress singularity and the condition of plane strain are preserved. The radial distance r is measured from the crack edge. The results obtained show that the crack moment intensity tends to decrease as the crack length to laminate plate thickness is increased. Hence, a laminated plate has the desirable feature of stabilizing a through crack as it increases its length at constant load. Also, the level of the average load intensity transmitted to a through crack can be reduced by making the inner layers to be stiffer than the outer layers. The present theory, although approximate, is useful for analyzing laminate failure to crack propagation under dynamic load conditions. Author

N80-26281# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
IDENTIFICATION OF THE ELASTIC CHARACTERISTICS OF COMPOSITE MATERIALS BY MEANS OF VIBRATION TESTS AND A MODEL OF DISCRETE CONSERVATIVE CALCULATION

Daniel Engrand and Daniel Louis *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-6 (ESA-TT-632) 1979 p 79-90 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-6, Nov. - Dec. 1979 p 401-409 Original report in FRENCH previously announced as A80-19993 (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-25385 Texas Univ. at Austin.
ELECTROTHERMAL ATOMIZATION IN ATOMIC ABSORPTION SPECTROMETRY: FUNDAMENTAL CAUSES OF INTERFERENCE EFFECTS AND A STUDY OF AN EXPLODING THIN FILM ATOMIZER Ph.D. Thesis
Robert Howard Eklund 1979 312 p
Avail: Univ. Microfilms Order No. 8009856

Exploding thin films by capacitive discharge was examined as a potential atomizer for atomic absorption spectrometry. Graphite, a good reducing agent, was chosen as the film material because it can be obtained inexpensively in a very pure form. Films were deposited on the inside of either a conical or cylindrical design. Machinable glass ceramic was initially used as a substrate material, but quartz was found to give lower background signals because of lower trace impurities. There were three gases (Ar, He, and air) and 5 pressures were examined. Signal reproducibility was found to be the major limitation in using exploding thin graphite films as an atomizer. The fundamental causes of the interference effects associated with atomic absorption spectrometry were also investigated using a filament atomizer. Data was gathered using steady state and transient modes of operation in order to ascertain the importance of gas phase reactions. There were three basic types of reactions studied: metal oxidant; oxidant scrubbing; and intermetallic formation. Results and considerations are reported. Dissert. Abstr.

N80-25386 Case Western Reserve Univ., Cleveland, Ohio.
RESONANCE RAMAN SPECTROSCOPY OF ADSORBED SPECIES AT SOLID-GAS INTERFACES Ph.D. Thesis
James Frank Bradzil, Jr. 1980 298 p
Avail: Univ. Microfilms Order No. 8013831

Probe molecules were used to study the nature of insulator, semiconductor and metal surfaces and the interactions of the molecules with these surfaces. Probe molecules were chosen which give an intrinsic resonance Raman enhancement and thus provide a high sensitivity for measuring their vibrational spectra. The probe molecules chosen were p-nitrosodimethylaniline and p-dimethylaminoazobenzene. Their resonance Raman and absorption spectra were studied in various solvents and adsorbed on three classes of adsorbents. These three classes were: (1) insulators (SiO_2, Al_2O_3); (2) semiconductors (ZnO, SnO_2, TiO_2); and (3) supported metals on silica (Ag, Pt, Pd). It was found that excellent quality vibrational spectra could be obtained for the adsorbed molecules at very low surface coverages by exciting the Raman in the region of the pi-pi(*) transition for these molecules. Dissert. Abstr.

N80-25387 Texas A&M Univ., College Station.
A STUDY OF REACTIONS IN A TIME-OF-FLIGHT MASS SPECTROMETER Ph.D. Thesis
David Lyle Turner, Jr. 1979 212 p
Avail: Univ. Microfilms Order No. 8012013

Three different reaction systems which occur in the ion source of time-of-flight mass spectrometer were investigated. Two of these systems involved the formation of the ion clusters NO(+) N sub 2 radical and Ar(3). Bond energies were determined for NO(+) N sub 2 radical and Ar(3) as 5.01 + or - 0.08 kcal/mole and 5.08 + or - 0.08 kcal/mole respectively. These bond energies were determined from measurement of the equilibrium constants for the formation reactions of NO(+) N sub 2 radical and Ar(3) at various temperatures. The final system involved a study of vaporization reactions of relatively nonvolatile solids of biological interest. The time-of-flight mass spectrometer was used to determine the masses of the vaporized ions. Several different ion sources were designed, constructed, and tested in order to develop a method of vaporizing the sample molecules intact. Among the vaporization/ionization methods tested were rapid heating of the sample, laser induced vaporization of the sample, and vaporization of the sample with a dc discharge. The results of these tests yielded mass spectra with less fragmentation than those obtained with conventional electron impact ion sources. Dissert. Abstr.

N80-25388 Wisconsin Univ. - Madison.
SURFACE VOLTAMMETRY AND COULOMETRY OF SOLID ELECTRODES Ph.D. Thesis
Gary Alan Mabbot 1979 244 p
Avail: Univ. Microfilms Order No. 8007558

A method was developed and an instrument was designed, built, and characterized for measuring the current and the charge passed in a surface reaction based on the response of an electrode to a very precise staircase potential waveform. This approach resulted in an improvement in the detection limit and the ability to isolate the signal from background processes over cyclic voltammetry and other techniques. The method also permitted the measurement of the total charge passed in oxidizing or reducing a surface group from which the surface concentration was calculated. Surface voltammograms and current time curves estimates of the formal potential and the standard reaction rate were also made. Dissert. Abstr.

N80-25389 Tennessee Univ., Knoxville.
AN ELECTRO-OPTICAL ION DETECTOR FOR SPARK SOURCE MASS SPECTROMETRY Ph.D. Thesis
David Lee Donohue 1979 124 p
Avail: Univ. Microfilms Order No. 8012460

A novel ion detection system for spark source mass spectrometry was developed. Various optical detectors were used in conjunction with the device, including a silicon vidicon TV camera, a linear diode array and a photomultiplier tube. In addition, a signal averager was used to accumulate the data and to provide a convenient means of background subtraction, thus increasing the signal-to-noise ratio. Quantitative data were obtained for three systems, showing different ways in which this detector might be used for chemical analysis. A study of isotope dilution, using the element indium, was performed. Also, fly ash was analyzed for six elements using a method in which separated isotopes were used as internal standards. Finally, the zirconium hafnium system was studied to show whether interelement measurements would be feasible with this detection system. The results of these studies revealed that the channel electron multiplier array, can be used to obtain data with precision and accuracy equal to that of existing detectors. Dissert. Abstr.

N80-25390 Houston Univ., Tex.
REACTION RATE SELF-OSCILLATIONS DURING THE OXIDATION OF HYDROGEN OVER NICKEL Ph.D. Thesis
Zelimir F. Kurtanjek 1979 329 p
Avail: Univ. Microfilms Order No. 8012530

The catalytic oxidation of hydrogen over nickel under conditions for which self-oscillatory states exist is discussed. Oscillatory states were investigated by measurements of: (1) contact potential difference (CPD) between the nickel sample and tungsten, (2) oxygen concentration in effluent, (3) catalyst temperature, and (4) temperature difference between the sample and surrounding gas. The CPD measurements enable monitoring of the surface under reaction conditions and identification of surface species. The reaction was studied in a once-through flow reactor and a recirculating reactor. Several stable surface states were observed. The CPD measurements indicate that the system oscillates between an active state in which oxygen is chemisorbed on a reduced surface and a less active state in which the surface is oxidized. Periodic oscillations were observed when either significant mass or heat transfer limitations existed. A periodic (chaotic) behavior existed when the transport resistances were small. The characteristics of the oscillatory states

became independent of linear gas velocity and residence time of the reactor when the transport limitations were small, indicating that the coupling between the transport and chemical state processes is not the cause of the oscillations. Dissert. Abstr.

N80-25391# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE IMPURITY RESITIVITY OF In DOPED CdS
Antonio Ferreira daSilva Feb. 1980 14 p refs Revised Submitted for publication
(INPE-1685-RPE/116-Rev) Avail: NTIS HC A02/MF A01

The previously developed theory of Matsubara-Toyozawa for impurity bands in doped semiconducotrs was investigated by including the effect of correlation via an alternant-molecular-orbital method in order to calculate the impurity resistivity of CdS:In. Specific results are reported. R.C.T.

N80-25392*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
POLLUTANT EMISSIONS FROM FLAT-FLAME BURNERS AT HIGH PRESSURES
Howard G. Maahs and Irvin M. Miller Jun. 1980 41 p refs
(NASA-TP-1673; L-13550) Avail: NTIS HC A03/MF A01 CSCL 07D

Maximum flame temperatures and pollutant emission measurements for NOx, CO, and UHC (unburned hydrocarbons) are reported for premixed methane air flat flames at constant total mass flow rate over the pressure range from 1.9 to 30 atm and for equivalence ratios from 0.84 to 1.12. For any given pressure, maxima typically occur in both the temperature and NOx emissions curves slightly to the lean side of stoichiometric conditions. The UHC emissions show minima at roughly the same equivalence ratios. The CO emissions, however, increase continually with increasing equivalence ratio. Flame temperature and NOx emissions decrease with increasing pressure, while the opposite is true for the CO and UHC emissions. The NOx data correlate reasonably well as a function of flame temperature only. Four flameholders, differing only slightly, were used. In general, the temperature and emissions data from these four flameholders are similar, but some differences also exist. These differences appear to be related to minor variations in the condition of the flameholder surfaces. Author

N80-25393# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EVALUATION OF EXISTING FLAMMABILITY TEST METHODS BY COMPARISON OF THE FLAMMABILITY CHARACTERISTICS OF INTERIOR MATERIALS Final Report, Oct. 1976 - Jun. 1979
Eldon B. Nicholas Mar. 1980 53 p refs
(FAA Proj. 181-521-100)
(AD-A083137; FAA-NA-79-46) Avail: NTIS HC A04/MF A01 CSCL 21/2

Twenty aircraft materials representing a cross section of the interior of a widebodied passenger compartment were tested by five laboratory test methods for comparability. The methods utilized were radiant panel, rate of heat release, vertical Bunsen burner, limited oxygen index, and thermogravimetric analysis. Correlation of the results obtained were made for ignitability, flame spread, heat release, performance, heat flux exposure, and ranking of materials by performance. Heat release data obtained from the rate of heat release apparatus and the E-162 radiant panel indicate the best correlation for panels. E.D.K.

N80-25394# Virginia Univ., Charlottesville.
CHEMICAL IONIZATION MASS SPECTROMETRY Final Report, 1 Jan. 1974 - 14 Sep. 1979
Donald F. Hunt 30 Jan. 1980 53 p refs
(Grants DAAG29-76-G-0326; DAHC04-74-G-0079)
(AD-A081249; ARO-1911713.1-C; ARO-17293.5-C) Avail: NTIS HC A04/MF A01 CSCL 07/4

Research results presented in this report include new methodology for obtaining mass spectra of thermally labile organics, for generating elemental composition data from low resolution GC/MS mass spectra, for counting protons in organic samples under GC/MS conditions, and for the direct analysis of complex mixtures by triple quadrupole mass spectrometry. Detection limits for organics under electron capture negative ion MS conditions are in the attomole (10 to the minus 18th mole) range. GRA

N80-25395# Virginia Univ., Charlottesville.
CHEMICAL IONIZATION MASS SPECTROMETRY OF NITROAROMATIC VAPORS Final Report, 21 Jan. - 30 Sep. 1976
Charles I. Collins and Donald F. Hunt Nov. 1979 25 p refs
(Contract DAAG53-76-C-0086)
(AD-A081228; MERADCOM-2285) Avail: NTIS HC A02/MF A01 CSCL 07/4

The negative ion chemical ionization mass spectra nitroaromatics using a Townsend discharge ion source are reported. The chemical ionization spectra were determined in the presence of various reagent gases and at various temperatures. A sensitivity study of a chemical ionization mass spectrometry system is included which compares detection limits for nitroaromatic compounds in both positive and negative ion detection modes and provides quantitative data on the detection limits for these and other compounds. These studies illustrate the ability of negative ion chemical ionization mass spectrometry to provide two or three orders of magnitude increase in specific ion current for compounds containing electronegative functional groups. The sensitivity observed in case of nitroaromatics is useful for detection of parent ions and also permits the observation of other ions and their relationship in terms of changes in internal energy. The finding that certain organic molecules will capture low-energy electrons (i.e., less than 1 eV) to form negative ions is expected to be of general interest, since this is a very low energy form of radiation interacting and producing profound changes in organic molecules. Of the types of radiation which interact with organic molecules, low-energy electrons are perhaps the least studied. GRA

N80-25396# Los Alamos Scientific Lab., N. Mex.
THEORETICAL EQUATIONS OF STATE FOR THE RARE GASES
G. I. Kerley and P. M. Henry Jan. 1980 41 p refs
(Contract W-7405-eng-36)
(LA-8062) Avail: NTIS HC A03/MF A01

Theoretical equations of state and related calculations are reported for the rare gases neon, argon, krypton, and xenon. The liquid and vapor phases were computed using a model which is based upon thermodynamic perturbation theory. The fluid model requires an expression for the potential energy of a molecule in the force field of its neighbors; this function is derived from the zero-temperature isotherm of the solid. The solid isotherm was determined from static compression data and statistical atom theory. The solid data were the only experimental information used to construct the liquid model. Comparisons were made with measured isothermal-compression data, sound speeds, vaporization curves, Hugoniots, structure factors, viscosities, and melting curves. DOE

N80-25397# Missouri Univ. - Columbia.
RELATIONSHIP OF THE GEOMETRY OF THE OBSERVED STEADY STATE CHEMICAL CONVERSION RATE TO THE BASIC SURFACE REACTION PROCESS IN ELECTROCHEMISTRY
D. G. Retzloff, B. DeFacio, J. E. Bauman, and P. H. Ragatz 1979 12 p refs Presented at the Conf. on Surface Phys., La Jolla, Calif., 6-19 Aug. 1979
(Contract W-7405-eng-82; Grant DAAG29-77-G-0216)
(ISM-243; CONF-7908108-1) Avail: NTIS HC A02/MF A01

Electrochemical corrosion reactions are used to explain why the usual Tafel Law and its associated model of the surface reactions involved is entirely inadequate to describe the physics of the anodic region of the polarization curve. Results as applied to electrochemical reaction studies of aluminum are described. DOE

N80-25398# Montana State Univ., Bozeman. Dept. of Chemical Engineering.
CATALYTIC HYDROGENATION OF COAL-DERIVED LIQUIDS Interim Report, Sep. - Nov. 1979
Lloyd Berg and F. P. McCandless Dec. 1979 25 p
(Contract EX-76-C-01-2034)
(FE-2034-17) Avail: NTIS HC A02/MF A01

Three catalysts containing molybdenum, cobalt, nickel and/or tungsten on bases of specific surface area, pore volume and pore diameter, were fabricated and partially evaluated. Two of them produced product equaling or exceeding the nitrogen specification. Regeneration via an air burnoff of the deposited carbon was accomplished on all three of the catalysts and a subsequent run with each indicated that activity had been restored. DOE

N80-25399# Sandia Labs., Livermore, Calif.
LASER SPARK IGNITION AND EXTINCTION OF A METHANE-AIR DIFFUSION FLAME
R. W. Schmieder Jan. 1980 22 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8288) Avail: NTIS HC A02/MF A01

Laser sparks have been used to ignite and extinguish a methane/air diffusion flame. Simple shock models of strong explosions and convective transport appear capable of accounting for the probabilities of ignition and extinction as a function of the position of the spark. DOE

N80-25400# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
COMBUSTION RESEARCH Annual Report, 1978
Oct. 1979 43 p refs
(Contract W-7405-eng-48)
(LBL-9809) Avail: NTIS HC A03/MF A01

The various fluid mechanical and chemical processes which are thought to be of critical importance in reducing pollutant formation are described. Principal program areas are the interaction of fluid mechanical turbulence with combustion reactions, important phenomena and pollutant generating processes associated with internal combustion engines, fire safety and flame spread, and diagnostics and formation mechanisms associated with the generation of nitrogen containing pollutants. DOE

N80-25401# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.
THERMOPHYSICAL PROPERTIES OF INORGANIC POLYSULFIDES Progress Report
George J. Janz Dec. 1979 25 p refs
(Contract DE-AC02-79ER-10387)
(COO-10387-01) Avail: NTIS HC A02/MF A01

The data needs for thermophysical properties of selected polysulfides, as required directly or indirectly in the advanced battery development programs were addressed along with the mechanisms of melting of ionic compounds. The research approach is briefly summarized and the accomplishments and status of the three principal tasks that were undertaken in this initial period are reported: preparative chemistry; the MSDCRPI DCS facility; and thermophysical properties measurements. First results for sodium trisulfide for the melting point, the enthalpy of fusion, and entrophy of fusion are 238.7 C, 5538 cal/mol, and 10.83 cal/deg mol. DOE

N80-25402# Argonne National Lab., Ill. Chemical Engineering Div.
THERMOPHYSICAL PROPERTIES OF SODIUM
Joanne K. Fink and Leonard Leibowitz May 1979 421 p refs
(Contract W-31-109-eng-38)
(ANL/CEN/RSD-79-1) Avail: NTIS HC A18/MF A01

The thermophysical properties of sodium are presented and summarized in tabular form for reactor safety studies. Subcooled, superheated and saturated properties are given. DOE

N80-25403# Argonne National Lab., Ill.
THERMAL CONDUCTIVITY MEASUREMENTS AND MOLECULAR ASSOCIATION IN ETHANOL VAPOR
D. J. Frurip, L. A. Curtiss, and M. Blander 1979 20 p refs
Presented at 16th Intern. Thermal Conductivity Conf., Chicago, 7-9 Nov. 1979
(Contract W-31-109-eng-38)
(CONF-791134-8) Avail: NTIS HC A02/MF A01

Thermal conductivity measurements on ethanol vapor are reported as a function of temperature (329-419 K) and pressure (100-1800 torr). The thermal conductivity versus pressure plots at constant temperature exhibit strong upward curvature at the lower temperatures and nearly linear increases at the higher temperatures. This enhancement in the thermal conductivity is indicative of the presence of a dimeric species and one or more larger clusters in the vapor. Analysis of the data gave best fits for monomer-dimer-tetramer and monomer-dimer-hexamer models. Quantum mechanical evidence indicates that the tetramer is the most probable associated species larger than the dimer. DOE

N80-25404# California Univ., Livermore. Lawrence Livermore Lab.
SUMMARY AND REVIEW OF HYDROGEN THEORETICAL EQUATION-OF-STATE MODELS AT LAWRENCE LIVERMORE LABORATORY
H. C. Graboske, Jr. and K. L. Wong 1 Feb. 1980 39 p refs
(Contract W-7405-eng-48)
(UCID-18489) Avail: NTIS HC A03/MF A01

A review and analysis of the hydrogen equations of state (EOS) are presented. Careful comparison to experimental data and among EOS's are performed and evaluated. The new hydrogen EOS (EOS95) and its representations produce the best agreement with experimental data and hydrodynamic simulation studies. DOE

N80-25405# Mound Lab., Miamisburg, Ohio.
USE OF MASS SPECTROSCOPY FOR CONTAMINATION CONTROL
Victoria M. Franchetti and Christopher Kinard 3 Mar. 1980 35 p
(Contract EY-76-C-04-0053)
(MLM-2686) Avail: NTIS HC A03/MF A01

The use of mass spectrometric techniques to identify oil contaminants on production materials was investigated. Mass spectrometry was found to have the specificity and sensitivity necessary for both identification and semiquantitation of oil contaminants. A mass spectrometric data file was established for use in identifying oils, adhesives, or other contamination that may be present on surface of production parts. Sample preparation and handling determine the quality of the analysis. Simulated and real problem situations were investigated and compared. DOE

N80-25406# Connecticut Univ., Storrs. Inst. of Water Resources.
METHODS OF EVALUATION OF POTENTIALLY HAZARDOUS ORGANICS IN WATER Technical Completion Report, Sep. 1976 - Sep. 1979
Ralph P. Collins 8 Jan. 1980 15 p ref
(Contract DI-14-34-0001-8007)
(PB80-135122; W80-02761; OWRT-A-072-CONN(1)) Avail: NTIS HC A02/MF A01 CSCL 07D

A method for fingerprinting of public water supplies for the presence of trace organic pollutants involves the trapping of organic compounds on Tenax GC columns, desorption of the compounds from the column and analysis by gas chromatography. A systematic procedure was devised for the characterization of trace organic pollutants in the Thames River. The process involves solvent extraction, separation into classes of organic compounds, and identification by means of gas chromatography and mass spectrometry. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-25407 Stanford Univ., Calif.
MICROWAVE SURFACE IMPEDANCE STUDIES ON COPPER AT LOW TEMPERATURE Ph.D. Thesis
Christopher Allen Waters 1980 101 p
Avail: Univ. Microfilms Order No. 8011725

The surface resistance and reactance was measured by means of the related cavity parameters of quality factor (Q) and resonant frequency respectively. The range of temperature investigated was from 1.6 to 14.0 Kelvin. Changes in resonant frequency with temperature were measured with an accuracy of about

one Hertz at a frequency of 9.120 megahertz, which corresponds to a fractional change in surface reactance of 10 to the minus 5th power. Fractional changes in surface resistance were measured with about 5 x 10 to the minus 4th power accuracy. The cavities were cylindrical, and were usually driven in the transverse electric 011 normal mode. A number of circular endplates and cylindrical bodies made of copper or aluminum were assembled in various combinations to form cavities. In one all copper cavity the frequency, as a function of temperature, has shown a discontinuous change of slope at 3.48 + or - 0.04 Kelvin. Although the shape of this function was influenced by various experimental factors, the temperature of the slope discontinuity was repeatable, and was not affected by adsorbed gas contamination on the cavity walls, or by the substitution of aluminum endplates for copper on one or both ends. Dissert. Abstr.

N80-25408 Cincinnati Univ., Ohio.
A PRESENTATION FOR THE DEFORMATION OF A METAL INCLUDING THE EFFECTS OF STRAIN HARDENING AND RECRYSTALLIZATION Ph.D. Thesis
Anand Deo Narayana 1979 130 p
Avail: Univ. Microfilms Order No. 8012242

A phenomenological constitutive theory is developed to predict the mechanical response of a metal that simultaneously undergoes strain hardening and recrystallization. The constitutive theory is developed within the framework of continuum mechanics and thermodynamics. It is subsequently specialized to successfully predict the mechanical response of copper experiencing dynamic recrystallization. An internal state variables approach to constitutive modeling is used to account for changes in the microstructure. The stored energy of cold work is the key macroscopic parameter used to characterize the microstructure. State variables are introduced to account for the total effect of arbitrary deformation and temperature histories on the microstructure. An analysis of the kinematics of recrystallization leads to a multiplicative decomposition of the total deformation mapping into these successive mappings. The mappings correspond to: (1) deformation associated with geometrical changes into the fully annealed current configuration; (2) a strain-hardening deformation into the current plastic configuration; and (3) an elastic deformation into the current configuration. Dissert. Abstr.

N80-25409 Cincinnati Univ., Ohio.
THE HIGH-TEMPERATURE LOW CYCLE FATIGUE BEHAVIOR OF A NEAR-ALPHA TITANIUM ALLOY Ph.D. Thesis
Paul John Bania 1977 189 p
Avail: Univ. Microfilms Order No. 8012230

The high temperature low cycle fatigue (HTLCF) behavior of the near-alpha Ti-5Al-5Sn-2Zr-2Mo-.25Si titanium alloy was examined, with the primary intent of determining the relative importance of microstructure, test temperature and test frequency. Of the four microstructures examined, two were produced by alpha + beta processing and heat treatment while the remaining two microstructures were produced by beta processing with heat treatments above and below the beta transus. The HTLCF tests were conducted under constant total strain control (R = -1.0) at temperatures of 800 F (426 C), 900 F (482 C) and 1000 F (538 C) and cyclic frequencies of 0.4 cpm (.0067 Hz), 2 cpm (.033 Hz) and 10 cpm (.167 Hz). Results indicate that only microstructure played a significant role in determining HTLCF life. The alpha + beta microstructures were seen to exhibit the best overall HTLCF response with the microstructure containing 50 vol pct primary alpha being slightly superior to the 90 vol pct primary alpha microstructure. Dissert. Abstr.

N80-25410 Case Western Reserve Univ., Cleveland, Ohio.
SECTION SIZE EFFECTS ON TOUGHNESS OF VARIOUS CAST STEELS Ph.D. Thesis
Renato Prado Maino 1980 160 p
Avail: Univ. Microfilms Order No. 8013852

The effect of section size on the toughness behavior of various commonly used cast steels was investigated. The steels included eleven commercial grades that were supplied by different manufactures. The various steels were cast as plates of 1 in, 3 in and 5 in section from a single heat for each lot and fully heat treated at the various foundaries. Specimens were removed from each section size to determine the nil ductility transition temperature from drop weight tests, the Charpy V-notched transition curve, tensile properties and microstructure. The primary effect of mass observed was on the fracture toughness of the thicker plates of the quenched and tempered steels. The nil ductility transition temperature increases an average of 22 F (12 C) and 27 F (15 C) in the 3 in and 5 in sections respectively compared to the 1 in thickness. A similar increase occurred in the 15 ft lb and 50 percent fibrosity temperatures of the Charpy test in these quenched and tempered steels. Other significant observations are reported. Dissert. Abstr.

N80-25411 Minnesota Univ., Minneapolis.
SPUTTERING OF MULTICOMPONENT SURFACES: SURFACE COMPOSITION CHANGES UNDER ION BOMBARDMENT AND ANGULAR EJECTION DISTRIBUTIONS OF SPUTTERED SPECIES Ph.D. Thesis
Rolf Robert Olson 1979 115 p
Avail: Univ. Microfilms Order No. 8011863

The sputtering of multicomponent materials is discussed with respect to composition changes at the target surface induced by the ion bombardment and the angular ejection distributions of the sputtered species. Results are shown for several elements and alloys at various bombardment energies. A model is presented which suggest that the phenomenon is a result of reflective collisions because lighter atoms can be backscattered from heavier ones underneath but not vice versa. Dissert. Abstr.

N80-25412*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF HOT CORROSION BEHAVIOR OF THERMAL BARRIER COATINGS
P. E. Hodge, R. A. Miller, and M. A. Gedwill 1980 11 p refs
Presented at Intern. Conf. on Met. Coatings, San Diego, Calif., 21-25 Apr. 1980
(Contract EF-77-A-01-2593)
(NASA-TM-81520; DOE/NASA/2593-16) Avail: NTIS HC A02/MF A01 CSCL 07D

Calcium silicate and yttria stabilized zirconia/MCrAlY thermal barrier coating systems on air-cooled specimens were exposed to sodium plus vanadium doped Mach 0.3 combustion gases. Thermal barrier coating endurance was determined to be a strong inverse function of ceramic coating thickness. Coating system durability was increased through the use of higher Cr + Al NiCrAl and CoCrAlY bond coatings. Chemical and electron microprobe analyses supported the predictions of condensate compositions and the determination of their roles in causing spalling of the ceramic coatings. Author

N80-25413*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF THE STRESS CORROSION CRACKING RESISTANCE OF SEVERAL HIGH STRENGTH LOW ALLOY STEELS
T. S. Humphries and E. E. Nelson May 1980 28 p refs
(NASA-TM-78276) Avail: NTIS HC A03/MF A01 CSCL 11F

The stress corrosion cracking resistance was studied for high strength alloy steels 4130, 4340, for H-11 at selected strength levels, and for D6AC and HY140 at a single strength. Round tensile and C-ring type specimens were stressed up to 100 percent of their yield strengths and exposed to alternate immersion in salt water, salt spray, the atmosphere at Marshall Space Flight Center, and the seacoast at Kennedy Space Center. Under the test conditions, 4130 and 4340 steels heat treated to a tensile strength of 1240 MPa (180 ksi), H-11 and D6AC heat treated to a tensile strength of 1450 MPa (210 ksi), and HY140 (1020 MPa, 148 ksi) are resistant to stress corrosion cracking because failures were not encountered at stress levels up to 75 percent of their yield strengths. A maximum exposure period of one month for alternate immersion in salt water or salt spray and three months for seacoast is indicated for alloy steel to avoid false indications of stress corrosion cracking because of failure resulting from severe pitting. A.R.H.

N80-25414*# Martin Marietta Aerospace, New Orleans, La.
STUDY OF ETCHANTS FOR CORROSION-RESISTANT METALS, SPACE SHUTTLE EXTERNAL TANK
J. R. Simmons 11 Jan. 1980 26 p refs
(Contract NAS8-30300)

(NASA-CR-161431; ETTR-52) Avail: NTIS HC A03/MF A01 CSCL 11F

Acceptable etchant concentrations and application and removal procedures for etching austenitic stainless steel, nickel base alloys, and titanium alloys (annealed) employed on the external tank were formulated. The etchant solutions were to be capable of removing a minimum of 0.4 mils of surface material in less than one hour. R.C.T.

N80-25415*# IIT Research Inst., Chicago, Ill. Materials Technology Div.

THERMAL FATIGUE AND OXIDATION DATA OF OXIDE DISPERSION-STRENGTHENED ALLOYS

K. E. Hofer, V. L. Hill, and V. E. Humphreys Mar. 1980 42 p refs

(Contract NAS3-17787)

(NASA-CR-159842; IITRI-M6001-82) Avail: NTIS HC A03/MF A01 CSCL 11F

Thermal fatigue and oxidation data were obtained 24 specimens representing 9 discrete oxide dispersion-strengthened alloy compositions or fabricating techniques. Double edge wedge specimens, both bare metal and coated for each systems, were cycled between fluidized beds maintained at 1130 C with a three minute immersion in each bed. The systems included alloys identified as 262 in hardness of HRC 38; 264 in hardness of HRC 38, 40 and 43; 265 HRC 39, 266 of HRC 37 and 40; 754; and 956. Specimens in the bare condition of 265 HRC 39 and 266 HRC 37 survived 6000 cycles without cracking on the small radius of the double edge wedge specimen. A coated specimen of 262 HRC 38, 266 HRC 37 and 266 HRC40 also survived 6000 cycles without cracking. A duplicate coated specimen of 262 HRC 38 alloy survived 5250 cycles before cracks appeared. All the alloys showed little weight change compared compared to alloys tested in prior programs. Authot

N80-25416# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.

THE RATE (TIME)-DEPENDENT BEHAVIOR OF Ti-7Al-2Cb-1Ta TITANIUM ALLOY AT ROOM TEMPERATURE UNDER QUASISTATIC MONOTONIC AND CYCLIC LOADING

D. Kujawski and E. Krempl Dec. 1979 41 p refs

(Contract N00014-76-C-0231)

(AD-A082623; RPI-CS-79-5) Avail: NTIS HC A03/MF A01 CSCL 11/6

Uniaxial tests using a servocontrolled testing machine and strain measurement at the gage length were performed on a high-strength, low-ductility, titanium alloy. Tests involved monotonic and cyclic loadings with strain rates between 2 x 10 to the minus 8th power to 10 to the minus 3rd power s to the minus 1st power, stress rates from 10 to the minus 1st power to 100 MPa s to the minus 1st power and short-term relaxation and creep tests. The inelastic behavior is strongly rate-dependent. Ratchetting is shown to increase as the stress rate decreases. No strain-rate history effect was found. A unique stress-strain curve is ultimately reached for a given strain rate irrespective of prior history as long as only positive stresses are imposed. In the plastic range the relaxation drop in a given time period depends only on the strain rate preceding the test and is independent of the actual stress and strain. The results are qualitatively in accordance with the viscoplasticity theory based on total strain and overstress. GRA

N80-25417# Rockwell International Corp., Thousand Oaks, Calif.

INFLUENCE OF ALPHA/BETA INTERFACE PHASE ON FRACTURE TOUGHNESS AND FATIGUE CRACK GROWTH RATE IN Ti-6Al-4V Technical Report, 1 Feb. 1978 - 31 Jan. 1979

C. G. Rhodes Feb. 1980 25 p refs

(Contract N00014-76-C-0598; NR Proj. 031-790)

(AD-A082456; SC5056.5TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The alpha/beta interface phase is a microstructural feature which occurs in two-phase, alpha/beta titanium alloys under certain processing conditions. Interface phase can grow to widths of up to approx. 500 nm and has been shown to exert an influence on tensile properties. In this work, its influence on fracture toughness and fatigue crack growth rate in Ti-6Al-4V has been examined. GRA

N80-25418# Lockheed-California Co., Burbank.

INVESTIGATION OF THE MECHANICAL AND CORROSION PROPERTIES OF MA-87 ALUMINUM POWDER ALLOY Final Report

Roy W. Brodie and Leon Bakow Dec. 1979 103 p refs

(Contract N62269-78-C-0446; WF54591001)

(AD-A082457; LR-29293; NADC-78185-60) Avail: NTIS HC A06/MF A01 CSCL 11/6

Mechanical, corrosion and fracture properties were determined for two MA87(CT91)-T7E69 powder alloy extruded shapes. Four lots of material were extruded and heat treated in production facilities. Mechanical properties including tensile, compression, shear and bearing were comparable to available data for 7075-T6 extrusions. The MA87(CT91)-T7E69 extrusions were resistant to exfoliation when exposed to EXCO, salt spray, or sea coast environments, although pitting was observed. GRA

N80-25419# Westinghouse Research and Development Center, Pittsburgh, Pa.

STUDY TO OPTIMIZE Cr-Mo STEELS TO RESIST HYDROGEN AND TEMPER EMBRITTLEMENT Annual Report

B. J. Shaw and E. W. Johnson 17 Dec. 1979 40 p refs

(Contract ET-78-C-01-3050)

(RR-79-9D9-HYTEM-R3; AR-1) Avail: NTIS HC A03/MF A01

Temper embrittlement and hydrogen embrittlement characteristics of 2-1/4 Cr-1 Mo steels are described and the most significant tests performed in H2S are outlined. The testing procedure developed to evaluate the hydrogen embrittlement susceptibility is presented along with the estimates of the crack arrest stress intensities measured on retempered commercial steels. DOE

N80-25420# Rocketdyne, Canoga Park, Calif. Energy Systems Group.

FORGING EVALUATION OF 304L STAINLESS STEEL

C. L. Packard and C. M. Edstrom 29 Oct. 1979 64 p refs

(Contracts EY-76-C-04-3533; DE-AC04-76DP-03533)

(RFP-2897) Avail: NTIS HC A04/MF A01

The effects of various forging parameters on the metallographic structure and mechanical properties of 304L stainless steel forgings were evaluated. Upset and die forgings were produced by hammer and Dynapak forging with forging temperatures ranging from 760 to 1145 C, upset reductions ranging from 20 to 60 percent, and annealing times ranging from 0 to 25 minutes at 843 C. The carbide precipitation behavior observed was found to be a function of forging temperature and annealing time. Higher forging temperatures were beneficial in avoiding continuous carbide precipitation and annealing at 843 C promoted increased carbide precipitation. The yield strength of the unannealed forgings decreased with increasing forging temperature and, with the exception of the 1145 C upset forgings, was significantly lowered by annealing. DOE

N80-25421# Westinghouse Research and Development Center, Pittsburgh, Pa. Research and Development Center.

STUDY TO OPTIMIZE Cr-Mo STEELS TO RESIST HYDROGEN AND TEMPER EMBRITTLEMENT

B J. Shaw and E. Johnson 23 Aug. 1979 17 p refs

(Contract ET-78-C-01-3050)

(FE-3050-T2; QR-3) Avail: NTIS HC A02/MF A01

Hydrogen sulfide environmental tests on a 2-1/4 Cr-1 Mo sample are presented. The present emphasis is on modifying a testing technique for low yield strength steels (by approximately 100 ksi) in which plane stress-plane strain and incubation time problems are severe. It is demonstrated that the plane stress zones pin the crack and that these zones can be eliminated by side grooving the specimen. The incubation time is reduced by pre-fatiguing in the environment. The reasons for using an arrest stress intensity value, from a simulated bolt load test (K/sub arr/), rather than a crack onset K, form a rising load test (K sub o) for an assessment of hydrogen embrittlement susceptibility are given. It is shown in this sample that a smooth sided 3T specimen has a 150 ksi in/sup 1.2/ whereas a side grooved

2T specimen has a K/sub arr/ approximately 20 ksi in/ sup 1/2/. DOE

N80-25422# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
NOTCH AND HYDROGEN EFFECTS ON SENSITIZED 21-6-9 STAINLESS STEEL
G. R. Caskey, Jr. 1979 18 p refs Presented at the TMS-AIME Fall Meeting, Milwaukee, 16-20 Sep. 1979
(Contracts EY-76-C-09-0001; AT(07-2)-1)
(DP-MS-79-22; CONF-790910-5) Avail: NTIS HC A02/MF A01

Type 21-6-9 stainless steel alloy is slightly notch sensitive in the solution annealed condition, a behavior that is aggravated by sensitization anneal at 920 K. The lower toughness of the sensitized alloy is a measure of microstructural embrittlement associated with carbide precipitation in grain boundaries. The tendency toward grain boundary fracture in the sensitized alloy is accentuated by stress concentration at the notch. Also, there is an increase in notch sensitivity when the alloy is tested in a high pressure (69 MPa) hydrogen environment, due to susceptibility of the grain boundaries to hydrogen embrittlement. DOE

N80-25423# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
THERMO-MECHANICAL PROCESS FOR TREATMENT OF WELDS Final Report
R. K. Malik Mar. 1980 24 p refs Presented at the WESTEC 80 Conf., Los Angeles, 20 Mar. 1980
(Contracts EY-76-C-07-1570)
(CONF-800316-2) Avail: NTIS HC A02/MF A01

Benefits from thermomechanical processing (TMP) of austentic stainless steel weldments, analogous to hot isostatic pressing (HIP) of castings are examined. It is shown that TMP improves ultrasonic inspectability of austenitic stainless steel welds owing to: conversion of cast dendrites into equiaxed austenitic grains; reduction in size and number of stringers and inclusion; and reduction of delta ferrite content. It is also shown that TMP induces structural homogenization and healing of void type defects and thus contributes to an increase in elongation, impact strength, and fracture roughness as well as a significant reduction in data scatter for these properties. Results indicate that an optimum temperature for TMP or HIP of welds is one which causes negligible grain growth and an acceptable reduction in yield strength, and permits healing of porosity. DOE

N80-25424# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
SOLIDIFICATION BEHAVIOR OF AUSTENITIC STAINLESS STEEL FILLER METALS
S. A. David, G. M. Goodwin, and D. N. Braski Feb. 1980 27 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7116) Avail: NTIS HC A03/MF A01

Thermal analysis and interrupted solidification experiments were conducted on selected austenitic stainless steel filler metals to provide an understanding of the solidification behavior of austenitic stainless steel welds. The sequences of phase separations found were for type 308 stainless steel filler metal and for type 310 stainless steel filler metal. In type 308 stainless steel filler metal, ferrite at room temperature was identified as either the untransformed primary delta-ferrite formed during the initial stages of solidification or the residual ferrite after Widmanstaetten austenite precipitation. Microprobe and scanning transmission electron microscope microanalyses revealed that solute extensively redistributes during the transformation of primary delta-ferrite to austenite, leading to enrichment and stabilization of ferrite by chromium. The type 310 stainless steel filler metal investigated solidifies by the primary crystallization of austenite, with the transformation going to completion at the solidus temperature. DOE

N80-25425# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
HYDROGEN CHARGING EFFECT ON CREEP OF PURE IRON
J. Nagakawa, K. S. Shin, C. G. Park, and M. Meshii 1979 4 p refs Presented at the 2nd Intern. Symp. on Hydrogen in Metals, Minikama Spa, Japan, 26 Nov. 1979; sponsored by Japan Inst. of Metals
(Contract EY-76-S-02-1367; Grant NSF DMR-79-80847)
(COO-1367-107; CONF-791132-4) Avail: NTIS HC A02/MF A01

The cathodic charging effect on mechanical properties of pure iron was examined using creep test. Single and polycrystal specimens prepared from MRC VP grade iron were purified in the ZrH2 system. While no effect was observed for the anodic potential, cathodic charging (approximately 5 volt, approximately 50 A/m(2)) increased the creep rate approximately 30 fold at 200 K. While the creep acceleration was equally prominent in both specimens, the hydrogen embrittlement occurred only in polycrystal specimens. DOE

N80-25426# Massachusetts Inst. of Tech., Cambridge. Nuclear Reactor Lab.
ALLOY DEVELOPMENT FOR IRRADIATION PERFORMANCE IN FUSION REACTORS Annual Report, Sep. 1978 - Sep. 1979
Dec. 1979 113 p refs
(Contract ER-78-S-02-5098)
(COO-5098; MIT-NRL-003) Avail: NTIS HC A06/MF A01

The development of improved performance alloys for each severe environments as the fusion reactor fist wall are described. Major emphasis is directed toward definition of alloy performance requirements, alloy design, alloy production and alloy performance evaluation. Integrated testing and modeling procedures are developed to minimize testing requirements. Progress during the first project year and future plans are summarized. DOE

N80-25427# Illinois Univ., Urbana.
ANELASTIC STUDIES OF INTERSTITIALLY TRAPPED HYDROGEN IN NIOBIUM Ph.D. Thesis
Philip Emerson Zapp 1979 139 p refs
(Contracts DE-AC02-76ER-01198; EY-76-C-02-1198)
(DOE/ER-01198/1299) Avail: NTIS HC A07/MF A01

The trapping and quantum mechanical motion of hydrogen were investigated in Nb-O-H and Nb-N-H by anelastic relaxation. The measured relaxations were caused by the local, stress induced reorientation of single H atoms bound to single, essentially immobile O and N atoms. The symmetries and binding enthalpies of O-H pairs were studied in oriented single crystals of high-purity Nb using pulse-echo attenuation of very high frequency longitudinal stress waves between 100 and 300 K. Well defined internal friction peaks were found in the <100>, <110>, and <111> directions of the of the b.c.c. lattice. Temperature dependence of the jump frequency of H below 100 K was studied in the Nb-N-H system using lower frequency methods. Internal friction peaks were measured, relaxation times were calculated from strain relaxation measurement below 60 K. Data show marked deviation from classical thermally activated Arrhenius behavior. DOE

N80-25428# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
LOW-TEMPERATURE HELIUM EMBRITTLEMENT OF TRITIUM-CHARGED STAINLESS STEEL
D. E. Rawl, Jr., G. R. Caskey, Jr., and J. A. Donovan 1980 25 p refs Presented at 109th Ann. AIME Meeting, Las Vegas, 24-28 Feb. 1980 Prepared in cooperation with Massachusetts Univ., Amherst
(Contracts EY-76-C-09-0001; DE-AC09-76SR-00001)
(DP-MS-79-64; CONF-800205-4) Avail: NTIS HC A02/MF A01

Specimens of Type 21-6-0 stainless steel were charged with tritium or protium to determine the effect of hydrogen isotope exposure on ductility. Specimens charged with either tritium or protium showed a 40% loss in ductility when tested immediately after charging. Protium-charged specimens stored 5.5 years at 250 K showed no additional loss in ductility. However, tritium-charged specimens suffered an additional loss of 86% in ductility when similarly stored. DOE

N80-25429# Bendix Corp., Kansas City, Mo.
THERMAL FATIGUE EVALUATION OF SOLDER ALLOYS Final Report
D. M. Jarboe Feb. 1980 33 p refs
(Contracts EY-76-C-04-0613; DE-AC04-76DP-00613)

(BDX-613-2341) Avail: NTIS HC A03/MF A01

The relative thermal fatigue resistance of 29 solder alloys was determined. A number of these alloys were found to be less susceptible to thermal fatigue cracking in encapsulated printed wiring board applications than the commonly used tin-lead eutectic (63Sn-37Pb). Three alloys, 95Sn-5Ag, 98.5Ag, and 95Sn-5S offered the greatest resistance to thermal fatigue. The selection of the encapsulation materials was confirmed to be a significant factor in thermal fatigue of solder joints, regardless of the solder alloy used. DOE

N80-25430# Ames Lab., Iowa.

HIGH TEMPERATURE CORROSION STUDIES. A. IRON: BASED SUPERALLOY IN SO2/O2 ATMOSPHERES. B. GAS: SOLID REACTION WITH FORMATION OF VOLATILE SPECIES Ph.D. Thesis

Tai-Kang Liu Mar. 1980 197 p refs

(Contract W-7405-eng-82)

(IS-T-893) Avail: NTIS HC A09/MF A01

The thermogravimetric method was used to study high temperature corrosion under SO2/O2 atmosphere applied to Armco 18SR alloys with different heat treatment histories. Armco T310 and pure chromium between 750 and 1100 C. Armco 18SR-C has the best corrosion resistance of the Armco 18SR alloys. Armco T310 is not protective at high temperatures. The available rate data on the oxidation of chromium oxide, chlorination of chromium, oxidation-chlorination of chromium oxide, chlorination of nickel and chlorination of iron were found to be predictable. The calculation of high temperature volatilization rate was performed using the available fluid correlation equations and the Lennard-Jones parameters derived from the molecule with similar structure and from the low temperature viscosity measurement. The lower predicted volatilization rate is due to the use of the Chapman-Enskog equation with the Lennard-Jones parameters mostly derived from the low temperature viscosity measurement. DOE

N80-25431# AD-EX, Portola Valley, Calif.

ELECTROCHEMICAL PROPERTIES OF CERTAIN NEW TERNARY AND QUATERNARY ALLOYS BASED ON ALUMINUM

B. Jovanovic, S. Zecevic, D. M. Drazic, and A. R. Despic Nov. 1979 12 p Transl. into ENGLISH of paper presented at 20th Cong. of Serbian Chemists, Belgrade, 18 Jan. 1977 Sponsored by DOE Prepared for California Univ., Lawrence Livermore Lab. (UCRL-Trans-11535) Avail: NTIS HC A03/MF A01

The effect of adding small amounts of various elements to aluminum on its electrochemical behavior was studied. It was demonstrated that 0.1 percent In, Ga, and Tl significantly changes three properties of aluminum and this otherwise electrochemically inactive metal is thus converted into a metal that can be used as a highly active anode in galvanic elements or in anticorrosion protection. These three properties are: the stationary potential (which for pure aluminum in a chloride solution amounts to only -0.56 V vs a normal hydrogen electrode, while with alloying it becomes more negative by several hundred millivolts); corrosion in an open circuit (which must be limited so that considerable self-discharge, i.e., unproductive consumption of the metal, does not occur); and corrosion of the metal during anode dissolution, which manifests itself by evolution of gaseous hydrogen and can be increased or decreased by increasing the anode current density and which is referred to in the electrochemical literature as a negative or positive differential effect. It was demonstrated that the introduction of additives reduces the negative differential effect (e.g., from 14 percent for pure aluminum to 0.5 percent for the alloy Al-In) and increases anodic utilization of aluminum correspondingly (from 86 percent to 99.5 percent). Two ternary combinations (Al-In-Tl) and Al-In-Ga) and a quaternary alloy with all three alloying elements (Al-In-Ga-Tl) were studied. DOE

N80-25432# California Univ., Livermore. Lawrence Livermore Lab.

MATHEMATICAL MODEL FOR SIMULATION OF THE FATE OF COPPER IN A MARINE ENVIRONMENT

G. T. Orlob, Davorin Hrovat, Thomas Wakeman, and Florence L. Harrison 27 Sep. 1979 62 p refs Prepared in cooperation with California Univ., Davis Prepared for Nuclear Regulatory Commission, Washington, D.C.

(Contract W-7405-eng-48)

(NUREG-CR-1098; UCRL-52728) Avail: NTIS HC A04/MF A01

A mathematical model for the simulation of the fate of copper in a marine environment was developed. The model, which describes the kinetics of copper transformation from ionic copper to complexes with dissolved organic matter and sorption on suspended sediment, is imbedded in a two dimensional finite element model which is capable of simulating advection and diffusion processes in natural receiving waters. Kinetic rate and equilibrium constants for the model were developed independently in laboratory experiments. A test simulation was performed under realistic conditions of slug discharge of ionic copper with the cooling water from a nuclear power station situated on the California coast. Results show that the model performed correctly under the conditions assumed. Future research and development is directed toward improving description of copper kinetics under varying environmental conditions and exploring the sensitivity of the model. DOE

N80-25433# Connecticut Univ., Storrs. Inst. of Materials Science.

ELECTRODE POLARIZATION STUDIES IN HOT CORROSION SYSTEMS Progress Report, 1 Jun. 1979 - 31 Apr. 1980

Owen F. Devereux Feb. 1980 39 p refs

(Contract EY-76-S-02-2960)

(COO-2960-4) Avail: NTIS HC A03/MF A01

A comprehensive set of tests were performed on iron, nickel, and types 304 and 316 stainless steel in gas mixtures of controlled CO, CO sub 2, H sub 2 and H sub 2S at a total pressure of one atmosphere and in a temperature range of 900 - 1000. The polarization curves thus derived were reduced to a set of empirical kinetic constants via computer modelling. Oxidation of iron in gas mixtures of controlled CO, CO2, H2, and H sub 2S at a total pressure of one atmosphere and a temperature of 900 C has been studied. In the S sub 2 and O sub 2 ranges employed sulfide scales were formed; O sub 2 influenced the short term sulfidation kinetics. Specimen geometry was seen as a significant factor influencing long term kinetics. A reproducible corrosive attack was seen at the metal/molten carbonate/gas phase junction. This attack was quantitatively evaluated and explained in terms of a diffusion model. Previous modelling procedures were expanded to include one or more anodic reactions displaying passive behavior. DOE

N80-25434# National Technical Information Service, Springfield, Va.

TUNGSTEN AND TUNGSTEN ALLOY POWDER METALLURGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1980

William E. Reed Mar. 1980 134 p Supersedes NTIS/PS-79/0222; NTIS/PS-78/0163

(PB80-806011; NTIS/PS-79/0222; NTIS/PS-78/0163) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Federally-funded studies on fabricating and processing of tungsten, its alloys and composites are cited. Methods described include compacting, pressing, sintering, extruding, and rolling. Infiltration of porous tungsten shapes is also covered. The mechanical properties, thermal properties, and microstructure of these products are reported. Some products studied are rocket nozzles, nuclear reactor materials, and porous ionizers. This updated bibliography contains 127 abstracts, 5 of which are new entries to the previous edition. GRA

N80-25435# National Technical Information Service, Springfield, Va.

TUNGSTEN AND TUNGSTEN ALLOY POWDER METALLURGY. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Feb. 1980

William E. Reed Mar. 1980 255 p Supersedes NTIS/PS-79/0223; NTIS/PS-78/0164

(PB80-806029; NTIS/PS-79/0223; NTIS/PS-78/0164) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Worldwide journal articles are cited on tungsten powder preparation and processing. Studies include sintering, densification, shrinkage, phase analysis, and heat treatment. The physical and mechanical properties of tungsten powder metal products

are included. The effects of additives and particle size on the sintering and sintered articles are also described. This updated bibliography contains 248 abstract, 31 of which are new entries to the previous edition. GRA

N80-25436# National Technical Information Service, Springfield, Va.
SUPERALLOYS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Feb. 1980
William E. Reed Mar. 1980 127 p Supersedes NTIS/PS-79/0220; NTIS/PS-78/0199; NTIS/PS-77/0160
(PB80-805831; NTIS/PS-79/0220; NTIS/PS-78/0199; NTIS/PS-77/0160) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Federally funded research on cobalt and nickel based superalloys is cited. Casting and powder metallurgy of these alloys are covered. Properties such as heat resistance, corrosion resistance, microstructure, fracture, and creep are described. The use of these materials in nuclear reactors, gas turbine parts, and high temperature equipment is a major part of this compilation. This updated bibliography contains 120 abstracts, 45 of which are new entries to the previous edition. GRA

N80-25437# National Technical Information Service, Springfield, Va.
SUPERALLOYS, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Mar. 1977 - 1979
William E. Reed Mar. 1980 272 p
(PB80-805849) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Worldwide research is cited on cobalt, iron, and nickel based superalloys. The manufacture, melting, casting, powder metallurgy, forging and welding of these alloys are covered. Studies on corrosion, high and low temperature properties, physical, and mechanical properties of these materials are included. Applications discussed are nuclear reactors, gas turbines, superconducting machinery, and heat exchangers. This updated bibliography contains 255 abstracts, none of which are new entries to the previous edition.

N80-25438# National Technical Information Service, Springfield, Va.
SUPERALLOYS, VOLUME 4. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1979 - Feb. 1980
William E. Reed Mar. 1980 139 p Supersedes NTIS/PS-79/0221; NTIS/PS-78/0201; NTIS/PS-77/0161
(PB80-805856; NTIS/PS-79/0221; NTIS/PS-78/0201; NTIS/PS-77/0161) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Worldwide research is cited on cobalt, iron, and nickel based superalloys. The manufacture, melting, casting, powder metallurgy, forging, and welding of these alloys are covered. Studies on corrosion, high and low temperature properties, physical, and mechanical properties of these materials are included. Applications discussed include nuclear reactors, gas turbines, superconducting machinery, and heat exchangers. This updated bibliography contains 132 abstracts, 126 of which are new entries to the previous edition. GRA

N80-25439# National Technical Information Service, Springfield, Va.
HYDROGEN EMBRITTLEMENT OF METALS. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1971 - 1979
William E. Reed Mar. 1980 212 p Supersedes NTIS/PS-79/0180
(PB80-805963; NTIS/PS-79/0180) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Research reports on hydrogen embrittlement of ferrous and nonferrous metals are cited. Studies relating to mechanical properties, corrosion, failure, testing, and inhibition are presented. Hydrogen embrittlement is described in pressure vessels, pipes, welds, and steels. Reports on materials used in pipeline, refinery, petrochemical and energy storage service are included. This updated bibliography contains 205 abstracts, 25 of which are new entries to the previous edition. GRA

N80-25440# National Technical Information Service, Springfield, Va.
HYDROGEN EMBRITTLEMENT OF METALS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - Feb. 1980
William E. Reed Mar. 1980 260 p Supersedes NTIS/PS-79/0177; NTIS/PS-78/0096 and NTIS/PS-77/0004
(PB80-805948; NTIS/PS-79/0177; NTIS/PS-78/0096; NTIS/PS-77/0004) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Studies on hydrogen embrittlement relating to mechanical properties, irradiation, crystal structure, and corrosion are cited. This compilation also covers testing, hydrogen analysis and diffusion, welding, electroplating, fabrication, and processing with respect to the ductile brittle transition in metals. Reports on nuclear reactor materials, hydrogen storage equipment, and energy related systems are included. This updated bibliography contains 253 abstracts, 45 of which are new entries to the previous edition. GRA

N80-25441# National Technical Information Service, Springfield, Va.
HYDROGEN EMBRITTLEMENT OF METALS, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Feb. 1980
William E. Reed Mar. 1980 260 p Supersedes NTIS/PS-79/0179; NTIS/PS-78/0097 and NTIS/PS-77/0006
(PB80-805955; NTIS/PS-79/0179; NTIS/PS-78/0097; NTIS/PS-77/0006) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Research from worldwide journal literature on hydrogen embrittlement of ferrous and nonferrous metals is cited in this bibliography. Studies on mechanical properties, heat treatment, crystal structure, fracture, hydrogen diffusion, grain growth, strain, pressure, and testing in relation to embrittlement are covered. This phenomena is described in pressure vessels, pipes, welds, engineering equipment, and electroplates. This updated bibliography contains 253 abstracts, 119 of which are new entries to the previous edition. GRA

N80-25442# National Technical Information Service, Springfield, Va.
CORROSION OF STAINLESS STEEL, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Feb. 1980
William E. Reed Mar. 1980 190 p Supersedes NTIS/PS-79/0208; NTIS/PS-78/0233 and NTIS/PS-77/0183
(PB80-805906; NTIS/PS-79/0208; NTIS/PS-78/0233; NTIS/PS-77/0183) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Federally funded research on stainless steel composition, mechanical properties, structure, and testing in relation to corrosion is cited. The majority of research concerns nuclear reactor materials. In addition, corrosion studies in coal gasification plants, rocket propellant tanks, underwater cables, batteries, and geothermal systems are included. This updated bibliography contains 183 abstracts, 54 of which are new entries to the previous edition. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-25443 Massachusetts Inst. of Tech., Cambridge.
CONSTITUTIVE EQUATIONS FOR POLYMERS UNDERGOING CHANGES IN MICROSTRUCTURE WITH DEFORMATION Ph.D. Thesis
Rosanna Falabella 1980 228 p
Avail: Univ. Microfilms Order No. 8012601

Constitutive equations for stress for solid polymers such as segmented polyurethane elastomers that undergo microstructural change with deformation are developed. Viscoelastic constitutive relations based on the fading memory assumption are shown to be inappropriate for materials that suffer a microstructural

weakening that depends on maximums in the strain history, regardless of when in the history the maximum occur. For the specific case of polyurethanes, a constitutive equation for stress is developed by defining the stress fuctional in terms of the history of the strain and the history of the orientation function of the hard chain segments of the polymers. The orientation functions of the hard and soft chain segments of the polyurethane, as determined by infrared dichroism, are shown to be simply related to each other and the tensile strain by assuming that the hard and soft chain segments act in series under load.

Dissert. Abstr.

N80-25444 Massachusetts Inst. of Tech., Cambridge.
INTERFACIAL TENSION THEORY FOR LOW MOLECULAR WEIGHT AND POLYMER SYSTEMS Ph.D. Thesis
Claudia Ingrid Poser 1980 210 p
Avail: Univ. Microfilms Order No. 8012636

The development of an interfacial tension theory applicable to low molecular weight fluids and polymer systems is reported. The theoretical treatment includes a rederivation of the free energy minimization formalism for inhomogeneous systems in the gradient approximation. The gradient approach is then combined with a slightly modified version of the lattice fluid model. The resulting theory describes liquid-vapor and liquid-liquid interfaces of pure and mixed nonpolar and slightly polar systems away from the critical region. The interfacial equations are amenable to numerical evaluation, and the theoretical predictions were tested against experiment for the cases of pure components and binary mixtures. For binary mixtures, the theory contains an additional parameter corresponding to the intermolecular interactions between unlike molecules. For nonpolar liquid mixtures, the theory can predict the composition dependence of the liquid-vapor interfacial tension to within 5%. Positive deviations from ideal tension behavior as well as strong preferential adsorption at the interface are correctly predicted.

Dissert. Abstr.

N80-25445 Case Western Reserve Univ., Cleveland, Ohio.
MICROSTRUCTURES OF STRUCTURAL CERAMICS Ph.D. Thesis
Linus Uzodimma Joseph Ogbuji 1979 142 p
Avail: Univ. Microfilms Order No. 8013654

Evidence is presented to show that dislocations are generated during the sintering of 0.4 micrometer Al2O3 powder, as a result of interparticle neck curvature stresses. The polymorphic phase transformation in sintered and hot pressed SiC is investigated. The /111/ coherent twins in the Beta envelope of a composite (alpha core/Beta envelope) grain are shown to play a centeral role in the transformation mechanism, their boundaries serving as preferred nucleation sites for the alpha phase. Various structural phenomena in SiC, such as profuse faulting in a single polytype, microsyntactic coalescence of different polytypes, and long period polytypism, are also examined and accounted for in the light of the proposed transformation mechanism.

Dissert. Abstr.

N80-25446 Case Western Reserve Univ., Cleveland, Ohio.
CRYSTALLIZATION OF ULTRA-QUENCHED POLYMER GLASSES Ph.D. Thesis
Charles Franklyn Pratt 1980 179 p
Avail: Univ. Microfilms Order No. 8013858

An ultraquenching technique was used to prepare thin (ca. 1000 angstroms) amorphous films of polyethylene, polypivalolactone, and poly(4-methylpentene-1). These films were characterized by electron microscopy, electron diffraction, and dynamic mechanical analysis. Other ultraquenched films of these polymers were crystallized by annealing for various times in the vicinity of their glass transition temperatures. Electron microscopy and electron diffraction were used to follow the reorganization of the thin films. Morphological and dynamic mechanical data confirm earlier findings of a double Tg for linear polyethylene. For ultraquenched films, a lower Tg(L) = 195 K was measured as the temperature at which crystallization of the amorphous polymer could first take place. Crystallization at Tg(L) appeared to proceed by the aggregation of the originally present nodules to form lamellar platelets, implying that some sort of chain folding was involved.

Dissert. Abstr.

N80-25447 Detroit Univ., Mich.
PHENOMENOLOGICAL STUDY ON REINFORCEMENT OF ELASTOMERS Ph.D. Thesis
Srimannarayana Kakarala 1980 170 p
Avail: Univ. Microfilms Order No. 8013692

The polymer-filler bonding of various filled rubbers was examined to study the influence of polymers and carbon blacks on reinforcement properties of elastomers. A central composite design with four independent variables, polymer Tg, carbon black surface, area structure, and amount was used in planning the experiments. In the unvulcanized state, the amount of insoluble rubber (bound rubber) and its effect on extrusion characteristics and glass transition temperature of the bonded polymer were measured. The filled rubber vulcanizate properties such as the dynamic moduli and loss tangent, equilibrium modulus, and solvent swell were compared to indicate the extent of the filler reinforcement. Response surface models were derived for the above filled rubber properties as a function of the four independent variables. The dynamic properties of the filled vulcanizates are strain dependent. The loss tangent was found to be a structure independent function of the total interfacial area of carbon blacks and seemed to depend on the continuity of the black network dispersed in the polymer matrix. The occluded rubber had a very significant effect on restricting the solvent swell and enhancing the equilibrium modulus.

Dissert. Abstr.

N80-25448# Honeywell Systems and Research Center, Minneapolis, Minn. Systems and Research Center.
SELECTIVE PAINT DEVELOPMENT Progress Report, 5 Dec. 1978 - 31 Jul. 1979
W. D. McKelvey, P. B. Zimmer, and R. J. H. Lin Aug. 1979 39 p refs
(Contract EM-78-C-04-4287)
(ALO-4287-T2) Avail: NTIS HC A03/MF A01

Eighteen hundred square feet of aluminum foil were coated with thickness-sensitive selective paint. The feasibility of a high speed, large-scale roller coating technique was demonstrated. Coating thermal stability, weathering and humidity resistance, and effects of pigment particle size on coating optical properties were studied. Thickness-insensitive paint with urethane binder was evaluated. A medium scale (1 kg) of thickness-insensitive paint solution was prepared which achieved an alpha/sub s/ of 0.90 and epsilon of 0.35.

DOE

N80-25449# Bendix Corp., Kansas City, Mo.
FAILURE ANALYSIS OF CERAMIC-TO-METAL SEALS
W. G. Gates Mar. 1980 25 p ref
(Contracts EY-76-C-04-0613; DE-AC04-76DP-00613)
(BDX-613-2414) Avail: NTIS HC A02/MF A01

A typical analysis of a failed assembly and a recommended rework process is presented. In addition, steps are proposed to minimize the occurrence of future ceramic-to-metal seal failures.

DOE

N80-25450# Mound Lab., Miamisburg, Ohio.
BULK POLYMERIZATION AND STABILITY OF ANAEROBIC ADHESIVES
Ruth B. Whitaker and John V. Dichiaro 25 Feb. 1980 57 p refs
(Contracts EY-76-C-04-0053; DE-AC04-76DP-00053)
(MLM-2647) Avail: NTIS HC A04/MF A01

A search of the literature on anaerobic adhesives from 1974 to 1978 was performed. Many candidate anaerobic adhesive formulations were prepared, and their reaction rates were determined in bulk from room temperature (RT) to 55 C. Formulations based on the monomer, tetraethylene glycol dimethacrylate (TEGDMA), or a 50/50 mixture of ethylene glycol dimethacrylate and TEGDMA yielded the best combination of storage stability combined with ability to polymerize. These systems employed cumene hydroperoxide as initiator, p-benzoquinone as inhibitor, and a latent accelerator. For polymerization at much lower temperatures (-18 to 0 C, systems were developed which employed TEGDMA or polyfunctional acrylate monomers, p-methane hydroperoxide as initiator, and, at 18 C, no inhibitor. The stability of stored anaerobic adhesive formulations and their ability to polymerize following aging were examined. It was found that most formulations of interest remain liquid at 54 C for > 100 days but solidify at 74 C in a much shorter time.

DOE

N80-25451# National Technical Information Service, Springfield, Va.
REINFORCED PLASTICS: FIBERGLASS REINFORCEMENT, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jan. 1980
Diane M. Cavagnaro Feb. 1980 110 p Supersedes NTIS/PS-79/0095; NTIS/PS-78/0090 and NTIS/PS-77/0068
(PB80-804743; NTIS/PS-79/0095; NTIS/PS-78/0090; NTIS/PS-77/0068) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

Physical properties, bonding, lamination, design, and test methods for fiberglass reinforced plastics are covered. Studies on fabrication and processing of these materials for aircraft, spacecraft, ship hulls, automobiles, and flywheels are included. Plastic matrices include epoxy resins, polyimide resins, polyesters, polyamides, and polyurethanes. This updated bibliography contains 103 abstracts, 25 of which are new entries to the previous edition. GRA

N80-25452# National Technical Information Service, Springfield, Va.
REINFORCED PLASTICS: BORON, CARBON, AND OTHER REINFORCING MATERIALS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Feb. 1980
Diane M. Cavagnaro Feb. 1980 213 p Supersedes NTIS/PS-79/0097; NTIS/PS-78/0091 and NTIS/PS-77/0070
(PB80-804750; NTIS/PS-79/0097; NTIS/PS-78/0091; NTIS/PS-77/0070) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

Studies on reinforced epoxy polyimide polyester and phenolic matrices are covered. Polymers to reinforced plastics are also described. Citations on fabrication, lamination, mechanical properties, stress analysis, and viscoelasticity are included. Reinforced plastics for aircraft and spacecraft applications are also included. This updated bibliography contains 206 abstracts, 103 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-25453*# United Technologies Corp., East Hartford, Conn.
EXTERNAL FUEL VAPORIZATION STUDY, PHASE 1
E. J. Szetela and L. Chiappetta Jun. 1980 133 p refs
(Contract NAS3-21971)
(NASA-CR-159850; UTRC-R80-914607-12) Avail: NTIS HC A07/MF A01 CSCL 21D

A conceptual design study was conducted to devise and evaluate techniques for the external vaporization of fuel for use in an aircraft gas turbine with characteristics similar to the Energy Efficient Engine (E(3)). Three vaporizer concepts were selected and they were analyzed from the standpoint of fuel thermal stability, integration of the vaporizer system into the aircraft engine, engine and vaporizer dynamic response, startup and altitude restart, engine performance, control requirements, safety, and maintenance. One of the concepts was found to improve the performance of the baseline E(3) engine without seriously compromising engine startup and power change response. Increased maintenance is required because of the need for frequent pyrolytic cleaning of the surfaces in contact with hot fuel. R.C.T.

N80-25454*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ANALYTICAL AND EXPERIMENTAL EVALUATIONS OF THE EFFECT OF BROAD PROPERTY FUELS ON COMBUSTORS FOR COMMERCIAL AIRCRAFT GAS TURBINE ENGINES
A. L. Smith Jun. 1980 20 p refs Presented at 16th Joint Propulsion Conf., Hartford, Conn., 30 Jun. - 2 Jul. 1980; sponsored by AIAA, ASME, and SAE
(NASA-TM-81496; E-433) Avail: NTIS HC A02/MF A01 CSCL 21D

The impacts of broad property fuels on the design, performance, durability, emissions, and operational characteristics of current and advanced combustors for commercial aircraft gas turbine engines were studied. The effect of fuel thermal stability on engine and airframe fuel system was evaluated. Tradeoffs between fuel properties, exhaust emissions, and combustor life were also investigated. Results indicate major impacts of broad property fuels on allowable metal temperatures in fuel manifolds and injector support, combustor cyclic durability, and somewhat lesser impacts on starting characteristics, lightoff, emissions, and smoke. E.D.K.

N80-25455# C-E Lummus, Bloomfield, N.J.
SYNTHANE PILOT PLANT, SOUTH PARK TOWNSHIP, PENNSYLVANIA Final Report
1979 548 p refs
(Contract EY-76-C-02-0003)
(COO-0003-41-T1) Avail: NTIS HC A23/MF A01

The Synthane pilot plant was operated during the period 1975-1978 to test the feasibility of the Synthane process to produce pipeline quality gas from coal. The operations of the Synthane pilot plant were suspended in September, 1978. The unit was mothballed and is presently being maintained in a standby mode. Various aspects of this project are summarized. The operation, technical evaluation, and engineering for the period 1976-1978 are also included. DOE

N80-25456# New Zealand Energy Research and Development Committee, Auckland.
POTENTIAL OF ENERGY FARMING FOR TRANSPORT FUELS IN NEW ZEALAND
G. S. Harris, M. L. Leamy, T. Fraser, J. B. Dent, W. A. N. Brown, W. B. Earl, T. W. Fookes, and J. Gilbert 1979 135 p refs
(NZERDC-46) Avail: NTIS HC A07/MF A01

Farming for production of fuel in New Zealand is discussed. The technical and economic aspects of energy farming and guidelines for development of this energy source are presented. Costs and energy ratios are given and areas of concern are highlighted. The results of studies on sugar beets, fodder beets, maize, lucerne, and radiata pine are discussed. The production of methanol, methane, and ethanol by fermentation and gasification are described. Environmental issues are also discussed. DOE

N80-25457# New Zealand Energy Research and Development Committee, Auckland.
POTENTIAL OF ENERGY FARMING FOR TRANSPORT FUELS IN NEW ZEALAND, APPENDICES
G. S. Harris, M. L. Leamy, T. Fraser, J. B. Dent, W. A. N. Brown, W. B. Earl, T. W. Fookes, and J. Gilbert 1979 135 p refs
(NZERDC-46-App) Avail: NTIS HC A07/MF A01

Farming for production of fuel in New Zealand is discussed. Subjects studied in this report are: the suitability and distribution of land for the production of biomass, forestry, agricultural crops, maize grain production in the Waikato; processing routes for transport fuels; advisory panel research in the Waikato; scenarios for transport fuels to 2000; toxicity and other potential danger considerations associated with distribution and opportunity costs. DOE

N80-25458# AD-EX, Portola Valley, Calif.
RELATION BETWEEN THE ELECTRONIC STRUCTURE AND THE SHOCK SENSITIVITY OF NITRATED SECONDARY EXPLOSIVES. 3: INFLUENCE OF THE CRYSTAL ENVIRONMENT
A. Delpuech and J. Cherville 1979 21 p refs Transl. into ENGLISH from Propellants and Explosives 4, France, 1979 p 61-65 Sponsored by DOE Prepared for California Univ., Lawrence Livermore Lab.
(UCRL-Trans-11510) Avail: NTIS HC A02/MF A01

The influence of crystal interactions on the molecular parameters correlated with the shock sensitivity is described. The results obtained permit more precise statement of the roles of the molecule and of the crystal respectively at the time of initiation of the detonation. They show that in this area, the conclusions drawn from calculations on an isolated molecule in its crystalline conformation are valid for the whole crystal. DOE

N80-25459/ Massachusetts Inst. of Tech., Cambridge. Energy Lab.
CRITICAL STUDIES OF THE RAPID PYROLYSIS AND HYDROPYROLYSIS OF COAL Quarterly Progress Report, 10 Feb. - 30 Jun. 1979
Jack B. Howard, Patrick C. Bigot, Ted W. Bush, Richard Carbon, Raymond Casaprima, Howard Franklin, Michael A. Serio, Robert M. Steinberg, Mark Zacharias, and William A. Peters 1979 5 p Sponsored in part by Mobile Research Foundation
(Contract EX-76-A-01-2295)
(FE-MIT-2295T26-9) Avail: NTIS HC A02/MF A01

Coal samples pretreated with minerals were prepared. Samples of demineralized coal were impregnated with CaO from solution, or co-slurried with suspensions of quartz, pyrite, kaolinite, shale, montmorillonite, or acid-treated montmorillonite. Runs were performed on demineralized bituminous coals under 1000 psi H2. Pyrolysis of the calcite and CaO pretreated samples was carried out at 1 atm. He under the test conditions of 700 C zero holding time, and 1000 C, 5 second holding time. Tar production was suppressed, light gas yield and ethylene/ethane ratio increased slightly, and there was a multifold increase in production of carbon oxides, CO2 at lower temperatures, shifting to CO at higher temperature. This effect was more pronounced with the CaCO3 sample than with the CaO sample, the excess carbon oxides in the former case probably originating from calcite decomposition. DOE

N80-25460/ Oklahoma State Univ., Stillwater. Dept. of Chemistry.
CONSEQUENCES OF THE MASS SPECTROMETRIC AND INFRARED ANALYSIS OF OILS AND ASPHALTENES FOR THE CHEMISTRY OF COAL LIQUEFACTION. CHARACTERIZATION OF COAL-DERIVED LIQUIDS AND OTHER FOSSIL FUEL RELATED MATERIALS EMPLOYING MASS SPECTROMETRY
P. A. Benson, S. E. Scheppele, G. J. Greenwood, T. Aczel, Q. G. Grindstaff, and B. F. Beier Sep. 1979 120 p refs Prepared in cooperation with Exxon Research and Engineering Co., Baytown, Tex.
(Contract EX-76-S-01-2537)
(FE-2537-10) Avail: NTIS HC A06/MF A01

A COED liquid was separated into oils, asphaltenes, and residue. Anion and cation exchange chromatography fractionated the oils and asphaltenes into acids, bases, and neutrals; silica gel chromatography separated neutral fractions into saturate and aromatic concentrates. Infrared spectra of the aromatic concentrates identified functional groups. Carbon number distributions for the aromatic concentrates were obtained using high and low resolution FI/MS and high resolution 70-eV EI/MS and ultra high resolution low-voltage EI/MS. The asphaltenes contain higher molecular weight Z series, higher molecular weight homologs and different compound types than do the oils. Results show that simple solvent extraction produces compositionally nonunique fractions. Thus, detailed molecular analysis is a prerequisite for the correct assessment of: (1) reaction conditions and catalyst on the mechanism and kinetics of coal liquefaction; and (2) alteration in process conditions on the quality of the coal liquid. DOE

N80-25461/ West Virginia Univ., Morgantown. Dept. of Chemical Engineering.
OPTIMIZATION STUDIES OF VARIOUS COAL-CONVERSIONS SYSTEMS: COAL DISSOLUTION PHENOMENA Interim Report, Apr. - Dec. 1978
C. Y. Wen and K. W. Han 1978 199 p refs
(Contract EX-76-C-01-2274)
(FE-2274-7) Avail: NTIS HC A09/MF A01

The bituminous coal dissolution was investigated in order to develop information which would be useful in the design and scale up considerations for a commercial liquefaction plant. The experiment data were derived from pilot plants using various coal liquefaction processes. The data were analyzed in order to better understand the phenomena which occur in the preheater and reactor sections during the liquefaction of coal. Two different stages were found to exist in the coal dissolution reactions. In the initial stage of coal dissolution, a first order reaction scheme was proposed, whereby coal undergoes a fast thermal reaction producing preasphaltene as the predominant product. In the second stage of coal dissolution, a slower first order rate expression was proposed in which the preasphaltene was converted to benzene solubles with subsequent rehydrogenation of the coal derived solvent. DOE

N80-25462/ Dynatech R/D Co., Cambridge, Mass.
LIQUID FUELS PRODUCTION FROM BIOMASS, NO. 7 Progress Report, 1 Jan. - 31 Mar. 1979
J. E. Sanderson, D. V. Garcia-Martinez, G. S. George, J. J. Dillon, and D. L. Wise 1979 86 p refs
(Contract EG-77-C-02-4388)
(COO-4388-7) Avail: NTIS HC A05/MF A01

The process of converting biomass into liquid hydrocarbon fuels is discussed with reference to another process which ferments marine algae to acedic acid. The conditions under which substrates other than marine algae may be converted in good yield to organic acids are also reported. Results indicate that the electrolysis of organic acids produced by fermentation to liquid hydrocarbon fuels operates with a favorable energy balance of 6/1 based on the applied potential and over 10/1 based on the working potential. DOE

N80-25463/ Adelphi Univ., Garden City, N. Y.
FEASIBILITY STUDY OF USING A COAL/WATER OIL EMULSION AS A CLEAN LIQUID FUEL Final Report
Feb. 1980 43 p
(Contract EX-76-S-01-2437)
(FE-2437-T1-Add) Avail: NTIS HC A03/MF A01

The combustion, rheology, and settling of various concentrations of No. 6 oil emulsions and slurries were compared with various average particle sizes of coal. The No. 6 oil and a slurry of 40 percent coal, 60 percent oil with an average coal particle size anti x = 56.6 microns were burned. Pendulum and viscosity data is presented on four different concentrations of coal, oil and water with four different particle size distributions. Infrared radiation tests were performed on No. 6 oil and a coal/No. 6 oil slurry, and for a comparison on No. 4 oil and a coal/No. 4 oil emulsion. DOE

N80-25464/ Scientific Design Co., Inc., New York.
EVALUATION OF THE TEXACO SYNTHESIS GAS GENERATION PROCESS FOR THE PRODUCTION OF HYDROGEN FROM SRC-2 RESIDUE
T. Y. Chang and Allan S. West Dec. 1979 87 p
(Contract W-7405-eng-26)
(ORNL/Sub-7240/6) Avail: NTIS HC A05/MF A01

The results are presented of an evaluation of the Texaco Synthesis Gas Generation Process for the production of hydrogen from SRC-II vacuum bottoms residue. Preliminary process designs for a gasification facility for a commercial scale coal liquefaction plant were prepared. A number of studies were performed to establish a near-optimal operating pressure and method of acid gas removal. Plant investment and operating cost estimates are included. It is concluded that the gasifier is well suited for the efficient production of hydrogen from SRC-II residue and only minimal developmental work is needed prior to commercializations. Because of the short duration of the test runs, refractory and burner lives are a point of concern. Based on the current state of oxygen compression technology the gasifier should be designed to operate at about 800 psig. DOE

N80-25465/ Battelle Pacific Northwest Labs., Richland, Wash.
THERMOCHEMICAL CONVERSION OF BIOMASS: AN OVERVIEW OF R AND D ACTIVITIES SPONSORED BY THE BIOMASS ENERGY SYSTEMS BRANCH OF DOE
G. F. Schiefelbein, L. J. Sealock, Jr., and S. Ergun Oct. 1979 18 p Prepared in cooperation with California Univ., Lawrence Berkeley Lab.
(Contract EY-76-C-06-1830)
(PNL-SA-8266) Avail: NTIS HC A02/MF A01

The mission is to develop competitive processes for the conversion of renewable biomass resources into clean fuels and chemical feedstocks which can supplement those produced from conventional sources were developed. A description of thermochemical conversion program areas and an overview of specific thermochemical conversion projects are presented. DOE

N80-25466# Garrett Energy Research and Engineering, Inc., Claremont, Calif.
CONVERSION OF BIOMASS MATERIALS INTO GASEOUS PRODUCTS. OPERATION OF THE POU Final Report
Donald E. Garrett and Ritchie D. Mikesell Sep. 1979 431 p refs
(Contract EY-76-C-03-1241)
(SAN-1241-3) Avail: NTIS HC A19/MF A01

Initial work on a two foot diameter, single hearth reactor provided comprehensive design data through an examination of the pertinent variable over a fairly wide range of operations. Kinetic and dynamic models were obtained for each of the reaction stages that would occur within a multiple hearth reactor. This data led to the design and construction of a process development unit (PDU) which consisted of four, four foot diameter hearths capable of processing six wet tons (50% moisture), or three dry tons of biomass per day through the steps of preheating, drying, pyrolysis, combustion, and gasification. Operation of the PDU included 10 to 20 runs on each of these steps, and work was completed with a five day, 24 hour per day, continuous operation. Process design, capital and operating costs, and an economic analysis based on this data indicated that no cost, moisture manure could produce about a 300 Btu gas with a breakeven price of $4 per million Btu's in a 100 dry ton per day unit and $2.40 per million Btu's in a 300 tons per day unit. DOE

N80-25467# Los Alamos Scientific Lab., N. Mex.
LIQUID HYDROGEN-FUELED VEHICLE PROJECT
Walter F. Stewart 1979 16 p refs Presented at the Automotive Technol. Develop. Contractor's Coord. Meeting, Dearborn, Mich., 23-25 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2883; CONF-791082-1) Avail: NTIS HC A02/MF A01

A cooperative evaluation and state-of-the-art demonstration project for liquid hydrogen vehicle onboard storage and refueling techniques is discussed. Safety, economic, and energy assessments for liquid hydrogen as a fuel are also include. A baseline system is provided representing present capabilities in engine conversion, liquid hydrogen storage, and liquid hydrogen refueling. DOE

N80-25468# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.
FLASH HYDROPYROLYSIS OF COAL Quarterly Report, 1 Jan. - 31 Mar. 1979
Meyer Steinberg and Peter Fallon Jun. 1979 104 p refs
(Contract EY-76-C-02-0016)
(BNL-51052; QR-8) Avail: NTIS HC A06/MF A01

Process chemistry and design information were obtained on the flash hydropyrolysis process. The design, construction, and operation of a 1 lb/hr downflow entrained tubular reactor system were included. The effect of process variables such as temperature, pressure, feed rates, residence time, coal type and feed gas composition were studied. R.C.T.

N80-25469# California Univ., Livermore. Lawrence Livermore Lab.
STATISTICAL TREATMENT OF HETEROGENEOUS CHEMICAL REACTION IN SHOCK-INITIATED EXPLOSIVES
Stephen G. Cochran 20 Feb. 1980 23 p refs
(Contract W-7405-eng-48)
(UCID-18548) Avail: NTIS HC A02/MF A01

A statistical treatment is introduced for heterogeneities that influence the shock initiation of explosives. Size distribution for hot spots and for local reactions sites are defined along with equations that evolve the distribution in time. The model of heterogeneous reaction along with a homogeneous reaction is solved numerically in a one dimensional hydrodynamic computer program. The model and some results is presented. DOE

N80-25470# Texas A&M Univ., College Station.
CATALYTIC CONVERSION OF METHANOL TO LOW MOLECULAR WEIGHT HYDROCARBONS Ph.D. Thesis
Balaji Bondili Singh Dec. 1979 212 p refs
(Contract EW-78-S-02-4717)
(COO-4717-T1) Avail: NTIS HC A10/MF A01

Methanol is converted to ethylene, propylene, and propane with carbon yields of 70 to 90% at reaction temperatures of 633 to 723 K and pressures from 1 to 18 atmospheres. No permanent deactivation was observed even though the catalyst was overheated once, and were deactivated and regenerated as many as 21 times. The ammonium exchange coupled with the water at high temperature suggest the formation of an ultrastable zeolite. Ethylene yields increase as the temperature increases from 633 to 723 K. DOE

N80-25471# Lummus Co., Bloomfield, N. J.
DEVELOPMENTAL RESEARCH PROGRAM FOR CLEAN INDUSTRIAL AND TRANSPORTATION FUELS FROM COAL: MILESTONE REPORT ON COMPARISON OF CATALYSTS, MARCH 1979
H. D. Schindler and R. H. Long Jul. 1979 36 p refs
(Contract EX-76-C-01-2514)
(FE-2514-M4) Avail: NTIS HC A03/MF A01

Employing a reference cobalt-molybdate 1/16 in extrudate catalyst, a short series of operations were conducted to obtain activity and performance data for comparison with the nickel-molybdenum catalyst previously utilized. Two sets of conditions were investigated as follows: temperatures - 830 and 850 F, pressures - 2100 and 2700 psig, coal space rates - 1.6 and 2.5 lbs coal/hr/lb catalyst, volumetric liquid recycle/fresh feed ratios - 1.5 and 0.8, and coal content of paste - 30 and 35 weight percent. Catalyst ages for the two sets of conditions were 170.4 and 275 lbs coal per lb of catalyst, respectively. The yields and product quality comparisons of the two catalysts at equivalent catalyst ages indicated very little difference in performance. DOE

N80-25472# Institute of Gas Technology, Chicago, Ill.
PREPARATION OF A COAL CONVERSION SYSTEMS TECHNICAL DATA BOOK Quarterly Report, 1 Nov. 1978 - 31 Jan. 1979
Nov. 1979 175 p refs
(Contract EX-76-C-01-2286)
(FE-2286-44) Avail: NTIS HC A08/MF A01

The results of calculations of ammonia and hydrogen sulfide partial pressures in NH3-H2S-H2O subsystem are composed. Results from application of a calorific value formula to chars are also presented. Enthalpies of distillate fractions of various syncrudes are reported along with the comparison of the experimental data with correlations developed for estimating the enthalpies of petroleum fractions. Combustion characteristics of SRC-I liquid are also described. Fixed bed gasification of coal is reviewed. For coal pyrolysis results of investigations of relations between tar-plus-light oil yield in Fischer Assay and various coal rank parameters are described. Carbon deposition boundaries are shown for temperatures between 600 F and 2400 F and pressures ranging between 15 psia and 1000 psia. Two types of carbon were considered graphite and non ideal. DOE

N80-25473# Gulf Research and Development Co., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS Quarterly Report, Jun. - Aug. 1979
D. C. Succop and F. E. Wynne Dec. 1979 22 p refs
(Contract EX-76-C-01-1800)
(FE-1800-42) Avail: NTIS HC A02/MF A01

Coal slurry heating for hydroliquefaction process is described. Results are reported for Taitel/Dukler predicted flow regimes. DOE

N80-25474# Exxon Research and Engineering Co., Florham Park, N.J.
EDS COAL LIQUEFACTION PROCESS DEVELOPMENT, PHASE 4 Interim Report
Sep. 1979 92 p ref Sponsored in part by Carter Oil Co., Elec. Power Res. Inst., Japan Coal Liquefaction Develop. Co., Phillips Petrol. Co., and Atlantic Richfield Co.
(Contract EF-77-A-01-2893)
(FE-2893-33) Avail: NTIS HC A05/MF A01

A maximum liquids case which utilizes steam reforming of methane, ethane, and propane for hydrogen generation is described. The FLEXICOKING of vacuum bottoms is utilized to

generate low Btu gas fuel for the plant. Main plant fuel utilized as onsite fuel and fuel to the offsite boilers is low Btu gas (LBG). A vaporized C3 LPG backup fuel system is provided in the steam reforming furnaces. Besides LBG, Illinois no. 6 coal can be used in the offsite boilers to generate steam. The short term onsite fuel system variability is accommodated by varying the coal firing rate in the offsite boilers. Longer term variability in onsite fuel demand is accommodated by varying the operations in FLEXICOKING. The plant utilizes LBG for pilots to protect against flameout in all onsite process furnaces, except steam reforming. Pilots are not needed in steam reformers because of the multiplicity of burners. Use of LBG for pilot gas avoids the consumption of high value LPG. DOE

N80-25475# Exxon Research and Engineering Co., Florham Park, N.J.
EDS COAL LIQUEFACTION PROCESS DEVELOPMENT, PHASE 4. EDS COMMERCIAL PLANT STUDY DESIGN UPDATE, OFFSITE DESIGN BASIS: ILLINOIS COAL MARKET FLEXIBILITY SENSITIVITY CASE Interim Report
Jul. 1979 66 p Sponsored in part by Carter Oil Co., Elec. Power Res. Inst., Japan Coal Liquefaction Develop. Co., Phillips Petrol. Co., and Atlantic Richfield Co.
(Contract EF-77-A-01-2893)
(FE-2893-37) Avail: NTIS HC A04/MF A01

The offsite design basis for the EDS commercial plant study design update Illinois coal market flexibility sensitivity case is presented. The use of partial oxidation to produce H2 and sell the C2 gas which was processed by steam reforming was evaluated. DOE

N80-25476# Bituminous Coal Research, Inc., Monroeville, Pa.
TEST AND EVALUATE THE TRI-GAS LOW BTU COAL GASIFICATION PROCESS Quarterly Report, Oct. - Dec. 1979
Jan. 1980 20 p refs
(Contracts ET-78-C-01-2798)
(FE-2798-74) Avail: NTIS HC A02/MF A01

Three tests were conducted in the TRI-GAS PEDU, each in the process design mode. Smooth transfer of both char and gas between reactors was accomplished. Several minor equipment problems were encountered which were alleviated through modifications. DOE

N80-25477# Argonne National Lab., Ill.
ENVIRONMENTAL CONTROL TECHNOLOGY FOR BIOMASS FLASH PYROLYSIS
J. B. L. Harkness, R. D. Doctor (Science Applications, Inc.), and W. H. Seward (Mittelhauser Corp.) 1980 32 p refs Presented at the Energy from Biomass and Wastes Conf., Orlando, Fla., 21 Jan. 1980
(Contract W-31-109-eng-38)
(CONF-800129-2) Avail: NTIS HC A03/MF A01

The effluent emission and control technologies for a dual fluid-bed pyrolysis unit is characterized. The system produces a raw products gas that is passed through a catalytic liquefaction system to produce a fuel comparable to no. 2 fuel oil. A program that will survey several biomass systems to standardize the sampling techniques, prioritize standard analyses and develop a data base so that environmental issues later may be addressed before they limit or impede the commercialization of biomass gasification and pyrolysis technologies was conducted. Emissions were related to both the current and anticipated emissions standards to generate material balances and set design parameters for effluent treatment systems. This permits an estimate to be made of the capital and operating costs associated with these technologies. E.J.R.

N80-25478# National Technical Information Service, Springfield, Va.
SYNTHETIC FUELS: METHANE, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1977
Diane M. Cavagnaro Feb. 1980 212 p
(PB80-805245) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

Reports from worldwide research are cited covering the production of methane. The citations pertain to the manufacturing processes and equipment process performance, economics, and combustion technology. The production of methane from wastes, especially agricultural wastes, are covered extensively. This updated bibliography contains 205 abstracts, none of which are new entries to the previous edition. GRA

N80-25479# National Technical Information Service, Springfield, Va.
SYNTHETIC FUELS: METHANE, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Jan. 1980
Diane M. Cavagnaro Feb. 1980 142 p Supersedes NTIS/PS-79/0030; NTIS/PS-78/0054
(PB80-805252; NTIS/PS-79/0030; NTIS/PS-78/0054) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The production of methane is discussed in this bibliography of worldwide journal articles. The reports pertain to the manufacturing processes, equipment used, performance, economics, and combustion technology. Many of the studies cover the production of methane from wastes, especially agricultural wastes. This updated bibliography contains 135 abstracts, 76 of which are new entries to the previous edition. GRA

N80-25480# Columbia Univ., New York. Dept. of Biochemistry.
BIOLOGICAL AND SYNTHETIC SYSTEMS FOR PRODUCTION OF HYDROGEN FROM WATER Semiannual Progress Report, 1 Mar. - 31 Aug. 1979
Alvin I. Krasna Aug. 1979 9 p refs
(Grant NSF AER-74-08381)
(PB80-146269; NSF/RA-790221) Avail: NTIS HC A02/MF A01 CSCL 06A

The production of hydrogen from water to organic compounds using light as the source of energy is considered. Two systems are studied the use of intact hydrogenase containing algae; and the use of spinach chloroplasts coupled to hydrogenase or synthetic catalysts. Since both systems produce oxygen by photolysis of water, a major objective is to develop methods for continuous removal of oxygen which will permit sustained production of hydrogen. The photoproduction of hydrogen by intact algae; a coupled system of chloroplasts and hydrogenase; and the development of partial and completely synthetic systems for photoproduction of hydrogen are described. Recent publications describing this research and related studies are cited. GRA

N80-25481# Tennessee Valley Authority, Muscle Shoals, Ala. Emission Control Development Projects.
EVALUATION OF PHYSICAL/CHEMICAL COAL CLEANING AND FLUE GAS DESULFURIZATION Final Report, Jun. 1978 - Oct. 1979
T. W. Tarkington, F. M. Kennedy, and J. G. Patterson Nov. 1979 378 p refs Sponsored by EPA
(PB80-147622; ECDP/B-5; EPA-600/7-79-250) Avail: NTIS HC A17/MF A01 CSCL 13B

The results of evaluations of physical coal cleaning (PCC), chemical coal cleaning (CCC), and coal cleaning combined with flue gas desulfurization (FGD). Process descriptions, cleaning performances, comparative capital investments, and annual revenue requirements are included. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-25482 Columbia Univ., New York.
VISCOSITY OF HE3 IN SUPERFLUID AND FERMI LIQUID REGIMES Ph.D. Thesis
Mark Steinback 1979 220 p
Avail: Univ. Microfilms Order No. 8009703

An oscillation type viscometer and cooling system was designed and constructued to measure the viscosity of liquid He(3). at very low temperature and under pressure. The viscosity experiments were performed over the pressure range 10 to 31 1/4 bar in the low temperature Fermi liquid region and the two superfluid phases of He(3). Between the superfluid transi-

tion temperatures (T sub c < or = 2,600 mK) and 7 mK the data fit the theoretical Germi liquid relation etu (P)T(2) = constant (P). The pressure dependence of this constant was obtained. A sudden decrease in the viscosity was observed in the superfluid phases as temperature decreased from the the transition, which changed to a slow decrease in viscosity with decreasing temperature at the lowest temperaturs attained. At pressures which passed through bot B and A phases, an increase in viscosity on going from B to A phase was observed. Dissert. Abstr.

N80-25483# Council for Scientific and Industrial Research, Pretoria (South Africa).
THE TESTING AND APPLICATION OF MACHINABILITY CRITERIA
I. Yellowley and G. Barrow 1979 29 p refs Transl. into ENGLISH from Fertigung (Switzerland), no. 1, 1971 p 21-29 (CSIR-Trans-1457) Avail: NTIS HC A03/MF A01

The criteria for tool breakdown is discussed with respect to the quality of the workpiece. The influence of the cutting speed, feed, and cutting depth on the tool life is considered. Various methods are used for the determination of tool life. R.C.T.

N80-25484# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
A REVIEW OF FABRIC USAGE IN PAVEMENTS CONSTRUCTED ON LOW-STRENGTH SOILS Final Report
Donald M. Ladd Dec. 1979 29 p refs
(Contract FAA-ER-430-015)
(AD-A083076; FAA-RD-79-93) Avail: NTIS
HC A03/MF A01 CSCL 13/2

A literature review was conducted to investigate the uses of fabrics in pavements in order to determine their applicability for use in constructing airport pavements on soft soils. Several theories are presented as to how a fabric enhances the performance of a pavement when fabrics are used as a reinforcement or as a separator over soft soils. Several design methods are discussed and results of several field installations are presented. Test methods and construction techniques are also discussed. R.C.T.

N80-25485# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN NO. 1979-5
1979 86 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 287-348 Original French report available from ONERA, Paris FF 36
(ESA-TT-613; ONERA-NT-1979-5) Avail: NTIS
HC A05/MF A01

Topics include: noise sources, Navier-Stokes equations, unsteady aerothermodynamic modeling, two dimensional unsteady flow, fatigue testing instrumentation, and harmonic excitation of mechanical systems. For individual titles, see N80-25486 through N80-25491.

N80-25486# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOTES ON VARIOUS NOISE SOURCES c71
Robert Legendre *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-5 (ESA-TT-613) 1979 p 1-9 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 287-292 Original report in FRENCH previously announced as A80-12354 (For primary document see N80-25485 16-31)
Avail: NTIS HC A05/MF A01

The sources of aircraft noise are classified and physical mechanism of such noise are explored. Two basic categories of noise are specified: noise generated by displacement and deformation of solid bodies, and aerodynamic noise generated by fluid turbulence. Particular consideration is given to panel flutter noise, point and multiple sources, boundary layer noise, vortex noise, and jet noise. Author (ESA)

N80-25487# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESOLUTION OF NAVIER-STOKES EQUATIONS BY A SPACE-TIME PSEUDO-SPECTRAL METHOD c34
Yves Morchoisne *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-5 (ESA-TT-613) 1979 p 11-31 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 293-306 Original report in FRENCH previously announced as A80-12355 (For primary document see N80-25485 16-31)
Avail: NTIS HC A05/MF A01

The precision of spectral or pseudo-spectral methods is mostly conditioned by the finite difference scheme used for the calculation of time derivatives. A pseudo-spectral method is proposed based on an iterative calculation and an approximate factorization of the given equations. This method is used for the numerical resolution of the Burgers equation and then the calculation of two dimensional flows of incompressible fluids (Navier-Stokes equation in terms of the stream function). The results are compared with those obtained by a finite difference method and a finite element method. Author (ESA)

N80-25488# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNSTEADY AEROTHERMODYNAMICS MODELING c34
Francis Hirsinger *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-5 (ESA-TT-613) 1979 p 33-54 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 307-323 Original report in FRENCH previously announced as A80-12356 (For primary document see N80-25485 16-31)
Avail: NTIS HC A05/MF A01

A numerical method is developed for the modeling of time dependent aerothermodynamic problems. The approach is based on a formulation, integral for space and differential for time, of balance equations for time variable or time invariant cells of any scale. The physical aspect of the model assures great flexibility of utilization and the introduction of different models. Application examples are presented for one or two phase one dimensional flows (biliquid rocket engines) and two dimensional flows with recirculation zones. Author (ESA)

N80-25489# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TRANSONIC SMALL PERTURBATION EQUATION APPLIED TO THE SOLUTION OF TWO-DIMENSIONAL UNSTEADY FLOWS c34
Michel Couston, Jean-Jacques Angelini, and Pierre Mulak *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-5 (ESA-TT-613) 1979 p 55-73 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 325-340 Original report in FRENCH previously announced as A80-12357 (For primary document see N80-25485 16-31)
Avail: NTIS HC A05/MF A01

The alternating direction implicit scheme is applied to two dimensional unsteady transonic flows, under conditions of potential flow. Numerical results based on the low frequency assumption are compared to results obtained by the linear double lattice method. Nonlinear results are then compared with experiments and calculations by other methods, and it is shown that the present method can be used to solve complex unsteady aerodynamic problems, including the determination of shock wave motions. Author (ESA)

N80-25490# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CYCLIC PLASTIC DEFORMATION FOLLOWER c39
Georges Baudin *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-5 (ESA-TT-613) 1979 p 75-76 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 341-343 Original report in FRENCH previously announced as A80-12358 (For primary document see N80-25485 16-31)
Avail: NTIS HC A05/MF A01

Electronic test equipment was developed for evaluating the low cycle fatigue life of a one dimensional specimen in the frequency range 0.1 to 100 Hz. Cyclic plastic deformation signals can be recorded conveniently by analog or digital means. A circuit diagram is given, and some sample results are presented on an aluminum alloy specimen. Author (ESA)

N80-25491# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HARMONIC EXCITATION OF MECHANICAL SYSTEMS AT HIGH FREQUENCIES AND LARGE ACCELERATORS c39
Henri Loiseau *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979 1979-5 (ESA-TT-613) 1979 p 79-84 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 345-348 Original report in FRENCH previously announced as A80-12359 (For primary document see N80-25485 16-31)
Avail: NTIS HC A05/MF A01

A structure may be excited for fatigue tests at high frequencies and amplitudes by a conventional electrodynamic exciter. The structure and the exciter are connected by a mechanical device designed to resonate at the excitation frequency. Author (ESA)

N80-25492# Los Alamos Scientific Lab., N. Mex.
MAGNETIC REFRIGERATION FOR SPACE APPLICATIONS: REPORT ON A DESIGN STUDY
J. A. Barclay and W. A. Steyert Feb. 1980 25 p refs
(Contract W-7405-eng-36)
(LA-8134) Avail: NTIS HC A02/MF A01

Results of a preliminary design study of magnetic refrigerators for space applications are summarized. Three items are discussed: (1) a design for a 5-W, 4 K to 20 K magnetic-wheel refrigerator; (2) a theoretical evaluation of a new device, called a regenerative-magnetic expander, that operates between 3.8 K and 20 K; and (3) an active magnetic regenerator that provides refrigeration at 4 K and expels heat at 200 K. DOE

N80-25493# Ames Lab., Iowa. Dept. of Physics.
FLUX-LINE-CUTTING THRESHOLD IN TYPE-2 SUPERCONDUCTORS M.S. Thesis
Ying-Chuen Spring Yeh Mar. 1980 50 p refs
(Contract W-7405-eng-82)
(IS-T-894) Avail: NTIS HC A03/MF A01

The stability of the vortex array in a slab geometry is analyzed. Numerical calculations of the force exerted on a vortex in a perturbed array exhibit the existence of a threshold for flux-line cutting. For angles exceeding the critical value, the array is driven towards flux-line cutting for small perturbations. The critical angle gradient can be employed to express the threshold for flux-line cutting. DOE

N80-25494# National Bureau of Standards, Boulder, Colo. National Measurement Lab.
NBS TIME AND FREQUENCY DISSEMINATION SERVICES Final Report
Sandra Howe, ed. Sep. 1979 25 p Revised
(PB80-147747; NBS-SP-432) Avail: NTIS HC A02/MF A01 CSCL 14B

Detailed descriptions are given of the time and frequency dissemination services of the National Bureau of Standards. These services include the broadcasts from radio stations WWV, WWVH, WWVB, and WWVL, and new times and frequency calibration services using television. The services available on 1 April 1979 are indicated. A list of other publications available about the Time and Frequency Division is also included. GRA

N80-25495# Research Corp. of New England, Wethersfield, Conn.
ASSESSMENT OF METHODS FOR CONTROL OF FUGITIVE EMISSIONS FROM PAVED ROADS Final Report, Sep. 1978 - Sep. 1979
Edward T. Brookman and Deborah K. Martin Nov. 1979 50 p refs
(Contract EPA-68-02-3115)
(PB80-139330; EPA-600/7-79-239) Avail: NTIS HC A03/MF A01 CSCL 13B

Urban road dust problems that are felt to require further attention and the priorities with which the data should be obtained are discussed. The approaches to be taken to obtain the desired information are also defined. GRA

N80-25496# National Bureau of Standards, Washington, D.C.
ANALYSIS OF TENTATIVE SEISMIC DESIGN PROVISIONS FOR BUILDINGS Final Report
Richard N. Wright, Steven J. Fenves (Carnegie-Mellon Univ.), and Richard N. Wright Jul. 1979 602 p refs
(Grants NSF AEN-76-14698; NSF AEN-76-19033)
(PB80-129182; NBS-TN-1100) Avail: NTIS HC A99/MF A01 CSCL 13M

The results are presented of a through study of the internal logic of the tentative provisions for the development of seismic regulations for buildings developed by the Applied Technology Council. The methods of analyses employed provide objective measures of clarity, completeness, and consistency and an alternative form in which to examine the technical validity of the provisions. These methods include decision logic tables for examining individual provisions information networks for representing the precedence among provisions and classification of the provisions to study their scope and arrangement. A formal representation of the provisions is presented by the data items, decision tables, networks, and classification systems developed in the study. An index and several alternate arrangements of the provision are also included. Opportunities for improvement of the tentative provisions are identified and discussed, and considerations for their future development and implementation within various national standards are highlighted. GRA

N80-25497# National Technical Information Service, Springfield, Va.
METRICATION IN THE UNITED STATES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1984 - Feb. 1980
Guy E. Habercom, Jr. Apr. 1980 199 p Supersedes NTIS/PS-79/0359; NTIS/PS-78/0316
(PB80-806938; NTIS/PS-79/0359; NTIS/PS-78/0316)
Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Materials are cited on the metric system of measurements and conversion of U.S. measurements to the metric system. The metrication process, industrial and economic impacts, problems involved, the benefits anticipated, and public reactions and relations are discussed. The metric system is discussed, along with its application to various fields. This updated bibliography contains 192 abstracts, 13 of which are new entries to the previous edition. GRA

N80-25498# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Mechanical Engineering.
TECHNICAL MANUAL FOR ENGINEERS AND SCIENTISTS
Mu Hao Wang, Lawrence K. Wang, and Wen-Yung W. Chan Nov. 1979 92 p Sponsored by ASCE
(PB80-143266; SIT-ME/11-79-3) Avail: NTIS HC A05/MF A01 CSCL 14B

The technical manual was prepared as a supplemental reference material for engineering and science students at Stevens Institue of Technology. The manual includes detailed conversion factors for both metric and British units, physical constants, temperature equivalent graph, dissolved oxygen nomograms, barometric pressure tables, saturation vapor pressure table, tables on water and air properties, gas density graph, Manning nomograph, Hazer Williams nomograph, partial flow diagram, screen scales table, and element table with atomic weights. GRA

N80-25499# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
MATERIALS COATING TECHNIQUES
Mar. 1980 186 p refs Lecture held in Lisbon, 27-28 Mar. 1980, in Athens, 31 Mar. - 1 Apr. 1980 and in Ankara, 3-4 Apr. 1980
(AGARD-LS-106; ISBN-92-835-1357-6) Avail: NTIS HC A09/MF A01

A review of the principles and the present state of the art of applying metallic, ceramic, and organic layers for the purposes of protection of engineering materials from the effects of corrosion, erosion, and wear is presented. The resultant structure and properties of the coating layers and their interaction with the bulk material is considered. The behavior of coated parts, as determined by the coating technique and material, and the effects in service of such aspects as corrosion, fatigue, tribology problems, and structural stability are considered. Techniques for the analysis and nondestructive evaluation of the composition properties and soundness of the layers are assessed. For individual titles, see N80-25500 through N80-25509.

N80-25500# California Univ., Los Angeles. School of Engineering and Applied Science.
HIGH RATE PHYSICAL VAPOR DEPOSITION PROCESSES
R. F. Bunshah *In* AGARD Mater. Coating Tech. Mar. 1980 16 p refs (For primary document see N80-25499 16-31)
Avail: NTIS HC A09/MF A01

The physical vapor deposition processes, evaporation, ion plating, and sputtering are reviewed. The deposition of metals, alloys, intermetallic compounds, and refractory compounds by these processes is discussed. The evolution of the microstructure and the influence of process parameters such as deposition temperature and gas pressure are presented and illustrated with examples. Texture and residual stresses in the deposit are considered. E.D.K.

N80-25501# Salford Univ. (England). Dept. of Aeronautical and Mechanical Engineering.
PLASMA AIDED TECHNIQUES
Dennis G. Teer *In* AGARD Mater. Coating Tech. Mar. 1980 13 p refs (For primary document see N80-25499 16-31)
Avail: NTIS HC A09/MF A01

The adhesion, crystallinity, and grain structure of coatings deposited by physical vapor deposition techniques are usually improved if the energy of the depositing particles is increased. Energy can be transferred to the coating atoms by heating the substrate. An alternative method is to increase the kinetic energy of deposition by ionizing the vapor atoms and accelerating them in an electric field. A variety of plasma aided techniques are described and it is shown that all the improvements brought about by high temperature substrates can be achieved at lower substrate temperatures. The very high ion energies can also cause production of unusual phases and a further advantage is the increased reactivity resulting in deposition of compound coatings. E.D.K.

N80-25502# Balzers Aktiengesellschaft (Liechtenstein).
TECHNIQUES OF CHEMICAL VAPOR DEPOSITION
A. J. Perry and N. J. Archer (Fulmer Research Inst. Ltd.) *In* AGARD Mater. Coating Tech. Mar. 1980 16 p refs (For primary document see N80-25499 16-31)
Avail: NTIS HC A09/MF A01

Chemical vapor deposition (CVD) which utilizes gas phase chemical reactions to produce metallic and ceramic coatings is described. The technique is used to form thin layers of refractory carbides for wear resistance, layers of metals for corrosion and oxidation resistance, and is also a forming technique which permits the fabrication of complex shapes, particularly in high temperature materials. Chemical vapor deposition depends upon a localized chemical reaction and so it is able to coat complex shapes, particularly internal surfaces. However, the reactions currently used for CVD require high reaction temperatures and this causes many limitations in terms of the substrates which may be coated. The equipment used and the properties of the materials produced are reviewed. E.D.K.

N80-25503# Dortmund Univ. (West Germany).
SPRAYED COATINGS
H.-D. Steffens *In* AGARD Mater. Coatings Tech. Mar. 1980 29 p refs (For primary document see N80-25499 16-31)
Avail: NTIS HC A09/MF A01

Thermal spraying is shown to be an efficient means for the protection of surface areas against elevated temperature, wear, corrosion, hot gas corrosion, and erosion in structural aircraft components. Particularly in jet engines, numerous parts are coated by flame, detonation, or plasma spraying techniques. The applied methods of flame, detonation, and plasma spraying are explained, as well as electric arc spraying. Possibilities for spray coatings which meet aircraft service requirements are discussed, as well as methods for quality control, especially nondestructive test methods. In particular, coating characteristics and properties obtained by different spray methods are described, and special attention is paid to low pressure plasma spraying. E.D.K.

N80-25504# Fiat Research Center, Orbassano (Italy).
LASER SURFACE ALLOYING
P. G. Cappelli *In* AGARD Mater. Coating Tech. Mar. 1980 13 p (For primary document see N80-25499 16-31)
Avail: NTIS HC A09/MF A01

Techniques based on high power lasers, which modify the chemical composition of the microstructure of the surface of a material in order to improve some of its properties are considered in terms of solving both the high melting point and segregation problems in the fabrication of metal and ceramic alloys. Application of these lasers in such materials processing areas as deep penetration autogeneous welding, cutting, drilling, transformation hardening, and experimental shock hardening is discussed. It is shown that the high power densities that lasers can produce, equivalent to thermal sources of temperature above 20,000 C, facilitate the melting of all phases of the alloy. Furthermore, the high power density of lasers allows melting to be localized at the surface, with negligible subsurface heating, thereby establishing high cooling rates. In this process, laser glazing, the extremely rapid chill rates of thin molten zones produce extremely homogeneous metallurgical microstructures, including amorphous alloys, the ultimate in alloy homogeneity. E.D.K.

N80-25505# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
CORROSION PROTECTION BY ELECTRO-DEPOSITED ALUMINUM
Richard Suchentrunk *In* AGARD Mater. Coating Tech. Mar. 1980 25 p refs (For primary document see N80-25499 16-31)
Avail: NTIS HC A09/MF A01

Deposition of aluminum on various substrates by using a nonaqueous organic electrolytic system is described. The metallic deposit has a high purity and good corrosion protection properties. It can be used as a substitute for the highly toxic cadmium. Possible fields of application are protection against corrosion of high strength steels without any danger of hydrogen embrittlement, the coating of lightweight materials like aluminum, magnesium, and titanium alloys, and the fabrication of fiber reinforced metal matrix composites. E.D.K.

N80-25506# California Univ., Berkeley. Lawrence Berkeley Lab.
OVERLAY COATINGS FOR GAS TURBINE AIRFOILS
Donald H. Boone *In* AGARD Mater. Coating Tech. Mar. 1980 13 p refs (For primary document see N80-25499 16-31)
Avail: NTIS HC A09/MF A01

The degradation modes associated with gas turbine operation under a variety of conditions are reviewed as a preliminary to defining the needs of protective airfoil coatings and processing techniques. These requirements and present coating procedures are briefly described as an introduction to the need for overlay type coatings in general and electron beam (EB) evaporation processed coatings in particular. A discussion of the features of production EB coaters is followed by a detailed description of the individual coating processing steps involved. While most are identical to other coating procedures, a few are significantly different and are discussed in detail. Current overlay coating compositions and their use and experience are reviewed. Future directions in overlay coating processing and composition including electron beam-physical vapor deposition applied ceramics are discussed. E.D.K.

N80-25507# Dortmund Univ. (West Germany).
APPLICATIONS OF SPRAYED COATINGS
H.-D. Steffens and M. Malik (Deutsche Lufthansa A.G., Hamburg, West Germany) *In* AGARD Mater. Coating Tech. Mar. 1980 12 p refs (For primary document see N80-25499 16-31)
Avail: NTIS HC A09/MF A01

Service demands of the coating properties of sprayed coatings are classified as: preventing, fretting, wear, and corrosion; controlled abradability; and thermal barrier. Developments in both coating techniques and coating materials which have allowed production of coatings which match the performance demands are considered. Applications of sprayed coatings in aircraft components are discussed. E.D.K.

N80-25508# Balzers Aktiengesellschaft (Liechtenstein).
WEAR RESISTANT COATINGS MADE BY CHEMICAL VAPOUR DEPOSITION
A. J. Perry and N. J. Archer (Fulmer Research Inst. Ltd.) *In* AGARD Mater. Coating Tech. Mar. 1980 12 p refs (For primary document see N80-25499 16-31)
Avail: NTIS HC A09/MF A01

The methods by which hard layers are formed by chemical vapor deposition and the properties of these hard materials are reviewed. The economics of chemical vapor deposition are discussed as this is an extremely attractive aspect of the process for large batches of small components. E.D.K.

N80-25509# California Univ., Los Angeles. School of Engineering and Applied Science.
APPLICATIONS OF PHYSICAL VAPOR DEPOSITION PROCESSES
R. F. Bunshah *In* AGARD Mater. Coating Tech. Mar. 1980 10 p refs (For primary document see N80-25499 16-31)
Avail: NTIS HC A09/MF A01

The applications of physical vapor deposition processes are discussed. They are coatings for decorative applications, heat/energy barriers, microelectronic devices, corrosion of aircraft parts, high temperature corrosion, tribological phenomena, cutting tools, optical components, thin transparent conductive layers, and materials conservation. The fabrication of self supporting shapes and potential applications are given. E.D.K.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-25510 Radio Technical Commission for Aeronautics, Washington, D. C.
VHF AIR-GROUND COMMUNICATION TECHNOLOGY AND SPECTRUM UTILIZATION
20 Jul. 1979 58 p
(RTCA/DO-169) Avail: Radio Technical Commission for Aeronautics, Suite 655, 1717 H Street, N.W., Washington, D.C. 20006

The best modulation technique to provide the most suitable air-ground voice communications is identified. The possible use of data transfer ôn some channels is included. The technical feasibility and transition problems of any proposed channel splitting scheme is addressed. Cost of airborne and ground equipment are also considered. R.C.T.

N80-25511 Radio Technical Commission for Aeronautics, Washington, D. C.
MINIMUM PERFORMANCE STANDARDS: EMERGENCY LOCATOR TRANSMITTERS: AUTOMATIC FIXED-ELT (AF), AUTOMATIC PORTABLE-ELT (AP), AUTOMATIC DEPLOYABLE-ELT (AD) OPERATING ON 121.5 AND 243.0 MEGAHERTZ
26 Jan. 1979 49 p Supersedes DO-147
(RTCA/DO-168; DO-147) Avail: Radio Technical Commission for Aeronautics, Suite 655, 1717 H Street, N.W., Washington, D.C. 20006

The minimum performance standards for automatic fixed, automatic portable, and automatic deployable type emergency locator transmitters are developed. The transmitters were tested in all conditions normally encountered in search and rescue operations. All of the components necessary for the equipment to properly perform its intended function were evaluated. R.C.T.

N80-25512 British Broadcasting Corp., Kingswood (England). Engineering Dept.
CARFAX: AN EXAMPLE OF AN FM SIGNAL GENERATED USING DIGITAL TECHNIQUES
P. Shelswell Mar. 1980 10 p refs
(BBC-RD-1980/2) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, England

A method is described for generating frequency-modulated signals using digital techniques. The digital process introduces little distortion and provides a stable centerfrequency. The drive for a CARFAX transmitter is described as an example of its application. Author

N80-25513 Radio Technical Commission for Aeronautics, Washington, D. C.
VHF AIR-GROUND TECHNOLOGY AND SPECTRUM UTILIZATION
8 Jun. 1979 58 p
(RTCA-155-79/SC140-17-Rev) Avail: Radio Technical Commission for Aeronautics, Suite 655, 1717 H Street, N.W., Washington, D.C. 20006

One of the recommendations of the RTCA Aviation Service Working Group (ASWG), set up at the FCC's request to coordinate nongovernment participation in the U. S. preparatory work for the ITU 1979 General World Administrative Radio Conference, was that an additional 2 MHz of VHF spectrum contiguous to the currently allocated 118-136 MHz band be assigned to the Aeronautical Mobile Service to help meet the expected demand for additional channels towards the end of the century. The Special Committee found the new spectrum will, in addition to more channels, facilitate the implementation of a further reduction of channel spacing in the present spectrum. SC-140 recommends that reduced channel spacing (possibly 12.5 kHz) be employed in the new spectrum, with continued use of amplitude modulation. Significant economic and operational penalties, with no corresponding spectrum use benefits, would result from the adoption of other modulation techniques. A further benefit of retaining amplitude modulation is the minimization of the technical problems of any subsequent transistion to reduced channel spacing in the existing spectrum. F.O.S.

N80-25514 Radio Technical Commission for Aeronautics, Washington, D. C.
AUDIO SYSTEMS CHARACTERISTICS AND MINIMUM PERFORMANCE STANDARDS. AIRCRAFT MICROPHONES (EXCEPT CARBON), AIRCRAFT HEADSETS AND SPEAKERS AND AIRCRAFT AUDIO SELECTOR PANELS AND AMPLIFIERS
30 Nov. 1979 119 p refs
(RTCA-305-79/SC132-54-Rev-2) Avail: Radio Technical Commission for Aeronautics, Suite 655, 1717 H Street, N.W., Washington, D.C. 20006

System audio response characteristics affecting the intelligibility of air-ground speech communication were analyzed. Recommendations for improvement include: speech level improvement, noise reduction, automatic gain control, and microphone positioning so as to minimize interference. F.O.S.

N80-25515 Stanford Univ., Calif.
THE INVERSE SCATTERING PROBLEM FOR PERTURBED WAVE EQUATIONS Ph.D. Thesis
Peter Lawrence Trudinger 1980 79 p
Avail: Univ. Microfilms Order No. 8011721

The inverse problem in scattering theory is the problem of characterizing the scatterer from knowledge of the scattering operator show how the convex hull of the support of the scatter may be recovered for two systems, one characterized by the classical wave equation with a potential and the other by the classical wave equation with variable sound speed and density, in the exterior of an obstacle (possibly empty) in three dimensional Euclidean space with Dirichlet boundary condition. The scatterer is assumed to be compactly supported, so that the equations reduce to the free space wave equation outside a large ball. Also, it is assumed that the potential is square integrable, that the speed and density are smooth positive functions, and that the obstacle has smooth boundary. The results obtained relate the support of the scatterer and the right end point of the support of the scattering kernel. The latter can be calculated from the time taken by a signal incident from one direction to generate a reflected signal in another direction. So then if this is determined for sufficiently many directions of incidence and reflection, the support of the scatterer is known. This enables the reconstruction of the convex hull of the support of the scatterer, even when the perturbation is infinitely differentiable and there is no reflection in the geometrical optics approximation to the solution. Most of the work is concerned with obtaining an asymptotic growth estimate for the transmission coefficient on the positive imaginary axis. In order to do this, various assumptions are made on the perturbation. The most important of these is that the potential be of one sign near the boundary

of its support, and that the speed be uniformly greater than, equal to, or less than one. Dissert. Abstr.

N80-25516 Catholic Univ. of America, Washington, D. C.
NON-GAUSSIAN CHARACTERISTICS OF THE FDM-FM SATELLITE BASEBAND VOICE CHANNEL Ph.D. Thesis
Chester Joseph Wolejsza, Jr. 1980 258 p
Avail: Univ. Microfilms Order No. 8012123

Data on the channel noise characteristics are analyzed for an FDM/FM communications satellite link to develop an analytical or empirical model which can describe the behavior of the channel noise modems used on such channels. In April 1977, a series of noise measurements were made at a satellite Earth station on a dedicated voice channel which was looped back at a remote Earth station. The principle measurements consisted of calibrated recordings of the background noise waveform over a protracted period of time. These noise samples were digitized and analyzed in the laboratory to produce measured exceedance probability functions. As a consequence of the preliminary results analytical models were studied and Middleton's Canonic model for impulse noise was selected as a likely candidate to model the actual measured exceedance probability function. The remaining portion of the research developed procedure for determining the best value of the parameters of the model to fit the model to the data, and a measure of accuracy with which the model fits the data. The results show that there were three classes of noise, near-Gaussian, narrowband speech related interference, and wide-band transient (impulsive) noise. Dissert. Abstr.

N80-25517 Texas A&M Univ., College Station.
LOOP YAGI ARRAY ANTENNAS Ph.D. Thesis
Fouad Antoine Raphael 1979 77 p
Avail: Univ. Microfilms Order No. 8011984

A technique for the derivation of the current distribution on array antenna element is presented. The analysis is carried out for an array of loops with arbitrary circumferences and spacings. The simultaneous integral-differential equations describing the array are reduced to a set of linear simultaneous equations by Fast Fourier Transformation and deconvolution of the Freen's function and the driving condition. It is shown that numerical implementation of this solution is relatively simple and requires short computational time and moderate storage memory. The results for simple cases are compared to previously available data. Several computed curves of the gain, front to back ratio, and input impedance corresponding to arrays of two and three element loop atennas are given. Some radiation patterns are also shown. This data is further experimentally substantiated. Dissert. Abstr.

N80-25518 British Broadcasting Corp., Kingswood (England). Engineering Div.
DIGITAL SOUND: AN INVESTIGATION OF DELTA-MODULATION/PULSE-CODE-MODULATION ANALOGUE-TO-DIGITAL CONVERSION
R. A. Belcher, W. I. Manson, and T. A. Moore Mar. 1980 13 p refs
(BBC-RD-1980/3) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, England

An apparatus was built to allow the potential of a sound signal delta modulation to pulse code modulation converter to be assessed practically. An 8 MHz 8 bit digital delta modulation integrator was tested. Addition of triangular dither to the studio input signal was found to improve performance markedly. Results show that a system for which 10 1/2 bit pulse code modulation equivalent quantizing noise was predicted in practice, achieved better than 12 bit equivalent performance with added dither. R.C.T.

N80-25519# National Aviation Facilities Experimental Center, Atlantic City, N. J.
FLIGHT EVALUATION OF A RADAR CURSOR TECHNIQUE Interim Report, Jul. - Aug. 1979
J. Perez Mar. 1980 37 p refs
(FAA Proj. 045-396-130)
(AD-A083027; FAA-RD-80-18; FAA-NA-80-8) Avail: NTIS HC A03/MF A01 CSCL 17/2

Preliminary results are presented of a flight test evaluation of a radar cursor technique to be used as an aid in acquiring and tracking the desired ground track during airborne radar approaches. The test was performed using a Sikorsky CH-53A helicopter. The airborne radar system used was a BENDIX RDR-1400A modified to electronically produce a radar cursor display of course error. Airborne radar approaches were made to an offshore and an airport test environment. The specific purpose of the test was to evaluate the practical utility of the radar cursor as an aid to performing airborne radar approaches. The preliminary conclusion of this test is that the use of the radar cursor improved course acquisition and ground tracking significantly with pilotage errors and total system cross-track errors reduced by one-half or better. The radar cursor technique shows potential in reducing airspace requirements for airborne radar approaches. F.O.S.

N80-25520*# Operations Research, Inc., Silver Spring, Md. Space Engineering and Communication Systems Div.
A PROPAGATION EFFECTS HANDBOOK FOR SATELLITE SYSTEMS DESIGN. A SUMMARY OF PROPAGATION IMPAIRMENTS ON 10-100 GHz SATELLITE LINKS, WITH TECHNIQUES FOR SYSTEM DESIGN Final Report, May 1979 - Mar. 1980
R. Kaul, R. Wallace, and G. Kinal Mar. 1980 392 p refs
(Contract NAS5-25725)
(NASA-CR-163207; ORI-TR-1679) Avail: NTIS HC A17/MF A01 CSCL 20N

This handbook provides satellite system engineers with a concise summary of the major propagation effects experienced on Earth-space paths in the 10 to 100 GHz frequency range. The dominant effect, attenuation due to rain, is dealt with in terms of both experimental data from measurements made in the U.S. and Canada, and the mathematical and conceptual models devised to explain the data. Rain systems, rain and attenuation models, depolarization and experimental data are described. The design techniques recommended for predicting propagation effects in Earth-space communications systems are presented. The questions of where in the system design process the effects of propagation should be considered, and what precautions should be taken when applying the propagation results are addressed in order to bridge the gap between the propagation research data and the classical link budget analysis of Earth-space communications system. A.R.H.

N80-25521*# Axiomatix, Los Angeles, Calif.
CRITIQUE OF THE HUGHES AIRCRAFT SHUTTLE Ku BAND LEADING EDGE BIT SYNCHRONIZER Interim Report
J. K. Holmes 5 May 1980 17 p refs
(Contract NAS9-15795)
(NASA-CR-160661; R8005-2) Avail: NTIS HC A02/MF A01 CSCL 17B

A bit synchronizer is analyzed via timing diagrams in a noise-free environment. It is believed that this new bit synchronizer will track the rising edge of the data bits with 25% asymmetry and up to a 90 deg phase shift between the received clock and data bit timing. In addition, the data bits will be demodulated correctly. It is not true that phase shifts larger than 90 deg will necessarily be corrected by this bit synchronizer. However, the specifications currently require the loop to operate over only a + or - 75 deg phase shift between the received data stream leading edges and the bit synchronizer leading edges; consequently, there should be no problem. A.R.H.

N80-25522*# Axiomatix, Los Angeles, Calif.
SHUTTLE Ku-BAND AND S-BAND COMMUNICATIONS IMPLEMENTATION STUDY Final Report
James G. Dodds, Gaylord K. Huth, Peter W. Nilsen, Andreas Polydoros, Marvin K. Simon, and Charles L. Weber 21 May 1980 274 p refs
(Contracts NAS9-15240E; NAS9-15240F)
(NASA-CR-160662; R8005-3) Avail: NTIS HC A12/MF A01 CSCL 17B

Various aspects of the shuttle orbiter S-band network communication system, the S-band payload communication system, and the Ku-band communication system are considered. A method is proposed for obtaining more accurate S-band antenna patterns of the actual shuttle orbiter vehicle during flight because the preliminary antenna patterns using mock-ups are not realistic that they do not include the effects of additional

appendages such as wings and tail structures. The Ku-band communication system is discussed especially the TDRS antenna pointing accuracy with respect to the orbiter and the modifications required and resulting performance characteristics of the convolutionally encoded high data rate return link to maintain bit synchronizer lock on the ground. The TDRS user constraints on data bit clock jitter and data asymmetry on unbalanced QPSK with noisy phase references are included. The S-band payload communication system study is outlined including the advantages and experimental results of a peak regulator design built and evaluated by Axiomatrix for the bent-pipe link versus the existing RMS-type regulator. The nominal sweep rate for the deep-space transponder of 250 Hz/s, and effects of phase noise on the performance of a communication system are analyzed. A.R.H.

N80-25523# Federal Aviation Administration, Atlantic City, N.J.
RADAR MICROWAVE LINK (RML) ELECTROMAGNETIC COMPATIBILITY MEASUREMENTS Final Report, Feb. - Jul. 1979
James G. Dong Mar. 1980 21 p
(FAA Proj. 213-062-860)
(AD-A083072; FAA-RD-80-11; FAA-NA-80-2) Avail: NTIS HC A02/MF A01 CSCL 20N

Two different microwave relay transmitter and receiver combinations operating in the frequency ranges of 7.125 to 8.4 GHz and 14.4 to 15.25 GHz were tested. Measurements to determine interference characteristics included: receiver off channel rejection; receiver intermodulation; transmitter spectrums; transmitter intermodulation; and second harmonics. Results indicate that adjacent frequency spacing should be at least 20 MHz and 50 MHz for radar microwave link-4 and TerraCom equipment, respectively. Additional measurements are recommended on new equipment in the 14.4 to 15.25 GHz range for valid criteria for the handbook in preparation. R.C.T.

N80-25524# General Dynamics/Electronics, San Diego, Calif.
WAVE PROPAGATION THROUGH AXIALLY-SYMMETRIC DIELECTRIC SHELLS Final Report
G. Tricoles and E. L. Rope Feb. 1980 47 p refs
(Contract N00019-78-C-0594)
(AD-A082378; R-80-008) Avail: NTIS HC A03/MF A01 CSCL 20/14

Section 1 describes a technique estimating the amplitude and phase of guided waves excited on finite dielectric slabs by incident plane waves. The procedure is based on the moment method, but it extends that method by postulating an explicit form for the guided waves and solving for the guided wave amplitudes. The method solves for the two guided waves that travel in opposite directions parallel to the slab. Experiment verified the technique. Section 2 describes nearfield scattering by a finite, solid, dielectric cylinder. Incidence was broadside. The procedure extends the theory originally developed by Richmond. It identifies the effects from the ends of the cylinder. Experiment verified the procedure for polarization parallel or perpendicular to the cylinder. Section 3 describes a new technique for nearfield scattering by a hollow dielectric cylinder. The moment method was used but the cells were finite angular sectors. This is a new shape. Singularities of integrands were integrable. Experiment verified our approximate theory, especially when a correction for the pattern of the probe antenna was utilized. GRA

N80-25525# SRI International Corp., Menlo Park, Calif.
ATS-6 MEASUREMENTS DURING AVEFRIA Final Report, 9 Jan. - 15 Dec. 1979
Alan A. Burns Aug. 1979 31 p
(Contract DNA001-78-C-0132)
(AD-A082192; AD-E300688; DNA-5044F) Avail: NTIS HC A03/MF A01 CSCL 20/14

An experimental program was conducted to measure dispersive-phase and amplitude perturbations caused by the AVEFRIA shaped-charge barium release series. The 360 and 1550 MHz signals from the ATS-6 geostationary satellite were used for those measurements. A novel technique, whereby the ATS-6 communications subsystem was phase locked to ATS-6 RF beacon, provided a 3950 MHz reference signal for the dispersive phase measurements. Four occultations were achieved during the two AVEFRIA events. Durations of strong effects were as long as four minutes, and some perturbations lasted until T + 20 m during one occultation. The greatest amplitude fluctuations measured were + 5 to -10 dB at 360 MHz. Maximum estimated phase excursions were about 1 radian at UHF, which corresponds to electron content changes of 4 x 10 to the 10th power electrons/sq cm. GRA

N80-25526# Sandia Labs., Albuquerque, N. Mex.
MISSILE CIRCUMFERENTIAL CURRENT DENSITY FOR PLANE WAVE ELECTROMAGNETIC FIELD ILLUMINATION
Charles W. Harrison, Jr. 7 Jul. 1970 20 p refs Sponsored by DOE
(AD-A082763; SC-R-70-4324) Avail: NTIS HC A02/MF A01 CSCL 20/14

The study of shadowing of plane wave electromagnetic fields by missiles is of importance because RF leakage into a missile through holes and slots in the wall and the RF pickup of cables furrowed into the skin leading to interior circuitry depends on the amplitude and the variation of current density along the circumference of the scattering obstacle. Clearly the azimuthal orientation of the missile with respect to the incident field has a bearing on the RF receiving characteristics of the slots and cables, if indeed electromagnetic field shadowing is significant. One topic discussed briefly in this memoradum is a theory for shadowing by tubular cylinders of arbitrary dimensions developed by Kao. As a practical matter, the coupled integral equations derived by him cannot readily be solved for very long cylinders because of the limited number of storage locations in a computer. To circumvent this, the author presents a theory for shadowing by a cylinder of infinite length. In the entire discussion of both finite and infinite tubes, it is assumed that the electric field is polarized parallel to the axis of the cylinder. This is the case of dominate interest in the field of RF hazards to ordnance. But this specific polarization is an unnecessary restriction. The angle the incident field makes with the axis of the cylinder may be arbitrary. In particular, the magnetic field may be polarized parallel to the conductor. GRA

N80-25527# Lincoln Lab., Mass. Inst. of Tech., Lexington.
WIDEBAND ADAPTIVE ANTENNA NULLING USING TAPPED DELAY LINES
Joseph T. Mayhan, Alan J. Simmons, and William C. Cummings 26 Jun. 1979 93 p refs
(Contract F19628-78-C-0002; AF Proj. 2029)
(AD-A082854; TN-1979-45; ESD-TR-79-162) Avail: NTIS HC A05/MF A01 CSCL 09/5

For some applications, it is desirable to have an antenna which can adaptively form antenna pattern 'nulls' in the directions of a collection of interference sources. These nulls are generally required to be below some specified level of directive gain over the entire system bandwidth. Typically the nulls are formed by adaptively weighting each output of an N-port antenna, such as an N-element array. For large arrays operating over wide percentage bandwidths, some sort of frequency compensation is required at each output port to accomplish broadband nulling. One technique commonly used is to employ a 'tapped' delay line at each element output, with controllable weights (frequency independent) at the output of each tap. The objective of this report is to develop some insight into the way in which delay line compensation leads to improved performance, to develop some quantitative estimates of how performance varies with antenna and delay line parameters, and to develop some tools useful in the performance evaluation of frequency dependent weighting. Practical considerations dictate that only a minimum number of taps/element be utilized. A primary consideration is to minimize the number of taps required for a specific system performance. With this objective in mind, we develop an analytic solution characterizing the two element array, employing a two tap delay line with each element. This provides valuable insight into the mechanism of delay line compensation. GRA

N80-25528# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A SIMPLE GRAPHICAL MODEL FOR ANALYZING RADAR HOMING INTERCEPTOR ENGAGEMENTS
Stephen D. Weiner 17 Dec. 1979 51 p ref
(Contract F19628-80-0002)
(AD-A082460; TN-1979-82; ESD-TR-79-284) Avail: NTIS HC A04/MF A01 CSCL 17/7

In this note, a simplified model of radar homing interceptor engagements is described. This model permits analysis of the interaction among sensor parameters such as angular accuracy and acquisition range, interceptor parameters such as maneuver limits and response time and system parameters such as closing velocity and handover accuracy. Simple expressions are obtained for the sensor prediction accuracy using various types of range-dependent measurement errors. These include glint, instrumentation error and thermal error for both active and semiactive sensors. A simple graphical technique is used to determine the feasibility of a homing engagement and to estimate the resulting miss-distance. A set of nomograms is included to permit full variation of the system and component parameters.
GRA

N80-25529# California Univ., Livermore. Lawrence Livermore Lab.
ELASTIC-WAVE RADIATION FROM SPHERICAL SOURCES
Howard C. Rodean 7 Dec. 1979 28 p refs
(Contract W-7405-eng-48)
(UCRL-52867) Avail: NTIS HC A03/MF A01

The radiation of spherical compressional waves from a spherical cavity in an ideal elastic solid is treated. The equations for radiation source and field are written in terms of the reduced displacement potential. The source equation is studied in terms of characteristic frequencies, corresponding periods and wavelengths, and damping. The field equations for the stresses, strains, radial displacement, etc., are reviewed with regard to the transitions between the near and far fields. The natural parameters for defining the dynamic source and field characteristics are 2b/R and b/a in some cases and a/R in others, where a is the compressional-wave velocity, b the shear-wave velocity, and R the cavity radius. Transient solutions for stresses, strain, radial displacement, etc., include damped sinusoidal oscillations. The initial and final value theorems for the Laplace transform are used to obtain solutions for tau(reduced time) yields 0 + (high frequency, farfield) and tau yields infinity (zero frequency, near-field).
DOE

N80-25530# California Univ., Livermore. Lawrence Livermore Lab.
STUDY OF NONLINEAR WAVES DESCRIBED BY THE CUBIC SCHROEDINGER EQUATION Ph.D. Thesis
Authur Eugene Walstead 12 Mar. 1980 245 p refs
(Contract W-7405-eng-48)
(UCRL-52920) Avail: NTIS HC A11/MF A01

The properties of the uniformly transiating periodic wave solutions of the one dimensional cubic Schroedinger equation (CSE) are examined. Explicit expressions for the characteristic velocities of the modulational equations are obtained for the full set of cnoidal waves. The results for several nontrivial limiting cases agree with those obtained by independent methods. The dynamics of the CSE generalized to two spatial dimensions are studied for the unstable case. A large class of similarity solutions with cylindrical symmetry are obtained systematically using infinitesimal transformation group techniques. The methods are adapted to obtain the symmetries of the action of functional of the CSE and to deduce nine integral invariants. A numerical study of the self-similar solutions reveals that they are modulationally unstable and that singularities dominate the dynamics of the CSE in two dimensions. The CSE is derived using perturbation theory for a specific problem in plasma physics: the evolution of the envelope of a near-monochromatic electromagnetic wave in a cold magnetized plasma.
DOE

N80-25531# National Technical Information Service, Springfield, Va.
SATELLITE TELEVISION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - 1979
William E. Reed Mar. 1980 120 p
(PB80-806318) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

This bibliography cites 113 abstracts concerning various aspects of satellite television systems. Topics include television broadcasting, television transmission, educational television, regulation, frequency allocations, equipment, and applications.
GRA

N80-25532# National Technical Information Service, Springfield, Va.
SATELLITE TELEVISION TRANSMISSION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - 1979
William E. Reed Mar. 1980 152 p
(PB80-806318) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

The bibliography cites 145 abstracts concerning various aspects of satellite television systems. Topics include television broadcasting, television transmission, educational television, frequency allocations, equipment, and applications.
GRA

N80-25533# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
UPDATE: LOCAL AREA NETWORKS Final Report
Robert Rosenthal, ed. and Norman B. Meisner, ed. 1979 347 p refs Presented at Local Area Commun. Network Symp., Boston, 7-9 May 1979 Sponsored in part by Mitre Corp.
(PB80-152903) Avail: NTIS HC A15/MF A01 CSCL 17B

An overview of local area networks, nondefense networks, and local area network technology are presented along with a discussion of defense-related networks, and future environments. Workshop summaries are included.
GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-25534 Rensselaer Polytechnic Inst., Troy, N. Y.
PARALLEL PROCESSING ALGORITHMS FOR THE IDENTIFICATION, ESTIMATION AND CONTROL OF NONLINEAR DYNAMICAL SYSTEMS Ph.D. Thesis
Richard H. Travassos 1979 238 p
Avail: Univ. Microfilms Order No. 8011513

A collection of parallel identification, estimation, and control algorithms were developed which are suitable for implementation on an advanced computer with the facility for large scale parallel processing. Parallel procedures were presented which utilize nonlinear process equations directly. The identification, estimation, and control algorithms also employ parallel minimization algorithms to accelerate convergence, parallel methods for integrating ordinary differential equations to speed up computations, and a procedure based upon partitioning the integration interval to improve accuracy and reduce the sensitivity of the solution.
Dissert. Abstr.

N80-25535 Radio Technical Commission for Aeronautics, Washington, D. C.
RECOMMENDATIONS ON POLICIES AND PROCEDURES FOR OFF-THE-SHELF ELECTRONIC TEST EQUIPMENT ACQUISITION AND SUPPORT
5 Dec. 1979 51 p
(RTCA-307-79/SC134-69) Avail: Radio Technical Commission for Aeronautics, Suite 655, 1717 H Street, N.W., Washington, D.C. 20006

Recommendations are presented on various topics concerning general purpose electronic test equipment, which are applicable to both government and industry users and manufacturers. The topics considered by the Committee are problem-oriented. The rationale and recommendations, if used, would be of major benefit to those responsible for the drafting of legislation, policies, procedures and guidelines for the acquistion and support of electronic test equipment. All government and industry users, as well as test equipment manufacturers and suppliers, should find these reports educational and beneficial. If applied, these recommendations would promote the objective of catalyzing further improvements in the acquistion and support process. The study and use of the information and these recommendations is encouraged.
F.O.S.

N80-25536 Stanford Univ., Calif.
THE USE OF MECHANICAL ALLOYING IN THE MANUFACTURE OF MULTIFILAMENTARY SUPERCONDUCTOR WIRE Ph.D. Thesis
Richard Longstreth White 1980 159 p
Avail: Univ. Microfilms Order No. 8011726

Mechanical alloying, a high energy ball milling technique, was used to process elemental metal powders. Multifilamentary Cu-Nb3Sn composites were formed by mixing the mechanically alloyed Nb/Sn powders with Cu powders, isostatically compacting the mixture, hydrostatically extruding to wire form, and diffusion reacting to form the A15 superconducting compounds from the mechanically alloyed powders. Superconducting transition temperature (Tc'S) as high as 18.0 K were recorded for uniaxially compacted and vacuum reacted MA Nb/Sn powders. It was determined that to optimize the critical current density (J sub c) of the composite wire, Nb and Sn powders must be processed in a 30 at. % Sn ratio. Nevertheless J sub c s as high as 800 amps/sq cm in an applied field of 3 Tesla were recorded.
Dissert. Abstr.

N80-25537 New Mexico Univ., Albuquerque.
DIGITAL SIGNAL PROCESSING WITH AN ADAPTIVE DELAY ELEMENT Ph.D. Thesis
Delores Maria Etter 1979 117 p
Avail: Univ. Microfilms Order No. 8012545

A new element, the adaptive delay, is developed as a means for synchronizing two signals that are highly correlated. An LMS error function is derived and gradient techniques are used to determine an adaptive delay algorithm. Like Widrow's adaptive filter coefficient algorithm, this adaptive delay algorithm does not explicitly utilize a priori statistics on the input signals. However, unlike the LMS error function for the adaptive filter, the LMS error function for the adaptive delay is not quadratic. Thus, the error function will be required to be unimodal in order to assure convergence of the adaptive delay to its optimum value. Further analysis of the adaptive algorithm determines when the gradient estimates is biased and gives bounds for the convergence parameter. Applications presented include delay-lock loops, frequency tracking, and seismic noise-canceling. The new adaptive element is significant in that, in certain situations, it can either replace entire adaptive filters or be used with a small adaptive filter and still minimize the error. In some configurations, the adaptive delay yields information not easily discernable from either adaptive filters or Wiener filters. Futhermore, while the simple adaptive algorithm requires a small amount of memory storage, it does not require squaring, differentiating, averaging, or the use of transforms, thus making it very attractive for use in micro-processor-based systems.
Dissert. Abstr.

N80-25538*# National Aeronautics and Space Administration. Pasadena Office, Calif.
STARK EFFECT SPECTROPHONE FOR CONTINUOUS ABSORPTION SPECTRA MONITORING Patent Application
Michael J. Kavaya, inventors (to NASA) (JPL) Filed 30 May 1980 16 p
(Contract NAS7-100)
(NASA-Case-NPO-15102-1; US-Patent-Appl-SN-154726) Avail: NTIS HC A02/MF A01 CSCL 09A

A Stark effect spectrophone is provided with a pulsed or continuous wave laser for monitoring the constituents of an unknown gas. The laser beam is directed through windows of a closed cell while the unknown gas to be monitored is caused to flow continuously through the cell between electric field plates disposed in the cell on opposite sides of the beam path through the cell. The plates are so disposed as to be divergent, e.g., flat plates at an oblique angle relative to each other, or plates shaped according to a mathematical function, so that with constant voltage applied across the plates there is a variation in electric field strength along the beam path. Discrete energy absorption sensors are positioned at field strength points of interest. When a beam is passed through the cell, energy absorbed by the gas then present in the cell will increase gas pressure and temperature at each point along the beam path according to the spectral lines of the constituents of the gas for the particular field strengths at those points. This increase is sensed at each point simultaneously while modulating the absorption of the beams energy by the gas sample in the cell.
NASA

N80-25539# RCA Solid State Div., Somerville, N.J.
HIGH RELIABILITY, LOW COST INTEGRATED CIRCUITS, PHASE 2 DEVELOPMENT REPORT Final Report, 3 Feb. 1977 - 22 May 1979
22 May 1979 124 p
(Contract N00039-76-C-0240; XF54586002)
(AD-A081666) Avail: NTIS HC A06/MF A01 CSCL 09/5

The objectives of phase 2 of this investigation were to fabricate significant quantities of eight integrated circuit types using the techniques defined in phase 1 (see phase 1 final development report for high reliability, low cost integrated circuits), perform a preliminary reliability investigation, and formulate comparative cost data. Wafers and finished devices were processed for eight integrated-circuit types. These types included three TTL circuits (5420, 5472, 5470), one Schottky TTL circuit (54S20), three CMOS circuits (CD4012B, CD4014A, CD4027A) and one linear circuit (CA741). The preliminary reliability investigations defined potential reliability problems, which were subsequently successfully resolved, and provided preliminary data regarding activation energies and failure rates. The comparative cost analysis indicated that the cost goal of the contract can be met.
GRA

N80-25540# Army Aviation Research and Development Command, St. Louis, Mo. Applied Technology Lab.
COMPARISON OF ONBOARD AIRCRAFT NICAD BATTERY CHARGERS Progress Report, Jun. 1978 - May 1979
J. D. Dickinson Jan. 1980 95 p refs
(DA Proj. 1L1-62209-AH-76)
(AD-A082515; USAAVRADCOM-TM-80-D-5) Avail: NTIS HC A05/MF A01 CSCL 10/3

A test was conducted at the Applied Technology Laboratory at Fort Eustis, Virginia to establish the performance characteristics of several onboard aircraft NiCad battery chargers. The test assessed performance characteristics of chargers from Utah Research and Development Company, Aerospace Avionics Corp., Eldec Corp., and Chrysler Corp. These performance characteristics were also compared to the battery performance associated with a simulated aircraft bus charging source. Adjunct tests investigated battery maintenance procedures.
GRA

N80-25541# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
NANOSECOND PULSERS FOR MM WAVE TUBES
J. Stover, N. Komatsu, and A. Nieto Feb. 1980 18 p
(Contract DAAB07-78-C-2991; DA Proj. 1L1-62705-AH-94)
(AD-A080990; HAC-FR-79-14-353; IR-2; DELET-TR-78-2991-2) Avail: NTIS HC A02/MF A01 CSCL 09/5

The AVG avalanche transistor has been selected as the switching element for the nanosecond pulsers. Still open for consideration is a high voltage (400 V) VMOS FET that will be available shortly for evaluation of that device operating in avalanche mode.
GRA

N80-25542# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
NANOSECOND PULSERS FOR MM WAVE TUBES Interim Report, Jun. - Sep. 1979
J. Stover, N. Komatsu, and A. Nieto Feb. 1980 23 p
(Contract DAAB07-78-C-2991; DA Proj. 1L1-62705-AH-94)
(AD-A080966; HAC-FR-79-14-1376; DELET-TR-78-2991-3; IR-3) Avail: NTIS HC A02/MF A01 CSCL 09/5

A pulser with turn on-turn off switching capability in the nanosecond region has been fabricated and is presently in the preliminary stage of evaluation. The unit is designed to deliver a 1000 V pulse into a 50 ohm resistive load.
GRA

N80-25543# TRW Defense and Space Systems Group, Redondo Beach, Calif. Microelectronics Center.
HIGH FREQUENCY ANALOG LSI DEVELOPMENT Annual Interim Report, 1 Sep. 1978 - 12 Nov. 1979
C. A. West and J. Choma, Jr. 12 Nov. 1979 251 p refs
Prepared for Naval Electronic Systems Command, Washington, D.C.
(Contract N00123-77-C-1045)
(AD-A082664; TRW-30491-6014-RU-00; NOSC/TR-5) Avail: NTIS HC A12/MF A01 CSCL 09/5

This report documents all design and related analysis efforts

undertaken in the second year of a three year program aimed toward utilizing GAT fabrication technology to develop building block circuits which satisfy the system requirements of communication networks operating through L-band signal frequencies. The designs of a wideband RF amplifier, narrowband IF amplifier, four quadrant analog multiplier, wideband operational amplifier, and high frequency voltage controlled oscillator are discussed at considerable depth, and the available experimental characterizations of these units are documented. As a prelude to circuit design discussions, the theories of bandwidth estimation, RF power flow, stability, and interstage coupling are rigorously developed and explained. These theories form the foundation upon which the circuit design methodology is structured. GRA

N80-25544# TRW Defense and Space Systems Group, Redondo Beach, Calif.

SURFACE ACOUSTIC WAVE MICROWAVE OSCILLATOR AND FREQUENCY SYNTHESIZER Interim Report, 1 Apr. - 1 Oct. 1979

M. Y. Huang and D. J. Dodson, Jr. Jan. 1980 120 p refs

(Contract DAAB07-78-C-2992)

(AD-A082351; DELET-TR-78-2992-2; IR-2) Avail: NTIS HC A06/MF A01 CSCL 09/5

The objective of the program is the development of Surface Acoustic Wave (SAW) oscillator and synthesizer technology. The two year effort is planned as follows: task 1 - development of SAW devices for oscillator applications at microwave (L-band) frequencies. Emphasis will be placed on achieving wideband tuning capabilities, improved oscillator stability performance and reduced power requirements. Task 2 - investigate UHF surface acoustic wave devices which can best impact on synthesizer performance parameters such as: switching speed, minimum frequency step size, total achievable bandwidth, short, medium and long term stability as well as maximum suppression of spurious mode level. Concurrently promising new synthesizer designs will be studied on the basis of these designs to arrive at target specification in a package providing a significant reduction is size, weight and power consumption. During the second six months of the program, the microwave oscillator design has been completed. A breadboard version of the circuit has been fabricated and is being evaluated. The oscillator design consists of a bank of four selectable SAW delay lines with passbands around 560 MHz, a varactor tuned quadrature hybrid phase shifter, a three stage loop amplifier, a transistor frequency tripler, and a power amplifier. An injection locked oscillator has also been developed to use in place of the power amplifier. Work on the frequency synthesizer was also initiated. GRA

N80-25546# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.

DIAMOND TECHNOLOGY STUDY Final Report, Jun. 1975 - Jan. 1979

11 Jun. 1979 101 p refs

(Contract N00039-75-C-0451)

(AD-A081928; PT-5413) Avail: NTIS HC A06/MF A01 CSCL 09/1

A comprehensive study has been conducted into the use of diamond as a TWT helix support material to increase the average output power capability of broadband high frequency helix TWT's. A survey of the progress from the inception of diamond supported helix work in 1971, at Raytheon, to the present is presented. Methods for constructing diamond supported helices using compression, brazed, and diffusion bonded interfaces are described. The construction and test of experimental helix assemblies of all three types are described, and it is shown that a compression supported helix is most practical to design and build. Test results on compression-type copper plated tungsten helix assemblies are presented showing power dissipations of 1800 watts per inch for solenoid focused I-band helices and 500 watts per inch for PPM focused K-band helices. The emphasis was on development of practical engineering design technology. A simple analysis procedure is described using thermal resistance methods for accurately calculating the temperature rise of a TWT helix for a given power dissipation. Correlation of calculated values with experimental results was good. This shows that the analysis method is accurate, and that the construction techniques used achieved the theoretical capability of the diamond supported helix. Detailed descriptions of the experimental results and methods are presented. GRA

N80-25546# Argonne National Lab., Ill.

COMPARISON OF FLYING COMPACITOR BRIDGE CIRCUITS AND INDUCTOR-CONVERTOR BRIDGE CIRCUITS FOR THE TRANSFER OF ENERGY BETWEEN SUPERCONDUCTING COILS

Robert L. Kustom 1979 6 p refs Presented at the Intern. Symp. on Superconductive Energy Storage, Osaka, 8-10 Oct. 1979

(Contract W-31-109-eng-38)

(CONF-791075-4) Avail: NTIS HC A02/MF A01

The design criteria for flying capacitor bridge circuits and inductor convertor bridge circuits were compared for similar energy transfer requirements. It is shown that the capacitive energy is proportional to the ratio of minimum commutation time versus energy transfer time. R.C.T.

N80-25547# Stanford Univ., Calif. Dept. of Materials Science and Engineering.

PHOTOELECTRONIC PROPERTIES OF ZINC PHOSPHIDE CRYSTALS, FILMS AND HETEROJUNCTIONS Quarterly Progress Report, 1 Oct. - 31 Dec. 1979

Richard H. Bube 31 Dec. 1979 15 p refs

(Contract EG-77-C-01-4042)

(SU-DSE-4042-T18; QPR-3) Avail: NTIS HC A02/MF A01

An increase in crystal growth rate for Zn3P2 was achieved by a vacuum baking step before crystal growth designed to reduce the pressure of excess gases in the ampoule. An analysis of the problem indicates that results are consistent with expectations. Samples have been submitted for mass spectroscopic evaluation and SIMS analysis. Construction of suitable equilibrium defect distribution diagrams for Zn3P2 was initiated. Good rectifying diodes were prepared by vacuum evaporation of Mg onto etched surfaces of Zn3P2. A barrier height of 0.75 eV was measured from C.V data in good agreement with the published value of 0.80EV. If the Zn3P2 surface was given a heat treatment in oxygen before Mg evaporation, the Mg made an ohmic contact indistinguishable from the normal treatment in hydrogen before Mg evaporation, good diode characteristics were observed, with strong forward current saturation above IV. DOE

N80-25548# Bendix Corp., Kansas City, Mo.

IMPROVING DELAMINATION RESISTANCE OF MULTILAYER PRINTED WIRING BOARDS

J. W. Lula Mar. 1980 19 p refs

(Contracts EY-76-C-04-0613; DE-AC04-76DP-00613)

(BDX-613-2413) Avail: NTIS HC A02/MF A01

The incorporation of black oxide innerlayer surface treatment prepreg conditioning into the manufacturing process for multilayer printed wiring boards (PWBs) is described. Both black oxide and red oxide innerlayer surface treatments show the capability to provide acceptable delamination resistance for mulilayer PWBs made from FR-4 material. Optimum processing parameters for applying the oxide treatment are discussed. In order to manufacture a multilayer PWB that will withstand solder dipping/leveling as well as subsequent drag soldering, it is necessary to remove absorbed moisture from the prepeg before lamination. Data are presented on the rate of moisture removal from prepreg when dried and on the rate of moisture reabsorption when dried prepreg is exposed to 24% C/50% relative humidity environment. DOE

N80-25549# California Univ., Berkeley. Lawrence Berkeley Lab.

DESIGN AND APPLICATION OF A MEGA-MOMENT ELECTROMAGNETIC DIPOLE SOURCE

C. A. Riveros and N. E. Goldstein Oct. 1979 18 p refs Presented at the 49th Ann. Meeting and Exposition, Soc. of Exploration Geophysicists, New Orleans, 4-8 Nov. 1979 Prepared in cooperation with Chicago Univ., Ill.

(Contract W-7405-eng-48)

(LBL-9920; CONF-791107-2) Avail: NTIS HC A02/MF A01

An electromagnetic transmitter capable of generating a magnetic dipole moment in excess of one million mks over a wide frequency range was designed and field tested in connection with geothermal exploration surveys. Engineering aspects of the transmitter pertinent to the design and construction of similar

transmitters for various geophysical applications are dealt with. A prototype transmitter specifically suited to, but not requiring adjustments for, the reactive nature of the transmitter loop was designed. This prototype was built around an existing 60 kW motor generator set mounted on a one ton, 4 wheel drive truck, and was designed as the EM 60 controlled source. Field tests were carried out with a horizontal loop transmitter in both Grass Valley, Nevada and on the flanks of Mount Hood, Oregon. During these tests, the magnetic moment exceeded one million mks (rms) over the frequency range .02 to 500 Hz, although only 1.4 to 1.6 km of no. 6 welding cable was used. Field tests indicated the transmitter design provides a safe and reliable system. DOE

N80-25550# Sandia Labs., Albuquerque, N. Mex.
PERFORMANCE OF DIGITAL INTEGRATED CIRCUIT TECHNOLOGIES AT VERY HIGH TEMPERATURE
J. L. Prince, B. L. Draper, E. A. Rapp, J. N. Kronberg, and L. T. Fitch 1980 10 p refs Presented at Electronic Component Conf., San Francisco, 28 Apr. 1980
(Contract EY-76-C-04-0789; N66001-78-C-3022)
(SAND-79-2092C; CONF-800410-2) Avail: NTIS HC A02/MF A01

Results of investigations of the performance and reliability of digital bipolar and CMOS integrated circuits over the 25 to 340 C range are reported. Included in these results are both parametric variation information and analysis of the functional failure mechanisms. Although most of the work was done using commercially available circuits (TTL and CMOS) and test chips from commercially compatible processes, some results of experimental simulations of dielectrically isolated CMOS are also discussed. It was found that commercial Schottky clamped TTL, and dielectrically isolated, low power Schottky-clamped TTL, functioned to junction temperatures in excess of 325 C. Standard gold doped TTL functioned only to 250 C, while commercial, isolated L functioned to the range 250 C to 275 C. Commercial junction isolated CMOS buffered and unbuffered, functioned to the range 280 C to 310 C depending on the manufacturer. Experimental simulation of simple dielectrically isolated CMOS integrated circuits, fabricated with heavier doping levels than normal, functioned to temperatures in excess of 340 C. High temperature life testing of experimental silicone-encapsulated simple TTL and CMOS integrated circuits have shown no obvious life limiting problems to data. No barrier to reliable functionality of TTL bipolar or CMOS integrated circuits at temperatures in excess of 300 C was found. DOE

N80-25551# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
RADIATION EFFECTS ON ORGANIC INSULATORS FOR SUPERCONDUCTING MAGNETS Annual Progress Report, period ending 30 Sep. 1979
R. R. Coltman, Jr., C. E. Klabunde, R. H. Kernohan, and C. J. Long Nov. 1979 56 p refs
(ORNL/TM-7077) Avail: NTIS HC A04/MF A01

The most recent efforts in a program to study the effects of irradiation near 5 K on organic insulators for fusion reactors have extended the irradiation dose from 2 x 10 to the 9th power to 1 x 10 to the 10th power rads and have studied additional effects due to fast neutrons. When added to a gamma-ray dose of 2.4 x 10 to the 9th power rads, a fast-neutron fluence of 2.4 x 10 to the 20th power n/sq m has little effect upon changes in electrical and mechanical properties. At this dose, present results are in agreement with previous results. At a dose of 1 x 10 to the 10 power rads, particle-filled life in terms of mechanical strength, while fiberglass-cloth-filled expoxies retain sufficient strength for use. Electrical-resistivity and voltage-breakdown values were reduced in some materials but remained in a usable range. Two sheet-type materials showed excellent stability in their electrical properties. Dimensional stability was generally good, except for one epoxy which showed considerable swelling at the higher dose. DOE

N80-25552# Ames Lab., Iowa.
PHOTOACOUSTIC DETECTION METHODS FOR CHARACTERIZING LASER IRRADIATION AND RECRYSTALLIZATION OF SEMICONDUCTORS
J. F. McClelland and R. N. Kniseley 1979 7 p refs Presented at Symp. on Laser and Electron Processing of Mater., Cambridge, Mass., 27-30 Nov. 1979
(Contract W-7405-eng-82)
(ISM-262; CONF-791173-1) Avail: NTIS HC A02/MF A01

The use of photoacoustic detection is discussed as a technique for monitoring laser heating and for characterizing implantation of recrystallization of semiconductors via optical absorption. Preliminary results are reported for laser heating of Ge. A method is proposed for signal processing to enable measurement of optical absorption coefficient changes due to implantation and recrystallization without a background signal from the unimplanted region of the semiconductor. DOE

N80-25553# Massachusetts Inst. of Tech., Cambridge. High Voltage Research Lab.
PARTICLE-INITIATED BREAKDOWN IN GAS DIELECTRIC CABLE INSULATION EXPANDED SCOPE PROGRAM Final Report
Chathan M. Cooke Nov. 1979 122 p refs Sponsored by Elec. Power Res. Inst.
(Contracts EX-76-C-01-1556; E(49-18)-1566; EPRI Proj. 7802)
(EPRI-EL-1264) Avail: NTIS HC A06/MF A01

The adverse influence of conducting particle contaminants in gas insulated power apparatus was investigated in a series of experiments that employed coaxial configurations and dc voltages to 1500 kV. Both SF6 and N2 gases at pressures from 1 to 14.6 atm absolute were used. The particles were intentionally introduced and ranged from 1.6 to 6.4 mm spheres and wires. Insulation failures due to the induced electric stress were examined along the surfaces of solid insulators and in the gas gap. Visual observations, photographs, and electrical measurements helped in distinguishing various processes. Particles could reduce the insulation performance by factors of 3 to 5 and were especially significant when moved to the center conductor. A comparison between dc and ac performance was made. The dc breakdown values exhibited wider scatter, though their lower limit was similar to that found under ac. Overall fundamental forces, and processes which involve particle contamination effects were identified and found to be the same for dc and ac voltage stresses. DOE

N80-25554# Ames Lab., Iowa.
SUPERCONDUCTIVITY IN THE LANTHANUM-YTTRIUM-MANGANESE ALLOY SYSTEM
Roger Joseph Stierman Mar. 1980 37 p refs
(Contract W-7405-eng-82)
(IS-T-895) Avail: NTIS HC A03/MF A01

An empirical approach involving lattice instabilities was investigated in the search for new superconducting materials. Pseudo-lanthanide compounds using La and Y were prepared for the system La/sub 1-x/Y/sub x/Mn2 by arc melting and subsequent heat treatment. Low temperature magnetic susceptibility and low temperature heat capacity measurements were made. The unit cell lattice parameters were determined from X-ray powder patterns taken on most samples and metallographic examination was carried out on selected samples. Alloys with low La concentrations (x equal to or greater than 0.6) showed RMn2 in the cubic C15 Laves phase as the major component with second phase material present. The magnetic susceptibility and X-ray data indicated a superconducting phase which seemed to be the RMn2 phase, but heat capacity measurements showed the second phase material was the superconductor, while the RMn2 was not. Failure to form compounds with higher La content was experienced and may be due to the lattice instability expected at x = 0.56. DOE

N80-25555# National Technical Information Service, Springfield, Va.
ELECTRON BEAM SEMICONDUCTOR DEVICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1980
William E. Reed Mar. 1980 79 p Supersedes NTIS/PS-79/0142; NTIS/PS-78/0174; NTIS/PS-77/0158
(PB80-805997; NTIS/PS-79/0142; NTIS/PS-78/0174; NTIS/PS-77/0158) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

Federally-sponsored research reports are cited, covering the design, development, fabrication, and applications of electron beam

semiconductor devices. Applications include amplifiers, pulse generators, image tubes, switches, and electron beam memory devices. This updated bibliography contains 72 abstracts, 5 of which are new entries to the previous edition. GRA

N80-25556# National Technical Information Service, Springfield, Va.
ELECTRON BEAM SEMICONDUCTOR DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Feb. 1980
William E. Reed Mar. 1980 97 p Supersedes NTIS/PS-79/0145; NTIS/PS-78/0175; NTIS/PS-77/0159
(PB80-806003; NTIS/PS-79/0145; NTIS/PS-78/0175; NTIS/PS-77/0159) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

The bibliography cites worldwide research on the design, development, fabrication, performance, and applications of electron beam semiconductor devices. Applications include amplifiers, image tubes, memory devices, pulse generators, and electron beam pumped semiconductor lasers. This updated bibliography contains 90 abstracts, 9 of which are new entries to the previous edition. GRA

N80-25557# National Technical Information Service, Springfield, Va.
SCHOTTKY BARRIER DEVICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1979
William E. Reed Feb. 1980 201 p Supersedes NTIS/PS-79/0045; NTIS/PS-78/0073 and NTIS/PS-77/0089
(PB80-804776; NTIS/PS-79/0045; NTIS/PS-78/0073; NTIS/PS-77/0089) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

Federally-sponsored research reports are cited on the development, fabrication, performance, and applications of Schottky barrier devices. Research on the physics of Schottky barriers is included. Applications cover solar cells, photodiodes, mixers, transistors, signal processors, and infrared devices. This updated bibliography contains 294 abstracts, 25 of which are new entries to the previous edition. GRA

N80-25558# National Technical Information Service, Springfield, Va.
SCHOTTKY BARRIER DEVICES, VOLUME 4. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report for 1978
William E. Reed Feb. 1980 202 p
(PB80-804784) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

An abstracted bibliography containing 195 citations of research on the development, fabrication, performance, and application of Schottky barrier devices is presented. Topics include the physics of Schottky barriers, microwave equipment, logic devices, field effect transistors, photodiodes, resistively loaded antenna, semiconductors, acoustic correlators, and solar cells. GRA

N80-25559# National Technical Information Service, Springfield, Va.
SCHOTTKY BARRIER DEVICES, VOLUME 5. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report for 1979
William E. Reed Feb. 1980 177 p Supersedes NTIS/PS-79/0047; NTIS/PS-78/0075; NTIS/PS-77/0091
(PB80-804792; NTIS/PS-79/0047; NTIS/PS-78/0075; NTIS/PS-77/0091) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

A bibliography containing 170 abstracts of worldwide research on the development, fabrication, performance and applications of Schottky barrier devices is presented. Research on the physics of Schottky barriers is included. Applications cover microwave equipment, logic devices, field effect transistors, photodiodes, surface acoustic wave devices, and solar cells. GRA

N80-25560# National Technical Information Service, Springfield, Va.
SWITCHING CIRCUITS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Feb. 1977 - Feb. 1980
Mar. 1980 208 p Supersedes NTIS/PS-79/0192; NTIS/PS-78/0218 and NTIS/PS-77/0106
(PB80-805880; NTIS/PS-79/0192; NTIS/PS-78/0218; NTIS/PS-77/0106) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography cites 201 Federally-funded research reports on the theory and applications of switching circuits. Studies on production engineering measures logic design, microelectronics, and system reliability are included. GRA

N80-25561# National Technical Information Service, Springfield, Va.
SWITCHING CIRCUITS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1972 - Feb. 1980
William E. Reed Mar. 1980 239 p Supersedes NTIS/PS-79/0193; NTIS/PS-78/0219; NTIS/PS-77/0107
(PB80-805898; NTIS/PS-79/0193; NTIS/PS-78/0219; NTIS/PS-77/0107) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography cites 232 abstracts on worldwide research on the theory and applications of switching circuits. Studies on logic design, performance features, and computerized simulation are included. GRA

N80-25562# National Technical Information Service, Springfield, Va.
HYBRID MICROELECTRONIC CIRCUITS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Feb. 1980
William E. Reed Mar. 1980 138 p Supersedes NTIS/PS-79/0210; NTIS/PS-78/0211 and NTIS/PS-77/0220
(PB80-805922; NTIS/PS-79/0210; NTIS/PS-78/0211; NTIS/PS-77/0220) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography presents 131 Federally sponsored research reports relating to the technology of thick and thin film hybrid microcircuits. Research on the design, materials, processing, fabrication, quality control, reliability, and applications of the circuits is included. GRA

N80-25563# National Technical Information Service, Springfield, Va.
HYBRID MICROELECTRONIC CIRCUITS, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Feb. 1980
William E. Reed Mar. 1980 276 p Supersedes NTIS/PS-79/0212; NTIS/PS-78/0212; NTIS/PS-77/0222
(PB80-805930; NTIS/PS-79/0212; NTIS/PS-78/0212; NTIS/PS-77/0222) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

Research reports from worldwide literature relating to the technology of thick and thin film hybrid microcircuits are cited. Research on the design, materials, processing, fabrication, quality control, reliability, and applications of the circuits is included. This updated bibliography contains 269 abstracts, 130 of which are new entries to the previous edition. GRA

N80-25564# National Bureau of Standards, Washington, D.C. Center for Electronics and Electrical Engineering.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: ACCURATE LINEWIDTH MEASUREMENTS ON INTEGRATED-CIRCUIT PHOTOMASKS Final Reprot
John M. Jerke, ed. Feb. 1980 171 p refs Sponsored in part by DARPA
(PB80-148216; NBS-SP-400-43; LC-79-600191) Avail: NTIS HC A08/MF A01 CSCL 13H

The progress of the NBS program to develop improved theory for accurate linewidth measurements with optical microscopes, to develop primary linewidth calibration of 1 to 10 micrometer wide lines on integrated-circuit (IC) photomasks, and to provide calibrated measurement artifacts and measurement procedures to the IC industry is discussed. GRA

N80-25565# RCA Labs., Princeton, N. J. Integrated Circuit Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: COMPREHENSIVE TEST PATTERN AND APPROACH FOR

CHARACTERIZING SOS TECHNOLOGY Final Report
W. E. Ham Jan. 1980 370 p refs
(Contract NBS-5-35916; ARPA Order 2397)
(PB80-147952; NBS-SP-400-56; LC-79-600194) Avail: NTIS HC A15/MF A01 CSCL 09E

Detailed information is presented concerning a comprehensive approach to parametric process characterization for IC processes. This includes defining the general areas of importance, devising structures which are sensitive to these areas, devising methods for testing the structures, documenting the structures, tests, and results producing suitable data reduction and presentation schemes, and considering the implementation of the methods in a practical sense. Proper methods for automatically testing some of these structures are explored. Seven divisions were created for the general types of test structure: (1) individual structures of nominal dimensions; (2) closely spaced identical structures; (3) structures of various sizes; (4) series and parallel combinations of structures; (5) structures especially sensitive to lithographic properties; (6) basic circuit building blocks; and (7) small area test circuits. GRA

N80-25566# National Technical Information Service, Springfield, Va.
TRANSISTOR AMPLIFIERS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jul. 1977 - Feb. 1980
William E. Reed Mar. 1980 206 p Supersedes NTIS/PS-79/0196; NTIS/PS-78/0225; NTIS/PS-77/0202
(PB80-806037; NTIS/PS-79/0196; NTIS/PS-78/0225; NTIS/PS-77/0202) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

The design, development, and applications of transistor amplifiers are covered in the cited reports. Research on reliability and radiation effects is included. This updated bibliography contains 99 abstracts, 23 of which are new entries to the previous edition. GRA

N80-26258# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESEARCH OF AN OPTIMAL CONFIGURATION FOR HIGH STABILITY QUARTZ OSCILLATORS ON BOARD AIRCRAFT AND MISSILES
Jacques Beaussier *In its* La Rech. Aerospatiale, Bimonthly Bull. no. 1979-6 (ESA-TT-632) 1979 p 39-53 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-6, Nov. - Dec. 1979 p 375-386 Original report in FRENCH previously announced as A80-19990 Sponsored in part by DRET (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-25567 Brown Univ., Providence, R. I.
AN APPROXIMATION AND AN ASSOCIATED NUMERICAL METHOD FOR TWO-DIMENSIONAL STEADY SUPERSONIC GAS DYNAMICS Ph.D. Thesis
Timothy Scott Lewis 1979 63 p
Avail: Univ. Microfilms Order No. 8007033

Approximate and exact methods are developed for computing everywhere supersonic two dimensional steady flow in which shock waves are present. In particular, the problem of flow over an airfoil with attached shocks at the leading and trailing edges is considered. In the classical simple wave approximation, the entropy and one of the Reimann invariants are taken to be constant. While both are in fact constant up to third order in the shock strength, the variation in the Reimann invariant is numerically smaller, by an order of magnitude for many cases of interest. Approximations incorporating variable entropy but assuming the Reimann invariant is constant everywhere or constant along streamlines are developed. The latter approximation can be considered an extension of shock expansion theory. The governing equations are transformed to coordinates consisting of the streamlines and one family of characteristics. In the simpler approximation, in which the Reimann invariant is taken to be constant everywhere, the solution in characteristic coordinates is explicit. Dissert. Abstr.

N80-25568 Brown Univ., Providence, R. I.
TWO NUMERICAL METHODS FOR STEADY STRATIFIED SHEAR FLOWS OVER AN OBSTACLE Ph.D. Thesis
William Kingsley Stevens 1979 81 p
Avail: Univ. Microfilms Order No. 8007071

The nonlinear problem of the steady flow of a stratified fluid of finite depth over an obstacle is investigated. The effects of viscosity are neglected and the pressure field is assumed to be hydrostatic. A numerical procedure for two dimensional flows is introduced which permits the calculation of all possible steady, continuous flow fields with or without closed streamlines for any given upstream velocity and entropy (or density for incompressible flow) profiles. The major contribution of this investigation consists in the treatment of flows with closed streamlines. It is found that a general feature of small Froude number flows with significant variation in entropy (or density) is the occurrence of stagnation points within the flow field. The streamline passing through such a point is allowed to split resulting in a flow field with closed streamlines. The portion of the field within the closed streamline corresponds to a region of recirculating or vortex flow. Constants of motion along streamlines are used to construct the boundaries of these regions. Calculations are carried out for upstream data obtained from actual measurements in the Rocky Mountains and comparison is made between the solutions corresponding to the compressible and incompressible models. Dissert. Abstr.

N80-25569 State Univ. of New York at Buffalo.
THE MEASUREMENT OF TURBULENCE WITH THE BURST-TYPE LASER DOPPLER ANEMOMETER: ERRORS AND CORRECTION METHODS Ph.D. Thesis
Preben Buchhave 1979 152 p
Avail: Univ. Microfilms Order No. 8005643

The functioning of the laser anemometer in the burst mode was investigated and sources of errors in the velocity determination were analyzed and measured. The residence time analysis of burst type (LDA) signals was developed to encompass spectral measurements as well as moments of the velocity distribution. It is shown both analytically and experimentally that the complete time statistics of the velocity field can be recovered from the random burst signal if the particle residence time is measured along with its velocity. Formulas for mean and mean square velocity, autocorrelation function and spectra were derived, and the difference in the results obtained by various data processing methods predicted from the theory were substantiated by measurements. The system is based on an LDA-counter processor coupled to a minicomputer through a special parallel interface with a buffer memory to absorb data arriving at random times. Results of the LDA data processing were compared to simultaneous measurements with conventional techniques. Dissert. Abstr.

N80-25570 Drexel Univ., Philadelphia, Pa.
NUMERICAL COMPUTATIONS OF FRICTION AND HEAT TRANSFER IN FREE SWIRLING PIPE FLOW Ph.D. Thesis
Frank C. Huang 1980 157 p
Avail: Univ. Microfilms Order No. 8011409

Elliptic equations governing flows and heat transfer for a laminar free swirling pipe flow (Re = 100, Pr = 0.7) and a turbulent free swirling pipe flow (Re = 49100, Pr = 0.7) were solved numerically. The flows under consideration are axisymmetric which were produced by an initial swirl promoter. A computer program with an effective iteration process was developed to solve the elliptic equations based on an existing upwind-difference scheme. In the laminar free swirling flow case, 17 unequally spaced grid points were selected in the axial direction and 21 equally spaced grid points were assigned in the radial direction. In the case of the turbulent flow, a total of 17 x 31 grid points were used in the flow field; and both axial and radial directions are unequally spaced. An extra fine grids

distribution was given in the radial direction for the near wall region to accommodate large physical properties change of this region. This method of treatment was found to be very effective. In addition to the calculated flow and temperature field, friction factors and Nusselt numbers were also computed to give the information on heat transfer augmentation. The results based on constant pumping power, indicate an increase in average Nusselt number over the fully developed value without swirl by 100% for laminar flow and 37% for turbulent flow at a location nine diameter from the inlet. The calculated results were compared with previous calculations and available data. They are in good agreement with the same intensity of the initial vortex promoter. Dissert. Abstr.

N80-25571 Minnesota Univ., Minneapolis.
HEAT TRANSFER TO STAGGERED ARRAYS OF IMPINGING CIRCULAR AIR JETS Ph.D. Thesis
Alireza Irani Behbahani 1979 148 p
Avail: Univ. Microfilms Order No. 8011764

Local heat transfer due to impinging arrays of staggered circular air jets on a flat plate is studied experimentally. Two different arrangements of multiple jets, of spacings S/D = 4 and 8 (where S is the jet spacing and D is the jet diameter) are employed. The parameters that were varied include jet orifice plate to impingement surface spacing, Y/D (Y/D from 2 to 5) and jet Reynolds number Re sub j (Re sub j from 5000 to 1500). Heat transfer coefficients are determined from the measured wall temperature and presented in the form of a Nusselt number. The driving force for heat transfer is defined as the temperature difference between the wall and the adiabatic wall temperature. At low jet exit velocity, the adiabatic wall temperature is approximately equal to the jet total temperature. Local Nusselt numbers are integrated to produce spanwise, spanwise-streamwise, and area averaged Nusselt numbers. The local Nusselt number shows a periodic variation with streamwise as well as spanwise directions, with high values occuring at stagnation regions. Stagnation Nusselt numbers are moved further in the downstream direction as the amount of cross-flow due to upstream jet air increases. A trend of decreasing heat transfer is observed around the last two rows of jets in the streamwise direction. Dissert. Abstr.

N80-25572 Minnesota Univ., Minneapolis.
A COORDINATE TRANSFORMATION METHOD FOR SOLVING A CONVECTION PHASE CHANGE PROBLEM Ph.D. Thesis
Lawrence Malm Hossfeld 1979 274 p
Avail: Univ. Microfilms Order No. 8011822

A computational method is presented for solving certain types of problems involving pure conduction or natural convection heat transfer in two dimensions in which a portion of the domain boundary is irregular and/or moving with respect to a fixed Cartesian coordinate system. The method is developed specifically for a problem involving axisymmetric melting of a solid around a vertical heating tube in a container of a finite height. The solid is initially at the melting temperature; thus heat transfer occurs only in the melted liquid. Equal liquid and solid densities are assumed, and the outer wall is assumed to be beyond the extent of the liquid region. Dissert. Abstr.

N80-25573 Houston Univ., Tex.
NATURAL CONVECTIVE HEAT TRANSFER IN TRAPEZOIDAL ENCLOSURES Ph.D. Thesis
Levent Muammer Iyican 1979 268 p
Avail: Univ. Microfilms Order No. 8012529

Natural convection in trapezoidal enclosures was investigated experimentally and analytically. Experimental heat transfer data were obtained on air confined in a test box with trapezoidal grooves, which was placed into a pressure vessel. Each groove had a water cooled top plate, an electrically heated bottom plate and two sidewalls. Two limiting cases of sidewall conditions were considered: highly conductive and highly insulative sidewalls. The experimental data was expressed as pious of Nusselt number versus Rayleigh number for various inclination angles. The experimental range of parameters covers Rayleigh numbers from 3000 to 4x10 to the 7th power and inclination angles from 0 to 180 degrees. A two dimensional analytical model was developed for the first two regimes of the natural convection motion: the conduction regime and the unicellular convection regime. The governing partial differential equations were solved by the Galerkin method and the resulting stream pattern, velocity components, temperature profiles and Nusselt numbers were given. Dissert. Abstr.

N80-25574 Texas A&M Univ., College Station.
FINITE ELEMENT ANALYSIS OF LAMINAR CONVECTIVE HEAT TRANSFER Ph.D. Thesis
Jesse Louis Holster 1979 215 p
Avail: Univ. Microfilms Order No. 8011956

A finite element method is developed for the analysis of two dimensional transient laminar convective heat transfer. The method is applied to three classes of problems over a range of flow and thermal conditions. The results of eight example problems are compared with other numerical solutions, existing experimental data, and experimental data collected by the author. The governing equations on continuity momentum, and energy are developed in dimensionless form after employing the Boussinesq approximation to the fluid medium. Pressure is eliminated as a variable by casting the dimensionless equations into a vorticity stream function temperature formulation. The finite element method chosen for the solution of this set of equations involves their formulation in variational form as functionals to be minimized. The time derivatives and convective terms in the vorticity and energy equation are treated as invariants over a small time interval. At implicit time stepping scheme is used to integrate forward with time from the initial conditions. Dissert. Abstr.

N80-25575 Oklahoma State Univ., Stillwater.
INCOMPRESSIBLE FLUID FLOW IN COLLAPSIBLE TUBES Ph.D. Thesis
David Lee Smith 1979 119 p
Avail: Univ. Microfilms Order No. 8013050

The problem of predicting fluid flow variables in a highly flexible tube which is collapsed by excessive external pressure was studied to measure and predict the steady-state flowrate versus pressure drop relationship for a collapsible tube. A significant improvement in agreement between predicted and measured upstream pressure is demonstrated over previous modelling attempts. This improvement is attributed to an analysis which was formulated solely from first physical principles. The effect of axial tube prestrain on the fluid pressure-flowrate data is demonstrated experimentally and analytically. Experimental data is presented which shows the onset of tube/fluid oscillation and its location in the pressure drop-flowrate relationship. The measured axial distribution of interior fluid wall pressure is presented with photographs of the corresponding exterior tube shape. Dissert. Abstr.

N80-25576 Iowa State Univ. of Science and Technology, Ames.
BOILING HEAT TRANSFER AND CRITICAL HEAT FLUX IN HELICAL COILS Ph.D. Thesis
Michael Keith Jensen 1980 292 p
Avail: Univ. Microfilms Order No. 8012969

The present study was initiated to obtain more information on boiling heat transfer in coils, with particular emphasis on the effect of an outside heat flux tilt on the CHF. An experimental investigation was conducted to determine the boiling heat transfer characteristics of R-113 in electrically heated, helically coiled tubes and in straight tubes (for reference). An experimental test loop was designed and constructed for this study. Electrically heated coils of three different ratios of tube diameter to coil diameter (d/D = 0.0182, 0.0353, and 0.0649) were tested using R-112 at a pressure of 0.94 MPa and with wide ranges of mass velocity, exit sub cooling quality, and flux tilt toward the outside of the coil. A straight, horizontal tube was tested for reference. Subcooled CHF is degraded in coils relative to straight, horizontal tubes. Degradation increases with increasing d/D and mass velocity. Quality CHF is enhanced and increases with increasing d/D; CHF initially increases with increasing mass velocity but begins to decrease after a maximum is reached. The degrading effect of buoyancy on CHF in straight, horizontal tubes and in coils is shown. A Forbidden Zone is described in which severe operational problems can occur if the heat exchanger is operating with low subcooling or low quality near the inlet and high quality near the exit. Dissert. Abstr.

N80-25577 Mississippi State Univ., State College.
NUMERICAL SOLUTION OF THE INCOMPRESSIBLE NAVIER-STOKES EQUATIONS ABOUT A THREE-DIMENSIONAL BODY USING BOUNDARY-FITTED COORDINATES Ph.D. Thesis
Tien Hua Fu 1979 179 p
Avail: Univ. Microfilms Order No. 8011480

Numerical solution of the three dimensional incompressible time dependent Navier-Stokes equations for laminar flow about a sphere is investigated. The numerical generated boundary fitted coordinate system is used in order to generate coordinate surfaces coincident with the boundary contours in the physical space. The Navier-Stokes equations are formulated in primitive variables. The pressure Poisson equation is obtained by the divergence operation on the momentum equations. Not all the terms are retained in the pressure equation. Boundary conditions imposed on the body surface are the no-slip and normal derivative of pressure. The constant free stream and constant pressure are used at infinity. Two methods (one and two step) are used to solve the Navier-Stokes equations. The one step method is the direct discretitation of the momentum and pressure equations. The two step method is formulated by splitting the momentum equation with an intermediate time step n + 1/2. The calculation is performed in two iteration steps. The comparisons are given at low and high Reynold's number flow conditions.
Dissert. Abstr.

N80-25578 Virginia Polytechnic Inst. and State Univ., Blacksburg.
NEAR-WALL SIMILARITY IN TWO- AND THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS Ph.D. Thesis
John Elias McAllister, Jr. 1979 785 p
Avail: Univ. Microfilms Order No. 8013268

Static pressure, mean velocity, indirect wall shear from Preston tubes, direct wall shear using a two dimensional (single line of action) floating element device, and direct wall shear measurements from an omnidirectional floating element capable of simultaneously determining magnitude and direction of a wall shear vector were completed over a modest range of two dimensional (near zero) pressure gradient flows. State pressure, mean velocity, and direct wall shear measurements using the omnidirectional meter were completed in a pressure driven, and two different shear driven three dimensional flows. These data were combined to evaluate ten of eleven three dimensional similarity models found in the literature. Uncertainty estimates on all the data are presented. Two dimensional experimental results show that the constants in the two dimensional law of the wall formula appear to be slightly dependent on Reynolds number, and the Patel calibration formulas for Preston tubes to be better than any other available formulas. Dissert. Abstr.

N80-25579 Stanford Univ., Calif.
POROUS MEDIA FLOW PROBLEMS: NATURAL CONVECTION AND NON-NEWTONIAN Ph.D. Thesis
Kenneth Lee Walker 1980 120 p
Avail: Univ. Microfilms Order No. 8011723

Natural convection of a Newtonian fluid and one dimensional flow of a nonNewtonian fluid are studied. Convection in a rectangular porous cavity driven by heating in the horizontal is analyzed by a number of different techniques which yield a fairly complete description of the two dimensional solutions. The solutions are governed by two dimensionless parameters: the Darcy-Rayleigh number R and cavity aspect ratio A. The flow behavior of a dilute solution of polyacrylamide in corn syrup flowing through porous media is also studied. Measurement of the pressure drop and flow rate are made for the solution flowing through a packed bed of glass beads. At low velocities the pressure drop as a function of velocity is the same as that for a Newtonian fluid of equal viscosity. At high flow rates the nonNewtonian fluid exhibited significantly higher pressure drops than a Newtonian fluid. Careful rheological measurements of the fluid are made using a Weissenberg rheogoniometer. From measurements of the dynamic viscosity shear it is determined that elastic effects are negligible. It is believed that the increased pressure gradients are caused by nonlinear viscous effects resulting from the extensional components of the flow.
Dissert. Abstr.

N80-25580 Washington Univ., Seattle.
NUMERICAL MODELING WITH A MOVING COORDINATE SYSTEM: APPLICATION TO FLOW THROUGH POROUS MEDIA Ph.D. Thesis
Ole Krough Jensen 1980 297 p
Avail: Univ. Microfilms Order No. 8013538

A numerical technique for solving convective diffusive equations is developed. Convective diffusive equations arise from mass conservation relations in flow through porous media. An analysis and comparison of numerical methods are performed. Criteria are given for the spatial mesh size to eliminate the oscillations for weighted residual methods. The solution technique developed minimizes the oscillations. The differential equations are transformed into a moving coordinate system with a time dependent velocity, which eliminates the influence of the convective term, but makes the boundary location change in time. Both linear and nonlinear, one and two dimensional equations are solved with physically realistic parameters. Methods for determining the moving coordinate system velocity and changing the location of the boundary conditions are described. Orthogonal collocation on finite elements, finite difference, and the Galerkin finite element method are applied. Several integration schemes including variable timestep schemes are used. Comparisons of the accuracy and the solution cost to exact solutions and schemes with a fixed coordinate system are made. Dissert. Abstr.

N80-25581 Washington Univ., Seattle.
A PHOTOGRAPHIC STUDY OF DROP FORMATION HEAT AND MASS TRANSFER Ph.D. Thesis
Paul Aubrey Klett 1979 376 p
Avail: Univ. Microfilms Order No. 8013548

The basis of a refined version of the photographic technique as applied to drop formation heat and mass transfer is discussed. Volume changes which are determined from diffusely backlighted forming drops are used to calculate instantaneous heat or mass transfer. Direct shadowgraphs are given and are used to interpret drop formation phenomena. Observations of growth characteristics of forming drops are reported, along with both mass transfer and heat transfer coefficients. Some of the forces acting on forming drops are inferred from the effects of heat transfer, and a possible synergism between simultaneous heat and mass transfer is recorded. Dissert. Abstr.

N80-25582 California Inst. of Tech., Pasadena.
MOTION OF A SPHERE IN THE PRESENCE OF A PLANE INTERFACE, 1. MODELING OF NON-ISOTHERMAL TURBULENT FLOWS, 2 Ph.D. Thesis
Seong Hee Lee 1980 257 p
Avail: Univ. Microfilms Order No. 8012209

The motion of a sphere in the presence of a fluid/fluid interface is studied. A solution is derived for a point force near a plane interface. Then the solution is extended to include the higher-order terms which are required to describe the motion of a solid sphere. Singularities of higher orders at the center of the sphere are obtained by using the method of reflections. This method yields asymptotic solutions for the general motion of a sphere in the presence of an interface. The second-order, mean Reynolds stress turbulence closure approximation is extended to nonisothermal turbulent flows with negligible buoyancy. The method of invariant modeling is used to systematically model the various higher order moments in the governing equations. This approach yields a general form for each unknown correlation in the transport equations of u sub i theta, theta squared and epsilon sub theta each containing many terms with parameters that must be determined from experimental data. For practical application, it is necessary to reduce the number of terms. The most important terms are filtered from the general model for each unknown moment and their parameters are evaluated based on experimental data. Dissert. Abstr.

N80-25583 Iowa Univ., Iowa City.
DEVELOPMENT OF THE FINITE-DIFFERENTIAL NUMERICAL METHOD AND ITS APPLICATION IN TWO-DIMENSIONAL NAVIER-STOKES EQUATIONS Ph.D. Thesis
Hamid Naseri-Neshat 1979 287 p
Avail: Univ. Microfilms Order No. 8012400

A numerical scheme called finite differential method is used

to solve the two dimensional Navier-Stokes equation. The basic idea of the finite differential method is the incorporation of local analytic solutions in the numerical solutions of linear, or nonlinear partial differential equations. In the finite differential method, the flow region is subdivided into a number of small rectangular subregions, in which the Navier-Stokes equation is linearized, so that analytic solutions are obtained. The local finite differential analytical solutions for these subregions are then overlapped to cover the entire flow region. The assembly of these local analytical solutions, which still preserve the overall nonlinearity of the Navier-Stokes equation, results in a system of linear algebraic equations which are solved iteratively to provide the numerical solution of the total problem for the flow domain. Dissert. Abstr.

N80-25584 Tennessee Univ., Knoxville.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF FLOW BETWEEN A SMOOTH STATIONARY DISC AND A GROOVED ROTATING DISC Ph.D. Thesis
Jack Rutherford Missimer 1979 167 p
Avail: Univ. Microfilms Order No. 8012479

The radial outflow between a smooth or grooved rotating disc and a smooth stationary disc was examined both analytically and experimentally with the main interest on flow rate drag moment and heat transfer. All investigations were conducted for a zero pressure differential across the disc. The analysis was based on an integral method with an area averaged boundary condition on the grooved rotor. A finite difference scheme was employed in the radial direction and the zero pressure differential across the disc was satisfied by an iterative solution technique. Two fluids, air and SAE 10 motor oil, were examined to determine the applicability of the nondimensional variables used in the analysis. A region near Re sub s = 670, where the Reynolds number is based on the gap spacing, was found where flow transition from laminar to turbulent flow is believed to occur in the flow between the stator and rotor. Additionally a region was found near Re sub w = 2000, Reynolds number is based on the groove width, where flow transition form laminar to laminar to turbulent flow is believed to occur in the grooves.
Dissert. Abstr.

N80-25585 Rutgers - The State Univ., New Brunswick, N. J.
DROPLET DRAG AND BREAKUP IN SHOCK-WAVE INDUCED UNSTEADY FLOWS Ph.D. Thesis
Harendra Kumar Mehta 1980 22 p
Avail: Univ. Microfilms Order No. 8013173

The drag experienced by small, spherical water droplets in unsteady flow fields was investigated experimentally in order to create unsteady flow fields, a shock tube having a conical driver section was used which produced N-Waves. The convective flows resulting from the passage of waves had maximum initial velocities in the range 253 to 1009 cm/sec corresponding to leading shock strengths in the range of 0.01 to 0.04. These shock waves provided test times of about 7 milliseconds. A droplet generator produced controlled streams of droplets such that the droplet diameters ranged from 115 to 187 microns. Since the combination of droplet diameters and shock strengths resulted in Weber numbers less than 0.15, the droplets were treated as spheres. Experiments were carried out to study droplet breakup in suddenly imposed flows. Side and front view pictures of deforming droplets leading to bag-mode and umbrella-mode of breakup were obtained. Both modes of breakup are discussed in detail. Transition from bag-mode to umbrella-mode was found to take place in the Weber number range $7.1 < We < 7.8$. Dissert. Abstr.

N80-25586*# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Science.
FEASIBILITY STUDIES FOR LIGHT SCATTERING EXPERIMENTS TO DETERMINE THE VELOCITY RELAXATION OF SMALL PARTICLES IN A FLUID Final Report, Jan. 1979 - May 1980
Charles Acquista and Lorenzo M. Narducci May 1980 18 p refs
(Grant NsG-2357)
(NASA-CR-163214) Avail: NTIS HC A02/MF A01 CSCL 20D

An approach for measuring the non-Markoffian component in the relaxation mechanism of a Brownian particle is proposed which combines desirable features of both the shock wave experiment and conventional light scattering experiments. It is suggested that the radiation pressure generated by a C.W. laser be used to guide an individual spherical particle to terminal velocity. At an appropriate time, the beam intensity is suddenly lowered to a value at which the radiation pressure is negligible, and the ensuing velocity relaxation is measured directly. A.R.H.

N80-25587# Weapons Systems Research Lab., Adelaide (Australia).
USE OF A NEW ANALYTICAL TECHNIQUE TO DETERMINE HEAT INPUT FROM INNER SURFACE TEMPERATURES MEASURED ON A HEMISPHERICAL SHELL DURING A FREE FLIGHT EXPERIMENT
G. Jepps Jan. 1979 64 p refs
(WSRL-0069-TR; AR-001-461) Avail: NTIS HC A04/MF A01

A technique for deriving outer surface temperature and heat transfer distributions from inner surface temperature measurements recorded from three arrays of thermocouples was investigated. A hemispherical shell which was mounted on the front of a rocket vehicle reached a maximum Mach number of 5.5 at 4 km altitude after 7 s of flight. It is concluded that the technique is successful but that the circumferential temperature and heat transfer resolutions could be improved by increasing the number of thermocouples in each array from seven to at least nine. R.C.T.

N80-25588*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCEEDINGS OF THE AERO-OPTICS SYMPOSIUM ON ELECTROMAGNETIC WAVE PROPAGATION FROM AIRCRAFT
Apr. 1980 666 p refs Symp. held at Moffett Field, Calif., 14-15 Aug. 1979 Sponsored in part by AFWL
(NASA-CP-2121; A-8090) Avail: NTIS HC A99/MF A01 CSCL 20D

Wind-tunnel and flight experiments concerning natural and induced turbulence around an airplane and the effects on propagation characteristics of an emitter mounted in the airplane are described. Some of the papers are concerned with phase distortion of the propagating radiation, and others deal with mechanical jitter of the optical elements when exposed to open-cavity turbulence. The results include both aerodynamic and optical measurements and a consideration of the relationship between the two. Primary emphasis is on the dynamic disturbances, but theoretical and experimental evaluations of steady-state distortions are also presented. For individual titles, see N80-25589 through N80-25612.

N80-25589*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TURBULENT TWO-DIMENSIONAL JET FLOW AND ITS EFFECT ON LASER BEAM DEGRADATION
G. D. Catalano, G. F. Cudahy, James T. VanKuren (AFWL, Kirtland AFB, N. Mex.), and H. E. Wright *In its* Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 1-33 refs (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

An experiment in which visible wavelength lasers traversed a well-documented two dimensional jet was conducted. Temperature perturbations varied from 0.25 to 1.80 K and velocity fluctuations ranged from 9.2 to 30.8 m/sec. Measured central spot intensities were as low as 18% of the undisturbed beam, depending on jet Mach number, beam position theory and experiment was two percent in terms of far field intensity. To supplement the flow field information, a laser Doppler velocimeter was developed to measure both mean and fluctuating velocities and a photo correlator was used as a signal processor. R.E.S.

N80-25590*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OVERVIEW OF 6- X 6-FOOT WIND TUNNEL AERO-OPTICS TESTS
Donald A. Buell *In its* Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 35-90 refs (For primary document see N80-25588 16-34)

Avail: NTIS HC A99/MF A01 CSCL 20D

The splitter-plate arrangement used in tests in the 6 x 6 foot wind tunnel and how it was configured to study boundary layers, both heated and unheated, shear layers over a cavity, separated flows behind spoilers, accelerated flows around a turret, and a turret wake are described. The flows are characterized by examples of the steady-state pressure and of velocity profiles through the various types of flow layers. R.E.S.

N80-25591*# Raman Aeronautics Research and Engineering, Inc., Palo Alto, Calif.

PRESSURE AND TEMPERATURE FIELDS ASSOCIATED WITH AERO-OPTICS TESTS

K. R. Raman *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 91-121 ref (For primary document see N80-25588 16-34)

(Contract NAS2-9920)

Avail: NTIS HC A99/MF A01 CSCL 20D

The experimental investigation carried out in a 6 x 6 ft wind tunnel on four model configurations in the aero-optics series of tests are described. The data obtained on the random pressures (static and total pressures) and total temperatures are presented. In addition, the data for static pressure fluctuations on the Coelostat turret model are presented. The measurements indicate that the random pressures and temperature are negligible compared to their own mean (or steady state) values for the four models considered, thus allowing considerable simplification in the calculations to obtain the statistical properties of the density field. In the case of the Coelostat model tests these simplifications cannot be assumed a priori and require further investigation. R.E.S.

N80-25592*# Air Force Weapons Lab., Kirtland AFB, N. Mex.

LINE SPREAD INSTRUMENTATION FOR PROPAGATION MEASUREMENTS

Wade H. Bailey, Jr. *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 123-126 refs Also presented at the SPIE Seminar on Laser Technol. for the Atmospheric Sci., San Diego, Calif., 25-26 Aug. 1977 (For primary document see N80-25588 16-34)

Avail: NTIS HC A99/MF A01 CSCL 20D

A line spread device capable of yielding direct measure of a laser beam's line spread function (LSF) was developed and employed in propagation tests conducted in a wind tunnel to examine optimal acoustical suppression techniques for laser cavities exposed to simulated aircraft aerodynamic environments. Measurements were made on various aerodynamic fences and cavity air injection techniques that effect the LSF of a propagating laser. Using the quiescent tunnel as a control, the relative effect of each technique on laser beam quality was determined. The optical instrument employed enabled the comparison of relative beam intensity for each fence or mass injection. It was found that fence height had little effect on beam quality but fence porosity had a marked effect, i.e., 58% porosity alleviated cavity resonance and degraded the beam the least. Mass injection had little effect on the beam LSF. The use of a direct LSF measuring device proved to be a viable means of determining aerodynamic seeing qualities of flow fields. R.E.S.

N80-25593*# Spectron Development Labs., Inc., Costa Mesa, Calif.

AERO-OPTICAL CHARACTERIZATION OF AIRCRAFT OPTICAL TURRETS BY HOLOGRAPHY, INTERFEROMETRY AND SHADOWGRAPH

J. D. Trolinger *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 127-151 Sponsored by AFWL (For primary document see N80-25588 16-34)

Avail: NTIS HC A99/MF A01 CSCL 20D

Density variations in the aircraft boundary layer, turret wakes and shock waves create distortion of an optical wavefront through associated refractive index variations. Such effects can be observed directly through optical flow visualization. The application of holographic interferometry, wave shearing interferometry, and laser shadowgraph to observe and quantify such effects is described. Examples of the results from five different wind tunnel tests are presented. The examples show that diagnostics have provided valuable qualitiative and quantitiative data. These include (1) wake dimensions, (2) optical strength of the flow field, (3) turbulence characterization, (4) shock location, and (5) direct observation of areo-optical effects. R.E.S.

N80-25594*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

UNSTEADY DENSITY AND VELOCITY MEASUREMENTS IN THE 6 FOOT X 6 FOOT WIND TUNNEL

William C. Rose (Rose Eng. and Res., Inc.) and Dennis A. Johnson *In its* Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 153-181 refs (For primary document see N80-25588 16-34)

Avail: NTIS HC A99/MF A01 CSCL 20D

The methods used and the results obtained in four aero-optic tests are summarized. It is concluded that the rather large values of density fluctuation appear to be the result of much higher Mach number than freestream and the violent turbulence in the flow as it separates from the turret. A representative comparison of fairing on-fairing off rms density fluctuation indicates essentially no effect at M = 0.62 and a small effect at M = 0.95. These data indicate that some slight improvement in optical quality can be expected with the addition of a fairing, although at M = 0.62 its effect would be nil. Fairings are very useful in controlling pressure loads on turrets, but will not have first order effects on optical quality. Scale sizes increase dramatically with increasing azimuth angle for a reprensentative condition. Since both scale sizes and fluctuation levels increase (total turbulence path length also increases) with azimuth angle, substantial optical degradation might be expected. For shorter wave lengths, large degradations occur. R.E.S.

N80-25595*# McDonnell Aircraft Co., St. Louis, Mo.

PREDICTION OF OPTICAL PROPAGATION LOSSES THROUGH TURBULENT BOUNDARY/SHEAR LAYERS

A. Verhoff *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 183-229 refs (For primary document see N80-25588 16-34)

Avail: NTIS HC A99/MF A01 CSCL 20D

A simplified mathematical model was developed which predicts the optical propagation losses which occur when an optical beam of given wave length passes through a turbulent boundary layer or shear layer. The optical losses are predicted in terms of line spread function (or Strehl ratio) and modulation transfer function by using experimentally determined values of layer thickness, streamwise, lateral and beamwise density fluctuation length scales, and distribution of the standard deviation of the density fluctuations through the turbulent layer. The prediction model was applied to the analysis of a number of selected cases of interest from the aerodynamic-optical interaction wind-tunnel investigation conducted in the NASA-Ames 1.83 x 1.83 meter (6 x 6 ft) wind tunnel. Direct optical measurements are compared with the results predicted by the aerodynamic analysis. R.E.S.

N80-25596*# Avco-Everett Research Lab., Mass.

ON OPTICAL IMAGING THROUGH AIRCRAFT TURBULENT BOUNDARY LAYERS

George W. Sutton *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 231-252 refs (For primary document see N80-25588 16-34)

(Contract F19628-70-C-0230)

(AMP-334) Avail: NTIS HC A99/MF A01 CSCL 20D

Optical resolution quality as affected by aircraft turbulent boundary layers is analyzed. Wind-tunnel data was analyzed to obtained the variation of boundary layer turbulence scale length and mass density rms fluctuations with Mach number. The data gave good agreement with a mass density fluctuation turbulence spectrum that is either isotropic of orthogonally anisotropic. The data did not match an isotropic turbulence velocity spectrum which causes an anisotropic non-orthogonal mass density fluctuation spectrum. The results indicate that the average mass density rms fluctuation is about 10% of the maximum mass density across the boundary layer and that the transverse turbulence scale size is about 10% of the boundary layer thickness.

The results indicate that the effect of the turbulent boundary layer is large angle scattering which decreases contrast but not resolution. Using extinction as a criteria the range of acceptable aircraft operating conditions are given. M.G.

N80-25597*# Adelphi Univ., Garden City, N. Y.
SECOND MOMENTS OF OPTICAL DEGRADATION DUE TO A THIN TURBULENT LAYER
W. J. Steinmetz *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 253-285 refs (For primary document see N80-25588 16-34)
(Grant NSG-2088)
Avail: NTIS HC A99/MF A01 CSCL 20D

The effect of the thin turbulent layers, including boundary layers and shear layers, on light propagation is examined from a theoretical point of view. In particular, a mathematical model is developed to describe the interaction between the aerodynamic or, more precisely, the density fluctuations and the electromagnetic field. It is assumed that the turbulence induces a normally distributed phase aberration which is a homogenous random function in the plane of the aperture. The optical degradation is described in terms of the optical transfer function and the Strehl ratio which are random. Expressions for the first and second moments of these two parameters are developed from the definitions. Asymptotic (large aperture) approximations to these expressions are derived and discussed. Finally, the exact approximate results are compared for several typical values of the ratios of aperture diameter to scale of density fluctuations and rms phase aberration to wave length respectively. Author

N80-25598*# Naval Postgraduate School, Monterey, Calif.
OPTICAL PHASE DISTORTION DUE TO COMPRESSIBLE FLOW OVER LASER TURRETS
Allen E. Fuhs and Susan E. Fuhs (Calif. Inst. of Tech., Pasadena) *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 287-325 refs Sponsored by AFWL (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

Analytical models for optical phase distortion due to compressible flow over a laser turret are developed. Phase distortion is calculated for both blunt and small perturbation turrets. For the blunt turret, the Janzen-Rayleigh technique is used to determine the flow field. Phase distortions of 2.2 wavelengths at 3.8 microns are calculated for the blunt turret. For small perturbation turrets, a versatile analytical model is developed for a turret on a fuselage with circular cross section. With a two dimensional Fourier series representation of the turret, any shape can be considered. Both subsonic and supersonic flows can be calculated. Phase distortions of 1.2 wavelengths at 3.8 microns are calculated for one turret at high subsonic Mach number. In addition to being of value for laser turrets, the methods are applicable to reconnaissance aircraft using photographic equipment and cruise missiles using celestial navigation. M.G.

N80-25599*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
INVISCID FLOW FIELD EFFECTS: EXPERIMENTAL RESULTS
Leonard J. Otten, III and Keith G. Gilbert *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 327-337 refs (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/ A01 CSCL 20D

The aero-optical distortions due to invisid flow effects over airborne laser turrets is investigated. Optical path differences across laser turret apertures are estimated from two data sources. The first is a theoretical study of main flow effects for a spherical turret assembly for a Mach number (M) of 0.6. The second source is an actual wind tunnel density field measurement on a 0.3 scale laser turret/fairing assembly, with M = 0.75. A range of azimuthal angles from 0 to 90 deg was considered, while the elevation angle was always 0 deg (i.e., in the plane of the flow). The calculated optical path differences for these two markedly different geometries are of the same order. Scaling of results to sea level conditions and an aperture diameter of 50 cm indicated up to 0.0007 cm of phase variation across the aperture for certain forward look angles and a focal length of F = -11.1 km. These values are second order for a 10.6 micron system. M.G.

N80-25600*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTIMIZED LASER TURRETS FOR MINIMUM PHASE DISTORTION
G. N. Vanderplaats, Allen E. Fuhs (Naval Postgraduate School), and Gregory A. Blaisdell (Calif. Inst. of Tech., Pasadena) *In its* Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 339-362 refs Sponsored by AFWL (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

An analysis and computer program which optimizes laser turret geometry to obtain minimum phase distortion is described. Phase distortion due to compressible, inviscid flow over small perturbation laser turrets in subsonic or supersonic flow is calculated. The turret shape is determined by a two dimensional Fourier series; in a similar manner, the flow properties are given by a Fourier series. Phase distortion is calcualted for propagation at serveral combinations of elevation and azimuth angles. A sum is formed from the set of values, and this sum becomes the objective function for an optimization computer program. The shape of the turret is varied to provide minimum phase distortion. M.G.

N80-25601*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
OVERVIEW OF RECENT AERO-OPTICS FLIGHT TESTS
Leonard J. Otten, III *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 363-395 refs (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

A chronological overview of aero-optics test flights is presented highlighting the objectives and conclusions from the tests. Flight tests performed in coordination with the PRESS reentry observation missions and the ALL Cycle 2 laser propagation and tracking demonstrations are described addressing the identification and quantification of distortion phenomena. Finally, current aero-optics flight investigations of an atmospheric turbulence probe are briefly discussed. M.G.

N80-25602*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
LEAR JET BOUNDARY LAYER/SHEAR LAYER LASER PROPAGATION EXPERIMENTS
K. Gilbert *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 397-414 (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

Optical degradations of aircraft turbulent boundary layers with shear layers generated by aerodynamic fences are analyzed. A collimated 2.5 cm diameter helium-neon laser (0.63 microns) traversed the approximate 5 cm thick natural aircraft boundary layer in double pass via a reflective airfoil. In addition, several flights examined shear layer-induced optical degradation. Flight altitudes ranged from 1.5 to 12 km, while Mach numbers were varied from 0.3 to 0.8. Average line spread function (LSF) and Modulation Transfer Function (MTF) data were obtained by averaging a large number of tilt-removed curves. Fourier transforming the resulting average MTF yields an LSF, thus affording a direct comparison of the two optical measurements. Agreement was good for the aerodynamic fence arrangement, but only fair in the case of a turbulent boundary layer. Values of phase variance inferred from the LSF instrument for a single pass through the random flow and corrected for a large aperture ranged from 0.08 to 0.11 waves (lambda = .63 microns) for the boundary layer. Corresponding values for the fence vary from 0.08 to 0.16 waves. Extrapolation of these values to 10.6 microns suggests negligible degradation for a CO2 laser transmitted through a 5 cm thick, subsonic turbulent boundary layer. M.G.

N80-25603*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTICAL MEASUREMENTS OF DEGRADATION IN AIRCRAFT BOUNDARY LAYERS
Dennis Kelsall *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from

Aircraft Apr. 1980 p 415-457 refs Sponsored by AF (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

Visible wavelength measurements of the degradation of optical beams when transmitted through the thin aerodynamic boundary layers around an aircraft are reviewed. The measured results indicated degradation levels for the KC-135 airplanes between 0.10 to 0.13 lambda increasing to 0.18 lambda (rms wavefront distortion). For the Lear Jet, degradation with a 25 mm diameter optics was roughly 0.07 lambda. The corresponding infinite aperture degradation levels are also calculated. The corresponding measured correlation lengths of roughly 12 mm for the KC-135 aircraft and 6 mm for the Lear Jet scale to roughly 20 and 25 mm, respectively, for infinite apertures. These boundary layer correlation lengths do not appear to reflect the different boundary layer thicknesses on the two different aircraft. M.G.

N80-25604*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SUMMARY OF ALL CYCLE II.5 SHEAR AND BOUNDARY LAYER MEASUREMENTS, AERODYNAMICS
William C. Rose (Rose Eng. and Res., Inc.), D. A. Johnson, and Leonard J. Otten, III (AFWL, Kirtland AFB, N. Mex.) *In its* Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 459-464 refs (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

The two measurement systems were used to measure mean velocity and velocity, mass flux, and total temperature fluctuations in the turbulent boundary on the fuselage of a KC-135 aircraft. The boundary layer thickness ranged between about 20 and 30 cm for the range of flight Mach numbers from about 0.25 to 0.85 and Reynolds numbers between 3 and 6 x 10 to the 6th power/m. The adaptation of each system for use in airborne applications is discussed. The data obtained from each system are given and compared with each other and they indicate that the two systems represent viable ones for use in future airborne turbulence experiments. Author

N80-25605*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
CYCLE II.5 AIRCRAFT AERO-OPTICAL TURBULENT BOUNDARY-LAYER/SHEAR-LAYER MEASUREMENTS
K. Gilbert *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 465-491 refs (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

The aero-optical effects associated with propagating a laser beam through aircraft turbulent boundary layers and shear layers were examined. Observed laser optical performance levels were compared with those inferred from aerodynamic measurements of unsteady densities and correlation lengths within these random flows. Optical instrumentation included a fast shearing interferometer (FSI). A 9 cm diameter collimated helium neon laser beam made a double pass through the aircraft random flow via an airfoil mirror located one meter from the fuselage. Typical aircraft turbulent boundary layer thickness measured 0.3 meters. Averaging many FSI generated modulation transfer functions (MTFs) and Fourier transforming, this average yields the expected far field intensity degradation associated with an aircraft mounted laser system. Aerodynamic instrumentation included fine wire probes to measure unsteady temperature and mass flux. A laser doppler velocimeter measured unsteady velocity within the flows. An analysis of these data yielded point measurements of unsteady density and correlation length. R.C.T.

N80-25606*# Rose Engineering and Research, Inc., Incline Village, Nev.
AIRBORNE MEASUREMENT OF ATMOSPHERIC TURBULENCE
William C. Rose and Leonard J. Otten, III (AFWL, Kirtland AFB, N.Mex.) *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 493-514 refs (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

A system capable of making measurements of fluctuating atmospheric density is described. Spatial scales required in assessing the quality of coherent radiation propagation are discussed. The special sensors, aircraft installation, data reduction procedures, and other special requirements necessary to obtain meaningful atmospheric turbulence data are also described. The spectral distribution of density fluctuation are presented. R.C.T.

N80-25607*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
SUMMARY OF AERODYNAMIC VIBRATION EFFECTS ON ALL TURRET
P. Merritt and L. Sher *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 515-535 refs (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

The effects of the airborne environment on a pointing and tracking system using a turret external to an aircraft are summarized. The data covered a series of flight tests and a span of seven years. The two major airborne effects were shown to be direct pressure loading of optical elements and vibrations of the entire turret. The direct optical loading problem was minimized by fence designs for the turret. R.C.T.

N80-25608*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
FLOW VISUALIZATION TECHNIQUES IN THE AIRBORNE LASER LABORATORY PROGRAM
R. E. Walterick and James T. VanKuren *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 537-565 refs (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

A turret/fairing assembly for laser applications was designed and tested. Wind tunnel testing was conducted using flow visualization techniques. The techniques used have included the methods of tufting, encapsulated liquid crystals, oil flow, sublimation and schlieren and shadowgraph photography. The results were directly applied to the design of fairing shapes for minimum drag and reduced turret buffet. In addition, the results are of primary importance to the study of light propagation paths in the near flow field of the turret cavity. Results indicate that the flow in the vicinity of the turret is an important factor for consideration in the design of suitable turret/fairing or aero-optic assemblies. R.C.T.

N80-25609*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
REDUCTION OF UNSTEADY WIND TORQUES ON AN OPEN PORT AIRBORNE OPTICAL TURRET
John P. Thomas, Jr. and James T. VanKuren *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 567-581 refs (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

Techniques for reducing the unsteady torques acting on the inner gimbal of a turret were developed. The reductions in the unsteady torques were obtained by using fixes that alter undesirable flow characteristics or change the acoustic properties of the turret cavity. These fixes were designed to be used in the subsonic and transonic flow regimes. The flow field about the turret generally three dimensional and turbulent, and shock waves formed because of the rapid acceleration of the compressible gas about the blunt turret. The situation was further complicated by the presence of the cavity flow, and the fact that the mouth of the cavity must sweep through a wide angular variation relative to the direction of the freestream. Results indicate that significant reductions of the unsteady pressures measured in the turret cavity could be obtained by the use of porous wind screens around the aperature of the cavity mouth. R.C.T.

N80-25610*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
MEASUREMENT OF EXTERNAL FORCES AND TORQUES ON A LARGE POINTING SYSTEM
R. C. Morenus *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 583-613 (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

Methods of measuring external forces and torques are discussed, in general and as applied to the Large Pointing System

wind tunnel tests. The LPS tests were in two phases. The first test was a preliminary test of three models representing coelostat, heliostat, and on-gimbal telescope configurations. The second test explored the coelostat configuration in more detail. The second test used a different setup for measuring external loads. Some results are given from both tests. Author

N80-25611*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Aeromechanics Div.
VALIDITY OF SMALL SCALE TESTS FOR TURRET/FAIRING LOADS AND CAVITY EFFECTS
Daniel J. McDermott and James T. VanKuren *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 615-656 refs (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

Data from several wind tunnel experiments along with available flight test data are used to discuss the validity of small scale tests and their inherent limitations. Tests were performed at transonic speeds to measure the turbulence levels in a cavity with and without a forward porous fence, turret drag with and without an aerodynamic fairing, and turret/fairing unsteady pressures. R.C.T.

N80-25612*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
AERO-OPTICS OVERVIEW
Keith G. Gilbert *In* NASA. Ames Res. Center Proc. of the Aero-Optics Symp. on Electromagnetic Wave Propagation from Aircraft Apr. 1980 p 657-675 (For primary document see N80-25588 16-34)
Avail: NTIS HC A99/MF A01 CSCL 20D

Various aero-optical phenomena are discussed with reference to their effect on airborne high energy lasers. Major emphasis is placed on: compressibility effects induced in the surrounding flow field; viscous effects which manifests themselves as aircraft boundary layers or shear layers; inviscid flow fields surrounding the aircraft due to airflow around protuberance such as laser turret assemblies; and shocks, established whenever local flow exeeds Mach one. The significant physical parameters affecting the interaction of a laser beam with a turbulent boundary layer are also described. R.C.T.

N80-25613*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN EXPERIMENTAL INVESTIGATION OF CONVECTION IN A FLUID THAT EXHIBITS PHASE CHANGE
D. E. Fitzjarrald May 1980 28 p refs
(NASA-TM-78277) Avail: NTIS HC A03/MF A01 CSCL 20D

Convection flows were systematically observed in a layer of fluid between two isothermal horizontal boundaries. The working fluid was a nematic liquid crystal, which exhibits a liquid-liquid phase change at which latent heat is released and the density changed. In addition to ordinary Rayleigh-Benard convection when either phase is present alone, there exist two types of convective motions initiated by the unstable density difference. When a thin layer of heavy fluid is present near the top boundary, hexagons with downgoing centers exist with no imposed thermal gradient. When a thin layer of light fluid is brought on near the lower boundary, the hexagons have upshooting centers. In both cases, the motions are kept going once they are initiated by the instability due to release of latent heat. Relation of the results to applicable theories is discussed. Author

N80-25614*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL STUDY OF NONADIABATIC BOUNDARY-LAYER STABILIZATION TIMES IN A CRYOGENIC WIND TUNNEL FOR TYPICAL STAINLESS STEEL WING AND FUSELAGE MODELS
Charles B. Johnson Jul. 1980 43 p refs
(NASA-TM-80212; L-13350) Avail: NTIS HC A03/MF A01 CSCL 20D

The time varying effect of nonadiabatic wall conditions on boundary layer properties was studied for a two dimensional wing section and an axisymmetric fuselage. The wing and fuselage sections are representative of the wing root chord and fuselage of a typical transport model for the National Transonic Facility. The analysis was made with a solid wing and three fuselage configurations (one solid and two hollow with varying skin thicknesses) all made from AISI type 310S stainless steel. The displacement thickness and local skin friction were investigated at a station on the model in terms of the time required for these two boundary layer properties to reach an adiabatic wall condition after a 50 K step change in total temperature. The analysis was made for a free stream Mach number of 0.85, a total temperature of 117 K, and stagnation pressures of 2, 6, and 9 atm. Author

N80-25615*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF VARIOUS ASSUMPTIONS ON THE CALCULATED LIQUID FRACTION IN ISENTROPIC SATURATED EQUILIBRIUM EXPANSIONS
Joseph W. Bursik (Renssalaer Polytechnic Inst., Troy, N.Y.) and Robert M. Hall Jun. 1980 33 p refs
(NASA-TP-1682; L-13437) Avail: NTIS HC A03/MF A01 CSCL 20D

The saturated equilibrium expansion approximation for two phase flow often involves ideal-gas and latent-heat assumptions to simplify the solution procedure. This approach is well documented by Wegener and Mack and works best at low pressures where deviations from ideal-gas behavior are small. A thermodynamic expression for luquid mass fraction that is decoupled from the equations of fluid mechanics is used to compare the effects of the various assumptions on nitrogen-gas saturated equilibrium expansion flow starting at 8.81 atm, 2.99 atm, and 0.45 atm, which are conditions representative of transonic cryogenic wind tunnels. For the highest pressure case, the entire set of ideal-gas and latent-heat assumptions are shown to be in error by 62 percent for the values of heat capacity and latent heat. An approximation of the exact, real-gas expression is also developed using a constant, two phase isentropic expansion coefficient which results in an error of only 2 percent for the high pressure case. Author

N80-25616# Stanford Univ., Calif.
FINITE ELEMENT SIMULATION OF SIMPLE THREE-DIMENSIONAL FULLY CAVITATING FLOWS Final Report, 10 Oct. 1974 - 31 Dec. 1979
Peter Y. Ko and Robert L. Street Nov. 1979 126 p refs
(Contract N00014-75-C-0277; SR0230101)
(AD-A082823; TR-241) Avail: NTIS HC A07/MF A01 CSCL 20/4

Based on potential flow theory, a formulation is given for three dimensional fully cavitating flow with a Riabouchinsky model. The model is nonlinear and the location of the free surface of the cavity is not known priori. Therefore, an iterative procedure is used to locate the free surface boundary. The employment of a trial free-boundary approach effectively reduces the fully nonlinear model to a linear one, and the solution at each iteration is obtained by means of the finite element method (FEM). Examples studied were fully cavitating flow past flat plates in a water tunnel. Results are given for pure drag flows past circular and elliptic plates and a lifting flow past a circular plate. Because of the change in flow boundary conditions at the separation edge and the failure of the FEM to resolve these conditions accurately, the ability of the numerical solution to maintain a constant pressure over the entire cavity decreases as the three dimensionality of the free surface increases. However, the present procedure produces absolutely stable iterations and shows no sign of drifting of the free surface. It is found that satisfaction of a tangent separation condition of the free surface from the flat plate body is crucial for the stability of the iterative procedure. Grid refinement in both the streamwise and transverse directions reduces the computational error. GRA

N80-25617# Sandia Labs., Albuquerque, N. Mex.
MEASUREMENT OF WEAK SHOCK-WAVE PROFILES
S. Winkler (Inst. fuer Festkoerpermech.) 7 Nov. 1979 13 p refs Transl. into ENGLISH of paper presented at High Speed Phys., the Spring Meeting of the German Phys. Soc., Hannover, West Germany, 25 Feb. 1976 10 p Sponsored by DOE
(SAND-79-6004; CONF-760276-1) Avail: NTIS HC A02/MF A01

Shock waves in solids and how their profiles can reflect

material properties are discussed. Pressure measurement with bimetallic contracts is described. A proportionality exists between the electrical voltage of thermocouples and the pressure giving rise to it. Application and advantages of this method are discussed. Results are presented for an iron flyer plate on Armco iron, an Al flyer on iron, and an austenitic Cr-Ni steel flyer on the same material. Impact pressures are also computed. DOE

N80-25618# Virginia Polytechnic Inst. and State Univ., Blacksburg.
HEAT CONDUCTION IN PARTIAL VACUUM Technical Progress Report, 7 Aug. 1978 - 31 Jan. 1979
J. R. Thomas. Feb. 1979. 32 p. refs.
(Contract EM-78-C-04-5367)
(ALO-5367-1) Avail: NTIS HC A03/MF A01

Basic theoretical work on heat conduction in evacuated solar collectors is reported. The results include estimates for minimum partial vacuum necessary to eliminate conduction, and the effects of helium penetration into the region. DOE

N80-25619# California Univ., Livermore. Lawrence Livermore Lab.
BRIGHTNESS TEMPERATURE MEASUREMENTS FOR HIGH-ENERGY JET PROPAGATION
H. D. Glenn. 16 Jan. 1980. 13 p. refs. Presented at the DNA Symp. on Fiber Optics in the Nucl. Environ., Adelphi, Md., 25-27 Mar. 1979. Submitted for publication.
(Contract W-7405-eng-48)
(UCRL-83609; CONF-800307-2) Avail: NTIS HC A02/MF A01

The use of fiber optics to measure times of arrival and brightness temperature profiles for high-energy gas jets is described. Voitenko compressors were used to produce high-energy air and oxygen jets through steel pipes 2 cm i.d. and 350 cm in length containing air initially at 0.02 Torr or less. Reduction of the time-of-arrival data indicated that velocities for the various identified jet components ranged between 2.40 and 7.95 cm/microsec. The fiber optics emplacement design and brightness temperature calibration procedure are described. Maximum brightness temperatures of 93,000 and 136,000 K were measured for air and oxygen jets, respectively, as they started down the exit pipes. Brightness temperature profiles were obtained to 50 microsec behind the jet front. The results suggest that delayed entrainment of wall material was the predominant factor in reducing pressures and temperatures in the slower components of the jet. DOE

N80-25620# Iowa State Univ. of Science and Technology, Ames. Dept. of Chemical Engineering.
SIMULATION OF CHEMICAL REACTION IN A TURBULENT FLOW
James C. Hill. 1979. 28 p. refs. Presented at Chem. Eng. Res. Symp., Ames, Iowa, 8 Mar. 1979. Sponsored in part by National Center for Atmospheric Research.
(Contract W-7405-eng-82)
(ISM-253; CONF-7903109-1) Avail: NTIS HC A03/MF A01

The mass conservation equations for chemical species undergoing convection, diffusion, and irreversible chemical reaction were numerically integrated over time using a numerical simulation of two-dimensional, homogeneous, turbulent velocity fields with assignable statistical properties. Statistical independence hypotheses, proposed by O'Brien for single-species reactions and by Toor for two-species reactions, were tested by comparing exact statistical quantities during evolution of the concentration fields. DOE

N80-25621# Hazleton-Nuclear Science Corp., Palo Alto, Calif.
NEW MATHEMATICAL TECHNIQUE FOR DETERMINING THE PARAMETERS OF GAS PERMEATION THROUGH SOLIDS
John F. Kohls. 1980. 30 p. refs. Presented at 9th Ann. Symp. of the Florida Chapter of the Am. Vacuum Soc., Tampa, 11-13 Feb. 1980.
(Contracts EY-76-C-04-0656; DE-AC04-76DP-00656)
(GEPP-OP-474; CONF-800214-1) Avail: NTIS HC A03/MF A01

The solution of Fick's equation for gas permeation through solid flat membranes yields a throughput rate equation with two unknown parameters, diffusivity and solubility. The common methods used to evaluate these parameters rely on knowing the equilibrium throughput rate. This equilibrium rate is in some cases rapidly established (on the order of seconds) in other cases slowly established (order of months). Thus, permeation measurements may require equipment usage over a long time period, precluding its use for other experiments. A mathematical technique for predicting the permeation parameters using the unequilibrated portion of the permeating throughput curve has been developed which overcomes this difficulty. The method developed (termed stabilized search) was tested with data simulated using a known amount of error. The predicted parameters were as accurate as the data, but the values were generated in only 20 to 40% of the time required for other methods. DOE

N80-25622# General Electric Co., Schenectady, N. Y. Mechanical Systems and Technology Lab.
LAMINAR FLOW CYCLONE DEVELOPMENT PROGRAM Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1979
W. B. Giles and K. L. Bekofske. Jul. 1979. 32 p.
(Contract ET-78-C-01-3242)
(FE-3242-8) Avail: NTIS HC A03/MF A01

The objective of this program is to develop a laminar flow cyclone concept which could have a marked reduction in collection cut size, improved efficiency, increased throughput per unit volume, and potentially low capital cost relative to more conventional high efficiency collectors. An analysis of the radial inlet swirl flow including the effects of the free-stream velocity components was completed. The principal constraint to high Reynolds number operation is due to boundary layer instability in the radial inflow region. Therefore, a modified model was built to study the influence of inlet wall heating with the water flow model. DOE

N80-25623# Sandia Labs., Albuquerque, N. Mex.
LONG TUBE HEAT EXCHANGER: THE FACILITY AND SOME PRELIMINARY TESTS ON THE DOWN CENTER/UP ANNULAR FLOW CONFIGURATION
D. O. Lee, R. W. Johnson, and R. L. Weatherbee. Mar. 1980. 63 p. refs.
(Contract EY-76-C-04-0789)
(SAND-78-0823) Avail: NTIS HC A04/MF A01

A test facility was designed and constructed to study forced flow boiling heat transfer in a closed loop long tube heat exchanger which is a two concentric-tube vertical design. The system consists of a 12 m long heat exchanger which can be operated at pressures to 689.3 kPa with pumped or natural convection flow rates from 0.0631 to 0.631 liters/second and which can be irradiated with a maximum steady heat flux rate of 50 kW sq m by a set of resistive heaters operable at temperatures up to 1250 C. The facility was also designed so that other heat exchanger configurations can be tested with minimum difficulty (i.e., little or no modification of the system other than to replace the heat exchanger). The preliminary tests indicate that the system can be operated in a stable mode. This facility was motivated primarily by the magma energy research program where energy is extracted from magma by heat exchangers similar to the configuration in this report. DOE

N80-25624*# Sandia Labs., Albuquerque, N. Mex. Gas Dynamics Div.
CALCULATION OF SKIN-FRICTION COEFFICIENTS FOR LOW REYNOLDS NUMBER TURBULENT BOUNDARY LAYER FLOWS M.S. Thesis - California Univ. at Davis
Pamela K. Barr. Jan. 1980. 82 p. refs.
(Contracts NCA2-OR180-704; EY-76-C-04-0789)
(NASA-CR-163062; SAND-79-8062) Avail: NTIS HC A05/MF A01 CSCL 20D

An analysis is presented of the reliability of various generally accepted empirical expressions for the prediction of the skin-friction coefficient C/sub f/ of turbulent boundary layers at low Reynolds numbers in zero-pressure-gradient flows on a smooth flat plate. The skin-friction coefficients predicted from these expressions were compared to the skin-friction coefficients of experimental profiles that were determined from a graphical method formulated from the law of the wall. These expressions are found to predict values that are consistently different than

those obtained from the graphical method over the range 600 < Re/sub theta < 2000. A curve-fitted empirical relationship was developed from the present data and yields a better estimated value of C/sub f/ in this range. The data, covering the range 200 < Re/sub theta < 7000, provide insight into the nature of transitional flows. They show that fully developed turbulent boundary layers occur at Reynolds numbers Re/sub theta/ down to 425. Below this level there appears to be a well-ordered evolutionary process from the laminar to the turbulent profiles. These profiles clearly display the development of the turbulent core region and the shrinking of the laminar sublayer with increasing values of Re/sub theta/. DOE

N80-25625# Los Alamos Scientific Lab., N. Mex.
INTRODUCTION TO DETONATION PHENOMENA
William C. Davis 1979 33 p refs Presented at Working Group Meeting on Detonation Phenomena, Menlo Park, Calif., 23-24 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2880; CONF-791084-1) Avail: NTIS HC A03/MF A01

The paper serves as an introduction to detonation phenomena for scientists who work in other fields. DOE

N80-25626# Sandia Labs., Albuquerque, N. Mex.
CORRELATION OF NOSETIP BOUNDARY-LAYER TRANSITION DATA MEASURED IN BALLISTICS-RANGE EXPERIMENTS
Daniel C. Reda Jan. 1980 16 p refs Presented at the 18th AIAA Aerospace Sci. Meeting, Pasadena, Calif., 14 Jan. 1980
(Contract EY-76-C-04-0789)
(SAND-79-0649C; CONF-800104-1) Avail: NTIS HC A02/MF A01

Preablated nosetips of various carbonaceous materials were tested in a ballistics range. Surface-temperature contours, measured with image-converter cameras, were used to define boundary-layer transition-front contours. Measurements of surface roughness, surface temperature, average transition-front location, and freestream environment were combined with calculations of nosetip flowfields, and with calculations of laminar boundary-layer development in these flowfields, to transform all data into various dimensionless parameters. These parameters were defined by previous attempts to correlate existing wind-tunnel data for transition on rough/blunt bodies. Of the available correlating techniques, only one, based on the concept of a constant (critical) roughness Reynolds number for transition, was found to successfully describe both the wind-tunnel and ballistics-range data, thereby validating the extrapolation of this concept to actual reentry-vehicle materials and environments. DOE

N80-25627# California Univ., Berkeley. Lawrence Berkeley Lab.
GAS-PARTICLE FLOW IN THE ENTRY REGION OF A CURVED PIPE Ph.D. Thesis
Woon-Shing Yeung Apr. 1979 100 p refs
(Contract W-7405-eng-48)
(LBL-9905) Avail: NTIS HC A05/MF A01

The flow of a dilute gas-particle mixture entering a circular curved pipe was investigated. The fluid is assumed to be incompressible and the flow nonseparating and laminar. Final results are presented and compared with other theoretical and experimental results. Since an irrotional core is assumed, the uniform entry profile changes to a two dimensional potential vortex shortly downstream of the entry section. This is consistent with published experimental data. There is also a cross flow directed from the outer bend towards the inner bend in the immediate neighborhood of the entry section. The dynamics of the particle phase are discussed. Lagrangian equations of motion for the particle phase are used. Due to the complexity of the momentum coupling between the two phases, (i.e., the gas phase and the particle phase), only the first order solution for the particle phase were obtained by neglecting its effect on the gas flow field. This has been proved adequate, for example in the erosion calculation of a curved pipe carrying a gas-solid mixture. Asymptotic expansion solutions for the particle trajectories are discussed. Finally, the density of the particle at the pipe wall is presented and the numerical results are discussed. DOE

N80-25628# Union Carbide Corp., Oak Ridge, Tenn. Computer Science Div.
CALCULATION OF FLUID CIRCULATION PATTERNS IN THE VICINITY OF SUBMERGED JETS USING ORSMAC
James E. Park and Kenneth E. Cross Jan. 1980 135 p refs
(Contract W-7405-eng-26)
(K/CSD-4) Avail: NTIS HC A07/MF A01

As the world demand for electricity is met by large coal or nuclear fueled central generating stations, the effluent streams from these plants will have an increasingly important impact on the local environment. The Nuclear Regulatory Commission has a responsibility to assess the impact of proposed and operating nuclear power plants. To support this NRC mission, a numerical algorithm and associated computer program were developed to predict the temperatures occurring in the immediate vicinity (the near field) of a hot water discharge from a power plant. The algorithm is a natural extension of the classic Marker-and-Cell (MAC) technique developed by F.H. Harlow at the Los Alamos Scientific Laboratory. ORSMAC adds the logic for simple turbulence modeling, energy conservation and buoyancy effects to the MAC model. Modern numerical techniques were used wherever practical. The MAC and SMAC (Simplified MAC) algorithms are reviewed, and the ORSMAC algorithm is described. The finite difference analogs are given and discussed. Solutions for several sample problems are presented which illustrate the features of the ORSMAC algorithm. A complete FORTRAN listing is included with input and sample output. Recommendations for further testing are included. DOE

N80-25629# Texas Univ., Austin.
DETERMINATION OF FRICTION FACTORS AND HEAT TRANSFER COEFFICIENTS FOR FLOW PAST ARTIFICIALLY ROUGHENED SURFACES Ph.D. Thesis
S. A. Hodge Dec. 1979 214 p refs
(Contract EY-76-C-05-0033)
(DOE/TIC-10283) Avail: NTIS HC A10/MF A01

Because convective heat transfer is enhanced in flow past rough surfaces, much experimental and analytical effort over the past several decades has been devoted to the evaluation of artifical roughening for potential application to the heat transfer surfaces of gas-cooled reactors. Unfortunately, much of the analytical development in this field has been inadequately explained in the literature; this led to misinterpretation of some of the subsequent experimental findings, compounding the uncertainty. A critical review is given of the underlying assumptions, theoretical foundations, and supporting experimental evidence for the analytical procedures in current use for the evaluation of roughness effects. A concise presentation of the available formulations with recommendations concerning their applicability to rough rod bundles is presented. DOE

N80-25630# Oak Ridge National Lab., Tenn.
PERFORMANCE EVALUATION OF A SELECTED THREE-TON AIR-TO-AIR HEAT PUMP IN THE HEATING MODE
A. A. Domingorena and S. J. Ball Jan. 1980 106 p refs
(Contract W-7405-eng-26)
(ORNL/CON-34) Avail: NTIS HC A06/MF A01

An air-to-air split system residential heat pump of nominal under laboratory conditions. This was the second of a planned series of experiments to obtain a data base of system and component performance for heat pumps. The system was evaluated under both steady-state and frosting-defrosting conditions; sensitivity of the system performance to variations in the refrigerant charge was measured. From the steady-state tests, the heating capacity and coefficient of performance were computed, and evaluations were made of the performance parameters of the fan and fan motor units, the heat exchangers and refrigerant metering device, and the compressor. System heat losses were analyzed. The frosting-defrosting tests allowed the observation of system and component performance under dynamic conditions, and measurement of performance degradation under frosting conditions. DOE

N80-25631# Argonne National Lab., Ill. Reactor Analysis and Safety Div.
LOCAL DRAG LAWS IN DISPERSED TWO-PHASE FLOW
M. Ishii and T. C. Chawla Dec. 1979 45 p refs
(Contract W-31-109-eng-38)

(NUREG-CR-1230; ANL-79-105) Avail: NTIS HC A03/MF A01

The ability to predict the interfacial drag between phases of considerable importance for analyzing a dispersed two-phased system undertransient conditions. Constitutive relations are developed for the drag force for bubbly, droplet, and particulate flows by a unified method. Simple drag similarity criteria and a mixture viscosity model are introduced in the analysis. The present drag correlation cover all concentration ranges and wide Reynolds number ranges, from the Strokes regime up to the Newton's regime or the churn-turbulent-flow regime. DOE

N80-25632# National Technical Information Service, Springfield, Va.

FLUID CONTROL DEVICES, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1972 - Jan. 1980

Guy E. Habercom, Jr. Feb. 1980 292 p Supersedes NTIS/PS-79/0199; NTIS/PS-78/0189 and NTIS/PS-77/0181 (PB80-805260; NTIS/PS-79/0199; NTIS/PS-78/0189; NTIS/PS-77/0181) Avail: NTIS HC $30.00/MF $30.00 CSCL 13G

The design, fabrication, application, and performance of fluidic and fluenic control devices are described in these Government-sponsored research reports. This updated bibliography contains 285 abstracts, 18 of which are new entries to the previous edition. GRA

N80-25633# National Technical Information Service, Springfield, Va.

FLUID CONTROL DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Feb. 1979

Guy E. Habercom, Jr. Feb. 1980 371 p Supersedes NTIS/PS-79/0120 and NTIS/PS-78/0190

(PB80-805278; NTIS/PS-79/0120; NTIS/PS-78/0190) Avail: NTIS HC $30.00/MF $30.00 CSCL 13G

The design, fabrication, application, and performance of fluidic and fluenic control devices are described in these abstracts of reports gathered in a worldwide literature survey. This updated bibliography contains 364 abstracts, 21 of which are new entries to the previous edition. GRA

N80-25487# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

RESOLUTION OF NAVIER-STOKES EQUATIONS BY A SPACE-TIME PSEUDO-SPECTRAL METHOD

Yves Morchoisne *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-5 (ESA-TT-613) 1979 p 11-31 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 293-306 Original report in FRENCH previously announced as A80-12355 (For primary document see N80-25485 16-31)

Avail: NTIS HC A05/MF A01

N80-25488# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

UNSTEADY AEROTHERMODYNAMICS MODELING

Francis Hirsinger *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-5 (ESA-TT-613) 1979 p 33-54 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 307-323 Original report in FRENCH previously announced as A80-12356 (For primary document see N80-25485 16-31)

Avail: NTIS HC A05/MF A01

N80-25489# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

TRANSONIC SMALL PERTURBATION EQUATION APPLIED TO THE SOLUTION OF TWO-DIMENSIONAL UNSTEADY FLOWS

Michel Couston, Jean-Jacques Angelini, and Pierre Mulak *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-5 (ESA-TT-613) 1979 p 55-73 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 325-340 Original report in FRENCH previously announced as A80-12357 (For primary document see N80-25485 16-31)

Avail: NTIS HC A05/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-25634# National Physical Lab., Teddington (England).

DESIGN AND CONSTRUCTION OF THE BOYD-ENGLAND HIGH PRESSURE APPARATUS

W. F. Wall Apr. 1980 22 p refs

(NPL-CHEM-110; ISSN-0143-7003) Copyright. Avail: Issuing Activity

The component materials, design, and construction procedures for a high pressure apparatus, for work in experimental petrology at temperatures up to 1600 C with pressures up to 4 GN/sq m are described. It is of simple construction, and electrical leads may readily be taken into the reaction zone, enabling measurements to be made under conditions of high pressure and high temperature. The apparatus consists of a tungsten carbide thick walled cylinder supported by a second thick walled cylinder of high strength steel, the two cylinders having a large interference fit. The compound formed by these two components is end-loaded with 400 Tonf via two water cooled pads, and a tungsten carbide piston is driven into the bore by a secondary ram to generate the high pressure within the base of the cylinder. M.G.

N80-25635*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPUTERIZED VIDEO DENSITOMETRY METHOD FOR RAPID ANALYSIS OF INFRARED PHOTOGRAPHIC IMAGES

Ernest Roberts, Jr., Frederick D. Calfo, and Frank G. Pollack Jun. 1980 13 p refs

(NASA-TP-1686; E-354) Avail: NTIS HC A02/MF A01 CSCL 14E

A computerized video densitometry method is described which is approximately 50 times faster than a corresponding manual method of analysis, with no apparent sacrifice of accuracy. The object of the technique is to determine the temperature distribution across a heated surface. Infrared photographs of the heated surfaces provide the raw data. A video based, computer operated image analysis system provides the equipment. Infrared photographic pyrometry using a flat bed microdensitometer forms the basis of the technique. The procedure is illustrated on a thermally cycled aircraft gas turbine blade. A.R.H.

N80-25636# Maryland Univ., College Park. Computer Vision Lab.

A MEDIAL AXIS TRANSFORMATION FOR GRAYSCALE PICTURES Interim Report

Shyuan Wang, Azriel Rosenfeld, and Angela Y. Wu Dec. 1979 17 p refs

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A081347; TR-843; AFOSR-80-0139TR) Avail: NTIS HC A02/MF A01 CSCL 14/15

Blum's medial axis transformation (MAT) for binary pictures yields medial axis points that lie midway between opposite borders of a region, or along angle bisectors. This note discusses a generalization of the MAT in which a score is computed for each point P of a grayscale picture based on the gradient magnitudes at pairs of points that have P as their midpoint. These scores are high at points that lie midway between pairs of antiparallel edges, or along angle bisectors, so that they define a MAT-like skeleton, which we may call the GRADMAT. However, this skeleton is rather sensitive to the presence of noise edges or to irregularities in the region edges. GRA

N80-25637# RCA Advanced Technology Labs., Camden, N. J.

ADVANCED IMAGE COMPRESSION STUDY Final Technical Report, 30 Sep. 1977 - 21 May 1979

W. B. Schaming and J. J. Rudnick Jan. 1980 119 p refs

(Contract F30602-77-C-0244; AF Proj. 6244)

(AD-A082014; RADC-TR-79-342) Avail: NTIS HC A06/MF A01 CSCL 14/5

The work described in this report primarily covers two areas. The first effort described is an attempt to group images for bandwidth compression using clustering techniques on statistical measurements. The second effort is an attempt to predict the performance of the cosine transform algorithms from statistics derived from the imagery. GRA

N80-25638# Naval Surface Weapons Center, Dahlgren, Va.
DATA GENERATOR FOR A SATELLITE-BORNE THREE-AXIS ACCELEROMETER Final Report
Carol G. Branch Mar 1980 65 p refs
(AD-A082827; NSWC/DL-TR-3849) Avail: NTIS
HC A04/MF A01 CSCL 22/3

Atmospheric drag has a significant effect on low altitude trajectories. To measure this force, an accelerometer will be tested which senses this nonconservative acceleration. The information obtained will then be used to improve the orbit and obtain a more accurate gravity field model. When the raw data is first received, all known systematic effects will be removed. These include gravity gradient and pitch-rate induced accelerations. However, the preprocessed data will still contain anomalies of which there is little or no a priori knowledge. Satellite attitude thruster-induced vibrations are a major source of unmodeled noise. As for the instrument itself, each axis of the accelerometer adds an undetermined bias to the output accelerations. In addition, the conversion of the digital output to engineering units introduces a scale factor error. Other effects may take the form of additive correlated noise and white noise. The first instrument to be flown is the miniature electrostatic accelerometer (MESA). The MESA senses accelerations along the vehicle pitch, roll, and yaw axes. Relying on the accuracy of the vehicle's attitude control system, these axes are assumed to be along the R,R X V, and -R vectors, respectively. Hence, any attitude errors will be reflected in the measurements. The MESA also introduces undetermined scale factor errors and biases. Consequently, a computer program was designed which applies a filter to the processed accelerations. This filter should statistically remove most of the unmodeled corruptions. The filtered data is then input to a special version of the Celest orbit determination program. GRA

N80-25639# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Systems Lab.
INNOVATIONS IN DIGITAL IMAGE PROCESSING Final Report
Albert N. Williamson Feb 1978 39 p ref
(AD-A082048; WES-MP-M-78-4) Avail: NTIS
HC A03/MF A01 CSCL 09/2

This paper discusses a technique for producing suspended material distribution maps by spectrum matching and two different techniques for detecting time-dependent changes recorded by the LANDSAT MSS-computer-generated false color composites for visual interpretation and detection by pixel-for-pixel comparison. Included in the paper are some of the results of a course of study and development at the U. S. Army Engineer Waterways Experiment Station (WES) that have produced a family of computer programs and algorithms designed to extract meaningful geometric and radiometric information from digitized image data, interpret the data, and depict the results as tabular lists printed with conventional line printers or as images on photographic film that can be used to make photographic images, maps, or charts. Specifically described are the equipment used for image data processing and applications of image data processing techniques for (a) suspended material distribution mapping, (b) production of color composites from LANDSAT computer-compatible tapes, (c) change detection, and (d) generation of color separations for offset printing. GRA

N80-25640# Argonne National Lab., Ill. Components Technology Div.
INVESTIGATION LEADING TO THE DEVELOPMENT OF AN ACOUSTIC DOPPLER SLURRY FLOWMETER
H. B. Karplus and A. C. Raptis Jun. 1979 39 p
(Contract W-31-109-eng-38)
(ANL-FE-49622; TM-06) Avail: NTIS HC A03/MF A01

The sonic Doppler shift principle is investigated for the measurement of high concentration coal slurries (5 to 40% solid). A nonintrusive system having a transducer on the outside of the pipe is especially attractive for safety and convenience in operation and maintenance. The ideal single frequency scattered energy is not realized in practice but a broad band of scattered energy is observed. The spectrum has a definite maximum value close to the expected Doppler frequency. A single number output can be obtained by amplitude limiting the difference frequency between transmitted and received signal and counting zero crossings. DOE

N80-25641# California Univ., Livermore. Lawrence Livermore Lab.
PROSPECTS FOR GENERATING 1-10 TPa PRESSURES WITH A RAILGUN
R. S. Hawke and J. K. Scudder 2 Oct. 1979 6 p refs Presented at the 7th Intern. High Pressure AIRAPT Conf. Le Creusot, France, 30 Jul. - 3 Aug. 1979 Revised
(Contract W-7405-eng-48)
(UCRL-82296-Rev-2; CONF-790709-4-Rev-2) Avail: NTIS
HC A02/MF A01

It has been demonstrated that a plasma arc can be accelerated along two current carrying parellel rails and used to accelerate a projectile. An extensive analysis found the task of using a railgun to accelerate an impactor plate to velocities of 10 to 40 mm. micro-A to be feasible with contemporary technology. This range of impact velocities would enable shock pressures of 1 to 10 TPa to be generated for EOS research. DOE

N80-25642# Argonne National Lab., Ill.
HOT CELL MEASURING AND TEST EQUIPMENT CALIBRATION CONTROL
Kenneth J. Taylor 1979 17 p refs Presented at Am. Nucl. Soc. - RSTD Conf., San Francisco, 11-15 Nov. 1979
(Contract W-31-109-eng-38)
(CONF-791103-73) Avail: NTIS HC A02/MF A01

The need for increasingly accurate date on the performance of fuels and materials in nuclear reactors has placed increased emphasis on the quality of measurement of data obtained in hot cells. A program was proposed to incorporate the basic features of a standard measurement laboratory while recognizing the unique aspect of hot cell measurements. That hot cells must comply with calibration procedures in order to maintain control of measurement parameters was the basis for the system proposed for implementation in the Hot Fuel Examination Facility at the Argonne-West Site, Idaho Falls, Idaho. DOE

N80-25643# Sandia Labs., Albuquerque, N. Mex. Electrical Standards Lab.
SEMIAUTOMATED CALIBRATION: A CASE STUDY
John C. Cunningham 1979 13 p Presented at 26th Intern. Instrumentation Symp., Seattle, 5 May 1980
(Contract EY-76-C-04-0789)
(SAND-79-2004C; CONF-800502-7) Avail: NTIS
HC A02/MF A01

A semiautomatic system for use in calibrating digital voltmeters, fixed resistors, and potentiometers is described. Its development from its beginnings in 1970 to the present is traced and some of the problems encountered with ground loops and resistance of the switches and cables are reviewed. Some implications for the future are discussed. DOE

N80-25644# Oregon Univ., Eugene. Inst. of Theoretical Science
CORRELATION HOLOGRAPHY: IMAGING OF ATOMS WHEN SIGMA SUB (INELASTIC) >>SIGMA SUB (ELASTIC)
Paul L. Csonka 1979 10 p refs
(Contract EY-76-S-06-2230-004)
(DOE/ER-70004/258; RLO-2230-T42-58) Avail: NTIS
HC A02/MF A01

Atomic scale resolution of details is possible with this method, even if protons interact with the atoms overwhelmingly inelastically, i.e., when sigma sub inelastic >> sigma sub elastic. Observation of small objects is compatible with quantum mechanics even if the disturbance of the object caused the observation process is arbitrarily small. DOE

N80-25645# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
COMPUTER CONTROL FOR A CLADDING THICKNESS TESTER

R. J. Sand Dec. 1979 14 p refs
(Contract EY-76-C-09-0001)
(DP-1537) Avail: NTIS HC A02/MF A01

A cladding thickness tester for extruded reactor fuel tubes was automated to provide reduced operator interaction. The classing thickness tester, which uses an X-ray fluorescence analyzer, was interfaced with an SRL/6800 microcomputer to control fuel tube orientation, operate the analyzer, calculate cladding thickness, and give pertinent data in hardcopy tabular form. DOE

N80-25290# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Rechenzentrum.
PROCESSING OF AIDS FLIGHT RECORDER DATA FOR A QUICK-LOOK WITH THE AID OF A HYBRID SYSTEM
H. Hoffmann *In its* Aircraft Integrated Data Systems Feb. 1979 p 34-362 In GERMAN; ENGLISH summary (For primary document see N80-25275 16-01)
Avail: NTIS HC A16/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-25646 Washington Univ., Seattle.
FLUID PROCESSES IN SUPERSONIC DIFFUSION LASERS Ph.D. Thesis
George William Butler 1979 132 p
Avail: Univ. Microfilms Order No. 8013504

The pressure distribution is measured downstream of two different screen nozzles in a combination shock-Ludwieg tube facility that mixes pure A or a 5% F/A oxidizer with H2 fuel. Oxidizer mixtures are thermally dissociated at the shock tube endwall and expanded through alternate columns of the nozzle array to the test section. Unheated fuel mixtures are simultaneously supplied to the companion nozzle columns by the Ludwieg tube. The expanded fuel and oxidizer mix and react downstresm, producing excited state HF and coupling significant amounts of energy back to the fluid. The combustion pressure data supports the development of a quasi one dimensional model which is used to identify and isolate prominent fluid processes. The combustion sensitivity to nonideal expansions, overall and relative shear layer entrainment, base entrainment and base pressure is examined and appropriate reference conditions selected. The theory is found to be in agreement with the experimental results. The model is then used to calculate HF laser performance for a typical flow condition. The intensity profiles demonstrate the significant influence of the principal flow processes.
Dissert. Abstr.

N80-25647# Army Missile Research and Development Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
ACTIVE/PASSIVE LONG WAVELENGTH INFRARED (LWIR) LASER GUIDANCE
M. D. Blue and G. R. Loefer 31 Jul. 1979 51 p refs
(AD-A082509; DRSMI-RE-CR-80-1) Avail: NTIS HC A04/MF A01 CSCL 17/7

A technical assessment has been made of the opportunities for the use of two or more wavelengths, or of passive and active optical systems, acting in combination for the purpose of missile guidance and target acquisition. In addition, considerations relative to the choice of waveband and current state-of-the-art in components and signal processing are related to requirements for guidance systems. Adverse environments and fire-and-forget capability are emphasized. Most dual wavelength systems described in the literature are of little value for the missile guidance and target acquisition problem where the target is likely to be imbedded in strong clutter. The combination of an active and passive system does offer a unique combination of advantages in contrast to other combinations of active-active and passive-passive systems. The characteristics of active-passive systems operating in the 8-14 micrometer wavelength region are discussed. The desirability of this wavelength region and the favorable status of component technology for the wavelength region make this an attractive alternative for seekers or trackers for missile guidance. The study also shows the strong need for more data on active signatures for both targets and clutter. GRA

N80-25648# State Univ. of New York at Albany.
THE EFFECT OF ATMOSPHERIC PARTICULATE MATTER ON THE PROPAGATION OF A LASER BEAM Final Report, 1 Jan. - 31 Dec. 1979
Petr Chylek Apr. 1980 51 p
(Grant DAAG29-79-G-0031)
(AD-A083039; ARO-16508.2-GS) Avail: NTIS HC A04/MF A01 CSCL 20/6

Contents: light scattering by a pair of conjugate nonspherical particles; verification of a linear relation between IR extinction, absorption and liquid water content of fogs; perturbation approach to light scattering by nonspherical particles; and surface waves in light scattering by nonspherical particles. GRA

N80-25649# Los Alamos Scientific Lab., N. Mex.
SHORT-PULSE CO2-LASER DAMAGE STUDIES OF NaCl AND KCl WINDOWS
B. E. Newnam, Andrew V. Nowak, and Dennis H. Gill 1979 22 p refs Presented at the 11th Ann. Symp. on Opt. Mater. for High Power Lasers, Boulder, Colo., 30 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-80-108; CONF-7910101-2) Avail: NTIS HC A02/MF A01

The damage resistance of bare surfaces and the bulk interior of NaCl and KCl windows was measured with a short-pulse CO2 laser at 10.6 microns. Parametric studies with 1.7 ns pulses indicated that absorbed water was probably the limiting agent on surface thresholds in agreement with previous studies at long pulsewidths. Rear-surface thresholds up to 7 J/cu cm were measured for polished NaCl windows, whereas KCl surfaces damaged at approximately 60% of this level. The breakdown electric field thresholds of exit surfaces were only 50% of the value of the bulk materials. The pulsewidth dependence of surface damage from 1 to 65 ns, in terms of incident laser fluence, increased as t/sup 1/3/. DOE

N80-25650# California Univ., Livermore. Lawrence Livermore Lab.
LASER PROGRAM, VOLUME 3 Annual Report, 1978
Michael J. Monsler, ed. and Brian D. Jarman, ed. Mar. 1979 266 p refs 3 Vol.
(Contract W-7405-eng-48)
(UCRL-50021-78-Vol-3) Avail: NTIS HC A12/MF A01

Progress in advanced quantum electronics, primarily the quest for advanced rep-rateable short wave length lasers with high efficiency, is documented. Application studies in electrical energy production and fissile fuel production are also described. Selected highlights of the advanced isotope separation program are also presented. DOE

N80-25651# California Univ., Livermore. Lawrence Livermore Lab.
LASER PROGRAM, VOLUME 2 Annual Report, 1978
Michael J. Monsler, ed. and Brian D. Jarman, ed. Mar. 1979 254 p refs 3 Vol.
(Contract W-7405-eng-48)
(UCRL-50021-78-Vol-2) Avail: NTIS HC A12/MF A01

Laser fusion experiments and analyses are detailed. The technology development programs required for the high performance needed in target diagnostic instrumentation and in solid state laser components are reviewed. DOE

N80-25652# California Univ., Livermore. Lawrence Livermore Lab.
LASER PROGRAM, VOLUME 1 Annual Report, 1978
Michael J. Monsler, ed. and Brian D. Jarman, ed. Mar. 1979 243 p refs 3 Vol.
(Contract W-7405-eng-48)
(UCRL-50021-78-Vol-1) Avail: NTIS HC A11/MF A01

An overview of the progress and resources of a laser fusion program is given. The Argus, Shiva, and Nova facilities are described. The theory of fusion target design is discussed along with specialized techniques of target fabrication. DOE

N80-25653# California Univ., Livermore. Lawrence Livermore Lab.
LARGE SCALE COPPER VAPOR LASER COMPUTER CONTROL SYSTEM
M. J. LaChapell, L. W. Spencer, and G. W. Coutts 15 May 1979 18 p Presented at Instr. Soc. of Am. Conf., Chicago, 22 Oct. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-82275; CONF-791005-6) Avail: NTIS HC A02/MF A01

High power pulse copper vapor laser systems consist of a master oscillator and numerous power amplifiers. Large systems used in laser isotope separation experiments require several automatic control systems. The rapid development of compact minicomputers over the past several years has enabled the implementation of sophisticated computer controlled copper vapor laser systems. Present systems provide automatic time synchronization and input power stabilization. Future systems will incorporate semi-automatic start-up capabilities. DOE

N80-25654# Sandia Labs., Albuquerque, N. Mex.
LASER HEATING OF A MOLECULAR GAS CHANNEL
J. N. Olsen and L. Baker Feb. 1980 24 p
(Contract EY-76-C-04-0789)
(SAND-80-0154) Avail: NTIS HC A02/MF A01

The first steps toward laser initiated discharge channels are outlined. The temperature and density changes which are to be expected with reasonable laser energies are determined. To this end, absorption cross sections were measured as a function of gas pressure, line tuning, and laser energy for NH3 and C2H4 gases. Based on these values a number of hydrodynamic simulations were performed with the CHARTB hydrocode which show that an efficient conversion of initial vibrational temperature into translational temperature occurs. Moreover, it is seen that the hydrodynamic motion is slow compared to reasonable relaxation times so that this efficiency is not unique to NH3 with its anomalously fast relaxation time. DOE

N80-25655# Los Alamos Scientific Lab., N. Mex.
EFFECT OF NONLINEAR REFRACTION ON BEAM BRIGHTNESS IN LASER FUSION APPLICATIONS
Claude R. Phipps, Jr., David E. Watkins, and Scott J. Thomas 1979 12 p refs Presented at the Lasers 1979 Conf., Orlando, Fla., 15-20 Dec. 1979
(Contract W-7405-eng-36)
(LA-UR-80-417; CONF-791220-5) Avail: NTIS HC A02/MF A01

The far-field brightness loss due to nonlinear refraction of a laser beam of finite transverse extent is a limitation for phase conjugation. Exact calculations are presented supported by measurements, for these effects in Gaussian beams. DOE

N80-25656# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
HIGH REPETITION RATE ELECTRO-OPTIC Q-SWITCHING OF Nd(3+):YAG LASERS SHOWING STRONG OPTICAL BIREFRINGENCE
Chen-Hsi Chang, Kurt Hirsch, and Hans Salzmann 1979 33 p refs Submitted for publication
(IPF-79-6) Avail: NTIS HC A03/MF A01

Using a configuration of two coupled resonators, electro-optic Q switching of CW pumped Nd(3+):YAG lasers was investigated. This technique yields two linearly polarized output beams with practically all the power contained in one beam. In the case of strong pumping, e.g., using high repartition rate flashlamp pumping, the optimization of mirror reflectivity leads to a single resonator configuration. As some applications make use of only one component of polarization, such as laser scattering diagnostics of thermonuclear plasmas, the usefulness of concentrating the available laser power into one linearly polarized output beam is shown. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-25657 Massachusetts Univ., Amherst.
FRICTIONAL DAMPING AT UNLUBRICATED METALLIC INTERFACES Ph.D. Thesis
Bharat Bhushan Aggarwal 1980 163 p
Avail: Univ. Microfilms Order No. 8012580

The contact of two nominally flat rough surfaces subjected to a constant normal load and a cyclic tangential load is investigated. The contact of two nominally flat rough surfaces with Gaussian peak height distributions is mathematically simulated by the contact of single equivalent tough surface with a rigid plane. An equivalent rough surface is a surface with a peak height distribution equal to the distribution of the sum of the peak heights of the original pair of rough surfaces and whose asperity curvature is the sum of the curvatures of the asperities in contact. The asperities on the equivalent rough surface are assumed to have spherical summits of equal radii. The mode of asperity deformation under normal load is assumed to be plastic. For tangential load, the tangential displacement of a contact spot on the interface is assumed to be the sum of the displacement of the center of contact due to plastic flow and the displacement of the center of contact due to the elastic displacement of the bulk of the asperity material. During load reversal the tangential displacement of the center of a contact spot is assumed to be elastic until a plastic flow condition is reached; the subsequent displacement is the sum of elastic and plastic displacements of the center or contact. Dissert. Abstr.

N80-25658 Houston Univ., Tex.
THE DYNAMIC ANALYSIS OF HIGH-SPEED FLEXIBLE CAM MECHANISMS Ph.D. Thesis
Sheng-Sheng David Young 1979 177 p
Avail: Univ. Microfilms Order No. 8012532

A theoretical study is presented on the dynamic behavior of high-speed, flexible cam mechanisms. A comparison study is presented of various dynamic models to establish conditions for the validity or regions of validity of these models. Then a parametric modeling error analysis is given to study the effect of modeling errors on the system responses and some easily used rules of thumb for the cam design are generated. In an effort to model more accurately the cam and follower system by a single degree of freedom system, a parameter identification technique utilizing an optimization algorithm is developed here. Furthermore, a new sensitivity analysis method using the eigenvector and eigenvalue derivatives with respect to system parameters is also presented in this dissertation. Finally, the presentation of cam mechanism separation using a retaining spring is thoroughly analyzed and some useful design information is generated. Dissert. Abstr.

N80-25659 Cincinnati Univ., Ohio.
FLY ASH EROSION IN GAS TURBINE MATERIALS Ph.D. Thesis
Rangnath Anandrao Kotwal 1979 165 p
Avail: Univ. Microfilms Order No. 8012237

Series of experiments were conducted to determine the resistance to erosion of 2024 aluminum, 6Al-4V titanium, 304 stainless steel, Rene 41 and INCO 718 alloys by samples of fly ash obtained form various power plants and also by several commercial abrasives. The effects of angle of attack, particle velocity, particle nature, particle size and target specimen temperature were investigated, and a semi-empirical relation was obtained which relates the erosive characteristics of fly ash to that of commercial abrasives. A simple computer program was developed to determine erosion loss on a material when the composition and particle size distribution of the fly ash are known. The computed erosion results are found to be in good agreement with the experimentally determined values. The computerized results show that the effect of fly ash composition is more significant for larger particles. High velocities and elevated temperatures also influence the effect of fly ash composition. Dissert. Abstr.

N80-25660*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HERMETIC SEAL FOR A SHAFT Patent Application
Frank Lombardi, inventor (to NASA) (JPL) Filed 30 May 1980 13 p
(Contract NAS7-100)
(NASA-Case-NPO-15115-1; US-Patent-Appl-SN-154725) Avail:

NTIS HC A02/MF A01 CSCL 11A

An hermetic seal for a linear rod with a portion projected axially through a port in a wall for a pressure chamber and supported for omnidirectional motion. The seal is characterized by a resilient, impervious, cylindrical body concentrically and integrally fixed to a shaft comprising a linear ordered array of annular flutes. A section integrally fixed to the wall of the chamber and concentrically related to the port comprises a second linear ordered array of annular flutes. A third section interposed between the first and second sections and integrally in coaxial alignment with them comprises an annular ordered array of linear flutes concentrically related to the shaft, which allows axial, angular, and pivoted motion of the rod. NASA

N80-25661*# AiResearch Mfg. Co., Torrance, Calif.
DESIGN STUDY OF TOROIDAL TRACTION CVT FOR ELECTRIC VEHICLES Final Report
A. E. Raynard, James Kraus, and Daniel D. Bell Jan. 1980 161 p refs
(Contracts DEN3-117; EC-77-A-31-1044)
(NASA-CR-159803; DOE/NASA/0117-80/1; Rept-80-16762)
Avail: NTIS HC A08/MF A01 CSCL 13I

The development, evaluation, and optimization of a preliminary design concept for a continuously variable transmission (CVT) to couple the high-speed output shaft of an energy storage flywheel to the drive train of an electric vehicle is discussed. An existing computer simulation program was modified and used to compare the performance of five CVT design configurations. Based on this analysis, a dual-cavity full-toroidal drive with regenerative gearing is selected for the CVT design configuration. Three areas are identified that will require some technological development: the ratio control system, the traction fluid properities, and evaluation of the traction contact performance. Finally, the suitability of the selected CVT design concept for alternate electric and hybrid vehicle applications and alternate vehicle sizes and maximum output torques is determined. In all cases the toroidal traction drive design concept is applicable to the vehicle system. The regenerative gearing could be eliminated in the electric powered vehicle because of the reduced ratio range requirements. In other cases the CVT with regenerative gearing would meet the design requirements after appropriate adjustments in size and reduction gearing ratio. M.G.

N80-25662# Shaker Research Corp., Ballston Lake, N. Y.
ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GUIDE. PART 4: CYLINDRICAL ROLLER BEARINGS Interim Report, 15 Apr. 1978 - Aug. 1979
A. B. Jones and J. M. McGrew, Jr. Wright-Patterson AFB, Ohio AFAPL Dec. 1979 74 p refs
(Contract F33615-76-C-2038; AF Proj. 3048)
(AD-A082355; SRC-79-TR-45; AFAPL-TR-78-6-PT-4) Avail: NTIS HC A04/MF A01 CSCL 13/9

This report is an update of the original Part 4 of the Rotor-Bearing Dynamics Design Technology Series, AFAPL-TR-65-45 (Parts 1 through 10). A computer program is given for preparation of cylindrical roller bearing stiffness data input for rotordynamic response programs. The complete stiffness matrix is calculated including centrifugal effects. Considerations such as elastohydrodynamic and cage effects are not included since they have little influence on the calculation of cylindrical roller bearing stiffness. The resulting program is reasonably small and easy to use. GRA

N80-25663# Naval Ordnance Station, Louisville, Ky.
EXPLOSIVELY JOINING DISSIMILAR METAL TUBES Final Report
Ted R. Marshall Nov. 1979 110 p refs
(AD-A082068; NOSL-MT-053) Avail: NTIS HC A06/MF A01 CSCL 13/8

This project was conducted to further develop the explosive cladding process and to use the process by joining pipes/tubes of metals that cannot be welded together by conventional methods. The project was diverted from the original plan to utilize a 'scarf-joint' transition joint of identical size pipes/tubes to development of a method of penetrating watertight bulkheads or decks with a pipe/tube having widely different properties. The emphasis was on penetrating aluminum bulkheads/decks with stainless steel pipes of sizes from 3/4 in. to 6 in. for surface effect ship application. GRA

N80-25664# Teesside Polytechnic, Cleveland (England). Dept. of Mechanical Engineering.
RELATION BETWEEN THE SURFACE FRICTION OF PLATES AND THEIR STATISTICAL MICROGEOMETRY M.S. Thesis. Interim Report, Apr. 1979 - Jan. 1980
M. J. King Jan. 1980 290 p refs
(Grant N00014-79-G-0053; NR Proj. 062-629)
(AD-A082758) Avail: NTIS HC A13/MF A01 CSCL 20/4

An attempt is made to relate the geometry of nominally flat surfaces to their resistance to fluid flow. The experimental work was carried out in an open flume, 20 meters in length, 30 cm wide, and 30 cm deep. The flow measurements were carried out over a range of free stream velocities from 35 cm/sec to 85 cm/sec. Hot film anemometry using a single sensor was used to measure the boundary layer velocity profile development along a 2.4 meter section of the channel floor which provides the base for the test surfaces. The velocity profiles are analyzed to determine the surface friction coefficient using the simplified momentum integral equation as well as the logarithmic inner law approach. The test surfaces, including a 4.8 meter long replica of a ship hull surface, were examined using a number of surface measurement instruments capable of recording surface wavelengths from microns to meters. Surface profiles were recorded and digitized and the data statistically analyzed to give an overall characterization of the surfaces under investigation using both amplitude and spatial parameters. GRA

N80-25665# Tribon Bearing Co., Cleveland, Ohio.
EVALUATION OF NEW MATERIALS FOR ROTOR HUB JOURNAL BEARINGS Final Report, Aug. 1976 - Nov. 1977
Donald W. Moyer Feb. 1980 23 p
(Contract DAAJ02-76-C-0060; DA Proj. 1F2-63209-DB-38)
(AD-A082444; USARTL-TR-78-39) Avail: NTIS HC A02/MF A01 CSCL 13/9

The nonlubricated bearing designs currently used in a number of helicopter rotor systems are based on a fabric-reinforced Teflon technology that is more than 10 years old. This test program was designed to evaluate some of the promising new self-lubricating materials and compare them to the present bearing design. These tests evaluated four new bearing materials plus two standard fabric reinforced Teflon bearings. Tests were conducted at normal flight loads and motions initially. The bearing loads were then increased in order to accelerate material deterioration and to reduce the required test time. GRA

N80-25666# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
COMPACT CLOSED CYCLE BRAYTON SYSTEM FEASIBILITY STUDY, VOLUME 1 Final Report, 20 May 1976 - 20 Jun. 1979
R. E. Thompson, R. L. Ammon, R. Calvo, L. R. Eisenstatt, and F. R. Spurrier Aug. 1979 204 p refs
(Contract N00014-76-C-0706)
(AD-A081379; WAES-TNR-237-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 20/13

This report presents the final results from a three year study which evaluated the feasibility of a closed Brayton cycle power conversion system for compact light weight naval propulsion plants. The overall objective of the program was to conduct the analytical study and experimental research required to evaluate and to demonstrate feasibility of a closed Brayton cycle power conversion system for a low volume, light weight marine propulsion plant. Another objective was to insure relevance of power conversion system study results to all candidate applications, including recognition of the various energy sources which the Navy could desire to use in the future. The Compact Closed Cycle Brayton System (CCCBS) program has included derivation of the most stringent representative requirements for the CCCBS power conversion system, consideration of the interfaces with the ship and with other powerplant components which were outside the scope of the system under study, investigation and evaluation of the components which are most critical to feasibility, iterative definition of a reference 52.2 M Pa (17,000 HP) CCCBS design concept; extensive creep-rupture tests of candidate turbine

materials in helium and in air at 927 C (1700 F), and overall evaluations and assessments. The results have shown the feasibility and attractive characteristics of a CCCBS and have indicated that no high risk developments or technology breakthroughs are needed for the CCCBS power conversion system. The results of this program provide a valuable baseline of data for use by the Navy in defining the advanced powerplants which will enhance the capabilities of many types of naval vessels. GRA

N80-25667# Bendix Corp., Kansas City, Mo.
MATHEMATICAL MODEL AND THE DYNAMIC SIMULATION OF AN ELECTROMECHANICAL ROTARY DEVICE
J. D. Emergy Feb. 1980 65 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2376) Avail: NTIS HC A04/MF A01

A mathematical model of an electromechanical rotary device is presented. This device contains a rotor, stator, and two springloaded arms which restrict the rotor motion. The desired action is the alignment of the rotor and the consequent movement of the arms. The SLENOID computer program for calculating the magnetic torque, air gap permeance, spring torque, damping effects, and motion of the rotor and arms is described. DOE

N80-25668# California Univ., Livermore. Lawrence Livermore Lab.
CONTINUOUSLY VARIABLE TRANSMISSIONS: THEORY AND PRACTICE
Norman H. Beachley and Andrew A. Frank Aug. 1979 50 p refs Prepared in cooperation with Wisconsin Univ., Madison
(Contract W-7405-eng-48)
(UCRL-15037) Avail: NTIS HC A03/MF A01

The five basic principles that can be used in the design of continuously variable transmissions (CVT) for motor vehicles are examined and compared. These include: hydrostatic, traction drive (V-belt and rolling contact), overrunning clutch, electric, and multispeed gearbox with slipping cluth. Commercially available CVTs suitable for motor vehicles are discussed along with the research and development programs for CVTs. DOE

N80-25669# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
IMPROVING THE PERFORMANCE AND FUEL CONSUMPTION OF DUAL CHAMBER STRATIFIED CHARGE SPARK IGNITION ENGINES Final Report
S. C. Sorenson, S. S. Pan, J. J. Bruckbauer, and G. R. Gehrke Sep. 1979 294 p refs
(Contract EC-77-S-02-4493)
(COO-4493-5; UILU-ENG-79-4012) Avail: NTIS HC A13/MF A01

A specially constructed single cylinder engine was used to both conduct experiments to study mixing effects and to obtain experimental data for the validation of the computer model which was constructed. The effect of fuel injection timing on performance and emissions was studied using the combination of orifice size and prechamber to main chamber rate ratio which gave the best overall compromise between emissions and performance. In general, fuel injection gave slightly higher oxides of nitrogen, but considerably lower hydrocarbon and carbon monoxide emissions than the carbureted form of the engine. Experiments with engine intake port redesign to promote swirl mixing indicated a substantial increase in the power output fron the engine and, that an equilvalent power levels, the nitric oxide emissions are approximately 30% lower with swirl in the main chamber without swirl. DOE

N80-25670# Sandia Labs., Albuquerque, N. Mex. Combustion Applications Div.
COMPARISON OF IGNITION LOCATIONS IN A HIGH SWIRL ENGINE
J. Ray Smith Oct. 1979 32 p refs Presented at the Western States Sect./The Combust. Inst., Berkeley, Calif., 15-16 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8715; CONF-791048-4) Avail: NTIS HC A03/MF A01

A comparison of the effect of different ignition locations on engine performance in a high swirl, homogeneous charge, spark ignition engine made using a focused laser as the ignition source. Using the indicated mean effective pressure (IMEP) as the performance indicater, the ignition location was varied from the center of the cylinder to the cylinder wall by moving the laser focusing lens. Fifty to one hundred millijoules of laser energy at 0.53 micron wavelength was required to give reliable ignition. The fuel was propane at an equivalence ratio of 0.8 at an engine speed of 1200 rpm. Whereas the spark location for optimum IMEP in a non swirl engine is typically the center, it was found that IMEP did not vary significantly with ignition location in the high swirl engine. This unexpected result was apparently due to the short burn durations achieved with a very high swirl at time of ignition. Although there appeared to be a slight decrease in induction time using a laser instead of spark plug, no significant difference in the rates of pressure rise were observed when the laser deposition energy was comparable to that of the spark plug. DOE

N80-25671# Oak Ridge National Lab., Tenn.
DIRECTIONS IN AUTOMOTIVE ENGINE RESEARCH AND DEVELOPMENT
Garland Samuels 1980 36 p Presented at WATTec 7th Ann. Energy Conf. and Exhibition, Knoxville, Tenn., 20 Feb. 1980
(Contract W-7405-eng-26)
(CONF-800212-2) Avail: NTIS HC A03/MF A01

The advent of high fuel costs and automotive fuel economy and emission regulations has cast doubt on the economic superiority and even the technical feasibility of conventional spark ignition and diesel engines, and has opened the field to other concepts. The emission regulations and their effect on the design and efficiency of conventional engines are reviewed, the research and development effort to improve the performance of conventional engines and to develop advanced engines is discussed, and the current status of these engines is presented. DOE

N80-25672# Combustion Electromagnetics, Inc., Lexington, Mass.
EFFECTS OF MICROWAVES ON THE PERFORMANCE OF INTERNAL COMBUSTION ENGINES Final Technical Report, 1 Mar. 1978 - 31 May 1979
M. A. V. Ward 30 Jun. 1979 99 p refs
(Contract ET-78-C-03-1865)
(SAN-1865-T1) Avail: NTIS HC A05/MF A01

The interaction of microwave energy with both an ignition plasma as well as with a hydrocarbon air flame plasma were studied. Lean mixture burn and increased flame speed of a hydrocarbon air fuel mixture in the internal combustion engine were also examined. Vehicular exhaust pollutants were reduced and engine efficiency was increased. DOE

N80-25673# Bettis Atomic Power Lab., West Mifflin, Pa.
FINITE ELEMENT ANALYSIS OF ARC WELDING
E. Friedman Jan. 1980 68 p refs
(Contracts EY-76-C-11-0014; DE-AC11-76PN-00014)
(WAPD-TM-1430) Avail: NTIS HC A04/MF A01

Finite element computer models of the gas tungsten arc welding process for determining the welding thermal cycle, weld bead shape, and penetration characteristics as well as for evaluating the stresses and distortions generated as a result of the temperature transienis are described. The analysis procedures are applicable to planar or axisymmetric welds with arbitrary cross sectional geometries, under quasistationary conditions. The method used for determining temperatures features an iteration procedure to accurately account for the latent heat absorbed during the melting and liberated during solidificatiom of the weld. A quasistationary formulation for moving welds enables temperatures to be calculated using a two dimensional heat conduction computer program. The present limitation of high welding speed can, however, be relaxed without altering the two dimensional framework of the procedure. DOE

N80-25674# National Technical Information Service, Springfield, Va.
ELECTRON BEAM WELDING, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Feb. 1980
William E. Reed Mar. 1980 104 p Supersedes NTIS/PS-79/

0156; NTIS/PS-78/0184; NTIS/PS-77/0156 2 Vol.
(PB80-805971; NTIS/PS-79/0156; NTIS/PS-78/0184; NTIS/PS-77/0156) Avail: NTIS HC $30.00/MF $30.00 CSCL 13H

Development, automation, and applications of electron beam welding are presented in these Federally sponsored research reports. Properties of electron beam welds and weldability of steel, aluminum, refractory metals, heat resistant alloys, and corrosion resistant alloys are included. This updated bibliography contains 97 abstracts, 17 of which are new entries to the previous edition. GRA

N80-25675# National Technical Information Service, Springfield, Va.
ELECTRON BEAM WELDING, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Feb. 1980
William E. Reed Mar. 1980 185 p Supersedes NTIS/PS-79/0517; NTIS/PS-78/0186; NTIS/PS-77/0157 2 Vol.
(PB80-805989; NTIS/PS-79/0157; NTIS/PS-78/0186; NTIS/PS-77/0157) Avail: NTIS HC $30.00/MF $30.00 CSCL 13H

Reports from worldwide research are cited covering the process, automation, equipment, and applications of electron beam welding. Properties and weldability of steel aluminum, titanium, refractory metals, and heat resistant alloys are included. This updated bibliography contains 178 abstracts, 37 of which are new entries to the previous edition. GRA

N80-25676# National Technical Information Service, Springfield, Va.
DIESEL EXHAUST EMISSIONS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jan. 1980
Diane M. Cavagnaro Feb. 1980 159 p Supersedes NTIS/PS-79/0037; NTIS/PS-78/0109; NTIS/PS-77/0104
(PB80-805385; NTIS/PS-79/0037; NTIS/PS-78/0109; NTIS/PS-77/0104) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

Aspects of exhaust gases from stationary and vehicular diesel engines are presented in these citations of Federally funded research. Pollution potential, composition, control, and formation processes in combustion reactions are included. The effects of achieving better fuel consumption on the types of exhaust gases formed are covered as well as research concerned with the health effects of these exhaust gases. This updated bibliography contains 152 abstracts, 45 of which are new entries to the previous edition. GRA

N80-25677# National Technical Information Service, Springfield, Va.
DIESEL EXHAUST EMISSION CONTROL FOR MOTOR VEHICLES, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1977
Diane M. Cavagnaro Feb. 1980 213 p
(PB80-805393) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

Research from worldwide journal literature on the control of exhaust gases from diesel motor vehicle engines is cited. Most studies are concerned with emission control through engine design; however, some studies cover the use of fuel additives for pollution control. This updated bibliography contains 206 abstracts, none of which is new to the previous edition. GRA

N80-25678# National Technical Information Service, Springfield, Va.
DIESEL EXHAUST EMISSION CONTROL FOR MOTOR VEHICLES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Jan. 1980
Diane M. Cavagnaro Feb. 1980 110 p
(PB80-805401; NTIS/PS-79/0038) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

Citation to worldwide research were selected that discuss the control of exhaust gases from diesel motor vehicle engines. Most of the studies are concerned with emission control through engine design; however, some studies also cover the use of fuel additives for pollution control. This updated bibliography contains 103 abstracts, 48 of which are new entries to the previous edition. GRA

N80-25679# National Technical Information Service, Springfield, Va.
DIESEL EXHAUST EMISSIONS. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1974 - Dec. 1980
Diane M. Cavagnaro Feb. 1980 204 p Supersedes NTIS/PS-79/0039
(PB80-805419; NTIS/PS-79/0039) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

This bibliography cites research reports concerning exhaust emissions from diesel motor vehicles. Topics include engine design, techniques of measuring gases, pollution control, and fuel additives. GRA

N80-25680# National Technical Information Service, Springfield, Va.
GAS BEARINGS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report 1970 - Nov. 1979
Guy E. Habercom, Jr. Dec. 1979 328 p Supersedes NTIS/PS-78/1278; NTIS/PS-77/1123; NTIS/PS-76/0971
(PB80-802507; NTIS/PS-78/1278; NTIS/PS-77/1123; NTIS/PS-76/0971) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

The design, performance, and applications of gas bearings are investigated in these reports pathered in a worldwide literature survey. Gas bearing configuration, gas flow lubrication, bearing load, and bearing stability are among the parameters reviewed. This updated bibliography contains 321 abstracts, 28 of which are new entries to the previous edition. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-25681# Goodrich (B. F.) Co., Brecksville, Ohio. Research and Development Center.
EVALUATION OF NONDESTRUCTIVE INSPECTION METHODS FOR AIRCRAFT TIRES Final Report, Feb. 1978 - Aug. 1979
Donald D. Ewing Feb. 1980 153 p
(Contract DOT-FA78WA-4103)
(AD-A082523; FAA-RD-80-10; Rept-3AT04G3) Avail: NTIS HC A08/MF A01 CSCL 01/3

Advanced nondestructive (NDT) aircraft tire inspection systems were evaluated and compared with the air needle inspection technique normally used to qualify air carrier aircraft tires for repair, retread, and return to service. The advanced NDT inspection systems considered were: the air needle buffing; holographic; pulse echo ultrasound; and X-ray types. The equipment, inspection procedure, typical visual displays, and analysis techniques are described for each inspection system. Equipment state-of-art, tradeoffs, operator skills, required manning, and inspection rates are discussed. Basic equipment, installation, and maintenance costs are provided. The effectiveness of the inspection systems in detecting, identifying type and size, and locating the position of defects is reported for a group of four old defective tires and four new tires with built in defects which were inspected by all evaluated systems. Some potential advances in state-of-art are discussed. R.C.T.

N80-25682# Claremont Mens Coll., Calif. Inst. of Decision Science.
ON PROBLEMS OF ESTIMATION FOR TWO PARAMETER DECREASING FAILURE RATE DISTRIBUTIONS APPLIED TO RELIABILITY
Janet M. Myhre and Sam C. Saunders Mar. 1980 39 p refs
(Contracts N00014-78-C-0213; N00014-79-C-0755)
(AD-A082991; Rept-80-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper some of the problems of parametric estimation for samples from distributions, which have decreasing failure rate, are discussed. Some of these distributions are obtained by mixing different exponential populations, others represent mechanisms analogous to 'work hardening' for each component where 'old is better than new'. Sufficient conditions are obtained that maximum likelihood estimators of appropriately chosen shape and scale parameters exist in both cases. The sample data which are available, when a decreasing failure rate distribution governs life, are usually censored with only a few failures observed; this limitation is dealt with. Actual data, obtained from the testing of integrated circuit electronic packages, are provided to illustrate these concepts and verify the applicability and usefulness of the techniques described. GRA

N80-25683# California Univ., Berkeley. Operations Research Center.
AN ADAPTIVE BAYESIAN SCHEME FOR ESTIMATING RELIABILITY GROWTH UNDER EXPONENTIAL FAILURE TIMES
Nozer D. Singpurwalla Dec. 1979 33 p refs Prepared in cooperation with Stanford Univ., Calif. and George Washington Univ., Washington, D.C.
(Grants AF-AFOSR-3179-77; DAAG29-77-G-0031; AF Proj. 2304)
(AD-A083006; ORC-79-17) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper we consider an adaptive approach for estimating reliability growth, based on prior information which is motivated from practical considerations. We discuss two situations: in the first one, both the prior distribution and the posterior distributions of the mean time to failure of an exponential distribution are stochastically ordered; in the second situation, the prior distribution is stochastically ordered with respect to the last posterior distribution. The former situation leads us to a procedure which is not fully Bayesian, and is therefore termed by us as 'pseudo Bayesian'. Since we do not know the properties of this pseudo Bayesian approach, we can best describe our work here as being a 'pseudo Bayesian scheme'. The second situation leads us to an approach which is fully Bayesian under certain assumptions. Our work in this general area of reliability growth is still in progress, and we invite the attention of other researchers to look into some of the problems that we have posed, and the questions that we have raised. GRA

N80-25684# Southeastern Center for Electrical Engineering Education, Inc., Orlando, Fla.
BAYESIAN RELIABILITY THEORY FOR REPAIRABLE EQUIPMENT Final Technical Report, 1 Jun. - 30 Sep. 1979
Theodore S. Bolis Feb. 1980 30 p refs
(Contract F30602-78-C-0148; AF Proj. 2338)
(AD-A083009; RADC-TR-80-30) Avail: NTIS HC A03/MF A01 CSCL 14/4

This report introduces an assumption called instantaneous resurrection which holds that a repaired equipment is returned to the state of an equipment of similar age which has not yet failed, rather than to the state of a new equipment. Under this assumption, the number of failures of an equipment in time t is a Poisson process with leading function - log R(t), where R(t) is the reliability function of the equipment. This fact can be used in the estimation of parameters of various prior distributions via the appropriate Poisson mixtures. The case of the two way truncated Gamma prior and its limiting forms is discussed in the report. GRA

N80-25685# Argonne National Lab., Ill.
DEVELOPMENT OF NONDESTRUCTIVE EVALUATION TECHNIQUES FOR HIGH-TEMPERATURE CERAMIC HEAT EXCHANGE COMPONENTS Quarterly Report, Oct. - Dec. 1979
Jan. 1980 25 p refs
(Contract W-31-109-eng-38)
(ANL/MSD/FE-80-1; QR-9) Avail: NTIS HC A02/MF A01

Nondestructive methods for testing ceramic components for high temperature heat exchangers are reported. The sensitivity of the ultrasonic bore side probe was demonstrated for detection of 125 micrometer deep circumferential EDM notches on ID and OD surfaces of sintered and siliconized tubes. The signal to noise ratios for the ultrasonic echoes are better than 10 to 1. Data were collected on the microprocessor controlled operation of the ultrasonic probe. Detection and recording of an EDM notch location was demonstrated. The acoustic microscope was modified to handle 30 MHz sound waves which improved the penetration ability of the sound in SiC tube walls. The modification resulted in less acoustic noise. The ability to detect a notch only 75 micrometers in width was demonstrated. DOE

N80-25686# Los Alamos Scientific Lab., N. Mex.
IMAGE PROCESSING APPLICATIONS IN NDE
Roger A. Morris 1980 11 p refs Presented at Soc. of Photo-Optical Instrumentation Engr., Los Angeles, 6-7 Feb. 1980 Sponsored by DOE
(LA-UR-80-172; CONF-800207-2) Avail: NTIS HC A02/MF A01

Most techniques for nondestructive examination (NDE) use visual imaging in one form or another and vary from holographic interferometry where displacements under stress are measured to the visual inspection of an object's surface to detect cracks after penetrant has been applied. The nondestructive and destructive testing of a product throughout its life cycle is described for the microballoon target used in the laser fusion program. The beads are mass produced by the millions and the first nondestructive test is to separate the obviously bad beads (broken or incomplete) from the good ones. The good beads are then inspected for sphericity and wall thickness uniformity. The microradiography of the glass, uncoated bead is performed on a specially designed low energy X-ray machine. The beads are mounted in a special jig and placed on a Kodak high resolution plate in a vacuum chamber that contains the X-ray source. The X-ray image is made with an energy less that 2 keV and the resulting images are then inspected at a magnification of 500 to 1000X. Some typical results are presented. DOE

N80-25687# Argonne National Lab., Ill.
APPLICATION OF RELIABILITY, MAINTAINABILITY, AND AVAILABILITY ENGINEERING TO SOLAR HEATING AND COOLING SYSTEMS
Prem S. Chopra and Ronald M. Wolosewicz 1980 7 p refs Presented at the Ann. Reliability and Maintainability Symp., San Francisco, 22-24 Jan. 1980
(Contract W-31-109-eng-38)
(CONF-800103-3) Avail: NTIS HC A02/MF A01

The reliability of solar hot water and heating systems is compared with that of conventional systems using block diagrams, failure modes and effects analysis, and fault trees. Although stand-alone solar-energy systems are not as reliable as conventional systems, the RMA of the combined solar and conventional system can be made comparable to currently available heating and hot-water systems. An availability matrix is presented that can be used to develop maintenance schedules that do not decrease the system's availability. Field data presented on operating solar heating and cooling systems indicate that these systems experience four major generic problems: freezing, leakage, controls, and collectors. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-25688 West Virginia Univ., Morgantown.
DYNAMIC RESPONSES OF A MULTI-LAYERED RECTANGULAR PLATE ON VISCOELASTIC FOUNDATION DUE TO MOVING LOADS Ph.D. Thesis
Cheng-jer Lin 1979 168 p
Avail: Univ. Microfilms Order No. 8012930

The investigation presents the formulation of a general equation of motion and its analytic and numerical solution for the determination of the dynamic deflections and stresses of a multilayered rectangular plate on viscoelastic foundation subject

to a constant force traveling at a constant velocity. Various combinations of simply-supported, clamped and free edge conditions of the plate are studied. The equation of motion is solved by expressing the deflection function of the plate and the moving load in the form of a double series of normal mode functions of two orthogonal plate strips diagonalizing the stiffness matrix and making use of the Laplace transformation method. The validity of general formulas developed is verified by reducing them into special cases for comparative studies with the published works. To illustrate the general methodology developed, three plates having SSSS, SSFF, and CCCC edge supports are studied. Computer programs newly developed, together with those commercially available subroutines are used, and the effects of some parameters are illustrated and briefly discussed.

Dissert. Abstr.

N80-25689 Michigan State Univ., East Lansing.
RESIDUAL STRESS FACTORS IN TORSIONAL FAILURE MODES OF INDUCTION-HARDENED STEEL AXLE SHAFTS Ph.D. Thesis
Stephen Adam Zayac 1979 150 p
Avail: Univ. Microfilms Order No. 8013822

A quantitative relation between surface residual stress and ultimate torsional strain of induction hardened SAE 1038 steel axle shafts was established experimentally. Two distinct failure modes were observed, a brittle mode, controlled by a maximum shear strain criterion, and a ductile mode, controlled by void coalescence. Residual stress measurements, obtained using a dual diffractometer technique prior to torsional testing, revealed that large local gradients exist in the surface residual stress distribution. Nevertheless, a mean residual stress level associated with each axle shaft and determined by an average of eight equispaced measurements on a transverse cross section was constant along the shaft except at the flange, where heat treatment conditions vary, and at the spline, where the material was severely cold worked. The angle of twist at failure increased as the compressive residual stress level increased and the failure mode was a function of this residual stress level. The residual stress level, and consequently the angle of twist at failure, can both be controlled by process selection and quench conditions.

Dissert. Abstr.

N80-25690 Case Western Reserve Univ., Cleveland, Ohio.
RELIABILITY OF STRUCTURAL SYSTEMS Ph.D. Thesis
Mark Robert Gorman 1980 386 p
Avail: Univ. Microfilms Order No. 8013839

Two aspects of the reliability of structural systems are investigated. The reliability of structural systems in performing satisfactorily all of the functions for which structures are designed is discussed. A risk model for structural systems is proposed. The model considers the load environments or hazards which act upon the structure and cause the structure to respond. This response may cause damage. Damage gives rise to undesirable consequences. The probability distribution of consequence F sub C(c) is used as a measure of risk by which alternative designs may be considered. The statistical moments of the ultimate resistance of redundant structural systems to static, proportional loading, are calculated from the statistical moments of the resistance of the component elements. The methods are directly applicable to two and three dimensional frameworks of either truss or rigid frame construction. Actual structure geometry is used, and the method can handle both brittle and ductile elements. The effect of correlation between element resistances is investigated.

Dissert. Abstr.

N80-25691 West Virginia Univ., Morgantown.
THEORETICAL AND PHYSICAL APPROACH TO LIGHT GAGE STEEL SHEAR DIAPHRAGMS Ph.D. Thesis
Hsin-Tien Huang 1979 261 p
Avail: Univ. Microfilms Order No. 8012925

This research was undertaken for the purpose of evaluating the performance of various types of steel deck, when used as a shear diaphragm in buildings. The principal contribution is the formulations of shear strengths and stiffness. The theoretical solution treats different shapes, thickness, lengths and types of panels, purlins, and fasteners and establishes general formulas for shear stiffness and shear strength. Design tables and figures are given for diaphragm stiffness and strength to account for various factors in common steel diaphragm installations currently being used. Standard evaluation forms for stiffness and strength for many deck profiles are presented. Design examples and the comparison of experimental to theoretical results from full-scale tests are shown. Also, load and resistance factor design (LRFD) method for the diaphragm and its fasteners is described and then applied to examples of practical design situations so that it may be used to establish necessary margins of safety as related to the quality of construction.

Dissert. Abstr.

N80-25692 Michigan State Univ., East Lansing.
PERMANENT DEFORMATION OF COHESIONLESS SUBGRADE MATERIAL UNDER CYCLIC LOADING Ph.D. Thesis
Rodney Ward Lentz 1979 232 p
Avail: Univ. Microfilms Order No. 8013768

The trend toward ever increasing axle loads on highway and airport pavements has led to the development of numerous methods of pavement design. All of these methods agree that, for flexible pavements, subgrades should not undergo significant volume change or permanent deformation under the application of traffic loads. Thus, parameters for characterizing permanent deformation of subgrade materials are required in each of these methods. Consequently, there exists a need for research in material characterization, particularly in development of simplified test procedures which will reduce the manpower, time and money required. A very simple and economical test procedure was developed to evaluate parameters of cohesionless subgrade soils. By this procedure, permanent strain in sand subjected to cyclic loading can be characterized using stress and strain parameters from the universally accepted static triaxial test. To develop the procedure duplicate samples were tested using both static triaxial apparatus and a closed loop electrohydraulically actuated cyclic triaxial system. The dynamic test results were normalized with respect to parameters obtained from the corresponding static triaxial test. The normalized cyclic principal stress difference showed a unique relationship to the normalized accumulated permanent strain. This relationship was found to be independent of moisture content, density, and confining pressure. Based on this finding a constitutive equation was developed which allows prediction of permanent strain after any number of load repetitions using only parameters obtained from a static triaxial test.

Dissert. Abstr.

N80-25693*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
HEATING AND COOLING SYSTEM Patent Application
Leland Imig and Mickey R. Gardner, inventors (to NASA) Filed 30 Apr. 1980 13 p
(NASA-Case-LAR-12393-1; US-Patent-Appl-SN-145208) Avail: NTIS HC A02/MF A01 CSCL 20K

An apparatus capable of cyclic heating and cooling of a test specimen undergoing fatigue testing is disclosed. Cryogenic fluid is passed through a block clamped to the specimen to cool the block and the specimen. Heating cartridges penetrate the block to heat the block and the specimen to very hot temperatures. Control apparatus is provided to alternately activate the cooling and heating modes to effect cyclic heating and cooling between very hot and very cold temperatures. The block is constructed of minimal mass to facilitate the rapid temperature change thereof.

NASA

N80-25694# Saab-Scania, Linkoping (Sweden).
SOME ASPECTS ON IMPROVEMENTS OF A FIRST-ORDER DYNAMIC OPTIMIZATION ALGORITHM
Bernt Jaermark 1980 20 p refs
(SAAB-TN-AE-73) Avail: NTIS HC A02/MF A01

Several devices concerning improvement of a first order differential dynamic programming method are discussed. These were tested and appear to be useful on optimal flight trajectory applications. Some convergence difficulties are due to instability in the differential equations or different sensitivity in the control within different time intervals. In order to reduce these difficulties, steps are taken by way of special choice of the penalty term in an earlier established convergence control parameter technique. To obtain better accuracy and stability when approaching or when close to optimum solution, a simplified second order

algorithm is discussed. A first order method is suggested for free terminal time. R.C.T.

N80-25695# Saab-Scania, Linkoping (Sweden).
BUCKLING OF SANDWICH PANELS SUBJECTED TO AXIAL COMPRESSION, SHEAR FORCES AND LATERAL PRESSURES. PART 2: ANALYSIS
Sven Erik Larsson, Harald Bengtsson, and Sten Oeberg 1980 79 p refs
(SAAB-TN-Ae-72-Bt-2) Avail: NTIS HC A05/MF A01

The Aerospace Division of SAAB-SCANIA initiated in 1962 a comprehensive study on analysis and testing of sandwich panels subjected to combined in-plane and normal loading. The investigation was related to bonded panels with aluminum skins and aluminum honeycomb core. The purpose of the investigation was to develop and verify analysis methods applied in the stress and strength analysis of honeycomb panels used in aircraft primary structures. Author

N80-25696# Royal Aircraft Establishment, Farnborough (England).
THE CONCEPT OF EFFECTIVE STRESS APPLIED TO ELASTICITY AND TO VISCOPLASTICITY IN THE PRESENCE OF ANISOTROPIC DAMAGE
J.-L. Chaboche Feb. 1980 31 p refs Transl. into ENGLISH of "Le Concept de Contrainte Effective Applique a l'Elasticite et a la Viscoplasticite en Presence d'un Endommagement Anisotrope", Rept. ONERA-1979-77 ONERA, Paris, 1979 Presented to the 115th Euromech Congr., Grenoble, France, 19-22 Jun. 1979
(RAE-Lib-Trans-2039; BR74076; ONERA-1979-77) Avail: NTIS HC A03/MF A01

The complex problems posed by the anisotropy which affects both the elastic behavior and the viscoplastic behavior are discussed. It is shown how a damage tensor of the fourth order can be introduced through the concept of effective stress in order to take into consideration the effect of the damage on the elastic behavior, on the basis of results furnished by homogenization techniques. A three dimensional law of anisotropy is proposed for creep damage, introducing a minimum number of characteristic coefficients. The possibilities of this law are evaluated for the case of the traction torsion of thin tubes and are compared with previous formulations. R.C.T.

N80-25697# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
COMPUTER PROGRAM FOR ELASTIC ANALYSIS OF PIPING SYSTEMS WITH SPECIAL REFERENCE TO THE POWER PIPING CODE B31.1
Daniel vanLeeuwen Apr. 1980 37 p refs
(MT-135) Avail: NTIS HC A03/MF A01

The program CRIF-PIPE is a user oriented computer program designed to run on a minicomputer. It allows the user to model efficiently an arbitrary three dimensional piping system and analyze the stresses and flexibility of different situations of the system with regard to thermal and mechanical loading. The theoretical basis is an elastic linear finite element model of the pipeline with linearly varying bending moments. The finite element stiffness method is particularly suited to complex systems involving many anchors, closed loops, interconnecting branch lines, and intermediate and terminal full, or partial restraints. The calculated stresses are compared to allowable stress levels described by the American power piping code B31.1. Author

N80-25698# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
APPLICATIONS IN STRUCTURAL ANALYSIS
Oct. 1978 49 p refs Presented at UUA/E 7th SIG Symp. on Appl. in Struct. Anal., Nice, 2-4 Oct. 1978
(ISD-251) Avail: NTIS HC A03/MF A01

Two papers dealing with computer assisted structural analysis are given. The first reviews basic initial load concepts and their application to inelastic transient stress analysis for thermal and mechanical loading. The plastic and creep branches of the ASKA computer program system are discussed. The second paper covers the OPTIMA 1.0 program addition to ASKA. Structural design problems within stress displacement and fabrication limits are studied. For individual titles, see N80-25699 through N80-25700.

N80-25699# Stuttgart Univ. (West Germany).
INELASTIC TRANSIENT STRESS ANALYSIS FOR THERMAL AND MECHANICAL LOADING
J. S. Doltsinis and H. Wuestenberg *In its* Appl. in Struct. Anal. Oct. 1978 p 1-22 refs (For primary document see N80-25698 16-39)
Avail: NTIS HC A03/MF A01

The basic initial load concept is reviewed and its direct applicability to reversible thermal problems is shown. The incremental procedure for irreversible thermomechanical processes is discussed with emphasis on the finiteness of the time step in the calculation. Plasticity and creep are described as independent contributions to the inelastic behavior at elevated temperatures. In situations where effects of history-dependence and rate-dependence are simultaneously present, the viscoplastic approach is recommended. This can be achieved within the inelastic part of ASKA by activating either the existing plastic or the creep branches of the program. Two recent applications involving inelastic transient thermomechanical response are presented. First the stress analysis of a vessel for liquid zinc during the initial heating phase is demonstrated. In the second example, the limiting cases of the elastic and the elasto-plastic approach are compared with the assumed elasto-viscoplastic behavior of the rate-sensitive material. Author (ESA)

N80-25700# Stuttgart Univ. (West Germany).
STRUCTURAL LAYOUT WITH STRESS-DISPLACEMENT AND FABRICATION LIMITS
J. Buehlmeier and H.-P. Mlejnek *In its* Appl. in Struct. Anal. Oct. 1978 p 23-47 refs (For primary document see N80-25698 16-39)
Avail: NTIS HC A03/MF A01

Structural optimization within a given system of loads, acting in assigned directions at specified points or specified regions of space, is examined. The computer program system, OPTIMA 1.0, a large-scale optimization package designed to conform with concepts, is introduced. The system combines energy methods and gradient methods of structural analysis. Examples of its application are given with results. Author (ESA)

N80-25701# Pennsylvania State Univ., University Park. Applied Research Lab.
VIBRATION OF CYLINDRICAL SHELLS, WITH AND WITHOUT RING STIFFENING M.S. Thesis, Mar. 1980
Eugene C. Eichelberger, Jr. 11 Jan. 1980 144 p refs
(Contract N00024-79-C-6043)
(AD-A082524; ARL/PSU-TM-80-03) Avail: NTIS HC A07/MF A01 CSCL 20/11

The dynamical response of two cylindrical shells, one with and one without ring stiffening, was investigated. The driving-point admittance was measured and compared with predictions using the mean-value admittance method. This method predicts the geometric mean of the response of a vibrator with respect to frequency and is useful in understanding the behavior of many complex structures. The basic computations involve the mode functions, mode masses, and the mode density. The measurements were in good agreement with the theory, and demonstrate that the mean-value admittance method is a practical means of predicting the vibrational response of shell structures to point excitation. GRA

N80-25702# ITT Electro-Optical Products Div., Roanoke, Va.
STUDY OF THE EFFECTS OF BENDING AND MICROBENDING ON GLASS FIBERS Final Report, 1 Oct. 1978 - 30 Nov. 1979
Frank I. Akers and Steven L. Mahurin 28 Nov. 1979 94 p
(Contract N00014-78-C-0852)
(AD-A081239; ITT-79-35-04B) Avail: NTIS HC A05/MF A01 CSCL 20/6

Single mode fibers are being used as media for acoustic sensors based on optical phase change detection. Deployment of this type of sensor requires the optical fiber to be tightly coiled around a small diameter mandrel. This tight coiling has been found to increase the fiber attenuation through bending and microbending loss mechanisms. As a result, ITT EOPD was

awarded contract N00014-78-C-0852 by the Office Naval Research, which allows for an investigation of mechanisms of optical losses in glass fibers under states of bending and microbending and a study of relationships between optical loss mechanisms and glass composition for development of low loss wide aperture fibers. Both high and low NA single mode fibers were fabricated using core compositions of SiO2/GeO2 and SiO2/P2O3. The fiber performs were fabricated both by the conventional one-step technique and also by a two-step rod-in-tube technique, in order to reduce waveguide imperfections. The fibers in this array of eight different fiber types were evaluated for attenuation while unstressed, attenuation when bent around a mandrel, and attenuation while subjected to microbends. While the low NA fibers of all types showed significant bend and microbend induced losses, the high NA fibers showed very induced losses. The one-step high NA germanosilicate core fiber exhibited negligible bending and microbending losses under all circumstances. The one-step high NA germanosilicate core fiber was selected for the jacket evaluation. When 30 m of high NA fiber were wrapped around an 8 mm mandrel, the resulting attenuation increase was less than 0.3 db. GRA

N80-25703# ITT Electro-Optical Products Div., Roanoke, Va.
STUDY OF DYNAMIC EFFECTS ON GLASS FIBERS Final Report, 1 Oct. 1978 - 30 Nov. 1979
Frank I. Akers, Steven L. Mahurin, and G. C. Salisbury 26 Nov. 1979 73 p
(Contract N00014-78-C-0880)
(AD-A081238; ITT-79-37-11) Avail: NTIS HC A04/MF A01 CSCL 20/6

The experimental effort expended during this contract has established that the attenuation of both low and high NA single mode fibers is insensitive to either low frequency dynamic tension or dynamic twisting. Evaluation of fibers with respect to dynamic bending showed that low NA single mode fibers were attenuated during the bending phase while the high NA fibers were unaffected. Coating materials having refractive indices either higher or lower than fused quartz were applied to single mode fibers and were found to have no effect on dynamic attenuation characteristics. No effects arising from dynamic interactions were found in that all attenuation effects observed during dynamic testing were explained on the basis of static twists, tension, or bendings. GRA

N80-25704# General Atomic Co., San Diego, Calif.
INCREMENTAL STRESS-STRAIN LAW FOR GRAPHITE UNDER MULTIAXIAL LOADINGS
Fu-kong Tzung Nov. 1979 33 p refs
(Contract DE-AT03-76ET-35300; Gen. Atomic Proj. 6400)
(GA-A-15573) Avail: NTIS HC A03/MF A01

An incremental stress-strain law for describing the nonlinear, compressible and asymmetric behavior of graphite under tension and compression as well as complex loadings is derived based on a dry friction model in the theory of plasticity. Stress-strain relations are defined by longitudinal-lateral strain measurements for specimens under uniaxial tension-compression. Agreements with experimentally determined curves from biaxial loading experiments are shown. Agreements in finite element computations using the present model with strain measurements for diametral compression and 4 point bend tests of graphite are also obtained. DOE

N80-25705# Battelle Pacific Northwest Labs., Richland, Wash.
COLLAPSE OF EXPERIMENTAL CAPSULES UNDER EXTERNAL PRESSURE
F. A. Simonen and R. J. Shippell, Jr. Jan. 1980 38 p refs
(Contract EY-76-C-06-1830)
(PNL-3165) Avail: NTIS HC A03/MF A01

Stress analyses and developmental tests of capsules fabricated from thick-walled tubing were performed for an external pressure design condition. In tests of AISI-1018 low carbon steel capsules, a significant margin was seen between yield and collapse pressure. However, the experimental yield pressures were significantly below predictions, essentially eliminating the safety margin present in the conservative design approach. The differences between predictions and test results are attributed to deficiencies in the plasticity theories commonly in use for engineering stress analyses. The results show that the von Mises yield condition does not accurately describe the yield behavior of the AISI-1018 steel tubing material for the triaxial stress conditions of interest. Finite element stress analyses successfully predicted the transition between uniform inward plastic deformation and ovalization that leads to catastrophic collapse. After adjustments to correct for the unexpected yield behavior of the tube material, the predicted pressure-deflection trends were found to follow the experimental data. DOE

N80-25706# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FATIGUE OF WELDMENTS IN NUCLEAR PRESSURE VESSELS AND PIPING
M. K. Booker, B. L. P. Booker, H. B. Meieran, and J. Heuschkel Mar. 1980 94 p refs
(Contract W-7405-eng-26)
(NUREG-CR-1351; NRNL/NUREG-64) Avail: NTIS HC A05/MF A01

Current (ASME) Code fatigue design rules for nuclear pressure vessels and piping include no special considerations for weldments other than purely geometric factors. Research programs aimed at nonnuclear applications have found weldments to display fatigue behavior inferior to that of pure base material. Available information on fatigue of weldments relevant to nuclear pressure vessels and piping was reviewed and determined changes in the current design rules appear to be dictated by the available information. Information was obtained and summarized and stored in a computerized data management system to facilitate correlation of facts and development of conclusion. Significant areas where development of additional data would substantially increase the ability to judge the adequacy of the current ASME design rules include a better understanding of the relative importance of crack initiation and crack propagation to fatigue life; additional fatigue data for prototype commercial weldments, including cumulative damage; properties of repair welds; significance of reheat cracks; quantitative effect of Code-allowable weld defects and the effect of variable microstructure across the weld joint. DOE

N80-25707# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy.
HYDROGEN SULPHIDE STRESS CORROSION CRACKING IN MATERIALS FOR GEOTHERMAL POWER Final Report
A. R. Troiano, R. F. Hehemann, and J. A. Peterson Aug. 1979 91 p refs Prepared in cooperation with Armco Steel Corp., Middletown, Ohio
(Contract EY-76-S-02-2602)
(COO-2602-7) Avail: NTIS HC A05/MF A01

Two point bent beam, NACE tensile, C-Ring and DCB stress intensity type specimens were employed to examine a series of steels SSC resistance in the standard NACE solution and in several modifications pertinent to geothermal environments. Where direct comparisons were possible, the different types of tests qualitatively ranked the alloys in the same order. These steels all exhibit a 15 to 20 percent higher yield strength break-point at service temperatures near 300 to 450 F and/or at pH values approaching 7. Several versions of well head equipment type steels with adequate hardenability have demonstrated satisfactory SSC threshold stress values at adequate yield strengths. The austenitic stainless steels displayed the usual sensitivity to chlorides and cold work. Overaging of several of the age hardenable variety improved the resistance to SSC with only a moderate reduction in strength. Two ferritic stainless steels have shown a higher threshold stress than their commonly employed counterpart. Examination of C-ring specimens cut from commercially treated casing and tubing clearly indicated the advantages of a tempered martensitic and the very real potential for temper embrittlement. DOE

N80-25708# Sandia Labs., Livermore, Calif. Data Processing Div.
USERS MANUAL: SECONDARY DATA REDUCTION PROGRAMS FOR THE ECLIPSE S-200/230 SHOCK AND VIBRATION MEASUREMENT SYSTEMS
H. W. Swan Nov. 1979 43 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8065) Avail: NTIS HC A03/MF A01

The manual describes the Eclipse secondary data reduction programs from the user's point of view. These secondary

processing routines manipulate the data in ways that are outside the scope of the primary reduction routines. These include logarithms, antilogarithms, and powers of data; polynomial smoothing, dividing and multiplying one data set by another, and scaling; combinations and separation; and others. DOE

N80-25709# Hanford Engineering Development Lab., Richland, Wash.

THE EFFECT OF CRACK LENGTH AND SIDE GROOVES ON THE DUCTILE FRACTURE TOUGHNESS PROPERTIES OF ASTM A533 STEEL

K. W. Carlson and J. A. Williams Jan. 1980 67 p refs
(Contracts EY-76-C-14-2170; DE-AC14-76FF-02170)
(NUREG-CR-1171; HEDL-TME-79-65) Avail: NTIS HC A04/MF A01

The ductile fracture toughness, J/sub Ic/, and tearing modulus, T, of ASTM A533, Grade B, Class 1 steel were evaluated by the unloading compliance method for determining J-R curves. These properties were measured for a matrix of 1T specimens in which the relative crack length, a/W, and the depth of side grooving were systematically varied to determine their individual effects. In addition, the applicability of an LVDT extensometer system was investigated for use in the unloading compliance method for J-R curve determination. DOE

N80-25710# Hanford Engineering Development Lab., Richland, Wash.

TENSILE PROPERTIES OF IRRADIATED AND UNIRRADIATED WELDS OF A533 STEEL PLATE AND A508 FORGINGS

J. A. Williams Jan. 1980 40 p refs
(Contracts EY-76-C-14-2170; DE-AC14-76FF-02170)
(NUREG-CR-1158; HEDL-TME-79-51) Avail: NTIS HC A03/MF A01

The tensile properties of welds of base metals ASTM A533, Grade B, Class 1 steel plate and ASTM A508, Class 1 forgings were evaluated in irradiated (3 to 21 x 10 to the 18 power/sq cm) and unirradiated conditions. Yield strength and ultimate strength both increased with increasing fluence, while small ductility losses were generally independent of fluence. Yield strength was found to be more sensitive to irradiation than ultimate strength for all welds. The strength and ductility responses to irradiation varied between the weld materials. These variations were attributed to differences in chemical constituents of the welds. DOE

N80-25711# Brown Univ., Providence, R. I. Div. of Engineering.

PLASTIC CREEP FLOW EFFECTS IN THE DIFFUSIVE CAVITATION OF GRAIN BOUNDARIES

A. Needleman and J. R. Rice Dec. 1979 69 p refs
(Contracts EY-76-S-02-3084; E(11-1)3084-74)
(COO-3084-74) Avail: NTIS HC A04/MF A01

The growth of cavities along grain interfaces was analyzed by the combined processes of grain boundary diffusion and plastic dislocation creep in the adjoining grains. It is shown that the coupling between the processes can be expressed in terms of a parameter L, which has the dimensions of length and which is a function of material properties, temperature and applied stress; L decreases with increasing temperature and stress and has values in the range of 0.25 to 25 microns for various pure metals when stressed to 0.001 shear modulus at 0.5 T/sub m/. The contribution of dislocation creep to the cavity growth rate is shown to be negligible when L is comparable to or larger than the cavity spacing, but significant interactions occur, leading to growth rates very much in excess of those predicted on the basis of boundary diffusion alone, when L is comparable to or smaller than the cavity size. The coupling occurs because extensive dislocation creep allows local accomodation of matter diffused into the grain boundary from the cavity walls. The cavity growth rate is analyzed by formulating a new variational principle that governs combined processes of grain boundary diffusion and nonlinear viscous creep, and by implementing this principle through the finite-element method to obtain numerical solutions. DOE

N80-25712# Argonne National Lab., Ill. Materials Science Lab.

MEASURED RESIDUAL STRESSES IN TYPE 304 STAINLESS STEEL PIPING BUTT WELDMENTS

W. J. Shack and W. A. Ellingson 1980 30 p refs Presented at Seminar on Countermeasures for BWR Pipe Cracking, Palo Alto, Calif., 22-24 Jan. 1980
(Contract W-31-109-eng-38)
(DOE/TIC-11126) Avail: NTIS HC A03/MF A01

Residualstress measurements on Type 304 stainless steel Schedule 80 4, 10, and 26 in. pipe weldments are presented. Both strain-gauge and X-ray diffraction techniques were used. The bulk of the measurements were made on the inner surface, since these stress levels presumably control the initiation of intergranular stress-corrosion cracking. Complete stress profiles were obtained through the thickness of the pipe wall, since the through-wall distribution controls the growth of a crack once it has initiated. DOE

N80-25713# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.

MICROCRACK TECHNOLOGY Progress Report, 1 Apr. 1979 - 29 Feb. 1980

Gene Simmons, Louis Caruso, Elaine Padovani, Steven Sirey, Jeffrey Mann, Thomas Wissler, and Ann Harlow Mar. 1980 62 p refs
(Contract DE-AC02-78ER-04972)
(DOE/ER-04972/2) Avail: NTIS HC A04/MF A01

Microcracks in samples of core from a 3000 foot hole in the Conway granite, near North Conway, New Hampshire, are abundant and most of them are sealed with siderite, chlorite, quartz, hematite, clay, or microbreccia. The sealed cracks are 1 to 100 microns wide, intersect many grain boundaries, often coincide with grain boundaries, and both intersect and contain minerals that are normally rich in U and Th. The abundances of U and Th in 100 gm bulk samples range from 0.1 to 30 ppM and from 6 to 100 ppM, respectively. The working hypothesis that U and Th have migrated through the microcracks in CO2-rich waters is proposed. In the Redstone Quarry core, the presently open microcracks are preferentially oriented; most open cracks have horizontal surfaces. Samples of Devonian shales were obtained for the purpose of examining microcracks in relation to the production of natural gas. The problems of sample preparation for fissile shale were largely solved. Samples from the NTS were prepared for the examination of microcracks in relation to possible disposal sites for radioactive waste. DOE

N80-25714# California Univ., Livermore. Lawrence Livermore Lab.

DYNAMIC, INELASTIC BUCKLING ANALYSIS OF MARK 1 TORUS SUPPORT COLUMNS

Brian J. Benda Sep. 1979 62 p refs
(Contracts W-7405-eng-48; NRC-FIN-A-0213)
(NUREG-CR-1038; UCRL-52723) Avail: NTIS HC A04/MF A01

Columns that support the Mark I BWR containment tori are subjected to short-duration dynamic loads during some accident conditions. To accurately predict the actual response under these conditions, an analysis must incorporate the dynamic behavior of the columns. Two different analysis methods were used in an effort to solve this dynamic, inelastic buckling problem. Neither method adequately solved the problem. The finite element approach gave unstable results for short-duration dynamic load pulses. The finite difference approach did not incorporate the plasticity effects needed to accurately predict column response. Results that were obtained, however, indicated that little additional load capacity could be realized for the combinations of dynamic and static loads, and for the column configurations considered. The results presented indicate that design modifications will be required either to reduce the magnitude of the dynamic load or to increase the strength of the torus support columns. DOE

N80-25715# Laboratoire Central des Ponts et Chaussees, Paris (France). Service de Physique.

THE APPLICATION OF HOLOGRAPHY TO STRESS ANALYSIS

J.-M. Caussignac Oct. 1978 70 p refs In FRENCH; ENGLISH summary
(LPC-84) Avail: NTIS HC A04/MF A01

A synthesis of stress analysis results obtained with holo-

graphic interferometry is presented. The nondestructive tests were performed on scale models of civil engineering structures such as highway bridges and pavement. The holographic method is explained and the quantitative results are presented.
Author (ESA)

N80-25716# Laboratoire Central des Ponts et Chaussees, Paris (France). Dept. des Betons et Metaux.
STABILITY, TOUGHNESS, AND CRACK PROPAGATION IN STEEL WIRES AND BARS Ph.D. Thesis - Paris VI Univ.
A. Athanassiadis Sep. 1979 84 p refs In FRENCH; ENGLISH summary
(LPC-89) Avail: NTIS HC A05/MF A01

The calculation of the fracture parameters of a plane defect (transverse surface crack) for a given stress, when the specimen sustains a tension, a pure bending, or a uniform lateral loading is presented. Steel is assumed to be an elastic medium for which the stress intensity factor K sub I varies along the crack front. For several forms and sizes of cracks, the parameters K sub I and G were calculated by means of a tridimensional program based on the boundary integral equations method. For determining the two fracture parameters, two approaches were made using either displacements or potential energy followed by a check of the consistency of the two methods. The K sub I variation along the crack front versus its geometry and the most probable progressive evolution of the defect, and the energy release rate variation versus its geometry, to determine the critical defects and the stability of existing defects in front of brittle fracture, were also calculated.
Author (ESA)

N80-25717# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.
LINEAR-ELASTIC AND ELASTIC-PLASTIC FRACTURE MECHANICS OF STRUCTURAL MATERIALS Thesis - Karlsruhe Univ.
Dietrich Munz Jul. 1979 250 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-649)
(DFVLR-FB-79-31; ESA-TT-649) Avail: NTIS HC A11/MF A01; DFVLR, Cologne DM 36.70

Methods used to describe linear elastic and elastic-plastic fracture mechanics are summarized. Results of measurements on aluminum and titanium alloys, and steels are used to discuss problems relating to the measurement, assessment, and range of application of the various characteristic parameters. It is shown that the applicability of linear elastic fracture mechanics is larger than was previously assumed. The J-integral method is emphasized.
Author (ESA)

N80-25718# European Space Agency, Paris (France).
MECHANICAL MODELING OF MICROSTRUCTURAL INSTABILITIES IN CYCLIC VISCOPLASTICITY AT VARIABLE TEMPERATURES Ph.D Thesis
Georges Cailletaud Mar. 1980 111 p refs Transl. into ENGLISH of "Modelisation Mecanique d'Instabilites Microstructurales en Viscoplasticite Cyclique a Temperature Variable", Rept. ONERA-NT-1979-6 ONERA, Paris, 1979 Original report in FRENCH previously announced as N80-23445
(ESA-TT-611; ONERA-NT-1979-6) Avail: NTIS HC A06/MF A01

Constitutive equations, in the framework of thermodynamics with internal variables, using phenomenological observations, are proposed and identified by tests involving isolated temperature changes. The model is successfully compared with simple tests and is used to predict the behavior of the material under study when simultaneously subjected to mechanical and thermal cycling.
Author (ESA)

N80-25719*# New Mexico Univ., Albuquerque. Technology Application Center.
FATIGUE TESTING MACHINES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Jan. 1980
Peter Moore Feb. 1980 36 p Sponsored by NASA and NTIS
(NASA-CR-162943; PB80-804057) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Fifty-one abstracts from the international literature relate to the design, operation, and performance of fatigue testing machinery, including control systems, components, and diagnostic equipment. Application to metals, alloys, composites, and polymers under conditions varying from cryogenic to high temperature, and vacuum to greater than 1000 MPA is described. Types of fatigue investigated include those due to thermal and corrosion stresses, as well as stresses arising from fretting, flexure, and impact.
GRA

N80-25490# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CYCLIC PLASTIC DEFORMATION FOLLOWER
Georges Baudin *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-5 (ESA-TT-613) 1979 p 75-76 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 341-343 Original report in FRENCH previously announced as A80-12358 (For primary document see N80-25485 16-31)
Avail: NTIS HC A05/MF A01

N80-25491# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HARMONIC EXCITATION OF MECHANICAL SYSTEMS AT HIGH FREQUENCIES AND LARGE ACCELERATORS
Henri Loiseau *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979 1979-5 (ESA-TT-613) 1979 p 79-84 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 345-348 Original report in FRENCH previously announced as A80-12359 (For primary document see N80-25485 16-31)
Avail: NTIS HC A05/MF A01

N80-26259# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VARIATIONAL FORMULATION OF THE PLATE EQUILIBRIUM PROBLEM. APPLICATION TO ISOPARAMETRIC FINITE ELEMENTS OF PLATES, PART 1
Daniel Osmont and Raoul Girard *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-6 (ESA-TT-632) 1979 p 55-67 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-6, Nov. - Dec. 1979 p 387-394 Original report in FRENCH previously announced as A80-19991 (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N80-25720 International Institute for Applied Systems Analysis, Laxenburg (Austria).
HYDROLOGICAL AND ECOLOGICAL MODELS OF SHALLOW LAKES AND RESERVOIRS
Sven E. Joergenson, ed. (Roy. Dan. School of Pharm.) Oct. 1979 170 p refs Presented at IIASA Workshop, Laxenburg, Austria, 11-14 Apr. 1978
(IIASA-CP-78-14) Copyright. Avail: Issuing Activity

Twelve papers covering various aspects of modeling hydrophysical and ecological characteristics of shallow bodies of water are presented. Among different model types, stoichiometric models are compared to element cycle ones. The ecosystem and eutrophication models are shown to be of special interest. The role of phosphorus controlled chemical reactions in shallow water

and sediments is discussed. Ecological variables, such as algae, phytoplankton, and fish populations, affecting water quality are emphasized. Mathematical as well as data collection and processing problems are also considered. For individual titles, see N80-25721 through N80-25732.

N80-25721 International Institute for Applied Systems Analysis, Laxenburg (Austria).
DISCUSSION OF QUESTIONS RELATED TO HYDROPHYSICAL AND ECOLOGICAL MODELING OF SHALLOW LAKES AND RESERVOIRS
G. vanStraten *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs Oct. 1979 p 5-45 refs (For primary document see N80-25720 16-43)
Copyright. Avail: Issuing Activity

Problems encountered in the mathematical modeling of ecosystems based on shallow lakes and reservoirs are discussed. Element cycle models are shown to be better than constant stoichiometric models, especially when leading to a eutrophication model. In the description of nutrient uptake rates, it is necessary to include phytoplankton, algae, and fishes. Blue green algal bloom is of special importance. The selection of the necessary number of state variables is considered. Conditions necessary to modeling the hydrodynamics of lake circulation (equations of motion, wind stress, eddy diffusivity, Coriolis effects) are also considered. Author (ESA)

N80-25722 International Institute for Applied Systems Analysis, Laxenburg (Austria).
THE ROLE OF IRON AND CALCIUM IN THE CYCLING OF PHOSPHATES IN SHALLOW LAKES
L. Lijklema and A. H. M. Hieltjes *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs Oct. 1979 p 49-58 refs (For primary document see N80-25720 16-43)
Copyright. Avail: Issuing Activity

The cycling of phosphates between sediments and overlying water is discussed in relation to the overall process of eutrophication. The role of inorganic phosphates, particularly iron and calcium compounds is emphasized. Some of the main connections between primary productivity and associated decay processes, as well as the transformation and transport of phosphates, are illustrated. Results point to phosphates as a key element in determining water quality from the interrelation between physical, chemical, and biological processes in surface waters. Author (ESA)

N80-25723 International Institute for Applied Systems Analysis, Laxenburg (Austria).
THE PREDICTION OF SOLUTIONS TO MANAGEMENT AND ENGINEERING PROBLEMS RELATED TO THE EUTROPHICATION OF BODIES OF WATER
V. A. Vavilin, V. B. Vasilyev, M. Y. Tsitkin, and S. V. Bagotskii *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs Oct. 1979 p 59-64 refs (For primary document see N80-25720 16-43)
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The eutrophication of bodies of water is a typical example of a long term process that requires predictive estimation. Various natural conditions contribute to the sharp changes that occur in aquatic ecosystems. These conditions are the duration of the warm summer season, the illumination and shallowness of the water (having a warming effect), little circulation of the water, and the lack of a restraining influence from other factors on algal and biotic production processes. Two groups of dynamic models for predicting the eutrophication rates in waste disposal ponds are discussed. These are small models considering a small number of internal links and external impacts, and large models with a considerable number of variables, internal links, and external impacts. Author (ESA)

N80-25724 International Institute for Applied Systems Analysis, Laxenburg (Austria).
TWO EXAMPLES OF THE USE OF HYDRODYNAMIC MODELS IN ECOLOGICAL STUDIES
J. F. Paul *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs Oct. 1979 p 65-78 refs (For primary document see N80-25720 16-43)
Copyright. Avail: Issuing Activity

To demonstrate the use of hydrodynamic models in ecological studies, two extremes cases are described. In the first case, the solution of the complete three dimensional hydrodynamic equations is required in order to describe the current pattern adequately. In the second, no equations need be solved in order to describe the pertinent processes. These two examples illustrate that the degree of hydrodynamic detail is dependent upon the particular problem under investigation. The first example involves a study to determine the vulnerability of yellow perch larvae, spawned at different locations in western Lake Erie, to possible entrainment at the water intake from the Detroit Edison Monroe power station. The second, which does not require a solution of the hydrodynamic equations, is an investigation into the occurrence of taste and odor problems in the water supply at the Saginaw-Midland water intake station at Whitestone point on Saginaw Bay, Lake Huron. Author (ESA)

N80-25725 International Institute for Applied Systems Analysis, Laxenburg (Austria).
THE MODELING OF AQUATIC ECOSYSTEMS OF SHALLOW LAKES EXCHANGING MATTER WITH SEDIMENT AND WITH NEIGHBORING BODIES OF WATER
P. Mauerberger *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs Oct. 1979 p 79-90 refs (For primary document see N80-25720 16-43)
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Seventeen chemical and biological components can be considered by this cascade model which has an arbitrary number of horizontally arranged compartments. The model represents the energy fluxes in the ecosystem, stoichiometric cycling of the nutrients phosphorus and nitrogen, horizontal inflows and outflows of chemical and biological components into/out of the segments, vertical exchange of nutrients and particulate organic matter between sediment and water, solar radiation, water temperature, wind and external loadings by nutrients and organic matter. Oxygen saturation of the whole water body is used. The influence on the model of fish and benthic components, time lag between the release of nutrients by organisms and the subsequent reuse by primary producers, and calculations of the hydrodynamic transport processes by a separate simple model are shown as well. The model is verified using data obtained along the Baltic Sea coast as well as data from the Grosser Mueggelsee, Germany. Author (ESA)

N80-25726 International Institute for Applied Systems Analysis, Laxenburg (Austria).
DEVELOPMENT AND VERIFICATION OF A MODEL FOR PREDICTING EUTROPHICATION TRENDS IN CZECHOSLOVAKIA
M. Straskraba *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs Oct. 1979 p 91-96 refs (For primary document see N80-25720 16-43)
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Some theoretically sound and empirically verified relationships relevant to eutrophication problems are examined using an ecological simulation model. A shallow lake is defined as a lake with no permanent temperature stratification. According to an empirical relationship observed for different sets of temperature lakes, the mixing depth is related to the surface dimensions of the lake as characterized by the maximum length, effective length, or, more precisely, the fetch size. The empirical relationships imply that a lake with a maximum depth of a few meters will be deep if small, whereas a large lake with a depth of 220 meters will be shallow. In order to compare model runs with observed trends an automatic program was used on a Hewlett-Packard 9810 calculator and on a IBM 370 computer, each time for one year simulations. Results show that the increase in mixing depth as the dimensions of the lake increase causes a hyperbolic decrease in the photosynthesis activity of plankton, and consequently of the chlorophyll concentration. Author (ESA)

N80-25727 International Institute for Applied Systems Analysis, Laxenburg (Austria).
THE MODELING OF NUTRIENT EXCHANGE BETWEEN SEDIMENT AND WATER
G. Jolankai *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs Oct. 1979 p 97-99 ref (For primary document see N80-25720 16-43)
Copyright. Avail: Issuing Activity

An aquatic ecosystem (eutrophication) model which represents nutrient uptake rates in the form of a time series is described. Data show that in shallow lakes this nutrient exchange process between the sediment and water is a time-varying phenomenon, or rather, it varies according to meteorological factors, such as wind velocity and wind induced fluid motion. The bottom sediment is stirred up occasionally by intensive wind and wave action, which causes the sediment particles and the adsorbed nutrients to be entrained, and which allows dissolved interstitial nutrients to enter the water. The limiting effects on eutrophication of water pollution, as well as their modeling, are also covered.
Author (ESA)

N80-25728 International Institute for Applied Systems Analysis, Laxenburg (Austria).
SIMULATION MODEL OF AN OLIGOTROPHIC LAKE
J. M. Svirezhev, N. K. Luckyanov, and D. O. Logofet. *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs. Oct. 1979. p 100-106. (For primary document see N80-25720 16-43)
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A set of computer runs was made to test a model of an oligotrophic lake having a given, limited amount of nutrients. The initial values of the living components were obtained from a study of Lake Onega while the dynamic behavior of ecosystem components was investigated at a constant temperature. The simulated dynamics of algae, zooplankton, and bacterioplankton are shown. The dynamics of the main biological components at a temperature of 15 C are given. The results of the runs appear to give a qualitatively correct representation of the main ecological processes occuring in the oligotrophic lake. Author (ESA)

N80-25729 International Institute for Applied Systems Analysis, Laxenburg (Austria).
EVALUATION OF AVAILABLE PHOSPHORUS MODELS
M. W. Lorenzen and F. M. Haydock. *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs. Oct. 1979. p 107-129. refs. (For primary document see N80-25720 16-43)
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The available models that can be used to analyze the effectiveness of possible options for controlling phosphorus loading are evaluated. Methods to compute phosphorus loading rates are reviewed. Land use loading rates and the data base created as part of the National Eutrophication Survey are discussed. Available lake response models for phosphorus are then considered. Three groups of models are studied: one box/one parameter, two box/one parameter, and two box/two parameter. It is shown that the selection of the specific procedures to be used as part of the evaluation of the impact of phosphorus control options is constrained by a number of factors. The large number of lakes to be used as a data base requires a relatively simple approach. The time scale of interest requires a method that can be applied to predict years into the future. The type of control options and specific effects on loading rates requires a tool that considers the direct result of the control. Author (ESA)

N80-25730 International Institute for Applied Systems Analysis, Laxenburg (Austria).
THEORETICAL INVESTIGATIONS INTO THE DEVELOPMENT OF AN INTENSIVELY USED SHALLOW LAKE WITH A RIVER FLOWING INTO IT
K. Bauer. *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs. Oct. 1979. p 130-136. refs. (For primary document see N80-25720 16-43)
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By using correlation theory, which forms part of stochastic processes theory, to evaluate available data, some interesting effects related to the evolution of a shallow lake ecosystem are shown. The shallow lake considered is the Grosser Mueggelsee, which forms a part of the water system subordinated to the management district of the capital of the GDR, Berlin. Although daily and weekly data of ecosystem components and chemical pollutants have been measured over a period of 32 years, changes in the composition of phytoplankton species were not considered. Results show, for all components of the ecosystem, low frequency one year variations. For longer time series of the variables water temperature, oxygen, suspended matter, chloride, chemical oxygen demand, and carbonate hardness an assessment is made on the basis of monthly means taken during the period from 1945 to 1977. Results are cited in support of recommendations for improving water quality. Author (ESA)

N80-25731 International Institute for Applied Systems Analysis, Laxenburg (Austria).
EUTROPHICATION MODELING EFFORTS FOR LAKE BALATON
P. Csaki, J. Fischer, L. Hajdu, and G. Jolankai. *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs. Oct. 1979. p 137-149. refs. (For primary document see N80-25720 16-43)
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Problems encountered in constructing an ecosystem and hydrology model of Lake Balaton are discussed. The model, intended for use as a control tool in water management, must describe the eutrophication process with reasonable accuracy, allow an identification of nutrient inputs and nonpoint pollution sources, and work within the constraints of available data bases. After an examination of these modeling criteria, the principal modeling problem is summarized as that of selecting one appropriate approach from the many that are available.
Author (ESA)

N80-25732 International Institute for Applied Systems Analysis, Laxenburg (Austria).
USE OF CHLOROPHYLL/SECCHI DISK RELATIONSHIPS
M. W. Lorenzen. *In its* Hydrol. and Ecol. Models of Shallow Lakes and Reservoirs. Oct. 1979. p 150-153. refs. (For primary document see N80-25720 16-43)
Copyright. Avail: Issuing Activity

For high concentrations of phytoplankton, reductions in their concentration produce little change in transparency. However, the implication that for low phytoplankton concentrations changes in their concentration would produce large changes in transparency is not necessarily true. A regression equation for obtaining chlorophyll-a Secchi Disk depth values is given. Next, a theoretical analysis illustrating the importance of the extinction coefficient for factors other than algae is presented. Results show that the use of observed data for chlorophyll-a Secchi Disk obtained from lakes other than the one under study can give misleading projections. It is suggested that the value of the extinction coefficient should be obtained for the lake being studied. An analysis to estimate the effects of changed chlorophyll on transparency is then more likely valid. Author (ESA)

N80-25733*# Geological Survey, Denver, Colo.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE. Progress Report, Dec. 1979 - Feb. 1980
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson. Feb. 1980. 3 p. Sponsored by NASA HCMM.
(E80-10151; NASA-CR-163168) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-25734*# California Univ., Berkeley. Space Sciences Lab.
REMOTE SENSING ANALYSIS OF WATER QUALITY AND THE ENTRAPMENT ZONE IN THE SAN FRANCISCO BAY AND DELTA. Final Report, 15 Mar. 1978 - 14 Aug. 1979
Robert N. Colwell, Allen W. Knight, Principal Investigators, and Siamak Khorram. 14 Aug. 1979. 40 p. refs. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS.
(Grant NeG-5256)
(E80-10152; NASA-CR-163169; SSL-Ser-20-Issue-42) Avail: NTIS HC A03/MF A01 CSCL 13B
The author has identified the following significant results. Data from an ocean color scanner flown on a U-2 aircraft at 65,000 ft and from LANDSAT MSS were enhanced to identify biologically active areas of San Francisco Bay, and to determine the salinity, turbidity, chlorophylls, and suspended solids. The best fit regression models for mapping water quality parameters were based on bands 3, 5, 7, and 10. Comparision of the results indicate that chlorophyll concentrations can best be estimated by the OCS or MSS data. Salinity can best be estimated by OCS data; turbidity can best be estimated by LANDSAT data.

Neither OCS nor MSS data provide reliable basis for estimating suspended solids. Aerial photography of the highest quality taken with either conventional color or infrared-sensitive color films was unable to locate the biologically active areas.

N80-25735*# Mississippi State Univ., Mississippi State.
APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 Nov. 1979 - 30 Apr. 1980
W. Frank Miller, Bradley D. Carter, Nancy Freeman, Jimmy L. Solomon, and Sidney G. Williams, Principal Investigators 1 May 1980 133 p refs ERTS
(Grant NGL-25-001-054)
(E80-10153; NASA-CR-163170; SAPR-13) Avail: NTIS HC A07/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-25736*# Telespazio, S.p.A., Rome (Italy).
AN AUTOMATIC CLASSIFICATION METHOD FOR LANDSAT DATA AS RESULTING FROM DIFFERENT EXPERIENCES IN THE ITALIAN ENVIRONMENT
Angelo Zandonella, Principal Investigator 1979 15 p refs Presented at the 2nd Congr. Nazl. sul Telerilevamento delle Risorse Terrestri, Varenna, Italy, 1979 Sponsored by NASA ERTS
(E80-10160; NASA-CR-163176) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-25737*# Columbia Univ., New York. Dept. of Geography.
APPLICATION OF DIGITAL ANALYSIS OF MSS DATA TO AGRO-ENVIRONMENTAL STUDIES Final Report
Robert A. Lewis and Samuel N. Goward, Principal Investigators 1 Mar. 1980 14 p ERTS
(Grant NsG-5080)
(E80-10161; NASA-CR-163178) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-25738*# Stanford Univ., Calif. Dept. of Geology.
HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA
Ernest I. Rich, Principal Investigator 21 Apr. 1980 2 p HCMM
(Contract NAS5-24479)
(E80-10163; NASA-CR-163180) Avail: NTIS HC A02/MF A01 CSCL 08M
The author has identified the following significant results. Empirical observations on the ground and examination of aerial color IR photographs indicate that in grassland terrain, the vegetation overlying sandstone tends to become less vigorous sooner in the late spring season than does the area overlain by an adjacent shale unit. The reverse relationship obtains in the fall. These relationships are thought to be a reflection of the relative porosity of each of the units and hence of their ability to retain or lose soil moisture. A comparison of the optically enlarged day and nite IR imagery of the Late Mesozoic interbedded sandstone and shale units along the western margin of the Sacramento Valley, California, taken at seasonally critical times of the year (late spring/early summer and late fall/early winter) reveals subtle seasonal variations of graytone which tend to support the empirical observations after consideration of Sun angle and azimuth, and the internal consistency of the data on each set of satellite imagery.

N80-25739*# Bern Univ. (Switzerland). Dept. of Geography.
TOPOCLIMATOLOGICAL AND SNOWHYDROLOGICAL SURVEY OF SWITZERLAND Progress Report
Matthias Winiger, Principal Investigator Apr. 1980 6 p Sponsored by NASA HCMM
(E80-10164; NASA-CR-163181; PR-2) Avail: NTIS HC A02/MF A01 CSCL 08L
The author has identified the following significant results. Low temperature zones depend on the topography and the terrain coverage type (besides the meteorological situation). The usual pattern of cold zones at the bottom of the valleys, warmer belts along the valley slopes, and cold mountain tops is modified by the terrain coverage type. Rural and forested areas normally have different surface temperatures, but along a vertical profile the temperature decrease (or increase) is often of the same order of magnitude. Because there is also a close correlation between the topography and terrain coverage (high percentage of forested areas at the valley slopes up to the timber line, much less along the valley floors), the surface temperature of the warm slope zone is increased compared to a valley profile with uniform coverage.

N80-25740*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATION OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report, 1 Dec. 1979 - 31 May 1980
Toby N. Carlson, Principal Investigator 1 Dec. 1979 4 p HCMM
(Contract NAS5-24264)
(E80-10165; NASA-CR-163182; QR-8) Avail: NTIS HC A02/MF A01 CSCL 13B
There are no author-identified significant results in this report.

N80-25741*# Canada Centre for Remote Sensing, Ottawa (Ontario).
HCMM: SOIL MOISTURE EXPERIMENT Progress Report
Josef Cihlar, Principal Investigator 30 Apr. 1980 4 p Sponsored by NASA HCMM
(E80-10166; NASA-CR-163183) Avail: NTIS HC A02/MF A01 CSCL 08M
There are no author-identified significant results in this report.

N80-25742*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
OPERATIONAL APPLICATIONS OF SATELLITE SNOW-COVER OBSERVATIONS
Albert Rango, ed. and Ralph Peterson, ed. (GE, Beltsville, Md.) May 1980 294 p refs Workshop held at Sparks, Nev., 16-17 Apr. 1979; sponsored in part by Nevada Univ. Original contains imagery. Original photography may be purchased form the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10167; NASA-CP-2116) Avail: NTIS HC A13/MF A01 CSCL 08L
The history of remote sensing of snow cover is reviewed and the following topics are covered: various techniques for interpreting LANDSAT and NOAA satellite data; the status of future systems for continuing snow hydrology applications; the use of snow cover observations in streamflow forecasts by Applications Systems Verification and Transfer participants and selected foreign investigators; and the benefits of using satellite snow cover data in runoff prediction. For individual titles, see N80-25743 through N80-25759.

N80-25743*# Environmental Research and Technology, Inc., Concord, Mass.
THE EVOLUTION OF SATELLITE SNOW MAPPING WITH EMPHASIS ON THE USE OF LANDSAT IN THE SNOW ASUT STUDY AREAS
James C. Barnes and Clinton J. Bowley, Principal Investigators *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 1-19 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L
There are no author-identified significant results in this report.

N80-25744*# National Environmental Satellite Service, Washington, D. C.
THE NOAA/NESS PROGRAM FOR OPERATIONAL SNOW-COVER MAPPING: PREPARING FOR THE 1980'S
Stanley R. Schneider, Principal Investigator *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 21-39 refs Original contains imagery. Original photography may be purchased from the EROS

Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-25745*# National Environmental Satellite Service, Washington, D. C.
NEW GOALS FOR SNOW MONITORING BY SATELLITE
D. R. Wiesnet, Principal Investigator *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 41-51 refs ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-25746*# Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineering Lab.
MAPPING NEW ZEALAND AND ANTARCTIC SNOWPACK FROM LANDSAT
I. L. Thomas, T. D. Prowse (Canterbury Univ.), and I. F. Owens, Principal Investigators (Canterbury Univ.) *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 53-72 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-25747*# Zurich Univ. (Switzerland). Dept. of Geography.
DIGITAL MAPPING OF MOUNTAIN SNOWCOVER UNDER EUROPEAN CONDITIONS
Harold Haefner, Principal Investigator *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 73-91 refs Original contains imagery. Orginal photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. A method for monitoring the snow cover in high mountain terrain such as the Swiss Alps includes the rapid classification of multitemporal data for small watersheds with very high accuracy. In addition to LANDSAT channels 4,5,6 and 7 an artificial channel was created containing the average altitude information of each pixel and allowing a subdivision of the watershed in accordance to the requirements of the runoff model. Even in very small watersheds of about 40 sq km the results achieved from LANDSAT data are at least as accurate as the ones gained from measurements of orthophotographs.

N80-25748*# IBM Norway, Oslo.
APPLICATION OF SATELLITE DATA FOR SNOW MAPPING IN NORWAY
H. A. Odegaard, T. Andersen (Norwegian Water Resources and Elec. Board, Oslo), and G. Ostrem, Principal Investigators (Norwegian Water Resources and Elec. Board, Oslo) *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 93-106 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. A close quantitative relationship was found between snow covered areas and subsequent runoff for different parts of the country despite climate differences. Digital LANDSAT data can be used for areas down to approximately 10 sq km to 20 sq km for accurate measurement of snow cover extent. On large watersheds (more than 500 sq km), digital NOAA/TIROS imagery can be used for snow mapping if the area/runoff relationship is determined by using observations from previous years.

N80-25749*# Geological Survey, Phoenix, Ariz.
SATELLITE SNOWCOVER AND RUNOFF MONITORING IN CENTRAL ARIZONA
Herbert H. Schumann, Edib Kirdar (Salt River Project), and William L. Warskow, Principal Investigators (Salt River Project) *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 107-126 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. Although the very high resolution experimental LANDSAT imagery permits rapid snow cover mapping at low cost, only one observation is available very 9 days. In contrast, low resolution operational imagery acquired by the ITOS and SMS/GOES satellites provide the daily synoptic observations necessary to monitor the rapid changes in snow covered areas in the entire Salt-Verde watershed. Geometric distortions in meteorological satellite imagery require specialized optical equipment or digital image processing for snow cover mapping.

N80-25750*# Bonneville Power Administration, Portland, Oreg.
USE OF SATELLITE DATA IN RUNOFF FORECASTING IN THE HEAVILY FORESTED, CLOUD-COVERED PACIFIC NORTHWEST
John P. Dillard and Charles F. Orwig, Principal Investigators (Natl. Weather Serv., Portland, Oreg.) *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 127-150 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. Satellite-derived snow cover data improves forecasts of stream flow but not at a statistically significant amount and should not be used exclusively because of persistent cloud cover. Based upon reconstruction runs, satellite data can be used to augment snow-flight data in the Upper Snake, Boise, Dworshak, and Hungry Horse basins. Satellite data does not compare well with aerial snow-flight data in the Libby basin.

N80-25751*# Soil Conservation Service, Denver, Colo.
LANDSAT DERIVED SNOWCOVER AS AN INPUT VARIABLE FOR SNOWMELT RUNOFF FORECASTING IN SOUTH CENTRAL COLORADO
B. A. Shafer and C. F. Leaf, Principal Investigators *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 151-169 refs ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-25752*# Colorado Div. of Water Resources, Denver.
A GRAPHICAL METHOD OF STREAM RUNOFF PREDICTION FROM LANDSAT DERIVED SNOWCOVER DATA FOR WATERSHEDS IN THE UPPER RIO GRANDE BASIN OF COLORADO
George F. Moravec and Jeris A. Danielson, Principal Investigators *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 171-183 refs ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-25753*# California State Dept. of Water Resources, Sacramento.
APPLICATION OF SNOWCOVERED AREA TO RUNOFF FORECASTING IN SELECTED BASINS OF THE SIERRA NEVADA, CALIFORNIA
A. J. Brown and J. F. Hannaford, Principal Investigators (Sierra Hydrotech) *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 185-200 refs ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. Direct overlay onto 1:1,000,000 prints takes about one third the time of 1:500,000 zone transfer scope analysis using transparencies, but the consistency of the transparencies reduce the time for data analysis. LANDSAT data received on transparencies is better and more easily interpreted than the near real-time data from Quick Look, or imagery from other sources such as NOAA. The greatest potential for water supply forecasting is probably in improving forecast accuracy and in expanding forecast services during the period of snowmelt. Problems of transient snow line and uncertainties in future weather are the main reasons that snow cover area appears to offer little in water supply forecast accuracy improvement during the peroid snowpack accumulation.

N80-25754*# Sierra Hydrotech, Placerville, Calif.
APPLICATION OF SATELLITE IMAGERY TO HYDROLOGIC MODELING SNOWMELT RUNOFF IN THE SOUTHERN SIERRA NEVADA
J. F. Hannaford and R. L. Hall, Principal Investigators *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 201-222 refs ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-25755*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISCHARGE FORECASTS IN MOUNTAIN BASINS BASED ON SATELLITE SNOW COVER MAPPING
J. Martinec (Federal Inst. for Snow and Avalanche Res., Davos, Switzerland) and Albert Rango, Principal Investigators *In its* Operational Appl. of Satellite Snowcover Observations May 1980 p 223-238 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57189 ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. A snow runoff model developed for European mountain basins was used with LANDSAT imagery and air temperature data to simulate runoff in the Rocky Mountains under conditions of large elevation range and moderate cloud cover (cloud cover of 40% or less during LANDSAT passes 70% of the time during a snowmelt season). Favorable results were obtained for basins with area not exceeding serval hundred square kilometers and with a significant component of subsurface runoff.

N80-25756*# Ecosystems International, Inc., Gambrills, Md.
COST/BENEFIT ANALYSIS FOR THE OPERATIONAL APPLICATIONS OF SATELLITE SNOWCOVER OBSERVATIONS (OASSO)
Peter A. Castruccio, Harry L. Loats, Jr., Donald Lloyd, and Pixie A. B. Newman, Principal Investigators *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 239-254 refs ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. The total cost associated with satellite snow cover area measurement (SATSCAM) in the Colorado ASVT was $2,050 which equates to 0.22/sq km. When extrapolated to the 2,238,890 km area impacted by snow-survey forecasting in the Western United States, the total yearly cost of employing SATSCAM is approximately $493k. The estimated total benefits to hydroeletric energy production is $10m yearly, with the Pacific Northwest receiving the smallest benefits, and the Rio Grande region the highest. Irrigated agriculture receives a yearly total benefit of $38m, with the Lower Colorado region receiving the largest per acre benefit and the Pacific Northwest receiving the lowest.

N80-25757*# National Environmental Satellite Service, Washington, D. C.
SNOW EXTENT MEASUREMENTS FROM GEOSTATIONARY SATELLITES USING AN INTERACTIVE COMPUTER SYSTEM
R. S. Gird, Principal Investigator *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 255-265 refs ERTS (For primary document see N80-25742 16-43)
(Contract NAS5-21798)
Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. A time series of GOES full resolution visible image sectors was viewed on the McIDAS video component in chronological order and registered to within plus or minus 1 image pixel to compute real time snow melting rates. Synoptic scale clouds were eliminated to create a snow covered area from a composite image. Results show good agreement with NESS products although a significant difference was noted for one two-day period when the NESS products showed an increase in the snow cover for the Verde Basin, while the GOES/McIDAS product implied no change in the snow cover for approximately the same period. A check of NWS radar reports indicated no precipitation had occurred within the Verde basin. The use of the registered image sequence eliminates instrument error since small changes in the snow cover between any two days are easily detected.

N80-25758*# National Environmental Satellite Service, Washington, D. C.
AN ALL-DIGITAL APPROACH TO SNOW MAPPING USING GEOSTATIONARY SATELLITE DATA
J. D. Tarpley, Stanley B. Schneider, Principal Investigators, Edwin J. Danaher, and Gordon I. Myers *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 267-279 refs Original contains imagery. Original photography may be purchased form the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-25759*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A REVIEW OF LANDSAT-D AND OTHER ADVANCED SYSTEMS RELATIVE TO IMPROVING THE UTILITY OF SPACE DATA IN WATER-RESOURCES MANAGEMENT
V. V. Salomonson and D. K. Hall, Principal Investigators *In its* Operational Appl. of Satellite Snowcover Observation May 1980 p 281-296 refs ERTS (For primary document see N80-25742 16-43)
Avail: NTIS HC A13/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-25760*# North Carolina State Univ. at Raleigh. Dept. of Electrical Engineering.
PATTERN CLASSIFICATION USING CHARGE TRANSFER DEVICES Final Report
16 Jun. 1980 138 p refs
(Grant NsG-1535)
(NASA-CR-163237) Avail: NTIS HC A07/MF A01 CSCL 14E

The feasibility of using charge transfer devices in the classification of multispectral imagery was investigated by evaluating particular devices to determine their suitability in matrix multiplication subsystem of a pattern classifier and by designing a protype of such a system. Particular attention was given to analog-analog correlator devices which consist of two tapped delay lines, chip multipliers, and a summed output. The design for the classifier and a printed circuit layout for the analog boards were completed and the boards were fabricated. A test j g for the board was built and checkout was begun. Author

N80-25761*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ALBEDO OF SNOW FOR PARTIALLY CLOUDY SKIES
B. J. Choudhury and A. T. C. Chang Apr. 1980 36 p refs Submitted for publication
(NASA-TM-80649) Avail: NTIS HC A03/MF A01 CSCL 08L

The input parameters of the model are atmospheric precipitable water, ozone content, turbidity, cloud optical thickness, size

and shape of ice crystal of snow and surface pressure. The model outputs spectral and integrated solar flux snow reflectance as a function of solar elevation and fractional cloudcover. The model is illustrated using representative parameters for the Antarctic coastal regions. The albedo for a clear sky depends inversely on the solar elevation. At high elevation the albedo depends primarily upon the grain size; at low elevation this dependence is on grain size and shape. The gradient of the albedo-elevation curve increases as the grains get larger and faceted. The albedo for a dense overcast is a few percent higher than the clear sky albedo at high elevations. A simple relation between the grain size and the overcast albedo is obtained. For a set of grain size and shape, the albedo matrices (the albedo as a function of solar elevation and fractional cloudcover) are tabulated. A.R.H.

N80-25762*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ALTERNATE ALGORITHM FOR CORRECTION OF THE SCANNING MULTICHANNEL MICROWAVE RADIOMETER POLARIZATION RADIANCES USING NIMBUS-7 OBSERVED DATA
Per Gloersen, D. J. Cavalieri, and Harold V. Soule (OAO Corp., Beltsville, Md.) Apr. 1980 27 p refs Submitted for publication
(NASA-TM-80672) Avail: NTIS HC A03/MF A01 CSCL 14B

The manner in which Nimbus-7 scanning multichannel microwave radiometer (SMMR) scan radiance data was used to determine its operational characteristics is described. The predicted SMMR scan radiance was found to be in disagreement at all wavelengths with a large area of average measured ocean radiances. A modified model incorporating a different phase shift for each of the SMMR horizontal and vertical polarization channels was developed and found to provide good data correlation. Additional study is required to determine the validity and accuracy of this model. A.R.H.

N80-25763*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OVERSEAS TRIP REPORT, CV 990 UNDERFLIGHT MISSION
P. Gloersen, J. Crawford, and L. Hardis (OAO Corp., Beltsville, Md.) Mar. 1980 95 p refs
(NASA-TM-80662) Avail: NTIS HC A05/MF A01 CSCL 08L

The scanning microwave radiometer-7 simulator, the ocean temperature scanner, and an imaging scatterometer/altimeter operating at 14 GHz were carried onboard the NASA CV-990 over open oceans, sea ice, and continental ice sheets to gather surface truth information. Data flights were conducted over the Norwegian Sea to map the ocean polar front south and west of Bear Island and to transect several Nimbus-7 footprints in a rectangular pattern parallel to the northern shoreline of Norway. Additional flights were conducted to obtain correlative data on the cryosphere parameters and characteristics of the Greenland ice sheet, and study the frozen lakes near Barrow. The weather conditions and flight path way points for each of the nineteen flights are presented in tables and maps. A.R.H.

N80-25764*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ECONOMIC BASELINES FOR CURRENT UNDERGROUND COAL MINING TECHNOLOGY Final Report
William B. Mabe 15 Dec. 1979 65 p refs
(Contracts NAS7-100; ET-75-1-01-9036)
(NASA-CR-163259; JPL-Pub-79-122) Avail: NTIS HC A04/MF A01 CSCL 08I

The cost of mining coal using a room pillar mining method with continuous miner and a longwall mining system was calculated. Costs were calculated for the years 1975 and 2000 time periods and are to be used as economic standards against which advanced mining concepts and systems will be compared. Some assumptions were changed and some internal model stored data was altered from the original calculations procedure chosen, to obtain a result that more closely represented what was considered to be a standard mine. Coal seam thicknesses were varied from one and one-half feet to eight feet to obtain the cost of mining coal over a wide range. Geologic conditions were selected that had a minimum impact on the mining productivity. E.D.K.

N80-25765# Colorado State Univ., Fort Collins. Dept. of Earth Resources.
APPLICATIONS OF REMOTE SENSING TO EMERGENCY MANAGEMENT Final Report, 15 May 1979 - 15 Feb. 1980
William E. Marlatt and E. Bruce Jones (Resources Consultants, Inc., Fort Collins, Colo.) 15 Feb. 1980 61 p
(Contract DCPA01-79-C-0268)
(AD-A082243) Avail: NTIS HC A04/MF A01 CSCL 14/5

Contents: foundations of remote sensing; data acquisition and interpretation; availability of remote sensing technology for disaster response; imaging systems, current and near future satellite and aircraft remote sensing systems; utilization of remote sensing in disaster response; categories of disasters, phases of monitoring activities; recommendations for utilization of remote sensing technology in disaster response; selected reading. GRA

N80-25766# Sandia Labs., Albuquerque, N. Mex.
DRILLING HORIZONTAL HOLES IN COAL BED FROM THE SURFACE WITH WATER JETS
Marvin Timmerman and Clark R. Barker 1980 14 p refs Presented at 5th Symp. of the Rocky Mountain Fuel Soc., Salt Lake City, 21 Feb. 1980
(Contract EY-76-C-04-0789)
(SAND-80-0057C; CONF-800229-1) Avail: NTIS HC A02/MF A01

A drilling system, using high pressure water jets is considered. The system could have important applications both in methane drainage and recovery and in well linking. DOE

N80-25767# Wyoming Univ., Laramie. Dept. of Electrical Engineering.
REMOTE ELECTROMAGNETIC SENSING OF UNDERGROUND COAL BURNS Final Report, Jun. 1976 - Jul. 1978
Edmund A. Quincy Oct. 1979 43 p refs
(Contract EX-76-S-01-2414)
(FE-2414-8) Avail: NTIS HC A03/MF A01

This research program developed an induction sounding system and estimator algorithm for remote determination of the location, shape and size of the reaction zone produced by Underground Coal Gasification. It was tested in Wyoming at DOE/LETC sites Hanna 2, Phase 1 and Hanna 2, Phases 2 and 3. Estimates of the volumes of coal gasified compared favorably with that obtained formerly by chemical estimation. However, the burn may have deviated to the side of the gasification wells more than was predicted by chemical instrumentation. Measurements taken repeatedly over a one year span on one traverse at Hanna 2, Phases 2 and 3 show aging characteristics that demonstrate a migration of the conducting anomaly toward the surface. The final system employed horizontal loops with a fixed separation and 0 to 10 kHz bandwidth. Soundings were made in line across the burn site. Pseudo-noise/cross-correlation techniques were employed to effectively combat the noise. The magnitude response at 1 kHz was used in the final statistical fitting of field data to induction models. DOE

N80-25768# New Mexico Inst. of Mining and Technology, Socorro. Petroleum Recovery Research Center.
DISPLACEMENT OF OIL BY CARBON DIOXIDE Annual Report, Oct. 1978 - Sep. 1979
F. M. Orr, Jr. and J. J. Taber Feb. 1980 72 p refs
(Contract DE-AC21-78MC-03260)
(DOE/MC-03260/4) Avail: NTIS HC A04/MF A01

A sophisticated apparatus for measurements of phase behavior and fluid properties of mixtures of CO_2 and crude oils was designed and built. The experimental setup permits a variety of multiple contact phase behavior experiments which explore mixture compositions which realistically model displacement processes at temperatures and pressures of interest. Gas chromatography techniques used to characterize crude oils was extended to allow analyses of mixtures containing CO_2 and hydrocarbons ranging from methane to molecules as heavy as tetracontane (C40). A qualitative analysis is given for the complex

phase behavior observed for mixtures of CO2 and crude oils at temperatures below 50 C and the effects of phase behavior on expected displacement efficiency are calculated. The results indicate that relatively small changes in pressure can be expected to have a strong influence on the efficiency of CO2 displacements of crude oils. DOE

N80-25769# Department of Energy, Washington, D. C.
STRATEGIC PETROLEUM RESERVE Annual Report
16 Feb. 1980 86 p
(DOE/RA-0047) Avail: NTIS HC A05/MF A01

Progress on implementing the Strategic Petroleum Reserve (SPR) program is reported. The volume of crude oil in storage through 1979 is 91.7 million barrels, the average cost of which was $14.00 per barrel. Phase 1 facilities development is described. The total reserve storage capacity is 226 million barrels and will be increased to 248 million barrels by the time Phase 1 is complete. Phase 2 construction goods are described. Changes in the world crude market has forced changes in realistic goals for 1979. Development of improved geotechnical capability for the SPR by interagency, laboratory and contractor support is discussed. The cost control and program management was improved and management disciplines were emphasized in 1979. The Distribution Plan for the SPR utilizing methods of allocation or competitive sale are described. DOE seeks to minimize the effects of SPR purchases on world oil prices and on the availability of supplies for domestic consumption. DOE

N80-25770*# New Mexico Univ., Albuquerque. Technology Applications Center.
REMOTE SENSING APPLIED TO PETROLEUM AND MINERAL EXPLORATION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Dec. 1979
Robert W. Gonzales Feb. 1980 34 p Sponsored by NASA and NTIS
(NASA-CR-163311; PB80-804800) Avail: NTIS HC $30.00/MF $30.00 CSCL 08I

The use of LANDSAT Satellites and other remote sensing methods used in petroleum and mineral exploration is discussed in 118 abstracts. Topics covered include mineral deposits, oil exploration, petroleum operations, geomorphology, resources management, thematic mapping, photogeology, photomapping and photointerpretation and imaging and digital techniques. GRA

N80-25771# National Technical Information Service, Springfield, Va.
INSTRUMENTATION AND DATA PROCESSING USED IN EARTH RESOURCES TECHNOLOGY SATELLITES (ERTS), VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - 1979
Audrey S. Hundemann Mar. 1980 244 p Supersedes NTIS/PS-79/0206; NTIS/PS-78/0070; NTIS/PS-77/0081
(PB80-805740; NTIS/PS-79/0206; NTIS/PS-78/0070; NTIS/PS-77/0081) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Abstracts are cited dealing with new or improved remote sensing techniques. Topic areas cover pattern recognition, spectrum analysis, image enhancement, photointerpretation, multispectral photography, and mapping. This updated bibliography contains 237 abstracts, 35 of which are new entries to the previous edition. GRA

N80-25772# National Environmental Satellite Service, Washington, D. C.
DATA EXTRACTION AND CALIBRATION OF TIROS-N/NOAA RADIOMETERS
Levin Lauritson, Gary J. Nelson, and Frank W. Porto Nov. 1979 80 p refs
(PB80-150824; NOAA-TM-NESS-107; NOAA-80010909) Avail: NTIS HC A05/MF A01 CSCL 22A

The TIROS N/NOAA series is the third generation of environmental satellites providing real-time data to direct readout users. Information is presented that enables users to extract from the telemetry streams data that are unique to a given sensor, to calibrate these data, and to develop an understanding of the accuracy and precision that can be expected of the calibrated data. GRA

N80-25773# Bureau of Mines, Pittsburgh, Pa. Pittsburgh Research Center.
DUST CONTROL FOR A BORER-TYPE CONTINUOUS MINER USING A VENTURI SCRUBBER ON A TRANSFER CAR
Natesa I. Jayaraman 1979 16 p refs
(PB80-144850; BM-RI-8408; LC-79-607043) Avail: NTIS HC A02/MF A01 CSCL 08I

A transfer car to carry the major components of a ventilation system designed for use with a borer-type continuous miner was designed. Dusty air was pulled through a 6,500 cfm venturi scrubber by a centrifugal fan mounted on the transfer car. The air passed through ducting installed on the miner and through flexible tubing between the miner and the transfer car. GRA

N80-25774# Oklahoma State Univ., Stillwater. Fluid Power Research Center.
DEVELOPMENT OF LIGHTWEIGHT MINE ROOF SUPPORTS Final Report, 1 Oct. 1977 - 31 May 1978
Aug. 1978 196 p refs
(Contracts DI-BM-HO-272017; DAAK70-77-C-0097)
(PB80-143936; BM-OFR-93-79) Avail: NTIS HC A09/MF A01 CSCL 08I

A load capacity of 196 kN (22 tons) and a height adjustable between 1.829 m (72 inches) and 2.438 m (96 inches) were taken as the design parameter for coal mine roof supports. The design goal was a unit weighing less than 22.3 kg (50 lb). Three alternative design concepts were explored: namely, mechanical, hydraulic, and hydromechanical, and 13 designs were analyzed in detail. Steel, aluminum alloy, and composites were the main potential construction materials investigated for suitability from structural, life, safety, and other considerations. It is shown that by using realistic mathematical models for stress and deflection calculations that it is possible to reduce prop weight to the design goal. The analysis presented for all-hydraulic props is applicable to hydraulic cylinders on all mining equipment and similar equipment. The computer program and user's guide are included as well as a bibliography on structural composites. GRA

N80-25775# Geological Survey, Reston, Va.
U.S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT, SEQUOIA, KINGS, CANYON NATIONAL PARK, CALIFORNIA. PROJECT NO. 8: CONSERVATION OF NATURAL AREAS AND OF THE GENETIC MATERIAL THEY CONTAIN
Janet Bonner, comp. 1980 12 p refs
(PB80-147291) Avail: NTIS HC A02/MF A01 CSCL 08F

Photographs and images of biosphere reserves taken from spacecraft and aircraft provide a significant data base showing broad views and details of the landscape and are invaluable in searching for changes and trends in forest, cover, water area, and other diagnostic landscape features. Each data report in this series lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

N80-25776# National Geodetic Survey, Rockville, Md.
USE OF AUXILLIARY ELLIPSOIDS IN HEIGHT-CONTROLLED SPATIAL ADJUSTMENTS
B. R. Bowring and T. Vincenty Nov. 1979 15 p refs
(PB80-155104; NOAA-TM-NOS-NGS-23; NOAA-80010901) Avail: NTIS HC A02/MF A01 CSCL 08E

In an adjustment of a geodetic network in the height-controlled three dimensional system it is convenient to use auxiliary ellipsoids. These surfaces are used for preserving correct heights of points and for simplifying the transformation of adjusted Cartesian coordinate to the geographic system. GRA

N80-25777# Arizona Univ., Tucson.
GEOPHYSICAL AND HYDROLOGIC PREDICTION OF FISSURING AND LAND SUBSIDENCE, SOUTH-CENTRAL ARIZONA Progress Report, 1 Oct. 1976 - 30 Sep. 1978

J. K. Boling, Jr., M. C. Carpenter, and S. N. Davis Jan. 1980 48 p refs
(Contracts DI-14-34-0001-7005; DI-14-34-0001-7006; DI-14-34-0001-8003)
(PB80-151434; W80-03710; OWRT-A-0730ARIZ(2)) Avail: NTIS HC A03/MF A01 CSCL 08G

Bimonthly horizontal strain measurements of fissures were made at seven dial gauages near Signal Peak Mountains, and in Avra Valley, Arizona. A Pyrex glass rod is fixed in one side of a fissure and pushes against a dial gaugefixed to the other side. Installations are in shallow covered trenches. Movemnets ranging form 5 micrometers to 25 mm are detected with a measurement error of less than 5 micrometers. Fissures were observed to open and close repeatly. With one exception, old and new cracks showed no pronounced differnece in character. Correlation of fissure movement, rainfall, pumping, and water-level fluctuations indicates that major earth fissure movements will occur after high pumping rates during or shortly after large storms. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-25778 Oklahoma State Univ., Stillwater.
DESIGN PARAMETERS FOR SOLAR POWERED ABSORPTION COOLING SYSTEMS WITH CHILLED WATER STORAGE Ph.D Thesis
Ping-Shian Shih 1979 120 p
Avail: Univ. Microfilms Order No. 8013046

A simulation model of a solar cooling system with chilled water storage was formulated. Simulations were performed using typical meteorological year data of seven SOLMET stations to study the relationship between the performance of the system and design parameters. The chilled water storage was found to be an effective scheme for improving the performance of the solar cooling system. The effectiveness of this scheme depends largely on the proper sizing of the chilled water storage, and collector area. The predictions of the semi-empirical equation were found to be within six percent accuracy of the simulation results. This equation was also found to be valid for locations with considerable differences in their weather patterns. The annual cost analysis showed that proper sizing of the chilled water storage, hot water storage, and collector area can improve significantly the economics of the solar cooling system. Although the solar cooling system is not economically feasible at the present time due to the high cost of the solar energy collector and the low cost of the conventional fuel, a properly designed solar cooling system can become economically attractive when the fuel cost becomes more expensive. Dissert. Abstr.

N80-25779*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL ENERGY STORAGE
Jun. 1980 77 p refs
(Contract EC-77-A-31-1034)
(NASA-TM-81514; E-457; DOE/NASA/1034-8) Avail: NTIS HC A05/MF A01 CSCL 10C

The planning and implementation of activities associated with lead center management role and the technical accomplishments pertaining to high temperature thermal energy storage subsystems are described. Major elements reported are: (1) program definition and assessment; (2) research and technology development; (3) industrial storage applications; (4) solar thermal power storage applications; and (5) building heating and cooling applications. R.E.S.

N80-25780*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PULSE CHARGING OF LEAD-ACID TRACTION CELLS
John J. Smithrick May 1980 22 p refs
(Contract EC-77-A-31-1044)
(NASA-TM-81513; DOE/NASA/1044-6; E-454) Avail: NTIS HC A02/MF A01 CSCL 10C

Pulse charging, as a method of rapidly and efficiently charging 300 amp-hour lead-acid traction cells for an electric vehicle application was investigated. A wide range of charge pulse current square waveforms were investigated and the results were compared to constant current charging at the time averaged pulse current values. Representative pulse current waveforms were: (1) positive waveform-peak charge pulse current of 300 amperes (amps), discharge pulse-current of zero amps, and a duty cycle of about 50%; (2) Romanov waveform-peak charge pulse current of 300 amps, peak discharge pulse current of 15 amps, and a duty of 50%; and (3) McCulloch waveform peak charge pulse current of 193 amps, peak discharge pulse current of about 575 amps, and a duty cycle of 94%. Experimental results indicate that on the basis of amp-hour efficiency, pulse charging offered no significant advantage as a method of rapidly charging 300 amp-hour lead-acid traction cells when compared to constant current charging at the time average pulse current value. There were, however, some disadvantages of pulse charging in particular a decrease in charge amp-hour and energy efficiencies and an increase in cell electrolyte temperature. The constant current charge method resulted in the best energy efficiency with no significant sacrifice of charge time or amp-hour output. Whether or not pulse charging offers an advantage over constant current charging with regard to the cell charge/discharge cycle life is unknown at this time. R.E.S.

N80-25781*# Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.
INVESTIGATION OF RELIABILITY ATTRIBUTES AND ACCELERATED STRESS FACTORS ON TERRESTRIAL SOLAR CELLS Annual Report
J. W. Lathrop and J. L. Prince Apr. 1980 168 p
(NASA-CR-163209; JPL-9950-338; DOE/JPL-954929-80/7; AR-2) Avail: NTIS HC A08/MF A01 CSCL 10A

Three tasks were undertaken to investigate reliability attributes of terrestrial solar cells: (1) a study of the electrical behavior of cells in the second (reverse) quadrant; (2) the accelerated stress testing of three new state-of-the-art cells; and (3) the continued bias-temperature testing of four block 2 type silicon cells at 78 C and 135 C. Electrical characteristics measured in the second quadrant were determined to be a function of the cell's thermal behavior with breakdown depending on the initiation of localized heating. This implied that high breakdown cells may be more fault tolerant when forced to operate in the second quadrant, a result contrary to conventional thinking. The accelerated stress tests used in the first (power) quadrant were bias-temperature, bias-temperature-humidity, temperature-humidity, thermal shock, and thermal cycle. The new type cells measured included an EFG cell, a polycrystalline cell, and a Czochralski cell. Significant differences in the response to the various tests were observed between cell types. A microprocessed controlled, short interval solar cell tester was designed and construction initiated on a prototype. R.E.S.

N80-25782*# Pennsylvania Univ., Philadelphia. School of Electrical Engineering.
ANALYSIS AND EVALUATION IN THE PRODUCTION PROCESS AND EQUIPMENT AREA OF THE LOW-COST SOLAR ARRAY PROJECT Annual Report, Oct. 1978 - Oct. 1979
H. Goldman and M. Wolf Oct. 1979 203 p refs
(Contract JPL-954796)
(NASA-CR-163208; JPL-9950-342; DOE/JPL-954796-79/7) Avail: NTIS HC A10/MF A01 CSCL 10A

Analyses of slicing processes and junction formation processes are presented. A simple method for evaluation of the relative economic merits of competing process options with respect to the cost of energy produced by the system is described. An energy consumption analysis was developed and applied to determine the energy consumption in the solar module fabrication process sequence, from the mining of the SiO2 to shipping.

The analysis shows that, in current technology practice, inordinate energy use in the purification step, and large wastage of the invested energy through losses, particularly poor conversion in slicing, as well as inadequate yields throughout. The cell process energy expenditures already show a downward trend based on increased throughput rates. The large improvement, however, depends on the introduction of a more efficient purification process and of acceptable ribbon growing techniques. R.E.S.

N80-25783*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
TEST RESULTS ON THE FRENCHMAN'S REEF SOLAR DATA ACQUISITION AND CONTROL SYSTEM
15 Jan. 1980 19 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161449) Avail: NTIS HC A02/MF A01 CSCL 10A

The Frenchman's Reef Data Acquisition and Control System (DACS), Sunlogger model 10000-1 was evaluated to determine the accuracy of control functions and the performance of the system in the environment of the planned installation site. The Sunlogger system was verified to perform normally in an environment of 100 F and approximately 90% humidity. It is recommended however that the Sunlogger be installed in a controlled environment with temperatures and humidity significantly lower than those referenced above. R.E.S.

N80-25784*# Radian Corp., Austin, Tex.
SOLAR HEATING AND COOLING DEMONSTRATION PROJECT AT RADIAN CORPORATION, AUSTIN, TEXAS Final Report
May 1980 41 p Sponsored in part by NASA
(Contract EX-76-C-01-2396)
(NASA-CR-161442) Avail: NTIS HC A03/MF A01 CSCL 10A

The solar heating and cooling system located at the Radian Corporation, Austin, Texas, is discussed. A technical description of the solar system is presented. The costs of the major components and the cost of installing the system are described. Flow diagrams and photographs of the solar system are provided. R.E.S.

N80-25785*# Georgia Inst. of Tech., Atlanta. Engineering Extension Lab.
PHOTOVOLTAIC SYSTEM COSTS USING LOCAL LABOR AND MATERIALS IN DEVELOPING COUNTRIES
Edward Jacobson, George Fletcher, and Gerald Hein 20 May 1980 60 p
(Grant NsG-3297)
(NASA-CR-163218) Avail: NTIS HC A04/MF A01 CSCL 10A

The use of photovoltaic (PV) technology in countries that do not presently have high technology industrial capacity was investigated. The relative cost of integrating indigenous labor (and manufacturing where available) into the balance of the system industry of seven countries (Egypt, Haiti, the Ivory Coast, Kenya, Mexico, Nepal, and the Phillipines) was determined. The results were then generalized to other countries, at most levels of development. The results of the study imply several conclusions: (1) the cost of installing and maintaining comparable photovoltaic systems in developing countries is less than in the United States; (2) skills and some materials are available in the seven subject countries that may be applied to constructing and maintaining PV systems; (3) there is an interest in foreign countries in photovoltaics; and (4) conversations with foreign nationals suggest that photovoltaics must be introduced in foreign markets as an appropriate technology with high technology components rather than as a high technology system. R.E.S.

N80-25786*# Telex Communications, Inc., Blue Earth, Minn.
SOLAR HEATING SYSTEM INSTALLED AT TELEX COMMUNICATIONS, INC., BLUE EARTH, MINNESOTA Final Report
26 Oct. 1977 177 p
(Contract E(49-18)-2376)
(NASA-CR-161437) Avail: NTIS HC A09/MF A01 CSCL 10A

The solar heating system for space heating a 97,000 square foot building which houses administrative offices, assembly areas, and warehouse space is summarized. Information on system description, test data, major problems and resolutions, performance, operation and maintenance manual, manufacturer's literature, and as-built drawings is presented. R.E.S.

N80-25787*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR DECADE 80 HOUSE, TUCSON, ARIZONA Progress Report, Nov. 1973 - Sep. 1979
May 1980 103 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161450) Avail: NTIS HC A06/MF A01 CSCL 10A

The operational and thermal performance of the Decade 80 solar energy system is described. The system was designed by Cooper Development Association, Inc. with space heating and space cooling to a one-story, single family residence located in Tucson, Arizona. The Decade 80 House was designed and built in the mid-70's to be a showplace/workshop for solar energy utilization. Superior construction techniques, the use of quality materials and a full time maintenance staff have served to make the entire system an outstanding example of the application of solar energy for residential purposes. The luxury of a full time, on-site maintenance person is perhaps the single most important aspect of this program. While most installations cannot support this level of maintenance, it was very useful in keeping all subsystems operating in top form and allowing for a full season data collection to be obtained. Several conclusions were drawn from the long term monitoring effort, among which are: (1) flat plate collectors will support cooling; (2) definite energy savings can be realized; and (3) more frequent periodic maintenance may be required on solar energy systems that are not custom built. R.E.S.

N80-25788*# Gilliland-Bell Associates, Inc., Greenwood, S.C.
SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT MUNICIPAL BUILDING COMPLEX, ABBEVILLE, SOUTH CAROLINA Final Report
Nov. 1979 54 p Sponsored in part by NASA
(Contract EM-78-F-01-5202)
(NASA-CR-161443) Avail: NTIS HC A04/MF A01 CSCL 10A

Information on the solar energy system installed at the new municipal building for the City of Abbeville, SC is presented, including a description of solar energy system and buildings, lessons learned, and recommendations. The solar space heating system is a direct air heating system. The flat roof collector panel was sized to provide 75% of the heating requirement based on an average day in January. The collectors used are job-built with two layers of filon corrugated fiberglass FRP panels cross lapped make up the cover. The storage consists of a pit filled with washed 3/4 in - 1 1/2 in diameter crushed granite stone. The air handler includes the air handling mechanism, motorized dampers, air circulating blower, sensors, control relays and mode control unit. Solar heating of water is provided only those times when the hot air in the collector is exhausted to the outside. R.E.S.

N80-25789*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UNFULFILLED TECHNOLOGY NEEDS IN SPACE POWER SYSTEMS
Luther W. Slifer, Jr. Apr. 1980 21 p refs Proposed for presentation at 15th Intersoc. Energy Conversion Engr. Conf., Seattle, 18-22 Aug. 1980
(NASA-TM-80677) Avail: NTIS HC A02/MF A01 CSCL 10A

Major power system technology development needs related to the solution of currently existing problems are defined. The identified problems were initially listed and categorized by technical area. They were then translated into terms of technology development requirements and consolidated where commonality was found. From these requirements, a set of ten specific recommendations for technology development was formulated. R.E.S.

N80-25790*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR IBM SYSTEM 1A, HUNTSVILLE, ALABAMA Contractor Report, Sep. 1978 - Aug. 1979
May 1980 85 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161464) Avail: NTIS HC A05/MF A01 CSCL 10A

The operational and thermal performance of the solar energy system, Sims Prototype System 1A, is described. The system was designed by IBM to provide 50 to 60 percent of the space heating and domestic hot water preheating load to a 2,000 square foot floor space single family residence in the Huntsville area. The load design temperature inside the building was to be maintained at 70 degrees fahrenheit with auxiliary energy for heating supplied by an electric heat pump assisted by an electric resistance strip heater. In general the disappointing operation of this system is attributed to the manner in which it was used. The system was designed for residential application and used to satisfy the demands of an office environment. The differences were: (1) inside temperature was not maintained at 70 F as expected; and (2) hot water usage was much lower than expected. The conclusion is that the solar energy system must be designed for the type of application in which it is used. Misapplication usually will have an adverse affect on system performance.
R.E.S.

N80-25791*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATON: SEASONAL REPORT FOR SOLARON-AKRON, AKRON, OHIO Contractor Report, Nov. 1978 - Oct. 1979
May 1980 87 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161465) Avail: NTIS HC A05/MF A01 CSCL 10A

The operational and thermal performance of the solar energy system by Solaron Corporation is described. The system was designed to provide an 1940 square foot floor area with space heating and domestic hot water for a dual-level single family residence in Akron, Ohio. The solar energy system uses air as the heat transport medium, has a 546 square foot flat plate collector array subsystem, a 270 cubic foot rock thermal storage bin subsystem, a domestic hot water preheat tank, pumps, controls and transport lines. In general, the performance of the Solaron Akron solar energy system was somewhat difficult to assess for the November 1978 through October 1979 time period. The problems relating to the control systems, various solar energy leakages, air flow correction factors and instrumentation cause a significant amount of subjectivity to be involved in the performance assessment for this solar energy system. Had these problems not been present, it is felt that this system would have exhibited a resonably high level of measured performance.
R.E.S.

N80-25792*# United Technologies Corp., South Windsor, Conn. Power System Div.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY. VOLUME 1: SUMMARY REPORT Final Report
Jan. 1980 125 p
(Contracts DEN3-30; EC-77-A-31-1062)
(NASA-CR-159759; DOE/NASA/0030-80/1;
UTC-FCR-1333-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 10A

Data and information in the area of advanced energy conversion systems for industrial congeneration applications in the 1985-2000 time period was studied. Six current and thirty-one advanced energy conversion systems were defined and combined with appropriate balance-of-plant equipment. Twenty-six industrial processes were selected from among the high energy consuming industries to serve as a framework for the study. Each conversion system was analyzed as a cogenerator with each industrial plant. Fuel consumption, costs, and environmental intrusion were evaluated and compared to corresponding traditional values. Various cogeneration strategies were analyzed and both topping and bottoming (using industrial by-product heat) applications were included. The advanced energy conversion technologies indicated reduced fuel consumption, costs, and emissions. Typically fuel energy savings of 10 to 25 percent were predicted compared to traditional on-site furnaces and utility electricity. With the variety of industrial requirements, each advanced technology had attractive applications. Overall, fuel cells indicated the greatest fuel energy savings and emission reductions. Gas turbines and combined cycles indicated high overall annual cost savings. Steam turbines and gas turbines produced high estimated returns. In some applications, diesels were most efficient. The advanced technologies used coal-derived fuels, or coal with advanced fluid bed combustion or on-site gasification systems.
R.E.S.

N80-25793*# United Technologies Corp., South Windsor, Conn. Power Systems Div.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY. VOLUME 2: INDUSTRIAL PROCESS CHARACTERISTICS Final Report
Jan. 1980 697 p refs
(Contracts DEN3-30; EC-77-A-31-1062)
(NASA-CR-159760; DOE/NASA/0030-80/2;
UTC-FCR-1333-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 10A

Information and data for 26 industrial processes are presented. The following information is given for each process: (1) a description of the process including the annual energy consumption and product production and plant capacity; (2) the energy requirements of the process for each unit of production and the detailed data concerning electrical energy requirements and also hot water, steam, and direct fired thermal requirements; (3) anticipated trends affecting energy requirements with new process or production technologies; and (4) representative plant data including capacity and projected requirements through the year 2000.
R.E.S.

N80-25794*# United Technologies Corp., South Windsor, Conn. Power Systems Div.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY. VOLUME 4: HEAT SOURCES, BALANCE OF PLANT AND AUXILIARY SYSTEMS Final Report
Jan. 1980 296 p
(Contracts DEN3-30; EC-77-A-31-1062)
(NASA-CR-159762; DOE/NASA/0030-80/4;
UTC-FCR-1333-Vol-4) Avail: NTIS HC A13/MF A01 CSCL 10A

Data and information established for heat sources balance of plant items, thermal energy storage, and heat pumps are presented. Design case descriptions are given along with projected performance values. Capital cost estimates for representative cogeneration plants are also presented.
R.E.S.

N80-25795*# United Technologies Corp., South Windsor, Conn. Power Systems Div.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY. VOLUME 6: COMPUTER DATA Final Report
Jan. 1980 535 p
(Contracts DEN3-30; EC-77-A-31-1062)
(NASA-CR-159764; DOE/NASA/0030-80/6;
UTC-FCR-1333-Vol-6) Avail: NTIS HC A22/MF A01 CSCL 10A

The potential technical capabilities of energy conversion systems in the 1985 - 2000 time period were defined with emphasis on systems using coal, coal-derived fuels or alternate fuels. Industrial process data developed for the large energy consuming industries serve as a framework for the cogeneration applications. Ground rules for the study were established and other necessary equipment (balance-of-plant) was defined. This combination of technical information, energy conversion system data ground rules, industrial process information and balance-of-plant characteristics was analyzed to evaluate energy consumption, capital and operating costs and emissions. Data in the form of computer printouts developed for 3000 energy conversion system-industrial process combinations are presented.
R.E.S.

N80-25796# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
HEATING A FLUID IN FULL FLOW INSIDE A HORIZONTAL CYCLINDRICAL PIPE USING SOLAR ENERGY M.S. Thesis [AQUECIMENTO DE UM FLUIDO EM ESCOAMENTO COMPLETAMENTE ESTABELECIDO NO INTERIOR DE UM TUBO CILINDRICO HORIZONTAL USANDO ENERGIA

SOLAR]
Sebastiao Cardoso Feb. 1980 27 p refs In PORTUGUESE; ENGLISH summary
(INPE-1680-TDL/020) Avail: NTIS HC A03/MF A01

The transfer of heat in a stead laminar flow inside an horizontal cylindrical tube under solar radiation heating is discussed. It is supposed that the tube at rest and that the flow is fully developed to its profile. The mathematical analysis is limited to an analytical solution of the energy equation adjusted for the system. The angular, radial, and axial distributions of temperature are presented along with variations of the Nusselt and Peclet numbers as a function of the axial coordinate. J.M.S.

N80-25797# TRW Defense and Space Systems Group, Redondo Beach, Calif. Applied Technology Div.
POTENTIAL APPLICATIONS OF BIOMASS TECHNOLOGY AT NATIONAL TECHNOLOGY LABORATORIES AND MISSISSIPPI ARMY AMMUNITION PLANT Final Report, 30 Jun. 1978 - 29 Feb. 1980
E. P. Motley, B. G. Cruz, L. McClanathan, and J. A. Anastasi Feb. 1980 211 p
(Contract DAAK10-78-C-0268)
(AD-A082756; TRW-33682) Avail: NTIS HC A10/MF A01 CSCL 21/4

This study was initiated to evaluate the feasibility of utilizing a common biomass (energy wood) system to produce energy for use at NASA's National Space Technology Laboratories (NSTL) and the proposed Mississippi Army Ammunition Plant (MSAAP) to be established at NSTL. The study investigated: the form and quantity of energy required at NSTL and MSAAP; the amount and characteristics of the available energy wood supply; the conversion technology; the legal and environmental issues associated with the operation of an energy wood plant; and the economics of an energy wood plant. GRA

N80-25798# CCB/CUMALI Associates, Oakland, Calif.
PASSIVE SOLAR CALCULATION METHODS Final Report, 15 Oct. 1978 - 15 Jun. 1979
Zulfikar O. Cumali, A. Osman Sezgen, and Robert Sullivan 15 Jun. 1979 112 p refs
(Contract EM-78-C-01-5221)
(DSE-5221-T1) Avail: NTIS HC A06/MF A01

An analytical treatment related to the generation of space specific weighting factors is presented using a recursion relationship which employs a heat balance of both the outside and inside surface. The multizone problem is then discussed. The use of frequency domain methods is detailed such that the amplitude ratio and phase shift characteristics for a sinusoidal excitation are derived for the thermal load resulting from radiation heat gain/loss and space air temperature fluctuations. The results of a parametric study related to variable floor properties, radiation distributions and space sizes are presented. The weighting factors generated for each perturbation were used to define the expected differences in space response characteristics. DOE

N80-25799# Value Engineering Co., Alexandria, Va.
OTEC SUPPORT SERVICES Quarterly Technical Progress Report, 15 Nov. 1978 - 14 Feb. 1979
28 Feb. 1979 17 p
(Contract ET-78-C-02-4931)
(COO-4931-T11; QTPR-3) Avail: NTIS HC A02/MF A01

System integration, engineering, and management support services provided for the Ocean Thermal Energy Conversion (OTEC) Program are described. The tasks include (1) survey, analysis, evaluation, and recommendation concerning program performance; (2) program technical monitoring;(3) development and implementation of methodology to identify and evaluate program alternatives; (4) technical assessments; (5) OTEC system integration; and (6) environment and siting considerations. DOE

N80-25800# Science Applications, Inc., McLean, Va.
SOLAR PHOTOVOLTAIC FLAT PANEL APPLICATIONS EXPERIMENT AT THE OKLAHOMA CENTER FOR SCIENCE AND ARTS Final Report, 30 Sep. 1978 - 31 May 1979
31 May 1979 186 p refs
(Contracts ET-78-C-04-5403; DE-AC04-78ET-23063)
(DOE/ET-23063/1) Avail: NTIS HC A09/MF A01

A photovoltaic power system was designed for the Oklahoma Center for Science and Arts in Oklahoma City. The system, with a basic rating of 250 kW, is enhanced to a summer peak output of 350 kW through the use of augmentation glass mirror reflectors which are arranged to maximize summer output and to match the summer output to the summer load. The baseline system consists of 3780 photovoltaic collector modules, utilizing polycrystalline silicon cells, and companion mirror reflectors arranged in modular fashion on the roof of the Center. Total system output is more than 450 MWh, of which over 420 MWh is used on-site to displace about 65 percent of the current on site load, or about 43 percent of the projected (1981) load. Another 30 MWh is returned to the utility under a buyback agreement. The total amount of energy displaced per year is approximately 850 barrels of oil, or Btu equivalent. DOE

N80-25801# Electric Storage Battery Co., Yardley, Pa.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF LEAD-ACID BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1978
Oct. 1979 106 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-78-8) Avail: NTIS HC A06/MF A01

The development of two levels of electric vehicle batteries, improved state-of-the-art (ISOA) and advanced is discussed. Two approaches, for the ISOA battery are being considered: one utilizing the flat pasted type plate in common use for present electric vehicle and automotive type batteries and the second utilizing the tubular type positive plate concept presently used in heavy duty industrial applications. Two battery design concepts appear to have the potential of meeting the advancing battery goals. One is tubular positive plate battery and the other is the bipolar type battery. R.E.S.

N80-25802# Gould, Inc., Rolling Meadows, Ill.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF NICKEL-ZINC BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1978
Oct. 1979 143 p
(Contract W-31-109-eng-38)
(ANL/OEPM-78-11) Avail: NTIS HC A07/MF A01

The progress towards the demonstration of technical and economic feasibility of the nickel-zinc battery for electric vehicle propulsion is described. Six major tasks are discussed: separator development; zinc electrode development; product design and analysis; cell/module/battery testing; process development; and pilot plant. R.E.S.

N80-25803# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
CONCEPTUAL DESIGN OF ADVANCED CENTRAL RECEIVER POWER SYSTEMS SODIUM-COOLED RECEIVER CONCEPT. VOLUME 4: COMMERCIAL AND PILOT PLANT COST DATA Final Report
Mar. 1979 200 p refs
(Contract EG-77-C-03-1483)
(SAN-1483-1/5; ESG-79-2-Vol-4) Avail: NTIS HC A09/MF A01

Cost summaries are presented for the 100 MWe and and 281 MWe commercial plants, and a summary for the cost summary data include Nth plant data for the 100 MWe and 281 MWe commercial plants, and a summary for the alternative concept air-rock storage system. The plant costing technique is described in the section discussing the 100 MWe baseline concept. DOE

N80-25804# Oak Ridge Associated Universities, Inc., Washington, D.C. Inst. for Energy Analysis.
ITALY: ESTIMATES OF FUTURE ENERGY/GDP RELATIONSHIPS
C. Davison and Edward L. Allen Dec. 1979 61 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA(M)-79-20 Avail: NTIS HC A04/MF A01

The Italian economy has experienced very rapid growth since World War II, accompanied by a sharp increase in the consumption of energy, the growth of which has been more rapid than the development of the economy. For the period 1960-76, energy consumption grew an average of 6.7% annually, compared with an annual growth rate of 4.6% for gross domestic

product. The ratio of energy use per unit of GNP increased in every year from the early 1960s until the oil price rise in 1973 and after a brief pause then began to rise again. By 1975, when the E/GDP ratios of other industrialized OECD countries were hitting record lows, Italy's ratio was at an all-time high. This increasing E/GDP ratio was largely the result of Italy's very rapid industrial expansion and its attempt to catch up with the stage of industrial maturity already achieved in other developed countries. It is anticipated that the E/GDP ratio will decline in the future as Italy's industrial expansion slows down. Increased efficiencies will flow from the application of new technologies and replacement of old plants. Pressure from higher oil prices and structural changes in Italian society also will dampen the E/GDP ratio, as it has in other industrialized countries. GDP growth will slacken as the fertility rate continues its downward trend and the average workweek falls. It is that by the year 2000 gross energy consumption in Italy will total 6.7 quads, or about 25% above the 1976 level, and that the E/GDP index (1976 = 100) will decline to about 79, with the residential and industrial sectors accounting for almost all of the decline. DOE

N80-25805# Los Alamos Scientific Lab., N. Mex.
SUPERCONDUCTING MAGNETIC ENERGY STORAGE (SMES) PROGRAM Progress Report, 1 Jan. - 31 Dec. 1979
J. D. Rogers, comp. Jan. 1980 30 p refs
(Contract W-7405-eng-36)
(LA-8199-PR) Avail: NTIS HC A03/MF A01

Work on the development of two superconducting magnetic energy storage units is described. One is a 30-MJ unit for use by the Bonneville Power Administration to stabilize power oscillations on their Pacific ac Intertie, and the second is a 1 to 1 GWh unit for use as a diurnal load-leveling device. A contract was placed for the fabrication design of the 30 MJ coil design. Orders were placed for the stabilizing system converter and protective energy dump system, converter transformer, automation of the 4.5 K refrigerator and its installation into a trailer and a trailer mounted heat-rejection system. A third compressor was added to the refrigeration system, and the refrigerator was tested and accepted. The superconductor for the 30 MJ coil was received, tested, and found to be satisfactory. The reference design for the 1 to 10 GWh diurnal load-leveling unit was completed. The summary and recommendations of the study are included. DOE

N80-25806# Colorado State Univ., Fort Collins. Solar Applications Energy Lab.
CSU SOLAR HOUSE 3: SOLAR HEATING AND COOLING SYSTEM PERFORMANCE Progress Report, 1 Oct. 1978 - 31 May 1979
D. S. Ward Aug. 1979 47 p refs
(Contract DE-AC02-79CS-30122)
(COO-30122-3) Avail: NTIS HC A03/MF A01

During the period 1 October 1978 through 31 March 1979, the Chamberlain liquid-heating state-of-the-art flat-plate solar collector was evaluated for a complete heating season. Significant and important results of the systems evaluation include: (1) the demonstration of the critical importance of temperature differentials between the collector outlet and the absorption chiller generator inlet, the effects of alternative control strategies, the marginal feasibility of cool storage, the devastating effect on system performance due to heat losses from the thermal storage unit, and the importance of minimizing electrical parasitic power requirements in obtaining feasibilty for solar absorption cooling systems; (2) the concept of overall system efficiency was shown to be essential in the determination of the feasibility of any solar installation; and (3) evaluation of acquired data on the performance of the Colorado solar house system has provided the theoretical construction and experimental No.3 verification of the importance of solar operating threshold. DOE

N80-25807# Development Planning and Research Associates, Inc., Manhattan, Kans.
WIND ENERGY APPLICATIONS IN AGRICULTURE: EXECUTIVE SUMMARY Final Report
Milton L. David, Robert J. Buzenberg, Earl F. Glynn, Gary L. Johnson, J. Kenneth Shultis, and John P. Wagner Aug. 1979 209 p refs Sponsored in part by Dept. of Agriculture
(Contract EX-76-A-29-1026)
(DOE/SEA-1109-20401-79/2) Avail: NTIS HC A10/MF A01

An assessment is presented of the potential use of wind turbine generator systems (WTGS) in US agriculture. In particular, the number of WTGS's economically feasible for use in US agriculture and the conditions which yielded economic feasibility of WTGS's for certain agricultural applications are presented. In addition, for each case, i.e., set of assumed conditions, under which WTGS's were found to be economically feasible are identified: (1) the agricultural WTGS applications in terms of location, type and size (complete farm and dedicated-use applications); (2) the number of WTGS's by wind machine and generator size category; (3) aggregate energy conversion potential; and (4) other technical and economic WTGS performance data for particular applications. The methodology, data and assumptions used for the analysis are described. DOE

N80-25808# Department of Energy, Washington, D. C.
SYSTEMS ENGINEERING FOR POWER: ORGANIZATIONAL FORMS FOR LARGE SCALE SYSTEMS, VOLUME 1
L. H. Fink, ed. and T. A. Trygar, ed. Oct. 1979 376 p refs
Conf. held at Davos, Switzerland, 30 Sep. - 5 Oct. 1979
(CONF-790904-P2) Avail: NTIS HC A17/MF A01

Several articles addressing electrical energy system engineering problems are presented. The development of decentralized organizational forms for large scale interconnected power systems is discussed. A number of strategies are investigated for obtaining the desired control structures including the approximation of centralized control laws; the development of controllers using multiple, approximate models of the overall system; the use of decomposition methods; and a direct formulation of decentralized optimal stochastic control problems. A particular emphasis is given to the numerical modeling methods for large scale systems. Descriptor system approaches are explored along with other deterministic and probabilistic modeling methods. Perturbation methods in the construction of model decompositions are analyzed and evaluated. M.G.

N80-25809# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THERMOELECTRIC GENERATOR TESTING AND RTG DEGRADATION MECHANISMS EVALUATION Progress Report
A. Lockwood and G. Stapfer Dec. 1979 49 p
(Contract EY-76-A-03-0959)
(SAN-0959-T2; PR-33) Avail: NTIS HC A03/MF A01

The n-type selenide legs after 10,600 hours continue to show agreement with published data. In the ingradient testing after 11,378 hours, the n-legs also show comparable performance to the published data. The new design p-type legs were placed on test. The remaining multihundred watt generator on test Q1-A has accumulated 19,567 hours and performance remains stable. Three 18 couple modules S/N-1, 2, and 3 previously tested were received for test and evaluation. S/N-1 had 1700 hours testing with results indistinguishable from those at the end testing in 1977. The performances of Lincoln Experimental Satellite 8/9 generators are following DEGRA predictions after 31,824 hours. The performance of the Voyager 1 and 2 radioisotope thermionic generators is reported after 19,577 hours and 20,122 hours of operation, respectively. DOE

N80-25810# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PROBLEMS AND OPPORTUNITIES FOR SOLAR ENERGY IN BIOMASS, PYROLYSIS, AND GASIFICATION
T. Reed Nov. 1979 12 p Presented at Solar Fuels Workshop, Albuquerque, N. Mex., 28-29 Nov. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-332-495) Avail: NTIS HC A02/MF A01

Passive solar input for drying crops and wood already make a significant input to the US energy budget, and active solar drying, requiring temperatures below 200 C, can easily make an important substitution for fossil fuels in drying. Pyrolysis of biomass typically requires less than 1.6 MBtu/dry ton at a temperature of 500 C, and this could potentially be supplied by direct solar heating. The heat input is likely to be indirect heating of a solid, liquid or gas heat-transfer agent. Fast pyrolysis requires modest heat inputs with high heat-transfer rates at temperatures

over 900 C and thus may be particularly suited to focusing collectors as energy sources. Char gasification, using steam or CO2, requires large energy inputs at temperatures over 900 C and thus is the least likely field of application of solar energy. Ultimately, the large scale application of solar energy to biomass pyrolysis and gasification will depend on the relative cost of direct solar versus biomass inputs. Biomass energy inputs now typically cost 1 to 3$/MBtu; when direct solar heat costs begin to approach this level, direct solar process heat may be used for biomass conversion. DOE

N80-25811# Chicago Univ., Ill. Enrico Fermi Inst.
DESIGN AND TEST OF NON-EVACUATED SOLAR COLLECTORS WITH COMPOUND PARABOLIC CONCENTRATORS
A. Rabl, J. OGallagher, and R. Winston Jul. 1979 60 p refs
(Contract EY-76-S-02-2446)
(EFI-79-42) Avail: NTIS HC A04/MF A01

The intermediate range of concentration ratios (1.5X-10X) which can be achieved with CPC's without diurnal tracking provides both economic and thermal advantages for solar collector design even when used with nonevacuated absorbers. The present paper summarizes more than 3 years of research on nonevacuated CPC's and reviews measured performance data and critical design considerations. Concentrations in the upper portions of the practical range (e.g., 6X) can provide good efficiency (40 percent to 50 percent) in the 100 C to 160 C temperature range with relatively frequent tilt adjustments (12 to 20 times per year). At lower concentrations (e.g., 3X) performance will still be substantially better than for a double glazed flat plate collector above about 70 C and competitive below, while requiring only semiannual adjustments for year round operation. In both cases the cost savings associated with inexpensive reflectors, and the optimal coupling to smaller, simple inexpensive absorbers (e.g., tubes, fins, etc.) can be as important an advantage as the improved thermal performance. DOE

N80-25812# GTE Labs., Inc., Waltham, Mass.
DEVELOPMENT OF MATERIALS FOR A LUMINESCENT SOLAR COLLECTOR Annual Progress Report, 1 Sep. 1978 - 31 Aug. 1979
A. Lempicki, L. Andrews, and B. C. McCollum 1979 42 p refs
(Contract ER-78-C-02-4996)
(COO-4996-1) Avail: NTIS HC A03/MF A01

The objectives of the research involved preparation of a number of Cr(3+) doped glasses beginning with common commercial types, and expansion of the number and variety of glasses as time allowed. The Cr(3+) doped glasses were evaluated by spectroscopic measurements which included absorption and emission as well as quantum yield determinations. In addition, the influence of concentration quenching was measured by studying the luminescence decay kinetics at various concentrations in a variety of glasses. As the program developed, and the problem of rather low quantum yields became apparent in all the glasses, a rather detailed investigation was undertaken to better understand the radiationless decay of Cr(3+) in order to best evaluate the future direction of the program. The results are summarized. DOE

N80-25813# General Electric Co., Philadelphia, Pa. Advanced Energy Program.
SOLAIR HEATER PROGRAM: SOLAIR APPLICATIONS STUDY Final Report
Dec. 1977 96 p
(Contract EY-76-C-02-2705)
(COO-2705-3) Avail: NTIS HC A05/MF A01

The evaluation identified attractive applications, evaluated corresponding control procedures, estimated system performance, compared economically insolation and insulation, and evaluated the repackaging of off-the-shelf equipment for improved cost effectiveness. A detailed commercialization study of a residential domestic water heating system using the Solair concept which has been selected as the most attractive application was done. Other attractive applications are space/domestic water heating and a heat pump assisted solar system/domestic water heating where the heat pump and the solar system function in parallel. A prime advantage of heated air solar systems over liquid systems is cost and longer life which results in higher Btu's/dollar. Other air system advantages are no liquid leakage problems, no toxicity of freezing problems, and less complicated equipment. A hybrid solar system has been identified that can improve the market penetration of solar energy. Details of this system are provided. DOE

N80-25814# Argonne National Lab., Ill. Solar Energy Group.
DESIGN OF A SYSTEM USING CPC COLLECTORS TO COLLECT SOLAR ENERGY AND TO PRODUCE INDUSTRIAL PROCESS STEAM
C. K. Hsieh (Florida Univ., Gainesville) Aug. 1979 105 p refs
(Contract W-31-109-eng-38)
(ANL-79-102) Avail: NTIS HC A06/MF A01

A system was designed to use CPC collectors to collect solar energy and to generate steam for industrial process heat purposes. The system is divided into two loops with the collectors in the collector loop to operate a preheater and the collectors in the boiler loop to heat water to elevated pressures and temperatures. A flash boiler is used to throttle the heated water to steam. Two types of CPC collectors are chosen. In the collector loop the CPC collectors are fitted with concentric tube receivers. In the boiler loop the collectors employ heat pipes to transmit heat. This design is able to alleviate the scaling and plumbing problems. A fragile receiver tube can also be employed without rupture difficulties. The thermal processes in the collectors were analyzed using a computer modeling. The results were also used to develop a thermodynamic analysis of the total system. Calculations show that the design is technically feasible. The CPC collector is shown to have an efficiency that is very weakly dependent on its operating temperatures, which makes the collector particularly attractive in high temperature applications. DOE

N80-25815# Monsanto Research Corp., Dayton, Ohio.
SUPERIOR HEAT TRANSFER FLUIDS FOR SOLAR HEATING AND COOLING APPLICATIONS Semiannual Report, 20 Aug. 1978 - 20 Feb. 1979
Leo Parts, David R. Miller, and Quentin E. Thompson Sep. 1979 55 p refs
(Contract DE-AC04-78CS-45356)
(ALO-35356-1; MRC-DA-904) Avail: NTIS HC A04/MF A01

The objectives of this program are: (1) to quantify the required design and handling properties of heat transfer fluids for solar collector applications; (2) to collect data and pertinent information for all fluids presently used or envisioned as potentially useful in solar energy applications, based on the current state-of-the-art; and (3) to organize the latter information to allow the designers of solar collection systems to select optimum fluids for their particular needs. Two broad surveys were conducted. One encompassed the designers and manufacturers of solar collectors and collection systems to establish the data base for the required fluids properties. The results of this survey are summarized in this report. The second survey was addressed to the manufacturers of heat transfer fluids. A list of commercially available heat transfer fluids, to which further additions are anticipated, is also included. DOE

N80-25816# International Business Machines Corp., Gaithersburg, Md.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION. ALBUQUERQUE WESTERN NO. 1, ALBUQUERQUE, NEW MEXICO Progress Report, Oct. 1978 - Mar. 1979
C. M. Fu 1979 65 p refs
(Contract EG-77-C-01-4049)
(SOLAR/1011-79/14) Avail: NTIS HC A04/MF A01

The Albuquerque Western site is a four story, 110 unit apartment building in Albuquerque, New Mexico. The solar energy system consists of two independently controlled systems: one system serves domestic hot water (DHW) preheating needs, the other serves to preheat hot water used in space heating. Only the DHW system is described. The solar energy system has an array of tracking collectors with a gross area of 1782 square feet. The array faces south at an angle of 35 degrees to the the horizontal. Water is the transfer medium that delivers solar energy from the collector array to storage. Solar energy is stored in a 2000 gallon wooden tank that contains a plastic liner. The DHW is continuously circulated throughout the building. When solar energy is insufficient to satisfy the hot water energy

requirements, auxiliary heating is provided by an inline gas-fired boiler. An operational summary of the performance of the system for the period October 1978 through March 1979 is presented. DOE

N80-25817# Los Alamos Scientific Lab., N. Mex.
HIGH TEMPERATURE HYDROGEN CYCLES FOR SOLAR HEAT SOURCES
M. G. Bowman 1979 16 p refs Presented at Solar Fuels Workshop, Albuquerque, N. Mex., 28-29 Nov. 1979; sponsored by Solar Thermal Test Facilities Users Assoc. Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-80-184; CONF-791143-3) Avail: NTIS HC A02/MF A01

Some of the criteria required for high temperature thermochemistry hydrogen cycles to couple efficiently with solar heat sources are defined. Some of the experimentally validated cycles that have been developed over the years in terms of these criteria are examined and potential cycles that are being considered for the higher temperatures potentially available from solar concentrators are discussed. Cycles discussed include oxide sulfate cycles, halide hydrolysis cycles, direct decomposition of H2O and CO2, oxide cycles, and sulfuric acid-metal cycles. DOE

N80-25818# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR A-FRAME INDUSTRIES' SINGLE FAMILY RESIDENCE: KANEOHE, HAWAII
27 Jul. 1979 44 p
(Contracts EX-76-A-29-1020; HUD-H-2372)
(SOLAR/1010-79/50) Avail: NTIS HC A03/MF A01

A solar energy system designed to provide domestic hot water heating is described. The system uses city water as the common heat transfer medium, and contains no energy storage tank or DHW tank heat exchanger loop. Therefore, the total operating energy is in the energy collection and storage subsystem (ECSS). The house has been fully instrumented for performance evaluation of the solar system since February 1978 and the compiled data are discussed. Original cost estimates for provisioning and installation of the solar system are given. DOE

N80-25819# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION. ALBUQUERQUE WESTERN-2 MULTI-DWELLING BUILDING ALBUQUERQUE, NEW MEXICO
D. Moore 23 Nov. 1979 43 p refs
(Contracts EX-76-A-29-1020; HUD-H-2372)
(SOLAR/1090-79/50) Avail: NTIS HC A03/MF A01

The Albuquerque Western-2 site is a four-story, 110 unit apartment building in Albuquerque, New Mexico. The solar energy system consists of a controlled system to preheat hot water used in space heating. The solar energy system is designed to provide approximately 54 percent of the conditioned space heating load. The system has an array of tracking collectors with a gross area of 6429 square feet. The array faces south at an angle of 35 degrees to the horizontal. Water is used as the medium for delivering energy from the collector array to storage. Solar energy is stored underground in a 57,000 gallon concrete storage tank. During the space heating season, the heated water from storage is continuously circulated through the building to satisfy the space heating needs for each apartment. Auxiliary heating is provided by three inline gas-fired boilers. The system has three modes of operation. Original cost estimates for provisioning and installation of the solar system are given. DOE

N80-25820# International Business Machines Corp., Gaithersburg, Md.
SOLAR ENERGY PERFORMANCE EVALUATION. ZIEN MECHANICAL CONTRACTORS NO. 1: SINGLE-FAMILY RESIDENCE, MILWAUKEE, WISCONSIN Progress Report, Oct. 1978 - Mar. 1979
Carl L. Werner 1978 67 p refs
(Contract EG-77-C-01-4049)
(SOLAR/1057-79/14) Avail: NTIS HC A04/MF A01

Zien Mechanical Contractors No. 1 is a single-family residence in Milwaukee, Wisconsin. The home has approximately 1304 square feet of conditioned space. The solar energy system consists of two independently controlled systems: one system serves domestic hot water (DHW) preheating; the other is used for space heating and space cooling. Only the space heating and cooling system is described. The system has an array of flat-plate collectors with a gross area of 384 square feet. The array faces south at an angle of 53 degrees to the horizontal. Air is the transfer medium that delivers solar energy from the collector array to storage. Solar energy is stored in a rock bin containing 41,250 pounds of rock located in the basement of the house. The rock bin has 2 inches of polyurethane insulation on the outside walls and fiberglass roll insulation in the ceiling. A heat pump delivers solar energy from storage to a heat exchanger located within an air-handler. Heated air is then blown from the air-handler to the load. When solar energy is insufficient to satisfy the space heating load, an electric resistance heater in the air-handler provides auxiliary energy for space heating. The system has 10 modes of solar operation for space conditioning. The performance of the system for the period October 1978 through March 1979 is described. DOE

N80-25821# Boeing Aerospace Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR PERL-MACK ENTERPRISES' SINGLE FAMILY RESIDENCES, DENVER, COLORADO
21 Aug. 1979 50 p
(Contracts EG-77-C-01-4049; HUD-H-2372)
(SOLAR/1015-79/50) Avail: NTIS HC A03/MF A01

The Perl-Mack Enterprises Co. solar energy systems, which are installed in a total of 25 single family dwellings located in Denver, Colorado, are described. The 25 dwellings are of three different configurations. Two of the twenty-five dwellings have been fully instrumented for performance monitoring and evaluation since September 1977. All the solar systems are designed to provide approximately 69 percent of the space heating and energy requirements for each dwelling. Solar energy is collected by an array of flat plate collectors having a gross area of 470 square feet. A water-glycol mixture is used as the medium for delivering solar heat from the collection to the storage tank. The storage tank has a total capacity of 945 gallons. A liquid-to-liquid heat exchanger, within the storage tank, transfers the stored heat from the transfer medium to the domestic hot water tank of the house. DOE

N80-25822# Bell Telephone Labs., Inc., Philadelphia, Pa.
WEST CHESTER WORK CENTER: SOLAR SPACE HEATING DEMONSTRATION PROJECT
May 1979 47 p ref
(Contract EY-76-C-02-4048)
(DOE/CS-4048/2; COO-4048-2) Avail: NTIS HC A03/MF A01

The construction stage of an integrated system providing solar energy space heating for 9982 sq ft, newly built, one-story building is described. The building is located at 966 Matlack Street, West Goshen Township, Chester County, Pennsylvania. Functionally, the building consists of two sections: an office and a storeroom. The office section is heated by solar-assisted water-to-air heat pump units. The storeroom section is heated by an air-handing unit, containing a water-to-air coil. Solar energy is expected to provide 62% of the heating load, with the balance provided by a back-up electric boiler. The system includes 1900 active (2112 gross) square feet of flat-plate solar collectors, and a 6000 gallon above ground indoor storage tank. Freeze protection is provided by a gravity drain-down scheme combined with nitrogen pressurization in a closed circuit. DOE

N80-25823# Wisconsin Univ. - Madison. Solar Energy Lab.
SIMULATION AND DESIGN OF SOLAR THERMAL PROCESSES
31 Oct. 1979 16 p refs
(Contract EY-76-S-02-2588)
(COO-2588-T1) Avail: NTIS HC A02/MF A01

Research on simulation using TRNSYS and FCHART methods is described including systems analysis, user services, design procedures, and model validation. DOE

N80-25824# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.
OCEAN ENERGY SYSTEMS. FISCAL YEAR 1979 Program

Summary Report
1979 284 p refs
(DOE/ET-0118) Avail: NTIS HC A13/MF A01

A review of ocean thermal energy conversion technology, test facilities, and research programs is given; and project summaries for DOE contracts are included. The project summaries list the contractor, contract title and number, funding, and work location and provide a brief description of the project. Also, project summaries for technologies for alternate ocean energy systems employing ocean currents, ocean waves, and salinity gradients are included. The technical status and program plans for each of the alternate technologies are discussed. DOE

N80-25825# General Electric Co., Philadelphia, Pa. Advanced Energy Dept.
SOLAR TOTAL ENERGY PROJECT SHENANDOAH Final Design Report
10 Jan. 1980 340 p
(Contract EG-77-C-04-3985; DE-AC04-77ET-20260)
(ALO-3985-1-Rev-1) Avail: NTIS HC A15/MF A01

A description of the final design for the Solar Total Energy System to be installed at the Shenandoah, Georgia, site of utilization by the Bleyle knitwear plant, is presented. The system is a fully cascaded total energy system design featuring high temperature paraboloidal dish solar collectors with a 235 concentration ratio, a steam Rankine cycle power conversion system capable of supplying 100 to 400 kW(e) output with an intermediate process steam take-off point, and a back pressure condenser for heating and cooling. The design also includes an integrated control system employing the supervisory control concept to allow maximum experimental flexibility. The system design criteria and requirements are presented including the performance criteria and operating requirements, environmental conditions of operation; interface requirements with the Bleyle plant and the Georgia Power Company lines; maintenance, reliability, and testing requirements; health and safety requirements; and other applicable ordinances and codes. DOE

N80-25826# BDM Services Co., Albuquerque, N. Mex.
CONCEPTUAL DESIGN AND ANALYSIS OF A 100 MWe DISTRIBUTED LINE FOCUS SOLAR CENTRAL POWER PLANT Topical Report, 29 Sep. 1978 - 4 May 1979
M. G. Semmens, A. Fong, G. J. Collaros, R. E. Dascher, R. E. Grassberger, D. B. Griego, and T. F. Stueber 1979 327 p
(Contract ET-78-C-03-2073)
(SAN-2073-1) Avail: NTIS HC A15/MF A01

A program to develop the optimum line focus solar central power plant system conceptual design is reported in detail. The approach consisted of a parametric analysis of each of the seven major subsystems: collector, receiver tube, working fluid, heat transport subsystem, energy storage subsystem, electric power generating subsystem, and master control subsystem. Systems analysis and selection of the baseline 100 MWe line focus power plant are described. Detailed performance and cost summaries are included. DOE

N80-25827# Argonne National Lab., Ill. Office of Program Management Support.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 1: COUNTRY DATA, AF-CO
Jun. 1979 345 p refs 11 Vol.
(Contract W-31-109-eng-38)
(ANL/PMS-79-2-Vol-1) Avail: NTIS HC A15/MF A01

The World Energy Data System contains organized data on those countries and international organizations that may have critical impact on the world energy scene. Country data on Afghanistan, Algeria, Argentina, Australia, Austria, Bangladesh, Belgium, Bolivia, Brazil, Burma, Canada, China, and Colombia are included in volume 1. The following topics are covered for most of the countries: economic, demographic, and educational profiles; energy exports, imports of energy supplies; environmental considerations; power production facilities; energy industries; commercial applications of energy; research and development activities of energy; and international activities. DOE

N80-25828# Argonne National Lab., Ill. Office of Program Management Support.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 2: COUNTRY DATA, CZ-KS
Jun. 1979 361 p refs 11 Vol.
(Contract W-31-109-eng-38)
(ANL/PMS-79-2-Vol-2) Avail: NTIS HC A16/MF A01

The World Energy Data System contains organized data on those countries and international organizations that may have critical impact on the world energy scene. Country data on Libya, Luxembourg, Malaysia, Mexico, Netherlands, New Zealand, Niger, Nigeria, Norway, Pakistan, Peru, Philippines, Poland, and Portugal are presented. The following topics are covered for most of the countries: economic, demographic, and educational profiles; energy policy; indigenous energy resources and uses; forecasts demand, exports, imports of energy supplies; environmental considerations of energy supplies; power production facilities; energy industries; commercial applications of energy; research and development activities of energy; and international activities. DOE

N80-25829# Argonne National Lab., Ill. Office of Program Management Support.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 2: COUNTRY DATA, LY-PO
Jun. 1979 364 p refs
(Contract W-31-109-eng-38)
(ANL/PMS-79-2-Vol-3) Avail: NTIS HC A16/MF A01

The World Energy Data System contains organized data on those countries and international organizations that may have critical impact on the world energy scene. Included in this volume, volume 2, are Czechoslovakia, Denmark, Egypt, Finland, France, Germany(East), Germany (West), Greece, Guinea, India, Indonesia, Iran, Italy, Japan, and Korea (South). The following topics are covered for most of the countries; economic, demographic, and educational profiles; energy policy; indigenous energy resources and uses; forecasts; demand, exports, imports of energy supplies; environmental considerations of energy use; power production facilities; energy industries; commercial applications of energy; research and development activities of energy; and international activities. DOE

N80-25830# Argonne National Lab., Ill. Office of Program Management Support.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 4: COUNTRY DATA, SG-YO
Jun. 1979 407 p refs 11 Vol.
(Contract W-31-109-eng-38)
(ANL/PMS-79-2-Vol-4) Avail: NTIS HC A18/MF A01

The World Energy Data System contains organized data on those countries and international organizations that may have critical impact on the world energy scene. Included in this volume are Senegal, South Africa, Soviet Union, Spain, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Turkey, United Kingdom, United States, Upper Volta, Venezuela, and Yugoslavia. The following topics are covered for most of the countries; economic, demographic, and educational profiles; energy policy; indigenous energy resources and uses; forecasts, demand, exports, imports of energy supplies; environmental considerations of energy supplies; power production facilities; energy industries; commercial applications of energy; research and development activites of energy; and international activities. DOE

N80-25831# Argonne National Lab., Ill. Office of Program Management Support.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 5: INTERNATINAL ORGANIZATION DATA
Jun. 1979 156 p refs 11 Vol.
(Contract W-31-109-eng-38)
(ANL/PMS-79-2-Vol-5) Avail: NTIS HC A08/MF A01

The World Energy Data System (WENDS) contains organized data on those countries and international organization that may have critical impact on the world energy scene. WENDS has acquired and organized information on the following energy-related organizations: Asian Development Bank; European Community; InterAmerican Development Bank; International Atomic Energy Agency; International Energy Agency; Nuclear Energy Agency; United Nations; and World Bank. Within each organization grouping most of the following topics are addressed; organization background, government background, energy background (energy

policy and objectives), energy research and development activities, and international activities. DOE

N80-25832# Teledyne Energy Systems, Timonium, Md.
SELENIDE ISOTOPE GENERATOR FOR THE GALILEO MISSION. HEAT PIPE ATTACHMENT TECHNOLOGY Final Report
Jul. 1979 56 p
(Contract DE-AC01-78ET-33009)
(TES-33009-45) Avail: NTIS HC A04/MF A01

The development of an optimum joining method for attaching copper/water heat pipes to an aluminum alloy (6061-T6) radiator and housing for the SIG/Galileo program is described. DOE

N80-25833# Teledyne Energy Systems, Timonium, Md.
SELENIDE ISOTOPE GENERATOR FOR THE GALILEO MISSION. GIG/GALILEO HERMETIC RECEPTACLE TEST PROGRAM Final Report
Sidney Roedel Jun. 1979 159 p
(Contract DE-AC01-78ET-33009)
(TES-33009-47) Avail: NTIS HC A08/MF A01

The purpose of the receptacle test program was to test various types of hermetically sealed electrical receptacles and to select one model as the spaceflight hardware item for SIG/Galileo thermoelectric generators. The design goal of the program was to qualify a hermetic seal integrity of equal to or less than 1 x 10 to the 9th power std cc He/sec-atm at 400 f(204 C) and verify a reliability of 0.95 at a 50% confidence level for a flight mission in excess of 7 years. DOE

N80-25834# Teledyne Energy Systems, Timonium, Md.
SELENIDE ISOTOPE GENERATOR FOR THE GALILEO MISSION. SIG THERMAL INSULATION TESTS EVALUATION
Jun. 1979 60 p
(Contracts ET-78-C-01-2865)
(TES-33009-50) Avail: NTIS HC A04/MF A01

Since the SIG program required the use of very high performance thermal insulation materials in rather severe thermal and environmental conditions, a thorough screening and testing program was performed. Several types of materials were included in the preliminary survey. Most promising were oxide and carbonaceous fibrous insulations, oxide and carbonaceous foamed materials, and multilayer materials with both powder and cloth spacers. The latter were only viable for the vacuum option. In all, over one hundred materials from more than sixty manufacturers were evaluated from literature and manufacturers' data. The list was pared to eighteen candidates in seven basic types, i.e., fibrous microporous SiO2, fibrous SiO2/Al2O3, fibrous ZrO2 fibrous carbon, foamed SiO2, foamed carbon, and multilayer. Test results are presented. DOE

N80-25835# Teledyne Energy Systems, Timonium, Md.
SELENIDE ISOTOPE GENERATOR FOR THE GALILEO MISSION. SIG HERMETIC BIMETAL WELD TRANSITION JOINT Final Report
W. J. Barnett Aug. 1979 79 p
(Contracts ET-78-C-01-2865)
(TES-33009-51) Avail: NTIS HC A05/MF A01

The successful development of the commercial 6061-T6561/Silver/304/L explosive clad plate material as a bimetal weld transistion joint material, as described herein, satisfies all SIG/Galileo design requirements for hermetic weld attachment of stainless steel subassemblies to aluminum alloy generator housing or end cover structures. The application of this type weld transition joint to the hermetic attachment of stainless steel shell connectors is well developed and tested. Based on on-going life tests of stainless steel receptacle/ bimetal ring attachment assemblies and metallurgical characterization studies of this transition joint material, it appears evident that this transition joint material has more than adequate capability to meet the 250 to 300 F and 50,000 hr design life of the SIG/Galileo mission. Its extended life temperature capability may well approach 350 to 400 F. DOE

N80-25836# Westinghouse Electric Corp., East Pittsburgh, Pa.
DESIGN STUDY AND ECONOMIC ASSESSMENT OF MULTI-UNIT OFFSHORE WIND ENERGY CONVERSION SYSTEMS APPLICATIONS. VOLUME 4: METEOROLOGICAL AND OCEANOGRAPHIC SURVEYS Final Report
14 Jun. 1979 344 p refs
(Contracts EX-76-C-01-2330; E(49-18)-2330)
(WASH-2330-78/4-Vol-4) Avail: NTIS HC A15/MF A01

The results are presented of a survey of the meteorology and oceanography of the United States offshore as they pertain to the design, cost, emplacement, operation and maintenance of offshore wind energy conversion systems (OWECS). This report is intended to define the environment in which OWECS are to be considered. DOE

N80-25837# Westinghouse Electric Corp., East Pittsburgh, Pa. Advanced Systems Technology Div.
DESIGN STUDY AND ECONOMIC ASSESSMENT OF MULTI-UNIT OFFSHORE WIND ENERGY CONVERSION SYSTEMS APPLICATION. VOLUME 3: SYSTEM ANALYSIS Final Report
14 Jun. 1979 192 p refs
(Contract EX-76-C-01-2330)
(WASH-2330-78/4-Vol-3) Avail: NTIS HC A09/MF A01

Optimum offshore wind energy conversion systems are described. The cost and performance of these systems were developed for a variety of conditions and the tradeoff between cost and energy production was made of the wide range of scenarios considered. The impact of the many design parameters on the major subsystems are briefly reviewed and the interactions which exist between subsystems are discussed. In particular, a section is devoted to dynamic interactions which might exist between the wind turbine generator plant and the platform. DOE

N80-25838# Westinghouse Electric Corp., East Pittsburgh, Pa.
DESIGN STUDY AND ECONOMIC ASSESSMENT OF MULTI-UNIT OFFSHORE WIND ENERGY CONVERSION SYSTEMS APPLICATION. VOLUME 2: APPARATUS DESIGNS AND COSTS Final Report
14 Jun. 1979 310 p refs
(Contracts EX-76-C-01-2330; E(49-18)-2330)
(WASH-2330-78/4-Vol-2) Avail: NTIS HC A14/MF A01

Parametric designs and companion cost functions are presented for each major component of an offshore wind energy conversion system (OWECS). These are: (1) the support platforms; (2) the wind turbine generated (WTG) plants; and (3) the electrical energy collection and transmission system including (4) substations. A backup hydrogen energy delivery system for extremely remote or deep water sites was also evaluated. Costs are presented for fabricating, transporting, installing, operating, and maintaining each of these components. DOE

N80-25839# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SOLAR TECHNOLOGY APPLICATION TO ENHANCED OIL RECOVERY
P. deLeon, K. C. Brown, J. W. Margolis, and L. H. Naar Dec. 1979 101 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-352-392) Avail: NTIS HC A06/MF A01

Solar energy systems which generate steam for thermal enhanced oil recovery are discussed. Six solar technologies are evaluated and two parabolic troughs and central receivers are selected for closer study. The legal and environmental issues attending solar enhanced oil recovery are analyzed. The petroleum producing companies' preferences and requirements are discussed. Alternative means of financing solar enhanced oil recovery are addressed. DOE

N80-25840# Delaware Univ., Newark. Coll. of Engineering.
THEORY OF THIN-FILM PHOTOVOLTAICS. NON-IDEAL DIODE FACTORS
K. W. Boer 1979 23 p refs
(Contract DE-AC01-79ET-23103)
(DOE/ET-23103; TR-3) Avail: NTIS HC A02/MF A01

It is shown that non-ideal diodes with an A-factor in the exponent larger than two can be explained when the junction recombination starts to saturate. In photovoltaic cells in which the density of minority carriers can be varied independent of the bias voltage, this behavior becomes transparent and is used as an example for the proposed models. DOE

N80-25841# Institute of Gas Technology, Chicago, Ill.
BENEFICIAL USE OF REJECTED HEAT FROM ELECTRIC POWER PLANTS Final Summary Report
Robert W. Porter Aug. 1979 17 p refs
(Contract EC-77-S-02-4531)
(COO-4531-9) Avail: NTIS HC A02/MF A01

The in situ beneficial uses of rejected heat from steam-electric power plants are evaluated. Applications, which include direct discharge into a municipal water supply, interaction with wastewater treatment, and open field irrigation, were examined. In each case, a thermal and economic systems analysis was performed and operational, legal, and other problems were assessed. In the case of the municipal water supply, the savings in cost of closed-cycle cooling and water-heater energy appear to offset operational problems in the water supply and may be sufficient to justify public acceptance. A number of more advanced wastewater treatment processes would benefit from dilution with a portion of condenser discharge. The treated mixture would serve as makeup for a smaller modified closed cycle cooling system and the balance would constitute a water product. Unfortunately, open-field irrigation does not seem feasible due to the large land areas required. DOE

N80-25842# Spire Corp., Bedford, Mass.
AMORPHOUS SILICON SOLAR CELLS BY HYDROGEN IMPLANTATION Quarterly Report, 1 Jan. - 31 Mar. 1979
A. R. Kirkpatrick and A. A. Malas Aug. 1979 24 p
(Contract DE-AC03-79ET-23042)
(SAN-3042-1; QR-1) Avail: NTIS HC A02/MF A01

The program to investigate applications of ion implantation to preparation of amorphous silicon material and cell devices was initiated. Emphasis was placed upon establishing a number of special ion implantation capabilities needed in order to conduct the program. Adequate beams of all ions of initial interest were made available over wide ion energy range. Special fixtures to provide active sample cooling and required area masking were produced. Implantation environments were experimentally verified. Analytical studies were conducted to insure that transient thermal effect problems could be avoided during high rate implantations to be employed. Ranges of available implantation effects for H-1(+), B-11(+), O-18(+), F-19(+), Si-28(+), P-31(+), and Ar-40(+) into silicon were examined. A cell device test structure was selected to be employed as a primary investigation vehicle for initial evaluation of implantation effects. R.E.S.

N80-25843# Varian Associates, Palo Alto, Calif.
NOVEL SOLAR CELL CONCENTRATOR PHOTOVOLTAIC CONVERTER SYSTEM Final Report
L. W. James and A. VanderPlas Dec. 1979 91 p refs Prepared for Sandia Labs., Albuquerque, New Mex.
(Contract EY-76-C-04-0789)
(SAND-79-7048) Avail: NTIS HC A05/MF A01

Attainment of photovoltaic conversion efficiencies greater than 25% to 30% thought necessary to make concentrator photovoltaics economical, seems possible if the solar spectrum is more efficiently used by splitting the spectrum and using solar cells of different bandgaps. For initial work on multi-bandgap concentrator solar cells, the spectrum was split by an optical filter which transmits light above 1.6 eV and below 1.1 eV and reflects light between 1.1 and 1.6 eV. Theoretical modeling of possible conversion efficiencies led to the choice of the filter bandpass energies and practical solar cell fabrication considerations have led to the choice of silicon and the Al(x) Ga(1-x)As system for initial development work. Special silicon concentrator solar cells with a p(+)-n(-)-n(+) structure designed for this application and have attained apparent cell conversion efficiencies of 16.2% at a current ratio of 455 suns. DOE

N80-25844# Motorola, Inc., Phoenix, Ariz. Solar Energy Dept.
THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS Quarterly Report, 1 Apr. - 30 Jun. 1979
K. R. Sarma, M. J. Rice, R. Legge, R. W. Cuttler, and W. C. Ramsey 30 Jun. 1979 72 p refs
(Contract ET-78-C-03-2207)
(SAN-2207-3) Avail: NTIS HC A04/MF A01

The effects of molybdenum substrate smoothness on the shear separation process were investigated. By Auger analysis of the substrates, shear separation was found to occur in the silicon film very near the MoSi2-Si interface. A moving substrate EBD system was designed and fabricated. Initial experiments were performed to determine the optimum resistivity for high efficiency cells and the effects of substrate temperature during deposition and of multiple gettering cycles on solar cell efficiency. Substrate temperatures between 1050 C and 1150 C did not appear to influence cell efficiency parameters. Because of the limited number of experiments performed to date, the optimum doping level and the benefits of multiple gettering cycles could not be conclusively determined. DOE

N80-25845# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
MATHEMATICAL MODELING OF THE LITHIUM ALUMINUM, IRON SULFIDE BATTERY Ph.D. Thesis
Richard Pollard Dec. 1979 167 p refs
(Contract W-7405-eng-48)
(LBL-10197) Avail: NTIS HC A08/MF A01

The LiAl/LiCl,KCl/FeS high temperature battery is a candidate for off-peak energy storage and for electric vehicle propulsion. A mathematical model is presented which is able to predict the operational characteristics of the cell and obtain pertinent information for its design and optimization. The theoretical results show many of the trends in behavior observed experimentally. The effects of state of charge, initial electrolyte composition, cell temperature, and current density are presented, and factors that can limit cell performance are identified. The influence of a period of relaxation between the end of discharge and the subsequent charge was also investigated. Furthermore, a separate, analytic treatment of porous electrodes was developed in order to clarify the nature of the highly nonuniform initial reaction distributions that are obtained with high exchange current densities. DOE

N80-25846# Montana Energy and MHB Research and Development Inst., Inc., Butte.
HIGH-TEMPERATURE FUEL CELL RESEARCH AND DEVELOPMENT Annual Technical Status Report, 1 Oct. 1978 - 30 Sep. 1979
30 Sep. 1979 25 p
(Contracts EC-77-C-03-1485; DE-AC03-77ET-11320)
(SAN-1485-T1) Avail: NTIS HC A02/MF A01

Materials which are chemically and physically stable in molten carbonate fuel cell electrolyte at 600 to 700 C were identified. Fibers of the identified materials were then prepared and characterized to determine the stability of the fibers in the molten carbonate electrolyte. DOE

N80-25847# Institute of Gas Technology, Chicago, Ill.
FUEL CELL RESEARCH ON SECOND-GENERATION MOLTEN-CARBONATE SYSTEMS Technical Report, 1 Oct. 1978 - 30 Jun. 1979
Oct. 1979 305 p refs
(Contract EM-78-C-03-1735)
(SAN-11276-1) Avail: NTIS HC A14/MF A01

Activities toward the development of a cell package containing cost effective cell components, having a cell performance satisfying utility requirements (125 W/ft 2 at 0.85 V using low Btu fuel gases), and having the capability of repeated thermal cycling with a pressure differential between the anode and the cathode are described. Structural analysis studies to identify the magnitude and the distribution of stress levels in the cell package show that differences in thermal expansion and mechanical properties of the cell components, bonding of the electrolyte tile to other cell components, and the cell design (location of supports and gas distribution channels) are extremely important. Efforts to minimize the phase transformations of the three crystalline forms of LiAlO2 during cell operation via anion or cation doping of the LiAlO2 for the purpose of stabilizing the LiAlO2 surface area at some acceptable level are showing only limited success. Both baseline and development cell components were tested in laboratory and in bench scale cells. DOE

N80-25848# Montana Energy and MHB Research and Development Inst., Inc., Butte.
HIGH TEMPERATURE FUEL CELL RESEARCH AND DEVELOPMENT Final Technical Status Report, Jun. 1977 - Sep. 1978

J. J. Rasmussen and R. Guidotti 15 Oct. 1978 253 p refs
(Contract EC-77-C-03-1485)
(SAN-1485-2) Avail: NTIS HC A12/MF A01

Ceramic materials with properties which made them potential candidates for use in molten-carbonate fuel cell tiles or electrodes were investigated. Thirteen compositions were tested statically at 1000 K in a Li2CO3-K2CO3 bath under a dry CO2 atmosphere. Four of the materials tested showed severe degradation reactions in the molten carbonate. A low temperature process for forming small diameter, high aspect ratio ceramic fibers for fuel cell use was developed. Results of a computer study on the thermodynamic analysis of fuel cell materials are discussed. The magnetohydrodynamic materials with potential use for fuel cell applications were surveyed. Laboratory facilities were established to conduct research on interfacial diffusion processes which could be detrimental to successful long term operation of the solid-electrolyte fuel cell. A variety of physical and chemical techniques were examined for the preparation of high density substituted LaCrO3 which was one component of a diffusion couple with Y2O3-stabilized ZrO2. Hydrolysis of a mixed metal nitrate solution with urea produced the most reactive powder. A final theoretical density of almost 98% was attained in cold pressed sintered discs of this material. DOE

N80-25849# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
EVALUATION OF RESIDENTIAL BUILDING ENERGY PERFORMANCE STANDARDS
Mark D. Levine, David B. Goldstein, Arthur H. Lokmanhekim, and Arthur H. Rosenfeld Dec. 1979 37 p refs Presented at Conf. on Thermal Performance of the Exterior Envelopes of Buildings, Orlando, Fla., 3-5 Dec. 1979
(Contract W-7405-eng-48)
(LBL-9816; CONF-791233-2) Avail: NTIS HC A03/MF A01

The development and analysis of energy performance standards for residential buildings in the United States is described. The approach involves an assessment of the economic costs and benefits of alternative standards and provides quantitative estimates of the reduction of energy use resulting from the implementation of standards. The sensitivities of building energy use to design parameters of buildings - including size, orientation, aspect ratio, basement type, window area, and construction material - are assessed. The DOE-2 building energy utilization analysis program was used to evaluate the heating and cooling loads of residential buildings. Residential buildings were simulated in ten weather climates using hourly weather data with a variety of energy conservation measures. DOE

N80-25850# Sperry Univac, St. Paul, Minn.
SOLAR COLLECTOR STUDIES FOR SOLAR HEATING AND COOLING APPLICATIONS Technical Progress Report, 18 Sep. 1978 - 18 Mar. 1979
S. O. Jensen, J. E. Kovacic, and J. H. Anderson (Scientific Sunsource Systems) 10 Mar. 1979 56 p refs
(Contract EM-78-C-04-5355)
(ALO-5355-T1) Avail: NTIS HC A04/MF A01

A summary of the literature, especially patent teachings pertaining to black fluid solar collectors, is given. Laboratory tests to determine the suspension stability of various carbon types in water/ethylene glycol are reported. The suspensions were aged at 160 F for 2000 hours and at -15 F for 500 hours. Tests to date demonstrate that colloidal carbon with Zanflow gum as the suspending agent gave excellent, stable suspensions even after evaporation and resuspension with water/ethylene glycol 50:50 solution. It is suggested that the suspending agent interacts with electrical charges on the carbon particles to prevent agglomeration. DOE

N80-25851# American Science and Engineering, Inc., Cambridge, Mass.
DEVELOPMENT OF A SECOND-GENERATION CONCENTRATING TRACKING SOLAR COLLECTOR Technical Progress Report, 28 Dec. 1978 - 19 Jun. 1979
William D. Antrim, Jr. 16 Aug. 1979 29 p
(Contract EM-78-C-04-4275)
(ASE-4460) Avail: NTIS HC A03/MF A01

A second generation concentrating tracking solar collector was developed. The approach combines an array of parabolic trough mirror concentrators each combined with a variation of the cylindrical blackbody receiver to provide a collector with a minimum concentration ratio of ten. The design of the prototype collector was completed, engineering model hardware produced, tested, and the design iterated. The collector design and some of the model hardware used to develop certain design features are described in detail. DOE

N80-25852# California Univ. at Berkeley. Sanitary Engineering Research Lab.
SOLAR ENERGY CONVERSION THROUGH BIOPHOTOLYSIS Annual Report, 1 Apr. 1978 - 31 Mar. 1979
J. R. Benemann, M. A. Murry, P. C. Hallenbeck, K. Miyamoto, A. G. Olafsen, D. J. Esteva, and L. V. Kochian 1 May 1979 236 p refs
(Contract EY-76-S-03-0034)
(SAN-0034-239-T1; AR-3) Avail: NTIS HC A11/MF A01

The state-of-the-art of biophotolysis was reviewed and a bioengineering analysis carried out. The conclusions were that practical biophotolysis systems are feasible; however, they will require, in most cases, relatively long-term R and D. The biophotolysis system developed, utilizing heterocystous blue-green algae, was demonstrated both indoors and outdoors with a model converter system using the heterocystous blue-green alga Anabaena cylindrica. Maximal light energy conversion efficiencies were 2.5 percent indoors and about 0.2 percent outdoors, averaged for periods of about two weeks. Achievement of such rates required optimization of N2 supply and culture density. DOE

N80-25853# Solarex Corp., Rockville, Md.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN FILM SOLAR CELLS Quarterly Technical Progress Report, Apr. - 30 Jun. 1979
George Storti, Scott Johnson, H. C. Lin, and R. W. Armstrong 30 Jun. 1979 32 p refs Prepared in cooperation with Maryland Univ., College Park
(Contract ET-78-C-01-3413)
(DSE-3413-T2; QTPR-3) Avail: NTIS HC A03/MF A01

The vertical junction effect in polysilicon solar cells (due to dopant penetration along grain boundaries) was investigated using a cylindrical grain model. The model shows that for small grain radii the short circuit current can increase above the single crystal value if the grain boundaries collect carriers and that the short-circuit current approaches the single crystal value as the grain size increases. Dark I-V characteristics were measured and illuminated characteristics are projected for each of the diodes. The diode characteristics are given together with SEM micrographs of the diodes and the effect of areal inhomogemetry was investigated. The relative orientations of adjacent crystal grains and the nature of the boundaries between grains were studied by X-ray diffraction, optical microscopy and SEM methods. Orientation data is presented along with electron channelling patterns obtained from individual grains. A conclusion is drawn on the origin of sinuous grain boundaries. DOE

N80-25854# Solarex Corp., Rockville, Md.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN FILM SOLAR CELLS Quarterly Technical Progress Report, 1 Jul. - 30 Sep. 1979
George Storti, Scott Johnson, H. C. Lin (Maryland Univ., College Park), and R. W. Armstrong (Maryland Univ., College Park) 30 Sep. 1979 51 p refs
(Contract ET-78-C-01-3413)
(DSE-3413-T3; QTPR-4) Avail: NTIS HC A04/MF A01

A detailed model of the vertical junction effect was generated which investigates both the increase in light generated current due to enhanced collection at the grain boundary and the increase in dark current due to the increased junction area. Results show that there is an overall increase in the cell's maximum power; however, the increase in power is negligible for grain widths exceeding a few tenths of a millimeter. Solar cells were fabricated on a longitudinal section of cast polysilicon which was analyzed crystallographically by means of X-ray diffraction patterns. Special crystallographic orientation relationships were identified for the relative orientations of adjacent grains and for the alignment of their boundary interfaces along certain planar segments. The dark I-V characteristics of the polysilicon cells

were dominated by recombination within the space-charge region. DOE

N80-25855# Solar Turbines International, San Diego, Calif.
DEVELOPMENT OF POLYIMIDE MATERIALS FOR USE IN SOLAR ENERGY SYSTEMS Semiannual Progress Report, 1 Aug. 1978 - 31 Jan. 1979
A. L. Wilcoxson, U. A. Sorathia, and J. Gagliani 1979 39 p refs
(Contracts EM-78-C-04-5305)
(DOE/CS-35305/T1; SR-79-R-4650-09) Avail: NTIS HC A03/MF A01

Two separate and distinct products were studied, a lightweight flexible insulating foam and a high density rigid, load bearing insulating foam. These products are derived from a polyimide resin. A critical characterization criteria was established in the form of environment exposure resistance. The foams were evaluated on the basis of this direct exposure test. Studies initiated to improve the resistance included additive studies, using reinforcements and uv absorbers, and postcure studies. The various formulations were also screened on the basis of humidity resistance. On the basis of testing conducted, four different resin formulations at a foam density of approximately 16 kg/cu m are meeting minimum requirements. The rigid foam was optimized through a glass reinforcement study and a process parameter study. The result was an optimized glass strand/microballoon reinforced foam which meets the tested property goals at a density of approximately 240 kg/cu m. DOE

N80-25856# Sandia Labs., Livermore, Calif.
SILVER DETERIORATION IN SECOND SURFACE SOLAR MIRRORS
Victor P. Burolla and Susan L. Roche Jan. 1980 40 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8276) Avail: NTIS HC A03/MF A01

The suitability of various heliostat mirror module designs for large solar central power systems, is examined with respect to the service life of the reflective surface. Observations on several module designs reveal significant deterioration of the silvered surface in an unexpectedly short time span. Information on the extent and nature of the deterioration noticed on several mirror module designs, on the accelerated tests designed to simulate field deterioration, on the potential design solutions avaliable, on the parameters necessary for conducting useful accelerated weathering tests, and on the nature of commercially prepared mirrors is presented. DOE

N80-25857# Sandia Labs., Albuquerque, N. Mex.
USE OF THIN GLASS REFLECTORS FOR SOLAR CONCENTRATORS
R. H. Marion 1980 12 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0109C; CONF-800220-1) Avail: NTIS HC A02/MF A01

Elastically deforming thin glass (thickness = 0.13 to 0.80 mm) provides an alternate method of forming a curved glass reflector which can eliminate some of the disadvantages of thicker glass. A concept is described where silvered thin glass is bonded to a steel backing to form a laminate with a reflectance greater than 93%. Subsequent bending of the flat reflector laminate to a concentrating profile produces compressive stresses throughout the glass if the laminate is properly designed. These compressive stresses enhance fracture resistance and the lamination provides protection for the silver. The design of the laminate is outlined for 0.25 and 0.51 mm thickness glass and fabrication procedures are discussed. Thermal/humidity cycling hail impact, bond strength measurement and reflectance results are presented which demonstrate the performance capabilities of this reflector laminate concept. DOE

N80-25858# Sandia Labs., Albuquerque, N. Mex.
SOLARIZATION OF HELIOSTAT GLASSES
J. Vitko, Jr. and J. E. Shelby Dec. 1979 26 p refs Presented at the Solar Reflective Mater. Workshop, San Francisco, 12-14 Feb. 1980
(Contracts EY-76-C-04-0789; DE-AC04-79DP-00789)
(SAND-79-8754) Avail: NTIS HC A03/MF A01

A solar induced decrease in FE(2+) absorption in heliostat glasses from the solar furnace at Odeillo, France, has been observed. This decrease occurs throughout the sampled (not just at the exposed surface) and is of sufficient magnitude to result in an increase of 2.5% in solar transmittance in a period of nine years. Optical and ESR studies did not detect a corresponding increase in FE(3+) concentration. The implication of these results on a microscopic model for the observed solarization is discussed. Solar simulation studies produced effects of magnitude and sign similar to those observed in the field exposed samples, and appear to offer an attractive means for screening samples for solarization tendencies. DOE

N80-25859# Sandia Labs., Albuquerque, N. Mex.
MAGMA ENERGY: A FEASIBLE ALTERNATIVE?
J. L. Colp 1979 21 p refs Presented at Conf. on Long-Term Energy Resources, Montreal, Canada, 3 Dec. 1979
(Contract EY-76-C-04-0789)
(SAND-80-0309C; CONF-791216-2) Avail: NTIS HC A02/MF A01

A program to investigate the scientific feasibility of extracting energy directly from deeply buried circulating magma sources is described. The following program tasks are discussed: sources location and definition, source tapping, magma characterization, magma/material compatibility, and energy extraction. DOE

N80-25860# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CLEANING AGENTS AND TECHNIQUES FOR CONCENTRATING SOLAR COLLECTORS
V. L. Morris 1980 65 p refs Presented at 2nd Solar Reflective Mater. Workshop, San Franciso, 12 Feb. 1980
(Contract EY-76-C-04-0789)
(SAND-80-7005C; CONF-800220-2) Avail: NTIS HC A04/MF A01

Tests were conducted to determine the nature of the soil which is irreversibly deposited on solar collectors during environmental exposure. Mehods of removing this soil were investigated. The mechanism of attachment of the soil to the surface was determined as a potential aid to cleaning agent formulation. Reflector specimens were environmentally exposed at several industrial sites. Three types of reflector surfaces were studied: second surface silvered glass, aluminized FEK-244 film on aluminum substrate, and RTV 670 on aluminum. Cleaning procedures were evaluated by microscopic examination of the solid surfaces before and after cleaning by measurement of specular reflectance. The effect of local environmental degradation specific to an industrial process on solar collector surfaces was investigated. DOE

N80-25861# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
HYBRID THERMAL STORAGE WITH WATER Final Report, 1 Sep. 1977 - 10 Nov. 1978
30 Sep. 1979 328 p refs
(Contract EG-77-C-02-4480)
(ESG-DOE-13259) Avail: NTIS HC A15/MF A01

After completion of a state-of-the-art survey, four distinct hybrid system concepts were developed. Two computer codes were developed to model the behavior of hybrid storage devices. A systems model code was also developed to compute the performance of solar heating systems. The systems model yielded results in excellent agreement with TRNSYS code, but required only 5% of the computer time to complete a 1 year simulation. Designs for a unique water tank in a bed of gravel system, using an annular tank, were developed. Three sizes of this design were estimated to be applicable to the majority of residential applications in the United States. It was estimated that the use of these designs could result in a reduction in total cost of a solar heating system of up to 21%. It must be noted that the large uncertainties in the experimental data on which the anlysis used in this study was based, and the uncertainties involved in the heat transfer modeling of hybrid systems, are significantly larger than the performance benefits indicated. DOE

N80-25862# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: SOLAR AGRICULTURAL AND INDUSTRIAL PROCESS HEAT

Sep. 1979 41 p refs
(DOE/EDP-0033) Avail: NTIS HC A03/MF A01

The Environmental Development Plan system which provides a common basis for planning, managing, and reviewing the environmental aspects of solar agricultural and industrial process heat is described. Solar heating for fossil fuel generated process heat is considered along with shelter heating, drying, process hot water, process steam, and cooling and refrigeration. Materials development, system analysis, and component development and testing are among the factors discussed. R.G.D.

N80-25863# Completion Technology Co., Houston, Tex.
PERFORMANCE EVALUATION OF MAGMA POWER COMPANY'S REINJECTION WELL NO. 46-7 AT THE EAST MESA KGRA, CALIFORNIA
R. M. Jorda Feb. 1980 35 p refs Sponsored in part by Sandia Labs., Albuquerque, N. Mex.
(Contract EY-76-C-04-0789)
(SAND-79-7127) Avail: NTIS HC A03/MF A01

Water has cooled to 100 F to simulate total heat extraction and then tested using membrane filter flow procedures. The cooled water contains particles which are in the high colloid size range, and formation impairment by these particles is unlikely. There is evidence that acid soluble corrosion products and calcium compounds constitute about two thirds of the particulates, and that the acid insoluble residue contains precipitated silica, insoluble corrosion products, and possibly formation fines carried in the produced water. Under stabilized conditions, the suspended solids content of the water is less than 2 parts per million. HOwever, during the frequent production well start ups, a higher concentration of suspended solids is carried in the produced water and into the injection well, conceivably augmenting fill in the injector. But most likely, fill occurs when the injection well surges during shut-downs, because of inadequate sand control in the well completion. At the time of the test, the injection well was found to be severely impaired. DOE

N80-25864# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
COMPARATIVE PERFORMANCE OF TWO TYPES OF EVACUATED TUBULAR SOLAR COLLECTORS IN A RESIDENTIAL HEATING AND COOLING SYSTEM Final Report, 1 Oct. 1977 - 30 Sep. 1978
G. O. G. Loef and W. F. Duff Sep. 1979 16 p
(Contract EY-76-S-02-2577)
(COO-2577-19) Avail: NTIS HC A02/MF A01

Two types of evacuated tubular solar collectors were operated in space heating, cooling, and domestic hot water heating systems in Colorado State University Solar House 1. A flat absorber plate inside a single walled glass tube is used in the Corning design, whereas heat is conducted through a single glass wall to an external heat exchanger plate in the Philips collector. The respective aperture areas are 50.0 sq m and 44.7 sq m. Since system designs and conditions of operation were not identical, efficiencies and energy deliveries of the two evacuated tubular collectors should not be compared without recognition of these factors. But in comparison with conventional flat plate collectors, both types show substantially reduced heat losses and improved efficiency. DOE

N80-25865# Battelle Pacific Northwest Labs., Richland, Wash.
LONG-TERM SUPPLY CURVES FOR GEOTHERMAL ENERGY: THE IMPACTS OF TECHNOLOGY
L. L. Fassbender and C. H. Bloomster Jan. 1980 94 p refs
(Contract EY-76-C-06-1830)
(PNL-3072) Avail: NTIS HC A05/MF A01

Near term and long term supply curves are presented for electric applications of geothermal energy. The GEOCOST model was used to determine the present and future energy production costs for identified high temperature and intermediate temperature hydrothermal resources. The long term supply curves illustrate the potential shifts in the near-term supply curve which would result from certain technology improvements currently being pursued. Curves were drawn to show the impacts of individual technology improvements and also to show the cumulative impacts of combinations of technological advances expected to be achieved by 1982 and 1985. Successful completion of all the programs evaluated would result in a cumulative cost reduction of $90 billion (not discounted) in electrical generating costs from the identified hydrothermal resources. DOE

N80-25866# Argonne National Lab., Ill. Energy and Environmental Systems Div.
RELIABILITY AND MAINTAINABILITY EVALUATION OF SOLAR COLLECTOR AND MANIFOLD INTERCONNECTIONS
J. A. Mavec, R. Wolosewicz, A. Clark, P. Wang, and P. S. Chopra Mar. 1979 50 p refs
(Contract W-31-109-eng-38)
(SOLAR/0902-79/70; ANL/SDP/TM-79-4) Avail: NTIS HC A03/MF A01

The problem associated with the interconnection devices currenty in use at demonstration sites were examined. The nature and causes of interconnection-related failures are presented, together with the corrective actions that were taken. Design criteria for interconnections in solar-energy systems were developed, and a number of guidelines are provided to assist designers in avoiding interconnection difficulties. DOE

N80-25867# Argonne National Lab., Ill.
TWO-TANK SEASONAL STORAGE CONCEPT FOR SOLAR SPACE HEATING OF BUILDINGS
B. K. Cha, D. W. Connor, and R. O. Mueller 1979 15 p refs Presented at the APS Electron and Atomic Phys. Meeting, Houston, Tex., 10-12 Dec. 1979
(Contract W-31-109-eng-38)
(CONF-791226-2) Avail: NTIS HC A02/MF A01

An analysis of a novel two tank water storage system is presented, consisting of a large primary water tank for seasonal storage of solar energy plus a much smaller secondary water tank for storage of solar energy collected during the heating season. The system offers the advantage of high collection efficiency during the early stages of the heating season, a period when the temperature of the primary tank is generally high. The resulting improvement in annual system efficiency through the addition of a small secondary tank is found to be substantial - for the site considered (Madison, Wisconsin), the relative percentage gain in annual performance is in the range of 10 to 20%. A simple computer model permits accurate hour-by-hour transient simulation of thermal performance over a yearly cycle. Results are presented of detailed simulations of collector and storage sizing and design tradeoffs for solar energy systems supplying 90 to 100% of annual heating load requirements. DOE

N80-25868# Aerojet Energy Conservation Co., Sacramento, Calif.
MULTI-USE GEOTHERMAL ENERGY SYSTEM WITH AUGMENTATION FOR ENHANCED UTILIZATION. A NON-ELECTRIC APPLICATION OF GEOTHERMAL ENERGY IN SUSANVILLE, CALIFORNIA Quarterly Technical Report, 1 Apr. - 30 Jun. 1978
G. R. Cunnington and G. K. Olson 1978 58 p refs
(Contract ET-78-C-03-1740)
(SAN-1740-2) Avail: NTIS HC A04/MF A01

The economic and technical feasibility of using the low to moderate temperature geothermal resource in the Susanville anomaly in a district heating/cooling system for public or private users and in a Park of Commerce developed in conjunction with the resources development is analyzed. Design approaches were studied which permit economical utilization of the resource regardless of the outcome of the drilling. The system selected depends on the result of the drilling program. A data base is presented on systems for the temperature range from 150 to 239 F. Based on a predicted fuel inflation rate of 7% and a municipal bond interest rate of 10%, the development of the Susanville Geo-Heating District is economically feasible over the entire range of anticipated reservoir conditions. Under conditions of high well costs ($130 to $175 thousands dollars per well) and low resources temperature (150 to 165 F), economic and operational advantages can be shown for the use of heat pumps to augment the resource temperature. DOE

N80-25869# Georgia Univ., Athens. Dept. of Chemistry.
DEVELOPMENT OF A PRACTICAL PHOTOCHEMICAL ENERGY STORAGE SYSTEM. THE NORBORNADIENE-QUADRICYCLENE ENERGY STORAGE SYSTEM Final Report

Richard R. Hautala, Charles R. Kutal, and R. Bruce King 15 Aug. 1979 41 p refs
(Contracts EY-76-S-09-0893; DE-AS09-76EV-00893)
(SRO-0893-17) Avail: NTIS HC A03/MF A01

The photosensitized conversion of norbornadiene to quadricyclene has been examined as a promising method for storing energy from sunlight. A device based on this reaction requires two steps: (1) energy storage through the sensitized photolysis of norbornadiene to quadricyclene in an endothermic reaction; and (2) energy release through the catalyzed reconversion of quadricyclene to norbornadiene in an exothermic reaction. Both sensitizers and catalysts have been sucessfully incorporated onto heterogeneous supports, and in several instances these immobilized components perform as well as or better than their homogeneous counterparts. An overview of the scientific progress achieved in each of the areas noted is reported. In addition, the energy capacity of the norbornadiene-quadricyclene system (relative to some typical applications) is assessed and the potential costs associated with this type of photochemical energy storage are analyzed. DOE

N80-25870# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
REQUIREMENT DEFINITION AND PRELIMINARY DESIGN OF A PHOTOVOLTAIC CENTRAL POWER STATION EXPERIMENTAL TEST FACILITY Final Report
G. OBrien, R. Pohl, and N. Turner Dec. 1979 481 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7022-Vol-1) Avail: NTIS HC A21/MF A01

The requirements and preliminary design for a photovoltaic central power station experimental test facility are described. Requirements, a preliminary design, costs and schedule were established for the facility construction. Utility participation was reviewed with selected utilities, and both a site selection methodology and a summary set of combined continental US insolation and meteorological data was prepared. The major results, the detailed technical discussion, cost and plans, for the experimental test facility as well as sets of preliminary specifications, drawings, and site selection data are given. DOE

N80-25871# Battelle Columbus Labs., Ohio.
THE DEVELOPMENT OF ELECTROCHEMICAL PHOTOVOLTAIC CELLS Technical Progress Report, 1 Aug. - 31 Oct. 1979
A. E. Austin, H. J. Byker, and E. W. Brooman 21 Nov. 1979 13 p Prepared for Midwest Research Inst., Golden, Colo.
(Contract EG-77-C-01-4042)
(DSE-4042-T11; TPR-2) Avail: NTIS HC A02/MF A01

The development of stable, efficient, photoelectrochemical cells based on silicon and gallium arsenide in nonaqueous electrolyte systems was investigated. Redox reactions of ferrocene, anthracene and anthraquinone were studied on platinum and n-silicon electrodes. The latter were further characterized by differential capacitance measurements. Cells and equipment were designed and set up for long term stability studies. DOE

N80-25872# Argonne National Lab., Ill.
EVALUATION OF RELIABILITY OF OPERATIONAL SOLAR-ENERGY SYSTEMS
J. A. Mavec, E. Waite, and R. Wolosewicz 1979 8 p refs
Presented at Ann. Solar Heating and Cooling Systems Operational Results, Colorado Springs, Colo., 27 Nov. 1979
(Contract W-31-109-eng-38)
(CONF-791105-2) Avail: NTIS HC A02/MF A01

A reliability study of two solar heating systems using air as the heat transfer medium is presented. Failure modes and effects analysis were used to examine the controls of the systems for three operating modes. Principal components were identified for each mode, and a fault tree and reliability block diagram was constructed to structure the fault or failed sequence. Established failure rates were assigned to each component, and an exponential failure distribution was assumed. For components operating on demand at a given average frequency, the adjusted demand and normal operating failure rates were combined to reflect the total contribution. Representative operational times and component frequencies were found for each operating mode. A fault tree computer code was used to determine minimal outsets to the top event, remove redundant events, and perform necessary calculations. DOE

N80-25873# Alabama Univ. in Huntsville. Environmental Energy Center.
DATA HANDBOOK FOR THE NATIONAL SOLAR ENERGY DEMONSTRATION BOOK
David L. Christensen May 1979 87 p
(Contract EM-78-S-01-5216)
(DSE-5216-T4) Avail: NTIS HC A05/MF A01

Information is provided in a matrix format listing technical and programmatic data concerning the various project sites selected for the National Solar Energy Demonstration Program. The commercial, residential, and other demonstration projects which are now a part of the national program, are incorporated into one handbook, as a reference source for technical and research purposes on a state-by-state basis. DOE

N80-25874# Department of Energy, Washington, D. C. Office of Energy Research.
PRELIMINARY ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM (SPS), REVISION 1. VOLUME 1: EXECUTIVE SUMMARY
Jan. 1980 64 p refs
(DOE/ER-0036/1) Avail: NTIS HC A04/MF A01

A preliminary assessment of the environmental impacts of the proposed satellite power system (SPS) is summarized. In this system, satellites would collect solar energy in space, convert it to microwaves, and transmit the microwaves to receiving antennas (rectennas) on Earth. At the rectennas, the microwaves would be converted to electricity. The assessment considers microwave and nonmicrowave effects on the terrestrial environment and human health, atmospheric effects, and disruption of communications and other electromagnetic systems. DOE

N80-25875# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
CONCEPTUAL DESIGN OF ADVANCED CENTRAL RECEIVER POWER SYSTEMS SODIUM-COOLED RECEIVER CONCEPT. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jun. 1979 64 p
(Contract EG-77-C-03-1483)
(SAN-1483-1/1; ESG-79-2-Vol-1) Avail: NTIS HC A04/MF A01

The conceptual design of an advanced receiver power system using liquid sodium as a heat transport medium was completed. The technical and economic advantages of this concept were determined for commercial-scale power plants. Topics covered included: (1) review and analysis of preliminary specification; (2) parametric analysis; (3) select commercial configuration; (4) commercial plant conceptual design; (5) assessment of commercial plant; (6) advanced central receiver power system development plan; (7) program plan; (8) reports and data; (9) program management; and (10) safety analysis. A programmatic overview of the accomplishments of this program is given. The 100 MW conceptual commercial plant, the 281 MW optimum plant, and the 10 MW pilot plant are described. DOE

N80-25876# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
CONCEPTUAL DESIGN OF ADVANCED CENTRAL RECEIVER POWER SYSTEMS SODIUM-COOLED RECEIVER CONCEPT. VOLUME 2, BOOK 1: COMMERCIAL PLANT CONCEPTUAL DESIGN Final Report
Mar. 1979 400 p refs
(Contract EG-77-C-03-1483)
(SAN-1483-1/2; ESG-79-2-Vol-2-BK-1) Avail: NTIS HC A17/MF A01

The conceptual design of the 100 MW solar tower focus commercial power plants is described in detail. Sodium is pumped up to the top of the tall tower where the receiver is located. The sodium is heated in the receiver and then flows down the tower, through a pressure reducing device, and into a large, hot storage tank made to meet a specific thermal energy storage capacity requirement. The sodium is pumped by a separate pump, through a system of sodium to water steam generators. The sodium flowing from the evaporator unit is piped to a cold

storage tank. From the cold storage tank, sodium is then pumped up to the tip of the tower to complete the cycle. The steam generated in the steam generators is fed to a conventional off-the-shelf, high-efficiency turbine. The steam loop operates in a conventional rankine cycle with the steam generators serving the same purpose as a conventional boiler and water being fed to the evaporator with conventional feedwater pumps. DOE

N80-25877# Oak Ridge National Lab., Tenn. Computer Sciences Div.
COMPARATIVE METHOD FOR THE EVALUATION OF ARRAY REFLECTOR MATERIALS
J. T. Thomas Oct. 1979 25 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-42) Avail: NTIS HC A02/MF A01

A general method for the evaluation of materials as reflectors surrounding array of subcritical units of fissile materials is presented. Applied to the materials used in a safe and secure trailer, it is concluded that the carrier effectiveness of a reflector can be expected to be less than that of a 2.5 cm thick water reflector. DOE

N80-25878# Battelle Pacific Northwest Labs., Richland, Wash.
SITING SMALL WIND TURBINES
W. T. Pennell and H. L. Wegley Mar. 1979 16 p refs Presented at the Workshop on Wind Energy Appl. in Agr., Ames, Iowa, 15-16 May 1979
(Contract EY-76-C-06-1830)
(PNL-SA-7603) Avail: NTIS HC A02/MF A01

A procedure is presented for choosing the best available site for a wind turbine. A method for estimating the pertinent wind characteristics once the site is chosen is also described. In some cases, extensive onsite measurements may be required before an accurate analysis of turbine performance can be made. DOE

N80-25879# Sandia Labs., Albuquerque, N. Mex.
PRELIMINARY DEVELOPMENT OF THE BAND TYPE VARIABLE INERTIA FLYWHEEL (BVIF) Final Report
D. G. Ullman Nov. 1979 163 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7089) Avail: NTIS HC A08/MF A01

An energy storage flywheel with variable moment of inertia, combining the functions of energy storage and power control is introduced and discussed. The specific configuration addressed is the band type variable flywheel (BVIF). This hollow shell flywheel is packed with long thin bands of flexible material mounted like the main spring in a watch. The performance equations of this configuration are derived and studied. A proof-of-concept model is described and conclusions are drawn on the BVIF'S operational potential. DOE

N80-25880# California Univ., Livermore. Lawrence Livermore Lab.
SITE AND BUILDING ENERGY-CONSERVATION STUDY: SURVEY OF BUILDING 251, DIAGNOSTIC CHEMISTRY
Oct. 1979 68 p
(Contract W-7405-eng-48)
(UCRL-15190) Avail: NTIS HC A04/MF A01

An energy-conservation study of Building 251, Diagnostic Chemistry, at Lawrence Livermore Laboratory was performed. The survey of Building 251 was based on a review of the design drawings, an on-site inspection of the 30,500 sq ft building, and discussions with the building manager and various operating personnel. Data were collected regarding the number of people occupying the building, operating schedules, and the energy loads imposed by installed and temporary equipment. The heating, ventilating, and air conditioning systems were investigated. The building energy systems were simulated using the DOE-1 energy program. A base year energy consumption run was made, together with simulation of the building's performance assuming installation of each of nine energy conservation opportunities (ECO's) identified. A summary of the energy savings that would result from implementation of the ECO's is presented. DOE

N80-25881# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
INTERNATIONAL ANALYSIS OF RESIDENTIAL ENERGY USE AND CONSERVATION
Lee Schipper Oct. 1979 28 p refs Presented at Intern. Conf. on Energy Use Management, Los Angeles, 22 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9383; CONF-791009-27) Avail: NTIS HC A03/MF A01

Data were collected and are being analyzed on residential energy use from Canada, Japan, UK, West Germany, France, Italy, and Sweden. Preliminary inspection indicates that much of the variation of energy use depends on structural of lifestyle factors such as incomes, house or appliance size, hot water, and indoor temperature habits. There appears to exist a wide range of energy intensities within each narrow end use category, each of these ranges suggest that there are interesting prospects for energy conservation in any one country based on technologies or ideas common elsewhere. DOE

N80-25882# Lockheed Missiles and Space Co., Palo Alto, Calif.
AMORPHOUS THIN FILMS FOR SOLAR CELL APPLICATION Quarterly Report, 31 Mar. - 30 Jun. 1979
A. D. Jonath, H. F. MacMillan, J. L. Crowley, W. W. Anderson, F. A. Junga, C. F. Kooi, T. K. McNab, W. R. Scoble, and J. A. Thornton Jul. 1979 33 p
(Contract DE-AC03-79ET-23040)
(DOE/ET-23040/1; LMSC-D678155; QR-1) Avail: NTIS HC A03/MF A01

The prospects for generation of significant electric power using low cost photovoltaic solar cells seem brighter with recent developments in sensitive impurity doping of glow-discharge-produced films of amorphous silicon containing large amounts of hydrogen (a-Si:H). The approach being taken to achieve the program objective centers on substituting sputtering for glow-discharge in the deposition of the a-Si:H films. Both planar and cylindrical forms of magnetron sputtering are being investigated in this program. Brief descriptions of the systems being used are presented. The planar system has the advantage that experimental costs are low; the cylindrical system is easily scalable to large product throughout. A-Si:H films are being prepared by magnetron sputtering, with reactive gases and/or doped Si targets, to achieve a reproducible and controllable process for the fabrication of solar cell devices. Ion implantation is being used for alloying and doping studies. DOE

N80-25883# Department of Energy, Washington, D. C. Office of Solar Applications.
SOLAR ENERGY PROJECT: AN OVERVIEW
Jan. 1980 44 p refs
(DOE/CS-0124) Avail: NTIS HC A03/MF A01

The secondary school project is described which was developed by divisions of the University of the State of New York including the State Education Department, the University at Albany's Atmospheric Sciences Research Center and secondary schools represented by 80 participating science teachers. This cooperative effort of scientist and educator resulted in 43 classroom-tested activities suitable for infusion into five science curriculum areas, including junior high science, earth science, biology, chemistry and physics. These activities are also appropriate for the development of a separate solar energy course of study. National dissemination and pilot testing of this project will begin during the fall of 1978. DOE

N80-25884# Department of Energy, Washington, D. C.
PHOTOVOLTAIC ENERGY SYSTEMS: PROGRAM SUMMARY
Jan. 1980 466 p refs
(DOE/CS-0146) Avail: NTIS HC A20/MF A01

The DOE Photovoltaic Energy Systems Program is designed to expand as rapidly as possible the commercial use of photovoltaic systems through a program of research, process development in support of the manufacturing industry, tests and applications, and general support of market development. The objective of the Photovoltaic Energy Systems Program is to reduce system costs to a competitive level in both distributed and centralized grid-connected applications. The program is also examining the technical, institutional, legal, environmental and social issues involved in fostering widespread adoption of photovoltaic energy systems. Activities of the program are divided into the following subprograms: advanced research and development; technology

development; systems engineering and standards; test and applications; commercialization; and planning, assessment, and integration. Summary sheets for each of the contractors in this program are presented. The summaries include project title, contractor, contract number, funding, principal investigator, and a brief description of the contract. DOE

N80-25885# Delaware Univ., Newark. College of Engineering.
THEORY OF THIN-FILM PHOTOVOLTAICS Quarterly Report, 16 Apr. - 30 Jun. 1979
Karl W. Boeer 30 Jun. 1979 10 p refs
(Contract DE-AC01-79ET-23103)
(DOE/ET-23103/4; QR-1) Avail: NTIS HC A02/MF A01

The carrier transport through heterojunctions is influenced by the interconnection between the bands of the two semiconductors, by space charge effects near this interconnection and by interface recombination. The estimation of the discontinuity of the conduction bands using the difference in electron affinities is insufficient. A modified model takes the chemical and crystallographical nature of the interconnection into consideration. The analysis includes the discussion of a space charge double layer caused by charged dangling bonds along the dislocation network and its compensation via charged defects. These cause certain donor-acceptor pair formation which act as efficient recombination centers and cause a reduction of the open circuit voltage. The space charge double layer and interface recombination may cause a non-monotonic band profile near the interface. The specifics of such band profile of CdS/Cu2S and Cd/sub x/Zn/sub 1-x/S/Cu2S heterojunctions are evaluated quantitatively and agree within the experimental error with the observation, that, with decreasing lattice mismatch, the open circuit voltage increases, while the short circuit current decreases. DOE

N80-25886# Boston Univ., Mass. Dept. of Chemistry.
PHOTOCHEMICAL DETERMINANTS OF THE EFFICIENCY OF PHOTOGALVANIC CONVERSION OF SOLAR ENERGY
Morton Z. Hoffman and Norman N. Lichtin 1979 35 p refs
(Contract EY-76-S-02-2889)
(COO-2889-5) Avail: NTIS HC A03/MF A01

A photogalvanic cell is a battery in which the cell solution absorbs light directly to generate species which, upon back reaction through an external circuit with the aid of suitable electrodes, produces electric power; photoactivation of the electrodes is not involved. The charge-carrying species have storage capacity if they are long-lived and can be prevented from engaging in degradative back reactions in bulk solution. The efficiency of a photogalvanic cell for the conversion of photon energy into electrical energy is determined by photochemical and electrochemical factors. Among the latter are the choice of electrode materials and the kinetics of electron transfer at the heterogeneous surfaces. The photochemical determinants of the efficiency of photogalvanic cell operations are examined: the absorption spectral characteristics of the cell solution, the efficiency of formation of separated charge carriers, and the lifetimes of the carriers toward back electron transfer. Modulation of bulk solution dynamics can be achieved by variation of the solution medium. The photochemical determinants are discussed with particular reference to the use of thionine or RU(bpy)2/3(+) as the light absorbing species. DOE

N80-25887# Texas Technological Univ., Lubbock.
VORTEX MODEL OF THE DARRIEUS TURBINE: AN ANALYTICAL AND EXPERIMENTAL STUDY
J. H. Strickland, B. T. Webster, and T. Nguyen Feb. 1980 156 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7058) Avail: NTIS HC A08/MF A01

A preliminary aerodynamic performance prediction model has been constructed for the Darrieus turbine using a vortex lattice method of analysis. A series of experiments were conducted for the express purpose of validating the analytical model. These experiments were conducted on a series of two dimensional rotor configurations which were towed in a large tank of water. The use of water as a working fluid was intended to facilitate both flow visualization and the ability to measure aerodynamic blade forces while allowing operation at sufficiently high Reynolds numbers. The primary purpose of this research was to allow reasonable predictions of aerodynamic blade forces and moments to be made. DOE

N80-25888# Rockwell International Corp., Golden, Colo. Rocky Flats Plant.
NEW DEVELOPMENTS IN WIND SYSTEMS TECHNOLOGY
R. L. Moment 1979 22 p refs Presented at 2d Intern. Conf. on Alternative Energy Sources, Miami, Beach, Fla. 10 Dec. 1979
(Contract EY-76-C-04-3533)
(RFP-3000; CONF-791204-20) Avail: NTIS HC A02/MF A01

Development programs for U.S. wind turbines of under 100 kW output are reviewed. The system configurations and approaches to component design are discussed. DOE

N80-25889# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
TECHNICAL AND MANAGEMENT SUPPORT FOR THE DEVELOPMENT OF SMALL WIND SYSTEMS Annual Report, 1 Oct. 1977 - 30 Sep. 1978
Feb. 1979 147 p refs
(Contract EY-76-C-04-3533)
(RFP-2974/3533-79-2) Avail: NTIS HC A07/MF A01

The FY 1978 annual report of the Rocky Flats Wind Systems Program describes the objectives, approach, and achievements of the program and each of its tasks areas during the period 1 October 1977 - 30 September 1978. During this period, additional testing of ten small wind energy conversion systems (SWECS) was conducted and the Test Center was expanded to accommodate up to 30 SWECS. Work on nine design and analysis projects for advanced prototypes in three size ranges progressed through a series of design reviews, with prototype delivery scheduled to begin in mid-1979. Supporting activities included a Systems Engineering project which analyzed the cost of SWECS components and fabrication, a task effort in technical support to standards development, and the dissemination of information. DOE

N80-25890# Institute of Gas Technology, Chicago, Ill.
HEAT-PUMP-CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEMS DEVELOPMENT, CONSOLIDATED NATURAL GAS SERVICE COMPANY Final Report
Nathaniel R. Baker, Timothy D. Donakowski, R. Bruce Foster, Darrell L. Sala, Raymond R. Tison, Thomas P. Whaley, Bernard D. Yudow, and Paul F. Swenson (Consolidated Nat. Gas Serv. Co., Cleveland) Jan. 1980 342 p refs Prepared for Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(ANL/CNSV/TM-29) Avail: NTIS HC A15/MF A01

The heat actuated heat pump centered integrated community energy system (HAHP-ICES) is described. The system utilizes a gas fired, engine-driven, heat pump and commercial buildings, and offers several advantages over the more conventional equipment it is intended to supplant. The general nonsite specific application assumes a hypothetical community of one 59,000 cu ft office building and five 24 unit, low rise apartment buildings located in a region with a climate similar to Chicago. Various sensitivity analyses are performed and through which the performance characteristics of the HAHP are explored. The results provided the selection criteria for the site specific application of the HAHP-ICES concept to a real world community. The site-specific community consists of: 42 town houses; five 120 unit, low rise apartment buildings; five 104 unit high rise apartment buildings; one 124,000 cu ft office building; and a single 135,000 cu ft retail building. DOE

N80-25891# EIC, Inc., Newton, Mass.
NEW ELECTROLYTES FOR DIRECT METHANE FUEL CELLS Final Report, 10 Jan. 1977 - 9 Jan. 1979
S. B. Brummer, J. Foos, J. McHardy, J. McVeigh, D. Toland, and M. Turner May 1979 74 p refs
(Contracts EY-76-C-03-1363; DE-AC03-79ET-11321)
(DOE/ET-11321/T1) Avail: NTIS HC A04/MF A01

A fuel cell electrolyte for the direct oxidation of CH4 and/or impure H2 fuels was developed. Emphasis is placed on di and tribasic methanesulfonic acids CX2(SO3H)2 and CX(SO3H3) here

X is H, F, or Cl. Synthetic routes to CH2(SO3H)2, CH(SO3H)3, CCl2(SO3H)2, and CCl(SO3H)3 were identified and optimized. The diphenyl ester of CF2(SO3H)2 was prepared for the first time and various approaches to CF(SO3H)3 was investigated. In parallel with the synthetic program, apparatus was designed and fabricated for the testing of the electrolytes under fuel cell conditions. Electrodes with low Pt loading were developed for use in electrolyte evaluation. Optimum performance with H3PO4 was achieved using 1 mg Pt/cu cm and 1 mg TFE 30 cu cm deposited on TFE tape, supported on a Au plated Ta screen, and sintered. Preliminary half cell tests using CH2(SO3H)2 and CH(SO3H)3 indicated that these acids are insufficiently stable for use as fuel cell electrolytes. DOE

N80-25892# California Univ., Berkeley. Energy and Resources Group.

RISK OF RENEWABLE ENERGY SOURCES: A CRITIQUE OF THE INHABER REPORT

John P. Holdren, Kent Anderson, Peter H. Gleick, Irvin Mintzer, Gregory Morris, and Mirk R. Smith (East-West Center Honolulu, Hawaii) Jun. 1979 142 p refs

(Contract W-7405-eng-48)

(ERG-79-3) Avail: NTIS HC A07/MF A01

The Inhaber report, Risk of Energy Production (Atomic Energy Control Board Report AECB-1119, Ottawa, Canada, 1978:EAPA 5.15) is refuted. Error and the consequences of correcting are described. Also discussed are the circumstances - including the roles of the author, the sponsors, and the knowledgeable tehnical community - that permitted to report to gain widespread credibility DOE

N80-25893# California Univ., Livermore. Lawrence Livermore Lab.

EVALUATION OF AIR CATHODES FOR POTENTIAL USE IN DEVELOPMENT OF ALUMINUM-AIR CELLS

J. W. Pyper, B. E. Kelly, and J. F. Cooper Dec. 1979 38 p refs

(Contract W-7405-eng-48)

(UCID-18561) Avail: NTIS HC A03/MF A01

Four air cathodes representing the products of three manufacturers were tested under conditions of continuous and intermittent polarization in order to determine their suitability for testing large scale aluminum-air single cells. The W electrode performed for 312 h with a decrease of potential of 0.11 V at 1.3 kA/sq m. The X standard electrode failed to sustain continuous polarization for longer than 12 h. Both W and Z electrodes met or nearly met polarization requirements. The tests demonstrated that the W electrode is sufficiently durable and low in polarization to be used for testing 0.1 sq m aluminum-air cells. DOE

N80-25894# Argonne National Lab., Ill.

RELIABILITY, ENERGY AND COST EFFECTS OF WIND INTEGRATION WITH CONVENTIONAL ELECTRICAL GENERATING SYSTEMS

W. A. Buehring, K. A. Hub, C. C. Huber, J. C. Vankuiken, and J. G. Gros (DOE, Washington, D.C.) 1979 14 p refs Presented at the 2nd Miami Intern. Conf. on Alternative Energy Sources., Miami Beach, Fla., 10-13 Dec. 1979

(Contract W-31-109-eng-38)

(CONF-791204-32) Avail: NTIS HC A02/MF A01

The importance of system integration analysis in evaluating the effects of wind powered generation on an electrical utility system was studied. For the assumed utility and wind conditions it was shown that an intermittent energy source such as wind can contribute to overall system reliability. Since reliability indices are the primary criteria for utility expansion planning, it should be possible to reduce conventional capacity installations in response to the reliability improvements associated with wind generation. With both energy and reliability benefits it appears that there is a reasonable potential for wind generators to be competitive, in limited penetrations, with conventional capacity. DOE

N80-25895# Argonne National Lab., Ill. Chemical Engineering Div.

ADVANCED FUEL CELL DEVELOPMENT Progress Report, Jan. - Mar. 1979

R. D. Pierce, P. A. Finn, K. Kinoshita, G. H. Kucera, R. B. Poeppel, J. W. Sim, and R. N. Singh Sep. 1979 47 p refs

(Contract W-31-109-eng-38)

(ANL-79-51) Avail: NTIS HC A03/MF A01

Advanced fuel cell research activities are discussed. The effort directed toward understanding and improving the components of molten-carbonate-electrolyte fuel cells operated at temperatures near 925 K. The primary focus of this work was the development of electrolyte structures that have good electrolyte retention and mechanical properties as well as long term stability, and on developing methods of synthesis amendable to mass production. Current electrolyte structures are comprised of LiAlO2 particles and an eutectic of Li2CO3 and K2CO3. DOE

N80-25896# Brookhaven National Lab., Upton, N. Y.

OPTIMIZATION OF SOLAR ASSISTED HEAT PUMP SYSTEMS VIA A SIMPLE ANALYTIC APPROACH

John W. Andrews 1980 6 p refs Presented at the 2d Ann. Systems Simulation and Econ. Anal. Conf., San Diego, Calif., 23-25 Jan. 1980

(Contract EY-76-C-02-0016)

(BNL-27316; CONF-800101-17) Avail: NTIS HC A02/MF A01

An analytic method for calculating the optimum operating temperature of the collector/storage subsystem in a solar assisted heat pump is presented. A tradeoff exists between rising heat pump coefficient of performance and falling collector efficiency as this temperature is increased, resulting in an optimum temperature whose value increases with increasing efficiency of the auxiliary energy source. Electric resistance is shown to be a poor backup to such systems. A number of options for thermally coupling the system to the ground are analyzed and compared. DOE

N80-25897# Sandia Labs., Albuquerque, N. Mex.

AERODYNAMIC INTERFERENCE BETWEEN TWO DARRIEUS WIND TURBINES

P. R. Schatzle, P. C. Klimas, and H. R. Spahr 1980 6 p refs Presented at the Wind Energy Conf., Boulder, Colo., 9 Apr. 1980

(Contract EY-76-C-04-0789)

(SAND-79-1984C; CONF-800406-2) Avail: NTIS HC A02/MF A01

The effect of aerodynamic interference on the performance of two curved bladed Darrieus-type vertical axis wind turbines was calculated using a vortex/lifting line aerodynamic model. The turbines have a power-to-power separation distance of 1.5 turbine diameters, with the line of turbine centers varying with respect to the ambient wind direction. The effects of freestream turbulence were neglected. For the cases examined, the calculations showed that the downwind turbine power decrement (1) was significant only when the line of turbine centers was coincident with the ambient wind direction, (2) increased with increasing tip-speed-ratio, and (3) is due more to induced flow angularities downstream than to speed deficits near the downstream turbine. DOE

N80-25898# Ames Lab., Iowa.

OXYGEN REDUCTION ON A GRAPHITE PASTE AND A CATALYST LOADED GRAPHITE PASTE ELECTRODE Ph.D. Thesis

Dennis Michael DiMarco Mar. 1980 166 p refs

(Contract W-7405-eng-82)

(IS-T-886) Avail: NTIS HC A08/MF A01

Oxygen reduction was studied in basic solution at a graphite paste electrode. The graphite paste electrode was used as the disk of a rotating ring disk electrode and experiments were done using the voltage scan technique. The enhancements afforded by catalysts applied to the graphite paste electrode were also studied. Oxygen reduction on a Graphite Paste Electrode was a two electron process resulting in the formation of peroxide. The Tafel slope (plotted as potential versus log [i/sub 1/xi/(i/sub1/-i)] was 180 millivolts. The presence of gold, silver, or platinum on the graphite paste electrode shifted the oxygen reduction gave approximately 800 millivolts in the anodic direction. The metal catalyzed graphite paste electrode produced a greater fraction of peroxide as a product than did the solid metal electrode. Silver and gold catalyzed graphite paste electrode gave Tafel slopes of about 120 millivolts. The intermediate catalysis of iron

and cobalt porphyrin was also examined. The cobalt prophyrin catalyzed oxygen reduction at a more anodic potential than the iron porphyrin and the latter appeared more active in reacting the peroxide formed as the product of the disk reaction. DOE

N80-25899# Aluminum Co. of America, Alcoa Center, Pa.
DESIGN AND FABRICATION OF A LOW-COST DARRIEUS VERTICAL AXIS WIND TURBINE SYSTEM, PHASE 1
Mar. 1980 295 p refs
(Contract EM-78-C-04-4272)
(ALO-4272) Avail: NTIS HC A13/MF A01

The design phase of a low cost Darrieus-type vertical axis wind turbine for commercialization in the United States is presented. The system definition, cost estimates, system performance analysis, structural design analysis, and environmental considerations are described. R.E.S.

N80-25900# Midwest Research Inst., Golden, Colo.
ANALYSIS OF COMMUNITY SOLAR SYSTEMS FOR COMBINED SPACE AND DOMESTIC HOT WATER HEATING USING ANNUAL CYCLE THERMAL ENERGY STORAGE
F. C. Hooper, J. D. McClenahan, J. D. Cook, F. Baylin, R. Monte, and S. Sillman Jan. 1980 9 p refs Presented at the 2nd Ann. Systems Simulation and Econ. Anal. Conf., San Diego, Calif., 23-25 Jan. 1980 Prepared in cooperation with Toronto Univ., Ontario
(Contract EG-77-C-01-4042)
(SERI/TP-355-570; CONF-800101-20) Avail: NTIS HC A02/MF A01

A simplified design procedure was examined for estimating the storage capacity and collector area for annual-cycle-storage, community solar heating systems in which 100% of the annual space heating energy demand is provided from the solar source for the typical meteorological year. Hourly computer simulations of the performance of these systems were carried out for 10 cities in the United States for 3 different building types and 4 community sizes. These permitted the use of design values for evaluation of a more simplified system sizing method. Results of this study show a strong correlation between annual collector efficiency and two major, location-specific, annual weather parameters: the mean air temperature during daylight hours and the total global insolation on the collector surface. Storage capacity correlates well with the net winter load, which is a measure of the seasonal variation in the total load, a correlation which appears to be independent of collector type. DOE

N80-25901# Department of Energy, Washington, D. C. Office of Buildings and Community Systems.
PROPOSED ENERGY PERFORMANCE STANDARDS FOR NEW BUILDINGS: STANDARD BUILDING OPERATING CONDITIONS
Nov. 1979 79 p
(DOE/CS-0118) Avail: NTIS HC A05/MF A01

The process of developing energy budget levels for new commercial buildings, in conjunction with the energy-performance standards for new buildings, includes the use of energy-analysis computer programs. These programs are used to estimate the design energy requirements of randomly selected commercial buildings. The input to these programs includes a set of data known as the Standard Building Operating Conditions (SBOC). These SBOC consist of temperatures, human-occupancy densities and profiles, lightning-usage profiles, and the like. They describe typical conditions under which a commercial or multifamily residential building would operate during the course of a day. The standardization of the building operating conditions is described. Alternative ways that SBOC may be applied in a regulatory compliance context are discussed as well as the advantages and disadvantages of each alternative. The implications of the standardization of operating conditions are examined.DOE

N80-25902# Department of Energy, Washington, D. C. Office of Buildings and Community Systems.
PROPOSED ENERGY-PERFORMANCE STANDARDS FOR NEW BUILDINGS: PASSIVE AND ACTIVE SOLAR-HEATING ANALYSIS
Nov. 1979 70 p
(DOE/CS-0117) Avail: NTIS HC A04/MF A01

The use of passive and active solar thermal heating technologies was analyzed in order to develop standards for new buildings. Maximum permissible levels of annual building design energy consumption were established for different building types in various climates. Besides reducing the use of depletable energy, the standards are intended to achieve maximum practicable increases in the use of nondepletable sources of energy. Cost and energy savings estimates were developed for optimally-sized passive solar systems corresponding to the prototype house characteristics represented by each point on the conservation cost/performance curves (from previous studies). An analysis was performed for each of the ten (Atlanta, Burbank, Chicago, Fresno, Ft. Worth, Houston, Minneapolis, Phoenix, Portland, and Washington) representative cities in the conservation study analysis. The key elements of the methodology were: thermal performance estimation, optimum system size determination, and sensitivity analysis. DOE

N80-25903# SRI International Corp., Menlo Park, Calif.
LINE-FOCUS SOLAR CENTRAL POWER SYSTEMS, PHASE 1 Topical Report, 29 Sep. 1978 - 30 Apr. 1979
A. J. Slemmons May 1979 115 p refs
(Contract EY-76-C-03-0015)
(SAN-0115-140-1) Avail: NTIS HC A06/MF A01

The subsystem and system parametric analysis for a 100 MW/sub e/ solar central power plant of the high temperature, line focus, cavity receiver type were completed. Annual levelized busbar energy costs of 55 mills/kWh are projected for the 80th plant. The conceptual design of the plant was initiated. DOE

N80-25904# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
SOLAR ENERGY PROGRAM. CHAPTER FROM THE ENERGY AND ENVIRONMENT DIVISION REPORT Annual Report
Aug. 1979 42 p refs
(Contract W-7405-eng-48)
(LBL-9630) Avail: NTIS HC A03/MF A01

Important aspects of assessing solar applications are discussed. The amount and character of circumsolar radiation is examined with respect to geographic location, climate, season, time of day, and observed wavelength. The major optical, physical, and chemical considerations involved in designing, building, and operating a solar receiver are evaluated. The application of passive solar design concepts to the nonresidential building sector are explored. R.C.T.

N80-25905# California Univ., Livermore. Lawrence Livermore Lab.
SOLAR-ASSISTED HEAT PUMP-SWIMMING POOL SYNERGISTICS FOR DOMESTIC HEATING
T. R. Galloway Oct. 1979 11 p refs Presented at Systems Simulation and Econ. Analysis Conf., San Diego, Calif., 23 Jan. 1980
(Contract W-7405-eng-48)
(UCRL-83458; CONF-800101-1) Avail: NTIS HC A02/MF A01

A 150 cu m home, clear performance and economic advantages are shown for a solar assisted heat pump, providing domestic hot water and space heating and cooling. The pump uses a year round solar heated swimming pool as a large thermal energy reservoir. The pool cycles seasonably between 18 and 31 C, allowing year round swimming, and provides an excellent water source for the heat pump and low cost, low temperature plastic solar panels operating at their near optimum efficiency. The system was optimized by examining the performance and cost characteristics of different glazed and unglazed solar panel collector (areas from 28 to 150 cu m and orientation from horizontal to 60 deg tilt) for sites in San Francisco Bay Area and in San Joaquin Valley. DOE

N80-25906# Southern California Gas Co., Los Angeles
SAGE, SOLAR ASSISTED GAS ENERGY Summary Report
S. J. Cunningham and J. Rice Sep. 1979 34 p
(Grant NSF PTP-75-03457)
(PB80-144363; NSF/RA-790330) Avail: NTIS HC A03/MF A01 CSCL 13A

A multidiciplinary effort to examine the problems of introducing solar energy into the United States building industry was conducted. The following were emphasized: (1) field installations and tests to evaluate new vs. retrofit installations; (2) market assessment of the potential for a SAGE water heating system in apartment buildings; and (3) policy analysis of strategies that would contribute to widespread utilization of SAGE water heating. Technical results of field installations and tests are described for two installations using the system configuration chosen from pilot plant analysis. GRA

N80-25907# Southern California Gas Co., Los Angeles.
SAGE, SOLAR ASSISTED GAS ENERGY Final Report
S. J. Cunningham Sep. 1979 225 p refs
(Grant NSF PTP-75-03457)
(PB80-153836; NSF/RA-790331) Avail: NTIS
HC A10/MF A01 CSCL 13A

A technical and economic baseline for assessing the practical potential of solar water heating for apartments was developed. Several steps were involved in the development: (1) installing and testing two solar assisted gas energy (SAGE) water heating systems; (2) assessing the market potential for a SAGE water heating system and possible business arrangements; and (3) analyzing strategies that would contribute to wide-spread utilization of SAGE water heating. Project findings are reported with respect to technical results, cost analysis, system performance and maintenance results, market assessment and policy analysis. GRA

N80-25908# NEUS, Inc., Santa Monica, Calif.
BIOSOURCES DIGEST, A JOURNAL ON BIOMASS UTILIZATION, VOLUME 1, NO. 1
Harry Sobel, ed. Jan. 1979 90 p refs
(Grant NSF PFR-77-12500)
(PB80-140973; NSF/RA/790088) Avail: NTIS
HC A05/MF A01 CSCL 10A

Biomass utilization, enzyme technology as it relates to it, renewable resources, industrial chemicals, fuels and energy from biomass biological nitrogen fixation, and biophotolysis are considered with energy derived from biomass. Benefits derived from stored solar energy collected from forests are discussed along with a theory and methodology for quantifying them. Alternatives to the presently-utilized processes for large-scale regeneration of ATP and ADP as required by biosynthetic processes are given. Production and collection of biomass and conversion of biomass are discussed. GRA

N80-25909# NEUS, Inc., Santa Monica, Calif.
BIOSOURCES DIGEST: A JOURNAL ON BIOMASS UTILIZATION, VOLUME 1, NO. 4
Harry Sobel, ed. Oct. 1979 61 p refs
(Grant NSF PFR-77-12500)
(PB80-140981; NSF/RA-790297) Avail: NTIS
HC A04/MF A01 CSCL 10A

Information on various aspects of biomass utilization is presented. Recent biomass related grants are abstracted and listed giving the title, sponsor, organization, grant number and project investigator. Articles are presented on thermochemical conversion of biomass to gasoline, predicting solar energy fluxes in polluted urban areas, principles, equipment and operation of two lab-scale biodigesters, energy farming in New Zealand, and a general procedure for converting latex-bearing crops to glucose, lignin and rubber. Also included are miscellaneous documents received and a report on forestation as a renewable energy source and one on the photoproduction of hydrogen. GRA

N80-25910# General Accounting Office, Washington, D. C. Energy and Minerals Div.
MAGNETOHYDRODYNAMICS: A PROMISING TECHNOLOGY FOR EFFICIENTLY GENERATING ELECTRICITY FROM COAL, REPORT TO THE CONGRESS
11 Feb. 1980 61 p refs
(PB80-143175; EMD-80-14) Avail: NTIS HC A04/MF A01
CSCL 10B

The status potential, and alternative Federal strategies for development of electricity from coal are discussed. It is recommended that the Secretary of Energy: (1) evaluate the status of testing at current facilities and its effect on maintaining the pilot plant design schedule; (2) analyze the advantages and disadvantages of alternative types of pilot plants; and (3) establish a mechanism for actively involving potential users in the program. GRA

N80-25911# National Bureau of Standards, Washington, D.C. National Engineering Lab.
ENERGY TEST METHOD DEVELOPMENT FOR ELECTRIC HEAT PUMP WATER HEATERS Final Report, Mar. 1978 - May 1979
C. Andrew Wan Jan. 1980 87 p refs
(Contract EW-78-I-05-5750)
(PB80-145212; NBSIR-79-1951) Avail: NTIS
HC A05/MF A01 CSCL 13A

Modifications are proposed for the current U.S. Department of Energy test procedures for water heaters in order to make them applicable to electric heat pump water heaters. The modifications are in the areas of definitions and technical procedures. The latter includes the test conditions, test procedures and measurements, and calculations. Reasons for making these modifications and laboratory test data are provided to support the modifications in the technical procedures. GRA

N80-25912# Research Triangle Inst., Research Triangle Park, N. C.
NOVEL CONCENTRATOR PHOTOVOLTAIC CONVERTER SYSTEM DEVELOPMENT Final Report, 24 Jan. - 30 Aug. 1979
S. M. Bedair, J. R. Hauser, M. F. Lamorte, S. Phatak, and M. L. Timmons Mar. 1980 62 p refs Prepared jointly with North Carolina Univ., Raleigh and North Carolina State Univ., Raleigh
(Contract EY-76-C-04-0789)
(SAND-80-7004) Avail: NTIS HC A04/MF A01

Several material systems were investigated for their potential use in a cascade solar cell. The studies included basic materials properties as well as p-n junction studies for the top cell, tunnel junction, and bottom cell. While junctions appropriate to each individual part of the cascade cell were demonstrated, problems still remain in fabricating a high efficiency cascade solar cell because of material and growth problems with the semiconductor layers which have optimum bandgaps. DOE

N80-26257# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Turbomachines Div.
AN OPEN CYCLE TURBINE SOLAR THERMAL POWER SYSTEM
Emile LeGrives *In its* La Rech. Aerospatiale, BiMonthly Bull. no. 1979-6 (ESA-TT-632) 1979 p 11-38 refs Transl. into ENGLISH Of La Rech. Aerospatiale, Bull. Bimestriel (Paris), No. 1979-6, Nov. - Dec. 1979 p 355-373 Original report in FRENCH previously announced as A80-19989 (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-25913 Louisiana State Univ. and A&M Coll., Baton Rouge.
MEASUREMENT AND CORRELATION OF MOLECULAR METAL POLLUTANTS IN THE AIR TO EXISTING WEATHER CONDITIONS. DEVELOPMENT OF CARBON ATOMIZERS FOR ATOMIC ABSORPTION WITH HIGH SENSITIVITY AND METAL SPECIATION CAPABILITY Ph.D. Thesis
Larry Jerome Rhodes 1979 295 p
Avail: Univ. Microfilms Order No. 8013142

A combinational thermal vaporizer/atomizer employing an atomic absorption detector was designed and built. This prototype instrument successfully demonstrated the concept of metal speciation by atomic absorption. Volatile organometallics and metal complexes were easily discernible from the much volatile inorganic metal species. The concentrations of ambient heavy metal pollutants were then related to existing weather conditions. Dissert. Abstr.

N80-25914# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
METEROLOGICAL EFFECTS ON AIR POLLUTION IN SAO PAULO
Alberto Setzer, Iracema F. A. Cavalcanti, and Bendita C. Marcelino
Jan. 1980 39 p refs In PORTUGUESE
(INPE-1669-RPE/107) Avail: NTIS HC A03/MF A01

The relation among the meteorological parameters and indexes of pollution was analyzed to determine the critical conditions for producing high indexes. The period of verification was analyzed to show the influence of the existing system at the station. Results indicate that the synoptic situation is of fundamental importance in providing the local effects, which favor the concentration or dispersal of pollutants. It is recommended that this analysis be used in forecasting air pollution.

Transl. by F.O.S.

N80-25915# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 122: F-16 AIRCRAFT, NEAR AND FAR FIELD NOISE
Robert G. Powell Aug. 1979 115 p refs
(AF Proj. 7231)
(AD-A081844; AMRL-TR-75-50-Vol-122) Avail: NTIS HC A06/MF A01 CSCL 01/2

This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for four power conditions. Near-field data are reported for eight locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. Refer to volume 1 of this handbook, 'USAF Bioenvironmental Noise Data Handbook, vol 1: Organization, Content and Application', AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations. GRA

N80-25916# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 144: F-106A IN-FLIGHT CREW NOISE
Harald K. Hille Jul. 1979 15 p refs
(AF Proj. 7231)
(AD-A081846; AMRL-TR-75-50-Vol-144) Avail: NTIS HC A02/MF A01 CSCL 01/2

The F-106A is a USAF all-weather fighter. This report provides measured data defining the bioacoustic environments at the pilot's location inside this aircraft for 19 flight conditions. Data are reported for one location in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to volume 1 of this handbook, 'USAF Bioenvironmental Noise Data Handbook, volume 1: Organization Content and Application,' AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. GRA

N80-25917# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 145: F-106B IN-FLIGHT CREW NOISE
Harald K. Hille Jul. 1979 16 p refs
(AF Proj. 7231)
(AD-A081847; AMRL-TR-75-50-Vol-145) Avail: NTIS HC A02/MF A01 CSCL 01/2

This volume provides measured data defining the bioacoustic environments produced inside the aircraft. Such data are essential to evalaute ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the F-106B aircraft. This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and ground support equipment. The far-field, community-type, noise data in the handbook describe the noise produced during ground operations of aircraft, ground support equipment, and other ground-based equipment or facilities. Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Refer to volume 1 (reference 1) for such information because it is not repeated in other handbook volumes. A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., in-flight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is avaialble upon request from AMRL/BBE, Wright-Patterson AFB, Ohio 45433. GRA

N80-25918# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 146: F-16B IN-FLIGHT CREW NOISE
Harald K. Hille Aug. 1979 21 p refs
(AF Proj. 7231)
(AD-A081848; AMRL-TR-75-50-Vol-146) Avail: NTIS HC A02/MF A01 CSCL 01/2

The F-16B is a two-seated light-weight fighter. This report provides measured data defining the bioacoustic environments at the pilot's location inside this aircraft for 31 flight conditions. Data are reported for two locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to volume 1 of this handbook, 'USAF Bioenvironmental Noise Data Handbook, volume 1: Organization, Content and Application,' AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedres, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. GRA

N80-25919# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
NATIONAL EMISSIONS DATA SYSTEM (NEDS), FUEL USE REPORT
Aug. 1979 127 p
(PB80-146905; EPA-450/4-79-020) Avail: NTIS HC A07/MF A01 CSCL 21D

Annual estimates of total consumption of major fuels such as coal, fuel, oil, natural gas, gasoline, and diesel fuel are summarized. Estimates of the consumption of a number of other comparatively minor fuels are also included. The data are distributed according to major categories of air pollutant emissions as a whole and for individual states, territories, and the District of Columbia. GRA

N80-25920# Aerodyne Research, Inc., Bedford, Mass.
HOMOGENEOUS PRODUCTION AND REMOVAL OF NOx FROM COMBUSTION EXHAUST GASES Quarterly Technical Summary Report, 1 Dec. 1979 - 29 Feb. 1980
J. A. Silver, C. M. Gozewski, and C. E. Kolb Mar. 1980 24 p refs
(Contract ET-78-C-01-3183)
(ARI-RP-52; QTSR-6) Avail: NTIS HC A02/MF A01

The final reaction rate constants for $NH_2 + NO$ were determined. A measurement of the fraction of product channels

which form OH provides an approximate value of 0.2, but the uncertainties in the method used make this value a lower limit. The reaction of OH + NH3 yields NH2 + H2O showed a simple Arrhenius dependence with temperatures to 1200 K. A chemical model of the NOx chemistry was developed. Runs using this set reproduced the gross temperature dependence of the thermal deNOx process. DOE

N80-25921# California Univ., Berkeley. Lawrence Berkeley Lab. Marine Sciences Group.
OCEAN THERMAL ENERGY CONVERSION ECOLOGICAL DATA REPORT FROM OSS RESEARCHER IN GULF OF MEXICO, 12-23 JULY 1977
M. S. Quinby-Hunt, comp. Jun. 1979 60 p refs
(Contract W-7405-eng-48)
(LBL-8945; GOTEC-01) Avail: NTIS HC A04/MF A01

Ecological measurements important for environmental assessment of the effect of an operating Ocean Thermal Energy Conversion plant were initiated in July 1977 at the proposed Gulf of Mexico site off the coasts of Louisiana, Mississippi, Alabama and Florida. The initial cruise of the OSS Researcher, in a joint effort with the Atlantic Oceanic and Meteorological Laboratories (AOML) of the National Oceanic and Atmospheric Administration (NOAA), and Lawrence Berkeley Laboratory (LBL) took place from 12 to 23 July 1977. The measurements were taken at 15 oceanographic stations to a maximum depth of 1000 m. Water was analyzed for trace metals, nutrients and chlorophyll a and ATP. Physical data, salinity and dissolved oxygen measurements were supplied by NOAA-AOML. Two bioassays were carried out using indigenous phytoplankton to estimate the effect of deep water on the rates of 14CO2 uptake of photic zone algae. The Deep Scattering Layer (DSL) was monitored at the site by a continuously recording 12 kHz depth sounder at the Mobile site. Data collected during the cruise is presented. DOE

N80-25922# Los Alamos Scientific Lab., N. Mex.
EFFECTS OF ROCKET EXHAUST PRODUCTS IN THE THERMOSPHERE AND IONOSPHERE
John Zinn and C. Dexter Sutherland. Feb. 1980 23 p refs
(Contract W-7405-eng-36)
(LA-8233-MS) Avail: NTIS HC A02/MF A01

The current state of understanding of the problem of ionospheric F layer depletions produced by chemical effects of the exhaust gases from large rockets is reviewed with particular emphasis on the heavy lift launch vehicles (HLLV) proposed for use in the construction of solar power satellites. The currently planned HLLV flight profile calls for main second stage propulsion confined to altitudes below 124 km, and a brief orbit circularization maneuver at apogee. The second stage engines deposit H2O and H2 molecules between 74 and 124 km. Model computations show that they diffuse gradually into the ionospheric F region, where they lead to weak but widespread and persistent depletions of ionization and continuous production of H atoms. The orbit circularization burn deposits 9 x 10 exhaust molecules at about 480 km altitude. These react rapidly with the F 2 region O(+) ions, leading to a substantial (factor-of-three) reduction in plasma density, which extends over a 1000 by 2000 km region and persists for four to five hours. DOE

N80-25923# Argonne National Lab., Ill.
CONSEQUENCES OF INCREASED COAL UTILIZATION
Arnold J. Goldbert, L. J. Hoover, and Terrance Surles. 1979 42 p ref. Presented at 72nd Ann. Am. Inst. of Chem. Engr. Meeting, San Francisco, 25-29 Nov. 1979. Prepared jointly with Brookhaven Nat. Lab., Los Alamos Sci. Lab., California Univ. Lawrence Berkley Lab., Oak Ridge Nat. Lab., and Pacific Northwest Labs.
(Contract W-31-109-eng-38)
(CONF-791108-16) Avail: NTIS HC A03/MF A01

The consequences of increasing coal use to meet the proposed goals of the National Energy Plan (1977) were regionally analyzed. Ten technical areas were considered: siting, air quality, long-range transport of sulfur dioxide, water quality, availability, solid wastes, socioeconomics, national economics, and occupational safety and health effects. The results of the analyses are summarized. DOE

N80-25924# Stanford Univ., Calif. Dept. of Statistics.
PROBABILITY MODELING AND ESTIMATION FOR HOURLY VARIATION OF AIR POLLUTION CONCENTRATIONS. STUDY ON STATISTICS AND ENVIRONMENTAL FACTORS IN HEALTH (SIMS) Ph.D. Thesis
Chen-Hui Foo. Dec. 1979 57 p refs. Sponsored in part by Rockefeller Foundation, Sloan Foundation, EPA and NSF
(Contract EY-76-S-02-2874)
(DOE/EY-22874/66; TR-31) Avail: NTIS HC A04/MF A01

Model building in air pollution research is considered, particularly the time when the concentration is high. The probability model presented is intended to describe the behavior of high pollutant concentrations. Data are from San Jose air monitoring. DOE

N80-25925# Aerodyne Research, Inc., Bedford, Mass.
HOMOGENEOUS PRODUCTION AND REMOVAL OF NOx FROM COMBUSTION EXHAUST GASES Quarterly Technical Summary Report, 1 Sep. - 30 Nov. 1979
J. A. Silver, C. M. Gozewski, and C. E. Kilb. Dec. 1979 18 p refs
(Contracts ER-78-C-01-3183; T-78-C-01-3815)
(ARI-RP-49; QTSR-5) Avail: NTIS HC A02/MF A01

The rate constant for the reaction of NH2 + NO was measured over the temperature range of 294 to 1200 K. It exhibits a decrease in value with increasing temperatures. An upper limit to the rate of reaction of NH3 + NO yields NH2 + HNO is also reported. The hydroxyl radical was identified as one of the products of the NH2 + NO reaction, and the implications of this upon the modeling is discussed. DOE

N80-25926# Department of Energy, Washington, D. C. Div. of Environmental Control Technology.
DIVISION OF ENVIRONMENTAL CONTROL TECHNOLOGY PROGRAM, 1978 Annual Report
Jun. 1979 259 p refs
(DOE/EV-0042; AR-2) Avail: NTIS HC A12/MF A01

The independent overview and assessment of environmental control aspects of both the U.S. Department of Energy's research, development, and demonstration programs and the Nation's energy policies and the reduction of potential environmental hazards at the radioactively contaminated sites that are presently owned or were formerly used by the Government are reviewed. A short summary is presented of objectives, approach, progress and results, future plans, and a reference bibliography for each research, development, or assessment project within the program areas described. DOE

N80-25927# Argonne National Lab., Idaho Falls, Idaho.
ENVIRONMENTAL ASSESSMENTS OF ALTERNATIVE ENERGY STRATEGIES IN THE UNITED STATES
Stephen W. Ballou and Arthur Katz (DOE, Washington, D.C.) 1979 18 p refs. Presented at the Intern. Inst. for Appl. Systems Analysis, Vienna, 5-9 Nov. 1979
(Contract W-31-109-eng-38)
(CONF-791172-1) Avail: NTIS HC A02/MF A01

The evaluation of the regional impacts of future energy development is discussed. The impacts described for 1990 are based on a national energy projection (scenario) that assumes medium energy demand and fuel supply through 1990, but does not incorporate the policies of the 1978 National Energy Act. County level patterns for utility, industry and mining activities for 1990 are developed from the federal region totals. Energy sources addressed are coal, nuclear, oil, oil shale, gas, geothermal, hydroelectric, and solar. The impact of these county-level patterns of utility, industry, and mining activities on the air, water, and land resources of the country and on the socioeconomic and health and safety aspects of the nation's welfare are analyzed. DOE

N80-25928# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
ENVIRONMENTAL ASSESSMENT OF SMALL WIND SYSTEMS Progress Report
Kathryn Lawrence, Carol Strojan, and Daniel ODonnell. Feb. 1980 37 p refs
(Contract EG-77-C-01-4042)
(SERI/PR-354-420) Avail: NTIS HC A03/MF A01

The first formal product of the environmental assessment of small wind energy conversion systems (SWECS) study is presented. An overview of the study's structure, planned activities, and a synopsis of task progress is given. DOE

N80-25929# Department of Energy, Washington, D. C. Assistant Secretary for Resource Applications.
ENVIRONMENTAL ASSESSMENT: GEOTHERMAL ENERGY GEOPRESSURE SUBPROGRAM. DOE SWEET LAKE NO. 1, CAMERON PARISH, LOUISIANA
Feb. 1980 245 p refs
(DOE/EA-0065) Avail: NTIS HC A11/MF A01

Geothermal geopressure resource feasibilities in the Louisiana-Texas Gulf Coast region were examined. An environmental assessment was prepared to evaluate environmental effects of test site construction of geothermal fluid wells for intermittent production testing. Physical and chemical composition of the fluids, their temperature, the nature of flow, fluid disposal techniques, and the reliability and performance of equipment were studied. Biological surveys were prepared of ecosystem cultural alterations due to the construction of the geothermal geopressure test facilities. R.G.D.

N80-25930# Automotive Testing Labs., Inc., Aurora, Colo.
A STUDY OF EMISSIONS FROM PASSENGER CARS IN SIX CITIES, VOLUME A Final Report
Jan. 1979 868 p 2 Vol.
(Contract EPA-68-03-2593)
(PB80-149800; EPA-460/3-78-011A) Avail: NTIS HC A99/MF A01 CSCL 13B

This is the first of two volumes presenting results from a series of exhaust emission and fuel economy tests performed on a representative sample of vehicles in six U.S. cities. Data presented in the following sections are generated in appendix form as part of a contract with the EPA to perform work for the FY 77 Passenger Car Emission Factor Program. Volume A includes a technical discussion of test and data handling procedures, laboratory facility descriptions, and test instrument maintenance and calibration practices. Pertinent data concerning vehicle sample composition and results of Federal Test Procedure, Highway Fuel Economy and Federal Short Cycle Tests are also presented. GRA

N80-25931# Automotive Testing Labs., Inc., Aurora, Colo.
A STUDY OF EMISSIONS FROM PASSENGER CARS IN SIX CITIES, VOLUME B Final Report
Jan. 1979 872 p 2 Vol.
(Contract EPA-68-03-2593)
(PB80-149816; EPA-460/3-78-011B) Avail: NTIS HC A99/MF A01 CSCL 13B

This is the second of two volumes presenting results from a series of exhaust emission and fuel economy tests performed on a representative sample of vehicles in six U.S. cities. Data presented in the following sections are generated in appendix form as part of a contract with the EPA to perform work for the FY 77 Passenger Car Emission Factor Program. Volume B includes the balance of individual vehicle data derived from the Two Speed Idle and Federal Three Mode tests. It also includes the results of Vehicle Driveability Evaluations, Maladjustment and Disablement Inspections, tire inspections and a listing of comparative mileage data. Information presented in volume B should not be interpreted without the benefit of additional descriptive data presented in volume A as both volumes comprise the results of a single work effort and are not intended to be considered separately. GRA

N80-25932# Virginia Highway and Transportation Research Council, Charlottesville.
AN EMPIRICAL RELATIONSHIP BETWEEN MESOSCALE CARBON MONOXIDE CONCENTRATIONS AND VEHICULAR EMISSION RATES Final Report
Gerardo G. Clemena Jul. 1979 53 p refs Sponsored by Federal Highway Admin., Virginia Dept. of Highways and Transportation, and Virginia Univ.
(PB80-138308; VHTRC-80-R2; FHWA/VA-80/2) Avail: NTIS HC A04/MF A01 CSCL 04A

Presented is a relatively simple empirical equation that resonably approximates the relationship between mesoscale carbon monoxide (CO) concentrations, areal vehicular CO emission rates, and the meteorological factors of wind speed and mixing height. The approximation is an extension of rollback modeling and was derived from aerometric data measured at a major urban area in Virginia. A similar equation has been found valid for data measured at another major urban area. Author

N80-25933# SRI International Corp., Menlo Park, Calif.
ASSESSMENT OF VERTICAL DISTRIBUTIONS OF PHOTOCHEMICAL POLLUTANTS AND METEOROLOGICAL VARIABLES IN THE VICINITY OF URBAN AREAS Final Report
F. L. Ludwig Aug. 1979 185 p refs
(Contract EPA-68-02-2662)
(PB80-139918; EPA-450/4-79-017) Avail: NTIS HC A09/MF A01 CSCL 04A

A system for classifying vertical profiles of ozone and other photochemical pollutants was derived by analyzing 268 ozone profiles obtained from published reports and EPA data files. The profiles fall into six different categories that are related to the relative importance of the following factors: destruction of ozone near the surface, vertical mixing, and photochemical production. One hundred and eight representative examples of the vertical profiles are presented and discussed, most with corresponding temperature data and many with aerosol (nephelometer), NOx, or hydrocarbon data. The locations relative to an urban area and the times when each profile type is most apt to occur are discussed in terms of the statistics of the data set and the physical processes involved. GRA

N80-25934# SRI International Corp., Menlo Park, Calif.
ATMOSPHERIC DISTRIBUTIONS, SOURCES AND SINKS OF SELECTED HALOCARBONS, HYDROCARBONS, SF6, AND N2O Final Report
H. B. Singh, L. J. Salas, H. Shigeishi, A. J. Smith, E. Scribner, and L. A. Cavanagh Nov. 1979 149 p refs
(Grant EPA-8038020)
(PB80-142706; EPA-600/3-79-107) Avail: NTIS HC A07/MF A01 CSCL 04A

Global distributions of a large number of halocarbons, hydrocarbons, SF6, and N2O are presented. These data are complemented with measurements in the polluted environments to establish urban-nonurban relationships of these species. Atmospheric growth rates of selected species are characterized based on measurements conducted between 1975 and 1978. GRA

N80-25935# Meteorology Research, Inc., Altadena, Calif.
POLLUTANT MEASUREMENTS IN PLUMES FROM POWER PLANTS AND CITIES - ST. LOUIS AREA, JULY 1976. A PROJECT MISTT (MIDWEST SULFUR TRANSFORMATION AND TRANSPORT) REPORT Final Report, Jun. 1976 - Dec. 1977
John A. Ogren, Jerry A. Anderson, and Donald L. Blumenthal Nov. 1979 59 p refs
(Contract EPA-68-02-2411)
(PB80-139058; MRI-78-FR-1586; EPA-600/7-79-242) Avail: NTIS HC A04/MF A01 CSCL 13B

Airborne measurements of aerosols and pollutant gases in urban and power plant plumes were conducted during July 1976 in the vicinity of St. Louis, Missouri. The measurements were designed to characterize the physical and chemical behavior of these plumes under a variety of meteorological conditions. The airborne data were analyzed to gain a better understanding of the factors affecting the transport, transformation, and removal of primary and secondary pollutants, particularly those containing sulfur. The field program and experimental techniques are described, and the results and conclusions of the analyses of the airborne measurements and meteorological data are presented. GRA

N80-25936# Battelle Columbus Labs., Ohio.
METHODS FOR ANALYZING INORGANIC COMPOUNDS IN PARTICLES EMITTED FROM STATIONARY SOURCES Interim Report, Jan. 1977 - Jul. 1978
William M. Henry Sep. 1979 130 p refs
(Contract EPA-68-02-2296)
(PB80-141781) Avail: NTIS HC A07/MF A01 CSCL 14B

Methods to identify and measure inorganic compounds in particulate emissions which emanate from sources using or processing fossil fuels were developed. Large masses, 20 to 100 grams of field samples were collected representative of a range of both coal and oil-fired fly ashes, and the selected methodology development efforts were evaluated on these field samples as well as synthesized samples. Fourier transform infrared spectroscopy, X-ray diffraction, and chemical phase separations and analyses are the methods which have provided the most definitive identification of inorganic compounds. The structural findings by these methods are complemented by complete cation-anion chemical determinations. GRA

N80-25937# Battelle Columbus Labs., Ohio.
EVALUATION OF STATIONARY SOURCE PARTICULATE MEASUREMENT METHODS. VOLUME 4: BASIC OXYGEN FURNACES Interim Report, Oct. 1973 - Jun. 1977
J. E. Howes, Jr., W. M. Henry, and R. N. Pesut. Aug. 1979. 68 p. refs.
(Contract EPA-68-02-0609)
(PB80-141633; EPA-600/2-79-141-Vol-4) Avail: NTIS. HC A04/MF A01. CSCL 14B

A procedure, EPA method 5, for sampling and determining particulate concentrations in emissions from stationary sources was specifically evaluated at basic oxygen furnaces (BOF) equipped with wet-scrubbers of electrostatic precipitators (ESP) controls. Although wet-scrubber emissions could potentially present the most difficulty since the sampling system must handle a moisture-laden gas stream with entrained water droplets, no problems were found when using method 5. Variation of the sampling rate at 0.7 and 1.3 times isokinetic also did not significantly affect the accuracy of the mass measurements. Chemical analyses confirmed that the method 5 procedure extracts a representative sample of the BOF/ESP stack particulate emissions. GRA

N80-25938# Martin Marietta Corp., Baltimore, Md. Environmental Center.
MODELING OF BUOYANT PLUME DISPERSION IN COMPLEX TERRAIN Final Report
Jeffrey C. Weil. Aug. 1979. 102 p. refs.
(PB80-145337; PPSP/PPRP-35) Avail: NTIS. HC A06/MF A01. CSCL 13B

A mathematical model for a bouyant plume in neutral and stably-stratified flows over a two dimensional hill was developed. Wind tunnel experiments under idealized conditions were used to test the model. Field measurements were then compared with wind tunnel simulations of stack plume dispersion from a real source in complex terrain. The mathematical model consisted of equations describing the ambient wind field and equations describing the plume superimposed on the wind. The equations were solved numerically to obtain the plume characteristics. A 1:2000 scale wind tunnel model of the stacks and terrain at the Westvaco pulp mill (Luke, Md.) was built to simulate the transport and dispersion of stack SO2 plumes about a large nearby hill. GRA

N80-25939# California Univ., Riverside. Statewide Air Pollution Research Center.
MECHANISMS OF PHOTOCHEMICAL REACTIONS IN URBAN AIR Final Report, 1 Dec. 1974 - 30 Nov. 1978
James Pitts, Karen Darnall, William P. L. Carter, Arthur M. Winer, and Roger Atkinson. Nov. 1979. 583 p. refs.
(Grant EPA-R-800649)
(PB80-132384; EPA-600/3-79-110) Avail: NTIS. HC A25/MF A01. CSCL 07D

Data required for the validation of models for chemical transformation in air pollution are presented. A 5800 liter, Teflon coated, evacuable, thermostatted chamber and a 25 kW xenon arc solar simulator were used for irradiations, under simulated atmospheric conditions, of various hydrocarbon NOx-air mixtures. Results from a total of 114 irradiation, employing representative alkanes, olefins, aromatics, and oxygenates, both singly and in two or multi-hydrocarbon mixtures, are reported. The kinetic and mechanism of the gas phase reaction of hydroxyl radicals with o-cresol and methoxy benzene were studied. The reactions of O3 with acetylene, methiglyoxal and a series of aromatic hydrocarbons were also studied. GRA

N80-25940# Bureau of Mines, Salt Lake City, Utah. Research Center.
FLUE GAS DESULFURIZATION BY THE MODIFIED CITRATE PROCESS: REPORT OF INVESTIGATIONS
R. H. Lien, D. A. Martin, and W. I. Nissen. 1979. 24 p. refs.
(PB80-134836; BM-RI-8403) Avail: NTIS. HC A02/MF A01. CSCL 13B

A flue gas desulfurization process was developed. The process known as the citrate process, involves absorption of sulfur dioxide (SO2) in a buffered solution of citric acid. As an adjunct to the citrate process, bench scale research shows that SO2-loaded citrate or glycolate solutions can be regenerated by countercurrent contact with steam (stripping) in packed towers. Stripping steam requirements were determined for treatment of 0.25, 50, 1.0, and 2.0% SO2 waste gases. Steam requirements decreased with increasing SO2 concentrations in the simulated waste gases. GRA

N80-25941# Environmental Monitoring and Support Lab., Research Triangle Park, N. C. Quality Assurance Branch.
TRANSFER STANDARDS FOR THE CALIBRATION OF AMBIENT AIR MONITORING ANALYZERS FOR OZONE: TECHNICAL ASSISTANCE DOCUMENT Final Report
Frank F. McElroy. Sep. 1979. 156 p. refs.
(PB80-146871; EPA-600/4-79-056) Avail: NTIS. HC A08/MF A01. CSCL 07D

Ozone transfer standards and their purpose and role in calibrating ambient ozone analyzers are described. Various advantages and disadvantages of their use are discussed. Several different types of ozone transfer standards are described, including analytical instruments, manual analytical procedures and ozone generation devices. The procedures necessary to establish the authority of ozone transfer standards are detailed. GRA

N80-25942# Delaware Univ., Newark. Dept. of Civil Engineering.
CONTRIBUTIONS OF URBAN LAND USE TO STREAM WATER QUALITY M.S. Thesis
Daniel Lain Davis. Jun. 1979. 147 p. refs.
(Contract DI-14-34-0001-8070)
(PB80-151178; WB0-03644; OWRT-B-018-DEL(2)) Avail: NTIS. HC A07/MF A01. CSCL 08H

The impact of urban runoff on stream water quality with respect to cadmium and lead in both the particulate and liquid phase, was examined for the Christiana River in the Newark, Delaware area. Five stations were selected, each depicting a different degree of urbanization. Measured concentrations were correlated with stream volumetric flow rates so that storm discharge values could be calculated. Four complete storm events were sampled at appropriate time intervals with results indicating that lead pollution originated from surface stormwater runoff. GRA

N80-25943# Gulf South Research Inst., New Orleans, La.
RESEARCH TO IDENTIFY COMPONENTS OF ENERGY-RELATED WASTES: A STATE-OF-THE-ART REPORT Final Report, Nov. 1978 - Nov. 1978
J. E. Gebhart and Mary M. McKown. Dec. 1979. 526 p.
(Contract EPA-68-03-2487)
(PB80-137961; EPA-600/7-79-255) Avail: NTIS. HC A23/MF A01. CSCL 13B

Pertinent abstracts from a survey of current (post 1976) research projects were categorized according to energy-related activity. Subjects include coal strip mines, oil refineries, oil shale operations, coal-fired power plants, geothermal energy production, coal liquefaction plants, and potential quality control standards. Abstracts of available technical reports are also presented using the same energy categories. These reports were obtained from a variety of sources, including MEDLINE, TOXLINE, BIOSIS, CAIN, NTIS, DIALOG, and Chemical Abstracts. Federal energy research centers supplied a large number of pertinent documents. This state-of-the-art summary is provided as an aid to researchers concerned with the environmental effects of energy-related activities. GRA

N80-25944# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
DETERMINATION OF THE EFFECTS OF AMBIENT CONDI-

TIONS ON CFM56 AIRCRAFT ENGINE EMISSIONS Final Report
T. F. Lyon, W. J. Dodds, and D. W. Bahr Dec. 1979 125 p refs
(Contract EPA-68-03-2388)
(PB80-138597; R79AEG632; EPA-460/3-79-011) Avail: NTIS HC A06/MF A01 CSCL 13B

The effects of ambient temperature, humidity, and pressure on the emissions of hydrocarbons, carbon monoxide, oxides of nitrogen, and smoke from a CFM56 engine combustor were determined through rig tests in which combustor inlet conditions could be carefully controlled. In addition, the data were verifed in full-scale engine tests under uncontrolled ambient conditions. For each test condition, emissions measurements were made twice. A total of 214 separate test points were run. The combustor test conditions, along with the measured emissions levels, were transmitted in computer-readable format for subsequent analysis of the data. R.E.S.

N80-25948# Environmental Sciences Research Lab., Research Triangle Park, N.C. Atmospheric Chemistry and Physics Div.
BIOGENIC HYDROCARBON CONTRIBUTION TO THE AMBIENT AIR OF SELECTED AREAS - TULSA; GREAT SMOKEY MOUNTAINS; RIO BLANCO COUNTY, COLORADO
Robert R. Arnts and Sarah A. Meeks Jan. 1980 43 p refs
(PB80-139066; EPA-600/3-80-023) Avail: NTIS HC A03/MF A01 CSCL 13B

In response to the suggestion that biogenic emissions are responsible for the high hydrocarbon concentrations described in several reports, a short term sampling was initiated as a means of validation. A limited number of whole-air samples were collected in Tedlar bags and analyzed by gas chromatography with flame ionization detection. The areas of study included: Tulsa, Oklahoma; Rio Blanco County, Colorado; and the Great Smokey Mountains in Tennessee. Although the tests were of short duration, the results suggest monoterpenes and isoprene constitutes minor components of rural air relative to anthropogenic hydrocarbons. GRA

N80-25949# Union Carbide Corp., Bound Brook, N.J. Chemical and Plastics Research Labs.
SOLID SORBENT FOR COLLECTING ATMOSPHERIC SULFUR DIOXIDE Final Report, May 1975 - Nov. 1977
R. J. Cotter and S. G. Smith Dec. 1979 44 p refs
(Contract EPA-68-02-1782)
(PB80-131949; EPA-600/2-79-205) Avail: NTIS HC A03/MF A01 CSCL 13B

A solid sorbent for collecting atmospheric SO2 was evaluated as part of an effort to develop a replacement method for the West-Gaeke method presently used to measure 24 hour ambient sulfur dioxide concentrations in ambient air. Research showed that a solid sorbent, consisting of Puramer S coated open cell polyurethane foam, can be used to fix the quantities of sulfur dioxide that would be collected if typical ambient air was filtered for 24 hours at 200 cc/min. Troublesome sulfur dioxide decay occuring during post collection storage was primarily the result of oxidation. Decay was minimized to an acceptable level by sealing the spent Puramer S collector devices to prevent oxygen thermal desorption and subsequent assaying. GRA

N80-25947# TRW Defense and Space Systems Group, Redondo Beach, Calif.
THE USE OF pH AND CHLORIDE ELECTRODES FOR THE AUTOMATIC CONTROL OF FLUE GAS DESULFURIZATION SYSTEMS Final Report, Sep. 1978 - Jul. 1979
Clinton Ung, Toby Accian, and Ray Maddalone Nov. 1979 80 p ref
(Contract EPA-68-02-2165)
(PB80-139464; EPA-600/2-79-202) Avail: NTIS HC A05/MF A01 CSCL 13B

The applicability of chloride and pH electrodes in automated control systems was investigated via a survey of chloride and pH electrodes in different flue gas desulfurization (FGD) systems and an evaluation of an industrial pH electrodes system. The survey showed that chloride ion measurements were necessary only where high chloride values correspond with FGD unit corrosion and when chloride values were used at correction factors in ph calculations. Chloride ion measurements are unnecessary for most of the surveyed companies. All survey companies use pH measurement to control scaling or to attain optimum performance in FGD units. The most common pH electrode problem was residue buildup (scaling) around the electrode, caused by the use of non-self-cleaning (standard) pH electrodes. The performance of self-cleaning and standard industrial pH electrodes was evaluated. GRA

N80-25948# PEDCo-Environmental, Inc., Cincinnati, Ohio.
GUIDANCE FOR LOWEST ACHIEVABLE EMISSION RATES FROM 18 MAJOR STATIONARY SOURCES OF PARTICULATE, NITROGEN OXIDES, SULFUR DIOXIDE, OR VOLATILE ORGANIC COMPOUNDS
Apr. 1979 358 p refs Sponsored by EPA
(PB80-140262; EPA-450/3-79-024) Avail: NTIS HC A16/MF A01 CSCL 13B

Ways for achieving lowest achievable emission rates (LAER) for 18 major stationary sources of particulate, nitrogen oxides, or volatile organic compounds are described. The source categories addressed are stationary gas turbines, kraft pulp mills, steel and iron foundries, petroleum refineries (three sources), fabric coating, industrial boilers, primary aluminum plants, bulk gasoline terminals, flat wood coating, gasoline and crude oil storage graphic arts, and the coating of automobiles and light trucks, metal furniture and large appliances, cans, metal coils, and paper. GRA

N80-25949# Wisconsin Univ. - Madison. Dept. of Soil Science.
A RAPID ANALYSIS OF SURFACE WATERS BY HIGH PRESSURE LIQUID CHROMATOGRAPHY M.S. Thesis
Kent Huibregtse 1979 160 p refs
(Contract DI-14-34-0001-6052)
(PB80-132681; W80-02603; OWRT-A-069-WIS(1)) Avail: NTIS HC A08/MF A01 CSCL 07D

A simple rapid method for obtaining fingerprint traces of nonpolar organic contaminants on water samples by trace enrichment and high pressure liquid chromatography was developed. Chromatograms of samples taken above, at, or below the outfalls of industrial plants sewage treatment facilities, and other point sources of pollution clearly revealed differences in water fingerprints which indicated the extent and persistance downstream of organic containments. GRA

N80-25950# Systems Applications, Inc., San Rafael, Calif.
PERFORMANCE MEASURES AND STANDARDS FOR AIR QUALITY SIMULATION MODELS Final Report
S. R. Hayes Oct. 1979 317 p refs
(Contract EPA-68-02-2593)
(PB80-152838; EPA-450/4-79-032) Avail: NTIS HC A14/MF A01 CSCL 04B

A concept for objectively evaluating model performance was developed. Five attributes of a well-behaving model are defined: accuracy of the peak prediction, absence of systematic bias, lack of gross error, temporal correlation, and spatial alignment. The relative importance of these attributes is shown to depend on the issue being addressed and the pollutant being considered. Acceptability of model behavior was determined by calculating several performance measures and comparing their values with specfic standards. GRA

N80-25951# Environmental Monitoring and Support Lab., Research Triangle Park, N.C. Statistical and Technical Analysis Branch.
AIR QUALITY DATA FOR METALS, 1976, FROM THE NATIONAL AIR SURVEILLANCE NETWORKS Final Report
Raymond C. Rhodes, Donald H. Fair, J. E. Frazer, S. J. Long, W. A. Loseke, V. A. Wheeler, and J. F. Walling Aug. 1979 272 p refs
(PB80-147432; EPA-600/4-79-054) Avail: NTIS HC A12/MF A01 CSCL 04B

The urban and nonurban concentrations of 11 metallic ions in suspended particulate matter are listed. The data are presented as a composite concentration value for each site for each of the four quarters of the calendar year; a yearly average is reported whenever valid data for all four quarters are obtained. Overall national summaries are compared for the years 1970 through 1976. GRA

N80-25952# Environmental Protection Agency, Washington, D.C. Div. of Stationary Source Enforcement.
COMPLIANCE STATUS OF MAJOR AIR POLLUTION FACILITIES Final Report
Feb. 1980 875 p
(PB80-154560; EPA-340/1-80-004) Avail: NTIS
HC A99/MF A01 CSCL 13B

The probable compliance status and related facility information for major stationary sources of air pollution are presented. The information reported is not intended to represent the true legal status of facilities with respect to applicable air pollution regulations but rather those facilities of interest to the states or the EPA for further investigation. GRA

N80-25953# Environmental Monitoring and Support Lab., Research Triangle Park, N. C.
MEASUREMENT OF PERCHLOROETHYLENE IN AMBIENT AIR Final Report, Mar. 1978 - Feb. 1979
G. F. Evans, R. E. Baumgardner, J. E. Bumgarner, P. L. Finkelstein, J. E. Knoll, A. L. Sykes (Res. Triangle Inst., Research Triangle Park, N.C.), D. E. Wagoner (Res. Triangle Inst., Research Triangle Park, N.C.), and C. E. Decker (Res. Triangle Inst., Research Triangle Park, N.C.) Aug. 1979 203 p refs
(PB80-144678; EPA-600/4-79-047) Avail: NTIS
HC A10/MF A01 CSCL 13B

The monitoring of perchloroethylene (i.e., tetrachloroethylene) an organic solvent widely used in dry cleaning and industrial metal degreasing operations is discussed. Short term field studies were conducted in each of three major metropolitan areas which were selected on the basis of the number, density and size of perchloroethylene emission sources as well as the proximity of such sources to centers of high population density. GRA

N80-25954# Environmental Monitoring and Support Lab., Research Triangle Park, N. C. Quality Assurance Div.
TEST METHODS TO DETERMINE THE MERCURY EMISSIONS FROM SLUDGE INCINERATION PLANTS
W. J. Mitchell, M. R. Midgett, J. C. Suggs, and D. Albrinck (PEDCo Environmental, Inc., Cincinnati, Ohio) Sep. 1979 59 p refs
(PB80-144611; EPA-600/4-79-058) Avail: NTIS
HC A04/MF A01 CSCL 13B

Two test methods for mercury are described along with the laboratory and field studies done in developing and validating them. One method decribes how to homogenize and analyze large quantities of sewage sludge. The other test method describes how to measure the mercury emissions from the stacks of sewage sludge incinerators. In this latter method, the samples are collected in a potassium permanganate/sulfuric acid solution and analyzed for mercury using flameless atomic absorption spectrometry. GRA

N80-25955# Environmental Measurements, Inc., San Francisco, Calif.
CROSS-COUNTRY URBAN AND RURAL MEASUREMENTS OF NOx AND SO2 Final Report
Lee Langan, Michael A. Peache, Jean Jacques Garbarz, Ralph E. Baumgardner, and Robert K. Stevens Jan. 1980 75 p
(PB80-137227; EPA-600/2-80-023; Contract EPA-68-02-2484) Avail: NTIS HC A04/MF A01 CSCL 13B

Total sulfur and oxides of nitrogen measurements, gathered along two long distance routes across the United States, are presented. Supportive information describing the instrumentation, procedures, moving laboratory, and regional meteorological conditions are provided. Over 300,000 measurements were made; points consisting of ten measurement averages were plotted; they are also presented in a graphic analysis. This analysis consists of frequency distribution plots of segments of the trip, for example, through rural areas and crossing urban developments. These plots provide a means of classification of the degree of pollution present and monitored with this moving laboratory technique. The laboratory stopped at six rural locations to record time averaged data, which are also presented. GRA

N80-25956# Chesapeake Research Consortium, Inc., Annapolis, Md.
PHYSICAL ALTERATIONS OF COASTAL SHORELINES: AN ANALYSIS OF CHESAPEAKE BAY SHORE ZONE DEVELOPMENT AND REGULATION
William H. Queen, ed. Mar. 1979 103 p refs
(Grant NSF AEN-74-22179)
(PB80-149875; CRC-PUB-64; NSF/RA-790178) Copyright. Avail: NTIS HC A06/MF A01 CSCL 13B

Shore zone modification and regulations are analyzed. The principal patterns, trends, and rates of physical alterations of the edges of the Chesapeake Bay are identified and their environmental significance is examined. Survey results are used to evaluate the policies and programs affecting environmental quality and land use in the region. GRA

N80-25957# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DEVELOPMENT OF AN AUTOMATIC H2SO4 MONITOR Final Report, Sep. 1977 - Oct. 1978
B. A. Knight and F. F. Brooks Jul. 1979 78 p
(Contract EPA-68-02-2165)
(PB80-138191; EPA-600/7-79-153) Avail: NTIS
HC A05/MF A01 CSCL 14B

The development, construction, and testing of a prototype automatic H2SO4 vapor and aerosol monitor are described. The monitor is capable of continuous unattended operation for a 24 hour period in streams of moderate (5 g/cu m) particulate loadings. Readings of solution conductivity are recorded continuously, and new samples of the gas stream for analysis are obtained every 10 minutes. The H2SO4 concentration is determined from the instrument and associated calibration curves within 5 minutes of sample acquisition. The prototype detects H2SO4 concentrations in the range of 0.5 to 500 ppm , at temperatures up to 300 C, with 3000 ppm SO2, 8-16% H2O, and up to 9 g/cu m of particulate matter in the gas stream. GRA

N80-25958# Southern Research Inst., Birmingham, Ala.
PARTICULATE SAMPLING AND SUPRORT: EXECUTIVE SUMMARY Final Report, Nov. 1975 - Nov. 1978
Kenneth M. Cushing Nov. 1979 50 p
(Contract EPA-68-02-2131)
(PB80-149883; SORI-EAS-79-415) Avail: NTIS
HC A03/MF A01 CSCL 13B

Many aspects of particulate sampling and measurement in industrial gaseous process and effluent streams were reviewed. Cascade impactors were calibrated and evaluated. Novel particle sampling cyclones were designed and evaluated. Technical and procedures manuals were prepared for control device evaluation and particle sampling methods. An electrostatic precipitator backup was designed for high flow rate systems. Advanced concepts in monitoring particle mass and size, using optical systems, were evaluated. A detailed examination of the results is also included. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-25959 Alaska Univ., College.
THE PLASMA BOUNDARY LAYER AND MAGNETOPAUSE LAYER OF THE EARTH'S MAGNETOSPHERE Ph.D. Thesis
Timothy Eric Eastman 1979 262 p
Avail: Univ. Microfilms Order No. 8013052

Observations of the plasma boundary layer (PBL) and magnetopause layer (MPL) of the Earth's magnetosphere by IMP 6 indicate that plasma in the low latitude portion of the PBL is supplied primarily by direct transport of magnetosheath plasma across the MPL and that this transport process is relatively widespread over the entire sunward magnetospheric boundary. The MPL is defined as the current layer, separating the magnetosheath from the PBL, through which the magnetic field shifts in direction. High temporal resolution data reveal that in all IMP 6 crossings, some magnetosheath-like plasma is observed earthward of the MPL, which implies the existence of the PBL. Bulk plasma flow in the low latitude part of the PBL

as observed by IMP 6 almost always has an anti-sunward component and often has a significant cross field component. A brief analysis of the lower hybrid drift instability indicates that it can provide substantial cross field diffusion and thus contribute to the PBL population. A comparison of various theoretical descriptions of the solar wind-magnetosphere interaction illustrates the problems posed for all theoretical models. Dissert. Abstr.

N80-25960 Washington Univ., Seattle.
BAROCLINIC WAVE VACILLATIONS Ph.D. Thesis
Byron Arthur Boville 1979 135 p
Avail: Univ. Microfilms Order No. 8013497

Previous studies of amplitude vacillation, both experimental and theoretical, are briefly reviewed. A nonlinear numerical model is constructed in spectral form, based on the quasi-geostrophic equations for a two layer fluid. A number of model integrations are performed using the f plane geometry. For small departures from the critical conditions for baroclinic instability, the model confirms the analytic theory. For large instability, significant deviations occur due to the nonlinear interactions of the primary wave with the other waves in the model. A number of model integrations are performed using beta plane geometry, which more closely simulates the midlatitude dynamics on the Earth than does the f plane. The integrations produce very different results from those obtained by the asymptotic f plane theory, or even by the f plane numerical model. Vacillations are still present for moderate dissipation and sufficiently large latitudinal thermal gradients. However, the structure and dynamics of the vacillation cycles are much different from those on the f plane.
Dissert. Abstr.

N80-25961 Southern Methodist Univ., Dallas, Tex.
ENERGY DISSIPATION OF RAYLEIGH WAVES DUE TO ABSORPTION ALONG THE PATH OF THE USE OF FINITE-ELEMENT METHOD Ph.D. Thesis
Ali A. Feizpour 1979 164 p
Avail: Univ. Microfilms Order No. 8013063

A Normally incident Rayleigh wave may be used for the investigation of a general vertical boundary and the attenuation of a viscoelastic medium. Use of energy conservation and proper boundary condition produce N second order differential equations, N being the number of viscoelastic layers in the medium. The homogeneous part of the differential equations can be transformed into an eigenvalue problem by the use of finite element technique; the eigenvalue and eigenvectors of the eigenvalue problem are the wave numbers and the displacement amplitudes of the viscoelastic layered medium. The real and imaginary parts of wave number determine the phase velocity and the attenuation of the layered medium, respectively. Dispersion and the attenuation curves can be obtained by using different periods. The above wave numbers can be used in the inhomogeneous differential equation; this equation contains the effect of the vertical boundary; solution of this equation determines the displacement at the vertical boundary. The displacements at the left and right sides of the boundary may be used in the energy equation to determine the reflected and the transmitted energy, respectively. The difference between the incident and transmitted energy determines the difference between the wave numbers at the left and right hand sides of the vertical boundary. Addition of these differences to the wavenumbers of the left hand boundary would result in the formation of the dispersion curve at the right hand boundary. Dissert. Abstr.

N80-25962 Washington Univ., Seattle.
AN ENERGY-BALANCE CLIMATE MODEL WITH SEPARATE LAND AND OCEANIC EFFECTS Ph.D. Thesis
Cho-Teng Liu 1979 124 p
Avail: Univ. Microfilms Order No. 8013558

An annually and zonally averaged, energy-balanced climate model was developed. The effects of land and oceans were considered separately. The interaction between atmosphere and ocean, the interaction between the atmosphere over ocean and the atmosphere over land, the atmosphere moisture transport, and the ice-albedo feedback were included features. The atmospheric circulation, the cloud cover, and the latitudinal shape function for precipitation were assumed to be independent of the climatic state. The major tuning parameters were the atmospheric and oceanic latitudinal diffusivities, and then present percentage of insolation reaching the Earth surface under clear sky. The result of a tuned model simulates well the observed latitudinal dependence of the sea-surface temperature, the surface air temperature, the difference between precipitation and evapotranspiration, the poleward energy transport and the planetary shortwave albedo. Dissert. Abstr.

N80-25963 Washington Univ., Seattle.
THE COMBINATION OF AERIAL AND TERRESTRIAL PHOTOGRAMMETRY IN STRUCTURAL MONITORING Ph.D. Thesis
John Nicholas Hatzopoulous 1979 178 p
Avail: Univ. Microfilms Order No. 8013533

The foundation for the method of combination of aerial and terrestrial photogrammetry in structural monitoring is provided by the theory of the standard bundle method of analytical phototriangulation. The traditional bundle method with some small modifications is summarized. The theoretical development of a rigorous adjustment method with proper algorithmic formulation for monitoring applications is outlined. The proper geometric configuration of a photogrammetric monitoring project which combines aerial and terrestrial photography based on a simulation experiment is established. Photogrammetric monitoring of a gabion wall based on four sets of data which involve aerial photography in a three year period of survey is assessed.
Dissert. Abstr.

N80-25964*# Illinois Univ., Urbana.
ROCKET MEASUREMENTS OF ELECTRON TEMPERATURE IN THE E REGION
R. K. Zimmerman, Jr. and L. G. Smith 1 Apr. 1980 173 p refs
(Grant NGR-14-005-181)
(NASA-CR-163210; UILU-ENG-80-2501; Aeronomy-92) Avail: NTIS HC A08/MF A01 CSCL 04A

The rocket borne equipment, experimental method, and data reduction techniques used in the measurement of electron temperature in the E region are fully described. Electron temperature profiles from one daytime equatorial flight and two nighttime midlatitude flights are discussed. The last of these three flights, Nike Apache 14.533, showed elevated E region temperatures which are interpreted as the heating effect of a stable auroral red arc. Author

N80-25965*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
NASA-JSC OZONE OBSERVATIONS FOR VALIDATION OF NIMBUS 7-LIMS DATA
Donald E. Robbins Apr. 1980 44 p refs
(NASA-TM-58227; JSC-16498) Avail: NTIS HC A03/MF A01 CSCL 04A

A series of balloon flights undertaken to validate data received from the limb infrared monitor of the stratorphere instrument aboard the Nimbus 7 satellite is discussed. Ozone data profiles, which included altitude, pressure, and mixing ratio, obtained during both ascent and descent of the balloons are reported. The measurement concept, instrumental uncertainties, and temporal variations observed for several time periods are discussed.
Author

N80-25966*# National Aeronautics and Space Administration, Washington, D. C.
NASA GEODYNAMICS PROGRAM Annual Report, 1979
May 1980 65 p refs
(NASA-TM-81978) Avail: NTIS HC A04/MF A01 CSCL 08G

The history and development of the geodynamics program are described, in addition to accomplishments and plans for the future years activities. Extramural grant titles are listed for general research, Lageos investigations, and Magsat investigations. E.J.R.

N80-25967*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
INITIAL GEOMAGNETIC FIELD MODEL FROM MAGSAT
R. A. Langel, R. H. Estes (Business and Technological Systems, Seabrook, Md.), G. D. Mead, E. B. Fabiano (USGS, Denver, Colo.), and E. R. Lancaster Apr. 1980 19 p refs Submitted for publication

(NASA-TM-80679) Avail: NTIS HC A02/MF A01 CSCL 04A

Magsat data from magnetically quiet days were used to derive a thirteenth degree and order spherical harmonic geomagnetic field model, MGSTI3/80). The model utilized both scalar and vector data and fit that data with standard deviations of 8, 52, 55 and 97 nT for the scalar magnitude, B sub r, B sub theta and B sub phi respectively. When compared with earlier models, the Earth's dipole moment continues to decrease at a rate of about 26 nT/year. Evaluation of earlier models with Magsat data shows that the scalar field at the Magsat epoch is best predicted by the POGO(2/72) model but that the AWC/75 and IGS/75 are better for predicting vector fields. Author

N80-25968# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ON THE EFFICIENCY OF MERIDIONAL EDDY TRANSPORT PROCESSES DURING THE MAJOR STRATOSPHERIC WARMING OF JANUARY 1977

Vadlamudi Brahmananda Rao and Jose Paulo Bonatti Mar. 1980 21 p refs Revised Submitted for publication

(INPE-1687-RPE/118) Avail: NTIS HC A02/MF A01

Correlation coefficients between the meridional wind and zonal wind and meridional wind and temperature measure the efficiencies of eddy transports of momentum and heat respectively. Efficiencies are calculated in terms of these correlation coefficients for the major warming event of January 1977. It is found that the eddies are more efficient in transporting heat than in transporting momentum. Further, the efficiency of heat transport increased substantially before the meridional temperature gradient reversed. Increase of efficiency in heat transport is found to be related to the increased westward tilt of a wave in the height field. Since this tilt is known to be associated with vertical propagation of wave energy, interesting connections are inferred between the efficiencies of eddy transports, wave structure, and energetics during a stratospheric warming. Author

N80-25969# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

LONGITUDINAL AND LATITUDINAL ABNORMALITIES IN THE DAILY VARIATION OF f0F2 IN THE SOUTH AMERICAN REGION

R. P. Kane Apr. 1980 30 p refs Revised Submitted for publication

(INPE-1722-RPE/127) Avail: NTIS HC A03/MF A01

The daily variation characteristics of f0F2 at locations in the South American region were studied for the IGY period. For pairs of stations at roughly similar dip latitudes, but either in different hemispheres or at different longitudes in the same hemisphere (particularly southern), considerable differences, qualitative as well as quantitative, were observed. Whereas the possibility that these are due to differences in electrodynamic effects, cannot be ruled out, it is suggested that irregular precipitation of low energy electrons from the magnetosphere could also be a possible cause. Author

N80-25970# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

COMPARISON OF f0F2 CHARACTERISTICS AT NEARBY EQUATORIAL LOCATIONS IN THE SOUTH AMERICAN REGION

R. P. Kane May 1980 16 p refs Revised Submitted for publication

(INPE-1737-RPE/136) Avail: NTIS HC A02/MF A01

The daily variation characteristics of ionospheric f0F2 at two locations on the magnetic equator in the American region viz. Huancayo (12 deg S, 75 deg W, Dip angle 2 deg N) and Natal (5 deg S, 35 deg W, dip angle 1 deg - 2 deg S in 1958 - 62) show considerable differences. Possible causes could be differences in electrodynamic effects and/or particle precipitation from magnetospheric regions at Natal, which is near the South Atlantic Geomagnetic Anomaly. Author

N80-25971# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

EXAMINATION OF THE EMPIRICAL FLUX-PROFILE MODELS IN THE ATMOSPHERIC SURFACE BOUNDARY LAYER

Y. Viswanadham May 1980 28 p refs Revised Submitted for publication

(INPE-1747-RPE/140) Avail: NTIS HC A03/MF A01

Values of Richardson number (Ri) and the wind profile Deacon number (beta) in the atmospheric surface layer are evaluated from the different experimental data sources. The relationship between Ri and beta shows some scatter, but gives agreement with the theoretical relations derived by empirical models for unstable conditions and for inversion conditions. J.M.S.

N80-25972# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ASSOCIATION BETWEEN PLASMA BUBBLE IRREGULARITIES AND AIRGLOW DISTURBANCES OVER BRAZILIAN LOW LATITUDES

J. H. A. Sobral, M. A. Abdu, C. J. Zamlutti, and I. S. Batista May 1980 9 p refs Revised

(INPE-1748-RPE/141) Avail: NTIS HC A02/MF A01

Meridional profiles of OI 6300 A nightglow emission measured using a scanning photometer over Cachoeira Paulista, a low latitude station, show propagating patches of airglow disturbances with north to south and west to east velocity components, occuring mostly in the premidnight period. Measurements carried out during a period of 28 months since January 1978, show significant seasonal dependence in the occurance of these disturbances, with most of the event occuring in the spring to summmer months and with very rare occurance during the winter solstice. The north to south propagation velocities lie in the range of 150 to 350 m/s. A case by case comparison of the occurrences of these airglow disturbances with simultaneous ionograms over Cachoeira Paulista show that almost the totality of these disturbances are accompanied by strong range type echoes in the ionograms and vice versa. These results therefore support the earlier contention that these types of airglow disturbances might be manifestations of the equatorial ionospheric plasma bubbles. J.M.S.

N80-25973# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

MAGNETOPAUSE RECONNECTION

W. D. Gonzales Jan. 1980 42 p refs Revised Submitted for publication

(INPE-1687-RPE/108) Avail: NTIS HC A03/MF A01

A revised model is presented to compute the electric potential of reconnection at the magnetopause for nonpolar geomagnetic field lines as a function of solar wind parameters. The model incorporates the recently claimed role that the Bx component of the interplanetary magnetic field seems to play in magnetopause reconnection, introducing a north-south asymmetry to the geometry of reconnection and consequent convection. This model is also extended to the cases when magnetopause reconnection on polar field lines becomes important. The Bx effect seems to be of the same nature, both, for magnetopause reconnection on nonpolar as well as on polar geomagnetic field lines, large (small) values of Bx result in a smaller (larger) reconnection potential. Author

N80-25974# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).

SPACED LIDAR AND NIGHTGLOW OBSERVATIONS OF AN ATMOSPHERIC SODIUM ENHANCEMENT

B. R. Clemesha, V. W. J. H. Kirchhoff, D. M. Simonich, H. Takahashi, and P. P. Batista Jan. 1980 21 p refs Submitted for publication

(INPE-1675-RPE/110) Avail: NTIS HC A02/MF A01

On the night of August 25 and 26, 1979, a large enhancement was observed in the density of atmospheric sodium at a height of 95 km. The enhancement, lasting about 15 minutes and extending over a height range of about 2 km, was observed at three positions about 50 km apart. Increases in sodium airglow occurring almost simultaneously were observed at two points separated by 107 km. From the time lags between the occurrence of the enhancement at the various measuring points, it is concluded that it was caused by the horizontal motion of a cloud of sodium with a density about 10 times the normal density at the peak of the sodium layer. The cloud appears to have been moving in an approximately SW direction with a velocity of the order of 200 m/s. On the assumption that the sodium was of meteoric origin, it is concluded that a minimum of 10 kg of meteoric

material was necessary for its formation. From the magnitude of the observed increases in sodium abundance and sodium airglow, a value of 3 x 10 to the 13th power/cu m is derived for the ozone density at 95 km. Author

N80-25975# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
EQUATORIAL COUNTERELECTROJET: TWO DISTINCT CATEGORIES
R. P. Kane Feb. 1980 8 p refs Revised
(INPE-1683-RPE/114) Avail: NTIS HC A02/MF A01

It is shown that among the equatorial counterelectrojets, there are two distinct categories, the fast one and the slow one, having different characteristics. Author

N80-25976# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
SOME OBSERVED AND THEORETICAL ASPECTS OF THE SUDDEN STRATOSPHERIC HEATING IN THE NORTHERN AND SOUTHERN HEMISPHERES M.S. Thesis [ALGUNS ASPECTOS OBSERVADOS E TEORICOS DO AQUECIMENTO ESTRATOFERICO BRUSCO NOS HEMISFERIOS SUL E NORTE]
Jose Paulo Bonatti Jan. 1980 144 p refs In PORTUGESE; ENGLISH summary
(INPE-1671-TDL/016) Avail: NTIS HC A07/MF A01

Synoptic and dynamic characteristics of the stratospheric warming of January 1977 in the Northern Hemisphere and the final warming of 1969 in the Southern Hemisphere are discussed. In the Northern Hemisphere case many of the features of the warming event are similar to those of a major warming while in the Southern Hemisphere the warming is shown to be minor. Synoptic charts, calculations of the scale and kinetic energy distribution as a function of wavelength, show that planetary scale waves dominated before the warming and shorter waves became important after the warming. The generation of short waves might be due to barotropic instability or nonlinear interaction. Calculation of the efficiency of eddy transports of momentum and heat shows some interesting results. Eddies seem to be more efficient in transporting heat than momentum. Further, efficiency of heat transport increases substantially before the warming. Energetics of the 1977 warming event show many similarities to the previous calculations, although the (K sub E, K sub Z) conversion was different. J.M.S.

N80-25977# Wentworth Inst., Boston, Mass.
DESIGN AND FABRICATION OF QUADRUPOLE ION MASS SPECTROMETER FOR UPPER ATMOSPHERE Scientific Report, 1 Oct. 1977 - 30 Sep. 1978
M. McDonald Dec. 1979 13 p 2 Vol.
(Contract F19628-78-C-0017; AF Proj. 1703)
(AD-A083019; AFGL-TR-80-0024; SR-1) Avail: NTIS HC A02/MF A01 CSCL 14/2

The cluster ion mass spectrometer consists of a two piece cone section with the top cone section electrically biased with respect to the lower cone. The front cone has an orifice opening of .03 - .04 in. diameter for ion sampling. The cone assembly was attached to a liquid helium cooled cryo pump supplied by another contractor. Attached to the bottom side of the liquid helium cryo pump is the base plate. 'O' rings provided the vacuum seal between the base plate and cryo pump. Rod housing was fixed to the base plate and extended upward through the pump section. A RF quadrupole assembly extended to the upper region of the front cone sampling area and downward to an ion detecting electronic multiplier. An aluminum ring was externally attached to the base plate to support the electronics section of the instrument. This section consisted of a series of leg supports to which was attached a deck plate to hold an electronics oscillator box and an assortment of other housekeeping equipment. Below this deck and mechanically to it is a complex cast aluminum housing of electronic equipment. This entire section was enclosed with a vacuum tight electronic cover can. GRA

N80-25978# Wentworth Inst., Boston, Mass.
DESIGN AND FABRICATION OF QUADRUPOLE ION MASS SPECTROMETER FOR UPPER ATMOSPHERE Scientific Report, 1 Oct. 1978 - 30 Aug. 1979
M. McDonald Dec. 1979 10 p 2 Vol.
(Contract F19628-78-C-0017; AF Proj. 6687)
(AD-A083022; AFGL-TR-80-0025; SR-2) Avail: NTIS HC A02/MF A01 CSCL 14/2

The material contained in this report describes in a quasi-historical format the design and fabrication of component parts and assemblies used in an Upper Atmosphere Composition Research Program conducted by the Composition Branch of the Aeronomy Laboratory, for AFGL. GRA

N80-25979# Colorado State Univ., Fort Collins. Solar Energy Application Lab.
VARIABILITY OF SOLAR RADIATION AT FOUR SELECTED STATIONS IN THE UNITED STATES Final Report, 1 Oct. 1977 - 30 Sep. 1978
Hsieh Wen Shen and Wen Chiang Wang Oct. 1979 99 p refs
(Contract EG-77-S-02-4521)
(COO-4521-1) Avail: NTIS HC A05/MF A01

The solar radiations considered are the total of direct and diffuse radiant energies received on a horizontal surface at ground level by a pyranometer during solar hours. Four stations, at Seattle-Tacoma, Washington; Madison, Wisconsin; Charleston, South Carolina; and Albuquerque, New Mexico were selected to represent different climatic conditions across the United States. The data were obtained from the National Climatic Center, Asheville, North Carolina. The data can be fitted by either a normal or gamma distribution and, for simplicity, a normal distribution was used. The coefficients of variation for all stations over the years were relatively low, and in general, were lower for summer months than for winter months. Of the four stations tested, Albuquerque had the lowest coefficients of variation and Seattle-Tacoma had the highest. It was estimated that no more than 16 years of records are needed for any of these stations to estimate a mean value which is within 10% of the true mean. Both the continuous daylight hours of high solar radiation (over 1100 kJ/sq m/hr) and the accumulated hourly solar radiation for these durations were studied. DOE

N80-25980# Los Alamos Scientific Lab., N. Mex.
PROCEEDINGS OF THE ATMOSPHERIC TRACERS AND TRACER APPLICATION WORKSHOP
Sumner Barr, comp. and Teymoor Gedayloo, comp. Dec. 1979 161 p refs Workshop held in Los Alamos, N. Mex., 22-24 May 1979
(Contract W-7405-eng-36)
(LA-8144-C; CONF-7905108) Avail: NTIS HC A08/MF A01

A number of low level background tracers such as heavy methanes and perfluorocarbons were discussed. Multiply labeled isotopes such as C-13(18)O2, helium 3 were covered in addition to sample collection techniques and analytical methods for various tracers. DOE

N80-25981# California Univ., Livermore. Lawrence Livermore Lab.
SEISMIC SAFETY MARGINS RESEARCH PROGRAM LOAD COMBINATION PROJECT. TASK 3: LOAD COMBINATION METHODOLOGY DEVELOPMENT
C. K. Chou, R. W. Mensing, P. D. Smith, K. Vepa, J. D. Collins (Wiggins (J. H.)Co., Redondo Beach, Calif.), C. A. Cornell (MIT, Cambridge), R. P. Kennedy (Structural Mechanics Assoc.), and M. K. Ravindra (Sargent and Lundy Engrs.) 31 Jan. 1980 89 p refs
(Contract W-7405-eng-48)
(UCID-18149; IR-1) Avail: NTIS HC A05/MF A01

A load combination methodology is presented. User oriented requirements on the methodology are discussed. Examples of similar applications of the reliability based methodology are presented and accompanied by a listing of some of the unique considerations in applying this type of methodology to nuclear design. A fairly detailed exposition of a component reliability and design code optimization scheme is given along with a brief discussion of system and plant reliability considerations. DOE

N80-25982# Northrop Services, Inc., Huntsville, Ala.
SOLAR RADIATION DATA FORECAST AND INTERPOLATION ANALYSIS. FOLDER 1, PART 1: EXECUTIVE SUMMARY. PART 2: TECHNICAL ANALYSIS (TASKS 1 AND 2). PART 3: APPENDICES (TASKS 1 AND 2) Final Report

John Woo, Jr. Apr. 1979 184 p refs
(Contract EG-77-C-02-4494)
(COO-4494-1) Avail: NTIS HC A09/MF A01

Data were evaluated from the rehabilitated 52 station SOLMET solar radiation network. Techniques were established to transform radiation measurements taken on a horizontal surface to an inclined surface. A climatological cell statistics (CCS) method was developed to obtain the statistics of up to 24 variables occurring in combination with each other using surface meteorological data and to relate these statistics to the solar radiation measurements. A method to evaluate the differences between two insolation data sets, called the Wedge method, was developed to determine the representative area of a radiation measurement site. These methods were used to evaluate the capabilities of the NOAA solar radiation model to interpolate between measurement sites. Twenty-four methods of calculating solar radiation on inclined surfaces were investigated. All algorithms were rewritten in a common convention and nomenclature and the measurements required for each method were categorized. DOE

N80-25983# Alaska Univ., Fairbanks. Inst. of Water Resources.
DETERMINATION OF SELECTED HYDRAULIC PROPERTIES OF SUBARCTIC SOILS
Douglas L. Kane Jan. 1980 30 p refs
(Contract DI-14-34-0001-9002)
(PB80-150956; COMPLETION-78-22; W80-03648; OWRT-A-064-ALAS(3)) Avail: NTIS HC A03/MF A01 CSCL 08M

The critical hydraulic properties of partially frozen soils were studied to aid in the evaluation of potential groundwater recharge and in forecasting surface runoff. Specific areas examined were: (1) the redistribution of moisture in near-surface soils during winter; (2) infiltration rates for partially frozen soils; (3) the role of soil moisture content in runoff generation; (4) the hydrologic significance of surface organic soils; and (5) the importance of permafrost terrain in surface runoff generation. GRA

N80-25984# Geological Survey, Menlo Park, Calif. Seismic Engineering Branch.
SEISMIC ENGINEERING PROGRAM Progress Report, Jan. - Apr. 1979
R. L. Porcella Apr. 1979 27 p refs
(Grant NSF CA-114)
(PB80-149909; USGS-818-A; NSF/RA-790354) Avail: NTIS HC A03/MF A01 CSCL 08K

A summary of accelerograms recovered from the Geological Survey's National Strong Motion Network during the period January 1 through April 30, 1979 is given. Also described is strong motion insturmentation in Imperial Valley, California. The seismicity of this region has been characterized by both earthquake swarms as well as mainshock-aftershock activity. Summaries of recent reports include information on earthquakes at Milford Sound, New Zealand; Santa Barbara, California; Bishop, California; St. Elias, Alaska; and Monte Negro, Yugoslavia. The availability of strong-motion information data reports, digitalized data, and additional information pertinent to strong-motion programs is presented. GRA

N80-25985# Geological Survey, Menlo Park, Calif.
THE TORSIONAL PENDULUM TEST FOR SOILS: A THEORETICAL INVESTIGATION
Albert T. F. Chen Jan. 1980 38 p refs
(PB80-154115; USGS/GD-80/003) Avail: NTIS HC A03/MF A01 CSCL 08M

A theoretical investigation of the torsional pendulum test for soils and its associated interpretation procedure is presented. By calculating the nonlinear, free-vibration response of known torsional testing systems, it was possible to examine the validity of existing interpretation procedures and to suggest improvements for them. Among the improvements suggested are the concept of effective displacement, the determination of vibration period, and the use of acceleration amplitudes for the logarithmic decrement in damping computation. It is also shown that, in theory, the torsional pendulum test can be an effective tool for testing the Masing's criterion and for determining the non-hysteretic damping component of soils. Author (GRA)

N80-26256# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BIRAMIS: DIRECT MEASUREMENT OF THE EARTH RADIATION BUDGET BY MEANS OF AN ACCELEROMETER IN SPACE
Anne-Marie Mainguy, Alain Bernard, Manola Romero, Jacques Bouttes, and Francois Barlier (CERGA, Grasse, France) *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-6 (ESA-TT-632) 1979 p 1-9 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-6, Nov. - Dec. 1979 9 p Presented at the Ann. Congr. of the French Phys. Soc., Toulouse, 25-30 Jun. 1979 Original report in FRENCH previously announced as A79-43634 (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-25986 Wisconsin Univ. - Madison.
VORTEX GENERATION IN A NESTED GRID NUMERICAL THUNDERSTORM MODEL Ph.D. Thesis
Jerome Bert Blechman 1979 139 p
Avail: Univ. Microfilms Order No. 8008805

A nested grid was embedded in a three dimensional numerical thunderstorm model. The resulting grid resolution (1.25 km x 1.25 km) was fine enough to allow detailed analysis of mesocyclone formation in numerical storm clouds. The vorticity equation was used to determine the rates of generation or advection of vorticity in the modeled mesocyclones. Experiments were run with varied base state wind profiles to help determine the role of vertical wind shear in generation of vortices within thunderstorms. Analysis of mechanisms involved in vortex growth showed that, during early and mature storm regimes, important contributions were made by three processes: tilting of horizontal vorticity into the vertical stretching of these vortices by wind convergence and vertical advection of vorticity. The combination of these three processes served to create strong cyclonic and anticyclonic vortex couples through extensive vertical columns in the modeled storms. In many respects the cyclonic vortices were favored over the anticyclonic ones. These included the generation of more positive than negative vorticity, the locations of each vortex within the storms in relation to the updrafts, and smaller tilts from vertical in the cyclonic vortices. Dissert. Abstr.

N80-25987 Hawaii Univ., Honolulu.
CHARACTERISTICS OF THE WINTER MONSOON OVER THE MALAYSIAN REGION Ph.D. Thesis
Joo Tick Lim 1979 234 p
Avail: Univ. Microfilms Order No. 8012262

Two periods, a strong and weak monsoon period, are chosen from the winter monsoon of 1974/75 for the study of some characteristics of the monsoon over the Malaysian region. In the strong monsoon period, it is found that a time lag of about three days existed between the cold surge arrival at Hong Kong and the occurrence of heavy rainfall over the east coast of Peninsular Malaysia. Interaction between the quasi-stationary near equatorial trough and monsoon surge caused the heavy rainfall over Malaysia. Mean maps of various radiative parameters for Southeast Asia for the two periods are analyzed. Of interest is the albedo map for the surge period, which indicates the maximum albedo (convective activity) areas were confined largely to the Peninsular Malaysia-South Thailand-South bay of Bengal region. Composite maps of surface wind speed, air temperature, dewpoint and sea surface temperature (SST) over the South China Sea are prepared. It is found that a strong wind band was aligned along the general wind direction during the monsoon surge. The strong wind band formed the main surface branch of the Hadley cell while the intense convective activity region, which lay downwind of the strong wind band, became the main ascending branch. In general, the distribution of SST, air temperature and dewpoint during the strong monsoon period showed large

gradients north of 15N. To the south of 15N, they were relatively uniform. Dissert. Abstr.

N80-25988 Washington Univ., Seattle.
A MODEL FOR MODIFICATION OF THE CLOUD-TOPPED MARINE BOUNDARY LAYER DURING COLD AIR OUTBREAK Ph.D. Thesis
Steven Arthur Stage 1979 290 p
Avail: Univ. Microfilms Order No. 8013598

A model is developed for the growth and evolution of a planetary boundary layer over warm water. The model includes the possible presence of a stratocumulus could layer in the upper part of the boundary layer, surface fluxes of latent and sensible heat, radiation at the cloud top and bottom, divergence, and entrainment. All air with positive buoyancy flux is assumed to produce turbulence kinetic energy (TKE) and the integrated rate of dissipation is assumed to be proportional to the total production in the layer. The entrainment rate is then obtained from the amount of energy required to mix entrained air uniformly throughout the layer and use of the TKE equation. The model is applied to a situation of cold air outbreak over Lake Ontario during the International Field Year for the Great Lakes (IFYGL). When computations are done beginning with soundings from the north shore, model soundings for the south shore give good agreement with soundings measured there. Tests are made which demonstrate the size of terms in the budget equations of the model during a typical cold air outbreak situation. Surface fluxes are the principal sources of the modification of the boundary layer. Radiative cooling of the cloud top is also important to the heat budget of the layer and in production of TKE and resulting entrainment. Dissert. Abstr.

N80-25989*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RAIN RATE RANGE PROFILING FROM A SPACEBORNE RADAR
Robert Meneghini Mar. 1980 28 p refs
(NASA-TM-80656) Avail: NTIS HC A03/MF A01 CSCL 04B

At certain frequencies and incidence angles the relative invariance of the surface scattering properites over land can be used to estimate the total attenuation and the integrated rain from a spaceborne attenuation-wavelength radar. The technique is generalized so that rain rate profiles along the radar beam can be estimated, i.e., rain rate determination at each range bin. This is done by modifying the standard algorithm for an attenuating-wavelength radar to include in it the measurement of the total attenuation. Simple error analyses of the estimates show that this type of profiling is possible if the total attenuation can be measured with a modest degree of accuracy. A.R.H.

N80-25990# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ON THE MOMENTUM TRANSPORT BY THE STATIONARY WAVES FORCED BY THE TOPOGRAPHY
Prakki Satyamurty and Vadlamudi Brahamanda Rao Apr. 1980 24 p refs Revised
(INPE-1720-RPE/125) Avail: NTIS HC A02/MF A01

A steady barotropic primitive equation model is solved by spectral methods for the stationary waves forced by topography between 60 N and 60 S. The meridional transports of momentum by these waves are compared with those calculated earlier from observations. The cross equatorial exchange of momentum by these waves is negligible compared to that by observed standing waves and thus the present study suggests the importance of the thermally forced stationary waves. The role of friction in determining the tilt, amplitude and the momentum transport is very crucial. J.M.S.

N80-25991*# Arkansas Univ., Fayetteville. Dept. of Mathematics.
STATISTICAL ANALYSIS OF MULTIVARIATE ATMOSPHERIC VARIABLES Final Report
Jack D. Tubbs 31 Mar. 1979 158 p refs
(Contract NAS8-31550)
(NASA-CR-161472) Avail: NTIS HC A08/MF A01 CSCL 04B

Topics covered include: (1) estimation in discrete multivariate distributions; (2) a procedure to predict cloud cover frequencies in the bivariate case; (3) a program to compute conditional bivariate normal parameters; (4) the transformation of nonnormal multivariate to near-normal; (5) test of fit for the extreme value distribution based upon the generalized minimum chi-square; (6) test of fit for continuous distributions based upon the generalized minimum chi-square; (7) effect of correlated observations on confidence sets based upon chi-square statistics; and (8) generation of random variates from specified distributions. A.R.H.

N80-25992*# Computer Sciences Corp., Huntsville, Ala.
VECTOR WIND PROFILE GUST MODEL Midterm Report, 10 Apr. - 10 Oct. 1979
Stanley I. Adelfang 20 Oct. 1979 145 p
(Contract NAS8-33433)
(NASA-CR-161474) Avail: NTIS HC A07/MF A01 CSCL 04B

Work towards establishing a vector wind profile gust model for the Space Transportation System flight operations and trade studies is reported. To date, all the statistical and computational techniques required were established and partially implemented. An analysis of wind profile gust at Cape Kennedy within the theoretical framework is presented. The variability of theoretical and observed gust magnitude with filter type, altitude, and season is described. Various examples are presented which illustrate agreement between theoretical and observed gust percentiles. The preliminary analysis of the gust data indicates a strong variability with altitude, season, and wavelength regime. An extension of the analyses to include conditional distributions of gust magnitude given gust length, distributions of gust modulus, and phase differences between gust components has begun. R.E.S.

N80-25993*# Computer Sciences Corp., Huntsville, Ala.
VECTOR WIND PROFILE GUST MODEL Final Report, 10 Apr. 1979 - 9 Apr. 1980
Stanley I. Adelfang and Beverly A. Evans 9 Apr. 1980 65 p refs
(Contract NAS8-33433)
(NASA-CR-161475) Avail: NTIS HC A04/MF A01 CSCL 04B

A methodology was developed for the derivation and analysis of small scale perturbations in Jimsphere wind profiles. Gusts in various wavelentgh bands have been derived from these perturbations; the probability distribution of gust components and associated gust length has been shown to be accurately represented by a gamma distribution. Theoretical and observed distributions of component gust vary significantly with season, altitude, and wavelength range. The results of this study provide the basis for a vector wind model for Cape Kennedy, Florida. R.E.S.

N80-25994*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A DIFFUSION CLIMATOLOGY FOR CAPE CANAVERAL, FLORIDA
Richard K. Siler Apr. 1980 50 p refs
(NASA-TM-58224) Avail: NTIS HC A03/MF A01 CSCL 04B

The problem of toxic effluent released by a space shuttle launch on local plant and animal life is discussed. Based on several successive years of data, nine basic weather patterns were identified, and the probabilities of pattern occurrence, of onshore/alongshore cloud transport, of precipitation accompanying the latter, and of ground-level concentrations of hydrogen chloride were determined. Diurnal variations for the patterns were also investigated. Sketches showing probable movement of launch cloud exhaust and isobaric maps are presented. R.E.S.

N80-25995# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
TECHNICAL NOTE APT/WEFAX 79-W2 [NOTA TECHNICA APT/WEFAX 79-W2]
Marlene Elias Apr. 1980 18 p In PORTUGUESE
(INPE-1727-NTE/159) Avail: NTIS HC A02/MF A01

Information is presented concerning the schedules, frequencies, and the type of data transmitted by the meteorological geostationary satellites. Transl. by F.O.S.

N80-25996# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
NUMERICAL WEATHER PREDICTION AND ITS OUTLOOK IN BRAZIL [PREVISAO NUMERICA DE TEMPO E SUA PERSPECTIVA NO BRASIL]
Marco Antonio Maringolo Lemes and Antonio Divino Moura Jan. 1980 40 p refs In PORTUGUESE; ENGLISH summary Presented at the 31st Reuniao da SBPC, Fortaleza, Brazil, Jul. 1979
(INPE-1670-RPE/108) Avail: NTIS HC A03/MF A01

A chronological description of the major events, considered milestones in the evolution of Numerical Weather Prediction (NWP) is presented. The scientific problem of NWP is briefly discussed and the basic requirements that must be fulfilled in the implantation of NWP, on an operational basis, are pointed out. Finally, a survey of the state-of-the-art of NWP in Brazil is included, together with an example of a numerical forecast obtained with a primitive equation barotropic model. J.M.S.

N80-25997# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
A HYDROMETEOROLOGICAL MODEL FOR MEDIUM SIZED HYDROGRAPHIC BASINS M.S. Thesis [UM MODELO HIDROMETEOROLOGICO PARA BACIAS HIDROGRAFICAS DE MEDIO PORTE]
Jose Carvalho deMoraes Apr. 1980 145 p refs In PORTUGUESE; ENGLISH summary Revised
(INPE-1729-TDL/025) Avail: NTIS HC A07/MF A01

The model proposed is a technique of hydrometeorological simulation, which consists of assigning mathematical functions for phenomena in hydrological cycle and simulating their interactions. The area under study is divided into finite elements called 'cells'. The water balance is included in every individual cell throughout the simulation. The superficial and channel processes are followed at any point in the basin in such a way that at any time of the simulation an instantaneous microscale picture (view) of the behavior of the basin is obtained. The hydrogram of the cell at the mouth of the river gives the overall behavior. The results obtained with a few hypothetical simulations are compatible with those expected. The tests demonstrate the possibility of simulation of diverse types of precipitation because the input is quite flexible. However, only an application to a true (real) basin could validate the model proposed. The algorithm is implemented in Algol on the B-6700 machine in a very general program which permits modification of the functions used. J.M.S.

N80-25998# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
A CLIMATOLOGICAL STUDY OF THE WIND AND TEMPERATURE FIELDS FOR THE UPPER LEVELS OVER SOUTH AMERICA M.S. Thesis - 1979 [UM ESTUDO CLIMATOLOGICO DOS CAMPOS DE VENTO E DE TEMPERATURA NOS NIVEIS SUPERIORES SOBRE A AMERICA DO SUL]
Zenaide Rosa Sobral Jan. 1980 149 p refs In PORTUGUESE; ENGLISH summary
(INPE-1672-TDL/017) Avail: NTIS HC A07/MF A01

The monthly mean resultant winds and mean temperature maps for South America, for four months of the year, representing the four seasons, (January, April, July and October) were analyzed for the levels 850 mb up to 200 mb - period 1969-1973. Analyses of the wind fields emphasized the positions of the subtropical ridges. The movements of the ridge lines between one year and another are discussed. Apart from these, the annual march of temperatures at various latitudes and the profile of temperatures along meridian 60 deg W are discussed. J.M.S.

N80-25999# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
INTRODUCTION TO INTERPRETING SATELLITE IMAGERY [INTRODUCAO A INTERPRETAGAO DE IMAGENS DE SATELITES]
Michael A. Fortune and Nelson Jesus Ferreira Feb. 1980 75 p refs In PORTUGUESE; ENGLISH summary
(INPE-1681-RPE/113) Avail: NTIS HC A04/MF A01

The basic meteorological concepts necessary for understanding the techniques of cloud system analysis using satellite imagery are outlined. The various types of satellite data and imagery and their diverse applications are included. Atmospheric radiation pertinent to satellite observations, systems of cloud analysis based on coud appearances and patterns, and the major components of atmospheric circulation are among the topics considered. Photointerpretation of various weather systems, mesoscale and synoptic scale, in both the tropics and the midlatitude is discussed. J.M.S.

N80-26000# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
THE 19308B MLRS, MISSILE NO. 1125, ROUND NO. V-98, 11 DECEMBER 1979
Dec. 1979 17 p
(DA Proj. 1F6-65702-D-127)
(AD-A082969; ERADCOM/ASL-DR-1104) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19308B MLRS, missile number 1125, round number V-98 are presented in tabular form. GRA

N80-26001# Atlas Corp., Santa Cruz, Calif.
EVALUATION OF THE TYPICAL METEOROLOGICAL YEARS FOR SOLAR HEATING AND COOLING SYSTEM STUDIES Final Report
Thomas L. Freeman Dec. 1979 77 p refs Prepared for Midwest Research Inst.
(Contract EG-77-C-01-4042)
(SERI/TR-8150-1) Avail: NTIS HC A05/MF A01

A summary is presented of an evaluation of the weather data set, generated at Sandia Laboratories, known as the Typical Meteorological Year (TMY) data. The purpose of the evaluation is to determine how well the TMY data represent actual long term weather data in affecting the performance of solar heating and cooling systems. The two data sets are compared through detailed SHAC simulation. DOE

N80-26002# Brookhaven National Lab., Upton, N. Y.
TRANSPORT AND DIFFUSION CLIMATOLOGY OF THE US ATLANTIC AND GULF COASTS
Gilbert S. Raynor and Janet V. Hayes 1980 4 p refs Presented at 2nd Conf. on Coastal Meteorology (AMS), Los Angeles, 31 Jan. - 1 Feb. 1980
(Contract EY-76-C-02-0016)
(BNL-26891; CONF-800107-4) Avail: NTIS HC A02/MF A01

Coastal meteorology and diffusion were studied to assist in site selection of energy facilities by describing the transport and diffusion climatology. The region studied is within the coastal plain and is generally characterized by flat beaches and very gentle slopes inland. Meteorological variables emphasized are those which govern or influence transport and diffusion of airborne gases and particles. Wind direction and speed and some measure of diffusive capacity such as turbulence, gustiness, or lapse rate are among the factors studied. Differences between day and night in wind direction distribution are shown along with the frequency of the five diffusion rating classes at the same coastal stations during onshore winds. The results obtained are arranged for easy use with diffusion models in which the primary meteorological inputs are wind speed and measure of lateral and vertical diffusion. DOE

N80-26003# California Univ., Livermore. Lawrence Livermore Lab.
CLIMATE PROGRAM PLAN, VOLUME 1
Jan. 1980 90 p refs 2 Vol.
(Contract W-7405-eng-48)
(DOE/EV-0062/1) Avail: NTIS HC A05/MF A01

The perceived and potential effects of energy technologies on climate that merit assessment are discussed along with the need for research on the prediction of weather and climate variations and assessment of their effects on power production. The need for assessing the cycles and budgets of the entire range of substances emitted in power production by the many technologies now in use is emphasized. To provide the basis for assessing the impacts of these emissions, specialized, mission-oriented research to improve understanding of processes that determine how these emissions are transported, transformed, and scavenged in the atmosphere, and of the natural processes that can be affected by energy activities are suggested. This latter category includes potential modification of surface properties caused, for example, by large arrays of solar collectors, extensive

biomass production and wind power modification of the boundary layer. DOE

N80-26004# Argonne National Lab., Ill.
PROCEEDINGS OF THE WORKSHOP ON METEOROLOGICAL EFFECTS OF SATELLITE POWER SYSTEM RECTENNA OPERATION AND RELATED MICROWAVE TRANSMISSION PROBLEMS
Dec. 1979 58 p refs Workshop held at Rosemont, Ill., 23 Aug. 1978 Sponsored by DOE
(CONF-7808114) Avail: NTIS HC A04/MF A01

From Workshop on Meteorological Effects of Satellite Power Systems Rectenna Operation and Related Microwave Transmission Problems: Rosemont, IL, USA (23 Aug. 1978). Discussion at the workshop concentrated on the effects of the Satellite Power System (SPS) on the atmosphere and the effects of the atmosphere on the SPS microwave beam propagation. The three main concerns were the effects on the atmosphere of the estimated 750 MW excess heat released at the SPS rectanna site, the microwave interactions with the atmosphere, possibly causing loss of beam control and scattering of beam energy, and the possible effects of the beam on atmospheric electrification processes. Construction of a rectenna will modify the thermal and radiative properties of the ground, and operations will introduce a heat source at the surface. It was generally agreed that the direct effects of any single causes due to an SPS in the lower atmosphere will be small but detectable in some instances, and that their combined effects need better definition. Variations in the refractive index of the atmosphere and the presence of hydrometeors in the atmosphere cause refraction, scattering, and adsorption of electromagnetic waves. Refractive-index anomalies in the atmosphere may impact on power beam control. The effect of the rectenna waste heat may be studied on two scales: the mesoscale (regional and city sizes, 10 to 100 km) and the cloud scale (10 km and less). At 2.45 GHz the refractive index of air at fixed pressure depends mostly on water vapor and temperature. In the presence of convective or turbulent air motions a spectrum of atmospheric refractivity develops. These variations can lead to beam wandering and spreading. Direct interactions with the atmospheric electricity fields are not thought to be crucial at the 2.45 GHz frequency. However, the mere physical presence of the rectenna might have some modifying influence on the occurrence and electrical behavior of thunderstorms over and around the rectenna. DOE

N80-26005# Arizona Univ., Tucson. Tree-Ring Research Lab.
ESTIMATING LONG-TERM STATISTICS FOR ANNUAL PRECIPITATION FOR SIX REGIONS OF THE UNITED STATES FROM TREE-RING DATA
Harold C. Fritts, Emily DeWitt, Geoffrey A. Gordon, John H. Hunt, and G. Robert Lofgren Dec. 1979 99 p refs
(Contract W-7405-eng-48)
(UCRL-15162) Avail: NTIS HC A05/MF A01

Spatial anomalies of seasonal precipitation for the United States and southwestern Canada were reconstructed from 1602 through 1961 using dendrochronological and multivariate techniques on 65 arid-site tree-ring chronologies from western North America. Seasonal reconstructions were averaged to obtain mean annual precipitation values for six regions of importance to the Nuclear Regulatory Commission (NRC) Nuclear Waste Management Program (NWMP). Statistics calculated from the regionally averaged annual values for 25 year and longer intervals show annual precipitation in the seventeenth through nineteenth centuries to be lower than in the twentieth century for three regions in the American Southwest and higher for one region in the Northwest and two regions in the East. The variability of precipitation generally was higher in the past three centuries than in the present century. Twenty-five-year intervals with noteworthy statistics are identified and important results are summarized. DOE

N80-26006# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
THE PRECIPITATION ENHANCEMENT PROJECT (PEP)
Dieter Paffrath Sep. 1979 88 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-642)
(DFVLR-Mitt-79-12; ESA-TT-642) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 15.30

The following workshop discussion topics are described: physics of clouds and predipitation, theories of weather modification, aircraft measuring systems, application of weather radar, microphysical measurements, condensation and ice nuclei, cloud seeding technology, hail suppression, and fog dispersal. Author (ESA)

N80-26007# National Center for Atmospheric Research, Boulder, Colo. Convective Storms Div.
CASE STUDIES OF CONVECTIVE STORMS. CASE STUDY 4: FIRST ECHOE CASE, 27 JULY 1976
Daniel W. Breed Nov. 1979 71 p refs
(Grant NSF ATM-77-23757)
(PB80-143233; NCAR/TN-147) Avail: NTIS HC A04/MF A01 CSCL 04B

On 27 July 1976, a relatively small, weak storm was investigated by the NCAR/NOAA instrumented sailplane in coordination with NCAR Queen Air 306D. The potential instability was weak on this day, and the investigated storm probably was initiated, from the observed surface convergence which resulted from outflow of an older storm to the northwest and/or surface topography. The sailplane made an extended penetration from 1635 to 1715 covering about 3400 m in altitude with weak updrafts initially, growing to moderately strong updrafts and then finally weak downdrafts. Ice particle concentration and size both increased throughout the penetration about 100/1 and 2-4 mm graupel. The Queen Air measured fairly weak updrafts at cloud base and mixed thermodynamic conditions. Later subcloud passes (about 1700) revealed theta(e) values. The storm had the characteristic life cycle of a simple rainshower. GRA

N80-26008# National Center for Atmospheric Research, Boulder, Colo. Convective Storms Div.
CASE STUDIES ON CONVECTIVE STORMS. CASE STUDY 5: FIRST ECHO CASE, 12 JULY 1978
Steven M. Hunter and Charles A. Knight Jan. 1980 52 p refs
(Grant NSF ATM-77-23757)
(PB80-143241; NCAR/TN-150) Avail: NTIS HC A04/MF A01 CSCL 04B

A small, isolated, short lived cumulus congestus was studied using primarily a 10 cm radar, a cloud penetration with an instrumented sailplane, and time lapse photography from an aircraft some 40 km distant. The radar data reveal a conventional reflectivity history for the northeast Colorado region. The sailplane penetration shows updraft until the reflectivity maximum was reached, then downdraft, and that the precipitation formation was through the ice process primarily. The photography indicates that the cloud top attained -20 C nearly fifteen minutes before the first 5 dBZ echo, which occurred nearly simultaneously throughout a vertical zone from -10 to -30 C. GRA

N80-26009# Texas Dept. of Water Resources, Austin. Weather Modification and Technology Section.
TEXAS HIPLEX INTERIM PROGRESS REPORT Interim Progress Report, 1 Apr. - 30 Sep. 1979
10 Oct. 1979 141 p refs Sponsored in part by Bureau of Reclamation
(Contract DI-14-06-D-7587)
(PB80-133101; TDWR/LP-110) Avail: NTIS HC A07/MF A01 CSCL 04B

Progres in mesoscale data evaluation, development of ssynoptic climatology, analysis of satellite radiance data, radar data analyses and interpretation, and operational cloud-sampling and seeding activities is reported. Analysis of the 1978 mesoscale data indicates findings similar to those of 1976-77 data. Moisture appears to be the primary parameter for establishing a suitable cloud-seeding environment for the Texas HIPLEX area. 1978 satellite imagery and radiance data are currently being analyzed and will be combined with 1976-77 data for a comprehensive analysis. Digitized M-33 (Snyder) radar tapes from 1976-78 are being reduced and analyzed. GRA

N80-26010# Texas Dept. of Water Resources, Austin.
TEXAS HIPLEX, 1979: FIELD OPERATIONS SUMMARY
William O. Alexander and Robert F. Riggio Nov. 1979 351 p

Sponsored in part by Bureau of Reclamation
(Contract DI-14-06-D-7587)
(PB80-134471; TDWR/LP-112) Avail: NTIS
HC A16/MF A01 CSCL 04B

Daily events pertaining to the 1979 HIPLEX Field Program are summarized. Weather conditions, aircraft observations, and equipment status are described. A tabular summary of the operations is included, as well as rawinsonde and precipitation data tables. GRA

N80-26011# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
MARINERS WEATHER LOG, VOLUME 23, NO. 6
Elwyn E. Wilson Nov. 1979 79 p refs
(PB80-145113; NOAA-79122607; ISSN-0025-3367) Avail: NTIS CSCL 04B

In addition to its regular sections, this issue contains the following articles: a frequent vistor to Lake Erie; buoy adrift from Station 41001; and Great Lakes ice season, 1978-1979. GRA

N80-26012# Washington State Univ., Pullman.
SYNOPTIC METEOROLOGY AND AIR QUALITY PATTERNS IN THE ST. LOUIS RAPS PROGRAM Final Report, May 1977 - Oct. 1979
Elmer Robinson and Richard J. Boyle Jan. 1980 98 p refs
(Grant EPA-805142)
(PB80-148299; EPA-600/4-80-001) Avail: NTIS
HC A05/MF A01 CSCL 04B

An objective statistical synoptic weather map classification scheme developed to stratify map patterns for further study was used to type regional weather patterns. The investigation extended over a 500 mile radius of the greater St. Louis area was intended for subsequent application to air pollution studies. This analysis correlated sea level pressure data at 21 selected National Weather Service stations at a specified time on a given day, with sea level pressures for these same stations on each of the other days in the four year period 1973 through 1976. To illustrate the potential usefulness of this method to air quality and synoptic weather relationships, a preliminary comparison of the weather typing system to suspended particles and carbon monoxide concentrations was also made. GRA

N80-26013# Texas A&M Univ., College Station. Dept. of Meteorology.
MODELS OF ATMOSPHERIC WATER VAPOR BUDGET FOR THE TEXAS HIPLEX AREA
Steven F. Williams and James R. Scoggins Dec. 1979 66 p refs Prepared for Texas Dept. of Water Resources
(Contract DI-14-06-D-7587)
(PB80-147986; TDWR/LP-117) Avail: NTIS
HC A04/MF A01 CSCL 04B

Water budget models developed for the Texas HIPLEX area for convective and non-convective conditions, as a function of echo height, areal coverage, and type (isolated cells, clusters of cells, and lines of cells) of convective activity are described. Intra and inter-comparisons of the water budget models indicate that greater amounts of water vapor are processed by increased depth and areal coverage of convective activity. An increased transport of water vapor near the surface is shown to be an important factor for increased convective activity. A 'storage' of water vapor aloft was observed to correlate with cases of increased precipitation. The net horizontal transport of water vapor exceeds other terms in the equation as being the primary moisture source for all cases of convection. GRA

N80-26014# National Oceanic and Atmospheric Administration, Seattle, Wash.
A REGIONAL SURFACE WIND MODEL FOR MOUNTAINOUS COASTAL AREAS
James E. Overland, Matthew H. Hitchman, and Young June Han Jun. 1979 41 p refs
(PB80-146152; NOAA-TR-ERL-407; PMEL-32;
NOAA-79122602) Avail: NTIS HC A03/MF A01 CSCL 04B

A mesoscale numerical model of the planetary boundary layer (PBL) was modified for application to mountainous regions along the northwestern coast of the contiguous United States and the southern coast of Alaska. The model treats the PBL as a one layer primitive equation system solving for boundary layer height, potential temperature, and the two components of horizontal velocity. Input parameters are the large scale geostrophic wind pattern and the stability of the air mass. Experiments with a cross-section version of the model were performed to assess its response to variable terrain, differential roughness at the coast for a domain containing both a flat coastal plain and low coastal mountains. The complete model was applied to three quite dissimilar meteorological situations for the Puget Sound/Strait of Jaun de Fuca system in northwestern Washington state. GRA

N80-26015# National Environmental Satellite Service, Washington, D. C.
ENVIRONMENTAL SATELLITE IMAGERY
May 1979 100 p refs
(PB80-153356; NOAA-80021221) Avail: NTIS
HC A05/MF A01 CSCL 04B

Current cloud data obtained by NOAA's operational environmental satellites is described. Daily global satellite imagery in condensed form is presented as a guide to data stored in the NOAA archive, and is designed to assist users in selecting data for research and climatological use. GRA

N80-26016# National Center for Atmospheric Research, Boulder, Colo.
INTERNAL STORM MOTIONS FROM A SINGLE NON-DOPPLER WEATHER RADAR
Ronald E. Rinehart Oct. 1979 278 p refs
(Grant NSF ATM-77-23757)
(PB80-143068; NCAR/TN-146) Avail: NTIS
HC A13/MF A01 CSCL 04B

A correlation analysis pattern recognition technique called TREC (tracking radar echoes by correlation) is developed which is capable of determining motions within storms. The limitations and capabilities of TREC were explored using two approaches. First, the properties of real radar echoes (reflectivities, reflectivity gradients, and temporal and spatial decorrelations) were studied for their effect on the results of TREC. Second, flow fields and reflectivity fields were modeled. The success of TREC depends upon the interrelationships between the flow and reflectivity field characteristics as well as the parameters of TREC processing. A comparison of TREC results with data from a triple Doppler radar system showed that TREC vectors are apparently often generated either above or below the level being examined. GRA

N80-26017# National Center for Atmospheric Research, Boulder, Colo.
LIQUID WATER MEASUREMENTS IN HIGH ELEVATION CONTINENTAL CUMULI M.S. Thesis
Daniel W. Breed 14 Dec. 1979 116 p refs Prepared in cooperation with Colorado State Univ., Fort Collins
(Grant NSF ATM-77-23757)
(PB80-143928; NCAR/CT-57) Avail: NTIS HC A06/MF A01 CSCL 04B

Measurements of cloud droplet spectra, liquid water content, vertical velocity, and state parameters, were obtained by the NCAR/NOAA sailplane and two powered aircraft. A relatively high droplet concentration of about 600/cu m, a narrow droplet distribution with a mean volume diameter of 7.6 micrometers, and liquid water contents of 0.5-1.0 g/cu m are characteristic of these high elevation cumuli. These continental characteristics and the lack of large droplets suggest that droplet coalescence is not a significant precipitation formation process, while observations of graupel particles and other ice forms show that accretional growth of ice particles is common. The measurements from the different aircraft and instruments are compared. GRA

N80-26018# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Quality Div.
ISENTROPIC TRAJECTORIES FOR DERIVATION OF OBJECTIVELY ANALYZED METEOROLOGICAL PARAMETERS
Philip Haagenson and Melvin A. Shapiro Dec. 1979 40 p refs
(Grant NSF ATM-77-23757)
(PB80-143118; NCAR/TN-149) Avail: NTIS

HC A03/MF A01 CSCL 04B

A numerical technique for calculating isentropic trajectories, and the objective analysis of trajectory derived meteorological parameters are presented. A brief historical summary of the isentropic trajectory concept and objective analysis method is presented. The requirement for large numbers of trajectories on a global scale necessitated development of an objective computer program. A brief case study illustrating the objective analysis of trajectory derived meteorological parameters is included. GRA

N80-26019# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

SATELLITE CLOUD CLIMATOLOGICAL RESULTS, 1978: COMPARISON TO 1976-77

David W. Reynolds and Richard W. Stodt Dec. 1979 42 p refs

(Contract DI-9-07-85-V00025)

(PB80-148117) Avail: NTIS HC A03/MF A01 CSCL 04B

Cloud statistics obtained from digital visible and infrared satellite data collected in support on HIPLEX for 1978 are summarized. Results of these cloud statistics are compared with previous results obtained for 1976 and 1977. Results from these comparisons show that: (1) cloud size distributions change little from year to year and from the Miles City region to the Goodland region; (2) the number of clouds within each target area shows a general trend upward for the past three years; (3) the timing and location of cloud development changes drastically from year to year for both locations; (4) separation of clouds of varying size appears to represent a rather well defined distribution for both Miles City and Goodland; and (5) stratification of a day's convective activity can be performed using satellite IR data. J.M.S.

N80-26020# National Technical Information Service, Springfield, Va.

HURRICANES FORECASTING, MODIFICATION, AND RESEARCH. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1980

Edward J. Lehmann and Robena J. Brown Feb. 1980 283 p Supersedes NTIS/PS-79/0018; NTIS/PS-78/0028; NTIS/PS-77/0026

(PB80-804255; NTIS/PS-79/0018; NTIS/PS-78/0028; NTIS/PS-77/0026) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

Presented are citations to research reports covering hurricane modeling, cloud seeding, remote sensing, air water interactions, heat transfer, and wind motion. This updated bibliography contains 278 abstracts, 11 of which are new entries to the previous edition. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-26021 Hawaii Univ., Honolulu.

GEOLOGICAL AND GEOTECHNICAL INVESTIGATION OF SEDIMENT REDISTRIBUTION ON THE CENTRAL EQUATORIAL PACIFIC SEAFLOOR Ph.D. Thesis

James Dennis Craig 1979 267 p

Avail: Univ. Microfilms Order No. 8012252

Examination of data shows that erosion rates during intensified circulation episodes in Eocene/Oligocene and middle Miocene time range from 10 to 30 meters/million years (m/my). The data suggest that erosion and redistribution are primarily influenced by local factors such as bathymetric relief, tectonic history or the frequency and lateral extent of erosive bottom currents. In two localities studied, the majority of sediment redistribution occurred prior to late Miocene time and involved approximately 25 to 50 m of material. This could be accomplished either by a relatively continuous process at rates of m/my or by active erosion during the middle Miocene episode. The majority of sediment cores collected in all bathymetric settings have a low strength surface layer to depths of about 10 cm produced by bioturbation. Because these sediments have high shear strengths, biotrubation may regulate erosion over geologic time. It is postulated that erosion of the seafloor occurs at current speeds greater than about 20 cm/s, and that this process rapidly scours the upper 1 to 2 cm across wide areas. Dense concentrations of suspended material tend to dampen near bottom turbulence causing erosion and vertical mixing, and these turbid layers transport material down slopes into local basins. Dissert. Abstr.

N80-26022 Wisconsin Univ. - Madison.

THE CLIMATIC IMPACT OF SEA SURFACE TEMPERATURE ANOMALIES ON ZONALLY SYMMETRIC AND ASYMMETRIC FLOWS: A QUASI-GEOSTROPHIC MODELING APPROACH Ph.D. Thesis

Thomas Joseph Phillips 1979 190 p

Avail: Univ. Microfilms Order No. 8007568

Some aspects of ocean atmosphere interaction were clarified by making use of a nonlinear model with simplified physics. Climatic mean and transient responses of zonally symmetric and zonally asymmetric atmospheric flows to smaller scale sea surface temperature anomalies were investigated. In cases of zonally asymmetric flows the climatic impact of longitudinal shifts in the position of these anomalies was studied. Climate effects of variations of vertical wind shear and static stability were also examined. The nonlinear simulations were compared with steady state linearized solutions as well as with results of selected general circulation model experiments. Dissert. Abstr.

N80-26023*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.

GEOS-3 RADAR ALTIMETER STUDY FOR THE SOUTH ATLANTIC BIGHT

C. D. Leitao, N.E. Huang, C. L. Parsons, C. G. Parra (EG and G Washington Analytical Services Center), J. D. McMill (EG and G Washington Analytical Services Center), and G. S. Hayes (Applied Sci. Associates, Inc.) May 1980 144 p refs

(Contract DI-AA551-IA8-39)

(NASA-TM-73286) Avail: NTIS HC A07/MF A01 CSCL 08C

Three years of radar altimeter data from GEOS-3 for the South Atlantic Bight were processed. Mean monthly topographic maps were produced which estimate geostrophic flow in the region. Statistical distribution of the surface wind speed and significant wave height as a function of both space and time are presented. R.E.S.

N80-26024# Miami Univ., Coral Gables, Fla.

COASTAL UPSWELLING ECOSYSTEMS ANALYSIS. PHYSICAL DYNAMICS OF THE COASTAL UPWELLING FRONTAL ZONE OFF OREGON Ph.D. Thesis

Thomas Brian Curtin Sep. 1979 336 p refs Prepared for NSF

(PB80-139843; NSF/IDOE/CUEA/TR-59; NSF/IDOE-79-127) Avail: NTIS HC A15/MF A01 CSCL 08C

The transient (wind-driven), coastal upwelling frontal zone off Oregon is described in terms of the main kinematic and hydrographic scales, geostrophy, potential vorticity, cross-shelf circulation and mixing. Along-shelf flow is in geostrophic balance in the interior one third of the water column over the shelf, with a tendency for the geostrophic shear to exceed the observed shear inshore of the frontal zone above 40 m. During spin-down, the surface density front moves shoreward and intensifies; the interior density front remains stationary at mid-shelf and weakens. Transport is shore-ward in the upper 2/3 of the water column, and seaward in the layer near the bottom. The structures of the water mass front, chlorophyll distributions, and horizontal velocity fields suggest a recirculation cell occurs in-shore of the interior density front. The frontal zone is most two dimensional during intervals of sustained upwelling or downwelling favorable winds exceeding a minimum magnitude. During times of slack winds or wind reversals, the frontal zone is inherently three dimensional. GRA

N80-26025# Woods Hole Oceanographic Institution, Mass.

NEW ENGLAND SHELF/SLOPE EXPERIMENT. DATA REPORT: THE MOORED ARRAY Technical Progress Report, Feb. - Aug. 1976

Hsien Wang Ou, John A. Vermersch, Wendell S. Brown (New Hampshire Univ.), and Robert C. Beardsley Jan. 1980 59 p refs

(Grants NSF OCE-76-01813; NSF OCE-78-19513)
(PB80-151640; WHOI-80-3) Avail: NTIS HC A04/MF A01 CSCL 08C

The kinematic and dynamic coupling of the low frequency oceanic motions between the outer New England shelf and the deeper slope/rise regions was studied. The current, temperature, and bottom pressure fluctuations across the New England continental margin were monitored simultaneously. Results are presented. GRA

N80-26026# Woods Hole Oceanographic Institution, Mass.
THE APPLICATION OF INVERSE METHODS TO PROBLEMS IN OCEAN CIRCULATION Ph.D. Thesis
Dean Howard Roemmich Jan. 1980 197 p refs
(Grants NSF OCE-76-80210; NSF OCE-79-19833)
(PB80-149651; WHOI-80-6) Copyright. Avail: NTIS HC A09/MF A01 CSCL 08C

The inverse method of estimating ocean circulation form hydrographic data is examined with particular attention to the problem of scale resolution. The method applies conservation constraints in a number of distinct layers separated by surfaces of constant potential density. These constraints are used to find a geostrophic flow field which is the product of a known linear resolution operator on the hydrographic station grid scale field of absolute velocity. Two simple hypothetical examples are analyzed in detail in order to illustrate why some features can be anticipated and identified in real problems. Three applications of the method are presented, using historical hydrographic data from the Atlantic Ocean. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-26027 Oregon State Univ., Corvallis.
VARIATIONS IN PHYTOPLANKTON PHYSIOLOGICAL PARAMETERS DURING TRANSIENT NITROGEN ENVIRONMENTS Ph.D. Thesis
John Michael Demanche 1980 121 p
Avail: Univ. Microfilms Order No. 8013666

The relationship among nitrogen uptake, assimilation and phytoplankton growth during changing or transient nitrogen environments was investigated. A new culture system, diffusion culture, was developed to provide realistic low nitrogen environments. Physiological parameters for two species of diatom, Skeletonema costatum and Thalassiosira aestivalis were determined for a variety of nitrogen regimes, progressing from non-nitrogen limited, two nitrogen adapted, and to nitrogen starved cultures. Additions of nitrate, or nitrate and ammonium, were made to each regime; uptake rate, assimilation rate, and changes in cell physiological parameters were measured. Internal pools of nitrate, ammonium, and total free amino acids were measured and related to both conditioning regime and nitrogen perturbation. Two mechanisms for nitrate reduction were found, one that is coupled to nitrate uptake and another independent of uptake. The rate of nitrate reduction was not solely a function of internal concentration. Ammonium inhibited nitrate uptake, but the inhibition could not be explained by changes in intracellular ammonium or free amino acids. A conceptual model of nitrate uptake for transient environments was developed. Dissert. Abstr.

N80-26028 Washington Univ., Seattle.
PHYTOPLANKTON PRIMARY PRODUCTION BELOW ARCTIC OCEAN PACK ICE: AN ECOSYSTEMS ANALYSIS Ph.D. Thesis
Clarence Greer Pautzke 1979 191 p
Avail: Univ. Microfilms Order No. 8013580

Chlorophyll, primary production, zooplankton, water temperature, salinity, nutrients, solar radiation, surface melt, air temperature, wind speed, and island movement were observed in the Canada Basin at T-3 from 1969 to 1973 and in the Beaufort Sea at AIDJEX in 1975. Primary production in the Arctic Ocean was then quantitatively related to the physical, chemical and biological components of the ecosystem. Submarine light and primary production were modelled using observed incident radiation, surface conditions, a theoretical photosynthesis-light relation and chlorophyll a distribution. Production was highest in July and August. Annual production was 2 to 6 g C/sq m. Calanus hyperboreus and glacialis, Microcalanus pygmaeus, and Oithona similis dominated the zooplankton. Each developed one brood in summer at AIDJEX. Zooplankton dry weight above 100 m was highest in summer and lowest in spring. Herbivores required 25 to 30% of the primary production in July and August for respiration, brood development, and food storage for overwintering. Dissert. Abstr.

N80-26029# Royal Aircraft Establishment, Farnborough (England).
CHANCES OF DETECTING AND DIFFERENTIATING CENTRAL SYSTEM EFFECTS OF DRUGS IN ANIMAL EXPERIMENTS WITH SPECIAL CONSIDERATION OF BEHAVIOURAL PHARMACOLOGICAL METHODS
F. Hoffmeister and W. Wuttke Nov. 1979 44 p refs Transl. into ENGLISH from Arzneim. Forsch. (West Germany), v. 25, no. 7A, 1975 p 1162-1178
(RAE-Lib-Trans-2034; BR73312) Avail: NTIS HC A03/MF A01

Animal experimental methods suitable for the assessment of actions of drugs of the central nervous system are described with special reference to behavioral actions. The value of those methods for the prediction of central nervous actions of drugs in man are discussed. R.C.T.

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N80-26030 Tennessee Univ., Knoxville.
THE RELATIONSHIP OF EXERCISE PERFORMANCE TO VARIATIONS IN BLOOD ACID-BASE STATUS INDUCED BY CHANGES IN THE INSPIRED OXYGEN FRACTION Ph.D. Thesis
Richard Paul Adams 1979 135 p
Avail: Univ. Microfilms Order No. 8012441

Possible limiting factors in human exercise performance were investigated. Six subjects rode a bicycle ergometer on three different occasions breathing either a 17 percent, 21 percent, or 60 percent oxygen mixture. In addition to rest and recovery periods, each subject worked for 10 minutes at 55 percent of maximal oxygen uptake and then to exhaustion at about 91 percent of maximal oxygen uptake. The values measured included performance time, inspired and expired gas fractions, minute ventilation heart rate, and 'arterialized' venous PO2, PCO2, and pH. Oxygen uptake, carbon dioxide output, respiratory exchange ratio, [H (+)], and [HCO3 (-)] were calculated. The results indicated that performance times were longer in hyperoxia than in normoxia or hypoxia. However, contrary to other published literature, oxygen uptake was not different at exhaustion in normoxia as compared to hypoxia (p greater than .1) or hyperoxia (p = .09). Also, during exercise the higher inspired oxygen fractions were generally associated with decreased HLa and increased [H (+)], PCO2, and [HCO3 (-)]. However, at exhaustion [H (+)] was not different under any inspired oxygen fraction (p = .8). Dissert. Abstr.

N80-26031 Louisiana State Univ. and A&M Coll., Baton Rouge.
MEASUREMENT OF THE MECHANICAL IMPEDANCE OF HUMAN SOFT TISSUE IN VIVO Ph.D. Thesis
Hany Mohamed Gamal-Eldin Hussein 1979 111 p
Avail: Univ. Microfilms Order No. 8013122

A test system was developed for the measurement of point impedance of human soft tissue in vivo at various frequencies and static preloads. Impedance data were analyzed utilizing a viscoelastic solid model. Phase angle measurements were utilized to separate the resistive and reactive components of the complex impedance. The tissue was excited by a swept sinusoidal forcing function at a constant RMS velocity. The relative contribution of the energy storage and dissipation functions to the tissue impedance is shown to be frequency dependent. Within the range of preloads employed in this study, it is shown that the dynamic stiffness of the tissue continues to rise with increasing

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preloads while the viscous damping coefficient increases with increasing preloads only up to an intermediate preload beyond which the damping coefficient is almost independent of preload. Dissert. Abstr.

N80-26032* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY. A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 207
Jun. 1980 65 p
(NASA-SP-7011(207)) Avail: NTIS HC $7.00 CSCL 06E
This bibliography lists 184 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1980. Author

N80-26033# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
USING REPRESENTATIVE KNOWLEDGE TO GUIDE DECISION MAKING IN AUTOMATIC DIAGNOSTIC SYSTEMS [EXTENSOES DA REPRESENTACAO DE CONHECIMENTO ATRAVES DE REGRAS DE DECISAO EM SISTEMAS DE DIAGNOSTICO AUTOMATICO]
Alfonso deLigorio Faria and Paulo Ouvera Simoni Mar. 1980 19 p refs In PORTUGUESE; ENGLISH summary Presented at the 6th Congr. Brasileiro de Engenhana Biomedica, 24-27 Oct. 1979 Revised
(INPE-1686-RPE/117-Rev) Avail: NTIS HC A02/MF A01
Many automatic medical diagnostic systems use artificial intelligence techniques for the representation and application of knowledge in order to get an approximation for the medical reasoning in the diagnostic process. It was observed that one limitation of these systems is the lack of flexibility in the representation of knowledge. A new representation for knowledge is proposed in the form of decision rules by conditional fuzzy propositions. Through this method the truth values of an attribute can be represented as well as possibility distributions over the universes. A uniform rule evaluation and evidence combinations are also attained. A set of rules for the diagnostic of the urinary tract infection of children was written, for which the proposed technique was applied. Author

N80-26034# SRI International Corp., Menlo Park, Calif.
MAMMALIAN TOXICOLOGICAL EVALUATION OF TNT WASTEWATERS. VOLUME 2: ACUTE AND SUBACUTE MAMMALIAN TOXICITY OF TNT AND LAP MIXTURE Final Report, Apr. 1976 - Sep. 1978
James V. Dilley, Charles A. Tyson, and Gordon W. Newell Jun. 1979 519 p refs
(Contract DAMD17-76-C-6050; DA Proj 3E1-62720-A-835)
(AD-A080957, LSU-5028) Avail: NTIS HC A22/MF A01 CSCL 06/20
The acute toxicity of TNT, RDX, LAP (1.6 TNT/1.0 RDX), and/or LAP(I) (photolyzed LAP: 0.032 TNT/1.0 RDX, 10% undegraded RDX) was determined in mammalian species. In male and female rats, respectively, the acute oral LD50s were: TNT, 1320 and 794 mg/kg; RDX, 71 and about 70 mg/kg; and LAP, 574 and 594 mg/kg or lower, depending on particle size. In male and female mice, respectively, the LD50s were: TNT, 660 mg/kg (both sexes); RDX, 75 and 86 mg/kg; and LAP947 and 1131 mg/kg. LAP(I) was examined in mice only; the acute oral LD50s in males and females were: 585 and 684 mg/kg, respectively. LAP and LAP(I) produced conjunctivitis, iritis, and/or corneal opacity in rabbit eyes; the irritation was not totally reversed in unwashed eyes after 7 days and longer. In in vitro microbial assays using microsomal activation (Ames Test), TNT was mutagenic. LAP was also mutagenic, and photolysis increased its mutagenicity. In contrast, in vivo cytogenetics studies on rat bone marrow extracts failed to detect an effect of either TNT or LAP on somatic cells. The effects of repeated oral administration of TNT and of LAP were determined in 90 day studies in dogs, rats, and mice. Observations common to the three species treated with either test material were depressed body weight and/or weight gain and food intake, mild to moderate hemolytic anemia, enlarged spleens and (usually) livers, hemosiderosis of the spleen and colored urine. GRA

N80-26035# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Aerospace Medical Div.
VARIOUS TECHNIQUES FOR EVALUATING CARDIODYNAMIC FUNCTION USING CHRONICALLY INSTRUMENTED CANINE MODELS
Kenneth C. Back and E. W. VanStee (National Inst. of Environmental Health Sciences, Research Triangle Park, N.C.) 1979 13 p refs Repr. from pharmac. Ther., V. 5, 1979 p 103-113 presented at Intern. Workshop on Pharmacol. Methods in Preclinical Safety Evaluation of New Drugs
(AF Proj. 6302)
(AD-A071264; AMRL-TR-78-119) Avail: NTIS HC A02/MF A01 CSCL 06/16
The pharmacological consequences of the initiation of low-molecular weight hydrocarbonated alkanes used in fire extinguishers were studied. A novel method for the determination of the maximum rate of ventricular pressure change or peak divided by the developed pressure. An application of the method to the evaluation of the isotropic effect of CBrF3 is described. R.E.S.

N80-26036# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. Clinical Research Div.
DEVELOPMENT OF AN AUTOMATED STRESS/DURESS DETECTION SYSTEM, PHASE 1 AND PHASE 2 Summary Report
Waneta C. Tuttle, Jerry G. Davis, E. R. Greene, and Jack A. Loeppky Sandia Labs. Dec. 1979 13 p refs
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-7038) Avail: NTIS HC A02/MF A01
Remote analysis of heart rate was investigated and was found to have potential as an effective means of automatic detection of stress in guards. The analysis of the data suggests that a heart rate greater than either CHR (criterion heart rate) + 20% (as established in the exercise test) or 150 beats per minute is the best criterion for initial establishment of alarm criteria. DOE

N80-26037# Analytic Sciences Corp., Reading, Mass.
USER'S MANUAL FOR BIOSPHERE AND DOSE SIMULATION PROGRAM (BIODOSE)
John J. Duffy and Gary P. Bogar 4 Jan. 1980 72 p refs
(Contract W-7405-eng-26)
(UCRL-15188) Avail: NTIS HC A04/MF A01
The BIOsphere Transport and DOSE program (BIODOSE) is described. BIODOSE simulates the transport of radionuclides in surface systems and the resulting concentration of nuclides in the food chain. It includes the prediction of human dosage risks for individuals and for populations resulting from release of radionuclides into surface water or well water. The BIODOSE program was designed for easy use, including standard defaults and a flexible input scheme. DOE

N80-26038# Argonne National Lab., Ill.
INNATE AND GENETIC NATURE OF CIRCADIAN RHYTHMS
Charles F. Ehret 1979 19 p refs Sponsored in part by NATO
(Contract W-31-109-eng-38)
(DOE/TIC-11132) Avail: NTIS HC A02/MF A01
Circadian cybernetics which deal with biological time constants in the temporal range from minutes to days is discussed. The mode rules, the period rules, and the phase rules are examined. The inmate and phylogenetically ubiquitous nature of circadian oscillations is comprehended, along with responses to a wide variety of environmental stimuli. DOE

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering, biotechnology, and space suits and protective clothing.

N80-26039*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HEAD-UP TRANSITION BEHAVIOR OF PILOTS DURING SIMULATED LOW-VISIBILITY APPROACHES
Richard F. Haines. Jun. 1980. 35 p. refs.
(NASA-TP-1618; A-8057) Avail: NTIS. HC A03/MF A01. CSCL 05H.

Each of 13 commercial pilots from four airlines flew a total of 108 manual flight director approaches in a moving base simulation of a medium-sized turbojet (95,000 lb gross weight) which had a day and night Redifon external scene. Three levels of runway visual range (RVR) (1,600; 2,400; and greater than 8,000 ft), three wind-shear profiles, nine ceiling heights, and continuous and intermittent visibility after initial breakout were tested. The results indicated that: (1) mean decision time ranged from 2 to 4.6 sec for ceilings under 380 ft across the three RVR conditions; (2) mean vertical distance traveled during the visual-cue assessment period was a relatively constant proportion below the existing ceiling; (3) a significant three way interaction in mean decision time between wind shear, day-night, and ceiling RVR variables occurred; (4) mean number of head-up transitions to VFR conditions after breakout ranged from 4.6 to 13.4 and increased as a function of ceiling and severity of wind shear; the typical duration of fixation out the window was 1.5 sec; and (5) subjective pilot ratings of controllability and precision of control as well as amount of skill, attention, or effort required to make the landing were influenced significantly by the wind shear, night conditions, and low breakout ceiling conditions. R.E.S.

N80-26040*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT-DECK AUTOMATION: PROMISES AND PROBLEMS
Earl L. Wiener (Miami Univ., Coral Gables, Fla.) and Renwick E. Curry. Jun. 1980. 27 p. refs.
(NASA-TM-81206; A-8210) Avail: NTIS. HC A03/MF A01. CSCL 05H.

The state of the art in human factors in flight-deck automation is presented. A number of critical problem areas are identified and broad design guidelines are offered. Automation-related aircraft accidents and incidents are discussed as examples of human factors problems in automated flight. R.E.S.

N80-26041# Eikonix Corp., Burlington, Mass.
TECHNOLOGY ASSESSMENT: THE IMPACT OF ROBOTS. Final Report
Sep. 1979. 261 p. refs.
(Grant NSF ESR-76-00637)
(PB80-142268; EC/2405801-FR-1; NSF/PRA-7600637) Avail: NTIS. HC A12/MF A01. CSCL 06D.

Intended to provide a data base for the development of policy options regarding the diffusion of robotics, the study is divided into four phases: surveying and forecasting relevant technology for the development of robots through 1990; examining possible application areas for technological feasibility and significance of impact resulting in the selection of major areas of application; investigating potential socio-economic ramifications of each of the selected application areas; and elucidating policy alternatives influencing robotics development. The study concluded that diffusion of robotics in the application areas selected at a rapid rate is highly unlikely. The technical constraints against a vast change in the scope of robotic capabilities is one reason for the slow diffusion rate. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-26042 Clarkson Coll. of Technology, Potsdam, N.Y.
MICROPROCESSOR SELF-DIAGNOSIS. Ph.D. Thesis
Ulhas Venkatesh Gumaste. 1980. 155 p.
Avail: Univ. Microfilms. Order No. 8013657.

An algorithm for microprocessor self fault detection concurrent with the program under execution is presented. This algorithm is shown to complete testing concurrently with any program under execution if the program is executed for sufficient length of time. A hardware design for self-fault detection using the suggested algorithm is also presented. The suggested design is economical since (1) it does not increase the hardware on the chip significantly, and (2) it does not increase the pin count of the chip. Also, an evaluation of the suggested self-testing architecture for an Intel 8080 type processor is presented. The results of this evaluation show that the testing of this microprocessor can be completed concurrently along with the entering and listing, and with the execution of a sample program in a very short time. Dissert. Abstr.

N80-26043 Rutgers - The State Univ., New Brunswick, N. J.
A MICROPROGRAMMABLE DIGITAL SIGNAL PROCESSOR: CONCEPTION, DESIGN, APPLICATION. Ph.D. Thesis
John Hartung. 1980. 198 p.
Avail: Univ. Microfilms. Order No. 8013160.

A microprogrammable digital signal processor structure (PSP) which efficiently implements both the classical and the new sequentially computed algorithms. The design is based on the modular logic machine design methodology and provides a structure which can be optimized with respect to functional units. Programs for the PSP are written in a microassembly language which is translated by an assembler running on the host computer. Experiments were run on the PSP to compare the performance of the cascade and UL filter algorithms. Both algorithms were implemented in the microassembly language of the PSP and achieved comparable bandwidths as measured by the number of microinstructions required to implement an elemental section. Dissert. Abstr.

N80-26044 Maryland Univ., College Park.
READ ONLY MEMORY OPTIMIZATION FOR MICROPROGRAMMED DIGITAL COMPUTERS. Ph.D. Thesis
Bor-Ren Albert Jeng. 1979. 159 p.
Avail: Univ. Microfilms. Order No. 8012659.

The optimization of read only memory (ROM) digit dimension for microprogrammed digital computers is considered. Given a

microprogram specification for a particular application, the designer is faced with the problem of encoding selected microoperations into groups in order to reduce the width of control memory words. A new efficient algorithm for grouping microoperations to reduce the width of control memory words is developed and analyzed here. This algorithm significantly extends and formalizes previous work for finding minimal group solutions by exploiting the intrinsic properties of compatibility relations among the microoperations without first finding the set of maximum compatibility classes. The power and practicality of this algorithm are demonstrated by evaluating its performance on all previously published ROM optimization examples, as well as, on large realistic problems taken from the microprogram specifications for two commercial digital computers. In every case this algorithm quickly produces the minimal group solution and near minimal dimension solution. Dissert. Abstr.

N80-26045*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW POWER NASA 36 BIT TIME CODE GENERATOR
David Langjahr. Apr. 1980. 16 p.
(NASA-TM-80597) Avail: NTIS HC A02/MF A01 CSCL 09B

A 36 bit time code generator implemented in CMOS is described. A microprocessor is used to minimize chip count. A modified 20 second format is available as an option, by changing two program steps. Author

N80-26046# Wayne State Univ., Detroit, Mich.
MODELLING AND RESOURCE ALLOCATION OF LINEARLY RESTRICTED OPERATING SYSTEMS Final Technical Report, May 1978 - Jan. 1979
Tse-Yun Feng and C. P. Hsieh. Griffiss AFB, N.Y. RADC Dec. 1979. 157 p. refs
(Contract F30602-76-C-0282; AF Proj. 5597)
(AD-A082363; RADC-TR-79-311) Avail: NTIS HC A08/MF A01 CSCL 09/2

Operating System is an integral part of a total computing utility. Its structure is complicated and the viewpoint on the subject is diversified. If the computing system is viewed upon as a collection of different resource types to serve different users with different demands, then the operating system assumes the managerial role. To best utilize the available resources to achieve a desirable level of production, i.e., computation, an optimal planning (programming) is needed. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-26047 Duke Univ., Durham, N. C.
ADAPTIVE MSE ESTIMATION ALGORITHMS Ph.D. Thesis
Steven Michael Sharpe. 1979. 154 p.
Avail: Univ. Microfilms Order No. 8012053

A very important problem in communication theory is the estimation of a signal in the presence of additive noise. A common approach to this problem is to form, from a weighted linear combination of the data, an estimate of the signal which approximates the signal in some sense. If the usual criterion of minimum mean square error between signal and estimate is employed, and if the signal and noise statistics are known, the optimum set of weights may be determined in a straightforward manner, leading to the well-known Wiener-Hopf equation. Two approaches are carefully compared, both theoretically, and through computer simulations. In addition, a number of subtle points relating to one or both algorithms, which frequently confuse comparisons, have been clarified. These points include the role of the convergence parameter mu, the idea of decorrelation delay, and the importance of the initial weight vector used to start the stochastic algorithm. Justification is given for using a zero initial weight vector, and the parameter mu is shown to be related to the memory of the algorithm and consequently to control not only the convergence rate, but also the steady state performance of the algorithm, and its ability to adjust to changing statistical conditions. Approximate analytical expressions for the performance of both algorithms are derived, which are in close agreement with simulation results in the very important region of low signal to noise ratios. Dissert. Abstr.

N80-26048 Washington Univ., Seattle.
THE COMPLEXITY OF PARALLEL ALGORITHMS Ph.D. Thesis
Gary Lynn Peterson. 1979. 126 p.
Avail: Univ. Microfilms Order No. 8013582

The complexity of problems in concurrent processing is analyzed. A formal model is presented with which the types of concurrent systems, the problems, and their complexity measures are expressed. The first problem analyzed is the critical section (mutual exclusion) problem in a simple distributed system with failures. Nearly tight upper and lower bounds were found, even when extra fairness conditions were imposed. A time analysis indicates that one algorithm in particular can be considered very efficient. The second problem is also the critical section problem, but in a system which allows test-and-set operations on shared variables. Again, remarkably tight space bounds are given. One algorithm is found to be optimal in time. The third major problem is to solve a version of the classic readers/writers problem, but where copying of the shared data is permitted. In all the versions of the problem studied, the number of copies that may have to be made is given exactly, i.e., both upper and lower bounds are equal. Solutions to the problem also answer the question of whether a distributed system with arbitrarily large shared variables is any more powerful than a system with only binary valued shared variables in the negative. The techniques developed to derive algorithms and lower bounds form the main contributions. Dissert. Abstr.

N80-26049 Washington Univ., Seattle.
SEQUENTIAL CONTROL STRUCTURE ABSTRACTIONS FOR PROGRAMMING LANGUAGES Ph.D. Thesis
Brian Thomas Lewis. 1979. 190 p.
Avail: Univ. Microfilms Order No. 8013557

An exploration of sequential control abstractions is described. A control abstraction facility (CAF) is presented, which is intended to be incorporated in object oriented programming languages to support the introduction of new sequential control abstractions. Practicality of the CAF is demonstrated by its inclusion in a Pascal-based programming language, CAL, which has been implemented with a compiler-interpreter. Several examples of control abstraction definition and use in CAL are given, including the loop with exit, guarded command selector, and loop, coroutine system, linear sequential pipeline, and generator-based for loop control abstractions. Experiences with the use of CAL and its implementation are noted. Dissert. Abstr.

N80-26050 Wisconsin Univ. - Madison.
THE INDUCTION OF THE SYNTAX OF NATURAL LANGUAGE BY COMPUTER Ph.D. Thesis
Paul James Orgren. 1979. 120 p.
Avail: Univ. Microfilms Order No. 8008832

A computer program, SYNNER, that attempts to learn an augmented transition network (ATN) grammar for English is described. The process being modelled is that of a human learner who already has some conceptual knowledge and a vocabulary relating to that knowledge. This learner observes a real-world event and hears a sentence describing that event, and then adjusts his rules of grammar, if necessary, to account for the new sentence. SYNNER's conceptual knowledge and vocabulary are predefined in terms of conceptual dependency (CD) theory, a representation based on a small number of primitives. To avoid the problems of perception, the real-world event is hand-coded into a CD structure, while the sentence is given as a string of words on an interactive computer terminal. The learning procedure begins by comparing the sentence to the event using its built-in knowledge of the vocabulary. This matching process determines the semantic role of each word in the sentence. A parse of the sentence is then attempted using the current ATN grammar. Dissert. Abstr.

N80-26051 Duke Univ., Durham, N. C.
PERFORMANCE COMPARISONS OF SEVERAL ADAPTIVE LEAST MEAN SQUARE ALGORITHMS Ph.D. Thesis

Rachel Messina Kinicki 1979 177 p
Avail: Univ. Microfilms Order No. 8012038

The estimation of a signal mixed with an additive noise process is an important problem in digital signal processing theory. The data available is in sampled form and it is desired to form an estimate of the signal to satisfy the chosen error criterion. When the minimum mean square error is the desired criterion and a causal, linear digital filter with finite unit sample response is utilized to form the signal estimate, the classical Wiener-Hopf solution results. This solution requires the data autocorrelation matrix and cross-correlation vector be known a priori and also involves the computation of a matrix inverse. Often, however, the data autocorrelation matrix and cross-correlation vector are unknown and as a result, many algorithms have been derived as an attempt to estimate the optimum Wiener-Hopf filter. One well known algorithm, the LMS (least mean square) algorithm based on the numerical method of steepest descent, was developed by Widrow at Standford in the 1950's. This algorithm requires choosing a convergence coefficient, mu, which greatly effects the convergence properties of the algorithm. The classical convergence proof of the LMS algorithm bounds the value of mu necessary for the mu convergence of the LMS weight vector to the Wiener-Hopf weight vector. This research shows that a tighter bound for mu is necessary for convergence due to an invalid assumption in the classical proof. Dissert. Abstr.

N80-26052 Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Automatique.

RESEARCH ON PARALLEL ESTIMATORS Final Report [RECHERCHE D'ESTIMATEURS A STRUCTURES PARALLELE]

Michel Gauvrit, Catherine Fargeon, and Pierre Rodrigo Dec. 1977 222 p refs In FRENCH
(Contract DGRST-76-7-0334)
(CERT-1/7125-DERA) Avail: Issuing Activity

An analysis is presented of the performance of parallel algorithms assuming: the state estimation of a linear stochastic system in an unknown noise environment, the state estimation of a linear system with unknown parameters (constant or time varying) the simultaneous estimation of state and parameters in an unknown noise environment. The importance of the convergence and the quality of the Bayes estimates is shown as well as the influence of passive control with state return. A parallel estimator has been implemented on a hardware system with eight microprocessors. Author (ESA)

N80-26053*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE RSZ BASIC PROGRAMMING LANGUAGE MANUAL

Raymond J. Stattel, James K. Niswander, and Avil K. Kochhar Jun. 1980 52 p refs
(NASA-TM-80690) Avail: NTIS HC A04/MF A01 CSCL 09B

The RSZ BASIC interactive language is described. The RSZ BASIC interpreter is resident in the Telemetry Data Processor, a system dedicated to the processing and displaying of PCM telemetry data. A series of working examples teaches the fundamentals of RSZ BASIC and shows how to construct, edit, and manage storage of programs. E.J.R.

N80-26054*# Wolf Research and Development Corp., Pocomoke City, Md.

ARC PROGRAM DOCUMENTATION

James D. McMillan Mar. 1976 52 p
(Contract NAS6-2639)
(NASA-CR-156867) Avail: NTIS HC A04/MF A01 CSCL 09B

A description of the input and output files and the data control cards for the altimeter residual computation (ARC) computer program is given. The program acts as the final altimeter preprocessor before the data is reformatted for external users. It calculates all parameters necessary for the computation of the altimeter observation residuals and the sea surface height. Mathematical models used for calculating tropospheric refraction, geoid height, tide height, ephemeris, and orbit geometry are described. M.G.

N80-26055*# Old Dominion Univ. Research Foundation, Norfolk, Va.

AN INVESTIGATION OF THE FEASIBILITY OF IMPROVING OCULOMETER DATA ANALYSIS THROUGH APPLICATION OF ADVANCED STATISTICAL TECHNIQUES Final Report, 1 Nov. 1978 - 31 Dec. 1979

Dharam S. Rana (Jackson State Univ., Miss.) Jun. 1980 36 p refs
(Grant NsG-1565)
(NASA-CR-163238) Avail: NTIS HC A03/MF A01 CSCL 09B

The data reduction capabilities of the current data reduction programs were assessed and a search for a more comprehensive system with higher data analytic capabilities was made. Results of the investigation are presented. E.J.R.

N80-26056*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

USER'S GUIDE FOR SKYLAB DYNAMICS PROGRAM, SKYDYN

M. S. Hopkins May 1980 73 p refs
(NASA-TM-78279) Avail: NTIS HC A04/MF A01 CSCL 09B

This user's manual describes the capabilities, required input data, and resulting output of SKYDYN, version of the 6 degree-of-freedom digital program REENTR which was extensively modified for the Honeywell CP-V system and was tailored to the specific requirements for SKYLAB. A.R.H.

N80-26057*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

AN APPLICATION OF SOFTWARE DESIGN AND DOCUMENTATION LANGUAGE

E. D. Callender, T. B. Clarkson, and C. E. Frasier Jun. 1980 41 p refs
(Contract NAS7-100)
(NASA-CR-163258; JPL-Pub-80-16) Avail: NTIS HC A03/MF A01 CSCL 09B

The software design and documentation language (SDDL) is a general purpose processor to support a lanugage for the description of any system, structure, concept, or procedure that may be presented from the viewpoint of a collection of hierarchical entities linked together by means of binary connections. The language comprises a set of rules of syntax, primitive construct classes (module, block, and module invocation), and language control directives. The result is a language with a fixed grammar, variable alphabet and punctuation, and an extendable vocabulary. The application of SDDL to the detailed software design of the Command Data Subsystem for the Galileo Spacecraft is discussed. A set of constructs was developed and applied. These constructs are evaluated and examples of their application are considered. A.R.H.

N80-26058# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).

NDTRAN: INTERPRETER OF DYNAMIC SYSTEMS [O INTERPRETADOR DE SISTEMAS DINAMICOS: NDTRAN]

Heloisa Galvao Villela Santos Borges Mar. 1980 64 p refs In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A04/MF A01

Computer methods for system dynamic simulation are examined with specific emphasis on the dynamic modeling translator (DYNAMO) and the Notre Dame Translator (NDTRAN). Both are specific for simulation of continuous time. The characteristics of the NDTRAN and the DYNAMO, together with the NDTRAN language syntax, are presented. Two examples illustrate the use of the NDTRAN. M.G.

N80-26059# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).

ALGORITHMS FOR SAMPLE CLASSIFICATION AND IMAGE FEATURE SELECTION [ALGORITMOS PARA CLASSIFICACAO DE AMOSTRAS E SELECAO DE ATRIBUTOS DE IMAGENS]

Carlos Roberto deSouza, Luiz Rogerio deCamargos, Ravindra Kumar, and Nelson D. A. Mascarenhas Apr. 1980 88 p refs In PORTUGUESE; ENGLISH summary
(INPE-171B-RPE/124) Avail: NTIS HC A05/MF A01

Two algorithms are described for sample classification in Earth resources multispectral imagery. The first one uses the

JM-distance, while the second one is based on the maximum likelihood criterium. A feature selection algorithm was also implemented under the following criteria: average JM-distance and minimum JM-distance. A.R.H.

N80-26060# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
PARTITIONING MULTISPECTRAL IMAGERY OF THE EARTH RESOURCES [PARTICIONAMENTO DE IMAGENS MULTIESPECTRAIS DE RECURSOS NATURAIS DA TERRA]
Walter Kenkiti Takahashi, Adael Woods DecFilho, and Ravindra Kumar Feb. 1980 65 p refs In PORTUGUESE; ENGLISH summary
(INPE-1678-RPE/111) Avail: NTIS HC A04/MF A01

An efficient algorithm is described for partitioning multispectral Earth resources imagery. Statistically homogeneous objects are extracted, for posterior classification. A.R.H.

N80-26061# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
A LANGUAGE FOR SIMULATING DYNAMIC HIERARCHICAL SYSTEMS M.S. Thesis [UMA LINGUAGEM PARA SIMULACAO DE SISTEMAS DINAMICOS HIERARQUIZADOS]
Heloisa Galvao V. S. Borges Apr. 1980 111 p refs In PORTUGUESE; ENGLISH summary
(INPE-1728-TDL/024) Avail: NTIS HC A06/MF A01

A software package for the simulation of hierarchical systems, written for the B6700 computer is described. The main purpose of the package is to simplify the modeling and subsequent simulation of large systems, by considering each of its parts as a subsystem. Flux and level diagrams are used as modeling tools. The HIERTRAN package was programmed utilizing the NDTRAN simulation language. A user's manual as well as implementation details are included. A.R.H.

N80-26062# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
A DIRECT SEARCH PROCEDURE USING LINEAR PROGRAMMING TO GENERATE NUMERICAL SUBOPTIMAL SOLUTIONS IN CONTROL PROBLEMS
Decio Castilho Ceballos and Atair Rios Nero Apr. 1980 7 p refs In PORTUGUESE; ENGLISH summary Proposed for presentation at the 30th Congr. Brasileiro de Automatica, Rio de Janeiro, 16-19 Sep. 1980
(INPE-1725-RPE/130) Avail: NTIS HC A02/MF A01

A direct search procedure, of first order, using linear programming, is proposed to obtain numerical suboptimal solutions in dynamical systems control problems. A particular functional form, dependent upon a set of unknown parameters, is assumed for the control function. Due to its characteristics it can be used in small computers and to generate computer programs of general application. Considerations about the functional form of the control are given and the results of application to a Earth-Mars orbit transfer problem are presented. M.G.

N80-26063# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
LANAC: A HIGH LEVEL LANGUAGE FOR DATA ACQUISITION AND PROCESS CONTROL BY MINICOMPUTERS [LANAC - UMA LINGUAGEM DE ALTO NIVEL PARA ACQUISICAO DE DADOS E CONTROLE DE PROCESSOS POR MINICOMPUTADOR]
Francisco E. C. Viola and Celsa de Renna e Souza Apr. 1980 16 p refs In PORTUGUESE Presented at the 70th Seminar Integrado de Software da Soc. Brasileira de Computacao
(INPE-1721-RPE/126) Avail: NTIS HC A02/MF A01

The 'Revised Report on the Algorithmic Language (ALGOL-6)' is the basis for a language proposed for programming minicomputers that handle data acquisition and the control of parallel processes in real time. The special implementation proposed is for the generation of symbolic codes of the assembly type for the Hewlett-Packard 2116B, and consists of a compiler written in ALGOL B-6700. Transl. by A.R.H.

N80-26064*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
COMPUTER PROGRAM DOCUMENTATION MODIFIED VERSION OF THE JA70 AERODYNAMIC HEATING COMPUTER PROGRAM H800 (MINIVER WITH A DISSPLA PLOT PACKAGE
L. Olmedo Mar. 1980 213 p
(Contract NAS9-15800)
(NASA-CR-160695; LEMSCO-14571; JSC-16500) Avail: NTIS HC A10/MF A01

The changes, modifications, and inclusions which were adapted to the current version of the MINIVER program are discussed. Extensive modifications were made to various subroutines, and a new plot package added. This plot package is the Johnson Space Center DISSPLA Graphics System currently driven under an 1110 EXEC 8 configuration. User instructions on executing the MINIVER program are provided and the plot package is described. A.R.H.

N80-26065*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION OF THE DATA ORDER PROCESSOR ORDHDT
A. Rios Mar. 1980 41 p
(Contract NAS9-15800)
(NASA-CR-160694; LEMSCO-14596) Avail: NTIS HC A03/MF A01 CSCL 09B

A description and subroutine documentation of the data order processor, ORHDT is given. As part of the LANDSAT imagery verification and extraction system, ORHDT creates a computer tape containing the AgRISTARS requirements for LANDSAT data to be ordered from Goddard Space Flight Center. A brief description of hardware requirements is also included. M.G.

N80-26066# Wisconsin Univ., Madison. Dept. of Computer Sciences.
ON K-LINE AND K X K BLOCK ITERATIVE SCHEMES FOR A PROBLEM ARISING IN 3-D ELLIPTIC DIFFERENCE EQUATIONS
Seymour V. Parter and Michael Steuerwalt (LASL) Jan. 1980 35 p refs
(Contracts N00014-76-C-0341; W-7405-eng-36)
(AD-A082390; CSTR-374; LA-UR-80-263) Avail: NTIS HC A03/MF A01 CSCL 09/2

Novel computer architectures and a desire to solve three dimensional problems have together aroused new interest in iterative methods for computing solutions to elliptic difference equations. Block iterative methods are particularly attractive for vector machines, such as the CRAY-1. Plane iterative schemes reduce a three dimensional elliptic system to two dimensional systems. We analyze the convergence rate of k-line and k x k block iterative methods for solving these two dimensional problems. GRA

N80-26067# Logos Development Corp., Middletown, N. Y.
DEVELOPMENT OF LOGOSCAN 2 Final Technical Report, Oct. 1978 - Aug. 1979
Charles E. Byrne, John C. Byrne, and Daniel J. Byrne Griffiss AFB, N.Y. RADC Dec. 1979 35 p
(Contract F30602-78-C-0361; AF Proj. 2183)
(AD-A081921; RADC-TR-79-315) Avail: NTIS HC A03/MF A01 CSCL 09/2

The purpose of this report was to test and evaluate the Logoscan II Optical Character Reader System to assess its potential for conversion of free formatted multifont typeset Russian text to a computer processable format compatible with the Russian-English machine translation system at Foreign Technology Division (FTD). Logoscan II scanned 27 pages of Russian text supplied by FTD at approximately 30 characters per second with an error rate of 1.0 - 2.0%. This report discusses the methodology used, technical problems, results, and manpower cost for a production system. GRA

N80-26068# Department of Defense, Washington, D. C.
MILITARY STANDARD, JOVIAL (J73)
15 Mar. 1979 173 p Supersedes MIL-STD-1589
(AD-A081927; DOD-MIL-STD-1589A; MIL-STD-1589) Avail: NTIS HC A08/MF A01 CSCL 09/2

This document is the revised MIL- STD-1589 a USAF definition of the upgraded J73 JOVIAL programming language. The primary purpose of the revision and upgrade was to incorporate into the J73 language some of the proven features of the J3 B-2 language. The sections are organized in a top-down manner. The first section describes the interactions between the modules

of the complete program so that in subsequent sections, the structures of the language can be described to the extent possible without reference to their interaction with other structures. Most sections are divided into separate parts entitled 'Syntax,' 'Semantics,' and 'Constraints.' The 'Syntax' descriptions define the grammar of the language in a modified BNF notation. The 'Semantics' discussions define the meaning of constructs that satisfy the Syntax and Constraints. The 'Constraints' discussions enumerate nonsyntactic requirements that must be met in order for the given constructs to be legal. The intent is that the Syntax, Semantics, and Constraints not be redundant with each other - e.g., the Semantics sections do not normally repeat something that should be obvious from the Syntax, neither do they repeat stipulations that are listed as Constraints. GRA

N80-26069# Carnegie-Mellon Inst. of Research, Pittsburgh, Pa. Dept. of Computer Science.
THE STRUCTURE OF PARALLEL ALGORITHMS Interim Report
H. T. Kung. Aug. 1979. 60 p. refs. Submitted for publication.
(Contract N00014-76-C-0370; Grant NSF MCS-78-23676)
(AD-A081987; CMU-CS-79-143) Copyright. Avail: Issuing Activity. CSCL 09/2

The purpose of this article is to create a general framework for the study of parallel algorithms. A taxonomy of parallel algorithms, based on their relations to parallel computer architectures, is introduced. Examples of parallel algorithms for many architectures are given; they include algorithms for SIMD array processors, for MIMD multiprocessors, and for direct chip implementations. By presenting these algorithms in a single place, issues and techniques in designing algorithms for various types of parallel architectures are discussed and compared. GRA

N80-26070# Boeing Aerospace Co., Seattle, Wash.
SOFTWARE QUALITY ASSURANCE: ONE OF THE SOFTWARE ACQUISITION ENGINEERING GUIDEBOOK SERIES Final Report
M. P. Kress. Wright-Patterson AFB, Ohio. ASD. Jan. 1979. 75 p. refs.
(Contract F33657-76-C-0723; AF Proj. 2238)
(AD-A082425; D180-24700-1; ASD-TR-78-47) Avail: NTIS. HC A04/MF A01. CSCL 09/2

This report is one of a series of guidebooks whose purpose is to assist Air Force Program Office Personnel and other USAF acquisition engineers in the acquisition engineering of software for Automatic Test Equipment and Training Simulators. This guidebook describes acquisition engineering and contractor tasks associated with quality assurance and control of software. It provides a practical guide to controlling software life cycle costs through quality assurance. GRA

N80-26071# Naval Ship Research and Development Center, Bethesda, Md.
DIGIT: THE CURVE DIGITIZING SUBSYSTEM OF THE INTERACTIVE DATA DISPLAY SYSTEM Final Report, Sep. 1977 - Apr. 1979
Mary Beth Marquardt. Mar. 1980. 50 p.
(SF43411301)
(AD-A082465; DTNSRDC-80/038) Avail: NTIS. HC A03/MF A01. CSCL 09/2

DIGIT is a high-performance interactive graphics program for use in extracting numerical data values (x,y-coordinates) from plots and drawings. It is a subsystem of the Interactive Data Display System (IDDS). In order to digitize, the user needs not only the program but also a digitizing tablet. IDDS, including DIGIT, is designed to run quickly and efficiently. Speed is obtained by minimizing the number of prompts. GRA

N80-26072# System Development Corp., Huntsville, Ala. Aerospace Medical Research Lab.
REDIMEN: SYSTEMS ANALYSIS OF INTEGRATED NETWORKS OF TASKS. SAINT REDIMENSIONING PROGRAM Technical Progess Report, Jul. 1977 - Oct. 1979
Deborah J. Seifert, George Koeplinger (Dayton Univ. Research Inst.), and Constance M. Hoyland (System Development Corp.). Feb. 1980. 20 p. refs.
(Contract F33615-79-C-0505; AF Proj. 7184)
(AD-A082735; SDC-TM-HU-539/000/00; AMRL-TR-80-5) Avail: NTIS. HC A02/MF A01. CSCL 09/2

The SAINT (Systems Analysis of Integrated Networks of Tasks) computer programs have fixed storage array dimensions. Different models may have storage requirements less than (or greater than) the presently defined array sizes in SAINT, which makes the SAINT programs inefficient (or impossible to run) unless the common statements in all of the subroutines are redimensioned. This is a laborious, error-prone task. REDIMEN was designed and implemented to eliminate most of the manual labor required to revise the SAINT source codes to tailor array sizes to the model or problem at hand. This document describes the REDIMEN program, its source code, necessary inputs, and its utilization in conjunction with SAINT applications efforts. GRA

N80-26073# Westinghouse Electric Corp., Pittsburgh, Pa.
PRIMER ON COMPUTER GRAPHICS PROGRAMMING Final Report
Richard Puk, Steve Orbon, Robert Bruns, and James M. Jones, II. Oct. 1979. 212 p. refs.
(Contract DACW39-78-M-2676)
(AD-A082732; WES-MP-0-79-4) Avail: NTIS. HC A10/MF A01. CSCL 09/2

This report is a tutorial for learning graphics programming with the Graphics Compatibility System (GCS). GCS is a collection of ANSI standard FORTRAN subroutines invokable by a user's FORTRAN program. The report covers GCS's capabilities. GCS can produce a simple line drawing or handle comprehensive general purpose axis creation and automatic clipped; arc and conic generation; graphics input; secondary coordinate systems; multiple software character fonts; data structures; segmentation; and color. The report addresses both two and three dimensional graphics capability within GCS. GRA

N80-26074# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Applied Mathematics.
SYNTHESIZED STRUCTURED PROGRAMMING Final Technical Report, 1 Aug. 1975 - 30 Sep. 1978
Zohar Manna. Jan. 1980. 188 p. refs.
(Grant AF-AFOSR-3483-78; AF Proj. 5550)
(AD-A082359; RADC-TR-79-326) Avail: NTIS. HC A09/MF A01. CSCL 09/2

Techniques of program modification are formulated, and an experimental software system implemented, whereby a given program that achieves one goal can be transformed into a new program to achieve a different goal. The essence of the approach is to find an analogy between the specifications of the given program and of the desired program, and then to transform the given program accordingly. Program debugging is considered as a special case of modification: if a program computes wrong results, it must be modified to achieve the intended results. The abstraction of a set of concrete programs to obtain a program schema and the instantiation of abstract schemata to solve concrete problems are also viewed from the perspective of modification techniques. Two tools are developed as aids in the above tasks. We describe transformation rules for synthesizing code from specifications in a top-down manner. They may be used when - in the course of modifying a program - the need arises to completely rewrite a program segment. For the purpose of determining what an incorrect program actually does, before attempting to debug it, we develop techniques of program annotation. These techniques are expressed as inference rules and derive invariant assertions from the program text. GRA

N80-26075# Sandia Labs., Albuquerque, N. Mex.
COMPARISON BETWEEN RESULTS OF THE HELIOS AND MIRVAL COMPUTER CODES APPLIED TO CENTRAL RECEIVER SOLAR-ENERGY COLLECTION
Charles N. Vittitoe, Frank Biggs, and Patricia L. Leary (Sandia Labs., Livermore, Calif.). Jan. 1980. 27 p. refs.
(Contract EY-76-C-04-0789)
(SAND-79-8266) Avail: NTIS. HC A03/MF A01

The computer codes HELIOS and MIRVAL, developed to predict the optical performance of reflecting solar concentrators and to model power collection by central-receiver solar energy power plants are compared in regard to their performance predictions. HELIOS is an analytic code, whereas MIRVAL use Monte Carlo ray-tracing techniques. The sample problems for

comparison consists of a rectangular target and alt-azimuth heliostats deployed in a north field. The results indicate that HELIOS and MIRVAL closely agree on prediction of field performance and of power density on the target plane. DOE

N80-26076# Sandia Labs., Albuquerque, N. Mex. Computer Aids System Development Div.
USER/PROGRAMMER GUIDE FO UCMD 64: DUMPING DRAWING FILES TO TAPE
Donald K. Robbins Jan. 1980 26 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0156) Avail: NTIS HC A02/MF A01

An Applicon AGS/900 user command is described for selectively dumping drawing files onto magnetic tape, through use of an Applicon system. DOE

N80-26077# Sandia Labs., Livermore, Calif. Mechanical Div.
SIXDOF: A COMPUTER PROGRAM FOR TRAJECTORY SIMULATION OF BALLISTIC FLIGHT VEHICLES
Roger N. Everett Oct. 1979 72 p refs
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-8260) Avail: NTIS HC A04/MF A01

The trajectory computer program, SIXDOF, for use in the flight simulation of ballistic flight vehicles is described. A presentation of the prominent features of the mathematical model which describes the vehicle aero- and flight dynamics is included. Additionally, detailed descriptions of the program input and output are provided as a user's guide. DOE

N80-26078# Sandia Labs., Albuquerque, N. Mex.
SEMICONDUCTOR DEVELOPMENT LABORATORY COMPUTER CONTROL SOFTWARE
Leo A. Doyal Oct. 1979 101 p
(Contract EY-76-C-04-0789)
(SAND-79-1709) Avail: NTIS HC A06/MF A01

A group of programs written to control semiconductor processing in the lab and keep track of device histories during wafer fabrication is described. The software design philosophy is based on a modular structure, relying primarily on FORTRAN programming techniques. DOE

N80-26079# Transportation Research Board, Washington, D.C.
APPLICATION OF COMPUTER AND INTERACTIVE GRAPHICS
Jerome M. Lutin, Yehonathan Hazony, Alain L. Kornhauser, Amir Eiger, Shih-Miao Chin, David Woodin, A. Keith Turner, and David A. Green 1979 28 p refs
(PB80-147051; TRB/TRR-729; ISBN-0-309-02984-8; ISSN-80-10938) Avail: NTIS HC A03/MF A01 CSCL 09B

Topics covered include interactive network model for analysis and cartographics display of railroad traffic flow; computer graphic animation of UTC-1/NETSIM traffic flows; interactive and graphic techniques of computer aided route selection; and improved highway safety through interactive graphics. GRA

N80-26080# General Services Administration, Washington, D.C. Federal Compiler Testing Center.
CII HONEYWELL BULL COBOL V-50.124-4 Validation Summary Report
22 Jan. 1980 64 p
(PB80-146012; CCVS74-VSR525) Avail: NTIS HC A04/MF A01 CSCL 09B

This validation summary report (VSR) for the CII Honeywell Bull Level 64 COBOL Compiler Version 50.124-4 (GCOS-L-64 Version 1-D) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated at the high level of FIPS PUB 21-1. The VSR is made up to several sections showing discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of descrepancies together with the tests which were failed. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-26081 Carnegie-Mellon Univ., Pittsburgh, Pa.
DESIGN OF MICROCOMPUTER ADAPTIVE CONTROLLERS Ph.D. Thesis
Robert Leonard Morris 1979 340 p
Avail: Univ. Microfilms Order No. 8010932

Analytic tools for the design of adaptive control algorithms for microcomputer implementation are discussed. Adaptive controllers are self tuning regulators which are conceived to maintain process performance at a specified level in spite of changes in, or lack of knowledge of the process characteristics. The multitude of approaches to adaptive control are cast into a common theoretical framework and compared in the light of practical constraints. Methods of classical control engineering and stability analyses of nonlinear tuning mechanisms are applied to evaluate and interpret these controllers. Novel adaptive controllers are then designed to meet the practical constraints. Process models are simulated on an EAI TR-20 analog computer and the adaptive control algorithm is implemented on a PDP 11/40 mini microcomputer. Adaptive control algorithms are then implemented on an 8080A microcomputer. These algorithms are evaluated by controlling both physical processes simulated on the analog computer and a fractional horsepower dc motor. Dissert. Abstr.

N80-26082*# Mitre Corp., Houston, Tex.
SOME QUEUING NETWORK MODELS OF COMPUTER SYSTEMS
E. S. Herndon Mar. 1980 56 p refs
(NASA Order T-8231-G; Contract F19628-80-C-0001; AF Proj. 8470)
(NASA-CR-160693; M80-7; JSC-16494) Avail: NTIS HC A04/MF A01 CSCL 09B

Queuing network models of a computer system operating with a single workload type are presented. Program algorithms are adapted for use on the Texas Instruments SR-52 programmable calculator. By slightly altering the algorithm to process the G and H matrices row by row instead of column by column, six devices and an unlimited job/terminal population could be handled on the SR-52. Techniques are also introduced for handling a simple load dependent server and for studying interactive systems with fixed multiprogramming limits. M.G.

N80-26083# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
THE USE OF NEGATIVE FEEDBACK AND CONVOLUTION INTEGRAL IN THE CONTROL OF NONLINEAR INSTABILITY [O USO DE REALIMENTACAO NEGATIVA E INTEGRAL DE CONVOLUCAO NO CONTROLE DA INSTABILIDADE NAO-LINEAR]
Celso Lopes Pereira Neto and Antonio E. Costa Pereira May 1980 6 p refs In PORTUGUESE; ENGLISH summary Proposed for presentation at 30th Congr. Brasileiro de Automatica, Rio de Janeiro, 16-19 Sep. 1980 Revised
(INPE-1733-RPE/133-Rev) Avail: NTIS HC A02/MF A01

Some methods used in the nonlinear instability control are analyzed. It is shown that these methods cause losses in the linear terms. A method that uses negative feedback is developed aiming to correct the instability produced by the positive feedback and employing convolution integral instead of Fourier transform followed by inverse Fourier transform, damping, or artificial viscosity. This method minimizes the losses in the linear terms. Author

N80-26084# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
OPTIMAL LINEAR ESTIMATION APPLIED TO GENERATE SUBOPTIMAL NUMERICAL SOLUTIONS FOR CONTROL PROBLEMS
Atair Rios Neto May 1980 6 p refs In PORTUGUESE; ENGLISH summary Proposed for presentation at the 30th Congr. Brasileiro de Automatica, Rio de Janeiro, 16-19 Sep. 1980
(INPE-1731-RPE/131) Avail: NTIS HC A02/MF A01

A procedure for the generation of suboptimal numerical solutions in dynamical systems optimal control problems is described. The approximation of the control by a functional dependent upon a finite number of parameters and the adoption of a linear perturbation scheme, with a direct search criterion, reduces the problem, in each iteration, to a parameter optimization. An estochastic interpretation of the search criterion and of the errors due to the linear approximation makes it possible to get the increment in each step by using optimal linear estimation. M.G.

N80-26085# Minnesota Univ., Minneapolis. Computerized Adaptive Testing Lab.
COMPUTERIZED ADAPTIVE PERFORMANCE EVALUATION Final Report, Feb. 1976 - Jan. 1980
David J. Weiss Feb. 1980 27 p refs
(Contract N00014-76-C-0627; NR Proj. 150-389; RR0420401)
(AD-A082845) Avail: NTIS HC A03/MF A01 CSCL 09/2

Three years of research on computerized adaptive achievement testing are summarized. The goals of the research program are described, and the research approach is summarized and related to the nine technical reports completed under this contract. Major research findings are presented. The implications of the research methods and results for future research in computerized adaptive achievement testing are described. Also included are abstracts of the nine technical reports and a list of other project reports and papers. GRA

N80-26086# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
SUBOPTIMAL APPROXIMATIONS FOR CONTROL IN OPTIMAL DYNAMIC PROGRAMS M.S. Thesis [APROXIMACOES SUB-OTIMAS PARA O CONTROLE EM PROGRAMAS DINAMICOS DE OTIMIZACAO]
Decio Castilho Ceballos Feb. 1980 187 p refs In PORTUGUESE; ENGLISH summary
(INPE-1676-TDL/019) Avail: NTIS HC A09/MF A01

A method for the numerical solution of suboptimal control problems is described in which the control is taken as a functional dependent on time and a finite number of parameters. In order to test the method, a computer program was developed with the capacity to solve a highly important group of optimization problems, requiring only two subprograms to be supplied. One of them embodies the dynamical equations of motion and the other is the partial differential of the constraints and the performance index equations with respect to final time and state vector. Applying the procedure to an Earth-Mars or orbit transfer problem, tests are made for various approximations of the control. For the previous problem a comparison is presented, relating the results obtained to the numerical optimal solution and to results from suboptimal procedures found in the literature. A.R.H.

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-26087*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPLICATION OF FUNCTIONAL ANALYSIS TO PERTURBATION THEORY OF DIFFERENTIAL EQUATIONS
Victor M. Bogdan and Victor B. Bond May 1980 22 p refs
(NASA-TM-81073; JSC-16507) Avail: NTIS HC A02/MF A01 CSCL 12A

The deviation of the solution of the differential equation $y' = f(t, y)$, $y(0) = y$ sub O from the solution of the perturbed system $z' = f(t, z) + g(t, z)$, $z(0) = z$ sub O was investigated for the case where f and g are continuous functions on I x R sup n into R sup n, where I = (o, a) or I = (o, infinity). These functions are assumed to satisfy the Lipschitz condition in the variable z. The space Lip(I) of all such functions with suitable norms forms a Banach space. By introducing a suitable norm in the space of continuous functions C(I), introducing the problem can be reduced to an equivalent problem in terminology of operators in such spaces. A theorem on existence and uniqueness of the solution is presented by means of Banach space technique. Norm estimates on the rate of growth of such solutions are found. As a consequence, estimates of deviation of a solution due to perturbation are obtained. Continuity of the solution on the initial data and on the perturbation is established. A nonlinear perturbation of the harmonic oscillator is considered a perturbation of equations of the restricted three body problem linearized at libration point. A.R.H.

N80-26088# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
MATHEMATICAL METHODS IN PHYSICS: TENSOR ANALYSIS 3 [METODOS MATHEMATICOS DA FISICA: 3 ANALISE TENSORIAL]
Rene A. Medrano-B. Dec. 1979 150 p refs In PORTUGUESE; ENGLISH summary Revised
(INPE-1648-RPE/102-Rev) Avail: NTIS HC A07/MF A01

An introduction to the study of tensors is presented. A treatment of Cartesian tensors is initiated with the derivation of the transformation relations for the components of a vector, through successive angular rotations of an orthogonal system of coordinates (Euler angles). Tensors of higher order are defined by means of the transformation relations of dyadics. The concept of covariant and contravariant tensors is coordinated. Some emphasis is placed on the geometric meaning of the fundamental tensor. Among other important concepts developed are: the contraction, relative tensors, the quotient theorem, Christoffel symbols, and the covariant derivative. Three applications on geodesics, Einstein's gravitational law, and the relativistic form of the Maxwell equations are presented. Whenever possible, illustrative examples are included. A.R.H.

N80-26089*# Mississippi State Univ., Mississippi State. Dept. of Mathematics.
A COMPARISON OF FINITE DIFFERENCE METHODS FOR SOLVING LAPLACE'S EQUATION ON CURVILINEAR COORDINATE SYSTEMS M.S. Thesis
Melba Jo McCoy 25 Jun. 1980 54 p refs
(Grant NsG-1577)
(NASA-CR-163236) Avail: NTIS HC A04/MF A01 CSCL 12A

Various finite difference techniques used to solve Laplace's equation are compared. Curvilinear coordinate systems are used on two dimensional regions with irregular boundaries, specifically, regions around circles and airfoils. Truncation errors are analyzed for three different finite difference methods. The false boundary method and two point and three point extrapolation schemes, used when having the Neumann boundary condition are considered and the effects of spacing and nonorthogonality in the coordinate systems are studied. A.R.H.

N80-26090# Virginia Polytechnic Inst. and State Univ., Blacksburg.
INEQUALITIES FOR JOINT DISTRIBUTION OF QUADRATIC FORMS
D. R. Jensen Dec. 1979 19 p refs
(Grant DAAG29-78-G-0172)
(AD-A083033; RR-Q-1; ARQ-15194.2-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Chebychev inequalities were given for joint central and noncentral distributions of k quadratic forms; these were sharpened when k = 2 using the canonical correlations of Hotelling. Complementary inequalities were found as versions of Markov's inequality. Applications were noted in ballistics, in statistical quality control, in establishing consistency of Gauss-Markov estimates under dependence, and in constructing conservative joint confidence sets depending on the underlying distribution only through its low order moments. E.J.R.

N80-26091# Texas Univ. at Arlington. Dept. of Mathematics.
PROPERTIES OF DIFFERENTIAL EQUATIONS THROUGH DIFFERENT MEASURES Final Report, 1 Jan. 1977 - 31 Dec. 1979

V. Lakshmikantham Mar. 1980 9 p refs
(Grant DAAG29-77-G-0062)
(AD-A082633; ARO-1913881.17-M) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Research is briefly summarized which addressed essentially eight areas of research: (1) reaction-diffusion equations; (2) quasi-solutions and large scale systems; (3) monotone iterative techniques; (4) Hopf bifurcation; (5) basic theory of differential equations in Banach spaces; (6) Sobolev type differential and integral equations; (7) stochastic differential equations; and (8) differential equations with infinite delay. GRA

N80-26092# Texas Univ. at Austin.
APPROXIMATION AND NUMERICAL ANALYSIS OF NONLINEAR EQUATIONS OF EVOLUTION Final Report, 1 Feb. 1977 - 15 May 1980
J. T. Oden 31 Jan. 1980 147 p refs
(Grant DAAG29-77-G-0087)
(AD-A082452; ARO-1914505.12-M) Avail: NTIS
HC A07/MF A01 CSCL 12/1

Important results were obtained in four areas: (1) Existence theorems, approximation theorems, a priori error estimates, numerical schemes, and finally computer codes were developed for the analysis of one and two dimensional, one and two phase Stefan problems characterized by variational inequalities; (2) Existence theorems, uniqueness theorems, theorems on the stability and asymptotic stability of solutions and regularity of solutions were developed for a large class of nonlinear, convective diffusion problems characterized by pseudo-monotone operators; (3) A priori error estimates for Galerkin and Faedo-Galerkin approximations (defined, in general, by finite element methods) were established for nonlinear convection diffusion problems involving general pseudomonotone operators; and (4) Existence theorems were obtained for a large class of nonlinear, degenerate evolution equations with solutions involving free boundaries. Applications to porous media and two-phase Stephan problems were completed. GRA

N80-26093# Sandia Labs., Albuquerque, N. Mex. Numerical Mathematics Div.
LINEAR EQUATIONS IN GENERAL PURPOSE CODES FOR STIFF ODEs
Lawrence F. Shampine Feb. 1980 13 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0429) Avail: NTIS HC A02/MF A01

It is noted that it is possible to improve significantly the handling of linear problems in a general purpose code with very little trouble to the user or change to the code. In such situations analytical evaluation of the Jacobian is a lot cheaper than numerical differencing. A slight change in the point at the Jacobian is evaluated results in a more accurate Jacobian in linear problems. DOE

N80-26094# Sandia Labs., Livermore, Calif. Gas Dynamics Div.
INVESTIGATION OF ROUTINES FOR INVERTING BLOCK TRIDIAGONAL MATRICES
K. D. Marx Mar. 1980 22 p refs
(Contract EY-76-C-04-0789)
(SAND-80-8206) Avail: NTIS HC A02/MF A01

Numerical experiments were performed to determine the computer time required to invert block tridiagonal matrices on the Sandia CDC 6600 and 7600 computer systems. Timing data for the DECBT/SOLBT and BTMS routines developed are given for various conditions of use. These routines are compared to other options, such as band solvers. A system for solving cyclic tridiagonal systems was derived; timing data for it are presented. The FORTRAN source decks and compiled versions of pertinent routines were collected in a permanent file and a library for general user access. DOE

N80-26095# Encoth Corp., Princeton, N.J.
STEADY STATE BOLTZMANN EQUATION SOLUTION BY NUMERICAL RELAXATION Technical Status Report, Jun. 1979
Timothy M. Smith 1979 44 p
(Contract DE-AC02-79ET-15422)
(DOE/ET-15422/T3; TSR-79-0002) Avail: NTIS
HC A03/MF A01

A procedure for the numerical solution of the steady state Boltzmann equation in one configuration space and two velocity space dimensions is described. The diffusive character of the Fokker-Planck collision terms is utilized to construct a numerical relaxation scheme. The mathematical problem and numerical algorithm are discussed, and the present state of computational development is indicated. Details of an existing computer code and results of computations are presented. DOE

N80-26096# General Atomic Co., San Diego, Calif.
ALGORITHM TO INTEGRATE SYSTEMS OF NONLINEAR ORDINARY DIFFERENTIAL EQUATIONS, WITH APPLICATION TO THE ADVANCED FIPER CODE
P. D. Smith 1 Feb. 1980 87 p refs
(Contract DE-AT03-76ET-35300)
(GA-A-15143) Avail: NTIS HC A05/MF A01

A general purpose algorithm for integrating nonlinear systems of ordinary differential equations is presented. A number of specific applications are discussed, such as mixed linear/nonlinear problems, mixed transient/steady state problems, and substructuring. The problem of integrating past singularities is briefly discussed. It is concluded that its efficient use in some of the more complicated problems requires a number of special considerations in the derivation and in the programming. Each application ultimately distills to the following essence: (1) the incremental predictor and corrector phases employ substantially the same steps; (2) the predictor phase is a modified implicit extrapolation of the current rates; (3) the corrector phase is a modified Newton's method based on the residual of a vector function; (4) in partially linear problems one can save steps by matrix partitioning; and (5) The frequency of updates of the tangent matrix is arbitrary, and the calculational efficiency can be optimized by simultaneously varying the size of the time step and the frequency of the matrix updates. DOE

N80-26097# Rice Univ., Houston, Tex. Dept. of Mathematical Sciences.
AUGMENTED LAGRANGIAN METHODS FOR CONSTRAINED OPTIMIZATION: THE ROLE OF THE PENALTY CONSTANT
R. A. Tapia 1979 33 p refs Presented at the Intern. Conf. on Nonlinear Optimization Appl., L'Aquila, Italy, 18 Jun. 1979
(Contract EY-76-S-05-5046)
(DOE/ER-05046/16; CONF-7906140-2) Avail: NTIS
HC A03/MF A01

The role of the penalty constant with respect to local convergence and rate of convergence is reviewed. Specifically, in the penalty function method local convergence is obtained if and only if the penalty constant becomes infinite. It is possible to obtain local convergence in the multiplier method for a fixed penalty constant, provided that this constant is sufficiently large. However, superlinear convergence is obtained if and only if the penalty constant becomes infinite. Finally, the quasi-Newton methods are locally superlinearly convergent for fixed values of the penalty constant, and actually the most natural formulation gives an algorithm that is independent of the penalty constant. M.G.

N80-26098# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
SYNCHRONIZATION OF WEAKLY COUPLED RELAXATION OSCILLATORS
M. J. W. Jansen (Vrije Univ., Amsterdam) Jul. 1978 24 p refs
(MC-TW-180/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Existence and approximation problems for periodic solutions of a system of weakly coupled relaxation oscillators are reduced to an algebraic problem. The starting point is a theorem by Mishchenko on periodic solutions of certain singularly perturbed ordinary differential equations. The results obtained are then used to prove some theorems relating to mutually synchronized relaxation oscillations as prototypes of oscillating systems in biology. Author (ESA)

N80-26099# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
SOME CONVEXITY PROPERTIES OF EULER'S GAMMA FUNCTION
J. vandeLune. May 1978. 16 p. refs
(MC-ZW-105/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2.88

Various convexity properties related to Euler's gamma function are discussed. Most of the properties are generalizations of monotonic approximation theorems for integrals. The theorems are developed and proofs are given. Author (ESA)

N80-26100# Sydney Univ. (Australia).
FINITE ELEMENT ANALYSIS OF PROBLEMS WITH INFINITELY DISTANT BOUNDARIES
J. R. Booker and J. C. Small. Nov. 1979. 50 p. refs
(PB80-149230; R-356) Avail: NTIS HC A03/MF A01 CSCL 12A

A method allowing for the presence of infinitely distant boundaries in prismatic bodies is developed. The method is closely related to the consistent boundary concept used in dynamic applications but the development presented is algebraic and context free and is thus applicable to a wide variety of geotechnical problems both static and dynamic. Author (GRA)

N80-26260# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL BRACKETING OF THE EIGENVALUES OF COMPLEX LINEAR STRUCTURES
Philippe Gibert. *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-6 (ESA-TT-632) 1979 p 69-78 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-6, Nov. - Dec. 1979 p 395-400 Original report in FRENCH previously announced as A80-19992 (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-26101 Syracuse Univ., N. Y.
CONFIDENCE INTERVAL ROBUSTNESS OF CORRELATION COEFFICIENT Ph.D. Thesis
Sanchen Patricia Chou. 1979. 195 p
Avail: Univ. Microfilms Order No. 8013366

The problem of constructing robust interval estimate of the Pearson product moment coefficient, rho, when non-normal distributions are considered is investigated. Several robust measures of correlation are investigated including those such as trimmed Pearson coefficient, one version of the biweight measure of correlation. Besides the usual Fisher-Z transformation, two more transformations on measures of correlation are considered for constructing interval estimates of rho. Several contaminated normal distributions were generated. For each distribution, 400 samples were randomly drawn with sample size 20 or 40. Some variance reduction technique was applied to increasing the accuracy of the results. The criteria used to judge the performance of an interval estimate were the robustness of efficiency and robustness of validity. Generally, with sample size 20 the 5 percent trimmed Pearson coefficient is recommended as robust interval estimates of rho. When the sample size is 40, the biweight measure of correlation is preferable.
Dissert. Abstr.

N80-26102 Boston Univ., Mass.
A COMPARISON OF SMOOTH EMPIRICAL BAYES ESTIMATORS Ph.D. Thesis
Jennifer Jane Anderson. 1980. 159 p
Avail: Univ. Microfilms Order No. 8013200

Two smooth nonparametric empirical Bayes rules for a compound estimation problem are developed. Each method involves explicit estimation of the mixing distribution. The empirical Bayes approach to the compound estimation of a location is reviewed. The derivation and implementation of an estimation based on the assumption of a Dirichlet process hyper-prior for the mixing distribution is discussed. The fully nonparametric maximum likelihood estimator is described and implemented using the EM algorithm. A Monte Carlo investigation of the performance under squared loss of the empirical Bayes rules obtained from the distribution estimates is also reported. Two classes of mixing distributions were simulated: discrete, and continuous with components conjugate to the kernel Gaussian and Poisson kernels and sample sizes between 5 and 50 were included. Each of the rules was found to have a range of conditions to which it is superior to Stein's rule or to a parametric empirical Bayes rule, although no one rule is uniformly better. Dissert. Abstr.

N80-26103 Iowa Univ., Iowa City.
TWO SAMPLE LOCATION AND SCALE TESTS FOR DISTRIBUTIONS WITH THE SAME FINITE INTERVAL OF SUPPORT Ph.D. Thesis
Zeinab Selim Soliman. 1979. 286 p
Avail: Univ. Microfilms Order No. 8012427

Adaptive testing procedures for two sample location and scale type problems, when the populations have continuous densities with the same bounded support for two basic adaptive procedures were developed: one procedure uses the first selection process to classify the shape of the null distribution and the second type of adaptive procedure used the estimated Beta parameters to transform the data. Two different transformations were used, one for the location problem and another for the scale. In both location and scale problems, the testing component of the adaptive procedure is the t-test applied to the transformed data. The performances of the adaptive techniques and other competitors were evaluated by means of Monte Carlo studies. For the location problem, it was shown that the second adaptive procedure, with the moment method used to estimate the parameters, was the best among all tests considered. For the scale problem, both types of adaptive procedures did well. The first adaptive procedure is especially recommended if a conservative test is preferred. The Psi sub S test also did well for symmetric underlying Beta distributions. Dissert. Abstr.

N80-26104 Boston Univ., Mass.
A PROPOSED SOLUTION TO THE BEHRENS-FISHER PROBLEM Ph.D. Thesis
Naomi Schwartz Fineberg. 1980. 176 p
Avail: Univ. Microfilms Order No. 8013204

A solution to the Behrens-Fisher problem was developed. It is easily applied by non stastisticians who do not have access to sophisticated computer equipment. A complete study is made of the size and power of this test. The robustness of all solutions discussed were examined. Dissert. Abstr.

N80-26105 Yale Univ., New Haven, Conn.
HYBRID CLUSTERING Ph.D. Thesis
Manshek Anthony Wong. 1979. 125 p
Avail: Univ. Microfilms Order No. 8012510

High density clusters are defined on a population with density f to be the maximal connected sets of form [x/f(x) greater than or equal to C]. It is desired to discover the high density clusters given a random sample of size N from the population. Density estimates generate clusters, namely the high density clusters corresponding to the estimates. The usual kernel type density estimates are expensive to compute, and it is also difficult to determine their high density clusters. A hybrid clustering method is proposed in which observations are first partitioned into a moderate number of clusters by k-means, and the centers of the clusters are then clustered by single linkage. Asymptotic consistency of the method for high density clusters is demonstrated. Empirical comparisons of computing and statistical efficiency are made with single linkage (nearest neighbor density estimation) and mode analysis (kth nearest neighbor density estimation); a very efficient k-means algorithm has been developed which is orders of magnitude faster than the two competing methods. Both artificial and real examples are used to illustrate the performance of this technique. Dissert. Abstr.

N80-26106# California Univ., Livermore. Lawrence Livermore Lab.
JOINT GAUSSIAN PROBABILITY PLOT PROGRAM
S. G. Azevedo and D. T. Gavel. Jan. 1980. 52 p. refs

(Contract W-7405-eng-48)
(UCID-18513) Avail: NTIS HC A04/MF A01

It is shown that the analysis of joint-Gaussian distribution of two variables is aided greatly by meaningful graphical techniques. Two elliptical equi-probability contour plots of the probability density function are produced, one using statistics from the raw data and the other using normalized (zero mean, unit variance) variables. Several separate data sets of the same variables may be plotted, for example, to compare estimators. The techniques discussed for interpreting the plots enable the user to gain insight into the statistical information being displayed. DOE

N80-26107# National Technical Information Service, Springfield, Va.
TIME SERIES FORECASTING AND PREDICTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1980
Jack E. Jones Feb 1980 195 p Supersedes NTIS/PS-79/0081; NTIS/PS-78/0022; NTIS/PS-77/0042
(PB80-804396; NTIS/PS-79/0081; NTIS/PS-78/0022; NTIS/PS-77/0042) Avail: NTIS HC $30.00/MF $30.00 CSCL 12A

A bibliography containing 188 abstracts concerning the use of time series analysis in predicting and forecasting various events is presented. Both specific applications and general theory studies are included. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-26108 Wisconsin Univ. - Madison.
CONTINUOUS TIME SERIES MODELING WITH APPLICATIONS Ph.D. Thesis
Tanakon Ungpiyakul 1979 260 p
Avail: Univ. Microfilms Order No. 8008847

An approach to system and data analysis is introduced in the form of continuous time sense modeling, which develops a stochastic differential equation model from a set of observed discrete data. The parameters in the continuous model are estimated on the basis of the established relationship between the continuous model and the model representing the discrete observations. A nonlinear least squares algorithm is used with the derived expressions for analytical partial derivatives to form a FORTRAN computer program for continuous parameter estimation. The development of a self-contained modeling procedure provides a means to obtain an adequate model from a set of discrete data without requiring any additional information. Two examples of modeling data taken from simulated continuous processes are presented to illustrate the developed modeling procedure. Dissert. Abstr.

N80-26109*# Western Union Telegraph Co., Upper Saddle River, N.J.
THE 30/20 GHz NET MARKET ASSESSMENT
John C. Rogers and Peter Reiner Feb. 1980 151 p
(Contract NAS3-21359)
(NASA-CR-159837) Avail: NTIS HC A08/MF A01 CSCL 12B

By creating a number of market scenarios variations dealing with network types, network sizes, and service price levels were analyzed for their impact on market demand. Each market scenario represents a market demand forecast with results for voice, data, and video service traffic expressed in peak load megabits per second. E.J.R.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-26110 Oklahoma State Univ., Stillwater.
UNIFIED HIGHER ORDER PATH AND ENVELOPE CURVATURE THEORIES IN KINEMATICS Ph.D. Thesis
Malladi Narasimha Siddhanty 1979 91 p
Avail: Univ. Microfilms Order No. 8013047

The instantaneous motion of a body and points and lines in that body are analyzed. Included are: a brief review of the state-of-the-art in instantaneous kinematics and curvature theory; determining the intrinsic invariants of a body in spatial motion considering it as a screw motion; determination of the canonical reference system and instantaneous invariants in that system; determination of stretch rotation characteristic numbers for specifying higher curvatures in a dimensionless form; derivation of characteristic equations for points with paths having the same third order characteristic numbers; development of the higher order tangent line envelope curvature theory deriving equations for tangent lines with envelopes having the same third and fourth order characteristic numbers; and discussion of the plans for the extension of the present study. The literature review reveals the need of developing simple methods to analyze instantaneous rigid body motion and develop path and envelope curvature theories. Methods are developed to describe uniquely the instantaneous rigid body motion in space by first, second, and third order screws and associated intrinsic invariants and to determine the canonical reference system and the associated instantaneous invariants from data with time as the parameter. Dissert. Abstr.

N80-26111# Princeton Univ., N. J. Dept. of Statistics.
RESEARCH ON DATA ANALYSIS IN THE PHYSICAL SCIENCES Final Progress Report, Mar. 1973 - Nov. 1979
J. W. Tukey and P. Bloomfield Nov. 1979 229 p
(Contract EY-76-S-02-2310)
(COO-2310-6) Avail: NTIS HC A11/MF A01

The development of data analytic methods and the improvement of existing methods, their implementation on computer, especially minicomputers, and the development of nonstatistical, systems-level software is reviewed. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-26112 Pennsylvania State Univ., University Park.
DIGITAL WAVEFRONT RECONSTRUCTION FOR ACOUSTICAL APPLICATIONS Ph.D. Thesis
Robert Leslie Cohen 1979 221 p
Avail: Univ. Microfilms Order No. 8010039

Holographic images of plates vibrating below coincidence frequency show radiation from regions of discontinuity and not from other regions. Digitally reconstructed images from acoustic holograms show the radiating part (far-field component) of the pressure at the source location. The image may be interpreted as a monopole distribution which would generate the same far field as did the original source distribution. A near-field scan records the entire field and yields an image which is proportional to the surface velocity of the plate. It shows the modal pattern of the plate vibration. The holographic far field image is

approximately equivalent to the near field image with the high wave numbers filtered out. Since the far field contains spatial frequencies only up to 1/lambda, image resolution is limited by the acoustic wavelength, i.e., the ideal image is convolved with an Airy pattern. Dissert. Abstr.

N80-26113 Washington Univ., St. Louis, Mo.
ELECTRON-PHOTON INTERACTIONS IN PIEZOELECTRIC SEMICONDUCTORS FOR THE PHASE INSENSITIVE DETECTION OF ULTRASOUND Ph.D. Thesis
Lawrence Joseph Busse 1979 222 p
Avail: Univ. Microfilms Order No. 8013458

A method for the noncoherent detection of ultrasound based upon the acoustoelectric effect in cadmium sulfide investigated. The interaction of ultrasound with conduction electrons in a piezoelectric semiconductor provides a means for making quantitative measurements of ultrasonic intensity in situations where wave propagation through random or regular inhomogeneities results in distortion of the ultrasonic wavefronts. The advantages of a noncoherent detection approach, over phase sensitive detection techniques based upon the direct piezoelectric effect, are demonstrated. A formalism describing the interaction of pulsed ultrasound with a piezoelectric semiconductor prepared in the form of a relatively thick (approximately 1 cm) plate is presented. Methods for the design and construction of practical acoustoelectric receivers are illustrated. A comparison of the response of finite aperture phase sensitive (piezoelectric) receivers and phase insensitive (acoustoelectric) receivers to nonuniform ultrasonic radiation is presented. The applicability of phase insensitive receivers to ultrasonic attenuation imaging using the methods of reconstructive tomography is also demonstrated. Dissert. Abstr.

N80-26114 Iowa Univ., Iowa City.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF THE INTERACTION BETWEEN AN ACOUSTIC FIELD AND CYLINDRICAL STRUCTURE ON SOUND TRANSMISSION LOSS Ph.D. Thesis
Allen Carl Fagerlund 1979 118 p
Avail: Univ. Microfilms Order No. 8012365

A theoretical and experimental investigation of the transmission of sound through the walls of a hollow cylinder is pursued by analyzing the interaction between the sound field and structural vibrations. The method used to investigate the problem is based on an energy balance between the internal acoustic field and the vibrational field of the cylinder wall. After the energy balance is established to determine the parameters to be analyzed, each parameter is then examined separately to determine its effect on the overall solution. Statistical energy methods are used to reduce the complexity of the analysis caused by the high number of interacting modes. Initial tests were conducted with a stationary acoustic field in an air filled cylinder and the static pressure near zero. These showed good agreement with the theory in pipes ranging in diameter from 4 to 12 inches and with wall thickness from .237 to .531 inches. When the static pressure was increased, this resulted in an increase in the density of the fluid. The change in transmission loss due to the static pressure increase was correctly predicted by the current analysis. Dissert. Abstr.

N80-26115*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
MEASURED AND PREDICTED IMPINGEMENT NOISE FOR A MODEL-SCALE UNDER THE WING EXTERNALLY BLOWN FLAP CONFIGURATION WITH A QCSEE TYPE NOZZLE
D. J. McKinzie, Jr. Jun. 1980 63 p refs
(NASA-TM-81494; E-432) Avail: NTIS HC A04/MF A01 CSCL 20A

Jet/flap interaction noise was measured and predicted for a small-scale model two-flap, under-the-wing, externally blown flap configuration equipped with and without noise suppression devices. The devices consisted of short spanwise fairings centered in relationship to the jet axis and positioned in the slots between the wing and flaps. The nozzle approximated that of the Quiet Clean Short-haul Experimental Engine (QCSEE). Takeoff noise reductions of 6 dB in the flyover and 5 dB in the sideline plane were obtained over a wide range of radiation angles. Approach noise reductions of about 5 dB were obtained only in the forward quadrant of the flyover plane; no reductions were obtained in the sideline plane. Models of several noise sources were combined analytically to form an overall noise prediction, the results from which compared favorably with the measured data. The aerodynamic performance characteristics for these configurations were substantially the same in the takeoff attitude. However, in the approach attitude, the suppressed configuration produced a 6 percent reduction in the flow turning efficiency. Author

N80-26116# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Technische Akustik.
OPTIMIZATION OF NOISE BARRIERS
Dieter Lohmann Dec. 1978 64 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-648)
(DFVLR-FB-79-29; ESA-TT-648) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 13,30

The effect of sound barriers on the reduction of noise emitted from the jet engines was studied. The Fresnel-Kirchhoff diffraction integral was solved for sound sources with arbitrary intensity patterns. It is shown that an amplifying effect can arise due to diffraction at the edges of the barrier. Author (ESA)

N80-25486# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOTES ON VARIOUS NOISE SOURCES
Robert Legendre *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-5 (ESA-TT-613) 1979 p 1-9 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-5, Sep. - Oct. 1979 p 287-292 Original report in FRENCH previously announced as A80-12354 (For primary document see N80-25485 16-31)
Avail: NTIS HC A05/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-26117 Oregon Univ., Portland.
SOME ASPECTS OF THE QUARK-PARTON MODEL IN THE WEAK AND THE STRONG INTERACTION PHENOMENOLOGY Ph.D. Thesis
Kamala Prasad Das 1979 162 p
Avail: Univ. Microfilms Order No. 8012306

The exact formulation of the guage models unifying the Weak and the Electromagnetic Interactions or the Lagrangian Field Theory of the Strong Interactions, called Quantum Chromodynamics is dependent on experimental findings. We put forward a model for the Weak Interactions to fit all available experimental data after considering a class of proposed models. A new parameter is added to the standard Weinberg-Salam model in order to give the best fit with the experimental data, and several tests for determining this parameter accurately are proposed. A detailed discussion of various future experimental tests and comparisons that can be made with the other existing models are also considered. These include the asymptotic ratio of antineutrino to neutrino deep-inelastic scattering, elastic scattering from protons, direct decays of charmed mesons into neutral leptonic channels, effects in atomic physics, and coherent neutrino-nucleus scattering. It is shown that although the neutral current experiments are the hardest to perform, this aspect of the Weak Interactions gives the best checks and is one of the better ways to sift through the multitude of models. Dissert. Abstr.

N80-26118 State Univ. of New York at Albany.
STUDIES IN RELATIVISTIC MANY-BODY PERTURBATION THEORY FOR ATOMIC SYSTEMS: HYPERFINE PROPERTIES AND FORBIDDEN OPTICAL TRANSITIONS Ph.D. Thesis
Mina Vajed-Samii 1980 245 p
Avail: Univ. Microfilms Order No. 8013684

The relativistic many-body perturbation theory is successfully

applied to the study of properties and processes in the ground and excited states of atomic systems. The properties and processes studied involve hyperfine interactions, both nuclear magnetic dipole and electric quadrupole interactions, correlation energy and oscillator strengths for forbidden transitions. The two aims of our investigation are first, to obtain accurate theoretical results for the individual systems in order to explain available experimental data and second, to gain physical insight into the nature and importance of relativistic and many-body effects by analyzing the trends followed by the various contributing factors for the different properties and systems studied. For our investigation of the magnetic hyperfine interaction, we have chosen the alkali-metal atom series. The relativistic and the nonrelativistic many-body perturbation approach were used to obtain the hyperfine coupling constant for the ground-state and the first three excited S-states of the rubidium atom, a relatively large and heavy atom of the series. In all the multiplet states the experimental results are explained. Dissert. Abstr.

N80-26119 State Univ. of New York at Albany.
RELATIVISTIC MANY BODY PERTURBATION THEORY: APPLICATION TO SPIN-HAMILTONIAN PARAMETERS OF ATOMS AND IONS WITH HALF-FILLED SHELLS Ph.D. Thesis
Krishnaswamy Raghunathan 1980 124 p
Avail: Univ. Microfilms Order No. 8013681

The relativistic ls coupling scheme is used to construct the ground state of many electron atoms, in particular, of S-state atoms with half filled shells. Some properties of the relativistic ls coupled (rls) ground state are discussed. The rls ground state is compared with that obtained from a multi-configurational approach. The suitability of the rls ground state for many body perturbation theory is discussed and it is seen to permit an appropriate adaptation of Bruckner-Goldstone perturbation expansion for relativistic theory. The high lights of our approach are: (1) the ls coupled basis of the theory permits the use of spin-orbit interaction as a perturbation even on a relativistic ground state and (2) the relativistic nature of the ground state enables the evaluation of the perturbative influence of Breit interaction on many electron wave functions. The rls formalism is tested by applying it to the quadrupole interaction in the ground state of 14 N atom. The relativistic formalism is fully exploited by evaluating the influence of Breit interaction explicitly. It is demonstrated that Breit interaction is crucial for an explanation of the experimental quadrupole interaction observed in this system. Dissert. Abstr.

N80-26120 Carnegie-Mellon Univ., Pittsburgh, Pa.
MOLLER-PLESSET ELECTRON CORRELATION STUDIES OF ATOMS AND SMALL MOLECULES Ph.D. Thesis
John Stephen Binkley 1979 149 p
Avail: Univ. Microfilms Order No. 8012771

The electron correlation problem is studied using Moller-Plesset perturbation theory terminated at second order. The theory is applied to determining the limiting ground state energies of the atoms helium to neon. Using large uncontracted Gaussian basis sets, equilibrium geometries are obtained for the ground states and some excited states of the hydrides AH and AH2 where A is of a first row atom (Li, Be, ..., F). Dissociation energies and the energy separations for states of different spin multiplicity are presented. This second order theory is also applied to determining the equilibrium geometries of some one and two heavy atom molecules. Theoretical structures are compared with available experimental data. Finally, the theory is applied to the questions of the energy ordering of the bridged and classical forms of the vinyl-cation, carbon-beryllium binding in CH2Be, the Lewis acid-base interaction of H2 with BH3 to form BH5, and the predicted energy ordering of the cis- and trans-isomers of 1,2-difluoroethylene. An appendix summarizing the computational details is also included. Dissert. Abstr.

N80-26121 Texas A&M Univ., College Station.
SPECTROSCOPIC STUDIES OF MOLECULAR STRUCTURE AND INTRAMOLECULAR DYNAMICS Ph.D. Thesis
Paul William Jagodzinski 1979 230 p
Avail: Univ. Microfilms Order No. 8011957

In an effort to better understand intramolecular forces, the structure and dynamics of a variety of molecules were analyzed using vibrational spectroscopy, quantum mechanics, and group theory. By examining samples in the solid, liquid, and gaseous phases it was shown that more information concerning intramolecular forces can be obtained from vapor phase studies in which intermolecular forces are minimized. Dissert. Abstr.

N80-26122 Texas A&M Univ., College Station.
IN-DEPTH ANALYSIS OF CONFORMATIONAL CHANGES IN SMALL RING MOLECULES Ph.D. Thesis
Joel Middleton Cooke, Jr. 1979 202 p
Avail: Univ. Microfilms Order No. 8011933

The low frequency far infrared and Raman spectra of 1,3-disilacyclobutane exhibit a series of transitions that are characteristic of the ring-puckering vibration. The motion of 1,3-disilacyclobutane during the ring-puckering vibration was investigated by a one dimensional analysis of the ring-puckering data for isotopically related disilacyclobutanes. The ring-puckering data were analyzed by the inclusion of kinetic energy expansions in the Hamiltonian. The model in which rocking was included fit the data better than the model in which rocking was not allowed. Silacyclobutane-1-d1 qas synthesized and the far infrared spectrum recorded and analyzed. The ring-puckering data for three isotopic forms of silacyclobutane were analyzed simultaneously with kinetic energy expansions incorporated in the Hamiltonian. Theoretical calculations were carried out to determine the importance of subtle effects of the Hamiltonian. Dissert. Abstr.

N80-26123 Washington Univ., Seattle.
VIBRATIONAL ENERGY TRANSFER BY MOLECULAR COLLISIONS AT HIGH TEMPERATURES UTILIZING THE DIFFUSION CLOUD TECHNIQUE Ph.D. Thesis
John Fred Burkhalter 1980 147 p
Avail: Univ. Microfilms Order No. 8013503

The development of the diffusion cloud technique and its application to the study of unimolecular reactions at high temperatures is discussed. An apparatus was first constructed to study the hydrodynamics of the method, using a nonreacting vapor, mercury. A second apparatus was built for high temperature studies. Cyclopropane was studied at 973 K and 1173 K. Relative collisional efficiencies were determined and the vibrational energy transferred on a collisional basis is reported for the bath gases helium, nitrogen, hydrogen, and carbon dioxide. The average energy down-jump size at 973 K was approximately 200, 400, 150, and 1100 cm-1, respectively. These values decrease with increasing temperature to 1175 K. The absolute rates were determined by a calibration technique. In a separate experiment, the apparatus was modified to collect all of the reactant-product mixture. With this modification, absolute rates were determined at 973 K and 1073 K for 1,1-cyclopropane-d sub 2 with the bath gases nitrogen and helium. The relative rates of the competitive isotopic isomerization channels were also measured. Values of the average energy down-jump size were computed from both the absolute rates and the isotopic relative rates by suitable modeling. Dissert. Abstr.

N80-26124# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THERMODYNAMIC PROPERTIES OF EXTENDED HUBBARD MODEL WITH STRONG INTRAATOMIC ATTRACTION AND ARBITRARY ELECTRON DENSITY
S. Robaszkiewicz (A. Mickiewicz Univ., Poland), R. Micnas, and K. A. Chao (Linkoeping Univ., Sweden) Apr. 1980 35 p refs Revised
(INPE-1726-NTE/158-Rev) Avail: NTIS HC A03/MF A01

A canonical transformation is used to derive an effective extended Hubbard Hamiltonian with intraatomic repulsion and Ising-type interatomic exchange interaction in an effective external magnetic field from the extended Hubbard model with intraatomic attraction. The absence of magnetic ordering in the original Hamiltonian is transformed into the condition of one quasiparticle per atom. In the strong intraatomic attraction limit, we can further derive from the transformed Hamiltonian an antiferromagnetic anisotropic Heisenberg Hamiltonian in an external field and with a given value of magnetization. A phase diagram of the charge ordered, the singlet superconducting, the mixed, and the nonordered phase is then obtained with the mean field approximation. The collective excitations are examined in the MFA states.

For various special cases results reduce to the known results or the exact solutions. J.M.S.

N80-26125*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
REVIEW OF SPECTROSCOPIC DATA FOR MEASUREMENTS OF STRATOSPHERIC SPECIES
Aaron Goldman, ed. (Denver Univ.) and James Hoell, ed. Jun. 1980 34 p Workshop held at Hampton, Va., 29-30 Oct. 1979
(NASA-CP-2136; L-13768) Avail: NTIS HC A03/MF A01 CSCL 20H

Results and recommendations from a two day workshop are discussed. A review of the current status of experimental and theoretical spectroscopic data on molecules of stratospheric interest is given along with recommendations for additional research. Methods for disseminating new and existing data are also discussed. E.J.R.

N80-26126# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.
COLLISIONAL STUDIES OF IONIZATION PROCESSES WITH HEAVY PARTICLE AND PHOTON Final Report, 1 Aug. 1976 - 31 Oct. 1979
Erhard W. Rothe and Gene P. Reck Jan. 1980 31 p refs
(Grants DAAG29-78-G-0136; DAAG29-78-G-0125)
(AD-A082640; ARO-14133.10-C) Avail: NTIS HC A03/MF A01 CSCL 07/4

This is the final report for grant DAAG-29-78-G-0125, which has been a joint project with the Air Force. Advances in chemical dynamics are not usually achieved by a single experiment but rather by a blend of informations using a variety of techniques. As a consequence, the results of this research project may be classified in separate categories: (1) preparation of and experiments with electronically excited atoms and molecules; and (2) measurements of kinetic energy thresholds for ion-pair production from molecular collisions, with subsequent derivation of molecular binding energies and electron affinities. In experiments of type (1) electronically excited sodium was used to promote the chemi-ionization reaction with O2 and SO2. Two photon ionization of Na2 and Li2 was also studied in order to investigate laser selection. GRA

N80-26127# Stanford Linear Accelerator Center, Calif.
CHARMED MESON PRODUCTION AND DECAY PROPERTIES AT THE psi(3770) Ph.D. Thesis
Rafe Hyam Schindler May 1979 220 p refs
(Contracts EY-76-C-03-0515; DE-AC03-76SF-00515)
(SLAC-219) Avail: NTIS HC A10/MF A01

A remeasurement of the resonance near E sub cm = 3.77 GeV in the e(+)e(-) annihilation is presented. The properties of the resonance are used to deduce branching fractions of charmed mesons into hadronic final states. Several previously unseen decay modes are reported. Decays into Cabibbo suppressed final states are observed. The inclusive properties of D meson decays are studied, including strangeness and charged particle multiplicity. The semileptonic branching fractions for D(o) and D sup - or + are measured, providing a determination of the relative lifetimes of these particles. DOE

N80-26128# Illinois Univ., Urbana. Materials Research Lab.
PHONON-DISLOCATION INTERACTION
A. C. Anderson 1979 8 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1281) Avail: NTIS HC A02/MF A01

The physical nature of the interaction of thermal phonons with dislocations is examined through a review of experimental data on crystal of LiF. Thermal conductivity measurements on LiF crystals in the temperature range 0.04 to 30 K demonstrate that, throughout this range, thermal phonons interact with dislocations via a dynamic or resonant process which is highly frequency and phonon mode dependent. The results of earlier work are consistent with this interpretation. DOE

N80-26129# SRI International Corp., Menlo Park, Calif.
IMPORTANT ATOMIC COLLISION PROCESSES IN THE HEAVY ION INERTIAL FUSION PROGRAM
R. E. Olson 24 Aug. 1979 26 p
(Contract EY-76-C-03-0115)
(SAN-0115-137-1) Avail: NTIS HC A03/MF A01

The charge changing cross sections needed to assess the feasibility of using a synchrotron accelerator in the heavy ion fusion program were determined. Two systems were studied in detail, Cs(+) + Cs(+) and Xe(+8) + Xe(+8), for which at a collision energy of 100 keV the charge changing cross sections were predicted to be 4 x 10 to the -16th power sq cm and 1 x 10 to the -16th power sq cm. With reference to collisional processes occurring in the target region of a heavy ion fusion reactor, a model was developed to predict the ionization cross sections of a buffer gas upon passage of a multiply charged ion. DOE

N80-26130# Pennsylvania State Univ., University Park.
OSCILLATOR STRENGTHS FOR HIGHLY IONIZED ATOMIC SYSTEMS Final Report, 1 May 1977 - 30 Dec. 1979
Charlotte Froese Fischer Dec. 1979 19 p refs
(Contract EG-77-S-02-4264)
(COO-4264-13) Avail: NTIS HC A02/MF A01

Oscillator strengths (or f-values) for resonance transitions in highly ionized atoms have assumed importance in fusion plasma research. Beam foil spectroscopy has been able to deduce some of these values but present experimental limitations restrict its applicability. A theoretical study of trends along an isoelectronic sequence has provided an alternative approach. The Multiconfiguration Hartree-Fock method is a general theoretical method for determining wavefunctions for atomic states from which oscillator strengths can be computed. A first order theory has been shown to yield reliabile f-values provided the ionization energy is predicted with reasonable accuracy and the transition matrix element is not sensitive to cancellation effects. General computer programs have been developed for this method and extended to include the dominant relativistic effects. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles, and reactor theory.

For space radiation see *93 Space Radiation*.

N80-26131# Battelle Pacific Northwest Labs., Richland, Wash.
RESEARCH AND DEVELOPMENT ACTIVITIES: HIGH-LEVEL WASTE IMMOBILIZATION PROGRAM Quarterly Progress Report, Jan. - Mar. 1979
J. L. McElroy, J. E. Mendel, W. F. Bonner, and M. H. Henry Nov. 1979 50 p refs
(Contract EY-76-C-06-1830)
(PNL-3050-1) Avail: NTIS HC A03/MF A01

The conversion of liquid waste, made from zirconium-clad UO2 power reactor fuel with an average burnup of 25,000 MWd/MT, to glass by the in-can melting process is discussed. An intrinsic-gamma melt-level detection system was tested; results showed that if a sufficient number of collimators are used the system will track the melt surface with a precision of 1 in. during the filling of cans with waste glass. One canister contains 116 kg of glass that generated 0.38 kW of self-heat when produced; the other contains 145 kg of glass, and generates 1.01 kW. Spray calcination of simulated Savannah River Plant liquid waste at a rate of 400 L/h was demonstrated in the 36 in. dia. calciner. Five waste forms are being compared: concrete-containing waste calcine, sintered waste glass, glass-ceramic, Synroc B (a crystalline assemblage of titanates), and borosilicate waste glass (composition 76-68). Results of initial tests indicate that the reaction rate of carbon with water, previously found to be very low, may be increased in a radiation field. DOE

N80-26132# Battelle Pacific Northwest Labs., Richland, Wash.
DEVELOPMENT AND CHARACTERIZATION OF SOLIDIFIED FORMS FOR HIGH LEVEL WASTES Annual Report, 1978
W. A. Ross, ed. and J. E. Mendel, ed. Dec. 1979 108 p refs
(Contract EY-76-C-06-1830)
(PNL-3060) Avail: NTIS HC A06/MF A01

Development and characterization of solidified high level waste

forms, directed at determining both process properties and long term behaviors of various solidified high level waste forms in aqueous, thermal, and radiation environments is discussed. Aluminum, nickel and iron were all found to increase the formation of nickel-ferrite spinel crystals in the waste glass. Four multibarrier advanced waste forms were produced on a one liter scale with simulated waste and characterized. Glass marbles encapsulated in a vacuum-cast lead alloy provided improved inertness with a minimal increase in technological complexity. Supercalcine spheres exhibited excellent inertness when coated with pyrolytic carbon and alumina and put in a metal matrix, but the processing requirements are quite complex. Effects caused by decay of actinides can be estimated to saturate at near 10 to the 19th power alpha-events/cu cm in homogeneous solids. Actually, in solidified waste forms the effects are usually observed around certain crystals as radiation causes amorphization and swelling of the crystals. DOE

N80-26133# California Univ., Livermore. Lawrence Livermore Lab.
GEOSCIENCE DATA BASE HANDBOOK FOR MODELING A NUCLEAR WASTE REPOSITORY, VOLUME 1
Dana Sherwood, David Carpenter, Willard Murray, Abelardo Ramirez, Donald Towse, Shosei Serata, Stefan Milnor, and Bartlett Paulding. Dec. 1979. 327 p. refs. Prepared in cooperation with Serata Geomech., Inc. Berkeley, Calif. and Geotech. Eng., Inc., Winchester, Mass.
(Contract W-7405-eng-48)
(NUREG-CR-0912-Vol-1; UCRL-52719-Vol-1) Avail: NTIS HC A15/MF A01

Reference information on parameters that should be considered in analyzing or modeling a proposed nuclear waste repository site is presented. In particular, salt as a repository medium is considered. The geology of bedded and dome salt, the geomechanics of salt, hydrology, geochemistry, natural and man-made features, and seismology are discussed. DOE

N80-26134# Cincinnati Univ., Ohio.
INELASTIC STRONG INTERACTIONS AT HIGH ENERGIES Annual Progress Report, 1 Jun. 1979 - 1 May 1980
Peter Suranyi. Feb. 1980. 9 p. refs.
(Contract EY-76-S-02-2978)
(COO-2978-5) Avail: NTIS HC A02/MF A01

Results of investigations in the area of grand unified field theories are presented. Various ways of breaking the SU(5) symmetric theory were studied. As usual, an approximate 24 of Higgs breaks the symmetry from SU(5) to SU(3) sub cxSU(2)xU(1). It is found that an approx. 45 of Higgs is acceptable for breaking the symmetry from SU(3) sub cxSU(2)xU(1) to SU(3) sub cxU(1) sub em. In addition phenomenologically correct quark-lepton mass ratios are obtained by use of renormalization group techniques if there are six generations of particles in the theory. Efforts directed at the development of approximate methods for extracting information from quantum field theories were continued. The quantum mechanics of polynomial potentials as a model for quantum field theories was investigated. A perturbation expansion for the energy levels and wave functions was constructed and is proven to be convergent for arbitrary values of the coupling constants, in contrast to ordinary perturbation expansions that have a zero radius of convergence. DOE

N80-26135# Oak Ridge National Lab., Tenn.
NUCLEAR WASTE MANAGEMENT: A PERSPECTIVE
R. E. Leuze. 1980. 37 p. Presented at Am. Nucl. Soc., Tulsa, Okla., 15 Jan. 1980.
(Contract W-7405-eng-26)
(CONF-800117-1) Avail: NTIS HC A03/MF A01

The scope of the problems with nuclear waste management is outlined. Present and future inventories of nuclear wastes are assessed for risk. A discussion of what is presently being done to solve waste management problems and what might be done in the future is presented. DOE

N80-26136# Ames Lab., Iowa. Dept. of Physics.
NUCLEAR MAGNETIC RESONANCE WIDE-LINE STUDY OF HYDROGEN IN THE YTTRIUM-YTTRIUM DIHYDRIDE SYSTEM M.S. Thesis
David LaVern Anderson. Mar. 1980. 126 p. refs.
(Contract W-7405-eng-82)
(IS-T-877) Avail: NTIS HC A07/MF A01

The H-1 nuclear magnetic resonance was studied in the yttrium hydrogen system (YHx in the composition range 0.20 less than or equal to x less than or equal to 1.98, and temperature range 77K< or equal to T< or equal to 490K). Both alpha and beta phases of YH sub x were investigated in polycrystalline (powdered) specimens. The second moments of the rigid lattice proton resonance were obtained for both alpha and beta phase samples. Analysis of the second moment for alpha YH sub x (alpha phase) indicates that the hydrogen resides in both the tetrahedral and octahedral interstitial sites of the hcp y lattice. Second moment values for beta-YH (beta phase) indicate that a sizeable fraction of the octahedral interstitial sites of the fcc yytrium metal lattice are occupied by hydrogen, while a nonnegligible fraction of the tetrahedral interstitial sites are vacant. The results for beta-YHx also indicate that as the H concentration increases, the probability of H occupation of octahedral sites increases. DOE

N80-26137# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
NUCLEAR INTERACTIONS OF LOW ENERGY LITHIUM IONS Progress Report, 1 Jun. 1979 - 31 May 1980
Edwin Norbeck. Feb. 1980. 32 p. refs.
(Contract DE-AC02-79ER-10409)
(COO-10409-1) Avail: NTIS HC A03/MF A01

Elastic scattering Li-6 + Li-6 and Li-7 was studied for E sub b/ =2.0 to 5.5 MeV. A double folding optical potential model provided a good fit to the data for Li-7 + Li-7, over the entire energy range and for Li-6 + Li-6 with energies low enough so that the breakup Li-6 yields alpha + d does not occur. At higher energies, the potential falls off rapidly. At 5.5 MeV the potential well was 36% as deep as was predicted by the folding model. The 2.0 MeV double folded potential allowed a magnificient fit to the experimental data when the 2Li-6 yields 3 alpha reaction was used in a DWBA calculation. The total cross section for producing a neutron from Li-7 + Li-7 was measured for a number of energies. These cross sections compare favorably with the total reaction cross section calculated from the partial wave amplitudes generated from the folding model potentials. The cross sections were large. The cross section at E sub b = 4.0 MeV was 0.475 b. DOE

N80-26138# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
SUMMARY OF THE FUSION-FISSION HYBRID FUEL CYCLE ANALYSIS (TRITIUMLESS HYBRIDS)
G. A. Moses, comp. Dec. 1979. 34 p. refs.
(Contract EY-76-S-02-2272)
(UWFDM-337) Avail: NTIS HC A03/MF A01

Fusion-fission hybrid reactors were used for the fusion to impact the energy productions. The elimination of the tritium breeding function in the fusion blanket and its effect on the early introduction of hybrid reactors are discussed. DOE

74 OPTICS

Includes light phenomena.

N80-26139 Howard Univ., Washington, D. C.
APODIZATION OF OPTICAL SYSTEMS WITH POOR RESOLVING POWER Ph.D. Thesis
John Ngumi Kibe. 1979. 146 p.
Avail: Univ. Microfilms Order No. 8013097

Wilkins proposed and solved the problem, referred to as problem A, of finding for a passive rotationally symmetric optical system a pupil function that produces a diffraction pattern for a point object on the optical axis that has a specified Rayleigh limit of resolution. Barakat has formulated and attacked the problem, referred to as problem B, of maximizing the central irradiance when the diffraction patterns are required, in addition, to have the same over-all transmittance, specified in advance. The mathematical formulation, used for the physical problems just stated is that conventionally accepted in apodization theory.

When thus formulated, the stated problems are ones in the calculus of variations with inequalities as constraints. The pupil functions found for problem A by applying a general theory for such variational problems are step functions with values + or - 1 and with two discontinuities the locations of which depend on the specified limit of resolution. In problem B, the similarly found pupil functions depend on the value of the over-all transmittance and the Rayleigh limit of resolution. In light of this, some pupil functions will be smooth; others will consist of two or more smooth pieces intersecting at corners, depending on how large the over-all transmittance is for each case.
Dissert. Abstr.

N80-26140# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)
EIGENVALUES FOR UNSTABLE RESONATORS WITH SLIGHTLY MISALIGNED STRIP MIRRORS
C. Santana and L. B. Felsen. May 1980. 17 p. refs. Revised. Submitted for publication.
(INPE-1738-RPE/137-Rev) Avail: NTIS HC A02/MF A01

Very small misalignments in unstable strip resonators may cause detachment of the low loss eigenmode at lower equivalent Fresnel number, N sub eq, and introduce different periodicities into the eigenvalue curve as a function of N sub eq. Using the resonance equation developed previously from waveguide mode theory, this behavior is explained in physical terms by coupling between mode fields with even and odd symmetry, which are uncoupled in the perfectly aligned configuration. A simplified explicit equation derived for the eigenvalues of the detached mode is found to predict correctly the periodicities of the eigenvalue oscillations. The waveguide method continues to provide an explicit and reliable procedure for rapidly locating the maxima and minima of the detached mode eigenvalues over broad ranges of N sub eq.
Author

N80-26141# Hughes Research Labs., Malibu, Calif.
INFRARED FIBER OPTICS. Interim Technical Report, 14 Apr. 1978 - 14 Apr. 1979
J. A. Harrington, R. Turk, M. Henderson, and Jon Myer. Griffiss AFB, N.Y. RADC. Dec. 1979. 52 p.
(Contract F19628-78-C-0109; AF Proj. 2306)
(AD-A082450; RADC-TR-79-290) Avail: NTIS HC A04/MF A01 CSCL 20/6

This interim technical report summarizes the first year's research efforts to fabricate optical communications fibers that are transmissive between 1 and 12 micrometers. The ultimate objective of this program is to prepare infrared transmitting fibers with losses less than 5 dB/km. In preparing infrared transparent fibers with these losses, we are emphasizing the extrusion into fiber of very pure KCl as this material has demonstrated bulk losses equal to or less than 5 dB/km in the 2 to 6 micrometers region. The primary approach used to meet the program goals, therefore, was the extrusion of reactive atmosphere process (RAP) grown KCl into 250 to 1000 micrometers-diameter optical fibers. After one year of effort, the best KCl fiber extruded had a loss of 4200 dB/km. This report also summarizes our efforts in fabricating a special infrared fiber prototype device for the detection of pulsed CO2 laser radiation. The prototype device, which is to be used in a battlefield identification friend or foe (BIFF) application, was successfully field tested in Germany.
GRA

N80-26142# Hughes Research Labs., Malibu, Calif.
MICROWAVE FIBER OPTICS DELAY LINE. Final Report, 25 Jun. - 24 Dec. 1979
C. Slayman and H. W. Yen. Jan. 1980. 31 p.
(Contract N00173-79-C-0098)
(AD-A082505) Avail: NTIS HC A03/MF A01 CSCL 20/6

A microwave delay line is one of the devices used in EW systems for preserving the frequency and phase contents of RF signals. For such applications, delay lines are required to have large dynamic range, wide bandwidth, low insertion loss, and a linear response. The basic components of a fiber-optics delay line are: an optical source, a wideband optical modulator, a spool of single-mode fiber with appropriate length to provide a given microwave signal delay, and a high-speed photodetector with an RF amplifier. This contract program is to study the feasibility of such a fiber-optic delay line in the frequency range of 4.0 to 6.5 GHz. The modulation scheme studied is the direct modulation of injection lasers. The most important issue identified is the frequency response of the injection laser and the photodetector.
GRA

N80-26143# Cornell Univ., Ithaca, N. Y.
OPTICAL PROPERTIES OF METALLIC SURFACES, SMALL PARTICLES AND COMPOSITE COATINGS FOR SOLAR ENERGY CONVERSION APPLICATIONS. Final Technical Report, 1 Apr. 1977 - 31 Aug. 1979
N. W. Ashcroft, R. A. Buhrman, A. J. Sievers, and J. W. Wilkins. Dec. 1979. 26 p. refs.
(Contract EG-77-S-03-1456)
(DOE/ET-20413/1) Avail: NTIS HC A03/MF A01

A combined theoretical experimental-program to understand the optical properties of heterogeneous materials is described. The primary experimental quantity measured was the optical response from the visible to the far infrared. The production, structure and optical properties of composite metal-insulator cermet films were investigated. Using effective medium theories the optical properties were calculated and compared to experimental measurements. Studies of the design of spectrally selective solar energy absorbers using cermet films were made both experimentally and with computer simulation. Composite films were produced by controlled coevaporation of the metal and an insulator. The materials used include Ni, V, Fe, and Pt metals with dielectrics Al2O3, SiO2, MgO and ZrO2. Some preliminary results on amorphous aluminum are described. Crystalline aluminum has the disadvantage that its reflectance in the visible is smaller than those of some good free electron metals such as silver, which is unsuitable as a front surface reflector because of rapid corrosion. Interband transitions depress the reflectivity of aluminum in the solar spectrum. If these interband transitions could be eliminated and the free electron reflectance of aluminum obtained, a superior reflective coating would result.
DOE

N80-26144# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
MECHANICAL AND DIELECTRIC PROPERTIES OF OPTICAL FILMS. Final Report
R. P. Wenz, J. F. Fontanella, M. Shure, R. W. Hoffman, and D. E. Schuele. 1979. 61 p. refs. Prepared for California Univ., Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15098) Avail: NTIS HC A04/MF A01

The intrinsic stress and microstructure of vacuum deposited TiO sub s thin films were studied as a function of oxygen partial pressure and substrate temperature (T sub s). Auger electron spectroscopy combined with Rutherford backscattering spectroscopy provided quantitative depth profiles of composition. Transmission electron microscopy and selected area diffraction allow structural characterization. For T sub s < 150 C the films are amorphous and the stress is independent of film thickness. In addition, stress changes occur upon exposure to room air resulting in a final stress of 3 x 10 to the 9th power dynes sq cm independent of the oxygen partial pressure and substrate temperature. At T sub s = 300 C the stress is again constant with film thickness having a value of 6 x 10 to the 9th power dynes sq cm independent of the oxygen partial pressure. However, the stress is stable upon exposure to room air. At T sub s = 300 C the films are polycrystalline with regions of TiO2 (anatase). Compositional data showed large variations, possibly indicating a void structure with varying quantities of water vapor.
DOE

N80-26145# Sandia Labs., Albuquerque, N. Mex.
FRACTURE ANALYSIS OF OPTICAL FIBERS
J. J. Mecholsky. 1980. 18 p. refs. Presented at Fiber Optic in the Nucl. Environment Symp., Adelphi, Md., 25 Mar. 1980.
(Contract EY-76-C-04-0789; DARPA Order 3285)
(SAND-79-2431C; CONF-800307-3) Avail: NTIS HC A02/MF A01

The quantitative relation of the fracture markings on glass optical fiber surfaces to the strength and time under load is demonstrated. Knowledge of the fracture initiating defects and the surrounding topography pinpoints the source of failure, aids in troubleshooting, and improves production procedures. It is

shown that the techniques of fracture surface analysis help analyze in-service failures as well as improve fiber optic production control. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-26146 Massachusetts Univ., Amherst.
EXPERIMENTAL INVESTIGATION OF GAS FLOW DYNAMICS OF AN INDUCTIVELY COUPLED ARGON PLASMA Ph.D. Thesis
John Lawrence Genna 1980 360 p
Avail: Univ. Microfilms Order No. 8012605

The flow phenomena of an argon inductively coupled plasma was investigated utilizing impact pressure measurements, high speed photography, and Schlieren photography. In addition, in order that local argon physical properties within the discharge, such as viscosity and density, could be calculated, detailed temperature determinations were performed utilizing the absolute intensities of Ar I lines and argon continuum. Measurements were performed over a variety of flow conditions including variations in flow rate of the plasma and aerosol flows. In addition, several torch configurations were investigated. A modification of the conventional ICP torch was made which increased the swirl velocity of the plasma gas allowing for reduced gas consumption while maintaining the analytical performance characteristics of conventional torches. Velocity measurements indicate three well-defined regions within the ICP. These include the aerosol channel, luminous core region, and a high plasma flow region near the torch walls. Both temperature and velocity measurements indicate little interaction of these flow regions while still within the confines of the plasma torch. Dissert. Abstr.

N80-26147 Pennsylvania Univ., Philadelphia.
TWO DIMENSIONAL ANALYSIS OF THE PHOTOIONIZATION CHAMBER Ph.D. Thesis
Donald Michael Giorgione 1979 149 p
Avail: Univ. Microfilms Order No. 8009407

An analysis of the photoionization chamber is presented wherein the rate of ionization is assumed to vary with both x (normal to chamber centerline) and z (parallel to the chamber center-line). Depending on the degree of ionization, which is proportional to alpha, the analysis can naturally be divided into three distinct regions. At relatively high ionization rates ambipolar diffusion occurs. In this region the ion and electron densities are necessarily large to balance production. The electric field, however, must remain finite. This region is known as the quasi-neutral region. The boundary layer equations are obtained by rescaling variables. For relatively low rates of ionization the free diffusion region exists. In this region the ion and electron densities are necessarily small. The potential due to charge separation is also small but the applied battery voltage, V, is arbitrary. When V is O(alpha), the governing equations can be simplified to the extent that analytical solutions can be obtained. However, when V is large, solutions must be obtained numerically. For intermediate rates of ionization between these two limits, no simplification of the governing equations occurs, and solutions must be obtained using numerical methods. Dissert. Abstr.

N80-26148 College of William and Mary, Williamsburg, Va.
NONLINEAR EVOLUTION OF THE MAGNETOHYDRODYNAMIC SHEET PINCH Ph.D. Thesis
William Henry Matthaeus 1979 200 p
Avail: Univ. Microfilms Order No. 8014019

The evolution of a sheet pinch is simulated using a spectral-method, incompressible, two dimensional turbulence code. Several diagnostics are employed, especially contour plots of the relevant fields, which display the status of the system visually. The nonlinear effects which seem to be the most important are current filamentation: a concentration of electric current density onto sets of small measure near a magnetic X-point, and rapid expulsion of magnetofluid from the X-point region parallel to the current sheet. Dissert. Abstr.

N80-26149 Tennessee Univ., Knoxville.
CHARGE EXCHANGE MEASUREMENTS OF ION BEHAVIOR IN THE ISX TOKAMAK Ph.D. Thesis
George Hutchinson Neilson 1979 198 p
Avail: Univ. Microfilms Order No. 8012481

Analysis of charge exchange neutrals is the standard method for measuring ion behavior in Tokamak plasmas. Limitations of this technique, which arise in dense and neutral beam heated plasmas, are discussed. Two refinements which address these limitations are described: a neutral particle analyzer which incorporates both mass and energy resolution to distinguish different ion components such as the fast and thermal ions in beam-heated plasmas; and an improved data analysis procedure which accounts for the effects of profiles and neutral attenuation in dense plasmas. A simple Monte Carlo neutral transport code was developed and used to investigate the effects of toroidally asymmetric neutral density profiles. Applications of these methods to experiments in ISX are discussed; they include energy confinement studies on ISX-A, neutral beam heating and high beta studies on ISX-B and pellet fueling studies on ISX-B. Dissert. Abstr.

N80-26150 Washington Univ., Seattle.
STIMULATED RAMAN SCATTERING FROM AN UNDERDENSE HYDROGEN PLASMA Ph.D. Thesis
Robert Gregory Watt 1979 195 p
Avail: Univ. Microfilms Order No. 8013613

Measurements of wavelength shifted backscattered radiation from several underdense hydrogen plasmas irradiated with high intensity 10.6 laser radiation was performed. Wavelength shifts consistent with those predicted for the stimulated Raman scattering parametric instability were observed. The intensity dependence of the backscattered radiation was shown to be exponential as predicted. An apparent saturation was observed at the highest intensity levels used which cannot be explained by the traditional nonlinear saturation mechanisms. A macroscopic temperature increase and corresponding density decrease due to classical inverse bremsstrahlung heating was proposed as the cause of this apparent saturation. The frequency dependence of the backscatter was shown to be more complicated than predicted on the basis of the infinite, homogeneous plasma theory. Observations of spectrally resolved backscatter with a wavelength shift consistent with that predicted for stimulated Brillouin scattering were made in the higher density and temperature plasma. Indirect evidence of the presence of stimulated Brillouin scattering was observed in the low density and temperature experiment. Dissert. Abstr.

N80-26151# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EFFECT OF ION DYNAMICS ON RELATIVISTIC NONLINEAR PLASMA OSCILLATIONS
Abraham C.-L. Chian Apr. 1980 37 p refs Revised
(INPE-1704-RPE/122-Rev) Avail: NTIS HC A03/MF A01

Relativistic nonlinear longitudinal waves in a cold plasma are studied by including ion dynamics in the analysis. All wave velocities are considered. Wave solutions with arbitrary plasma stream velocities are obtained by a suitable choice of a dynamic parameter. The solutions of the problem can be reduced to two equations related to conservation of energy and momentum of the system. For large amplitude waves, ion dynamics play an important role in the wave properties. Author

N80-26152# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RELATIVISTIC NONLINEAR CYCLOTRON WAVES IN A HOT ELECTRON-ION PLASMA
A. C.-L. Chian Apr. 1980 14 p refs Revised Submitted for publication
(INPE-1723-RPE/128-Rev) Avail: NTIS HC A02/MF A01

The propagation of relativistic nonlinear circularly polarized waves along a uniform magnetic field in a streaming hot electron-ion plasma is examined. It is shown that, in the presence of extremely intense waves, the ions play an important role on

wave properties. In addition, it is shown that a finite temperature increases the effective inertia of plasma. Author

N80-26153# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TWO-DIMENSIONAL EQUILIBRIUM OF FIELD-REVERSED ION RINGS
Gerson Otto Ludwig May 1980 46 p refs Revised
(INPE-1724-RPE/129-Rev) Avail: NTIS HC A03/MF A01

The axially symmetric equilibrium of intense ion rings is examined for field-reversed configurations. A rigid rotor model is assumed for the ion distribution, with background or accompanying electrons providing space charge neutralization. This equilibrium configuration is described by three macroscopic quantities, the ring particle density, the ring pressure, and the azimuthal component of the vector potential. Within the Vlasov-Maxwell framework, these quantities must satisfy Ampere's law and the pressure balance equation. The system of equations is completed assuming that the pressure and the density satisfy a general power law (equation of state). The equilibrium solution for intense ion layers (one dimensional problem) is examined in the general case, but for intense ion rings (two dimensional problem) the analysis is restricted to the uniform particle density case. The sharp boundary that separates the constant density and zero density regions is approximated by a stepwise function and determined for several values of the ring parameters. Author

N80-26154# Nagoya Univ. (Japan). Institute of Plasma Physics.
NEW TYPE OF RAY TRAJECTORY OF THERMAL MODE IN AN INHOMOGENEOUS MAGNETOPLASMA
H. Sanuki, T. Watanabe (Hiroshima Univ.), and T. Ohnuma (Tohoku Univ.) Mar. 1980 17 p refs
(IPPJ-447) Avail: NTIS HC A02/MF A01

The three dimensional behavior of the ray trajectory of thermal modes are numerically investigated. The ray trajectory of the thermal mode is shown to represent a different type of ray characteristic from the usual resonance cone. The preliminary numerical results associated with the ray tracing of thermal mode in an inhomogeneous magnetoplasma are presented. E.D.K.

N80-26155# Nagoya Univ. (Japan). Institute of Plasma Physics.
A DISC LaB6 CATHODE FOR PLASMA PRODUCTION IN MAGNETIC FIELD
Joshin Uramoto, Kazushige Ishii, and Yusuke Kubota Mar. 1980 10 p refs
(IPPJ-448) Avail: NTIS HC A02/MF A01

A disc LaB6 cathode is proposed in order to improve demerits of a cylindrical LaB6 cathode when a plasma source is produced by a discharge in a magnetic field. Author

N80-26156# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONLINEAR ALFVEN WAVE IN AN ULTRA-RELATIVISTIC ELECTRON-POSITRON PLASMA
Jun-ichi Sakai and Tutomu Kawata Mar. 1980 16 p refs
(IPPJ-449) Avail: NTIS HC A02/MF A01

A nonlinear Alfven wave propagating parallel to a constant magnetic field in an ultrarelativistic electron-positron plasma is investigated in the frame of a covariant two fluid model equation. The basic equations are derived from the Einstein equation, Maxwell equations, and the continuity equation in the case of special relativity. The derivation for the equation describing the nonlinear evolution of a circular polarized Alfven wave is presented. Finally, some stational solutions (bright solitons, kink solution, spiky soliton with rapid phase rotation) are discussed. M.G.

N80-26157# Nagoya Univ. (Japan). Inst. of Plasma Physics.
WAVES IN AN ULTRA-RELATIVISTIC ELECTRON-POSITRON PLASMA
Jun-ichi Sakai and Totumu Kawata Mar. 1980 15 p refs
(IPPJ-450) Avail: NTIS HC A02/MF A01

Basic equations describing the macroscropic behavior of an ultrarelativistic plasma are formulated in a covariant form. Waves in an electron-positron plasma are investigated in the frame of a two fluid model equation. Dispersion relations for electrostatic waves, electromagnetic waves and Alfven waves propagating parallel to a constant magnetic field are shown. In the case that both electron and positron gases have the same temperature, there does not exist the slow mode which corresponds to the ion acoustic wave. Right and left circular polarized waves propagate with the same dispersion relation which is different from that of the nonrelativistic electron-ion plasma. M.G.

N80-26158# Nagoya Univ. (Japan). Institute of Plasma Physics.
NEGATIVE SHEAR FERROMAK FOR STABILIZATION OF CURRENT DISRUPTIONS IN TOROIDAL DISCHARGE
Kazunari Ikuta Mar. 1980 10 p refs
(IPPJ-451) Avail: NTIS HC A02/MF A01

A possibility to realized (1=2)+(1=3) magnetic configuration with the help of ferromagnetic material is analyzed with an aim to control the current disruption occuring in Tokamaks. By a careful choice of parameters it is not difficult for a negative shear configuration to be reduced into practice by the use of standard soft irons, where the negative shear configuration means the one whose rotational transform decreases as it moves outwards from the magnetic axis. J.M.S.

N80-26159# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A QUICK START OF HIGH CURRENT DISCHARGE FROM A COLD LaB6 CATHODE FOR NEUTRAL BEAM INJECTION
Joshin Uramoto Mar. 1980 21 p refs
(IPPJ-453) Avail: NTIS HC A02/MF A01

A cathode system with a high current density, long life, fast rise time at discharge, and mechanical simplicity is described for use in the fast neutral beam injection of thermonuclear fusion. A cold LaB6 cathode with a large heat capacity can be used for a high current discharge which needs a fast rise time (below 0.1 sec) if the discharge is fired twice in series. The temperature decay of the cathode after the first discharge held to a very slow rise time to protect the cathode) is very slow. The second discharge rises up quickly due to remaining heat and the effective plasma confinement in the cathode system even if a time interval between in the first and the second is near 30 sec. M.G.

N80-26160# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PARTICLE SIMULATION STUDIES ON BEHAVIOR OF LASER-PRODUCED HIGH-BETA PLASMA IN A MAGNETIC FIELD
Masamitsu Aizawa, Tadashi Sekiguchi (Tokyo Univ.), Yukiharu Ohsawa, Kohnosuke Sato, and Tetsuo Kamimura Mar. 1980 42 p refs
(IPPJ-452) Avail: NTIS HC A03/MF A01

Macroscopic and microscopic behaviors of the laser produced high-beta plasma were studied by the magnetostatic particle simulation code. The expansion process of the plasma, the rethermalization phenomena, the structure of high-beta sheath and the instability are examined in detail. As the plasma radius becomes maximum, the shell structure of the density appears. The thermalization of the expansion energy occurs and the instabilty arises in this shell. This instability is similar to that observed in the experiments and the growth rate is almost equal to that of the lower hybrid drift instability. When the expansion stops, the width of the sheath is nearly equal to the hybrid Larmor radius. J.M.S.

N80-26161*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
ION EXTRACTION FROM A PLASMA Ph.D. Thesis. Progress Report, 1 Dec. 1979 - 1 Dec. 1980
Graeme Aston Jun. 1980 93 p refs
(Grant NGR-06-002-112)
(NASA-CR-159849) Avail: NTIS HC A05/MF A01 CSCL 20I

An experimental investigation of the physical processes governing ion extraction from a plasma is presented. The screen hole plasma sheath of a multiaperture ion accelerator system is defined by equipotential plots for a variety of accelerator system geometries and operating conditions. A sheath thickness of at least fifteen Debye lengths is shown to be typical. The electron density variation within the sheath satisfies a Maxwell Boltzmann density distribution at an effective electron temperature

dependent on the discharge plasma primary to Maxwellian electron density ratio. Plasma ion flow up to and through the sheath is predominately one dimensional and the ions enter the sheath with a modified Bohm velocity. Low values of the screen grid thickness to screen hole diameter ratio give good ion focusing and high extracted ion currents because of the effect of screen webbing on ion focusing. Author

N80-26162*# Argonne National Lab., Ill.
MODIFIED NASA-LEWIS CHEMICAL EQUILIBRIUM CODE FOR MHD APPLICATIONS
R. A. Sacks, H. K. Geyer, S. J. Grammel, and E. D. Doss Dec. 1979 60 p refs
(Contract W-31-109-eng-38)
(NASA-TM-80903; ANL/MHD-79-15) Avail: NTIS HC A04/MF A01 CSCL 20I

A substantially modified version of the NASA-Lewis Chemical Equilibrium Code was recently developed. The modifications were designed to extend the power and convenience of the Code as a tool for performing combustor analysis for MHD systems studies. The effect of the programming details is described from a user point of view. DOE

N80-26163# Columbia Univ., New York. Plasma Lab.
NUMERICAL SIMULATION STUDIES OF TOROIDAL PINCHES
Wonchull Park 1978 157 p refs
(Contract EY-76-S-02-2456)
(COO-2456-57) Avail: NTIS HC A08/MF A01

A time dependent two dimensional magnetohydrodynamic calculation for pinch experiments is improved and modified so that very long calculations (until the plasma reaches a quasi-equilibrium state) are possible. The calculation method is presented, and the simulation results of the Jutphaas screw pinch SP-1 and the Los Alamos reverse-field pinches ZT-I, ZT-S, and ZT-40 are studied. DOE

N80-26164# Columbia Univ., New York. Plasma Lab.
SPECTROSCOPIC STUDY OF TURBULENT HEATING IN THE HIGH BETA TOKAMAK, TORUS 2 Ph.D. Thesis
George E. Georgiou 1979 144 p refs
(Contract EY-76-S-02-2456)
(COO-2456-70) Avail: NTIS HC A07/MF A01

Visible spectroscopy, involving line profile and line intensity measurements, was used to study the turbulent heating of the rectangular cross section high beta Tokamak Torus II. The spectroscopy was done in the visible wave length region using a six channel polychrometer having 0.2 A resolution, which is capable of radial scans of the plasma. The plasma, obtained by ionizing helium, is heated by poloidal skin currents, induced by a rapid (tau/sub R/ approximately 1.7 microsec) change of the toroidal magnetic field either parallel or antiparallel to the initial toroidal bias magnetic field, which converts a cold toroidal Z-pinch plasma into a hot Tokamak plasma. DOE

N80-26165# California Univ., Livermore. Lawrence Livermore Lab. National Magnetic Fusion Energy Computer Center.
MAGNETIC CONFINEMENT IN PLASMAS IN NUCLEAR DEVICES
Carol G. Tull 12 Jul. 1979 13 p refs Presented to the Soc. of Women Engr., San Francisco, 25 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82765; CONF-790698-3) Avail: NTIS HC A02/MF A01

The main emphasis of the magnetic fusion energy research program today lies in the development of two types of confinement schemes: magnetic mirrors and Tokamaks. Experimental programs for both of these confinement schemes have shown steady progress toward achieving fusion power break-even. The scaling of the current machines to a reactor operating regime and newly developed methods for plasma heating will very likely produce power break-even within the next decade. Predictions are that the efficiency in a fusion power plant should exceed 32%. DOE

N80-26166# Argonne National Lab., Ill. Engineering Div.
CONVECTIVE HEAT TRANSFER IN MHD CHANNELS AND ITS INFLUENCE ON CHANNEL PERFORMANCE
R. K. Ahluwalia and Ezzat D. Doss 1980 12 p refs Presented at 18th AIAA Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980
(Contract W-31-109-eng-38)
(CONF-800104-5) Avail: NTIS HC A02/MF A01

The limitations of the integral boundary layer methods and the potential of the differential boundary layer method in analyzing MHD channel flows are assessed. The sensitivity of results from the integral method to the parametrization of boundary layer profiles and calcualtion of wall heat transfer is established. A mixing-length type turbulence model for flow on rough wall is developed and validated by comparison with experimental data. The turbulence model is used in a quasi-three-dimensional boundary layer model to evaluate the influence of wall rougheness and pressure gradients on the flow characteristics and performance of MHD channels. The behaviors of skin friction and Stanton number calculated from the analytical model are found to differ considerably from the empirical correlations valid for non-MHD flows without pressure gradients. DOE

N80-26167# Argonne National Lab., Ill.
POWER TAKE-OFF ANALYSIS FOR DIAGONALLY CONNECTED MHD CHANNELS
Yen-Cheng Pan and Ezzat D. Doss 1980 13 p refs Presented at 18th AIAA Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980
(Contract W-31-109-eng-38)
(CONF-800104-6) Avail: NTIS HC A02/MF A01

The electrical loading of the power take-off region of diagonally connected MHD channels is investigated by a two dimensional model. The loading schemes typical of those proposed for the U-25 and U-25 Bypass channels are examined. The model is applicable for the following four cases: (1) connection with diodes only, (2) connection with diodes and equal resistors, (3) connection with diodes and variable resistances to obtain a given current distribution, and (4) connection with diodes and variable resistors under changing load. The analysis is applicable for the power take-off regions of single or multiple-output systems. The general behaviors of the current and the potential distributions in all four cases are discussed. The analytical results are in good agreement with the experimental data. It is found possible to design the electrical circuit of the channel in the take-off region so as to achieve a fairly even load current output under changing total load current. DOE

N80-26168# TRW Defense and Space Systems Group, Redondo Beach, Calif.
MICROWAVE SCALING OF LASER PLASMA INTERACTIONS Final Report
W. F. DiVergilio, B. H. Quon, W. Gekelman, and A. Y. Wong Jan. 1980 23 p refs
(Contract DE-AC08-78DP-40067)
(DOE/DP-40067/T1) Avail: NTIS HC A02/MF A01

The limitations of previous target plasmas and the requirements for improved target plasmas are discussed. The discharge technqiues previously used in the QUIPS facility and utilizing a combination of the pulsed RF plasma production techniques with a new pulsed magnetic field technique, producing a target plasma are discussed. The latter-target plasma production technique was based on plasma production by intense, short pulse laser irradiation of a solid target. The resulting blowoff plasma expands into vacuum and, after a suitable delay time, was irradiated by a pulsed microwave beam. The blowoff plasma properties and preliminary results of microwave interaction experiments are described. DOE

N80-26169# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
AXIAL LASER HEATING OF THREE METER THETA PINCH PLASMA
A. L. Hoffman and D. D. Lowenthal Nov. 1979 46 p refs Submitted for publication
(Contracts DE-AC06-76ET-53027; EY-76-C-06-2319)
(MSNW-79-1045-5) Avail: NTIS HC A03/MF A01

The results of a four year effort on laser heating a 3 m long plasma in a fast rising solenoidal field are presented. It was found that beam trapping density minimums could be maintained for the length of the laser pulse if the plasma diameter exceeded about 1.5 cm. The erosion of the density minimum

was governed by classical diffusion processes. Three meter long plasmas in 2.6 cm bore plasma tubes could be fairly uniformly heated by 3.0 kJ of CO2 laser radiation. Best results were obtained when heating began before or during the theta pinch implosion phase and the plasma fill pressure exceeded 1.0 torr H2. Plasma line energies of about 1 kJ/m could be obtained in a magnetic field rising to 6 tesla in 4.7 microsec. DOE

N80-26170# Los Alamos Scientific Lab., N. Mex.
OPTICAL MIXING AS A PLASMA DIAGNOSTIC
Peter R. Forman and Werner Riesenfeld Mar. 1980 38 p refs
(Contract W-7405-eng-48)
(LA-8262-MS) Avail: NTIS HC A03/MF A01

The nonlinear interaction of electromagnetic waves in a plasma are examined as the basis for a new and useful diagnostic tool. In particular, the Raman-Induced Kerr effect is considered (RIKE) in a magnetic field-free plasma, the characteristics of various laser sources and detecting equipment necessary for the implementation of a sensitive RIKE scattering system are evaluated. It is concluded that the present state of technology permits the design of promising diagnostic systems of this type. Finally, reasonable conjectures are discussed on the generalization of the effect to magnetoplasmas, in which the measurement could lead to the determination not only of density, but also of the magnitude and direction of the imbedded magnetic field. DOE

N80-26171# Argonne National Lab., Ill. Fusion Power Program.
STARFIRE: A COMMERCIAL TOKAMAK REACTOR Interim Status Report, May - Sep. 1979
Dec. 1979 193 p Prepared in part by McDonnell Douglas Astronautics Co., St. Louis, Mo., General Atomic Co., San Diego, Calif., and Ralph M. Parson Co., Pasadena, Calif.
(Contract W-31-109-eng-38)
(ANL/FPP/TM-125) Avail: NTIS HC A09/MF A01

Design concepts for a commercial Tokamak fusion electric power plant based on the deuterium/tritium/lithium fuel cycle are discussed. The key technical objective is to develop the best embodiment of the Tokamak as a power reactor consistent with credible engineering solutions to design problems. Another key goal is to give careful attention to the safety and environmental features of a commercial fusion reactor. Design considerations for plasma engineering, first-wall/blanket, heat transport system, reactor facility, toroidal field coil system, and maintenance are specifically addressed. DOE

N80-26172# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
MHD HIGH PERFORMANCE DEMONSTRATION EXPERIMENT Quarterly Progress Report, 1 Apr. - 30 Jun. 1979
Jul. 1979 33 p refs
(Contract ET-78-I-01-2895)
(DOE/ET-2895/5) Avail: NTIS HC A03/MF A01

The attainment of MHD performance was demonstrated on a sufficiently large scale to verify that the projected efficiency of the commercial MHD concept is attainable. To perform the experiment, an existing facility at the Arnold Engineering Development Center (USAF) was refurbished and the new systems required for performaning the experiment were designed and built. In particular, the largest systems which have required the greatest expenditure of resources are the generator channel and the 6 Tesla (T) cryogenically cooled magnet. The pressure testing of the generator channel was completed and the channel was installed in the magnet to facilitate final alignment of the burner. The diffuser assembly operations were completed. The magnet was retested in the warm mode. No problems were encountered in the latest tests and the magnet was subsequently cooled to 165 K and pulsed to a peak field strength of 2.9T. DOE

N80-26173# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
CONTRIBUTION TO THE STUDY OF ELECTROSTATIC AND ELECTROMAGNETIC WAVES NEAR THE LOWER HYBRID FREQUENCY IN IONOSPHERIC PLASMA Ph.D. Thesis - Orleans Univ. [CONTRIBUTION A L'ETUDE DES ONDES ELECTROSTATIQUES ET ELECTROMAGNETIQUES AU VOISINAGE DE LA FREQUENCE HYBRIDE BASSE DANS LE PLASMA IONOSPHERIQUE]
Michel Hamelin 1978 152 p refs In FRENCH
(CRPE-NT-61) Avail: NTIS HC A08/MF A01

Wave dispersion near the lower hybrid frequency in a homogeneous plasma with several ionic types was studied. The different macroscopic theories were reviewed: cold pasma theory; adiabatic theory in electrostatic approximation; and complete adiabatic theory. Electrostatic waves in perpendicular propagation and in quasiperpendicular propagation were examined. A complete study of electromagnetic and electrostatic wave progation in a weakly inhomogenous environment near the lower hybrid frequency is exposed in the frame of the adiabatic theory. The response to a point source electric impulse in a homogenous environment was investigated with reference to moving plasma. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-26174 Maine Univ., Orono.
SPECTRUM OF ACOUSTIC WAVES EXCITED IN SINGLE AND MULTIPLE LAYERED CRYSTALLINE MEDIA Ph.D. Thesis
Ashok Jhunjhunwala 1979 265 p
Avail: Univ. Microfilms Order No. 8013249

Acoustic waves in various crystallographic orientations and materials are studied for eventual use in microwave acoustic devices. In particular, the acoustic waves propagating in a source-free multiple layered crystalline media and the spectrum of acoustic waves excited by an interdigital transducer (IDT) in a piezoelectric half space are theoretically studied. Properties such as the wave velocity, coupling coefficient, temperature coefficient of delay and/or velocity, power flow angles, and diffraction profiles associated with these waves are predicted. Computer programs are developed which calculate properties for these waves for various materials and orientations. The surface acoustic wave (SAW) and pseudo SAW properties of a new material, Fresnoite (Ba2Si2TiO8) and of BSO (Bi12SiO20) using the measured piezoelectric constants are guided. Fresnoite is found to have potential applications in convolvers and BSO has potential applications in long delay lines. Surface wave properties are studied for a fused Quartz layer over a LiNbO3 substrate and are found to have both temperature compensation and a high coupling coefficient, properties particularly attractive for device applications. The spectrum of waves excited by an IDT is evaluated for certain orientations on quartz, Berlinite, LiTaO3 and LiNbO3. Dissert. Abstr.

N80-26175 Rutgers - The State Univ., New Brunswick, N. J.
LATTICE DYNAMICS WITH SHORT-RANGE CORRELATIONS APPLIED TO TWO-PHONON RAMAN SCATTERING Ph.D. Thesis
John Granville Leese 1980 140 p
Avail: Univ. Microfilms Order No. 8013171

The lattice dynamics of heavy rare gas solids is investigated in the high temperature limit, using the Horner method of including short range correlations and anharmonicity in self-consistent phonon theory. Short range correlations are taken into account by modifying the simple Gaussian pair correlation function employed in harmonic theories. Realistic and model potentials are used. The Horner method is found to give significantly better results than previous theories over a large temperature range. The calculated phonon frequencies and bulk properties compare favorably with experiment. These results are applied to a study of two phonon Raman scattering of light in rare gas solids, using the point-dipole model, over a wide range of temperatures and pressures. Theoretical and experimental force constants are used to compute the phonons. The calculated spectral lineshapes are in generally good agreement with experiment. However, there are some discrepancies to account for. These have to do with phonon scattering, deficiencies of the point-dipole model, contributions from ladder diagram

processes, and uncertainties in the experimental data. Dissert. Abstr.

N80-26176 Wisconsin Univ. - Madison.
FABRICATION AND DIAGNOSTICS OF OXIDE TUNNELING BARRIERS IN NIOBIUM BASED SUPERCONDUCTIVE TUNNEL JUNCTIONS Ph.D Thesis
Pramod Chintaman Karulkar 1979 260 p
Avail: Univ. Microfilms Order No. 8008822

Different oxide barrier formation techniques (thermal, dc glow discharge, and RF glow discharge) used in fabrication of niobium based superconductive tunnel junctions are examined. Fabrication and electrical testing of Nb-Nb oxide-Pb junctions and X-ray photoelectron and Auger electron spectroscopic analysis of the very thin niobium oxide films used as the tunneling barriers in well characterized junctions is discussed. A qualitative description of different processes taking place in the low voltage RF glow discharge oxidation is given. The RF glow discharge oxidation offered better control and yield than thermal of dc glow discharge oxidation procedures. The effect of argon ion bombardment on the compositions of NbO, NbO2 and Nb2O5 is examined. Preferential sputtering of oxygen from the surfaces of these oxides was observed. An X-ray photoelectron spectroscopic study of thin oxide films showed that large leakage currents in Nb based junctions are associated with the presence of niobium suboxides in the tunneling barrier. A comparative study of oxide barriers formed by dc glow discharge RF glow discharge, and thermal oxidation techniques led to the conclusion that the oxide films produced by RF glow discharge oxidation exhibit lower tunneling resistance. Dissert. Abstr.

N80-25177# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
FORMATION AND TRANSFORMATION OF POLYTYPES IN MX2 COMPOUNDS
V. K. Agrawal May 1980 12 p refs Proposed for presentation at 6th Intern. Conf. on Crystal Growth, Moscow, 10-16 Sep. 1980 Revised
(INPE-1735-RPE/135) Avail: NTIS HC A02/MF A01

On the basis of a review of experimental studies made on single crystals of PbI2, CdI2 and CdBr2, it is shown that the high polytypes in a substance are formed as a matter of chance in the initial stages of the growth of crystals and they are in the metastable state, therefore, transform generally into a basic type during growth/on annealing. As regards to formation of a basic type, the ionicity of the compound is found to have a direct influence in determining which of the closely related structures should be formed. On the basis of polytypic structures of CdI2 and PbI2, it is found that the second and third neighbors anion-anion layer interactions dominate the interlayer interactions during growth/transformation of polytypes. A criterion for the occurrence of Zhdanov number 3 in Zhdanov symbols of a crystal structure (only at places where the sum of the numbers occurring before it is an odd number) is evolved which would help in the determination of structures of high polytypes of CdI2 and PbI2. M.G.

N80-26178# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A CALCULATION OF THE PRESSURE DEPENDENT ENERGY BANDS OF CuCL
Paulo S. Guimaraes and Nelson de Jesus Parada Jan. 1980 19 p refs Revised
(INPE-1674-RPE/109) Avail: NTIS HC A02/MF A01

The calculation of the energy bands of CuCl by the cluster method is presented. Several clusters were used, all giving the same results. The calculated energy bands coincide with the known experimental facts on CuCl. The calculated bands present a sudden change at 40 kbar, very suggestive of the transition that CuCl undergoes at such pressures. Author

N80-26179# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
RADIATIVE AND NONRADIATIVE RECOMBINATION TIMES IN SEMICONDUCTING FILMS
M. T. Pacheco Feb. 1980 24 p refs Revised Submitted for publication
(INPE-1679-RPE/112) Avail: NTIS HC A02/MF A01

The dependence of the fluorescence lifetime upon the thickness of active thin films is discussed. For systems in which the radiative recombination rate is dominant over the nonradiative ones, the total recombination time can be changed by suitable modifications of the film thickness. In this situation the nonradiative rate can be evaluated. Experimental results for the case of cadmium sulfide thin films are presented. E.D.K.

N80-26180# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
ROLES OF THE LOWER AND UPPER HUBBARD BANDS AND THE DONOR-EXCITONIC STATES IN THE THEORY OF SHALLOW IMPURITY STATES IN DOPED SEMICONDUCTORS
K. A. Chao, R. Rklund, and A. Ferreira DaSilva Feb. 1980 20 p refs Revised Submitted for publication
(INPE-1684-RPE/115) Avail: NTIS HC A02/MF A01

A self consistent unrestricted Hartree Fock pseudo-cluster calculation was performed to investigate the roles of various bands in doped semiconductors. While the lower and the upper Hubbard bands are well defined at low concentration, the donor excitonic states are important at higher concentration where the upper Hubbard band is pushed into the conduction band. The so modified MHA model can still explain almost all the experimental results. J.M.S.

N80-26181*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
SOLID STATE CRYSTAL PHYSICS AT VERY LOW TEMPERATURES Annual Report
W. Davis, K. Krack, J. P. Richard, and J. Weber Apr. 1980 38 p
(Grant NsG-7196)
(NASA-CR-163240) Avail: NTIS HC A03/MF A01 CSCL 20L

The properties of nearly perfect crystals was studied at cryogenic temperatures. A large Helium 3 and Helium 4 dilution refrigerator has been assembled, and is described. A cryostat suitable for cooling a 35 liter volume to .020 Kelvin was designed and constructed, together with instrumentation to observe the properties of nearly perfect crystals. E.J.R.

N80-26182*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE PLANAR MULTIJUNCTION CELL: A NEW SOLAR CELL FOR EARTH AND SPACE
John C. Evans, An-Ti Chai, and Chandra Goradia 1980 8 p refs Proposed for presentation at 15th Intern. Energy Conversion Engr. Conf., Seattle, Wash., 18-22 Aug. 1980; sponsored by AIAA, presented at 14th IEEE Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980
(NASA-TM-81526) Avail: NTIS HC A02/MF A01 CSCL 20L

A family of high-voltage solar cells, called the planar multijunction (PMJ) cell is being developed. The new cells combine the attractive features of planar cells with conventional or interdigitated back contacts and the vertical multijunction solar cell. The PMJ solar cell is internally divided into many voltage-generating regions, called unit cells, which are internally connected in series. The key to obtaining reasonable performance from this device was the separation of top surface field regions over each active unit cell area. Using existing solar cell fabricating methods, output voltages in excess of 20 volts per linear centimeter are possible. Analysis of the new device is complex, and numerous geometries are being studied which should provide substantial benefits in both normal sunlight usage as well as with concentrators. Author

N80-26183# Rome Air Development Center, Griffiss AFB, N.Y.
SINGLE CRYSTAL GROWTH OF ZIRCONIA UTILIZING A SKULL MELTING TECHNIQUE
R. C. Marshall and J. A. Adamski Aug. 1979 26 p refs
(AF Proj. 2306)
(AD-A082323; RADC-TR-79-227) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report reviews the problems associated with the high temperature growth of non-metallic single crystals, particularly refractory oxides. Various approaches to circumvent the problems of melt contamination and containment are discussed. The cold wall R.F. heated skull technique is discussed in detail. This

technique is applied to the growth of yttria stabilized zirconia to meet specific requirements, and to establish the viability of this technique. The resulting crystals are characterized by a number of optical, chemical, and physical techniques. GRA

N80-26184# Los Alamos Scientific Lab., N. Mex.
ELECTRONIC STRUCTURE, BONDING AND CHEMISORPTION IN METALLIC HYDRIDES
John W. Ward 1980 19 p refs Presented at Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, Colo., 7-11 Apr. 1980 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-80-458; CONF-800402-8) Avail: NTIS HC A02/MF A01

Problems that can arise during the cycling steps for a hydride storage system usually involve events at surfaces. A unifying concept is offered, which satisfactorily correlates many of the properties of transition-metal, rare-earth and actinide hydrides. The metallic hydrides can be differentiated on the basis of electronegativity, metallic radius (valence) and electronic structure. For those systems where there are d (transition metals) or f (early actinides) electrons near the Fermi level a broad range of chemical and catalytic behaviors are found, depending on band-width and energy. The more electropositive metals (rare-earth, actinides, transition metals with d < 5) tend to strongly chemisorb electrophilic molecules; this is a consequence of the manner in which new bonding states are introduced. More electronegative metals (d > 5) dissolve hydrogen and form hydrides by an electronically somewhat different process, and as a class tend to adsorb electrophobic molecules. DOE

N80-26185# Brookhaven National Lab., Upton, N. Y. Physics Dept.
MONTE CARLO SIMULATIONS OF LATTICE GAUGE THEORIES
C. Rebbi Feb. 1980 23 p refs Presented at Lecture on Common Trends in Particle and Condensed Matter Phys. Les Houches, France, 1980
(Contract EY-76-C-02-0016; DE-AC02-76CH-00016)
(BNL-27323) Avail: NTIS HC A02/MF A01

Monte Carlo simulations done for four dimensional lattice gauge systems are described, where the gauge group is one of the following U(1);SU(2); Z sub N, i.e., the subgroup of U(±) consisting of the elements e2 in/N with integer n and N; the eight element group of quaternions, Q; the 24 and 48 element subgroups of SU(2), denoted by Tand O, which reduce to the rotation groups of the tetrahedron and the octahedron when their centers Z2, are factored out. All of these groups can be considered subgroups of SU(2) and a common normalization was used for the action. The following types of Monte Carlo experiments are considered: simulations of a thermal cycle, where the temperature of the system is varied slightly every few Monte Carlo iterations and the internal energy is measured; mixed-phase runs, where several Monte Carlo iterations are done at a few temperatures near a phase transition starting with a lattice which is half ordered and half disordered; measurements of averages of Wilson factors for loops of different shape. DOE

N80-26186# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
CHEMISORPTION AND REACTIVITY STUDIES OF SMALL MOLECULES ON RHODIUM SURFACES Ph.D. Thesis
David G. Castner Sep. 1979 211 p refs
(Contract W-7405-eng-48)
(LBL-9471) Avail: NTIS HC A10/MF A01

The chemisorption of H2, O2, CO, CO2, NO, C2H2, C2H4, and C on clean Rh(111), (100), (755), and (331) surfaces is studied. Low energy electron diffraction, Auger electron spectroscopy, and desorption mass spectroscopy were used to determine the size and orientation of the unit cells, desorption temperatures, and decomposition characteristics for each adsorbate. All of the molecules readily chemisorbed on all surfaces and several ordered surface structures were observed. DOE

N80-26187# National Bureau of Standards, Washington, D.C.
POLARIZED LEED STUDY OF SURFACE MAGNETISM
D. T. Pierce, R. J. Celotta, G. C. Wang, G. P. Felcher, S. D. Bader, and K. Miyano 1979 11 p refs Presented at the Intern. Conf. on Magnetism, Munich, 3-7 Sep. 1979 Prepared in cooperation with Argonne Natl. Lab., Ill.
(Contract W-31-109-eng-38)
(CONF-790909-15) Avail: NTIS HC A02/MF A01

The surface magnetization of ferromagnetic Ni(110) was observed via the use of a spin polarized electron beam. The spin dependence of the scattered electron intensity was measured as a function of external magnetic field strength and temperature. DOE

N80-26188# Sandia Labs., Albuquerque, N. Mex.
CROSS SECTIONS FOR ELECTRON AND PHOTON PROCESSES REQUIRED BY ELECTRON-TRANSPORT CALCULATIONS
James M. Peek Nov. 1979 121 p refs
(Contract EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-0772) Avail: NTIS HC A06/MF A01

Electron transport calculations rely on a large collection of electron-atom and photon-atom cross section data to represent the response characteristics of the target medium. These basic atomic-physics quantities and certain qualities derived from them that are now commonly in use, are critically reviewed. Cases for which data improvements can be made from existing information are identified. Ranges of parameters for which state-of-the-art data are not available are sought out, and recommendations for explicit measurements and/or calculations with presently available tools are presented. An attempt is made to identify the maturity of the atomic-physics data and to predict the possibilities for rapid changes in the quality of the data. Finally, weaknesses in the state-of-the-art atomic-physics data and in the conceptual usage of these data in the context of electron transport theory are discussed. Brief attempts are made to weigh the various aspects of these questions and to suggest possible remedies. DOE

N80-26189# National Technical Information Service, Springfield, Va.
GALLIUM ARSENIDE EPITAXIAL GROWTH, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Feb. 1980
Brian Carrigan Mar. 1980 236 p Supersedes NTIS/PS-79/0213; NTIS/PS-78/0227 and NTIS/PS-77/0139
(PB80-805583; NTIS/PS-79/0213; NTIS/PS-78/0227; NTIS/PS-77/0139) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 20L

Research abstracts on GaAs epitaxial growth in liquid and vapor phases are included in this bibliography. Techniques, tests, physical properties, crystal structure, and doping are described. The use of gallium arsenide in optical modulators, fiber optics, semiconductor diodes, and microwave equipment is cited. This updated bibliography contains 229 abstracts, 45 of which are new entries to the previous edition. GRA

N80-26190# National Technical Information Service, Springfield, Va.
GALLIUM ARSENIDE EPITAXIAL GROWTH, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Feb. 1980
Brian Carrigan Mar. 1980 250 p Supersedes NTIS/PS-79/0215; NTIS/PS-78/0228 and NTIS/PS-77/0141
(PB80-805591; NTIS/PS-79/0215; NTIS/PS-78/0228; NTIS/PS-77/0141) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 20L

Citations from worldwide research journals on gallium arsenide vapor and liquid phase and molecular beam epitaxial growth are presented. Crystal structure and physical properties of epitaxial gallium arsenide are included, as are studies on doping effects, defects, and semiconductor devices. This updated bibliography contains 243 abstracts, 75 of which are new entries to the previous edition. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N80-26191# Los Alamos Scientific Lab., N. Mex.
RENORMALIZING THE STRONG-COUPLING EXPANSION FOR QUANTUM FIELD THEORY: PRESENT STATUS
Fred Cooper, David Sharp, Carl M. Bender (Brown Univ., St. Louis, Mo.), G. S. Guralnik (Brown Univ.), and Ralph Roskies (Pittsburgh Univ.) 1980 33 p refs Presented at Orbis Scientiae, Coral Gables, Fla., 14 Jan. 1980
(Contract W-7405-eng-36)
(LA-UR-80-482; CONF-800123-2) Avail: NTIS HC A03/MF A01

The lattice version of the path integral representation for the Green's functions with restrictions to lambda phi 4 field theory in d dimensions was examined. The unrenormalized strong coupling expansion on the lattice was determined. This was a series in a dimensionless parameter, x. A simple set of graphical rules for determining the Green's functions of the theory in a power series in x was derived. For finite field theories d < 2 scheme for extrapolating the zero lattice spacing (a yields 0) was presented. This scheme determines a sequence of approximants to the unrenormalized strong coupling series in the form of a series. The lattice field theory consists of eliminating x in favor of y, a renormalized x. For d < 2, M sub r squared = 0 occured when M sub O yields infinity, where M sub R is the renormalized mass and M sub O is the bare mass. The path integral was dominated by instantons. The renormalized strong coupling expansion was valid for the double well where M sub R square is < < lamba sup 2 (4d). DOE

N80-26192# National Technical Information Service, Springfield, Va.
RELATIVITY THEORY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Feb. 1980
Brian Carrigan Mar. 1980 209 p Supersedes NTIS/PS-79/0183; NTIS/PS-78/0253; NTIS/PS-77/0201
(PB80-805542; NTIS/PS-79/0183; NTIS/PS-78/0253; NTIS/PS-77/0201) Avail: NTIS HC $30.00/MF $30.00 CSCL 20J

Research studies are presented on special and general relativity. Gravitational theory, field theory, and space-time studies are included, as are studies involving Minkowski space, the Dirac equation, and Lorentz transformations. This updated bibliography contains 202 abstracts, 9 of which are new entries to the previous edition. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

No abstracts in this category.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N80-26193* National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
TECHNICAL PUBLICATIONS OF THE NASA-WALLOPS FLIGHT CENTER, 1973 - 1979
J. N. Foster, comp. May 1980 76 p
(NASA-TM-73285) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md 21240 CSCL 05B

This bibliography lists approximately 500 publications sponsored by the NASA Wallops Flight Center during the period 1973 through 1979. The compilation contains citations listed by type of publication (i.e., formal report, contractor report, journal article, or presentation); contract/grant number; and accession number. E.J.R.

N80-26194# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
BROWSING IN LARGE DATA BASES
Douglas D. Dankel, II Feb. 1979 25 p refs
(Contract N00014-75-C-0612)
(AD-A081987; WP-17) Avail: NTIS HC A02/MF A01 CSCL 09/2

The formation of data bases containing information on mechanical systems for trouble shooting purposes has become increasingly popular and important. Examination of these data bases by humans can be very costly. A system called BROWSER is currently under development to heuristically search a data base containing information on Navy aircraft with little or no human intervention. BROWSER searches the data base guided by models and heuristics looking for interesting patterns or configurations. The user is then notified of the existence of these patterns. GRA

N80-26195# Control Data Corp., St. Paul, Minn.
APPLICATIONS OF A RECONFIGURABLE ARRAY OF FLEXIBLE PROCESSORS IN INTELLIGENCE INFORMATION RETRIEVAL Final Report, Jan. 1978 - Apr. 1979
Walling R. Cyre Griffiss AFB, N.Y. RADC Dec. 1979 119 p
(Contract F30602-78-C-0065; AF Proj. 4594)
(AD-A082324; RADC-TR-79-313) Avail: NTIS HC A06/MF A01 CSCL 09/2

The objective of this study was to investigate the applicability of a Reconfigurable Array of Flexible Processors, with enhanced word processing capabilities, to the problem of document retrieval. The work performed during the study falls into three categories. First, the intelligence information retrieval application at AFSC Foreign Technology Division (FTD), Wright-Patterson AFB, Ohio was analyzed for characteristics which might serve as system design and performance evaluation measures. The analysis was conducted by reviewing the data base and system usage characteristics at FTD and by synthesizing and analyzing a small experimental data base. From this, several areas in which the Reconfigurable Array with an associative processing unit might be used to advantage were identified, and a number of system sizing parameters were found. The second category of work included the design modification and fabrication of an exploratory model of an associative unit, and its integration with a laboratory Reconfigurable Array. The third category of effort included the development and exercising of a demonstration document retrieval system using a Reconfigurable Array of Flexible Processors, the Exploratory Development Model Associative Unit, and the experimental data base. The results of the evaluations performed during the study indicate that a Reconfigurable Array with a fully populated Associative Unit should perform searches about 200 times faster than the current system. GRA

N80-26196# Kappa Systems, Inc., Arlington, Va.
CLEARINGHOUSE AND INFORMATION RESOURCES OFFERING UTILITY-RELATED PRODUCTS AND SERVICES

10 Dec. 1979 40 p
(Contract DE-RP01-79RG-10019)
(DOE/RG-10019/T1) Avail: NTIS HC A03/MF A01

This report, designed for use within the utility community, offers informative descriptions of some of the more relevant organizations engaged in providing information concerned with utility rate regulation. Eighteen information profiles are structured to include the name, address, and telephone number of each of the organizations, and where appropriate, personnel who should be contacted for assistance. A brief synopsis of relevant data indicates type of information and services available to users. DOE

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-26197# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
ANALYSIS OF THE UNCERTAINTIES ASSOCIATED WITH COST ESTIMATION M.S. Thesis [ANALISE DA INCERTEZA ASSOCIADA A ESTIMACAO DE CUSTOS]
Luiz Antonio Nogueira Lorena Mar. 1980 107 p refs In PORTUGUESE; ENGLISH summary
(INPE-1692-TDL/022) Avail: NTIS HC A06/MF A01

Some cost analysis techniques are considered as an integral part of cost-effectiveness analysis. Particular emphasis is given to the application of the Delphi method and statistical methods to cost analysis. The main thrust however, is to quantify cost uncertainities, proposing its use as a decision tool. A.R.H.

N80-26198*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COST ESTIMATING RELATIONSHIPS FOR AIRFRAMES IN THE DEVELOPMENT AND PRODUCTION PHASES
Donald G. Eide Jun. 1980 50 p refs
(NASA-TM-80229; L-13297) Avail: NTIS HC A03/MF A01 CSCL 05C

Cost estimating relationships are presented along with their statistical properties for the development phase and production phase for aircraft airframe programs. These relationships were derived for the engineering, tooling, manufacturing, and materials subdivisions of work during each phase. Cost estimating relationships are also presented for development support and flight test operations during the development phase. The purposes of the separation of costs by phase and by subdivision of work are to obtain better discounted dollar comparisons of different aircraft vehicles, to estimate the costs of vehicle programs with limited production requirements, and to evaluate the impact of technology advances affecting different subdivisions of work in different phases of the vehicle program. Author

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-26199# Committee on Commerce, Science, and Transportation (U. S. Senate).
AGREEMENT GOVERNING THE ACTIVITIES OF STATES ON THE MOON AND OTHER CELESTIAL BODIES, PARTS 1 AND 2
Eilene Galloway Washington GPO 1980 272 p refs Rept. presented to the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., May 1980
(GPO-59-896) Avail: SOD HC CSCL 05D

The history of the development of legal principles to guide the behavior of nations, international organizations, and individuals in the exploration and exploitation of celestial bodies in the solar system (other than Earth) is reviewed. Recent U.N. negotiations on the Moon agreement are summarized. A section-by-section comparative analysis with other space treaties now in force is presented along with the issues and questions raised by the analysis. The text of the agreement, those international agreements mentioned in it, and several other international documents deemed useful in understanding this proposal are included. A.R.H.

N80-26200# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
FUNDING FOR HIGHWAY SAFETY RESEARCH, DEVELOPMENT, AND DEMONSTRATION IN THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION Final Report, Jul. 1978 - Nov. 1979
Thomas C. Anderson Nov. 1979 132 p refs Sponsored by Motor Vehicle Manufacturing Assoc.
(PB80-137672; UM-HSRI-79-88) Avail: NTIS HC A07/MF A01 CSCL 05A

The National Highway Traffic Safety Administration's (NHTSA) allocation of resources to highway safety research, development, and demonstration programs is examined for the 1970-1979 time period, and additional analysis is made of the allocation of 403 contract expenditures in NHTSA's proposed 1980-1984 plan. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-26201*# Minicars, Inc., Goleta, Calif.
NEAR HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM, PHASE 1. APPENDICES A AND B. MISSION ANALYSIS AND PERFORMANCE SPECIFICATION STUDIES REPORT, VOLUME 1
Oct. 1979 468 p Revised Sponsored in part by DOE
(Contract NAS7-100)
(NASA-CR-163330; JPL-9950-37) Avail: NTIS HC A20/MF A01 CSCL 13F

The three most promising vehicle use patterns (missions) for the near term electric hybrid vehicle were found to be all-purpose city driving, commuting, and family and civic business. The mission selection process was based principally on an analysis of the travel patterns found in the Nationwide Transportation Survey and on the Los Angeles and Washington, D.C. origin-destination studies data. Travel patterns in turn were converted to fuel requirements for 1985 conventional and hybrid cars. By this means, the potential fuel savings for each mission were estimated, and preliminary design requirements for hybrid vehicles were derived. A.R.H.

N80-26202*# Minicars, Inc., Goleta, Calif.
NEAR HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM, PHASE 1. APPENDICES C AND D, VOLUME 2 Final Report
Oct. 1979 352 p Sponsored in part by DOE
(Contract NAS7-100)
(NASA-CR-163331; JPL-9950-337; FR-4500-09-79-11) Avail: NTIS HC A16/MF A01 CSCL 13F

Results of tradeoff studies are presented in summary form. Various aspects of the overall vehicle design discussed include selection of the base vehicle, the battery pack configuration, structural modifications, occupant protection, vehicle dynamics, and aerodynamics. The drivetrain design and integration, power conditioning unit, battery subsystem, control system, environmental system are described. Specifications, weight breakdown, and energy consumption measures, and advanced technology components are included. A.R.H.

N80-26203*# General Electric Co., Schenectady, N. Y.
NEAR-TERM HYBRID VEHICLE PROGRAM, PHASE 1. APPENDIX B: DESIGN TRADE-OFF STUDIES Final Report

8 Oct. 1979 204 p refs Prepared for JPL
(Contract JPL-955190)
(NASA-CR-163227; SRD-79-134/3-App-B-Vol-1;
JPL-9950-334-App-B-Vol-1) Avail: NTIS HC A10/MF A01
CSCL 13F

The relative attractiveness of various hybrid/electric power train configurations and electrical and mechanical drive-line components was studied. The initial screening was concerned primarily with total vehicle weight and economic factors and identified the hybrid power train combinations which warranted detailed evaluation over various driving cycles. This was done using a second-by-second vehicle simulation program which permitted the calculations of fuel economy, electricity usage, and emissions as a function of distance traveled in urban and highway driving. Power train arrangement possibilities were examined in terms of their effect on vehicle handling, safety, serviceability, and passenger comfort. A dc electric drive system utilizing a separately excited motor with field control and battery switching was selected for the near term hybrid vehicle. Hybrid vehicle simulations showed that for the first 30 mi (the electric range of the vehicle) in urban driving, the fuel economy was 80 mpg using a gasoline engine and 100 mpg using a diesel engine. In urban driving the hybrid would save about 75% of the fuel used by the conventional vehicle and in combined urban/highway driving the fuel saving is about 50%. J.M.S.

N80-26204*# General Electric Co., Schenectady, N. Y.
NEAR-TERM HYBRID VEHICLE PROGRAM, PHASE 1. APPENDIX B: DESIGN TRADE-OFF STUDIES REPORT. VOLUME 2: SUPPLEMENT TO DESIGN TRADE-OFF STUDIES Final Report
8 Oct. 1979 319 p refs Prepared for JPL
(Contract JPL-955190)
(NASA-CR-163228; SRD-79-134/4-App-B-Vol-2;
JPL-9950-334-App-B-Vol-2) Avail: NTIS HC A14/MF A01
CSCL 13F

Results of studies leading to the preliminary design of a hybrid passenger vehicle which is projected to have the maximum potential for reducing petroleum consumption in the near term are presented. Heat engine/electric hybrid vehicle tradeoffs, assessment of battery power source, and weight and cost analysis of key components are among the topics covered. Performance of auxiliary equipment, such as power steering, power brakes, air conditioning, lighting and electrical accessories, heating and ventilation is discussed along with the selection of preferred passenger compartment heating procedure for the hybrid vehicle. Waste heat from the engine, thermal energy storage, and an auxiliary burner are among the approaches considered. J.M.S.

N80-26205*# General Electric Co., Schenectady, N. Y.
NEAR-TERM HYBRID VEHICLE PROGRAM, PHASE 1. APPENDIX B: DESIGN TRADE-OFF STUDIES REPORT. VOLUME 3: COMPUTER PROGRAM LISTINGS Final Report
8 Oct. 1979 115 p Prepared for JPL
(Contract JPL-955190)
(NASA-CR-163229; SRD-79-134/5-App-B-Vol-3;
JPL-9950-334-App-B-Vol-3) Avail: NTIS HC A06/MF A01
CSCL 13F

A description and listing is presented of two computer programs: Hybrid Vehicle Design Program (HYVELD) and Hybrid Vehicle Simulation Program (HYVEC). Both of the programs are modifications and extensions of similar programs developed as part of the Electric and Hybrid Vehicle System Research and Development Project. J.M.S.

N80-26206*# General Electric Co., Schenectady, N. Y.
NEAR-TERM HYBRID VEHICLE PROGRAM, PHASE 1 Final Report
8 Oct. 1979 146 p refs Prepared for JPL
(Contract JPL-955190)
(NASA-CR-163230; SRD-79-134/1; JPL-9950-334) Avail: NTIS HC A07/MF A01 CSCL 13F

The preliminary design of a hybrid vehicle which fully meets or exceeds the requirements set forth in the Near Term Hybrid Vehicle Program is documented. Topics addressed include the general layout and styling, the power train specifications with discussion of each major component, vehicle weight and weight breakdown, vehicle performance, measures of energy consumption, and initial cost and ownership cost. Alternative design options considered and their relationship to the design adopted, computer simulation used, and maintenance and reliability considerations are also discussed. J.M.S.

N80-26207*# General Electric Co., Schenectady, N. Y.
NEAR-TERM HYBRID VEHICLE PROGRAM, PHASE 1. APPENDIX A: MISSION ANALYSIS AND PERFORMANCE SPECIFICATION STUDIES REPORT Final Report
8 Oct. 1979 136 p refs Prepared for JPL Original contains color illustrations
(Contract JPL-955190)
(NASA-CR-163231; SRD-79-134/2-App-A;
JPL-9950-334-App-A) Avail: NTIS HC A07/MF A01 CSCL 13F

Results of a study leading to the preliminary design of a five passenger hybrid vehicle utilizing two energy sources (electricity and gasoline/diesel fuel) to minimize petroleum usage on a fleet basis are presented. The study methodology is described. Vehicle characterizations, the mission description, characterization, and impact on potential sales, and the rationale for the selection of the reference internal combustion engine vehicle are presented. Conclusions and recommendations of the mission analysis and performance specification report are included. J.M.S.

N80-26208*# General Electric Co., Schenectady, N. Y.
NEAR-TERM HYBRID VEHICLE PROGRAM, PHASE 1. APPENDIX C: PRELIMINARY DESIGN DATA PACKAGE Final Report
8 Oct. 1979 208 p Prepared for JPL
(Contract JPL-955190)
(NASA-CR-163232; SRD-79-134/6-App-C;
JPL-9950-334-App-C) Avail: NTIS HC A10/MF A01 CSCL 13F

The design methodology, the design decision rationale, the vehicle preliminary design summary, and the advanced technology developments are presented. The detailed vehicle design, the vehicle ride and handling and front structural crashworthiness analysis, the microcomputer control of the propulsion system, the design study of the battery switching circuit, the field chopper, and the battery charger, and the recent program refinements and computer results are presented. J.M.S.

N80-26209*# General Electric Co., Schenectady, N. Y.
NEAR-TERM HYBRID VEHICLE PROGRAM, PHASE 1. APPENDIX D: SENSITIVITY ANALYSIS RESPORT Final Report
8 Oct. 1979 55 p refs Prepared for JPL
(Contract JPL-955190)
(NASA-CR-163233; SRD-79-134/7-App-D;
JPL-9950-334-App-D) Avail: NTIS HC A04/MF A01 CSCL 13F

Parametric analyses, using a hybrid vehicle synthesis and economics program (HYVELD) are described investigating the sensitivity of hybrid vehicle cost, fuel usage, utility, and marketability to changes in travel statistics, energy costs, vehicle lifetime and maintenance, owner use patterns, internal combustion engine (ICE) reference vehicle fuel economy, and drive-line component costs and type. The lowest initial cost of the hybrid vehicle would be $1200 to $1500 higher than that of the conventional vehicle. For nominal energy costs ($1.00/gal for gasoline and 4.2 cents/kWh for electricity), the ownership cost of the hybrid vehicle is projected to be 0.5 to 1.0 cents/mi less than the conventional ICE vehicle. To attain this ownership cost differential, the lifetime of the hybrid vehicle must be extended to 12 years and its maintenance cost reduced by 25 percent compared with the conventional vehicle. The ownership cost advantage of the hybrid vehicle increases rapidly as the price of fuel increases from $1 to $2/gal. M.G.

N80-26210*# Minicars, Inc., Goleta, Calif.
NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM, PHASE 1 Final Report
Jan. 1980 144 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-955188)

(NASA-CR-163235; JPL-9950-337; FR-4500-01-80) Avail: NTIS HC A07/MF A01 CSCL 13F

Missions for hybrid vehicles that promise to yield high petroleum impact were identified and a preliminary design, was developed that satisfies the mission requirements and performance specifications. Technologies that are critical to successful vehicle design, development and fabrication were determined. Trade-off studies to maximize fuel savings were used to develop initial design specifications of the near term hybrid vehicle. Various designs were 'driven' through detailed computer simulations which calculate the petroleum consumption in standard driving cycles, the petroleum and electricity consumptions over the specified missions, and the vehicle's life cycle costs over a 10 year vehicle lifetime. Particular attention was given to the selection of the electric motor, heat engine, drivetrain, battery pack and control system. The preliminary design reflects a modified current compact car powered by a currently available turbocharged diesel engine and a 24 kW (peak) compound dc electric motor. A.R.H.

N80-26211# Fiat Research Center, Turin, Italy.
ELECTROCHEMICAL ENERGY STORAGE ON BOARD OF ROAD ELECTRIC VEHICLES
P. Montalenti, G. Brusaglino, M. Marchetto (Fabrica Italiana Magneti, Marelli), and M. Maja (Inst. di Elettrochimica del Politecnico di Torino) 1979 11 p refs Presented at Intern. Assembly on Energy Storage, Dubrovnik, Yugoslavia, 27 May - 1 Jun. 1979
Avail: NTIS HC A02/MF A01

The use of batteries to power electric vehicles is evaluated in terms of accelerations and maximum speed. A kaline, lead/acid, and high energy density batteries are analyzed for lifetime cycles, weight range, and power density. It is concluded that the lead/acid and Ni/Cd batteries are suitable for immediate application, but improvement in lifetime and reliability for economy is recommended. Future configurations of the Ni/Fe and Ni/Zn batteries will open the market to urban, suburban and commercial transportation. F.O.S.

N80-26212*# AiResearch Mfg. Co., Torrance, Calif.
ADVANCED PROPULSION SYSTEM FOR HYBRID VEHICLES Final Report
L. V. Norrup and A. T. Lintz Jan. 1980 213 p refs
(Contracts DEN3-91; EC-77-A-31-1044)
(NASA-CR-159771; DOE/NASA/0091-80/1; AiResearch-79-16430) Avail: NTIS HC A10/MF A01 CSCL 13F

A number of hybrid propulsion systems were evaluated for application in several different vehicle sizes. A conceptual design was prepared for the most promising configuration. Various system configurations were parametrically evaluated and compared, design tradeoffs performed, and a conceptual design produced. Fifteen vehicle/propulsion systems concepts were parametrically evaluated to select two systems and one vehicle for detailed design tradeoff studies. A single hybrid propulsion system concept and vehicle (five passenger family sedan)were selected for optimization based on the results of the tradeoff studies. The final propulsion system consists of a 65 kW spark-ignition heat engine, a mechanical continuously variable traction transmission, a 20 kW permanent magnet axial-gap traction motor, a variable frequency inverter, a 386 kg lead-acid improved state-of-the-art battery, and a transaxle. The system was configured with a parallel power path between the heat engine and battery. It has two automatic operational modes: electric mode and heat engine mode. Power is always shared between the heat engine and battery during acceleration periods. In both modes, regenerative braking energy is absorbed by the battery. Author

N80-26213# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY-STORAGE SYSTEMS FOR AUTOMOBILE PROPULSION, 1979 STUDY. VOLUME 3: BATTERY/FLYWHEEL ELECTRIC VEHICLES USING ADVANCED BATTERIES
M. Schwartz 15 Dec. 1979 58 p refs
(Contract W-7405-eng-48)
(UCRL-52841-Vol-3) Avail: NTIS HC A04/MF A01

The effect of applying flywheels to electric vehicles using advanced batteries is determined. The specific energy of the batteries is maximized at the expense of peak power capability to optimize performance when used with flywheels. The characteristics of battery flywheel vehicles are determined and compared to all-battery vehicles subjected to the same range and peak power specifications. Three combinations of vehicle power and range are considered for an SAE J2279aD cycle: 0.026 kW/kg and 120 km; 0.033 kW/kg and 210 km; and 0.049 kW/kg and 400 km. The combination of 0.016 kW/kg and 80 km is used with an SAE J227aC cycle. The batteries considered are lead/acid, Ni/Fe, Ni/Zn, ZnCl2, LiAl/FeS2, Na/S(cer), and Na/S(glass). Projected improvements in batteries and flywheels are considered over the next 20 y, based on probable and optimistic performance. The results show that flywheels do not necessarily yield a saving in vehicle mass (or range increase for constant vehicle mass). DOE

N80-26214# Department of Energy, Washington, D. C. Office of Transportation Programs.
ADVANCED SUBSYSTEMS FOR PRACTICAL ELECTRIC VEHICLES. ELECTRIC AND HYBRID VEHICLE SUBSYSTEMS TECHNOLOGY DEVELOPMENT PROGRAM
Sep. 1979 25 p
(DOE/CS-0102/1) Avail: NTIS HC A02/MF A01

The Electric and Hybrid Vehicle (EHV) Subsystem Technology Program of the US Department of Energy (DOE) is charged with developing the advanced technology base, other than energy storage, necessary for practical electric and hybrid vehicles. The success of this endeavor requires close liaison and continued communication between the government, industry, and the consumer market. In addition to identifying current technology problem areas and outlining the potential solutions being pursued, it communicates to the EHV industry expected component and subsystem performance achievements to assist them in their product planning and future developmental activities. The document is also intended to serve as an avenue for obtaining additional information, as well as to describe the procedures for participating in the subsystem technology development program. For these latter purposes, appropriate contact points are identified. DOE

N80-26215# Detroit Diesel Allison, Indianapolis, Ind.
GAS TURBINE ENGINES AND TRANSMISSIONS FOR BUS DEMONSTRATION PROGRAMS Status Report, 31 Jul. - 31 Oct. 1979
D. N. Nigro Nov. 1979 6 p
(Contract EM-78-C-02-4867)
(COO-4867-05) Avail: NTIS HC A02/MF A01

The procurement and delivery of eleven GT 404-4 gas turbine engines and five HT740CT and six V730CT automatic transmissions is reported. Software items such as cost reports, technical reports, installation drawings, acceptance test data and parts lists are required by the contract. A recent decision by the DOE will modify the build configuration for the last four transit coach engines. It was decided that these engines are to be built with ceramic regenerators. DOE

N80-26216# Brookhaven National Lab., Upton, N. Y. Electrochemical Technology Group.
DEVELOPMENT OF FUEL CELL TECHNOLOGY FOR VEHICULAR APPLICATIONS Annual Report, 1 Oct. 1977 - 30 Sep. 1978
J. McBreen, E. J. Taylor, K. V. Kordesch, G. Kissel, F. Kulesa, and S. Srinivasan May 1979 108 p refs
(Contract EY-76-C-02-0016)
(BNL-51047) Avail: NTIS HC A06/MF A01

A survey of the present state-of-the-art of fuel cells and batteries suitable for hybrid fuel cell/battery power plants is presented. Also given are a systems study on phosphoric acid fuel cells for transportation applications and the results of an experimental study of phosphoric acid and alkaline fuel cells under conditions and intermittent operation. A review of fuel options and fuel processing for fuel cells is included. DOE

N80-26217# Operations Research, Inc., Silver Spring, Md.
RISK ASSESSMENT OF AIR VERSUS OTHER TRANSPORTATION MODES FOR EXPLOSIVES AND FLAMMABLE CRYOGENIC LIQUIDS. VOLUME 1: RISK ASSESSMENT METHOD AND RESULTS Final Report
G. Kloeber, M. Cornell, T. McNamara, and A. Moscati Dec.

1979 147 p refs 2 Vol.
(Contract DOT-RC-82036)
(PB80-138472; ORI/TR-1552-Vol-1;
DOT-RSPA-MTB-79-13-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 13F

A method for assessing the comparative risks of transporting hazardous materials by alternative routes and modes is described and applied to the transport of Class A explosives and liquid hydrogen between specific origin destinations, testing the air-highway modal combination with alternative combination with alternative combinations of highway, rail, and marine modes. The risks are found to be highly route-dependent; however, for those routes selected, the air-highway modal combination showed generally lower risks. Rerouting and improvement in terminal operations show the greatest opportunity for risk reduction. GRA

N80-26218# Operations Research, Inc., Silver Spring, Md.
RISK ASSESSMENT OF AIR VERSUS OTHER TRANSPORTATION MODES FOR EXPLOSIVES AND FLAMMABLE CRYOGENIC LIQUIDS. VOLUME 2: SUPPORTING DOCUMENTATION Final Report
G. Kloeber, M. Cornell, T. McNamara, and A. Moscati Dec. 1979 419 p refs 2 Vol.
(Contract DOT-RC-82036)
(PB80-138480; ORI/TR-1552-Vol-2;
DOT-RSPA-MTB-79-14-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 13F

A methodology for performing a comparative assessment of risks involved in the transport of hazardous materials over specific routes by alternative modes applied to the transport of Class A explosives between six different origin-destinations and to the transport of liquid hydrogen over six different origin-destinations. In each case the risks associated with the transport by air compared with various combinations of highway, rail, and marine modes. The risks associated with specific operational phases, with handling operations, and with demographic characteristics of specific routes are defined and quantified. GRA

N80-26219# Office of Technology Assessment, Washington, D. C.
IMPACT OF ADVANCED GROUP RAPID TRANSIT TECHNOLOGY
Jan. 1980 68 p
(PB80-153323; OTA-T-106; LC-80-600001) Avail: NTIS HC A04/MF A01 CSCL 13B

This assessment of advanced group rapid transit (AGRT) was made in response to a request of the House Committee on Appropriations to evaluate the need for this technology and its relationship to national mass transportation goals. Increases in traffic congestion, petroleum shortages, and decreasing mobility for the transit-dependent reflect a growing need for more efficient and effective transportation options. The need for further advances in automated guideway transit (AGT) technology, are examined and their potential impacts on various stakeholder groups are evaluated. GRA

N80-26220# American Association of Community and Junior Colleges, Washington, D.C.
COMMUNITY COLLEGES AND APPROPRIATE TECHNOLOGY
1979 36 p refs
(Contract NSF 79-SP-0851)
(PB80-131634) Avail: NTIS HC A03/MF A01 CSCL 05A

Appropriate technology is defined as alternate, intermediate, small-scale, light-capital, and neighborhood technology. Appropriate technology places a high priority on local needs, resources, skills, and benefits. Because of their strong community base, community colleges are in an ideal position to capitalize on this local orientation. Appropriate technology places heavy emphasis on practicality, on developing and employing useful tools to do constructive work. Some avenues for community college involvement in appropriate technology are: job training; hands-on workshops; public education; resource centers; demonstration sites; research, and appropriate technology entrepreneurship. Two strategies for launching appropriate technology programs are characterized as the add-on approach, involving tacking on individual courses of projects wherever there is a need or opportunity, and the institutional approach, entailing a far more systematic effort involving the entire college and the local community. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-26221 Yale Univ., New Haven, Conn.
THE DWARF SPHEROIDAL GALAXY IN DRACO Ph.D. Thesis
Peter Brailey Stetson 1979 270 p
Avail: Univ. Microfilms Order No. 8012095

The color-magnitude diagram of the dwarf spheroidal galaxy in Draco is redetermined, and forms the basis of a discussion of the evolutionary status of stars in this distant, metal-poor satellite of the Galaxy. Besides photoelectric photometry for 39 stars and precise photographic photometry for 514 stars to V approximately 21 m, membership probabilities derived from stars' relative proper motions, and a reddening determination from uvby-H beta photometry of early-type foreground stars have been obtained. The detailed spectrophotometry of Draco giants by Zinn (1978 Astrophys. J 255, 790) has also been rediscussed in the light of the new data. A new technique for deriving precise photographic magnitude indices from scans of photographic plates with a PDS microdensitometer was developed and is described. Dissert. Abstr.

N80-26222 Washington Univ., Seattle.
SHOCK-INDUCED GRAIN ALIGNMENT IN THE ORION NEBULA Ph.D. Thesis
Paul Elvin Johnson 1979 111 p
Avail: Univ. Microfilms Order No. 8013541

Infrared polarimetry of the Orion Nebula is presented including circular polarimetry of the Becklin-Neugebauer Source (BN) from 1.6 to 3.1 micrometers and linear polarimetry of the Kleinmann-Low Nebula (KL) and IRS2 at 2.2 micrometers. The ellipticity of the polarization of BN is about 10% and is approximately independent of wavelength from 1.6 to 3.4 micrometers. The three measured points in the KL nebula and IRS2 are found to have polarization position angles within 30 deg of the position angle of BN. The polarization is attributed to the effect of aligned, aspherical grains in KL. The degree of grain alignment necessary to produce the observed polarization of BN is most likely explained by the Purcell pinwheel alignment mechanism, driven by hydrogen recombination on the surface of grains. It is hypothesized that a shock provides the atomic hydrogen abundance necessary to excite this process. A comprehensive model of the wavelength and spatial dependencies of linear and circular polarization of KL and BN is developed based on the radiative transfer of infrared radiation through a centrally heated cloud of aligned dust grains. Dissert. Abstr.

N80-26223 Massachusetts Univ., Amherst.
SURFACE PHOTOMETRY OF THE COMA CLUSTER OF GALAXIES Ph.D. Thesis
John Spencer Sloan 1980 196 p
Avail: Univ. Microfilms Order No. 8012643

A large region of the Coma Cluster was studied using a photometer which can discriminate against the light of foreground stars. While able to accurately correct for contaminating starlight, the overall photometric utility of the photometer is limited by night sky variations. The total light distribution of the Coma Cluster at lambda 7150 A and lambda 8200 A is found to have an elliptical shape, the position angle of the major axis lying between 67 deg to 90 deg. The observed light distribution

is found to correlate well with the galaxy distribution. Along the major axis of the Cluster, the luminosity can be traced out over two degrees from the Cluster center. At lambda 7150A a mass-to-light ratio of 230 is found using a King model for the central region of the Cluster. Marginal evidence exists that at distances greater than 1.5 from the Cluster center along the major axis, the Cluster is redder, indicating an integrated spectra of (K1V-K7V). Dissert. Abstr.

N80-26224 Rochester Univ., N. Y.
ATMOSPHERES FOR HOT, HIGH-GRAVITY, PURE HELIUM STARS Ph.D. Thesis
Francois Wesemael 1979 414 p
Avail: Univ. Microfilms Order No. 8013877

An extensive grid is presented of pure helium stellar model atmosphere calculations for hot, high gravity stars. These models are intended to help elucidate the nature and characteristics of the progenitors of the DB white dwarfs. The surface gravity in our model grid ranges from log g = 6.0(1.0)9.0, whereas the effective temperature ranges from T = 25,000K at log g = 6.0 and 8.0 (T = 40,000K at log g = 7.0 and 9.0) up to temperatures close to the Eddington limit at each gravity. All our models assume hydrostatic equilibrium, steady state statistical equilibrium, pure helium composition, and plane-parallel geometry. Most of the models are unblanketed and in LTE, and include convective energy transport. In addition to these, smaller grids of NLTE models (assuming detailed radiative balance in the helium lines) and of LTE, helium-line blanketed models (including convective energy transport) were computed to assess the importance of these effects. For all LTE, unblanketed models, Greenstein's multichannel colors and detailed profiles are tabulated for the HeI 3889, 4026, 4387, 4438, 4471, 4713, 4921, 5015, 5047, 5876, 6678, 7065 and HeII 1085, 1640, 3203, 4340, 4542, and 4686 lines. Dissert. Abstr.

N80-26225 Boston Univ., Mass.
CALCULATIONS OF NLTE CARBON 2-4 SPECTRA IN LINE-BLANKETED MODEL ATMOSPHERES OF EARLY-TYPE STARS Ph.D. Thesis
Louis Alan York 1980 298 p
Avail: Univ. Microfilms Order No. 8013308

The interpretation of the spectra and atmospheric structure of O and B stars plays an important role in our understanding of galactic structure, the interstellar medium, and stellar structure and evolution. Until recently, analyses of O and B stars have been carried out subject to the limiting approximation of local thermodynamic equilibrium (LTE). However, since the temperature of O and B stars is high and the resulting radiation fields intense, it is expected that serious inconsistencies may arise as a result of the use of the LTE hypothesis. The basic problems in analyzing the spectra of early-type stars are discussed along with a description of earlier calculations performed to test the validity of the LTE hypothesis. The basic radiative transfer problem and the modifications necessary to allow for a partial coupling of the radiative transfer and statistical equilibrium equations via the equivalent two-level atom formalism are discussed. Also discussed is a method of including line-blanketing effects in the non-LTE calculations via weighted mean line opacities. Dissert. Abstr.

N80-26226 Washington Univ., Seattle.
AN ANALYSIS OF THE ATMOSPHERE OF THE RV TAURI STAR AC HERCULIS Ph.D. Thesis
Scott Rogers Baird 1979 294 p
Avail: Univ. Microfilms Order No. 8013486

The atmosphere of the RV Tauri variable AC Herculis was analyzed. A series of high dispersion coude spectrograms were obtained at all major phases in the star's cycle. Equivalent widths were measured for atomic and molecular lines on these plates. A grid of model atmospheres was calculated which were used to calculate theoretical line strengths that were then matched to the observations to give the effective temperatures and surface gravities of AC Her as a function of phase. The comparison of theoretical and observed line strengths was also used in abundance determinations for Fe/H, C/H, N/H, and O/H. A mysterious high redshift velocity system was found to appear for a short time during the rise from primary light minimum to primary light maximum. The lines in this system were quite numerous and roughly the same strength as those of the lower velocity systems which were presumably formed in the photosphere. This high redshift system contained lines of neutral and ionized metals, including some with lower excitation potentials around 4eV. This appears to be the first time in any star that such a velocity system has been recorded that contained metallic lines. Dissert. Abstr.

N80-26227 Washington Univ., Seattle.
PERIODIC MASS TRANSFER IN THE X-RAY BINARY SYSTEM HER X-1/HZ HER Ph.D. Thesis
Lidia Marta Crosa 1979 160 p
Avail: Univ. Microfilms Order No. 8013512

Mass transfer and accretion in the binary system HZ Her/Her X-1 is studied analyzing various absorption features in the X-ray flux curve. Pre-eclipse dips, anomalous dips, 0.3 and 0.7 orbital phase turn-ons, post-eclipse recoveries, are all seen to be aspects of only a single process of periodic mass transfer in this system. That is, one can understand quantitatively the periodicities and phases of these events in terms of an enhancement of the rate of mass events in terms of an enhancement of the rate of mass arrival at the outer boundary of the disk every 0.81 days, the circulation time of that material around the disk perimeter and the relaxation time of the scale height of that material as it joins the disk. Mass transfer episodes appear to be correlated with the periodic passage of the X-ray shadow of the tilted accretion disk over the most strongly heated portion of the face of HZ Her. The model not only explains the observed absorption features in the X-ray flux curve but predicts that no other adsorption feature should exist. In addition the model is used to construct an ephemeris of optical emission lines assuming they might be originated in the matter associated with the discrete accretion events on the disk. Dissert. Abstr.

N80-26228*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE DISCOVERY OF OPTICAL EMISSION FROM THE SNR G 126.2 + 1.6
W. P. Blair (Michigan Univ.), R. P. Kirshner (Michigan Univ.), T. R. Gull, D. L. Sawyer (Wesleyan Univ.), and R. A. R. Parker (NASA, Johnson Space Center) May 1980 18 p refs
(NASA-TM-80708) Avail: NTIS HC A02/MF A01 CSCL 03A

Interference filter photographs were used to identify an arc of nebulosity that is coincident with the radio contours of the galactic supernova remnant G 126.2 + 1.6. Spectrophotometry of the filament shows that the emission line spectrum matches the spectra of other galactic supernova remnants. In particular, the arc shows the usual strong [SII], and [NII] emission lines seen in other remnants and unusually strong [OII] emission as seen in a few remnants. The spectrum can be adequately matched by a shock of velocity near 100 km/s in an interstellar cloud of density 3. If the SNR is at a distance of 4.5 kpc as indicated by the radio signal-D relation, then the observed pressure in the filament requires an initial energy near 4 x 10 to the 51st power (d/4.5 kpc) to the 3rd power ergs. A.R.H.

N80-26229*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SYNCHROTRON COOLING AND ANNIHILATION OF AN E(+)-E(-) PLASMA: THE RADIATION MECHANISM FOR THE MARCH 5, 1979 TRANSIENT
R. Ramaty, R. E. Lingenfelter (California Univ., San Diego), and R. W. Bussard Mar. 1980 21 p refs
(NASA-TM-80674) Avail: NTIS HC A02/MF A01 CSCL 03A

Positron-electron pair radiation is examined as a mechanism that could be responsible for the impulsive phase emission of the March 5, 1979 transient. Synchrotron cooling and subsequent annihilation of the pairs can account for the energy spectrum, the very high brightness, and the approximately 0.4 MeV feature observed from this transient, whose source is likely to be a neutron star in the supernova remnant N49 in the Large Magellanic Cloud. In this model, the observed radiation is produced in the skin layer of a hot, radiation dominated pair atmosphere, probably confined to the vicinity of the neutron star by a strong magnetic field. The width of this layer is only about 0.1 mm. In this layer, approximately 10 to the 12th power generations of pairs

are formed (by photon-photon collisions), cooled and annihilated during the approximately 0.15 sec duration of the impulsive phase. The very large burst energy implied by the distance of the Large Megellanic Cloud, and its very rapid release, are unsolved problems. Nonetheless, the possibility of neutron star vibrations, which could transport the energy coherently to the surface, heat the atmosphere mechanically to a hot, pair-producing temperature, and have a characteristic damping time roughly equal to the duration of the impulsive phase are addressed. E.J.R.

N80-26230°# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GODDARD PROGRAM OF GAMMA RAY TRANSIENT ASTRONOMY
T. L. Cline, U. D. Desai, and B. J. Teegarden Mar. 1980 30 p refs Presented at the Symp. and Workshop on Cosmic Gamma Ray Bursts, Toulouse, France, 26 Nov. 1979 Submitted for publication
(NASA-TM-80675) Avail: NTIS HC A03/MF A01 CSCL 03A

Gamma ray burst studies are reviewed. The past results, present status and future expectations are outlined regarding endeavors using experiments on balloons, IMP-6 and -7, OGO-3, ISEE-1 and -3, Helios-2, Solar Maximum Mission, the Einstein Observatory, Solar Polar and the Gamma Ray Observatory, and with the interplanetary gamma ray burst networks, to which some of these spacecraft sensors contribute. Additional emphasis is given to the recent discovery of a new type of gamma ray transient, detected on 1979 March 5. Author

N80-26231°# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF ELECTRON GYROHARMONIC WAVES AND THE STRUCTURE OF THE IO TORUS
T. J. Birmingham, J. K. Alexander, M. D. Desch (Maryland Univ., College Park), R. F. Hubbard (JAYCOR, Alexandria, Va.), and B. M. Pedersen (Observatoire de Paris-Meudon, France) May 1980 34 p refs Submitted for publication
(NASA-TM-80696) Avail: NTIS HC A03/MF A01 CSCL 03A

Narrow-banded emissions were observed by the Planetary Radio Astronomy experiment on the Voyager 1 spacecraft as it traversed the Io plasma torus. These waves occur between harmonics of the electron gyrofrequency and are the Jovian analogue of electrostatic emissions observed and theoretically studied for the terrestrial magnetosphere. The observed frequencies always include the component near the upper hybrid resonant frequency, (fuhr) but the distribution of the other observed emissions varies in a systematic way with position in the torus. A refined model of the electron density variation, based on identification of the fuhr line, is included. Spectra of the observed waves are analyzed in terms of the linear instability of an electron distribution function consisting of isotropic cold electrons and hot losscone electrons. The positioning of the observed auxiliary harmonics with respect to fuhr is shown to be an indicator of the cold to hot temperature ratio. It is concluded that this ratio increases systematically by an overall factor of perhaps 4 or 5 between the inner and outer portions of the torus. A.R.H.

N80-26232# Los Alamos Scientific Lab., N. Mex.
LIGHT CURVE OF TYPE I SUPERNOVAE
S. A. Colgate, Albert G. Petschek (New Mexico Institute of Mining and Technol.), and John T. Kriese 1980 9 p refs Presented at Atomic Phys. and Spectry. for Supernovae Spectra, La Jolla, Calif., 10-12 Jan. 1980 Sponsored in part by NSF (Contract W-7405-eng-36)
(LA-UR-80-463; CONF-800126-1) Avail: NTIS HC A02/MF A01

Calculations of the intermediate and late time luminosity of type I supernovae based on 100 percent efficiency for optical emission of energy deposited by the Ni-56 decay chain give good agreement with observations provide m/sub/ej/v/2 = (2.2 + - 0.5) x 10 to the 17th power m. sq s/sq cm where M/sub ej/ is ejected mass and v is the expansion velocity. Account must be taken of the escape of both gamma rays and positrons. These two escape processes as well as the early luminosity peak as calculated by Colgate and McKee are all consistent with the same value of M/sub ej//sq v. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-26233 Iowa Univ., Iowa City.
MILLIARCSECOND STRUCTURE OF NINE COMPACT EXTRAGALACTIC SOURCES AT 1671 MHz Ph.D. Thesis
Robert Boone Phillips 1979 224 p
Avail: Univ. Microfilms Order No. 8012407

Nine compact extragalactic sources were observed interferometrically at lambda = 18 cm with baselines having fringe spacings from 0.0045 to 0.035 milliarcseconds. Four of the sources exhibit widely separated bright components reminiscent of extended double sources. The variable source NRAO 150 has complex structure extending over 0.020 milliarcseconds. The BL Lac object 0735 + 178 has compound structure at the limiting resolution of the observations in contradiction of concentric multicomponent models for this source and its flat radio spectrum. Three sources show simple, single component structure similar to several other sources at this wavelength. Morphology of the compact radio emission at lambda = 18 cm appears correlated to radio spectrum in a sense opposite to usual interpretations. Sources with simple spectra, reconcilable with a single radiating component instead showed multiple, separated components. Other sources with complex spectra showed comparatively simple radio structure. The radio emission of NRAO 150 however appears to come from at least three regions which also give rise to a complex system. Dissert. Abstr.

N80-26234 Maryland Univ., College Park.
ON THE PHYSICAL ENVIRONMENT IN GALACTIC NUCLEI
James Howard Beall 1979 191 p
Avail: Univ. Microfilms Order No. 8012653

Galactic nuclei quasars emit radiation over the entire electromagnetic spectrum. There is considerable interest in the nature of the emission mechanisms which may be responsible for the observed radiation. The possiblity that a single mechanism is responsible for a wide frequency range of the electromagnetic flux suggests that multiple frequency observations of galactic nuclei and quasars can be used to place constraints on models for the source mechanisms involved. In conjunction with observations by the High Energy X-ray Spectrometer on OSO-8, four extragalactic sources have been investigated in this manner: (1) the nucleus of the elliptical galaxy, Centaurus A (NGC 5128); (2) the quasar, 3C273; (3) the nucleus of the Seyfert galaxy, NGC 4151; and (4) the nucleus of the Milky Way galaxy. Concurrent observations have been taken for Cen A at radio and X-ray frequencies, and for NGC 4151 at radio, infrared, optical, and X-ray frequencies. The data from these observations and from other work are used to construct composite spectra (radio to gamma-ray) for the sources. Additionally, a computer program has been developed to obtain source strengths from regions of the sky where more than one source is in the OSO-8. Dissert. Abstr.

N80-26235°# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1979 X-RAY OUTBURST OF CEN X-4
L. J. Kaluzienski, S. S. Holt, and J. H. Swank May 1980 25 p refs Submitted for publication
(NASA-TM-80694) Avail: NTIS HC A02/MF A01 CSCL 03B

X-ray observations of the first major outburst (since its initial discovery in 1969) of the 'classical' transient X-ray source Cen X-4 were obtained with the Ariel 5 All-Sky Monitor. The flare light curve exhibits a double-peaked maximum at a level of approximately 4 times the Crab nebula, and its duration and characteristic decay time scale are the shortest yet observed from the class of 'soft' X-ray transients. A total X-ray output of approximately 3 x 10 to the 43rd power ergs, a factor of approximately 20 less than that of the 1969 outburst is estimated. In addition, evidence is found for a regular modulation of the flux during the decline phase at a period of 8.2 plus or minus 0.2 hours. The existing data are consistent with a source model involving episodic mass exchange from a late-type dwarf

onto a neutron star comparison in a relatively close binary system. A.R.H.

N80-26236*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE EVOLUTION OF SUPERNOVA REMNANTS IN DIFFERENT GALACTIC ENVIRONMENTS, AND ITS EFFECTS ON SUPERNOVA STATISTICS
Minas Kafatos (George Mason Univ.), Sabatino Sofia, Frederick Bruhweiler (Computer Sciences Corp., Silver Spring, Md.), and Theodore R. Gull. May 1980. 39 p. refs.
(NASA-TM-80707) Avail: NTIS HC A03/MF A01 CSCL 03B

Examination of the interaction between supernova (SN) ejecta and the various environments in which the explosive event might occur shows that only a small fraction of the many SNs produce observable supernova remnants (SNRs). This fraction, which is found to depend weakly upon the lower mass limit of the SN progenitors, and more strongly on the specfic characteristics of the associated interstellar medium, decreases from approximately 15 percent near the galctic center to 10 percent at Rgal approximately 10 kpc and drops nearly to zero for Rgal > 15 kpc. Generally, whether a SNR is dectectable is determined by the density of the ambient interstellar medium in which it is embeeede. The presence of large, low density cavities arpund stellar associations due to the combined effects of stellar winds and supernova shells strongly suggests that a large portion of the detectable SNRs have runway stars as their progenitors. These results explain the differences between the substantially larger SN rates in the galaxy derived both from pulsar statistics and from observations of SN events in external galaxies, when compared to the substanially smaller SN rates derived form galactic SNR statistics. A.R.H.

N80-26237# State Univ. of New York at Albany. Space Astronomy Lab.
BACKGROUND SKY BRIGHTNESS MEASUREMENTS FOR APPLICATION TO SPACE SURVEILLANCE SYSTEMS. Final Report, 1 Oct. 1977 - 30 Sep. 1979
J. L. Weinberg. 14 Feb. 1980. 32 p. refs.
(Contract F49620-78-C-0013; AF Proj. 2311)
(AD-A081881; AFOSR-80-0174TR) Avail: NTIS HC A03/MF A01 CSCL 03/2

Background starlight has been mapped in blue and red wavelengths over the entire sky, using Pioneer 10 observations from beyond the asteroid belt where the zodiacal light is negligible. Zodiacal light has been isolated in observations between 1 and 3 AU to derive heliocentric dependence. The general solution for inversion of the zodiacal light brightness integral has been derived and is used to yield the scattering function of interplanetary dust for each position traversed by the probe moving through the solar system. Properties of the dust are found to change with heliocentric distance. Polarization of zodiacal light was determined at the north celestial, south ecliptic, and north galactic poles. For inner zodiacal light, symmetry plane of interplanetary dust is close to orbital plane of Venus. At 110 degrees from the sun, it is close to orbital plane of Mars. There appears to be more than one symmetary (plane) for the dust; position of maximum dust density relates closely to orbital planes of the planets. Dust rotation/bursting have been studied as possible important mechanism in comets, interplanetary space, reflection nebulae, stellar envelopes, interstellar medium. GRA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-26238*# Old Dominion Univ. Research Foundation, Norfolk, Va.
LAMINAR AND TURBULENT FLOW SOLUTIONS WITH RADIATION AND ABLATION INJECTION FOR JOVIAN ENTRY. Final Report, period ending 29 Feb. 1980
Ajay Kumar and S. N. Tiwari. May 1980. 40 p. refs.
(Grant NsG-1464)
(NASA-CR-163215) Avail: NTIS HC A03/MF A01 CSCL 03B

Laminar and turbulent flow-field solutions with coupled carbon-phenolic mass injection are presented for the forebody of a probe entering a nominal Jupiter atmosphere. Solutions are obtained for a 35-degree hyperboloid and for a 45-degree spherically blunted cone using a time-dependent, finite-difference method. The radiative heating rates for the coupled laminar flow are significantly reduced as compared to the corresponding no-blowing case; however, for the coupled turbulent flow, it is found that the surface radiative heating rates are substantially increased and often exceed the corresponding no-blowing values. Turbulence is found to have no effect on the surface radiative heating rates for the no-blowing solutions. The present results are compared with the other available solutions, and some additional solutions are presented. Author

N80-26239*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IMAGES OF MARS: THE VIKING EXTENDED MISSION
Michael H. Carr (Geological Survey) and Nancy Evans. 1980. 35 p.
(NASA-SP-444) Avail: NTIS HC A01; SOD HC $2.25 CSCL 03B

Although the Viking spacecraft were designed to operate for only 90 days, the two landers and one orbiter have been observing seasonal changes in the Martian atmosphere and surface for almost 4 years (2 Martian years). Views of the planet, some taken as recently as late 1979, show volcanoes, lava plains, channels, canyons, plateaus, impact craters, wind erosion, global dust storms, polar caps, clouds, and the surface features of Phobos and Deimos. The latter image is the highest resolution picture ever taken of another ouject from an orbiter or flying spacecraft. A.R.H.

N80-26240*# Science Applications, Inc., Pasadena, Calif. Planetary Science Inst.
VIKING ORBITER STEREO IMAGING CATALOG. Final Report
Karl R. Blasius, Amelia V. Vetrone, and Michael D. Martin (JPL) Washington NASA. Jun. 1980. 303 p. refs.
(Contracts NASw-3208; JPL-954149)
(NASA-CR-3277) Avail: NTIS HC A14/MF A01

The extremely long missions of the two Viking Orbiter spacecraft produced a wealth of photos of surface features. Many of which can be used to form stereo images allowing the earth-bound student of Mars to examine the subject in 3-D. This catalog is a technical guide to the use of stereo coverage within the complex Viking imaging data set. Since that data set is still growing (January, 1980, about 3 1/2 years after the mission began), a second edition of this catalog is planned with completion expected about November, 1980. A.R.H.

N80-26241# Tennessee Univ., Knoxville.
DETERMINATION OF PRIMORDIAL AND COSMOGENIC RADIOACTIVITY IN ACHONDRITIC METEORITES BY LOW-LEVEL, GAMMA-RAY SPECTROMETRY. Ph.D. Thesis
Richard August Muntean. Aug. 1979. 140 p. refs.
(Contract EY-76-C-05-0033)
(DOE/TIC-11096) Avail: NTIS HC A07/MF A01

A high-sensitivity, low-background gamma-ray spectrometer containing two 23 cm by 13 cm thallium-activated, sodium iodide detectors was used to measure long-lived primordial and cosmogenic radioactivity in a suite of achondritic meteorites. Potassium, thorium, uranium, and Al-26 abundances were established for sixteen brecciated eucrites, two unbrecciated eucrites, a nakhlite, a chassignite, and a unique meteorite from Antarctica by nondestructive counting techniques. In several cases, multiple samples of the same meteorite fall were examined. Concentrations ranged from 79.8 ppM to 1150 ppM for potassium, 55.6 ppb to 683 for thorium, 18.1 ppb to 190 ppb for uranium, and 45.0 dpm/kg to 99.0 dpm/kg for Al-26. In addition, a Cs-137 concentration of 284 dpm/kg was observed in the Allan Hills 77005,9 specimen. DOE

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-26242*# Illinois Univ., Urbana.
ROCKET OBSERVATIONS OF SOLAR RADIATION DURING THE ECLIPSE OF 26 FEBRUARY 1979
H. M. Bliss and L. G. Smith 1 May 1980 129 p refs
(Grant NGR-14-005-181)
(NASA-CR-163211; UILU-ENG-80-2502; Aeronomy-93) Avail: NTIS HC A07/MF A01 CSCL 03B

Three Nike Tomahawk rockets were launched in Red Lake, Ontario, one previous to, and two during, the total eclipse of the Sun, for the purpose of studying the atmosphere and its interaction with solar radiation. The method and preliminary results of three experiments that were used to measure solar radiation in the X-ray, Lyman-alpha, and visible parts of the spectrum are described. The instrumentation designed for this investigation is discussed as well as post-flight data processing techniques. The retrieved data were processed to some extent to verify that a valid representation of the solar radiation was obtained. The Lyman-alpha experiment yielded very good results, and preliminary data are included. The visible radiation experiment served as support for the other experiments and also functioned well. Due to a high level of energetic particles during the eclipse, the X-ray data were contaminated and are not presented. However, satellite observations indicate no appreciable level of X-rays from the Sun during the time of the eclipse. A.R.H.

N80-26243# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)
ASPECTS OF SOLAR WIND THEORIES
Rene A. Medrano-B. Dec. 1979 25 p refs Revised
(INPE 1636-RPE/095) Avail: NTIS HC A02/MF A01

A critical review of past and present theories is presented in order to identify the main difficulties that should be surmounted by any modern theoretical model to achieve satisfactory results. It is found that the major difficulties are insufficient knowledge about the damping of the magnetohydrodynamic waves to heat the solar wind protons and about electron heat conduction flux density for the collisonless interplanetary plasma. More experimental information about the boundary conditions of the low corona, which became more important after the coronal holes were identified as probable sources of the solar wind, should be obtained. E.D.K.

N80-26244# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 423, PART 1. PROMPT REPORTS: DATA FOR OCTOBER 1979, SEPTEMBER 1979
Helen E. Coffey Nov. 1979 179 p
(PB80-146160-SGD-423-PT-1; NOAA-79122801) Avail: NTIS HC A09/MF A01 CSCL 03B

This prompt report provides data for October 1979 on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, coronal holes, and Boulder Geomagnetic Substorm Log. It also provides data for September 1979 on: daily solar activity center, sudden ionospheric disturbances, solar x-ray radiation, solar radio emission, cosmic rays, geomagnetic indices and radio propagation indices. GRA

N80-26245# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMER 423, PART 2. COMPREHENSIVE REPORTS. DATA FOR MAY 1979, MARCH 1979 AND MISCELLANEA
Helen E. Coffey Nov. 1979 96 p
(PB80-146178; SGD-423-PT-2; NOAA-79122802) Avail: NTIS HC A05/MF A01 CSCL 03B

This comprehensive report provides data for May 1979 on: solar radio emmission, energetic solar particles and plasma, and solar X-ray radiation. The data for March 1979 consists of: solar flares, synoptic charts, and abbreaviated calendar record. The miscellaneous data includes solar flares spacecraft observations and coronal holes for September 1979, solar radio emission for July and August 1979, cosmic rays for August 1979, regional flare index for Februaey 1979 and stacked magnetograms for selected events in 1978. GRA

N80-26246# National Technical Information Service, Springfield, Va.
SOLAR ECLIPSES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1980
Brian Carrigan Mar. 1980 174 p Supersedes NTIS/PS-79/0181; NTIS/PS-78/0241; NTIS/PS-77/0250
(PB80-805732; NTIS/PS-79/0181; NTIS/PS-78/0241; NTIS/PS-77/0250) Avail: NTIS HC $30.00/MF $30.00 CSCL 03B

The bibliography cities observations of solar radiation, solar corona, and effects on the Earth's atmosphere, taken during solar eclipses. Observations of eclipses from 1961 are included. This updated bibliography contains 167 abstracts, 3 of which are new entries to the previous edition. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-26247 Yale Univ., New Haven, Conn.
X-RAYS FROM ACTIVE GALACTIC NUCLEI: EMISSION MECHANISMS AND INTERACTION WITH AMBIENT MEDIA Ph.D. Thesis
David Glenn Payne 1979 106 p
Avail: Univ. Microfilms Order No. 8012105

In the context of thermal Comptonization, both steady and time-dependent, the X-ray emission from active galactic nuclei is discussed. Analytic solutions are obtained to the Kompaneets equation for a finite medium. The results are then used to infer various properties of the source. It is argued that, if the X-rays from active galactic nuclei are interpreted as being thermal in origin, the emitting gas must be optically thin to free-free absorption and emission. The enormous X-ray luminosities from active galactic nuclei can then be explained by accretion onto massive black holes through 'non-standard', optically thin (to free-free emission and absorption) accretion disk models. The possibility of there being significant interaction between hard X-rays and ambient media in active galactic nuclei is explored. A model is suggested in which the X-rays produce the broad optical emission lines. For the case of hard X-rays, the ionization and heating is dominated by inelastic Compton scattering, rather than photoionization. Many of the results of the calculations should be applicable to hard X-ray sources in other astronomical contexts. Dissert. Abstr.

N80-26248 Washington Univ., St. Louis, Mo.
ABUNDANCES AND ENERGY SPECTRA OF INDIVIDUAL ELEMENTS IN THE HEAVY COSMIC RAYS Ph.D. Thesis
Jack Tueller 1979 407 p
Avail: Univ. Microfilms Order No. 8013477

Individual element abundances in the charge region equal to or less than Z equal to or less than 30 are derived from two balloon flights of a very large geometry (6.6 sq m ster) electronic detector. The quality of this experiment provided not only single charge resolution over the entire charge range, but also ample statistics to determine relative abundance for each element as a function of energy and atmospheric depth. Absolute energy spectra in the region 0.6 to 1.2 GeV/amu are derived for the reference elements Iron (Z = 26) and Silicon (Z = 14). Some of the unique results of this experiment include: the first measurement of Zinc (Z = 30) which can display a clearly resolved charge peak, a new upper limit on the Cobalt (Z = 27) abundance with significant astrophysical consequences, and an empirically derived correction for atmospheric interactions which significantly reduces the systematic uncertainty in the abundance of secondary elements at the top of the atmosphere. Dissert. Abstr.

N80-26249 Minnesota Univ., Minneapolis.
THE ORIGIN AND RELATIONSHIP OF THE RADIO, INFRARED AND VISUAL RADIATION FROM COMPACT NONTHERMAL SOURCES Ph.D. Thesis
Jeffery John Puschell 1979 269 p
Avail: Univ. Microfilms Order No. 8011872

The results of a study of the flux variability and polarization of compact extragalactic sources are presented. The studied set of 17 objects includes two class 1 Seyfert galaxies (3C 120 and NGC 4151), one class 2 Seyfert (NGC 1068), one broad line radio galaxy (3C 382), two QSOs (III Zw 2 and 3C 273) and 11 BL Lac objects (0109 + 224, AO 0235 + 164, 0300 + 471, Pks 0735 + 178, OI 090.4, OJ 287 Mk 421, 1308 + 326, 1418 + 546, Mk 501 and BL Lac). As BL Lac objects show the most extreme forms of both flux variability and polarization - important characteristics of presumed nonthermal activity - the attention of this dissertation is directed primarily at these sources in the hope they provide the best indications of the intrinsic nature of compact extragalactic nonthermal sources. The spectral-flux distributions of the observed sources are generally flat or peaked in the radio portion of the spectrum with a steep decline into the infrared region. For most of the objects observed, this decline continues into the visual region. But, for some of the sources notably III Zw 2 and 3C 273, the visual spectral-flux distribution cannot be joined smoothly to the infrared, suggesting different physical mechanisms are responsible for the observed emission in each region. Dissert. Abstr.

N80-26250 Minnesota Univ., Minneapolis.
THE ISOTOPIC COMPOSITION OF COSMIC RAYS Ph.D. Thesis
Judith Sharn Young 1979 209 p
Avail: Univ. Microfilms Order No. 8011904

Results from an airborne cosmic ray telescope designed to detect and resolve the isotopes of the heavy cosmic ray nuclei are discussed. Nuclear charge was measured with a double scintillator-Cerenkov array and mass was determined by combining the Cerenkov signal with the residual range measured in a stack of nuclear emulsions. Of the 27,000 nuclei detected, 5,000 nuclei stopped in the nuclear emulsions and are therefore suitable for mass analysis. Mass spectra are presented for the nuclei of Ne, Al, Ca, Sc, Ti, Cr, Mn, Fe, and Ni. The (26) Al/Si abundance ratio places an upper limit of rho approx. <0.4 atoms/cu cm on the density of the interstellar medium in the vicinity of the Sun. An overabundance of (44) Ca was detected, suggesting either large uncertainties in the cross section for production of (44) Ca from iron, or the decay of appreciable amounts of (44) Ti at the source before acceleration. The latter hypothesis suggests that the time delay between nucleosynthesis and acceleration is approx. >100 years. The neutron excess is determined from the iron group isotopes and the astrophysical implications of the results are discussed. Dissert. Abstr.

N80-26251*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IS THE REMNANT OF SN1006 CRAB-LIKE?
R. H. Becker, A. E. Szymkowiak, E. A. Boldt, S. S. Holt, and P. J. Serlemitsos May 1980 14 p refs Submitted for publication
(NASA-TM-80689) Avail: NTIS HC A02/MF A01 CSCL 03B

The solid state spectrometer on the Einstein Observatory and the GSFC cosmic X-ray spectrometer on OSO-8 observed the X-ray spectrum of SN1006. The data can be well-represented by a power-law model with alpha = 1.2, similar to the spectrum of the Crab nebula. This is in contrast to the radio and X-ray maps of SN1006 which show a shell structure more typical of SNR with thermal X-ray emission. The X-ray spectrum is suggestive of nonthermal synchrotron emission, raising the possibility that the remnant of SN1006 contains a source of relativistic electrons. Author

N80-26252*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH RESOLUTION SPECTROSCOPY OF TWO GAMMA-RAY BURSTS IN NOVEMBER 1978
B. J. Teegarden and T. L. Cline Oct. 1979 16 p refs Submitted for publication
(NASA-TM-80575) Avail: NTIS HC A02/MF A01 CSCL 03B

The first results from the ISSEE-3 radiatively colled germanium gammray burst spectrometer are presented. Spectra and time histories from two events on the 1978 November 4 and 1978 November 19 are given. A significant difference in the continuum spectra for the two events was observed. Evidence is presented for two spectral features in the features in the November 19 events, a broad one at approximately 420 key KeV and a narrower one at 740 KeV with a suggestion of an accompanying high energy tail. Author

N80-26253# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MAXIMUM ENTROPY SPECTRAL ANALYSIS OF GEOMAGNETIC DISTURBING INDICES
R. P. Kane Mar. 1980 21 p refs Revised
(INPE-1693-RPE/120-Rev) Avail: NTIS HC A02/MF A01

Burg spectra of geomagnetic disturbance indices Ap, AN, AS, AE, AU, AL, Dst and Cosmic ray neutron intensity at Deep River were obtained for 1965 and 1969 from daily means and for longer periods from monthly means also. A large number of peaks of periodicities from 2 days to several years is obtained, many of which are shown by all the indices and are likely to be genuine. Some of these are harmonics of the 27 days solar rotation period and the 10.2 years sunspot cycle period but may others do not find ready explanation. Results are compared with those of earlier workers who reported fewer peaks. A.R.H.

N80-26254# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
NUCLEAR GAMMA RAY LINES FROM SUPERNOVAE
Jeronimo O. D. Jardim Jan. 1980 14 p refs Revised
(INPE-1665-RPE/105) Avail: NTIS HC A02/MF A01

From theoretical observations of the behavior of gamma ray lines fluxes occurring after a supernova explosion, the 1.156 and 0.847 MeV lines are seen to be the most likely to be observed. The 1.156 MeV line was previously observed by other investigators. Observations are reported of the 0.847 MeV line, and 1.332, 1.173 and 0.059 MeV lines using a Ge(Li) telescope aboard a stratospheric balloon which was flown in Brazil in 1977. The observation using a NaI(Tl) detector of a line in the energy interval 1.5 - 1.6 MeV is also reported. It may be due to O18 (p, p prime) O18* reaction. Author

99 GENERAL

N80-26255# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN NUMBER 1979-6
1979 92 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-6, Nov. - Dec. 1979 p 340-409 Original French report available from ONERA, Paris FF 36 Prepared for ESA
(ESA-TT-632; ONERA-NT-1979-6) Avail: NTIS HC A05/MF A01

Topics include: instrumentation for Earth radiation budget measurements, a solar powered air turbine thermal power system, high stability quartz oscillators, plate equilibrium problems, numerical bracketing of the eigen frequencies of complex linear structures, and identification of the elastic characteristics of composite materials. For individual titles, see N80-26256 through N80-26261.

N80-26256# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BIRAMIS: DIRECT MEASUREMENT OF THE EARTH RADIATION BUDGET BY MEANS OF AN ACCELEROMETER IN SPACE c46
Anne-Marie Mainguy, Alain Bernard, Manola Romero, Jacques Bouttes, and Francois Barlier (CERGA, Grasse, France) *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-6 (ESA-TT-632) 1979 p 1-9 refs Transl. into ENGLISH of La Rech. Aerospatiale,

Bull. Bimestriel (Paris), no. 1979-6, Nov. - Dec. 1979 9 p Presented at the Ann. Congr. of the French Phys. Soc., Toulouse, 25-30 Jun. 1979 Original report in FRENCH previously announced as A79-43634 (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

A program for measuring the radiation budget of the Earth using the SUPER CACTUS, an ultrasensitive accelerometer housed in a spherical satellite, was undertaken. The accelerometer measured the resultant of accelerations in the 10 to the minus 9th to minus 10th a range due to radiation pressures from different sources. These were subsequently translated into energy fluxes. Specific results are reported. Author (ESA)

N80-26257# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Turbomachines Div.
AN OPEN CYCLE TURBINE SOLAR THERMAL POWER SYSTEM c44
Emile LeGrives *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-6 (ESA-TT-632) 1979 p 11-38 refs Transl. into ENGLISH Of La Rech. Aerospatiale, Bull. Bimestriel (Paris), No. 1979-6, Nov. - Dec. 1979 p 355-373 Original report in FRENCH previously announced as A80-19989 (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

Solar electrical power generation using a heated air turbine in conjunction with a tower mounted central receiver and heliostat field was hybrid fossil fuel fired so as to avoid thermal storage problems. Using a regenerative gas turbine open cycle, no cooling system was required. It is shown that with a solar receiver concept allowing a fast thermal response to transient radiation situations, a turbine inlet temperature of 1100 to 1150 K can be reached with an overall efficiency (power available on turbine shaft/power radiated into receiver) of 25 percent, with a 2000 Sun concentration ratio. Solar receiver, turbocompressor and regenerator sizes are given for a thermal power input of 1 MW into the receiver. Author (ESA)

N80-26258# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESEARCH OF AN OPTIMAL CONFIGURATION FOR HIGH STABILITY QUARTZ OSCILLATORS ON BOARD AIRCRAFT AND MISSILES c33
Jacques Beaussier *In its* La Rech. Aerospatiale, Bimonthly Bull. no. 1979-6 (ESA-TT-632) 1979 p 39-53 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), No. 1979-6, Nov. - Dec. 1979 p 375-386 Original report in FRENCH previously announced as A80-19990 Sponsored in part by DRET (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

The optimal configuration of compact and easily startable quartz oscillators of stability close to that of atomic clocks for use in the time frequency systems of aircraft and missiles is summarized. The stability requirements of a time frequency standard are discussed and the operating parameters of quartz oscillators and atomic clocks are compared. The configurations of oscillators developed are then described, taking into consideration problems encountered with the resonator and the electronic circuits associated with it and the specifications, operation, design, and significance of the dual thermostats within the oscillators. The four 5 MHz and two 100 MHz oscillators realized are described, and results of test of test of long, medium and short term frequency stability in nonperturbed environments and of acceleration and temperature sensitivity in simulated aircraft and missile environments are reported. It is found that the 5 MHz oscillators exhibit greater stability while the 100 MHz oscillators are smaller, and quartz oscillator stabilities surpassing those of rubidium standards are reported. Author (ESA)

N80-26259# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VARIATIONAL FORMULATION OF THE PLATE EQUILIBRIUM PROBLEM. APPLICATION TO ISOPARAMETRIC FINITE ELEMENTS OF PLATES, PART 1 c39
Daniel Osmont and Raoul Girard *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-6 (ESA-TT-632) 1979 p 55-67 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-6, Nov. - Dec. 1979 p 387-394 Original report in FRENCH previously announced as A80-19991 (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

The problem of plate equilibrium is discussed in terms of a stress tensor and displacement space for a plate discretizable by isoparametric finite elements. The stress tensor is derived from the three dimensional equilibrium equations assuming the linearly of parallel stresses in the midplane of the plate, and the form of the Reissner functional is obtained for the stress tensor and for stress displacement pairs. A mixed variational formulation and displacement variational formulations to which finite elements with linear interpolation within the thickness of the plate can be applied are then defined for the problem of plate equilibrium. Author (ESA)

N80-26260# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL BRACKETING OF THE EIGENVALUES OF COMPLEX LINEAR STRUCTURES c64
Philippe Gibert *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-6 (ESA-TT-632) 1979 p 69-78 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-6, Nov. - Dec. 1979 p 395-400 Original report in FRENCH previously announced as A80-19992 (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

Consideration is given to the numerical bracketing of the eigenvalues of a symmetrical operator associated with elliptical partial differential equations for the case of a complex linear structure. A method for solving a supplemental static problem by means of a mixed variational formulation is presented. It is shown that the method allows an explicit boundary for the eigenvalue error to be obtained, as well as an approximate constraint which would verify the equilibrium equations better than that obtained by a standard finite element method. The application of the method to a one dimensional problem is illustrated, and it is noted that it can also be reduced to the level of a finite element solutions. Author (ESA)

N80-26261# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
IDENTIFICATION OF THE ELASTIC CHARACTERISTICS OF COMPOSITE MATERIALS BY MEANS OF VIBRATION TESTS AND A MODEL OF DISCRETE CONSERVATIVE CALCULATION c24
Daniel Engrand and Daniel Louis *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1979-6 (ESA-TT-632) 1979 p 79-90 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1979-6, Nov. - Dec. 1979 p 401-409 Original report in FRENCH previously announced as A80-19993 (For primary document see N80-26255 16-99)
Avail: NTIS HC A05/MF A01

A method for determining the elastic properties necessary to define a truly representative calculation model of a composite structure is proposed. The method consists of defining, in terms of stiffness, the difference between a preliminary computation and experimentally determined eigenmodes, and then iteratively minimizing this difference in elasticity coefficients by adjusting the calculation model. Applications of the proposed method to three orthotropic cylindrical shells are presented which demonstrate its rapid convergence. Author (ESA)

N80-26262# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AGARD HIGHLIGHTS
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Contents: The Role of Italy in Space Cooperation; Philosophy of Aeronautical Development Programmes for Italian Defence Modernization; Spacelab - a Reality of Today Projected into the Future; Summary of 1980 Meeting Themes. GRA

N80-26263# Office of Naval Research, London (England).
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Willard D. Bascom and Robert E. Machol 31 Jan. 1980 55 p refs
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This is a monthly publication presenting brief articles concerning recent developments in European Scientific Research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by calling attention to current developments and to institutions and individuals engaged in these scientific efforts. The articles are written primarily by members of the staff of ONRL and occasionally articles are prepared by, or in cooperation with, a member of the scientific staff of the United States Air Force's European Office of Aerospace Research and Development and the United States Army Research and Standardization Group. Articles are also contributed by visiting Stateside scientists. GRA

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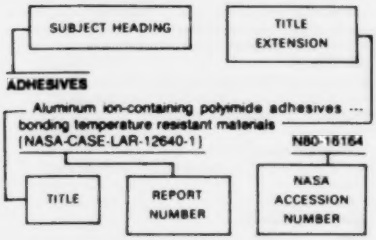

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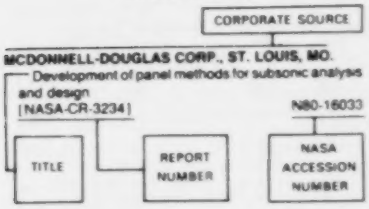

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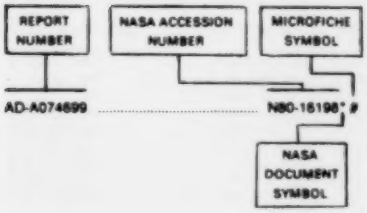

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AD-A082623 ..... N80-25 '6 #
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INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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93 SPACE RADIATION 2356
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2357

Note: N.A. means that no abstracts were assigned to this category for this issue.

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TYPICAL CITATION AND ABSTRACT

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NASA ACCESSION NUMBER → **N80-10198*#** Teledyne Ryan Aeronautical Co., San Diego, Calif. ← CORPORATE SOURCE

TITLE → **STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE**

PUBLICATION DATE

AUTHOR → D. J. Mourey. 3 Sep. 1979. 409 p. refs.

(Contract NAS1-15624) ← AVAILABILITY SOURCE

CONTRACT OR GRANT → (NASA-CR-159149) Avail: NTIS HC A18/MF A01

CSCL 01C ← COSATI CODE

REPORT NUMBER → The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, FUEL/ENGINE/AIRFRAME COST TRADE-OFF STUDIES

T. Peacock, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DF461870; F33615-78-C-2001)

To determine the optimum aviation turbine fuel properties based upon an examination of the trade-off/relationship between fuel, engine and airframe.

Examine the fuel refinement/aircraft system trade-off so that an optimized solution to the alternate fuels problem may be formulated. In addition to refinery operation cost factors, estimates of combustion and fuel system modifications as well as airframe alterations will be made. exploratory development programs will be intensified in areas identified by the study as critical or sensitive.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0002, DEVELOPMENT OF SUPERSONIC STORE SEPARATION METHOD FOR NON-CIRCULAR AIRCRAFT

J.N. Nielsen, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DF137080; F33615-76-C-3077)

This work unit supports TPO 3, flight control, and flight control system design techniques. Combat effectiveness of military aircraft has decreased over the years. The objective of this effort is to increase combat effectiveness of future systems by developing an analytical tool through which store separation may be factored into the total system design. Using the tool to be developed under this work effort, self inflicted damage can be reduced as well as increasing the safe release envelop of future systems. A method to mathematically model the flow field in the region near realistic supersonic aircraft will be developed and used to predict store separation trajectories.

The approach will develop an anlytical method in conjunction with an experimental program. The analytical effort will involve development of mathematical models for the flow fields around realistic fighter-bomber type aircraft. Next, an experimental program to gather flow field data will be conducted in Tunnel A at AEDC. Finally, this data will be used to refine and substantiate the methods developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, CARBON/CARBON COMPOSITE FOR ADVANCED TURBINE ENGINE EXHAUST

Unknown, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF464260; F33615-78-C-2078)

Characterize the properties of carbon/carbon composite materials applicable to the turbine engine exhaust nozzle.

(1) Material selection, (2) oxidation testing, (3) mechanical and physical testing, and (4) flap liner design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0004, F101 CENTRAL INTEGRATED TEST SUBSYSTEM EVALUATION

Unknown, General Electric Co., *7735 Old Georgetown Rd., Bethesda, Maryland* 20014 (DF463660; F33615-79-C-2022)

To evaluate the effectiveness of a state-of-the-art turbine engine monitoring system.

4400 hours of engine flight data will be correlated with monitoring system output and maintenance actions. Results will be used to provide an indication of system effectiveness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - HIGH ANGLE OF ATTACK STABILITY AND CONTROL

S. Gully, Analytic Sciences Corp., *6 Jacob Way, Reading, Massachusetts* 01867 (DN575168; N00014-75-C-0432)

At high angles of attack the flying qualities of most high performance aircraft deteriorate due to undesirable characteristics such as wing rock or departure from controlled flight. These characteristics significantly reduce tracking capability and maneuverability and can lead to loss of control and difficult or impossible recovery problems. The objective of this program is to develop an analytical framework of study for the high angle of attack stability and control problem, and to identify designs of departure preventing control systems.

Present efforts are being directed towards the validation of the pilot model developed during this project. The response patterns of the pilot model are being compared with these of human pilots.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0006, DEVELOPMENT AND DESIGN OF THE ADVANCE ACCESS PANEL FASTENING SYSTEM FOR HELICOPTERS

Unknown, Foster Miller Associates Inc., *135 2nd Ave., Waltham, Massachusetts* 02154 (DN081192; N62269-79-R-0222)

To develop an advance fastening system for helicopter access panels, that would not depend on the stud receptacle type panel fastener presently used. To exploit new contruction techniques and concepts and to develop a useful fastening system that will be highly reliable and overcome the inadequacies of the present system. This contract supports work unit ZA601, Agency Accession No. DN681080.

Define problem area, exploit and evaluate new construction techniques and concepts. Based on this evaluation, select optimum design and design concept.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0007, DEVELOPMENT OF IMPROVED FUEL QUANTITY MEASUREMENT SYSTEM FOR FUTURE NAVY AIRCRAFT

C. Buzzell, General Electric Co., *50 Fordham, Wilmington, Massachusetts* 01887 (DN081110; N62269-78-C-0433)

The general objective of this task is to develop Navy capability to define and specify aircraft fuel system components for advanced types of Navy aircraft in the 1980 era. Future high performance naval aircraft will require both airframe and engine sensors that are improvements over the current state of the art. Flight regimes for such aircraft will be particularly demanding in areas such as fuel management. The specific objective is to develop a fuel quantity measurement system with accuracy equal to or better than a Class III system and having improved reliability over present capabilities in probe systems.

Two approaches have been considered. One uses fiber-optic probes the other uses ultrasonic probes. The ultrasonic approach was started in Sep 79.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0008, FLUID & MECHANICAL POWER TECHNOLOGY DEMONSTRATION

K.E. Binns, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458380)

To demonstrate new technology for potential aircraft users. Specific technology to be demonstrated will be 30,000 rpm vane pump, oscilating spool power transfer units, electrohydraulic digital actuators and emergency back up fuel pump system for F-16 aircraft.

Prototype hardware delivered as result of AFAPL R&D contracts will be installed in laboratory systems and demonstrated to potential users. Tests of a 30,000 rpm vane pump will be conducted to verify its performance for use in future A/C hydraulic systems. In-house concepts will be pursued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0009, TURBINE ENGINE INTEGRATION ANALYSIS PROCEDURES

E.G. Blevins, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF452670)

To generate the propulsion system (inlet, engine, exhaust) performance trends and establish the engineering techniques necessary for improving delivered thrust-fuel flow characteristics during engine part-power operation.

Generate time-phased analysis and test techniques that forecast elemental propulsion system performance to defined levels of accuracy. Identify critical tests that must occur to define exhaust system-engine performance intereffects. Identify engine and exhaust system internal changes that are necessary to maximize delivered thrust at low throttle ratios.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0010, GROUND EFFECT TAKEOFF AND LANDING SYSTEM (GETOL)/ALTERNATE AIRCRAFT TAKEOFF SYSTEM (AATS) DEVELOPMENT/TEST/EVALUATION

R.J. Almassy, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143840)

This effort supports the development of ground effect takeoff and landing (GETOL) systems and alternate aircraft takeoff system (AATS) for Air Force aircraft. Current aircraft equipped with conventional wheel type landing gear are limited to operating on fixed, costly runways, and are limited in their ability to be launched from bomb-damaged runways. The objective of this effort is to accomplish in-house analysis and laboratory testing needed to establish the feasibility and a sound technical base for GETOL and AATS development. A GETOL system will provide ability to operate at any level ground site and is not tied to the use of fixed airfields. Thereby, aircraft mobility is increased, while aircraft vulnerability and costs for airfields are significantly reduced. AATS will provide a rapid means to launch current fighter aircraft from bomb damaged runways to accomplish urgent missions.

Analytical techniques will be developed for the prediction of getol performance and operational characteristics. Laboratory and model flight testing will be conducted to obtain data needed for analytical technique development, criteria establishment and evaluation of GETOL and AATS concepts. An AATS advisor team will be established and used to review and evaluate ongoing AATS efforts, and to assist in the preparation of AATS advanced development program (ADP) plans.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, HIGH-ANGLE-OF-ATTACK SIMULATION STUDIES

M.E. Bise, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144250)

This work unit supports TPO 3, flight control, and major thrust FG02B, flight control system design techniques. Specifically, it addresses the problem area of aircraft performance and loss of control due to roll/pitch inertial coupling at low airspeeds and high roll rates. The technical objective is to analyze data gathered from 1) a manned simulation at the AFFTC, Edwards AFB, 2) a digital analysis and 3) two recently developed high-angle-of-attack (AOA) pilot rating scales. This data will be used to identify factors that limit high-AOA maneuverability, specifically, roll/pitch coupling. The information gathered will be used to improve the understanding of the high-AOA phenomenon and develop improved design guides for high-AOA maneuvering flights.

Analysis of high-AOA aerodynamic data, simulation time histories, the flight control system, and pilot comments (already gathered in previous work unit 24030512) will be conducted to identify factors that limit high-AOA maneuverability. Specifically, this will involve the identification of factors that cause roll/pitch coupling characteristics of a statically unstable aircraft at low airspeeds and high roll rates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0012, VISUAL ENVIRONMENT PROBLEM ASSESSMENT STUDY

E.D. Blanch, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142860)

The function of this effort is to support the development of design specifications and legibility criteria for advanced multipurpose displays. The problem has been that there is a need to document crew station illumination and display legibility problems in order to permit systematic solutions. The objective of this effort is to conduct a cross sectional survey on USAF pilot opinions on crew station illumination and display legibility problems with respect to the mission requirements of a wide variety of aircraft. A second objective is to obtain mission correlated visual environment data. The data obtained from this effort will aid in the identification of crew station illumination problems within a mission context and substantially enhance AF capability to develop meaningful design critieria for alleviating potential problems with display technologies for future aircraft. The successful completion of this effort will result in recommendations to support the development of design specifications for crew station lighting improvement, display legibility improvement, and low life-cycle costs.

To survey crew station illumination and display legibility problems, FGR will formulate a pilot questionnaire. This proposed research effort will involve an extensive literature review of existing studies relevant to the problems of cockpit illumination and display legibility of past and current aircraft. Problems which cause degradation in display legibility and mission performance on single and multi-purpose CRT and standard instruments will be identified and documented. Data will be collected on aircraft accidents related to crew station illumination and display legibility problems. Data will be obtained on mission related visual effects such as flares, weapon detonation and flashes. This effort will utilize the above information to update and de-

velop a questionnaire that assesses crew station illumination problems with respect to the mission requirement of current aircraft. This questionnaire will be administered to pilots current and proficient in the latest AF aircraft and the results will be tabulized and analyzed. A visual environment problem assessment technical report will be published and a computerized data base formulated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, DYNAMIC DERIVATIVE PREDICTION AND CORRELATION

R.J. Matter, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143640)

This work unit supports TPO3, flight control, and major thrust FG02D3, aircraft stability and control prediction. Specifically, it addresses the problem of dynamic stability (damping) derivative prediction. The objective of this effort is to evaluate current methods for predicting damping derivatives and to develop and verify a method for predicting derivatives more accurately using experimental wing pressure data. The output of this effort will make it possible to more accurately predict the dynamic characteristics of an aircraft from wind tunnel data early in the design process.

Wing pressure data from the F-111/TACT program will be used in this program. These data will be used in a computer program that calculates the deformed wing contribution to the damping derivatives. The output will be compared with flight test and wind tunnel extracted derivatives. the program will be modified as appropriate to achieve accurate results and the final results will be documented.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, DUCT ACOUSTICS RESEARCH

D.W. Quinn, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143110)

To understand the dependence of sound levels within ducts upon such factors as duct geometry, sound absorbing properties of the duct walls, type of sound source, and flow within the duct. Specifically, to develop new aero-acoustic models and solution techniques for general duct acoustics problems. This work will be a significant contribution to the AF Aero Propulsion Laboratory's efforts to reduce turbine engine noise levels. To quote RN-AFAPL-08-72-9, 'Current engine noise levels are hazardous to personnel and structures, detrimental to tactical operations and annoying to the general public.' Eventually we should be able to 'Assess engine performance/noise trades' in the design of aircraft engines.

To handle variable area ducts with no flow a method of conformal mapping in conjunction with a finite difference method is used. As an alternative approach for the same problem an integral equation/potential theoretic method is appropriate. For the more general problem of variable area ducts containing fairly general flows a finite element method may be required. The acoustic equation for this general problem must be derived and an efficient numerical method must be implemented using local computer facilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, DEVELOPMENT OF ACCEPTANCE PLANS FOR BITUMINOUS CONCRETE AIRPORT PAVEMENTS

J.L. Burati, Pennsylvania State University, University Park Campus, Pennsylvania Transportation Inst., *Research Bldg. B, University Park, Pennsylvania* 16802 (193038 (HRB NO.))

The objective is to develop a statistically based, price adjustment acceptance plan for bituminous airport pavement construction (FAA Item P-401). The procedure includes a review of literature to identify current practices, a data collection and analysis to determine quality levels on existing FAA pavement construction projects, and the development of price adjustment procedures.

SUPPORTED BY U.S. Dept. of Transportation, Federal Highway Admin.

1.0016, PROPULSIVE-LIFT POWERED RESEARCH MODEL TESTS

P.D. Whitten, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF142540; F33615-78-C-3032)

Recent wind tunnel tests and studies have indicated that significant STOL and maneuver performance benefits are possible as a result of propulsive aerodynamic concept application for advanced tactical aircraft. In particular, the combination of both spanwise blowing and upper surface blowing, e.g., the vectored engine-over-wing (VEO-wing) concept has been shown to provide improvements over the entire angle of attack range at subsonic and transonic speeds. Unpowered configuration model tests have indicated that viable design arrangements, which do not degrade performance, are possible, however, the powered data base is somewhat deficient. The objective of this effort is to expand the powered data base by experimentally investigating engine nacelle location, nozzle arrangements and control surface variations applicable to realistic advanced tactical aircraft configurations. Results will be available for assessment of the STOL and maneuver performance of air-to-surface and air-to-air fighters.

Testing will be conducted in the NASA/LARC 16-foot transonic and V/STOL wind tunnels using a contractor owned powered research model. Longitudinal aerodynamic/stability and control data will be obtained over the angle of attack range of minus 4 to 40 degrees and at Mach numbers from low speed to 1.2. Variations in nacelle location, nozzle arrangement and control surface deflections will be investigated at typical fighter aircraft engine operating conditions. The experimental data will be analyzed to verify the propulsion/aerodynamic benefits.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, FLIGHT CONTROL SYSTEM FOR ADVANCED MARITIME PATROL AIRCRAFT (MPA)

A.D. Stern, Boeing Co., Boeing Aerospace, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN081104; N62269-78-C-0234)

To develop the requirements and design of a minimum redundancy, fail-operational digital flight control system for the next generation patrol aircraft. This contract supports work unit ZA601, Agency Accession No 631080.

Design flight control alternate configurations and select the optimum system; develop mission requirements flight control interface; demonstrate software operation in laboratory.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0018, EVALUATION OF EXPLOSAFE

A. Szego, Canadian Commercial Corp., *Ottawa, Ontario, Canada* (DF460700; F33615-77-C-3115)

Evaluation of an advanced explosion suppression material called 'explosafe' for use in aircraft fuel tanks.

The program is structured into two major phases. Phase i consists of initial material qualification testing by the contractor and determining the feasibility of installing explosafe in aircraft fuel tanks. Phase II consists of the USAF evaluating the explosion suppression performance of explosafe at various densities and joint AF/Army evaluation against ballistic threats.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, SUPERPLASTIC FORMED ALUMINUM

H.C. Hamilton, Rockwell International Corp., *1049 Camios Dos Rios, Thousand Oaks, California* 91360 (DF143960; F33615-79-C-3218)

This work unit will support AFFDL TPO 1 structural mechanics technology goal FB04 'demonstration and validation of lower cost innovative structures and aeroelastic concepts'. This effort will investigate the superplasticity limitations of 7000 and 2000 series aluminum alloys and identify potential applications which can exploit the superplastic forming process to reduce aluminum assembly costs. The potential for these materials and processes to contribute significantly to an Air Force low-cost fighter thrust is substantial.

The approach to fulfill the above objective consists of a four task effort as follows: (1) assessment of the extent of cavitation or voids formed during processing, (2) formability limits, (3) fracture mechanics data on superplastic formed aluminum material, (4) application evaluation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0002, ENERGY MIGRATION AND RELAXATION IN MOLECULAR SOLIDS

S.D. Colson, Yale University, School of Chemistry, Dept. of Chemistry, *206 Elm, New Haven, Connecticut* 06520 (CHE78-08123)

This research is in the area of Quantum Chemistry. Dr. Colson's program of study focuses on the processes of energy migration and relaxation that result from intermolecular interactions in molecular solids. The work is designed to capitalize on recent theoretical and experimental advances in the field and to accelerate the progress on both of these fronts. The understanding of the theory will be enhanced by providing critical new data and by working in close collaboration with other theorists in the field. The availability of this new data will result in part from the further development of new and highly sensitive laser spectroscopic techniques. In particular, he will study in detail the mechanism of long-range electronic energy migration in molecular solids. This information is of fundamental theoretical and practical importance. For instance, the efficiency of this process will impact directly on the feasibility of any molecular based solar conversion device. Of similar importance is the interaction between migrating energy packets (excitons) which can result in exciton annihilation and energy upconversion. He will measure directly the magnitude and distance dependence of these important exciton-exciton interactions. To complement these findings, a new absorption induced transient lensing technique will be used to study weakly absorbing states and to allow the non-radiative decay of molecular excited states. This research represents a continuation of that currently supported by Foundation grant CHE-7513771.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0003, DYNAMICS OF MULTIPHOTON ULTRAVIOLET PHOTODISSOCIATION

W.M. Jackson, Howard University, School of Liberal Arts, Dept. of Chemistry, *2400 6th St. N.W., Washington, District of Columbia* 20001 (CHE78-05375)

Dr. Jackson intends to continue and expand a program of research in the area of photochemistry. He will study the sequential multiphoton absorption by molecules of ultraviolet radiation produced by an argon fluoride laser. The absorption yields highly excited molecules which dissociate and yield small radicals which are electronically excited. Emission resulting from the decay of the radicals will be identified and measured. The effects of experimental parameters such as pressure, laser intensity, laser wavelength, and time will be investigated. Ground state products will be determined by laser induced fluorescence and with a quadrupole mass spectrometer. Such studies provide information about the properties of excited molecular fragments. Such information has potental importance with regard to future practical applications of lasers to chemistry.

This grant renews support of a research program currently supported under NSF Grant CHE-7512848.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, PROPERTIES OF COMPOSITIONALLY MODULATED ALLOYS

J.E. Hilliard, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science & Engineering, *633 Clark St., Evanston, Illinois* 60201 (DMR78-24339)

This is an investigation of the magnetic and superconducting properties of Cu-Ni, Ni-Pd, Pb-Sb, Nb-Ge and Pb-Bi foils containing short wavelength (8-80 AO) composition modulations produced by vapor deposition. These alloy systems will be investigated to determine if magnetic anomalies occur, and whether metastable crystal structures can be fabricated. These crystal structures can be fabricated. These crystal structures may have a high superconducting transition temperature. Another objective of this study is to determine the d-shell interactions and their correction to magnetic and superconducting properties. It is expected the results of this research will constitute an important addition to our fundamental knowledge in microstructural science.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0005, ADSORPTION ON METALS

R. Gomer, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (CHE77-08328 A01)

Measurements of absolute coverages, adsorbate dipole moments, and sticking coefficients of adsorbed gases on single-crystal planes will be extended to oxygen, CO, nitrogen, Xe and others on various planes of tungsten. Sticking coefficients will be measured as functions of coverage and surface and gas temperatures. Surface diffusion studies on single-crystal planes will be continued by measuring the time correlation function of field emission current fluctuations from regions of single planes when adsorbate-covered emitters are heated to temperatures where adsorbate becomes mobile. The two-dimensional equation of state of adsorbed layers will be studied by measuring the temperature variation of the mean square fluctuation. Field emission spectroscopic measurements will study the effect of metallic adsorbates on the surface resonance on tungsten and molybdenum planes. This resonance seems to survive to monolayer coverages for 'tungsten-like' adsorbates and one can obtain information about self-consistent potential at adsorbate atoms, using the resonance as a probe. Other electron impact desorption and low-temperature adsorption experiments are planned. This research is a continuation of that currently supported by Foundation Grant, CHE-7412059.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, SPECTROSCOPY IN SUPERSONIC MOLECULAR BEAMS

D.H. Levy, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (CHE7825555)

This grant will support the research of Dr. Levy in the area of structural studies of van der Waals molecules. Hence, the program is the responsibility of the Structural Chemistry and Thermodynamics Program. Dr. Levy will utilize supersonic molecular beam spectroscopy in order to simplify the spectral data.

The fluorescence excitation spectrum and dispersed fluorescence spectrum will be used to provide potential curves for NaAr. The potential curve for the state responsible for collisionally induced predissociation in iodine molecules will be extracted from van der Waals dissociation data. In addition, the dynamics of photodissociation of van der Waals complexes will be

examined. Complexes of rare gas atoms with chromyl chlorides as well as larger clusters of rare gas atoms with iodine will be systems of interest. An attempt will also be made to extend the work to nonvisible absorbing and non fluorescing molecules. Multiphoton ionization spectroscopy and coherent anti-Stokes Raman spectroscopy will be used to study nonfluorescent species.

This research is a continuation of that currently supported by Foundation Grant, CHE 7606098.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0007, PRECIPITATION PROCESSES IN REFRACTORY METAL-INTERSTITIAL SYSTEMS USING ANALYTICAL ELECTRON MICROSCOPY

H.L. Fraser, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mining Engineering & Metallurgy, *207 Engineering Hall, Urbana, Illinois* 61801 (DMR78-07761)

This is a study of phase transformations and precipitation processes that occur in refractory metal-interstitial systems, from the point of view of microchemistry and correlation of chemical changes with modifications in the morphology, microstructure, and crystal structure of the resultant precipitates. An important part of this program involves, of necessity, development of appropriate analytical electron microscopy techniques. The alloys chosen for this study include the Nb-O, Nb-N and Nb-O-N systems, since they exhibit multistage precipitation processes. Since the pure metal is seldom used in high temperature environments and energy conversion systems, Nb-Ti-interstitial alloys will also be studied. The segregation of Ti will be determined, and the results obtained will be correlated to changes in the precipitation processes. In these studies, elemental analysis will be achieved through a combination of the complementary techniques of energy dispersive x-ray analysis and electron loss spectroscopy. Since application of the latter technique to light element analysis is relatively new, technique development is an important part of this research. It is expected the results of this research will contribute to an understanding of multistage precipitation processes in refractory metal-interstitial systems. This is the first year of a three year continuation grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0008, ENVIRONMENT-ASSISTED FAILURE OF FACE-CENTERED-CUBIC HIGH ALLOYS

N.F. Fiore, University of Notre Dame, School of Engineering, Dept. of Materials Science & Engineering, *Notre Dame, Indiana* 46556 (DMR78-07167)

This is a continuation of a fundamental investigation of the interaction between environment, metallurgical structure, and embrittlement in highly alloyed stainless steels (316 L and 20 Cb3) and Ni-base superalloys (alloy G and C-276). The alloys will range in structure from cold-worked to fine grained polycrystalline and single crystalline. Electrochemical hydrogen permeability measurements will define hydrogen mobility as a function of matrix composition and passive film behavior. Flow sorption studies will establish the extent to which aggressive ions absorb on the alloy surfaces, and to which inhibiting ions prevent adsorption and cracking. Electrochemical dissolution studies will establish the extent of selective ion dissolution present in the alloys. In all cases, environment-assisted-cracking (EAC) tendency will be established by time-to-failure and fracture mechanics testing. It is expected the results of this research will: (1) assess the validity of proposed EAC theories such as hydrogen embrittlement by decohesion, failure by stress-sorption, and selective-ion dissolution for these alloys; and (2) establish which metallurgical forms of these alloys show maximum resistance to EAC in standard H, Cl and S-bearing environments. This is a continuation of research previously funded under NSF Grant DMR76-08901 A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0009, HIGH-TEMPERATURE GAS REACTIONS USING THE COMPLEMENTARY SHOCK TUBE TECHNIQUE

R.D. Kern, Louisiana State University, University of New Orleans, School of Science, Dept. of Chemistry, *Lakeshore Dr., Lake Front, New Orleans, Louisiana* 70122 (CHE76-08529 A02)

The complementary shock tube technique continues to be a most powerful method to study the rates of reactions occurring exclusively in the gas phase at known temperatures, pressures, and densities. The strength of the method is the ability to record the dynamic behavior of reactants, products, and intermediates by utilizing two independent analytical techniques which when applied to the same reaction system provide a check on the sampling procedure and the validity of the experimental results.

The facility consists of two shock tubes. One tube is equipped to record simultaneously the infrared emission from two reacting species. The second tube is coupled to the ion source of a time-of-flight mass spectrometer. By this technique, in addition to the internal check on the kinetic data, systems which achieve an observable equilibrium condition are subject to external check with the calculated thermodynamic equilibrium constant.

The self-exchange of nitrogen is being examined to complete the trilogy (H2 plus D2 and 13CO plus C18O) of fundamental exchange reactions. The exchange of 15N16O plus 12C18O is being examined to assess the effect of an unpaired electron upon the exchange process. Studies of other exchange processes are being undertaken. Considerable effort is being devoted to complex reaction systems such as CNCl plus H2 and to CNCl plus HCN. The pyrolysis of water as generated from the reaction of CO2 plus H2 at elevated temperatures is also being examined. This work is a continuation of that currently supported by Foundation grant, GP-33949X.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0010, THERMODYNAMICS OF IONIC AND MOLECULAR CRYSTALLINE PHASES

E.F. Westrum, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Chemistry, *Ann Arbor, Michigan* 48104 (CHE77-10049 A01)

Dr. Westrum is studying the Verwey, Mott, and Wigner-crystallization transitions in magnetite (Fe3O4) and related phenomena in other spinels, molybdates and tungstates; the molecular freedom, plastic crystal and melting transition in nearly spherical carborane molecules, the magnetic and phase transitions in molybdenum compounds, etc. He is obtaining thermodynamic data for the molecular and ionic crystalline state, the mesomorphic phase and the transition to the liquid state. The energetic spectrum and thermal properties arising from structural anisotropy, are determined by precise, adiabatic calorimetry at least over the range 5-350 K and sometimes to 1500 K. Particular studies are being made on 'key compounds' and on the gradual transformation from classical solid-liquid behavior to mesomorphic phases. The thermophysical behavior of charge-transfer complexes in the crystalline phase, and the melting behavior of salts of organic acids are planned for intensive study.

This research is a continuation of that currently supported by Foundation Grant, CHE-7410317.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0011, THEORY OF HIGH-ENERGY ION-ATOM AND ATOM-ATOM COLLISIONS

J.S. Dahler, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Chemical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (CHE76-11037 A02)

This research involves the development and testing of efficient theoretical procedures for estimating the cross section (both differential and total) for a variety of the excitation and quenching processes that take place in high-energy (approximately 1-200 keV) ion-atom and atom-atom collisions. Among the many systems to be considered are alkaline earth ion-rare gas and alkali metal-rare gas pairs, e.g., Be ion, Mg ion,.../He,... Ne,... and Li, Na,.../He, Ne...Xe. The processes of interest include excitation and quenching of the projectile alkaline earth ions and alkali atoms, excitation of the target rare gas, charge exchange, and electron detachment. The plan involves the systematic investigation of a variety of scattering theory approximations including solution of the close coupled equations of the impact parameter method and Born and distorted wave Born approximations. Great emphasis is placed upon the testing and evaluation of different models for the electronic Hamiltonian operator or, more specifically, of the pseudo-potentials which are used (either explicitly or implicitly) to represent interactions of the electrons with the many-electron 'cores' of the projectile and target species.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0012, NOBLE GASES IN THE EARTH AND ITS ATMOSPHERE

O.K. Manuel, University of Missouri, Rolla Campus, School of Arts & Sciences, Dept. of Chemistry, *103 Parker Hall, Rolla, Missouri* 65401 (EAR78-09251)

This is a continuation of research supported under NSF grant EAR76-03956. This project concerns the measurement of the amount and isotopic composition of xenon, argon, and helium in terrestrial materials. The materials to be studied include CO2-rich fluid inclusions from a series of dunite xenoliths collected from recent lava flows in Hawaii, samples of josephinite and its serpentine host rock from the Klamath Mountains in Oregon, ultramafic xenoliths from the Matsoku kimberlite pipe in South Africa, and CO2-rich well gas from the U.S. Southwest and from Japan. Noble gases from these mantle-derived (?) samples appear to be isotopically very similar to noble gases from chondritic meteorites and may therefore be displaying characteristics inherited from the solar nebula condensate.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

3.0013, PHOTOIONIZATION AND PHOTOCONDUCTIVITY IN MOLECULAR MATERIALS

C.L. Braun, Dartmouth College, School of Arts & Sciences, Dept. of Chemistry, *P.O. Box 833, Hanover, New Hampshire* 03755 (DMR77-00318 A01)

The Principal Investigator continues his study of photoionization and photoconduction including work on liquid insulators as well as solids. A more detailed picture of photoionization, geminate charge recombination, and photoconductivity in condensed-phase materials is being developed. There are three principal goals: 1. To determine the primary quantum yield of photoionization for several molecules (e.g., benzene) as a function of excitation wavelength using high electric fields and fluorescence quenching as complementary probes. 2. To use Onsager theory to determine the distribution function of separation distances between just-thermalized electrons and their parent positive ions for a number of solutes, solvents and photon energies. 3. To understand the origins of photoconductivity near threshold energy. Spectroscopic observation of Wannier exciton series will be important in this effort.

This work should have practical significance for the understanding of quantum efficiency limitations of photoconductive devices and organic photovoltaic cells.

This is a continuation of research support under DMR72-03035.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0014, IMPROVED FROTH FLOTATION FOR MINERAL PROCESSING

R.K. Jain, Columbia University, School of Engineering & Applied Science, Dept. of Chemical Engineering, *Broadway & W. 116th St., New York, New York* 10027 (AER76-81578)

Froth flotation is acknowledged to be the most important process in use for the concentration of minerals in ores. The objective of this award is to gather complete information on froth flotation mechanisms necessary for the development of a new flotation process suitable for processing fine size minerals. This research is directed to quantify the effects of particle-bubble approach velocity, medium pH, hydrophobicity as measured by contact angle, interfacial potential as measured by electrokinetic methods, surfactant adsorption density, and contact angle hysteresis on the rupture kinetics of thin liquid film separating the bubble from the mineral surface. The quantitative data will be used to generate a mathematical model to serve as a tool in the design of flotation processes and equipment suitable for low grade ores.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Energy & Resources Research & Technology

3.0015, OPTICAL PROPERTIES OF CERAMIC MATERIALS AT HIGH PRESSURE

K. Vedam, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR76-82074 A01)

This research will continue studies of the piezo-optical behavior of ceramics at high pressures. Specifically, the effect of high pressure on several optical properties will be studied, namely the refractive index, optical rotary dispersion, and circular dichroism. Research on determining the piezo- and elasto-optic coefficients of tellurium oxide, lead oxide-germanium oxide, and the nitrates of lead, barium and strontium will be completed. This is a renewal of NSF Grant DMR76-82074.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0016, CROSSED BEAM STUDIES OF EXCITED ATOM COLLISIONS

P.E. Siska, University of Pittsburgh, School of Arts & Sciences, Dept. of Chemistry, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (CHE76-84434 A02)

A continuation of the study of metastable rare-gas atom collisions in crossed molecular beams, currently supported by Foundation grant CHE-7403072, is planned. Time-of-flight experiments will allow the measurement of state-to-state absolute differential cross sections for electronic excitation transfer processes in a number of systems. Angle-energy distribution measurements for Penning ionization systems will continue, and they will be extended to include open-shell atom partners and halogen-containing molecules. Elastic scattering in nonquenching metastable atom systems is planned as a means of obtaining unambiguous information on excited-state potentials. Differential scattering measurements in H, N, and O atom systems also will be carried out.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0017, MOLECULAR BEAM REACTION OF ORIENTED MOLECULES

P.R. Brooks, Rice University, Graduate School, Dept. of Chemistry, *6100 Main St., Houston, Texas* 77001 (CHE77-09428 A01)

Dr. Brooks intends to continue and expand a program of research currently supported by Foundation grant CHE-7408466. He plans to study steric effects by studying the reactions of molecules which have been oriented in molecular beams. So far these studies have been limited to K atoms abstracting halogen atoms from simple alkyl halides, CH3I, CF3I, t-C4H9I, CCl3H, and CH3CCl3. The breadth of the studies will be extended by changing the alkali metal or the size and nature of the substituents of the CR3X molecule. A partially completed

apparatus with an unusual detector will ultimately enable him to extend the study of abstraction reactions to other atoms besides the alkali metals. The depth of the studies will be extended by velocity analysis of the product scattered from different orientations. These studies are necessary for complete understanding of any system, but it is also possible that reactive scattering from different ends of a molecule will proceed via quite different mechanisms and be reflected by different recoil velocity distributions. He also plans to study the reaction of a molecule which has been magnetically selected: the upper component of the NO doublet ground state can be separated from the ground state by magnetic deflection. He plans to study the reaction NO plus O3 yields NO2* plus O2 to see what effect the electronic state of the reagent has on the reactivity.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, ION IMPLANTATION IN SEMICONDUCTORS

J.W. Mayer, California Inst. of Technology, Graduate School, Dept. of Electrical Engineering, *1201 E. California Blvd., Pasadena, California* 91109 (INT78-08779)

The objective of this continued cooperative research project is to advance basic knowledge of the structures and properties of thin-film materials, which may lead to new and improved semiconducting devices such as integrated circuits.

The aim is to investigate the use of ion implantation systems for analyzing implanted semi-conducting materials, and for forming silicon-germanium heterojunctions. Rutherford backscattering techniques at low-energy levels (300-800 KeV) will be explored as an analytical tool; the regrowth of an amorphous layer produced by ion implantation with that of the epitaxial growth of an evaporated film will be studied to see if in this fashion heteroepitaxial growth can be induced.

This grant is for the continuation of a previously funded project investigating the implantation process in semiconductor (NSF Grant OIP-7401930 A01). The work will be conducted in cooperation with Dr. Jozsef Gyulai of the Central Institute for Physics, Budapest, Hungary.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

4.0002, NFMRAD MICROPROCESSOR FEASIBILITY STUDY (PHASE II)

R.A. Birgenheier, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DF902620; F19628-77-C-0073)

AF function - tactical battlefield surveillance mission. Deficiency or opportunity - Air Force lacks all-weather capability of tactical battlefield surveillance especially against concealed slowly moving tactical ground targets. Objective - the objective of this work is to continue the study of efficient microprocessor implementation for null filter mobile radar (NFMRAD) for standoff battlefield applications. How research contributes - research will define the efficient, minimal hardware implementations of an airborne null filter mobile radar.

A study will be conducted to investigate a means to incorporated a single knot moving target capability in the NFMRAD processing design. Also airframe presence and flexure as well as RF and PRF source instabilities will be considered for their affect on NFMRAD antenna pattern characteristics and Doppler filter responses. Additionally, the capability for countering ECM threats within the NFMRAD processor will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0003, FILTERED ESB COVERGLASS DEVELOPMENT

P. Iles, Optical Coating Lab. Inc., *Santa Rosa, California* 95403 (DF461550; F33615-77-C-2035)

The objectives of this program are to fabricate and evaluate improved designs of solar cell coverglass/filter configurations for enhanced cell array survivability to natural and military satellite environments.

Design, fabricate, and evaluate improved filtered/ESB 7070 coverglass-cell configurations. Conduct optical tests and thermal environmental tests to verify filter and ESB integrity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0004, ION IMPLANTATION AND LASER ANNEALING IN SEMICONDUCTORS AND RELATED MATERIALS

J.F. Gibbons, Stanford University, School of Engineering, Dept. of Engineering, *Stanford, California* 94305 (DMR78-19970)

This research will be a study of the effects of laser annealing on removing damage induced in semiconductors by ion implantation. The objective will be to determine the mechanism whereby this occurs, particularly in view of the fact that the annealing does not result in any change in the ion implanted concentration profile. The research will include both experimental and theoretical studies of the recrystallization mechanisms of ion implanted silicon using both pulsed and continuous wave laser annealing.

Work will be initiated to apply the laser annealing technique to other semiconductor systems and metal oxides where thermal annealing is known to produce self-compensation of the implanted species. Another task will involve application of laser annealing to recrystallization of superconducting intermetallic compounds. Although fundamental in nature, the results of this work could have a significant impact on the electronics industry.

This grant continues studies initiated under NSF Grant DMR76-18000, and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

4.0005, RELIABILITY ANALYSIS OF GRACEFULLY DEGRADING COMPUTING SYSTEMS

E.J. McCluskey, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DF054970; F49620-79-C-0069)

AF function - digital avionics systems. Important functions in growing numbers are being performed by digital systems on USAF aircraft. The consequent demand for reliable computing require newer and better designs in electronic circuitry. Deficiency - for computers used in real-time applications such as control of aircraft, it is crucial that they function correctly for long periods, and that they be provided with sufficient fail-safe features. Objective - to develop more useful and accurate techniques for the analysis of diverse competing computer systems and component parts, to provide a better understanding of the interrelationships between performance and reliability, and to achieve ultimately better architectures for higher reliability. How work contributes - the results of this research would contribute toward the design and construction of ultra reliable computers which are needed for advanced technology aerospace vehicles.

Several factors in the design of computer systems are to be investigated from the viewpoint of reliability, maintainability, and performance. These include executive routines, hardware failure studies, and fault detection and reconfiguration strategies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, EXPERIMENTAL AND NUMERICAL STUDY OF FLOW IN CURVED DUCTS WITH HEAT TRANSFER

J.A. Humphrey, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (ENG78-27007)

Turbulent flow in a curved duct of square cross-section with heat transfer through the outer radius wall is investigated experimentally and theoretically. The duct is relatively tightly curved so as to induce secondary motions due to centrifugal force-radial pressure gradient imbalances. Measurement of the flow is performed by means of a laser-Doppler velocimeter for the velocity and turbulence characteristics and by means of an infrared spectra radiometer for temperature. Detailed mapping of the flow, with and without heat transfer, is made at various stations in the duct. A calculation procedure which has been applied successfully to three-dimensional laminar flows is extended to calculate the experimentally measured turbulent flow. A two-equation model of turbulence is utilized.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0007, AEROELASTIC OPTIMUM DESIGN OF LIFTING SURFACES WITH ACTIVE CONTROLS

L.A. Schmit, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DF054030; F49620-79-C-0018)

AF function - advanced flight vehicles will require maximum efficiency from all on-board systems. Opportunity - optimization techniques have been demonstrated for static structural behavior but have not been fully considered for aeroelastic responses in conjunction with active control systems. Objective - the objective of this research is to develop an efficient and accurate solution technique for the aeroelastic behavior of minimum weight structures with active controls. How work contributes - the research contributes to the goal of achieving a fully automated optimum design procedure for aircraft.

Highly efficient modern aircraft are designed for maximum flight efficiency and minimum weight. Initially, all strength conditions are satisfied by the design. Subsequently flutter margins are analyzed with either stiffness increases or mass balancing utilized. In addition, recent developments have used active flight control systems to suppress flutter. This research will expand minimum weight optimization methods to consider aeroelastic phenomena and active control techniques. Two basic approaches will be followed by this effort: first, a serial approach in which all parameters are considered sequentially, second, a parallel treatment of the parameters. Each approach will be considered in solving high and low aspect ratio wing problems for supersonic and subsonic aerodynamic conditions respectively. Solutions and solution procedures will be compared in terms of accuracy and computational efficiency.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, CHARACTERISTICS OF AN INTEGRATED OPTICS RING-INTERFEROMETER FOR LASER GYRO APPLICATION

E. Garmire, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF055580; F49620-79-C-0113)

AF function - navigation, guidance and control of aircraft, spacecraft and missiles require sensors of angular rotation rate in inertial space. However, conventional gyroscopic sensors pose cost and adaptation problems. Opportunity - although the coming use of ring lasers in strapdown systems will offer considerable advantages,proper use of new integrated optics and integrated circuit advances will minimize the cost and maximize the adaptability and availability of these new sensors which allow the direct measurement of absolute inertial rotation rate without requiring comparison with other standards for calibration. Objective - the intrinsic limitations of ring lasers are to be avoided by new approaches which have the potential for integrated optics implementation and high performance cost ratio. How work contributes - this research should lead to devices which are free from lock-in and bias effects encountered in conventional laser gyros, have high sensitivity and accuracy and allow ready adaptation to specific requirements such as size reduction, cost decrease or sensitivity increase and adaptation to a specific environment and geometry.

Investigation of the feasibility of a new solid state laser optical inertial rotation sensor which uses a passive ring resonator as the sensing element and two independently controlled laser frequencies to read out the lengths of the clockwise and counterclockwise paths of the resonator. Because the laser is outside the ring solid state lasers and thin films waveguides may be used, which would make the gyroscope small in size and conducive to microoptic fabrication. This effort considers the solid state implementation of the previously explored MIT passive ring resonator gyro concept and focusses in its first phase on experimental and theoretical studies of making highest finesse single mode integrated ring interferometers using glass or fused silica. In particular, electrical-thermal migration of ions will be used to make thick, buried, ultra low loss single mode planar waveguides.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, EXPERIMENTAL INVESTIGATION OF SUPERSONIC JET NOISE

R.E. Kaplan, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (ENG76-22529 A01)

The primary aim of this project is to determine whether the large-scale, coherent structures contribute significantly to the radiated noise of a supersonic jet. Measurement of the far-field noise radiated from a fixed region of the jet will be made to correlate this data with near-field measurements and to identify the latter with the turbulent jet structure.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0010, INVESTIGATION OF JUNCTION FIELD EFFECT TRANSISTORS

K. Lehovec, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (ENG76-84530 A01)

The objective of this program is the electrical characterization of the interface between a semiconducting channel and an insulating substrate to determine those electrical parameters which are of importance for field effect transistor design. The semiconductor-substrate combinations to be studied are silicon on sapphire, and semiconducting gallium arsenide on semi-insulating gallium arsenide.

The Shockley-Read-Hall parameters pertaining to the surface states at the silicon-sapphire interface will be derived by (1) applying and extending the transient current method recently developed under this program and (2) by using the standard metal-oxide-semiconductor capacitance-voltage and resistance-voltage methods in conjunction with the metal/sapphire/interdigital silicon test structure developed in the program.

The gradual transition between an ion-implanted n-channel and a chromium-doped semi-insulating gallium arsenide substrate will be studied using distributed network analysis and the dual bias method for determining impurity profiles. The latter method eliminates the ambiguities arising from capacitance-voltage measurements with nearly pinched-off channels. This is a continuation of research under NSF grant ENG-7405551.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0011, KINETIC RATE CONSTANTS OF IMPORTANCE TO KRF AND ARF RARE-GAS-HALOGEN LASERS

G.J. Collins, Colorado State University, School of Engineering, Dept. of Electrical Engineering, *Fort Collins, Colorado* 80523 (ENG77-21625)

This research concerns a novel technique to measure excited state reaction rates of importance to the argon fluoride and krypton fluoride lasers. The novel technique involves measuring the radiative lifetimes of the upper laser levels of both ArF and KrF molecules and determine several collisional quenching rates. These quenching cross sections are of crucial importance to an understanding of high pressure electron beam and TEA

discharge excited ArF and KrF lasers where the possible products of reaction, as well as the rates, are presently unknown.

Finally, having measured the rate constants, the He-Ar-RF and He-Kr-RF discharges which are employed in practical TEA, ArF and KrF lasers will be investigated to identify the major excitation mechanisms, the role of helium and determine if the excitation mechanism differs from the simple Kr-RF and Ar-RF mixtures.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0012, DF ROTATIONAL RELAXATION STUDIES

J.J. Hinchen, United Technologies Corp., United Technologies Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DF054170; F49620-79-C-0032)

AF function - improved Air Force operations in communications, reconnaissance and other electromagnetic signal propagation areas require developments in laser technology. Deficiency - there is presently a lack of proper understanding of the laser physics and chemistry in DF chemical lasers and how these affect power output and spectral characteristics. Objective - perform an experimental study to measure relaxation and collisional linewidths of rotationally excited deuterium fluoride gas, and measure V-R transfer. How work contributes -provides information on population differences in specific V, R levels which in turn determine the power for each laser transition in CW lasers and specify time-energy-wavelength relationships for pulsed lasers.

Use IR double resonance technique which employs a pulsed laser to excite HF molecular populations to a particular rotation level and a CW HF laser to probe this or other rotation levels to determine the time dependence of population transfer between levels. Perform these measurements at room temperature and at several values of HF gas pressure. Computer analyze the experimental data to extract specific relaxation rate constants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, ISOTOPE SEPARATION IN PLASMAS

J.L. Hirshfield, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (ENG76-22430)

An experimental study of multi-ion resonances in a plasma will be initiated with a view towards isotope separation. The effort will attempt to combine the considerable accumulated experience on RF heating of ions in a plasma and recent work indicating that copious production of metal ions can occur in laser-initiated arcs. The investigation will explore the possibility of developing a new class of electromagnetic isotope separators. The underlying view in this work will not be to evolve a design for a separation unit per se, but rather to attempt to understand the basics to an extent that reasonable guesses can be ventured as to feasibility.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Chemical & Process Engineering

4.0014, FUEL STORAGE EMISSION CONTROL

T.B. Stauffer, U.S. Dept. of Defense, Air Force, Engineering & Services Center, Engineering & Services Lab., *Tyndall Air Force Base, Panama City, Florida* 32403 (DF336580)

To determine the specific emission standards the AF must meet for hydrocarbon vapor emissions from underground JP-4 storage tanks and develop appropriate control devices to fulfill compliance. Some AF bases in Southern California may not meet local air pollution criteria. The entire AF-wide problem will be investigated and currently available control devices evaluated in terms of abatement requirements. Information obtained in the study should permit selection of devices that meet local air pollution control requirements.

The extent of the Air Force problem will be determined. Types of devices that will control evaporative hydrocarbons to required levels will be identified. Currently available control devices will be evaluated for achieving compliance with applicable regulations. If no currently available devices will control JP-4 emissions, new systems will be developed. The final technical report will be widely distributed to make selection criteria readily available to base civil engineers and environmental coordinators.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0015, ELECTRON BEAM CONTROLLED GAS LASERS

T.A. DeTemple, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (ENG75-21515 A01)

The use of electron beams as an aid in obtaining laser operation at high pressures is now a demonstrated technique. Direct beam excitation has been employed in rare-gas halide lasers, charge exchange lasers and rare-gas molecular lasers. Alternately using the beam as an ionizer with the predominate excitation coming from a conventional energy storage sustainer supply has resulted in substantial performance from CO and CO2 infrared lasers.

This research program concerns the use of an ionizer-sustainer mode of operation as a means of studying laser action at high pressures with the general goals of seeking new transitions and obtaining enhanced performance from known transitions. In addition extended electron diagnostic experiments and optical pumping experiments will be conducted.

This research is a continuation of a program previously supported under National Science Foundation Grant No. ENG-7521515.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0016, STABILITY AUGMENTATION SCALING

R.L. Fanin, General Motors Corp., *4700 W. 10th St., Indianapolis, Indiana* 46206 (DF457340; F33615-75-C-2044)

The objective of this effort is to establish the usefulness of local metal matrix composites to increase the vibration stability of fan/compressor blades.

This program consists of five tasks. Task I is a design and analysis effort to parametrically define the influence of locally stiffening turbine engine fan/compressor blades using metal matrix composite inlays. Task II establishes the manufacturing processes to produce a low cost, reproducible blade. Task III includes the fabrication of fan/compressor blading with the composite panel inlays. Task IV emphasizes the verification of frequency, mode shape and strength characteristics using Task III hardware. Task V covers the instrumentation, assembly and piggyback engine testing of a full stage of composite inlaid blades. Additional AMST and experimental flight testing is scheduled to structurally verify the Ti metal matrix in the engine environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0017, CALCULATION OF BOUNDARY LAYER EFFECTS IN SUPERSONIC MIXED-COMPRESSION INLETS AT ANGLE OF ATTACK

J.D. Hoffman, Purdue University, School of Engineering, Dept. of Mechanical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 3311)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0018, AEROSOL FILTRATION BY FIBROUS FILTERS

T. Ariman, University of Notre Dame, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Notre Dame, Indiana* 46556 (ENG77-09387)

A coordinated analytical and experimental research program will be conducted on fibrous filtration in an electrostatic field. The investigation will be based on a model fibrous filter with a staggered array arrangement of fibers. The major objective of the research is the development of the fundamental and predictive relationships for the collection efficiency as well as the pressure drop in fibrous filtration in an electrostatic field for the staggered-array fibrous filter model. In the experimental part of the research, a number of experiments will be performed using fibrous filters of uniform sized fibers and monodispersed aerosols in an electrostatic field and the fundamental relationships for the collection efficiency as well as the pressure drop will be evaluated.

Particles smaller than 3 microns aerodynamic diameter are the most difficult to collect with the available techniques and equipment. Unfortunately, fine particles also have a much greater impact on public health, visibility, and cloud nucleation when compared with the same weight of larger particles. It is expected that the outcome of the research will be utilized in the controlling of fine particles.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0019, AERODYNAMICS OF CASCADED AIRFOILS OSCILLATING OR SUBJECT TO THREE DIMENSIONAL FLOW DISTURBANCES

H. Atassi, University of Notre Dame, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Notre Dame, Indiana* 46556 (DF053760; F49620-79-C-0014)

AF function - advanced turbomachinery. Opportunity - improve capability to predict unsteady aerodynamic forces on turbomachine blading systems. Objective - analyze the nonstationary aerodynamic properties and the aeroelastic stability of a row of loaded blades in a subsonic flow. How work contributes - will increase our basic understanding of nonlinear effects in unsteady aerodynamics.

Two distinct problems will be investigated. The first one deals with the stability analysis of oscillating airfoils in a cascade. The research will concentrate on applications to discern and identify the important aerodynamic and aeroelastic properties of highly loaded cascades. The other problem deals with the response of a cascade of airfoils to three-dimensional flow disturbances. Three-dimensional effects cause distortion of the magnitude, phase and wavelength of the oncoming vortical wave as it interacts with the airfoil. The proposed research will be directed at determining the resulting non-stationary aerodynamic forces and moments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, DEVELOPMENT OF A DIODE LASER FLUORINE ATOM DIAGNOSTIC

C.E. Kolb, Aerodyne Research Inc., *Bedford Research Pk., Bedford, Massachusetts* 01730 (DF055340; F49620-79-C-0107)

AF function - this effort will experimentally devise fluorine atom diagnostic techniques of importance to major Air Force development programs in chemical lasers and other areas. Opportunity - the proposed technique using a tunable diode laser offers a unique opportunity for providing a simple usable fluorine atom diagnostic. Objective - to investigate, analyze and demonstrate the use of a tunable diode laser absorption technique as a fluorine atom diagnostic in chemical laser and other systems. Contributions - the AF will make extensive use of the diagnostic technique demonstrated, if this research is successful.

A tunable diode laser in the wavelength region of 404 wave numbers will be used to demonstrate and measure absorption by the ground state fine structure states of the fluorine atom. Measurements will be made on a flowing discharge fluorine atom generating apparatus and data taken will be used to analyze and document the use of such absorption measurements for the purpose of fluorine atom concentration measurements in hydrogen fluoride lasers and other facilities where such a diagnostic technique is important.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, MODE-MEDIUM INTERACTION STUDIES FOR CW LASERS

S. Glicker, Avco Corp., Everett Research Laboratory Inc, *2385 Revere Beach Pkwy., Everett, Massachusetts* 02149 (DF056290; F49620-79-C-0195)

AF function - advanced weapons concepts. Deficiency - the capability does not exist to quantitatively model the undesirable unsteady phenomena high power continuous-wave lasers have exhibited in the near field-unsteady power output and unsteady phase fronts. Objective - to devise a model to relate the laser design properties to the unsteady performance so that the effect of variations in the laser parameters on nonsteady performance can be ascertained and the means provided to study ways to minimize the nonsteady phenomena. How work contributes - the unsteady phenomena discussed lead to a reduced laser flux at a target. To obtain the design performance, an order of magnitude increase in dwell time or aperture power would be necessary to overcome these effects. Alternatively, developing theoretical means for modeling the unsteady phenomena would permit the relatively inexpensive (compared with empirical approaches) investigation of ways to minimize the deleterious effects on laser performance.

Based on the previous development of a model for the acoustic or transverse mode-medium instability for a continuous wave carbon dioxide electric discharge laser, research will be directed at extending the model to the longitudinal or downstream-steering mode. The nonlinear model will be used to investigate the range of laser parameters which result in acceptable beam quality. Also, based on the flow equations applicable to a supersonic laser, a model will be formulated to describe the alignment sensitivity of the optical axis to perturbations in flux, gain, and density. The effect of heating on the density profile and its propagation along characteristics shall be included. This model will be used to assess the influence of a variation of key laser design parameters on power and beam quality.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, APPLICATION OF ARRAY PROCESSORS AND SPECIALIZED COMPUTERS TO NUMERICAL FLUID MECHANICS

W.T. Thompkins, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 3309)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0023, INP METAL CONTACTS

G.Y. Robinson, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Electrical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DF903750; F19628-77-C-0204)

AF function - communications. Deficiency or opportunity - the properties of metal contacts on indium phosphide are inadequate and the mechanisms involved not well understood presently. Objectives - to develop an understanding of the electrical and metallurgical properties of the metal/InP system that will enable a superior contact to be formed. How research contributes - an understanding of the metal/InP interface will allow proper design of detectors operating beyond .94 (microns) for fiber-optic communications systems.

Auger electron spectroscopy combined with barrier energy measurements, contact resistance measurements, and visual evaluation by scanning electron spectroscopy will be used to obtain metallurgical, chemical and electrical analysis of the metal/InP interface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0024, II-IV-V2 CHALCOPYRITES FOR HIGH-SPEED DEVICES

C.M. Wolfe, Washington University, School of Engineering & Applied Science, Dept. of Electrical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF054860; AFOSR-79-0096)

AF function - microwave solid state electronic devices are essential components of Air Force reconnaissance, electronic countermeasures and communications systems. Opportunity - Air Force systems needs continue to demand improvements in frequency, power, bandwidth, noise performance and efficiency in solid state electronic devices. Currently GaAs, InP, and III-V ternary and quaternary alloys of various composition are being investigated because of their high electron mobility, high saturated velocity and transferred electron effects. The II-IV-V2 chalcopyrites offer similar parameters but without the disadvantages of low thermal conductivity and other effects caused by random alloy scattering. Objective - to develop suitable growth techniques for ZnGeAs2 on GaAs or Ge, CdSnP2 on InP, and determine the suitability of these materials for application in high speed devices. How work contributes - successful completion of this effort could lead to new or improved types of microwave device materials.

Epitaxial layers of CdSnP2 will be grown on InP substrates in a liquid-phase epitaxial system using elemental Cd and P as initial sources in a Sn solution. Variations in melt temperature, melt composition, and cool-down rate will be accomplished to obtain good quality epilayers. Epitaxial layers of ZnGeAs2 will be grown on GaAs or Ge substrates in a vapor phase system using elemental Zn and Ge, and AsCl3 as a source of As and Cl to transport the Ge. Variations in source and substrate temperatures and flow rates will be made to obtain good quality epilayers. Investigation of intentionally added dopants will be performed in both types of materials. Other technologies including that for forming ohmic contacts and Schottky barriers, and the development of etchants for the delineation of interfaces and defects will also need to be developed so that the resulting layers can be characterized.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0025, SPARK IGNITION OF LIQUID FUEL SPRAYS

C.E. Polymeropoulos, Rutgers the State University of New Jersey, New Brunswick Campus, School of Engineering, Dept. of Mech Aerospace & Industrial Engineering, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (ENG76-15603)

The research covers an experimental study of the minimum spark ignition energy of liquid fuel sprays. The study will examine fundamental parameters, and will employ primarily monodisperse sprays and laminar flow. The effect of droplet size, air-fuel ratio, and flow velocity on minimum spark ignition energy will be assessed. Holographic observations of the expanding spark kernel will furnish information on the effect of kernel development on particle concentration. Existing methods for the estimation of the fraction of spark energy that is useful for ignition will be employed. The critical spark and mixture conditions for ignition will be correlated using available heat balance models at the critical kernel size, adapted for the presence of droplets.

Monodisperse tetralin sprays will be employed to identify the quenching distance as a function of droplet diameter for a range of flow velocities and air-fuel ratios. The spark discharge time will be optimized in terms of obtaining the smallest ignition energy for each droplet size. The effect of the expanding spark kernel on the distribution of droplets around the igniter will be assessed using high-speed holography. Finally, measurements of minimum spark energy for ignition obtained using polydisperse sprays will be carried out, and the results will be interpreted in terms of the monodisperse spray results. To aid the interpretation and presentation of experimental data, existing concepts of the thermal balance at the critical kernel size, which were developed for homogeneous mixtures, will be employed for deriving similar relations for heterogeneous mixtures. In addition, the fraction of spark energy useful for ignition will be estimated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0026, SIGNAL PROCESSING ARCHITECTURE STUDY

V. Eveleigh, Syracuse University, L.C. Smith College of Engineering, Dept. of Electrical & Computer Engineering, *Link Hall, Syracuse, New York* 13210 (DF920520)

The objective of this effort is to apply multi-level computer simulation to the design and verification of signal processor architectures optimized to the requirements of radar and electrooptical sensors located on space platforms.

The framework of this effort will be a design trade-off study using computer simulation to investigate signal processor architectures in context with physical design goals and a broad range of mission requirements. The flexibility of the processor architecture and the survivability of its software, independent of evolving device technologies or modifications of mission requirements, will be emphasized.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0027, IN HOUSE MEASUREMENTS PROGRAM

D.W. Hanson, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF740510)

Air Force function - this effort supports research to improve the space object characterization and mission assessment capability of the USAF. Deficiency - high resolution imagery of space objects cannot be obtained from ground based sensors, due to optical phase aberrations caused by turbulence in the earth's atmosphere. Mission assessment and identification of spacecraft must therefore depend on other than high resolution imagery. Objective - to measure atmospheric and optical propagation parameters. How research contributes - the data obtained will be used to verify existing theoretical analyses and to provide design parameters for compensated imaging systems.

Theoretical considerations will be used to establish a priority on parameters to be measured. Existing scientific packages at the Verona Test Site will be used to make the required measurements. The coelostat and one meter telescope gives the Verona facility the capability of extremely accurate positioning, limited tracking, and making both up and down path measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0028, GAS CORRELATION FOR HYDROCARBONS

D.E. Burch, U.S. Environmental Protection Agency, *Research Triangle Park, North Carolina* 27709 (DF336420)

To determine the feasibility of using a gas correlation method for the remote (non-contact) sensing of hydrocarbon pollution generated by Air Force operations. Presently available point monitoring sensors have proven unreliable or inappropriate for determining the contribution of airfield operations to local environmental quality. A remote system would provide an integrated pollutant load.

Joint funding with EPA. An existing gas correlation instrument will be modified to sense hydrocarbons. High resolution spectra will be furnished by the EPA project officer for use by the contractor to determine the most promising approach.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0029, TURBINE ENGINE LUBRICANT DEVELOPMENT

G.A. Beane, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451060)

Develop new lubricants and define requirements for current and proposed turbine engine and power generation systems.

Provide engine lubricant requirements to industry in terms of physical properties and performance criteria. Conduct oil testing laboratory and full scale engine to ensure oils meet these requirements, and to study advanced lubricant capabilities. Evaluate the toxicological characteristics of lubricant formulations and additives considered suspect.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0030, ENVIRONMENTAL IMPLICATIONS OF ALTERNATE FUELS

T. Jackson, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF409540)

To determine the changes in the quality and quantity of pollutants emitted by various blends of potential AF alternate jet fuels when burned in three different combustor types or utilized in various AF fuel handling systems.

Up to twelve different blends of potential AF alternate jet fuels will be burned in three different combustor types (low pressure can, high pressure can, and high pressure annular) to determine the changes in the quality and quantity of emitted pollutants (NOx, CO, smoke, and UBHC). Certain physical and chemical properties of the fuel blends will also be determined. The work will be accomplished by the AFAPL through multiple contracts with industry. The appropriate AFAPL JONS are as follows. 30480581 (low pressure can), 30480584 (high pressure annular), and 30480595 (high pressure can). A CEEDO/AFAPL technical report will be published for each of the anticipated three contracts to be performed during this program.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0031, EXCITATION STUDIES AND MASS SPECTROMETRY OF PLASMAS

J.F. Prince, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458830)

AF function - communication, weaponry, illumination, R.F. effect in communications, nuclear weapons effects. Deficiency - lack of knowledge on excitation, ionization and dissociation processes in gas discharge lasers and the upper atmosphere especially under energetic conditions. Research - mass analysis of gas discharges relevant to molecular gas discharge lasers. Direct and cumulative excitation cross-sections. How research contributes - improved gas discharge laser systems and improved understanding of atmospheric processes.

A modulated molecular beam mass spectrometer is used to monitor the relative and absolute concentrations of various molecular species existing in typical laser plasmas. Neutral, ionic, and reactive species are measured under carefully defined plasma conditions. Time resolved observations of the species concentrations allows direct analysis of dissociation and association rates. Phase sensitive detection of the modulated beam and use of a low energy, efficient ionizer assures unambiguous measurement of the true plasma ions and neutral concentrations. Direct and cumulative excitations of atomic and molecular gases are measured using a dual electron beam system interacting with a molecular beam. A high speed pumping system allows measurement of these cross-sections in dissociating gases. Photon counting, synchronous detection, and sophisticated digital data handling techniques are used to obtain and analyze reliable data. A low energy electron analyzer permits direct measurement of elastic and inelastic scattering of electrons by atoms and molecules. This instrument has a resolution of better than 0.03 eV and is capable of resolving resonant states of atoms and molecules. Data from these experiments is used to improve existing theoretical models of non-equilibrium plasmas and to aid in the analysis of the plasma properties of discharge lasers. Direct and cumulative excitation and ionization measurements lead to a better understanding of the effects of natural and man-made ionospheric disturbances.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0032, COMPRESSOR RESEARCH FACILITY INSTRUMENTATION AND DATA ACQUISITION

Unknown, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF463700)

To establish and maintain a state-of-the-art capability for the measurement, collection, and processing of CRF facility and test article related performance parameters, and to advance the state-of-the-art in related instrumentation and measurement techniques.

To establish and maintain close communication and working relationship with the engine testing community and to anticipate future needs and establish in-house or contracted R&D programs directed toward the solution of unique or advanced instrumentation concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0033, LIFE CYCLE COST OF SIMULATED VS ACTUAL AVIONICS MAINTENANCE EQUIPMENT FOR THE F-16 TRAINING PROGRAM

F.T. Eggemeier, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF228260)

To compare the life-cycle cost of F-16 avionics intermediate level training when conducted on simulated vs. actual aircraft and maintenance equipment. The results of the analysis will be a factor used by the F-16 System Program Office (SPO) to decide if a training simulator should be procured. The information provided by this study could also potentially impact on the cost and training effectiveness of other planned and existing systems. This analysis was requested by the F-16 SPO. The final product of this program will be a life cycle cost technical report.

This program is being conducted in two phases. Phase I (completed dec 76) was a general comparison of estimated life cycle costs for each type of equipment and was conducted in-house by AFHRL/AS. Phase I provided early estimates of the general configuration of the simulated equipment required to accomplish the training objectives and a general comparison of systems costs. Phase I results provided input for initial decisions about equipment procurements and were used to decide if a more detailed life cycle cost comparison was warranted. Since Phase I supported the use of simulated equipment, Phase II (Jul 78-Jul 79) is being conducted. Phase II is a detailed life-cycle cost comparison which will be based on the more extensive training and test station information scheduled to be available during that period.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

4.0034, A NEW MULTIPLIER STRUCTURE FOR DIGITAL SIGNAL PROCESSING

F.J. Taylor, University of Cincinnati, School of Engineering, Dept. of Electrical Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (DF055120; F49620-79-C-0066)

AF function - military aircraft use digital computers as part of their avionics systems, and future control and communications systems will increasingly exploit digital microprocessors. Deficiency - although digital methods have many advantages over the older analog systems, the current costs in money, weight, and electrical power for the new processors do not permit their use as much as would be true if the costs were reduced. Objective - to perfect a new type of digital multiplier which makes use of stored tables and which would be fast, accurate and inexpensive. How work contributes - the results of this research could improve the cost effectiveness of all digital signal processing, i.e., faster and cheaper computer algorithms for automatic control, communications, and radar would be possible.

The principal idea is to exploit the fact that a bilinear form can be expressed as sums and differences of quadratic forms, which means that tables of squares can be used for multiplication. Specific applications will be thoroughly tested, including the adaptive filter and the residue recursive filter.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0035, STRUCTURAL MECHANICS

J.W. Harvey, Oklahoma State University, Agricultural Experiment Station, Dept. of Civil Engineering, *107 Whitehurst Hall, Stillwater, Oklahoma* 74075

The research combined aerodynamic and stress simulation of blades, interfacing existing technology in the separate disciplines with extensions as appropriate to permit automated propulsion gas turbine blade designs.

SUPPORTED BY Oklahoma State Government

4.0036, DEVELOPMENT OF NEW INTERCALATED CATHODE MATERIALS IN USE IN SODIUM BATTERIES

W.L. Worrell, University of Pennsylvania, School of Engineering & Applied Sciences, Dept. of Metallurgy & Materials Science, *4001 Spruce, Philadelphia, Pennsylvania* 19104 (NSG 3300)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0037, ENGINEERING ASPECTS OF PLASMA WAVES

I. Alexeff, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Electrical Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (ENG78-03400)

An experimental and theoretical investigation of certain wave and particle problems in plasma dynamics is under investigation. Topics being studied include: 1. The effects of plasma boundaries on the absorption and reflection properties of ion-acoustic waves; 2. The characteristics of cold electrons injected in the troughs of ion-acoustic waves; 3. The potential effectiveness of time-of-flight isotope separation in a plasma separator; and 4. Ignition and turn-off characteristics of plasma discharges in high voltage switching.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0038, RESEARCH ON NUMERICAL ALGORITHMS FOR THE THREE-DIMENSIONAL NAVIER-STOKES EQUATIONS

A.J. Baker, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Engineering Science & Mechanics, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DF143080)

This work will produce a novel technique for the solution of the turbulent flow of a compressible fluid about aerodynamic bodies and will greatly impact the Air Force mission of flow field prediction. The accuracy and economy of the numerical algorithms developed under this research will be evaluated. The goal of the work is to derive, implement and evaluate numerical algorithms for the solution of the three-dimensional Navier-Stokes equations for turbulent compressible fluid flow. Employment of these standardized computer algorithms in the design phase of new aerospace systems may greatly decrease the wind tunnel testing requirements and thereby shorten their design cycle, improve their accuracy and reduce their cost.

Finite element interpolation theory will be used to develop a factored Jacobian computer algorithm for the solution of the nondimensionalized conservative form of the steady state time averaged Navier-Stokes equations for turbulent fluid flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0039, ELECTROMIGRATION IN ALUMINUM ALLOY FILMS

P.B. Ghate, Texas Instruments Inc., *13500 N. Central Expy., P.O. Box 5621, Dallas, Texas* 75222 (DF912230; F30602-78-C-0186)

The objective of this study is the development of fundamental physical information needed to assess and predict the electromigration of thin film binary and ternary aluminum alloys used as solid state device interconnection paths.

Test structures incorporation alluminum alloy conductive films will be coated with deposited dielectric layers and subjected to a series of current density and temperature stress. Information will be obtained on the rates of electromigration failure due to both open conductor stripes and resistance changes due to dopant atom redistribution. These failure mechanisms will be related to stripe composition and geometry and also the integrity of the overlying dielectric layer. Study results will be combined with existing information on silicon doped aluminum films and used to develop improved test methods and specifications for high reliability microelectronic devices. The end item will be a report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0040, COMPLEX TURBULENT FLOWS

L.S. Kovasznay, University of Houston, Graduate School, *3801 Cullen Blvd., Houston, Texas* 77004 (DF056490; F49620-79-C-0227)

AF function - aerospace vehciles. Deficiency - turbulent flow fields are only partially understood, the interactions between turbulent shear flows of different turbulence structure is even less understood. Objective - to increase the understanding of the interactions when two turbulent streams of different turbulent structure mix. How work contributes - increased understanding of this flow situation will aid in the design of advanced aerospace vehicles in the area of jet augmentation systems, the mixing of fuel and oxidizer streams for combustion, nozzle arrays in laser cavities, stability or decay of wakes and wake vortices, the stability of boundary layers, boundary layer separation and other.

An experimental investigation of the behavior of the large scale structures of axisymmetrical flow streams when different turbulence structures are initially present within the interacting streams will be performed. The results of these interactions will be compared to existing prediction methods of the transport properties and new modeling methods will be proposed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0041, PROTECTION OF ADVANCED ELECTRICAL POWER SYSTEMS FROM ATMOSPHERIC ELECTROMAGNETIC HAZARDS

Unknown, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF463260; F33615-79-C-2006)

Determine the vulnerability of advanced aircraft electrical power systems to lightning induced transients and develop cost-effective protection techniques to minimize electrical power system failures and reduce transients injected into aircraft equipment by the electrical power and distribution wiring.

State-of-the-art analytical techniques will be used to determine electrical power generation and distribution system and system component vulnerabilities. Trade studies will be conducted between viable protection techniques to determine cost and performance impact of alternative protection schemes. Design guidelines will be developed for electrical power system protection for advanced aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0042, APPLICATION OF FUNCTIONAL ANALYSIS IN FLUID MECHANICS

L. Napolitano, Universita degli Studi di Napoli, *1 Corso Umberto, Naples, Italy* (DF054480; AFOSR-79-0055)

AF function - advanced aerospace vehicles. Opportunity - to provide improved design and analysis computational tools suitable for the development and evaluation of future, high performance Air Force aerospace vehicles. Objective - to develop a new class of spline functions applicable to interpolation and/or smoothing problems for closed curves (one-dimensional spline) or closed surfaces (two-dimensional spline). How work contributes - in computational aerodynamics it is often necessary to solve interpolating problems for closed curves. Using classical splines for such cases is, in general, unsatisfactory due to problems arising at the closure point. This work has potential application in computational fluid dynamics to geometry specification and grid handling for complex geometric shapes representative of realistic flight vehicles.

The research will apply functional analysis in order to define and study various classes of closed spline functions. This will involve the definition of the spline functions as solutions of appropriate minimization problems in Hilbert spaces. A number of optimization and trade-off problems associated with applications of the splines will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0043, ENERGY CONVERSION - AIR BREATHING ENGINES SYMPOSIUM
J. Swithenbank, University of Sheffield, *Mappin St., Sheffield, England, United Kingdom* (DN475335; N00014-76-G-0026)

This work unit, giving partial support for the Third International Air Breathing Engines Symposium will be instrumental in providing interaction between research and development efforts of the participating countries and groups concerned with utilization of air breathing engines relative to aircraft and missile applications. As part of the energy conversion subelement, this effort gives support to all work units under the Navy's energy utilization task.

Activities of the third symposium to be conducted by the chief investigator with the assistance of an organizing committee and international representatives, will include the following: (a) organization and operation of the symposium, to be held 7-12 March 1976 in Munich, Germany (Holiday Inn) and (b) publication, in book form, of the symposium proceedings.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0044, ANALYSIS OF DAMAGE EFFECTS IN THE FATIGUE LOADING OF STRUCTURAL COMPOSITES BY MEANS OF REAL-TIME MOIRE INTERFEROMETRY
C. Walker, University of Strathclyde, *Glasgow, Scotland, United Kingdom* (DF289770; AFOSR-78-3719)

This research will help fill the need for a method to investigate failure mechanisms in composites for structural components. Not only will a new technique be developed but also greater insight into the fracture process will be achieved.

A new method of real-time in-plane strain visualization and measurement will be used to investigate mechanisms of failure and load redistribution in composite materials typical of those used for aircraft structures. The experimental technique, which has been developed at CII, University of Strathclyde, depends upon a grid attached to the specimen, and an interferometer which senses changes in the grid deformation. The object of the study is both to provide a greater understanding of mechanisms in composites, and to demonstrate the range of a potentially useful monitoring technique.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, TEMPERATURE AND WINDS IN THE DISTURBED HIGH LATITUDE IONOSPHERE
M.H. Rees, University of Alaska, College Campus, Geophysical Inst., *Bunnel Memorial Bldg., College, Alaska* 99735 (ATM77-23141)

This grant supports a two-year program to carry out measurements of the neutral gas temperature and the ion and electron temperatures in the geomagnetically disturbed high latitude ionosphere. The neutral temperature will be deduced from Doppler profiles of forbidden lines of atomic oxygen, measured with a Fabry-Perot interferometer. The ion and electron temperatures will be obtained from measurements made with the Chatanika incoherent-scatter radar. A band of the N 2 plus 1NG system will be measured with the Poker Flat spectrophotometric facility to deduce energy input rates by particle bombardment, as well as obtain the rotational temperature of the band, which is essentially equal to the kinetic temperature of the neutral gas. The observations will be analyzed in terms of aurorally associated joule and particle heating of the ionized and neutral gases by appropriate modeling.

Measurements of E- and F-region neutral winds will be undertaken using the Fabry-Perot interferometer to observe Doppler shifts of the 01 auroral emission lines. These results will be compared with ion drift measurements deduced from radar observations. Neutral wind data provide the essential input to a high latitude thermospheric circulation model, a topic that is just beginning to be explored.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0002, STUDIES OF N (2P0) AND N(2D0) POPULATION RATES IN AURORAS
G.G. Sivjee, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-24837)

The question of odd nitrogen formation and removal is important at all levels of the atmosphere. The question of the method of formation of nitrogen oxide (NO) in some aurorae and in large amounts is of particular importance to the understanding of the aurora.

Several processes in auroras produce nitrogen atoms in 4S0, 2D0 and 2P0 states. Since some chemical reactions involving odd nitrogen proceed at a faster rate when the latter is in an excited rather than in the ground state, a knowledge of the population rates of N(2P0) and N(2D0) is crucial to the understanding of the chemical processes in auroras, especially the production of NO. Lack of precise information about the relative distribution of nitrogen atoms, produced through various auroral mechanisms, among the different electronic states precludes reliable calculation of N(2P0) and N(2D0) in different auroras characterized by precipitation of electrons of different average and total energies. The measurements involve SIMULTANEOUS spectrophotometric observations of numerous spectral emission features in auroras with complementary incoherent scatter radar measurements. Because of the long radiative lifetimes of N(2P0) (approximately 12 sec) and N(2D0) (approximately 26 hrs), measurements of their population rates during particle bombardment of air can only be made in a wall-free environment as in auroras and not in ground-based laboratories.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0003, DYNAMICS AND MICROPHYSICS OF STABLE OROGRAPHIC CAP CLOUDS - COMPARISON BETWEEN THEORY AND OBSERVATION
K.C. Young, University of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (ATM77-04287)

The objectives of this research are two-fold; namely, model development and model verification. Two types of models will be developed. A three-dimensional, dynamical model will be developed in order to describe the flow field over and around Elk Mountain to be used as input into the microphysical model. A three-dimensional, microphysical model will be developed based on an existing two-dimensional model of orographic precipitation. The models will be restricted to cases where the flow within the cap cloud is stable and reasonably steady-state.

Model verification will be undertaken in two stages. First, aircraft observations of the thermodynamic variables and winds will be used in verification of the dynamical model. If the agreement between the model predictions and the observations is felt to be deficient, the observations will be used to improve the predicted flow field.

The predictions of the microphysical model will be compared to airborne and ground-based microphysical observations. Comparisons will emphasize the types and sizes of particles and the precipitation rate at the ground.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0004, SOME AERONOMIC PROBLEMS IN PHOTODISSOCIATION, PHOTOABSORPTION, AND ENERGY TRANSFER
T.G. Slanger, S R I International, Molecular Physics Center, *300 Ravenswood Ave., Menlo Park, California* 94025 (ATM78-07605)

This grant supports basic laboratory studies of molecular processes of importance to Earth's atmosphere. Using a pulsed 1610 A H2 laser as a light source the basic common O (1D) plus 2 energy transfer reaction will be investigated in unprecedented but needed detail. Specifically the kinetics and temperature parameters of this reaction will be determined. The same systems will also be used to measure the rate of the aeronomically important coefficients for quenching O(1D) and O2(b1 sigma g plus) v equals n states by ground state oxygen atoms, processes that may be of considerable atmospheric importance. The laser will also be used to measure O (1D) yields from various aeronomically important triatomic molecules at 1610 A.

Studies will be extended of the atomic products following photodissociation in O2 in the wavelength region below the Schumann-Runge continuum with emphasis on fine structure appearing in the O2 absorption spectrum below 1200 A. The extent of predissociation in the several states of NO, accessible from the ground state at absorption wavelengths between 1500 and 1900 A, will also be measured.

Absorption spectra of the common atmospheric gases are not generally available at elevated temperatures; at 1000 degrees K, calculations show that gases may easily have absorption cross sections three times larger than at 300 K. Such an effect would have considerable impact on modeling calculations, and measurements will be made on all the common atmospheric gases between 1050 A and 2000 A, at temperatures up to 1000 K.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0005, EVALUATION OF RUNOFF DURING PERIODS OF LOW FLOW

W.D. Simons, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *345 Middlefield Rd., Menlo Park, California* 94025 (WR 70-062)

Inflow to reservoirs associated with hydroelectric plants during the low-flow periods (July-April) is an important part of the water supply available for the production of electrical energy. If the amount of reservoir inflows during the drawdown period can be accurately evaluated, then the project can be operated more efficiently and greater use can be made of the available reservoir and bank storage.

To develop a procedure for evaluating potential inflow to selected reservoirs during the low-flow period based on current hydrologic and meteorologic data and conditions, and to determine the historical range in variations of these factors.

Several methods of evaluating the inflows to 'power' reservoirs have been developed previously based on combining recession data with current hydrologic and meteorological conditions. This would be studied for various units of time within the overall July-April period. Data used in these studies would be adjusted as needed, to reflect 'current' conditions. Step-regression analyses would be used to composite upstream data to downstream locations.

During the period July-April weekly summaries of runoff potentials for one to four months in advance were prepared and sent to Bonneville Power Administration. These are based on weekly runoff reports from Northwest Water Resources Data Center. Additional statistical data developed for some of the upstream stations were used. Comparison with observed runoff values for Grand Coulee, Ice Harbor, and the Dalles Dams has been started. Limited view was made of changes in irrigation development and modified flows for 1975 level of development.

Prepare a comparison of projected and observed runoff for both upstream and downstream locations.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Water Resources Div.

5.0006, INVESTIGATIONS OF HIGH-LATITUDE IONOSPHERIC ABSORPTION

H.J. Chivers, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (DPP76-80556 A01)

The objective of this research is to investigate the detailed processes controlling the interactions of the magnetosphere and the ionosphere. The investigations will be made using observations made with a network of newly developed riometers which measure the ionospheric absorption of cosmic radio noise at Siple, South Pole, and McMurdo Stations in Antarctica and at Roberval and Frobisher Bay in Canada. Ionospheric absorption profiles will be compared with simultaneous ground-base and satellite observations of VLF phenomena and magnetic and photometric effects.

The Principal Investigator will visit McMurdo, South Pole, and Siple Stations in Antarctica in the austral summer of 1976/77 and 1977/78.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

5.0007, A KINETIC THEORY APPROACH TO THE MAGNETOSPHERIC ELECTRIC FIELD

E.C. Whipple, University of California, San Diego Campus, Graduate School, Dept. of Atmospheric Science, *P.O. Box 109, La Jolla, California* 92037 (ATM77-04857 A01)

This grant will support an effort to develop a model for the magnetospheric convection electric field, based on kinetic theory. The work will use McIlwain's approach in following particle trajectories in the magnetic equator but will be extended to include non-equatorially mirroring particles. Data from the ATS-5 and ATS-6 satellites will be used to guide the theoretical work, particularly with respect to the location of particle sources and sinks, and as a test of the reasonableness of assumed particle distribution functions. Initially, the steady-state collisionless problem will be treated, but these restraints will be relaxed in later phases of the work. The aim of this work is a description of the macroscopic electric and magnetic fields in the magnetosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0008, ROCK MAGNETISM - TEMPERATURE DEPENDENCE OF HYSTERESIS PROPERTIES OF TITANOMAGNETITES AND OCEANIC BASALTS

M.D. Fuller, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geological Sciences, *Santa Barbara, California* 93106 (EAR78-03325)

This project is an extension of earlier efforts to understand the nature of thermo-remanent magnetization, TRM, and the single domain/ multidomain transition. The principal experiments are: (1) Continuation of studies of the temperature dependence of (a) hysteresis properties, (b) reversible susceptibility. (2) Acquisition and thermal demagnetization of TRM, with special emphasis on the region near to the Curie point, and attempts to observe magnetic shielding effects. (3) A search for magnetic annealing effects in specimens carrying TRM acquired in varying field strengths.

These experiments will be carried out with synthetic titanomagnetites and with DSDP (Deep Sea Drilling Program) oceanic basalts. Work of this type is a necessary step in placing paleomagnetic studies, in particular intensity estimates, on a better theoretical footing.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0009, ATMOSPHERIC RADIATIVE TRANSFER AND ATOMIC PROCESSES

A.E. Green, State University System of Florida, University of Florida, School of Engineering, Dept. of Aerospace Engineering, *220 Black Hall, Gainesville, Florida* 32611 (ATM75-21962 A03)

This grant will fund research into a variety of problems. These include: 1. Theoretical atmospheric radiative transfer calculations. These calculations deal with multiple scattering processes in a variety of environments including a partially obscured

sky. 2. Experimental atmospheric radiative transfer measurements. These measurements will be used to check the validity and accuracy of the radiative transfer calculations. Few measurements of this type have been made in the past. These relatively simple measurements should enhance our knowledge of the intensity of ultraviolet radiation in the lower atmosphere. 3. Atomic calculations for aeronautical applications. This work will continue the calculation and the 'cataloging' of electron collision cross sections of aeronomic interest.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0010, OPTICAL OBSERVATION SMOKE TRAILS
H.D. Edwards, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (DF580160; F19628-78-C-0077)

AF function - to gain quantitative understanding of stratospheric dynamics needed to predict environmental effects of af aircraft and missile operations in and through the stratosphere. Deficiency -reliable prediction of emission effects from supersonic aircraft and missile operations. Research - measurements of transport processes by observation of smoke trails. How research contributes - will provide the data to define and model transport mechanisms.

Photographic observations of upper atmosphere or stratospheric smoke releases provide data relevant to the physical state and motion of the stratosphere or lower thermosphere. Of special interest are smoke trail positions, drifts, and growth, from which ambient winds, wind shears and divergences are determined by photographic triangulation. The results of these studies provide improved physical models of the atmosphere in the natural and disturbed state, as well as data on winds, wind shears and turbulence at supersonic aircraft operating altitudes.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0011, COORDINATED OBSERVATIONS OF LOWER THERMOSPHERICAL CIRCULATION
R.G. Roper, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (ATM76-81558)

This grant funds coordinated observations of lower thermospheric circulation being carried out by a global network of meteor wind facilities and incoherent scatter radars. It also funds the collation, interpretation and publication of the results as they pertain to global neutral atmosphere motions in the height range 80 to 120 kilometers, with due regard being given to interaction with the lower and higher atmosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0012, DEVELOPMENT OF INTRODUCTORY COURSE IN REMOTE SENSING AND INTERPRETATION AND ANALYSIS
C.A. Budelsky, Southern Illinois University, Carbondale Campus, School of Agriculture, Dept. of Forestry, *Carbondale, Illinois* 62901 (SER78-00010)

This project is designed to provide an opportunity for undergraduate students, majoring in the natural resource sciences at Southern Illinois University, to develop functional skills in remote sensing techniques. Remote sensing has been shown to provide significant advantages in collecting and interpreting inventory data over large geographical areas at a substantial reduction in time and expense.

An introductory course will be developed, utilizing the facilities of a currently acquired remote sensing laboratory, to increase the assortment of inventory and diagnostic skills that are needed by students of the natural sciences. The multidisciplinary nature of the student enrollment will be utilized to enhance the development of all class members. Faculty representatives of several departments and undergraduate students will function in an advisory capacity to identify pertinent topics for inclusion, so that the presentation will be relevant to the needs of the students. Consultants from the University's Learning Resource Center and from other institutions currently offering programs in remote sensing will provide an evaluation of course content, presentations and laboratory exercises.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div.
of Science Education Resources
Improvement

5.0013, REMOTE SENSING OF FOREST RESOURCES
R.M. Hoffer, Purdue University, Agricultural Experiment Station, Dept. of Forestry & Conservation, *Executive Bldg., West Lafayette, Indiana* 47907 (0032384; IND059030)

OBJECTIVE: Analyze multispectral/multi-temporal scanner data from satellite altitudes, registered to supplemental data sets, and develop a set of computer-aided techniques that can be used in a repeatable, cost-effective manner to obtain maps and acreage estimates of forest and other natural resources features.

APPROACH: Utilize LANDSAT, SKYLAB, and other multispectral scanner data. Analyze spectral data characteristics and test several techniques for computer-aided analysis of multispectral, multi-temporal scanner data. Digitally overlay and register topographic, soils, and land ownership data onto LANDSAT scanner data. Define most effective techniques to obtain various types of map outputs requested by resource managers.

PROGRESS: Use of LANDSAT satellite data and digital computer processing techniques offers a potential for monitoring significant changes in forest cover on an annual basis. Research this past year was directed at the development of methods and computer software to relate known U.S.F.S. Forest Survey sample locations (identified by U.T.M. coordinates) to X-Y coordinates in LANDSAT data, and to develop an approach for monitoring change in forest cover using a combination of such Forest Survey and LANDSAT data. Results indicate that Forest Survey ground photo locations can be located in the LANDSAT data to within 80 meters, but additional work needs to be done to define the significance of spectral differences occuring on LANDSAT data obtained in different years. A second project involved the use of topographic data (elevation, slope, and aspect) in combination with LANDSAT data to identify and map individual forest cover types, using computer-aided analysis techniques. Several different procedures were defined, developed and applied to a set of LANDSAT data which was digitally overlaid with topographic data for a test site in the San Juan Mountains of Colorado. Preliminary results indicate that the combination of topographic and spectral data enables a significant improvement in classification accuracy, as compared to the use of spectral data above.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative
Research Office, Indiana

5.0014, MEASUREMENT OF THE THERMODYNAMICS OF THE SOMALI JET BY HIGH-RESOLUTION RADIOSONDINGS
J.M. Coleman, Louisiana State University, Agricultural & Mechanical College, Coastal Studies Inst., *University Station, Baton Rouge, Louisiana* 70803 (ATM78-13388)

The objective of this research is to study the thermodynamic structure of a rapidly moving, low level, atmospheric jet stream called the Somali jet. This jet stream of air crosses the equator over the Indian Ocean, flows north along the east coast of Africa and then northeastward across the Arabian Sea towards India where it is known as the 'southwest monsoon.' It is in part responsible for providing the thermal energy and moisture for the intense monsoon rains that fall over India and southeast Asia during the summer.

This project will consist of setting up three upper-air observing stations in Somalia to monitor the temperature, moisture and winds within the Somali jet. It will be carried out in conjunction with a related Florida State University program. The data will be analyzed with the research objective of studying the time evolution of the structure of the jet in relation to the pre- onset- and active-monsoon periods.

This project is a part of the GARP Monsoon Experiment (MONEX). MONEX is a major study to increase our knowl-

edge and understanding of the dynamics and thermodynamics of the atmosphere and ocean in monsoon regions. It is important scientifically and also has significance for global agriculture, economics and politics. The initiative for MONEX is from the Government of India with the USSR and U.S. playing major roles. In addition to the benefits mentioned above, MONEX offers an excellent opportunity for scientific and technical cooperation between, and of mutual benefit to, the U.S., India and the USSR.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0015, LOW ENERGY ELECTRONS OVER THE POLAR REGION BY USING THE USAF OPERATIONAL DMSP SATELLITES

C. Meng, Johns Hopkins University, Graduate School, *Laurel, Maryland* (DF053850; AFOSR-79-0010)

AF function - the accurate knowledge of the polar ionosphere in real time is vital to transpolar radio wave propagation. Deficiency - an effective method is required for the remote sensing of conditions in the polar ionosphere. Objective - by using data from the USAF DMSP satellites, the electron precipitation characteristics for different auroral activities and other types of low energy electron precipitation are to be identified. Contribution - after completion of this work, it should be possible to infer global distributions of detailed auroral electron precipitation based on DMSP auroral photographs.

The following studies will be made of the simultaneous auroral and electron data from a dawn-dusk orbiting DMSP-32 satellite and the new DMSP block 5D satellites, precipitation characteristics of morning oval auroras, characteristics of auroral arcs in the polar cap, precipitation characteristics over the dayside oval, especially near the cusp region. several coordinated ground-based and satellite observations are planned using DMSP-32 or 33 and the geosynchronous satellite ATS-6, NASA's polar orbiting AE-C and D satellites and the incoherent scatter radar at Chatanika in Alaska.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0016, MET AND MATH ANALYSES

A. Gerlach, Systems & Applied Sciences Corp., *6811 Kenilworth Ave., Riverdale, Maryland* 20840 (DF582220; F19628-79-C-0033)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of adequate information and techniques to satisfy military weather support requirements. Objective -(T2310G2) Determine the most appropriate numerical weather prediction model resolution for a given initial observational density. (T667007) Develop real-time radar diagnostic software for a minicomputer operated on-line with an advanced Doppler weather radar. (T667008) Develop techniques for applying digitized meteorological satellite imagery data to short range (0-6 hrs) weather forecasting. Improve the output of the AFGL/LY man computer interactive data access system (MCIDAS) to support development of techniques in satellite meteorology. (T667010) Evaluate the temporal and spatial characteristics of critical aviation weather parameters and develop descriptive display methodologies. Develop mesoscale (0-6 hr) objective weather prediction techniques for critical aviation weather parameters. How research and development contribute -provide improved weather analysis and forecasting techniques in (T2310G2) Mathematical models of atmospheric processes. (T667007) Improving the utility of advanced Doppler radar. (T667008) Improving DMSP satellite imagery and techniques for using MCIDAS. (T667010) Development of real-time use of advanced weather systems and automated weather forecasts and warning techniques.

(T2310G2) Analytical and numerical techniques will be applied to problems in atmospheric dynamics. (T667007) Develop the following: software, for pattern recognition, real-time estimation of horizontal wind speed, direction, and convergence or divergence based on quantitative measurements from a single Doppler weather radar, the operational identification and prediction of damaging winds. (T667008) Acquire, navigate and archive samples of digitized satellite imagery data, correct data for various system errors and analyze in conjunction with other meteorological data. (T667010) Test and improve a prototype modular automated weather system (MAWS) using data acquired at the AFGL field facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, REMOTE SENSING APPLICATIONS TO HYDROLOGY AND WATER RESOURCES

E.T. Engman, U.S. Dept. of Agriculture, Federal Research Office, Plant Physiology Inst., Hydrograph Lab., *Bldg. 007, Room 139B, Beltsville, Maryland* 20705 (0045249; 1109-20811-003)

OBJECTIVE: Investigate the feasibility of using remote sensing (particularly microwave) for input to hydrologic models. Investigate scale relationships among point measurements and areas of various sizes.

APPROACH: Microwave data, LANDSAT and infrared data will be tested for applications as input data to hydrologic models and for direct measurement of runoff potential. Remotely sensed data from several altitudes, plus an intensive field sampling program will be used to investigate the scale of hydrologic parameters that is important in predictive models. Models will be developed to simulate the processes of remote sensing. These models will be used to generate accuracy information for various sensor-parameter problems.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Beltsville Agricultural Research Center

5.0018, GEOLOGIC MODELING OF THE PATOSPSO WATERSHED MARYLAND

H.G. Siegrist, University of Maryland, College Park Campus, Graduate School, Dept. of Geology, *College Park, Maryland* 20742 (NSG 5423)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0019, ANALYSIS OF SATELLITE SENSOR DATA

D.E. Delorey, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF275460; F19628-76-C-0190)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density and composition variations with time and space cannot be accurately predicted. Research - direct density and composition measurements with solar and geophysical parameters. How research contributes - permits development of accurate models to be used in forecasting techniques. Mathematical techniques and computer routines are developed to process satellite attitude and sensor data to calculate parameters to provide increased knowledge of atmospheric properties.

Develop and implement computer routines and techniques for the continued reduction of raw digital data from sensor outputs to vehicle attitude, sensor position vectors and associated ionospheric parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, ATMOSPHERIC DENSITY MODELS INCLUDING TIDES

J.M. Forbes, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF246720; F19628-79-C-0088)

AF function - orbital navigation, orbital surveillance. Deficiency - ephemerides of operational satellites cannot be computed accurately due to lack of knowledge of spatial and time variations of density at critical altitudes. Objective - development of improved models of the thermosphere including the effects of tides and test and evaluation of model atmospheres for use by COESA and Air Force operational organizations. How research contributes - new models, which will include work done on this contract, can be recommended for use by the NORAD Chey-

enne Mountain Space Computation Center and by COESA in the development of revised U.S. standard supplements.

A multiple linear regression (MLR) model of the thermosphere will be compared with an independent set of observations, the Jacchia (1977) empirical model and the MSIS model. A complete hybrid observational-theoretical wind model will be developed for consideration by COESA. Evaluation of the MLR model's ephemeris prediction capability will be made using data from Doppler beacon, OV1-17, OV1-21 and more recent satellites. Appropriate recommendations concerning the new models will be made to COESA and ADCOM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, MATH AND PHYSICS STUDIES

N. Grossbard, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF582640; F19628-79-C-0063)

AF function - 1. missile guidance, 2. trans-ionospheric communications, 3. infrared optical detection systems, 4. reconnaissance - target acquisition and tracking. Deficiency or opportunity - 1. lack of detailed knowledge of the gravity field contributes to missile guidance error, 2. present models of the photoelectron flux are not accurate enough to permit remote satellite monitoring, 3. lack of knowledge of the optical and infrared emissions induced by the detonation of high altitude nuclear weapons, 4. the performance of any optical system looking through the atmosphere is degraded by atmospheric light scattering. Objective - 1. determine global gravity field with maximum accuracy and precision, 2. to model approximate cross sections and to calculate the photoelectron flux, 3. to measure the spectral emissions induced in the atmosphere by electron accelerators, 4. study the intensity of solar radiation. How research contributes - 1. reduction of geodetic and gravity errors will lead to improved guidance performance, 2. the contribution of the photoelectron flux studies is to provide a more accurate specification and understanding of ionospheric properties so as to enhance the capabilities of current and future AF systems, 3. the measurement of the spectral nature of the atmospheric emissions induced by nuclear weapons will improve the infrared optical detection systems, 4. achieving the objective of this study will lead to an improved capability to predict the effects of the atmosphere on EO systems.

Mathematical studies and numerical algorithms will be applied to properly analyze and test the models related to the above systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, HIGH-ALTITUDE CHARGE TRANSPORT

M. Kanal, Clark University, Graduate School, *950 Main St., Worcester, Massachusetts* 01610 (DF582520; F19628-79-C-0008)

AF function - satellite communication, navigation, command and control. Deficiency - inadequate knowledge of high-altitude transport and heating mechanisms for the proper interpretation of data from AF satellites. Objective - to calculate the effects of high-altitude electron-ambient plasma coulomb interactions and the pitch-angle scattering of electrons in the plasmasphere on electron transport in the upper atmosphere. Results will be compared with current AF satellite data. How research contributes - provides information essential to microwave and radio frequency transmission through the upper ionosphere. Provides data essential for design and utilization of communication guidance and surveillance systems. Provides understanding of upper ionosphere transport mechanisms which affect the neutral upper atmosphere.

Solve the Boltzmann equation for high-altitude (above 500 km) conditions, emphasizing the plasmasphere and taking into account the effects of coulomb interactions and pitch-angle scattering. From this solution calculate the heat flow vector and compare the predicted electron temperatures with those obtained from AF satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, PHASE AND AMPLITUDE SCINTILLATION MODELLING AT EQUATORIAL AND HIGH LATITUDES

S. Basu, Emmanuel College, Graduate School, *400 the Fenway, Boston, Massachusetts* 02115 (NSG 5419)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0024, RESEARCH DIRECTED TOWARD DESIGN FABRICATION TEST AND LAUNCH SERVICES FOR SCIENTIFIC ROCKET PAYLOADS

L.J. O'Connor, Northeastern University, School of Engineering, Dept. of Electrical Engineering, *360 Huntington Ave., Boston, Massachusetts* 02115 (DF248250; F19628-76-C-0152)

AF function - missile detection, surveillance, reconnaissance and communications systems. Deficiency - plume radiation characteristics of low thrust rocket engines operated at high altitude. Effects on LF/VLF wave propagation during periods of abnormal ionization in the lower atmosphere. Objective - design of multi spectral measurement payloads to determine the radiant intensity, spatial radiance distribution, and infrared and ultraviolet spectra of low thrust rocket engines operated at high altitudes. Design of small sounding rocket payloads for ion and neutral mass spectrometer measurements, IR interferometer measurements and solid rocket motor post burnout characteristics. How research contributes - the payloads developed under this contract will enable AFGL scientist to make IR and UV measurements of small rocket engines at high altitude - to make measurements of positive and negative ions and charged particles - measure the density of thermospheric species in support of a calibration of the DMSP-SSD package - determine the magnitude of the post burnout thrust and outgassing of solid rocket motors.

Under line item 0001, the contractor will conduct engineering liaison with AFGL scientists and engineers in order to define technical requirements, design, fabricate or refurbish, test and provide launch services for six (6) multi spectral measurement program payloads. The contractor will be responsible for the design, fabrication and test of the payload in-flight power system - programmers for all onboard logic functions - payload aspect and attitude measurements - all instrument support structures - interconnecting wiring - nose cone and aerodynamic fairings - nose cone ejection and fairing opening system necessary to expose scientific instruments or support equipment in their measuring regime during exoatmospheric flight. The contractor will be responsible for design, fabrication and operation of all GSE necessary for assembly, test and launch support of the payloads at the contractor plant, AFGL, and test facility and the eventual launch site. Under line item 0002, the contractor will conduct engineering liaison with AFGL scientists and engineers in order to define technical requirements, design, fabricate, or refurbish, test and provide launch services for up to fifteen (15) scientific sounding rocket payloads. These payloads will be flown in support of various AFGL IHWU. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, STUDY OF MAGNETIC STORM PARTICLES ENERGIZATION

B.F. Sellers, Panametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DF582030; F19628-79-C-0009)

AF function - communications, surveillance and navigation. Deficiency - Air Force space systems are subject to constant irradiation damage and ground-based systems are affected by ionizing particles incident on the ionosphere. The way by which trapped and precipitating particles acquire damaging energy is not known in sufficient detail to model and predict resultant disturbances. Objective - to solve various magnetospheric problems related to charged particle motion for trapped and precipitating particles. How research contributes - increased capability for modeling magnetospheric events will provide inputs for improved disturbance predictions and for assessing radiation hardening requirements.

High resolution electrostatic analyzer data from Air Force rocket and satellites will be used as inputs for the study of inverted V events, describing the average electron environment

and for the study of particle energy deposition in the atmosphere as related to acceleration mechanisms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, SATELLITE RADIATION DOSIMETER
Unknown, Panametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DF581660; F19628-78-C-0247)

AF function - navigation, communications and surveillance. Deficiency - inaccurate environmental specification for radiation hardness of microelectronic components will result in inefficient design criteria for military satellite systems. Objective - acquire a high energy (1-10 meV) electron radiation dosimeter for satellite measurements. How research contributes - direct measurement of the radiation dosage due to the high energy electron spectrum is needed to resolve uncertainties in calculations of radiation hardening requirements.

A radiation dosimeter will be designed, fabricated and launched aboard a satellite to measure the specific radiation encountered by a specific target due primarily, to electrons (1-10 meV).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, FILM ANALYSIS
I. Kofsky, Photometrics Inc., *Lexington, Massachusetts* 02173 (DF583700; F19628-79-M-0010)

AF function - surveillance and communication satellites. Deficiency - electrical charging of satellites causes failures of on-board electronic components. Objective - analysis of film used on a sounding rocket payload to record arcing and discharge phenomena due to vehicle charging. How research contributes - by determining the volume emission in the sheath during vehicle charging, information will be obtained as to the mechanism of vehicle neutralization. This information will be used to develop instrumentation to control and reduce satellite spacecraft charging.

Photographic film records obtained during the flight of Astrobee F rocket No. A31.603 will be reduced by microdensitometer procedures and analyzed to determine volume emission rates in the payload sheath during the rocket flight. Theoretical volume emission rates will be calculated assuming various scenarios of return currents and will be compared to the measured values.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, REACTIONS OF EXCITED ATMOSPHERIC GASES SPECTRAL DATA
I.L. Kofsky, Photometrics Inc., *Lexington, Massachusetts* 02173 (DF583280; F19628-79-C-0073)

Air Force function - communications, surveillance, detection, tracking. Deficiency - predictive capability for electron concentrations and other atmospheric parameters following atmospheric nuclear bursts. Objective - identification of the visible and ultraviolet spectral data requirements most needed for digital computer codes used to predict atmospheric nuclear effects. How research contributes - this study will allow the in-house program to concentrate its limited resources on the most important inputs for codes such as OPTIR, ROSCOE, HARC, PHARO, etc.

Problem areas in systems codes will be identified and correlated with deficiencies in the spectral data used as inputs to the codes. The sensitivity of the effects to possible uncertainties in the inputs will be considered. Particular attention will be given to defense systems codes in the areas of satellite communications, electronic and optical surveillance, and tactical military operations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, INSTRUMENTATION ANALYSIS DESIGN AND FABRICATION OF SYSTEMS FOR AIR FORCE PROGRAMS
A.H. Howell, Tufts University, Medford Campus, School of Engineering, Dept. of Electrical Engineering, *Medford, Massachusetts* 02155 (DF248700; F19628-77-C-0047)

AF function - scientific balloon systems and associated instrumentation. Deficiency or opportunity - exploit the performance capabilities of free and tethered balloons by designing systems for highly specialized scientific payloads or for unusual flight performance requirements. Objective - to provide expert analysis and design, and limited fabrication of instrumentation and balloon system component for special applications. How research contributes - appropriately designed, instrumented balloon systems provide efficient and often uniquely useful high altitude and tethered platforms for emergency communications, surveillance and optical observations.

Balloon/payload configurations such as the balloon altitude mosaic system (BAMM), the air launched balloon system (ALBS) and the LORAN C balloon-borne antenna system will be analyzed and component design changes initiated if needed to ensure optimum balloon/payload performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, DEVELOP ION MASS SPECTROMETER TO MEASURE D-REGION CLUSTER IONS FOR LF/VLF COMMUNICATIONS
A.D. Bailey, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581100)

AF function - communications, detection, track and intercept, nuclear weapons delivery. Deficiency - inability to forecast atmospheric interactions affecting the design and operation of military LF/VLF and other systems such as over-the-horizon radar, polar communications, reentry vehicles and satellite ephemerides. Objective - develop and test instrumentation to accurately measure positive and negative ion composition and densities in the D and E regions, especially between 40 and 90 km for calculations of LF/VLF transmissions. How research contributes - provides instruments for, and conducts experiments measuring the composition and densities of ion species important to AF systems operations. The mass distribution of large positive and negative ion clusters between 40 and 90 km is not well known. This effort will attempt to determine the ion composition and physical-chemical processes which degrade LF/VLF communications and otherwise affect AF EM systems operations.

A new instrument will be designed to overcome difficulties previously encountered in attempts to measure heavy ions in the 40 to 90 km region. Rocket-borne measurements with this instrumentation are planned to measure mid-latitude diurnal variations. Measurements are planned for eclipse or twilight measurements of photo-detachment and electron attachment processes. Such basic measurements should establish the capability to assess cluster concentrations in future programs during polar disturbances.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, SPACE VEHICLE CHARGE EJECTION STUDIES
H.A. Cohen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583620)

AF function - communications, satellite survivability and surveillance. Deficiency - inadequate knowledge of the effects of charged particle ejection systems on space vehicles in the upper atmosphere. Objective - to study and determine Air Force applications of rocket- and satellite-borne charged particle ejection systems. How research contributes - the research will determine both the advantages and disadvantages of Air Force applications of charged particle ejection systems on space vehicles.

A sounding rocket payload will be designed, built, tested, and flown to achieve the objectives of measuring spacecraft

charging during beam ejection, determining limitations of using unneutralized beams, and investigating techniques and problems of high energy charged particle ejection and beam-ambient plasma interactions. Charged particle ejection sources will be used to eject charged particles both positive and negative with a wide dynamic range of current, mass, energy and injection period. For the purpose of investigating spacecraft charging during the rocket payload flight measurements will be made of beam characteristics, vehicle charging, the shape and structure of sheaths, and changes in return current characteristics. Measurements will also be made of the important ambient and vehicle parameters such as ion and electron density and temperature before and during charge ejection, the neutral density and characteristics of the ambient near the vehicle, and vehicle pitch and aspect angles. The data will also be compared to theory for validation and extension of models used to explain and predict beam ejection effects on space vehicles and the atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, BALLOON MEASUREMENTS OF SOLAR ULTRAVIOLET RADIATION IN THE STRATOSPHERE

L.A. Hall, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF244820)

AF function - environmental impact of high-altitude vehicles. deficiency - effect of aircraft effluents on solar UV absorption and on ozone. Objective - to determine solar, ultraviolet energy deposition rates and ozone concentrations. How research contributes - energy deposition rates and ozone concentrations will improve models used in computation of environmental impact of Air Force vehicles.

Balloon flights of a solar spectrometer will provide data on the solar spectrum in the range 2000-3000 A, as a function of height in the stratosphere. From these data, energy deposition rates and ozone concentrations will be computed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, ELECTRON FLUX AND OPTICAL EMISSION STUDIES

J.R. Jasperse, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583190)

AF function - trans-ionospheric ranging and communications, remote ionospheric monitoring. Deficiency - present state-of-the-art in relating natural optical emissions to the electron density profile is not understood well enough to permit remote satellite monitoring of the auroral oval and mid-latitude ionosphere. Objective - to develop knowledge in relating optical emissions to electron density profiles. How research contributes - in the short-term, to assist AWS and SAMSO in their ionospheric modelling and monitoring effort by supplying computer codes for calculating the electron flux and electron density profiles. In the long term, to provide a more accurate specification and understanding of ionospheric properties so as to enhance the capabilities of current and future AF systems.

Optical emissions in the auroral oval and at mid-latitudes will be surveyed. Satellite measurements of the incoming electron flux in the oval will be studied. Preliminary calculations will be made which relate these fluxes and emissions to the electron density profile. Computer codes will be developed to perform detailed calculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0034, AURORAL SCINTILLATION MODELLING STUDIES

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AF function - communications/navigation. Deficiency - signal fading, range errors. Objective - to model ionospheric parameters and predict deficiencies. How research contributes - develops and tests predictive models of ionospheric scintillation based on actual data to be used by AWS. Model will include effects of elevation and frequency scaling.

Using actual data from Goose Bay and Narssaq Point, models will be constructed using geophysical parameters to predict scintillation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0035, HEAO-C THEORETICAL STUDIES

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AF function - communications and detection. Opportunity - geomagnetic field models are used to predict effects important to a number of USAF communication and detection systems. The HEAO-C satellite (to be launched in 1980) will provide a unique, hitherto unavailable opportunity to check the absolute accuracy of mathematical models of the magnetic field in the magnetosphere by comparing the calculated effects of the magnetic field on energetic charged particles with the forthcoming experimental measurements. Objective - to perform theoretical studies of the energetic charged particle access through the inner magnetosphere where the internal geomagnetic field dominates. These studies are to be conducted within the framework of the expected observations to be available from the HEAO-C satellites. How research contributes - the results to be obtained are the calculations that must be made prior to satellite launch in order to have the theoretical predictions that can be compared with the satellite measurements to be obtained.

There are specific detailed characteristics of energetic charged particle access to the geomagnetic field that have been theoretically predicted but have never been experimentally measured because the experimental resolution has not been adequate. The planned observations from the HEAO-C satellite are expected to have sufficient detail in resolution to measure these effects. The primary technical 'tool' to be utilized in this research effort is the high speed digital computer. In this effort, numerical calculations of energetic charged particle access into the domain controlled by the geomagnetic field will be made for selected positions for the HEAO-C satellite orbit as defined by geographic latitude, geographic longitude, and altitude. Utilizing a current model of the quiescent geomagnetic field, such as the International Geomagnetic Reference Field, numerical results for a sufficient number of directions and locations for a satisfactory description of the structure expected in the access of energetic charged particles to the satellite are to be derived. The numerical results are to be completed before the satellite is launched in 1980.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0036, LOWER IONOSPHERE EM DISTURBANCES

W. Swider, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582810)

AF function - VLF/HF/VHF communications/radar. Deficiency -inability to determine effects of nuclear scenarios and natural disturbances on communications/radar such as VLF (AABNCP), HF (SAC-ROCS-72) (MAC-GOR 3-72), OTH-B (TN-ESD-RADC-0401-71-01). Objective - to measure ionospheric D- and E-region parameters during a solar proton event (SPE) in order to develop predictive software for communication/radar systems in natural solar disturbances and general nuclear conditions. How research contributes - payoff is through better predictability of ionospheric disturbances on VLF-HF communications/ radar systems. This will assist both operational and design requirements.

Rocket payloads containing positive and negative ion mass spectrometers, Gerdien condensers, and energetic charged particle detectors will be launched during an SPE, especially around sunrise and sunset periods. Supporting ground-based and satellite observations of opportunity will be incorporated into the program. In this manner, essential parameters will be determined to develop detailed physical-chemical predictive codes describing ionospheric conditions which can be used to determine the effects of ionospheric disturbances of natural/nuclear origin on electro-magnetic propagation. Concurrently, labora-

tory work on significant related chemical processes also will be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0037, MISSILE CEP IMPROVEMENT FROM IMPROVED GRAVITY MODELS

B. Szabo, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582900)

AF function - strategic weapons delivery. Deficiency - current gravity models are inadequate to satisfy CEP goals of advanced ICBM's in the mid 1980's. Objective - determination of the impact errors of advanced long range ICBM's by utilizing improved regional and global gravity models. How research contributes - determines expected ICBM impact errors due to various gravity models.

Gravity models (launch region and global) derived by new combination technique and from new gravity data (such as satellite altimetry) will be used for the determination of the omission and commission errors of the global model. This error will be combined with the launch region gravity model, GM, and launch site gravity errors for the total gravity dependent error of an advanced ICBM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0038, SUNSPOT-FLARE ASSOCIATION

F.W. Ward, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580830)

The determination of the latitudinal and longitudinal motions of sunspot groups and their systematic variations over the course of the cycle of their development. In particular, this study will uncover the systematic differences between the active and inactive portions of the cycle, and any implications related to spot development.

The analysis will consist of the stratification of the data on the occurrence and two-dimensional motions of spot groups from a long and homogeneous record. This stratification will determine the rates of motion as a function of latitude, and the variation of these motions as the focus of activity moves to progressively lower latitudes during the cycle. An attempt will be made to determine the rate at which the underlying physical processes shift with latitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0039, SPECTRAL INTERFEROMETER SWIR DAYLIGHT BACKGROUND

N.B. Wheeler, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583080)

AF function - this work supports the Air Force functions of detection, surveillance, tracking and early warning. Deficiency -present operational and future satellite infrared surveillance systems at short and middle infrared wavelengths are limited by the background clutter from enhanced atmospheric emissions from disturbed atmospheres both natural, such as aurora, and nuclear. Improvements in such systems will depend on proper selection of spectral filters. Objective - to obtain high resolution short and middle infrared spectra of atmospheric emissions associated with natural and disturbed daylite backgrounds. How research contributes - spectral properties of the daylit auroral and natural backgounds will be measured from 1.5 to 7.5 microns and categorized. The results will be presented to Air Force programs offices as appropriate and utilized in predictive infrared nuclear code development and in system design.

A rocket-borne field widened interferometer has been developed. It is capable of obtaining excellent spectra at 2/cm resolution. It has become feasible to make high resolution sensitive measurements of atmospheric emitters in the natural and disturbed daylit atmosphere. One rocket-borne instrument will be launched at White Sands, New Mexico for undisturbed mid-latitude backgrounds. Another rocket-borne instrument will be launched at Poker Flat, Alaska into a daylit auroral event. The spectra so obtained with these flights will be an important tool in understanding the chemistry of these emitters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0040, THE OPAQUE MINERAL CHEMISTRY OF ALLENDE, BASALTIC ACHONDRITES, AND THE ANTARCTIC METEORITE SUITE

S.E. Haggerty, University of Massachusetts, Amherst Campus, School of Natural Sciences & Mathematics, Dept. of Geology, *Amherst, Massachusetts* 01002 (NSG 7549)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0041, USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION

R.D. Vlasin, Michigan State University, Agricultural Experiment Station, Dept. of Resource Development, *New Administration Bldg., East Lansing, Michigan* 48823 (0064769; MICL01168)

OBJECTIVE: To demonstrate the operational ability and uses of remote sensing for land use planning and policy formulation. Specifically to: develop, apply, and evaluate a system which will incorporate remote sensing for classifying land use and resource characteristics; apply remote sensing to program needs of selected Michigan agencies; apply the findings of the research to the land use policy formulation process in Michigan.

APPROACH: Actual sites selected with governmental units to test usefulness of various RS applications. 'Short-term' direct agency applications to permit development, completion, evaluation, and approaches. Applications also to longer-run policy efforts. Departments of Crop & Soil Sciences, Forestry, Resource Development, Urban Planning & Landscape Architecture, and Geography are involved.

PROGRESS: During 1978, remote sensing techniques were used to derive data required for effective land/resource use decisions by agencies in Michigan. Photo-derived information on open water and marshes, forested wetlands, and residential areas in Saginaw and Bay counties is being used by field teams in mosquito treatment operations. A vegetation inventory of the Shiawassee National Wildlife Refuge was prepared. A procedure was developed to identify 'wild areas' using LANDSAT and aerial imagery. The Michigan Department of Natural Resources will use information provided for six counties to select sites for dedication as natural preserves. LANDSAT imagery, supplemented by NASA PB-57 and other aerial photography, is being used to determine the location, extent, and biomass of non-commercial timber resources in west central Michigan. The information will be used by private firms in planning for two wood-chip burning electric power generating plants. Temporal aerial photos are being used to assess the environmental (particularly drainage alteration) impacts of existing gas and oil pipelines crossings of streams and wetlands. The study is aimed at identifying better pipeline construction methods which prevent or mitigate impacts on sensitive environments. Project personnel have developed a sand dune morphology classification for the shore zone of Michigan and procedures for inventory and monitoring of sand dune mining operations using aerial imagery.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Michigan

5.0042, THE INTERACTION OF A SPACECRAFT WITH ITS ENVIRONMENTAL SPACE PLASMA

U. Samir, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM76-19790 A01)

This grant funds studies of the interaction of a spacecraft with the plasma environment, with the emphasis on the wake region behind the spacecraft. This is an important research areas which has received considerable theoretical attention, but where little effort has gone into experimental testing or verification of the theoretical ideas. There is increased interest in this subject at present because of proposals to use a wake shield with the shuttle spacecraft to produce an ultra-high vacuum. It may be that

the electrical wake will be the limiting factor on the particle density in the region behind the wake shield.

Specifically, research under this grant will pursue two points: 1) Analysis of in situ observations (from the AE-C/E satellites) in order to perform a phenomenological, parametric investigation, focusing on interaction dependences upon spacecraft velocity, diameter, and potential (measured in units of the ambient plasma parameters. 2) Comparisons between theory and experiment as well as between different theoretical models. Such studies should enhance our physical understanding regarding the nature and range of applicability of the assumptions (physical and mathematical) used in various wake/sheath theories.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0043, TROPOPAUSE CLIMATOLOGY

Unknown, Control Data Corp., *8100 34th Ave. S., Minneapolis, Minnesota* 55420 (DF583570; F19628-79-C-0098)

AF function - environmental impact assessments and laser propagation. Deficiency - current meteorological definition of tropopause height is frequently misleading regarding mid-latitude division between stratosphere air mass and troposphere air mass. This leads to a poor assessment of the stratosphere-troposphere interchange and the rate of removal of stratospheric pollutants. Objective - it is the objective of effort to review existing historical records and derive a more appropriate definition of the tropopause and to then determine the seasonal and latitudinal variations of the mass exchange across the tropopause. How research contributes - the planned measurements will lead to a new description of aerosol distribution in the lower atmosphere. This data will be used in environmental assessments and in computer models predicting optical propagation.

Analyze on a global basis a minimum of ten years of ozonesonde and radiosonde records to evaluate possible definitions of tropopause from the viewpoint of stratosphere-troposphere mass exchange. Apply the appropriate definition to the ten year set of data to determine suitable climatology. Tables and charts are to be prepared presenting monthly means and frequency distributions as a function of year, latitude and longitude. Estimates of the stratosphere-troposphere exchange are to be determined from seasonal adjustments in the turbopause altitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0044, FORMATION OF ATMOSPHERIC AEROSOLS

K.T. Whitby, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Mechanical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (R803851-03S4; G603A-AA-019)

Aerosol size distributions have been measured in the St. Louis area as part of EPA's Project MISTT using aircraft and ground-based self-contained mobile laboratories. The University of Minnesota's portion of the project included aerosol measurements aboard an aircraft and the operation of a mobile van on the ground under the plumes.

The past year was devoted primarily to data analysis, the development of new analysis techniques and reporting results of aerosols data obtained over the past several years in Project MISTT and the Roadway Aerosol Study.

During the coming year the Particle Technology Laboratory of the University of Minnesota will be measuring aerosol size distribution for EPA's Project STATE (Sulfur Transport and Transformation in the Environment) in Tennessee and for EPA's Project SCRUB in Alabama and Minnesota. The STATE Program is directed to describing reactions and atmospheric processes affecting plume behavior over time scales of 12-96 hours and distances out to 1000 km. By contrast the SCRUB program will provide an assessment of the transport and transformation occurring within a power plant plume with an SO2 scrubber out to distances of about 1000 km and travel times mostly less than 12 hours.

Resources will be provided to complete data analysis and report on Project MISTT and to participate in the planning of Project SCRUB and the subsequent data analysis. Other tasks include the measurement of gaseous and aerosol pollutants under and in plumes being characterized in Project STATE and development of an aerosol mobility chromatograph to determine molecular composition of sulfur-containing aerosols.

SUPPORTED BY U.S. Environmental Protection Agency,
Office of Research & Development,
Environmental Sciences Research Lab.

5.0045, TORNADO MEASUREMENTS

S.A. Colgate, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (ATM76-82562)

The objective of this research is the testing of small instrumented rockets fired from a slow-flying aircraft to make measurements in water spouts, and, potentially, tornadoes. The rockets will measure pressure, temperature, magnetic field ionization and electric field with 2.5 meter spatial resolution. The capabilities have already been demonstrated of firing small rockets of 350 grams mass, speed Mach 1.5, accuracy plus or minus .02 radians with adequate receiver telemetry signals strength at 6 kilometers from a slow-flight STOL-equipped Cessna 210 G. Initially, an extensive calibration and flight-testing will be performed in Florida using water spouts as targets. If these are successful, an attempt will be made to investigate tornado targets with the aircraft operation in Oklahoma, Texas and Kansas.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0046, INVESTIGATION OF PLANETARY-SCALE FLUCTUATIONS OF THE ATMOSPHERE

R.J. Deland, New York University, Washington Square & University College of Arts & Sciences, Dept. of Applied Science, *421 1st Ave., New York, New York* 10012 (ATM77-07094 A01)

The structure and dynamics of planetary-scale fluctuations of the atmosphere are the basic objectives of this research. The analysis is based on global observations of isobaric geopotential and temperature, augmented by satellite measurements of the thermal radiance in narrow spectral bands, from which atmospheric temperature is deduced by regression relations between radiances and temperatures.

The work has two main objectives: deduction from statistical results of models of the atmosphere's planetary-scale behavior that satisfy the physical constraints, and estimation of upward energy transport associated with the fluctuating planetary-scale waves and variations of the zonal wind.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0047, ATMOSPHERIC ELECTRICITY

B. Vonnegut, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Atmospheric Science, *1400 Washington Ave., Albany, New York* 12222 (ATM76-00908 A02)

The scientific objectives of this project are more specific than previously mentioned but fall within the same four topics.

They are: (1) Initiation cirriform clouds by seeding ice supersaturated air with silver iodide. (2) Study of rainfall structures with various synoptic conditions. (3) Interpretation of satellite data for lightning detection. (4) Quantitative information concerning the extraordinary electrical activity during tornado events.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0048, MULTISPECTRAL PHOTOGRAPHIC REMOTE SENSING SYSTEM TO EXPEDITE DETECTION OF TREE STRESS IN URBAN ENVIRONMENT

T.M. Lillisand, State University of New York, College of Environmental Science & Forestry, Graduate School, McIntire Stennis Program, *Syracuse, New York* 13210 (0066320; NYZ-113-0-003)

OBJECTIVE: Quantify changes in the photometric and geometric properties of selected species in response to stress mechanisms typical of urban environments; develop and test a photographic remote sensing data acquisition and analysis system which would permit expeditious detection of stress for the species/stress mechanisms studied above; delineate mechanisms by which the above detection system might be integrated into the urban tree cover inventory and maintenance process on a regional basis.

APPROACH: Laboratory investigation of the photometric and geometric response of trees to controlled sources of stress will be used to design an aerial photographic stress detection system. Photographic effects (film processing, atmospheric attenuation, etc.) precluding remote stress detection will be negated through sensitometric film control and analysis. Close range photogrammetry, laboratory spectroradiometry, multispectral aerial photography and semi-automated electronic image analysis will be employed.

PROGRESS: An Experimental Photographic Interpretation Console (EPIC) was used to detect nutrient deficiency and pathogen induced disease by spectral ratioing of color film records acquired under field conditions.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New York

5.0049, SATELLITE ACCELEROMETER FIELD SUPPORT

W. Lange, Textron Inc., *P.O. Box 1, Buffalo, New York* 14205 (DF249770; F19628-77-C-0121)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be accurately predicted. Objective - provide field services associated with the launch of atmospheric density triaxial accelerometer systems. How research contributes - permits development of accurate density forecasting techniques.

The new SETA triaxial accelerometer will be flown on three Air Force satellites. The new ROCA accelerometer will be flown on an Air Force satellite. Pre-launch integration and testing will be supported to verify that installation and checkout procedures are as required and that instrument operation is normal. The second and third NAVPAC units will require additional vibration testing and subsequent recalibration. These procedures will ensure that all instruments are properly integrated and operating prior to launch.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0050, 3-D SCATHA MODEL VALIDATION

J. Roche, U.S. National Aeronautics & Space Admin., Lewis Research Center, *21000 Brookpark Rd., Cleveland, Ohio* 44135 (DF583470)

AF function - communications, surveillance and navigation. Deficiency - anomalous behavior of high-altitude satellites due to spacecraft charging. Objective - a 3-D SCATHA satellite computer model will be constructed and validated. How research contributes - the SCATHA sheath model is required for the interpretation of SCATHA data. The SCATHA model is a general code which can model any existing or proposed spacecraft for the purpose of the spacecraft charging analysis, and for the analysis of contamination and active control.

A finite element computer model of the SCATHA satellite is set up. Potentials on the satellite surface and in the surrounding space are set up. Photosheaths, secondary emission and plasma shielding as well as solar shadowing are accounted for. Particle trajectories from ion and electron guns are computed, as well as the response of particle detectors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0051, INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF REMOTELY SENSED DATA

G.W. Petersen, Pennsylvania State University, University Park Campus, Agricultural Experiment Station, Dept. of Agronomy, *201 Shields Bldg., University Park, Pennsylvania* 16802 (0071504; PEN02289)

OBJECTIVE: Develop techniques for the processing, interpretation and analysis of remotely sensed data collected by aircraft and spacecraft.

APPROACH: Remotely sensed data collected by aircraft and satellite will be interpreted by a multidisciplinary team. Imagery and digital data will be analyzed using conventional airphoto interpretation techniques as well as automatic data processing techniques. Emphasis will be placed on the following areas: Soil mapping, forest inventory, strip mining, land use, crop yield predictions and geology. Multi-spectral and multidate data will be used.

PROGRESS: The Office for Remote Sensing of Earth Resources (ORSER), a center within the Institute for Research on Land and Water Resources at The Pennsylvania State University, is an interdisciplinary group established in 1970 for the purpose of participating in projects involving the use of remotely sensed data of earth resources. Investigators involved in ORSER research projects have been from the fields of agronomy, civil engineering, computer science, electrical engineering, forestry, geology, geophysics, hydrology, plant pathology, pattern recognition, regional planning, and soils. A problems-oriented, rather than a discipline-oriented, approach is taken in the completion of tasks, in order that associates from various disciplines may work together toward a common goal. ORSER has directed most of its efforts toward processing, analysis, and interpretation of multispectral remotely-sensed data, most of which have been supplied by NASA in both imagery and digital format. Photointerpretation has been a vital part of the overall analytical process, but the emphasis has been on the use of digital computer algorithms for data processing. The end product of a project is typically a computer map showing various environmental and land use characteristics of data points in the analyzed scenes. NER, D. A., LOBAUGH, B., MUELLER, W. J. 1978. Effect of calcitonin on acid-base balance and blood calcium of chickens. IN: D. H. Copp and R. V. Talmage (eds.). Endocrinology of Calcium Metabolism. Excerpta Medica, p. 384.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Pennsylvania

5.0052, THE NONLINEAR DYNAMICS AND MOIST CONVECTION AND ITS EFFECT ON EXTRATROPICAL CIRCULATION SYSTEMS

J.A. Dutton, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (ATM78-02699)

The overall objective of this research is to improve the understanding of the feedback mechanisms between mesoscale precipitation systems and the larger scale extratropical circulations.

Specifically, the goals are: (1) verification of mesoscale forecast model, (2) testing, verification, and improvement of parameterization schemes for cumulus convection, (3) development of improved initialization schemes that can utilize subsynoptic scale data, such as satellite, radar, or surface weather observation in a way to improve short-range forecasting.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0053, ANALYSIS OF BOUNDARY LAYER WIND PROFILES

H.A. Panofsky, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (ATM78-01009)

Three kinds of investigations will be made at the new Boulder Atmospheric Observatory. First, to calibrate the site, that is, to use wind profiles to infer the distribution of roughness length

with wind direction and season. Second, Monin-Obukhov wind profile theory will be applied to the mean winds measured at the 300-meter tower. Surface stresses obtained from the theory will be compared with direct measurements as a check. An attempt will be made to find the limits to which the theory is applicable. Further, simple techniques will be developed for estimation of winds at 100 meters and above from wind near the surface, and from simple estimates of stability and roughness. Third, the variances and spectra of the horizontal wind components will be related to easily available predictors, such as wind speed, roughness length, height of mixed layer and var measures of stability.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0054, REMOTE SENSING OF ATMOSPHERIC PROPERTIES/OCEAN UPPER LAYER TEMPERATURE

K.J. Petri, U.S. Dept. of Defense, Navy, Naval Air Development Center, Sensors & Avionics Tech Directorate, *Warminster, Pennsylvania* 18974 (DN081135)

To investigate the feasibility of utilizing a shipborne lidar to remotely measure atomspheric properties which impact the performance of radio/optical frequency systems, and an airborne lidar to remotely measure subsurface ocean temperature profiles.

Shipborne lidar techniques will be tested and evaluated to determine the optimum method of remotely measuring the radio refractive index and electrooptical properties of the atmosphere. Airborne pulsed blue-green Raman lidar techniques will be evaluated to determine the depth/accuracy limits of remote temerature measurement predictive models.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Tech Admin.

5.0055, DEVELOPMENT OF A SOIL MOISTURE PROFILE MODEL FOR USE WITH REMOTE SENSORS

B.J. Blanchard, Texas A & M University, College Station Campus, School of Engineering, Dept. of Agricultural Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (ENG77-28343)

This research project is for the investigation of remote sensing by microwave equipment as a means of mapping variations in soil moisture that occur naturally. The objectives of this study are to: (1) define the relation between time series measurement of moisture in two dynamic depths of near surface soil for both evaporation and infiltration; (2) define the deviations in the above relations due to differences in physical characteristics of the soil and the soil profile; and (3) develop and test a soil profile model that requires only remote sensing input for use in areas where detailed climatic data are not available.

It is expected that the results of this research project will help to realize the potential of remote sensing techniques for estimating flood potential on ungauged watersheds.

This is the first year of a 2 year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

5.0056, DISTURBED ATMOSPHERIC RADIATION MEASUREMENTS

D. Burt, Utah Higher Education System, Utah State University, Graduate School, *Main Bldg., Room 132, Logan, Utah* 84321 (DF582410; F19628-79-C-0080)

AF function - surveillance and detection, and support of USAF nuclear weapons effects development programs. Deficiency - spatial and time-varying infrared backgrounds interfere with target detection, tracking and identifications. Ionization of the atmosphere interferes with radio wave propagation. A lack of knowledge of the infrared properties and ionization of the upper atmosphere limits our ability to evaluate the effects of nuclear detonations on the aerospace environment. Therefore, these properties must be measured and understood. Research - measurements of infrared atmospheric emissions and of atmospheric ionization under both disturbed (auroral) and undisturbed conditions, utilizing rocket, satellite, balloon and aircraft platforms, supported by both ground based in situ measurements, laboratory experiments and investigative studies. How research contributes - measurements of atmospheric ionization and infrared emissions provides information about atmospheric molecular composition as well as the spatial and temporal variations. The results of this research are necessary for determining the characteristics of the infrared background, for predicting the infrared radiation from natural (air glow and auroral) sources as well as disturbed (nuclear or otherwise) backgrounds, and for predicting radio wave propagation in a disturbed atmosphere. These results are directly applicable to the design and operation of surveillance and detection systems and communications systems utilizing radio wave propagation.

To provide for the conducting of field measurements utilizing sounding rocket, satellite, aircraft, and balloon platforms, and to provide for the development of new instrumentation and measurement techniques and laboratory simulation studies. This effort is to include: a. Design, fabrication, testing and engineering calibration of instrumentation, including infrared field-widened interferometer, particle counters, photometers, radiometers, mass spectrometers and langmuir probes; b. Design, fabrication and integration of multi-sounding rocket payloads and field support; c. Development of high power electron accelerators, for stimulating the atmosphere and design of instrumented payloads to carry these accelerators; d. Development of advanced techniques for rocketborne probes of the atmosphere; e. Reduction and analysis of flight measurements data, and studies of these results to determine possible directions of future measurements programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0057, NEAR-INFRARED SPECTROMETRIC AIRGLOW MEASUREMENTS DURING THE TOTAL SOLAR ECLIPSE OF 26 FEB 1979

W.R. Pendleton, Utah Higher Education System, Utah State University, School of Science, Dept. of Physics, *Main Bldg., Office 104, Logan, Utah* 84321 (DF054340; AFOSR-79-0040)

AF function - advanced space-borne surveillance systems and modelling in support of ionospheric dependent communications and radar systems require detailed knowledge of the energetic chemistry and IR emission of atmospheric species under natural and nuclear conditions. Opportunity - scattered sunlight makes it impossible to measure the IR dayglow to test our knowledge/models of the excitation/emission of atmospheric molecules. The eclipse of 26 Feb 79, the last over N.A. this century, and recent instrument development provide a unique opportunity to acquire first-ever moderate resolution (both spectral and temporal) near IR spectra of the residual dayglow. Objective - to measure the time dependent near IR emissions of OH and O2, at 10 sec/spectrum temporal and 3 per cm spectral resolution to test excitation and relaxation chemistry models. How work contributes - the data will permit testing of the photochemical models of the mesosphere and, due to the capability of measuring the relaxation emissions, models of nuclear effects.

D-based dayglow measurements in the .8-1.7 and 1.5 to 2.3 micron regions will be acquired from a site in N. Canada near the centerline of the eclipse. Comparisons with NASA, AFGL and NRC rocket measurements will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0058, IMPROVED ANALYSIS METHODS FOR ATMOSPHERIC EXPERIMENTS

J. Simpson, University of Virginia, School of Arts & Sciences, Dept. of Environmental Science, *Garrett Hall, Charlottesville, Virginia* 22903 (ATM78-10087)

This research develops statistical and physical tools to advance the ability to detect changes in one or more related variables in atmospheric experiments. The technique development is based primarily on the physical and statistical data from the Florida Area Cumulus Experiment (FACE) in which the investigators were participants.

One objective of the research is to examine the validity and physical reasons for a few cases providing most of the cloud

seeding effect in FACE. Intensive meteorological case studies are being carried out which integrate data from digitized radar, aircraft, upper air and surface networks. A second objective is to develop new statistical tools to analyze relevant atmospheric processes. These tools will involve new multivariate formulations appropriate to skewed data, non-standard time series analyses, and a systematic study of the use of angular data in multivariate contexts.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0059, DEVELOPMENT OF METHODS FOR IMPROVED USE OF SATELLITE IMAGES AND SYNTHESIS WITH OTHER GATE DATA SETS

D. Suchman, University of Wisconsin, Madison Campus, Space Science & Engineering Center, *Agriculture Hall, Madison, Wisconsin* 53706 (ATM78-09716)

The objective of this research is to continue an ongoing program aimed at extracting meteorological information from the GARP Atlantic Tropical Experiment (GATE) geostationary satellite data sets. The emphasis during this year of funding will be to combine satellite and other GATE data sources to produce more complete and valuable data sets. Specifically, the objectives are: 1. Improve the methods whereby satellite, rawinsonde and aircraft wind data can be combined; this includes improving cloud tracking, especially of clouds in the middle troposphere.

In order to accomplish the above goal, work must continue on the improvement of methods for extracting more information from satellite image data. Consequently, to make the combined data set more useful, the project will: 2. Continue the improvement of cloud height and thickness determined by treating multiple cloud layers, and by adding local sounding data to the cloud height calculation. 3. Improve means whereby satellite brightness data can be used both to isolate deep convection and to be combined with radar echo intensity information as a means of mapping precipitation from satellite images. 4. Combine satellite and other data sources for the purpose of mapping clouds including the three-dimensional distribution of clouds, the stage and growth of convection, and cloud organization such as lines or squalls. 5. Improve the methods for viewing and analyzing clouds and cloud systems in a quasi-Langrangian frame of reference.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0060, ENVIRONMENTAL IMPACTS OF RESOURCE MOBILIZATION IN THE HUMID TROPICS/DEVELOPMENT IN QUINTANA ROO, MEXICO

C.R. Edwards, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Geography, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (SOC78-08475)

Quintana Roo, Mexico, until recently an underpopulated and underutilized tropical region, is presently undergoing massive development, the success of which will depend ultimately upon the congruence among cultural systems, development strategies, and the ability of ecological bases to sustain such development.

The 1955 predevelopment landscape will be reconstructed, and the processes and impacts of technological innovations in crop agriculture, livestock husbandry, lumbering, and fishing will be analyzed, using LANDSAT imagery as well as standard field observation, mapping, and interviewing.

This research will contribute to understanding the ability of humid tropical environments to meet expectations for increased food production and settlement of surplus populations. The historical-geographical reconstruction provides a base line for measurement of subsequent changes and their impacts, and is prerequisite to formulation of theory concerning the conduct and consequences of modern development in the humid tropics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral &
Social Sciences, Div. of Social &
Economic Science

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, LDF 79-2, AIRCREW PROTECTIVE RESTRAINT SYSTEM EVALUATION PROTOTYPE

B. McDonald, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DF325320; F33615-79-C-0522)

Recent aircraft accident experience has resulted in high level reemphasis on techniques and equipment for aircrew restraint and escape. It is apparent that new approaches will be needed in order to achieve significant improvements in the injury and fatality rate. This effort will evaluate the feasibility and utility of novel concepts for aircrew protection against multiaxis acceleration associated with projected operational and escape environments.

The biomechanical protection branch is engaged in an advanced design contract effort to conceptually evaluate a number of innovative techniques in aircrew restraint system design. The techniques include adaptive support and restraint surfaces, powered torso and head reorientation, and conformable seat cushions for restraint and escape systems. These techniques are presently in the conceptual stage of development and will reach the design aid mock-up stage by approximately 1 January 1979. The opportunity will then be available to pursue an agressive aeromedical evaluation of the concepts establishing the potential for reduction in morbidity and mortality associated with escape. Improved operational restraint configurations also have potential for improving the performance of the human operator subject to multiaxis acceleration. Funding will be used to establish a contract effort to produce conceptual prototype equipment suitable for human centrifuge and impact testing of the aeromedical aspects of the concepts discussed above. The result of this effort would allow AMRL to pursue the evaluation necessary to substantiate potential improvements to be realized.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0002, DEVELOPING ENHANCED SENSITIVITY TO VISUAL MOTION

R.W. Sekuler, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Psychology, *633 Clark St., Evanston, Illinois* 60201 (DF054600; AFOSR-79-0064)

AF function - this research supports aircrew training R and D, especially for tactical pilots flying high performance aircraft. Deficiency - there appear to be large and stable differences between people in their sensitivity to visual motion. This type of sensitivity is extremely important for many flying tasks, including a number of critical combat tasks. There is insufficient knowledge to know if these differences are real or artifacts of particular experimental designs. Further, there is no knowledge about whether these sensitivities can be improved through training. Objective - this research will study the range of differences in visual motion sensitivity, determine its locus, and develop candidate techniques which will improve the sensitivities of those on the lower end of the sensitivity spectrum and those on the upper end. How research contributes - this research will determine whether concern is indicated for pilots who might possibly have poor visual motion sensitivity, whether sensitivity can be improved and how, and whether sensitivity should be considered in selecting pilot candidates.

A series of experiments will be conducted to assess the range of motion sensitivities among a large population of subjects. Subjects with good sensitivity and those with poor sensitivity will be separated from the group and the effects of various training exercises will be evaluated. The results will indicate if the human visual system can become more sensitive to motion using these techniques, and whether this effect is as

strong for those whose sensitivity is already good as it is for those with poor sensitivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0003, VARIABILITY OF HUMAN PHYSIOLOGICAL RESPONSES TO THERMAL STRESS

F.H. Rohles, Kansas State University, School of Arts & Sciences, Dept. of Psychology, *Anderson Hall, Manhattan, Kansas* 66502 (DF320440; F33615-77-C-0601)

This effort is to define man's inter- individual variability in physiological responses to heat. The findings will provide USAFSAM scientists with rationale and criteria required to establish realistic design specifications for modern aircraft environmental control systems.

A sample population will be selected that is representative of Air Force flying personnel, male and female, of sufficient number to permit meaningful statistical application of results to the entire population in question. Normal range of selected physiological responses when this population is exposed to rest in various hot-dry and hot-humid environments will be determined. The time course of recovery of these physiological parameters after the removal of thermal stresses will be charted. A technical report will be composed which will include a comprehensive discussion of (a) related literature, and (b) the experimental findings of this study with particular emphasis on the predictability of man's physiological responses to thermal stress.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0004, MALE/FEMALE DIFFERENCES IN FLYING SKILL ACQUISITION, FLIGHT SAFETY AND ACCIDENT PRONENESS, AND MOTIVATION FOR FLYING

J. Zvara, Aerospace Systems Inc., *121 Middlesex Tpke., Suite 202, Burlington, Massachusetts* 01803 (DF232860; F33615-77-C-0028)

To investigate civilian male/female differences in flying skill acquisition, flight performance and safety, and motivation for an interest in flying.

A threefold approach will be utilized. First, a review of civilian aircraft accident data will be undertaken with an emphasis on determining if either sex appears disposed towards a greater incidence or type of accidents. Second, a field survey will be administered to a sample of 750 FAA flight instructors, and third, a field survey will be administered to samples of 750 male and 750 female FAA pilots. The emphasis of the field survey will be to determine the existence and possible impact of sex difference. Milestones - Stage I, review of literature, 1.5 months, Stage II, preparation and approval of survey instruments, 3.0 months, Stage III, investigation of accident data (partly concurrent with Stage II), 1.5 months, Stage IV, survey administration, 2.5 months, Stage V, analysis, 2.5 months, Stage VI, preparation of final technical report, 3.0 months.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, PILOTING PARAMETERS FOR HANDLING QUALITIES RATING SCALE DEVELOPMENT

N.D. Geddes, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF056040; F49620-79-C-0158)

AF function - although the application of current control systems theory to pilot-aircraft systems has resulted in many insights into the complexities of man-machine interactions, the final test of an aircraft's acceptability is still the subjective opinion of the evaluation pilot. This subjective opinion is most commonly expressed as a numerical Cooper-Harper rating, possibly a pilot induced oscillation rating (PIOR), and detailed supporting comments. Deficiency - both the Cooper-Harper scale and PIOR scale, however, exhibit characteristics that often have resulted in criticism for both theoretical and practical reasons such as: (1) the scales are truncated and nonlinear, (2) interpretation of the adjectives of the scale varies from pilot to pilot, and (3) the ratings must be supported by detailed comments to permit identification of a deficiency with sufficient accuracy for design correction purposes. Objective - the research will assess the feasibility of applying the psychometric techniques of multidimensional or multivariate scaling to the development of subjective rating scales capable of evaluating the handling qualities of dynamic systems such as flight simulators and vehicle displays, and flight vehicles. How research contributes - such techniques can reduce the ambiguity and increase the information content of the rating system, allowing an easier interpretation by both the evaluation pilot and aircraft designer. The resulting increase in scale discriminability may make this approach useful for the evaluation of heretofore difficult to assess effects, such as simulator dynamic fidelity.

The research will conduct the feasibility assessment of multidimensional and multivariate techniques as three serial tasks - (1) identification of piloting cues, (2) formulation of candidate rating scales, and (3) establishment of an experimental protocol for testing the reliability of the candidate scales. The point of departure for this study will be the task requirements and sensations experienced by the pilots rather than the parameters which comprise the present engineering models such as the servo model, dual loop servo model, or optimal control model. It is intended that the experimental protocol will provide the bridge which ties the candidate rating scales to particular engineering parameters of design importance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0006, FIELD STUDIES ON APPLICATION OF NOISE-CHECK TECHNOLOGY FOR MONITORING AIRCRAFT NOISE

R.A. Lee, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF324600)

Current plans are for field surveys to be conducted in February 79 and May 79 with AF Occupational Environmental Health Lab (OEHL) participation to evaluate equipment and procedures under actual operational conditions. Instrumentation will be checked out under various weather conditions, operations, instrument location and aircraft types to insure the adequacy of equipment and procedures for the variety of Air Force applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0007, VOICE COMMUNICATION ANALYSIS, EVALUATION AND ENHANCEMENT

R.L. McKinley, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325110)

Current and future requirements call for analysis, evaluation and enhancement of voice communications. The objective of this effort is to improve voice communications in an operational environment.

The approach is to analyze, evaluate and enhance voice communication by laboratory test, utilizing a standard aircraft voice intercommunication system which is capable of reproducing a realistic and valid simulation of the operational environment. This includes a multi-station intercommunication system, a respiration system, appropriate terminal equipment (helmets, masks, headsets, etc.), accurate simulation of the spectra and levels of specific weapons systems air and ground noise environs, radio static, auditory warning signals and various communication situations such as quiet to noise, noise to noise, etc. An automated display and scoring approach is being incorporated into the system at this time. This will result in significant cost effective use by greatly reducing testing time, data collection and analysis and the number of items that can be evaluated per unit time. Semiannual review was accomplished 30 Sep 78 in conjunction with the preparation of the TMR.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0008, THE IDENTIFICATION OF PSYCHOPHYSIOLOGIC CORRELATES OF COGNITIVE PROCESSING
F.J. Bremner, Trinity University, School of Arts & Sciences, Dept. of Psychology, *715 Stadium Dr., San Antonio, Texas* 78212 (DF055850; F49620-79-C-0139)

AF function - a requirement exists for monitoring the brain activity of the pilot, evaluating his workload, his decision making ability, his workload processing ability, and his capability to respond to the system interface. Deficiency - the relationship of cortical events to the cognitive/information processing/decision making activities of mental processes has not been well documented. Also, it is not known how workload affects cortical events nor how fatigue affects electrophysiological correlates of cognitive processing. Objective - the research will (1) demonstrate the feasibility of using electrophysiological variables to assess the level of cognitive processing occurring at any given time in aircraft pilots, and (2) determine if variables previously shown to be potent in decreasing pilot effectiveness will also affect the electrophysiological variables associated with cognitive processing. How research contributes - the proposed research represents an initial attempt to explore and identify selected psychophysiologic correlates (electroencephalogram, visual evoked response, heart rate, and heart rate variance) of cognitive processing. In addition, it will be possible to evaluate the cortical effects of fatigue on these correlates.

Four subject groups will be selected. Group one will perform a high-cognitive processing task. Group two will perform a low-workload cognitive processing task. Group three will perform the high workload task plus be subjected to a situational state representative of cognitive fatigue. Group four will perform a non-cognitive processing control task. The dependent variables will be (1) electrophysiological, and (2) motor responses. The inherent EEG variables will be analyzed by means of a fast Fourier transform. The dependent variables will be submitted to a factor analysis. Results of the statistical treatments will identify predictor variables for future studies designed to expand current knowledge and use of brain monitoring technology in the context of the man/machine interface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, UTILIZATION OF WOMEN IN NON-TRADITIONAL AREAS
J.A. Bergmann, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234160)

To evaluate the impact of female assignment in non-traditional areas in terms of utilization,performance, attrition, training success, task requirements, and attitudes.

A job inventory, various task factor surveys, and attitude surveys will be administered to approximately 2000 females and a 2x1 matched male sample of 431x1 and 431x2 aircraft maintenance specialist job incumbents and their supervisors. A time 2 survey will be conducted 12 months after the initial survey. Milestones - instrument development, 4 MASD, field review and revision, 6 MASD, survey administration, 8 MASD, data reduction, 11 MASD, tech school analysis, 12 MASD, survey analysis, 17 MASD, documentation Phase I, 20 MASD, resurvey, 21 MASD, data reduction, 22 MASD, analysis and follow-up, 30 MASD, documentation Phase II, 33 MASD.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0010, AIR FORCE VALIDATION OF ASVAB FORMS 6 AND 7
J.J. Mathews, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233130)

To validate operational ASVAB subtests and composites against Air Force technical training performance criteria.

Current ASVAB tests will be correlated with technical training criteria. Some analyses will involve data which has been collected on 9,000 airmen experimentally administered ASVAB-7A. Possible sex and racial interactions in selector composite based prediction will also be investigated. In instances where feasible, new composites will be formed for appropriate technical courses. Operational ASVAB test data collected at field stations (data will be obtained from MARDAC tapes) will also be validated, and comparisons will be made between experimentally and operationally administered test results. Milestones -- field tested samples selected - 1 May 77 to 1 Jul 77, operational test analyses - 1 Jul 77 to 1 Nov 77, interim TR preparation - 1 Nov 77 to 1 Mar 78, ASVAB-7A samples selected - 1 Jun 77 to 1 Sep 77, ASVAB-7A analyses - 1 Sep 77 to 1 Feb 78, administration comparison - 1 Mar 78 to 1 Sep 78, final TR preparation - 1 Oct 78 to 1 Mar 79.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0011, DETECTION AND MEASUREMENT OF AMINE-BASED PROPELLANT VAPORS
L.J. Luskus, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF320860)

This work unit will develop detection methodology and breadboard instrumentation to measure toxic and subtoxic concentrations of amine-based propellants including hydrazine, MMH and UDMH. The requirement is based on occupational safety of workers involved in rocket testing, missile maintenance, and more recently in the projected worldwide deployment of F-16 aircraft which employs a hydrazine fueled emergency power unit.

Electrochemical and chemiluminescence instrumentation will be developed and evaluated for use as area and confirmation monitors. Personal dosimeters will be developed contractually with final evaluation testing accomplished under this work unit. Solid state devices and wet methods for field use will be developed and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0012, AUTOMATED AIDS TO ISD
P. Smith, Veda Inc., *1755 Jefferson Davis Hwy., Arlington, Virginia* 22202 (DN994031; N61339-79-C-0076)

Procure a contract to continue development of a system for aiding ISD activities for the application of ISD to naval aircrew training. The continuation of effort also will acquire: (a) a manual and instructional course on the use and completion of development of the system, (b) a specification and assessment of the source of anticipated benefits of the system, and (c) a final report on the activities and results of the effort.

Instructional personnel will develop and instruct NavTraEquipCen personnel in the development of data bases and application programs in a computer software format such that ISD data from previous ISD efforts can be accessed and applied to current ISD needs. These programs will be tested at NavTraEquipCen.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, APPLICATIONS OF THE ISING MODEL
E. Barouch, Clarkson College of Technology, School of Science, Dept. of Mathematics, *51 Main St., Potsdam, New York* 13676 (DMR77-11324 A01)

Continuation of research supported under DMR 75-07147.

Investigations of the mathematical properties of the Ising Model will be continued. In particular, the multi-spin correlations near the critical point will be calculated in order to determine the behavior of the isothermal magnetization and susceptibility of a magnetic crystal.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

7.0002, ROTATION AND CHARGE OF A BLACK HOLE IN RADIATIVE EQUILIBRIUM - QUANTUM TRANSITIONS, DISSIPATION, AND FLUCTUATIONS
U. Gerlach, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Mathematics, *164 W. 17th Ave., Columbus, Ohio* 43210 (PHY77-04983)

A program of theoretical research in gravitational physics will be initiated. Among the specific topics to be investigated are: 1. Black hole viscosity. 2. RMS fluctuations in charge and angular momentum induced by emission of quanta by a black hole.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

7.0003, HAMILTONIAN SYSTEMS AND CELESTIAL MECHANICS
K.R. Meyer, University of Cincinnati, McMicken College of Arts & Sciences, Dept. of Mathematics, *Van Wormer Adm. Bldg., Room 204, Cincinnati, Ohio* 45221 (MCS78-01425)

Renewal of MCS-7505862.

This project concentrates on the quantitative and qualitative theory of differential equations, with special emphasis on Hamiltonian systems. For the latter, periodic solutions will be considered. Lie transformations will figure in this work, both in the qualitative theory and in the asymptotic methods. Applications to the N-body problem and to lunar theory will be considered.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0004, COMPUTER-AIDED GEOMETRIC DESIGN
R.E. Barnhill, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Mathematics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (MCS78-01966)

Computer-Aided Geometric Design (CAGD) is the effective computer representation of curves and surfaces. CAGD enables one to quantify mathematically and then to design interactively free-form curves and sculptured surfaces. Applications include the design of surfaces of airplanes, automobiles, ships, and the finite element analysis of these surfaces. Additional applications include the display of the surface of the human heart and of the earth. Computer graphics is integral to this research. The underlying mathematics for surfaces are variations of Coons patches for rectangles and triangles and of Shepard's Formula for arbitrarily spaced data. For curves, B-splines are used. Geometric handles for surface manipulation from a data tablet have been devised. This graphical software is necessary for real-time surface recomputation. This research is a combination of mathematical and computer software, requiring research contributions from Mathematics and Computer Science.

This is a continuation of grant MCS-7413017 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, MEASUREMENT OF ATOMIC TRANSITION PROBABILITIES
W. Whaling, California Inst. of Technology, Graduate School, Dept. of Physics, *1201 E. California Blvd., Pasadena, California* 91109 (AST76-81607 A01)

This research program will be concerned with measuring atomic transition probabilities useful for the quantitative analysis of hot gases and plasmas. The transition probabilities for various atomic species can be measured by (1) beam-foil time-of-flight-measurements of the radiative lifetime of a level, followed by (2) branching ratio measurements to apportion the total transition probability among the individual transitions by which the level decays.

Transitions to be studied will be those that are prominent in astrophysical spectra. For neutral and singly charged ions, the experimental procedure includes a comparison with solar measurements to test the internal consistency of the measured transition probabilities. There will be measurements on the resonance lines of doubly ionized iron, and the ultraviolet spectrometer will be used to measure transition probabilities for other prominent lines in the wavelength region of 1200-2000 angstroms. Studies of transitions important for ground-based astronomy will deal with cobalt, samarium, and vanadium.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0002, THEORETICAL STUDIES OF INHOMOGENOUS ELECTRONIC SYSTEMS IN SOLIDS
H.B. Shore, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Physics, *5402 College Ave., San Diego, California* 92115 (DMR77-11532 A01)

Theoretical investigations in solid-state physics previously supported by NSF grant DMR-7203107 A01 will be continued and extended in new directions. Calculations will be done on the surface energy of simple metals within the density functional formalism of Kohn and Sham, using newly developed non-local corrections to the exchange-correlation energy. The methods used for this calculation will also be applied to other problems involving the inhomogenous electron gas: the energy of solution of hydrogen in metals using the spin-dependent version of the density functional formalism and the behavior of the above calculation in the limit of very low electronic density. Also, inhomogenous electron gas methods will be applied to the problem of the electron-hole liquid in semiconductors. Problems to be investigated include the surface energy of a droplet, the binding energy of the liquid to an impurity, and the stabilization energy of exciton complexes by a point charge. Included also will be study of lithium impurities in silicon.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0003, PSEUDOPOTENTIAL METHODS IN PHYSICS
W.A. Harrison, Stanford University, Graduate School, Dept. of Applied Science, *Stanford, California* 94305 (DMR77-21384)

This is a continuation of research previously supported under DMR-7302351. Theory relating the electronic structure of solids to the dielectric and bonding properties of those solids will be developed. A systematic set of matrix elements for transition-metal solids, analogous to those for simple solids, will be derived from the known electronic structure of a number of such systems. Calculations of various properties will be carried out in terms of these parameters. Also, elementary LCAO theory will be applied to covalent and ionic solids.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, SURFACE PROPERTIES OF METALS AND SUBSTITUTIONAL ALLOYS AND THEIR RELATIONSHIP TO CATALYSIS
W.E. Spicer, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DMR77-23442)

This is a continuation of studies on surface composition electronic structure, chemisorption and surface reactions on bimetallic surfaces. The overall goal is to provide critical knowledge toward understanding surface reactivity and catalysis. Single crystals and bulk samples will be examined at low pressures by ultraviolet photoelectron spectroscopy with conventional light sources and also with synchrotron radiation, Auger electron spectroscopy, low energy electron diffraction, tempera-

ture programmed reactions and desorption. The results obtained at low pressures will be compared to catalytic activity measurements on small metal particles at pressures near one atmosphere. Specifically, reactions between H2 and preadsorbed oxygen at low pressures, will be studied, first on single crystals of Pd as a reference metal and then started on selected PdAu bimetallic bulk samples. These studies will help to understand previous catalytic studies pertaining to the reaction between H2 and O2 on small Pd and Pd/Au particles at high pressures. The combined experimental results will be used to elucidate the mechanism of the hydrogen-oxygen reaction, both at low and high pressure. A second bimetallic to be investigated is the Cu-Ni system which was extensively studied in the previous grant period. The research will be extended to include the effect of the bimetallic surface composition on the selectivity of the decomposition of formic acid to form CO and CO2. The results obtained on well-characterized single crystal surfaces at low pressures will be compared to those on small particles at high pressure. The combined data will be used to assess again the relationship between studies done on single crystals at low pressures to those done on small particles at high pressures. In addition experimental work will be done on formaldehyde and methanol decomposition on the Cu-Ni alloys.

To gather a more fundamental understanding of the interactions between metal and absorbed gases which is the essence of the catalytic process, a program recently initiated involving photoemission measurements (including angularly resolved work) and theoretical work will be continued. The prime objective of this work is to increase understanding of the relationship between the electronic structure of the metal and its interaction with the adsorbed gas. (Text Abridged)

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, STUDY OF X-RAY ANOMALOUS DISPERSION AND ITS APPLICATION

A.I. Bienenstock, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (INT77-06310)

Scientists of the Stanford Synchrotron Radiation Project (SSRP) and the Institute for Solid State Physics, University of Tokyo, will collaborate on high energy resolution, accurate measurements of the anomalous dispersion changes of atomic X-ray scattering factors as a function of photon energy near absorption edges as well as comparisons of these changes with existing calculations. Specific samples to be studied include GaAs, GaP, ZnS, and PbS. The changes will be obtained through measurement of the energy dependences of the radiation provided by the storage ring SPEAR at SSRP. This award supports travel and subsistence costs for Dr. Bienenstock and Dr. Hastings in Tokyo; the Japanese Society for the Promotion of Science will support costs associated with Dr. Hosoya and his colleagues travel and subsistence at Stanford.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0006, MAGNETIC STRUCTURES AND FIELD RECONNECTION - MECHANISMS OF SOLAR-TERRESTRIAL ACTIVITY

G. VanHoven, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (ATM77-09581 A01)

Sheared magnetic fields and current-sheet dynamics are believed to dominate solar and magnetospheric activity. This grant has several related objectives concerning the fields and currents. They include the study of nearly force-free magnetic structures in non-uniform situations and the further consideration of loop configurations, with attention to their flare, or resistive-instability, behavior. A desire to improve on a magnetic-tearing model underlies the investigation of modifications of the basic mechanism due to heating effects (connected with the thermal instability) and secondary observable characteristics, such as acceleration and resistivity (flare-phase) transitions.

The ultimate aim of this research is the development of empirical tests which will demonstrate the reality of the various proposed solar (and auroral) field-structure and flare-reconnection models, including those involving resistive tearing.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0007, EXPERIMENTAL STUDIES OF ONE-DIMENSIONAL ORGANIC METALS, ONE-DIMENSIONAL INSULATORS, AND NEW SUPERCONDUCTING MATERIALS

W.G. Clark, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR77-23577)

An experimental research program to study the polymeric superconductor polysulfur-nitride (SN), the superconducting rare earth molybdenum selenides, and several types of pseudo one-dimensional (1-D) materials is under way. The superconducting properties of (SN)x are investigated at temperatures as low as 7 millikelvin through measurements of the critical field, critical currents, specific heat, and thermal conductivity. One of the quantities sought is the superconducting energy gap. Chevrel-phase superconductors, such as Gd1.0Mo6Se8, are studied by measurements of specific heat at very low temperatures in external magnetic fields up to 80 kG to test for the coexistence of ordered magnetism and superconductivity in this material. The magnetic properties of the ground and low-lying excited states of several highly conducting, pseudo one-dimensional charge transfer salts will be studied using nuclear magnetic resonance, susceptibility, and specific heat measurements at very low temperatures.

First year of a three-year continuing grant. This is continuation of research supported under DMR 73-07612.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, EXCITED STATE CROSS-SECTIONS IN CARBON MONOXIDE

R. Poe, University of California, Riverside Campus, School of Physical Sciences, Dept. of Physics, *Riverside, California* 92502 (DF461220; F33615-77-C-2011)

Obtain theoretical values for electron impact cross sections in carbon monoxide. Cross sections will include momentum transfer, rotational, and vibrational excitation for ground and excited vibrational-rotational states.

Semi-classical and quantum methods will be employed in numerical solutions of inelastic scattering of electrons from molecules with permanent dipole moments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

8.0009, GENERAL RELATIVITY AND RELATIVISTIC ASTROPHYSICS

J.B. Hartle, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (PHY78-09620)

Research in gravitation theory supported under NSF Grant PHY76-08551 A01 will be continued. Among the topics to be investigated are: 1) Particle production in the early universe. This process is the most promising mechanism to explain the large scale homogeneity and isotropy of the universe, and the observed photon to baryon ratio. 2) Black holes and gravitational collapse: They may explain the enormous energies necessary for the activity of quasars and galactic nuclei. 3) Relativistic stellar structures: Studies will concentrate on the possible end states of stellar and galactic evolution associated with rapidly rotating objects.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0010, NEW EFFECTS IN MULTIPHOTON ATOMIC AND MOLECULAR PROCESSES

P.P. Lambropoulos, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (PHY78-23812)

Research in theoretical atomic physics initiated under NSF grant PHY76-23163A01 will be continued. Among topics in multiphoton processes to be investigated are: 1) atomic structure calculations; 2) electric quadrupole effects; 3) photon correlation effects; 4) AC Stark splitting; 5) light-polization and electron-spin effects; 6) resonance effects; 7) quantum beat phenomena; 8) resonant harmonic generation; 9) strong field effects; 10) resonance multiphoton processes; and 11) stochastic properties of nonmonochromatic fields.

These investigations will deal with basic aspects of multiphoton processes as well as their application to spectroscopy, laser isotope separation and ionization under very strong fields.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0011, ORIGIN OF COMETS AND THE EVOLUTION OF THEIR ORBITS

E. Everhart, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (AST7817513)

Support is to continue a study of the interaction of comets with the solar system using Monte Carlo methods. Besides planetary perturbations, which change the total energies of the comets, the impulses caused by passing stars will also be included for these can make large changes in the perihelia of comets. In comparing the distributions generated by a realistic model with the distributions for real comets, one can get information about dissipation and observational selection effects. Thus, one can find numerical values for the average probability that a comet will be observed on various returns. Another part of the study is to investigate the past and future orbits for a few well-known objects, such as Chiron, a small body with a perihelion at 8.4 times the earth's distance from the sun, recently discovered by Kowal. In particular, calculations will be carried out to find out if Chiron is in a stable libration orbit, or whether it is in an orbit which is chaotic or random in character.

Prior support was by NSF grant AST 76-18891.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0012, SPECTROSCOPY OF ELECTRONS IN INVERTED METAL OXIDE SEMICONDUCTOR STRUCTURES

R.G. Wheeler, Yale University, Graduate School, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (DMR78-20071)

Research on the quasi-two-dimensional electronic subbands in a semiconductor surface inversion layer, previously supported under grant DMR 7514026, will be extended to very thin (5-10nm) oxide structures. In this regime electron-electron interactions are deemphasized, thus narrowing the energy width of the subband levels and modifying the infrared tuning characteristics of the silicon MOSFET (metal-oxide-semiconductor field effect transistor). Infrared spectroscopy, photoconductive and Hall effect measurements will be made on (100) and (110) silicon surfaces and a search undertaken for a new effect, plasma resonances in the non-continuum region.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, TOPICS IN THEORETICAL PLASMA PHYSICS

I.B. Bernstein, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (PHY78-08433)

Research in theoretical plasma physics currently supported under NSF grant PHY76-06191 A01 will be continued. The topics to be investigated include the following subjects: (1) The linear geometric optics theory of the relativistic free electron laser will be extended to determine the gains to be expected, taking into account effects such as realistic geometrics, the back reaction of the high-frequency fields on the beam, and the influence of beam electron density fluctuations. (2) The theory of laser initiated plasma diode will be developed so as to determine in self-consistent fashion the electromagnetic fields, and charged particle densities and temperatures, so as to interpret the on-going experiments and assess the utility of the device for isotope separation. (3) A quasi-linear theory will be developed describing the action of turbulent microfields on quasi-static particle distribution functions f, taking into account special variation of both microfields and f.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0014, CONDENSED MATTER SCIENCE - NUCLEAR RESONANCE STUDIES AT HIGH PRESSURE AND LOW TEMPERATURE

T.A. Scott, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (DMR77-08658 A01)

This established research program on condensed matter is being continued with a wide variety of experiments on solids and liquids at low temperature and high pressure. Nuclear magnetic and nuclear electric quadrupole resonance spectroscopy are used. Work is concentrated on relatively simple and important molecular systems, such as nitrogen, carbon monoxide, chlorine, hydrogen chloride, etc., with the objective of attaining an in-depth understanding of their intermolecular potentials and physical properties over an extended range of pressure, volume, and temperature. Specific areas under study include molecular and solid-state structure; phase transitions and their pressure-temperature phase stability boundaries; order-disorder processes; ferroelectricity; magnetic shielding anisotropy in solids; the Knight shift in metals; electric field gradients in anisotropic metals and nonmetallic materials; nuclear relaxation processes due to diffusion and other forms of molecular motion in solids, liquids, mixtures, and microemulsions; isotope effects and defect properties. Novel experiments on rare isotopes, including both stable and radioactive species, are planned. Pulsed quadrupole resonance techniques are being developed for observing the very broad lines often encountered in disordered systems, as are procedures for performing nuclear resonance experiments at pressures up to 70 kbar.

This is a continuation of research supported under DMR 75-20161. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, OXYGEN-SULFUR, AND CARBON CHEMISORBED ON IRON USING ANGLE RESOLVED PHOTOEMISSION

M.W. Ribarsky, Georgia Inst. of Technology, School of Physics, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DMR77-22851)

This combination of experiments is a useful tool for investigating the mechanisms of the adsorption process, which is an intermediate step in many catalytic reactions.

A coupled experimental and theoretical study of oxygen, sulfur and carbon adsorbed on the low index faces of iron will be carried out. Angle resolved photoemission spectroscopy (ARPS) using both a discharge source and synchrotron radiation will be the primary tool in this work. Angle integrated photoemission, Auger spectroscopy (AES) and low and medium energy electron diffraction (LEED) and (MEED) also will be used. Island formation and growth will be followed by AES and LEED, while island sizes will be determined by LEED spot profiles. The mechanisms of island formation will be studied with emphasis on the changes in bonding accompanying changes in island structure and growth as indicated by ARPS and LEED.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, A THEORETICAL STUDY OF NUCLEAR STRUCTURE AND INTERMEDIATE-ENERGY NUCLEAR REACTIONS

J.T. Londergan, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (PHY77-07656 A01)

Research in theoretical nuclear physics initiated under NSF grant PHY75-07803 A01 will be continued. Topics to be investigated include: I. Electromagnetic Interactions. A) Theory of the (gamma, N) interaction at medium energies (Londergan, Nixon). B) Formulation and investigation of intermediate isobar productions in (e,electron) and (e,electron p) (Londergan, Walker, Coste). II. Nucleon-Nucleus Interactions. A) Continuation of ongoing program in (p,p), (P,2p) and (p,d) reactions with emphasis on interpretation of new data and model studies of two-step processes. (Walker, Picklesimer). B) Field theoretic and multiple scattering formalisms (Londergan, Weiss). III. Pion Physics. A) Microscopic field theoretic pion-bound nucleon and pion-nucleus formalism (Walker). B) Pion-nucleus quasi-elastic scattering (Walker). C) Study of the pion-nucleon inverse problem with isobars (Londergan). IV. Weak Interactions. Muon production by medium-energy protons (Walker, Weiss). V. Kaon-Nucleus Interactions. The K ion probe as a tool for studying nuclear structure with emphasis on inelastic scattering and knockout reactions (Walker). VI. Heavy Ion Physics. VII. Nuclear Structure.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0017, ELECTRONIC TUNNELING FROM METALS (QUASIPARTICLE INTERFERENCE)

W.J. Tomasch, University of Notre Dame, College of Science, Dept. of Physics, *Notre Dame, Indiana* 46556 (DMR78-12994)

Electron tunneling experiments will be performed to examine the modification of the excitation spectrum due to perturbing the energy gap at one surface of a thick superconducting film. The tunneling measurements will be used to measure the quasiparticle velocities at the Fermi surface, to determine changes in the electron-phonon interaction that occur near the Fermi surface and to study the influence of proximity effect phenomena on the formation of energy levels. These measurements will be made on Zn, Cd, Tl and possibly Sn. Exploratory studies will be made of phonon-related structure in the tunneling characteristics of very thin binary films. These studies are important for the understanding of non-equilibrium superconductivity and the electronic devices based on this phenomenon. This is a continuation of work supported under DMR76-16998.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, DENSITY FUNCTIONAL THEORY OF METALS AND METAL SURFACES

J.P. Perdew, Tulane University of Louisiana, School of Arts & Sciences, Dept. of Physics, *6823 St. Charles Ave., New Orleans, Louisiana* 70118 (DMR78-12398)

Theoretical research in metal physics will be carried out using the density functional theory of the inhomogeneous interacting electron gas. This method will be used to investigate the face-dependence of the metallic surface energy, work functions, lattice relaxation at a surface and the surface plasmon dispersion. Also, a variational study will be made of the relative stabilities of the paramagnetic state and the spin-and charge-density waves in metals. In addition, extensions of the theory will be developed, by adding the effects of local pseudopotentials and the exchange corrections to the random phase approximation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, SURFACE CRYSTALLOGRAPHY AND SURFACE THERMAL PROPERTIES USING RUTHERFORD BACKSCATTERING AND LOW-ENERGY ELECTRON DIFFRACTION

W.N. Unertl, University of Maine, Orono Campus, School of Arts & Sciences, Dept. of Physics, *36 Winslow Hall, Orono, Maine* 04473 (DMR77-28543)

This is a basic investigation of structural and thermal properties of the crystal surface of Pt and Ni, using both Rutherford backscattering and low energy electron diffraction techniques. The objectives of this study are threefold: (1) to gain insight into the relationship between surface crystallography, interatomic force constants, and their deviations from bulk behavior; (2) to advance technique development for surface structure determination; and (3) to develop new methods to investigate the nature of surface defects and disorder. The experiments are designed to yield quantitative information about surface defect structure, including stepped surfaces, and to provide new insight into microscopic processes at solid surfaces. The experiments will be performed at the Rutherford backscattering/low-energy electron diffraction facility at the Canadian Chalk River Nuclear Laboratories.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, SOLID-STATE STUDIES USING THE MOSSBAUER EFFECT

J.C. Walker, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (DMR77-07127 A01)

Mossbauer effect experiments will be carried out to observe the microscopic behavior in a variety of magnetic materials. The effects of sample thickness on the magnetic properties of ultra-thin films will be examined. Epitaxially grown films of iron with thicknesses between 10 and 220A will be made with the critical temperature and the nature of the magnetic order to be measured using Mossbauer spectroscopy.

Some splat-cooled Fe40, Ni40, B20-type amorphous ferromagnets will be used to study the spin-wave behavior and the magnetic phase transition as well as the magnetostriction. Mossbauer measurements will be made using an RF sideband technique developed by Chien and Walker to measure the magnetostriction.

A study of iron-poor FePd alloys will be made in an attempt to establish a closer connection between the magnetic properties of disordered alloys and those of amorphous ferromagnets.

This is a continuation of research previously supported under DMR75-13354.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, DETERMINATION OF THE MECHANISM OF HIGH-POWER ULTRASONIC SOFTENING OF METALS

R.E. Green, Johns Hopkins University, School of Engineering, Dept. of Mechanics, *34th & Charles Sts., Baltimore, Maryland* 21218 (DMR78-05944)

Although it has been known for at least twenty years that the application of ultrasonic vibrations of sufficient amplitude during tensile deformation of metallic materials reduces the stress required for further deformation, the mechanisms causing stress reduction are not understood. The objective of this research is to undertake experiments in which all proposed mechanisms for high power ultrasonic softening are measured simultaneously during insonation of a variety of single crystal and polycrystalline metallic specimens which are undergoing tensile elongation. The materials under investigation include single crystals of aluminum and zinc, and polycrystalline aggregates of aluminum, zinc, steel, copper, brass, magnesium, and titanium alloys. The various parameters being measured simultaneously are the applied tensile load; the specimen elongation; the contract force between ultrasonic horn and test specimen; the electrical power input to the horn; the high power insonation; the vibrational amplitude of horn, specimen, and grips; the tempera-

ture distribution in the test specimen; the linear elastic longitudinal wave speed; and the ultrasonic attenuation. It is expected that the results of this research identify the mechanisms responsible for high power ultrasonic softening of metallic materials, and advance basic understanding of the nature of interactions between stress waves and dislocations in metallic materials. This is a continuation of research, previously supported under NSF Grant DMR76-02537.

This is the first year of a three year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, ELEMENTARY PARTICLE THEORY AND QUANTUM FIELD THEORY

O.W. Greenberg, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (PHY76-16562 A02)

Work is proposed in several areas of elementary particle theory. Among the subjects which will be studied are: spontaneous symmetry breaking in SU(4)4, 'naturalness' of atomic parity conservation within left-right symmetric theories, excitation of color degrees of freedom, astrophysical implications of present developments in elementary particle physics, and properties of bound states in relativistic quantum field theories.

This work is a continuation of that currently supported under NSF grant PHY76-16562 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0023, THEORETICAL STUDIES OF NONLINEAR PHENOMENA IN PLASMAS

C.S. Liu, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DN775702; N00014-77-C-0590)

Investigate nonlinear phenomena in plasmas with particular emphasis on fundamental problems related to the generation of localized field entities called solitons. This work provides improved information needed for solution to the problems of nonlinear effects in plasma experimental test systems which relate to Navy applications such as directed energy and weapons simulation.

Study the analytic properties of nonlinear wave equations in inhomogeneous media. Perform a theoretical investigation on certain fundamental problems in nonlinear plasma physics related to the generation of solitons. Specifically, this includes a theoretical analysis of solitons and parametric instabilities in inhomogeneous, magnetized plasmas and their role in plasma turbulence and particle acceleration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0024, THEORETICAL STUDIES OF GRAVITY

C.W. Misner, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (PHY78-09658)

Theoretical research on general relativity and related topics will be carried out. The principal areas of research will be (1) the development of a class of non-linear quantum field theories that model a type of gravitational non-linearity different from that modelled by Yang-Mills theories, (2) further development and applications of geometrical spacetime perturbation theory, (3) studies of black holes, including estimates of quantum influences on the nature of their hidden internal singularities and probes of the 'cosmic censorship' hypothesis through attempts to convert black holes into naked singularities. Other problems will also be studied when they seem apt for solution and significant for a fundamental understanding of gravity and its relationship to the rest of physics or astrophysics.

This work is a continuation of that currently supported under NSF grant PHY76-20029 AO1.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0025, POSITRON ANNIHILATION MEASUREMENTS IN LOW-TEMPERATURE HELIUM

K. Canter, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR78-09199)

Measurements will be made of the annihilation rates of positrons (antimatter electrons) and positronium (electron-positron bound states) in low temperature helium gas and liquid. Experiments are designed to separate the atomic from many-body features of positronium trapped in helium by contrasting annihilation data from helium-3 and helium-4. An understanding of the trapped mechanism will lead to a clarification of the behavior of waves in disordered systems.

This is a continuation of research supported under DMR-7602041. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, THEORETICAL PROBLEMS IN CONDENSED MATTER AND STATISTICAL PHYSICS

P.C. Martin, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Biophysics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DMR77-10210 A01)

Continuation of research supported under DMR75-02649.

Theoretical research on a wide variety of problems in condensed matter science will be carried out. These include: (1) The statistical mechanics of systems near a critical point with applications to multicritical points, effects of impurities on magnetic systems and liquid crystal phase transitions. (2) Dynamical critical phenomena, utilizing the theory of the renormalization group on liquid helium, He3-He4 mixtures, structural phase transitions and spin-waves. (3) Solvable models of one-dimensional Fermi systems, such as an electron gas and coupled electron chains. (4) The study of the onset of turbulence in fluids. (5) Electronic properties of transition metals, alloys and compounds, e.g., transition metal hydrides. (6) Investigations of disordered systems, such as liquid and amorphous metals and spin glasses. (7) Layered superconductors and non-equilibrium superconductivity.

Other miscellaneous topics will be investigated such as spinodal decomposition, the dynamic structure of fluids, superradiance, photoemission, L/F noise and the origin of the earth's magnetic field.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, EXCITATION OF METASTABLE ATOMIC HYDROGEN BY LOW-ENERGY ELECTRONS

J.C. Zorn, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY77-18832)

This grant initiates an experiment in atomic physics to measure the differential cross section for excitation of a particular excited state (the 2 2 S 1/2 state) of atomic hydrogen by impact of low-energy electrons. The cross section for this fundamental collision process has been calculated many times in a variety of approximations, but there is no data on the differential cross section in the interesting energy range of 0-1.4 eV above threshold. The time-of-flight experiment used here is particularly well suited for cross section measurements in the near-threshold regime. It avoids the electron optics problems inherent in conventional cross section determinations, and it provides values of the cross section over the complete range of 0-180 degrees.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0028, TUNNELING IN MAGNETIC SUPERCONDUCTING SYSTEMS

A.M. Goldman, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Physics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DN875609; N00014-78-C-0619)

This study of the superconducting and magnetic properties of thin-film rare-earth chevral phase materials is of interest to the Navy for possible use in high power microwave weapons systems exploiting superconductors.

Thin films of rare-earth chevrel-phase superconductors (e.g., HoMoS, TbMoS and ErMoSe) will be prepared by RF sputtering. Diagnostic techniques used to characterize these films will include x-ray diffraction, transmission electron microscopy and Auger electron spectroscopy. The interplay between magnetic ordering and superconductivity will be studied using both quasi-particle and air-tunneling techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0029, MULTI-USE GAMMA RAY SCATTERING FACILITY

W.B. Yelon, University of Missouri, Columbia Campus, Research Reactor Facility, *130 Jesse Hall, Columbia, Missouri* 65201 (DMR76-17349 A01)

A high resolution gamma diffractometer will be built at the University of Missouri Research Reactor to study some basic properties of some simple systems. There include a study of the defects in doped-silicon by Huang Defect Scattering (HDS), plastic deformations of some perfect crystals by HDS and high resolution studies of covalency effects in simple metals by accurate determination of the structure factors. The possibility of performing inelastic scattering studies as well as some other possible uses of an intense, monoenergetic gamma-ray source will be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, MICROSCOPIC THEORY OF QUANTUM FLUIDS AND EXTENDED NUCLEAR SYSTEMS

J.W. Clark, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR78-08552)

Research previously supported by DMR76-14929.

Theoretical research in condensed matter and nuclear physics will be carried out. The emphasis will be on the microscopic theory of dense quantum systems, with application to liquid helium, nuclear structure and astrophysics. The specific projects to be undertaken include: (1) the evaluation of the one- and two-body density matrices of quantum fluids, (2) the development of hypernetted-chain methods for the calculation of distribution functions, (3) the application of the method of correlated basis functions to the ground states of liquid helium-three and nuclear matter, (4) investigations of non-uniform phases of extended nuclear systems, and (5) the calculation of the low states of the closed-shell nucleus, oxygen-16, in a correlated subspace.

The main thrust of this research is the development of the method of correlated basis functions, which is an accurate technique for calculating ground state properties of interacting particles. This will lead to an enhanced understanding of the behavior of realistic systems at the microscopic level.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, ACOUSTIC MAGNETIC RESONANCE STUDIES OF METAL HYDRIDES, BULK METALS AND PARAMAGNETIC INSULATORS

D.I. Bolef, Washington University, School of Engineering & Applied Science, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR78-11567)

Acoustic magnetic resonance investigations of metal hydrides, bulk metals and semiconductors, and of magnetoelastic and spin-lattice relaxation effects will be carred out via nonresonant, (delta m equals O) interactions in paramagnetic systems. Special emphasis is placed on use of a high field superconducting magnet with homogeneity and sweep capabilities particularly suited for the investigation of metals and metal hydrides by nuclear acoustic resonance (NAR). These experiments will make use of the dynamic Alpher-Rubin coupling as well as dynamic quadrupole coupling mechanism. Particular areas that will be addressed are NAR of hydrogen via dipolar coupling in alpha, beta, and mixed phases of transition metal hydrides and NAR in single crystals of Be, Mg, and Ge.

This research was previously supported under NSF grant DMR-7680158, and DMR-7400360. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, TRICRITICAL PHENOMENA AND DYNAMICS OF HYDROGEN-BONDED CRYSTALS

V.H. Schmidt, Montana State University, School of Letters & Sciences, Dept. of Physics, *Bozeman, Montana* 59715 (DMR78-09205)

The 'critical' point in a liquid-gas system is the temperature and pressure at which it is impossible to distinguish between the liquid and gas, i.e., the surface tension goes to zero. Other types of systems, such as magnetic systems, superfluids, and those with turbulent flow also show critical phenomena. A recent major development in a unified theoretical treatment of all these phenomena. The importance of Professor Schmidt's work is that the ferroelectric, hydrogen bonded salts (such as KH2PO4) are different from other types of systems studied, have four variables that can be changed at will, and thus offer a specially favorable opportunity to examine dynamic effects near tricritical points and to test theory of critical phenomena.

Static and dynamic phenomena associated with phase transitions are investigated in potassium hydrogen (or deuterium) phosphate-type ferroelectric crystals by means of dielectric, nuclear magnetic resonance, birefringence, Brillouin scattering, and/or neutron scattering measurements. These measurements are made at various temperatures and pressures, with various applied electric fields, and with varying degrees of deuteration to examine behavior near the critical lines in temperature-pressure-electric field space and near the tricritical point which occurs at about 2.4 kbar in KH2PO4.

This is a continuation of work supported under DMR 76-11828.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, ELECTRONS IN COMPLEX SOLIDS

D.J. Sellmyer, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (DMR78-10781)

The object of this research is the investigation of electronic and magnetic states in relatively complex solids. These materials either exhibit new types of physical phenomena or require new theoretical models for their understanding. Several classes of problems will be studied: (1) electronic structure of d and f band metallic compounds, (2) electronic and magnetic states in limited dimensionality conductors, and (3) electronic and magnetic states in metallic glasses.

The experimental work will consist of high-field magnetoresistance and quantum oscillatory measurements in fields up to 220 KOe. In systems where electronically driven or magnetic phase transitions are involved, electron transport, magnetic susceptibility, and high-field magnetization measurements will be performed.

The results should contribute to our understanding of (1) the relationship between electronic structure and magnetic, structural, and superconducting phase transitions, (2) the relationship between electronic structure and chemical bonding in structures where the bonding is poorly understood, (3) the localized-moment and itinerant-electron aspects of magnetism in conducting solids, (4) the electronic structure and electron-transport properties of intertransition-metal amorphous alloys, and (5) the dependence of the magnetic properties of glassy metals on fluctuations of exchange constants, local random anisotropy, charge transfer, and structural effects.

This research was previously supported under DMR-7617417. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, THERMODYNAMIC AND DIELECTRIC PROPERTIES OF POLAR FLUIDS

J.L. Lebowitz, Rutgers the State University of New Jersey, New Brunswick Campus, Graduate School, Dept. of Physics & Mathematics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (CHE78-08730)

This project is in the Structural Chemistry and Thermodynamics program, in the subarea of liquid state theory. Dr. Lebowitz and Dr. Wertheim will study the dielectric and thermodynamic properties of dense systems of polar molecules by theoretical methods. The methods to be used are graphical techniques and thermodynamic perturbation theory. Some effort will also be devoted to development of formal theory and rigorous results. The research will be directed towards understanding the behavior of models of polarizable polar molecules, which are closer approximations to real molecules than the non-polarizable models mostly studied so far. Results will be compared with computer simulation, carried out elsewhere, and experiment, where appropriate.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0035, PIEZO-SPECTROSCOPIC INVESTIGATION OF BANDS AND BONDS IN SOLIDS

F.H. Pollak, City University of New York, Brooklyn College, School of Science, Dept. of Physics, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (DMR78-03030)

The stress induced splittings and shifts of the electronic energy bands and phonon frequencies will be investigated for a number of different solids. Uniaxial stress provides a tool for probing locations of band extrema, symmetrics of interband transitions, deformation potentials, crystal field splittings, effective masses and excitonic transitions. The techniques to be used in these investigations include optical modulation spectroscopy, Raman scattering and resonance Raman scattering. Solids to be investigated include rutile materials, transition metal oxides and copper oxide.

This is a continuation of research previously supported by NSF grant DMR-7518936 at Yeshiva University.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, SUPERFLUID HELIUM-3 IN HIGH MAGNETIC FIELDS

D.M. Lee, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR78-10901)

This is a continuation of work performed under DMR-7621669. The properties of superfluid helium-3 in very high magnetic fields will be studied. The temperature dependence of the properties of the A-1 phase will be examined. Ultrasonic attenuation, high-frequency nuclear magnetic resonance, Andronikashvili techniques and possible fourth sound measurements will be employed in these studies. This work is important for understanding the behavior of quantum fluids.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, A STUDY OF HOMOGENEOUS STEADY-STATE PLASMA IN RF ELECTROMAGNETIC FIELDS

H.H. Brown, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (PHY77-26928)

A new device will be constructed to form and maintain a plasma in a heated cavity. Barium atoms will be ionized so that optical diagnostics can be used to obtain detailed information concerning the plasma. The hot walls will form part of an RF cavity so that microwave diagnostics can be used as a diagnostic and to supply an RF electric field for plasma interactions. Phenomena to be studied include: the effect of a ponderomotive force, parametric instabilities, and turbulence.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0038, ELECTROMIGRATION IN METALS

H.B. Huntington, Rensselaer Polytechnic Inst., School of Science, Dept. of Physics & Astronomy, *110 8th, Troy, New York* 12181 (DMR77-24953)

Research previously supported by DMR76-81239.

The phenomenon of electromigration in metals will be studied. Of the projects to be pursued, two deal with interstitials, i.e., 'fast diffusers' in lead and other polyvalent metals, and gaseous impurities in the noble metals. Recently, improved accuracy and consistency in the measurements of nickel in lead have demonstrated a marked concentration dependence even in the range of a few parts per million. This work will be continued to study the behavior of cadmium in lead and of a series of fast diffusers in single crystal tin. The electromigration of hydrogen in copper will also be investigated. A third project will try to understand forced motion effects in Met-Glass systems, especially in the high-temperature range.

First year of a 2-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0039, LEED CRYSTALLOGRAPHY AND SURFACE RECONSTRUCTION

F. Jona, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (DMR77-27933)

Experimental studies of atomic structures on single crystal surfaces using low-energy electron diffraction (LEED) which previously were funded by NSF grant DMR-7203294 will be continued. This research will be concentrated in three areas: (1) The problem of structural reconstruction on semiconductor surfaces. This effort will include work on the structure of Ge(001)2x1 and Si(001)2x1, as well as studies of metallic adsorbates on both the (001) and the (111) surfaces of of Si and Ge. (2) The problem of molecular adsorption and structural reconstruction on metal surfaces. This effort will involve reexamination of the low-temperature reconstruction on W(001) and Mo(001), and resumption of analyses of the ordered chemisorbed layers of CO and O on Mo(001). (3) The investigation of search procedures for the rapid identification of probable and improbable models in LEED crystallography.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0040, HIGH RESOLUTION RF SPECTROSCOPY OF ATOMS AND IONS

H.G. Robinson, Duke University, Trinity College of Arts & Sciences, Dept. of Physics, *Durham, North Carolina* 27706 (PHY77-22567)

Research will continue to determine gJ(4He ion, 1 2s1/2) relative to gJ(1H, 1 2S1/2) or gJ(Electron) to a precision of between 1 and 5 parts in 10 to the 8th power. The precision determination of gJ(4He, 2 3S1) / gJ(1H, 1 2S1/2) will be continued and concluded with the goal of reducing systematic effects so that advantage can be taken of the exceptionally narrow (220Hz) linewidth achieved for the helium metastable Zeeman resonance. In addition, an experiment is to be initiated to determine the fine and hyperfine structure of the 3 3P state of helium. Motivation is provided through comparison with the theory of these fundamentals one and two electron systems. Finally, toward an understanding of collision processes in helium-

alkali cells, Penning ionization cross-sections will be determined for Rb, Cs, and K colliding with 4He, 2 3S1.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0041, SPACE CHARGE AND ELECTRODE REACTION EFFECTS IN SOLIDS AND LIQUIDS

J.R. MacDonald, University of North Carolina, Chapel Hill Campus, School of Arts & Sciences, Dept. of Physics, *Chapel Hill, North Carolina* 27514 (DMR76-84187 A01)

This work is concerned with the electrical behavior of systems in which a nonmetallic solid or liquid is in contact with metal electrodes. Greater understanding of such systems is desirable both for its intrinsic scientific value and for its technological applications, notably in the area of energy conversion and storage. The primary goal is to relate electrical responses observable in the laboratory (transient and steady-state AC and DC response) to the parameters which characterize the behavior of the system on a microscopic level.

The research includes the following: The exact small signal AC response is being determined for a somewhat more general microscopic model than treated previously, representing a wider variety of systems. The exact response will be cast into simplified forms for easier comparison with experiment. The transient and steady-state AC and DC response of a selected group of systems will be determined by computer simulation. Modifications will be made in the basic microscopic equations to better represent materials, such as superionic conductors, in which the motions of individual mobile charges are strongly coupled with each other.

Continuation of work supported under DMR-75-10739. Three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0042, LOW TEMPERATURE TRANSPORT PHENOMENA IN METALS

J.C. Garland, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DMR78-09428)

Experimental studies of thermoelectricity in superconducting metals and of the strong field galvanomagnetic properties of inhomogenous metals previously supported by NSF grant DMR-7611633 will be continued. The low temperature transport studies will be concentrated in two problem areas. The first of these will include measurements of thermoelectricity in pure superconductors by a technique developed earlier in which magnetic flux is generated within a toroidal cavity. This is an extension of previous research which identified a thermoelectric effect unique to the superconducting state. The second problem area is concerned with the effect of inhomogeneities on electron transport in metals under the influence of strong magnetic fields. The experiments will be concentrated on materials consisting of superconducting grains imbedded in a normal metal medium.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0043, ISOSPIN AND GIANT-RESONANCE EFFECTS IN NEUTRON SCATTERING AND NEUTRON-INDUCED CHARGED-PARTICLE REACTIONS

J. Rapaport, Ohio University, Athens Campus, School of Arts & Sciences, Dept. of Physics, *Athens, Ohio* 45701 (PHY78-09911)

This grant will support a program of basic research in nuclear physics. An 11-meV high intensity pulsed Tandem Van de Graaff accelerator produces mono-energetic neutrons which are being used to carry out studies of neutron-nucleus interactions. Studies of isospin and giant-resonance effects in neutron scattering will be carried out. An entirely new technique to study neutron-induced charged-particle reactions with previously unavailable and flexibility will be further developed.

Giant resonance effects will be studied using high-energy neutrons as probes. Studies of inelastic scattering from several targets will be done in order to see directly these giant states, or as in the case of Carbon-12, to answer other basic questions such as isospin mixing. Measurement of the excitation functions of excited states in isospin equals 0 nuclei will be carried out with high energy neutrons to study the influence of these giant states on the scattering to lower states.

A new facility capable of a broad range of neutron induced charged-particle reaction studies will be developed. Important questions of basic physics as well as important applications will also be pursued.

This is a continuation of work supported under NSF grant PHY76-11450 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0044, THE PHYSICS OF FLUIDS

R.J. Donnelly, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DMR78-10782)

This is a continuation of work sponsored under DMR-7621814.

Research on the hydrodynamics and thermodynamics of helium-II will be continued. Measurements will be made of quantum fluid turbulence to determine the mean and fluctuating parts of the vortex line density in a counterflow of normal and superfluid components. Equations of motion are being sought which contain all the realistic properties of the system, such as quantized vortices, healing and relaxation effects. A consistent data base for the thermodynamic properties of helium-II and mixtures of helium-3 and helium-4 will be generated. The results of this work are significant for the cooling of superconducting devices.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0045, THEORY OF ELECTRON SPIN POLARIZATION IN PHOTOEMISSION

P.H. Cutler, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR77-09934)

A theoretical study will be carried out on electron spin polarized (ESP) emission as a fundamental new probe of magnetic solids; specific applications will be made to the investigation of surface and bulk electronic properties of 3-D-ferromagnetic metals. The project comprises the following three interrelated studies: a. A transfer Hamiltonian formulation for field emission of polarized electrons, including band structure, correlation and spin dependent surface interactions; b. A new many-body formulation of spin polarized tunneling and field emission; c. A theoretical investigation of matrix element effects on the ESP of photoemitted electrons from ferromagnetic 3-D-transition metals.

The purpose of the study is (1) to clarify the relation between the measured ESP and the bulk spin polarization; (2) to determine whether, and for what reason, the ESP measurements of photo- and field-emitted electrons complement or contradict each other; (3) to determine the adequacy of the itinerant model of ferromagnetism in the transition metals, and possible extension of the model suggested by field- and photoemission ESP experiments; (4) to determine the importance of many-body effects beyond the mean (exchange) field in the ESP field- and photoemitted electrons, using both established and new techniques.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0046, SMALL ANGLE NEUTRON SCATTERING FROM FERROFLUIDS

A.C. Nunes, University of Rhode Island, School of Arts & Sciences, Dept. of Physics, *Kingston, Rhode Island* 02881 (DMR78-03024)

A ferrofluid (a collodial suspension of magnetic particles) is a magnetic fluid which has unique applications in rotating seals and particle separators. As a collection of subdomain sized particles a ferrofluid is a physically interesting magnetic system, a superparamagnet, whose properties are presumably dominated by surface phenomena, because of their relatively large surface to volume ratio. Several measurements of ferrofluids have demonstrated magnetic properties significantly different from the bulk materials. Most of these techniques measure volume averages however, and there is little direct information of the magnetic structure of the particles themselves. A polarized neutron small angle scattering investigation of a ferrofluid will be undertaken to ascertain the chemical makeup and magnetic structure of a colloidal ferrite suspended in water. This will be the first application of small angle neutron scattering to such a system. Results will be compared with model predictions. Experience gained in this work may also have technological ramifications in the field of polarized neutron scattering as a polarizing filter.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0047, VIBRATIONAL POTENTIAL FUNCTIONS FOR SMALL MOLECULES

R.W. Redding, North Texas State University, School of Arts & Sciences, Dept. of Physics, *N. Texas Station, Box 13707, Denton, Texas* 76203 (B-516)

We have succeeded in the first phase of our calculation regarding the Eckart frame for non-linear molecules. Our primary interest is in correlating the symmetry of molecular vibrations with motions of this reference frame, which is important in achieving simplification of the vibration-rotation Hamiltonian. The work so far has been directed toward understanding the contributions that the various symmetry species of the molecule's point group make in causing movement of the frame. Our approach is patterned after perturbation theory, and yields good results. In particular, we are able to pick out on the basis of their symmetry those vibrations which cause no changes in the Eckart frame, regardless of their amplitude. This work is continuing.

Our work on the avoided crossing problem in diatomic molecules has continued. We are currrently applying a new technique that we previously developed for calculating the parabolic cylinder functions, which are key components in the ultimate application of our overall method to experimental data. Our recent calculations give good indication that this new method provides the necessary accuracy, unavailable until now.

SUPPORTED BY Robert A. Welch Foundation

8.0048, COLLISIONS INVOLVING ATOMS IN HIGH RYDBERG STATES

R.F. Stebbings, Rice University, Graduate School, Dept. of Physics, *6100 Main St., Houston, Texas* 77001 (PHY78-09860)

Research will continue on the structure and properties of very highly excited ('Rydberg') atoms. Topics to be pursued include: 1. Thermal collisions with atoms and molecules; 2. Collisions with low-energy electrons; 3. Field ionization; 4. Production of Rydberg atoms; 5. Excitation transfer; 6. Chemiionization.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0049, THE ROLE OF GRAVITATION IN PHYSICS

B.S. DeWitt, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (PHY77-22489)

Research initiated on NSF grant PHY74-03563 A03 will continue on the role of gravitation in physics, at the quantum level and in the realm of astrophysics. The specific problems to be undertaken are: 1. Computer calculations of (a) collapsing spherical and nonspherical, rotating and nonrotating distributions of matter, (b) the formation of black holes, and (c) the gravitation radiation emitted. Standard polytropic equations of state will be used. The computer will also be used to study maximal slicings of the Kerr geometry. 2. A study of the vacuum stress (vacuum polarization) in strong gravitational fields, in accelerating frames, and in regions with curved boundaries. 3. Further study of quantum field theory in curved spacetime. 4. Differential geometry, Lie group theory and fiber-bundle theory on Z-graded algebras. 5. Further development of quantum theories of gravity and supergravity. 6. Topics in classical relativity.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0050, THE METAL-NONMETAL TRANSITION IN LIQUID MIXTURES

J.C. Thompson, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR7821744)

The metallic state in disordered materials, both liquids and solids, can not be understood on the basis of present theories for crystalline systems. To reach an understanding of these systems, the metal-nonmetal transition must be understood. This is the goal of the present work.

Systems of present interest are solutions of an alkali metal in liquid ammonia, and liquid alloys of Group IIIA Metals with such chalcogens as tellurium. Four techniques are used: optical reflectance from 0.5 to 5.0 eV; conductivity and (electrodeless) Hall coefficient measurements; photoconductivity; and field effect. The last two are new methods for liquids. Densities of electron states as well as carrier densities, mobilities and lifetimes are determined as functions of composition and temperature. These are interpreted in terms of disorder, electron-electron interaction, structural defects, and chemical bonding.

This is a continuation of work supported by DMR76-84338. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0051, ATOMIC AND MOLECULAR PHYSICS

C.B. Collins, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (INT76-18982)

To date, this project has introduced the concept of hybrid resonances in multiphoton spectroscopy, demonstrated a technique suited for the examination of diffuse molecular bands, and pointed a direction toward discovery, identification and analysis of repulsive and weakly bound states of alkali molecules. In the forthcoming period, work will be directed to quantitative studies significant to broad areas of plasma chemistry, laser physics, and aeronomy, and specifically to applied physics efforts in e-beam lasers and photochemistry. Structure and properties of repulsive states of alkali-bearing molecules will be defined, primarily by multiphoton spectroscopy. The order of occurrence of repulsive states of cesium, not expected in earlier theory, will be further delineated by examination of the dissociative part of the cesium spectrum. The work will be extended to rubidium, and subsequently applied to cesium and rubidium combinations with inert gases in order to obtain comprehensive spectroscopic data on the excimer states of these alkali-inert gas molecules. Finally, collisional effects will be studied by variation of the time delay between laser excitation of molecular transition and laser detection of the dissociation fragments.

This work will be conducted in cooperation with Iovitzu Popescu, et al., Institute of Physics, Bucharest, Romania. Experimental work on cesium will produce quantitative values of line strengths and potential curves for comparison with developing theory. The evolving theory itself is mainly a Romanian contribution, and will be numerically evaluated on U.S. comput-

ers. Application will then be directed to fine structure effects and subsequently extended to additional alkali systems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0052, NONEQUILIBRIUM SUPERCONDUCTIVITY
J.L. Paterson, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR74-23661 A01)

These studies are important for delineating the basic properties of nonequilibrium superconductivity and for understanding the behavior of the devices derived from thin-film junctions.

Studies of nonequilibrium superconductivity will be made by means of thin-film, double tunnel junctions. The quasiparticle energy distribution will be measured as the degree of nonequilibrium increases. Elastic and inelastic branch-mixing times and inelastic scattering times will be determined in the weakly-perturbed regime. Explanations for the first order phase transition and two energy gaps in the center film in the strongly-perturbed regime will be sought.

This is a continuation of research supported under DMR74-23661.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0053, ELEMENTARY PARTICLE THEORY
V.L. Teplitz, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Physics, *Blacksburg, Virginia* 24061 (PHY78-08436)

The proposed work is in the field of theoretical physics, emphasizing study of the interactions among elementary particles. Specific problems to be examined include: a) Continuation of the unitary pi N yields pi pi N isobar analysis; b) Extension of the results in A to pi N elastic scattering and pi pi N threshold (current algebra) analysis; c) study of M1 transitions using the MIT bag model; d) application of astrophysics to weak interaction phenomenology.

This work is a continuation of that currently supported under NSF grant PHY-7611349A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0054, SINGLE ATOMIC PARTICLES AT REST IN SPACE
H.G. Dehmelt, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (PHY78-08562)

This is an experimental research program in fundamental physics. By means of novel techniques for storing and studying simple atomic particles, measurements will continue of the magnetic moment anomalies-of the electron and the positron to reach an accuracy comparable to that now routinely achieved in high-resolution proton NMR studies (i.e., one part in ten billion) for a precision test of particle-antiparticle symmetry. These measurements will be the most precise determination of the structure of elementary particles.

This is a continuation of work currently supported by NSF Grant PHY76-11176 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0055, GALACTIC ELECTRONS, ENERGY SPECTRUM OVER 300 GEV
J.J. Lord, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (INT78-06972)

This award will support Professor Jere J. Lord of the University of Washington in Seattle over a period of two years in a program of cooperative instrumented balloon flights with Professor Jun Nishimura of the Institute of Space and Aeronautical Science, University of Tokyo, for the purpose of studying cosmic radiation at ultra-high energies. Professor Lord and another member of his research group will travel to Tokyo for coordination and training in preparation for several research balloon launches from Palestine, Texas, and for final analysis of data, utilizing experimental facilities at the University of Tokyo.

The project will utilize emulsion chamber detection techniques to study the high-energy portion of the primary cosmic ray electron spectrum, one of the important problems in astrophysics where improved data is necessary to determine the origin of the electron component. The results derived from this research will have an important bearing on the origin of cosmic rays and their propagation through the galaxy. The joint efforts of the U.S. and Japanese research groups in the design, fabrication, and operation of the balloon instruments and in the subsequent analysis of data will make possible the performance of reliable measurements in a program too large to be handled by a single research group.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0056, STATISTICAL MECHANICS OF SIMPLE SYSTEMS
L.W. Bruch, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Physics, *Agriculture Hall, Madison, Wisconsin* 53706 (DMR78-09429)

Research previously supported by DMR74-19826.

Research in condensed matter physics on the theory of inert gas systems, especially under the conditions of physical adsorption, will be carried out. The goals of the program are: (1) clarification of the forces which act in physical adsorption and (2) the development of statistical mechanical theories of the inert gases in dense phases, including helium at low temperatures where there are large quantum mechanical effects. The research includes: semi-empirical analysis of experimental data to identify the dominant interaction mechanisms for adsorbed krypton and xenon; the study of continuum approximations for the adsorbing surface with idealized models; and variational calculations of the ground state energy of weakly bound systems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, PITCH ANGLE DISTRIBUTIONS OF THERMAL IONS IN THE INNER THERMOSPHERE
J.L. Horwitz, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Physics, *Huntsville, Alabama* 35807 (NSG 5413)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0002, ANTARCTIC ATMOSPHERIC INFRASOUND
C.R. Wilson, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (DPP77-22997)

Observations of auroral infrasonic waves (AIW) will be carried out at Windless Bight near McMurdo Station, Antarctica, during 1979, using a four-microphone array. Data from the microphone array will be collected at a central point and telemetered to Scott Base where it will be recorded in digital form on chart recorders and on slow-speed magnetic tape.

During the second year of this grant, the AIW data, along with riometer, magnetometer, and all-sky camera data collected at Scott Base, will be used to investigate how auroral infrasonic waves are generated.

Logistics support is required for one person at McMurdo during the austral summer of 1979/80.

Previous award number is DPP-7305897 A03 (Proposal Number DPP-7719091).

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

10.0003, STUDY OF MAGNETOPAUSE/BOUNDARY LAYER AND PLASMA SHEET STRUCTURES
L.C. Lee, University of Alaska, Fairbanks Campus, Graduate School, *Fairbanks, Alaska* 99701 (NSG 5409)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0004, THEORETICAL STUDIES OF INTERPLANETARY MAGNETIC FIELDS, TURBULENCE AND COSMIC RAYS
E.H. Levy, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (ATM76-17058 A01)

A significant part of the sun's influence on the earth and the planets is exerted through the intermediary of the solar wind. In addition, our general ideas about the behavior of astrophysical plasmas can be directly tested only in interplanetary space. For these reasons solar-wind studies have relevance over wide areas of science.

The grant continues support for theoretical studies of a range of basic solar-wind properties and behaviors. In this continuing program, the investigations undertaken will include the effects of turbulence influctuations on measured radial variations of, for example, solar-wind density, the interplanetary magnetic field and the density of cosmic rays. Also the large-scale morphology of the interplanetary magnetic field will be studied, with particular emphasis given to the effect of the field's structure on cosmic-ray propagation and anisotropies. Scintillations in the flux of astronomical radio waves are produced by turbulence and fluctuations in the solar-wind. This has opened an avenue for ground-based studies of solar-wind variations. Since the theory of these scintillations is still incomplete, research into the causes of radio scintillations will be undertaken.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0005, STUDIES IN STELLAR ASTRONOMY
J. Greenstein, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST77-09191)

The properties of intrinsically faint stars have been under study by the principal investigator for many years. A large amount of observational material is already available as a result of observing programs carried out on the 200-inch Hale reflector on Mt. Palomar. Statistical and astrophysical studies of these observations will be made in order to determine the spatial distribution and kinematics of these stars in our Galaxy and the solar neighborhood. Physical characteristics, such as temperatures and composition differences, will also be determined. This program will provide new data on low-mass stars which will be of use in studies of stellar and galactic evolution.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, SPECTROSCOPIC OBSERVATIONS OF QUASARS
M. Schmidt, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST77-22615)

The following research programs will be carried out: 1) A continuing search for, and measurement of the spectroscopic studies of bright quasars, 2) The obtaining of spectra and red shifts of faint quasars, 3) A study of the optical continuum of quasars, and 4) Other incidental studies of radio quasars. The studies of bright and faint quasars will yield information on the exact shape of the very steep decrease of quasar space density with cosmic time. The study of the optical continuum, which already has uncovered a wavelike deviation from a power law, may lead to improved understanding of the radiation mechanism at work in the generation of the extraordinary luminosity exhibited by quasars. Spectroscopic studies of radio quasars are designed to improve our knowledge of the radio luminosity function of quasars.

This is a continuation of research done under grant AST 75-22923 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, HIGH-RESOLUTION INTERFEROMETRY OF SOLAR RADIO SOURCES
H. Zirin, California Inst. of Technology, Graduate School, Dept. of Astrophysics, *1201 E. California Blvd., Pasadena, California* 91109 (ATM76-80782 A01)

This grant continues a program of high-resolution interferometry of the quiet and active sun at the Owens Valley Radio Observatory, California. Solar bursts will be measured at 2.8 cm with 1 sec time resolution, 4 arc sec one-dimensional resolution and compared with simultaneous optical data. Equipment to reduce the time constant to 0.1 sec and to keep bursts from saturation will be developed. Data already accumulated will be further analyzed. A program of observations at the Very Large Array (VLA) will be carried out.

The work should result in new understanding of the size and intensity distribution in solar flare bursts, the height of the energetic source, and the relation of the polarization to magnetic field structure. The quiet sun work will give new data on temperature fluctuations in the chromospheric network.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0008, DETERMINATION OF INTERSTELLAR ABUNDANCES BY CORRELATED X-RAY AND ULTRAVIOLET OBSERVATIONS
A.B. Walker, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (NSG 5417)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0009, APPLICATION OF IMPROVED DETECTOR TECHNOLOGY TO A CONTINUING PROGRAM OF SOLAR-SYSTEM OBSERVATIONS
A.L. Broadfoot, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 7644)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space Science

10.0010, OPTICAL OBSERVATIONS OF CELESTIAL X-RAY SOURCES
B. Margone, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (AST77-27745)

A research program to study several characteristics of galactic and extragalactic X-ray sources will be carried out using the latest ground-based spectrophotometric, photometric, and photographic techniques. A major portion of the effort will be devoted to discovering visible or near-infrared counterparts of galactic X-ray binary stars by using the very accurate X-ray positions available from recent satellite experiments. The objects so identified, plus a number of already known identifications, will be observed spectroscopically to help understand the effects of the nearby X-ray source on the structure and evolution of the

relatively normal companion star. Results of this research will bear directly on several problems on the late stages of stellar evolution. Because most X-ray sources are thought to involve a collapsed object, such as a neutron star or black hole, these data will provide insights which are impossible to gain in the laboratory concerning the physics of these very unusual stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, OBSERVATIONS OF THE SUN, ALPHA CENTAURI AND CLUSTER STARS

D.C. Barry, University of Southern California, School of Letters Arts & Sciences, Dept. of Astronomy, *3551 University Ave., Los Angeles, California* 90007 (NSG 5412)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0012, A COMPARATIVE STUDY OF THE FAR ULTRAVIOLET SPECTRA OF BE STARS

G.J. Peters, University of Southern California, School of Letters Arts & Sciences, Dept. of Astronomy, *3551 University Ave., Los Angeles, California* 90007 (NSG 5422)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0013, THEORETICAL ASTROPHYSICS RESEARCH

R. McCray, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *1200 University Ave., Boulder, Colorado* 80302 (AST78-06714)

Theoretical problems concerning the interstellar medium will be studied. These include: 1) the maintenance and stability of a hot (T approximately 10 to the 6th power degrees K) phase of the gas that results from supernova blasts; 2) the effects of precursor ionization by high velocity shocks propagating in neutral atomic hydrogen (HI) regions; 3) the characteristics of time-dependent molecular hydrogen (H2) dissociation fronts.

A broad program for studying cosmic X-ray sources will be continued. Various problems having to do with the transfer of X-rays through the gas distribution around the source and the associated gas dynamical response will be investigated. A major goal is to predict the optical, ultraviolet, and X-ray spectral response of various idealized gas distributions in order to provide a framework for initiating and interpreting observations of such spectra with ground-based and space observatories. The particular systems to be studied include: 1) Stellar atmospheres illuminated by a companion X-ray source; 2) X-ray sources embedded in stellar winds from a binary companion; 3) Optically thick distributions of gas surrounding the magnetosphere of a neutron star X-ray source; 4) Models for Seyfert galaxies and quasars involving accretion by a supermassive black hole.

This is a continuation of research done under AST 75-24590 A01.

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of Astronomical Sciences

10.0014, HIGH RESOLUTION SPECTROPHOTOMETRIC OBSERVATIONS OF INTERSTELLAR ABSORPTION LINES

T.P. Snow, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (NSG 7626)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space Science

10.0015, OBSERVATIONS OF MASS LOSS FROM HD-193793 AND OTHER WOLF-RAYET STARS

S.T. Gottesman, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Astronomy, *208 Tigert Hall, Gainesville, Florida* 32601 (AST78-01278)

Wolf-Rayet stars are hot, luminous stars with expanding atmospheres. Material is being ejected from them as a stellar wind at a rate of at least a billion times that of the sun. The structure, the physical cause for the high mass loss rates, and the evolutionary history of these stars are not understood. This project will be concerned with radio observations of Wolf-Rayet stars, and in particular one known as HD-193739. A large change has occurred in the stellar wind of HD 193793. By observing radio waves from the tenuous, outer regions of its stellar wind this disturbance can be studied. Variations in the rate of mass ejection, and the expansion velocity of the stellar wind will be determined.

In addition to HD 193793, only two other radio emitting Wolf-Rayet stars are known. The Very Large Array in New Mexico and the Green Bank radio interferometer in West Virginia will be used to search for radio emissions from other Wolf-Rayet stars.

SUPPORTED BY U.S. National Science Foundation,
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of Astronomical Sciences

10.0016, THE PHYSICAL PROPERTIES AND EVOLUTION OF GALACTIC NEBULAR COMPLEXES

H.R. Dickel, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST77-21021)

The study of molecules in galactic nebular complexes has led to physical models of the structure and dynamics of these molecular clouds. There is observational evidence for fragmentation, systematic motions, and an evolutionary progression within these clouds. The regions to be studied will include ionized hydrogen (HII) region-molecular cloud complexes. The dynamics of these clouds will be explored in the context of possible processes of star formation, the evolutionary development of prostellar envelopes and the transfer of the radiation in the molecular lines. Models which can (or cannot) explain an all-pervasive broad-wing feature in the line profiles we have observed in the DR21-W75 area will be investigated. The self-absorption interpretation of our observed 12CO profiles toward W3 will be further examined by comparing our observations of other molecules, such as 13CO, C18O, HCN, CS, and H2CO (at 6 cm. and 2 mm.), with their behavior predicted from the model-calculations. The possibility of self-absorption of the 12CO emission toward NGC 7538 will be studied. The investigation of the apparent correlation of molecular line width delta V with temperature TB found for a limited number of sources will be continued.

This is a continuation of research done under grant AST 75-2208 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0017, FUNDAMENTAL STUDIES IN THEORETICAL X-RAY ASTRONOMY

D.Q. Lamb, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (NSG 7653)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space Science

10.0018, INFRARED STUDIES RELEVANT TO A SATELLITE OF PLANET JUPITER

R.K. Khanna, University of Maryland, College Park Campus, Graduate School, Dept. of Chemistry, *College Park, Maryland* 20742 (NSG 5424)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0019, SOLAR MAXIMUM MISSION - GROUND SUPPORT PROGRAMS AT THE HARVARD RADIO ASTRONOMY STATION

A. Maxwell, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NSG 7648)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0020, EXPERIMENTAL AND THEORETICAL INVESTIGATIONS IN HIGH ENERGY ASTROPHYSICS

G.W. Clark, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 7643)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0021, GROUPS OF GALAXIES

J.R. Gott, Princeton University, Graduate School, Dept. of Astrophysical Science, *205 Nassau Hall, Princeton, New Jersey* 08540 (AST7624481 A01)

Most galaxies in the universe including our own are members of small groups. A systematic study of groups of galaxies has been started by developing a computer algorithm for identifying small groups as surface density enhancements in the sky (Turner and Gott). In collaboration with S. Aarseth in England, several 1000-body and 4000-body dynamical simulations of galaxy clustering in an expanding universe have been made. The simulations can then be observed and catalogues made of groups of galaxies just as is done for the observations. So far the results have been quite promising. Galaxy pair separations in the simulations are nearly identical to those observed and groups of galaxies in the simulations compare well with observed groups. Computer runs representing both open and closed cosmologies having a variety of initial conditions have been made. By analyzing these simulations, it is hoped to learn more about the masses of galaxies, the formation and properties of groups, and to provide clearer tests of whether the universe is open or closed.

This is a continuation of work done under grant AST 76-24481.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0022, STUDIES OF DEGENERATE STARS

H.M. Van Horn, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (AST76-80203 A01)

This work will be concerned with three main areas of research on degenerate stars: 1) There will be a study of the atmospheres and the internal structure and evolution of white dwarf stars. The non-radial oscillations and emission of gravitational radiation will be examined. 2) The properties of neutron stars will be studied. In particular there will be an investigation of the structure and evolution of cooling neutron stars and of neutron stars undergoing accretion. The non-radial oscillations and gravitational wave radiation of these objects will also be studied. 3) There will be a continuation of work on a computer program to permit the calculation of self-consistent, quasi-static models of the evolution of rotating stars. There will also be some research on magnetic field evolution in degenerate stars.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0023, A STUDY OF STELLAR SURFACE PHENOMENA

B.W. Bopp, University of Toledo, School of Arts & Sciences, Dept. of Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (AST77-09450)

Surface phenomena on our Sun have a variety of forms. Flares, plages, faculae and prominence activity are all localized phenomena, occupying only a small fraction of the solar disc. If we assume our Sun to be a typical star, then obviously other stars must exhibit surface phenomena also. However, for stellar flare activity to be detected, either the level of activity must be considerable higher than that of the Sun, or the background light from the undisturbed stellar photosphere must be low.

This investigation will be a comprehensive examination of stellar surface phenomena, with the objective of obtaining detailed information on the lifetime, development, location, and geometry of stellar active regions. The chromospheric emission lines and the stellar continuum in many stars with a high degree of surface activity will be monitored. In some cases, these observations will be coordinated with far-ultraviolet satellite observations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0024, LONG-RANGE ANTINEUTRINO BURST DETECTOR

K.E. Lande, University of Pennsylvania, School of Arts & Sciences, Dept. of Astronomy, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (AST76-17786 A01)

This research grant provides support for completion of construction and initial operation of a five hundred cubic meter neutrino and antineutrino burst detector situated in the Homestake Gold Mine in Lead, South Dakota. The detector will consist of ninety-six water Cerenkov counter modules and eighty liquid scintillation counters and will look for: 1) neutrinos and antineutrinos from collapsing stars in our galaxy; 2) high-energy neutrinos from localized extraterrestrial sources such as young pulsars; 3) oscillations of neutrinos produced by cosmic ray primaries in the Earth's atmosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0025, OBSERVATIONS OF SPECTRUM VARIABILITY OF HOT PECULIAR A STARS

S.J. Adelman, Citadel Military College of South Carolina, Graduate School, Dept. of Physics, *Charleston, South Carolina* 29409 (NSG 5420)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0026, INVESTIGATION OF MASS FLOW IN STELLAR ATMOSPHERES

J.L. Modisette, Houston Baptist University, School of Science & Health Professions, Dept. of Physics, *7502 Fondren Rd., Houston, Texas* 77036 (NSG 5421)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0027, THEORETICAL STUDY OF PLASMA FLOW INTERACTIONS WITH PLANETS

P.A. Cloutier, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (ATM77-12996 A01)

This grant will support theoretical research on the interaction of flowing plasmas with planetary bodies in continuation of the investigations conducted under previous NSF Grants GA 28033x and DES 74-19668. Work to date under these grants has been directed at an understanding of solar-wind interactions with the atmospheres and ionospheres of non-magnetic or weakly magnetic planets such as Venus and Mars, and has led to formulation of models which appear to explain the general features of the flow of solar wind plasma in the vicinity of these planets. However, a more detailed study will be undertaken to allow predictions of localized atmospheric profiles and structures, including effects of asymmetries in flow patterns, vari-

ations in atmospheric parameters with time and geographic location, and especially the effects of photochemistry, diffusion, and thermalization. The major aims of this work are to produce a quantitative model relevant to and an understanding of the PVO physical mechanisms concerning the interaction of the solar wind with planetary atmospheres.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Atmospheric Sciences

10.0028, THE MARTIAN CARTOGRAPHIC COORDINATES AND THE ROTATIONAL ELEMENTS OF MARS

G.H. De Vaucouleurs, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-81090 A01)

The ephemeris for physical observations of Mars, in the national ephemerides, is based on the coordinates of the north pole of Mars, its rotational period, and the value for the longitude of the central meridian at a selected epoch. Extensive new data from radar observations and by direct imaging from spacecraft have made accurate cartography of the Martian surface possible. To use this as a basis for the physical ephemeris of Mars, it is essential to relate the new cartographic coordinates rigorously to the rotational elements.

The International Astronomical Union has recommended a new set of physical elements of Mars be adopted and a new physical ephemeris of Mars based on these elements be published when two critical unknowns have been determined: 1) An improved value for the rotation period of Mars from the past 3 centuries of observations, and 2) The relation between the traditional system of areographic coordinates and the new system adopted for the Mariner 9 cartographic results.

This investigation will compiete the analysis of central meridian transits and areographic longitude data for the period 1877-1971 and extend it to the period 1659-1875, to derive a definitive value for the rotation period of Mars, also make detailed comparisons between the coordinates of surface features from telescopic observations and from Mariner 6, 7, and 9 to establish the zero-point differences between the old and new systems.

SUPPORTED BY U.S. National Science Foundation,
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of Astronomical Sciences

10.0029, THE CHEMICAL COMPOSITION OF STARS

D.L. Lambert, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (F-634)

Chemical elements beyond carbon are synthesized by nuclear reactions in the hot interior of stars. Through convective mixing, newly synthesized elements may be brought to the spectroscopically accessible surface. Experimental tests of element synthesis-mixing theories have been performed using high resolution low noise stellar spectra obtained at the W.J. McDonald Observatory.

Emphasis has been placed on several kinds of stars whose spectra suggest an anomalous chemical composition. A detailed analysis of a cool star with unusually weak lines of the CH molecule revealed that the atmosphere was severely contaminated with the products of the nuclear reaction network known as the CN bi-cycle. The spectrosopic evidence includes a low ratio of C to N and the ratio 12C/13C equals 4 which is equal to the predicted equilibrium ratio for the CN bi-cycle. It is proposed that such rare stars were mixed by meridional circulation induced by rapid rotation.

Analysis of profiles of MgH A2pi-X2zeta lines in the spectra of classical Barium stars show that the isotopic abundance ratios 24Mg/25Mg are terrestrial. Severe enhancements in the concentrations of heavy elements are attributed to irradiation by slow neutrons. The Mg isotope analysis shows that the neutron source is not 22Ne(alpha,n)25Mg but 13C(alpha,n)16O.

SUPPORTED BY Robert A. Welch Foundation

10.0030, EVOLUTION AND DYNAMICS OF EXPLODING STARS

J.C. Wheeler, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-07629 A01)

This research will be devoted to a study of the final phases of the evolution of a star. The collapse of the interior of a star will be investigated. The subsequent supernova explosion, if it occurs, and the effects of neutrino degeneracy and general relativity will be examined. The late stages of evolution of intermediate mass stars will be investigated. There will also be a study of the effects of supernovae explosions in the depths of dense molecular clouds.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0031, SPECTROSCOPY AND THEORY OF HERBIG-HARO OBJECTS AND OF ATMOSPHERES OF WHITE DWARF STARS

K. Bohm, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST76-22262 A01)

The research to be carried out will involve the very early and the very late stages of stellar evolution. Research on the very early stages of stellar evolution will be concerned with a study of the properties of the Herbig-Haro objects. These are objects which are believed to be stars in the very early stages of evolution. All known objects of this type are found within the boundaries of dark clouds. There will be a study of the spectra, the lifetimes, the geometrical size and the chemical abundances of these objects.

White dwarf stars, which represents a very late stage in the evolution of a star will be studied. Theoretical calculations on the atmospheres and envelopes of these stars will be made, and the effects of energy transfer in the atmospheres of the very cool white dwarf stars to be examined. The possible formation of a corona around white dwarf stars and the consequences of this theory on predictions of the soft X-ray and extreme ultraviolet fluxes emitted by these stars will be determined.

This is a continuation of work previously supported by NSF grant AST76-22262.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-26264*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
LOW-SPEED AIRSPEED CALIBRATION DATA FOR A SINGLE-ENGINE RESEARCH-SUPPORT AIRCRAFT
Bruce J. Holmes. Jun. 1980. 22 p. refs.
(NASA-TM-81832). Avail: NTIS. HC A02/MF A01. CSCL 01D.

A standard service airspeed system on a single engine research support airplane was calibrated by the trailing anemometer method. The effects of flaps, power, sideslip, and lag were evaluated. The factory supplied airspeed calibrations were not sufficiently accurate for high accuracy flight research applications. The trailing anemometer airspeed calibration was conducted to provide the capability to use the research support airplane to perform pace aircraft airspeed calibrations. Author

N80-26265# Transportation Research Board, Washington, D.C.
AVIATION FORECASTING, PLANNING, AND OPERATIONS
David E. Raphael, Adib Kanafani, Redha Behbehani, Huey-Shin Yuan, and Sergio Zuniga. 1979. 86 p. refs.
(PB80-154354; TRB/TRR-732; LC-80-11905;
ISBN-0-039-02987-2; ISSN-0361-1981). Avail: NTIS. HC A05/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418. CSCL 05C.

The overall business environment in aviation, markets and prices, completion and regulation, and operations and technology are addressed. Major emphasis is placed on the following: aviation forecast assumptions and discontinuities; forecasting airport traffic; and airport planning. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-26266*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
A COMPUTER PROGRAM TO GENERATE TWO-DIMENSIONAL GRIDS ABOUT AIRFOILS AND OTHER SHAPES BY THE USE OF POISSON'S EQUATION
Reese L. Sorenson. May 1980. 62 p. refs.
(NASA-TM-81198; A-8178). Avail: NTIS. HC A04/MF A01. CSCL 01A.

A method for generating two dimensional finite difference grids about airfoils and other shapes by the use of the Poisson differential equation is developed. The inhomogeneous terms are automatically chosen such that two important effects are imposed on the grid at both the inner and outer boundaries. The first effect is control of the spacing between mesh points along mesh lines intersecting the boundaries. The second effect is control of the angles with which mesh lines intersect the boundaries. A FORTRAN computer program has been written to use this method. A description of the program, a discussion of the control parameters, and a set of sample cases are included. E.D.K.

N80-26267*# Boeing Vertol Co., Philadelphia, Pa.
DESIGN AND ANALYTICAL STUDY OF A ROTOR AIRFOIL Final Report
L. U. Dadone. May 1978. 93 p. refs.
(Contract NAS1-14659).
(NASA-CR-2988; D210-11239-1). Avail: NTIS. HC A05/MF A01. CSCL 01A.

An airfoil section for use on helicopter rotor blades was defined and analyzed by means of potential flow/boundary layer interaction and viscous transonic flow methods to meet as closely as possible a set of advanced airfoil design objectives. The design efforts showed that the first priority objectives, including selected low speed pitching moment, maximum lift and drag divergence requirements can be met, though marginally. The maximum lift requirement at M = 0.5 and most of the profile drag objectives cannot be met without some compromise of at least one of the higher order priorities. Author

N80-26268*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
A COMPUTER PROGRAM FOR CALCULATING AERODYNAMIC CHARACTERISTICS OF LOW ASPECT-RATIO WINGS WITH PARTIAL LEADING-EDGE SEPARATION
Sudhir C. Mehrotra and C. Edward Lan. May 1978. 132 p.
(Grant NsG-1046).
(NASA-CR-145362; CRINC-FRL-266-2). Avail: NTIS. HC A07/MF A01. CSCL 01A.

The necessary information for using a computer program to predict distributed and total aerodynamic characteristics for low aspect ratio wings with partial leading-edge separation is presented. The flow is assumed to be steady and inviscid. The wing boundary condition is formulated by the Quasi-Vortex-Lattice method. The leading edge separated vortices are represented by discrete free vortex elements which are aligned with the local velocity vector at midpoints to satisfy the force free condition. The wake behind the trailing edge is also force free. The flow tangency boundary condition is satisfied on the wing, including the leading and trailing edges. The program is restricted to delta wings with zero thickness and no camber. It is written in FORTRAN language and runs on CDC 6600 computer. J.M.S.

N80-26269*# Aerospace Systems, Inc., Burlington, Mass.
STEADY, OSCILLATORY, AND UNSTEADY SUBSONIC AND SUPERSONIC AERODYNAMICS, PRODUCTION VERSION (SOUSSA-P 1.1). VOLUME 1: THEORETICAL MANUAL Final Report
Luigi Morino. Jan. 1980. 134 p.
(Contract NAS1-14977).
(NASA-CR-159130; ASI-TR-78-45-Vol-1). Avail: NTIS

HC A07/MF A01 CSCL 01A

Recent developments of the Green's function method and the computer program SOUSSA (Steady, Oscillatory, and Unsteady Subsonic and Supersonic Aerodynamics) are reviewed and summarized. Applying the Green's function method to the fully unsteady (transient) potential equation yields an integro-differential-delay equation. With spatial discretization by the finite-element method, this equation is approximated by a set of differential-delay equations in time. Time solution by Laplace transform yields a matrix relating the velocity potential to the normal wash. Premultiplying and postmultiplying by the matrices relating generalized forces to the potential and the normal wash to the generalized coordinates one obtains the matrix of the generalized aerodynamic forces. The frequency and mode-shape dependence of this matrix makes the program SOUSSA useful for multiple frequency and repeated mode-shape evaluations. A.R.H.

N80-26270*# Boeing Commercial Airplane Co., Seattle, Wash.
AN ADVANCED PANEL METHOD FOR ANALYSIS OF ARBITRARY CONFIGURATIONS IN UNSTEADY SUBSONIC FLOW Contractor Report, Mar. 1978 - Feb. 1980
Arthur R. Dusto and Michael A. Epton Feb. 1980 198 p refs
(Contract NAS2-7729)
(NASA-CR-152323; D6-48848) Avail: NTIS
HC A09/MF A01 CSCL 01A

An advanced method is presented for solving the linear integral equations for subsonic unsteady flow in three dimensions. The method is applicable to flows about arbitrary, nonplanar boundary surfaces undergoing small amplitude harmonic oscillations about their steady mean locations. The problem is formulated with a wake model wherein unsteady vorticity can be convected by the steady mean component of flow. The geometric location of the unsteady source and doublet distributions can be located on the actual surfaces of thick bodies in their steady mean locations. The method is an outgrowth of a recently developed steady flow panel method and employs the linear source and quadratic doublet splines of that method. Author

N80-26271# Naval Ship Research and Development Center, Annapolis, Md.
NUMERICAL OPTIMIZATION OF CIRCULATION CONTROL AIRFOILS Interim Report, Sep. 1978 - Dec. 1979
Tsze Tai, C., George H. Kidwell, Jr., and Garret N. Vanderplaats Apr. 1980 48 p refs
(DTNSRDC-80/060; Aero-1285) Avail: NTIS
HC A03/MF A01

A numerical procedure developed for optimizing the circulation control airfoils is presented. The procedure finds the optimum basic airfoil shapes subjected to specified flow conditions and geometric constraints. It consists of a numerical optimization code for linear constrained problems coupled with a viscous potential flow interaction analysis for necessary viscous inviscid flow field calculations. The desired airfoil shape is defined by a combination of baseline shapes representative of airfoils suitable for circulation control purpose. The coefficients of these basis vectors are then used as the design variables in the optimization process. Three baseline shapes (a cambered ellipse, a cambered ellipse with a drooped trailing edge, and cambered ellipse with a logarithmically spiralled trailing edge) are employed for special contouring of the trailing edge geometry. With some minor modification of the analysis method, the combined program allows optimization for maximum lift without substantial difficulty; but for minimizing the drag, further improvement of the analysis method is required. Author

N80-26272# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SCHLIEREN DIAGNOSTICS OF A HYPERSONIC GAS TARGET NEUTRON GENERATOR
A. A. Hassz and J. H. Lever Feb. 1980 71 p refs Sponsored by National Science and English Research Council of Canada
(UTIAS-242; ISSN-0082-5255) Avail: NTIS
HC A04/MF A01

The gasdynamic behavior of a planar model of the Los Alamos geometry hypersonic Gas Target Neutron Generator (GTNG) was investigated using Schlieren flow visualization photographs, static and total pressure and spill flow measurements. The model consisted of two symmetrical expansion nozzles with 220 microns throats producing a combined flow of about Mach 4 in the GTNG channel. Stagnation pressures of 100-800 kPa were used. Two basic flow configurations, spill line closed and spill line open, were studied in order to gain insight into the complex boundary layer development near the nozzle exit planes. Both flow configurations are discussed qualitatively, making use of the pressure measurements and theoretical analysis. Author

N80-26273# Weapons Systems Research Lab., Salisbury (Australia).
IMPROVEMENTS TO THE NSWC AERODYNAMICS PREDICTION PROGRAM OF PARTICULAR SIGNIFICANCE FOR BOMBS
Mar. 1980 19 p refs
(WSRL-0146-TR; AR-001-970) Avail: NTIS
HC A02/MF A01

Deficiencies in the Naval Surface Weapons Center missile aerodynamics prediction program were found. Effective corrections were devised. The boattail normal force at subsonic and transonic speeds was given. Normal force results were large in magnitude when the base diameter was small. A correction for boattail center of pressure was included. Due to fuses and lugs on bombs, allowances were devised for truncated nose viscous separation pressure drag at subsonic and transonic speeds, and for excrescence drag at all speeds. An allowance was made for viscous separation drag at the nose shoulder, at transonic speeds. A correction was included to account for the wave drag due to large amounts of nose blunting, including the region near the drag rise Mach number. B.D.

N80-26274*# Cincinnati Univ., Ohio.
A CALCULATION PROCEDURE FOR VISCOUS FLOW IN TURBOMACHINES, VOLUME 3
I. Khalil, Y. Sheoran, and W. Tabakoff Jun. 1980 46 p
(Contract NAS3-21609)
(NASA-CR-159864) Avail: NTIS HC A03/MF A01 CSCL 01A

A method for analyzing the nonadiabatic viscous flow through turbomachine blade passages was developed. The field analysis is based upon the numerical integration of the full incompressible Navier-Stokes equations, together with the energy equation on the blade-to-blade surface. A FORTRAN IV computer program was written based on this method. The numerical code used to solve the governing equations employs a nonorthogonal boundary fitted coordinate system. The flow may be axial, radial or mixed and there may be a change in stream channel thickness in the through-flow direction. The inputs required for two FORTRAN IV programs are presented. The first program considers laminar flows and the second can handle turbulent flows. Numerical examples are included to illustrate the use of the program, and to show the results that are obtained. A.R.H.

N80-26275*# National Aeronautics and Space Administration, Washington, D. C.
WORKS ON THEORY OF FLAPPING WING
V. V. Golubev Jun. 1980 140 p refs Transl. into ENGLISH from the book "Trudy po Teorii Mashushchego Kryla" Moscow, State Publishing House of Tech.-Theoret. Lit., 1957 p 399-569 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75750) Avail: NTIS HC A07/MF A01 CSCL 01B

It is shown mathematically that taking account of the boundary layer is the only way to develop a theory of flapping wings without violating the basic observations and mathematics of hydromechanics. A theory of thrust generation by flapping wings can be developed if the conventional downstream velocity discontinuity surface is replaced with the observed Karman type vortex streets behind a flapping wing. Experiments show that the direction of such vortices is the reverse of that of conventional Karman streets. The streets form by breakdown of the boundary layer. Detailed analysis of the movements of certain birds and insects during flight "in place" is fully consistent with this theory of the lift, thrust and drag of flapping wings. Further directions for research into flight with flapping wings are indicated. Author

N80-26276# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Computational Aerodynamics Group.
RESEARCH IN COMPUTATIONAL AERODYNAMICS Final Report, Jul. 1976 - Sep. 1979
W. L. Hankey Feb. 1980 38 p refs
(AF Proj. 2307)
(AD-A083242; AFFDL-TR-79-3127) Avail: NTIS
HC A03/MF A01 CSCL 20/4

Experience obtained by the Computational Aerodynamics Group, WPAFB, in numerically solving viscous flow problems with the Navier-Stokes equations shall be addressed. Topics discussed include grid generation for arbitrary geometries, numerical instabilities, turbulence models, accuracy, efficiency, and smearing of discontinuities. Applications are reported for the method to solve shock wave-boundary layer interactions, 3D interactions, inlets and nozzle flow fields and unsteady viscous flows. GRA

N80-26277# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Analysis and Optimization Branch.
UNSTEADY PRESSURE MEASUREMENTS ON OSCILLATING MODELS IN EUROPEAN WIND TUNNELS
James J. Olsen Mar. 1980 83 p refs
(AF Proj. 2307)
(AD-A083248; AFWAL-TM-80-1-FIBR) Avail: NTIS
HC A05/MF A01 CSCL 20/4

The purpose of this report is to summarize the broad aspects of the aerodynamic tests that have been performed over the last twenty years on oscillating bodies and wings in European wind tunnels. While an extensive list of references is available in the open literature, there does not seem to be a general awareness in the United States government or aerospace industry of the intensity and diversity of European efforts. This report gives the background of the development of the major European testing facilities and illustrates the payoffs that have been accrued in the Netherlands, Germany, France and England. GRA

N80-26278# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SUPERSONIC WIND TUNNEL MEASUREMENTS OF STATIC AND MAGNUS AERODYNAMIC COEFFICIENTS FOR PROJECTILE SHAPES WITH TANGET AND SECANT OGIVE NOSES Final Report
Charles J. Nietubicz and Klaus O. Palka Feb. 1980 69 p refs
(DA Proj. 1L6-62618-AH-80)
(AD-A083297; AD-E430401; ARBRL-MR-02991) Avail: NTIS
HC A04/MF A01 CSCL 20/4

Wind tunnel tests have been conducted for a series of projectile configurations. The shapes tested include a three caliber secant ogive nose and three caliber tangent ogive nose configuration. The overall model length was fixed at 6 calibers for all configurations tested. Static and Magnus aerodynamic coefficient data were obtained at Mach numbers 2.0, 3.0 and 4.0 for angles of attack up to 10.0 deg. The data are presented in graphical form along with tabulations of the summary data. The tangent ogive nose produced a slight increase in the Magnus moment coefficient when compared to similar secant ogive configurations. The boattail configuration, when compared to the cylinder shapes, was found to increase the Magnus moment; however, this effect was shown to decrease with increasing Mach number. GRA

N80-26279# ARO, Inc., Arnold Air Force Station, Tenn.
INFLUENCE OF WIND TUNNEL NOISE ON THE LOCATION OF BOUNDARY-LAYER TRANSITION ON A SLENDER CONE AT MACH NUMBERS FROM 0.2 TO 5.5. VOLUME 1: EXPERIMENTAL METHODS AND SUMMARY OF RESULTS Final Report, 28 Jan. 1970 - 28 Apr. 1977
N. Sam Dougherty, Jr. Mar. 1980 52 p refs
(AD-A083165; AEDC-TR-78-44-Vol-1) Avail: NTIS
HC A04/MF A01 CSCL 20/4

A study was conducted to investigate the effects of wind tunnel noise on the location of boundary layer transition. The study was carried out by conducting experiments on a particular slender, highly polished cone having an included angle of 10 deg. Wind tunnel noise levels were measured in the test section by flush mounted microphones imbedded in the cone surface. The measurement of boundary layer transition location was made using either a traversing pitot pressure probe in contact with the cone surface or the flush mounted microphones. The experiments were carried out in 23 different subsonic, transonic, and supersonic wind tunnels over a range of Mach numbers from 0.2 to 5.5 and a unit Reynolds number range from 1.0 to 7.0 million per foot, the bulk of the data being obtained for a range from 2.0 to 4.0 million per foot. The results clearly show a strong influence of wind tunnel noise on boundary layer transition location correlatable with overall root mean square noise levels. Because the noise level generally varied with Mach number and unit Reynolds number, the unit Reynolds number was found to have little effect on transition Reynolds number. GRA

N80-26280# ARO, Inc., Arnold Air Force Station, Tenn.
INFLUENCE OF WIND TUNNEL NOISE ON THE LOCATION OF BOUNDARY-LAYER TRANSITION ON A SLENDER CONE AT MACH NUMBERS FROM 0.2 TO 5.5. VOLUME 2: TABULATED AND PLOTTED DATA Final Report, 28 Jan. 1970 - 28 Apr. 1977
N. Sam Dougherty, Jr. Mar. 1980 249 p refs
(AD-A083166; AEDC-TR-78-44-Vol-2) Avail: NTIS
HC A11/MF A01 CSCL 20/4

A study was conducted to investigate the effects of wind tunnel test section noise on the location of boundary-layer transition. The study was carried out by conducting experiments on a slender, highly polished cone with an included angle of 10 deg. Wind tunnel test section noise was measured by microphones flush-mounted on the cone surface. In most of the experiments, boundary-layer transition was measured with a surface-mounted, traversing pitot pressure probe. The experiments were conducted in 23 different subsonic, transonic, and supersonic wind tunnels over a Mach number range from 0.2 to 5.5 and a unit Reynolds number range from 1.0 to 7.0 million per foot, the bulk of the data being obtained between 2.0 and 4.0 million per foot. The results show an influence of wind tunnel noise on boundary-layer transition for most of the wind tunnels. GRA

N80-26281# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AERODYNAMICS IN THE NEIGHBORHOOD OF A ROTATING SPOILER B.S. Thesis
W. U. Leong and I. Tsangoulis Jun. 1979 87 p refs
(BU-232) Avail: NTIS HC A05/MF A01

The aerodynamic characteristics of a three dimensional spoiler with controllable rotary speed are investigated using three different flow visualization techniques and pressure measurements. Both vented and unvented spoilers with ratios of free stream speed to spoiler tip speeds of 126 or less were studied. Results indicate that the spoiler aerodynamic hinge force is directly related to the opening rate, but the maximum static force is related only to free stream speed. The size of a separation bubble behind the unvented spoiler also depended on opening rate, but was unrelated to free stream speed in the range tested.Author (ESA)

N80-26282# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Environmental and Applied Fluid Dynamics Dept.
ANALYTICAL MODELING OF MEAN PRESSURE DISTRIBUTION AROUND A TWO-DIMENSIONAL CIRCULAR CYLINDER AT HIGH REYNOLDS NUMBERS
J. P. Borleteau, D. Livani, and A. Turi Sep. 1979 28 p refs
(VKI-TN-134) Avail: NTIS HC A03/MF A01

Two analytical models which describe the mean flow pressure distribution around a two dimensional circular cylinder at high Reynolds numbers are presented. The first model reproduces the cylinder and the wake region using a conformal mapping technique, whereas the second model describes the cylinder and the wake boundaries by linear segments of distributed vorticity (panel method). Neither model considers the flow field within the wake region. Only the external potential flow is studied. The input data for the two models, namely the base pressure and the position of the separation point, are provided by experimental results which are also compared with the computed pressure distribution. Both models lead to a computed pressure distribution which is generally in good agreement with the experimental data when considering a smooth cylinder. However, only the second model provides satisfactory matching in the case of cylinders with surface roughness where the boundary layer thickness has a strong influence on the location and the

level of the peak suction as well as on the pressure rise which follows up to separation. The second model allows the boundary layer effects to be taken into account by adding to the geometrical shape of the cylinder the displacement thickness of the layer.
Author (ESA)

N80-26283# Royal Aircraft Establishment, Farnborough (England).
THE FORM OF THE SOLUTIONS OF THE LINEAR INTEGRO-DIFFERENTIAL EQUATIONS OF SUBSONIC AEROELASTICITY
D. L. Woodcock London HMSO Sep. 1979 48 p refs
(RAE-TM-Struct-956; BR70935) Avail: NTIS HC A03/MF A01

The solution of the subsonic flutter problem, when the commonly used linear differential equation model is replaced by the more correct linear integro-differential equation model, is studied, and the nature of the system's free motion established. The different forms appropriate to two dimensional and three dimensional flow, and to the cases when the system has a zero characteristic value, are developed in detail. It is shown that, for large time t, the behavior can variously be like 1, 1/log t, 1/tsq, 1/tcu.
Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-26284*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FUSELAGE VENTILATION DUE TO WIND FLOW ABOUT A POSTCRASH AIRCRAFT
Jay W. Stuart 15 Jun. 1980 26 p refs
(Contract NAS7-100)
(NASA-CR-163273; JPL-Pub-80-36) Avail: NTIS HC A03/MF A01 CSCL 01C

Postcrash aircraft fuselage fire development, dependent on the internal and external fluid dynamics is discussed. The natural ventilation rate, a major factor in the internal flow patterns and fire development is reviewed. The flow about the fuselage as affected by the wind and external fire is studied. An analysis was performend which estimated the rates of ventilation produced by the wind for a limited idealized environmental configuration. The simulation utilizes the empirical pressure coefficient distribution of an infinite circular cylinder near a wall with its boundary later flow to represent the atmospheric boundary layer. The resulting maximum ventilation rate for two door size openings, with varying circumferential location in a common 10 mph wind was an order of magnitude greater than the forced ventilation specified in full scale fire testing. The parameter discussed are: (1) fuselage size and shape, (2) fuselage orientation and proximity to the ground, (3) fuselage-openings size and location, (4) wind speed and direction, and (5) induced flow of the external fire plume is recommended. The fire testing should be conducted to a maximum ventilation rate at least an order of magnitude greater than the inflight air conditioning rates.
B.D.

N80-26285*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
PRELIMINARY RESULTS OF SIMULATED VORTEX ENCOUNTERS BY A TWIN-ENGINE, COMMERCIAL AIRCRAFT DURING FINAL LANDING APPROACH
Earl C. Hastings, Jr., G. Thomas Holbrook, and Gerald L. Keyser, Jr. May 1980 56 p refs
(NASA-TM-81782) Avail: NTIS HC A04/MF A01 CSCL 01C

Piloted simulations of encounters with vortices of various ages and degrees of attenuation were performed with the Visual Motion Simulator. In the simulations, a twin engine, commercial transport on final approach, encountered the modeled vortices of a four engine, wide body, commercial transport. The data show the effect of vortex age and attenuation on the severity of the initial upset, as well as the effect of the vortex encounters on the landing capability.
Author

N80-26286# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AVIATION ISSUE NUMBER 8, 1979 ACCIDENTS
25 Jun. 1980 170 p
(NTSB-BA-80-5) Avail: NTIS HC A08/MF A01

Three hundred general aviation aircraft accident reports, occurring in the U.S. civil aviation operations during calendar year 1979 are discussed. The facts, conditions, circumstances, and probable cause (s) for each accident are studied. Additional statistical information is tabulated by injury index injuries and causal factors.
B.D.

N80-26287# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: COMAIR, INC., PIPER PA-31-310, NAVAJO, N6642L, GREATER CINCINNATI AIRPORT, COVINGTON, KENTUCKY, 8 OCTOBER 1979
28 May 1980 36 p
(NTSB-AAR-80-8) Avail: NTIS HC A03/MF A01

On October 8, 1979, at 1008:26, COMAIR, Inc., Flight 444, a Piper PA31-310, with a pilot and seven passengers on board, crashed on takeoff from runway 18 at the Greater Cincinnati Airport, Covington, Kentucky. The pilot and the seven passengers on board were killed, and the aircraft was distroyed. After 1,500 to 2,000 ft of takeoff roll, the aircraft lifted off abruptly and climbed slowly to about 150 ft above the runway. Following liftoff, the pilot reported a loss of power from an engine, and the tower controller cleared the pilot to return and land. Seconds later, the aircraft rolled to the right to an inverted position and dove, nose first, to the ground. The National Transportation Safety Board determines that the probable cause of the accident was the loss of control following a partial loss of power immediately after liftoff. The accident could have been avoided if either the pilot had rejected the takeoff or had raised the landing gear and flaps. His failure to take decisive action may have been due to preoccupation with correcting the malfunction, and a lack of familiarity with the aircraft and with its emergency procedures. Contributing to the accident was the pilot's inexperience in multiengine aircraft, a hurried departure, inadequate training, inexperienced company management, and ineffective FAA certification and surveillance of the operator.
Author

N80-26288# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Technical and Resources Management Div.
AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS: ESCAPE, RESCUE AND SURVIVAL Annual Report
D. C. Kittinger Feb. 1980 34 p Supersedes ASD-TR-79-5038
(AD-A083552; ASD-TR-80-5010; ASD-TR-79-5038) Avail: NTIS HC A03/MF A01 CSCL 06/7

This report is a part of a compilation of formalized Technology Needs (TN) covering Equipment Subsystems as identified in the Aeronautical Systems Division. They are based on development/operational experience, systems studies and new concepts - all related to future system applications. Their presentation is to serve a threefold purpose; i.e., (1) guidance for technology program, (2) proven developmental potential, and (3) engineering data/requirements essential for technology use in systems. The identified needs delineate progress desired in performance, control, design flexibility, safety and cost.
GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-26289# Megatek Corp., San Diego, Calif.
OMEGA HAWAII ANTENNA SYSTEM: MODIFICATION

AND VALIDATION TESTS. VOLUME 1: REPORT PROPER
Final Report
J. C. Hanselman 19 Oct. 1979 143 p
(Contract N00123-78-C-0043)
(AD-A082114; NOSC-TR-493-Vol-1) Avail: NTIS
HC A07/MF A01 CSCL 17/7

Electronic measurements were performed on the Hawaii Omega Antenna System during the months of May and June 1978 and March and May 1979. The work was performed under NOSC Project MP015 B10 with Megatek as contractor. The electrical height of the antenna is 169 metres for all frequencies. The station can easily radiate more than 10 kW on all frequencies. There is no measurable deviation from omnidirectional radiation due to the proximity of the Haiku Valley walls to the south, west, and north of the antenna. The apparent capacitance of the antenna was measured. Also, the inductance of the spare variometer and its variation was measured. From these preliminary measurements, the optimum location of the 11.050 kHz helix tap was determined and connected. The value of the antenna system's resistance was measured on three days of different weather conditions and found to vary. This variation is related to the degree of salt deposit on the antenna insulators. A recommended set of gear ratios for the variometer gear boxes is determined. GRA

N80-26290# Megatek Corp., San Diego, Calif.
OMEGA HAWAII ANTENNA SYSTEM: MODIFICATION AND VALIDATION TESTS. VOLUME 2: DATA SHEETS
Final Report
J. C. Hanselman 19 Oct. 1979 112 p
(Contract N00123-78-C-0043)
(AD-A082115; NOSC-TR-493-VOl-2) Avail: NTIS
HC A06/MF A01 CSCL 17/7

During the performance of modification and validation tests at OMEGA Hawaii, data and all pertinent information collected were recorded on appropriate data sheets. Data sheets designed to facilitate analysis and computation of desired operating parameters are presented. E.D.K.

N80-26291# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE 29TH GUIDANCE AND CONTROL PANEL SYMPOSIUM ON AIR TRAFFIC MANAGEMENT. CIVIL/MILITARY SYSTEMS AND TECHNOLOGIES
C. deBruyn (Liege Univ., Belgium) Mar. 1980 20 p Symp. held at Copenhagen, 9-12 Oct. 1979
(AGARD-AR-149; ISBN-92-835-1356-8) Avail: NTIS
HC A02/MF A01

Air traffic control is considered as a joint civil/military system with emphasis on the caom compatibility, the coordination, and the complementary aspects of the civil and military components. The adequacy of those ATC concepts in current use is discussed and recent advances in technology are reviewed. J.M.S.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-26292# National Inst. for Aeronautics and Systems Technology, Pretoria (South Africa).
THE ANALYTICAL PREDICTION OF THE SEPARATION BEHAVIOUR OF EXTERNAL STORES AFTER RELEASE FROM THE CARRIER AIRCRAFT. PART 2: APPLICATIONS
G. J. vandenBroek Aug. 1979 225 p refs
(CSIR-NIAST-79/103-Pt-2; ISBN-0-7988-1650-3) Avail: NTIS
HC A10/MF A01

An analytical store separation prediction method was developed. The method is based on inviscid linear potential theory for subsonic and supersonic flow. The aircraft and external store are divided into a large number of panels, each of which contains an aerodynamic singularity distribution. Source and vortex distributions are used. The strengths of the singularities are determined and the store loads obtained. The store loads are combined with the six-degree-of-freedom equations of motion to provide the separation characteristics of the store. Various aspects of the computational method are investigated in considerable detail. Approximative schemes are studied to speed up the calculations, resulting in an economical separation prediction method. Extensive comparisons with experimental data regarding the various aspects of the computational method, are included. In general, satisfactory agreement is observed. Areas for improvement are defined. F.O.S.

N80-26293*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.
DESIGN STUDIES OF LAMINAR FLOW CONTROL (LFC) WING CONCEPTS USING SUPERPLASTICS FORMING AND DIFFUSION BONDING (SPF/DB) Final Report, Aug. 1978 - Sep. 1979
Vernon E. Wilson May 1980 114 p refs
(Contract NAS1-15488)
(NASA-CR-159220) Avail: NTIS HC A06/MF A01 CSCL 01C

Alternate concepts and design approaches were developed for suction panels and techniques were defined for integrating these panel designs into a complete LFC 200R wing. The design concepts and approaches were analyzed to assure that they would meet the strength, stability, and internal volume requirements. Cost and weight comparisions of the concepts were also made. Problems of integrating the concepts into a complete aircraft system were addressed. Methods for making splices both chordwise and spanwise, fuel light joints, and internal duct installations were developed. Manufacturing problems such as slot alignment, tapered slot spacing, production methods, and repair techniques were addressed. An assessment of the program was used to developed recommendations for additional research in the development of SPF/DB for LFC structure. E.D.K.

N80-26294# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
EVOLUTION OF MATERIALS AND ASSOCIATED TECHNOLOGIES IN AEROSPACE MATERIAL STRUCTURES [EVOLUTION DES MATERIAUX ET DES TECHNOLOGIES ASSOCIEES DANS LES STRUCTURES DE MATERIALS AEROSPATIAUX]
G. Sertour and G. Hilaire 30 May 1979 57 p In FRENCH Presented at 14th Congr. Intern. Aeron., Paris, 6-8 Jun. 1979
(SNIAS-792-551-106) Avail: NTIS HC A04/MF A01

A brief history of developments is given. Specific topics examined include: propagation of fatigue cracks, stress corrosion, aluminum alloy forming processes, and composite materials. Selected applications are illustrated: tanks for the 1st stage of Ariane, structures of the Mirage 2000, Concorde and Airbus a 300B aircraft and Intelsat 5, Marecs antenna, a rigid solar generator, Ariane's double launching system, composite carbon-carbon materials with multidirectional armatures, and a Kevlar coil for a propulsion device. Author (ESA)

N80-26295# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
QUALITY OF NONMETALLIC MATERIALS [QUALITE DES MATERIAUX NON METALLIQUES]
G. Hilaire 28 Aug. 1979 38 p In FRENCH Presented at Forum Intern. Mater. Composites, Collage et Adhesion, Lyon, 11-14 Sep. 1979
(SNIAS-792-551-108) Avail: NTIS HC A03/MF A01

Some philosophical and practical considerations are put forward concerning the difficulties of ensuring adequate quality control. Relevant parameters are defined. Composition, guarantees as far as raw materials are concerned, and manufacturing procedures are discussed. Fabrication parameters (ambient conditions, polymerization conditions, manufacturing time) are examined together with the qualities of individual manufactured parts, failure probabilities and the nondestructive testing procedures employed. The results of some specific tests and experiments are given. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-26296*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HEAD-UP DISPLAY IN THE NON-PRECISION APPROACH
J. M. Naish May 1980 20 p refs
(NASA-TM-81167; A-8061) Avail: NTIS HC A02/MF A01 CSCL 01D

The problem of head-up guidance for an aircraft making an instrument approach without glide slope information is discussed. Requirements for path control are considered for each section of the approach profile and a head-up display is developed to meet these needs. The display is an unreferenced flight director which is modified by adding a ground referenced symbol as an alternative guidance component. The director is used for holding altitude in the first segment and for descent at a controlled rate in the second segment. It is used in the third segment to maintain the minimum decision altitude while assessing the approach situation. This is done by means of occasional brief changes to the referenced symbol. In the final segment a visual approach is made with the referenced symbol used continuously for path control. The display is investigated experimentally in simulated approaches made by three pilots. The results show a fair agreement between objective and subjective estimates of the quality of landing decisions. E.D.K.

N80-26297*# Old Dominion Univ. Research Foundation, Norfolk, Va.
EXPERIMENTAL AND ANALYTICAL STUDIES OF A TRUE AIRSPEED SENSOR Final Report, period ending 29 Feb. 1980
G. L. Goglia and J. Y. Shen Jun 1980 173 p refs
(Grant NsG-1177)
(NASA-CR-163261) Avail: NTIS HC A08/MF A01 CSCL 10D

A true airspeed sensor having a flow phenomenon which is the vortex precession or the vortex whistle, no moving parts, and is independent of temperature, density, altitude, or humidity changes is proposed. The designed sensor consists basically of a vortex tube, a swirler, and a pickup system. When air passes through the swirler a precessional flow is generated at the region before and after the sudden enlargement area. An audible vortex whistle is generated; the signal picked up by the microphone, and the frequency response shown in a frequency counter. Measurements for both the closed conduit test and wind tunnel test are recorded. A computer is used to obtain the numerical solution. For a specific flow rate or airspeed, the larger the exit swirler angle, the greater the frequency response. For a smaller cross sectional area at a precessional flow region, the frequency response is higher. As the airspeed is increased the Strouhal number, dependent only on the exit angle of the swirler, remains constant. E.D.K.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-26298* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REDUCTION OF NITRIC OXIDE EMISSIONS FROM A COMBUSTOR Patent
Roger A. Craig and Huw O. Pritchard, inventors (to NASA) Issued 27 May 1980 6 p Filed 8 Sep. 1977 Supersedes N77-31260 (15 - 22, p 2912) Continuation of abandoned US Patent Appl. SN-684045, filed 7 May 1976
(NASA-Case-ARC-10814-2; US-Patent-4,204,402; US-Patent-Appl-SN-831632; US-Patent-Class-60-39.06; US-Patent-Class-60-733; US-Patent-Class-60-746; US-Patent-Appl-SN-684045) Avail: US Patent and Trademark Office CSCL 21E

A turbojet combustor and method for controlling nitric oxide emissions by employing successive combustion zones is described. After combustion of an initial portion of the fuel in a primary combustion zone, the combustion products of the primary zone are combined with the remaining portion of fuel and additional plenum air and burned in a secondary combustion zone under conditions that result in low nitric oxide emissions. Low nitric oxide emissions are achieved by a novel turbojet combustor arrangement which provides flame stability by allowing stable combustion to be accompanied by low nitric oxide emissions resulting from controlled fuel-lean combustion (ignited by the emission products from the primary zone) in a secondary combustion zone at a lower combustion temperature resulting in low emission of nitric oxide.

Official Gazette of the U.S. Patent and Trademark Office

N80-26299*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DURABILITY TESTS OF SOLENOID VALVES FOR DIGITAL ACTUATORS
A. N. Baez Jun. 1980 11 p refs
(NASA-TM-81522; E-466) HC A02/MF A01 CSCL 21E

The durability of various materials used to make solenoid valve poppets and seats was investigated. Six different poppet materials and two seat materials were considered. Each material was tested for over 100 million cycles. Serious damage was found in four kinds of poppet materials tested. Less damage was evident in an aluminum poppet and in graphite composite poppet. The graphite composite poppet in combination with a Vespel seat was considered the most promising combination for use in digital electronic controls for gas turbine engines. E.D.K.

N80-26300*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
EXPERIMENTAL AERODYNAMIC AND ACOUSTIC MODEL TESTING OF THE VARIABLE CYCLE ENGINE (VCE) TESTBED COANNULAR EXHAUST NOZZLE SYSTEM
D. P. Nelson and P. M. Morris 15 Jun. 1980 83 p
(Contract NAS3-20061)
(NASA-CR-159710; PWA-5550-31) Avail: NTIS HC A05/MF A01 CSCL 21E

Aerodynamic performance and jet noise characteristics of a one sixth scale model of the variable cycle engine testbed exhaust system were obtained in a series of static tests over a range of simulated engine operating conditions. Model acoustic data were acquired. Data were compared to predictions of coannular model nozzle performance. The model, tested with and without a hardwall ejector, had a total flow area equivalent to a 0.127 meter (5 inch) diameter conical nozzle with a 0.65 fan to primary nozzle area ratio and a 0.82 fan nozzle radius ratio. Fan stream temperatures and velocities were varied from 422 K to 1089 K (760 R to 1960 R) and 434 to 755 meters per second (1423 to 2477 feet per second). Primary stream properties were varied from 589 to 1089 K (1060 R to 1960 R) and 353 to 600 meters per second (1158 to 1968 feet per second). Exhaust plume velocity surveys were conducted at one operating condition with and without the ejector installed. Thirty aerodynamic performance data points were obtained with an unheated air supply. Fan nozzle pressure ratio was varied from 1.8 to 3.2 at a constant primary pressure ratio of 1.6; primary pressure ratio was varied from 1.4 to 2.4 while holding fan pressure ratio constant at 2.4. Operation with the ejector increased nozzle thrust coefficient 0.2 to 0.4 percent. B.D.

N80-26301*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
EXPERIMENTAL AERODYNAMIC AND ACOUSTIC MODEL TESTING OF THE VARIABLE CYCLE ENGINE (VCE) TESTBED COANNULAR EXHAUST NOZZLE SYSTEM: COMPREHENSIVE DATA REPORT
D. P. Nelson and P. M. Morris Jun. 1980 225 p

(Contract NAS3-20061)
(NASA-CR-159711; PWA-5550-40) Avail: NTIS HC A10/MF A01 CSCL 21E

The component detail design drawings of the one sixth scale model of the variable cycle engine testbed demonstrator exhaust syatem tested are presented. Also provided are the basic acoustic and aerodynamic data acquired during the experimental model tests. The model drawings, an index to the acoustic data, an index to the aerodynamic data, tabulated and graphical acoustic data, and the tabulated aerodynamic data and graphs are discussed. B.D.

N80-26302*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

CF6 JET ENGINE PERFORMANCE IMPROVEMENT PROGRAM: HIGH PRESSURE TURBINE AERODYNAMIC PERFORMANCE IMPROVEMENT

W. A. Fasching Jul. 1980 156 p refs
(Contract NAS3-20629)
(NASA-CR-159832) Avail: NTIS HC A08/MF A01 CSCL 21E

The improved single shank high pressure turbine design was evaluated in component tests consisting of performance, heat transfer and mechanical tests, and in core engine tests. The instrumented core engine test verified the thermal, mechanical, and aeromechanical characteristics of the improved turbine design. An endurance test subjected the improved single shank turbine to 1000 simulated flight cycles, the equivalent of approximately 3000 hours of typical airline service. Initial back-to-back engine tests demonstrated an improvement in cruise sfc of 1.3% and a reduction in exhaust gas temperature of 10 C. An additional improvement of 0.3% in cruise sfc and 6 C in EGT is projected for long service engines. Author

N80-26303# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

THEORETICAL PERFORMANCE FOR NON-STATIC EJECTOR THRUST AUGMENTORS Final Report, Feb. - Sep. 1979

James S. Petty Jan. 1980 54 p
(AF Proj. 3066)
(AD-A083246; AFAPL-TR-79-2120) Avail: NTIS HC A04/MF A01 CSCL 21/5

An analytical study was performed to determine the theoretical limits on the performance of nonstatic ejector thrust augmentors. Idealizing assumptions were made, such as inviscid compressible working fluids, isentropic flows in inlets, diffusers, nozzles and ducts, constant pressure mixing, and thermally and calorically perfect fluids. By ignoring details of the primary flow 'pump', the performance of ejector augmentors was found in terms of three parameters (the secondary/primary mass flow ratio, a pressure parameter and a temperature parameter) in a form which was not an explicit function of the flight Mach number. It was also shown that multi-stage ejectors offered no performance improvement over ideal single-stage ejectors. Two primary 'pump' devices, a turbine engine gas generator and an isentropic compressor, were considered. With them, the Mach number dependent behavior of ideal ejectors was determined. As a result of this study, the following conclusions were drawn: (1) the performance of ideal ejector is severely degraded by increasing the primary fluid temperature, (2) the performance of ideal ejectors is degraded faster than that of ideal turbofans as the flight Mach number is increased, (3) neither the turbine engine nor the isentropic compressor is a suitable 'pump' for ideal ejectors, except at very low Mach numbers, and (4) ejector augmentors should be most useful for low flight speed applications; e.g., V/STOL. GRA

N80-26304# Boeing Aerospace Co., Seattle, Wash. Boeing Military Airplane Development.

PIPSI/NAVY RAPID EVALUATION OF PROPULSION SYSTEM EFFECTS FOR THE NAVY GAS TURBINE ENGINE CODE NEPCOMP Final Report, 28 Jun. - 11 Oct. 1979

W. H. Ball 11 Oct. 1979 58 p refs
(Contract N62269-79-C-0278)
(AD-A083172; NADC-TM-79081-60) Avail: NTIS HC A04/MF A01 CSCL 21/5

This report describes the work accomplished during a fourteen-week contract to modify two existing interactive computer programs for calculating installed engine performance, including inlet and nozzle corrections and to demonstrate their use for the NADC. GRA

N80-26305# Naval Air Test Center, Patuxent River, Md. Strike Aircraft Test Directorate.

A COMPREHENSIVE APPROACH IN-FLIGHT THRUST DETERMINATION

Paul W. Chapin 15 Feb. 1980 22 p
(AD-A081511; NATC-TM-3-SA) Avail: NTIS HC A02/MF A01 CSCL 21/5

A systematic, comprehensive approach was used recently to develop an in-flight thrust computational routine for a mixed-flow, dual spool, augmented turbofan engine with a variable area convergent-divergent exhaust nozzle. To provide an insight for the necessity of this approach, a brief historical background of in-flight thrust measurement is presented and classical nozzle theory is discussed briefly. The development of the computational routine is discussed and some general test planning guidelines are presented. GRA

N80-26306# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

ADVANCED CONTROL SYSTEMS FOR AIRCRAFT POWERPLANTS

Feb. 1980 226 p refs Partly in ENGLISH and FRENCH
Presented at the 54th Propulsion and Energetics Panel Specialist's Meeting, Cologne, 1-2 Oct. 1979
(AGARD-CP-274; ISBN-92-835-0258-2) Avail: NTIS HC A11/MF A01

Control systems for aircraft power units are discussed. Areas of consideration are: development experience; control implementation; optimum control strategies; and digital control concepts. For individual titles, see N80-26307 through N80-26325.

N80-26307*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE SHUTTLE MAIN ENGINE DIGITAL CONTROLLER

Walter T. Mitchell *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 11 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

The controller provides responsive control of engine thrust and mixture ratio through the digital computer in the controller, updating the instructions to the engine control elements 50 times per second (every 20 milliseconds). Additionally, precise engine performance is achieved through closed loop control, utilizing 16 bit computation, 10 bit input/output resolution, and self calibrating analog-to-digital conversion. Engine reliability is enhanced by a dual redundant control system that allows normal operation after the first failure and a fail-safe shutdown after a second failure. The digital computer is programmable, allowing modification of engine control equations and constants by change of the stored program (software). The controller is packaged in a sealed, pressurized chassis with cooling provided by convection heat transfer through pin fins as part of the main chassis. The electronics are distributed on functional modules having special provisions for thermal and vibrational protection. R.C.T.

N80-26308# Rolls-Royce Ltd., Bristol (England).

EXPERIMENTAL FULL-AUTHORITY DIGITAL ENGINE CONTROL ON CONCORDE

J. McNamara, C. G. Legge, and E. Roberts (Sperry Gyroscope Co., Great Neck, N.Y.) *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 17 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The first ever flight standard full-authority digital engine controller is described. As well as the existing dry engine control and monitoring functions, the controller incorporated reheat control, fault recording and ground-check, and fitted into the same volume as the existing analogue dry engine controller. Particular emphasis is given to computer monitoring techniques and the production of high-integrity software. R.C.T.

N80-26309# VDO-Luftfahrtgeraete Werk Adolf Schindling G.m.b.H., Frankfurt (West Germany).

THE SECONDARY POWER SYSTEM CONTROL UNIT, AND ELECTRONIC SUBSYSTEM IN THE PANAVIA TORNADO
W. Bender *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 8 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The Secondary Power System Control Unit is discussed with emphasis on system configuration. The automatic starting cycle of the APU operation of the accessory drive gearboxes under well defined speed and acceleration conditions as well as the starting phase of the aircraft engines are described. R.C.T.

N80-26310# Bendix Corp., South Bend, Ind. Electronic Controls Div.
CONCURRENT DEVELOPMENT AND TEST OF A DIGITAL ELECTRONIC CONTROLLER WITH AN ADVANCED VARIABLE CYCLE ENGINE
Richard W. Cording and Frank J. OKeefe *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 10 p Prepared in cooperation with Detroit Diesel Allison, Indianapolis, Ind. (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The need for high performance systems with wide operating envelopes is discussed with respect to the design of advanced technology variable cycle engines. A program is described in which full authority digital electronic controller is used as a tool in the development of an advanced technology variable cycle engine. The problems and advantages associated with an advanced variable cycle engine are highlighted in a discussion of the control system development. R.C.T.

N80-26311# Societe Microturbo, Toulouse (France).
A NEW FUEL SUPPLY CONTROL SYSTEM FOR SMALL TURBOMACHINES [NOUVEAU SYSTEME DE COMMANDE DE DEBIT DE CARBURANT POUR PETITES TURBOMACHINES]
F. Arnaud, J. Gonzales, and B. Secher *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 13 p In FRENCH (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Small turbomachines used as starting systems or as autonomous power groups require specific devices for controlling fuel flow. The constraints proper to these turbomachines and the different solutions possible are reviewed. The underlying principle and operations are described for an original system which is composed of an electropump whose speed can be varied by an electronic device and a simplified pressure differential regulator. The main problems encountered in two particular applications are discussed. Transl. by A.R.H.

N80-26312# Plessey Aerospace Ltd., Titchfield (England).
TRANSDUCERS FOR ENGINE CONTROL SYSTEMS
G. E. Davies *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 12 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Some active fluidic transducers which measure the fundamental nondimensional quantities required for engine control systems are described. The use of these transducers offers a true nondimensional measurement of engine performance and allows the system designer a freer choice of control parameters. R.C.T.

N80-26313# Pierburg Luftfahrtgeraete Union G.m.b.H., Neuss (West Germany).
A COMBINED PARALLEL-DIGITAL AND PULSE-DURATION MODULATED FUEL METERING SYSTEM
H. Holzem *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 6 p refs (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

A fuel metering system is presented which is controlled parallel-digitally by a computer. This system is preferably suited for small and medium size engines. High accuracy requirements coupled with both robust and simple construction are met. The design and functional description is supplemented by the laboratory test results so far achieved. R.C.T.

N80-26314# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Suresnes (France).
THE APPLICATION OF MICROPROCESSORS TO THE REGULATION OF MILITARY AIRCRAFT ENGINES: THE DESIGN OF ELECTRONIC REGULATORS [APPLICATION DES MICROPROCESSEURS A LA REGULATION DES MOTEURS D'AVIONS MILITAIRES. CONCEPTION DES REGULATEURS ELECTRONIQUES]
J. M. Collin and B. Gaj *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 16 p refs In FRENCH (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The availability of highly integrated circuits offers the designer new possibilities for rationally defining automatons numerically integrated in the engine regulating system. The architecture of these automatons is defined by simultaneously taking into consideration functional specifications, operational specifications which have an important bearing on the reliability and security of missions, and the technological constraints imposed by an aggressive environment. The possibilities offered by microprocessors are illustrated with a summary description of three types: a minicomputer type regulator, a multimicroprocessor system, and a regulator with a data processor. Transl. by A.R.H.

N80-26315# Hawker Siddeley Dynamics Ltd., Hatfield (England).
THE DESIGN CONCEPT AND EXPERIMENTAL RESULTS USING THE INTEL 8080/8085 MICROPROCESSOR
Nicholas A. Justice *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 9 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Prototype flight equipment was built using the 8080A and is flying with full authority in a twin engine helicopter. Isochronous load sharing on torque with simultaneous data logging output of transducer inputs and control functions was provided for monitoring purposes. This detailed background provided valuable insight to the true flexibility of a microprocessor controller and also illustrated any shortcomings that the later generation devices will need to overcome. R.C.T.

N80-26316*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
DESIGN, EVALUATION AND TEST OF AN ELECTRONIC, MULTIVARIABLE CONTROL FOR THE F100 TURBOFAN ENGINE
Charles A. Skira (Systems Control, Inc., Palo Alto, Calif.), Ronald L. DeHoff, and W. Earl Hall, Jr. (Systems Control, Inc., Palo Alto, Calif.) *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 21 p refs Sponsored in part by NASA (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

A digital multivariable control design procedure for the F100 turbofan engine is described. The controller is based on locally linear synthesis techniques using linear, quadratic regulator design methods. The control structure uses an explicit model reference form with proportional and integral feedback near a nominal trajectory. Modeling issues, design procedures for the control law and the estimation of poorly measured variables are presented. R.C.T.

N80-26317# Pisa Univ. (Italy).
ENGINE INTAKE CONTROL DESIGN FOR ADVANCED FIGHTER AIRCRAFT
Dino Dini and R. Lazzeretti *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 11 p refs (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The factors influencing variable geometry intake design for fighter aircraft over their flight velocity profile are reviewed. Separate operating performance ranges, depending on the positions of the changeover valves, ramps and doors, are analyzed for an acceptable design compromise. A criterion for prediction of airframe integration effects on inlet stability with application to advanced fighter aircraft is presented and discussed. To accomodate desired flow changes through the engine as flight speed, altitude, and climatic conditions, change, the control of intake is studied and designed, taking into account mutual interferences between propulsion units and controlled elements.

Airframe/propulsion integration in fighter aircraft is considered in the design of intake control. M.G.

N80-26318# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Automatique.
DETERMINING THE OPTIMAL CONTROL LAWS FOR SETTING THE RPM'S OF A TURBOJET ENGINE [DETERMINATION DE LOIS OPTIMALES DE MONTEE EN REGIME D'UN TURBOREACTEUR]
C. Barrouil *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 4 p refs In FRENCH (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Two operational modes can be distinguished for a simple body turbojet engine without afterburning: changing the limits and regulating the limits. A rapid change of limits is desirable but a suitable margin of safety must be assured during the transition and the engine must be left in a practically stabilized state after the transition. The engine controls are the fuel flow and the tail pipe section. They are released by actuators which are themselves controlled by a digital or analog computer or electromechanically. The control laws are not sought for the actuators directly, but for the fuel flow and the optimal tail pipe section. The laws determined are those displayed on the actuators. Transl. by A.R.H.

N80-26319# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
MODE CONTROL: A FLEXIBLE CONTROL CONCEPT FOR MILITARY AIRCRAFT ENGINES
Klaus Bauerfeind *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 9 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

An engine control concept (mode control) which will minimize the aircraft performance penalties due to normal engine matching to severe handling requirements is described. In mode control these penalties are reduced by matching the engine closer to the optimum steady state performance of the aircraft. Extreme flight conditions are registered and signalled to an electronic control system. This control system then trims and overrides the normal control laws in order to provide the necessary margins required for safe operation so long as the extreme condition prevails. In order to implement mode control successfully the response rates of the engine variables or trims must be compatible with the requirements, i.e., the respective rates at which a certain problem can develop. Because of the type of computing required a digital control system is more suitable for this task than an analogue one. The example of a military three spool by-pass engine equipped with an afterburner is presented. M.G.

N80-26320# Smiths Industries Ltd., Basingstoke (England). Aviation Div.
REDUNDANCY CONCEPTS IN FULL AUTHORITY ELECTRONIC ENGINE CONTROL, PARTICULARLY DUAL REDUNDANCY
E. S. Eccles, E. D. Simons (Dowty and Systems, Cheltenham, England), and J. F. O. Evans *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 14 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The available methods of redundancy in full authority electronic engine controls and the reasons for their selection in particular applications are surveyed with particular reference to the effects of the electro-hydromechanical interface. Various 'dual' redundant arrangement, Adour and Pegasus engine controls, and helicopter controls are specifically addressed. System safety and the variety of failure survival strategies which can be employed are considered. In general, ease of analysis is accompanied by simple failure survival strategies. More complex strategies may result in higher system availabilities and there is therefore a trade-off to conduct between non-recurring design cost and system availability in service. The impact of more flexible system architectures due to microprocessors and military requirements are discussed and the direction of future development is indicated. M.G.

N80-26321# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Bureau d'Etudes Installation Motrice.
CONTROL OF THE ENGINES FOR THE NEW AIRBUS FAMILY [CONDUITE DES MOTEURS DE LA NOUVELLE FAMILLE AIRBUS]
Jean-Claude Tchavdarov *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 14 p refs (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The general problem of engine performance is considered including the objectives to be satisfied and the basic principles to be retained. The operation of the A-300 aircraft is described with emphasis on gas control, hydromechanical regulation, principal instrumentation, motors, the theory and choice of performance parameters, associated automatic systems, and operational procedures. Solutions currently envisioned for future AIRBUS A-310 are presented, particularly the introduction of partially electronic regulation. Transl. by A.R.H.

N80-26322# National Research Center for Energetics and Propulsion, Milan (Italy).
CONTROL OF ALTERNATIVE ENGINES BY MICROCOMPUTER SYSTEMS
C. Casci, F. M. Montevecchi, and B. Abbiati *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 9 p refs (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Development in microcomputer controlled fuel systems for internal combustion engines are discussed. Three cars - Fiat 127, Ford Fiesta and Alfa Romeo Alfasud - were provided with a microcomputer to control mixture ratio by means of floating chamber pressure regulation in the carburetor. A complex feedback control loop adjusts pressure level depending upon exhaust gases oxygen contents. Experimental testing of the device evidentiated the dependence of control system time delay upon rpm along with sensitivity to manifold geometry, sensor positioning, and related engine design details. Implemented control has taken into account rpm in relation with the forecast map of the specific engine. Tests were carried out on both at constant rev. speed and in emission tests. Engine design parameters and sensor location showed a strong influence on control system performance. Results indicated inherent limitations in control loop efficiency related to the use of exhaust sensors. The closed loop approach looks potentially capable of controlling automotive engines in the demanding future operational requisites. Progress is dependent upon improvement in air-fuel mixing techniques and in combustion sensors. M.G.

N80-26323# Lucas Aerospace Ltd., Birmingham (England).
A UNIFIED DIGITAL APPROACH TO THE CONTROL OF A DIVERSE RANGE OF ENGINES
M. J. Joby and R. D. Powell *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 12 p refs (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Digital control systems for gas turbine engines are examined in the light of the commonality of hardware and software requirements between diverse applications. Alternative control configurations for a main gas turbine engine are examined including: (1) a full hydromechanical, (2) hydromechanical with a supervisory electronic trim, (3) a full electronic with a hydromechanical backup, and (4) a full electronic with a further electronic backup. Through a consideration of the digital control unit structure for the different configurations, the commonality in hardware requirements is demonstrated. In addition, by having modules for each input and output a standard 'pack of cards' can be created from which a selection can be made for any application. Self monitoring and testing capabilities in digital systems are examined and examples from different applications are discussed, including helicopters, civil transport engines, industrial gas turbines, and military power plants. M.G.

N80-26324# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
ADVANTAGES OF THE DIGITAL TECHNOLOGY FOR THE REALIZATION OF ENGINE CONTROL SYSTEMS
G. Dahl and H. Drtil *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 8 p (For primary document

see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Requirements to be met by the digital control units and the advantages resulting therefrom are discussed. It is shown that with respect to their capacity future digital engine control units have essential advantages (integrated engine-flight control, functions, reliability, adjustments) compared to hydromechanical and analog electronical systems. Digital control units have a higher efficiency but will probably be of the same volume than actual control units. A considerable reduction of the interface and its volume will only be possible if the environment of the digital computer is digitalized as well, that means if sensors are provided with a digital pick-up, and if a direct digital control of the actuators and the displays is available. M.G.

N80-26325# Rolls-Royce Ltd., Leavesden (England). Aero Div.
THE DIGITAL CONTROL SYSTEM AS PART OF AN INTEGRATED ACCESSORY FIT FOR FUTURE ENGINES
M. P. Perks and T. G. Morton *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 11 p ref (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The development of digital control systems for gas turbine engines is discussed. It is suggested that the traditional approach of designing the control system in isolation from the other accessories on a gas turbine engine may not provide the most cost effective total solution for an engine having a digital control system. It is considered that the integrity of the digital control can be maintained while providing additional functions not associated with its prime control task. This could allow the development of advanced monitoring systems to minimize life cycle costs and achieve maximum aircraft utilization. The application of these principles to helicopter engines is discussed and an arrangement proposed which could provide substantial benefits both to the helicopter pilot and to the ground crew. Pilot work-load would be substantially reduced by advising him of engine or aircraft management factors on a 'need to know' basis. Operators would benefit from regular information on the operational status of the engines. M.G.

N80-26326# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE 54TH(B) PROPULSION AND ENERGETICS PANEL MEETING ON COMBUSTOR MODELLING
David Dryburgh (Rolls Royce, Darby, England) and Raymond B. Edelman (Science Applications, Inc., Canoga Pk., Calif.) Mar. 1980 20 p Meeting held at Cologne, 3-5 Oct. 1979
(AGARD-AR-153; ISBN-92-835-1355-X) Avail: NTIS HC A02/MF A01

After a short introduction, the meeting papers are classified into categories concerning model elements, dimensionality, survey type, application and theoretical development. The first evaluation follows this classification, while other evaluations are related to the manufacturer's and the researcher's point of view. Conclusions and recommendations for future treatment of combustor modelling are presented. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-26327*# Optimization Software, Inc., Los Angeles, Calif.
OPTIMIZATION AND SIMULATION OF FLIGHT CONTROL LAWS UNDER PARAMETER UNCERTAINTY AND EXTERNAL DISTURBANCES Final Report
1 Dec. 1979 136 p refs
(Contract NASw-3158)
(NASA-CR-163292) Avail: NTIS HC A07/MF A01 CSCL 01C

Several tasks pertinent to flight control in parameter uncertainty and wind-gust loading were successfully completed. Identification algorithms for extracting stability and control derivatives from flight data taking gust loading into account were developed. They were verified by simulation and evaluated throughly on actual flight data taken on a Lockheed Jet Star flying in turbulence. In particular the need for automatically generated dither-like inputs was studied. Criteria for performance evaluation using stochastic models were developed for gust alleviation as well as handling quantities. Algorithms for assessing degradation in performance due to parameter uncertainty were developed and evaluated using flight test data. Author

N80-26328*# National Aeronautics and Space Administration, Hugh L. Dryden Flight Research Center, Edwards, Calif.
DEVELOPMENT AND FLIGHT TEST RESULTS OF AN AUTOTHROTTLE CONTROL SYSTEM AT MACH 3 CRUISE
Glenn B. Gilyard and John J. Burken Jul. 1980 40 p refs
(NASA-TP-1621; H-1090) Avail: NTIS HC A03/MF A01 CSCL 01C

Flight test results obtained with the original Mach hold autopilot designed the YF-12C airplane which uses elevator control and a newly developed Mach hold system having an autothrottle integrated with an altitude hold autopilot system are presented. The autothrottle tests demonstrate good speed control at high Mach numbers and high altitudes while simultaneously maintaining control over altitude and good ride qualities. The autothrottle system was designed to control either Mach number or knots equivalent airspeed (KEAS). Excellent control of Mach number or KEAS was obtained with the autothrottle system when combined with altitude hold. Ride qualities were significantly better than with the conventional Mach hold system. E.D.K.

N80-26329# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
INTERACTIVE DESIGN SYSTEM FOR AIRCRAFT DYNAMIC CONTROL PROBLEMS
Wolfgang J. Kubbat, G. Oesterhelt, and U. Korte 6 Sep. 1979 19 p Presented at SMP of AGARD Meeting, Neubiberg, West Germany, 3-6 Sep. 1979
(MBB-FE-324/S/Pub/11) Copyright. Avail: NTIS HC A02/MF A01

An interactive system for control law design and synthesis is described. Available methods (continuous discrete, time domain-frequency domain) are reviewed and the system is illustrated. Selection of method (i.e., discrete vs. continuous complete vs. incomplete state feedback, optimal control vs. pole-placement etc.) is followed by a dialog designer-computer with immediate results presented in numerical and graphical form (plots, print-outs). Each result is stored and can be compared with any other via dual plots. The system also allows the input of disturbance like white or colored noise, ramps, steps, sine and cosine combinations. There is no practical restriction on the number of state variables. A helicopter control problem is used to demonstrate use of the system. Author (ESA)

N80-26330# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SYMPOSIUM ON AERODYNAMIC CHARACTERISTICS OF CONTROLS
H. H. B. M. Thomas Mar. 1980 18 p refs
(AGARD-AR-157; ISBN-92-835-1351-7) Avail: NTIS HC A02/MF A01

The different ways in which active control technology can impact aircraft design and tasks facing the aerodynamist are reviewed, including the effect of aircraft configuration on relaxed stability and the effect of control integration on aerodynamics. The correlation of flight and wind tunnel control effectiveness measurements is considered as well as difficulties in predicting transonic flow and attached flow. A.R.H.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-26331# Yang (Nai C.) and Associates, New York, N.Y.
NONDESTRUCTIVE EVALUATION OF AIRPORT PAVEMENTS. VOLUME 3: OPERATION MANUAL FOR MLGPAV PROGRAM AT TCC
David Yang Sep. 1979 47 p
(Contract DOT-FA77WA-3964)
(AD-A079591; FAA-RD-78-154-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 01/5

Sensitivity analysis of aircraft parameters on functional pavement design is discussed. The MLGPAV program is an integrated system which is data independent based on defined mathematical models and operational logic. The input data is divided into job and universal default inputs. The job inputs consists of only the aircraft data such as: (1) forecast of aircraft movements; (2) maximum takeoff weight; (3) natural frequency of aircraft at tire pavement interface; (4) tire pressure of main landing gear wheel; (5) wheel configuration of main landing gear; and (6) gear spacing. The default system contains all of the data independent of the aircraft, such as: (1) regional cost values; (2) types of facility, runway, taxiway, apron; (3) navigation system; (4) operation speed; (5) roughness and maintenance standards; (6) subgrade conditions; and (7) airport traffic distribution. A unified mechanistic method is used to design five types of functional pavements for identical service requirements on riding quality and maintenance needs. They are: (1) asphalt pavements in southern or northern region; (2) concrete pavements on stabilized or aggregate base; and (3) full depth stabilized base pavement. J.M.S.

N80-26332# Oregon Univ., Eugene. Dept. of Psychology.
LOW COST SIMULATION OF PILOTING TASKS
Gerald M. Reicher, Brian J. Davidson, Harold L. Hawkins, and Gilbert Osgood 21 Jan. 1980 29 p refs
(Contract N00014-77-C-0643)
(AD-A080856; TR-4) Avail: NTIS HC A03/MF A01 CSCL 05/9

An attempt was made to validate a low cost, low fidelity, computer driven flight simulator. The validation is required so that the simulator can be used as a criterion task to see whether we can predict flight performance on the basis of performance on other tests of individual cognitive ability like attentional flexibility, visual representational skill, priority setting and planning. The simulator was based on instrument flying rather than visual contact flying and incorporated secondary tasks to further tax the pilot's capacity. Simulator performance is correlated with hours of flight training, the best correlations coming from conditions which impose additional task demands. GRA

N80-26333# Lockheed-California Co., Burbank.
BUILT-IN-TEST AND EXTERNAL TESTER RELIABILITY CHARACTERISTICS Final Technical Report, May 1978 - Jul. 1979
Donald E. Tuttle and Richard Loveless Mar. 1980 101 p refs
(Contract F30602-78-C-0157; AF Proj. 2338)
(AD-A083488; LR-29052; RADC-TR-80-32) Avail: NTIS HC A06/MF A01 CSCL 15/5

This report presents the results of a study of built-in-test (BIT) and external test equipment reliability impact on prime equipment design and maintenance down time. Sixty (60) units were analyzed from the S-3A, C-5A, and MK-86 weapons systems to develop BIT and external tester measurement effectiveness versus unit design characteristics. Tradeoff criteria are developed for predicting BIT and test equipment reliability during the acquisition of new systems. GRA

N80-26334# Johns-Manville Sales Corp., Denver, Colo. Research and Development Center.
HEAT RECLAMATION FROM FLIGHT SIMULATORS Final Report, 1 Sep. 1978 - Mar. 1980
P. B. Shepherd Mar. 1980 7 p
(Contract DAAK70-78-D-0002)
(AD-A081754) Avail: NTIS HC A02/MF A01 CSCL 05/9

The objective of Task Order no. 9 was to conduct a market and literature survey to determine the current state-of-the-art on heat reclamation devices for air conditioners used with flight simulators. Applicability of such devices to each flight simulator facility will be evaluated and will include energy savings, cost effectiveness, operation, maintenance, safety code compliance and product warranty limitation considerations. GRA

N80-26335# Air Force Human Resources Lab., Williams AFB, Ariz. Flying Training Div.
APPLICATION OF FLIGHT SIMULATOR RECORD/PLAYBACK FEATURE Interim Report, Jan. - May 1979
Ronald G. Hughes, Samuel T. Hannan, and William E. Jones Dec. 1979 16 p refs
(AF Proj. 1123)
(AD-A081752; AFHRL-TR-79-52) Avail: NTIS HC A02/MF A01 CSCL 05/9

Undergraduate Pilot Training (UPT) students acquired a complex visual task in ASPT under one of three instructional conditions which differed in their use of an automated record/playback feature. The study evaluated differences in performance resulting from (1) periodic, repeated use of a recorded, instructor-presented demonstration, (2) periodic use of replay of student performance, and (3) use of equivalent training time for additional practice. The data indicated little or no instructional value associated with repeated exposures to the original demonstration of the task to be learned. While the (replay) condition produced terminal performances with fewer errors on the average than the (demo) condition, differences between (practice) and (replay) groups were not statistically significant. The surprising finding of the study was the effectiveness of simple practice relative to that of the two, so-called, (instructional) conditions. These data would suggest that, at least in some instances, a training approach that provided only for basic performance feedback e.g., a (score) might be equally as effective as one with provision for presenting repeated access to recorded demonstrations and/or replays of previous performance. GRA

N80-26336# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Technical and Resources Management Div.
AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS-TEST FACILITIES AND TEST EQUIPMENT Annual Report
Donald C. Kittinger Feb. 1980 56 p refs Supersedes ASD-TR-79-5039
(AD-A083553; ASD-TR-80-5011; ASD-TR-79-5039) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report is part of a compilation of formalized Technology Needs (TN) covering Equipment Subsystems as identified by the Aeronautical Systems Division. They are based on development/operational experience, system studies and new concepts - all related to future system applications. Their presentation is to serve a threefold purpose; i.e., guidance for technology program, proven development potential, and engineering data/requirements essential for technology use in systems. The identified needs delineate progress desired in performance, control, design flexibility, safety and cost. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-26337*# Relay Development Corp., Branford, Conn.
A SEARCH FOR EXPERIMENTS TO EXPLOIT THE SPACE SHUTTLE ENVIRONMENT, VOLUME 1 Final Report
John B. Fenn 15 Dec. 1979 70 p refs 2 Vol
(Contracts NAS7-100; JPL-955578)
(NASA-CR-163030) Avail: NTIS HC A04/MF A01 CSCL 22A

A search for worthwhile experiments in pure and applied physics and chemistry which might take advantage of conditions

achievable aboard the space shuttle is documented. Of particular interest were the very large pumping speeds at high or ultra high vacuum, the highly nonequilibrium composition of the ambient atmosphere, and the relative absence of gravitational effects. Ideas and suggestions were solicated in the course of visits to 31 research establishments in Western Europe, India, and Japan; conversations with over 90 scientists; and presentations at 3 international meetings. Intriguing possibilities emerged in the following arenas: (1) spectroscopy of the transition state in chemical reactions; (2) flame structure and analysis; (3) solid propellant combustion; (4) analysis of atmospheric composition; (5) turbulence effects on aerosol coagulation. M.G.

N80-26338*# Relay Development Corp., Branford, Conn.
A SEARCH FOR EXPERIMENTS TO EXPLOIT THE SPACE SHUTTLE ENVIRONMENT, VOLUME 2 Final Report
John B. Fenn 15 Dec. 1979 32 p 2 Vol.
(Contracts NAS7-100; JPL-955578)
(NASA-CR-163031) Avail: NTIS HC A03/MF A01 CSCL 22A

Institutions and laboratories in India, Japan, and Western Europe which were visited during a search for experiments to exploit the space shuttle environment are described. The facilities and current research interests of the various centers are discussed with particular emphasis given to the Indian Space Research Organization. M.G.

N80-26339*# Analytical and Computational Mathematics, Inc., Houston, Tex.
MISSION ANALYSIS DATA FOR INCLINED GEOSYNCHRONOUS ORBITS, PART 1
Otis F. Graf, Jr. and K. C. Wang May 1980 81 p refs
(Contract NAS9-15883)
(NASA-CR-160702; ACM-TR-121-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 22A

Data needed for preliminary design of inclined geosynchronous missions are provided. The inertial and Earth fixed coordinate systems are described, as well as orbit parameters and elements. The complete family of geosynchronous orbits is discussed. It is shown that circular inclined geosynchronous orbits comprise only one set in this family. The major orbit perturbation and their separate effects on the geosynchronous orbit are discussed. Detailed information on the orbit perturbation of inclined circular geosynchronous orbits is given, with emphasis on time history data of certain orbital elements. Orbit maintenance delta velocity (V) requirements to counteract the major orbit perturbations are determined in order to provide order of magnitude estimates and to show the effects of orbit inclination on delta V. Some of the considerations in mission design for a multisatellite system, such as a halo orbit constellation, are discussed. E.D.K.

N80-26340* Analytical and Computational Mathematics, Inc., Houston, Tex.
MISSION ANALYSIS DATA FOR INCLINED GEOSYNCHRONOUS ORBITS, PART 2. APPENDIX A: BIBLIOGRAPHY
May 1980 50 p
(Contract NAS9-15883)
(NASA-CR-160703; ACM-TR-121-Pt-2-App-A) Avail: NTIS HC A03/MF A01 CSCL 22A

A bibliography of papers and reports on geosynchronous orbits, as well as background papers concerned with the fundamentals of orbital mechanics is presented. A listing of computer programs developed for this study is included. E.D.K.

N80-26341*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TELECOMMUNICATIONS AND DATA ACQUISITION REPORT Progress Report, Mar. - Apr. 1980
15 Jun. 1980 176 p refs
(Contract NAS7-100)
(NASA-CR-163249; JPL-Pub-42-57) Avail: NTIS HC A09/MF A01 CSCL 22A

Progress in the development and operations of the Deep Space Network is reported. Developments in Earth based radio technology as applied to geodynamics, astrophysics, and radio astronomy's use of the deep space stations for a radio search for extraterrestrial intelligence in the microwave region of the electromagnetic spectrum are reported. For individual titles, see N80-26342 through N80-26363.

N80-26342*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE: TELECOMMUNICATIONS TECHNOLOGY c17
R. E. Edelson and G. S. Levy *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 1-8 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

Efforts to discover evidence of intelligent extraterrestrial life have become not only feasible, but respectable. Fledgling observational projects have begun that will use state-of-the-art hardware to develop sophisticated receiving and data processing systems. The rationale behind the Search for Extraterrestrial Intelligence, the manner in which the program is taking shape, and the implications for telecommunications are described. It is concluded that the breadth of technological development required for the detection of signals from galactic brethren has particular relevance for the future of telecommunications in Earth oriented uses. E.D.K.

N80-26343*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SETI OBSERVATIONAL PLAN c32
A. L. Berman *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 43-49 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The SETI (Search for Extraterrestrial Intelligence) Project's primary thrust is to search the microwave region of the spectrum for signals of extraterrestrial intelligent origin. The project will search a well defined volume of search parameter space using existing antennae and a sophisticated data acquisition and analysis system. Two major components are included, the target survey, which will observe at very high sensitivity all attractive stellar candidates within 75 light years of the Sun, and the sky survey, which will observe the entire celestial sphere at a lower sensitivity. E.D.K.

N80-26344*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ERROR ESTIMATION FOR ORION BASELINE VECTOR DETERMINATION c32
S. C. Wu *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 16-31 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

Effects of error sources on Operational Radio Interferometry Observing Network (ORION) baseline vector determination are studied. Partial derivatives of delay observations with respect to each error source are formulated. Covariance analysis is performed to estimate the contribution of each error source to baseline vector error. System design parameters such as antenna sizes, system temperatures and provision for dual frequency operation are discussed. E.D.K.

N80-26345*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 32-34 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized. Deep Space Station, ground communication, and network operations control capabilities are described. E.D.K.

N80-26346*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN COMMAND SYSTEM MARK III-80 c32
H. C. Thorman *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 35-42 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The Deep Space Network command system configuration

and functional operation are described. Voyager and Helios command operations are supported with Deep Space Station store and forward data handling; Viking and Pioneer are supported with the older, near real time data handling method. Author

N80-26347*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER VENUS MULTIPROBE ENTRY TELEMETRY RECOVERY **c17**
R. B. Miller and R. Ramos (NASA. Ames Res. Center) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 43-49 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

The entry phase of the Pioneer Venus Multiprobe Mission involved data transmission over a two hour span. The criticality of recovering those two hours of data, coupled with the fact that there were no radio signals from the probes until their arrival at Venus, dictated unique telemetry recovery approaches on the ground. The result was double redundancy, use of spectrum analyzers to aid in rapid acquisition of the signals, and development of a technique for recovery of telemetry data without the use of real time coherent detection, which is normally employed for all other planetary missions. E.D.K.

N80-26348*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT **c15**
N. Fanelli and H. Nance *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 50-53 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

Special events participated in by the Deep Space Stations (DSS) for the period of February through April 1980 are presented. The status of the DSS is reviewed for the same period, including system performance tests and operational verification tests. A list of software accepted for operation at the DSS is given. E.D.K.

N80-26349*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERNATIONAL SOLAR POLAR MISSION SUPPORT **c15**
R. B. Miller *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 54-57 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The primary objective of the International Solar Polar Mission (ISPM) is to investigate solar and interplanetary phenomena as a function of the solar latitude. The mission is to be accomplished by using a gravity assist at the planet Jupiter to send two spacecraft out of the ecliptic plane. Available trajectory information is supplied, and spaceborne experiments under consideration are discussed. An introduction to the key characteristics of both spacecraft is given, emphasizing communication equipment. E.D.K.

N80-26350*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING ORBITER COMPLETION MISSION AND VIKING LANDER MONITOR MISSION **c91**
R. L. Gillette *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 58-61 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03B

A brief history of the Viking Missions is presented. The status of the present Viking Orbiter and Landers for the period from February 1, 1980 through March 31, 1980 is discussed, with emphasis on data transmission abilities. E.D.K.

N80-26351*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A THEORETICAL MODEL OF PHASE CHANGES OF A KLYSTRON DUE TO VARIATION OF OPERATING PARAMETERS **c33**
A. Kupiszewski *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 62-64 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

A mathematical model for phase changes of the VA-876 CW klystron amplifier output is presented and variations of several operating parameters are considered. The theoretical approach to the problem is based upon a gridded gap modeling with inclusion of a second order correction term so that actual gap geometry is reflected in the formulation. Physical measurements are contrasted to theoretical calculations. Author

N80-26352*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE 64 METER ANTENNA OPERATION AT K SUB A BAND **c32**
P. D. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 65-70 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The future potential of the 32 GHz K sub A band frequency region to planetary exploration, and the expected performance of the 64 m antenna network at 32 GHz is addressed. A modest level of noninterference upgrade work is assumed to achieve reasonable antenna aperture efficiency and alleviate antenna pointing difficulties. Electronic compensation of antenna aperture phasing errors is briefly considered as an alternative to the physical upgrade. E.D.K.

N80-26353*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH-POWER TRANSMITTER AUTOMATION **c33**
R. Gosline *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 71-81 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

The current status of the transmitter automation development applicable to all transmitters in the deep space network is described. Interface and software designs are described that improve reliability and reduce the time required for subsystem turn-on and klystron saturation to less than 10 minutes. M.G.

N80-26354*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RFI RECEIVER **c32**
R. Lay *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 82-86 ref (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

An S-band radio frequency interference (RFI) receiver to analyze and identify sources of RFI problems in the Deep Space Network DSN tracking stations is described. The RFI receiver is a constant gain, double conversion, open loop receiver with dual sine/cosine channel outputs, providing a total of 20 MHZ monitoring capability. This receiver is computer controlled using a MODCOMP II miniprocessor. The RFI receiver has been designed to operate at a 150 Kelvin system noise temperature accomplished by cascading two low noise field effect transistor (FET) amplifiers for the receiver front-end. The first stage low noise FET amplifier is mounted at the feed horn to minimize any cable losses to achieve a lower system noise temperature. The receiver is tunable over the frequency range of 2150 to 2450 MHz in both sine/cosine output channels with a resolution of 100 kHz. M.G.

N80-26355*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ON THE APPLICATION OF A FAST POLYNOMIAL TRANSFORM AND THE CHINESE REMAINDER THEOREM TO COMPUTE A TWO-DIMENSIONAL CONVOLUTION **c84**
T. K. Truong, R. Lipes, I. S. Reed (Univ. of Southern California), and C. Wu *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 87-102 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 12A

A fast algorithm is developed to compute two dimensional convolutions of an array of d sub 1 X d sub 2 complex number points, where d sub 2 = 2(M) and d sub 1 = 2(m-r+) for some 1 < or = r < or = m. This algorithm requires fewer multiplications and about the same number of additions as the conventional fast fourier transform method for computing the two dimensional convolution. It also has the advantage that the

operation of transposing the matrix of data can be avoided.
Author

N80-26356*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE STATION (DSS-13) AUTOMATION DEMONSTRATION **c14**
D. S. Remer and G. Lorden (California Inst. of Technology) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 103-119 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The data base collected during a six month demonstration of an automated Deep Space Station (DSS 13) run unattended and remotely controlled is summarized. During this period DSS 13 received spacecraft telemetry data from Voyager, Pioneers 10 and 11, and Helios projects. Corrective and preventive maintenance are reported by subsystem including the tradtional subsystems and those subsystems added for the automation demonstration. Operations and maintenance data for a comparable manned Deep Space Station (DSS 11) are also presented for comparison. The data suggests that unattended operations may reduce maintenance manhours in addition to reducing operator manhours. Corrective maintenance for the unmanned station was about one third of the manned station, and preventive maintenance was about one half. M.G.

N80-26357*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SYNCHRONIZATION OF REED-SOLOMON CODES **c17**
R. L. Miller and R. B. Newman (California Inst. of Technology) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 120-122 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

The synchronization capabilities of Reed-Solomon codes when an appropriate coset of the code is used instead of the code itself are examined. In this case an E-error correcting Reed-Solomon code is transformed into a code capable of determining that there are m symbols out of sync, if e symbol errors occurred, whenever m + e < E. In the event that m = 0, i.e., the word is in sync, then decoder will correct any pattern of E - 1 on fewer symbol errors. M.G.

N80-26358*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STRESS DISTRIBUTION IN A SEMI-INFINITE BODY SYMMETRICALLY LOADED OVER A CIRCULAR AREA **c39**
H. McGinness *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 123-130 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20K

Algorithms are developed for computing stresses in a semi-infinite body when loaded by a uniform pressure acting over a circular area. The algorithm allows easy determination of any stress component in a semi-infinite body having a known Poisson's ratio. Example curves are plotted for Portland cement grout and metal representative values. M.G.

N80-26359*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPTIMAL PERIODIC BINARY CODES OF LENGTHS 28 TO 64 **c61**
S. Tyler and R. Keston *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 131-135 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09B

Results from computer searches performed to find repeated binary phase coded waveforms with optimal periodic autocorrelation functions are discussed. The best results for lengths 28 to 64 are given. The code features of major concern are where (1) the peak sidelobe in the autocorrelation function is small and (2) the sum of the squares of the sidelobes in the autocorrelation function is small. M.G.

N80-26360*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
UTILIZATION OF THE VENUS STATION (DSS 13) 26 METER ANTENNA DURING CY 1979 **c32**
E. B. Jackson *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 136 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The various activities for which the Venus Station's 26 m antenna was used are described and the number of manned tracking hours devoted to each activity are given. A brief description of the goal of each activity supported is provided, and, where appropriate, the observing technique is summarized. Projects involving spacecraft tracking, advanced systems development, and radio astronomy are included. M.G.

N80-26361*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DATA ACQUISITION FOR MEASURING THE WIND ON VENUS FROM PIONEER VENUS **c91**
J. R. Smith and R. Ramos (NASA Ames Res. Center) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 140-149 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03B

The data acquisition and processing technqiues used in the Pioneer Venus differential long baseline interferometry experiment are discribed. The experiment was designed to measure the motion in three dimensions of the Pioneer probes during their fall to the surface of Venus, using a combination of Doppler and long baseline ratio interferometric methods. The design of the experiment and the equipment and software techniques that were developed specially for this experiment are also described. M.G.

N80-26362*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANETARY RADAR **c89**
R. M. Taylor and G. S. Downs *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 150 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03A

The radar astronomy activities supported by the Deep Space Network are reported. The high power S- and X-band radar transmitters at the Goldstone 64 meter station were used for a radar probe of Mars during January, February, and March 1980, which was designed to provide range and Doppler data derived from signals reflected from the Martian surface, taking advantage of the planet's nearness during opposition. M.G.

N80-26363*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SURVEY OF NUMERICAL MODELS FOR WIND PREDICTION **c47**
D. Schonfeld *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 151-170 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 04B

A literature review is presented of the work done in the numerical modeling of wind flows. Pertinent computational techniques are described, as well as the necessary assumptions used to simplify the governing equations. A steady state model is outlined, based on the data obtained at the Deep Space Communications complex at Goldstone, California. Author

N80-26364*# Martin Marietta Corp., Denver, Colo.
COMET NUCLEUS IMPACT PROBE FEASIBILITY STUDY Final Report
Angelo J. Castro 15 Apr. 1980 69 p refs
(NASA Order A-71116-B)
(NASA-CR-152375; MCR-80-1002) Avail: NTIS HC A04/MF A01 CSCL 22A

A top level listing of the comet nucleus impact probe (CNIP) feasibility experiments requirements are presented. A conceptual configuration which shows that the feasibility of engineering the experiment is possible and describes the candidate hardware is discussed. The design studies required in order to design the operating experiment are outlined. An overview of a program plan used to estimate a rough order of magnitude cost for the CNIP experiment is given. E.D.K.

N80-26365*# Rockwell International Corp., Downey, Calif.
SPACE PLATFORM UTILITIES DISTRIBUTION STUDY
A. E. LeFever Jul. 1980 84 p refs

best copy available

(Contract NAS1-15322)
(NASA-CR-159272) Avail: NTIS HC A05/MF A01 CSCL 22A

Generic concepts for the installation of power data and thermal fluid distribution lines on large space platforms were discussed. Connections with central utility subsystem modules and pallet interfaces were also considered. Three system concept study platforms were used as basepoints for the detail development. The tradeoff of high voltage low voltage power distribution and the impact of fiber optics as a data distribution mechanism were analyzed. Thermal expansion and temperature control of utility lines and ducts were considered. Technology developments required for implementation of the generic distribution concepts were identified. B.D.

N80-26366*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
SPACE ASSEMBLY FIXTURES AND AIDS Final Report
K. A. Bloom and A. N. Lillenas Jul. 1980 198 p refs
(Contract NAS1-15322)
(NASA-CR-159285; SSD-80-0021) Avail: NTIS HC A09/MF A01 CSCL 22A

Concepts and requirements for assembly fixtures and aids necessary for the assembly and maintenance of spare platforms were studied. Emphasis was placed on erectable and deployable type structures with the shuttle orbiter as the assembly base. Both single and multiple orbiter flight cases for the platform assembly were considered. Applicable space platform assembly studies were reviewed to provide a data base for establishing the assembly fixture and aids design requirements, assembly constraints, and the development of representative design concepts. Conclusions indicated that fixture requirements will vary with platform size. Larger platforms will require translation relative to the orbiter RMS working volume. The installation of platform payloads and subsystems (e.g., utility distribution) must also be considered in the specification of assembly fixtures and aids. Author

N80-27248# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
PRESENT STATE AND FUTURE OF THE SCIENTIFIC SPACE PROGRAM OF THE FEDERAL REPUBLIC OF GERMANY
W. Regula *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 205-217 In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-26367# Range Commanders Council, White Sands Missile Range, N. Mex. Meteorological Group.
RANGE ATMOSPHERIC AND OCEANIC ENVIRONMENTAL SUPPORT CAPABILITIES / REQUIREMENTS / PROCUREMENTS
1980 222 p Supersedes MG-125-72
(AD-A082755; RCC/MG-125-80; MG-125-72) Avail: NTIS HC A10/MF A01 CSCL 04/2

Discussed are range natural atmospheric and oceanic environmental support capabilities/requirements, which must be known both to satisfy present needs and for long-range planning to meet projected needs. The identification of planned procurements, and equipment excess to requirements will foster exchanges, transfers, joint procurements and the cost savings to all member ranges. This document represents a current identification of those capabilities/requirements/procurements. It supersedes IRIG Document 125-72 which is obsolete and should be destroyed. GRA

N80-26345*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 32-34 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N80-26358*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE STATION (DSS-13) AUTOMATION DEMONSTRATION
D. S. Remer and G. Lorden (California Inst. of Technology) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 103-119 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-26368# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A REVIEW OF SATELLITE LIFETIME AND ORBIT DECAY PREDICTION
J. deLafontaine and S. C. Garg Jun. 1980 81 p refs Sponsored by Canada Dept. of Communication
(UTIAS-43; ISSN-0082-5247) Avail: NTIS HC A05/MF A01

The modelling and the methods necessary to predict satellite lifetimes are reviewed. Orbital perturbations, models for Earth's potential field, luni-solar attraction and atmospheric drag are considered. Static and dynamic density models are presented. Satellite properties (projected area and drag coefficient) are discussed. Analytical methods for using these models are examined and compared with other methods. The state of the art is assessed and areas requiring more research are identified. A.R.H.

N80-26369# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Dept. Etudes Speciales.
A MAGNETIC SUSPENSION WITH PASSIVE RADIAL CENTERING FOR SATELLITE FLYWHEEL AND KINETIC ENERGY STORAGE SYSTEMS
P. C. Poubeau Paris 1979 23 p refs Presented at 3d Intern. Workshop on Rare Earth-Cobalt Permanent Magnets and their Appl., San Diego, Calif., 27-30 Jun. 1978 Sponsored by Intern. Telecommun. Satellite Organ., ESA, and CNES
(SNIAS-792-422-111) Avail: NTIS HC A02/MF A01

The overall concept of satellite flywheels is described as well as their rotor magnetic suspension and associated subsystems. The possible evolution of such equipment towards kinetic energy storage systems which could be utilized for satellite as well as for ground applications in a wide range of rotation speeds is examined. Author (ESA)

N80-26370# Stuttgart Univ. (West Germany). Inst. fuer Kernenergetik und Energiesysteme.
LIFETESTS OF TELECOMMUNICATIONS SATELLITE HEAT PIPES Final Report
W. D. Muenzel Jan. 1979 81 p refs
(Contract ESA-1857/73-JS)
(ESA-CR(P)-1312) Avail: NTIS HC A05/MF A01

The life testing of low temperature heat pipes designed for satellite thermal control is discussed. Five stainless steel/ammonia artery heat pipes and four aluminum/ammonia artery heat pipes were operated at elevated temperatures of about 60 C with a heat load of 15 watts for each pipe. In addition, two axially grooved aluminum/ammonia heat pipes operating at 60 C with a heat load of 50 watts, each were tested. Major results obtained from controlled maximum performance tests are compiled. Moreover, the results of some mechanical tests, burst pressure tests, and a post-mortem analysis of one of the aluminum artery heat pipes are included. Life testing of stainless steel heat pipes indicates no signs of deterioration over a period of three years. The aluminum heat pipes develop a steadily increasing amount of non condensible gas. However, life testing of axially grooved aluminum heat pipes show that the small amounts of non condensible gas generated after a period of nearly one year, produce little effect on the heat transport characteristics of these pipes. M.G.

N80-26371# British Aerospace Dynamics Group, Stevenage (England).
PALLET-ONLY CONFIGURATION IMPROVEMENT STUDY-RIDER: TECHNICAL STUDY Final Report
B. Collins, comp. Nov. 1979 77 p refs
(Contract ESA-3608/78)
(BAE-TPD-7761; ESA-CR(P)-1315) Avail: NTIS HC A05/MF A01

Two systems, (1) free-flying pallets connected to the NASA power module and (2) autonomous free-flying pallet, are examined in more detail. A background description of each system is given. Thermal control options are reviewed for the first system along with the feasibility of assembling longer pallet trains. For the second system aspects of the attitude and orbit control system, the thermal control system, and the command and data management system are considered. The study shows that Coastal Oceans Monitoring Satellite can be accommodated by the second system using a half-pallet. Author (ESA)

N80-26372# Royal Aircraft Establishment, Farnborough (England).
TABLE OF EARTH SATELLITES. VOLUME 3: 1974 TO 1978
J. A. Pilkington, D. G. King-Hele, H. Hiller, and Doreen M. C. Walker London HMSO Jan. 1980 220 p refs
(RAE-TR-80001; RAE-Space-573; BR72771) Avail: NTIS HC A10/MF A01

The 607 Earth satellite launches are arranged chronologically, giving the name and international designation of each instrumented satellite and its associated rocket(s), with the date of launch, lifetime (actual or estimated), mass, shape, dimensions and at least one set of orbital parameters. Other fragments associated with a launch are listed, without details. Author (ESA)

N80-26348*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT
N. Fanelli and H. Nance *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 50-53 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N80-26349*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERNATIONAL SOLAR POLAR MISSION SUPPORT
R. B. Miller *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 54-57 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations, and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-26373*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
THERMAL PERFORMANCE OF A MECHANICALLY ATTACHED ABLATOR TILE FOR ON-ORBIT REPAIR OF SHUTTLE TPS
Stephen S. Thompkins, Claud M. Pittman, and Albert B. Stacey, Jr. May 1980 51 p refs
(NASA-TM-81822) Avail: NTIS HC A04/MF A01 CSCL 22B

The reusable surface insulation (RSI) material used in the shuttle thermal protection system is susceptible to damage. If any RSI tiles are damaged or lost during ascent, they must be repaired or replaced prior to entry. One approach to replacing a damaged or missing RSI tile consists of mechanically attaching a tile of ablation material in the place of the RSI tile. The thermal performance of this type of repair tile was evaluated in a simulated entry heating environment. The test specimen consisted of the ablator repair tile mechanically fastened to the strain isolation pad and surrounded by RSI tiles. The evaluation of the thermal performance was based on temperature response, surface integrity, and predicted flight performance. When the ablator tile protruded 1/8 inch above the surrounding RSI tiles, the forward facing steps caused significant inflow of hot gas down the ablator RSI joints and this inflow caused greatly increased back surface temperatures. E.D.K.

N80-26374*# Boeing Commercial Airplane Co., Seattle, Wash.
TECHNOLOGY REQUIREMENTS FOR FUTURE EARTH-TO-GEOSYNCHRONOUS ORBIT TRANSPORTATION SYSTEMS. VOLUME 2: TECHNICAL RESULTS Final Report
Vincent A. Caluon Jun. 1980 247 p refs
(Contract NAS1-15301)
(NASA-CR-3266) Avail: NTIS HC A11/MF A01 CSCL 22A

Technologies either critical to performance of offering cost advantages compared to the investment required to bring them to usable confidence levels are identified. A total transportation system is used as an evaluation yardstick. Vehicles included in the system are a single stage to orbit launch vehicle used in a priority cargo role, a matching orbit transfer vehicle, a heavy lift launch vehicle with a low Earth orbit delivery capability of 226,575 kg, and a matching solar electric cargo orbit transfer vehicle. The system and its reference technology level are consistent with an initial operational capability in 1990. The 15 year mission scenario is based on early space industrialization leading to the deployment of large systems such as power satellites. Life cycle cost benefits in discounted and undiscounted dollars for each vehicle, technology advancement, and the integrated transportation system are calculated. A preliminary functional analysis was made of the operational support requirements for ground based and space based chemical propulsion orbit transfer vehicles. E.D.K.

N80-26375*# ARO, Inc., Arnold Air Force Station, Tenn.
HEAT-TRANSFER TESTS OF THE NASA/ROCKWELL INTERNATIONAL SPACE SHUTTLE ORBITER OH-84 B, IH-102 AND OH-106 Final Report, 2-23 May 1979
K. W. Nutt, G. L. Dommerman, and A. C. Mansfield AEDC Aug. 1979 109 p
(NASA-CR-163288; AD-A083142; AEDC-TSR-79-V42) Avail: NTIS HC A06/MF A01 CSCL 22/2

Heat transfer tests were conducted on two 0.0175 scale and one 0.04 scale models of the space shuttle orbiter using the thin skin thermocouple technique. Data were recorded at Mach numbers 3 and 4 in the AEDC-VKF Supersonic Wind Tunnel A and at Mach 8 in the Hypersonic Tunnel B. Ten model configurations were tested including each orbiter model and the two 0.0175 scale models integrated with the external tank and both solid rocket boosters. The objective of the test was to obtain heating data in regions of the orbiter where no previous data exist or where data extrapolation was not feasible. The model angle of attack ranged from -40 to 40 degrees with yaw angles varying from -15 to 10 degrees. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-26342*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE: TELECOMMUNICATIONS TECHNOLOGY
R. E. Edelson and G. S. Levy *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 1-8 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

N80-26347*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER VENUS MULTIPROBE ENTRY TELEMETRY RECOVERY
R. B. Miller and R. Ramos (NASA Ames Res. Center) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 43-49 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

N80-26357*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SYNCHRONIZATION OF REED-SOLOMON CODES
R. L. Miller and R. B. Newman (California Inst. of Technology) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 120-122 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-26376*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DISCUSSION MEETING ON GOSSAMER SPACECRAFT (ULTRALIGHTWEIGHT SPACECRAFT) Final Report
Roy G. Brereton, ed. 15 May 1980 186 p refs Meeting held at Pasadena, Calif., 19-20 Dec. 1979
(Contract NAS7-100)
(NASA-CR-163275; JPL-Pub-80-26) Avail: NTIS HC A09/MF A01 CSCL 22B

Concepts, technology, and application of ultralightweight structures in space are examined. Gossamer spacecraft represented a generic class of space vehicles or structures characterized by a low mass per unit area (approximately 50g/sq m). Gossamer concepts include the solar sail, the space tether, and various two and three dimensional large lightweight structures that were deployed or assembled in space. The Gossamer Spacecraft had a high potential for use as a transportation device (solar sail), as a science instrument (reflecting or occulting antenna), or as a large structural component for an enclosure, manned platform, or other human habitats. Inflatable structures were one possible building element for large ultralightweight structures in space. B.D.

N80-26377*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
ATM-CMG CONTROL SYSTEM STABILITY
W. W. Anderson, L. M. Avio, and K. L. Jacobs May 1980 75 p refs
(NASA-TM-81827) Avail: NTIS HC A04/MF A01 CSCL 22B

Stability analyses and simulation data and results are presented for an initial Control Moment Gyroscope system proposed for the Apollo Telescope Mount cluster (later named Skylab) using momentum vector feedback. A compensation filtering technique is presented which significantly improved analytical and simulation performance of the system. This technique is quite similar to the complementary filtering technique and represents an early NASA application. Author

N80-26378*# California Univ., San Diego, La Jolla. Space Physics Group.
ACTIVE EXPERIMENTS IN MODIFYING SPACECRAFT POTENTIAL: RESULTS FROM ATS-5 AND ATS-6 Final Report, May 1977 - Feb. 1979
R. C. Olsen and E. C. Whipple Mar. 1979 159 p refs
(Contract NAS5-23481)
(NASA-CR-159993; UCSD-SP-79-01) Avail: NTIS HC A08/MF A01 CSCL 22B

The processing of data from onboard spacecraft instruments are described. The modification of spacecraft potentials is reviewed. Analysis of this data yielded the following results: (1) electron emission (E approximately < 10 electron-volts) did not perturb the status of a satellite at low potential the absolute value of phi approximately < 50 volts by more than 50 volts (the ATS 5 low energy limit), (2) emission of a low energy plasma (E approximatey < 10 volts) does not change low potentials (the absolute value of phi approximately < 5 volts) by more than a few volts (ATS 6 low energy resolution), (3) when ATS 6 entered eclipse in the presence of a high energy plasma (10 keV), the neutralizer suppressed any rise in the absolute value of phi (within a few volts resolution), (4) when the electron emitter on ATS 5 operated, it served to discharge negative potentials from thousands to hundreds of volts, and (5) when the neutralizer on ATS 6 was operated, it served to discharge kilovolt potentials to below 50 volts. Low altitude (100 - 300 km) experiments with KV electron beams are studied. Differential charging was eliminated by the operation of the main thruster on ATS 6 clamped on the spacecraft at -5 volts. B.D.

N80-26379*# National Aeronautics and Space Administration, Washington, D. C.
WITHOUT TABLES OF RANKS AND THE ISKRA STUDENT DESIGN BUREAU
N. Grigoryeva and B. Pankratov Jul. 1980 18 p Transl. into ENGLISH from 'Bez Tabeli o Rangakh' and 'SKB Iskra', Radio (USSR), no. 1, Jan. 1979 p 9-12 Transl. by Scientic Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76277) Avail: NTIS HC A02/MF A01 CSCL 22B

A brief overview of the development of ham radio Earth satellites in the Soviet Union is given. Emphasis is placed on the design and operation of the small man made satellites. For individual titles, see N80-26380 through N80-26381.

N80-26380*# National Aeronautics and Space Administration, Washington, D. C.
WITHOUT A TABLE OF RANKS: PRESENTING THE CREATORS OF RADIO-1 AND RADIO-2
N. Grigoryeva *In its* Without Tables of Ranks and the Iskra Student Design Bureau (NASA-TM-76277) Jul. 1980 p 1-23 Transl. into ENGLISH from "Bez Tabeli o Rankh", Radio (USSR), no. 1, Jan. 1979 p 9-11 (For primary document see N80-26379 17-18)
Avail: NTIS HC A02/MF A01 CSCL 22B

The design and operation of ham radio operator satellites is discussed. Major emphasis is placed on the personalities involved in the project. J.M.S.

N80-26381*# National Aeronautics and Space Administration, Washington, D. C.
SKB ISKRA
B. Pankratov *In its* Without Tables of Ranks and the Iskra Student Design Bureau (NASA-TM-76277) Jul. 1980 p 13-16 Transl. into ENGLISH from 'SKB Iskra', Radio (USSR), no. 1,

Jan. 1979 p 11-12 (For primary document see N80-26379 17-18)
Avail: NTIS HC A02/MF A01 CSCL 22B

The design and construction of small size man made Earth satellites for scientific research and scholarly purposes is reviewed. All stages of the work organization, from design to launching of a satellite, are covered. J.M.S.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-26382*# Old Dominion Univ. Research Foundation, Norfolk, Va.
ANALYSIS OF THE RIM INERTIAL MEASURING SYSTEM (RIMS) Progress Report, 21 Oct. 1979 - 21 Feb. 1980
S. M. Joshi May 1980 29 p refs
(Contract NAS1-15648)
(NASA-CR-159270) Avail: NTIS HC A03/MF A01 CSCL 17G

Nonlinear equations of motion are derived for the rim inertial measuring system, which is mounted in a strapped down configuration on a carrier vehicle. The measurement and equations derived from angular rates and linear accelerations were interfaced with the dynamic model of a user defined carried vehicle. Two methods are presented for rate measurement, and the results of the nonlinear computer simulation are presented. B.D.

N80-26383# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
THE PRECIPITATION ELECTRON DETECTORS (SSJ/3) FOR THE BLOCK 5D/FLIGHTS 2-5 DMSP SATELLITES CALIBRATION AND DATA PRESENTATION Interim Report
D. A. Hardy, M. S. Gussenhoven (Boston Coll.), and A. Huber (Emmanuel Coll.) 14 Sep. 1979 52 p refs
(AF Proj. 7601)
(AD-A083136; AFGL-TR-79-0210; AFGL-IP-282) Avail: NTIS HC A04/MF A01 CSCL 22/2

In addition to weather monitoring devices, the Defense Meteorological Satellite Program satellites currently have on-board auroral imaging devices, precipitating electron detectors, and thermal plasma analyzers. Together these provide a strong tool for analyzing the high latitude, near Earth, magnetospheric environment. The precipitating electrons are measured in 16 energy channels spanning an energy of 50 eV to 20 keV. The data have the potential of providing real-time monitoring of auroral activity through oval boundary measurements. It contains the following: a general description of the DMSP-F2 orbit, its variations in universal time and season, and the pertinence of these variations to boundary measurements, a description of the SSJ/3 pakcage, one of which is built for each of four DMSP satellites and the results of calibrating two of the instruments; a discussion of the way data is processed; a comparison of Northpole-Southpole passes during a magnetospherically quiet period and during an active period, and a discussion of the general features of the electron precipitation as they may be used to determine auroral boundaries. GRA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-26384*# National Aeronautics and Space Administration, Washington, D. C.
SPATIAL MOTION WITHOUT MATERIAL PROPULSION
A. Fenioux Mar. 1980 10 p Transl. into ENGLISH from the French Patent (Appl. no. 79/18601, 18 Jul. 1979) p 1-7 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75933) Avail: NTIS HC A02/MF A01 CSCL 21C

The retrograde system of a space vehicle is described which permits motion in space without the projection of gas by rotor or jet engine. It is composed of masses, which accelerate, decelerate and guide the center of gravity in space in an ordered actuation. The invention may be used to replace rotors and jet engines of our present space vehicles. In space, it may use electrical solar energy and develop indefinitely in the solar system. A.R.H.

N80-26385# Naval Surface Weapons Center, Dahlgren, Va.
ROCKET MOTOR BLAST EFFECTS AND PROPOSED ABLATIVE PROTECTION FOR RAM LAUNCHING SYSTEM EX 43, ADDENDUM Final Report
Earl E. Biermann and Allen B. Coates Apr. 1980 18 p
(AD-A083315; NSWC/TR-80-94) Avail: NTIS HC A02/MF A01 CSCL 16/1

The results of the flyaway and environmental tests of ablative materials described in this report show that (1) all of the materials tested are satisfactory for use in the RAM launching system and (2) Dow Corning 93-104 w/graphite is an acceptable adhesive for bonding of the recommended materials to the launcher and/or deck surface. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-26386*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREPARATION OF PERFLUORINATED IMIDOYLAMIDOXIMES Patent Application
Reinhold H. Kratzer (Ultrasystems, Inc., Irvine, Calif.), Kazimiera J. L. Paciorek (Ultrasystems, Inc., Irvine, Calif.), Thomas I. Ito (Ultrasystems, Inc., Irvine, Calif.), and Robert W. Rosser, inventors (to NASA) Filed 27 Jun. 1980 8 p
(NASA-Case-ARC-11267-1; US-Patent-Appl-SN-163839) Avail: NTIS HC A02/MF A01 CSCL 07C

A method of preparing perfluorinated imidoylamidoximes is disclosed. The imidoylamidoximes are synthesized by the condensation of a perfluorinated nitrile with a perfluorinated amidoxime in vacuo or in an inert atmosphere at a temperature within the range of about 20 to 70 C for a period of 24 to 240 hours. When both the nitrile and the amidoxime reactants are difunctional, oligomeric or polymeric product are obtained, which, after cyclization of the imidoylamidoxime groups to 1,2,4-oxadiazole linkages, yield excellent heat, chemical, and solvent resistant elastomers. NASA

N80-26387# Vacuumschmelze G.m.b.H., Hanau (West Germany).
DEVELOPMENT OF SOFT MAGNETIC MATERIALS WITH SPECIAL PROPERTIES Final Report
Albrecht Mager Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 167 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-32) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 34,65

Results on the influence of crystal grains, inclusions, and mechanical stresses on the soft magnetic properties of Ni-Fe alloys are given. Soft magnetic alloys were developed and improved for low temperature applications, for small temperature coefficients, for different shapes of hysteresis loops, and for high wear resistance. Author (ESA)

24 COMPOSITE MATERIALS

Includes laminates.

N80-26388* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CORK-RESIN ABLATIVE INSULATION FOR COMPLEX SURFACES AND METHOD FOR APPLYING THE SAME Patent

Hill M. Walker, Max H. Sharpe, and William G. Simpson, inventors (to NASA) Issued 27 May 1980 3 p Filed 12 Sep. 1978 Supersedes N78-32190 (16 - 23, p 3052)
(NASA-Case-MFS-23626-1; US-Patent-4,204,899; US-Patent-Appl-SN-941711; US-Patent-Class-156-212; US-Patent-Class-156-213; US-Patent-Class-156-285; US-Patent-Class-264-118; US-Patent-Class-264-119; US-Patent-Class-264-124; US-Patent-Class-260-17.2) Avail: US Patent and Trademark Office CSCL 11D

A method of applying cork-resin ablative insulation material to complex curved surfaces is disclosed. The material is prepared by mixing finely divided cork with a B-stage curable thermosetting resin, forming the resulting mixture into a block, B-stage curing the resin-containing block, and slicing the block into sheets. The B-stage cured sheet is shaped to conform to the surface being insulated, and further curing is then performed. Curing of the resins only to B-stage before shaping enables application of sheet material to complex curved surfaces and avoids limitations and disadvantages presented in handling of fully cured sheet material.

Official Gazette of the U.S. Patent and Trademark Office

N80-26389*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A SILICON-SLURRY/ALUMINIDE COATING Patent Application

D. L. Deadmore and S. G. Young, inventors (to NASA) Filed 20 Jun. 1980 11 p
(NASA-Case-LEW-13343-1; US-Patent-Appl-SN-161254) Avail: NTIS HC A02/MF A01 CSCL 11D

A low cost coating is disclosed which protects metallic base system substrates from high temperatures, high gas velocity oxidation, thermal fatigue and hot corrosion. The coating is particularly useful for protecting vanes and blades in aircraft and land based gas turbine engines. A lacquer slurry comprising cellulose nitrate containing high purity silicon powder is sprayed onto the superalloy substrates. The silicon layer is then aluminized to complete the coating. The Si-Al coating is less costly to produce than advanced aluminides and protects the substrate from oxidation and thermal fatigue for a much longer period of time than the conventional aluminide coatings. While more expensive Pt-Al coatings and physical vapor deposited MCrALY coatings on certain superalloys in high gas velocity oxidation and thermal fatigue. Also, the Si-Al coating increased the resistance of certain superalloys to hot corrosion. NASA

N80-26390*# National Aeronautics and Space Administration, Washington, D. C.

FURTHER DEVELOPMENT AND APPLICATION OF POLYCRYSTALLINE METAL WHISKERS

Hermann J. Schladitz Dec. 1979 61 p Transl. into ENGLISH of Weiterentwicklung und Anwendung von Polykristallinen Metallwhiskern (Bonn), Final Report, BMFT-FB-T-76-18, Jun. 1976 75 p Translation was announced as N77-12219 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Bundesministerium fuer Forsch. und Technol., Bonn
(Contract NASw-3198)
(NASA-TM-75745; BMFT-FB-T-76-18) Avail: NTIS HC A04/MF A01 CSCL 11D

High strength metal whiskers have a larger versatile field of application than monocrystalline whiskers. Although polycrystalline metal whiskers can be used for composites, preferably by extrusion in thermoplastics or by infiltration of resins or metals into whisker networks, the chief application at present may be the production and various use of whisker networks. Such networks can be produced up to high degrees of porosity and besides high mechanical strength, they have high inside surfaces and high electric conductivity. There are for instance, applications concerning construction of electrodes for batteries and fuel cells, catalysts and also new heat-exchanger material, capable of preparing fuel oil and gasoline in order to assist a high-efficiency combustion. The technical application of polycrystalline metal whiskers require their modification as well as the construction of a pilot production unit. Author

N80-26391*# Little (Arthur D.), Inc., Cambridge, Mass.

AN ASSESSMENT OF THE RISK ARISING FROM ELECTRICAL EFFECTS ASSOCIATED WITH THE RELEASE OF CARBON FIBERS FROM GENERAL AVIATION AIRCRAFT FIRES

Donald Rosenfield and Joseph Fiksel Feb. 1980 104 p
(Contract NAS1-15380)
(NASA-CR-159206) Avail: NTIS HC A06/MF A01 CSCL 11D

A Poisson type model was developed and exercised to estimate the risk of economic losses through 1993 due to potential electric effects of carbon fibers released from United States general aviation aircraft in the aftermath of a fire. Of the expected 354 annual general aviation aircraft accidents with fire projected for 1993, approximately 88 could involve carbon fibers. The average annual loss was estimated to be about $250 (1977 dollars) and the likelihood of exceeding $107,000 (1977 dollars) in annual loss in any one year was estimated to be at most one in ten thousand. Author

N80-26392*# Little (Arthur D.), Inc., Cambridge, Mass.

AN ASSESSMENT OF THE RISK ARISING FROM ELECTRICAL EFFECTS ASSOCIATED WITH CARBON FIBERS RELEASED FROM COMMERCIAL AIRCRAFT FIRES

Ashok S. Kalelkar, Joseph Fiksel, Donald Rosenfield, David L. Richardson, and John Hagopian Feb. 1980 144 p
(Contract NAS1-15380)
(NASA-CR-159205; C-81857) Avail: NTIS HC A07/MF A01 CSCL 11D

The risks associated with electrical effects arising from carbon fibers released from commercial aviation aircraft fires were estimated for 1993. The expected annual losses were estimated to be about $470 (1977 dollars) in 1993. The chances of total losses from electrical effects exceeding $100,000 (1977 dollars) in 1993 were established to be about one in ten thousand. Author

N80-26393*# Operations Research, Inc., Silver Spring, Md.

ADVANCED RISK ASSESSMENT OF THE EFFECTS OF GRAPHITE FIBERS ON ELECTRONIC AND ELECTRIC EQUIPMENT

L. Pocinki, Merrill Cornell, and Lawrence Kaplan May 1980 167 p refs
(Contract NAS1-15379)
(NASA-CR-159210) Avail: NTIS HC A08/MF A01 CSCL 11D

An assessment of the risk associated with accidents involving aircraft with carbon fiber composite structural components is examined. The individual fiber segments cause electrical and electronic equipment to fail under certain operating conditions. A Monte Carlo simulation model was used to computer the risk. Aircraft accidents with fire release of carbon fiber material, entrainment of carbon fibers in a smoke plume transport of fibers downwind, transfer of some fibers/into the the interior of buildings, failures of electrical and electronic equipment, and economic impact of failures are discussed. Risk profiles were prepared for individual airports and the Nation. The vulnerability of electrical transmission equipment to carbon fiber incursion and aircraft accident total costs is investigated. B.D.

N80-26394*# Little (Arthur D.), Inc., Cambridge, Mass.

AS ASSESSMENT OF POWER SYSTEM VULNERABILITY TO RELEASE OF CARBON FIBERS DURING COMMERCIAL AVIATION ACCIDENTS

Gerald R. Larocque Jan. 1980 41 p refs
(Contract NAS1-15380)
(NASA-CR-159208) Avail: NTIS HC A03/MF A01 CSCL 11D

The vulnerability of a power distribution system in Bedford and Lexington, Massachusetts to power outages as a result of exposure to carbon fibers released in a commercial aviation accident in 1993 was examined. Possible crash scenarios at Logan Airport based on current operational data and estimated carbon fiber usage levels were used to predict exposure levels

and occurrence probabilities. The analysis predicts a mean time between carbon fiber induced power outages of 2300 years with an expected annual consequence of 0.7 persons losing power. In comparison to historical outage data for the system, this represents a 0.007% increase in outage rate and 0.07% increase in consequence. Author

N80-26395*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
UNIAXIAL AND BIAXIAL TENSIONING EFFECTS ON THIN MEMBRANE MATERIALS
W. F. Hinson and J. W. Goslee Jun. 1980 25 p refs
(NASA-TM-81812) Avail: NTIS HC A02/MF A01 CSCL 11D

Thin laminated membranes are being considered for various surface applications on future large space structural systems. Some of the thin membranes would be stretched across or between structural members with the requirement that the membrane be maintained within specified limits of smoothness which would be dictated by the particular applications such as antenna reflector requirements. The multiaxial tensile force required to maintain the smoothness in the membrane needs to be determined for use in the structure design. Therefore, several types of thicknesses of thin membrane materials have been subjected to varied levels of uniaxial and biaxial tensile loads. During the biaxial tests, deviations of the material surface smoothness were measured by a noncontacting capacitance probe. Basic materials consisted of composites of vacuum deposited aluminum on Mylar and Kapton ranging in thickness from 0.00025 in (0.000635 cm) to 0.002 in (0.00508 cm). Some of the material was reinforced with Kevlar and Nomex scrim. The uniaxial tests determined the material elongation and tensile forces up to ultimate conditions. Biaxial tests indicated that a relatively smooth material surface could be achieved with tensile force of approximately 1 to 15 Newtons per centimeter, depending upon the material thickness and/or reinforcement. Author

N80-26396*# Rocketdyne, Canoga Park, Calif.
DEVELOPMENT AND DEMONSTRATION OF MANUFACTURING PROCESSES FOR FABRICATING GRAPHITE/LARC-160 POLYIMIDE STRUCTURAL ELEMENTS, PART 4, PARAGRAPH B Quarterly Progress Report, 18 Dec. 1979 - 15 Mar. 1980
15 Mar. 1980 248 p
(Contract NAS1-15371)
(NASA-CR-159303; QPR-7-Pt-4) Avail: NTIS HC A11/MF A01 CSCL 11D

A quality assurance program was developed which included specifications for celion/LARC-160 polyimide materials and quality control of materials and processes. The effects of monomers and/or polymer variables and prepeg variables on the processibility of celion/LARC prepeg were included. Processes for fabricating laminates, honeycomb core panels, and chopped fiber moldings were developed. Specimens and conduct tests were fabricated to qualify the processes for fabrication of demonstration components. R.C.T.

N80-26397*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
THERMAL CYCLING GRAPHITE-POLYIMIDE
Michael W. Hyer and Jane A. Hagaman (Old Dominion Univ.) Apr. 1979 134 p refs
(Grant NsG-1167)
(NASA-CR-163294; VPI-E-79-115) Avail: NTIS HC A07/MF A01 CSCL 11D

The effects of repetitive thermal cycling on the temperature-thermal deformation relation of graphite-polyimide were determined. The bending and axial strains, measured with strain gages, of unsymmetric [0 deg sub 2/90 deg sub 2] and [0 deg sub 4/90 deg sub 4] laminates were used as an indication of thermal deformation. The strains were measured as a function of temperature and two temperature ranges were used, room temperature to 180 C and room temperature to 315 C. Five cycles were run in each temperature range and the cycling was done in quasistatic fasion. The response of a flat [0 deg sub 8] laminate was measured as were the effects of repetitive cycling on the strain gages themselves. A piece-wise linear theory, based on classical lamination theory and using the variation of mechanical and thermal expansion properties with temperature, was compared with the experimental results. The correlation between theoretical predictions and experimental results for the thinner laminate was poor. R.C.T.

N80-26398*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE STRUCTURAL BEHAVIOR OF A GRAPHITE-POLYMIDE HONEYCOMB SANDWICH PANEL WITH QUASI-ISOTROPIC FACE SHEETS AND AN ORTHOTROPIC CORE
Michael W. Hyer and Jane A. Hagaman (Old Dominion Univ. Research Foundation) Jun. 1979 124 p refs
(Grant NsG-1167)
(NASA-CR-163297; VPI-E-79-23) Avail: NTIS HC A06/MF A01 CSCL 11D

The results of a series of tests of graphite-polyimide honeycomb sandwich panels are presented. The panels were 1.22 m long, 0.508 m wide, and approximately 13.3 m thick. The face sheets were a T-300/PMR-15 fabric in a quasi-isotropic layup and were 0.279 mm thick. The core was Hexcel HRH 327-3/16 - 4.0 glass reinforced polyimide honeycomb, 12.7 mm thick. Three panels were used in the test: one was cut into smaller pieces for testing as beam, compression, and shear specimens; a second panel was used for plate bending tests; the third panel was used for in-plane stability tests. Presented are the experimental results of four point bending tests, short block compression tests, core transverse shear modulus, three point bending tests, vibration tests, plate bending tests, and panel stability tests. The results of the first three tests are used to predict the results of some of the other tests. The predictions and experimental results are compared, and the agreement is quite good. E.D.K.

N80-26399*# Oregon Graduate Center for Study and Research, Beaverton.
FABRICATION AND SURFACE CHARACTERIZATION OF COMPOSITE REFRACTORY COMPOUNDS SUITABLE FOR THERMIONIC CONVERTERS Annual Report, 1 Aug. 1978 - 31 Jul. 1979
P. R. Davis and L. W. Swanson Dec. 1979 61 p refs
(Contracts NAS7-100; JPL-955156)
(NASA-CR-163040; JPL-9950-356) Avail: NTIS HC A05/MF A01 CSCL 11D

The techniques of fabricating and characterizing the surface properties of electrode materials were investigated. The basic surface properties of these materials were studied with respect to their utilization as thermionic energy converter electrodes. Emphasis was placed on those factors (e.g. cesium disorption kinetic and mechanisms of low work function production) which are of primary concern to thermionic converter performance. R.C.T.

N80-26400*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MASS LOSS OF A TEOS-COATED, REINFORCED CARBON-CARBON COMPOSITE SUBJECTED TO A SIMULTED SHUTTLE ENTRY ENVIRONMENT
C. W. Stroud and Donald R. Rummler Jul. 1980 62 p
(NASA-TM-81799; L-13400) Avail: NTIS HC A04/MF A01 CSCL 11D

Coated, reinforced carbon-carbon (RCC) is used for the leading edges of the space shuttle. The mass loss characteristics of RCC specimens coated with tetraethyl orthosilicate (TEOS) were determine for conditions which simulated the environment expected at the lug attachment area of the leading edge. Mission simulation included simultaneous application of load, temperature, and oxygen partial pressure. Maximum specimen temperature was 900 K (1160 F). Specimens were exposed for up to 80 simulated missions. Stress levels up to 6.8 MPa (980 psi) did not significantly affect the mass loss characteristics of the TEOS-coated RCC material. Mass loss was correlated with the bulk density of the specimens. Author

N80-26401# Manchester Univ. (England). Dept. of Metallurgy.
MEASUREMENT OF THE THERMAL DIFFUSIVITY OF

CARBON/CARBON FIBER COMPOSITES FROM 20-3000 C
Interim Report, 30 Sep. 1977 - 30 Sep. 1979
R. Taylor and R. N. Proctor Nov. 1979 74 p refs
(Grant AF-AFOSR-3449-77; AF Proj. 2308)
(AD-A083570; AFOSR-80-0320TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

Thermal diffusivity measurements from 300-3000 K have been made on the following materials using the laser pulse method: (a) 3-D carbon fiber carbon composites types 'A' and 'B' made using Fiber 'F' material; (b) 1-D carbon fiber composite; (c) the matrix material used in their fabrication. Thermal conductivity has been calculated from these results and a model of composite conductivity presented. GRA

N80-26402# Marquette Univ., Milwaukee, Wis. Dept. of Mechanical Engineering.
PRESSURE AND TEMPERATURE BEHAVIOR OF FRAMEWORK SILICATES AND NITRIDES
L. Cartz and J. D. Jorgensen 1979 8 p refs Presented at 16th Intern. Thermal Conductivity Conf. and 7th Intern. Thermal Expansion Symp., Chicago, 7-9 Nov. 1979 Prepared in cooperation with Argonne Nat. Lab., Ill.
(Contract W-31-109-eng-38)
(CONF-791134-11) Avail: NTIS HC A02/MF A01

The response of silicates and nitrides to changes of pressure or of temperature depends on the flexibility of the bond angles of the crystal structures. Where bond angles can vary between neighboring tetrahedra linked at one corner, relative tilting or rotations occur which modify the three dimensional framework and this dominates the response of the crystal structure to temperature or pressure changes. Direct evidence for this behavior is available from measurements by time-of-flight neutron diffraction with multi-component profile refinement procedures, where atomic position changes have been determined to pressures of approximately 3 x 10 to the 9th power Pa. The importance of the framework structural type was illustrated by studies of the flexible alpha quartz structures of SiO2 and GeO2 which have volume compressibility coefficients K/sub v/ approximately 26 x 10 to the minus 12 power/Pa, the partially flexible structures Si2N2O and Ge2N2O with K approximately 9 x 10 to the minus 12 power/Pa, and the rigid structures alpha and beta Si3N4 with k/sub v/ approximately 3 x 10 to the minus 12 power/Pa. DOE

N80-26403# Dow Corning Corp., Midland, Mich.
DEVELOPMENT OF IMPROVED INSULATION MATERIALS
Final Technical Report, 1 Sep. 1978 - 30 Sep. 1979
J. A. Rabe, S. Spells, G. R. Homan, D. M. Rasch, C. L. Lee, and R. C. Parmele Sep. 1979 168 p refs
(Contract EM-78-C-04-4295)
(ALO-4295-T2) Avail: NTIS HC A08/MF A01

Evaluations of three types of silicone foam, for use as insulation in flat plate solar collectors are presented. The three types of foam were: Type 1A: a two part, room temperature curing foam corss linked through identical with SiOSi identical with linkages; Type 1B: a one part, heat activated foam also crosslinked through identical with SiOSi identical with bonds; and Type 2: a two part, room temperature curing foam cross linked with = NCOS(CH2)3 identical with linkages. A composite, in which a thin layer of type 1A foam protects a secondary layer of less expensive but thermally unstable isocyanurate foam, is also evaluated. DOE

N80-26404# Societe Nationale Industrielle Aerospatiale, Paris (France).
ON THE PRODUCTION OF COMPOSITE MATERIALS [PRODUIRE EN COMPOSITE]
M. Georges Jube 1979 25 p In FRENCH
(SNIAS-792-502-103) Avail: NTIS HC A02/MF A01

The properties, advantages and disadvantages of composite materials are presented. The suppliers of these materials are given, together with the different ways in which they are fabricated and later employed. The problems encountered with these materials are discussed. The specific materials manufactured by various companies are described together with their characteristics. Design features, calculation principles and certification procedures are reviewed together with cost considerations. Aeronautic and other applications in the United States and European countries are presented. Author (ESA)

N80-26405# Royal Aircraft Establishment, Farnborough (England).
EFFECT OF DEGREE OF ABRASION OF CARBON FIBER COMPOSITE SURFACES ON STRENGTHS OF ADHESIVE BONDED JOINTS
M. H. Stone London HMSO Dec. 1979 10 p refs
(RAE-TM-MAT-327; BR71986) Avail: NTIS HC A02/MF A01

Strengths of double lap joints between carbon fiber composite and aluminum alloy varied over a three fold range, and low strengths were correlated with a high proportion of failure in adhesion to the composite. Low strengths were traced to incomplete abrasion by grit blasting of the composite surface before bonding, although the effect appeared to depend on the adhesive used. Low strengths of lightly abraded joints were probably due to PTFE residues from release cloth. Careful control of blasting conditions allied to thorough inspection is necessary to ensure complete abrasion without exposure of carbon fiber. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-26406*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
CELL AND METHOD FOR ELECTROLYSIS OF WATER AND ANODE THEREFOR Patent Application
John R. Aylward, inventor (to NASA) (Hamilton Standard, Windsor Locks, Conn.) Filed 20 Jun. 1980 20 p Sponsored by NASA
(NASA-Case-MSC-16394-1; US-Patent-Appl-SN-161255) Avail: NTIS HC A02/MF A01 CSCL 07D

An electrolytic cell for the conversion of water vapor to oxygen and hydrogen is disclosed. The electrolytic converter includes an anode comprising a foraminous conductive metal base member having a coating thereon of 65-85 weight percent iridium oxide and 15-35 weight percent of a high temperature resin binder. Also included are a matrix member and a cathode, with the matrix member containing an electrolyte and the cathode being substantially inert to the electrolyte. The foraminous metal member is most desirably expanded tantalum mesh, and the cell desirably includes reservoir elements of porous sintered metal in contact with the anode to receive and discharge electrolyte to the matrix member as required. Upon entry of a water vapor-containing airstream into contact with the outer surface of the anode and thence into contact with iridium oxide coating, the water vapor is electrolytically converted to hydrogen ions and oxygen with the hydrogen ions migrating through the matrix to the cathode and the oxygen gas produced at the anode to enrich the air stream passing by the anode. NASA

N80-26407*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
PREPARATION OF PERFLUORINATED 1,2,4-OXADIAZOLES Patent Application
Reinhold H. Kratzer (Ultrasystems, Inc., Irvine, Calif.), Kaximiera J. L. Paciorek (Ultrasystems, Inc., Irvine, Calif.), Thomas I. Ito (Ultrasystems, Inc., Irvine, Calif.), and Robert W. Rosser, inventors (to NASA) Filed 27 Jun. 1980 9 p
(NASA-Case-ARC-11267-2; US-Patent-Appl-SN-163838) Avail: NTIS HC A02/MF A01 CSCL 07D

A method of preparing fluorinated alkyl or alkylether 1,2,4-oxadiazoles is disclosed. The oxadiazoles are synthesized by cyclizing the corresponding alkyl or alkylether imidoylamidoximes in vacuo or in an inert atmosphere at a temperature within the range of 40 to 100 C for a period of 8 to 144 hours in the presence of an acid compound which can accept ammonia to form a salt. The imidoylamidoximes usable in this process

may be either polymeric or nonpolymeric. As a result of the low cyclization temperatures, the quality and quantity of the 1,2,4-oxadiazole polymers are better than other disclosed processes. NASA

N80-26408*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SUBMILLIMETER, MILLIMETER, AND MICROWAVE SPECTRAL LINE CATALOGUE
R. L. Poynter and H. M. Pickett 1 Jun. 1980 141 p refs
(NASA-CR-163284; JPL-Pub-80-23) Avail: NTIS
HC A07/MF A01 CSCL 07D

A computer accessible catalogue of submillimeter, millimeter, and microwave spectral lines in the frequency range between 0 and 3000 GHz (such as; wavelengths longer than 100 m) is discussed. The catalogue was used as a planning guide and as an aid in the identification and analysis of observed spectral lines. The information listed for each spectral line includes the frequency and its estimated error, the intensity, lower state energy, and quantum number assignment. The catalogue was constructed by using theoretical least squares fits of published spectral lines to accepted molecular models. The associated predictions and their estimated errors are based upon the resultant fitted parameters and their covariances. B.D.

N80-26409*# Institute of Gas Technology, Chicago, Ill.
STUDIES OF THERMOCHEMICAL WATER-SPLITTING CYCLES Final Report
R. J. Remick and S. E. Foh May 1980 48 p refs
(Contracts NAS7-100; JPL-955494)
(NASA-CR-163029; JPL-9950-371) Avail: NTIS
HC A03/MF A01 CSCL 07D

Higher temperatures and more isothermal heat profiles of solar heat sources are developed. The metal oxide metal sulfate class of cycles were suited for solar heat sources. Electrochemical oxidation of SO2 and thermochemical reactions are presented. Electrolytic oxidation of sulfur dioxide in dilute sulfuric acid solutions were appropriate for metal oxide metal sulfate cycles. The cell voltage at workable current densities required for the oxidation of SO2 was critical to the efficient operation of any metal oxide metal sulfate cycle. A sulfur dioxide depolarized electrolysis cell for the splitting of water via optimization of the anode reaction is discussed. Sulfuric acid concentrations of 30 to 35 weight percent are preferred. Platinized platinum or smooth platinum gave the best anode kinetics at a given potential of the five materials examined. B.D.

N80-26410*# Illinois Univ. at Urbana-Champaign, Urbana.
EFFECT OF A ZERO g ENVIRONMENT ON FLAMMABILITY LIMITS AS DETERMINED USING A STANDARD FLAMMABILITY TUBE APPARATUS Final Report
Roger A. Strehlow and David L. Reuss Jun. 1980 30 p refs
Document includes a Microfiche supplement
(Grant NsG-3043)
(NASA-CR-3259) Avail: NTIS HC A03/MF A01 CSCL 21B

Flammability limits in a zero gravity environment were defined. Key aspects of a possible spacelab experiment were investigated analytically, experimentally on the bench, and in drop tower facilities. A conceptual design for a spacelab experiment was developed. R.C.T.

N80-26411# Arizona Univ., Tucson.
OPERATION OF VAN DE GRAAFF ACCELERATORS FOR BASIC EXPERIMENTS IN ATOMIC SPECTROSCOPY Final Report, 1971 - 1979
Stanley Bashkin 11 Apr. 1980 15 p refs
(Contract N00014-75-C-0499)
(AD-A083623; Rept-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

This contract resulted in the publication of approximately 12 research papers and books per year, primarily in the field of beam-foil spectroscopy. Eight students received the degree of Ph.D., and two the degree of M.S. during the reporting period. One Ph.D. student is currently completing his work. A list of publications and personnel is included. GRA

N80-26412# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Metallics and Surface Interactions Branch.
DATA TREATMENT IN ELECTRON AND ION SPECTROSCOPY Interim Report, Jul. 1977 - Jul. 1979
William L. Baun Dec. 1979 20 p refs Submitted for publication
(AF Proj. 2419)
(AD-A083201; AFML-TR-79-4211) Avail: NTIS
HC A02/MF A01 CSCL 07/4

In order to fully utilize newly developed electron and ion surface spectroscopies, the data from these methods must be treated carefully to assure quality and clarity both during and after the experiment. Signal conditioning during the experiment puts the data into proper form for recording and may include steps for amplifying, digitizing, discriminating, modulating, gating, transforming and filtering. In Auger Electron Spectroscopy (AES) where modulation and synchronous detection methods are used, special tailored waveform modulation may be necessary to minimize elemental profile artifacts. Dynamic background subtraction, digital filtering and Fourier transforms improve the signal to noise ratio and facilitate further data processing. If possible, an entire spectrum should be digitally stored at each plotted point on the elemental depth profile. Such spectral storage allows retrieval and examination of the spectrum for peak shape changes or appearance of peaks which were not expected to occur. A point which must be considered is that in bulk spectroscopies we may accumulate signal for whatever period is necessary to obtain desired counting statistics while in surface spectroscopies using an ion beam (such as ISS and SIMS), the eroding surface is ever changing and only a finite time is available for counting at a given depth. GRA

N80-26413# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 7: CYLINDRICAL AND SPHERICAL PREMIXED FLAMES Interim Technical Report
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 32 p refs
(Grant DAAG29-79-C-0121)
(AD-A083546; TR-109-Ch-7; ARO-15882.13-M) Avail: NTIS
HC A03/MF A01 CSCL 21/2

This report is Chapter 7 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. Cylindrical and spherical premixed flames are discussed, the latter with a view to application to the burning monopropellant drop. Cylindrical flames have a planar character, while spherical flames exhibit ignition and extinction. GRA

N80-26414# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 9: BURNER FLAMES
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 36 p refs
(Grant DAAG29-79-C-0121)
(AD-A083547; TR-111-Ch-9; ARO-15882.14-M) Avail: NTIS
HC A03/MF A01 CSCL 21/2

This report is Chapter 9 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. The three parts of a burner flame (namely base, cone and tip) are examined using both the slowly varying and near-equidiffusional theories of Chapter 8. GRA

N80-26415# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 11: STABILITY
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 51 p refs
(Grant DAAG29-79-C-0121)
(AD-A083548; TR-113-Ch-11; ARO-15882.15-M) Avail: NTIS
HC A04/MF A01 CSCL 21/2

This report is Chapter 11 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. The investigation is narrowed to the stability of freely propagating premixed flames, the only area that has yielded to mathematical analysis so far. Special emphasis is placed on the cellular flames that are found experimentally to be the result of instability. GRA

N80-26416# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.

MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 12: IGNITION AND EXPLOSION Interim Report
J. D. Buckmaster and G. C. S. Ludford Mar. 1980 52 p refs
(Contract DAAG29-79-C-0121)
(AD-A083549; TR-114-Ch-12; ARO-15882.16-M) Avail: NTIS HC A04/MF A01 CSCL 21/2

This report is Chapter 12 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. The induction, explosion, transition, propagation and relaxation phases are described for a slab of reactant whose faces are kept at a constant temperature. Under ignition, the application of a heat flux to a half space is considered. Finally, the explosion of initially separated reactants after they have mixed is shown to be very similar to the explosion of premixed reactants. GRA

N80-26417# Texas A&M Univ., College Station. Dept. of Chemical Engineering.
KINETIC ANALYSIS OF COMPLEX REACTION SYSTEMS-METHANOL CONVERSION TO LOW MOLECULAR WEIGHT OLEFINS
Rayford G. Anthony and Balaji Bondili Singh 1979 19 p refs Presented at the 72nd AICHE Meeting, San Francisco, 25 Nov. 1979
(Contract EW-78-S-02-4717)
(CONF-791108-17) Avail: NTIS HC A02/MF A01

An analysis of the selectivity data when converting methanol to low molecular weight hydrocarbons suggest that methane, propylene, and propane are formed by the primary reaction of methanol decomposition. Ethane, carbon monoxide, and dimethyl ether are formed by primary reactions and participate in secondary reactions. Carbon dioxide and ethylene are produced by secondary reactions. DOE

N80-26418# Brookhaven National Lab., Upton, N. Y.
UPTAKE RATES FOR HYDROGEN BY Nb AND Ta: EFFECT OF THIN METALLIC OVERLAYERS
M. A. Pick, Myron Strongin, and M. G. Greene 1980 12 p refs Presented at the Intern. Symp. on the Properties and Appl. of Metal Hybrides, Colorado Springs, Colo., 7 Apr. 1980
(Contract EY-76-C-02-0016)
(BNL-27208; CONF-800402-7) Avail: NTIS HC A02/MF A01

The hydrogen uptake rates of clean Nb and Ta foils were measured as a function of temperature and pressure. The sticking coefficient (number of hydrogen atoms entering the bulk divided by the number of hydrogen atoms hitting the surface) of hydrogen on clean Nb and Ta, at approximately .000022 Torr hydrogen and room temperature, was found to be surprisingly low, approximately .005 and approximately .05. The uptake rates were enhanced or decreased by the surface deposition of a thin layer of Pd, Pt, or Ni. For Pb a layer less than one monolayer thick did not change or even inhibit the hydrogen uptake, whereas a layer over one monolayer thick enhanced the sticking coefficient to a value of 1. The change at one monolayer was related to a phase transition of the Pd surface layer at that coverage. Both Pt and Ni did not exhibit this effect but did influence the uptake rate by an amount which depended on their thickness. Thick overlayers inhibit uptake due to a limited permeation rate through the layer. DOE

N80-26419# California Univ., Livermore. Lawrence Livermore Lab.
MODELING OF LAMINAR FLAMES IN MIXTURES OF VAPORIZED LIQUEFIED NATURAL GAS (LNG) AND AIR
Charles K. Westbrook 5 Feb. 1980 12 p refs
(Contract W-7405-ENG-48)
(UCID-18540) Avail: NTIS HC A02/MF A01

Numerical models dealing with the liquefied natural gas vapor cloud generation and dispersion were developed. Chemical kinetics submodels were required for these codes to describe the fuel air burning that might occur in a large LNG spill. The development of these chemical kinetics submodels is described. DOE

N80-26420# Sandia Labs., Albuquerque, N. Mex. Combustion Research Div.
VELOCITY AND TEMPERATURE MEASUREMENTS IN TURBULENT DIFFUSION FLAMES
G. D. Rambach, R. W. Dibble, and R. E. Hollenbach Feb. 1980 56 p refs Presented at the Fall Combust. Meeting, Western States Sect., Berkeley, Calif., 15-16 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8775; CONF-791048-6; Paper-79-51) Avail: NTIS HC A04/MF A01

Nonintrusive, time and space resolved measurements of velocity and temperature were performed in turbulent diffusion flames. The velocity measurements were made with a laser Doppler velocimeter on a confined turbulent hydrogen diffusion flame in coflowing air. Mean velocity, velocity standard deviation and turbulence intensity profiles were produced and compared with high speed shadowgraph movies and visual measurements of the flame boundaries. Single point velocity probability density functions were also produced for all spatial measurement points. Temperature measurements were made using Rayleigh scattering on an unconfined turbulent diffusion flame. The fuel and its products had approximately the same Rayleigh scattering cross section as air so that temperature could be inferred directly from the scattering intensity using the state equation for a perfect gas. The temperature measurements also included the probability density functions at several locations. DOE

N80-26421# Rockwell International Corp., Richland, Wash. Handford Operations.
HIGH PRESSURE LIQUID CHROMATOGRAPHY WITH ELEMENT-SPECIFIC DETECTION
D. E. Nelson and J. G. Metcalf Jun. 1979 14 p refs Presented at 34th Northwest Regional Meeting of the Am. Chem. Soc., Richland, Wash., 13 Jun. 1979
(Contract EY-77-C-06-1030)
(RHO-SA-115; CONF-790666-7) Avail: NTIS HC A02/MF A01

Element specific detection for high pressure liquid chromatography is discussed in terms of its several advantages over nospecific detection. These advantages include: simpler chromatograms (less peak overlap); faster analysis costly solvents can be used. Three applications (chemistry speciation, rare earth separations, and ethylenediamine triacedic acid/N-(2-hydroxyethyly) ethylenediamine triacedic acid determinations are discussed. DOE

N80-26422# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE ENTHALPY OF FUSION OF INDIUM: CERTIFICATION OF A SAMPLE FOR USE AS A CRM
R. J. L. Andon, J. E. Connett, and J. F. Martin Jul. 1979 14 p refs
(NPL-Chem-101) Avail: NTIS HC A02/MF A01

The enthalpies of fusion of three samples of indium were measured by adiabatic calorimetry. One sample was certified for use as a reference material for thermal analysis. The equipment and the experimental technique are described. The results of the measurements are presented and discussed in the light of published work. Author (ESA)

N80-26423# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computer Science.
NUMERICAL SOLUTION OF STEADY DIFFUSION-MIGRATION EQUATIONS REPRESENTING THE MASS CONCENTRATION OF DISSOLVED SPECIES IN CRACKS
D. H. Ferriss and G. F. Miller Nov. 1979 27 p refs
(NPL-NAC-22/79) Avail: NTIS HC A03/MF A01

Numerical techniques are employed to determine solutions to systems of nonlinear ordinary differential equations arising in the one dimensional analysis of steady diffusion and migration of dissolved species in metal cracks. In one situation where the migration effect is ignored it is shown that, to a good approximation, the problem can be reduced to the solution of an algebraic quartic equation. The validity of this approximation is investigated. In general, the problems in ordinary differential equations are converted to nonlinear integral equations to which a variant of the Newton-Raphson iterative techniques is applied. Author (ESA)

N80-26424# Materials Quality Assurance Directorate, London (England). Analytical Development Branch.

THE DETERMINATION OF SILICON BY ATOMIC ABSORPTION SPECTROMETRY
B. T. N. Newland HMSO Nov. 1977 19 p refs
(MOAD-TP-685; BR60889) Avail: NTIS HC A02/MF A01

The determination of silicon by atomic absorption spectrometry was investigated and applied to the analysis of a machine washing powder and silicone alkyd paint binders in aqueous and organic solvents respectively. Interferences by other ions in aqueous solutions are overcome by the addition of sodium, while in the organic solvent, interferences are minimal. Coefficients of variation are of the order 0.6% in aqueous solution and 1.0% in organic solvent. Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-26425 Wisconsin Univ. - Madison.
MODE 3 DUCTILE FRACTURE OF 2024-T351 ALUMINUM Ph.D. Thesis
William Robert Garver 1979 183 p
Avail: Univ. Microfilms Order No. 8008815

The fracture of torsionally-loaded circumferentially notched aluminum cylinders was studied. Stress-field solutions based on continuum theory and models of fracture for a microscopically heterogeneous material are discussed. Fracture initiation is analyzed in terms of Mode III stress intensity factor, the J-integral, and the near notch tip shear strain. The integral expression for J in cylindrical coordinates is included along with an expression to determine J for deeply notched geometries from the torsional load displacement record. A finite difference formulation for power-law-hardening elastic-plastic material is used to obtain the stress field solution for a notched cylinder loaded in torsion. Better agreement with experimental results is obtained using a fracture initiation criterion based on achieving a critical strain throughout a finite fracture process zone than using criteria based on the stress intensity factor or the J-integral. The transition from stable to unstable crack growth is analyzed using the tearing modulus concept. Calculations are consistent with experiment. However, evidence is presented indicating that an undetermined amount of Mode I loading occurs at a crack tip nominally loaded in Mode III, preventing more exact analysis of fracture instability. Dissert. Abstr.

N80-26426*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED PFB OPERATIONS: 400-HOUR TURBINE TEST RESULTS
R. J. Rollbuhler, S. M. Benford, and G. R. Zellars 1980 23 p refs Presented at 6th Intern. Conf. on Fluidized Bed Combust., Atlanta, 9-11 Apr. 1980; sponsored by DOE, Elec. Power Res. Inst., EPA and TVA
(NASA-TM-81511; E-260) Avail: NTIS HC A02/MF A01 CSCL 11F

A pressurized fluidized bed (PFB) coal-burning reactor was used to provide hot effluent gases for operation of a small gas turbine. Preliminary tests determined the optimum operating conditions that would result in minimum bed particle carryover in the combustion gases. Solids were removed from the gases before they could be transported into the test turbine by use of a modified two stage cyclone separator. Design changes and refined operation procedures resulted in a significant decrease in particle carryover, from 2800 to 93 ppm (1.5 to 0.05 grains/std cu ft), with minimal drop in gas temperature and pressure. The achievement of stable burn conditions and low solids loadings made possible a 400 hr test of small superalloy rotor, 15 cm (6 in.) in diameter, operating in the effluent. Blades removed and examined metallographically after 200 hr exhibited accelerated oxidation over most of the blade surface, with subsurface alumina penetration to 20 micron m. After 400 hours, average erosion loss was about 25 micron m (1 mil). Sulfide particles, indicating hot corrosion, were present in depletion zones, and their presence corresponded in general to the areas of adherent solids deposit. Sulfidation appears to be a materials problem equal in importance to erosion. A.R.H.

N80-26427*# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
HOT CORROSION OF Co-Cr, Co-Cr-Al, AND Ni-Cr ALLOYS IN THE TEMPERATURE RANGE OF 700-750 DEG C Semiannual Report, 1 Sep. 1979 - 29 Feb. 1980
K. T. Chiang and G. H. Meier Jun. 1980 29 p
(Grant NsG-3214)
(NASA-CR-159689; SAR-3) Avail: NTIS HC A03/MF A01 CSCL 11F

The effect of SO3 pressure in the gas phase on the Na2SO4 induced hot corrosion of Co-Cr, Ni-Cr, and Co-Cr-Al alloys was studied in the temperature range 700 to 750 C. The degradation of the Co-Cr and Ni-Cr alloys was found to be associated with the formation of liquid mixed sulfates (CoSO4-Na2SO4 or NiSO4-Na2SO4) which provided a selective dissolution of the Co or Ni and a subsequent sulfidation oxidation mode of attack which prevented the maintenance of a protective Cr2O3 film. A clear mechanism was not developed for the degradation of Co-Cr-Al alloys. A pitting corrosion morphology was induced by a number of different mechanisms. B.D.

N80-26428# United Technologies Research Center, East Hartford, Conn.
COATINGS FOR DIRECTIONALLY SOLIDIFIED GAMMA PRIME-GAMMA PLUS ALPHA EUTECTICS Final Report, Aug. 1978 - Nov. 1979
John G. Smeggil Oct. 1979 36 p refs
(Contract N62269-78-C-0311)
(AD-A081934; UTRC/R79-914424-4) Avail: NTIS HC A03/MF A01 CSCL 11/3

Coating compositions were developed to protect the directionally solidified gamma/gamma prime-alpha alloy (Ni-31w/oMo-6.2w/oAl) during cyclic oxidation and sulfidation in burner rig tests. The coating composition Ni-13.8w/oCo-15.8w/oCr-8.2w/oAl-16.9w/oPt-0.1w/oY was specifically identified in this study. For the family of alloys represented by gamma prime-alpha, the addition of 17 percent platinum to the NiCoCrAlY composition was insufficient to prevent cracking of the coating. Coatings containing 37 w/o platinum did not crack in the 2100 F cyclic oxidation tests. Chromium used as an intervening layer between gamma prime-alpha and the overlay coating reacted with the substrate to form brittle phases which cracked during thermal cycling. The substitution of nickel for chromium as an intervening layer resulted in void formation (Kirkendall porosity) leading to eventual coating delamination. GRA

N80-26429# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
THIN ANODIC OXIDE FILMS ON ALUMINUM ALLOYS AND THEIR ROLE IN THE DURABILITY OF ADHESIVE BONDS Final Report, Jan. - Feb. 1979
Neil T. McDevitt and James S. Solomon Feb. 1980 29 p refs
(AF Proj. 2419)
(AD-A083202; AFML-TR-79-4216) Avail: NTIS HC A03/MF A01 CSCL 11/6

The structure and chemical composition of anodic oxide films on aluminum alloys is discussed with reference to pure aluminum. The potential effects of these inhomogeneities are also discussed with reference to the durability of adhesively bonded structures. GRA

N80-26430# SRI International Corp., Menlo Park, Calif.
FURTHER DEVELOPMENT OF A COMPUTATIONAL SHEAR BAND MODEL Final Report, May 1977 - Sep. 1978
D. C. Erlich, D. R. Curran, and L. Seaman Mar. 1980 85 p refs
(Contract DAAG46-77-C-0043)
(AD-A083574; AMMRC-TR-80-3) Avail: NTIS HC A05/MF A01 CSCL 11/6

Experimental and analytical work was performed to improve the computational model for adiabatic shear band nucleation and growth (SNAG). A series of contained fragmenting cylinder experiments were performed with 4340 steel treated to hardness of R sub c 40, R sub c 52, and R sub c 21. The resulting damage ranged from homogeneous plastic deformation to extensive shear banding and resulting fragmentation. The results showed strong positive correlation between shear banding damage

and material hardness for identical loading conditions. A simplified method of damage quantification was used to obtain shear band density, size and orientation distributions for all of the R sub c 40 experiments. Preliminary computer simulations were performed to determine plastic shear strain rate histories in the direction of the predominant shear banding orientation mode, and the computations were compared with experimental data to yield first estimates for the values of the nucleation and growth parameters. A shear band nucleation criterion based on measurable material properties was proposed and tested against the experimental data; the criterion was seen to be promising although not yet conclusive. Several experimental techniques for characterizing the shear banding resistance of materials were evaluated and compared. The contained fragmenting cylinder experiment was concluded to be the best single technique, although the dynamic punch test has special value for armor penetration applications. GRA

N80-26431# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
APPLICATION OF RAPIDLY SOLIDIFIED ALLOYS
C. M. Adam, R. G. Bourdeau, J. W. Broch, and A. R. Cox Jun. 1979 25 p
(Contract F33615-76-C-5136)
(AD-A083496; PWA-FR-12127) Avail: NTIS HC A02/MF A01 CSCL 11/6

This program is being conducted for the purpose of applying the principle of rapid solidification to aluminum and iron alloy powder and subsequent development of stronger alloy compositions for fan blade application (Al alloys) and higher speed bearing materials (Fe alloys). Centrifugal atomization and forced convective cooling are being used to produce the fast cooled powder. During this report period, adaptation of the RSR process to aluminum and iron systems was continued. The evaluation of the first aluminum alloy matrix was partially completed, and a second matrix was selected. Hardness testing and microstructural evaluation of Fe alloys was performed. GRA

N80-26432# Naval Research Lab., Washington, D. C. Ocean Technology Div.
CASE STUDIES OF FATIGUE CRACK GROWTH USING AN IMPROVED MICROLIGAMENT INSTABILITY MODEL Interim Report
J. M. Krafft 30 Jan. 1980 71 p refs
(RR0230345; WR0220101)
(AD-A083394; AD-E000392; NRL-MR-4161) Avail: NTIS HC A04/MF A01 CSCL 11/6

The tensile ligament instability model TLIM has been refined and modified. A large set of new data cases is analyzed using the improved algorithm, most of these with high fidelity. In microstructurally varied titanium alloys, the process zone size is associated with the effective grain size; in structural and alloy steels it decreases with increasing yield strength, presumably here too related to grain refinement. The other fitting parameters, of environmental surface attack, show an internal consistency among the various specimen materials and environments. The modified model is thought to provide an advantageous means of comparing crack propagation data, and, in selected classes of materials, a suitable basis for predicting fatigue propagation life. GRA

N80-26433*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THREE DIMENSIONAL FINITE-ELEMENT ELASTIC ANALYSIS OF A THERMALLY CYCLED DOUBLE-EDGE WEDGE GEOMETRY SPECIMEN Final Report, 1 Jun. 1977 - 1 Jan. 1979
Sandra K. Drake, Richard J. Hill, Peter T. Bizon, Jeffrey L. Kladden, and Bruce P. Guilliams Mar. 1980 49 p refs Prepared in cooperation with AF Wright Aeronautical Labs., Wright-Patterson AFB, Ohio
(AF Proj. 3066)
(NASA-TM-80980; AD-A083245; AFWAL-TR-80-2013) Avail: NTIS HC A03/MF A01 CSCL 11/6

An elastic stress analysis was performed on a wedge specimen (prismatic bar with double-edge wedge cross-section) subjected to thermal cycles in fluidized beds. Five alloys (IN 100, Mar-M 200, Mar-M 302, NASA TAZ-8A, and Rene 80) subjected to the same thermal cycling condition were analyzed. This condition was alternate 3 minute immersions in fluidized beds maintained at 316 C and 1088 C (600 and 1990 F). The analyses were performed as a joint effort of two laboratories using different models and computer programs (NASTRAN and ISO3DQ). Stress, strain, and temperature results are presented. GRA

N80-26434# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
FUNDAMENTAL STUDIES OF HIGH-TEMPERATURE CORROSION REACTIONS Annual Progress Report
Robert A. Rapp, Suresh Verma, B. S. Lee, and G. M. Raynaud Feb. 1980 83 p refs
(Contract DE-AC02-79ER-10404; DE-AC02-79ER-02671)
(DOE/ER/10404-1; APR-5) Avail: NTIS HC A05/MF A01

Metal oxidation reactions and the mechanism of the sulfidation of molybdenum by sulfur gases were studied. Equipment including a SEM microscope, heater, and power supply which were used is described. DOE

N80-26435# Battelle Columbus Labs., Ohio.
STRESS CORROSION CRACKING OF ZIRCONIUM IN NITRIC ACID
J. A. Beavers, J. C. Griess (Oak Ridge Natl. Lab., Tenn.), and W. K. Boyd (Battelle Houston Operations, Tex.) 1980 21 p refs Presented at Natl. Assoc. of Corrosion Engrs. Meeting, Chicago, 3-7 Mar. 1980
(Contract W-7405-eng-26)
(CONF-800305-6) Avail: NTIS HC A02/MF A01

The susceptibility of zirconium and its common alloys to stress corrosion cracking (SCC) in nitric acid was investigated by slow strain rate and constant deflection techniques. Cracking occurred at 25 C over a wide range of acid concentrations and electrochemical potentials. The crack velocity increased slightly with increasing temperature. The failure mode was transgranular and the morphology was similar to SCC failures of zironium alloys in other environments. The fracture was very orientation dependent suggesting that it occurs on a single crystallographic plane in the material. The results are not consistent with a hydrogen mechanism for cracking. DOE

N80-26436# General Astrometals Corp., Yonkers, N.Y.
ASSESSMENT OF MARTENSITIC STEELS AS STRUCTURAL MATERIALS IN MAGNETIC FUSION DEVICES
J. M. Rawls, W. Y. K. Chen, E. T. Cheng, J. A. Dalessandro, P. H. Miller, S. N. Rosenwasser, and L. D. Thompson Jan. 1980 59 p refs
(Contract DE-AT03-76ET-51011)
(GA-A-15749) Avail: NTIS HC A04/MF A01

The results of preliminary experiments are presented and analyzed to assess the feasibility of incorporating ferromagnetic martensitic steels in fusion reactor designs and to evaluate the possible advantages of this class of material with respect first wall/blanket lifetime. The general class of alloys under consideration are ferritic steels containing from about 9 to 13 percent Cr with some small additions of various strengthening elements such as Mo. These steels are conventionally used in the normalized and tempered condition for high temperature applications and can compete favorably with austenitic alloys up to about 600 C. The material and magnetic properties are discussed as well as expected lifetimes for tritium breeding blanket modules. The problem of magnetic perturbations is addressed. Safety and environmental factors are considered. DOE

N80-26437# California Univ., Livermore. Lawrence Livermore Lab.
HYDROGEN ABSORPTION BY YNi5, LaPt5, AND ThNi5 INTERMETALLICS
John F. Lakner and Tako Takeshita 21 Feb. 1980 7 p refs
(Contract W-7405-eng-48)
(UCID-18558) Avail: NTIS HC A02/MF A01

The absorption of H by YNi5, LaPt5 and ThNi5 at pressures above those reported in the literature were studied. These alloys were reported to absorb no significant H2 at low pressures. DOE

N80-26438# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.

STUDY OF LOCAL ATOMIC AND ELECTRONIC STRUCTURE IN GLASSY METALLIC ALLOYS Progress Report, 1 Mar. - 1 Dec. 1979
R. P. Messmer and J. Wong 1979 29 p refs
(Contract DE-AC02-79ER-10382)
(DOE/ER-10382/1) Avail: NTIS HC A03/MF A01

Atomic arrangements in metallic glasses as characterized by X-ray diffraction are reviewed. The EXAFS experiment to study the local structure and dynamics of ferromagnetic metals in a series of Fe(40)Ni(40)P(20-x)B(x) glasses as a function of phosphorus content and annealing temperature are reported. Theoretical results in a study of cluster models of amorphous metal alloys. A.R.H.

N80-26439# Ames Lab., Iowa. Dept. of Materials Science and Engineering.
ELECTRO- AND THERMOTRANSPORT OF CARBON IN IRON-NICKEL ALLOYS Ph.D. Thesis
Ignatius Celestine Izuchukwu Okafor Mar. 1980 104 p refs
(Contract W-7405-eng-82)
(IS-T-887) Avail: NTIS HC A06/MF A01

Results of studies on the electrotransport, thermotransport and chemical diffusion of carbon in gamma phase iron - 32.5 wt % nickel alloys are described. The transport parameters Z, Q and D were measured as a function of temperature and carbon concentration and values for the activation energies for diffusion and electrotransport were obtained. The solubility limit of carbon in gamma Fe-32.5 wt % Ni for the temperature range 850 C to 1200 C and the electrical resistivity versus temperature for carbon concentrations of 0.0, 0.1, 0.2, 0.5 and 0.86 wt % C between 25 C and 1350 C were determined. An anomalously large mass transport effect observed in two phase alloy during thermotransport experiments was investigated for the Fe-Ni-C system. DOE

N80-26440# Ohio State Univ., Columbus. Fontana Corrosion Center.
CORROSION, STRESS CORROSION CRACKING, AND ELECTROCHEMISTRY OF THE IRON AND NICKEL BASE ALLOYS IN CAUSTIC ENVIRONMENTS Final Report
R. Koehler, F. H. Beck, A. K. Agrawal, B. Soendjasmono, and R. W. Staehle Feb. 1980 56 p refs
(Contract DE-AS02-76ER-02421)
(DOE/ER-02421/6) Avail: NTIS HC A04/MF A01

The electrochemical behavior of high purity (99.95% to 99.99%) iron in 0.6M NaCl and 1.0M Na2SO4 containing H2S (50 ppM to 34,000 ppM) was studied using cyclic voltammetry, chronoamperometry, and slow scan rate polarization. Results indicate that iron does undergo passivation in sulfate solutions containing H2S, iron dissolution depends on the presence of the concentration of H2S and solution pH. An equation is given that describes the anodic Tafel current densities. The slow strain rate test was used to evaluate the effect of electrode potential on the susceptibility of 2-1/4Cr, Mo steel to stress corrosion cracking in boiling 50% NaOH solution. Susceptibility decreased and general corrosion increased with increasing potentials. Failures contained a combination of ductile and brittle fracture. Time-to-failure was longest for controlled potentials of -700 and -600 mV (Hg/HgO reference) in the -1100 to -400 mV range in this study. DOE

N80-26441# Little (Arthur D.), Inc., Cambridge, Mass.
SURVEY OF POTENTIAL PROCESSES FOR THE MANUFACTURING OF ALUMINUM
Dec. 1979 84 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-79-4) Avail: NTIS HC A05/MF A01

Alternative processes to the Hall-Heroult cell for the production of primary aluminum direct carbothermic reduction of alumina are considered: reduction of bauxite to an aluminum silicon alloy; the subchloride process; the disproportionation of aluminum sulphide; the production through a nitride intermediate; and electrolysis of aluminum chloride aluminum sulphide and aluminum nitride; and plating from nonaqueous solvents. Energy consumption requirements for these techniques are compared with current Hall-Heroult technology and with projected improved technology - particularly titanium diboride cathodes and permanent anodes. The major conclusion is that the only alternative technology at present is the Alcoa chloride electrolysis process but that sulphide and nitride electrolytic processes offer potential advantages in the future. With the exception of thermal reduction to an aluminum - silicon alloy, none of the carbothermic processes is competitive because they require electric furnaces. Significant improvements in energy consumption could be achieved with titanium diboride cathodes in the Hall-Heroult cell. DOE

N80-26442# Sandia Labs., Livermore, Calif. Material Development Div. 1.
PLATING ON SOME DIFFICULT-TO-PLATE METALS AND ALLOYS
J. W. Dini and H. R. Johnson Feb. 1980 25 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8069) Avail: NTIS HC A02/MF A01

Electrodeposition of coatings on metals such as beryllium, beryllium-copper, Kovar, lead, magnesium, thorium, titanium, tungsten, uranium, zirconium, and their alloys can be problematic. This is due in most cases to a natural oxide surface film that readily reforms after being removed. The procedure recommended for plating on these metals to rely on replacing the oxide film with a displacement coating, or etching to allow mechanical keying between the substrate and plated deposit. The effectiveness of the procedures is demonstrated by interface bond strength found in ring shear and conical head tensile tests. DOE

N80-26443# National Physical Lab., Teddington (England). Div. of Materials Applications.
A MODEL OF CRACK ELECTROCHEMISTRY FOR STEELS IN THE ACTIVE STATE
A. Turnbull and J. G. N. Thomas Oct. 1979 50 p refs
(NPL-DMA(A)-11) Avail: NTIS HC A03/MF A01

A model of the electrochemical and mass transport processes within a static crack was developed for steels in the active state in order to improve the understanding of the electrochemical processes at the crack tip. The main reactions considered were dissolution and hydrolysis of ferrous ions and the cathodic reduction of hydrogen ions and water. The dissolution of alloying elements in the steel (e.g., chromium) and subsequent hydrolysis of the ions was considered and the effect of the buffering action of sea water was examined. Mass conservation equations were constructed for each of the species in the crack and solved using numerical methods. The pH within the crack was evaluated as a function of potential, bulk pH, crack geometry and other parameters and compared to the available experimental data. Author (ESA)

N80-26444# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
HEAT TREATMENT OF LIGHT AERONAUTIC ALLOYS: DEVELOPMENTS IN RESIDUAL STRESS STUDIES [LE TRAITEMENT THERMIQUE DES ALLIAGES LEGERS AERONAUTIQUES. DEVELOPPEMENT DE L'ASPECT. CONTRAINTES RESIDUELLES]
Jacques Odorico 23 Jun. 1979 9 p In FRENCH Presented at Assoc. Tech. de Traitement Thermique Conf., Tarbes, France, 3 Jun. 1978
(SNIAS-792-551-101) Avail: NTIS HC A02/MF A01

The specific case of alloy 7075 in the T73 state was studied. The effect of quenching water temperature on its mechanical characteristics at 20/25 C was investigated. Plastic deformation taking place between quenching and tempering was studied; for certain simply shaped parts, this effect can considerably reduce stress. For more complex parts a deliberately introduced deformation between quenching and tempering may reduce stresses as may a modification in cooling rates. Author (ESA)

N80-26445# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
USE OF THE FISSAD TEST BAR FOR STUDIES, QUALIFICATIONS CONTROL OF AERONAUTICAL CONSTRUCTION MATERIALS [UTILISATION DE L'EPROUVETTE FISSAD DANS LES ETUDES, LES QUALIFICATIONS ET LES CONTROLES DE PRODUITS DESTINES AUX CONSTRUCTIONS AERONAUTIQUES]
Jacques Odorico and Etienne Budillon 6 Apr. 1979 9 p In FRENCH Presented at Meeting Italien sur la Fissuration, Milan, 31 May 1979

(SNIAS-792-551-103) Avail: NTIS HC A02/MF A01

The heat treatments applied to 40 CDV 12 steel (used in the construction of AIRBUS) are described together with the steel's composition and the corresponding latitudes admissible. The required characteristics are stated. The effects of quenching (air, salt baths, oil) and austenizing on breaking energies and brittle/ductile transition curves are shown. The results of FISSAD on various grade steels, titanium alloys and some other light alloys are also given. Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-26446* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

VITRA-VIOLET PROCESS FOR PRODUCING FLAME RESISTANT POLYAMIDES AND PRODUCTS PRODUCED THEREBY Patent

Madeline S. Toy (Sci. Appl., Inc., La Jolla, Calif.) and Roger S. Stringham, inventors (to NASA) (Sci. Appl., Inc., La Jolla, Calif.) Issued 20 May 1980 4 p Filed 6 Dec. 1976 Supersedes N77-14262 (15 - 05, p 0594) Sponsored by NASA

(NASA-Case-MSC-16074-1; US-Patent-4,203,723; US-Patent-Appl-SN-747674; US-Patent-Class-8-115.5; US-Patent-Class-8DIG.12; US-Patent-Class-8DIG.18; US-Patent-Class-204-159.15; US-Patent-Class-204-159.19; US-Patent-Class-525-426) Avail: US Patent and Trademark Office CSCL 07C

Aromatic polyamides with improved nonflammability characteristics are produced by contacting a polyamide substrate with a gaseous medium comprising a minor amount of a haloolefinic material and an inert diluent in the presence of light having sufficient energy to effect chemical addition of the haloolefin to the polyamide substrate.

Official Gazette of the U.S. Patent and Trademark Office

N80-26447*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LOW TEMPERATURE CROSS LINKING POLYIMIDES Patent Application

Tito T. Serafini and Peter Delviss, inventors (to NASA) Filed 20 Jun. 1980 14 p

(NASA-Case-LEW-12876-1; US-Patent-Appl-SN-161253) Avail: NTIS HC A02/MF A01 CSCL 07C

A way of forming a prepolymer polyimide which can be cross-linked at a relatively low temperature is disclosed. Usually a polyimide is formed by cross linking a prepolymer formed by reacting a polyfunctional ester, a polyfunctional amine, and an end-capping unit. By providing a styrene derivative end-capping unit, the prepolymer is curable at a temperature of about 175 to 245 C. NASA

N80-26448*# Mechanical Technology, Inc., Latham, N. Y.

HIGH TEMPERATURE SELF-LUBRICATING COATINGS FOR AIR LUBRICATED FOIL BEARINGS FOR THE AUTOMOTIVE GAS TURBINE ENGINE Final Report

Bharat Bhushan 1 Jul. 1980 232 p refs

(Contracts DEN3-43; EC-77-A-31-1040)

(NASA-CR-159848; DOE/NASA/0043-2) Avail: NTIS HC A11/MF A01 CSCL 13I

Coating combinations were developed for compliant surface bearings and journals to be used in an automotive gas turbine engine. The coatings were able to withstand the sliding start/stops during rotor liftoff and touchdown and occasional short time, high speed rubs under representative loading of the engine. Some dozen coating variations of CdO-graphite, Cr2O3 (by sputtering) and CaF2 (plasma sprayed) were identified. The coatings were optimized and they were examined for stoichiometry, metallurgical condition, and adhesion. Sputtered Cr2O3 was most adherent when optimum parameters were used and it was applied on an annealed (soft) substrate. Metallic binders and interlayers were used to improve the ductility and the adherence. R.C.T.

N80-26449*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HIGH-TEMPERATURE ADHESIVES FOR BONDING POLYIMIDE FILM

Anne K. StClair, Wayne S. Slemp, and Terry L. StClair May 1980 28 p refs Presented at the 23rd Natl. SAMPE Symp., Anaheim, Calif., May 1978

(NASA-TM-81824) Avail: NTIS HC A03/MF A01 CSCL 11A

Experimental polyimide resins were developed and evaluated as potential high temperature adhesives for bonding Kapton polyimide film. Lap shear strengths of Kapton/Kapton bonds were obtained as a function of test temperature, adherend thickness, and long term aging at 575 K (575 F) in vacuum. Glass transition temperatures of the polyimide/'Kapton' bondlines were monitored by thermomechanical analysis. Author

N80-26450*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.

A FUNDAMENTAL APPROACH TO ADHESION: SYNTHESIS, SURFACE ANALYSIS, THERMODYNAMICS AND MECHANICS Semiannual Report

Betty Beck, Ranjani Siriwardane, and James P. Wightman Jul. 1980 19 p refs

(Grant NsG-1124)

(NASA-CR-163024) Avail: NTIS HC A02/MF A01 CSCL 11A

Several techniques were used to study pretreated Ti 6-4 surfaces including scanning electron microscopy (SEM), electron spectroscopy of chemical analysis (ESCA), and, reflectance visible spectroscopy. Each pretreatment type gave a characteristic surface morphology as seen by SEM. Elemental analysis of the Ti 6-4 surfaces was done using ESCA. Trace residual contaminants from particular chemical pretreatments were identified readily. Results indicate that reflectance visible spectroscopy using indicator dyes placed on Ti 6-4 surfaces appears to be a feasible approach to establish surface acidity. Differences in surface acidity were observed using bromthymol blue on Ti 6-4 surfaces pretreated by two different methods. R.C.T.

N80-26451*# National Aeronautics and Space Administration, Washington, D. C.

HYDROPHOBIC COATING OF SOLID MATERIALS BY PLASMA-POLYMERIZED THIN FILM USING TETRAFLUOROETHYLENE

Keiichiro Hozumi, Keisuke Kitamura, and Tatsuya Kitade Mar. 1980 17 p refs Transl. into ENGLISH from Yakugaku Zasshi (Japan), v. 99, no. 5, 1979 p 521-527 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Kyoto Coll. of Pharm.

(Contract NASw-3199)

(NASA-TM-75778) Avail: NTIS HC A02/MF A01 CSCL 07C

Glass slides were coated with plasma-polymerized tetrafluoroethylene films of different thickness using the glow discharge technique in a tube-shaped chamber, and the plasma conditions, film growth rates, light permeability of the polymer films, and particle bond strength in the polymer films were studied. Ashed sections of mouse organs and ashed bacillus spores were also coated to give them hydrophobic treatment without damaging their shapes or appearance. The hydrophobic coating of the specimens was successful, and the fine ash patterns were strongly fixed onto the glass slides, making permanent preparations. Author

N80-26452# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio. Materials Engineering Div.

EVALUATION OF POLYIMIDE FLEXIBLE FOAM

W. Paul Robbins Mar. 1980 11 p

(AD-A082742; PTPT-80-6) Avail: NTIS HC A02/MF A01 CSCL 11/9

A 0.5 pcf polyimide flexible foam developed by Solar Turbines International, Division of International Harvester Corp., was evaluated for cushioning and flammability characteristics. The results showed that the dynamic cushioning characteristics were equivalent to 0.5 polyurethane foam at 72 F, superior at -40 F and the foam has improved reuseability. When exposed to a

flame of a bunsen burner the polyimide foam was considered non-burning, with little smoke emission or odor. GRA

N80-26453# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
DYNAMIC FRACTURE IN VISCOELASTIC SOLIDS Annual Report, Aug. 1978 - Aug. 1979
Mool C. Gupta and Wolfgang G. Knauss. Mar. 1980. 53 p. refs
(Contract N00014-78-C-0634)
(AD-A083609; GALCIT-SM-80-5; AR-1) Avail: NTIS HC A04/MF A01 CSCL 11/9

The purpose of our studies is to gain fundamental information on the failure of elastomers, both unfilled and filled with particulate material; specially to determine the amount of fragmentation that occurs on failure under dynamic conditions. Experimental information sought relates to crack velocity and crack branching. At present we are studying the onset of crack propagation, and possible crack branching in elastomers using high speed cinematography under loads induced with an electromagnetic loading device. In this report we describe the material preparation, experimental technique and some preliminary results obtained on crack growth in Solithane (a polyurethane elastomer). GRA

N80-26454# Bendix Corp., Kansas City, Mo.
EFFECTS OF HUMIDITY DURING PHOTOPROCESSING ON THIN FILM METALLIZATION ADHESION
D. P. Norwood. Mar. 1980. 46 p. ref
(Contracts EY-76-C-04-0613; DE-AC04-76DP-00613)
(BDX-613-2312) Avail: NTIS HC A03/MF A01

Humidity effects during photoprocessing on tantalum/chromium/gold thin film networks (TFNs) were investigated. Humidity conditions at various process steps were controlled by placing either desiccant or water in handling containers for the TFNs. The TFNs photoprocessed in humid conditions had a much higher occurrence of metallization failures compared to TFNs processed in dry conditions. Ceramic surface defects were shown to cause pores in the thin films, and these pores enhanced corrosion susceptibility for the films. A desiccated storage process for production of TFNs were developed. DOE

N80-26455# Florida Univ., Gainesville. Dept. of Electrical Engineering.
INFLUENCE OF GRAIN BOUNDARIES ON RECOMBINATION IN POLYSILICON PN-JUNCTION SOLAR CELLS
J. G. Fossum, A. Neugroschel, F. A. Lindhom, and J. A. Mazer. 1980. 7 p. refs. Presented at 14th IEEE Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980
(Contract ET-78-C-01-3421)
(CONF-800106-24) Avail: NTIS HC A02/MF A01

The physics controlling recombination in polysilicon pn-junction cells is described. Analytic models characterizing this recombination, whose parameters can be related directly to experiment, are developed. The analysis reveals that, in general, the description of intra-grain and grain-boundary recombination in a polysilicon solar cell requires the solution of a nonlinear, three-dimensional boundary-value problem. Cases of practical interest for which this problem is tractable are discussed. The analysis predicts an exp(qV/2kT) dependence (the reciprocal slope factor is exactly two) for carrier recombination at a grain boundary within the junction space charge region of a nonilluminated, forward based cell. This result, and others of the analysis, are shown to be consistent with measured current-voltage characteristics of pn junctions fabricated on polycrystalline silicon. DOE

N80-26456# Cities Service Oil Co., Tulsa, Okla.
EL DORADO MICELLAR-POLYMER DEMONSTRATION PROJECT Progress Report, Sep. 1978 - Aug. 1979
G. W. Rosewald, ed. and W. D. Howell (Bartlesville Energy Technology Center, Okla.). Feb. 1980. 242 p. refs
(Contract ET-78-C-03-1800)
(DOE/ET-13070/53; AR-5) Avail: NTIS HC A11/MF A01

The micellar fluid injection was completed in the north (Chesney) pattern, and injection of polymer solution was initiated. Polymer solution was injected into the south (Hegberg) pattern. Fluid movement at the observation wells has been monitored closely. Oil mobilization has been indicated by the detection of an oil bank moving past some of the observation wells in both patterns. No significant changes in fluid composition have occurred at the eight production wells. Three flow tests designed to define the optimal salinity for the north pattern polymer drive were made using El Dorado 650 ft Sandstone cores. Results of these tests indicated that a polymer drive with 1.0 wt %. NaCl in El Dorado lake water has the highest oil recovery efficiency. The pressures in the project monitoring wells were measured four times. Two sets of pressure transient tests were conducted to determine the extent of a hydraulic fracture. An estimate of recovery efficiency was made based on the updated calculations and the data taken for the one foot interval at well MP 131. These preliminary results showed about 40% displacement efficiency. DOE

N80-26457# Sandia Labs., Albuquerque, N. Mex.
DEMIXING PROBLEMS IN POLYMERS
J. F. Joanny. Nov. 1979. 108 p. refs. Transl. into ENGLISH of "Problemes de Denmixtion dans les Polymeres", Ph.D. Thesis, Paris 6 Univ., Oct. 23, 1980. 108 p.
(SAND-80-6000) Avail: NTIS HC A06/MF A01

Phase transitions in polymers were studied. Emphasis was place on the following: Flory-Huggins theory and experiment; critical demixing properties; effects of polydispersion; and two dimensional systems. DOE

N80-26458# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
USE OF HIGH PERFORMANCE POLYMERS IN THE AEROSPACE INDUSTRY [UTILISATION DES POLYMERS PERFORMANTS DANS L'AEROSPATIALE]
J. P. Bentejac. 10 Aug. 1979. 10 p. In FRENCH. Presented at Symp. sur les Polymers a Hautes Performances et leurs Appl. Recentes, 7 Nov. 1978
(SNIAS-792-551-104) Avail: NTIS HC A02/MF A01

The applicability of polymers to various fabricated parts and structures is discussed from both the technical and financial point of view. The factors determining the choice of materials are reviewed together with the evolution in such materials over recent years. A table is given showing the interdependance between mechanical and thermal characteristics, various behavior properties, economic parameters and specific applications. The different characteristics and applications (aircraft, ballistics missiles, helicopters, etc.) of the various different thermosetting plastics are described. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-26459# California Univ., Irvine.
COMPARATIVE METABOLISM OF PROPELLANT HYDRAZINES Annual Report, 1 Jun. 1978 - 31 May 1978
Ronald C. Shank. Wright-Patterson AFB, Ohio AMRL. Aug. 1979. 50 p. refs
(Contract F33615-76-C-5005)
(AD-A074634; AMRL-TR-79-57) Avail: NTIS HC A03/MF A01 CSCL 21/9

Co-administration of hydrazine and 14C-methyl-methionine to rats and mice resulted in the methylation of liver DNA at the 7-position of guanine; this methylation occurs rapidly and was detectable one after hydrazine administration. No 7-methylguanine was found in animals given 14C-methyl-methionine alone. Administration of monomethylhydrazine (MMH) resulted in the formation of 7-methylguanine in rat and mouse liver DNA but not in DNA from other tissues: MMH served indirectly as the methyl donor. Administration of 1,1-dimethylhydrazine (UDMH) does not result in DNA methylation. The pattern DNA methylation by hydrazine and MMH was not similar to that produced by 1,2-dimethylhydrazine (SDMH), a strong carcinogen. MMH and UDMH were metabolically oxidized to CO_2 at different rates by various tissues from rats, mice, and hamsters. Deoxyribonucleic acid methylation in animals treated with propellant

hydrazines, to determine whether the nitrogen atoms in these hydrazines form adducts with tissue DNA, and to identify all adducts formed by mass spectrometry was examined. B.D.

N80-26460*# National Aeronautics and Space Administration. Pasadena Office, Calif.
AUTOCATALYTIC COAL LIQUEFACTION PROCESS Patent Application
Shaik A. Qader, inventor (to NASA) (JPL) Filed 28 Jan. 1980 31 p Sponsored by NASA
(NASA-Case-NPO-14876-1; US-Patent-Appl-SN-116310) Avail: NTIS HC A03/MF A01 CSCL 21D

An improved process is disclosed for liquefying coal in which coal minerals at high content are utilized as a hydrocracking catalyst. A slurry of 10 to 60% by weight of coal in recycled liquefied coal product which contains 15% to 30% by weight of coal minerals, is pressurized with excess hydrogen to a pressure of 2,000 to 4,000 psi and heated to a temperature of 450 to 550 C. The coal minerals autocatalytically convert coal solids to a low viscosity liquid product and to gas product in high yields while reducing oxygen, nitrogen and sulfur content of the coal product as compared to other coal liquefaction processes under development. NASA

N80-26461# Pittsburgh Energy Technology Center, Pa.
THE 2ND INTERNATIONAL SYMPOSIUM ON COAL-OIL MIXTURE COMBUSTION, VOLUME 2
1979 689 p refs Symp. held at Danvers, Mass., 27 - 29 Nov. 1979 Sponsored by DOE 2 Vol.
(CONF-791160-Vol-2) Avail: NTIS HC A99/MF A01

Technologies associated with coal oil mixtures (COM) are assessed. Production of COM, including techniques as well as equipment used, properties of the mixture, and additives needed for stabilization are discussed. Combustion efficiencies and byproducts are also studied. For individual titles, see N80-26462 through N80-26487.

N80-26462# Pennsylvania State Univ., University Park. Mineral Processing Section.
GRINDING OF COAL IN OIL
P. T. Luckie and P. S. Bagga *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 20 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Grinding kinetic parameters were determined in various fluids for three typical coals. It was found that the breakage action parameters for all of the coals did not change with environment as previously thought. Measurements of power draw of the test batch mill were also made. The implications of these findings to industrial results are discussed. Fuel oil as a grinding fluid appears to create a more sensitive tumbling action condition, and hence, lifter configuration and operational critical speed may be more critical. In addition, heating the fuel oil may achieve results similar to grinding the coal in water. E.D.K.

N80-26463# Transamerica Delaval, Inc., Crystal River, Fla. Imo Pump Div.
HANDLING COAL OIL MIXTURES WITH POSITIVE DISPLACEMENT PUMPS
Timothy W. Mabes, Sr. *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 5 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The use of two and three screw positive displacement pumps for use with coal oil mixtures is discussed. Particular attention is given to both the location of wear that occurs within these pumps as well as its effect on volumetric performance. consideration is also given to the economics involved for coal oil mixture pump packages versus conventional fuel oil pump packages. E.D.K.

N80-26464# Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
GRINDING OF COAL-IN-OIL SLURRIES
O. Trass and G. Papachristodoulou *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 28 p refs Prepared in cooperation with General Comminution Inc., Don Mills, Ontario (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Grinding of coal in fuel oil for COM preparation is simpler and may give better slurry properties than dry grinding followed by dispersion in oil. A 42 weight percent slurry of 600 to 840 micrometer monosize of hard Pittsburgh coal in No. 2, No. 4, and No. 6 fuel oils was ground with the Szego mill. Particle size distributions at different residence times are reported down to a 10 micrometer mean size, along with energy consumption data. Low mill hold ups and high rotational speeds enhanced the rate of grinding. E.D.K.

N80-26465# New England Power Service Co., Westborough, Mass.
DEVELOPMENT OF STANDARDS FOR COAL-OIL MIXTURES
Sushil K. Batra and Roy C. Kurtzrock (Pittsburgh Energy Technol. Center) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 6 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

As the coal oil mixture technology nears it commercialization, there is a need for uniform performance criteria, testing procedures, and quality control for trouble free and reliable utilization of this technology. Also, various terminologies associated with this technology need to be defined more precisely to have more meaningful application. With this in view, a Standards and Practice Committee was formed to establish criteria for process equipment, instrumentation, characterization of the coal oil mixtures, and combustion characteristics with respect to industrial and utility application of coal oil mixtures, as well as to develop guidelines and procedures considering feasibility from the standpoints of both cost and engineering. The goals and objectives of this committee with special reference to the various efforts underway in the area of development of standards and procedures are presented. E.D.K.

N80-26466# Dravo Corp., Pittsburgh, Pa.
PROGRESS IN DEVELOPING ULTRAFINE COAL-OIL MIXTURES
F. R. Sell and J. W. Cochran (Florida Power Corp., Crystal River) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 23 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

A comparison between ultrafine COM and 200 mesh COM shows that ultrafine COM has many potential advantages, such as low settling rate, minimization of equipment erosion and abrasion, reduction of boiler ash related problems, and beneficiation potential. Despite high grinding costs, the total cost of ultrafine COM fuel compares favorably with 200 mesh/additive COMs. Work on the fluid mill grinding approach for preparing ultrafine (100% minus 325 mesh) COM was continued. A technical development program to address energy consumption, mill wear, and scale-up of COM fuels for U.S. and foreign user evaluations was created. Plans are discussed concerning the building of a COM preparation plant for producing large quantities of demonstration fuel. E.D.K.

N80-26467# Massachusetts Univ., Amherst.
COAL-OIL MIXTURES 4: SEDIMENTATION AND SUBSIDENCE STUDIES OF THE STABILITY AND STRUCTURE OF COAL-OIL MIXTURES
R. L. Rowell, B. J. Marlow, T. S. Tsai, Sushil K. Batra, and J. R. Pitman (New England Power Co., Salem, Mass.) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 21 p refs Sponsored by Elec. Power Res. Inst. Prepared in cooperation with New England Power Service Co., Westborough, Mass. (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The limits of the sedimentation column method are explored and the techniques of sedimentation and subsidence are applied to long term studies of the stability and structure of coal oil mixtures. Significant environmental effects are considered, especially the effect of carbon dioxide as a blanketing gas. It is shown that sedimentation and subsidence measurements are a

sensitive probe of the stability and structure of coal oil fluids. The importance of the concept of a critical solids concentration is shown and model studies of stabilized and unstabilized COM at high concentration are given. Preliminary test results of slurry samples from various locations in the system are presented and compared to samples produced at the laboratory. The standard tests include determination of solid concentration, particle size distribution, sedimentation column drain time and sedimentation column bottom compaction. E.D.K.

N80-26468# Tufts Univ., Medford, Mass. Dept. of Chemical Engineering.
CHARACTERIZATION AND STRUCTURAL STUDIES OF THE VARIOUS TYPES OF COM
G. D. Botsaris, Y. M. Glazman, M. Adams-Viola, P. S. Goldsmith, and R. J. Haber *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 37 p refs (For primary document see N80-26461 17-28)
(Contract DE-AS01-78ET-10746)
Avail: NTIS HC A99/MF A01

The surface properties of coal, specifically its philicity or oleophilic/hydrophilic nature, are important parameters governing both the aggregative and sedimentative stability, the structure, and the rheology of COM. Moreover, it is contended that the surface properties of the coal are not only important in COM which contain additives but also in those which do not. The rheology and stability properties of various COM formulations prepared with different coals were investigated. Three parameters, a sedimentation number, an aggregation number, and a gelation number were developed to concisely reflect the results of the rheological and stability tests. An attempt was made to develop a model to explain the effect of additives on the structure, stability, and rheological properties of COM prepared from coals having different surface properties. E.D.K.

N80-26469# New England Power Service Co., Westborough, Mass.
FEASIBILITY STUDY OF USING A COAL/OIL/WATER EMULSION AND COAL/OIL MIXTURES AS CLEAN LIQUID FUELS 2
S. Y. Tsai, S. K. Batra, John P. Dooher (Adelphi Center for Energy Studies), Richard W. Genberg (Adelphi Center for Energy Studies), Sung Moon (Adelphi Center for Energy Studies), Donald Wright (Adelphi Center for Energy Studies), Steven E. Jakatt (Adelphi Center for Energy Studies), Barbara J. Gilmartin (Adelphi Center for Energy Studies), Donald Albert (Adelphi Center for Energy Studies), and Carl Denauski (Adelphi Center for Energy Studies) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 13 p (For primary document see N80-26461 17-28)
(Contract DE-AC22-79PC-10328)
Avail: NTIS HC A99/MF A01

The rheological and combustion properties of coal-water-oil mixtures were investigated and the use of alkaline additives to remove the sulfur oxide gases were studied. Results on stability and pumpability indicate that mixtures of 50% by weight of coal and stoichiometric concentrations of alkaline absorbents are pumpable. Correlation between viscometer data and pumping data follows a power law behavior for these mixtures. Thermal efficiencies are about the same as for pure oil. Combustion efficiencies are approximately 97%. It is possible to remove in a small scale combustion from 50 to 80% of the sulfur dioxide gases. E.D.K.

N80-26470# Germantown Labs., Inc., Philadelphia, Pa.
THE PRODUCTION OF STABLE COAL-OIL MIXTURES USING HIGH INTENSITY MECHANICAL MIXING DEVICES
C. S. Stokes and N. H. Cherry *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 28 p ref (For primary document see N80-26461 17-28)
(Contract DE-AC77-ET-10634)
Avail: NTIS HC A99/MF A01

The use of four different commercially available high intensity mechanical mixing devices to produce stable coal-oil-water mixtures were investigated. The four types of mixing devices used included a Gaulin Corporation Model 15 Homogenizer, a Sonic Corporation Triplex 1000A, a Branson Sonic Power Model 190 Ultrasonic Processing System, and a Total (French) System. The stability of a coal-oil-water mixture up to 45% coal loading was evaluated by a K-scan unit. A detailed description of the parameters and operating conditions for producing the stable mixtures using the four different units is presented. The Gaulin unit proved to be the most versatile unit producing stable 45% coal loaded materials using single pass operation. The unit also produced relatively stable 30% coal loaded mixtures using a recycle mode. The Sonic unit and the Branson equipment produced similar stable emulsions, and either apparatus could be used for 45% coal loaded mixtures. The Total system produced only stable emulsions using 45% coal loaded mixtures under recycle operation. M.G.

N80-26471# Adelphi Univ., Garden City, N. Y.
RHEOLOGICAL PROPERTIES OF SOLVENT REFINED COAL-OIL MIXTURES
John P. Dooher, E. P. Foster (Air Products/Wheelabrator-Frye Joint Venture), A. S. Gudta (Air Products/Wheelabrator-Frye Joint Venture), and C. M. Kelly *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 p 1-14 Prepared in cooperation with Villanova Univ., Pa. (For primary document see N80-26461 17-28)
(Contract DE-AC05-78ORO-3054)
Avail: NTIS HC A99/MF A01

The rheological properties and stability of various mixtures of solvent refined coal (SRC) solid in No. 6 oil and one mixture with No. 5 oil are investigated. The apparent viscosity was measured as a continuous function of shear rate by a rotoviscometer. Suspension settling stability was assessed by using a pendulum-period technique. The mixtures were found to differ somewhat from coal-oil mixtures of equivalent composition. SRC solid-oil mixtures are non-Newtonian, with an apparent viscosity significantly higher than coal-oil mixtures of equivalent composition. Except for very finely divided SRC particles at low shear rate, all mixtures tested are considered pumpable. There is apparently no significant reaction between SRC solid and the oil, as indicated by a lack of change of viscosity with time. Mixtures of SRC solid and oil alone settled somewhat. Mixtures stabilized by emulsification with water or addition of surfactant are felt to be sufficiently stable for commercial use. Of the mixtures tested, an emulsion of 47 wt% SRC solid, 47 wt% No. 6 oil, and 6 wt% water is considered the best. M.G.

N80-26472# Pittsburgh Energy Technology Center, Pa.
THE ROLE OF COAL AND OIL CHARACTERISTICS IN THE STABILITY OF COAL-OIL MIXTURES
J. M. Ekmann and D. Bienstock *In its* the 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 30 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The effect of coal type and oil type on the settling behavior of coal-oil mixtures (COM) is examined. Some discussion on the role of dispersion method and addition of water is included. The effect of oil chemistry and viscosity on settling was examined for five No. 6 oils - a correlation was found. Viscosity of the No. 6 oil strongly influenced COM viscosity, while no significant difference was found for several coals. Simple models for the shear stress-shear rate relationship were fit to available data - significant deviation from the models were found for high coal loadings. A simple model for settling is discussed. M.G.

N80-26473# Kentucky Univ., Lexington. Institute for Mining and Minerals Research.
EVALUATION OF "STABLE" EMULSIONS OF COAL
T. T. Coburn *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 25 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

A method of testing the long term stability of coal/oil/water emulsion samples is described. The emulsions investigated were commercial coal/oil/water mixtures, 55/35/10 by weight, prepared by an ultrasonic emulsifying method. Apparent viscosity determination proved to be a convenient method of sample evaluation. A rotational type viscometer was used, and a method based on an expression which had previously been used to determine the concentration of solids in latex dispersion was

applied: Log(apparent viscosity) = a Log(Spindle speed) + b. For emulsion samples from which solids settled slightly over a period of time, the weight percent solids as a function of depth could be related to the a term in the expression. At low spindle speeds it was more convenient to relate apparent viscosity and concentration of solids directly. A gravimetric method which required isolation of the dry coal solids was used to check the viscometry results. M.G.

N80-26474# Dow Chemical Co., Midland, Mich.
STABILIZATION OF COAL/FUEL OIL SLURRIES
W. C. Meyer *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 15 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Water as an effective means of stabilizing coal-oil mixtures (COM) against settling by acting as a flocculating third phase is examined. Wetting agents are found to enhance the flocculating efficiency of water by increasing the cross sectional area of contact between coal particles, as evidenced by increased static yield values--a measure of particle-particle interaction. At excessive levels of wetting agent, the more favorable wetting of the hydrophobic surface of coal by water is counterbalanced by greatly reduced interfacial tensions between water and oil. Some loss of flocculating efficiency occurs. The effect of particle size distribution, solids content, type of fuel oil, and type of coal (having a highly oxidized surface), along with the substitution of formamide in place of water as the flocculating third phase, are briefly examined to further define the stabilizing influence of water in COM. Possible adverse consequences of continuous agitation or recirculation on COM stability dervied via this means are pointed out. M.G.

N80-26475# Kawasaki Heavy Industries, Ltd., Akashi (Japan).
RESULTS OF EXPERIMENT PRODUCTION OF FINE COM BY WET TYPE MILL
Noboru Sato *In* Pittsburgh Energy Technol. Center The 2nd Inter. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 28 p ref (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The experimental production of fine coal-oil mixtures (COM) with a wet type mill using four kinds of bituminous coal together with Middle East heavy crude oil is discussed. The following results were obtained: (1) the holdup of COM in the mill has an important influence on grindabilty; (2) all types of coal submitted to the tests presented good grindabilty; (3) the coal density of 50% and 55% presented satisfactory grindability; (4) the temperature of COM during the pulverizing prcess should be as high as possible; (5) an increase in the production rate coarsens the particle size distribution of COM almost linearly; (6) when total moisture content of the crushed coal is of the order to 10% or less, it was confirmed that the residual moisture content of COM can be dewatered to approximately 2%, by heating the heavy oil supplied to the mill. M.G.

N80-26476# Hitachi, Ltd., Tokyo (Japan). Shipbuilding and Engineering Div.
FINE COM PREPARATION TEST
Masazumi Yanase *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 32 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Tests designed to determine the coal-oil mixture (COM) preparation conditions required to attain a satisfactory COM stability with a line mixer are discussed. The results indicate that, in premixing, the time between injection of the additive and agitation in the line mixer should be as short as possible. However a macroscopically homogenous mixing by agitation, as well as the method of injection of additive are necessary and important factors. Preparation using a line mixer gives better results compared with other preparation methods. In the preparation of COM with a line mixer, both specific agitation energy and turbine blade edge speed exceeding definite values are required. The optimum COM preparation conditions are different according to the additive, but these differences are not very pronounced. M.G.

N80-26477# Dai-ichi Kogyo Seiyaku Co. Ltd., Tokyo (Japan).
THE USE OF ADDITIVES TO STABILIZE COAL-OIL MIXTURE
Akihiro Naka *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 44 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The performance of additives intended to stabilize oil-coal mixtures (COM) is discussed. Approximately 1,300 types of additives were mixed more than 10 different COM and the obtained mixture was poured into a cylinder in order to measure precipitation of the coal particles after stell storage at a temperature of 70 C. As a result of these tests, several types of additives with excellent stabilizing effects were idscovered. The effectiveness of these stabilizers in the COM was tested under various conditions, i.e., vibration, heat, freezing, and agitation. Based on these tests, the additive presenting the best results was selected (ACOM). The addition of approximately 0.1 wt% of ACOM to a mixture, without addition of water, resulted in more than 10 types of COM stable for periods of one to two months and showing, in addition, excellent economic characteristics. M.G.

N80-26478# Neos Co. Ltd., Tokyo (Japan).
COM STABILITY FORECASTING METHOD
Yoshikazu Ogura *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 32 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

From a discussion of a stable system model composed of coal-oil mixtures (COM) with addition of an additive, a method for evaluating long term stability of the system, by measuring the quantity of additive distributed in the COM immediately after production is devised. The distribution forms considered are (1) additive dispersed and dissolved in the oil medium; (2) additive absorbed in the coal; and (3) additive present on the surface of coal. In case of using additive NEOS N-1, if the quantity of additive present on the surface of the coal exceeds 1,000 micro-g/coal-g experimental results demonstrate that the COM in question is able to remain as a stable system, even when still-stored for more than one month. M.G.

N80-26479# Kao Soap Co. Ltd., Tokyo (Japan).
STUDIES ON THE STABILIZATION OF COM
Masaaki Yamamura, Tatsuji Yamashita (Lion Fat and Oil Co. Ltd., Tokyo), and Taizo Igarashi (Nippon Oil and Fat Co. Ltd., Tokyo) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 57 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Stabilizers for coal-oil-mixtures (COM) and related technologies were developed. Emphasis was placed on developing stabilizers to minimize the sedimentation of coal particles contained in the COM. The factor influencing COM stability were determined and measures to cope with the variations occurring in the these factors were surveyed R.C.T.

N80-26480# Electric Power Development Co. Ltd. (Japan).
FINE AND COARSE COAL OIL MIXTURE COMBUSTION TESTS OF AIR ATOMIZED BURNER IN JAPAN
Y. Nakabayashi and Donald J. L. Lin, P. E. (Forney International, Inc.) *In* Pittsburgh Energy Technol., Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 24 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

A tristage air atomized burner was tested at the facilities of the three leading boiler makers in Japan. Coal oil mixtures (COM) of 50/50 weights with both fine and coarse coal particles were tested under conventional excess air and modified off-stoichiometeric combustion modes. Nitrogen-oxygen reduction techniques via flue gas recirculation and two stage off-stoichiometric combustion were confirmed. Coal-oil-mixture combustion characteristics were compared to those of heavy oil. R.C.T.

N80-26481# Atlantic Research Corp., Alexandria, Va.
DEVELOPMENT AND EVALUATION OF HIGHLY-LOADED COAL SLURRIES

R. S. Scheffee and E. T. McHale *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 14 p refs (For primary document see N80-26461 17-28)
(Contract DE-AC01-77-ET-13041)
Avail: NTIS HC A99/MF A01

Highly loaded coal slurry fuels were developed and evaluated. Slurry fuels comprised of either bitumionous, subbituminuos, or lignite coal and either aqueous media or emulsions of No. 6 oil in water as the carrier were examined at solids loadings up to 70% by weight. The water slurries of bituminous coals were emphasised. These slurries were developed for use in place of No. 6 oil in oil fired burners, and represent a companion concept to coal-oil-mixtures. R.C.T.

N80-26482# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
ATOMIZATION OF COAL SLURRY JETS
T. Butcher, A. Pucci, and C. R. Krishna *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 13 p refs (For primary document see N80-26461 17-28)
(Contract EY-76-C-02-0016)
Avail: NTIS HC A99/MF A01

Jet length and drop size were examined for water and No. 2 oil slurries up to 30% concentration. Preliminary data from an air-atomized nozzle are presented for illustration. R.C.T.

N80-26483# Wayne State Univ., Detroit, Mich. Dept. of Mechanical Engineering.
ATOMIZATION OF COAL-OIL MIXTURES
S. Carmi and M. R. Ghassemzadeh *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 17 p refs (For primary document see N80-26461 17-28)
(Grant DE-FG01-77-ET-10658)
Avail: NTIS HC A99/MF A01

Atomization characteristics of coal-oil mixtures were studied by an experimental set up consisting of an airblast atomizer fed from a flow control rig, which discharges through a spray channel into a storage tank. Vapors generated were removed via an exhaust system. The fully developed spray was photographed at different axial locations using 35 mm camera fitted with a microflash designed for high speed photography. Slides and prints were analyzed for particle size distribution. R.C.T.

N80-26484# Mitsubishi Heavy-Industries Ltd., Tokyo (Japan).
BASIC STUDIES ON COM COMBUSTION
U. Takahaski, H. Hino, U. Fujima, and A. Komori *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-oil Mixture Combust., Vol. 2 1979 29 p (For primary document see N80 26461 17-28)
Avail: NTIS HC A99/MF A01

Special appropriate conditions necessary for the satifactory atomization of the coal-oil-mixture (COM) were examined. The conditions preventing the atomizer, which has very narrow passages for transporting the COM, from clogging in order to achieve stable operation was studied. The feasibility of the technological development aiming at coping with that problem was investigated. R.C.T.

N80-26485# Hitachi, Ltd., Tokyo (Japan).
REPORT ON FINE COM COMBUSTION TEST
Hitoshi Migaki *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-oil Mixture Combust., Vol. 2 1979 15 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The utilization fine coal-oil mixtures transported as a fluid and as a fuel for boilers was investigated. Major emphasis was placed on the combustion, the nitrogen-oxygen countermeasures (i.e., two stage combustion), and the recirculation of gas mixing combustion. R.C.T.

N80-26486# Methacoal Corp., Dallas, Tex.
THE CFOS (CARBONACEOUS FUEL-IN-OIL SUSPENSOIDS) FUELS
Leonard J. Keller *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combustion, Vol. 2 1979 16 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The methods producing carbonaceous fuel-in-oil suspensoid fuels are discussed. It is shown that most of the CFOS fuels, if made from pulverized coal, although not as completely stable as those made from CHC fuels, are relatively stable compared to other coal-oil-mixtures fuels. R.C.T.

N80-26487# Argonne National Lab., Ill.
COAL/OIL MIXTURE PIPELINE: A VIABLE ALTERNATIVE COAL TRANSPORTATION SYSTEM?
J Harkness, B. L. and L. J. Petrovic (Resource Engineering, Inc.) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 22 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

A coal transportation system which utilizes coal/oil mixture technology is compared to the coal/water system and to another alternative, coal/ methanol system. Major emphasis is placed on the system design considerations and trade-offs, the resource requirements (including capital), and the cost of delivered energy. The system environmental impacts, the status of the technologies, oil quality and supply, and the potential system flexibilities are discussed qualitatively. R.C.T.

N80-26488# European Space Agency, Paris (France).
EXPLOSIVES AND PYROTECHNICS: SPACE APPLICATIONS
W. R. Burke, ed. and J. Mort, ed. Jan. 1980 361 p refs Partly in FRENCH and ENGLISH Presented at ESA/CNES Intern. Colloq., Toulouse, 23-25 Oct. 1979
(ESA-SP-144; ISSN-0379-6566) Avail: NTIS HC A16/MF A01; ESA, Paris FF 75

Pyrotechnic components and systems are discussed in terms of fundamental theory modeling, and experimentation. Major emphasis is given to reliability theory and applications. For individual titles, see N80-26489 through N80-26523.

N80-26489# Poitiers Univ. (France). Groupe de Recherches de Chimie Physique de la Combustion.
PHYSICAL CHEMISTRY OF PYROTECHNIC REACTIONS
M. L. Bernard *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 3-14 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Experimental and theoretical considerations are developed concerning pyrotechnic components and systems. Included are systems whose main function is the conversion of an external excitation, and pyrotechnic systems and devices having varied functions (instantaneous mechanical action, generation of gases, illumination, masking and labeling). Emphasis is given to the following phenomena: combustion, solid-solid reactions, reactions without gas, thermochemical behavior; chemical kinetics; and heat diffusion. The properties of some specific pyrotechnic materials are also presented. Author (ESA)

N80-26490# Societe Europeenne de Propulsion, Bordeaux (France).
MEASUREMENT OF THE COMBUSTION ENERGY OF PYROTECHNIC COMPOSITIONS BY DIFFERENTIAL SCANNING CALORIMETRY
Georges Krassoulia, Michel Bourgeon, and Joel Bonnete *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 15-19 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The advantages of the calorimeter are discussed with emphasis on its ease of utilization, rapid operation, safety and accuracy. The design and structure of the apparatus are also described. Topics included are: detector, electronic equipment, gaseous atmosphere control system, recorder, and sample holding crucibles. R.C.T.

N80-26491# Poitiers Univ. (France). Groupe de Recherches de Chimie Physique de la Combustion.
RECENT ADVANCES IN THE KINETIC THEORY OF DETONATION
M. Auzanneau, E. Boysset, and M. L. Bernard *In* ESA Explosives

and Pyrotech.: Space Appl. Jan. 1980 p 21-28 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

A correlation is established between the ideal detonation velocity of an explosive and its molecular properties. Molecular volumes of fresh explosive and shock waves (activated complex) are calculated with empirical addition rules using volume increment values cited in previous publications for both liquids and solids. It is shown that only groups with fragile bonds (explosophores) are compressed. Results indicate that it is possible to calculate detonation velocities for condensed explosives and their mixtures. The complementary nature of the kinetic theory of detonation and hydrodynamic theory is also demonstrated. Author (ESA)

N80-26492# Societe Europeenne de Propulsion, Bordeaux (France).
EXPERIMENTAL STUDY AND MODELING OF THE IGNITION OF SOLID PROPERGOL-DRIVEN MOTORS
Pierre Thebault, Joel Guernigou (ONERA, Paris), and Pierre Gerard Mentre (ONERA, Paris) *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 29-40 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Multidimensional Navier-Stokes equations to predict the ignition phases of solid-propellant motors were developed. Data were obtained from flux measurements made during previous work on equivalent motors or from special tests on models of the motor under study. Special miniaturized devices for measuring flux and detecting local propellant ignition (flux meters, photodiodes, impedance probes) were also developed. Author (ESA)

N80-26493# Poitiers Univ. (France). Groupe de Recherches de Chimie Physique de la Combustion.
PRESSURE GRADIENT KINETIC ANALYSIS IN BOMB TESTS WITH SOME PYROTECHNIC COMPOSITIONS. APPLICATION TO THEIR CHARACTERISTICS
J. L. Carreau and M. L. Bernard *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 41-49 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The pressure rise law is analyzed as a function of time. The adiabatic combustion of the Al NH4ClO4 system initiated by a primary composition is studied. The straight lines obtained from the equation developed makes it easy to extract the reaction gain and the initial time, and to anticipate how these parameters may possibly be affected by the relative masses of principal and initiating compositions. Author (ESA)

N80-26494# Dynamit Nobel A.G., Troisdorf (West Germany).
NEW ELECTRIC PRIMERS BASED ON METALLIC FILM TECHNOLOGY AND A DISCUSSION OF THEIR CHARACTERISTICS
U. Brede *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 51-56 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The advantages and disadvantages of gap type and bridge wire type devices are discussed. Metal film technology combines the advantages of both types of device. The production of the device is described and the construction of two metal layer initiators is reported. A series of typical electrical characteristics is given for one of the igniters (dc and h.f.). Author (ESA)

N80-26495# Societe Nationale des Poudres et Explosifs, Vert-Le-Petit (France). Centre de Recherches du Bouchet.
DELAY CORDS
L. R. Guy and P. P. Cord *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 57-61 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Delay fuses were manufactured using a metal sleeve technique. These fuses have a diameter of about 2 mm and may have burning rates as low as 2 mm/sec, with excellent linearity and a low temperature coefficient. Other fuses having higher burning rates (up to 25 mm/sec) were also studied. It is shown that a detonation order can be retransmitted by incorporating a transition relay at the delay mechanism outlet, which exclusively loaded with secondary explosive converts the combustion signal into detonation. Author (ESA)

N80-26496# Societe Nationale des Poudres et Explosifs, Sorgues (France).
HEXANITROSTILBENE FOR PYROTECHNIC APPLICATIONS
Jean-Marie L. Emeury *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 63-68 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

A reliable continuous process for manufacturing hexanitrostilbene (HNS) is described. The HNS, which is obtained by recrystallization from nitric acid has the correct form and grain size distribution for pyrotechnic applications. The apparatus used (rapid mixing type, e.g., injector followed by reactor nozzle) is briefly described. The injector enables a reagent mixture to be obtained in less than one second with rigorous temperature control (1 C). The nozzle presents the following advantages: considerable increase in reagent exchange surface/volume ratio; increase in reacting fluid flow rate; and avoidance of fresh reagent mixing with intermediate reaction products. Author (ESA)

N80-26497# Commissariat a l'Energie Atomique, Paris (France).
SOME THERMOSTABLE BOOSTER EXPLOSIVES: SYNTHESIS AND PROPERTIES
J. C. Adenis, C. Kassel, G. Poulain, J. Sorel, and C. Michaud *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 69-76 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Certain nitrated and picrylated heterocyclic compounds were synthesized and studied. The general synthesizing sequence consists of picrylation followed by nitration with nitric acid. These products have an excellent thermostability equal to or even exceeding that of hexanitrostilbene. Their ability to be initiated by an exploding wire was investigated: only DNDPF was initiated with 10kv, PYX deflagrated in excess of 6 kv, HNS and BTX did not react. All the explosives reacted positively when hit with a projectile. Author (ESA)

N80-26498# Societe Nationale des Poudres et Explosifs, Vert-Le-Petit (France). Centre de Recherches du Bouchet.
POURABLE, COMPRESSIBLE, AND MACHINABLE EXPLOSIVES FOR MISSILE APPLICATIONS
C. Maurin *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 77-84 refs (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Detonation tests were conducted on three compositions after exposure to various climatic conditions. A B2150, containing octogene, thermostable, and employing a silicon binder, and a B2151, having a small critical diameter and high power were unaffected by the environmental tests. A third composition, P12044, a compressed product exhibited temperature behavior characteristics better than those of hexanitrostilbene, together with good detonation properties as well as good booster characteristics. Author (ESA)

N80-26499# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
SHOCK WAVES: KNOWLEDGE, USE AND PROTECTION
C. Mas *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 91-100 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The use of one and two dimensional computer programs for detonation studies (wave propagation) is described. Experimental work encountered in the literature is presented together with the results of accelerometry measurements made to define shock spectra envelopes recorded on missile and missile launching structures. The way in which pyrotechnic shock effects on materials are predetermined is discussed. Mathematical modeling techniques and the appropriate calculations which enable the pyrotechnic forces to be understood and exploited are examined. Author (ESA)

N80-26500# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
MECHANICAL SAFETY SCREENS FOR DETONATION STUDIES: CALCULATIONS AND OPTIMIZATION
J. P. Dumont and A. Langellier *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 101-106 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Analytical means (modeling the various physical phenomena taking place) are used to optimize screen design. Pyrotechnic signals must be transmitted only when required, and under such conditions in accordance with correctly conceived design parameters. The mechanical properties of various materials subjected to projectile impacts are listed. A system composed of three layers of different materials is proposed: a first layer resisting the penetration of the projectile and made of a very hard material (steel or alumina), a second layer dampening shock (teflon, carbon felt), and a third layer of high resistance capable of withstanding the shock induced. Author (ESA)

N80-26501# Societe Nationale des Poudres et Explosifs, Vert-Le-Petit (France).
HEXANITROSTILBENE DETONATING CORDS
L. R. Guy, J. Lecloitre, and A. Thibieroz (Soc. Natl. des Poudres et Explosifs, Sorgues, France) *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 107-111 refs (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

As HNS is less sensitive than hexogene, safety is improved. It is possible to use fuses with silver sleeves over a wide temperature range (liquid nitrogen temperature to more than 200 C). Cutting fuses were developed with capacities ranging from 1.4 to 5.6 mm of very soft steel. Very small diameter transmission fuses can be fabricated. However, the smallest diameter fuse which can be used in conjunction with a backup relay, itself charged with HNS, corresponds to a loading of 0.45g/m. A flexible sleeve which is thermo-stable and capable of withstanding the effects of detonating a 0.9g/m loaded fuse and which remains leaktight after operation is described. Author (ESA)

N80-26502# European Space Research and Technology Center, Noordwijk (Netherlands).
LC3 APPLICATION AS A STANDARD PYROTECHNIC POWER AMPLIFIER
D. Levins, D. OSullivan, and A. Weinberg *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 113-117 refs (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

A breadboard design is presented for a new nondissipative current controller (limit Cycle Conductance Control) designed to supply a standard squib firing pulse of five amperes for a time duration of 40 milliseconds. This type of control can be provided by a low energy source with an unregulated voltage input. A standard system is thus available that can be re-used for various firings. Economic, time saving and reliability advantages are to be gained. Author (ESA)

N80-26503# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
PYROTECHNIC LOGIC APPLICATIONS FOR ARIANE LAUNCHER
P. H. Boeglin and J. R. Fauvel *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 119-124 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The multiple pyrotechnic functions to be assured on ballistic and space missiles led to the development of pyrotechnic logic. The Ariane destruction and separation system requires a series of functions to be fulfilled: destruction of the three stages, ignition of braking and accelerating rockets, the disposal of accelerating rockets after use and the separation of 1/2 and 2/3 stages. The components used are described together with ways of improving performance. Author (ESA)

N80-26504# Centre National d'Etudes Spatiales, Toulouse (France).
NEUTRON RADIOGRAPHY APPLIED TO THE DEVELOPMENT AND QUALITY CONTROL OF ARIANE LAUNCHER'S PYROTECHNIC SYSTEMS
J. P. Bouloumie and A. Laporte (CEA, Fontenay-aux-Roses, France) *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 127-137 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The usefulness of neutron radiography as a nondestructive testing tool for examining hermetically sealed pyrotechnic and synthesis materials is briefly reviewed. The two industrial scale installations used to examine Ariane components are described. The pyrotechnic systems of the launch vehicle are presented. The specific roles of neutron radiography during the different phases in the development of these systems is then discussed together with future progress likely in this field. Author (ESA)

N80-26505# Commissariat a l'Energie Atomique, Paris (France). Centre d'Etudes.
CHARACTERIZATION AND NON-DESTRUCTIVE TESTING OF EXPLOSIVE MATERIALS BY ULTRASONIC METHODS
N. Chretien and C. Perennes *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 139-148 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The measurement unit employed is described; it consists of a repetitive ultrasonic pulse generator, a wide band receiver-amplifier system with visual display facilities and a means of synchronizing the generator and receiver. Various related topics are discussed: choice of testing frequency, choice of transmitter-receiver and required sample characteristics. The different methods employed to obtain specific information (homogeneity, cracking) are described. The application of the techniques presented enables the quality and reliability of explosive material parts to be improved. Author (ESA)

N80-26506# Societe Europeenne de Propulsion, Bordeaux (France).
THERMAL TEST FOR ELECTROPYROTECHNIC COMPONENTS. A NEW METHOD: SPECIFICATIONS AND PERFORMANCES OF THE ELECTROMAGNETIC TESTING SET
Pierre Thabault, Jean-Marie Gramond, Jean Claude Massaloux, and Jean Francois Roux *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 149-161 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The state of the filament/pyrotechnic composition interface of electropyrotechnic initiators was examined. The thermal response method involves monitoring the potential difference across the ends of the filament as it heats up. Normally the results of such tests do not provide sufficient information. A three dimensional, nonstationary model is proposed to exploit the results obtained. Two parameters appear necessary to define the real thermal response, the percentage of the filament surface in contact with the adjacent material, and the heat storage capacity of the filament during the temperature rise period. The equipment, performance, and results are presented.Author (ESA)

N80-26507# Commissariat a l'Energie Atomique, Paris (France).
ELECTROTHERMAL NON-DESTRUCTIVE TESTING FOR HOT WIRE PYROTECHNIC INITIATORS
C. Kassel and N. Chretien *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 163-169 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Cooling and heating techniques were studied. The heating technique was found to be the most sensitive. The application, theory and results obtained with this technique are presented. It is possible to detect filament welding defects, air films having thicknesses in excess of 0.05 mm, variations in the explosive packing density in contact with the wire and differences arising from grain shape variations. Author (ESA)

N80-26508# European Space Research and Technology Center, Noordwijk (Netherlands).
THE PYROTECHNIC FIRING TEST: ITS SIGNIFICANCE AND THE IMPORTANCE OF ENVIRONMENTAL CONDITIONING AND INSTRUMENTATION IN ITS SUCCESS

N. Cable *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 171-177 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The significance of the firing test is explained with reference to the single shot nature of the pyrotechnic and the test program used to establish the system's capability. Test requirements are given together with the sequence of events culminating in firing. Test equipment falls into two categories, that needed to establish and maintain environmental conditions, and that required for the actual test. Both types of equipment are described. Realism, robustness and repeatability considerations are important. The characteristics of the instrumentation required are defined.
Author (ESA)

N80-26509# Direction des Constructions et Armes Navales, Toulon (France). Groupe d'Etude et Recherche de Pyrotechnie.
DETERMINATION OF ELECTRICAL OR ELECTROMAGNETIC SENSITIVITY IN ELECTROPYROTECHNIC INITIATORS BY STATISTICAL METHODS
R. Malabiau *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 179-200 refs In FRENCH (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

In this type of problem, the parameters of the distribution law are not known with sufficient accuracy and the variations sought are often masked by fluctuations. A comparative study is made of some applicable statistical tests (Bruceton test, one-shot test, Probits test). The effectiveness of each of these tests is established. It is shown how the various statistical parameters involved are handled. A general method combining the properties of the above tests is proposed with a higher degree of accuracy being obtained.
Author (ESA)

N80-26510# Franklin Inst., Philadelphia, Pa. Applied Physics Lab.
ELECTROSTATIC TESTING OF ELECTROEXPLOSIVE DEVICES
R. Thompson *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 201-209 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Four commercial electrostatic testers for electroexplosive devices were analyzed by direct computer integration of the relevant transmission line equations. Results show that pin to pin electrostatic tests with these four testers can show differences of a factor of 62 in the energy deposited in the bridgewire of the electroexplosive device. Pins to case testing results showed up only minor differences in peak voltages delivered to the electroexplosive device's pins to case impedance. Author (ESA)

N80-26511# Commissariat a l'Energie Atomique, Paris (France).
EXPLOSIVE SAFETY LIMIT ESTIMATION: EVALUATION OF A SENSITIVITY LAW BY DETERMINATION OF LOW PROBABILITY REACTION LEVELS
J. Sorel, C. Kassel, and J. M. Brosse *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 211-220 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

It is shown that low probability levels can be reached in simple tests such as the drop hammer test on small pellets. The experimental equipment used is described. Up and down transformed response analysis enables pyrotechnic reaction probability levels differing from 50 percent to be approximated experimentally. This analysis was applied to impact tests on different explosive formulas. A sensitivity curve was deduced from the results. The form of the sensitivity laws governing the behavior of these explosives is deduced from this curve.
Author (ESA)

N80-26512# Direction des Constructions et Armes Navales, Toulon (France). Groupe d'Etude et Recherche de Pyrotechnie.
MEANS FOR DECREASING THE SENSITIVITY OF ELECTROPYROTECHNIC DEVICES
R. Malabiau *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 221-237 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

A survey of techniques used to reduce or eliminate interference effects of internal of external origin is presented. Suitable insulation, shielding and grounding are among the precautions to be taken. Other means include using devices with very low sensitivity to electromagnetic radiation, filtering cells and incorporating electrical relays, and isolating the electropyrotechnic device from the firing circuit. The costs, material characteristics, and methods for mounting the filters are examined, together with common mode failure problems and the behavior of filters when subjected to pulses.
Author (ESA)

N80-26513# Bundesinstitut fuer Chemisch-Technische Untersuchgen, Swisttal-Heimerzheim (West Germany).
SAFETY OF SECONDARY EXPLOSIVE FUSE TRAINS
H. Bartels *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 239-246 refs (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Design safety principles for modern fuses are interpreted and requirements for exploding bridgewire detonators are discussed. The various components are presented. The shock wave sensitivity of booster devices is checked by means of a special test. The influence of low-intensity shock waves on such explosive devices was considered for a drop test. Tests using a French exploding bridgewire detonator are described.
Author (ESA)

N80-26514# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
ESTIMATED AND EXPERIMENTAL RELIABILITY IN SPACE PYROTECHNICS
C. Lemay *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 247-251 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The specific nature of pyrotechnic materials and their conditions of use are described. And the methods and problems associated with the theoretical analysis and estimation of pyrotechnic reliability are presented. The experimental approximation of reliability by a statistical analysis of test results, and the constraints affecting the validity and implementation of sensitivity testing are discussed.
Author (ESA)

N80-26515# Centre National d'Etudes Spatiales, Toulouse (France).
EVALUATION OF A PYROTECHNIC ACTUATOR CONCEPT BY MEANS OF THE PROBIT STATISTICAL METHOD
J. Maquet and C. Tarrieu *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 253-260 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The equipment and pressure circuits involved are presented. It is shown that the experimental reliability of a pyrotechnic valve (or any other pyrotechnic device) can be determined from an aging model, the results of a certain number of ignition tests and the application of Probits method. An advantage of this procedure is that in many cases, overcharging, which is often the cause of functional problems (distortion, leakage etc.), can be prevented.
Author (ESA)

N80-26516*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLES: A PYROTECHNIC OVERVIEW
Thomas J. Graves *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 263-269 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01 CSCL 19A

Pyrotechnic components specified in Shuttle system designs to accomplish varied tasks during all mission phases are described. The function of these pyrotechnics in the operation of the space shuttle vehicle is discussed. Designs are presented for pyrotechnics with innovative features of those meeting unique shuttle requirements for safety and reliability. A rationale for the qualification and certification of these devices is developed. Maintenance of this qualified system in production hardware is explained through a description of shuttle flight certification review process.
Author (ESA)

N80-26517# Centre National d'Etudes Spatiales, Toulouse (France).
PYROTECHNIC FUNCTIONS AND SYSTEMS OF THE ARIANE LAUNCH VEHICLE. DESIGN AND DEVELOPMENT METHODOLOGY
J. P. Bouloumie and P. Gauge (CNES, Paris) *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 271-286 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

A brief description is given of the Ariane launch vehicle together with the different associated pyrotechnic functions. The design and development of the pyrotechnic systems is examined, the methodology being based on a strictly controlled cost/effectiveness ratio. The technical criteria governing the design of the various pyrotechnic systems are presented. The control procedures applied to the development of these systems are then described. A cost breakdown is given for a standard pyrotechnic system from which future solutions are envisaged. Author (ESA)

N80-26518# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
PYROTECHNIC DEVICES MANUFACTURED BY AVIONS MARCEL DASSAULT-BREGUET AVIATION FOR THE ARIANE LAUNCHER: THEIR CHARACTERISTICS
L. Pierron *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 287-295 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Some special features of the pyrotechnic devices in the Ariane launch vehicle are described: the pyrotechnic system initiating the Ariane nose fairing separation device, hot wire electrical initiators of the 1 ampere/1 watt/5 minute no flame type, and ten and twenty second pyrotechnic delay devices (to be inserted in transmission systems with detonating fuses). Various components are presented together with the particular ways in which they are used. Author (ESA)

N80-26519# Societe Nationale des Poudres et Explosifs, Vert-Le-Petit (France). Centre de Recherches du Bouchet.
DESTRUCTION CUTTER FOR THE THIRD STAGE OF THE ARIANE LAUNCH VEHICLE
L. R. Guy and J. Lecloitre *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 297-301 ref In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The destruction function of the third stage of the Ariane launch vehicle, unlike that of the first two stages, can not be achieved by standard cutting fuses because of the particular composition of the tanks in this stage. A specific dihedral charge was developed, obtained by injection, followed by in situ polymerization of a composite explosive with octogene in a light alloy case. This charge has a cutting capability sufficient to make a large cut in the tank walls, despite the large operating distance necessitated by the thickness of the thermal protection and by the layer of ice which may form on the outside of this protection. Qualification tests demonstrated the normal functioning of this cutting device under real conditions simulation of the mechanical and environmental conditions corresponding to Ariane). Author (ESA)

N80-26520# Nobel's Explosives Co. Ltd., Stevenston (England).
THE MEASUREMENT AND PREDICTION OF OUTPUT CHARACTERISTICS OF MINIATURE PYROTECHNIC ACTUATORS
R. Woomble and L. E. Medlock *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 303-312 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The measurement of output characteristics of pyrotechnic actuators is described. The characteristics studied include operating time, stroke, energy of work output, thrust-time profile and stroke-time relationship of the actuators. The static pressure-time characteristics of the gas producing compositions used in the actuators were also studied. By choice of the type and quantity of gas producing charge, the design can be optimized for operation against a given load and the effect of stand-off of the actuator from the mechanism to be operated can be measured. The thrust-time profile was recorded for actuators of the dimple, piston and bellows type and the effect of a number of variables including, charge weight, stroke length and load, were quantified. Author (ESA)

N80-26521# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
PYROTECHNIC APPLICATIONS IN AERONAUTICS
S. Morlan *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 313-317 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Progress made in recent years to in-flight safety (military fighting aircraft and prototype civil aircraft) and to ground safety of crashed transport aircraft (emergency exits) is reviewed. The pyrotechnic systems employed depend on the functions desired (e.g., in-flight ejection, ground separation, etc.). The materials used are described. Author (ESA)

N80-26522# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
CREW RESCUE SYSTEM ON FALCON 50 AIRCRAFT PROTOTYPE
G. Dupin *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 319-324 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The life preservation installation for the two pilots fitted in the prototype Falcon 50 aircraft is described. The specifications of the system are given together with the ejection method used. A description of the sequences necessary to carry out the various operations is presented. Finally, the pyrotechnic circuit used to perform these sequences is briefly described, together with the sequence chronology. Author (ESA)

N80-26523# Societe Nationale des Poudres et Explosifs, Paris (France).
PYROTECHNIC APPLICATIONS IN MARINE TECHNOLOGY
H. Frier *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 327-331 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The history of pyrotechnic applications to marine technology is briefly reviewed. The various applications include underwater cutting systems, gas generators and syntactic foam (buoyancy applications), explosive welding, underwater propulsion devices, small generators for torpedos and underwater vehicles, and pyrotechnic starters for large marine diesel engines. Descriptions are given of the specifications and characteristics of the different equipment developed. Author (ESA)

N80-26524# Germantown Labs., Inc., Philadelphia, Pa.
INVESTIGATION OF FUELS CONTAINING COAL-OIL-WATER EMULSIONS Quarterly Report, 1 Oct. - 1 Dec. 1978
Norman H. Cherry and Charles S. Stokes Jan. 1979 16 p
(Contract EF-77-C-01-2689)
(FE-2689-5; QR-5) Avail: NTIS HC A02/MF A01

A total of five emulsifiers were assessed for the production of stable coal-oil-water emulsions and the determination of the practibility of their use in a boiler system was being investigated. Ancillary equipment was set up and experiments completed on two units. Mounting fixtures designed and fabricated for the third and fourth units. The third unit was evaluated using 45% coal, 50% number 6 Gulf oil and 5% water. The stability of the emulsions was evaluated on the K-scan unit. DOE

N80-26525# Rockwell International Corp., Canoga Park, Calif. Environmental and Energy Systems Div.
DEVELOPMENT OF A SINGLE-STAGE, ENTRAINED-FLOW, SHORT-RESIDENCE-TIME HYDROGASIFIER Final Report
Jul. 1979 503 p refs
(Contract EF-77-C-01-2518)
(FE-2518-24) Avail: NTIS HC A22/MF A01

A single-storage, entrained flow, short residence time reactor for flash hydrogasification of coal was developed. The unique

feature was the application of rocket engine injection/mixing techniques to the rapid mixing and reaction of hot hydrogen (approximately 2000 F) and pulverized coal in very high throughput reactors. Experiments were conducted in three different hydrogasifier reactor systems. The first was a bench scale apparatus with coal feed rates of 2 to 4 lbm/hr. Results are reported for a subbituminous coal where overall carbon conversion varied between 21 and 55% and were comparable with conversions of lignite. Engineering scale tests were conducted in the other two reactor systems at a nominal coal feed rate of 1/4 ton/hour. Results with subbituminous coal compared well with those from the bench scale reactors. DOE

N80-26526# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. Development Div.
DYNAMIC MECHANICAL ANALYSIS OF LX-13, AN EXTRUDABLE EXPLOSIVE
Gary L. Flowers Jan. 1980 34 p
(Contract EY-76-C-04-0487)
(MHSMP-80-04) Avail: NTIS HC A03/MF A01

Rheometrics mechanical spectrometers was used characterize LX-13, an extrudable explosive comprised of Sylgard 182 and PETN. Characterization included evaluating four lots of LX-13 of various extrudability and determining isothermal curing properties as functions of time. The dynamic shear storage and loss moduli as functions of temperature were also determined for cured samples. LX-13 require a long time period to completely cure, approximately 125 C and the crystalline melting temperature was found to be -40 C, the same as the binder, polydimethlysiloxane. DOE

N80-26527# Sandia Labs., Albuquerque, N. Mex. Initiating and Pyrotechnic Components Div.
COMPACTION BEHAVIOR OF TEN PYROTECHNIC MATERIALS
Olden L. Burchett, Russell W. Dietsel, and Arsenio P. Montoya Jan. 1980 16 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1833) Avail: NTIS HC A02/MF A01

The compaction behavior of KClO4, Ti/KCL O4 (33/67), TiH(065)/KClO4 (33/67), TiH(1 68)/KClO4 (33/67), HNAB, CP, b/CaCrO4 (20/80), Pd/Al (94/6), Pd/Si(90/10), and Pd/Al(80/20), was determined by using a simple compaction test and a two-step iterative procedure to fit an assumed three parameter pressure-density relationship to the test results. DOE

N80-26528# Catalytic, Inc., Wilsonville, Ala.
SOLVENT REFINED COAL (SRC) PROCESS OPERATION OF SOLVENT REFINED COAL PILOT PLANT, WILSONVILLE, ALABAMA Annual Report, Jan. - Dec. 1978
H. E. Lewis, W. H. Weber, G. B. Usnick, W. R. Hollenack, H. O. Blair, and R. G. Boykin Oct. 1979 227 p refs Prepared in cooperation with Southern Serv., Inc., Birmingham, Ala.
(Contract EX-76-C-01-2270)
(FE-2270-46) Avail: NTIS HC A11/MF A01

Operating conditions and test results obtained at six ton per day solvent refined coal (SRC) pilot plant are summarized. Two coals were processed and the effects of process variables on SRC yield and solvent quality were investigated. These variables included space rate, coal mineral concentration in the dissolver, hydrogen partial pressure, and temperature. A system for continuously withdrawing a portion of the dissolver contents was operated to investigate the effects of minimizing the concentration of solids in the dissolver. Tests confirming the high rate of coal conversion at short residence time were completed. Several methods of deashing the low pressure reaction product were tested: pressure leaf filtration; centrifugation with antisolvent addition; and 10 mm hydroclones with antisolvent addition. Both horizontal and vertical pressure leaf filtration units were tested. Filter aids such as perlite, fly ash, and several grades of diatomite were used. Operating without precoat was also studied. DOE

N80-26529# Catalytic, Inc., Philadelphia, Pa.
PRELIMINARY ENGINEERING EVALUATION OF PROMISING COAL LIQUEFACTION CONCEPTS Final Report, Dec. 1979
D. Agarwal, J. J. Cicalese, J. H. Harkins, M. T. McShance, D. J. Oriolo, and J. R. Polek Dec. 1979 201 p refs
(EPRI Proj. 832-2)
(EPRI-AF-884) Avail: NTIS HC A10/MF A01

Cost liquefaction concepts were evaluated. Ten thousand tons of coal per day were processed in the liquefaction section. Emphasis was placed on producing clean burning solid and liquid fuels suitable for electric power generation. Flash hydrogenation, supercritical gas extraction, conventional solvent refined coal (with filtration of ash), two stage solvent refined coal, conventional solvent refined coal (with critical solvent deashing), and short contact time solvent refined coal (with critical solvent deashing and hydrotreating) were investigated. For the liquefaction sections, detailed material balances, process flow diagrams, equipment sections, detailed material balances, process flow diagrams, equipment specifications, utility requirements and estimated costs were developed. For areas ancillary to the liquefaction sections, terminal material balances, overall utility requirements, and estimated costs were calculated. The conventional SRC design produced the highest thermal efficiency and product heating value, primarily due to the higher recovery of SRC when using fibration as compared to critical solvent deashing for ash removal. DOE

N80-26530# Fluor Engineers and Constructors, Inc., Irvine, Calif.
ENGINEERING EVALUATION OF CONCEPTUAL COAL CONVERSION PLANT USING THE H-COAL LIQUEFACTION PROCESS Final Report, Dec. 1979
P. A. Buckingham, R. Ravikumar, and A. A. Leavitt Dec. 1979 199 p refs
(EPRI Proj. 411-4)
(EPRI-AF-1297) Avail: NTIS HC A09/MF A01

The objective was to develop the capital costs and the product costs for and H-Coal liquefaction facility were developed. A key part of this effort was the development of a processing configuration in order to provide self sufficient facilities with respect to hydrogen, fuel, electric power, and all other utility services. The overall facility consists of a coal liquefaction plant along with the required support, utility and offsite facilities to comprise a self-sufficient operation. The major processing sections included coal preparation, coal liquefaction and product separation, light ends processing, hydrogen plant, oxygen plant, emission control systems, effluent control systems, product storage and shipping, utility systems and offsites. Capital costs upon a mid 1979 basis are $1.146 billion and $1.315 billion. The primary products naphtha, turbine oil, and distillate fuel oil are desulfurized to very low levels. The oxygen content of all three products is very high, while the nitrogen content of the turbine oil and the distillate fuel oil exceeds usual levels for conventional petroleum stocks. DOE

N80-26531# Forskningsinstitutet for Atomfysik, Stockholm (Sweden).
DEMONSTRATION PLANT FOR METHANOL PRODUCTION FROM DOMESTIC RAW MATERIALS
1979 93 p In SWEDISH
(NE-1979-5) Avail: NTIS (US sales only) HC A05/MF A01; DOE Depository Libraries

The techniques, markets and possible localization for a demonstration plant for methanol production from peat and biomass are reviewed. High temperature Winkler or Shell-Koppers gasification processes are preferred. Results indicate that the demonstration plant should have a capacity of 20 kton methanol/year and the investment cost is estimated to about 95 Mskr. DOE

N80-26532# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
DESIGN, FABRICATION AND OPERATION OF A BIOMASS FERMENTATION FACILITY
Daniel J. O'Neil, Alton R. Colcord, Mahendra K. Bery, Ronnie S. Roberts, Dalip K. Sondhi, Bryan C. Robb, Ronald R. Williams, Alfred A. Cook, J. J. Nachowiak, and J. D. Crider Aug. 1979 50 p refs Prepared in cooperation with Sverdrup and Parcel, Inc., St. Louis
(Contract ET-78-C-01-3060)
(DSE-3060-T3) Avail: NTIS HC A02/MF A01

Process economics and optimization for hexose production from wood by dilute acid hydrolysis were investigated. Application to a plug flow reactor (PFR) and to a fixed bed reactor (FBR)

were undertaken. The results indicate that the FBR is at least comparable to a PFR in terms of process economics. DOE

N80-26533# Midwest Research Inst., Kansas City, Mo.
CONTINUATION OF SYSTEMS STUDY OF FUELS FROM GRASSES AND GRAINS, PHASE 2 AND PHASE 3 Final Report
A. D. McElroy, Cynthia Tinberg, Michael Davis, Michael Snyder, and A. D. Allen 31 Jul. 1979 195 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T2) Avail: NTIS HC A09/MF A01

Biomass-derived fuels from grasses and grains are studied. A region-by-region analysis of biomass production, considering both the present (near term) and the furture (mid term) is presented. The near term analyses involved least cost estimate of production, transportation, and energy convserion. The mid term analyses involved modified crop production systems, improved crop management, and crop mixes. Conversion plants ranged in size from 500 oven dry tons per day to 3000 oven dry tons per day, or an energy input of 75 x 10 to the 9th power Btu to 45 x 10 to the 9th power Btu 7500 Btu per pound. The conversion processes consisted of anaerobic digestion, fermentation, direct combustion, and thermochemical conversion. Ammonia and methanol production was accomplished by using thermochemical conversion. DOE

N80-26534# SRI International Corp., Menlo Park, Calif.
HOMOGENEOUS CATALYTIC HYDROCRACKING PROCESSES FOR CONVERSION OF COAL TO LIQUID FUELS: BASIC AND EXPLORATORY RESEARCH Quarterly Report, 16 Sep. - 15 Dec. 1979
1979 15 p refs
(Contract EF-76-C-01-2202)
(FE-2202-51) Avail: NTIS HC A02/MF A01

The major chemical features of the catalytic activity in our CO-blue water system was determined and a preliminary investigation of its potential for coal upgrading was conducted. The nature of blue water catalysis and test its effectiveness with CO and H2 was studied. Catalyst candidates of selected transition metal salts were similarly tested. We have determined that blue water catalysis is not due to coal-derived components, and we have ruled out any major involvement of formate. It is shown that the activity of blue water is due to transition metals content. Also blue water catalysts is less effective in the pressure of H2 than CO. DOE

N80-26535# SRI International Corp., Menlo Park, Calif.
PREPARATION OF A COST DATA BANK FOR DOE/BIOMASS ENERGY SYSTEMS BRANCH Quarterly Progress Report, 1 Jul. - 30 Sep. 1979
Anthony Y. Kam, Ronald L. Dickenson, Jerry L. Jones, David C. Bomberger, Anil K. Chatterjee, Wing S. Fong, Paul C. Meagher, and Donald J. Wilhelm 1979 82 p refs
(Contract EY-76-C-03-0115-141; Contract DE-AT03-76ET-20605)
(DOE/ET-20605/4: QPR-4) Avail: NTIS HC A05/MF A01

Technical and economic analyses of Biomass Energy Systems (BES) technology options are reviewed. A total of 22 biomass conversion technology options (14 thermochemical and 8 biochemical) were selected for inclusion in the data bank. These options cover the production of electric power, steam, gases, liquids, and solid fuels from biomass. A consistent methodology for construction of the data bank was developed. For each option, the process/product data were gathered and analyzed. A base case was established to generate estimates for plant investments required, operating cost, and product cost. Statistical methods to produce error band estimates are used. Preliminary results for catalytic liquefaction (PETC and LBL processes), gasoline from biomass (China Lake process), and MBG from wood, ethanol fermentation are reported. A sensitivity analysis for cogeneration is also reported. DOE

N80-26536# International Nickel Co., Inc., Suffern, N. Y.
MICROSTRUCTURE AND HYDRIDING STUDIES OF AB5 HYDROGEN STORAGE COMPOUNDS Final Report
P. D. Goodell, G. D. Sandrock, and E. L. Huston Jan. 1980 176 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7095) Avail: NTIS HC A09/MF A01

Data on the microstructure, pressure-composition-temperature, and absorption/desorption kinetics of AB sub 5 metal hydrides are presented. The most significant result to emerge from the investigation is that many of the AB sub 5 metal hydrides, especially the LaNi5 related materials, show instantaneous absorption and desorption response in proportion to the amount of cooling or heating or heating which is provided. DOE

N80-26537# California Univ., Livermore. Lawrence Livermore Lab.
LLL DATA ACQUISITION SYSTEM FOR LIQUEFIED GASEOUS FUELS PROGRAM
John Baker 17 Mar. 1980 15 p
(Contract W-7405-eng-48)
(UCID-18576) Avail: NTIS HC A02/MF A01

The liquefied natural gas dispersion tests were examined. The system employed 51 battery powered complementary metal oxide semiconductor (CMOS) data acquistion units to measure gas concentration, wind direction and speed, temperature, humidity, and heat flux. Data acquired by the CMOS data acquisition units were telemetered via UHF radio links to a trailer based microcomputer command, control, and data recording system (CCDRS). In the CCDRS wind data were displated graphically. DOE

N80-26538# Los Alamos Scientific Lab., N. Mex.
UTILIZATION OF SOLAR THERMAL SOURCES FOR THERMOCHEMICAL HYDROGEN PRODUCTION
Melvin G. Bowman 1980 6 p refs Presented at the Am. Sect. of the Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2-6 Jun. 1980 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-80-837; CONF-800604-3) Avail: NTIS HC A02/MF A01

The utilization of high temperature solar heat for the production of electricity and/or fuels is considered. Solar concentrator systems are discussed in terms of cost and practicallity. Conversion efficiency and energy. storage requirements are also considered. DOE

N80-26539# Brookhaven National Lab., Upton, N. Y.
HEAT TRANSFER ENHANCEMENT IN METAL HYDRIDE SYSTEMS
M. J. Rosso, Jr. and G. Strickland Dec. 1979 8 p refs Presented at the 2nd Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10 Dec. 1979
(Contract EY-76-C-02-0016)
(BNL-27347; CONF-791204-27) Avail: NTIS HC A02/MF A01

The Brookhaven National Laboratory, Department of Energy and Environment has been engaged in finding solutions to the engineering problems associated with the storage of hydrogen as metal hydrides - principally iron-titanium hydride. The thermal conductivity in beds of fine particles, whatever their composition, is inherently poor. Attempts to enhance the heat transfer by the addition of small fractions of high conductivity materials in various configurations are described. The results indicate that the form of the enhancement material rather than its composition is the more critical factor. DOE

N80-26540# Oak Ridge National Lab., Tenn.
BIOLOGICALLY IMPORTANT COMPOUNDS IN SYNFUELS PROCESSES
B. R. Clark 1980 26 p refs Presented at the 179th Meeting of the Am. Chem. Soc., Symp. on Environ. Control in Synfuels Processes, Houston, Tex., 25 Mar. 1980
(Contract W-7405-eng-26)
(CONF-800303-13) Avail: NTIS HC A03/MF A01

Biologically active constituents were isolated in preparative scale amounts from complex mixtures utilizing combinations of liquid-liquid extraction and various liquid chromatographic column-eluant combinations. Fractions were characterized using a combination of spectroscopic techniques and gas chromatography/mass spectrometry. DOE

N80-26541# Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (West Germany).

INVESTIGATION OF THE BEHAVIOR OF MENTHANOL AS AN ENGINE FUEL
1979 111 p refs In GERMAN
(NP-24342; RR-45151) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

The use of methanol as a substitute fuel and as a mixing component for the dilution of Otto engine fuels was investigated. The results indicate that if methanol is to be used for the operation of Otto engines, vehicles must be adapted, and the supply system must be modified. For methanol/fuel mixtures, solutions to the important problem of demixing must be found. DOE

N80-26542# Kernforschungsanlage, Juelich (West Germany).
CALCULATIONS AND ANALYSIS OF STEAM METHANE REFORMING USING HIGH TEMPERATURE REACTOR HEAT
H. Neis Jul. 1979 155 p refs In GERMAN
(Juel-Spez-48) Avail: NTIS (US Sales Only) HC A08/MF A01; DOE Depository Libraries

The application of nuclear process heat for steam methane reforming as a modification of conventional technology was studied. A computer program was developed which allows the calculation of heat transfer to an extend heated tubular reactor in which the catalytic reactor takes place. Calculations for comparison with experimental data are in satisfactory agreement. A sensitivity analysis shows the influence of single model parameters on the computational results. From parametric studies design data for steam reformers were obtained which may serve as basis for project work of a process heat plant. DOE

N80-26543# Occidental Research Corp., Irvine, Calif.
FLASH PYROLYSIS COAL LIQUEFACTION PROCESS DEVELOPMENT Final Report, Jul. 1976 - Jun. 1978
Stanley C. Che, Kandaswamy Duraiswamy, Everett W. Knell, and Chang-Kuei Lee Apr. 1979 184 p refs
(Contract EX-76-C-01-2244)
(FE-2244-26) Avail: NTIS HC A09/MF A01

A specially designed, proprietary, caking coal reactor was demonstrated to process caking coals without oxidative pretreatment. Tar yields of about 35 wt % mixed amine fuel (MAF) were achieved in a 3 ton per day process development unit (PDU) from Western Kentucky No. 9 seam bituminous coal, and tar yields of about 22 wt % MAF were achieved from Wyoming Monarch seam subbituminous coal at a reactor residence time of about 1.5 seconds and a temperature of about 1200 F. The hydrorefining processability of the pyrolysis tar was demonstrated using a continuous hydrotreater. Two major technical problems were encountered and solved: (1) the initial PDU tar yield results were low compared to projections from the bench scale reactor; and (2) poor char rate control severely limited the PDU reactor operability. DOE

N80-26544# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PROCESS DEVELOPMENT STUDIES ON THE BIOCONVERSION OF CELLULOSE AND PRODUCTION OF ETHANOL
Charles R. Wilke and Harvey W. Blanch Dec. 1979 41 p refs
(Contract W-7405-eng-48)
(LBL-10373) Avail: NTIS HC A03/MF A01

Fermentation operations were conducted in S-liter New Brunswick fermentors. The medium was used for all experiments. Ball-milled solka floc (BW 200) and Tween 80 at 1.0% and 0.02% concentration, respectively, was used for all runs. Four day old, 10% mycelium inoculum was used for all fermentation. The pH was adjusted with 2N NaOH, and 2N H2SO4. The effect of operating conditions on state variables was demonstrated. Results indicate that controlling the temperature of 28 C throughout the fermentation decreases the Beta glucosidase activity and soluble protein, while C sub 1, C sub x, and EPA activities remain the same. The higher level of beta glucosidase permits more rapid conversion of cellobiose to glucose. This then relieves the cellobiose inhibition of the C sub 1 enzyme and hence increases the rate of depolymerization of crystalline cellulose. R.C.T.

N80-26545# Gulf Research and Development Co., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS Annual Report, Jun. 1978 - May 1979
D. C. Succop and F. E. Wynne Jul. 1979 120 p
(Contract EX-76-C-01-1800)
(FE-1800-39-Vol-1) Avail: NTIS HC A06/MF A01

Urgently needed design criteria for hydroliquefaction slurry heating were developed. It is shown that data needed on heat transfer coefficients, tube wall temperatures, slurry viscosities, slurry residence times and solvent characteristics. It is also shown that reactions occur within the slurry heaters but the extent of these reactions and the effect of heater design on the reactions is not clearly defined in terms of heat requirements, physical property changes and the effect of heater design on subsequent reaction in the downstream reactors and their design. Also, heater operating limits related to fouling are needed and fouling tests conducted with coal/petroleum resid slurries indicated that these limiting factors could be examined by similar tests. DOE

N80-26546# Gulf Research and Development Co., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS
D. C. Succop and F. E. Wynne Jul. 1979 298 p Annual Report, Jun. 1978 - May 1979
(Contract EX-76-C-01-1800)
(FE-1800-39-Vol-2) Avail: NTIS HC A13/MF A01

Data are presented characterizing the operating conditions as well as the product yield for the process of converting coal to synthetic gasoline and other distillate motor fuels. Yields of distillate and residue were obtained by gas chromatography of the heater total liquid product. Hydrocarbon type analysis for the total liquid product was obtained by liquid chromatography and is reported under recovered heavy distillate. A common elemental analysis of the total liquid product is shown as product liquid fractions. Products were vacuum distilled and boiling ranges of the cuts were corrected to obtain optimum yields. R.C.T.

N80-26547# Teledyne CAE, Toledo, Ohio.
GAS TURBINE DEMONSTRATION OF PYROLYSIS-DERIVED FUELS Technical Progress Report, 1 Sep. 1978 - 31 Mar. 1979
G. Jasas 1979 34 p refs
(Contract ET-78-C-03-1839)
(SAN-1839-T1; TPR-1) Avail: NTIS HC A03/MF A01

A potential nonpetroleum base alternate fuel for gas turbines was identified. This fuel was derived from agricultural and forestry products/wastes through a pyrolysis conversion. Three combustible products were produced: a heavy oil; residual char; and gas. Blending of the char and oil products yielded a two phase (slurry) fuel with a heating value that was approximately 85 percent (volumetric) of typical petroleum base fuels. R.C.T.

N80-26548# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).
INITIATION OF AERATED NITROGLYCERINE IN AN EDUCTOR
D. G. Tasker London HMSO Oct. 1979 15 p refs
(PERME-TR-120; BR70957) Avail: NTIS HC A02/MF A01

A technique is described for the measurement of the shock wave pressures generated within nitroglycerine (NG), when the liquid surface strikes a steel cylinder. These pressures have been observed in a model of a Biazzi Nitroglycerine Eductor; they are shown to be in close agreement with those theoretically predicted and indicate that this mechanism for the initiation of explosion in NG requires serious consideration. Author (ESA)

N80-26549# Chemical Engineering Research Group, Pretoria (South Africa).
HYDRODENITROGENATION OF COAL LIQUIDS AND PETROLEUM WITH HETEROGENOUS CATALYSTS IN MULTIPHASE REACTORS. REVIEW AND RECOMMENDATIONS FOR FURTHER WORK
C. M. Stander Nov. 1979 35 p refs
(PB80-151442; CSIR-CENG-298; ISBN-0-7988-1721-6) Avail: NTIS HC A03/MF A01 CSCL 21D

Absorption and catalytic hydrodenitrogenation in three stage reactors are considered for the removal of nitriles and heterocyclics from coal liquids. The intraparticle rate controlling processes were studied by determining effective diffusivities using model liquids and the interparticle rate controlling processes were evaluated by studying the hydrodynamics of coal liquids in trickle-bed reactors. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-26550# Department of Energy, Washington, D. C. Federal Energy Management Program.
ARCHITECTS AND ENGINEERS GUIDE TO ENERGY CONSERVATION IN EXISTING BUILDINGS
1 Feb. 1980 468 p
(DOE/CS-0132) Avail: NTIS HC A20/MF A01

A field-tested approach to identifying, analyzing, and recommending action on the wide range of opportunities and options available to reduce energy use in most existing buildings is offered. Besides a review of the principles of energy use and conservation, the manual provides a step-by-step methodology for assessing and improving the year-round energy performance of buildings, as well as a series of forms, charts, and nomographs designed to enhance and simplify the work of those architects and engineers whose practice includes the analysis and modification of existing buildings to reduce both fuel consumption and operating costs. A.R.H.

N80-26551# Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group Microwaves.
[ON MICROWAVE MEASUREMENT, TRANSMISSION AND RECEPTION]
J. Sneider, ed. Dec. 1978 138 p refs
(PhL-1978-54) Avail: NTIS HC A07/MF A01

Thirteen papers dealing with microwave measurement, transmission, and reception are presented. Subjects covered include sea-clutter and target signatures, planar as well as linear phased array antennas, diode and ferrite phase shifters, and rain attenuation of microwaves shown by 95 GHz propagation measurements. Noteworthy results relate to the effect on transmitted power of placing a sheet with a low dielectric constant in front of a planar phased array antenna. Also, a comparison of statistical distribution methods points out the usefulness of a scattering theory in the analysis of microwave propagation data. For individual titles, see N80-26552 through N80-26564.

N80-26552# Physics Lab. RVO-TNO, The Hague (Netherlands).
CHARACTERISTICS OF CLUTTER AND TARGETS AT X- AND Ku-BANDS c32
H. Sittrop *In its* On Microwave Meas., Transmission and Reception Dec. 1978 28 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The radar backscatter of the sea per unit area and the rms clutter velocity spread versus grazing angle and wind velocity are described by an experimental model. The obtained results justify the assumption that the model can be used in the near grazing and in the plateau regions. The two scatter mechanisms of Bragg resonant capillary waves and small facet overlayer the shorter gravity waves are discussed. Characteristic ratios of sae per unit area are presented versus velocity. Next, a multipath radar cross section approximation for a variety of target models and clusters is given numerically in a closed form. Optimum signal to clutter ratios are discussed for the detection of buoys by shipping traffic. Characteristics of arbitrarily chosen target clusters are simulated and typical discrepancies between clutter and target scintillations are demonstrated. The influence of precession, nutation, and rotation on radar backscatter, due to irregularities of a body of revolution, is shown. Clutter and target model applications in finding an optium combination of relevant and environmental parameters are discussed. Author (ESA)

N80-26553# Physics Lab. RVO-TNO, The Hague (Netherlands).
SEA-CLUTTER DEPENDENCY ON WINDSPEED c32
H. Sittrop *In its* On Microwave Meas., Transmission and Reception Dec. 1978 4 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The capillary wave effect on radar sea-clutter is discussed. The interaction between wind speed and these capillary waves is shown to be instantaneous and hence, is a first order effect which has an impact on various clutter characteristics. Computations to determine the average radar cross sections per unit area and the rms clutter velocity spread, both from experimentally derived constants, indicate that clutter cell size seems to significantly influence the statistical behavior of sea-clutter at horizontal polarization and is thus of vital importance in finding threshold levels for target detection. Author (ESA)

N80-26554# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE DESIGN CONSTRUCTION AND TEST RESULTS OF THE CAISSA PLANAR SPACE FED PHASED ARRAY ANTENNA c32
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 13 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The design, construction, and test results of the CAISSA antenna with 850 radiating elements are given. The elements are open-ended rectangular waveguides placed in a triangular grid. The antenna was tested from 5.4 to 5.9 GHz to a maximum scan angle of 60 deg. A multimode feed horn was used. The production results of the phase shifters and methods of how to reduce the spread in insertion phase are mentioned. The influence of the rms error on the sidelobe level is discussed. A special far field measuring method for quickly measuring antenna radiation patterns was used. Experimental results are given regarding beamwidth, gain, sidelobe level, and monpoulse as a function of scan angle frequency. The degradation of a phased array antenna due to random failing of elements is also discussed. Author (ESA)

N80-26555# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE PERFORMANCE OF AN IRIS-LOADED PLANAR PHASED-ARRAY ANTENNA OF RECTANGULAR WAVE-GUIDES WITH AN EXTERNAL DIELECTRIC SHEET c32
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 8 p refs Repr. from IEEE Trans. on Antennas and Propagation, v. AP-26, no. 3 May 1978 8 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

A method for calculating the performance of an iris-loaded planar phased-array antenna of rectangular waveguides is presented. The method is based upon the expansion of the tangential electric aperture field in terms of judiciously chosen functions. Also, the influence of a dielectric sheet in front of an antenna, the apertures of which are loaded with inductive irises, is investigated. In the experiments, a sheet with a low relative permittivity is placed in front of a space-fed planar antenna of some 850 radiating elements; the total transmitted power of the antenna is measured as a function of frequency and scan angle. The results indicate that both in theory and in practice an excellent match can be achieved with a polythene sheet or a Perspex sheet. Author (ESA)

N80-26556# Physics Lab. RVO-TNO, The Hague (Netherlands).
THEORETICAL AND EXPERIMENTAL RESULTS OF AN IRIS-LOADED PLACAR PHASED-ARRAY ANTENNA WITH AN EXTERNAL DIELECTRIC SHEET c32
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The influence of a dielectric sheet on the performance of an iris-loaded, planar, phased-array antenna of rectangular waveguides was investigated both theoretically and experimentally. Particularly, the influence of a sheet with a low dielectric constant is shown. In practice, the influence of the matching structure on the transmitted power of a planar, space-fed array of some 850 radiating elements was determined as a function of frequency. It is found that a simple polythene/perspex sheet improves wide

angel scan considerably over the frequency band from 5.4 to 5.9 GHZ. Author (ESA)

N80-26557# Physics Lab. RVO-TNO, The Hague (Netherlands).
NUMERICAL AND EXPERIMENTAL ANTENNA PATTERNS OF A SPACE-FED PLANAR PHASED-ARRAY ANTENNA **c32**
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The illumination function and the far field radiation pattern of the space-fed antenna is considered. Numerical and experimental results, related to the performance of a planar, space-fed, phased array antenna of circular cross section, operating in the C-band (5.4 to 5.9 GHz) with some 850 radiating elements and 325 dummy elements (placed at the rim of the antenna), are presented. This antenna is referred to as the CAISSA antenna. A method to deal with the differences in phase correction pertaining to the different elements of the antenna and which originates from the free-space propagation of the wave emitted by the feeding horn is given. Further, the influence of the failure of a certain percentage of the phase shifters on the antenna pattern of the CAISSA antenna is illustrated experimentally. Author (ESA)

N80-26558# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SIMPLE AND FAST MATCHING METHOD FOR MUTUAL COUPLING OF A LINEAR PHASED ARRAY ANTENNA WITH WAVEGUIDE APERTURES AS RADIATING ELEMENTS **c32**
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

Loss due to mutual coupling in a phased array antenna is considered. As an example, a linear array of open-ended rectangular waveguides was used. Coupling coefficients were measured. With these coefficients it was possible to calculate mutual coupling as a function of scan angle and frequency. Using internal matching structures, the performance of the linear array was then improved. Results show that simply matching the array elements of a linear array in their natural surroundings to free space at the center frequency gives almost optimum compensation for mutual coupling over the scan interval. Author (ESA)

N80-26559# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SURVEY OF PROPERTIES OF LATCHED NON RECIPROCAL FERRITE PHASE SHIFTERS WITH CYLINDRICAL RODS AT 3, 5.5, 9.3 AND 16 GHz **c33**
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

Experimental results of non reciprocal latched ferrite phase shifters are given in the frequency bands S, C, X, and Ku. The flux drive principle is used for the driver. The shape of the ferrite is for all examined cases a cylinder with an axial conentric hole for the switching wire of the driver. Two narrow flat strips are ground on the cylinder in order to achieve good contact with both broad walls of the rectangular waveguide in which the ferrite toroid is placed. The width of the waveguide over the length of the toroid is adjusted in such a way that the differential phase shift is independent of frequency over a bandwidth of at least 20%. In general, this width is smaller than the standard waveguide width. The height of this waveguide part is identical to the height between the two narrow flat strips and therefore just a little smaller than the diameter of the toroid. With the aid of matching transformers and waveguide tapers, the cross section of the ferrite loaded waveguide is brought to that of the standard waveguide. With this setup, the phase shift, the insertion loss, the temperature dependence of the phase shift, and the peak power capability of the phase shifter are measured. Various types of ferrite are examined, such as magnesium-manganese ferrite, lithium ferrite, and mixed garnets. The saturation magnetization value is selected in such a way that low-field losses are avoided. Author (ESA)

N80-26560# Physics Lab. RVO-TNO, The Hague (Netherlands).
PERFORMANCE OF FERRITE AND DIODE PHASE SHIFTERS AT MILLIMETER WAVELENGTHS **c33**
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 21 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The performance possibilities at millimeter wavelengths of the nonreciprocal latched ferrite phase shifter, the reciprocal dual mode latched ferrite phase shifter, the diode phase shifter, and the Reggia-Spencer type of reciprocal ferrite phase shifter are discussed. An indication is given as to the availability of suitable ferrites for these high frequencies. Use is made of available information on lower frequencies for extrapolation to higher frequencies. Various types of ferrite, such as magnesium-manganese ferrite, lithium ferrite, and mixed garnets, are examined. Characteristics considered include differential phase shift and insertion loss, peak power capability, and temperature dependence. The several phase shifters are then ranked according to an arbitary figure of merit. Author (ESA)

N80-26561# Physics Lab. RVO-TNO, The Hague (Netherlands).
MICROSTRIP DIODE PHASE SHIFTERS FOR S-BAND AND C-BAND **c33**
W. P. M. N. Keizer *In its* On Microwave Meas., Transmission and Reception Dec. 1978 8 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

Two 4 bit PIN diode phase shifters operating at S band and C band are described. Both devices, constructed in microstrip on 0.635 mm thick alumina dielectric, consist of 22.5 deg and 45 deg loaded line configurations and of 90 deg and 180 deg rat-race hybrid coupled sections. Details of the design of the single bits, carried out with computer aided design techniques, are presented. Measured results are included. They indicate for the S band phase shifter (2.85 to 3.15 GHz) + or - 4 deg phase shift accuracy, 1.7 dB average insertion loss, and 1.4 maximum VSWR; for the C band phase shifter (5.4 to 6.0 GHz) there is + or - 0.7 deg phase shift accuracy, 1.3 dB average insertion loss, and 1.5 maximum VSWR. Author (ESA)

N80-26562# Physics Lab. RVO-TNO, The Hague (Netherlands).
COMPARISON BETWEEN FERRITE AND DIODE PHASE SHIFTERS TO BE USED IN PHASED-ARRAY ANTENNAS **c33**
J. Sneider and W. P. M. N. Keizer *In its* On Microwave Meas., Transmission and Reception Dec. 1978 9 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

A survey is given of the properties of the nonreciprocal latched remanent ferrite phase shifter and of the diode phase shifter in microstrip. A comparison is made between these two types at 3 GHz where items which are important for use in phased array antennas are used as a yardstick. The deviating results at lower and higher frequencies are mentioned separately. Other types of ferrite and diode phase shifters are also discussed. The possibilities of realizing phase shifters at millimeter wavelengths are mentioned. An indication of very recent and expected future trends is given. Some remarks on cost are made. Author (ESA)

N80-26563# Physics Lab. RVO-TNO, The Hague (Netherlands).
RAIN ATTENUATION MEASUREMENTS AT 94 GHz: COMPARISON OF THEORY AND EXPERIMENT **c32**
W. P. M. N. Keizer, J. Sneider, and C. D. deHaan *In its* On Microwave Meas., Transmission and Reception Dec. 1978 9 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

Measurements were made of attenuation at 94 GHz caused by rain on a 935 m terrestrial path since October 1977. Simultaneously, the raindrop size distribution was measured with a distrometer and the rainfall intensity was recorded with three rapid response rain gages spaced about 500 m apart along the propagation path. Using the measured raindrop size distribution and assuming spherical raindrops, the attenuation caused by rain was calculated with the aid of Mie's scattering theory for water spheres. The result is compared with the measured data. In the case of uniform rainfall along the path a good agreement is observed between the measured and the calculated attenuation.

The description of the propagation link, the experimental results, and the comparison between theory and measurement are given. Also, the descrease of antenna gain at 94 GHz due to water on a 1.2 m Cassegrain antenna is discussed. It is shown that for accurate propagation measurements it is absolutely necessary to equip the antennas with protective shelters. Author (ESA)

N80-26564# Physics Lab. RVO-TNO, The Hague (Netherlands).
PROPAGATION MEASUREMENTS AT 94 GHz AND COMPARISON OF EXPERIMENTAL RAIN ATTENUATION WITH THEORETICAL RESULTS DERIVED FROM ACTUALLY MEASURED RAINDROP SIZE DISTRIBUTIONS c32
W. P. M. N. Keizer, J. Sneider, and C. D. deHaan. *In its* On Microwave Meas., Transmission and Reception. Dec. 1978. 7 p. refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

A propagation experiment at 94 GHz designed to provide rain attenuation data on millimeter wave frequencies is discussed. The propagation link, including location, path length, and transmitting as well as receiving antenna characteristics, is described. A comparison between the measured rain attenuation and that calculated from the measured drop size distribution using Mie's scattering theory, is given. Results show better agreement between theory and measurement when using the Mie scattering theory than with other average drop size distributions, such as the Laws-Parsons distribution or the Marshall-Palmer one. The decrease in antenna gain at 94 GHz due to water on a 1.2 m Cassegrain antenna is also pointed out. It is shown that for accurate propagation measurement it is absolutely necessary to equip the antennas with protective shelters. Author (ESA)

N80-26565# Band, Lavis and Associates, Inc., Severna Park, Md.
CLASSIFICATION OF INTACT STABILITY STANDARDS FOR DYNAMICALLY SUPPORTED CRAFT. Final Report, Jul. - Oct. 1979
David R. Lavis. Oct. 1979. 122 p. refs
(Contract DOT-CG-806510-A)
(AD-A082161; Rept-117-3; USCG-D-76-79) Avail: NTIS HC A06/MF A01 CSCL 13/10

In recent years there has been an increasing employment of high-speed marine craft dependent on dynamic and air-cushion lift for support and stability. Existing regulations for the safety of ships and craft at sea are based upon displacement mode operation and cannot adequately be applied to high-speed craft when operating with their dynamic or air cushion means of support. As a result, the U.S. Coast Guard has begun a study of stability standards for such craft which is being carried out as part of the Coast Guard's overall Commercial Vessel Safety (CVS) Program. This report presents the results of the second (or classification) task of four-task study of intact-stability standards. Four broad categories of dynamically supported craft are examined: Amphibious Air-Cushion Vehicles (ACV), Rigid-Sidehull Surface-Effect Ships (SES), Hydrofoil Craft, Planing Craft. The different methods by which stability in the nondisplacement mode is achieved by each of these categories is examined, along with the various stability related operational hazards to which they can be subjected. Existing stability standards are reviewed. From these examinations and from the results of the background study prepared as Task 1, the four categories of dynamically supported craft considered have been divided into classes for which the same, or similar intact stability standards can apply. Tasks 3 and 4 which have not yet been initiated are designed for the detailed investigation of stability parameters and for the development of recommended stability standards for one, or more, of the categories of craft examined. GRA

N80-26566# Sandia Labs., Albuquerque, N. Mex. Parachute Systems Div.
PARACHUTE/FLOTATION BAG RECOVERY SYSTEM FOR A LARGE RV NOSE CONE
William B. Pepper. Mar. 1980. 20 p. refs
(Contract EY-76-C-04-0789)
(SAND-79-1800) Avail: NTIS HC A02/MF A01

The design and development of a single stage recovery system consisting of a 6 ft diameter guide surface parachute with a 3.5 cubic foot ram air filled flotation bag for ocean recovery of a 120 lb nose cone is described. Recovery producres start with jettisoning a portion of the initial reentry mass before deploying the parachute. DOE

N80-26567# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
HIGH TEMPERATURE FURNACE APPLICATION OF CRYOPUMPS
G. B. McClellan. 11 Feb. 1980. 11 p. refs. Presented at the 9th Ann. Symp. of the Florida Chapter of the Am. Vacuum Soc., Tampa, Fla., 11 Feb. 1980
(Contract EY-76-C-04-0656)
(GEPP-OP-483; CONF-800214-2) Avail: NTIS HC A02/MF A01

The basic imcompatibilities of a high temperature, 720 C, furnace and the low temperature, 12 k, cryopump are throughly investigated. The performance of the completed system is extensively investigated and is excellent. Cost comparisons are made with a duplicate diffusion pumped system. DOE

N80-26568# Kaiser Engineers, Oakland, Calif.
SITE AND BUILDING ENERGY-CONSERVATION STUDY: SURVEY OF BUILDING 435, MFE RESEARCH
Oct. 1979. 70 p. Prepared in cooperation with Consultants Computation Bureau, Oakland, Calif. Prepared for Calif. Univ., Livermore; Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15198; REPT-79-72-RE) Avail: NTIS HC A04/MF A01

Review of the design drawings, an on-site inspection of the 49,700-sq ft building, and discussions with the building manager and various operating personnel are discussed. Data were collected regarding the number of people occupying the building, operating schedules, and the energy loads imposed by installed and temporary equipment. The heating, ventilating, and air conditioning systems were investigated. The building energy systems were simulated using the DOE-1 energy program. A base-year energy consumption run was made, together with simulations of the building's performance assuming installation of each of eleven energy-conservation opportunities (ECO's) identified. A summary of the energy savings that would results from implementation of the ECO's is given. DOE

N80-26569# Military Vehicles and Engineering Establishment, Christchurch (England).
CODE OF PRACTICE FOR ENGINEERING DRAWINGS
London. HMSO. Sep. 1979. 79 p.
(MVEE-Proced-101; BR71172) Avail: NTIS HC A05/MF A01

The application of British standards to the preparation of engineering drawings is presented. Some of the most commonly applied standards, specifications, symbols, and abbreviations are listed for reference purposes and examples of completed drawings and diagrams are included. Author (ESA)

N80-26570# Texas Transportation Inst., College Station.
RESIDUAL STRESSES DUE TO TRAVELING LOADS AND REFLECTION CRACKING. Interim Report, Sep. 1974 - Jun. 1979
W. O. Yandell and R. L. Lytton. Jun. 1979. 90 p. refs. Sponsored in part by Texas State Dept. of Highways and Public Transportation, Austin
(PB-80-159395; FHWA/TX-79/18/207-6; TTI-2-8-75-207-6) Avail: NTIS HC A05/MF A01 CSCL 13B

The potential capabilities of the three dimensional mechano-lattice stress strain analysis for predicting rut depth, fatigue cracking, corrugations, and reflection cracking are demonstrated. The mechano-lattice analogy is the only techniques available which is capable of predicting the behavior of linear or nonlinear elasto-plastic or energy absorbing material subjected to directional traveling wheel loads. It is rigorous technique that preserves equilbrium and has strain compatibility. The problems investigated are the repeated one directional pneumatic tire rolling on a single layer of a compacted elasto-plastic sand-clay mixture various boundary conditions and the behavior of an elasto-plastic overlay with potential reflection cracking. The build up of residual stresses and strains is demonstrated to have significant effects on the accuracy of present day pavement design and construction procedures, including rutting and fatigue crack prediction. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-26571*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FREQUENCY TRACKED PULSE TECHNIQUE FOR ULTRASONIC ANALYSIS Patent Application
John H. Cantrell and Joseph S. Heyman, inventors (to NASA) Filed 10 Jun. 1980 21 p
(NASA-Case-LAR-12697-1; US-Patent-Appl-SN-158183) Avail: NTIS HC A02/MF A01 CSCL 20N

A tracking generator is slaved to a spectrum analyzer to produce an input signal having a frequency that follows the frequency of the spectrum analyzer sweeping local oscillator. The input signal is gated to a transducer by a transmitter gate to produce ultrasonic waves in the sample. The resulting ultrasonic echoes are converted into electrical signals by the transducer and then gated into the spectrum analyzer by receiver gate. This arrangement produces spectra that are equivalent to shock-exciting the transducer with a true delta function shock-excitation. NASA

N80-26572*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ELECTRO-OPTICS LABORATORY EVALUATION: DEUTSCH OPTICAL WAVEGUIDE CONNECTORS
Jun. 1980 39 p
(NASA-TM-74108; KSC-TR-32-1) Avail: NTIS HC A03/MF A01 CSCL 17B

A description of a test program evaluating the performance of an optical waveguide connector system is presented. Both quality and effectiveness of connections made in an optical fiber, performance of the equipment used and applicability of equipment and components to field conditions are reviewed. E.D.K.

N80-26573*# Telephonics, Huntington, N.Y.
WIRELESS MICROPHONE COMMUNICATION SYSTEM TELEPHONICS P/N 484D000-1
[1980] 281 p
(Contract NAS9-14824)
(NASA-CR-160731; WMCS-001) Avail: NTIS HC A13/MF A01 CSCL 17B

The wireless microphone is a lightweight, portable, wireless voice communications device for use by the crew of the space shuttle orbiter. The wireless microphone allows the crew to have normal hands-free voice communication while they are performing various mission activities. The unit is designed to transmit at 455 or 500 kilohertz and employs narrow band FM modulation. Two orthogonally placed antennas are used to insure good reception at the receiver. E.D.K.

N80-26574*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER PROGRAM TO CALCULATE RADIATION PROPERTIES OF REFLECTOR ANTENNAS
Pradeep K. Agrawal May 1978 77 p refs
(NASA-TM-78721) Avail: NTIS HC A05/MF A01 CSCL 20N

A computer program to calculate the radiation properties of the reflector antennas is presented. It can be used for paraboloidal, spherical, or ellipsoidal reflector surfaces and is easily modified to handle any surface that can be expressed analytically. The program is general enough to allow any arbitrary location and pointing angle for the feed antenna. The effect of blockage due to the feed horn is also included in the computations. The computer program is based upon the technique of tracing the rays from the feed antenna to the reflector to an aperture plane. The far field radiation properties are then calculated by performing a double integration over the field points in the aperture plane. To facilitate the computation of double intergral, the field points are first aligned along the equispaced straight lines in the aperture plane. The computation time is relatively insensitive to the absolute size of the aperture and even though no limits on the largest reflector size have been determined, the program was used for reflector diameters of 1000 wavelenghts. E.D.K.

N80-26575*# National Aeronautics and Space Administration, Washington, D. C.
COMMUNICATIONS VIA THE RADIO ARTIFICIAL EARTH SATELLITE: DESIGN OF THE TRACKING DIAGRAM AND FEATURES FOR CONDUCTING QSO
V. Dobrozhanskiy and V. Rybkin Mar. 1980 17 p refs Transl. into ENGLISH from Provedennya QSO Radio. (USSR), no. 1, 1979 p 17-20 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76105) Avail: NTIS HC A02/MF A01 CSCL 17B

A detailed examination is made of the operation of a transmitting artifical Earth satellite. A tracking diagram for the satellite is constructed. The zone of radio visibility can be determined based on the techniques proposed. Author

N80-26576*# Axiomatix, Los Angeles, Calif.
SHUTTLE ORBITER KU-BAND RADAR/COMMUNICATIONS SYSTEM DESIGN EVALUATION. KU BAND BENT-PIPE CHANNEL PERFORMANCE EVALUATION Interim Report
Jack K. Holmes and James G. Dodds 20 Jun. 1980 54 p refs
(Contract NAS9-15795)
(NASA-CR-160696; R8006-5) Avail: NTIS HC A04/MF A01 CSCL 17I

Because of difficulties with the bit detector of the SPA mode 1 channel 3 input port, a new bit synchronizer was required. The two prime candidate designs are described and analyzed. The selected design is a modification of one which utilizes a phase frequency detector to track the received data clock frequency and a mid-bit transition point sample detector to generate a bit timing error (phase error) signal to control the relative phase between the local clock and the local data stream. The model used to calculate the effects of cable attenuation and rise time degradation is discussed. A.R.H.

N80-26577*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Dept. of Space.
CUMULATIVE SLANT PATH RAIN ATTENUATION ASSOCIATED WITH COMSTAR BEACON AT 28.56 GHz FOR WALLOPS ISLAND, VIRGINIA
Julius Goldhirsh Aug. 1978 33 p refs
(NASA Order S-50748-A)
(NASA-CR-159997; APL/JHU-SIR78U-039) Avail: NTIS HC A03/MF A01 CSCL 20N

Yearly, monthly, and time of day fade statistics are presented and characterized. A 19.04 GHz yearly fade distribution, corresponding to a second COMSTAR beacon frequency, is predicted using the concept of effective path length, diedrometer, and rain rate results. The yearly attenuation and rain rate distributions follow with good approximation log normal variations for most fade and rain rate levels. Attenuations were exceeded for the longest and shortest periods of times for all fades in August and February, respectively. The eight hour time period showing the maximum and minimum number of minutes over the year for which fades exceeded 12 dh were approximately between 1600 to 2400, and 0400 to 1200 hours, respectively. In employing the predictive method for obtaining the 19.04 GHz fade distribution, it is demonstrated theoretically that the ratio of attenuations at two frequencies is minimally dependent of raindrop size distribution providing these frequencies are not widely separated. E.D.K.

N80-26578# Electronics Research Lab., Adelaide (Australia).
RADAR EMITTER RECOGNITION USING PULSE REPETITION INTERVAL
R. M. Hawkes Mar. 1980 57 p refs
(ERL-0132-TR; AR-001-976) Avail: NTIS HC A04/MF A01

A method for estimating radar emitter pulse repetition interval parameters from intercepted emissions is presented. Adaptive parameter estimates based on certain measurements are derived. The measurements are obtained by a readily implementable

observation procedure. The approach can deal with emitters with variable pulse repetition interval in a dense environment. Computer simulation results for the techniques are included.
Author

N80-26579*# Stanford Univ., Calif. Dept. of Engineering Systems.
COST COMPARISON OF COMPETING LOCAL DISTRIBUTION SYSTEMS FOR COMMUNICATION SATELLITE TRAFFIC
Frederick E. Dopfel Oct. 1979 15 p ref
(Contract NASw-3204)
(NASA-CR-163282; SU-26) Avail: NTIS HC A02/MF A01 CSCL 17B

The boundaries of market areas which favor various means for distributing communications satellite traffic are considered. The distribution methods considered are: control Earth station with cable access, rooftop Earth stations, Earth station with radio access, and various combinations of these methods. The least cost system for a hypothetical region described by number of users and the average cable access mileage is discussed. The region is characterized by a function which expresses the distribution of users. The results indicate that the least cost distribution is central Earth station with cable access for medium to high density areas of a region combined with rooftop Earth stations or (for higher volumes) radio access for remote users.
B.D.

N80-26580*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
AN ILLUSTRATIVE ANALYSIS OF TECHNOLOGICAL ALTERNATIVES FOR SATELLITE COMMUNICATIONS
Murray R. Metcalfe, Edward G. Cazalet, and D. Warner North Oct. 1979 78 p refs
(Contract NASw-3204)
(NASA-CR-163281; SU-24) Avail: NTIS HC A05/MF A01 CSCL 17B

The demand for satellite communications services in the domestic market is discussed. Two approaches to increasing system capacity are the expansion of service into frequencies presently allocated but not used for satellite communications, and the development of technologies that provide a greater level of service within the currently used frequency bands. The development of economic models and analytic techniques for evaluating capacity expansion alternatives such as these are presented. The satellite orbit spectrum problem, and also outlines of some suitable analytic approaches are examined. Illustrative analysis of domestic communications satellite technology options for providing increased levels of service are also examined. The analysis illustrates the use of probabilities and decision trees in analyzing alternatives, and provides insight into the important aspects of the orbit spectrum problem that would warrant inclusion in a larger scale analysis.
B.D.

N80-26581*# National Aeronautics and Space Administration, Washington, D. C.
RADIO EMISSION EVOLUTION OF NONSTATIONARY SOURCES IN THE HEDGEHOG MODEL
Yu. A. Kovalev and V. P. Mikhaylutsa Jun. 1980 24 p refs Transl. into ENGLISH of 'Evolyutsiya Radioizlucheniya Nestatsionarnykh Istochnikov v Modeli Yezhika'', Rept. Pr-324, Moscow, 1977 p 1-26 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences (USSR)
(Contract NASw-3198)
(NASA-TM-76210; PR-324) Avail: NTIS HC A02/MF A01 CSCL 20N

Correlations are obtained for numerical calculation of flux F sub v and polarized radiation intensity of a cloud of arbitrary geometry, consisting of ultrarelativistic electrons that dissipate in a radial magnetic field of the nucleus at a random angle to the observer. It is possible that some of the variable extragalactic objects that were previously described by the Shklovskiy model are young formations in the examined model. Radio astronomical observations would permit a determination of their distance, age, and lifetime.
E.D.K.

N80-26582# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
NEAR MILLIMETER WAVE RADAR TECHNOLOGY, PHASE 1 Interim Report
R. W. McMillan, R. E. Forsythe, R. A. Bohlander, R. G. Shackelford, R. N. Trebits, and W. A. Holm 11 Jan. 1980 106 p refs
(Contract DAAK70-79-C-0108)
(AD-A083493) Avail: NTIS HC A06/MF A01 CSCL 17/9

The proposed system consists of a transmitter, receiver, antenna duplexer, and antenna subsystem. An attempt will be made to phase lock the Varian VKY-2429R EIO transmitter to the receiver local oscillator to give a quasi-coherent system. Quasi-coherent means that the transmitted pulse is coherent near its center and incoherent during rise and fall times. The receiver will be of all solid state design, using an f/4 subharmonic mixer developed at Georgia Tech together with a Hughes 55 GHz phase locked Gunn local oscillator. The antenna duplexer will be an optical subsystem, depending partially for its operation on the change in sense of circular polarization when reflected from a single-bounce target, and partially on the operation of an interferometric switch used for receiver isolation. The antenna will be a 15 cm (6 inch) lens machined from a piece of TPX plastic, and the beam will be steered by a 2-axis gimbal system. Although there will be no signal processing hardware included in the proposed system, the antenna will have both a raster scan mode for search and a conical scan mode for track. The entire system will be designed to be amendable to the addition of radar signal processing at a later time.
GRA

N80-26583# California Univ., San Diego. Dept. of Electrical Engineering and Computer Sciences.
A SIMPLIFIED THEORY OF ELF PROPAGATION IN THE EARTH-IONOSPHERE TRANSMISSION LINE AND ITS WORLDWIDE APPLICATION Final Report, 1 Aug. 1978 - 31 Mar. 1980
Henry G. Booker 31 Mar. 1980 174 p refs
(Contract N00014-78-C-0682)
(AD-A083097) Avail: NTIS HC A08/MF A01 CSCL 20/14

An approximate theory of ELF propagation in the Earth-ionosphere transmission line is developed by combining the reflection theory of Booker and Lefeuvre (1977) with Greifinger and Greifinger's treatment 81978, 1979) of the effect of ionization below the level of reflection. The theory allows for the influence of the Earth's magnetic field, for reflection from the gradient on the under side of the D region (or, at night, of a ledge below the E region), for reflection from the gradient on the under side of the E region, and for reflection from the gradient on the top side of the E region. The procedure is to compare local vertical gradient with local wavelength, thereby classifying altitude into intervals where the gradient is high and ones where it is low. Where the gradient is low, the phase-integral treatment is adequate. An interval where the gradient is high may, to a first approximation, be replaced by a discontinuity. The amount of the discontinuity is the difference between the refractive indices at the top and bottom of the interval of high gradient, judged in relation to local wavelength. It is then a matter of combining reflections from the several discontinuities. This requires calculation of the complex phase-changes between the discontinuities. But these are the intervals where the phase-integral treatment is available. To a better approximation, there is a non-zero phase-change associated with an interval of high gradient. The method for incorporating this is described.
GRA

N80-26584# Oklahoma State Univ., Stillwater. Electronics Lab.
TRADAT MICROCOMPUTER BASED TRAJECTORY SYSTEM
R. M. Fike Hanscom AFB, Mass. AFGL 30 Nov. 1979 79 p refs
(Contract F19628-78-C-0033; AF Proj. 7659)
(AD-A083074; SCIENTIFIC-1; AFGL-TR-80-0012) Avail: NTIS HC A05/MF A01 CSCL 16/1

Tradat V is a lightweight, relatively inexpensive trajectory data system which was designed to be used with a portable autotrack antenna system. The combined Tradat V/Tracker system provides trajectory data for vehicles such as sounding rockets or balloons which are launched at remote launch sites where there are no fixed site radar sets. The tracker provides telemetry reception and the azimuth and elevation angles to the vehicle and the Tradat V system provides the following: slant range to

better than + or - .05 KM RMS, using a PCM ranging system in conjunction with the vehicle telemetry system; a serial PCM trajectory data code (for tape recording) containing: (a) Time, (b) Status indicators, (c) Raw azimuth, elevation, and slant range data; and a microcomputer printout containing: (a) Time, (b) Status indicators, (c) Computed ellipsoidal Earth coordinate data (Mean sea level altitude, ground range, distance North, and distance East or mean sea level altitude, vehicle latitude, and vehicle longitude), (d) Azimuth, elevation, and slant range referenced to one of three selectable data origin sites. This report contains an electrical and physical description of the Tradat V system, set-up and operation procedures, description of an optional command through ranging system, a microcomputer software description and equation derivation section, discussion of Tradat V mission results. GRA

N80-26585# Ohio State Univ., Columbus. Electroscience Lab.
A CAVITY-TYPE BROADBAND ANTENNA WITH A STEERABLE CARDIOID PATTERN Final Report
B. A. Munk and C. J. Larson Dec. 1979 92 p refs
(Contract N00014-78-C-0855)
(AD-A083226; ESL-711559-2) Avail: NTIS
HC A05/MF A01 CSCL 09/5

This report describes a new vertically polarized cavity-type antenna with a cardioid pattern steerable in the horizontal plane. The front-to-back ratio is better than 15 dB over a 25% bandwidth and better than 20 dB within half that total bandwidth. The average gain is approximately 2 dB above a monopole and the VSWR-2 except at the very end of the band. The beamwidth in the front as well as the nullwidth in the back is so wide that the beam is directed only in the four cardinal directions in the horizontal plane. A working model will be delivered to NRL as part of the contract. GRA

N80-26586# Naval Environmental Prediction Research Facility, Monterey, Calif.
ANOMALOUS MICROWAVE PROPAGATION ASSESSMENT IN THE LOWER TROPOSPHERE USING A BULK METEOROLOGICAL PARAMETER Final Report
Wayne Sweet Feb. 1980 24 p refs
(AD-A083156; NEPRF-TR-80-01) Avail: NTIS
HC A02/MF A01 CSCL 20/14

In their 1967 study 'On the Influence of the Meteorological Conditions on the Radiation Properties of Long Range Radars and on the Field Strength From a Distant Radio Transmitter,' Gjessing and Moene (G M) developed a procedure which uses a delta N parameter evaluated at the 850 mb level to assess the propagation properties for microwave transmissions. This present study examines the skill of the G M procedure to determine resulting accuracy, optimum value of delta N, and preferred vertical region of assessment. EASTPAC radiosonde soundings are used to determine the refractive structure in the given vertical region, and to calculate the value of delta N (850 mb). The G M procedure's skill is found to be comparable to, or in some cases better than, the skill of present day weather forecasts. The G M procedure is found to have skill in assessing the existence of anomalous propagation between the surface and the 850 mb level with no indication to the vertical location within this region. The optimum value of delta N is found to be similar to that used by Gjessing and Moene. GRA

N80-26587# Naval Research Lab., Washington, D. C. Radar Div.
NONLINEAR SPECTRAL ANALYSIS AND ADAPTIVE ARRAY SUPERRESOLUTION TECHNIQUES Interim Report
William F. Gabriel 1 Feb. 1980 28 p refs
(RR0210541, WR02101002)
(AD-A083391; AD-E000390; NRL-8345) Avail: NTIS
HC A03/MF A01 CSCL 09/5

Two nonlinear spectral analysis techniques, the Burg maximum entropy method and the maximum likelihood method, are related to their similar nonlinear adaptive array antenna counterparts, which consist of the sidelobe canceller and directional gain constraint techniques. The comparison analysis permits an examination of their principles of operation from the antenna spatial pattern viewpoint, and helps to qualify their superresolution performance. The real-time adaptive resolution of two incoherent sources located within a beamwidth was simulated, and results are presented in the form of a universal superresolution curve over a SNR range of 0 to 40 dB. Two alternative adaptive spatial spectrum estimators are suggested, consisting of a circular array predicting to its center point, and a new 'thermal noise' algorithm. GRA

N80-26588# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A HIGH PERFORMANCE UHF SATELLITE TRANSMITTER
Mark L. Stevens 28 Nov. 1979 86 p refs
(Contract F19628-80-C-0002)
(AD-A083262; TN-1979-68; ESD-TR-79-273) Avail: NTIS
HC A05/MF A01 CSCL 17/2

This note describes the design, construction, and performance of a 50 W UHF satellite transmitter which was built to demonstrate design and construction techniques that lead to easy replication of circuits in a manufacturing environment, without sacrifice in performance. High-efficiency performance is demonstrated over a 20 MHz band, centered at 260 MHz, with a fixed-tuned, single-ended design. GRA

N80-26589# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PATTERN DEGRADATION OF SPACE FED PHASED ARRAYS
John Ruze 5 Dec. 1979 144 p refs
(Contract F19628-80-C-0002; ARPA Order 3724)
(AD-A083264; SBR-1; ESD-TR-79-278) Avail: NTIS
HC A07/MF A01 CSCL 17/9

The far field pattern degradation of space fed phased arrays suitable for a space based radar is examined. The effects considered are: Structural: (1) Axial lens surface distortions, (2) Uniform radial thermal expansion, and (3) Axial and lateral feed displacements; Electrical: (1) Element phase and amplitude excitation errors, and (2) Failed elements. An introductory section discusses the size, cost, and weight penalties of low sidelobe designs. The final section presents a method of phase compensation or coherence of large axial lens distortions. GRA

N80-26590# Ohio State Univ., Columbus. Electroscience Lab.
ON GRATING NULLS IN ADAPTIVE ARRAYS
A. Ishide and R. T. Compton, Jr. Mar. 1980 38 p refs
(Contract N00019-79-C-0281)
(AD-A083687; ESL-711847-6) Avail: NTIS
HC A03/MF A01 CSCL 09/5

This report considers the effect of element patterns on grating nulls in adaptive arrays. Two simple array models, a two-element and a three-element array with dipole element patterns, are used to study this question. The element patterns are assumed unequal (i.e., the beam maxima point in different directions). It is shown that element patterns greatly affect the occurrence of grating nulls in the array. Unequal element patterns cause extra grating nulls (sign reversal grating nulls) to occur, in addition to conventional grating nulls. These sign reversal grating nulls can occur even with element spacing less than a half-wavelength. For a two-element array with dipole element patterns, it turns out that grating nulls cannot be avoided if the spacing is greater than a half wavelength. However, with more than two elements, the situation is not so bleak. An example is given of a three-element array with dipole patterns and one wavelength spacing in which all grating nulls are eliminated. GRA

N80-26591# Naval Postgraduate School, Monterey, Calif.
CLUTTER SUPPRESSION IN RADARS BY AN APPLICATION OF DIGITAL FILTERS TO MTI SYSTEMS M.S. Thesis
John Elias Sarris Dec. 1979 82 p refs
(AD-A083837) Avail: NTIS HC A05/MF A01 CSCL 17/9

A significant part of radar technology has been concerned with developing techniques which permit satisfactory operation of radar systems when moving targets are in the presence of relatively fixed targets (clutter). This thesis presents the significant aspects of old, improved and modern anticlutter techniques, each of which is described with its principal advantages and disadvantages. A tabulation is made which compares each anticlutter technique on the basis of its clutter suppression capability. Continuing, an application of digital filters is made by designing a fourth-order recursive filter with Butterworth characteristics, using a computer program. This filter can be used in a range-gated

MTI (Moving Target Indication) receiver to improve its performance. Special consideration was given to the AN/UPS-1 and AN/SPS-40B,C radars which are used in the Greek Navy in a clutter environment characteristic of the Mediterranean Sea. Appropriate modifications to their existing analog systems are suggested. GRA

N80-26592# Los Alamos Scientific Lab., N. Mex.
TRANSIENT RESPONSE OF THIN-WIRE ANTENNAS AND SCATTERERS LOADED WITH CIRCUITS AND NONLINEAR ELEMENTS
J. A. Landt Feb. 1980 16 p refs Sponsored in part by Dept. of Agriculture
(Contract W-7405-eng-36)
(LA-8242-MS) Avail: NTIS HC A02/MF A01

A numerical technique is presented that is capable of calculating the transient response of a thin-wire antenna or scatterer loaded by a network. The network contains nonlinear as well as linear elements. The numerical solution is obtained by a single computer code execution. The formation is cast in the time domain, and the solution is obtained by a time stepping procedure. DOE

N80-26593# National Physical Lab., Teddington (England). Div. of Electrical Science.
THE PROPAGATION OF PLANE WAVES THROUGH A LAMELLA
R. J. Cook Aug. 1979 15 p refs
(NPL-DES-52) Avail: NTIS HC A02/MF A01

Single and multiple reflections were considered in deriving expressions, in terms of the refractive index n and the absorption index K, for the power transmission coefficient, power reflection coefficient and phase shifts for a Lamella placed in a plane wave at normal incidence. The expressions were successfully used in a free space microwave bridge to compare transmission and reflection measurements on the same sample. Author (ESA)

N80-26594# GEC-Marconi Electronics Ltd., Chelmsford (England). Communications Research Lab.
ON-BOARD SYNTHETIC APERTURE RADAR (SAR) PROCESSOR DEFINITION Final Report
S. R. Brooks, A. P. Luscombe, and A. B. E. Ellis Oct. 1979 264 p refs
(Contract ESTEC-2897/76)
(MTR-79/96; ESA-CR(P)-1284) Avail: NTIS HC A12/MF A01

A spaceborne synthetic aperture radar (SAR) system which utilizes onboard image processing in real time is described. The system components (radar, antenna, platform, data link) are considered, leading to an evaluation of processor performance requirements within the constraints of given image quality specifications. The system analysis is developed to quantify the processor operations. The implementation of the processing is studied for several candidate processor designs. Storage and data rates are emphasized. Results favor the digital approach. The availability of suitable devices limits the analog approach, while its subsequent stabilty is found to be difficult to maintain and monitor. Author (ESA)

N80-26595# Oulu Univ. (Finland). Dept. of Electrical Engineering.
A MICROCOMPUTER BASED MEASUREMENT AND MAIN LOBE CONTROL SYSTEM FOR AN ARRAY ANTENNA
Simo Lehto, Jorma Kekaelaeinen, and Jorma Kajava 1978 16 p refs
(S-52-1978; ISBN-951-42-0578-2; ISSN-0356-0899) Avail: NTIS HC A02/MF A01

A microcomputer based measurement and main lobe control system is presented. It was designed and constructed for a three stack, two bay array antenna for medium and long distance HF communication. The antenna system is used to gather and process ionospheric and propagation data (amplitude distribution of received signals, slow and fast fading, and the quality of the received signal). The main lobe of the array can also be automatically directed to the direction of the best propagation modes. The research antenna system is presently being used for propagation studies and tests in practical world-wide communications for assessing the effect of main lobe control on the short term and long term performance of HF antennas. Author (ESA)

N80-26596# Oulu Univ. (Finland). Dept. of Electrical Engineering.
MODELING AND OPTIMIZATION OF TRANSMITTING ARRAY ANTENNAS IN THE PRESENCE OF IMPERFECT GROUND
Simo Lehto, Jorma Kekaelaeinen, Jorma Kajava, and Kalevi Kalliomaeki, ed. 1978 22 p refs
(S-53-1978; ISBN-951-42-0579-0; ISSN-0356-0899) Avail: NTIS HC A02/MF A01

An arbitrarily oriented antenna system consisting of an array of N antennas and a test antenna above the imperfect ground is described by (N+1) -port network. By using the field representation, the result shows how the ground parameters are incorporated into the model. The radiation pattern, directivity, and the power gain of the array are formulated in the transmitting case. The optimum excitations which maximize the directivity, and the power gain, are obtained as solutions of the corresponding eigenvalue equations. Author (ESA)

N80-26597# Stanford Univ., Calif.
NEW TECHNICAL OPPORTUNITIES FOR UHF TELEVISION TRANSMITTERS
C. Chapin Cutler Feb. 1980 50 p refs
(Contract FCC-2184-9)
(PB80-137193) Avail: NTIS HC A03/MF A01 CSCL 17B

The prospects for improved efficiency in power amplifying devices for UHF broadcast television transmitters are examined. Estimates of dollar and power savings are presented for a number of devices. GRA

N80-26598# Aeronautical Radio, Inc., Annapolis, Md.
SHIP DATA COMMUNICATIONS SYSTEM (SDCS): A STUDY OF FEASIBILITY AND COST-BENEFIT ANALYSIS FOR THE UNITED STATES - FLAG MERCHANT FLEET Final Report, Sep. 1978 - Jan. 1980
L. B. Greene Jan. 1980 77 p
(Contract MA-8-3085)
(PB80-158645; MA-RD-930-80025; ARINC-1353-02-1-2031)
Copyright. Avail: NTIS HC A05/MF A01 CSCL 17B

The results of a study of shipboard data communications to determine the requirements for ship-to-shore data communications, to determine the availability of ship-to-shore data communications systems, to compare these systems in terms of costs and benefits, and to make recommendations for future implementation of these systems are presented. The resulting analysis of costs and benefits of each communications mode established the maritime satellite (MARIST) high data rate service as clearly superior to any other mode at all volume levels. GRA

N80-26343*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SETI OBSERVATIONAL PLAN
A. L. Berman *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 43-49 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26344*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ERROR ESTIMATION FOR ORION BASELINE VECTOR DETERMINATION
S. C. Wu *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 16-31 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26346*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN COMMAND SYSTEM MARK III-80
H. C. Thorman *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 35-42 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26352*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE 64 METER ANTENNA OPERATION AT K SUB A BAND
P. D. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 65-70 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26354*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RFI RECEIVER
R. Lay *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 82-86 ref (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26360*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
UTILIZATION OF THE VENUS STATION (DSS 13) 26 METER ANTENNA DURING CY 1979
E. B. Jackson *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 136 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26552# Physics Lab. RVO-TNO, The Hague (Netherlands).
CHARACTERISTICS OF CLUTTER AND TARGETS AT X- AND Ku-BANDS
H. Sittrop *In its* On Microwave Meas., Transmission and Reception Dec. 1978 28 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26553# Physics Lab. RVO-TNO, The Hague (Netherlands).
SEA-CLUTTER DEPENDENCY ON WINDSPEED
H. Sittrop *In its* On Microwave Meas., Transmission and Reception Dec. 1978 4 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26554# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE DESIGN CONSTRUCTION AND TEST RESULTS OF THE CAISSA PLANAR SPACE FED PHASED ARRAY ANTENNA
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 13 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26555# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE PERFORMANCE OF AN IRIS-LOADED PLANAR PHASED-ARRAY ANTENNA OF RECTANGULAR WAVE-GUIDES WITH AN EXTERNAL DIELECTRIC SHEET
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 8 p refs Repr. from IEEE Trans. on Antennas and Propagation, v. AP-26, no. 3 May 1978 8 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26556# Physics Lab. RVO-TNO, The Hague (Netherlands).
THEORETICAL AND EXPERIMENTAL RESULTS OF AN IRIS-LOADED PLACAR PHASED-ARRAY ANTENNA WITH AN EXTERNAL DIELECTRIC SHEET
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26557# Physics Lab. RVO-TNO, The Hague (Netherlands).
NUMERICAL AND EXPERIMENTAL ANTENNA PATTERNS OF A SPACE-FED PLANAR PHASED-ARRAY ANTENNA
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26558# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SIMPLE AND FAST MATCHING METHOD FOR MUTUAL COUPLING OF A LINEAR PHASED ARRAY ANTENNA WITH WAVEGUIDE APERTURES AS RADIATING ELEMENTS
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26563# Physics Lab. RVO-TNO, The Hague (Netherlands).
RAIN ATTENUATION MEASUREMENTS AT 94 GHz: COMPARISON OF THEORY AND EXPERIMENT
W. P. M. N. Keizer, J. Sneider, and C. D. deHaan *In its* On Microwave Meas., Transmission and Reception Dec. 1978 9 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26564# Physics Lab. RVO-TNO, The Hague (Netherlands).
PROPAGATION MEASUREMENTS AT 94 GHz AND COMPARISON OF EXPERIMENTAL RAIN ATTENUATION WITH THEORETICAL RESULTS DERIVED FROM ACTUALLY MEASURED RAINDROP SIZE DISTRIBUTIONS
W. P. M. N. Keizer, J. Sneider, and C. D. deHaan *In its* On Microwave Meas., Transmission and Reception Dec. 1978 7 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-26599* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
PORTABLE DEVICE FOR USE IN STARTING AIR-START-UNITS FOR AIRCRAFT AND HAVING CABLE LEAD TESTING CAPABILITY Patent
William R. Rosier (Serv-Air, Inc., Edwards, Calif.) and George G. Volk, inventors (to NASA) (Serv-Air, Inc., Edwards, Calif.) Issued 20 May 1980 7 p Filed 9 Mar. 1978 Supersedes N78-19166 (16 - 10, p 1263) Sponsored by NASA
(NASA-Case-FRC-10113-1; US-Patent-4,204,154; US-Patent-Appl-SN-885066; US-Patent-Class-324-51) Avail: US Patent and Trademark Office CSCL 09C

A portable device for starting aircraft engines and the like is disclosed. The device includes a lead testing and motor starting circuit characterized by: (1) a direct current voltage source, (2) a pair of terminal plugs connected with the circuit (each being characterized by a first, second, and third terminal) (3) a pair of manually operable switches for connecting the first terminal of each plug of the pair to the positive side of the voltage source, (4) a circuit lead connecting to the second terminal of each plug the negative side of said source, (5) a pair of electrical cables adapted to connect said first and second terminals of each plug to an air-start unit, and means for connecting each cable of the pair of cables between the first terminal of one plug and the third terminal of the other plug of the pair, and (6) a second pair of manually operable switches for selectivity connecting the third terminal of each plug of the pair to the negative side of the voltage source.

Official Gazette of the U.S. Patent and Trademark Office

N80-26600# Environmental Law Inst., Washington, D. C.
STATE OPTIONS IN LIGHTING: EFFICIENCY STANDARDS FOR EXISTING PUBLIC BUILDINGS
Frank Meeker Jun. 1979 51 p refs
(Contract EM-78-C-01-5255)
(DOE/CS-5255/2) Avail: NTIS HC A04/MF A01

Requirements and options for state lighting efficiency standards for existing public buildings under the Energy Policy and Conservation Act are discussed. It is recommended that

states adopt a requirement that owners of all public buildings submit reports of lighting energy audits and estimates of energy savings from modifications to comply with substantive standards. It is further recommended that while filing of reports should be mandatory, substantive compliance, at least initially, need not be. It is recommended that exemptions from the standards be limited to small buildings and that variances under a mandatory standard be available only when an applicant can show insufficient capital to make required modifications, even though they would soon pay for themselves in reduced operating costs. It is suggested that a lighting standard of the kind recommended should substantially reduce wasted energy in lighting, be simple enough to be easily understood and applied, be technically and economically reasonable, and allow for needed exemptions without loopholes. E.D.K.

N80-26601*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
JFET OSCILLATOR Patent Application
Leonard L. Kleinberg, inventor (to NASA) Filed 27 May 1980 14 p
(NASA-Case-GSC-12555-1; US-Patent-Appl-SN-153240) Avail: NTIS HC A02/MF A01 CSCL 09A

A high frequency oscillator circuit is described. The circuit uses a low cost junction type field effect transistor (T sub 1) with a tuned circuit connected to its gate. The frequency of operation is determined by the tuned circuit and the capacitance reflected from the the source to the gate. The transistor is matched to the grequency of operation so that this frquency falls within the roll-off portion of the transistor's transconductance verses frequency curve, above the 3 db point in frequency. Phase shifting necessary to sustain oscillation occur to the operation of the transistor in the roll off portion of the curve and the addition of a phase shifting network (R sub 1 C) at the source. The resulting oscillator is small, stable, linear, and inexpensive. NASA

N80-26602*# Mississippi State Univ., Mississippi State. Microelectronics Research Lab.
A STUDY OF TRENDS AND TECHNIQUES FOR SPACE BASE ELECTRONICS Quarterly Progress Report, 10 Mar. - 10 Jun. 1978
J. D. Trotter, T. E. Wade, J. D. Gassaway, and Q. Mahmood Jun. 1978 24 p refs
(Contract NAS8-26749; MSU-EE-OUAR-3-78)
(NASA-CR-163293) Avail: NTIS HC A02/MF A01 CSCL 09C

A sputtering system was developed to deposit aluminum and aluminum alloys by the dc sputtering technique. This system is designed for a high level of cleanliness and for monitoring the deposition parameters during film preparation. This system is now ready for studying the deposition and annealing parameters upon double-level metal preparation. A technique recently applied for semiconductor analysis, the finite element method, was studied for use in the computer modeling of two dimensional MOS transistor structures. It was concluded that the method has not been sufficiently well developed for confident use at this time. An algorithm was developed for confident use at this time. An algorithm was developed for implementing a computer study which is based upon the finite difference method. The program which was developed was modified and used to calculate redistribution data for boron and phosphorous which had been predeposited by ion implantation with range and straggle conditions. Data were generated for <111> oriented SOS films with redistribution in N2, dry O2 and steam ambients. J.M.S.

N80-26603*# RCA Solid State Technology Center, Somerville, N. J.
CHARACTERIZATION OF SILICON-GATE CMOS/SOS INTEGRATED CIRCUITS PROCESSED WITH ION IMPLANTATION Final Report, 1 Jul. 1976 - 30 Jun. 1977
D. S. Woo Aug. 1977 52 p ref
(Contract NAS8-31986)
(NASA-CR-150607; PRRL-77-CR-40) Avail: NTIS HC A04/MF A01 CSCL 09A

Progress in developing the application of ion implantation techniques to silicon gate CMOS/SOS processing is described. All of the conventional doping techniques such as in situ doping of the epi-film and diffusion by means of doped oxides are replaced by ion implantation. Various devices and process parameters are characterized to generate an optimum process by the use of an existing SOS test array. As a result, excellent circuit performance is achieved. A general description of the all ion implantation process is presented. E.D.K.

N80-26604*# Boeing Aerospace Co., Seattle, Wash.
GROUND/BONDING FOR LARGE SPACE SYSTEM TECHNOLOGY (LSST) Final Report
W. G. Dunbar Apr. 1980 93 p refs
(Contract NAS8-33432)
(NASA-CR-161486) Avail: NTIS HC A05/MF A01 CSCL 09C

The influence of the environment and extravehicular activity remote assembly operations on the grounding and bonding of metallic and nonmetallic structures is discussed. Grounding and bonding philosophy is outlined for the electrical systems and electronic compartments which contain high voltage, high power electrical and electronic equipment. The influence of plasma and particulate on the system was analyzed and the effects of static buildup on the spacecraft electrical system discussed. Conceptual grounding bonding designs are assessed for capability to withstand high current arcs to ground from a high voltage conductor and electromagnetic interference. Also shown were the extravehicular activities required of the space station and or supply spacecraft crew members to join and inspect the ground system using manual on remote assembly construction. DOE

N80-26605# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
SPEED CONTROL OF A FIELD CONTROLLED DC MOTOR
M. Pachter Oct. 1979 18 p refs
(CSIR-TWISK-120) Avail: NTIS HC A02/MF A01

An optimal (minimal time) feedback control law is synthesized. Speed control of a field controlled DC motor in a battery driven vehicle application is considered. B.D.

N80-26606# Naval Research Lab., Washington, D. C. Microwave Technology Branch.
INTERACTIVE EFFECTS OF BOND WIRES USED FOR MICROWAVE SEMICONDUCTOR DEVICE COMBINING AND MATCHING CIRCUITRY Interim Report
R. E. Neidert, H. A. Willing, and B. E. Spielman 5 Mar. 1980 11 p refs Submitted for publication
(RR0210346)
(AD-A083920; NRL-8388) Avail: NTIS HC A02/MF A01 CSCL 09/1

For arrays of bond wires, inter-wire coupling can significantly affect the parameters of the individual wires. Design information is given for two port problems consisting of multiple bond wire arrays over a ground plane. Secondly, bond wire coupling can degrade the combining efficiency of several wire-combined solid state devices (such as transistor unit cells). This problem is modeled and analyzed, and remedies are suggested. GRA

N80-26607# California Univ., Livermore. Lawrence Livermore Lab.
TEST OF A VACUUM/DIELECTRIC SURFACE FLASHOVER SWITCH
Ian D. Smith (Ian D. Smith, Inc.) 25 Feb. 1980 13 p Prepared jointly with DARPA
(Contracts W-7405-eng-48; N60921-80-PO-w001; ARPA Order 3718)
(UCID-18553) Avail: NTIS HC A02/MF A01

A vacuum surface flashover switch is being considered for >10 kHz operation in a 250 kV, 10 ohm, 40 ns coaxial water Blumlein. Various possible switch designs are compared and two promising ones selected for tests in a switch test facility. The initial test configurations are described. DOE

N80-26608# Sandia Labs., Albuquerque, N. Mex.
SEMICONDUCTORS FOR HIGH TEMPERATURE ACTIVE DEVICES: SILCON, GaAs, AND GaP
Joe Allen Coquat 1980 10 p refs Presented at the Electro/80 Professional Program Meeting, Boston, 13 May 1980
(Contract EY-76-C-04-0789)
(SAND-80-0379C; CONF-800504) Avail: NTIS HC A02/MF A01

Developments in the area of high temperature active semiconductor devices for use at 275 C in instrumentation needed to characterize geothermal resources are described. Surveys of silcon bipolar, MOS, and JFET devices operated at high temperature and development work on high temperature silicon CMOS logic and DI analog circuits are reviewed. The initial results of development work on GaAs and GaP diodes are discussed. These efforts have identified several promising devices for high temperature applications, however, further development is required to resolve such problems as excessive leakage currents, metalization degradation, device stability, and long term aging. DOE

N80-26609# California Univ., Livermore. Lawrence Livermore Lab. Electronic Engineering Dept.
THE STANDING WAVE METHOD OF DETERMINING THE RESONANT FREQUENCY OF CIRCUITS INVOLVING LOW L AND HIGH C
H. Graham 13 Mar. 1980 11 p
(Contract W-7405-eng-48)
(UCID-18580) Avail: NTIS HC A02/MF A01

A method is described which is capable of determining the resonant frequency of L C circuits involving inductances as low as .001 uH and net impedances as low as .001 ohm, provided the resonant frequency is below 15 mc. External circuitry does not effect the accuracy of measurement as this circuitry is not included in the parameters of the circuit being measured. It is possible to determine the effective resistance of the circuit being measured and thereby obtain the efficiency of the system. DOE

N80-26610# Bendix Corp., Kansas City, Mo.
CONTROL OF ELECTROSTATIC DAMAGE TO ELECTRONIC CIRCUITS
Whitson J. Kirk, Jr. Mar. 1980 21 p refs Presented at the 6th Ann. Reliability Testing Inst., Tucson, Ariz., 14-18 Apr. 1980
(Contract EY-76-C-04-0613)
(BDX-613-2428; CONF-800440-1) Avail: NTIS HC A02/MF A01

The static voltages generated by movements degrade or destroy many solid state devices currently used in sophisticated electronic equipment. Discharge of static voltages through these sensitive devices during assembly operations lead to a nonfunctional assembly fabricated from parts which previously were acceptable or to later failure of an assembly which was functional after fabrication. Sources of electrostatic charges, equipment and methods for minimizing the generation of electrostatic voltages during the production, assembly and packaging of solid state electronic equipment, and the sensitivity of solid state devices to electrostatic damage are discussed. Static awareness is the key to an effective electrostatic damage (ESD) control program. Production facilities must incorporate electrostatic protection facilities, materials, and processes so that workers can concentrate on producing a high quality product without having to be overly concerned about ESD procedures. DOE

N80-26611# Mission Research Corp., Albuquerque, N. Mex.
TRANSIENT EFFECTS FROM LIGHTNING. VOLUME 1: TRANSIENT ELECTROMAGNETIC FIELDS FROM LIGHTNING DISCHARGES
H. Fowles, L. Scott, and J. Hamm Jan. 1980 184 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7051-Vol-1) Avail: NTIS HC A09/MF A01

The effects of lightning on solar photovoltaic systems in the 100 kilowatt to 1 megawatt power range, and methods for protecting these systems from lightning are discussed. The statistics of lightning strokes is reviewed, and the model which predicts the electromagnetic fields and optical power density is summarized. Coupling of the electromagnetic fields to photovoltaic system elements is also discussed, and the experience of power and telephone companies with lightning transients is drawn upon. A theoretical model fcr predicting damage thresholds for modern terrestrial solar cells is presented. The thresholds are presented in the form of peak currents as a function of pulse width for two separate failure modes: melting of the deposited metal grid and burnout of the junction. Lightning protection techniques which are technically and economically feasible for photovoltaic systems are discussed. The techniques of shielding and terminal protection are discussed. DOE

N80-26612# National Physical Lab., Teddington (England). Div. of Electrical Science.
THE LOCATION OF REFLECTIONS IN TWO-PORT MICROWAVE COMPONENTS
A. E. Fantom Nov. 1979 42 p refs
(NPL-DES-61) Avail: NTIS HC A03/MF A01

The location of reflections in microwave components is discussed with particular regard to two port devices. It is shown that the extra information which can be obtained when both ports are accessible can be used to distinguish between lossy and lossless reflexions. An instrument is proposed (the locating absorptometer) based on this fact. Two versions of the instrument are investigated; one using an analog method of obtaining the Fourier transform, the other using a computer to perform the transform. Qualitative results were obtained with the analog version. The computer version was tested with known sources of reflection having reflection coefficients between 0.15 and 0.42 and gave agreement within 0.04. Author (ESA)

N80-26613# European Space Agency, Paris (France).
THEORETICAL EVALUATION OF A GROUNDING CONFIGURATION FOR AN INDIUM-OXIDE-COATED THERMAL-CONTROL MATERIAL
S. J. Bosma (ESTEC, Noordwijk, Netherlands) Jan. 1980 22 p refs
(ESA-STM-212) Avail: NTIS HC A02/MF A01

The electrical grounding of thermal control materials coated with indium oxide was investigated using a theoretical evaluation. It is shown that the application of basic circular grounding point is an adequate method of grounding for thermal control sheets of any size or shape. The method reduces labor and material costs and leads to only small losses of optical performance. Author (ESA)

N80-26614# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbeiter.
DEVELOPMENTS OF HIGH COMPLEXITY LINEAR INTEGRATED CIRCUITS Final Report
Bernd Eichler Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 60 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-36) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12.20

Requirements for an economical production of linear integrated bipolar circuits of high complexity are described. The results of this study were used to develop several complex integrated circuits using specific optimization techniques. Typical examples explain measurement techniques used with these circuits. Two concepts for PAL decoders with four and three integrated circuits are described. Author (ESA)

N80-26615# AEG-Telefunken, Heilbronn (West Germany). Fachbereich Halbleiter.
DEVELOPMENT OF TECHNICAL INTEGRATED CIRCUITS Final Report
Ingo Hagenloch Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 51 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-41) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 10.30

The results of integrated circuit development studies are reported. The following circuits are described: (1) two touch switches for mode and channel setting on radio and television receivers; (2) a phase control and a zero crossing switch to drive SCRs or Triacs; (3) a directional and a warning circuit for motor vehicles; (4) an automotive seat belt interlock system; (5) a timer for electronic watches; and (6) a light dimmer with touch control. Author (ESA)

N80-26616# Siemens A.G., Erlangen (West Germany). Forschungslab.
SUPPLEMENTARY INVESTIGATIONS FO FUNDAMENTAL RESEARCH PROGRAM PLASMA TECHNIQUES Final Report
Walter Hertz, Juergen Mentel, Harald Motschmann, and Wilhelm

Tiemann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 192 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-43) Avail: NTIS HC A09/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 40

The flow of SF6 in a double nozzle circuit breaker model with and without arc is investigated through the use of holographic systems. The gas flow interferograms are evaluated and a program is developed to calculate the gas density and velocity for adiabatic flow. The ac discharges in SF6 gas flows are investigated for a double nozzle circuit breaker. Author (ESA)

N80-26617# AEG-Telefunken, Ulm (West Germany). Forschungsinst.
SEMICONDUCTOR CROSSPOINTS FOR DIRECT REPLACEMENT OF ELECTROMECHANICAL SWITCHES WITH HIGH VOLTAGE REQUIREMENTS Final Report
Erich Baechle, Reinhard Becker, Helmut Knapp, Max Kuisi, Friedrich Laemmel, Bernhard Rall, Klaus Schlueter, and Hans Schuessler Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 166 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-44) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 34,45

Specifications for solid state switches were developed based on studies of telephone exchange systems. It was found that a sufficiently high breakdown voltage coupled with a low resistance when the switch is closed are difficult to achieve. Hybrid integration with thick film technology led to solutions for crosspoint elements which were found to be only marginally cost effective. Alternative solutions are proposed. Author (ESA)

N80-26618# Brown, Boveri und Cie. A.G., Heidelberg (West Germany). Zentrales Forschungslab.
PASSIVATION OF SILICON POWER DEVICES BY THERMAL OXIDATION Final Report
Arno Neidig, Georg Wahl, Klaus Weimann, and Gabriele Gilbers Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 77 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-48) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16

A method was developed for the passivation of high voltage silicon power devices which opens the way for low cost packaging of high voltage power devices. Thermal oxidation at temperatures between 600 C and 900 C is used followed by chemical vapor deposition of a barrier larger against alkaline impurities. Author (ESA)

N80-26619# Siemens A.G., Munich (West Germany). Unternehmungsbereich Bauelemente.
INTEGRATED CIRCUITS FOR REMOTE COMMAND AND DATA TRANSMISSION Final Report
Eckart Schatter Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 26 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-50) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 5,05

A universal system for command transmission was developed using as a starting point remote control techniques for television receivers. The system uses an infrared light carrier and features extremely high noise protection together with a wide action range. A digital transmitter and a receiver integrated circuit as well as a bipolar high-gain preamplifier were developed for this application. Author (ESA)

N80-26620# Danish Research Center for Applied Electronics, Hoersholm.
CHARACTERIZATION OF RANDOM ACCESS MEMORIES: STRATEGIES, TEST PATTERNS AND PARAMETERS INVOLVED IN THE CHARACTERIZATION OF RAM MEMORIES AND AN EVALUATION OF 16 k RAM'S OF EIGHT MANUFACTURES
Eskild Jensen and Birger Schneider Nov. 1979 55 p refs
(ECR-93) Avail: NTIS HC A04/MF A01

Techniques for the testing and characterization of dynamic random access memories (RAM's) are described. The general background of RAM operations and related failure modes are discussed. This includes descriptions of typical RAM sensitivities due to supply voltage variations, supply voltage interactions, extreme temperatures, test patterns, operational modes, and timing conditions. An operating region can be defined for each device under test. In addition it is shown how the characterization will result in worst case test conditions for use in production testing. A characterization of eight manufactures of industry standard 16 k x 1 bit dynamic RAMS's is carried out and the sensitivities revealed are described and commented on. Author (ESA)

N80-26351*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A THEORETICAL MODEL OF PHASE CHANGES OF A KLYSTRON DUE TO VARIATION OF OPERATING PARAMETERS
A. Kupiszewski *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 62-64 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

N80-26353*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH-POWER TRANSMITTER AUTOMATION
R. Gosline *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 71-81 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

N80-26559# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SURVEY OF PROPERTIES OF LATCHED NON RECIPROCAL FERRITE PHASE SHIFTERS WITH CYLINDRICAL RODS AT 3, 5.5, 9.3 AND 16 GHz
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26560# Physics Lab. RVO-TNO, The Hague (Netherlands).
PERFORMANCE OF FERRITE AND DIODE PHASE SHIFTERS AT MILLIMETER WAVELENGTHS
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 21 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26561# Physics Lab. RVO-TNO, The Hague (Netherlands).
MICROSTRIP DIODE PHASE SHIFTERS FOR S-BAND AND C-BAND
W. P. M. N. Keizer *In its* On Microwave Meas., Transmission and Reception Dec. 1978 8 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26562# Physics Lab. RVO-TNO, The Hague (Netherlands).
COMPARISON BETWEEN FERRITE AND DIODE PHASE SHIFTERS TO BE USED IN PHASED-ARRAY ANTENNAS
J. Sneider and W. P. M. N. Keizer *In its* On Microwave Meas., Transmission and Reception Dec. 1978 9 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-26621*# Systems and Applied Sciences Corp., Hampton, Va.
TRANSITION PREDICTION USING THREE DIMENSIONAL STABILITY ANALYSIS
Mujeeb R. Malik Jun. 1980 31 p refs
(Contract NAS1-15604)
(NASA-CR-159277; R-SAL-6/80-01) Avail: NTIS

HC A03/MF A01 CSCL 20D

Several methods of transition prediction by linear stability analysis are compared. The spectral stability analysis code SALLY is used to analyze flows over laminar flow control wings. It is shown that transition by the envelope method and a new modified wave packet method are comparable in reliability but that the envelope method is more efficient computationally. Author

N80-26622*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NOISE REDUCTION IN A MACH 5 WIND TUNNEL WITH A RECTANGULAR ROD-WALL SOUND SHIELD

Theodore R. Creel, Jr., J. Wayne Keyes, and Ivan E. Beckwith Jun. 1980 82 p refs

(NASA-TP-1672; L-13451) Avail: NTIS HC A05/MF A01 CSCL 20D

A rod wall sound shield was tested over a range of Reynolds numbers of 0.5 x 10 to the 7th power to 8.0 x 10 to the 7th power per meter. The model consisted of a rectangular array of longitudinal rods with boundary-layer suction through gaps between the rods. Suitable measurement techniques were used to determine properties of the flow and acoustic disturbance in the shield and transition in the rod boundary layers. Measurements indicated that for a Reynolds number of 1.5 x 10 to the 9th power the noise in the shielded region was significantly reduced, but only when the flow is mostly laminar on the rods. Actual nozzle input noise measured on the nozzle centerline before reflection at the shield walls was attenuated only slightly even when the rod boundary layer were laminar. At a lower Reynolds number, nozzle input noise at noise levels in the shield were still too high for application to a quiet tunnel. At Reynolds numbers above 2.0 x 10 the the 7th power per meter, measured noise levels were generally higher than nozzle input levels, probably due to transition in the rod boundary layers. The small attenuation of nozzle input noise at intermediate Reynolds numbers for laminar rod layers at the acoustic origins is apparently due to high frequencies of noise. Author

N80-26623# TRW Defense and Space Systems Group, Redondo Beach, Calif.

DEVELOPMENT STUDY OF A TWO-STAGE CONTINUOUS FLOW IMPACTOR Final Report

Nahum Gat Aberdeen Proving Ground, Md. ARRACOM Mar. 1980 89 p refs

(Contract DAAK11-78-C-0103)

(AD-A083387; AD-E410241; TRW-33437-6001-RU-00; ARCSL-CR-80009) Avail: NTIS HC A05/MF A01 CSCL 14/2

Two units of a Continuous Flow Impactor (CI) were designed, constructed and tested. The units have been calibrated using DOP droplets and their fractionation points are approximately 4 and 1 micrometers for the first and second units respectively. The principal design criteria established in previous studies have been verified, and reshaping the collection chambers has proven effective in improving performance. The steepness of the cross-over efficiency of the 1st unit is comparable to that of other commercially available impactors. The performance of the 2nd unit is not as good though; this is attributed to high particle loss in that unit. The two units have been operated in a cascade arrangement which separates an airborne (window) of a desired particle size range - between the fractionation points of the two stages - out of a polydispersed aerosol. The particle loss mechanisms are discussed and improvements are suggested to reduce the loss. Other potential applications of the CI such as in the separation of monodispersed aerosols, density measurement of spherical particles and shape factor determination are discussed as well. GRA

N80-26624# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.

AN INTEGRAL METHOD AND ITS APPLICATION TO SOME THREE-DIMENSIONAL BOUNDARY-LAYER FLOWS

T. F. Zien 18 Jul. 1979 68 p refs Sponsored by Navy (zr0140201)

(AD-A083447; NSWC/TR-79-139) Avail: NTIS HC A04/MF A01 CSCL 20/4

The simple integral method developed and successfully employed by the author to provide accurate approximate solutions to a wide variety of problems in viscous boundary-layer flows and transient heat conduction with phase changes is further studied. A simple boundary value problem in ordinary differential equation is used as the model problem for the study. Different schemes of the method used in earlier applications are examined in some detail along with a new and potentially more accurate scheme. On the basis of the comparison between the approximate solutions and the exact solution, some remarks on the relative merits of the various schemes are made along with some observations on the judicious choice of the approximate profiles for use in the calculation. The method is then applied to yield approximate solutions of a class of relatively simple three-dimensional boundary-layer flows. Results are reported of boundary layers on a semi-infinite flat plate with parabolic and circular inviscid surface streamlines, and boundary layers over an infinite yawed wing. Results are presented in terms of skin-friction, and are all obtained in simple closed form. Comparisons with existing exact solutions are included to indicate the accuracy of the method. GRA

N80-26625# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistic Research Lab.

NUMERICAL CALCULATION OF THREE-DIMENSIONAL DISPLACEMENT EFFECT ON BODIES OF REVOLUTION Final Report

Robert P. Reklis Feb. 1980 24 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A083296; AD-E430402; ARBRL-MR-02993) Avail: NTIS HC A02/MF A01 CSCL 20/4

Moore's differential equation for the three dimensional displacement thickness is solved numerically for bodies of revolution. Comparison is made to a known analytic solution for the special case of a cone in supersonic flow. Results are presented for spinning and non-spinning artillery projectile shapes. GRA

N80-26626# Los Alamos Scientific Lab., N. Mex.

NUMERICAL STUDY OF CONDENSATION IN CONCURRENT STRATIFIED FLOWS

B. J. Daly and F. H. Harlow Feb. 1980 28 p refs

(Contract W-7405-eng-36)

(NUREG-CR-1108; LA-8077) Avail: NTIS HC A03/MF A01

A mathematical model of mass, momentum, and energy exchange in two phase, separated flow is described, with application to the study of condensation processes in concurrent, horizontally stratified, steam water flow. Steady state numerical solutions are obtained for a variety of steam and water inflow conditions and are compared with experimental measurements. Analysis of these results provides insight regarding the interrelationship of the various processes that influence condensation. DOE

N80-26627# Science Applications, Inc., La Jolla, Calif.

STATE-OF-THE-ART ASSESSMENT OF HYBRID HEAT PUMPS Final Report

M. H. Blatt and R. C. Erickson Dec. 1979 171 p refs

(EPRI Proj. 1201-6)

(EPRI-EM-1261) Avail: NTIS HC A08/MF A01

The hybrid heat pump is evaluated and is compared with other heating, ventilating, and air conditioning (HVAC) system options. A hybrid heat pump is an HVAC system which includes an electrically driven heat pump and supplementally fired gas or oil boiler. This system was compared with heat pumps, oil-fired boilers, and gas-fired boilers. DOE

N80-26628# Argonne National Lab., Ill. Chemistry Div.

REVERSE ABSORPTION MODE OF THE HYCSOS CHEMICAL HEAT PUMP WITH LOW GRADE (APPROXIMATELY 30 DEG C) THERMAL ENERGY INPUTS

D. M. Gruen, M. Mendelsohn, I. Sheft, and G. Lamich 1980 23 p refs Presented at the Workshop on Thermochem. Energy Storage, Stockholm, 7-9 Jan. 1980; sponsored by the Swedish Royal Academy of Engineering Sciences

(Contract W-7405-eng-38)

(CONF-800133-1) Avail: NTIS HC A02/MF A01

An efficient and cost competitive chemical heat pump and energy conversion system driven by solar, and by fossil fuels (gas or oil), are discussed. The HYCOS concept uses two different

metal hydrides with different free energies of formation enabling hydrogen to flow from one to another of the hydrides under the influence of appropriate thermal gradients. In the chemical heat pump mode, hydrogen flows between two pairs of four vessels which take the place of the generator condenser and evaporator absorber elements of conventional absorption refrigerators. The functions of generator absorber and condenser evaporator are interchanged at the end of each two minute cycle. The chemical heat pump materials are based on the AB5 alloys which combine a remarkable ability to absorp hydrogen rapidly and reversibly at moderate pressures near ambient temperature with a large hydrogen storage capacity. DOE

N80-26629# Oregon State Univ., Corvallis. School of Oceanography.

MESOSCALE STUDIES OF FLOW REGIMES AND FLUXES OF PARTICULATE MATTER IN COASTAL WATERS Annual Progress Report, 1 Apr. 1979 - 31 Mar. 1980

David M. Nelson, Hasong Pak, Lawrence F. Small, and J. Ronald V. Zaneveld Mar. 1980 44 p refs

(Contract EY-76-S-06-2227)

(RLO-2227/T29-10) Avail: NTIS HC A03/MF A01

Suspended particle distributions and dynamics provide a tremendous collective surface area for adsorption and absorption of materials directly or indirectly involved with the production and distribution of energy reserves. The following subject areas are included: (1) seasonal effects on the distributions and movements of suspended particulate matter (spm) in a near coast region of smooth bathymetry; (2) summer effects on the distribution and movement of spm in a submarine canyon; (3) development of a numerical model of time space distribution of spm in a near coast region of smooth bathymetry; (4) fractionation of spm into organic and inorganic fractions; (5) identification of sources, sinks, and fluxes of different compartments of the spm; and (6) development of in situ instrument packages. DOE

N80-26630# Admiralty Underwater Weapons Establishment, Portland (England).

A MATHEMATICAL MODEL OF WATER ENTRY

A. M. Mackey London HMSO Oct. 1979 51 p refs

(AUWE-TN-636/79) Avail: NTIS HC A04/MF A01

A computer simulation of the water entry of an axisymmetric body with or without a cruciform tail and with or without a parachute delivery system is described. The predictions of the simulation are shown to agree with experimental observations of water entry motion. The FORTRAN program which implements this model is listed. Over the range of impact velocities (20 to 40 m/sec) which were experimentally investigated using a full scale dummy torpedo, the simulation gave reasonable agreement with the measured water entry behavior. Author (ESA)

N80-26631# National Engineering Lab., East Kilbride (Scotland). Flow Measurement Div.

FLOW MEASUREMENT IN SWIRLING OR ASYMMETRIC FLOW

F. C. Kinghorn May 1979 27 p refs Presented at The Appl. of Flow Measuring Tech. Symp., Brighton, England, Apr. 1977

(NEL-663) Avail: NTIS HC A03/MF A01

Information on the use of pressure difference flowmeters and traverse methods in poor flow conditions are summarized and alternative approaches to being able to achieve accuracies of the order of two or three percent under such conditions are described. Particular attention is given to the use of flow straighteners of various types. The effects of a few particular bends on orifice plates are defined. Author (ESA)

N80-26632# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.

INVESTIGATION OF TRANSONIC STEAM TURBINE TIP SECTIONS WITH VARIOUS SUCTION SIDE BLADE CURVATURES

C. C. H. Sieverding, R. Decuypere (Ecole Roy. Mil.), and P. Hautot Dec. 1978 35 p refs Presented at Inst. of Mech. Engr. Design Conf. on Steam Turbines for the 1980's, London, Oct. 1979 Submitted for publication

(VKI-Preprint-1979-2) Avail: NTIS HC A03/MF A01

Theoretical and experimental results from studies of three transonic steam turbine rotor tip sections are presented. The aim is to evaluate the effect of various suction side curvatures on the blade performance at both design and off-design conditions. The experiments were conducted in a high speed cascade tunnel in the outlet Mach number range 0.8 to 1.7 with air as the working medium. The experiments included flow visualization tests using Schlieran photographs, detailed blade pressure distribution measurements, and blade performance measurements. The experimental blade velocity distributions and the outlet flow angles are compared with theoretical predictions obtained with a time marching method. Results confirm the usefulness of this time dependent finite area method in predicting performance of transonic blades. It is shown that any improvement of the design point performance by careful shaping of the suction side results in considerable reduction of the operating range. Author (ESA)

N80-26633# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

A NUMERICAL ESTIMATION OF THE ERROR ON THE INDUCED VELOCITY DUE TO A DISCRETE APPROXIMATION OF A TWO-DIMENSIONAL VORTEX SHEET

A. Turi Jun. 1979 28 p refs

(VKI-TN-131) Avail: NTIS HC A03/MF A01

A two dimensional infinite vortex sheet of the Prandtl type is considered, having along its finite width the same vorticity distribution as from the trailing edge of a symmetrically loaded wing. Four types of discretization are analyzed reproducing the vortex sheet by making use of singularities. The first and second models represent the sheet by discrete vortices, while a piecewise continuous vorticity distribution is posed by the other two models. The error analysis is based on the evaluation of the velocity induced by the discretized vorticity distribution at a certain number of points along a segment of vorticity identified with a normal section of the sheet itself. The velocities induced by each model of discretization are then compared with the corresponding exact values given by an analytical formula. The error is computed as a function of the number of singularities, discrete or continuous, used by each to reproduce the actual vortex sheet.Author (ESA)

N80-26634# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Environmental and Applied Fluid Dynamics Dept.

COMPARISON OF SOME FINITE DIFFERENCE METHODS FOR THE PREDICTION OF HEAT TRANSFER PHENOMENA IN A POROUS, HEAT PRODUCING MEDIUM

C. Benocci and J-M. Buchlin Sep. 1979 46 p refs Prepared in cooperation with Centre d'Etude de l'Energie Nucleaire, Mol, Belguim

(VKI-TN-133) Avail: NTIS HC A03/MF A01

The testing of some advanced finite difference techniques for the prediction of natural convection in a porous, heat producing medium saturated by a liquid layer is discussed. This requires the solutions be of a set of nonlinear partial differential equations. Various step splitting methods are applied. Essentially, these are the 'alternate direction explicit and the alternate direction implicit methods. results are compared and discussed. It is shown that the explicit method is too slow for practical application, while alternate direction implicit techniques offer acceptable results. Thus, heat transfer phenomenology in packed beds is amenable to successful numerical study with reasonale machine times. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-26635* National Aeronautics and Space Administration. Pasadena Office, Calif.

COOLED ECHELLE GRATING SPECTROMETER Patent

Reinhard Beer, inventor (to NASA) (JPL) Issued 27 May 1980 6 p Continuation of abandoned US Patent Appl. SN-646333, filed 2 Jan. 1976 Sponsored by NASA
(NASA-Case-NPO-14372-1; US-Patent-4,205,229; US-Patent-Appl-SN-956529; US-Patent-Class-250-352; US-Patent-Class-250-338; US-Patent-Class-250-353; US-Patent-Class-356-328; US-Patent-Appl-SN-646333) Avail: US Patent and Trademark Office CSCL 14B

A cooled echelle grating spectrometer for detecting wavelengths between one micron and fifteen microns is disclosed. More specifically, the spectrometer has a cross-dispersing grating for ordering infrared energy and an echelle grating for further ordering of the infrared energy. Ordered radiation from the echelle grating is sensed by a detecting means. Also disclosed is use of a Schmidt camera for focusing the further ordered radiation from the echelle grating onto a detector array having individual detectors dispersed on a plane which substantially corresponds to a curved focal plane of the Schmidt camera. A spectrometer constructed according to the teachings of the present invention will continuously cover the spectrum between one micron and fifteen microns and have a resolution of 0.1/cm.

Official Gazette of the U.S. Patent and Trademark Office

N80-26636 Naval Aircraft Materials Lab., Fleetlands (England).
EVALUATION OF THE USE OF MONO-SIZE SPHERES FOR CALIBRATING AUTOMATIC PARTICLE COUNTERS
C. C. Bird, D. J. Byng, and D. Maundrell 3 Jan. 1978 17 p refs
(BR60651) Avail: Issuing Activity

A method for calibrating sensor heads of automatic particle counters (APCs) was evaluated. The technique relies on the use of mono-sized spheres suspended in a liquid medium. The evaluation shows that the method can be readily applied to APCs utilizing the light blockage principle and suggests certain advantages of the technique over existing methods. The use of mono-sized spheres is recommended as a suitable alternative to present calibration techniques. Author (ESA)

N80-26637*# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOFT X-RAY POLYCHROMATOR FOR THE SOLAR MAXIMUM MISSION Final Report
C. W. Gilbreth, C. W. Acton, and C. J. Wolfson Apr. 1980 37 p refs
(Contract NAS5-23758)
(NASA-CR-159994) Avail: NTIS HC A03/MF A01 CSCL 14B

The design, fabrication, development tests, integration, and acceptance tests of the X-ray polychromator are reported. Spacecraft integration and test support, orbital operations preparations, and launch and post launch operations support tasks are discussed. B.D.

N80-26638*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
A 94/183 GHz AIRCRAFT RADIOMETER SYSTEM FOR PROJECT STORM FURY Final Technical Report, 20 Sep. 1976 - 30 Apr. 1980
J. A. Gagliano, J. A. Stratigos, R. E. Forsythe, J. M. Schuchardt, J. M. Welch, and D. O. Gallentine Apr. 1980 96 p
(Contract NAS5-23710)
(NASA-CR-160000) Avail: NTIS HC A05/MF A01 CSCL 14B

A radiometer design suitable for use in NASA's WB-57F aircraft to collect data from severe storm regions was developed. The design recommended was a 94/183 GHz scanning radiometer with 3 IF channels on either side of the 183.3 GHz water vapor line and a single IF channel for a low loss atmospheric window channel at 94 GHz. The development and construction of the 94/183 GHz scanning radiometer known as the Advanced Microwave Moisture Sounder (AMMS) is presented. The radiometer scans the scene below the aircraft over an angle of + or - 45 degrees with the beamwidth of the scene viewed of approximately 2 degrees at 94 GHz and 1 degree at 183 GHz. The AMMS data collection system consists of a microcomputer used to store the radiometer data on the flight cartridge recorder, operate the stepper motor driven scanner, and collect housekeeping data such as thermistor temperature readings and aircraft time code. B.D.

N80-26639*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PRELIMINARY DESIGN OF THE CRYOGENIC COOLED LIMB SCANNING INTERFEROMETER RADIOMETER (CLIR), PHASE 2 Final Report
20 Jan. 1978 45 p
(Contract NAS5-25320)
(NASA-CR-159992; LMSC-D633472) Avail: NTIS HC A03/MF A01 CSCL 14B

A cryogenic system to be utilized with a mounted pointing system is designed. The analysis indicates that the resulting design is significantly heavier than previous design due to the increased diameter of the system, resulting in greater tank and vacuum enclosure weights. Additional weight is also required in the area where the payload is attached to the pointing system in order to provide additional stiffness to the payload. The vacuum shell required to enclose the instrument is shorter and therefore an attendant reduction in instrument package weight would be expected. The primary resonance of the cooler instrument package occurs at 21 Hz, a mode in which the flexibility of the vacuum shell allows motion of the cryogen tank and instrument, and which can be increased by additional stiffening in the region of the pointing system vacuum shell connection at the cost of additional weight. The second resonance at 59 Hz is due to vibration of the helium tank on the fiberglass support tubes. The parasitic heat load can be reduced to 0.28 W by the utilization of a sandwich support tube structure in place of the monocoque structure assumed in the design. E.D.K.

N80-26640# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
AN OSCILLATORY MASS FLOWMETER FOR GAS-LIQUID FLOWS
L. M. Druzhkova, V. G. Bulygin, V. E. Egorov, V. S. Nesterenko, and A. L. Lavrov-Averin 1980 9 p refs Transl. into ENGLISH from Pribory i sistemy upravleniya (USSR), no. 11, 1972 p 22-24
(NRC/CNR-TT-1967; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

An oscillatory flowmeter (BMP-1) designed to measure the mass flow of gas liquid mixtures without the prior separation of the liquid was developed. The flowmeter consists of a BMP-1 sensing device and a decremeter. The sensing device includes a mechanical pendulum, an output sensor, and a driver unit. The electromagnets of the driver unit receive cyclic signals, when transmitting stops the pendulum freely oscillates in a transverse direction. The fluid whose flow rate is to be measured flows through the central passage of the pendulum, so as to dampen the pendulum oscillations. The coefficient of attenuation of the pendulum oscillations is proportional to the fluid mass flow G which is to be metered. A numerical evaluation of the effect of the structural dimensions of the sensing unit on its output performance is conducted. E.D.K.

N80-26641*# Harris Corp., Melbourne, Fla.
OPTICAL MASS MEMORY INVESTIGATION Final Report
2 May 1980 123 p
(Contract NAS8-30564)
(NASA-CR-161489) Avail: NTIS HC A06/MF A01 CSCL 14B

The MASTER 1 optical mass storage system advanced working model (AWM) was designed to demonstrate recording and playback of imagery data and to enable quantitative data to be derived as to the statistical distribution of raw errors experienced through the system. The AWM consists of two subsystems, the recorder and storage and retrieval. The recorder subsystem utilizes key technologies such as an acoustic travelling wave lens to achieve recording of digital data on fiche at a rate of 30 Mbits/sec, whereas the storage and retrieval reproducer subsystem utilizes a less complex optical system that employs an acousto-optical beam deflector to achieve data readout at a 5 Mbits/sec rate. The system has the built in capability for detecting and collecting error statistics. The recorder and storage and retrieval subsystems operate independent of one another and are each constructed in modular form with each module

performing independent functions. The operation of each module and its interface to other modules is controlled by one controller for both subsystems. E.D.K.

N80-26642*# National Aeronautics and Space Administration, Washington, D. C.
DEVELOPMENT OF A FEED MONITOR SYSTEM FOR A HELIUM-COOLED MICHELSON INTEREROMETER FOR THE SPACELAB
P. Essenwanger Jun. 1980 75 p Transl. into ENGLISH of 'Entwicklung eines Vorschubmessystems fuer ein Helium-Gekuehltes Michelsoninferometer auf spacelab', Rept. MPI-PAE/Extraterr.-161, Max-Planck Inst. fuer Phys. und Astrophys., Inst. for Extraterrestrial Physics., Munich, Jan. 1980 p 1-85 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76275; MPI-PAE/Extraterr-161) Avail: NTIS HC A04/MF A01 CSCL 14B

A Michelson interferometer feed monitor system developed for Spacelab is described. The device is helium cooled and is to be used to measure far infrared radiation sources in space. Performance data and development sequence are presented. Author

N80-26643# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN ELECTROPHORETIC IMAGE DISPLAY Quarterly Technical Report, 1 Aug. - 31 Oct. 1979
Richard Liebert and Joseph Lalak Nov. 1979 17 p ref
(Contracts MDA903-79-C-0439; DARPA Order 3802)
(AD-A083489; QTR-1) Avail: NTIS HC A02/MF A01 CSCL 14/2

The purpose of this work is to develop a 350 x 600 element X-Y addressed electrophoretic image display (EPID). The design and fabrication of a control-grid electrode supported by a Mylar dielectric has been investigated. Computer modeling is being used as a design aid, and ion-beam milling has been successfully used to fabricate the Mylar control-grid electrode. The Mylar dielectric is attached to the In2O3 coated substrate using heat and pressure alone or in combination with an epoxy adhesion promoter. Good seals, with occasional nonbonded areas, were obtained by heating the Mylar while applying pressure. Better seals were obtained when one side of the Mylar was coated with epoxy. Operating life-test results indicate no adverse interactions between the electrophoretic suspension and the Mylar/epoxy seal. Computer modeling of the electrostatic potential in the device is in progress. GRA

N80-26644# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN ELECTROPHORETIC IMAGE DISPLAY Quarterly Technical Report, 1 Nov. 1979 - 31 Jan. 1980
Richard Liebert and Joseph Lalak Mar. 1980 25 p refs
(Contracts MDA903-79-c-0439; DARPA Order 3802)
(AD-A083490) Avail: NTIS HC A02/MF A01 CSCL 14/2

The size of the ion-beam milled control-grid structure was increased to 2.0 in. x 2.6 in. (from 0.75 in. x 0.75 in.); the diameter of the uniform area is 2.7 in. Fabrication techniques for this larger size are being developed. The design of a working display is nearly complete. Using the results of the computer model, the dimensions of the display were chosen. The potential wells will be 30 micrometers x 102 micrometers with 6 micrometers wide walls. The maximum separation between electrodes will be 62 micrometers, and the wells with be 12 micrometers deep. The display will have 16 rows of 32 characters in a 5 x 7 dot matrix font with a resolution of 2 1p/mm. The active area will be 2.22 in. x 1.43. in and contain 32,224 pixels. It was decided to use In2O3 as the material for the grid electrode instead of aluminum; deposition of the In2O3 will begin as soon as the sputtering system is modified. GRA

N80-26645# Los Alamos Scientific Lab., N. Mex.
APPLICATIONS OF DIGITAL IMAGE RESTORATION TO PHOTOGRAPHIC EVIDENCE
H. J. Trussell and T. M. Cannon 1980 6 p refs Presented at the Conf. on Crime Countermeas., Lexington, Ky., 14-16 May 1980
(Contract W-7405-eng-36)
(LA-UR-80-399; CONF-800512-1) Avail: NTIS HC A02/MF A01

A review of the cepstral method of blur determination for motion blur and out-of-focus lens is given. A review of the maximum a posteriori restoration method is given. The reasons why this method produces few artifacts are discussed. Results of the complete image restoration process are given. DOE

N80-26646# Sandia Labs., Albuquerque, N. Mex. Exploratory Chemistry Div.
AUTOMATION OF A REPETITIVE EXPERIMENT APPLIED TO A THERMOGRAVIMETRIC ANALYZER
Keith Burris Mar. 1980 15 p
(Contract EY-76-C-04-0789)
(SAND-80-8010) Avail: NTIS HC A02/MF A01

In order to automate the recording of data from a thermogravimetric analyzer, a controller was designed to fetch instrument readings at specified time intervals and send the data to a teletype/paper tape punch. Additional goals were to minimize cost, hardware design time, software development time, and debugging time. Project details which can be applied to a general class of repetitive experiments that are common in a laboratory environment are described. DOE

N80-26647# National Physical Lab., Teddington (England). Dept. of Electrical Science.
A LARGE APERTURE CALORIMETER FOR FUSION LASER MEASUREMENTS
J. G. Edwards and P. A. Smith Sep. 1979 13 p refs
(NPL-DES-57) Avail: NTIS HC A02/MF A01

A large aperture calorimeter intended for laser fusion measurements on beams up to 20 cm diameter was constructed. The laser beam is absorbed in a glass disc backed by a disc carrying a resistance wire. It performs with a noise equivalent energy of 20 mJ and a maximum energy of about 100 J, but difficulties encountered in construction caused a 17% variation of sensitivity across the aperture. Author (ESA)

N80-26648# National Physical Lab., Teddington (England). Div. of Electrical Science.
COIL-MEASURING MACHINE
P. Vigoureux Dec. 1979 24 p refs
(NPL-DES-58) Avail: NTIS HC A02/MF A01

A machine was constructed to measure the diameters and axial positions of the turns of single layer coils used for realizing or monitoring electric units. The diameters are referred to a length standard previously measured in terms of the meter, but the axial positions are measured directly by an interferometer forming part of the machine. All results are punched on tape, and the desired property of the coil is solved by computer. Author (ESA)

N80-26649# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
DEVELOPMENT AND CALIBRATION OF A TOTAL TEMPERATURE PROBE FOR THE IMPERIAL COLLEGE AERONAUTICS DEPARTMENT GUN TUNNEL
R. P. Bartlett, A. J. Edwards, and R. Hillier Jun. 1979 32 p refs
(Contract AT/2037/084)
(IC-Aero-79-02) Avail: NTIS HC A03/MF A01

Development of a vented-shield thermocouple probe for total temperature measurements in a hypersonic turbulent boundary layer concentrated on maximizing both the transient response rates and the steady state recovery factor (which eventually reached about 98% at the highest test Reynolds numbers) is described. This performance was achieved by maximizing the unit Reynolds number within the shield and hence the convective heating of the sensor; and by improving the sensor aspect ratio parameters which control the conduction losses. The probe was operated with an unheated shield. It is argued that shielding a probe affords aerodynamic and response advantages compared with its unshielded counterpart. Performance deteriorates with reduction in Reynolds number and hence with immersion in the boundary layer. The critical limit in a short duration facility must always be failure to reach a steady state. Probes were calibrated against Reynolds number for the required range but at fixed total temperature. It is expected

that the worst error in steady state temperature for a given probe would be of order 40 K with a considerable improvement in overall accuracy for profile data averaged from several probes. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-26650# Mississippi Univ., University. Dept. of Mechanical Engineering.
AN INVESTIGATION OF TURBULENT MIXING IN THE CHEMICAL LASER USING HOLOGRAPHIC IMAGERY Final Report, 1 Dec. 1975 - 30 Nov. 1979
C. R. Wimberly 31 Dec. 1979 92 p refs
(Grant DAAG29-76-G-0044; DA Proj. 1T1-61102-BH-57)
(AD-A083047; ARO-13224.1-E) Avail: NTIS HC A05/MF A01 CSCL 20/5

An investigation was conducted to determine the mixing characteristics in chemical laser systems using a holographic flow field diagnostic network. Cold flow simulation was done using a variety of nozzles in an effort to uncover the effects of geometry, flow conditions and gas mixture combinations on the mixing of high speed parallel jets. GRA

N80-26651# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
RESEARCH IN LASER PROCESSES Semiannual Report, 1 Feb. - 31 Jul. 1979
A. V. Phelps and A. C. Gallagher 15 Apr. 1980 50 p refs
(Contract N00014-76-C-0123; ARPA Order 2683)
(AD-A083427) Avail: NTIS HC A03/MF A01 CSCL 20/5

A model has been completed of the NaXe discharges examined experimentally under this contract. This model includes the effects of electron excitation, deexcitation and ionization of excited Na atoms, as well as electron loss processes such as dissociative recombination with Na2(-). By adopting apparently reasonable rate coefficients and reaction end products we are able to satisfactorily reproduce the measured steady-state densities of excited Na atoms. However, a serious and unexplained discrepancy is found in the energy balance for these discharges. By extrapolating these results to high Na densities we find what appears to be a region of sufficient optical gain at 700 nm for laser oscillation. Such a laser would require a short excitation pulse (approx. 100 ns) and would have a low discharge impedance. A new technique has been developed for the measurement of electron excitation rate coefficients for the metastable states of the rare gases. A multipass absorption cell and a single mode dye laser allow measurement of metastable densities as low as 1,000,000 atom/cc. GRA

N80-26652# Lockheed Missiles and Space Co., Huntsville, Ala. Huntsville Research and Engineering Center.
PLASMA CHEMISTRY PROCESSES IN THE CLOSED CYCLE EDL Final Report, 5 Jul. 1978 - 5 Jul. 1979
Juergen Thoenes and Shelby C. Kurzius Jul. 1979 161 p refs 2 Vol.
(Contract DAAH40-78-C-0196)
(AD-A083222; LMSC-HREC-TR-D568999; DRCPM-HEL-CR-79-11-Vol-1) Avail: NTIS HC A01/MF A01 CSCL 20/5

Theoretical modeling of plasma chemistry effects on the performance of closed cycle, pulsed, electron beam sustained electric discharge lasers is described. The one dimensional model considers the mutual interaction of the electron beam, the discharge, the plasma and laser radiation. The most important processes are modeled in terms of experimentally controllable parameters which include the post-foil electron beam current density, primary electron energy, applied electric potential, electrode spacing, initial gas composition, temperature and pressure, electron beam and discharge pulse width, and laser cavity characteristics. Results obtained for several laser gas mixtures are described and compared with experimental data. A detailed analysis has been made of test cases for closed cycle devices under development, including the effect on performance of variations in the electric field, the electron beam current, and the gas mixture composition. Electrophilic plasma by-products have been identified, and recommendations have been developed for experimental efforts to verify the predictions. GRA

N80-26653# Lockheed Missiles and Space Co., Huntsville, Ala. Huntsville Research and Engineering Center.
EDLAMP USERS MANUAL
Juergen Thoenes Jul. 1979 37 p refs Supersedes DRDMI-H-CR-77-VOL-2
(Contract DAAK40-78-C-0196)
(AD-A083223; LMSC-HREC-TR-D697555; DRCPM-HEL-CR-79-11-Vol-2; DRDMI-H-CR-77-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 20/5

A computer program is described which can be used to analyze plasma chemistry effects on the performance of pulsed, electron-beam sustained, electric discharge lasers operating either in the open cycle or closed cycle mode. GRA

N80-26654# United Technologies Corp., East Hartford, Conn.
NOVEL RESONATORS FOR HIGH POWER CHEMICAL LASERS Final Report
H. R. Garcia, G. E. Palma, A. W. Angelbeck, R. D. Quinnell, and J. B. Urquhart (Pratt and Whitney Government Products Div.) 1979 66 p
(Contract N00173-79-C-0410)
(AD-A083230) Avail: NTIS HC A04/MF A01 CSCL 20/5

For the equivalent compacted ring resonator, beam injection can help maintain bare resonator power coupling at the unperturbed value. For small misalignments, injection improves bare beam quality, but it does not improve quality degradation due to astigmatism. For the annular ring resonator, beam injection maintains both bare resonator power coupling and beam quality at the unperturbed values for very small misalignments. And, as expected, this resonator is much more sensitive to misalignment than its equivalent compacted resonator. Additionally, the reverse wave analysis has shown the unstable ring/linear stable MO injection configuration to offer satisfactory reverse wave suppression. Based on bare resonator analyses, injection locking shows promise. To determine its potential, loaded resonator analyses for high-power devices must be performed. Mode discrimination, possible parasitics, sensitivity to misalignment, and scale-ability to high power are potential problems that need in-depth investigation. Additionally, the technical issues associated with cavity length equalization to less than lambda; matching of the MO and HEL spectra; and the stability, mode matching and power requirements for the MO need to be addressed experimentally so the real hardware requirements can be established. GRA

N80-26655# Systems Science and Software, Hayward, Calif.
DEVELOPMENT OF SPARK CATHODE ELECTRON GUNS FOR THE CO2 LASER FUSION PROGRAM Final Report, Jul. 1978 - Dec. 1979
G. K. Loda and R. A. Lindstrand Jan. 1980 55 p
(Contract DE-AC08-78DP-40064)
(DOE/DP-40064/1) Avail: NTIS HC A04/MF A01

Spark cathodes are designed and constructed to replace the bladed cold cathode structure in the electron guns of the Los Alamos Scientific Laboratory, Antares, prototype power amplifier and driver amplifier. Design work is described and data from cathode testing is reported. The spark cathode offers precise control of emission site location, design flexibility, and high reliability. DOE

N80-26656# Sandia Labs., Albuquerque, N. Mex.
SIMULATIONS OF THE EFFECT OF APPLIED MAGNETIC FIELDS ON REB DIODES FOR LASER EXCITATION
J. P. Quintenz and M. T. Buttram Jan. 1980 25 p refs
(Contract EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-2138) Avail: NTIS HC A02/MF A01

A computer code is described which simulates the performance of diodes with sidewalls or applied magnetic fields. The effects of applying an external magnetic field on the electron flow pattern in the diodes are detailed. Implications for the design of such diodes to meet applications where the survival of the anode foil is critical are discussed. DOE

N80-26657# Royal Aircraft Establishment, Farnborough (England).
THE PROPAGATION OF FOCUSED TRUNCATED LASER

BEAMS IN THE ATMOSPHERE
A. G. Purcell London HMSO Jun. 1979 31 p refs
(RAE-TM-Math-Comp-7903; BR70928) Avail: NTIS HC A03/MF A01

A formula for the mean intensity distribution resulting from a focused laser beam in the presence of turbulence is confirmed and extended to include annular apertures. Segmented apertures are considered and some indication presented of the likely improvement in focal intensity when the segments are optimally adjusted to counteract turbulence. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-26658* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPOSITE SEAL FOR TURBOMACHINERY Patent
Robert C. Bill and Lawrence P. Ludwig, inventors (to NASA) Issued 10 Jun. 1980 4 p Filed 4 Aug. 1978 Supersedes N78-31103 (16 - 22, p 2897) Division of US Patent Appl. SN-801290, filed 27 May 1977, US Patent-4,135,851
(NASA-CASE-LEW-12131-2; US-Patent-4,207,024; US-Patent-Appl-SN-931090; US-Patent-Class-415-174; US-Patent-Class-415-196; US-Patent-Appl-SN-801290; US-Patent-4,135,851) Avail: US Patent and Trademark Office CSCL 11A

A gas path seal suitable for use with a turbine engine or compressor is provided. A shroud wearable or abradable by the abrasion of the rotor blades of the turbine or compressor shrouds the rotor blades. A compliant backing surrounds the shroud. The backing is a compliant material covered with a thin ductile layer. A mounting fixture surrounds the backing.
Official Gazette of the U.S. Patent and Trademark Office

N80-26659*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIESEL ENGINE CATALYTIC COMBUSTOR SYSTEM Patent Application
Lloyd W. Ream, inventor (to NASA) Filed 6 Jun. 1980 10 p
(NASA-Case-Lew-12995-1; US-Patent-Appl-SN-157150) Avail: NTIS HC A02/MF A01 CSCL 21A

A low compression turbocharged diesel engine is described in which the turbocharger can be operated independently of the engine to power auxiliary equipment. Fuel and air are burned in a catalytic combustor to drive the turbine wheel of the turbine section which is initially caused to rotate by the starter motor. By opening a flapper valve, compressed air from the blower section is directed to the catalytic combustor when it is heated and expanded, serving to drive the turbine wheel and also to heat the catalytic element. To start the engine, one valve is closed, combustion is terminated in the catalytic combustor, and another valve is then opened to utilize air from the blower for the air driven motor. When the engine starts, the constituents in its exhaust gas react in the catalytic element and the heat generated provides additional energy for the turbine section.
NASA

N80-26660*# National Aeronautics and Space Administration. Pasadena Office, Calif.
IMPROVED METHOD FOR DRIVING TWO-PHASE TURBINES WITH ENHANCED EFFICIENCY Patent Application
David G. Elliott, inventor (to NASA) (JPL) Filed 20 Jun. 1980 11 p
(Contract NAS7-100)
(NASA-Case-NPO-15037-1; US-Patent-Appl-SN-161257) Avail: NTIS HC A02/MF A01 CSCL 21A

A method is disclosed for driving a two-phase turbine characterized by an output shaft having at least one stage including a bladed rotor connected in driving relation with the shaft. A two-phase fluid is introduced into the stage at a known flow velocity and caused to pass through the rotor in order to impart angular velocity. The speed of the rotor is controlled so that the angular velocity of the blade tips is equal to at least 50% of the velocity of the flow of the two-phase fluid. NASA

N80-26661*# National Aeronautics and Space Administration. Pasadena Office, Calif.
AN IMPROVED HEAD FOR HIGH SPEED SPINNER HAVING A VACUUM CHUCK Patent Application
Frank Lombardi, inventor (to NASA) (JPL) Filed 27 Jun. 1980 12 p
(Contract NAS7-100)
(NASA-Case-NPO-15227-1; US-Patent-Appl-SN-163840) Avail: NTIS HC A02/MF A01 CSCL 13I

A head for a high-speed spinner is characterized by a cylindrical body adapted to be mounted at the distal end of a vertically oriented drive shaft. A vacuum chuck having an upwardly facing chamber is circumscribed by an annular surface for receiving a silicon chip. An ordered array of low-pressure cavities is defined about the periphery of the body and is connected with the chamber via radially extended bores for translating low pressures to the chamber as the head is angularly displaced. A pressure differential is thus established across the chip for securing it to the head.
NASA

N80-26662*# Rocketdyne, Canoga Park, Calif.
SMALL, HIGH PRESSURE LIQUID HYDROGEN TURBOPUMP Final Report, 7 Jun. 1977 - 26 Oct. 1979
A. Csomor and D. J. Warren 23 May 1980 234 p refs
(Contract NAS3-21008)
(NASA-CR-159821; RI/RD79-322) Avail: NTIS HC A11/MF A01 CSCL 13K

A high pressure, low capacity, liquid hydrogen turbopump was designed, fabricated, and tested. The design configuration of the turbopump is summarized and the results of the analytical and test efforts are presented. Approaches used to pin point the cause of poor suction performance with the original design are described and performance data are included with an axial inlet design which results in excellent suction capability. E.D.K.

N80-26663*# National Aeronautics and Space Administration, Washington, D. C.
STUDIES ON QUESTIONS OF DESIGN AND CONSTRUCTION OF CHAIN SCRAPER CONVEYORS
Hubert Guder Mar. 1980 35 p refs Transl. into ENGLISH of Glueckauf-Forschungshefte, (West Germany) v. 30, no. 3, Jun. 1969 p 103-116 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75810) Avail: NTIS HC A03/MF A01 CSCL 13I

The basic behavior of mining crushed goods in chain scraper conveyors was examined using a special test stand. The characteristics resistance lines of the upper end-piece were determined for conveyor idle as a function of the determinative crushed good characteristics (granular structure, moisture content, type of goods) on the size of the conveyor load, on the conveyor construction and on the stopped time of the conveyor. Crushed goods with a narrow granular profile and sphere-like grains caused about 35% greater resistance than fine coal and raw coal with broad granular profile. For goods containing water more than 10% by weight, the solids friction retreated in favor of flow friction. The coefficient of resistance decreased considerably in the range of lower speeds and then increased with increasing conveyor speed. The conveyance of sandstone ore required about 280% greater specific drive than the conveyance of raw coal. Resistance coefficients for coal and raw coal showed no dependence on the design of the conveyor. Start-up of loaded conveyors after longer stop times was simulated and the specific break-loose force was determined. A.R.H.

N80-26664*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
INVESTIGATIONS INTO THE MECHANICAL BEHAVIOR OF COMPOSITE BOLTED JOINTS
J. C. Perry (Old Dominion Univ. Research Foundation) and M. W. Hyer Jun. 1979 63 p refs
(Grant NsG-1167)
(NASA-CR-163295; VPI-E-79-22) Avail: NTIS HC A04/MF A01 CSCL 13I

Testing procedures and data reduction and interpretation techniques were established for a program to study the mechanical behavior of bolted joints at room temperature, -157 C (-250 F), and 315 C (600 F). The load transfer characteristics, from one

bolt to another, in double-bolt joints were investigated by examining data generated in previous investigations. From the results, it appears the increase in load-carrying capacity by adding a second bolt in tandem can be predicted. A.R.H.

N80-26665*# Connecticut Univ., Storrs. Dept. of Mechanical Engineering.
TURBINE ENDWALL TWO-CYLINDER PROGRAM Semiannual Report, 1 Jan. - 1 Jul. 1980
Lee S. Langston 1 Jul. 1980 49 p ref
(Grant NsG-3238)
(NASA-CR-163026; SASR-3) Avail: NTIS HC A03/MF A01 CSCL 21A

Progress is reported in an effort to study the three dimensional separation of fluid flow around two isolated cylinders mounted on an endwall. The design and performance of a hydrogen bubble generator for water tunnel tests to determine bulk flow properties and to measure main stream velocity and boundary layer thickness are described. Although the water tunnel tests are behind schedule because of inlet distortion problems, tests are far enough along to indicate cylinder spacing, wall effects and low Reynolds number behavior, all of which impacted wind tunnel model design. The construction, assembly, and operation of the wind tunnel and the check out of its characteristics are described. An off-body potential flow program was adapted to calculate normal streams streamwise pressure gradients at the saddle point locations. A.R.H.

N80-26666# Orshansky Transmission Corp., San Diego, Calif.
DESIGN AND DEVELOPMENT OF A CONTINUOUSLY VARIABLE RATIO TRANSMISSION FOR AN AUTOMOTIVE VEHICLE, PHASE 4 Quarterly Progress Report
31 May 1978 87 p
(Contract EY-76-C-03-1165)
(SAN-1165-T2) Avail: NTIS HC A05/MF A01

Progress in the design and development of a continuously variable ratio transmission for an automotive vehicle is reported. The major automotive hydromechanical transmission development problem continues to be the reduction of hydrostatic noise and the project plan, therefore, concentrated on the new hydrostatic module. The potential for achieving acceptably low noise levels in the second generation hydromechanical transmission was assessed by comparing the noise levels of the hydrostatic modules for the first and second generation transmissions. A set of twelve test points was selected, comprising of road load, steady state, and wide-open-throttle acceleration at 10, 20, 30, 40, 50, and 60 mph. The module operating conditions for the two transmissions at each of these twelve points were calculated. Baseline noise data was measured on the first generation module. The results are given; testing of co-axial hydrostatic module for second generation hydromechanical transmission will be emphasized. DOE

N80-26667# Babcock and Wilcox Co., Alliance, Ohio. Research and Development Div.
DEVELOPMENT OF AUTOMATED WELDING PROCESSES FOR FIELD FABRICATION OF THICKWALLED PRESSURE VESSELS: ELECTRON BEAM METHOD Quarterly Report, 1 Jul. - 30 Sep. 1979
Charles M. Weber 1979 29 p
(Contract EF-77-C-01-2606)
(FE-2606-8; QR-8) Avail: NTIS HC A03/MF A01

An electron beam welding procedure for welding 8 inch thick SA 387 Grade 22 Class (2-1/4 Cr-1 Mo) steel is described. A total of 469 experimental welds were made to date. Efforts to develop welding procedures which produce defect-free welds were successfully completed. Techniques for acceptably starting and stopping electron beam welds were developed. Work on developing an EB repair technique is in progress. It was learned that re-welding of holes, without metal additions, is unacceptable. Work to define the joint fit-up requirements is nearly complete. A considerable amount of joint mismatch can be readily welded and a joint gap opening in excess of 0.100 inch can be welded without alteration of the welding procedure. Another large test plate was welded using equipment with a modified drive. The weld was unacceptable due to porosity. It appears that poor base metal quality is adversely affecting weld quality. Specimens for testing the as-welded mechanical properties have been machined and are being tested. DOE

N80-26668# Kloeckner-Humboldt-Deutz A.G., Cologne (West Germany).
LOW EMISSION VEHICLE ENGINE BASED ON THE AD PROCESS Final Report
H. Kuepper Jun. 1979 141 p refs
(DOE-TR-212) Avail: NTIS HC A07/MF A01

An existing multifuel system, derived from a diesel engine (AD system KHD) was designed for running on gasoline only. The advantages of the diesel engine (low specific fuel consumption and low gaseous emissions) are combined with those of the Otto engine (high specific power, no soot). The system selected for the transfer to the multicylinder engine is characterized by late mixing of fuel and air near the wall of the piston bowl. It is suitable for supercharging and its fuel consumption is typical for diesel engines. Moreover, the system has low black smoke levels and is largely insensitive to the octane and cetane numbers of the fuel. The relatively high HC and CO emissions of the system were reduced by the installation of a precious metal catalyst. The multicylinder engine BF 6 L 510 adapted with the Deutz-stratified charge system was installed in a Magirus-Deutz R 81 bus with which test bed and roller dynamometer trials were carried out. DOE

N80-26669# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
HIGH-TEMPERATURE TURBINE TECHNOLOGY PROGRAM LOW-Btu GAS, LOW-TEMPERATURE CHEMICAL CLEANUP PILOT PLANT: DESIGN, CONSTRUCTION, STARTUP, AND OPERATION
M. W. Horner, A. Caruvana, G. A. Cincotta, J. C. Corman, K. L. House, S. G. Kimura, R. G. Lavigne, C. C. Lawson, C. K. Neulander, H. K. Ruhl et al Feb. 1980 89 p refs
(Contract EX-76-C-01-1806)
(FE-1806-78) Avail: NTIS HC A05/MF A01

The completion of the low Btu gas, low temperature cleanup system pilot plant represents a major step toward a complete integrated coal gasification pilot plant which simulates the full-scale commercial Coal Gasification Combined Cycle Plant. Several important programmatic and technical milestones in the program were attained during the design, construction, and startup of the pilot scale chemical cleanup system. The ability to operate the system in a 30 hr fired test after only three short attempts at fired operation, attests to the excellence of the plant design, preparation, and operation personnel. The performance of the Benfield system met or exceeded expectations based on sulfur and carbon dioxide removal. The reheat and saturation equipment performed well and controllably. No evidence of foaming or mist carry over to the process gas stream was observed, and the particulate and alkali loading of the clean process gas was well within design limitations. DOE

N80-26670# Argonne National Lab., Ill.
CLASSIFICATION AND EVALUATION OF ELECTRIC MOTORS AND PUMPS
Feb. 1980 251 p refs
(Contract W 31-109-eng-38)
(DOE/CS-0147) Avail: NTIS HC A12/MF A01

Classification and evaluation of electric motors and pumps are discussed. The industrial, transportation, commercial, agricultural, and municipal sectors of the US economy are studied. The range of electric motors included all ac and dc integral and fractional hp units equalling or exceeding 1/6 hp. However, units of less than 1/6 hp and those in use in other than the previously defined sectors were treated to ensure completeness. Pump equipment covered included the wide range of fluid handling equipment powered by all energy forms. The range of sizes analyzed correlated with those for motors, roughly 1/6 to 20,000 shaft hp. An analysis task called for developing scenarios for the policy options based on labeling and standards, evaluating barriers to their implementation, and then evaluating probable results. DOE

N80-26671# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH-TEMPERATURE TURBINE

SYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS PHASE 2 Quarterly Report, Oct. - Dec. 1979
1979 129 p ref
(Contract EX 76-C-01-1806)
(FE-1806-76) Avail: NTIS HC A07/MF A01

The development of a high temperature gas turbine for use in a combined cycle power plant, with coal-derived fuel, at a firing temperature of 2600 F and with growth capability to 3000 F is discussed. Component design and technology testing and system design and trade-off analyses are described including hot gas path development tests, turbine simulator tests, low temperature-low Btu gas cleanup system, and aerodynamic evaluations. DOE

N80-26672# General Atomic Co., San Diego, Calif. HTGR Systems Dynamics Branch.
DYNAMICS AND CONTROL MODELING OF THE CLOSED-CYCLE GAS TURBINE (GT-HTGR) POWER PLANT
Alexander Bardia Feb. 1980 30 p refs Presented at 4th Power Plant Dyn., Control and Testing Symp., Gatlinburg, Tenn., 17-19 Mar. 1980 Submitted for publication
(Contract DE-AT03-76SF-70046)
(GA-A-15677; CONF-800332-1) Avail: NTIS HC A03/MF A01

A 800 MW(e) two-loop gas turbine high temperature gas cooled reactor (GT-HTGR) plant design is simulated with a transient analysis computer code, and the modeling of control strategies called for by the inherently unique operational requirements of a multiple loop GT-HTGR is described. Plant control of the GT-HTGR is constrained by the nature of its power conversion loops in which the core cooling flow and the turbine flow are directly related and thus changes in flow affect core cooling as well as turbine power. Additionally, the high thermal inertia of the reactor core precludes rapid changes in the temperature of the turbine inlet flow. DOE

N80-26673# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
EFFECT OF THE WATER CONTENT OF OIL IN GEAR BOXES ON THEIR LIFETIMES [INFLUENCE DE LA TENEUR EN EAU DE L'HUILE DE BOITES D'ENGRENAGES SUR LEUR DUREE DE VIE]
Jacques Odorico and Jean Philippe 7 Aug. 1979 10 p In FRENCH Presented at Groupement pour l'Avan. de la Mecan. Ind. Conf. (Journees d'Etudes sur la Fatigue-Corrosion)
(SNIAS-792-551-105) Avail: NTIS HC A02/MF A01

Fatigue tests were carried out on gears cut out of 16NCD 13 and subject to the following treatment: machining, cementing, quenching and tempering, and rectification. Behavior with ordinary oil and oil with additional water (0.15 to 0.20%) was investigated. The apparatus simulating real conditions is described and the results obtained are given. Two types of control appear to be necessary: determination of the water content of fresh oil after storage, monitoring the magnesium content of oil sampled from operational gear boxes (the excess acidity caused by the water attacks the casing) using spectroscopic methods or simple visual inspection (blackening of the oil). Author (ESA)

N80-26674# General Electric Co., Whetstone (England). Reactor Equipment Ltd.
ROTOR: A FORTRAN PROGRAM TO CALCULATE THE CRITICAL SPEEDS OF ROTATING SHAFTS
P. Brooks and D. L. Duffett Jan. 1979 41 p refs Supersedes REL/TM(78)23
(REL/R(79)2; REL/TM(78)23) Avail: NTIS HC A03/MF A01

A computer program is described written in FORTRAN for the PDP 11-70 which can be used to calculate any number of critical speeds of transverse vibration of a rotating shaft supported in two bearings. It can deal with a shaft of variable cross section, with hollow or solid sections, and carrying additional discs. In the calculations the resistance of the bearings and the gyroscopic effects are taken into account. Operating instructions, method of calculation, comparisons made with other methods of calculation, and test problems are given. Author (ESA)

N80-26675# National Centre of Tribology, Risley (England). European Space Tribology Lab.
[SPACE TRIBOLOGY TESTS AND EXPERIMENTS] Progress Report, 1976
E. J. Robbins Sep. 1979 14 p refs
(Contract ESA-2584/75-MD)
(ESA-ESTL-43; ESA-CR(P)-1310) Avail: NTIS HC A02/MF A01

Mechanism tests and experiments in support of tribological research are described. Thermal vacuum tests of various solar array drive mechanisms to be used on satellites are reported on. In addition, results from slip ring tests, sleeve bearing tests, and boom hinge bearing tests are given. The torque of ball bearings using dry lubricants, the relative lubricity of oils, and cage effects in oil lubricated bearings are considered. Ball bearings with titanium carbide coated balls are also investigated. Author (ESA)

N80-26676# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Betriebsbereich Ottobrunn.
DEVELOPMENT OF AN EXHAUST NOISE SUPPRESSOR WITH NEGLIGIBLE BACK PRESSURE Final Report
Paul J. VandenBrulle Bonn Bundesmin. fuer Forsch. u. Technol. May 1979 33 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-HA-79-02) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 6.50

Methods of exhaust noise reduction were studied using mufflers of small sizes and negligible back pressures. One muffler was designed to permit the adding in series of an ejector with ejector chamber and achieved a noise reduction of 28 dB with negligible pressure loss. Another muffler was developed using a combination of ejector effect, partitioning of the jet stream, and acoustic absorption. This muffler achieved a noise reduction of 22 dB with no pressure loss. Author (ESA)

N80-26677# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Betriebsbereich.
VIBRATION ABSORBERS FOR DAMPING OF SOLID STATE NOISE Final Report
Helmut Albrecht Bonn Bundesmin. fuer Forsch. u. Technol. May 1979 45 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-HA-79-03) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9.05

Methods were studied to damp mechanical vibrations of machines in industrial plants and thus achieve noise reductions. It is shown that metal bar absorbers of various shapes are more efficient than antidrumming compounds and sand of the same mass. Tests on industrial machines showed that noise reductions of up to 7 dB could be achieved. Author (ESA)

N80-26678# Southampton Univ. (England). Inst. of Sound and Vibration Research.
DIAGNOSTICS OF GEAR ASSEMBLY: A NEW APPROACH USING IMPACT ANALYSIS
M. F. Ranky (Acad. of Sci., Budapest) Aug. 1978 29 p refs
(ISVR-TR-100) Avail: NTIS HC A03/MF A01

A technique which employs torsional excitation and an accelerometer fitted to the structure is used to estimate the backlash distribution of gears in mesh. Imperfections in circularity are computed from measured data in terms of absolute phase lags and normalized magnitudes. The theoretical concepts are outlined and results of experiments are presented. Author (ESA)

N80-26679# AiResearch Mfg. Co., Torrance, Calif.
EFFECT OF MACHINE LENGTH ON THE PERFORMANCE OF LINEAR INDUCTION MOTORS: AN EXPERIMENTAL INVESTIGATION Final Report, Jun. 1976 - Aug. 1977
R. J. A. Bevan Jan. 1979 252 p refs
(PB80-156243; FRA/ORD-79/07) Avail: NTIS HC A12/MF A01 CSCL 13F

The full-scale testing of a 10 pole, double-sided linear induction motor, for a research vehicle modified to permit excitation of 9, 5, 4, or 2 poles in addition to full to-pole excitation is described. Testing in reduced-pole configurations enabled the effect of a discontinuous excitation at the front and rear of the motor to be investigated, as well as the validity of certain mathematical models that assume infinite primary iron extending in the forward and reverse directions. A mathematical model of the motor is also presented that shows good correlation with

test results. The motor had a peak thrust capability of 15.3kN at 60 m/s at an excitation current of 2000 A. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-26680# Lockheed-California Co., Burbank.
SUMMARY OF 1979 INDEPENDENT RESEARCH ON RISK ANALYSIS METHODS
L. Bakow and J. C. Elwell 22 Dec. 1977 43 p refs
(LR-28390) Avail: NTIS HC A03/MF A01

A statistical analysis was conducted on aluminum superconducting-nonconducting (S-N) fatigue test data. The scatter (log normal standard deviation) for S-N data is comparable to the scatter for spectrum fatigue test data. However, the log normal standard deviation of the S-N data was larger than spectrum fatigue data for higher levels of confidence. Scatter factors to be applied to fatigue test results were worked out for various levels of probability and confidence. The scatter characteristics of the K sub Ic aluminum fracture toughness data was also evaluated. A statistical procedure was developed to determine A-basis and B-basis fracture toughness values. B.D.

N80-26681*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
RAPID DATA COMPARISON TECHNIQUE DEVELOPMENT FOR N-RAY/X-RAY ANALYSIS Final Report
Robert L. Butterfield Oct. 1979 9 p
(NASA-TM-81089; KSC-TR-60-1) Avail: NTIS HC A02/MF A01 CSCL 14D

An operational N-ray/X-ray computer analysis system for nondestructive testing problems was realized by developing: (1) more efficient data transfer routines for use in existing image processing systems; (2) the capability to store and analyze multiple N-ray/X-ray images; (3) an efficient 2-D Fast Fourier Transform; and (4) transfer functions compensation capability to correct for distortions and nonlinearities of N-rays/X-rays. Applications of the technique are summarized for the following: thermal protection system tile with hydraulic fluid; thermal protection system tile with corrosion; thermal protection system tile debonding; stainless steel tubing corrosion; defective electrical devices; fast film restoration and debiur; corrosion tracking over time; reduction of source vignetting, and identification of materials (O rings, Teflon parts, soft goods) via table look up. A.R.H.

N80-26682*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUANTITATIVE ULTRASONIC EVALUATION OF ENGINEERING PROPERTIES IN METALS, COMPOSITES AND CERAMICS
Alex Vary 1980 18 p refs Presented at First Seminar on Advanced Ultrasonic Tech., Longueuil, Quebec, 9-10 Jun. 1980; sponsored by National Research Council of Canada
(NASA-TM-81530; E-482) Avail: NTIS HC A02/MF A01 CSCL T4D

Ultrasonic technology from the perspective of nondestructive evaluation approaches to material strength prediction and property verification is reviewed. Emergent advanced technology involving quantitative ultrasonic techniques for materials characterization is described. Ultrasonic methods are particularly useful in this area because they involve mechanical elastic waves that are strongly modulated by the same morphological factors that govern mechanical strength and dynamic failure processes. It is emphasized that the technology is in its infancy and that much effort is still required before all the available techniques can be transferred from laboratory to industrial environments. E.D.K.

N80-26683# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
ESTIMATORS FOR THE BINOMIAL FAILURE RATE COMMON CAUSE MODEL Interim Report
Corwin L. Atwood Mar. 1980 83 p refs Prepared for Nuclear Regulatory Comm., Washington, D.C.
(Contracts EY-76-C-07-1570; DE-AC07-76ID-01570)
(EGG-EA-5112; NRC-FIN-A6292) Avail: NTIS HC A05/MF A01

A binomial failure rate model wherein a system of m components is hit by random shocks which may cause components simultaneously to fail, each component with equal probability is examined. Individual components may also fail when no shock has occurred. The data possibilities considered are that causes of single failures are identifiable (as shock or not) or not identifiable. Given data from such a system, non-Bayesian and Bayesian point and interval estimators are found for the various quantities of interest. Residual analyses and hypothesis tests are presented for checking the model assumptions. An example is worked out. DOE

N80-26684# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
ACCELERATED AND NATURAL AGING OF GLUED ASSEMBLIES USED IN AERONAUTICS [VIEILLISSEMENT ACCELERE ET VIEILLISSEMENT NATUREL D'ENSEMBLES COLLES UTILISES DANS L'AERONAUTIQUE]
G. Briens 22 Aug. 1979 27 p In FRENCH Presented at Forum Intern. Mater. Composites, Collage et Adhesion, Lyon, 11-14 Sep. 1979
(SNIAS-792-551-107) Avail: NTIS HC A03/MF A01

Conditions prevalent in tropical, equatorial, polar, and marine environments were simulated in order to determine the behavior and performance of thin film adhesives used to bond aluminum alloys in aircraft structures. The effects of humidity, surface treatment, and the nature of the adhesive were determined. Various types of shear stress tests were used. Variables included conditions of exposure (without loads, static loads, dynamic loads) and the ambient temperature of the humidity (50 C, 60 C, and 70 C.) Accelerated life tests conducted at 70 C with 100% humidity for 750 h, at 35 C with 5% NaCl for 750 h, and at 100 h in dry heat permitted the rapid elimination of adhesives with unsatisfactory performance. Transl. by A.R.H.

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-26685 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NO. 1
Judith Nagle-Eshleman, ed. Jan. 1980 104 p refs
(AD-A081171) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00 set, annual rate $100.00 CSCL 20/11

Transient problems of submerged elastoplastic structures and advances in helicopter vibration control are addressed. A bibliography dealing with shock and vibration technology is included. For individual titles, see N80-26686 through N80-26687.

N80-26686 Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
SOME TRANSIENT PROBLEMS OF SUBMERGED ELASTO-PLASTIC STRUCTURES
D. Krajcinovic *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 1 Jan. 1980 p 15-19 refs (For primary document see N80-26685 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

The elasto-plastic response of dynamically loaded cylindrical shells submerged in acoustic medium is addressed. The time dependent load, inertia forces, and fluid resistance (radiated pressure) cause the regions of plastic stresses in the shell to appear, grow, move, shrink, and disappear only to appear again. Mathematically, the problem is governed by two systems of partial

differential equations in the shell; one is for the elastic and the other for plastic regions. The wave equation represents the fluid (external domain). The systems of equations are coupled by matching conditions on moving boundaries; this matching process further complicates the problem. The complexity of the numerical solution to the problem is emphasized and possibilities of solution discussed. J.M.S.

N80-26687 City Univ., London (England). Dept. of Mechanical Engineering.
RECENT ADVANCES IN HELICOPTER VIBRATION CONTROL
G. T. S. Done *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 1 Jan. 1980 p 21-25 refs (For primary document see N80-26685 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

The control of forced vibration excitation and response of helicopter airframes is addressed. Methods and hardware for vibration control, including isolators, absorbers, direct rotor control, and structural modification are considered. J.M.S.

N80-26688 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NO. 3
Judith Nagle-Eshleman, ed. Mar. 1980 102 p refs
(AD-A082399) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

The ability of shock and vibration tests to predict the response structures to shock loads is addressed. Dynamic tests techniques, the shock response spectrum approach, and applications of the periodic structures theory to vibration testing are covered. For individual titles, see N80-26689 through N80-26691.

N80-26689 Hughes Aircraft Co., Culver City, Calif.
DYNAMIC TESTING: HOW FAR WE'VE COME, HOW MUCH FURTHER TO GO
A. J. Curtis *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 3 Mar. 1980 p 3-8 Presented at the 50th Shock and Vibration Symp., Colorado Springs, Colo., Oct. 1979 (For primary document see N80-26688 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

An overview of dynamic test techniques is given and the route of past technical developments is extrapolated to predict likely future capabilities. In parallel, shortcomings of these techniques vis-a-vis desired capabilities are examined to detect where improvements are most needed and/or can most readily be achieved. Particular attention is devoted, on the one hand, to the future of the most sophisticated techniques of digital control, and on the other hand, to the simplicity desired for screening tests. J.M.S.

N80-26690 National Aerospace Lab., Tokyo (Japan).
SHOCK RESPONSE SPECTRUM AND MAXIMAX RESPONSE
Y. Matsuzaki *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 3 Mar. 1980 p 11-15 refs (For primary document see N80-26688 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

A literature survey on the shock response spectrum and the greatest maximum, or maximax, response of structures subjected to shock loads is given. The shock response spectrum (SRS) approach is simple, well established, and easy to apply, particularly to single degree of freedom systems. It is shown that the SRS approach has been applied to large structures with many degrees of freedom and the maximax response of a linear structure has been predicted from the information of the upper limit of the load energy or the response of energy transmitted by the load. The loading condition for the maximax response is specified more grossly than for the SRS. The maximax response is considered a useful alternative for design and analysis. J.M.S.

N80-26691 Boeing Commercial Airplane Co., Seattle, Wash.
VIBRATION OF PERIODIC STRUCTURES
G. SenGupta *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 3 Mar. 1980 p 17-31 refs (For primary document see N80-26688 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

Many practical engineering structures consist of many basic periodic units. Aircraft fuselages, ship hulls, tall multi-storied buildings, periodically supported pipes, composite materials, and heat exchanger tube banks in a nuclear reactor are examples. Application of periodic structure theory to the analysis of dynamic responses of such structures is reviewed. J.M.S.

N80-26692 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NO. 4
Judith Nagle-Eshleman, ed. Apr. 1980 101 p refs
(AD-A084108) Avail: SVIC, Code 5804 Naval Research Lab., Washington, D.C. 20375; $15.00/ set, annual rate $100.00 CSCL 20/11

A review of dynamic analysis and design is given with emphasis on space craft design. A bibliography of shock and vibration technology is included. For individual title, see N80-26693.

N80-26693 Boeing Aerospace Co., Seattle, Wash.
DYNAMIC ANALYSIS AND DESIGN: CHALLENGE FOR THE FUTURE
R. W. Hager *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 4 Apr. 1980 p 3-12 Presented at the 50th Shock and Vibration Symp., Colorado Springs, Colo., Oct. 1979 (For primary document see N80-26692 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

A review of the history of dynamic analysis and design through the past 49 sessions of the Shock and Vibration Symposia is given. The significant progress made, and the problems and shortcomings being encountered today are examined. Concerns and challenges for the future of dynamic analysis and design are discussed. J.M.S.

N80-26694*# National Aeronautics and Space Administration, Washington, D. C.
THE NASTRAN USER'S MANUAL (LEVEL 17.0)
Dec. 1979 867 p
(NASA-SP-222(04)) Avail: NTIS HC A99/MF A01 CSCL 20K

NASTRAN embodies a lumped element approach, wherein the distributed physical properties of a structure are represented by a model consisting of a finite number of idealized substructures or elements that are interconnected at a finite of grid points, to which loads are applied. All input and output data pertain to the idealized structural model. The general procedures for defining structural models are described and instructions are given for each of the bulk data cards and case control cards. Additional information on the case control cards and use of parameters is included for each rigid format. A.R.H.

N80-26695*# Rohr Industries, Inc., Chula Vista, Calif.
DESIGN AND FABRICATION OF TITANIUM MULTI-WALL THERMAL PROTECTION SYSTEM (TPS) TEST PANELS
Contractor Report, Jan. - Aug. 1979
Winford Blair, John E. Meaney, Jr., and Herman A. Rosenthal
Feb. 1980 66 p
(Contract NAS1-15646)
(NASA-CR-159241; RHR-79-111) Avail: NTIS HC A04/MF A01 CSCL 20K

A titanium multiwall thermal protection system panel was designed. The panel is a nine sheet sandwich structure consisting of an upper and lower face sheet; four dimpled sheets, three septum sheets, and clips for attachment to a vehicle structure. An acceptable fabrication process was developed, and the panel design was verified through mechanical and thermal testing of component specimens. A design was completed which takes into consideration fabrication techniques, thermal properties, mechanical properties, and materials availability. B.D.

N80-26696*# General Electric Co., Philadelphia, Pa.
VIBRATION ANALYSIS OF THE LONG DURATION EXPO-

SURE FACILITY (LDEF) USING SPAR
Harold Edighoffer Jun. 1980 96 p refs
(Contract NAS1-14375)
(NASA-CR-159239) Avail: NTIS HC A05/MF A01 CSCL 20K

The structural modeling of the Long Duration Exposure Facility (LDEF) utilizing the SPAR system of computer programs for vibration analysis is discussed. The technical areas of interest were: (1) development of the LDEF finite element model; (2) derivation of tray effective panel stiffness matrix using finite element tray models; (3) assessment of attachment conditions and end fitting flexibility by comparing SPAR with test static displacements; (4) SPAR grouping; and (5) derivation of the LDEF frequencies and mode shapes and comparing them with tests. Special detailed finite element modeling was required to obtain good agreement between analytical and test vibration modes. An orthotropic panel in the overall model was developed. Orthotropic stiffness for this panel were obtained from finely detailed statically loaded SPAR models which included stiffness and allowed for partial relative sliding of the tray clamping attachments. Sensitivity to LDEF joint boundary conditions was determined, and static test data proved valuable in assessing modeling of local end fittings. B.D.

N80-26697*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
NONLINEAR TRANSIENT ANALYSIS BY ENERGY MINIMIZATION: A THEORETICAL BASIS FOR THE ACTION COMPUTER CODE
Manohar P. Kamat Jul. 1980 109 p refs
(Contract NAS1-15080; Grants NGR-47-004-14; NsG-1546)
(NASA-CR-3287) Avail: NTIS HC A06/MF A01 CSCL 20L

The formulation basis for establishing the static or dynamic equilibrium configurations of finite element models of structures which may behave in the nonlinear range are provided. With both geometric and time independent material nonlinearities included, the development is restricted to simple one and two dimensional finite elements which are regarded as being the basic elements for modeling full aircraft-like structures under crash conditions. Representations of a rigid link and an impenetrable contact plane are added to the deformation model so that any number of nodes of the finite element model may be connected by a rigid link or may contact the plane. Equilibrium configurations are derived as the stationary conditions of a potential function of the generalized nodal variables of the model. Minimization of the nonlinear potential function is achieved by using the best current variable metric update formula for use in unconstrained minimization. Powell's conjugate gradient algorithm, which offers very low storage requirements at some slight increase in the total number of calculations, is the other alternative algorithm to be used for extremely large scale problems. A.R.H.

N80-26698*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
STRAIN MEASUREMENTS IN COMPOSITE BOLTED-JOINT SPECIMENS
Michael W. Hyer, Michael C. Lightfoot (Old Dominion Univ. Research Foundation), and James C. Perry (Old Dominion Univ. Research Foundation) May 1979 87 p refs
(Grant NsG-1167)
(NASA-CR-163296; VPI-E-79-17) Avail: NTIS HC A05/MF A01 CSCL 20K

Strain data from a series of bolted joint tests is presented. Double lap, double hole, double lap, single hole, and open hole tensile specimens were tested and the strain gage locations, load strain responses, and load axial displacement responses are presented. The open hole specimens were gaged to determine strain concentration factors. The double lap, double hole specimens were gaged to determine the uniformity of the strain in the joint and the amount of load transferred past the first bolt. The measurements indicated roughly half the load passed the first bolt to be reacted by the second bolt. Author

N80-26699# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMIZATION AND STABILITY OF COLUMNS UNDER OPPOSING DISTRIBUTED AND CONCENTRATED LOADS
Sarp Adali Oct. 1979 45 p refs
(CSIR-TWISK-122) Avail: NTIS HC A03/MF A01

A bar subjected to simultaneous compressive and tensile axial loads, which behaves like either a column or tie, depending on the relative magnitudes of these loads is examined along with the resulting stability boundary which separates a conditionally stable region (column action) from an unconditionally stable region (tie action). The optimal design of the structure, when in the conditionally stable region is presented. The stability boundaries of uniform and optimal columns are given for various problem parameters. The columns are elastically clamped at one end and free at the other, and subjected to nonuniformly distributed and concentrated loads which act in opposite directions. The cross sectional area is determined, such as to maximize the load carrying capacity of the column subject to volume and thickness constraints. That variational bounds are given which provide upper and lower estimates on the buckling loads of optimal columns. Stability problems are formulated which arise in connection with columns attached to the rim or hub of a rotating wheel. B.D.

N80-26700*# Lehigh Univ., Bethlehem, Pa.
VISCOELASTIC ANALYSIS OF ADHESIVELY BONDED JOINTS
F. Delale and F. Erdogan Mar. 1980 28 p refs
(Grants NGR-39-007-011; NSF ENG-78-09737)
(NASA-CR-159294) Avail: NTIS HC A03/MF A01 CSCL 20K

An adhesively bonded lap joint is analyzed by assuming that the adherends are elastic and the adhesive is linearly viscoelastic. After formulating the general problem a specific example for two identical adherends bonded through a three parameter viscoelastic solid adhesive is considered. The standard Laplace transform technique is used to solve the problem. The stress distribution in the adhesive layer is calculated for three different external loads, namely, membrane loading, bending, and transverse shear loading. The results indicate that the peak value of the normal stress in the adhesive is not only consistently higher than the corresponding shear stress but also decays slower. Author

N80-26701*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEFLECTIONS OF BEAM COLUMNS ON MULTIPLE SUPPORTS
W. Jefferson Stroud, William H. Greene, and Melvin S. Anderson Jun. 1980 19 p refs
(NASA-TM-81829) Avail: NTIS HC A02/MF A01 CSCL 20K

Lateral deflections of beam columns on multiple equally spaced supports are calculated using the STAGS nonlinear structural analysis computer program. Three lateral loadings are considered, uniform, linear, and uniform over only the center bay. Two types of boundary conditions are considered at the end supports, clamped, and simple support. The effect of an initial sinusoidal imperfection are considered. Deflections in the center and end bays of the beam columns are presented as a function of applied axial compressive load. As the number of bays becomes large, the effect of boundary conditions on the deflections in the center bays diminishes. For cases involving a uniform or linearly varying load, imperfections can have a much larger effect on deflections in the center bays than can lateral pressure. E.D.K.

N80-26702# California Univ., Berkeley. Lawrence Berkeley Lab. Nuclear Theory Group.
ROLE OF FLUCTUATIONS IN THE QUANTAL DESCRIPTION OF DAMPED MOTION
E. S. Hernandez Jan. 1980 30 p refs Sponsored in part by Consejo Nacl. de Invest. Cient. y Tech. of Argentina
(Contract W-7405-eng-48)
(LBL-10321) Avail: NTIS HC A03/MF A01

The construction of a frictional time dependent Schroedinger equation is reviewed for harmonic motion in a restricted framework, i.e., demanding the conservation of the Gaussian shape of wave packets. The evolution of the quanta fluctuations is discussed in a time dependent model, and it is shown that such a situation does not correspond to damped harmonic oscillations. The role of fluctuations in providing dissipative

behavior is discussed and the time evolution of arbitrary wave functions subject to damped motion as described by Schroedinger-Kostin equation is analyzed in detail. DOE

N80-26703# Sandia Labs., Albuquerque, N. Mex.
FLEXURAL RESPONSE ON KEVLAR/EPOXY COMPOSITE BEAMS ADHESIVELY BONDED AT THE MID-PLANE
T. R. Guess and R. E. Allred 1980 54 p refs Presented at 25th Natl. SAMPE Symp., San Diego, Calif, 6 May 1980
(Contract EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1356C; CONF-800518-1) Avail: NTIS HC A04/MF A01

The results of an analytical and experimental study to determine the effect of a thin adhesive interlayer on the flexural stiffness and strength of warp aligned Kelvar 49 style 143 fabrix/55208 epoxy composite beams are reported. Layered and sold composite laminate constructions 12.5 mm thick were analyzed by finite element techniques. The layered construction consisted of two 6.25 mm thick laminates bonded together with a 0.076 to 0.229 mm adhesive bond. Bend test runs at 22 C verified that the layered and solid beams have essentially identical stiffness and strength. Changes indicate the temperature depends on the composite. DOE

N80-26704# Societe Nationale Industrielle Aerospatiale, Paris (France).
EXPERIMENTAL METHODOLOGY AND THE APPLICATION OF RUPTURE MECHANICS CONCEPTS TO METALS
J. Odorico 1979 22 p In FRENCH; ENGLISH summary Presented at 14th. Congr. Intern. Aeron., Paris, 6-8 Jun. 1979
(SNIAS-792-551-109) Avail: NTIS HC A02/MF A01

Standard metal testing procedures are reviewed, including ASTM tests for aluminum alloys. The use of data from these tests is discussed in terms of minimizing costs and enhancement of safety. Results from tests concerning the parameters K sub Ic, curve R, da/dN, and da/dt are presented. Author (ESA)

N80-26705# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
ON A PENALTY FUNCTION METHOD FOR THE SIMULATION OF MECHANICAL SYSTEMS SUBJECT TO CONTRAINTS
Per Loetstedt 1979 51 p refs Sponsored in part by Swed. Inst. of Appl. Math.
(TRITA-NA-7919) Avail: NTIS HC A04/MF A01

The mathematical properties of a penalty method for the digital simulation of mechanical systems of rigid bodies with constraints are investigated. The solutions of the systems of ordinary differential equations are expanded in Taylor series about a small parameter dependent on the penalty function. Under certain assumptions, the solution is close to that obtained by Lagrange multipliers. A Coulomb friction model is also presented and analyzed. This model has deficiences which are pointed out in two examples. Author (ESA)

N80-26706# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
A NUMERICAL METHOD FOR THE SIMULATION OF MECHANICAL SYSTEMS WITH UNILATERAL CONSTRAINTS
Per Loetstedt 1979 72 p refs Sponsored in part by Swed. Inst. of Appl. Math.
(TRITA-NA-7920) Avail: NTIS HC A04/MF A01

The simulation of the time dependent behavior of mechanical systems of rigid bodies on digital computers calls for the solution of second order ordinary differential equations with unilateral constraints. The underlying principle for the construction of the computational scheme is the Gaussian principle of least constraint. The Coulomb law of friction is modified slightly to allow an efficient solution of systems where such friction plays an important role. Limited computational experience is reported. Author (ESA)

N80-26707# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
ON THE NUMERICAL SIMULATION OF THE MOTION OF A SYSTEM OF RIGID BODIES SUBJECT TO VARIABLE CONSTRAINTS
Per Loetstedt 1979 11 p refs Sponsored in part by Swed. Inst. of Appl. Math.
(TRITA-NA-7922) Avail: NTIS HC A02/MF A01

A summary is presented of a thesis consisting of four separate papers on the simulation of mechanical systems with restraints, the use of penalty functions, numerical methods, and the interactive simulation of the progressive collapse of a building. Author (ESA)

N80-26708# Oxford Univ. (England). Dept. of Engineering Science.
INELASTIC BUCKLING OF COLUMNS PARTIALLY RESTRAINED AGAINST SWAY AND ROTATION
Giuseppe Olivato 1979 26 p refs Sponsored in part by Transport and Road Res. Lab. and CNR
(OUEL-1298/79) Avail: NTIS HC A03/MF A01

A computer program is described for calculating the buckling load and the buckling shapes of columns restrained at intervals against sway and/or rotation by elastic springs. Beyond the elastic limit of the material, the analysis is performed by introducing the tangent modulus in a procedure similar to that of Engesser-Shanley for simple columns. The program is particularly suitable for a desk computer because of the very small amount of storage required. Some numerical results are presented. Author (ESA)

N80-26709# General Electric Co., Whetstone (England). Reactor Equipment Ltd.
INVESTIGATION OF THE FAILURE OF AN AC-3 CONDUCTION PUMP DUCT
G. Rowden Jun. 1979 15 p refs
(REL/R(79)27) Avail: NTIS HC A02/MF A01

The failure of the duct in an AC-3 conduction pump after 3,000 hours service at 350/400 C in a high temperature sodium circuit, was investigated. Examination shows that failure resulted from gross overheating and local melting of the duct wall. It is concluded that failure probably resulted from operating the pump outside the recommended regime. Author (ESA)

N80-26710# National Aerospace Lab., Amsterdam (Netherlands). Div. of Structures and Materials.
APPLICATION OF FINITE ELEMENT METHODS TO THE ANALYSIS OF CRACKS Final Report
G. Bartelds 1979 53 p refs
(Contract ESA-3411/77-NL-PP(SC))
(NLR-TR-79118-U; ESA-CR(P)-1311) Avail: NTIS HC A04/MF A01

The applicability of finite element methods to the analysis of cracks was studied. Methods available for the calculation of elastic stress intensity data for cracks of arbitrary shape using finite element techniques were evaluated. The indirect energy release method using virtual crack front variation is found to be the more efficient while the direct displacement extrapolation method is identified as a valuable backup procedure. Special automatic program control lists were then generated for the ASKA package to perform elastic energy release rate calculations. The use of modified elements to improve accuracy is explained and well documented benchmark problems are provided. The preferred procedures identified were applied to three different structural configurations. Experimental verification was provided by means of constant amplitude fatigue tests and residual strength tests. A calibrated relationship between the fatigue crack growth rate and the stress intensity variation during each cycle was used to generate stress intensity data. A comparison between fatigue data and ASKA results shows a rather close agreement, but the residual strength data shows a poor correlation. Author (ESA)

N80-26358*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STRESS DISTRIBUTION IN A SEMI-INFINITE BODY SYMMETRICALLY LOADED OVER A CIRCULAR AREA
H. McGinness *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 123-130 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

N80-26711*# SRI International Corp., Menlo Park, Calif.
APPLICATION OF THE SRI CLOUD-TRACKING TECHNIQUE TO RAPID-SCAN GOES OBSERVATIONS Final Report, 5 Jun. 1978 - 30 Jan. 1980
Daniel E. Wolf and Roy M. Endlich Mar. 1980 34 p refs
(Contract NAS5-25027)
(NASA-CR-159989) Avail: NTIS HC A03/MF A01 CSCL 05B

An automatic cloud tracking system was applied to multilayer clouds associated with severe storms. The method was tested using rapid scan observations of Hurricane Eloise obtained by the GOES satellite on 22 September 1975. Cloud tracking was performed using clustering based either on visible or infrared data. The clusters were tracked using two different techniques. The data of 4 km and 8 km resolution of the automatic system yielded comparable in accuracy and coverage to those obtained by NASA analysts using the Atmospheric and Oceanographic Information Processing System. B.D.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-26712*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT-2 AND LANDSAT-3 FLIGHT EVALUATION Report, 23 Jul. 1979 - 23 Jan. 1980
1 Feb. 1980 262 p ERTS
(Contract NAS5-21808)
(E80-10129; NASA-CR-159959; Doc-80SDS4200) Avail: NTIS HC A12/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26713*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE REMOTE SENSING OF SOIL MOISTURE CONTENT OVER BARE AND VEGETATED FIELDS 3
J. R. Wang, J. C. Shiue, and J. E. McMurtrey, III, Principal Investigators (Agr. Res. Center, Beltsville, Md.) Mar. 1980 16 p refs Submitted for publication ERTS
(E80-10123; NASA-TM-80669) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Ground truth of soil moisture content, and ambient air and soil temperatures were acquired concurrently with measurements of soil moisture in bare fields and fields covered with grass, corn, and soybeans obtained with 1.4 GHz and 5 GHz radiometers mounted on a truck. The biomass of the vegetation was sampled about once a week. The measured brightness temperatures over the bare fields were compared with those of radiative transfer model calculations using as inputs the acquired soil moisture and temperatures data with appropriate values of dielectric constants for soil-water mixtures. A good agreement was found between the calculated and measured results over 10 deg to 70 deg incident angles. The presence of vegetation reduced the sensitivity of soil moisture sensing. At 1.4 GHz the sensitivity reduction ranged from about 20% for 10 cm tall grassland cover to over 50 to 60% for the dense soybean field. At 5 GHz corresponding reduction in sensitivity ranged from approximately 70% to approximately 90%.

N80-26714*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
A METHODOLOGY FOR DETERMINING OPTIMUM MICROWAVE REMOTE SENSOR PARAMETERS
J. C. Holtzman, Principal Investigator and V. H. Kaupp Feb. 1980 200 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57918 ERTS
(Contract NAS9-15602)
(E80-10124; NASA-CR-160564; RSL-TR-380-1) Avail: NTIS HC A09/MF A01 CSCL 14B

There are no author-identified significant results in this report.

N80-26715*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): AS BUILT FUNCTIONAL DESIGN
M. L. Brown, A. M. Fails, M. V. Martin, A. S. Story, and E. A. Weisblatt, Principal Investigator Jan. 1980 115 p ERTS
(Contract NAS9-15800)
(E80-10125; NASA-CR-160561; LEMSCO-13258; JSC-16458)
Avail: NTIS HC A06/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26716*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
CONTEXTUAL CLASSIFICATION OF MULTISPECTRAL IMAGE DATA
P. H. Swain, S. B. Vardeman, and J. C. Tilton, Principal Investigator 10 Jan. 1980 39 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Grant NSF MCS-78-04366; Proj. AgRISTARS)
(E80-10126; NASA-CR-160587; SR-PO-00443; LARS-TR-011080) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-26717*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONITORING FOREST CANOPY ALTERATION AROUND THE WORLD WITH DIGITAL ANALYSIS OF LANDSAT IMAGERY
Darrel L. Williams and Lee D. Miller, Principal Investigator (Texas A and M Univ., College Station) Aug. 1979 46 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10127; NASA-TM-80761) Avail: NTIS HC A03/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-26718*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
EVALUATION OF TRANSITION YEAR CANADIAN TEST SITES
R. W. Payne, Principal Investigators Apr. 1980 36 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10128; NASA-CR-160655; FC-LO-00422; LEMSCO-14320; JSC-16338) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. The spring small grain proportion accuracy in 15 Saskatchewan test sites was found to be comparable to that of the Large Area Crop Inventory Experiment Phase 3 and Transition Year results in the U.S. spring wheat states. Spring small grain labeling accuracy was 94%, and the direct wheat labeling accuracy was 89%, despite the low barley separation accuracy of 30%.

N80-26719*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
SOIL TEXTURAL EFFECTS ON RADAR RESPONSE TO SOIL MOISTURE
Fawwaz T. Ulaby, Principal Investigator and M. C. Dobson Oct. 1979 240 p refs ERTS
(Contract NAS9-14052)

(E80-10131; NASA-CR-160585; RSL-TR-264-30) Avail: NTIS HC A11/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-26720*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN EXAMINATION OF SPECTRAL BAND RATIONING TO REDUCE THE TOPOGRAPHIC EFFECT ON REMOTELY SENSED DATA

Brent Holben and Chris Justice, Principal Investigator Feb. 1980 34 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E80-10133; NASA-TM-80640) Avail: NTIS HC A03/MF A01 CSCL 14E

There are no author-identified significant results in this report.

N80-26721*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

PHYSIOCHEMICAL, SITE, AND BIDIRECTIONAL REFLECTANCE FACTOR CHARACTERISTICS OF UNIFORMLY MOIST SOILS

Eric R. Stoner and Marion F. Baumgardner, Principal Investigator Feb. 1980 104 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15466; Proj. AgRISTARS)

(E80-10134; NASA-CR-160571; SR-PO-00431; LARS-TR-11679) Avail: NTIS HC A06/MF A01 CSCL 02C

The author has identified the following significant results. The bidirectional reflectance factor (0.5 micron to 2.3 micron wavelength interval) and physiochemical properties of over 500 soils from 39 states, Brazil and Spain were measured. Site characteristics of soil temperature regime and moisture zone were used as selection criteria. Parent material and internal drainage were noted for each soil. At least five general types of soil reflectance curves were identified based primarily on the presence or absence of ferric iron absorption bands, organic matter content, and soil drainage characteristics. Reflectance in 10 bands across the spectrum was found to be negatively correlated with the natural log of organic matter content.

N80-26722*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

FOREST RESOURCE INFORMATION SYSTEM, PHASE 3 Quarterly Report, 1 Oct. - 31 Dec. 1979

R. P. Mroczynski, Principal Investigator, F. E. Goodrick, S. Schwingendorf, B. Shelley, D. Freeman, C. Kozlowski, C. Smith, and C. Peterson 20 Jan. 1980 65 p ERTS

(Contract NAS9-15325)

(E80-10135; NASA-CR-160570; LARS-CR-012080) Avail: NTIS HC A04/MF A01 CSCL 20F

There are no author-identified significant results in this report.

N80-26723*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

CONTEXT DISTRIBUTION ESTIMATION FOR CONTEXTUAL CLASSIFICATION OF MULTISPECTRAL IMAGE DATA

J. C. Tilton, P. H. Swain, and S. B. Vardeman, Principal Investigator Apr. 1980 12 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15466; Proj. AgRISTARS)

(E80-10136; NASA-CR-160588; SR-PO-00444; LARS-TR-040280) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-26724*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 1: SYSTEM OVERVIEW

P. J. Aucoin and J. Stewart, Principal Investigator Aug. 1978 226 p ERTS

(Contract NAS9-15200)

(E80-10137; NASA-CR-160595; LEC-12563-Vol-1; JSC-13821-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26725*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 2: USER'S REFERENCE MANUAL

P. J. Aucoin, Principal Investigators and J. Stewart Dec. 1978 307 p refs ERTS

(Contract NAS9-15200)

(E80-10138; NASA-CR-160594; LEC-12564-Vol-2; JSC-13821-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26726*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

EARTH OBSERVATIONS DIVISION VERISON OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 4: PROGRAM LISTINGS

M. L. Burnell and P. J. Aucoin, Principal Investigator Jan. 1979 527 p ERTS

(Contract NAS9-15800)

(E80-10139; NASA-CR-160592; LEC-12565-Vol-4; JSC-13821-Vol-4) Avail: NTIS HC A23/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26727*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 4: PROGRAM LISTINGS

M. L. Burnell and P. J. Aucoin, Principal Investigator Nov. 1979 535 p Revised ERTS

(Contract NAS9-15800)

(E80-10140; NASA-CR-160572; LEC-12566-Rev-A; JSC-13821-Rev-A) Avail: NTIS HC A23/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26728*# London Univ. (England). Dept. of Geography.

HCMM AND LANDSAT IMAGERY FOR GEOLOGICAL MAPPING IN NORTHWEST QUEENSLAND

M. M. Cole and D. J. Edmiston, Principal Investigator [1980] 7 p refs Sponsored by NASA HCMM

(E80-10141; NASA-CR-163159) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Photographic prints made from negatives of day-visible and day-IR cover of selected areas were compared with enhanced color composites generated from LANDSAT computer compatible tapes and films. For geological mapping purposes, HCMM imagery is of limited value. While large scale features like the Mitakoodi anticlinorium, contrasting lithological units, and major structures may be distinguished on day-visible and day-IR cover, the spectral bands are too broad and the resolution too coarse even for regional mapping purposes. The imagery appears to be most useful for drainage studies. Where drainage is seasonal, sequential imagery permits monitoring of broad scale water movement while the day-IR imagery yields valuable information on former channels. In plains areas subject to periodic change of stream courses, comparable IR cover at a larger scale would offer considerable potential for reconstruction of former drainage patterns essential for the correct interpretation of geochemical data relative to mineral exploration.

N80-26729*# London Univ. (England).

HCMM IMAGERY FOR THE DISCRIMINATION OF ROCK

TYPES, THE DETECTION OF GEOTHERMAL ENERGY SOURCES AND THE ASSESSMENT OF SOIL MOISTURE CONTENT IN WESTERN QUEENSLAND AND ADJACENT PARTS OF NEW SOUTH WALES AND SOUTH AUSTRALIA Progress Report
Monica M. Cole, Principal Investigator 28 Feb. 1980 5 p Sponsored by NASA HCMM
(E80-10142; NASA-CR-163160) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Day-visible and day-IR imagery of northwest Queensland show that large scale geological features like the Mitakoodi anticlinorium, which involves rocks of contrasting lithological type, can be delineated. North of Cloncurry, the contrasting lithological units of the Knapdale quartzite and bedded argillaceous limestones within the Proterozoic Corella sequence are clearly delineated in the area of the Dugald River Lode. Major structural features in the Mount Isa area are revealed on the day-visible cover which provides similar but less detailed information than the LANDSAT imagery. The day-IR cover provides less additional information for areas of outcropping bedrock than had been expected. Initial studies of the day-IR and night-IR cover for parts of South Australia suggest that they contain additional information on geology compared with day-visible cover.

N80-26730*# Bureau de Recherches Geologiques et Minieres, Orleans (France).
SPATIAL THERMAL RADIOMETRY CONTRIBUTION TO THE MASSIF ARMORICAIN AND THE MASSIF CENTRAL (FRANCE) LITHO-STRUCTURAL STUDY Progress Report, Aug. 1979 - Feb. 1980
Jean-Yves Scanvic, Principal Investigator Mar. 1980 25 p refs Sponsored by NASA and CNES HCMM
(E80-10143; NASA-CR-163161) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. Although the limited number of images received did not permit construction of a thermal inertia map, important geological details were obtained in the areas of lithology and tectonics. Interpretation of day, night, and seasonal imagery resulted in differentiating broad calcareous and dolomitic units in the Causse Plateau. In the Massif amoricain, some granite massifs were delineated which were not observed by LANDSAT. Neotectonic faults were also revealed.

N80-26731*# National Environmental Satellite Service, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 31 Mar. 1980 3 p Sponsored by NASA HCMM
(E80-10144; NASA-CR-163162) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N80-26732*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, 1 Jan. - 31 Mar. 1980
James C. Barnes, Principal Investigator Apr. 1980 17 p HCMM
(Contract NAS5-24316)
(E80-10145; NASA-CR-163163; QPR-10) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Analysis of HCMM digital thermal data for daytime passes over the Salt-Verde Watershed area on five dates show a gradual depletion of snow cover in the watershed (and in the Little Colorado Watershed to the north) from a maximum on February 9th to a nearly complete disappearance of the snow pack by April 15th. Temperature contours correspond closely with the snowline observed in the visible image.

N80-26733*# Telespazio, S.p.A., Rome (Italy).
GREEN AND SOIL BRIGHTNESS INDICATORS OBTAINED THROUGH A LANDSAT DATA TRANSFORMATION PROCEDURE
Angelo Zandonella, Principal Investigator 1980 11 p refs Presented at the 27th Rass. Intern. Elettronica Nucl. ed Aerospaziale, Rome, 7-16 Mar. 1980 and the 20th Convegno sullo Spazio, Rome, 11-13 Mar. 1980 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10146; NASA-CR-163164) Avail: NTIS HC A02/MF A01 CSCL 14E

There are no author-identified significant results in this report.

N80-26734*# Geological Survey, Denver, Colo.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, Dec. 1979 - Feb. 1980
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Feb. 1980 3 p Sponsored by NASA HCMM
(E80-10147; NASA-CR-163165) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significiant results in this report.

N80-26735*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
LABEL IDENTIFICATION FROM STATISTICAL TABULATION (LIST) TEMPORAL EXTENDABILITY STUDY
T. B. Dennis, Principal Investigator Feb. 1980 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10148; NASA-CR-160563; SR-LO-00424; LEMSCO-14278; JSC-16334) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. The most apparent contributors to the problem of poor temporal extension of LIST are the drastic changes in the brightness keys and an inadequate set of AI responses in Phase 3. The brightness trajectories change drastically from Phase 3 to the transition year (TY). Removing brightness channels from the discriminant does not completely correct the lack of extendability. Removing brightness increases the accuracy of the extension from Phase 3 to TY from 57.7 percent to 64.18 percent. The removal of the AI keys increases accuracy to 65.76 percent. Although the latter increase appears insignificant when compared to the first, the removal of only the AI keys increased accuracy to 63.58 percent. Proper weighting of the responses explains 73.8 percent of the ground truth labels but only 56.7 percent of the AI labels. By contrast, the TY responses which were weighted to explain the TY ground truth labels fared equally well, explaining 73.6 percent of those labels and 87.1 percent of the AI labels.

N80-26736*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report
Toby N. Carlson, Principal Investigator 1 Jun. 1980 4 p HCMM
(Contract NAS5-24264)
(E80-10150; NASA-CR-163167; QR-10) Avail: NTIS HC A02/MF A01 CSCL 13B

There are no author-identified significant results in this report.

N80-26737*# Environmental Research Inst. of Michigan, Ann Arbor.
LANDSAT TECHNOLOGY TRANSFER USING COMMUNITY COLLEGES Progress Report, Jan. - Apr. 1980
Robert H. Rogers, Principal Investigator May 1980 48 p ERTS
(Contract NASw-3308)
(E80-10154; NASA-CR-163171; ERIM-147200-4-P) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26738*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Progress Report, Jan. - Mar. 1980
Donald G. Moore, Principal Investigator and J. L. Heilman Mar. 1980 7 p HCMM
(Contract NAS5-24206)
(E80-10155; NASA-CR-163172; SDSU-RSI-80-03) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. Day thermal data were analyzed to assess depth to groundwater in the test site. HCMM apparent temperature was corrected for atmospheric effects using lake temperature of the Oahe Reservoir in central South Dakota. Soil surface temperatures were estimated using an equation developed for ground studies. A significant relationship was found between surface soil temperature and depth to groundwater, as well as between the surface soil-maximum air temperature differential and soil water content (% of field capacity) in the 0 cm and 4 cm layer of the profile. Land use for the data points consisted of row crops, small grains, stubble, and pasture.

N80-26739*# Instituto Geografico Nacional, Madrid (Spain).
THERMAL MAPPING, GEOTHERMAL SOURCE LOCATION, NATURAL EFFLUENTS AND PLANT STRESS IN THE MEDITERRANEAN COAST OF SPAIN Progress Report
Rodolfo Nunez delasCuevas, Principal Investigator, Fernando Lopez Sagredo, Joaquin Melia Miralles, Pedro Herranz Araujo, Jesus Paredes Perlado, D. Antonio Parrillo, D. J. Luis Piecon, D. J. Luis Labrandero, and F. Gonzalez Bernaldez 31 Dec. 1979 41 p refs Sponsored by NASA Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10156; NASA-CR-163173; PR-2) Avail: NTIS HC A03/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-26740*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Progress Report
W. D. Rosenthal, J. C Harlan, and Bruce J. Blanchard, Principal Investigator Feb. 1980 24 p Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(Contract NAS5-24383)
(E80-10157; NASA-CR-163174; PR-3712-8) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-26741*# Dartmouth Coll., Hanover, N.H.
AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCE/FEATURE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. A: LANDSAT. B: REMOTE SENSING OF VOLCANIC EMISSIONS Semiannual Status Report, 1 Jul. - 31 Dec. 1979
Richard W. Birnie, Richard E. Stoiber, Principal Investigator, Emily Bryant, A. G Dodge, Ken Sutherland, Joseph Francica, and Lawrence Malinconico 31 Dec. 1979 27 p ERTS
(Grant NsG-5014)
(E80-10158; NASA-CR-163177) Avail: NTIS HC A03/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-26742*# Montana Univ., Missoula. Wildlife-Wildlands Inst.
GRIZZLY BEAR HABITAT ANALYSIS. SECTION 2: EVALUATION OF GRIZZLY BEAR FOOD PLANTS, FOOD CATEGORIES AND HABITAT
John J. Craighead and Jay S. Sumner, Principal Investigator 1980 172 p refs Sponsored by NASA ERTS
(E80-10159; NASA-CR-163175) Avail: NTIS HC A08/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-26743*# Applied Science Associates, Inc., Apex, N. C.
A STUDY OF GEOS-3 TERRAIN DATA WITH EMPHASIS ON RADAR CROSS SECTION Final Report
R. W. Priester May 1980 53 p refs
(Contract NAS6-2810)
(NASA-CR-156865) Avail: NTIS HC A04/MF A01 CSCL 08B

Radar cross sections (RCS) of terrain are studied using GEOS 3 radar altimeter data. Maps of RCS for portions of four east coast states (U.S.A.) are presented and used to draw curves of RCS versus inland distance as measured from the land/sea interface. The results show RCS to decay approximately exponentially with inland distance. The GEOS 3 data are also used to develop curves of RCS seasonal variation for the same regions. Observed variations correlate strongly with local potential evaporation. Results also show that farming operations in the state of North Carolina are observable in the RCS data. A restricted method for determining surface roughness features from saturated average return waveforms for some types of terrain is developed. Sensor bias induced by receiver saturation for certain terrain returns is briefly discussed. J.M.S.

N80-26744*# General Electric Co., Philadelphia, Pa.
ASSESSMENT OF THE USE OF SPACE TECHNOLOGY IN THE MONITORING OF OIL SPILLS AND OCEAN POLLUTION: EXECUTIVE SUMMARY
U. R. Alvarado, ed. Apr. 1980 68 p
(Contract NAS1-15657)
(NASA-CR-159243) Avail: NTIS HC A04/MF A01 CSCL 13B

The adequacy of current technology in terms of stage of maturity, of sensing, support systems, and information extraction was assessed relative to oil spills, waste pollution, and inputs to pollution trajectory models. Needs for advanced techniques are defined and the characteristics of a future satellite system are determined based on the requirements of U.S. agencies involved in pollution monitoring. A.R.H.

N80-26745*# General Electric Co., Philadelphia, Pa. Space Div.
ASSESSMENT OF THE USE OF SPACE TECHNOLOGY IN THE MONITORING OF OIL SPILLS AND OCEAN POLLUTION: TECHNICAL VOLUME. EXECUTIVE SUMMARY
U. R. Alvarado, ed., G. Chafaris, J. Chestek, J. Contrad, G. Frippel, R. Gulatsi, A. Heath, H. Hodara (Tetra Tech., Inc., Pasadena, Calif.), H. Kritikos (Pennsylvania Univ., Philadelphia), and K. Tamiyasu Apr. 1980 464 p refs
(Contract NAS1-15657)
(NASA-CR-159242; Doc-80SDS4203) Avail: NTIS HC A20/MF A01 CSCL 13B

The potential of space systems and technology for detecting and monitoring ocean oil spills and waste pollution was assessed as well as the impact of this application on communication and data handling systems. Agencies charged with responsibilities in this area were identified and their measurement requirements were ascertained in order to determine the spatial resolution needed to characterize operational and accidental discharges. Microwave and optical sensors and sensing techniques were evaluated as candidate system elements. Capabilities are described for the following: synthetic aperture radar, microwave scatterometer, passive microwave radiometer, microwave altimeter, electro-optical sensors currently used in airborne detection, existing space-based optical sensors, the thematic mapper, and the pointable optical linear array. A.R.H.

N80-26746*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
MICROWAVE REMOTE SENSING OF SNOWPACKS Final Report
William H. Stiles and Fawaz T. Ulaby Jun. 1980 438 p refs
(Contract NAS5-23777)
(NASA-CR-3263) Avail: NTIS HC A19/MF A01 CSCL 08L

The interaction mechanisms responsible for the microwave backscattering and emission behavior of snow were investigated, and models were developed relating the backscattering coefficient (sigma) and apparent temperature (T) to the physical parameters of the snowpack. The microwave responses to snow wetness, snow water equivalent, snow surface roughness, and to diurnal variations were investigated. Snow wetness was shown to have an increasing effect with increasing frequency and angle of incidence for both active and passive cases. Increasing snow wetness was observed to decrease the magnitude sigma and increase T. Snow water equivalent was also observed to exhibit a significant influence sigma and T. Snow surface configuration (roughness) was observed to be significant only for wet snow surface conditions. Diurnal variations were as large as 15 dB for sigma at 35 GHz and 120 K for T at 37 GHz. Simple models for sigma and T of a snowpack scene were developed in terms of the most significant ground-truth parameters. The coefficients for these models were then evaluated; the fits to the sigma and T measurements were generally good. Finally, areas of needed additional observations were outlined and experiments were specified to further the understanding of the microwave-snowpack interaction mechanisms. A.R.H.

N80-26747# Geological Survey, Anchorage, Alaska.
THE UNITED STATES GEOLOGICAL SURVEY IN ALASKA, 1979 PROGRAMS
Katherine M. Reed, ed. 1979 100 p
(Circ-804-A) Avail: NTIS HC A05/MF A01

A survey of programs designed to identify the land, water, energy, and mineral resources of Alaska is presented. Emphasis is placed on demonstrating how the needs of both conservation and development can be met. Classification of federally owned mineral lands and water-power sites, the exploration and development of energy and natural resources on Federal and Indian lands, and the exploration and appraisal of the petroleum potential of the National Petroleum Reserve in Alaska are among the topics discussed. Regional geology, economic geology, stratigraphy, paleontology, hydrology, marine geology, and engineering and environmental geology are included. J.M.S.

N80-26748# Geological Survey, Washington, D. C.
INTRODUCTION TO MONITORING DYNAMIC ENVIRONMENTAL PHENOMENA OF THE WORLD USING SATELLITE DATA COLLECTION SYSTEMS, 1978
William D. Carter and Richard W. Paulson 1979 26 p refs
(Circ-803) Avail: NTIS HC A03/MF A01

Satellite telemetry systems that can collect and transmit environmental data from remote regions of the world to regional resources information centers are described. The features and limitations of global information systems are discussed with respect to instrumentation. R.C.T.

N80-26749# Central Intelligence Agency, Washington, D.C.
THE WORLD OIL MARKET IN THE YEARS AHEAD: A RESEARCH PAPER
Aug. 1979 87 p
(ER-79-10327U) Avail: NTIS HC A05/MF A01

A review of the oil market before 1973, during the period 1973 to 1978, and at the present time is given. The outlook for the world oil market over the next several years is analyzed. Oil production in the industrial countries, supplies from the developing countries, net exports from communist countries, and OPEC supplies are discussed. Alternative energy sources and the energy supply outlook for OECD countries are also considered. Other topics covered are factors affecting demand, the future energy market, and oil supplies in the long term. J.M.S.

N80-26750*# Miami Univ., Coral Gables, Fla. School of Engineering and Architecture.
THREE DIMENSIONAL THERMAL POLLUTION MODELS. VOLUME 1: REVIEW OF MATHEMATICAL FORMULATIONS Final Report
Samuel S. Lee and Subrata Sengupta May 1978 202 p refs 3 Vol.
(Contract NAS10-8926)
(NASA-CR-154624-Vol-1; KSC-TR-43-2-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 13B

A mathematical model package for thermal pollution analyses and prediction is presented. These models, intended as user's manuals, are three dimensional and time dependent using the primitive equation approach. Although they have sufficient generality for application at sites with diverse topographical features; they also present specific instructions regarding data preparation for program execution and sample problems. The mathematical formulation of these models is presented including assumptions, approximations, governing equations, boundary and initial conditions, numerical method of solution, and same results. J.M.S.

N80-26751*# Miami Univ., Coral Gables, Fla. School of Engineering and Architecture.
THREE DIMENSIONAL THERMAL POLLUTION MODELS. VOLUME 2: RIGID-LID MODELS Final Report
Samuel S. Lee and Subrata Sengupta May 1978 364 p 3 Vol.
(Contract NAS10-8926)
(NASA-CR-154624-Vol-2; KSC-TR-43-2-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 13B

Three versions of rigid lid programs are presented: one for near field simulation; the second for far field unstratified situations; and the third for stratified basins, far field simulation. The near field simulates thermal plume areas, and the far field version simulates larger receiving aquatic ecosystems. Since these versions have many common subroutines, a unified testing is provided, with main programs for the three possible conditions listed. J.M.S.

N80-26752*# Miami Univ., Coral Gables, Fla. School of Engineering and Architecture.
THREE DIMENSIONAL THERMAL POLLUTION MODELS. VOLUME 3: FREE SURFACE MODELS Final Report
Samuel S. Lee and Subrata Sengupta May 1978 231 p 3 Vol.
(Contract NAS10-8926)
(NASA-CR-154624-Vol-3; KSC-TR-43-2-Vol-3) Avail: NTIS HC A11/MF A01 CSCL 13B

Two sets of programs, named Nasum 2 and Nasum 3 are presented in detail. Nasum 2 is a far field formulation and is used without including the plant thermal discharge. Nasum 3 uses horizontal stretching to provide higher resolution at thermal discharge joints; and includes far field influences such as varying tides and ambient currents far from point of discharge. J.M.S.

N80-26753# Phoenix Corp., McLean, Va.
AN OVERVIEW OF THE EXTERNAL MAGNETIC FIELD WITH REGARD TO MAGNETIC SURVEYS Interim Report, May - Oct. 1979
Robert D. Regan and Paul Rodriguez 1 Oct. 1979 72 p refs
(Contract N00014-79-C-0409)
(AD-A083227) Avail: NTIS HC A04/MF A01 CSCL 08/14

This report sponsored by the Earth Physics Program of the Office of Naval Research, is an attempt to bring together in a coherent manner, for those involved in magnetic surveys, the relevant aspects of the external geomagnetic field. Although there are several excellent introductory texts on geomagnetism that treat much of this subject (most notably, Sugiura and Heppner, 1968; and Knecht, 1972) it was thought that there was a need to condense and present this and other supportive material in a form that would be more applicable to the objectives of magnetic surveys, as there is considerable interest in correcting magnetic surveys for the effects of the external field. Such efforts must start with a sufficiently detailed understanding of the geomagnetic environment in which magnetic survey data are collected and particularly of the various external field sources. Hopefully this report will serve to provide such an understanding. GRA

N80-26754# Pennzoil Co., Vienna, W. Va.
OIL RECOVERY BY CARBON DIOXIDE INJECTION Annual Report, Jul. 1978 - Jun. 1979

Paul E. King Nov. 1979 57 p
(Contracts EF-76-C-05-5301; DE-AC21-76MC-05301)
(ORO-5301-47) Avail: NTIS HC A04/MF A01

After one year of response, the increase in production due to waterflooding ended by December, 1978. The total production credited to the waterflood process was 10,403 barrels or 529 barrels per acre. Less than one month after limited carbon dioxide injection began, a high carbon dioxide content was found in the produced gas at Shaffer No. 1, apparently as a result of channeling through the Big Lime thief zone. In April, the carbon dioxide injection rate was reduced to a total of 90 tons per day in an attempt to increase the effective injection from 26.7% to the designed 50%. The net carbon dioxide injection was 10,595.50 tons on July 1, 1979, 42.3% of the total to be injected. DOE

N80-26755# World Meteorological Organization, Geneva (Switzerland).
APPLICATIONS OF REMOTE SENSING TO HYDROLOGY
R. D. Wiesnet, V. G. Konovalov, and S. I. Solomon 1979 62 p refs
(WMO-513; ISBN-92-62-10513-8) Avail: NTIS HC A04/MF A01; WMO, Geneva SWFR 10

The application of remote sensing to the collection of data on surface waters and related water balance elements is considered. The principles and techniques used are reviewed and the nature of the results obtained and their application are discussed. The various types of sensor, data-transmission systems and remote-sensing platforms which are used to obtain data on different hydrological elements are described. The practical application of remote sensing of surface water, lakes, snow, glaciers, precipitation and soil moisture is discussed. Subjects such as the use of meteorological radar of natural gamma radiation for remote sensing are dealt with to a limited extent. To determine the state-of-the-art in remote sensing of hydrological elements, a questionnaire was sent to selected members on WMO. A summary of the infividual replies to this questionnaire is appended. Author (ESA)

N80-26756# New York State Museum and Science Service, Albany.
AN EVALUATION OF THE IMPACT OF NATURAL RESOURCE INFORMATION ON LAND-USE DECISION MAKERS Final Report
James F. Davis, Robert Fakundiny, Richard Monheimer, Edgar Reilly, and Cathy A. Chazen 1 Jan. 1979 158 p refs
(Grant NSF DSI-75-12769)
(PB80-149131; NYSGS-79-0605-F) Avail: NTIS HC A08/MF A01 CSCL 13B

The effectiveness of natural resource data products on the governmental decision-making process was evaluated. Hartford, Connecticut and Syracuse, New York were studied to determine the most effective means for transmitting information from data producers to users, determine natural resource characteristics considered most significant by producers and users, and evaluate whether the effectiveness of data production and public land-use decisions can be determined. GRA

N80-26757# New York State Museum and Science Service, Albany.
AN EVALUATION OF THE IMPACT OF NATURAL RESOURCES INFORMATION ON LAND-USE DECISION MAKERS. APPENDICES 1-7 Final Report
James F. Davis, Robert Fakundiny, Richard Monheimer, Edgar Reilly, Cathy A. Chazen, Deborah G. Roach, Barbara A. Beberwych, Thomas Triscari, Elizabeth Mikols, and Mark Rappaport 1 Jan. 1979 291 p refs
(Grant NSF DSI-15-12769)
(PB80-149149; NYSGS-79-0605-App) Avail: NTIS HC A13/MF A01 CSCL 13B

Assessment of the effectiveness of natural resource data products on the governmental decision-making process in Hartford, Connecticut and Syracuse, New York suggests that all data producers should undertake an evaluation of users needs before designing the product. The basic questions to be asked are provided and product characteristics that should be considered are suggested. The information flow-system through which the products pass should be defined and translator/advisors should be identified and questioned. GRA

N80-26758# New Mexico Univ., Albuquerque.
REMOTE SENSING: PHOTOINTERPRETATION TECHNIQUES OF LANDSAT DATA. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977 - Jan. 1980
Robert W. Gonzales Mar. 1980 40 p Sponsored in cooperation with NASA and NTIS
(PB80-805484) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E

Various aspects of photointerpretation of LANDSAT data are considered in 152 abstracts of reports on photomapping, geologic and soil investigations, effect of vegetation on rock and soil, ecological land classification, forestry, terrain and crop analysis, and additive viewing as an interpretation technique. GRA

N80-26759# South Carolina Land Resources Conservation Commission, Columbia.
APPLICATION OF SATELLITE DATA TO SURFACE MINE MONITORING IN SELECTED COUNTIES OF SOUTH CAROLINA Final Report, Sep. 1977 - Sep. 1978
James N. Bayne and Hewson Lawrence Mar. 1979 141 p refs
(Grant DI-BM-G0-177166)
(PB80-144629; BM-OFR-11-80) Avail: NTIS HC A07/MF A01 CSCL 08I

The LANDSAT data from computer compatible tapes were used to explore the capability of LANDSAT digital imagery to monitor mining and reclamation activity in several South Carolina mining operations. Differentiation between active-spoil-partially and completely reclaimed areas was successfully demonstrated including small mining operations of less than 30 acres. GRA

N80-26760# National Weather Service, Salt Lake City, Utah. Hydrology Div.
OCCURRENCE AND DISTRIBUTION OF FLASH FLOODS IN THE WESTERN REGION
Thomas L. Dietrich Dec. 1979 53 p refs
(PB80-160344; NOAA-TM-NWS-WR-147; NOAA-80012202)
Avail: NTIS HC A04/MF A01 CSCL 08H

Flash floods that have occurred in the western United States as reported in the U.S. Geological Survey Annual Flood Summaries from 1950 to 1969 are described. GRA

N80-26761# Colorado Univ., Boulder.
NONSTRUCTURAL FLOODPLAIN MANAGEMENT STUDY: OVERVIEW
Gilbert F. White 1 Oct. 1979 14 p Sponsored in part by Water Resources Council, Washington, D. C.
(PB80-158538) Avail: NTIS HC A02/MF A01 CSCL 08H

Impediments to Federal sponsorship of nonstructural measures for flood plain management are discussed. GRA

N80-26762# Tetra Tech, Inc., Lafayette, Calif.
SEDIMENT-POLLUTANT RELATIONSHIPS IN RUNOFF FROM SELECTED AGRICULTURAL, SURBURBAN, AND URBAN WATERSHEDS. A STATISTICAL CORRELATION STUDY Final Report, Sep. 1977 - Sep. 1978
Stanley W. Zison Jan. 1980 150 p refs
(Contract EPA-68-03-2611)
(PB80-158108; EPA-600/3-80-022) Avail: NTIS HC A07/MF A01 CSCL 08H

Data from agricultural, surburban, and urban watersheds were subjected to statistical correlation analysis to estimate potency factors. These factors were coefficients that, when multiplied by sediment mass emission rates (transported in runoff), provide esimates of mass emission rates for other pollutants. The data were also subjected to multiple regression analysis to examine the effect of storm parameters on runoff water quality and the interrelationship among runoff water quality constituent concentrations themselves (other than sediment load). GRA

N80-26763# California Univ., Los Angeles. School of Engineering and Applied Science.
BENEFITS OF LONG-RANGE STREAMFLOW PREDICTION
William W-G. Yeh, Leonard Becker, Marvin J. Cohn (Calif. State

Dept. of Water Resources), and Robert Zettlemoyer Feb. 1980 38 p refs Sponsored in part by Calif. State Dept. of Water Resources, Sacramento
(PB80-156276; Contrib-181; ISSN-0575-4941) Avail: NTIS HC A03/MF A01 CSCL 08H

Improved benefits that might be gained from the use of long range stream flow forecasts in the operation of a typical multipurpose reservoir are assessed. Long range is defined as a period of time ranging from one month to one year. The Oroville-Thermalito reservoir system is selected for study. Major benefits to be derived from long term stream flow prediction for this system are hydropower generation, water conservation for irrigation and/or other beneficial uses, and decreased seepage damage to crops. Flood control benefits are potentially high but those benefits are more amenable to short term rather than long term forecasting. The reservoir is theoretically operated over the 1914 to 1973 time period. GRA

N80-27099# International Training Centre for Aerial Survey, Enschede (Netherlands).
DIGITAL IMAGE PROCESSING OF SATELLITE PHOTOGRAPHS [DIGITALE BEELDVERWERKING VAN SATELLIET OPNAMEN]
Nico H. W. Donker *In* Amsterdam Univ. The Computer in Phys. Geograph. 1979 p 35-61 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-26764* National Aeronautics and Space Administration, Washington, D. C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Apr. 1980 408 p
(NASA-SP-7043(25)) Avail: NTIS HC A18 CSCL 10B

This bibliography lists 1428 reports, articles, and other documents introduced into the NASA scientific and technical information system from January 1, 1980 through March 31, 1980. Author

N80-26765# Gulf Research and Development Co., Pittsburgh, Pa.
REFINERY ENERGY PROFILE: USER'S GUIDE
R. W. Maier, W. P. Olivent, D. L. Brandt, and T. G. Golden Jan. 1979 146 p
(Contract EY-77-C-05-5262)
(ORO-5262-6) Avail: NTIS HC A07/MF A01

The step by step procedure that was developed for preparing energy profiles at any refinery is described. The technique is presented in four parts covering preparation, data gathering, performing calculations and preparing the profiles. Rigorous calculation procedures are used that require the collection of substantial amounts of data and in some cases use commercially available computer programs. Since situations can arise where the data required for rigorous procedures or computer programs cannot be obtained, alternate calculation procedures are given which can be used when some sacrifice in accuracy is justifiable and acceptable. R.E.S.

N80-26766*# Travis-Braun and Associates, Inc., Dallas, Tex.
SOLAR ENERGY FACILITY AT NORTH HAMPTON RECREATION CENTER, DALLAS, TEXAS Final Report
May 1980 141 p
(Contract EX-76-C-01-2543)
(NASA-CR-161444) Avail: NTIS HC A07/MF A01 CSCL 10A

The solar energy facility located at the North Hampton Park Recreation and Health Center, Dallas, Texas is presented. The solar energy system is installed in a single story (two heights), 16,000 sq ft building enclosing a gymnasium, locker area, and health care clinic surrounded by a recreational area and athletic field. The solar energy system is designed to provide 80 percent of the annual space heating, 48 percent of the annual space cooling, and 90 percent of the domestic hot water requirements. The system's operation modes and performance data acquisition system are described. The system's performance during the months of June, July, August, September, and October of 1979 are presented and show a negative savings of energy. Experience to date indicates however that the system concept has promise of acceptable performance. It is concluded that if proper control and sequencing components was maintained, then the system performance would improve to an acceptable level. R.E.S.

N80-26767*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 13: ELECTRICAL CHARACTERISTICS OF HUGHES LPE GALLIUM ARSENIDE SOLAR CELLS AS A FUNCTION OF INTENSITY AND TEMPERATURE
B. E. Anspaugh, D. M. Beckert, R. G. Downing, T. F. Miyahira, and R. S. Weiss 1 Jun. 1980 40 p
(Contract NAS7-100)
(NASA-CR-163025; JPL-Pub-78-15-Vol-13) Avail: NTIS HC A03/MF A01 CSCL 10A

Electrical characteristics of Hughes Liquid phase epitaxy, P/N gallium aluminum arsenide solar cells are presented in graphical and tabular format as a function of solar illumination intensity and temperature. Author

N80-26768*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PHOTOVOLTAIC RESIDENTIAL APPLICATIONS PROGRAM IMPLEMENTATION WORKSHOP PROCEEDINGS
R. H. Barbieri 15 May 1980 166 p Workshop held at Calif. Inst. of Tech., Pasadena, 12-13 Feb. 1980
(Contract NAS7-100; EX-76-A-29-1012)
(NASA-CR-163274; JPL-Pub-80-22) Avail: NTIS HC A08/MF A01 CSCL 10B

Two major aspects of the workshop are presented: (1) presentations on the Photovoltaic program and the National Solar Heating and Cooling Demonstration program, and (2) discussions on the issues pertinent to the Residential Application program. R.E.S.

N80-26769*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Solar Thermal Power Systems Project.
COST AND PRICE ESTIMATE OF BRAYTON AND STIRLING ENGINES IN SELECTED PRODUCTION VOLUMES
H. R. Fortgang and H. F. Mayers 31 May 1980 16 p
(Contracts NAS7-100; DE-AI01-79ET-20397; JPL Proj. 5105-29)
(NASA-CR-163265; DOE/JPL-1060/35; JPL-Pub-80-42) Avail: NTIS HC A02/MF A01 CSCL 10B

The methods used to determine the production costs and required selling price of Brayton and Stirling engines modified for use in solar power conversion units are presented. Each engine part, component and assembly was examined and evaluated to determine the costs of its material and the method of manufacture based on specific annual production volumes. Cost estimates are presented for both the Stirling and Brayton engines in annual production volumes of 1,000, 25,000, 100,000 and 400,000. At annual production volumes above 50,000 units, the costs of both engines are similar, although the Stirling engine costs are somewhat lower. It is concluded that modifications to both the Brayton and Stirling engine designs could reduce the estimated costs. R.E.S.

N80-26770*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THERMAL POWER SYSTEMS (TPS); POINT-FOCUSING THERMAL AND ELECTRIC APPLICATIONS (PFTEA).

VOLUME 2: DETAILED REPORT, FISCAL YEAR 1979
15 Jan. 1980 146 p refs
(Contracts NAS7-100; Contract DE-AI01-79ET-20397)
(NASA-CR-163023; DOE/JPL-1060/31-Vol-2; JPL-Pub-79-118-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 10A

Progress in the development of systems which employ point focusing distributed receiver technology is reported. Emphasis is placed on the first engineering experiment, the Small Community Solar Thermal Power Experiment. Procurement activities for the Military Module Power Experiment the first of a series of experiments planned as part of the Isolated Load Series are included. J.M.S.

N80-26771*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COST OF CZOCHRALSKI WAFERS AS A FUNCTION OF DIAMETER
M. H. Leipold, C. Radics, and A. Kachare 15 Feb. 1980 20 p
(Contracts NAS7-100; EX-76-A-29-1012)
(NASA-CR-163277; DOE/JPL-1012/37; JPL-Pub-80-25) Avail: NTIS HC A02/MF A01 CSCL 10A

The impact of diameter in the range of 10 to 15 cm on the cost of wafers sliced from Czochralski ingots was analyzed. Increasing silicon waste and decreasing ingot cost with increasing ingot size were estimated along with projected costs. Results indicate a small but continuous decrease in sheet cost with increasing ingot size in this size range. Sheet costs including silicon are projected to be $50 to $60/sq m (1980 $) depending upon technique used. R.E.S.

N80-26772*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOTHERMAL DIRECT HEAT USE: MARKET POTENTIAL/PENETRATION ANALYSIS FOR FEDERAL REGION 9
William Powell, ed. and Kenneth Tang, ed. May 1980 337 p
(Contract NAS7-100)
(NASA-CR-163267; JPL-Pub-80-41) Avail: NTIS HC A15/MF A01 CSCL 10B

A preliminary study was made of the potential for geothermal direct heat use in Arizona, California, Hawaii, and Nevada (Federal Region 9). An analysis was made of each state to: (1) define the resource, based on the latest available data; (2) assess the potential market growth for geothermal energy; and (3) estimate the market penetration, projected to 2020. Findings of the study include the following: (1) Potentially economical hydrothermal resources exist in all four states of the Region: however, the resource data base is largely incomplete, particularly for low to moderate temperature resources. (2) In terms of beneficial heat, the total hydrothermal resource identified so far for the four states is on the order of 43 Quads, including an estimated 34 Quads of high temperature resources which are suitable for direct as well as electrical applications. (3) In California, Hawaii, and Nevada, the industrial market sector has somewhat greater potential for penetration than the residential/commercial sector. In Arizona, however, the situation is reversed, due to the collocation of two major metropolitan areas (Phoenix and Tucson) with potential geothermal resources. R.E.S.

N80-26773*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LOW-COST SOLAR ARRAY PROJECT AND PROCEEDINGS OF THE 14TH PROJECT INTEGRATION MEETING Progress Report, Aug. - Dec. 1979
R. R. McDonald 3 Apr. 1980 479 p Meeting held 5-6 Dec. 1979
(Contracts NAS7-100; EX-76-A-29-1012; JPL Proj. 5101-142)
(NASA-CR-163263; DOE/JPL-1012/42; JPL-Pub-80-21; PR-14) Avail: NTIS HC A21/MF A01 CSCL 10A

Activities are reported on the following areas: project analysis and integration; technology development in silicon material, large area sheet silicon, and encapsulation; production process and equipment development; and engineering and operations, and the steps taken to integrate these efforts. Visual materials presented at the project Integration Meeting are included. R.E.S.

N80-26774*# Toledo Univ., Ohio.
NONLINEAR AEROELASTIC EQUATIONS OF MOTION OF TWISTED, NONUNIFORM, FLEXIBLE HORIZONTAL-AXIS WIND TURBINE BLADES Final Report
Krishna Rao V. Kaza Jul. 1980 70 p refs
(Grant NsG-3139; Contract EX-76-I-01-1028)
(NASA-CR-159502; DOE/NASA/3139-1) Avail: NTIS HC A04/MF A01 CSCL 10A

The second-degree nonlinear equations of motion for a flexible, twisted, nonuniform, horizontal axis wind turbine blade were developed using Hamilton's principle. A mathematical ordering scheme which was consistent with the assumption of a slender beam was used to discard some higher-order elastic and inertial terms in the second-degree nonlinear equations. The blade aerodynamic loading which was employed accounted for both wind shear and tower shadow and was obtained from strip theory based on a quasi-steady approximation of two-dimensional, incompressible, unsteady, airfoil theory. The resulting equations had periodic coefficients and were suitable for determining the aeroelastic stability and response of large horizontal-axis wind turbine blades. R.E.S.

N80-26775*# Boeing Engineering and Construction, Seattle, Wash.
MOD-2 WIND TURBINE SYSTEM CONCEPT AND PRELIMINARY DESIGN REPORT. VOLUME 2: DETAILED REPORT
Jul. 1979 269 p
(Contracts DEN3-2; DE-A101-793T-20305)
(NASA-CR-159609; DOE/NASA-0002-80/2) Avail: NTIS HC A12/MF A01 CSCL 10A

The configuration development of the MOD-2 wind turbine system (WTS) is documented. The MOD-2 WTS project is a continuation of DOE programs to develop and achieve early commercialization of wind energy. The MOD-2 is design optimized for commercial production rates which, in multiunit installations, will be integrated into a utility power grid and achieve a cost of electricity at less than four cents per kilowatt hour. J.M.S.

N80-26776*# General Electric Co., Philadelphia, Pa.
DESIGN, FABRICATION, TEST, AND QUALIFICATION AND PRICE ANALYSIS OF THIRD GENERATION DESIGN SOLAR CELL MODULES
N. F. Shepard 31 Mar. 1980 113 p
(Contract JPL-955401)
(NASA-CR-163028; DOE/JPL-955401-80/1; JPL-9950-353) Avail: NTIS HC A06/MF A01 CSCL 10A

The Block 4 shingle type module makes it possible to apply a photovoltaic array to the sloping roof of a residential building by simply nailing the overlapping hexagon shaped shingles to the plywood roof sheathing. This third-generation shingle module design consists of nineteen series connected 100 mm diameter solar cells which are arranged in a closely packed hexagon configuration to provide in excess of 75 watts/sq m of exposed module area under standard operating conditions. The solar cells are individually bonded to the embossed underside of a 4.4 mm thick thermally tempered piece of glass. An experimental silicone pottant was used as the transparent bonding adhesive between the cells and glass. The semi-flexible portion of each shingle module is a composite laminate construction consisting of an outer layer of FLEXSEAL bonded to an inner core of closed cell polyethylene foam. Silaprene is used as the substrate laminating adhesive. The module design has satisfactorily survived qualification testing program which includes 50 thermal cycles between -40 and +90 C, a seven day temperature-humidity exposure test, and a wind resistance test. E.J.R.

N80-26777*# Sanders Associates, Inc., Nashua, N. H. Energy Systems Center.
DEVELOPMENT OF AN AIR BRAYTON SOLAR RECEIVER
[1980] 149 p
(Contract JPL-955120)
(NASA-CR-163027; JPL-9950-351) Avail: NTIS HC A07/MF A01 CSCL 10A

Various receiver configurations and operating conditions were examined. The interface requirements between the receiver/concentrator/power module were addressed. Production cost estimates were obtained to determine the cost of the receiver during the 1980 timeframe. A conceptual design of an air Brayton solar receiver is presented based on the results. The following

design goals were established: (1)peak thermal input power - 85 KWt; (2)receiver outlet air temperature - 1500 F; (3)receiver inlet air temperature - 1050 F; (4)design mass flow rate - 0.533 lb/sec; and (5)design receiver inlet pressure - 36.75 psia. J.M.S.

N80-26778*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR ELCAM TEMPE ARIZONA STATE UNIVERSITY, TEMPE, ARIZONA Progress Report, Jun. 1979 - Jan. 1980
May 1980 71 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161466) Avail: NTIS HC A04/MF A01 CSCL 10A

The solar system, Elcam-Tempe, was designed by Elcam Incorporated, Santa Barbara, California, to supply commercial domestic hot water heating systems to the Agriculture Department residence at Arizona State University. The building is a single story residence located at the agriculture experiment farm of the Arizona State University. The energy system's four modes of operation are described. Electrical energy savings at the site was a net of 5.54 million Btu after the 0.17 million Btu of operating energy required to operate collector loop circulating pump were subtracted. The energy savings due to solar was less than the system's potential. On an average, twice as much hot water could have been used with signifient solar energy contribution. The system corrosion and deposits caused by using dissimilar metals in the collector loop was the only problem noted with the Elcam-Tempe system. R.E.S.

N80-26779*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
PARAMETRIC STUDY OF PROSPECTIVE EARLY COMERCIAL MHD POWER PLANTS (PSPEC). GENERAL ELECTRIC COMPANY, TASK 1: PARAMETRIC ANALYSIS Final Report
C. H. Marston, F. N. Alyea, D. J. Bender, L. K. Davis, T. C. Dellinger, J. G. Hnat, E. H. Komito, C. A. Peterson, D. A. Rogers, A. J. Roman et al Feb. 1980 358 p refs Prepared in cooperation with Foster Wheeler Corp., Livingston, N.J., Hooker Chemical Co., Niagara Falls, N.Y. and Bechtel National, Inc., San Francisco
(Contract DEN3-52; EF-77-A01-2674)
(NASA-CR-159634; DOE/NASA/0052-79/1) Avail: NTIS HC A16/MF A01 CSCL 10B

The performance and cost of moderate technology coal-fired open cycle MHD/steam power plant designs which can be expected to require a shorter development time and have a lower development cost than previously considered mature OCMHD/steam plants were determined. Three base cases were considered: an indirectly-fired high temperature air heater (HTAH) subsystem delivering air at 2700 F, fired by a state of the art atmospheric pressure gasifier, and the HTAH subsystem was deleted and oxygen enrichment was used to obtain requisite MHD combustion temperature. Coal pile to bus bar efficiencies in ease case 1 ranged from 41.4% to 42.9%, and cost of electricity (COE) was highest of the three base cases. For base case 2 the efficiency range was 42.0% to 45.6%, and COE was lowest. For base case 3 the efficiency range was 42.9% to 44.4%, and COE was intermediate. The best parametric cases in bases cases 2 and 3 are recommended for conceptual design. Eventual choice between these approaches is dependent on further evaluation of the tradeoffs among HTAH development risk, O2 plant integration, and further refinements of comparative costs. J.M.S.

N80-26780*# MB Associates, San Ramon, Calif.
PROCESS DEVELOPMENT FOR AUTOMATED SOLAR CELL AND MODULE PRODUCTION. TASK 4: AUTOMATED ARRAY ASSEMBLY Final Report
30 Jun. 1980 204 p
(Contract JPL-954882)
(NASA-CR-163032; DOE/JPL-954882-80/21; JPL-9950-364)
Avail: NTIS HC A10/MF A01 CSCL 10A

A process sequence which can be used in conjunction with automated equipment for the mass production of solar cell modules for terrestrial use was developed. The process sequence was then critically analyzed from a technical and economic standpoint to determine the technological readiness of certain process steps for implementation. The steps receiving analysis were: back contact metallization, automated cell array layup/interconnect, and module edge sealing. For automated layup/interconnect, both hard automation and programmable automation (using an industrial robot) were studied. The programmable automation system was then selected for actual hardware development. R.E.S.

N80-26781*# Bechtel National, Inc., San Francisco, Calif.
STUDY OF CURVED GLASS PHOTOVOLTAIC MODULE AND MODULE ELECTRICAL ISOLATION DESIGN REQUIREMENTS Final Report
Jun. 1980 182 p refs
(Contract JPL-954698)
(NASA-CR-163033; DOE/JPL-954698-80/2; JPL-9950-365)
Avail: NTIS HC A09/MF A01 CSCL 10A

The design of a 1.2 by 2.4 m curved glass superstrate and support clip assembly is presented, along with the results of finite element computer analysis and a glass industry survey conducted to assess the technical and economic feasibility of the concept. Installed costs for four curved glass module array configurations are estimated and compared with cost previously reported for comparable flat glass module configurations. Electrical properties of candidate module encapsulation systems are evaluated along with present industry practice for the design and testing of electrical insulation systems. Electric design requirements for module encapsulation systems are also discussed. R.E.S.

N80-26782*# Spectrolab, Inc., Sylmar, Calif.
HIGH RESOLUTION, LOW COST SOLAR CELL CONTACT DEVELOPMENT Final Report
N. Mardesich Dec. 1979 50 p
(Contracts NAS7-100; JPL-955298)
(NASA-CR-163289; DOE/JPL-955298-80/2; JPL-9950-368)
Avail: NTIS HC A03/MF A01 CSCL 10A

The experimental work demonstrating the feasibility of the MIDFILM process as a low cost means of applying solar cell collector metallization as reported. Cell efficiencies of above 14% (AMI, 28 C) were achieved with fritted silver metallization. Environmental tests suggest that the metallization is slightly humidity sensitive and degradation is observed on cells with high series resistance. The major yield loss in the fabrication of cells was due to discontinuous grid lines, resulting in high series resitance. Standard lead-tin solder plated interconnections do not appear compatible with the MIDFILM contact. Copper, nickel and molybdenum base powder were investigated as low cost metallization systems. The copper based powder degraded the cell response. The nickel and molybdenum base powders oxidized when sintered in the oxidizing atmosphere necessary to ash the photoresin. Author

N80-26783*# Syncal Corp., Sunnyvale, Calif.
DEVELOPMENT OF ADVANCED THERMOELECTRIC MATERIALS, PHASE A
30 May 1980 42 p
(Contract JPL-954349)
(NASA-CR-163041; JPL-9950-370) Avail: NTIS HC A03/MF A01 CSCL 10A

Work performed on the chemical system characterized by chrome sulfide, chrome selenide, lanthanum selenide, and lanthanum sulfide is described. Most materials within the chemical systems possess the requisites for attractive thermoelectric materials. The preparation of the alloys is discussed. Graphs show the Seebeck coefficient, electrical resistivity, and thermal conductivity of various materials within the chemical systems. The results of selected doping are included. A.R.H.

N80-26784*# Aerospace Corp., El Segundo, Calif.
CENTRAL STATION APPLICATIONS PLANNING ACTIVITIES AND SUPPORTING STUDIES Final Report
S. L. Leonard and B. Siegel Apr. 1980 117 p refs
(Contract JPL-955434)
(NASA-CR-163042; JPL-9950-372; ATR-80(7820-04)-2) Avail: NTIS HC A06/MF A01 CSCL 10B

The application of photovoltaic technology in central station (utility) power generation plants is considered. A program of

data collection and analysis designed to provide additional information about the subset of the utility market that was identified as the initial target for photovoltaic penetration, the oil-dependent utilities (especially municipals) of the U.S. Sunbelt, is described along with a series of interviews designed to ascertain utility industry opinions about the National Photovoltaic Program as it relates to central station applications. J.M.S.

N80-26785*# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
MICROWAVE BEAMED POWER TECHNOLOGY IMPROVEMENT Final Report
W. C. Brown 15 May 1980 48 p
(Contracts NAS7-100)
(NASA-CR-163043; JPL-9950-373; PT-5613) Avail: NTIS HC A03/MF A01

The magnetron directional amplifier was tested for (1) phase shift and power output as a function of gain, anode current, and anode voltage, (2) background noise and harmonics in the output, (3) long life potential of the magnetron cathode, and (4) high operational efficiency. Examples of results were an adequate range of current and voltage over which 20 dB of amplification could be obtained, spectral noise density 155 dB below the carrier, 81.7% overall efficiency, and potential cathode life of 50 years in a design for solar power satellite use. A fabrication method was used to fabricate a 64 slot, 30 in square slotted waveguide array module from 0.020 in thick aluminum sheet. The test results on the array are discussed. J.M.S.

N80-26786# Committee on Science and Technology (U. S. House)
OVERSIGHT: INDUSTRIAL ENERGY CONSERVATION, VOLUME 10
Washington 1979 327 p refs Hearing before Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 49, 11 Sep. 1979
(GPO-53-020) Avail: SOD

Testimony delivered and statements received in support of industrial energy conservation through cogeneration are presented. The Federal government's role and policy on industrial energy conservation is discussed. R.E.S.

N80-26787# Central Technical Inst. TNO, Apeldoorn (Netherlands). Afdeling Warmte- en Koudetechniek.
LECTURES ON HEAT TECHNOLOGY IN THE NETHERLANDS [VOORDRACHTEN VAN DE 39 STE VAKANTIE-LEERANG VOOR WARMTETECHNIEK, GEHOUDEN OP 23 EN 24 AUGUSTUS, 1977]
1977 69 p refs In DUTCH; ENGLISH summary Lectures of the 39th Summer Course on Heat Technol., 23-24 Aug. 1977 Prepared in cooperation with Koninkelijke Inst. van Ingenieurs, The Hague, Netherlands Technische Vereniging voor Verwarming en Luchtbehandeling
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

Lectures were given dealing with heat-activated heat pumps, heat pumps in home heating, air/air heat pumps, energy consumption and possible savings in office buildings, solar water heating, and design of a home solar heating unit through use of a mathematical model. For individual titles, see N80-26788 through N80-26793.

N80-26788# Central Technical Inst. TNO, Apeldoorn (Netherlands). Afdeling Warmte- en Koudetechniek.
HEAT-ACTIVITED HEAT PUMPS
H. vanderRee *In its* Lectures on Heat Technol. in the Netherlands 1977 p 5-18 refs In DUTCH; ENGLISH summary (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

The thermodynamics of energy conversion through heat-activated heat pumps are described. Some practical systems, heat performances and recent developments in this field are discussed. A distinction is made between processes which depend on the transfer of mechanical energy and systems that are characterized by the fact that moving parts are absent or nearly absent (absorption, resorption, ejector heat pumps) Author (ESA)

N80-26789# Central Technical Inst. TNO, Apeldoorn (Netherlands). Afdeling Warmte- en Koudetechniek.
SURVEY OF FOREIGN RESEARCH IN THE FIELD OF HEAT PUMPS FOR THE HEATING OF DWELLINGS [OVERZICHT VAN BUITENLANDSE ONDERZOEKEN AAN WARMTEPOMPEN VOOR WONINGVERWARMING]
W. E. J. deBeyer *In its* Lectures on Heat Technol. in the Netherlands 1977 p 19-29 refs In DUTCH (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

The literature of the U.S.A., Germany, France, Sweden, Denmark, Switzerland, and England shows that parallel and often overlapping research is being done. Topics covered are: heat recovery; cycle systems; waste heat recovery; cryogenics; unitary heat pumps; thermal flow; and mono and bivalent heat pumps. Economic aspects are also discussed. Author (ESA)

N80-26790# Central Technical Inst. TNO, Apeldoorn (Netherlands). Afdeling Warmte- en Koudetechniek.
CASE STUDY OF AN AIR TO AIR HEAT PUMP [PRAKTIJKONDERZOEK AAN EEN LUCHT/LUCHT WARMTEPOMP]
J. F. vanderHorst *In its* Lectures on Heat Technol. in the Netherlands 1977 p 31-38 refs In DUTCH (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

A commercially available, electrically operated air-to-air heat pump was installed and tested in a single family dwelling in the Netherlands. The unit functioned reliably, but no energy savings was possible. Air transport via the evaporator and condenser was insufficient, and did not permit the manufacturers specifications to be met. Author (ESA)

N80-26791# Technische Physische Dienst TNO-TH, Delft (Netherlands).
EXAMINATION OF ENERGY CONSUMPTION AND THE POSSIBILITIES OF ENERGY SAVINGS IN OFFICE BUILDINGS [ONDERZOEK OUER HET ENERGIEVERBRUIK EN OVER DE MOGELIJKHEDEN TOT ENERGIEBESPARING IN UTILITEITSGEBOUWEN]
P. Euser, M. Hugenholtz (Adviesbureau), and P. W. Deerns (Bureau Deerns) *In* Central Tech. Inst. Lectures on Heat Technol. in the Netherlands 1977 p 39-50 refs In DUTCH (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

Projected energy savings were computed for various building shapes and orientations with respect to the Sun. The effects of making better use of daylight, of using lower light levels, of directing light at work areas, and of continuously regulating the levels of artificial lighting, are shown. Author (ESA)

N80-26792# Technische Physische Dienst TNO-TH, Delft (Netherlands).
THE POTENTIAL FOR HEAT PRODUCTION WITH SOLAR WATER HEATERS IN THE NETHERLANDS CLIMATE [DE POTENTIELE WARMTEPRODUKTIE MET EEN ZONNEBOILER IN HET NEDERLANDSE KLIMAAT]
C. denOuden *In* Central Tech. Inst. Lectures on Heat Technol. in the Netherlands 1977 p 51-57 refs In DUTCH (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

The technical aspects of the solar water heater are described, and various designs presented. The energy production during an average year in the Netherlands using different configurations is computed. An economic analysis based upon a system with a 4 sq m collector is given. Author (ESA)

N80-26793# Technische Physische Dienst TNO-TH, Delft (Netherlands).
THE DESIGN OF A SOLAR HOME HEATING INSTALLATION, USING A MATHEMATICAL MODEL [HET ONTWERPEN VAN EEN ZONNEVERWARMINGS- INSTALLATIE VOOR EEN WONING MET BEHULP VAN EEN REKENMODEL]
E. vanGalen, A. J. T. M. Wijsman, and C. denOuden *In* Central Tech. Inst. Lectures on Heat Technol. in the Netherlands 1977

p 59-69 ref In DUTCH Sponsored by Netherlands Min. van Econ. Zaken (For primary document see N80-26787 17-44) Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

The model is capable of simulating a complete system, including the collector and the distribution system in the home. Efficiencies of various types of collectors are accommodated. Results of some runs are presented. Comparative cost data for solar and conventional systems are given. Solar systems are shown to be economical for home heating only in well-insulated buildings. Author (ESA)

N80-26794# American Univ., Washington, D. C.
DEFINITION OF CHEMICAL AND ELECTROCHEMICAL PROPERTIES OF A FUEL CELL ELECTROLYTE Interim Technical Report, 24 Jul. 1978 - 24 Dec. 1979
Jalil Ahmad and R. T. Foley Jan. 1980 70 p refs
(Contract DAAK79-77-C-0080; DA Proj. 1K1-61102-AH-51)
(AD-A083608) Avail: NTIS HC A04/MF A01 CSCL 07/4

The present research is oriented toward the task of developing an improved electrolyte for the direct hydrocarbon-air fuel cell. The electrochemical behavior of methanesulfonic acid, ethanesulfonic acid, and sulfoacetic acid as fuel cell electrolytes was studied in a half cell at various temperatures. The rate of electro-oxidation of hydrogen at 115 degrees was very high in methanesulfonic acid and sulfoacetic acids. The rate of the electro-oxidation of propene in methanesulfonic acid at 80 C and 115 C was low. Further, there is evidence for adsorption of these acids on the platinum electrode. Sulfoacetic acid with H2 has supported about two times higher current density than trifluoromethanesulfonic acid monohydrate, but, attempts to purify the compound were unsuccessful. It was concluded that anhydrous sulfonic acids are not good electrolytes; water solutions are required. Sulfonic acids containing unprotected C-H bonds are adsorbed on platinum and probably decompose during electrolysis. A completely substituted sulfonic acid would be the preferred electrolyte. GRA

N80-26795# Tennessee Univ., Knoxville. Dept. of Chemistry.
EVALUATION OF LOW MELTING HALIDE SYSTEMS FOR BATTERY APPLICATIONS Interim Report, 1 Sep. 1978 - 31 Aug. 1979
Gleb Mamantov AFAPL Wright-Patterson AFB, Ohio Nov. 1979 47 p refs
(Contract F33615-78-C-2075; AF Proj. 3145)
(AD-A083434; AFAPL-TR-79-2124) Avail: NTIS HC A03/MF A01 CSCL 10/3

This three year program involves evaluation of selected low temperature molten salt solvent systems containing inorganic and/or organic chlorides and bromides for battery applications. The research involves determination of the liquidus temperatures, the specific electrical conductivity, and the electrochemical span of selected halide systems. Characterization of the solvent species by Raman spectroscopy, vapor pressure measurements, and the electrochemical study of a few cathode and anode systems will be undertaken for the most promising solvent system. GRA

N80-26796# Rocketdyne, Canoga Park, Calif.
HIGH ENERGY STORAGE FLYWHEEL TEST PROGRAM Final Report
D. R. Hodson 28 Jan. 1980 148 p refs
(Contract DAAG53-75-C-0278)
(AD-A083302; RI/RD78-207-1) Avail: NTIS HC A07/MF A01 CSCL 10/3

The RS-31 Flywheel System is an energy storage device which is accelerated by an AVCO LYCOMING T55-L-7C 2930 SHP drive engine to 14,508 RPM. The two contra-rotating double disk rotors of the flywheel module have an inertia of 320,176 sq. in.-lbs storing 30 KW-HRS of energy at design speed. This was a Research Development test activity designed to explore and verify design predictions of system performance. GRA

N80-26797# Research Triangle Inst., Research Triangle Park, N. C.
DEVELOPMENT OF HIGH EFFICIENCY STACKED MULTIPLE BANDGAP SOLAR CELLS Final Report, 1 Aug. 1978 - 30 Sep. 1979
S. M. Bedair, J. R. Hauser, M. F. Lamorte, S. Phatak, M. L. Timmons, J. E. Andrews, and M. Simmons Wright-Patterson AFB AFAPL Oct. 1979 102 p refs
(Contract F33615-78-C-2077)
(AD-A083092; RTI-41U-1678; AFAPL-TR-79-2116) Avail: NTIS HC A06/MF A01 CSCL 10/2

The objective of this research was to develop the technology required to fabricate two-junction, cascade solar cell assemblies having conversion efficiencies exceeding 25 percent when operating at 25 deg C under 1 sun, AM O conditions. The experimental effort has focused on several different III-V ternary and quaternary materials that show promise for use in fabricating a cascade cell. These include GaAlAs, GaInAs, GaInP, GaAsSb, and GaAlAsSb. The work also includes theoretical calculations of cascade solar cell performance over a wide range of operating temperatures. GRA

N80-26798# Army Construction Engineering Research Lab., Champaign, Ill.
DENSIFIED BIOMASS AS AN ALTERNATIVE ARMY HEATING AND POWER PLANT FUEL HEATING Final Report
S. A. Hathaway, J. S. Lin, D. Mahon, T. Magrino, and K. Duster Mar. 1980 88 p refs
(AD-A083317; CERL-TR-E-158) Avail: NTIS HC A05/MF A01 CSCL 10/1

This investigation evaluated the technical and economic potential of using of densified biomass (principally wood pellets) as a coal substitute in Army heating and power plants. The report reviews Department of Defense DOD experience with and tests of wood pellets production of wood pellets (excluding silvicultural aspects) handling, storing, and feeding; combustion; major environmental considerations; and economics of use. GRA

N80-26799# Naval Research Lab., Washington, D. C. Plasma Technology Branch.
CURRENT INTERRUPTION IN INDUCTIVE STORAGE SYSTEMS WITH INERTIAL CURRENT SOURCE Interim Report
I. M. Vitkovitsky, D. Conte, R. D. Ford, and W. H. Lupton 5 Mar. 1980 23 p refs
(RP0110941)
(AD-A083914; NRL-MR-4168) Avail: NTIS HC A02/MF A01 CSCL 10/2

Utilization of inertial current source inductive storage with high power output requires a switch with short opening time. This switch must operate as a circuit breaker, i.e., be capable to carry the current for a time period characteristic of inertial systems, such as homopolar generators. For reasonable efficiency, its opening time must be fast to minimize the energy dissipated in downstream fuse stages required for any additional pulse compression. A switch that satisfies these criteria, as well as other requirements such as that for high voltage operation associated with high power output, is an explosively driven switch consisting of large number of gaps arranged in series. The performance of this switch in limiting and/or interrupting currents produced by large generators has been studied. Single switch modules were designed and tested for limiting the commutating current output of 1 MW, 60 Hz, generator and 500 KJ capacitor banks. Current limiting and commutation were evaluated, using these sources, for currents ranging up to 0.4 MA. The explosive opening of the switch was found to provide an effective first stage for further pulse compression. It opens in tens of microseconds, commutates current at high efficiency (> = 905) recovers very rapidly over a wide range of operating conditions. GRA

N80-26800# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
REQUIREMENT DEFINITION AND PRELIMINARY DESIGN OF A PHOTOVOLTAIC CENTRAL POWER STATION EXPERIMENTAL TEST FACILITY. VOLUME 2: SOLMET SITE INSOLATION AND WEATHER DATA
G. OBrien Dec. 1979 481 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7022-Vol-2) Avail: NTIS HC A21/MF A01

The results of a study of the requirements and preliminary design for a photovoltaic central power station experimental

test facility presented. The facility's initial capacity of 2 MW with growth to 10 MW is intended to assess photovoltaic array fields operating as generation sources in utility systems. Requirements, a preliminary design, costs and schedule were established for the facility construction. Utility participation were reviewed with selected utilities, and both a site selection methodology and a summary set of combined continental US insolation and meteorological data was prepared. A set insolation and weather data for 26 SOLMET sites are included. DOE

N80-26801# Boeing Engineering and Construction, Seattle, Wash.
SOLAR CENTRAL RECEIVER PROTOTYPE HELIOSTAT. VOLUME 3: COST ESTIMATES
1 Jun. 1978 149 p
(Contract EG-77-C-03-1604)
(SAN-1604-3) Avail: NTIS HC A07/MF A01

The Boeing heliostat design was produced and installed for a capital cost of $42 per square meter at high commercial plant quantities and rates. This is 14% less than the DOE cost target. Even at a low commercial plant production rate of 25,000 heliostats per year the captial cost of $48 per square meter 2% less than the cost goal established by the DOE. Projected captial cost and 30 year maintenance costs for three scenarios of production and installation are presented: (1) commercial rate production of 25,000, 25,000 and 1,000,000 heliostats per year; (2) a one-time only production of 25,000 heliostats per year with each plant (25,000 heliostats) installed at widely dispersed sites throughout the southwestern United States. These three scenarios for solar plant locations and the manufacturing/installation processes are fully described, and detailed cost breakdowns for the three scenarios are provided. DOE

N80-26802# Jalar Associates, San Francisco, Calif.
INDUSTRIAL COMPRESSED AIR APPLICATIONS FOR SOLAR ENERGY CONVERSION/STORAGE DEVICES Final Report
Laurence B. McEwen, Jr. and John W. Swain, Jr. Jan. 1980 162 p refs Prepared for Sandia Labs., Albuquerque
(Contract EY-76-C-04-0789)
(SAND-79-7077) Avail: NTIS HC A08/MF A01

A survey was made of industrial compressed air installations in this country with emphasis on air usage patterns, types of equipment, and energy/power requirements. This was followed by an investigation into the technical feasibility of utilizing solar energy conversion systems to power representative industrial compressed air systems. The final task was to evaluate the economic merits of three diverse scenarios of conceptual industrial compressed-air installation. None of the three were found to be economically attractive until approximately 10 years after completion of construction with one of the primary reasons being the high capitalized cost of the associated solar powered air compression systems. A proper combination of technological improvements in solar energy conversion systems, reduced capital costs, accelerated rises in utility rates, and continued uncertainty in fossil fuel availability is regarded as necessary before further pursuit of this concept is warranted. DOE

N80-26803# AiResearch Mfg. Co., Torrance, Calif.
HIGH-ENERGY-DENSITY COMPOSITE FLYWHEEL
David L. Satchwell and Dennis A. Towgood Feb. 1980 113 p refs
(Contracts EY-76-C-04-0789; AT(29-1)-789)
(SAND-79-7019) Avail: NTIS HC A06/MF A01

A flywheel was designed and fabricated to demonstrate a high energy density of 80 w-h/kg in the rotor. The rotor design consists of a multiring, subcircular rim made of S-glass/epoxy composite and Kevlar/epoxy composite materials and mounted on a spoked hub made of graphite/epoxy composite materials. DOE

N80-26804# Battelle Pacific Northwest Labs., Richland, Wash.
POTENTIAL PETROPHYSICAL AND CHEMICAL PROPERTY ALTERATIONS IN A COMPRESSED AIR ENERGY STORAGE POROUS ROCK RESERVOIR
J. A. Stottlemyre, R. L. Erikson, and R. P. Smith Oct. 1979 88 p refs
(Contract EY-76-C-06-1830)
(PNL-2974) Avail: NTIS HC A05/MF A01

Successful commercialization of compressed air energy storage (CAES) systems depends on long term stability of the underground reservoirs subjected to somewhat unique operating conditions. A discussion on relative importance to CAES of several potential porous media damage mechanisms is presented. In this context, damage is defined as a reduction in intrinsic permeability (measure of air transport capability), a decrease in effective porosity (measure of storage capability), or an increase on elastic and/or inelastic deformation of the porous material. The potential damage mechanisms presented include: (1) disaggregation, (2) particulate plugging, (3) boundary layer viscosity anomalies, (4) inelastic microstructural consolidation, (5) clay swelling and dispersion (6) hydrothermal mineral alteration, (7) oxidation reactions, and (8) well casing corrosion. DOE

N80-26805# Brobeck (William M.) and Associates, Berkeley, Calif.
CONCEPTUAL DESIGN OF A FLYWHEEL ENERGY STORAGE SYSTEM Final Report
Nov. 1979 103 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7088; REPT-4500-92-9-R1) Avail: NTIS HC A06/MF A01

A conceptual design of a flywheel energy storage system suitable for on-site interfacing with residential photovoltaic (PV) energy sources was developed. The basic design concept and the general approach to the conceptual design of the energy storage system are described. Cost of the system was determined for production models to be produced in annual quantities up to one hundred thousand for both 10-kWh and 50-kWh capacities, and also for a 10 kWh one-of-a-kind demonstration model. DOE

N80-26806# California Univ., Livermore. Lawrence Livermore Lab.
SITE AND BUILDING ENERGY CONSERVATION STUDY. LOW-CONDUCTIVITY COOLING WATER SYSTEM
Oct. 1979 13 p
(Contract W-7405-eng-48)
(UCRL-15196; Rept-79-83-R) Avail: NTIS HC A02/MF A01

Low conductivity cooling water is a high quality deionized cooling water which is recirculated. The system supplies water for experimental cooling equipment, shop equipment, and as a condenser cooling medium for refrigeration and air conditioning systems. Low conductivity water is purified, cooled, and recirculated at three buildings. The systems description, operation, and energy conservation opportunities are indentified. DOE

N80-26807# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
DISCHARGE CHARACTERISTICS OF LITHIUM-BORON ALLOY ANODE IN MOLTEN SALT THERMAL CELLS
H. Szwarc and R. D. Walton 31 Mar. 1980 26 p refs
(Contract EY-76-C-04-0656)
(GEPP-TIS-451) Avail: NTIS HC A03/MF A01

Thermal cells comprised of Li-B anodes, LiCl-KCl eutectic electrolyte, and one of three depolarizers, $CaCrO_4$, Li_2CrO_4, or FeS_2, were investigated. These cells require a separator layer to obviate direct redox reactions between the anode and the cathode. The separator developed for these cells is an electrolyte layer immobilized with MgO is inert with respect to the anode as well as other cell components. Of the three systems investigated, the LiB/FeS_2 combination is most promising for primary thermal batteries, particularly for long-life power designs. . DOE

N80-26808# Kaiser Engineers, Oakland, Calif.
SITE AND BUILDING ENERGY-CONSERVATION STUDY: SURVEY OF BUILDING 3, EXPERIMENTAL PHYSICS
Oct. 1979 106 p Prepared in cooperation with Consultants Computation Bureau, Oakland, Calif. Prepared for Calif. Univ., Livermore, Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15195; REPT-79-65-RE) Avail: NTIS HC A06/MF A01

An energy conservation study of Building 3, Experimental Physics was conducted. The survey was based on a detailed review of the as-built drawings, an onsite inspection of the 100,000-sq ft building, and discussions with the building manager

and various operating personnel. Data were collected regarding the number of people occupying the building, operating schedules, and the energy loads imposed by installed and temporary equipment. The heating, ventilating and air conditioning systems were investigated. A base-year energy-consumption run was made, together with simulations of the building's performance assuming installation of each of nine energy conservation opportunities (ECO's) and combinations identified. The energy savings resulting from the implementation of the ECO's are summarized. DOE

N80-26809# Spire Corp., Bedford, Mass.
AMORPHOUS SILICON SOLAR CELLS BY HYDROGEN IMPLANTATION Quarterly Report, 1 Apr. - 30 Jun. 1979
A. R. Kirkpatrick and A. A. Melas Aug. 1979 19 p
(Contract DE-AC03-79ET-23042)
(SAN-3042-2; QR-10064-02) Avail: NTIS HC A02/MF A01

The use of cell devices to provide information regarding application of ion implantation to amorphous silicon cells was investigated. Developmental activities described include the preparation of implantation capabilities and procedures, preparation of processing routines for a test cell device and preliminary evaluation of the effects of hydrogen implantation upon operation of devices. DOE

N80-26810# TRW Systems Group, McLean, Va.
COMPARISON OF COSTS FOR AUTOMOBILE ENERGY CONSERVATION VS SYNTHETIC FUEL PRODUCTION
Richard Gorman and Kenneth L. Heitner 1980 32 p refs
Presented at the 5th Symp. on Automotive Propulsion Systems, Dearborn, Mich., 14 Apr. 1980
(Contract AC01-79PE-70151)
(CONF-800419-1) Avail: NTIS HC A03/MF A01

The analysis suggests that there are a large number of potential technical options for reducing energy consumption in automobiles. Furthermore, the cost to the user of purchasing these conservation options is less than the discounted cost of purchasing the additional fuel required if the conservation option is not chosen. There is a significant cost savings even if fuel costs remain at current levels. These savings would increase if fuel prices continue to rise or if more costly than synthetic fuels, at least for another 15 to 20 years. Cost effective conservation could enable new vehicles to reach 40 to 50 mpg corporate average fuel economy by the year 2000. It is clear that the potential for making these changes exists, but better data are needed to evaluate many of these options and to ensure the development and implementation of those that are desirable. DOE

N80-26811# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR ZIEN MECHANICAL CONTRACTORS-I SINGLE FAMILY RESIDENCE, MILWAUKEE, WISCONSIN
D. Beers 5 Feb. 1980 48 p
(Contract EX-76-A-29-1020)
(SOLAR/1057-79/50-Pt-1) Avail: NTIS HC A03/MF A01

The Zien Mechanical site is a single family residence located in Milwaukee, Wisconsin. The home has two separate solar energy systems: an air system for space heating and cooling; a liquid system to preheat the potable hot water. The space heating and cooling system design and operation modes are described. The space heating system is designed to apply approximately 44 percent of the space heating requirements for the 1388 square foot residence. Engineering drawings are provided and the performance evaluation instrumentation is described. R.E.S.

N80-26812# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR ALPHA CONSTRUCTION COMPANY'S SINGLE FAMILY RESIDENCE, CANTON, OHIO
D. Beers 21 Sep. 1979 53 p
(Contract EX-76-A-29-1020)
(SOLAR/1034-79/50) Avail: NTIS HC A04/MF A01

The solar energy system for a new single family detached residence in Canton, Ohio, preheats domestic hot water and supplements heating energy for 2460 square feet of occupied space. The solar energy system is designed to provide approximately 50 percent of the space heating and 70 percent of the hot water energy requirements for the home. The system design and operation modes are described. Engineering drawings are provided and the performance evaluation instrumentation is described. R.E.S.

N80-26813# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR STEWART-TEELE-MITCHELL SINGLE FAMILY RESIDENCE, MALTA, N.Y.
D. Beers 5 Dec. 1979 51 p
(Contract EX-76-A-29-1020)
(SOLAR/1018-79/50) Avail: NTIS HC A04/MF A01

The Stewart-Teele-Mitchell solar energy system is installed in a 1900 square-foot, single family dwelling located in Malta, New York. The system is designed to provide solar energy for space heating, and domestic hot water heating. The system design and operation modes are described. Engineering drawings are provided and the performance evaluation instrumentation is described. R.E.S.

N80-26814# Boeing Co. Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR WASHINGTON NATURAL GAS COMPANY'S SINGLE FAMILY RESIDENCE, KIRKLAND, WASHINGTON
D. Beers 12 Sep. 1979 48 p
(Contract EX-76-A-29-1020)
(SOLAR/1001-79/50) Avail: NTIS HC A03/MF A01

The solar energy system for a new single family detached residence in Kirkland, Washington, preheats domestic hot water and heats 2607 square feet of occupied space. The system design and operation modes are described. Engineering drawings are provided and the performance evaluation instrumentation is described. R.E.S.

N80-26815# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR ZIEN MECHANICAL 2 SINGLE FAMILY RESIDENCE, MILWAUKEE, WISONSIN
5 Feb. 1980 44 p
(Contracts EX-76-A-29-1020; H-2372)
(SOLAR/1057-79/50-Pt-2) Avail: NTIS HC A03/MF A01

Zien Mechanical Contractors No. 2 is a single-family residence in Milwaukee, Wisonsin. The home has approximately 1304 square feet of conditioned space. The solar energy system consists of two independently controlled systems: one system is used for domestic hot water preheating, the other is used for space heating and cooling. The domestic hot water system design and operation modes are described. Engineering drawings are provided and the performance evaluation instrumentation is described. R.E.S.

N80-26816# Burt, Hill, Kosar, Rittleman, and Associates, Butler, Pa.
SOLAR-ASSISTED LOW ENERGY DWELLINGS Final Report
Torben V. Esbensen Feb. 1980 113 p refs
(Contract EY-76-S-05-4908)
(DOE/CS-0145; CCMS-93) Avail: NTIS HC A06/MF A01

The Zero Energy House Group was formed as a subproject of the CCMS Solar Energy Pilot Study in 1974 by seven participating countries experimenting with solar-assisted low-energy dwellings for temperate and northern European climatic conditions. A Zero Energy House is one in which solar energy is used to meet the reduced energy needs of buildings incorporating various thermal energy conservation features. This is the final report of the Zero Energy House Group. It includes brief descriptions of 13 major low-energy dwellings in the participating CCMS countries. An overall assessment of the state-of-the-art in solar-assisted low-energy dwellings is given. DOE

N80-26817# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PROJECTS FROM FEDERAL REGION 9: DEPARTMENT OF ENERGY APPROPRIATE ENERGY TECHNOLOGY PROGRAM, PART 2
C. W. Case, H. R. Clark, J. Kay, F. B. Lucarelli, and S. Rizer Jan. 1980 50 p refs
(Contract W-7405-eng-48)
(LBL-10098) Avail: NTIS HC A03/MF A01

Details and progress of appropriate energy technology programs in Region 9 (Arizona, California, and Hawaii) are

presented. Each on-going project is individually described and includes details on direct and indirect energy savings. Also included are information on innovative features, regional or national demonstration possibilities, and aspects of the project which can be replicated elsewhere either on a regional or national scale. R.E.S.

N80-26818# Mississippi State Univ., Mississippi State. Engineering and Industrial Research Station.
ADDITION OF INEXPENSIVE SOLAR AIR-HEATERS TO A PRE-ENGINEERED METAL BUILDING Final Report, 25 Sep. 1977 - 25 Mar. 1979
Richard E. Forbes and Ronald W. McClendon May 1979 52 p refs
(Contracts EG-77-G-04-4086; EG-77-C-29-0001)
(ALO-4086-1) Avail: NTIS HC A03/MF A01

The use of site built solar collectors for heating air in poultry houses was studied in order to design and test a functional air heater solar collector which would be inexpensive to construct and acceptable to poultry producers. The results reported are an extension of the original concept. The basic concept is to use a pre-engineered metal building for the structure and incorporate the solar air heaters as an integral part of the south facing wall of the building. The outer skin of the building is used as the absorber plate for the collectors. Construction and testing of the solar collectors and heat storage systems are discussed, and the performance characteristics of the site built solar collectors are described. DOE

N80-26819# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
DEVELOPMENT OF POLYCRYSTAL GaAs SOLAR CELLS Quarterly Technical Progress Report, 1 Aug. - 30 Oct. 1979
D. L. Miller, Marshall J. Cohen, J. S. Harris, Jr., Joseph Ballantyne (Cornell Univ., Ithaca, N.Y.), and Elias Stefanakos (N.C. A and T State Univ., Greensboro) Dec. 1979 49 p
(Contract EG-77-C-01-4042)
(DSE-4042-T28; QTPR-3) Avail: NTIS HC A03/MF A01

Progress on the development of thin film polycrystal GaAs solar cells with 10% conversion efficiency is described. Highlights include the growth of Ga on Fe substrates and the investigation of various grain boundary passivation schemes. DOE

N80-26820# Midwest Research Inst., Golden, Colo.
SERI SOLAR ENERGY STORAGE PROGRAM
Robert J. Copeland, John D. Wright, and Charles E. Wyman Feb. 1980 12 p refs Presented at the Thermal Energy Storage Review Meeting, Tysons Corner, Va., 3 Dec. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-333-497; CONF-791232-1) Avail: NTIS HC A02/MF A01

Research on advanced technologies, system analyses, and assessments of thermal energy storage for solar applications in support of the Thermal and Chemical Energy Storage program are presented. Currently, research is in progress on direct contact latent heat storage and thermochemical energy storage and transport. Systems analyses are being performed of thermal energy storage for solar thermal applications, and surveys and assessments are being prepared of thermal energy storage in solar applications. DOE

N80-26821# Southern Methodist Univ., Dallas, Tex.
THIN FILM CADMIUM TELLURIDE SOLAR CELLS Technical Progress Report, 1 Jul. - 30 Sep. 1979
Ting L. Chu Oct. 1979 33 p refs
(Contract DE-AC04-79ET-23009)
(DOE/ET-23009/T1; TPR-1) Avail: NTIS HC A03/MF A01

Cadmium telluride films deposited on a number of substrates by the direct combination of cadmium and tellurium on the substrate surface at 550 to 740 C. At substrate temperatures below 550 C, the deposit was non-adherent. In the temperature range 580 to 740 C, the deposition rate 0.5 to 1 micrometers min. and the microstructure and crystallographic properites of deposited films, were investigated. Without intentional doping, cadmium telluride films deposited on mullite substrates have room temperature resistivities and carrier concentrations of (4-7) x 10 to the 4th power ohm-cm and (6-9) x 10 to the 12th power/cu cm, respectively. Current-voltage measurements os Schottky barriers prepared from cadmium telluride films indicate the rectifying interface in CdTe/W/graphite, CdTe/graphite, CdTe/Al/graphite structures and the presence of pinholes in the films. DOE

N80-26822# Stanford Linear Accelerator Center, Calif.
MORE ON DUAL PURPOSE SOLAR-ELECTRIC POWER PLANTS
F. F. Hall Feb. 1980 17 p refs Presented at the 2nd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10 Dec. 1979
(Contract EY-76-C-03-0515)
(SLAC-PUB-2477; CONF-791204-33) Avail: NTIS HC A02/MF A01

Dual purpose solar-electric plants are discussed. The rationale for such plants is reviewed and plant elements are listed. Heat extraction, energy storage, and plant costs are discussed. DOE

N80-26823# Trident Engineering Associates, Inc., Annapolis, Md.
SURVEY AND EVALUATION OF CURRENT DESIGN OF EVACUATED COLLECTORS Final Technical Report
B. J. Graham 30 Sep. 1979 192 p refs
(Contract EM-78-C-04-5350)
(ALO-5350-1) Avail: NTIS HC A09/MF A01

The general development of evacuated collectors is described. A table summarizing all of the available collectors, along with their characteristics, is presented. There are four evacuated collectors which have been tested, used in demonstration sites, and developed for the market. These collectors are described in detail, and they are compared in performance and cost with a well engineered, double glazed, selectively coated, flat plate collector. A rather simple model system of about 2000 sq ft of collector area for each of the four evacuated collectors and the flat plate collector is described, along with the support structure and the piping for each. Details of the cost are presented in order to compare collector costs with component costs. All of the available efficiency curves of collectors were plotted for comparison with the effeciency curve of a good, flat plate collector. DOE

N80-26824# Argonne National Lab., Ill. Energy and Environmental Systems Div.
RELIABILITY AND MATERIALS PERFORMANCE OF SOLAR HEATING AND COOLING SYSTEMS
P. S. Chopra Jun. 1979 24 p refs
(Contract W-31-109-eng-38)
(SOLAR/0906-79/70; ANL/SDP-TM-79-8) Avail: NTIS HC A02/MF A01

The reliability field information collected to date from the solar heating and cooling systems sponsored by the US Department of Energy and the evaluation of four system-reliability problems freezing, leaks, controls, and collectors are summarized. An example of a reliability analysis for a hot water preheating system is presented using data on component failures obtained primarily from nonsolar sources. The status of material assessment activities is discussed along with the results of initial studies of the properties of heat transfer fluids and the scaling caused by the fluids. DOE

N80-26825# Delaware Univ., Newark. College of Engineering.
SHAPE OF CURRENT VOLTAGE CHARACTERISTICS OF SOLAR CELLS. THEORY OF THIN-FILM PHOTOVOLTAICS
Karl W. Boeer 1979 39 p refs Prepared in cooperation with SES, Inc., Newark, Del.
(Contract DE-AC01-79ET-23103)
(DOE/ET-23103/10; TR-2) Avail: NTIS HC A03/MF A01

By proper integration of Poisson and transport equations, considering the junction boundary conditions, current-voltage characteristics of a wide variety of shapes are obtained. The shape depends critically on these boundary conditions and on material properties. In turn, deviation from the ideal characteristics can be used to determine several material properties of a photovoltaic device. It is possible to categorize deviation from the ideal diode behavior and use simple approximations to obtain defect level distribution, interface recombination velocity and critical fields for field related junction effects. This discussion

augments the previous model using a resistive network to alter characteristics and modifies the model using diodes of different A-factors in the exponent. It assists in analyzing less than perfect solar cells to obtain directions for possible improvements. DOE

N80-26826# California Univ., Berkeley. Lawrence Berkeley Lab. Energy Analysis Program.
ASSESSMENT OF SOLAR ENERGY WITHIN A COMMUNITY: SUMMARY OF THREE COMMUNITY-LEVEL STUDIES Summary Report
Ronald L. Ritschard Oct. 1979 37 p refs Sponsored by DOE
(DOE/EV-0054) Avail: NTIS HC A03/MF A01

An analysis of the potential health, environmental, and social/economic consequences of large-scale (national in scope) commercialization of solar technologies is discussed. A summary of three studies concentrating on the potential community-level impacts of such commercialization is given. The results of these studies provide enrichment of the national-level project by identifying for policymakers specific community-level issues that may arise as a result of federal policy. The three studies are: (1) community-level environmental impacts of decentralized solar technologies; (2) community impediments to implementation of solar energy; and (3) three solar urban futures: characterizations of a future community under three energy supply scenarios.DOE

N80-26827# EIC, Inc., Newton, Mass.
ELECTRODEPOSITION OF POLYCRYSTALLINE AND AMORPHOUS SILICON FOR PHOTOVOLTAIC APPLICATIONS Quarterly Technical Progress Report, 11 Sep. - 30 Nov. 1979
R. D. Rauh, T. G. Hoover, and D. L. Natwig Feb. 1980 26 p refs
(Contract DE-AC03-79ET-23046)
(DOE/ET-23046/2; QTR-2) Avail: NTIS HC A03/MF A01

Electrochemical measurements were made on SHCl3 and (CH3)3SiCl to determine if they were suitable precursors for electrodepositing silicon from organic solvents. The precursors were dissolved in solutions of propylene carbonate containing 0.1M tetrabutylammonium tetrafluoroborate (TBATFB). Cyclic voltammograms of the systems were run at 25 C and 70 C using Pt as the reference electrode and Pt, Al, or Mo wires as the working electrode. The results showed that the two peaks appearing between 0 and -1.0V could be attributed to impurities made electroactive by addition of the silicon precursor. Reduction to silicon occurred with SHCl3 between -1.0 to -2.8V; however, for (CH3)3SiCl, no reduction leading to silicon deposition was observed in this region. Several deposits of silicon were done potentiostatically on Mo, Al, and Ni discs. The thickness, surface finish and color of the amorphous deposits were dependent on the precursor concentration, temperature and material, and surface finish of the metal working electrode. DOE

N80-26828# Exxon Research and Engineering Co., Linden, N.J. Advanced Energy Systems Labs.
THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS Quarterly Report, 1 Jul. - 30 Sep. 1979
Amal K. Ghosh, Tom Feng, and H. Paul Maruska 1979 30 p refs
(Contract DE-AC03-79ET-23047)
(DOE/SF/23047-3; QR-3) Avail: NTIS HC A03/MF A01

The details of the fabrication procedures for making SnO2/nSi, ITO/n-Si, and metal insulated semiconductors solar cells are given. A low cost and highly reproducible spray deposition process for tin oxide and indium tin oxide (ITO was used to make SnO2/n-Si and ITO/n-Si, solar cells with power conversion efficiencies of 10 and 13% for polycrystalline and single crystal silicon, respectively. Continued improvements in the efficiencies of diffused p-n junction cells were made; efficiencies of 10.3 and 9% were obtained for polysilicon cells of 1- and 20-cu cm sizes, respectively. The effects of grain boundaries on the generation of photocurrent were studied. The Hall mobility of polysilicon in the dark and under illumination, developed a served resistivity and mobility results. A comparison of the spectral response curves of SnO2/n-Si heterojunction and diffused p/n junction cells indicates a lower diffusion length in the diffused cells. The stability studies of the SnO2/n-Si cells were continued. DOE

N80-26829# Florida Univ., Gainesville. Coll. of Engineering.
PHYSICAL MODELS OF THIN FILM POLYCRYSTALLINE SOLAR CELLS BASED ON MEASURED GRAIN-BOUNDARY AND ELECTRONIC-PARAMETER PROPERTIES Final Report, 18 Sep. 1978 - 31 Dec. 1979
F. A. Lindholm, J. G. Fossum, P. A. Holloway, A. Neugroschel, J. A. Smazer, S. C. Pao, P. Russell, and M. A. Shibib 1979 18 p refs
(Contract ET-78-C-01-3421)
(DSE-3421-T1) Avail: NTIS HC A02/MF A01

The identification and characterization of the basic photovoltaic mechanisms that govern the conversion efficiency of polycrystalline thin-film solar cells, the experimentally determined electronic parameters related to photovoltaic mechanisms, and the relationship of the mechanisms and parameters to the conversion efficiency through theoretical physical models developed for engineering design are discussed. The theory of grain boundary and intragrain boundary recombination in polysilicon is presented. DOE

N80-26830# General Electric Co., Philadelphia, Pa. Space Div.
CONCENTRATING ARRAY PRODUCTION PROCESS DESIGN. VOLUME 1: STUDY SUMMARY. VOLUME 2: STUDY RESULTS Final Report
Ronald C. Hodge, A. Koeing, A. Hetzel, J. Nichols, A. Zucker, M. McCullough, R. Fogaroli, R. McCarthy, R. Drummond, and J. Dougherty Mar. 1980 213 p refs Prepared for Sandia Labs, Albuquerque, N.M.
(Contract EY-76-C-04-0789)
(SAND-78-7072-Vol-1/2) Avail: NTIS HC A10/MF A01

Existing P/V concentrator designs are evaluated in terms of their performance and low production and life cycle cost potential. Alternate designs and modifications are defined that will be potentially less costly to produce in large scale production. Manufacturing processes commensurate with four levels of production are defined for a prime array design. Manufacturing and life cycle costs are determined as a function of production level, category, and salient design features, e.g., optical type. DOE

N80-26831# Hanford Engineering Development Lab., Richland, Wash.
MATERIALS ANALYSIS METHODS FOR EXAMINATION OF SOLAR CELLS
C. N. Wilson, comp. Mar. 1980 97 p refs
(Contracts EY-76-C-14-2170; DE-AC14-76FF-02170)
(HEDL-6694) Avail: NTIS HC A05/MF A01

Photovoltaic device performance depends on properties of thin surface and near surface layers of solid state materials. Cell structures investigated for solar cells typically involve one or more thin film layers of semiconducting material. The chemical and physical structure of these layered material systems affects photovoltaic cell performances. In particular, the composition, abruptness, and chemical nature of layer interfaces are important. Also of interest is the degree of crystallinity, grain size and orientation, and the physical nature of grain boundaries within the various layers. Comprehensive examination of the structure and chemistry of photovoltaic materials requires application of several analysis methods. An overview of materials analysis methods and a summary of capabilities of several methods available are presented. DOE

N80-26832# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
ADVANCED DEVELOPMENT OF A SHORT RESIDENCE-TIME HYDROGASIFIER Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1979
Aug. 1979 181 p refs
(Contract ET-78-C-01-3125)
(FE-3125-8; QTPR-3) Avail: NTIS HC A09/MF A01

The design, construction, and operation of a hydrogasifier reactor for commercial application is discussed. The tests were performed at three quarter tons per hour and then at 4 tons per hour. Injection element scaling was investigated by studying single element and clustered multiple element injections at a sufficient magnification factor. Subbituminous coal was used in the test proceedings. Nitrogen usage and cooling tower require-

ments were lower than expected. The lower nitrogen usage reduced the heat load on the product gas cooler as less water was formed in the reactor. B.D.

N80-26833# Institut Francais de l'Energie, Paris.
GUIDE FOR ENERGY COMPATIBILITY
M. J. Braun and J. Lefebvre May 1979 160 p refs In FRENCH
(NP-24016; Rept-65) Avail: NTIS (US Sales Only) HC A08/MF A01; DOE Depository Libraries

A guide for the energy manager in the acquisition and processing of data necessary for energy conservation is presented. Energy conservation is defined and its objectives outlined. The principles and characteristics of measurement devices used are given. The use of the measurements in the establishment of energy balances is described. Examples are given of establishments that have instituted energy conservation plans. Tables are presented of comparative characteristics, by manufacturer and by type of measurement device, for 300 manufacturers operating in the French market. DOE

N80-26834# EIC, Inc., Newton, Mass.
ELECTRODEPOSITION OF POLYCRYSTALLINE AND AMORPHOUS SILICON FOR PHOTOVOLTAIC APPLICATIONS Quarterly Progress Report, 11 Jun. - 10 Sep. 1979
R. D. Rauh Nov. 1979 20 p refs
(Contract DE-AC03-79ET-23046)
(DOE/ET-23046/1; QPR-1) Avail: NTIS HC A02/MF A01

The design, construction, and testing of two cells for low and high temperature electrodeposition of silicon is described. The glass, low temperature cell for use with organic solvents incorporates the advantageous features of a small cell volume. Several survey experiments were made with the glass cell using SiHCl3 and SiCl(CH3)3 as the silicon precursors. Use of the former with AgCl/Ag as the reference electrode resulted in decomposition of the reference resulting in plating of silver on the electrode. It was also determined that LiAsF6 is not usable as the supporting electrolyte with SiHCl3. The cyclic voltammogram of the SiCl(CH3)3 solution showed two reduction peaks, but no indication of silicon deposition was observed. The high temperature cell for electrodeposition from molten salts was made from a nickel tube fitted with a lid using vacuum components to allow inlets for the electrodes, a pumping port, helium bubbler, and thermocouple. The salt mixture is contained in a molybdenum crucible. DOE

N80-26835# Los Alamos Scientific Lab., N. Mex.
VALIDATION OF SOLAR SYSTEM SIMULATION CODER BY THE INTERNATIONAL ENERGY AGENCY
James C. Hedstrom and Thomas L. Freeman (Atlas Corp., Santa Cruz, Calif.) 1980 7 p refs Presented at 2nd Ann. Systems Stimulation and Econ. Analysis Conf., San Diego, Calif., 23-25 Jan. 1980
(Contract W-7405-eng-36)
(LA-UR-80-387; CONF-800101-18) Avail: NTIS HC A02/MF A01

Validation of active solar energy system simulation codes by the International Energy Agency using data from the Los Alamos Study Center is described. Two rounds of comparisons of predicted to measure performance were completed. In the first round, all participants were given detailed system description data and a period of measured hourly weather and loads data with the corresponding measured hourly performance data. In the second round, the participants were given minor changes to the system description and a second period of measured hourly performance. In the first round, each of the participants was able to predict the results provided. However, this required an undocumented series of adjustments to the user input and the models and comparisons of measured and predicted results. Agreement of measured and predicted results were nearly as good in the second round except for two codes that predicted significantly erroneous results. As a result of this exercise, errors and shortcomings were found and corrected in most of the codes and confidence in the ability of all codes to model real systems has been increased. However, the questions of a workable methodology for validation and the means of dealing with user error remain unanswered. DOE

N80-26836# Department of Energy, Washington, D. C. Office of Energy Research.
PRELIMINARY ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM (SPS), REVISION 1. VOLUME 2: DETAILED ASSESSMENT
Jan. 1980 205 p refs
(DOE/ER-00362-Vol-2) Avail: NTIS HC A10/MF A01

The satellite power system (SPS) collects solar energy through a system of satellites in space and transfers this energy to Earth. A reference system is described that converts the energy to microwaves and transmit the microwave energy via directive antennas to large receiving/rectifying antennas (rectennas) located on the Earth. At the rectennas, the microwave energy is converted into electricity. The key environmental issues associated with the SPS which concern human health and safety, ecosystems, climate, and electromagnetic systems interactions are addressed. Microwave-radiation health and ecological effects; nonmicrowave health and ecological effects; atmospheric effects; effects on communication systems due to ionospheric disturbance, and electromagnetic compatibility are among the factors discussed. DOE

N80-26837# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.
DEMONSTRATION SALT GRADIENT SOLAR POND Ph.D. Thesis
Federica Zangrando and H. C. Bryant 10 Jul. 1979 149 p refs
(Contract EG-77-S-04-3977)
(ALO-3977-T1; SAPR-4) Avail: NTIS HC A07/MF A01

A thorough account is given of a solar pond study underway at the University of New Mexico since 1975. This report consists of the Ph.D. dissertation of Federica Zangrando entitled Observation and Analysis of a Full-Scale Experimental Salt Gradient Solar Pond. The stability condition for a nonconstant gradient, doubly-diffusive system is derived and a precription for the routine detection of potential instabilities is presented. Techniques for handling unstable regions are described. Conclusions so far strongly support the viability of the solar pond concept. Salt gradient ponds appear to have a very definite niche in the ecology of energy production. DOE

N80-26838# State Univ. of New York, Buffalo. Electrical Engineering Dept.
DEPOSITION, FABRICATION AND ANALYSIS OF POLYCRYSTALLINE SILICON MIS SOLAR CELLS Quarterly Technical Progress Report, 1 Jul. - 30 Sep. 1979
Wayne A. Anderson 30 Oct. 1979 54 p refs
(Contract DE-AC03-79ET-23044)
(DOE/ET-23044/T3; QTPR-3) Avail: NTIS HC A04/MF A01

A computer model was established to predict MIS solar cell performance as a function of semiconductor and solar cell design parameters. The solar cell fabrication procedure was modified to more carefully examine the effect of t/sub ox/. An oxide growth temperature of 550 to 600 C was shown to give good values of FF, V sub oc, and J sub sc which gave efficiency values consistently in the 9 to 10% range on Xtal-Si and 6.5 to 7.5% range on poly-Si. This revised process increased the average solar cell efficiency but did not increase maximum efficiency due to other parameters which were not optimum. I-V data for 77 K < T < 400 K were obtained for MIS solar cells on poly.-Si. Unpolished poly.-Si was shown to give space charge limited conduction indicative of a Gaussian trap distribution. Polished poly.-Si gave a tunneling mechanism at low temperatures and tunneling via interface states at higher temperatures. Electron beam deposition of thin (20 microns) Si films on Al coated stainless steel was resumed during this quarter. These films showed good adhesion to the metal substrate SEM studies revealed columnar growth with 5 microns dia columns. Radiation effect studies on MIS solar cells revealed an increased interface state density for proton and electron-irradianced solar cells. Auger studies on an oxide-covered Si surface reveal a mixture of silicon oxide and oxygen atoms chemisorbed to the Si surface (WHK). DOE

N80-26839# Arizona Public Service Co., Phoenix.
AIRPORT SOLAR PHOTOVOLTAIC CONCENTRATOR PROJECT, PHASE 1 Final Report, 1 Jun. 1978 - 28 Feb. 1979

Dec. 1979 347 p Prepared in cooperation with Motorola, Inc., Scottsdale, Ariz.
(Contract ET-78-C-04-5317)
(DOE/CS-05317/1) Avail: NTIS HC A15/MF A01

The system design, analysis, and specification, site preparation, and operation and evaluation plan for a 500 kWe photovoltaic power supply to be located at the Phoenix Sky Harbor International Airport in Phoenix, Arizona, are presented. The solar cell arrays are concentrator silicon solar cells with tracking 70X Cassegrain-type concentrators. The power conditioning system, tracking system, and control systems are described. Environmental impact studies are described. Component specifications and drawings are included. DOE

N80-26840# Argonne National Lab., Ill. Solar Applications Group.
DESIGN AND INSTALLATION MANUAL FOR THERMAL ENERGY STORAGE
Roger L. Cole, Kenneth J. Nield, Raymond R. Rohde, and Ronald M. Wolosewicz Jan. 1980 381 p refs
(Contract W-31-109-eng-38)
(ANL-79-15-Ed-2) Avail: NTIS HC A17/MF A01

The design and installation of thermal energy storage in active solar systems is discussed. Both air based and liquid based systems are covered with topics on designing rock beds, tank types, pump and fan selection, installation, costs, and operation and maintenance. Topics relevant to latent heat storage include properties of phase change materials, sizing the storage unit, insulating the storage unit, available systems, and cost. Topics relevant to heating domestic water include safety, single-, and dual-tank systems, domestic water heating with air and liquid based space heating systems, and stand alone domestics hot water systems. Also examined are common problems with storage systems and their solutions, heat transfer fluid properties, economic insulation thickness, heat exchanger sizing, and sample specifications for heat exchangers, wooden rock bins, steel tanks, concrete tanks, and fiberglass reinforced plastic tanks. DOE

N80-26841# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF A LOW-TEMPERATURE, LOW-COST, BLACK LIQUID SOLAR COLLECTOR, PHASE 2 Semiannual Report, 1 Sep. 1979 - 29 Feb. 1980
D. K. Landstrom, S. G. Talbert, and V. D. McGinniss 20 Mar. 1980 24 p refs
(Contract DE-AC04-79CS-30171)
(ALO-30171-1) Avail: NTIS HC A02/MF A01

The long-term durability of various plastic materials and solar collector designs was evaluated and sufficient outdoor performance data to design a full-scale demonstration of a black-liquid solar collector for a commercial application were obtained. Besides conducting indoor weathering tests of various plastic materials, two outdoor automated test facilities were built. One unit was in use for about two winter months in Columbus, Ohio, and the other unit is ready for testing in Phoenix, Arizona. Extruded polycarbonate panels and extruded acrylic panel designs were investigated. DOE

N80-26842# Department of Energy, Washington, D. C. Office of Solar Applications for Buildings.
SOLAR FEDERAL BUILDINGS PROGRAM PLAN
Feb. 1980 27 p
(DOE/CS-0147A) Avail: NTIS HC A03/MF A01

The Solar Federal Buildings Program (SFBP) is a multi-year program designed to stimulate the growth and improve the efficiency of the solar industry by providing funds to Federal agencies for the design, acquisition, construction, and installation of commercially applicable solar hot water, heating, cooling, and process systems in new and existing Federal buildings. The program plan to be used in implementing this major solar commercialization effort is outlined. DOE

N80-26843# Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF HARDWARE SIMULATORS FOR TESTS OF SOLAR COOLING/HEATING SUBSYSTEMS AND SYSTEMS. PHASE 2: UNSTEADY RATE HARDWARE SIMULATION OF RESIDENTIAL ABSORPTION CHILLER
Paul C. Auh Sep. 1979 29 p refs
(Contracts EY-76-C-02-0016; DE-AC02-76CH-00016)
(BNL-51121) Avail: NTIS HC A03/MF A01

Transient and cycling performance characteristics of an advanced solar absorption chiller were determined. Laboratory tests of the second generation Arkla chiller (Solaire 36, model WF36), using the BNL simulator, were performed. Chiller performance was measured against fast and slow cycling periods under both the conventional and modified control modes. The degree of performance improvement under the modified control mode, as a function of the cycle period and such effects on the integrated chiller performance, was thoroughly investigated. DOE

N80-26844# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
LOW-COST SOLAR ANTIREFLECTION COATINGS Annual Report, 24 Jul. 1978 - 24 Sep. 1979
R. J. H. Lin, J. C. Lee, and P. B. Zimmer Oct. 1979 99 p refs
(Contracts EM-78-C-04-5300; DE-AC04-78CS-35300)
(ALO-5300-T2) Avail: NTIS HC A05/MF A01

The etched antireflection (AR) coating process was scaled up to etch full size glass panes but the chemical control of the etching solution remains a problem. Analytical methods including high pressure liquid chromatography (HPLC), flame excited atomic absorption, infrared spectroscopy, Coulter counter techniques, and liquid index of refraction measurements were examined for application to this process monitor and control problem. A phenomenological model for the key reaction species in the etching process is presented along with a monitor control scheme using refractive index measurements to set the initial reactant concentrations and HPLC to track in process concentrations. The environmental durability of the organic AR coating of fused FEP-120 Teflon dispersion was improved by the use of a hydrofluoric acid etch/silane coupling agent pretreatment. Improved coating processing technique were developed culminating in the demonstration of scale up feasibility for glass panels up to 1 ft by 1 ft with good batch sample to sample repeatability. DOE

N80-26845# EIC, Inc., Newton, Mass.
CORROSION PROTECTION OF SOLAR-COLLECTOR HEAT EXCHANGERS WITH ELECTROCHEMICALLY DEPOSITED FILMS Semiannual Report, 1 Dec. 1978 - 31 May 1979
S. B. Brummer, V. R. Koch, and G. H. Schnaper Jul. 1979 44 p refs
(Contract EM-78-C-04-4297)
(COO-4297-2; SAR-2) Avail: NTIS HC A03/MF A01

A novel corrosion protection technique was demonstrated for the common solar collector metals Al, Cu, and Fe as mild steel. This involves the potentiostatic electrochemical deposition of thin, adherent polymer films on the interior of heat exchanger tubes by application of a current in the presence of a suitable organic monomer. Polyphenylene oxide (PPO) films were anodically deposited onto Al, Cu and Fe coupons from methanolic media. However, defects in these films afforded poor corrosion protection. Suitably functionalized PPO films have been crosslinked via Schiff base formation in a subsequent chemical step. While these chemically modified PPO films were demonstrably more resistant to ethylene glyco H2O media at elevated temperatures, they too were undetermined by the thermal transfer medium. Cinnamaldehyde, a styrene type monomer, has been successfully electrodeposited onto Al coupons. This process involved a constant, albeit unreferenced potential technique in which the Al is made the negative electrode. DOE

N80-26846# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
COLLECTOR ARRAY PERFORMANCE REPORT FOR SITES OF THE NATIONAL SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM
Jul. 1979 146 p
(Contract EG-77-C-01-4049)
(SOLAR/0021-79/07) Avail: NTIS HC A07/MF A01

The following data are given: (1) single-panel instantaneous efficiency curve coefficients; (2) current month instantaneous efficiency curve coefficients; (3) cumulative (through current month) instantaneous efficiency curve coefficients; (4) cumulative (through current month) second order curve coefficients; (5) daily

energy gain comparisons for the current month; (6) properties of the collector transport fluid; (7) array flow rate (average for the month); (8) single panel flow rate; (9) array temperature gain (average for the month); and (10) monthly energy gain comparisons for the most recent 12 months. DOE

N80-26847# Los Alamos Scientific Lab., N. Mex.
ADDITIONAL SOLAR/LOAD RATIO CORRELATIONS FOR DIRECT GAIN BUILDINGS
William O. Wray 1980 6 p refs Presented at the Ann. Meeting of the Am. Sect. of ISES, Phoenix, Ariz., 2-6 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-954; CONF-800604-2) Avail: NTIS HC A02/MF A01

Solar/load ratio (SLR) correlations were developed for two new reference direct gain designs. The new reference designs are identical to the originals except that the glazing air gap has been increased from 1/4 in. to 1/2 in. and a vector average of the local hourly windspeed was used in the thermal network calculations rather than an assumed average value of 15 mph. Both of these modifications are realistic and enhance the predicted performance of direct gain buildings. A comprehensive set of mass sensitivity calculations was performed in order to provide information needed to select an appropriate set of parameters for new lightweight direct gain designs for which additional SLR correlations will be developed. DOE

N80-26848# Northrop Services, Inc., Huntsville, Ala.
EVALUATION OF HEAT TRANSFER ENHANCEMENT IN AIR-HEATING COLLECTORS Final Report
Donald L. Mattox Jun. 1979 187 p refs
(Contracts EM-78-C-04-5352; DE-AC04-78CS-05352)
(ALO-5352-T1) Avail: NTIS HC A09/MF A01

Increasing the thermal efficiency of air heating solar collectors through identification and development of optimum design and operation criteria for solar absorber to air heat exchangers is reported. A transient heat transfer analysis of a complete solar air heating collector was used to demonstrate that an optimum absorber to air heat exchanger design could be provided with several interrupted fin configurations. Additional analyses were performed to establish that the maximum solar collector thermal performance to required pumping power was realized for a Reynolds number range of 1000 to 2000. This Reynolds number range was used to establish a theoretical design limit curve for maximum thermal performance versus required pumping power for all interrupted fin designs as published in the open literature. Heat and momentum transfer empirical relationships were defined for scaling the state of the art high conductance fin designs identified from a conpact configuration for the less compact designs needed for solar collectors. DOE

N80-26849# Midwest Research Inst., Golden, Colo.
END-USE MATCHING FOR SOLAR INDUSTRIAL PROCESS HEAT Final Report
Kenneth C. Brown, Douglas W. Hooker, Ari Rabi, Shirley A. Stadjuhar, and Ronald E. West Jan. 1980 235 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-34-091) Avail: NTIS HC A11/MF A01

Because of the large energy demand of industry (37% of US demand) and the wide spectrum of temperatures at which heat is required, the industrial sector appears to be very suitable for the matching of solar thermal technology with industrial process heat (IPH) requirements. A methodology for end-use matching was devised, complete with required data bases and an evaluation program PROSYS/ECONMAT. Six cities in the United States were selected for an analysis of solar applications to IPH. Typical process heat requirements for 70% of the industrial plants in each city were identified and evaluated in conjunction with meteorological and economic data for each site to determine lowest cost solar systems for each application. The flexibility and scope of PROSYS/ECONMAT is shown in a variety of sensitivity studies that expand the results of the six city analysis. Case studies of two industrial plants were performed to evaluate the end use matching procedure, these results are reported.DOE

N80-26850# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
CUPROUS OXIDE PHOTOVOLTAIC CELLS Final Report, 1 Sep. 1978 - 30 Nov. 1979
D. Trivich 1979 57 p refs
(Contract ET-78-S-02-4726)
(COO-4726-1-T1) Avail: NTIS HC A04/MF A01

The research described represents the beginning of a second phase of research on cuprous oxide photovoltaic cells. The first phase was concerned with the development of procedures of making Schottky barriers on isolated films of Cu2O, including single crystals. It was found that properties of these Schottky barrier cells, in particular the barrier heights, were limited by chemical changes at the junction especially with metals of low work function which tend to be more active chemically, e.g., Al. The motivation of the present phase of the research was to construct junctions that would avoid this chemical degradation while maintaining electrical contact between the Cu2O and a low work function material in order to attain larger barrier heights. Essentially the approach involved placing the Cu2O in contact with a stable oxide. When this oxide is used as a thin layer between the Cu2O and a top metal contact this gives an MIS structure. As another approach, the other oxide can be an n-type semiconductor in thicker layers to form a heterojunction. Results are reported. DOE

N80-26851# Tennessee Technological Univ., Cookeville.
WIND EFFECTS ON COLLECTORS Final Report, 1 Oct. 1978 - 1 Oct. 1979
Hudy C. Hewitt, Jr. and Edwin I. Griggs 1 Nov. 1979 113 p refs
(Contract EM-78-C-04-5364)
(DOE/CS-35364/T1) Avail: NTIS HC A06/MF A01

Consideration was given to modeling wind speed data and to a scheme for correlating data between two separate stations. A sensor system was developed to measure the effect of wind on collector performance. The specifications for the sensor are presented, and a discussion of the calibration of the sensor is given. Four experiments were performed to determine wind flow patterns around buildings. The velocity profile over an actual collector was also measured as a function of free stream velocity. A mathematical model for a solar collector and three experimental efforts to measure the effect of wind on collector performance are reported. DOE

N80-26852# Northwestern Univ., Evanston, Ill.
STUDIES OF METAL: SEMICONDUCTOR INTERFACES IN CATALYSIS AND ENERGY CONVERSION Annual Report, 15 Jun. 1979 - 14 Jun. 1980
Y. W. Chung Mar. 1980 27 p refs
(Contracts ER-78-S-02-4946; DE-AC02-78ER-4946)
(COO-4946-2) Avail: NTIS HC A03/MF A01

Experimental capabilities were enhanced by the incorporating of an Al/Mg K alpha X-ray source for X-ray photoemission studies, a micro-computer for data acquisition and analysis, an isolation cell attachment to the UHV surface analysis chamber for performing high pressure chemical reaction studies, a high intensity UV light source for photochemical studies, and finally an ultra-sensitive quartz crystal thickness monitor for controlled metal deposition. A method was developed to measure the chemical state of ad-atoms on semiconductor surfaces using X-ray photoemission. Using such a technique, it was found that the Pt atoms in contact with the SrTiO3 (100)-(1x1) surface acquire a negative charge, viz 0.6 electron/Pt-atom. By studying the line shape changes of the Ti 2p core levels, it was found that the charge transfer is via the Ti(3+) oxygen vacancy complexes on the SrTiO3 surface. DOE

N80-26853# Aerojet Energy Conservation Co., Sacramento, Calif.
MULTI-MEGAWATT ORGANIC RANKINE ENGINE POWER PLANT (MORE). PHASE 1A: SYSTEM DESIGN OF MORE POWER PLANT FOR INDUSTRIAL ENERGY CONSERVATION EMPHASIZING THE CEMENT INDUSTRY Final Report, 15 Sep. 1978 - 30 Sep. 1979
E. K. Bair, B. Breindel, F. N. Collamore, J. N. Hodgson, and G. K. Olson 31 Jan. 1980 94 p refs
(Contract DE-AC03-78ET-12434)
(DOE/ET-12434/T1) Avail: NTIS HC A05/MF A01

The Multi-Megawatt Organic Rankine Engine (MORE) program is directed towards the development of a large, organic Rankine

power plant for energy conservation from moderate temperature industrial heat streams. Organic Rankine power plants are ideally suited for use with heat sources in the temperature range below 1100 F. Cement manufacture was selected as the prototype industry for the MORE system because of the range of parameters which can be tested in a cement application. This includes process exit temperatures of 650 F to 1110 F for suspension preheater and long dry kilns, severe, dust loading, multi-metawatt power generation potential, and boiler exhaust gas acid dew point variations. The work performed during the Phase 1A System Design contract period is described. The System Design task defines the complete MORE system and its installation to the level necessary to obtain detailed performance maps, equipment specifications, planning of supporting experiments, and credible construction and hardware cost estimates. The MORE power plant design is based upon installation in the Black Mountain Quarry Cement Plant near Victorville, California. DOE

N80-26854# SRI International Corp., Menlo Park, Calif.
APPLICATION OF MICROFABRICATION TECHNOLOGY TO THERMIONIC ENERGY CONVERSION Progress Report, 1 Nov. 1979 - 31 Jan. 1980
Ivor Brodie and Duane C. Gates 10 Mar. 1980 12 p refs
(Contract DE-AC02-79ET-15423; SRI Proj. 8558)
(DOE/ET/15423-2; PR-2) Avail: NTIS HC A02/MF A01

Two diode designs are studied that required different fabrication techniques. The fabrication of electrodes was begun to test the concepts and the feasibility of these designs. This work was done with polished molybdenum electrode surfaces and vapor-deposited alumina insulator structures. Initial results were obtained in the close spacing of molybdenum electrodes with alumina insulators. Spacings were demonstrated with 1/2-inch diameter discs in the range of 3 to 5 micron m, using 1-micro m thick insulators. The deposition of thin alumina films on a molybdenum substrate was demonstrated, upon which arrays of thin film electrodes about 1/32-inch in diameter were deposited. A second approach uses a thin film as one of the electrodes. An analysis of the thermal and electrical transport properties of 1-micro m thick tungsten film shows that edge-connected films about 1 mm square in area could withstand the stresses generated by differential thermal expansion when the film is attached to the opposite electrode by stand-off insulators. DOE

N80-26855# Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
DESIGN OF ANNUAL STORAGE SOLAR SPACE HEATING SYSTEMS
F. C. Hooper and J. D. Cook Nov. 1979 13 p refs Presented at the 72nd Ann. AICHE Meeting, San Francisco, 25-29 Nov. 1979 Submitted for publication
(Contract EY-76-C-02-2939)
(DOE/CS-32939/10; CONF-791108-20) Avail: NTIS HC A02/MF A01

A simulation model for the performance of such systems is described, and a method of classifying system configurations is proposed. It is shown that annual systems sized for unconstrained performance, with no unused collector or storage capacity, and no rejected heat, minimize solar acquisition costs. The optimal performance corresponds to the condition where the marginal storage-to-collector sizing ratio is equal to the corresponding marginal cost ratio. DOE

N80-26856# Sandia Labs., Livermore, Calif. Materials Science Div.
SIGMA PHASE FORMATION IN ALLOYS FOR SO2/SO3 THERMAL ENERGY STORAGE SYSTEMS
D. A. Hughes Feb. 1980 39 p refs
(Contract EY-76-C-04-0789)
(SAND-80-8205) Avail: NTIS HC A03/MF A01

A screening test was completed which identifies the tendency for sigma phase formation in alloys for SO2/SO3 thermal energy storage systems. The candidate alloys include austenitic and ferritic stainless steels, Fe-Ni Base, and Ni base alloys. Test specimens were aged for 4,000 hours at ambient temperature, 700, 800, 900, and 1000 C. Aged specimens were tested for Charpy V-notch toughness. Decreases in toughness upon aging correlated well with the observed changes in microstructure. DOE

N80-26857# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects Div.
AERODYNAMIC PERFORMANCE OF THE 17-M-DIAMETER DARRIEUS WIND TURBINE IN THE THREE-BLADED CONFIGURATION: AN ADDENDUM
Mark H. Worstell Feb. 1980 59 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1753) Avail: NTIS HC A04/MF A01

The US Department of Energy (DOE)/Sandia 17-m wind turbine has been tested in the three bladed configuration at five rotational speeds. These data are presented along with some fundamental comparisons to the earlier two bladed results. Also included is the theoretical output of the three bladed 17-m turbine at two selected rotational speeds. DOE

N80-26858# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
ENERGY FOR WIND POWERED OSCILLATORS Semiannual Technical Progress Report, 1 Aug. 1979 - 31 Jan. 1980
Patrick J. Starr 1980 10 p refs
(Contract DE-FG02-79R5-10129)
(DOE/R5/10129-1) Avail: NTIS HC A02/MF A01

Information is presented concerning a literature review on flow induced vibrations; an estimation of available power; design procedure for both votex shedding and galloping; and conversion schemes. DOE

N80-26859*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERNATIONAL PHOTOVOLTAIC PROGRAM. VOLUME 2: APPENDICES
Dennis Costello, Robert Koontz, David Posner, Patricia Heiferling, Paul Carpenter, Sylvia Forman, and Lewis Perelman Dec. 1979 218 p refs Prepared jointly with Midwest Research Inst., Golden, Colo., Massachusetts Inst. of Technol. Cambridge and Illinois Inst. of Technol., Chicago 2 Vol.
(Contract EG-77-C-01-4042)
(NASA-CR-163339) Avail: NTIS HC A10/MF A01

The results of analyses conducted in preparation of an international photovoltaic marketing plan are summarized. Included are compilations of relevant statutes and existing Federal programs; strategies designed to expand the use of photovoltaics abroad; information on the domestic photovoltaic plan and its impact on the proposed international plan; perspectives on foreign competition; industry views on the international photovoltaic market and ideas about the how US government actions could affect this market;international financing issues; and information on issues affecting foreign policy and developing countries. DOE

N80-26860# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
BASELINE DESIGN OF AN OTEC PILOT PLANTSHIP. VOLUME A: DETAILED REPORT
J. F. George, D. Richards, and L. L. Perini May 1979 437 p refs
(Contract EG-77-A-29-1076)
(DOE/CS-1076/2-Vol-A; APL/JHU/SR-78-3A) Avail: NTIS HC A19/MF A01

A baseline design of an ocean thermal energy conversion (OTEC) pilot plantship was developed. The baseline design features a platform that is configured to produce up to 20 MW(e) (net) power, using low cost folded-tube aluminum heat exchangers, while it grazes slowly in tropical waters where the thermal gradient is greatest and the ocean environment is least severe. The design rationale, important calculations, for future work, and a study of system costs are discussed. DOE

N80-26861# Department of Energy, Washington, D. C. Office of Energy Technology.
SOLAR, GEOTHERMAL, ELECTRIC AND STORAGE SYSTEMS PROGRAM SUMMARY DOCUMENT, FY 1980
Jul. 1979 449 p Sponsored by DOE
(DOE/ET-0102) Avail: NTIS HC A19/MF A01

Current and planned programs in solar technology, geothermal energy, electric energy systems, and energy storage systems

are covered. After national energy policy with respect to these programs is introduced, the program structure. FY 1980 budget request, strategies, and management are identified. For each energy technology program, activity areas are described and their status outlined. Program aspects which crosscut all energy technologies (e.g., regional activities, commercialization, environmental and socioeconomic aspects, small and minority business utilization, and international programs) are described. DOE

N80-26862# Department of Energy, Washington, D. C. Div. of Energy Storage Systems.
THERMAL AND MECHANICAL ENERGY-STORAGE PROGRAM, PROJECT SUMMARY DATA FY 1980
1980 196 p Sponsored by DOE
(DOE/CS-0150) Avail: NTIS HC A09/MF A01

The Department of Energy's Division of Energy Storage Systems (STOR) is supporting a broad range of projects to conserve energy and to make possible shifting away from oil and natural gas by developing new and/or improved energy storage systems applicable to central power generation dispersed power generation, solar and waste heat utilization, and vehicle propulsion. These programs include: Thermal Energy Storage; Chemical/Hydrogen Energy Storage; Mechanical and Magnetic Energy Storage; and Underground Energy Storage. Technical and Economic Analysis is supported concurrently to evaluate competitive energy storage options. This summary report addresses the above categories except for Technical and Economic Analysis. Thermal and Chemical/Hydrogen Energy Storage technologies offer the greatest potential for near term impact of all the storage technologies under development. During FY 80, STOR will commit nearly $32 million to the Thermal and Mechanical Energy Storage Program. The breakdown of budget authorized funding for FY 1979 and FY 1980 is shown. This publication consists principally of summary sheets for each active project in the Thermal, Chemical/Hydrogen, and Mechanical Energy Storage Program for FY 1979. DOE

N80-26863# Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF HARDWARE SIMULATORS FOR TESTS OF SOLAR COOLING/HEATING SUBSYSTEMS AND SYSTEMS. PHASE 1: RESIDENTIAL SUBSYSTEM HARDWARE SIMULATOR AND STEADY STATE SIMULATION
Paul C. Auh Sep. 1979 29 p refs
(Contract EY-79-C-02-0016)
(BNL-51120) Avail: NTIS HC A03/MF A01

The proposed hardware simulator was successfully built and has been operational since its construction. The hardware simulator has the following unique features: it has been incorporated with a measurement double checking system, it is a totally closed loop system, it employs three separate energy storage tanks, and it has been automated to perform instantaneous data collection and reduction. With the external energy storage, all the external test conditions can be easily set up for any steady state or transient run. The simulator is described in detail with schematics and actual photographs. The steady state testing of Arkla's Solaire 36 absorption chiller has been performed. The test dealt primarily with chiller capacity or coefficient of performance as a function of generator hot water inlet temperature (1) with condenser cooling water inlet temperature as parameter, and (2) with evaporator chilled water outlet temperature as parameter. DOE

N80-26864# Franklin Research Center, Philadelphia, Pa.
SYSTEM PLANNING ANALYSIS APPLIED TO OTEC: INITIAL CASES BY FLORIDA POWER CORPORATION, TASK 2
Mar. 1980 111 p ref Prepared for Florida Power Corp., St. Petersburg
(Contract DE-AC02-79ET-29187)
(DOE/ET/29187-2: FC-5237-2) Avail: NTIS HC A06/MF A01

The FPC system planning methodology was used on:(1) Base Case, 10 year generation expansion plan with coal plants providing base load expansion, and (2) same, but 400 MW of OTEC substituting for coal burning units with equal resultant system reliability. The OTEC inputs were based on reasonable economic projections of direct capital cost and O and M costs for first generation large commercial plants. The Base Case conditions for FPC system planning methodology involved base load coal fueled additions during the 1980's and early 1990's. The first trial runs of the PROMOD system plannung model substituted OTEC for 400 MW purchases of coal generated power during 1988-1989 and then 400 MW coal capacity thereafter. Result showed higher system reliability than Base Case runs. Production costing computer model runs were used as input to Corporate Model to examine corporate financial impact. Results show present value of total revenue requirements unfavorable to OTEC as compared to coal units. DOE

N80-26865# Oregon State Univ., Corvallis. School of Oceanography.
EXPOSURE: A NEWSLETTER FOR OCEAN TECHNOLOGISTS, VOLUME 8, NO. 1
Rod Mesecar Mar. 1980 8 p
(AD-A083941) Avail: NTIS HC A02/MF A01 CSCL 10/3

Dramatic progress has been made in the development of high performance batteries in recent years. Much of this development effort has concentrated on lithium-based batteries. The reason for the interest in lithium is that it has the highest potential of the metals in the electromotive series. Consequently, the theoretical energy density of lithium-based electrochemical couples is higher than other couples. As a result of research and development efforts carried out in industry and in government laboratories, the potential benefits of lithium-based batteries are now being realized in practical hardware. Lithium-sulfur and lithium-halogen couples are being developed for secondary (rechargeable) battery applications and lithium-thionyl chloride, lithium-sulfur dioxide, and lithium-vanadium pentoxide are the better known couples being developed for primary (nonrechargeable) battery applications. Comparisons of two representative examples of lithium battery electrochemistry, namely lithium sulfur dioxide ($LiSO_2$) and lithium thionyl chloride ($LiSOCl_2$) are made with other primary battery power sources. GRA

N80-26866# Research Triangle Inst., Research Triangle Park, N. C.
APPLICATION ANALYSIS AND PHOTOVOLTAIC SYSTEM CONCEPTUAL DESIGN FOR SERVICE/COMMERCIAL/INSTITUTIONAL AND INDUSTRIAL SECTORS. VOLUME 2: TECHNICAL REPORT Final Report
R. A. Whisnant, C. B. Morrison, N. G. Staffa, and R. D. Alberts Dec. 1979 219 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7020-Vol-2) Avail: NTIS HC A10/MF A01

Data on the attributes of the applications that are germane to solar photovoltaic systems application were identified and acquired, and the figure of merit, utilizing the collected data, that indicates the relative photovoltaic potential for displacement of conventionally generated electricity of the various of applications were devised and applied. The expected profitability of photovoltaic application was determined from the discounted future costs of conventional energy sources, capital costs, and projected operating and maintenance costs over the life of the system. This was combined with the energy consumption of the application to obtain an estimte of the energy market potential. The application ranking and subjective evaluations of market size diversity, and public exposure were used to select five applications and their locations for design of a suitable photovoltaic system. For each of the selected applications, the various relevant characteristics are identified, potential photovoltaic system configurations are identified, and performance and economic models are used to design a representative system. DOE

N80-26867# Oak Ridge National Lab., Tenn. Solar and Special Studies Div.
PHOTOVOLTAIC APPLICATIONS: PAST AND FUTURE
Stephen I. Kaplan 1980 6 p Presented at the 14th Photovoltaics Specialists Conf., San Diego, Calif., 7 Jan. 1980
(Contract W-7405-eng-26)
(CONF-800106-4) Avail: NTIS HC A02/MF A01

Three planned or proposed photovoltaic projects are described. The 240 kWe system at Mississippi County Community College consists of an array of 270 106 unit strings of single crystal Si cells mounted at the focus of 40x concentrating parabolic troughs. The system is expected to be complete in the spring

of 1980. The four 50 kWp photovoltaic systems planned for Northwest Mississippi Junior College consist of different types of solar cells using different types of concentrators. The system is expected to go into operation in the summer of 1980. The proposed system for Georgetown University has not reached the hardware grant stage. DOE

N80-26868# Midwest Research Inst., Golden, Colo.
ANALYSIS METHODS FOR PHOTOVOLTAIC APPLICATIONS
[1980] 7 p
(Contract EG-77-C-01-4042)
(SERI/SP-35-230) Avail: NTIS HC A02/MF A01

Brief descriptions of a variety of photovoltaic power systems simulation models and design tools are given. Services available through photovoltaic module manufacturers are outlined, and computer codes for systems analysis are described. DOE

N80-26869# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHASE 2 EXPERIMENT TEST PLAN: SOLAR PHOTOVOLTAIC/THERMAL RESIDENTIAL EXPERIMENT
Duncan B. Sheldon 23 Jan. 1980 27 p refs
(Contract EY-76-C-02-4094)
(COO-4094-65) Avail: NTIS HC A03/MF A01

The Solar Photovoltaic/Thermal Energy Project requires a Phase 2 test plan for its Solar Energy Research (SERF). This Phase 2 test plan is provided. The purpose of the research being conducted at the SERF is reviewed, and references describing Phase 1 work are listed. DOE

N80-26870# Los Alamos Scientific Lab., N. Mex.
PASSIVE SOLAR DESIGN HANDBOOK. VOLUME 2 OF TWO VOLUMES: PASSIVE SOLAR DESIGN
J. Douglas Balcomb, Dennis Barley, Robert McFarland, Joseph Perry, Jr., William O. Wray, and Scott Noll Jan. 1980 230 p
(Contract W-7405-eng-48)
(DOE/CS-0127/2) Avail: NTIS HC A11/MF A01

A manual for the design and performance evaluation and analysis of passive solar heating systems is presented. Two passive solar building types are analyzed: direct gain and thermal storage walls. Rules of thumb for the schematic design phase and simpified procedure for the design development phase are described. Analysis methods for the construction documents phase are given. The design procedure for fan-forced rock beds for hybrid systems is presented. Economic analysis methods for passive solar buildings are described. Tables of monthly average solar radiation, temperature and degree days for various locations in the US and southern Canada are included. DOE

N80-26871# Midwest Research Inst., Golden, Colo.
ANALYSIS METHODS FOR SOLAR HEATING AND COOLING APPLICATIONS: PASSIVE AND ACTIVE SYSTEMS, THE SECOND EDITION
Jan. 1980 19 p refs
(Contract EG-77-C-01-4042)
(SERI/SP-35-232R) Avail: NTIS HC A02/MF A01

Brief descriptions of analysis methods and design tools which are valuable in performing parametric studies of candidate designs are presented. The methods included range from rules-of-thumb for builders to the simulation packages used by researchers. DOE

N80-26872# Argonne National Lab., Ill. Energy and Environmental Systems Div.
RELIABILITY AND MAINTAINABILITY EVALUATION OF SOLAR CONTROL SYSTEMS
E. Waite, D. Patterson, L. Prucha, H. Singh, R. M. Wolosewicz, and P. S. Chopra Mar. 1979 48 p refs
(Contract W-31-109-eng-38)
(SOLAR/0903-79/70; ANL/SDP-TM-79-5) Avail: NTIS HC A03/MF A01

Control system problems affected the performance or reduced the effectiveness of 25 percent of the 47 DOE sponsored solar heating and cooling sites that were reviewed. The reliability field information presented indicates that most of the control system problems that were encountered so far were design related. The second major reason the systems experienced operating difficulties was improper sensor calibration, location, and installation. Defective components caused some operating problems, but the incidence of these problems was approximately one-third that of the design related problems. After an introductory look at control systems and terminology, control problems are presented in detail. Since the major control problem is design-related, a Failure Modes and Effects Analysis (FMEA) on two existing systems is presented. While the FMEA cannot be used to improve the design of these operational systems, the results can be used to critique the system and to indicate where improvements can be made in future systems. DOE

N80-26873# Department of Housing and Urban Development, Washington, D. C. Office of Policy Development and Research.
SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM: A DESCRIPTIVE SUMMARY OF HUD CYCLE 4 AND 4A SOLAR RESIDENTIAL PROJECTS
Jul. 1979 167 p
(Contract EX-76-A-29-1020)
(HUD-PDR-455) Avail: NTIS HC A08/MF A01

The US Department of Housing and Urban Development (HUD) has awarded nearly $8.5 million in grants for the purchase and installation of solar energy equipment in 6,851 residences. This cycle is fourth in a series of five cycles of residential demonstration projects with solar heating and cooling systems sponsored by HUD in a national effort to demonstrate widespread use of solar energy. Each project is summarized. The grantee and the location and size of the project are described. A rendering of the unit is given along with a description of energy system. DOE

N80-26874# Gruy Federal, Inc., Arlington, Va.
GEOTHERMAL DIRECT USE, ECONOMIC AND ENGINEERING STUDY INTEGRATION. VOLUME 1: METHODOLOGY AND RESULTS Final Report
Charles A. Bakewell, Neil Book, and E. Hunter Herron Aug. 1979 107 p
(Contract ET-78-C-03-2072)
(SAN-2072-1-Vol-1) Avail: NTIS HC A06/MF A01

The technical approach to the problem of comparative evaluation of the twenty economic-engineering studies on nonelectric uses of geothermal energy is described. The Geodec model is presented and the analyses made and the results calculated are described. The conclusions and recommendations arising from these results are discussed. Sample data input/output forms for each of the modules which make up Geodec and the detailed input data and calculated results for each process analyzed are included. DOE

N80-26875# Gruy Federal, Inc., Arlington, Va.
GEOTHERMAL DIRECT USE, ECONOMIC AND ENGINEERING STUDY INTEGRATION. VOLUME 2: DATA BASE Final Report
Charles A. Bakewell, Neil Book, and E. Hunter Herron Aug. 1979 375 p
(SAN-2072-1-Vol-2) Avail: NTIS HC A16/MF A01

Process analyses are presented including input and output data base for each of the twenty economic-engineering studies on nonelectric uses of geothermal energy identified. DOE

N80-26876# Entwicklungs- und Forschungslabor, Lorrach (West Germany).
WATER HEATING BY SOLAR ENERGY WITH PLASTIC COLLECTORS Final Report
Juergen Kleinwaecher Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1979 163 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-29) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 34

A low price, high efficiency, light weight, and easy to transport solar collector was developed using a plastic monotube with transparent top and dark bottom. Various synthetic materials were examined with regard to their optical and thermal properties and their durability. Prototype installations for swimming pool heating, domestic hot water and house heating in combination with a heat pump are described. Author (ESA)

N80-26877# Grammer (Willibald), Amberg (West Germany). Abteilung Solar-Klima-Technik.
SOLAR COLLECTOR SYSTEM USING AIR COLLECTORS FOR A PRE-DRYING FACILITY IN A GRASS DRYING PLANT Final Report
Hermann Barthel Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1979 19 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(SKT-Teil-1; BMFT-FB-T-79-30) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 3,60

The design, construction, and installation of a solar collector system for the drying of grass with hot air is described. The collector surface measures 1456 square meters. Measurements were taken during field tests and their results are reported. Water removal is about 18%. Author (ESA)

N80-26878# AEG-Telefunken, Wedel (West Germany). Fachbereich Raumfahrt, Neue Technologien.
DESIGN AND FABRICATION OF TERRESTRIAL PHOTOVOLTAIC SOLAR GENERATORS FOR FIELD TESTING IN REGIONS OF INTENSIVE INSOLATION Final Report
Hans-Dieter Wegmann Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-34) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 7,15

The design and production of photovoltaic solar energy converters is described for three different applications: a transmitter station, a navigation buoy, and a laboratory building. The collectors consisted of interconnected 5 cm x 5 cm silicon solar cells encapsulated in glass or glass fiber reinforced acrylic resin. The largest device delivered 2000 W of electrical power. Author (ESA)

N80-26879# Austrian Solar and Space Agency, Vienna.
COLLECTOR TEST METHODS: ANALYSIS OF TEST METHODS FOR THE DETERMINATION OF THE THERMAL EFFICIENCY OF FLAT-PLATE COLLECTORS
Manfred Bruck, Walter Heindl, Harald Koch, Gottfried Schaffar (Technische Univ., Vienna), and Peter Varga Sep. 1979 236 p refs Sponsored by Austrian Federal Ministry of Science and Research
(ASSA-FA-10; ISBN-3-7041-0050-1) Avail: NTIS HC A11/MF A01

Test methods were evaluated for the determination of the thermal efficiency of flat-plate solar collectors with a liquid as the transfer fluid by means of a mathematical simulation. A comparison of experimental results obtained from tests conducted by the National Bureau of Standards (NBS) and by the International Energy Agency (IEA) with the results of the theoretical analysis shows that the observed scatter of data is primarily caused by systematic errors when conducting the test. However, the scatter is also caused by production-dependent changes of the collector properties and by the fact that ambient conditions were not sufficiently considered. The analysis of the test methods by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and by the Bundesverband fuer Solarenergie (BSE) showed that the BSE standard yields better results - particularly for the climatic conditions in Central Europe - than the ASHRAE standard. A simple correction of the systematic deviations observed in BSE tests, causec by the fact that the temperature of the absorber is lower than of the transfer fluid, is suggested. Author (ESA)

N80-26880# Open Univ., Milton (England) Energy Research Group.
A CHEMICAL HEAT-PUMP/ENERGY STORAGE DEVICE AND ITS APPLICATIONS
Sep. 1978 78 p refs Prepared jointly with Rutherford High Energy Lab., Chilton, England
(Grant SRC-G/RA/5360 4)
(ERG-030) Avail: NTIS HC A05/MF A01; Secr. Energy Res. Group, Milton Keynes, England

A prototype heat-pump was constructed and operated, using sulfuric acid and water as the chemical pair. It achieved a power output of 3.5 kW (this with malfunctioning heat exchangers). The heat-pump chemicals can be reconcentrated either using heat (greater than 120 C) or electricity; in the latter case the chemicals store heat-pumping capacity (with a COP of about 1.5). Thus the chemical heat-pump may find application in conjunction with either waste-heat or off-peak electricity (from nuclear, wind or wave devices at any time other than peak demand time). On the basis of present cost-assumptions, the chemical heat-pump may be immediately cost-effective: using waste heat to provide industrial process heat, using waste heat to provide space-heating and cooling, and as an off-peak heat-pump (reconcentration by electricity). Industrial heat demand in the dairy, bottle washing and brewing industries was analyzed. Author (ESA)

N80-26881# American Association for the Advancement of Science, Washington, D.C. Office of Public Sector Programs.
ENERGY AND RESOURCE RECOVERY FROM SOLID WASTE: REPORT FROM A WORKSHOP CONSIDERING PROBLEMS IDENTIFIED BY THE INTERGOVERNMENTAL SCIENCE, ENGINEERING, AND TECHNOLOGY ADVISORY PANEL
1979 237 p refs Conf. held in Lanham, Md., 24-26 Sep. 1979
(Grant NSF OPA-78-24464)
(PB80-150790; AAAS/PUB-79/R/17; NSF/RA-790345) Avail: NTIS HC A11/MF A01 CSCL 13B

Problem areas considered by a workshop on energy and resource recovery from solid waste include: institutional and economic issues; environment and health issues; production technology issues; and use technology issues. Separate working groups, set up to consider each of these issues, prepared draft reports which make up the separate sections of this report. GRA

N80-26882# Illinois Inst. of Natural Resources, Springfield.
ILLINOIS STATE PLAN: ENERGY CONSERVATION IN INSTITUTIONS (INSTITUTIONAL BUILDINGS GRANT PROGRAM)
Steven K. Thomas, Steven L. Tuma, and John Shum 15 Aug. 1979 96 p Prepared in cooperation with Contract Research Corp., Chicago
(PB80-148182) Avail: NTIS HC A05/MF A01 CSCL 10A

The Illinois state plan for the Institutional Buildings Grant Program is presented. The plan addresses very narrow legislative requirements of the Energy Conservation Policy Act. The plan illustrates the strategies and commitments to achieve full implementation of the Energy Grant Program in Illinois. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-26883*# Research Triangle Inst., Research Triangle Park, N. C.
THE 1979 SOUTHEASTERN VIRGINIA URBAN PLUME STUDY (SEV-UPS): SURFACE AND AIRBORNE STUDIES
J. H. White, W. C. Eaton, M. L. Saeger, R. B. Strong, and J. B. Tommerdahl May 1980 239 p refs
(Contract NAS1-15827)
(NASA-CR-159233; RTI/1816/01-F) Avail: NTIS HC A11/MF A01 CSCL 13B

The operation of two surface monitoring stations (one in downtown Norfolk, Virginia, one south of the city near the Great Dismal Swamp) and the collection of 40 hours of airborne measurements is described. Surface site measurements of ozone, oxides of nitrogen, sulfur dioxide, temperature, dew point, b sub seat, and condensation nuclei were made. Instrument calibrations, quality assurance audits, and preliminary data analysis in support of the Urban Plume Study were also made. The air pollution problems that were addressed are discussed. Data handling procedures followed for the surface stations are presented. The operation of the aircraft sampling platform is described. Aircraft sampling procedures are discussed. A preliminary descriptive analysis of the aircraft data is given along with data or plots for surface sites, airborne studies, hydrocarbon species, and instrument performance audits. Several of the aircraft flights clearly show the presence of an urban ozone plume downwind of Norfolk in the direction of the mean wind flow. J.M.S.

N80-26884# National Research Inst. for Oceanology, Stellenbosch (South Africa). Coastal Engineering and Hydraulics Div.

BEACH SEDIMENT SAMPLING METHODS

L. Lenhoff Aug. 1979 75 p refs

(CSIR-RR-366; ISBN-0-7988-1561-2) Avail: NTIS HC A04/MF A01

The sampling of beach sediments can be done in numerous ways and in many instances a choice of sampling method is made without considering the degree of accuracy which can be expected. Since the median grain diameter is a critical factor in many coastal engineering problems, the accurate determination of this parameter is of great importance. A standard sampling lay-out for the foreshore part of a beach profile is necessary in order to obtain a reliable estimate of the mean median grain diameter for coastal engineering application. Experiments were done on six test beaches which were selected on the basis of their different sediment characteristics. The results of different sample combinations were statistically analysed in order to determine the number of samples which is necessary to obtain a reliable estimate of the grain size within a given confidence band. The most significant conclusion which can be drawn is the recognition of two distinct grain size populations which are separated by the mid-tide line. A minimum of five samples is needed from each zone to obtain an acceptable estimate of the mean value of the median grain size. All the samples from the same zone may be combined into one composite sample to simplify the analysis. This implies that only two samples are obtained for each beach section, namely, one for the upper and one for the lower foreshore. Some sampling techniques which can be applied to simplify the sampling procedure were also evaluated. A number of recommendations with regards to these techniques are given. Author

N80-26885*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

SUPPORTING STATEMENT FOR COMMUNITY STUDY OF HUMAN RESPONSE TO AIRCRAFT NOISE

Thomas K. Dempsey, Richard DeLoach, and David G. Stephens Mar. 1980 30 p

(NASA-TM-81803) Avail: NTIS HC A03/MF A01 CSCL 13B

A study plan for quantifying the relationship between human annoyance and the noise level of individual aircraft events is studied. The validity of various noise descriptors or noise metrics for quantifying aircraft noise levels are assessed. E.D.K.

N80-26886*# San Jose State Univ., Calif.

STRATOSPHERIC POLLUTANT TRANSPORTS BY PLANETARY WAVES AND TROPICAL CIRCULATIONS Final Report, Jul. 1979 - Mar. 1980

Christopher A. Riegel and Leonhard Pfister Mar. 1980 3 p (Contract NCC2-17)

(NASA-CR-163278) Avail: NTIS HC A02/MF A01 CSCL 13B

Radiosonde and U-2 aircraft data from the Intertropical Convergence Zone experiment of July, 1977 were analyzed. The radiosonde data above 15 km was plotted in the form of time-height sections so that wave motions in the meteorological variables (temperature, zonal wind, and meridional wind) could be easily delineated. The results showed the presence of a planetary 16 day Kelvin wave. More significantly, large amplitude gravity waves with vertical wavelengths on the order of 3-6 km were found. Spectral analysis of frequencies showed peaks in meridional wind variance at 2-3 days and 5 days, with the shorter periods stronger at higher altitudes. In the time domain, two instances of organized wave groups propagating upward into the stratosphere were isolated. Associated with one of these wave groups was a region of very large vertical shear in which either turbulence or small scale (10 km wavelength or less) gravity wave activity had been found by the U-2 aircraft. R.E.S.

N80-26887# Committee on Science and Technology (U. S. House).

IMPLEMENTATION OF THE CLIMATE ACT

Washington GPO 1979 234 p refs Hearing before the Subcomm. on Nat. Resources and Environ. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 40, 10 Jul. 1979

(GPO-52-471) Avail: Subcomm. on Natural Resources and Environment

A 5-year plan for assessing natural and man-induced climatic processes and their biological and socioeconomic implications and impacts is presented and examined. Tactics for basic research and for considering the variability of climate in planning national programs related to agriculture, energy, transportation, and water resources are stated along with methods for information dissemination by the twelve government agencies involved. A.R.H.

N80-26888# World Meteorological Organization, Geneva (Switzerland).

THE LONG-RANGE TRANSPORT OF POLLUTANTS AND ITS RELATION TO GENERAL CIRCULATION INCLUDING STRATOSPHERIC/TROPOSPHERIC EXCHANGE PROCESSES

1979 450 p refs Presented at WMO Symp., Sofia, 1-5 Oct. 1979

(WMO-538; ISBN-92-63-10538-3) Avail: NTIS HC A19/MF A01

The following topics are discussed: emissions of pollutants sustained in long range transport and dust occurrences; distribution of pollutants and dust transport in space and time; chemical transformations of pollutants during the long range transportation; removal processes and removal rates during the long range transportation; modeling and meteorology of long range transport of pollutants and dust including stratospheric tropospheric exchange processes; and scientific problems related to measurement of relevant pollutants and dust. For individual titles, see N80-26889 through N80-26942.

N80-26889# Norwegian Inst. for Air Research, Lillestrom.

EMISSION OF GASEOUS AND PARTICULATE MATTER IN RELATION TO LONG-RANGE TRANSPORT OF AIR POLLUTANTS

Arne Semb *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 12 p refs Sponsored in part by Norwegian Min. Council (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

The sources for preparing emission surveys for SO2 and NOx are discussed. These are based mainly on fossil fuel consumption data. Comparable estimates can also be made for reactive hydrocarbons, soot, lead, and vanadium. The data relate mainly to the OECD countries of Europe. Author (ESA)

N80-26890# Battelle Pacific Northwest Labs., Richland, Wash.

EMISSION SOURCE SPECIFICATION IN A REGIONAL POLLUTANT TRANSPORT MODEL

D. J. McNaughton *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 3-8 refs (For primary document see N80-26888 17-45)

(Contract EY-76-C-06-1830)

Avail: NTIS HC A19/MF A01

A series of sensitivity and verification tests are examined to evaluate various means of emission source specification in a regional model. The regional air quality model incorporates pollutant transport, dispersion, chemical transformation, dry deposition, and precipitation scavenging of primary and secondary pollutants. Specification of emissions sources in a regional model can be a difficult and time consuming activity where temporal and spatial resolution of predictions must be weighted against computational costs. In regional scale modeling, the resolution of this problem may lie in the relative contributions of initial input data to pollutant concentration patterns contrasted with other causal factors such as precipitation scavenging and other removal mechanisms. The effects of spatial averaging of emissions are discussed as would be applicable to models using gridded emissions as input. The analysis makes use of observed ambient air concentration data for sulfate and sulfur dioxide and sulfate concentrations in precipitation. Author (ESA)

N80-26891# Power Research Inst., Prague (Czechoslovakia).

SOME RESULTS OF AIRBORNE AIR POLLUTION MONI-

TORING FROM CROSS-SECTION FLIGHTS OVER CZECHOSLOVAKIA

M. Prokup *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 11-15 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

A series of 13 sampling flights were made between 50 and 2700 m altitude in clear weather, testing for SO2 and sulfates using Whatman 40 filters and barium perchlorate Thorin. The main sources of pollution are a concentration of lignite-fired thermal power stations. The effects of frontal activity and temperature inversions on sampling are discussed. Author (ESA)

N80-26892/ National Inst. of Public Health, Bilthoven (Netherlands).

AERIAL DETERMINATION OF LONG RANGE TRANSPORT

T. Schneider *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 17-23 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

Two series of sampling flights over the Netherlands are described; the first measuring the transport of air pollution over sea (from Great Britain), the second studying the interaction of ozone with other pollutants. Levels of SO2 were found to vary greatly with altitude. Air masses transported over land were found to contain less ozone than those arriving over the sea. The source of the ozone is open to question, but the concentrations correlate with plant damage data. Author (ESA)

N80-26893/ Rhode Island Univ., Kingston. Graduate School of Oceanography.

LONG-RANGE TRANSPORT OF POLLUTION AEROSOL TO THE ARCTIC: A PROBLEM WITHOUT BORDERS

Kenneth A. Rahn and Richard J. McCaffrey *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 25-35 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

Large amounts of aerosol are found in the Arctic atmosphere during winter. Constituents such as V, Mn, sulfate, and Pb210 increase by factors of 10 to 30 from summer to winter and cause the Arctic haze. The bulk of the aerosol is thought to be aged, secondary in nature, and pollution-derived. The dominant source is probably Eurasia. Author (ESA)

N80-26894/ Risoe National Lab., Roskilde (Denmark). Danish Air Pollution Lab.

REGIONAL SOURCE QUANTIFICATION MODEL FOR SULFUR OXIDES IN EUROPE

L. P. Prahm, K. Conradsen (Tech. Univ. of Denmark, Lyngby), L. B. Nielsen (Tech. Univ. of Denmark, Lyngby), and A. Eliassen (Norwegian Meteorol. Inst.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 37-44 refs Sponsored by Scandinavian Council of Ministers (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

Location and emission strength of sulfur oxide sources in Europe are estimated by a meteorological air quality model based on air quality measurements and air trajectories. The data base used consists of 24 hour SO2 and SO4 measurements from 45 stations in Europe during the period from 1973 to 1975, and of air trajectories arriving 4 times a day at each station. A large number of linear equations are produced estimating SO2 and SO4 values with emission fields as unknowns. Relating the measured and estimated SO2 and SO4 values to each other by a least square method gives an estimate of the emission fields. Agreement between the calculated estimate and the model result was found for most of the emission areas. The emission in some European areas, however, was found to be both overestimated and underestimated. Possible reasons for this disagreement are discussed. The regional source quantification model is demonstrated to be useful for source estimation on a regional scale. Author (ESA)

N80-26895/ Hydrometeorological Inst. (Czechoslovakia).

SULFUR COMPOUNDS IN BACKGROUND AIR POLLUTION IN CZECHOSLOVAKIA

Santroch Jaroslav and Zavodsky Dusan *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 45-51 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

Site descriptions and operating criteria are given for two background stations co-located with regular meteorological stations. Monthly mean concentrations of sulfur oxides, annual weighted averages of pH, conductivity and concentrations of all basic components in precipitation and other data are shown for 1978. Average concentrations of SO2 and particulate sulfates for air trajectories are plotted. Author (ESA)

N80-26896/ Finnish Meteorological Inst., Helsinki.

ON THE CONTRIBUTION OF METEOROLOGICAL FACTORS TO THE SEASONAL VARIATIONS IN ATMOSPHERIC SULFUR CONCENTRATIONS

Goeran Nordlund *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 53-63 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

High concentrations of SO2 at ground level in rural Finland were found to occur in a few winter months in a way which could not be explained by the seasonal differences in emission values. Meteorological data from Jokioinen were analyzed, including wind speed and direction, calculated mixing depth and precipitation frequencies, amounts, and rates. It is concluded that the seasonal variations in the mean mixing depth and the occurrence of surface inversions has a decisive influence on the variations in ground level sulfur concentrations due to long distance transport. Author (ESA)

N80-26897/ Environmental Research and Technology, Inc., Westlake Village, Calif.

ASSESSMENT OF REGIONAL AIR POLLUTION OVER THE EASTERN UNITED STATES. RESULTS FROM THE SULFATE REGIONAL EXPERIMENT (SURE)

G. M. Hidy, P. K. Mueller, T. F. Lavery, and K. K. Warren *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 65-76 refs Sponsored by Electric Power Research Inst. (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

The results of the SURE program have provided insight into the behavior of sulfur oxides on a regional scale over the eastern United States. During the study period of 1977-1978, there was definite evidence of widespread accumulation of particulate sulfate concentrations centered in the Ohio Valley and western Pennsylvania near a zone of high SO2 emission density. Nitrate levels displayed a geographical distribution differing from sulfate, with concentrations at the ground lower than sulfate. Nitrate was the more prevalent along the Great Lakes and on the East coast compared with sulfate maximum in the rural areas of the Midwest. Sulfate concentrations were found to be maximum in summer with minimal sulfur dioxide, but sulfate also was high in concentration with high sulfur dioxide in winter. Nitrate displayed a strong maximum in winter with a seasonal nitrogen oxide concentration maximum. The regional elevations of sulfate were episodic in nature, with a duration of 2-5 days. Two kinds of regional scale events were observed, the first associated with broad air mass stagnation around the southern parts of a high pressure over high SO2 emission areas. The second was found in a southwesterly directed, ductad flow of polluted air extending over distances exceeding a 1,000 km, between frontal disturbances and a mountainous topography. The latter appears to have a character identifiable with long range transport of pollution. Author (ESA)

N80-26898/ Institute of Applied Geophysics, Moscow (USSR).

THE PRINCIPLE OF SITING CONTROL STATIONS IN LONG RANGE TRANSPORT OF AIR POLLUTANTS

B. N. Bronin *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 79-84 refs

(For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

An algorithm was written for identifying pollution sources given a discrete concentration field, the wind field, and a model of long range pollution transport. A second algorithm was developed for optimally using a limited number of monitoring stations, using as input the information calculated in the first algorithm. Author (ESA)

N80-26899# Teknekron, Inc., Waltham, Mass. Energy and Environmental Systems Div.
CHARACTERIZATION OF REGIONAL EPISODES OF PARTICULATE SULFATES AND OZONE OVER THE EASTERN UNITED STATES AND CANADA
Eugene Y. Tong, Michael T. Mills, Brand L. Niemann, and Lowell Smith (EPA, Washington, D.C.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 85-93 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Compilation of existing aerometric data for the eastern United States and Canada has enabled a synoptic regional analysis to be made of air pollution episodes due to the occurrence of particulate sulfates and ozone. Analysis of the air quality and meteorological data bases on both the regional and local scales has provided the delineation of those meteorological patterns that are most conductive to the onset, peaking, and decline of particulate sulfates and ozone. It was found that there is strong evidence in support of the co-occurrence of elevated concentrations of atmospheric sulfates and ground-level ozone over the industrialized eastern United States and Canada. These warm episodes are not only related to the trajectories of the polluted air parcels, but also to certain easily identifiable synoptic features on the daily weather maps. The most outstanding sulfate/oxidant episodic situation is related to a generally eastward moving (over the Great Lakes) occluded frontal system and the circulation around the Bermuda High. The presence of a southeastward moving cold front often enhances the channeling effects for long distance transport. The manifestation of these regional episodes can often be spatial scales of several hundred miles or more. There is also evidence that precipitation over the haze layer removes suspended sulfates which in turn decrease the pH of the rain water. Author (ESA)

N80-26900# Atomic Energy Research Establishment, Harwell (England). Environmental and Medical Sciences Div.
DRY DEPOSITION OF GASEOUS POLLUTANTS
J. A. Garland *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 95-103 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The dry deposition process is defined and methods of measurement with the advantages and disadvantages of each are presented. Deposition velocities for gases to land surfaces and uptake by the sea are described. It is concluded that while dry deposition for ozone and sulfur dioxide are well documented, information on most other gases of interest is incomplete. Author (ESA)

N80-26901# Institute of Applied Geophysics, Moscow (USSR).
SNOW COVER AS AN INDICATOR OF A LONG-RANGE POLLUTANT TRANSPORT IN THE MONITORING SYSTEM
T. N. Jygalovskaya, I. M. Nazarov, O. S. Renne, and S. D. Fridman *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 105-108 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

An area 2000 km long having a low natural background of pollutants, and located downwind of an industrial complex was studied. Concentrations of Ni, Pb, Zn, Cu, V, Ti, Ag, and Co were measured in snow samples at the time of standard determination of snow water content. Pollutants were detected at distances greater than 1000 km. Author (ESA)

N80-26902# Institute of Applied Geophysics, Moscow (USSR).
PETROLEUM HYDROCARBON ATMOSPHERIC TRANSPORT
V. P. Andryukov and I. M. Nazarov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 109-115 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The physical properties and chemical composition of samples of organic aerosols taken near an industrial complex and in background regions in the Soviet Union were studied to determine their removal rates and to assess the proportion of petroleum hydrocarbons in the total. Samples were taken on glass fiber filters, extracted with carbon tetrachlorine and analyzed chromatographically. It was found that: (1) organic aerosols in the continental atmosphere mainly contain petroleum hydrocarbons with molecules that consist of 12 and more atoms of carbon; (2) aerosols, containing petroleum hydrocarbons, have a diameter less than 0.2 micrometer; (3) to define anthropogenic hydrocarbons in the marine atmosphere it is necessary to sample aerosols with a diameter less than 0.2 micrometer; and (4) in the atmospheric transport of petroleum hydrocarbons, paraffin hydrocarbons are subjected to the most rapid chemical destruction. Author (ESA)

N80-26903# Institute of Applied Geophysics, Moscow (USSR).
INVESTIGATION OF PARAMETERS OF DILUTION AND REMOVAL OF SULFUR DIOXIDE AND LEAD DURING TRANSPORT ABOVE THE OCEAN
S. M. Korolev and A. G. Ryaboshapko *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 117-124 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Long range lead and SO2 transport from industrial complexes situated on the coast to 1000 km over the ocean are examined to determine dilution and removal parameters. Measurements were made near the sea surface. Atom absorption was used to determine lead content, the West-Gaeke method for SO2, and lead 214 concentration by gamma spectrometry methods. Reverse trajectories of air mass were drawn for each sample to determine transport time. Curves are presented for pollutant concentrations as a function of transport time, and for concentrations at various distances from the coast. Author (ESA)

N80-26904# Norwegian Inst. for Air Research, Lillestrom.
LONG RANGE TRANSPORT OF AIR POLLUTANTS WHICH ARE RE-EMITTED TO THE ATMOSPHERE
Brynjulf Ottar *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 125-125k refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The re-emission of some air pollutants having a high vapor pressure in the solid state to the atmosphere is discussed. Information collected on the emission, dispersion, and deposition of mercury and polychlorinated hydrocarbons shows that re-emission of previously deposited amounts plays an important part in the long range transport of these substances. Because the re-emission depends on temperature and seasonal climatic variations, as well as the vapor pressure and other chemical characteristics of the specific components, the establishment of the large scale dispersion pattern must be a slow process. In the case of mercury the natural emissions dominate on a global scale. The man-made emissions may only modify this pattern on a local or regional scale. The more important abatement efforts for mercury pollution in air and water will therefore be of a local character. Measurements indicate that the mercury concentration in the topsoil is enhanced at higher lattitudes in the northern hemisphere, because of a systematic transfer of mercury from warmer areas. A similar development has been suggested for the polychlorinated hydrocarbons. Author (ESA)

N80-26905# Institute of Applied Geophysics, Moscow (USSR).
ATMOSPHERIC TRANSPORT OF ORGANOCHLORINE PESTICIDES
V. M. Koropalov and I. M. Nazarov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 127-132 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

Aircraft sampling of pesticide distribution in the atmospheric boundary layer was conducted over a region in Central Asia. Vertical profiles of pesticide and atmospheric aerosol indicate that most of the pesticide enters the atmosphere as vapor, that sorption of the pesticide on atmospheric aerosol occurs in the atmosphere, and pesticide removal is largely determined by the removal rate of the aerosol fraction. Author (ESA)

N80-26906# Institute for Hydrology and Meteorology, Sofia (Bulgaria).

FLUCTUATIONS OF THE ABUNDANCE OF CARBON MONOXIDE

S. Bodanov, P. Videnov, and E. Savov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 135-139 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

Spectroscopically determined abundances of CO from an urban area and from rural background locations were compared in an attempt to relate background amounts to the change in the air mass over the region. Measurements for several days in the same air mass gave equal background abundances, and varied with the change of the air mass. It is concluded that variations in background abundance in periods on the order of one month are related to the origin and trajectories of the air masses. Author (ESA)

N80-26907# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.

MECHANISMS AND RATES OF FORMATION OF SULFUR AEROSOLS IN POWER PLANT PLUMES

R. F. Pueschel and Y. Mamane (Technion - Israel Inst. of Tech.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 141-148 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

Aerosol size distributions, aerosol elemental composition, and the concentrations of fine particles and trace gases at three typical locales in order to explore the potential effects on the environment of coal-fired power plant operations. The three cases are the plume proper of a 2150 megawatt power plant burning low sulfur coal, the atmosphere outside but close to the plume, and the atmosphere of a region hundreds of miles away from any industrial operation. The aerosol dynamics, discussed in terms of the lumped mode heterodisperse coagulation model show that the formation rates of condensation nuclei are similar for the power plant plume and the rural atmosphere. However, the rural aerosol is of natural origin and is dominated by organic particles, whereas the plume aerosol consists of siliceous spheres mixed with sulfate particles. The aerosol dynamics further show that the accumulation mode at around 0.1 micron radius is the most persistent feature of the atmospheric aerosol with turnover times of weeks to months. The particle concentration and modal radius of this mode is larger in the plume and its immediate vicinity than it is in the rural atmosphere. The data also show a significant increase in aerosol concentration in the plume at the coarse particle mode of radii larger than 1 micron. However, rapid settling of these relatively large particles results in turnover times of only hours. M.G.

N80-26908# Atomic Energy Research Establishment, Harwell (England). Environmental and Medical Sciences Div.

SOME ASPECTS OF THE FORMATION, TRANSPORT AND DESTRUCTION OF PHOTOCHEMICAL OXIDANTS IN NORTH-WEST EUROPE

R. G. Derwent *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 149-156 refs Sponsored by UK Dept. of Environ. (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

The time scales for formation and decay of the photochemical air pollutants (ozone, peroxyacetylnitrate (PAN), sulfates, and nitrates) are reviewed. A two step reaction model was developed for secondary pollutant formation, and is used to calculate typical behavior of secondary pollutants in southeast England. Author (ESA)

N80-26909# Environmental Protection Agency, Research Triangle Park, N.C. Regional Field Studies Office.

TRANSFORMATION DURING TRANSPORT: A STATE-OF-THE-ART SURVEY OF THE CONVERSION OF SO2 TO SULFATE

William E. Wilson and Noor V. Gillani (Washington Univ., St. Louis) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 157-164 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

The parameters influencing the conversion rate of SO2 to sulfate are examined. A conceptual model of the various stages in the physical and chemical life history of a power plant plume is constructed and used to examine and interpret the influence of parameters such as mixing, solar radiation, and background air reactivity on reaction rates. Experimental evidence for various aspects of the model from field measurements and smog chamber studies is described. M.G.

N80-26910# Stockholm Univ. (Sweden). Dept. of Meteorology.

FORMATION OF SULFURIC AND NITRIC ACID IN THE ATMOSPHERE DURING LONG RANGE TRANSPORT

H. Rodhe, P. Crutzen (Natl. Center for Atmospheric Res.), and A. Vanderpol (Meteorol. Res., Inc.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 165-171 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

A simple chemical model describing the basic transformation of sulfur and nitrogen oxides to the corresponding acid is presented and combined with a model for transport and deposition over time scales of a few days. Formation of HNO3 in the model takes place faster than that of H2SO4, agreeing with observations. An increase in the emission rate of hydrocarbons is found to enhance the rate of acid production. Changes in the emission of NOx may similarly affect the formation of both sulfuric acid and nitric acid. A proportional dependence of concentrations on emission rates may not be assumed in coupled chemical systems; demonstrated by the model results showing that increased acid concentrations in the air is much less than the increase in the emission rates of NOx and SO2. M.G.

N80-26911# Atomic Energy Research Establishment, Harwell (England). Environmental and Medical Sciences Div.

GENERATION OF SECONDARY POLLUTANTS IN THE ATMOSPHERIC BOUNDARY LAYER IN A HIGH PRESSURE SITUATION

Oeystein Hov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 173-180 refs Sponsored by Royal Norwegian Res. Council for Sci. and Technol. and UK Dept. of Environ. (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

An atmospheric model was used to investigate theoretically the potential for oxidant formation from UK emissions of hydrocarbons, nitrogen oxides and sulfur dioxide, and evaluate the potential for long range transport of species generated from UK emissions during anticyclonic weather. NO, SO2, CO, and various hydrocarbons are emitted into the model volume, in all, 40 species. The emissions of the various species are split into eight source categories. The chemical formulation of the model includes approximately 145 intermediate and end products, in addition to the 40 emitted species. About 300 reactions are required to describe the degradation pathways. Model generated species are compared with measurements from the literature. Data for ozone and sulfate show good agreement. Smog formation mechanisms are shown to be different for intense urban smog where the time scale is short and on a multiday scale. Author (ESA)

N80-26912# Swedish Water and Air Pollution Research Lab., Goeteborg.

INTERACTION OF GASES WITH SULFURIC ACID AEROSOL IN THE ATMOSPHERE

Ying-Hua Lee and Cyrill Brosset *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 181-192 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The interactions of sulfuric acid dorplets with gaseous components in the ambient air are examined. Calculations are carried out for the systems H2SO4-H2O-NH3 and H2SO4-H2O-NH3-HNO3-HCL, in the form of fine droplets (nucleation mode). The composition of the solutions at the respective points in mole/kg solution of (NH4)2SO4 and H2SO4 is given. Ion composition is calculated as well as the molar ratios (NH4+):(H+)-O. Composition of the liquid phase is presented in terms of ratios of total concentration of NH4+ and SO4 with relative humidity and partial pressures of NH3, HNO3 and HCL. Concentration of nitrate and chloride in solution amounts to 0.1 and 0.05, respectively of total sulfate. Author (ESA)

N80-26913# National Pollution Control Commission, Manila (Philippines).

A COMPARISON BETWEEN TWO METHODS OF MEASURING THE CONCENTRATION OF SUSPENDED PARTICULATES

Guillermo A. Pecache *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 193-197 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A high volume sampler which determines particulate concentration by a gravimetric method, and a light scattering sampler are compared. Analysis of the daily average suspended particulate concentration data shows that there exists a significant relationship between the 24 hour average particulate concentrations as measured by both instruments. The relationship obtained for the data is expressed in terms of the linear equation Y = 7 + 2.5 X which given the value of the concentration determined by the high volume sampler as a function of the concentration recorded by the light scattering instrument. Since the tests of significance indicated that the intercept is not different from zero, it can be said further that the concentrations are simply directly proportional to each other; which consequently leads to the generalization that multiplying the light scattering instrument reading by 2.5 would be a fairly good way of obtaining the corresponding probable value that would result from a high volume sampler. Author (ESA)

N80-26914# Swedish Water and Air Pollution Research Lab., Goeteborg.

OXIDIZED NITROGEN COMPOUNDS IN LONG RANGE TRANSPORTED AIR MASSES

Peringe Grennfelt *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 199-206 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Measurements of oxidized nitrogen compounds made at a remote station (Roervik) on the Swedish west coast are examined. Wind trajectories were determined for isolated episodes of high concentration, and nitrogen mass balances determined. It is concluded that: in Europe, nitrogen oxides are transported over large distances in the same manner as sulfur oxides; practically no nitrogen monoxide remains in a long range transported air mass (for winter situations also); most of the nitrogen compounds remain in gas phase during transport, and only a minor fraction is found on particle filters; the dominant oxidized nitrogen compound in a long range transported air mass is usually NO2. Only a minor fraction of atmospheric nitrates will be found on particles, and the total solar concentration of oxidized nitrogen compounds exceeds the total concentration of oxidized sulfur compounds in long range transported air masses. Author (ESA)

N80-26915# Argonne National Lab., Ill. Chemical Engineering Div.

USE OF OXYGEN ISOTOPY IN THE STUDY OF TRANSFORMATIONS OF SO2 TO SULFATES IN THE ATMOSPHERE

Ben D. Holt, Paul T. Cunningham, and R. Kumar *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 207-212 refs Sponsored by DOE (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Atmospheric sulfate formation is analyzed using oxygen isotopy. Sequential seven day samples of water vapor, particulate sulfate and sulfur dioxide were continuously collected throughout the four seasons. Samples of rain and snow were also collected for most of the precipitation events during this period. The isotopic results obtained from the sampling program were plotted versus time. The data are given in units of delta o18, which is the deviation in parts per thousand of the o18/o16 ratio of the sample from that of Standard Mean Ocean Water. The curves for atmospheric water vapor and precipitation are similar, while curves for sulfate in precipitation show the influence of the precipitation water on the delta o18 of the dissolved sulfate, as well as a seasonal variation. Aerosol sulfate shows no distinct seasonal variation, unlike particulate sulfates collected on inert filters at the same site. Various explanations are presented for this phenomenon. Author (ESA)

N80-26916# Atmospheric Environment Service, Downsview (Ontario).

AN ATMOSPHERIC SULFUR BUDGET FOR EASTERN NORTH AMERICA

Douglas M. Whelpdale and James N. Galloway (Virginia Univ.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 213-221 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

An atmospheric sulfur budget for eastern North America is constucted. The input terms considered are man-made emissions, natural emissions, and flows from outside the region; the outputs considered are wet deposition, dry deposition, and outflows across the boundaries of the region. Estimates of the budget terms are made separately for Canada and the U.S., then combined to produce a budget for the region as a whole, using recent data. From independent best estimates of budget terms a reasonable balance is found between inputs and outputs of sulfur in the atmosphere of eastern North America. The inputs and outputs which are dominant in the biogeochemical sulfure cycle of the region are man-made emissions, wet and dry deposition, and outflow to the oceans. Major uncertainties exist in the magnitudes of the biogenic emission terms, but these inputs are small relative to other inputs. Of the approximately 18 Tg S y entering the region s atmosphere, some 57% of it is deposited back to the surface of the region as a result of wet and dry deposition. The remainder leaves the region by atmospheric transport, primarily to the east. Author (ESA)

N80-26917# Institute of Meteorology and Water Management, Warsaw (Poland).

AN ASSESSMENT OF WET REMOVAL OF SULFUR FROM AIR BY RAINFALL IN POLAND

Regina A. Hryniewicz *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 223-229 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Concentrations of sulfur compounds taken from precipitation samples in Poland are used to calculate the empirical efficiency coefficients of wet sulfur removal. The coefficients are defined as a ratio of the amount of sulfur removed from 1 cu mm of air by 1 mm of precipitate, to the concentration of sulfur in the air. A constant rate for wet sulfur removal is obtained by multiplying the efficiency coefficient by the real or assumed rain rate. Coefficients for winter months varied from 0.164 mm to 0.103 mm, and are 2.3 times greater for the remaining months. Comparisons with other European stations indicate that differing climate conditions have an effect on the values of the calculated parameters, and that efficiency coefficients have lower values for areas having higher pollution levels. Author (ESA)

N80-26918# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.

THE ACIDITY OF HAWAIIAN PRECIPITATION AS EVI-

DENCE OF LONG-RANGE TRANSPORT OF POLLUTANTS
John A. Miller *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 231-237 refs (For primary document see N80-26888 17-45)
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Precipitation samples were collected at five sites on the island of Hawaii from sea level to 3400 m for a period of four years. Samples were taken on a daily or biweekly basis and analyzed for pH, conductivity, and certain ions such as sulfate and nitrate were analyzed. The data show that the most acidic rains fall above the 2500 m level. Since the precipitation forming clouds must scavenge material above this level, it is suggested that acid forming pollutants reach mid troposphere levels and are transported long distances until being scavenged in the Hawaiian rains. Further analysis showed that the acidity measured at the 3400 m level is significantly higher when trajectories come from a northerly direction than from a southerly direction, perhaps reflecting differences in hemisphere sources.
Author (ESA)

N80-26919# Meteorological Office, Bracknell (England). Boundary Layer Research Branch.
THE CHARACTER AND IMPORTANCE OF PLUME LATERAL SPREAD AFFECTING THE CONCENTRATION DOWNWIND OF ISOLATED SOURCES OF HAZARDOUS AIRBORNE MATERIAL
F. B. Smith *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 241-251 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Lateral spread at short range is discussed to show that various statistical methods exist which are effective and allow for distance and travel time, with or without consideration for wind shear. It is shown that at a somewhat longer range (100 km) mesoscale turbulence is significant. At longer distances synoptic features are totally dominant and have an influence on lateral spread.
Author (ESA)

N80-26920# Bulgarian Academy of Science, Sofia. Inst. for Hydrology and Meteorology.
PRESSURE AND TOPOGRAPHY EFFECTS ON LONG-RANGE AIR POLLUTANTS TRANSPORT
G. D. Djolov and D. E. Syrakov (Sofia Univ.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 253-258 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A long range air pollution transport model was developed, which treats regions on the scale of 2000 km in 50 km horizontal steps. The pollutant cloud was assumed to be transported by an external wind having constant velocity components in the cloud area. Topography and turbulent friction were parameterized through the field of the generated vertical motions. Results of numerical experiments are given, which show in particular that small values for vertical velocities on the order of a few cm/sec can cause large changes in the ground level concentration field.
Author (ESA)

N80-26921# Atmospheric Environment Service, Downsview (Ontario).
A NUMERICAL EXPERIMENT IN TRAJECTORY OF AIR POLLUTANTS OVER THE GREAT LAKES REGION
S. M. Daggupaty, P. I. Misra (Ontario Min. of Environ.), and R. E. Munn (Inst. of Environ. Studies) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 259-264 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A numerical scheme was developed which incorporates the effects of variable acceleration in air parcels. Trajectories based upon the Pettersen numerical iterative scheme show discrepancies under light variable wind conditions, and near singular points associated with anticyclonic, cyclonic, and deformation zones. Acceleration in the described model was evaluated as a residue of the balance between pressure, coriolis and frictional forces. Calculations of the trajectory end points obtained by the new and by the old methods in a case study of a winter storm, differ by an average of 180 km at the end of 24 hr.
Author (ESA)

N80-26922# Institute of Meteorology and Water Management, Warsaw (Poland).
SENSITIVITY OF UNI-LEVEL TRAJECTORY MODEL TO RANDOM ERRORS IN INITIAL FIELDS
J. Bartnicki, J. Pruchnicki, and J. Pudy-Kiewicz *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 265-270 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The effects of errors involving initial conditions in trajectory models were studied by randomly disturbed wind and emission fields. The effect on concentration fields of SO2 and SO4 was observed. Chemical transformations were determined using mass balance equations. Errors were found to be much greater in the case of disturbances in the wind field as opposed to the emission field. The maximal model error was 50-60% for SO2 concentration, and 60-70% for SO4.
Author (ESA)

N80-26923# Institute of Applied Geophysics, Moscow (USSR).
A MODEL FOR OPERATIVE EVALUATION OF TRANS-BOUNDARY FLOWS OF POLLUTANTS (SULFUR DIOXIDE AND SULFATES)
Y. A. Izrael, J. E. Mikhailova, and A. J. Pressman *In its* The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 271-279 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The model incorporates both dry deposition and precipitation washout processes, and permits calculation of SO2 mass reduction occurring through chemical transformations. It is possible also to estimate the concentration field produced by multiple sources, and to identify that fraction of pollutants imported from external sources.
Author (ESA)

N80-26924# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
METEOROLOGICAL DATA AND THE MESOS MODEL FOR THE LONG-RANGE TRANSPORT OF ATMOSPHERIC POLLUTANTS
J. Wrigley, H. M. ApSimon, and A. J. H. Goddard *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 281-287 refs (For primary document see N80-26888 17-45)
(Contract BC1687)
Avail: NTIS HC A19/MF A01

The most important parameters affecting the transport of pollutants, over distances of order 1000 km, are considered. These include: the effective wind speed and direction to determine trajectories; the state of the boundary layer in terms of changing mixing layer depth; stability and atmospheric turbulence; and depletion processes such as washout in rain. These parameters are used in the MESOS model to study the possible consequences of accidental releases of radioactivity and exposure from routine continuous releases from sites within Europe. The development of the data base providing all the relevant meteorological data across Europe, at 3-hourly intervals over a year, is described. Examples of the use of the data base with the MESOS model are given to illustrate the importance of accounting for spatial and temporal variation of meteorological data.
R.C.T.

N80-26925# Hydrometeorological Centre of the USSR (Moscow).
A MODEL FOR EVALUATION OF TRANSBOUNDARY SULPHUR DIOXIDE FLUX WITH THE INCLUSION OF VERTICAL MOTIONS
N. S. Valtischeva *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 289-295 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Improvements made to an existing three dimensional air

pollution transport model were examined. The number of computational levels in the lower 300 meters was increased, and a turbulence coefficient variable with height introduced. Model runs were made using actual SO2 concentrations as initial data. Comparisons with observed values were made which demonstrated the improved accuracy achieved when vertical motions were included. A model run was made which showed that the Western European contribution to SO2 in the Western U.S.S.R. is 6% to 7% of the total. Author (ESA)

N80-26926# Battelle Pacific Northwest Labs., Richland, Wash.
COMPARISON OF THE RESULTS OF AN EIGHT LAYER REGIONAL MODEL VERSUS A SINGLE LAYER REGIONAL MODEL FOR A SHORT TERM ASSESSMENT
W. E. Davis *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 297-304 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The results from an eight layer diabatic regional assessment model with estimates of vertical motions are compared to results from a single layer model without vertical motions for April 1974. Deposition results from the eight layer model with and without estimates of below cloud scavenging indicate that significant differences can occur in amounts deposited (in percent of total released), as well as in surface air concentrations of pollutants. Author (ESA)

N80-26927# Uppsala Univ. (Sweden). Dept. of Meteorology.
INITIAL DRY DEPOSITION AND TYPE OF SOURCE IN RELATION TO LONG DISTANCE TRANSPORT OF AIR POLLUTANTS
Ulf Hoesgstroem *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 305-306 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A method for estimating the dry deposition loss in the immediate surroundings of a source was investigated, along with a sulfur budget for the Paris area. Budget data were based on air quality data from a station situated 37 km south of central Paris. A visual point source model is used, from which the wet and dry deposition loss were removed, along with an allocation loss factor. Author (ESA)

N80-26928# Sofia Univ. (Bulgaria). Dept. of Physics.
ON LAGRANGIAN CHARACTERISTICS OF TURBULENCE AND DIFFUSION IN THE PLANETARY BOUNDARY LAYER
Eugeni Syrakov and D. Yordanov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 307-314 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The joint influence of stratification, baroclinity, and wind rotation on the Lagrangian characteristics of turbulence and diffusion in the planetary boundary layer were investigated on the basis of similarity theory. A simple two layer model of a barotropic and neutrally stratified planetary boundary layer was considered. The Lagrangian trajectories are shown for different roughness parameters, and are in good agreement with experimental data. Results from Lagrangian trajectories are shown to be useful in determining some diffusion characteristics in the planetary boundary layer. Author (ESA)

N80-26929# Sofia Univ. (Bulgaria). Dept. of Physics.
ON THE GAUSSIAN AND NONGAUSSIAN MODELS OF TURBULENT DIFFUSION IN SYNOPTIC AND GLOBAL SCALES IN THE ATMOSPHERE
Eugeni Syrakov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 315-320 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A semiempirical description of atmospheric turbulent diffusion is given. Diffusion coefficients are calculated for Gaussian and nonGaussian cases. The concentration distribution in the horizontal plane is computed and is shown to be, in most cases of a nonGaussian character. In the direction perpendicular to the wind, the concentration decreases more slowly than in the Gaussian case. Author (ESA)

N80-26930# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
LONG-RANGE MODEL OF SO2 AND SULFATE AND ITS APPLICATION TO THE EASTERN UNITED STATES
Teizi Henmi *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 321-328 refs (For primary document see N80-26888 17-45)
(Grant EPA-R-805271)
Avail: NTIS HC A19/MF A01

A model was developed which treats SO2 and sulfate transport and transformation in the daytime mixing layers, nighttime stable layer, and the layer between. A program that calculates the trajectories of plumes leaving from any chosen source area dispersion parameters, and the parameters necessary for concentration calculations along trajectory segments using observed wind data were included as well as a program that calculated the concentration of sulfur dioxide and sulfate along trajectory segments and interpolates the plume concentrations to grid intersections. The model was used to calculate the geographical distribution of 24 hour average concentrations of SO2 and sulfate over the Ohio River Basin. Input data included 60 sources of SO2 which constitute 90% of the total emissions over the area. Model output was compared with actual readings from background areas. Distribution patterns of calculated concentrations of both SO2 and sulfate were statistically related to those of the observed with correlation coefficients R = 0.550 and 0.487 respectively. Author (ESA)

N80-26931# Deutscher Wetterdienst, Offenbach am Main (West Germany).
ON THE EFFECT OF METEOROLOGICAL SIMPLIFICATIONS IN THE NUMERICAL SIMULATION OF REGIONAL TRANSPORT PROCESSES
Maria Heese, Ingo Jacobsen, Eberhard Mueller, and Juergen Pankrath (Fed. Environ. Agency, Berlin) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 329-336 refs Sponsored by Fed. Environ. Agency (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Numerical experiments were performed with a weather prediction model having a mesh size of 63.5 km, 6 layers below 2 km, and using a second order closure scheme. A full physics model run was compared with runs in which vertical transport of sulfur was added, changes in deposition velocities made, and advection added by 870 mbar winds. Variations in mean and dry deposition rates are shown for each model configuration with the passage of a low pressure area. Vertical profiles for the mixing ratios at the center of the surface depression show that a great part of the sulfur is transported to the upper layers. Author (ESA)

N80-26932# Teknekron, Inc., Berkeley, Calif. Aerometric Research Group.
APPLICATION OF A REGIONAL TRANSPORT MODEL TO THE SIMULATION OF OF MULTI-SCALE SULFATE EPISODES OVER THE EASTERN UNITED STATES AND CANADA
Brand L. Niemann, Allan A. Hirata, and Lowell F. Smith (EPA, Washington, D.C) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 337-346 refs (For primary document see N80-26888 17-45)
(Contract EPA-68-02-3092)
Avail: NTIS HC A19/MF A01

A pseudospectral technique for solution of regional transport equations was adapted to the problem of predicting multiscale sulfate episodes over the eastern United States and Canada. The initial evaluation of pseudospectral regional transport model was expanded to include the simulation of multiscale sulfate episodes under the three basic meteorological patterns that were found to be associated with regional and subregional scale sulfate episodes: strong persistent winds with quasistraight

trajectories; light variable winds with recirculating trajectories; and a combination of the first two in sequence or at the same time in different locations. The computational efficiency of the pseudospectral technique permitted extensive sensitivity analysis of the model predictions to the conversion and removal rates and comprehensive studies of the relative contributions from various pollutants (SO2 and primary sulfates), source categories and subregions to concentrations in other subregions. The agreement between model predictions and observations was generally very good for reasonable values of the conversion and removable rates. Author (ESA)

N80-26933# Oslo Univ. (Norway). Inst. of Geophysics.
TRANSPORT AND DISTRIBUTION OF POLLUTANTS IN THE TROPOSPHERE
Ivar S. A. Isaksen *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1978 p 347-358 refs Sponsored by Norwegian Res. Council for Sci. and the Humanities (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The chemistry of ozone and carbon monoxide formation and their tropospheric distribution were studied with a two dimensional time dependent model. The model covers all latitudes from the North Pole (-90 deg) to the South Pole (90 deg), with 10 deg (1100 km) distance between each gridpoint. In the vertical direction the model consists of 20 levels, with two different grid distances. Below 3.5 km delta Z=500 m, while above it is equal to 1 km. Marked differences in chemical activity with latitude and season are found. Calculated global distribution of carbon monoxide does not compare well with observations, which show a more uniform distribution with height in the Northern Hemisphere. Photochemical production of ozone is seen to have a noticable effect on the distribution in the Northern Hemisphere, where there is a net production of ozone at middle and low latitudes both during summer and winter months. It results in approximately 50% larger ozone densities in the lower troposphere in the Northern Hemisphere than what is obtained in the Southern Hemisphere. Outside the area which is influenced by man made sources, tropospheric chemistry is not found to favor any large ozone formation. Author (ESA)

N80-26934# Danish Meteorological Inst., Copenhagen.
GLOBAL TWO DIMENSIONAL SPECTRAL DISPERSION MODEL
Ruwim Berkowicz, Lars P. Prahm (Risoe Natl. Lab.), and Jean-Francois Louis (European Centre for Medium Range Weather Forecasts) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 359-365 refs (For primary document see N80-26888 17-45)
(Contract EEC-306-77-ENV-DK)
Avail: NTIS HC A19/MF A01

A diffusion model based on the spectral turbulent diffusivity theory (STD) is tested on dispersion of radioactive tracers in the atmosphere. A significant improvement is achieved compared with results obtained with the gradient-transfer formulation of diffusion. The STD theory makes it possible to treat atmospheric diffusion with a scale-dependent diffusivity, but in an Eulerian framework. Author (ESA)

N80-26935# Bulgarian Academy of Science, Sofia. Inst. of Geophysics.
INFLUENCE OF VERTICAL MOTIONS INDUCED BY THE FRICTIONAL CONVERGENCE IN PLANETARY BOUNDARY LAYER ON LONG RANGE POLLUTION
D. Yordanov, G. D. Djolov, and D. Syrakov (Sofia Univ.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 367-369 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The influence of the planetary boundary layer (PBL) on the long range transport of pollutants is investigated. An expression for the turbulent exchange coefficient is derived using the vertical velocity at the top of the PBL as a characteristic of the ordered vertical motions, considering adiabatic stratification and horizontal temperature homogenity. Rossby number and tabulated coefficients are used to express the former as a function of synoptic parameters. A numerical experiment is described giving the percentage change of surface concentration along the symmetry axis in graphical form. Author (ESA)

N80-26936# Sofia Univ. (Bulgaria). Dept. of Physics.
ON THE BASIC DEPENDENCIES OF THE RELATIVE EDDY DIFFUSION IN SYNOPTIC SCALES FOR ROTATING ATMOSPHERE
Eugeni Syrakov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 371-376 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The relative eddy diffusion of a pollution cloud is studied in a coordinate system having its base identical with its center of gravity. A statistical theory of turbulence is used wherein turbulence is viewed as a statistical ensemble of vortices having various scales. In the appropriate scales, rotational effects are treated by the introduction of dimensionless parameters. The relative diffusion coefficients are in qualitive agreement with observational data. Author (ESA)

N80-26937# National Center for Atmospheric Research, Boulder, Colo.
THE EXCHANGE OF CHEMICAL CONSTITUENTS BETWEEN THE STRATOSPHERE AND TROPOSPHERE THROUGH TURBULENT MIXING PROCESSES WITHIN TROPOPAUSE FOLDS
M. A. Shapiro *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 377-383 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Small scale turbulent mixing processes within the jet stream associated tropopause folds were studied as a mechanism for chemical exchange across the tropopause. By combining the turbulent motion sensing capability of the Sabreliner research aircraft with fast response ozone and condensation nuclei measurements, the turbulent vertical flux of stratospheric ozone and tropospheric condensation nuclei across the tropopause was evaluated. Analysis of the flight data show the characteristic downward intrusion of high ozone concentration air into the folded portion of the tropopause. The tropopause fold was filled with planetary boundary layer concentrations of condensation nuclei, which when taken together with the ozone data provide evidence for the coexistence of chemical trace constituents of both tropospheric and stratospheric origin within the region of tropopause folding. The observations suggest that tropopause folds are mixing regions whose chemical characteristics lie somewhere in between those of the troposphere and the stratosphere, and that turbulent mixing is of first order importance as a mechanism for stratospheric-tropospheric chemical exchange in the vicinity of tropopause folds. Author (ESA)

N80-26938# New York State Univ., Albany. Atmospheric Sciences Research Center.
CIRCUMPOLAR MEASUREMENTS OF OZONE, PARTICLES, AND CARBON MONOXIDE FROM THE 50TH ANNIVERSARY FLIGHT OF A PAN AMERICAN AIRLINER
R. Pratt and P. Falconer *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 385-392 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Beginning in San Francisco and then circling the globe over both poles before returning 54 hours later, this flight simultaneously sampled gases (ozone, carbon monoxide) and particles (condensation nuclei, light scattering fraction) around the world. High resolution measurements were taken of several constituents, with interruptions only for calibration. These data constitute a rather unique example of the simultaneous measurement of several trace constituents, in a variety of meteorological situations. Curves are given showing the distribution of all constituents averaged over one deg latitude intervals. Data are presented chronologically as segments from the North and South polar stratospheres, and from the tropical and subtropical tropospheres of the Atlantic and Pacific hemispheres. Tropical ozone measurements indicate

that even within the tropics, the distribution of ozone is largely determined by quasi-horizontal, synoptic scale meteorological transport in the troposphere. Author (ESA)

N80-26939# Colorado State Univ., Fort Collins. Dept. of Atmospheric Sciences.

TROPOSPHERIC-STRATOSPHERIC TRANSPORT PROCESSES: INDICATIONS OF THEIR INTERANNUAL VARIABILITY

Elmar R. Reiter *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 393-400 refs (For primary document see N80-26888 17-45)
(Grants NSF ATM-78-17835; EPA-805271-02)
Avail: NTIS HC A19/MF A01

Evidence is presented of a considerable interannual variability in the tropospheric-stratospheric transport processes, involving the tropical branches of the Hadley cells of the two hemispheres. This variability should effect the injection of tropospheric trace substances into the stratosphere. The observed interannual variability of the global ozone distribution might have its cause in the variability of these injection processes. Stratosphere-tropospheric air mass exchange in the let-stream region also appears to be subject to an interannual variability. Author (ESA)

N80-26940# Wisconsin Univ. - Madison.

SYSTEMATIC STRATOSPHERIC-TROPOSPHERIC EXCHANGE THROUGH QUASI-HORIZONTAL TRANSPORT PROCESSES WITHIN ACTIVE BAROCLINIC WAVES

Donald R. Johnson *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 401-408 refs (For primary document see N80-26888 17-45)
(Grant NSF ATM-77-22976)
Avail: NTIS HC A19/MF A01

A mechanism is presented within the isentropic structure of active baroclinic waves that provides for systematic stratospheric-tropospheric exchange within latitudinal domains where geostrophic motion occurs. The role of the exchange within the isentropic zonally-averaged structure of the global circulation is outlined. Large scale quasi-horizontal transport was identified within active baroclinic waves that provides for a net poleward transport of mass whthin isentropic layers that are located in the troposphere and stratosphere. The balance requirements inferred from zonally-averaged isentropic coordinates and some preliminary results dictate that the net exchange within isentropic layers that link the polar stratosphere with the troposphere of the lower latitudes must be poleward. The net mass transport in the isentropic zonally-averaged circulation structure occurs through a systematic covariance between the mass and meridional velocity within the baroclinic wave structure. Author (ESA)

N80-26941# World Meteorological Organization, Geneva (Switzerland).

REPARTITION IN SPACE AND TIME OF DUST HAZE SOUTH OF THE SAHARA

J. Bertrand, A. Cerf, and J. L. Domergue *In its* The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 409-415 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Hourly visibility observations from 27 stations were compiled from 1970 to 1974 in West Africa. Using the number of hours or number of days with visibilities reduced by dust haze, the spatial and temporal distributions of dust haze south of the Sahara were estimated statistically. The importance of dust as an atmospheric phenomenon in this region is demonstrated by figures. Critical zones and seasonal variations linked to the Intertropical Front position appear clearly. A general increase of dust haze since 1970, related to a pluviometric deficit in Sahelian zones, was noted. Author (ESA)

N80-26942# Washington Univ., St. Louis, Mo. Center for Air Pollution Impact and Trend Analysis.

SYNOPTIC-SCALE DISTRIBUTION OF MAN-MADE AEROSOLS

R. B. Husar and D. E. Patterson *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 12 p refs (For primary document see N80-26888 17-45)
(Grants EPA-R-803896; EPA-R-806548)
Avail: NTIS HC A19/MF A01

Sulfate aerosol from fossil fuel combustion can be monitored on the regional scale by relating it to reduced visual range measured at most meteorological stations. The synoptic or regional scale is shown to be appropriate for the impact assessment of sulfates and other agrosols. A global pollution dispersion model is presented, based upon projected fossil fuel combustion and hemispheric winds. Author (ESA)

N80-26943# Netherlands Organization for Applied Scientific Research TNO, Delft.

PHOTOCHEMICAL SMOG FORMATION IN THE NETHERLANDS

Robert Guicherit, ed. Oct. 1978 209 p refs Sponsored by Dutch Min. of Public Health and Environ. Hyg.
Avail: NTIS HC A10/MF A01

Problems encountered in smog formation and air pollution diffusion studies are presented. The determination of peroxybenzoyl nitrate in ambient air, volumetric ultraviolet measurements as a parameter of photochemical smog formation, and sources of primary (precursor) pollutants are among the topics covered. The experimental and mathematical simulation of photochemical air pollution as well as a simple air quality simulation model are also studied. Finally, the adverse effects of using polyvinyl fluoride in smog chamber experiment and a classification of organic compounds by their contributions to air pollution are shown. For individual titles, see N80-26944 through N80-26954.

N80-26944# Netherlands Organization for Applied Scientific Research TNO, Delft.

RESOLVED AND UNRESOLVED ISSUES IN PHOTOCHEMICAL AIR POLLUTION STUDIES

J. vanHam *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 1-19 refs (For primary document see N80-26943 17-45)
Avail: NTIS HC A10/MF A01

Key issues in oxidant control to improve air quality are defined and reviewed relative to the situation in the Netherlands. These are oxidant/ozone measurement, stratospheric ozone intrusion, natural organic emissions, reactivity, 'smog chamber method' evaluation, oxidant transport, current air quality simulation model utility, and optimum oxidants control strategy. Some of the conclusions that can be drawn from the review are dramatic, because they indicate that even after three decades of scientific research knowledge of the phenomenon of photochemical air pollution is still essentially inadequate. Author (ESA)

N80-26945# Netherlands Organization for Applied Scientific Research TNO, Delft.

ATMOSPHERIC PRECURSORS AND OXIDANT CONCENTRATIONS IN THE NETHERLANDS

R. Bos, E. Goudena, Robert Guicherit, A. Hoogeveen, and J. deVreede *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 20-59 refs (For primary document see N80-26943 17-45)
Avail: NTIS HC A10/MF A01

The measuring of photochemical oxidants and precursors as part of a program on photochemical smog formation is described. An emission inventory of nitrogen oxides for the Netherlands is presented. Trends in air quality for primary pollutants are shown. The determination and analysis of atmospheric levels of hydrocarbons, mainly by gas chromatographic techniques, are discussed. Results show that for both nitrogen oxides and hydrocarbons emitted by mobile sources an upward trend in concentration levels exists. Ambient air quality for NO2 falls between 0.05 ppm and 0.02 ppm (daily average). Ambient air quality for nonmethane hydrocarbons frequently exceeds 0.24 ppm when sampling between 6:00 and 9:00 am (three hourly average). Next, aircraft measurements of ozone levels are examined. Maximum recorded hourly ozone concentrations during smog forming episodes often reach values of over 0.35 ppm while, maximum peak concentrations of peroxyacetylnitrate up to 20 ppb were recorded. Author (ESA)

N80-26946# Netherlands Organization for Applied Scientific Research TNO, Delft.

DETERMINATION OF PEROXYBENZOYL NITRATE (PBzN) IN AMBIENT AIR

G. M. Meijer and H. Nieboer *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 60-63 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

A method for measuring peroxybenzoyl nitrate (PBzN) in ambient air by gas liquid chromatography with flame ionization detection is described. After an extensive test program to assure the accuracy of the method, PBzN was measured during a period of a few weeks (with anticyclonic conditions over northwest Europe) to analyze outdoor air. Results confirm that PBzN occurs in ambient air. It is noted that the levels measured are relatively high (an average of 4.6 ppb between 2:00 and 4:00 pm) and not far from the levels at which eye irritation can be expected.

Author (ESA)

N80-26947# Netherlands Organization for Applied Scientific Research TNO, Delft.

THE WEEK-END EFFECT

P. J. Blokzijl and Robert Guicherit *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 64-67 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

A statistical investigation of air quality data was conducted in order to determine whether any one day of the week had a tendency towards higher pollutant indexes than any other. A nonparametrical analysis of variance test was used. Results imply that for ozone, concentration levels on weekends and weekdays are similar in most urban and suburban areas despite markedly different precursor emission levels; the hydrocarbon to nitrogen oxides ratio is also stable throughout the week. However, the rates of secondary reactions in which nitrogen compounds are involved are higher on weekdays, resulting in higher concentrations of organic and inorganic nitrates.

Author (ESA)

N80-26948# Netherlands Organization for Applied Scientific Research TNO, Delft.

VOLUMETRIC ULTRAVIOLET MEASUREMENTS AS A PARAMETER OF PHOTOCHEMICAL SMOG FORMATION

G. Brunner, J. deVreede, and Robert Guicherit *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 68-78 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

A continuous recording actinometer, consisting of a cubical arrangement of six horizontal plate physical sensors, was used to measure volumetric ultraviolet radiation intensity in an urban area. The system was calibrated against the photoisomerization of o-nitrobenzaldehyde to o-nitrosobenzoic acid. Data were used in the study of photochemical reaction models. Results show that an important parameter of photochemical reaction kinetic diffusion models is the rate constant (K) for the photodissociation of NO2 and other chemical components, such as O3, HNO2, H2O2, and aldehydes. For various atmospheric conditions, such as aerosol loading, and depending on solar zenith angle, K may increase about 25% for small zenith angles to more than 60% for zenith angles over 70 deg in the lowest kilometer of the atmosphere. These changes will noticeably effect model calculations.

Author (ESA)

N80-26949# Netherlands Organization for Applied Scientific Research TNO, Delft.

SOURCES OF PRIMARY (PRECURSOR) POLLUTANTS

Robert Guicherit and A. Hoogeveen *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 79-88 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

Air pollutant concentrations were measured at a pollution monitoring station and the data correlated with wind direction. Results show that the relative concentrations of hydrocarbons in the atmosphere gives information about their origin. For the areas studied it appears that the composition of hydrocarbons in the atmosphere is entirely different for different wind directions, pointing to different sources. The most important sources for these areas are identified as natural gas leaks, traffic, gasoline spillage, and petrochemical industries.

Author (ESA)

N80-26950# Netherlands Organization for Applied Scientific Research TNO, Delft.

EXPERIMENTAL AND MATHEMATICAL SIMULATION OF PHOTOCHEMICAL AIR POLLUTION

H. Neiboer and J. H. Duyzer *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 89-150 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

The properties of a cascade reactor which is suitable for simulating the chemical processes of photochemical air pollution are described. The ozone quantity originating during irradiation of a mixture of carbon monoxide and nitrogen oxides in humid air is determined by the rate of the heterogeneous formation of nitrous acid from nitrogen oxides and water. The rate constant of the formation of nitrous acid deduced from the observed ozone formation is shown to be satisfactory for checking the model with experiments in the nitrogen oxide/hydrocarbon system. The measured formation of ozone and peroxyacetyl nitrate at nitrogen oxide concentrations of less than 100 ppb and propylene nitrogen oxide ratios between 1 and 10 agrees well with the formation calculated on the basis of the model. The dynamic equilibrium of peroxyacetyl nitrate with nitrogen dioxide and acetylperoxy radicals included in the model also agrees well with the behavior of peroxyacetyl nitrate under the influence of light and in the presence of NO.

Author (ESA)

N80-26951# Netherlands Organization for Applied Scientific Research TNO, Delft.

AN ACCURACY EVALUATION OF A SIMPLE AIR QUALITY SIMULATION MODEL

H. Nieboer, J. vandenEikhoff, and L. J. J. Wittebrood *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 151-171 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

A box model to simulate changes in air quality due to variations in the rates of pollutant emission, entrainment of pollutants, pollutant transport (by advection), and of light intensity is presented. An evaluation of the model's ability to realistically relate meteorological, emission, and chemical parameters to smog formation is given. Analysis of a simulation shows that for the formation of ozone from hydrocarbons and nitrogen oxides major factors to be considered are wind speed, light intensity, concentrations of pollutants above an inversion, parallel changes in emission of hydrocarbons and nitrogen oxides, and reactions between peroxy radicals and aerosols. Intermediate factors are inversion height, nonparallel changes in the emission of hydrocarbons and nitrogen oxides, and reactions between polar compounds and aerosols. Minor factors to be modeled are temperature as well as reactions between gaseous pollutants and the surface of the Earth (dry deposition). Moreover knowledge of precursor and product concentrations in background areas and in higher air layers is demonstrated to be extremely important for obtaining accurate results by model calculations.

Author (ESA)

N80-26952# Netherlands Organization for Applied Scientific Research TNO, Delft.

OBJECTIONS TO THE USE OF POLYVINYL FLUORIDE IN SMOG CHAMBER EXPERIMENTS

J. vanHam and T. Lems *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 172-177 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

The interference of polyvinyl fluoride (PVF) sampling bags in smog chamber experiments was examined. From irradiation experiments and model simulations, results show that the release of organic compounds by PVF causes serious interference when this material is used in these experiments. For this reason, the use of PVF bags in studies of photochemical air pollution is not recommended. The interference manifests itself in such essential parameters as (total) hydrocarbon concentration, NO response, hydrocarbon/NO ratio, and formation of ozone and PAN. The interference decreases with increasing surface-to-volume ratios and with increasing precursor concentrations, but is otherwise difficult to quantify.

Author (ESA)

N80-26953# Netherlands Organization for Applied Scientific Research TNO, Delft.

CLASSIFICATION OF A NUMBER OF ORGANIC COMPOUNDS ACCORDING TO THEIR CONTRIBUTIONS TO PHOTOCHEMICAL AIR POLLUTION

H. Nieboer and J. vanHam *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 178-186 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

As an aid to choosing the best way to abate photochemical air pollution, a classification of hydrocarbons which typically contribute to smog formation is presented. Photochemical air pollution is attended by ozone formation. The rate constant of the reaction between hydrocarbon and hydroxyl radicals is proposed as a measure of its reactivity and ozone formation potential. It is stressed that the amount of ozone formed in a given parcel of air depends also on the concentrations of hydrocarbons and nitrogen oxides. In order to abate photochemical air pollution in a specific area the restriction of hydrocarbon emissions must be balanced by the restriction of nitrogen oxide emission as well. Author (ESA)

N80-26954# Netherlands Organization for Applied Scientific Research TNO, Delft.

SOME NOTES ON THE ABATEMENT OF PHOTOCHEMICAL OZONE PRODUCTION

Robert Guicherit, P. L. Blokzijl, and C. J. Plasse *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 187-204 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

Mathematical models and laboratory as well as field experiments, used to relate emission rates of precursors to oxidant air quality, are reviewed. Two processes (precursor dispersion; photochemical reactions) are elucidated in regards to forming smog abatement strategies. Ozone monitoring is discussed as a means of determining pollution levels. A control strategy aimed at adjusting the ratio of nonmethane hydrocarbons to nitrogen oxides as far away as possible from the optimum for ozone formation is called for. Author (ESA)

N80-26955# SRI International Corp., Menlo Park, Calif.

CHARACTERIZATION OF THE EPRI DIFFERENTIAL ABSORPTION LIDAR (DIAL) SYSTEM Final Report

R. A. Baumgartner, J. G. Depp, W. E. Evans, W. B. Grant, J. G. Hawley, R. G. March, E. R. Murray, and E. K. Proctor Dec. 1979 103 p ref

(EPRI-EA-1267) Copyright. Avail: Issuing Activity

A differential absorption lidar (DIAL) was developed as a mobile field system for making remote measurements of SO2,NO2, and O2. After field testing, the lidar was prepared for the system calibration testing where lidar measurements were compared to in situ profiles of SO2, NO2, and O3. This program determined overall system accuracy and reliability in measuring varying ambient gas concentrations. Tests were then made using an NO2 sample chamber to simulate a calibrated No2 plume, and ambient measured NO2 concentrations were compared with values from a regional air pollutant monitoring station. Following the local calibration and the systems fields tests, the performance and reliability of the lidar was reevaluated. It was concluded that although the remote measuring capability was successfully demonstrated in the field program, several systems improvements would increase the lidar accuracy and reliability. DOE

N80-26956# Brookhaven National Lab., Upton, N. Y. Progress Sciences Div.

ENVIRONMENTAL CONTROL TECHNOLOGY FOR ATMOSPHERIC CARBON DIOXIDE Final Report

Anthony S. Albanese and Meyer Steinberg Sep. 1979 58 p refs

(Contracts EY-76-C-02-0016; DE-AC02-76CH-00016)

(BNL-51116) Avail: NTIS HC A04/MF A01

The impact of fossil fuel use in the United States on worldwide CO2 emissions and the impact of increased coal utilization on CO2 emission rates are assessed. The aspects of CO2 control are discussed as well as the available CO2 control points (CO2 removal sites). The primary factor affecting the practicability of a CO2 control system is the energy required by the control system. Of the three potential CO2 control points, removal from the stacks of fossil fuel power plants appears to require the least amount of energy. Estimates of the energy required to capture and recover CO2 from coal-fired power plant stacks by various processes are presented. Although capture and recovery of CO2 is an important consideration in the overall scheme of CO2 control, disposal or reuse of recovered CO2 may be the weakest link in the CO2 control chain. Of the several options considered, deep ocean storage appears to be the most promising. Two control scenarios are evaluated, one based on the absorption of CO2 contained in power plant flue gas by seawater; the other, based on absorption of CO2 by monoethanolamine (MEA). Captured CO2 is injected into the deep ocean in both cases. Analysis indicate that capture and disposal by seawater is not feasible, whereas capture and disposal using MEA is a possibility. However, the economic penalties of CO2 control are significant; for example, at a CO2 removal efficiency of 50%, it is estimated that the power generation efficiency of a conventional coal fired power plant would be reduced from 34 to about 25%. The cost of power generation would be expected to double. For 90% CO2 removal, power generation efficiency is reduced to between 15 and 6% and the cost of power generation increases by a factor of from 4 to 7. DOE

N80-26957# California Univ., Livermore. Lawrence Livermore Lab.

POTENTIAL CHANGES TO STRATOSPHERIC OZONE FROM POSSIBLE CHLOROFLUOROCARBON PRODUCTION

Donald J. Wuebbles and Raymond L. Tarp 17 Mar. 1980 35 p refs

(Contract W-7405-eng-48)

(UCID-18583) Avail: NTIS HC A03/MF A01

Atmospheric emission rates of the chlorofluorocarbons CFC13 are discussed. Potential industrial production and commerical applications, and the eventual release of these chemicals into the atmosphere are examined. The potential effect on stratospheric ozone resulting from future chlorofluorocarbon emissions as suggested by these scenarios are examined. Assessments are based upon model calculations using the one dimensional coupled transport and chemical kinetics model of the troposphere and stratosphere. DOE

N80-26958# Colorado Univ., Boulder.

HETEROGENEOUS CHEMISTRY OF IMPORTANCE IN DECISIONS CONCERNING THE ENVIRONMENTAL IMPACT OF ENERGY PRODUCTION AND THE SITING OF NEW ENERGY SOURCES Progress Report, 1 Mar. 1979 - 29 Feb. 1980

A. W. Castleman, Jr. Feb. 1980 17 p refs

(Contract EP-78-S-02-4776)

(COO-4776-2) Avail: NTIS HC A02/MF A01

The following are reported: (1) the formation, stability, and structure of ion-clusters both by high pressure mass spectrometric experiments and approximate molecular orbital quantum mechanical calculations; (2) the exchange of energy and angular momentum during ion-molecule association reactions using computer dynamics calculations; (3) related experimental and theoretical studies of nucleation and solvation phenomena; (4) laser photophysics of ion clusters including measurement of cross sections for photodissociation, fluorescence, and energy exchange by pulsed infrared techniques; (5) the growth, stability, and structure of weakly-bound van der Waals and charge-transfer complexes employing electric deflection techniques and taking advantage of the first-order Stark effect; and (6) the multiphoton ionization of metal atom clusters to prove the transition from the isolated atomic to the condensed metallic state, and to elucidate their electronic states and potential as sites for the catalytic conversion of absorbed pollutants. DOE

N80-26959# Department of Energy, Washington, D. C. Office of Health and Environmental Research.

CARBON DIOXIDE EFFECTS RESEARCH AND ASSESSMENT PROGRAM. CARBON DIOXIDE RESEARCH Progress Report, Fiscal Year 1979

Roger C. Dahlman, Thomas Gross, Lester Machta (NOAA, Silver Spring, Md.), William Elliott (NOAA, Silver Spring, Md.), and Michael MacCracken (Calif. Univ., Livermore, Lawrence Livermore Lab.) Apr. 1980 88 p refs

(DOE/EV-0071) Avail: NTIS HC A05/MF A01

Research on the global carbon cycle and the effects of increased carbon dioxide on the global climate system is reported.

Environmental and societal effects related to CO2 and environmental control technology for CO2 are also discussed. Lists of research projects, reports, and publications of the Carbon Dioxide and Climate Research Program are included. An expanded CO2 monitoring network is providing increased coverage for interpretation of patterns of sources and sinks seasonal variability and documentation of the global growth of CO2. Initial studies in the equatorial Pacific are helping quantify estimates of the amount of outgassing CO2 from tropical waters. Model simulations of the effect of doubled CO2 concentration carried out with fixed ocean temperatures showed relatively small summer heating over land areas. On the other hand, simulations in which the oceanic temperatures could come into instantaneous equilibrium with atmospheric conditions continued to show global temperature increases of 3 + or - 1.5 C, accentuated at high latitudes. DOE

N80-26960# New Jersey Inst. of Tech., Newark Air Pollution Research Lab.
ANALYSIS OF SELECTED VOLATILE ORGANIC SUBSTANCES IN AMBIENT AIR Final Report, Apr. - Nov. 1978
Joseph W. Bozzelli and Barbara B. Kerbekus Oct. 1979 80 p refs
(PB80-144694; NJDEP-79/02) Avail: NTIS
HC A05/MF A01 CSCL 07D

Sampling/analytical methodologies and laboratory techniques in determining the concentrations of selected volatile organic substances in the vapor phase are described. A total of 330 samples from northern New Jersey were collected. The samples were then analyzed for benzene, carbon tetrachloride, chloroform, o- and p-dichlorobenzene, 1,2-dichloroethane, nitrobenzene, tetrachloroethylene, 1,1,1-trichloroethane, trichloroethylene, and vinyl chloride. Full data sets for all samples are appended to the report. GRA

N80-26961# Wisconsin Univ., Madison. Dept. of Statistics.
STATISTICAL ANALYSIS OF THE LOS ANGELES CATALYST STUDY DATA
Johannes Ledolter, George C. Tiao, Spencer B. Graves, Jian-Tu Hsieh, and Gregory B. Hudak Oct. 1979 88 p refs
(Contract EPA-68-02-2261)
(PB80-144439; EPA-600/4-79-070) Avail: NTIS
HC A05/MF A01 CSCL 04A

Statistical analyses of the data from the Los Angeles Catalyst Study were performed in order to determine the effects of the introduction of the catalytic converter upon the atmospheric concentration levels of a number of air pollutants. Analysis of the CO, Pb, SO4, O3, NO and NO2 data covering the period from June 1974 to November 1977 is presented. Models were built to evaluate the freeway contribution to CO and Pb as a function of traffic, windspeed, and wind direction. The models were used to assess both the time trend in the pollutant measurements and the pollution concentrations at points near the freeway. Frequency distributions for ambient air quality data near freeways are discussed. GRA

N80-26962# Cambridge Systematics, Inc., Mass.
TRANSPORTATION AIR QUALITY ANALYSIS - SKETCH PLANNING METHODS. VOLUME 1: ANALYSIS METHODS Final Report
Dec. 1979 284 p refs Sponsored in part by DOT
(Contract EPA-68-01-4977)
(PB80-158702; EPA-400/1-80-001A-Vol-1) Avail: NTIS
HC A13/MF A01 CSCL 13B

Analytical methodologies are described for use by metropolitan planning organizations and other state and local transportation agencies in analyzing the air quality potential of candidate urban transportation measures. As sketch planning techniques, the methods are designed to produce first-cut estimates of a proposed transportation measure's impact for a relatively small investment of time and effort. Quantitative methods oriented to auto restricted zones, high occupancy vehicle priorities, transit improvements, parking programs, carpool/vanpool incentives, and staggered work hours are provided. The methods use worksheet, programmable calculator, and computerized approaches to apply disaggregate behavioral models. They can be used to predict traveller demand as a function of transportation system characteristics, transportation facility operations as a function of their usage and their physical characteristics, and special impacts including vehicular emissions, fuel consumption, and operating costs. Guidelines are provided both to those responsible for designing the transportation-air quality analysis approaches in specific local areas, and to those who will carry out these analyses. In addition, references are provided to documents which provide additional detail on the methods. GRA

N80-26963# University of Southern California, Los Angeles.
A BIOLOGIC INDICATOR FOR AIR POLLUTION
Russell P. Sherwin Sep. 1979 85 p refs
(Grants EPA-R-800881; EPA-R-804545)
(PB80-143274; EPA-600/1-79-038) Avail: NTIS
HC A05/MF A01 CSCL 06F

Guinea pigs and mice were exposed to low levels of nitrogen dioxide either continuously or on an intermittent schedule in order to develop highly sensitive discriminants involving correlations of structural and functional alterations. The two major test areas developed were the quantitative measurements of type 2 cell populations and protein leakage with in the lung. It is concluded that the research data supports the hypothesis that to properly evaluate the possible health effects from air pollutants one must give attention to the subclinical cellular alterations that deplete the functional and structural reserves of organs which are the primary target for air pollutants. GRA

N80-26964# Booz-Allen and Hamilton, Inc., Florham Park, N.J. Foster D. Snell Div.
ECONOMIC IMPACT OF IMPLEMENTING RACT GUIDELINES IN THE NON-ATTAINMENT AREAS FOR OZONE IN SOUTH CAROLINA Final Report
Mar. 1979 294 p refs
(Contract EPA-68-02-2544)
(PB80-134067; EPA-904/9-79-032) Avail: NTIS
HC A13/MF A01 CSCL 13B

The direct economic impact of implementing reasonably available control technology -(RACT) standards in five non-attainment counties for ozone in South Carolina was investigated. The economic impact was assessed for the following 8 RACT industrial categories: surface coatings (paper and fabrics); solvent metal cleaning; bulk gasoline terminals; bulk gasoline plants; storage of petroleum liquids in fixed roof tanks; gasoline dispensing stations-Stage 1; and use of cutback asphalt. Direct economic costs and benefits from the implementation of RACT limitations were identified and quantified. Secondary impacts (social, energy, employment, etc.) are also discussed. GRA

N80-26965# AeroVironment, Inc., Pasadena, Calif.
OZONE AND PRECURSOR TRANSPORT INTO AN URBAN AREA: EVALUATION OF MEASUREMENT APPROACHES Final Report
Michael W. Chan, Douglas W. Allard, and Ivar Tombach Dec. 1979 166 p refs
(Contract EPA-68-02-3027)
(PB80-153927; EPA-450/4-79-039) Avail: NTIS
HC A08/MF A01 CSCL 13B

Five techniques for measuring the transport of ozone and precursors into an urban area are evaluated. The techniques were tested in Philadelphia during the summer of 1978. The data collected in the field program indicate that, in general, advection of ozone aloft is the main route by which pollution of photochemical interest is transported into Philadelphia. Transport of ozone along the surface and transport of oxides of nitrogen and non-methane hydrocarbons, both aloft and along the surface, are minimal. Thus, the recommended techniques must primarily be able to quantify the ozone transported aloft. Of the five techniques, three were determined applicable for quantifying the ozone transported aloft. GRA

N80-26966# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
DESIGN CRITERIA FOR STATIONARY SOURCE CATALYTIC COMBUSTION SYSTEMS
J. P. Kesselring, W. V. Krill, H. L. Atkins, R. M. Kendall, and J. T. Kelly Aug. 1979 457 p refs
(Contract EPA-68-02-2116)
(PB80-147317; EPA-600/7-79-181; Rept-78-278) Avail: NTIS HC A20/MF A01 CSCL 13B

An investigation of the applicability of catalytic combustion to stationary gas turbine, boiler, and furnace systems is reported. System operating characteristics and potential for NOx emmisions reduction are identified. An experimental program was conducted to develop catalyst materials and combustor concepts with useful heat extraction. GRA

N80-26967# Rockwell International Corp., Creve Couer, Mo. Environmental Monitoring and Service Center.
REGIONAL AIR POLLUTION STUDY. CARBON DIOXIDE EFFECTS ON RAMS (REGIONAL AIR MONITORING SYSTEM) SULFUR MONITORS Final Report
D. H. Hern Oct. 1979 42 p refs
(Contract EPA-68-02-2093)
(PB80-137508; EPA-600/4-79-065) Avail: NTIS
HC A03/MF A01 CSCL 13B

Effects of carbon dioxide (CO2) content of the air on the response of flame photometric sulfur gas analyzers of two types, the Tracor model 270 HA sulfur chromatograph and the Meloy model SA 185 total sulfur analyzer are examined. These analyzers were used in the regional air monitoring system (RAMS). For each instrument, measurements were made to determine response to a matrix of five CO2 levels and three sulfur dioxide (SO2) levels. Measurements were also made of CO2 concentrations in the influent to and effluent from heatless air dryers providing zero air for calibration at the RAMS stations. GRA

N80-26968# New Jersey Inst. of Tech., Newark Air Pollution Research Lab.
LEAD AND TOXIC METALS IN AIRBORNE PARTICULATES Final Report, Apr. - Nov. 1978
Joseph W. Bozzelli and Barbara B. Kebbekus Oct. 1979 92 p refs
(PB80-137201; NJDEP-79/03) Avail: NTIS
HC A05/MF A01 CSCL 07D

The first phase of a planned multi-year investigation of air quality in New Jersey is described. The development of sampling and analytical methodologies and laboratory techniques in determining the concentrations of selected metals in airborne particulates through use of atomic absorption spectroscopy is detailed. A total of 102 samples were collected in portions of northern New Jersey using high volume samplers. Twenty-one of these were separated into five fractions by size using cascade impaction samplers. Samples were analyzed for arsenic, cadmium, lead, manganese, mercury, nickel and zinc, and data sets for all samplers are appended. GRA

N80-26969# Monsanto Research Corp., Dayton, Ohio.
PORTABLE MINIATURE SAMPLER FOR POTENTIAL AIRBORNE CARCINOGENS IN MICROENVIRONMENTS. PHASE 1, DEVELOPMENT Interim Report, Sep. 1977 - Oct. 1978
J. J. Brooks and D. S. West Jan. 1980 92 p refs
(Contract EPA-68-02-2774)
(PB80-150105; EPA-600/2-80-026) Avail: NTIS
HC A05/MF A01 CSCL 13B

Research towards the development of a portable, miniature, sorbent-type collection system for sampling and preconcentrating organics in general, and carcinogens and associated compounds (e.g., mutagens, precarcinogens, and cofactors) in particular, from ambient air is discussed. Progress is described concerning the following: (1) the selection of candidate sorbent materials; (2) the selection of test compounds for sorbent evaluation; (3) the evaluation of the sorbent materials in terms of capacity, desorption properties, and physical properties that relate to pressure drops and ultimate system design; and (4) the selection of a three-sorbent system based on Tenax-GC, Porapak R, and Ambersorb. GRA

N80-26970# Industrial Environmental Research Lab., Research Triangle Park, N. C.
PARTICULATE CONTROL HIGHLIGHTS: RESEARCH AT HIGH TEMPERATURE/PRESSURE
Dennis C. Drehmel and James H. Abbot Dec. 1979 25 p refs
(PB80-149891; EPA-600/8-79/031B) Avail: NTIS
HC A02/MF A01 CSCL 13B

Environmental Protection Agency (EPA) high temperature and high pressure programs, aimed at demonstrating control technology to meet enviromental standards for the ambient concentration of particles and the emission rate of particles from new sources, are highlighted. Among the control devices considered in the EPA programs are cyclones, granular bed filters, dry scrubbers, molten scrubbers, electrostatic precipitators, ceramic bag filters, and other ceramic filters. Advantages and disadvantages of the devices involve parameters such as simplicity of operation, materials problems, inability to collect submicron particles, difficulty in regenerating the collection media, and those related to cost, including size and pressure drop. GRA

N80-26971# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
EVALUATION OF HC (HYDROCARBON) CONTROL STRATEGIES FOR GENERAL AVIATION PISTON ENGINES
Richard S. Wilcox Jul. 1979 19 p refs
(PB80-155393; EPA-AA-SDSB-79-17) Avail: NTIS
HC A02/MF A01 CSCL 01C

The cost effectiveness of controlling hydrocarbon (HC) exhaust emissions from general aviation piston powered aircraft is evaluated. Recent analyses have indicated that these aircraft are not major contributors to violations of the National Ambient Air Quality Standard for CO which adversely affect the public health and welfare. Although HC emissions from general aviation are also small when compared to many other sources, the oxidant problem is so widespread that all reasonable controls should be implemented. GRA

N80-26972# Environmental Monitoring and Support Lab., Research Triangle Park, N. C. Quality Assurance Div.
TECHNICAL ASSISTANCE DOCUMENT FOR THE CALIBRATION OF AMBIENT OZONE MONITORS Final Report
Richard J. Paur and Frank F. McElroy Sep. 1979 72 p refs
(PB80-149552; EPA-600/4-79-057) Avail: NTIS
HC A04/MF A01 CSCL 14B

In February, 1979, EPA revised certain parts of the ambient air pollution monitoring regulations to specify a new procedure for calibration of ambient ozone analyzers. The new procedure is based on ultraviolet (UV) absorption photometry, and specifies in detail the UV photometer, other apparatus, and the procedure necessary for establishing quasi-primary ozone concentration standards derived from the known absorption coefficient of ozone at 254 nm. In order to help agencies and organizations which must use the new procedure, absorption photometry is discussed with emphasis on the transmittance measurement and measurement errors. Step-by-step explanatory information and advice keyed to each paragraph of the procedure is presented. Ultraviolet photometers, their design and operational characteristics, and several commercially available models are described. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-26973 Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de Physique Generale.
STUDY OF TRACE CONSTITUENTS IN THE ATMOSPHERE BY ABSORPTION SPECTROMETRY Final Report [VARIATIONS SAISONNIERES ET CLIMATIQUES DE CONSTITUANTS STRATOSPHERIQUES A L'ETAT DE TRACE]
Andre Girard, Jean Besson, Renee Giraudet, and Louis Gramont 16 Nov. 1977 89 p refs Partly in ENGLISH and FRENCH
(Contract DGRST-76-6-1051)
(ONERA-RF-2/3376-PY) Avail: NTIS HC A05

Measurements by infrared absorption spectrometry using the Sun as a source at sunset or at sunrise are presented. The experiments were performed in November 1976 as part of the 'latitude survey mission' from the NASA Convair 990 between 72 deg N and 52 deg S, the flight altitude was 11 km. The instrument, which is essentially a spectrometer associated with a Sun tracker automated through a control module, is briefly

described. Five spectral intervals were scanned for the purpose of measuring: NO, NO2, HCl, HNO3, O3, CH4, and H2. The results show the correlated seasonal and climactic variations of trace constituents. Author (ESA)

N80-26974# World Meteorological Organization, Geneva (Switzerland).
THE PLANETARY BOUNDARY LAYER
G. A. McBean, ed., K. Bernhardt, S. Bodin, Z. Litynska, A. P. VanUlden, J. C. Wyngaard, B. R. Kerman, J. D. Reid, Z. Serbjan, and J. L. Wolmsley 1979 215 p refs Original contains color illustrations
(TN-165; WMO-530) Avail: NTIS HC A10/MF A01

An introduction to the general properties of the planetary boundary layer is given. The status and structural aspects are reviewed with an emphasis on presenting the physical insights to problems. The Ekman layer is discussed in detail with emphasis on the semi-empirical and resistance low descriptions. The tropical boundary layer is discussed. The important differences between the tropical and higher latitude boundary layers are addressed. The modelling of the atmospheric boundary layer is studied. Both research and operational types of models are reviewed. The observational methods used in boundary-layer meteorology are presented and the major observational programs that have been conducted are described. The applications of boundary layer knowledge are discussed. Three topics, the estimation of surface fluxes, aeronautical meteorology and urban boundary layers are presented in some detail while two further topics, electromagnetic and acoustic wave propagation and problems of mountain meteorology and climatology related to the boundary layer, are briefly reviewed. F.O.S.

N80-26975# Geological Survey, Washington, D. C.
EARTHQUAKES IN THE UNITED STATES, JANUARY TO MARCH 1978
C. W. Stover, J. H. Minsch, and B. G. Reagor 1980 32 p refs
(Circ-819-A) Avail: NTIS HC A03/MF A01

A complete listing of macroseismic effects of earthquakes is presented for use in risk studies, nuclear power plant site evaluations, and seismicity studies. The earthquakes are listed in chronological order by state indicating data, origin time, hypocenter, magnitude, and maximum intensity. F.O.S.

N80-26976# Geological Survey, Washington, D. C.
SEISMIC ENGINEERING PROGRAM REPORT, JANUARY TO APRIL 1979
1979 25 p refs
(Grant NSF CA-114)
(Circ-818-A) Avail: NTIS HC A02/MF A01

Summaries of the accelerograms recovered from the U.S. Geological Survey's National Strong-Motion Network are presented. Strong-motion instrumentation in the Imperial Valley, California is reported along with information on strong-motion sources. F.O.S.

N80-26977*# Indiana Univ., Bloomington.
THE ORIGIN AND EVOLUTION OF SULFUR IN AN ARCHEAN VOLCANO-SEDIMENTARY BASIN, DEER LAKE AREA, MINNESOTA M.S. Thesis
Dorian L. Nicol May 1980 61 p refs
(Grant NsG-7520)
(NASA-CR-163285) Avail: NTIS HC A04/MF A01 CSCL 08G

Rocks of the Deer Lake area, northcentral Minnesota, consist of Archean (age greater than 2.6 billion years) metasediments and metavolcanics intruded by mafic layered sills. Geologic and sulfur isotopic data suggest that sulfides in the sediments are bacteriogenic, having formed in response to the activity of sulfate reducing bacteria during diagenesis. Deposition of the sediments appears to have occurred in a deep marine basin with restricted circulation of sea water. The bulk of the sulfur in the igneous rocks is of deep seated origin, but basal contacts of the sills show evidence of assimilation of biogenic sulfur from the intruded sediments. This assimilation of biogenic sulfur is the primary geochemical control of local Cu-Ni sulfide mineralization. Author

N80-26978*# Indiana Univ., Bloomington. Dept. of Geology.
SULFUR ISOTROPIC STUDIES OF ARCHEAN SLATE AND GRAYWACKE FROM NORTHERN MINNESOTA: EVIDENCE FOR THE EXISTENCE OF SULFATE REDUCING BACTERIA
Edward M. Ripley and Dorian L. Nicol 1979 33 p refs
(Contract NsG-7520)
(NASA-CR-163286) Avail: NTIS HC A03/MF A01 CSCL 08G

Sulfur isotopic studies of pyrite from metasediments in the > 2.6 b.y. old Deer Lake greenstone sequence, Minnesota, were conducted in order to evaluate the possible importance of sulfate reducing bacteria in sulfide formation. Pyrite occurs as ovules up to 2 cm in diameter within graphitic slates, and as fine disseminations in metagraywacke units. SEM studies indicate the pyrite is framboidal in morphology. Delta notation values of pyrite from the Deer Lake sediments range from -2.3 to 11.1 0/00, with a peak at approximately +2 o/oo. Isotopic data is consistent with either high temperature inorganic reduction of circulating seawater sulfate, or low temperature bacterial reduction. However, the lack of sulfide bands or massive occurrences in the sediments, the restriction of pyrite mineralization to the sediments, and the absence of evidence for hot spring activity suggest that a diagenetic origin of pyrite is more feasible. Sulfide in such an environment would be produced principally by the action of sulfate reducing bacteria. Author

N80-26979*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
APPLICATION OF LASER RANGING AND VLBI DATA TO A STUDY OF PLATE TECTONIC DRIVING FORCES Final Report, 1 May 1979 - 30 Apr. 1980
Sean C. Solomon 30 Apr. 1980 111 p refs Presented at Conf. on the Magnitude of Deviatoric Stresses in the Earth's Crust and Upper Mantle, Carmel, Calif., 29 Jul. - 2 Aug. 1979; sponsored by U.S. Geological Survey
(Contract NCC5-14; Grants NSG-7329; NSF EAR-78-1293C)
(NASA-CR-163019) Avail: NTIS HC A06/MF A01 CSCL 08G

The conditions under which changes in plate driving or resistive forces associated with plate boundary earthquakes are measurable with laser ranging or very long base interferometry were investigated. Aspects of plate forces that can be characterized by such measurements were identified. Analytic solutions for two dimensional stress diffusion in a viscoelastic plate following earthquake faulting on a finite fault, finite element solutions for three dimensional stress diffusion in a viscoelastic Earth following earthquake faulting, and quantitative constraints from modeling of global intraplate stress on the magnitude of deviatoric stress in the lithosphere are among the topics discussed. J.M.S.

N80-26980*# Ohio State Univ. Research Foundation, Columbus. Dept. of Physics.
INVESTIGATION OF INFRARED SPECTRA OF ATMOSPHERIC GASES TO SUPPORT STRATOSPHERIC SPECTROSCOPIC INVESTIGATIONS Semiannual Report, 1 Nov. 1979 - 30 Apr. 1980
John H. Shaw Jun. 1980 30 p refs
(Grant NsG-7479)
(NASA-CR-163018) Avail: NTIS HC A03/MF A01 CSCL 04A

Spectroscopic instrumentation and the absorption characteristics of atmospheric gases are discussed in relation to the requirements of spectroscopic stratospheric experiments. Improvement in the spectral resolution, accuracy of the line parameters, and the ranges of atmospheric conditions over which information is to be obtained are among the factors considered. Methods of simultaneously analyzing entire bands containing many lines were developed and applied to the analysis of bands of N2O and CO2. Progress in this analysis is reported. J.M.S.

N80-26981# Naval Civil Engineering Lab., Port Hueneme, Calif.
SEISMIC SOIL LIQUEFACTION STUDIES Final Report, Oct. 1978 - Oct. 1979
J. B. Forrest, J. M. Ferritto, and G. Wu Dec. 1979 39 p refs
(YF53534091)
(AD-A081944; CEL-TN-1566) Avail: NTIS HC A03/MF A01 CSCL 08/13

Earthquake-induced soil liquefaction is considered from the points of view of site evaluation technology, and computer-based analytical developments. In-situ expedient testing procedures are compared with the results of laboratory testing on undisturbed samples. Several types of friction cone penetrometer tests are described, and mechanical cone, electrical cone, and piezometric cone sounding data are compared. Recent developments on analytical effective stress soil models are discussed. Liquefaction behavior is separated into two categories: (1) the inherently unstable situation wherein in-situ stress exceeds residual strength; and (2) the case where accumulation of deformation reaches unacceptable levels. It is suggested that the accumulated deformations category cannot be adequately evaluated using available experimental procedures, but must depend upon effective stress soil model development. GRA

N80-26982# Argonne National Lab., Ill. Energy and Environmental Systems Div.
PROCEEDINGS OF THE WORKSHOP ON IONOSPHERIC AND MAGNETOSPHERIC EFFECTS OF SATELLITE POWER SYSTEMS (SPS)
Dec. 1979 106 p refs Workshop held at Rosemont, Ill., 28-30 Aug. 1978
(Contract W-31-109-eng-38)
(CONF-7808115) Avail: NTIS HC A06/MF A01

Atmospheric effects of a satellite power system are discussed. Atmospheric effects originating from the release of rocket propellant emissions into the ionosphere and magnetosphere are discussed. A listing of potentially important issues with assigned importance ratings; explanations of each issue and diagrams illustrating the interrelationships between the various satellite power systems causes and identified potential atmospheric effects, and possible final impacts, recommendations for both short and long term research objectives, and recommended approaches to achieve those objectives are presented. DOE

N80-26983# Toronto Univ. (Ontario). Dept. of Mechanical Engineering
A MODEL FOR THE ANGULAR DISTRIBUTION OF SKY RADIANCE
F. C. Hooper and A. P. Brunger Aug. 1979 7 p refs Presented at Joint ASME/AIChE 18th Natl. Heat Transfer Conf., San Diego, Calif., 6-8 Aug. 1979
(Contract EY-76-C-02-2939)
(DOE-CS-32939-9; CONF-790808-23) Avail: NTIS HC A02/MF A01

A flexible mathematical model is introduced which describes the radiance of the dome of the sky under various conditions. This three component continuous distribution (TCCD) model is compounded by the superposition of three separate terms, the isotropic, circumsolar and horizon brightening terms, each representing the contribution of a particular sky characteristic. In use a particular sky condition is characterized by the values of the coefficients of each of these three terms, defining the distribution of the total diffuse component. The TCCD model was demonstrated to fit both the normalized clear sky data and the normalized overcast sky data with an RMS error of about ten percent of the mean overall sky radiance. By extension the model could describe variable or partly clouded sky conditions. The model can aid in improving the prediction of solar collector performance. DOE

N80-26984*# Uppsala Ionospheric Observatory (Sweden)
TRIGGER, AN ACTIVE RELEASE EXPERIMENT THAT STIMULATED AURORAL PARTICLE PRECIPITATION AND WAVE EMISSIONS
G. Holmgren, R. Bostroem, M. C. Kelley (Cornell Univ.), P. M. Kintner (Cornell Univ.), R. Lundin (Kiruna Geophys. Inst., Sweden), U. V. Fahleson (Roy. Inst. of Technol., Stockholm), E. A. Bering (Houston Univ.), and W. R. Sheldon Jul. 1979 34 p refs Submitted for publication Sponsored by NASA, NSF, and Swedish Board for Space Activities
(NASA-CR-163255; UIO-SR-79-02) Avail: NTIS HC A03/MF A01 CSCL 04A

The experiment design, including a description of the diagnostic and chemical release payload, and the general results are given for an auroral process simulation experiment. A drastic increase of the field aligned charged particle flux was observed over the approximate energy range 10 eV to more than 300 keV, starting about 150 ms after the release and lasting about one second. The is evidence of a second particle burst, starting one second after the release and lasting for tens of seconds, and evidence for a periodic train of particle bursts occurring with a 7.7 second period from 40 to 130 seconds after the release. A transient electric field pulse of 200 mv/m appeared just before the particle flux increase started. Electrostatic wave emissions around 2 kHz, as well as a delayed perturbation of the E-region below the plasma cloud were also observed. Some of the particle observations are interpreted in terms of field aligned electrostatic acceleration a few hundred kilometers above the injected plasma cloud. It is suggested that the acceleration electric field was created by an instability driven by field aligned currents originating in the plasma cloud. Author (ESA)

N80-26985# Oulu Univ. (Finland). Dept. of Physics
ON THE DISCREPANCY BETWEEN THE MAGNETIC D-COMPONENT AND THE OVERHEAD HORIZONTAL CURRENT AT HIGH LATITUDES
L. Jalonen and T. Nygren Oct. 1978 20 p refs Sponsored in part by Finnish Acad. of Sci.
(Rept-66/1978; ISBN-951-42-0645-2) Avail: NTIS HC A02/MF A01

The discrepancy between the overhead E-region current and the magnetic D-component is studied using data obtained by the Chatanika incoherent scatter radar (L - 5.8). The F-region horizontal current is estimated to be too small to cause the observed D-deflection. Also, the assumption that the magnetic effects of the Pederson and field-aligned currents cancel each other on the ground is shown to be inadequate to solve the problem. The significance of the inclination angle in the data analysis and the importance of the field aligned current sheets are discussed. Author (ESA)

N80-26986# Technology Service Corp., Santa Fe, N. Mex.
EXISTING VISIBILITY LEVELS IN THE UNITED STATES. ISOPLETH MAPS OF VISIBILITY IN SUBURBAN/ NONURBAN AREAS DURING 1974 - 1978 Interim Report, May - Sep. 1978
John Trijonis and Dawn Shapland Sep. 1979 35 p refs
(Grant EPA-802815)
(PB80-156177; EPA-450/5-79-010) Avail: NTIS HC A03/MF A01 CSCL 04A

Maps are prepared which illustrate median, midday visibility levels in suburban/ nonurban locations of the continental United States. Median visibilities at 94 locations are determined from cumulative frequency distributions of quality-checked airport observations. Seven locations in the Southwest with photographic photometery of nephelometry data (which agree quite well with the airport data) are also included. The spatial pattern of visibility is demonstrated with isopleth maps for both the annual medians and summertime medians during the years 1974-1978. GRA

N80-26987# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
THE USE OF RADAR OBSERVATIONS OF (C-2) SUB N VS. HEIGHT TO DEDUCE HEIGHT PROFILES OF REFRACTIVE INDEX
E. E. Gossard Dec. 1979 55 p refs
(PB80-160963; NOAA-TM-ERL-WPL-47; NOAA-80020501) Avail: NTIS HC A04/MF A01 CSCL 04A

The possibility of significantly improving the height resolution and accuracy of the standard radiometric retrieval methods by adding information from active radar sounding of the clear atmosphere is examined. Evidence is presented that the intensity is closely related to the height gradient of the refractive index. GRA

N80-26988# National Geodetic Survey, Rockville, Md.
DETERMINATION OF THE GEOPOTENTIAL FROM SATELLITE-TO-SATELLITE TRACKING DATA
B. C. Douglas, C. C. Goad, and F. F. Morrison Jan. 1980 36 p refs
(PB80-161086; NOAA-TM-NOS-NGS-24) Avail: NTIS HC A03/MF A01 CSCL 08E

Simulations were made of the recovery of mean gravity anomalies from intersatellite Doppler measurements. A pair of

surface-force compensated satellites was assumed to be in identical polar orbits, spaced by 3 degrees, at an altitude of 200 km, taking intersatellite data with a precision of 0.001 mm/s. The results for a half-year mission indicate that 1 degree by 1 degree mean gravity anomalies can be obtained to a precision of a few milligals. In contrast to previous analyses, results are indicative of data obtainable from a global solution free of debatable a priori constraints or assumptions about the geopotential. Thus a property optimized mission using additional information, such as results from altimetry or mean surface anomalies, could improve upon the results presented here. GRA

N80-26989/ Kentucky Bureau of Highways, Lexington. Div. of Research.
EVALUATION OF TRIAXIAL TESTING EQUIPMENT AND METHODOLOGIES OF THREE AGENCIES
Tommy C. Hopkins and David L. Allen. Dec. 1979. 29 p. refs (PB80-157654; RR-533) Avail: NTIS HC A03/MF A01 CSCL 08M

The initiation and establishment of a triaxial testing forum whereby any geotechnical laboratory engaged in triaxial testing can check the quality of their triaxial results and therefore evaluate their testing procedures and equipment make-up against the results obtained by other agencies is proposed. Isotropically consolidated, undrained triaxial tests with pore pressure measurements were performed by three agencies on remolded standardized kaolinite specimens in order to initiate the forum. The triaxial results reported by each agency and analyses of all data are reported and show that the three participating agencies obtained about the same results. The forum will be useful to any governmental agency for accrediting any geotechnical laboratory performing work for that agency. GRA

N80-27270*/ Arizona Univ., Tucson.
VOLCANO-ICE INTERACTIONS ON THE EARTH AND MARS Ph.D. Thesis
Carlton Carl Allen. *In* NASA, Washington. Advan. in Planetary Geol. Jun. 1980. p 165-264. refs (For primary document see N80-27268 17-99)
(Grant NGL-03-002-191)
Avail: NTIS HC A14/MF A01 CSCL 03B

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-26990 Iowa State Univ. of Science and Technology, Ames.
PERIODIC VARIABILITY FROM LONG-TERM WEATHER RECORDS Ph.D. Thesis
Robert Stephen Weinbeck. 1980. 111 p.
Avail: Univ. Microfilms Order No. 8012989

Analyses using spectral and superposed epoch methods and empirical orthogonal functions were made of series of 41 state-averaged temperatures and precitation amounts for 1890 to 1977 and 42 selected, area-weighted individual U.S. station values for 1873 to 1977. Cross spectral analyses of these series with sunspot numbers and geomagnetic activity indices also were made. The derived series consisted of areas subject to excesses or deficits from the variable's average defined by the upper and lower 16th percentile limits of the values for the length of record. The temperature and precipitation results are consistent with observed drought patterns in the central Great Plains where drought areas are a maximum following negative to positive transition of the double sunspot cycle. The 21 year periodicity in areas experiencing abnormally high precipitation as defined by their upper 16th percentile years within the record is stronger yet. Dissert. Abstr.

N80-26991 Royal Netherlands Meteorological Inst., De Bilt.
SYNOPTIC AND UPPER AIR OBSERVATIONS IN THE NETHERLANDS, VOLUME 23
1978. 397 p. In ENGLISH and DUTCH
(KNMI-142-23) Avail: Roy. Netherlands Meteorol. Inst., De Bilt FL 25

Synoptic observations are given for stations in the Netherlands, including lightships and fixed platforms in the North Sea. Summaries of monthly and yearly upper air data are also presented for De Bilt. Station locations, instruments used, and observations made are listed. Author (ESA)

N80-26992*/ National Aeronautics and Space Administration, Pasadena Office, Calif.
CLOUD COVER SENSOR Patent Application
Eric G. Laue, inventor (to NASA) (JPL). Filed 27 Jun. 1980. 11 p.
(Contract NAS7-100)
(NASA-Case-NPO-14936-1; US-Patent-Appl-SN-163837) Avail: NTIS HC A02/MF A01

An apparatus is described which provides a numerical indication of the cloudiness at a particular time of a day. The apparatus includes a frame holding several light sensors such as photovoltaic cells, with a direct sensor mounted to directly face the Sun and indirect sensors mounted to face different portions of the sky not containing the Sun. A light shield guards the direct sensor from most of the sky except a small portion contining the Sun, and also shields each of the indirect sensors from direct sunlight. The relative values of the outputs from the direct and indirect sensors, enables the generation of a numerical indication of the degree of cloudiness at a particular time of day. NASA

N80-26993*/ SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
APPLICATION OF AN AUTOMATIC CLOUD TRACKING TECHNIQUE TO METEOSAT WATER VAPOR AND INFRARED OBSERVATIONS Final Report, 3 May 1979 - 31 May 1980
Roy M. Endlich and Daniel E. Wolf. May 1980. 32 p. refs
(Contract NAS5-25730; SRI Proj. 8600)
(NASA-CR-159995) Avail: NTIS HC A03/MF A01 CSCL 04B

The automatic cloud tracking system was applied to METEOSAT 6.7 micrometers water vapor measurements to learn whether the system can track the motions of water vapor patterns. Data for the midlatitudes, subtropics, and tropics were selected from a sequence of METEOSAT pictures for 25 April 1978. Trackable features in the water vapor patterns were identified using a clustering technique and the features were tracked by two different methods. In flat (low contrast) water vapor fields, the automatic motion computations were not reliable, but in areas where the water vapor fields contained small scale structure (such as in the vicinity of active weather phenomena) the computations were successful. Cloud motions were computed using METEOSAT infrared observations (including tropical convective systems and midlatitude jet stream cirrus). B.D.

N80-26994*/ Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
EVALUATION AND DEVELOPMENT OF SATELLITE INFERENCES OF CONVECTIVE STORM INTENSITY USING COMBINED CASE STUDY ANALYSIS AND THUNDERSTORM MODEL SIMULATIONS Technical Report, 1 May - 30 Apr. 1980
William R. Cotton and Gregory J. Tripoli. 30 Jul. 1980. 25 p. refs
(Grants NsG-5341; NSF ATM-79-08297)
(NASA-CR-163270) Avail: NTIS HC A02/MF A01 CSCL 04B

Major research accomplishments which were achieved during the first year of the grant are summarized. The research concentrated in the following areas: (1) an examination of observational requirements for predicting convective storm development and intensity as suggested by recent numerical experiments; (2) interpretation of recent 3D numerical experiments with regard to the relationship between overshooting tops and surface wind gusts; (3) the development of software for emulating satellite-inferred cloud properties using 3D cloud model predicted data; and (4) the development of a conceptual/semi-quantitative model of eastward propagating, mesoscale convective complexes forming to the lee of the Rocky Mountains. R.E.S.

N80-26996*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AVE-SESAME 2: THE 25-MB SOUNDING DATA
Stephen F. Williams, Myron L. Gerhard, and Robert E. Turner Jun. 1980 377 p refs
(NASA-TM-78281) Avail: NTIS HC A17/MF A01 CSCL 04B

The rawinsonde sounding program for the AVE-SESAME II experiment is described. Data at 25 mb intervals from the surface to 25 mb for the 23 National Weather Service and 19 special stations participating in the experiment are presented. Soundings were taken at 3 hr intervals beginning at 1200 GMT on April 19, 1979, and ending at 1200 GMT on April 20, 1979 (nine sounding times). The method of processing is discussed briefly, estimates of the rms errors in the data presented, an example of contact data given, reasons given for the termination of soundings below 100 mb, and soundings listed which exhibit abnormal characteristics. Author

N80-26996*# City Coll. of the City Univ. of New York.
EIGENVECTOR ANALYSIS OF SOME OBSERVED AND MODEL-GENERATED CLIMATOLOGICAL FIELDS
Michael Dennis Jul. 1980 11 p refs
(Grant NGR-33-013-086)
(NASA-CR-163271) Avail: NTIS HC A02/MF A01 CSCL 04B

An empirical orthogonal function analysis of monthly mean synoptic fields computed with a general circulation model and the corresponding observed climatological patterns is presented. A computer program was used to compute the principal components of the data matrices representing global maps of various observed and model-generated climatological fields. The variables analyzed were: 500mb geopotential height, 850 mb temperature, and sea level pressure. It is concluded that eigenvector analysis of observed and model-generated synoptic climatological fields is a useful diagnostic aid in the evaluation of global model simulation. The maps of any climatological variables are readily decomposed into a few orthogonal components which account for a large fraction of the total spatial variance, and the observed and model-generated patterns may then be compared in terms of these principal components of the original data matrices. R.E.S.

N80-26997*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AVE-SESAME 3: 25-MB SOUNDING DATA
Steven T. Williams, Myron L. Gerhard, Luke P. Gilchrist, and Robert E. Turner Jun. 1980 384 p refs
(NASA-TM-78283) Avail: NTIS HC A17/MF A01 CSCL 04B

The rawinsonde sounding program for the AVE-SESAME 3 experiment is described and tabulated data at 25-mb intervals from the surface to 25 mb for the 23 National Weather Service and 19 special stations participating in the experiment are presented. Soundings were taken at 3 hr intervals beginning at 1200 GMT on April 25, 1979, and ending at 1200 GMT on April 26, 1979 (nine sounding times). The method of processing is discussed briefly, estimates of the rms errors in the data presented, an example of contact data given, reasons given for the termination of soundings below 100 mb, and soundings listed which exhibit abnormal characteristics. A.R.H.

N80-26998*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ICEX: ICE AND CLIMATE EXPERIMENT. REPORT OF SCIENCE AND APPLICATIONS WORKING GROUP
Dec. 1979 152 p refs
(NASA-TM-81028) Avail: NTIS HC A08/MF A01 CSCL 04B

The Ice and Climate Experiment (ICEX), a proposed program of coordinated investigations of the ice and snow masses of the Earth (the 'cryosphere') is described. These investigations are to be carried out with the help of satellite, aircraft, and surface based observations. Measurements derived from the investigations will be applied to an understanding of the role of the cryosphere in the system that determines the Earth's climate, to a better prediction of the responses of the ice and snow to climatic change, to studies of the basic nature of ice forms and ice dynamics, and to the development of operational techniques for assisting such activities in the polar regions as transportation, exploitation of natural resources, and petroleum exploration and production. A high-inclination satellite system with a set of remote-sensing instruments specially tailored to the task of observing the important features of snow, sea ice, and the ice sheets of Greenland and the Antarctic is to be used to record the near-simultaneous observations of multiple geophysical parameters by complementary sensors. J.M.S.

N80-26999*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPLORATORY MEETING ON AIRBORNE DOPPLER LIDAR WIND VELOCITY MEASUREMENTS
George H. Fichtel, ed., John W. Kaufman, ed., and William W. Vaughan, ed. Apr. 1980 57 p refs Meeting held in Huntsville, Ala., 1 Apr. 1980
(NASA-CP-2140) Avail: NTIS HC A04/MF A01 CSCL 04B

The scientific interests and applications of the Airborne Doppler Lidar Wind Velocity Measurement System to severe storms and local weather are discussed. The main areas include convective phenomena, local circulation, atmospheric boundary layer, atmospheric dispersion, and industrial aerodynamics. For individual titles, see N80-27000 through N80-27008.

N80-27000*# Desert Research Inst., Reno, Nev.
AIRBORNE DOPPLER LIDAR WIND MEASURING SYSTEM: APPLICATION TO ATMOSPHERIC PROBLEMS
James W. Telford *In* NASA. Marshall Space Flight Center Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 11-12 (For primary document see N80-26999 17-47)
Avail: NTIS HC A04/MF A01 CSCL 04B

The ability to map velocities over a large area on one side of the aircraft flight path offers a number of opportunities to elucidate scientific questions related to atmospheric dynamics. Several types of experiments which are possible are described. R.E.S.

N80-27001*# Tennessee Univ. Space Inst., Tullahoma. Atmospheric Science Div.
POTENTIAL SCIENTIFIC RESEARCH WHICH WILL BENEFIT FROM AN AIRBORNE DOPPLER LIDAR MEASUREMENT SYSTEM
Walter Frost *In* NASA. Marshall Space Flight Center Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 13-15 (For primary document see N80-26999 17-47)
Avail: NTIS HC A04/MF A01 CSCL 04B

Areas of research which can be significantly aided by the Doppler lidar airborne system are described. The need for systematic development of the airborne Doppler lidar is discussed. The technology development associated with the systematic development of the system will have direct application to satellite systems for which the lidar also promises to be an effective instrument for atmospheric research. R.E.S.

N80-27002*# Texas A&M Univ., College Station. Dept. of Meteorology.
[POTENTIAL USES OF THE AIRBORNE DOPPLER LIDAR WIND VELOCITY MEASUREMENT SYSTEM]
James R. Scoggins *In* NASA. Marshall Space Flight Center Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 16-17 (For primary document see N80-26999 17-47)
Avail: NTIS HC A04/MF A01 CSCL 04B

Four aspects of the Doppler lidar are discussed: (1) error analysis of the system; (2) design of the first field program; (3) potential areas of application; and (4) verification of Doppler lidar data by independent measurements. R.E.S.

N80-27003*# National Science Foundation, Washington, D. C. Atmospheric Sciences Div.
[POTENTIAL APPLICATIONS OF THE DOPPLER LIDAR MEASUREMENTS]
L. Randall Koenig *In* NASA. Marshall Space Flight Center Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 18-19 (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

The potential application of the Doppler lidar measurements to the determination of material (e.g., water vapor) and energy budgets, momentum transports, etc., in the environment at all stages and in the development of convective clouds are discussed. R.E.S.

N80-27004*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

[MEASUREMENT OF PHENOMENA ASSOCIATED WITH WATER CLOUDS USING DOPPLER LIDAR]

David A. Bowdle *In its* Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 20-24 (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

Doppler lidar measurements of phenomena associated with water clouds (such as aerosols) are discussed. The purpose of the measurements and details of executing the experiment are described. R.E.S.

N80-27005*# Florida State Univ., Tallahassee. Geophysical Fluid Dynamics Inst.

[APPLICATION OF THE DOPPLER LIDAR SYSTEM TO AGRICULTURAL BURNING AND AIR-SEA INTERACTIONS]

Daniel Fitzjarrald *In* NASA. Marshall Space Flight Center Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 25 (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

The Doppler lidar system is potentially a very powerful measurement system. Three areas concerning the system are discussed: (1) error analysis of the system to verify the results; (2) application of the system to agricultural burning in California central valley; and (3) oceanographic possibilities of the system. R.E.S.

N80-27006*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

WIND FIELD MEASUREMENT IN THE NONPRECIPITOUS REGIONS SURROUNDING STORMS BY AN AIRBORNE PULSED DOPPLER LIDAR SYSTEM, APPENDIX A

James W. Bilbro and William W. Vaughan *In its* Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 31-39 refs (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

Coherent Doppler lidar appears to hold great promise in contributing to the basic store of knowledge concerning flow field characteristics in the nonprecipitous regions surrounding severe storms. The Doppler lidar, through its ability to measure clear air returns, augments the conventional Doppler radar system, which is most useful in the precipitous regions of the storm. A brief description of the Doppler lidar severe storm measurement system is provided along with the technique to be used in performing the flow field measurements. The application of the lidar is addressed, and the planned measurement program is outlined. Author

N80-27007*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

THE MSFC DOPPLER LIDAR SYSTEM, APPENDIX B

James W. Bilbro and Michael C. Krause (Raytheon Co., Wayland, Mass.) *In its* Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 40-42 (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

The development of pulsed and continuous wave Doppler lidars for atmospheric measurement is discussed. A description of how the lidar systems operate is presented. The scanning mode is also described. R.E.S.

N80-27008*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

POSSIBLE APPLICATIONS OF MSFC DOPPLER LIDAR SYSTEM, APPENDIX C

George H. Fichtel and John W. Kaufman *In its* Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 43-46 refs (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

An interpretation of the Doppler lidar return is presented. Possible applications of the system to severe storm research are discussed. The present project schedule of the Doppler lidar system is outlined. R.E.S.

N80-27009# Danish Meteorological Inst., Copenhagen.

ON CLIMATE CHANGES AND RELATED PROBLEMS

Knud Frydendahl, ed. 1978 287 p refs Proceedings of Nordic Symp., Copenhagen, 24-28 Apr. 1978

(DMI-Climatol-Papers-R-4; ISBN-87-7478-154-5) Avail: NTIS HC A13/MF A01

Thirty papers dealing with climate and climatic history are presented. Subjects covered include global paleoclimatic chronology, glacial and arctic climates, climate and history, bioclimatology, and recent events (temperature observations, solar radiation flux density measurements, etc.) as evidence of climatic variations. Results show, in particular the cyclicity of climatic change, arctic responses to climatic fluctuations, the effects of climate on fauna as well as various plants, and the importance of considering climatic variability in formulating meteorological models. For individual titles, see N80-27010 through N80-27039.

N80-27010# Bern Univ. (Switzerland).

FLUCTUATIONS IN THE DURATION OF SNOW COVER IN SWITZERLAND SINCE THE LATE SEVENTEENTH CENTURY

Christian Pfister *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 1-6 refs (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

Weather fluctuations towards colder and warmer runs of years, discernable in the last few centuries, are considered in view of how snow was affected by secular climatic change. Records of snowfall, duration of snow cover, and of snow cover occurrence are examined. Problems of interpretation of snow cover chronicles compiled in Switzerland are brought out. Comparison of snow cover observations with pressure maps is made where possible. The impact of climatic fluctuations, especially on the severity of the winter season, is correlated with history for grain and dairy production. Results show that Swiss harvest failures can be attributed to climatic extremes, so far absent from modern weather statistics. Furthermore, as the weather-crop relationships are based on thresholds, climatic change need not be drastic to have a significant impact on crops. Author (ESA)

N80-27011# Danish Meteorological Inst., Copenhagen.

TREE-RING GROWTH AND TEMPERATURE

Alf Braethen *In its* On Climate Changes and Related Probl. 1978 p 7-9 (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

The effect of climatic factors on the growth of trees is studied. It is postulated that tree ring observations can be extrapolated to mean day summer temperatures for ten year periods in the past. One thousand one hundred samples from oak (Quercus Robur) which have grown within a radius of about 100 km of a small village north of Gothenburg were measured and investigated. A few hundred of these samples were used to create a chronological reference curve, built up from yearly tree ring growth between A.D. 831 and 1975. A graph of temperature results reflects the figures derived from the prime values, while nothing about their error can be stated. Author (ESA)

N80-27012# Copenhagen Univ. (Denmark). Geographical Inst.

ICE WEDGES AS A GEOMORPHOLOGICAL INDICATOR OF CLIMATIC CHANGES

Harald Svensson *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 9-17 refs (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

In the evaluation of climatic changes, quantitative meteorological evidence, biological findings, or glacial fluctuations serve as indicating factors. The possible use of another type of indicator,

directly related to frost processes and indicative of a special climatic situation is discussed. Annual observations on ice wedge growth caused by frost cracking are studied. Based on a mean value for the growth of an ice wedge (the width of the winter crack) and the total width of the wedge, the number of winter cracks can be calculated and thereby the age of the wedge determined. The distinction between active, inactive, and fossil ice wedges is drawn. The use of fossil ice wedges as paleoclimatic indicators is discussed and supportive studies of thermal conditions for recent ice wedge formation to improve this technique are suggested. The use of active ice wedges as potential climatic indicators, supplementary to glaciers, for recording climatic variations in present periglacial or arctic areas is shown.

Author (ESA)

N80-27013# Danish Meteorological Inst., Copenhagen.
CYCLIC CHANGES IN CLIMATE DURING 5,500 YEAR PERIOD REFLECTED IN DANISH RAISED BOGS
Bent Aaby *In its* On Climate Changes and Related Probl. 1978 p 18-26 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

A climate investigation based mainly on changes in the degree of decomposition of peat is presented. The study centers on raised bog which are lens shaped, while the peat surface is highest in the central part of the bog. The upper peat layers on the bog do not receive any minerogenic water from their surroundings. Raised bogs therefore have their own water balance with all of the moisture supplied from the atmosphere as rain or snow. The humidity in the upper peat layers layers depends essentially on precipitation, temperature, and evaporation, which makes these bogs very sensitive to variations in climate. The interplay between changes in temperature and precipitation is examined for its effect on peat humification. A statistical test was made to check the significance of the apparent periodicity of humification patterns and also to determine more accurately the length of the period. Results show evidence of a major long term fluctuation in climate with a cyclic periodicity of about 260 years, over the past 5,500 years in northwestern Europe.

Author (ESA)

N80-27014# Lund Univ. (Sweden). Inst. of Economic History.
THE LIMITATIONS OF CLIMATOLOGY AS A FACTOR IN EXPLAINING HUMAN INSTITUTIONS
Gisli Gunnarsson *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 27-34 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Theories of the influence of climatic variations on the development or decline of economic structures throughout history are examined. Numerous references to the connection between climate and the economic troubles of the late Middle Ages are cited. Also mentioned are historical records (1600) from the Faroese Islands concerning fishing, Icelandic historical annals on grain cultivation, and studies on the mystery of the Maya civilization in Mexico. It is concluded that the connection between climate and human activity is often tenuous and that looking for social causes is a more useful approach. Author (ESA)

N80-27015# Danish Meteorological Inst., Copenhagen.
SPECIFICATION IN ETHIOPIAN LEPIDOPTERA INDICATING A CLIMATIC CHANGE
S. J. R. Birket-Smith *In its* On Climate Changes and Related Probl. 1978 p 35-44 refs Sponsored by Natl. Geograph. Soc. (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The compositions of the butterfly faunas in gallery forests and in isolated patches of rain forest in the southern Congo are exactly the same as in the continuous rain forest. This leads to the conclusion that these gallery forests and the isolated patches are the results of a relatively recent regression of the forest in southern Congo. The hypothesis that the present, large numbers of closely related species in many of these rain forest genera are the result of an earlier period of regression of the forest caused by a climatical change is offered and supported by observations. Author (ESA)

N80-27016# Stockholm Univ. (Sweden). Geological Inst.
RECORDED PALEOCLIMATIC CHANGES: CYCLICITY, CORRELATIONS AND RELATION TO CHANGES IN THE ORBITAL GEOMETRY AS WELL AS TO PALEOMAGNETIC AND PALEOGEOID CHANGES
Nil-Axel Moerner *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. Jan. 1978 p 45-52 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Seven major paleoclimatic cycles are identified and discussed. Two cycles are directly related to fluctuations in climate and eustasy, having a periodicity varying between 230 and 1000 years for one, and 1000 to 3600 years for the other. A third cycle with a periodicity of 5250 years depends on cyclic geoid changes. The fourth, fifth, and sixth represent variables in the Earth/Sun constellation, i.e., precession, tilt, and eccentricity. The seventh, controlled by core/mantle changes, consists of a 2.4 million year cyclic change in paleoclimatic amplitude. The seven cycles analyzed range from 100 to 1,000,000 years and seem to be driven by changes in the solar activity, the Earth/Sun constellation, and the core/mantle coupling and interface. The cycles are expressed, directly or indirectly, in many different variables and are influenced by numerous modulating factors. There is a multiple interaction between most geophysical parameters implying that almost any change leads to a variety of secondary effects and feedback mechanisms.

Author (ESA)

N80-27017# Danish Meteorological Inst., Copenhagen.
SOME POINTS OF VIEW ON CHANGES IN THE COMPOSITION OF THE BEETLE FAUNA OF LAKE SHORES IN NORTHERN SCANDINAVIA DUE TO WATER USE REGULATIONS: AN ATTEMPT TO INDICATE THE ALTERATIONS IN PART AS A CONSEQUENCE OF CLIMATIC CHANGES
Axel Friden *In its* On Climate Changes and Related Probl. 1978 p 54-59 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/ MF A01

Ecological problems in Scandinavia, especially those connected with beetle fauna, are discussed. Special attention is given to lake shore areas affected by water use regulation. Results of a census of the beetle population taken twice at a 30 year interval are compared. Some trends in species tolerance to environmental change are noted but no statement on the statistical confidence of data can be made. Water management seems to have little influence on the climate in general. Author (ESA)

N80-27018# Copenhagen Univ. (Denmark). Geographical Inst.
POPULATION AND CLIMATE IN THE DEVELOPMENT OF THE FAROESE PEASANT SOCIETY
Jesper Brandt (Roskilde Univ.) and Rolf Guttsen *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 60-67 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Climate and its decisive influence on the way in which the geographical milieu may be used in the production processes through which a society secures its continuing existence is examined. Population, its size, density, growth, and distribution are seen as another decisive element necessary to understand the conditions under which a society develops. Meteorological data on the Faroe Islands, collected as early as 1781, is reviewed and climatic variations are pointed out. An attempt is then made to relate seasonal trends in the weather to historical social trends in population growth or decline, agricultural, and to the organization of land ownership, trade, and the fishing industry. Results show that although there is evidence of climatic change being at the root of cultural trends, it is not possible to draw a distinct relationship between climate and population due to a lack of empirical evidence. Author (ESA)

N80-27019# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Meteorology.
ON CLIMATIC CHANGES IN FINLAND
Raino Heino *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 68-75 refs Sponsored by Emil Aaltonen Found. (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Areal temperature and precipitation trends in Finland are

described. Observation series are long enough to reveal the climatic developments of the 20th century, but are too short to give a good idea of changes which occured in the 19th. Nonetheless, analysis shows that the main features of temperature and precipitation curves presented correspond fairly well with the picture of global climatic changes. Author (ESA)

N80-27020# Aarhus Univ. (Denmark). Dept. of Paleoecology.
CLIMATE CHANGE IN THE PALEOZOIC AGE
Nils Spjeldnaes *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 76-84 (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

During the Paleozoic and late Precambrian there were three periods of glaciation: in the latest Precambrian, in the Ordovician, and in the Permo-Carboniferous. All three have peculiarities of areal distribution, sequence, duration, and other aspects which provide some clues as to the mechanics of climatic change. An analysis of these three glaciations is given, together with a review of some of the related biological and geological parameters influencing climatic change, such as the development of the continental albedo (related to the origin of land plants), the oxygen and ozone content of the atmosphere, and the position and movements of the continental plates in relation to the oceanic and atmospheric circulation systems. Author (ESA)

N80-27021# Lund Univ. (Sweden). Dept. of Physical Geography.
THE LATE GLACIAL CLIMATE IN WESTERN SWEDEN
Aske Hillefors *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 85-92 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Landforms in western Sweden are studied. Interstadial land surfaces with periglacial morphological features, such as layers of blown sand, windcutting, and ice wedge casts, covered by fill as well as by glaciofluvial sand are found. Late glacial abrasion by coastal breakers and currents is also investigated. Deglaciation and the dating of isobase surfaces as well as of periglacial features are discussed. Results are used to support conjecture on the climatic conditions necessary to explain apparent rate control of glacial drift. Author (ESA)

N80-27022# Copenhagen Univ. (Denmark). Zoological Inst.
CLIMATE AND DANISH FOREST INSECT PESTS
Broder Bejer-Peterson *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 93-97 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The relation between climate and insect populations is examined. A direct influence of shifts towards a warm, dry climate in Denmark on subsequent mass outbreaks of moths in forest regions is cited. Changing seasonal weather and its effect on jumps in Spruce Aphid and Barkbeetle populations are also shown. In conclusion, closer cooperation in preparing meteorological data by climatologists and zoologists is called for. Author (ESA)

N80-27023# East Anglia Univ., Norwich (England). Climatic Research Unit.
THE VARIETY IN BIOLOGICAL EFFECTS OF CLIMATIC CHANGE
Michael J. Ford *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 98-102 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Climatologists frequently make use of the biological effects of climatic changes in attempting to reconstruct the history of past climates. The considerable variety of such effects which is apparent from responses of the fauna and flora of Britain to the climatic changes that have taken place during the present century is discussed. Studies show that many animals and plants are restricted to specific habitats for essentially climatic reasons. In recent years a number of such species, particularly those restricted to heathland, have become endangered as specialized habitat is reduced due to human population pressure on the environment. Reducing the availability of optimal habitats which are as refuges for plants and animals during unfavorable climatic conditions means that present and future climatic changes can have much more significant effects on the natural fauna and flora, as well as on man himself. Author (ESA)

N80-27024# Copenhagen Univ. (Denmark). Zoological Inst.
CUTWORM ATTACKS IN RELATION TO RAINFALL AND TEMPERATURE DURING A 70 YEAR PERIOD
Ole Zethner and Peter Esbjerg (State Plant Pathol. Inst., Lyngby, Denmark) *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 103-108 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The influence of precipitation and temperature on the occurrence of reported cutworm damage in Denmark is studied in detail. Rainfall and temperature data for the period 1906 to 1976 were considered. Seven years of extreme cutworm damage as compared to nine years of little cutworm damage were identified. The analysis of weather influence is based on a homogeneous evaluation of cutworm attacks by the computer program STAPEL. Results indicate that total May, June, and July precipitation during the year of cutworm infestation is the most important factor in evaluating the risk of crop damage. Author (ESA)

N80-27025# Risoe National Lab., Roskilde (Denmark). Meteorology Section.
STOCHASTIC MODEL BUILDING FOR DISCRETE TIME SERIES APPLIED ON A PALEOTEMPERATURE SERIES FROM THE LAST 700,000 YEARS
Erik Lundtang Petersen and Soeren E. Larsen *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 109-113 refs Repr. from 5th Conf. on Probability and Statistics, Preprint Vol., Nov. 1977 (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

A time series is shown which displays an indicator of the temperature variations in the Northern Hemisphere over the last 700,000 years. Methods from stochastic forecast and control theory are applied to model this time series in terms of linear stochastic models. The model constructed are then used to forecast future behavior of the series. The different model predictions are compared. Results show that for model building the series presented has the disadvantage of including variations of many time scales. The longest (90,000 years) is so long compared to the series length that it difficult to represent it in any statistically reliable way. However, for the immediate future (5,000 to 15,000 years) all models agree in their forecasts, indicating a coming global cooling over the scales considered. Author (ESA)

N80-27026# Copenhagen Univ. (Denmark). Zoological Inst.
APHID FLIGHT ACTIVITY AFFECTED BY WIND FACTORS AND OTHER CLIMATIC CONDITIONS
Holger Philpsen *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 114-115 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

A suction trap network for catching small flying insects and covering parts of Great Britain, Holland, and Denmark is described. One trap in Denmark used to study aphids, was emptied once an hour in order to measure the effect of climatic conditions on flight activity with particular emphasis on the influence of wind factors. For this purpose wind speed as well as wind direction were registered. The trappings often lead to the characteristic bimodal activity curve, but cases with one peak or no peaks at all are frequent. Some of these cases can be explained by extreme, high wind speeds preventing aphid flight. On several occasions, pronounced peaks in flight activity appear at the same time as changes in wind direction. No simple connection between single climatic factors and flight activity can be expected, but the findings indicate that changing wind direction can be an additional and stimulating factor for aphid flight, presupposing that no other factors cause limitation. Author (ESA)

N80-27027# East Anglia Univ., Norwich (England). Climatic Research Unit.
THE VARIABILITY OF CLIMATE: OBSERVATION AND UNDERSTANDING
H. H. Lamb *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 116-144 refs (For primary document

see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The changing perception of, and attitudes toward, climatic variation during the development of meteorological science and the importance of climatology at the present day are reviewed. What is now known of the magnitudes, rapidity, and the geographical as well as timewise distributions of climatic fluctuations and changes are examined. Subjects touched on include the construction of longer records of climate, analysis of climatic records, and the prediction of future trends. Conclusions are related to a global cooling trend in atmospheric temperature. Author (ESA)

N80-27028# Danish Meteorological Inst., Copenhagen.
AN APPROACH TO THE UNDERSTANDING OF THE SUMMER CLIMATE 7,000 TO 6,000 BEFORE PRESENT IN RYFYLKE, SOUTHWEST NORWAY
Lotte Selsing and Erik Wishman *In its* On Climate Changes and Related Probl. 1978 p 145-153 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Archaeological findings reveal that a mesolithic hunting culture utilized the Ryfylke mountain areas around the 1000 m level only during the period 7,000 to 6,000 before present. An attempt is made to related these findings to changes in the natural environment during the period. The pine forest in this area was studied. Observations show that the forest reached its highest level between 7,000 and 6,000 years before present and that it differs from the present limit by nearly 200 m. The east-west inclination of the average pine forest limit was about the same 7,000 to 6,000 years ago as it is today (i.e., around 5 m/km). These data are interpreted in order to derive a mean summer temperature for the area during the time when the mean pine forest limit was situated at its highest (Atlantic period). The temperature estimate is used to determine reasonable circulation patterns which could have dominated the area during the summer season for the period discussed. Author (ESA)

N80-27029# Danish Meteorological Inst., Copenhagen.
ARCTIC CLIMATE AND ECOLOGICAL CHANGES, THE SPRING-TIDES, AND THE DECLINATION OF THE SUN
Christian Vibe *In its* On Climate changes and Related Probl. 1978 p 154-161 (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The coincidence between fluctuations in arctic climate and rhythmic fluctuations in animal populations is investigated. Studies of arctic herbivorous mammals, sea mammals, and sea birds, in conjunction with data on drift ice and the seasonal occurrence of maximum tides in the Arctic ocean, are cited. The periodicity of fluctuations in the numbers of animals, such as the Greenland whale, the caribou, the hare, the lynx, the polar bear, and the arctic fox, is shown. Simultaneously, a periodic influx of deep Atlantic water to the surface of the Arctic ocean is found. Author (ESA)

N80-27030# Copenhagen Univ. (Denmark). Inst. of Historical Geology and Palaeontology.
OXYGEN ISOTOPE PALEOTEMPERATURES FROM THE TERTIARY NORTH SEA: EVIDENCE OF A 30 MILLION YEAR CLIMATIC PERIODICITY
Bjoern Buchardt *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 162-167 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The climatic development of northwestern Europe during the last 65 megayears, the Tertiary period, which includes the important shift from the overall warm global climates to the glacian extremes that have characterized the last million years, is considered. The climatic history of periods older than those known from written information are studied by indirect methods. Studies of the changing character of floras and faunas in the European Tertiary deposits reveal that climatic fluctuations did take place during this period. Data based on oxygen isotope measurements about variations in the water temperature of the Tertiary North Sea are evaluated, while the influence of probable global climatic oscillations on these variations is assessed. Data from Upper Cretaceous (80 to 65 megayears old) deposits in Europe indicate higher northwestern European temperatures when compared to the Middle Paleocene (60 megayears ago) values obtained. A second climatic minimum about 30 megayears ago is also identified. The temporal spacing of the observed minima suggests the existence of a 30 megayear climatic cyclicity during the Tertiary and Quarternary periods. Author (ESA)

N80-27031# Danish Meteorological Inst., Copenhagen.
WATER RESOURCE PLANNING AND CLIMATIC CHANGES
Richard Thomsen *In its* On Climate Changes and Related Probl. 1978 p 168-174 ref (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Research into possible water resources and their potential to meet demand, especially in the agricultural sector, was carried out on the Island of Samsoe, Denmark. Present and future water supply demand, along with the quantity and quality of ground water resources available, were assessed. The limits for extended use of ground water without permanent damage to the aquifers were considered. Results show the importance of the climatic factor in determining ground water replacement through the percolation of precipitation. Author (ESA)

N80-27032# Danish Meteorological Inst., Copenhagen.
HOLOCENE (10,000 YEARS AGO TO PRESENT) CLIMATES IN GREENLAND AND NORTH ATLANTIC ATMOSPHERIC CIRCULATION
Svend Funder (Geologisk Museum, Copenhagen) *In its* On Climate Changes and Related Probl. 1978 p 175-180 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Ten thousand years ago the margins of the Greenland Inland ice were shrinking rapidly, while plants and animals migrated into the newly exposed land areas and coastal waters. The records for these organisms and for the retreat of the ice margin were worked out by pollen analysis of lake sediment, investigations of the faunas of isostatically raised marine deposits, and mapping of moraine systems; they have all been dated by carbon 14. An investigation and comparison of these records are made. The correlation is not particularly good, especially when low arctic west Greenland is compared to high arctic east Greenland. Differences in the climatic development as a likely cause for some of the lack of correlation is suggested. As a working hypothesis it is supposed that the differences may be explained by changing atmospheric circulation over the North Atlantic. Author (ESA)

N80-27033# East Anglia Univ., Norwich (England). Climatic Research Unit.
TOWARDS AN UNDERSTANDING OF CLIMATIC CHANGE: ITS IMPACT IN HISTORY AND IN THE MODERN WORLD
H. H. Lamb *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 181-204 ref (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The influence of climatic change on the development of civilization is stressed. Different records, such as actual meteorological reports of the weather observed, of fossil records which register the effects of past weather and climate, are considered. Results allow for the identification of cyclic changes in global climate. These fluctuations are used to postulate a forecasting scheme. To emphasize the need for a better understanding of climatic variations, various natural disasters involving widespread human suffering are cited from history. Author (ESA)

N80-27034# Danish Meteorological Inst., Copenhagen.
FLUCTUATIONS IN THE TEMPERATURE OF THE SURFACE WATER IN AREAS OF THE NORTHERN NORTH ATLANTIC, 1876 TO 1975
Jens Smed (Intern. Council for the Exploration of the Sea) *In its* On Climate Changes and Related Probl. 1978 p 205-210 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Regular observations of the sea surface temperature made either on board ships or at coastal weather stations in the north Atlantic Ocean are reported. Temperature data analysis is discussed and monthly means are found. Temperature anomalies for 1 deg squares both monthly and yearly, are then derived

and weighted according to the density of measurements. Surface water temperature trends over the period are shown.
Author (ESA)

N80-27035# Danish Meteorological Inst., Copenhagen.
VARIATION OF CLIMATE, AS INDICATED BY EXTENDED TEMPERATURE RECORDS FROM DENMARK, THE FAROES AND GREENLAND: A SHORT REVIEW OF SUN-WEATHER RELATIONSHIPS
Niels Woetmann *In its* On Climate Changes and Related Probl. 1978 p 212-222 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The possible influence of solar activity cycles on climatic variations is examined. It is noted that an unusually cold period in Europe from the 16th century through the early 19th century corresponds almost exactly with a period in the history of the Sun with exceptionally few sunspot observations. Next, atmospheric temperature records, consisting of monthly mean temperatures and dating from as early as 1792, are studied. The temperature records were filtered by applying a 20 year moving average. Results are shown graphically, then used to identify cooling or warming seasonal trends. Author (ESA)

N80-27036# Danish Meteorological Inst., Copenhagen.
INCREASE IN SOLAR RADIATION ABOUT 1915
Knud Frydendahl *In its* On Climate Changes and Related Probl. 1978 p 224-234 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The differences between astronomical sunrise and start of the burnt track on a Campbell-Stokes heliograph, as well as the differences between sunset and the end of the track, were measured. To diminish the errors from skew mountings of the cards, the sum of these differences (at dawn and sunset) was taken as a measure of how good radiation conditions were on each single day. For each month, the day with the smallest sum of differences (i.e. the day optimal for solar radiation at dawn and sunset) was chosen. results show that about 1915 the solar intensity at the surface of the earth increased all over the world. It is also found that there is a probable correlation between climatic changes and this increase in the solar constant. Author (ESA)

N80-27037# Danish Meteorological Inst., Copenhagen.
SEA SURFACE TEMPERATURES IN THE NORTH ATLANTIC 1957 TO 1976
G. Stougaard-Nielsen *In its* On Climate Changes and Related Probl. 1978 p 235-242 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Sea surface temperatures for each 1 deg square in the area 50 deg to 80 deg N, 0 deg to 60 deg W were extracted from meteorological log books kept by since 1895. The reports are, stored on magnetic tape at regional centers according to the rules of CMM/WMO. With 20 year of observations stored, a subarea was chosen along the main route between Denmark and Greenland so that the distribution of observations was reasonably close. During most years, no sea ice occurred inside the region. The whole region was divided into 18 areas. Each area covers 4 deg of latitude and 4 deg of longitude, and has a number composed of the latitude and the longitude of the central point. Several tables of mean temperature trends were calculated and a few of them are shown. The mean temperatures for the years 1957 to 1976 and those for the years 1876 to 1915 are compared. Author (ESA)

N80-27038# Danish Meteorological Inst., Copenhagen.
WHAT HISTORIANS KNOW ABOUT THE CLIMATE IN DENMARK DURING THE MIDDLE AGES
Svend Gissel *In its* On Climate Changes and Related Probl. 1978 p 249-250 (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

An abstract of a study made on the possible correlation between climatic variations and historical events in Denmark is presented. Emphasis is on the desertion of villages and eventual recolonization, or in some cases new colonization, as recorded in annals or as evidenced from archeological investigations. Pollen studies made by analyzing high bogs are also cited to corroborate the dating of climatic changes. Results show some relation between climatic deterioration and history, however, coincidence cannot be ruled out. Author (ESA)

N80-27039# Danish Meteorological Inst., Copenhagen.
AN INTRODUCTION TO STATISTICAL METHODS
Peter Nimmo Allerup *In its* On Climate Changes and Related Probl. 1978 p 252-260 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The use of statistical models and statistical methods, especially the manipulation of mathematical formulas is discussed in terms of coming to grips with the complexity of natural phenomena. Normal distribution (in the movements of a pendulum as an example), time series analysis, the specification of accuracy, and the identification of data structures are considered. The possibilities for enlarging the scope of statistical analyses in research work is discussed. Author (ESA)

N80-27040# Air Force Global Weather Central, Offutt AFB, Nebraska.
THE AFGWC AUTOMATED ANALYSIS/FORECAST MODEL SYSTEM
Terry C. Tarbell and James E. Hoke Dec. 1979 60 p refs (AD-A083157; AFGWC/TN-79/004) Avail: NTIS HC A04/MF A01 CSCL 04/2

This technical note (TN) describes the automated analysis/forecast model system that currently exists at the Air Force Global Weather Central (AFGWC). The emphasis will be on the interrelation and cycling of the various analysis/forecast models in the production cycle. This description of the automated analysis/forecast system was written for managers, programmers, computer operations personnel, users of the ultimate products, and the meteorological community at large. This TN will only address analysis/forecast models that are the primary meteorological data-base builders. Most applications programs that access the data bases are therefore not included. GRA

N80-27041# Air Force Global Weather Central, Offutt AFB, Nebraska.
TRAINING GUIDE FOR SEVERE WEATHER FORECASTERS
Charlie A. Crisp Nov. 1979 82 p refs (AD-A083125; AFGWC/TN-79/002) Avail: NTIS HC A05/MF A01 CSCL 04/2

Presented here is a formal and detailed training guide designed for a forecaster's initial exposure to the Air Force Global Weather Central's (AFGWC) severe weather function. This TN details the analysis procedures for all charts and prognostic tools available to the severe weather function. Significant severe weather parameters are analyzed at the surface 850 mb, 700 mb, and 500 mb levels. Additionally, the 850/500 mb thickness and maximum wind charts are examined. Also discussed are the severe weather parameters chart and the 12-hour surface pressure change chart. A detailed, step-by-step evaluation of a synoptic situation is presented along with appropriate forecasts and verification data. Finally, the automated prognoses available at AFGWC are discussed in relation to severe weather forecasting. Prior to using this guide, forecasters should become familiar with AWSTR 200 (Rev), 'Note on Analysis and Severe Storm Forecasting of the Air Force Global Weather Central'. AWSTR 200 (Rev) is referred to briefly when relating analyzed parameters to those synoptic patterns producing severe thunderstorms and tornadoes. This TN will familiarize field users with the techniques used to produce the Military Weather Advisory (MWA). GRA

N80-27042# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL WIND FIELD MODEL VALIDATION IN COMPLEX TERRAIN WITH APPLICATION TO POLLUTANT TRANSPORT
William M. Porch Mar. 1980 7 p refs Presented at 2nd Joint Conf. on Applications of Air Pollution Meteorology, New Orleans, 24-27 Mar. 1980 Submitted for publication (Contract W-7405-eng-48)
(UCRL-83269; CONF-800327-3) Avail: NTIS HC A02/MF A01

The interaction of meteorological data taken at points in a region with numerical models can be done smoothly in gently varying terrain. However, it is fraught with difficulties in complex terrain. Computer memory size limits the resolution of the topography and a point measurement becomes representative of smaller scales as the topography becomes more complex. This paper describes how remotely sensed spatially averaged winds from optical anemometers can be used to help the interaction of wind measurements made at points within a region and numerical regional wind field models. Emphasis is placed on model validation both as wind field estimates for applications such as wind energy prospecting and as input to pollutant dispersion models. DOE

N80-27043# Battelle Pacific Northwest Labs., Richland, Wash.
SIMULATION OF ATMOSPHERIC TURBULENCE
W. C. Cliff and D. L. Hall Jan. 1980 29 p refs
(Contract EY-76-C-06-1830)
(PNL-3276) Avail: NTIS HC A03/MF A01

A method is described for constructing an artificial temporal sequence of velocity values for simulating atmospheric turbulence. The method develops the conditional probability density distribution of velocity given that the previous value of velocity is known. A value is randomly selected from the conditional probability density which then serves as a known value for the next conditional probability density function. Continuing this procedure provides the desired simulated sequence of velocity values. Based upon this simulation method a program is developed for a hand-held calculator for simulating the longitudinal component of atmospheric turbulence during neutral or strong wind conditions. DOE

N80-27044# Sandia Labs., Albuquerque, N. Mex. Environmental Research Div.
APPLICATION OF WIND DATA TOWARD REVISION OF THE ANSI WIND LOADS STANDARD
Hugh W. Church 1980 10 p refs Presented at 2nd Joint Conf. on Applications of Air Pollution Meteorology, New Orleans, 24 Mar. 1980
(Contract EY-76-C-04-0789)
(SAND-79-1973C; CONF-800327-1) Avail: NTIS HC A02/MF A01

The American National Standards Institute provides the machinery for creating voluntary standards, which represent general agreement among maker, seller, and user. The ANSI A58.1 standard: Building Code Requirements for Minimum Design Loads in Buildings and Other Structures, last revised in 1972, is currently undergoing the consensus phase toward its scheduled 1980 revision and publication. This standard is intended to provide minimum load requirements for the design of building code requirements. The A58 Windloads Subcommittee has produced an updated national map of annual probable extreme wind speeds to be used in assessing wind loads on structures. After a brief review of previous wind map versions, data selection criteria establishment and collection, data homogenization and reduction, statistical analysis, extreme wind field map analysis, and treatment of special regions are discussed. Finally, some of the data problem areas are discussed with some suggestions offered for their improvement. DOE

N80-27045# Royal Netherlands Meteorological Inst., De Bilt.
PRECIPITATION, 1978
1979 125 p In ENGLISH and DUTCH
(KNMI-117-79) Avail: NTIS HC A06/MF A01; Roy. Netherlands Meteorol. Inst., De Bilt FL 10

Daily precipitation data for the Netherlands during 1978 are listed by station. Averages were computed, and monthly and yearly summaries shown for each station. A map gives the location of each rain gauge. Author (ESA)

N80-27046# Royal Netherlands Meteorological Inst., De Bilt.
A VERTICALLY DETAILED ANALYSIS OF SOME AIR MASS PROPERTIES
G. J. Cats and J. Reiff 1979 21 p refs
(KNMI-V-329) Avail: NTIS HC A02/MF A01

A method for obtaining a detailed analysis of air mass properties such as temperature and humidity for use in isentropic trajectory models is described. The temperature and humidity of the advected air mass are analyzed as linear combinations of observed temperatures (respectively humidities) at nearby stations. The weights are taken proportional to the inverse of the square of the distance between air mass source and observation point. Since only at some levels the air mass source is known (namely at the trajectory levels), the weights are linearly interpolated between those levels. Some analysis examples are given. Author (ESA)

N80-27047# Royal Netherlands Meteorological Inst., De Bilt. Bureau Vakopleidingen.
WIND MAXIMA IN THE UPPER BOUNDARY LAYER, WINTER 1978-1979 [WINDMAXIMA AAN DE BOVENZIJDE VAN DE GRENSLAG GEDURENDE DE WINTER VAN 1978-1979]
C. J. vanderHam 1980 33 p refs In DUTCH
(KNMI-V-336) Avail: NTIS HC A03/MF A01

A synoptic study of low level wind maxima was made for nocturnal, frontal and non frontal cases. Situations with glazed frost fronts seemed to favor the occurrence of maxima. Maxima were also frequent in situations with east winds in a shallow cold boundary layer. In a few cases, sea influences played a role. Author (ESA)

N80-27048# Royal Netherlands Meteorological Inst., De Bilt.
A CONVERGENCE ANALYSIS OF A NUMERICAL METHOD FOR SOLVING THE BALANCE EQUATION
S. J. Bijlsma and R. J. Hoogendoorn 1980 18 p refs
(KNMI-WR-80-1) Avail: NTIS HC A02/MF A01

The convergence of an iterative method for solving the nonlinear balance is analyzed. It is shown that this iterative method will be convergent if sufficiently accurate initial approximation is used and if the subsequent iterates satisfy the ellipticity condition. Otherwise if the successive approximate solutions do not all satisfy the ellipticity condition the method may be divergent. Measures to make the method convergent in this case are described. Experimental results are given. Author (ESA)

N80-27049# Resource Analysis, Inc., Waltham, Mass.
MEAN SQUARE ERROR ESTIMATION COMPUTER PACKAGE USER'S MANUAL
Guillermo J. Vivens, Donald S. Grossman, R. R. Evans, and D. Leighton Sep. 1979 80 p
(Contract NBS-7-35111)
(PB80-150808; NOAA-80010202) Avail: NTIS HC A05/MF A01 CSCL 04B

The mean square error estimation (MSEE) computer package is described. The MSEE package is a computerized methodology for evaluating the accuracy of a rainfall measurement network. GRA

N80-27050# National Weather Service, Salt Lake City, Utah.
THE BART EXPERIMENT
Morris S. Webb, Jr. Oct. 1979 45 p refs
(PB80-155112; NOAA-TM-NWS-WR-146; NOAA-80010904)
Avail: NTIS HC A03/MF A01 CSCL 04B

The BART (Bay Area Regional Temperature) Experiment attempts to objectively forecast temperatures at seven locales in the San Francisco Bay Area by statistical means. The method of least squares and a type of screening regression were used to create sets of seasonal forecast equations. Forecasts of daily maximum and minimum temperature at seven stations in northern and central California that are forecast points for the 'Model Output Statistics technique plus the date/time group of the forecast serve as predictors for the BART equations. Appendices containing FORTRAN IV programs developed during the experiment and the procedure which obtains the temperature forecasts are also presented. GRA

N80-27051# Texas A&M Univ., College Station. Dept. of Meteorology.
TEXAS HIPLEX MESOSCALE EXPERIMENT: SUMMER 1979 DATA TABULATIONS
Steven F. Williams, Myron L. Gerhard, and James R. Scoggins Jan. 1980 721 p refs
(Contract DI-14-06-D-7587)
(PB80-153034; LP-118) Avail: NTIS HC A99/MF A01 CSCL 04B

A mesoscale experiment was conducted in the High Plains

of west Texas during the summer of 1979 as part of the High Plains Cooperative Program. Data are presented for five special (manual) surface stations and seven rawinsonde stations. The surface data consist of five minute averages of temperature, relative humidity and pressure for each hour on the hour for the period June 20 through July 20, 1979. Rawinsonde data are presented at 25 millibar intervals for 23 operational days during the period May 21 through July 18, 1979. Radar observed convective activity taken from Midland NWS radar data is presented for each day during the period May 21 through July 19, 1979. GRA

N80-27052# National Weather Service, Salt Lake City, Utah.
A REAL-TIME RADAR INTERFACE FOR AFOS
Mark Mathewson Jan. 1980 100 p
(PB80-151605; NOAA-TM-NWS-WR-148; NOAA-80021501)
Avail: NTIS HC A05/MF A01 CSCL 04B

Real time radar data is very important in flash flood and severe thunderstorm situations. The software interface between a WSR 74C weather radar and AFOS is described. By using a Nova 312 minicomputer as the interface device, real time displays can be made available to forecasters on AFOS. The hardware interface between the WSR 74C radar and Nova 312 has been described in detail. Schematics and waveform diagrams have been included. The software description is also supplemented by flowcharts and tables. The appendix contains program listings, MDB interface board descriptions and schematics, and examples of AFOS-radar output. GRA

N80-27053# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
PROJECT SEVERE ENVIRONMENTAL STORMS AND MESOSCALE EXPERIMENT: SESAME 1979 FIELD-PROCESSED RAWINSONDE DATA FROM SUPPLEMENTARY SITES, 10 APRIL - 8 JUNE
Stanley L. Barnes Oct. 1979 261 p refs
(PB80-156219; NOAA-80010903) Avail: NTIS
HC A12/MF A01 CSCL 04B

The field data reduced soundings from the supplementary stations are presented to allow investigators a preliminary view of the meteorological conditions associated with the various experiments. Between April 10 and June 8, 1979, there were 21 days of SESAME upper air operations. The soundings are given in the unchecked form in the report. GRA

N80-27054# Utah Water Research Lab., Logan.
USE OF EXTREME VALUE THEORY IN ESTIMATING FLOOD PEAKS FROM MIXED POPULATIONS
R. V. Canfield, D. R. Olsen, R. H. Hawkins, and T. L. Chen Feb. 1980 47 p refs
(Contract DI-14-43-0001-9100)
(PB80-161052; UWRL/H-80/01; W80-04015;
OWRT-B-173-UTAH-1) Avail: NTIS HC A03/MF A01 CSCL 04B

The problem encountered when empirical fit alone is used to select a best distribution is presented along with the application of extreme value theory to stream flows which have homogeneous sources. The results clearly demonstrate the usefulness of extreme value theory. The extreme value theory is extended to the case in which the events in the annual series are random variables from two different populations (e.g., thunderstorm and cyclonic events). The mechanics of applying these results in flood frequency analysis are discussed. GRA

N80-27055# Chicago Univ., Ill. Dept. of Geophysical Sciences.
RAWINSONDE DETECTION OF STRATOSPHERIC MOISTURE IN THE VICINITY OF THUNDERSTORM TOPS
Peter D. McGurk Jun. 1979 22 p refs
(Grant NOAA-04-4-158-1)
(PB80-161458; SMRP-RP-176; NOAA-80021226) Avail: NTIS HC A02/MF A01 CSCL 04B

Approximately 200 soundings were taken at Yorkville, Illinois for project NIMROD. Many of these ascents were tracked well into the lower stratosphere to their burst and descent back into the troposphere. Soundings taken during a severe thunderstorm over northern Illinois, detected humidity in the stratosphere a few kilometers above the storm top. The location of the radiosondes in relation to the thunderstorms was determined by using a sequence of satellite pictures. The overshooting and collapsing processes atop severe thunderstorms are suggested as a mechanism for the moisture transport. GRA

N80-27056# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
MARINERS WEATHER LOG, VOLUME 29, NO. 1
Elwyn Wilson, E., ed. Jan. 1980 85 p Sponsored by NOAA
(PB80-161193; NOAA-80021104) Avail: NTIS
HC A05/MF A01 CSCL 04B

Regular sections include: Hints to the observer; Tips to the radio officer; Hurricane alley; On the editor's desk; Marine weather review and Marine weather diary. In addition this issue includes the following articles: Drift of the VENOIL in the Agulhas Current; Typhoon Hope, August 1979; Tropical storms Mac and Nancy; and High waves in the Benguela Current. GRA

N80-27057# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE, NO. 7. SUMMARY REPORT 1978
Bernard G. Mendonca Dec. 1978 138 p refs
(PB80-165962; NOAA-80030505) Avail: NTIS
HC A07/MF A01 CSCL 04B

A remote sensing technique to measure vertical ozone profiles by incorporating more Dobson wavelengths in the measurements was refined and evaluated against the older Umkehr method. A procedure to correct the ozone profiles for perturbations in stratospheric aerosol concentrations is described. Two solar irradiance studies that measure urban effects on incoming radiant energy were completed. Twenty-seven summary reports from cooperative programs are given. Investigations of aerosol chemistry at Barrow and the South Pole were the major efforts of the cooperative programs for 1978. GRA

N80-27058# National Center for Atmospheric Research, Boulder, Colo. Convective Storms Div.
NATIONAL HAIL RESEARCH EXPERIMENT DATA CATALOG, 1972 - 1976 Final Report
Dec. 1979 265 p
(Grant NSF ATM-77-23757)
(PB80-160419; NCAR-TN-148) Avail: NTIS
HC A12/MF A01 CSCL 04B

The observational systems and networks involved in a hail research experiment are described and summaries of selected daily research activities are given. Instrument development and data quality and availability are also discussed. GRA

N80-27059# Interior Dept., Denver, Colo. Water and Power Resources Service.
SIERRA COOPERATION PILOT PROJECT. DATA INVENTORY, 1978 - 1979
Jul. 1979 146 p
(PB80-144934) Avail: NTIS HC A07/MF A01 CSCL 04B

An inventory of all data that were collected from November 1978 to April 1979 in association with the Sierra Cooperative Pilot Project, a weather modification research project in winter orographic cloud seeding is presented. Forecasting, radar, satellite, aircraft, rawinsondes, precipitation gage network, other surface observations, ice nucleus and seeding tracer detection system, ground microphysics, snow profiles, cooperative and operational seeding activities, and National Weather Service are among the topics covered. GRA

N80-27060# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A COMPARISON OF THEORETICAL AND OBSERVED RADIANCES FROM NON-PRECIPITATING CUMULUS CLOUDS
Mark DeMaria and Thomas McKee May 1979 97 p refs
(Grant NSF ATM-76-80568)
(PB80-150923; AS-PAPER-313; ISSN-0067-0340) Avail: NTIS HC A05/MF A01 CSCL 04A

Relative radiances from a theoretical model for the scattering of solar radiation by finite clouds were compared to observed radiances from the sides of nonprecipitating cumulus clouds. The

sides of five cumulus clouds ranging from 1 to 3 km in depth, with width to depth ratios of about 1.5 were scanned with an aircraft mounted radiometer sensitive in the spectral range of 0.65 to 0.95 micrometers. Photographs of each cloud were taken just before each scan with a camera optically aligned with the radiometer. GRA

N80-26363*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SURVEY OF NUMERICAL MODELS FOR WIND PREDICTION
D. Schonfeld *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 151-170 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-27061# Skidaway Inst. of Oceanography, Savannah, Ga.
CONTINENTAL SHELF PROCESSES AFFECTING THE OCEANOGRAPHY OF THE SOUTH ATLANTIC BIGHT Progress Report, Jun. 1979 - 31 May 1980
L. P. Atkinson 29 Feb. 1980 9 p
(Contract DE-AS09-76EV-00889)
(DOE/EV/00889-6) Avail: NTIS HC A02/MF A01

Progress is reported on research conducted on various oceanographic aspects of the South Atlantic Bight. Research topics includes: (1) a flashing model of Onslow Bay, North Carolina based on intrusion volumes; (2) a description of a bottom intrusion in Onslow Bay, North Carolina; (3) detailed observations of a Gulf Stream spinoff eddy on the Georgia continental shelf; (4) Pelagic tar of Georgia and Florida; (5) a surface diaton bloom in response to eddy forced upwelling; and (6) hydrographic observations off Savannah and Brunswick, Georgia. DOE

N80-27062# Columbia Univ., Palisades, N.Y. Lamont-Doherty Geological Observatory.
TRANSPORT AND TRANSFER RATES IN THE WATERS OF THE CONTINENTAL SHELF Annual Report
P. E. Biscaye, Arnold L. Gordon, Yuan-Hui Li, and Thomas C. Malone Aug. 1979 160 p refs
(Contract EY-76-S-02-2185)
(COO-2185-12) Avail: NTIS HC A08/MF A01

Two cruises designed to expand the sample base, measure the time variability of several transfer processes, and to test specific hypotheses on the mechanisms for processes which effect exchange of continental margin with open ocean waters were carried out. Progress was made in understanding the relative roles of nutrients and light in controlling the productivity of important primary biomass. Progress was also made in understanding the influences of phytoplankton populations on distribution of inorganic nutrients, dissolved oxygen and particulate organic matter. Radionuclides were studied in water columns and in sediments to develop an understanding of processes associated with suspended solids and with sediments as sinks for radionuclides and other pollutants. Major progress was made on the analysis of hydrographic data from all previous cruises and to evolve a comprehensive picture of the stratification of the waters of the New York Bight. The CO_2-H_2O equilibration system required for the preparation of samples for oxygen isotope analysis was completed. DOE

N80-27063# Woods Hole Oceanographic Institution, Mass.
OBSERVATIONS OF LONG PERIOD WAVES IN THE TROPICAL OCEANS AND ATMOSPHERE Ph.D. Thesis - MIT
Douglas S. Luther Feb. 1980 215 p refs
(Grant NSF OCE-73-01384)
(PB80-158843; WHOI-80-17) Avail: NTIS HC A10/MF A01 CSCL 08C

The existence of resonant, baroclinic, equatorially trapped, inertia gravity waves is confirmed in the mid Pacific by spectral analysis of long sea level records. The energy of the low mode inertia gravity waves is found to decrease toward the meridional boundaries. A simple spectral model, acknowledging the dispersive characteristics of the equatorial waves, adequately reproduces the observed mid Pacific sea level spectra in the 1 to 6 day band. Model spectra computed at latitudes outside the equatorial waveguide of the gravest meridional modes suggest the presence of 'inertial' peaks in several observed sea level spectra. Resonant, low mode inertia gravity waves may also exist in the Indian Ocean. GRA

N80-27064# Environmental Research and Technology, Inc., Concord, Mass.
SUMMARY AND ANALYSIS OF PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL INFORMATION ON THE CONTINENTAL SHELF AND BLAKE PLATFORM FROM CAPE HATTERAS TO CAPE CANAVERAL. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jul. 1979 32 p
(Contract DI-AA550-CT-7-16)
(PB80-159072; ERT-2904-Vol-1; BLM/YM/ES-79/20) Avail: NTIS HC A03/MF A01 CSCL 08C

The synthesis and analysis of the physical oceanographic and meteorological data on the continental shelf and Blake Plateau from Cape Hatteras to Cape Canaveral is presented. Numerous information sources were searched to obtain an analysis of the climatology, wave data, hydrography, and the circulation of the continental shelf waters, which are crucial to platform construction, safety procedures, and management decisions. Seasonal variances of air temperature, wind speed and wind direction, cloud cover, cloud ceilings, visibility, precipitation, storms, weather fronts, solar radiation, and precipitation runoff are discussed and summarized. GRA

N80-27065# Environmental Research and Technology, Inc., Concord, Mass.
SUMMARY AND ANALYSIS OF PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL INFORMATION ON THE CONTINENTAL SHELF AND BLAKE PLATEAU FROM CAPE HATTERAS TO CAPE CANAVERAL. VOLUME 2, SECTIONS 1 - 5 Final Report, 1977
Jul. 1979 393 p refs
(Contract DI-AA550-CT-7-16)
(PB80-159080; ERT-P-2904-Vol-2; BLM/YM/ES-79/21) Avail: NTIS HC A17/MF A01 CSCL 08C

The data sources contacted for potential data, how the data were screened, and the final sets of data used to assess the environmental effects of offshore oil and gas development are described. Procedures for future data identification and assembly efforts are recommended. A wide range of meteorological and climatological data are presented and discussed. Information sources included satellite imagery as well as more conventionally collected data. A detailed discussion and analysis of the wave data available for the South Atlantic OCS region is presented. The seasonal physical characteristics of water masses are presented and discussed. Parameters analyzed and presented in graphs include temperature, salinity, sigma-t, dissolved oxygen, nitrate, phosphate, and silicate. J.M.S.

N80-27066# Environmental Research and Technology, Inc., Concord, Mass.
SUMMARY AND ANALYSIS OF PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL INFORMATION ON THE CONTINENTAL SHELF AND BLAKE PLATEAU. VOLUME 5; SECTIONS 6, 7, AND 8 Final Report, 1977
Jul. 1979 373 p refs
(Contract DI-AA550-CT-7-16)
(PB-80-159098; ERT-P-2904-Vol-3; BLM/YM/ES-79/22) Avail: NTIS HC A16/MF A01 CSCL 08C

The general circulation and oceanographic conditions on the continental shelf are discussed based on many types of data including: hydrography, current meter, climatology, tidal gauge, atmospheric forcing, and drift-buoy data. The most recent current meter data available are used in the analysis. A qualitative discussion of the interaction of the Gulf Stream with the Continental Shelf and Blake Plateau is given based on a heat balance formulation and satellite imagery. The biological consequences of the hydrography and circulation on the Continental

Shelf and Blake Plateau are presented. Recommendations for future studies and research are presented. J.M.S.

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-27067* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD AND AUTOMATED APPARATUS FOR DETECTING COLIFORM ORGANISMS Patent
W. Preston Dill (Boeing Aerospace Co., Houston, Tex.), Rueben E. Taylor (Boeing Aerospace., Houston, Tex.), and Eldon L. Jeffers, inventors (to NASA) (Boeing Aerospace Co., Houston, Tex.) Issued 20 May 1980 14 p Filed 4 Apr. 1978 Sponsored by NASA
(NASA-Case-MSC-16777-1; US-Patent-4,204,037;
US-Patent-Appl-SN-893657; US-Patent-Class-435-3;
US-Patent-Class-23-230B; US-Patent-Class-204-195B;
US-Patent-Class-422-68; US-Patent-Class-435-32;
US-Patent-Class-435-34; US-Patent-Class-435-38;
US-Patent-Class-435-39; US-Patent-Class-435-289;
US-Patent-Class-435-290; US-Patent-Class-435-291;
US-Patent-Class-435-311; US-Patent-Class-435-316) Avail: US Patent and Trademark Office CSCL 06C

Method and automated apparatus are disclosed for determining the time of detection of metabolically produced hydrogen by coliform bacteria cultured in an electroanalytical cell from the time the cell is inoculated with the bacteria. The detection time data provides bacteria concentration values. The apparatus is sequenced and controlled by a digital computer to discharge a spent sample, clean and sterilize the culture cell, provide a bacteria nutrient into the cell, control the temperature of the nutrient, inoculate the nutrient with a bacteria sample, measures the electrical potential difference produced by the cell, and measures the time of detection from inoculation.
Official Gazette of the U.S. Patent and Trademark Office

N80-27068*# National Aeronautics and Space Administration, Washington, D. C.
CHANGE IN RADIOSENSITIVITY OF RATS DURING HYPOKINETIC STRESS
I. P. Chernov Jan. 1980 11 p refs Transl. into ENGLISH from Radiobiologiya (USSR), no. 4, 1978 p 574-578 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75968) Avail: NTIS HC A02/MF A01 CSCL 06C

The laws governing stress modification of radiation sickness in relation to hypokinetic stress were investigated. It was found that gamma irradiation (800 rad) of rats on the third day of exposure to hypokinesia increased the radiosensitivity of the animals which was determined by the survival rate and the dynamics of body weight and the weight of some internal organs. The same radiation dose was given on the 20th day of hypokinesia and on the third day of recovery from the 20 day hypokinesia decreased the radiosensitivity of rats. It is concluded that the variations in the radiosensitivity observed may be due to a stress effect of hypokinesia. R.E.S.

N80-27069*# Oregon Univ. Health Sciences Center, Portland. Dept. of Neurology.
COUNTERCURRENT DISTRIBUTION OF BIOLOGICAL CELLS Final Report, 1 Jan. 1978 - 31 Mar. 1979
D. E. Brooks Mar. 1979 46 p refs
(Contract NAS8-32817)
(NASA-CR-161487) Avail: NTIS HC A03/MF A01 CSCL 06C

A neutral polymer phase system consisting of 7.5 percent dextran 40/4.5 percent PEG 6, 0.11 M Na phosphate, 5 percent fetal bovine serum (FBS), pH 7.5, was developed which has a high phase droplet electrophoretic mobility and retains cell viability over many hours. In this and related systems, the drop mobility was a linear function of drop size, at least in the range 4-30 micron diameter. Applications of and electric field of 4.5 v/cm to a system containing 10 percent v/v bottom phase cleared the system more than two orders of magnitude faster than in the absence of the field. At higher bottom phase concentrations a secondary phenomenon intervened in the field driven separations which resulted in an increase in turbidity after clearing had commenced. The increase was associated with a dilution of the phase system in the chamber. The effect depended on the presence of the electric field. It may be due to electroosmotic flow of buffer through the Amicon membranes into the sample chamber and flow of phase system out into the rinse stream. Strategies to eliminate this problem are proposed. R.E.S.

N80-27070*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF SHARPLY LOWERED MUSCULAR ACTIVITY ON THE THYROID GLAND OF THE WHITE RAT
K. Bekishev Apr. 1980 9 p refs Transl. into ENGLISH from Izv. Akad. Kaz. Khim. SSR, (USSR) no. 2, Mar. - Apr. 1978 p 75-78 Transl. by Kanner (Leo) Associates, Redwood, Calif.
(Contract NASw-3199)
(NASA-TM-76114) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of hypokinesia on the thyroid gland of 200 white rats was studied. The rats were kept in 16x6x6 cm cages for 90 days. The functional activity of the thyroids increased after 24 hrs of partial immobilization and peaked after 15 days. After 30 days of immobilization, the functional activity returned to normal in one third of the test animals and after 60 days in all animals. After 15 days of immobilization, the test animals began to lose weight (in comparison to the controls) and remained underweight for the rest of the test period (up to 90 days). When returned to normal conditions, they caught up with and even overtook in weight the control animals after about 1 month. All changes produced by hypokinesia were reversible after 1 month. Author

N80-27071*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT PRODUCED BY PHENOBARBITAL, SEX HORMONE AND BY CASTRATION ON THE DEVELOPMENT OF GASTRIC MUCOSA DESTRUCTION DUE TO ELECTRIZATION OF IMMOBILIZED RATS
P. S. Botsolin May 1980 7 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 31, no. 2, 1968 p 197-199 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-76156) Avail: NTIS HC/ A02/MF A01 CSCL 06C

The action of phenobarbital on the development of gastric mucosa destruction in rats, brought on through three hours of electrization of immobilized animals, was studied. The evidence showed that phenobarbital exerts a preventive action on the development of destructive lesions affecting the gastric mucosa in non-castrated rats of both sexes, in non-castrated males receiving testosterone propionate, as well as in castrated males and non-castrated females receiving diethylstilbestrol propionate. In castrated female rats, however, phenobarbital proved to be of little effect. Author

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-27072* National Aeronautics and Space Administration, Pasadena Office, Calif.
SIMULTANEOUS MUSCLE FORCE AND DISPLACEMENT TRANSDUCER Patent
Cyril Feldstein (JPL), Gilbert W. Lewis (JPL), and Virgil H. Culler, inventors (to NASA) (JPL) Issued 27 May 1980 5 p Filed 30 Sep. 1977 Supersedes N80-12730 (18 - 03, p 0376) Sponsored by NASA
(NASA-Case-NPO-14212-1; US-Patent-4,204,544;
US-Patent-Appl-SN-838308; US-Patent-Class-128-642;
US-Patent-Class-128-774; US-Patent-Class-128-782;
US-Patent-Class-33-125R; US-Patent-Class-73-781;
US-Patent-Class-338-2) Avail: US Patent and Trademark Office CSCL 06B

A myocardial transducer for simultaneously measuring force

and displacement within a very small area of myocardium is disclosed. The transducer comprised of an elongated body forked at one end to form an inverted Y shaped beam with each branch of the beam constituting a low compliant tine for penetrating the myocardium to a predetermined depth. Bonded to one of the low compliance tines is a small piezoresistive element for converting a force acting on the beam into an electrical signal. A third high compliant tine of the transducer, which measures displacement of the myocardium in a direction in line with the two low compliant tines, is of a length that just pierces the surface membrane. A small piezoresistive element is bonded to the third tine at its upper end where its bending is greatest. Displacement of the myocardium causes a deformation in curvature of the third tine, and the second small piezoresistive element bonded to the surface of its curved end converts its deformation into an electrical signal.

Official Gazette of the U.S. Patent and Trademark Office

N80-27073*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

AN IMPLANTABLE ELECTRICAL DEVICE Patent Application

Murzban D. Jhabvala, inventor (to NASA) Filed 27 May 1980 12 p

(NASA-Case-GSC-12560-1; US-Patent-Appl-SN-153246) Avail: NTIS HC A02/MF A01 CSCL 06B

A fully implantable and self-contained therapeutic device for stimulating the regeneration of severed nerves by electrical energy is disclosed. The device is composed of a flexible electrode array for surrounding damaged nerves and a signal generator for driving the electrode array with periodic electrical impulses of nanoampere magnitude to induce regeneration of the damaged nerves. NASA

N80-27074*# National Aeronautics and Space Administration, Washington, D. C.

CHANGES IN LEUKOCYTE STABILITY IN HYPODYNAMIA

I. I. Federov, Z. P. Federova, Ye. N. Pekus, and T. L. Sakun Jan. 1980 8 p refs Transl. into ENGLISH from Vrach. Delo. (USSR), Apr. 1972, p 44-48 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-2791)

(NASA-TM-75944) Avail: NTIS HC A02/MF A01 CSCL 06P

Leukocytolysis was determined under conditions of hypokinesia of 10 days to 1 month duration in healthy persons and in experiments on albino rats of 1 month duration. It was found that prolonged restriction of movement resulted, both in clinical and experimental conditions, in a considerable increase of leukocytolysis (by two-three-fold). Leukocytolysis also continued for several days after cessation of hypokinesia. R.E.S.

N80-27075*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

ERROR ANALYSIS AND CORRECTIONS TO PUPIL DIAMETER MEASUREMENTS WITH LANGLEY RESEARCH CENTER'S OCULOMETER

C. L. Fulton (Purdue Univ.) and R. L. Harris, Jr. May 1980 17 p refs

(NASA-TM-81806) Avail: NTIS HC A02/MF A01 CSCL 06B

Factors that can affect oculometer measurements of pupil diameter are: horizontal (azimuth) and vertical (elevation) viewing angle of the pilot; refraction of the eye and cornea; changes in distance of eye to camera; illumination intensity of light on the eye; and counting sensitivity of scan lines used to measure diameter, and output voltage. To estimate the accuracy of the measurements, an artificial eye was designed and a series of runs performed with the oculometer system. When refraction effects are included, results show that pupil diameter is a parabolic function of the azimuth angle similar to the cosine function predicted by theory; this error can be accounted for by using a correction equation, reducing the error from 6% to 1.5% of the actual diameter. Elevation angle and illumination effects were found to be negligible. The effects of counting sensitivity and output voltage can be calculated directly from system documentation. The overall accuracy of the unmodified system is about 6%. After correcting for the azimuth angle errors, the overall accuracy is approximately 2%. Author

N80-27076*# National Aeronautics and Space Administration, Washington, D. C.

SOME PROBLEMS OF HUMAN ADAPTATION AND ECOLOGY UNDER THE ASPECT OF GENERAL PATHOLOGY

V. P. Kaznacheyev Jul. 1980 15 p refs Transl. into ENGLISH from Vestn. Akad. Med. Nauk SSSR (USSR), no. 11, Nov. 1979 p 51-57 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(NASA-TM-76095) Avail: NTIS HC A02/MF A01 CSCL 06S

The main problems of human adaptation at the level of the body and the population in connection with the features of current morbidity of the population and certain demographic processes are analyzed. The concepts of health and adaptation of the individual and human populations are determined. The importance of the anthropo-ecological approach to the investigation of the adaptation process of human populations is demonstrated. Certain features of the etiopathogenesis of diseases are considered in connection with the population-ecological regularities of human adaptation. The importance of research on general pathology aspects of adaptation and the ecology of man for planning, and organization of public health protection is discussed. Author

N80-27077*# National Aeronautics and Space Administration, Washington, D. C.

THE USE OF ANTIGRAVITY SUITS IN THE TREATMENT OF IDIOPATHIC ORTHOSTATIC HYPOTENSION

K. Landmark and S. Kravik Apr. 1980 8 p refs Transl. into ENGLISH from Tidsskr. Norske Laegforen. (Norway), v. 99, no. 30, 1979 p 1530-1531 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75804) Avail: NTIS HC A02/MF A01 CSCL 06E

Idiopathic orthostatic hypotension is an uncommon disease characterized by a drop in blood pressure when going from a recumbent to a standing position. Treatment by medication generally produces poor results. Three patients at the Royal Hospital in Oslo were treated with antigravity suits and all were able to maintain adequate blood pressures in the standing position. One patient improved dramatically and was able to take short walks while wearing the suit. The two other patients, however, felt that wearing the suits eventually became uncomfortable. This treatment represents a useful treatment alternative for intractable cases. Author

N80-27078*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECT OF HYPODYNAMIA ON MINERAL AND PROTEIN METABOLISM IN CALCIFIED TISSUES OF THE MAXILLODENTAL SYSTEM (EXPERIMENTAL RADIOISOTOPE STUDY)

A. A. Prokhonchukov, Ye. A. Kovalenko, A. G. Kolesnik, Yu. I. Kondratyev, and N. A. Ilyushko Jul. 1980 15 p refs Transl. into ENGLISH from Stomatologiya (USSR), v. 49, no. 4, 1970 p 1-6 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Central Dental Research Inst., Moscow

(Contract NASw-3199)

(NASA-TM-75998) Avail: NTIS HC A02/MF A01 CSCL 06P

Mineral and protein metabolism was studied in experiments on 60 white rats, using P-32 and Ca-45 uptake in the mineral fractions, 2C-14-glycine in the protein fractions, and P-32 in both fractions of calcified tissues as indices over a 100 day period of experimental hypodynamia. Combined alterations in mineral and protein metabolism occurred in the calcified tissues of the experimental animals. The most pronounced changes were found in P-32 and 2C-14-glycine metabolism. In the incisors and femoral bones, these alterations occurred in two phases: P-32 and 2C-14-glycine uptake first increased, then decreased. Changes in Ca-45 metabolism were less pronounced, particularly in the initial period of the experiment. A marked reduction in P-32, Ca-45, and 2C-14-glycine uptake was found in various fractions of the calcified tissues on the 100th day of experimental hypodynamia. Author

N80-27079*# National Aeronautics and Space Administration, Washington, D. C.
THE BEHAVIOR OF FATTY ACIDS IN THE BLOOD PLASMA OF MONKEYS FOLLOWING EXPOSURE TO SHORT TERM STRESSES
M. L. Michailov, U. Gnuechtel, S. Nitschkoff, R. Baumann, and G. Gnauck May 1980 8 p refs Transl. into ENGLISH from Acta Biol. Med. Ger. (East Germany), v. 32, 1974 p 675-680 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by East German Acad. of Sci.
(NASA-TM-76151) Avail: NTIS HC A02/MF A01 CSCL 06P

Monkeys exposed to short term stresses (immobilization, jealousy) were found to develop hyperlipacidemia with a rise in concentration of unsaturated fatty acids in blood plasma, especially of oleic acid, and a relative decrease of saturated free fatty acids, chiefly of palmitinic acid. This finding was more pronounced under immobilization stress than in the jealousy situation. Meanwhile, the composition of triglycerides did not change essentially under the conditions used. Author

N80-27080# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
HUMAN RESPONSE TO HYPOXIA-MOTION SICKNESS STRESS AS A PREDICTOR OF THE SPACE SICKNESS SYNDROME
Aaron V. Barson, Jr. Oct. 1979 6 p refs Presented at Intern. Aerospace Federation, Manila, 8-12 Oct. 1979 Sponsored by AE
(AF Proj. 7231)
(AD-A080306; AMRL-TR-79-86) Avail: NTIS HC A02/MF A01 CSCL 06/19

The change observed during the hypoxia runs supports the hypothesis that hypoxic states lower human tolerance to vestibular stimuli. The frequency of occurrence of symptoms in this study is encouraging since little change in presentation was found between the normoxia and hypoxia runs. Large variations in the symptom presentations would have indicated that hypoxia symptoms were being misread as motion sickness symptoms, thereby skewing the results. From these results it is obvious that a significant research effort is needed to futher delineate and verify the various aspects of this theory. Additional human investigations in one-g and zero-g are needed to verify that the proposed hemodynamic changes and oxygenation parameters potentiates or causes space sickness. Animal studies will be needed to quantify the type and amount of circulatory disruption and hypoxia caused by zero-g exposure. If hypoxia proves to be implicated in the space sickness syndrome, it may be possible to use this hypoxia-motion sickness stress response as an indicator (in earth gravity) of a person's susceptibility to zero-g space sickness. GRA

N80-27081# California Univ., Berkeley. Lawrence Berkeley Lab. Physics Computer Science and Mathematics Div.
MAGNETIC FIELD ON HUMANS: EPIDEMIOLOGICAL STUDY DESIGN, PART 2
John S. Colonias Sep. 1979 20 p refs
(Contract W-7405-eng-48)
(LBL-9357-Pt-2) Avail: NTIS HC A02/MF A01

A study, designed to investigate the epidemiological health effects resulting from occupational magnetic field exposure produced by various nuclear instruments such as cyclotrons, bubble chambers, and spectrometers was previously described. The methodology involved in determining the magnetic field exposure to such instruments is described. DOE

N80-27082# Rensselaer Polytechnic Inst., Troy, N. Y.
PRIMARY PRODUCTIVITY, HETEROTROPHY, METABOLIC INDICATORS OF STRESS AND INTERACTIONS IN ALGAL-BACTERIAL MAT COMMUNITIES AFFECTED BY A FLUCTUATING THERMAL REGIME Ph.D. Thesis
David Lawrence Tison 1980 44 p refs
(Contract EY-76-C-09-0001)
(DP-MS-80-14) Avail: NTIS HC A03/MF A01

Thermal habitats in effluent cooling waters from production nuclear reactors at the Savannah River Plant are unlike natural thermal habitats in that the reactor operations are periodically halted, exposing the organisms growing in these thermal habitats to ambient temperatures for unpredictable lengths of time. Rates of primary production, glucose heterotrophy, and the composition of algal-bacterial mat communities growing along a thermal gradient from about 50 to 35 C during periods of reactor operation were studied. Cyanobacteria were the only photoautotrophs in mat communities above 40 C while cyanobacteria and eucaryotic algae comprised the photoautotrophic component of mat communities below 40 C. The heterotrophic component of these communities above 40 C was made up to stenothermic and eurythermic thermophilic bacteria while both eurythermic thermophiles and mesophilic bacteria were found in communities below 40 C. Results of temperature shift experiments indicated that the short-term response of the photoautotrophic component of these communities to thermal stress was an increase in the percentage of photosynthate released extracellularly. DOE

N80-27083# Massachusetts General Hospital, Boston.
CdTe AMBULATORY VENTRICULAR FUNCTION MONITOR
J. L. Lazewatsky, N. M. Alpert, R. H. Moore, C. A. Boucher, H. W. Strauss, G. Entine (Radiation Monitoring Devices, Inc.), R. Chaney (Ohio Nuclear Inc.), and R. Schreiner (Ohio Nuclear Inc.) 1979 5 p refs Presented at IEEE Nucl. Sci. Symp., San Francisco, 17 Oct. 1979
(Contract EY-76-C-02-2541)
(CONF-791037-26) Avail: NTIS HC A02/MF A01

A prototype device consisting of two arrays of CdTe detectors, ECG amplifiers and gate, microprocessor, and tape recorder was devised to record simultaneous ECG and radionuclide blood pool data from the left ventricle for extended periods during normal activity. The device is intended to record information concerning both normal and abnormal physiology of the heart and to permit the evaluation of the pharmaceuticals under everyday conditions. Preliminary results indicate that the device is capable of recording and reading out data from both phantoms and patients. DOE

N80-27084# Chicago Univ., Ill. Dept. of Radiology.
MODIFIED CONJUGATE COUNTING TECHNIQUE FOR QUANTITATIVE MEASUREMENT OF RADIOACTIVITY IN VIVO
B. M. W. Tsui, C.-T. Chen, N. J. Yasillo, C.J. Ortega, and D. B. Charleston 1979 24 p Presented at the 21st Ann. Meeting of the AAPM, Atlanta, 29 Jul. - 2 Aug. 1979 Prepared in cooperation with Franklin McLean Mem. Res. Inst., Chicago
(Contract EY-76-C-02-0069)
(CONF-790782-1) Avail: NTIS HC A02/MF A01

A modified conjugate counting method is presented for studying biochemical transformations in health and disease, in making realistic radiation-absorbed dose estimates, and in developing clinical procedures indicative of abnormal functions. A new instrument design improves the accuracy to within 5%. DOE

N80-27085# National Physical Lab., Teddington (England). Div. of Electrical Science.
DEVELOPMENT OF A METHOD FOR THE TRACEABLE CALIBRATION OF DEFIBRILLATOR ENERGY METERS
J. R. Stockton and R. C. Smith Aug. 1979 41 p refs
(NPL-DES-55) Avail: NTIS HC A03/MF A01

The development, intercomparison and agreement of two independent, traceable methods: one calorimetric and one digital sampling; for the measurement of the energy of cardiac defibrillator pulses, are discussed. The use of the sampling method to calibrate a defibrillator energy meter, a commercial instrument used for the routine calibration of defibrillators is described. Some observations on methods of making future measurements on energy meters and on possible designs for digital energy meters are included. Author (ESA)

N80-27086# Technische Universitaet, Brunswick (West Germany). Sonderforschungsbereich 58.
HEART RATE VARIABILITY, PILOT WORKLOAD, TASK DIFFICULTY, TRACKING
Fred Volker Schick and Hans Radke Jul. 1979 38 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-653) Sponsored by DFVLR
(DFVLR-FB-79-33) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8.60

The usefulness of measurements of heart rate variations for the assessment of pilot workload was studied in a laboratory experiment. Statistical methods were used to analyze the data. The heart rate variations were studied as a function of standard deviations, sums of absolute differences, and frequencies of reversals of instantaneous heart rate. Author (ESA)

N80-27087# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE EFFECT OF HEARING PROTECTORS ON THE PERCEPTION OF WARNING AND INDICATOR SOUNDS: A GENERAL REVIEW
P. A. Wilkins and A. M. Martin Aug. 1978 217 p refs
Sponsored by UK Health and Safety Executive
(ISVR-TR-98) Avail: NTIS HC A10/MF A01

The literature on the auditory effects of wearing hearing protectors was reviewed. A conceptual model of the perception process suggests that the three components, audibility, attention demand and recognition are of importance. Several suggested methods of predicting the audibility of complex sounds in noise are compared and their limitations highlighted. Although a number of studies consider the attention demand of warning sounds, it is concluded that they do not allow any firm conclusions on the effect of inattention to be drawn. Inconsistent use of hearing protectors could, via a temporary shift in the threshold of hearing, result in signals being inaudible when subsequently wearing hearing protectors. It is hypothesized that by reducing the loudness and changing the spectral character of sounds, hearing protectors may impair their attention demand value and their recognition by the wearer. An evaluation of the situation of workers who suffer from an existing noise-induced hearing loss suggests that when wearing hearing protection their perception of sounds in noise may be governed by their doubly elevated absolute thresholds rather than the masker threshold criteria relevant to those with normal hearing. Author (ESA)

N80-27088# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
AN EVALUATION OF MICROWAVE EMISSIONS FROM SENSORMATIC ELECTRONIC SECURITY SYSTEMS Final Report
Howard I. Bassen Feb. 1980 8 p refs
(PB80-155385; DHEW/PUB-FDA-80-8106) Avail: NTIS HC A02/MF A01 CSCL 13L

The concern over potential microwave radiation hazards associated with models of the Sensormatic Electronic Security System has recently been expressed by various groups in the public health, labor, and industrial sectors. Because of this concern, a reevaluation of these specific devices was initiated to confirm Bureau of Radiological Health measurements taken on early models of this device in 1971. The findings of both the early survey, and this more recent one, confirm the BRH's position that emissions from the Sensormatic devices fall well below current U. S. guidelines for permissible exposure of humans to microwave radiation. GRA

N80-27089# Lister Hill National Center for Biomedical Communications, Bethesda, Md. Communications Engineering Branch.
ADAPTIVE DELTA MODULATION FOR TELEPHONE BIOTELEMETRY OF ECG (ELECTROCARDIOGRAPH) Final Report
Surachai Suthasinekul Jun. 1979 57 p refs
(PB80-160773; LHNCBC-79-21) Avail: NTIS HC A04/MF A01 CSCL 06B

Signal processing techniques and their applications in biomedical communications were investigated. Emphasis was on the application of digital coding techniques in telephone biotelemetry of electrocardiograph (EEG) signals. Existing techniques for telephone biotelemetry are briefly reviewed, their shortcomings are identified, and some possible solutions to the problems are discussed. One particular approach is the application of adaptive delta modulation (ADM) for digital encoding of ECG. The design and implementation of such an ADM system in the laboratory indicates that three ADM-encoded ECGs can be time-division multiplexed and transmitted through one telephone channel. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-27090*# National Aeronautics and Space Administration, Washington, D. C.
COMMUNITY REACTIONS TO AIRCRAFT NOISE IN THE VICINITY OF AIRPORT: A COMPARATIVE STUDY OF THE SOCIAL SURVEYS USING INTERVIEW METHOD
Yasutaka Osada Apr. 1980 18 p refs Transl. into ENGLISH of Koshu Eiseiin Kenkyu Hokoku (Tokyo), v. 20, no. 2, 1971 p 119-127 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75439) Avail: NTIS HC A02/MF A01 CSCL 05J

A comparative study was performed on the reports of community reactions to aircraft noise. The direct and immediate reactions to aircraft noise such as perceived noisiness, interference with conversations, etc. and various emotional influences were most remarkable; indirect and long term influences such as disturbance of mental work and physical symptoms were less remarkable. Author

N80-27091*# Boeing Commercial Airplane Co., Seattle, Wash.
NASA TLA WORKLOAD ANALYSIS SUPPORT. VOLUME 2: METERING AND SPACING STUDIES VALIDATION DATA
James L. Sundstrom Jul. 1980 402 p refs
(Contract NAS1-13741)
(NASA-CR-3239) Avail: NTIS HC A18/MF A01 CSCL 05H

Four sets of graphic reports--one for each of the metering and spacing scenarios--are presented. The complete data file from which the reports were generated is also given. The data was used to validate the detail task of both the pilot and copilot for four metering and spacing scenarios. The output presents two measures of demand workload and a report showing task length and task interaction. R.E.S.

N80-27092*# National Aeronautics and Space Administration, Washington, D. C.
THE MORALE CLIMATE OF THE CREW (FROM OBSERVATIONS OF A SUBMARINE DOCTOR)
V. Kulikov Jul. 1980 8 p Transl. into ENGLISH from Morsk. Sb. (USSR), no. 7, Jul. 1979 p 35-38 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76094) Avail: NTIS HC A02/MF A01 CSCL 05J

Personnel interrelationships as affected by sociopsychological compatibility are examined. Practical examples are cited. The principle of complementary temperaments is explored. Stress is laid upon the need for creating conditions that will permit personnel to deal with compatibility problems during the prevoyage preparation period and especially during the confining conditions of a long voyage. J.M.S.

N80-27093*# Boeing Commercial Airplane Co., Seattle, Wash.
NASA TLA WORKLOAD ANALYSIS SUPPORT. VOLUME 3: FFD AUTOPILOT SCENARIO VALIDATION DATA Final Report
James L. Sundstrom Jul. 1980 361 p
(Contract NAS1-13741)
(NASA-CR-3240) Avail: NTIS HC A16/MF A01 CSCL 05H

The data used to validate a seven time line analysis of forward flight deck autopilot mode for the pilot and copilot for NASA B737 terminal configured vehicle are presented. Demand workloads are given in two forms: workload histograms and workload summaries (bar graphs). A report showing task length and task interaction is also presented. R.E.S.

N80-27094# Air Force Human Resources Lab., Brooks AFB, Tex. Flying Training Div.
APPLIED BEHAVIOR ANALYSIS IN FLYING RESEARCH Interim Report, Jun. - Aug. 1978
Jon S. Bailey (Florida State Univ., Tallahassee) and Ronald G. Hughes Jan. 1980 17 p refs

best copy available

(AF Proj. 1123)
(AD-A081750; AFHRL-TR-79-38) Avail: NTIS HC A02/MF A01 CSCL 05/9

Research developments in learning theory over the past 50 years have led to principles of behavior which have been shown in innumerable applied settings to be valuable in analyzing and modifying human behavior. When applied to flying training using simulators, these principles suggest that a significant contribution could be made in improving the way in which instructor pilots teach new students via more effective use of simulator functions. In addition, flying skills could probably be acquired more readily if tasks were presented in a more systematic manner, taking the principles of learning into account. When the simulator is conceptualized as merely an inferior copy of an aircraft, its potential as a teaching device (perhaps superior to the actual plane, in this regard) is likely to be overlooked. Thus, a behavioral analysis of optimal conditions of learning would make a major contribution to both the design and use of current and future flight simulators. In this report, an attempt is made to elucidate the basic principles of behavior and to relate them to the task of improving flying training. GRA

N80-27095# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
THE INFLUENCE OF THE FLIGHT ALTITUDE AND THE LIMITATION OF THE FIELD OF VIEW ON THE VISIBILITY OF TARGETS ON THE GROUND AND THE MAXIMUM VISIBILITY FLIGHT ALTITUDE
Hans-Eberhard Hoffmann. Sep. 1979. 44 p. refs. In GERMAN; ENGLISH summary. Report will also be announced as translation (ESA-TT-654)
(DFVLR-FB-79-35; ESA-TT-654) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8.60

The visibility of targets on the ground for observers in an aircraft was studied. The maximum flight altitudes at which detection, recognition, or identification of ground targets is still possible were calculated under the assumption that the visibility distance is a logarithmic function of the altitude. The constants of this function were determined experimentally. Author (ESA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

No abstracts in this category.

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N80-27096# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
THE COMPUTER IN PHYSICAL GEOGRAPHY [DE COMPUTER IN DE FYSISCH GEOGRAFIE]
1979. 118 p. refs. In DUTCH. Proc. held in Amsterdam, 14 Apr. 1978.
Avail: NTIS HC A06/MF A01

Topics include: computerized modeling and simulation, image processing of satellite photographs, on-line literature searching, processing of metrology data, and statistical analysis of geographical data. For individual titles, see N80-27097 through N80-27103.

N80-27097# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
THE COMPUTER AS AN INSTRUMENT IN PHYSICAL GEOGRAPHY [DE COMPUTER ALS HULPMIDDEL IN DE FYSISCHE GEOGRAFIE] c60
Rob vanderTuin. *In its* The Computer in Phys. Geograph. 1979. p. 1-11. refs. In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

A general description of computer hardware and programming languages and concepts is given, along with the organization of the academic computer center in Amsterdam (SARA). Author (ESA)

N80-27098# Amsterdam Univ. (Netherlands). Landbouwhogeschool Wageningen.
COMPUTER SYSTEMS AND SIMULATION MODELS [COMPUTER SYSTEMEN EN SIMULATIE MODELLEN] c62
Johan A. A. Berkhout. *In its* The Computer in Phys. Geograph. 1979. p. 13-33. refs. In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

Examples from the field of geography are used to demonstrate the capabilities of the computer for modeling and the steps involved in constructing a model. The importance of grouping the variables is stressed. These are identified as the state variables, forcing, rate, auxiliary, and output variables. Author (ESA)

N80-27099# International Training Centre for Aerial Survey, Enschede (Netherlands).
DIGITAL IMAGE PROCESSING OF SATELLITE PHOTOGRAPHS [DIGITALE BEELDVERWERKING VAN SATELLIET OPNAMEN] c43
Nico H. W. Donker. *In* Amsterdam Univ. The Computer in Phys. Geograph. 1979. p. 35-61. refs. In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

The significance of remote sensing for developing countries is emphasized, and some applications mentioned, using LANDSAT data in particular. Also discussed are digital imagery, geometric and radiometric corrections, and automatic classification of soil cover using multispectral data. Author (ESA)

N80-27100# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
COMPUTERIZED LITERATURE SEARCHING IN THE GEOGRAPHIC SCIENCES [LITERATUUR ZOEKEN MET DE COMPUTER, IN HET BIJZONDER BIJ DE GEOGRAFISCHE WETENSCHAPPEN] c62
Piet Tielman. *In its* The Computer in Phys. Geograph. 1979. p. 63-89. refs. In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

An overview of developments in the mechanization of libraries and document centers is presented, including on-line information retrieval, computer techniques applied to catalogs in scientific libraries, automatic indexing, and COM produced catalogs. Author (ESA)

N80-27101# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
AUTOMATED PROCESSING OF SENSOR DATA [DE GEAUTOMATISEERDE VERWERKING VAN MEETGEGEVENS] c61
Ed deWater. *In its* The Computer in Phys. Geograph. 1979. p. 91-113. In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

The evolution of data acquisition and data processing

techniques is reviewed. The characteristics of digital and analog recording, and the conversions of data on cassettes to nine track computer readable format are explained. Author (ESA)

N80-27102# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
A PROGRAM FOR THE AUTOMATIC PROCESSING OF MEASUREMENT DATA [EEN PROGRAMMA VOOR DE AUTOMATISCHE VERWERKING VAN MEETGEGEVENS] **c61**
Rob vanderTuin *In its* The Computer in Phys. Geograph. 1979 p 103-114 In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

The use of a data logger to gather hydrological field data, and the subsequent processing of the cassette tapes are described. Precipitation intensity and quantity, water levels and temperature, soil temperature, pH, conductivity and turbidity were recorded. A FORTRAN program is given for reformating and plotting the cassette data. Author (ESA)

N80-27103# International Training Centre for Aerial Survey, Enschede (Netherlands).
COMPUTERIZED STATISTICAL PROCESSING, PARTICULARLY WITH THE SPSS PACKAGE [STATISTICHE BEWERKINGEN MET DE COMPUTER, IN HET BIJONDER MET HET PROGRAMMAPAKKET SPSS] **c61**
Harry vanZon *In* Amsterdam Univ. The Computer in Phys. Geograph. 1979 p 115-123 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

The development of program libraries as a result of growing computation loads and the complexity of statistical programs are outlined. Precautions to be taken by the users of standardized programs are mentioned. The use of the Statistical Package for the Social Sciences, including data management techniques is briefly described. Author (ESA)

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components, see *33 Electronics and Electrical Engineering*.

N80-27104# Stanford Linear Accelerator Center, Calif.
COM: A UNIBUS TROUBLE SHOOTING TOOL
Gerard J. Oxoby and Quang H. Trang Mar. 1980 7 p refs (Contracts EY-76-C-03-0515; DE-AC03-76SF-00515) (SLAC-TN-80-1) Avail: NTIS HC A02/MF A01

In a computer controlled system it is often difficult to trouble shoot the hardware and software. The task is even more complicated in the case of transient faults on a large system with many I/O ports. A module to help diagnose problems on a PDP 11 system was designed and built by Group B at SLAC. It monitors the Unibus control lines, keeps a history of the last sixteen Unibus operations, and can be programmed to interrupt the PDP 11 when a particular word appears either on the address or data lines. DOE

N80-27105# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
COMPUTER ARCHITECTURE AND SOFTWARE TOOLS FOR THE GENERATION AND SIMULATION OF MICROPROGRAMS
Magnus Persson 1979 22 p refs Sponsored in part by Swedish Inst. for Appl. Math. and Swedish Board for Tech. Develop.
(TRITA-NA-7916; TRITA-CS-7904) Avail: NTIS HC A02/MF A01

A summary is presented of five separate papers on microprogramming floating point arithmetic for the Varian-73 computer, a program and microprogram generator for the Varian-73, and a microprogrammed Fast Fourier Transform for the same machine. Author (ESA)

N80-27106# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.
BIPOLAR MICROPROCESSOR CIRCUITS Final Report
Gerhard Weil Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 82 p refs Partly in GERMAN and ENGLISH Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-49) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16,80

Partial results of a study to develop bipolar microprocessor devices as well as their associated cross assemblers and simulators are reported. Samples of two MSI peripheral devices were produced and work was started on three bipolar microprocessor devices. Author (ESA)

N80-27107# National Technical Information Service, Springfield, Va.
DATA COMPRESSION, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1977
Brian Carrigan Dec. 1979 251 p
(PB80-801640) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography of worldwide journal literature citing research on techniques and equipment for data compression is given. Reports on video communications, data management, and computer storage devices are included. The bibliography contains 245 abstracts. GRA

N80-27097# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
THE COMPUTER AS AN INSTRUMENT IN PHYSICAL GEOGRAPHY [DE COMPUTER ALS HULPMIDDEL IN DE FYSISCHE GEOGRAFIE]
Rob vanderTuin *In its* The Computer in Phys. Geograph. 1979 p 1-11 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-27108*# Computer Sciences Corp., Houston, Tex.
PRELIMINARY MATHEMATICAL SPECIFICATIONS FOR AREA TARGETS AND SPACE VOLUMES
M. Bishop Mar. 1979 74 p ref
(Contract NAS9-15700)
(NASA-CR-160192; CSC-0229; JSC-14722) Avail: NTIS HC A04/MF A01 CSCL 09B

The preliminary level B/C mathematical specifications for the Mission Control Center (MCC) area targets and space volumes processor are presented. J.M.S.

N80-27109*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER PROGRAM FOR ESTIMATION FROM INCOMPLETE MULTINOMIAL DATA
Karen R. Credeur May 1978 77 p refs
(NASA-TM-78704) Avail: NTIS HC A05/MF A01 CSCL 09B

Coding is given for maximum likelihood and Bayesian estimation of the vector p of multinomial cell probabilities from incomplete data. Also included is coding to calculate and approximate elements of the posterior mean and covariance matrices. The program is written in FORTRAN 4 language for the Control Data CYBER 170 series digital computer system with network operating system (NOS) 1.1. The program requires approximately 44000 octal locations of core storage. A typical case requires from 72 seconds to 92 seconds on CYBER 175 depending on the value of the prior parameter. J.M.S.

N80-27110*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
COMPUTER PROGRAM DOCUMENTATION: CYBER TO

UNIVAC BINARY CONVERSION USER'S GUIDE
E. W. Martin May 1980 13 p
(Contract NAS9-15800)
(NASA-CR-160688; JSC-16692; LEMSCO-14699) Avail: NTIS HC A02/MF A01 CSCL 09B

A user's guide for a computer program which will convert SINDA temperature history data from CDC (Cyber) binary format to UNIVAC 1100 binary format is presented. The various options available, the required input, the optional output, file assignments, and the restrictions of the program are discussed. J.M.S.

N80-27111*# Washington Univ., St. Louis, Mo. McDonnell Center for Space Sciences.
BIRP: SOFTWARE FOR INTERACTIVE SEARCH AND RETRIEVAL OF IMAGE ENGINEERING DATA
Raymond E. Arvidson, Lawrence K. Bolef, Edward A. Guinness, and Peter Norberg Jul. 1980 76 p
(Grant NsG-7087)
(NASA-CR-3299; SL-4) Avail: NTIS HC A05/MF A01 CSCL 09B

Better Image Retrieval Programs (BIRP), a set of programs to interactively sort through and to display a database, such as engineering data for images acquired by spacecraft is described. An overview of the philosophy of BIRP design, the structure of BIRP data files, and examples that illustrate the capabilities of the software are provided. M.G.

N80-27112# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
CUBTRI: AUTOMATIC CUBATURE OVER A TRIANGLE
D. P. Laurie Aug. 1979 9 p refs
(CSIR-TWISK-116) Avail: NTIS HC A02/MF A01

An algorithm which implements a method for automatic numerical integration over a triangle is described. An absolute error criterion is used when the mean value of the integrand lies between + or - 1, and a relative error criterion otherwise. Four program modules are supplied: subroutines CUBTRI and CUBRUL, function RNDERR, and a BLOCK DATA module. Separate single precision and double precision versions are supplied in order to take advantage of storage saving devices. M.G.

N80-27113# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AN ALGORITHM FOR COMPUTING HIGH-ORDER DERIVATIVES OF NOISY EXPERIMENTAL DATA SEQUENCES
H. Hatze Nov. 1979 15 p refs
(CSIR-TWISK-123) Avail: NTIS HC A02/MF A01

An algorithm utilizing optimally regularized (filtered) Fourier series for estimating higher order derivatives of noisy data sequences is described. As the optimal filtering process takes place in the derivative domain, use being made of the statistical information contained in the periodogram of the data sequence, no numerical differentiation as such takes place, and all the problems known to be associated with such a procedure are avoided. The optimally filtered approximation to the function itself is obtained by the same technique. The algorithm is based on known results from time series and approximation theory and offers several advantages when compared with other techniques: the optimally filtered approximations of the function and all its required derivatives are obtained in a single run; compact analytical Fourier representations of the filtered function and the derivatives are available; all the desirable properties of Fourier approximations can be utilized; if fast Fourier transforms are used, the algorithm is computationally far more efficient than other techniques. M.G.

N80-27114*# National Aeronautics and Space Administration, Washington, D. C.
HIGH LEVEL LANGUAGE FOR MEASUREMENT COMPLEX CONTROL BASED ON THE COMPUTER E-100I
B. V. Zubkov Jun. 1980 34 p refs Transl. into ENGLISH of Russian report Pr-404, Moscow, 1978 p 1-32 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences (USSR), Moscow
(Contract NASw-3198)
(NASA-TM-76243; Pr-404) Avail: NTIS HC A03/MF A01 CSCL 09B

A high level language was designed to control the process of conducting an experiment using the computer 'Elektrinika-1001'. Program examples are given to control the measuring and actuating devices. The procedure of including these programs in the suggested high level language is described. Author

N80-27115*# National Aeronautics and Space Administration, Washington, D. C.
DESCRIPTION AND TEXTS FOR THE AUXILIARY PROGRAMS FOR PROCESSING VIDEO INFORMATION ON THE YeS COMPUTER. PART 3: TEST PROGRAM 2
V. I.02Naan Borisenko, G. G. and Z. A. Stetsenko Jun. 1980 30 p Transl. into ENGLISH of ' ' Opisaniyg i Teksty Vspomogatelnykh Program Obrabotki Videoinformatsii na YeS EVM Chast 3, Programma Testa", Rept. Pr-426 Acad. of Sci. USSR Inst. of Space Res., Moscow 1978 p 1-25 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76252; Pr-426) Avail: NTIS HC A03/MF A01 CSCL 09B

The functions were discribed and the operating instructions, the block diagram and the proposed versions are given for modifying the program in order to obtain the statistical characteristics of multi-channel video information. The program implements certain man-machine methods for investigating video information. It permits representation of the material and its statistical characteristics in a form which is convenient for the user.Author

N80-27116# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
VISUAL ANALOG REPRESENTATIONS FOR NATURAL LANGUAGE UNDERSTANDING
David L. Waltz and Lois Boggess Feb. 1979 30 p refs
(Contract N00014-75-C-0612)
(AD-A081956; WP-20) Avail: NTIS HC A03/MF A01 CSCL 05/8

In order for a natural language system to truly 'know what it is talking about,' it must have a connection to the real-world correlates of language. For language describing physical objects and their relations in a scene, a visual analog representation of the scene can provide a useful target structure to be shared by a language understanding system and a computer vision system. This paper discusses the generation of visual analog representations from input English sentences. It also describes the operation of a LISP program which generates such a representation from simple English sentences describing a scene. A sequence of sentences can result in a fairly elaborate model. The program can then answer questions about relationships between the objects, even though the relationships in question may not have been explicit in the original scene description. Results suggest that the direct testing of visual analog representations may be an important way to bypass long chains of reasoning and to thus avoid the combinational problems inherent in such reasoning methods. GRA

N80-27117# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
THE EVENT BASED LANGUAGE AND ITS MULTIPLE PROCESSOR IMPLEMENTATIONS Ph.D. Thesis
Asher Reuveni Jan. 1980 291 p refs Sponsored in part by ARPA
(Contract N00014-75-C-0661)
(AD-A081950; MIT/LCS/TR-226) Avail: NTIS HC A13/MF A01 CSCL 09/2

This research defines and analyzes a simple language for parallel programming which is designed for multiple processor systems. The language (EBL) is based on events which provide the only control mechanism. Events are explicitly caused by the program, and they activate instances of dynamic program units called event handlers. The only operation that can be performed by an instance of an event handler is the causing of new events. The language constructs are primitive; nevertheless, the capability of hierarchical program design is provided via static modules and other modularity sources. The language does not contain conventional constructs such as: variables, assignment statements, goto statements, iteration constructs, procedures, functions and semaphores; however, these can be easily modeled. In addition, events allow activation of parallel processes, synchronization of parallel processes, mutual exclusion, message passing, immutable

objects, and the effect of mutable objects. Schemes for implementation of the language on processor networks are investigated. An implementation scheme based on communicating managers which operate without any centralized control is described. A relaxed distributed locking algorithm in which deadlocks are prevented is developed; it does not assume a total order on all objects to be locked. Several optimization problems, e.g., optimal distribution of objects in a network, are investigated. GRA

N80-27118# Naval Surface Weapons Center, Dahlgren, Va. Strategic Systems Dept.
NSWC/DL LIBRARY OF MATHEMATICS SUBROUTINES
Alfred H. Morris, Jr. Mar. 1980 186 p Supersedes NSWC/DL-TR-3843
(AD-A083163; NSWC/TR-79-338; NSWC/DL-TR-3843) Avail: NTIS HC A09/MF A01 CSCL 09/2

This report describes a high quality collection of general-purpose mathematics subroutines for the CDC 6700 computer. The routines are written in FORTRAN. Included are routines for computing Bessel functions, evaluating the complete and incomplete elliptic integrals of the first, second, and third kinds, finding least squares solutions for systems of linear equations, computing eignevalues and eigenvectors of matrices, solving linear programming problems, computing definite integrals, and solving systems of ordinary differential equations. The routines have been selected from a variety of sources. GRA

N80-27119# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
A RECURSIVE METHOD FOR SOLVING ASSIGNMENT PROBLEMS
Gerald L. Thompson Oct. 1979 45 p refs
(Contracts N00014-76-C-0932; N00014-75-C-0621; NR Proj. 047-048)
(AD-A083596; MSRR-448) Avail: NTIS HC A03/MF A01 CSCL 12/1

The recursive algorithm is a polynomially bounded nonsimplex method for soling assignment problems. It begins by finding the optimum solution for a problem defined from the first row, then finding the optimum for a problem defined from rows one and two, etc., continuing unitl it solves the problem consisting of all the rows. It is thus a dimension expanding rather than an improvement method such as the simplex. During the method the row duals are non-increasing and the column duals non-decreasing. Best and worst case behavior is analyzed. It is shown that some problems can be solved in one pass through the data, while others may require many passes. The number of zero shifts comparable to degenerate pivots in the primal method is shown to be at most n-squared/2. Extensive computational experience on the DEC-20 computer shows the method to be competitive for at least some kinds of assignment problems. Further tests on other computers are planned. GRA

N80-27120# General Electric Co., Arlington, Va.
A MATCHED PROJECT EVALUATION OF MODERN PROGRAMMING PRACTICES. VOLUME 1: MANAGEMENT REPORT ON THE ASTROS PLAN Interim Report, 1 Sep. 1977 - 30 Nov. 1978
Phil Milliman RADC Griffiss AFB, N.Y. Feb. 1980 53 p refs 2 Vol.
(Contract F30602-77-C-0194; AF Proj. 2528)
(AD-A083512; DOC-791SP005; RADC-TR-80-6-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

A plan for improving software development called Advanced Systematic Techniques for Reliable Operational Software (ASTROS) has been developed. This system provides guidelines for applying the following modern programming practices to software development: structured design and testing, HIPO charts, chief programmer teams, structured coding, structured walk-throughs, and program support library. In order to test the utility of these techniques, two development projects (non-real-time) sponsored by SAMTEC from the Metric Integrated Processing System were chosen for a quasi-experimental comparison. This system provides control and data analysis for missile launches. The Lauch Support Data Base (LSDB) was developed under the guidelines of the ASTROS plan, while the Data Analysis Processor (DAP) was developed using conventional techniques. This volume presents a condensed report of the results of this study which has been prepared for a nonscientific and/or managerial audience. The performance of the LSDB project was comparable to that of similar sized software development projects on numerous criteria. The amount of code produced per man-month was typical of conventional development efforts. Nevertheless, the performance of the LSDB project was superior to that of the DAP project. Thus, the benefits of the modern programming practices employed on the LSDB project were limited by the constraints of environmental factors such as computer access and turnaround time. GRA

N80-27121# General Electric Co., Arlington, Va.
A MATCHED PROJECT EVALUATION OF MODERN PROGRAMMING PRACTICES. VOLUME 2: SCIENTIFIC REPORT ON THE ASTROS PLAN Interim Report, 1 Sep. 1977 - 30 Nov. 1978
Phil Milliman and Bill Curtis RADC Griffiss AFB, N.Y. Feb. 1980 123 p refs 2 Vol.
(Contract F30602-77-C-0194; AF Proj. 2528)
(AD-A083513; DOC-791SP006; RADC-TR-80-6-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 09/2

A detailed account of the theories and analyses underlying the results of a quasi-experimental comparision of the Launch Support Data Base (LSDB) developed under the guidelines of the ASTROS Plan and the Data Analysis Processor (DAP) developed using conventional techniques is presented. The performance of the LSDB Project was comparable to that of similar sized software development projects on numerous criteria. The amount of code produced per man month was typical of conventional development efforts. Nevertheless, the performance of the LSDB Project was superior to that of the DAP Project. The benefits of the modern programming practices employed on the LSDB Project were limited by the constraints of environmental factors such as computer access and turnaround time. J.M.S.

N80-27122# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TOWARD VALIDATION OF COMPUTER SIMULATION MODELS IN OPERATIONAL TEST AND EVALUATION M.S. Thesis
James M. Arnett Dec. 1979 180 p refs
(AD-A083516; AFIT/GOR/SM/790D-1) Avail: NTIS HC A09/MF A01 CSCL 09/2

Validation of complex computer simulations is considered in the context of the operational test and evaluation of the air launched cruise missile. Published literature on validation is reviewed. Validation is described as a problem-dependent process. The goal of that process is an acceptable level of confidence that the actual and simulated data agree closely enough for an inference about the simulation to be a valid inference about the actual system. The cost of accepting a given level of confidence must be balanced against the cost of obtaining a higher level. Experimental design is seen as the key to obtaining the maximum amount of information from a limited number of test runs and is discussed. The following approach to validity is suggested. Use a screening design to identify the few, most important variables in the simulation. Use a more complete design to specify parameter/level combinations for simulated and actual data comparison. Finally, explicitly incorporate decision analysis in judging the validity of the model based on that comparison and the use that will be made of the simulation results. A fractional factorial design is used to screen out the important factors from the clutter and multipath sub-model in TAC ZINGER. GRA

N80-27123# Oak Ridge National Lab., Tenn. Computer Sciences Div.
IMPLEMENTING SPARSE MATRIX TECHNIQUES IN THE ERATO CODE
D. S. Scott Apr. 1980 29 p
(Contract W-7405-eng-26)
(ORNL/CSD/TM-117) Avail: NTIS HC A03/MF A01

Changes made to the ERATO code, which computes the stability of an equilibrium with respect to the linear magnetohydrodynamic equation, are described. One program of the code takes given matrices A and B, and a shift parameter, omega sub o, and computes the Choleski factorization (U/sup T/DU)

of the matrix A - omega sub o B. It then uses the factorization to implement inverse iteration to find the eigenvalue of the generalized eigenvalue problem A - lambda B closest to omega sub o and its corresponding eigenvector. The matrices A and B are highly structured and quite sparse. Both are symmetric and B is positive definite. Each block consists of 16 square sub-blocks. DOE

N80-27124# Oak Ridge National Lab., Tenn.
SLIDES 2: A PROGRAM TO DRAW TEXT, SLIDES AND POSTERS
D. H. McCollough and K. N. Fischer Mar. 1980 93 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-103) Avail: NTIS HC A05/MF A01

SLIDES is a program which takes text and commands as input and prepares lettered slides and posters. Originally written by Richard Bertrand and John Schofield at Argonne National Laboratory, SLIDES has been modified to operate in an interactive design mode on the PD-10 as well as in a batch production mode on the IBM computers. When run on the time sharing computer, the program can display its output on a graphics terminal; in batch, it can direct its output to a variety of plotters. The program uses DISSPLA graphical subroutines. This report, revised from ANL-77-26 and again revised from ORNL/CSD/TM-44, contains material written for the beginning user, who should be able to produce useful slides or posters by following the examples. This report also serves as a complete reference for the SLIDES program. DOE

N80-27125# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
AUTOMATED UNCERTAINTY ANALYSIS METHODS IN THE FRAP COMPUTER CODES
S. O. Peck 1980 41 p refs Presented at IAEA Specialists Meeting, Blackpool (England), 17 Mar. 1980
(Contract EY-76-C-07-1570)
(CONF-800331-1) Avail: NTIS HC A03/MF A01

A user oriented, automated uncertainty analysis capability was incorporated in the Fuel Rod Analysis Program (FRAP) computer codes and developed for the analysis of Light Water Reactor fuel rod behavior during steady state (FRAPCON) and transient (FRAP-T) conditions. The objective of uncertainty analysis of these codes is to obtain estimates of the uncertainty in computed outputs of the codes as a function of known uncertainties in input variables. The methods used to generate an uncertainty analysis of a large computer code are presented, the assumptions that are made and are discussed, techniques for testing them are given. An uncertainty analysis of FRAP-T calculated fuel rod behavior during a hypothetical loss-of-coolant transient is presented as an example and carried through the discussion to illustrate the various concepts. DOE

N80-27126# National Physical Lab., Teddington (England). Computing Services Unit.
A CROSS-REFERENCE INDEX FOR THE SYNTAX OF THE PROGRAMMING LANGUAGE FORTRAN 77
R. S. Scowen Dec. 1979 25 p refs
(NPL-CSU-5) Avail: NTIS HC A02/MF A01

The syntax of the new FORTRAN 77 standard is presented in alphabetical order. Cross-reference indexes for both terminal and nonterminal symbols of language are included. The syntax is written in the meta-language defined in a draft British Standard. The report includes a brief description of the meta-language which is similar to that used in ALGOL 60, PASCAL and ADA. Author (ESA)

N80-27127# National Physical Lab., Teddington (England). Computing Services Unit.
A CROSS-REFERENCE INDEX FOR THE SYNTAX OF THE PROGRAMMING LANGUAGE ADA
R. S. Scowen Dec. 1979 17 p refs
(NPL-CSU-6) Avail: NTIS HC A02/MF A01

ADA is a programming language sponsored by the US Department of Defense. The syntax is presented in alphabetical order, with cross-reference indexes for both terminal and nonterminal symbols of the language. The syntax is written in the meta-language defined in a draft British Standard. A brief description of the meta-language which is similar to that used in the ADA manual is included. Author (ESA)

N80-27128# General Electric Co., Whetstone (England). Reactor Equipment LTD.
GENERAL PLOTTING PROGRAM
D. Bartlett May 1979 26 p refs
(REL/R(79)17) Avail: NTIS HC A03/MF A01

Instructions are given for the use of a program written for the PDP 11/70 to plot graphs from tabular data. The graphs can be displayed on a HP2648A graphics terminal and plotted on a HP7221A plotter. The program is not listed. Author (ESA)

N80-27129# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
INTERPRETATION TECHNIQUES
Paul Klint May 1979 21 p refs Submitted for publication
(MC-IW-110/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2.88

The relative merits of implementing high level programming languages by means of interpretation or compilation are discussed. The properties and the applicability of interpretation techniques known as classical interpretation, direct threaded code, and indirect threaded code are described and compared. Author (ESA)

N80-27130# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
A PRELIMINARY REPORT ON NUMERICAL OPERTORS IN ALGOL 68: A SKELETON FOR A MODERN NUMERICAL SOFTWARE LIBRARY
P. W. Hemker and D. T. Winter May 1979 74 p refs
(MC-NW-66/79) Avail: NTIS HC A04/MF A01; Stichting Math. Centrum, Amsterdam FL 7.69

A proposal for a set of numerical operators in ALGOL 68 is described. These operators enable ALGOL 68 users to program standard numerical computations in an easy, flexible way (i.e., in a way resembling the usual mathematical notation). The system of operators serves the same purpose as a numerical library (e.g., FORTRAN or ALGOL 60). Computations in numerical algebra, elementary numerical analysis (quadrature, root-finding) and initial value problems for ODE's are considered. In addition a flexible error message system is provided. Author (ESA)

N80-27131# Research Inst. of National Defence, Stockholm (Sweden).
[ACTIVITIES REPORT OF THE LABORATORY FOR IMAGE PROCESSING] Annual Report, 1979
Jan. 1980 52 p refs
(FOA-C-30179-E1) Avail: NTIS HC A04/MF A01

Application projects centered on image processing, image enhancement, visual perception, visual processing of pictorial information, and evaluation and optimization of information systems are described. Author (ESA)

N80-27132# Montpellier Univ. (France). Dept. de Physique Mathematique.
A PACKAGE OF ROUTINES FOR LINEAR INVERSE PROBLEMS
Michel Cuer and Roger Bayer 1979 36 p refs
(Contract CNEXO-78-5773)
(PM-79/24) Avail: NTIS HC A03/MF A01

A package of FORTRAN routines using linear programming techniques in linear inverse problems such as gravimetry or geomagnetism is described. The package can be applied to inverse gravity or geomagnetic problems with a maximum data size on IBM 360/65 of the order: number of measurements up to 250, number of unknowns 600 or less. Author (ESA)

N80-26359*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPTIMAL PERIODIC BINARY CODES OF LENGTHS 28 TO 64
S. Tyler and R. Keston *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 131-135 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09B

N80-27101# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
AUTOMATED PROCESSING OF SENSOR DATA [DE GEAUTOMATISEERDE VERWERKING VAN MEETGEGEVENS]
Ed deWater *In its* The Computer in Phys. Geograph. 1979 p 91-113 In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

N80-27102# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
A PROGRAM FOR THE AUTOMATIC PROCESSING OF MEASUREMENT DATA [EEN PROGRAMMA VOOR DE AUTOMATISCHE VERWERKING VAN MEETGEGEVENS]
Rob vanderTuin *In its* The Computer in Phys. Geograph. 1979 p 103-114 In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

N80-27103# International Training Centre for Aerial Survey, Enschede (Netherlands).
COMPUTERIZED STATISTICAL PROCESSING, PARTICULARLY WITH THE SPSS PACKAGE [STATISTICHE BEWERKINGEN MET DE COMPUTER, IN HET BIJONDER MET HET PROGRAMMAPAKKET SPSS]
Harry vanZon *In* Amsterdam Univ. The Computer in Phys. Geograph. 1979 p 115-123 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N80-27133 Duke Univ., Durham, N. C.
PERFORMANCE-ORIENTED DESIGN OF INTERACTIVE COMPUTER SYSTEMS Ph.D. Thesis
Anna Elisabeth Katharina VonMayrhauser 1979 322 p
Avail: Univ. Microfilms Order No. 8012060

Six different design models for interactive systems are studied. The first two are interactive multiprogrammed models with CPU and device speeds as decision variables. One assumes no memory contention, the second restricts access to the computer subsystem based on the amount of memory available. Some of the decision variables for the design optimization are changed to other hardware or software aspects such as device capacities and file assignments across secondary storage devices. The block sizes and record sizes are allowed to vary from device to device and file to file. For each model numerical examples demonstrate its application. The examples also include extensive but efficient sensitivity analyses. Finally an attempt is made to combine all these models into an automated design aid. The structure and features of the proposed design optimizer DESOP are explained including its usefulness and limitations. Dissert. Abstr.

N80-27134# Maryland Univ., College Park. Dept. of Computer Science.
AN ALGORITHM FOR MUTUAL EXCLUSION IN COMPUTER NETWORKS Interim Report
Glenn Ricart and Ashok K. Agrawala Feb. 1980 35 p refs Revised Sponsored in part by NIH
(Grant AF-AFOSR-3654-78; AF Proj. 2304)
(AD-A083268; TR-869-Rev; AFOSR-80-0303TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

An algorithm is proposed which creates mutual exclusion in a computer network whose nodes can communicate only by messages and do not share memory. The algorithm sends only 2*(N-1) messages, where N is the number of nodes in the network, per critical section invocation. This number of messages is a minimum if parallel, distributed, symmetric control is used; hence, the algorithm is optimal in this minimal under some general assumptions. Like Lamport's 'bakery algorithm,' unbounded sequence numbers are used to provide first-come first-served priority into the critical section. It is shown that the number can be contained in a fixed amount of memory by storing it as the residue of a modulus. The number of messages required to implement the exclusion can be reduced by using sequential node-by-node processing, by using broadcast message techniques or by sending information through timing channels. The readers and writers problem is solved by a simple modification of the algorithm. The modifications necessary to make the algorithm robust are described. GRA

N80-27098# Amsterdam Univ. (Netherlands). Landbouwhogeschool Wageningen.
COMPUTER SYSTEMS AND SIMULATION MODELS [COMPUTER SYSTEMEN EN SIMULATIE MODELLEN]
Johan A. A. Berkhout *In its* The Computer in Phys. Geograph. 1979 p 13-33 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-27135# Honeywell Systems and Research Center, Minneapolis, Minn.
OPTIMAL LINEAR CONTROL Final Report
C. A. Harvey, M. G. Safonov, G. Stein, and J. C. Doyle Dec. 1979 119 p refs
(Contract N00014-75-C-0144; RR0141184)
(AD-A083130; ONR-CR-215-238-4F; REPT-79-SRC87) Avail: NTIS HC A06/MF A01 CSCL 12/1

This is the final report on a multi-year research program to bridge the gap between modern control theory and practical control system design. The results of the total program are summarized and the last year's results are described in detail. Characterizations of optimal linear controls have been derived, from which guides for selecting the structure of the control system and the weights in the performance index were developed, so that optimal controls meeting conventional design specifications can be designed for single-input systems. For multi-input systems a method of selecting weights for the performance index on the basis of desired closed-loop modal properties and system bandwidth was developed. For such systems it was also found that optimal controls which use state estimators have no guaranteed stability margins, and a method was developed for adjusting the state estimator design so that good margins could be obtained. It was also found that single-loop stability margins in multi-input systems were inadequate measures of robustness, the quality of stability being preserved for a class of perturbations of system characteristics. A new measure of robustness expressed in terms of singular values was developed which is a valid generalization of the concept of stability margins for single-input systems. A method for estimating bounds on system perturbations in terms of singular values associated with parameter uncertainties and unmodeled dynamics, including some forms of nonlinearities, is described in detail in this report. Illustrative examples have been treated in each phase of the program. In this report such an example is presented, demonstrating the se of singular value analysis in design. GRA

N80-27136# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
STOCHASTIC AND ADAPTIVE SYSTEMS Final Report, 1 Feb. 1979 - 31 Jan. 1980
Michael Athans, Sanjoy K. Mitter, and Lena Valavani Mar. 1980 19 p refs
(Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A083614; LIDS-FR-981; AFOSR-80-0304TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This research is concerned with various aspects of stochastic and adaptive systems. Topics covered include: linear and non-linear state estimation, stochastic control and adaptive control. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-27137# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
METHODS FOR SOLUTION OF FREDHOLM INTEGRAL EQUATIONS OF THE FIRST KIND M.S. Thesis - South Africa Univ.
M. L. Baart Sep. 1979 144 p refs
(CSIR-TWISK-104) Avail: NTIS HC A07/MF A01

A Fredholm integral equation of the first kind is an example of an ill-posed problem, the most troublesome aspect being the fact that the solution need not depend continuously on the given function, so that small inaccuracies in the data can cause large solution deviations. Various methods are investigated for solving these integral equations. These methods are divided into three interconnected classes: (1) best approximate solution methods, (2) singular value decomposition methods, and (3) regularization methods. Selected methods from each category are discussed, as well as connections between these methods. Finally, four methods are used to compute solutions to problems with varying degrees of stability. In all cases considered, the exact solutions are known, so that the accuracy of the computed solutions obtained by different methods can be compared. The results provide some justification for a priori selection of the most suitable method in a given case. F.O.S.

N80-27138# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Mathematical Statistics.
ON A FISHER-CORNISH TYPE EXPANSION OF WISHART MATRICES
D. G. Nel and P. C. N. Groenwald Aug. 1979 15 p refs
(TR-47) Avail: NTIS HC A02/MF A01

The limiting distributions of U = the square root of (n)(A/n)-sigma where A is similar to W (sigma,n) or A is similar to W(sigma,n,omega = o(1) is respectively extended to asymptotic approximations to the distributions of U. The Fisher-Cornish approximation to a chi(2)sub n distribution is shown to be a special case of this approximation up to the order terms involved. Asymptotic approximations to the distribution of U = the square root of(n)((A/n)-sigma(1+theta)) is also derived when A is similar to W(sigma,n,omega) and omega = o(n). Author

N80-27139# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMAL CONTROL OF PARTIALLY OBSERVABLE JUMP DIFFUSION PROCESSES
M. Friedman (Nuclear Research Centre, Beer-Sheva, Israel) Jul. 1979 24 p refs
(CSIR-TWISK-84) Avail: NTIS HC A02/MF A01

The optimal control problem dealt with is to find a feedback control law. By applying the calculus of variations, necessary conditions on optimal controls are derived, these conditions being given by a pair of coupled nonlinear partial integro-differential equations. A stochastic second-order system, describing a perturbed Duffing oscillator, is used as a test case, and two numerical methods for computing the optimal controls of the system are suggested, the efficiency and applicability of the second method is demonstrated with the aid of examples. J.M.S.

N80-27140# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ROBUST ESTIMATION OF THE VARIOGRAM 1
Noel Cressie Jul. 1979 20 p refs
(CSIR-TWISK-83) Avail: NTIS HC A02/MF A01

It is a matter of common experience that ore values do not follow the normal (or lognormal) distributions assumed for them, but some other heavier-tailed distribution. The robust estimation is discussed of the variogram when the distribution is normal-like in the central region, but heavier than normal in the tails. It is shown that the use of a fourth-root transformation with or without the use of M-estimation yields stable robust estimates of the variogram. Author

N80-27141# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
INITIAL ESTIMATES OF THE MOVING AVERAGE PARAMETERS IN A TIME SERIES MODEL
D. P. Laurie Oct. 1979 12 p refs
(CSIR-TWISK-118) Avail: NTIS HC A02/MF A01

An algorithm for the polynomial factorization involved in the initial estimates of the moving average parameters in a time series model is presented. A two stage algorithm is described which uses a linearly convergent algorithm in the fast version until the current iterate is sufficiently accurate to allow the use of a quadratically convergent algorithm, in the fast version. The FORTRAN subroutines are given. M.G.

N80-27142# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
TANGENTIAL APPROXIMATIONS IN ABSTRACTS MULTIPLIER RULES
R. J. Gardner Oct. 1979 13 p refs Presented at 10th Intern. Symp. on Math. Programming, Montreal, 27-31 Aug. 1979
(CSIR-TWISK-124) Avail: NTIS HC A02/MF A01

An axiomatic examination centering around a very general abstract multiplier rule (The intersection principle) is presented. Notions of tangential approximant which combine the advantages of certain existing notions are developed. M.G.

N80-27143# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A GEOMETRIC CHARACTERIZATION OF H-SETS
M. Brannigan Oct. 1979 13 p refs
(CSIR-TWISK-121) Avail: NTIS HC A02/MF A01

The geometric characterization of H-sets in terms of convex polyhedral cones or, in special cases, simplices is examined. In particular the characterization of minimal H-sets is considered and used to find an upper bound for the number of possible minimal H-sets of a finite-dimensional space. M.G.

N80-27144# Stanford Univ., Calif. Dept. of Computer Science.
RELATION BETWEEN THE COMPLEXITY AND THE PROBABILITY OF LARGE NUMBERS
Peter Gacs Sep. 1979 11 p refs
(Contract N00014-76-C-0330; Grant NSF MCS-77-23738)
(AD-A083192; SU-STAN-CS-79-765) Avail: NTIS HC A02/MF A01 CSCL 12/1

H(x), the negative logarithm of the apriori probability M(x) is Levin's variant of Kolmogorov's complexity of a natural number x. Let alpha(n) be the minimum complexity of a number larger than n, s(n) the logarithm of the a priori probability of obtaining a number larger than n. It was known that s (n) < or = alpha(n) < or = s (n) and H(s(n)). We show that the second estimate is in some sense sharp. GRA

N80-27145# Stanford Univ., Calif. Dept. of Computer Science.
UPDATING FORMULAE AND A PAIRWISE ALGORITHM FOR COMPUTING SAMPLE VARIANCES
Tony F. Chan (Yale Univ.), Gene H. Golub, and Randall J. LeVeque Nov. 1979 21 p refs Sponsored in part by NSF
(Grant DAAG29-78-G-0179)
(AD-A083170; SU-STAN-CS-79-773) Avail: NTIS HC A02/MF A01 CSCL 12/1

A general formula is presented for computing the sample variance for a sample of size m and n given the means of variances for two subsamples of sizes m and n. This formula is used in the construction of a pairwise algorithm for computing the variance. Other applications are discussed as well, including the use of updating formulae in a parallel computing environment. We present numerical results and rounding error analyses for several numerical schemes. GRA

N80-27146# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CONTINUOUS DENSITY APPROXIMATION ON A BOUNDED INTERVAL USING INFORMATION THEORETIC CONCEPTS Ph.D. Thesis
James E. Miller, Jr. Mar. 1980 265 p refs

(AF Proj. 2404)
(AD-A083514; AFIT/DS/MA/80-1) Avail: NTIS HC A12/MF A01 CSCL 12/1

This report presents the theoretical development and numerical implementation of a procedure for approximating continuous probability density functions on a bounded interval. The work is applicable to Bayesian decision models and that available information is used to update or obtain the prior distribution. The procedure is based on the solution of a constrained entropy maximization problem and requires information in the form of expected values of information functions. The approach involves three steps: estimation of expected (or average) values of potential information functions, selection of the active subset of functions to define the approximation family, and simultaneous solution of the constraints to select the specific approximating density for a given set of data. A useful set of potential information functions is developed, and three numerical methods for active set selection are demonstrated. Numerical techniques for expected value computation are discussed, and a scheme for solution of the constraints is developed and implemented. Theoretical development includes theorems on form and uniqueness. Approximation accuracy is related to potential set definition and data accuracy. The procedure is applied to several known distributions to demonstrate applicability. Applications to computer simulation and interval arithmetic models are demonstrated with specific examples. GRA

N80-27147# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.
KWIC INDEX FOR NUMERICAL ALGEBRA
J. A. Carpenter and R. A. Lewis Mar. 1980 379 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-46) Avail: NTIS HC A17/MF A01

The second supplement to the 'key word in context' (KWIC) index for numerical algebra is presented. The first supplement is included in its entirety, together with the subsequent corrections and recent journal citations. A standard bibliography of 3,864 citations is also included along with an author index. DOE

N80-27148# Oxford Univ. (England). Dept. of Engineering Science.
THE SIGNORINI PROBLEM FOR A COSSERAT PLATE
J. R. Turner 1979 23 p refs
(OUEL-1296/79) Avail: NTIS HC A02/MF A01

The potential of Cosserat plate theory to give physically acceptable solutions to a number of practical plate problems involving unilateral constraints is investigated. Example solutions to three problems are obtained by the finite element method. These are the Signorini problem of a plate bent over a rigid parabolic obstacle, the problem of a plate resting on a rigid, frictionless foundation indented from above by a rigid frictionless ball, and that of a plate bonded to a rigid foundation indented from above by a rigid frictionless ball. Author (ESA)

N80-27149# Royal Netherlands Meteorological Inst., De Bilt. Meteorologisch Onderzoek.
METHODS FOR ESTIMATING SPECTRA [INLEIDING IN ENKELE METHODEN VOOR HET SCHATTEN VAN SPECTRA]
Wouter Kuik 1980 60 p refs In DUTCH
(KNMI-V-335) Avail: NTIS HC A04/MF A01

A literature review was performed of techniques for determining the spectra of finite time series. A historic overview is given, with a discussion of general problems in determining spectra. Specific methods with the advantages and disadvantages of each are presented, including periodogram methods, with or without window, the variable record length technique, maximum entropy method, maximum likelihood method and exact spectral representation based on filtering. Author (ESA)

N80-26355*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ON THE APPLICATION OF A FAST POLYNOMIAL TRANSFORM AND THE CHINESE REMAINDER THEOREM TO COMPUTE A TWO-DIMENSIONAL CONVOLUTION
T. K. Truong, R. Lipes, I. S. Reed (Univ. of Southern California), and C. Wu *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 87-102 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-27150*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN AUTOMATED APPROACH TO THE DESIGN OF DECISION TREE CLASSIFIERS
P. Argentiero, P. Chin, and P. Beaudet Mar. 1980 19 p refs
(NASA-TM-80676) Avail: NTIS HC A02/MF A01 CSCL 12A

The classification of large dimensional data sets arising from the merging of remote sensing data with more traditional forms of ancillary data is considered. Decision tree classification, a popular approach to the problem, is characterized by the property that samples are subjected to a sequence of decision rules before they are assigned to a unique class. An automated technique for effective decsion tree design which relies only on apriori statistics is presented. This procedure utilizes a set of two dimensional canonical transforms and Bayes table look-up decision rules. An optimal design at each node is derived based on the associated decision table. A procedure for computing the global probability of correct classfication is also provided. An example is given in which class statistics obtained from an actual LANDSAT scene are used as input to the program. The resulting decision tree design has an associated probability of correct classification of .76 compared to the theoretically optimum .79 probability of correct classification associated with a full dimensional Bayes classifier. Recommendations for future research are included. J.M.S.

N80-27151# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Mathematical Statistics.
A CIRCULAR APPROACH TO CYCLICAL DATA
D. J. deWaal and P. H. Hewitt Jul. 1979 12 p refs
(TR-45) Avail: NTIS HC A02/MF A01

An approach to analyzing cyclical data such as the number of mosquitoes over the seasons of a year is presented. The data are presented on the circumference of a unit circle and a predictive density is fitted. As calculated the predictive density can also take account of the effect of possible independent variables. An application using the weekly abundance, over a year, of two mosquito species is given. M.G.

N80-27152# Clemson Univ., S.C. Dept. of Mathematical Sciences.
A NOTE ON THE INCOMPLETE BETA FUNCTION
Khursheed Alam 25 May 1979 11 p refs
(Contracts N00014-75-C-0451; NR Proj. 047-202)
(AD-A083529; N107; TR-316) Avail: NTIS HC A02/MF A01 CSCL 12/1

The incomplete beta function arises in various statistical problems. It is known, for example, that the tail probability of the binomial distribution can be expressed as an incomplete beta function. This paper gives some results on a monotonicity property of the incomplete beta function. The given results are shown to have application in a problem of ranking and selection. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-27153# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
SCIENTIFIC MODELS AND METHODS M.S. Thesis [MODELOS E METODO CIENTIFICO]
Artur Milhomen Neto and Horacio Hideki Yanasse Jan. 1978

402 p refs In PORTUGUESE; ENGLISH summary
(INPE-1180-TPT/080) Avail: NTIS HC A18/MF A01

Models, their role in the scientific method, their construction, and their use are discussed. The current state-of-the-art is appraised. The fundamentals of modeling are examined in relation to the scientific method. After careful study of the scientific method, the aspects are considered: (1) classification of the types of models based on explaining the relation between the variables; and (2) development of methodology, isomorphic to the pragmatic method, for constructing models. Some existing models are criticized, and an orientation for the systematic use of models is presented. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-27154# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A NOTE ON THE DUALITY OF TIME-VARYING DECOMPOSABLE SYSTEMS
G. Naude Nov. 1979 11 p refs
(CSIR-TWISK-125) Avail: NTIS HC A02/MF A01

Results on the duality between reachability and observability for time-invariant decomposable systems in a category are extended to the time-varying case. In particular the results can be applied to time-varying infinite-dimensional linear systems in Banach spaces, and to time-varying linear systems over rings. M.G.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-27155# Argonne National Lab., Ill.
RESISTIVITY, HYSTERESIS, AND MAGNETIZATION OF 9% CR STAINLESS STEEL AS A FUNCTION OF TEMPERATURE AND ITS ELECTROMAGNETIC SHIELDING EFFECTS IN CYLINDRICAL STRUCTURES
W. F. Praeg 1979 8 p refs Presented at 8th Symp. on Eng. Problems on Fusion Res., San Francisco, 13-16 Nov. 1979
(Contract W-31-109-eng-38)
(CONF-791102-128) Avail: NTIS HC A02/MF A01

Ferromagnetic stainless steels may offer significantly greater wall life-times for first wall/blanket and vacuum vessel structures than commonly used nonmagnetic stainless steels. One steel under consideration has the following composition, in weight percent: Fe(86.24%), Cr(9.0%) etc. The resistivity, the hysteresis loop, and magnetization were measured as a function of temperature up to the Curie point. DOE

N80-27156# California Univ., Livermore. Lawrence Livermore Lab.
ADIABATIC COMPRESSION AND RADIATIVE COMPRESSION OF MAGNETIC FIELDS
C. H. Woods 12 Feb. 1980 19 p refs
(Contract W-7405-eng-48)
(UCID-18579) Avail: NTIS HC A02/MF A01

Flux is conserved during mechanical compression of magnetic fields for both nonrelativistic compressors. However, the relativistic compressor generates radiation, which can carry up to twice the energy content of the magnetic field compressed adiabatically. The radiation may be either confined or allowed to escape. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-27157*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
APPLICATION OF IMAGING AND ULTRASOUND TO THE QUALITY GRADING OF BEEF
V. J. Anselmo and P. M. Gammell 1 Apr. 1980 41 p Sponsored in part by Dept. of Agriculture. Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-163276; JPL-80-33) Avail: NTIS HC A03/MF A01 CSCL 20A

The results of a study conducted to assist the Department of Agriculture in the task of considering innovative methods for the grading of carcass beef for human consumption is presented. The processing of photographic, television and ultrasound images of the longissimus dorsi muscle at the 12/13th rib cut was undertaken. The results showed that a correlation could be developed between the quality grade of the carcass as determined by a professional grader, and the fat to area ratio of the muscle as determined by image processing techniques. In addition, the use of ultrasound shows the potential for grading of an unsliced carcass or a live animal. E.J.R.

N80-27158*# Wyle Labs., Inc., Huntsville, Ala. Scientific Services and Systems Group.
ANALYSIS OF SRB REENTRY ACOUSTIC ENVIRONMENTS Final Report
T. Coffin, R. E. Dandridge, and U. W. Haddock Jun. 1979 185 p refs
(Contract NAS8-32112)
(NASA-CR-161476; WR-79-15) Avail: NTIS HC A09/MF A01 CSCL 20A

Space shuttle solid rocket booster reentry aeroacoustic environments were estimated. Particular emphasis was given to the aft skirt/exit plane region for the Mach number regime 0.6 = or greater than M infinity = or less than 3.5. The analysis is based on the evaluation of wind tunnel model results in conjunction with Monte Carlo simulation of trajectory parameters. The experimental approach is described as well as the evaluation process utilized. Predicted environments are presented in terms of one-third octave band spectra representing space averaged values for critical regions on the solid rocket booster. A.R.H.

N80-27159*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
BROADBAND JET NOISE AMPLIFICATION BY A PURE TONE EXCITATION Semiannual Report
P. J. Morris 14 Jul. 1980 24 p refs
(Grant NsG-1580)
(NASA-CR-163269) Avail: NTIS HC A02/MF A01 CSCL 20A

A model is proposed for the change in turbulent structure of a round jet in the presence of an acoustic excitation. The excitation is initial amplitude at the jet exit. As these waves propagate downstream they extract energy from the mean flow and transfer it to the random turbulence. This results in an increase in the levels of the turbulence and a resulting increase in the radiated broadband noise. An examination is made of the effect of excitation level and frequency on the jet flow. The numerical procedure allows for radial as well as axial variations in the averaged properties of jet to be calculated. The results indicate that the presence of a finite amplitude instability wave increases the spreading of the jet. Author

N80-27160# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
SOUND RADIATION FROM A FINITE LENGTH UNFLANGED CIRCULAR DUCT WITH UNIFORM AXIAL FLOW
Kenji Ogimoto May 1980 172 p refs
(UTIAS-231; CN-ISSN-0082-5255) Avail: NTIS HC A08/MF A01

In addition to the noise caused by the turbulent jet exhaust flow, the noise generated by the fans and compressors operating in the inlet duct is a dominant contributor to the overall jet aircraft engine noise. To assist in improving the understanding of the basic characteristics of this type of noise source, a general theory is developed using a simplified model. This model

consists of a finite length hard wall unflanged circular duct, an arbitrary general planar source distribution in the duct and a uniform axial flow inside and outside the duct radius. The Wiener-Hopf-Technique, which is useful in solving mixed boundary value problems, was employed in the solution. The study by Williams of the scattering of plane waves by a finite length unflanged hollow cylindrical duct is particularly relevant. The plane wave in Williams' study is replaced by a general planar source distribution inside the duct. In addition, a uniform axial flow inside and outside the duct radius is also included. The model simulates a low thrust engine operating condition such as landing or steady flight and includes the diffraction of sound waves at the duct ends. However, the refraction effects due to the large nonuniform exterior flow fields, which are encountered near the inlet and exhaust under conditions of high thrust (i.e., at take-off) are excluded. The solution in the present work also includes the results of earlier studies with semi-infinite length unflanged circular ducts as a limiting case. However, the present finite length model provides a much improved simulation of the actual flow problem and it drastically changes the picture of the resulting sound radiation. The reasons for the changes are attributable to the resonance within the duct (leading to interior standing waves) and to the interference of the two sound waves radiated to the duct exterior from the duct ends.

Author

N80-27161*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A NUMERICAL TECHNIQUE FOR CALCULATION OF THE NOISE OF HIGH-SPEED PROPELLERS WITH ADVANCED BLADE GEOMETRY

Paul A. Nystrom and F. Farassat Jul. 1980 33 p refs
(NASA-TP-1662; L-13535) Avail: NTIS HC A03/MF A01 CSCL 20A

A numerical technique and computer program were developed for the prediction of the noise of propellers with advanced geometry. The blade upper and lower surfaces are described by a curvilinear coordinate system, which was also used to divide the blade surfaces into panels. Two different acoustic formulations in the time domain were used to improve the speed and efficiency of the noise calculations: an acoustic formualtion with the Doppler factor singularity for panels moving at subsonic speeds and the collapsing sphere formulation for panels moving at transonic or supersonic speeds. This second formulation involves a sphere which is centered at the observer position and whose radius decreases at the speed of sound. The acoustic equation consisted of integrals over the curve of intersection for both the sphere and the panels on the blade. Algorithms used in some parts of the computer program are discussed. Comparisons with measured acoustic data for two model high speed propellers with advanced geometry are also presented.

B.D.

N80-27162# National Physical Lab., Teddington (England). Div. of Electrical Science.

A TECHNIQUE FOR CALIBRATING NOISE SOURCES AT MILLIMETRE AND SUBMILLIMETRE WAVELENGTHS

A. E. Costley, J. A. How (CEA, Fontenay aux Roses, France), and D. R. Vizard (Appleton Lab.) Mar. 1978 34 p refs
(NPL-DES-54) Avail: NTIS HC A03/MF A01

A technique for calibrating noise sources in the far infrared and millimeter wavelength range is described. Results obtained with a commercial neon gas discharge microwave noise tube in the range 60 less than F less than 900 GHz and at a minimum resolution of 5 GHz are presented. Also, a comparison is given of the power received from this tube in a typical millimeter/submillimeter wave spectroscopic system to that received with a conventional mercury arc lamp in the same arrangement. The results show that up to eight times more power per unit frequency interval was received with the noise tube over its rated operating range (90 to 140 GHz), indicating that these tubes are useful for broadband spectroscopy at millimeter wavelengths.

Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-27163* National Aeronautics and Space Administration. Pasadena Office, Calif.

MINIATURE CYCLOTRON RESONANCE ION SOURCE USING SMALL PERMANENT MAGNET Patent

Vincent G. Anicich (JPL) and Wesley T. Huntress, Jr., inventors (to NASA) (JPL) Issued 3 Jun. 1980 7 p Filed 11 Sep. 1978 Supersedes N80-12851 (18 - 03, p 0391) Sponsored by NASA
(NASA-Case-NPO-14324-1; US-Patent-4,206,383;
US-Patent-Appl-SN-940970; US-Patent-Class-313-362;
US-Patent-Class-250-427; US-Patent-Class-313-156;
US-Patent-Class-313-363) Avail: US Patent and Trademark Office CSCL 20H

An ion source using the cyclotron resonance principle is described. A miniaturized ion source device is used in an air gap of a small permanent magnet with a substantially uniform field in the air gap of about 0.5 inch. The device and permanent magnet are placed in an enclosure which is maintained at a high vacuum (typically 10 to the minus 7th power) into which a sample gas can be introduced. The ion beam end of the device is placed very close to an aperture through which an ion beam can exit into the apparatus for an experiment.

Official Gazette of the U.S. Patent and Trademark Office

N80-27164*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DIFFERENTIATION OF OPTICAL ISOMERS THROUGH ENHANCED WEAK-FIELD INTERACTIONS

S. Aronowitz Jun. 1980 13 p refs
(NASA-TM-81208; A-8212) Avail: NTIS HC A02/MF A01 CSCL 20 H

The influence of weak field interaction terms due to the cooperative effects which arise from a macroscopic assemblage of interacting sites is studied. Differential adsorption of optical isomers onto an achiral surface is predicted to occur if the surface was continuous and sufficiently large. However, the quantity of discontinuous crystal surfaces did not enhance the percentage of differentiation and thus the procedure of using large quantities of small particles was not a viable technique for obtaining a detectable differentiation of optical isomers on an achiral surface.

B.D.

N80-27165*# National Aeronautics and Space Administration, Washington, D. C.

INTERACTION OF THE INTERMEDIATE ENERGY NEUTRINO WITH NUCLEI

E. V. Bugayev, M. A. Rudzskiy, G. S. Bisnovatyy-Kogan, and Z. F. Seidov Jun. 1980 48 p refs Transl. into ENGLISH of "Vzaimodeystviye Neytrino Srednykh Energiy s Yadrami" Rept. PR-403 Acad. of Sci. USSR, Inst. of Space Research, Moscow, 1977 p 1-49 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76242) Avail: NTIS HC A03/MF A01 CSCL 20H

The interaction of the electronic neutrino with nuclei C-12, O-16, Ci-37, Fe-56, Ga-71, and Br81 is considered for neutrino energy up to 300 MeV. The nuclei are described by single-particle shell-model with Woods-Saxon potential. The parameters of the potential are specially chosen for each nuclei in order to describe correctly the upper occupied single particle levels of the nuclei. The cross sections for inelastic and elastic interactions of neutrino with nuclei are calculated within this model, taking into account charged and neutral current of weak interaction. The neutral currents are described by Weinberg theory. The results of the cross section calculations are presented and the comparisons with the results of the other authors are given. The possibilities of improvement of the exactness of obtained results are discussed. Some details of the calculations are included.

Author

N80-27166# California Univ., Berkeley. Lawrence Berkeley Lab.

COMPUTATIONAL METHODS FOR MOLECULAR STRUC-

TURE DETERMINATION: THEORY AND TECHNIQUE
1979 397 p Conf. held in Bloomington, Ind. 13-24 Aug. 1979
(Contract W-7405-eng-48; Grant NSF CHE-77-21305)
(LBL-9882; CONF-790892; NRCC-Proc-8) Avail: NTIS HC A17/MF A01

The use of state-of-the-art computer codes for the semi-empirical and ab initio computation of the electronic structure and geometry of small and large molecules is examined. The theoretical foundations of the codes are detailed. Computational quantum chemistry, self consistent field theory, generalized valence bond, the geometry of large systems, and molecular mechanics are among the topics discussed. DOE

N80-27167# Los Alamos Scientific Lab., N. Mex.
LARGE MOMENTUM TRANSFER NEUTRON PICKUP WITH THE (PI(+),p) AND (p,d) REACTIONS
Gregory Richard Smith (Schweizerisches Inst. fur Nuklearforschung) Jan. 1980 393 p refs
(Contract W-7405-eng-36)
(LA-8166-T) Avail: NTIS HC A17/MF A01

The (p,d) reaction was studied at 800 MeV on seven targets ranging from Li to Ca. The experimental resolution (400 keV) attained was sufficient to observe many discrete levels in each of the residual nuclei. A modified version of the one nucleon model successfully describes the magnitude and angular dependence of almost all of the transitions observed. A specific counter example to the two nucleon model of the reaction mechanism is suggested. The calculations are also sensitive to the neutron single particle wave function. High resolution measurements of the /p::(+),p/ reaction were also performed on (6)Li,(7)Li,(12)C, and (13)C at pion bombarding energies on and off the pion nucleon resonance. Calculations employing a one-nucleon model of the reaction mechanism similar to the model successfully used for the (p,d) reaction are unable to account for transitions in the /pi(+),p/ reaction. DOE

N80-27168# Argonne National Lab., Ill. High Energy Physics Div.
SPIN MEASUREMENTS IN NUCLEON-NUCLEON SCATTERING UP TO 12 GeV/c, AND PRESENT STATUS OF MANY DINUCLEON RESONANCES
Akihiko Yokosawa 8 Jan. 1980 35 p refs Presented at 2-Nucleon Systems and Dibaryon Resonances Meeting, Hiroshima
(Contract w-31-109-eng-38)
(ANL/HEP-CP-80-01; CONF-791174-1) Avail: NTIS HC A03/MF A01

The processes of proton-proton (PP) scattering for various spin directions are investigated in the beam momentum range of 1 to 12 GeV/c. Various pp scattering parameters are measured at 6 GeV/c, including three-spin parameters, which are sufficient to determine pp elastic scattering amplitudes in a model independent way at 0.2 < the absolute value of t < 0.8 (GeV/c) squared. Measurements of spin-spin correlation parameters have been extended to higher t and higher energies, revealing the importance of the spin-dependent interaction. These measurements may shed light on the nature of the constituents and their interactions. Diproton resonances in the mass region 2100 to 2800 MeV were discussed. Here are presented a number of candidates for I = 0 and I - 1 dinucleon resonances and summarized various evidence for the existence of resonances. DOE

N80-27169# Argonne National Lab., Ill.
MICROSCOPIC ANALYSIS OF PION-NUCLEUS INELASTIC SCATTERING
T. S. H. Lee 1980 12 p refs Presented at Nucl. Struct. with Intermediate Energy Probes Workshop, Los Alamos, N. Mex., 14-17 Jan. 1980
(Contract W-31-109-eng-1)
(CONF-800131-38) Avail: NTIS HC A02/MF A01

Theoretical methods of analyzing pion-nucleus inelastic scattering with energy near the (3,3) resonance are reviewed. It is illustrated that the DWIA in momentum space provides a reasonable tool to reveal microscopically the structure of nuclear states from the existing data. DOE

N80-27170# California Univ., Berkeley. Lawrence Berkeley Lab.
PHOTOELECTRON SPECTROSCOPY OF HEAVY ATOMS AND MOLECULES Ph.D. Thesis
Michael George White Jul. 1979 154 p refs
(Contract W-7405-eng-48)
(LBL-9527) Avail: NTIS HC A08/MF A01

The importance of relativistic interactions in the photoionization of heavy atoms and molecules is investigated by the technique of photoelectron spectroscopy. Experiments are reported which illustrate the effects of the spin orbit interaction in the neutral ground state, final ionic states and continuum states of the photoionization target. DOE

N80-27171# Oak Ridge National Lab., Tenn.
THE p, n REACTION AT INTERMEDIATE ENERGY
Charles D. Goodman 1979 30 p refs Presented at the Conf. on p,n Reaction and the Nucleon-Nucleon Force, Telluride, Colo., 29 Mar. 1979
(Contract W-7405-eng-26)
(CONF-790348-7) Avail: NTIS HC A03/MF A01

The use of the (p,n) reaction in exploring effective interactions is reviewed. Some recent data on self conjugate nuclei are presented, and the differences between low and high energy data are emphasized. Experimental problems and techniques used are briefly described. It is concluded that forward angle (p,n) spectra at energies greater than 100 MeV are dominated by Gamow-Teller (GT) transitions, while Fermi transitions dominate near 45 MeV. Prominent GT transitions are expected from a pion exchange interaction. DOE

N80-27172# Stanford Linear Accelerator Center, Calif.
PRODUCTION OF RESONANCES IN PHOTON-PHOTON COLLISIONS
Frederick J. Gilman Jan. 1980 18 p refs Presented at the Intern. Conf. on Two-Photon Interactions, Lake Tahoe, Nev., 30 Aug. - 1 Sep. 1979
(Contracts EY-76-C-03-0515; DE-AC03-76SF-00515)
(SLAC-PUB-2461; CONF-7908102-2) Avail: NTIS HC A02/MF A01

The subject of production of resonances via two photons in +e -e colliding beams is discussed. The quark content of these states and or the dynamics of their two photon decays are discussed. The charmonium states, a measurement of the two photon decay widths are presented. At LOP energies the cross sections for production of any particular state are rather small. The pi is examined. A measurement of this coupling is much easier using the complimentary technique. DOE

N80-27173# California Univ., Berkeley. Lawrence Berkeley Lab.
PROCEEDINGS OF THE WORKSHOP ON STOCHASTIC MOLECULAR DYNAMICS. NRCC PROCEEDINGS NO. 6
David Ceperley, ed. and John Tully, ed. 1979 69 p refs Conf. held at Woods Hole, Mass., 8-11 July 1979
(Contract W-7405-eng-48)
(LBL-9510; CONF-790735) Avail: NTIS HC A04/MF A01

Twenty papers are included which discuss methods for incorporating effects of surrounding media and for reducing the number of degrees of freedom by means of stochastic elements in molecular dynamics simulations. Many of the critical problems which currently limit the utility of molecular dynamics, stochastic dynamics, and Monte Carlo simulations were examined. Condensed phase processes, polymer motion, surface chemistry, and gas phase dynamics were explored. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-27174# JAYCOR, Alexandria, Va.
INVESTIGATION OF COLLECTION ION ACCELERATION

USING INTENSE RELATIVISTIC ELECTRON BEAMS Final Report, 11 Dec. 1978 - 13 Dec. 1979
Frederick Mako Feb. 1980 30 p refs
(Contract N00173-79-C-0408)
(AD-A081958; JAYCOR-320-80-002-FR) Avail: NTIS HC A03/MF A01 CSCL 20/7

Recently there has been an increased interest in a compact high energy intense light-ion accelerator. Some of the areas of application for such an accelerator include directed energy research, inertial fusion and magnetic fusion. The new approach that has been proposed for investigation is the space charge wave accelerator. With the space charge wave type of collective ion acceleration scheme, one can expect a compact, efficient ion accelerator which is capable of producing high energy and high current ion beams. The ion energy limit occurs when the ion velocity equals that of the electrons. Thus, for an easily producible 1 MeV electron beam about 2 GeV protons are expected. Since a large number of electrons are needed for an intense relativistic electron beam, a proportional but smaller number of ions are expected by momentum balance. With an accelerating electric field having a strength of 1 MV/cm, the 2 GeV proton can be obtained in a short accelerator length of 20 meters. GRA

N80-27175# Rockwell International Corp., Richland, Wash.
RADIOACTIVE LIQUID WASTES DISCHARGED TO GROUND IN THE 200 AREAS DURING 1978
J. D. Anderson and B. E. Poremba 26 Mar. 1979 235 p refs
(Contract EY-77-C-06-1030)
(RHO-CD-78-34-4Q) Avail: NTIS HC A11/MF A01

The radioactive liquid wastes that have been discharged to the ground in the 200 Areas are summarized. In addition to data for 1978, cumulative data since plant startup are presented. Also,a listing of decayed activity to the various plant sites is given. DOE

N80-27176# Exxon Nuclear Idaho Co., Inc., Idaho Falls.
OVERVIEW OF HIGH-LEVEL WASTE MANAGEMENT ACCOMPLISHMENTS
H. Lawroski, J. R. Berreth, and W. A. Freeby 1980 14 p refs Presented at Waste Management Conf., Tucson, Ariz., 10 Mar. 1980
(Contract EX-76-C-07-1570)
(CONF-800313-3) Avail: NTIS HC A02/MF A01

Storage of power reactor spent fuel is discussed in relation to the lack of reprocessing operations particularly in the U.S. By considering the above solidification and storage scenario, there is more than reasonable assurance that acceptable, stable, low heat generation rate, solidified waste can be produced and safely disposed. By maintaining the liquid and solidified high level waste in secure, above ground storage until acceptable decay heat generation rates are achieved, by producing a compatible, high integrity, solid waste form, by providing a second or even third barrier as a compound container and by inserting the enclosed waste form in a qualified repository with spacing to assure moderately low temperature disposal conditions, there appears to be no technical reason for not progressing further the disposal of high level wastes and needed implementation of the complete nuclear power fuel cycle. DOE

N80-27177# Los Alamos Scientific Lab., N. Mex.
SPACE NUCLEAR REACTOR POWER PLANTS
D. Buden, W. A. Ranken, and D. R. Koenig Jan. 1980 33 p refs
(Contract W-7405-eng-36)
(LA-8223-MS) Avail: NTIS HC A03/MF A01

Nuclear power is probably the only source for some deep space missions and a major competitor for many orbital missions, especially those at geosynchronous orbit. Because of the potential requirements, a technology program on space nuclear power plant components was initiated. The missions that are foreseen, the current power plant concept, the technology program plan, and early key results are described. DOE

N80-27178# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT OF ADVANCED CONCEPTS FOR IMPROVED HEAVY WATER PRODUCTION TECHNOLOGY Quarterly report, 1 Oct. - Dec. 1979
F. T. Aldridge, I. P. Herman, J. B. Marling, and L. L. Wood 5 Feb. 1980 31 p refs
(Contract W-7405-eng-48)
(UCID-17736-79-4) Avail: NTIS HC A03/MF A01

During the last quarter, work continued on deuterium separation by metal hydride chromatography and by CO2 laser multiple-photon dissociation (MPD). In the chromatographic process Ca8Ni4 Cu plus Ni powder mixtures were examined as possible column materials. The photochemical studies centered on further investigation of the quite promising technqiue of MPD of trifluoromethane. DOE

N80-27179# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
DEVELOPMENT OF TAILORED CERAMICS FOR GEOLOGIC STORAGE OF NUCLEAR WASTES Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
15 Feb. 1980 25 p
(Contract DE-AC09-79ET-41900)
(DOE/ET-41900/T1) Avail: NTIS HC A02/MF A01

Tailored ceramics are crystalline assemblages which closely approximate those found in natural minerals and are made by high temperature and pressure consolidation of a nuclear waste with selected additives. The multitask program includes generic and fundamental studies, formulation and consolidation studies, radiation and transmutation effects, and geologic compatibility. Equipment development and process evaluation techniques are included. DOE

N80-27180# Department of Energy, Washington, D. C. Div. of Spent Fuel Storage and Transfer.
SPENT FUEL STORAGE REQUIREMENTS: THE NEED FOR AWAY-FROM-REACTOR STORAGE
Jan. 1980 12 p
(DOE/NE-0002) Avail: NTIS HC A02/MF A01

The away-from-reactor storage requirements estimate published in February 1979 are updated to reflect recent data on reactor operations and spent fuel storage. In addition to the updates of cases representing the range of AFR requirements in DOE/ET-0075, new cases of interest reflecting utility and regulatory trends are presented. DOE

N80-27181# California Univ., Livermore. Lawrence Livermore Lab.
SOLID STATE TRACK DETECTORS IN THE INERTIAL CONFINEMENT FUSION PROGRAM AT LLL
N. M. Ceglio and E. V. Benton (San Francisco Univ.) 30 Jan. 1980 27 p refs Presented at the 10th Intern. Conf. on Solid State Nucl. Track Detectors, Lyon, 2-7 Jul. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-82550-Rev-1; CONF-790765-4) Avail: NTIS HC A03/MF A01

Two recent conference papers on the use of cellulose nitrate and CR-39 to diagnose laser fusion targets are combined with a chronological introduction and update to efforts in this area. DOE

N80-27182# R and D Associates, Marina Del Rey, Calif.
HIGH ENERGY BREMSSTRAHLUNG IN AN INTENSE LASER FIELD
L. Schlessinger and J. A. Wright Feb. 1980 24 p refs
(Contract W-7405-eng-48)
(UCRL-15200; RDA-TR-114000-001) Avail: NTIS HC A02/MF A01

The cross section for bremsstrahlung emission and absorption by electrons in an intense laser field was calculated in the Born approximation for the electron ion potential. Typical numerical results are presented as a function of the ratio of the electron quiver energy to its energy and the ratio of the bremsstrahlung energy to the electron energy. The intense field correction factor for the rate of bremsstrahlung emission and absorption for electrons with a Boltzmann distribution of energies was calculated. Numerical results for the correction factor are presented for the Boltzmann case as a function of the ratio of the electron quiver energy to its thermal energy and the ratio of the

bremsstrahlung energy to the thermal energy. For typical laser fusion parameters, this correction factor which is the ratio of the thermal bremsstrahlung emission rate in the intense laser field to the rate at zero field can be quite significant. DOE

N80-27183# California Univ., Livermore. Lawrence Livermore Lab.
MODELING OF BEAM FOCUSING AND KINK INSTABILITY FOR COLLIDING RELATIVISTIC ELECTRON AND POSITRON BEAMS
William M. Fawley and Edward P. Lee 8 Feb. 1980 23 p refs
(Contracts W-7405-eng-48; N60921-80-WR-W0188; ARPA Order 3718)
(UCID-18584) Avail: NTIS HC A02/MF A01

A simulation code was developed and exercised to study the time evolution and resultant luminosity of intersecting pulses of electrons and positrons. Under the extreme conditions of high current and small radius recently proposed, the pulses mutually pinch to a smaller mean radius than that achieved by free flight alone. The effective luminosity is enhanced by a factor of about 3 in the best case, corresponding to zero initial emittance and pulse length equal 1/4 the mean betatron wavelength. Gaussian profiles in the longitudinal and transverse coordinates are preferred over flat profiles in order to minimize disruptive oscillations in radius which reduce luminosity. A second potential source of disruption is the kink instability. This is always present to some degree during the interaction of opposed pulse. However, the maximum growth rate is only one half the angular betatron frequency and therefore mode growth is limited to a very low level if the pulses are short compared with a betatron wavelength. DOE

N80-27184# Nantes Univ. (France). Lab. de Spectroscopie Nucleaire.
CLASSICAL STUDIES OF THE ELLIPSOIDAL SHAPES FOR DYNAMICAL DEFORMATION THEORIES OF THE NUCLEUS
B. Remaud 1979 36 p refs
(LSNN-78-04) Avail: NTIS HC A03/MF A01

The shape dependent functions of the liquid drop and the droplet models are analytically calculated for an ellipsoid. Using the ellipsoidal symmetries, these functions (including the curvature function) are written in terms of three basic expressions. The nuclear deformation energy can be calculated in a simple way for axially symmetric and asymmetric ellipsoidal nuclei whatever the magnitude of the deformation. Author (ESA)

74 OPTICS

Includes light phenomena.

N80-27185* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHROMATICALLY CORRECTED VIRTUAL IMAGE VISUAL DISPLAY Patent
William M. Kahlbaum, Jr., inventor (to NASA) Issued 10 Jun. 1980 4 p Filed 23 Oct. 1978
(NASA-Case-Lar-12251-1; US-Patent-4,206,970; US-Patent-Appl-SN-953389; US-Patent-Class-350-175E; US-Patent-Class-350-226) Avail: US Patent and Trademark Office CSCL 20F

An in-line, three element, large diameter, optical display lens is disclosed which has a front convex-convex element, a central convex-concave element, and a rear convex-convex element. The lens, used in flight simulators, magnifies an image presented on a television monitor and, by causing light rays leaving the lens to be in essentially parallel paths, reduces eye strain of the simulator operator.
Official Gazette of the U.S. Patent and Trademark Office

N80-27186# Hughes Research Labs., Malibu, Calif.
FIBER OPTICS DELAY LINE (250 KHz - 250 MHz) Final Report, 15 Mar. - 15 Sep. 1979
C. W. Slayman, H. W. Yen, W. H. Wallace, and R. R. Burns Mar. 1980 50 p
(Contract N00173-79-C-0098)
(AD-A083616) Avail: NTIS HC A03/MF A01 CSCL 20/1

Three stabilized semiconductor laser transmitters, one photodiode-amplifier module, and one 475-m section of optical fiber were packaged for application in a fiber-optic delay line. The design and performance of the transmitter and receiver are presented over a bandwidth of 50 kHz to 350 MHz. The entire system, consisting of a transmitter-fiber-receiver, displays a dynamic range of 30 dB or better and a pulse delay of 2.2 microseconds. The system is flat to + or - 1 dB across the entire band. GRA

N80-27187# Hughes Aircraft Co., Culver City, Calif.
TECHNIQUES FOR FABRICATING HIGH RESOLUTION LIQUID CRYSTAL RETICLES Interim Technical Report, Oct. 1978 - Sep. 1979
Barry C. Gilbert Dec. 1979 54 p
(Contract DAAK10-78-C-0386)
(AD-A083286; HAC-FR-80-72-505; HAC-REF-E1635) Avail: NTIS HC A04/MF A01 CSCL 20/6

The overall objective of this two-phase program was to develop techniques for fabricating high resolution liquid crystal reticles suitable for military application. The first phase of this program consisted of three technology development tasks, namely substrate improvements, liquid crystal seals, and electronic seals. The goal of each development task was successfully accomplished. Results are summarized below: (1) Techniques were developed to produce 98 percent working electrode lines without repair (100 percent with repair) on LCR plates with a density of 580 lines per inch. Results were verified by optical inspection and electrical test. (2) LC cells fabricated with Ablefilm 539 sealant have now surpassed 7000 hours at -80 C and -17 C without cell deterioration. Additional cells with bulk electrodes and continuous AC voltage have surpassed 6200 hours at -25 C without alignment change. Other cells fabricated with Ablefilm 539 showed no signs of weakening when exposed to liquid nitrogen or boiling water conditions. (3) A dual coating of silicon nitride and parylene demonstrated moisture protection, but the process was costly to apply and difficult to repair. Conventional hybrid solder sealing technology was used to devise two alternate packaging concepts to maximize producibility and maintainability with potentially lower production costs. GRA

N80-27188# Los Alamos Scientific Lab., N. Mex.
FIBER-OPTICS TECHNOLOGY REVIEW
Peter B. Lyons 1980 19 p refs Presented at DNA Symp. on Fiber Optics in the Nucl. Environment, Washington, D.C., 25-27 Mar. 1980
(Contract W-7405-eng-36)
(LA-UR-80-667; CONF-800322-2) Avail: NTIS HC A02/MF A01

A history of fiber technology is presented. The advantages of fiber optics are discussed (bandwidth, cost, weight and size, nonmetallic construction, and isolation). Disadvantages of fiber systems discussed are fiber and cable availabilty, fiber components, radiation effects, receiver and transmitters, and material dispersion. Development of fibers and systems optimized for use at wavelengths near 1.3 micrometers and development of wavelengths multiplexers for simultaneous system operation at several wavelengths. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-27189*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
PLASMA PHYSICS ANALYSIS OF SERT-2 OPERATION
Harold R. Kaufman Jan. 1980 59 p refs
(Grant NsG-3011)
(NASA-CR-159814) Avail: NTIS HC A04/MF A01 CSCL 20I

An analysis of the major plasma processes involved in the SERT 2 spacecraft experiments was conducted to aid in the

interpretation of recent data. A plume penetration model was developed for neutralization electron conduction to the ion beam and showed qualitative agreement with flight data. In the SERT 2 configuration conduction of neutralization electrons between thrusters was experimentally demonstrated in space. The analysis of this configuration suggests that the relative orientation of the two magnetic fields was an important factor in the observed results. Specifically, the opposed field orientation appeared to provide a high conductivity channel between thrusters and a barrier to the ambient low energy electrons in space. The SERT 2 neutralizer currents with negative neutralizer biases were up to about twice the theoretical prediction for electron collection by the ground screen. An explanation for the higher experimental values was a possible conductive path from the neutralizer plume to a nearby part of the ground screen. Plasma probe measurements of SERT 2 gave the clearest indication of plasma electron temperature, with normal operation being near 5 eV and discharge only operation near 2 eV. E.D.K.

N80-27190# Toronto Univ., Downsview (Ontario). Institute for Aerospace Studies.

A STUDY OF THE CHARACTERISTICS OF AN ATMOSPHERIC PRESSURE MICROWAVE-INDUCED ARGON PLASMA

S. K. Wong May 1980 62 p

(UTIAS-TN-225; CN-ISSN-0082-5263) Avail: NTIS HC A04/MF A01

A microwave induced argon plasma is produced at atmospheric pressure in a capacity loaded resonant cavity operated at 2450 MHz and 100 to 300 watts. Plasma parameters such as electron temperature and electron density are measured spectroscopically under various argon flow rates and power inputs to the cavity. The gas translational temperature of the plasma is estimated by measuring the rotational temperature of C2 molecules, this is done by mixing 5% of methane by volume with the argon gas. The general characteristics of the microwave induced argon plasma as a possible ion source for mass spectroscopy are studied. E.D.K.

N80-27191# Colorado Univ. at Boulder. Dept. of Astro-Geophysics.

PLASMA WAVE TURBULENCE AND PARTICLE HEATING CAUSED BY ELECTRON BEAMS, RADIATION AND PINCHES Final Report, 1 Aug. 1976 - 1 Oct. 1979

Martin V. Goldman Nov. 1979 528 p refs Submitted for publication

(Contract F49620-76-C-0005; AF Proj. 2301)

(AD-A081883; CU-1036; AFOSR-80-0167TR) Avail: NTIS HC A23/MF A01 CSCL 20/9

For electron beams, a theory of the dynamics of driven Langmuir wave turbulence was developed. In low density beams, Langmuir wave evolution was found to be governed by nonlinear index of refraction effects, and associated self-focusing, rather than by wave reaction back on the beam. In laser-plasma interactions, the nonlinear theoretical work was verified experimentally in collaboration with Dr. N. Peacock of Culham Laboratories. In an experiment on nonlinear interactions of a carbon dioxide laser with a dense plasma focus device, almost 100 percent anomalous absorption of the radiation was observed along with intense Langmuir turbulence. The results were published in Physical Review Letters. A classical theory of the Raman-induced Kerr effect was developed. A computer code was developed to help determine plasma temperatures, radiation, impurity distributions, and overall plasma evolution in Z-pinch plasmas. GRA

N80-27192# STD Research Corp., Arcadia, Calif.

OPEN-CYCLE MHD SYSTEMS ANALYSIS Final Report

R. A. Harvey, C. D. Maxwell, J. L. Miller, and S. T. Demetriades Nov. 1979 156 p refs Sponsored by Electric Power Research Inst.

(EPRI-AF-1230) Avail: NTIS HC A08/MF A01

The power plant performance and economic characteristics of six open cycle magnetohydrodynamics (MHD) power plant options are investigated: four with directly fired air preheaters, one with separately fired air preheaters, and one using oxygen enrichment. Using the directly fired options, the effects of high sulfur Eastern coal and low sulfur Western coal, sulfur emissions control by seed regeneration and by wet limestone scrubbers, and slag removal performance in the MHD combustor unit are compared. Critical components requiring further development are identified. DOE

N80-27193# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.

PERFORMANCE ANALYSES OF ELMO BUMPY TORUS PLASMAS AND PLASMA SUPPORT SYSTEMS

Max E. Fenstermacher 31 Dec. 1979 110 p refs Prepared for Westinghouse Elec. Corp., Pittsburgh

(Contract EG-77-C-02-4231)

(WFPS-TME-79-030) Avail: NTIS HC A06/MF A01

The development and application of the OASIS Code (operational analysis of ELMO bumpy torus support and ignition systems) for the study of ELMO bumpy torus (EBT) device and plasma performance are presented. The code performs a time independent, zero dimensional, self consistent calculation of plasma and plasma support systems parameters for the physics and engineering of EBT devices. The features of OASIS modeling for the EBT plasma include: (1) particle balance of the bulk toroidal and electron ring plasma components for experimental as well as reactor devices; (2) energy balance in the bulk and ring plasmas for externally heated or ignition devices; (3) alpha particle effects for reactor devices; (4) auxiliary heating effects, including microwave RF heating and neutral beam methods; and (5) ignition conditions, including fusion power, alpha power, and neutron wall loading. DOE

N80-27194# Oxford Univ. (England). Dept. of Engineering Science.

ELECTRON BEAM SCATTERING IN PARTIALLY IONIZED GASES

Denis R. Gross Mar. 1979 117 p refs

(Contract AT/2057/042)

(OUEL-1283/79) Avail: NTIS HC A06/MF A01

The scattering of a tenuous (10 to the minus 10th power amps) medium energy (10-30 KeV) electron beam in a partially ionized gas was investigated with a view to developing a diagnostic for weakly ionized low density gas flows. An electron beam 100 microns in diameter was passed through a hollow cathode discharge in a direction parallel to the axis of the cylindrical cathode. The discharge occurred in helium and argon gases at pressures between 0.3 and 2.0 torr. Maintaining the electron beam current at 10 to the minus 10th power amps ensured that any collective interaction between the beam and the plasma would be negligible in comparison with the collisional interaction. Beam profile results were in fair agreement with Langmuir probe results taken in the same discharge. Typically, ion densities of the order of 3 x 10 to the 17th power per cu were found. It is concluded that the electron beam constitutes a valid diagnostic for measurements of charged particle density, and that the correctness of the theories of multiple scattering in plasma is indicated. Author (ESA)

N80-27195# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.

A PROGRAM TO SOLVE ROTATING PLASMA PROBLEMS

M. Bakker and M. S. vandenBerg (FOM Inst. voor Atoom- en Molecuulfysica) Aug. 1979 39 p refs Submitted for publication

(MC-NW-70/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5

It is shown that the solution of a rotating plasma problem minimizes a suitably chosen functional. The variational problem is solved by means of the Ritz-Galerkin method using piecewise bilinear functions and applying Newton-Cotes-like quadrature. The resulting linear system with sparse non-negative definite matrix is solved by an adaptive conjugate gradient method. A documented FORTRAN program is presented for solving the elliptic boundary problem. Author (ESA)

N80-27196# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.

DIAGNOSTICS AND SIMULATION OF THE INITIAL IONIZATION IN NaCl-CONTAMINATED ARGON PLASMA

C.-P. Schneider and G. Hahne (Hochschule der Bundeswehr, Munich) 17 Jul. 1979 19 p refs

(MBB-UA-498-79Oe) Avail: NTIS HC A02/MF A01

A method for cleaning shock tubes was investigated which involves glass bead peening of the shock-tube walls followed by multiple flushing of the tube. This method, however, left a practically irreducible and non-negligible residue of sodium chloride vapor in the tube. The observed time dependence of the electron density, the electron temperature, and the emitted sodium D light, in shock-heated argon contaminated by a small amount of sodium chloride vapor was simulated theoretically. It was found that accounting for the effects of contaminants requires important revisions in rate constants for pure argon from previously determined values. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-27197*# National Aeronautics and Space Administration, Washington, D. C.

CHARACTERIZATION AND GROWTH OF EPITAXIAL LAYERS OF Ga EXHIBITING HIGH RESISTIVITY FOR IONIC IMPLANTATION

Dec. 1979 91 p refs Transl. into ENGLISH of Final Report (Limeil-Brevannes, France), LEP-79/19, SME-441-H and DGRST-76-7-0067, Dec. 1977 p 1-90 Translation was announced as N79-24881 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Lab. D'Electronique et de Physique Appliquee, LimeilBrevannes, France

(Contract NASw-3198)

(NASA-TM-75747; LEP-79/19; SME-441-H; DGRST-76-7-0067) Avail: NTIS HC A05/MF A01 CSCL 20L

Either classical or low temperature epitaxial growth techniques can be used to control the deposition of buffer layers of GaAs on semiconducting substrates and to obtain the resistivity and purity desired. Techniques developed to study, as a function of thickness, the evolution of mobilities by photoHall, and the spectroscopy of shallow and deep centers by cathodoluminescence and current transients reveal one very pure layer of medium resistivity and high mobility, and another 'dead layer' of elevated resistivity far from the surface. The highly resistive layer remains pure over several microns, which appears interesting for implantation. A.R.H.

N80-27198# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.

GaAs MONOLITHIC MICROWAVE SUBSYSTEM TECHNOLOGY BASE Technical Report, 30 Sep. 1978 - Sep. 1979

J. G. Oakes and J. E. Degenford Jan. 1980 242 p refs

(Contract N00014-78-C-0268; DARPA Order 3543)

(AD-A083613; Rept-80-0077; NR-251-029-10) Avail: NTIS HC A11/MF A01 CSCL 09/5

During the period covered by this report, a number of decisions on GaAs material growth and processing, improvements in device design, and changes in device and circuit fabrication were made. In addition, all of the required processing fabrication and measurement equipment has become fully operational. The above, in turn, have resulted in: (1) increased yields of FET devices, (2) more uniform DC and RF characteristics, (3) improved FET performance as demonstrated by substantially higher output power per unit of gate width and higher power added efficiency, and (4) a faster program pace as manifested by more device and monolithic circuit processing runs per unit time. The benefits of the Melbourn Liquid Encapsulated Czochralski facility are becoming evident as large diameter, low impurity GaAs boules grown in pyrolitic boron nitride crucibles are available and being used in this program. Measurements of mobilities have shown values close to the theoretical limit for the case of a zero background impurity level, i.e., a mobility of 5500 for n = 5 x 10 to the 16th power. GRA

N80-27199# Hughes Research Labs., Malibu, Calif.

GALLIUM ARSENIDE ADVANCED CRYSTAL GROWTH AND BEAM PROCESSING Final Progress Report, 1 May 1978 - 30 Jul. 1979

C. L. Anderson Jan. 1980 133 p refs

(Contract N00014-78-C-0337; ARPA Order 3564)

(AD-A083096) Avail: NTIS HC A07/MF A01 CSCL 20/2

This report describes the progress made during a fifteen month program to study the feasibility of growth of high purity epitaxial quality bulk GaAs crystals from solution and annealing of implanted layers and Ohmic contacts for device applications using laser and electron beams. Millimeter-thick crystals have been grown by the low-temperature solution-growth process. Room-temperature n-type carrier concentrations of 2 times 10 to the 15th power/cu cm and liquid nitrogen mobilities of 30,000 sq cm/V/sec have been achieved. Theoretical studies of a variety of potential growth configurations were performed. A detailed study of the laser of annealing implanted layers and Ohmic contacts was performed using several Q-switched and cw lasers. State-of-the-art results were achieved in both the implant-annealing and Ohmic-contact areas. Preliminary investigations of the annealing of implanted layers and Ohmic contacts using pulsed electron beams were also performed. GRA

N80-27200# Cornell Univ., Ithaca, N. Y. Materials Science Center.

ELECTRON DIFFRACTION AND MICROSCOPY STUDIES OF THE STRUCTURE OF GRAIN BOUNDARIES IN SILICON

C. B. Carter, H. Foell, D. G. Ast, and S. L. Sass Feb. 1980 42 p refs

(Contract EY-76-S-02-2899)

(COO-2899-T2; MSC-4151) Avail: NTIS HC A03/MF A01

The diffraction effects expected from the periodic structure of twist boundaries in Si were determined by an examination of the reciprocal lattice of these boundaries. Methods of analysis were developed to distinguish between the real diffraction spots due to the periodic boundary structure and those due to double diffraction effects. The electron microscope images for the boundaries studied in Si bicrystals frequently were complex and contained Moire fringes which provided no information on the actual boundary structure. By analyzing the electron diffraction patterns from these boundaries for the presence of new diffraction spots it was possible to show that all the sigma 1/001/, sigma 1/111/, sigma 3/111/ twist boundaries examined have a periodic structure. DOE

N80-27201# Stanford Linear Accelerator Center, Calif.

ELECTRON TRAJECTORY PROGRAM

William B. Herrmannsfeldt Nov. 1979 119 p refs

(Contract EY-76-C-03-0515; DE-AC03-76SF-00515)

(SLAC-226) Avail: NTIS HC A06/MF A01

SLAC electron trajectory program is described and instructions and examples for users are given. The program is specifically written to compute trajectories of charged particles in electrostatic and magnetostatic focusing systems including the effects of space charge and self-magnetic fields. Starting options include Child's Law conditions on cathodes of various shapes. Either rectangular or cylindrically symmetric geometry may be used. Magnetic fields may be specified using arbitrary configurations of coils, or the output of a magnet program such as Poisson or by an externally calculated array of the axial fields. The program is available in IBM FORTRAN but can be easily converted for use on other brands of hardware. The program is intended to be used with a plotter whose interface the user must provide. DOE

N80-27202# Northwestern Univ., Evanston, Ill.

INVESTIGATION OF DEEP LEVEL DEFECTS IN EPITAXIAL SEMICONDUCTING ZINC SULPHO-SELFNIDE Progress Report, 15 Jun. 1979 - 14 Jun. 1980

B. W. Wessels 1980 33 p

(Contract DE-AC02-79ER-10390)

(DOE/ER-10390) Avail: NTIS HC A03/MF A01

In an effort to understand the defect structure of the ternary 2-6 compound zinc sulpho-selenide, the binary compound zinc selenide was investigated. Thin single crystalline films of zinc selenide were heteroepitaxially grown on (100) GaAs. Epitaxial layers from 5 to 50 microns thick could be readily grown using a chemical vapor transport technique. The layers had an excellent morphology with few stacking faults and hillocks. Detailed epitaxial growth kinetics were examined as a function of temperature

and reactant concentration. It was found that hydrogen flow rate, source and substrate temperature affect the growth rate of the epitaxial films. Au - ZnSe Schottky barrier diodes and ZnSe - GaAs n-p heterojunctions were prepared from the epitaxial layers. Current-voltage characteristics were measured on both types of diodes. From capacitance-voltage measurements the residual doping density of the epitaxial layers were found to be of the order of 10 to the 14th power to 10 to the 15th power/cu cm. Finally, the deep level spectrum of both the Schottky barrier diodes and the heterojunctions are being measured. Deep level transient spectroscopy appears to be well suited for determining trapping states in ZnSe provided the material has a low enough resistivity. DOE

N80-27203# General Electric Co., Schenectady, N. Y.
INFLUENCE OF PHASE BOUNDARIES OF PHOTOINDUCED ELECTRON TRANSFER REACTIONS Final Report, 1 Jul. 1977 - 31 Aug. 1979
George L. Gaines, Jr. Aug. 1979 9 p refs
(Contract EG-77-C-02-4395)
(COO-4395-1) Avail: NTIS HC A02/MF A01

A summary is presented of results of research which was conducted on bipyridyl complexes of ruthenium, with the objective of storing visible light energy. The research covered analytical techniques, synthesis, properties of Ru complexes in monolayers and micelles, and luminescence quenching. DOE

N80-27204# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.
ADVANCED ION IMPLANTATION TECHNIQUES Final Report
Arno Kostka and Wilfried Quast. Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 72 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. (BMFT-FB-T-79-37) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14.70

Three different applications of ion implantation techniques were developed and tested for their production compatibility. The implantation of gold ions into the back of diode wafers allowed a more precise control of reverse recovery times than with conventional methods. The implantation of boron ions into the region near the surface of pnp transistors suppressed effects caused by inversion of the collector zone. Using the lateral component during diffusion from implanted sources, HF MOSFETS were fabricated with very small channel lengths. Author (ESA)

N80-27206# Bureau of Mines, Avondale, Md.
METHODOLOGY FOR EVALUATING INTEGRAL GAUSSIAN PROFILES
Arthur B. Campbell 1980 24 p refs
(PB80-158595; BM-IC-8811) Avail: NTIS HC A02/MF A01 CSCL 20L

A method that uses a computer program to evaluate integral Gaussian profiles of atomic concentration versus depth in a solid is described. The specific use illustrated involves profiling ion implanted metals using proton induced X-ray emission analysis and ion sputtering for sectioning. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-27208# Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.
AN ANALYSIS OF THE IRREVERSIBLE THERMODYNAMICS MODEL FOR COUPLED HEAT AND MOISTURE TRANSPORT PHENOMENA IN UNSATURATED POROUS MEDIA
J. A. Havens 1980 125 p refs
(PB80-149321; PUB-67; W80-03639; OWRT-A-042-ARK(2))
Avail: NTIS HC A06/MF A01 CSCL 20M

An irreversible thermodynamics based model for the description of coupled heat and moisture transfer was analyzed. The transport coefficients appearing in the model equations were independently determined, and the equations were numerically integrated to predict temperature and moisture content profiles for a closed system of water unsaturated glass beads. An experimental investigation of the moist glass beads medium provided measurements of steady state profiles of local temperatures and moisture content. These data when compared with model predictions, indicated the validity of the irreversible thermodynamics approach. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-27207# Environmental Law Inst., Washington, D. C.
ENERGY-EFFICIENT PROCUREMENT IN STATE AND LOCAL GOVERNMENTS
Joe W. Russell, Jr. Jul. 1979 70 p refs
(Contract EM-78-C-01-5255)
(DOE/CS-5255/1) Avail: NTIS HC A04/MF A01

State and local governments have been slow in preparing and implementing plans for energy conservation with resepect to the development of energy efficient standards and policies. This lack of compliance with the Energy Policy and Conservation Act is due to a lack of reliable information on many energy-consuming products, a resistance to change on the part of purchasing officials to their superiors, and reluctance in the tax revolt era to spend money in order to save money and energy as well. To overcome these obstacles, states and localities should consider mandating energy-efficient procurement pratices through either executive orders or legislation. In addition, states and localities should consider adopting institutional arrangements, such as centralized purchasing and joint or cooperative purchasing that will facilitate energy-efficient procurement. Life cycle costs should be considered as bid evaluation criterion. To further state and local efforts in this area, the federal government should provide technical and financial assistance to an organization of purchasing officials to establish an information clearinghouse. A.R.H.

N80-27208# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
QA MANAGEMENT APPROACH UNIQUE TO R AND D PROGRAMS
R. J. Beaver and J. R. Weir, Jr. 1980 7 p Presented at the 34th Ann. Tech. Conf. of the Am. Soc. for Quality Control, Atlanta, 20 May 1980
(Contract W-7405-eng-48)
(CONF-800505-1) Avail: NTIS HC A02/MF A01

The approach to the current quality assurance management of the Metals and Ceramics Division at ORNL is discussed. The organization disciplines interrelate with the QA programming. Procedure QA-MC-1-100 defines control of experimental tasks, which represent about 90% of the Division's work. Procedure QA-MC-1106 defines action plans for projects. The QA coordinator, independent of line management, communicates, audits, and reviews to assist line management in the understanding and acceptance of the Division QA procedures. DOE

N80-27209# Office of Personnel Management, Washington, D.C. Personnel Research and Development Center.

THE DESIGN AND DEVELOPMENT OF AN INTERORGANIZATIONAL PERFORMANCE EVALUATION AND REFERRAL SYSTEM Final Report
Charles N. MacLane Aug. 1979 39 p refs
(PB80-151012; TM-79-19) Avail: NTIS HC A03/MF A01 CSCL 05I

There has been an increasing recognition that performance appraisal (PA) research should begin from open-systems assumptions. Evidence supporting this view comes from studies showing that contextual variables such as change in organizational setting, rater organizational level, and composition of subordinate work group may explain useful amounts of variance in PA outcomes. In view of these findings, the development of valid and reliable PA instruments for inter-organizational use presents some methodological problems. The development of such a system incorporating a behavioral expectation scale approach which generates measures of the equivalency of performance behavior domains and performance standards across organizations is described. GRA

N80-27249# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE IMPORTANCE OF THE LONG-TERM PLANNING OF THE EUROPEAN SPACE AGENCY FOR SPACE RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY
K. Pinkau *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p. 219-232 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-27210# Calculon Corp., Philadelphia, Pa.
DISTRIBUTED DATA BASE TECHNOLOGY STATE-OF-THE-ART REVIEW Final Technical Report, Mar. 1978 - Sep. 1979
Griffiss AFB, N.Y. RADC Feb. 1980 80 p refs
(Contract F30602-78-C-0113; AF Proj. 4594)
(AD-A082037; RADC-TR-80-7) Avail: NTIS HC A05/MF A01 CSCL 09/2

This document provides theoretical information relating to the development of information systems where large data bases are utilized. The study considers the problems associated with the construction, implementation and maintenance of those data bases in a distributed processing environment. The data base management systems, data communications networking and the utilization of multi-processor configurations are also included in the investigation. Four specific problem areas of the update function under the distributed concept were studied and are reported upon. They are data integrity, logging and recovery, deadlock and security. GRA

N80-27211# Instituut TNO voor Wiskunde, Informatieverwerking en Statistiek, The Hague (Netherlands).
A LOOSE BUT INDULGENT RETRIEVAL STRATEGY FOR COMPUTERS [EEN SLORIDGE MAAR TOEGEEFIJKE ZOEKSTRATEGIE VOOR COMPUTERS]
T. deHeer Mar. 1978 20 p refs In DUTCH; ENGLISH summary
Avail: NTIS HC A02/MF A01

A retrieval system design is described in which information records consisting of pieces of natural language are attached to each other, leaving fuzzy semantic traces behind in the form of sets of three letter strings which have been derived from the original texts. The system calculates an 'importance value' for each possible answer to a user query. Queries also may be given in the form of a simple piece of natural language. Answers are communicated to the user, if he so wishes, in descending order of 'importance value' as calculated by the system. Author (ESA)

N80-27100# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
COMPUTERIZED LITERATURE SEARCHING IN THE GEOGRAPHIC SCIENCES [LITERATUUR ZOEKEN MET DE COMPUTER, IN HET BIJZONDER BIJ DE GEOGRAFISCHE WETENSCHAPPEN]
Piet Tielman *In its* The Computer in Phys. Geograph. 1979 p 63-89 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-27212 Societe Nationale Industrielle Aerospatiale, Paris (France). Direction Centrale Industrielle.
VALUE ANALYSIS FOR THE AIRCRAFT AIRBUS [L'ANALYSE DE LA VALEUR DANS UN PROGRAMME INTERNATIONAL]
Robert Tessinari 1979 34 p In FRENCH Presented at Soc. of Am. Value Eng. Intern. Conf. on Save Proc., Vol. 19, 1979 (SNIAS-792-501-105) Avail: NTIS HC A03

The implementation of an agreement among Germany, England, France, Netherlands, and more recently, Spain, to develop a transport aircraft is discussed with emphasis on the economic and technical aspects involved. The method in which the various tasks were assigned and performed is described. Project and value engineering considerations are reviewed as well as the factors determining the choice of materials and the methods for optimizing the system. The management of modification procedures is described and some value analysis examples are included. A.R.H.

N80-27213*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
AN INQUIRY INTO THE HOUSEHOLD ECONOMY
Ralph D. Samuelson Oct. 1979 68 p refs
(Contract NASw-3204)
(NASA-CR-163280; SU-22) Avail: NTIS HC A04/MF A01 CSCL 05C

The value of the time which people devote to each activity of their lives is compared with the money they spend on the activity. After tax wage rates are used to value an individual's time. The enormous size of the household economy and the fact that for most activities the value of the consumer's time devoted to an activity exceeds the money expenditures on the activity, suggest that there are many opportunities for productivity improvements in the household economy which have been overlooked in most traditional thinking on productivity. E.D.K.

N80-27214*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
ECONOMIC ASPECTS OF SPECTRUM MANAGEMENT
Robert D. Stibolt Oct. 1979 43 p refs
(Contract NASw-3204)
(NASA-CR-163279; SU-25) Avail: NTIS HC A03/MF A01 CSCL 05C

Problems associated with the allocation of the radio frequency spectrum are addressed. It is observed that the current method very likely does not allocate the resource to those most valuing its use. Ecomonic criteria by which the effectiveness of resource allocation schemes can be judged are set forth and some thoughts on traditional objections to implementation of market characteristics into frequency allocation are offered. The problem of dividing orbit and spectrum between two satellite services sharing the same band but having significantly different system characteristics is discussed. The problem is compounded by the likelihood that one service will commence operation much sooner than the other. Some alternative schemes are offered that, within proper international constraints, could achieve a desired flexibility

in the division of orbit and frequency between the two services domestically over the next several years. E.D.K.

N80-27215*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
THE ECONOMIC BASIS FOR NATIONAL SCIENCE AND TECHNOLOGY POLICY
Donald A. Dunn Oct. 1979 39 p refs
(Contract NASw-3204)
(NASA-CR-163290; SU-23) Avail: NTIS HC A03/MF A01 CSCL 05C

National science and technology policy is concerned with societal choices with respect to the rate and directions of technological change and the adoption and use of new technology in society. Such policy choices occur primarily in connection with management of the creation, dissemination, and use of scientific and technical information. Two categories of policy instruments discussed are market-oriented approaches, and direct public action. Possibilities for increased use of market-oriented approaches that can provide benefits to society in the form of an increased rate of innovation and of more 'appropriate' technology, better suited to the needs of consumers are indicated. A.R.H.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-27216# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1981, PART 2
Washington GPO 1980 509 p Hearings on S. 2238 and S. 2240 before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., 6-7 and 20 Feb. 1980
(GPO-58-741) Avail: Subcomm. on Sci., Technol. and Space

Funding requests to support research and development, construction and of facilities and program management are justified in testimony delivered and responses to questions asked during a 6 day hearing period. Particular emphasis is given to the supplemental funds needed to support development and evaluation of space shuttle components, as well as to plans for the Galileo Project and Spacelab experiments. Accomplishments and plans are reviewed for the following areas: space science, space transportation system, astronaut program, energy programs, technology utilization, space and terrestrial applications, international affairs, aeronautics, space research and technology, and tracking and data systems. Employment policies are also examined. A.R.H.

N80-27217# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1981
Washington GPO 1980 631 p Hearings on S. 2238 and S. 2240 before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci. and Transportation, 96th Congr., 2nd Sess., 21, 27, and 29 Feb. and 3 Apr. 1980
(GPO-59-779) Avail: Subcomm. on Sci., Technol. and Space

The capabilities, benefits, and transfer of aerospace technology are considered with particular emphasis on remote sensing, space manufacturing, resources management, and environmental monitoring. Fundamental research and technology in aerodynamics, materials and structures, aeronautical propulsion, avionics, and human factors is described as well as accomplishments and advances in space technology. Cooperation with DOE, DOD, and NOAA is highlighted. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-27218# Centec Corp., Fort Lauderdale, Fla.
COMPUTER TECHNOLOGY CAN ENHANCE INDUSTRIAL ENERGY EFFICIENCY
1979 38 p refs
(Contract EX-76-C-01-2123)
(DOE/CS-2123/T1) Avail: NTIS HC A03/MF A01

Computer applications that have potential for minimizing energy consumption are discussed. An overview of the current level of computer technology and terminology as it applies to the process industry is given. Emphasis is placed on energy conservation and the use of more energy efficient process equipment. J.M.S.

N80-27219*# National Aeronautics and Space Administration, Washington, D. C.
LESSONS OF THE NASA TECH HOUSE
Howard Allawey 1980 41 p Original contains color illustrations
(NASA-SP-442; LC-80-607024) Avail: NTIS MF A01; SOD HC $3.00 CSCL 13B

The performance and effectiveness of the various systems incorporated into the NASA Technology House are described and evaluated in relation to the HUD reference house. The various aerospace technologies used (advanced electronics, solar energy utilization, water recycling, fire retardant materials) are discussed as well as the improved materials, design configurations, and construction techniques developed under other government programs and by industry. Tabular data show the consumption and conservation of electrial energy and water for each month over one full weather cycle, during which time a family of four was in residence. A.R.H.

N80-27220# Geological Survey, Washington, D. C.
TRANSFERRING EARTH SCIENCE IN FORMATION TO TO DECISIONMAKERS: PROBLEMS AND OPPORTUNITIES AS EXPERIENCED BY THE UNITED STATES GEOLOGICAL SURVEY
Thomas F. Bates 1979 35 p refs
(Circ-813; LC-79-600138) Avail: NTIS HC A03/MF A01

The experiences of the U.S. Geological Survey scientists in interfacing with members of the land use planning and decision making community are reported along with the experiences at the producer-user interface. It is concluded that areas throughout the Nation must be identified and those needs must be continuously reassessed. Effective working relationships between the Earth scientists and the users must be established. F.O.S.

N80-27221*# Stanford Univ., Calif. Dept. of Engineering Economic Systems.
GOVERNMENT PATENT POLICY: AN ANALYSIS OF THE EFFECTS OF THREE ALTERNATIVE PATENT POLICIES ON TECHNOLOGY OF GOVERMENT INVENTIONS
Mark Matousek Oct. 1979 39 p refs
(Contract NASw-3204)
(NASA-CR-163283; SU-27) Avail: NTIS HC A03/MF A01 CSCL 05B

The effects of present and proposed Government patent policies on the process of technology transfer and the commercialization of inventions resulting from Government sponsored research are addressed. The function of the patent system in Government research and the value of patents resulting from government sponsored research are examined. Three alternative patent policies, title in the contractor, title in the Government, and the waiver policy, are examined in terms of their effect on the commercialization of inventions, industrial competitions, disclosure of inventions, participation of research contractors and

administrative costs. Efforts to reform the present Government patent policy are also described. J.M.S.

N80-27222*# South Coast Technology, Inc., Santa Barbara, Calif.

THE NEAR-TERM HYBRID VEHICLE PROGRAM, PHASE 1 Final Report

10 Sep. 1979 153 p refs Sponsored by NASA Prepared for JPL

(Contract JPL-955189)

(NASA-CR-163034; JPL-9950-355) Avail: NTIS HC A08/MF A01 CSCL 13F

Performance specifications were determined for a hybrid vehicle designed to achieve the greatest reduction in fuel consumption. Based on the results of systems level studies, a baseline vehicle was constructed with the following basic paramaters: a heat engine power peak of 53 kW (VW gasoline engine); a traction motor power peak of 30 kW (Siemens 1GV1, separately excited); a heat engine fraction of 0.64; a vehicle curb weight of 2080 kg; a lead acid battery (35 kg weight); and a battery weight fraction of 0.17. The heat engine and the traction motor are coupled together with their combined output driving a 3 speed automatic transmission with lockup torque converter. The heat engine is equipped withe a clutch which allows it to be decoupled from the system. A.R.H.

N80-27223*# South Coast Technology, Inc., Santa Barbara, Calif.

MISSION ANALYSIS AND PERFORMANCE SPECIFICATION STUDIES REPORT, APPENDIX A

25 Jan. 1979 177 p refs Sponsored by NASA Prepared for JPL Prepared in cooperation with Gen. Res. Corp., Santa Barbara, Calif.

(Contract JPL-955189)

(NASA-CR-163035; JPL-9950-355) Avail: NTIS HC A09/MF A01 CSCL 13F

The Near Term Hybrid Passenger Vehicle Development Program tasks included defining missions, developing distributions of daily travel and composite driving cycles for these missions, providing information necessary to estimate the potential replacement of the existing fleet by hybrids, and estimating acceleration/gradeability performance requirements for safe operation. The data was then utilized to develop mission specifications, define reference vehicles, develop hybrid vehicle performance specifications, and make fuel consumption estimates for the vehicles. The major assumptions which underlie the approach taken to the mission analysis and development of performance specifications are the following: the daily operating range of a hybrid vehicle should not be limited by the stored energy capacity and the performance of such a vehicle should not be strongly dependent on the battery state of charge. E.D.K.

N80-27224*# South Coast Technology, Inc., Santa Barbara, Calif.

DESIGN TRADEOFF STUDIES AND SENSITIVITY ANALYSIS, APPENDIX B

25 May 1979 251 p refs Sponsored by NASA Prepared for JPL

(Contract JPL-955189)

(NASA-CR-163036; JPL-9950-355-App-B) Avail: NTIS HC A12/MF A01 CSCL 13F

Further work was performed on the Near Term Hybrid Passenger Vehicle Development Program. Fuel economy on the order of 2 to 3 times that of a conventional vehicle, with a comparable life cycle cost, is possible. The two most significant factors in keeping the life cycle cost down are the retail price increment and the ratio of battery replacement cost to battery life. Both factors can be reduced by reducing the power rating of the electric drive portion of the system relative to the system power requirements. The type of battery most suitable for the hybrid, from the point of view of minimizing life cycle cost, is nickel-iron. The hybrid is much less sensitive than a conventional vehicle is, in terms of the reduction in total fuel consumption and resultant decreases in operating expense, to reductions in vehicle weight, tire rolling resistance, etc., and to propulsion system and drivetrain improvements designed to improve the brake specific fuel consumption of the engine under low road load conditions. It is concluded that modifications to package the propulsion system and battery pack can be easily accommodated within the confines of a modified carryover body such as the Ford Ltd. E.D.K.

N80-27225*# South Coast Technology, Inc., Santa Barbara, Calif.

DESIGN TRADEOFF STUDIES AND SENSITIVITY ANALYSIS, APPENDICES B1 - B4

25 May 1979 190 p Sponsored by NASA Prepared for JPL (Contract JPL-955189)

(NASA-CR-163037; JPL-9950-355-App-B1-B4) Avail: NTIS HC A09/MF A01 CSCL 13F

Documentation is presented for a program which separately computes fuel and energy consumption for the two modes of operation of a hybrid electric vehicle. The distribution of daily travel is specified as input data as well as the weights which the component driving cycles are given in each of the composite cycles. The possibility of weight reduction through the substitution of various materials is considered as well as the market potential for hybrid vehicles. Data relating to battery compartment weight distribution and vehicle handling analysis is tabulated. A.R.H.

N80-27226*# South Coast Technology, Inc., Santa Barbara, Calif.

PRELIMINARY DESIGN DATA PACKAGE, APPENDIX C

25 Jul. 1979 239 p refs Sponsored by NASA Prepared for JPL

(Contract JPL-955189)

(NASA-CR-163038; JPL-9950-355-App-C) Avail: NTIS HC A11/MF A01 CSCL 13F

The data and documentation required to define the preliminary design of a near term hybrid vehicle and to quantify its operational characteristics are presented together with the assumptions and rationale behind the design decisions. Aspects discussed include development requirements for the propulsion system, the chassis system, the body, and the vehicle systems. Particular emphasis is given to the controls, the heat engine, and the batteries. A.R.H.

N80-27227*# South Coast Technology, Inc., Santa Barbara, Calif.

PRELIMINARY DESIGN DATA PACKAGE, APPENDICES C1 AND C2

25 Jul. 1980 202 p refs Sponsored by NASA Prepared for JPL

(Contract JPL-955189)

(NASA-CR-163039; JPL-9950-355-App-C1; JPL-9950-355-APP-C3) Avail: NTIS HC A10/MF A01 CSCL 13F

The HYBRID2 program which computes the fuel and energy consumption of a hybrid vehicle with a bi-modal control strategy over specified component driving cycles is described. Fuel and energy consumption are computed separately for the two modes of operation. The program also computes yearly average fuel and energy consumption using a composite driving cycle which varies as a function of daily travel. The modelling techniques are described, and subroutines and their functions are given. The composition of modern automobiles is discussed along with the energy required to manufacture an American automobile. The energy required to scrap and recycle automobiles is also discussed. F.O.S.

N80-27228# Committee on Science and Technology (U. S. House).

ANALYSIS AND COMMENTARY ON THE FIRST ANNUAL SCIENCE AND TECHNOLOGY REPORT

Dorothy M. Bates, Mary Mogee, and Robert Chivak Washington GPO 1979 128 p refs Rept. presented to the Subcomm. on Library of Congress Sci., Res. and Technol., 96th Congr., 1st Sess., Nov. 1979 Prepared by Congressional Research Service, Library of Congress

(GPO-56-097) Avail: Subcomm. on Sci. Res. and Technol.

The requirement that the President transmit to Congress an annual Science and Technology Report was a congressional initiative which was with the signing of the National Science and Technology Policy, Organization and Priorties Act of 1976. An analysis and commentary on the first Science and Technology Report is presented. The commentary considers the legislative

history of the requirement and the extent to which the report met the congressional intent as well as the substantive content of the report. The annual requirement was shown to be a normal congressional requirement. Following this, various proposals for the preparation of an annual science and technology report which were made in the 1965-1974 period were reviewed, including those of several individuals, two congressional subcommittees, and a panel of the National Academy of Sciences. J.M.S.

N80-27229# Committee on Science and Technology (U. S. House).
SOVIET SCIENTIFIC AND TECHNICAL COOPERATION WITH COUNTRIES OTHER THAN THE UNITED STATES
Robert Civiak Washington GPO 1979 112 p refs Rept. Presented to the Subcomm. on Sci., Res. and Technol., 96th Congr., 1st Sess., Feb. 1979 Prepared by Congressional Research Service, Library of Congress
(GPO-37-444) Avail: SOD HC

The countries other than the United States with which the Soviet Union has had significant contacts in science and technology are identified. Also information on the Soviet Union's most active areas of international cooperation in science and technology is provided. The Soviet Union's most extensive Western contacts are with France, Italy, West Germany, Finland and Japan. However, the members of the Council for Mutal Economic Assisstance (CEMA) are still the Soviet Union's prevailing partners in sceintific and technical cooperation. India, Vietnam, Iraq and Iran are the developing countries which have received the largest amounts of nonmilitary scientific and technical assisstance from the Soviet Union. The Soviet Union's most active fields of international scientific and technical activity are power engineering, petroleum and mining, metallurgy space and the chemicals industry. Western technology transfer to the Soviet Union is most extensive in the chemicals industry and also important in electronics and transportation. J.M.S.

N80-27230# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Electrical Power Lab.
EVA METRO SEDAN ELECTRIC-PROPULSION SYSTEM: TEST AND EVALUATION
E. Eberhart Reimers Sep. 1979 290 p refs
(Contract EC-77-A-31-1042)
(DOE/CS-1042/1) Avail: NTIS HC A13/MF A01

The procedure and results of the performance evaluation of the EVA Metro Sedan (car no.1) variable speed dc chopper motor drive and its three speed automatic transmission are presented. The propulsion systems for a battery powered vehicle manufactured by Electric Vehicle Associates, Valley View, Ohio, was removed from the vehicle, mounted on the programmable electric dynamometer test facility and evaluated with the aid of a HP 3052A Data Acquistion System. Performance data for the automatic transmission, the solid state dc motor speed controller, and the dc motor in the continuous and pulsating dc power mode, as derived on the dynamometer test facility, as well as the entire propulsion system are given. This concept and the system's components were evaluated in terms of commercial applicability, maintainability, and energy utility to establish a design base for the further development of this system or similar propulsion drives. DOE

N80-27231*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 7: HYBRID VEHICLE REVIEW
K. O. Leschly 30 Sep. 1979 44 p refs Sponosred by NASA 10 Vol.
(Contract EM-78-I-01-4209)
(NASA-CR-163298; CONS-4209-T1-Vol-7) Avail: NTIS HC A03/MF A01 CSCL 13F

Review of hybrid vehicles built during the past ten years or planned to be built in the near future is presented. An attempt is made to classify and analyze these vehicles to get an overall picture of their key characteristics. The review includes onroad hybrid passenger cars, trucks, vans, and buses. DOE

N80-27232# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY STORAGE SYSTEMS FOR AUTOMOBILE PROPULSION, 1979 STUDY. VOLUME 2: DETAILED REPORT
H. C. Forsberg, C. J. Anderson, E. Behrin, W. Cliff (Battelle Pacific Northwest Lab.), R. Crisp (Arkansas Univ.), C. L. Hudson (Interplan Corp.), L. G. OConnell, J. S. Payne, R. Renner, and M. D. Schrot 15 Dec. 1979 288 p refs
(Contract W-7405-eng-48)
(UCRL-52841-Vol-2) Avail: NTIS HC A13/MF A01

The findings of a national multilaboratory study of energy-storage propulsion systems for automobiles are presented, including a technical and cost update for the energy-storage devices and resultant vehicles. In addition, an evaluation methodology is described for national energy and market impact, a manufacturing and service infrastructure study is introduced, and an examination is made of certain specialty markets. The energy-storage device characteristics are projected and the resulting vehicles are evaluated. The systems analyzed included several that were not considered in the 1978 work, and three that had not been previously evaluated: the short-range but high-performance all-electric vehicle; the hydrogen-fuel-cell-powered electric; and the advanced-battery eV, power boosted with an advanced-design, fiber-composite flywheel. DOE

N80-27233# California Univ., Livermore. Lawrence Livermore Lab.
DYNAMIC TESTING OF THE ROADWAY POWERED ELECTRIC VEHICLE (RPEV) SYSTEM
D. D. Davis, C. W. Dease, Ronald I. Wallace, and Carl E. Walter 27 Feb. 1980 17 p refs Presented at the 3d Intern. Elec. Vehicle Exposition and Conf., St. Louis, 20-22 May 1980
(Contract W-7405-eng-48)
(UCRL-83662; CONF-800523-2) Avail: NTIS HC A02/MF A01

Practicality of the roadway powered electric vehicle (RPEV) system under dynamic operating conditions is being examined. In the RPEV system, energy is electromagnetically coupled without mechanical contact from a powered roadway to electric vehicles. Energy from the roadway can be used for high speed, long range travel, and for replenishing energy stored onboard the vehicles. The stored energy is available for shorter range travel on nonpowered surface streets. The dynamic test system includes a 50 m lane of powered roadway, an ac power source, and an electrically propelled test vehicle equipped with a roadway power pickup, onboard batteries, and instrumentation. The dynamic power coupling system allows up to 16 W of coupled power. Its design is based on results obtained from static prototype tests. Dynamic tests will examine power coupling capacity, system characteristics, vehicle performance, roadway compatibility, and safety. DOE

N80-27234# Ventura Regional County Sanitation District, Calif.
RESIDUAL WASTE MANAGEMENT: PHASE 1 REPORT Final Report, 1 Jan. 1975 - 15 Feb. 1978
Feb. 1980 145 p refs
(Contract EPA-S-803223-01-0)
(PB80-139744; EPA-600/2-80-051) Avail: NTIS HC A07/MF A01 CSCL 13B

The economic, social and environmental analysis regarding alternative plans for the handling and disposal of residual organic waste in Ventura County is presented. Waste quanities from municipal treatment plants, livestock operations, agricultural operations and meat and fish processes were inventoried. GRA

N80-27235# Vought Corp., Dallas, Tex.
AIRTRANS URBAN TECHNOLOGY PROGRAM. PHASE 2, VOLUME 5: SYSTEMS OPERATION Final Report
D. E. Benjamin, G. M. Jones, and G. F. Ruprecht Oct. 1979 133 p refs Sponsored by DOT
(PB80-157704; UMTA-TX-06-0020-79-6-Vol-5) Avail: NTIS HC A07/MF A01 CSCL 13F

The effects of several improvements on AIRTRANS operation were investigated. Among the improvements investigated and reported were increased speed, increased system capacity, additional bypasses and sidings, additional failure management strategies and demand mode operation. Much of this analysis was performed using ASIM, the AIRTRANS simulation model. Additional simulation work was performed using Vought's demand-responsive automated transit simulation model (DRATS) and the Transportation Systems Center's discrete event simulation model (DESM). GRA

N80-27236# Vought Corp., Dallas, Tex.
AIRTRANS URBAN TECHNOLOGY PROGRAM. PHASE 2, VOLUME 6: SEVERE WEATHER Final Report
W. C. Albach, R. A. Doores, R. J. Fewel, J. L. King, and B. L. Koonce Oct. 1979 170 p refs Sponsored by DOT
(PB80-157696; UMTA-TX-06-0020-79-7) Avail: NTIS HC A08/MF A01 CSCL 13F

Modifications to AIRTRANS, an automated guideway transit (AGT) system, that would allow the system to be used in urban locales with severe weather environments are identified. Results of analysis and testing of the vehicle and guideway components and systems which would be exposed to severe weather in urban AGT systems are reported. Also, cold and ice tests performed in the laboratory with components and subsystems installed on test fixtures are presented. Although significant progress has been made toward a severe weather capable AIRTRANS, more development is recommended. GRA

N80-27237# Florida Dept. of Administration, Tallahassee.
SCIENCE, ENGINEERING, TECHNOLOGY AND FLORIDA'S GOVERNMENT
Joseph H. Gerry and Malcolm P. Thomas Apr. 1979 99 p
(Grant NSF ISP-78-05131)
(PB80-139389; NSF/RA-790311) Avail: NTIS HC A05/MF A01 CSCL 05A

The structure and process of Florida's executive branch in relation to science, engineering, and technology (SET) was examined in order to determine a strategy to facilitate improvements in the way state resources are used in SET endeavors, and to provide assistance in the improvement of the policy formation process within Florida. Topics covered include an organizational profile of Florida's executive branch; a review of the overall relationship of the State Comprehensive Plan to SET; a synthesis of significant observation observations from respondents participating in interviews and survey questionnaires; an overview of the activities of other states including findings to be considered for Florida's improvement in SET; analysis of considerations affecting Florida's utilization of and relationship with SET; and development of strategic requirements and a proposal for an organizational structure for Florida. A project description and an overview of the development of SET in the United States are included in the appendix. GRA

N80-27238# Mitre Corp., McLean, Va.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON ADVANCED PROPULSION SYSTEMS FOR URBAN RAIL VEHICLES
Feb. 1980 241 p Conf. held at Washington, D.C., 5-6 Feb., 1980
(PB80-149099; MTR79W00455; UMTA-VA-06-0053-80-1)
Avail: NTIS HC A11/MF A01 CSCL 13F

It is shown that on the basis of current R&D activities in the area of propulsion system designs, advances in control systems, motor design, thermal control techniques, diagnostics and energy efficient systems are realizable. Both designer and user viewpoints toward the propulsion technology are presented. This approach has emphasized the experience of propulsion equipment in the transit environment and presented its effects on transit system performance. GRA

N80-27239# Massachusetts Inst. of Tech., Cambridge. Center for Transportation Studies.
POTENTIAL CHANGE STRATEGIES IN URBAN TRANSPORTATION: AN OVERVIEW AND TENTATIVE APPRAISAL Final Report, Jul. 1975 - Jan. 1978
Alan Altshuler, James Womack, and John Pucher Dec. 1979 87 p refs
(Contract DOT-OST-50240)
(PB80-155278; DOT/RSPA/DPB/50-79/8) Avail: NTIS HC A05/MF A01 CSCL 13B

Innovations in the urban transportation system which combine political feasility and cost effectiveness are identified. Problems of urban transportation in the United States are emphasized. GRA

88 SPACE SCIENCES (GENERAL)

N80-27240# Astronomische Gesellschaft, Hamburg (West Germany).
REVIEW ARTICLES OF THE ASTRONOMISCHE GESELLSCHAFT, NO. 47
1980 272 p refs In GERMAN and ENGLISH
(ISSN-0374-1958) Avail: NTIS HC A12/MF A01

The behavior of the intergalactic and interstellar media is studied with respect to insight into galactic evolution. Emphasis is placed on galactic radio sources, their properties and techniques of observation. For individual titles, see N80-27241 through N80-27250.

N80-27241# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
INTERGALACTIC MATTER AND THE EVOLUTION OF GALAXIES **c90**
George B. Field *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 7-55 refs (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

The current status of observations of gas within clusters and superclusters of galaxies, and perhaps outside of superclusters, is reviewed, with emphasis on the interpretation of X-ray emission by hot gas and the physical effects of such gas upon galaxies. It is concluded that while interfalactic gas probably makes a contribution to the mean desnity of the universe which is to for closure, it can nevertheless profoundly affect the evolution universe which is too small fro closure, it can nevertheless profoundly affect the evoluation of galaxies eitherby sweeping out their interstellar gas or by accreting on the to them. E.D.K.

N80-27242# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
XUV ASTRONOMY **c89**
K. P. Beuermann *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 65-88 refs In GERMAN; ENGLISH summary Prepared in cooperation with Technische Univ., Berlin, West Germany (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

The field of extreme ultraviolet astronomy at wavelengths from 50 A to 912 A is reviewed. Observations in this wavelength band can be performed due to the circumstance that the Sun is located in an extended region of extremeley low interstellar gas density. Hence, the horizon for observations at 100 A due to the photoelectric opacity of the interstellar medium is typically at a distance of about 200 pc. Sources which radiate primarily in the extreme ultraviolet were detected and even the small list of currently observed objects has had immediate impact on the studies of both stellar evolution and the interstellar medium. Diffuse emission from the interstellar medium results from a hot 100,000 to 1,000,000 K component of the interstellar gas. Prime stellar candidates for extreme ultraviolet observations are (1) hot low luminosity stars at the blue end of the HR diagram, (2) atmospheric emission from stars surrounded by a hot corona or with flaring acitivty, and (3) mass exchanging binary systems. The prospects of extreme ultraviolet astronomy are discussed and the existing observations of extreme ultraviolet emission from the interstellar medium and from stellar sources of the different categories are reviewed. E.D.K.

N80-27243# Wuerzburg Univ. (West Germany). Inst. fuer Astronomie und Astrophysik.
STELLAR CHROMOSPHERES **c89**
P. Ulmschneider *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 93-106 refs In GERMAN; ENGLISH Summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

Observations indicating the presence of stellar chromospheres are summarized. Undisputed indicators for hot stellar envelopes are spectral lines of highly ionized atoms, Fe (2) emission lines, flares in late type stars, and the presence of the He (1)

10830 A line. The combined evidence to date shows that all nondegenerate type stars have chromospheres except possibly the A stars. There are, however, theoretical reasons for expecting chromospheres in A stars. Empirical chromosphere models for a rapidly growing sample of stars was recently constructed on the basis of Ca (2) and Mg (2) line observations. A discussion of possible heating mechanisms is given and the relative importance of these mechanisms is evaluated. For the low and middle chromosphere the short period acoustics heating mechanisms seems to be the dominant process, although there are still uncertainties. Both steady and time dependent theoretical models of stellar chromospheres based on the short period acoustics heating theory are discussed, and predictions of these models are compared with results from empirical models. This relatively favorable comparison shows that the explanation of the Wilson-Bappu effect might be at hand. E.D.K.

N80-27244# Max-Planck-Institut fuer Radioastronomie, Bonn (West Germany).
RADIO CONTINUUM OBSERVATIONS OF NEARBY GALAXIES c93
R. Wielebinski *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 107-116 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

The radio continuum emission observed in galaxies is produced by both the thermal emission in ionized regions and the nonthermal emission from relativistic electrons spiralling in the magnetic fields of a galaxy. Recent observations at low frequencies and at high radio frequencies have similar angular and intensity resolution. In the disks of a number of nearby galaxies, spectral variations could be definitely identified. These in turn could be shown to be due to the mixing of thermal and nonthermal radiation. Using optical H alpha data, a lower limit to thermal emission from these H (2) regions can be predicted. In some galaxies there is evidence of emergence of the thermal emission as the major component at frequencies of 4800 MHz and above. Observations of the radio continuum emission away from the plane of the edge-on galaxies shows a dramatic steepening of the spectral index. This must be attributed to truncation of the electron energy spectrum and/or fall-off in the magnetic field intensity. Recent observations of M51, M31, and M33 indicate that in each of these galaxies large scale magnetic fields exist aligned along the spiral arm directions. E.D.K.

N80-27245# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE 80 cm X-RAY TELESCOPE: FACILITIES AND OBSERVATIONAL POSSIBILITIES c89
B. Aschenbach, H. Braeuninger, U. Briel, H. Fink, G. Kettenring, E. Pfeffermann, P. Predehl, and J. Truemper *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 117-137 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

A telescope with an 80 cm aperture was developed for emplementation on the space shuttle. The design features as well as its specifications for use are presented. R.C.T.

N80-27246# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
PLASMA DYNAMICAL PROCESSES IN THE SOLAR WIND c92
Arne K. Bichter *In* Astronomishche Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 139-164 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88) Avail: NTIS HC A12/MF A01

Observations of proton and electron velcity distributions and of their moments at different radial distances from the Sun and in different parts of streamstructured solar wind between 0.3 and 1 angstrom units are described. These observations are then compared with the corresponding results of theoretical studies on the plasmakinetics of a collisionless solar wind. The discrepancy deduced from these comparison then suggests that waves and their resonant interactions with these particles under consideration and instabilities of their distributions must play an important role in the physics of solar wind. In situ observations of these modes in the interplanetary medium are also discussed. Some of the theoretical results under which circumstances the proton and electron distribution might become unstable with respect to the ionacoustic mode are reviewed and some indirect observational evidence that these instabilities might indeed operate in the soalr wind are given. R.C.T.

N80-27247# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
ACCRETION OF PLASMA ONTO NEUTRON STARS c93
G. Boerner and H. Riffert *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 165-203 refs (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

Some aspects of the accretion of matter onto compact X-ray sources are discussed. The interaction of the accreted matter with the strong magnetic field of the compact star is considered. The hydrodynamics of the accretion flow is described. R.C.T.

N80-27248# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
PRESENT STATE AND FUTURE OF THE SCIENTIFIC SPACE PROGRAM OF THE FEDERAL REPUBLIC OF GERMANY c12
W. Regula *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 205-217 In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

Project management as well as implimentation proceedures of the European Space Agency are discussed. A number of aspects of science policy are also adressed. R.C.T.

N80-27249# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE IMPORTANCE OF THE LONG-TERM PLANNING OF THE EUROPEAN SPACE AGENCY FOR SPACE RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY c81
K. Pinkau *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p. 219-232 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

The European space research and the European Space Agency are assessed for their technological contribution. Aspects of operations research as well as of financial management support are addressed. R.C.T.

N80-27250# Institut fuer Astrophysik und Extraterrestrische Forschung, Bonn (West Germany).
ASPECTS OF THE INTERACTION OF STARS WITH DENSE INTERSTELLAR GAS CLOUDS c90
Hans J. Fahr *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 233-276 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

Different hydrodynamical approaches to calculating the circumstellar gas flow are reviewed. The calculation of properties and dynamical variables of this flow is discussed for the case of a single particle kinetic or hydrodynamical approach. It is found that the physically appropriate approach to a specific problem is not always clear cut, rather, it is proved that a hydrodynamical treatment of the outer circumstellar regions sometimes has to be replaced by a single particle kinetic description of the inner regions since the local mean free paths become large compared to the dimensions of these regions. R.C.T.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-27251*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

DATA REDUCTION AND ANALYSIS OF SAS-1 DATA Final Report
Riccardo Giacconi Feb. 1979 30 p
(Contract NAS5-20048)
(NASA-CR-159990) Avail: NTIS HC A03/MF A01 CSCL 03A

An abstracted bibliography of 59 articles addressing the analysis of X-ray observations from the UHURU X-Ray Observatory (SAS-1) is presented. Investigations of galactic and extragalactic X-ray sources, X-ray binaries, and transient and burst phenomena are highlighted. M.G.

N80-27252# South African Astronomical Observatory, Sutherland.
SOUTH AFRICAN ASTRONOMICAL OBSERVATORY, 1978 Technical Report, period ending 1 Jan. 1979
8 Feb. 1979 32 p
Avail: NTIS HC A03/MF A01

Summaries of the research conducted during 1978 are presented. The research was in the area of globular clusters, variable stars, galactic structure, Magellanic clouds, X-ray sources, and Earth satellites. Publications during this period are listed, and the equipment, and facilities are described. F.O.S.

N80-27253# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
ASTRONOMIC POSITION ACCURACY CAPABILITY STUDY Final Report
Paul F. Gilbert and James K. Barton Oct. 1979 83 p refs
(AD-A080292; DMAHTC-TR-79-002) Avail: NTIS HC A05/MF A01 CSCL 03/1

Both first order (FO) and modified first order (MFO) astronomic position accuracy figures were determined in this study. Only qualified and experienced observers using refined techniques with Wild T-4 theodolites were evaluated. Only FK4 stars were observed. The Sterneck method of astronomic latitude observaton and reduction was employed. Astronomic longitude observations and reduction techniques used the meridian transit method.GRA

N80-27254# Royal Observatory, Edinburgh (Scotland).
THE UK 1.2m SCHMIDT TELESCOPE AND THE SOUTHERN SKY SURVEY. PART 3: PLATE COPYING
P. R. Standen and K. P. Tritton 1979 12 p refs
(ROE-OR-5; ISSN-0309-099X) Avail: NTIS HC A02/MF A01

The plate copying procedures used to make the atlas film copies of the blue (3aJ) half of a southern sky survey are described. The accepted original negatives for the survey are on 356 x 356 mm glass plates, 1 mm thick. The copying process has been optimized for the faintest objects. Intermediate positives are made using Kodak Process emulsion on 356 mm x 356 mm glass plates 3 mm thick. Copy plates are developed in Kodak D-76. Atlas film copies are produced from the positive using Kodak Aerographic 4421 emulsion on Estar Thick base. A Versamat 317 automatic processor is used for developing the films in Versamat B developer. All quality control procedures are given. Author (ESA)

N80-28362*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANETARY RADAR
R. M. Taylor and G. S. Downs *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 150 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03A

N80-27242# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
XUV ASTRONOMY
K. P. Beuermann *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 65-88 refs In GERMAN; ENGLISH summary Prepared in cooperation with Technische Univ., Berlin, West Germany (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

N80-27243# Wuerzburg Univ. (West Germany). Inst. fuer Astronomie und Astrophysik.
STELLAR CHROMOSPHERES
P. Ulmschneider *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 93-106 refs In GERMAN; ENGLISH Summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

N80-27245# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE 80 cm X-RAY TELESCOPE: FACILITIES AND OBSERVATIONAL POSSIBILITIES
B. Aschenbach, H. Braeuninger, U. Briel, H. Fink, G. Kettenring, E. Pfeffermann, P. Predehl, and J. Truemper *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 117-137 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-27241# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
INTERGALACTIC MATTER AND THE EVOLUTION OF GALAXIES
George B. Field *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 7-55 refs (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

N80-27250# Institut fuer Astrophysik und Extraterrestrische Forschung, Bonn (West Germany).
ASPECTS OF THE INTERACTION OF STARS WITH DENSE INTERSTELLAR GAS CLOUDS
Hans J. Fahr *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 233-276 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-27255*# Biospherics, Inc., Rockville, Md.
DEVELOPMENT OF BIOLOGICAL AND NONBIOLOGICAL EXPLANATIONS FOR THE VIKING LABEL RELEASE DATA Final Report, 15 Feb. 1979 - Feb. 1980
1 Jul. 1980 74 p refs
(Contract NASw-3249)
(NASA-CR-163291) Avail: NTIS HC A04/MF A01 CSCL 03B

The plausibility that hydrogen peroxide, widely distributed within the Mars surface material, was responsible for the evocative response obtained by the Viking Labeled Release (LR) experiment on Mars was investigated. Although a mixture of gamma Fe2O3 and silica sand stimulated the LR nutrient reaction with hydrogen peroxide and reduced the rate of hydrogen decomposition under various storage conditions, the Mars analog soil prepared by the Viking Inorganic Analysis Team to match the Mars analytical data does not cause such effects. Nor is adequate resistance to UV irradiation shown. On the basis of the results and consideration presented while the hydrogen peroxide theory remains the most, if not only, attractive chemical explanation of the LR data, it remains unconvincing on critical points. Until problems concerning the formation and stabilization of hydrogen peroxide on the surface

of Mars can be overcome, adhere to the scientific evidence requires serious consideration of the biological theory. A.R.H.

N80-27256*# Martin Marietta Corp., Denver, Colo.
STUDY OF SAMPLE DRILLING TECHNIQUES FOR MARS SAMPLE RETURN MISSIONS Final Report
D. C. Mitchell and P. T. Harris Apr. 1980 140 p
(Contract NAS9-15907)
(NASA-CR-160723; MCR-79-615-Issue-3) Avail: NTIS HC A07/MF A01 CSCL 03B

To demonstrate the feasibility of acquiring various surface samples for a Mars sample return mission the following tasks were performed: (1) design of a Mars rover-mounted drill system capable of acquiring crystalline rock cores; prediction of performance, mass, and power requirements for various size systems, and the generation of engineering drawings; (2) performance of simulated permafrost coring tests using a residual Apollo lunar surface drill, (3) design of a rock breaker system which can be used to produce small samples of rock chips from rocks which are too large to return to Earth, but too small to be cored with the Rover-mounted drill; (4)design of sample containers for the selected regolith cores, rock cores, and small particulate or rock samples; and (5) design of sample handling and transfer techniques which will be required through all phase of sample acquisition, processing, and stowage on-board the Earth return vehicle. A preliminary design of a light-weight Rover-mounted sampling scoop was also developed. A.R.H.

N80-27257*# Santa Clara Univ., Calif. Dept. of Physics.
WIND TUNNEL SIMULATION OF MARTIAN SAND STORMS
Ronald Greeley 8 Jul. 1980 31 p refs
(Grant NsG-2286)
(NASA-CR-163262) Avail: NTIS HC A03/MF A01 CSCL 03B

The physics and geological relationships of particles driven by the wind under near Martian conditions were examined in the Martian Surface Wind Tunnel. Emphasis was placed on aeolian activity as a planetary process. Threshold speeds, rates of erosion, trajectories of windblown particles, and flow fields over various landforms were among the factors considered. Results of experiments on particles thresholds, rates of erosion, and the effects of electrostatics on particles in the aeolian environment are presented. J.M.S.

N80-27258*# Arizona State Univ., Tempe.
RESEARCH ON LUNAR MARE EMPLACEMENT AND IMPACT CRATERING EXPERIMENTS
Ronald Greeley, Peter H. Schultz, and Donald E. Gault 10 Jul. 1980 4 p refs
(Grant NsG-7429)
(NASA-CR-163264) Avail: NTIS HC A02/MF A01 CSCL 03B

A model was derived enabling the interpretation of lunar styles of volcanism through the analysis of various surface features. The model was applied to several areas on the Moon, including the Orientale Basin, the Smythii Basin, the Herigonious region, and several highland areas. Concurrent with the application of the model, several topical studies of various aspects of lunar volcanism were completed. A series of impact crater experiments was conducted at NASA Ames in order to determine the effect that viscous targets would have on cratering mechanics and morphology for application in studies of Martian ejecta flow craters. The results of the experiments led to a model that can account for the formation of multiple flow lobes and the general morphology of some aspects of Martian craters. A.R.H.

N80-27259*# Purdue Univ., Lafayette, Ind.
ON THE CHEMICAL COMPOSITION OF L-CHONDRITES
Charles W. Neal, Robert T. Dodd (State Univ. of New York, Stony Brook), Eugene Jarosewich (Smithsonian Inst., Washington, D.C.), and Michael E. Lipschutz Jul. 1980 36 p refs Submitted for publication
(Grant NGL-15-005-140)
(NASA-CR-163260) Avail: NTIS HC A03/MF A01 CSCL 03B

Radiochemical neutron activation analysis of Ag, As, Au, Bi, Co, Cs, Ga, In, Rb, Sb, Te, Tl, and Zn and major element data in 14 L4-6 and 3 LL5 chondrites indicates that the L group is unusually variable and may represent at least 2 subgroups differing in formation history. Chemical trends in the S/Fe rich subgroup support textural evidence indicating late loss of a shock formed Fe-Ni-S melt; the S/Fe poor subgroup seemingly reflects nebular fractionation only. Highly mobile In and Zn apparently reflect shock induced loss from L chondrites. However, contrasting chemical trends in several L chondrite sample sets indicate that these meteorites constitute a more irregular sampling of, or more heterogeneous parent material than do carbonaceous or enstatite chondrites. Data for 15 chondrites suggest higher formation temperatures and/or degrees of shock than for LL5 chondrites. Author

N80-27260*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROJECT ORION: A DESIGN STUDY OF A SYSTEM FOR DETECTING EXTRASOLAR PLANETS
David C. Black, ed. 1980 214 p refs Original contains color illustrations
(NASA-SP-436; LC-80-11728) Avail: NTIS MF A01; SOD HC $5.50 CSCL 03B

A design concept for a ground based astrometric telescope that could significantly increase the potential accuracy of astrometric observations is considered. The state of current techniques and instrumentation is examined in the context of detecting extrasolar planets. Emphasis is placed on the direct detection of extrasolar planets at either visual or infrared wavelengths. The design concept of the imaging stellar interferometer (ISI), developed under Project Orion, is described. The Orion ISI employs the state-of-the-art technology and is theoretically capable of attaining 0.00010 arc sec/yr accuracy in relative astrometric observations. J.M.S.

N80-27261*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
MAGNETIC PUMPING OF PARTICLES IN THE OUTER JOVIAN MAGNETOSPHERE
J. E. Borovsky Mar. 1980 81 p refs Sponsored in part by NSF
(Grants NsG-7632; NGL-16-001-002)
(NASA-CR-163022; Rept-80-5) Avail: NTIS HC A05/MF A01 CSCL 03B

The mechanism of magnetic pumping consists of two processes, the adiabatic motion of charged particles in a time varying magnetic field and their pitch-angle diffusion. The result is a systematic increase in the energy of charged particles trapped in mirror (and particularly, magnetospheric) magnetic fields. A numerical model of the mechanism is constructed, compared with analytic theory where possible, and, through elementary exercises, is used to predict the consequences of the process for cases that are not tractable by analytical means. For energy dependent pitch angle diffusion rates, characteristic 'two temperature' distributions are produced. Application of the model to the outer Jovian magnetosphere shows that beyond 20 Jupiter radii in the outer magnetosphere, particles may be magnetically pumped to energies of the order of 1 - 2 MeV. Two temperature distribution functions with 'break points' at 1 - 4 KeV for electrons and 8 - 35 KeV for ions are predicted. A.R.H.

N80-27262# Battelle Pacific Northwest Labs., Richland, Wash.
DURABILITY OF METALS FROM ARCHAEOLOGICAL OBJECTS, METAL METEORITES, AND NATIVE METALS
A. B. Johnson, Jr. and B. Francis Jan. 1980 117 p refs
(Contract EY-76-C-06-1830)
(PNL-3198) Avail: NTIS HC A06/MF A01

Many objects fashioned from silver, copper, bronze, iron, lead, and tin have survived for several thousand years. Dry environments, such as tombs, appear to be optimum for metal preservation, but some metals have survived in shipwrecks for over a thousand years. Some meteoritic masses with ages estimated to be 5,000 to 20,000 years have weathered very little, while other masses from the same meteorites are in advanced stages of weathering. Copper masses from the Michigan deposits were transported by the Pleistocene glaciers. Areas on the copper surfaces which appear to represent glacial abrasion show minimal corrosion. Dry cooling tower technology demonstrates that in pollution free moist environments, metals fare better at tempera-

tures above than below the dewpoint. Thus, in moderate temperature regimes, elevated temperatures may be useful rather than detrimental for exposures of metal to air. In liquid environments, relatively complex radiolysis reactions can occur, particularly where multiple species are present. A dry environment largely obviates radiolysis effects. DOE

N80-26350*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING ORBITER COMPLETION MISSION AND VIKING LANDER MONITOR MISSION
R. L. Gillette *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 58-61 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03B

N80-26361*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DATA ACQUISITION FOR MEASURING THE WIND ON VENUS FROM PIONEER VENUS
J. R. Smith and R. Ramos (NASA. Ames Res. Center) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 140-149 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03B

N80-27269*# Cornell Univ., New York.
GEOMORPHOLOGY OF MARTIAN VALLEYS
David Christopher *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 5-160 refs (For primary document see N80-27268 17-99)
Avail: NTIS HC A14/MF A01 CSCL 03B

N80-27271*# Washington Univ., St. Louis, Mo.
THE STRATIGRAPHIC SEQUENCE OF VOLCANIC AND SEDIMENTARY UNITS IN THE NORTH POLAR REGION OF MARS M.S. Thesis
Michael Edward Botts *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 267-326 refs (For primary document see N80-27268 17-99)
Avail: NTIS HC A14/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-27263*# National Aeronautics and Space Administration, Washington, D. C.
HOURLY AVERAGE VALUES OF SOLAR WING PARAMETERS (FLOW RATE AND ION TEMPERATURES) ACCORDING TO DATA OF MEASUREMENTS OF THE VENERA-9 AND VENERA-10 AUTOMATIC INTERPLANETARY STATIONS ON AN EARTH-VENUS DURING THE PERIOD JUNE 1975 - APRIL 1976
O. L. Vaysberg, A. V. Dyachkov, V. N. Smirnov, K. B. Tsyrkin, and R. A. Isaeva Jun. 1980 26 p Transl. into ENGLISH of Russian report Pr-494, Moscow, 1979 p 1-50 Transl. by Kanner (LEO) Associates, Redwood City, Calif. Original doc. prepared by Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-76213; Pr-494) Avail: NTIS HC A03/MF A01 CSCL 03B

Four electrostatic analyzers with channel electron multipliers as detectors were used to measure solar wind ionic flow. The axes of the fields of vision of two of these analyzers were directed along the axis of the automatic interplanetary station, oriented towards the Sun, while the other two were turned in one plane at angles of +15 deg and -15 deg. The full hemisphere of the angular diagram of each analyzer was approximately 5 deg. The energetic resolution was approximately 6%, and the geometric energy was 0.002 sq cm ave. keV. Each analyzer covered an energetic range of approximately 10 in eight energetic intervals. Spectral distributions were processed in order to obtain the velocity and temperature of the protons. Tabular data show the hour interval (universal time) and the average solar wind velocity in kilometers per second. A.R.H.

N80-27264# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 424, PART 1 (PROMPT REPORTS). DATA FOR NOVEMBER 1979, OCTOBER 1979
Helen E. Coffey Dec. 1979 159 p
(PB80-156946; SGD-424-Pt-1; NOAA-80011701) Avail: NTIS HC A08/MF A01 CSCL 03B

This prompt report provides data on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, and Boulder Geomagnetic Substorm Log. It also provides data on: daily solar activity center, sudden ionospheric disturbances, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N80-27265# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 424, PART 2 (COMPREHENSIVE REPORTS). DATA FOR JUNE 1979 AND MISCELLANEA
Helen E. Coffey Dec. 1979 50 p
(PB80-156938; SGD-424-Pt-2; NOAA-80011702) Avail: NTIS HC A03/MF A01 CSCL 03B

This comprehensive report provides data on: solar radio emission, enegetic solar particles and plasma, and solar X-ray radiation. The miscellaneous data includes solar wind measurements, coronal holes, spacecraft observations, and solar flares. GRA

N80-27246# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
PLASMA DYNAMICAL PROCESSES IN THE SOLAR WIND
Arne K. Bichter *In* Astronomishche Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 139-164 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88) Avail: NTIS HC A12/MF A01

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-27266*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
PARTICLE ENERGIZATION IN THE INNER, NONAZIMUTHALLY SYMMETRIC MAGNETOSPHERES OF NEUTRON STARS
Joseph E. Borovsky, Christoph K. Goertz, and Glenn Joyce Mar. 1980 32 p refs Sponsored in part by NSF
(Grants NsG-7632; NGL-16-001-002)
(NASA-CR-163021; Rept-80-6) Avail: NTIS HC A03/MF A01 CSCL 03B

The energization process of magnetic pumping, a combination of time dependent magnetic mirror fields with pitch-angle scattering, is applied to trapped charged particles drifting in corotating, azimuthally nonsymmetric neutron star magnetospheres. When particle energization is balanced by synchrotron radiation loss, it is found that protons, rather than electrons, reach considerable kinetic energies and radiate, in the X-ray regime, at rates up to the 10 to the 6th power MeV/proton/sec. Author

N80-27267*# Stanford Univ., Calif. Inst. for Plasma Research.
CONTRIBUTION TO THE EXTRAGALACTIC X-RAY BACKGROUND FROM CLUSTERS OF GALAXIES
Marie-Christine S. Zolcinski and Arthur B. C. Walker, Jr. May 1980 22 p refs
(NASA-CR-163020 SUIPR-811) Avail: NTIS HC A02/MF A01 CSCL 03B

The contribution to the extragalactic background from clusters of galaxies in the 2-6 keV band was computed. Two different cluster luminosity functions and two different models for cluster evolution were considered and a cluster X-ray luminosity-temperature relationship of the type L alpha T sup alpha +1/2 was assumed. It is found that the overall contribution of clusters to the background is approximately 10% of the total observed X-ray extragalactic approximately 150 eV is superimposed on the observed background. This result is quite insensitive to the different set of assumptions made in the calculation.
A.R.H.

N80-27244# Max-Planck-Institut fuer Radioastronomie, Bonn (West Germany).
RADIO CONTINUUM OBSERVATIONS OF NEARBY GALAXIES
R. Wielebinski *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 107-116 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

N80-27247# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
ACCRETION OF PLASMA ONTO NEUTRON STARS
G. Boerner and H. Riffert *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 165-203 refs (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

99 GENERAL

N80-27268*# National Aeronautics and Space Administration, Washington, D. C.
ADVANCES IN PLANETARY GEOLOGY
Alex Woronow, ed. Jun. 1980 309 p refs
(NASA-TM-81979) Avail: NTIS HC A14/MF A01 CSCL 03B

Research reports concerning the planetary geology of Mars are presented. Topics covered include the geomorphology of Martian valleys and various aspects of Martian volcanology. For individual titles, see N80-27269 through N80-27271.

N80-27269*# Cornell Univ., New York.
GEOMORPHOLOGY OF MARTIAN VALLEYS **c91**
David Christopher *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 5-160 refs (For primary document see N80-27268 17-99)
Avail: NTIS HC A14/MF A01 CSCL 03B

Data on morphology and planetmetric characteristics of 240 Martian valley networks reveal seven network patterns (e.g., digitate, parallel, stem, centrifugal, centripetal (interior and exterior), and fragmented, and three major system assemblage categories (i.e., reoccurring juxtapositions of network patterns: integrated, longitudinal and slope valley systems). Integrated networks (e.g., combinations of parallel and digitate networks) are most like terrestrial dendritic networks, but well organized, space efficient, true dendritic patterns are markedly absent on Mars. A simple physical model was devised to correlate rate of decrease of slope down network with increasing tributary junction angles, in order to infer longitudinal profile from planimetric pattern. Dendritic terrestrial networks are consistent with this model with exponentially decreasing slopes. It is concluded that Martian valley systems are ancient landforms which show little evidence of having been formed by rainfall erosion. Truth table analysis of various alternative formation processes finds flow from lithospheric source accompanied by sapping as the most likely mechanism.
R.E.S.

N80-27270*# Arizona Univ., Tucson.
VOLCANO-ICE INTERACTIONS ON THE EARTH AND MARS Ph.D. Thesis **c46**
Carlton Carl Allen *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 165-264 refs (For primary document see N80-27268 17-99)
(Grant NGL-03-002-191)
Avail: NTIS HC A14/MF A01 CSCL 03B

Analogs to terrestrial table mountains, ridges and pseudocraters have been identified on Viking imagery of Mars, notably in Acidalia Planitia. Photointerpretation of this region has led to the formulation of a consistent geologic history. An ice rich regolith once overlay the present plains surface, and may still exist in the adjacent highlands. Volcanic eruptions beneath this layer produced the Martian analogs to table mountains and ridges. Estimates of the heights of these features indicate that the regolith averaged approximately 500 m thick. At some time, changes in in climate or subsurface heat flow led to melting of the ice and breakdown of the regolith. Subsequently the exposed lowlands were extensively resurfaced by thin lava flows. A similar history is postulated for all of the northern plains of Mars, based on the occurrence of geologic features resembling those in Acidalia Planitia. The ice rich regolith required by this model could have contained 8 times 10 to the 21st power cu cm of water. This is several times the total volume thought to have been outgassed by the planet, based on atmospheric measurements. A serious discrepancy thus exists between interpretations of geologic and atmospheric data concerning the history of water on Mars.
R.E.S.

N80-27271*# Washington Univ., St. Louis, Mo.
THE STRATIGRAPHIC SEQUENCE OF VOLCANIC AND SEDIMENTARY UNITS IN THE NORTH POLAR REGION OF MARS M.S. Thesis **c91**
Michael Edward Botts *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 267-326 refs (For primary document see N80-27268 17-99)
Avail: NTIS HC A14/MF A01 CSCL 03B

Based on photogeologic mapping of Viking Orbiter images of Mars, four distinct informal stratigraphic units can be defined for the region north of 70 N latitude. They are: (1) bulbous plains, (2) mantled plains, (3) dune deposits, and (4) layered deposits/perennial ice. The bulbous plains unit underlies all other north polar units and represents a sub-unit of the mottled cratered plains. The low albedo of bulbous plains and the appearance of what appears to be a dike suggest that bulbous plains has a volcanic origin. Cumulative crater size frequency distribution functions for bulbous and mantled plains support the interpretation that mantled plains were formed by dust blanketing of bulbous plains. Dune deposits occur in the form of longitudinal, transverse, and barchan dunes, and possibly as sheet sand deposits. A gradation from densely spaced transverse dunes to more dispersed barchan and transverse dunes implies a general thinning of circumpolar dune deposits downwind of extensive areas mapped as bulbous plains. It is concluded that dune material is being stripped from bulbous plains and is accumulating as dunes downwind on mantled plains.
R.E.S.

N80-27272*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY, 1979 Bibliography Report, Jan. - Dec. 1979
15 May 1980 207 p
(Contract NAS7-100)
(NASA-CR-163287; JPL-Bibl-39-21) Avail: NTIS HC A10/MF A01 CSCL 05B

This bibliography includes 1004 technical reports, released during calendar year 1979, that resulted from scientific and engineering work performed, or managed, by the Jet Propulsion Laboratory. Three classes of publications are included: (1) JPL Publications; (2) articles published in the open literature; and (3) articles from the bimonthly Deep Space Network Progress Report. The publications are indexed by: (1) author, (2) subject, and (3) publication type and number. A descriptive entry appears under the name of each author of each publication; an abstract is included with the entry for the primary (first listed) author. Unless designated otherwise, all publications listed are unclassified.
J.M.S.

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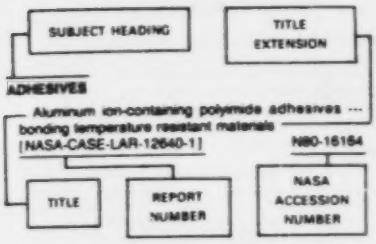

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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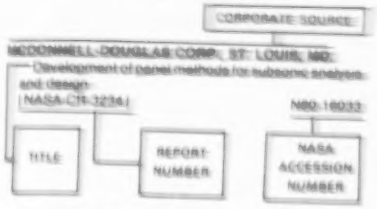

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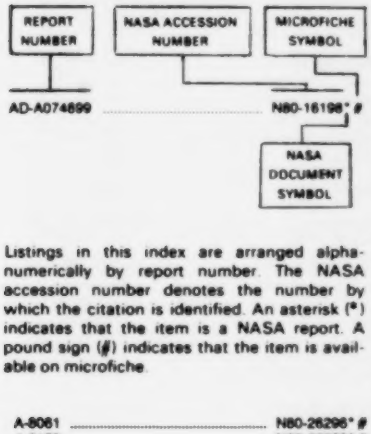

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NASA-CR-3239 ..... N80-27091* #
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NASA-CR-3259 ..... N80-26410* #
NASA-CR-3263 ..... N80-26746* #
NASA-CR-3266 ..... N80-26374* #
NASA-CR-3287 ..... N80-26697* #
NASA-CR-3299 ..... N80-27111* #
NASA-CR-145362 ..... N80-26268* #
NASA-CR-150607 ..... N80-26603* #
NASA-CR-152323 ..... N80-26270* #
NASA-CR-152375 ..... N80-26364* #
NASA-CR-154624-VOL-1 ..... N80-26750* #
NASA-CR-154624-VOL-2 ..... N80-26751* #
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NASA-CR-156865 ..... N80-26743* #
NASA-CR-159130 ..... N80-26269* #
NASA-CR-159205 ..... N80-26392* #
NASA-CR-159206 ..... N80-26391* #
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NASA-CR-159210 ..... N80-26393* #
NASA-CR-159220 ..... N80-26293* #
NASA-CR-159233 ..... N80-26883* #
NASA-CR-159239 ..... N80-26696* #
NASA-CR-159241 ..... N80-26695* #
NASA-CR-159242 ..... N80-26745* #
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NASA-CR-159689 ..... N80-26427* #
NASA-CR-159710 ..... N80-26300* #
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NASA-CR-160000 ..... N80-26638* #
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NASA-CR-160655 ..... N80-26718* #
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NSWC/TR-79-139 ..... N80-26624 #
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NTSB-AAR-80-8 ..... N80-26287 #

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OWRT-A-042-ARK(2) ..... N80-27206 #

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PB80-137201 ..... N80-26968 #
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PB80-139389 ..... N80-27237 #
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PB80-144629 ..... N80-26759 #
PB80-144694 ..... N80-26960 #
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PB80-149552 ..... N80-26972 #
PB80-149891 ..... N80-26970 #
PB80-150105 ..... N80-26969 #
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PB80-150808 ..... N80-27049 #
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PB80-151012 ..... N80-27209 #
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PB80-153034 ..... N80-27061 #
PB80-153927 ..... N80-26965 #
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RHO-CD-78-34-4Q ..... N80-27175 #

RHO-SA-115 ..... N80-26421 #

RHR-79-111 ..... N80-26695* #

RI/RD78-207-1 ..... N80-26796 #
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RLO-2227/T29-10 ..... N80-26629 #

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RR-833 ..... N80-26989 #
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RSL-TR-264-30 ..... N80-26719* #
RSL-TR-380-1 ..... N80-26714* #

RTI-41U-1878 ..... N80-26797 #

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SAN-2072-1-VOL-1 ..... N80-26874 #
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SAN-3042-2 ..... N80-26809 #

SAND-78-7072-VOL-1/2 ..... N80-26830 #
SAND-79-1356C ..... N80-26703 #
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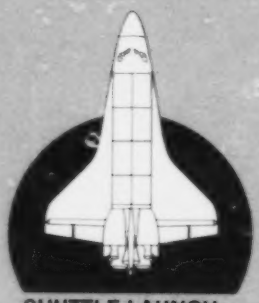

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01 AERONAUTICS (GENERAL) 2359

02 AERODYNAMICS 2359

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 2363

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 2364

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For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 2370

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 2372

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 2372

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 2377

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 2378

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 2378

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13 ASTRODYNAMICS N.A.

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 2379

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

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Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 2381

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 2382
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20 SPACECRAFT PROPULSION AND POWER 2382
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) N.A.
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24 COMPOSITE MATERIALS 2383
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For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 2388
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27 NONMETALLIC MATERIALS 2391
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28 PROPELLANTS AND FUELS 2393
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ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 2397
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32 COMMUNICATIONS 2399
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33 ELECTRONICS AND ELECTRICAL ENGINEERING 2407
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34 FLUID MECHANICS AND HEAT TRANSFER 2411
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For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 2418
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36 LASERS AND MASERS 2420
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37 MECHANICAL ENGINEERING 2421
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38 QUALITY ASSURANCE AND RELIABILITY 2423
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39 STRUCTURAL MECHANICS 2424
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GEOSCIENCES

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For related information see also *Space Sciences*.

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43 EARTH RESOURCES 2430

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 2435

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 2440

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

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Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 2452

Includes weather forecasting and modification.

48 OCEANOGRAPHY 2462

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 2463

Includes genetics.

52 AEROSPACE MEDICINE 2471

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 2475

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 2475

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

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61 COMPUTER PROGRAMMING AND SOFTWARE 2477

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 2480

Includes computer networks.

63 CYBERNETICS 2480

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 2482

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65 STATISTICS AND PROBABILITY 2486

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 2487

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS N.A.

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

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73 NUCLEAR AND HIGH-ENERGY PHYSICS 2493
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77 THERMODYNAMICS AND STATISTICAL PHYSICS 2500
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2500
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2501
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2503
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2503
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2506
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2507
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2509
Includes planetology; and manned and unmanned flights.
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92 SOLAR PHYSICS 2509
Includes solar activity, solar flares, solar radiation and sunspots.

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NASA ACCESSION NUMBER → N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif ← CORPORATE SOURCE

TITLE → **STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE**

PUBLICATION DATE

AUTHOR → D. J. Mourey 3 Sep 1979 409 p refs

(Contract NAS1-15624)

AVAILABILITY SOURCE

CONTRACT OR GRANT → (NASA-CR-159149) Avail: NTIS HC A18/MF A01

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REPORT NUMBER

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, NAVY VEHICLE DESIGN AND CONSTRUCTION - VORTEX/WING VISCOUS INTERACTION THEORY AND ANALYSIS
C.J. Dixon, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DN475229; N00014-74-C-0151)

The objective is to expand the understanding and knowledge concerning the creation, development and stability of leading edge and other wing intersecting vortices, and to develop the analytical tools to explore these phenomena for the design of tactical aircraft wings, utilizing optimized wing-vortex interactions for improved aerodynamic efficiency

The approach is to refine and improve the viscous numerical model developed under the conraact, and to use that model to investigate the effects of vortex formation, strength, position, growth or decay, and incipient burst, on the lifting-surface interacting vortex. Specific knowledge concerning the critical leading edge conditions and typical boundary conditions is to be obtained through wind tunnel tests and boundary-layer computations in the leading edge region. The viscous numerical model is being coupled with a potential flow model to provide complete aircraft forces and moments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0002, INTEGRATED CONTROL SET
J. Whitton, General Electric Co., Aerospace Electronic Systems Division, *French Rd., Utica, New York* 13502 (DN081108; N62269-78-C-0375)

Current military aircraft cockpits abound with dedicated switches and controls which are used for a relatively short portion of the total mission. The numbers and locations of these dedicated switches and controls increase the pilots mission workload, clutter the cockpit instrument panel and foster errors and omission during phases of the mission in addition to increasing pilot training requirements. The integrated control set is designed to centralize the location of control switches, reduce the number of controls and switches needed and reduce pilot workload and training time.

Investigate the feasibility of using liquid crystal technology to fabricate the ICP. A number of switches shall have legends which are programmable according to mission phase. Switches will provide tactile and visual feedback and shall be readable in high ambient light level.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0003, QUIET PROPELLER CONCEPT EVALUATION
R.M. McGregor, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451910)

The objective of this program is to evaluate the noise characteristics of various tail rotor configurations to determine the noise reduction potential of various new designs. Variables to be investigated include number of blades, blade to hub phasing angles and blade length.

This exploratory research program is divided into three phases as follows: Phase I - analytical prediction. This phase consists of the development of analytical techniques to predict the performance and acoustic characteristics of the various tail rotor configurations under consideration. The prediction programs will then be used to select the final test configurations. Phase II - experimental verification. This phase consists of the experimental verification of predicted performance and acoustic characteristics utilizing the propeller acoustics static test facility. Static performance and near-field acoustic data will be acquired for representative configurations. Phase III - correlation. This phase consists of a comparison of the results acquired during Phases I and II, modification of the prediction methods developed during Phase I where necessary and development of design procedures for reducing propeller and rotor noise.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0004, EMPIRICAL REPRESENTATION OF PARAMETRIC TURBINE ENGINE PERFORMANCE
J.R. Ruble, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF457530)

This effort will attempt to develop and/or modify multi-dimensional empirical procedures to represent engine performance (thrust, airflow, fuel flow) for a matrix of engine designs. Independent or input parameters to be examined will include bypass ratio, fan pressure ratio, overall pressure ratio, altitude, Mach number and power setting.

Currently, multi-dimensional empirical procedures are being developed by aircraft manufacturers to represent complex functions of several independent airframe parameters (wing loading, aspect ratio, sweep, thrust loading, etc) for some desired dependent parameter (takeoff gross weight, range, combat performance, etc). The need for this type of development is to reduce the amount of computer time required to evaluate preliminary aircraft system performance as a function of several (8 to 17) variables. The empirical procedures, when properly applied, can reduce preliminary design computer run time by an order of magnitude. In this effort, these procedures, or modifications of them, will be examined to determine if engine performance data can be represented empirically.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0005, HALON 1301 FIRE EXTINGUISHER SYSTEMS FOR AIRCRAFT DRY BAYS
C.L. Anderson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143820)

This work unit will provide a technical data base to improve the vulnerability and survivability of aircraft in the combat environment. the major cause of aircraft combat losses is fuel system fire/explosion resulting from ballistic impact. Dry bays adjacent to aircraft fuel tanks are highly vulnerable to fires resulting from ballistic impact and are difficult to protect using current technology. The objective of this work unit will be to explore the use of halon 1301 fire extinguisher systems for protection against ballistically induced dry bay fires. Current tech-

nology is well developed for the use of halon 1301 fire extinguisher in well controlled situations such as engine nacelles. The use of halon 1301 extinguisher systems for ballistic protection is a natural extension of existing technology. However, the effects of ballistic impact performance is not fully understood and will require experimental investigation. The use of halon 1301 fire extinguisher systems for ballistic protection in dry bays will offer an attractive alternate protection concept to the aircraft designer. This type of system will be lighter in weight and will not have the environmental problems encountered with present state-of-the-art technology.

Evaluate present state-of-the-art technology for extinguisher system applications and choose a representative system/aircraft configuration to perform experimental/analytical investigations. Perform agent discharge tests to determine the effects of ballistic impact on extinguisher system performance. Perform high realism ballistic tests for proof of performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, INVESTIGATION OF SIDESTICK CONTROLLER DYNAMICS

G.T. Black, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144160)

The function or mission supported by this work unit is the updating of military flying quality requirements contained in MIL-F-8785B, specifically the development of flying qualities design criteria for sidestick-controller dynamics and sidestick-controlled aircraft. The problem area is optimally interfacing the pilot with the controller and aircraft for sidestick-controlled aircraft. The objective is to assemble a data base and to develop sidestick controller and sidestick-controlled aircraft criteria for use in the military flying qualities specification. The military relevancy is to improve the effectiveness of combat aircraft through better pilot/control-stick/aircraft interface characteristics.

The approach to be taken in fulfilling the objective is to assemble the available data base and prepare specification criteria based on these data for inclusion in the new MIL-PRIME-STD for flying qualities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, SMALL SCALE MILITARY FLIGHT VEHICLE TECHNOLOGY

D.T. Lowe, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143010)

This effort supports development of advanced configurations of remotely-piloted vehicles (RPVs). Currently aerodynamic efficient drone vehicle designs which can be produced cheaply and are expendable do not exist. The objective of this effort is to develop and test the technologies to produce inexpensive, lightweight, small-scale drone vehicles. The configurations and subsystems developed in this effort will provide attractive low-cost options for carrier vehicles to conduct such military operations as defense suppression, target strike, ecm or reconnaissance.

Examine and adapt available hardware and concepts from small military drones. The major difficulties will be in achieving sufficient size reduction and low cost to meet cost and weight goals. The airframe design configurations will be proven by wind tunnel and flight testing. Low cost flight stabilization and control subsystems will be considered, as will radar cross-section and survivability. Developments from airframe and avionics contracts will be integrated into final designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, WIND SHEAR SUPPORT PROGRAM

H. Wolowicz, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143470)

This work unit is the Air Force part of a joint USAF/FAA effort in wind shear research under interagency agreement DOT-FA70WAI-173, modification 16. This combination of resources allows both organizations to supplement each other by exploiting their special capabilities and expertise to address the wind shear problem. In recent years, wind shear has been identified as the probable cause of a number of civilian and military aircraft accidents in the landing and takeoff phases of flight. Data compiled by the Air Force inspection and safety center reveals that from 1965 through 1974, 41 probable shear/vortex related terminal area accidents cost the Air Force over 18 million dollars (multi-command ROC 501-76, 'Low-altitude wind warning system'). Additionally, just as wind shear affects landings and takeoffs, it can also disrupt the accuracy of weapon delivery operations. Since the FAA has been designated as the lead agency for wind shear research, the Air Force will not develop a separate program, but will support the FAA through this cooperative effort. The objectives of this work unit are to develop, test and evaluate systems that provide to the flight crew, timely warnings of wind shear conditions, and to develop techniques for aircraft control through such conditions. The capability to reduce, or eliminate, the wind shear hazard to aircraft operations will increase the probability of successful mission accomplishment.

The Speckled Trout flight test aircraft will be used to test and demonstrate experimental wind shear systems. Present systems under development include wind shear sensors, displays, and telementry systems to aid the aircrew during flight operations. Additionally, the test aircraft, with its inertial navigation and data acquisition systems, will be used to verify wind shear forecasts at selected locations. All testing will be done on a non-interfering basis and will be scheduled around the Speckled Trout operational commitments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CHEMISORPTION AND CATALYSIS ON SOLID SURFACES USING MOLECULAR MANY-BODY TECHNIQUES

W.A. Goddard, California Inst. of Technology, Graduate School, Dept. of Chemistry & Chemical Engineering, *1201 E. California Blvd., Pasadena, California* 91109 (DMR74-04965 A03)

It is proposed to carry out quantum mechanical calculations of (1) the electronic states of surfaces, (2) of chemisorption of atoms and molecules onto surfaces, and (3) of the reactions of adsorbed atoms and molecules on surfaces (heterogeneous catalysis). This study will make use of the many-body quantum mechanical techniques developed and applied in the last two years to the study of the electronic states and reaction mechanisms of small molecules (O_3, butadiene, etc.). Such techniques seem better geared to answering the important questions about chemisorption and catalysis than the more standard techniques of solid-state physics. The objective is to establish the basic mechanisms involved in chemisorption and heterogeneous catalysis and to develop computational techniques that can provide a detailed understanding of the fundamental processes.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0002, DYNAMICS AND INTERACTIONS IN CONDENSED SYSTEMS

J.P. McTague, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Chemistry, *405 Hilgard Ave., Los Angeles, California* 90024 (CHE76-21293 A03)

The structure, dynamics, interactions, and phase transitions in condensed phases and monolayer films will be investigated by three techniques: neutron and light scattering, and molecular dynamics simulation. Neutron scattering experiments on monolayer systems will explore the molecular structures, orientations, and phase transitions. Concomitant computer studies will attempt to ascertain the mechanisms of the two-dimensional phase transitions in these systems, as well as examining the details of

the process of freezing in three dimensions. A combined neutron and light scattering study will explore the dynamics of liquid N2. This work is a continuation of that currently supported by Foundation grant GP-40350X.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0003, REACTIONS OF METASTABLE ATOMS AND MOLECULES

E.E. Muschlitz, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Chemistry, *208 Tigert Hall, Gainesville, Florida* 32601 (CHE76-17244 A03)

Dr. Muschlitz will continue experimental research on transfer of electronic excitation energy in molecular collisions using molecular beams, optical, and mass spectrometric techniques (currently supported by NSF Grant GP-30846X). In particular, more precise determination of the velocity dependence of absolute cross sections for Penning and association ionization will be made for reactions of state-selected beams of helium metastable atoms with various gases. New molecular beam investigations will be made of the velocity dependence of fluorescence following electronic energy transfer in collisions of metastable rare gas atoms. In particular, the vibrational energy distribution of product species will be determined by spectroscopic analysis of the emitted light. The results of these experiments would provide detailed answers concerning the mechanism of these bimolecular energy transfer processes which are of considerable importance in our understanding of upper atmosphere phenomena and the mechanism of laser action.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, ENVIRONMENTAL FATE OF HYDRAZINE FUELS

M.J. MacNaughton, U.S. Dept. of Defense, Air Force, Engineering & Services Center, Engineering & Services Lab., *Tyndall Air Force Base, Panama City, Florida* 32403 (DF408060)

Because of the increased use of the hydrazine family of compounds in rocket fuels and in monopropellent generators it is necessary to understand the chemistry of these compounds in the environment subsequent to their release by spills, venting or incomplete combustion. This data is necessary because of the toxic nature of these fuels and the requirement to assess the environmental effect of their use.

The time dependent fate of these fuels will be determined in the atmospheric, aquatic and terrestrial phases. The level of minor components which may be significant will also be determined. Infrared and mass spectral analysis will be used to determine reaction rates and decomposition products.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

3.0005, EXTENDED KOOPMANS' THEOREM AND ITS APPLICATION TO QUANTUM CHEMISTRY

D.W. Smith, University of Georgia, School of Liberal Arts, Dept. of Chemistry, *Athens, Georgia* 30601 (CHE75-02353 A02)

Dr. Smith intends to continue a program of research currently supported by Foundation grant, GP-34497X. Koopmans' Theorem in its original formulation states that in the independent particle scheme, the energy to remove an electron from an atom or molecule is equal to the energy of the orbital which the electron occupied. These energies must be calculated by the self-consistent-field method to be physically significant. Dr. Smith plans to investigate an extension of this theorem through calculations of ionization potentials and through development of the mathematical and conceptual basis of the extended theorem. While the original theorem has been widely used in chemistry and electron physics, and is so basic to chemical and physical thinking that it is implied in most discussions of electron loss, capture, and excitation, there are two major drawbacks to the use of the theorem. First, it assumes a self-consistent (independent-particle) approximation for the parent atom or molecule undergoing ionization, and therefore ignores correlation effects. Second, it does not allow for rearrangement of the other electrons when one is removed. His extended theorem corrects for these two deficiencies in such a way as to give extremely accurate predictions of valence electron ionization energies in preliminary studies so far, on 4-electron systems. He plans to study additional systems such as the Li and Ne atoms and the N2 molecule, and to investigate the properties of the new effective single-particle potential which comes out of the theory.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, A PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL PRODUCED FROM WHOLE CRUDE SHALE OIL

W.A. Sutton, Ashland Oil Inc., *1409 Winchester Ave., Ashland, Kentucky* 41101 (DF463890; F33615-78-C-2080)

The objectives of this program are to optimize new procedures for the efficient and economic processing of whole crude shale oil into high yields of military fuels while maximizing the yield of aviation turbine fuel and to determine the trade-offs between jet fuel yield, jet fuel properties, and processing costs.

The proposed program will be a 28 month effort incorporating all the following aspects, (1) process variable analysis, (2) analysis of laboratory samples, (3) production of component test samples, and (4) overall economic optimization by computer model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0007, ELECTRON TRANSPORT IN NONPOLAR FLUID

H.T. Davis, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Chemical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (CHE78-08663)

This research is under the Structural Chemistry and Thermodynamics program, in the subarea of electronic processes in fluids. Professor Davis will undertake an experimental investigation of the drift velocity, diffusivity, attachment rates and dynamical instabilities of excess electrons in nonpolar fluids as a function of field, temperature, density and fluid composition. The object is to understand the fundamental nature of electronic processes in nonpolar fluids and to investigate the potential of such fluids for making devices such as chemical spectrometers (attachment rate studies) and as microwave amplifiers.

This research is a continuation of that currently supported by Foundation Grant, CHE-7402124.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, MATERIAL SUPPORT TECHNOLOGY - CORRELATION, DISORDER, AND NOISE IN ELECTRONIC SYSTEMS - METAL-INSULATOR TRANSITIONS IN SEMICONDUCTORS

D.C. Licciardello, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (DN775758; N00014-77-C-0711)

The fundamental processes in non-crystalline systems determine the important electronic properties of a wide range of materials that are important for naval system applications, from glass to sophisticated electronic semiconducting devices. Unfortunately, many of these fundamental processes are not well understood. This program will address the electronic properties of these non-crystalline systems.

This program will carry out basic research into the electronic properties of disordered and non-crystalline systems. The underlying principles for understanding these phenomena have been exposed within the last twenty years or so, but only recently has the kind of quantitative progress been made that is necessary for a predictive science. In particular, this program will address the theoretical aspects of the interacting Fermi glass, power law localization phenomena, semiconductor-oxide-metal systems, and noise properties. The sophisticated tech-

niques of renormalization group theory and scaling will be employed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0009, MOLECULAR BEAM AND LASER-INDUCED FLUORESCENCE SPECTROSCOPY OF SMALL MOLECULES

J.S. Muenter, University of Rochester, School of Arts & Sciences, Dept. of Chemistry, *260 Crittenden Blvd., Rochester, New York* 14627 (CHE77-12527 A01)

Using the techniques of molecular beam electric resonance spectroscopy and laser-induced fluorescence spectroscopy, Prof. Muenter will study electronic properties of a variety of small molecules. The molecular beam methods will be used to accurately measure dipole moments, polarizabilities, and nuclear hyperfine parameters of the ground electronic state of molecules. The molecules which will be studied have been chosen because of unusual chemical characteristics and in general contain fluorine, chlorine, and/or nitrogen atoms. A major goal in these studies will be obtaining information which better defines the intermolecular interactions of the molecules in question.

The laser-induced fluorescence experiments will be directed toward extending high-resolution measurements, which have been routine for the electronic ground state of molecules, to excited electronic states. Wavelength tunable dye lasers will be used to excite molecules to upper electronic levels where radio frequency and microwave transitions will be studied. The high-resolution transitions will be detected by observing the excited electronic state fluorescence. The molecular properties obtained in these experiments will provide important parameters which characterize photochemically active molecules. This research represents a continuation of that currently supported by Foundation grant CHE-7412250.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0010, GRAIN BOUNDARY PINNING OF FLUX LINES IN NIOBIUM BICRYSTALS

Y.T. Chou, Lehigh University, School of Engineering & Physical Science, Dept. of Metallurgy & Materials Science, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DMR79-15799)

This is a fundamental study of grain boundary flux pinning in niobium bicrystals. Oriented bicrystals will be grown directly from the melt, and the segregation of impurities of the grain boundary will be determined by Auger analysis. The bicrystals will be used as a model material to measure resistive current as a function of the applied magnetic field and the angle between the field and the grain boundary. The critical current measurements will be done at the Oak Ridge National Laboratory, in collaboration with Dr. DasGupta.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0011, A PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL PRODUCED FROM WHOLE CRUDE SHALE OIL

A. Schneider, Suntech Inc., *P.O. Box 1135, Marcus Hook, Pennsylvania* 19061 (DF462710; F33615-78-C-2024)

The objectives of this program are: (1) To optimize new procedures for the efficient and economic processing of whole crude shale oil into high yields of military fuels while maximizing the yield of aviation turbine fuel. (2) To determine the trade-offs between jet fuel yield, jet fuel properties and processing costs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0012, RESEARCH INITIATION - SURFACE EFFECTS ON THE MECHANICAL BEHAVIOR OF TITANIUM

E.I. Savage, University of Rhode Island, Graduate School, *Green Hall, Kingston, Rhode Island* 02881 (DMR78-05427)

The objective of this investigation is to examine in detail some previously observed effects relating surface condition to the bulk mechanical properties of titanium. The effects observed included a drop in flow stress or increase in creep rate in proportion to the applied current for commercial purity polycrystalline titanium undergoing anodic dissolution in an acidic solution. Stress relaxation experiments will be undertaken as a function of purity level, surface cleanliness, and stress reversal. The results obtained are expected to contribute toward understanding stress corrosion cracking processes in metallic materials.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0013, LASER SPECTROSCOPY OF IONS IN THE GAS PHASE

M.L. Vestal, University of Houston, School of Natural Sciences & Mathematics, Dept. of Chemistry, *3801 Cullen Blvd., Houston, Texas* 77004 (D-693)

The tandem quadrupole mass spectrometer has been mated with a new laser system consisting of a tunable dye laser pumped by a 400 KW pulsed nitrogen laser. This laser system provides continuous coverage of the spectrum from 360 to 750 nm with a bandwidth of 0.4/cm. Experimental measurements of photodissociation cross sections for the rare gas dimer ions such as Ar2 plus and Ne2 plus are currently in progress. In addition to spectroscopic investigations on the electronically excited states of ions, the present studies should provide data on collisional relaxation of specific vibrational levels of the ground electronic state. The instrument has recently been modified to allow investigations of laser photodetachment of negative ions as well as the photodissociation measurements conducted previously. This new capability is presently being applied to studies on competitive autodetachment and predissociation of laser excited CO3 ions formed in CO2 and CO2/O2 mixtures.

SUPPORTED BY Robert A. Welch Foundation

3.0014, SYNTHESIS AND OPTICAL STUDIES OF CLUSTERS AND SOLIDS EXHIBITING COOPERATIVE PHENOMENA

G.A. Crosby, Washington State University, School of Arts & Sciences, Dept. of Chemistry, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DMR78-10008)

In recent years, there has been a surge of interest in the cooperative interactions between paramagnetic transition-metal ions coupled in clusters and coupled in chains, layers, and three-dimensional solids. These interactions, classified as exchange or superexchange, are of paramount interest because of their manifestations as agents of magnetic ordering. In Professor Crosby's laboratory, optical investigations of compounds displaying these cooperative phenomena are carried out. These compounds include binuclear complexes of chromium(III) containing organic ligands, binuclear species of chromium, molybdenum and tungsten bridged by halide ligands, and simple bridged structures containing group (VIII) elements. The immediate goal of the research is to investigate both the ground and excited electronic terms of a few systems in order to obtain, by direct optical techniques, information on coupling schemes and selection rules. The long-range goal of the research is to generate new classes of compounds, mainly of the second and third row transition elements, that will display potentially interesting and useful magnetic and electronic properties.

This is a continuation of work supported by DMR 74-14443. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0015, STATIC CHARGE GENERATION ASSOCIATED WITH PLASTIC FOAM AND SURFACE COATING MATERIALS IN AIRCRAFT FUEL TANKS
A.W. Bright, University of Southampton, *Southampton, England, United Kingdom* (DF461770; AFOSR-77-3373)

Investigate the electrostatic phenomena arising from use of reticulated polyurethane foams, surface coatings, and bladder cells in aircraft fuel tanks, and the effect of fuel electrical conductivity upon the charge generation rate.

Determine the dielectric properties of various aircraft fuel tank components such as foams, coatings, and fuel cell elastomers. Study charge relaxation of fuel tank materials. Conduct part-scale and full-scale tests to determine electrostatic behavior of foams, coatings, and fuel cell materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, C-141 RELIABILITY CRITERIA MAINTENANCE
N. Singpurwalla, Southeastern Center for Electrical Engineering Education Inc, *Auburn, Alabama* 36830 (DF918890; F30602-78-C-0148)

Contractual support on this project will involve analyses of selected criteria variables in order to detect changes in location of measures of central tendency due to RCM (reliability centered maintenance) treatment. Such analyses will primarily involve time series techniques which will require review of data, identification and evaluation of candidate time series models, and discussion on the relative merits of each model proposed. Required data processing support will be provided by the AFLMC (Air Force Logistics Management Center) to include box Jenkins techniques.

Contractual support will also involve review of supporting documentation concerning the USAF RCM program (to be provided by the AFLMC), comparison of the USAF RCM concept with concepts embraced by commercial airlines, and constructive criticism as to how USAF RCM concepts might be enhanced to improve fleet availability or reduce fleet maintenance costs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0002, HIGH LOAD CAPACITY FOIL BEARING DEVELOPMENT
Unknown, Signal Co. Inc., Airesearch Manufacturing Company, *402 S. 36th St., Phoenix, Arizona* 85034 (DF463550)

To increase the load carrying capability of gas lubricated foil bearings, with primary emphasis on the journal bearing, in order to meet the maneuver load requirements of MIL-E-5007D.

(1) Use existing foil bearing analytical capability to optimize advanced foil bearing designs, (2) evaluate advanced designs in modified test rigs which eliminated rotor dynamics problems, (3) correlate experimental results with analytical predictions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0003, VPE GROWTH III-V STRUCTURES
G. Stringfellow, Hewlett Packard Co., *1501 Page Mill Rd., Palo Alto, California* 94304 (DF903150; F19628-77-C-0199)

AF function - integrated optics for communications systems. Deficiency or opportunity - GaAs-AlGaAs epitaxial structures for integrated optics devices are being grown exclusively by liquid phase epitaxial techniques. Problems involving consistent surface morphology, and reproducibility have slowed progress, and scaling up has not been demonstrated. How research contributes - vapor phase epitaxial processes have demonstrated an ability to produce layers with superior morphology and in the case of LED production have been scaled successfully. The ability to deposit AlGaAs and high purity GaAs layers by using organometallics in a vapor phase system has been shown. Successful application of this technique to the fabrication of integrated optics devices could eliminate the present deficiencies of liquid phase preparation techniques.

A vapor phase deposition process using organometallic compounds will be investigated, studied, and developed to produce GaAs-AlGaAs device structures for use as components in integrated optics systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0004, INFRARED AND OPTICAL MICROSCOPY EMPLOYING NONLINEAR OPTICAL TECHNIQUES
R.W. Hellwarth, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (ENG78-04774)

The objective of this project is to explore and expand the use of nonlinear optics in microscopy. Means are being sought to make visible microstructures, such as domains and inclusions in materials, which are not visible to other microscopes. The most exciting new techniques being explored are those based on a discovery that a time-reversed replica of a monochromatic image can be generated utilizing the inherent nonlinear refraction that is present in all materials. These techniques, which fall into three classes, are used to image: (1) The structure in the nonlinear refractive index in classes of materials, (2) Regions in which the linear refractive index is not the same for the forward and reversed waves, and (3) Spatial changes in birefringence of materials.

Resonant enhancement, and the experimental means of implementing the replication process are being investigated. This research is important not only to microscopy but to signal and image processing as well.

This research was previously supported under NSF Grant ENG75-19335.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0005, LARGE APERTURE SYSTEM APPLICATIONS
F. Ayer, Charles Stark Draper Lab. Inc., *68 Albany St., Cambridge, Massachusetts* 02139 (DF911430; F30602-78-C-0128)

The objective of this effort is to assess active control concepts for disturbance suppression and performance enhancement of large aperture, ultra light weight space radar antennas. Also to develop design criteria for improved performance of such antennas with and without active control.

Active control approaches shall be analytically investigated for distortion suppression of modeled disturbance characteristic of large aperture, ultra light weighted radar antennas for space applications. Mechanical/electrical implementations shall be assessed for both reflective and phased array antennas. Performance benefits shall be contrasted against passive distortion suppression approaches.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0006, HETEROSTRUCTURE NEAR-INFRARED DETECTORS, LIGHT EMITTERS AND PHOTOCATHODES
C.G. Fonstad, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ENG76-09586)

A study of a quaternary system composed of aluminum, gallium, arsenic and antimony for application in heterostructure geometry, near-infrared detectors, emitters, and photocathodes will be made. The use of a quaternary is necessary to avoid lattice mismatch dislocations in heterostructure devices. Reduced junction recombination, laser thresholds, and leakage in detectors and photocathodes, and increased radiative efficiency and operating lifetimes of high intensity sources are possible. Liquid phase epitaxy will be used to thoroughly characterize the growth, lattice constant, and energy gap of this quaternary. The

program will emphasize applications to heterostructure laser diodes for use in fiber-based optical communication systems. The use of silicon doping in the active region is an important and, for this alloy system, a unique feature of this program.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0007, HIGH ENERGY DENSITY PHOTOVOLTAIC CONVERTERS

D.H. Navon, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Electrical Engineering, *Amherst, Massachusetts* 01002 (ENG76-80145)

An investigation will be initiated into the optimum designs of semiconductor photovoltaic converters under high energy density irradiation conditions. The work is motivated by interest in collection systems that use mirrors and lenses to focus the incident solar energy onto relatively small solar cell devices. The research will be directed toward calculating the current density and temperature distributions in a two-dimensional model of a semiconductor photovoltaic cell, as well as the power output under intense illumination. Due to the highly nonlinear nature of the electrical carrier flow and heat flow equations describing the device operation, a difference equation computer analysis of the problem will be employed. This will facilitate investigation of a variety of device structures incorporating heterotaxial layers, arbitrary impurity distributions, different electrode configurations, unusual cell geometries, etc. Effects such as the impurity concentration, temperature, and field dependence of the carrier mobilities, the temperature dependence of the thermal conductivity, the various surface and bulk recombination mechanisms, etc., will be included in this computer-aided two-dimensional, high current density level, nonisothermal model.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0008, MEASUREMENT OF THREE-DIMENSIONAL TEMPERATURE FIELDS BY HOLOGRAPHIC INTERFEROMETRY

C.M. Vest, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Mechanical Engineering, *Ann Arbor, Michigan* 48104 (ENG76-24121)

Multidirectional holographic interferometry will be developed for application to measurement of three dimensional, asymmetric temperature field in fluids, and will be applied to the study of thermal plumes. Emphasis will be on improvement of attainable accuracy and alleviation of experimental difficulties due to refraction and opaque objects in the test section. Experimental accuracy will be improved by developing a holographic interferometer in which phase shifts are measured with high precision by electronic means. The accuracy with which temperature fields are computed from interferometric data will be improved by a direct three-dimensional reconstruction method that more fully utilizes the data available in a multidirectional interferogram. A method for using holographic interferometry to measure temperature fields that significantly refract probing optical rays will be developed. Methods for reconstructing temperature fields when an opaque object blocks a portion of the probing optical rays will be developed. The use of fringe localization measurement in analysis of interferograms will be explored. The technique developed during this program will be used to study the interaction of thermal plumes above multiple sources, and natural convection above surfaces of arbitrary platforms. The feasibility of determining the spatial distribution of temperature in turbulent plumes will be assessed.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0009, MEASUREMENTS OF OH FLUOROESCENCE AND ABSORPTION USING A TUNABLE DYE LASER

C.C. Wang, Wayne State University, School of Engineering, Dept. of Electrical & Computer Engineering, *5950 Cass Ave., Detroit, Michigan* 48202 (ENG77-26618)

Theoretical and experimental studies are being conducted to assess the feasibility of using a tunable dye laser and the technique of resonance absorption to determine the temperature and the OH concentration in combustion media. In particular, efforts are being made to determine: (1) the conditions under which the population distribution among high-lying rotational levels can be used for estimating the temperature of the medium; (2) the pressure and temperature range over which the translational temperature of OH can be deduced from the linewidth of the absorption transitions of OH; and (3) the nature of such physical phenomena as the saturation of the absorption transition and their effect on the results of measurements.

The fluorescence technique for temperature determination in a combustion medium is also being studied. Particular attention is being given to the pressure and temperature dependence of such parameters as linewidth of the absorption transition and quenching of the excited OH. In addition, interference effects due to fluorescence and spontaneous Raman emission of other molecular species present in the medium are being considered. A dye laser system consisting of the two independently tunable lasers is being set up in order to measure the relative absorption of two different rotational levels and to thereby determine rotational temperatures.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0010, FLICKER NOISE IN SEMICONDUCTOR DEVICES

A. van der Ziel, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Electrical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (ENG78-25426)

The low frequency noise properties of semiconductor devices are being examined from both theoretical and experimental points of view. Interest is centered on developing a comprehensive model to characterize flicker noise and to resolve questions concerning the noise source. These questions deal with carrier density and mobility fluctuation contributions to the noise and with the relation of these effects to such phenomena as trapping and detrapping of carriers in oxide-semiconductor interface states. Experiments are performed in semiconductor diodes that are subjected to diffusion and related surface treatments and are operated under varying conditions of surface inversion. Measurements on thermoelectric and Hall effect devices are also being performed and correlated with theory.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0011, STOCHASTIC METHODS IN WIND-STRUCTURE INTERACTION

M. Shinozuka, Columbia University, School of Engineering & Applied Science, Dept. of Civil Engineering & Engineering Mechanics, *Broadway & W. 116th St., New York, New York* 10027 (ENG76-12257)

The specific objectives and methodologies are twofold. Mathematical Modeling of Wind-Structure Interaction - since most civil engineering structures are not well streamlined and since the incoming flow can be highly turbulent the existing aerodynamic theories under the conditions of steady fluid do not adequately describe the wind-structure interaction. Therefore, it is intended to utilize the existing theory of nonsteady aerodynamics of bluff bodies in a turbulent flow as well as the random process theory to establish an analytical model between wind velocity and wind forces for a variety of structures of practical importance. Then, utilizing the existing experimental observation from full scale measurements and wind tunnel testing, the validity and the necessary modifications of the analytical wind-structure interaction models will be established. Identification of Structural-Aerodynamic Systems - recently some effort has been made to identify structural dynamic parameters such as damping and natural frequencies from measurements of structural response under ambient excitation. However, it is of equal importance to identify the self-excited and buffeting aerodynamic wind loads acting on the structure. The time-domain procedure to be developed will provide a simple and relatively inexpensive alternative for identifying the characteristics of in-

teracting wind-structure systems since it only requires the measurements of input and output or sometimes output data alone. Specifically, the objectives here are to explicitly identify all structural and aerodynamic parameters involved in the equation of motion of the interacting system from observed time histories of (wind velocity) input and (deformation) response output.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0012, ACTIVE CONTROL SYSTEMS FOR CIVIL ENGINEERING STRUCTURES

T.T. Soong, State University of New York, Buffalo Campus, School of Engineering & Applied Science, Dept. of Civil Engineering, *3435 Main St., Buffalo, New York* 14214 (ENG76-82226 A01)

This grant provides the second year of funding for theoretical research previously described under NSF/ENG-76-82226. Additionally, it incorporates limited experimental work using two five foot aerodynamic models in a wind tunnel to verify the potential of active surfaces for dissipation of unwanted kinetic energy in structures.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0013, TURBINE ENGINE EXHAUST NOZZLE PERFORMANCE INVESTIGATION

D.A. Dusa, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF455850; F33615-73-C-2037)

The objective of this program is to assess the potential for use of various plug nozzle types in advanced integrated propulsion systems of the future. In particular, the contractor will define external and internal flow characteristics and performance of promising plug nozzle designs installed in afterbodies of advanced design.

Phase I, design studies of various plug nozzle types and afterbody shapes for use in advanced technology engines. Phase II, fabrication and testing of the most promising of these configurations. Phase III, definition of follow-on full simulation testing program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0014, TF 34 ENGINE TEST

L. Colemerrill, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF462080)

To provide definition and assessment of performance, functional, and life characteristics of the TF34 model engine.

Conduct a series of sea level static tests in the AFAPL facilities to acquire and analyze performance, functional and life data of the TF34 engine and submit appropriate recommendations regarding current problem solutions and improvements. The first test (Phase I) will consist of an engine/facility checkout program for personnel familiarization and confirmation of installation, instrumentation and operation aspects. Phase II will consist of a series of cyclic endurance tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0015, CRF FLOW QUALITY INVESTIGATION

R. Rivir, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF460540)

The primary objectives of this program are to determine the steady-state and dynamic distortion levels within the test chamber and the compressor bell-mouth of the compressor research facility (CRF) and to develop techniques to reduce these levels to acceptable values.

A series of tests are being carried out on a one-tenth scale model of the crf using global mach number scaling with flow control elements employing Reynolds number similarity. Current and planned distortion tests involve parameters such as pressure, temperature, velocity, and flow direction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0016, APPLIED NONLINEAR INTERACTIONS IN GASES AND PLASMAS

P.W. Schreiber, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458810)

AF function - laser development, combustion studies, compressor studies, chemical emissions, aerodynamic testing. Deficiency - on-site methods are needed to determine temporarily and spatially resolved species concentrations in reacting and nonreacting flows. Research -development of an experimental and theoretical base for the applications of nonlinear and linear spectroscopy to the measurement of species concentrations, temperature and velocity in plasma and gases. How research contributes- recent experimental and theoretical studies in nonlinear optics indicate that these effects may provide powerful new methods to measure spatially and temporally resolved temperature, species concentrations, and velocity in laser and combustion media. These effects will be explored analytically and experimentally for potential applications to current Air Force problems. Where applicable, programs will be initiated to develop the required optical systems for the evaluation of the new techniques.

Nonlinear effects such as stimulated Raman scattering (SRS), stimulated Brillouin scattering (SBS), and coherent anti-Stokes Raman scattering (CARS) have been generated in the laboratory in gases. In particular, CARS has been observed at low pressures for a large number of molecules. These effects will be evaluated analytically and experimentally as potential methods to measure temporally and spatially resolved temperature, velocity and number density distributions in combustion laser, and gas dynamic systems of interest to the Air Force. Special emphasis will be placed on the evaluation and interpretation of experimental data realistic environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0017, INVESTIGATION OF METHODS OF PLASMA EXCITATION

M. Lake, Universal Energy Systems Inc., *Dayton, Ohio* (DF461390; F33615-77-C-3113)

AF function - communication, illumination, weaponry. Deficiency -lack of data on efficient methods of plasma excitation and of microscopic excitation processes. Research - experimental analysis of excitation methods and cross sections. How research contributes -provides total ionization cross sections and excited state cross sections in both atomic and molecular gases. Microwave excitation provides efficient distributed discharge excitation.

The research will be conducted using three existing experimental configurations located in Bldg 450, WPAFB. They are a cross-beam excitation analyzer (2xB), a fast Fourier transform (FFT) facility and a microwave excitation facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0018, PRESTON TUBE RESPONSE IN TRANSONIC FLOWS

W.G. Tiederman, Oklahoma State University, Agricultural Experiment Station, Dept. of Mechanical & Aerospace Engineering, *107 Whitehurst Hall, Stillwater, Oklahoma* 74075

Modifications were made to the boundary layer computer program so that it could simulate the response of a Preston tube as the tube is traversed from the laminar to the fully turbulent portion of a boundary layer.

SUPPORTED BY Oklahoma State Government

4.0019, MATERIALS RESEARCH LABORATORY
G.S. Heller, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR76-80560 A01)

Partial research support is provided for 36 faculty from the Departments of Physics, Chemistry, Applied Mathematics, and Geological Sciences and from the Division of Engineering. Major interdisciplinary research programs are carried out in the following four areas: (1) Microscopic and Macroscopic Dynamic Plasticity; (2) Fracture of Solids -atomistic, microstructural, and continuum; (3) Inorganic Glasses -ionic oxides, semiconductors, and metallic alloys; (4) Chemisorption and Related Surface Interactions.

Minor programs are also carried out on the Low Temperature Properties of Materials and on the Synthesis and Properties of Pseudo-One-Dimensional Conductors.

Support is also provided for the operation and maintenance of nine central experimental facilities, with particular emphasis on materials synthesis, mechanical testing, and optical properties measurement.

This award is a continuation of Grant DMR76-00890.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

4.0020, LARGE DEFLECTIONS OF DYNAMICALLY LOADED STRUCTURES WITH PLASTIC AND VISCOPLASTIC MATERIAL BEHAVIOR
P.S. Symonds, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (ENG77-11874)

This continues research begun under NSF/ENG74-21258 and is aimed at providing techniques for estimating large deformations of engineering structures caused by high intensity pressure pulses or by impact. Strain rate sensitive plastic flow will be taken as the primary feature of inelastic behavior (in mild steel and titanium, for example), and the techniques to be investigated assume constitutive laws of homogeneous viscous type with constants derived from stress-strain data at elevated strain rates. These constants will be adjusted to correspond to changing levels of strain and strain rate in the structure. Based on these constitutive equations, two techniques of approximation will be investigated, namely, a deflection bound method, and the 'mode approximation' technique. The former furnishes an upper bound on the final deflection at any point of the structure in terms of the initial kinetic energy and on the response time. The latter provides an approximate solution for particular initial velocity conditions from any full solution of the field equations, the simplest such solution being one in modal form, i.e., a product of a time function and a function of space variables. The extension to large deflections with viscoplastic behavior will be investigated by use of the concept of instantaneous mode solutions. These satisfy the field equations at large deflections with the deflection slope field treated as known and fixed at a given instant. The unknown deflection may be obtained by an iterative scheme or a direct calculation, the shape and acceleration constituting a nonlinear eigen-problem. The computations required for the deflection bound, which have been found to be analogous to those which determine the instantaneous mode, will be further clarified and generalized.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0021, IAP SURFACE GEOMETRY GENERATION
R. Robertson, Atlantic Research Corp., *5390 Cherokee Ave., Alexandria, Virginia* 22314 (DF737690; F30602-77-C-0126)

The objective of this effort is to develop the algorithms and computer codes to generate within the computer the description of a given geometrical surface to be used as an input for the RADC electromagnetic compatibility analysis codes. Examples of such surfaces include aircraft fuselages, wings and ground-based antenna towers.

The contractor will determine the geometry inputs required by the analysis codes now existing or planned within the framework of the intrasystem compatibility analysis program (ICAP), such as the intrasystem electromagnetic compatibility analysis program (IEMCAP) and the general electromagnetic model for the analysis of complex systems (GEMACS). Based on the requirements determined from this evaluation the contractor will develop the algorithms and a computer code for a geometry generation module (GGM) that shall interface with the ICAP codes. This will enable the user to enter a physical description of the system geometry into the required solution technique to the degree of accuracy required. Candidate techniques that can be used to generate the surface geometry include generic elements (cylinders, cones, spheres, etc.) and spline function descriptors. The end item is a computer code and its documentation which can be used in a stand-alone mode or in concert with ICAP codes to mathematically model a physical system as a combination of surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0022, COMPATIBLE MILITARY/COMMERCIAL AIRCRAFT MULTIPLEX DATA BUS SYSTEM
M.D. Schule, Boeing Co., Boeing Aerospace, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN081137; N62269-79-C-0339)

The objective of this task is to generate and provide the required documentation which will allow the Navy to propose a multiplex data BUS structure which can be accepted by both the military and commercial avionics and aircraft industry for implementation within military and commercial aircraft. This contracted effort supports work unit ZC101, Agency Accession Number CN 081123.

This effort is to be accomplished within the context of existing tri-service MIL-STD-1553B and commercial ARNIC data BUS standards and specification. Additionally, work is to be performed within the framework of existing tri-service and industry multiplex data bus organizations and committees who have extensive experience and background in the area of data BUS standards, technology, and implementation.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0023, PULSE PROPAGATION AND SCATTERING IN RANDOM MEDIA
A. Ishimaru, University of Washington, School of Engineering, Dept. of Electrical Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (ENG77-12544)

This program is concerned with propagation and scattering characteristics of a short pulse in a random medium and the effect of transmission medium inhomogeneities on wave fluctuations. The study will concentrate on the following specific topics: (a) Pulse scattering from a dense random medium and image resolution. This includes studies on coherence time, coherence bandwidth, the effects of particle size and velocity distributions, backscattering and bistatic scattering from turbulence and particles, range and lateral resolutions and the effect of the imaging system. (b) Effects of inhomogeneities. This involves study of the effect of ray-bending and shrinkage of the Fresnel size on wave fluctuation characteristics, and extension of the analysis to the strong fluctuation case and to thin screen theory. The above studies will be conducted with a view towards optical, acoustic and microwave applications in communications, remote-sensing, detection, and imaging problems. Some ultrasound and optical experiments will be conducted to verify theoretical predictions.

This is a continuation of research previously supported under NSF grant ENG-7423540.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0024, LOW FREQUENCY POLAR REFLECTIVITY
N.V. Jensen, Danske Meteorologiske Institut, *Lyngby, Denmark* (DF904350; AFOSR-78-3545)

AF function - navigation and survivable communications. Deficiency - communication interference from natural and nu-

clear ionospheric disturbances. Objective - employ high resolution techniques to measure arctic propagation stability under normal and disturbed ionospheric conditions. How research contributes - provides the experimental information required for interpreting and modeling VLF/LF propagation.

The propagation reliability of these frequencies is based on theoretical modeling for which there is only limited quantitative data, particularly for disturbed conditions. As the lower ionosphere is severely disturbed during polar cap absorption events which occur occasionally at high latitudes, a unique opportunity is provided to investigate propagation effects. To observe this phenomenon, AFGL'S VLF/LF ionosounder was moved to Greenland with the transmitter at Thule Air Base and the receiver at the Danish Meteorological Institute's ionospheric observatory in Qanaq, Greenland. Through this research grant the receiver will be installed and operated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, MODULATION PHASE AND FARADAY ROTATION OBSERVATIONS OF ATS-6 SATELLITE RADIO BEACON TRANSMISSION AT COLLEGE, ALASKA

R.D. Hunsucker, University of Alaska, College Campus, Geophysical Inst., *Bunnel Memorial Bldg., College, Alaska* 99735 (ATM77-23433)

This grant funds the deployment of a 140 and 360 MHz Polarimeter receiver to measure modulation phase and Faraday rotation of the ATS-6 satellite radio beacon experiment transmission on the ATS-6 ray path to Fairbanks, Alaska.

Geosynchronous satellites allow ionospheric and plasmaspheric plasma content measurements to be made by the use of relatively simple and reliable ground based receivers. Combining two techniques (modulation phase and Faraday rotation) one can in principle sort out the near (F region) plasma content from the distant (plasmaspheric) portion along a total line of sight charged particle content. In practice this is done with accuracy inadequate to many purposes of interest unless additional information is available on the altitude distribution of the F region plasma. The receiver to be employed in the work funded here is at a location where the incoherent scatter radar (Chatanika) will provide this information, thereby allowing meaningful interpretation of the satellite transmission data received. The derived plasmaspheric electron contents are at a sufficiently high latitude that they are unique for plasmaspheric dynamical studies; the uniqueness is by virtue of the proximity to that latitude at which the very sharp plasmaspheric boundary is found to sensitively respond to geomagnetic events. One important question the data should address is whether the shrinkage of the plasmasphere during magnetospherically disturbed periods results from 'peeling away' of outer shells or an inward compression of the plasma into the ionosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0002, AURORAL HIGH LATITUDE MORPHOLOGY AND DYNAMICS

S. Akasofu, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (DF582490; F19628-79-C-0067)

AF function - transpolar communications, radar and navigation. Deficiency - the polar ionosphere is presently very unpredictable to such a degree that the above functions are frequently degraded or crippled. Objective - investigate the phenomenology of the arctic ionosphere to provide a capability for the prediction of the onset and intensity of ionospheric substorms. How research contributes - provides for the interpretation of data in terms of magnetospheric phenomenology and theory as a basis for the prediction of the onset and severity of magnetospheric substorms and warning of disturbances in support of AF systems. This effort provides inputs to in-house research for modelling effects of particle precipitation on arctic ionosphere. Investigates the phenomenology of arctic precipitation through the collection and analysis of data to provide a framework for the interpretation of data collected by AFGL airborne ionospheric observatory, NKC-135 aircraft, number 53131 and the AFGL Goose Bay ionospheric observatory.

Process and maintain aircraft and ground station all-sky camera data. Gather and interpret ionospheric and magnetospheric data for selected periods in support of special studies. Investigate ionospheric response during a magnetospheric substorm. Clarify relationship between discrete and continuous aurora using DMSP data. Study the interaction of the interplanetary magnetic field with the geomagnetic field in relation to magnetospheric substorms. Evaluate and develop techniques for predicting magnetospheric substorms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0003, CHARGED-PARTICLE BEAM INJECTION STUDIES

Unknown, Jaycor, *1401 Camino Del Mar, Del Mar, California* 92014 (DF583530; F19628-79-C-0121)

AF function - satellite survivability and communications. Deficiency - the space-environmental effects of beam injection experiments are not fully understood. Objective - to gain an understanding of the effects on the vehicle and ambient plasma of charged-particle beam injection from a vehicle and the characteristics of the beam in the vicinity of the vehicle. How research contributes -will provide a basis for assessing the effect of charged-particle beam injection into the ionosphere.

Pertinent theory and experiments in the literature will be studied. Effects of charged particle injection in the ionosphere in the vicinity of the vehicle will be calculated. These will include the steady-state and time-dependent vehicle potential, the charge-current emission limitations, secondary electron and ion effects, and the energy spectrum of the beam leaving the vicinity of the vehicle.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0004, ACTIVE AND PASSIVE MAGNETOSPHERIC PROBING AT VLF - A PROGRAM OF DATA ANALYSIS AND DATA ACQUISITION

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ATM78-05746)

This award supports a grant for very low-frequency (VLF) research on the properties of the earth's magnetized plasma envelope or magnetosphere. The program has two major components: (1) data acquisition at Roberval, Quebec, Canada, with emphasis on the reception of signals from an experimental VLF transmitter located at Siple Station, Antarctica, and (2) analysis from both active and passive probing experiments. The passive experiments will include coordinated international observing campaigns, direction finding compaigns, and multi-technique observations from a single location. The program is aimed at gaining understanding of wave particle interaction in the magnetosphere and of the distribution and dynamic behavior of the 'cool' background component of the magnetospheric plasma. The importance of these studies lies in the fact that the magnetosphere plays an important role in transmitting energy from the sun to the earth. Wave particle interactions within the magnetosphere are believed to be important factors in the process of energy storage and flow within the magnetosphere. Furthermore, the particular ways in which these processes occur in the middle atmosphere may reveal fundamental properties about magnetized collisionless plasmas as they exist elsewhere in the universe.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0005, AUTOMATIC WEATHER STATIONS FOR ANTARCTIC METEOROLOGICAL RESEARCH

A.M. Peterson, Stanford University, Stanford Electronics Lab., *Stanford, California* 94305 (DPP78-00548)

Twenty automatic weather stations (AWS) will be constructed in 1978 and 1979 for use in Antarctica. During austral summer of 1978/79, three of these AWS will be installed between Dome C and Dumont d'Urville for a study of katabatic winds; four AWS will be installed near McMurdo Station for use in a mesoscale meteorology research project; and one AWS will be installed at Siple Station for field testing in heavy snow environment. During austral summer 1979/80, the remaining twelve AWS units will be installed in data-sparse regions along the Weddell Sea coast, the Bellingshausen Sea coast, and the Amundsen Sea coast. During austral summer 1980/81, the AWS units used in the katabatic wind study will be redeployed to the Dry Valleys area near McMurdo for a study of the climatology of that region. During the second through the fourth years of this project, the deployed AWS units will be visited annually for servicing and repair. The data collected by these AWS will be transmitted back to the U.S. via polar orbiting satellites for use by researchers and for archiving at the National Climate Center in Asheville, N.C.

Logistics support is required in austral summer 78/79 and 79/80 for two men to deploy the AWS. In AS 80/81 and 81/82, logistics support is required for two men to repair and service the AWS units in the field.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

5.0006, RADIOWAVE DIAGNOSTIC STUDIES OF THE EARTH'S PLASMA ENVIRONMENT

V.H. Rumsey, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (ATM78-06770)

This grant will use the technique of interplanetary scintillation (IPS) to probe the solar wind in regions normally inaccessible to spacecraft. This technique allows an estimate of the solar wind velocity (and its random component) and the spatial spectrum of electron density. An observatory consisting of three widely spaced antennas operating at 74 mHz has been set up under previous NSF grants. It is well suited to measuring IPS at solar distances of 60 to 250 solar radii (Ro). In this range it is possible to concentrate on high latitudes observations.

The observations outside of 60 Ro will be regular and continuous. Thus they will be used to study the latitude structure of streams and by comparison the latitude structure of the corona. As the solar activity increases and transients become increasingly important, it will also be possible to map the spatial structure of these events. Observations inside 60 Ro are more complex because the solar wind is more variable. However, by using multiple antennas and/or multiple frequencies the velocity and spatial spectrum can be reliably estimated. The basic objective is to study the development and evolution of turbulence in the acceleration region of the solar corona as it expands to become the solar wind.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0007, SEASONAL CLIMATE FORECASTING

E.B. Weiss, Georgetown University, Law Center, *660 New Jersey Ave. N.W., Washington, District of Columbia* 20001 (OCE78-21646)

The North Pacific Experiment (NORPAX), which measures variation in the surface temperature of the northern Pacific Ocean, may lead to an operational capability for seasonal prediction of weather patterns over the continental United States. This project will study the impact of such predictions for the management of energy resources.

A model will be developed to simulate for the northern United States the impact of climate on oil and gas consumption, using data from the 1976-77 and 1971-72 periods, which had severe and relatively mild winters, respectively. Simulated climate forecasts of the type that may reasonably be expected to come from the NORPAX research will be applied to the model to then forecast energy consumption. Energy decision-making as it is presently carried out in the public and private sectors and as it might be carried out in the presence of qualitative seasonal climate predictions of varying degrees of accuracy will be studied. Alternative strategies available to government and to the private sector to take advantage of such climate forecasts will be developed and institutional adaptions useful to government and to the private sector (when experience shows seasonal climate forecasting to be a reliable technology) will be identified. The project will also examine the impact of seasonal climate predictions on United States foreign policy, focussing on the energy sector, and study the implications of alternative policies for dissemination of these predictions.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Ocean Sciences

5.0008, EXPLORATION OF INTERSTELLAR MOLECULAR CLOUDS BY SUBMILLIMETER POLORIMETRY

R.H. Hildebrand, University of Chicago, Enrico Fermi Inst., *5801 S. Ellis Ave., Chicago, Illinois* 60637

In the last decade it has become possible to do infrared mapping of interstellar clouds which are undetectable or, at best, only partially observable in visible light but emit thousands or millions of times the total luminosity of the sun in the far infrared and submillimeter bands of the spectrum: i.e., in the wavelength bands approximately 10 to approximately 100 microns and approximately 100 to 1000 microns. These energetic clouds are complex objects, containing newly formed stars, protostars ionized plasmas and denser regions of cold gas and dust. It is the thermal radiation from the dust which produces the great flux of far infrared and submillimeter radiation.

From polarization studies of absorbed and scattered radiation at visual and mid-infrared wavelengths, one infers that the dust grains are non-spherical and are aligned by the magnetic field within the cloud. If this is so, the thermal emission from the grains (at far infrared and submillimeter wavelengths) should be polarized. The degree of polarization and its wavelength dependence can be used to infer the structure of the magnetic field in the cloud and characteristics of the grains.

We propose to investigate the polarization of the submillimeter emission from luminous molecular clouds (in particular, Sagittarius A, a large cloud near the center of the Galaxy, and the Kleinmann-Low Nebula, a component of the Great Nebula in Orion), using techniques already developed in our laboratory. Except for our own preliminary observational tests on Venus and Jupiter, these would be the first such observations for any celestial objects.

SUPPORTED BY National Geographic Society

5.0009, LAKE-EFFECT SNOW STORMS

R.R. Braham, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (ATM78-18459)

Intense snow storms are generated on the lee shore of Lake Michigan during the early winter months when cold air flows over the relatively warm lake waters. These snows are important meteorologically and because of their socio-economic impact on the region. Lake Michigan is near the upwind end of the Northeast Corridor, that belt of industrialization-urbanization stretching from Chicago-Gary to the east coast. Snow storms in the Northeast Corridor are important scavengers of air pollution and may in turn be modified by pollution.

This research is pursuing three principal objectives: 1. To develop a coherent model of the circulations, cloud microphysics and precipitation mechanisms of lake-effect snowstorms. 2. To observe and describe anthropogenic influences on winter clouds and cloud nuclei. 3. To complete a numerical modeling study of mesoscale boundary layer circulations with applications to the urban heat island and lake snowstorms.

Field measurements are conducted near Muskegan, Michigan during early winter. The field program centers around co-

ordinated use of an instrumented aircraft and a dual-wavelength Doppler radar. The field program cooperates with a study of air pollution scavenging from the same lake storms.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0010, STUDIES OF IONOSPHERIC SCINTILLATION PROBLEMS
C.H. Liu, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (ATM77-22485)

Recent coordinated observations have now provided a sufficiently meaningful data base defining the equatorial ionospheric irregularities that quantitative modeling is possible. One of the most striking results is the Jicamarca incoherent scatter observation of plume like structures which now have led many to view the instabilities as due to instabilities associated with upwelling of depleted plasma density regions (bubbles) from the lower F regions. Radar, in situ, and scintillation data provide a broad spectral picture of the phenomenon.

This grant will fund the processing and analysis of this data with emphasis on the possible link to the phenomenon of rising bubbles. Preliminary calculations for the satellite transmission data base have shown one a priori viable hypothesis, ducting in the field aligned bubbles, to be unlikely; while another hypothesis, multi-path type refractive scattering at the extreme sharp density gradients at the 'walls' of the bubbles, appears feasible. This will be examined in detail. It has been suggested that a hierarchy of instabilities may be operative during equatorial spread F to produce the full wave number spectrum of irregularities. The modeling will test scintillation dependence for a multi-frequency (amplitude and phase) data base.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0011, STUDIES IN PROBABILITY FORECASTING AND THE VALUE OF WEATHER FORECASTING
R.L. Winkler, Indiana University, Indiana University - Purdue University at Indianapolis, School of Business, Dept. of Quantitative Business Analysis, *1121 W. Michigan, Indianapolis, Indiana* 46202 (ATM77-24060)

The objectives of this research are to investigate probability forecasting in meteorology and to study the value of weather information in the context of weather-related decision making problems. The research will include the development of new methods through the use of experiments, surveys, specific meteorological applications, and other types of studies. The research program in the area of probability forecasting in meteorology consists of three types of studies: experimental studies, methodological studies, and surveys. The research program in the area of the value of weather information includes two types of studies: specific applications and methodological studies. These results are important for probability forecasting in meteorology, implications for probability forecasting and decision making in general, and specific implications for the particular meteorological situations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0012, ANALYSIS OF SPACECRAFT CHARGING SATELLITE DATA
D. Delorey, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF582320; F19628-79-C-0018)

AF function - communications, navigation and surveillance. Deficiency - lack of adequate methods of predicting geophysical conditions with the AF operating environment and their probable effects on the success of future AF operations. Objective - analysis and interpretation of environmental data collected from high altitude research satellite. How research contributes - leads to reliable methods for predicting geophysical conditions.

Develop and implement mathematical techniques and analytical routines to analyze geosyncronous space probe data to produce unified compacted geophysical data bases for integrated investigations of the spacecraft charging/discharging and plasma interaction phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0013, SPACECRAFT CHARGING AND GEOSYNCHRONOUS ORBIT
J. Feynman, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF583410; F19628-79-C-0031)

AF function - communication, navigation and command. Deficiency -AF space systems are degraded through interaction with the space environment. There is inadequate knowledge of magnetospheric processes at geosynchronous orbit and in polar cap to meet AF requirements. Objective - to model the physical processes at geosynchronous orbit in order to understand how spacecraft build up large electrostatic potentials and how these potentials can be controlled. To investigate electrodynamic structures in polar and aurora region to determine how energy is communicated from solar wind to ionosphere. How research contributes - provides information necessary for building communication satellites that are capable of withstanding radiation damage in severe plasma regimes. Provides information as to how energy is put into the ionosphere and how the morphology of the ionosphere is modified by these inputs.

Analyze data from AF satellites to determine what physical processes are operative under varying external conditions at geosynchronous orbit and in the polar ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0014, ULTRAVIOLET AIRGLOW PHOTOMETER
H.A. Miranda, Epsilon Lab. Inc., *Bedford, Massachusetts* 01730 (DF582090; F19628-79-C-0019)

AF function - trans-ionospheric ranging and communications, remote ionospheric monitoring. Deficiency - present state-of-the-art in relating natural optical emission to the electron density profile is not understood well enough to permit remote satellite monitoring of the auroral oval. Objective - in situ measurements with rockets of UV fluxes. How research contributes - provides direct measurements of atmospheric parameters to correlate with other measurements and computer codes being generated in the auroral E program.

Contractor shall design, fabricate and test an airglow photometer to measure the altitude profile of ultraviolet airglow emissions during flight on sounding rockets.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0015, AURORAL OPTICAL STUDY
R.H. Eather, Keo Consultants, *Newton, Massachusetts* (DF248640; F19628-77-C-0097)

AF function - communications and detection. Deficiency - understanding effects both of precipitating particle and non-particle produced ionospheric disturbances which degrade communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by means of auroral spectral emission features measured with a sensitive T.V. system. How research contributes -provides a new and powerful technique for large-scale and high time resolution auroral measurements. Coordination with other simultaneous measurements from the AFGL airborne ionospheric observatory, NKC-135 aircraft, will allow comprehensive measurements of ionospheric response to substorms over sub-auroral, auroral and polar cap domains.

Perform comprehensive investigation of the latitude and local time behavior of large scale ionospheric disturbance phenomena resulting from auroral particle precipitation in the vicinity of the auroral oval. this investigation will be based primarily on ground and airborne all-sky imaging photometer, all-sky

camera and meridian scanning photometer auroral measurements. Investigate the dynamic properties of the equatorial F-region and the formation of ionospheric irregularities through associated airglow signatures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, LASER RANGE/VLBI DATA ANALYSIS
C.C. Counselman, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF583150; F19628-79-C-0064)

AF function - strategic aerospace systems. Deficiency - need for improved definition of launch site and target position uncertainties. Objective - development of precise geodetic measurements. How research contributes - it will allow improvements in costs, precision, versatility and timeliness of Air Force geodetic surveys.

Analyze data from lunar laser ranging and very long baseline interferometry to precisely determine variations in the earth's rotation rate and polar motion. LLR data will be used from McDonald observatory and other laser observatories as available. VLBI data will be collected approximately bimonthly from the Haystack, Owens Valley and Onsala (Sweden) radio observatories and data from other radio observatories will be used as available. Results from LLR and VLBI analyses will be compared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, FLUORESCENCE FROM GASES
B.D. Green, Physical Sciences Inc., *30 Commerce Way, Woburn, Massachusetts* 01801 (DF581820; F19628-78-C-0115)

AF function - infrared targets and backgrounds. Deficiency - lack of knowledge of infrared properties of the atmosphere. Objective -analysis of data obtained from laboratory measurements. How research contributes - analysis of the properties of infrared atmospheric emission provide information about atmospheric composition and infrared backgrounds. The results of this research are necessary for understanding and predicting the infrared from natural and disturbed backgrounds.

Utilizing AFGL LABCEDE facility with its Michelson interferometer, a detailed analysis of the fluorescence phenomena in electron irradiated gases will be performed. These observations of radiative spectrum are invaluable in determining and quantifying the relevant electron, ionic and neutral chemical kinetics occuring in the irradiated system. The results will be applied to infrared models and will be directly applicable to understanding infrared backgrounds for Air Force surveillance systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, INVESTIGATIONS INTO TECHNIQUES FOR MEASURING STRATOSPHERIC TURBULENCE
G. Murphy, Tri Con Associates Inc., *Cambridge, Massachusetts* (DF580530; F19628-78-C-0194)

AF function - environmental impact statements of high altitude Air Force operations. Deficiency - current or anticipated Air Force operations in the stratosphere may deposit harmful material and it is important to be able to assess the dispersion and residence time of such material in the stratosphere. Objective - provide research into various techniques for measuring winds and turbulence at stratospheric altitude. This will lead to profiles of the dynamic stratospheric wind fields. How research contributes - this research is needed in order to design, develop and fabricate new instrumentation which will measure stratospheric winds and turbulence. This will provide information leading to an understanding of atmospheric transport which is important in assessing the impact of systems which may contribute to environmental pollution.

Investigate, design, develop new techniques and devices to measure stratospheric winds and turbulence with a frequency response of DC to 1KHz for altitudes up to 45 km. Devices may be but are not limited to corona and hot wire anemometers. Desired linear velocity range is 0-25 m/s with a resolution of 0.001 m/s. Instrumentation is to be balloon launched from remote sites in usa.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, RADIO INTERFEROMETRIC STUDY OF SOLAR FINE-SCALE STRUCTURES
K.R. Lang, Tufts University, Medford Campus, School of Arts & Sciences, Dept. of Physics, *Medford, Massachusetts* 02155 (DF582610; F19628-79-C-0010)

AF function - communication and surveillance. Deficiency -capability of medium-range (1-5 day) prediction of operationally disruptive solar activity does not presently exist. Objective - to investigate the time-varying fine-scale structure of the microwave radiation from solar active regions by very high resolution radio interferometry. How research contributes - will provide a knowledge of flare precursor mechanisms needed to establish prediction techniques to forecast electromagnetic and energetic-particle emissions that disrupt HF communications, OTH radars, and satellite sensors.

Microwave observations (in brightness temperature and polarization of the time-varying fine-scale structure of very small sources in solar active regions will be made using two-element interferometers at NRAO or JPL and the aperture-synthesis network of the very large array (VLA) at Socorro, N.M. The greater radio-radiation detail made possible through the use of these very high resolution instruments will hopefully lead to greater knowledge of the flare triggering mechanisms present in very small sources. Any possible flare precursors will be evaluated for their importance as operational predictors of disruptive solar activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, IONOSPHERIC REFRACTION FOR DEEP SPACE SURVEILLANCE RADARS
R.S. Allen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580880)

AF function - advanced radar and navigation systems. Deficiency -the sensitivity of ground based and satellite radars which detect and track deep space targets is severely limited by ionospheric effects. The normal variability of the ionosphere causes target signal phase to vary so rapidly that present and proposed radars can only integrate coherently for small samples of 10 to 100 seconds. Objective - develop a technology to support ADCOM requirements for deep space systems, tailored to the range extension modification of SPADATS radars and to the deep space surveillance radar system. How research contributes -increases the sensitivity of radar detection and tracking in deep space so that trade-offs can be made between system performance and costs. Provides a technique to use local measurements of changes in the ionosphere so that AWS predictions of median ionospheric conditions can be adapted to the real time conditions in the attack corridors. This will make the range extension feasible at existing ADCOM radars. Provides design and development technology for the follow on deep space surveillance systems for use in preliminary design and system development. Investigate time rate of change of ionospheric refractive effects for deep space surveillance systems, using existing AFGL models of electron density profiles and of ionospheric parameters. Develop and validate computer algorithms so that the Air Weather Service can provide a monthly median prediction of refractive effects for deep space radars. Develop adaptive techniques to use real time local radar and ionospheric measurements to correct for the hour to hour variability of the ionosphere. Determine the optimum grid of local observations and the optimum interval between updates to meet the performance requirements over the system field of view.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, LARGE SCALE CLOUD SYSTEMS
L.V. Delgado, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581340)

AF function - military operations involving Air Force vehicles and erosion effects on nosecones during reentry. Deficiency - there is a need for statistical information on hydrometeor size distribution and crystal habit for weather erosion programs and for their effects on systems operated on high-performance aircraft. Objective - to measure, describe and develop prediction techniques for the microphysical characteristics of clouds. How research contributes - this research will provide a broader data base for characterizing hydrometeors in large scale cloud systems and will advance our understanding of these cloud systems.

Data collected during past years on ABRES and Minuteman weather erosion programs will be reviewed and combined with new hydrometeor data obtained with improved instrumentation on the present program to provide suitable statistics for hydrometeor characterization. New sampling instruments will be developed and flown to enable more accurate measurements to be made of hydrometeor sizes and crystal habits.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, CORRELATIONS BETWEEN OPTICAL AND RADIO OBSERVATIONS OF CORONAL HOLES AND ENVIRONMENTAL DISTURBANCES
H.L. Demastus, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580800)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to determine the correlation between solar 'coronal holes' (regions of unusually low density in the corona), as observed in both the optical and radio regions of the spectrum, and geomagnetic disturbances. How research contributes - a definite relationship has been discovered between coronal holes as observed in soft x-rays from satellites and rockets, and the source of high-speed solar wind streams. At times of low solar activity these patterns become long-lived and result in recurrent geomagnetic storms. These in turn affect Air Force systems and communications, and are the subject of prediction efforts by the Air Weather Service. Because observations of coronal holes by satellites and rockets are not available continuously, they are not well suited to ongoing prediction schemes, so AWS requires more regular observations of these phenomena. This work unit will investigate a number of possible ground-based observation schemes, as well as the specific relationship between the time and space location of coronal holes observed by these methods and geomagnetic disturbances. the success of this work unit will result in more reliable predictions of geomagnetic disturbances for AWS. This effort directly supports the task objectives of isolating causes and propagation mechanisms of solar-induced environmental disturbances.

Observations of coronal holes will be attempted in the atomic lines of Fexiv 5303a and HeI 10830A, and in the radio spectrum. The present instrument for observing Fe53O3 at Sacramento Peak Observatory (SPO) will be upgraded by the addition of a system designed to suppress scattered light from the objective lens and the atmosphere. The suppression instrument will be developed under contract utilizing frontier technology that is untested in this particular application. techniques for observing He10830 both photographically and photoelectrically will be developed in collaboration with Aura (NSF contractor) personnel at SPO. A feasibility study will be conducted to develop and test a diode-array observing system to produce spectroheliograms in He10830 utilizing an existing instrument at SPO. Radio observations have been obtained. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, EMULSION PACKAGE FOR SPACE SHUTTLE
R.C. Filz, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580730)

AF function - communications and survivability. Deficiency or opportunity - improved prediction of space radiation resulting in improved prediction of spacecraft systems life cycle cost. Objective -to design, construct, and space-qualify the long duration exposure emulsion package (LDEEP) for the LDEF space shuttle flight. How research contributes - provides definitive data on low energy trapped particle fluxes required to improve models of the radiation environment in space.

A special nuclear emulsion sliding plate mechanism will be designed to obtain daily observations of 1 to 100 mev trapped proton fluxes over the six-month life time of the LDEF flight. Special techniques will be developed to shield the emulsion from background. Emulsions will be selected and calibrated for use with six-month space exposure. Mechanical and electronic devices will be designed, constructed and space qualified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, SCATHA ENVIRONMENTAL ATLAS
H.B. Garrett, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583240)

AF function - AF communications satellites at synchronous orbit are degraded by satellite charging induced by the plasma environment. Deficiency - the space environment during periods of satellite charging is not sufficiently defined. Objective - comprehensive specification of the geosynchronous electron and ion population. How research contributes - plasma data from the SCATHA satellite will be used to supplement the AFGL geosynchronous plasma atlas allowing a complete specification of the geosynchronous orbit environment. The specification will aid in the understanding of the spacecraft charging phenomenon which is necessary so that steps may be taken to prevent damage to satellites from electrostatic discharges (ESD). This work supports a MIL Standard which contributes to operational capabilities of AF satellites.

Data from the SCATHA (satellite charging at high altitudes) satellite will be incorporated into the AFGL geosynchronous plasma atlas to provide a final comprehensive specification of the geosynchronous and near-geosynchronous plasma environment. The specification will be the basis of a MIL Standard.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, AURORAL E-LAYER
A.P. Krukonis, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580970)

AF function - HF radio wave communication, OTH radar system. Deficiency - variability of auroral E-layer leads to impairment of propagation characteristics of this E-layer mode. Objective - mapping of circumpolar auroral E-layer as function of magnetic activity. How research contributes - understanding of auroral E-layer characteristics will assist providing improvement of operation of HF communication and radar systems through polar regions.

Airborne noon sector ionospheric auroral E-layer data and simultaneously acquired satellite particle and ground based ionospheric data will be analyzed to determine the temporal and spatial characteristics of the circum-oval auroral E-layer. The results of a recently completed case study will provide the background for selection and study of data taken during IGY (1957-1958), a high sunspot period, during which a greater number of ionospheric stations were operating. Ionograms, representative of auroral zone and polar cap stations will be scaled to provide FOEA, H'EA, FBES, H'ES and FMIN. Initially. periods of moderately high magnetic activity will be analyzed to determine if an auroral E-layer existed in much or all of the polar cap during such time. If 'mantle' E-layer did exist, the analysis will be expanded to include a complete data base. Concurrently, a completed study of the statistical relations between precipitating particle flux and the location of the diffuse aurora derived from analysis of J-data and DSMP photos will serve as a basis for determining: 1) the spatial differences between the particle and optical boundaries of the E-layer of the oval, 2) vs magnetic activ-

ity indicators (i.e KP, AE, Q, DST). The end result of the total effort will be to produce maps of E-layer parameters for the Northern Hemisphere as a function of magnetic activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, AIRCRAFT ICING PROBABILITIES

I.A. Lund, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583010)

AF function - design and operation of aircraft. Deficiency - more accurate icing information is required because new airframes such as the A10, HH-53, cruise missiles, RPV's and PGM's operate without anti-icing/deicing capabilities. Objective - to collect objectively measured ice accretion observations and to relate them to observations taken by standard radiosondes, and also to relate them to concurrent observations of liquid water content, drop size distributions and associated temperatures. How development contributes - icing probabilities will be used for determining the need of anti-icing/ deicing capabilities, in mission planning, in the setting of design criteria, and the development of operational procedures for flight safety. Observations of icing conditions are needed to obtain verification statistics on current forecasting methods, and to develop and test new methods.

The AFGL/LY MC-130E research aircraft will be instrumented with a Rosemont Model 871 FA ice detector. When the aircraft is available at Wright-Patterson AFB and icing conditions are forecast above a radiosonde station, within about 300 miles of Wright Patterson AFB, the aircraft will be dispatched to take observations approximately concurrent with and along the flight of the radiosonde. A number of such flights will be made. The MC-130E will also take icing observations on its flights which are not directly related to this effort, the C-5A, F-15, F-14, F-111, etc. of the Air Force and the L-1011 of Eastern, Delta and TWA also have Rosemont ice detectors. Efforts will be made to obtain observations from flights with some of these aircraft also.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, DEVELOPMENT OF NEW TECHNIQUES FOR FLARE PREDICTION

D.F. Neidig, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583170)

AF function - communications, surveillance detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to develop techniques for improving predictions of solar flares. How research contributes - reliable prediction of flare - induced geophysical disturbances is needed to assure optimum performance and design criteria for AF communication, detection and navigation systems. These predictions require continuous magnetic field data such as the solar observing optical network (SOON) can supply. New techniques for the measurement and interpretation (within a flare-forecasting framework) of magnetic fields and other physical parameters need to be developed in order to achieve the required prediction capability. The effort in this IHWU is directed toward the identification and early detection of the solar conditions leading to flares.

To predict solar flares and their associated geophysical disturbances requires: (1) identification of solar active regions which will be flare productive, (2) detection and early recognition of flare phenomena (before geophysically significant emissions occur), (3) real-time evaluation of flare characteristics which lead to geophysical effects. Observable parameters relating to these areas, collected from optical, radio, and magnetic data, will be systematically evaluated in order to determine the parameters which are most significant in predicting both the occurrence of flares and their geophysical importance. New techniques for the measurement and interpretation of solar magnetic fields and other physical parameters will be tested for application to the SOON telescopes, these, in turn, will add to the data base of possibly significant flare parameters. The procedure will use a multivariant discriminant analysis (MVDA) which, in addition to identifying significant parameters, is also capable of making flare predictions from active region data. Optical data from the AWS-SOON network, as well as microwave data from supporting contracts, will be incorporated with observations made at Sacramento Peak Observatory in order to determine the significance of suggested prediction parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, PHOTODISSOCIATION OF CLUSTER IONS

J.F. Paulson, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582790)

AF function - nuclear weapons effects, environmental effects of AF operations. Deficiency - inadequate knowledge of reaction rates for prediction of composition, density and ionization of perturbed atmosphere. Objective - to measure cross sections for photodissociation of atmospheric cluster ions. How research contributes - provides information used in computer models to predict the effects of pollutants and of natural and nuclear atmospheric perturbations upon ion composition of the stratosphere and mesosphere.

Cross sections for photon induced dissociation reactions of cluster ions are measured in a double mass spectrometer system. A tunable dye laser, with frequency doubling, is used as a photon source. Ionic products of the dissociation reactions are mass and velocity analyzed. Energy disposition in the reaction is determined from the velocity distribution of the products.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, SHUTTLE EJECTION STUDY

L. Katz, Visidyne Inc., *Burlington, Massachusetts* 01803 (DF583650; F19628-79-C-0109)

AF function - communications, satellite survivability and surveillance. Deficiency - inadequate knowledge of the effects of charged particle ejection systems on space transportation system vehicles. Objective - to study and determine Air Force applications of space transportation system charged particle ejection systems. How research contributes - the research will determine both the advantages and disadvantages of Air Force applications of charged particle ejection systems on vehicles of the space transportation system.

A plan will be developed for a series of charge ejection payloads for the space transportation system. The purpose of these payloads will be the systematic study of the advantages and problems of using charged particle ejection systems on space vehicles for direct military applications and for studying geophysical problems relevant to Air Force application. The problems of environmental modifications, and direct dangers to personnel, vehicles and equipment will also be investigated. a complete charge ejection payload for space shuttle use will be designed based on the overall plan and studies of relevant problems and opportunities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, DESIGN OF AEROSPACE EXPERIMENTAL INSTRUMENTS

J. Otis, Wentworth Inst. of Technology, Undergraduate School, *550 Huntington Ave., Boston, Massachusetts* 02115 (DF580010; F19628-78-C-0017)

AF function - military operations of the B-1, F-15 and other AF vehicles in the stratosphere, nuclear weapons delivery, communications, detection, track, and intercept. Deficiency - environmental effects of AF stratospheric operations cannot be predicted because of a lack of stratospheric data. Further, mixing and chemical effects of jet engine or missile effluents are only poorly defined. Also, inability to forecast upper atmosphere interactions affecting the design and operation of military systems such as reentry vehicles, over-the-horizon radar, polar communications and satellite ephemerides. Research -design, test and provide quadrupole mass spectrometers and gas sampling hardware with associated support equipment to be used in rocket and balloon-borne experiments. Cryogenic, vacuum, and

contaminant-free technologies are used. How research contributes - establish stratospheric standards and criteria by period in-situ and laboratory gas analysis and provide data for upper atmospheric assessment models by measurement of neutral and ionized species.

Consultation between experimenters and mechanical designers to include review of mechanical designs and monitoring the fabrication, delivery of prototype instruments, testing in flight configurations, design, updates, if necessary. Designers may be required to operate instruments during field experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, RELATING SOIL AND LANDSCAPE CHARACTERISTICS TO LAND USE

F.C. Westin, South Dakota State University, Agricultural Experiment Station, Dept. of Plant Sciences, *Brookings, South Dakota* 57006 (0071295; SD00769)

OBJECTIVE: Using adapted crops, develop models or quantitative equations to predict yields or suitability based on soil and landscape properties. Test and apply the ratings developed above.

APPROACH: Committee members will serve as subcommittee organized by crops or interpretation to evaluate soil climate and landscape parameters for yields and suitability ratings. Compare crop ratings developed with actual yields; compare land value ratings with actual land values by cooperation with economists; work with planners, managers, builders to test engineering interpretations; experiment with techniques to communicate information to user groups (computer maps, computer graphics).

PROGRESS: Research efforts to support this project are grouped under several headings: (1) soil genesis, (2) cartography, (3) relationships between soil map units and intepretations for agronomic, engineering and recreation uses of soils. To support these aspects several publications were prepared. A journal article was published on Organic Phosphorus Changes Over a Growing Season. About half of the phosphorus in S.D. soils is in the organic form so the behavior of this fraction is important for crops. The study was designed to see if soils on different landscape positions had different levels of organic phosphorus and if these levels were affected by moisture and temperature changes over a growing season. A second journal article was published dealing with the identification of soil associations and vegetation using satellite data. With the growing interest in crop inventory by satellite imagery, it is important to know the limits of these techniques under S.D. conditions. A second objective was to investigate the feasibility of using satellite imagery to identify soils. Two experiment station bulletins were co-authored with D.D. Malo. The first was an overhaul of a bulletin describing the occurrence, use and management of South Dakota soil. Included are a soil map in color, descriptions of the soil, yield potentials of the soils, and maps describing the use of soils. The second bulletin describes an agronomic rating system for all soil series and phases presently in use in South Dakota.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, South Dakota

5.0032, DIGITAL IONOSONDE STUDIES OF THE IONOSPHERE AT SIPLE STATION, ANTARCTICA, AND ROBERVAL, QUEBEC, CANADA

G.S. Stiles, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (DPP77-22170)

One of the newly developed digital ionosondes will be acquired. After successful laboratory tests, and suitable software development, this unit will be installed at Roberval, Quebec, Canada, for research on the ionosphere there in conjunction wih other experimental programs on the ionosphere and magnetosphere now being conducted at Roberval.

After a year's operation at Roberval, the ionosonde will be shipped (in the summer of 1980) to Siple Station, Antarctica, its ultimate destination, for correlative studies of VLF wave-particle interactions, the F-layer trough and its relationship to the plasmapause, and the effect of the ionosphere upon magnetic variations. Another digital ionosonde, on loan from the Chatanika facility in Alaska, will be installed at Roberval in 1980 to permit studies of the conjugacy of convection, electric fields, thermospheric winds, and particle precipitation.

Antarctic logistics support is required for three people at Siple Station during the austral summer of 1980/81 and for one winter-over person during the austral winter of 1981.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0033, INVESTIGATION OF THE CIRCULATION AND PRECIPITATION STRUCTURES OF SOUTH CHINA SEA DISTURBANCES DURING THE WINTER MONEX

J. Simpson, University of Virginia, School of Arts & Sciences, Dept. of Environmental Science, *Garrett Hall, Charlottesville, Virginia* 22903 (ATM78-00233)

The objective of this proposal is to study weather disturbances in the South China Sea as a part of the U.S. program under the Monsoon Experiment (MONEX), a regional subprogram of the Global Atmospheric Research Program (GARP). The principal platform for these studies will be the National Center for Atmospheric Research (NCAR) Electra Aircraft. MONEX is a study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmosphere and ocean in monsoon regions of the world. The monsoon is an intense regional weather phenomenon, but is second only to the global general circulation of the atmosphere (the Hadley Circulation) in energy content and, therefore, affects weather and climate on a global scale.

Specific research goals are to investigate: 1) The relationship between growth, development and decay of South China Sea disturbances to the cold surges of the winter monsoon; 2) The small-scale structure of these disturbances, the organization of their clouds and precipitation; and 3) How the monsoon and the disturbances, down to the small-scale cloud structures, interact to control or modulate precipitation over the maritime continent of Malaysia.

These investigations contribute to two main MONEX objectives: 1) Improved precipitation forecasting for the Malay Peninsula, a vital problem owing to the heavy flooding often occurring in early winter; and 2) Documentation of the latent heat supply for the winter planetary (Hadley cell) circulations in the Asian Monsoon area.

A secondary objective of this research is to compare the dynamics, thermodynamics and structure of cloud and disturbance scale weather phenomena over the monsoon region with those over the GARP Atlantic Tropical Experiment (GATE) area. The PI and her group were active participants in GATE which was carried out in 1974.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0034, GENERAL CIRCULATION STUDIES

J.M. Wallace, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (ATM78-07369)

This research is directed toward a deeper understanding of the atmospheric general circulation, which exerts a strong influence on the geographical and temporal variability of climate.

One major area of effort involves the geographical variability of the time averaged general circulation; as manifested in the so-called 'standing waves' which occur in response to longitudinal heating contracts and the uneven topography of the earth's surface. The time averaged jet streams and storm tracks occur in certain preferred positions relative to these standing wave patterns. These features will be investigated by means of observational studies based on long time series of synoptic maps, sea-surface temperature analyses and satellite imagery, together with theoretical studies based on a primitive equation spectral model.

The temporal variability of the general circulation will be the subject of a number of closely related observational studies

which will focus on the frequency dependence and three-dimensional structure of natural climate fluctuations on time scales ranging from seasons out to about a decade. From such studies it is hoped a clearer understanding will be gained of the physical processes which control such variability. A number of feedback mechanisms will be considered which may contribute to short-term climatic variability. Major emphasis will be placed on interactions involving the temporal variability of sea surface temperature, cloudiness, and certain characteristics of the stratospheric circulation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, DEVELOPMENT OF A METHODOLOGY FOR AIRCREW WORKLOAD ASSESSMENT

J. Buck, Auburn University, Graduate School, *Auburn, Alabama* 36830 (DF325210; F33615-78-D-0617)

The objective of this effort is to establish techniques and criteria for aircrew performance/workload assessment based on job and time standards methods. The method must take into account cognitive as well as motor, or psychomotor, demands of critical aircrew tasks.

Conventional industrial engineering techniques and metrics will be evaluated in the light of aircrew functions and associated tasks to identify necessary adaptations or additions to assure compatibility of industrial practices with Air Force operations. Criteria for assuring the effectiveness of any required modifications or additions to conventional techniques will be established. The criteria will be applied to preliminary tests of the effectiveness of the adapted methodology for a selected aircraft. The resultant method will be appropriate for generating data inputs to a computer-based data bank compatible with man-machine system modeling requirements. Initial emphasis will be on single-place aircraft. Task analytic data, time-line analyses, and an aircraft simulator will be used to support the methodology development and verification process.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0002, AFHRL/NTEC ASPT/AWAVS COOPERATIVE RESEARCH-CARRIER LANDING

R.R. Woodruff, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224190)

To determine pilots' ability to perform carrier landings using a wide field of view following training under either wide field of view or narrow field of view conditions.

A carrier modeled for use with the ANAVS will be displayed in the ASPT. Three groups of T-38 IPs will be trained in carrier landings. Group A will fly a circling approach and landing under wide FOV conditions, Group B will fly a circling approach and landing under narrow FOV conditions. Group C will fly a straight-in approach under narrow FOV conditions. After completing these training trials, the IPs in Groups B and C will fly circling approaches and landings under wide FOV conditions. The IPs in Group B will be provided audio or visual stimuli designed to cue them as to when they should begin their turn to final approach. The number of trials required to reach a criterion level of performance will be recorded and analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, PERSONNEL TECHNOLOGY - PARAMETERS OF VISUAL SEARCH CAPABILITY

J.E. Hoffman, University of Delaware, School of Arts & Sciences, Dept. of Psychology, *Newark, Delaware* 19711 (DN875565; N00014-78-C-0762)

Many Navy and Marine Corps jobs (e.g., flying) require rapid and efficient visual search at the same time as other information-processing tasks. This work is concerned with the extent to which such search tasks interfere with other tasks, or vice-versa. Specific objectives are to formulate a stage model of search, deermine how speed and automaticity of search develop in search tasks, and identify the best predictors of an individual's capacity to develop such automaticity.

The model will formalize the notion of a fast parallel search of the display, followed, if necessary, by a slower, serial search. Development of automaticity will be characterized as increasing efficiency of the faster, parallel process. To test the model, data will be collected, experimentally, in a variety of search conditions, including those which do or do not allow the development of automaticity. Parameter estimates, on an individual basis, will be related both to overall performance and to selected psychometric measures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0004, HUMAN OPERATOR CONTROL STRATEGY MODEL

J.L. Birchfield, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF228160; F33615-77-C-0042)

Develop and validate a model of human operator control strategy on perceptual/motor tasks such as flying and investigate relationships between control strategy and cue utilization, learning, and changes in task variables.

Identify human operator characteristics that ought to be considered, develop an operational definition of control strategy, conceptualize and implement a model based on a defendable theory-of-control strategy development and learning, and conduct extensive validation tests. Milestones - contract award, 1 Apr 1977, theory development, 1 Oct 1977, model design, 1 Dec 1977, model testing, 1 Oct 1978, first TR, 30 Apr 1979, validation, Dec 1979, second TR, May 1980, optional demonstration, Oct 1980, final TR, Mar 1981.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, ANALYSIS OF REFRESHER PHYSIOLOGICAL TRAINING

F.D. Leimkuhler, Purdue University, School of Industrial Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (DF325610; F33615-78-D-0617)

Air Force regulation 50-27 requires that air crew member receive appropriate physiological training every three years. The course presently taught is a broad spectrum educational effort covering many environmental stresses. This training currently employs low pressure flight chambers and is designed to prevent aircraft and personnel loss following biomedical effects that can be induced by the flight environment, e.g., decompression and hypoxia. An apparent new method of training which employs mask-applied gas mixtures, rather than flight chambers, has been proposed. This contract effort will evaluate the new training proposal from the cost/benefit point of view and in so doing will provide improved methodology for subsequent training evaluations.

An operations analysis approach will be applied. Aircraft and personnel loss caused by physiological incidents will be examined and correlated with training course content to estimate prevention rates achieved. Alternative methods are evident and need comparison on a cost-benefit basis with analysis to include hardware and personnel costs and preventive capabilities. Alternative training methods will be studied to estimate their prevention capability with a final trade-off being accomplished via comparison of prevention vs. cost.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0006, SPACEGRAPH IOS DISPLAY STUDY

L.D. Sher, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF228820; F33615-79-C-0013)

The objective of this effort is to study the various ways in which the unique 3-D capabilities of the space graph display can

be matched to the specialized display problems of the IOS of a modern flight simulator.

The study will examine the overlap between the information-display attributes of an IOS and the corresponding attributes of spacegraph which promise utility in IOS applications. The work will include identifying and categorizing the types of information to be displayed and current characteristics of spacegraph which are applicable, developing new ways of using space graph and examining those characteristics which promise utility, developing additional parts of the space graph system, generating priorities for future developments and demonstrating the system. Project initiation - 11 Oct 78; contract award - 1 Dec 78; display requirements - 1 May 79; new uses - 1 Oct 79; contract comp - 1 Jun 80.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0007, BIODYNAMIC RESPONSE

A.I. King, Wayne State University, School of Engineering, Dept. of Mechanical Engineering, *5950 Cass Ave., Detroit, Michigan* 48202 (DN123393; N00014-75-C-1015)

For the purpose of minimizing pilot injury, experimental and analytical techniques are being used to study the biodynamic response of naval pilots when subjected to parachute opening or ejection shock.

Because of the relevance of cervical vertebral motion to neck injury, improved instrumentation techniques are being planned to better determine vertebrae kinematics during test runs on cadavers or anthropomorphic dummies. In addition, some experiments are being contemplated wherein body motion will be examined subsequent to target impact and correlations attempted with mathematical models of the same.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0008, VISUALLY ACQUIRED REFLECTIVE GLIDE SLOPE INDICATOR, LDF 79-10

H.L. Task, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325540)

The purpose of this effort is to design, build and test a reflective glide slope indicator that will use the aircraft landing lights as the light source. The VARGSI will provide a color coded reflection of the aircraft landing lights to visually cue the pilot to the correct glide slope angle.

There are several ways in which an optical system can be devised that would be capable of producing the desired effect. Each method has certain advantages and disadvantages in terms of intensity of the reflected light, ease of color coding, complexity and expense. Each design will be evaluated on paper. Working models of one or more designs will be produced and tested under lab conditions. The most promising design(s) will then be field tested to determine visibility and angle sensitivity characteristics under actual outdoor conditions. If the field tests are favorable, it is possible that the device would undergo flight testing. Tentative arrangements have been made with the Army Aeromedical Research Labs at Fort Rucker, AL to test the final device for helicopter landings. This effort is supported by O and M contract documented under work unit 71840006.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0009, VISUAL PERFORMANCE OF AIRCREW PERSONNEL UNDER SPECTRALLY SELECTIVE FILTER CONDITIONS

G.T. Chiuen, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN081091)

To determine the effect of transparencies of various spectrally selective absorbencies on visual performance. Visors designed for both eye protection in special environments, such as laser exposure environments and high light environments, and for display purposes often selectively absorb and or reflect across the visible spectrum. The result is both distortion of environmental stimuli and selective adaptation of the visual processes. The extent to which these effects degrade or enhance visual performance will be assessed.

Visual task will be performed by human observers wearing spectrally selective filters. That performance will be compared with performance under unfiltered conditions, and the extent to which performance is degraded or enhanced will be determined. The results will be used to provide guidelines for the development and utilization of visual transparencies by flight personnel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

6.0010, CAREER PROGRESSION AND PERFORMANCE OF ENLISTED AIR FORCE PERSONNEL

S.A. Brown, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233030)

To investigate career progression and performance of enlisted personnel during the time period of 1 Jan 70 through 31 Dec 75 at yearly time intervals. Comparisons will be made during the time period to assess similarities between male and female enlistees in an attempt to achieve maximum utilization of female talent and potential and to determine pre-enlistment identifiers of desirable career personnel.

Biographic, attitudinal, and performance data will be compiled from airman record files on yearly input of male and female enlistees (1970-1975). Criterion data of special interest will include disciplinary actions, APRs, unsuitability discharges medical data (if available) and reenlistment. Particular attention will be directed to areas where male and female performance is disparate and to factors which may be related to early separation prior to completion of initial tour of duty. Where sample size is sufficient for meaningful interpretation, analyses will be accomplished by AFSC. Distributional, correlational and regression analyses will be accomplished. Milestones - generation of data base, Nov 76-Sep 77, 11 mos, computer analyses, Oct 77-Apr 78, 7 mos, interpretation of data, May 78-Sep 78, 5 mos, preparation of final report, Oct 78-Jan 79, 4 mos, TR clearance and reproduction, Feb 79-May 79, 4 mos.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0011, DEVELOPMENT OF THE PMS ENLISTED PJM

J.C. Fast, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234240)

To develop a classification model that provides the same set of logical processes to be used in the pre-enlistment and post-enlistment phases of an airman's career. As a part of this, a policy system will be developed which calculates the appropriateness of assigning specific people to specific jobs vis-a-vis their contemporaries. Research started under work unit 20770401 and continued under 20770407 will be used as a basis for the work done under this work unit.

The methodology developed under 20770407 will be used to completely define a pipeline management system (PMS) enlisted PJM policy. An initial policy will be implemented using all the new variables identified previously. AFHRL will assist AFMPC in the implementation of this model and will continue to consult throughout the life of the work unit on operational problems. An algorithm for selection of candidates for HRP screening will be developed using data previously gathered by AFMPC. This algorithm will become part of the post enlistment classification system and will be used to enhance PJM. A simulation technique will be developed to allow managers to look at proposed policy changes and assess the impact on the operational system. AFHRL will continue to analyze the PJM history file to determine the effectiveness of PJM. Milestones - development of initial PMS policy (1 May 79), incorporation of new variables into PMS (1 Jul 79), assist in implementation process (as required), development of policy simulation (30 Jun 80), development of algorithm for assessment (1 Jul 79), final product (31 Oct 81).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0012, SCREENING OF PROSPECTIVE AIR TRAFFIC CONTROLLER OPERATORS
J.C. Quebe, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233970)

To develop a controller oriented screening device for air traffic control (ATC) applicants. Present requirements are AQE score of 60 or better in administrative or general and a Class II physical exam (including ARMA), neither of which appear to be positive indicators of eventual success in the air traffic control field.

Analyzing the results from a 1975 FAA exam administered to ATC (27230) students at Keesler and of AQE scores, against performance in the ATC field, determine what factors in test batteries are predictive of success in the career field. Develop new screening device based upon the prediction parameters and employing current and advanced testing technology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0013, TEST AND EVALUATION OF CHEMICAL DEFENSE EQUIPMENT & EXTREME CHANGES IN COCKPIT ENVIRONMENT
R.W. Krutz, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322610)

Previous efforts in this area were documented under work unit 7930-09-15. The purpose of this effort is to conduct in-house test and evaluation of chemical defense personal equipment in direct support to the 412A life support SPO, chemical defense division (AEL). The work unit is structured to address biomedical and environmental test requirements that are expected to arise during various stages of new equipment development and modification of existing equipment by the SPO. The capability to conduct quantitative leakage assessment of CD respiratory devices will be established and the chemical properties of CD filter materials will be studied for their compatibility with the flight environment. The justification for establishing this supportive effort is based upon an approved memorandum of agreement between AMD and ASD/AEL (30 Jun 76), and TAF (ROC) 326-75, 7 Nov 75 (CW mask for tactical fighter aircrew). The MOA states that T&E support will be provided on a cost reimbursement basis, the latter defined as a specific cost schedule in AMD letter to ASD/AEL, 9 Feb 76.

The work unit monitor will serve as the OPR for the CD program to be accomplished within the USAFSAM. He will plan programs and coordinate all T&E activities to be accomplished by various organizations within the laboratory. However, laboratory elements at both the USAFSAM and AMRL will charge against this work unit to insure proper reimbursement. Specific areas of test and environmental simulation will consist of altitude exposure, including pressure breathing levels and rapid decompression, respiratory impedance measurements, thermal/cold effects, air combat manuevering (ACM) g exposures, mask leakage characteristics, equipment related performance decrement, and integration with other life support equipment and cockpit configurations. Realistic operational profiles for the environmental conditions will be simulated and the sodium chloride cloud technique will be utilized for lead testing purposes (actual CW agents, simulants or antidotes will not be used for any tests). The OPR and others will also provide biomedical consultation and review technical requirements for equipment design when requested.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0014, CREW UTILIZATION AND WORKLOAD ASSESSMENT FOR MAXIMUM OPERATIONS
W.F. Storm, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF325010)

Both strategic and tactical operations impose unique stresses and workloads on USAF air and ground crewmen. This work unit examines and evaluates crew fatigue, physiologic cost, and performance effectiveness during standard, contingency, and maximum effort operations such as long range/nonstop deployments, sortie surges, airborne and ground based C3 operations, low level/high speed ACM, and all-weather rescue operations. Guidelines for operational commanders on stress/fatigue loads and their effects on performance and safety are presented as crew utilization recommendations for use in planning and operational practice. Special emphasis is given to defining post-mission/post-duty rest and recovery requirements for single and repetitive missions/duty periods.

Currently established psychobiological and performance measurement methods are applied systematically to evaluate and scale crew effects of single and multiple operational stresses in order to identify optimized mission workloads and crew duty cycles. The current battery of field measurements includes subjective fatigue, mood, and activity questionnaires, biochemical analyses of urine samples for neuroendocrine and metabolic indices, and human factors engineering and workload evaluations. When appropriate and feasible, other psychobiological measures, such as temperature and heart rate, are also obtained. Other laboratories and scientific literature are constantly monitored for new and improved methods which may serve to better evaluate man/machine effectiveness in USAF operations. Laboratory studies complement field studies, providing for better controlled means of evaluating new performance and physiological tests for eventual field use and for validating data collected under the uncontrolled conditions of real world operations. Previous efforts now assigned to this work unit were ongoing under 79301002, 79301004, 79301005, and 79301020. Performance and physiological data collected in an inhouse laboratory study involving long duration missions in GAT-1 trainers is undergoing analysis and preliminary report preparation. A unique information processing task shows promise for adaptation to field studies. Crew fatigue data have been collected on 2 F-4 sortie surges, and a similar surge involving A-10s will be studied in mid-August. Evaluations of C3 operator fatigue will be conducted. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, FORMAL TRANSFORMS ARISING IN GEOMETRIC QUANTIZATION
R.J. Blattner, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Mathematics, *405 Hilgard Ave., Los Angeles, California* 90024 (MCS78-01332)

This continues research under MCS 7517621 A01.

Blattner will continue his work on geometric quantization by working on four problems. 1. Developing an indefinite Hodge theory adequate to describe the metaplectic representation of U(k,1). 2. Extending the half-form pairing to nonpositive polarizations using sheaf cohomology. 3. Understanding Rawnsley's nonunitary pairing arising in the 'Kepler problem.' 4. Extension of Kostant's pairing of symplectic spinors to the non-transverse case.

John H. Rawnsley will collaborate with Blattner on (1), (2) and (3) for three months.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0002, DEVELOPMENT OF NEW CENTRIFUGE CONTROL ALGORITHMS
R.J. Crosbie, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN081187)

To investigate and establish criteria which will be used in the development of new algorithms for controlling the human centrifuge as a dynamic flight simulator. The current method of

controlling the centrifuge during dynamic flight simulations produces unrealistic and often undesirable angular artifacts to the simulator pilot. The proposed method will seek to minimize these angular artifacts and will provide a continuing benefit in optimizing the centrifuge control for all future centrifuge programs prior to their implementation.

An existing simulation, which includes mathematical models of the centrifuge, a generic aircraft, and an aircraft/centrifuge conversion network, will be used as it is excited by various simulated pilot inputs. By comparing human sensory response, both simulated and actual, to the dynamic environment of the simulated aircraft and the centrifuge, new centrifuge control algorithms will be developed which will minimize undesirable artifacts. When the simulated system is judged to be of optimum control, it will be incorporated into the actual aircraft/centrifuge conversion network and be validated through manned testing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, MODERN SPECTROSCOPY AND COLLISION STUDIES OF FUNDAMENTAL ATOMIC AND MOLECULAR SYSTEMS

W.H. Wing, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (PHY77-15217 A02)

Research is proposed on three problems in modern spectroscopy of fundamental atomic and molecular systems. In the first project, a recently developed ion-beam infrared-laser resonance apparatus will be used to perform extremely high-resolution spectroscopy and collision measurements on the hydrogen molecular ion. In the second project, precise microwave-optical spectroscopic and collision studies will be made on highly excited helium atoms. Both these systems represent three-body problems fundamental to the understanding of atomic and molecular structure. In both cases the precision achievable is several orders of magnitude greater than is achievable by conventional optical spectroscopy.

The first project has the additional potential to improve knowledge of fundamental contrasts, especially mass ratios, and also will be extended to include other ions important in astrophyics, quantum chemistry, and high-temperature gaseous and plasma processes.

In the third problem theoretically predicted and recently observed velocity-dependent sharp features in the helium-neon excitation transfer process responsible for laser action, and the velocity dependence of metastable and Rydberg helium-normal helium collisions, will be studied by a computerized time-of-flight method.

This work is a continuation of that currently supported under NSF grant number PHY75-03549A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0002, EXPERIMENTAL STUDY OF ELECTRON-MOLECULE (ATOM) COLLISION PROCESSES

S. Trajmar, U.S. National Aeronautics & Space Admin., Jet Propulsion Lab., Physics Section, *4800 Oak Grove Dr., Pasadena, California* 91103 (INT76-22192)

This collaborative research project involves Dr. Sandor Trajmar of the Jet Propulsion Laboratory (Pasadena, California), with Drs. Sergio Porto, George Csanak, and Dimitrios Bozinis of the University of Campinas (Campinas, Brazil).

NSF is contributing to the linkage of these scientists for the purposes of expanding their research efforts in electron-molecule (atom) collision physics. The joint research efforts will be concentrated in areas which are of importance from the point of view of laser and plasma physics, isotope separation, and surface chemistry and physics. Three specific research areas have been chosen: a) Electron scattering from atomic and molecular beams. This will involve experimentation with lasers in metal vapors, and vibrational excitation of diatomic and polyatomic molecules. b) Isotope separation. Exploratory research on isotope separation through combinations of laser photoexcitation followed by selective photoionization or chemical reactions will be carried out. c) Electron scattering from surfaces. Here planning and feasibility studies will be done to utilize low- and intermediate-energy elastic and inelastic electron scattering for probing surfaces.

The laboratory measurements will be carried out at JPL by the two main investigators from each country. The evaluation and interpretation of the results will be shared and carried out at Campinas and JPL, and will be closely correlated with ongoing theoretical work at Campinas under Dr. Csanak.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0003, BASIC RESEARCH IN PLASMA PHYSICS

N. Rynn, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (PHY78-07816)

This research project will study certain basic properties of hot, full-ionized gasses (plasmas). An experimental and theoretical investigation of turbulent diffusion and transport across a magnetic field is proposed. The experimental program will use an extension of previously developed laser diagnostics to probe the density and the temperature of the plasma both in space and time. The development of the optical diagnostic techniques is discussed in detail. It is also proposed to investigate instabilities caused by anisotropic velocity distributions, parametric decay and excitation of ion cyclotron waves, plasma filamentation and the coherence of modes and 'clump' theory. All of these programs overlap at at least one point.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0004, MULTICRITICAL POINT BEHAVIOR

G.E. Everett, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Physics, *Riverside, California* 92502 (DMR77-11323 A01)

The research will employ detailed high resolution magnetization measurements for investigations of 'multi-critical' behavior in iron and europium selenide. It has been shown, using renormalization group techniques, that cubic ferromagnetic iron is equivalent to the theoretical Pott's model. Mean-field analysis has predicted several anomalous multicritical points for various directions of an applied magnetic field. Magnetization components parallel and perpendicular to the applied field will be measured versus field and temperature in single crystal samples in order to test these theoretical predictions.

Multicritical point-like behavior is also observed in EuSe for one field direction. A line of critical points which is required by symmetry considerations but which has not yet been observed will be investigated with high resolution experiments. The existence of multicritical behavior associated with other field directions and the dependence on uniaxial stress will also be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, FUNDAMENTAL PROCESSES IN PLASMAS

J.H. Malmberg, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (PHY77-20613 A01)

The research will include both theory and experiment and emphasize problems in plasma physics for which very precise experimental tests of theory can be obtained. Most of the experiments will be done with an important new type of plasma--an unneutralized, magnetically confined electron gas. Such plasma can be made by simple methods and contained for minutes, with the effects of both classical and anomalous transport clearly ob-

served. The first objective is to understand this transport in detail. A second objective is to increase the plasma confinement time until the electrons come to thermal equilibrium with each other. A third objective is to decrease the plasma temperature and increase the plasma density until electron-electron correlations become strong. One can speculate that if this development succeeds, the electron gas will liquify, and at very low temperature freeze into a crystal.

The research on the TWT experiment will also continue. The next objective for this work is to observe the 'explosive instability.' This class of instability has been predicted theoretically but has never been directly observed experimentally.

This work is a continuation of that currently supported under NSF grant number PHY73-05125A03.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0006, MEASUREMENTS OF THE ORDERED PHASES OF SOLID HELIUM-3

J.M. Goodkind, University of California, San Diego Campus, Revelle College, Dept. of Physics, *La Jolla, California* 92093 (DMR78-23974)

Research was previously supported by DMR7721014.

A Superconducting Quantum Interference Device (SQUID) will be used to study the spin-ordered state of solid helium-3. Nuclear cooling techniques will be used to extend specific heat and nuclear magnetic resonance measurements to ultra-low temperatures. Successful acquisition of these data will help in the identification of the nature of the spin-ordered states of solid helium-3.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, MICROSCOPIC STUDY OF LOW-LYING EXCITATIONS IN SUPERFLUID 3HE AND SUPERCONDUCTORS

K. Maki, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR76-21032 A01)

This is a continuation and extension of research started under NSF grant DMR74-23429. The basic thrust is to study the theory of dynamical properties of superfluid 3He and superconductors from a completely microscopic point of view. Specific problems under study are: 1.) Nonlinear Dynamics of Superfluid 3He - The basic equation governing the spin motion in superfluid 3He-A and B in the absence of dissipation has been derived. Explicit solutions of physical relevance remain to be found. 2.) Dissipation Phenomena in Superfluid 3He - A formulation of the transport coefficients in superfluid 3He-B has been developed. Of further interest is the effect of dissipative terms on the nonlinear spin-orbital dynamics of superfluid 3He. 3.) Surface Phenomena in Superfluid 3He - The magnetic coupling as well as the acoustic coupling between liquid 3He and magnetic or nonmagnetic substance will be studied. 4.) Low-Lying Excitations in Superconductors - Of particular interest are the fluctuation of the order parameter in the clean type II superconductor, and that in the type I superconductor far below the transition temperature. 5.) Dynamics of Superconductors with Periodic Substructures - The interaction between the periodic substructure and the vortex lattice will be examined and the effect of periodicity on the basic superconducting properties will be studied.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, THERMAL PROPERTIES OF SOLID HELIUM-3 AT VERY LOW TEMPERATURES

A.S. Greenberg, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (DMR78-09427)

A thermal conductivity apparatus will be modified so that constant volume and constant pressure samples of BCC 3He can be examined in a magnetic field. Systems comprised of solid helium isotopic mixtures in which spinodal decomposition has been observed will be investigated. Further studies of low-temperature amorphous systems will be made by means of CW ultrasonic spectroscopy. This is a continuation of work begun under DMR76-21341.

Solid helium-3 is of fundamental importance to understanding the quantum nature of condensed matter. This work will clarify the anomalous behavior of solid helium-3 at temperatures below 100 mK.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, NUCLEAR ACOUSTIC RESONANCE IN METALS

R.G. Leisure, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (DMR76-11117 A01)

The study of atomic motions in solids and how they influence the behavior of nuclear magnetic spins is an area of considerable interest in condensed matter science. The interaction between acoustic waves and nuclear spins will be investigated in several metals. Preliminary results on sodium will be extended in order to determine the mechanism responsible for coupling the acoustic energy to the nuclear spins in this material. The resonant attenuation of acoustic waves due to this mechanism (nuclear acoustic resonance) will then be studied near the temperature of the sodium martensitic phase transition. Previous nuclear acoustic resonance experiments on lead will be extended to a single-crystal lead-indium alloy. The absence of electric quadrupole effects on the lead resonance makes possible a particularly clean study of isotropic and anisotropic knight shifts. Careful nuclear acoustic resonance intensity measurements will be made in aluminum in the temperature-magnetic field range for which the Hall field vanishes. Preliminary results indicate a need for a revision of the dipolar coupling theory. A new class of nuclear acoustic resonance experiments will be explored. These experiments involve the concept of adiabatic demagnetization in a rotating reference frame.

This research was previously supported under NSF grant DMR-7611117.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0010, SUPERCONDUCTING AND NORMAL ELECTRICAL PROPERTIES OF ANISOTROPIC AND ION IMPLANTED MATERIALS

W.C. Moulton, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (DMR78-21612)

Research initiated under grant DMR 7610845 will be continued and extended. Although the proposed program represents a single research effort involving a study of strong-coupled superconductors, detailed investigations will be performed in three somewhat diverse areas: 1) the hexagonal tungsten bronzes, 2) the layered dichalcogenides, and 3) ion-implanted samples of transition metal elements and compounds. Work with the bronzes will emphasize materials preparation and measurements of electrical resistance, Hall coefficient and Seebeck voltages. The objective of this work is a detailed study of compositional and ion-size effects upon a suspected high temperature phase transition and its relationship to the occurrence of high transition temperatures in these superconducting compounds. Studies concerned with the dichalcogenides and ion-implanted systems will concentrate on the effects which magnetic-ion additions have on the normal state and superconducting state properties of the host matrix. A newly commissioned vibrating magnetometer will provide additional data with regard to the magnetic state of these compounds. A superconducting solenoid will be used to extend studies of the field dependence of the Hall coefficient and magnetoresistance to magnetic field values as high as 5T. This work will yield essential data about the magnetic inter-

actions occuring in these compounds and their effects upon the technologically important parameters of the superconducting state.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, AN EPR-ENDOR STUDY OF EXOELECTRON EMISSION TRAPS IN CERAMIC AND SINGLE CRYSTALLINE BERYLLIUM OXIDE

A.K. Garrison, Emory University, Graduate School, Dept. of Physics, *1364 Clifton Rd. N.E., Atlanta, Georgia* 30322 (DMR77-00314 A01)

Continuation of research supported under DMR75-03281.

Electron nuclear double resonance (ENDOR) will be used to characterize the traps involved in exoelectron emission (EE) in the crystalline and ceramic forms of BeO which have been previously exposed to ionizing radiation. Since thermally stimulated EE (TSEE) is the basis for a sensitive radiation dosimeter made from ceramic BeO, the aim of the study is not only to increase the understanding of the basic EE processes but also to aid in the development of a more reliable TSEE detector.

Initial ENDOR studies done by the co-principal investigators have shown that lithium is present in the BeO ceramic dosimeter material at levels at least two orders of magnitude above that previously known. It serves as a charge trap and may be the primary trap in the exoelectron and luminescence processes. Once all the paramagnetic traps are characterized by ENDOR, it is proposed to use the ENDOR signals as unique microscopic probes into the role of these traps in the EE processes. This will be done by combining ENDOR measurements with TSEE and thermoluminescence (TL) readout, optical stimulation of the traps, various radiation and annealing treatments, electron paramagnetic resonance (EPR) kinetic studies and electric conductivity measurements.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0012, DEEP LEVEL DEFECTS IN SEMICONDUCTORS

S. Sundaram, University of Illinois, Chicago Circle Campus, School of Liberal Arts & Sciences, Dept. of Physics, *601 S. Morgan St., Chicago, Illinois* 60680 (DN875661; N00014-78-C-0732)

The operation of solid state electron devices used in Navy electronics systems is controlled by the electronic nature of impurity atoms incorporated in the semiconductor materials. Deep level impurities do not contribute directly to the material conductivity but affect carrier lifetime and recombination proceses. Such impurities and their effects are not understood and must be investigated for improving solid state devices.

Studies will be made of the electronic properties of deep level defects in gallium arsenide (GaAs) and indium phosphide (InP) produced by impurities such as chromium and iron. Photoluminescence measurements with and without uniaxially applied stress will be made to deduce the valence states and resultant energy levels of the impurity. Theoretical models based on crystal field theory will be developed to correlate predictions of luminescent intensities, and energy of deep levels with the experimental results. Various valence states will be considered, configuration mixed representations of the multi-electron systems will be used, and crystal symmetry models for various possible impurity configurations in the lattice will be included in the analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0013, TIME RESOLVED SPECTROSCOPY OF THE ELECTRON-HOLE LIQUID IN SEMICONDUCTORS

J.P. Wolfe, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801

At low temperatures, the photoexcited states of the semiconductors silicon and germanium may be simply described as classical particles. A gas of 'excitons,' bound electron-hole pairs analagous to hydrogen atoms, produces 'excitonic molecules,' analagous to molecular hydrogen (H2), and may further condense to a (non-classical) metallic liquid phase. These particles disappear when the excitation light is removed. Recombination times (100 ns-1 ms) are determined by time-resolved spectroscopy, and basic properties of these photoexcited states will be determined by temperature-, stress-, and density-dependences of their lifetimes.

SUPPORTED BY Research Corp.

8.0014, QUANTUM LIQUIDS IN TWO AND THREE DIMENSIONS

J.M. Mochel, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR78-11538)

This is a continuation of work sponsored under DMR-7203291. An experimental study will be made of 4He between 10mK and 1K. An investigation of the properties of ultra thin films will be made by means of third sound resonance. The behavior of surface impurities of 3He as a two-dimensional Fermi gas, using the closed surface of 4He films as the substrate, will be studied. A new method of time-of-flight phonon spectroscopy in bulk 4He both with and without 3He impurities will be examined. This work is important to understanding the physics of quantum fluids.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, COMPARATIVE MULTICRITICAL POINT MEASUREMENTS ON ORDERED AND DISORDERED MATERIALS

M.B. Salamon, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR78-07763)

In Condensed Matter Science, there are many materials in which there are competing interactions. These materials generally are expected to have complex and interesting phase diagrams. In ordered materials such as metamagnets, the competition leads to a change in the nature of the phase transition from second to first order at a special point called the tricritical point. In randomly disordered systems, the nature of the magnetic state changes completely, giving rise to the spin-glass phase. Experimental detail on the nature of these phase transitions, is sparse. Experiments will be carried out on pure metamagnets, randomly diluted metamagnets, and magnetically random metallic glasses to fill the gap between experimental results and theoretical predictions. To do this it is necessary to measure thermodynamic properties and magnetic properties simultaneously because of the need to correct accurately for demagnetizing effects. Simultaneous critical point measurements will be made, using Faraday rotation to provide the needed magnetization data. These experiments will test existing theories of the multicritical point of metamagnets and explore the effect of randomness on the multicritical point. They will provide a new approach to the spin-glass problem by studying the evolution of the spin-glass phase from the magnetically ordered state as the degree of randomness is increased. This can provide new understanding of the magnetic behavior of non-crystalline materials.

This research was previously supported under DMR-7610379.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, RESEARCH ON QUASARS AT RADIO WAVELENGTHS

J.F. Wardle, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (AST78-01006)

Several areas of research on radio sources associated with quasi-stellar objects (quasars) will be carried out. The main topics will be concerned with the compact variable radio sources, the linear polarization and its wavelength dependence, the structure and evolution of quasars and the linear size distribution, and possible cosmological tests derived from observations. The observations and interpretations will include the angular structure and high frequency spectra of complete samples of quasars and the relationship of the angular size and red shifts of these quasars. The quasars are exotic objects which release hundreds of times more light than a single giant galaxy and give off enormous amounts of energy on timescales of days to months.

This is a continuation of research begun under grant AST 74-18631 A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

8.0017, DYNAMICAL THEORY OF CHARGED PARTICLE SYSTEMS

H.A. Gould, Clark University, School of Arts & Sciences, Dept. of Physics, *Worcester, Massachusetts* 01610 (DMR78-10306)

Theoretical research in condensed matter physics will be carried out. Past work on self-diffusion in a dense one-component classical plasma (electron gas) has shown that it is possible to perform realistic microscopic dynamical calculations of charged particle systems in the absence of a small perturbation parameter. The theory will be extended to treat the dynamical properties of superionic conductors and molten salts. The techniques and insights to be developed will also be applicable to a highly compressed plasma, quantum liquids, and classical dense gases. The theoretical calculations will be compared to results obtained from experiment and molecular dynamics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0018, ATOMIC PHYSICS EXPERIMENTS USING FAST ATOMIC BEAMS

F.M. Pipkin, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY78-09657)

Fast atomic beams will be used in conjunction with laser and radiofrequency spectroscopy techniques to make precision measurements of the fine and hyperfine structure of the excited states of hydrogen-like atoms, to study charge exchange collisions, to measure the fine structure in the excited states of complex atoms and to measure the lifetimes of atomic states.

This work is a continuation of that currently supported by NSF Grant PHY76-14857 A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0019, MOLECULAR BEAM, HYDROGEN MASER, AND STORED ATOM RESEARCH

N. Ramsey, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY77-13938 A01)

High-precision molecular beam magnetic resonance apparatus will continue to be used to study internal orientation-dependent interactions in molecules, such as nuclear electric quadrupole, nuclear spin-rotational and spin-spin magnetic interactions. Primary emphasis will be on non-polar molecules. The dependence of the electric and magnetic susceptibilities on molecular orientation and rotational distortion parameters of molecules will also be studied. Measurements of similar orientation-dependent interactions in polar molecules will be studied with a new molecular beam electric resonance apparatus which combines an unusually high precision electric resonance apparatus with a strong magnetic field. Atomic hydrogen masers will be studied and improved. Major improvements can be expected for a large storage box hydrogen maser with deformable walls, which has just recently come into operation. Hydrogen masers will be used to obtain more accurate values of the hyperfine separation and the effect of an electric field upon the hyperfine separation. Experiments with other stored atoms will be carried out by various methods including the hydrogen maser spin exchange technique.

This work represents a continuation of that currently supported by Foundation grant MPS-7412429.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0020, MEASUREMENT OF TROPOSPHERIC UV FLUXES AS RELATED TO DEFINITION OF HYDROXYL FREE RADICAL ATMOSPHERIC CONCENTRATIONS

F.B. Sellers, Panametrics Inc., Radiation Physics, *221 Crescent St., Waltham, Massachusetts* 02154 (ATM76-23902 A01)

The GAMETAG program is providing the first set of coordinated measurements of trace atmospheric gases over a wide geographic area. Simultaneous solar UV fluxes are being measured for analysis of GAMETAG data by instruments provided and operated by Panametrics, Inc. These measurements and the subsequent data are crucial for calculations of photodissociation rates and excited species photoproduction rates, which are essential parameters for interpretation of GAMETAG results for concentrations of species such as OH and O3. This grant provides for continuation of the solar UV flux measurements and data reduction for the GAMETAG program. Downward fluxes in the 280-400 nm region are measured and reported in 10 bands varying from 2 t0 20 nm in width. Upward fluxes are measured with broad band Eppley pyranometers to assess effects of backscattered UV on photodissociation processes.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0021, THEORETICAL STUDIES OF THE QUANTUM LIQUIDS AND SOLIDS

R.A. Guyer, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Amherst, Massachusetts* 01002 (DMR76-14447 A01)

Work begun under NSF grant DMR76-14447 will be continued and extended. Theoretical studies of quantum solids and fluids will be undertaken with special emphasis on helium-3 and helium-4. Magnetism in solid helium-3 will be investigated using the Heisenberg field approximation to calculate the magnetic and thermal properties. The current data base for solid helium-3 is not self-consistent at present and the source of this discrepancy will be sought. In another area, diffusion of the two-dimensional lattice gas for both helium-3 and helium-4 will be studied for comparison with experimental studies of monolayers adsorbed on grafoil. Problems of registry, vacancy tunneling, and phase transitions in monolayer systems will be investigated. A new area of research in the study of solitons and non-linear effects in quantum systems will be undertaken.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0022, THE ELECTRON G-FACTOR ANOMALY AND RELATED EXPERIMENTS

A. Rich, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY77-26037)

This experiment uses the techniques of precise atomic metrology to measure a key fundamental property of an elementary particle (the electron) and its anti-particle (the positron). This is the measurement of the g-factor anomaly to an accuracy of 25 parts per billion. This will be a significant test of quantum electrodynamics and other fundamental physical theories. The method used is an extension of the Mott double-scattering technique. The anomaly is determined directly by observing the precision of the electron spin with respect to its velocity between

the two scatterings. A number of improvements have been incorporated in the experiment.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0023, NONCRYSTALLINE MAGNETIC MATERIALS

A.M. De Graaf, Wayne State University, School of Liberal Arts, Dept. of Physics, *4841 Cass Ave., Detroit, Michigan* 48202 (DMR78-08657)

Research previously supported under DMR76-17036.

Theoretical research in condensed matter physics will be carried out in order to study the properties of noncrystalline magnetic materials in general and those of cobalt and manganese aluminosilicate glasses in particular. In addition, several experiments on these glasses will be coordinated in cooperation with research groups at Wayne State University, the University of Sao Paulo and the University of Campinas. Various models of amorphous magnetism will be studied theoretically and compared with experimental results. This research will contribute to a deeper understanding of non-magnetic glasses, spin glasses, and other amorphous magnetic materials.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0024, THEORY OF SOLIDS AND LIQUIDS

J.W. Halley, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minn sota* 55455 (DMR76-05186 A01)

Research previously supported by DMR76-05186.

Theoretical research in condensed matter physics will be carried out on a number of different topics, in order to enhance our understanding of the behavior of complex materials. These topics will include: (1) Magnetic systems, especially those which behave like one-and two-dimensional Heisenberg systems. Also, the dynamics of itinerant ferromagnets will be investigated. (2) Classical liquids, including the calculation of dynamical structure factors and depolarized light scattering. (3) Conductivity in disordered solids, particularly the use of percolation models and an analysis of metallic conductivity in the strong scattering limit.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, THERMALLY STIMULATED CURRENTS IN ALKALI-CONTAINING GLASSES

D.E. Day, University of Missouri, Rolla Campus, Center for Materials Research, *103 Parker Hall, Rolla, Missouri* 65401 (DMR77-13002)

This research will be an investigation of the storage and motion of electrical charge (polarization and conductivity) in alkali silicate glasses using thermally stimulated current (TSC) and ionic thermal current (ITC) techniques in order to obtain information about the nature of the alkali sites in vitreous solids. The study will investigate the localized sodium (Na) motion recently observed in a sodium silicate glass with these techniques, and which is currently attributed to the trapping of Na ions at the interface of immiscible phases, interfacial polarization, and to Na ion motion around the non-bridging oxygen ions, Na ion-(NBO)anion dipole polarization. The dependence of the parameters for this localized motion upon both glass composition and microstructure will be determined in order to evaluate those characteristics of the local alkali ion environment and glass microstructure which control short-range, and consequently, long-range alkali motion.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, MAGNETIC RESONANCE AND OTHER STUDIES AT LOW TEMPERATURES

R.E. Norberg, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR78-10780)

This is a continuation of work sponsored under DMR-7618863. The diffusion and relaxation of dilute impurities of hydrogen and helium in simple solids and liquids will be measured. The Kapitza problem of energy transfer across a solid-liquid helium-II interface will be studied by means of measurements of phonon transmission and reflection. Metal hydrides will be studied by a method of hydrogen nuclear acoustic resonance. Defect controlled spin relaxation and ultra slow diffusion in solid krypton and krypton rare gas mixtures will be studied. Collective excitations in amorphous solids will be studied by magnetic specific heat at temperatures down to 100 mK. This work is important for understanding the nature of helium-II excitations at low temperature and the nature of diffusion in simple solids and liquids.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, THE STUDY OF VIBRATIONALLY EXCITED MOLECULES BY LOW-ENERGY ELECTRON SCATTERING

P.D. Burrow, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (ENG77-14649)

The research deals with the detection and study of vibrationally excited molecules by means of low-energy electron scattering techniques. Two methods for the determination of vibrational populations will be used and applied to excited nitrogen. Other electron impact processes with excited molecules will be investigated. Cross sections for collision processes such as ionization and dissociative attachment will be studied as a function of vibration content, for example, a study of the ionization of vibrationally excited nitrogen. New diagnostic techniques to examine the vibrational distribution of molecules will be developed. The production and deactivation of vibrationally excited molecules by collision with hot metal walls will be investigated. It appears that the numbers of collisions with a hot wall which are required before the vibrational temperature of a gas in contact with the wall reaches equilibrium with the wall temperature have not yet been determined quantitatively. Research will be initiated by using diagnostic techniques in conjunction with an oven source for vibrationally excited molecules. The oven will possess a simple tubular geometry with a variable length such that the number of wall collisions can be estimated with accuracy. The optical temperature of the oven and the vibrational distribution of the effusing molecules will be monitored. The research is a continuation of that done under NSF Grant No. ENG-7102472 AO1.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

8.0028, THEORETICAL STUDIES OF ATOMIC COLLISIONS

A. Halpern, City University of New York, Brooklyn College, School of Science, Dept. of Physics, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (PHY78-11611)

Research in theoretical atomic physics will be initiated. Topics of interest include investigations of elastic scattering of charged particles by atoms, excitation of atoms and ions by electrons, protons, alpha particles, and other fully stripped atoms, atom-atom and ion-atom collisions, ionizing collisions, Glauber theory, and charge transfer collisions. The calculations are of both formal and practical interest in atomic physics. They will also be relevant to aspects of astrophysics and atmospheric physics, and to the plasma physics aspects of energy production and of nuclear pumped lasers.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0029, PHOTOSYNTHETIC PROCESS PROBED DIRECTLY WITH PICOSECOND LASER PULSES

R.R. Alfano, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (PCM77-14966 A01)

The understanding of the primary processes in photosynthesis has benefited greatly from direct picosecond kinetics measurements and studies in the picosecond fluorescence kinetics have opened a new era in photosynthesis research. Principally this project encompasses the systematic time dependent study of the kinetics, spectrum, and polarization of the subnanosecond fluorescent emmission and absorption difference from photosynthetic systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral & Social Sciences, Div. of Physiology Cellular & Molecular Biology

8.0030, ELECTRON SPECTROMETRY OF SOLID SYSTEMS

J. Silcox, Cornell University, Ithaca Campus, School of Engineering, Dept. of Engineering & Applied Physics, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR78-09204)

This is an extension of the research previously supported by DMR-7600834.

Experimental studies of the excitation spectra of solid state systems will be carried out using an electron microscope electron spectrometer system to measure inelastic electron scattering. A variable temperature stage will be used to monitor changes in phonon-electronic scattering terms in the multiple scattering. Single crystals of aluminum will be studied first with later extensions to metals with different screening radii. We expect data relevant to dynamical scattering effects to become available and propose detailed comparisons with existing calculations. Use of the variable temperature stage in studies dichalcogenide materials is proposed with particular concern for compounds of the form Nb1-xVxSe2, a search for two-dimensional electron gas behavior and dynamical scattering effects. One-dimensional materials will be explored when they become available at Cornell.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, PHOTOPION REACTIONS IN COMPLEX NUCLEI

J.E. Winhold, Rensselaer Polytechnic Inst., School of Science, Dept. of Physics, *110 8th, Troy, New York* 12181 (PHY77-09408 A01)

A program of photopion production studies at the Bates Linear Accelerator (MIT) will be continued in collaboration with Boston University and MIT. The program will emphasize observation of charged pions and measurement of differential cross sections for specific final nuclear states. Initially a low-energy pion spectrometer completed in 1976 will be used to cover a pion energy range from 10 to 45 MeV with 1 MeV energy resolution, extending recently published measurements on carbon-12 to a variety of other nuclei. Lithium-6, carbon-12, carbon-13 and oxygen-16 will be used as targets for studies of the production cross sections for positive and negative pions; searches will be made for production of giant multipole resonances, especially electric and magnetic dipole resonances; measurements will be made of pion production on very light nuclei, especially deuterium and helium-3. Towards the end of the three-year program it is hoped to initiate measurements with a new and larger spectrometer now being planned at MIT which will permit studies at higher energies.

Analysis of the data is expected to provide new insight into the interaction between pions and nuclei, and to provide new types of information concerning nuclear structure and transitions.

This work is a continuation of that performed under Foundation grant PHY76-14909.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0032, ULTRAHIGH FREQUENCY ABSORPTION AND NONLINEAR KAPITZA CONDUCTANCE MEASUREMENTS

J.H. Constable, State University of New York, Binghamton Campus, School of Arts & Sciences, Dept. of Physics, *Vestal Parkway, Binghamton, New York* 13901 (DMR76-11114 A01)

This is a continuation of work begun under DMR76-11114. The resonant absorption of orthohydrogen (oH2) and paradeuterium (pD2) impurities in parahydrogen (pH2), HD and orthodeuterium (oD2) host crystals will be measured in the ultrahigh frequency range and the absorption related to various anisotropic interactions such as the crystalline field. The importance of phonon attenuation and frequency conversion in the energy transport across a crystalline boundary will be assessed by studies of such effects near the boundaries of dielectric crystals.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, MAGNETIC RESONANCE PROPERTIES OF IONS IN NOBLE GAS LIQUIDS AND SOLIDS

J.F. Reichert, State University of New York, Buffalo Campus, School of Natural Sciences & Mathematics, Dept. of Physics, *3435 Main St., Buffalo, New York* 14214 (DMR78-23973)

This research is a continuation and extension of work sponsored under grant DMR7610135. Negative ions in liquid helium-3 constitute a unique, model system for studying, in depth, fundamental aspects of electron-nuclear, spin-spin interactions. Professor Reichert's recent experimental achievements in applying magnetic resonance techniques have resulted in the first experimental data suggesting the existence of a strong hyperfine coupling spin-lattice relaxation process in liquid helium-3. Techniques are now available to use this 'microscopic probe' of liquid helium-3 to study dynamic nuclear-polarization effects. Electron spin resonance and electron-nuclear double resonance techniques will be used to elucidate details pertaining to the fundamental nature of the hyperfine interaction. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, THEORETICAL STUDY OF SOLID ELECTROLYTES (SUPER-IONIC CONDUCTORS)

S. Choi, University of North Carolina, Chapel Hill Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Chapel Hill, North Carolina* 27514 (DMR7822207)

Solid electrolytes are interesting because one species of ions in the crystal tends to be disordered and liquid-like while other species remain in a crystalline framework. They have an abnormally high ionic electrical conductivity and other interesting properties such as varied phase transitions. For engineering applications, solid electrolytes are important because they may be used as an electrolyte in a battery, a fuel cell, or a heat-to-electricity converter. Although our understanding of most promising solid electrolytes such as beta-alumina and RbAg4I5 has made considerable progress, there are many phenomena and properties not well understood. Theoretical studies and numerical computations will be done on the equilibrium and transport properties of mixed (solid solution) beta-alumina, properties of charge compensating defects and impurities in beta-alumina, and the silver ion conduction in RbAg4K5. Classical many-body theories will be modified or improved, an also some numerical computation (such as the Monte Carlo method) will be done to enhance our understanding of the above mentioned properties and phenomena.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, ELECTRON AND PHONON INTERACTIONS IN METALS

J.J. Trivisonno, John Carroll University, Graduate School, Dept. of Physics, *20700 N. Park Blvd., University Heights, Cleveland, Ohio* 44118 (DMR76-00784 A01)

This is a continuation of research previously supported by NSF grant DMR-7600784.

Ultrasonic attenuation experiments will be done in ultra pure magnesium single crystals to determine the electronic contribution to the ultrasonic attenuation of longitudinal and shear waves. Doppler-shifted cyclotron resonance experiments will also be done in order to obtain information about electron life times and electron-phonon interactions. Realistic calculations of the magnetic field dependence of the attenuation in magnesium, cadmium, and zinc will be made using the Fermi surfaces of these metals based on band structure calculations. A transducerless electromagnetic generation and detection technique will be employed to study the Martensitic phase transformation in lithium six, lithium seven and sodium. This technique will also be used to study attenuation absorption edges in potassium. Phonon propagation characteristic studies in degenerate semiconductors will be continued in an attempt to obtain information about electron-phonon interactions and phonon mean free paths in these materials.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, ELECTRON PARAMAGNETIC RESONANCE CHARACTERIZATION AND MONITORING OF SILICON DETECTOR MATERIALS

G.K. Miner, University of Dayton, School of Arts & Sciences, Dept. of Physics, *300 College Park Ave., Dayton, Ohio* 45469 (DF055040; AFOSR-79-0108)

AF function - microwave solid state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communication systems. The development of silicon based infrared detector material is dependent upon the knowledge and control of dopants and impurities. Opportunity - this research should improve the ability to develop detectors for the 3-5 micron range and large detector arrays. Objective - the objective of this research is to characterize and monitor impurities and dopants in silicon detector materials. How work contributes - this work will provide feedback to establish crystal growth conditions to improve silicon detector materials.

X-level samples and neutron transmutation doped samples will be examined with x-band spectrometer. Dangling bond observations will be attempted. K-band and dispersion modes will be employed for general study of defects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0037, MAGNETIC RESONANCE STUDIES OF DEFECT BEHAVIOR IN PEROVSKITE AND RUTILE STRUCTURED MATERIALS

L.E. Halliburton, Oklahoma State University, School of Arts & Sciences, Dept. of Physics, *Agricultural Hall, Stillwater, Oklahoma* 74075 (DMR77-08465 A01)

This research was previously supported under DMR 73-07656.

The principal goal of this research program is to determine the formation mechanisms and resulting electronic structure of defects in perovskite and rutile structured halides. Specifically, the self-trapped exciton triplet states in KMgF3 and MgF2 will be investigated by combining optical and magnetic resonance techniques. The results of these experiments will provide a better understanding of the photochemical damage process in low-symmetry materials. The second area of investigation will be the magneto optic properties of luminescing Mn2 ion-F center exchange coupled close pairs in KMgF3. Finally, electron-nuclear double resonance (ENDOR) studies of the self-trapped hole and the impurity-associated fluorine interstitial centers in KMgF3 will be continued, as well as extension of this work to an electron spin resonance (ESR) investigation of interstitial centers in RbCaF3.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0038, STUDY OF ELECTRON IMPACT OF LASER MEDIA WITH EMPHASIS ON THE ROLE OF TEMPORARY NEGATIVE ION FORMATION

D.E. Golden, University of Oklahoma, Norman Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (ENG76-82943 A01)

This experimental program is aimed at the measurement of the basic parameters necessary for the design of laser pumped by electron impact. The researchers will measure electron impact excitation cross sections, optical branching ratios of the subsequent decays, excited state lifetimes, polarization of the radiation, and collisional deactivation decay and energy transfer rates in the case of metastable excitation for a number of target atoms and molecules. The measurements will be performed at sufficient electron energy resolution so that particular attention can be directed towards the role of resonances in the excitation process. The experimental design is such that high energy resolution measurements can be performed with sensitivities much larger (by more than a factor of 5000 in some cases) than previously thought possible. This is a continuation of research previously supported under NSF grant ENG-7523512.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

8.0039, ELECTRONIC STRUCTURE AND SPIN-RESOLVED K-SPACE SPECTROSCOPY IN METALS

D.H. Lowndes, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DMR78-06271)

This research was previously supported under DMR-7407652.

Improved resolution of the de Haas-van Alphen technique will be used in studies of electronic structure in a variety of metals. These studies include an investigation of the onset of ferromagnetism in a metal with dilute magnetic impurities; an investigation of the connection between the electronic structure and the A-15 structural phase transition in superconducting Nb3Sn and V3Si; and an investigation of the electronic structure in the La(Gd,Ce)Al2 system in which superconductivity may coexist with a magnetic state. Experiments will also be carried out in single crystals of mercury to investigate the quenching of the electron-phonon mass enhancement by an intense magnetic field. Large magnetic field-dependent increases in electron-impurity scattering will be studied by examination of the line shape from single quantum oscillations. Experiments will be continued to investigate the combined effects of Fermi surface geometry and the spin-orbit interaction in order to understand the origin of large shifts in the electronic g-factor.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0040, THERMODYNAMICS AND STATISTICAL MECHANICS OF PHASE TRANSITIONS

R.B. Griffiths, Carnegie Mellon University, Mellon Inst. of Science, Dept. of Physics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DMR78-20394)

Research previously supported by DMR7623071. The following topics in the general area of phase transitions and critical phenomena will be investigated: 1. A thermodynamic model of a tricritical point in a particular mixture will be constructed in order to assist some research groups which are studying light scattering in this mixture and to test for the presence of expected logarithmic corrections to the thermodynamic properties. 2. The possible utility of the mathematical discipline of Catastro-

phe Theory for classifying multicritical points will be investigated, with special reference to multicritical points in liquid mixtures. 3. Theoretical models will be constructed in an effort to understand the phase transitions which occur when noble gases are adsorbed on a graphite substrate. Of particular interest are the first-order transitions observed as single layers are added to the substrate, and the various transitions which occur below or near a coverage of one layer. 4. Previous research has indicated that real-space renormalization-group methods, which are widely used for certain problems in statistical mechanics, suffer from certain mathematical difficulties. The study of these difficulties will continue. 5. Mathematical models will be constructed for various non-linear processes which occur during first-order phase transitions, such as dendritic growth of crystals.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0041, SURFACE QUANTIZATION AND ELECTRON-ELECTRON INTERACTIONS

P.J. Stiles, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR77-10218 A01)

Experimental studies of the electronic transport properties of inversion and accumulation layers in semiconductors will be continued. This is an extension of research previously supported by NSF grant DMR-7302401. Measurements of the magnetoconductivity, Shubnikov-de Haas effect, cyclotron resonance will be used to investigate the one-electron states as well as the one-electron and many-electron excitations of the quasi-two-dimensional (Q2D) electron gas localized at the interface between silicon and silicon dioxide. Specific topics to be addressed include: the formation of superlattices in Q2D systems; measurement of Q2D plasmons; electron-phonon interactions in Q2D electron systems; and the localization of electronic states due to potential fluctuations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0042, MAGNETIC EFFECTS IN POLYATOMIC GASES AND AMORPHOUS METALS

T.W. Adair, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (A-288)

The thermomagnetic torque (TMT) has been measured in nitrogen-helium gas mixtures at room temperature. The TMT in nirogen gas is the result of non-spherical non-spherical particle interaction. By adding helium to the nitrogen gas an additional contribution is observed due to the non-spherical spherical particle interaction. This interaction has been studied by varying the helium concentration in the mixture and measuring the change in the characteristic maximum magnetic field-pressure ratio, (H/p)max and the maximum torque times pressure divided by the temperature difference, (P/delta T)max. As the helium concentration has increased the value (H/p)max was found to decrease linearly. The maximum value of (P/delta T) max was observed at concentration of 50% helium. Hall coefficient measurements for the amorphous transition metal alloy La8Ga2 have been obtained at LHe, LN2 and room temperatures. Rh varies from plus 8.9 at room temperature to plus 11 at 4.2K in units of 10 to the minus 11th power cu. m/As. The values of Rh are consistent with the literature value for the pure liquid metal in contrast to the literature value of minus 8.9 for crystalline dhcp La.

SUPPORTED BY Robert A. Welch Foundation

8.0043, ATOMIC AND MOLECULAR PROCESSES

J.C. Browne, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Computer Sciences, *200 W. 21st St., Austin, Texas* 78712 (F-379)

Charge transfer reactions of the type, A plus q plus B yields A(plus q minus 1) plus B may leave the A(plus q minus 1) ion in a highly excited electronic state. This excited state may in some cases radiate to a lower state with the emission of VUV or X-ray photons. If the cross section for charge transfer is large, a population inversion and a potential X-ray laser may result.

The system He ions plus Li yields He ion plus Li ion colliding at low energy has been found by ab initio computations to preferentially produce He ion (3l) which may decay either by the emisson of 256A photons or by a cascade of 1640A and 304A photons. At low relative collision velocities, v approximately 0.5 x 10 to the 8th power sq. cm/sec, cross-sections of sigma approximately 10 to the minus 15th power sq. cm for the production of He ion (3l) are found. At larger velocities, v greater than 2 x 10 to the 8th power cm/sec, the ionization reaction A plus q plus B yields A(plus q minus 1) plus B ions plus e predominates thus destroying the possibility of population inversion on an excited electronic state. A principal significance of this work is its narrowing of a large and very difficult experimental domain. Experimental validation of this potential population inversion is needed.

SUPPORTED BY Robert A. Welch Foundation

8.0044, THEORETICAL-NUMERICAL STUDIES OF PHYSISORPTION AND OTHER PROPERTIES OF CRYSTALLINE SURFACES

F.W. de Wette, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (F-433)

In our continuing studies of dynamical and related properties of ionic crystal surfaces we have completed the calculation of the infrared absorption properties of microcrystals of MgO. We found close agreement between the main infrared absorption frequency omega m of these near-cubical clusters of the Frohlich frequency omega P of the continuum theory of infrared absorption in small spheres; the size dependence of the calculated absorption spectrum appears to agree quite well with experimentally observed absorption spectra.

A collaborative effort has been initiated with scientists of the Max-Planck Institut fur Festkorperforschung, Stuttgart, West Germany, to study and develop shell models describing ionic interactions near the surfaces of ionic crystals. The aim is to arrive at models that will: (1) describe the bulk properties properly, and (2) allow the simultaneous calculation of surface structural and surface dynamical properties. Such models are of particular importance for the description of surface properties of crystals containing O ions (such as MgO). The free O ions seem to be unstable, and in crystalline environments its polarizability is proportional to the ionic volume. Hence variable anion polarizability (and possible charge transfer near the surface) has to be taken into account in the modified shell models.

SUPPORTED BY Robert A. Welch Foundation

8.0045, ULTRASOUND STUDIES OF CONCENTRATION OR CRITICAL FLUCTUATIONS IN LIQUID BINARY SYSTEMS WHICH EXHIBIT A METAL-NONMETAL TRANSITION

D.E. Bowen, University of Texas, El Paso Campus, School of Liberal Arts, Dept. of Physics, *El Paso, Texas* 79902 (DMR78-08494)

The broad goal of this work is to understand what factors govern the transition of a substance from a conducting state at higher temperatures to a non-conducting state at a lower temperature. This transition is called a metal-nonmetal (MNM) transition and is of broad interest in condensed matter science. The attenuation and velocity of ultrasound through solutions of alkali metals in liquid ammonia are measured as functions of temperature near the critical point. The data are analyzed using Fixman-Kawasaki theory to infer correlation lengths and, perhaps, scaling parameters.

This is a continuation of work supported under DMR 75-23652.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0046, LOCALIZED AND COLLECTIVE EXCITATION AND ORDERING PROCESSES IN IONIC CRYSTALS

F. Luty, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR77-12675 A01)

Research previously supported by DMR74-13870.

The investigations will cover a variety of systems with the purpose of establishing interconnections between localized defect and collective crystal behavior. (1) Molecular and off-center paraelectric defects will be investigated. Particular emphasis will be on studies of these systems under hydrostatic pressure. The close similarities of the pressure-induced transitions to the behavior of displacive ferroelectrics will be explored. (2) Mixed alkali-halide-cyanide crystals of the type KBr1-x(CN)x will be studied by means of Raman, optical and dielectric techniques. (3) Resonance Raman scattering and hot luminescence effects of F-center defects will be carried out. The systems to be studied will include hydrogen defects in alkali-halides. The motivation of this work, besides the fundamental interest in the interrelation of the resonance scattering process, will be the potential of these systems for broadly tunable IR laser application.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0047, ELECTRONIC PROPERTIES OF METALS AND ALLOYS IN HIGH MAGNETIC FIELDS

R.V. Coleman, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR78-02553)

The electronic structure and properties of layer crystals exhibiting charge density wave (CDW) transitions will be investigated experimentally. Measurements of quantum oscillatory phenomena at high magnetic fields will be made on single crystals of layer structure dichalcogenides and trichalcogenides. DC transport measurements including Hall effect, magnetoresistance and superconducting anisotropy will also be carried out. Both Shubnikov de Haas and de Haas van Alphen oscillations will be measured using AC modulation and harmonic detection. These techniques are being extended for use on the high field Bitter solenoids at the National Magnet Laboratory. Charge density wave formation in the chalcogenides will be studied and the effects of organic intercalation and pressure on the CDW will be followed by measuring the quantum oscillatory phenomena. DC susceptibility, Hall effect and magnetoresistance as a function of temperature will also be used to correlate results with CDW formation.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0048, DISLOCATION DYNAMICS

J.W. Mitchell, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR77-26168)

This is a continuation of a fundamental investigation on the motion of high velocity dislocations in solids. The objective is to understand the origins of resistance to the motion of individual dislocations from a theoretical and experimental point of view. Studies on Cu-Ni-Pd-Al alloys which have relatively high yield points due to solute segregation at residual dislocations, and yet have an apparent low fractional resistance to dislocation motion will be continued. The dislocation velocities as a function of temperature (4.2 degrees to 300 degrees K) and applied stress will be determined for single crystals of these alloys, as well as for single crystals of Cu-Ni and Cu-Al-Ni alloys surface hardened by diffusion of Pd into the surface layers. Supplementary studies required to establish the detailed dislocation mechanisms of the relaxation processes will be done. Current research on the lattice dynamical theory of dislocation motion will be continued with particular emphasis on the velocity range half the speed of sound, where low stress long-range motion of straight dislocations has been shown to occur in simple lattice models. In addition, a detailed study of the interaction of moving dislocations with phonons, with the aim of establishing a theory of the temperature dependence of dislocation mobility will be undertaken, and will include the effect of dispersed impurities in a non-dilute alloy. Lastly, theoretical studies on the propagation of dislocation avalanches and microcracks will be undertaken. This is a continuation of research, previously funded under NSF Grant DMR76-01059. This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0049, X-RAY ABSORPTION SPECTROSCOPIC INVESTIGATION OF THE STRUCTURE OF NON-CRYSTALLINE SURFACE LAYERS

F.W. Lytle, Boeing Engineering & Construction Co., *Seattle, Washington* 98124 (DMR77-12919 A01)

This research will be a study of the structure of surface oxide layers on metals such as titanium, aluminum and tantalum using Extended X-ray Absorption Fine Structure (EXAFS) experiments at the Standard Synchrotron Radiation Project. Determination of the structure and energy position of the absorption edges will yield information about the orbitals of chemical bonding and ionicity of the bonds. The EXAFS spectra will be analyzed to determine the number, distance and type of coordinating atoms surrounding the adsorbing atom.

The aim is to understand the interatomic relationships between the metal and oxide, hydroxide or other anions from the anodizing solution. Such information has not been possible in the past and may reflect on common usage of these materials varying from structural applications, protective finishes, and dielectric strength to fuel cells, electrode processes and exo-electron emission.

This is a continuation of research initiated under NSF Grant DMR74-24261 AO1.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0050, SKIN ALIGNED ATOMIC HYDROGEN

O.E. Vilches, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR77-27528)

An experimental study will be made of the production, storage, and thermodynamic properties of spin polarized atomic hydrogen and its isotopes in their three dimensional bulk forms and as absorbed films. The prediction that at all temperatures spin polarized atomic hydrogen is gas which shows strong quantum effects will be tested. Further, the prediction that for spin polarized deuterium the liquid and vapor phases coexist to the lowest available temperature will be tested.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, STABLE FREQUENCY SOURCE UTILIZING A SUPERCONDUCTING-CAVITY-STABILIZED OSCILLATOR

M.H. Cohen, California Inst. of Technology, Graduate School, Dept. of Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST76-23634)

Very long base line interferometry (VLBI) is the technique in which two radiotelescopes thousands of miles apart can be used together to resolve the finest details of distant radio sources. This is done by recording the signals from the separate telescopes along with timing information from a highly accurate clock and later playing back both tapes into a special processor. The success of the method depends upon the accuracy of the clocks at each telescope. Until now most telescopes have used hydrogen maser time standards which are quite expensive. A

new type of standard based on a superconducting cavity stabilized oscillator will be developed for use at the Owens Valley Radio Observatory of the California Institute of Technology which does not have a hydrogen maser. The new standard will greatly improve the stability and sensitivity of VLBI observations made at the observatory and will be available to all qualified users.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0002, OBSERVATIONAL STUDIES IN GALACTIC AND EXTRAGALACTIC ASTROPHYSICS

B.T. Soifer, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (AST7682890A02)

Infrared spectrophotometric observations of galactic and extragalactic sources will be carried out. The UCSD-U. Minn. Mt. Lemmon Observatory and the 3-m telescope of Lick Observatory will be used. Necessary improvements will be made in the multi-detector, grating spectrometer in order to increase the ultimate sensitivity of infrared spectroscopy.

The infrared observations will consist of moderate resolution lambda/delta 70) spectrophotometry from 2 to 4 and 8 to 13 microns. Galactic sources to be studied are those that might exhibit the unidentified spectral features discovered in NGC 7027, newly discovered sources, and chemically peculiar stars. Extragalactic sources to be studied include some of the brightest quasistellar objects in which optical emission lines are redshifted into the 2 micron window. A few of the brightest infrared galaxies will also be observed.

In developing the grating spectrometer, the aim is to build the most efficient instrument possible and to test and demonstrate its performance. The use of an up-looking configuration, Fabry field optics, and the best demonstrated photoconductors were dictated by this aim. They shall test the spectrometer on the Mt. Lemmon telescope, make any necessary improvements, test and improve the data acquisition and reduction techniques, and use the system for useful astronomical observations.

This is a continuation of AST-7682890.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0003, A SPECTROSCOPIC STUDY OF O-TYPE STARS

P.S. Conti, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics/Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (AST78-20135)

Support is for a program of spectroscopic research on the O-type stars, the hottest, brightest, and most massive of all stars. These stars must be very young on a cosmic time scale since they pour out energy at so large a rate (100,000 to one million times the luminosity of the sun). They ionize the immediate stellar neighborhood; and their presence is important for the formation and early evolution of other nearby stars. All O-type stars lose mass, for the hottest ones, at such a rate that the outer atmosphere of the star is substantially modified. This 'stellar wind' also influences the immediate surrounding and affects the subsequent evolution of the O-type star itself.

Spectroscopic observations of O-type stars will be obtained in two areas. The first is to study phenomena in the stellar winds as evidenced by the emission and absorption line profiles, as points of contact with the theory of expanding and extending atmospheres. This will permit specific statements about the mass-loss mechanism and the physical phenomena observed in the stellar winds. The second aspect will be to determine stellar masses by investigations of O-type binary stars. It is suggested that O stars with masses up to 100 times that of the sun may exist, but only binary stars can give directly derived numbers. The determination of the fundamental parameter of stellar mass has overriding importance in the understanding of the evolution of these very luminous stars.

Prior support was by NSF grant AST76-20842 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0004, SOLAR WIND STUDIES USING THE COCOA CROSS RADIOTELESCOPE

W.M. Cronyn, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (ATM77-27530)

The solar terrestrial research program to study dynamic solar wind features associated with, and delineated by interplanetary scintillation (IPS) activity of natural radio sources, using the University of Iowa Cocoa Cross radiotelescope is to be continued. Its operating frequency and large electronically steerable collecting area make it possible to take daily synoptic measurements of scintillation index and spectra on far more sources over a larger range of ecliptic coordination than would be possible with any other telescope in the world.

Utilizing a numerical modeling code and recently installed digital data acquisition systems, it should be possible to deduce estimates of distance, velocity and electron density power spectrum (including power law index). Correlation with in situ spacecraft measures will continue with detailed analysis of events to deduce the shape and extent of the irregularity structures in and out of the ecliptic plane. The occurrence and physical characteristics of the plasma turbulence which gives rise to IPS will be studied on time scales of 27 days, 1 day and less than 1 minute to study streams, transient fast-moving plasmoids and shock fronts and associations with solar phenomena.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0005, A LABORATORY EXPERIMENT OF AN IONOSPHERIC INTEREST - MICROWAVE SCATTERING BY A SYSTEM OF PLASMA WAVES OR IRREGULARITIES

N. D'Angelo, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (ATM78-00529)

A process of cosmic noise absorption (CNA), involving backscatter of 20-30 MHz electromagnetic radiation of cosmic origin by E region plasma waves, has been recently suggested. The relevant E region plasma waves are produced by the Farley-Buneman instability, which is excited by large ionospheric electric fields.

This grant funds studies in the laboratory, in a multidipole plasma device, of the scattering of electromagnetic radiation (3 cm mu waves) by systems of Farley-Buneman waves. Scattering cross-sections will be measured for a given level of Farley-Buneman turbulence. This will then be compared to theory to test its validity and/or seek improvements therein.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0006, INVESTIGATION OF A GROUP OF DENSE ROTATING INTERSTELLAR CLOUDS WHICH ARE UNDERGOING EXTENSIVE FRAGMENTATION

F.O. Clark, University of Kentucky, College of Arts & Sciences, Dept. of Physics & Astronomy, *Limestone & Euclid, Lexington, Kentucky* 40506 (AST76-80200 A01)

In the Taurus region of the sky there is a group of interstellar gas clouds which are rotating, extensively fragmented, and probably in a state of gravitational collapse. These clouds will be studied by means of the microwave spectral lines of the common interstellar molecules formaldehyde, hydroxyl radical, and carbon monoxide. The study will determine the physical parameters of these clouds, such as kinetic temperature, density and density gradient, kinematics (rotation, fragmentation, and other measurable motions), and possibly also chemistry. The study will establish the details of rotation and fragmentation for

this group of interstellar clouds, and demonstrate how the collapse motions are consistent with the conservation of angular momentum. The results will be useful for understanding how these processes actually take place and will provide an observational basis for theoretical calculations of realistic models which include rotation. The study is based on preliminary results which show unexpected detailed fragmentation taking place.

This is a continuation of work done under grant AST 76-80200.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, RADIO CORONAL HOLES AND GEOMAGNETIC DISTURBANCES

M.D. Papagiannis, Boston University, Graduate School, Dept. of Astronomy, *705 Commonwealth Ave., Boston, Massachusetts* 02215 (DF249650; F19628-77-C-0189)

AF function - communications and navigation. Deficiency - radio signal fading and changes in satellite orbit ephemerides. Objective -to determine the relationship between solar coronal hole radio parameters and the magnitude of terrestrial magnetic disturbances initiated by the high speed wind streams from the holes. How research contributes -defines those radio coronal hole parameters that are operationally significant in forecasting the occurrence and severity of geomagnetic disturbances.

Archival radioheliograms obtained with moderate resolution radiotelescopes in the United States and Brazil at wavelengths from 21 cm to 0.12 cm will be examined and scaled for coronal hole data. Spectral characteristics of the radio coronal hole will be compared with solar wind and geomagnetic data to establish operational forecast parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

10.0008, RADIO ASTRONOMY AT THE HAYSTACK OBSERVATORY

P.B. Sebring, Northeast Radio Observ. Corp., *Cambridge, Massachusetts* 01886 (AST75-14701 A03)

The Haystack Observatory will provide a radio astronomy observing facility available to all U.S. astronomers and easily accessible to radio astronomy groups based in New England. A great deal of research in the coming year will center around programs aimed at understanding the characteristics of molecules found in interstellar space and their relationship to clouds of dust and hydrogen gas out of which stars are being formed. Molecules to be considered include water, methanol and ammonia.

A considerable amount of effort will be devoted to Very Long Baseline Interferometry. This work involves worldwide cooperative projects and now provides the highest resolution and most accurate positional measurements in astronomy. One-fourth of the radio observing time will be used for this type of work.

This is a continuation of support under NSF Grant AST 75-14701.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, ASTROPHYSICAL FLUID DYNAMIC STUDIES

R.F. Stein, Michigan State University, School of Natural Sciences, Dept. of Astronomy & Astrophysics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (AST76-22479 A01)

Techniques for solving coupled radiative transfer-nonlinear fluid flow problems in one dimension and nonlinear fluid flow problems in two and three dimensions will be developed and used to study interrelated solar problems: 1) The generation of acoustic and magnetic waves by nonlinear interaction with turbulent motions and by overstability due to interaction with the radiative flux. 2) The deposition of energy and momentum in the chromosphere and corona. The goal is to develop tools for analyzing observed solar waves and models of the energy balance in the chromosphere and corona with heating by magnetic, acoustic, and gravity waves. Once a self-consistent solar model is constructed, the same techniques will be applied to other stars where chromospheres and coronas are observed.

Also, accretion onto protostars and the formation of compact H II regions in the dense circumstellar cloud will be studied through the calculation of theoretical models of the evolution of compact H II regions to use with infrared and radio observations to analyze conditions of star formation.

Prior support was by NSF grant AST 76-22479.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, TWO-DIMENSIONAL CLASSIFICATION OF STARS SOUTH OF PLUS 20 DEGREES IN THE HENRY DRAPER CATALOGUE

C.R. Cowley, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Astronomy, *Ann Arbor, Michigan* 48104 (AST77-27744)

This project will continue two-dimensional spectral classification of the southern stars of the Henry Draper catalogue. The spectra are on high-quality objective-prism plates taken with the Michigan Curtis Schmidt telescope located at the Cerro Tololo Inter-American Observatory in Chile. Volume 1, containing 36,000 stars between declinations of 90 degrees and minus 53 degrees was published in 1975, and Volume 2, containing 31,000 stars between declinations between minus 53 degrees and minus 40 degrees is now being prepared for publication.

During the two-year period of this grant it is expected that Volume 3 (containing classifications of about 32,000 stars) will be started. Also, the remaining plates for regions accessible rom Cerro Tololo will be obtained. In addition some combined statistical analyses of Volume 1 and 2 will be made, and lists of stars of special interest will be published.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, SPECTROSCOPY OF FAINT SOURCES

A. Slettebak, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Astronomy, *164 W. 17th Ave., Columbus, Ohio* 43210 (AST77-26890)

Observations with an image-dissector scanner attached to a Cassegrain spectrograph on the Perkins 72-inch telescope in Flagstaff, Arizona, will be made of objects identified by means of three independent deep-sky surveys: (1) the Steward Observatory Near-Infrared Photographic Sky Survey, (2) Dr. A. A. Hoag's lists of faint objects with peculiar emission, obtained through the use of transmission-grating slitless spectroscopy, and (3) the Ohio State University Radio Observatory lists of radio sources. Many different kinds of objects, both galactic and extragalactic, have been and are being detected by these surveys and will be studied spectroscopically with the image-dissector scanner. These observations are expected to help provide a better understanding of the galactic structure and the morphology of external systems.

This grant will provide funds for the acquisition of a minicomputer at the Ohio State University for data reduction and software development, and for travel to make the necessary observations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0012, EXTRAGALACTIC AND SOLAR SYSTEM RADIO ASTRONOMY

J.N. Douglas, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST77-28477)

A program of extragalactic radio astronomy will be carried out in three main phases: 1. Continuation of the Texas Sky

Survey. Accurate (plus or minus 1") positions, flux density structure and variability data are being obtained at 380 and 335 MHz for all sources north of minus 35 degrees declination and brighter than 0.25 Jansky (about 50,000 sources). Basic observations will be 95 per cent complete and one-third of the data will have been reduced to publishable form by the spring of 1979. 2. Identification of radio sources from the survey with optical objects from the National Geographical Society - Palomar Sky Survey, using our accurate radio positions and accurate optical positions measured with our computer-interactive laser measuring engine. Experience to date shows about 45 per cent of radio sources to have optical counterparts within 5", having an identification reliability higher than 90 per cent. The entire survey is thus expected to produce about 22,000 optical identifications, an order-of-magnitude increase over what is now available in the literature. 3. Spectroscopic and photometric observations of selected large samples of the identifications are carried out at McDonald Observatory by Drs. Derek and Beverly Wills.

Supplementary programs in instrumentation and synoptic monitoring of Jupiter will also be carried out. This is a continuation of research done under AST 76-01883 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0013, GALACTIC ABUNDANCES OF THE CHEMICAL ELEMENTS

P.A. Vanden Bout, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (F-623)

Radio frequency studies of galactic molecular clouds have been made to investigate the effects of chemical reactions on the relative abundances of different isotopic species of interstellar molecules. Knowledge of the effects is necessary if correct relative abundances of nuclear isotopes are to be obtained from astronomical observations of molecular spectral lines. Work has concentrated on deuterated molecules. Interstellar deuterium isocyanide, DNC, was discovered by observing its J equals 2-1 rotational transition at 152.60977 GHz. Measurements of the (DNC/HNC) ratio in a variety of molecular clouds are correlated with cloud kinetic temperatuue and indicate that the deuteration of HNC proceeds via exchange reactions between HD and a molecular ion. Observations of HCO ion and DCO ion have been made and analyzed to put limits on the abundance of free electrons in galactic molecular clouds. Results are consistent with the abundances necessary for gas-phase ionmolecule chemistry to operate.

Optical wavelength sppctroscopy of interstellar atoms has been continued with the detection of lithium 6708 A toward an additional two stars, bringing the total number of interstellar clouds in which lithium abundances can be studied to six.

SUPPORTED BY Robert A. Welch Foundation

10.0014, DEVELOPMENT OF INFRARED ARRAY SPECTROMETER SYSTEMS

R.D. Gehrz, University of Wyoming, School of Arts & Sciences, Dept. of Physics, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (AST76-05039 A02)

Observations at infrared wavelengths in combination with radio, millimeter and optical studies are rapidly adding to our knowledge of a variety of objects in the universe. An array of six infrared detectors has been used to improve the efficiency of observing the inherently weak infrared signals.

A program of further development of array detectors on spectrometer systems will be carried out. The number of detectors will be increased and the wavelength coverage will be expanded. The resulting instruments will be tested at Kitt Peak National Observatory and will be the main auxiliary instruments to be used on the University of Wyoming 90-inch infrared telescope.

This is a continuation of work currently supported under NSF grant AST 76-05039 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0015, SPACECRAFT CHARGING STUDIES IN EUROPE

G.L. Wrenn, University of London, University College, Mullard Space Science Lab., *Dorking, England, United Kingdom* (DF289750; AFOSR-78-3713)

AF function - space system survivability by control or elimination of differential spacecraft charging effects. Deficiency - a comprehensive knowledge of European capabilities in spacecraft charging technology would enable the USAF to fully capitalize on advances in this field by European R&D organizations. Research - this effort will complement AFGL, AFOSR, AFML and SAMSO programs to understand the spacecraft charging phenomena and to control or eliminate its effects on USAF and DOD space systems. Research will investigate European advances in this field and assess applications possibilities for lengthening the lifetimes of space systems. How research contributes - research will enable AFGL to incorporate the latest European advances in spacecraft charging technology to the SCATHA satellite program and to obtain more accurate knowledge of the space environment in which space systems operate.

An internationally respected authority in space physics will conduct an assessment of European capabilities in the field for further examination and application by AFGL space environment experts.

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01 AERONAUTICS (GENERAL)

N80-27273/ Battelle Columbus Labs., Ohio
THE GENERAL AVIATION DYNAMICS MODEL. VOLUME 1: EXECUTIVE SUMMARY Final Report, 2 Sep. 1977 - 30 May 1979
Michael A. Duffy and Jane H. McCreery 30 May 1979 31 p
(Contract DOT-FA77WA-4043)
(AD-A073543; FAA-AVP-79-8-Vol-1) Avail: NTIS
HC A03/MF A01 CSCL 01/2

A brief non-technical overview of the General Aviation Dynamics model, an evaluation of its first post-sample period forecast, and a discussion of some of its more recent applications are given. The model is a dynamic simulation, interactive computer model built upon the cause-effect interactions displayed between various sectors of the general aviation system. GRA

N80-27274/ Battelle Columbus Labs., Ohio
THE GENERAL AVIATION DYNAMIC MODEL. VOLUME 2: TECHNICAL REPORT Final Report, 2 Sep. 1977 - 30 May 1979
Michael A. Duffy and Jane H. McCreery 30 May 1979 169 p refs
(Contract DOT-FA77WA-4043)
(AD-A073544; FAA-AVP-79-8-Vol-2) Avail: NTIS
HC A08/MF A01 CSCL 01/2

A detailed description of the General Aviation Dynamics (GAD) model is given. It contains a complete set of statistics, including actual data, for the estimated causal relationships within each sector of the model. Also illustrated is how the GAD model can be used to evaluate alternative policy actions. The model is a dynamic simulation, interactive computer model built upon the cause-effect interactions displayed between various sectors of the general aviation system. GRA

N80-27275/ Federal Aviation Administration, Washington, D. C. Office of Aviation Policy
FAA AVIATION FORECASTINGS, FISCAL YEARS 1980 - 1991
Sep. 1979 91 p
(AD-A075382; FAA-AVP-79-9) Avail: NTIS
HC A05/MF A01 CSCL 01/2

The Official Federal Aviation Administration (FAA) forecasts of domestic aviation activity for the years 1980 to 1991 are presented in this volume. It contains forecasts of aviation activity at FAA towered airports and Air Route Traffic Control Centers, as well as services provided by flight service stations. Aviation activity forecasts for the four major users of the National Airspace System, the trunk and local air carriers, the air taxi and commuter air carriers, general aviation, and the military, also are presented. GRA

N80-27276/ Transportation Systems Center, Cambridge, Mass.
GENERAL AVIATION PILOT AND AIRCRAFT ACTIVITY SURVEY, CONDUCTED IN 1978
Susan J. Pinciaro Dec. 1979 52 p refs
(AD-A081726; TSC-FAA-79-29; FAA-MS-79-7) Avail: NTIS
HC A04/MF A01 CSCL 01/2

This report provides a summary and analysis of the data collected in the 1978 General Aviation Pilot and Aircraft Activity Survey. The survey was conducted at a random sample of airports across the nation and Puerto Rico, throughout the months of July and August 1978, by the Federal Aviation Administration with the assistance of the Civil Air Patrol. The survey data provide information regarding the magnitude and characteristics of general aviation including: type and source of aircraft, flight purpose, utilization of flight plan and weather information services, trip length in time and distance, pilot age and certification. Estimates are made of total 1978 general aviation operations, fuel consumption and aircraft miles flown. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-27277 Pennsylvania State Univ., University Park.
A NUMERICAL AND EXPERIMENTAL STUDY OF THE TURBULENT WAKES OF TURBOMACHINERY ROTOR BLADES, ISOLATED AIRFOILS, AND A CASCADE OF AIRFOILS Ph.D. Thesis
Chunill Hah 1980 341 p
Avail: Univ. Microfilms Order No. 8015798

Three turbulence models were employed to obtain closure of the governing equations. The first model was comprised of transport equations for the turbulent kinetic energy and the rate of energy dissipation, and the second and third models were comprised of equations for the rate of turbulent kinetic energy dissipation and Reynolds stresses, respectively. The second model handles the convection and diffusion terms in the Reynolds stress transport equation collectively, while the third model handles them individually. All three models were modified for the effect of streamline curvature. The rotation originated redistribution terms were added in the transport equation of Reynolds stresses of the second and third models. The turbulent wakes of an isolated airfoil and a cascade of airfoils are handled as simpler cases of the general rotating three dimensional wake. The numerical results demonstrate that the second and third models provide accurate predictions, but the computer time and memory storage can be considerably saved with the second model. Dissert. Abstr.

N80-27278 California Univ., Los Angeles.
AIRFOILS AT SONIC VELOCITY Ph.D. Thesis
Egbert Sau-Nam Tse 1980 103 p
Avail: Univ. Microfilms Order No. 8016054

A method for calculating flows and corresponding airfoils shapes where the free-stream Mach number is unity is described.

The calculation is done in two parts: both are on hodograph planes. The basic equation is the Tricomi equation and is solved numerically. In one part which corresponds to the front section of the airfoil, the equation is solved in a region where it changes type. The algorithm developed is thus type dependent. The implicit difference scheme formulates uses a rectangular grid in the elliptic region and a characteristic grid in the hyperbolic region. In the other part which corresponds to the rear part of the airfoil, a method of characteristics is used. The boundary curve is prescribed in the hodograph and the shape of the airfoil is determined afterwards. This is useful in airfoil design. The computed result for a thin wedge is in good agreement with analytic results obtained by others. Airfoil with convex surfaces and parabolic noses are generated. Their center of pressure distribution, lift coefficient, drag coefficient and moment coefficient are also obtained. Dissert. Abstr.

N80-27279*# National Aeronautics and Space Administration, Washington, D. C.
TRANSONIC SMALL DISTURBANCES EQUATION APPLIED TO THE SOLUTION OF TWO-DIMENSIONAL NONSTEADY FLOWS
M. Couston, J. J. Angelini, and P. Mulak Apr. 1980 36 p refs Transl. into ENGLISH from la Rech. Aerospatiale, no. 5, Sep. - Oct. 1979 p 325-340 Original document prepared by ONERA Original language document announced as A80-12357 Transl. by Kannar (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75795) Avail: NTIS HC A03/MF A01 CSCL 20D

Transonic nonsteady flows are of large practical interest. Aeroelastic instability prediction, control figured vehicle techniques or rotary wings in forward flight are some examples justifying the effort undertaken to improve knowledge of these problems is described. The numerical solution of these problems under the potential flow hypothesis is described. The use of an alternating direction implicit scheme allows the efficient resolution of the two dimensional transonic small perturbations equation L.F.M.

N80-27280*# Boeing Aerospace Co., Seattle, Wash.
AN IMPROVED PANEL METHOD FOR THE SOLUTION OF THREE-DIMENSIONAL LEADING EDGE VORTEX FLOWS. VOLUME 2: USER'S GUIDE AND PROGRAMMER'S DOCUMENT Report, Dec. 1977 - May 1979
E. N. Tinoco, P. Lu, and F. T. Johnson Washington NASA Jul. 1980 176 p refs
(Contracts NAS1-15169; NAS1-15275)
(NASA-CR-3279) Avail: NTIS HC A09/MF A01 CSCL 01A

A computer program developed for solving the subsonic, three dimensional flow over wing-body configurations with leading edge vortex separation is presented. Instructions are given for the proper set up and input of a problem into the computer code. Program input formats and output are described, as well as the overlay structure of the program. The program is written in FORTRAN. A.R.H.

N80-27281*# Lockheed-Georgia Co., Marietta.
EXPLORATORY STUDIES OF THE CRUISE PERFORMANCE OF UPPER SURFACE BLOWN CONFIGURATIONS Final Summary Report
J. A. Braden, J. P. Hancock, J. E. Hackett, K. P. Burdges, and V. Lyman Washington NASA Jul. 1980 191 p refs
(Contract NAS1-13871)
(NASA-CR-3193; LG77ER0028) Avail: NTIS HC A09/MF A01 CSCL 01A

The data and major conclusions obtained from an experimental/analytical study of upper-surface blown (USB) configurations at cruise are summarized. The high-speed (subsonic) experimental work, studying the aerodynamic effects of wing-nacelle geometric variations, was conducted around semi-span model configurations composed of diversified, interchangeable components. Power simulation was provided by high pressure air ducted through closed forebody nacelles. Nozzle geometry was varied across size, exit aspect ratio, exit position and boattail angle. Both 3-D force and 2-D pressure measurements were obtained at cruise Mach numbers from 0.5 to 0.8 and at nozzle pressure ratios up to about 3.0. The experimental investigation was supported by an analytical synthesis of the system using a vortex lattice representation with first-order power effects. Results are also presented from a compatibility study in which a short-haul transport is designed on the basis of the aerodynamic findings in the experimental study as well as acoustical data obtained in a concurrent program. High-lift test data are used to substantiate the projected performance of the selected transport design. A.R.H.

N80-27282*# Boeing Aerospace Co., Seattle, Wash.
AN IMPROVED PANEL METHOD FOR THE SOLUTION OF THREE-DIMENSIONAL LEADING-EDGE VORTEX FLOWS. VOLUME 1: THEORY DOCUMENT Topical Report, Dec. - May 1977
F. T. Johnson, P. Lu, and E. N. Tinoco Washington NASA Jul. 1980 123 p refs
(Contract NAS1-15169; NAS1-15275)
(NASA-CR-3278) Avail: NTIS HC A06/MF A01 CSCL 01A

An improved panel method for the solution of three dimensional flow and wing and wing-body combinations with leading edge vortex separation is presented. The method employs a three dimensional inviscid flow model in which the configuration, the rolled-up vortex sheets, and the wake are represented by quadratic doublet distributions. The strength of the singularity distribution as well as shape and position of the vortex spirals are computed in an iterative fashion starting with an assumed initial sheet geometry. The method calculates forces and moments as well as detail surface pressure distributions. Improvements include the implementation of improved panel numerics for the purpose of elimination the highly nonlinear effects of ring vortices around double panel edges, and the development of a least squares procedure for damping vortex sheet geometry update instabilities. A complete description of the method is included. A variety of cases generated by the computer program implementing the method are presented which verify the mathematical assumptions of the method and which compare computed results with experimental data to verify the underlying physical assumptions made by the method. F.O.S.

N80-27283*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
EFFECT OF REYNOLDS NUMBER ON STABILITY CHARACTERISTICS OF A CRUCIFORM WING-BODY
Robert L. Stallings, Jr., Milton Lamb, and Carolyn B. Watson Jul. 1980 111 p refs
(NASA-TP-1683; L-13530) Avail: NTIS HC A06/MF A01 CSCL 01A

An experimental investigation was conducted to determine the effect of Reynolds number on the stability characteristics of a body with cruciform wings at large angles of attack. Pressure distributions and force and moment data (axial force not measured) are presented for Mach 1.60 and 2.70, Reynolds numbers based on body diameter from approximately 130,000 to 2,800,000, and angles of attack from 0 deg to 50 deg. In general, the data show only small effects of Reynolds number throughout the range of test condition. Also discussed are force balance and pressure data that suggest a direct relationship between wind choking and the onset of a nonlinear stability variaton with angle of attack. Author

N80-27284*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CAS2D: FORTRAN PROGRAM FOR NONROTATING BLADE-TO-BLADE, STEADY, POTENTIAL TRANSONIC CASCADE FLOWS
Djordje S. Dulikravich Jul. 1980 36 p refs
(NASA-TP-1705; E-253) Avail: NTIS HC A03/MF A01 CSCL 01A

An exact, full-potential-equation (FPE) model for the steady, irrotational, homentropic and homoenergetic flow of a compressible, homocompositional, inviscid fluid through two dimensional planar cascades of airfoils was derived, together with its appropriate boundary conditions. A computer program, CAS2D, was developed that numerically solves an artificially time-dependent form of the actual FPE. The governing equation was discretized by using type-dependent, rotated finite differencing and the finite area technique. The flow field was discretized by providing a boundary-fitted, nonuniform computational mesh. The mesh was generated by using a sequence of conforming mapping,

nonorthogonal coordinate stretching, and local, isoparametric, bilinear mapping functions. The discretized form of the FPE was solved iteratively by using successive line overrelaxation. The possible isentropic shocks were correctly captured by adding explicitly an artificial viscosity in a conservative form. In addition, a three-level consecutive, mesh refinement feature makes CAS2D a reliable and fast algorithm for the analysis of transonic, two dimensional cascade flows. Author

N80-27285*# Transportation Systems Center, Cambridge, Mass.
FAA/NASA PROCEEDINGS WORKSHOP ON WAKE VORTEX ALLEVIATION AND AVOIDANCE
William D. Wood, ed. Oct. 1979 343 p Workshop held at Cambridge, Mass., 28-29 Nov. 1978; sponsored by FAA, Washington, D.C. Sponsored in part by NASA
(NASA-CR-163317; AD-A077897; TSC-FAA-79-77; FAA-RD-79-105) Avail: NTIS HC A15/MF A01 CSCL 01/2

This document is a record of the joint FAA/NASA Workshop on Wake Vortex Alleviation and Avoidance conducted at the DOT Transportation Systems Center, November 28-29, 1978. The workshop was sponsored by the Federal Aviation Administration to apprise the appropriate specialists of the state of the art and to formulate program recommendations for wake vortex alleviation at the source, for wake avoidance systems, and for operations, and safety regulations. GRA

N80-27286*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ALTERNATIVE APPROACH TO THE NUMERICAL SIMULATION OF STEADY INVISCID FLOW
Gary M. Johnson Jun. 1980 8 p refs Presented at 7th Intern. Conf. on Numerical Methods in Fluid Dyn., Stanford, Calif., 23-27 Jun. 1980; sponsored by NACA, AFOSR, NSF, and ONR
(NASA-TM-81542) Avail: NTIS HC A02/MF A01

A numerical procedure for the efficient simulation of steady inviscid flow is described and its utility demonstrated. Application of the surrogate equation technique allows the formulation of stable, fully conservative, type dependent finite difference equations for use in obtaining numerical solutions to systems of first order partial differential equations, such as the steady state Euler equations or their various approximations. Computational results are presented for the full Euler equations and for the transonic disturbance equations. For the latter case, a computational efficiency greater than that obtained by means of the standard perturbation potential approach is indicated. E.D.K.

N80-27287*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL STUDIES OF SCALE EFFECTS ON OSCILLATING AIRFOILS AT TRANSONIC SPEEDS
Sanford S. Davis Jul. 1980 16 p refs
(NASA-TM-81216; A-8259) Avail: NTIS HC A02/MF A01 CSCL 01A

Experimental data are presented on the effect of Reynolds number on unsteady pressures induced by the pitching motion of an oscillating airfoil. Scale effects are discussed with reference to a conventional airfoil (NACA 64A010) and a supercritical airfoil (NLR 7301) at mean-flow conditions that support both weak and strong shock waves. During the experiment the Reynolds number was varied from 3,000,000 to 12,000,000 at a Mach number and incidence necessary to induce the required flow. Both fundamental frequency and complete time history data are presented over the range of reduced frequencies that is important in aeroelastic applications. The experimental data show that viscous effects are important in the case of the supercritical airfoil at all flow conditions and in the case of the conventional airfoil under strong shock-wave conditions. Some frequency-dependent viscous effects were also observed. Author

N80-27288*# Pennsylvania State Univ., University Park.
THREE DIMENSIONAL MEAN FLOW AND TURBULENCE CHARACTERISTICS OF THE NEAR WAKE OF A COMPRESSOR ROTOR BLADE Final Report
A. Ravindranath and B. Lakshminarayana Jun. 1980 298 p refs
(Grant NsG-3012)
(NASA-CR-159518; PSU-TURBO-R-80-4) Avail: NTIS HC A13/MF A01 CSCL 01A

The investigation was carried out using the rotating hot wire technique. Measurements were taken inside the end wall boundary layer to discern the effect of annulus and hub wall boundary layer, secondary flow, and tip leakage on the wake structure. Static pressure gradients across the wake were measured using a static stagnation pressure probe insensitive to flow direction changes. The axial and the tangential velocity defects, the radial component of velocity, and turbulence intensities were found to be very large as compared to the near and far wake regions. The radial velocities in the trailing edge region exhibited characteristics prevalent in a trailing vortex system. Flow near the blade tips found to be highly complex due to interaction of the end wall boundary layers, secondary flows, and tip leakage flow with the wake. The streamwise curvature was found to be appreciable near the blade trailing edge. Flow properties in the trailing edge region are quite different compared to that in the near and far wake regions with respect to their decay characteristics, similarity, etc. Fourier decomposition of the rotor wake revealed that for a normalized wake only the first three coefficients are dominant. E.D.K.

N80-27289# Detroit Diesel Allison, Indianapolis, Ind.
TIME-VARIANT AERODYNAMICS FOR TORSIONAL MOTION OF LARGE-TURNING AIRFOILS Final Report
R. L. Jay, M. D. Rothrock, R. E. Riffel, and G. T. Sinnet Jan. 1980 109 p refs
(Contract N00019-79-C-0087)
(AD-A083766; DDA-EDR-10192) Avail: NTIS HC A06/MF A01 CSCL 20/4

A cascade of five airfoil sections modelling the hub section of an advanced design turbine featuring a high inlet Mach number and 112 degrees of turning was evaluated at 4 steady-state conditions of varying exit Mach number and expansion ratio. The resulting steady-state airfoil surface pressures were compared to a state-of-the-art analytical prediction. A time-variant investigation was conducted at the 4 operating conditions of the steady-state experiment. Time-variant pressure signals were obtained from a Kulite-instrumented airfoil as the cascade was torsionally oscillated at four values of interblade phase angle per expansion ratio by computer-controlled electromagnetic drive systems. The dynamic pressure signals were evaluated in amplitude and phase lag (referenced to blade motion) and correlated with a state-of-the-art analytical prediction based on a flat-plate cascade. A quasi-static experiment was performed to relate the dynamic surface pressure amplitudes to those obtained by resetting the cascade to various temporal positions in the torsional cycle of oscillation. GRA

N80-27290# Nielsen Engineering and Research, Inc., Mountain View, Calif.
DATA REPORT FOR AN EXTENSIVE STORE SEPARATION TEST PROGRAM CONDUCTED AT SUPERSONIC SPEEDS Final Report, Jun. 1975 - Aug. 1979
Frederick K. Goodwin and Calvin L. Dyer (AFFDL) Wright-Patterson AFB, Ohio AFFDL Dec. 1979 292 p refs
(Contract F33615-76-C-3077; AF Proj. 2403)
(AD-A083848; NEAR-TR-205; AFFDL-TR-79-3130) Avail: NTIS HC A13/MF A01 CSCL 20/4

This report describes an extensive store separation test program conducted at Mach number range covering 1.5 to 2.5. The purpose of the program was to provide a systematic set of data which could be used to evaluate and improve analytical techniques for predicting supersonic store separation trajectories. Parent aircraft configurations tested ranged from a simple circular body, mid-wing configuration without pylons and racks to a noncircular fuselage with wing, flow through engine inlets, and pylons and racks. The parent configuration was built up component by component so model component effects could be isolated. Flow-field survey, store pressure-distribution, store force-and-moment and store trajectory data were obtained. The store tested were circular and elliptical in cross section with various fin arrangements. The data obtained during five wind-tunnel entries are summarized in this report. The data have been collected on magnetic tapes and FORTRAN computer programs have been written which retrieve the data from the tapes. This report also describes the use of these programs and tapes and describes the tabulated output from the programs. GRA

N80-27291# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
FLUTTER ANALYSIS OF A TWO-DIMENSIONAL AND TWO-DEGREE-OF-FREEDOM SUPERCRITICAL AIRFOIL IN SMALL-DISTURBANCE UNSTEADY TRANSONIC FLOW Final Report, Nov. 1978 - Oct. 1979
T. Y. Yang, P. Guruswamy, and Alfred G. Striz Wright-Patterson AFB, Ohio AFWAL Mar. 1980 94 p refs
(Grant AF-AFOSR-3523-78; AF Proj. 2307)
(AD-A084172; AFWAL-TR-80-3010) Avail: NTIS HC A05/MF A01 CSCL 20/4

Flutter analysis is performed for a MBB A-3 supercritical airfoil at transonic Mach numbers. Two degrees of freedom, pitching and plunging, are considered. The unsteady aerodynamic data are obtained by using two separate transonic aerodynamic computational codes: (1) LTRAN2 based on the time integration method and (2) STRANS2 and UTRANS2 based on the harmonic analysis method. The steady aerodynamic results are shown in the form of upper and lower surface pressure curves. The unsteady aerodynamic coefficients are obtained and tabulated for various values of low reduced frequency by pitching the MBB A-3 airfoil about the quarter chord axis. For the case of zero mean angle of attack, the coefficients obtained by the two computer codes are directly compared and discussed. At design Mach number of 0.765 and zero mean angle of attack, flutter results are obtained by both methods and compared. They are presented as plots of flutter speed and the corresponding reduced frequency vs. one of the four parameters: airfoil - air mass ratio; position of mass center; position of elastic axis; and plunge-to-pitch frequency ratio. GRA

N80-27292# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
THE LOW-SPEED CHARACTERISTICS OF A 15-PERCENT QUASI-ELLIPTICAL CIRCULATION CONTROL AIRFOIL WITH DISTRIBUTED CAMBER Final Report
Jane Abramson May 1979 46 p refs
(AD-A084176; DTNSRDC/ASED-79/07) Avail: NTIS HC A03/MF A01

The aerodynamic characteristics of a circulation control elliptic airfoil section with a 15-percent thickness-to-chord ratio were evaluated subsonically. The airfoil, designated NCCR1513-7559E, incorporates a high degree of nose camber and an increased leading edge radius in a profile designed for high subsonic speeds. Critical Mach numbers in excess of 0.7 were predicted analytically for several typical operating conditions. Lift coefficients up to 4.63 were produced at momentum coefficients of 0.22. Equivalent lift-to-drag ratios of approximately 40 were also produced at C_{μ} = 0.8. GRA

N80-27293# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
NUMERICAL OPTIMIZATION OF CIRCULATION CONTROL AIRFOILS Interim Report, Sep. 1978 - Dec. 1979
Tsze C. Tai, George H. Kidwell, Jr., and Garret N. Vanderplaats Apr. 1980 51 p refs
(ZR0230201)
(AD-A084129; DTNSRDC/AERO-1265; DTNSRDC-80/060) Avail: NTIS HC A04/MF A01 CSCL 20/4

A numerical procedure developed for optimizing the circulation control airfoils is presented. The procedure finds the optimum basis airfoil shapes subjected to specified flow conditions and geometric constraints. It consists of a numerical optimization code for linear constrained problems coupled with a viscous-potential flow interaction analysis for necessary viscous-inviscid flow field calculations. The desired airfoil shape is defined by a combination of baseline shapes representative of airfoils suitable for circulation control purposes. The coefficients of these basis vectors are then used as the design variables in the optimization process. Three baseline shapes (a cambered ellipse, a cambered ellipse with a drooped trailing edge, and a cambered ellipse with a logarithmically spiralled trailing edge) are employed for special contouring of the trailing edge geometry. With some minor modification of the analysis method, the combined program allows optimization for maximum lift without substantial difficulty; but for minimizing the drag, further improvement of the analysis method is required. GRA

N80-27294# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
A SECOND ORDER ACCURATE NUMERICAL METHOD FOR SUPERSONIC BOUNDARY LAYER FLOW PAST A COMPRESSION CORNER M.S. Thesis. Final Report, May 1978 - May 1979
Bernardo Fortunato and M. J. Werle Jun. 1979 91 p refs
(Contract F33615-76-C-3091; AF Proj. 2307)
(AD-A084550; AFFDL-TR-79-3061) Avail: NTIS CSCL 20/4

The compressible and incompressible boundary layer equations are solved for laminar flow past a configuration with an interior (concave) compression region. The approach first employs conformal coordinates to map the body geometry to a flat wall, and then the boundary layer scale laws to identify the principal terms of the compressible counterpart of the Navier-Stokes equations. A Levy-Lees type transformation is identified in these coordinates to simplify the governing equations. These are then solved with a second order accurate numerical scheme in both the longitudinal and normal directions. Solutions are obtained for adiabatic and 'warm' wall conditions for configurations with and without separation. Emphasis is placed here on achieving accurate reliable results while maintaining minimal computer time expenditure. GRA

N80-27295# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mathematics.
FINITE ELEMENT ANALYSIS OF TRANSONIC FLOWS Final Report, 1 Nov. 1978 - 31 Oct. 1979
George J. Fix May 1980 8 p refs
(Grant DAAG29-77-G-0026)
(AD-A084636; ARO-14371.9-M) Avail: NTIS HC A02/MF A01 CSCL 20/4

Finite element algorithms were developed for the following class of problems: (1) Transonic flow problems governed by the potential equations; (2) Moving boundary problems; and (3) Incompressible flow problems governed by the Navier-Stokes equations. GRA

N80-27296# ARO, Inc., Arnold Air Force Station, Tenn.
MUTUAL INTERFERENCE OF MULTIPLE BODIES IN THE FLOW FIELD OF THE F-4C AIRCRAFT IN THE TRANSONIC SPEED RANGE Final Report, 12 - 21 Nov. 1979
A. A. Hesketh AEDC Dec. 1979 90 p refs
(AD-A084704; AEDC-TSR-79-P79) Avail: NTIS HC A05/MF A01 CSCL 20/4

A wind tunnel field was conducted to study the mutual interference of multiple bodies in the flow field of the F-4C aircraft. The test utilized 1/20 scale models of the F-4C aircraft, the MK-83 bomb (with and without fins) and the triple ejector rack (TER) to obtain aerodynamic loads on the MK-83 at, and near, the carriage position on the wing inboard pylon. Flow field data in the vicinity of the TER were also obtained. Test variables included aircraft angle of attack from -3 to 17 deg, freestream Mach number from 0.60 to 0.95, and aircraft configuration. Freestream aerodynamic loads data were also obtained on the MK-83 bomb model. GRA

N80-27297# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.
GAS REPLENISHMENT TECHNIQUES FOR USE IN HIGH-ALTITUDE, LONG-DURATION SCIENTIFIC BALLOON FLIGHTS Final Report
Andrew S. Cartan, Jr. and Charles F. Sindt 14 Nov. 1979 78 p refs
(AD-A084496; AFGL-TR-79-0278; AFGL-IP-283) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report covers the theoretical advantages and practical ramifications of a proposed new technique for compensating for the daily loss of lift (gamma) experienced by long-duration high-altitude scientific balloon flights. This technique, 'Gas Replenishment' would transfer stored helium from an onboard dewar to the balloon, to replace gas lost due to temperature excursions. It would be a direct substitute for systems presently in use which drop ballast, that is, reduce system gross weight, to compensate for loss of lift. With gas replenishment, lift is restored directly, with only a small change in system gross weight. A short summary of zero pressure balloon flight theory is given at the start, to lead into the explanation of conventional ballast

practices and computations. The ballast equations are then modified to apply to the gas replenishment technique. Calculations for typical constant-gamma flights are summarized for each method of loss compensation and the clear superiority of gas replenishment is demonstrated in the areas of gross system weight of launch, usable payload weight and anticipated flight duration. Basic equations are then developed for a more complicated model of the gas replenishment system in which the value of gamma varies from day to day. Computations using these formulas are summarized in tabular form. The final section of the report is given over to the design problems associated with the type of dewar and heat exchange equipment needed to implement the gas replenishment concept. GRA

N80-27298# National Technical Information Service, Springfield, Va.
LIGHTER THAN AIR VEHICLES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 272 p Supersedes NTIS/PS-79/0471 and NTIS/PS-78/0409
(PB80-808066; NTIS/PS-79/0471; NTIS/PS-78/0409) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 01C

The design and applications of balloons, dirigibles, and airships are investigated in these Government-sponsored research reports. Passenger or cargo transport, tethering, and fabric selection are among the aspects investigated. Meteorological balloons are excluded. This updated bibliography contains 265 abstracts, 15 of which are new entries to the previous edition. GRA

N80-27299# National Technical Information Service, Springfield, Va.
LIGHTER THAN AIR VEHICLES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 94 p Supersedes NTIS/PS-79/0472 and NTIS/PS-78/0410
(PB80-808074; NTIS/PS-79/0472; NTIS/PS-78/0410) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 01/C

Safety factors related to the use of balloons, dirigibles and aerostats for passenger and cargo transport are considered in reports from worldwide literature. Structural design, material selection and tethering are discussed as well as the use of airships for heavy lift operations. This updated bibliography contains 89 abstracts, 7 of which are new to the previous edition. A.R.H.

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N80-27300 Ohio State Univ., Columbus.
GENERAL AVIATION DYNAMICS: THE IMPACT OF COST RECOVERY Ph.D. Thesis
Michael Alan Duff 1980 231 p
Avail: Univ. Microfilms Order No. 8015869

The regulation of air commerce to promote its development and safety as well as the operation of the air traffic control system are discussed. A complete application of the policy approach to the problem of general aviation cost recovery is described. Some additional quantitative insight into understanding the general aviation system and its probable response to increased user charges are provided. Dissert. Abstr.

N80-27301 California Univ., Los Angeles.
A DYNAMIC MODEL OF THE AIR TRANSPORT INDUSTRY Ph.D. Thesis
Mohammad Bagher Ayati 1980 298 p
Avail: Univ. Microfilms Order No. 8015950

A modeling process to stimulate the dynamic process of economics of the Air Transportation industry is presented. The model process consists of development of a conceptual model to relate aircraft technology, aviation fuels, airline operation, and economics of air transportation. A methodology based on digraph theory is suggested to facilitate a straightforward technique for presentation and simulation of a class of socio-economic systems. The methodology has been successfully applied to simulate a dynamic model of air transportation economics. Results of the model validation shows negligible difference between actual and projected values. Dissert. Abstr.

N80-27302*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
TIRE STIFFNESS AND DAMPING DETERMINED FROM STATIC AND FREE-VIBRATION TESTS
Robert K. Sleeper and Robert C. Dreher Jul. 1980 45 p refs
(NASA-TP-1671; L-13500) Avail: NTIS HC A03/MF A01 CSCL 01C

Stiffness and damping of a nonrolling tire were determined experimentally from both static force-displacement relations and the free-vibration behavior of a cable-suspended platen pressed against the tire periphery. Lateral and force-and-aft spring constants and damping factors of a 49 x 17 size aircraft tire for different tire pressure and vertical loads were measured assuming a rate-independent damping form. In addition, a technique was applied for estimating the magnitude of the tire mass which participates in the vibratory motion of the dynamic tests. Results show that both the lateral and force-and-aft spring constants generally increase with tire pressure but only the latter increased significantly with vertical tire loading. The fore-and-aft spring constants were greater than those in the lateral direction. The static-spring-constant variations were similar to the dynamic variations but exhibited lower magnitudes. Damping was small and insensitive to tire loading. Furthermore, static damping accounted for a significant portion of that found dynamically. Effective tire masses were also small. Author

N80-27303*# National Aeronautics and Space Administration, Washington, D. C.
THE DEVELOPMENT OF THE ZEPPLIN DIRIGIBLE FOR LONG DISTANCE TRANSPORTATION
Albert Ehrle Apr. 1980 18 p Transl. into ENGLISH of "Gedenken an die Hundertste Wiederkehr des Geburtstages des Grafen Zeppelin", Deutchen Academie der Luftfahrtforschung, West Germany, 17 Jun. 1938 p 33-47 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76143) Avail: NTIS HC A02/MF A01 CSCL 01C

Changes in the design and construction of German airships for regular transoceanic passenger transportation during the 1916 to 1938 period are described. Technical problems related to structural weight, fuel reduction, and passenger comfort are considered. A.R.H.

N80-27304# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
THE 1976 ACCIDENT EXPERIENCE OF CIVILIAN PILOTS WITH STATIC PHYSICAL DEFECTS
J. Robert Dille and Charles F. Booze Aug. 1979 8 p refs
(AD-A077189; FAA-AM-79-19) Avail: NTIS HC A02/MF A01 CSCL 01/2

The 1974 and 1975 aircraft accident experiences of civilian pilots with eight selected static physical defects have been examined and reported previously. Three categories, blindness or absence of either eye, deficient color vision with a waiver, and deficient distant vision, had significantly more accidents than were expected on the basis of observed-to-expected ratios. However, pilots with these conditions reported considerably higher median 6-month flight times than did an active airman population sample and accident airmen without selected pathology. In 1975 the reported recent and total flying times for all airmen with these defects were determined and accident rates were calculated. The rates for airmen with blindness or absence of an eye were still found to be significantly higher. The contact lens group was also selected to receive special attention in a study of the 1976 accident data because marginal significance was found on analysis of the 1975 data and, after 1976, this group will not carry a pathology code or require a waiver and thus will be difficult to study. Observed-to-expected ratios for

1976 are 1.91 for deficient color vision with a waiver, 1.28 for contact lens users, 1.37 for blindness or absence of either eye, and 1.62 for deficient distant vision. The accident rates per 100,000 hours of cumulative and last 6 months' flying experience were significantly greater for contact lens users and monocular pilots than for the active airman population. GRA

N80-27305# Federal Aviation Administration, Washington, D. C. Office of Management Systems.
CURRENT AVIATION STATISTICS: AIR TRAFFIC ACTIVITY TERMINAL AREA RELATIONSHIPS, FISCAL YEARS 1977 AND 1978
1979 101 p
(AD-A078617; FAA-AMS-220-79-4) Avail: NTIS HC A06/MF A01 CSCL 01/2

Busy hour estimates are obtained from periodic counts of 60 minutes in duration. These counts are made during known high activity periods for each traffic category. From this sample, tower personnel select a count which is representative of daily busy hour activity for each category. The statistical tables in this publication contain traffic estimates for each airport at which an air traffic control tower operated during all of FY 1977 and FY 1978. Provided with peak day and busy hour counts are average day and hour operations computed from the annual operations counts. Measures of peaking characteristics are given by the ratios peak day to average day and busy hour to average hour by individual airport by size group. GRA

N80-27306# Transportation Systems Center, Cambridge, Mass.
CHICAGO MONOSTATIC ACOUSTIC VORTEX SENSING SYSTEM. VOLUME 1: DATA COLLECTION AND REDUCTION Final Report, Jan. 1976 - Sep. 1977
D. C. Burnham Oct. 1979 34 p refs
(AD-A076929; TSC-FAA-79-18-1-Vol-1; FAA-RD-79-103-1) Avail: NTIS HC A03/MF A01 CSCL 20/4

A Monostatic Acoustic Vortex Sensing System MAVSS was installed at Chicago's O'Hare International Airport to measure the strength and decay of aircraft wake vortices from landing aircraft. The MAVSS consists of an array of acoustic antennas which measure the vertical profile up to 60 m altitude of the vertical component of the wind. The decay in wake vortex strength is measured as the vortex passes over successive antennas in the array. Volume I describes the MAVSS principles of operation, the hardware developed, and data reduction methods employed. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-27307# Systems Control, Inc., Palo Alto, Calif.
WEST COAST LORAN-C FLIGHT TEST Final Report
Thomas E. Scalise, Erich Bolz, and Edwin D. McConkey Mar. 1980 209 p refs
(Contract DOT-FA75WA-3662)
(AD-A084039; FAA-RD-80-28) Avail: NTIS HC A10/MF A01 CSCL 17/7

A flight test program was flown within the coverage area of the West Coast Loran-C chain during June and July 1979. The purpose of the test was to add to the growing statistical data base that will be used to assess Loran-C as a supplement to, or replacement for, the present VOR/DME navigation system. The test objectives were to: (1) Evaluate the West Coast Loran-C chain by quantifying navigation and position errors within its coverage area; (2) Test Loran-C as a non-precision approach aid in mountainous conditions, using a commercially available Loran-C receiver/navigator, in this case a Teledyne TDL-711; (3) Record the effects of bias shifts and station outages on overall accuracy and approach procedures, especially near a baseline extension; (4) Calculate the absolute flight technical error (FTE) during Loran-C approaches using a typical general aviation aircraft. The main conclusions of the test were: The West Coast Loran-C chain appears stable and dependable. Time difference errors were consistent and related to signal propagation differences over land and over water; TDL-711 was found to be easy to operate, giving stable and repeatable course guidance, although susceptible to random loss of track, a problem which may be software related. The system did not accurately calculate cross track deviation and distance to waypoint. Without needed hardware, software, and/or procedural changes, Loran-C may not meet the RNAV non-precision approach requirements of AC 90-45A. GRA

N80-27308# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ATARS/ATC SIMULATION TESTS WITH SITE ADAPTATION LOGIC IN THE PHILADELPHIA TERMINAL AREA Final Report, May - Oct. 1978
Gary W. Morfitt, Sidney B. Rossiter, James R. Windle, Arthur W. Fillius, and Thomas A. Choyce Mar. 1980 56 p refs
(FAA Proj. 034-242-340)
(AD-A083718; FAA-NA-79-23; FAA-RD-79-116) Avail: NTIS HC A04/MF A01 CSCL 17/7

The purpose of this project was to provide further evaluation and refinement of the Automatic Traffic Advisory and Resolution Service (ATARS) concept. The tests were conducted at the National Aviation Facilities Experimental Center (NAFEC) at Atlantic City, New Jersey, using the Air Traffic Control Simulation Facility (ATCSF). Test results indicated that ATARS had no significant impact on the controllers or control procedures in a Philadelphia Terminal Control Area (TCA) environment. Outside the immediate TCA, where the majority of encounters occurred, the factors contributing to the generation of alarms were, in general, satellite operations and the use of Visual Flight Rules (VFR) separation criteria. The incidence of positive resolution advisories was low, averaging only 0.5 encounters per hour. Recommendations are to reduce the size of the ATARS desensitization zone at the Philadelphia main airport to approximately 2.0 nautical miles (nmi) from runway thresholds, to incorporate a convergence/divergence detection filter into the ATARS algorithm, and to investigate the possibility of reducing tracker lag by improving turn and level off detection. GRA

N80-27309# AMAF Industries, Columbia, Md.
FEASIBILITY OF OFFSET CARRIER SYSTEMS FOR AIR TRAFFIC CONTROL Interim Report
J. David Claiborne Oct. 1979 17 p refs
(Contract DOT-FA78WAI-830)
(AD-A084044; FAA-RD-79-106; IR-2) Avail: NTIS HC A02/MF A01 CSCL 17/7

A brief description of FAA trials of offset carriers systems and multiple outlet systems is given. Short descriptions are also given of existing offset carrier systems in Great Britain and the ARINC system in the United States. The communication deficiencies that could be remedied by an offset carrier system are listed. A short discussion is given concerning the system design deficiencies inherent with an offset carrier system. No conclusions are made concerning the usefulness or practicality of an offset carrier system. GRA

N80-27310# Arinc Research Corp., Annapolis, Md.
AN EVALUATION OF AIRCRAFT SEPARATION ASSURANCE CONCEPTS USING AIRLINE FLIGHT SIMULATORS. VOLUME 1: STUDY REPORT Final Report
Bruce Morgenstern and Thomas P. Berry Nov. 1979 108 p
(Contract DOT-FA78WA-4091)
(AD-A083986; Rept-1343-01-3-2058-Vol-1; FAA-RD-79-124-1) Avail: NTIS HC A06/MF A01 CSCL 01/2

This report documents an evaluation of Aircraft Separation Assurance (ASA) concepts using an airline flight simulator. The primary objective of the experiment was to determine the cockpit information requirements for an aircraft collision avoidance system. Qualified pilots from commercial aviation and industry flew typical operational scenarios in the simulated Los Angeles area. During the flight, conflict situations with other aircraft developed, and pilots were asked to respond to these situations on the basis of

information presented to them by one of three experimental collision avoidance displays. Computer-collected data on pilot response to collision avoidance commands and resultant miss distances were correlated with data from questionnaires filled out by participating pilots to determine the cockpit information requirements. The subjective commments addressed the areas of required display information items, use of color, audible alert, symbols, workload, pilot confidence in the system, and pilot display preference. Altitude, range, relative bearing, and other aircraft heading have been identified as the most important and most essential information elements in the resolution of potential conflicts. The report provides a statistical analysis of the accumulated data and includes recommendations for the development and operational implementation of the ASA program. GRA

N80-27311# Arinc Research Corp., Annapolis, Md.
AN EVALUATION OF AIRCRAFT SEPARATION ASSURANCE CONCEPTS USING AIRLINE FLIGHT SIMULATORS. VOLUME 2: APPENDICES Final Report
Bruce Morgenstern and Thomas P. Berry Nov. 1979 170 p refs
(Contract DOT-FA78WA-4091)
(AD-A083897; Rept-1343-01-3-2058-Vol-2; FAA-RD-79-124-2) Avail: NTIS HC A08/MF A01 CSCL 01/2

This report supplements the main study report of a cockpit evaluation of ASA concepts. It contains a description of the flight scenarios used, a copy of the pilot advance briefing and pre-briefing copies of the flight crew questionnaire and supplemental questionnaire with all comments, data analysis formulas, and test bed description details. GRA

N80-27312# Ohio Univ., Athens. Avionics Engineering Center.
IN-SERVICE IMPROVEMENTS TO RELIABILITY AND MAINTAINABILITY OF THE INSTRUMENT LANDING SYSTEM Final Report, Oct. 1977 - May 1979
May 1979 487 p refs
(Contract DOT-FA78WA-4062)
(AD-A075556; EER-40-1; FAA-R-6750.2; FAA-AAF-420) Avail: NTIS HC A21/MF A01 CSCL 17/7

This report documents results of task efforts undertaken by Ohio University between October 1977 and May 1979. Engineering data resulting from a study of the sideband reference, glide-slope system baseline operating parameters and the effects of specific faults are presented. A series of perturbational studies conducted at commissioned sideband reference facilities and numerous field experiments at Ohio University's Tamiami, Florida site facility are described. Suggested technical improvements and text changes for existing technical manuals have also resulted. The effects of a wide range of terrain profiles on the performance of sideband reference, null reference, and capture effect systems are compiled in album form. Sideband reference system setup procedures are reviewed, the electrical and physical requirements for the counterpoise are explored, and an introductory look at threshold-plane DDM profiles is presented. ILS anomaly investigations have resulted in the design, testing, and implementation of a modification to the Type FA-5723 clearance transmitter. Also, predictions of complete glide-slope performance for a proposed site on Runway 22L at Boston Logan are presented. The maximum allowable VSWR for the 15-element V-Ring and the O-Ring localizers are investigated based on theoretical and experimental work. The findings are that the maximum VSWR is not that of a simple specification but rather that of values that are within the bounds of worst and best-case conditions depending on the value of the complex reflection coefficient. GRA

N80-27313# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
POTENTIAL USE OF HIGH FREQUENCY DATA TRANSMISSION FOR OCEANIC AIR TRAFFIC CONTROL IMPROVEMENT Final Report, Aug. 1978 - Jul. 1979
Martin Nesenbergs Sep. 1979 48 p refs
(Contract DOT-FA-RA-78-15)
(AD-A075810; FAA-AM-TSC-79-9) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report is concerned with the transatlantic Air Traffic Control (ATC) data links in the high frequency (HF) band. The report tries to broaden the appropriate communication system concepts by fortifying them with general parametric objectives. While such a broad approach cannot escape practical constraints and reductions, especially in eventual design and implementation stages, it is nevertheless a useful tool here. It leads one to characterize the HF propagation medium more fully. This in turn enables one to conceive data communications outlines with more advanced structures and with emphasis on exploiting the latest technology, both hardware and software. A full study should be beyond this initial effort and incorporate several system alternatives, plus their tradeoffs in terms of objective gains versus system costs. This brief report concludes with a parametric summary of ATC HF channel issues, operational factors, and the importance of performance specification. Pertinent unresolved issues are also listed at the end. GRA

N80-27314# Transportation Systems Center, Cambridge, Mass.
ANALYSIS OF EXPANDABILITY AND MODIFIABILITY OF COMPUTER CONFIGURATION CONCEPTS FOR ATC. VOLUME 1: DISTRIBUTED CONCEPT Final Report
David F. Clapp, Joseph B. Hagopian, and Ronald M. Rutledge Nov. 1979 195 p refs
(AD-A084045; TSC-FAA-79-31; FAA-EM-79-22-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 17/7

The questions of expandability and modifiability of a 1990-era Air Traffic Control (ATC) system are addressed. Two strawman systems are described at the functional level: a Baseline System, which represents the ATC system as it might be just after the replacement of the current National Airspace System (NAS) en route computers, and a Future System, which represents what might be derived ten years later under an appropriate scenario for ATC development. A distributed processing computer configuration is postulated for the Baseline System, and processing and communications loads are calculated on the basis of traffic and parameter estimates for 1985. Expansion and modification of the Baseline System to produce the Future System designed to meet estimated 1995 loads under the supplied scenario are examined. The distributed processing concept, as considered here, was deemed generally suitable for use in the ATC system of the future. GRA

N80-27315# Transportation Systems Center, Cambridge, Mass.
AN INVESTIGATION OF LASER LIGHTING SYSTEMS TO ASSIST AIRCRAFT LANDING Final Report, Oct. 1978 - Sep. 1978
D. C. Burnham and J. F. Fantasia Oct. 1979 64 p refs
(AD-A077722; TSC-FAA-79-22; FAA-RD-79-97) Avail: NTIS HC A04/MF A01 CSCL 17/7

A model for the visual detectability of narrow light beams was developed and used to evaluate the system performance of two laser lighting system configurations: (1) a laser VASI and (2) a crossed beam glide path indicator. Laboratory experiments confirmed the validity of the model. Using a criterion taken from the Federal Standard for laser safety, the potential hazards of each of the system concepts were evaluated. The following results were obtained for readily available laser power levels: neither system will work during bright daylight, the laser VASI can be seen at night at the middle marker for visual ranges greater than 5000 ft, the crossed beam system can be seen at night at the middle marker for visual ranges greater than 700 ft. GRA

N80-27316# Transportation Systems Center, Cambridge, Mass.
TESTS OF AN ATCRBS BASED TRILATERATION SENSOR AT LOGAN INTERNATIONAL AIRPORT Final Report, Oct. 1977 - Sep. 1978
P. E. Manning Nov. 1979 65 p
(AD-A078979; TSC-FAA-79-12; FAA-RD-79-115) Avail: NTIS HC A04/MF A01 CSCL 17/7

Field test results of accuracy and coverage for an ATCRBS based surface trilateration sensor at Logan International Airport are described. This sensor was previously tested at NAFEC for feasibility and because of a lack of sufficient aircraft traffic and multipath, further tests were recommended at an operational airport. These tests show that a beacon trilateration sensor can accurately determine the position of a transponder equipped vehicle on the surface, extract its beacon code and provide

excellent coverage without interference with the operational ATCRBS. GRA

N80-27317# Royal Signals and Radar Establishment, Malvern (England).
PRECISION NAVIGATION FOR AIR TRAFFIC MANAGEMENT
S. Radcliffe Oct. 1979 9 p refs Presented at the AGARD GCP Symp., Copenhagen, 29 Oct. 1979
(AD-A083947; RSRE-Memo-3220; DRIC-BR72506) Avail: NTIS HC A02/MF A01 CSCL 17/7

This report discusses the problems that would arise if airspace users had the use of NAVSTAR or some other much better position fixing aid than at present, and the uses that ATC could, or could not, make of this capability. There would be formidable transitional problems in the vertical plane, because NAVSTAR measures height from the Earth's center whereas current altimeters measure atmosphere pressure. In either vertical or horizontal planes much work will be necessary to prove that the separation standards can be reduced at all. The paper discusses changes that might be possible in the ATC system should appreciable reductions in separation standards prove possible. NAVSTAR might form the basis of a collision avoidance system based on either the broadcast coordinates of each aircraft or on a time-frequency basis using NAVSTAR as the time reference. The latter scheme would offer protection of a fully equipped aircraft against a threat that could not afford the expense of a NAVSTAR fit. This paper is a contribution to the 29th AGARD GCP Symposium, Copenhagen, Oct 1979. It is issued as a memo to make it available earlier and in an unclassified document. GRA

N80-27318# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Common Avionics Div.
CHARACTERISTIC FOR A MODERATE ACCURACY INERTIAL NAVIGATION SYSTEM (INS)
24 Aug. 1979 360 p Supersedes ASD/ENAC-77-1-Rev-1-Amend-1-3
(AD-A084038; ASD/ENAC-77-1-Rev-2-Amend-1-3; ASD/ENAC-77-1-Rev-1-Amend-1-3) Avail: NTIS HC A16/MF A01 CSCL 17/7

This specification establishes the requirements in terms of form, fit and function (including performance) for an inertial navigation system applicable to a broad spectrum of vehicles. It is the intent of this specification to define the INS requirements to a sufficient extent to allow multiple contractor designed and produced hardware to be used interchangeably at the LRU level in any given vehicle. GRA

N80-27319# Transportation Systems Center, Cambridge, Mass.
ENHANCED TERMINAL INFORMATION SERVICES (ETIS) UTILIZING THE DISCRETE ADDRESS BEACON SYSTEM (DABS) DATA LINK-CONCEPT DESCRIPTION Final Report, Sep. 1978 - Apr. 1979
Robert W. Wisleder Jul. 1979 90 p refs
(AD-A073205; TSC-FAA-79-11; FAA-RD-79-73) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report describes a concept for providing enhanced terminal information services (ETIS) to aircraft utilizing the ground-air-ground data link capability of the Discrete Address Beacon System (DABS). ETIS is envisioned as an eventual replacement for, and significant improvement to the Automated Terminal Information Services (ATIS) in use today. The initial step in developing the concept is the establishment of requirements for an ETIS system. This is followed by a determination of the information and data to be provided to the aircraft over the data link, and the probable sources of that data. An assumption is made that the availability of automated weather sensor systems of some form will coincide with implementation of ETIS. A detailed functional description of the system is then given, including system configuration, interfaces with other ATC automation systems, and hardware and software both at the airport and at the controlling ATC facility. Also discussed are message content and formats, controller and pilot display design considerations, criteria for dispatch of ETIS messages, and a number of operational considerations. The report concludes with several typical flight scenarios representative of different levels of aircraft, avionics, and pilot capabilities in an air traffic control environment where ETIS is implemented. GRA

N80-27320# Facility Checking Squadron (1866th) (AFCS), Scott AFB, Ill.
SSILS INITIAL EVALUATION REPORT. DAVIS-MONTHAN AFB, ARIZONA, 16-20 NOVEMBER 1979 Final Report
Joseph P. Coyle 11 Apr. 1980 109 p
(AD-A084635; Rept-79/66N-195) Avail: NTIS HC A06/MF A01 CSCL 01/4

This report presents the results of the 16 - 20 November 1979 TRACALS Evaluation of the Davis-Monthan AFB AN/GRN-29(V), SSILS and associated power systems. The evaluation was conducted in conjunction with the system commissioning to determine the capabilities and limitations of the system in its installed environment. Results presented in this report can be used as a guide to anticipated performance until there is a significant change in ground equipment, siting environment, screening, or operational use. GRA

N80-27321# General Electric Co., Santa Barbara, Calif.
LORAN-C SIGNAL ANALYSIS Final Report, Aug. 1977 - Dec. 1979
Larry W. Nelson and Burt Gambrill Dec. 1979 105 p refs (Contract DOT-CG-64810-A)
(AD-A084239; GE79TMP-78; USCG-D-4-80) Avail: NTIS HC A06/MF A01 CSCL 17/7

This report summarizes the results of experimental efforts and theoretical analysis conducted on the Loran-C Signal Analysis project. Experiments to test the stability of the U.S. West Coast Chain, to provide a data base for assessing the predictability of Loran-C signal phase, and to provide data for calibrating San Francisco Harbor are described. Estimates of system error budgets and evaluation of the performance of Loran-C in various operational modes are also described. GRA

N80-27322# National Technical Information Service, Springfield, Va.
DISCRETE ADDRESS BEACON SYSTEM. CITATIONS FROM THE NTIS DATA BASE
William E. Reed Apr. 1980 161 p Supersedes NTIS/PS-79/0244; NTIS/PS-78/0064
(PB80-807522; NTIS/PS-79/0244; NTIS/PS-78/0064) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

The development of the Discrete Address Beacon System is treated in these Federally-sponsored research reports. Topics include the data link, message formats, antenna systems, signal propagation, transponders, and interface with the Air Traffic Control Radar Beacon System. This updated bibliography contains 154 abstracts, 14 of which are new entries to the previous edition. GRA

N80-27323# National Bureau of Standards, Washington, D.C. Center for Applied Mathematics.
PROBABILITIES OF VERTICAL OVERLAP: A SENSITIVITY ANALYSIS
Howard K. Hung, Judith F. Gilsinn, and Karla F. Hoffman Mar. 1980 72 p refs Sponsored in part by FAA, Washington, DC.
(PB80-161151; NBSIR-80-1990) Avail: NTIS HC A04/MF A01 CSCL 01C

Because of the potential increase in traffic at FL 290 and above, both current and alternative vertical separation standards are being reviewed. A sensitivity analysis carried out to assess how different assumptions about the probability distribution of 'total vertical error' affect the probability of vertical overlap is documented. The four factors affecting the probability of vertical overlap which are examined are: the functional form of the vertical-error distribution function; the standard deviation of this probability distribution; the vertical dimensions of the aircraft; and the vertical separation standard. Probabilities of vertical over-lap were computed over a range of possibilities for each of these four factors in order to discern the effect of each factor. GRA

N80-27324# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AIR TRAFFIC MANAGEMENT: CIVIL/MILITARY SYSTEM AND TECHNOLOGIES
Feb. 1980 300 p refs Presented at the Guidance and Control Panel Symp., Copenhagen, 9-12 Oct. 1979
(AGARD-CP-273; ISBN-92-835-1347-9) Avail: NTIS

HC A13/MF A01

Various aspects of air traffic on control in civil and military systems and technologies are presented. The specific areas discussed are: (1) operational scene and requirements; (2) civil/military cooperation; (3) aspects of air traffic management philosophy (criteria and human factors; communications and separation); (4) air traffic management in hostile environment; (5) flight management in terminal area; (6) subsystem technology; and (7) advanced systems. For individual titles, see N80-27325 through N80-27347.

N80-27325# Board of Trade, London (England).
AIR TRAFFIC IN NATO EUROPE: ITS CHARACTERISTICS AND ITS NEEDS
I. M. Pedder *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 3 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The needs and characteristics of air traffic in NATO Europe are reviewed. The divergent requirements and particular problems of airspace users are described and it is concluded that efficient use of the airspace can only be achieved through cooperation between the civil and military authorities. Areas where research and development would be fruitful are listed. Author

N80-27326# Army Avionics Research and Development Activity, Fort Monmouth, N. J. Air Traffic Management Systems Div.
HELICOPTER AIR TRAFFIC MANAGEMENT SYSTEMS WITH CIVIL/MILITARY INTEROPERABILITY
Joseph T. Saganowich *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 16 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

In order to achieve significant near-term improvement in the Army's air traffic management capability, several configurations of 'very lightweight air traffic management equipment' (VLATME) were developed. Based upon totally compatible use of today's common civil/military system ATCRBS (air traffic control radar beacon system). Concurrently with the VLATME development, helicopter instrument landing technology work over the past few years has revealed that the key to solving this problem lies in the ability to perform deceleration of the aircraft on instruments, along the approach path, so as to bring the aircraft to a hover a few feet above the intended landing point. The decelerated instrument approach means that helicopter spacings will have to be much smaller than those encountered in fixed wing practice if reasonable flow rates are to be realized. Because of the potential garbling problem in conventional ATCRBS with closely spaced aircraft, a system which integrates the ground and airborne equipments of a scanning beam microwave landing system with the airborne transponder while preserving interoperability was also developed and successfully tested. R.E.S.

N80-27327# Selenia S.p.A., Rome (Italy).
A STUDY FOR DEVELOPMENT OF METHODS FOR AIR TRAFFIC MANAGEMENT
R. Petrioli, S. Pardini, G. Bertoni (Bologna Univ.), and C. Bonivento (Bologna Univ.) *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 14 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

Models and methods for optimal air traffic management were studied as part of the multi-year project 'Navigation aids and air traffic control' funded by the Italian National Research Council (CNR). The scope of the study on the context of CNR project is reviewed. The software structure, its main characteristics and possible utilizations in the planning and management of air traffic system is discussed. Finally, a description is given of more relevant used models and algorithms. R.E.S.

N80-27328# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Human Engineering Dept.
SYSTEM, AIRSPACE, AND CAPACITY REQUIREMENTS FOR FUTURE ATC-SYSTEMS
Ruediger Seifert and Guenther Och *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 15 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

Based on control capacity measurements of various air traffic control (ATC) systems, a theory of control capacity was developed. The theory of control capacity allows comprehensive knowledge to be gained concerning the relationship and interdependence of the following: (1) The airspace configuration (including the present separation requirements), the traffic structure and the resulting conflict probability. (2) The airspace capacity, the control capacity of the ATC control positions (functional units) and their dependence on air traffic structure and the technical ATC system features and capabilities. Using the theory of control capacity, systems of different technical structure were then assessed. Outdated, present day's, and future ATC systems are compared, showing the effect certain technical components and/or system functions have on system capacity. R.E.S.

N80-27329# Civil Aeromedical Inst., Oklahoma City, Okla. Aviation Psychology Lab.
AIR TRAFFIC CONTROL AUTOMATION: ITS IMPACT AND USE IN THE SELECTION AND SCREENING OF AIR TRAFFIC CONTROLLERS
James O. Boone *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 7 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The impact of automation in air traffic control on personnel screening is discussed. The mathematical and technical aspects as they are currently being developed are focused upon. R.E.S.

N80-27330# Eurocontrol Agency, Brussels (Belgium).
DATA LINK: THE KEY TO IMPROVEMENTS IN CIVIL/MILITARY AIR TRAFFIC MANAGEMENT?
M. E. Cox *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 20 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

Experimental work which is being undertaken both to explore how an air/ground data link might be exploited for future air traffic control purposes and to determine its possible capacity requirements is described. Details of the form and functions of experimental equipment built to investigate what is believed to be the major problem area influencing communications improvements, the pilot/link interface, are given. Details are also given of studies investigating the possible use of the link in transferring aircraft, derived data both to yield improvements in the precision of meteorological forecast data and to enhance the performance of radar-based tracking and conflict-alerting systems. Capacity requirements and the feasibility of realizing a link for these purposes within the next two decades are discussed. R.E.S.

N80-27331# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
MIDAIR CONFLICTS AND THEIR POTENTIAL AVOIDANCE BY PROGRESSIVE IMPLEMENTATION OF AUTOMATION
O. Weber *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 16 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

Actual midair conflicts between civil and military aircraft in German airspace where at least one of the airplanes involved was flying under visual flight rules were analyzed. Operational, environmental and human factors, which contributed to the accidents, and the limits of the 'see and avoid' concept for collision avoidance are discussed. Some shortcomings of the present air traffic control system are mentioned. Taking the actual midair conflicts and some simulated three dimensional flights as examples, the improvement of collision avoidance by progressive implementation of advanced techniques is discussed. The lead time to the potential conflict or to a circular zone of protection, the distance at the closest approach and some other thresholds, estimated by means of a ground-based radar system or an airborne electronic collision avoidance system, are used as main criteria for an automatic conflict alert. Potential advantages of a data link to detect sudden manoeuvres in time are mentioned. R.E.S.

N80-27332# National Aerospace Lab., Amsterdam (Netherlands).
DETERMINATION OF THE SAFETY IN A NORTH ATLANTIC ORGANIZED TRACK SYSTEM WITH REDUCED LATERAL SEPARATION
G. Moek and C. R. Traas *In* AGARD Air Traffic Management:

Civil/Mil. Systems and Technol. Feb. 1980 7 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

Collision risk modelling as related to the reduction of lateral separation from 120 NM to 60 NM at any fixed level in the North Atlantic Organized Track System is considered. Requirements on the navigation performance are described which aircraft must be able to meet if this reduction would be implemented. Two statistical tests are derived which can be applied to the measured number of navigation errors to determine whether the actual navigation performance is such that the system with 60 NM lateral separation meets a target level of safety. The first test which belongs to the standard equipment of the NAT/SPG for judging the safety of the track system is based on one random model for all navigation errors. The second test is applicable for the case different types of navigation errors can be distinguished and modelled separately. The different contribution of each type of error to the total risk is taken into account by the use of weighting factors. This test, however, is still in discussion in the North Atlantic Systems Planning Group. A.R.H.

N80-27333# Army Air Traffic Control Office, APO New York, N.Y. 09056.
US ARMY USERS OUTLOOK ON AIR TRAFFIC MANAGEMENT
William H. Maloney and Larry P. Kreps *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 5 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The need for air traffic control, not only in support of its fixed base peace-time mission, but also its tactical mission is recognized by the U.S. Army. Air traffic management as it existed during the Vietnam era of the 1960's and as it evolved during the 1970's is described. The European scenario literally dictates doctrine for hostile operations in a mid-intensity environment. What is happening and planned from an ATC viewpoint in support of U.S. Army/Europe (USAREUR) is discussed including the future potential of a global positioning system. A.R.H.

N80-27334# Army Avionics Research and Development Activity, Fort Monmouth, N. J. Advanced Avionics Systems Div.
THE DEVELOPMENT AND TEST OF A TACTICAL SELF-CONTAINED LANDING SYSTEM
Norman K. Shupe *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 25 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The existence of a digital symbol generator (DSG) whose basic function is to compute and display the augmenting symbolic data necessary to operate a helicopter in the NOE environment via a FLIR presentation of the contact world, and a digitally-generated topographic map display (DMG) is sufficient justification to consider adaptation of the DSG and DMG equipments to the reversionary function of providing IMC terrain-following and tactical landing capabilities. The control/display architecture necessary to use a radar altimeter to control the elevation flight path of the aircraft and a Doppler radar to control the deceleration of the aircraft is presented. The assumed precision navigation system provides the Northing/Easting aircraft position: (1) to permit the aircraft to be steered along the prescribed ground track to the landing zone; (2) to provide a starting point for interrogation of the DMG terrain elevation data for purposes of generating anticipation for the TF system; and (3) to act in concert with the velocity output of the Doppler radar for purposes of following a preprogrammed deceleration profile to the landing zone. A multi-phase simulation and flight-test program to assess the performance of the complete system in the NOE environment are described. A.R.H.

N80-27335# Bendix Corp., Detroit, Mich. Communications Div.
VERY LIGHTWEIGHT AIR TRAFFIC MANAGEMENT SYSTEM USING AN ELECTRONIC SCAN ANTENNA
P. J. Woodall and J. L. Shagena, Jr. *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 12 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

An electronically scanned antenna with all solid-state interrogator, complemented by a multi-microprocessor driver tactical interactive display, provides a full alphanumeric PPI air traffic management system. This system utilizes the standard Mark X/XII ACTRBS/IFF airborne transponder to provide position information on all targets (up to 100) and tracked range, azimuth, and altitude (via mode C) on up to 13 targets. The two key features of this system are the electronically steered matrix-fed cylindrical array and the microprocessor based intelligent controller. The controller performs search and active track, minimizing interrogator PRF (64-198.5/Sec) and electromagnetic interference. The antenna and R/T are physically integrated into a single assembly to minimize set-up time and maximize reliability. A.R.H.

N80-27336# Elektronik-System G.m.b.H., Munich (West Germany).
TECHNICAL AND OPERATIONAL FACTORS CONCERNING THE LICENSING AND INTRODUCTION OF A NEW MICROWAVE LANDING SYSTEM FOR CATEGORY 2
K. G. Brammer and K. D. Kricke *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 12 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

For the new aircraft Tornado and Alpha-Jet, the landing system SETAC is now being prepared for category 2 service at the assigned air bases in Germany. As soon as this system's technical capabilities are to be exploited to the full extent for operational use, all relevant rules and regulations applicable for ILS category 2 operations must be exhaustively expanded and supplemented. This concerns concepts for infrastructural measures, such as extension of obstacle clearance limits to the whole area of coverage, calibration and testing of the total radio field, modifications of the approach light pattern, additional training and licensing of ATC staff and pilots etc. In order to reduce this extensive task to a short-term solution, a stagewise procedure of system introduction is outlined. The concept is to utilize SETAC equipment with all the corresponding advantages regarding installation, but to retain in the first stage as closely as possible all regulations, flight procedures and instrumentation pertaining to ILS approach and landing. A.R.H.

N80-27337# Systems Control, Inc., West Palm Beach, Fla.
THE INTEGRATION OF AREA NAVIGATION AND THE MICROWAVE LANDING SYSTEM
Donald W. Richardson and Paula M. Rich (FAA, Washington, D.C.) *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 17 p Sponsored by FAA (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The RNAV and MILS are non-competitive complementary navigation/landing systems that, working together, can markedly enhance the safety and efficiency of terminal area operation while at the same time impacting the overall concept of terminal airspace management. Primarily, these systems afford the opportunity, which has been debated so vigorously for many years, of converting to a distributed management philosophy of ATC system design and operation in which much of the navigation function is transferred from the radar vectors issued by the ground controller to the flight crew, aided by increasingly available, low cost, multifunction avionics systems. Some activities on the part of the United States Federal Aviation Administration to develop and integrate these complementary capabilities into the terminal area airspace system are examined. A.R.H.

N80-27338# Thomson-CSF, Arcueil (France).
SINTAC-C TMA: APPLICATION OF SINTAC-C IN THE TERMINAL AREA, DURING LANDING AND GROUND TAXIING
Lj. Milosevic and J. Hetyei *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 20 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

An integrated navigation, traffic control, collision avoidance and communication system is described which can control between 200 and 1000 aircraft according to the number of runways (or airports) included in terminal area. During final approach and landing, the system controls 16 aircraft, the maximum which can be considered in the MLS beam, with a

30 second landing rate. According to the required control capacity, the system uses one, two or three time-shared nets for all the functions and for all the in flight and ground phases. The navigation transmission rates are very high (32-16 Hz) thus ensuring a practically continuous navigation function. The surveillance and synchronization frequency depend on the area: a maximum of 4 seconds in the terminal area and a 1 second maximum at landing time. Three types of SINTAC ground stations are considered: (1) SINTAC-TMA: 100-150 km range covering the TMA area with three or four stations; (2) SINTAC-landing: located at the far-end of the runway (precision DME), range and antenna beam aperture same as MLS; and (3) SINTAC-ground taxiing: airport area coverage by three stations: station range: 5 to 10 km. A.R.H.

N80-27339# Singer-Kearfott, Wayne, N. J.
EVOLUTION AND TRANSITION OF TODAY'S MILITARY LANDING SYSTEM TO COMPATIBILITY WITH PRESENT AND FUTURE CIVIL MILITARY SYSTEMS
Albert J. Shapiro *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 13 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The operational need for a single avionics system to operate with the present instrument landing system, the future ICAO approved microwave landing system and the Marine remote area approach landing system (MRAALS), is discussed. The operational solution developed in response to a U.S. Navy/Marine requirement is a multimode receiver that is capable of operating with any of the systems mentioned above. The evolutionary process involved in progressing from a single to a multiple mode system capability is reviewed with emphasis on the technological advances leading to a most cost and volume effective solution. Author

N80-27340# Hollandse Signaalapparaten N. V., Hengelo (Netherlands).
INTRODUCTION ON LORADS AND ASDE
Erik Chr. Priebee *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 18 p (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

A long range radar and display system (LORADS) and airport surface detection equipment (ASDE) are described. A panoramic view of both systems, its functional and operational requirements, and the system architecture of both the hardware and software are given. M.G.

N80-27341# Ferranti Ltd., Bracknell (England). Computer Systems.
APPLICATIONS OF MICROPROCESSORS IN AIR TRAFFIC c64
David L. Stoddart *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 10 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The use of microprocessors in air traffic control (ATC) systems is examined. The characteristics of microprocessors are compared with those of mini and main frame computers to identify the most suitable role of the microprocessor in ATC Systems. The application of microprocessors for system functions such as Data Link Management, Display Console Management and Format Converters is discussed. To emphasize the impact of microprocessors on system design a conventional display system is compared with one using microprocessors where this device is built into the overall design of the display system with consequent saving in display generation hardware. The design is extended so that the display microprocessor becomes the central element in display console management. The F100L microprocessor is described in some detail and used as model to define the capability of a microprocessor. M.G.

N80-27342# Royal Signals and Radar Establishment, Malvern (England). Ground Radar and ATC Dept.
PRECISION NAVIGATION FOR AIR TRAFFIC MANAGEMENT
S. Ratcliffe *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 5 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The problems that would arise if airspace users had the use of NAVSTAR or some other much better position-fixing aid than at present, and the uses that air traffic control (ATC) could or could not make of this capability are examined. There would be formidable transitional problems in the vertical plane, because NAVSTAR measures height from the Earth's center whereas current altimeters measure atmosphere pressure. In either vertical or horizontal planes much work would be necessary to prove that the separation standards can be reduced at all. The changes that might be possible in the ATC system should appreciable reductions in separation standards prove possible are discussed. NAVSTAR might form the basis of a collision avoidance system based on either the broadcast coordinates of each aircraft or on a time frequency basis using NAVSTAR as the time reference. The latter scheme would offer protection of a fully equipped aircraft against threat that could not afford the expense of a NAVSTAR fit. M.G.

N80-27343# Mitre Corp., Bedford, Mass.
JTIDS: AN INTEGRATED COMMUNICATIONS NAVIGATION AND IDENTIFICATION SYSTEM, AND ITS POTENTIAL FOR AIR TRAFFIC MANAGEMENT
Donald D. Neuman *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 13 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The integrated data communications, voice communications, navigation, and identification features of the Joint Tactical Information Distribution System (JTIDS) are described with emphasis on those features applicable to air traffic management. The JTIDS system architecture simultaneously provides data at the ground centers and in the cockpit. Airspace control and advisory data are made available to all aircraft to permit subscribers to be aware of, and comment upon, directions provided to others. Network control techniques are discussed which support civil air traffic management applications. These techniques provide for the apportionment of capacity among subscribers in such a manner as to allow all subscribers access to all data in their area of interest without real time network management. The potential exists for a substantial reduction in the avionics boxes aboard aircraft. A JTIDS like system can simultaneously provide the data for airspace management and control, collision avoidance, area navigation, air-to-air coordination, cooperative surveillance, cockpit situation display, airport surface traffic control, and possibly instrument landing. The transition from the existing air traffic management system to a JTIDS like system is also addressed. Austere terminal designs appear to be possible at a cost that is affordable for general aviation. M.G.

N80-27344# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
DISCRETE ADDRESS BEACON SYSTEM
P. D. Hogkins *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 10 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

A discrete address beacon system (DABS) to provide upgraded air traffic control radar beacon system (ATCRBS) surveillance is discussed. The DABS concept provide improved air traffic control automation service and ground based automatic traffic advisory and resolution service through its integral high capacity digital air ground data link. The compatibility of DABS with ATCRBS, interrogation concepts, and the computer processing subsystem are specifically discussed and current testing and evaluations of the system are reviewed. M.G.

N80-27345# Royal Signals and Radar Establishment, Malvern (England).
ADSEL: SELECTIVE ADDRESS SSR, PERFORMANCE OF THE EVALUATION STATION
R. C. Bowes, T. B. Nichols, and J. M. Bonny *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 8 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

A selectively addressed radar system (ADSEL) designed to overcome the 'garble' problem of the current secondary surveillance radar (SSR) system and provide a data link facility is

discussed. The system requires aircraft to carry a transponder which includes the selective address mode of operation and a ground station with monopulse direction finding system plus data processing facilities. In particular the evaluation trials that have been carried out are reviewed and the results of a large number of aircraft flights are given. The main aim of the trials is to assess the accuracy with which the position of an aircraft can be measured, the performance of the communication links, and to optimise the operating rules. A detailed analysis is given of the performance of the SSR and ADSEL system when monitoring two aircraft flying close together such that their transponder replies were 'garbling'. M.G.

N80-27346# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SURVEILLANCE PERFORMANCE MEASUREMENTS OF THE SSR MODE OF THE DISCRETE ADDRESS BEACON SYSTEM
Vincent A. Orlando and Paul R. Drouilhet. *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 11 p refs Sponsored by FAA (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

The field measurements, taken to evaluate the surveillance performance of the Discrete Address Beacon System (DABS), are described. Simultaneous measurements made by transportable measurements facilities and the existing ground stations provided the opportunity for a side-by-side comparison of DABS off-boresite monopulse and conventional surveillance measurement performance. The results indicate that both range and azimuth accuracies of the DABS design are four times better than those provided by current terminal secondary surveillance radar (SSR) equipment. Blip/scan ratio for monopulse SSR is 98% or better, and remains high in crossing track situations where the performance of existing equipment is observed to degrade. Significantly, this improvement in SSR performance was accomplished with 1/4 the pulse repetition frequency of the present equipments. M.G.

N80-27347*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTIVENESS OF ADVANCED FUEL-CONSERVATIVE PROCEDURES IN THE TRANSITIONAL ATC ENVIRONMENT
L. Tobias and Paul J. Obrien (National Aviation Facilities Experimental Center, Atlantic City, N.J.) *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 14 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01 CSCL 17G

The real time simulation (involving both the pilot and the air traffic controller) of fuel conservative approaches, profile descents, and four dimensional area navigation to assess the effectiveness of the procedures is discussed. Generally, results indicate some difficulties with the procedures tested in a mixed traffic environment and point to the need for computer assistance for effective implementation of candidate procedures. M.G.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-27348 Washington Univ., Seattle.
EFFECT OF SOME STRUCTURAL PARAMETERS ON ELASTIC ROTOR LOADS BY AN ITERATIVE HARMONIC BALANCE Ph.D. Thesis
Abraham Eipe 1979 122 p
Avail: Univ. Microfilms Order No. 8012195

The coupled flap-lag equations of motion for an elastic helicopter blade in forward flight are derived including several structural coupling parameters. These nonlinear equations of motion are solved by an iterative harmonic balance method. Depending on the nature of the rotor load trim, the equations for the steady thrust and roll and pitch moments are also solved simultaneously with the flap equation of motion to obtain the unknown control settings. Once the generalized coordinates and the control settings are known the rotor load harmonics are computed by Fourier analysis. Effects of various structural coupling parameters on rotor loads are studied for three typical rotors: a stiff in-plane hingeless tail rotor, a soft in-plane hingeless main rotor, and an articulated main rotor. The results show excellent convergence of the iterative solution scheme. Dissert. Abstr.

N80-27349 California Univ., Los Angeles.
MULTILEVEL OPTIMUM DESIGN OF WING BOX STRUCTURES WITH FIBER COMPOSITE PANEL COMPONENTS Ph.D. Thesis
Massood Mehrinfar 1980 180 p
Avail: Univ. Microfilms Order No. 8016018

A multilevel approach is used which considers the overall sizing of the structure using equivalent thickness type design variables as a system level task while detailed design is carried out at the component level for each individual panel. The total structural weight is taken as the system level objective function while the change in equivalent system stiffness is taken to be the objective function for each of the uncoupled component level problems. The key idea is to select the component level objective function so as to minimize change in component loads due to subsequent force redistribution, accomplished by taking the change in stiffness as the component level objective function to be minimized. Finite element analysis is used at the system level to compute the internal forces. Each fiber composite panel is modelled by stacking layers of orthotropic assumed stress rectangular elements representing equivalent thicknesses. Approximation concepts such as linking, constraint deletion, and explicit approximations of retained constraints are employed. A quadratic extended interior penalty function formulation is used as the optimization tool at both the system and component design modification levels. Dissert. Abstr.

N80-27350*# Hydraulic Research Textron, Valencia, Calif.
FLIGHTWORTHY ACTIVE CONTROL LANDING GEAR FOR A SUPERSONIC AIRCRAFT Final Report
Irving Ross Washington NASA Jun. 1980 141 p ref
(Contract NAS1-15455)
(NASA-CR-3298) Avail: NTIS HC A07/MF A01 CSCL 01C

A flightworthy active control landing gear system for a supersonic aircraft was designed to minimize aircraft loads during takeoff, impact, rollout, and taxi. The design consists of hydromechanical modifications to the existing gear and the development of a fail-safe electronic controller. Analytical results indicate that for an aircraft sink rate of 0.914 m/sec (3 ft/sec) the system achieves a peak load reduction of 36% during landing impact. L.F.M.

N80-27351*# National Aeronautics and Space Administration, Washington, D. C.
MEASURES FOR IMPROVING THE ZEPPELIN AIRSHIPS FOR LONG DISTANCE TRANSPORTATION
Ludwig Ferdinand Duerr Apr. 1980 19 p Transl. into ENGLISH of "Gedenken an die Hundertste Wiederkehr des Geburtstages des Grafen Zeppelin", Deutschen Akademie der Luftfahrtforschung, West Germany, 17 Jun. 1938 p 15-30 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76142) Avail: NTIS HC A02/MF A01 CSCL 01C

Factors to be considered in the construction of dirigibles include the design and weight of support structures, static and aerodynamic loads on the main ring, the annealing of support materials, and the dynamic gas pressure. Adaptations made for using helium as the lifting gas, and a method for extracting ballast are described. A.R.H.

N80-27352# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MUZZLE BLAST OVERPRESSURE LEVELS ON THE AH-1S HELICOPTER TOW SIGHT UNIT Final Report
Edward M. Schmidt and Edmund J. Gion Mar. 1980 32 p Supersedes ARBRL-IMR-620
(DA Proj. 1L1-61102-AH-43)
(AD-A084027; AD-E430410; ARBRL-MR-02997;

ARBRL-IMR-620) Avail: NTIS HC A03/MF A01 CSCL 19/1

An experimental program was conducted to measure the muzzle blast overpressures upon a simulated AH-1S Helicopter TOW Sight Unit (TSU). Different weapon configurations were fired to examine the effect of gun caliber and the presence of muzzle devices. Surface pressure distributions were measured along the line of symmetry of the TSU and were supplemented by spark shadowgraphs of the blast wave propagation. Limited data was acquired in the BRL Aerodynamics Range to measure the trajectory perturbation association with the internal gas dynamics of the muzzle devices. GRA

N80-27353# McDonnell Aircraft Co., St. Louis, Mo.

THE F-4 SERVICE LIFE TRACKING PROGRAM CRACK GROWTH GAGES Final Report, Feb. 1978 - Sep. 1979

C. R. Saff Wright-Patterson AFB, Ohio AFFDL Dec. 1979 138 p refs

(Contract F42600-78-D-0014; AF Proj. 2401)

(AD-A083978; AFFDL-TR-79-3148) Avail: NTIS HC A07/MF A01 CSCL 01/3

The objective of this program was to evaluate the ability of a crack growth gage to monitor potential crack growth damage in fatigue critical locations of F-4C/D aircraft structure. Crack growth gages were designed for use on the lower wing skin of F-4 aircraft. An element test program was performed to verify gage design and provide data for predicting gage behavior when attached to the fatigue test article. Results of those tests prompted performance of a supplemental test program to investigate effects of sheet thickness on crack growth retardation. Results from both of these test programs were used to develop procedures to predict crack growth in gages attached to the fatigue test article. Eight gages were bonded to the test article using room temperature cure adhesive after an elevated cure temperature adhesive failed. Results show gage crack growth is predictable. Analysis results demonstrate the monitoring potential of the gage. GRA

N80-27354# Boeing Vertol Co., Philadelphia, Pa.

STUDY OF COST/BENEFIT TRADEOFFS AVAILABLE IN HELICOPTER NOISE TECHNOLOGY APPLICATIONS Final Report

R. H. Spencer and H. Sternfeld, Jr. Jan. 1980 34 p refs

(Contract DOT-FA78WA-4161)

(AD-A083955; FAA/EE-80-5) Avail: NTIS HC A03/MF A01 CSCL 01/3

This study investigated cost/benefit tradeoffs using the case histories of four helicopters for which design and development were complete, and in three cases, have undergone substantial flight testing. The approach to quieting each helicopter was an incremental reduction of each source as required to obtain reductions in flyover noise with modifications to other secondary systems only as necessary. The methodology used to predict the effects of the design modifications on acquisition, maintenance, and operating costs were typical of those employed by rotorcraft manufacturers. The reduction of helicopter flyover noise generally was achieved through reductions in rotor tip speed. Performance characteristics were maintained to specified minimums for each aircraft in the study. GRA

N80-27355# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy.

ENERGY CONSERVATION POTENTIAL OF GENERAL AVIATION ACTIVITY

Sep. 1979 52 p refs

(AD-A081182; FAA/EE-79-20) Avail: NTIS HC A04/MF A01 CSCL 01/2

Three approaches for reducing energy consumption were investigated: hardware modification, pilot education, and air traffic control. It is recommended that research into new aircraft engine designs, automatic mixture controls, conventional engine fuel saving improvements, composite materials development, and aerodynamic drag reduction continue and that this hardware be introduced into the fleet when cost, reliability and safety considerations allow. It is further recommended that the pilot awareness and education programs listed above be implemented by the FAA and the general aviation industry, and finally, that the ATC actions listed should be further evaluated to determine whether the anticipated fuel savings justify their implementation. GRA

N80-27356# Noah (J. Watson) Associates, Inc., Falls Church, Va.

COSTS AND BENEFITS OF REQUIRING NEW PRODUCTION OF OLDER AIRCRAFT TYPES TO MEET AMENDED NOISE STANDARDS Final Report

C. F. Day and E. D. Studholme Sep. 1979 76 p refs

(Contract DOT-FA78WA-4192)

(AD-A080130; FAA/EE-79-22) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report examines costs and benefits associated with requiring new production of older aircraft models to meet amended noise standards. Two cases are examined: (1) all aircraft produced after 1983 must meet a noise emission standard halfway between Stage 2 and Stage 3 limits; and (2) all aircraft produced after 1985 must meet Stage 3 noise standards. The cost elements are combined and expressed as a change in direct operating costs in either cost-per-passenger mile or cost-per-aircraft mile, as appropriate. Noise benefits are estimated in terms of the change in area under a 100 EPNL contour resulting from the amended standards. GRA

N80-27357# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

COST/BENEFIT TRADEOFFS AVAILABLE IN AIRCRAFT NOISE TECHNOLOGY APPLICATIONS IN THE 1980'S Final Report

John F. Wilby and William J. Galloway Dec. 1979 175 p refs

(Contract DOT-FA77WA-4037)

(AD-A082028; BBN-3856; FAA/EE-80-2) Avail: NTIS HC A08/MF A01 CSCL 01/3

The current status of aircraft noise control technology is reviewed to identify those measures that have a reasonable potential for application to aircraft coming into service in the 1980's. Noise reduction achievable when these noise control measures are applied to two transport category airplanes, a business jet, and a small propeller-driven twin is determined. Costs and performance penalties are determined for each noise control option. Benefits are measured by reductions in FAR 36 certification noise levels and in reductions in EPNL contour areas. The study shows that current, late 1970's, noise control practices permit transport category airplanes to meet the FAR 36 Stage 3 noise limits, yet application of additional noise control measures is not likely to provide additional reduction of the noise levels for these aircraft by more than 3 decibels. New business jet noise levels will be as much as 10 decibels lower than Stage 3 limits for takeoff, and as much as 5 decibels lower on approach, with additional reductions of more than 3 decibels unlikely. Introduction of newly designed, geared reciprocating engines would provide reductions of 10 or more decibels for high performance single and twin-engined, propeller-driven small airplanes, relative to existing practice. GRA

N80-27358# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering.

QUATERNION UTILIZATION IN A MISSILE MODEL M.S. Thesis

William John Thome Mar. 1980 105 p

(AD-A084263; AFIT/GST/MA/80M-3) Avail: NTIS HC A06/MF A01 CSCL 16/4

The air-to-air missile model used by the Cruise Missile Independent Survivability Team did not contain data useful to the cruise missile. The objective of this study was to modify the subroutine SIGNAL in the model to incorporate the cruise missile data. The modification required an understanding of quaternion algebra utilized within the model to represent three dimensional motion. These quaternions allow real time outputs from the model for use by tactical ranges. The study contains a discussion of quaternions and their algebra. GRA

N80-27359# General Electric Co., Burlington, Vt. Armament Systems Dept.

AIR TO AIR HELICOPTER FIRE CONTROL EQUATIONS AND SOFTWARE GENERATION Final Report, 20 Dec. 1978 - 31 Aug. 1979

John W. Carlson, David B. Ellis, Theresa Parisi, and Abbas A. Rizvi. Nov. 1979. 111 p.
(Contract DAAK10-79-C-0028)
(AD-A084115; Doc-80APB509) Avail: NTIS
HC A06/MF A01 CSCL 19/5

Fire control equations suitable for use in a helicopter air-to-air gunnery engagement are developed. Maximum use is made of existing software from the Closed Loop Fire Control System (CLFCS). New target state estimator, ballistics, and gun order modules are developed to account for target motion effects. The resulting software was coded and run in the CLFCS fire control computer, and made to interface with a modified Multiweapon Fire Control System. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-27380*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
FLIGHT INVESTIGATION OF COCKPIT-DISPLAYED TRAFFIC INFORMATION UTILIZING CODED SYMBOLOGY IN AN ADVANCED OPERATIONAL ENVIRONMENT
Terence S. Abbott, Gene C. Moen, Lee H. Person, Jr., Gerald L. Keyser, Jr., Kenneth R. Yenni, and John F. Garren, Jr. Jul. 1980. 31 p. refs.
(DA Proj. 1L2-62209-AH-76)
(NASA-TP-1684; AVRADCOM-TR-80-B-4; L-13584) Avail: NTIS HC A03/MF A01 CSCL 01D

Traffic symbology was encoded to provide additional information concerning the traffic, which was displayed on the pilot's electronic horizontal situation indicators (EHSI). A research airplane representing an advanced operational environment was used to assess the benefit of coded traffic symbology in a realistic work-load environment. Traffic scenarios, involving both conflict-free and conflict situations, were employed. Subjective pilot commentary was obtained through the use of a questionnaire and extensive pilot debriefings. These results grouped conveniently under two categories: display factors and task performance. A major item under the display factor category was the problem of display clutter. The primary contributors to clutter were the use of large map-scale factors, the use of traffic data blocks, and the presentation of more than a few airplanes. In terms of task performance, the cockpit-displayed traffic information was found to provide excellent overall situation awareness. Additionally, mile separation prescribed during these tests. L.F.M.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-27381*# Curtiss-Wright Corp., Wood-Ridge, N.J.
PERFORMANCE, EMISSIONS, AND PHYSICAL CHARACTERISTICS OF A ROTATING COMBUSTION AIRCRAFT ENGINE, SUPPLEMENT A
R. K. Lamping, I. Manning, D. Myers, and B. Tjoe. May 1980. 74 p.
(Contract NAS3-20808)
(NASA-CR-135119; CW-WR-76-028.3) Avail: NTIS
HC A04/MF A01 CSCL 21E

Testing was conducted using the basic RC2-75 engine, to which several modifications were incorporated which were designed to reduce the hydrocarbon emissions and reduce the specific fuel consumption. The modifications included close-in surface gap spark plugs, increased compression ratio rotors, and provisions for utilizing either side or peripheral intake ports, or a combination of the two if required. The proposed EPA emissions requirements were met using the normal peripheral porting. The specific fuel economy demonstrated for the modified RC2-75 was 283 g/kW-hr at 75% power and 101 brake mean effective pressure (BMEP) and 272.5 g/kW-hr at 75% power and 111 BMEP. The latter would result from rating the engine for takeoff at 285 hp and 5500 rpm, instead of 6000 rpm. E.D.K.

N80-27382*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COMPOSITE WALL CONCEPT FOR HIGH TEMPERATURE TURBINE SHROUDS: HEAT TRANSFER ANALYSIS
Francis S. Stepka and Lawrence P. Ludwig. 1980. 17 p. refs. Presented at Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by Soc. of Automotive Engr.
(NASA-TM-81539; E-402) Avail: NTIS HC A02/MF A01 CSCL 21E

A heat transfer analysis was made of a composite wall shroud consisting of a ceramic thermal barrier layer bonded to a porous metal layer which, in turn, is bonded to a metal base. The porous metal layer serves to mitigate the strain differences between the ceramic and the metal base. Various combinations of ceramic and porous metal layer thicknesses and of porous metal densities and thermal conductivities were investigated to determine the layer thicknesses required to maintain a limiting temperature in the porous metal layer. Analysis showed that the composite wall offered significant air cooling flow reductions compared to an all impingement air cooled, all metal shroud. Author

N80-27383*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
NUMERICAL CALCULATION OF TRANSONIC AXIAL TURBOMACHINERY FLOWS
Djordje S. Dulikravich. 1980. 10 p. refs. Presented at 7th Intern. Conf. on Numerical Methods in Fluid Dyn., Stanford, Calif., 23-27 Jun. 1980; sponsored by NASA, AFOSR, NSF, and ONR
(NASA-TM-81544; E-500) Avail: NTIS HC A02/MF A01 CSCL 21E

A numerical method and the results of a computer program are presented for solving an exact, three dimensional, full potential equation that models rotating and nonrotating inviscid, absolutely irrotational, homentropic flows. Besides calculating the flows through an arbitrarily shaped rotor or stator blade row mounted on an axisymmetric hub and confined in an axisymmetric duct, the computer program is also capable of analyzing flow fields about arbitrarily shaped wing body combinations, propellers, helicopter rotors in hover, and wind turbine rotors. The governing equation is solved numerically in a fully conservative form by using an artificial time concept, a finite volume technique, rotated type dependent differencing, successive line overrelaxation, and sequential boundary conforming grid refinement. An artificial viscosity is added in fully conservative form, and an initial guess for the potential field is applied, as determined by a two dimensional cascade analysis. Author

N80-27384*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CF6-6D ENGINE PERFORMANCE DETERIORATION
Ray H. Wulf, W. H. Kramer, J. E. Pass, and J. J. Smith. Jan. 1980. 286 p. refs.
(Contract NAS3-20631)
(NASA-CR-159786; R80AEG216) Avail: NTIS
HC A13/MF A01 CSCL 21E

Cruise cockpit recordings and test cell performance data in conjunction with hardware inspection data from airline overhaul shops were analyzed to define the extent and magnitude of performance deterioration of the General Electric CF6-6D model engine. These studies successfully isolated short-term deterioration from the longer term, and defined areas where a significant reduction in aircraft energy requirements for the 1980's can be realized. Unrestored losses which remain after engine refurbishment represent over 70% of the loss at engine shop visit. Sixty-three percent of the unrestored losses are cost-effective to restore which could reduce fuel consumed by CF6-6D engines in 1980 by 10.9 million gallons. Author

N80-27365*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
LOSS MODEL FOR OFF-DESIGN PERFORMANCE ANALYSIS OF RADIAL TURBINES WITH PIVOTING-VANE, VARIABLE-AREA STATORS
Peter L. Meitner and Arthur J. Glassman 1980 22 p refs
Proposed for presentation at the Aerospace Congr., Los Angeles, 13-16 Oct. 1970; sponsored by the Society of Automotive Engineers Prepared in cooperation with Army Aviation Research and Development Command, Cleveland
(NASA-TM-81532; AVRADCOM-TR-80-C-18; E-455) Avail: NTIS HC A02/MF A01 CSCL 21E

An off-design performance loss model is developed for variable-area (pivoted vane) radial turbines. The variation in stator loss with stator area is determined by a viscous loss model while the variation in rotor loss due to stator area variation (for no stator end-clearance gap) is determined through analytical matching of experimental data. An incidence loss model is also based on matching of the experimental data. A stator vane end-clearance leakage model is developed and sample calculations are made to show the predicted effects of stator vane end-clearance leakage on performance. Author

N80-27366# United Technologies Corp., Windsor Locks, Conn.
INFLUENCE OF NOISE REDUCTION ON WEIGHT AND COST OF GENERAL AVIATION PROPELLERS Final Report
Robert J. Klatte and Frederick B. Metzger Jun. 1979 111 p refs
(Contract DOT-FA78WA-4111)
(AD-A082120; FAA-AEE-79-18) Avail: NTIS
HC A06/MF A01 CSCL 01/3

Results of a study are reported in which the influence of noise reduction on weight and cost of propellers used in General Aviation aircraft was evaluated. Aircraft performance was not to be degraded by installation of the reduced noise propellers. Only propeller modifications were permitted. Engine modifications, such as introduction of a gearbox to reduce noise by reduction of RPM, were not permitted in the study. Major factors in noise reduction found promising in the study were (1) optimization of performance by use of the best available airfoils, (2) use of thin airfoils and a narrow elliptical tip blade planform, and (3) increasing the number of blades consistent with maintaining aircraft performance. For the three aircraft studied (a single engine, a light twin and a heavy twin) the flyover noise reduction potential varied from 3 to 8 dBA with no weight or cost penalty. Greater reductions in noise resulted in increased weight and/or cost penalties. Also, in some cases, engine noise would have to be reduced to achieve greater reductions. The progress by General Aviation aircraft manufacturers in reducing noise is indicated by the finding that the most recent aircraft design had the smallest noise reduction potential. GRA

N80-27367# Science Applications, Inc., Canoga Park, Calif.
AFOSR CONTRACTORS MEETING ON AIR-BREATHING COMBUSTION DYNAMICS AND KINETICS, 1979 ABSTRACTS
R. B. Edelman 1 Feb. 1980 159 p refs Conf. held in Alexandria, Va., 28 Jan. - 1 Feb. 1980
(Contract F49620-77-C-0044; AF Proj. 2308)
(AD-A083651; AFOSR-79-1173TR) Avail: NTIS
HC A08/MF A01 CSCL 21/5

The report consists of a collection of abstracts of the numerous research progress reports given by AFOSR contractors and of invited papers from other governmental agencies and contractors. These papers presented over a five day period composed the 1979 annual contractors meeting on Air-Breathing Combustion Dynamics and Kinetics. The principal investigators and their organizational association are also identified. GRA

N80-27368# Pennsylvania State Univ., University Park. Applied Research Lab.
DOCUMENTATION OF CASCADE UNSTEADY PRESSURE DIFFERENCE PROGRAM
I.-C. Shen 5 Jan. 1980 46 p refs
(Contract N00024-79-C-6043)
(AD-A083987; ARL/PSU-TM-80-10) Avail: NTIS
HC A03/MF A01 CSCL 21/5

The response of an axial flow turbomachine to spatial velocity variations can be determined by the unsteady pressure distribution function which has been developed and represents an extension of an earlier analysis of the unsteady lift. A computer program has been written to formulate the unsteady pressure difference as a function of design parameters. This program is versatile in that it includes the effects of the cascade geometrical parameters and disturbance flow characterisitics, such as the blade camber, angle of incidence, nonconvected disturbance, and it also gives the unsteady lift and moment. The documentation and the use of this program are presented herein. GRA

N80-27369# Pennsylvania State Univ., University Park. Applied Research Lab.
NATURE OF INLET TURBULENCE AND STRUT FLOW DISTURBANCES AND THEIR EFFECT ON TURBOMACHINERY NOISE
R. Trunzo, B. Lakshminarayana, and D. E. Thompson 25 Feb. 1980 64 p refs
(Contract N00024-79-C-6043)
(AD-A084355; ARL/PSU-TM-80-20) Avail: NTIS
HC A04/MF A01 CSCL 21/5

Results of an investigation in which turbomachinery rotor sound spectra were correlated with aerodynamic measurements of the inlet turbulence, strut wake, and vortex flow strengths are reported. Aerodynamic measurements includeo mean velocity profiles, turbulence intensity, and axial length scales. Inlet turbulence data indicate that the major effect of flow contraction appears to be the elongation of turbulent eddies from 20 cm to 200 cm. Eddies of this size dominate the blade passing frequency (BPF) tones. Decreasing eddy size by use of a grid revelaed vortex flow strength to be the second major sound source. A doubling of vortex flow strength produced a 6 dB increase in the SPL of the first BPF. The sound pressure level showed less than a 2 dB change with doubling of wake turbulence intensity or velocity defect. A discussion of the relative importance of various sources of noise due to flow distribution at the inlet is given. This report will be submitted to the Journal of Sound and Vibration for publication. GRA

N80-27370# Detroit Diesel Allison, Indianapolis, Ind.
HIGH-TEMPERATURE RADIAL TURBINE DEMONSTRATION Final Report, 15 Jun. 1977 - 15 Nov. 1979
B. A. Ewing and Donald S. Monson Apr. 1980 204 p refs
(Contract DAAJ02-77-C-0031; DA Proj. 1L2-62209-AH-76)
(AD-A084120; DDA-EDR-9990; USAAVRADCOM-TR-80-D-6)
Avail: NTIS HC A10/MF A01 CSCL 21/5

The objective of this program was to provide and demonstrate the technology required to economically manufacture a cooled, high temperature, radial turbine with sufficient integrity and aerodynamic performance to meet future Army requirements for a reliable, low-cost, high performance, small gas turbine engine. The work to accomplish this objective was subdivided into three phases. GRA

N80-27371# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
COMBUSTOR MODELLING
Feb. 1980 377 p refs In ENGLISH and FRENCH Meeting held in Cologne, 3-5 Oct. 1979
(AGARD-CP-275; ISBN-92-835-0260-4) Avail: NTIS
HC A17/MF A01

Twenty-four papers addressing the different models and methods used in turbine engine research are presented. Four general areas are discussed: basic phenomena, transient phenomena and instabilities, furnaces and boilers, and gas turbine combustors and R/H systems. For individual titles, see N80-27372 through N80-27395.

N80-27372# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France). Dept. du Combustion.
MODELING THE COMBUSTION CHAMBER OF A GAS TURBINE: A MECHANICS VIEWPOINT [MODELISATION DES FOYERS DE TURBOREACTEURS: POINT DE VUE D'UN MOTORISTE]
Ph. Gastebois *In* AGARD Combustor Modelling Feb. 1980 7 p refs In FRENCH (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

Two objectives must be met when modeling combustion chambers for gas turbines. The optimization of combustion chambers presently directed towards the reduction of pollutant emissions, but which can be directed towards performance, stability, and relighting, must take into consideration the characteristics of the injection system, the primary zone, and the dilution. In addition, the prediction of combustion chamber performances should also permit the prediction of the characteristics of the outlet temperature, the wall temperature, and of the polluting emissions. To fill these two objectives, the mechanical engineer wants two types of models: a simplified one for performance estimation, and a more thorough model for optimizing the architecture of the combustion chamber. In both cases, a better knowledge of the physical phenomena (radiation, transfer, and reaction kinetics) obtained from improved measurements is indispensable. Transl. by A.R.H.

N80-27373# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.

FUNDAMENTAL MODELLING OF MIXING, EVAPORATION AND KINETICS IN GAS TURBINE COMBUSTORS

J. Swithenbank, A. Turan (Science Applications, Inc., Woodland Hills, Calif.), P. G. Felton, and D. B. Spalding (Imperial Coll. of Science and Technology) *In* AGARD Combustor Modelling Feb. 1980 21 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

Past achievements current status and future prospects of combustor modeling are discussed. The past achievements largely consist of detailed studies of idealized flames which have given an understanding of the relevant fundamental processes. However, gas turbine combustor computations must include the simultaneous interacting processes of three dimensional two-phase turbulent flow, evaporating droplets, mixing, radiation and chemical kinetics. At the present time numerical prediction algorithms are becoming available which can model all these processes to compute the hydrodynamic, thermodynamic and chemical quantities throughout a three dimensional field. Complementary stirred reactor network algorithms permit the prediction of minor consistuents (pollutants), again including such effects as droplet evaporation and unmixedness. Experimental verification of these various predictions reveals remarkably good agreement between measured and predicted values of all parameters in spite of the physical and mathematical assumptions currently used. Future problems include: more accurate modeling of turbulence/kinetic interactions, numerical procedure optimization and detailed measurements of residence time distribution and two-phase parameters in real, hot combustors. R.E.S.

N80-27374# Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering and Chemical Technology.

MATHEMATICAL MODELLING OF GAS-TURBINE COMBUSTION CHAMBERS

W. P. Jones and J. J. McGuirk *In* AGARD Combustor Modelling Feb. 1980 11 p refs Sponsored by Rolls-Royce Ltd. (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A mathematical model for predicting the performance of gas turbine combustion chambers is described. The model is based on the finite difference solution of the averaged forms of the governing partial differential conservation equations and turbulent transport is approximated via a variable density form of the k-epsilon turbulence model. The reactions associated with heat release are assumed sufficiently fast for chemical equilibrium to prevail on an instantaneous basis; and the influence of local turbulent fluctuations in mixture strength accounted for by a beta-probability density function. Liquid fuel sprays are represented by a transport equation for the probability density function describing the variation of droplet mass fraction with droplet radius. Computations of 2-d axisymmetric and 3-d flows are compared with experimental results and an assessment made of the adequacy of the various submodels embodied in the prediction procedure. Author

N80-27375# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

A PREDICTION MODEL FOR TURBULENT DIFFUSION FLAMES INCLUDING NO-FORMATION

J. Janicka (RWTH, Aachen, West Germany) and W. Kollmann *In* AGARD Combustor Modelling Feb. 1980 17 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A prediction model for turbulent diffusion flames burning gaseous fuels was developed and applied to H2-air flames. In the (simplified) system of chemical reactions the fast reactions are assumed in equilibrium, equilibrium whereas three-body recombinations are treated in non-equilibrium. For the H2-air flames this assumption leads to a description of the reacting system with only two variables f and r. Two methods of treating such a system in a turbulent flow are discussed: (1) modeling and solving transport equations for first and second order moments of these variables and prescribing the form of the pdf of f and r as a function of the selected moments, or (2) modeling and solving the equation for the pdf of f and r. Both sets of equations are complemented with a modified version of the k-epsilon turbulence model. The NO-formation in such flames can be calculated using the non-equilibrium values (mean values and covariances) of the O and H radicals. The results obtained with both models are compared with experiment and show good agreement. R.E.S.

N80-27376# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Antriebstechnik.

TURBULENT REACTION AND TRANSPORT PHENOMENA IN JET FLAMES

H. Eickhoff, K. Grethe (Karlsruhe Univ.), and F. Thiele (Technische Univ., Berlin, West Germany) *In* AGARD Combustion Modelling Feb. 1980 11 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A new reaction model accounting for intermediate species was applied in connection with the k-epsilon model to predict different free and enclosed turbulent natural gas flames. The reaction model is based on the assumption of a quasilaminar flame substructure of a turbulent diffusion flame and a probability density distribution of fuel-atom-concentration. It is assumed, that the quasilaminar flames are in local chemical equilibrium within zones of finite thickness. The influence of variable density on the mixing process was studied for different jets and jet flames. In the parabolic flow cases it was found necessary to account for variable density which was done by a mixing length relation. Different numerical procedures were applied for the parabolic and elliptic flow fields. Author

N80-27377# Karlsruhe Univ. (West Germany). Inst. fuer Thermische Stroemungsmaschinen.

ON THE PREDICTION OF TEMPERATURE PROFILES AT THE EXIT OF ANNULAR COMBUSTORS

Osama M. F. Elbahar and Sigmar L. K. Wittig *In* AGARD Combustor Modelling Feb. 1980 9 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

Despite their inherent limitations, two dimensional prediction procedures based on solving the basic equations and incorporating the k-epsilon model of turbulence are shown to be effective tools in designing annular combustors. In comparing the results it was found that predictions from available jet mixing correlation data within certain limitations represent measurements from single row injection more accurately. Detailed calculations, however, are more effective in predicting opposite wall cooling air injection, multiple row jet mixing, heat transfer, film cooling and the effects of converging combustor exit. R.E.S.

N80-27378# Aeronautical Research Associates of Princeton, Inc., N. J.

SECOND-ORDER CLOSURE MODELING OF TURBULENT MIXING AND REACTING FLOWS

Ashok K. Varma, Guido Sandri, and Coleman duP. Donaldson *In* AGARD Combustor Modelling Feb. 1980 13 p refs (For primary document see N80-27371 18-07)

(Contracts N00014-75-C-1143; N00014-79-C-0335; F44620-76-C-0048; Proj. SQUID)

Avail: NTIS HC A17/MF A01

Models for the scalar probability density function (PDF) have to be developed to achieve closure of turbulent transport equations for mixing and reacting flows. A delta function typical eddy model was developed for the joint PDF of the scalar variables. It was demonstrated that delta functions are a necessary part of PFTs in order to attain the extremums of the statistical constraints on the moments. The statistical bounds on a number of moments of interest for two and three species flows were derived. It was proven that a rational PDF composed of a set of delta functions alone can always be constructed at any point within the statistically valid moment space. The model provides a good representation of actual PDFs in two species, variable density, mixing flows. The model was directly compared to experimental PDF measurements and good agreement for higher order moments was demonstrated. It can be shown that the delta function PDF model is significantly simpler than other proposed PDF models and is more than adequate for the closure of the transport equations. E.D.K.

N80-27379*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

COMBUSTOR MODELLING FOR SCRAMJET ENGINES

J. Philip Drummond, R. Clayton Rogers, and John S. Evans *In* AGARD Combustor Modelling Feb. 1980 30 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A system of computer programs being developed to model complex combustor flow fields is discussed. Each code solves a system of equations compatible with the type of flow being analyzed in any particular part of the combustor. For flows that remain supersonic throughout, a parabolic Navier-Stokes solver is used successfully. An extension of this computer program, to partially introduce elliptic character into the analysis by accounting for a full three dimensional pressure field, is being tested. This partially elliptic scheme accounts for the effects of streamwise pressure feedback present in the subsonic flow, thereby allowing the detection and calculation of embedded subsonic regions known to be present in the combustor. Although the partially elliptic procedure can handle mixed subsonic-supersonic flows, it still requires that a predominant flow direction exists; for recirculating flows, the fully elliptic Navier-Stokes equations are required. Since recirculating flow does exist in regions near points of fuel injection from struts in the engine, work is currently underway to begin development of a three dimensional elliptic Navier-Stokes solver. Initial work includes development of a two dimensional elliptic code for the analysis of slot fuel injectors. E.D.K.

N80-27380# International Flame Research Foundation, Ijmuiden (Netherlands).

DEVELOPMENT AND VERIFICATION OF RADIATION MODELS

H. Bartelds (Organization for Applied Scientific Research, TNO, Apeldoorn, Netherlands) *In* AGARD Combustor Modelling Feb. 1980 20 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The prediction of radiative heat transfer from a flame may be divided into three categories: (1) the evaluation of temperature distribution and radiating species concentrations; (2) the evaluation of the absorption, emission, and scattering characteristics of the species at the prevailing temperatures; and (3) the evaluation of the radiation exchange. All three categories are discussed with respect to experiments and mathematical models. Emphasis is placed on models falling into categories two and three. The models were verified by comparison with measured radiation intensities and measured radiative heat fluxes from relatively large gas flames. Measured temperatures and species concentrations were used as input to the models. However, the models are well suited to be combined with each other and with prediction procedures for fluid flow and combustion. E.D.K.

N80-27381# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

ASSESSMENT OF AN APPROACH TO THE CALCULATION OF THE FLOW PROPERTIES OF SPRAY-FLAMES

Y. El Banhawy and J. H. Whitelaw *In* AGARD Combustor Modelling Feb. 1980 11 p refs Sponsored by the Minister of Defence (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A method for the calculation of the local properties of spray flames is described and its capabilities and limitations appraised by comparing calculated results with measurements. The method solves elliptic differential equations representing the conservation of mass, momentum, enthalpy, and species concentrations in finite difference form. In addition, Lagrangian equations for the droplet motion and thermal balance are solved for the finite ranges of droplet size. A two equation turbulence model, a combustion model based on mean mass fraction equations for fuel and oxidant, and a four flux radiation model are used. The droplet model assumes that the evaporating droplets act as distributed point sources of fuel vapor. The merits of the method are quantified by comparison with measurements obtained for three different spray flame geometries. The assumption of representing the spray by a finite number of size ranges was also examined and the results indicate that the importance of this number is related to the spray type and the aerodynamic features of the flow close to the spray. E.D.K.

N80-27382# Science Applications, Inc., Woodland Hills, Calif. Combustion Dynamics and Propulsion Technology Div.

FUNDAMENTAL CHARACTERIZATION OF ALTERNATIVE FUEL EFFECTS IN CONTINUOUS COMBUSTION SYSTEMS

R. B. Edelman, A. Turan, P. T. Harsha, E. Wong, and W. S. Blazowski (Exxon Research and Engineering Co., Linden, N.J.) *In* AGARD Combustor Modelling Feb. 1980 14 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The problem of net soot generation which is aggravated by the reduced hydrogen content characteristic of syncrudes that have been identified as probable alternate fuel sources for use in gas turbines is addressed. The kinetics of the process are modeled using the quasi-global concept while experimental data are developed primarily from a laboratory jet stirred combustor. Results are presented showing that soot emissions can be characterized in terms of major species and that soot oxidation must be included in the prediction of net soot generation. In addition, the techniques being employed for coupling the chemical and aerodynamic processes are outlined. E.D.K.

N80-27383# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

CHEMICAL KINETIC MODELLING FOR COMBUSTION APPLICATION

F. L. Dryer and C. K. Westbrook (California Univ., Livermore, Lawrence Livermore Lab.) *In* AGARD Combustor Modelling Feb. 1980 17 p refs (For primary document see N80-27371 18-07)

(Contracts W-7405-eng-48; EC-77-S-02-4272)

Avail: NTIS HC A17/MF A01

A systematic study of kinetic oxidation models for practical fuels is described. The construction of detailed reaction mechanisms for the oxidation of typical hydrocarbon fuels and the validation of these mechanisms through careful comparisons between computer and experimental data are discussed. These mechanisms are strongly hierarchical with reactions for complex fuels containing subsets which describe the combustion of chemically simpler fuels. Progress to date includes relatively complete descriptions of carbon monoxide, hydrogen, methane, and methanol oxidation. In the development and verification of these reaction mechanisms, data from a variety of experimental sources including slow reactor techniques at intermediate temperatures and shock tube results at high temperatures were used. In addition, ranges in fuel-air equivalence ratio between very lean through stoichiometric to very rich were also considered. E.D.K.

N80-27384# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering and Applied Mechanics.

COALESCENCE/DISPERSION MODELLING OF GAS TURBINE COMBUSTORS

David T. Pratt *In* AGARD Combustor Modelling Feb. 1980 13 p refs Presented at the Proj. SQUID Workshop on Gas Turbine Combust., Princeton, N.J., 31 May - 1 Jun. 1978 Sponsored in part by Utah Univ. and AVCO-Lycoming Corp. (For primary document see N80-27371 18-07)

(Grant NSF ENG-76-84533)

Avail: NTIS HC A17/MF A01

Finite rate micromixing may be introduced into both the perfectly stirred reactor (PSR) and plug flow reactor (PFR) models due to recent advances in computation of stochastic or Monte Carlo methods together with improved algorithms for calculating equilibrium and nonequilibrium chemistry. In the PSR this improvement allows assessment of the effects of primary zone inhomogeneities due to fuel-air ratio, temperature, and age or degree of reactedness within fluid elements. In the PFR regions finite rate mixing of secondary air admission into the post primary stream may be described, leading eventually to prediction of mixing inhomogeneities on pattern factors. E.D.K.

N80-27385# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).

COMBUSTION ZONE MODELING IN UNSTEADY REGIME

Francis Hirsinger and Helene Tichtinsky *In* AGARD Combustor Modelling Feb. 1980 12 p refs In FRENCH; ENGLISH summary (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

A modeling of the flows was undertaken reveal characteristic behaviors rather than to represent the whole set of phenomena taking place in actual, geometrically complicated combustion zones. The modeling technique consists of writing the equations of unsteady aerothermochemical budgets, taking into account the gas dynamics of the laminar or turbulent diffusion and the chemical kinetics for a series of cells representing the domain under study. These budget equations are treated in an integral manner in space and a differential manner in time. This method makes it possible to exactly follow the actual unsteady phenomena or to have a faster access to steady regimes through virtual unsteady evolutions. The applications presented correspond to a two dimensional flow in a duct partially choked by a plate representing a flame holder and to a three dimensional flow in a domain representing a section of flame tube fed by lateral orifices. This method permits the simulation of the establishment of the cold flow from rest, then an ignition initiated in a small zone at high temperature and the resulting oscillations, as well as the onset of a permanent flame. E.D.K.

N80-27386# California Inst. of Tech., Pasadena.

ANALYSIS OF LOW-FREQUENCY DISTURBANCES IN AFTERBURNERS

Frank E. Marble, Malladi V. Subbaiah, and Sebastien Candel, M. *In* AGARD Combustor Modelling Feb. 1980 11 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The behavior of stabilized flame zones were examined when they were situated in an afterburner. The turbine discharge and the nozzle inlet planes were represented by appropriate admittance functions for low frequencies. The distances which separate turbine discharge, flame holders, and nozzle throat, as well as the number of flame holders, were parameters in the problem. The results show that small disturbances which originate in combustion roughness, may be amplified to serious amplitudes and the amplitude level is a strong function of the geometric parameters of the flame-afterburner arrangement. In some instances instability may result. R.E.S.

N80-27387# International Flame Research Foundation, Ijmuiden (Netherlands).

SURVEY ON PREDICTION PROCEDURES FOR THE CALCULATION OF FURNACE PERFORMANCE

J. B. Michel, S. Michelfelder, and R. Payne *In* AGARD Combustor Modelling Feb. 1980 16 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The numerous published mathematical models for the prediction of furnace heat transfer were classified into three categories. The degree of subdivision chosen for the heat transfer calculations (dimensionality) was used as the main criterion. It is shown that the flow pattern and the desired accuracy determine the required degree of subdivision, which can be zero dimensional (model type 1), one dimensional (model type 2) or multidimensional (model type 3). The survey on models and some applications show also that all model types have their justification and their specific range of application. Models of the type 1 and 2 are generally considered to be especially suitable for practical furnace calculations and parameter studies. In principle these calculations can also be performed with models of the type 3 although their applicability is as yet confined to special cases which can be handled computationally and where the greater effort and expense is justified. For typical 3D geometries and if pollution emission data are to be predicted, which depend heavily on local properties, the use of type 3 models is indispensable. A.R.H.

N80-27388# Politecnico di Milano (Italy).

NUMERICAL ANALYSIS AND EXPERIMENTAL DATA IN A CONTINUOUS FLOW COMBUSTION CHAMBER: A COMPARISON

F. Gamma, C. Casci, A. Cogne, and U. Ghezzi *In* AGARD Combustor Modelling Feb. 1980 15 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

Measured and computed temperature distribution, axial velocity, and swirl velocity results obtained in an experimental furnace using methane as the fuel are presented and compared. The finite difference solution was obtained to the equations controlling combustion in the combustion chamber which was essentially a cylinder of inner 200 mm diameter with a test length of 1,000 mm. The fuel nozzle was placed axially in the injection head and the oxidizer was fed by two different lines. Primary air flowed through a tube surrounding the fuel nozzle, and the dilution air entered at the periphery of the injection head. In general, the agreement between theory and experiments can be considered as acceptable. A.R.H.

N80-27389# Centre de Recherche Claude-Delorme de l'Air Liquide, Jouy-en-Josas (France).

MODELING FURNACES FED WITH OXYGEN-ENRICHED AIR [MODELISATION DES FOURS ALIMENTES A L'AIR ENRICHI EN OXYGENE]

R. Guenot, A. Ivernel, F. C. Lockwood, and A. P. Salooja *In* AGARD Combustor Modelling Feb. 1980 12 p refs In FRENCH Prepared in cooperation with Imperial Coll. of Science and Technology, London, England (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The numerical modeling of combustion chambers with furnaces fed with oxygenated air presents particular problems related partly to the thermal dissociation produced by high temperatures, and partly to the increased role played by radiative transfer. A model is presented for including these phenomena in existing calculations. The method is in the process of verification by means of measurements obtained on an experimental 300 kW furnace designed to operate with high intensity boilers fed by natural gas and oxygenated air or pure oxygen. The first experimental results are in good agreement with predictions made using the model. Transl. by A.R.H.

N80-27390# Technische Hogeschool, Delft (Netherlands). Thermal Power Engineering Lab.

AN EFFECTIVE PROBABILISTIC SIMULATION OF THE TURBULENT FLOW AND COMBUSTION IN AXISYMMETRIC FURNACES

Th. T. A. Paauw, A. J. Stroo, and C. W. J. Vanloppen *In* AGARD Combustor Modelling Feb. 1980 22 p refs (For primary document see N80-27371 18-07)

Avail: NTIS HC A17/MF A01

The conservation equations governing the flow field and the combustion process in isothermal and in diffusion controlled combusting confined flows are solved using a numerical finite difference technique; the results are compared with measurements. The combustion process of the hydrocarbon fuel was modeled by using instant reaction with fluctuations in the mixture fracture, and with three different assumptions for the chemical conditions: frozen chemistry, equilibrium chemistry and partial equilibrium chemistry. Attention is paid to the formation of nitrogen oxides, and it is shown that in hydrocarbon diffusion flames a substantial amount of the NO formed is due to prompt NO formation. An effective model is presented for this process. Author

N80-27391# Institut Francais du Petrole, Rueil-Malmaison.

MATHEMATICAL MODELING OF BOILER OPERATIONS

[MODELISATION MATHEMATIQUE DU FONCTIONNEMENT DES CHAUDIERES DE CHAUFFAGE]
E. Perthuis *In* AGARD Combustor Modelling Feb. 1980 24 p refs In FRENCH (For primary document see N80-27371 18-07)
Avail: NTIS HC A17/MF A01

During a cooperative study of small boilers for domestic heating, a mathematical model was developed which describes the phenomena regulating the boiler operations and studies their evolution as a function of practical parameters. The operations of a given apparatus can be simulated in continuous or discontinuous regime. The influences on the boiler of such a parameters as heat insulation, load factor, boiler control, and control of the differential of the aquastat can be estimated. The order of magnitude of heat maintenance can also be predicted, something which is difficult to determine on a test bed.
Transl. by A.R.H.

N80-27392# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
A CHEMICAL REACTOR MODEL AND ITS APPLICATION TO A PRACTICAL COMBUSTOR
W. Krockow, B. Simon, and E. C. Parnell (Rolls-Royce Ltd., Bristol, England) *In* AGARD Combustor Modelling Feb. 1980 19 p refs Sponsored in part by Bundesministerium der Verteidigung (For primary document see N80-27371 18-07)
Avail: NTIS HC A17/MF A01

A computer model of a combustion chamber is presented, which in its approach is based on chemical reactors. The reactive flow field of the combustor primary zone is divided into elements (vortices) with different mixture ratios and residence times. The variations in concentration in each element are calculated by means of a detailed kinetic reaction mechanism, in which the decomposition of the fuel to carbon monoxide and hydrogen is described by a one-step-quasi-global reaction rate. Each element born in the primary zone of the combustor reacts according to its residence time and is subsequently followed on its way through the remaining zones of the combustor by the computer, with discrete amounts of air being added corresponding to the boundary conditions in the combustor. Idealization of the model (normal distribution) is supported by measurement of the gas concentration at the outlet from the primary zone of a vaporiser-annular combustion chamber. Comparison between the calculated primary zone and outlet concentrations of nitric oxide, CO and unburned hydrocarbons and the measurements show very good agreement.
Author

N80-27393# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
SEMI-EMPIRICAL CORRELATIONS FOR GAS TURBINE EMISSIONS, IGNITION, AND FLAME STABILIZATION
A. M. Mellor *In* AGARD Combustor Modelling Feb. 1980 13 p refs (For primary document see N80-27371 18-07)
(Contract F33615-77-C-2069)
Avail: NTIS HC A17/MF A01

For operating conditions where the fuel evaporation rate is fast compared to the fuel vapor/air mixing rate, a characteristic time model has been formulated to predict gaseous emissions and efficiency in terms of combustor inlet conditions and geometry. The model, which involves kinetic and fluid mechanic times, has been used to design low metric oxide burners, and study of several different conventional engine combustors suggests that the correlation may be universal. A related model, which includes a fuel droplet evaporation time, is being validated with data from laboratory combustors for spark ignition and lean flame stabilization. The preliminary application of this latter model to engine situations is described.
Author

N80-27394# Universite Laval (Quebec).
COMBUSTION MODELLING WITHIN GAS TURBINE ENGINES, SOME APPLICATIONS AND LIMITATIONS
J. Odgers *In* AGARD Combustor Modelling Feb. 1980 14 p refs (For primary document see N80-27371 18-07)
Avail: NTIS HC A17/MF A01

Some of the more pertinent models postulated to describe the performance of gas turbine combustors are reviewed. Six different design/development stages are considered: (1) the initial sizing of a combustor; (2) the initial development testing; (3) primary zone modelling; (4) secondary zone modelling; (5) dilution zone modelling; and (6) changes due to the alteration of ambient conditions. The models are assessed in scope 1 plausibility, experimentally, and in terms of time and economic justification. For (1) it is suggested that a zero-dimensional model suffice, as also for (2). Item (3) will probably require a three dimensional model; (4) and (5) with probably suffice with A zone or two dimensional model. For item (6) a zero-order model might well be satisfactory. If it can be produced with sufficient accuracy, a single complex (probably three dimensional) model could adequately describe all items, (1) to (6). The need of future data, the type of models which may be used currently, and those which are likely to be used in the future are discussed.
A.R.H.

N80-27395# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
AERODYNAMIC STUDY OF A COMBUSTION CHAMBER WITH A VIEW TO ITS SEMI-EMPIRICAL MODELLING
Patrick Hebrard and Philippe Magre *In* AGARD Combustor Modelling Feb. 1980 18 p refs In FRENCH; ENGLISH summary (For primary document see N80-27371 18-07)
Avail: NTIS HC A17/MF A01

The prediction of combustion performance and of polluting species formation in turbomachine combustors requires a calculation method that takes into account all phenomena taking place in various parts of the combustion chamber. Among these, aerodynamic effects, often very poorly known, must be introduced to justify modelling methods based on a combination of elementary combustors; these methods rest on a correct description of their features and their relationships: location, nature, volume, flowrate and distribution, connexions. To this end, experiments were carried out on a combustor model, both without and with combustion, with a view to: (1) characterize the combustor aerodynamics, by visualizations in the water tunnel and velocity measurements on an aerodynamic model; (2) measure residence times in a flame tube by thermodilution (aerodynamics) and particle dynamics (water tunnel); and (3) determine the combustion efficiency and the polluting species production for each regime. Using these results for the development of a one dimensional model of elementary combustors makes it possible to calculate the distribution function of residence time in all elmentary reactors, especially in the primary zone. The overall performance of the combustor can also be predicted. The agreement between calculated and experimental results is satisfactory if the simplicity of the assumptions on which the model is based is considered.
A.R.H.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-27396 California Univ., Berkeley.
COUPLED BENDING-TORSION FLUTTER IN CASCADES WITH APPLICATIONS TO FAN AND COMPRESSOR BLADES Ph.D. Thesis
Oddvar Olav Bendiksen 1980 270 p
Avail: Univ. Microfilms Order No. 8015952

A method is presented for determining the aeroelastic stability boundaries of a cascade with aerodynamic, inertial, and structural coupling between the bending and torsional degrees of freedom. The real rotor is modeled as an infinite two dimensional cascade of identical harmonic motion, with an arbitrary but constant interblade phase angle. Lane's assumption about the possible flutter mode shapes is assumed to hold. Two different unsteady aerodynamic theories are incorporated into the flutter analysis. The first is Whitehead's solution for the unsteady incompressible flow through an oscillating cascade. The second is a solution for the unsteady supersonic flow through a cascade with a subsonic leading edge locus. The aeroelastic stability boundary of the cascade is obtained by solving a complex eigenvalue problem, analogous to the isolated wing case. The eigenvalue problem is solved directly, and the critical interblade phase angle is determined by minimizing the flutter speed with respect to this

phase angle, while maintaining the restrictions imposed by Lane's assumption. Boundaries are presented for both the incompressible and the supersonic case, for several cascade configurations, locations of elastic axis, coupling strength, and structural damping. Dissert. Abstr.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-27397*# Northrop Corp., Hawthorne, Calif. Aerosciences Lab.
SYSTEM DESCRIPTION AND ANALYSIS. PART 1: FEASIBILITY STUDY FOR HELICOPTER/VTOL WIDE-ANGLE SIMULATION IMAGE GENERATION DISPLAY SYSTEM Final Report
Oct. 1977 198 p Sponsored in part by Army Air Mobility and Research and Development Lab. and Ames Research Center, Mountain View, Calif.
(Contract NAS2-9351)
(NASA-CR-152376; NOR-77-102-Pt-1) Avail: NTIS HC A09/MF A01 CSCL 14B

A preliminary design for a helicopter/VSTOL wide angle simulator image generation display system is studied. The visual system is to become part of a simulator capability to support Army aviation systems research and development within the near term. As required for the Army to simulate a wide range of aircraft characteristics, versatility and ease of changing cockpit configurations were primary considerations of the study. Due to the Army's interest in low altitude flight and descents into and landing in constrained areas, particular emphasis is given to wide field of view, resolution, brightness, contrast, and color. The visual display study includes a preliminary design, demonstrated feasibility of advanced concepts, and a plan for subsequent detail design and development. Analysis and tradeoff considerations for various visual system elements are outlined and discussed. E.D.K.

N80-27398# Operations Research, Inc., Silver Spring, Md.
STUDY OF OPTICAL TECHNIQUES FOR INDIRECT GENERATION OF RUNWAY APPROACH LIGHTS Final Report, Sep. 1978 - Sep. 1979
James C. Bremer, L. James Happel, and Ronald A. Parise Sep. 1979 55 p refs
(AD-A080434; ORI-TR-1557) Avail: NTIS HC A04/MF A01 CSCL 01/5

The steel towers which are currently used to support runway approach lights present a significant collision hazard to landing aircraft, and are being replaced by frangible towers which reduce, but do not eliminate, this hazard. This study analyzes optical concepts for indirect generation of runway approach lights which would reduce the tower height or the mass of elevated components. Three concepts are investigated: projection of images with mirrors, use of a ground based lamp in conjunction with a diverging mirror in the light plane, and use of a fiber optic light pipe. The projection of images can achieve a height reduction of several feet, but would require the construction and maintenance of large mirrors. The other two techniques could eliminate wiring from elevated structures, but would require more complex optics and higher levels of power consumption. None of these techniques appears to be practical when the marginal benefits are weighted against their complexity and cost. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-27399*# General Dynamics/Convair, San Diego, Calif.
SPACE CONSTRUCTION AUTOMATED FABRICATION EXPERIMENT DEFINITION STUDY (SCAFEDS), PART 3. VOLUME 3: REQUIREMENTS Final Report
29 Jun. 1979 115 p refs
(Contract NAS9-15310)
(NASA-CR-160747; CASD-ASP78-016-Pt-3-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 22A

The performance, design and verification requirements for the space Construction Automated Fabrication Experiment (SCAFE) are defined. The SCAFE program defines, develops, and demonstrates the techniques, processes, and equipment required for the automatic fabrication of structural elements in space and for the assembly of such elements into a large, lightweight structure. The program defines a large structural platform to be constructed in orbit using the space shuttle as a launch vehicle and construction base. E.D.K.

N80-27400*# Rockwell International Corp., Downey, Calif. Satellite Systems Div.
SPACE CONSTRUCTION SYSTEM ANALYSIS STUDY: PROJECT SYSTEMS AND MISSIONS DESCRIPTIONS Final Report
26 Apr. 1979 301 p refs
(Contract NAS9-15718)
(NASA-CR-160748; SSD-79-0077) Avail: NTIS HC A14/MF A01 CSCL 22A

Three project systems are defined and summarized. The systems are: (1) a Solar Power Satellite (SPS) Development Flight Test Vehicle configured for fabrication and compatible with solar electric propulsion orbit transfer; (2) an Advanced Communications Platform configured for space fabrication and compatible with low thrust chemical orbit transfer propulsion; and (3) the same Platform, configured to be space erectable but still compatible with low thrust chemical orbit transfer propulsion. These project systems are intended to serve as configuration models for use in detailed analyses of space construction techniques and processes. They represent feasible concepts for real projects; real in the sense that they are realistic contenders on the list of candidate missions currently projected for the national space program. Thus, they represent reasonable configurations upon which to base early studies of alternative space construction processes. E.D.K.

N80-27401# National Aeronautical Lab., Bangalore (India). Materials Science Div.
PROCESSING OF MATERIALS IN SPACE
S. Ramaseshan Jul. 1978 18 p refs
(ISRO-SN-04-78) Avail: NTIS HC A02/MF A01

The generation of convection flow by gravity and surface tension forces is examined and the advantages of weightlessness processing for materials are discussed with particular attention on electrophoresis, liquid phase miscibility gap, eutectic alloys, crystal growth, and magnetic materials. The use of a molecular shield for producing ultrahigh vacuum over a large volume at an altitude of 200 to 300 km is described. Opportunities provided by space shuttle for spaceborne experiments in these areas are summarized and possible Indian Space program experiments are mentioned. A.R.H.

N80-27402*# National Aeronautics and Space Administration, Washington, D. C.
PROBLEMS AND STRATEGY OF THE FIRST FLIGHT TO THE COMETS
V. D. Davydov Jun. 1980 25 p refs Transl. into ENGLISH "Problemy i Strategiya Pervogo Poleta k Komete", rept. Pr-399 Acad. of Sci. USSR Inst. of Space Res., Moscow, 1978 p 1-25 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76241; PR-399) Avail: NTIS HC A02/MF A01 CSCL 22A

Substantiation is given for the urgency of using space equipment to study comets in order to work out the basic problem of the origin and evolution of the solar system. The potentialities and advantages of selecting ballistically-accessible objects among the newly discovered comets are shown (as a preliminary study).

The technique of early detection of such objects is discussed.
Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-27403*# General Dynamics/Convair, San Diego, Calif.
CONCEPTUAL DESIGN OF TWO-PHASE FLUID MECHANICS AND HEAT TRANSFER FACILITY FOR SPACELAB
B. F. North and M. E. Hill Jun. 1980 190 p refs
(Contract NAS3-21750)
(NASA-CR-159810; GDC-CRAD-80-002) Avail: NTIS HC A09/MF A01 CSCL 14B

Five specific experiments were analyzed to provide definition of experiments designed to evaluate two phase fluid behavior in low gravity. The conceptual design represents a fluid mechanics and heat transfer facility for a double rack in Spacelab. The five experiments are two phase flow patterns and pressure drop, flow boiling, liquid reorientation, and interface bubble dynamics. Hardware was sized, instrumentation and data recording requirements defined, and the five experiments were installed as an integrated experimental package. Applicable available hardware was selected in the experiment design and total experiment program costs were defined. Author

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-27404# Department of Energy, Washington, D. C. Office of Energy Research.
SATELLITE POWER SYSTEMS (SPS): CONCEPT DEVELOPMENT AND EVALUATION PROGRAM, PRELIMINARY ASSESSMENT
Sep. 1979 21 p refs
(DOE/ER-0041) Avail: NTIS HC A02/MF A01

Preliminary results of a DOE-NASA 3-year study of satellite solar energy conversion and microwave transmission to Earth are presented. The assessment includes technical and economic feasibility; the effects of the microwave power transmission beam on biological, ecological, and electromagnetic systems; the impact of SPS construction, deployment and operations on the biosphere and on society; and the merits of SPS compared to other future energy alternatives. DOE

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-27405*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. STS-7 CONCEPTUAL FLIGHT PROFILE. IUS/TDRS-A
Jun. 1979 110 p Supersedes JSC-13968
(NASA-TM-81090; JSC-15045; JSC-13968; Rept-79-FM-22)
Avail: NTIS HC A06/MF A01 CSCL 22A

The Space Transportation System (STS) Flight Assignment Manifest has has scheduled a Tracking and Data Relay Satellite System (TDRSS) spacecraft for a February 1981 launch on STS Flight 7. The preliminary flight profile that conceptually implements the flight requirements and constraints levied by the STS, inertial upper stage (IUS), and the TDRS spacecraft is presented. The integrated major flight design guidelines and requirements used in the development of the flight profile are included together with a flight sequence of events and time line that describe the profile and reflect implementation of the integrated set of requirements. L.F.M.

N80-27406*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. STS-7 FEASIBILITY ASSESSMENT: IUS/TDRS-A
Jul. 1979 63 p refs Supersedes JSC-14235
(NASA-TM-81091; JSC-16026; JSC-14235; Rept-79-FM-23)
Avail: NTIS HC A04/MF A01 CSCL 22A

This Space Transportation System 7 (STS-7) Flight Feasibility Assessment (FFA) provides a base from which the various design, operation, and integration elements associated with Tracking and Data Relay Satellite-A can perform mission planning and analysis. The STS-7 FFA identifies conflicts, issues, and concerns associated with the integrated flight design requirements and constraints.
E.D.K.

N80-27407*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. ONORBIT NAVIGATION INTEGRATOR RESULTS FOR TYPICAL SHUTTLE ORBITS
Oscar W. Olszewski Jul. 1979 40 p refs
(NASA-TM-81092; JSC-16011; Rept-79-FM-25) Avail: NTIS HC A03/MF A01 CSCL 22A

Three types of navigation onorbit numerical integrators were evaluated: (1) power integrators with no delta-V incorporation, just coasting (using Taylor series expansion integrators); (2) coasting integrators using the Cowell method of special perturbations; and (3) coasting integrator using the Pines variation of parameter perturbation method. Results show that the super G integrator is a very simple and effective for 2 and 4 second time steps. Since IMU delta-V data can be easily incorporated in the integration scheme, its use as the standard onorbit navigation propagator for the maintenance of the current state was implemented in the onboard navigation software. The Pines formulation method with a Runge-Kutta-Gill fourth-order integrator method produces excellent results up to 300 second time steps. On orbit prediction with this method was implemented in the onboard onorbit navigation scheme. The Runge-Kutta third order, using Cowell's method, is an excellent general purpose determination integrator for time steps up to a 60 second duration. A.R.H.

N80-27408*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. MCC LEVEL C FORMULATION REQUIREMENTS: ENTRY GUIDANCE AND ENTRY AUTOPILOT
Jon C. Harpold and Oliver Hill Jan. 1980 118 p refs
(NASA-TM-81093; JSC-11746; Rept-76-FM-98) Avail: NTIS HC A06/MF A01 CSCL 22A

A set of preliminary entry guidance and autopilot software formulations is presented for use in the Mission Control Center (MCC) entry processor. These software formulations meet all

level B requirements. Revision 2 incorporates the modifications required to functionally simulate optimal TAEM targeting capability (OTT). Implementation of this logic in the MCC must be coordinated with flight software OTT implementation and MCC TAEM guidance OTT. The entry guidance logic is based on the Orbiter avionics entry guidance software. This MCC requirements document contains a definition of coordinate systems, a list of parameter definitions for the software formulations, a description of the entry guidance detailed formulation requirements, a description of the detailed autopilot formulation requirements, a description of the targeting routine, and a set of formulation flow charts. A.R.H.

N80-27409*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. MCC LEVEL C FORMULATION REQUIREMENTS: SHUTTLE TAEM GUIDANCE AND FLIGHT CONTROL
Gilbert L. Carman Jan. 1980 86 p Revised
(NASA-TM-81094; JSC-11786-Rev-2; Rept-76-FM-87-Rev-2) Avail: NTIS HC A05/MF A01 CSCL 22A

The Level C requirements for the shuttle orbiter terminal area energy management (TAEM) guidance and flight control functions to be incorporated into the Mission Control Center entry profile planning processor are defined. This processor will be used for preentry evaluation of the entry through landing maneuvers, and will include a simplified three degree-of-freedom model of the body rotational dynamics that is necessary to account for the effects of attitude response on the trajectory dynamics. This simulation terminates at TAEM-autoland interface. A.R.H.

N80-27410*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM: OFT ASCENT/DESCENT ANCILLARY DATA REQUIREMENTS DOCUMENT
A. C. Bond, Jr. and J. Knoedler Feb. 1980 58 p ref Revised
(NASA-TM-81095; JSC-14C-14370-Rev-1; Rept-78-FM-40-Rev-1) Avail: NTIS HC A04/MF A01 CSCL 22A

Requirements are presented for the ascent/descent (A/D) navigation and attitude-dependent ancillary data products to be generated for the space shuttle orbiter in support of the orbital flight test (OFT) flight test requirements, MPAD guidance and navigation performance assessment, and the mission evaluation team. The A/D ancillary data support for OFT mission evaluation activities is confined to providing postflight position, velocity, attitude, and associated navigation and attitude derived parameters for the Orbiter over particular flight phases and time intervals. A.R.H.

N80-27411*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 3: ASCENT, CYCLE 3
May 1980 300 p refs Revised
(NASA-TM-81096; JSC-14483-Vol-3-Rev-1; Rept-78-FM-51-Vol-3-Rev-1) Avail: NTIS HC A13/MF A01 CSCL 22A

The ascent opeational flight profile for the space transportation system 1 flight is designed (1) to limit the maximum undispersed dynamic pressure to 580 lb/sq ft, (2) to follow the design load indicator profiles where q alpha is a specified profile and q beta is desired to be as close to zero as passible, and (3) to maximize nominal and abort performance. Significant trajectory parameters achieved are presented. A maximum dynamic pressure of 575 lb/sq ft was achieved, a minimum q alpha of -2187 lb-deg/sq ft was achieved, and q beta was limited to approximately + or - 100 lb-deg/sq ft in the high q region of the trajectory. The trajectory performance allows a press to main engine cutoff capability with one space shuttle main engine out at 262 seconds ground elapsed time. The orbital maneuvering system burns achieve a final orbit of 150.9 x 149.9 x 149.8 n. mi. and the desired inclination of 40.3 degrees. E.D.K.

N80-27412*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 5: DESCENT, CYCLE 3. APPENDIX C: MONTE CARLO DISPERSION ANALYSIS
Jun. 1980 336 p refs Revised
(NASA-TM-81097; JSC-14483-Vol-5-Rev-1-App-C; Rept-78-FM-51-Vol-5-R-1-App-C) Avail: NTIS HC A15/MF A01 CSCL 22A

The results of three nonlinear the Monte Carlo dispersion analyses for the Space Transportation System 1 Flight (STS-1) Orbiter Descent Operational Flight Profile, Cycle 3 are presented. Fifty randomly selected simulation for the end of mission (EOM) descent, the abort once around (AOA) descent targeted line are steep target line, and the AOA descent targeted to the shallow target line are analyzed. These analyses compare the flight environment with system and operational constraints on the flight environment and in some cases use simplified system models as an aid in assessing the STS-1 descent flight profile. In addition, descent flight envelops are provided as a data base for use by system specialists to determine the flight readiness for STS-1. The results of these dispersion analyses supersede results of the dispersion analysis previously documented. E.D.K.

N80-27413*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 6: ABORT ANALYSIS
Jun. 1980 624 p refs Revised
(NASA-TM-81098; JSC-14483-Vol-6-Rev-1; Rept-78-FM-51-Vol-6-Rev-1) Avail: NTIS HC A99/MF A01 CSCL 22A

The abort analysis for the cycle 3 Operational Flight Profile (OFP) for the Space Transportation System 1 Flight (STS-1) is defined, superseding the abort analysis previously presented. Included are the flight description, abort analysis summary, flight design groundrules and constraints, initialization information, general abort description and results, abort solid rocket booster and external tank separation and disposal results, abort monitoring displays and discussion on both ground and onboard trajectory monitoring, abort initialization load summary for the onboard computer, list of the key abort powered flight dispersion analysis. E.D.K.

N80-27414*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER S-BAND DIRECT LINK SYSTEM VERIFICATION TEST REPORT
B. K. Vermillion May 1980 141 p refs
(NASA-TM-81110; JSC-16680) Avail: NTIS HC A07/MF A01 CSCL 22B

Space-to-ground S-band communications system compatibility and performance tests were performed for the various radio frequency links. These tests consisted of the various uplink and downlink signal combinations (data rates) for the phase modulation system and both realtime and playback data rates for the frequency modulated downlink systems. In addition, tests involving encryption/decryption, Doppler, and acquisition were performed. Results show that the S-band transponder for the space shuttle orbiter is compatible with the S-band equipment of the AFSCF/RTS (Air Force Satellite Control Facility/Remote Tracking Station). It is also concluded that the performance of the orbiter-AFSCF/RTS direct link exceeds the required performance and that this communications link will meet the system requirements of the Space Transportation System. L.F.M.

N80-27415*# Remtech, Inc., Huntsville, Ala.
SPACE SHUTTLE MAIN ENGINE PLUME RADIATION MODEL
John E. Reardon and Young C. Lee Dec 1978 196 p refs (Contract NAS8-29270)
(NASA-CR-161498; RTR-014-7) Avail: NTIS HC A09/MF A01 CSCL 21H

The methods are described which are used in predicting the thermal radiation received by space shuttles, from the plumes of the main engines. Radiation to representative surface locations were predicted using the NASA gaseous plume radiation GASRAD program. The plume model is used with the radiative view factor (RAVFAC) program to predict sea level radiation at specified

body points. The GASRAD program is described along with the predictions. The RAVFAC model is also discussed. F.O.S.

N80-27416*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RETRIEVAL TECHNIQUES: LVLH AND INERTIALLY STABILIZED PAYLOADS
J. A. Yglesias May 1980 42 p
(NASA-TM-81099; JSC-16425; Rept-80-FM-12) Avail: NTIS HC A03/MF A01 CSCL 22B

Procedures and techniques are discussed for retrieving payloads that are inertially or local vertical/local horizontal (LVLH) stabilized. Selection of the retrieval profile to be used depends on several factors: (1) control authority of the payload, (2) payload sensitivity to primary reaction control system (PRCS) plumes, (3) whether the payload is inertially or LVLH stabilized, (4) location of the grapple fixture, and (5) orbiter propellant consumption. The general retrieval profiles recommended are a V-bar approach for payloads that are LVLH or gravity-gradient stabilized, and the V-bar approach with one or two phase flyaround for inertially stabilized payloads. Once the general type of profile has been selected, the detailed retrieval profile and timeline should consider the various guidelines, groundrules, and constraints associated with a particular payload or flight. Reaction control system (RCS) propellant requirements for the recommended profiles range from 200 to 1500 pounds, depending on such factors as braking techniques, flyaround maneuvers (if necessary), and stationkeeping operations. The time required to perform a retrieval (starting from 1000 feet) varies from 20 to 130 minutes, depending on the complexity of the profile. The goals of this project are to develop a profile which ensures mission success; to make the retrieval profiles simple; and to keep the pilot workload to a minimum by making use of the automatic features of the orbiter flight software whenever possible. F.O.S.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-27417 Cornell Univ., Ithaca, N. Y.
AN ATTITUDE ACQUISITION TECHNIQUE FOR DUAL-SPIN SPACECRAFT Ph.D. Thesis
Carl Henry Hubert 1980 125 p
Avail: Univ. Microfilms Order No. 8015681

Alignment of the spacecraft rotor axis with the angular momentum vector is achieved by spinning up the rotor, and then allowing passive energy dissipation mechanisms to act while the rotor is made to spin at a constant rate relative to the remainder of the spacecraft. If the rotor spin rate is correct, the desired state will be asymptotically stable, no other stable state will exist, and the alignment will be achieved. The validity of this technique is demonstrated by an energy analysis, illustrated by a geometrical technique, and confirmed by the results of computer simulations. It is demonstrated that, with the proper choice of rotor speed, the initial conditions and dynamic history of the spacecraft during rotor spin up are irrelevant to the ultimate convergence of the rotor axis to the desired orientation. Because of this, a number of maneuvers previously thought to be impossible are now known to be feasible. Dissert. Abstr.

N80-27418*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHAPE CHANGE OF GALILEO PROBE MODELS IN FREE-FLIGHT TESTS
Chul Park and Charles F. Derose Jun. 1980 41 p refs
(NASA-TM-81209; A-8223) Avail: NTIS HC A03/MF A01 CSCL 22B

Scale models of the Galileo Probe made of polycarbonate, AXF5Q graphite, carbon-carbon composite, and carbon-phenolic were flown in a free flight range in an ambient gas of air, krypton, or xenon. Mach numbers varied between 14 and 24, Reynolds numbers between 300,000 and 1,000,000, stagnation pressures between 31 and 200 atm, and stagnation point heat transfer rates between 10 and 1,000 kW/sq cm. Shadowgraphs indicate gouging ablation of the aft portion of the frustum; the gouging was moderate in air and severe in the noble gases. The graphite models break in the same region. An explanation of the phenomena is offered in terms of the strong compression and shear caused by the reattachment of a turbulent separated flow. Conditions are calculated for similar tests appropriate for Von Karman Facility of the Arnold Engineering Development Center in which a larger model can be flown in argon. Author

N80-27419*# Howard Univ., Washington, D. C. School of Engineering.
THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES, 3. PART A: SHAPE AND ORIENTATION CONTROL OF A PLATFORM IN ORBIT USING POINT ACTUATORS Final Report
Peter M. Bainum, A. S. S. R. Reddy, R. Krishna, and Paul K. James Jun. 1980 179 p refs
(Grant NsG-1414)
(NASA-CR-163253) Avail: NTIS HC A09/MF A01 CSCL 22B

The dynamics, attitude, and shape control of a large thin flexible square platform in orbit are studied. Attitude and shape control are assumed to result from actuators placed perpendicular to the main surface and one edge and their effect on the rigid body and elastic modes is modelled to first order. The equations of motion are linearized about three different nominal orientations: (1) the platform following the local vertical with its major surface perpendicular to the orbital plane; (2) the platform following the local horizontal with its major surface normal to the local vertical; and (3) the platform following the local vertical with its major surface perpendicular to the orbit normal. The stability of the uncontrolled system is investigated analytically. Once controllability is established for a set of actuator locations, control law development is based on decoupling, pole placement, and linear optimal control theory. Frequencies and elastic modal shape functions are obtained using a finite element computer algorithm, two different approximate analytical methods, and the results of the three methods compared. Author

N80-27420# TRW Defense and Space Systems Group, Redondo Beach, Calif.
COST/BENEFIT ANALYSIS OF REENTRY VEHICLE HARDNESS TESTING USING THE FAST METHODOLOGY. VOLUME 2: METHODS Final Report, 23 Jan. 1978 - 30 Mar. 1979
L. H. Donahue 30 Mar. 1979 64 p refs
(Contract DNA001-78-C-0135)
(AD-A083336; AD-E300739; TRW-33030-6003-RU-81-Vol-2; DNA-4949F-2) Avail: NTIS HC A04/MF A01 CSCL 16/3

The Failure Analysis by Statistical Techniques (FAST) methodology was extended to provide new techniques for estimating the potential benefits of testing under uncertainty. A new computer code named ELF, Evaluation of Likelihood Function, was developed to provide a thorough evaluation of test results. Two demonstrate the ELF Code, this code was used to analyze magnetic flyer plate data on graphite resin material samples. The development of the statistical and analytical techniques that

were incorporated into the ELF code is described in detail. Also reported is a version of the FAST code, FAST7, Conditional Probability FAST, which shows great promise for test planning and evaluation analysis. J.M.S.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-27421*# Stanford Univ., Calif.
[RESULTS OF AN ISEE-1 EXPERIMENT TO STUDY THE INTERACTIONS BETWEEN ENERGETIC PARTICLES AND DISCRETE VLF WAVES IN THE MAGNETOSPHERE] Final Report
Apr. 1980 241 p
(Contract NAS5-20871)
(NASA-CR-160006) Avail: NTIS HC A11/MF A01 CSCL 14B

Despite the malfunctioning of the digital portion of the experiment which is encoding the absolute amplitude of the wave spectrum with a fixed bias of approximately 20 dB, the analog portion of the instrument is acquiring excellent data concerning the wave function and relative amplitude. Results obtained over a 2-year period which have important implications for magnetospheric wave-particle interactions are examined in the areas of emission generation by nonconducted coherent waves, and cold plasma distribution in the inner magnetosphere. A.R.H.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-27422 Washington State Univ., Pullman.
THE FATE AND BEHAVIOR OF FUEL-SULFUR IN COMBUSTION SYSTEMS Ph.D. Thesis
John Charles Kramlich 1980 225 p
Avail: Univ. Microfilms Order No. 8015151

The behavior of sulfur during the combustion of methane, propane, acetylene, hydrogen, and a mixture of hydrogen and carbon was studied in a modified Longwell jet-stirred reactor operating at 0.92 atmospheres. Sulfur dioxide was shown to represent the majority of the flame sulfur and the sulfur behavior observed was, to first order, independent or sulfur additive type. The results for the hydrogen flame were consistent with the assumption that the sulfur species were mutually equilibrated within the non-equilibrium flame. A partial equilibrium model predicted that, after SO2, SO was the most important flame species. A chemical kinetic probe model was applied to the modeled combustion gases which resulted in the reduction of sampled SO into H2S within the probe at fuel-rich conditions; at fuel-lean conditions, SO was oxidized into SO2. The results for the hydrocarbon flames indicated that the measured H2S, COS, and CS2 were probe formed from sulfur in the reactive intermediates SO, CS,S and SH. Dissert. Abstr.

N80-27423*# Remtech, Inc., Huntsville, Ala.
A COMPUTER PROGRAM FOR THERMAL RADIATION FROM GASEOUS ROCKET EXHUAST PLUMES (GASRAD)
John E. Reardon and Young C. Lee Dec. 1979 183 p refs
(Contract NAS8-29270)
(NASA-CR-161496; RTR-014-9) Avail: NTIS HC A09/MF A01 CSCL 21H

A computer code is presented for predicting incident thermal radiation from defined plume gas properties in either axisymmetric or cylindrical coordinate systems. The radiation model is a statistical band model for exponential line strength distribution with Lorentz/Doppler line shapes for 5 gaseous species (H2O, CO2, CO, HCl and HF) and an appoximate (non-scattering) treatment of carbon particles. The Curtis-Godson approximation is used for inhomogeneous gases, but a subroutine is available for using Young's intuitive derivative method for H2O with Lorentz line shape and exponentially-tailed-inverse line strength distribution. The geometry model provides integration over a hemisphere with up to 6 individually oriented identical axisymmetric plumes, a single 3-D plume. Shading surfaces may be used in any of 7 shapes, and a conical limit may be defined for the plume to set individual line-of-signt limits. Intermediate coordinate systems may specified to simplify input of plumes and shading surfaces. Author

N80-27424*# Xerox Electro-Optical Systems, Pasadena, Calif.
INERT GAS ION THRUSTER DEVELOPMENT Interim Report, Apr. 1978 - Feb. 1979
William D. Ramsey Mar. 1980 99 p refs
(Contract NAS3-21345)
(NASA-CR-159805; XEOS-2372; IR-1) Avail: NTIS HC A05/MF A01 CSCL 21C

Two 12 cm magneto-electrostatic containment (MESC) ion thrusters were performance mapped with argon and xenon. The first, hexagonal, thruster produced optimixed performance of 48.5 to 79 percent argon mass utilization efficiencies at discharge energies of 240 to 425 eV/ion, respectively, Xenon mass utilization efficiencies of 78 to 95 percent were observed at discharge energies of 220 to 290 eV/ion with the same optimized hexagonal thruster. Changes to the cathode baffle reduced the discharge anode potential during xenon operation from approximately 40 volts to about 30 volts. Preliminary tests conducted with the second, hemispherical, MESC thruster showed a nonuniform anode magnetic field adversely affected thruster performance. This performance degradation was partially overcome by changes in the boundary anode placement. Conclusions drawn the hemispherical thruster tests gave insights into the plasma processes in the MESC discharge that will aid in the design of future thrusters. Author

N80-27425# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ROCKET RESEARCH AT GEORGIA TECH. Interim Report, 1 Oct. 1978 - 30 Sep. 1979
E. W. Price, W. C. Strahle, Ben T. Zinn, J. E. Hubbartt, D. H. Neale, R. K. Signan, and B. R. Daniel Nov. 1979 135 p refs
(Contract F49620-78-C-0003; AF Proj. 2308)
(AD-A083764; AFOSR-80-0305TR) Avail: NTIS HC A07/MF A01 CSCL 21/8

Progress is reported on four distinct projects which are administered as a group. The individual projects are identified as tasks and reported on separately. A summary for each task follows: Task I. Work concerned improvement and application of the impedance tube method for measurement of the pressure-coupled combustion response of solid propellants and measurement of the bulk damping in the product flow. Improvements included increased sites and amplitude range of pressure measurements; increased capacity of the data acquisition system; and a modified, more rapid data reduction program. Admittances and bulk loss coefficients of nonaluminized and aluminized propellants were measured over a range of frequencies. Task 2. Studies were continued on external burning using an axisymmetric model at Mach 3. Tests with actual combustion of radially and axially injected hydrogen are then reported. Outstanding performance values with significant base drag reduction is shown for injection and burning directly in the near-wake (base burning). Task 3. Investigations continued on the accumulation processes of aluminum on the propellant burning surface that lead to formation of agglomerate droplets, the size of which dominates aluminum combustion. Task 4. Experimental and analytical studies were continued on the subject of turbulence-induced pressure fluctuations in a rocket-like cavity. A new theory was constructed for the generation of pressure disturbances by the turbulence. Undeniable separation has been achieved between propagational and local pressure fluctuations, and the agreement is adequate. GRA

N80-27426# Aerospace Corp., El Segundo, Calif.
MULTICOLOR INVERSION DIAGNOSTIC FOR TACTICAL MOTOR PLUMES Interim Report
Stephen J. Young May 1980 93 p
(Contract F04701-79-C-0080; AF Proj. 5730)
(AD-A083904; TR-0080(5623)-1; AFRPL-TR-80-30) Avail: NTIS HC A05/MF A01 CSCL 21/2

A theoretical and analytical analysis is presented on the application of multispectral emission/absorption inversion to the retrieval of temperature and concentration profiles of tactical rocket motor plumes. Consideration is given to both monochromatic and band model spectral scales. A main conclusion drawn from the analysis is that application in the infrared on either the monochromatic or wide band spectral scale cannot yield adequate inversions for small plumes with mild temperature gradients such as those encountered for tactical rocket motor. Even under the most ideal circumstances, temperature and concentration errors up to 30% are encountered. The failing of the method is due to the lack of spatial resolution inherent in the inversion weighting functions. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N80-27427 Cornell Univ., Ithaca, N. Y.
THE STATISTICAL STRENGTH OF FIBROUS MATERIALS AS INFLUENCED BY FIBER LOAD-SHARING AND GEOMETRIC CONFIGURATION Ph.D. Thesis
Roland Evan Pitt 1980 205 p
Avail: Univ. Microfilms Order No. 8015720

A linear spring model is presented for approximating the mechanics of a fiber matrix composite. It is observed that in long tubular structures, the load of a failed fiber is spread over a greater number of fibers than local load sharing predicts, but the load is mainly concentrated on the four nearest neighbors, with tapering. As the structure length becomes small in relation to the material properties, the load sharing is found to become that of equal load sharing or local sharing, depending on whether the fiber ends are uniformly deflected or uniformly stressed. The results of the linear spring model are used in the calculation of probablity distributions for the strength of small tubular and hexagonal bundles using the method of failure sequences. In both arrangements, the fibrous assembly exhibits greater mean strength and about the same variability in strength as it would under local load sharing. The linear spring model is also used in the development of a tapered load sharing rule for large tubular bundles and a local load sharing rule for large hexagonal bundles. Dissert. A. tr.

N80-27428*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOISTURE DETERMINATION IN COMPOSITE MATERIALS USING POSITRON LIFETIME TECHNIQUES
Jag J. Singh, William R. Holt, and Willis Mock, Jr. Jul. 1980 23 p refs
(NASA-TP-1681; L-13651) Avail: NTIS HC A02/MF A01 CSCL 11D

A technique was developed which has the potential of providing information on the moisture content as well as its depth in the speciman. This technique was based on the dependence of positron lifetime on the moisture content of the composite specimen. The positron lifetime technique of moisture determination and the results of the initial studies are described. R.C.T.

N80-27429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FEASIBILITY OF KEVLAR 49/PMR-15 POLYIMIDE FOR HIGH TEMPERATURE APPLICATIONS
Morgan P. Hanson 1980 16 p refs Proposed for presentation at the 12th Natl. SAMPE Tech. Conf., Seattle, 7-9 Oct. 1980
(NASA-TM-81560; E-521) Avail: NTIS HC A02/MF A01 CSCL 11D

Kevlar 49 aramid organic fiber reinforced PMR-15 polyimide laminates were characterized to determine the applicability of the material to high temperature aerospace structures. Kevlar 49/3501-6 epoxy laminates were fabricated and characterized for comparison with the Kevlar 49/PMR-15 polyimide material. Flexural strengths and moduli and interlaminar shear strengths were determined from 75 F to 600 F for the PMR-15 and from 75 F to 450 F for the Kevlar/3501-6 epoxy material. The effects of hydrothermal and long-term elevated temperature exposures on the flexural strengths and moduli and the interlaminar shear strengths were also studied. Author

N80-27430# Vought Corp., Dallas, Tex.
INVESTIGATION OF APPLICATION PARAMETERS AND TESTING OF RAIN EROSION COATINGS Final Technical Report
G. W. Kelly 13 Mar. 1980 93 p refs
(Contract N00019-78-C-0125)
(AD-A083578; Rept-2-30400/OR-52380) Avail: NTIS HC A05/MF A01 CSCL 11/4

This program was sponsored in order that the performance of selected rain erosion coatings might be evaluated and that those parameters affecting the performance of these materials might be studied with the goal in mind to upgrade rain erosion coatings for use on high performance aircraft. In order to realize this goal, the following characteristics of two select polyurethane materials were evaluated: coating adhesion to the reinforced composite substrates; solvent evaporation rates or 'solvent release' from each select rain erosion coating material for the purpose of reducing coating porosity of the cured material; a polymerization study related to the chemical reactivity of these moisture reactive materials after exposure to known quantities of free water; a coating familiarization study for each of the rain erosion coating materials; radar signal attenuation studies to determine signal losses through the rain erosion coating; and high-speed erosion tests for selected coating materials and primer combinations. GRA

N80-27431# Stanford Univ., Calif. Div. of Applied Mechanics.
ELASTICITY THEORY OF COMPOSITES Interim Report
J. R. Willis Mar. 1980 83 p refs
(Contract N00014-76-C-0054)
(AD-A083173; SUDAM-80-2) Avail: NTIS HC A05/MF A01 CSCL 11/4

Variational methods for estimating overall properties of composites are reviewed. Bounds that allow for general two-point correlations are emphasized and new explicit formulae are given for a two-component composite. A new general third-order bound is also given. Finally a variational treatment of wave propagation problems for random composites is presented, of which the preceding static formulation is a limiting case. GRA

N80-27432# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
CYLINDRICAL SHELLS OF BIMODULUS COMPOSITE MATERIAL
Charles W. Bert and V. Sudhakar Reddy Feb. 1980 25 p refs Proposed for presentation at the ASCE Natl. Conv., Hollywood, Fla., 27-31 Oct. 1980
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A083974; OU-AMNE-80-3; TR-12) Avail: NTIS HC A02/MF A01 CSCL 11/4

Certain fiber-reinforced materials, especially those with slightly curved fibers in very soft matrices, exhibit considerably smaller stiffnesses when loaded in compression than when loaded in tension. Examples are tire cord-rubber, wire-reinforced solid

propellants, and certain soft biological tissues. For purposes of analysis and design, such materials can be modeled as a bimodulus material, i.e., one having one set of stiffnesses when the fiber-direction strain is tensile and another set when this strain is compressive. Using the fiber-governed bimodulus-material model introduced several years ago by the senior author and verified for cord-rubber composites, the present authors extend their previous work on the deflection of single-layer and cross-ply laminated rectangular plates to circular cylindrical shells of the same construction. A closed-form solution is presented for a thin, freely supported, cylindrically curved panel under sinusoidally distributed loading. Numerical results are presented to show the effect of shell curvature on the neutral-surface positions and deflection. GRA

N80-27433# Texas A&M Univ., College Station. Mechanics and Materials Center.
COMPOSITE MATERIALS FOR STRUCTURAL DESIGN Annual Technical Report, 15 Jan. - 31 Dec. 1979
R. A. Schpey et al. Feb. 1980 97 p refs
(Contract F49620-78-C-0034; AF Proj. 2307)
(AD-A083721; MM-3724-80-1; AFOSR-80-0307TR; ATR-2) Avail: NTIS HC A05/MF A01 CSCL 11/4

Summarized are research activities related to polymer-matrix composite materials in the areas of processing and dynamic mechanical testing, physical aging, delamination fracture characterization, temperature and moisture effects, finite element modelling of nonlinear viscoelastic materials, and neutron radiography. Also included are Abstracts of five M.S. theses and six papers describing several recently completed experimental and analytical research investigations of factors which pertain to processing, testing, and design of composite structures. GRA

N80-27434# Pennsylvania State Univ., University Park. Materials Research Lab.
COMPOSITE PYROELETRIC MATERIALS Final Technical Report, 1 Jul. 1978 - 30 Sep. 1979
R. E. Newnham and A. S. Bhalla 30 Jun. 1979 53 p refs
(Contracts N00014-78-C-0291; MDA903-78-C-0306; ARPA Order 3617)
(AD-A083726) Avail: NTIS HC A04/MF A01 CSCL 11/4

Pyroelectric materials develop electric charge with temperature change. They are used in thermal device applications such as surveillance, burglar alarms and vidicon night-image systems. Greater pyroelectric sensitivity is needed for many vidicon applications. We are exploring ways of increasing the pyroelectric figure-of-merit (pyroelectric coefficient/permittivity) through the use of composite materials. In this report we discuss the results of work carried out at Penn State and at the North American Philips Laboratory (Dr. J. Dougherty and Dr. W. Smith). The design principles and experimental data for a model system are described in the section entitled Pyroelectric PZT composites. For PZT-Spurrs composites with parallel connectivity, the pyroelectric figure-of-merit is more than five times larger than for a poled PZT ceramics. GRA

N80-27435# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
VIBRATION OF COMPOSITE STRUCTURES
Charles W. Bert Mar. 1980 25 p refs Presented at Intern. Conf. on Recent Advan. in Structural Dyn., Southampton, England, 7-11 Jul. 1980
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A084069; OU-AMNE-80-6; TR-13) Avail: NTIS HC A02/MF A01 CSCL 11/4

The purpose of this paper is to review some of the recent contributions to the field of vibration of composite structures. The topics of fatigue and fracture, while quite important in the overall dynamic performance of composite structure, are not considered in this survey. The survey treats these topics: dynamic stiffness and damping of composite materials, beams and curved bars and rings, flat panels, and cylindrically curved panels and shells. It concludes with some suggestions for future research. It is well established that fiber-reinforced composite materials, by virtue of the geometry of the fibers acting stiffeners, behave macroscopically like homogeneous but anisotropic materials. The class of elastic symmetry depends upon the geometric arrangement of the fibers. GRA

N80-27436# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
LARGE DEFLECTION AND LARGE-AMPLITUDE FREE VIBRATIONS OF LAMINATED COMPOSITE-MATERIAL PLATES
J. N. Reddy and W. C. Chao Apr. 1980 29 p refs
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A084070; OU-AMNE-80-7; TR-14) Avail: NTIS HC A03/MF A01 CSCL 11/4

Finite-element analysis of the large-deflection theory (in von Karman's sense), including transverse shear, governing moderately thick, laminated anisotropic composite plates is presented. Linear and quadratic rectangular elements with five degrees of freedom (three displacements, and two shear rotations) per node are employed to analyze rectangular plates subjected to various loadings and edge conditions. Numerical results for bending deflections, stresses, and natural frequencies are presented showing the parametric effects of plate aspect ratio, side-to-thickness ratio, orientation of layers, and anisotropy. GRA

N80-27437# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
RESIDUAL STRESS MEASUREMENTS ON ALUMINUM--GRAPHITE COMPOSITE USING X-RAY DIFFRACTION TECHNIQUES
Swe-Den Tsai, Deepak Mahulikar, H. L. Marcus, Ismail C. Noyan, and J. B. Cohen 8 Apr. 1980 15 p refs Prepared in cooperation with Texas Univ. at Austin
(Contract N00014-75-C-0580; NR Proj. 031-733)
(AD-A083795; TR-26) Avail: NTIS HC A02/MF A01 CSCL 11/4

Metal Matrix Composites (MMCs) have generated considerable interest in the materials field, because of their potential applications in dynamic structures. A MMC with its excellent mechanical as well as physical properties carries a distinct advantage over other composite systems, particulary at high temperatures. At the same time a MMC system is characterized by heterogeneity, anisotropy and interfaces which affect those properties considerably. Interfaces have been known to influence the properties of MMCs significantly and their importance has been discussed extensively. However, the interface chemistry and its exact role in alteration of various properties is not well-known yet. One of the important things needed for better understanding of the interface is its stress state. Thermal and mechanical treatments involved in the fabrication of composite materials, give rise to triaxial residual stresses. Speculations are that these stresses, originating from the differing thermal coefficients of the reinforcement and the matrix, play an important part in the transverse properties of the MMCS. GRA

N80-27438# National Technical Information Service, Springfield, Va.
ABLATION AND ABLATIVE MATERIALS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 168 p Supersedes NTIS/PS-79/0381 and NTIS/PS-78/0313
(PB80-807837; NTIS/PS-79/0381; NTIS/PS-78/0313)
Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

Ablation and the properties and performance of ablative materials are covered in this bibliography. Among the materials cited are pyrolytic graphite, silicon dioxide, carbon-carbon composites, reinforced plastics, expoxy resins, and refractories. Studies include ablative flow, aerodynamic heating, erosion, and combustion. Equipment discussed in these citations are rocket nozzles, nosetips, reentry vehicles, heat shields, shock tubes, and combusiton chambers. Computer programs, spacecraft design, space simulation, mathematical models bibliogaphy contains 161 abstracts, 16 of which are new entries to the previous edition. GRA

best copy available

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-27439 Florida Univ., Gainesville.
SATURATED ATOMIC FLUORESCENCE AS A DIAGNOSTIC TOOL FOR FLAMES AND PLASMAS Ph.D. Thesis
James Neill Bower 1979 178 p
Avail: Univ. Microfilms Order No. 8016512

An experimental approach to the determination of three flame diagnostic parameters is developed. The experimental application of saturated atomic fluorescence to the measurement of quantum efficiency, total number density, and noise power is discussed. Data for quantum efficiency and total number density are compared to the scant literature values. Four elements and three different flame compositions are investigated. Preliminary noise power spectra are discussed as background for the use of saturated atomic fluorescence to measure noise in the atomization and nebulization processes. Dissert. Abstr.

N80-27440 California Univ., Berkeley.
THEORETICAL STUDY OF A REACTION-DIFFUSION MODEL FOR FLAME PROPAGATION IN A GAS Ph.D. Thesis
Shao-Shiung Lin 1979 112 p
Avail: Univ. Microfilms Order No. 8014780

A system of two equations of a reaction diffusion model for flame propagation in a gas is considered. The system of two equations contains a parameter, the Lewis number, which is the ratio of the heat conduction coefficient to the coefficient of chemical species diffusion. Flame fronts are traveling wave solutions connecting an unburned gas state and the corresponding adiabatic burned gas state. Dissert. Abstr.

N80-27441 California Univ., Berkeley.
TIME-RESOLVED SPECTROSCOPY USING SYNCHROTRON RADIATION Ph.D. Thesis
Erwin David Poliakoff 1979 109 p
Avail: Univ. Microfilms Order No. 8014844

The timing characteristics of the SPEAR beam (pulse width less than or equal to 0.4 nsec, pulse repetition period = 780 nsec) were exploited to determine dynamic behavior of atomic, molecular, excimeric, and photodissociative gas phase species excited by vacuum ultraviolet radiation. Fast fluorescence timing measurements were done to determine excited state lifetimes of Kr and Xe. Pressure dependent timing studies on Xe gas at higher concentrations demonstrated some of the problems associated with previous kinetic modeling of the Xe2 system. It was found that even qualitative agreement of observed Xe2 lifetimes as a function of pressure required the assumption that the radiative lifetime was a strong function of internuclear separation. Dissert. Abstr.

N80-27442 California Univ., Berkeley.
CROSSED BEAM REACTIVE SCATTERING OF OXYGEN ATOMS AND SURFACE SCATTERING STUDIES OF GASEOUS CONDENSATION Ph.D. Thesis
Steven Jay Sibener 1979 239 p
Avail: Univ. Microfilms Order No. 8014880

A series of beam surface scattering experiments are described which examined the internal and translational energy dependence of molecular condensation probabilities for collisions involving either CCl4 or SF6 and their respective condensed phases. It is conclusively demonstrated that excitation of a polyatomic molecule's rational and vibrational degrees of freedom can inhibit its probability of sticking upon impact with a cryogenically cooled surface. Dissert. Abstr.

N80-27443 Purdue Univ., Lafayette, Ind.
A MULTITECHNIQUE APPROACH TO SURFACE STUDIES OF METALS AND ALLOYS USING X-RAY PHOTOELECTRON SPECTROSCOPY AND SECONDARY ION MASS SPECTROSCOPY Ph.D. Thesis
George James Slusser 1979 203 p
Avail: Univ. Microfilms Order No. 8015520

X-ray photoelectron spectroscopy (XPS or ESCA) and secondary ion mass spectrometry (SIMS) were combined into the same ultrahigh vacuum system to the study of the reactions occuring on metal and alloy surfaces. The XPS and SIMS instrumentation are contained in separate vacuum chambers, which are interconnected with a set of magnetically driven UHV-compatible sample transfer devices. The effectiveness of the approach was demonstrated in determining the effects of the interaction of charged particles on the surface electronic structure and composition of PdAg alloys of various compositions, and the reaction of CO with polycrystalline foils of Ag, Pd and PdAg alloy. The chemisorption of oxygen on these same polycrystalline foils was also investigated to elucidate the various mechanisms by which oxygen is chemisorbed on these surfaces. Adsorption of O2 is very fast on Pd, reaching saturation at 2L. Adsorption of O2 on Ag is slow, with only 0.1 monolayer of oxygen detected by XPS after 10,000 L exposure. Adsorption of O2 on the 79% PdAg alloy is similar to that of Ag. Dissert. Abstr.

N80-27444 City Univ. of New York, N. Y.
CONFORMATION, ELECTRONIC STRUCTURE AND REACTIVITY AS PROBED BY PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis
Garo Horozoglu Armen 1980 121 p
Avail: Univ. Microfilms Order No. 8014950

The He(I) photoelectron spectra (PES) of complexes of Co(III) with acetylacetone and several derivatives are reported. The ionization potentials of metal localized d-electrons and ligand pi-orbitals are used to probe the extent of metal-to-ligand pi-bonding and possible aromatic character in the chelate ring. The possibility of modifying structure, based on PES results, in order to enhance chemical reactivity is suggested. Dissert. Abstr.

N80-27445 California Univ., Berkeley.
THE KINETICS AND MECHANISM OF THE FORMATION OF OZONE BY THE ANODIC OXIDATION OF WATER Ph.D. Thesis
Peter Chadwick Foller 1979 294 p
Avail: Univ. Microfilms Order No. 8014680

The kinetics and mechanism of the synthesis of ozone by the anodic oxidation of water is described. Relevant prior work in oxygen and ozone evolution kinetics is critically evaluated in discussions of both the optimization of ozone current efficiency, and in speculations as to the mechanism of its formation. The beta crystalline form of lead dioxide is shown to be the most effective anode material for the evolution of ozone. Ozone evolution current efficiencies in many different electrolytes are assessed, and a rationale is developed to explain their sequence. The rationale is based both on the adsorptivity of the anions on anode surfaces, and their electronegativity, that is, their ability to stabilize intermediate cationic species. In general, fluoro-anion electrolytes are found to give higher ozone yields than oxy-anion electrolytes. Dissert. Abstr.

N80-27446 California Univ., Berkeley.
OPTICAL SPECTROSCOPY OF MOLECULES ABSORBED ON THE NICKEL (111) SURFACE Ph.D. Thesis
Antonio Rafael Gallo 1979 217 p
Avail: Univ. Microfilms Order No. 8014691

The ultraviolet spectra of various organic molecules adsorbed to a clean metal surface are studied using spectroscopic ellipsometry. An ultrahigh vacuum system equipped with a liquid helium cooled crystal holder is used to prepare and characterize a clean metal surface and control the formation of the absorbed overlayer. The first observation of excited state vibrational frequencies of pyridine and pyrazine overlayers physisorbed on the nickel (III) surface is reported. The possible interactions of the adsorbed molecule with the metal surface, and propose a geometrical structure for the adsorbed overlayer are discussed. Dissert. Abstr.

N80-27447 Kansas State Univ., Manhattan.
REACTION PATHWAYS FOR ELECTROCHEMICALLY GENERATED RADICAL ANIONS Ph.D. Thesis

Kathy Jo Borham 1979 135 p
Avail Univ Microfilms Order No 8015243

Generation of hypovalent species (viz., carbenes and carbene radical anions) was attempted by the electrochemical reduction of precursors known to produce such species upon photolysis or thermolysis. The electrochemical techniques utilized were cyclic voltammetry, single and double potential step chronoamperometry, and controlled potential electrolysis. All reductions were performed at a platinum cathode in dimethylformamide using a tetraalkylammonium salt as the supporting electrolyte. Significant results are reported. Dissert Abstr

N80-27448 Purdue Univ., Lafayette, Ind.
LOW ENERGY ION MOLECULE REACTIONS IN CHEMICAL IONIZATION aY MASS-ANALYZED ION KINETIC ENERGY SPECTROMETRY Ph.D. Thesis
Douglas Cameron 1979 238 p
Avail Univ Microfilms Order No 8015435

The technique of mass analyzed ion kinetic energy spectrometry (MIKES) was used to obtain structural and thermochemical information from several types of ion/molecule reactions. The site of protonation was of particular interest in terms of studying the intrinsic properties of molecules and in studying the fragmentation patterns of even-electron ions. The MIKE spectra of protonated molecular ions, in general, do not provide unambiguous results concerning the site of protonation, but with deuterium labeling evidence was obtained for ring protonation of phenol and aniline. Ethylation of these substrates was done to model the protonation process. For phenol, ring ethylation, apparently occurs exclusively, while aniline shows competitive ring and N-ethylation. Results for the protonation and ethylation of the isometric cresols and toluidines were also determined. Dissert Abstr

N80-27449 Cornell Univ., Ithaca, N Y
AN INVESTIGATION OF THE EMPIRICAL CALIBRATION METHOD IN QUANTITATIVE SECONDARY ION MASS SPECTROMETRY ANALYSIS Ph.D. Thesis
John Dean Ganjei 1979 137 p
Avail Univ Microfilms Order No 8015772

The empirical calibration method for the quantification of secondary ion intensities in secondary ion mass spectrometry (SIMS) was investigated. Relative sensitivity factors derived from external standards were used to interpret sample secondary ion intensities in terms of elemental concentrations. The SIMS results were compared with the samples' elemental composition determined by other analytical techniques. Two different types of sample matrices were investigated: conducting metal alloys and insulating glass oxides. Dissert Abstr

N80-27450 Cornell Univ., Ithaca, N Y
QUANTITATIVE SECONDARY ION MASS SPECTROMETRIC ANALYSIS USING ION IMPLANTATION Ph.D. Thesis
Daniel Paul Leta 1980 163 p
Avail Univ Microfilms Order No 8015689

The utility of the ion implantation technique for use in quantitative secondary ion mass spectrometry (SIMS) materials characterization was investigated. Many elemental implants into the semiconductor matrices were performed, and the resulting SIMS analysis of these materials has provided a detailed look at both the ion implantation process itself and at SIMS ion yields, sensitivities and detection limits. Dissert Abstr

N80-27451*# National Aeronautics and Space Administration, Washington, D C
OXIDATION OF GALLIUM ARSENIDE IN A PLASMA MULTIPOLE DEVICE. STUDY OF THE MOS STRUCTURES OBTAINED
Serge Gourrier, Andrei Mircea, and Francois Simondet May 1980 58 p refs Transl into ENGLISH of "Oxydation de L'Arseniure de Callium par Plasma en L'Arseniure de Callium par Plasma en Utilisant in Dispositif Multipolaire Etude des Structures Mos Obtenues", Rept LEP-79/62 SME-687-A and DGRST-77-7-1638 Limeil-Brevannes, France, Dec 1978 p 161 Translation was announced as N80-11181 Transl by Scientific Translation Service, Santa Barbara, Calif
(Contract NASw-3198)
(NASA-TM-75471; LEP-79/62 SME-687-A; DGRST-77-7-1638) Avail NTIS HC A04/MF A01 CSCL 07D

The oxygen plasma oxidation of GaAs was studied in order to obtain extremely high frequency responses with MOS devices. In the multipole system a homogeneous oxygen plasma of high density can easily be obtained in a large volume. This system is thus convenient for the study of plasma oxidation of GaAs. The electrical properties of the MOS diodes obtained in this way are controlled by interface states, located mostly in the upper half of the band gap where densities in the 10 to the 13th power/(sq cm) (eV) range can be estimated. Despite these interface states the possibility of fabricating MOSFET transistors working mostly in the depletion mode for a higher frequency cut-off still exists. E D K

N80-27452*# National Aeronautics and Space Administration, Washington, D C
STRUCTURE OF COMPLEXES BETWEEN ALUMINUM CHLORIDE AND OTHER CHLORIDES. 2: ALKALI-(CHLOROALUMINATES). GASEOUS COMPLEXES
Magdolna Hargittai Apr 1980 36 p refs Transl into ENGLISH from Kem. Kozlem., v 50, no 4, 1978 p 489-514 Transl by Kanner (Leo) Associates, Redwood City, Calif
(Contract NASw-3199)
(NASA-TM-75762) Avail NTIS HC A03/MF A01 CSCL 07D

The structural chemistry of complexes between aluminum chloride and other metal chlorides is important both for practice and theory. Condensed-phase as well as vapor-phase complexes are of interest. Structural information on such complexes is reviewed. The first emphasis is given to the molten state because of its practical importance. Aluminum chloride forms volatile complexes with other metal chlorides and these vapor-phase complexes are dealt with in the second part. Finally, the variations in molecular shape and geometrical parameters are summarized. Author

N80-27453*# United Technologies Research Center, East Hartford, Conn.
CONCEPTUAL DESIGN STUDY FOR COHERENT ANTI-STOKES RAMAN SPECTROSCOPY (CARS) DIAGNOSTICS IN THE AMMRC BALLISTIC COMPRESSOR FACILITY Final Report, Jul. - Nov. 1979
John A Shirley and Robert J Hall Mar 1980 55 p refs
(Contract DAAG46-79-C-0060; DA Proj 1L1-6110-EAH-42)
(AD-A083492; AMMRC-TR-80-7) Avail NTIS HC A04/MF A01 CSCL 07/4

A conceptual design of a diagnostic system using coherent anti-Stokes Raman Spectroscopy (CARS) to determine time resolved temperature and species concentrations in the Army Mechanics and Materials Research Center ballistic compressor has been formulated. Performance calculations have been carried out for hydrogen which is an ideal diagnostic species for this application. Results are also presented of computer code calculations of collision narrowed spectra of nitrogen. Several pump laser systems were compared, and a high repetition frequency Nd:YAG laser was determined to be superior. Population saturation, stimulated Raman gain, and optical breakdown are not expected to pose severe limitations on laser intensity or measurement signal-to-noise ratios. Consideration is given to problems pertinent to operation of the ballistic compressor including compressor recoil, window deflections and generation of CARS from the test section windows. Finally, the possibility of using pulsed stimulated Raman gain spectroscopy (SRGS) as an alternative to CARS at the high densities typical of the ballistic compressor has been identified. SRGS appears to offer adequate measurement ability and possesses certain advantages over CARS. GRA

N80-27454# North Carolina Univ. at Chapel Hill. Dept. of Chemistry
SYNTHESIS AND CHARACTERIZATION OF METALLO-ORGANIC CONDUCTING MATERIALS WITH TETRA-AZAANNULENES
William E Hatfield 15 Apr 1980 8 p refs
(Contract N00014-76-C-0816; NR Proj 053-617)
(AD-A083765; TR-10) Avail NTIS HC A02/MF A01 CSCL 07/3

Compounds of the macrocyclic ligand 4,11-dihydro-dibenzo(b,i)(1,4,8,11)tetraaza(14)annulene, dB-TAA, have been prepared with Cu(2-), Ni(2-), Co(2-), Pd(2-), Pt(2-). The palladium complex crystallizes in two crystalline modifications, one of which is similar to the structurally characterized compound Ni(dB-TAA), while the second form packs as cofacial dimers in the solid state. GRA

N80-27455# Purdue Univ., Lafayette, Ind.
SHOCK TUBE STUDIES OF THE N2O/CH4/CO/Ar SYSTEMS
Anthony M. Dean and Ron L. Johnson. Apr. 1979. 43 p. refs. Prepared in cooperation with Univ. of Missouri, Columbia
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A083722; SQUID-UMO-S-PU) Avail: NTIS
HC A03/MF A01 CSCL 07/4

Reflected shock waves were used to heat N2O/C2H6/CO/Ar and N2O/CH4/CO/Ar mixtures to temperatures of 1875-2855 K at total concentrations of 5 x 10 to the 18th power CC. Oxygen atom production was monitored via the flame band emission at 450 nm, and CO2 production was observed at 4.27 micrometers. These data were then compared to the results of numerical integration of the rate equations, using rate constant and mechanistic information obtained in earlier studies of H2 and CH2O under similar conditions. For the C2H6 mixture, it was possible to achieve good agreement between these calculations and the observed data using only one addition reaction O + CH3 yields CH2O + OH. The calculations were insensitive to the precise value used, but the results are consistent with recent high temperature literature values. For the CH4 mixture, the best agreement was achieved using a recent high temperature value for O + CH4 yields CH3 + OH. The data indicated that this reaction has a markedly non-Arrhenius rate constant; use of a value based upon low temperature data gives results inconsistent with those observed. The CH4 system was insensitive to any other methane reaction rate constant. There was some experimental evidence to suggest an unsuspected complexity in methyl radical decay channels at the lowest temperatures observed. The mechanism/rate constant combination used here was then applied to the analysis of literature data for CH3 oxidation by O2. This analysis was designed to obtain a value for the rate constant of CH3 + CH3 + O2 yields CH2O. GRA

N80-27456# Ohio State Univ. Research Foundation, Columbus. Dept. of Aeronautical and Astronautical Engineering.
IGNITION, COMBUSTION, DETONATION, AND QUENCHING OF REACTIVE MIXTURES Interim Report, 1 Apr. 1978 - 31 Mar. 1979
Rudolph Edse. Nov. 1979. 51 p. refs.
(Grant AF-AFOSR-3604-78; AF Proj. 2308)
(AD-A083737; AFOSR-80-0302TR) Avail: NTIS
HC A04/MF A01 CSCL 21/2

The effects of initial gas temperature, pressure, density, and energy transfer to the gas in the detonation wave have been studied to develop an equation which can be used to predict the length of transition from deflagration to detonation (induction distance) in confined and unconfined combustible gas mixtures. Flame speeds of various hydrogen-oxygen-inert gas mixtures have been measured to determine the relationship between flame speed (deflagration) and induction distance. A nozzle burner having a sine curve contour was used for these experiments to obtain well-defined laminar flame cones permitting reliable and reproducible evaluations. The quenching distances of methane-air, methane-oxygen, acetylene-air and hydrogen-air flames were not affected by potassium chloride, sodium-bicarbonate, or potassium phosphate coatings on the quenching surfaces. It was also found that the quenching distances of these flames are independent of the linear speed of the unburned gas as long as the flows are laminar. Variations of the burner width also did not affect the quenching distances. However, rather significant increase of the quenching distances were observed when the narrow sides between the quenching distances were observed when the narrow sides between the quenching surfaces were closed. New iteration formulas have been developed to simplify and reduce the computational work for calculating detonation parameters and the performance of thermal engines (ramjet, rocket, gas turbine, and internal combustion engine). GRA

N80-27457# Naval Research Lab., Washington, D. C.
COMPUTATIONAL APPROACHES TO THE STUDY OF REACTIVE FLOW MIXING Interim Report
Jay P. Boris and Elaine S. Oran. 13 Feb. 1980. 51 p. refs.
(RR0240241)
(AD-A083912; NRL-MR-4137) Avail: NTIS
HC A04/MF A01 CSCL 21/2

The presence of turbulence alters mixing and reaction times in chemically reactive flows. These effects in turn modify the heat and mass transfer rates and hence the local and global dynamics of combustion systems. The goal of this paper is to first describe the fundamental physical processes we must model to understand reactive flow turbulence and then to show how detailed ab initio modelling of these phenomena may be used to help construct phenomenological turbulence model for reactive flows. Three different aspects of reactive flow mixing are identified as focal points for the detailed modelling and several important criteria are established which an accurate and consistent sub grid reactive flow mixing phenomenology should satisfy. One possible representation for such a generalized phenomenology is presented. GRA

N80-27458# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 5: UNSTEADY BURNING OF A LINEAR CONDENSATE Interim Technical Report
J. D. Buckmaster and G. S. S. Ludford. Mar. 1980. 29 p. refs.
(Grant DAAG29-79-C-0121)
(AD-A083738; TR-107; ARO-15882.12-M) Avail: NTIS
HC A03/MF A01 CSCL 21/2

This report is Chapter 5 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. The unsteady burning of a linear condensate is discussed due, for example, to an impinging acoustic wave. Stability of steady states is also considered. GRA

N80-27459# ARO, Inc., Arnold Air Force Station, Tenn.
RAMAN SCATTERING STUDIES OF SOLID-PHASE SPECIES Final Report, 1 Oct. 1977 - 30 Sep. 1979
D. P. Weaver and J. W. L. Lewis. AEDC. Apr. 1980. 41 p. refs.
(AD-A083926; AEDC-TR-80-4) Avail: NTIS
HC A03/MF A01 CSCL 07/4

The Raman spectra of cryosorbed samples of CO2, CO, N2, O2, CH4, NH3, and H2O were obtained. Cryodeposit thickness was nominally 10 to 11 micrometers, and sample temperatures were systematically varied over the range of 17 to 85 K. Spectral scans were obtained for both the lattice mode region (25 to 1/200 cm) and intramolecular vibrational mode region (200 to 2/4000 cm). Additionally, the Raman spectra of single polystyrene latex spheres in diameter and bulk, powdered samples of inorganic particles of NaNo3 and NH4 NO3 were recorded. The dependence of the Raman scattering signature of NaNO2 on sample temperature and the spectral variations as a function of change in concentration of a sample formed from a mixture of NaNO3 and NH3NO3 were investigated. GRA

N80-27460# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ANALYTICAL MODELS FOR THE COMPRESSIVE HEATING IGNITION OF HIGH EXPLOSIVES Final Report
John Starkenberg. Mar. 1980. 44 p. refs.
(DA Proj. 1L1-61102-AH-60)
(AD-A083889; AD-E430415; ARBRL-TR-02225) Avail: NTIS
HC A03/MF A01 CSCL 21/2

Two one-dimensional models to predict the temperature history of an explosive surface subject to compressive heating from the rapid collapse of an adjacent air layer are reported herein. Computations made using the more sophisticated finite compression-rate model show qualitative agreement with the experimental behavior while results obtained from the simpler adiabatic compression model are sometimes misleading. The most important observation is that planar one-dimensional gap closure cannot explain ignition as observed in experiments. Several multidimensional effects have been introduced into the models. The results show that enhanced energy transport caused by convection and turbulence must be present in conjunction with

rapid local pressurization and/or convergent air-flow, unless the enhancement is confined to a boundary layer adjacent to the explosive. In addition, the dieseling mechanism of sensitization has been considered indicating that explosive particle sizes small enough to exhibit increased temperature may be present. GRA

N80-27461# Wisconsin Univ. - Madison. Mathematics Research Center.
EVOLUTION OF DEFLAGRATION IN A COLD COMBUSTIBLE SUBJECTED TO A UNIFORM ENERGY FLUX
A. K. Kapila. Feb. 1980. 35 p. refs
(Contract DAAG29-75-C-0024)
(AD-A083822; MRC-TSR-2040) Avail: NTIS
HC A03/MF A01 CSCL 21/2

The title problem is treated in the limit of large activation energy. It is shown that the evolutionary process takes place in a series of distinct stages, and the spatial and temporal structure of each stage is described. It is found that subsequent to thermal runaway, the behavior of the system resembles that of self-induced combustion, except that the thermal explosion is now confined to a thin surface layer. Burning of an initially cold combustible material is studied. It is assumed that combustion is initiated by heating the surface of the material. This will result in a chemical reaction first occurring at the surface, and then spreading through the material in the form of a flame or deflagration wave. Asymptotic methods are used to study the transient process leading to the establishment of the flame. Attention is confined to solid combustibles, but it is envisaged that the techniques developed here will aid in the eventual understanding of the evolution of gaseous combustion. GRA

N80-27462# Purdue Univ., Lafayette, Ind. Center for Information and Numerical Data Analysis and Synthesis.
THERMOPHYSICAL AND ELECTRONIC PROPERTIES INFORMATION ANALYSIS CENTER (TEPIAC). A CONTINUING SYSTEMATIC PROGRAM ON DATA TABLES OF THERMOPHYSICAL AND ELECTRONIC PROPERTIES OF MATERIALS. Annual Final Report 1 Jan. - 31 Dec. 1979
Y. S. Touloukian and Cho-Yen Ho. Mar. 1980. 124 p. refs
(Contract DLA900-79-C-1007)
(AD-A083943; AMMRC-TR-80-15) Avail: NTIS
HC A06/MF A01 CSCL 05/2

This Annual Final Report on Contract No. DLA900-79-C-1007 covers the activities and accomplishments of the Thermophysical and Electronic Properties Information Analysis Center (TEPIAC) for the period 1 January to 31 December 1979. TEPIAC's activities reported herein include literature search, acquisition, and input of source information; documentation review and codification; material classification; information organization; operation of a computerized bibliographic information storage and retrieval system; data extraction and compilation; data evaluation, correlation, analysis, synthesis, and generation of recommended values; preparation and publication of handbooks, data books, properties literature retrieval guides, state-of-the-art reports, critical reviews, and technology assessments; development of a computerized numerical data storage and retrieval system; technical and bibliographic inquiry services; and current awareness and promotion efforts. TEPIAC covers 14 thermophysical properties and 22 electronic, electrical, magnetic, and optical properties of nearly all materials at all temperatures and pressures and in all environments. GRA

N80-27463# Massachusetts Inst. of Tech., Cambridge. Ralph L. Parson Lab. for Water Resources and Hydrodynamics.
ADSORPTION OF TRACE METALS BY HYDROUS FERRIC OXIDE IN SEA WATER. Ph.D. Thesis. Final Report, 1978
Francois Morel and K. C. Swallow. Jan. 1980. 63 p. refs
Submitted for publication
(Grant EPA-R-803738)
(PB80-152804; EPA-600/3-80-011) Avail: NTIS
HC A04/MF A01 CSCL 07D

The adsorption of trace metals by amorphous hydrous ferric oxide in seawater was studied with reference to simple model systems designed to isolate the factors which may have an effect on the isotherms. Results show that the complex system behaves in a remarkably simple way and that the data obtained under various conditons of total metal concentration and total oxide concentration can be reduced to an apparent reaction constant, K which is a function of pH only. the high capacity of the oxide for trace metals renders the concept of a surface reaction useless to explain the uptake of metals. A physical picture of the oxide as a swollen hydrous get permeable to hydrated ions is presented. GRA

N80-27464# Cincinnati Univ., Ohio. Physical and Chemical Methods Branch.
PROGRAM DOCUMENTATION FOR THE GAS CHROMATOGRAPHY AUTOMATION SYSTEM
Jonathan E. Kopke. Feb. 1980. 188 p.
(Contract EPA-GS-05S-10458)
(PB80-166481; EPA-600/4-80-001)
Avail: NTIS HC A09/MF A01 CSCL 14B

The program listings, program flowcharts, symbol definitions, symbol references, and program descriptions of all the BASIC language programs which implement the functional specifications for an advanced chromatography automation system are presented. The structure of all data file is also completely described. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-27465 California Univ., Berkeley.
THE EFFECTS OF NON-CARBIDE FORMING ELEMENTS ON THE MECHANICAL PROPERTIES AND MICROSTRUCTURE OF A SECONDARY HARDENING STEEL Ph.D. Thesis
Warren Manford Garrison, Jr. 1979. 248 p.
Avail: Univ. Microfilms Order No. 8014694

The influence of additions of Si and a combination of Si and Al on the microstructure and mechanical properties of secondary hardening steels was investigated as a function of austenitizing and tempering temperatures. The secondary hardening steels with Si and Al additions showed a marked improvement in toughness with increasing austenitizing temperature, while the toughness of secondary hardening steels not containing Si or Al decreased with austenitizing temperature. It was observed that the Si and Al - Si additions delayed softening on tempering to temperatures above 550 C. The Si additions were found to completely repress the precipitation of intralath cementite and stabilized the epsilon carbides to tempering temperatures above 400 C. The fracture toughness of some of the secondary hardening steels alloyed with Si and Al was found to be over twice that of conventional medium carbon secondary hardening steels of comparable strength levels. The effect of Si and Mo on tempered martensite embrittlement was also studied. The results show that Si and Mo delay tempered martensite embrittlement to higher tempering temperatures. Dissert. Abstr.

N80-27466 California Univ., Los Angeles.
THE SULFIDATION BEHAVIOR OF NICKEL-CHROMIUM, NICKEL-ALUMINUM, AND NICKEL-CHROMIUM-ALUMINUM ALLOYS WITH AND WITHOUT YTTRIUM Ph.D. Thesis
Evan J. Vineberg. 1980. 217 p.
Avail: Univ. Microfilms Order No. 8016056

The sulfidation kinetics were determined using a continuous weight gain system. Mechanisms of the sulfidation reactions were deduced from the kinetics behavior, scale analyses, and morphological observations. Marker experiments were performed for several of the alloys. Analytical tools used in the study included X-ray diffraction analysis, metallographic examination, scanning electron microscopy, X-ray energy dispersive analysis, X-ray mapping, and Auger analysis. Except for the alloys with high chromium content (50 w/o chromium), the mechanism of scale formation was found to be one of counter-current diffusion with a net inward flux of sulfur. The scales were nonprotective, and linear kinetics were observed. In the presence of 50 w/o chromium, a protective Cr_2S_3 layer formed by outward cation diffusion, and parabolic kinetics were observed. The rate of sulfidation was shown to decrease with increasing chromium and aluminum concentrations. The addition of 1 w/o yttrium

consistently reduced the sulfidation rate. It is postulated that the presence of yttrium promotes the formation of a Cr2S3 and/or Al2S3 layer which is more protective than that which forms in the absence of yttrium. Dissert. Abstr.

N80-27467 California Univ., Berkeley.
AN INVESTIGATION OF THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF THICK SECTION Cr-Mo STEELS Ph.D. Thesis
Rameshchandra Jitendrakumar Kar 1979 161 p
Avail: Univ. Microfilms Order No. 8014755

An investigation was carried out to correlate the microstructure and mechanical behavior in thick section Cr-Mo steels. It was found that the transformation products of slow-cooled 2.25 Cr-1Mo steel, consisted of mixtures of bainite and polygonal ferrite. The bainitic carbides were a mixture of interand intra-lath cementite and it was found that these played an important role during subsequent tempering. These poor properties were attributed to undesirable morphologies of the microconstituents in 2.25 Cr-1Mo steel. It was found that minor additions of Ni/Mn were effective in eliminating free ferrite from slow-cooled 2.25 Cr-1Mo. The effect of Ni/Mn alloy modification was to alter the tempering response of the continuously cooled bainites. Precipitation of alloy carbides was observed at lower temperatures than in the 2.25 Cr-1Mo base alloy. Temper embrittlement studies were carried out on commercial heats of 2.25 Cr-1Mo and two of its Ni-Mn modifications. Dissert. Abstr.

N80-27468 California Univ., Berkeley.
THE MECHANISM OF MICROSTRUCTURAL CHANGE AND ITS CONSEQUENCES IN A LOW CARBON 6 NICKEL ALLOY Ph.D. Thesis
Jungihl Kim 1979 130 p
Avail: Univ. Microfilms Order No. 8014759

The mechanism of microstructural changes during a three-step thermomechanical treatment and the effects of resulting microstructures on mechanical properties were investigated in a low carbon Fe-6Ni alloy. Refinement of the grain size appeared to be achieved after two step treatment. Heating by temperature cycling up to the austenite reversion temperature was found primarily to refine prior austenite grains. Controlled rolling was revealed to be an effective means to replace these thermal cyclings. Two-phase tempering showed ultrafine grains through two phase decomposition and development of subgrains with large angle grain boundaries. In the first intercritical annealing process, regions of high alloy element concentration were provided and these regions were revealed to be preferential sites for a second two phase decomposition. The effects of the stable precipitated austenite were found to be beneficial to fracture toughness by either scavenging a deleterious carbide precipitation in the austenite or by preventing a sharp crack propagation. Dissert. Abstr.

N80-27469 Washington Univ., Seattle.
BETA DECOMPOSITION IN BINARY Ti-Cr ALLOYS Ph.D. Thesis
V. Chandrasekaran 1979 162 p
Avail: Univ. Microfilms Order No. 8013509

The transformation behavior and properties of binary Ti-Cr alloys were studied with special emphasis on the following: (1) the isothermal transformation from the metastable beta to the transitional omega phase; (2) the influence of microstructure on the temperature coefficient of electrical resistivity (TCR); (3) the mechanical properties and fracture modes associated with the beta plus omega and omega reverted microstructure. The lack of one-to-one correspondence between the beta and the omega precipitates is consistent with separate nucleation sites for the omega phase. Evidence is presented which suggests that the final transition to discrete omega particles is triggered by strain. The omega morphology is not well defined during the initial stages of precipitation. With continued aging the morphology is distinctly platelike and the omega particles form parallel to the [110] beta and [112] beta planes. The negative TCR was established as a singular property of the metastable beta phase. The TCR is very sensitive to omega precipitation and can be used to monitor the onset and progress of the omega reaction during aging and deformation. Dissert. Abstr.

N80-27470 Pittsburgh Univ., Pa.
THE STRENGTH AND PLASTIC PROPERTIES OF DILUTE COPPER-TITANIUM ALLOY SINGLE CRYSTALS Ph.D. Thesis
James Greggi, Jr. 1979 254 p
Avail: Univ. Microfilms Order No. 8015380

Cu-1.2 at percent Ti (0.9 wt percent) alloy single crystals were grown by a modified Bridgment technique and seeded to produce orientations close to the 'soft' [123] direction. Solution treated and quenched tensile specimens were aged at 673 K for times up to 2 x 10,000 min. Simple tensile tests were conducted over a temperature range extending from 77 K to 473 K at a nominal strain rate of 8.3 x 0.0001/sec. For crystals aged to contain discrete, order beta particles, plastic flow was initiated by the formation and propagation of a Luders band, followed by uniform deformation up to the maximum load. The coarse secondary slip formed as a stable Luders band at 77 K but led to tensile instability and fracutre at higher test temperatures. The yield strength and various parameters related to the deformation behavior such as workhardening rates, extent of primary slip, overshoot of the symmetry boundary, and the coarseness and disposition of the secondary slip bands were all found to vary systematically with particle size and strength and testing temperature. The aging response was initially weak but increased significantly for aging times between 10 min and 1,000 min. For aging times longer than 1,000 min, the aging response decreased sharply, but the yield strength continued to increase slowly resulting in a broad aging peak. Dissert. Abstr.

N80-27471 Pittsburgh Univ., Pa.
THE MICROSTRUCTURAL BEHAVIOR OF AUSTENITE DUE TO HOT ROLLING Ph.D. Thesis
Elliot Lewis Brown 1979 309 p
Avail: Univ. Microfilms Order No. 8015376

The microstructural behavior of High-Strength Low-Alloy (HSLA) austenite subjected to relatively simple thermomechanical treatments as well as more complexed treatments are discussed. The following areas are emphasized: (1) starting material characterization and behavior during reheating; (2) thermomechanical treatment of typical C-Mn and HSLA steel compositions in the form of single and double pass (50 percent reduction) rolling schedules; and (3) thermomechanical treatment of a model, stable austenitic material. The microstructural behavior is characterized by optical microscopy, transmission electron microscopy, electron diffraction, analysis of chemically isolated precipitates, and crystallographic texture measurement. The importance of AlN and microalloy precipitation in controlling the microstructural behavior of the steel during reheating is emphasized. Abnormal grain growth resulted at low to intermediate austenite reheat temperatures and rapid normal grain growth at high austenite temperatures. Dissert. Abstr.

N80-27472 Johns Hopkins Univ., Baltimore, Md.
THE MAGNETIC PROPERTIES OF AMORPHOUS (Fe-Ni-Co)-METALLOID ALLOYS Ph.D. Thesis
Daniel Paul Musser 1980 164 p
Avail: Univ. Microfilms Order No. 8014728

The magnetic properties of several amorphous transition metal-metalloid alloys were studied with Fe-57 Mossbauer spectroscopy. The transition metal elements in the alloys are Fe, Ni, and Co; the metalloid elements are B, P, C, and Al. The alloys studied included several series in which the Fe to Ni or Fe to Co concentration is varied, with the metalloid concentration being fixed; several in which the metalloid concentration is varied with the metal concentration being fixed; and the binary series Fe sub x B sub 100-x. Dissert. Abstr.

N80-27473*# National Aeronautics and Space Administration, Washington, D. C.
THE CRITICAL POINTS OF ALLOYS OF IRON AND COBALT DURING RAPID HEATING
V. N. Gridnev (Academy of Sciences of the Ukranian SSR, Kiev) and S. P. Oshkaderov (Academy of Sciences of the Ukranian SSR, Kiev) Apr. 1980 7 p refs Transl. into ENGLISH from Metallofizika (USSR), no. 27, 1970 p 80-84 Original language document was announced as A70-36203 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)
(NASA-TM-75825) Avail: NTIS HC A02/MF A01 CSCL 11F

The influence of the rate of heating on the position of the critical points of iron-cobalt alloys was studied. It is shown that when an alloy with 8% Co by weight is heated at the rate of 7000 deg/sec, a shift in the temperature of phase conversion of almost 30 deg occurs. When an alloy with 15% Co by weight is heated at the same rate, the conversion temperature is shifted by approximately 20 deg. For an alloy with 15% Co by weight, for which under ordinary conditions of heating the points of phase conversion and magnetic randomization (the Curie point) coincide, it was possible to show that for high rates of heating, a separation with respect to temperature occurs which clearly confirms the fact of the shift in the critical points of phase conversion. Author

N80-27474# Georgia Inst. of Tech., Atlanta. Fracture and Fatigue Research Lab.
THE EFFECT OF MICROSTRUCTURE ON THE PROPERTIES OF HIGH STRENGTH ALUMINUM ALLOYS Annual Report, Feb. 1979 - Feb. 1980
Edgar A. Starke, Jr. and T. H. Sanders, Jr. Feb. 1980 67 p refs
(Grant AF-AFOSR-3471-78; AF Proj. 2306)
(AD-A083768; AFOSR-80-0367TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

This program was initiated on 1 January 1978. During 1979, the effect of copper content on the FCP behavior of four Al-6Zn-2Mg-XCu-T7351 alloys was investigated in dry air and distilled water and compared with last year's study of the T651 condition. The peak-aged-treatment exhibited a lower growth rate in dry air over the range of delta K studied, and also displayed a higher threshold and resistance to fatigue cracking near the threshold in the distilled water environment. GRA

N80-27475# Cornell Univ., Ithaca, N. Y. School of Chemical Engineering.
FUNDAMENTAL STUDIES OF THE STRUCTURE AND CHEMISTRY OF SOLID SURFACES Final Report
Robert P. Merrill Jan. 1980 27 p refs
(Contract F49620-77-C-0118; AF Proj. 2303)
(AD-A083964; AFOSR-80-0295TR; SSN-222-26-6728) Avail: NTIS HC A03/MF A01 CSCL 11/6

Decomposition of hydrazine has been studied on Ir(111) from temperatures below 200k up to 1500k using a supersonic molecular beam scattering system. The decomposition begins around 200k producing nitrogen, ammonia, and hydrogen. An extremely strong angular dependence was found for nitrogen. This is the first time normally directed emission of nitrogen has been observed for surface decomposition. A Fourier transform of the entire waveform has been utilized to deduce the details of the decomposition mechanism. Photoemission from hydrazine and ammonia on Ir(111) using high intensity polarized UV radiation has been investigated. The results are consistent with the data from the scattering experiments. AES was used to monitor the absorption of oxygen on Al(111) surfaces and was found to be dependent on both time and oxygen pressure. Further studies will concentrate on the kinetics of aluminum oxidation. GRA

N80-27476# Princeton Univ., N. J.
THE EMBRITTLEMENT OF ALLOYS UNDER IMPULSE THERMAL, PRESSURE AND CHEMICAL CONDITIONS Final Report, 1 Dec. 1978 - 30 Nov. 1979
A. Kahn Apr. 1980 8 p refs
(Grant DAAG29-79-G-0038)
(AD-A083743; ARO-1916152.2-A-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

During the past two years, we directed our metallurgical study of the embrittlement of bore surfaces toward the examination of the composition of large-calibre gun barrel surfaces via the combines SEM/SAM (Scanning Electron Microscope/Scanning Auger Microprobe) techniques. In this final report, we outline the principal results of this study. GRA

N80-27477# Pennsylvania Univ., Philadelphia.
ELECTRONIC EFFECTS OF SULFUR IN NICKEL: A MODEL FOR GRAIN BOUNDARY EMBRITTLEMENT Interim Report
C. L. Briant and R. P. Messmer 10 Apr. 1980 19 p refs
Prepared in cooperation with General Electric Co., Schenectady, N.Y. Submitted for publication
(Contract N00014-79-C-0991)
(AD-A083649; TR-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

This paper reports the first study employing detailed electronic structure calculations to investigate a model of grain boundary embrittlement. The results show that adding sulfur to a cluster of nickel atoms causes strong bonds to be formed between the sulfur atom and the nickel atoms nearest to it, while simultaneously weakening bonds between these nickel atoms and their neighboring nickel atoms in the cluster. As a consequence one can suggest that sulfur forms very strong bonds within the plane of the boundary but weakens metal-metal bonds perpendicular to this plane. Although, for the present, the results can be considered only as suggesting one possible embrittlement mechanism, they do demonstrate the insight which such calculations can provide into this very central question of grain boundary embrittlement. GRA

N80-27478# Georgia Inst. of Tech., Atlanta. Fracture and Fatigue Research Lab.
THE EFFECT OF ION PLATING AND ION IMPLANTATION ON THE CYCLIC RESPONSE AND FATIGUE CRACK INITIATION OF METALS AND ALLOYS Technical Progress Report, 1 Mar. 1979 - 29 Feb. 1980
S. B. Chakrabortty, S. Spooner, and Edgar A. Starke, Jr. 9 Apr. 1980 61 p refs
(Contract N00014-78-C-0270)
(AD-A083643; TR-2) Avail: NTIS HC A04/MF A01 CSCL 11/6

Fatigue crack initiation can be affected by surface phenomena and the possibility exists for improving the fatigue performance by altering the state of the surface without greatly changing bulk properties. This program was initiated on 1 March 1978, with the objective of determining the effect of ion implantation and ion plating on the cyclic stress-strain response and fatigue crack nucleation of a metal substrate. To meet this objective, we have selected surface film-substrate combinations designed to separate the various parameters, e.g., crystal structure, SFE, shear modulus, misfit, residual stress, etc., which control near surface deformation and associated crack initiation. This report summarizes our progress during the period 1 March 1979 - 29 February 1980. Three aspects of the program are discussed: (1) The effect of silver and nickel ion plating on the low and high cycle fatigue behavior of polycrystalline copper, (2) x-ray diffraction analysis of ion implanted crystals, and (3) the effect of aluminum-ion implantation on the fatigue crack initiation of polycrystalline copper. GRA

N80-27479# California Univ., Los Angeles.
DETERMINATION OF RESIDUAL STRESS BY MAGNETOMECHANICAL ACOUSTIC EMISSION
Kanji Ono, M. Shirata, and May M. Kwan Apr. 1980 22 p refs Presented at ASM Conf. on Residual Stress for Designers and Engrs., Chicago, 9-10 Apr. 1980
(Contract N00014-75-C-0419)
(AD-A084065; TR-80-01-ONR) Avail: NTIS HC A02/MF A01 CSCL 11/6

This paper presents a newly discovered method for residual stress measurements. It applies to ferromagnetic materials only, but has a greater depth of penetration than X-ray diffraction and other methods, and is nondestructive. Materials under test are subjected to alternating magnetic fields. When internal structures of magnetic domains are altered, ultrasonic waves are generated; that is acoustic emission. This magnetomechanical acoustic emission (MAE) depends on the level of residual stress. It is also affected by the chemical composition, microstructure (heat treatment) and prior cold working of the material. Basic behavior and dependencies of MAE are to be described. Several applications will be discussed, including MAE measurements on structural shapes, welds and railroad rails. GRA

N80-27480# Bureau of Mines, Albany, Oreg. Albany Metallurgy Research Center.
IRON-BASED ALLOYS STRENGTHENED BY TERNARY

LAVES PHASES
J. S. Dunning 1980 19 p refs
(PB80-157233; BM-RI-8411) Avail: NTIS HC A02/MF A01 CSCL 11F

As a possible substitute for the solid solution strengthening of chromium and nickel, the precipitation hardening characteristics of a number of binary iron-based systems in which Laves phase precipitates, such as Fe2Mo, are formed were investigated. Several hardening responses were observed, but none was ideal. The Fe-Ta binary system had the highest magnitude of hardening, even with low alloy additions, and the Fe-Mo system had unique stability at temperature. Accordingly, the Fe-Mo-Ta system was selected for study to determine if a ternary Laves phase could combine high hardening with long-term stability at elevated temperature. GRA

N80-27481# National Materials Advisory Board, Washington, D. C. Commission on Sociotechnical Systems.
ANALYSIS OF LIFE PREDICTION METHODS FOR TIME-DEPENDENT FATIGUE CRACK INITIATION IN NICKEL-BASE SUPERALLOYS Final Report
1980 96 p refs Sponsored in part by DOD, Washington, D.C.
(Contract MDA903-74-C-0167)
(PB80-158116; NMAB-347) Avail: NTIS HC A05/MF A01 CSCL 11F

The design of turbine disks for high performance aircraft gas turbine engines requires an elevated temperature, time dependent fatigue lifetime prediction method for advanced nickel base superalloys. Two prominent empirical methods, strain range partitioning and frequency modified fatigue life, contain elements that are suited to representing viscoplastic and oxidation assisted cracking but require modification to meet the requirements of turbine disk design in the early stages of use. In addition, these methods have not yet been applied successfully to the formation and link up of microcracks and thus are not suitable where this process constitutes the major portion of the initiation lifetime. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-27482 Washington Univ., Seattle.
THE BIOSYNTHESIS OF NATURAL RUBBER AND OTHER HYDROCARBON POLYMERS Ph.D. Thesis
Kevin Richard Hirschbuehler 1979 243 p
Avail: Univ. Microfilms Order No. 8012196

The rate at which rubber and/or hydrocarbon latices isolated from various plants incorporate isopentenyl pyrophosphate and sodium acetate was determined. The latices used were obtained from Hevea brasiliensis, Euphorbia tirucalli, Ficus elastica, Castilla elastica, and Manihot glaziovii. All of these latices continued to generate rubber (or hydrocarbon) after isolation. They converted isopentenyl pyrophosphate and sodium acetate to water insoluble hydrocarbon polymers. Latices isolated from various plants significantly in their rate of rubber and hydrocarbon production. Euphorbia tirucalli latex was significantly more reactive to sodium acetate incorporation than the other latices, and Hevea brasiliensis latex was significantly more reactive to isopentenyl pyrophosphate incorporation than the other latices. Dissert. Abstr.

N80-27483*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF W AND WC ON THE OXIDATION RESISTANCE OF YTTRIA-DOPED SILICON NITRIDE
Susan Schuon 30 Apr. 1980 12 p refs Presented at the Annual Meeting of the Am. Ceramic Soc., Chicago, 28-30 Apr. 1980
(NASA-TM-81528; E-9744) Avail: NTIS HC A02/MF A01 CSCL 07C

The effect of W and WC contamination on the oxidation and cracking in air of sintered Si3N4 - 8 w/o Y2O3 ceramics at 500, 750, and 1350 C is examined. A mixture of Si3N4 - 8Y2O3, milled with alumina balls, was divided into four portions. Three portions were doped with 2 w/o WC W, and 4 w/o W respectively, in order to simulate contamination during milling. The fourth portion was undoped and used on a control. The addition of W or WC did not affect the phase relationships in the system, as all bars with or without additions contained melilite as the major Si-Y-O-N phase after sintering. At 750 C, instability (rapid oxidation and cracking) of W-doped bars appears to have occurred as a result of oxidation of the tungsten containing melilite phase. No intermediate temperature instability was observed in bars containing 2 w/o WC or in bars with no additive. Specimens exposed at 1350 C had good oxidation resistance due to the formation of a protective siliceous oxide layer. A specimen containing 4 w/o W which was preoxidized at 1350 C had improved oxidation resistance at 750 C. The tendency towards oxidation and cracking of Si3N4 - 8 Y2O3 at 750 C is concluded to be related to tungsten content of the sintered bars. M.G.

N80-27484*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF STARTING POWDER CHARACTERISTICS ON DENSITY, MICROSTRUCTURE AND LOW TEMPERATURE OXIDATION BEHAVIOR OF A Si3N48w/o Y2O3 CERAMIC
Susan Schuon and Sunil Dutta 1980 23 p refs Presented at the Ann. Meeting of the Am. Ceramic Soc., Chicago, 28-30 Apr. 1980
(NASA-TM-81536; E-490) Avail: NTIS HC A02/MF A01 CSCL 07D

The densification and oxidation behavior of Si3N4 - 8w/oY2O3 prepared from three commercial starting powders were studied. Bars of SN 402, SN 502, and CP 85/15 were sintered for 3 to 4.5 hours at 1750 C. A second set was hot pressed for 2 hours at 1750 C. The microstructures were studied by transmission electron microscopy and scanning electron microscopy, densities were determined, and the phase compositions were determined by X-ray diffraction. Densification and microstructure were greatly influenced by the starting powder morphology and impurity content. Although SN 402 exhibited the maximum weight lose, the highest sintered and hot pressed densities were obtained with this powder. All powders had both equiaxed and elongated grains. Sintered bars were composed of beta silicon nitride and n-melelite. In contrast, hot pressed bars contained beta silicon nitride, H-phase, and J-phase, but no melelite. Yttria distribution in sintered bars was related to the presence of cation impurities such as Ca, Fe, and Mg. A limited oxidation study at 750 C in air showed no instability in these Si3N4 - 8 w/oY2O3 specimens, regardless of startin powder. Author

N80-27485# Akron Univ., Ohio. Inst. of Polymer Sciences.
TEAR STRENGTH AND TENSILE STRENGTH OF MODEL FILLED ELASTOMERS
P. Dreyfuss, A. N. Gent, and J. R. Williams 10 Apr. 1980 29 p refs
(Contract N00014-76-C-0408; NR Proj. 092-555)
(AD-A083168; TR-7) Avail: NTIS HC A03/MF A01 CSCL 11/9

Measurements have been made of the tear strength, tensile strength, and energy dissipated during stretching for model filled elastomers consisting of polybutadiene with glass beads incorporated. The glass beads were pretreated with various silanes, some of which could, in principle, form covalent bonds with the polybutadiene matrix during free-radical crosslinking of the latter and some of which could not. The tear strength of the elastomer was increased by the addition of glass beads, by about 25 per cent for the largest beads, having a mean diameter of 150 micrometers. This effect is attributed to increased roughness of the tear path. The breaking elongation in tension was reduced by the addition of glass beads but the breaking stress was only seriously reduced for the least-well-adhering beads. GRA

N80-27486# Douglas Aircraft Co., Inc., Long Beach, Calif.
PRIMARY ADHESIVE BONDED STRUCTURE TECHNOLOGY (PABST). PHASE 3: TOOLING, FABRICATION AND QUALITY ASSURANCE Final Report, Feb. 1975 - Jun. 1979
K. L. Land and F. B. Lennert 15 Oct. 1979 107 p refs
(Contract F33615-75-C-3016; AF Proj. 486U)
(AD-A083228; MDC/MR/DR-983; AFFDL-TR-79-3154) Avail:

NTIS HC A06/MF A01 CSCL 11/2

The Primary Adhesively Bonded Structure Technology (PABST) program's overall objective was to demonstrate significant improvements in cost, integrity, and durability of primary fuselage structures using latest adhesive bonding techniques, materials, and processes. Accordingly, this document summarizes the findings during Phase 3, Fabrication, and details highlights of the Manufacturing and Quality Assurance effort in the areas of Tooling and Fabrication. Construction of the Full Scale Demonstration Component (FSDC) provides important performance comparisons of various bond tools, surface preparation techniques, adhesives, primers, bagging approaches and inspection methods. The fabrication of large constant and non-constant section bonded panels for the FSDC also provided invaluable manufacturing experience; established a natural testbed for validation of Phase 2, Detail Design; and yielded excellent feedback for advancement of the PABST technology in Engineering, Materials and Process, and Quality Assurance. GRA

N80-27487# Wyoming Univ., Laramie. Dept. of Mechanical Engineering.

FATIGUE BEHAVIOR OF HERCULES 3501-6 EPOXY RESIN Final Report, Sep. 1978 - Dec. 1979

David E. Walrath and Donald F. Adams 25 Jan. 1980 48 p refs

(Contract N62269-78-C-0340)

(AD-A083494; UWME-DR-004-101-1; NADC-78139-60) Avail: NTIS HC A03/MF A01 CSCL 11/9

Plates and solid rods of Hercules 3501-6 neat epoxy were cast, from which tensile, compressive and torsional shear specimens were machined. Half of the tensile specimens were moisture-preconditioned for six months at 65 C in a 98% RH environment. Room temperature static and fatigue tests were conducted, and a scanning electron microscope used to examine representative failure surfaces. Stress versus number of cycles to failure plots were prepared. GRA

N80-27488# Army Armament Research and Development Command, Watervliet, N. Y.

EFFECT OF CVD TUNGSTEN AND TaClaC COATINGS ON THE MECHANICAL BEHAVIOR OF SiC(C)

I. Ahmad, N. Hill, and W. Heffernan Dec. 1979 49 p refs

(DA Proj. 1L1-62105-AH-84)

(AD-A083395; AD-E440058; ARLCB-TR-79035) Avail: NTIS HC A03/MF A01 CSCL 11/3

Effects of the chemically-vapor-deposited tungsten and TaC coatings on the mechanical properties of silicon carbide (carbon core) filament have been investigated. In the temperature range of interest, because of the possible chemical interaction of tungsten with carbon rich silicon carbide phase on its surface and the columnar grain structure of the coating the filament was found to be embrittled. However, by controlling the initial nucleation of tungsten by adjusting the temperature, the direction of flow of reactants and filament speed, the degradation effect of the coating can be minimized. TaC coating did not decrease the strength of the filament, because it did not react with the filament and had fine grain structure. Coatings of tungsten and TaC decreased the 100 hr 2000 deg F, rupture strength of the filament from 1.9 GN/sq M (280 Ksi) to respectively 1.05 GN/sq M (150 Ksi) and 1.6 GN/sq M (240 Ksi). The tensile strength of the W coated filament was superior to that coated with TaC in the temperature range 1000-1500 deg C. Thermal cycling (room temperature - 1600 deg C) induced cracks in the TaC coating while W coating remained unaffected. GRA

N80-27489# Colorado State Univ., Fort Collins. Dept. of Chemistry.

HEAT STABLE POLYMERS: POLYQUINOLINES AND OTHER AROMATIC POLYMERS Final Report, Jan. 1977 - Dec. 1979

J. K. Stille 1 Jan. 1980 35 p refs

(Grant DAAG29-77-G-0177)

(AD-A083129; ARO-1503.12-C) Avail: NTIS HC A03/MF A01 CSCL 11/9

Polyquinolines can be synthesized by an acid catalyzed polymerization reaction that allows a variety of structural modifications, resulting in a range of chain stiffness that can be altered from a relatively flexible amorphous polymer with a moderately low glass transition temperature (250 deg C) to a rod-like molecule with a high degree of crystallinity and a high crystalline transition temperature (>550 deg C). Fibers can be spun and films cast from solution. The rigid rod polyquinolines form anisotropic solutions and, as a result, produce crystalline fibers with a high degree of orientation and a high modulus. A series of polyquinolines containing biphenylene units in the main chain were prepared in order to effect crosslinking reactions of these materials. Crosslinking took place thermally, above the Tg of the polymer, to give insoluble polymers with higher Tg's and higher moduli both above and below Tg. Transition metals catalyze the crosslinking reactions, allowing lower curing temperatures. Polyaramides, polybenzimidazoles and polyquinoxalines could be similarly crosslinked by incorporating biphenylene into these polymers. GRA

N80-27490# University Coll. of North Wales, Bangor.

A STUDY OF THE NATURE AND ORIGINS OF PYROELECTRICITY IN POLYVINYLIDENEFLUORIDE AND ITS COPOLYMERS Final Technical Report, Feb. 1978 - Oct. 1979

D. K. Das-Gupta Jan. 1980 149 p refs

(Grants DA-ERO-77-G-088; DA-ERO-78-G-004)

(AD-A084448) Avail: NTIS HC A07/MF A01 CSCL 11/9

The results of these experiments indicate that at least a large part of the polarization in PVF2 after poling is due to dipole orientation in the crystalline regions. There is ample evidence to show that crystallites are aligned by the poling field and remain in or close to this new angular position when the field is removed. Aging experiments indicate that they do not return to their original positions even after annealing at high temperature. GRA

N80-27491# Cambridge Univ. (England).

LIQUID IMPACT EROSION MECHANISMS IN TRANSPARENT MATERIALS Interim Scientific Report, 30 Sep. 1978 - 30 Sep. 1979

J. E. Field, M. J. Mathewson, and S. vanderZwaag Wright-Patterson AFB, Ohio AFWAL Nov. 1979 47 p refs

(Grants AF-AFOSR-0125-78; AF-AFOSR-3705-78; AF Proj. 2422)

(AD-A084267; AFWAL-TR-80-4057) Avail: NTIS HC A03/MF A01 CSCL 17/5

A study has been made of damage mechanisms caused by liquid drop impact on various infra-red transparent solids. Techniques are described for producing liquid jets which simulate the damage produced by impact with spherical drops. Advantages of this approach are the simplicity of the experimentation, the low construction cost and the broad range of drop size and velocity which can be covered. A hydraulic strength measuring apparatus for brittle materials is described which allows 'residual strengths' to be measured. Materials examined in this report include silicon nitride, zinc sulphide and zinc selenide. GRA

N80-27492# Universal Energy Systems, Inc., Dayton, Ohio.

ELECTRON SPECTROSCOPIC STUDIES OF SURFACES AND INTERSURFACES FOR ADHESIVE BONDING Final Report, Jan. 1977 - Aug. 1979

Gerald E. Hammer and J. T. Grant Jan. 1980 86 p refs

(Contract F33615-77-C-5040; AF Proj. 2303)

(AD-A084254; AFML-TR-79-4220) Avail: NTIS HC A05/MF A01 CSCL 11/3

This report summarizes the results from a thirty-one month research effort conducted to study the interaction of simple organic molecules on aluminum and titanium surfaces prepared for adhesive bonding using electron spectroscopic techniques. Other electron spectroscopic studies of specimens related to the surface phenomena program are also reported. GRA

N80-28032# Joint Publications Research Service, Arlington, Va.

SYSTEM OF HYGIENIC INSPECTION OF NONMETAL MATERIALS USED IN SPACECRAFT EQUIPMENT

G. I. Solomin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 110-115 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 70-74 (For primary document see N80-28015 18-51)

Avail: NTIS HC A08/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-27493 California Univ., Berkeley.
THE COMBUSTION OF CARBON, COAL AND COAL RELATED FUELS IN AN OPPOSED FLOW DIFFUSION FLAME BURNER Ph.D. Thesis
Wing Kai Chin 1979 44 p
Avail: Univ. Microfilms Order No. 8014636

The burning characteristics of various carbonaceous fuels as well as polymethylmethacylate (PMMA) were compared and showed PMMA to have the highest regression rate. The comparison results also indicated that a high rate of volatiles yield enhances the regression rate. The relative importance of oxygen and carbon dioxide on the surface oxidation mechanism was investigated by determining the regression rates in mixtures of oxygen and carbon dioxide and comparing with that obtained in mixtures of oxygen and nitrogen. Because of the opposing effects of carbon dioxide as an oxidizing agent and heat sink, its importance in the surface combustion mechanism could not be unambiguously determined. The gaseous products from the combustion of coal at various oxygen mole fractions and oxidizer velocities were measured and showed that the ratios of carbon monoxide to carbon dioxide decreases with increasing oxygen mole fraction. Temperature profiles in the solid and gas phases and surface temperature were determined. Dissert. Abstr.

N80-27494# Pittsburgh Energy Technology Center, Pa.
THE 2ND INTERNATIONAL SYMPOSIUM ON COAL-OIL MIXTURE COMBUSTION, VOLUME 1
1979 595 p refs Symp. held at Danvers, Mass., 27-29 Nov. 1979 Sponsored by DOE 2 Vol.
(CONF-791160-Vol-1) Avail: NTIS HC A25/MF A01

The status of various coal-oil mixture (COM) programs is assessed, including production, conversion from conventional systems, and demonstration pilot plants. Additional topics include efficiency of both the COM and boilers, combustion byproducts and their environmental effects as well as effects on boilers, and storage tanks. For individual titles, see N80-27495 through N80-27508.

N80-27495# Electric Power Development Co. Ltd. (Japan).
OVERVIEW OF R&D STATUS ON COM TECHNOLOGY IN JAPAN
Yasuyuki Nakabayashi *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 p 1-13 (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

General trends referring to commercialization of coal-oil mixtures (COM) in Japan are presented. Progress in research and development on COM, public interest, and government support is summarized. E.D.K.

N80-27496# Canadian Combustion Research Lab.-CANMET, Chatham (New Brunswick).
CURRENT STATUS OF THE CANADIAN COAL-OIL MIXTURE PROGRAM
H. Whaley *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 13 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

A description is given of the status of four projects together with an outline of other related COM work currently being undertaken or planned in Canada. The projects include: (1) a small COM utility boiler demonstration plant, (2) determination of the rheological properties of coal-oil slurries, (3) research and development study of the preparation combustion and emission characteristics of beneficiated coal-oil mixtures, and (4) development of coal-oil slurry fuels for blast furnace injection. E.D.K.

N80-27497# Tsinghua Univ., Beijing (China). Dept. of Thermal Engineering.
PRELIMINARY CONSIDERATIONS OF THE USE OF COM IN THE EXPERIMENTAL POWER PLANT OF TSINGHUA UNIVERSITY AS AN ENERGY FUEL
Lin Hao *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 17 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

The peculiarity of the Chinese energy fuels and fuel systems are described. For converting an oil fired boiler to COM, problems that may be encountered and alternative projects to be taken into consideration are discussed. Test results of viscosities and burning profiles are introduced, as well as the scheme of a COM production system and a principal sketch of an experimental power plant's burner. E.D.K.

N80-27498# New Brunswick Electric Power Commission, Fredericton.
COAL-OIL MIXTURE COMBUSTION APPLIED TO CANADIAN UTILITY BOILERS
P. J. Whalen, F. W. Davies, L. K. Lee, M. Natarajan (Montreal Engineering Co., Ltd.), and R. L. Wang (Montreal Engineering Co., Ltd.) *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 17 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

Operating experience on coal in COM relating to combustion stability, boiler efficiency, boiler slagging/fouling, and equipment erosion are reported. On line oil agglomeration coal beneficiation process is discussed. Based on a nation wide survey conducted on all oil fired canadian utility boilers, cost/benefit analyses of COM conversion for several unit sizes were carried out. Potential oil savings were predicted and a correlation between boiler sizes and break even points for benefit against cost was discussed. A candidate boiler of 100 MW capacity was selected for testing COM process and combustion. E.D.K.

N80-27499# New England Power Service Co., Westborough, Mass.
STARTUP AND INITIAL FEASIBILITY TESTING ON THE SALEM HARBOR COM DEMONSTRATION
Richard M. Dunn *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 16 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

An 80 MW coal fired boiler which had been converted to burn No. 6 oil was equipped with new burners and accessories to burn coal-oil mixture. A description of the 30% coal and 70% oil mixture preparation facility is given. Results of initial coal-oil mixture (COM) blending, combustion, and stack emission tests are presented along with a discussion of initial startup problems encountered. Recommendations are made for additional COM research and product development to improve reliability. R.C.T.

N80-27500# CoaLiquid, Inc., Louisville, Ky.
OPERATION OF A CENTRAL PREPARATION PLANT FOR COAL-OIL-WATER MIXTURES
G. T. Hawkins *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 16 p (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

A commercial scale, preparation plant for coal oil water mixtures was constructed. The facility is capable of producing 2,500 GPH at start up, and is expandable to up to 5000 GPH, with little additional expense. Various aspects of its operation are discussed. R.C.T.

N80-27501# Tennessee Valley Authority, Chattanooga.
INVESTIGATIONS OF COAL-OIL MIXTURES AS A UTILITY BOILER LIGHT-OFF FUEL
Stephen R. Smith, Randy M. Cole, Ronald B. Cox (Tenn. Univ., Chattanooga), T. C. Derbridge (Acurex Corp., Mountain View, Calif.), R. J. Schreiber (Acurex Corp., Mountain View, Calif.), and A. K. Yasuda (Acurex Corp., Mountain View, Calif.) *In* Pittsburgh Energy Technol. Center The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1 1979 144 p refs (For primary document see N80-27494 18-28)
Avail: NTIS HC A25/MF A01

The fluid properties of unstabilized and stabilized coal-oil-water mixtures were investigated and the economics of converting light off system of a large (2600-MW) coal fired utility boiler to coal-oil-mixture firing were examined. An experimental agitator was used to determine the following: viscosity; stability; and mixing characteristics of Nos. 2, 4, and 6 fuel oil with pulverized coal. Agitation is required to obtain useful suspensions. A stabilized coal-oil-water emulsion was tested for long-term storage stability. Over a 6-month period, there was no indication of settling. An economic analysis was performed that compares COM costs to the present system using No. 2 oil and the sensitivity of COM economics to significant variables. R.C.T.

N80-27502# Tennessee Valley Authority, Chattanooga.
COAL/OIL/WATER MIXTURE STABILITY, APPENDIX A
R. H. Carty and T. T. Coburn. *In* Pittsburgh Energy Technol. Center. The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1. 1979. 33 p. refs (For primary document see N80-27494 18-28)
Avail: NTIS. HC A25/MF A01

The stability of a coal-oil-water mixture prepared by an ultrasonic agitation method for stabilization of the mixture was examined. A one quart sample of this mixture was obtained to determine the test procedure for analyzing other samples for stability. Test procedures as well as the results are given. R.C.T.

N80-27503# British Petroleum Co. Ltd., Sunbury-on-Thames (England).
STABLE COAL/FUEL OIL DISPERSIONS
C. J. Veal, D. R. Wall, and A. J. Groszek. *In* Pittsburgh Energy Technol. Center. The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1. 1979. 23 p. refs (For primary document see N80-27494 18-28)
Avail: NTIS. HC A25/MF A01

A novel method was developed for preparing very stable coal/fuel oil dispersions without the use of additives. The dispersions were handled like and substituted for fuel oils. Such dispersions have been shown to be stable at 100 C for periods of at least 13 weeks and also at higher temperatures (150 C) for at least a week. A total of 52 000 litres of such a dispersion were prepared, handled, stored and fired in a system designed primarily for heavy fuel oil. R.C.T.

N80-27504# Pittsburgh Energy Technology Center, Pa.
COMBUSTION OF COAL-OIL MIXTURES IN A 700 HP WATERTUBE BOILER
Y. S. Pan, G. T. Bellas, M. P. Mathur, and D. Bienstock. *In its* The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1. 1979. 27 p. refs (For primary document see N80-27494 18-28)
Avail: NTIS. HC A25/MF A01

Coal-oil mixtures containing up to 50 percent coal by weight were successfully burned in a 700 high pressure watertube boiler, designed for oil firing, with no derating occuring. Carbon conversion efficiencies were above 98 percent and boiler efficiencies were the same as when firing No. 6 fuel oil. Combustion tests were conducted with No. 6 fuel oil mixed with Pittsburgh Seam coal pulverized to a coal particle size of 90 percent minus 200 mesh. Test results related to boiler performance, pollutant emissions, and ash deposition are presented. The equipment, instrumentation, and data acquisition system of the combustion test facility are described. The modest changes required to adapt the facility designed for oil firing to utilize coal-oil mixtures are discussed. Additional combustion tests needed to assess bottom ash accumulation and the corrosion, erosion, and fouling behavior inherent in the long duration operability of coal-oil mixtures in an oil fired boiler are underway. R.E.S.

N80-27505# Mitre Corp., Bedford, Mass.
A TEST PLAN FOR THE NEPSCO COAL-OIL MIXTURE COMBUSTION PROJECT
Oliver K. Foo, Edward M. Jamgochian, and Alberto J. Sabadell. *In* Pittsburgh Energy Technol. Center. The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1. 1979. 32 p. refs (For primary document see N80-27494 18-28)
Avail: NTIS. HC A25/MF A01

Test objectives include the collection of technical and economic data to evaluate system performance, operability/maintainability, availability/reliability, and costs. A continuous 12 month test period was established. Superimposed on this period are four structured test periods during which the boiler load will be maintained at preselected levels while performance tests on the preparation plant and boiler are conducted. The end use of the data collected will provide a technical and economic data base to satisfy regulatory requirements and contribute to the commercialization of COM technology. E.D.K.

N80-27506# Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan).
DESIGN CONSIDERATION OF FINE COM STORAGE
Morio Kubota, Yashuhiko Kamijo (Tsukishima Kikai Co., Ltd.), and Koichi Tamura (Satake Chemical Equipment Mfg., Ltd.). *In* Pittsburgh Energy Technol. Center. The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1. 1979. 38 p. (For primary document see N80-27494 18-28)
Avail: NTIS. HC A25/MF A01

Conclusions affecting design and method of using storage tanks for COM are presented. Test items referred to include (1) an agitation test to prevent COM from setting in the tank; (2) fluidization test of COM settled in the tank; (3) still storage test of COM without agitation; (4) heat transfer in the tank; and (5) corrosion testing to determine suitable tank materials. E.D.K.

N80-27507# Hitachi, Ltd., Tokyo (Japan).
REPORT ON PUMPING CHARACTERISTIC TESTS AND PIPING PRESSURE LOSS MEASUREMENT TESTS FOR FINE COM
Isao Koyama. *In* Pittsburgh Energy Technol. Center. The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1. 1979. 28 p. (For primary document see N80-27494 18-28)
Avail: NTIS. HC A25/MF A01

Data were established for transport of coal-oil mixtures (COM) and developing a design for an actual plant. The tests were carried out with two types of pumps to determine their characteristics and illuminate the pressure loss characteristics for piping transportation of COM. Four types of COM, characterized by the coal brand, coal concentration, and brand of additive mixed in the COM to prevent precipitation of coal particles, were used. The results show that pump handling of the COM is possible. R.C.T.

N80-27508# Mitsui Engineering and Shipbuilding Co. Ltd., Tokyo (Japan).
PILOT PLANT TEST ON COARSE COM SYSTEM. TESTS ON TRANSPORTATION, DE-OILING AND COMBUSTION OF COARSE COM
Kenichi Nagata, Akira Shiozawa, and Isao Koyama (Babcock-Hitachi K. K., Tokyo). *In* Pittsburgh Energy Technol. Center. The 2d Intern. Symp. on Coal-Oil Mixture Combust., Vol. 1. 1979. 41 p. refs (For primary document see N80-27494 18-28)
Avail: NTIS. HC A25/MF A01

The major characteristics of the coarse coal-oil-mixtures (COM) system are described. Themes for the development and status of the COM system are addressed. Design specifications and implimentation procedures for the pilot plant and other test equipment are given. R.C.T.

N80-27509*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
USE OF PETROLEUM-BASED CORRELATIONS AND ESTIMATION METHODS FOR SYNTHETIC FUELS
A. C. Antoine. Jun. 1980. 23 p. refs
(NASA-TM-81533; E-485) Avail: NTIS. HC A02/MF A01. CSCL 21D

Correlations of hydrogen content with aromatics content, heat of combustion, and smoke point are derived for some synthetic fuels prepared from oil and coal syncrudes. Comparing the results of the aromatics content with correlations derived for petroleum fuels shows that the shale-derived fuels fit the petroleum-based correlations, but the coal-derived fuels do not. The correlations derived for heat of combustion and smoke point are comparable to some found for petroleum-based correlations. Calculated values of hydrogen content and of heat of combustion are obtained for the synthetic fuels by use of ASTM estimation methods. Comparisons of the measured and calculated values show biases in the equations that exceed the critical statistics values.

Comparison of the measured hydrogen content by the standard ASTM combustion method with that by a nuclear magnetic resonance (NMR) method shows a decided bias. The comparison of the calculated and measured NMR hydrogen contents shows a difference similar to that found with petroleum fuels. Author

N80-27510*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
ADVANCED FUEL SYSTEM TECHNOLOGY FOR UTILIZING BROADENED PROPERTY AIRCRAFT FUELS
G. M. Reck Jun. 1980 23 p refs Proposed for presentation at 12th Congr. of the Intern. Council of the Aeron. Sci., Munich, 13-17 Oct. 1980
(NASA-TM-81538; E-492) Avail: NTIS HC A02/MF A01 CSCL 21D

Possible changes in fuel properties are identified based on current trends and projections. The effect of those changes with respect to the aircraft fuel system are examined and some technological approaches to utilizing those fuels are described. R.C.T.

N80-27511# Southwest Research Inst., San Antonio, Tex. Mobile Energy Div.
FUEL PROPERTY EFFECTS ON COMBUSTOR PERFORMANCE Final Report
C. A. Moses and D. W. Naegeli Mar. 1980 54 p refs
(Contract N00140-77-C-1345)
(AD-A084017; SwRI-MED114) Avail: NTIS HC A04/MF A01 CSCL 21/2

Two combustor rigs have been used to study the sensitivities of combustor operation to the physical and chemical properties of fuels. Eighteen fuels including synfuels were used to accentuate the properties of concern: composition, viscosity, and boiling-point distribution. Flame radiation and smoke were best correlated by hydrogen content rather than hydrocarbon structure; the soot formation was due to gas-phase reactions. Lean-blowout conditions were about the same for all fuels except that gasoline could be burned leaner at idle conditions. Ignition limits were more sensitive to volatility than viscosity. Gaseous emissions and combustion efficiency were not significantly affected by fuel properties although some sensitivity to boiling point distribution was evident. In all performance areas, the syncrude fuels correlated in the same ways as the petroleum-derived fuels except for the NOx emissions from the nitrogen containing shale oil fuel. GRA

N80-27512# Exxon Research and Engineering Co., Linden, N.J.
CARBON SLURRY FUELS FOR VOLUME LIMITED MISSILES Annual Report, Sep. 1978 - Oct. 1979
R. H. Salvesen, D. C. Rigano, W. S. Blazowski, and W. F. Taylor Nov. 1979 219 p refs
(Contract F33615-78-C-2025; AF Proj. 3048)
(AD-A084710; EXXON/PLUS.1KWX.79; AR-1; AFAPL-TR-79-2122) Avail: NTIS HC A10/MF A01 CSCL 21/4

The Air Force has contracted with ER E to develop a carbon slurry fuel with a minimum of 180,000 BTU/gal. This report provides results of the first year's effort of this twenty-seven month program. Initial results indicate that a dispersion of carbon black in JP-10 with select dispersing agents can be made that meets the BTU requirements. Preliminary results look promising. Combustion tests using a specially developed Liquid Fuel Jet Stirred Combustor (LFJSC) have demonstrated that carbon burnout efficiencies greater than 90% are achievable with 300 nm particles in residence times down to 4 ms. Homogeneous iron, lead, manganese, and zirconium catalysts at concentrations up to 1000 ppm proved ineffective as accelerators of carbon burnout. Further tests are in progress to optimize the composition of the most promising formulations and to test these materials under more vigorous conditions in order to determine their suitability for missile applications. GRA

N80-27513# Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE 1H AND 13C FOURIER TRANSFORM NMR CHARACTERIZATION OF JET FUELS DERIVED FROM ALTERNATED ENERGY SOURCES Final Progress Report, 23 Mar. 1978 - 30 Aug. 1979
H. C. Dorn 30 Aug. 1979 80 p refs
(Contract N00173-78-C-0424)
(AD-A084169) Avail: NTIS HC A05/MF A01 CSCL 07/4

Initially, four jet samples were examined in this phase of the study using gel permeation liquid chromatography. We have previously discussed these results in the six month Progress Report. Although the gel permeation approach has the advantage of nearly quantitative recovery from the chromatography column (typically greater than 95%) and high preparative loading, it suffers from two drawbacks in studies of the present jet fuels. In general, the molecular weight and/or size of the compounds present in typical jet fuels do not cover a broad range. This is an obvious result of the relatively narrow distillation range(s) used to generate the jet fuels. That is, the gel permeation approach is more ideally suited in separations involving mixtures with a broad range in size and/or molecular weight (e.g., 100-1000 MW), whereas, the jet fuels have a more narrow range (e.g., 100-250MW). GRA

N80-27514# Puerto Rico Univ., Rio Piedras. Agricultural Experiment Station.
PRODUCTION OF SUGARCANE AND TROPICAL GRASSES AS A RENEWABLE ENERGY SOURCE Annual Report, 1978 - 1979
1979 134 p refs
(Contract ET-78-S-05-5912)
(ORO-5912-T2; AR-2) Avail: NTIS HC A07/MF A01

The agronomic and economic feasibility of mechanized, year round production of solar dried biomass, through the intensive management of sugarcane and napier grass as tropical forages were investigated. Alternate tropical grasses as potential sources for intensive biomass production were also examined. The selection and breeding of new sugarcane progeny having superior biomass productivity as their principal attribute were considered. R.C.T.

N80-27515# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS, RISER CRACKING OF COAL Quarterly Report, 1 Jul. - 30 Sep. 1979
D. A. Duncan, J. L. Beeson, and R. D. Oberle Dec. 1979 23 p refs
(Contract EX-76-C-01-2307; Proj. 61001)
(FE-2307-58) Avail: NTIS HC A02/MF A01

The technology of short residence time hydropyrolysis of lignites and coals for optimized yields of high octane gasoline blending stock constituents was developed. The design, construction, and operation of a bench scale unit (5 to 10 lb/hr) and a process development unit (50 to 100 lb/hr) were surveyed. The technical and economic aspects of large scale operation were evaluated. R.C.T.

N80-27516# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS, RISER CRACKING OF COAL Quarterly Report, 1 Apr. - 30 Jun. 1979
D. A. Duncan and J. L. Beeson Nov. 1979 28 p refs
(Contract EX-76-C-01-2307)
(FE-2307-55) Avail: NTIS HC A03/MF A01

The effect of heating rate on the conversion of feed carbon was studied and the distribution of products among gases, hydrocarbon liquids, and spent char was evaluated. A comparison was then made of product distribution obtained by hot hydrogen processing and by concurrent heating of the lignite and hydrogen to pyrolysis temperatures. The distribution of feed carbon among carbon oxides, methane, ethane, and hydrocarbon liquids were similar, and the yield of hydrocarbon liquids was practically identical. Equipment problems encountered thus far were minor and were easily corrected. An equipment flow sheet for a process plant was developed and various processing options were evaluated. DOE

N80-27517# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS, RISER CRACKING OF COAL Annual Report, 1 Apr.

1978 - 31 Mar. 1979
D. A. Duncan, J. L. Beeson, and R. D. Oberle Sep. 1979 128 p refs
(Contract EX-76-C-01-2307; Proj. 61001)
(FE-2307-50) Avail: NTIS HC A07/MF A01

The effects of operating pressure and heating rate on rector performance were studied. Several techniques for processing caking coals were explored and trails of bentonite clay and iron oxide as catalysts were made. Certain aspects of the process development unit in the operation of the preheater as well as in the operation of the combustor sections were clarified. The major observations and results are reported. DOE

N80-27518# General Electric Co., Wilmington, Mass. Direct Energy Conversion Programs.
HYDROGEN PRODUCTION USING SOLID-POLYMER-ELECTROLYTE TECHNOLOGY FOR WATER ELECTROLYSIS AND HYBRID SULFUR CYCLE Final Report, Sep. 1979
J. M. Sedlak, J. H. Russell, A. B. LaConti, D. K. Gupta, J. F. Austin, and J. S. Nugent Sep. 1979 130 p refs
(EPRI Proj. 1086-3)
(EPRI-EM-1185) Avail: NTIS HC A07/MF A01

The comparative technoeconomics of hydrogen production using the solid polymer electrolyte technology was evaluated. Two advanced processes were emphasized: water electrolysis; and hybrid sulfur cycle water decomposition. It is concluded that the solid polymer electrolyte based hybrid sulfur cycle process shows no technological or economic advantage over existing (solid polymer electrolyte based) water electrolysis systems for the production of hydrogen. DOE

N80-27519# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
RAPID ETHANOL PRODUCTION VIA FERMENTATION
Brian Maiorella, Harvey W. Blanch, and Charles R. Wilke Nov. 1979 29 p refs Presented at the Am. Inst. of Chem. Eng. Meeting, San Francisco, 29 Nov. 1979
(Contract W-7405-eng-48)
(LBL-10219; CONF-791108-19) Avail: NTIS HC A03/MF A01

The flash ferm process for industrial rapid ethanol fermentation with ethanol removal and concentration in an auxilliary flash vessel was developed. The super high productivities (80-g ethanol/L hr) of the vacu-ferm processes were maintained and many advantages were eliminated. Flash ferm continued synergistically with a vacuum distillation to provide a high ethanol concentration feed to the less strongly pinch limited separate. A 42% savings and a 54% reduction in manufacturing cost (exclusive of feed) was achieved as compared to conventional bath processes. DOE

N80-27520# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
CATALYTIC LIQUEFACTION OF BIOMASS
Manu Seth, Roger Djafar, Gary Yu, and Sabri Ergun Nov. 1979 46 p refs Presented at Thermochem. Conversion Contractor's Meeting, Rolla, Mo., 7 Nov. 1979
(Contract W-7405-eng-48)
(LBL-10091; CONF-791166-1) Avail: NTIS HC A03/MF A01

Two concepts for biomass liquefaction are considered. The first involves solvolytic depolymerization of wood followed by hydrogenation of the resulting slurry (or solution). The second entails the hydrolysis of wood followed by hydrogenation of the hydrolyzed slurry. Acid-catalyzed transfer of hydrogen from solvent molecules is being tested for the hydrogenation step. The effects of process variables on the yields and quality of products are being studied for three catalysts: sodium carbonate, ferric chloride and hydrogen iodide. The effects of reaction temperature, residence time, catalyst concentration, pressure of reducing gases and type of feed (e.g., pre-hydrolyzed slurry vs wood flour) were determined for the ferric chloride system. DOE

N80-27521# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PROCESS DEVELOPMENT STUDIES ON THE BIOCONVERSION OF CELLULOSE AND PRODUCTION OF ETHANOL
Charles R. Wilke and Harvey W. Blanch Sep. 1979 58 p refs
(Contract W-7405-eng-48)
(LBL-9909) Avail: NTIS HC A04/MF A01

The biosynthesis of ethanol from cellulose is discussed. The following topics are covered: enzymatic hydrolysis of bagasse; high pressure hydrogen chloride process; cellulase; enzyme recovery; media development and growth factors in ethanol fermentation; process development studies on ethanol production; xylase fermentation; and isolation of xylase fermenting organisms. Cost determinations for both enzymatic and acid hydrolysis are given. DOE

N80-27522# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PROCESS DEVELOPMENT STUDIES ON THE BIOCONVERSION OF CELLULOSE AND PRODUCTION OF ETHANOL
C. R. Wilke and Harvey W. Blanch Jun. 1979 39 p refs
(Contract W-7405-eng-48)
(LBL-9220) Avail: NTIS HC A03/MF A01

Trichoderma viride strain C-30 was evaluated by comparing cellulose productivity with strain QM 9414. Fermentation operations were conducted in S-liter New Brunswick fermentors. The medium was used for all experiments except that urea was deleted from the medium unless otherwise indicated. Ball-milled solka floc (BW 200) at 1.0% concentration was used as a substrate. Four day old, 10 percent mycelium inoculum was used for all fermentations. The pH was adjusted with 2N NaOH and 2N H2SO4. It is shown that there is an increase in cellulose enzyme activities in addition to an increase in soluble protein. The addition of urea to the fermentation medium effects all the activities except beta-glucosidase and soluble protein. There is a three fold increase in beta-glucosidase activity at 25 C as compared to other temperatures. The increased potency in terms of glucose production is probably due to the selectively higher level of beta-glucosidase in the culture filtrate. The higher level of beta-glucosidase would permit more rapid conversion of cellobiose to glucose. R.C.T.

N80-27523# Argonne National Lab., Ill. Systems Engineering and Technology Group.
HYCSOS: HYDRIDE CONVERSION AND STORAGE SYSTEM SENSITIVITY ANALYSIS
Jeffrey S. Horowitz Sep. 1979 19 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-63) Avail: NTIS HC A02/MF A01

The hydride conversion of solar energy system (HYCSOS) chemical heat pump was developed. A computer program was also developed to design a HYCSOS system. Although it is recognized that the program used is not entirely correct, it is felt that studies of this kind are valuable for determining the important parameters of the system design. Results of test studies are discussed. DOE

N80-27524# McKee (Arthur G.) and Co., Cleveland, Ohio.
COAL: AN ALTERNATE FUEL FOR THERMAL ENHANCED OIL RECOVERY STEAM GENERATION Final Report
Aug. 1979 98 p
(Contract EX 76-C-01-2418)
(SAN-2418-1) Avail: NTIS HC A05/MF A01

The technical and economic aspects of using coal to replace lower tier crude oil as fuel for thermal enhanced oil recovery steam generation is examined. Three coal technologies were evaluated: coal-oil mixtures; coal gasification; and fluidized bed combustion. Coal-oil mixtures and coal gasification were evaluated for retrofit application. Fluidized bed combustion was evaluated from the standpoint of providing replacement or future steam generating capacity. DOE

N80-27525# National Technical Information Service, Springfield, Va.
COAL GASIFICATION TECHNOLOGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Apr. 1980
Diane M. Cavagnaro Apr. 1980 224 p Supersedes NTIS/PS-79/0516 and NTIS/PS-77/0305
(PB80-808090; NTIS/PS-79/0516; NTIS/PS-77/0305) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 07A

Research reports on coal gasification are cited. They cover the techniques and processes of the conversion of coal to

chemicals or fuels. Coal desulfurization, cleaning, or preparation, which do not involve conversion to gaseous fuels or chemical, are not covered. Also excluded are in-situ gasification studies. This updated bibliography contains 217 abstracts, 172 of which are new entries to the previous edition. GRA

N80-27526# National Technical Information Service, Springfield, Va.
COAL LIQUEFACTION TECHNOLOGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1978 - Apr. 1980
Diane M. Cavagnaro Apr. 1980 227 p Supersedes NTIS/PS-79/0375 and NTIS/PS-77/0305
(PB80-808108; NTIS/PS-79/0375; NTIS/PS-77/0305) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 07A

A bibliography containing 217 citations on the techniques and processes of the conversion of coal to liquid chemicals or fuels is given. Most aspects of the processes including design, performance evaluation, cost analysis, and plant equipment are covered. GRA

N80-27527# National Technical Information Service, Springfield, Va.
COAL GASIFICATION TECHNOLOGY. CITATIONS FROM THE NTIS DATA CENTER Progress Report, May - Dec. 1978
Diane M. Cavagnaro Apr. 1980 152 p
(PB80-808082) Avail: NTIS HC $30.00/MF $30.00 CSCL 07A

This bibliography cites research reports on coal gasification technology. The citations discuss the techniques and processes of the conversion of coal to chemicals or fuels coal desulfurization, cleaning, or fuels on chemicals, are not covered. Also excluded are in-situ gasification studies. This updated bibliography contains 145 abstracts, none of which are new entries to the previous edition. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-27528 California Univ., Los Angeles.
A STUDY OF PERSISTENT CURRENT IN SUPERFLUID 4He Ph.D. Thesis
Talaghany Roset Khosropour 1980 116 p
Avail: Univ. Microfilms Order No. 8015996

Decay of persistant currents in superleaks in contact with bulk superfluid helium was studied using Doppler shifts of the acoustic modes of an annular resonator partially packed with superleak. The two acoustic modes are an interpolated first-fourth sound and a modified second sound. They have proven to be a usefull means of measuring persistant currents in both the packed and unpacked regions of the waveguide measured at 1.35 K for annuli 10,20, 40, 60, 80, 90, 95, and 100 percent filled with superleak. The main result, which is somewhat surprising, is that the saturated persistent current and its fractional decay rate varies only slightly with superleak depth. This means that the stability of the current in powder is neither affected by the free exchange of mass between the two regions nor is it a strong function of the magnitude of the depth of the powder. Starting from 100% packing the fractional decay rate is about 2% per decade and increases to about 3% per decade at 10% packing. However, there exists a local maximum in decay rate at 90% packing). Another phenomenon which was also studied is the Doppler shift of gravity waves in a partially packed annalus, in relation to its possible application in the detection of persistent currents. Dissert. Abstr.

N80-27529# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DOUBLY-ASYMPTOTIC, BOUNDARY-ELEMENT ANALYSIS OF NONLINEAR SOIL STRUCTURE INTERACTION Final Report, 14 Nov. 1977 - 30 Jun. 1979
P. G. Underwood and T. L. Greer 30 Jun. 1979 68 p refs
(Contract DNA001-78-C-0026)
(AD-A083330; AD-E300725; LMSC/D673964; DNA-4953F) Avail: NTIS HC A04/MF A01 CSCL 20/11

This report describes a doubly-asymptotic (DA), boundary-element (BE) treatment of a surrounding nonlinear soil medium for dynamic soil structure interaction analysis. Linear soil structure interaction is reduced to a surface relationship that is asymptotically exact at both high and low frequencies. Nonlinear soil structure interaction is treated similarly, except a volume contribution is added in the volume; a quasi-static and quasi-dynamic (axisymmetric) problem for which finite-element solutions have been obtained for comparison. For soil behavior based on J sub 2-plasticity theory, reasonable agreement is obtained. For soil behavior based on the Cap model, which is a combined I sub 1- and J sub 2-plasticity theory agreement is not obtained. GRA

N80-27530# Kentucky Bureau of Highways, Lexington. Div. of Research.
ROAD RATER AND BENKELMAN BEAM PAVEMENT DEFLECTIONS Interim Report
Gary W. Sharpe and Herbert F. Southgate Jun. 1979 42 p refs
(PB80-158439; RR-523) Avail: NTIS HC A03/MF A01 CSCL 13B

The Benkelman beam is one of the most commonly used methods of measuring surface deflections of a highway pavement. A Benkelman beam is based on a simple lever-arm principle and uses dial gauges to measure surface deflection under an applied load. The Road Rater applies a sinusoidal force to the pavement at a fixed frequency; surface wave velocities are measured and electronically integrated to obtain surface deflections. Since 1971, work has progressed toward the development of a pavement evaluation methodology using Road Rater deflections. Analyses presented illustrate some relationships between the Benkelman beam and Road Rater deflections. Theoretical and field measured deflections are considered. GRA

N80-27531# Texas Transportation Inst., College Station.
PERFORMANCE OF OPEN-GRADED FRICTION COURSES Final Report, Sep. 1977 - Jun. 1979
S. C. Britton, B. M. Gallaway, and R. L. Tomasini Jun. 1979 259 p refs Sponsored in part by Texas State Dept. of Highways and Public Transportation and FHWA
(PB80-162985; TTI-2-9-78-234-1F; FHWA/TX-79/28+234-1F) Avail: NTIS HC A12/MF A01 CSCL 13C

A method for accurately determining open graded asphalt friction course (OGAFC) layer permeability was developed. Specific empasis was placed on predicting the rainfall intensity which causes incipient flooding of the pavement surface. It is shown that this method can be applied for field measurements to monitor the internal drainage capacity of OGAFC overlays when they are constructed as well as to assess changes in this aspect of performance that may result from layer densification by traffic. It is further indicated that such permeability measurements appear to be more practical and meaningful as OFAFC drainage capacity indicators than air void determinations. R.C.T.

N80-27532# California Univ., Richmond. Earthquake Engineering Research Center.
OPTIMUM INELASTIC DESIGN OF SEISMIC-RESISTANT REINFORCED CONCRETE FRAME STRUCTURES
Stan W. Zagajeski and Vitelmo V. Bertero (Colorado State Univ., Fort Collins) Jan. 1980 122 p refs
(Grant NSF ENV-76-01419)
(PB80-164635; UCB/EERC-80/03) Avail: NTIS HC A06/MF A01 CSCL 13M

The preliminary design phase of a proposed inelastic design procedure comprises three steps: preliminary analysis, preliminary design, and analysis of the preliminary design. Seismic design story shears are found by a spectral modal analysis technique which includes an approximation to the P-delta effect. A nonlinear optimization technique (the cutting-plane method) is employed at each story to find the beam design moment capacities which minimize a function proportional to the volume of flexural reinforcement. Design constraints are imposed to ensure that a safe, serviceable, and practical design results. Actual member design is found employing computer design aids. In the final

step, the preliminary design is analyzed to evaluate its acceptability. Acceptability is determined by comparing the results of a series of linear elastic and nonlinear analysis with established design criteria and assumptions made in formulating the design problem. GRA

N80-27533# California Univ., Berkeley. Earthquake Engineering Research Center.
HYSTERIC BEHAVIOR OF REINFORCED CONCRETE STRUCTURAL WALLS
J. M. Vallenas, V. V. Bertero, and E. P. Popov. Aug. 1979. 258 p. refs.
(Grant NSF ENV-76-04263)
(PB80-165905; UCB/EERC-79/20; NSF/RA-79-350) Avail: NTIS. HC A12/MF A01. CSCL 13M.

The behavior of reinforced concrete structural walls subjected to high shear earthquake loading conditions is studied. Results of eight earthquake simulation tests on 1/3 scale structural R/C wall subasemblage model specimens are presented. Details of the test set up, the models tested, and the test procedure are summarized. The main experimental results are evaluated in terms of the hysteretic characteristics (strength, deformation, and energy dissipation capacity), the modes of failure, ease of construction, and effectiveness of repair. Present code design methods for walls are assessed, the seismic-resistant design implications of the results are discussed, and areas of further study are recommended. GRA

N80-27534# California State Dept. of Transportation, Sacramento.
DEVELOPMENT OF A REBAR DOWEL ANCHORAGE SYSTEM FOR ATTACHING THE CALIFORNIA TYPE 25 CONCRETE BARRIER TO EXISTING BRIDGES. Final Report
J. P. Dusel, Jr. and J. R. Stoker. Jun. 1979. 127 p. refs. Sponsored in part by DOT.
(PB80-161722; TL-636871; FHWA/CA-TL-79-16) Avail: NTIS. HC A07/MF A01. CSCL 13B.

An anchorage system for attaching New Jersey-shaped concrete bridge replacement barrier onto existing concrete decks was developed. Initially dynamic pullout tests of rebar dowels were conducted to develop methods which would maximize pullout strengths. Ultimate pullout loads ranging from 25.0 kips to 34.8 kips were attained with individual no. 6 rebar dowels. Secondly, static load tests were performed on standards California Type 25 concrete barrier and replacement barriers to determine maximum horizontal loads which could be resisted. In preliminary tests, two 3-foot lengths of replacement barrier, attached with grouted no. 6 rebar dowels, withstood higher horizontal loads than did the standard Type 25 concrete barrier. A 16-foot-long replacement barrier withstood a maximum static horizontal load of 93 kips applied to a concentrated area about 26 inches above the deck surface. GRA

N80-27535# Enviro Control, Inc., Rockville, Md.
CRITERIA FOR A RECOMMENDED STANDARD: OCCUPATIONAL EXPOSURES IN COAL GASIFICATION PLANTS
Sep. 1978. 206 p. refs. Sponsored in part by EPA.
(Contract PHS-210-76-0171)
(PB80-164874; DHEW/PUB/NIOSH-78-191) Avail: NTIS. HC A10/MF A01. CSCL 06J.

The criteria and standards applicable to exposure of employees to toxicants and hazardous operating conditions in commercial coal gasification plants are reported. Several aspects of preventative maintenance are discussed with specific emphasis on employee workplace monitoring and medical surveillance. R.C.T.

N80-27536# Enviro Control, Inc., Rockville, Md.
RECOMMENDED HEALTH AND SAFETY GUIDELINES FOR COAL GASIFICATION PILOT PLANTS. Interagency Energy-Environment Research and Development Program Report
Jan. 1978. 240 p. refs.
(Contract PHS-210-76-0171)
(PB80-164890; DHEW/PUB/NIOSH-78-120; EPA-600/7-78-007) Avail: NTIS. HC A11/MF A01. CSCL 06J.

Potential hazards to workers in coal gasification pilot plants are identified and hazard control strategies are presented. Worker protection measures such as safe work practices, personal protective equipment and clothing, industrial and personal hygiene, workplace and medical monitoring, labeling and posting, hazard information and awareness, and recordkeeping are emphasized. Although this document is specific for pilot scale coal gasification plants, many of the potential hazards and research and development needs identified are transferable to those of bench or demonstration scale coal gasification or coal liquefaction facilities. GRA

N80-27537# Maine Dept. of Transportation, Bangor. Materials and Research Div.
FRICTIONAL RESISTANCE OF PAVEMENTS. Interim Report
D. A. Madden. Jun. 1979. 28 p.
(PB80-162662; FHWA/ME-TP-79-4) Avail: NTIS. HC A03/MF A01. CSCL 13B.

The frictional variation of roadways in the state of Maine were investigated. The magnitude and cause(s) of traverse and seasonal frictional variation were determined. The effects of time (long term) on pavement frictional characteristics were examined. GRA

N80-27538# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
INELASTIC SEISMIC RESPONSE OF A TORSIONALLY UNBALANCED SINGLE-STORY BUILDING MODEL
H. M. Irvine and G. E. Kountouris. Jul. 1979. 172 p. refs.
(Grant NSF ENV-77-14174)
(PB80-164197; NSF/RA-790389; R79-31; Rept-2) Avail: NTIS. HC A08/MF A01. CSCL 13M.

The dynamic effects of coupling between torsion and translocation using a simple torsionally unbalanced single-story building model are described. The investigation deals with a two-degree-of-freedom model in which two frames support a diaphragm the center of mass of which may be offset from the center of stiffness. A comprehensive parameter study was undertaken to identify trends in the peak ductility demands of the worst situated frame. A simple frequency domain analysis outlines why the peak ductility demands occur in the frame farthest from the center of mass. The study indicates that the most important parameter is one involving the product of diaphragm mass and spectral acceleration normalized by a yield level in the frame. GRA

N80-27539# National Bureau of Standards, Washington, D.C. Building Economics and Regulatory Div.
STANDARDIZATION IN FRANCE. Final Report
I. M. Martinez. Mar. 1980. 66 p.
(PB80-162126; NBSIR-79-1959) Avail: NTIS. HC A04/MF A01. CSCL 05A.

An overview of the voluntary standards system in France is presented. The following aspects of the French standard system are examined: (1) organization, (2) French standards, (3) standards development, (4) certification, (5) government use of standards, (6) the role of consumers and labor in standardization, and (7) France's participation in international standards activities. GRA

N80-27540# New Jersey State Dept. of Transportation, Trenton. Bureau of Structures, Materials and Applied Mechanics Research.
PREFORMED ELASTOMERIC JOINT SEALERS FOR BRIDGES. PHASE 2: EXECUTIVE SUMMARY REPORT. Final Report
George S. Kozlov. Jul. 1979. 19 p.
(PB80-162845; Rept-80-006-7731; FHWA/NJ-80-006) Avail: NTIS. HC A02/MF A01. CSCL 13B.

An effort to develop a realistic material specification closely related to the actual field performance of sealers is described. A method for testing the life expectancy of performed elastomeric bridge sealers is also described and the data gathered through such testing are presented. GRA

N80-27541# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.

PATCHING FLEXIBLE AND RIGID PAVEMENTS Final Report
Leonard Hartvigas Oct. 1979 49 p
(PB80-161243; RR-74; FHWA/NY/RR-79/74) Avail: NTIS
HC A03/MF A01 CSCL 13B

Available patching materials for both flexible and rigid pavements were evaluated. An infrared heater was also used for cold weather flexible pavement patching. Cold mix and a proprietary mix were used to fill potholes in flexible pavements during two winters; the more expensive proprietary mix proved to be a durable repair material for winter patching. Summer patching was not investigated on flexible pavements because the standard top course mix is used and presents no problems. Fourteen cement base and two asphalt base materials were used to repair rigid pavement. Six cement and one asphalt base materials were used in winter, with only the latter providing good service. GRA

N80-27542# Texas Transportation Inst., College Station.
FLEXIBLE PAVEMENT DEFLECTION EQUATION USING ELASTIC MODULI AND FIELD MEASUREMENTS Final Report
Robert L. Lytton and Chester H. Michalak Aug. 1979 63 p
Sponsored in part by Texas State Dept. of Highways and Public Transportation
(PB80-159247; TTI-2-8-75-207-7F; FHWA/TX-79/164207-7F)
Avail: NTIS HC A04/MF A01 CSCL 13B

A method of predicting the vertical deflections in a multilayered flexible pavement is summarized. The method has the following four characteristics: (1) it is based upon elastic layered theory; (2) it makes use of material properties that can be determined by nondestructive testing in the field; (3) it is simple enough that deflection calculations can be made very rapidly and inexpensively on a computer; and (4) it uses the elastic modulus of materials since that property can be measured in the laboratory. GRA

N80-27543# California Univ., Berkeley. Structures and Materials Research.
NONLINEAR GEOMETRIC, MATERIAL AND TIME DEPENDENT ANALYSIS OF REINFORCED AND PRESTRESSED CONCRETE SLABS AND PANELS Report of Structures and Materials Research
Johannes VanGreunen and A. C. Scordelis Oct. 1979 286 p
(Grant NSF ENV-77-00146)
(PB80-167349; UC-SESM-79-3) Avail: NTIS
HC A13/MF A01 CSCL 13C

A numerical procedure was developed for the material and geometric nonlinear analysis of reinforced and prestressed concrete slabs and panels including the time dependent effects due to load history, temperature history, creep, shrinkage and aging of the concrete, and relaxation of prestress. The procedure, based on the finite element method, is capable of predicting the response of these structures throughout their service load history as well as throughout elastic, cracking, inelastic, and ultimate load ranges. An updated Lagrangian formulation is employed to take the effects of changing structural geometry on the response of planar structures into account. Slabs or panels having an arbitrary tendon layout with either pretensioned, or bonded pr unbonded post-tensioned tendons can be analyzed. A series of numerical examples is presented to study the validity and applicability of the method. GRA

N80-27544# Oklahoma State Univ., Stillwater. Fluid Power Research Center.
FIRE-RESISTANT HYDRAULIC FLUID SAFETY Final Report, 3 Aug. 1978 - 3 Aug. 1979
E. C. Fitch and J. S. Campbell 3 Aug. 1979 53 p refs
(Contract DI-BM-JO-166054)
(PB80-159486; BM-OFR-33-80) Avail: NTIS
HC A04/MF A01 CSCL 13K

Fire resistant hydraulic fluid safety from three directions are discussed. Results of a survey prepared for the fire resistant hydraulic journal are analyzed. Operational limitations of fire resistant hydraulic fluids are examined. Laws and standards of various foreign countries are investigated. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-27545 British Broadcasting Corp., Kingswood (England). Engineering Div.
ENHANCED UK TELETEXT MOVES TOWARDS STILL PICTURES
J. P. Chambers Jun. 1980 31 p refs
(BBC-RD-1980/4) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Methods are proposed for the enhancement of the UK teletext system leading towards a high-definition still picture capability in addition to row of text and mozaic graphics. A teletext system is described wherein binary code groups are formed into data-lines for inclusion in the television field blanking interval. The control and address information carried on each dataline, together with the special page-header data-lines and the sequence of transmission of the data-lines, allow the data-lines corresponding to the rows of a selected page to be identified. The page structure can be used to send information other than pages of text. Certain data-lines can be used for functions unrelated to teletext. In addition, techniques utilizing a multipage store are examined for improving access; and teh extension of the character repertoire to enhance multilanguage capabilities is addressed. M.G.

N80-27546 California Univ., Los Angeles.
MAGNETOSPHERIC PULSATIONS: MODEL AND OBSERVATIONS OF STANDING ALFVEN WAVE RESONANCES Ph.D. Thesis
Howard Joseph Singer 1980 209 p
Avail: Univ. Microfilms Order No. 8016043

Observations of ultra low frequency waves in the Pc 3,4, and 5 period range (10 to 600 sec) are presented. The generation of the waves is examined and the structure and distribution of these waves in space provides evidence to support the notion that many of the waves are standing Alfven wave resonances of the earth's magnetic field lines. In addition, the results of a theoretical model of standing Alfven wave resonances in a realistic magnetospheric magnetic field geometry are presented. Using the basic MHD equations, an equation is derived for the amplitude and period of low frequency transverse standing waves in an arbitrary field geometry. The Olson-Pfitzer field model which includes ring, tail and boundary currents is used, and the results indicate that the predicted period of oscillation can be quite different from that predicted by previous models in dipole field geometries. One important use for the model is for determining densities along field lines in space from ground based observations. Dissert. Abstr.

N80-27547 Cornell Univ., Ithaca, N. Y.
SPECTRA FROM 50 MHz AURORAL RADAR ECHOES Ph.D. Thesis
Roger Wesley Reed 1980 175 p
Avail: Univ. Microfilms Order No. 8015731

Auroral radar observations made with a radar system operating at 50 MHz with a power of about 10KW and a long dipole array antenna are examined. The radar points north and obtains echoes over a region which extends approximately from L=3.5 to L=5.5. Typical observations had a spatial resolution of 5 to 10 km and temporal resolution of 2s. The early morning of April 1, 1976 was a magnetically very disturbed period with K sub p =8. Some unusual spectra with a very narrow peak at a Doppler shift of about 70 Hz were observed at the southern edge of the westward electrojet, a region where large field-aligned currents are expected. These echoes persisted while the location of the echoing region moved poleward at an average velocity of approximately 1 km/s. Ion cyclotron waves occuring in the lower F-region are a possible scattering source for these unusual spectra. Multiple spectral peaks occured, sometimes with one spectrum containing peaks with both negative and positive Doppler shifts. The structure observed extended to the limits of both spatial and temporal resolution. Implications of these

observations to the instability theories and to ideas on the nature of the auroral electrojet are discussed. Dissert. Abstr.

N80-27548 State Univ. of New York at Buffalo.
HIGH CAPACITY LOW DELAY PACKET BROADCASTING MULTIACCESS SCHEMES FOR SATELLITE REPEATER SYSTEMS. Ph.D. Thesis.
Sanjay Kumar Bose. 1980. 210 p.
Avail: Univ. Microfilms. Order No. 8016354.

Demand assigned packet radio schemes using satellite repeaters can achieve high capacities but often exhibit relatively large delays under low traffic conditions when compared to random access. Several schemes which improve delay performance at low traffic but which have high capacity are presented and analyzed. These schemes allow random acess attempts by users, who are waiting for channel assignments. The performance of these are considered in the context of a multiple point communication system carrying fixed length messages between geographically distributed (ground) user terminals which are linked via a satellite repeater. Channel assignments are done following a BCC queueing discipline by a (ground) central controller on the basis of requests correctly received over a collision type access channel. In TBACR Scheme A, some of the forward message channels are set aside for random access transmissions, the rest are used in a demand assigned mode. Schemes B and C operate all their forward message channels in a demand assignment mode but, by means of appropriate algorithms for trailer channel selection, allow random access attempts on unassigned channels. The latter scheme also introduces framing and slotting of the time axis to implement a more efficient algorithm for trailer channel selection than the former.
Dissert. Abstr.

N80-27549 California Univ., Los Angeles.
ON THE SPATIAL CAPACITY OF PACKET RADIO NETWORKS. Ph.D. Thesis.
John Andrew Silvester. 1980. 153 p.
Avail: Univ. Microfilms. Order No. 8016042.

Point-to-point network can achieve much higher performance levels due to the ability to spatially reuse the channel. Optimum transmission ranges and retransmission policies (maximizing capacity) for various configurations of ALOHA networks are derived. For one dimensional random networks (i.e., random topolgies) with random traffic matrices, satisfied by exactly adjusted transmission range, allowing communication in one hop, a capacity proportional to the logarithm of the number of nodes in the network was obtained. For regular (topology) networks using fixed transmission ranges and multi-hop communication to support uniform traffic matrices, a throughput of 2/e was obtained. For two dimensional networks, throughput proportional to the square root of the number of nodes in the network was obtained for both regular and random topologies. The best regular design is a hexagonal tesselation. The optimum average degree for random networks in which each node uses the same (fixed) transmission radius is shown to be about 6. Several routing algorithms are presented and the best performanced: it is shown that the routing algorithm which balances traffic flow, seems to produce the best performance.
Dissert. Abstr.

N80-27550 Ohio State Univ., Columbus.
PROTOCOL CONSTRUCTIONS FOR COMMUNICATION NETWORKS. Ph.D. Thesis.
Yanpyng Albert Teng. 1980. 277 p.
Avail: Univ. Microfilms. Order No. 8015929.

Various issues in constructing network communication protocols that are correct, modifiable and maintainable are discussed. Specific emphasis is placed on the practical techniques that enable these protocols to be implemented in an effective way and at acceptable cost. A systematic protocol construction methodology using both formal language and software engineering techniques.
Dissert. Abstr.

N80-27551 North Carolina Univ. at Chapel Hill.
RADIATION COUPLED DYNAMICS OF RAM CONFINED RADIO SOURCES. Ph.D. Thesis.
Gary Guy Rolison. 1979. 90 p.
Avail: Univ. Microfilms. Order No. 8013987.

It is found that internal turbulence generated by coupling between the plasmoid and the external flow, while providing a mechanism for relativistic particle acceleration, causes rapid expansion leading to a decrease in both penetrating power and long term luminosity. However, inclusion of the effects on dynamics of internal energy loss through synchrotron and free-free emission reveals that this energy loss mechanism can dominate the plasmoid's internal energy balance. The resulting plasmoid contraction introduces a new mechanism for the maintenance of relativistic particle energy-compressive work. The scenario in which both compressive work and turbulent particle acceleration occur results in the greatest plasmoid penetration and best long term luminosity maintenance. It is found that a plasmoid which encounters a decreasing background density has an increased tendency to expand, resulting in a lower internal energy and luminosity. Conversely, contraction is favored for plasmoids encountering an increasing background density.
Dissert. Abstr.

N80-27552 Cornell Univ., Ithaca, N. Y.
COMMUNICATION OVER A QUANTUM CHANNEL WITH FEEDBACK. Ph.D. Thesis.
John Edward Kaufmann. 1980. 183 p.
Avail: Univ. Microfilms. Order No. 8015693.

The use of an ideal feedback channel was investigated in a quantum communication system where coherent signals were used and the transmitter was subject to an average energy constraints. The quantum system corresponding to the optical field arriving at the receiver was assumed to be in a pure state. Binary message sequences were transmitted and the receiver employs a sequential detection strategy where bit-by-bit measurements were made, one corresponding to each symbol of the transmitted sequence. The measurement performed at each step was allowed to change, where the choice was determined by the message source statistics and the previous decisions made by the receiver. The forward channel was assumed to be noise free so that performance was limited only by quantum effects at the receiver.
Dissert. Abstr.

N80-27553 Colorado Univ. at Boulder.
THEORETICAL AND EXPERIMENTAL STUDY OF THE CHARACTERISTICS OF A THIN CIRCULAR LOOP ANTENNA ABOVE A HOMOGENEOUS, DISSIPATIVE HALF-SPACE.
Ahmed Saad Abulkassem. 1980. 204 p.
Avail: Univ. Microfilms. Order No. 8011261.

The problem of two parallel, staggered loop antennas of the same radius located in free space was investigated. Current distributions on the two loops were obtained by solving two coupled integral equations simultaneously using the well-known Fourier series expansion technique. It is found that when the separation between the two loops is large compared to the radius of the wire loops, the coupling between the two coaxial resonant loops is generally much stronger than that between two coplanar loops. It is also found that the change in input conductance, which sometimes can be as large as 60 percent of the value of the input conductance of an isolated antenna, occurs usually when the separation of the two coaxial loops are close to integer multiples of wavelength. Proximity effects not only change the overall amplitudes of the currents on the loops, but the distribution of the currents as well.
Dissert. Abstr.

N80-27554 Cornell Univ., Ithaca, N. Y.
INFRARED STUDY OF HYDROGEN CHEMISORBED ON W(100) BY SURFACE ELECTROMAGNETIC WAVE SPECTROSCOPY. Ph.D. Thesis.
Yves Jean Chabal. 1980. 209 p.
Avail: Univ. Microfilms. Order No. 8015651.

The first high resolution measurements of the v sub 1 vibrational mode of hydrogen chemisorbed on W(100) have been made using an infrared technique. The technique utilized the properties of inhomogeneous surface electromagnetic waves (SEW's) which propagated for several centimeters along a metal surface for wavelengths in the 10 micron region. Two methods for exciting SEW's on a metal surface were investigated. It was found that broadband SEW's could be generated by bombarding the surface with low energy electrons (approximately 100 eV), but the yield was too small to allow spectroscopic studies. A coupling geometry based on the principle of total internal reflection was devised to convert bulk radiation from a laser beam into

SEW's. This edge coupler was shown to be more efficient and more convenient than the usual two prism coupler or the grating coupler. With this coupler, the sensitivity of SEW's to monolayer coverages of molecules on metal surfaces was tested by studying the internal modes of KReO4 and SF6 physisorbed on gold films. Dissert. Abstr.

N80-27555*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
FOCAL AXIS RESOLVER FOR OFFSET REFLECTOR ANTENNAS
R. F. Schmidt. May 1980. 36 p. refs.
(NASA-TM-80683) Avail: NTIS HC A03/MF A01 CSCL 09C

Described are electrical means for determining the focal axis of an offset reflector antenna whose physical rim is not coincident with the boundary of the electrical aperture. Even and odd sensing functions are employed in the focal region, leading to both amplitude and phase criteria for resolving a focal axis generally inclined with respect to the system axis. The analytical aspects of the problem are discussed, and an example related to a 4-meter Large-Antenna Multiple-Frequency Microwave Radiometer (LAMMR) is included. The technique is useful for focal axis determination in mathematical simulations and in the physical world. Author

N80-27556*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
COMPUTER PREDICTION OF LARGE REFLECTOR ANTENNA RADIATION PROPERTIES
Alan Botula. Jul. 1980. 169 p. refs.
(Grant NsG-1588)
(NASA-CR-163253) Avail: NTIS HC A08/MF A01 CSCL 17I

A FORTRAN program for calculating reflector antenna radiation patterns was rewritten and extended to include reflectors composed of a number of panels. These individual panels must be analytic surfaces. The theoretical foundation for the program is as follows. Geometrical optics techniques are used to trace rays from a feed antenna to the reflector surface and back to a mathematical plane just in front of the reflector. The resulting tangential electric field distribution, assumed to be the only source of forward radiation, is integrated numerically to calculate the radiation pattern for a desired set of angles. When the reflector is composed of more than one panel, each panel is treated as a separated antenna, the ray-tracing procedure and integration being repeated for each panel. The results of the individual aperture plane integrations are stored and summed to yield the relative electric field strength over the angles of interest. An example and several test cases are included to demonstrate the use of the program and verify the new method of computation. A.R.H.

N80-27557*# Clarkson Coll. of Technology, Potsdam, N.Y.
A MICROPROCESSOR BASED HIGH SPEED PACKET SWITCH FOR SATELLITE COMMUNICATIONS. Final Report, 15 Apr. 1978 - 30 May 1980
Mohammed Arozullah and Stephen C. Crist. 30 May 1980. 347 p. refs.
(Grant NsG-3191)
(NASA-CR-163357) Avail: NTIS HC A15/MF A01 CSCL 17B

The architectures of a single processor, a three processor, and a multiple processor system are described. The hardware circuits, and software routines required for implementing the three and multiple processor designs are presented. A bit-slice microprocessor was designed and microprogrammed. Maximum throughput was calculated for all three designs. Queue theoretic models for these three designs were developed and utilized to obtain analytical expressions for the average waiting times, overall average response times and average queue sizes. From these expressions, graphs were obtained showing the effect on the system performance of a number of design parameters. A.R.H.

N80-27558*# Clarkson Coll. of Technology, Potsdam, N.Y.
A MICROPROCESSOR BASED HIGH SPEED PACKET SWITCH FOR SATELLITE COMMUNICATIONS. EXECUTIVE SUMMARY Executive Summary Report, 15 Apr. 1978 - 30 May 1980
Mohammed Arozullah and Stephen C. Crist. 30 May 1980. 16 p. refs.
(Grant NsG-3191)
(NASA-CR-163357) Avail: NTIS HC A02/MF A01 CSCL 17B

The feasibility of using microprocessors to control satellite-borne packet switching was investigated by designing a packet switch architecture suitable for microprocessor control, using 2900 series components to design the processor(s), and evaluating the packet switch in terms of system throughput, delay, and queue sizes without the packet switch. System architecture for one, three, and multiple processors was designed and evaluated. The production cost of the single processor packet switch is estimated at $500,000, excluding cost of development. The three processor version which can support a maximum throughput of 500,000 packets/sec is estimated to have a production cost of under $100,000. For the multiple processor system, cost is believed to be proportional to throughput, with $1,000,000 for 500,000 packets/sec being the proportionality factor. A.R.H.

N80-27559# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INFORMATION PROCESSING TECHNIQUES PROGRAM. VOLUME 1. PACKET SPEECH SYSTEMS TECHNOLOGY Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1979
Theodore Bially. 30 Sep. 1979. 40 p. refs.
(Contract F19628-78-C-0002; ARPA Order 2006)
(AD-A083195; ESD-TR-79-281) Avail: NTIS HC A03/MF A01 CSCL 17/2

The current program has two major thrusts; i.e., the development and refinement of practical low-cost, robust, narrowband and variable-rate speech algorithms and voice terminal structures, and the establishment of an experimental wideband satellite network to serve as a unique facility for the realistic investigation of voice/data networking strategies. This report covers work in the following areas: development of a custom-LSI-based narrowband channel vocoder; studies and real-time implementation of improved vocoder structures and algorithms; evaluation of speech processing capability of CCD-based spectrum analysis hardware; preparation of hardware and firmware for an upcoming speech algorithm test and evaluation program; design and implementation of packet voice terminals and local area access facilities; progress in satellite network and internetted packet voice conferencing and in the development of new packet voice network protocols; and design of a traffic emulation module for the wideband experimental network. GRA

N80-27560# Naval Research Lab., Washington, D. C.
ELECTROMAGNETIC SCATTERING PATTERNS FROM SINUSOIDAL SURFACES: VERTICAL POLARIZATION
R. H. Lang and A. K. Jordan. 17 Mar. 1980. 18 p. refs.
(AD-A083919; NRL-MR-4188) Avail: NTIS HC A02/MF A01 CSCL 20/14

In this paper we present an analysis and calculation of scattering patterns resulting from a vertically polarized beam of electromagnetic plane waves incident on a sinusoidal surface. This model is frequently used to study scattering from periodically rough surfaces. The horizontally polarized case is treated in a previous paper by the authors. The vector properties of this electromagnetic scattering problem are considered in this communication by extending the previous analysis to the vertically polarized case and comparing the scattering patterns for the two polarizations. GRA

N80-27561# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FEEDBACK NULLING DEMONSTRATION SYSTEM HARDWARE
David A. Siegel, David M. Hodsdon, Bing M. Potts, Howard S. Babbitt, Ervin S. Davis, Warren K. Hutchinson, and Karen Leeds. 23 Nov. 1979. 108 p. refs.
(Contract F19628-80-C-0002; AF Proj. 2029)
(AD-A084013; TN-1979-12; ESD-TR-79-272) Avail: NTIS HC A06/MF A01 CSCL 17/4

As part of the technology development of anti-jam satellite communications, Lincoln Laboratory has developed, built, and tested a demonstration analog-feedback adaptive-nulling antenna

system. The system, which is based on the Howells-Applebaum feedback loop, is designed to increase the signal-to-interference ratio when desired signals operate in the presence of interference signals. The signals received from interfering or undesirable signal sources are minimized by appropriately modifying the antenna radiation pattern so as to attenuate signals from the direction of those sources relative to the desired signals. The demonstration system consists of a simulated array of antenna elements and uplink signals and a real-time adaptive receiver-processor which controls the weighting of each element signal prior to combining. The weighting process involves changing the relative amplitudes and phases of the received signals thus changing the effective receiving radiation pattern of the antenna, i.e., its relative response to signals arriving from different directions. The system operation involves taking the signals from N independent antenna elements and weighting and combining them to form a single output signal in which the signal-to-interference ratio is enhanced over what it is for any individual antenna element. The task of the nulling processor is to select the set of weights for the antenna element array in some optimum fashion. GRA

N80-27562# Magnavox-General Atronics, Philadelphia, Pa.
HIGH POWER HF AND NOISE CANCELLATION SYSTEM Final Technical Report, Oct. 1978 - Jan. 1980
Samuel J. Harris and Stephen J. Rosasco. Griffiss AFB, N.Y. RADC. Mar. 1980. 48 p. refs.
(Contract F30602-78-C-0338; AF Proj. 2338)
(AD-A084016; GAC-3392-3403-13; RADC-TR-80-56) Avail: NTIS. HC A03/MF A01. CSCL 20/14

The objectives of this effort were achieved and should permit high power HF (2-30 MHz) transmitters and conventional HF receivers to be collocated on an aircraft and operated simultaneously (full duplex) with appreciably less than 10% frequency separation between the transmit and receive channels. The option of frequency assignment between the Maximum Usable Frequency (MUF) and the Lowest Usable Frequency (LUF) for the transmit and receive frequencies can result in a 40 dB improvement in a duplex circuit, or stated another way, it may be the only way to establish a circuit between two points. One or more full duplex HF circuits can be operated simultaneously on an aircraft. The technique employed is a high power HF Interference Cancellation System which is adaptive and completely automatic. The significance of this effort is that it has direct application to C3 aircraft and collocated ground HF sites, including those sites with transmitters of ultra high power output (1 kW). In addition, the ultra linear high power weight/controller technology employing goniometers can be applied in any frequency range from VLF to UHF. GRA

N80-27563# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
INTERMEDIATE RESULTS OF THE RADAR BACKSCATTER STUDY OF SEA ICE IN THE BEAUFORT SEA
C. V. Delker, R. G. Onstott, and R. K. Moore. Mar. 1980. 48 p. refs.
(Contract N00014-76-C-1105)
(AD-A083644; RSL-TR-331-15) Avail: NTIS. HC A03/MF A01. CSCL 08/12

As a part of the Beaufort Sea segment of the Surveillance Satellite Project (SURSAT), a team of investigators from the University of Kansas conducted experiments to obtain quantitative measurements of radar backscatter from sea ice during the month of March 1979. Thick first-year sea ice, thin first-year sea ice, and an inland fresh water lake were studied using a surface-based FM-CW scatterometer that swept from 1.1 - 1.9 GHz and 8.5 - 17.5 GHz with angles of incidence (from vertical) of 10 deg. to 75 deg and various linear polarizations. Measurements of thick first-year sea ice, thin first-year sea ice, brackish sea ice, and an inland fresh-water lake were also made using a helicopter-borne FM-CW scatterometer that swept from 8.5 - 17.5 GHz with incidence angles of 20 deg. to 60 deg. and VV polarization only. The 1.1 - 1.9 GHz measurements show that lake ice can be distinguished from thick and thin first-year sea ice. The radar cross-sections of thick and thin first-year sea ice are not significantly different for incidence angles less than 45 deg. The 8.5 - 17.5 GHz measurements indicate that lake ice can be distinguished from the other types in all cases. Thick and thin first-year sea ice are separated by a 2 - 4 dB difference for incidence angles greater than 40 deg. The effect of snow cover on the return from lake ice was also investigated with dramatic results. GRA

N80-27564# Catholic Univ. of America, Washington, D. C. Dept. of Physics.
RESONANCES OF RADAR TARGETS AND TARGET DISCRIMINATION Final Report, 6 Mar. 1979 - 5 Mar. 1980
Herbert Uberall. Mar. 1980. 45 p. refs.
(Contract N00019-79-C-0270)
(AD-A083680) Avail: NTIS. HC A03/MF A01. CSCL 17/9

The topic of the research program covers methods for target discrimination by radar scattering, making use of the natural resonances of the targets. The general plan of the program consists in a study of resonances of targets of simple shape (e.g., sphere) but complex composition (e.g., dielectric coating of conductors) during the first year, followed by simple conducting targets and comparison with parallel measurements performed at NSWC Dahlgren in the second year, with further extension to conductors of more complex shapes, using Waterman's methods, later on. The emphasis of our study is two-fold, namely: (1) to study ways how the resonance structure of the radar echo can be used for identifying the nature of the target (the 'inverse scattering problem'); and (2) to obtain a physical understanding of the phenomena that cause the resonances, and how they manifest themselves in both steady-state and pulsed echoes. Such an understanding, in preference to a more mechanical use of the singularity expansion method, will provide us with the true capability of mastering the target discrimination problem. GRA

N80-27565# Army Engineer Topographic Labs., Fort Belvoir, Va.
BACKSCATTERING OF ELECTROMAGNETIC WAVES FROM A LAYER OF VEGETATION
Richard A. Hevenor. 15 Feb. 1980. 29 p. refs.
(AD-A083922; ETL-R008) Avail: NTIS. HC A03/MF A01. CSCL 17/9

A theoretical model for the backscattering of electromagnetic waves from a layer of vegetation is computed using a first order renormalization technique to determine volume scattering. The vegetation soil interface is assumed rough according to the tangent plane approximation and the scattering from this boundary is added incoherently to the volume scattering result. The mean wave in the vegetation is obtained using a bilocal approximation of the Dyson's equation. A free space dyadic Green's function is used along with a correlation function of the dielectric fluctuations which is exponential in form and which also possess different correlation lengths lx, ly, and lz in the x, y, and z, directions. Effective propagation constants are obtained for both horizontal and vertical polarizations. The scattered wave is solved for using a two dimensional Fourier transform technique and the boundary conditions at either end of the vegetation layer are matched. The far field backscatter coefficients are computed for both horizontal and vertical polarizations. The mean and variance of the dielectric fluctuations are calculated with the aid of Peake's model for the dielectric constant of vegetation. The theory is matched to experimental data taken from a corn field. The resulting values for the correlation parameters are then used to monitor the growth pattern of the corn field over a period of time. Comparison between the theoretical and experimental results over this time period are shown. The theory is also matched to experimental data from spring and fall deciduous trees. GRA

N80-27566# Army Electronics Research and Development Command, Fort Belvoir, Va. Electronics Technology/Devices Lab.
EFFECT OF VARIOUS DIELECTRICS ON THE DESIGN OF MILLIMETER-WAVE LINE SCANNING ANTENNAS
Kenneth L. Klohn. Nov. 1979. 26 p. refs.
(DA Proj. 1L1-62705-AH-94)
(AD-A083791; DELET-TR-79-24) Avail: NTIS. HC A03/MF A01. CSCL 09/5

The effect of using various materials having different relative dielectric constants on the theoretical design of millimeter-wave

line scanning antennas has been examined. Three typical dielectrics were chosen for comparative purposes; silicon (epsilon(r) = 12, sapphire (epsilon(r) = 9.4), and boron nitride (Epsilon(r) = 4). Theoretical calculations were made for each material over the frequency range of 60 to 220 GHz, with special emphasis at 94 GHz due to its increasing use in new millimeter-wave systems. Comparisons were made among the dielectric materials in regard to their maximum allowable physical size for single E(y) 11 mode operation. Using each of the three dielectrics with periodic surface perturbations as a line scanning antenna, the effects on the angle of radiating energy due to changes in the waveguide size and perturbation spacing were determined and evaluated. GRA

N80-27567# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DEVELOPMENT OF AN AUTOMATED REMOTE COMMUNICATIONS AIR-GROUND (RCAG) MONITORING SYSTEM Final Report, Mar. 1978 - May 1979
Nicholas J. Talotta and Albert J. Rehmann Apr. 1980 192 p refs
(AD-A083754; FAA-NA-79-44; FAA-RD-79-125) Avail: NTIS HC A09/MF A01 CSCL 14/2

A monitoring System for remote communication air-ground (RCAG) facility equipment was developed, including the design and fabrication of an engineering model. Sensor techniques for the transmitters and receivers were investigated. The design made use of a microprocessor with associated hardware and software to 'continuously monitor' critical parameters. Certification data and/or alarms were reported via a terminal. It is concluded that production of automated monitoring equipment for Federal Aviation Administration (FAA) air/ground communication facilities with the specific sensor techniques, processing, and control used in this experimentation is feasible. GRA

N80-27568# Transportation Systems Center, Cambridge, Mass.
THEORETICAL FEASIBILITY OF DIGITAL COMMUNICATION OVER OCEAN AREAS BY HIGH FREQUENCY RADIO Final Report, Aug. 1978 - Jul. 1979
George W. Haydon, Charles M. Rush, and Larry R. Teters Nov. 1979 89 p refs Prepared in cooperation with the National Telecommunication Information Admin., Boulder, Colo.
(AD-A079424; TSC-FAA-79-26; FAA-EM-78-20) Avail: NTIS HC A05/MF A01 CSCL 17/2

The theoretical reliability of digital data transmission via high-frequency radio is examined for typical air traffic routes in the Atlantic and Pacific areas to assist the U.S. Department of Transportation in the evaluation of a system for improving air traffic control over ocean areas. The expected performance of a reference high-frequency data transmission system of 1200 bits per second with a permissible error rate of one in a thousand binary error is expressed as a percentage of time that a given theoretical reliability will be equaled or exceeded. The expected performance of air-to-air HF systems is also considered, and it is concluded that these systems should work for the reference communication system out to the line-of-sight range of about 800 km for high-flying aircraft. GRA

N80-27569# Morgenthaler (Frederick R.), Wellesley, Mass.
THEORETICAL STUDIES OF MICROSTRIP ANTENNAS. VOLUME 2: ANALYSIS AND SYNTHESIS OF MULTI-FREQUENCY ELEMENTS Final Report, Apr. 1978 - Jul. 1979
Frederic R. Morgenthaler Sep. 1979 50 p
(Contract DOT-TSC-15364)
(AD-A075540; TSC-FAA-79-21-2; FAA-EM-79-11-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

Volume 2 of Theoretical Studies of Microstrip Antennas deals with the analysis and synthesis of several types of novel multi-resonant elements with emphasis on dual-frequency operation of rectangular microstrip patch antennas with or without external matching networks. Specifically, we analyze dual resonances created within a single rectangular patch by means of appropriate dielectric loading and also those associated with a patch capacitively-coupled to either a lumped or distributed matching network. In all cases radiation is obtained from slots in the rectangular patch in combination with open-circuited edges. Rather than separately design the dual-resonating elements and matching networks and hope for efficient radiation and proper patterns at both frequencies, we favor and herein pursue an integrated synthesis which demands simultaneous fulfillment of the design goals. A synthesis approach, based upon coupled resonator theory, is also developed and applied to situations in which one resonant element is a rectangular microstrip patch and the second element either a second patch or else a lumped or distributed matching network. Based upon these considerations, several new antenna configurations are proposed that utilize either in line or stacked element geometries. Volume I of this report deals with general design techniques and analyses of single and coupled microstrip radiating elements. GRA

N80-27570# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
COMPUTER PROGRAMS FOR ELECTROMAGNETIC TRANSMISSION THROUGH A FILLED SLIT OF ARBITRARY CROSS SECTION IN A CONDUCTING PLANE OF FINITE THICKNESS Progress Report, Nov. 1978 - Jul. 1979
David T. Auckland and Roger F. Harrington Griffiss AFB, N.Y. RADC Mar. 1980 148 p refs
(Contract F30602-79-C-0011; AF Proj. 2338)
(AD-A084352; RADC-TR-80-59) Avail: NTIS HC A07/MF A01 CSCL 09/2

Three computer programs are presented for the analysis of electromagnetic transmission through a filled slit of arbitrary cross section in a conducting plane of finite thickness. The first and second programs utilize a non-modal and model formulation, respectively, which are derived in detail in an earlier report. Some approximate solutions are available when the slit cross section is a rectangular shape and these are investigated in the third program. The programs are all written in FORTRAN IV language. Quantities computed are equivalent electric and magnetic currents on the contour defining the slit cross section, transmission coefficients, gain patterns, and normalized field patterns. Sample input and output data are presented for each program. Detailed instructions concerning the use of each program and its capabilities are given. GRA

N80-27571# SRI International Corp., Menlo Park, Calif.
GRADIENT SCATTERING THEORY DEMONSTRATES THAT VHF, SPREAD-F RADAR BACKSCATTER REVEALS STREAMING INSTABILITIES Progress Report, Jan. - Oct. 1978
Walter G. Chesnut 30 Nov. 1978 53 p refs
(Contract DNA001-78-C-0075)
(AD-A084644; AD-E300761; DNA-4801) Avail: NTIS HC A04/MF A01 CSCL 17/9

Field-aligned radar backscatter echoes have been obtained from the equatorial F region using frequencies from slightly above the plasma frequency to as high as 415 MHz. In this report we study the possibility that such echoes result from steep transitions from low- to high-density plasmas. We have studied four profile forms for this transition. The first, the only physically based profile, is assumed to be associated with the gyroradius distribution of the ions in the plasma. The second profile, the Epstein profile, is subject to exact reflectivity analysis and is used to provide guidance concerning the accuracy of the Born approximation used in our other calculations. The third profile, a half Gaussian wedded to a step function, a form used by Balsley and Farley, and a fourth profile, a raised cosine form, lead to very intense scattering, by hundreds of dBs, compared with that derived from our physically based gyroradius distribution. We believe we have shown that the intense scattering results computed by Balsley and Farley are due to mathematical discontinuities in the second derivatives of these last two profiles. As a result, we argue that the half-Gaussian profile is an inappropriate, unphysical model, and results based upon this model are probably unrealistic. GRA

N80-27572# Physical Dynamics, Inc., Bellvue, Wash.
STATISTICAL BEHAVIOR OF SIGNALS FROM THE WIDEBAND SIGNAL Final Report, 15 Nov. 1977 - 31 Dec. 1978
Edward J. Fremouw 31 Dec. 1978 59 p refs
(Contract DNA001-78-C-0042)
(AD-A084646; AD-E300759; PD-NW-79-193R; DNA-4818f) Avail: NTIS HC A04/MF A01 CSCL 20/14

Optical and radio signals that have been scattered by random

refractive-index structure must be described statistically in systems-oriented codes and other applications. The general nature of the statistics that would best describe such signals has been an open question for some time, with different models being used close to the medium (log-normal) and far from it (Rician). Signal behavior in the intermediate zone, which is the relevant distance regime for radiowave communication through the structured ionosphere and through striated, high-altitude nuclear plasmas, has been difficult to characterize in a general and systematic way. The Wideband satellite experiment, with its multiple, coherent frequencies and its variety of observing geometries, has provided a wealth of data upon which to base a general model. In this work, careful and detailed analysis has been performed of VHF, UHF, and L-band data from the Wideband receiving stations at Ancon, Kwajalein, Stanford, and Poker Flat to establish the statistical behavior of scattered signals over a wide range of scattering strength, Fresnel-zone size (which sets the effective distance), and scattering geometry. Histograms of intensity and phase were compared, by means of chi-square testing, with probability density functions derived from four leading signal-statistical hypotheses: log-normal; generalized Gaussian, of which Rice statistics are a special case; two-component, which invokes the log-normal and generalized Gaussian hypotheses in different regimes of the signal fluctuation spectrum; and Nakagami-m, which is an approximation to generalized Gaussian statistics addressing only the behavior of signal intensity. GRA

N80-27573# Ohio State Univ., Columbus.
RADIATION BY SOURCES ON PERFECTLY CONDUCTING CONVEX CYLINDERS WITH AN IMPEDANCE SURFACE PATCH
L. Ersoy and P. H. Pathak. Griffiss AFB, N.Y. RADC Jan. 1980 129 p refs
(Contract F19628-77-C-0107; AF Proj. 2305)
(AD-A084345; ESL-784641-2) Avail: NTIS
HC A07/MF A01 CSCL 20/14

This report deals with an asymptotic high frequency analysis of the radiation patterns of a magnetic line source, or a magnetic line dipole, located on a uniform impedance surface patch which partly covers an electrically large perfectly conducting convex cylinder. This work is relevant, for example, to the analysis of fuselage mounted airborne antennas for satellite communication purposes. In the latter application impedance surface patches may be employed to increase the radiation intensity near the horizon over that which would ordinarily exist in the absence of any such impedance loading. In the present analysis, the impedance surface patch is represented as an equivalent aperture in the rest of the perfectly conducting convex cylinder. Approximate asymptotic expressions for the (equivalent aperture distribution); i.e., for the (currents on the impedance surface patch) are developed in this work for the two source types; these expressions for the currents are valid in the neighborhood of the source. The radiation pattern of this configuration is then found in a straightforward manner by numerically integrating this current distribution in conjunction with a simple and accurate asymptotic high frequency form of the perfectly conducting, convex cylinder Green's function. Radiation pattern calculations based on this analysis are found to compare quite well with a numerical moment method type solution, a previous GTD solution for those impedances which support an Elliot mode, and also with some presently available experimental results. GRA

N80-27574# Ohio State Univ., Columbus. ElectroScience Lab.
BROADBAND METALLIC RADOME Interim Report, Jan. 1978 - Sep. 1979
J. S. Ernst. Wright-Patterson AFB, Ohio AFAL Sep. 1979 121 p refs
(Contract F33615-76-C-1024; AF Proj. 7633)
(AD-A084663; ESL-784346-11; AFAL-TR-79-1142) Avail: NTIS HC A06/MF A01 CSCL 09/5

This report studies the transmission properties of metallic radome configuration of two slot arrays consisting of three-legged elements imbedded in three dielectric layers. The purpose is to design a bandpass filter with as large a bandwidth as possible while still maintaining a constant bandwidth for all angles of incidence. GRA

N80-27575# Science Applications, Inc., Tucson, Ariz.
RADAR TEST RANGE DESIGN CONSIDERATIONS Final Report
Dino Sofianos 29 Apr. 1980 83 p refs
(Contract F33657-79-C-0178)
(AD-A084400; SAI-TR-04-165-3) Avail: NTIS
HC A05/MF A01 CSCL 17/4

This report presents considerations for and the preliminary design of a synthetic aperture RADAR (SAR) test range. The purpose is to present a methodology and conceptual design for a Flexible Test Bed (FTB) digital processor operational test. The objectives of this operational test are to: (1) determine whether the processor modifications improved image quality, (2) establish a processor performance baseline, and (3) determine whether the system will attain desired levels of probability of detection. It is assumed that SAI would develop a test design while GAC will fabricate and install the required radar test range. GRA

N80-27576# Ohio State Univ., Columbus. ElectroScience Lab.
COMMUNICATION APPLICATION OF ADAPTIVE ARRAYS Final Report
R. T. Compton, Jr. Mar. 1980 8 p ref
(Contract N00019-79-C-0291)
(AD-A084402; ESL-771847-7) Avail: NTIS
HC A02/MF A01 CSCL 17/2

There are three areas of work under this contract. The first involves studies on weight jitter and dynamic range for the improved LMS loop. The second is a continuation of research on a reference signal generation technique for FSK signals. The third area involves the preparation of a monograph on adaptive arrays. GRA

N80-27577# Naval Postgraduate School, Monterey, Calif.
VOICE TRANSMISSION AT 6000 BITS PER SECOND USING DELTA MODULATION M.S. Thesis
Elias Emmanuel Padouvas Dec. 1979 36 p refs
(AD-A084375) Avail: NTIS HC A03/MF A01 CSCL 17/2

Digital systems are of major importance in modern communications. This research investigates the minimum clock (bit) rate of a commercially available delta modulator/demodulator needed to transmit intelligible voice signals. Intelligible voice and music signals were recovered using a clock rate as low as 6 Kbits/sec. GRA

N80-27578# Naval Postgraduate School, Monterey, Calif.
COMPARISON OF AN ALPHA-BETA AND KALMAN FILTER IN TRACK WHILE SCAN RADARS M.S. Thesis
Dimitrios Emmanuel Mayiatis Dec. 1979 153 p refs
(AD-A084464) Avail: NTIS HC A08/MF A01 CSCL 17/9

The efficient use of a search-surface radar or sonar, in which one or more targets appear on the screen intermittently usually demands a device for tracking the targets automatically. Such a device, called a track while scan system, must make an estimate of each target's instantaneous position from the sampled-data information provided by the radar. For this purpose, an alpha-beta filter and an optimal Kalman filter, that must track maneuvering targets, are analyzed here and compared in terms of tracking accuracy for tactical application. GRA

N80-27579# Naval Postgraduate School, Monterey, Calif.
BACKGROUND MONITOR FOR THE SATCOM SIGNAL ANALYZER M.S. Thesis
Heinz-Joachim Niemann Dec. 1979 201 p refs
(AD-A084381) Avail: NTIS HC A10/MF A01 CSCL 09/2

A SATCOM Signal Analyzer (SSA) is being developed by the Satellite Communications Laboratory of the Naval Postgraduate School. The purpose of this system is to provide high-speed multi-channel digital spectrum analysis and characterization of the outputs of UHF communication satellite transponders while in orbit and operating. A Digital Computer Subsystem provides the control for most of the equipment in the system. The thesis documents a portion of the software development for this subsystem. This software performs all operator interaction using a Touch Input System and a Graphics Display. It is controlled to a large extent by menu data stored in a disc file, which can easily be extended or modified. Non-trivial file management and

concurrent processing of several functions are major characteristics of this software. GRA

N80-27580# Mississippi Univ., University.
ELECTROMAGNETIC SCATTERING BY SURFACES OF ARBITRARY SHAPE
Donald R. Wilton, S. S. M. Rao, and Allen W. Glisson Griffiss AFB, N.Y. RADC Mar. 1980 69 p refs
(Contract F30602-78-C-0148; AF Proj. 2338)
(AD-A084347; RADC-TR-79-325) Avail: NTIS HC A04/MF A01 CSCL 20/14

The electric field integral equation (EFIE) is used with the moment method to develop a simple and efficient numerical procedure for treating problems of scattering by arbitrarily-shaped objects. The objects are modeled for numerical purposes by planar triangular surface patch models. Because the EFIE formulation is used, the procedure is applicable to both open and closed bodies. Crucial to the formulation is the development of a set of special subdomain basis functions defined on pairs of adjacent triangular patches. The basis functions yield a current representation which is free of line or point charges at subdomain boundaries. A second approach using the magnetic field integral equation (MFIE) and employing the same basis functions is also developed. Although the MFIE applies only to closed bodies, the moment matrix of the MFIE is also needed in dielectric scattering problems and in the so-called combined field integral equation used to eliminate difficulties with internal resonances present in the MFIE and EFIE formulations. The EFIE approach is applied to the scattering problems of plane wave illumination of a flat square plate, a bent square plate, a circular disk, and a sphere. Comparisons of surface current densities are made with previous computations or exact formulations and good agreement is obtained in each case. The MFIE approach is also applied to the sphere and reasonable agreement with exact calculations is obtained. GRA

N80-27581# Martin Marietta Aerospace, Denver, Colo.
ADAPTIVE TECHNIQUES FOR LARGE SPACE APERTURES Final Technical Report, 6 Nov. 1978 - 5 Nov. 1979
R. J. Richardson, John Coyner, Alan Fenn, and Al Brook Griffiss AFB, N.Y. RADC Mar. 1980 329 p refs
(Contract F30602-79-C-0017; AF Proj. 4506)
(AD-A084631; RADC-TR-80-52) Avail: NTIS HC A15/MF A01 CSCL 17/9

Two missions which utilize large space apertures were considered on the program. These were the space-based radar mission (SBR) and the space-based millimeter-wave radiometer mission (MWR). The greater part of the effort was spent on the radar mission. The intent of the program was to investigate reflector-based alternates to the space-fed phased array system that is the current baseline for the space-based radar program. The three major tasks on the program were Task 1, Concept Development/Assessment; Task 2, Performance Analysis, Selected Approach; and Task 3, Specific Mission Designs. The adaptive techniques of interest were those that might be required to compensate for surface irregularities in the large, space-deployable reflectors that would be required for these missions. This and other system requirements were considered in selecting an antenna system for each mission. GRA

N80-27582# Lockheed Missiles and Space Co., Palo Alto, Calif.
SAR OBJECT CHANGES DETECTION STUDY Final Technical Report, 29 Sep. 1978 - 15 Jun. 1979
Kalyan Dutta and Charles D. Kuglin Griffiss, AFB. N.Y. RADC Mar. 1980 58 p refs
(Contract F30602-78-C-0347; AF Proj. 4594)
(AD-A084630; LMSC/D676644; RADC-TR-80-69) Avail: NTIS HC A04/MF A01 CSCL 17/9

This study assessed the applicability of three area-based change-detection algorithms to the problem of recognizing differences between two images. These approaches are based on defining sets of descriptors for small regions of each scene and then comparing these sets of descriptors to indicate areas of change. The first algorithm is based on the phase-correlation concept, a technique for extracting accurate estimates of the relative displacement of two images from the phase of their cross-power spectrum. The 2nd is based on using a subset of power-spectral coefficients for each image; the subset is chosen to minimize differences due to scene bias, shading, or high-frequency noise content. The 3rd is based on defining image moments and a set of functions of these moments which are invariant with respect to a number of geometrical distortion or scale changes of the image. These algorithms were applied to furnished SAR images. Results of the three algorithms are consistent among themselves but correlate weakly with known ground truth. Studies to determine the size of targets that can be reliably detected by use of these methods indicate that the size of targets in the furnished images fails to meet the size criterion for reliable change detection. It is concluded that, for imagery of this quality and resolution, target detection and association algorithms should prove to be more effective for change detection. GRA

N80-27583# General Electric Co., Santa Barbara, Calif.
LORAN-C SIGNAL ANALYSIS PROPAGATION MODEL EVALUATION Final Report, Jun. 1977 - May 1978
Burt Gambill and Kenneth Schwartz Jul. 1979 228 p refs
(Contract DOT-CG-64810-A)
(AD-A084338; GE78TMP-51; USCG-D-20-80) Avail: NTIS HC A11/MF A01 CSCL 20/14

This report compares predictions of groundwave propagation time with experimental values. The prediction methods included an integral equation technique that accounts for both terrain and impedance variations, a method developed by J.R. Wait that accounts for impedance variations, and Millington's or Pressey's technique that accounts for inhomogeneous impedance. Experimental incremental time-of-arrival data were acquired between eight sites along a propagation path from Search-light, NV. to Ft. Cronkhite (near San Francisco Bay). The major conclusions reached from the analysis and comparison of results are: terrain variations produce significant local and cumulative phase variations, in this case, a cumulative large increase in total secondary phase; impedance values need to be known to within less than a factor of two to be sufficient for preparing charts for navigation in restricted waterways; a priori definition of terrain variation can be performed with required accuracy - a priori definition of surface impedance values with sufficient accuracy is unlikely without supporting measurements; and a combination of predictions and measurements is required for accurate chart preparation. Predictions can be used to define appropriate measurement locations and to interpolate between measurement values. GRA

N80-27584# Communications Research Centre, Ottawa (Ontario). Radio and Radar Research Branch.
HF DIRECTION FINDING BY WATERFRONT TESTING
D. W. Rice Mar. 1980 47 p refs
(AD-A084549; CRC-1333) Avail: NTIS HC A03/MF A01 CSCL 17/3

Calculations are reported of the probability of observation of various degrees of phase-front non-linearity for two and three signals incident from different directions upon a phase-measuring array. It is assumed that the signals fade independently, and that their amplitude probability densities are described by a Rayleigh law. It is shown that, under the worst-case conditions of equal powers in the signals, the probability of observing an rms phase deviation of 25 degrees or less from the best-fit straight line to the phase along an array, is about 0.5 when 2 rays are present, and about 0.2 when 3 rays are present. Experimental measurements over a 911km mid-latitude path and a 2100km trans-auroral-zone path, confirm the general behavior predicted by the theory. It is well known that amplitude fading can be attributed to various ionospheric effects; however the measurements show that modulation imposed on the signal at the transmitter can also play an important part in decorrelating the amplitudes of signals received (after different time delays) via different ionospheric modes. In the latter case, the modulation can markedly reduce both the waiting time between phase-linear events, and their duration. The experimental program included concurrent measurements over the same path using FMCW, CW and SSB signals from a co-operative transmission. GRA

N80-27585# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
QUIET RADAR PROCESSOR ANALYSIS BY COVARIANCE MATRIX TRANSFORMATIONS

Neal B. Lawrence Oct. 1979 53 p refs
(AD-A084453; DRSMI/RE-80-4) Avail: NTIS
HC A04/MF A01 CSCL 17/9

The MICOM Quiet Radar program is a multi-year exploratory development effort to build and test a short-range air-defense system radar with Anti-Radiation Missile (ARM) immunity. By transmitting a low-power, bi-phase modulated, continuous-wave waveform in conjunction with ultra-low sidelobes antenna and a frequency-agile carrier frequency, it is possible to reduce ARM lock-on capabilities to ineffective ranges. The objective of this effort was to determine probability of detection for a given false alarm rate for a candidate Quiet Radar processor by performing covariance matrix transformations. The analysis included range cell averaging CFAR. Results were obtained for two possible configurations of the Quiet Radar processor. The results are given as plots where the probability of detection in each frequency cell is shown for various probabilities of false alarm and CFAR range cell window widths. The analysis has verified previously determined CFAR losses and shown that processor performance is dependent on the low pass filter used for noise reduction. GRA

N80-27586# Arizona Univ., Tucson. Engineering Experiment Station.
EXTERIOR-INTERIOR APERTURE COUPLING OF A RECTANGULAR CAVITY WITH WIRE OBSTACLE Final Technical Report, 30 Aug. 1979 - 31 Jan. 1980
William Arthur Johnson 31 Mar. 1980 73 p refs
(Grant AF-AFOSR-3462-77; AF Proj. 2301)
(AD-A084258; AFOSR-80-0413TR) Avail: NTIS
HC A04/MF A01 CSCL 20/14

In this work, the exterior-interior coupling problem of a cavity backed aperture in a perfectly conducting infinite sheet is considered. The cavity is assumed to be rectangular and contains a perfectly conducting obstacle. For numerical considerations the obstacle is taken to be a straight, thin wire, oriented perpendicular to one of the cavity walls. The problem is formulated in the frequency domain with an e(to the i omega tau power) time dependence. The dyadic formulation of this vector electromagnetic boundary value problem is given. The controversy over the longitudinal wave functions and their contribution to field dyads is resolved. Specific attention is given to the singularities and completeness of the Green's dyads: eigenfunction expansions. Numerically tractable integral equations for the aperture electric fields and the wire currents are obtained. A summation method is developed for evaluation of otherwise slowly converging eigenfunction expansions of potentials dyads when source and observation points become close. The numerical reduction of the integral equations by the method of moments is described. The numerical results for the aperture fields and the wire currents disclose a minus sign discrepancy between the results and previous results of Seidel. A discussion is given which supports the sign in the present work. GRA

N80-27587# Applied Science Associates, Inc., Apex, N. C.
AN ANALYTICAL STUDY OF WAVE PROPAGATION THROUGH FOLIAGE Final Technical Report, 9. Sep. 1978 - 30 Sep. 1979
Gary S. Brown and William J. Curry Griffiss AFB, N.Y. RADC Jan. 1980 213 p refs
(Contract F19628-78-C-0159; AF Proj. 4600)
(AD-A084348; ASA-79(AF)-1; RADC-TR-79-359) Avail: NTIS
HC A10/MF A01 CSCL 20/14

A model is developed for the effect of foliage on the average or coherent field propagating in the foliage and parallel to the foliage-air or foliage-ground interfaces. The model is based upon a number of assumptions which considerably reduce its complexity to the point where it can be used by systems designers in evaluating the effect of foliage on Synthetic Aperture Radars operating near grazing incidence. The model is hypothesized to be valid in the frequency range of about 0.1 to 1.5 GHz for deciduous trees and from 0.1 to about 3 GHz for needle bearing trees. Comparisons with available measurements indicate a surprisingly high degree of agreement considering the simplicity of the model. Suggestions for future analytical and experimental efforts are presented. GRA

N80-27588# Aerodyne Research, Inc., Bedford, Mass.
A STUDY OF REAL TIME SIGNAL PROCESSING METHODS FOR DECODING SPREAD SPECTRUM SYSTEMS Final Report
H. J. Caulfield, Robert Haimes, and Peter Mueller Griffiss AFB, N.Y. RADC Feb. 1980 41 p refs
(Contract F19628-79-C-0032; AF Proj. 4600)
(AD-A084349; RADC-TR-80-24) Avail: NTIS
HC A03/MF A01 CSCL 09/4

Spread spectrum signals require several kinds of processing. First, the effects of tracking error, Doppler shifts, etc. must be compensated out or ignored in some clever way to give the 'raw' signal. Second, the raw signal at high bandwidth must be decoded to give the low bandwidth information stream. Often this requires comparison of the raw signal with a properly synchronized pseudo random reference signal. Third, the low bandwidth signal may or may not be burst error correction coded and hence require appropriate decoding. In this study we found that all three steps in spread spectrum decoding could be approached optically. Specific, stand-alone developments from this program were two in number. First we developed a 'generalized matched filter' which can be used just as a matched filter but which out performs the matched filter in several important ways. Second, we developed a way of obtaining a high spectral resolution tunable acousto-optic filter using existing components. Both developments should find wide application outside spread spectrum decoding. GRA

N80-27589# Lister Hill National Center for Biomedical Communications, Bethesda, Md.
DIGITAL TRANSMISSION EXPERIMENT OVER CTS (COMMUNICATION TECHNOLOGY SATELLITE) AUDIO CHANNELS Final Report
Samuel Yep and Surachai Suthasinekul Jul. 1979 70 p refs
(PB80-159544; LHNCBC-79-14) Avail: NTIS
HC A04/MF A01 CSCL 17B

An experiment is reported involving digital data transmission over a PHS/CTS (Public Health Service/Communications Technology Satellite) audio baseband channel. Since it is desired to evaluate the performance of the existing system from a digital data transmission standpoint, the interface between the digital subsystem and the audio channel is made at the baseband, thereby avoiding major modifications of the existing facilities. A two-level polar baseband signalling technique is employed which, besides being simple to implement, provides the flexibility for experimenting with various data rates. Experimental results indicate that digital transmission with a bandwidth efficiency of 2 bits per cycle for a 0.0001 bit error rate requires an S/N of about 13 dB, approximately 2 dB higher than the theoretical requirement. Possible causes for the degradation are suggested. It is recognized that since the S/N available in the audio baseband channel is much higher than 13 dB, this excess S/N could be exploited by using a multilevel technique to achieve a higher bandwidth efficiency or equivalently, a higher data rate. GRA

N80-27590# Institute for Telecommunication Sciences, Boulder, Colo.
SHARING OF THE BAND 12.2-12.7 GHz BETWEEN THE BROADCASTING-SATELLITE AND FIXED SERVICES
Hiroshi Akima Jan. 1980 45 p ref
(PB80-157423; NTIA/REPORT-80-32) Avail: NTIS
HC A03/MF A01 CSCL 17B

The United States Administration has proposed for the 1979 WARC (World Administrative Radio Conference) to move the BSS (Broadcasting-Satellite Service) in ITU (International Telecommunication Union) Region 2 from the band 11.7-12.2 GHz to the band 12.2-12.7 GHz, which is also allocated to the terrestrial FS (fixed service). This report discusses the potential of sharing between the BSS and the FS in the band 12.2-12.7 GHz. It is concluded that sharing is feasible under certain conditions. GRA

N80-27591# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
HF (HIGH-FREQUENCY) RADIO NOISE IN THE TOPSIDE IONOSPHERE
Charles M. Rush, Rayner K. Rosich, and Carlene Mellecker Feb. 1980 60 p refs Sponsored in part by AFGL

(PB80-162670; NTIA/REPORT-80-33) Avail: NTIS HC A04/MF A01 CSCL 17B

The results of studies undertaken in order to develop a morphological picture of the radio environment in the ionosphere above the peak of the F2 region are discussed. The factors and assumptions that must be considered in assessing the propagation of terrestrially based signals through the ionosphere to satellite heights are summarized. Some general characteristics of the DMSP HF receiver are also given. R.C.T.

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-27592 Purdue Univ., Lafayette, Ind.
THE THEORY AND EFFECTS OF NEGLECTING STATOR AND NETWORK TRANSIENTS Ph.D. Thesis
Timothy Lyall Skvarenina 1979 154 p
Avail: Univ. Microfilms Order No. 8015519

The reduced order linearized equations of the induction machine are derived. Analytical results are developed to show that a ratio of machine parameters may be used as an indication of the accuracy of the eigenvalues predicted by the reduced order model. Large excursion studies of induction machines are presented and the accuracy of the results is shown to be dependent upon the machine parameters and type of study when the stator transients are neglected. Results are presented which show that it is not generally acceptable to neglect the stator and network transients when turbine generator shaft torques are of interest. It is shown that the magnitude of shaft torques resulting from faults in the system is very dependent upon the impedance between the machine and the point of the fault. A method is developed to allow the use of a modified standard transient stability program for the calculation of shaft torques.
Dissert. Abstr.

N80-27593 California Inst. of Tech., Pasadena.
THE HOMOGENEOUS MACHINE Ph.D. Thesis
Bartholomew Nicholas Locanthi 1980 142 p
Avail: Univ. Microfilms Order No. 8016368

The problem of orchestrating many computing elements in the performance of general purpose computations is addressed. A scheme which automatically detects and exploits concurrencies in computations expressed in an applicative subset of the LISP programming language is suggested. The mapping of numerical and symbolic computations onto array and tree structures is also described. The design of multiprocessor systems as a problem in bandwidth reduction is evaluated and the concept of a multi level cache is introduced. Dissert. Abstr.

N80-27594 Washington Univ., Seattle.
MODELING AND ANALYSIS OF SWITCHED INTERCONNECTION NETWORKS Ph.D. Thesis
Petre Nichifor Turcu 1979 108 p
Avail: Univ. Microfilms Order No. 8012201

A traffic flow model was developed for the analysis of interconnection networks used in a circuit switched communications system. Using this model, rectangular banyan networks are analyzed. It is shown that, considering the number of component switches, rectangular banyan networks have a relatively large number of paths available to satisfy requests for communication. A graphical technique, is introduced to describe the synthesis and growth of balanced banyan networks for large traffic flows. This technique also provides insight into the size of the area and the number of levels necessary for two-dimensional implementations of balanced banyan networks. A two-dimensional implementation model for networks built out of 2 input, 2 output ports switches was developed and used to characterize the area occupied by crossbar and rectangular banyan networks when realized as VLSI circuits. The area occupied by these networks and the traffic flow values under one-to-one request functions are synthesized in an overall performance measure which allows us to compare crossbar networks and rectangular banyan networks. It is shown that for conservative designs crossbar networks are preferable to rectangular banyan networks. Dissert. Abstr.

N80-27595 Cornell Univ., Ithaca, N. Y.
TRANSIENT STABILITY ANALYSIS OF ac-dc POWER SYSTEMS Ph.D. Thesis
Asrat Teshome 1980 155 p
Avail: Univ. Microfilms Order No. 8015744

A non-linear model of a combined high-voltage ac-dc power system was digitally simulated. The model is used for the study and prediction of the effects of transient interactions between a high-voltage-direct-current (HVDC) transmission line and turbine-generator-shaft torsional behavior when the system is subjected to large disturbances. Improvement of a-c line loadability due to the stabilizing influence of a HVDC link was also examined. Turbine-generator torsional interaction studies were based on subsynchronous phenomena requiring an evaluation of the frequency, magnitude and decay of the subsynchronous currents in the ac-dc system following major system disturbances. The complex waveform of subsynchronous current, obtained by digital simulation, was analyzed using the Fast Fourier Transform technique. Results demonstrate that a HVDC link can affect the incidence of turbine-generator torsionals, can significantly improve the stability of the system in general and can be used to effect increased loadability of the a-c lines. Dissert. Abstr.

N80-27596 Purdue Univ., Lafayette, Ind.
PARTICLE SIZE EFFECTS ON ELECTRICAL PROPERTIES OF THICK FILM RESISTORS Ph.D. Thesis
Ching-Tzuen Tarn 1979 155 p
Avail: Univ. Microfilms Order No. 8015527

Resistors were made with varying combinations of glass and RuO2 particle sizes at varying weight percents of RuO2. Spherical glass particles were used in order to eliminate any possible particle shape defect. The sizes of glass and RuO2 powders were determined with the scanning electron microscope and nitrogen adsorption surface area measurement. In making resistors, special care was taken to throughly blend the resistor pastes so that the blending factor was removed or reduced to a minimum. Different firing temperatures and times were used to fire resistors in an attempt to find a single firing condition that would make all resistors in their optimum sintered regions where optimum conducting chains were formed. The optimum single firing condition could not be found, and compromise conditions were chosen. Resistivities and temperature coefficients of resistance were measured, blending curves were plotted, and the critical conductive volume percents V sub mc's were obtained for plots of log G vs. log (V sub m-V sub mc)/G and V sub m being the conductivity and conductive volume percent respectively).
Dissert. Abstr.

N80-27597 California Univ., Los Angeles.
MUTUAL COUPLING BETWEEN DIPOLES AND SLOTS IN THE PRESENCE OF GROUNDED DIELECTRIC SLABS Ph.D. Thesis
Isaac Khan Tasinga 1980 166 p
Avail: Univ. Microfilms Order No. 8016053

The mutual impedance between slender microstrip dipoles and the mutual admittance between narrow slots which are covered by a dielectric layer are calculated by using a combination of analytical and numerical methods. The basis of the analysis is a conformal transformation which facilitates function theoretic manipulations in the complex plane. This analysis leads to the determination of an integration path along which Sommerfeld integrals converge exponentially. The limits of applicability of this method are discussed. Results for different dielectric materials and substrate thicknesses for known resonant lengths are presented, and are in good agreement with results from other formulations. Results of mutual admittance calculations are presented for narrow slots. These computations are very efficient and are useful in the design of antenna arrays. Dissert. Abstr.

N80-27598 California Univ., Berkeley.
STOCHASTIC INTEGRATION, MARKOV PROPERTY AND MEASURE TRANSFORMATION OF RANDOM FIELDS

Ph.D. Thesis
Bruce Edward Hajek 1979 89 p
Avail: Univ. Microfilms Order No. 8014716

Classes of continuous parameter random fields with Markov properties or stochastic integral representations and random fields arising by absolutely continuous measure transformation were identified and studied. Specific emphasis is given to the central role of Markov properties, innovation representations, and measure transformations in nonlinear recursive estimation for multiple parameter random processes. Dissert. Abstr.

N80-27599 Purdue Univ., Lafayette, Ind.
ANALYSIS AND MODELLING OF A CURRENT-FED FORCE-COMMUTATED POWER CONVERTER Ph.D. Thesis
Samir Sayed Abd-El-Hamid 1979 124 p
Avail: Univ. Microfilms Order No. 8015416

A simplified current fed force commutated converter model was developed and investigated. The simplified model was a quasisteady state representation based on an average value and fundamental frequency formulation of the circuit equations. The simplified converter model was first used to develop an analytical model for a rectifier/current source inverter induction motor drive. The simplified converter model was also used to develop a simplified model of a force commutated inductor converter unit. Dissert. Abstr.

N80-27600 California Univ., Berkeley.
ELECTRON ENERGY DISSIPATION IN LAYERED MEDIA Ph.D. Thesis
Ilesanmi Adesida 1979 137 p
Avail: Univ. Microfilms Order No. 8014594

The influence of electron scattering on the resolution of electron beam lithography was studied theoretically and experimentally. Theoretical calculations of the spatial disruption of electron energy dissipation in a very thin electron sensitive polymer film coated on various thicknesses of silicon substrates have been made using two different Monte Carlo models. Experimentally, elementary lithographic patterns on the layered structures mentioned above. Both theory and experiment showed that higher resolution in electron beam lithography can be achieved by using thinner electron sensitive polymer films, higher voltages, and thinner substrates. Dissert. Abstr.

N80-27601*# Texas Instruments, Inc., Dallas.
IC KU-BAND IMPATT AMPLIFIER Final Report, 1 Jun. 1977 - 31 Jan. 1979
V. Sokolov, M. R. Namordi, F. H. Doerbeck, and W. R. Wisseman Mar. 1979 111 p refs
(Contract NAS5-24182)
(NASA-CR-160004) Avail: NTIS HC A06/MF A01 CSCL 09A

High efficiency GaAs low-high-low IMPATTs were investigated. Theoretical analyses were employed to establish a design window for the material parameters to maximize microwave performance. Single mesa devices yielded typically 2 to 3 W with 16 to 23% efficiency in waveguide oscillator test circuits. IMPATTs with high reliability Pt/TiW/Pt/Au metallizations were subjected to temperature stress, non-rf bias-temperature stress, and rf bias-temperature stress. Assuming that temperature is the driving force behind the dominant failure mechanism, a mean-time-to-failure considerably greater than 500,000 hours is indicated by the stress tests. A 15 GHz, 4W, 56 dB gain microstrip amplifier was realized using GaAs FETs and IMPATTs. Power combining using a 3 db Lange coupler is employed in the power output stage having an intrinsic power-added efficiency of 15.7%. Overall dc-to-rf efficiency of the amplifier is 10.8%. The amplifier has greater than a 250 MHz, 1 db bandwidth; operates over the 0 deg to 50 C (base plate) temperature range with less than 0.5 db change in the power output; weighs 444 grams; and has a volume of 220 cu cm. A.R.H.

N80-27602# Defence Research Establishment, Ottawa. (Ontario). Electromagnetics Section.
NON-LINEAR JUNCTION CHARACTERIZATION
Myles R. McMillan May 1979 53 p refs In ENGLISH; FRENCH summary
(AD-A083898; DREO-TN-79-7) Avail: NTIS HC A04/MF A01 CSCL 09/1

The phenomena of non-linear junctions formed by contacting metal surfaces was investigated and a method to characterize these junctions is described. Normally linear components, such as points of contact, can become nonlinear elements. These can occur in coupling hardware of coaxial transmission lines, in flanged joints of wave guides and in other waveguide components that are bolted together. Chemical compounds build up on metal contact surfaces exposed to the atmosphere. The compounds, oxides and sulphides for example, are semiconductive and tend to increase contact resistance. They have a non-linear current-voltage characteristic that can be used to characterize Metal-Oxide-Metal junctions by non-linear measurements. When a pure sinusoidal current flows through a component (point of contact) the voltage across it is distorted by any nonlinearities present. The distorted voltage can be considered the sum of a fundamental frequency voltage and a number of voltages at harmonic frequencies. The magnitude of these harmonic voltages can serve as a measure of the nonlinearity present in the contact. For convenience, the third harmonic is usually chosen since it has the largest magnitude and therefore is easiest to measure. GRA

N80-27603# Defence Research Establishment, Ottawa. (Ontario). Radar ESM Section.
A COMPREHENSIVE REVIEW OF TRAVELLING WAVE TUBE TECHNOLOGY
Robert Luiz Nov. 1979 80 p refs
(AD-A083899; DREO-TN-80-1) Avail: NTIS HC A05/MF A01 CSCL 09/1

A review of TWT technology is presented comparing selected aspects and design procedures relative to application. The general theory of operation of various types of TWT designs is discussed together with a review of principles of their construction and trade offs. The travelling-wave tube (TWT) was invented by R. Kompfner in 1943, and the principle of TWT amplification was demonstrated by him at Birmingham University in the same year. A small signal theory of this device was extensively developed by J.R. Pierce. The TWT has been constructed to operate at many wavelengths, ranging from one meter to one millimetre. It has found wide application primarily because at any given frequency or power level, it offers much more bandwidth than any of its competitors. The travelling-wave tube, though structurally simple, is a 'Constructred Complication'. Because of its structural simplicity, TWTs have been built to operate at frequencies as high as 50 GHz. Modern requirements for TWT amplifiers often call for very wide bandwidths combined with high power output. For any practical application an ideal TWT is seldom available as an 'off-the-shelf' item mainly because more than two dozen independent parameters are required in order to completely describe the tube. GRA

N80-27604# Westinghouse Research and Development Center, Pittsburgh, Pa.
THEORY AND DESIGN OF ELECTRICAL ROTATING MACHINERY Final Report, 1 May 1972 - 31 Oct. 1979
W. J. Carr, Jr. Apr. 1980 50 p refs
(Contract N00014-72-C-0432)
(AD-A083499) Avail: NTIS HC A03/MF A01 CSCL 09/3

The objective of this program was to contribute toward new and improved rotating machines for Naval applications, with emphasis on superconducting machinery. Work has been performed on the theory of ac losses in multifilament superconductors and experiments were made to check the theory. A list of publications and abstracts of scientific papers published under the contract is given, and a review is given of the theory of losses. A macroscopic theory for superconductivity in multifilament superconductors was developed, and the theory was used to calculate the hysteresis and eddy current losses which occur in the presence of changing magnetic fields. Both the transverse field and the longitudinal field cases were considered, and also the self-field loss of an alternating transport current, along with some examples of the combined loss due to alternating applied field and transport current. The results are useful for the design of superconducting devices, such as superconducting motors and generators. A small amount of additional work was done on studies of novel homo- and heteropolar motors. GRA

N80-27605# RCA Corp., Lancaster, Pa. SSD-Electro-Optics and Devices.
MANUFACTURING METHODS AND TECHNOLOGY MEASURE FOR FABRICATION OF SILICON TRANSCALENT RECTIFIER Interim Report, 17 Dec. 1978 - 22 Oct. 1979
B. B. Adams, M. F. DeVito, W. L. Krown, and R. E. Reed Oct. 1979 65 p
(Contract DAAK70-78-C-0120)
(AD-A083122) Avail: NTIS HC A04/MF A01 CSCL 09/1

Successfully completed were the fabrication and testing of the ten confirmatory samples of Silicon Transcalent Rectifiers. This report thoroughly describes the test results as well as the basis for selecting the prototype design. It also includes a picture or block diagram of each test circuit utilized. All devices passed all inspections with a yield of 100%. GRA

N80-27606# Hughes Aircraft Co., Torrance, Calif. Torrance Research Center.
THE 140 GHz PULSED IMPATT COMBINER HIGH POWER SOURCE Final Report, 1 Jul. 1977 - 30 Nov. 1978
T. T. Fong, T. A. Midford, E. M. Nakaji, and Y. C. Ngan Jan. 1980 103 p refs
(Contract DAAK11-77-C-0040)
(AD-A083450; AD-E430384; HAC-W-42585; ARBRL-CR-00414) Avail: NTIS HC A06/MF A01 CSCL 09/1

The objective of this program was to develop silicon IMPATT diode and power combiner circuit technology in order to demonstrate improved pulse power generating capability at 140 GHz. The program efforts have led to significant advances in the state-of-the-art for pulsed solid state power generation IND-band. The diodes fabricated for this program were double drift IMPATT's with active regions formed by a combination of n-type epitaxial growth and multiple dose/energy p-type ion implants. Copper heat sinks were used. The most successful diode package configuration was a double quartz standoff configuration. The three types of power combining structures investigated were: (1) a resonant rectangular waveguide structure with center-mounted diodes; (2) a variation of 1, employing the coplanar biasing configuration; (3) a rectangular waveguide combiner with sidewall-mounted diodes Kurakowa circuit. The rectangular cavity with sidewall mounted diodes was by far the most successful. In this circuit, power from two pulsed diodes was combined with approximately 90% combining efficiency. High peak power output at 14 GHz was achieved for both single and multiple diode oscillators. Single diode peak power levels of 3.0 watts at 3% efficiency were obtained for a 100 ns pulse length and a 50 KHz pulse repetition frequency. A two-diode power combiner based on an oversize version of Kurakowa circuit was constructed which produced 3.0 watts of peak output power. Two high power pulsed sources complete with modulators were delivered to the Army. One of these sources is a single diode oscillator, the other a two diode power combiner oscillator. Both of these sources meet the program object of 3.0 watts of peak output power at pulse lengths of 50-100 ns. GRA

N80-27607# Varian Associates, Palo Alto, Calif. Research Solid State Lab.
NONCOPLANAR HIGH POWER FET Final Report, Dec. 1974 - Nov. 1978
S. G. Bandy, D. M. Collins, D. R. Decker, J. H. Dully, R. D. Fairman, S. B. Hyder, C. K. Nischimoto, and R. Sahkaran Dec. 1979 138 p refs
(Contract N00014-76-C-0303; RF54581001)
(AD-A083682) Avail: NTIS HC A07/MF A01 CSCL 09/1

Using a p- substrate as the gate and employing low-doped V-grooves under the source and drain to reduce parasitic capacitances, a noncoplanar power FET was designed and fabricated which achieved submicron gate lengths with photolithography masks employing a resolution limit of several microns. Device performance was limited by low values of pinch-off voltage and gate breakdown voltage. Ion implantation or diffusion should enable the breakdown voltage to be raised by virtue of separating the p-n junction from the growth interface. GRA

N80-27608# Varian Associates, Palo Alto, Calif.
CONTIGUOUS GRIDDED GUN DEVELOPMENT PROGRAM Final Technical Report, Mar. 1978 - Aug. 1979
Glen Huffman Griffiss AFB, N.Y. RADC Mar. 1980 33 p
(Contract F30602-78-C-0123; AF Proj. 4506)
(AD-A084046; RADC-TR-80-51) Avail: NTIS HC A03/MF A01 CSCL 09/1

A gridded gun, suitable for operating megawatt level linear beam tubes, has been designed and tested at lower levels in a beam analyzer. The new gun features a shadow grid in contact with the cathode surface. A major goal was to achieve low control grid interception. Guns with contiguous grid systems are in common use in low and medium power tubes. The purpose of this program was to extend existing lower power gridded gun technology to the megawatt level. The basic gun parameters including beam diameter, voltage, current, perveance and grid operating voltage are all quite conservative and readily achievable in an 83 kV gun. The most critical requirement was that the maximum outer diameter of the gun assembly not exceed 5.48 inches. This limit forced a compromise between cathode emission density and high voltage gradients and dictated the use of a tungsten matrix cathode. A scale model gun was built and tested in a beam analyzer. After modification to the design, a full-scale gun was built and also tested in the beam analyzer. Extrapolations from the beam analyzer test data show that the gun should meet all performance objectives at full power except for heater power and grid bias voltage. The intercepted control grid current cannot be accurately estimated for full power operation, but it is believed that it will be less than the 40 milliamps specified. GRA

N80-27609# Rutgers - The State Univ., Piscataway, N. J. High Pressure Materials Research Lab.
PIEZOELECTRICITY IN NYLON 11
B. A. Newman, P. Chen, K. D. Pae, and J. I. Scheinbeim 1 Apr. 1980 19 p refs Submitted for publication
(Contract N00014-75-C-0540; NR Proj. 356-564)
(AD-A083719; TR-19) Avail: NTIS HC A02/MF A01 CSCL 11/9

At the present time only poled, crawn poly vinylidene fluoride PVF 2 films give evidence of sufficiently high piezoelectric response to be useful in device applications, and for this reason the great majority of research has centered around this polymer. As in the case of PVF 2, many of the odd nylons crystallize in a polar space group with a large net dipole moment in the unit cell. On the basis of the understanding now reached of the properties of poled PVF 2 films it would appear that the occ nylons have the potential to make films with high piezoelectric activity. Piezoelectricity and pyecelectricity in nylon 11 films have been studied previously and piezoelectric strain coefficients found were higher than most polymers but still two orders of magnitude less than the corresponding activity found in poled oriented PVF 2 d 31 approx. 20p C/N . Studies carried out in this laboratory have shown that by appropriate variation of poling conditions and sample microstructure quite large piezoelectric constants can be obtained for nylons 11 films d 31 approx. 3p C/N. The dependence of the piezoelectric strain constant d 31 on poling temperature, poling field and crystal structure will be discussed. GRA

N80-27610# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF A TWO-FLUID EHD POWER GENERATOR INCLUDING EFFECTS OF COMPRESSIBILITY
T. H. Gawain and Oscar Biblarz Jan. 1980 94 p refs
(Contract ER-78-A-03-2122)
(AD-A084125; NPS67-80-002) Avail: NTIS HC A05/MF A01 CSCL 10/2

A detailed analysis and method of calculation is presented for determining the complete thermodynamic cycle of either a one-fluid or a two-fluid electrohydrodynamic (EHD) power generator. The analysis takes fully into account the compressibility of the media. Parameters are included which express the thermodynamic losses in the various components of the overall system. The severe restriction on output created by the electrical breakdown limit of the medium is clearly shown. The method for computing the net-electrical work output per unit mass of primary fluid and the net overall thermal efficiency of the system is carefully developed. The calculation procedure is illustrated by a completely worked out numerical example. The techniques presented here may be used to determine the performance

possibilities and limitations of various one-fluid and two-fluid EHD power generators. GRA

N80-27611# Commonwealth Associates, Inc., Jackson, Mich.
MODEL FOR THE READY DEFINITION AND APPROXIMATE COMPARISON OF ALTERNATIVE HIGH VOLTAGE TRANSMISSION SYSTEMS
Dec. 1978 183 p
(Contract ET-78-C-05-5916)
(DOE/ET-5916-1) Avail: NTIS HC A09/MF A01

A model of generic overhead transmission systems in the range of 362 to 1200 kV ac, and + or - 400 to + or - 800 kV dc is developed. Such generic systems are to include: (1) transmission from generation to load; and (2) interconnection of two large integrated systems, with and without the existence of an underlying, lower voltage network in either case. The model provides a means whereby an engineer with some experience in power systems planning can make a reconnaissance study of alternatives within a relatively short span of time and with fair accuracy. Given an amount of power to be transferred over a specified distance, the model is used: to define the workable alternatives in terms of voltages, number of lines, series compensation, and certain other factors affecting transfer capability; to delineate other salient features of the selected alternatives, notably shunt compensation requirements; and to compare the alternatives in terms of potentially relevent benefits and costs. The significant properties of the model, the basis and assumptions necessary to its formulation, instructions for its use, and inherent limitations upon the accuracy to be expected are described. DOE

N80-27612# National Bureau of Standards, Washington, D.C. National Engineering Lab.
DEVELOPMENT OF FLAMMABILITY CRITERIA FOR TRANSFORMER DIELECTRIC FLUIDS Final Report
Richard G. Gann Feb. 1980 56 p refs Sponsored in part by DOE, Washington, D.C.
(PB80-163777; NBSIR-80-1992) Avail: NTIS HC A04/MF A01 CSCL 09A

The fire safety requirements for electrical insulating fluids are examined. The hazards are delineated and the magnitude of the transformer fire problem is assessed. The fire code and standard test methods are shown to be inadequate. Approaches to fluid fire performance testing are presented as a basis for evaluating the economic impact of alternative fire safety strategies. GRA

N80-27613# National Bureau of Standards, Washington, D.C. National Engineering Lab.
DEVELOPMENT OF TEST STRUCTURES FOR CHARACTERIZATION OF THE FABRICATION AND PERFORMANCE OF RADIATION-HARDENED CHARGE-COUPLED DEVICE (CCD) IMAGERS Annual Report, 1 Dec. - 30 Nov. 1978
G. P. Carver and S. Rubin Mar. 1980 23 p refs Sponsored in part by Charles Stark Draper Lab., Inc., Cambridge, Mass.
(PB80-160708; NBSIR-80-2000) Avail: NTIS HC A02/MF A01 CSCL 09A

Test structures and test methods useful for the characterization of radiation hardened charged coupled device imagers are evaluated. The results of measurements on buried channel gated diodes and buried layer metal oxide semiconductor field effect transistor direct current profilers are reported. Further advantages in the development of the integrated gated diode electrometer are also reported. GRA

N80-27614# National Technical Information Service, Springfield, Va.
PRINTED CIRCUITS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Feb. 1980
William E. Reed Apr. 1980 168 p Supersedes NTIS/PS-79/0241; NTIS/PS-78/0222
(PB80-807571; NTIS/PS-79/0241; NTIS/PS-78/0222) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

Citations from worldwide research on the design, fabrication, testing, and applications of printed circuits are presented. Subjects include printed circuit boards, bonding, soldering, interconnections, coatings, layout, and inspection. This updated bibliography contains 161 abstracts, 77 of which are new entries to the previous edition. GRA

N80-27615# National Technical Information Service, Springfield, Va.
PRINTED CIRCUITS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Feb. 1980
William E. Reed Apr. 1980 182 p Supersedes NTIS/PS-79/0239; NTIS/PS-78/0221
(PB80-807563; NTIS/PS-79/0239; NTIS/PS-78/0221) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The design, fabrication, testing, and applications of printed circuits are presented in these citations of Federally-sponsored research reports. Research on computer aided design, soldering, etching, plating, photolithography, and materials are cited. This updated bibliography contains 175 abstracts, 41 of which are new entries to the previous edition. GRA

N80-27616# National Technical Information Service, Springfield, Va.
MICROWAVE OSCILLATORS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1976 - Mar. 1980
William E. Reed Apr. 1980 279 p Supersedes NTIS/PS-79/0414; NTIS/PS-78/0333
(PB80-808280; NTIS/PS-79/0414; NTIS/PS-78/0333) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

Federally sponsored research reports are cited on the design, development, application, reliability, and radiation effects of microwave oscillators. This updated bibliography contains 272 abstracts, 22 of which are new entries to the previous edition. GRA

N80-27617# National Technical Information Service, Springfield, Va.
MICROWAVE OSCILLATORS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Mar. 1980
William E. Reed Apr. 1980 221 p Supersedes NTIS/PS-79/0416; NTIS/PS-78/0334
(PB80-808298; NTIS/PS-79/0416; NTIS/PS-78/0334) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography contains reports from worldwide research on the design, performance, properties and applications of microwave oscillators, including Gunn, IMPATT, transistor, TRAPATT, transferred electron, Schottky, and surface acoustic wave oscillators. This updated bibliography contains 214 abstracts, 88 of which are new entries to the previous edition. GRA

N80-27618# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: MODULATION MEASUREMENTS FOR MICROWAVE MIXERS Final Report, 1 Jan. 1970 - 31 Mar. 1974
James M. Kenney Feb. 1980 90 p refs Sponsored in part by Naval Electronic System Command
(PB80-166952; NBS-SP-400-16; LC-79-600161) Avail: NTIS HC A05/MF A01 CSCL 14B

The measurement of mixer conversion loss using periodic or incremental modulation of the local oscillator, and the evaluation and minimization of the associated systematic and random uncertainties, are discussed in terms of an X-band mixer measurement system. It is shown that the systematic uncertainty in the incremental modulation method of measuring conversion loss results largely from the uncertainties in the calibration of microwave attenuation and power. It is also shown that the modulation (periodic modulation) and incremental (incremental modulation) methods of measuring conversion loss are essentially identical, the only practical distinction being in the somewhat different instrumentation required by the different modulation rates. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N80-27619 Princeton Univ., N. J.
PREDICTOR-CORRECTOR METHODS FOR TIME DEPENDENT COMPRESSIBLE FLOWS Ph.D. Thesis
Keith Meintjes 1980 239 p
Avail: Univ. Microfilms Order No. 8015407

A general family of predictor-corrector finite difference methods, with application to problems in viscous, compressible fluid dynamics is considered. The generalization is sufficiently broad to include a number of known methods but still allows the necessary detailed analysis to be performed. Some properties are continuous functions of the generalizing parameters and may be optimized, while other characteristics are independent of these parameters and guaranteed a priori. It is shown analytically and numerically that the behavior of the computational solution of the Navier-Stokes equations at least for quasi one dimensional flow, is given by the study of Burgers' equation. Dissert. Abstr.

N80-27620 Houston Univ., Tex.
AN EXPERIMENTAL STUDY OF THE COHERENT MOTIONS IN AN AXISYMMETRIC MIXING LAYER Ph.D. Thesis
Arch Ray Clark, III 1979 447 p
Avail: Univ. Microfilms Order No. 8014104

An axisymmetric free mixing layer was investigated using both hot-wire measurements and high speed flow visualization photography. The large scale structures were characterized on the basis of wavelength, convection velocity and frequency (Strouhal number) of the dominant (i.e., most energetic) scale (eddy). Measurements of the spacetime (longitudinal velocity) correlation and its complete (double) Fourier transform, viz., the wavenumber frequency spectral function, were carried out along lines of constant mean velocity in the mixing layer over the region of self preservation. Dissert. Abstr.

N80-27621 Illinois Univ. at Chicago Circle, Chicago.
THE STUDY OF NON-NEWTONIAN FLOWS IN THE FALLING BALL VISCOMETER Ph.D. Thesis
Young Ill Cho 1980 179 p
Avail: Univ. Microfilms Order No. 8014222

Variational methods in conjunction with the power law model were used to predict the drag coefficient of a slowly moving sphere. Two upper bound solutions were recalculated with the first approximation stream function and Tomita's modified stream function, resulting in a substantial improvement over the previous reported values particularly in the range of n, the power law index, less than 0.5. It is shown that Tomita's modified stream function known as the best function for the upper bound fails to give the Newtonian results as n approaches unity. Dissert. Abstr.

N80-27622 California Univ., Berkeley.
SEPARATION EFFECTS IN GAS-PARTICLE FLOWS AT HIGH REYNOLDS NUMBERS Ph.D. Thesis
Joseph Adel Laitone 1979 96 p
Avail: Univ. Microfilms Order No. 8014768

A general numerical solution is presented which extends a numerical scheme for gas flow to a solution suitable for dilute gas solid particle flows over a much wider range of conditions and geometries. The proposed method is designed to solve the time dependent equations but may be used in the steady state case as well. An exact solution for the inviscid two phase flow near a stagnation point is also presented. A transformation is used that reduces the partial differential governing equation to a second order linear differential equation. The numerical method is applied to the flow of gas and particles about a cylinder. A cutoff value is found in particle size which determines particles that do not impact with the cylinder but are deflected around it. Dissert. Abstr.

N80-27623 Johns Hopkins Univ., Baltimore, Md.
A NEW THEORY OF TURBULENT CONVECTION OVER A HEATED SURFACE
Ching-Sheng Chern 1980 86 p
Avail: Univ. Microfilms Order No. 8014264

The turbulent thermal convection which exists between two horizontal plates was investigated and field observations of the planetary boundary layer were made under unstable conditions. It is shown that near a surface there exist large eddies with a typical horizontal length scale of the order of H, the total convection layer thickness. The interaction of these big eddies with the surface and general frictional processes in the wall region are associated with a second boundary layer, called the mesolayer, whose thickness, when scaled on the buoyancy flux at the wall q and viscosity v, is proportional to R(1/4). In the mesolayer, the big eddies are anisotropic and three dimensional. They get their kinetic energy from the energy of the outer region which originates as available potential energy. Dissert. Abstr.

N80-27624 California Univ., Berkeley.
NUMERICAL METHODS FOR INVERSE TRANSIENT HEAT CONDUCTION PROBLEMS Ph.D. Thesis
Diego Antonio Murio 1979 118 p
Avail: Univ. Microfilms Order No. 8014823

A transient heat conduction problem with slab symmetry. The temperature and heat flux histories f(t) and q(t) on the right hand surface are desired and unknown, but the temperature and heat flux histories F(t) and Q(t) on the left hand surface are approximately measurable for all t in (minus infinity, infinity). Certain inverse and direct convolution kernels are introduced with which the numerical problem is solved with an absolute minimum of computation. Dissert. Abstr.

N80-27625 California Univ., Berkeley.
HEAT AND MASS TRANSFER FROM A ROTATING DISK WITH PHASE CHANGE Ph.D. Thesis
Chi-Sheng Wang 1979 118 p
Avail: Univ. Microfilms Order No. 8014921

Experimental measurements were made in a rotating disk evaporator. The condensate flow rate, pressure, and temperature across the disk and the rotational speed of the disk were measured. The overall heat transfer coefficients were determined from the above measured data. Tests were carried out on a copper disk with and without a wiper on the evaporation surface of the disk and on a monel disk with a wiper. Evaporation heat transfer coefficients were calculated based on the thermal resistance method. A study of impinging, rotating, and condensing flow was carried out. An integral method was used to obtain the results for the impinging flow case. Two impinging conditions are considered: A liquid boundary layer only, without a vapor drag effect and two boundary layers, liquid and vapor, with a vapor drag effect. The results show that the copper disk with a wiper yields higher condensation rates, evaporation heat transfer coefficient, and overall heat transfer coefficients than does the copper disk without a wiper. Also, the copper disk with a wiper yields higher values than does the monel disk with a wiper. The theoretical studies show that the effect of vapor drag on the condensation heat transfer is small for impinging flow. Dissert. Abstr.

N80-27626 California Univ., Berkeley.
FINITE DIFFERENCE SOLUTION OF THE NONLINEAR COSSERAT JET EQUATIONS FOR A VISCOUS FLUID WITH SURFACE TENSION Ph.D. Thesis
Sabbas Joseph Shine 1979 138 p
Avail: Univ. Microfilms Order No. 8014877

A simultaneous finite difference solution of the nonlinear Cosserat fluid jet equations for a semi-infinite jet emanating from a nozzle is presented. The problem is treated as a time dependent one with a small amplitude periodic excitation of the velocity at the nozzle. Solutions for the jet radius and velocity are computed until the radius becomes zero or the absolute value of the velocity exceeds a chosen maximum value. It is shown that when the dimensionless frequency of the excitation is less than one the generated wave grows in amplitude until it finally breaks up the jet at a definite point downstream. The breakoff point depends on the frequency and amplitude of the excitation, the jet velocity, and the viscosity of the fluid. When

the frequency of excitation is more than one the disturbance is stable and therefore no jet breakup occurs. Even for the unstable frequencies of excitation is less than one, high viscosity can appreciably damp out the growth of the disturbance.

Dissert. Abstr.

N80-27627 Purdue Univ., Lafayette, Ind.
THE SOLUTION OF BOUNDARY VALUE PROBLEMS IN DIFFUSIVE HEAT AND MASS TRANSFER WITH CONVECTION: FUNCTIONAL ANALYTIC METHODS Ph.D. Thesis
Eleftherios Papoutsakis 1979 303 p
Avail: Univ. Microfilms Order No. 8015503

An entirely analytical solution to the Graetz problem with a variety of wall boundary conditions was formulated based on a self-adjoint formalism resulting from a decomposition of the convective diffusion equation into a pair of first order partial differential equations. Physically, the decomposition views the convective diffusion process as a pair of stipulations on how the temperature (or concentration) and the axial energy (or mass) flow through a partial tube cross section vary with radial and axial distances. The solutions obtained are simple, and readily computed. A variety of computational results are also discussed physically.

Dissert. Abstr.

N80-27628 Cornell Univ., Ithaca, N. Y.
TURBULENCE AND VORTEX DYNAMICS IN TWO DIMENSIONS Ph.D. Thesis
Hassan Aref 1980 126 p
Avail: Univ. Microfilms Order No. 8015634

The dynamics of a system of point vortices in the plane is studied, both analytically and numerically, as a model of two dimensional flow. It is argued, that the basic interacting unit in an N-vortex system is a triple of vortices. It is a classical result that the motion of three point vortices of arbitrary strengths, defines an integrable Hamiltonian system. A novel analysis of the properties of the motion of three vortices is given using a phase diagram technique. This generalizes recent work by Novikov on the motion of three identical vortices. A complete classification is obtained of possible regimes of motion as the vortex strengths are varied. When the vortex strengths (K sub 1, K sub 2, K sub 3) have the values (+K,+K,-K) the phase diagram can be interpreted in terms of the scattering of a neutral vortex pair by a single vortex. Details of the scattering process are presented. If the harmonic mean of the three strengths vanishes, the vortex triangle can expand or contract without change of shape. For certain initial conditions the triangle collapses to a point in a finite time for this case.

Dissert. Abstr.

N80-27629 California Univ., Berkeley.
ANALYSIS OF ALGORITHMS FOR ADVECTION IN DISCONTINUOUS FLOWS Ph.D. Thesis
Charles Paine Fenimore 1979 110 p
Avail: Univ. Microfilms Order No. 8014674

An analysis is presented of two algorithms for the approximate solution of the equations of multifluid, gas dynamic flow in two space dimensions. Sharp interfaces separate the distinct fluids and the flow field can have discontinuities such as shocks and slip lines. The species are advected by the fluid velocity field, and there is no diffusion of the species. Both algorithms are alternating direction methods which reduce the full two dimensional problem to a sequence of one dimensional ones. A hybrid scheme is presented which has high resolution and can represent phenomena occurring on a scale smaller than the mesh size. The hybrid scheme employs the detailed information produced by Glimm's method to advance the fluid interfaces defined by the straight line algorithm. The hybrid is seen to conserve species. The method is applied to test problems in which one dimensional waves move obliquely to the two dimensional mesh sweeping over a blob in the flow. It is found that the method while of low order is able to represent interfaces sharply, even for very thin blobs. Numerical and graphical results are included.

Dissert. Abstr.

N80-27630°# Remtech, Inc., Huntsville, Ala.
SSV GENERIC OFT FIRST STAGE ASCENT BASE CONVECTIVE HEATING ENVIRONMENTS
Robert Lee Bender, Jr. and Young C. Lee 31 Oct. 1978 63 p refs
(Contract NAS8-29270)
(NASA-CR-161499; RTR-014-6) Avail: NTIS HC A04/MF A01 CSCL 20D

Space Shuttle Vehicle (SSV) base convective heating environments during the recirculated flow time segment of first stage ascent were determined for the Generic OFT trajectory and performance conditions. These environments are presented in the attachments as cold wall convective heat transfer coefficients for individual or groups of design points for all affected SSV base surfaces. Two gas recovery temperatures applicable to upper and lower base region surfaces are also included. The environments were based upon magnitudes and trends from analysis of data taken during Base Heating Tests IH-39, IH-75, and IH-83. The plume heating trajectory and performance data were supplied by Rockwell International for both the OFT-1 Generic Mission A and Mission C.

A.R.H.

N80-27631°# Remtech, Inc., Huntsville, Ala.
ADDENDUM TO SSV GENERIC OFT FIRST STAGE ASCENT BASE CONVECTIVE HEATING ENVIRONMENTS
Robert Lee Bender, Jr. and Young C. Lee 20 Dec. 1978 5 p ref
(Contract NAS8-29270)
(NASA-CR-161497; RTR-014-8) Avail: NTIS HC A02/MF A01 CSCL 20D

Convective environments for OFT Mission C are presented in graphs for first stage convective heating to the internal surfaces of the OMS nozzle, to the aft facing 8 and 9 RCS nozzles, and to the base (trailing edge) of the vertical tail.

A.R.H.

N80-27632°# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLUENCE OF PRESSURE DRIVEN SECONDARY FLOWS ON THE BEHAVIOR OF TURBOFAN FORCED MIXERS
B. Anderson, L. Povinelli, and W. Gerstenmaier Jul. 1980 28 p refs Presented at 16th Joint Prop. Conf., Hartford, Conn., 30 Jun. - 2 Jul. 1980; sponsored by AIAA, ACME, and SAE
(NASA-TM-81541; E-493) Avail: NTIS HC A03/MF A01 CSCL 20C

A finite difference procedure was developed to analyze the three dimensional subsonic turbulent flows in turbofan forced mixer nozzles. The method is based on a decomposition of the velocity field into primary and secondary flow components which are determined by solution of the equations governing primary momentum, secondary vorticity, thermal energy, and continuity. Experimentally, a strong secondary flow pattern was identified which is associated with the radial inflow and outflow characteristics of the core and fan streams and forms a very strong vortex system aligned with the radial interface between the core and fan regions. A procedure was developed to generate a similar generic secondary flow pattern in terms of two constants representing the average radial outflow or inflow in the core and fan streams as a percentage of the local streamwise velocity. This description of the initial secondary flow gave excellent agreement with experimental data. By identifying the nature of large scale secondary flow structure and associating it with characteristic mixer nozzle behavior, it is felt that the cause and effect relationship between lobe design and nozzle performance can be understood.

E.D.K.

N80-27633# Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
RESEARCH ON NUMERICAL ALGORITHMS FOR THE THREE DIMENSIONAL NAVIER-STOKES EQUATIONS. 1: ACCURACY, CONVERGENCE AND EFFICIENCY Interim Technical Report, 1 Oct. 1978 - 30 Sep. 1979
A. J. Baker Sep. 1979 61 p refs
(Grant AF-AFOSR-0005-79; AF Proj. 2307)
(AD-A083664; AFFDL-TR-79-3141) Avail: NTIS HC A04/MF A01 CSCL 12/1

The objective of this research is to develop a highly accurate and efficient numerical solution algorithm for the non linear three dimensional Navier-Stokes equations for aerodynamics applications. A candidate algorithm has been derived employing finite element interpolation theory, the non-linear extension of quasi-variational principles, and the concept of tensor product bases. The resultant solution statement is rendered soluable using an implicit integration algorithm, and the replacement of the

standard Jacobian of a Newton iteration algorithm with a tensor matrix product form. A linearized stability analysis indicates the basic algorithm is spatially fourth order accurate in its most elementary embodiment. The control of an added dissipation mechanism can elevate this to sixth order, but numerical experimentation indicates the resultant artificial diffusion is unacceptably large. By the same measure, this additional accuracy is intrinsic to the quadratic element embodiment of the algorithm with freedom from artificial diffusion. The results of several numerical experiments for single and multi dimensional convection-dominated test problems confirms the basic viability of this algorithm and its tensor produce formulation. The latter is of paramount importance in rendering the algorithm nominally as efficient as familiar lower order accurate finite difference formulations. GRA

N80-27634# Rockwell International Corp., Columbus, Ohio. North American Aircraft Div.
COMPUTATION OF THE TURBULENT MIXING IN CURVED EJECTORS Final Report, 1 Sep. 1978 - 31 Aug. 1979
E. F. Schum, P. M. Bevilaqua, and S. V. Patankar 30 Apr. 1980 44 p refs
(Contract N00014-78-C-0557; RF41411801)
(AD-A083905; NR80H-11; ONR-CR-212-249-2F) Avail: NTIS HC A03/MF A01 CSCL 20/4

A numerical method has been developed to calculate the effects of curvature on the turbulent mixing within a thrust augmenting ejector. Curvature modification are included in both the kinetic energy and dissipation equations of the turbulence model. The elliptic effects of curvature on the mean flow are determined by combining an elliptic solution for the pressure field with a conventional marching solution for the velocity field. Predictions of the velocity profiles for jets and curved duct flows are compared with experimental data. Computation of the curvature effects are shown for an ejector having Coanda jets and one central jet. GRA

N80-27635# Purdue Univ., Lafayette, Ind.
FLOW FIELD MEASUREMENT USING RAMAN AND LDV TECHNIQUES Interim Report
S. Lederman, A. Celentano, and J. Glaser Apr. 1979 37 p refs Prepared in cooperation with Polytechnic Inst. of New York, Farmingdale
(Contract N00014-75-C-1143; NR Proj. 098-038; Proj. SQUID)
(AD-A083767; SQUID-PIB-36-PU) Avail: NTIS HC A03/MF A01 CSCL 20/4

The application of spontaneous Raman, Coherent Antistokes Raman Scattering (CARS) and Laser Doppler Velocimeters (LDV) techniques to a wide spectrum of flow fields confirms the basis hypothesis, that these laser based diagnostic techniques have a very wide range of applicability and can be instrumental in providing experimental data in friendly as well as hostile environments unobtainable by conventional means. The data can be obtained non-intrusively and remotely. GRA

N80-27636# Purdue Univ., Lafayette, Ind.
COLLOQUIUM ON FLOW SEPARATION
Roger L. Simpson Aug. 1979 107 p refs Prepared in cooperation with Southern Methodist Univ., Dallas
(Contract N00014-75-C-1143; NR Proj. 098-038; Proj. SQUID)
(AD-A083741; SQUID-SMU-3-PU) Avail: NTIS HC A06/MF A01 CSCL 20/4

Turbulent flow separation continues to be a nuisance to fluid dynamicists because it may be present in many practical machines or devices, thus reducing their performance, and because there is no adequate method to calculate such flows. In general, the maximum performance of such machines occurs at conditions close to the onset of separation. In order of increasing difficulty, designers need to know (a) whether or not a boundary layer separates for a prescribed pressure distribution, (b) how the pressure distribution is affected by boundary layer development with small regions of separated flow, and (c) how the overall performance is affected when large regions of separation are present. This Colloquium on Turbulent Flow Separation was held by Project SQUID at SMU to discuss fruitful areas for future research. A number of active researchers were invited to participate in discussions on five topics: terminology, measurements, flow modeling, unsteady effects, and control of separated flow. These topics are fundamental to future advances since a common nomenclature should be used to describe phenomena that are measured and modeled. GRA

N80-27637# Michigan State Univ., East Lansing Div. of Engineering Research.
SUMMARY OF THE AFOSR/MSU RESEARCH SPECIALISTS WORKSHOP ON COHERENT STRUCTURE IN TURBULENT BOUNDARY LAYERS Final Report, 1 Jul. - 30 Sep. 1979
S. J. Kline and R. E. Falco 30 Sep. 1979 69 p refs Workshop held at East Lansing, Mich., 30 Jul. - 1 Aug. 1979 Prepared in cooperation with Stanford Univ., Calif. Sponsored in part by Michigan State Univ.
(Contract F49620-79-C-0211; AF Proj. 2307)
(AD-A083717; AFOSR-80-0290TR; CSL-80-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

There was general agreement that progress towards a consensus of turbulent boundary layer structural information was made, and that the directions which future research work should take were clarified. There was general recognition that a number of different coherent motions exist in the boundary layer, and that different techniques (both visual and probe) emphasize some at the expense of others. It is necessary to determine what role each of the coherent motions play, as well as the importance of the interactions between these motions. Substantial progress has been made, but a consensus emerged that more overlap of techniques and objectives is needed, and that more experiments which combine flow visualization with quantitative measurements should be performed. Three different theoretical approaches were discussed. Each qualitatively simulated the occurrence of some of the observed structural features, via their underlying mechanisms. At this stage, none of the theories can be considered complete or predictive. Some potentially important qualitative correspondences were made between numerical large eddy simulations and recent wall region data. GRA

N80-27638# Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
CAVITATION DAMAGE MECHANISMS: REVIEW OF LITERATURE Final Report, Aug. 1977 - Sep. 1979
D. C. Wiggert, C. S. Martin, and H. Medlarz Wright-Patterson AFB, Ohio AFAPL Feb. 1980 58 p refs
(Contract F33615-77-C-2036)
(AD-A083805; AFAPL-TR-79-2125) Avail: NTIS HC A04/MF A01 CSCL 13/7

This report is a companion volume to 'Cavitation Damage Mechanisms: Experimental Study of Cavitation in a Spool Valve.' The state-of-the-art available in the literature is reviewed relative to occurrence of cavitation, the effects of dissolved and free gas, and so-called secondary aspects of combustion/sonoluminescence and electrical/chemical effects. It should be noted that a paucity of literature exists with regard to cavitation in oil hydraulic systems; consequently much of the material discussed deals with water as the working fluid. Throughout the text, clear distinctions are made as to the fluid under discussion. The small number of references which do relate to oils are covered as thoroughly as deemed necessary. The last topic to be presented concerns cavitation in hydraulic actuators. This is a markedly different type of cavitation than is dealt with in the present experimental study; it is included for completeness and due to the fact that it can be a potential problem in control system performance, although most often it creates no permanent mechanical damage to actuator components. GRA

N80-27639# College of Aeronautics, Cranfield (England).
INVESTIGATION OF THREE-DIMENSIONAL SHOCK WAVE BOUNDARY LAYER INTERACTIONS. A FLOWFIELD MODEL OF THE GLANCING SHOCK/TURBULENT BOUNDARY LAYER INTERACTION Final Scientific Report, Jun. 1976 - Oct. 1979
H. Kubota Jan. 1980 231 p refs
(Grant AF-AFOSR-3006-76)
(AD-A083703; COA-8001) Avail: NTIS HC A11/MF A01 CSCL 20/4

Three-dimensional glancing-shock/turbulent boundary-layer interaction has been investigated at the Cranfield Institute of Technology in two separate test programmes using a 2.5 x 2.5 inch intermittent tunnel and a 9 x 9 inch continuous tunnel, at a Mach number of approximately 2.5. The experimental results

include oil-flow pictures, vapour-screen photographs, surface static pressure distributions, local heat transfers, liquid crystal pictures of surface temperature, and viscous layer surveys. The test data indicate that the interaction region consists of two different viscous flows, the side-wall boundary layer and an induced layer originating near the shock generator root and crossing the path of the side-wall boundary layer. In this flow field model, no flow separation appears as long as the surface stream lines of the side-wall boundary layer can be pliable enough to be bent along the edge of the induced layer, even when the surface-flow deflection exceeds the shock angle. However, an ordinary separation does take place when the induced layer forces the surface stream lines to deflect beyond a maximum permissible angle. GRA

N80-27640# Army Missile Command, Redstone Arsenal, Ala. Systems Simulation and Development Directorate.
CALCULATION OF THE LAMINAR VISCOSITY OF A GASEOUS MIXTURE FOR GAS DYNAMIC MIXING COMPARISONS FOR A REACTING SHEAR LAYER
B. J. Walker Oct. 1979 55 p refs
(AD-A083970; DRSMI/RD-80-2) Avail: NTIS
HC A04/MF A01 CSCL 20/4

This investigation determined the laminar viscosities of NO2 and O3 at elevated temperatures. The technique to accomplish this is relevant to other gases and a generalized method for calculation of viscosities of other gases is presented. The results are compared to the calculational method of Svehla (2) for CO2 at elevated temperatures. A cubic spline interpolation routine using a Lagrangian polynomial treatment of the end points is formulated and coded. GRA

N80-27641# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
FINITE ELEMENT METHODS FOR HEAT TRANSFER PROBLEMS Final Report, 15 Jun. 1978 - 15 Sep. 1979
F. Bisshopp, R. B. Caswell, and M. E. Michaud 2 Apr. 1980 94 p refs
(Grant DAAG29-79-G-0178)
(AD-A084450; ARO-13548.2-MX) Avail: NTIS
HC A05/MF A01 CSCL 20/4

At the start, three and a half years ago, the finite fluid element method Section 1 was the only one under consideration. Things went badly with that method, and progress with its implementation went far more slowly than we ever anticipated. As a result, by the end of the first year, a second method, which originally was developed for a check on results of the first, had become by far the more promising of the two. Most of this report Sections 3-6 describes progress we have made with the application of biased differences Section 2 to a variety of fairly difficult problems of numerical fluid mechanics. Finally, in the last six months of the period covered by this report, the major difficulties with finite fluid elements were overcome, so it became possible to begin a comparison of the two methods Section 6. Preliminary indications are that both methods are reliable, and both considerably more efficient than a third method with which they have been compared. Section 7 is a report of progress with a boundary integral method that is not closely related to the others except by being numerical, and Section 8 is a description of the kinds of graphical software we had to develop for interpretation of our numerical computations. GRA

N80-27642# ARO, Inc., Arnold Air Force Station, Tenn.
AN EXPERIMENTAL INVESTIGATION OF REACTIVE, TURBULENT, RECIRCULATING JET MIXING Final Report, Oct. 1977 - Feb. 1979
G. D. Smith and T. V. Giel AEDC May 1980 74 p refs
(AF Proj. 2308)
(AD-A084546; AEDC-TR-79-79) Avail: NTIS
HC A04/MF A01 CSCL 20/4

An experimental investigation of ducted, two-stream, subsonic, turbulent jet mixing with recirculation was conducted. A primary jet of air at a mass flow rate of 0.580 lbm/sec and bulk velocity of 335 ft/sec was surrounded by an outer hydrogen stream at a mass flow rate of 0.002 lbm/sec and bulk velocity of 3 ft/sec (overall equivalence ratio of 0.12). The ratio of the duct to inner nozzle diameter was 2.5. Radial distributions of mean axial and radial velocity, axial and radial turbulence intensity, velocity cross correlation, gas composition, static temperature, and total pressure, as well as axial distribution of wall static pressure, are presented for axial stations from zero to six duct diameters from the nozzle exit plane, both with and without chemical reactions. The maximum turbulent intensities which occurred in the center of the mixing layer and within the recirculation eddy were very high, having values in excess of 20 percent of the jet exit velocity. The data clearly indicate that the mixing is slower in the chemically reactive flow field than in the nonreactive flow field and that the presence of chemical reactions had a significant effect on the size and location of the recirculation zone within the mixing duct. GRA

N80-27643# Aeronautical Research Associates of Princeton, Inc., N. J.
FUNDAMENTAL RESEARCH IN TURBULENT MODELING Annual Technical Report, 1 Jan. - 31 Dec. 1979
Carmen Cerasoli, Coleman dup Donaldson, and Guido Sandri Feb. 1980 44 p refs
(Contract F44620-76-C-0048; AF Proj. 2307)
(AD-A084238; ARAP-TM-80-2; AFOSR-80-0324TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

A summary of both the theoretical and experimental studies carried out during the first year of a program of fundamental research on turbulent modeling is given. On the theoretical side, the application of a modeled tensor scale equation together with a modeled Reynolds stress equation to the case of homogeneous shear flow is discussed in some detail. It is shown that such modeling gives results that are in good agreement with experiment. On the experimental side, preliminary data on the effect of swirl on the structure of turbulence in an annular pipe flow are presented. GRA

N80-27644# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
NUMERICAL SOLUTIONS FOR LAMINAR BOUNDARY LAYER BEHIND BLAST WAVES Interim Report
Shaowen W. Liu and Harold Mirels 1 May 1980 109 p refs
(Contract F04701-79-C-0080)
(AD-A084435; TR-0080-5940-02-2; SP-TR-80-23) Avail: NTIS HC A09/MF A01 CSCL 20/4

Numerical solutions are obtained for plane and axisymmetric laminar boundary layers induced by blast waves. Explicit dependence on time is eliminated by a similarity transformation. The entire region between the shock and the blast origin is considered. Numerical results are presented for ideal air. Wall shear and heat transfer are found to increase at a rate faster than that indicated by previous solutions for the flow directly behind the shock. The results are applicable in the laminar boundary layer region. R.C.T.

N80-27645# Naval Postgraduate School, Monterey, Calif.
FINITE ELEMENT ANALYSIS PROGRAM (FEAP) FOR CONDUCTION HEAT TRANSFER M.S. Thesis
Jorge Martins Bettencourt (Portuguese Navy) Dec. 1979 163 p refs
(AD-A084522) Avail: NTIS HC A08/MF A01 CSCL 20/13

The Finite Element Analysis Program (FEAP) was expanded to solve linear and nonlinear, two and three dimensional heat conduction problems. The usual types of boundary conditions, including radiation, may be specified. A wide range of two and three time level schemes for the solution of time dependent problems is available in the program and a discussion of those most commonly used in presented. The algorithms for the solution of typical practical problems are described and several numerical examples are presented. The results are compared with the available analytical solutions. A listing of this expanded version of FEAP and the corresponding user's instructions are provided. GRA

N80-27646# Naval Ocean Systems Center, San Diego, Calif.
DIGITAL IMAGE ANALYSIS OF TWO PHASE FLOW DATA Final Report, 1979
M. M. Reischman, J. M. Holzmann, and N. H. Hughes (San Diego State Univ. Foundation, Calif.) 15 Jan. 1980 23 p refs
(AD-A084187; NOSC/TR-502) Avail: NTIS
HC A02/MF A01 CSCL 20/4

The analysis of flow visualization data documenting a variety of fluid phenomena has been severely limited in the past by the subjective nature of data interpretation and limitations imposed by actual sample size. Video digitization offers a reliable method of automating the analysis of such visual data. This paper describes an experiment wherein the distribution of sizes of bubbles formed by air injection into a water stream was found. Previous results were limited to special cases due to the amount of data required for a full documentation. Several geometric and flow parameters were varied and their effects are reported. Data reduction was via a digital image processing system. This type of system holds the promise of high speed, objective data reduction for a broad range of fluid mechanics problems. GRA

N80-27647# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TURBULENT BOUNDARY LAYERS: EXPERIMENTS, THEORY AND MODELING
Jan. 1980 386 p refs Mainly in ENGLISH; partly in FRENCH Presented at the Fluid Dyn. Panel Symp., The Hague, 24-26 Sep. 1979
(AGARD-CP-271; ISBN-92-835-0257-4) Avail: NTIS HC A17/MF A01

Experimental and theoretical research directed towards understanding the turbulent boundary layer in both incompressible and compressible fluid flow is presented. Specific topics discussed include: computer modeling techniques, coherent vortex structures, flow visualization, hot wire anemometry, nonlinear vortex interactions, decomposition of fluctuating flow fields, and turbulence during, or immediately following transition. For individual titles, see N80-27648 through N80-27672.

N80-27648# Ecole Centrale de Lyon (France). Lab. de Mecanique des Fluides.
EXPERIMENTAL METHODS AND TECHNIQUES IN TURBULENT BOUNDARY LAYER RESEARCH
Genevieve Comte-Bellot *In* AGARD Turbulent Boundary Layers Jan. 1980 35 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

The state-of-the-art of methods and techniques available to investigate turbulent boundary layers is surveyed. Three specific areas are discussed: objectives of boundary layer research, transducer techniques, and signal processing techniques. R.E.S.

N80-27649# Centre National de la Recherche Scientifique, Marseilles (France). Inst. de Mecanique Statistique de la Turbulence
AN EXPERIMENTAL STUDY OF INWARD AND OUTWARD FLOW IN A TURBULENT BOUNDARY LAYER [ETUDE EXPERIMENTALE DES APPORTS ET DES EJECTIONS DE FLUIDE DANS UNE COUCHE LIMITE TURBULENTE]
M. Elena, L. Fulachier, and R. Dumas *In* AGARD Turbulent Boundary Layers Jan. 1980 21 p refs In FRENCH; ENGLISH summary (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Experimental results concerning the structure of the internal and external zone of the boundary layer are presented. In the viscous sublayer, the flow has obvious intermittent characteristics; particularly the inward flows from regions which are farther from the wall prevail over the outward flows and penetrate the sublayer randomly. As the number of inward flow decreases with uncreasing distance from the wall, it becomes of the same order as the number of outward flow in the fully turbulent region. The measurements of the space-time correlations reveal that, at least in the internal region, there exists a linkage between the inward and outward flows, the latter being the more dominating. Measurements of conditional probabilities show that the trajectories of these disturbances are in agreement with the trajectories obtained through visualizing or measuring thermal diffusion from a point located at the wall. Additionally, measurements of three point space-time correlations indicate that the outward flows are more coherent and spanwise thinner than the disturbances corresponding to the inward flow. These outward flows expand when moving off the wall and diffuse through the boundary layer. R.E.S.

N80-27650# Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).
EXPERIMENTAL STUDY OF COHERENT STRUCTURES IN THE TURBULENT BOUNDARY LAYER OF PIPE FLOW USING LASER-DOPPLER ANEMOMETRY
H. R. E. vanMaanen *In* AGARD Turbulent Boundary Layers Jan. 1980 20 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

The coherent structures in the turbulent boundary layer of a pipe flow were investigated. These structures, often called bursts, are thought to be the main mechanism involved in the generation and maintenance of turbulence in flow. Measurements were carried out in a pipe 6 m long and 50 mm in internal diameter, filled with water, using a laser-Doppler velocimeter, down to 0.25 mm from the wall, with the size of the measuring volume in radial direction being 0.1 mm. The output signal of the laser-Doppler anemometer, which can be regarded as the flow velocity, was fed into a burst detector and into an electronic delay line. The output signal of the burst detector was used to conditionally average the delayed signal. The conditional averages close to the pipe wall ($y(+)$ approximately equal to 20) were in good agreement with those found by Blackwelder and Kaplan, but further from the wall significant deviations were observed. Burst phenomena even for $y(+) = 100$ were found indicating that the structure is bigger than expected. Results of the measurements of the burst frequency spread as a function of the Reynolds number, as well as the conditional averages, are presented. R.E.S.

N80-27651# New York Univ., N. Y. Dept. of Applied Science.
TURBULENT BOUNDARY LAYER AT LOW AND HIGH SUBSONIC SPEEDS
V. Zakkay, V. Barra, and K. Hozumi *In* AGARD Turbulent Boundary Layers Jan. 1980 20 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Results of simultaneous measurements of velocity, wall pressure, and wallshear fluctuations in a turbulent boundary layer are presented. The results were analyzed in an attempt to obtain a description of the coherent or quasiordered structure of the boundary layer turbulence. On a large scale, the boundary layer is dominated by vortical structures which extend to the viscid-inviscid region. The wall region is dominated by the so called bursting process. The relationship or interaction between the large scale outer structure and the turbulent bursts is still not clearly defined. The results of this investigation at high speed, while confirming some of the previous results with regard to the mean period between coherent events, and their geometrical configuration, did not yet resolve the question as to whether at high subsonic speeds there is, besides the outer flow processes, a distinct inner region. With the limited instrumentation available it was not possible at the high subsonic speed to resolve any inner sublayer region, although it was found that the outer flow structures exert a strong influence on the wall. The experimental results at low subsonic speeds, on the other hand, did identify an inner and outer region, and duplicated some of the results obtained at low subsonic speed by other investigations. R.E.S.

N80-27652# Wright State Univ., Dayton, Ohio.
COHERENT STRUCTURES IN TIME DEPENDENT SHEAR FLOWS
Herman Viets *In* AGARD Turbulent Boundary Layers Jan. 1980 14 p refs (For primary document see N80-27647 18-34) (Grant AF-AFOSR-3525-78)
Avail: NTIS HC A17/MF A01

The existence of large scale coherent structures in forced unsteady flows is demonstrated. The time dependency is produced in the free jet case by a fluidically controlled flapping jet and in the wall boundary layer case by a mechanical vortex generator. Advantages of the unsteady flows and similarities to steady turbulent shear flow structure are discussed. Author

N80-27653# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
AN INVESTIGATION OF THE STRUCTURE OF EQUILIBRIUM TURBULENT BOUNDARY LAYERS

L. F. East and W. G. Sawyer *In* AGARD Turbulent Boundary Layers Jan. 1980 19 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Seven low speed equilibrium boundary layer flows ranging from mildly favorable pressure gradients to adverse pressure gradients almost sufficient to cause incipient separation are described. The flows are turbulent and second and third order correlations of the turbulence are included in addition to measurements of the mean flow. The flow parameters are shown to be consistent with existing equilibrium loci. It is also shown that the law of the wall applies to all the flows and that therefore the value of von Karman's 'constant' in the mixing length formulation of shear stress must vary. The data strongly support the concept of gradient diffusion and it is demonstrated that for flows in strong adverse pressure gradient the shear stress gradient results from the strong diffusion of turbulence towards the wall and not from changes in the dissipation term. Thus, although the mixing length is dependent upon pressure gradient, the dissipation length is not. R.E.S.

N80-27654# British Columbia Univ., Vancouver. Dept. of Mechanical Engineering.
EQUILIBRIUM BOUNDARY LAYERS OVER VERY ROUGH SURFACES
I. S. Gartshorne and K. A. deCroos *In* AGARD Turbulent Boundary Layers Jan. 1980 11 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Commonly used wall shear stress correlations appropriate for rough walls imply a degree of equilibrium between the boundary layer and the wall. For two roughness geometries examined experimentally in zero pressure gradient, equilibrium in the mean velocity appears to exist beyond 350 times the roughness height from the origin of roughness. For moderately close spacing of simple three dimensional roughness elements, a correlation due to Dvorak appears accurate; for less dense spacing (but still fully rough conditions) the correlation underestimates the wall stress significantly. The equilibruim boundary layer studied experimentally showed unexpectedly large turbulent intensities, constant integral length scales, no region of constant stress and a semi-logarithmic region best described with a von Karman constant of 0.36 + or - .02. Author

N80-27655# Centre d'Essai Aeronautique, Toulouse (France).
TURBULENCE BEHAVIOR IN A SHOCK WAVE/BOUNDARY LAYER INTERACTION
P. Ardonceau, D. H. Lee, T. Alziary deRoquefort, and R. Goethals *In* AGARD Turbulent Boundary Layers Jan. 1980 14 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Two dimensional shock wave boundary layer interaction was investigated. Experiments were carried out at a nominal Mach number of 2.25 for three compression corners of 8 deg, 13 deg and 18 deg corresponding respectively to attached flow, incipient separation, and well separated flow. The measurements involved wall static pressure, static and total pressure profiles, determination of the mean and root of mean square fluctuations of the u and v velocity components with a laser Doppler anemometer, hot wire measurements of the mass flow flutuations, and spectrum analysis of the hot wire signal. R.E.S.

N80-27656# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
LONGITUDINAL VORTICES IN CONCAVE SURFACE BOUNDARY LAYER
R. I Crane and S. H. Winoto *In* AGARD Turbulent Boundary Layers Jan. 1980 10 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Local measurements of mean and fluctuating velocity by laser anemometer were made inside the developing concave surface boundary layer in a free surface water channel at Reynolds numbers up to 16000. Concave surface radius was 3.5 times channel width and the ratio of spanwise mean boundary layer thickness to surface radius ranged between 0.03 and 0.11. Systems of longtitudinal vortices developed without artificial triggering. Vortex wavelength varied across the span by as much as a factor of 2, but mean wavelength was typically 1.3 times the boundary layer thickness and did not vary significantly in the flow direction. Continuous vortex growth at Reynolds number = 9800 contrasted with apparent breakup of the vortices at Reynolds number = 16000. R.C.T.

N80-27657# Technische Univ., Berlin (West Germany). Herman-Foettinger-Inst. fuer Thermo und Fluiddynamik.
A DISCUSSION OF PROBE EFFECTS AND IMPROVED MEASURING TECHNIQUES IN THE NEAR-WALL REGION OF AN INCOMPRESSIBLE THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER
J. D. Vagt and H. H. Fernholz *In* AGARD Turbulent Boundary Layers Jan. 1980 17 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Comprehensive measurements of mean and fluctuating velocities and shear stresses are provided. It is shown that measuring techniques for such measurements are improved, especially in the near wall region of a pressure driven three dimensional boundary layer on a curved wall. R.C.T.

N80-27658*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENTS IN THE COMPUTATION OF TURBULENT BOUNDARY LAYERS
Morris W. Rubesin *In* AGARD Turbulent Boundary Layers Jan. 1980 23 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Two methods of turbulence computation are discussed in terms of their basic simularities. It is shown that the two methods are interrelated and that each can gain from advances in the other. The degree of success of a pair of increasingly complex Reynolds stress models to broaden their range of applicability is examined through comparison with experimental data for a variety of flow conditions. An example of a large eddy simulation is presented, compared with experimental results, and used to evaluate the models for pressure rate of strain correlation and dissipation in the Reynolds averaged equations. R.C.T.

N80-27659*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A NAVIER-STOKES FAST SOLVER FOR TURBULENCE MODELING APPLICATIONS
J. D. Murphy and M. W. Rubesin *In* AGARD Turbulence Boundary Layers Jan. 1980 16 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

A computer code for the evaluation and/or optimization of the predicative potential of second order turbulent closure models in simple two dimensional flow configurations is discussed. A procedure for the numerical solution of the steady constant property Navier-Stokes equations are described together with algebraic, one dimensional and two dimensional equations of turbulence closure models. Four turbulence models are compared with several sets of experimental data. The effects of initial conditions and boundary conditions are also described. The effects of purely numerical parameters, such as mesh size, boundary locations, and convergence criteria are presented. R.C.T.

N80-27660*# California Univ., Davis.
REYNOLDS STRESS CLOSURES: STATUS AND PROSPECTS
Brian E. Launder *In* AGARD Turbulent Boundary Layers Jan. 1980 13 p refs (For primary document see N80-27647 18-34) (Grant NsG-2256)
Avail: NTIS HC A17/MF A01 CSCL 20D

The basic pattern of Reynolds closures and the reason they look as an attractive type of model for practical shear flow calculations is summarized. The relationship between the organized structures and Reynolds stress closures is discussed. An outline given of fundamental developments that are being introduced to extend the modest reliability of Reynolds stress closures. R.C.T.

N80-27661*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LARGE EDDY SIMULATION OF TURBULENT CHANNEL FLOW: ILLIAC 5 CALCULATION

John Kim and Parviz Moin *In* AGARD Turbulent Boundary Layers Jan. 1980 18 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

The capabilities of large eddy simulation in the prediction and analyses of wall-bounded turbulent shear flows are demonstrated. The dynamical equations for large scale field motions are derived. The computational grid network is described and its relation to the observed physical length scales in the flow are discussed. Some aspects of the mechanics and structure of the flow are examined both in the vicinity of the wall and in regions away from the wall. An attempt is made to correlate numerical results with laboratory observations. Other significant observations and conclusions are presented. R.C.T.

N80-27662# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
A TURBULENCE CLOSURE OF THE TRANSPORT EQUATION FOR THE PROBABILITY DENSITY OF VELOCITY
M. M. Ribeiro (CTAMFUL-DTA, Lisbon) *In its* Turbulent Boundary Layers Jan. 1980 12 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

A proposal for a first order closure of the hierarchy of transport equations for the probability density of velocity in a turbulent field is presented. The fluid is assumed to be incompressible and Newtonian. The effects of the pressure deviations on the probability density are modelled based on the assumption of homogeneous behavior of the flow field. The closure is shown to be compatible with a well-known Reynolds stresses closure. Particular attention is given to the physical implications of the assumptions embodied in the modelling of the unknown terms that occur in the exact equation. R.C.T.

N80-27663# Douglas Aircraft Co., Inc., Long Beach, Calif.
MODELLING REQUIREMENTS FOR THE CALCULATION OF THE TURBULENT FLOW AROUND AIRFOILS, WINGS AND BODIES OF REVOLUTION
Turner Cebeci and H. U. Meir (Deutsche Forschungs- und Versuchsanstalt Fuer Luft- und Raumfahrt, Goettingen, West Germany) *In* AGARD Turbulent Boundary Layers Jan. 1980 12 p refs (For primary document see N80-27647 18-34)
(Contract N00019-78-M-0466)
Avail: NTIS HC A17/MF A01

The merits of turbulence models were considered for the calculation of the flow around geometric configurations of relevance to airplane and missile design. Calculated results obtained with three turbulence models were compared to each other and to the boundary layer measurements. Significant results are reported. R.C.T.

N80-27664# Norges Tekniske Hoegskole, Trondheim. Inst. for Mekanikk.
THE TURBULENT BOUNDARY LAYER AND THE CLOSURE PROBLEM
Leif N. Persen *In* AGARD Turbulent Boundary Layers Jan. 1980 5 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Previous attempts to establish a proper phenomenological relation for turbulent flows are reviewed followed by a suggested approach to the problem in the case of a turbulent boundary layer. An attempt is made at showing the extreme flexibility that such a relation must exhibit if it is to account for effects of outside conditions and pre-history of the flow. By selecting proper 'inner variables' as parameters and properly characterizing the outer flow it is shown how a sufficiently general phenomenological relation can be established and how the closure problem may thus be considered in a different perspective. M.G.

N80-27665# National Aerospace Lab., Amsterdam (Netherlands).
BOUNDARY LAYER MEASUREMENTS ON A TWO-DIMENSIONAL WING WITH FLAP AND A COMPARISON WITH CALCULATIONS
B. vandenBerg and B. Oskam *In* AGARD Turbulent Boundary Layers Jan. 1980 14 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

Measurements performed on a wing flap configuration which was so designed that flow separations occur nowhere apart from a small laminar separation bubble on the wing nose are presented and discussed. The measurements comprise surface pressure measurements, boundary layer and wake traverses at 16 stations, and flow visualization tests to establish the presence of separation bubbles and boundary layer transition regions. The data resolve the various flow phenomena sufficiently well to provide a significant test case for calculation methods for the flow around multielement airfoils. Comparison with such a calculation method showed satisfactory agreement in many respects. A need for improved modelling was found to exist in some regions, particularly for the wing wake above the flap. M.G.

N80-27666# Aix-Marseilles Univ. (France).
THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER: RESTRUCTURATION OF AN AXISYMMETRIC FLOW SUBJECTED TO A DISCONTINUITY OF THE WALL PERIPHERAL VELOCITY [COUCHE LIMITE TURBULENTE TRIDIMENSIONNELLE: TRIQUE SOUMIS A UNE DISCONTINUITE DE LA VITESSE DE PAROI]
E. Arzoumanian, L. Fulachier, Jean Cousteix (ONERA, Toulouse), and Bertrand Aupoix (ONERA, Toulouse) *In* AGARD Turbulent Boundary Layers Jan. 1980 11 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

The influence of the rotation of a cylinder on the restructuration of a developing three dimensional boundary layer is studied by using the analysis of the mean velocity field. A three dimensional turbulent boundary layer is developed on a circular cylinder the axis of which is parallel to the flow. In the downstream region the boundary layer is fully developed and the rear part of the cylinder rotates about its axis. The peripheral velocity at the wall is practically equal to the external velocity. The model used can account for the inequality of the turbulent shear stress direction and the velocity gradient direction. Emphasis is placed on the study of the buffer layer down to the viscous sublayer. The measurements reveal that the collaterality of the flow is first obtained in a very thin region near the wall and then seems to extend progressively in the boundary layer. In contrast, the calculations indicate a more extended linear portion of the hodograph. M.G.

N80-27667# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EVIDENCE FOR INSTABILITY-WAVES IN THE VELOCITY-FIELD OF A FULLY DEVELOPED TURBULENT CHANNEL-FLOW
Michael Hofbauer *In* AGARD Turbulent Boundary Layers Jan. 1980 5 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

The results from hot film measurements and quantitative visual investigations, performed in the turbulent flow of an oil-channel at a low Reynolds number (Re = 8000), are discussed. The main result of the hot film measurements is the power spectrum of the v-component of the fluctuating velocity. The power spectrum has regular maxima and minima. The frequencies corresponding to the maxima of the power spectrum are plotted as a function of the order n of the maxima. This graph demonstrates that the frequencies of the maxima are the harmonics of a fundamental frequency which are determined to be about 0.15 Hz. An estimation shows that the fundamental frequency is of the same order of magnitude as the roughly calculated unstable Tollmien-Schlichting frequencies of the mean turbulent velocity profile. This fundamental frequency is interpreted as the most excited frequency of Tollmien-Schlichting-like instability waves. The harmonics are believed to be due to a nonlinear amplification of the primarily excited instability waves. The evidence of regular oscillations in the near-wall region of the fully developed turbulent flow from the visual studies is examined. M.G.

N80-27668# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
EXPERIMENTAL RESULTS CONCERNING THE INFLUENCE OF TRANSITION PROCESSES ON THE INITIAL STRUCTURE OF A TURBULENT BOUNDARY LAYER
Daniel Arnal and Jean-Claude Juillen *In* AGARD Turbulent Boundary Layers Jan. 1980 9 p refs In FRENCH; ENGLISH

summary (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

How the initial structure of the turbulent boundary layer can be influenced by the transition mechanism is examined. In the case of zero pressure gradient the evolution from the laminar to the turbulent regime is characterized by the intermittency phenomenon; the conditional sampling of the hot wire signal shows that the turbulent spots exhibit a structure similar to the classical turbulent boundary layer structure. With a mild positive pressure gradient, it becomes difficult to describe the intermittency. When the transition is beginning downstream from the laminar separation point, the shape parameter decreases but the intermittency appears no longer. Only a progressive deformation of the instability waves is observed; at the end of the transition, the spectrum of the turbulent energy is composed of a series of peaks corresponding to harmonics of the instability waves. M.G.

N80-27669# Scientific and Technical Research Council of Turkey, Ankara.
SOME MEASUREMENTS IN SYNTHETIC TURBULENT BOUNDARY LAYERS
Oemer Savas *In* AGARD Turbulent Boundary Layers Jan. 1980 12 p refs (For primary document see N80-27647 18-34) (Grants NSF ENG-75-03694; NSF ENG-77-23541)
Avail: NTIS HC A17/MF A01

Synthetic turbulent boundary layers are examined which were constructed on a flat plate by generating systematic moving patterns of turbulent spots in a laminar flow. The experiments were carried out in a wind tunnel at a Reynolds number based on plate length of 1,700,000. Spots were generated periodically in space and time near the leading edge to form a regular hexagonal pattern. The disturbance mechanism was a camshaft which displaced small pins momentarily into the laminar flow at frequencies up to 80 Hz. The main instrumentation was a rake of 24 hot wires placed across the flow in a line parallel to the surface. The main measured variable was local intermittency; i.e., the probability of observing turbulent flow at a particular point in space and time. The results are reported in x-t diagrams showing the evolution of various synthetic flows along the plate. The dimensionless celerity or phase velocity of the large eddies is found to be 0.88, independent of eddy scale. All patterns with sufficiently small scales eventually showed loss of coherence as they moved downstream. A novel phenomenon called eddy transposition was observed in several flows which contained appreciable laminar regions. The large eddies shifted in formation to new positions, intermediate to their original ones, while preserving their hexagonal pattern. The present results, together with some empirical properties of a turbulent spot, are used to estimate the best choice of scales for constructing a synthetic boundary layer suitable for detailed study. The values recommended are: spanwise scale/thickness = 2.5, streamwise scale/thickness = 8. M.G.

N80-27670# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.
COHERENT STRUCTURES IN TURBULENT BOUNDARY LAYERS
R. F. Blackwell *In* AGARD Turbulent Boundary Layers Jan. 1980 7 p refs (For primary document see N80-27647 18-34) (Grant DAAG29-76-G-0297)
Avail: NTIS HC A17/MF A01

The nature of coherent eddy structures in turbulent boundary layers is examined. The dynamics of turbulent boundary layers are controlled by two different eddy structures. In the intermittent region, the large scale outer structure dominates the flow field and controls the entrainment of nonturbulent fluid. Near the wall, counter-rotating streamwise vortices, with resulting elongated streaks of low speed fluid lying between them, are the predominate eddies. The interaction between these two different eddy structures seems to be the primary means by which turbulent energy is produced. The main features of these characteristic eddies are reviewed and some remaining problems are outlined. M.G.

N80-27671# Cambridge Thermionic Corp., Mass. Dept. of Engineering.
FLOW VISUALIZATION OF TURBULENT BOUNDARY LAYER STRUCTURE
M. R. Head and P. Bandyopadhyay *In* AGARD Turbulent Boundary Layers Jan. 1980 12 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A17/MF A01

The results from flow visualization experiments performed using an argon-ion laser to illuminate longitudinal and transverse sections of the smoke filled boundary layer in zero pressure gradient are discussed. Most of the experiments were confined to the range 600 < Re sub theta < 10,000. Results indicate that the boundary layer consists almost exclusively of vortex loops or hairpins, some of which may extend through the complete boundary layer thickness and all of which are inclined at a more or less constant characteristic angle of approximately 45 deg to the wall. Since the cross-stream dimensions of the hairpins appear to scale roughly with the wall variables U sub tau and nu, while their length is limited only by the boundary layer thickness, there are very large scale effects on the turbulence structure. At high Reynolds numbers (Re sub theta = 10,000) there is little evidence of large-scale coherent motions, other than a slow overturning of random agglomerations of the hairpins just mentioned. M.G.

N80-27672# Adelaide Univ. (Australia). Dept. of Mechanical Engineering.
SOME OBSERVATIONS OF THE STRUCTURE OF THE TURBULENT BOUNDARY LAYER
Andrew S. W. Thomas *In* AGARD Turbulent Boundary Layers Jan. 1980 11 p refs (For primary document see N80-27647 18-34)
Avail: NTIS HC A02/MF A01

Results are presented to describe some measured features of the organized large structure of a turbulent boundary layer. The spanwise correlation scale, the conditional Reynods stress contribution, and the experimentally determined streamline pattern of the large structure are discussed. Correlation and conditional sampling techniques are employed to examine the influence of this structure at the wall. It is found that increased activity at the wall is associated with curved streamlines. This is to be expected if it is a rotational instability that couples the turbulent bursts to the large structure. Author

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-27673 Princeton Univ., N. J.
RESONANT DOPPLER VELOCIMETER Ph.D. Thesis
Micha Zimmermann 1980 230 p
Avail: Univ. Microfilms Order No. 8016470

A technique for visualization and for quantitative measurements of velocity, temperature and pressure of a gaseous flow was developed. These were achieved by shining a single frequency laser beam into a flow which was seeded with an atomic species. The laser was tuned through the absorption frequencies of the seeded species and the absorption profile was detected by observing fluorescence as the atoms relax back to the ground state. The flow velocity was determined by observing the Doppler shift in the absorption frequency. Spectroscopic absorption line broadening mechanisms furnished information regarding the static temperature and pressure of the moving gas. Dissert. Abstr.

N80-27674*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE GSFC MARK-2 THREE BAND HAND-HELD RADIOMETER
C. J. Tucker, W. H. Jones, W. A. Kiley, and G. J. Sundstrom Jan. 1980 33 p refs Submitted for publication
(NASA-TM-80641) Avail: NTIS HC A03/MF A01 CSCL 14B

A self-contained, portable, hand-radiometer designed for field usage was constructed and tested. The device, consisting of a hand-held probe containing three sensors and a strap supported electronic module, weighs 4 1/2 kilograms It is powered by flashlight and transistor radio batteries, utilizes two silicon and one lead sulfide detectors, has three liquid crystal displays, sample and hold radiometric sampling, and its spectral configuration corresponds to LANDSAT-D's thematic mapper bands. The device was designed to support thematic mapper ground-truth data collection efforts and to facilitate 'in situ' ground-based remote sensing studies of natural materials. Prototype instruments were extensively tested under laboratory and field conditions with excellent results. Author

N80-27675*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
LARGE ANTENNA MULTIFREQUENCY MICROWAVE RADIOMETER (LAMMR) SYSTEM DESIGN
J. Larry King May 1980 33 p refs
(NASA-TM-80685) Avail: NTIS HC A03/MF A01 CSCL 14B

The large Antenna Multifrequency Microwave Radiometer (LAMMR) is a high resolution 4 meter aperture scanning radiometer system designed to determine sea surface temperature and wind speed, atmospheric water vapor and liquid water, precipitation, and various sea ice parameters by interpreting brightness temperature images from low Earth orbiting satellites. The LAMMR with dual linear horizontal and vertical polarization radiometer channels from 1.4 to 91 GHZ can provide multidiscipline data with resolutions from 105 to 7 km. The LAMMR baseline radiometer system uses total power radiometers to achieve delta T's in the 0.5 to 1.7 K range and system calibration accuracies in the 1 to 2 deg range. A cold sky horn/ambient load two point calibration technique is used in this baseline concept and the second detector output uses an integrated and dump circuit to sample the scanning cross-tract resolution cells.

N80-27676# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DYNAMICS OF A LIQUID-FILLED GYROSCOPE: UP-DATE OF THEORY AND EXPERIMENT Final Report
Richard D. Whiting and Nathan Gerber Mar. 1980 52 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A083886; AD-E430411; ARBRL-TR-02221) Avail: NTIS HC A04/MF A01 CSCL 17/7

New comparisons are made between the theory of Stewartson, as modified by Wedemeyer, and existing experimental measurements of the motion of liquid-filled gyroscopes. Errors in previous comparisons are pointed out and corrected, as are some errors in several published presentations of the theory. Because some key parameters were not recorded during the experiments, complete comparisons of theoretical predictions with observed behavior cannot be made. The limited comparisons which can be made show that predicted and measured frequencies of greatest instability of the motion agree to within the experimental error; the growth rates of these frequencies agree to within 10% for Reynolds number greater than 10 to the 4th power, and to within 25% for the lower Reynolds number. GRA

N80-27677# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CAPILLARY FLOWMETERS FOR A ACCURATE, STABLE FLOWS OF GASES
Mark A. Dewilde Mar. 1980 14 p
(DA Proj. 1L1-61102-AH-43)
(AD-A083874; AD-E430407; ARBRL-TR-02230) Avail: NTIS HC A02/MF A01 CSCL 14/2

Capillary flow meters have been used for a number of years now to meter gases into flow systems. This report described a flowmeter/controller that is accurate to 1% and delivers a constant flow independent of delivery pressure between 0-0.10 MP a 0-15 psia. GRA

N80-27678# Naval Postgraduate School, Monterey, Calif.
A 16 LEVEL COLOR DISPLAY SYSTEM FOR TWO DIMENSIONAL ULTRASONIC DATA M.S. Thesis
Eugene L. Moon Dec. 1979 101 p refs
(AD-A083854) Avail: NTIS HC A06/MF A01 CSCL 14/5

A 16 level color display computer program for use with an ultrasonic acoustic imaging system is presented. This display system is the second half of a two part ultrasonic imaging system built at the Naval Postgraduate School. The RAMTEK GX-100A display terminal and a PDP 11/50 digital computer were used as the display system. The software implementation and C language are discussed. Photographs of actual display using an experimental data tape and the computer program are also included. GRA

N80-27679# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MATERIALS RESEARCH FOR ADVANCED INERTIAL INSTRUMENTATION. TASK 3: RARE EARTH MAGNETIC MATERIAL TECHNOLOGY AS RELATED TO GYRO TORQUERS AND MOTORS Technical Report, 1 Jul. 1978 - 30 Sep. 1979
D. Das, K. Kumar, and E. Wettstein Oct. 1979 50 p refs
(Contract N00014-77-C-0388)
(AD-A083968; R-1306; TR-2) Avail: NTIS HC A03/MF A01 CSCL 17/7

For inertial applications, high-energy product SmCo5 magnets are required which possess very low flux decay rates, near zero temperature coefficient of magnetization, and thermal expansion coefficient similar to that of beryllium. Concentrated effort has been directed towards achieving and understanding the underlying mechanism of high flux stability. In the ensuing period, efforts will be directed towards temperature compensation and tailoring of thermal expansion along with further studies on stability.GRA

N80-27680# Naval Air Propulsion Test Center, Trenton, N.J. Measurement and Information Systems Dept.
TURBINE FLOWMETERS AND THEIR APPLICATIONS AT THE NAVAL AIR PROPULSION CENTER Final Report
R. E. Oberndorfer Apr. 1980 31 p refs
(W05980000)
(AD-A084181; NAPC-MS-34) Avail: NTIS HC A03/MF A01 CSCL 14/2

At the Naval Air Propulsion Center, it has a specific requirement to make accurate mass flow measurements on the fuel flow of a gas turbine engine to determine the performance characteristics. The problem of acquiring mass flow from the inherent volumetric flow data of a turbine flowmeter is discussed. The development of a universal curve from calibration data is discussed. The unique curve fits for flowmeter, viscosity and specific gravity and their use during on-line data acquisition is described. The accuracy of the final mass flow data and its dependence on the errors associated with viscosity, specific gravity, temperature and frequency measurement is discussed. Some techniques used at NAPC to reduce these errors are described. GRA

N80-27681# National Technical Information Service, Springfield, Va.
HOLOGRAPHIC FLOW VISUALIZATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1968 - Mar. 1980
Brian Carrigan Apr. 1980 84 p Supersedes NTIS/PS-79/0453; NTIS/PS-78/0351
(PB80-808199; NTIS/PS-79/0453; NTIS/PS-78/0351) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

A bibliography containing 77 abstracts concerning the use of holographic methods in flow visualization is presented. Research covering flow in wind tunnels, gas lasers, aircraft wakes, aircraft engines, supersonic flow, and shock waves is cited. Most of the techniques involve interferometric holography. GRA

N80-27682# National Technical Information Service, Springfield, Va.
HOLOGRAPHIC FLOW VISUALIZATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
Brian Carrigan Apr. 1980 128 p Supersedes NTIS/PS-78/0352
(PB80-808207; NTIS/PS-79/0454; NTIS/PS-78/0352) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Worldwide research on holographic flow visualization is cited. The studies cover techniques, theory, equipment, and various

applications to measure flow in lasers, shock tubes, wind tunnels, and over aerodynamic surfaces. This updated bibliography contains 122 abstracts, 19 of which are new entries to the previous edition. DOE

N80-28036# Joint Publications Research Service, Arlington, Va.
USE OF POLYURETHANE FOAM DEFORMATION SENSOR TO RECORD RESPIRATORY ACTIVITY
V. I. Bredov and V. S. Baranov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14 No. 2, 1980 (JPRS-75654) 8 May 1980 p 134-136 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar/Apr. 1980 p 84-85 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-27683 California Univ., Berkeley.
LASER INDUCED FLUORESCENCE SPECTROSCOPY OF OH IN FLAMES Ph.D. Thesis
Calvin Kwok-Yu Chan 1979 155 p
Avail: Univ. Microfilms Order No. 8014633

A technique using laser-induced fluorescence spectroscopy to make OH concentration measurements in flames was developed. The technique requires modeling the dynamics of the relaxation processes of the OH molecules under excitation and solving the rate equation of every rotational level to obtain the number density distribution in the excited states. The emission spectrum based on this distribution was compared with the fluorescence spectrum to back out the quenching cross section and hence the fluorescence yield of the excited OH molecules through an iterative procedure. Absolute calibration of the OH concentration was made using laser absorption spectroscopy. A linear curve of growth for the fluorescence signal was obtained. Local temperature information was also obtained through the same matching process. Other aspects of laser-induced fluorescence spectroscopy including quenching, saturation, trapping and chemistry effects have also been discussed. The potential of using this technique to make turbulent measurements was assessed. Probability distribution function measurement of OH concentration in turbulent flames was demonstrated. Dissert. Abstr.

N80-27684 Arizona Univ., Tucson.
OPTICAL PERFORMANCE ANALYSIS OF CO2 LASER FUSION SYSTEMS Ph.D. Thesis
George Nelson Lawrence 1980 164 p
Avail: Univ. Microfilms Order No. 8015595

The components and phenomena which must be considered in the analysis of the CO2 laser fusion system are described. The applicability of ray trace, interferogram reduction, and prior diffraction propagation programs is discussed. The basic structure of the LOTS CO2 laser fusion analysis program is outlined. The general three dimensional complex amplitude description. Methods of treating the nonlinear gain and saturable absorber media are developed. The numerical calculation of near-field diffraction distributions in noncollimated beams and the far-field diffraction distributions in spatial filters and imaging is discussed. Estimates of sampling errors are developed for the case of diffraction from a uniformly illuminated circular aperture for the near and far field. Methods of introducing interferometric data into the calculations are described. Smoothed random wavefronts are used to substitute for components known only by their specification values. Requirements and techniques of construction of these random wavefronts are explored. Capabilities and commands for the LOTS program are presented. A preliminary design of the Antares 100 kilojoule CO2 laser fusion system is analyzed to demonstrate how the LOTS code is used. Dissert. Abstr.

N80-27685 Texas Christian Univ., Fort Worth.
WAVEFRONT REPRODUCTION BY STIMULATED BRILLOUIN AND RAMAN SCATTERING Ph.D. Thesis
Robert Mays, Jr 1979 93 p
Avail: Univ. Microfilms Order No. 8014213

Experimental investigations were made of the wavefront reproduction process (WFR) by backward stimulated Brillouin scattering (SBS) and backward stimulated Raman scattering (SRS)in CS2 with a linearly polarized ruby pump beam. The experimental studies were carried out as a function of the power pump into the cell, the diameter of the optical waveguide, the length of the optical waveguide, and the frequency shift, between the pump and backscattered beams for both CS2 and C7H6O. Photographic records comparing the pump beam with the backscattered SBS and SRS beams were obtained over several orders of magnitude of exposure and quantitative measurements of percentage of nonreproduced radiation in the backscattered beams were made. In all of the cases studied there was a high degree of replication observed between the SBS and pump beams using both non-Gaussian and near-Gaussian incident laser profiles. In all of the cases studied the efficiency of the WFR process by backward SBS was better than 85% and it improved as the pump intensity was increased and the frequency shift was decreased. Neither the diameter nor the length of the optical waveguides utilized in these experiments appeared to significantly influence the efficiency of the WFR process by backward SBS. Dissert. Abstr.

N80-27686# Michigan State Univ., East Lansing.
COMPUTER MODELING OF PULSED CHEMICAL LASERS Final Report, 1 Nov. 1978 - 31 Oct. 1979
R. L. Kerber 1 Dec. 1979 283 p refs
(Grant AF-AFOSR-2842-75; AF Proj. 2303)
(AD-A083648; AFOSR-80-0300TR) Avail: NTIS HC A13/MF A01 CSCL 09/2

The goal of this research is to quantify laser pulse energy and intensity on P-branch and rotational lasing transitions and provide data from well-defined experiments for interpretation and analysis of computational studies of HF and DF chemical lasers. A compendium of technical reports and publications on rotational non-equilibrium effects in the HF and DF lasers is presented. Modeling efforts have assessed the sensitivity of laser performance to various kinetic mechanisms. The importance of rotational non-equilibrium is identified and the possible effect of vibrational to rotational energy transfer on P-branch and rotational lasing is considered. GRA

N80-27687# Atomic Weapons Research Establishment, Aldermaston (England).
A MULTIPLE PULSE CO2 TEA LASER FOR USE IN THERMAL BLOOMING STUDIES
T. D. J. Cameron, J. A. McMordie, and R. J. Prosser Mar. 1980 18 p refs
(AD-A083930; AWRE-O-6/80; DRIC-BR73030) Avail: NTIS HC A02/MF A01 CSCL 20/5

The design, performance and operating characteristics of a multiple pulse CO2 TEA laser constructed at AWRE for use in thermal blooming studies is described. Using unstable resonator optics, at the maximum pulse repetition frequency of approx. 10.4 Hz, this laser yielded a good quality output beam of mean power 28 + or - 2 W. GRA

N80-27688# Avco-Everett Research Lab., Mass.
VISIBLE LASER RESEARCH ONE METER DEVICE Interim Report, 1 Jul. 1979 - 28 Feb. 1980
D. W. Trainor and H. Hyman 1980 53 p refs
(Contract N00014-76-C-1032; DARPA Order 3152)
(AD-A084196) Avail: NTIS HC A04/MF A01 CSCL 20/5

Stimulated Raman Scattering Experimental Results are discussed. The pump laser was XeF lambda = 350 nm) and two step conversion to the blue-green spectral region was accomplished using molecular hydrogen and deuterium. Conversion efficiencies were measured and overall conversion from the UV to the blue-green of = 40% is reasonable. GRA

N80-27689# SRI International Corp., Arlington, Va.
FREE ELECTRON LASERS WITH VARIABLE PARAMETER WIGGLERS
Norman M. Kroll, Philip Morton, and Marshall N. Rosenbluth Feb. 1980 165 p refs
(Contract MDA903-78-C-0086; ARPA Order 2504)
(AD-A084323; SRI-JSR-79-01) Avail: NTIS

HC A08/MF A01

A general discussion of free electron lasers with variable parameter wigglers is presented with a view towards their potential for the production of high power optical radiation at reasonable efficiency. The theoretical analysis is based upon a one dimensional relativistic Hamiltonian formulation and is developed in a manner to take advantage of the analogy between the free electron laser process and radio frequency accelerators. Three promising operational modes are identified and analyzed. The first may be thought of as an electron decelerator and is thought to have the most promise for single pass devices. Both oscillator and amplifier configurations are studied. The second is based upon adiabatic trapping and detrapping, intended to reduce the spread in electron energy typically induced by the FEL process. The third is based upon the method of phase area displacement. It has the advantage of wide gain bandwidth and small induced energy spread, and is thought to have the most promise for storage ring applications. Generally speaking, it is found that high peak power is intrinsic to these modes of operation. Potential problems from parasitic oscillations analogous to the stimulated Raman effect are analyzed, and some others arising from transverse inhomogeneity are identified. GRA

N80-27690# Naval Postgraduate School, Monterey, Calif.
COMPUTER PROGRAM FOR THE KINETICS AND POPULATIONS IN A XENON FLUORIDE LASER M.S. Thesis
Lonnie William Cole Dec. 1979 88 p refs
(DARPA Order 3747)
(AD-A084459; NPS69-79-013) Avail: NTIS
HC A09/MF A01 CSCL 20/5

To highlight in a qualitative manner the kinetics of an excimer laser, a simple computer model for calculating the species populations in a KrF laser cavity is developed; subsequently a computer program is modified to calculate the population of the different electronic configurations of excited neon present in a XeF laser. When modified, the NRL program accounts for 185 reactions and requires 9.5 minutes of CPU time using the IBM 360/67. The populations obtained are applied to the calculation of the index of refraction in the laser cavity. The phase shift is determined per unit length for two laser wavelengths; one laser wavelength is non-resonance with neon and the other is at resonance. Neon is the dominant specie relative to concentration and within the population distribution the neon ground state dominates by a factor of a million. The calculations show that the ground state neon determines the index of refraction. GRA

N80-27691# Air Force Systems Command, Wright-Patterson AFB, Ohio.
PROJECT GROUP FOR LASER RESEARCH Annual Report
1979 142 p refs
(LA-TR-79-46) Avail: NTIS HC A07/MF A01

The organization and development of the Project Group for Laser Research are discussed. Cooperation of the Group with other scientific and technical institutions is noted. Research in the departments of plasma physics and high power laser development, laser chemistry, and laser spectroscopy is summarized. The isotope selective excitation of UF6 which is of interest in connection with uranium isotope separation requires a laser which can be tuned exactly to an absorption line of the molecule in the region where the wavelength equals 16 micrometers. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-27692 California Univ., Berkeley.
A STUDY OF ABRASIVE WEAR Ph.D. Thesis
Ambrish Misra 1979 152 p
Avail: Univ. Microfilms Order No. 8014814

The various types of three body abrasive wear are classified. Existing three body abrasive wear testers were examined and a tester to simulate a certain type of three body abrasive wear was designed. With simple modifications the tester can also be used for two body abrasive wear tests. A study of the effect of various variables on two body and three body abrasive wear revealed that many of the results reported in the literature are not strictly valid for two body abrasive wear. The effect of abrasive particle size on wear rate was an explanation based on a preferentially work-hardened layer near the surface due to dislocation tangles and pile-ups is presented to explain this phenomenon. A simple additive wear rule for estimating the abrasive wear damage under field conditions is given along with factors to be considered when selecting materials for abrasive wear applications. Dissert. Abstr.

N80-27693 City Univ. of New York, N. Y.
FORCE BALANCING MACHINES AND OPTIMIZATION OF DYNAMIC RELATIONS FOR PLANAR MECHANISMS Ph.D. Thesis
Stephen J. Tricamo 1980 321 p
Avail: Univ. Microfilms Order No. 8014992

Experimentation showed that a mechanism designed to be fully force balanced exhibits a residual imbalance, brought about by unavoidable manufacturing tolerances and material nonhomogeneities. A theory for a group of devices which allow the complete removal of these residual shaking forces of a four bar linkage and other balanceable mechanisms, is presented and applied to the actual design of a balancing device for a four bar linkage. It was found that the goal of complete elimination of the residual shaking forces was not attainable and that it was necessary to modify the theory such that the best possible reduction in these forces could be obtained. Subsequent experiments, which use minimax as well as least squares approaches and had most successful outcomes, are described. A nonlinear optimization formulation which makes it possible to simultaneously minimize the maximum values of the various dynamic reactions of a four bar linkage while maintaining the ability to prescribe the maximum shaking force, is introduced. Dissert. Abstr.

N80-27694*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RELEASE MECHANISM FOR RELEASING AND REATTACHING EXPERIMENTS ON THE SPACE SHUTTLE
A. V. Clark Jul. 1980 21 p
(NASA-TP-1702; M-301) Avail: NTIS HC A02/MF A01 CSCL 22B

The release mechanism (REM) unlatches an experiment so that it can be moved about inside and outside the shuttle bay by the remote manipulator system (RMS), and then reattaches it to the REM base. Operated from the crew compartment after the RMS has been attached to the experiment, the REM releases the experiment by an electric motor driving a gear train and linkage which extracts four pins from holes in four plates. Electrical connectors on the REM are disengaged by the mechanical action of the structural pins retracting from the plates. When the REM releases the experiment, an unlatched indicator is actuated in the crew compartment, and then the experiment can be moved by using the RMS. To reattach the experiment to the REM, the RMS places the experiment with REM attachment angles against the flat, smooth surface of the REM; then the RMS moves the experiment into position for latchup. Actuation of an electric motor drives the four pins into the four holes in the plates. When fully latched, a switch actuated by the motion of the linkage, shuts the electric motor off and gives an indication to the crew compartment that the REM is latched. A.R.H.

N80-27695*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC ANALYSIS OF NONCONTACTING FACE SEALS
I. Etsion May 1980 40 p refs
(NASA-TM-79294; E-458) Avail: NTIS HC A03/MF A01 CSCL 11A

The dynamic behavior of a noncontacting coned face seal is analyzed taking into account various design parameters and operating conditions. The primary seal ring motion is expressed by a set of nonlinear equations for three degrees of freedom. These equations, which are solved numerically, allow identification of two dimensionless groups of parameters that affect the seal dynamic behavior. Stability maps for various seals are presented. These maps contain a stable-to-unstable transition region in which the ring wobbles at half the shaft frequency. The effect of various

parameters on seal stability is discussed and an empirical expression for critical stability is offered. Author

N80-27696*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE RESPONSE OF TURBINE ENGINE ROTORS TO INTERFERENCE RUBS
Albert F. Kascak 1980 18 p refs Presented at Army Sci. Conf., West Point, N. Y., 17-19 Jun. 1980 Film Supplement number C-294 to this report is available on request from Chief, Management Services Division (5-5), National Aeronautics and Space Administration, Lewis Research Center, 21000 Brookpark Road, Cleveland, Ohio 44135
(NASA-TM-81518; AVRADCOM-TR-80-C-14; E-462) Avail: NTIS HC A02/MF A01 CSCL 21D

A method was developed for the direct integration of a rotor dynamics system experiencing a blade loss induced rotor rub. Both blade loss and rotor rub were simulated on a rotor typical of a small gas turbine. A small change in the coefficient of friction (from 0.1 to 0.2) caused the rotor to change from forward to backward whirl and to theoretically destroy itself in a few rotations. This method provides an analytical capability to study the susceptibility of rotors to rub induced backward whirl problems. L.F.M.

N80-27697*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRESSES AND DEFORMATIONS IN ELLIPTICAL CONTACTS
Bernard J. Hamrock 1980 19 p refs Lecture presented at Lulea Univ., Sweden, 24 Jul. - 16 Aug. 1980
(NASA-TM-81535; E-488) Avail: NTIS HC A02/MF A01 CSCL 13I

Topics presented deal with defining conformal and nonconformal surfaces, curvature sum and difference, and surface and subsurface stresses in elliptical contacts. Load-deflection relationships for nonconformal contacts are developed. The deformation within the contact is, among other things, a function of the ellipticity parameter and elliptic integrals of the first and second kinds. Simplified expressions that allow quick calculations of the deformation to be made simply from a knowledge of the applied load, the material properties, and the geometry of the contacting elements are presented. L.F.M.

N80-27698*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FULLY FLOODED ELASTOHYDRODYNAMIC LUBRICATED ELLIPTICAL CONTACTS
Bernard J. Hamrock 1980 27 p refs Lecture presented at Lulea Univ., Sweden, 24 Jul. - 16 Aug. 1980
(NASA-TM-81543; E-497) Avail: NTIS HC A03/MF A01 CSCL 13I

Emphasis is on fully flooded, elastohydrodynamic lubricated, elliptical contacts. A fully flooded conjunction is one in which the film thickness is not significantly changed when the amount of lubricant is increased. A brief description of the relevant equations used in the elastohydrodynamic lubrication of elliptical contacts is given. The most important practical aspect of the elastohydrodynamic theory is the determination of the minimum film thickness within the contact. The maintenance of a fluid film of adequate magnitude is an essential feature of the correct operation of lubricated machine elements. The results presented show the influence of contact geometry on minimum film thickness as expressed by the ellipticity parameter and the dimensionless speed, load, and materials parameters. Film thickness equations are developed for materials of high elastic modulus, such as metal, and for materials of low elastic modulus, such as rubber. In addition to the film thickness equations that are developed, plots of pressure and film thickness are presented. These theoretical solutions for film thickness have all the essential features of previously reported experimental observations based on optical interferometry. Correlation between theory and experiments is also presented. L.F.M.

N80-27699*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STARVED ELASTOHYDRODYNAMIC LUBRICATED ELLIPTICAL CONTACTS
Bernard J. Hamrock 1980 23 p refs Lecture presented at Lulea Univ., Sweden, 24 Jul. - 16 Aug. 1980
(NASA-TM-81549; E-507) Avail: NTIS HC A02/MF A01 CSCL 13I

A theoretical study of the influence of lubricant starvation on film thickness and pressure in hard and soft elliptical elastohydrodynamic contacts is presented. From the results for both hard and soft EHL contacts a simple and important dimensionless inlet boundary distance is specified. This inlet boundary defines whether a fully flooded or a starved condition exists in the contact. Furthermore it is found that the film thickness for a starved condition could be written in dimensionless terms as a function of the inlet distance parameter and the film thickness for a fully flooded condition. Contour plots of pressure and film thickness in and around the contact are shown for fully flooded and starved conditions. The theoretical findings are compared directly with results obtained experimentally. Author

N80-27700# New Mexico Univ., Albuquerque. College of Engineering.
THE WAVY MECHANICAL SEAL: THEORETICAL AND EXPERIMENTAL RESULTS Summary Report, 1 Dec. 1978 - 30 Nov. 1979
A. O. Lebeck and L. A. Young Jan. 1980 224 p refs
(Contract N00014-76-C-0071)
(AD-A083933; ME-105(80)ONR-414-1) Avail: NTIS HC A10/MF A01 CSCL 11/1

In this report the results of theoretical and experimental investigations on the effects of waviness on mechanical face seal performance are presented. In previous work it was shown how waviness imposed on a seal face leads to reduced friction and wear while creating only a small leakage in a water seal. It was also shown that the waviness must be moved slowly around the seal ring in order that the effect of waviness remain indefinitely. A test apparatus for measuring the effects of waviness is described. A computer based system is used to record the data and monitor the test. A test procedure is outlined. Results from wavy seal experiments show that waviness reduces seal wear compared to a flat face seal a factor of four to forty and reduces torque a factor of four. Long term tests show that by moving the wave the effect remains indefinitely. As the amount of waviness is increased, friction torque decreases and leakage increases. Wear profiles show that the seal faces have a tilt in addition to waviness. This alters the pressure distribution significantly when compared to the radially parallel wavy faces analyzed previously. Tests using a converging radially tapered seal show that the taper wears away with time. GRA

N80-27701# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Fluid, Lubricants, and Elastomers Branch.
FLUOROALKYLENEETHER SILICATE/VITON GLT BLENDS FOR HYDRAULIC SYSTEM SEALS: SYNTHESIS, BLENDING, AND TESTING Final Technical Report, Sep. 1976 - Mar. 1979
Alan A. Shaffer, Robert E. Cochoy, and William E. Berner Mar. 1980 51 p refs
(AF Proj. 2421)
(AD-A084708; AFML-TR-79-4142) Avail: NTIS HC A04/MF A01 CSCL 11/1

Fluoroalkyleneether silicate (FES) polymers were obtained from the reaction between fluoroether bis-dimethyl carbinols and bis-dimethylamino methyl-vinyl and dimethyl silane derivatives. Peroxide cure reactivity through the pendant vinyl moieties was demonstrated. In an effort to improve the low temperature flexibility of a commercial fluorocarbon elastomer (Viton GLT from DuPont), blends were prepared using the FES materials as an additive co-curing plasticizer. Temperature retraction tests demonstrated an optimum 9 F improvement in low temperature flexibility. O-ring seal evaluations in Freon E6.5 fluid (chew and piston seal tests) demonstrated some seal enhancement and comparable durability in comparison to standard Viton GLT O-rings. GRA

N80-27702# Sonobond Corp., Westchester, Pa.
ULTRASONICALLY ACTIVATED DIFFUSION BONDING FOR FLUIDIC CONTROL ASSEMBLY Final Report
Howard A. Scheetz, Paul L. Coppa, and Janet Devine Dover, N. J. Army Armament Res. And Develop. Command Feb.

1979 161 p refs
(Contract DAAA21-76-C-0186)
(AD-A084658; AD-E400293; ARLCD-CR-79005) Avail: NTIS HC A08/MF A01 CSCL 13/8

Modified ultrasonic metal bonding equipment was used to develop a new fluidic stack assembly process. Ultrasonically activated diffusion bonding was successfully applied to aluminum laminates of different sizes (up to 1 by 1 inch), different foil thicknesses (2, 3, and 5 mils), and different number of layers (up to 18). Bonds were obtained without excessive deformation, within a few seconds of ultrasonic bonding time, on as-received surfaces, with special atmospheres, on commercially prepared etched foil fluidic laminate stacks. Bonds were judged good quality from visual examination of stack surfaces and edges, from electrical resistance measurements made face to face, and from photomicrographic analysis of assembly cross sections. Analysis of the bonding system led to establishment of fundamental bonding parameters and equipment requirements for assembly of larger and thicker stacks. Investigation of the use of increased ultrasonic power for assisting the diffusion bonding of fluidic elements verified the fact that increased areas and/or thickness of laminates can be joined, but that dedicated tooling must be developed to assure the success of the process development. GRA

N80-27703# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
HYDROLYZED WOOD SLURRY FLOW MODELING
J. Wrathall and Sabri Ergun Nov. 1979 9 p Presented at the Thermochem. Conversion Contractor's Meeting, Rolla, Mo., 7 Nov. 1979
(Contract W-7405-eng-48)
(LBL-10090) Avail: NTIS HC A02/MF A01

The catalytic conversion of hydrolyzed wood slurry to fuel oil is considered. A process to convert Douglas Fir chips into a pumpable fuel at costs comparable to current spot prices for Middle Eastern crude oil was designed. Operating difficulties that have developed at the pilot plant, include the production and handling of a pumpable, nonclogging hydrolyzed slurry as feedstock for a liquefaction process. A flow system was set up to investigate the properties of the hydrolyzed slurry in hopes of acquiring proficiency in control of slurry flow and development of conditions and correlations that will be of general usefulness to the chemical engineering community. Operating directives will be issued based on the research which will be of value in solving some of the problems encountered. DOE

N80-27704# Gulf Research and Development Co., Chestwick, Pa.
EFFECT OF AMBIENT TEMPERATURE ON VEHICLE EMISSIONS AND PERFORMANCE FACTORS Final Report
R. S. Spindt, R. E. Dizak, R. M. Stewart, and W. A. P. Meyer Sep. 1979 175 p refs
(Contract EPA-68-03-2530)
(PB80-162753; EPA-460/3-79-006A) Avail: NTIS HC A08/MF A01 CSCL 13F

Ambient temperatures are reported to affect automotive emissions and fuel economies since 1966. The results of exhaust emissions (regulated and unregulated) and fuel economies associated with fourteen selected vehicles tested at ambient temperatures ranging from 0F (-18C) to 110F(43C) are presented using the various test procedures. GRA

N80-27705# National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Div. of Physical Sciences and Engineering.
CONTROL OF PHYSICAL AGENT HAZARDS OF ARC WELDING AND CUTTING
David L. Bartley, William N. McKinnery, Jr., and Kenneth R. Wiegand Sep 1979 50 p refs
(PB80-164866) Avail: NTIS HC A03/MF A01 CSCL 06J

The ultraviolet radiation from gas tungsten arc welding (GTAW), gas metal (spray arc) welding (GMAW), and plasma arc cutting (PAC) was measured using a micro-computer controlled rapid scan spectroradiometer. Welding of aluminum alloys containing low concentrations of magnesium were found to yield radiation of considerably greater biological activity than nonmagnesium alloys and, at a distance of one meter from the arc, up to a thousand times that of sunlight at the Earth's surface. Magnesium in small concentrations was found to be important to radiation emission owing to the ease of vaporization into the arc and to the existence of magnesium emissions in the ultraviolet. GMAW emission dependencies on process, shielding gas, gap, and magnesium concentration were determined. Ultraviolet radiation and third octave band noise analyses of PAC were also carried out. Preliminary measurements of welders' clothing transmittance were made. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-27706 Pennsylvania State Univ., University Park.
SAMPLE SIZE DETERMINATIONS FOR SOME RELIABILITY PROBLEMS Ph.D. Thesis
Terry Lee King 1980 71 p
Avail: Univ. Microfilms Order No. 8015809

It is shown that if two or more reliability functions are being considered and these functions are normal or Weibull, then it is not possible to choose one population which has a larger value for the reliability at all values of t. In these cases it is therefore necessary to choose a point, say t^*, at which to draw inferences. Sample sizes are presented for three different settings. In the first setting, sample sizes are given for selecting the population among K normal populations which has the highest reliability at t^*. In the second setting, when a two parameter Weibull distribution is assumed and the experiment is censored on time, the Neyman-Pearson lemma is applied to produce lower bounds on the sample size required to select the most reliable population. In the third setting, again the normal distribution is assumed. Tables giving the power of a one sided hypothesis test are presented for the situation in which the statistic is distributed as a noncentral t random variable under the null and the alternative hypotheses. These tables will aid the experimenter in determining the sample size to be used in an experiment that will result in the construction of a tolerance interval or the variables sampling plan. Dissert. Abstr.

N80-27707 California Univ., Berkeley.
GRAPHICAL TECHNIQUES IN RELIABILITY THEORY Ph.D. Thesis
Bernard Paul Davis 1979 71 p
Avail: Univ. Microfilms Order No. 8014646

The concept of total time on test is extended to the bivariate case. In the one dimensional situation the failure rate function completely describes the aging characteristics of the underlying life distribution. The bivariate analogue of the failure rate function is the hazard gradient. This is a vector-valued function of two variables and jointly, the two functions in the hazard gradient describe the aging as well as dependence characteristics of the underlying bivariate life distribution. The hazard gradient is studied in detail in the context of some general types of dependence. A bivariate form of the total time on test transform is defined and some of its properties are discussed. Its relationship to the hazard gradient is shown to be similar to that of the one dimensional total time on test transform to the failure rate function. The empirical total time on test and the bivariate total time on test plot are discussed and some asymptotic properties of the empirical transform are presented. A bivariate version of the cumulative total time on test statistic is defined and some possible applications to data analysis are discussed. Finally, the structure of the cumulative total time on test statistic is investigated and some distributional results are presented. Dissert. Abstr.

N80-27708# Virginia Polytechnic Inst. and State Univ., Blacksburg.
MULTICHARACTERISTIC QUALITY CONTROL: A SURVEY
P. M. Ghare, Y. V. Hui, and D. R. Jensen Mar. 1980 27 p refs
(Grant DAAG29-78-G-0172)
(AD-A083894; ARO-1915194.5-M) Avail: NTIS

HC A03/MF A01 CSCL 12/2

Multicharacteristic quality control is concerned with inspecting the quality of an allotment of items and with monitoring production processes when the quality of an item or the state of a process is determined by a number of observable characteristics. This report reviews procedures currently available for multicharacteristic quality control when the characteristics are either variables or attributes. Attention is given to both location and dispersion parameters in the case of variables. Some limitations of these procedures are noted. GRA

N80-27709# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.

GENERALIZED APPROACH TO NEW PROBLEMS IN ULTRASONIC INSPECTION (GANPUI)

Joseph L. Rose and Michael J. Avioli 2 Apr. 1980 98 p refs

(Contract N68335-78-C-1041)

(AD-A083931; NAEC-192-140) Avail: NTIS HC A05/MF A01 CSCL 14/2

Generalized approach to new problems in ultrasonic inspection is detailed. It is an operator-computer interactive scheme involving application of latest techniques in ultrasonic inspection, pattern recognition, and minicomputer technology. GRA

N80-27710# Desmatics, Inc., State College, Pa.

AN INVESTIGATION OF A STATISTICAL PROCEDURE FOR MONITORING TWO-SAMPLE LIFE TESTS

Leslie A. Kalish and Dennis E. Smith Apr. 1980 25 p refs

(Contract N00014-75-C-1054)

(AD-A084041; TR-106-9) Avail: NTIS HC A02/MF A01 CSCL 14/2

A statistical procedure is described for comparing two lifetime distributions when the data is reviewed repeatedly over time. The procedure provides the capability of early decision while maintaining both a fixed significance level and fixed maximum length for the entire experiment. The effects which staggered entry, number of looks at the data and maximum test length have on power and expected test length are discussed. An application is made to a bearing fatigue-life test. GRA

N80-27711# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.

X-RAY TECHNIQUES FOR THE MEASUREMENT OF RESIDUAL STRESSES IN THE REAL WORLD

Jerome B. Cohen 8 Apr. 1980 14 p refs

(Contract N00014-75-C-0580; NR Proj. 031-733)

(AD-A083796; TR-27) Avail: NTIS HC A02/MF A01 CSCL 14/2

The principles of the X-ray method of measuring residual stresses are reviewed, with special emphasis on the latest developments in both procedures and equipment. Rapid in-the-field measurements are now being performed. It is possible to obtain stress gradients without layer removal and to obtain the entire stress tensor (not just the surface stress). GRA

N80-27712# Houston Univ., Tex.

INTERDISCIPLINARY STUDY ON ADVANCED NDI TECHNIQUES Interim Report, 1 Sep. 1978 - 30 Nov. 1979

Auguste B. El-Kareh, Stuart Long, C. Gerald Gardner, and Kamal Salama Jan. 1980 99 p refs

(Grant AF AFOSR-3457-77; AF Proj. 2307)

(AD-A084242; AFOSR-80-0331TR) Avail: NTIS HC A05/MF A01 CSCL 14/2

In Part 1 of this report - Development of an ultrasonic method for nondestructive evaluation of residual stresses - a measure of the temperature dependence of the ultrasonic velocity is used to evaluate the state of internal stress in a solid. In Part 2 - Electromagnetic methods for nondestructive evaluation - a study is made on quantitative low frequency eddy current testing on nonferromagnetic structural metals and/or microwave testing of nonmetalic materials. GRA

N80-27713# National Bureau of Standards, Washington, D.C. National Measurement Lab.

DEFECT CHARACTERIZATION AND DIMENSIONING OF CRACKS IN WELDS BY THE ULTRASONIC DIFFRACTION METHOD

S. Golan Mar. 1980 27 p refs

(PB80-161755; NBSIR-80-1983) Avail: NTIS HC A03/MF A01 CSCL 13C

The possibility of applying an ultrasonic diffraction method for dimensioning of crack-line defects in welds was investigated. A feasibility study was carried out and optimum test conditions were established using a series of test specimens with narrow slits. A series of welded specimens with in-weld cracks were tested. The possibility of using a quantitative diffraction technique for nondestructive examination of pipeline welds in field conditions is discussed. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-27714 Purdue Univ., Lafayette, Ind.

A UNIFIED NUMERICAL APPROACH FOR THERMALLY INDUCED STRESS WAVES Ph.D. Thesis

Hsu-Chao Chen 1979 159 p

Avail: Univ. Microfilms Order No. 8015437

A simple procedure is proposed for modifying an existing computer code to extend its capability to solve problems which involve heat expansions and thermomechanical coupling effects. The procedure is based on a unified variational formulation which introduces the concept of heat displacement and a compatible generalized displacement vector to represent the mechanical response, the thermal response, and their coupling effects. To illustrate the applications of the concept, a plane-stress/plane-strain analysis program was modified and numerically verified examples for uniaxial stress waves, known as the Danilovskaya's problems in thermoelasticity, biaxial stress waves generated by boundary heating or a concentrated heat source were studied. The latter simulates a cutting or a welding problem for thin plates. Numerical data were compared with the analytical solutions are available. Emphasis was focused on the significance of the thermomechanical coupling effects. Dissert. Abstr.

N80-27715 Cornell Univ., Ithaca, N. Y.

INELASTIC ANALYSIS AND DESIGN OF COLD-FORMED STEEL BEAMS WITH STIFFENED COMPRESSION FLANGES Ph.D. Thesis

Muzaffer Yener 1980 403 p

Avail: Univ. Microfilms Order No. 8015753

On the basis of test results on specimens formed from mild structural steel sheets having a yield stress of approximately 37 ksi it is found that ultimate compressive strain mainly depends on: (1) the compression flange slenderness ratio, w/t, and (2) the moment of gradient. A limiting case of moment gradient is defined and beams are divided into two categories. Accordingly, beams subjected to moment gradients higher than the specified limit are classified as members under moment gradient and those with gradients lower than the specific limit as beams under uniform moment. The compressive strain failure criterion is conveniently and conservatively expressed in terms of only one parameter, w/t, for each of the two categories of beams. The failure criterion is verified experimentally for high strength structural steel beams having a yield stress of 56 ksi subjected to moment gradient and uniform moment. In addition, restrictions on the web slenderness ratio, h/t, of sections designed in accordance with the proposed compressive strain failure criterion are provided by modifying the procedure followed in determining such ratios for hot rolled sections. Dissert. Abstr.

N80-27716 Illinois Univ. at Chicago Circle, Chicago.

SERVICEABILITY AND RELIABILITY ANALYSIS OF PARTIALLY PRESTRESSED CONCRETE BEAMS Ph.D. Thesis

Amnuayporn Siriaksorn 1980 495 p

Avail: Univ. Microfilms Order No. 8014233

The serviceability and reliability analysis of partially prestressed concrete beams is addressed. An accurate and rational

method of analysis is developed for partially prestressed concrete beams based on equilibrium, compatibility, and constitutive relations for both the cracked and uncracked sections. Direct equations are derived for the stresses and strains in the materials taking into account the change in the prestressing force due to the application of loads. A design procedure based on satisfying ultimate strength requirements and serviceability criteria is proposed. In addition, a reliability based design model for partially prestressed concrete beams is proposed. It is essentially based on the method called first order second moment which requires the knowledge of only the mean and variance of the distributions of the resistance and load. The reliability index beta of partially prestressed concrete beams at six serviceability limit states is evaluated. The six limit states considered are: maximum crack width, short and long term deflection and fatigue stress ranges in the concrete, the reinforcing steel and the prestressing steel. The effects of many parameters on the observed values of the reliability index beta are analyzed. Dissert. Abstr.

N80-27717 California Univ., Berkeley.
NONLINEAR GEOMETRIC, MATERIAL AND TIME DEPENDENT ANALYSIS OF REINFORCED AND PRESTRESSED CONCRETE SLABS AND PANELS Ph.D. Thesis
Johannes VanGreunen 1979 281 p
Avail: Univ. Microfilms Order No. 8014915

A numerical method of analysis is developed to trace the quasi-static response of reinforced and prestressed concrete slabs and panels under short time and sustained load conditions. Time-dependent effects due to load history, temperature history, creep shrinkage and aging of concrete and stress relaxation in prestressing steel are incorporated. The load-deflection history of such structures through the elastic, inelastic and ultimate ranges is calculated. The ultimate failure of these structures due to in-plane membrane plus bending effects is then predicted considering local failures in steel and concrete along with the deterioration of the structural stiffness due to progressive cracking. A finite element tangent stiffness formulation, coupled with a time step integration scheme, is developed to analyze reinforced and prestressed concrete slab and panel structures. Within a time step, an incremental load procedure with an iterative approach to obtain and equilibrium position of the structure for each load increment, is adopted to trace the nonlinear behavior of such structures. Dissert. Abstr.

N80-27718 California Univ., Los Angeles.
STRUCTURAL AND ACOUSTIC RESPONSE OF SUBMERGED SHELLS OF REVOLUTION Ph.D. Thesis
Allen John Bronowicki 1980 114 p
Avail: Univ. Microfilms Order No. 8015957

A reduction in dimensionality of the problem is achieved through a decomposition of motion into circumferential harmonics. The acoustic relation is thus represented as an integral equation defined along the shell meridian. This relation, derived on the basis of a Green's function technique featuring toroidal wave functions, is applicable to surfaces having arbitrary meridianal shape, including corners. In order to assure uniqueness of solution, interior equations are appended to the set of surface integral equations. The concept of an acoustic element, with meridianal pressure variation determined by the response at a number of surface pressure nodes, is introduced. The structure is represented in terms of an assemblage of conical frustum shell elements having either two or three nodal rings. The capability of representing prestress effects is included in these elements. The fluid-structure interaction relation is consistently developed on the basis of modal degrees of freedom. The final product is an accurate, efficient scheme to predict structural response, and surface and exterior pressure fields. Dissert. Abstr.

N80-27719*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF ELASTIC AND ELASTIC-PLASTIC STRUCTURAL ANALYSES FOR COOLED TURBINE BLADE AIRFOILS
Albert Kaufman Jul. 1980 15 p refs
(NASA-TP-1679; E-241) Avail: NTIS HC A02/MF A01 CSCL 20K

Elastic plastic stress strain states in cooled turbine blade airfoils were calculated by three methods for the initial takeoff transient of an advanced technology aircraft engine. The three analytical methods compared were a three dimensional elastic plastic, finite element analysis, a three dimensional, elastic, finite element analysis, and a one dimensional, elastic plastic, beam theory analysis. Structural analyses were performed for eight cases involving different combinations of mechanical and thermal loading on impingement cooled airfoils with and without leading edge film cooling holes. The von Mises effective total strains at maximum takeoff computed from the elastic and elastic plastic finite element analyses agreed with 9 percent for rotating airfoils and 28 percent for stationary airfoils with the elastic results on the conservative side. Author

N80-27720*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
INSTRUCTIONS FOR THE USE OF THE CIVM-JET 4C FINITE-STRAIN COMPUTER CODE TO CALCULATE THE TRANSIENT STRUCTURAL RESPONSES OF PARTIAL AND/OR COMPLETE ARBITRARILY-CURVED RINGS SUBJECTED TO FRAGMENT IMPACT
Jose J. A. Rodal, Susan E. French, Emmett A. Witmer, and Thomas R. Stagliano Dec. 1979 38 p refs
(Grant NGR-22-009-339)
(NASA-CR-159873; ASTL-MR-154-1) Avail: NTIS HC A03/MF A01

The CIVM-JET 4C computer program for the 'finite strain' analysis of 2 d transient structural responses of complete or partial rings and beams subjected to fragment impact stored on tape as a series of individual files. Which subroutines are found in these files are described in detail. All references to the CIVM-JET 4C program are made assuming that the user has a copy of NASA CR-134907 (ASRL TR 154-9) which serves as a user's guide to (1) the CIVM-JET 4B computer code and (2) the CIVM-JET 4C computer code 'with the use of the modified input instructions' attached hereto. L.F.M.

N80-27721# SRI International Corp., Menlo Park, Calif.
DEVELOPMENT AND APPLICATION OF A COMPUTATIONAL SHEAR BAND MODEL Final Report, 7 Apr. 1976 - 7 Apr. 1977
D. C. Erlich, L. Seaman, D. A. Hockey, and D. R. Curran Mar. 1980 123 p refs
(Contract DAAD05-76-C-0762)
(AD-A084029; AD-E430412; ARBRL-CR-00416) Avail: NTIS HC A06/MF A01 CSCL 12/1

A computational shear band model has been developed and used to predict the fragmentation response of explosively-loaded cylinders and munitions. The model is based on the physical processes occurring in the material that lead to fragmentation, as observed in experiments in which the fragmentation process was stopped at various stages of development. Good agreement was obtained between measured and computed fragment size distributions for two widely different steels, which suggests that the model can be used to predict the effects of variation of geometry, strain rate, and internal pressure on the fragmentation yield of munitions. In addition, fragments of long-rod penetrators of steel and a tungsten-7Ni-3Fe alloy were examined metallographically to establish the failure modes. The observations suggest that shear banding is a principal mode of penetrator failure. Computational simulations of a plate impacting on edge another plate at various oblique angles were performed using the two dimensional wave propagation code TROTT with the BFRACT fracture model. The results showed the distribution of shear, compression, and bending stresses in the projectile and indicated the regions where tensile fracture of shear banding might occur. GRA

N80-27722# Pacific-Sierra Research Corp., Santa Monica, Calif.
SURVEYS OF HIGH-PRESSURE EFFECTS IN SOLIDS Final Report, 21 May - 30 Sep. 1979
M. Sparks, L. J. Sham (Univ. of Calif. at La Jolla, San Diego), and M. Ross (Univ. of Calif., Lawrence Livermore Lab., Livermore) Nov. 1979 91 p refs
(Contract MDA903-79-C-0395)
(AD-A083728; PSR-931) Avail: NTIS HC A05/MF A01 CSCL 20/11

The density-functional formalism is used as the framework

within which to assess previous calculations and to suggest new avenues of research. As a result of the study, we judge that significant results should be obtained from theoretical high-pressure-physics investigations at one of three levels of sophistication: the Gordon-Kim-Boyer scheme with our suggested modifications; use of the exchange-correlation potential in the local-density approximation in such an accurate band-structure calculation as the augmented-plane-wave, Korringa-Kohn-Rostoker, or linear-combination-of-muffin-tin-orbital methods; or a complete calculation of the electron dynamics in the local-density approximation, which would also be useful in calculating the phonon spectrum. This approach should yield good results for the equation of state, which is the required basis for studies of dynamic and nonlinear effects, structural transitions in insulators and semiconductors (possibly providing a microscopic understanding of the successful ionicity scale of Phillips), simple insulator-metal transitions, polymorphic transitions in metals, and mixed-valence salt transitions. The state of the art in experimental and theoretical high-pressure physics research is surveyed in the context of recent studies on iodine, xenon, and cesium. Ultrahigh-pressure methods now under development are also reviewed. GRA

N80-27723# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

STRESS SINGULARITY AT THE VERTEX OF A FLAT WEDGE-SHAPED CRACK BY A VARIABLE METHOD

M. A. Hussain, B. Noble, and S. L. Pu Jan. 1980 34 p refs
Presented at the ASME-CSME Appl. Mech./Bioeng. Conf./Fluid Eng. Conf., Niagara Falls, N.Y., 18-20 Jun. 1979 and the 2d MACSYMA User's Conf., Washington, D.C., 20-22 Jun. 1979
Submitted for publication
(DA Proj. 1L1-61102-H-60)
(AD-A083871; AD-E440064; ARLCB-TR-80002) Avail: NTIS HC A03/MF A01 CSCL 20/11

Three dimensional elasticity problems are generally complex. In this paper we present the analysis for the stress singularity at the apex of a three dimensional, flat, wedge-shaped crack under general loadings. The problem is reduced to a set of coupled dual integral equations. Because of the complexity they are not amenable to a closed form solution. A variational method is developed to handle such problems. The physical interpretation of the results is also presented. GRA

N80-27724# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.

FREE VIBRATIONS OF A CONCENTRIC CIRCULAR CONICAL BEAM WITH A CONCENTRIC CIRCULAR CYLINDRICAL BORE

Rurik K. Loder Feb. 1980 37 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A083292; AD-E430396; ARBRL-TR-02216) Avail: NTIS HC A03/MF A01 CSCL 19/6

An analytical solution describing the free transverse vibration of a concentric circular conical tube with a concentric circular cylindrical bore has been derived for a variable domain which is characteristic for ballistic tubes. Eigenvalues and eigenvectors are discussed for a particular set of boundary conditions. GRA

N80-27725# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.

STRESS INTENSITIES AROUND TRANSVERSE SURFACE FLAWS IN CYLINDRICAL SHELLS BY PHOTOELASTIC STRESS FREEZING

John A. Schaeffel, Jr. 1 Oct. 1979 48 p refs
(AD-A083073; DRSMI/RL-80-1) Avail: NTIS HC A03/MF A01 CSCL 14/5

This report documents a set of seven tests for the determination of K sub I stress intensity factors for isotropic cylinders with transverse part-circular cracks loaded in combined uniaxial extension and internal pressure. Part-circular cracks were machined into birefringent Hysol CP5-4290 photoelastic cylinders. The cylinders were then subjected to combined loading while in a stress freezing cycle. Slices of the cracks were made at various angles and analyzed with a photoelastic polariscope. A least-squares curve fit of the photoelastic data was used to generate K sub I stress intensity factors. K sub I data are plotted versus slice angle into the crack for various crack parameters. The results of the tests were compared with the results of previous tests in which the cylinders were loaded in either pure uniaxial tension or internal pressure. GRA

N80-27726# Delaware Univ., Newark. Applied Mathematics Inst.

A BOUNDARY LAYER THEORY FOR THE ANISOTROPIC PLATE Interim Report

R. P. Gilbert and M. Schneider Mar. 1980 29 p refs
(Grant AF-AFOSR-2879-76)
(AD-A083265; AFOSR-80-0297TR; TR-71A) Avail: NTIS HC A03/MF A01 CSCL 20/11

To our knowledge the results of the pioneering paper on the boundary layer theory for plates by K. O. Friedrichs and R. F. Dressler have not been extended to anisotropic plates. Yet the basic conclusion of the above paper, namely that the equations of the three dimensional isotropic elasticity can be split into two independent systems seems to have been accepted by some authors to include also the case of anisotropic elasticity. While this happens to be true it is by no means obvious as the following presentation illustrates; hence, we believe our providing a detailed analysis of the orthotropic plate will be of interest to researchers in the field of composite materials and laminates. GRA

N80-27727# Lockheed Missiles and Space Co., Palo Alto, Calif.

DYNAMIC INSTABILITY OF AN ELASTIC CYLINDRICAL SHELL EXCITED BY A TRANSIENT ACOUSTIC WAVE Interim Report, 14 Nov. 1977 - 12 Jul. 1979

T. L. Geers and C. L. Yen 12 Jul. 1979 61 p refs
(Contract DNA001-78-C-0029)
(AD-A083338; AD-E300740; LMSC/D67676; DNA-5026Z) Avail: NTIS HC A04/MF A01 CSCL 20/11

Governing equations are developed for the dynamic instability of an infinite, elastic, circular cylindrical shell submerged in an infinite fluid medium and excited by a transverse, transient acoustic wave. These equations derive from circumferential Fourier series decomposition of the field quantities appearing in appropriate energy functionals, and from application of the 'residual potential formulation' for rigorous treatment of the fluid-structure interaction. Extensive numerical results are presented that provide understanding of the phenomenology involved and permit evaluation of the 'doubly asymptotic approximation' for treatment of the fluid-structure interaction. GRA

N80-27728# Naval Research Lab., Washington, D. C. Composite Materials Branch.

PLASTIC DEFORMATION AND DUCTILE FRACTURE AT AN ANGLE SLIT IN A SHEET UNDER TENSION Final Report, 1977 - 1979

S. C. Sanday and O. Richmond (U.S. Steel Research Lab., Monroeville, Pa.) 17 Mar. 1980 20 p refs
(RR0220441)
(AD-A084564; AD-E000409; NRL-8391) Avail: NTIS HC A02/MF A01 CSCL 11/6

A theoretical solution is obtained for the growth of narrow plastic zones and for the initiation of ductile fracture at the ends of an angled slit in a metal sheet under remote uniform tension. The theoretical model assumes two distinct regions: narrow plastic zones at the ends of the slit caused by necking of the sheet, and a surrounding elastic region. The direction of the narrow plastic zones is assumed to be normal to the remote tension regardless of the slit angle. The length of the plastic zones is assumed to be governed by Dugdale's hypotheses of yield stress attainment along the plastic zone-elastic region boundary and continuity of stress at the end of the plastic zone. Finally, fracture initiation is postulated to occur at the ends of the slit when the ratio of slit opening displacement to plate thickness attains a critical value representative of the material ductility. Experimental results on hard-rolled copper sheets support the assumptions and closely match the predicted results. GRA

N80-27729# Maurer Engineering, Inc., Houston, Tex.

BENDING STRESS AND FREQUENCY CALCULATIONS FOR THE BEARING-PACK SHAFT

Jeff Barnwell and Don W. Dareing Apr. 1980 33 p
(Contract EY-76-C-04-0789)

(SAND-80-7030) Avail: NTIS HC A03/MF A01

The bearing-pack shaft investigation was conducted to analyze bending and cycle fatigue stresses and resonance. The bending stresses produced were considered to be minimal, and the cycle fatigue stress was less than the material's endurance level. Resonating frequencies were estimated to be sufficiently high to preclude problems. DOE

N80-27730# National Technical Information Service, Springfield, Va.

STRESS CRACK PHENOMENA. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1979 - Feb. 1980

Guy E. Habercom, Jr. Apr. 1980 178 p Supersedes NTIS/PS-79/0270; NTIS/PS-78/0149

(PB80-807886; NTIS/PS-79/0270; NTIS/PS-78/0149) Avail: NTIS HC $30.00/MF $30.00 CSCL 20K

Stress analyses of various materials in which cracks are generated are considered. Stress corrosion, fracture mechanics and crack propagation are included. This updated bibliography contains 171 abstracts, all of which are new entries to the previous edition. GRA

N80-27731# National Technical Information Service, Springfield, Va.

STRESS CRACK PHENOMENA. CITATIONS FROM THE NTIS DATA BASE Progress Report, Feb. 1978 - Feb. 1979

Guy E. Habercom, Jr. Apr. 1980 205 p

(PB80-807878) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 20K

Research on the stress corrosion cracking of reactor materials, pressure vessels, and other structures made of high strength steels and other alloys, prestressed concretes, and ceramic materials is cited. Methods for stress analysis and nondestructive investigations of crack propagation, and metal fatigue are included. This updated bibliography contains 194 abstracts, none of which is new to the previous edition. A.R.H.

42 GEOSCIENCES (GENERAL)

N80-27732*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

GEOID ANOMALIES IN THE VICINITY OF SUBDUCTION ZONES

David C. McAdoo May 1980 46 p refs Submitted for publication

(NASA-TM-80678) Avail: NTIS HC A03/MF A01 CSCL 08E

The regional geoid of the southwest Pacific is matched reasonably well by results from a model of the upper mantle density structure (including slabs) associated with subduction zones of the region. Estimates of the geoid are obtained from Geos-3 and Seasat radar altimeter data. These data are very well suited to the task of detecting intermediate wavelength (600-4000 km) geopotential variations. Actually, subducting slabs can be expected to produce primarily intermediate and longer wavelength variations. Gravimetric profiles across trench/island arc complexes resolve primarily short wavelengths. The model represents subducting slabs as thin surfaces of anomalous mass per unit area. These surfaces are positioned using published seismicity results which detail the configuration of the Benioff zones. Crustal effects are ignored. Effects due to the contrast between the young thermal lithosphere of the behind-arc regions (marginal basins) and the older lithosphere seaward of the trench are modelled. Results indicate that the New Hebrides slab possesses an average areal density anomaly of about 300,000 gm/sq cm. This is about three times that which is estimated for the Tonga-Kermadec slab. Additional modelling suggests that slabs worldwide may be an important source of large, long wavelength gravity highs; i.e., they may contribute substantially to geopotential power of harmonic degree as low as three or four up to twenty or more. Author

N80-27733# European Space Agency, Paris (France). Dept. of Application Programmes.

ON CLIMATOLOGY, HYDROLOGY, ATMOSPHERIC RESEARCH AND METEOROLOGY (CHARM) FROM SPACE

T. D. Guyenne, ed. Feb. 1980 220 p refs Partly in ENGLISH and FRENCH Proceedings of ESA Workshop on CHARM, Ajaccio, France, 12-16 Nov. 1979 Sponsored in part by Comm. of European Communities Original contains color illustrations

(ESA-SP-150) Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Various aspects of the global environment are considered as well as different spaceborne techniques for monitoring these phenomena. Climate and climate modeling are highlighted as well as radiation and radiation processes. The Earth's hydrosphere and cryosphere are covered along with atmospheric structure and composition. Reviews of meteorological research and recently developed space technqiues for remote sensing are included. For individual titles, see N80-27734 through N80-27760.

N80-27734# World Meteorological Organization, Geneva (Switzerland).

CLIMATE AND CLIMATE MODELING Final Report c47

B. W. Boville *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 14-18 (For primary document see N80-27733 18-42)

Avail: NTIS HC A10/MF A01

The problems of monitoring global climate and assessing climatic trends are reviewed. The use of satellite observations in the development of mathematical climatic models is considered. Various international data collection programs are cited. Numerical weather prediction is emphasized. In relation to man and his impact on the global environment, the problem of fluctuations in the level of atmospheric CO2 is treated. In conclusion, data requirements regarding climate modeling are specified. Author (ESA)

N80-27735# Cologne Univ. (West Germany). Inst. for Geophysics and Meteorology.

RADIATION BALANCE AND RADIATION PROCESSES Final Report c48

E. Raschke *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 19-27 refs (For primary document see N80-27733 18-42)

Avail: NTIS HC A10/MF A01

In an attempt to quantify the primary energy source (solar radiation) for all circulation processes within the Earth-atmosphere-ocean system, satellite sounding to determine net radiation flux is proposed. The role of cloud cover in modifying radiation fluxes is emphasized. Observational requirements in measuring radiation budget components and radiation processes, such as energetics and optical properties, are outlined in terms of setting up numerical models. In conclusion, a satellite instrument package, consisting of a pyrheliometer, a pyranometer, a pyradiometer, and a scanning radiometer, is recommended. Author (ESA)

N80-27736# Kiel Univ. (West Germany). Inst. for Marine Research.

THE EARTH'S HYDROSPHERE AND CRYOSPHERE Final Report c46

W. Krauss *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 28-34 (For primary document see N80-27733 18-42)

Avail: NTIS HC A10/MF A01

The role of upper ocean circulation as a critical element in models of climatic change on the scale of weeks or decades is discussed. Emphasis is placed on the sea surface temperature as the most important quantity for climate studies, because it controls the transfer of thermal energy from the ocean to the atmosphere. It is proposed that key ocean parameters be monitored from space. Instrumentation considered includes satellite-borne altimeters, scatterometers, scanning multichannel microwave radiometers, and infrared radiometers. Both Oceanographic and ice measurements are covered. Author (ESA)

N80-27737# British Meteorological Office, Bracknell (England).

ATMOSPHERIC STRUCTURE AND COMPOSITION Final Report c48

K. Stewart *In* ESA On Climatol., Hydrol., Atmospheric Res.

and Meteorol. (CHARM) from Space Feb. 1980 p 35-38 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The practical importance of stratospheric research, particularly regarding changes in ozone levels, is discussed. In the field of atmospheric structure and dynamics a lack of data on stratosphere troposphere interactions is identified. Emphasis is placed on the mechanisms whereby materials (water vapor, aerosols, pollutants) are transferred from stratosphere to troposphere and distributed within the stratosphere. In terms of constructing numerical models of these transport phenomena, observational requirements are established. Satellite observation in conjunction with ground-based sounding is suggested. Author (ESA)

N80-27738# Servizio Meteorologico dell'Aeronautica Militare (Italy).
METEOROLOGICAL RESEARCH Final Report c47
B. Bizzarri *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 39-43 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The collection and processing of meteorological data is examined in terms of optimizing data analysis. Three data categories are discussed: (1) data for numerical weather prediction, (2) imagery and products from image processing, and (3) data on transport mechanisms in the atmosphere. In conclusion, improvement in satellite data processing is called for. As for atmospheric dynamics, refinement of vertical temperature and humidity sounding techniques, refinement in wind determination, and development of techniques for surface pressure measurements are seen as necessary. Author (ESA)

N80-27739# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
SPACE TECHNIQUES Final Report c47
A. Berroir *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 44-48 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

A review of meteorological parameters significant to climatic research is followed by a state of the art examination of measurement techniques. Parameters include radiation budget, cloud properties, and ocean as well as ice data. Also of interest are pressure, wind, temperature, and moisture fields. Data collection techniques include optics, such as lidar, passive interferometry and stereoscopic measurement, as well as passive microwave radiometry and active microwave techniques.
Author (ESA)

N80-27740# European Centre for Medium-Range Weather Forecasts, Reading (England).
ATMOSPHERIC MODELS c48
A. Wiin-Nielsen *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 51-62 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The multitude of atmospheric models presently in existence for purposes of prediction on a regional, hemispheric, and global scale, and for the purpose of simulation of the atmospheric general circulation and climate are briefly described. A global prediction model is considered in detail to illustrate the data requirements for prediction and simulation with a model incorporating energy sources and sinks. The use of atmospheric models in climate research is discussed, illustrating the limitations in various models due to the lack of ability to model the various parts of the climatic system. Author (ESA)

N80-27741# Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).
STOCHASTIC PROCESSES IN THE ATMOSPHERE-OCEAN SYSTEM c48
K. Herterich *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 63-65 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Examples of stochastic processes in the atmosphere-ocean system are given and their relation to climate is mentioned. In the case of sea surface temperature (SST) anomalies the technique of inverse modeling (a method of fitting models to stochastic data) is described. The results of the modeling lead to a redefinition of the data requirements. For climatic studies the data should be of global coverage and of long duration in time (decades). Specification of data resolution is also considered. Results show that for modeling SST anomalies the necessary resolution is serveral degrees in longitude and latitude, a few weeks for the time step, and 1/10 C for the precision in temperature.
Author (ESA)

N80-27742# Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
ICE SHEETS, GLACIERS, AND CLIMATE c47
L. Lliboutry *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. Res. (CHARM) from Space Feb. 1980 p 67-71 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Main problems of glacier and ice sheet dynamics are reviewed. A correlation between mass balances and meteorological factors is given. The importance of unusual synoptic situations or unusual sea ice cover in June-July-August is pointed out (e.g., quaternary ice sheets may have started on shallow seas). Results show that the thickness of an ice sheet of given width is much more sensitive to mass balance and air temperatures than often assumed. Spatial geodesy is suggested as useful to check numerical calculations of flow, but can give altitude changes only in some special areas. Author (ESA)

N80-27743# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.
RADIATIVE TRANSFER IN THE CLOUDY AND DUSTY ATMOSPHERE c48
J. Lenoble *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 75-81 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The transfer of radiation in a scattering atmosphere is briefly reviewed considering the possible approximations and parametrizations. Cloudiness is the main factor governing the planetary radiation balance; climate models should allow for cloud radiation interactions to be properly included. Results are shown concerning the influence of various cloud parameters. Aerosols have a more subtle influence as their role is much weaker, but thier variations can induce local or global climate variations. The need for an improvement in knowledge on aerosol parameters is underlined. Finally, a strategy for both cloud and aerosol radiation studies is proposed. Author (ESA)

N80-27744# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.
ENERGY TRANSPORT IN THE EARTH-ATMOSPHERE SYSTEM AND THE RADIATION BALANCE c48
H.-J. Bolle and P. Speth (Cologne Univ.) *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 83-89 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The conversion of absorbed short wave energy to infrared radiation emitted to space provides the driving force for large scale transport in the atmosphere-ocean system, which determines the average climate conditions on Earth. The response of the atmosphere and of the oceans to the variations in the energy input is a 'meteorological noise' which generates by interference climate variations. The kind of variability which can be expected depends at least partly on the distribution of energy sources and sinks in the atmosphere-land-ocean-system itself and their variability. The many processes and feedback mechanisms involved are reviewed. As manifestation of the sum of these processes, is the radiation balance at the top of the atmosphere.
Author (ESA)

N80-27745# Physikalisch-Meteorologisches Observatorium, Davos (Switzerland).
THE SOLAR CONSTANT AND ITS SPECTRUM c92
C. Froelich *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 91-94 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The present status of knowledge of the solar constant and the solar spectral irradiance is described. The most probable value of the solar constant is 1366 + or - 5W/sq m. As to a possible variability no conclusions can be drawn. Accurate determinations over extended periods of time are therefore recommended. The accuracy of the solar spectral irradiance in the energetic bulk part of the spectrum is poor, partly due to instrumental and calibration problems. Recommendations to improve this situation are given. Author (ESA)

N80-27746# Institut Royal Meteorologique de Belgique, Brussels.
SAMPLING PROBLEMS AND RADIATION BUDGETS: DATA REQUIREMENTS [PROBLEMES D'ECHANTILLONAGE ET BILANS RADIATIFS: LEUR PROBLEMATIQUE] **c46**
D. Crommelynck *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 95-102 refs In FRENCH; ENGLISH summary (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

How knowledge of the different radiation budgets with their components is largely dependent on space time sampling of the radiation field of the Earth-atmosphere system is shown. Whichever instrumental approach is adopted (wide angle view or high resolution) it affects the space time integration of the fluxes measured, either directly or as calculated. In this last case, necessary knowledge of the reflection pattern depends, in addition, on the angular sampling of the radiation. A series of questions is considered for which the answers are a prequisite to the organization of a global observation system. Author (ESA)

N80-27747# Institute of Oceanographic Sciences, Wormley (England).
SPACE AND TIME SCALES OF OCEAN CIRCULATION **c48**
W. J. Gould *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 105-110 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The developments which have led to the present view of mesoscale features in the deep ocean are described. Results illustrating the space and time scales of features studied during the mid-ocean dynamics experiment are presented. Suggestions are made for fields in which satellite data are likely to enhance knowledge of ocean circulation. Author (ESA)

N80-27748# Institute of Oceanographic Sciences, Wormley (England).
SATELLITE ALTIMETRY MEASUREMENTS OF THE SEA SURFACE **c43**
T. D. Allan *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 113-120 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Some of the preliminary observations made with the SEASAT precise radar altimeter are reviewed. Examples are taken from recently published work on data from over the western North Atlantic where the dynamic height profiles, calculated from the available geoid model, exhibit not only a strong one to two M signal over the width of the Gulf Stream, but also smaller amplitude anomalies which are associated with mobile cold rings of some 200 km diameter. Examples of repeat profiles recorded during the period of the SEASAT frozen orbit are shown over an area in the eastern Atlantic. They exhibit a remarkable repeatability of small features in the geoid and analysis to detect possible eddies and currents is discussed. A comparison of significant wave heights measured by the altimeter and by a surface buoy is shown to agree to about 20 cm. Author (ESA)

N80-27749# Appleton Lab., Slough (England).
SATELLITE MEASUREMENTS OF ATMOSPHERIC TEMPERATURE **c46**
J. T. Houghton *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 123-127 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The remote sounding of atmospheric temperature is discussed. Application of this data to the study of variations in atmospheric density is mentioned. A formula to interpret emitted radiation observations at a given spectral frequency in terms of the distribution of temperature throughout the atmosphere is given. The accuracy with which temperature can be measured is evaluated relative to TIROS-N, NOAA 5, and NIMBUS satellite data. Results are compared to data collected by a worldwide radiosonde balloon network. Indications are that good meteorological analyses can be obtained from satellite data alone, also with better coverage of ocean areas. Author (ESA)

N80-27750# Freie Univ., Berlin (West Germany).
THE INTERANNUAL VARIABILITY OF THE STRATOSPHERE **c46**
K. Labitzke *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 129-133 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Midwinter warmings, circulation anomalies in the stratosphere, are discussed. As an example of the synoptic evolution of such a warming, radiances obtained by Nimbus 6 are given and analyzed. Results confirm that these warmings are forced by the planetary waves of the troposphere. The variability of the planetary waves and of their vertical structure is reflected by the large interannual variability of the stratosphere during the northern winters. It is suggested to monitor this interannual variability, which has not yet been explained, and to measure the vertical temperature distribution of the stratosphere, preferably with the same instrument, continuously over several years. Author (ESA)

N80-27751# National Physical Lab., Teddington (England).
COMPOSITION OF THE MIDDLE ATMOSPHERE: STATUS AND PRIORITIES **c46**
J. E. Harries *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 135-142 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

A brief review of the current status of knowledge of middle atmosphere composition is given. The importance of coupling between photochemistry, dynamics, and radiation is stressed. A list of outstanding scientific problems is given, and some priorities for future research using satellites are established. Author (ESA)

N80-27752# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
OZONE MONITORING FROM SPACE **c46**
A. Ghazi *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 143-151 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Different methods of ozone observation by satellite are reviewed. A summary of the analyzed satellite ozone date is given. The importance of atmospheric ozone in influencing climate is emphasized based on the theoretical and observational knowledge obtained to date. Future needs of measurements and research priorities are briefly outlined. Author (ESA)

N80-27753# Technische Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
WATER VAPOR IN THE UPPER TROPOSPHERE AND IN THE STRATOSPHERE **c46**
H. Fischer *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 153-159 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Knowledge of the global water vapor distribution and its seasonal changes in the upper troposphere and stratosphere is reviewed. The circulation of water vapor and the exchange processes between troposphere and stratosphere are emphasized in terms of contributions from satellite observation. In contrast to known mean water vapor distributions in the upper troposphere, only single measurements of the mixing ratio have been published for the stratosphere so that the theory about the stratospheric water vapor cycle cannot yet be confirmed. Although expected results of two limb sounding experiments aboard Nimbus 7 will yield new information, recommendations for future improved satellite systems are offered. Author (ESA)

N80-27754# Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).
MOUNTAIN OVERFLOW PHENOMENA IN SATELLITE IMAGERY **c47**
V. Zwatz-Meise *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 163-168 ref (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Several orographically induced cloud configurations are investigated with the help of satellite images, while the necessary neteorological and geographical conditions for their formation are discussed. Possible applications of the results in meteorological research are shown, while the difficulties, such as low image resolution, the lack of appropriate ground truth measurements, and a low image frequency to show the whole formation process, are mentioned. Author (ESA)

N80-27755# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
METEOROLOGICAL RESEARCH AND CLOUD PARAMETER DERIVATION FROM SATELLITE DATA **c47**
M. Desbois and G. Szejwach *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 169-172 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The current problems occurring in meteorological research from satellites, with emphasis on cloud parameter determination and imagery capabilities for synoptic and mesoscale studies, are reviewed. It is shown that much research is still needed given the data provided by the existing instrumentation. To effect some required improvements in the quality of information actually derived from satellite data, better accuracy and better time space resolution of the measurements are necessary. Author(ESA)

N80-27756# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
METHODS AND PROBLEMS IN SATELLITE TEMPERATURE PROFILES AND WINDS **c47**
B. Bizzari *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 173-182 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Analysis methods to determine vertical temperature profiles as well as wind parameters from satellite data are reviewed. Emphasis is on instrumentation shortcomings as revealed by theoretical considerations. Problems are ranked according to their limiting effect on analysis accuracy. Some methods containing loose assumptions relating to calculations are identified as being readily corrected by a more careful use of data. Other difficulties of a technical nature, such as cloud interference with readings, vertical resolution in sounding, or height attribution in winds, are seen as necessitating further developments in measurement technology. Author (ESA)

N80-27757# Centre National d'Etudes Spatiales, Paris (France). Paris Univ. (France).
A VIEW ON OUTSTANDING EXPERIMENTAL PROBLEMS IN SPACE OBSERVATION FOR METEOROLOGY AND CLIMATOLOGY **c47**
P. Morel *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 185-188 Prepared jointly with Paris Univ. (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

The application of meteorological satellite observation resources to climatology and related problems is discussed. Data needs include measurements on the radiation balance, the radiation effects of extended cloudiness, heat and moisture transport determinations, sea surface measurements, and ice processes observations. Emphasis is on possible European contributions to gathering this data. Author (ESA)

N80-27758*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A MICROWAVE PRESSURE SOUNDER FOR THE REMOTE MEASUREMENT OF ATMOSPHERIC SURFACE PRESSURE **c47**
D. A. Flower and G. E. Peckham *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 189-192 refs Sponsored jointly with UK Science Research Council Prepared jointly with Heriot-Watt Univ., Edinburgh (For primary document see N80-27733 18-42)
(Contract NAS7-100)
Avail: NTIS HC A10/MF A01 CSCL 04B

An instrument to measure atmospheric pressure at the Earth's surface from an orbiting satellite is considered. Surface pressure can be deduced from measurements of the transmission of an atmospheric column at several frequencies at the edges of the 60 GHz oxygen absorption band. An active microwave instrument proposed to make these measurements is the subject of a joint UK-US development program to demonstrate its capabilities. The results of an extensive analysis of the potential performance of the instrument are summarized. Author (ESA)

N80-27759# University Coll., London (England). Dept. of Physics and Astronomy.
GLOBAL WIND DETERMINATION BY INTERFEROMETRIC TECHNIQUES IN THE TROPOSPHERE, STRATOSPHERE AND MESOSPHERE **c47**
D. Rees *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 193-206 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Remote sensing of atmospheric winds from the middle troposphere to the thermosphere on a global basis by means of a single instrument mounted on a low altitude, polar orbiting spacecraft is discussed. Factors of the instrument design, such as aperture and thermal stability, and of the spacecraft performance, particularly attitude control and measurement, are shown to be the major constraints affecting the accuracy of wind profile reconstruction and the obtainable spatial resolution. Given the practical possibilities offered by prospective missions, such as the NASA Upper Atmosphere Research Satellite (UARS) Program and the ESA/NASA shuttle/Spacelab missions, a target accuracy of 3 m/sec combined with a horizontal resolution of 100 to 200 km can be achieved with an altitude resolution of 3 km (up to 20 km) or 5 km (up to 70 km). The rapidity with which global wind data can be reconstructed and made available for meteorological purposes is mainly dependent on the stability and absolute accuracy of the spacecraft attitude control system. Author (ESA)

N80-27760# Cambridge Univ. (England). Dept. of Applied Mathematical and Theoretical Physics.
OCEAN CIRCULATION **c48**
D. L. T. Anderson *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 209-215 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

Several different phenomena are discussed which have quite a large signature in sea surface elevation. Satellite altimetry is shown to have the potential for monitoring these phenomena and increasing knowledge of them. To date, only eddies have been mapped successfully by altimeters. Nonetheless, attempts should be made to try to measure other variables both at and below the ocean surface. Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-27761 Kansas Univ., Lawrence.
THE EVALUATION OF A METHODOLOGY TO MEASURE MANUAL DIGITIZING ERROR IN CARTOGRAPHIC DATA BASES Ph.D. Thesis
Charles Tim Traylor 1979 122 p
Avail: Univ. Microfilms Order No. 8014441

Four hypotheses were tested: (1) that digitizing error is a nonrandom phenomenon; (2) that individual subjects make systematic errors that are related to the direction of motion of

the hands and arms; (3) that similar directional errors occur across the entire subject population; and (4) that individual digitizing performance can be improved through a program of training using specially designed feedback. The procedure involved the arithmetic comparison of two digital files, one representing the X-Y coordinates of a test shape, and the other representing sample responses from subjects digitizing the shape. Fifteen subjects were tested to establish the general patterns of error, and one subject was tested to establish that this new information might be used in a training program to reduce the errors. The results indicated that direction of motion was a contributing factor to the overall error pattern of a digitizer operator, and that the error pattern can be modeled. Also, the digitizing error was found to be a nonrandom phenomenon. The training program indicated that knowledge of the error pattern could lead to decreased error. Dissert. Abstr.

N80-27762 Cornell Univ., Ithaca, N. Y.
THE BOUNDARY INTEGRAL EQUATION METHOD APPLIED TO FREE SURFACE FLOW PROBLEMS IN POROUS MEDIA Ph.D. Thesis
Gerard Patrick Lennon 1980 179 p
Avail: Univ. Microfilms Order No. 8015700

The boundary integral equation method (BIEM) is an efficient numerical method which can be employed to solve a wide variety of applied engineering problems because all computations are performed on the boundary of the region of interest rather than throughout the solution domain. The method is restricted to rather simple partial differential equations with a known Green's function. For transient problems, the BIEM can be used in conjuction with a time-stepping procedure to obtain solutions without iteration. For steady-state problems, part of the boundary data are applied on the steady-state free surface; however, because the location of the free surface is part of the problem, the problem cannot be solved unless the location of the free surface is know. The BIEM uses an efficient iteration scheme to locate the steady-state surface. Problems considered include the rise of water table resulting from the application of fluid recharge, steady-state axisymmetric flow towards a fully penetrating pumping well in an unconfined aquifer, and the steady-state flow from a pond towards a water table. Dissert. Abstr.

N80-27763 California Univ., Berkeley.
STATISTICAL INVESTIGATION OF THE PROPAGATION OF RANDOM AND NON-RANDOM ERRORS IN BLOCK AEROTRIANGULATION SYSTEMS Ph.D. Thesis
Clement Changyun Lee 1979 323 p
Avail: Univ. Microfilms Order No. 8014773

Three block aerotriangulation techniques including bundle adjustment, independent models, and polynomials were utilized. The computer programs for simulating various types of data blocks and for fully analytical block adjustments containing error propagation capability were developed and used with simulated data blocks. Results indicate that simulated photogrammetric data provide a very effective method for studying individual and compound error propagation in analytical aerotriangulation systems. The study shows that the propagated errors of exterior orientation parameters are not suitable for distinguishing random or nonrandom errors. On the basis of statistical tests, the bundle method provides more accurate results than adjustment with independent models or by polynomials. On the other hand, the bundle adjustment with addition parameters indicates that this procedure is a very effective technique for compensation of uncorrected nonrandom errors. However, the image coordinates refinement technique is still very useful, and should be applied. Dissert. Abstr.

N80-27764*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
LABEL IDENTIFICATION FROM STATISTICAL TABULATION (LIST)
T. B. Dennis, Principal Investigator Mar. 1980 18 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10132; NASA-CR-160584; SR-LO-00430; LEMSCO-14390; JSC-16345) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-27765*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
ON THE ACCURACY OF PIXEL RELAXATION LABELING
D. A. Landgrebe, Principal Investigator, J. A. Richards, and P. H. Swain Mar. 1980 34 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10185; NASA-CR-160691; SR-PO-00455; LARS-TR-030180) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27766*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DATA RESOLUTION VERSUS FORESTRY CLASSIFICATION
Edwin P. F. Kan and David L. Ball, Principal Investigators Dec. 1974 34 p refs Sponsored in part by USDA ERTS
(Contract NAS9-12200)
(E80-10189; NASA-CR-160610) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27767*# Environmental Research Inst. of Michigan, Ann Arbor.
ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Quarterly Progress Report, 16 Feb. - 15 May 1980
Robert Horvath, R. Cicone, E. Crist, R. Kauth, and W. Pont, Principal Investigators May 1980 142 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10191; NASA-CR-160692; ERIM-132400-40-P) Avail: NTIS HC A07/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27768*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
AS-BUILT SPECIFICATION FOR THE ERIM TAPE CONVERSION TO LARSYS 2 PROGRAM (ECTL2)
L. F. Robinson, Principal Investigator Dec. 1976 25 p ERTS
(Contract NAS9-12200)
(E80-10202; NASA-CR-160614; LEC-9857; JSC-11833) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27769*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
FINAL DESIGN SPECIFICATION FOR LARSYS/ISOCLS MODIFICATION FOR LACIE PHASE 3
B. F. Wills, Principal Investigator Feb. 1977 70 p ERTS
(Contract NAS9-12200)
(E80-10212; NASA-CR-160612; LEC-10161; JSC-12542) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27770*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
TRANSFER OF INTERACTIVE REPORT EXTRACTED DATA (TIRED) REQUIREMENTS SPECIFICATION
Kenneth L. Pattison, Principal Investigator Jun. 1976 10 p ERTS
(Contract NAS9-12200)
(E80-10219; NASA-CR-160615; LEC-8841; JSC-11365) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27771*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

TRANSFER OF INTERACTIVE REPORT EXTRACTED DATA (TIRED) REQUIREMENTS SPECIFICATION
Kenneth L. Pattison, Principal Investigator Jun. 1976 10 p ERTS
(Contract NAS9-12200)
(E80-10221; NASA-CR-160611; LEC-8841-Rev-A; JSC-11365-Rev-A) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27772*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
PDP 11/45 LACIE PHASE 11/111 AUTOMATIC STATUS AND TRACKING SYSTEM FUNCTIONAL DESIGN SPECIFICATION
J. M. Everette and D. L. Smith, Principal Investigators Nov. 1976 53 p ERTS
(Contract NAS9-12200)
(E80-10222; NASA-CR-160613; LEC-9861; JSC-11835) Avail: NTIS HC A04/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-27773*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
A NOTE ON THE GENERATION OF POISSON-DISTRIBUTED RANDOM NUMBERS WITH LARGE MEAN
George R. Terrell, Principal Investigator Apr. 1980 11 p refs ERTS
(Contract NAS9-15800)
(E80-10224; NASA-CR-160656) Avail: NTIS HC A02/MF A01 CSCL 12A

There are no author-identified significant results in this report.

N80-27774*# Lockheed Electronics Co., Houston, Tex.
SCREWWORM ERADICATION DATA SYSTEM, PHASE 2 PROJECT PLAN: FIELD TESTS
Aug. 1975 15 p ERTS
(Contract NAS9-12200)
(E80-10225; NASA-CR-160616; LEC-6473; JSC-09825) Avail: NTIS HC A02/MF A01 CSCL 08C

There are no author-identified significant results in this report.

N80-27775*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 3: AS-BUILT DOCUMENTATION (SECTIONS 1-12)
M. L. Burnell and P. J. Aucoin, Principal Investigators Apr. 1980 349 p ERTS
(Contract NAS9-15800)
(E80-10226; NASA-CR-160658; LEMSCO-12565-Rev-A; JSC-13821-Rev-A) Avail: NTIS HC A15/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27776*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 3: AS-BUILT DOCUMENTATION (SECTIONS 13-23)
M. L. Burnell and P. J. Aucoin, Principal Investigators Apr. 1980 442 p ERTS
(Contract NAS9-15800)
(E80-10227; NASA-CR-160659; LEMSCO-12565-Rev-A; JSC-13821-Rev-A) Avail: NTIS HC A19/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-27777*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF RADIATIVE TRANSFER MODELS FOR PREDICTING THE MICROWAVE EMISSION FROM SOILS
T. J. Schmugge (Computer Sciences Corp., Silver Spring, Md.) and B. J. Choudhury May 1980 32 p refs Submitted for publication
(NASA-TM-80688; G-F4504) Avail: NTIS HC A03/MF A01 CSCL 08M

Two general types of numerical models for predicting microwave emission from soils are compared-coherent and noncoherent. In the former, radiation in the soil is treated coherently, and the boundary conditions on the electric fields across the layer boundaries are used to calculate the radiation intensity. In the latter, the radiation is assumed to be noncoherent, and the intensities of the radiation are considered directly. The results of the two approaches may be different because of the effects of interference, which can cause the transmitted intensity at the surface (i.e., emissivity) to be sometimes higher and sometimes lower for the coherent case than for the noncoherent case, depending on the relative phases of reflected fields from the lower layers. This coupling between soil layers in the coherent models leads to greater soil moisture sampling depths observed with this type of model, and is the major difference that is found between the two types of models. In noncoherent models, the emissivity is determined by the dielectric constraint at the air/soil interface. The subsequent differences in the results are functions of both the frequency of the radiation being considered and the steepness of the moisture gradient near the surface. The calculations were performed at frequencies of 1.4 and 19.4 GHz and for two sets of soil profiles. Little difference was observed between the models at 19.4 GHz; and only at the lower frequency were differences apparent because of the greater soil moisture sampling depth at this frequency. Author

N80-27778*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGSAT SCIENTIFIC INVESTIGATIONS
Robert A. Langel May 1980 42 p refs Submitted for publication
(NASA-TM-80698) Avail: NTIS HC A03/MF A01 CSCL 08G

The Magsat spacecraft is providing the first global, vector magnetic survey. Investigations using the Magsat data are being carried out by scientists at NASA's Goddard Space Flight Center, at the U.S. Geological Survey of the Department of the Interior and by 32 selected investigators. Nineteen of the investigators are from the United States and 13 are from various foreign nations. The investigations described fall into four categories: (1) geomagnetic field modeling; (2) crustal magnetic anomaly studies; (3) investigations of the inner Earth: the core, mantle and core-mantle interface; and (4) studies of external current systems. Author

N80-27779*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SNOWPACK MONITORING IN NORTH AMERICA AND EURASIA USING PASSIVE MICROWAVE SATELLITE DATA
J. L. Foster, A. Rango, and D. K. Hall [1980] 23 p refs Submitted for publication
(NASA-TM-80706) Avail: NTIS HC A02/MF A01 CSCL 08L

Areas of the Canadian high plains, the Montana and North Dakota high plains, and the steppes of central Russia were studied in an effort to determine the utility of spaceborne electrical scanning microwave radiometers (ESMR) for monitoring snow depths in different geographic areas. Significant regression relationships between snow depth and microwave brightness temperatures were developed for each of these homogeneous areas. In the areas investigated, Nimbus 6 (.081 cm) ESMR data produced higher correlations than Nimbus 5 (1.55 cm) ESMR data in relating microwave brightness temperature and snow depth from one area to another because different geographic areas are likely to have different snowpack conditions. L.F.M.

N80-27780*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REMOTE SENSING OF SOIL MOISTURE CONTENT OVER BARE FIELDS AT 1.4 GHz FREQUENCY

J. R. Wang and B. J. Choudhury (Computer Sciences Corp., Silver Spring, Md.) Jun. 1980 26 p refs Submitted for publication

(NASA-TM-80711) Avail: NTIS HC A03/MF A01 CSCL 08M

A simple method of estimating moisture content (W) of a bare soil from the observed brightness temperature (T sub B) at 1.4 GHz is discussed. The method is based on a radiative transfer model calculation, which has been successfully used in the past to account for many observational results, with some modifications to take into account the effect of surface roughness. Besides the measured T sub B's, the three additional inputs required by the method are the effective soil thermodynamic temperature, the precise relation between W and the smooth field brightness temperature T sub B and a parameter specifying the surface roughness characteristics. The soil effective temperature can be readily measured and the procedures of estimating surface roughness parameter and obtaining the relation between W and smooth field brightness temperature are discussed in detail. Dual polarized radiometric measurements at an off-nadir incident angle are sufficient to estimate both surface roughness parameter and W, provided that the relation between W and smooth field brightness temperature at the same angle is known. The method of W estimate is demonstrated with two sets of experimental data, one from a controlled field experiment by a mobile tower and the other, from aircraft overflight. The results from both data sets are encouraging when the estimated W's are compared with the acquired ground truth of W's in the top 2 cm layer. An offset between the estimated and the measured W's exists in the results of the analyses, but that can be accounted for by the presently poor knowledge of the relationship between W and smooth field brightness temperature for various types of soils. An approach to quantify this relationship for different soils and thus improve the method of W estimate is suggested.

L.F.M.

N80-27781*# National Aeronautics and Space Administration, Washington, D. C

THE HIGH VISIBLE RESOLUTION (HVR) INSTRUMENT OF THE SPOT GROUND OBSERVATION SATELLITE

G. Otrio Apr. 1980 22 p Transl. into ENGLISH of conf. paper "L'Instrument a Haute Resolution Visible (HRV) du Satellite d'Observation de la Terre: Spot", Rept. IAF-79-F-239 Intern. Astronautical Federation, Munich, Sep. 1979 p 1-13 Presented at 30th Intern. Astronautical Federation, Munich, Sep. 1979 Original language document was announced as A79-53369 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Natl. Space Studies Center, Toulouse

(Contract NASw-3199)

(NASA-TM-75830: IAF-79-F-239) Avail: NTIS HC A02/MF A01 CSCL 20F

Two identical high resolution cameras, capable of attaining a track width of 116 km in an almost vertical line of sight from the two 60 km images of each instrument, will be carried on the initial mission of the space observation of Earth satellite (SPOT). Specifications for the instrument, including the telescope and CCD devices are summarized. The present status of development is described including the optical characteristics, structure and thermal control, detector assembly, elctronic equipment, and calibration. SPOT mission objectives include the developments relating to soil use, the exploration of EART Earth resources, the discrimination of plant species, and cartography.

A.R.H.

N80-27782*# National Aeronautics and Space Administration, Wallops Flight Center, Wallops Island, Va.

AIRBORNE LASER TOPOGRAPHIC MAPPING RESULTS FROM INITIAL JOINT NASA/US ARMY CORPS OF ENGINEERS EXPERIMENT

W. B. Krabill, J. G. Collins (Army Corps of Engineers, Vicksburg, Miss.), R. N. Swift (EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.), and M. L. Butler (EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.) Jun. 1980 36 p

(NASA-TM-73287) Avail: NTIS HC A03/MF A01 CSCL 08B

Initial results from a series of joint NASA/US Army Corps of Engineers experiments are presented. The NASA Airborne Oceanographic Lidar (AOL) was exercised over various terrain conditions, collecting both profile and scan data from which river basin cross sections are extracted. Comparisons of the laser data with both photogrammetry and ground surveys are made, with 12 to 27 cm agreement observed over open ground. Foliage penetration tests, utilizing the unique time-waveform sampling capability of the AOL, indicate 50 cm agreement with photogrammetry (known to have difficulty in foliage covered terrain).

Author

N80-27783# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Geopositional Dept.

ANALYTICAL PLOTTERS IN DEFENSE MAPPING AGENCY

David H. Alspaugh Apr. 1980 13 p refs

(AD-A083794) Avail: NTIS HC A02/MF A01 CSCL 08/2

Computer assisted stereoplotters and comparators have been in development and in use by DMA for many years. Use of this type of equipment has reached a reasonable state of maturity in the support of the DMA production programs. Application of this type of equipment in DMA exemplify its potential to aerial triangulation and compilation of relief and planimetry. Several of these applications are reviewed so as to emphasize the range of tasks that can be performed on computer assisted equipment given the proper software engineering.

GRA

N80-27784# Ohio Agricultural Research and Development Center, Wooster.

RESEARCH ON THE HYDROLOGY AND WATER QUALITY OF WATERSHEDS SUBJECTED TO SURFACE MINING. PHASE 1: PREMINING HYDROLOGIC AND WATER QUALITY CONDITIONS Summary Report, 22 Jan. 1976 - 22 Jan. 1978

Gary E. McIntosh and W. R. Harmon 22 Dec. 1979 35 p Prepared in cooperation with Science and Education Administration, Coshocton, Ohio

(Contracts DI-BM-J0-166054; DI-BM-J0-166055)

(PB80-159510: BM-OFR-31-80) Avail: NTIS HC A03/MF A01 CSCL 08H

Five watersheds, ranging in size from 29 to 52 acres, were selected in east-central Ohio for the purpose of investigating the hydrologic and water quality conditions occuring before, during, and after surface mining. The average concentrations of the water quality parameters for all watersheds were as low or lower than the Environmental Protection Agency recommended maximum allowable concentrations in drinking water except for suspended solids. Before mining the average concentration of suspended solids in storm runoff ranged from 118 to 1,100 micrograms/1, and for base flow the range was from 44 to 247 micrograms/1; the higher concentrations were associated with the watersheds exhibiting the greatest premining disturbance. Iron ranged from an average of less than 3 to 228 micrograms/1. Manganese ranged from less than 41 to 334 micrograms/1. Premining ground water systems for each watershed had two major perched aquifers within the top 205 ft.

GRA

N80-27785# Bendix Field Engineering Corp., Grand Junction, Colo.

DEVELOPMENT OF DATA ENHANCEMENT AND DISPLAY TECHNIQUES FOR STREAM-SEDIMENT DATA COLLECTED IN THE NATIONAL URANIUM RESOURCE EVALUATION PROGRAM OF THE UNITED STATES DEPARTMENT OF ENERGY

G. S. Koch, Jr. (Georgia Univ., Athens), R. J. Howarth (Imperial Coll., London), R. H. Carpenter (Georgia Univ., Athens), and J. H. Schvenemeyer (Delaware Univ.) Athens, Ga. Georgia Univ. Aug. 1979 236 p refs

(Contract EY-76-C-13-1664)

(GJBX-28(80)) Avail: NTIS HC A11/MF A01

Statistical, mapping, and geological techniques were combined in order to evaluate and appropriately display geochemical data for the identification of uranium associated halos utilizing the NURE hydrogeochemical and stream sediment reconnaissance data base. A set of computer-based procedures implemented in a time-sharing interactive mode on a Control Data Corporation Cyber 70 and 174 computer was developed. Techniques of data analysis are developed. Results of the data analysis for the

Southeastern area, Seguin quadrangle, and Pueblo quadrangle are presented. Conclusions are drawn and recommendations are stated. DOE

N80-27786# Massachusetts Univ., Amherst. Water Resources Research Center.
THE DEVELOPMENT OF PALIS: A PONDS AND LAKES INFORMATION SYSTEM FOR MASSACHUSETTS
Paul J. Godfrey, Spencer A. Joyner, Jr., Edward L. Goldstein, and Linda Ross Dec. 1979 254 p
(Contract DI-14-34-0001-9023)
(PB80-156979; Pub-108; W80-03902; OWRT-A-124-MASS(1)) Avail: NTIS HC A12/MF A01 CSCL 08H

A state-of-the-art information system for managing ponds and lakes resources at the state level was accomplished for Massachusetts by (1) assessing the quality and quantity of existing ponds and lakes information, (2) surveying the state of the art of computerized management information systems including water resources information systems, (3) evaluating the implications for state agencies of computerizing in a single system all the ponds and lakes information they already possess and (4) designing a management information system for Massachusetts ponds and lakes information. This design included the creation of a complex data base structure which was suited to existing computer software packages, and the development of a functioning pilot demonstration system based on state agency for 20 lakes and ponds. GRA

N80-27787# Texas Dept. of Water Resources, Austin.
GROUND-WATER RESOURCES AND MODEL APPLICATIONS FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER IN THE SAN ANTONIO REGION, TEXAS
Glenward R. Elder, William B. Klemt, Tommy R. Knowles, and Thomas W. Sieh Oct. 1979 96 p refs
(PB80-157332; TDWR/R-239) Avail: NTIS HC A05/MF A01 CSCL 08H

The occurrence, availability, and dependability of the Edwards Aquifer in the Nueces, San Antonio, Guadalupe-Blanco River basins was determined in order to develop a ground water resources management tool for use in a total water-resource management program for the three river basins. The quantitative aspects of ground-water withdrawals, spring flows, and aquifer characteristics were of particular interest. Test wells were drilled: (1) to describe the lithology of the stratigraphic units which make up the Edwards (Balcones Fault Zone) aquifer; (2) to determine the upper and lower hydrologic boundaries; (3) to determine the average total porosity for various aquifer levels; and (4) to determine the average effective porosity (specific yield) and the approximate artesian storage values for the aquifer through core analysis. GRA

N80-27788# Arizona Univ., Tucson. Dept. of Geosciences.
GEOPHYSICAL AND HYDROLOGIC PREDICTION OF FISSURING AND LAND SUBSIDENCE, SOUTH-CENTRAL ARIZONA
J. S. Sumner and F. J. Christie Mar. 1980 9 p refs
(Contracts DI-14-34-0001-7005; DI-14-34-0001-7006)
(PB80-159908; W80-04013; OWRT-A-073-ARIZ(3)) Avail: NTIS HC A02/MF A01 CSCL 08G

The gravity exploration method was employed to survey the Picacho basin area in south-central Arizona where numerous fissures are located and where the land has subsided in excess of 12.5 feet (3.96 m) since 1952. A differential subsidence concept would predict that vertical offset fissures would most likely occur over basement irregularities. Therefore, the gravity data were interpreted in terms of the probable variation in thickness of alluvium overlying the more dense bedrock. Modeling of the bedrock surface under the basin area reveals a strong correlation between gravity gradients and earth fissures. It can be concluded that most vertical offset earth fissures are related bedrock irregularities, and that the gravity method holds promise in predicting the probable occurrence of these features. GRA

N80-27789# Woodard-Clyde Consultants, San Francisco, Calif.
DEWATERING SYSTEMS FOR SURFACE COAL MINES Final Report, Sep. 1977 - Dec. 1979
J. E. ORourke and K. OConnor 21 Dec. 1979 260 p refs
(Contract DI-BM-JO-275025)
(PB80-160153; BM-OFR-32-80) Avail: NTIS HC A12/MF A01 CSCL 08I

Available dewatering technology is assessed and its relevance to surface coal mines in the interior province of the United States is evaluated. Guidelines for the selection, design, and construction of dewatering systems are included. On the basis of documented experience, candidate dewatering systems were selected and evaluated with respect to their anticipated impact on the environment and mine operations. Laws and regulations that can impact on dewatering operations are summarized. Geologic and hydrogeologic conditions within the interior province are described and potential dewatering problems at surface coal mines are identified. Model mines are developed that exhibit the most difficult dewatering problems identified, and it is demonstrated how available technology can be utilized to deal with them. GRA

N80-27790# Texas A&M Univ., College Station. Coll. of Geosciences.
SONAR PROBING AS A MINING AND TUNNELING TOOL Progress Report, 21 Dec. 1978 - 30 Sep. 1979
Robert R. Unterberger 30 Sep. 1979 95 p refs
(Grant NSF APR-76-21764)
(PB80-159239; NSF/RA-790255) Avail: NTIS HC A05/MF A01 CSCL 08I

To avoid multiple signals which are difficult to interpret, a narrow beam is produced in rock salt to determine the azimuth and elevation of the various targets seen in time. A high frequency transducer is driven to two frequencies that causes the salt itself to go nonlinear and generate the difference frequency which is comparable to that of the high frequency beam. It is believed that this breakthrough could drastically improve the ability of the sonar probing system to discriminate reflected signals in salt in azimuth and elevation. Unsuccessful experiments on attenuation measurements of sound in salt are described, as well as successful tests, to improve the signal to noise ratio of the signals reflected from discontinuities in the salt. Measurements on the amount of noise in salt as a function of frequency are briefly discussed. GRA

N80-27791# Great Lakes Basin Commission, Ann Arbor, Mich.
FUTURE US PHOSPHORUS LOADINGS TO THE GREAT LAKES: AN INTEGRATION OF WATER QUALITY MANAGEMENT PLANNING INFORMATION Final Report
Thomas M. Heidtke, Timothy J. Monteith, Rose Ann Sullivan, Douglas J. Scheflow, and William E. Skimin Oct. 1979 75 p refs Sponsored in part by Water Resources Council
(PB80-160336; GLBC/GLEPS-11) Avail: NTIS HC A04/MF A01 CSCL 08H

Information derived from individual water quality management plans was aggregated to generate projections of U.S. total phosphorus loads to the Great Lakes. Computer simulation techniques were then used to evaluate and compare the cost-effectiveness of alternatives for controlling phosphorus inputs from municipal point sources and land drainage. The results reveal that reduction of municipal wastewater effluent concentrations to meet a 1 mg/l total phosphorus limitation represents the most critical step in controlling future loadings, in terms of both cost-effectiveness and net reduction in annual input to the Great Lakes. Implementation of this control measure will result in almost a 60 percent reduction in the U.S. municipal input between the mid 1970's and the year 1990. Although population growth will result in a gradual increase in the load between the years 1990 and 2000, the municipal input will remain well below mid-1970 levels. GRA

N80-27792# Water Resources Council, Washington, D.C.
OPTIONS TO IMPROVE FEDERAL NONSTRUCTURAL RESPONSE TO FLOODS
Rutherford H. Platt (Massachusetts Univ., Amherst) 1 Dec. 1979 141 p refs Sponsored in part by President's Committee on Water Policy
(PB80-160146) Avail: NTIS HC A07/MF A01 CSCL 08H

Federal response to floods at present is fragmented by agency, by objective, by authority, and by mode of cost sharing. Various programs rehabilitate private victims through grants, loans, and tax subsidies. Other programs address community restoration

through the restoration of structures, debris clearance, repair of flood controls, and emergency livestock feeding. Methods for reducing the suscestibilities of properties and lives to future losses are discussed with emphasis on cooperation with local governments and agencies. Topics covered include flood plain regulation, land acquisition, flood proofing, and flood insurance. A.R.H.

N80-27793# Water Resources Council, Washington, D.C.
IMPROVED FORMULATION AND EVALUATION OF NONSTRUCTURAL ELEMENTS FOR WATER RESOURCES PLANS IN FLOOD HAZARD AREAS
Leonard A. Shabman (Virginia Polytechnic Inst. and State Univ., Blacksburg) Oct. 1979 34 p ref
(PB80-160120) Avail: NTIS HC A03/MF A01 CSCL 08H

Planning concepts and procedures are considered, especially multiple purpose planning. Three standards are suggested: (1) full and equal consideration of the multiple means of resource management for water and related land resources; (2) recognize that several available means for resource management can be developed to serve multiple purposes; and (3) evaluate the contributions of serving multiple purposes to multiple social objectives by application of conceptually sound evaluation methodologies. GRA

N80-27794# National Oceanic and Atmospheric Administration, Boulder, Colo. World Data Center A for Glaciology.
INVENTORY OF SNOW COVER AND SEA ICE DATA
R. G. Crane, comp. Dec. 1979 166 p
(PB80-164007; GD-7; NOAA-80022901) Avail: NTIS HC A08/MF A01 CSCL 08L

Snow cover and sea ice data were surveyed with emphasis on map series or data sets which characterize these two cryospheric parameters on a regional to global scale. Such information is of broad relevance to problems of global climate, hydrology, and environmental monitoring, as well as for operational and planning purposes in conjunction with engineering projects, transportation, agriculture, and energy assessments. The present inventory is primarily concerned with sets of large-scale snow cover data. A summary of data available from the State Snow Surveys and from a few of the regional-scale operational and experimental snow cover data sets is included. Some national data sets from non-U.S. sources are also described. The inventory of sea ice data sources focuses on mapped information relating to the seasonal cycle. GRA

N80-27795# NEUS, Inc., Santa Monica, Calif.
BIOSOURCES DIGEST, A JOURNAL ON BIOMASS UTILIZATION, VOLUME 1, NO. 2
Harry Sobel, ed. Apr. 1979 73 p refs
(Grant NSF PFR-77-12500)
(PB80-157662; NSF/RA-790175) Avail: NTIS HC A04/MF A01 CSCL 10A

The management and uses of marine resources are considered including current and potential developments in ocean farming which utilize the giant kelp (Macrocystis pyrifera). This rapidly growing species may be converted anaerobically into substitute natural gas and additionally produce enormous quantities of minerals, fertilizers, and livestock and human feed. It also enhances local fish crops. Preliminary cost estimates show this process of gas production to be competitive with alternate gas supply sources. Some of the technical and economic factors of ocean farming are discussed as well as methods for obtaining chemicals from a northern kelp. Books and papers received, grants awarded by NSF, DOE, and USDA, pertinent patents, NTIS publications, research announcements, and future meetings are listed. GRA

N80-27748# Institute of Oceanographic Sciences, Wormley (England).
SATELLITE ALTIMETRY MEASUREMENTS OF THE SEA SURFACE
T. D. Allan *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 113-120 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-28293# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE KLOPPENHEIM SATELLITE OBSERVATION STATION: DETERMINATION OF LONGITUDE, LATITUDE, AND ASTRONOMICAL AZIMUTH WITH THE PASSAGE INSTRUMENT Ap 70 [SATELLITENBEOBACHTUNGSSTATION KLOPPENHEIM BESTIMMUNG VON LAENGE, BREITE UND AZIMUTH MIT DEM PASSAGEINSTRUMENT Ap 70]
Hansdieter Grosse *In its* Activities of the Kloppenheim Satellite Obs. Station 1979 p 5-19 refs In GERMAN; ENGLISH summary (For primary document see N80-28292 18-99)
Avail: NTIS HC A04/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-27796 State Univ. of New York at Buffalo.
CURRENT CONDUCTION MECHANISM AND DESIGN OPTIMIZATION STUDY OF MIS SOLAR CELLS Ph.D. Thesis
Kamal Rajkanan 1980 384 p
Avail: Univ. Microfilms Order No. 8016237

The current conduction mechanism studies are related to the design optimization problems in MIS solar cells. Specifically, a SiO-Cu-Cr-SiO2-(p)Si-Al structure on both single and polycrystalline silicon was used. The current conduction mechanisms in these MIS solar cells were determined by studying the dark and solar characteristics over a wide range of temperature. It was shown that the current can be either diffusion limited, tunnel limited or space charge limited, depending on the design and the surface conditions. Band to band tunneling and the tunneling via surface states were identified. Based on experimentally determined current conduction mechanisms, a simulation model was developed which considers the total design of the real world MIS solar cell. The simulated results are shown to agree with the experimental data on the actual devices. The simulation model was used to determine the loss mechanisms in these solar cells. The sensitivity of device performance with different design variables was determined, thus establishing overall design guidelines for fabricating high efficiency MIS solar cells. Dissert. Abstr.

N80-27797 California Univ., Berkeley.
CHEMICAL, STRUCTURAL AND OPTICAL CHARACTERIZATION OF A BLACK CHROME SOLAR SELECTIVE ABSORBER Ph.D. Thesis
Carl Matthew Lampert 1979 170 p
Avail: Univ. Microfilms Order No. 8014770

The very popular black chrome coating, Harshaw Chemical's 'Chromonyx' was analyzed in terms of materials science to determine the nature of its microstructure and the relationship to wavelength selectivity. This coating serves as an efficient solar thermal conversion coating for both concentrating and flat plate solar collectors. Principally, energy dispersive X-ray analysis as well as scanning and transmission electron microscopy were employed for thin film analysis. A wide range of experiments were performed to correlate both the as-plated and annealed microstructure to reflectance measurements. Along with supplemental information on Auger and XPS depth profiling from other investigators, it was possible to develop a physical metallurgical model for the wavelength selectivity properties of this coating. Microstructural analysis was performed on 1 - 100 hour annealed specimens over the temperature range of 300-600 C, in atmospheres of air and medium vacuum. Black chrome solar selectivity degrades by the nucleation and growth of Cr2O3 particles. These particles alter the absorptive properties of the coating by depleting and redistributing metallic chromium. The coating also emanates CO and CO2 which may break up the coating, enhancing oxidation. At high temperatures above

500 C this coating appears densified and totally oxidized. It is suggested that this black chrome degrades by a simple diffusion controlled oxidation mechanism. Dissert. Abstr.

N80-27798 California Univ., Berkeley.
PHOTOVOLTAIC PROPERTIES OF METAL-MEROCYANINE-TiO2 SANDWICH CELLS Ph.D. Thesis
Terje Asbjorn Skotheim 1979 147 p
Avail: Univ. Microfilms Order No. 8014882

Photocurrent generation in thin films of merocyanine photosensitizing dyes sandwiched between an n-type semiconductor and a metal overlayer was studied using photovoltaic techniques. In the system analyzed in detail TiO2 single crystal, doped n-type, was used as the semiconductor and a semitransparent Au film as a metal overlayer. A comprehensive theoretical model was developed to explain the observed photovoltaic properties. The model assumes that the principal route for the formation of charge carriers is via singlet excitons diffusing to the merocyanine TiO2 interface followed by dissociation of the excitons into electron-hole pairs, the electrons being injected into the TiO2 conduction band and the holes into the merocyanine. The model also incorporates field dependence of the quantum efficiency for charge generation and is strongly supported by a variety of steady state and kinetic measurements. An exciton diffusion length of 79 angstroms was determined by analyzing the short circuit action spectra using the theoretical model developed. Dissert. Abstr.

N80-27799*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENGINEERING TEST FACILITY DESIGN DEFINITION
R. W. Bercaw and G. R. Seikel 20 Jun. 1980 16 p refs
Presented at 7th Intern. Conf. on Magnetohydrodynamic Elect. Power Generation, Cambridge, Mass., 16-20 Jun. 1980; sponsored by Symp. on the Eng. Aspects of Magnetohydrodynamics, Inc.
(Contract EF-77-A-01-2674)
(NASA-TM-81499; DOE/NASA/2674-11; E-436) Avail: NTIS HC A02/MF A01 CSCL 10A

The Engineering Test Facility (ETF) is the major focus of the Department of Energy (DOE) Magnetohydrodynamics (MHD) Program to facilitie commercialization and to demonstrate the commercial operability of MHD/steam electric power. The ETF will be a fully integrated commercial prototype MHD power plant with a nominal output of 200 MW sub e. Performance of this plant is expected to meet or surpass existing utility standards for fuel, maintenance, and operating costs; plant availability; load following; safety; and durability. It is expected to meet all applicable environmental regulations. The current design concept conforming to the general definition, the basis for its selection, and the process which will be followed in further defining and updating the conceptual design. Author

N80-27800*# Lutz-Sotire Partnership, Stamford, Conn.
SOLAR HEATING SYSTEM INSTALLED AT STAMFORD, CONNECTICUT Final Report
Sep. 1979 83 p Sponsored in part by DOE
(Contract EX-76-C-01-2377)
(NASA-CR-161436) Avail: NTIS HC A05/MF A01 CSCL 10A

The solar heating system installed at the Lutz-Sotire Partnership Executive East Office Building, Stamford, Connecticut is described. The Executive East Office Building is of moderate size with 25,000 sq ft of heated space in 2 1/2 stories. The solar system was designed to provide approximately 50 percent of the heating requirements. The system components are described. Appended data includes: the system design acceptance test, the operation and maintenance manual, and as-built drawings and photographs. R.E.S.

N80-27801*# General Electric Co., Wilmington, Mass. Aircraft Equipment Div.
SOLID POLYMER ELECTROLYTE FUEL CELL TECHNOLOGY PROGRAM Final Report
31 May 1980 53 p refs
(Contract NAS9-15286)
(NASA-CR-160734; TPR-77) Avail: NTIS HC A04/MF A01 CSCL 10A

Work is reported on phase 5 of the Solid Polymer Electrolyte (SPE) Fuel Cell Technology Development program. The SPE fuel cell life and performance was established at temperatures, pressures, and current densities significantly higher than those previously demonstrated in sub-scale hardware. Operation of single-cell Buildup No. 1 to establish life capabilities of the full-scale hardware was continued. A multi-cell full-scale unit (Buildup No. 2) was designed, fabricated, and test evaluated laying the groundwork for the construction of a reactor stack. A reactor stack was then designed, fabricated, and successfully test-evaluated to demonstrate the readiness of SPE fuel cell technology for future space applications. R.E.S.

N80-27802*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR CONTEMPORARY-MANCHESTER, MANCHESTER, NEW HAMPSHIRE Progress Report, Mar. 1979 - Feb. 1980
30 Jul. 1980 80 p Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161471) Avail: NTIS HC A05/MF A01 CSCL 10A

The operational and thermal performance of the solar energy system, Contemporary-Manchester, is described. The system was designed by Contemporary Systems Incorporated to provide space heating and domestic hot water preheating for a three story dwelling located on the New Hampshire Vocational Technical College campus, Manchester, New Hampshire. The net fossil energy savings for the period from March, 1979 to February, 1980 was 14.52 million Btu. However, the performance of the system must be degraded due to the fact that the building was unoccupied throughout the data assessment and analysis period. The unoccupied status prevented the normal adjustment of heating and ventilating controls for maintenance of comfort levels within the building. This lack of occupancy also prevented the typical family hot water usage, which would have allowed for more realistic evaluation of the hot water subsystem. R.E.S.

N80-27803*# Wichita State Univ., Kans.
FEASIBILITY STUDY OF AILERON AND SPOILER CONTROL SYSTEMS FOR LARGE HORIZONTAL AXIS WIND TURBINES Final Report
W. H. Wentz, Jr., M. H. Snyder, and J. T. Calhoun May 1980 69 p refs
(Grant NsG-3277; Contract EX-76-I-01-1028)
(NASA-CR-159856; DOE/NASA/3277-1; WER-10) Avail: NTIS HC A04/MF A01 CSCL 10A

The feasibility of using aileron or spoiler controls as alternates to pitch control for large horizontal axis wind turbines was studied. The NASA Mod-0 100 kw machine was used as the basis for the study. Specific performance studies were conducted for 20% chord ailerons over the outboard 30% span, and for 10% chord spoilers over the same portion of the span. Both control systems utilized control deflections up to 60 deg. Results of the study show that either ailerons or spoilers can provide the control necessary to limit turbine power in high wind conditions. The aileron system, as designed, provides overspeed protection at hurricane wind speeds, low wind speed starting torque of 778 N-m (574 ft. lb) at 3.6 m/sec, and a 1.3 to 1.5% increase in annual energy compared to a fixed pitch rotor. The aileron control system preliminary design study includes aileron loads analysis and the design of a failsafe flyweight actuator for overspeed protection in the event of a hydraulic system failure. L.F.M.

N80-27804*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT ON COMBINED CYCLE EFFICIENCY OF STACK GAS TEMPERATURE CONSTRAINTS TO AVOID ACID CORROSION Final Report
Joseph J. Nainiger Jul. 1980 16 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-81531; DOE/NASA/2593-17; E-483) Avail: NTIS HC A02/MF A01 CSCL 10B

To avoid condensation of sulfuric acid in the gas turbine exhaust when burning fuel oils containing sulfur, the exhaust stack temperature and cold-end heat exchanger surfaces must be kept above the condensation temperature. Raising the exhaust

stack temperature, however, results in lower combined cycle efficiency compared to that achievable by a combined cycle burning a sulfur-free fuel. The maximum difference in efficiency between the use of sulfur-free and fuels containing 0.8 percent sulfur is found to be less than one percentage point. The effect of using a ceramic thermal barrier coating (TBC) and a fuel containing sulfur is also evaluated. The combined-cycle efficiency gain using a TBC with a fuel containing sulfur compared to a sulfur-free fuel without TBC is 0.6 to 1.0 percentage points with air-cooled gas turbines and 1.6 to 1.8 percentage points with water-cooled gas turbines. Author

N80-27805*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPACT OF PROPULSION SYSTEM R AND D ON ELECTRIC VEHICLE PERFORMANCE AND COST
Harvey J. Schwartz and Andrew L. Gordan 22 May 1980 16 p refs Presented at 3d Intern. Electric Vehicle Exposition and Conf., St. Louis, 20-22 May 1980
(Contract EC-77-A-31-1044)
(NASA-TM-81548; DOE/NASA/1044-9; E-504) Avail: NTIS HC A02/MF A01 CSCL 10B

The efficiency, weight, and manufacturing cost of the propulsion subsystem (motor, motor controller, transmission, and differential, but excluding the battery) are major factors in the purchase price and cost of ownership of a traffic-compatible electric vehicle. The relative impact of each was studied, and the conclusions reached are that propulsion system technology advances can result in a major reduction of the sticker price of an electric vehicle and a smaller, but significant, reduction in overall cost of ownership. L.F.M.

N80-27806*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION-SEASONAL REPORT FOR ELCAM SAN DIEGO, SAN DIEGO, CALIFORNIA Progress Report, Mar. - Sep. 1979
May 1980 71 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161481) Avail: NTIS HC A04/MF A01 CSCL 10A

The solar energy system, Elcam San Diego, was designed to supply domestic hot water heating for a single family residence located in Encinitas, California. System description, performance assessment, operating energy, energy savings, maintenance, and conclusions are presented. The system is a 'Sunspot' two tank cascade type, where solar energy is supplied to either a 66 gallon preheat tank (solar storage) or a 40 gallon domestic hot water tank. Water is pumped directly from one of the two tanks, through the 65 square feet collector array and back into the same tank. Freeze protection is provided by automatically circulating hot water from the hot water tank through the collectors and exposed plumbing when freezing conditions exist. Auxiliary energy is supplied by natural gas. Analysis is based on instrumented system data monitored and collected for one full season of operation. L.F.M.

N80-27807*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ASHMET: A COMPUTER CODE FOR ESTIMATING INSOLATION INCIDENT ON TILTED SURFACES
Robert F. Elkin and Ronald G. Toelle May 1980 44 p refs Sponsored in part by DOE
(NASA-TM-78286) Avail: NTIS HC A03/MF A01 CSCL 10A

A computer code, ASHMET, was developed by MSFC to estimate the amount of solar insolation incident on the surfaces of solar collectors. Both tracking and fixed-position collectors were included. Climatological data for 248 U. S. locations are built into the code. The basic methodology used by ASHMET is the ASHRAE clear-day insolation relationships modified by a clearness index derived from SOLMET-measured solar radiation data to a horizontal surface. L.F.M.

N80-27808*# Spectrolab, Inc., Sylmar, Calif.
SCREEN PRINTING TECHNOLOGY APPLIED TO SILICON SOLAR CELL FABRICATION Final Report, Nov. 1977 - Feb. 1979
Jay W. Thornhill and William E. Sipperly Apr. 1980 64 p refs
(Contract NAS3-20826)
(NASA-CR-159789) Avail: NTIS HC A04/MF A01 CSCL 10A

The process for producing space qualified solar cells in both the conventional and wraparound configuration using screen printing techniques was investigated. Process modifications were chosen that could be easily automated or mechanized. Work was accomplished to optimize the tradeoffs associated with gridline spacing, gridline definition and junction depth. An extensive search for possible front contact metallization was completed. The back surface field structures along with the screen printed back contacts were optimized to produce open circuit voltages of at least an average of 600 millivolts. After all intended modifications on the process sequence were accomplished, the cells were exhaustively tested. Electrical tests at AMO and 28 C were made before and after boiling water immersion, thermal shock, and storage under conditions of high temperature and high humidity. L.F.M.

N80-27809*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY, PHASE 3 Final Report, Dec. 1979 - May 1980
Jun. 1980 69 p refs 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160742; D180-25969-1-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 10A

Results of a three phase study of the Solar Power Satellite System are summarized. Various options and alternate systems were considered and the following conslusions were reached: antenna mounted solid state transmitters are potentially as cost effective as the klystron approach, althrough limited to 2500 megawatts net output; the free electron laser and optical diode laser appear most promising for laser power transmission; ground antenna siting need not be restricted to below 35 degrees of latitude; and nonrecurring cost reductions attainable by using a smaller Heavy Lift Launch Vehicle are highly attractive. L.F.M.

N80-27810*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 2, PART 3: FINAL BRIEFING, 16 MAY 1980, PHASE 3
Jun. 1980 410 p 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160743; D180-25969-2-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 10A

Alternatives to the microwave transmission system previously defined Solar Power Satellite Systems were investigated. These were the laser power transmission, transportation systems, and an analysis or solid state power transmission. The advantages of each system are presented. F.O.S.

N80-27811*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 3: LASER SPS ANALYSIS, PHASE 3 Final Report, Dec. 1979 - May 1980
Jun. 1980 99 p refs 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160744; D180-25969-3-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 10A

The potential use of lasers for transmitting power to Earth from Solar Power Satellites was examined. Free electron lasers appear most promising and would have some benefits over microwave power transmission. Further research in laser technology is needed. L.F.M.

N80-27812*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 4: SOLID STATE SPS ANALYSIS, PHASE 3 Final Report, Dec. 1979 - May 1980
Jun. 1980 79 p 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160745; D180-25969-4-Vol-4) Avail: NTIS HC A05/MF A01 CSCL 10A

A 2500 megawatt solid ground output Solar Power Satellite (SPS) of conventional configuration was designed and analyzed. Because the power per receiving antenna is halved, as compared

with the klystron reference, twice the number of receiving antennas are needed to deliver the same total power. The solid state approach appears feasible with a slightly greater specific mass and slightly higher cost than the klystron SPS design. L.F.M.

N80-27813*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 5: SPACE TRANSPORTATION ANALYSIS, PHASE 3 Final Report, Dec. 1979 - May 1980
Jun. 1980 153 p refs 5 Vol.
(Contract NAS9-15636)
(NASA-CR-160746; D180-25969-5-Vol-5) Avail: NTIS HC A08/MF A01 CSCL 10A

A small Heavy Lift Launch Vehicle (HLLV) for the Solar Power Satellites (SPS) System was analyzed. It is recommended that the small HLLV with a payload of 120 metric tons be adopted as the SPS launch vehicle. The reference HLLV, a shuttle-derived option with a payload of 400 metric tons, should serve as a backup and be examined further after initial flight experience. The electric orbit transfer vehicle should be retained as the reference orbit-to-orbit cargo system. L.F.M.

N80-27814# Defence Research Establishment, Ottawa. (Ontario).
EVALUATION OF THE VERTICAL AXIS WIND TURBINE AT DREO
Howard R. Braun, David J. Bristow, and Sylvia J. Wake Jan. 1980 100 p refs
(AD-A083961; DREO-R-822) Avail: NTIS HC A05/MF A01 CSCL 10/2

A Vertical Axis Wind Turbine-Battery Storage System was installed at the Defence Research Establishment Ottawa (DREO) in December 1975 and was operated for three years. The system was instrumented to control and monitor its operation and performance. This report deals with an evaluation study of a Vertical Axis Wind Turbine-Battery Storage System for a low-power unattended power source. The System's wind turbine, energy-generating and battery-storage system, mechanical drive system, installation, control-circuitry and data-acquisition system are described. Also, a performance-history outlining the problem areas encountered and a data-summary of two years of performance-data acquired during this study are presented. The objective of this study was to assess the System's ability to provide sixty watts of continuous power. The frequency of mechanical falures, especially in the turbine electrical drive system, made this particular system unsuitable as an unattended power source. It was also concluded that the average annual wind speed in the test location was of insufficient magnitude to provide the specified power output. GRA

N80-27815# Defence Research Establishment, Ottawa. (Ontario).
INVESTIGATION OF CADMIUM SELENIDE PHOTOELECTROCHEMICAL CELLS
Robert A. Sawchuk and David R. Snelling Jan. 1980 69 p refs
(AD-A083690; DREO-TN-80-4) Avail: NTIS HC A04/MF A01 CSCL 10/3

Three photoelectrochemical devices, developed at Simon Fraser University, employing electrochemically deposited cadmium selenide photoanodes, a polysulphide redox electrolyte and an in situ energy storage compartment were evaluated at DREO. The photoelectrochemical devices were initially tested using tungsten filament lamps, and the evaluation was completed with a xenon lamp which closely matched a solar spectrum corresponding to AM1 (air mass 1) conditions having an irradiance level of 2/889 Wm. Maximum power output of the devices was in the 10-20 mW range resulting in a solar (AM1) to electrical conversion efficiency of less than 1%. A fill-factor approaching 0.25 was typical for the photoelectrochemical cells examined. Counter electrode polarization and electrolyte light absorption were identified and evaluated as efficiency limiting factors. Proposed loss mechanisms are: series resistance in the semiconductor bulk, electron tunneling to surface states, current carrier losses at electron-hole recombination centers, and shorting to the nickel substrate. The concept of in situ energy storage was not successfully demonstrated. It is concluded that counter electrode polarization can be overcome and that further research is required in order to detect the presence of surface states and electron-hole recombination centers as well as research oriented to characterize the structure of the depletion layer and the CdSe/electrolyte interface. The efficiency of the electrochemically deposited CdSe should approach the 5-10% efficiency observed for single crystal and pressure sintered CdSe. GRA

N80-27816# Defense Intelligence Agency, Washington, D.C.
HYDROGEN TECHNOLOGY: FOREIGN, CHANGE 1 Report for period ending Feb. 1980
James D. Busi and Phillip Greenbaum 14 Apr. 1980 66 p
(AD-A083665; DIA-DST-1860S-522-78-CHG-1) Avail: NTIS HC A04/MF A01 CSCL 10/2

Hydrogen is both a promising medium for the efficient storage and transmission of energy and a potential alternate fuel. Hydrogen is not a primary energy source, however, since its production is dependent upon other energy sources (thermal, electrical, and radiant). To be practicable as a fuel, hydrogen must be produced in bulk quantities with a standardized purity that will satisfy consumer specifications. In addition, improved distribution systems must make hydrogen widely available to military, industrial, and domestic consumers if the successful evolution of a hydrogen economy is to occur. The greatest potential military impact of hydrogen lies in its use as an aviation fuel. Because of its high specific energy (124 kJ/kg--2.7 times greater than conventional aviation fuels), hydrogen has potential use as a fuel for subsonic transports, supersonic aircraft, and helicopters; however, safety measures, logistics, and storage and handling systems must be developed and standardized before this capability can be achieved. Initial experimental use of hydrogen in military aircraft may occur in the 1980s. A followup conversion and modification of aircraft and airports to hydrogen will require an additional 10 to 15 years. Secondary military interests include the use of hydrogen fuel cells for portable and transportable power generation, and its use as a propellant in aerospace applications. GRA

N80-27817# Battelle Pacific Northwest Labs., Richland, Wash.
WIND CHARACTERISTICS FOR DESIGN OF WIND TURBINES: RESEARCH IN THE USA
J. R. Connell 1 Dec. 1979 22 p Presented at the IEA Meeting, Stockholm, 12-13 Sep. 1979
(Contract EY-76-C-06-1830)
(PNL-SA-7967; CONF-7909128-1) Avail: NTIS HC A02/MF A01

The Pacific Northwest Laboratory (PNL) of the United States Department of Energy has the primary responsibility for providing information on wind characteristics for design and for evaluation of performance of wind energy conversion systems (WECS). The objectives of the whole program are, broadly, to develop technical wind information which is relevant to the design of WECS, to determine suitable methods of measuring and analyzing the wind for evaluating WECS performance, and to communicate the information usefully to WECS designers. DOE

N80-27818# Technical Univ. of Denmark, Lyngby. Thermal Insulation Lab.
INVESTIGATION OF HEAT STORAGES WITH SALT HYDRATE AS STORAGE MEDIUM BASED ON THE EXTRA WATER PRINCIPLE
S. Furbo 1980 83 p refs
(EUR-6646-Pt-2) Avail: NTIS (US Sales Only) HC A05/MF A01; DOE Depository Libraries

Experimental and computational studies of a full scale heat storage with salt hydrate as storage medium and based on the extra water principle are reported. Two different types of full scale heat storage, both making use of an incongruently melting salt hydrate as storage medium and based on the extra water principle, were examined by means of long term experiments. No decrease in the performance of the storages during the long term experiments was observed, and experiences for both storage types are obtained. By means of computer calculations, heat of fusion storage with oil as the heat transfer fluid in direct contact with the storage medium were compared with hot water storage as part of solar heating systems with the Danish Reference Year as a basis. With results of these calculations, examples of economical comparisons between heat of fusion storage and hot water storages are carried out. DOE

N80-27819# Lockheed Missiles and Space Co., Palo Alto, Calif.
AMORPHOUS THIN FILMS FOR SOLAR CELL APPLICA-

TION Quarterly Report, 1 Oct. - 31 Dec. 1979
A. D. Jonath, K. M. Monahan, J. L. Crowley, and H. F. MacMillan 1979 17 p refs
(Contract DE-AC03-79ET-23040)
(DOE/ET-23040-3; QR-3) Avail: NTIS HC A02/MF A01

The identification content and role of impurities in alpha Si thin films was investigated. Emphasis was on the measurement of oxygen concentration profiles through the film using Rutherford backscattering and nuclear reaction methods and the control over oxygen inclusion in the sputtered films. DOE

N80-27820# Sandia Labs., Livermore, Calif. Materials Development Div.
HYDROGEN COMPATIBILITY OF STRUCTURAL MATERIALS FOR ENERGY STORAGE AND TRANSMISSION Annual Report, 1 Oct. 1978 - 30 Sep. 1979
W. R. Hoover, J. J. Iannucci, S. L. Robinson, J. R. Spingarn, and R. E. Stoltz Feb. 1980 70 p refs
(Contract EY-76-C-04-0789)
(SAND-80-8202) Avail: NTIS HC A04/MF A01

This annual report documents the activities and contributions accomplished during FY79 on a research contract aimed at assessing the feasibility of transporting hydrogen gas through the existing natural gas pipeline network. Studies of the hydrogen-induced degradation of pipeline steels reveal that hydrogen can be transported in these steels if a number of precautions are taken. These issues are discussed and plans for further research are presented. DOE

N80-27821# SRI International Corp., Menlo Park, Calif.
COMMUNITY IMPEDIMENTS TO IMPLEMENTATION OF SOLAR ENERGY
M. D. Armstrong and J. E. Armstrong Nov. 1979 112 p refs
(Contract W-7405-eng-48)
(DOE/EV-0059) Avail: NTIS HC A06/MF A01

The complete array of institutional problems expected to emerge when solar technology is implemented on a national scale is assembled. The findings of the study are presented in two formats. First, the results are organized by the time frames of delays in solar implementation caused by the inherent difficulties a national energy policy would encounter in changing the way a given institution responds to specific solar technologies. Delay categories of 10 years or more, 6 to 8 years, and 3 to 5 years were selected; all were assigned under the assumption that a strong national policy promoting adoption of solar technologies would be in effect. The second format constitutes a description of the difficulties at the community level, associated with implementing each solar technology. DOE

N80-27822# Midwest Research Inst., Golden, Colo.
HETEROJUNCTION SOLAR CELLS
S. Wagner 1978 17 p refs Presented at Royal Soc. Discussion Meeting on Solar Energy, London, 15 Nov. 1978
(Contract EG-77-C-01-4042)
(SERI/TP-32-134; CONF-7811142-1) Avail: NTIS HC A02/MF A01

A qualitative description of semiconductor/semiconductor heterojunction solar cells is given. The two groups of heterojunctions of greatest economic potential, very highly efficient cells for concentrator applications and moderately efficient thin film cells for flat plates, are described with examples. These examples illustrate the role of heterojunctions in surface passivation, monolithic multijunction devices, devices with semiconductors of only one conductivity type, and low-temperature fabrication techniques. DOE

N80-27823# National Technical Information Service, Springfield, Va.
SOLAR PROCESS HEAT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
Audrey S. Hundemann Apr. 1980 67 p
(PB80-807936) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 10A

Feasibility, design, cost, and economic potential of solar process heat are discussed. Potential applications to industries using hot water or steam and to heat used for dehydration processes in agriculture are covered. Contains 60 abstracts.GRA

N80-27824# Idaho Univ., Moscow. Water Resources Research Inst.
UNDEVELOPED HYDROPOWER AS A POTENTIAL ENERGY SOURCE IN IDAHO
C. C. Warnick and L. F. Heitz Nov. 1979 28 p refs
(PB80-157399; W80-03918; OWRT-A-057-IDA(2)) Avail: NTIS HC A03/MF A01 CSCL 10B

The potential energy available in both regulated and unregulated streams in Idaho and the Pacific Northwest through the use of small scale hydro development was surveyed. For the survey a technique was developed to find low duration information along reaches of streams that do not have flow records due to inadequate gaging. Also a method for estimating flow duration curves for regulated streams was developed and applied. To determine head for power computations the difference in elevation at the inflow and outflow points of a reach was used. A preliminary social, political, and environmental feasibility evaluation was also made for each reach with theoretical energy potential. Summaries of the survey results are included. GRA

N80-27825# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Oct. - Dec. 1979
Feb. 1980 49 p refs
(Contracts EX-76-A-36-1008; DE-AI01-79ET-27025)
(PB80-163686; JHU/APL/EQR/79-4) Avail: NTIS HC A03/MF A01 CSCL 10A

Work on various tasks to develop energy resources, utilization concepts, and storage methods is summarized. Reports are presented in the following areas: geothermal prospecting; hydroelectric power generation in southeastern states; neotectonic investigations in Connecticut; ocean thermal energy conversion core unit testing and recovery of landfill methane; and unconventional gas sources--Eastern devonian shales. R.E.S.

N80-27826# National Bureau of Standards, Washington, D.C. National Engineering Lab.
EVALUATION OF A PROPOSED ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS) STANDARD GUIDE TO ASSESS THE COMPATIBILITY OF METAL-HEAT TRANSFER LIQUID PAIRS IN SOLAR HEATING AND COOLING SYSTEMS
Paul Wencil Brown and John W. Grimes, II Nov. 1979 46 p refs Sponsored in part by DOE
(PB80-161748; NBSIR-79-1919) Avail: NTIS HC A03/MF A01 CSCL 13A

A proposed testing methodology for laboratory screening of metallic containment materials for use with liquids in solar heating and cooling systems was evaluated with emphasis on the procedural aspects of each test method. It was determined that the tests described in this standard practice can be carried out as a basis for evaluating metal-heat transfer liquid pair interactions under conditions simulative of various modes of solar containment system operation. GRA

N80-27827# National Bureau of Standards, Washington, D.C. National Engineering Lab.
ANALYSIS OF CODE RELATED RESPONSES FROM THE SOLAR DEMONSTRATION PROGRAM Final Report
Jan. 1980 156 p Sponsored in part by HUD and DOE
(PB80-153968; NBSIR-79-1957) Avail: NTIS HC A08/MF A01 CSCL 10A

The building regulatory information gathered during the course of the Residential Solar Demonstration Program from inception of the program through September 30, 1978 is documented. It is concluded that existing codes do not present a barrier to the installation and acceptance of solar systems; however, code officials need additional training and better back-up material to properly evaluate solar systems. GRA

N80-27828# New Mexico Energy Inst., Albuquerque.
DEVELOPMENT OF A LOW-COST NON-TRACKING HEAT PIPE CONCENTRATING COLLECTOR Final Report, 1 Jul. 1978 - 30 Jun. 1979
K. T. Feldman, Jr. and Darryl Lee Noreen Jul. 1979 182 p refs Sponsored in part by New Mexico Energy and Minerals

Dept.
(PB80-160443; NMEI-23) Avail: NTIS HC A09/MF A01 CSCL 13A

A solar water heater which uses a multi-heat-pipe energy absorber is discussed. In the absorber configuration, wickless heat pipes which rely on only gravity and a puddle-flow mechanism are used. In order to design an energy absorber with sufficient heat transfer capability, the performance of a puddle-flow gravity-assisted heat pipe is theoretically investigated. The maximum heat transport capability of methanol, water, and Freon-11 heat pipes was studied. The relationship between various heat pipe parameters and axial heat transport capability is discussed. GRA

N80-27829# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
AN INVESTIGATION OF WIND LOADS ON SOLAR COLLECTORS. APPENDIX 2: NET PRESSURE COEFFICIENTS Final Report
H. W. Tieleman, R. E. Akins, and P. R. Sparks Jan. 1980 170 p
(Contract EO-A01-78-3605)
(PB80-158769; VPI-E-80-1-App-2) Avail: NTIS HC A08/MF A01 CSCL 10A

A wind tunnel study of a series of model solar collector installations (flat-plate collectors) immersed in a thick turbulent shear layer was undertaken in order to determine design wind loads on such installations. Wind tunnel measurements were made of the mean and fluctuating pressures on a model of a single flat plate collector which was a component of different multipanel installations. The pressures were spatially integrated over the top and bottom of the single collector separately. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-27830 Maryland Univ., College Park.
THE COMPOSITION, SOURCES AND SINK OF SOUTH POLAR AEROSOLS Ph.D. Thesis
William Charles Cunningham 1979 459 p
Avail: Univ. Microfilms Order No. 8016345

In order to develop a better understanding of global aerosol transport processes background aerosols collected at the South Pole were studied. The composition of South Polar aerosols was approximately the same over a period of seven years, but there were strong seasonal variations in aerosol source strengths. Sources that are significant contributors to the South Polar aerosols include the stratospheric sulfate layer, the seas, the Earth's crust, meteorites and, possibly, volcanoes. Comparisons of the seasonal variations in source component concentrations with one another and with radioisotopic tracers of stratospheric origin indicated specific transport mechanisms. Crustal material and sea salt are transported to the South Pole via the troposphere. Sulfate and meteoritic debris enter the troposphere at some distance from the South Pole and mix with tropospheric air during transport. Ice-crystal formation was found to effectively remove crustal and marine aerosols. Dissert. Abstr.

N80-27831 California Univ., Los Angeles.
A NUMERICAL INVESTIGATION OF THE EFFICIENCY WITH WHICH AEROSOL PARTICLES COLLIDE WITH CLOUD AND SMALL RAIN DROPS Ph.D. Thesis
Solomon Norman Grover 1980 299 p
Avail: Univ. Microfilms Order No. 8015981

A numerical investigation of the scavenging of aerosol particles by cloud and rain drops is presented. A numerical model which calculates collision efficiencies for drops colliding with particles was developed and applied to a wide variety of cases naturally occurring in the atmosphere. The model deduces the collision efficiency by integrating particle trajectories relative to the collector drop using a stable fourth order predictor-corrector scheme. Effects included are those due to the particle's inertia, the air flow pattern around the falling collector drop, electric forces which exist when external electric fields or charges on the drop and particle are present, and thermo-diffusiophoretic forces which arise when the relative humidity is below 100%. Dissert. Abstr.

N80-27832*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COORDINATED AIRCRAFT AND SHIP SURVEYS FOR DETERMINING IMPACT OF RIVER INPUTS ON GREAT LAKES WATERS. REMOTE SENSING RESULTS
Charles A. Raquet, Jack A. Salzman, Thom A. Coney, Roger A. Svehla, Donald F. Shook, and Richard T. Gedney Jul. 1980 105 p refs
(NASA-TP-1694; E-172) Avail: NTIS HC A06/MF A01 CSCL 13B

The remote sensing results of aircraft and ship surveys for determining the impact of river effluents on Great Lakes waters are presented. Aircraft multi-spectral scanner data were acquired throughout the spring and early summer of 1976 at five locations: the West Basin of Lake Erie, Genesee River - Lake Ontario, Menomonee River - Lake Michigan, Grand River - Lake Michigan, and Nemadji River - Lake Superior. Multispectral scanner data and ship surface sample data are correlated resulting in 40 contour plots showing large-scale distributions of parameters such as total suspended solids, turbidity, Secchi depth, nutrients, salts, and dissolved oxygen. The imagery and data analysis are used to determine the transport and dispersion of materials from the river discharges, especially during spring runoff events, and to evaluate the relative effects of river input, resuspension, and shore erosion. Twenty-five LANDSAT satellite images of the study sites are also included in the analysis. Examples of the use of remote sensing data in quantitativley estimating total particulate loading in determining water types, in assessing transport across international boundaries, and in supporting numerical current modeling are included. The importance of coordination of aircraft and ship lake surveys is discussed, including the use of telefacsimile for the transmission of imagery. J.M.S.

N80-27833*# National Aeronautics and Space Administration, Washington, D. C.
ANNOYANCE DUE TO NOISE AND AIR POLLUTION TO THE RESIDENTS OF HEAVILY FREQUENTED STREETS
H. U. Wanner, Brigit Wehrli, J. Nemecek, and V. Turnan Apr. 1980 23 p refs Transl. into ENGLISH from Sozial und Praeventivmedizin, Zurich v. 22, 1977 p 108-122 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75496) Avail: NTIS HC A02/MF A01 CSCL 13B

The residents of different streets with varying traffic density and building density were questioned about annoyance due to traffic noise and air pollution. Results show that annoyance felt is dependent not only on the measured noise levels and/or air pollution concentrations, but that there do exist interactions between the residential quarters and annoyance. These interactions should be considered when fixing the limits and standards. Author

N80-27834*# National Aeronautics and Space Administration, Washington, D. C.
NOISE LEVELS NEAR STREETS, EFFECTIVENESS AND COST ABATEMENT MEASURES
Judith Lang Apr. 1980 11 p refs Transl. into ENGLISH of conf. paper "Laermbelastung an Strassen, Wirksamkeit und Kosten von Laermschutzmassnahmen" Vienna, OAL-Fachtagung p 156-162 Presented at Tech. Conf. of the OEAL, Vienna, 1978 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75814) Avail: NTIS HC A02/MF A01 CSCL 13B

During the years 1975-1978, research was carried concerning the current noise levels near streets, the annoyance felt by the population, possible noise abatement measures for these streets, and the economic impact of such measures. The results of the research are summarized. R.E.S.

N80-27835*# National Aeronautics and Space Administration, Washington, D. C.
CONSTRUCTION AND APPLICATION OF A QUESTION-

NAIRE FOR THE SOCIAL SCIENTIFIC INVESTIGATION OF ENVIRONMENTAL NOISE EFFECTS
R. Guski, U. Wichmann, B. Rohrmann, and H. O. Finke. May 1980. 29 p. refs. Transl. into ENGLISH from Z. fur Sozialpsychologie (West Germany) v. 9, 1978. p. 50-65. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75492) Avail: NTIS HC A03/MF A01 CSCL 13B

A social psychological questionnaire was developed to study the effects of environmental noise and was applied to 636 people living in 19 different areas of Hamburg. The theoretical foundations and the statistical means employed in its development are described. Four main reactions to noise are isolated statistically, and it is determined that these are moderated by several intervening variables, chief of which are coping capacity for noise, the perceived dangerousness of the noise source, other daily loads, and the individual's lability. Author

N80-27836*# University of Central Florida, Orlando. Dept. of Biological Sciences.
A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEMS AT JOHN F. KENNEDY SPACE CENTER. EXECUTIVE SUMMARY. Report, Jun. 1976 - Mar. 1979
I. J. Stout. Jul. 1980. 133 p. refs.
(Contract NAS10-8986)
(NASA-CR-163122; KSC-TR-51-2) Avail: NTIS
HC A07/MF A01 CSCL 13B

Studies conducted in and around John F. Kennedy Space Center, Merrit Island, Florida were designed to establish baseline conditions for various attributes of the biotic and abiotic environment. Features were described and quantitatively measured. Certain condition were found to be appropriate for the detection and assessment of possible environmental perturbations caused by future NASA activities. These include plant communities, mammal populations, rainfall chemistry, fish populations, and the status of rare and endangered species. On the basis of statistical analysis of quantitative data and logistic considerations, it was possible to refine the kinds and amounts of measurements needed to evaluate perturbations in selected environmental components. F.M.

N80-27837# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
COMMUNITY NOISE EXPOSURE RESULTING FROM AIRCRAFT OPERATIONS. VOLUME 7: ACOUSTIC DATA ON AIRCRAFT GROUND RUNUP NOISE SUPPRESSORS
Robert A. Lee. Dec. 1979. 282 p.
(AF Proj. 7231)
(AD-A083701; AMRL-TR-73-110-Vol-7) Avail: NTIS
HC A13/MF A01 CSCL 01/2

This report presents the results of field measurements of the far-field noise produced on the ground by military aircraft operating inside Grade-2 demountable suppressors during ground runup operations. For these ground runups, data are presented as a function of angle and distance to the aircraft. All of the data are normalized to standard acoustic reference conditions of 59 F temperature and 70% relative humidity. Volume 1 discusses the scope, limitations, and definitions needed to understand and use the volumes containing the noise data. Noise data are presented in this Volume 7 for the following aircraft suppressor systems: A-7 in the AF32A-19 and AF-32A-24 noise suppressors, KC-135A in the modified AF32A-52 noise suppressor, F-4 in the AF32A-14 noise suppressor, F-5 in the AF32A-18 noise suppressor, F-15 in the AF32A-23 noise suppressor, F-16 in the AF32A noise suppressor, F-100 in the AF32A-16 noise suppressor, F-106 in the AF32A-17 noise suppressor, F-111 in the AF32A-13 noise suppressor and T-38 in the AF32A-18 noise suppressor. GRA

N80-27838# Computer Sciences Corp., Arlington, Va.
NOISE ABATEMENT ECONOMIC POLICY ANALYSIS MODEL NAEPAM. VOLUME 2: USER'S GUIDE. Final Report, Sep. 1978 - Jul. 1979
Andras Spiegel and Roger A. Shepherd. Jul. 1979. 162 p. 2 Vol.
(Contract DOT-FA78WA-4163)
(AD-A081159; FAA-AEE-79-8-2) Avail: NTIS
HC A08/MF A01 CSCL 01/2

The development and evaluation of noise emission charge systems for inducing aircraft noise abatement modifications is described in 'Noise Abatement Economic Policy Analysis Model -- /NAEPAM'. The objective of this User's Guide is to describe the model implementation and to provide the necessary information to analysts who wish to execute the model. GRA

N80-27839# Computer Sciences Corp., Arlington, Va.
NOISE ABATEMENT ECONOMIC POLICY ANALYSIS MODEL NAEPAM, VOLUME 1. Final Report, Sep. 1978 - Jul. 1979
Andras Spiegel and Roger A. Shepherd. Jul. 1979. 73 p. refs. 2 Vol.
(Contract DOT-FA79WA-4163)
(AD-A081190; FAA-AEE-79-8-1) Avail: NTIS
HC A04/MF A01 CSCL 01/2

This report examines the role of economic disincentive as an inducement to noise abatement. The particular disincentive analyzed is a system of noise emission charges (NEC) which is imposed at airports on commercial aircraft operations which are above maximum noise emission allowances. The methodology developed is in the form of a mathematical programming (MP) model which seeks to minimize the total cost of a disincentive-based policy. Preliminary analyses conducted with the model indicate (qualitatively) that the method of noise emission charges, administered at the airport level on operations exceeding the current noise emission standards, is an economically feasible method for inducing noise abatement. The single most critical assumption underlying this conclusion is that if the NEC administration is voluntary, then a sufficient number of airports must impose the charges. The modeling concept presented is suitable for the analysis of a broad spectrum of aviation economic policy related issues. GRA

N80-27840# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy.
INTEGRATED NOISE MODEL (INM). VERSION 2. USER'S GUIDE
Thomas Connor and Robert Hinckley. Sep. 1979. 405 p. Supersedes FAA-EQ-78-01
(AD-A079493; FAA-AEE-79-09; FAA-EQ-78-01) Avail: NTIS
HC A18/MF A01 CSCL 01/2

This document contains the instructions to execute the Integrated Noise Model (INM), Version 2. The INM is a collection of computer programs which can calculate the aircraft noise environment in the vicinity of an airport given certain information on airport location, layout, and the type and movement of its air traffic. GRA

N80-27841# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy.
FEDERAL AVIATION ADMINISTRATION HIGH ALTITUDE POLLUTION PROGRAM, SECOND BIENNIAL REPORT, PREPARED IN ACCORDANCE WITH THE OZONE PROTECTION PROVISION, SECTION 153G, OF THE CLEAN AIR ACT AMENDMENTS OF 1977. Biennial Report, Jan. 1978 - Dec. 1979
N. Sundararaman, W. Smith, and J. Rogers. Dec. 1979. 64 p. refs.
(AD-A081520; FAA-EE-79-24) Avail: NTIS
HC A04/MF A01 CSCL 13/2

This report was prepared in accordance with the Stratospheric Ozone Protection provisions of Public Law 95-95, the Clean Air Act Amendments of 1977. The impact of high altitude aviation on stratospheric ozone is now believed to be an increase in total columnar ozone for flights up to 20 km (about 66,000 feet). This result has been brought about through improvements in one-dimensional chemical kinetics-transport model of the stratosphere. They show that aircraft-injected pollutants (primarily nitrogen oxides) generate ozone through simplified 'amog' mechanisms in the upper troposhere and lower stratosphere while depleting it through the classic catalytic destruction mechanism at higher altitudes. The net result at present is a slight overall ozone increase. The uncertainty in the present model calculations, however, is unknown. The effort of the High Altitude Pollution Program of the Federal Aviation Administration is aimed at

identifying and resolving the uncertainties so that a 'consensus' method or methods can be obtained for future assessments of the impacts of high altitude aviation on the environment. GRA

N80-27842# Mitre Corp., McLean, Va. Metrek Div.
FAA INTEGRATED NOISE MODEL VALIDATION. PHASE 1: ANALYSIS OF INTEGRATED NOISE MODEL CALCULATIONS FOR AIR CARRIER FLYOVERS
R. G. Gados and J. M. Aldred. Dec. 1979. 103 p. refs.
(Contract DOT-FA80WA-4370)
(AD-A081426; MTR-79W; FAA/EE-80-04) Avail: NTIS
HC A06/MF A01 CSCL 01/3

The Federal Aviation Administration's Integrated Noise Model is a set of computer programs which is used to predict the noise impact of aircraft in the vicinity of an airport. Through use of extensive statistical analyses, this study investigates the accuracy and suitability of the noise model in calculating aircraft noise exposure by: examining the agreement between the noise model in calculating single noise events and the actual measurement of those events, assessing the sensitivity and controllability of the noise model to aircraft thrust assumptions, and investigating noise curves used in calculating noise exposure by testing variables for significance in estimating noise and by comparing the shape of empirical noise curves with those already in the noise model. Data for the analysis were obtained from field observations of noise from air carrier flight operations over various noise monitoring sites near Washington National and Dulles International Airports. GRA

N80-27843# California Univ., Berkeley. Energy and Environment Div.
LAND USE AND ENVIRONMENTAL IMPACTS OF DECENTRALIZED SOLAR ENERGY USE
Robert H. Twiss, Patricia L. Smith, Allen E. Gatzke, and Scott T. McCreary. Jan. 1980. 206 p. refs.
(Contract W-7405-eng-48)
(DOE/EV-0067) Avail: NTIS HC A10/MF A01

The physical, spatial and land-use impacts of decentralized solar technologies applied at the community level by the year 2000 are examined. The results are intended to provide a basis for evaluating the way in which a shift toward reliance on decentralized energy technologies may eventually alter community form. Six land-use types representative of those found in most US cities are analyzed according to solar penetration levels identified in the maximum solar scenario for the year 2000. The scenario is translated into shares of end use demand in the residential, commercial and industrial sectors. These proportions become the scenario goals to be met by the use of decentralized solar energy systems. The percentage of total energy demand is assumed to be 36.5 percent, 18.8 percent and 22.6 percent in the residential, commercial and industrial sectors respectively. The community level scenario stipulated that a certain percentage of the total demand be met by on-site solar collection, i.e. photovoltaic and thermal collectors, and by passive design. This on-site solar goal is 31.9 percent (residential), 16.8 percent (commercial) and 13.1 percent (industrial). DOE

N80-27844# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
DRAFT RECOMMENDED PRACTICE FOR MEASUREMENT OF GASEOUS AND PARTICULATE EMISSIONS FROM HEAVY-DUTY DIESEL ENGINES UNDER TRANSIENT CONDITIONS
Eugene Danielson. Apr. 1979. 86 p.
(PB80-153943; EPA-AA-SDSB-79-18) Avail: NTIS
HC A05/MF A01 CSCL 13B

The equipment required and the procedures to be followed in measuring exhaust emissions from heavy-duty diesel engines are described. For clarity and continuity, this document is structured to be totally compatible with the proposed heavy-duty gaseous emission regulations. It should be noted that: (1) this procedure does not negate or adversely affect the proposed heavy-duty regulations, but merely specifies the additional equipment and steps necessary for diesel particulate testing; and (2) this format incorporates diesel particulate testing for the 1983 and later model years. Sections in the proposed heavy-duty gaseous emission regulations which are affected by the incorporation of particulate testing are included. GRA

N80-27845# Cambridge Systematics, Inc., Mass.
TRANSPORTATION AIR QUALITY ANALYSIS - SKETCH PLANNING METHODS. VOLUME 2: CASE STUDIES. Final Report
Dec. 1979. 334 p. Sponsored by Urban Mass Transportation Admin., Washington, D.C. and EPA, Washington, D.C. 2 Vol.
(Contract EPA-68-01-4977)
(PB80-158710; EPA-400/1-80-001B-Vol-2) Avail: NTIS
HC A15/MF A01 CSCL 13B

Case studies illustrating the application of a selection of techniques for transportation-air quality planning are presented. The analysis approaches illustrated should be useful in developing the transportation portions of State Implementation Plans, as required to meet national ambient air quality standards under the Clean Air Act, as amended. The effects these measures should have on travel; the transportation system; energy conservation; and a host of other social, environmental, economic, and financial concerns; as well as on air quality was evaluated within a broadly participatory, interactive planning process. GRA

N80-27846# West Virginia Univ., Morgantown. Water Research Inst.
FUNCTIONAL POLYMERS FOR REMOVAL OF HEAVY-METAL POLLUTANTS FROM WATER
Anthony Winston, Darrell G. Kirchner, and James W. Rosthauser. 1980. 48 p. refs.
(Contract DI-14-34-0001-8052)
(PB80-158215; Information-13; WRI-WVU-80-01;
W80-03911; OWRT-A-031-WVA(1)) Avail: NTIS
HC A03/MF A01 CSCL 13B

Polymeric ion-exchange resins specific for metal ions and for systems for removing iron from water were designed. The resins are vinyl polymers bearing hydroxamic acids and have strong affinity for iron. Polymers were prepared in which the spacing of the hydroxamic acids were varied. The stability constants of the iron complexes showed that the spacing of the hydroxamic acids was important both in complex stability and in the selectivity of the resin for iron. Polymers for binding copper and mercury were synthesized and evaluated. The functional group for copper was the tripeptide glycylglycylhistidine. For mercury, polymers containing sulfide were studied. Preliminary evaluation showed that the polymers formed complexes with copper and mercury. Various applications of these resins in environment, health, and industry are suggested. GRA

N80-27847# Southern Research Inst., Birmingham, Ala.
CONTROL OF PARTICULATE EMISSIONS IN THE PRIMARY NONFERROUS METALS INDUSTRIES. Final Report
Richard L. Meek, ed. Dec. 1979. 515 p. refs. Symp. held at Monterey, Calif., 18-21 Mar. 1979.
(Grant EPA-R-804955)
(PB80-151822; EPA-600/2-79-211) Avail: NTIS
HC A22/MF A01 CSCL 13B

Foreign and domestic technology applicable to copper, lead, zinc and aluminum is described. Advanced technology, measurement techniques, and current EPA programs that are pertinent to particulate control in the nonferrous metals industry are discussed. GRA

N80-27848# Battelle Columbus Labs., Ohio.
CHARACTERIZATION OF PRIORITY POLLUTANTS FROM AN AIRPLANE PARTS MANUFACTURING FACILITY. Final Report, Jan. - Dec. 1978
A. K. Reed, M. A. Eischen, M. M. McKown, and G. R. Smithson, Jr. Jan. 1980. 44 p. refs.
(Contract EPA-68-03-2552)
(PB80-151566; EPA-600/2-80-019) Avail: NTIS
HC A03/MF A01 CSCL 13B

Wastewater from an airplane parts manufacturing plant was sampled using the U.S. EPA screening protocol for the 129 priority pollutants. The results of the study show that the treatment practiced at this site removes more than 90 percent of the chromium and zinc and 70 percent of the copper. The system is slightly less effective for cadmium because of its low concentration in the influent to the treatment plant. Nevertheless, in excess of 60 percent of the cadmium is removed. Because of the extremely low concentrations of other metals in the influent to the treatment plant, the effectiveness of the treatment for

their removal could not be evaluated with any degree of confidence. GRA

N80-27849# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
STUDY OF NEW ENGLAND UTILITIES' PARTICULATE AIR POLLUTION CONTROL FACILITIES TO DETERMINE RELATIVE VIABILITY OF APPROACHES TO UPGRADE AND RETROFIT
James R. Melcher and Peter Zieve. Nov. 1979. 439 p. refs. Sponsored by Boston Edison Co., New England Power Service Co. and Northeast Utilities Service Co.
(PB80-154073; MIT-EL-79-017) Avail: NTIS
HC A19/MF A01 CSCL 13B

Scenarios were developed that describe the air pollution control requirements of five facilities selected from those owned by the sponsoring utilities. The use of innovative technologies as retrofits was investigated for each. Six innovative technologies were chosen from a review of available literature according to their potential for solving utility emissions problems. GRA

N80-27850# Massachusetts Inst. of Tech., Cambridge. Sea Grant Coll. Program.
THE EFFECTS OF SURFACE PHENOMENA ON THE SPREADING OF OIL ON WATER
Riyaz A. Fazal and Jerome H. Milgram. Nov. 1979. 73 p. refs. (Grant NOAA-04-7-158-44074)
(PB80-163629; MITSG-79-31; NOAA-80021405) Avail: NTIS
HC A04/MF A01 CSCL 13B

The spreading of fi r kinds of crude extracted from around the world, as well a the spreading of a mixture of pure hydrocarbons and of uesel fuel is described. It is concluded that spreading effects are not wholly determined by bulk properties, but are also affected by the properties of the individual components in the oil. GRA

N80-27851# Mitre Corp., McLean, Va. METREK Div.
A REVIEW OF STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES: SECONDARY LEAD SMELTERS
John W. Watson and Kathryn J. Brooks. Mar. 1979. 131 p. refs.
(Contract EPA-68-02-2526)
(PB80-154065; MTR-7871; EPA-450/3-79-015) Avail: NTIS
HC A07/MF A01 CSCL 13B

The current standards are summarized and the status of applicable control technology and the ability of secondary lead smelthers to meet the current standards are examined. Compliance test results are analyzed and a recommendation made to retain the current standard. Information used in this report is based upon data available as of November 1978. GRA

N80-27852# SRI International Corp., Menlo Park, Calif.
REMOTE MEASUREMENTS OF AIR POLLUTANTS. Final Report
E. R. Murray and R. L. Byer (Stanford Univ.). Jan. 1980. 98 p. refs.
(Grants NSF GI-38986; NSF AEN-73-10596; NSF ENV-73-10596; NSF ENV-77-10198; SRI Proj. 2687; SRI Proj. 6892)
(PB80-164791; NSF/RA-800014) Avail: NTIS
HC A05/MF A01 CSCL 14B

The development and demonstration of laser techniques for performing remote measurements of air pollutants are described. The investigation focused on the differential absorption laser radar or DIAL technique to detect trace constituents of the atmosphere. DIAL system measurements of NO2, SO2, O3, HCl, CH4, N2O, H2O, and CH2 – CH2 in various spatial regions demonstrate the feasibility of obtaining remote measurements at high sensitivity and long range using currently available technology. Applications of this research encompass measurement of the environment, exploration of new energy resources, and military uses. Specific applications of the DIAL systems include enforcement of air pollution regulations, testing air pollution models, and explorations of regions of geothermal activity. DIAL systems are being investigated for petroleum exploration. GRA

N80-27853# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
AIR RESOURCES LABORATORIES ATMOSPHERIC TRANSPORT AND DISPERSION MODEL (ARL-ATAD)
Jerome L. Heffter. Feb. 1980. 31 p. refs.
(PB80-163652; NOAA-TM-ERL-ARL-81; NOAA-80030501)
Avail: NTIS HC A03/MF A01 CSCL 13B

The Air Resources Laboratories Atmospheric Transport and Dispersion Model (ATAD) is oriented toward practical application for pollution studies. Each trajectory is calculated using transport winds averaged in a vertical layer. Dispersion calculations are made for the forward trajectories. Standard model output includes tables of transport layer depth, maximum vertical wind shear in the transport layer, and trajectory position. Optional output includes trajectory plots and maps of time averaged surface air concentrations and deposition amounts. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-27854 California Univ., Berkeley.
FINITE ELEMENT MODELLING OF TORSIONAL EIGENVIBRATIONS OF THE EARTH. Ph.D. Thesis
James Fairman Stifler. 1979. 96 p.
Avail: Univ. Microfilms Order No. 8014896

A numerical algorithm of how the Earth vibrates was developed. Finite elements allow a realistic three dimensional Earth to be modelled having both radial and lateral variations in seismic properties. Numerical algorithms are produced that yield efficient estimations of the nondegenerate eigenfunctions and eigenfrequencies of this laterally inhomogeneous spheroid. These serve as quite independent alternatives to previous mathematical methods to study this problem. The algorithms rely upon Rayleigh's Variational Principle to solve the finite element eigenproblem. The Earth model used is perfectly elastic and nonrotating. The deviations in eigenfrequencies due to the structural contrasts between the continents and the oceans are found to increase with increasing order of oscillation. The variations of the amplitudes of the eigenfunctions of these oscillations are seen to have a significant global variation. The lower order models show a latitudinal dependence of the amplitudes that would be expected were the Earth a simple ellipsoid. The higher order modes have more longitudinal amplitude dependence as a result of the increased perturbation effects of the continents. Dissert. Abstr.

N80-27855 Cornell Univ., Ithaca, N. Y.
MAGMA MIGRATION. Ph.D. Thesis
Judson Lewis Ahern. 1979. 104 p.
Avail: Univ. Microfilms Order No. 8015628

The principles of magma migration by porous flow and convective upwelling are applied to the modeling of the thermal evolution of the moon. Radioactive heat-producing elements are concentrated in the first partial melts formed early in the moon's history. Subsequently, magma migration causes removal of heat-producing elements to the surface. Finite difference thermal modeling of the moon shows this effect to be important. Moon models which are initially hot may have a lower present-day heat flux than colder models. Two distinct melting episodes can arise due to radioactive element distribution. The first of these is responsible for the feldspathic lunar crust; the second melting episode, between 4 and 3 billion years ago, produced the mare basalts. Dissert. Abstr.

N80-27856 Pittsburgh Univ., Pa.
THE PALEOMAGNETISM OF THE CARBONIFEROUS STRATA IN THE NORTHERN APPALACHIAN BASIN WITH APPLICATIONS TOWARD MAGNETOSTRATIGRAPHY. Ph.D. Thesis
Stephen John Shulik. 1979. 305 p.
Avail: Univ. Microfilms Order No. 8015327

Rocks from the upper Devonian redbeds through the Pennsylvanian to the contact between the Pennsylvanian Allegheny and Conemaugh Groups from southwestern Pennsylvania and the proposed Pennsylvanian Stratotype in West

Virginia were sampled. The samples were sequentially demagnetized and measured using a superconducting rock magnetometer (ScT). The resulting data produced Virtual Geomagnetic Poles for these rocks. Several different pole groupings were noted: reverse and normal Carboniferous, present day, normal Cretaceous, and equatorial poles which can be interpreted as various combinations of the other four poles. Normal Carboniferous poles are recorded in the lower portion of the Wymp's Gap Limestone (Chesterian) and in the shales between the Lower and Middle Kittanning Coals (Desmoinesian). Dissert. Abstr.

N80-27857 North Carolina Univ. at Chapel Hill.
THE CONTRIBUTION OF OZONE ALOFT TO SURFACE OZONE MAXIMA Ph.D. Thesis
Roy Bruce Evans 1979 310 p
Avail: Univ. Microfilms Order No. 8013939

Three principal sources contribute to urban ozone concentrations: (1) background of baseline concentrations advected into the upwind side of the city; (2) entrainment of left-over ozone trapped above the noctural radiation inversion; and (3) the photochemical production of ozone from the reaction of local emissions (hydrocarbons and NOx and advected ozone and precursors. Contributions of these three sources to urban ozone concentrations were estimated by analysis of data collected on seven case days in St. Louis in 1976 as part of the Regional Air Pollution Study (RAPS). For the seven days examined the baseline concentrations being advected into the St. Louis area contributed fractions of the observed maximum O3 concentration ranging from 39% to 60%. Examination of the ambient monitoring data obtained with instrumented helicopters and from a surface monitoring network indicates that the O3 entering St. Louis on the upwind side was mixed downward from aloft and had been transported into the St. Louis area by nighttime winds above the nocturnal radiation inversion. Simulation of three of the seven case days with a physically simple photochemical box model indicates that the mechanism of entrainment is responsible for a relatively minor portion of the maximum city center O3 concentration (between 5 and 9%); advection of the ozone by winds after the breakup of the inversion is an important mechanism, however, contributing more than half of the ozone concentrations observed in the city center for the days modeled. Dissert. Abstr.

N80-27858 Idaho Univ., Moscow.
CAMBRIAN STRATIGRAPHY OF THE LIBBY TROUGH, MONTANA Ph.D. Thesis
Rolf Konrad Aadland 1979 323 p
Avail: Univ. Microfilms Order No. 8012065

Three exposures of Cambrian rocks occur as erosional remnants in the Libby Trough, Montana. The trough is a northwest-southeast striking faulted syncline, located between Thompson Falls and Libby, Montana. Three measured sections were obtained in the southernmost exposure, and one measured section each in the northern exposures. Nine hundred five samples were collected, stabbed, polished and described using a binocular microscope. Ninety representative thin sections were examined to verify the primary rock descriptions. Cambrian rocks throughout western Montana include a basal sandstone overlaid by a succession of two shale and two carbonate units in alternating sequence. Although the measured sections are incomplete, the carbonates can be subdivided into five lithologic units. Quartz arenites of the Flathead Formation (approximately 8 m thick) form the basal unit of the transgressive sequence. Shales with interbeds of shaley sandstones and shaley lime mudstones characterize the Wolsey Shale (approximately 75 m thick). The overlying carbonate sequence (Fishtrap dolomite) is about 915 m thick and is divided into five lithofacies. Dissert. Abstr.

N80-27859 Ohio State Univ., Columbus.
SPECTRAL ANALYSIS OF GEOS-3 ALTIMETER DATA AND FREQUENCY DOMAIN COLLOCATION Ph.D. Thesis
Kamil Eren 1980 157 p
Avail: Univ. Microfilms Order No. 8015872

The mathematical background in spectral analysis as applied to geodetic applications is summarized. In geodetic problems, there are usually discrete and nonperiodic data. The resolution of the GEOS-3 altimeter data was examined by determining the shortest wavelength recoverable. The data from some 18 profiles were used. The total power in the sea surface topography with respect to the reference ellipsoid as well as with respect to the GEM-9 surface was computed. A fast inversion algorithm for matrices of simple and block Toeplitz matrices and its application to least squares collocation is explained. This algorithm yields a considerable gain in computer time and storage in comparison with conventional least squares collocation. Frequency domain least squares collocation techniques are introduced and applied to estimating gravity anomalies from GEOS-3 altimeter data. These techniques also reduce the computer time and requirements in storage associated with the conventional least squares collocation. Dissert. Abstr.

N80-27860 California Univ., Berkeley.
COMPUTER-ORIENTED METHODS FOR ASSESSING RELIABILITY OF COMPLEX SYSTEMS Ph.D. Thesis
Randall Ramon Willie 1979 148 p
Avail: Univ. Microfilms Order No. 8014933

An important task in reliability analysis of a complex system is identification of the logical dependence of system performance on performance of components. An explicit description of this logical dependence, usually in terms of reliability minimal cut and patch set families was studied. These families are useful not only for evaluating reliability characteristics of a system but also as a design tool to guide system modification for enhancing reliability. The first problem to be considered is that of the determining families of critical failure modes when the logical relationship between system failure and failure of its subsystems and components can be modelled effectively as a Boolean logic tree, commonly called fault tree. Some new computer-oriented methods for deriving these failure modes from a system fault tree. The methods are based on a rapid procedure for decomposition of the fault tree and various subtrees. The structure of some complex systems may not be suitable for decomposition of the fault tree and various subtrees. The structure of some complex systems may not be suitable for development of a fault tree. Dissert. Abstr.

N80-27861 California Univ., Berkeley.
LOW-ENERGY PLASMA IN THE DAYSIDE AURORAL ZONE Ph.D. Thesis
Roy Banks Torbert 1979 68 p
Avail: Univ. Microfilms Order No. 8014908

Measurements of ions and electron in the energy range of 10 eV to 10 keV/Q are presented from the flights of two sounding rockets launched from Sondre Stromford, Greenland, into the dayside auroral zone at 09.00 MLT. Observations of energy versus time dispersion of precipitating ions indicate that H+ and He(++) were injected into the magnetosphere some 7 to 19 R sub E from the rocket probe. The spectra of these ions are consistent with solar wind origin. From the correlation of deviations from the expected ion dispersion curve and the onset of auroral electron precipitation, a region of parallel electric field is determined to exist within a few earth radio of the probe. Measurements of electron angular distributions support this conclusion. Implications of these measurements to the structure and dynamics of an open magnetosphere are presented in a qualitative model. Dissert. Abstr.

N80-27862 California Univ., Los Angeles.
COMPUTER SIMULATION OF A MAGNETOSPHERIC SUBSTORM Ph.D. Thesis
Moshe Harel 1980 143 p
Avail: Univ. Microfilms Order No. 8015982

Results of the first comprehensive computer simulation of the behavior of the earth's inner magnetosphere during a substorm-type event are reported. The model was tested for a substorm-type event that occurred on September 19, 1976. Satellite data (primarily from the Air Force S3-2 satellite) were used extensively both for boundary conditions and for comparisons with model predictions. Other data were also used as input for our time-dependent magnetic field and conductivity models. The S3-2 data for the event show some novel features, independent of the simulation. Dawn-dusk electric fields show a general correlation with the east-west magnetic field perturbations. Unexpectedly, two of the passes display substantial regions of sunward plasma flow poleward of the main part of the region-1 Birkeland currents. The cross-polar-cap potential drops

computed from the data represent the first effort at satellite monitoring of this important parameter during various phases of a substorm, and show an important enhancement during the substorm. Dissert. Abstr.

N80-27863 Purdue Univ., Lafayette, Ind.
THE KINETIC ENERGY CLIMATOLOGY OF TROPOSPHERIC AND LOWER STRATOSPHERIC FLOW REGIMES ASSOCIATED WITH 500 MB INTERMEDIATE AND SHORT WAVES OVER NORTH AMERICA Ph.D. Thesis
Yi-Tsuei Sheu 1979 113 p
Avail: Univ. Microfilms Order No. 8015517

A diagnostic analysis of total, vertical mean and vertical shear kinetic energy budgets for mid latitude 500 mb synoptic scale waves in the winter-spring season is presented. The data used were standard twice daily rawinsonde observations in 50 mb increments from surface to 100 mb over Southern Canada and the United States for December 1967, 1969 and March, April, 1970. Several conclusions can be drawn from the results of this study. (1) The generation and dissipation of kinetic energy balance each other in the boundary layer. (2) Although not balanced, a significant negative correspondence between the generation and the horizontal transport exists in the free atmosphere. Positive generation and horizontal flux divergence are observed in moist waves. (3) Both barotropic and baroclinic processes provide a source of kinetic energy to wave systems. Most of the baroclinic source is contributed in the boundary layer, although baroclinic processes extract energy from the waves in the free atmosphere. (4) Kinetic energy dissipation occurs primarily in the barotropic component of the flow. Baroclinic flow supplies energy from subgrid scale motions to the waves. (5) The energy is converted from the vertical shear to mean regimes. This vertical shear to mean kinetic energy conversion reveals that the atmosphere tends toward a more barotropic state at the expense of the baroclinic energy. Dissert. Abstr.

N80-27864 Cornell Univ., Ithaca, N. Y.
NUMERICAL SIMULATION AND THEORY OF STRONG IONOSPHERIC GRADIENT-DRIFT TURBULENCE Ph.D. Thesis
Michael John Keskinen 1978 286 p
Avail: Univ. Microfilms Order No. 8015763

Numerical and analytical studies are made of the nonlinear development of the gradient-drift or E x B instability using the mathematical model that describes the Type 2 irregularities in the E region equatorial electrojet. Using a two dimensional electrostatic fluid code with parameters typical of the daytime electrojet, the temporal and spatial power spectra are computed over a much larger range of wavelengths (9 to 128 m) than is presently studied with radar. The mean frequencies obtained agree well with linear theory except at short wavelengths while the linewidths are greater by up to an order of magnitude than the linear damping rates. For the linearly damped modes at a particular wavelength the linewidths increase with increasing electron drift velocity contrary to linear theory while at a fixed drift velocity the linewidths increase with decreasing wavelength. For three drift velocities the time averaged spatial power spectra are found to be essentially isotropic. Analytically, the direct interaction approximation of Kraichnan as modified by Kadomtsev is employed to develop a strong turbulence theory which predicts both a nonlinear wave damping, a power law for the two dimensional spectrum. Dissert. Abstr.

N80-27865 Pittsburgh Univ., Pa.
ROCKET BORNE COMPOSITION MEASUREMENTS OF THE LOWER THERMOSPHERE WITH A NEW TYPE OF INSTRUMENTATION: AURORAL SECONDARY ELECTRON ENERGY SPECTRA MEASURED WITH A NEW FORM OF CYLINDRICAL ANALYZER Ph.D. Thesis
Peter Wayne Erdman 1979 136 p
Avail: Univ. Microfilms Order No. 8015299

In an effort to improve measurements in several problem areas of atmospheric physics, two new instruments were developed for use onboard sounding rockets. Each provides significantly improved capabilities over devices previously available to researchers, and they make possible measurements which would otherwise be impractical or less precise. Both of these instruments have a multitude of laboratory as well as geophysical applications and are potentially of interest to workers in other fields. The first, which has been named the 'Optical Compsotion Spectrometer' (OCS), takes advantage of the characteristic emission spectra of an atom or molecule produced by electron impact in order to measure the absolute number density of that species. The second instrument is a new form of cylindrical, charged particle energy analyzer. This device features high energy dispersion, differential output, simple mechanical and electrical design, and high 'etendue'. Dissert. Abstr.

N80-27866*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH RESOLUTION INFRARED SPECTROSCOPY TECHNIQUES FOR UPPER ATMOSPHERIC MEASUREMENTS
David G. Murcray, ed. (Denver, Univ.) and Jose M. Alvarez, ed. May 1980 109 p refs Workshop held in Silverthorne Colo., 31 Jul. - 2 Aug. 1979
(NASA-CP-2134; L-13780) Avail: NTIS HC A06/MF A01 CSCL 04A

Infrared heterodyne techniques were considered primarily for detecting molecules predicted to be present but not yet detected in the upper atmosphere. For individual titles, see N80-27867 through N80-27870.

N80-27867*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXECUTIVE SUMMARY OF THE WORKSHOP ON HIGH RESOLUTION INFRARED SPECTROSCOPY TECHNIQUES FOR UPPER ATMOSPHERIC MEASUREMENTS
In its High Resolution Infrared Spectry. Tech. for Upper Atmospheric Meas. May 1980 p 1-32 refs (For primary document see N80-27866 18-46)
Avail: NTIS HC A06/MF A01 CSCL 04A

The role of high resolution techniques in measurements of trace gases in the stratosphere was assessed. The capabilities of proposed infrared instruments for measurements of stratospheric trace constituents were reviewed with particular emphasis on laser heterodyne techniques. R.C.T.

N80-27868*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE INFLUENCE OF NO AND ClO VARIATIONS AT TWILIGHT ON THE INTERPRETATION OF SOLAR OCCULTATION MEASUREMENTS
Robert Boughner, Jack C. Larsen (Systems and Appl. Sci. Corp., Hampton, Va.), and Murali Natarajan *In its* High Resolution Infrared Spectry. Tech. for Upper Atmospheric Meas. May 1980 p 39-53 refs (For primary document see N80-27866 18-46)
Avail: NTIS HC A06/MF A01 CSCL 04A

The influence of short lived photochemically produced species on solar occultation measurements of ClO and NO was examined. Time varying altitude profiles of ClO and NO were calculated with a time dependent photochemical model to simulate the distribution of these species during a solar occultation measurement. These distributions were subsequently used to calculate simulated radiances for various tangent paths from which mixing ratios were inferred with a conventional technique that assumes spherical symmetry. These results show that neglecting the variation of ClO in the retrieval process produces less than a 10 percent error between the true and inverted profile for both sunrise and sunset above 18 km. For NO, errors are less than 10 percent for tangent altitudes above about 35 km for sunrise and sunset; at lower altitudes, the error increases, approaching 100 percent at altitudes near 25 km. the results also show that average inhomogeneity factors, which measure the concentration variation along the tangent path and which can be calculated from a photochemical model, can indicate which species require more careful data analysis. R.C.T.

N80-27869*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPERIMENT CONCEPT TO MEASURE STRATOSPHERIC TRACE CONSTITUENTS BY LASER HETERODYNE SPECTROSCOPY
Frank Allario, James M. Hoell, Steven J. Katzberg, and Jack C. Larsen (Systems and Appl. Sci. Corp., Hampton, Va.) *In its* High Resolution Infrared Spectry. Tech. for Upper Atmospheric Meas. May 1980 p 55-79 refs (For primary document see

N80-27866 18-46)
Avail: NTIS HC A06/MF A01 CSCL 04A

Laser heterodyne spectroscopy (LHS) techniques were used to measure radical gases from Spacelab. Major emphasis was placed on the measurement of ClO, ClOnO2, HO2, H2O2, N2O5, and HOCl in solar occultation with vertical resolution less than or equal to 2-km and vertical range from 10 to 70-km. Sensitivity analyses were performed on ClO and O3 to determine design criteria for the LHS instrument. Results indicate that O3 and ClO vertical profiles can be measured with an accuracy more than or equal to 95% and more than or equal to 80%, respectively, over the total profile. R.C.T

N80-27870*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REVIEW OF SPECTROSCOPIC DATA FOR MEASUREMENT OF STRATOSPHERIC SPECIES
Aaron Goldman, ed. (Denver Univ.) and James Hoell, ed. *In its* High Resolution Infrared Spectry. Tech. for Upper Atmospheric Meas. May 1980 p 81-112 (For primary document see N80-27866 18-46)
Avail: NTIS HC A06/MF A01 CSCL 04A

The role of various infrared techniques in measurements of trace gases in the stratosphere were surveyed. Particular emphasis was placed on the role of instruments exhibiting ultrahigh resolution (i.e., less than or equal to 0.00/cm) such as laser heterodyne spectrometers. R.C.T.

N80-27871*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATIONS OF SATELLITE DATA RELAY TO PROBLEMS OF FIELD SEISMOLOGY
W. J. Webster, Jr., W. H. Miller, R. Whitley, R. J. Allenby, and R. T. Dennison (Computer Sciences Technicolor Assoc., Seabrook, Md.) Apr. 1980 112 p refs Submitted for publication
(NASA-TM-80673) Avail: NTIS HC A06/MF A01 CSCL 08K

A seismic signal processor was developed and tested for use with the NOAA-GOES satellite data collection system. Performance tests on recorded, as well as real time, short period signals indicate that the event recognition technique used is nearly perfect in its rejection of cultural signals and that data can be acquired in many swarm situations with the use of solid state buffer memories. Detailed circuit diagrams are provided. The design of a complete field data collection platform is discussed and the employment of data collection platforms in seismic network is reviewed. Author

N80-27872*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
REDUCING THE ERROR OF GEOID UNDULATION COMPUTATIONS BY MODIFYING STOKES' FUNCTION
Christopher Jekeli May 1980 55 p refs
(Grant NGR-36-008-161)
(NASA-CR-163316; Rept-301) Avail: NTIS HC A04/MF A01 CSCL 08E

The truncation theory as it pertains to the calculation of geoid undulations based on Stokes' integral, but from limited gravity data, is reexamined. Specifically, the improved procedures of Molodenskii et al. are shown through numerical investigations to yield substantially smaller errors than the conventional method that is often applied in practice. In this improved method, as well as in a simpler alternative to the conventional approach, the Stokes' kernel is suitably modified in order to accelerate the rate of convergence of the error series. These modified methods, however, effect a reduction in the error only if a set of low-degree potential harmonic coefficients is utilized in the computation. Consider, for example, the situation in which gravity anomalies are given in a cap of radius 10 deg and the GEM 9 (20,20) potential field is used. Then, typically, the error in the computed undulation (aside from the spherical approximation and errors in the gravity anomaly data) according to the conventional truncation theory is 1.09 m; with Meissl's modification it reduces to 0.41 m, while Molodenskii's improved method gives 0.45 m. A further alteration of Molodenskii's method is developed and yields an RMS error of 0.33 m. These values reflect the effect of the truncation, as well as the errors in the GEM 9 harmonic coefficients. The considerable improvement, suggested by these results, of the modified methods over the conventional procedure is verified with actual gravity anomaly data in two oceanic regions, where the GEOS-3 altimeter geoid serves as the basis for comparison. The optimal method of truncation, investigated by Colombo, is extremely ill-conditioned. It is shown that with no corresponding regularization, this procedure is inapplicable. Author

N80-27873*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Dept. of Space.
ASSESSMENT OF ATMOSPHERIC HEIGHT UNCERTAINTIES FOR HIGH PRECISION SATELLITE ALTIMETER MISSIONS TO MONITOR OCEAN CURRENTS
Julius Goldhirsh and John R. Rowland Jun. 1980 73 p refs
(Contract NASA Order P-78192; Contract N00024-78-C-5384)
(NASA-CR-156868; JHU/APL-SIR80U-018) Avail: NTIS HC A04/MF A01 CSCL 04A

The influence of the atmosphere on nadir directed signal associated with satellite altimeters are examined. Frequencies at 6, 13.5, and 35 GHz are selected so as to provide a parameter study. Uncertainties are summarized in both existing and proposed techniques which establish ionospheric and tropospheric height corrections. The error summary thus gives values describing the best you can do in height resolution (as dictated by atmospheric parameters) for a satellite borne altimeter system. The results presented reflect data gleaned from the literature, at large, as well as from the existing body of published literature associated with the Seasat A Altimeter Experiment. Specifically considered are: (1) the effects of precipitation on altimeter signals, (2) range errors due to refractive index variations in both the clear atmosphere (convective and nonconvective) and clouds, and (3) range errors introduced by the ionosphere. A preliminary analysis is pursued establishing the feasibility of incorporating rain rate range gates in a future satellite-borne altimeter system. F.O.S.

N80-27874# European Space Agency, Paris (France).
EUROPEAN EARTHQUAKE PREDICTION PROGRAM
T. D. Guyenne, ed. and G. Lavy, ed. Mar. 1980 218 p refs
Partly in ENGLISH and FRENCH Proceedings of Council of Europe Parliamentary Assem. and ESA Workshop on European Earthquake Prediction Program, Strasbourg, 31 Jan. - 1 Feb. 1980 Prepared jointly with Council of Europe, Strasbourg, France
(ESA-SP-156) Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The collection of geophysical data, the identifying of earthquake precursors, and the forecasting of earthquake events are considered. Various programs and projects covering seismogeneticity, seismotectonics, and the development of data collection systems are proposed, including cost estimates. Research emphasis is on the Iberian peninsula, the Italian peninsula, the area around Greece, and the North Anatolian fault zone. Methodology is explained, while a METEOSAT data collection system and a European data center are described. For individual titles, see N80-27875 through N80-27891.

N80-27875# Instituto Geografico Nacional, Madrid (Spain).
A BRIEF SUMMARY OF A PROPOSED PROGRAM FOR EARTHQUAKE PREDICTION AND THE STUDY OF PLATE DYNAMICS IN SOUTHWEST EUROPE
A. Lopez-Arroyo *In* ESA European Earthquake Prediction Program Mar. 1980 p 19-21 (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

A program to develop and test, on a seismically active zone, observational techniques for earthquake prediction, to measure the relative displacement of the Euro-Asiatic, African, and American plates, and to investigate the influence of such plate dynamics on the seismic energy release in a given area is proposed. The earthquake prediction experiment will be carried out in a zone selected from one of the two most active regions of Spain, Andalucia and Murcia, where recent earthquakes (Granada 1884, Torrevieja 1826) resulted in considerable damage and hundreds of casualties. Data handling techniques and cost considerations are discussed. Author (ESA)

N80-27876# Instituto Geografico Nacional, Madrid (Spain).
PROPOSED PROGRAM FOR EARTHQUAKE PREDICTION

IN SOUTHERN SPAIN
A. Lopez-Arroyo *In* ESA European Earthquake Prediction Program Mar. 1980 p 23-35 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Southern Spain, included for the most part in the Alpine chain, and located close to the contact zone of two large plates (Eurasia and Africa) is the site of a seismic activity responsible for some catastrophic earthquakes in the past. A program to develop and test in this zone different techniques of earthquake prediction is proposed. Many techniques already tried in other regions will be tested, such as the study of past and present day seismicity (variation in time and space of geometric and dynamic focal parameters), the application of geodetic methods (repeated triangulations, trilaterations, and levelling), geophysical measurements relative to the Earth magnetic and gravity fields, tilt and strain recording, etc. It is hoped that the best suited techniques for earthquake prediction in each zone can be derived from the test. Data handling techniques and cost considerations are also discussed. Author (ESA)

N80-27877# Instituto Nacional de Meteorologia e Geofisica, Lisbon (Portugal).
INVESTIGATION OF PRECURSORS AROUND THE AZORES ARCHIPELAGO AND THE SEISMOGENETIC CAPACITY OF THAT AREA: MODELS OF THE EARTHQUAKE PROCESS ALONG THE BOUNDARY BETWEEN THE AFRICAN AND EURASIAN PLATES, AFFECTING THE PORTUGUESE TERRITORY
L. A. MendesVictor *In* ESA European Earthquake Prediction Program Mar. 1980 p 37-53 (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The behavior of the Earth's surface, mainly uplift and subsidence, were analyzed and models suggested that relate the changes in elevation to earthquakes are suggested. A program to monitor various earthquake precursors is proposed. Gravity measurements, strain measurements, tilt, magnetic field configuration, electrical resistivity, and seismic p and s wave velocities are all suggested for study. Data analysis for larger networks than the one proposed as well as comparison of results obtained for different regions are also brought up. For the moment the described project intends to study the time and space evolution of two seismic active structures and their seismogenetic capacity. Author (ESA)

N80-27878# Trieste Univ. (Italy). Ist. di Geodesia e Geofisica.
FEASIBILITY STUDY FOR THE TELETRANSMISSION OF DATA FROM GEOPHYSICAL NETWORK INSTALLED IN A SEISMIC AREA TO AN OPERATIONAL CENTER
C. Ebblin and M. Zadro *In* ESA European Earthquake Prediction Program Mar. 1980 p 57-66 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The possibility of transmitting geophysical data, first by radio from outlying data collection platforms to a central receiving station, then by telephone to a data processing center, is studied. A tilt and strain meter network located in Italy is used as an example. The earthquake prediction activities of this network are explained in detail. The scheme of the data teletransmission system is modular and is shown to be readily adaptable to any other kind of network with similar instrumentation. Transmission equipment specifications and data compatibility requirements are given. Author (ESA)

N80-27879# Trieste Univ. (Italy). Ist. di Miniere e Geofisica Applicata.
THE FEASIBILITY STUDY FOR ABSOLUTE MEASUREMENT MONITORING OF GRAVITY FIELD VARIATIONS, CONNECTED WITH INTERNAL MASS VARIATION
C. Morelli *In* ESA European Earthquake Prediction Program Mar. 1980 p 67-71 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Geodetic nets associated with high accuracy gravimetric networks, suitable for studying earthquake precursors are considered. A gravimetric network in Italy is described and two more for the same country are proposed. The development and improvement of the gravimeter in use is discussed. A cost estimate of the project covering the necessary field and laboratory work is included. Author (ESA)

N80-27880# Consiglio Nazionale delle Ricerche, Rome (Italy).
PROJECT FOR SEISMOGENETIC RESEARCH IN THE CALABRAIS ARC [PROJET DE RECHERCHE SUR LA SISMOGENESE DANS L'ARC CALABRIS]
In ESA European Earthquake Prediction Program Mar. 1980 p 73-83 refs In FRENCH Prepared jointly by Centre National de la Recherche Scientifique, Paris, France (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

A project for the study of a seismically active area in Italy is proposed. Investigations are to include data acquisition on the general geological structure of the region as well as on crust and upper mantle formations. Measurement techniques involve looking at the speed of propagation and attenuation of surface waves, at aeromagnetic data, and include gravimetric and differential magnetic field readings. Financing and data handling are also covered. Author (ESA)

N80-27881# Thessaloniki Univ. (Greece).
PROPOSAL FOR AN EARTHQUAKE PREDICTION PROJECT IN NORTHERN GREECE
E. Livieratos, B. C. Papazachos, and D. Vlachos *In* ESA European Earthquake Prediction Program Mar. 1980 p 87-97 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

An earthquake prediction program proposed for the Thessaloniki area (Greece) is presented. The zone where seismic, geophysical, and geodetic measurements will be performed is analyzed seismologically. Observation infrastructures along with the availability of instrumentation and software are discussed. Data handling is also considered. Author (ESA)

N80-27882# Paris-Sud Univ., Orsay (France).
IN SITU MEASUREMENTS OF CONSTRAINTS TO BE MADE IN GREECE [MESURES DE CONTRAINTES IN SITU EN GRECE]
C. Froidevaux *In* ESA European Earthquake Prediction Program Mar. 1980 p 99-100 refs In FRENCH (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

A project complementary to the earthquake prediction program in the Thessaloniki area is proposed. In situ measurements of neotectonic constraints are to be taken in the Aegean domain. Observation techniques include shallow drilling, the use of strain gages at the base of the shaft, and core sampling. The data to be obtained are considered as useful in explaining seismic mechanisms and in evaluating seismic risk. Author (ESA)

N80-27883# Paris-Sud Univ., Orsay (France).
CRUSTAL STRESS AND HEAT FLOW MEASUREMENT IN NORTHERN ANATOLIA
C. Froidevaux *In* ESA European Earthquake Prediction Program Mar. 1980 p 103-105 (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Earthquake precursor phenomena along the North Anatolian fault zone is considered in order to determine the crustal stress field associated with this major seismic zone. Only two other major intracontinental active shear zones comparable with that of North Anatolia are presently under study, the San Andreas fault system in California and the Alpine fault in New Zealand. It is suggested that the mechanical behavior of these three transcurrent faults be tested and compared. To this end it is of primary importance to determine best flow profiles and make series of in situ stress measurements. Techniques include the use of bore holes (300 m deep) for heat flow measurements and stress measurements based on hydrofracturing. Project cost considerations are also taken into account. Author (ESA)

N80-27884# Bonn Univ. (West Germany). Inst. fuer Theoretische Geodaesie.
A FIRST EUROPEAN JOINT EFFORT IN EARTHQUAKE PREDICTION RESEARCH

M. Bonatz, R. Meissner (Kiel Univ.), and J. Zschau (Kiel Univ.) *In* ESA European Earthquake Prediction Program Mar. 1980 p 107-122 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

An area along the trans-Anatolian fault zone in Turkey selected for an intensive study on earthquake precursor phenomena was based on historical and statistical data of earthquake occurence. As the nucleus of a European earthquake prediction program, including future measurements from space, three kinds of ground based experiments are proposed: (1) a geodetic experiment, i.e., high precision distance and angle measurements for the determination of pre-, co-, and post-seismic strain and creep phenomena; (2) a seismic experiment for measuring velocities and absorption in two perpendicular directions; and (3) a tiltmeter experiment, measuring surface tilt related to changes in elastic and inelastic parameters. The data handling system, including satellite data relay, and experiment cost are also considered.
Author (ESA)

N80-27885# Ankara Univ. (Turkey).
EARTHQUAKE PREDICTION RESEARCH FOR THE NORTHERN ANATOLIAN FAULT ZONE (TURKEY)
A. Isikara (Istanbul Univ.), R. Ates, and A. Guerpinar *In* ESA European Earthquake Prediction Program Mar. 1980 p 123-131 (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Various earthquake precursors observed in the Anatolian fault area are studied in order to contribute to earthquake prediction methodology. A precise knowledge of the rate of movement and strain accumulation on a time scale derived from tectonic theory is sought. Data are to be collected on microearthquakes, geodetics, tilt, seismic wave velocities, magnetic field changes, gravity field changes, and changes in ground water level. Public observations on anomalous events are also considered to be useful.
Author (ESA)

N80-27886# Imperial Coll. of Science and Technology, London (England).
AN OUTLINE PROPOSAL OF SOME AIMS, STRATEGIES AND OBJECTIVES
B. K. Atkinson *In* ESA European Earthquake Prediction Program Mar. 1980 p 135-155 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

Some general comments are made concerning the overall philosophy of earthquake hazard reduction. An outline is presented of the key areas that need studying in any European earthquake prediction program. Finally, a specific project for experimental studies of the physical mechanisms of earthquake sources is proposed. Phenomena to be studied include static fatigue leading to subcritical crack growth, dynamic fatigue in the development of fault rock, fracture healing processes, acoustic emission, and post failure events. The measurement of geophysical parameters is also proposed. Funding requirements are discussed.
Author (ESA)

N80-27887# Bureau de Recherches Geologiques et Minieres, Orleans (France).
SEISMOTECTONIC EVALUATION OF EUROPE, EXCLUDING THE BALKANS [EVALUATION SISMOTECTONIQUE DE L'EUROPE EXCEPTE LES BALKANS]
In ESA European Earthquake Prediction Program Mar. 1980 p 157-159 In FRENCH (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

A project to compile macroseismic historical data as well as tectonic instrument data so as to evaluate the geophysical structure of most of Europe is proposed. The end product is a 1/25,000,000 scale map showing the seismotectonic characteristics of the European continent. Emphasis is on the correlation of data confidence.
Author (ESA)

N80-27888# European Space Agency, Paris (France). Inst. fuer Meteorologie und Geophysik.
RESEARCH ON SPECIFIC MODELS FOR THE OCCURRENCE OF SIGNIFICANT EARTHQUAKES IN EUROPE
H. Berckhemer (Inst. fuer Meteorol. u. Geophys., Frankfurt am Main, West Germany) and G. Purcaru *In* ESA European Earthquake Prediction Program Mar. 1980 p 161-176 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The existence of regularities in the occurrence of earthquake events is discussed relative to European earthquake case histories. Emphasis is on identifying a pattern as to location, magnitude, and time of occurrence data. The concepts of seismic cycle and seismic gap in prediction models are described. As an example, the Yugoslavian earthquake (April 15, 1979; seven on the Richter scale) is examined. Results show this event could have been predicted using the presented method. A project to implement the method is porposed.
Author (ESA)

N80-27889# Freie Univ., Berlin (West Germany). Inst. fuer Geophysik.
FUTURE ASPECTS OF EARTHQUAKE PREDICTION RESEARCH
A. Vogel *In* ESA European Earthquake Prediction Program Mar. 1980 p 177-179 ref (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

An assessment of progress made towards the understanding of earthquake generation, both through experimental and theoretical approaches, is presented. Emphasis is on defining prediction constraints based on observations of strain physical properties, and seismotectonics. Particular reference is made to work being done in the North Anatolian fault zone.Author (ESA)

N80-27890# European Space Data Centre, Darmstadt (West Germany). Meteosat Data Management Dept.
THE METEOSAT DATA COLLECTION SYSTEM AND ITS POTENTIAL AS A DATA RELAY FOR GEOPHYSICAL MEASUREMENTS
R. Robson and H. Houet *In* ESA European Earthquake Prediction Program Mar. 1980 p 183-188 (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The Meteosat data collection and relay system is described. How this data system can be incorporated into a ground based data collection program is explained. Emphasis is on the relaying of geophysical data from observation sites spread out over a wide area to a central processing center. Application to earthquake prediction programs is suggested.
Author (ESA)

N80-27891# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. of Geophysics.
THE EUROPEAN-MEDITERRANEAN SEISMOLOGICAL CENTRE (EMSC)
S. Mueller *In* ESA European Earthquake Prediction Program Mar. 1980 p 189-193 refs (For primary document see N80-27874 18-46)
Avail: NTIS HC A10/MF A01; ESA, Paris FF 80

The European-Mediterranean Seismological Center and its activities are described. The objectives of this data processing center are (1) to initiate a system for the rapid determination of European and Mediterranean epicenters and to transmit the results as needed, (2) to gather all seismological data necessary for the functioning of the center in a unified format directly amenable to calculation in order to promote processing, and (3) to exchange data with other data centers.
Author (ESA)

N80-27892# Preussag A.G., Erdoel und Erdgas, Hannover (West Germany).
INVESTIGATION OF WAVE FREQUENCY AT DIFFERENT TRAVEL TIMES Final Report
Guenther Babbel, Ludwig Engelhard, and Carsten Schimanowski Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 42 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-77) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8.85

Changes of frequency spectra due to travel time and interbedded layers investigated using seismic field recordings, synthetic models, and model-seismic records (three layer model) are considered. Results of investigations to determine the absorption of seismic waves are presented. For individual titles, see N80-27893 through N80-27895.

N80-27893# Preussag A.G., Erdoel und Erdgas, Hannover (West Germany).
INVESTIGATION OF AMPLITUDE AND FREQUENCY IN SEISMIC REFLECTIONS: STUDY OF THE ABSORPTION OF REFLECTED SEISMIC STUDIES Final Report [AMPLITUDEN- UND FREQUENZUNTERSUCHUNGEN IN DER REFLEXIONSSEISMIK. ABSORPTIONSUNTERSUCHUNGEN AN REFLEXIONSSEISMISCHEN SIGNALEN]
G. Babbel (Technische Univ., Clausthal, West Germany) *In its* Invest. of Wave Freq. at Different Travel Times Dec. 1979 p 8-16 In GERMAN (For primary document see N80-27892 18-46)
Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8,85

A method of amplitude spectra division is presented to determine the absorption coefficient of a reflected seismic wave as a linear function of the frequency, while the Q factor becomes constant. It is demonstrated that classical methods for determination of absorption using real data cannot solve these problems. Theoretical consideration should give good results of the Q factor in case of va wavelets not superimposed by multiple events.
Author (ESA)

N80-27894# Preussag A.G., Erdoel und Erdgas, Hannover (West Germany).
EXPERIMENTS IN THE DETERMINATION OF SEISMIC WAVE ABSORPTION Final Report [ERFAHRUNGEN BEI DER BESTIMMUNG DER ABSORPTION SEISMISCHER WELLEN]
L. Engelhard (Technishce Univ., Brunswick) *In its* Invest. of Wave Freq. at Different Travel Times Dec. 1979 p 17-27 In GERMAN (For primary document see N80-27892 18-46)
Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8,85

Methods to test and refine investigative findings on the mechanism of seismic reflection are studied. Results lead to the development of an algorithm by which the absorption coefficient (defined as the proportional inverse of the Q factor) can be determined as a supplementary lithological parameter of seismogram readings.
Author (ESA)

N80-27895# Preussag A.G., Erdoel und Erdgas, Hannover (West Germany).
INVESTIGATION OF A SEISMIC MODEL USING A THREE LAYER MODEL Final Report [MODELLSEISMISCHE UNTERSUCHUNGEN AN DREI-SCHICHT-MODELLEN]
C. Schimanowski (Technische Univ., Berlin) *In its* Invest. of Wave Freq. at Different Travel Times Dec. 1979 p 28-37 In GERMAN (For primary document see N80-27892 18-46)
Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, Germany DM 8,85

The propagation of P and S waves through a laboratory test medium was studied. The medium consisted of an aluminum base to which was fixed a layer of PVC, then a layer of plexiglass, and finally a layer of Makrolon (three layer model). Horizontal and vertical velocity components as well as power spectra were measured and compared to known wave travel times for the various layers. A PDP 11/40 computer was used in the analysis.
Author (ESA)

N80-27896# Washington Univ., Seattle. Dept. of Electrical Engineering.
MULTIPLE SCATTERING EFFECTS ON TRANSMISSION THROUGH THE ATMOSPHERE Annual Summary Report, 1 Sep. 1979 - 31 Aug. 1980
Akira Ishimaru Apr. 1980 7 p refs
(Contract N00014-78-C-0723)
(AD-A083615; ONR-TR-2) Avail: NTIS HC A02/MF A01 CSCL 04/1

The work is directed to the investigation of the transmission characteristics of optical waves with wavelengths in the range of 1-15 micrometers through various atmospheric conditions including clouds, fog, turbulence, rain, hail, snow, and inhomogeneous layers. Progress was made in the areas of plane wave solution, beam wave solution, and pulse wave solution of

N80-27897# Utah State Univ., Logan. Space Measurements Lab.
DEVELOPMENT OF A SMALL ROCKET SYSTEM FOR CONDUCTIVITY MEASUREMENTS IN THE HIGH LATITUDE DISTURBED D-REGION IN SUPPORT OF ELF/VLF PROPAGATION STUDIES Final Report, 9 Oct. 1978 - 20 Jun. 1979
D. A. Burt, E. F. Pound, and G. D. Allred 30 Jun. 1979 27 p refs
(Contract DNA001-78-C-0342)
(AD-A083331; AD-E300715; DNA-5039F) Avail: NTIS HC A03/MF A01 CSCL 20/14

An ultra-miniature conductivity probe for small rocket applications has been developed for measurements within the lower atmosphere (D-region and below). The probe is contained within a MET rocket and may be launched from standard MET sites with a minimum of personnel and equipment. The measuring instrument is a miniature Gerdien condenser, which is ejected near apogee and is trailed by a starute to reduce descent speeds below sonic values. Accumulated data are transmitted via telemetry to a recording ground station. The initial application of this instrument was at the White Sands Small Missile Range on 14 December 1978. After payload ejection near apogee data were recorded for over an hour as the instrument descended on the starute. Some modifications are indicated, but basically the concept and experiment appear sound.
GRA

N80-27898# Air Force Geophysics Lab., Hanscom AFB, Mass.
A DISCUSSION OF ARCTIC IONOGRAMS Interim Report
R. A. Wagner and C. P. Pike 14 Apr. 1980 24 p refs Presented at AGARD Tech. Meeting, Lindau/Harz, West Germany, Sep. 1971
(AD-A083550; AFGL-TR-80-0120) Avail: NTIS HC A02/MF A01 CSCL 04/1

Example of arctic ionogram sequences, recorded on the AFCRL Flying Ionospheric Laboratory, are presented. The purpose of this paper is to show that: (a) ionogram sequences, recorded on arctic flights, facilitate the interpretation of oblique incidence echoes from E- and F-layer heights, (b) parameters of the arctic ionosphere can be mapped by using the 'auroral oval' as an ordering system, (c) vertical and oblique incidence echoes, appearing on ground station ionograms, can be interpreted in terms of the station's position relative to the auroral oval. The analysis of a three hour flight with 6 latitudinal scans underneath an auroral band shows the close relationship between auroral sporadic E echoes (Esa) and discrete aurora. The investigation of 49 latitudinal scans through the auroral oval during times of low magnetic activity revealed the existence of a particle produced E layer which is oval aligned, is 2 deg to 6 deg wide in corrected geomagnetic latitude and occurs at all corrected geomagnetic times. This layer produces the night E echoes. A new ionogram analysis procedure, which uses oblique incidence F-layer echoes, is demonstrated, and the feasibility of monitoring the latitude of the southern edge of the polar F-layer irregularity zone by using this new analysis procedure is demonstrated.
GRA

N80-27899# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
A METHOD FOR DIRECT DETERMINATION OF REAL HEIGHT FROM VIRTUAL HEIGHT DATA FOR THE AURORAL REGION OF THE IONOSPHERE Environmental Research Papers. Interim Report
Milton M. Klein 14 Nov. 1979 21 p refs
(AF Proj. 4643)
(AD-A083139; AFGL-TR-79-0276; AFGL-ERP-684) Avail: NTIS HC A02/MF A01 CSCL 04/1

As part of an effort to determine electron density profiles in the auroral region of the ionosphere, a method has been developed for directly calculating real height from virtual height data obtained at high latitudes. The essential ingredient of the method is the representation of the curved portion of the ordinary ray dispersion curve by an analytic form which reduces the virtual height - real height integral relation to a form of Abel's integral equation. Numerical checks indicate that the present method gives an accurate representation of the dispersion curve. The correctness of the present procedure has been verified for the case of a linear electron density profile. The present method will be applied

in the auroral region from virtual height data. The accuracy and convenience of the present method will be assessed by comparison of the results with those obtained from standard programs. GRA

N80-27900# Air Force Geophysics Lab., Hanscom AFB, Mass.
MARINE BOUNDARY LAYER SAMPLING, FLIGHT NO. 2 Environmental Research Papers. Interim Report
Ian D. Cohen 11 Oct. 1979 73 p refs
(AF Proj. 317J)
(AD-A083158; AFGL-TR-79-0242; AFGL-ERP-678) Avail: NTIS HC A04/MF A01 CSCL 04/2

On 22 March 1979, an instrumented MC-130E for cloud physics measurements by AFGL made a series of 8 min sampling passes at altitudes ranging from 100 to 1000 ft above the ocean surface off the coast of Washington. The flight profile was similar to that flown by the same aircraft on 10 July 1978 off the coast of California (AFGL-TR-79-0013). Winds were light, and the visibility generally was 7 miles or greater. Varying numbers of particles were detected in the 2 to 22 micrometer range at all levels. The number of particules was fairly constant with altitude; liquid water content (LWC) was about 0.001 g/cu m at all levels. This was in contrast to the 10 July 1978 flight, where LWC varied much more, both with height and location. The differences between the two flights are attributed to the lower windspeeds and the resultant fewer whitecaps observed on this second flight. GRA

N80-27901# Rome Air Development Center, Griffiss AFB, N.Y.
ULF/LF REFLECTIVITY OF THE POLAR IONOSPHERE Technical Report, 31 Dec. - 5 May 1979
Robert P. Pagliarulo, John P. Tuttle, John E. Rasmussen, Robert L. Coley, and Wayne I. Klemetti (Megapulse, Inc.) Oct. 1979 86 p refs
(AF Proj. 4600)
(AD-A083240; RADC-TR-79-273) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplementary data. GRA

N80-27902# SRI International Corp., Menlo Park, Calif.
EFFECTS OF IMPULSIVE HEATING EVENTS ON F-REGION CHEMISTRY AND ELECTRON DENSITY Topical Report, Mar. 1978 - Jul. 1979
John D. Kelly 31 Jul. 1979 41 p refs
(Contract DNA001-77-C-0042)
(AD-A083333; AD-E300727; NDA-5028T; HAES-Rept-81) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Chatanika incoherent rada was used to study the ionospheric effects of impulsive auroral heating events. In some cases, the time integrated auroral energy deposition is similar in magnitude to that expected from a high altitude nuclear event outside the fireball region. The resulting ionospheric effects are significant. The elevated temperatures and atmospheric heave contribute to s substantial change in F region ion chemistry, changing the domainant F region ion from atomic to molecular species. As a result, a significant depletion of the F region electron density occurs. Currently these effects are not accurately predicted by the nuclear codes, as the function of the codes is to predict the large-scale perturbations. The Chatanika radar data can be used to improve the ambient ionospheric models and to improve the predictions of F region changes resulting from sudden heating events. Author

N80-27903# Naval Research Lab., Washington, D. C. Geophysical Plasma Dynamics Branch.
NONLINEAR EQUATORIAL SPREAD F: SPATIALLY LARGE BUBBLES RESULTING FROM LARGE HORIZONTAL SCALE INITIAL PERTURBATIONS
S. T. Zalesak and S. L. Ossakow 6 Feb. 1980 44 p refs
Sponsored in part by DNA, Washington, D.C.
(AD-A083393; AD-E000391; NRL-MR-4154) Avail: NTIS HC A03/MF A01 CSCL 04/1

Motivated by the observations of large horizontal scale length equatorial spread F 'bubbles', we have performed numerical simulations of the nonlinear evolution of the collisional Rayleigh-Taylor instability in the nighttime equatorial ionosphere, using large horizontal scale length initial perturbations. The calculations were performed using a new, improved numerical code which utilizes the recently devaloped, fully multidimensional flux corrected transport (FCT) techniques. We find that large horizontal scale initial perturbations evolve nonlinearly into equally large horizontal scale spread F bubbles, on a time scale as fast as that of the corresponding small horizontal scale length perturbations previously used. Further, we find the level of plasma depletion inside the large scale bubbles to be appreciably higher than that of the smaller scale bubbles, approaching 100%, in substantial agreement with the observations. This level of depletion is due to the fact that the plasma comprising the large scale bubbles has its origin at much lower altitudes than that comprising the smaller scale bubbles. Analysis of the polarization electric fields produced by the vertically aligned ionospheric irregularities show this effect to be due to fringe fields similar in structure to those produced at the edge of a parallel plate capacitor. GRA

N80-27904# Technology Service Corp., Santa Fe, N. Mex.
EMPIRICAL STUDIES OF THE RELATIONSHIPS BETWEEN EMISSIONS AND VISIBILITY IN THE SOUTHWEST Interim Report, May 1978 - Mar. 1979
Marilyn Marians and John Trijonis Sep. 1979 118 p refs
(Grant EPA-802815)
(PB80-156136; EPA-450/5-79-009) Avail: NTIS HC A06/MF A01 CSCL 04A

Historical emission trends of SOx, NOx, and NMHC are determined year-by-year from 1948 to 1975 for four Southwestern states (Arizona, Colorado, Nevada, and Utah). Trends in visibility levels (medians and other percentiles) are documented for the period 1948-1976 at 12 airports in the Southwest. Two analyses are used to relate emission changes to variations in regional extinction levels. The first analysis examines the air quality changes associated with a 90 percent reduction of Southwestern SOx emissions during a nine month copper strike and estimates the extinction produced by SOx emissions on various spatial scales. The second analysis involves regression studies relating historical extinction levels from 1948-1975. Because of limitations in the analytical methods, there is a high degree of uncertainty in many of the results. However, the studies do provide insights into the effects of aerosol precursor emissions on extinction at various distances from sources. In the case of mesoscale effects of SOx in the Southwest, quantitative coefficients are proposed which link emissions to regional extinction. GRA

N80-27905# National Oceanic and Atmospheric Administration, Boulder, Colo.
THE NOAA SEL HF RADAR SYSTEM (IONOSPHERIC SOUNDER)
R. N. Grubb Oct. 1979 22 p refs
(PB80-160989; NOAA-TM-ERL-SEL-55; NOAA-80012206) Avail: NTIS HC A02/MF A01 CSCL 04A

The Space Environment Laboratory of the National Oceanic and Atmospheric Administration has developed a new general purpose computer based system for pulsed RF measurements of the ionosphere in the 100 kHz - 30 MHz frequency range. This is a development of the earlier Dynasonde concept to permit full digital signal processing of returned echoes, a dual channel receiver to enable faster measurements of wave polarization and direction of arrival, and a considerably enhanced data process and display capability. The system philosophy adopted is discussed and some details of the implementation and performance of the instrument are given. A number of instruments are now being produced for various institutions which will form the basis of a coordinated research program over the next ten years. GRA

N80-27906# California Univ., Los Angeles. Earthquake Lab.
CORRELATIONS OF SEISMIC VELOCITY WITH DEPTH IN SOUTHERN CALIFORNIA
Kenneth W. Campbell, Robert Chieruzzi, C. Martin Duke, and Marshall Leu Oct. 1979 52 p refs
(Grants NSF GI-44056; NSF ATA-73-0323)
(PB80-164080; UCLA-ENG-7965; NSF/RA-790386) Avail: NTIS HC A04/MF A01 CSCL 08K

Updated correlations relating seismic velocity and Poisson's

ratio with depth and various geotechnical parameters for different soil and rock classifications found in Southern California are presented. Prior data are incorporated with 48 new velocity measurements. Shear-wave and compressed wave velocity is presented together with supporting geotechnical data. Statistics are compared for each classification for surface and near surface waves and for Poisson's ratios. Correlations to depth are presented for a few of the classifications for which sufficient data are available. The geotechnical parameters significant to seismic velocity and Poisson's ratio include geologic age, gravel content, water table depth, dry density, and depth of overburden. GRA

N80-27907# National Oceanic and Atmospheric Administration, Boulder, Colo. World Data Center A for Solid Earth Geophysics.
GEOMAGNETIC OBSERVATIONS 1978
C. Sucksdorff, H. Nevanlinna, and K. L. Svendsen Nov. 1979 95 p refs Prepared in cooperation with Finnish Meteorological Inst., Helsinki
(PB80-146087; SE-21) Avail: NTIS HC A05/MF A01 CSCL 04A

Two hundred nine of the known geomagnetic observatories throughout the world are described. Based on response to a questionnaire distributed by the Working Group on Magnetic Observatories for the International Association of Geomagnetism and Aeronomy (IAGA), information on data reporting and exchange, recording instruments and methods of baseline control was obtained. The observatories are listed according to name, latitude and country. The questionnaire and IAGA resolutions concerning magnetic observatories adopted since 1963 are included. GRA

N80-27908# Colorado State Univ., Fort Collins. Dept. of Earth Resources.
APPLICATION OF GEOMORPHIC PRINCIPLES TO ENVIRONMENTAL MANAGEMENT IN SEMIARID REGIONS
S. A. Schumm, M. T. Bradley, and Z. B. Begin Colorado Water Resources Inst. Feb. 1980 57 p refs
(Contract DI-14-34-0001-7143)
(PB80-169303; COMPLETION-93; W80-04443; OWRT-B-150-COLO(2)) Avail: NTIS HC A04/MF A01 CSCL 08M

In many valleys of the semiarid West valley floors are either flat and vegetated without a channel, or they are gullied. Using previously collected data from the Piceance Creek area of western Colorado, it is possible to identify a valley-slope threshold above which, for a given drainage area, gullying is probable. Below this valley-slope threshold, the valley floors are stable; above it they are susciptable to gullying. When the relations and techniques developed in western Colorado were applied to the Chalk Bluffs area of northeastern Colorado, it was determined that valley width was also a significant factor determining valley stability, and a ratio of valley slope to valley width could be used to identify at a given drainage area a threshold zone of velley floor instability. GRA

N80-27735# Cologne Univ. (West Germany). Inst. for Geophysics and Meteorology.
RADIATION BALANCE AND RADIATION PROCESSES Final Report
E. Raschke *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 19-27 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27736# Kiel Univ. (West Germany). Inst. for Marine Research.
THE EARTH'S HYDROSPHERE AND CRYOSPHERE Final Report
W. Krauss *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 28-34 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27737# British Meteorological Office, Bracknell (England).
ATMOSPHERIC STRUCTURE AND COMPOSITION Final Report
K. Stewart *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 35-38 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27740# European Centre for Medium-Range Weather Forecasts, Reading (England).
ATMOSPHERIC MODELS
A. Wiin-Nielsen *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 51-62 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27741# Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).
STOCHASTIC PROCESSES IN THE ATMOSPHERE-OCEAN SYSTEM
K. Herterich *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 63-65 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27743# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.
RADIATIVE TRANSFER IN THE CLOUDY AND DUSTY ATMOSPHERE
J. Lenoble *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 75-81 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27744# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.
ENERGY TRANSPORT IN THE EARTH-ATMOSPHERE SYSTEM AND THE RADIATION BALANCE
H.-J. Bolle and P. Speth (Cologne Univ.) *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 83-89 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27746# Institut Royal Meteorologique de Belgique, Brussels.
SAMPLING PROBLEMS AND RADIATION BUDGETS: DATA REQUIREMENTS [PROBLEMES D'ECHANTILLONAGE ET BILANS RADIATIFS: LEUR PROBLEMATIQUE]
D. Crommelynck *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 95-102 refs In FRENCH; ENGLISH summary (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27749# Appleton Lab., Slough (England).
SATELLITE MEASUREMENTS OF ATMOSPHERIC TEMPERATURE
J. T. Houghton *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 123-127 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27750# Freie Univ., Berlin (West Germany).
THE INTERANNUAL VARIABILITY OF THE STRATOSPHERE
K. Labitzke *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 129-133 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27751# National Physical Lab., Teddington (England).
COMPOSITION OF THE MIDDLE ATMOSPHERE: STATUS AND PRIORITIES
J. E. Harries *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 135-142 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27752# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
OZONE MONITORING FROM SPACE

A. Ghazi *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 143-151 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27753# Technische Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
WATER VAPOR IN THE UPPER TROPOSPHERE AND IN THE STRATOSPHERE
H. Fischer *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 153-159 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-27909 Miami Univ., Fla.
RESPONSE TO SUBTROPICAL MARINE BOUNDARY-LAYER CLOUDINESS TO LARGE-SCALE FORCING Ph.D. Thesis
Howard Paul Hanson 1979 161 p
Avail: Univ. Microfilms Order No. 8014169

Clouds in the undisturbed trades are modeled with focus on the similarities and differences between the stratocumulus regime and the trade cumulus regime. Vertical mixing processes are separated into small scale quasi isotropic turbulence and large scale convective updrafts and compensating subsidence between the clouds. As a lowest order approach cloud area, lateral cloud entrainment and detrainment by evaporating clouds are taken to be constant with height. The budgets of heat and water are solved to obtain thermodynamic profiles in the boundary layer Cloud base is found as the lifting condensation level for near surface parcels and cloud top height is found by a simple closure on the small scale turbulence. The cloud base convective updraft velocity is found from a circulation integral of the vertical equation of motion. Results show that cloud area decreases with increasing surface temperature and decreasing large scale divergence. If the surface temperature is large enough or the large scale divergence low enough, the model breaks down corresponding qualitively to the onset of deep convection. Associated with decreases of cloud area is the result that the vertical mixing processes take on larger scales, i.e., the contribution of overall mixing by the convective updrafts increase relative to the small scale turbulence. Dissert. Abstr.

N80-27910 Florida State Univ., Tallahassee.
NUMERICAL SIMULATION OF HURRICANES USING RADAR AND SATELLITE-DERIVED RAINFALL Ph.D. Thesis
John Ernest Molinari 1979 141 p
Avail: Univ. Microfilms Order No. 8014139

Rainfall rates determined from airborne radar data and infrared satellite images are used to specify the heating rate in a three dimensional primitive equation simulation of Hurricane Anita (1977) on a 0.1 degree latitude-longitude mesh. Initial winds from all available sources are analyzed at several levels and initial pressure and temperature are computed via the reverse balance equation and hydrostatic equation. A dynamic initialization procedure is developed for hurricane models by specifying the time dependent heating during a twelve hour pre-forecast integration, after which the heating is computed internally by the model. The specified heating forces the initial wind and mass fields toward a realistic initial state, and produces improved 12 and 24 hour forecasts of both position and intensity compared to a control integration, for which the heating was computed internally by the entire period. Calculations indicate that a significant term in the momentum balance is the inward flux of momentum by azimuthal eddies at 200 mb. This large contribution is produced both by eddies associated with asymmetries in the rainfall pattern and interactions with the storm environment. Dissert. Abstr.

N80-27911 State Univ. of New York at Albany.
PRELIMINARY INVESTIGATIONS OF THE ELECTRICAL RESPONSE OF WATER SURFACES DURING MARINE THUNDERSTORMS Ph.D. Thesis
Ray Brewer Toland 1979 99 p
Avail: Univ. Microfilms Order No. 8014036

Laboratory and field experiments were devised and carried out to evaluate some of the effects of intense electric fields on water surfaces during marine thunderstorms. The field experiments included employment of: (1) corona-detection antennas on floats for measuring maximum potential gradients over water; (2) Faraday cages to determine space charge density near shorelines; and (3) long, thin, horizontal wires for measuring corona current and estimating potential gradients near shorelines. Laboratory experiments included use of physical models of Worthington jets and gentle waves for determining effective field intensification due to waves, and a laboratory simulator that produced intense bubbling and splashing in known electric fields for measuring electric current densities due to corona and levitated water drops. An explanation of each apparatus and a theory of its operation are given. Results from the field experiments indicate that during thunderstorms over water, surface electric fields often attain maximum values of 30 to 50 kV/m. Two values greater than 100 kV/m have been measured, and there is some evidence that short peak values of even greater magnitude occur. Corona current, electric field intensity, and space charge density data from marine thunderstorms on 30 July and 9 August 1978 were analyzed. When fields estimated at 30 kV/m occurred near brackish water, corona currents of 10E-6 A/m flowed from a long wire apparatus to ground. Space charge densities at the shoreline, in the presence of 5 m/sec sea breezes were commonly 1000 to 2000 el. ch. cmE-3 during the same storms. The sign of the space charge was usually positive near sea water and was negative near fresh water. Dissert. Abstr.

N80-27912 Utah Univ., Salt Lake City.
A CYLINDRICAL CLOUD MODEL FOR MICROWAVE AND INFRARED RADIATIVE TRANSFER-APPLICATIONS TO DEFENSE METEOROLOGICAL SATELLITE PROGRAM MICROWAVE SOUNDERS Ph.D. Thesis
Grant Clifford Aufderhaar 1980 160 p
Avail: Univ. Microfilms Order No. 8016358

Analytic solutions to the thermal radiative transfer equation for one and two dimensional cylindrical geometries for an isothermal cloud cylinder are derived using a truncated spherical harmonics expansion for the intensity and scattering phase function. Case studies are presented utilizing Defence Meteorological Satellite Program microwave sounder data along with standard meteorological data. Calculations for nonprecipitating and clear cases were similar and in good agreement with observations. Precipitating cloud cases were simulated well by the cylinder model, while the plane-parallel model failed in cases with higher rainfall rates. Finally, temperature profile retrievals were performed using the Air Force Global Weather Central statistical method. The method was shown to fail in case studies where there was a precipitating cloud in the field of view. Dissert. Abstr.

N80-27913*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACCURACY OF AIRCRAFT VELOCITIES FROM INERTIAL NAVIGATION SYSTEMS FOR APPLICATION TO AIRBORNE WIND MEASUREMENTS
Richard H. Rhyne Jul. 1980 15 p refs
(NASA-TM-81826; L-13616) Avail: NTIS HC A02/MF A01 CSCL 04B

An experimental assessment was made of two commercially available inertial navigation systems (INS) with regard to their velocity measuring capability for use in wind, shear, and long-wavelength atmospheric turbulence research. The assessment was based on 52 sets of postflight measurements of velocity (error) during a 'Schuler cycle' (84 minutes) while the INS was still operating but the airplane was motionless. Four INS units of one type and two units of another were tested over a period of 2 years after routine research flights similar to air-linetype operations of from 1 to 6 hours duration. The maximum postflight errors found for the 52 cases had a root mean square value of 2.82 m/sec with little or no correlation of error magnitude with flight duration. Using an INS for monitoring ground speed during

landway in a predicted high wind shear situation could lead to landing speeds which are dangerously high or low. L.F.M.

N80-27914*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

METEOROLOGICAL SATELLITES

Lewis J. Allison, ed., Abraham Schnapf (RCA Corp.), Bernard C. Diesen, III (USAF), Philip S. Martin (USAF), Arthur Schwalb (NOAA), and William R. Bandeen Jun. 1980 78 p refs Submitted for publication

(NASA-TM-80704) Avail: NTIS HC A05/MF A01 CSCL 04B

An overview is presented of the meteorological satellite programs that have been evolving from 1958 to the present, and plans for the future meteorological and environmental satellite systems that are scheduled to be placed into service in the early 1980's are reviewed. The development of the TIROS family of weather satellites, including TIROS, ESSA, ITOS/NOAA, and the present TIROS-N (the third generation operational system) is summarized. The contribution of the Nimbus and ATS technology satellites to the development of the operational-orbiting and geostationary satellites is discussed. Included are descriptions of both the TIROS-N and the DMSP payloads currently under development to assure a continued and orderly growth of these systems into the 1980's. Author

N80-27915*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

X-RAY SPECTRAL CONSTRAINTS ON THE BROAD-LINE CLOUD GEOMETRY OF NGC 4151

S. S. Holt, R. F. Muchotzky, R. H. Becker, E. A. Boldt, P. J. Serlemitsos, A. E. Szymkowiak, and N. E. White Jun. 1980 17 p refs Submitted for publication

(NASA-TM-80726) Avail: NTIS HC A02/MF A01 CSCL 04B

X-ray spectral data from NGC 4151 taken with the Einstein Solid-State Spectrometer (SSS) and the HEAO-1 A-2 experiment cannot be simply reconciled with absorption from a uniform column of cold gas. The SSS data can, however, be explained in terms of a clumped absorber with approximately 10% uncovered fraction and factor-of-two overabundances in Z equal to or greater than 14 elements relative to solar oxygen. It is shown that these and previously reported spectral and variability data can be quantitatively reconciled with absorption arising in the cold clouds responsible for the broad optical line emission if the cloud dimensions are small compared to the central source size. It is suggested that the lack of significant X-ray absorption observed from much higher luminosity Seyferts and quasars is a natural consequence of our picture for NGC 4151. Author

N80-27916*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A PRELIMINARY LOOK AT AVE-SESAME 2 CONDUCTED ON 19-20 APRIL 1979

Steven F. Williams, Nicholas Horvath (Texas A and M. Coll. Station), and Robert E. Turner Jun. 1980 58 p ref

(NASA-TM-78280) Avail: NTIS HC A04/MF A01 CSCL 04B

Preliminary information on data collected, synoptic conditions, and severe and unusual weather reported during the AVE-SESAME 2 period is presented. The information provides researchers a preliminary look at conditions during the AVE-SESAME 2 period. L.F.M.

N80-27917# World Meteorological Organization, Geneva (Switzerland).

CLIMATE MODELS: PERFORMANCE, INTERCOMPARISON AND SENSITIVITY STUDIES, VOLUME 1 Global Atmospheric Research Programme

W. Lawrence Gates, ed. Dec. 1979 615 p refs Proceedings of WMO/ICSU Joint Organizing Comm. Study Conf., Washington, D.C., 3-7 Apr. 1978 Prepared in cooperation with International Council of Scientific Unions, Rome 2 Vol.

(GARP-Publ-22-Vol-1) Avail: NTIS HC A99/MF A01

An overview and intercomparison was made of the seasonal climate simulation capability of different climate models, and of the various general circulation models in particular. Sensitivity studies which have been made with both general circulation models and statistical-dynamical models were reviewed. For individual titles, see N80-27918 through N80-27937.

N80-27918# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

OVERVIEW OF THE CLIMATE MODELING PROGRAM

J. Smagorinsky *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 1-12 (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The derivation of climate models from atmospheric general circulation models is described. The problems of predictability and validation in climate modeling are summarized, and the need for a global data set is indicated. The fundamental differences in opinion as to which physical processes are important in climate modeling are given as justification for greater diversity in research efforts. Author (ESA)

N80-27919# National Center for Atmospheric Research, Boulder, Colo.

REVIEW OF ATMOSPHERIC GENERAL CIRCULATION MODELS

C. E. Leith *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 13-22 refs Sponsored by NSF (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The application of general circulation models to the study of climate questions is reviewed. The climate noise problem arising from sampling fluctuations, and the nature of the climate signal or response to external forcing influences necessary for determining predictability of the second kind are discussed. The observed one year lagged correlation in summer temperatures in the North American continent and the observed spatial and temporal correlation properties of the Southern Oscillation in the equatorial Pacific region suggest the existence of slow physical processes coupled into the climate system for which model studies would be valuable. It is pointed out that the understanding of the atmospheric blocking phenomenon could have important consequences for predictions of the first kind arising from internal dynamical solutions of the equations of motion for the climate system. Author (ESA)

N80-27920# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

MODELS OF THE OCEAN CIRCULATION AND THE GLOBAL HEAT BALANCE

K. Bryan *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 23-40 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The questions as to what can be learned from existing models about the role of the oceans in the global heat balance, and the potential of ocean models for studying the problem are discussed. It is shown that the least known element in the global heat balance is the role of the ocean in transporting heat poleward and moderating the seasons by heat storage in the upper ocean. The few results available from model calculations that have been analyzed suggest that meridional overturning is the most important mechanism for transporting heat at low latitudes, with horizontal gyres and mesoscale eddies becoming important at higher latitudes. Also the thermohaline circulation and wind-driven overturning act together to transport heat poleward in the trade wind zone. At higher latitudes the wind-driven overturning and the thermohaline circulation tend to oppose each other, diminishing the effectiveness of the ocean meridional heat flux. Author (ESA)

N80-27921# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

CLIMATE SIMULATIONS WITH SPECTRAL MODELS OF THE ATMOSPHERE: EFFECT OF SPECTRAL TRUNCATION

S. Manabe, D. G. Hahn, and J. L. Holloway *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 41-94 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The climate simulation performance of three semi-spectral

models differing only in spectral resolution is evaluated and compared. As the spectral resolution is increased, tropical rainbelts become narrower and better defined, subtropical dry zones expand, and the sea level pressure gradient between the subtropics and subpolar regions increases. While these spectral models maintain a level of eddy kinetic energy which is less than observed, they tend to underestimate the transient component of eddy kinetic energy and overestimate the stationary component. In general, the spectral climate models are able to simulate many of the large scale features of climate, and the quality of the simulations tends to improve with increasing spectral resolution. Comparison is made between the performance of these semi-spectral climate models and that of finite difference climate models. With some exceptions, the simulated climate of the spectral models compare favorably with those of the finite difference models of comparable resolution. Author (ESA)

N80-27922# National Center for Atmospheric Research, Boulder, Colo.

PRELIMINARY ATMOSPHERIC SIMULATION WITH THE THIRD-GENERATION NCAR GENERAL CIRCULATION MODEL: JANUARY AND JULY

W. M. Washington, R. Dickinson, V. Ramanathan, T. Mayer, D. Williamson, G. Williamson, and R. Wolski. *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 95-138 refs Sponsored by NSF (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The first atmospheric simulation results from a general circulation model (GCM) are presented. Although the model is still undergoing development and the results should be viewed as preliminary, the model already shows a greatly improved wind and temperature structure. The computed outgoing longwave radiation and albedo are in good agreement with satellite measurements. The strengths of the midlatitude transports of momentum and sensible heat are up to observed values. Much of this improvement can be credited to better numerical treatment, changes in both solar and longwave radiation, inclusion of convective transports of momentum and moisture, and a method of treating the boundary layer and Earth's surface. Author (ESA)

N80-27923# Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.

PERFORMANCE OF THE OREGON STATE UNIVERSITY TWO-LEVEL ATMOSPHERIC GENERAL CIRCULATION MODEL

Michael E. Schlesinger and W. Lawrence Gates. *In* WMO Climate Models: Performance Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 139-206 refs (For primary document see N80-27917 18-47)

(Contract DAHC15-73-C-0181; Grants NSF ATM-77-16923; NSF ATM-77-26406)

Avail: NTIS HC A99/MF A01

A version of the two level atmospheric general circulation model was developed. The model simulates the large-scale distributions of January and July climate with reasonable accuracy including: the primary climatic variables of pressure, temperature, wind, cloudiness, and precipitation; the simulated meridional distribution of the meridional transports of zonal momentum, heat, and water vapor; the elements of the associated heat and hydrologic balances; and the seasonal energy cycle. The most prominent errors of the model are: a tropical Hadley circulation which is too strong and a midlatitude Ferrel circulation which is too weak in both hemispheres; precipitation and evaporation rates which are too large off the east coasts of the winter hemisphere continents; midlatitude stationary eddies and zonal winds which are too strong; and surface air temperatures which are too high in the winter polar regions. The causes of these errors appear to be related to the subgrid scale vertical flux of momentum and to the treatment of the boundary layer. Author (ESA)

N80-27924*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPARISONS OF OBSERVED SEASONAL CLIMATE FEATURES WITH A WINTER AND SUMMER NUMERICAL SIMULATION PRODUCED WITH THE GLAS GENERAL CIRCULATION MODEL

M. Halem, J. Shukla (MIT, Cambridge), Y. Mintz (California Univ., Los Angeles), M. L. Wu (NAS-NRC), R. Godbole (NAS-NRC), G. Herman (Wisconsin Univ., Madison), and Y. Sud (Sigma Data Services Corp., Inc.) *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 207-253 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01 CSCL 04B

Results are presented from numerical simulations performed with the general circulation model (GCM) for winter and summer. The monthly mean simulated fields for each integration are compared with observed geographical distributions and zonal averages. In general, the simulated sea level pressure and upper level geopotential height field agree well with the observations. Well simulated features are the winter Aleutian and Icelandic lows, the summer southwestern U.S. low, the summer and winter oceanic subtropical highs in both hemispheres, and the summer upper level Tibetan high and Atlantic ridge. The surface and upper air wind fields in the low latitudes are in good agreement with the observations. The geographical distributions of the Earth atmosphere radiation balance and of the precipitation rates over the oceans are well simulated, but not all of the intensities of these features are correct. Other comparisons are shown for precipitation along the ITCZ, rediation balance, zonally averaged temperatures and zonal winds, and poleward transports of momentum and sensible heat. Author (ESA)

N80-27925# Meteorological Office, Bracknell (England).

THE METEOROLOGICAL OFFICE 5-LAYER GENERAL CIRCULATION MODEL

A. Gilchrist. *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 254-295 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

After a brief description of the main features of the model, results are presented for two separate integrations in which the sea surface temperature, ice cover, and radiation parameters were maintained at their climatological values for January and July. Standard deviations of quantities were calculated from values sampled at daily intervals during the simulation periods. These include sea level pressure, mean 500 mb height, mean rainfall, zonal wind speed, mean meridional circulation, heat transport, zonal momentum transport, and water vapor transport. Author (ESA)

N80-27926# Australian Numerical Meteorology Research Center, Melbourne.

A SIMULATION OF THE JANUARY GLOBAL CIRCULATION USING A SPECTRAL MODEL

B. McAvaney, W. Bourke, and K. Puri. *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 296-317 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The model uses a semi-implicit time integration algorithm for computational economy, has nine levels in the vertical, and employs a horizontal resolution of up to wave number 15 (rhomboidal truncation). The physical parameterizations employed follow closely those of GFDL. Comparisons of model results from the last 30 days of a 104 day integration for perpetual January insolation are made with observed values, for mean sea level pressure, wind field, temperature, 500 mb geopotential field, precipitation, and radiation flux. Author (ESA)

N80-27927# Akademiya Nauk SSSR, Novosibirsk. Computer Center.

NUMERICAL SIMULATION OF THE GLOBAL CIRCULATION OF THE ATMOSPHERE

G. I. Marchuk, V. P. Dymnikov, V. N. Lykosov, V. Ya. Galin, I. M. Bobyleva, and V. L. Perov. *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 318-370 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

A description of the model is presented, which, while based upon previous work in the field, introduces some improvements into the process of constructing the difference approximation of differential equations without violating the properties of initial operators. This includes skew-symmetry of operators which makes

it possible to substantiate theoretically the stability of a computing process on the basis of the easily determined law of conservation of quadratic norms. In the model, the splitting up method serves as a methodological basis for the solution of the difference equations. Theoretical substantiation of the method was consecutively developed for all stages of its application. By employing this method, it is possible to eliminate a strict stability criterion, replacing it with an 'easier' and natural approximation criterion. Two numerical experiments on the simulation of mid-January circulation of the atmosphere were made. Comparisons of the calculated and observed global values of kinetic and available potential energy, and other parameters, indicate that the model can be useful for climate simulation studies.

Author (ESA)

N80-27928# Main Geophysical Observatory, Leningrad (USSR).
SIMULATION OF JANUARY CLIMATE WITH A GENERAL CIRCULATION MODEL
V. R. Meleshko, B. E. Shneerov, M. E. Shvets, L. R. Dmitrieva, G. V. Parshina, C. V. Bogachenko, V. A. Ponomarev, E. P. Yushina, L. H. Magazenkov, and D. A. Sheinin. *In* WMO. Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1. Dec. 1979. p 371-408. refs (For primary document see N80-27917 18-47)
Avail: NTIS. HC A99/MF A01

The model is described briefly. Simulation of the January climate was chosen because the atmospheric processes associated with the development and realization of baroclinic instability, as well as interactions between the oceans and the atmosphere, are well exposed in the winter. Comparisons of model output with observations show that the model is capable of simulating some general features of the mean atmospheric circulation in January, namely the temperature, wind and sea surface pressure distributions and the heat and water balance components. Deficiencies of the model concern the inadequate vertical resolution of the model atmosphere, which causes some problems in the description of the heat sources, and poor spectral selectivity of the horizontal diffusion scheme used. The diffusion scheme, based on the deformation approach, damps disturbances with wavenumbers 1 to 4 rather significantly. The ratio of the eddy kinetic energy to zonal energy is approximately 0.28 for January in the present version of the model. Author (ESA)

N80-27929# Atmospheric Environment Service, Downsview (Ontario).
THE ATMOSPHERIC GENERAL CIRCULATION MODEL
G. J. Boer and N. A. McFarlane. *In* WMO. Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1. Dec. 1979. p 409-460. refs (For primary document see N80-27917 18-47)
Avail: NTIS. HC A99/MF A01

The model, in the developmental stage, contains the following features which make it appreciably different from others: spherical harmonic representation of the variables in the horizontal, semi-implicit time stepping, and subgrid scale diffusion of the Leith type. The model is described in some detail. A 90 day integration using as initial conditions an analysis from the GARP global data set for 4 Nov. 1969 was made. The results, although exhibiting certain apparent difficulties, are not widely at variance with the results of other general circulation models (GCM) or with the observed atmosphere. In particular, the use of a spectral model, together with an appropriate formulation of subgrid-scale dissipation, has apparently overcome one of the shortcomings of grid-point GCM s, namely that of insufficient eddy kinetic energy. Author (ESA)

N80-27930# National Center for Atmospheric Research, Boulder, Colo.
RESPONSE OF THE NCAR GENERAL CIRCULATION MODEL TO CHANGED OCEAN SURFACE TEMPERATURE
R. M. Chervin. *In* WMO. Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1. Dec. 1979. p 461-481. refs. Sponsored by NSF (For primary document see N80-27917 18-47)
Avail: NTIS. HC A99/MF A01

Several prescribed change experiments with various versions of the NCAR general circulation model which attempt to assess the sensitivity of the model to changed ocean surface temperatures are reviewed. One such experiment involving altered temperatures in the tropical eastern Pacific Ocean is discussed in detail. The model response in this case features a relative thermally direct circulation driven primarily by the latent heat of condensation. The interaction between the dynamics and thermodynamics is evident since the maximum atmospheric response (in terms of cloudiness and precipitation) to increased ocean surface temperature occurs westward of the largest temperature increases, and the subtropical jet stream north of the prescribed change region is significantly affected. Furthermore, these model results indicate that at least this particular version of the NCAR general circulation model is relatively more sensitive to tropical as opposed to midlatitude ocean surface temperature anomalies. Author (ESA)

N80-27931# Meteorological Office, Bracknell (England).
STATISTICAL ASSESSMENTS OF SEA TEMPERATURE ANORMALY EXPERIMENTS
P. R. Rowntree. *In* WMO. Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1. Dec. 1979. p 482-500. refs (For primary document see N80-27917 18-47)
Avail: NTIS. HC A99/MF A01

Two aspects of the statistical assessments of anomaly experiments carried out with atmospheric models are described. The first concerns the interpretation of results of Student's t-test with particular reference to assessing the probability of particular results occuring by chance. The second concerns a correlation technique which can be applied with small samples or when a pair (control and anomaly) of experiments are made with different models. The effects of extratropical anomalies were not detectable using these statistical techniques. The tropical anomalies studies produce highly significant effects in the model tropics. The t-test provides strong evidence of significant effects in other latitude bands, especially the subtropics and (for the tropical Pacific anomalies) middle latitudes of the Northern Hemisphere.

Author (ESA)

N80-27932*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
EFFECT OF A PACIFIC SEA-SURFACE TEMPERATURE ANOMALY ON THE CIRCULATION OVER NORTH AMERICA: A NUMERICAL EXPERIMENT WITH THE GLAS MODEL
J. Shukla (MIT, Cambridge) and B. Bangaru (Sigma Data Services Corp., Inc.). *In* WMO. Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1. Dec. 1979. p 501-518. refs (For primary document see N80-27917 18-47)
Avail: NTIS. HC A99/MF A01. CSCL 04B

A numerical experiment was carried out to determine the effect of sea surface temperature anomalies over the Pacific on the circulation over North America. The sea surface temperature (SST) anomaly pattern chosen for this study was similar to the one observed during January 1977. It is shown that a cold sea surface temperature anomaly over the Pacific produces a strong southward flow over the United States and colder temperature in eastern Canada and the United States, as it was observed during the 1977 winter. The results indicate that the SST anomaly over the Pacific can produce a significant downstream effect over the continental United States. Author (ESA)

N80-27933# Reading Univ. (England). Atmospheric Modelling Group.
A SIMPLE MODEL OF THE ATMOSPHERIC RESPONSE TO A TROPICAL SEA-SURFACE TEMPERATURE ANOMALY
B. J. Hoskins and A. J. Simmons. *In* WMO. Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1. Dec. 1979. p 519-524. refs (For primary document see N80-27917 18-47)
Avail: NTIS. HC A99/MF A01

The linearized barotropic vorticity equation is used, with tropical forcing of divergence, to model the effect of the temperature anomaly on the 300 mb flow. The 30 day averages produced by a hemispheric model using the winter climatological zonal flow and an elliptical forcing show good agreement with the observed January 1963 height field anomaly. Author (ESA)

N80-27934# International Institute for Applied Systems Analysis, Laxenburg (Austria).
GENERAL CIRCULATION MODEL EXPERIMENTS USING

GLACIAL PERIOD AND RELATED BOUNDARY CONDITIONS

Jill Williams *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 525-537 refs (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The NCAR general circulation model was used to simulate the atmospheric circulation with boundary conditions representing those of the last glacial period maximum and a July with extensive snow cover and glacial period sea surface temperatures. A January and July control case was run with present day boundary conditions (albedo, orography, and sea surface temperature). Results of the experiments are presented for the following parameters: sea level pressure; pressure at 6 km; the zonally averaged u component of the wind; and cyclone tracks. Surface temperature, kinetic energy, Hadley circulation, and specific humidity variability are also discussed. Author (ESA)

N80-27935*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.

THE RESPONSE OF THE GODDARD GENERAL CIRCULATION MODEL TO SEA ICE BOUNDARY CONDITIONS

G. G. Herman (Wisconsin Univ., Madison) and W. T. Johnson (Sigma Data Service Corp., Inc.) *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 538-562 refs (For primary document see N80-27917 18-47)

(Grant NsG-5152)

Avail: NTIS HC A99/MF A01 CSCL 04B

The effect of variation in the location of Arctic sea ice boundaries on the model's mean monthly climatology was examined. When sea ice boundaries were at their maximum extent the differences resulted in the January-February climatology. Sea level pressure was higher over the Barents Sea, in the Davis Strait, and in the Sea of Okhotsk. Pressure was lower by as much as 8 mb in the North Atlantic between Iceland and the British Isles, and in the Gulf of Alaska. Pressure rises in the eastern subtropical regions of the North Atlantic and North Pacific accompanied pressure falls in the Gulf of Alaska and Icelandic region. Geopotential heights at 500 mb were more than 100 gpm lower in the Bering Sea, and more than 120 gpm lower in the Icelandic region. Zonally averaged temperatures were cooler by 4 deg C below 3800 mb between 50 deg and 70 deg N with little change elsewhere. Zonally averaged geopotentials were lower by as much as 70 gpm in the mid-troposphere between 50/-70 deg N and zonal winds increased by as much as 3 m/s in the mid-troposphere between 35/-50 deg N. Author (ESA)

N80-27936# National Center for Atmospheric Research, Boulder, Colo.

RESPONSE OF THE NCAR GENERAL CIRCULATION MODEL TO CHANGED LAND SURFACE ALBEDO

Robert M. Chervin *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 563-581 refs Sponsored by NSF (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

A series of experiments with a July version of the model was performed to assess the model's response to changes in the prescribed surface albedo for the United States High Plains and the Sahara Desert. These experiments confirm the earlier hypothesis that large scale increases in surface albedo result in reduced precipitation over the prescribed change region and increased precipitation to the south. The statistical significance of the results (both local and global), the physical mechanisms involved, and implications for desertification are discussed. Author (ESA)

N80-27937# National Center for Atmospheric Research, Boulder, Colo.

SAMPLING CONSIDERATIONS IN ESTIMATING SECOND MOMENT CLIMATE QUANTITIES

Robert M. Chervin *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 1 Dec. 1979 p 582-606 refs Sponsored by NSF (For primary document see N80-27917 18-47)

Avail: NTIS HC A99/MF A01

The inherent variability which exists in the climatic means (monthly, seasonal, etc.) simulated by general circulation models (GCM's) is an analog to the natural variability occurring in real atmospheric statistics derived from observations in several different years. From a sampled ensemble of five independent realizations of a perpetual January version of the NCAR GCM, it is also shown that considerable inherent variability exists in the time average estimates of variance of model fields, that is, there is a sizeable variance of the variance. For this same sampled ensemble, estimates are made of the characteristic time (T sub 0) between effectively independent sample values. These estimates are based on the estimated time average variances and the variances of the means of the means for each realization. Due to sampling consideration, uncertainties also exist in these estimates of T sub 0. Author (ESA)

N80-27938# World Meteorological Organization, Geneva (Switzerland).

CLIMATE MODELS: PERFORMANCE, INTERCOMPARISON AND SENSITIVITY STUDIES, VOLUME 2 Global Atmospheric Research Programme

W. Lawrence Gates, ed. Dec. 1979 449 p refs Proceedings of WMO/ICSU Joint Organizing Comm. Study Conf., Washington, D.C., 3-7 Apr. 1978 Prepared in cooperation with International Council of Scientific Unions, Rome, Italy 2 Vol.

(GARP-Publ-22-Vol-2) Avail: NTIS HC A19/MF A01

An overview and intercomparison was made of the seasonal climate simulation capability of different climate models, and of the various general circulation models in particular. Sensitivity studies which have been made with both general circulation models and statistical dynamical models were reviewed. For individual titles, see N80-27939 through N80-27959.

N80-27939*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md. Lab. for Atmospheric Sciences.

ON THE SIMULATION OF THE OCEANIC GENERAL CIRCULATION

Y. Mintz *In* WMO Climate models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 607-687 refs (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01 CSCL 04B

Two global ocean simulations based on the physics of a highly viscous ocean are discussed, one having realistic atmospheric functions for calculating the thermal forcing of the ocean. The velocity field of this model compares reasonably well with the relatively small amount of real data available. Temperature and heat budget components of the model reproduce best the equatorial band of heating. A simulation based upon the physics of a weakly viscous ocean is described, which produces the correct pattern of isotherms. This model has not yet been run to thermal equilibrium. The Gulf Stream and eddies and their influence on the oceanic and atmospheric heat budgets are discussed in the terms of their importance in coupled ocean-atmosphere models. Author (ESA)

N80-27940# Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.

THE ANNUAL VARIABILITY OF SEA SURFACE TEMPERATURE: OBSERVATION AND SIMULATION

J.-W. Kim and W. L. Gates *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 688-714 refs (For primary document see N80-27938 18-47)

(Grant NSF OCE-76-80182)

Avail: NTIS HC A19/MF A01

The mean annual variability of the sea surface temperature on the large scale as determined from observations is simulated by two runs of an oceanic general circulation model with and without an imbedded surface mixed layer. The comparative simulations suggest a strong role of turbulent mixing in the mean annual variability of sea surface temperature, whereas an intercomparison of the observed annual variabilities of surface forcing functions and sea surface temperature suggests the importance of the advective redistribution of heat. The turbulent mixing and advection are likely to be important also in modeling the large-scale structure of the short-term interannual variability. Author (ESA)

N80-27941# Missouri Univ. -St. Louis. Dept. of Physics.
SIMPLE SEASONAL CLIMATE MODELS
G. R. North and J. A. Coakley (National Center for Atmospheric Research) *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 715-727 refs Sponsored by NSF (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

The largest scales of the zonally averaged temperature, albedo, infrared flux, and solar flux are represented by a few terms in a Fourier-Legendre expansion in latitude and a Fourier series in time. Prior to fitting, the data were symmetrized so that only data from the Northern Hemisphere were used. A simple energy balance climate model is constructed with diffusive heat transport and an albedo value jump on a snow line which follows a specific isotherm. In order to achieve the proper seasonal temperature field it is necessary to consider the land and ocean-covered areas separately. It is suggested that such models might be useful in the study of sensitivity of the temperature field to changes in various climate forming parameters.
Author (ESA)

N80-27942# National Center for Atmospheric Research, Boulder, Colo.
VERIFICATION OF PARAMETERIZATIONS IN CLIMATE MODELING
Stephen H. Schneider *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 728-751 refs Sponsored by NSF (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

The performance of climate models is discussed in relation to their response to externally forced physical changes. It is suggested that a satisfactory performance in the following areas will improve the confidence of the user in the veracity of the model: model resolution; physical comprehensiveness; performance of individual physical parameterizations against independent data; simulation of equilibrium climate data; and response to nature's sensitivity experiments (seasonal cycle, volcanic dust veils, orbital variations).
Author (ESA)

N80-27943# Missouri Univ. -St. Louis. Dept. of Physics.
RECENT WORK ON HEAT-BALANCE MODELS
Gerald R. North *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 752-765 refs Sponsored by NSF (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

The solution properties of climate models of the Budyko-Sellers type are surveyed. One group of model studies attempts to improve the parameterization in the heat balance equation with better formulas and the latest observational data. A second group involves theoretical studies which are attempts to understand the nature of the climate solutions in a way that is more or less independent of the numerical values of the various empirical constants. Slope stability theorems and parameter independent proofs for certain classes of models are discussed, particularly as they relate to the tendency of models which have ice lines attached to isotherms and assume a constant cloud cover function, to plunge to an ice-covered Earth. The extension of the simple models to include seasonal effect and their failure to explain the Milankovitch effect is mentioned.
Author (ESA)

N80-27944*# Maryland Univ., College Park. Meteorology Program.
THE PERFORMANCE OF A SEASONAL GLOBAL CLIMATIC MODEL. Ph.D. Thesis - MIT
Allan Robock *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 766-802 refs (For primary document see N80-27938 18-47) (Grants NsG-5208; NSF OCD-74-03969)
Avail: NTIS HC A19/MF A01 CSCL 04B

A seasonal global climatic model developed by Sellers is studied. Several changes are made to correct errors in the original model and to allow its use in a time dependent simulation mode. The major changes are in the infrared radiation formulation and in the size of the time steps. The seasonal cycles of surface temperature, wind, ice, snow, albedo, horizontal heat transport, and vertical flux of solar and infrared radiation are compared to recent observations. The seasonal cycle of temperature is fairly well reproduced, but has too small an amplitude in the Northern Hemisphere high latitudes. An overestimate of albedo at the poles is found, which is related to errors in some of the other variables. The sensitivity of the model to CO2 and solar constant (Q) changes is summarized. Doubling the CO2 amount causes a 2.45 K increase in global average surface temperature (T). Increasing Q by 1% increases T by 3.14K. Decreasing Q by 1% decreases T by 4.65K. An annual average version of the model is more sensitive to changes in Q than the model with the seasonal cycle.
Author (ESA)

N80-27945# Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
EQUILIBRIUM CLIMATIC ZONATION DEDUCED FROM A STATISTICAL-DYNAMICAL MODEL
B. Saltzman *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 803-841 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

A model containing a parameterization of the meridional eddy flux of momentum, as well as most of the important elements of a complete theory of the zonal mean state including the hydrologic cycle is described. The following approximations are applied to the hydrostatic equations governing the zonal and time averaged atmospheric variables: the climatic average is taken for a winter and summer half year; the atmosphere is assumed to be in an equilibrium state; transports due to stationary waves are neglected; and mean zonal motions are assumed to be negligible compared to the surface friction. Calculations for present global boundary conditions show that a satisfactory first approximation to the observed climatic zonation can be deduced, including tha main differences between the seasons and the hemispheres. There is agreement with observations for the energy fluxes and atmospheric heating. When the model is applied to the surface ice conditions prevailing during the glacial maximum at 17,000 BP, an equilibrium state is obtained that qualitatively agrees with other dynamical modeling experiments.Author (ESA)

N80-27946# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
EXPERIMENTS WITH SOME SIMPLE ZONAL AVERAGE AND LONG WAVE ATMOSPHERIC MODELS
A. A. White *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 842-851 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

Two models using Green's scheme for the parameterization of baroclinic eddies were designed to test the applicability of this scheme in climate-scale integration. Both are two parameter beta plane formulations. Integrations with the zonal average model made for winter and summer conditions give acceptable qualitative reproduction of atmospheric behavior, but with a weak mean meridional circulation. Integration with a long wave winter model shows that forced long waves contribute slightly to the total eddy flux of potential temperature, and more substantially to the total eddy flux of zonal motion.
Author (ESA)

N80-27947# California Univ., Livermore. Lawrence Livermore Lab.
PERFORMANCE OF THE LAWRENCE LIVERMORE LABORATORY ZONAL ATMOSPHERIC MODEL
G. L. Potter, H. W. Ellsaesser, M. C. MacCracken, and F. M. Luther *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 852-871 refs (For primary document see N80-27938 18-47) (Contract W-7405-eng-48)
Avail: NTIS HC A19/MF A01

The two dimensional model uses primitive conservation equations, and is designed to assess the potential climatic effects of atmosphere and surface perturbations, and to study climatic feedback mechanisms. The model is divided vertically into nine pressure layers. The prognostic variables are temperature, water vapor mixing ratio, surface pressure, and wind velocity. Surface fluxes of sensible heat and moisture and fractional cloud cover are calculated. Precipitation and convection are parameterized. The land surface boundary is divided into layers which may be

snow, ice, or land, with surface temperature calculated by type. The ocean is an isothermal layer 50 m thick, and accommodates sea ice of varying thickness and extent. Data from a two year integration of the seasonal version compare well with other general circulation model experiments and observations for cloud cover, precipitation, air temperature, evaporation, sensible heat flux, albedo, radiative flux, and reflected and absorbed solar radiation. Author (ESA)

N80-27948# Harvard Univ., Cambridge, Mass.
A SEVERELY TRUNCATED SPECTRAL MODEL
Isaac M. Held *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 872-880 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

Results from a two level primitive equation model are summarized in terms of its value in studying climate variability and sensitivity. Numerical experiments were conducted with a two wave, 3 to 6 model. In one set of experiments, surface albedo and cloud were fixed and the solar constant varied. Two versions of the model were utilized, one 'moist' and the other 'dry'. In the dry cases, the poleward flux increases 2.5% for each 1% increase in solar constant. This increase in poleward flux is sufficient to force the meridional temperature gradient to decrease slightly, in spite of the increased meridional radiation gradient. In the moist model, the potential temperature flux increases in high latitude, but not in low latitudes, as the solar constant increases. Other experiments were performed to study the large ice-cap instability. It was found that when the solar constant was lowered a few percent, the ice cap does become unstable to growth, but does not continue growing until the Earth is ice-covered. An additional decrease in the solar constant of 5% is required to destabilize it. Author (ESA)

N80-27949# Reading Univ. (England). Atmospheric Modeling Group.
TRANSPORTS BY NONLINEAR BAROCLINIC WAVES
B. J. Hoskins and A. J. Simmons *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 881-885 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

Integrations were made with a 15 layer primitive equation model which uses a spectral representation in the horizontal, truncated triangularly at total wavenumber N = 42. Some runs were made with a truncation at N = 63. A zonal flow is specified and, for a particular zonal wavenumber, the most unstable normal mode derived. The zonal flow plus the normal mode with a very small amplitude is then used as initial condition for a nonlinear integration. When averaged over their life cycles all the wavenumber 6 baroclinic waves give qualitatively similar transports of momentum and heat. The transport of momentum is principally poleward. The extreme life cycle values of the transport of momentum vary by almost a factor of 3. The wavenumber 9 heat transport remained low level but all the wavenumber 6 disturbances deepened such that the average heat transport varied little with depth. It is seen that baroclinic waves and their transports are very sensitive to wavenumber and to barotropic components in the basic flow. Linear theory does not give a good qualitative indication of momentum transports and gives little idea of the life cycle averaged values of any transport. Author (ESA)

N80-27950*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ENERGY-BALANCE MODEL OF GLACIATION CYCLES
M. Ghil (New York Univ.,) and K. Bhattacharya (Columbia Univ.,) *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 886-916 refs (For primary document see N80-27938 18-47)
(Grants NsG-5130; NsG-5136)
Avail: NTIS HC A19/MF A01 CSCL 04B

A one dimensional energy balance model is presented which contains a time lagged albedo to account for the delayed dependence of continental ice sheets on temperature; it also includes a smoothing of temperature gradients in the tropics to account for the effect of the Hadley circulation on the strong flattening of meridional temperature profiles there. The model exhibits finite amplitude, sustained free oscillations; these oscillations are triggered by a change in the insulation parameter and occur in the absence of any external forcing. This model behavior strongly suggests the possibility of an almost-intransitive mechanism playing a role in glaciation cycles. This behavior also occurs on shorter time scales which might be relevant to the interannual variability of the atmosphere. Author (ESA)

N80-27951# Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
A SIMPLE SEA-ICE/OCEAN-TEMPERATURE OSCILLATOR MODEL
B. Saltzman *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 917-933 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

An idealized, mechanistic, thermodynamic model was considered in which the Earth is covered by ocean and there are no seasonal variations. The rate of melting and freezing at the ice edge is determined from the surface heat balance condition. The heat balance condition includes downward flux of heat at the surface due to short and long wave radiation, atmospheric conduction and convection, evaporation, and subsurface conduction and convection. The ocean heat balance equation is integrated to obtain an equation for the rate of change of the mean ocean temperature. Physical constants and empirical values of climatic variables are used to evaluate the equilibrium values. A linear analysis is shown for one set of values showing the possibility that the terrestrial climatic system can exhibit internal free oscillations having periods ranging up to several thousand years. Author (ESA)

N80-27952# National Center for Atmospheric Research, Boulder, Colo.
ZONAL AND SEASONAL RADIATIVE EFFECTS OF A DOUBLING OF ATMOSPHERIC CARBON DIOXIDE CONCENTRATION
V. Ramanathan *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 934-946 refs Sponsored by NSF (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

Results are presented of the seasonal and latitudinal radiative heating of the surface and troposphere for a doubling of the CO_2 concentration from the present day value. It is shown that the vertical distribution of CO_2 radiative heating is a strong function of latitude. At the equator the tropospheric heating is a factor of 2.5 larger than the surface heating while at the polar regions the surface heating is larger than the tropospheric heating by a factor of about 2.5. The results also indicate that at the middle and high latitudes the heating is maximum during summer and minimum during winter. At high latitudes (i.e., poleward of 70/deg) the Southern Hemisphere heating rates are significantly smaller than the Northern Hemisphere heating rates. The seasonal, latitudinal, and interhemispheric differences in CO_2 heating rates are caused by: (1) the temperature dependence of the 15 micrometer Planck function and the opacity of CO_2 hot bands, and (2) the overlap of CO_2 and H_2O bands in the 12 to 18 micrometer region. Author (ESA)

N80-27953# General Motors Research Labs., Warren, Mich. Physics Dept.
INFLUENCE OF AIRBORNE PARTICLES ON THE EARTH'S RADIATION BALANCE
Ruth A. Reck *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 947-973 refs (For primary document see N80-27938 18-47)
Avail: NTIS HC A19/MF A01

The Manabe-Wetherald radiative-convective model with parameterized background aerosols was used to demonstrate the radiative, convective, and thermal role of aerosols. Aerosols are found to cool the atmosphere, reduce convection, and increase the planetary albedo. Global seasonal aerosol effects (due to surface albedo changes) are small but polar seasonal effects may be expected to be appreciable. Aerosol optical properties are found to be most important for small sized aerosols and for longer wavelengths. They have been demonstrated to produce nonlinear effects with other simultaneous parameter changes.

Background aerosols produce an order to magnitude less surface temperature change than the same percentage changes in surface albedo and relative humidity. Their thermal effect is one third as significant as the same percentage changes in CO2.

Author (ESA)

N80-27954# State Univ. of New York at Buffalo. Dept. of Biophysical Sciences.

HARMONIC ANALYSIS OF FEEDBACKS: A TRANSFER FUNCTION CLIMATE MODEL

Fred M. Snell, Paul S. Lee, and Paul Wolfson *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 974-994 refs (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01

The physics describing climate dynamics are represented in a series of operators that transform one climatic data set into another. The relationships between zonally averaged intra-annual climatological data sets are analyzed zone by zone, in order to calculate the cumulative annual gain and the net power weighted and properly phased gain. The calculated relationships are in effect transfer functions mapping one data set onto another either in time (within the annual cycle) or in space (along the meridional coordinate) or both. Annual averaged and zonally averaged climatic statistics are assembled sequentially in a closed loop to create an interannual climate model. It is shown that by altering the distribution of the solar insolation according to the astronomical theory of glaciation proposed by Milankovitch, the resultant temperature field at 71,000 and 24,000 YBP was consistent with that expected at the maximum of the last glacial period, whereas that of 11,000 YBP had markedly warmer poles, probably sufficient for glacial melt.

Author (ESA)

N80-27955# California Univ., Livermore. Lawrence Livermore Lab.

CLIMATE EXPERIMENTS: ALBEDO EXPERIMENTS WITH A ZONAL ATMOSPHERIC MODEL

G. L. Potter, H. W. Ellsaesser, M. C. MacCracken, and F. M. Luther *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 995-1001 refs (For primary document see N80-27938 18-47)

(Contract W-7405-eng-48)

Avail: NTIS HC A19/MF A01

Experiments were designed to simulate the climatic effects resulting from tropical deforestation and desertification from overgrazing. For the first experiment, the surface characteristics were modified for that fraction of the land surface type that could be characterized as tropical rain forest (0.34) in the latitudinal band from 5 deg N to 5 deg S. Model response included: reduced equatorial absorption of solar radiation; an increase in tropospheric lapse rates; a reduction in evaporation rate; weakened Hadley circulation; and an increase in precipitation in the latitude bands adjacent to the equator. The increased surface albedo and consequent reduced surface absorption of solar radiation associated with the desertification experiment resulted in a similar chain of events except that the effect on the Hadley circulation was reversed. These zonal model experiments with modified surface boundary conditions suggest an initial chain of feedback processes that is largest at the site of the perturbation with the possibility that self-induced growth of the subtropical deserts could serve as a possible mechanism to cause the initial global cooling that then initiates a glacial advance, thus activating the positive feedback loop involving ice-albedo feedback.

Author (ESA)

N80-27956# National Center for Atmospheric Research, Boulder, Colo.

DEVELOPMENT OF A SEASONALLY-VERIFIED PLANETARY ALBEDO PARAMETERIZATION FOR ZONAL ENERGY BALANCE CLIMATE MODELS

Starley L. Thompson *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 1002-1023 refs Sponsored by NSF (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01

A comparison of the monthly observations of planetary albedo was made with a parameterization using the Cess cloud albedo-zenith angle relationship in order to test the suggestion that the latitudinal variation in mean annual planetary albedo appears to be caused largely by the solar zenith angle dependence of the cloud albedo. The parameters and their derivation for ozone absorption Rayleigh scattering, water vapor absorption, dry and wet aerosol scattering, cloud, ocean, and land are shown. Computed and observed zonal distribution of the annual mean planetary albedo show good agreement, as does the seasonal variation. To estimate the relative influence that seasonal variation in temperature and solar zenith angle have on the planetary albedo, an experiment was performed in which the temperature is held fixed at each latitude at its mean annual value. This eliminates all temperature dependent seasonal albedo changes in the parameterization. The use of mean annual temperatures reduces the seasonal albedo variation by about one third.

Author (ESA)

N80-27957# Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.

VIEWS OF THE FUTURE DEVELOPMENT, APPLICATION AND VALIDATION OF GENERAL CIRCULATION MODELS

A. E. Gill *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 1024-1029 ref (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01

Validation of ocean models for use in air-sea interaction studies involves testing their ability to predict sea surface temperatures. Sufficient data are now available to study both seasonal variations in surface temperature, and variations in currents with periods up to five years. Developments in ocean models and atmospheric models are at a point where linked models should be used to study the southern oscillation. A quantitative measure of the performance of atmospheric models in predicting those fields most relevant for climate questions is suggested.

Author (ESA)

N80-27958# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

SOME PERSONAL VIEWS ON THE USE OF GENERAL CIRCULATION MODELS

Abraham J. Oort *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 1030-1036 refs (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01

It is suggested that general circulation models may be profitably used in the near future to study the pronounced seasonal cycle with superimposed year to year variations in the observed mean temperature of the Earth. Other areas of interest are: polar cap energy balance, the diurnal variation, the role of biology in the chemical evolution of the oceans and atmosphere, and further testing the adequacy of observational networks.

Author (ESA)

N80-27959# Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).

SOME COMMENTS ON THE DESIGN OF MODEL RESPONSE EXPERIMENTS FOR MULTI-TIME-SCALE SYSTEMS

K. Hasselmann *In* WMO Climate Models: Performance, Intercomparison and Sensitivity Studies, Vol. 2 Dec. 1979 p 1037-1047 refs (For primary document see N80-27938 18-47)

Avail: NTIS HC A19/MF A01

It is shown that the natural climatic noise spectrum contains most of its variance in the same frequency range as the response function of the system. In a simple model of natural climate variability, the spectrum is actually given by the system response function applied to white noise. Enhanced signal-to-noise ratios must be obtained by ensemble averaging over a series of experiments, using identical changes in the boundary conditions or initial values, but different noise realizations. A strategy is presented for coupling models designed for different time scale ranges into a combined model covering a broader range of time scales. The more rapidly changing system can be regarded as being in a state of statistical quasi-equilibrium on the time scales characteristic of the evolution of the slowly changing system, and can therefore be parameterized by averaging over a time interval intermediate between the characteristic time scales of the two.

Author (ESA)

N80-27960# Oregon State Univ., Corvallis. School of Oceanography.
ANALYSIS OF METEOROLOGICAL OBSERVATIONS FROM AN ARRAY OF BUOYS DURING JASIN M.S. Thesis
Hiroshi Ishida Jan. 1980 75 p refs
(Contracts N00014-76-C-0067; N00014-79-C-0004; NR Proj. 083-102)
(AD-A084034; Rept-80-2) Avail: NTIS HC A04/MF A01 CSCL 04/2

Observations of wind speed and direction, air and sea temperature, and solar radiation were obtained from an array of buoys in JASIN. The observations were analyzed to show spatial and temporal variability. Spectra of wind speed and air and sea temperature were computed to illustrate the distribution of variance over periods ranging from 3.5 minutes to 40 days. When plotted on log-log graphs the spectral estimates generally decrease with increasing frequency with slopes between -3/2 and -2. Spectra of air and sea temperature have a peak at the diurnal frequency. When plotted in variance-preserving form, the spectrum of wind speed is consistent with a spectral gap and is qualitatively similar to other observations of low frequency spectra. On the basis of a cross-correlation analysis, it appears that mesoscale eddies propagated with the mean wind speed except during frontal passages. Based on the cross-correlation between wind and air temperature, there is evidence of horizontal roll vortices or organized convection. GRA

N80-27961# National Aviation Facilities Experimental Center, Atlantic City, N. J.
A STUDY OF THE USE OF METEOROLOGICAL SATELLITE, WEATHER RADAR, AND INTEGRATED GRAPHICS PRODUCTS IN THE FLIGHT SERVICE STATION SYSTEM Final Report, Nov. 1977 - Mar. 1978
T. D. Boldt Apr. 1980 28 p
(FAA Proj. 131-402-814)
(AD-A084012; FAA-NA-79-38; FAA-RD-79/92) Avail: NTIS HC A03/MF A01 CSCL 04/2

A study was conducted on the use of meteorological satellite imagery, weather radar imagery, and computer-generated meteorological graphics in the automated flight service station (FSS). The present meteorological satellite network and image distribution system is explained. The use of image processing of meteorological satellite imagery was investigated. The National Weather Service, Federal Aviation Administration, and United States Air Force's plans for improved weather were investigated. The use of computer-generated and animated graphics for display of meteorological information was investigated. The study concluded that: (1) satellite imagery could be made available in the near term by utilizing components of the present closed circuit television system; (2) the National Weather Service (NWS) network of WSR-57 weather radars provides the best available information for small area detection and depiction of precipitation; and (3) integration of satellite imagery and weather radar imagery will help the specialist in recognizing and interpreting the information available to him. The study recommended: (1) implementation of present video disc and cathode-ray tube technology for electronically storing, displaying, and sequencing satellite images and NWS facsimile weather charts at FSS's; and (2) various studies as to application of available image processing techniques to meteorological satellite images, application of monochromatic and color displays for satellite imagery, and techniques to automatically derive graphic products from the Federal Aviation Administration Service A circuit. GRA

N80-27962# Ben Gurion Univ. of the Negev, Beersheva (Israel). Inst. for Desert Research.
DESERT CONVECTION CLOUDS Final Report, 1 Nov. 1976 - 31 Oct. 1979
Louis Berkofsky Hanscom AFB, Mass. AFGL 12 Feb. 1980 7 p
(Grant AF-AFOSR-3159-77; AF Proj. 2301)
(AD-A083965; AFGL-TR-80-0140) Avail: NTIS HC A02/MF A01 CSCL 04/2

Equipment is being set up to measure various properties of desert clouds. The equipment includes a 3 cm. radar, a 0.86 cm vertically pointing radar, a GMD-1 rawinsonde, 12 weighing bucket rain gauges, cameras for stereophotography of clouds. The measurements will include cloud base, cloud height, growth rate of clouds, cloud base radius, rainfall rates, liquid water content, ambient atmosphere temperature, humidity, wind. Along with the observational set-up, a one dimensional time dependent plume model has been developed for predicting growth of desert clouds. The program is almost completely checked out. Information from the above-mentioned observational program will be used as input data and as verification data for the model. GRA

N80-27963# California Univ., Berkeley. Statistical Lab.
COMMENTS ON THE SPECIAL ISSUE OF COMMUNICATIONS IN STATISTICS (VOLUME A8, NO. 10) CONCERNED WITH WEATHER MODIFICATION EXPERIMENTS
Jerzy Neyman Nov. 1979 21 p refs
(Contract N00014-75-C-0159; Grant DAAG29-76-G-0167)
(AD-A083628; ONR-79-06) Avail: NTIS HC A02/MF A01 CSCL 04/2

As stated by the Editors of the Special Issue, it was compiled with reference to two of my statements: (1) that much of the current weather modification literature is slanted and unreliable, and (2) that progress in the building of a reliable weather modification technology requires an interdisciplinary study of as many completed cloud seeding experiments as possible. The material published in the Special Issue related to two completed experiments, the Tasmania and the Israeli experiments. It is shown that a realistic appraisal of a completed experiment requires a prolonged effort, including an examination of quite a few relevant publications and, on occasion, some numerical work on published raw data. It appears that an interdisciplinary reanalysis of the Tasmania experiment can contribute to the development of a reliable cloud seeding technology. GRA

N80-27964# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
MICROPHYSICAL PROPERTIES OF A LARGE SCALE CLOUD SYSTEM Interim Report, 1-3 Mar. 1978
Donald J. Varley 7 Jan. 1980 100 p refs
(AF Proj. 2310)
(AD-A083140; AFGL-TR-80-0002; AFGL-ERP-690) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report describes the microphysical properties observed by a specially-instrumented C-130 while flying in portions of a large cloud system on 3 successive days in March 1978. Each of the flights was made slightly east of an upper level trough as it moved across the U.S. Horizontal sampling passes of 50 to 100 nm (93 to 186 km) in length were made at various levels from approximately 2 to 9 km above ground in portions of the cloud system that were relatively homogeneous horizontally and vertically. Particle spectra data from PMS 1-D spectrometers were averaged for consecutive 20 sec periods. On each of the 3 days the particles having the smallest mean size were observed at the highest levels flown and had median diameters near 100 micrometers. The calculated equivalent liquid water content from 7 to 9 km was near 0.0 1 g cu m. The total particle count was between 8,000 and 18,000 cu m over Arkansas and coastal Delaware, but was near 25,000 cu m over the mountains of New Mexico. Values of mass and particle size increased with particle distance fallen, by indicating growth by collective means. The largest equivalent liquid water content values were near 1 g cu m and were recorded in the large snow just above the freezing level. The form factor, a mathematical parameter, was found useful in studying particle spectra. Certain maxima and minima observed in several plotted spectra, especially those from 7 km altitude data, are suggested as being due to an aggregation mechanism. GRA

N80-27965# National Hurricane and Experimental Meteorology Lab., Coral Gables, Fla.
NATIONAL HURRICANE AND EXPERIMENTAL METEOROLOGY LABORATORY, FISCAL YEAR 1979 Annual Report
Jan. 1980 59 p refs
(PB80-165228; NOAA-80022903) Avail: NTIS HC A04/MF A01 CSCL 04B

The National Hurricane and Experimental Meteorology Laboratory, Coral Gables, Florida, is NOAA's primary focus for research in tropical meteorology. Its two main areas of emphasis are: research on hurricanes and cumulus clouds related to improvement of the description, understanding, and prediction of these phenomena, and implementation of weather modification

experiments. This annual report for fiscal year 1979 presents the laboratory structure, personnel trends, research and related activies, and publications both in print and in preparation. GRA

N80-27966# Pennsylvania State Univ., University Park. Dept. of Meteorology.
SELECT RESEARCH GROUP IN AIR POLLUTION METEOROLOGY Final Report, May 1972 - Mar. 1978
R. A. Anthes, A. K. Blackadar, R. I. Kabel, J. L. Lumley, and H. Tennekes Feb. 1980 87 p refs
(Grant EPA-R-800297)
(PB80-166879; EPA-600/4-80-012) Avail: NTIS HC A05/MF A01 CSCL 04B

The development of a comprehensive mesoscale predictive transport model capable of nesting within a global scale grid system and sufficiently flexible in scale to be used for either regional or urban problems was identified as a central problem in air pollution meteorology. It was found that the treatment of the boundary was sufficiently general to permit application of the model to complex terrain problems. A variety of subsidiary one and two dimensional models for the prediction of mixed layer depth, nocturnal mixed layer evolution and buoyantly driven convection regimes was also developed. Work was also done on deposition processes and on facility development for measurements of air quality and model validation needs. GRA

N80-27967# Environmental Sciences Research Lab., Research Triangle Park, N.C. Meteorology and Assessment Div.
TURBULENT DIFFUSION FROM A POINT SOURCE IN STRATIFIED AND NEUTRAL FLOWS AROUND A THREE DIMENSIONAL HILL. PART 1: DIFFUSION EQUATION ANALYSIS
W. H. Synder (Cambridge Univ., England), J. C. R. Hunt (Atmospheric Environment Service, Downsview, Ontario), and J. S. Puttock 1979 14 p refs Submitted for publication
(PB80-163058; EPA-600/J-79-048) Avail: NTIS HC A02/MF A01 CSCL 04B

In stable stratified flow around three dimensional hills, vertical motion and vertical diffusion is negligible. Consequently turbulent diffusion from a point source can be modelled by considering horizontal flow and horizontal diffusion. Using an eddy diffusivity, the advective diffusive equation around a three dimensional hill which is axisymmetric about a vertical axis is solved to show how source positions on and off the center line affect the trajectories and splitting of impinging plumes and the value and position of the maximum surface concentration on the hill. A plume is analyzed in a neutrally stable potential flow around an axisymmetric obstacle such as a hemisphere, also using the diffusion equation. The solutions show how, because streamlines approach the surface of a 3 dimensional hill much more closely than the surface of a 2 dimensional hill, the maximum surface concentrations on the hill can become very much greater than in the absence of the hill. But this only occurs for a limited range of source heights. GRA

N80-27968# National Oceanic and Atmospheric Administration, Rockville, Md.
RED RIVER VALLEY TORNADOES OF APRIL 10, 1979. A REPORT TO THE ADMINISTRATOR Natural Disaster Survey Report
Jan. 1980 70 p ref Original contains color illustrations
(PB80-165210; NOAA-NDSR-80-1; NOAA-80030301) Avail: NTIS HC A04/MF A01 CSCL 04B

The three main storms in the Red River Valley outbreak were giant tornadoes. Each lasted for an hour or more and left a continuous track of ground damage 35 miles or longer. In addition, the damage path of all three was wider than normal. A NOAA disaster survey team was formed on April 11, 1979, to review the performance of the National Weather Service (NWS) and the National Environmental Satellite Service (NESS). The warning program, warning dissemination, disaster preparedness, and public response are discussed. GRA

N80-27969# National Weather Service, Silver Spring, Md. Meteorological Services Div.
PROBABILITY FORECASTING: REASONS, PROCEDURES, PROBLEMS
Lawrence A. Hughes Jan. 1980 96 p refs
(PB80-164353; NOAA-TM-NWS-FCST-24; NOAA-80022902) Avail: NTIS HC A05/MF A01 CSCL 04B

A comprehensive discussion of probability forecasting, based mainly on that for precipitation probability is presented to cover points of concern to those persons making probability forecasts. Points pertinent to those making management decisions concerning a probability program are included. Also included is a history of probability forecasting and an extensive set of references for those wanting more information. GRA

N80-27970# Oklahoma Univ., Norman. School of Meteorology.
PROVIDE AIRCRAFT OPERATION AND ANALYSIS FOR SESAME-79 Final Report
John McCarthy Dec. 1979 11 p
(Grant NA79RA-D-00016)
(PB80-165301) Avail: NTIS HC A02/MF A01 CSCL 04B

The University of Oklahoma provided personnel to support aircraft operations and analysis during SESAME-79. A summary of aircraft operations is given in tabular form. GRA

N80-27971# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.
A FIELD INVESTIGATION OF ELECTRIC CURRENTS ASSOCIATED WITH SEVERE LOCAL STORMS Final Report
Christopher Church Oct. 1979 26 p refs
(Grant NA79RA-D-00014)
(PB80-165632; NOAA-80022205) Avail: NTIS HC A03/MF A01 CSCL 04B

Recent efforts to evaluate the nature and magnitude of point discharge currents during severe storms are described. During the early part of 1979 several corona current amplifiers were developed, and installed at surface mesonet stations in central Oklahoma, where they provided corona data during a major portion of SESAME-79. The results of the endeavor and details concerning instrumentation and operations are presented. GRA

N80-27972# Oklahoma Univ., Norman. School of Meteorology.
THE UNIVERSITY OF OKLAHOMA SEVERE STORMS INTERCEPT PROJECT-1979 Final Report, 15 Mar. - 31 Dec. 1979
Howard B. Bluestein Dec. 1979 46 p refs
(Grant NA79RA-D-00012)
(PB80-166010; NOAA-80022203) Avail: NTIS HC A03/MF A01 CSCL 04B

Ground-based visual observations in the wind field of thunderstorms observed simultaneously by Doppler radar were conducted from 1 April 1979-15 June 1979. Severe storm phenomena and related damage as well as tornadic debris clouds were photographed. Results and applications are discussed. GRA

N80-27734# World Meteorological Organization, Geneva (Switzerland).
CLIMATE AND CLIMATE MODELING Final Report
B. W. Boville *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 14-18 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27738# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
METEOROLOGICAL RESEARCH Final Report
B. Bizzarri *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 39-43 (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27739# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
SPACE TECHNIQUES Final Report
A. Berroir *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 44-48 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27742# Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
ICE SHEETS, GLACIERS, AND CLIMATE
L. Lliboutry *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. Res. (CHARM) from Space Feb. 1980 p 67-71 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27754# Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).
MOUNTAIN OVERFLOW PHENOMENA IN SATELLITE IMAGERY
V. Zwatz-Meise *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 163-168 ref (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27755# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
METEOROLOGICAL RESEARCH AND CLOUD PARAMETER DERIVATION FROM SATELLITE DATA
M. Desbois and G. Szejwach *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 169-172 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27756# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
METHODS AND PROBLEMS IN SATELLITE TEMPERATURE PROFILES AND WINDS
B. Bizzari *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1979 p 173-182 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27757# Centre National d'Etudes Spatiales, Paris (France). Paris Univ.
A VIEW ON OUTSTANDING EXPERIMENTAL PROBLEMS IN SPACE OBSERVATION FOR METEOROLOGY AND CLIMATOLOGY
P. Morel *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 185-188 Prepared jointly with Paris Univ. (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27758*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A MICROWAVE PRESSURE SOUNDER FOR THE REMOTE MEASUREMENT OF ATMOSPHERIC SURFACE PRESSURE
D. A. Flower and G. E. Peckham *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 189-192 refs Sponsored jointly with UK Science Research Council Prepared jointly with Heriot-Watt Univ., Edinburgh (For primary document see N80-27733 18-42)
(Contract NAS7-100)
Avail: NTIS HC A10/MF A01 CSCL 04B

N80-27759# University Coll., London (England). Dept. of Physics and Astronomy.
GLOBAL WIND DETERMINATION BY INTERFEROMETRIC TECHNIQUES IN THE TROPOSPHERE STRATOSPHERE AND MESOSPHERE
D. Rees *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 193-206 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-27973 Johns Hopkins Univ., Baltimore, Md.
PROPAGATION AND GENERATION OF INTERNAL TIDES ON THE CONTINENTAL MARGIN Ph.D. Thesis
Wen-Ssn Chuang 1980 126 p
Avail: Univ. Microfilms Order No. 8014265

The propagation of internal tide in the ocean is strongly affected by the effect of bottom topography and the effect of horizontal density stratification. In the particular case of a normal mode internal tide propagating into a region of linearly sloping, subcritical bottom plane and isopycnals, only the weak (discontinuous) solution can be constructed based upon the ray theory. It is shown that part of the incoming energy flux is induced upward along the characteristics at the sloping bottom and across the vertical line where the isopycnals change from level to upward inclination. Dissert. Abstr.

N80-27974 Florida State Univ., Tallahassee.
A MODEL OF A SUSPENDED SEDIMENT INDUCED, STABLY STRATIFIED OCEANIC BOTTOM BOUNDARY LAYER Ph.D. Thesis
Charles Earl Adams, Jr. 1980 77 p
Avail: Univ. Microfilms Order No. 8014108

A suspended sediment induced stably stratified oceanic bottom boundary layer is examined with a second moment turbulence closure model. The boundary layer momentum and mass conservation equations are coupled through the eddy diffusion coefficients for momentum and mass which are functions of the dependent variables of the problem. The bottom boundary layer BBL of the Florida current is modeled using observed geostrophic currents, bottom sediment size distribution and bottom roughness height as input parameters. Model results indicate that the boundary layer response to a suspended sediment concentration gradient is to reduce appreciably the level of turbulence and to modify significantly the velocity profile of the BBL. The turbulent kinetic energy and eddy conductivity are reduced by about 40% and 25% respectively and the bottom stress is reduced by approximately 45%. Dissert. Abstr.

N80-27975# Scripps Institution of Oceanography, La Jolla, Calif.
PROFILES OF VELOCITY AND TEMPERATURE NEAR THE INDIAN OCEAN EQUATOR, REVISION
R. A. Knox and M. J. McPhaden Mar. 1980 101 p refs
(Contracts N00014-75-C-0152; N00014-69-A-0200)
(AD-A083779; SIO-Ref-80-6-Rev) Avail: NTIS
HC A06/MF A01 CSCL 08/3

Between January 1973 and May 1975, quasi-weekly vertical profiles of temperature and velocity were obtained near the equatorial island of Gan (00 deg 41 min S, 73 deg 10 min E) in the Central Indian Ocean. This report presents the profiles directly. One analysis of the data, treating the seasonal cycle of near-surface currents, has been published (Knox, 1976); others are in progress. GRA

N80-27976# Naval Postgraduate School, Monterey, Calif.
FIRST GENERATION NUMERICAL OCEAN PREDICTION MODELS: GOAL FOR THE 1980'S Progress Report, Oct. 1978 - Dec. 1979
Russell L. Elsberry and Roland W. Garwood, Jr. Dec. 1979 43 p refs
(AD-A083855; NPS63-79-007) Avail: NTIS
HC A03/MF A01 CSCL 08/10

Using the experience of numerical weather prediction during the 1950's and 1960's as a model, a case is presented for development during the 1980's of an ocean prediction capability. Examples selected from recent research at the Naval Postgraduate School are used to illustrate some aspects of the theoretical background, representation of physical processes, observational-support systems and the justification for a first-generation ocean prediction system. GRA

N80-27977# National Marine Fisheries Service, Seattle, Wash.
BOTTOM-WATER TEMPERATURE TRENDS IN THE MIDDLE ATLANTIC BIGHT DURING SPRING AND AUTUMN, 1964-76
Clarence W. Davis Dec. 1979 21 p refs
(PB80-166200; NOAA-TR-NMFS-SSRF-739;
NOAA-80012404) Avail: NTIS HC A02/MF A01 CSCL 08J

Annual variations of bottom-water temperatures on the continental shelf between Cape Cod and Cape Hatteras were examined for the spring and autumn from 1964 to 1976. Temperatures generally were highest since 1972 during both seasons. For waters between Cape Code and Hudson Canyon, maximum temperatures occurred in the spring of 1976 (8.3C) and autumn of 1972 (12.8C); between Cape Hatteras and Hudson Canyon, temperatures peaked in the spring of 1974 (9.0C) and the autumn of 1972 (15.7C) GRA

N80-27978# National Oceanic and Atmospheric Administration, Miami, Fla. Atlanta Oceanographic and Meteorological Labs.
PHYSICAL OCEANOGRAPHIC CONDITIONS AT A POTENTIAL OTEC SITE IN THE GULF OF MEXICO, 88 DEG W, 29 DEG N
Robert L. Molinari, Dennis Mayer, and Frank Chew Nov. 1979 160 p refs Sponsored in part by DOE, Washington, D.C.
(PB80-163710; NOAA-TM-ERL-AOML-41; NOAA-80020503)
Avail: NTIS HC A08/MF A01 CSCL 08J

Physical oceanographic data were collected at the nominal position, 88 degrees W, 29 degrees N from July, 1977 through October, 1978. The position is some 150 km south of Mobile, Alabama and was occupied to obtain data needed in the OTEC design effort. Site occupations by research vessel and current meter deployments were used to obtain temperature, density and current data. GRA

N80-27747# Institute of Oceanographic Sciences, Wormley (England).
SPACE AND TIME SCALES OF OCEAN CIRCULATION
W. J. Gould *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 105-110 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

N80-27760# Cambridge Univ. (England). Dept. of Applied Mathematical and Theoretical Physics.
OCEAN CIRCULATION
D. L. T. Anderson *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 209-215 refs (For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-27979 California Univ., Berkeley.
TRANSIENT DIFFUSION IN MULTI-LAYER BIOLOGICAL TISSUE Ph.D. Thesis
Joseph Rasson 1979 126 p
Avail: Univ. Microfilms Order No. 8014852

The oxygen tension profile in the human cornea while a soft contact lens is in situ was investigated to answer some of the questions concerning the clinical application of soft contact lenses. A mathematical model of the cornea contact lens system was developed to predict the transient response of a Clark-type oxygen sensor pressed into the lens. Due to the lack of data on human corneal diffusion parameters, an analysis of the effect of different parameters on the oxygen tension profile was performed. The results indicate that the diffusion properties of corneal epithelium, specifically, its oxygen up-take rate and thickness, have dominant effects on oxygen tension under the lens. These findings could prove useful in determining which individuals can and cannot wear soft contact lenses. The diffusion property of the contact lens, its oxygen transmissibility, also has a significant effect on the oxygen tension under the lens. The agreement between the experimental results and the mathematical model indicates that the diffusion properties of the human cornea which exist in the literature are a reasonable estimation of actual normal diffusion parameters. Dissert. Abstr.

N80-27980 California Univ., Berkeley.
INSTRUMENTATION FOR THE MEASUREMENT OF VISCOSITY AND FLOW OF BIOLOGICAL FLUIDS Ph.D. Thesis
Lawrence Eugene Crooks 1979 223 p
Avail: Univ. Microfilms Order No. 8014642

Several ways to use nuclear magnetic resonance (NMR) to measure properties of fluids were investigated with emphasis on the measurement of fluid flow velocity. The technique also provided a measure of molecular self diffusion which was converted to the fluid's viscosity. The flow characteristic measured was a velocity distribution function which relates the fraction of fluid flowing to the fluid velocity. It is shown that a multiple pulse NMR sequence can be used to determine the velocity distribution. A self diffusion measurement gives the diffusion coefficient of a whole sample, whether it is stationary or flowing. It is also shown that varying the experiment timing, restricted diffusion can be observed and the size of biological miscelles can be estimated. The results of a study of diffusion in cervical mucus are presented. Results indicate that NMR relaxation time can also be used to determine the hemaglobin concentration in whole blood. Results of this type of measurement on leukemic whole blood and various blood fractions are presented. Dissert. Abstr.

N80-27981*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL GASTRIC ULCERS INDUCED BY IMMOBILIZATION AND ELECTRIC SHOCK OF RATS AND THEIR PHARMACOTHERAPY
O. N. Zabrodin May 1980 7 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 28, no. 6, 1965 p 717-719 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76157) Avail: NTIS HC A02/MF A01 CSCL 06C

The mechanism of development of experimental gastric ulcers, induced in rats by combined immobilization and electric shock, was analyzed pharmacologically with peripheral neurotropic agents. It is concluded that: (1) The most marked preventive effect in the development of the experimentally induced gastric ulcers was displayed by agents capable of blocking the ascending activation system of the reticular formation. (2) Sympathetic fibers, which disrupt the trophism of the gastric wall, form the efferent portion of the reflex arc. (3) Gastric secretion does not appear to be the primary cause of ulceration. R.E.S.

N80-27982*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF CENTRAL NEUROTROPIC SUBSTANCES ON THE HYPOPHYSISADRENAL CORTEX SYSTEM DURING IMMOBILIZATION OF ANIMALS
V. Ye. Ryzhenkov May 1980 9 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 31, no. 5, 1968 p 545-548 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76158) Avail: NTIS HC A02/MF A01 CSCL 06C

The immobilization of guinea pigs for 5, 12, 24 and 48 hours, by securing to a slab, results in a persistent rise of the blood plasma 17-oxycorticosteroid concentration. Repeated administration of phenobarbital (50 mg/kg) and of the sodium salt of gamma-oxybutyric acid (500 mg/kg), as well as the combined administration of central m- and n-cholinolytics with small doses of phenobarbital tends to inhibit activation of the adrenal cortex during 48 hour immobilization of the animals. Repeated administration of aminazine (20 mg/kg) tends to decrease activation of the adrenal cortex. The administration of reserpine (0.1-5 mg/kg) 12-18 hours before immobilization of guinea pigs increases the response of the hypophysis-adrenal cortex system. Author

N80-27983*# National Aeronautics and Space Administration, Washington, D. C.
OXYGEN CONSUMPTION OF ANIMALS UNDER CONDITIONS OF HYPOKINESIA
Ye. N. Loginova, A. I. Volozhin, I. G. Krasnyku, and Ye. A. Stroganova May 1980 11 p refs Transl. into ENGLISH from Patrol. Fiziol. Eksp. Ter. (USSR), no. 4, Jul.-Aug. 1975 p 32-38 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original Doc. prepared by Med. Stomatological Inst., Moscow
(Contract NASw-3198)
(NASA-TM-76167) Avail: NTIS HC A02/MF A01 CSCL 06C

The influence of hypokinesia on the oxygen consumption of rats, dog, and squirrels was investigated. Three periods of gaseous exchange were revealed in rats under conditions of a limited motor activity. During the first 10-15 days O2 consumption displayed a sharp elevation; on the 20th-30th day, it became stabilized at a higher level (in comparison with control) and it sharply rose again on the 40th-100th day. In dogs, hypokinesia produced a reduction of O2 consumption and then a tendency to its elevation was seen. A short period of physical exercises in squirrels after hypokinesia led to increased oxygen consumption at rest. R.E.S.

N80-27984*# National Aeronautics and Space Administration, Washington, D. C.

MECHANISMS OF WATER-SALT METABOLISM DISTURBANCES IN DOGS SUBJECTED TO SIX MONTH HYPOKINESIA

V. I. Korolkov, Ye. A. Kovalenko, V. P. Krotov, N. A. Ilyushko, V. A. Kondratyeva, and Yu. I. Kondratyev May 1980 9 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 6, 1977 p 32-35 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76170) Avail: NTIS HC A02/MF A01 CSCL 06C

Water-salt metabolism in dogs during prolonged restricted motor activity (hypokinesia) was investigated. It was found that hydration occurred and fluid was redistributed between the extra- and intra-cellular sectors. Also, electrolyte excretion rose, and magnetism and calcium metabolism changed significantly. It is concluded that the forces caused by muscle strain proper (which was decreased under conditions of hypokinesia) influence the state of bone metabolism. R.E.S.

N80-27985*# National Aeronautics and Space Administration, Washington, D. C.

BIOLOGICAL AND AERODYNAMIC PROBLEMS WITH THE FLIGHT OF ANIMALS

Erich V. Holst and Dietrich Kuchemann May 1980 37 p refs Transl. into ENGLISH from die Naturwissencchaften (Geottigen, West Germany), v. 24/25, 13 Jun. 1941 p 348-362 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75337) Avail: NTIS HC A03/MF A01 CSCL 06C

Biological and aerodynamic considerations related to birds and insects are discussed. A wide field is open for comparative biological, physiological, and aerodynamic investigations. Considerable mathematics related to the flight of animals is presented, including 20 equations. The 15 figures included depict the design of bird and insect wings, diagrams of propulsion efficiency, thrust, lift, and angles of attack and photographs of flapping wing free flying wing only models which were built and flown. L.F.M.

N80-27986*# National Aeronautics and Space Administration, Washington, D. C.

THE GROWTH OF BIRDWINGS

K. Meunier May 1980 46 p refs Transl. into ENGLISH from Leipzig Abetilung, (East Germany), v. 161, no. 3-4, 1959 p 444-482 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by State Bird Protection Station, Schleswig-Holstein, West Germany

(Contract NASw-3199)

(NASA-TM-75821) Avail: NTIS HC A03/MF A01 CSCL 06C

Growth and order allometry is defined and applied to the growth of bird effects of negative wing allometry discussed with regard to body size and flight power. Transposition and evolutionary significance are explained. R.E.S.

N80-27987*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF IMMOBILIZATION ON THE EEG OF THE BABOON. COMPARISON WITH TELEMETRY RESULTS FROM UNRESTRICTED ANIMALS

J. Bert and H. Collomb Apr. 1980 5 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol. (France) v. 159, no. 5, 1965 p 1202-1204 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(NASA-TM-76137) Avail: NTIS HC A02/MF A01 CSCL 06C

The EEG of the baboon was studied under two very different sets of conditions: 37 were totally immobolized while 12 were studied in their free movements with 4 channel telemetry. For the immobilzed, 3 stages were described: (1) activation, record desynchronized; (2) rest with 13-15 cm/sec rhythm, like the human alpha rhythm stage but with eyes open or closed; (3) relaxation with a decrease in 13-15 rhythm and the appearance of 5-7 cm/sec theta waves, eyelids closed, animal apparently sleeping. For the free animals the rest stage appeared when the animal's attention was not directed anywhere and there was no relaxation stage. It is concluded that the EEG pattern of the immobilized animal that was described as the 'relaxation' stage really represents a special functional state which one must distinguish clearly from the physiological stages of sleep. R.E.S.

N80-27988*# National Aeronautics and Space Administration, Washington, D. C.

CALORIGENIC EFFECT OF ADRENALINE IN RATS UNDER CONDITIONS OF RESTRICTED MOTOR ACTIVITY

L. Tomaszewska, H. Kaciuba-Uscilko, and S. Kozlowski Jun. 1980 8 p refs Transl. into ENGLISH from Artif. Satell. (Poland), 1/2, 1973 p 75-80 Presented at Symp. on Cosmic Biol. and Med., Warsaw, 12-17 Jun. 1972 Translation was announced as A74-20558 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76192) Avail: NTIS HC A02/MF A01 CSCL 06C

In previous studies, it was demonstrated that long term restricted motor activity in rats induces a decrease in body weight, an increase in release of adrenaline, and a decrease in the release of noradrenaline with the urine, as well as a reduction in activity of the thymus gland and level of thyroxin in the blood. At the same time, a decrease was found in the internal body temperature that was accompanied by an increase in the rate of metabolism in the state of rest. An investigation is presented which attempts to clarify whether the calorigenic effect of adrenaline under conditions of increased metabolism in the period of immobility is exposed to changes. R.E.S.

N80-27989*# National Aeronautics and Space Administration, Washington, D. C.

DISPLACEMENT OF PLASMA PROTEIN AND CONDUCTION VELOCITY IN RATS UNDER ACTION OF ACCELERATION FORCES AND HYPOKINESIA

S. Baranski, Z. Edelwejn, and M. Wojtkowiak Jun. 1980 10 p refs Transl. into ENGLISH from Postepy Astronautyki (Poland), v. 5, no. 2, 1972 p 61-70 Original language document annouced as A73-17769 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Military Academy of Aviation Medicine, Warsaw

(NASA-TM-76195) Avail: NTIS HC A02/MF A01 CSCL 06C

The permeability of capillary vessels was investigated in order to determine if acceleration alone or following prolonged hypokinesia would induce changes in the vascular wall leading to the penetration by I-albumins and/or proteins with larger molecules. In rats undergoing action of +5 Gz accelerations, no increase in vascular permeability, as tested with the use of (Cr-5k)-globulin, was demostrated. In rats immobilized for 4 weeks before centrifugation, rather weak migration of (Cr-51)-globulin from the vessels was observed. Immobilization resulted also in lowering of conduction velocity in the sciatic nerve. R.E.S.

N80-27990*# National Aeronautics and Space Administration, Washington, D. C.

EXPERIMENTAL CORONARY SCLEROSIS INDUCED BY IMMOBILIZATION OF RABBITS: A NEW MODEL OF ARTERIOSCLEROSIS

V. V. Tyavokin and W. W. Tjawokin Jun. 1980 19 p refs Transl. into ENGLISH from Virchows Arch., A. (West Germany), v. 346, 1969 p 29-45 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3198)

(NASA-TM-76196) Avail: NTIS HC A02/MF A01 CSCL 06C

A new method for producing arteriosclerosis with coronary insufficiency in rabbits by means of immobilization is described and discussed. The experimentally induced atherosclerosis develops due to hypodynamics imposed by the reduced muscular activity without overloading with exogenous cholesterol. The atherosclerosis and coronary insufficiency are associated. With variations in the duration and extent of immobilization, coronary insufficiency alone or with atherosclerosis can be produced.

R.E.S.

N80-27991*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF PSYCHOTROPIC DRUGS ON GASTRIC ULCERS INDUCED BY IMMOBILIZATION: INCREASED PROTECTIVE EFFECT OF AMITRIPTYLINE CAUSED BY CHLORDIAZEPOXIDE

J. E. Blum and A. Huerlimann Jun. 1980 6 p refs Transl. into ENGLISH from Med. Pharmacol. Exp. (Switzerland), v. 15, no. 6, 1966 p 615-617 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by F. Hoffmann-La Roche and Co., Basel, Switzerland

(Contract NASw-3199)

(NASA-TM-76197) Avail: NTIS HC A02/MF A01 CSCL 06C

Amitriptyline, but not chlordiazepoxide, protects rats from the occurrence of gastric erosions and ulcers following immobilization. When, however, chlordiazepoxide is given together with amitriptyline the protective effect of the latter is markedly increased.

Author

N80-27992*# National Aeronautics and Space Administration, Washington, D. C.

EFFECTS OF HYPODYNAMIA ON THE HEMOCOAGULATIVE PROPERTIES OF THE VASCULAR WALL AND MYOCARDIUM

V. I. Inchina Jun. 1980 9 p refs Transl. into ENGLISH from Kardiologiya (USSR),v. 18, no. 3, Mar 1978, p 126-129 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(NASA-TM-76199) Avail: NTIS HC A02/MF A01 CSCL 06C

The hemocoagulative properties of the aorta (laminar), myocardium, hollow veins, and fibrinolytic capacity of tissues were studied in 14 rabbits subjected to 7 days of restricted mobility and compared to those of 10 control animals. Two tables of results show that, as a result of hypodynamia, the thromboplastic activity of the inner and middle layers of the aorta together with the destruction of endothelium increases the hemocoagulative potential and creates the threat of thrombogenesis. There is also an increase in fibrin-stabilizing activity for all tissues.

Author

N80-27993*# National Aeronautics and Space Administration, Washington, D. C.

EFFECTS OF IMMOBILIZATION ON SPERMIOGENESIS

E. R. Meitner 30 Jul. 1980 14 p refs Transl. into ENGLISH from Acta Anat. (Switzerland), no. 95, 1976 p 300-308 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Comenius Univ. of Bratislava, Czecholovakia

(Contract NASw-3199)

(NASA-TM-76282) Avail: NTIS HC A02/MF A01 CSCL 06C

The influence of immobilization stress on spermiogenesis in rats was investigated. After 96 hour immobilization, histological changes began to manifest themselves in the form of practically complete disappearance of cell population of the wall of seminiferous tubule as well as a markedly increased number of cells with pathologic mitoses. Enzymological investigations showed various changes of activity (of acid and alkaline phosphatase and nonspecific esterase) in the 24, 48, and 96 hour immobilization groups.

R.E.S.

N80-27994# Joint Publications Research Service, Arlington, Va.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 14, NO. 3, 1980

27 Jun. 1980 158 p refs Transl. into ENGLISH of Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 158 p (JPRS-75956) Avail: NTIS HC A08/MF A01

The effects of prolonged exposure to space flight factors are examined. Hemodynamic responses, physiological effects, biological effects as well as the effects of reduced motor activity and weightlessness are considered. Results of ground-based and spaceborne experiments on various laboratory animals are included. For individual titles, see N80-27995 through N80-28014.

N80-27995# Joint Publications Research Service, Arlington, Va.

BIOCHEMICAL BASES OF PATHOGENESIS OF HYPOKINESIA **c54**

I. V. Fedorov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 1-12 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 3-10 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

An attempt to gain an insight into pathogenetic mechanisms and sequence of reactions responsible for changes in the metabilism of proteins, carbohydrates, and fats of hypokinetic animals is described.

J.M.S.

N80-27996# Joint Publications Research Service, Arlington, Va.

RESULTS OF STUDIES OF PULSED BLOOD FLOW AND REGIONAL VASCULAR TONUS DURING FLIGHTS IN THE FIRST AND SECOND EXPEDITIONS ABOARD THE SALYUT-6 - SOYUZ ORBITAL COMPLEX **c52**

V. F. Turchaninova and M. V. Domracheva *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 13-18 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 11-14 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

The dynamics of pulse blood filling and regional vascular tone was studied in the crewmembers of 96 and 140 day flights aboard the station Salyut-6 - Soyuz. Measurements were taken before, during and after flights, using a specially designed tetrapolar rheography. Rheograms of the torso, forearms, legs, and rheoencephalograms of the right and left hemispheres in the frontal-mastoidal lead were recorded. The results show that in zero-g the cosmonauts developed typical hemodynamic changes indicative of cephalad blood shifts.

Author

N80-27997# Joint Publications Research Service, Arlington, Va.

CIRCULATION IN EXERCISING CREW MEMBERS OF THE FIRST MAIN EXPEDITION ABOARD SALYUT-6 **c52**

V. S. Georgiyevskiy, N. A. Lapshina, L. Ya. Andriyako, L. C. Umnova, V. G. Doroshev, I. V. Alferova, V. N. Ragozin, and Ye. A. Kobzev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 19-23 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 15-18 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

During the 96 day flight aboard the Salyut-6 station the crewmembers showed a satisfactory response to bicycle ergometry of moderate load. However, cardiovascular regulation during exercise declined, particularly by the end of the first and the begining of the second month. This was mainly associated with deconditioning due to an inadequate work load. Its increase helped to restore an initial level of circulation during exercise by the end of the mission.

Author

N80-27998# Joint Publications Research Service, Arlington, Va.

HEMODYNAMICS AND PHASE STRUCTURE OF THE CARDIAC CYCLE IN MEMBERS OF THE FIRST CREW OF SALYUT-5 AT REST **c52**

V. A. Degtyarev, V. G. Doroshev, N. A. Lapshina, V. N. Ragozin, Z. A. Kirillova, S. I. Ponamarev, and O. B. Kulikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 24-28 refs Transl. into

ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 18-21 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

In the Salyut-5 flight studies of circulatory functions were continued. Heart rate, arterial pressure, time intervals of the left and right ventricles were measured at rest. Peripheral resistance and cardiac output were calculated. At early flight stages cardiovascular changes occurred due to an increased blood inflow to the heart. During the second half of the mission cardiac output and arterial pressure remained elevated, as fatigue of the cosmonauts increased. Author

N80-27999# Joint Publications Research Service, Arlington, Va.

EFFECT OF WEIGHTLESSNESS AND ARTIFICIAL GRAVITY ON ION-REGULATING FUNCTION OF RAT KIDNEYS

Ye. A. Ilin, Yu. V. Natochin, N. A. Ilyushko, Yu. I. Kondratyev, V. T. Bakhteyeva, Ye. M. Gazhala, O. A. Gomcharevskaya, Ye. A. Lavroua, and Ye. I. Shakhmatova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 29-34 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 21-25 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Weightless rats showed greater changes in the fluid-electrolyte metabolism and ion regulatory function of the kidneys than centrifuged rats. During water loads they exhibited an increased sodium excretion. During potassium loads they displayed a higher potassium excretion. The study of electrolyte composition of different kidney segments demonstrated a reduced potassium content in the wet cortical and medullary matter due to elevated tissue hydration. Kidney microdissection did not reveal any structural differences in nephrons of the weightless and centrifuged rats. Author

N80-28000# Joint Publications Research Service, Arlington, Va.

ACTIVITY OF SOME HEPATIC ENZYMES AND LIPOGENETIC PROCESSES IN RAT AIPOSE TISSUE AFTER SPACE FLIGHT

L. Makho, Sh. Nemet, M. Palkovich, V. Shtrbak, and R. A. Tigranyan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 35-40 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 26-29 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

The rats flown aboard Cosmos-782 showed a significant increase in the activity of tyrosine aminotransferase and tryptophan pyrolase, i.e., the enzymes whose activity depends on the corticosterone level. The synchronous rats displayed a small increase in the enzyme activity. The flight and synchronous animals exhibited a slight increase in the activity of gluconeogenetic enzymes and a decrease in the activity of glucose-6-phosphatase. Immediately after flight and, to a lesser extent, after the synchronous experiment the activity of lipogenetic enzymes decreased. On the R+25 day the enzyme activity remained unchanged. The study of lipogenesis in the epididymal fat, using C14-glucose incorporation into lipids, did not reveal any differences in the flight and synchronous rats. The findings demonstrated that changes in the enzyme activity induced by the flight and synchronous experiments returned to the normal during readaptation. Author

N80-28001# Joint Publications Research Service, Arlington, Va.

STATE OF RAT THYROID C CELLS FOLLOWING FLIGHTS ON THE COSMOS TYPE OF BIOSATELLITES (ACCORDING TO RESULTS OF A MORPHOLOGICAL STUDY)

G. I. Plakhuta-Plakutina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 41-46 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 29-33 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Calcitonin-secreting cells (C-cells) of the thyroid glands from 51 SPF Wistar rats flown for 18.5 to 22 days aboard biosatellites Cosmos-605, 782 and 936 and sacrificed 4.5-13 hours, 1-2 and 25-27 days after recovery were examined histologically and karyometrically. Vivarium (57) and synchronous (58) rats were used as controls. Variations in the nuclear volume of C-cells and their density were shown to depend on the experimental conditions and time interval elapsed after recovery. Morphological changes in C-cells were assumed to be associated with alterations in calcium metabolism during an exposure of rats to weightlessness, artificial gravity, and Earth gravity. Author

N80-28002# Joint Publications Research Service, Arlington, Va.

SOME ASPECTS OF APPLICATION OF THE SYSTEMIC APPROACH TO AVIATION ENGINEERING PSYCHOLOGY **c53**

V. A. Ponomarenko and N. D. Zavalova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 47-52 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 33-37 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

The role of study and analysis of systemic properties of the equipment of cockpits for its optimization is examined. Pilot's errors caused by disadvantages of the total systemic quality of various components of the equipment are described. Methods for eliminating causes of some erroneous actions of pilots are discussed. J.M.S.

N80-28003# Joint Publications Research Service, Arlington, Va.

EFFECT OF PROLONGED +Gz ACCELERATIONS ON HUMAN PERFORMANCE **c53**

A. S. Barer, T. A. Sokolova, V. M. Tardov, and Yu. P. Yashin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 53-59 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 37-40 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

With an increase in acceleration value, the accuracy of human performance decreases. This becomes very noticeable at $+Gz > 5$ g. In this situation work capacity can be raised by increasing an angle between the Gz vector and the long axis of the human body. Pilots need to be tested for acceleration clearance before they are allowed to fly at $+Gz >$ or $= 8$ g. Author

N80-28004# Joint Publications Research Service, Arlington, Va.

HUMAN COLOR DISCRIMINATING FUNCTION WITH MUSCULAR TENSION DURING EXPOSURE TO VESTIBULAR STIMULI **c52**

Zh. M. Kudryashova and A. A. Shipov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 60-64 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 41-44 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Human studies have demonstrated that arbitrary tension of muscle (back and legs) during repeated vestibular exposures not only delays the development of motion sickness but also contributes to the maintenance of color discriminative stability of the visual function. Author

N80-28005# Joint Publications Research Service, Arlington, Va.

EFFECT OF TRANSVERSE ACCELERATIONS ON INNERVATION OF THE GUINEA PIG'S CRURAL SKELETAL MUSCLES

V. Ya. Osaulenko *In its* USSR Rept.: Sapce Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 65-71 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 44-48 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

Guinea pigs were exposed to chest-to-back acceleration of 8 G for an hour. This exposure brought about significant

morphological changes of a primary-reactive pattern in nerve elements of skeletal leg muscles. With time they enhanced: 6 hours and then 3 days after the experiment a small portion (1-1.5%) of nerve fibers underwent fragmentation and degradation. Motor nerve endings showed the highest resistance. The first signs of restitution of changes in the peripheral nervous system were seen 6 days after the exposure. Nerve fibers did not return to the normal 9 days after the beginning of the experiment.

Author

N80-28006# Joint Publications Research Service, Arlington, Va.

STUDIES OF PROGNOSTIC SIGNIFICANCE OF ANTIORTHOSTATIC POSITION **c52**

Kh. Kh. Yarullin, V. A. Gornago, T. D. Vasilyeva, and M. Ye. Gugushvili. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 72-80 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 48-54 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

The prognostic significance of head-down tilt at -15 deg and -30 deg for 6 min at each step was assessed in 40 normal men, aged 22 to 39. The study of mean values of the maximal amplitude, relative duration of the anacrotic phase, dicrotic, and diastolic indices of hemispheric and bimastoidal rheoencephalography as well as of health condition helped to determine cerebral circulation in test subjects with good and moderate tolerance to head-down tilt and to define the criteria of tilt tolerance. The test subjects who showed good tolerance to head-down tilt displayed a simultaneous compensatory increase of the tone of large caliber arteries and arterioles that was accompanied by a noticeable increase in cerebral pulse blood filling at -15 deg and a moderate increase at -30 deg as well as the feeling of a slight blood rush to the head. The test subjects who displayed moderate tolerance to heat-down tilt showed only an increase in the tone of large caliber vessels; they also exhibited a marked decrease in the tone of arterioles, venules, and veins (especially at -30 deg) which was combined with a significant increase in the cerebral pulse blood filing and an appearance of marked venous waves on rheoencephalograms.

Author

N80-28007# Joint Publications Research Service, Arlington, Va.

EVALUATION OF EFFICACY OF THE SET OF PREVENTIVE MEASURES REFERABLE TO THE HUMAN NEUROMUSCULAR SYSTEM UNDER HYPOKINETIC CONDITIONS **c52**

V. A. Tishler, V. 1. Safonov, and Z. A. Krivitsina. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 81-85 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 3, 1980 p 54-57 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

Excitability and lability of the musculus rectus femoris was studied to evaluate efficiency of exercises during bed rest. A combination of exercises with other countermeasures did not reduce their prophylactic effect.

A.M.S.

N80-28008# Joint Publications Research Service, Arlington, Va.

THE STRESS REACTION TO HYPOKINESIA AND ITS EFFECT ON GENERAL RESISTANCE **c52**

I. P. Chernov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 86-90 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 57-60 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

Rat experiments demonstrated that the development of the hypokinetic syndrome involves occurrence of a three stage, stress reaction characterized by a change in the general health state, body mass, and activity of the hypothalamic-pituitary-adrenal system. The hypokinetic stress affects total resistance and ionizing radiation sensitivity of animals. At a certain stage of development the hypokinetic stress contributes to the state of elevated cross resistance.

J.M.S.

N80-28009# Joint Publications Research Service, Arlington, Va.

REGIONAL REDISTRIBUTION OF RAT BLOOD AFTER 7 AND 30 DAYS OF HYPOKINESIA

O. A. Kovalev, V. F. Lysak, V. I. Severovostokova, and S. K. Sheremetevskaya. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 91-96 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 60-64 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

An exposure of rats to hypokinesia was accompanied by a significant increase in the total amount of circulating blood per unit body mass. The percentage blood content was increased in the myocardium, lungs, liver, kidneys, small intestine, muscles and bones of the chest. The percentage blood content was decreased in the skin of different body segments, muscles and bones (except of the chest), tail, viscera (large intestine, adrenals, spleen, bladder, testes). The major regional redistribution of blood was its displacement into the liver.

Author

N80-28010# Joint Publications Research Service, Arlington, Va.

SECRETION, INCRETION AND RESECRETION OF PANCREATIC LIPASE DURING PROLONGED RESTRICTION OF MOTOR ACTIVITY **c52**

I. L. Medkova, N. M. Nikolayeva, and K. V. Smirnov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 97-103 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 64-67 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

The effect of 20, 60, 90 and 120 day hypokinesia on secretion, incretion, and recretion of pancreatic lipase of rats was examined. It was found that 60, 90 and 120 day hypokinesia induced significant and similar changes - lipase decrease in the pancreas and increase in blood, bile, salivary glands and stomach mucosa; 20 day hypokinesia did not produce any effect on the above parameters.

Author

N80-28011# Joint Publications Research Service, Arlington, Va.

THEORETICAL ANALYSIS OF THE EFFECT OF STATE OF PULMONARY CIRCULATION ON DISTRIBUTION OF VENTILATION-PERFUSION RELATIONS AND GAS EXCHANGE IN THE LUNGS **c52**

A. I. Dyachenko and V. G. Shabelnikov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 104-109 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 68-71 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

Using a mathematical model of functionally nonuniform lungs, the effect of gravational inequality of ventilation perfusion relations on gas exchange was studied. The dependence of tensions of respiratory gases in the mixed arterial blood and alveolar air upon pulmonary circulation pressure was demonstrated. The influence of changes in the tone of lung vessels on the distribution of ventilation perfusion relations and gas exchange was investigated.

Author

N80-28012# Joint Publications Research Service, Arlington, Va.

METHOD FOR ASSESSING HEMODYNAMICS AND DETECTING LATENT INSUFFICIENCY OF CEREBRAL CIRCULATION IN COSMONAUT CANDIDATES **c52**

D. A. Alekseyev. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 110-116 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 71-74 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

Experience in screening cosmonaut candidates shows that many of them present osteochondrosis of the cervical spine. In some of the selected individuals, the signs of intervertebral osteochondrosis are progressing. Osteophytes in this region

sometimes cause ischemic circulatory disturbances in the vertebrobasilar system as a result of reflex angiospasm of vertebral arteries and mechanical compression of the latter. For this reason, it is very important to assess blood flow in the systems of the vertebral arteries (basilar and internal carotid) and determine the functional capabilities of collaterals and latent circulatory disturbances in the corresponding vascular reservoirs. A functional test used for this purpose, involving rotation of the head and throwing it back to an angle of 45 deg is described. J.M.S.

N80-28013# Joint Publications Research Service, Arlington, Va.

ULTRASONIC METHOD OF RECORDING GAS BUBBLES IN ANIMAL VENOUS BLOOD IN A RAREFIED ATMOSPHERE **c52**

R. T. Kazakova. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 117-121 refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 74-76 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

A method of recording [demonstrating] intravascular gas bubbles, which appear under the influence of decompression due to elevated pressure, with the use of ultrasonic equipment is described. The possibility of using the ultrasonic method to study the process of gas production in animals and man in a rarefied atmosphere is demonstrated. This method can be used in the system for monitoring the physiological condition of man at high altitudes. J.M.S.

N80-28014# Joint Publications Research Service, Arlington, Va.

ISOLATION AND GAS CHROMATOGRAPHIC DEMONSTRATION OF VOLATILE ORGANIC SUBSTANCES IN THIN-LAYER BIOLOGICAL SAMPLES

N. F. Sopikov and A. I. Gorshunova. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 122-127 refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 77-79 (For primary document see N80-27994 18-51)

Avail: NTIS HC A08/MF A01

Gas chromatographic methods are used to demonstrate organic compounds in studies of the effects of space flight factors and conditions (for example, hypokinesia, radiation, hypoxia, etc.) on processes of accumulation, distribution and elimination of volatile chemicals from the human and animal organism. A simple and rapid method was developed for isolating volatile organic substances from biological media and tissues to be submitted to gas chromatographic analysis. This method was based on the principle of direct thermal evaporation of volatile compounds from thin layer biological samples, obtained by using a pyrolytic attachment with the chromatograph. J.M.S.

N80-28015# Joint Publications Research Service, Arlington, Va.

USSR REPORT. SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 14, NO. 2, 1980

O. G. Gazenko, ed. 8 May 1980 157 p refs. Transl. into ENGLISH of Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 157 p

(JPRS-75654) Avail: NTIS HC A08/MF A01

The biological and physiological effects of long term space flight are examined. Hyperbaric conditions, hypokinesia, weightlessness, hypoxia, and hypercapnia are among the support systems are included. For individual titles, see N80-28016 through N80-28036.

N80-28016# Joint Publications Research Service, Arlington, Va.

RESPIRATION AND GAS EXCHANGE UNDER HYPERBARIC CONDITIONS **c52**

L. A. Bryantseva, I. S. Breslav, and A. G. Dianov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 1-14 refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 3-10 (For primary document see N80-28015 18-51)

Avail: NTIS HC A08/MF A01

The effects of hyperbaric environments on respiratory function are discussed. Respiratory mechanics, pulmonary ventilation, and oxygen and carbon dioxide transport are included. Particular attention is given to the respiratory system as a limiting factor for human performance in a hyperbaric environment. Optimization of gas mixtures used in undersea dives is discussed. J.M.S.

N80-28017# Joint Publications Research Service, Arlington, Va.

CIRCULATION AT REST IN CREW MEMBERS OF THE FIRST MAIN EXPEDITION ABOARD SALYUT 6 **c52**

V. A. Degtyarev, V. G. Doroshev, V. M. Mikhaylov, V. S. Georgiyevskiy, S. A. Kobzev, Z. A. Kirillova, N. A. Lapshina, V. G. Savelyeva, and L. V. Umnova. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 15-19 refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 11-14 (For primary document see N80-28015 18-51)

Avail: NTIS HC A08/MF A01

Results of in-depth medical examinations of crew members who participated in the first expedition involving a 96 day space flight aboard the Salyut-6 orbital station are presented. Distinct variations of certain cardiovascular parameters exhibited an early stage, later returned to the normal. These changes are characteristics of individual processes of human adapatation to weightlessness. J.M.S.

N80-28018# Joint Publications Research Service, Arlington, Va.

STATE OF HUMAN BONE TISSUE PROTEIN FRACTION AFTER SPACE FLIGHTS **c52**

A. A. Prokhonchukov, V. K. Leontyev, N. A. Zhizhina, R. A. Tigranyan, A. G. Kolesnik, and N. A. Komissarova. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 20-26 refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 14-18 (For primary document see N80-28015 18-51)

Avail: NTIS HC A08/MF A01

Amino acid composition and bone mineralization were studied qualitatively and qualititatively on autopsy of the three crewmembers after their 28 day space flight aboard the orbital station Salyut 1. Sixteen amino acids were detected in the bone protein fraction: cystine and cysteine, lysine histidine, arginine, aspartic acid, serine, glycine, glutamic acid, threonine, alanine, proline, valine, phenylalanine, leucine and isolcusine, oxyproline. No abnormalities in the amino acid composition or the bone organic content were found in the postflight analysis. The role of protein matrices of calcified tissues in mechanisms of bone resistance and adaptation to space flight effects is discussed. J.M.S.

N80-28019# Joint Publications Research Service, Arlington, Va.

RESEARCH HARDWARE AND HABITAT OF ANIMALS USED IN EXPERIMENT ABOARD COSMOS-936 BIOSATELLITE

B. A. Adamovich, Ye. A. Ilin, A. D. Noskin, V. I. Milyavskiy, G. N. Pliskovskaya, V. K. Golov, V. S. Poleshchuk, V. K. Ovcharov, and A. A. Shipov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 27-32 refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 18-22 (For primary document see N80-28015 18-51)

Avail: NTIS HC A08/MF A01

The hardware used to provide the support to experimental animals (rats) and to obtain information in-flight is described. The hardware includes two specially designed centrifuges to generate artificial gravity. The environmental parameters in the mock-up cabin and field laboratories used at the recovery site are also described. J.M.S.

N80-28020# Joint Publications Research Service, Arlington, Va.

PRINCIPAL RESULTS OF PHYSIOLOGICAL EXPERIMENTS WITH MAMMALS ABOARD THE COSMOS-936 BIOSATELLITE

O. G. Gazenko, Ye. A. Ilin, A. M. Genin, A. R. Kotovskaya, V. I. Korolkov, R. A. Tigranyan, and V. V. Portugalov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 33-37 refs. Transl. into ENGLISH

from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 22-25 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The program of the 18.5 day flight of the biosatellite Cosmos-936 included studies of physiological effects of prolonged weightlessness (20 rats) and artificial gravity (10 rats). The latter produced a normalizing effect on the function of the myocardium, musculo-skeletal system, and excretory system. Simultaneously, artificial gravity exerted an adverse effect on the functions dependent on several sensors, primarily optic, vestibular, and motor sensors. It is postulated that the adverse effects are associated with a relatively high rate of rotation and a short arm of the centrifuge. Author

N80-28021# Joint Publications Research Service, Arlington, Va.

SEMICIRCULAR CANAL FUNCTION IN RATS AFTER FLIGHT ABOARD THE COSMOS-936 BIOSATELLITE

A. A. Shipov and V. G. Ovechkin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 38-44 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 25-30 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The nystagmic reflex, latent period, total and mean number of events, and their duration were measured in the rats flown for 18.5 days aboard the biosatellite Cosmos-936 under the conditions of weightlessness and artificial gravity. It is demonstrated that prolonged weightlessness did not influence the receptor formations and centers of semicircular canals. A long exposure to artificial gravity brought about a decrease in reactivity and sensitivity of semicircular canals. The mechanisms of these phenomena are discussed. J.M.S.

N80-28022# Joint Publications Research Service, Arlington, Va.

ROLE OF DYNAMIC SPACE FLIGHT FACTORS IN THE PATHOGENESIS OF INVOLUTION OF LYMPHATIC ORGANS (EXPERIMENTAL MORPHOLOGICAL STUDY)

A. S. Kaplanskiy and G. N. Durnova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 45-52 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 30-35 (For primary document see N80-28015 18-51)
Avail: NTIS HC A02/MF A01

The role of the dynamic factors in accidental involution of lymph organs was investigated in a ground based study simulating a 20 day space flight. It is inferred from the study that lymph organ involution observed in rats exposed to prolonged space flights is caused by chronic and acute stresses. Chronic stress is associated with weightlessness and leads to hypoplasia of lymphs organs; acute stress is connected with the transition from weightlessness to normal gravity (gravity stress), thus enhancing chronic stress induced lymph tissue hypoplasia. Spleens of both weightless and hypokinetic rats slow inhibition of crythropoiesis and accumulation of hemosiderine due to accelerated erythrocyte degradation caused by diminished motor activity. J.M.S.

N80-28023# Joint Publications Research Service, Arlington, Va.

EFFECT OF HIGH AMBIENT TEMPERATURE ON HUMAN PERFORMANCE c53

A. N. Azhayev, V. I. Zorile, and A. N. Koltsov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 53-57 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 20 Mar./Apr. 1980 p 35-38 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

Mental and physical capacity of men exposed to 30 to 35 deg at low humidity and to 25 to 30 deg at high humidity remained unaltered. The capacity of men exposed to 40 to 55 C at 10 to 25% of relative humidity and to 35 to 40 C at 85% of relative humidity declined. Author

N80-28024# Joint Publications Research Service, Arlington, Va.

DYNAMICS OF HUMAN EXTERNAL RESPIRATION AND BLOOD GASES UNDER THE COMBINED EFFECT OF HYPERCAPNIA AND HYPOXIA c52

L. Kh. Bragin, A. Ye. Severin, N. A. Agadzhanyan, G. A. Davydov, and Yu. A. Spasskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 58-62 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 38-41 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

In manned experiments gas mixtures with a step-by-step increasing (p)CO2 and hypoxia of different levels were used. The experiments demonstrated variations in respiration, buffer systems, and gases of the blood. The studies emphasized an important physiological role of a constant (p)CO2 in blood, when breathing gas mixtures with a different O2 content. Author

N80-28025# Joint Publications Research Service, Arlington, Va.

FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM UNDER THE COMBINED EFFECT OF 28 DAY IMMERSION, ROTATION ON A SHORT-ARM CENTRIFUGE AND EXERCISE ON A BICYCLE ERGOMETER c52

I. F. Vil-Vilyams and Ye. B. Shulzhenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 63-68 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 42-45 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The cardiovascular function of four test subjects exposed to 28 day dry immersion was examined before and after 6 day cycles of rotation in a short-arm centrifuge to provide 1 to 2 Gz, bicycle ergometer exercise, and their combination. An exposure to acceleration of 3 Gz in a 7.25 m arm centrifuge was used as a provocative test. The above countermeasures reduced but not eliminated entirely immersion-induced cardiovascular deconditioning. A combined use of acceleration of 1 to 2 Gz in a short-arm centrifuge and bicycle ergometer exercise can be recommended as a countermeasure against cardiovascular deconditioning in weightlessness. J.M.S.

N80-28026# Joint Publications Research Service, Arlington, Va.

PHARMACOLOGICAL ANALYSIS OF PHYSIOLOGICAL MECHANISMS OF ORTHOSTATIC HEMODYNAMIC STABILITY c52

L. I. Osadchiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 69-74 refs Tansl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 45-49 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

In urethane anesthesized cats, securinine brought about a distinct increase in compensatory reactions of arterial pressure and cardiac output during an upright tilt at 45 deg. The experiments also showed a substantial increase in compensatory recovery of the volume velocity of circulation in the posterior vena cava. Myorelaxant induced arrest of contractile function of skeletal muscles prior to securinine administration reversed compensatory reactions of arterial pressure and cardiac output during tilt test. Author

N80-28027# Joint Publications Research Service, Arlington, Va.

BIOELECTRIC ACTIVITY OF THE HUMAN BRAIN DURING AND AFTER 182-DAY ANITORTHOSATIC HYPOKINESIA c52

T. N. Krupina, Kh. Kh. Yarullin, and D. A. Alekseyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 75-83 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 49-54 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

Cerebral bioelectric activity of 18 healthy test subjects, aged 31 to 40, was examined during and after their 182 day head-down tilting. The test subjects were divided into a group that performed countermeasures (exercise, muscle stimulation) against hypokinesia-induced disorders and a control group. During

the study EEG changes were most pronounced in the controls: alpha-rhythm amplitude, frequency, and index decreased; slow wave frequency reduced; index of zonal differences and amplitude beta and slow waves increased. Phasic changes in the central nervous system excitability in response to a flickering light of 8 to 25 cps were found. Typical changes in spontaneous EEG during a 3 min pulmonary hyperventilation test were enhanced. The study gives evidence that the dynamics of spontaneous EEG as well as cerebral bioelectric activity in response to flickering light and pulmonary hyperventilation are important indicators of the cerebral function, especially of the cortical activity decrease.
Author

N80-28028# Joint Publications Research Service, Arlington, Va.
MORPHOMETRIC ANALYSIS OF GLOMERULES AND JUXTAGLOMERULA SYSTEM OF THE RAT KIDNEY IN THE COURSE OF EXPERIMENTAL HYPOKINESIA **c52**
I. P. Chernov and A. G. Gafarov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 84-89 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 54-47 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

A certain correlation between variations in the means of the volume of cortical and juxtamedullary glomerules and the function of the juxtaglomerular apparatus was established. It is hypothesized that at early hypokinesia renal vascular changes are nonspecific. The phenomenon of renal excretion of fluids and electrolytes is explained in terms of a simultaneous increase in the reninangiotensin activity and 11-hydroxycorticosteroid content in plasma.
J.M.S.

N80-28029# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPOKINESIA ON CHANGES IN CARBOHYDRATE AND LIPID METABOLISM IN THE HEART AND LIVER **c52**
Yu. P. Rylnikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 90-96 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 57-62 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The rate of assimilation of carbohydrates via glycolysis and the pentose-phosphate pathway, as well as changes in B bile in hypokinetic rabbits were studied. Results indicate that rigid immobilization of rabbits is accompanied by a reduction of glycolysis rate in the liver and, particularly, in the heart, and a simultaneous increase of the fraction of carbohydrate utilization in the pentose phosphate pathway. It is also followed by cholesterol accumulation in the blood and tissues in spite of an accelerated bile excretion of cholesterol and its derivatives, biles acids.
J.M.S.

N80-28030# Joint Publications Research Service, Arlington, Va.
EFFECT OF CONDITIONING FOR HYPOXIA ON FERTILITY OF WHITE MICE
V. B. Malkin and Ye. A. Stroganova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 97-102 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 62-66 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

A prolonged effect of hypoxia on the reproductive function and development of pups of white mice was investigated. Beginning with the age of 2 months the animals were exposed to an altitude of 5500 m for 6 hours a day during 9 months. The mice that were so adapted to and mated in hypoxia did not deliver any offspring. The animals that were adapted to hypoxia during intrauterine and postnatal development and mated at 5500 m delivered normal although much smaller litters.
J.M.S.

N80-28031# Joint Publications Research Service, Arlington, Va.
THE QUESTION OF USING DEHYDRATED FOODS DURING LONG-TERM SPACE FLIGHTS **c54**
V. P. Bychkov and M. V. Markaryan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 103-108 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 66-70 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The results of five studies on 35 test subjects conducted to test diets of dehydrated products to be used in prolonged space flights are discussed. It is demonstrated that a diet consisting of only dehydrated food products can be used for a prolonged time (up to 1 year). Dehydrated foods after a 2 year storage and proton irradiation at a dose of 24,000 rad retain their biological value and assure and adequate nutritional status. On this basis a space diet composed of dehydrated foods developed.
J.M.S.

N80-28032# Joint Publications Research Service, Arlington, Va.
SYSTEM OF HYGIENIC INSPECTION OF NONMETAL MATERIALS USED IN SPACECRAFT EQUIPMENT **c27**
G. I. Solomin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 110-115 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 70-74 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

In view of a wide use of polymers in the spacecraft interior and their potential harzard, a system of hygienic control over their safety at every manufacture stage was introduced. The system includes: an analysis of a list of polymers; laboratory testing of samples under standard conditions; bench testing of various polymers used in the hardware and software under operational conditions; and examination of space cabin environments in real flights. The system of hygienic control allows selection of the safest polymers, i.e., those with minimum outgassing.
Author

N80-28033# Joint Publications Research Service, Arlington, Va.
STUDY OF COMPATIBILITY OF CERTAIN HIGHER PLANTS AND CHLORELLA AS RELATED TO A BIOREGENERATIVE HUMAN LIFE SUPPORT SYSTEM **c54**
Yu. I. Shaydorov, B. N. Shebalin, and G. I. Mateshko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 116-122 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 74-78 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

Mutual effects of Chlorella and higher plants cultivated together in a closed atmosphere are discussed. It can be inferred that gaseous products of Chlorella did not exert a significant effect on the carbon dioxide consumption by wheat and radish plants or on their biomass increment. In turn, gaseous products of higher plants did not or influence Chlorella growth. It can, therefore, be concluded that Chlorella and the above higher plants, when cultivated in a common atmosphere, do not inhibit each other and can be regarded as biologically compatible constituents of the photoautotrophic component of future bioregenerative life support systems.
J.M.S.

N80-28034# Joint Publications Research Service, Arlington, Va.
GENERALIZED NYSTAGMOMETRIC CHARACTERISTICS FOR DIAGNOSTIC PURPOSES **c52**
M. M. Lauashov and A. I. Tumakov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 123-129 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 78-82 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The optokinetic reactions of children ranging in age from three to seven years who were not suffering from vestibular dysfunctions were recorded at three stimulus rates. The results of statistical processing for the parameters of right and left optokinetic reactions are reported. A distinct difference in behavior of two parameters of nystagmus, RSC and frequency, is noted.
J.M.S.

N80-28035# Joint Publications Research Service, Arlington, Va.
UPGRADING EFFICACY OF MEMBRANE TECHNIQUES FOR REGENERATING WATER FROM URINE c54
B. A. Adamovich, V. D. Volgin, N. M. Nazarov, Yu. Ye. Sinyak, and S. V. Chuhov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 130-113 ref Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), V. 14, no. 2 Mar./Apr. 1980 p 82-83 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

A method of regenerating water from urine involving evaporation through membranes and reverse osmosis is described. The effectiveness of the process was tested on a laboratory unit with an evaporator made of porous cermet. The productivity of the process was found to be stable over a long period of time. J.M.S.

N80-28036# Joint Publications Research Service, Arlington, Va.
USE OF POLYURETHANE FOAM DEFORMATION SENSOR TO RECORD RESPIRATORY ACTIVITY c35
V. I. Bredov and V. S. Baranov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14 No. 2, 1980 (JPRS-75654) 8 May 1980 p 134-136 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 84-85 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

The sensor developed has some substantial advantages over other known types. It is highly sensitive over a wide range of strain loads. The level of the output signal is linearly related to the force exerted on it, and it is sufficient for direct recording without using amplifiers of electric signals. The sensor is based on elastic, spongy material, polyurethane foam (porolon) with current-conducting material on the pore surface, current-conducting carbon black or electrode paste. The elastic properties of the sensor are built in the actual base of the strain-sensitive element, which simplifies the construction substantially and increases the reliability of the unit. In order to test the possibility of using this sensor to examine respiratory function, human pneumograms were recorded with the subject in a calm state along with the respiratory activity of experimental animals (dogs). Samples of the respiratory curve are shown. The simplicity of design of the sensor makes it possible to use it in various physiological experiments. J.M.S.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-28037 Johns Hopkins Univ., Baltimore, Md.
NONLINEARITIES IN AUDITORY-NERVE FIBER RESPONSES TO BANDLIMITED NOISE: AN EXPERIMENTAL STUDY AND A MODEL Ph.D. Thesis
Thomas Barton Schalk 1980 222 p
Avail: Univ. Microfilms Order No. 8014270

Discharge rate was measured as a function of spectral level for noise bursts of one bandwidth and center frequency. Such rate-level functions were measured for a number of bandwidths; either the low or high cutoff frequencies were set at fiber characteristic frequency (CF). Rate-level functions were also measured, simultaneously, for single tones at CF. Dynamic range is defined as the range, in dB, over which rate increases from 10 percent to 80 percent of the maximum driven rate to CF tones. When pooling data across CF in single cats, dynamic range is an increasing function of fiber threshold for CF tones and noise stimuli. Narrow bands of noise produce rate-level functions that are similar to those for CF tones. For noise bands centered above CF, rate-level functions became less steep as bandwidth is increased, and are always monotonic. For wide bands of noise centered below CF, rate-level functions can be nonmonotonic or appear to plateau at rates less than the saturation rate to CF tones. Thus, wide bands of noise centered above or below CF can produce lower discharge rates than do narrowbands at the same spectral level. Dissert. Abstr.

N80-28038# Naval Medical Research Inst., Bethesda, Md.
MEASUREMENT OF LUNG FUNCTION USING MAGNETOMETERS. 1: PRINCIPLES AND MATHEMATICAL MODELING Progress Report
Donald L. Vawter Nov. 1979 54 p refs
(AD-A083910; MNRI-79-78; Rept-2) Avail: NTIS HC A04/MF A01 CSCL 06/16

The use of magnetometer systems to predict pulmonary air volumes was studied. The sensitivity of the system to angular rotations was found to be small because magnetometers are normally mounted to the subject. Seven mathematical models for predicing volume were investigated, with the finding that two parameter models are adequate for quiet breathing. For complicated maneuvers, a three-parameter model is necessary, and for predictive usefulness, the model must be calibrated using a complex maneuver. Results of studies of the dimensional changes, and the correlation between the dimensional changes, that occur during normal breathing are presented. Author

N80-28039*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF HYPOKINESIA ON INVERTASE ACTIVITY OF THE MUCOSA OF THE SMALL INTESTINE
A. Abdusattarov Jun. 1980 5 p refs Transl. into ENGLISH from Uzb. Biol. Zh. (USSR), no. 1, 1978 p 61-62 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Academy of Sciences (USSR)
(NASA-TM-76191) Avail: NTIS HC A02/MF A01 CSCL 06P

The effect of prolonged hypokinesia on the enzyme activity of the middle portion of the small intestine was investigated. Eighty-four mongrel white male rats weighing 170-180 g were divided into two equal groups. The experimental group were maintained in single cages under 30 days of hypokinetic conditions and the control animals were maintained under ordinary laboratory conditions. It is concluded that rates of invertase formation and its inclusion in the composition of the cellular membrane, if judged by the enzyme activity studied in sections of the small intestine, are subject to phase changes in the course of prolonged hypokinesia. R.E.S.

N80-28040*# National Aeronautics and Space Administration, Washington, D. C.
MORPHOFUNCTIONAL CORRELATIONS IN THE EXPERIMENTAL STUDY OF MYOCARDIOPATHIES UNDER THE STRESS OF FORCED RESTRAINT. NOTE 2: THE INFLUENCE OF ADRENAL IMBALANCE
M. Dinu, S. Dolinescu, and A. Sneer May 1980 12 p refs Transl. into ENGLISH from Rev. Med.-Chir. (Iasi) (Romania), no. 1, 1978 p 87-91 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Orginal doc. prepared by Inst. of Med. and Pharmacy
(Contract NASw-3199)
(NASA-TM-76138) Avail: NTIS HC A02/MF A01 CSCL 06S

Tests were performed with 70 rats to determine the effects of restraint on the functions and structure of the myocardium under varying conditions of adrenal imbalance. Results showed that in rats with adrenal imbalance, fasting and restraint produced the same biochemical alterations as in the controls. The morphologic alteractions, as well as their electric expression, were more varied and evident in the animals with adrenal imbalance. Persistence of the microscopic and electrocardiographic alterations after 72 hours restraint in the animals subjected to unilateral adrenalectomy suggests chronic evolution of the myocardial lesions. This proves the necessity of intact adrenals for a good adaptability to stress. L.F.M.

N80-28041*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES OF THE BODY FUNCTIONS DURING LONG-TERM HYPOKINESIA
Ye. A. Kovalenko, V. L. Popkov, Yu. I. Kondratev, E. S. Mailyan, Yu. S. Galushko, A. A. Prokhonchukov, V. A. Kazaryan, R. S. Morozova, L. V. Serova, A. N. Potapov et al. May 1980 13 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 6, 1970 p 3-9 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)
(NASA-TM-76166) Avail: NTIS HC A02/MF A01 CSCL 06S

Prolonged hypokinesis (100-170 days) studied in 2000 rats kept in cages limiting their mobility provoked considerable changes in the gaseous and energetic metabolism: an elevation of the total gaseous metabolism and of the rate of O2 requirement by the muscles (in the late periods of hypokinesis) and a change in the intensity of tissue respiration of the liver and myocardium. There also proved to be a reduction in the level of phosphorylation and separation of oxidative phosphorylation in the myocardium, liver, and partially in the skeletal muscle. Prolonged hypokinesia led to changes in tissue metabolism: a disturbance of development of the animals, a marked delay and an increase in the weight of the organism and the muscular system, and disturbances of the mineral and protein metabolism. Prolonged hypokinesis also lead to exhaustion of the hypothalamus-hypophysis-adrenal cortex system. R.E.S.

N80-28042*# National Aeronautics and Space Administration, Washington, D. C.
THE RELATION BETWEEN TILT TABLE AND ACCELERATION-TOLERANCE AND THEIR DEPENDENCE ON STATURE AND PHYSICAL FITNESS
K. E. Klein, F. Backhausen, H. Bruner, J. Eichhorn, D. Jovy, J. Schotte, L. Vogt, and H. M. Wegman. Apr. 1980. 30 p. refs. Transl. into ENGLISH from Intern. A. Angew. Physiol. (West Germany), v. 26, 1968 p 205-226. Original language document announced as A69-21304. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75796) Avail: NTIS HC A03/MF A01 CSCL 06S

A group of 12 highly trained athletes and a group of 12 untrained students were subjected to passive changes of position on a tilt table and positive accelerations in a centrifuge. During a 20 min tilt, including two additional respiratory maneuvers, the number of faints and average cardiovascular responses did not differ significantly between the groups. During linear increase of acceleration, the average blackout level was almost identical in both groups. Statistically significant coefficients of product-moment correlation for various relations were obtained. The coefficient of multiple determination computed for the dependence of acceleration tolerance on heart-eye distance and systolic blood pressure at rest allows the explanation of almost 50% of the variation of acceleration tolerance. The maximum oxygen uptake showed the expected significant correlation to the heart rate at rest, but not the acceleration tolerance, or to the cardiovascular responses to tilting. L.F.M.

N80-28043*# National Aeronautics and Space Administration, Washington, D. C.
VERTEBRAL PAIN IN HELICOPTER PILOTS
R. Auffret, R. P. Delahaye, P. J. Metges, and Vicens. Jun. 1980. 19 p. transl. into ENGLISH of "Les Algies Vertebrales des Pilotes d'Helicopteres", Rept. AGARD-CP-255, AGARD, Paris, Dec. 1978. 7 p. Translation was announced as N79-19656. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75792) Avail: NTIS HC A02/MF A01 CSCL 06P

Pathological forms of spinal pain engendered by piloting helicopters were clinically studied. Lumbalgia and pathology of the dorsal and cervical spine are discussed along with their clinical and radiological signs and origins. R.E.S.

N80-28044*# National Aeronautics and Space Administration, Washington, D. C.
THE CONTENT OF CATECHOLAMINES IN THE ADRENAL GLANDS AND SECTIONS OF THE BRAIN UNDER HYPOKINESIA AND INJECTION OF SOME NEUROTROPIC AGENTS
B. E. Melnik and E. S. Paladiy. Mar. 1980. 10 p. refs. Transl. into ENGLISH from Biol. Nauki (USSR), v. 15, no. 11, 1972 p 45-49. Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by V. I. Lenin Kishinev State Univ. USSR
(Contract NASw-3199)
(NASA-TM-76010) Avail: NTIS HC A02/MF A01 CSCL 06S

The dynamics of catecholamine content were studied in the adrenal glands and in various region of the brain of white rats under hypokinesia and injections of neurotropic agents. Profound changes in body catecholamine balance occured as a result of prolonged acute restriction of motor activity. Adrenalin retention increased and noradrenanalin retention decreased in the adrenal glands, hypothalamus, cerebral hemispheres, cerebellum and medulla oblongata. Observed alterations in catecholamine retention varied depending upon the type of neurotropic substance utilized. Mellipramine increased catecholamine retention in the tissues under observation while spasmolytin brought about an increase in adrenalin concentration in the adrenals and a decrease in the brain. R.E.S.

N80-28045*# National Aeronautics and Space Administration, Washington, D. C.
MECHANISM OF SELECTIVE LESION OF THE CARDIOVASCULAR SYSTEM IN PSYCHO-EMOTIONAL STRESS
Yu. M. Repin and V. G. Startsev. Apr. 1979. 14 p. refs. Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (USSR), v. 8, 1975 p 71-76. Translation was announced as N76-12713. Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by USSR Acad. of Med. Sci. Inst. for Pathology and Therapy
(Contract NASw-3199)
(NASA-TM-76035) Avail: NTIS HC A02/MF A01 CSCL 06S

A species predisposition to hypertensive and ischemic heart disease occurs in mammals only at the level of primates, and is associated with social regulation of biological reactions. The specific physiological mechanism giving rise to psychonerogenic pathology may be an inhibition of the motor component of the agressive-defensive response. Repeated combination of pursuit with subsequenct immobilization resulted in four out of five experimental baboons developing serious arterial hypertension and ischemic lesion of the heart which lasted many years. Author

N80-28046*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF THE INVESTIGATION OF THE OTOLITH FUNCTION IN MANNED SPACE FLIGHTS
L. N. Kornilova, G. D. Syrykh, I. K. Tarasov, and I. Ya. Yakovleva. Jun. 1980. 9 p. refs. Transl. into ENGLISH from Vestn. Otorino-Laringol. (USSR), no. 6, 1979 p 21-24. Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Ministry of Health, Moscow
(Contract NASw-3198)
(NASA-TM-76103) Avail: NTIS HC A02/MF A01 CSCL 06P

The effects of conditions of long term and short term space flights on the otolith function of cosmonauts were investigated via pre and post examinations. The results show that after long term flight, the intensity of the otolith reflex increased and asymmetry occurred in the indicators of the otolith function. Large changes in terms of expression and duration in the indicators of the otolith function after long term flight as compared with short term flight were also noted. R.E.S.

N80-28047*# National Aeronautics and Space Administration, Washington, D. C.
CHARACTERISTICS OF ENZYMATIC INDUCTION PROVOKED BY CHLORDANE
A. Denys, E. Guilbert-Ber, and Jeanne Levy. Jun. 1980. 18 p. refs. Transl. into ENGLISH from Therapie (France), v. 30, 1975 p 277-288. Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Pharmacology, Paris
(Contract NASw-3198)
(NASA-TM-76194) Avail: NTIS HC A02/MF A01 CSCL 06P

The effects of various stresses, such as restraint and lowering or raising of environmental temperature, in mice pretreated with chlordane were investigated. (Chlordane is an inhibitor of protein synthesis.) It was found that restraint or exposure to a cold environment for three hours mobilized the chlordane stored in the adipose tissue of mice. R.E.S.

N80-28048*# National Aeronautics and Space Administration, Washington, D. C.
CARDIOVASCULAR AND RESPIRATORY PHYSIOPATHOLOGICAL ASPECTS OF HYPOKINESIA
A. Dagianti. Jun. 1980. 26 p. refs. Transl. into ENGLISH from Recenti Progr. Med. (Italy), v. 52, no. 4, 1972. p. 323-344. Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-76198) Avail: NTIS HC A03/MF A01 CSCL 06S

The many effects of hypokinesia on the human organism are described. The differences in normally mobile subjects and hypokinetic subjects as relates to heart rate, average humeral pressure, cardiac capacity, cardia index, systolic range, and large cycle resistances are discussed. It is concluded that further studies must be carried out in seven specific areas of cardiocirculatory damage due to hypokinesia. R.E.S.

N80-28049# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
EFFECTS OF OZONE ON EXERCISING AND SEDENTARY ADULT MEN AND WOMEN REPRESENTATIVE OF THE FLIGHT ATTENDANT POPULATION
E. A. Higgins, M. T. Lategola, J. M. McKenzie, C. E. Melton, and J. A. Vaughan. Oct. 1979. 106 p. refs.
(AD-A080045; FAA-AM-79-20) Avail: NTIS HC A06/MF A01 CSCL 06/16

Three studies at two ozone concentrations have been carried out in an attempt to define the effect level for ozone under simulated flight conditions. All experiments were carried out in an altitude chamber held at 6,000 feet MSL; relative humidity was kept at 10-12 percent and temperature at 68 - 74 F. Subjects paid were nonsmoking men and women in their third decade who had the anthropomorphic characteristics of airline flight attendants. All subjects were exposed to ozone in one experiment and to air only in another. Order of presentation of the experiments was balanced, and sessions were separated by 1 week. Study 1 consisted of exposure of 15 men and 12 women to 0.20 parts per million by volume (ppmv) ozone for 4 h with treadmill exercise for the last 10 min of each hour. In the second study 14 men and 14 women were exposed to 0.30 ppmv ozone for 3 h with 10 min exercise at the end of each hour. The third study consisted of exposure of 14 men and 14 women to 0.30 ppmv without exercise. Cardiopulmonary, performance, visual, and symptoms assessments were made. GRA

N80-28050# National Technical Information Service, Springfield, Va.
BIOLOGICAL EFFECTS OF MICROWAVES. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1978 - Apr. 1980
Elizabeth A. Harrison. Apr. 1980. 95 p. Supersedes NTIS/PS-79/0433; NTIS/PS-78/0432.
(PB80-808256; NTIS/PS-79/0433; NTIS/PS-78/0432) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 06R

The selected abstracts cover the biological effects on man and animals from exposure to microwaves. In addition to dosages and tolerances, regulations, and standards are included. This bibliography contains 88 abstracts, 43 of which are new entries to the previous edition. GRA

N80-28051# National Technical Information Service, Springfield, Va.
TOXICITY OF VINYL CHLORIDE. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1969 - Mar. 1980
Elizabeth A. Harrison. Apr. 1980. 102 p. Supersedes NTIS/PS-79/0419; NTIS/PS-78/0442.
(PB80-807662; NTIS/PS-79/0419; NTIS/PS-78/0442) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 06T

Research is cited on the health hazards from exposure to vinyl chloride and vinyl chloride resins. Studies are included on the epidemiology of industrial and public exposures to the compound and its degradation and combustion products. This updated bibliography contains 90 abstracts, 8 of which are new entries to the previous edition. GRA

N80-28052# National Technical Information Service, Springfield, Va.
ALTITUDE HYPOXIA. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1978 - Mar. 1980
Elizabeth A. Harrison. Apr. 1980. 47 p.
(PB80-807696; NTIS/PS-79/0428; NTIS/PS-78/0443) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

The selected abstracts of research reports cover stress physiology, narcosis, acceleration tolerance, adaptation (physiology), psychophysiology, respiration, metabolism, and cardiovascular system as applied to altitude hypoxia. This updated bibliography contains 40 abstracts, 23 of which are new entries to the previous edition. GRA

N80-27996# Joint Publications Research Service, Arlington, Va.
RESULTS OF STUDIES OF PULSED BLOOD FLOW AND REGIONAL VASCULAR TONUS DURING FLIGHTS IN THE FIRST AND SECOND EXPEDITIONS ABOARD THE SALYUT-6-SOYUZ ORBITAL COMPLEX
V. F. Turchaninova and M. V. Domracheva. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980. p. 13-18. refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980. p. 11-14. (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-27997# Joint Publications Research Service, Arlington, Va.
CIRCULATION IN EXERCISING CREW MEMBERS OF THE FIRST MAIN EXPEDITION ABOARD SALYUT-6
V. S. Georgiyevskiy, N. A. Lapshina, L. Ya. Andriysko, L. C. Umnova, V. G. Doroshev, I. V. Alferova, V. N. Ragozin, and Ye. A. Kobzev. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980. p. 19-23. refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980. p. 15-18. (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-27998# Joint Publications Research Service, Arlington, Va.
HEMODYNAMICS AND PHASE STRUCTURE OF THE CARDIAC CYCLE IN MEMBERS OF THE FIRST CREW OF SALYUT-6 AT REST
V. A. Degtyarev, V. G. Doroshev, N. A. Lapshina, V. N. Ragozin, Z. A. Kirillova, S. I. Ponamarev, and O. B. Kulikov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980. p. 24-28. refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980. p. 18-21. (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28004# Joint Publications Research Service, Arlington, Va.
HUMAN COLOR DISCRIMINATING FUNCTION WITH MUSCULAR TENSION DURING EXPOSURE TO VESTIBULAR STIMULI
Zh. M. Kudryashova and A. A. Shipov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980. p. 60-64. refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980. p. 41-44. (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28006# Joint Publications Research Service, Arlington, Va.
STUDIES OF PROGNOSTIC SIGNIFICANCE OF ANTIORTHOSTATIC POSITION
Kh. Kh. Yarullin, V. A. Gornago, T. D. Vasilyeva, and M. Ye. Gugushvili. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980. p. 72-80. refs. Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980. p. 48-54. (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28007# Joint Publications Research Service, Arlington, Va.
EVALUATION OF EFFICACY OF THE SET OF PREVENTIVE MEASURES REFERABLE TO THE HUMAN NEUROMUSCULAR SYSTEM UNDER HYPOKINETIC CONDITIONS
V. A. Tishler, V. I. Safonov, and Z. A. Krivitsina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 81-85 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 3, 1980 p 54-57 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28008# Joint Publications Research Service, Arlington, Va.
THE STRESS REACTION TO HYPOKINESIA AND ITS EFFECT ON GENERAL RESISTANCE
I. P. Chernov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 86-90 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 57-60 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28010# Joint Publications Research Service, Arlington, Va.
SECRETION, INCRETION AND RESECRETION OF PANCREATIC LIPASE DURING PROLONGED RESTRICTION OF MOTOR ACTIVITY
I. L. Medkova, N. M. Nikolayeva, and K. V. Smirnov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 97-103 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 64-67 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28011# Joint Publications Research Service, Arlington, Va.
THEORETICAL ANALYSIS OF THE EFFECT OF STATE OF PULMONARY CIRCULATION ON DISTRIBUTION OF VENTILATION-PERFUSION RELATIONS AND GAS EXCHANGE IN THE LUNGS
A. I. Dyachenko and V. G. Shabelnikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 104-109 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 68-71 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28012# Joint Publications Research Service, Arlington, Va.
METHOD FOR ASSESSING HEMODYNAMICS AND DETECTING LATENT INSUFFICIENCY OF CEREBRAL CIRCULATION IN COSMONAUT CANDIDATES
D. A. Alekseyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 110-116 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 71-74 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28013# Joint Publications Research Service, Arlington, Va.
ULTRASONIC METHOD OF RECORDING GAS BUBBLES IN ANIMAL VENOUS BLOOD IN A RAREFIED ATMOSPHERE
R. T. Kazakova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 117-121 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 74-76 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28016# Joint Publications Research Service, Arlington, Va.
RESPIRATION AND GAS EXCHANGE UNDER HYPERBARIC CONDITIONS
L. A. Bryantseva, I. S. Breslav, and A. G. Dianov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 1-14 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 3-10 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28017# Joint Publications Research Service, Arlington, Va.
CIRCULATION AT REST IN CREW MEMBERS OF THE FIRST MAIN EXPEDITION ABOARD SALYUT 6
V. A. Degtyarev, V. G. Doroshev, V. M. Mikhaylov, V. S. Georgiyevskiy, S. A. Kobzev, Z. A. Kirillova, N. A. Lapshina, V. G. Savelyeva, and L. V. Umnova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 15-19 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 11-14 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28018# Joint Publications Research Service, Arlington, Va.
STATE OF HUMAN BONE TISSUE PROTEIN FRACTION AFTER SPACE FLIGHTS
A. A. Prokhonchukov, V. K. Leontyev, N. A. Zhizhina, R. A. Tigranyan, A. G. Kolesnik, and N. A. Komissarova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JRPS-75654) 8 May 1980 p 20-26 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 14-18 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28024# Joint Publications Research Service, Arlington, Va.
DYNAMICS OF HUMAN EXTERNAL RESPIRATION AND BLOOD GASES UNDER THE COMBINED EFFECT OF HYPERCAPNIA AND HYPOXIA
L. Kh. Bragin, A. Ye. Severin, N. A. Agadzhanyan, G. A. Davydov, and Yu. A. Spasskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 58-62 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 38-41 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28025# Joint Publications Research Service, Arlington, Va.
FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM UNDER THE COMBINED EFFECT OF 28 DAY IMMERSION, ROTATION ON A SHORT-ARM CENTRIFUGE AND EXERCISE ON A BICYCLE ERGOMETER
I. F. Vil-Vilyams and Ye. B. Shulzhenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 63-68 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 42-45 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28026# Joint Publications Research Service, Arlington, Va.
PHARMACOLOGICAL ANALYSIS OF PHYSIOLOGICAL MECHANISMS OF ORTHOSTATIC HEMODYNAMIC STABILITY
L. I. Orlodchiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 69-74 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 45-49 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28027# Joint Publications Research Service, Arlington, Va.
BIOELECTRIC ACTIVITY OF THE HUMAN BRAIN DURING AND AFTER 182-DAY ANITORTHOSATIC HYPOKINESIA
T. N. Krupina, Kh. Kh. Yarullin, and D. A. Alekseyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 75-83 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14,

no. 2, Mar./Apr. 1980 p 49-54 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28028# Joint Publications Research Service, Arlington, Va.
MORPHOMETRIC ANALYSIS OF GLOMERULES AND JUXTAGLOMERULA SYSTEM OF THE RAT KIDNEY IN THE COURSE OF EXPERIMENTAL HYPOKINESIA
I. P. Chernov and A. G. Gaffarov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 84-89 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 54-47 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28029# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPOKINESIA ON CHANGES IN CARBOHYDRATE AND LIPID METABOLISM IN THE HEART AND LIVER
Yu. P. Rylnikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 90-96 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2 Mar./Apr. 1980 p 57-62 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28034# Joint Publications Research Service, Arlington, Va.
GENERALIZED NYSTAGMOMETRIC CHARACTERISTICS FOR DIAGNOSTIC PURPOSES
M. M. Leuashov and A. I. Tumakov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 123-129 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 78-82 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-28053 New York Univ., N. Y.
RESPONSE TIME, OPERATOR PRODUCTIVITY AND JOB SATISFACTION Ph.D. Thesis
Raymond Earle Barber 1979 117 p
Avail: Univ. Microfilms Order No. 8014200

The impact is examined of on-line system response time on operator productivity and job satisfaction. A user organization in Cincinnati, Ohio and its five on-line systems provided the environment for the study. The impact of response time on productivity suggests that all or nearly all (e.g., 98%) transactions should be completed in 12 seconds or less. Beyond this level, the user organization suffers severe penalties in lost productivity. When response times are less than six seconds, productivity is relatively flat. That is, the impact of response time on productivity is not as great when average response time is less than six seconds as it is when average response time is greater than six seconds. It is concluded that the normal operating range of the systems studied should be in the four to six second range. It was predicted, prior to the study, that all categories of job satisfaction would be adversely affected by longer response times. The results, however, indicate that response time has a mixed impact on job satisfaction. Some categories showed decreased satisfaction as predicted. Others, however, demonstrated an improvement in job satisfaction as response time increased. These were mainly categories dealing with interpersonal relationships. Based upon the results the implications of response time on system operation and system design are discussed. A method is suggested that would allow the response time models to be applied to other online systems. Desirable directions for future research are discussed in depth. Dissert. Abstr.

N80-28002# Joint Publications Research Service, Arlington, Va.
SOME ASPECTS OF APPLICATION OF THE SYSTEMIC APPROACH TO AVIATION ENGINEERING PSYCHOLOGY
V. A. Ponomarenko and N. D. Zavalova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 47-52 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 33-37 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28003# Joint Publications Research Service, Arlington, Va.
EFFECT OF PROLONGED +Gz ACCELERATIONS ON HUMAN PERFORMANCE
A. S. Barer, T. A. Sokolova, V. M. Tardov, and Yu. P. Yashin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 53-59 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 37-40 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28023# Joint Publications Research Service, Arlington, Va.
EFFECT OF HIGH AMBIENT TEMPERATURE ON HUMAN PERFORMANCE
A. N. Azhayev, V. I. Zorile, and A. N. Koltsov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 53-57 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 20 Mar./Apr. 1980 p 35-38 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-28054# Perceptronics, Inc., Woodland Hills, Calif.
A CONCEPT FOR DEVELOPING HUMAN PERFORMANCE SPECIFICATIONS Final Report
Jonathan D. Kaplan and William H. Crooks Aberdeen Proving Ground, Md. Human Eng. Labs. Apr. 1980 47 p refs (Contract DAAK11-79-C-0115)
(AD-A084617; PTR-2020-80-3; HEL-TM-7-80) Avail: NTIS HC A03/MF A01 CSCL 15/5

OMB Circular A-109 emphasizes the front end of systems acquisition with the intent of (1) expressing needs and program objectives in 'mission' terms rather than 'equipment' terms, and (2) allowing competitive exploration of alternative methods of meeting those needs. For human factors specialists to comply with these requirements, it will be necessary for them to produce explicit specifications for the critical human performance which is required for system performance. This paper presents a concept for producing these required human performance specifications prior to the initial design of a system. It also presents an example of a detailed human performance specification as well as Appendices containing material used to produce human performance specifications for various kinds of systems. GRA

N80-28055# National Bureau of Standards, Washington, D.C. Product Safety Technology Div.
A MATHEMATICAL MODEL FOR USE IN EVALUATING AND DEVELOPING IMPACT TEST METHODS FOR PROTECTIVE HEADGEAR
Robert E. Berger Oct. 1979 79 p
(PB80-164957; NBSIR-80-1987) Avail: NTIS HC A05/MF A01 CSCL 06Q

A lumped parameter mathematical model was developed to connect injury parameters in real life head impact environments to output parameters of test methods for evaluating protective headgear. Analytical/experimental schemes were developed for

mathematically representing the parameters that characterize each of the three distinct elements of the model: the head or headform; the impact surface; and the helmet. The model was shown to be useful in determining test method pass/fail criteria which corresponds to the threshold of injury in the real life situation. GRA

N80-27995# Joint Publications Research Service, Arlington, Va.
BIOCHEMICAL BASES OF PATHOGENESIS OF HYPOKINESIA
I. V. Fedorov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 3, 1980 (JPRS-75956) 27 Jun. 1980 p 1-12 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 3, 1980 p 3-10 (For primary document see N80-27994 18-51)
Avail: NTIS HC A08/MF A01

N80-28031# Joint Publications Research Service, Arlington, Va.
THE QUESTION OF USING DEHYDRATED FOODS DURING LONG-TERM SPACE FLIGHTS
V. P. Bychkov and M. V. Markaryan. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 103-109 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 66-70 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28033# Joint Publications Research Service, Arlington, Va.
STUDY OF COMPATIBILITY OF CERTAIN HIGHER PLANTS AND CHLORELLA AS RELATED TO A BIOREGENERATIVE HUMAN LIFE SUPPORT SYSTEM
Yu. I. Shaydorov, B. N. Shebalin, and G. I. Meleshko. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 116-122 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 14, no. 2, Mar./Apr. 1980 p 74-78 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

N80-28035# Joint Publications Research Service, Arlington, Va.
UPGRADING EFFICACY OF MEMBRANE TECHNIQUES FOR REGENERATING WATER FROM URINE
B. A. Adamovich, V. D. Volgin, N. M. Nazarov, Yu. Ye. Sinyak, and S. V. Chizhov. *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 2, 1980 (JPRS-75654) 8 May 1980 p 130-113 ref Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), V. 14, no. 2 Mar./Apr. 1980 p 82-83 (For primary document see N80-28015 18-51)
Avail: NTIS HC A08/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-28056*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
APPROACH TO SOUNDING ON THE VAS PROCESSOR
Dennis Chesters Mar. 1980 23 p refs
(NASA-TM-80713) Avail: NTIS HC A02/MF A01 CSCL 09B

The key features of the sounding software laboratory being installed on the VAS Processor at NASA/GSFC are outlined. Emphasis is on the support data and personal guidance that a meteorological researcher must provide to attune a physically modeled VAS sounding to his experiment. The fundamental aim of the sounding-support effort is to provide a system which makes use of: radiation transfer models based upon laboratory data, analytic inversion schemes, human guidnace for quality control, statistically conditioned retrieval methods, and current ancillary data. Author

N80-28057# Computer Corp. of America, Cambridge, Mass.
SPATIAL DATA MANAGEMENT SYSTEM Quarterly Research and Development Technical Report, 1 Sep. - 30 Nov. 1979
David Kramlich, Christopher F. Herot, Richard Carling, and Mark Friedell 30 Nov. 1979 38 p refs
(Contract MDA903-78-C-0122; APRA Order 3487)
(AD-A083729) Avail: NTIS HC A03/MF A01 CSCL 09/2

Work on the design and implementation of a prototype Spatial Data Management System (SDMS) is described. Spatial Data Management is a technique for storing and retrieving information which employs pictorial representations of data arranged on a collection of flat surfaces which the user can view on a color, raster scan display. Tools are provided for interactively entering graphical and symbolic data, including a mechanism for generating graphical representations of existing, shared symbolic data bases. Several new features that increase the utility of the system were implemented. These are: a new statement in the modified query language of the underlying DBMS; extensions to the graphical editor; extensions to the module which manages objects in the graphical Data Space (GDS); and a terminal emulator to provide a text interface to SDMS. GRA

N80-28058# Naval Postgraduate School, Monterey, Calif.
PERFORMANCE PREDICTION FROM A COMPUTER HARDWARE DESCRIPTION
Lyle Ashton Cox, Jr. Dec. 1979 25 p refs
(RR0000110)
(AD-A083842; NPS52-79-001) Avail: NTIS HC A02/MF A01 CSCL 09/2

Today's computers are among the most complex man made systems in existence today. How can we make our designs not only more precise, but make these systems more accurately and cost effectively achieve their goals? We have begun to rely upon computer aided design techniques. The use of these techniques often commences not with the statement of the system goals, but rather with the specification of an architecture and a logic technology. In view of the high costs of computer development, we should be quite confident that our architecture/technology combination is capable of meeting the system requirements before we proceed to more detailed design phases. The entire system design process must be integrated, and include performance prediction and verification techniques. This design process should be reflected in a single description language. A methodology for accomplishing this goal capable of employing many existing design practices is discussed here. GRA

N80-28059# SRI International Corp., Menlo Park, Calif. Computer Science Lab.
FORMAL TECHNIQUES FOR FAULT-TOLERANCE IN DISTRIBUTED DATA PROCESSING (DDP) Final Report
Jack Goldberg, William H. Kautz, Leslie Lamport, Peter G. Neumann, Robert E. Shostak, and Marshal C. Pease 1 May

1980 70 p refs
(Contract DASG60-78-C-0046; SRI Proj. 7242)
(AD-A084537) Avail: NTIS HC A04/MF A01 CSCL 09/2

Previous work on the logical specification of distributed systems has been continued. The basic approach involves specifying the logical functioning of the system in terms of an abstract state machine. Part of the fault-tolerance of the system is achieved by the reliability of this state machine. However, the problem of faulty inputs must be explicitly handled by the state machine. A fault-tolerant DDP system must handle malfunctioning components that give conflicting information to different parts of the system. This problem is expressed abstractly as the 'Byzantine Generals Problem', involving a group of generals communicating by messenger who must reach agreement upon a common battle plan despite the fact that one or more of them may be traitors trying to confuse the others. Several solutions are described and their use in implementing fault-tolerant DDP systems is discussed. Achieving fault-tolerance requires the detection and diagnosis of faults. Our work on the diagnosis of faulty nodes and communication links in a DDP system is described. In the event of a failure, one would like a DDP system to recover rapidly with a minimal loss of information. The value of a hierarchical design methodology in achieving a recovery capability is discussed. GRA

N80-28060# Verchron Systems, Saline, Mich.
DISTRIBUTED SENSOR SYSTEMS AND ELECTROMECHANICAL ANALOG FACILITY Final Report
Richard A. Volz, S. L. Bement, Richard Jungclas, T. Rosenbaum, E. J. Sesek, J. Wenstrand, S. Cagliastro, A. Zemon, and P. Beck (ARADCOM, Dover, N.J.) Jan. 1980 500 p refs
(Contract DAAG29-76-D-0100)
(AD-A084656; AD-E400397; ARPAD-CR-80001) Avail: NTIS HC A21/MF A01 CSCL 09/2

Distributed sensor systems are key ingredients in many real world applications. Specific instances abound both in industrial and military environments, e.g., the monitoring (and possibly control) of manufacturing operations, or the dispersion of various types of sensors to detect enemy movements. There are two major areas of study in distributed sensors: the design and development of the sensors themselves, and the logical use of such sensors. This report is directed toward mechanisms to study the latter. Some examples of the latter, explained in detail, are based on CICE/ECE/IOE 469, a course in Real Time Computing Systems developed at the University of Michigan, Ann Arbor. Both student and faculty critiques of the electromechanical analog facility used in the program are included. GRA

N80-28061# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: VALIDATION VERIFICATION, AND TESTING FOR THE INDIVIDUAL PROGRAMMER Final Report
Martha A. Branstad, John C. Cherniavsky, and W. Richards Adrion Feb. 1980 31 p refs
(PB80-166960; NBS-SP-500-56; LC-80-600005) Avail: NTIS HC A03/MF A01 CSCL 09B

Guidelines are given for program testing and verification to insure quality software for the programmer working alone in a computing environment with limited resources. The emphasis is on verification as an integral part of the software development. Guidance includes developing and planning testing as well as the application of other verification techniques at each lifecycle stage. Relying upon neither automated tools nor formal quality assurance support, the guidelines should be appropriate for applications programmers doing small development projects. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-28062 Purdue Univ., Lafayette, Ind.
OPTIMIZATIONS OF STOCHASTIC SYSTEMS THROUGH SIMULATION USING STOCHASTIC APPROXIMATION METHOD Ph.D. Thesis
Farhad Azadivar 1979 170 p
Avail: Univ. Microfilms Order No. 8015423

An algorithm was developed for optimizing the response function of simulation models with stochastic behavior. Principles of stochastic approximation were used in developing this algorithm which guaranteed convergence to the optimum, if large number of observations were made. The algorithm yielded accurate answers even when the number of observations were not too large. The algorithm is further developed to optimize such simulation models even when the decision variables were subject to a set of linear constraints. Dissert. Abstr.

N80-28063 Kansas State Univ., Manhattan.
A STUDY OF THE SEQUENTIAL REGRESSION (SER) ALGORITHM AND ITS APPLICATIONS
David Lynn Soldan 1979 160 p
Avail: Univ. Microfilms Order No. 8015280

The sequential regression (SER) algorithm which enables a direct adaptive implementation of the least squares optimum filter is discussed. It has superior convergence characteristics when compared to other algorithms. Since the SER algorithm computes the inverse of the autocorrelation matrix of the input data, problems can arise if a unique inverse does not exist. A modification is given that guarantees a unique solution thus enabling the SER algorithm to be used for all input signals. Factors that effect the performance of an adaptive filter implementing the SER algorithm when it is in a long-term signal processing environment are also considered. An additional modification is presented to obtain the performance necessary for long-term signal processing. The results revolving the SER algorithm for phase compensation are given. These clearly demonstrate that the performance of the SER algorithm is superior to existing algorithms used for this purpose. Dissert. Abstr.

N80-28064 Ohio State Univ., Columbus.
TREATMENT OF UNGRAMMATICAL AND EXTRAGRAMMATICAL PHENOMENA IN NATURAL LANGUAGE UNDERSTANDING SYSTEMS Ph.D. Thesis
Stan C. Kwasny 1980 148 p
Avail: Univ. Microfilms Order No. 8015897

Several language phenomena commonly considered deviant by linguistic standards, and how they might be integrated into a computer model for understanding Natural Language were investigated. Techniques developed within the Augmented Transition Network (ATN) model are shown to be adequate to relate many of these cases to well-formed counterparts. First, linguistic problems are defined and discussed and then techniques for overcoming these problems are presented. The techniques require a normative grammar be given which specifies the processing required of grammatical inputs. Our mechanisms work to relate ungrammatical inputs to appropriate grammatical ones and to process them accordingly. The mechanisms proposed include two techniques for relaxing restrictions in the grammar, a new arc type employing pattern matching, and a method for dynamically ordering the evaluation of arcs. The efficiency and structural characteristics of the original normative grammar are not altered by these mechanisms. Dissert. Abstr.

N80-28065 California Inst. of Tech., Pasadena.
A SOFTWARE DESIGN SYSTEM Ph.D. Thesis
Gideon David Hess 1980 193 p
Avail: Univ. Microfilms Order No. 8016367

The goal of the research was to build a system that supports, without interfering with, the activity of systematic software design and takes upon itself mechanical activities the designer can be spared. Two of the main activities which constitute the process of software creation are: (1) designing a solution to the problem; (2) implementing the design. The activity of design has to be performed by the programmer himself, it can only be aided by the computer. Producing a program from a complete design is a mechanical activity the computer can take upon itself. These observations lead to the following objectives that a software design system should meet: (1) Providing tools that support the design activity and enable maximum flexibility; (2) Recognizing the lowest level primitives of the design as the target language and producing the program in this language. A system along

these guidelines was implemented. It permits the user to write definitions which refine high level design decisions into lower levels and, at the same time, serve as syntax descriptions and translation rules for the languages used in the design.
Dissert. Abstr.

N80-28066 Rochester Univ., N. Y.
PROGRAM CHECKING Ph.D. Thesis
Graeme John Williams 1980 130 p
Avail: Univ. Microfilms Order No. 8014345

A set of language features for declaring properties of variables. The scheme allows for richer descriptions of variables than simple data types is more expressive than the type mechanism in other languages, and can be checked efficiently. Properties differ from types in that a variable may have more than one property, and the matching of the actual argument of a procedure call to the formal in the definition is by implication. There are two kinds of properties: interpreted and uninterpreted. Interpreted properties depend only on the value of a variable, for example positive or odd. They can be defined with a built-in unary relation and a variable, such as odd(x), or with a binary relation, a variable and a constant, such as $y > 0$. They are a natural extension of subrange types. Uninterpreted properties provide implicit information about the domain of a variable. For example one variable might be a number of apples, another a number of organges. Uninterpreted properties allow each variable to be labelled with the property apples or oranges. A property fruit related to both apples and oranges, may be defined, so that adding apples to oranges makes sense if finding the total number of fruit, but not otherwise.
Dissert. Abstr.

N80-28067 Cornell Univ., Ithaca, N. Y.
THE APPLICATION OF REGRESSION METHODS TO THE INITIAL TRANSIENT PROBLEM IN COMPUTER SIMULATIONS Ph.D. Thesis
Mark Kamerer Snell 1980 178 p
Avail: Univ. Microfilms Order No. 8015742

Regression methods were developed for inferring first order stationary behavior of simulated systems. The multivariate response sampled during a simulation experiment was regarded as a stationary stochastic process contaminated by an additive stochastic transient process. The transient process was introduced when initial conditions for the runs in the experiment were selected. Parameters of an underlying stationary model were estimated when the transient contamination was present. Both point and interval estimators were considered. The procedure, under stipulated conditions, lead to estimators that were consistent, efficient and converge in law to a multivariate normal distribution. Two general growth models were proposed for the transient process. These regressors were used to improve short run length bias due to initialization. The consequences of misspecification of the transient model were studied.
Dissert. Abstr.

N80-28068 Purdue Univ., Lafayette, Ind.
A COMPUTER GRAPHICS SYSTEM FOR MACROMOLECULAR MODEL BUILDING Ph.D. Thesis
James Ross Miller 1979 243 p
Avail: Univ. Microfilms Order No. 8015492

A design system was developed which automatically segments and pages the electron density map data and allows users to build molecular models into this map a single residue at a time. All communications between the user and the system was in the language of the model builder. The system was tested by constructing a model of southern bean mosaic virus (SBMV) into a 2.8 angstrom resolution electron density map. With a few exceptions the resultant molecular coordinates were found to be in close agreement with those obtained from building a physical model of SBMV into the same map, and the time required to build the model on the graphics system was much less than that required for the physical model.
Dissert. Abstr.

N80-28069# Wisconsin Univ. - Madison. Mathematics Research Center.
PROGRAMMING LANGUAGE FACILITIES FOR NUMERICAL COMPUTATION Progress Report
John R. Rice Jan. 1980 33 p refs
(Contract DAAG29-75-C-0024)
(AD-A083815; MRC-TSR-2033) Avail: NTIS HC A03/MF A01 CSCL 09/2

Numerical software to stimulate discussion of a possible group project is presented. The project is to describe the facilities in a programming language that make it useful for numerical computation. The facilities are classified and their importance measured. A framework for this project and an initial draft of the facility descriptions is presented. The opinions and ratings contained here are those of the author and do not reflect a consensus of IFIP WG 2.5.
GRA

N80-28070# Naval Research Lab., Washington, D. C. Applied Optics Branch.
HYBRID IMAGE PROCESSING SYSTEM Final Report
T. H. May and J. A. Blodgett 18 Mar. 1980 14 p refs
(RR0110741)
(AD-A084563; AD-E000415; NRL-8389) Avail: NTIS HC A02/MF A01 CSCL 09/2

A hybrid optical/digital image processing system has been developed for an ongoing research program in hybrid image processing. This system is described and its capabilities and limitations are discussed. Major system components include a coherent optical processor, digital processor (mini-computer), and optical/digital input/output (I/O) devices. The I/O devices include an image dissector camera, microdensitometer, video camera, and film writer. An extensive menu-oriented software package is installed in this system.
GRA

N80-28071# Maryland Univ., College Park. Computer Science Center.
PROBABILITY TRANSFORMS OF DIGITAL PICTURES
Ann Scher and Azriel Rosenfeld Apr. 1979 24 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084286; TR-758) Avail: NTIS HC A02/MF A01 CSCL 09/2

Let g be any local property (e.g., gray level or gradient magnitude) defined on a digital picture. Let pg(z) be the relative frequency with which g has value z. At each point (x,y) of the picture we can display pg(g(x,y)), appropriately scaled; the result is called the pg-transform of the picture. Alternatively, we can use joint or conditional frequencies of pairs of local properties to define transforms. This note gives examples of such transforms for various g's and h's and discusses their possible uses and limitations.
GRA

N80-28072# Maryland Univ., College Park. Computer Vision Lab.
A PATH-LENGTH DISTANCE TRANSFORM FOR QUADTREES
Michael Shneier Jul. 1979 41 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084293; TR-794) Avail: NTIS HC A03/MF A01 CSCL 05/8

The size of a region in an image and distances between subregions of an image are useful geometric properties for describing region shape. In particular, the distance of interior points from the border is a useful measure for operations such as thinning and finding skeletons of regions. Most algorithms for finding the distance from a point inside a region to the border have involved multiple passes over the data, each pass incrementing a local counter denoting the distance of the associated point in the image. This paper presents an algorithm that computes the distance function in a single pass over an image represented by a quadtree. A distance measure is defined for a quadtree representation of a binary image. An algorithm is presented that calculates the distance from the center of each BLACK node to the border of the nearest WHITE node. The distance is defined as the path length from the center of the BLACK node, through the center of intervening BLACK nodes, to the WHITE border. The worst case average execution time is shown to be proportional to the product of the log of the image diameter and the number c^d blocks in the image.
GRA

N80-28073# Lockheed Missiles and Space Co., Palo Alto, Calif. Applied Mechanics Lab.
INTERACTIVE NONLINEAR STRUCTURAL ANALYSIS. A REVIEW OF THE GIFTS-STAGS UNION Final Report
31 Mar. 1980 24 p refs

(Contract N00014-79-C-0070)
(AD-A084209; LMSC-D686137) Avail: NTIS HC A02/MF A01 CSCL 09/2

The three primary tasks were: (1) the GIFTS and STAGS finite element programs were to be data-base linked permitting GIFTS graphics-interactive pre- and post-processing of STAGS batch nonlinear structural analysis; (2) interactive software was to be introduced to facilitate convenient operation of the software assembly; and (3) the resulting integrated system was to be verified and documented. The corresponding results: (1) It is now possible to utilize GIFTS pre-and post-processing for a limited variety of STAGS analyses; (2) the software assembly is accessible to the user within a totally conversational environment in which both batch and interactive phases of analysis are prepared, managed and data-base monitored; and (3) current capabilities have been verified with respect to a modest selection of sample problems. GRA

N80-28074# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
BMG REFERENCE MANUAL Technical Report, 20 Mar. 1979 - 19 Mar. 1980
Norton Greenfield, Frank Zdybel, Eugene Ciccarelli, and Martin Yonke Apr. 1980 58 p refs
(Contract N00039-79-C-0316; ARPA Order 3740)
(AD-A084454; BBN-4368) Avail: NTIS HC A04/MF A01 CSCL 09/2

This is the second design and implementation round of the BMG (for Bit Mapped Graphics) package in use at Bolt Beranek and Newman Inc's. Information Sciences Division for experimentation with the concepts and limitations of raster scan graphics systems. It is being used by research projects in command and control systems, natural language systems, and other advanced user interface work. This reference manual for the BMG system is intended primarily for Interlisp programmers who wish to interface an application directly to the graphics system. GRA

N80-28075# Aerospace Corp., El Segundo, Calif. Engineering Group.
THE ELECTRIC SIMULATOR PROGRAM (ESP) USAGE GUIDE Interim Report, 1 Jul. 1975 - 1 Dec. 1979
Emmagene R. Coffey and Harvey J. Wertz 1 May 1980 203 p refs
(Contract F04701-79-C-0080)
(AD-A084676; TR-0080(9320)-1; SD-TR-80-21) Avail: NTIS HC A10/MF A01 CSCL 09/2

The Eclectic Simulator Program (ESP) is a system (a precompiler plus a collection of subroutines) that permits the fast, easy solution of ordinary differential equations. Any user with a general knowledge of FORTRAN can utilize ESP's many labor saving devices to code a problem with minimal effort. Special ESP features permit translation of engineering blocks, discontinuities, and hysteresis patterns directly into computer code, and the use of WHELP in conjunction with ESP facilitates efficient coding of matrix algebra equations. Simple input cards enable the user to directly control solution and timing accuracy and to specify or change run times, initial conditions, and various other parameters easily when making multiple or stacked runs. Finally, ESP allows the user to select from a wide variety of output options. This manual is intended to be both a learning tool for the novice and a detailed reference for the experienced user. GRA

N80-28076# Texas Univ. at Austin. Center for Cybernetic Studies.
COMPLEXITY AND COMPUTABILITY OF SOLUTIONS TO LINEAR PROGRAMMING SYSTEMS
A. Charnes, W. W. Cooper (Harvard Univ., Cambridge, Mass.), S. Duffuaa, and M. Kress Feb. 1980 39 p refs
(Contracts N00014-75-C-0569; N00014-80-C-0242; NR Proj. 047-071; NR Proj. 047-021)
(AD-A084682; CCS-367) Avail: NTIS HC A03/MF A01 CSCL 09/2

Complexity, computability and solution of linear programming systems are re-examined in the light of Khachian's new notion of (approximate) solution. Algorithms, basic theorems and alternate representations are reviewed. It is shown that the Klee-Minty example has never been exponential for (exact) adjacent extreme point algorithms and that the Balinski-Gomory (exact) algorithm is polynomial where (approximate) ellipsoidal 'center-cut-off' algorithms (Levin, Shor, Khachian, Gacs-Lovasz) are exponential. Both the Klee-Minty and the new J. Clausen example are shown to be trivial (explicitly solvable) interval programming problems. A new notion of computable (approximate) solution is proposed together with an a priori regularization for linear programming systems. New polyhedral 'constraint contraction' algorithms are proposed for approximate solution and the relevance of interval programming for good starts or exact solution is brought forth. GRA

N80-28077# Texas A&M Univ., College Station. Inst. of Statistics.
ONESAM, A COMPUTER PROGRAM FOR NONPARAMETRIC DATA ANALYSIS AND DENSITY QUANTILE ESTIMATION
Emanuel Parzen and Scott Anderson Mar. 1980 78 p
(Contract DAAG29-80-C-0070)
(AD-A084259; TR-B-1; ARO-16992.1-M) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report is a User's Guide to ONESAM, a mainline FORTRAN computer program that implements the one sample nonparametric data analysis and Goodness of Fit procedures introduced by Parzen. GRA

N80-28078# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering.
PERFORMANCE RIPPLE EFFECT ANALYSIS FOR LARGE-SCALE SOFTWARE MAINTENANCE Interim Report, Nov. 1977 - Nov. 1979
Stephen S. Yau and James S. Collofiello Griffiss AFB, N.Y. RADC Mar. 1980 125 p refs
(Contract F30602-76-C-0397; AF Proj. 5581)
(AD-A084351; RADC-TR-80-55) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report analyzes the possible ripple effect of software modifications during the maintenance phase on the performance of the system, and leads to the development of a maintenance technique for predicting which performance requirements in the system may be affected by a proposed modification. This report formalizes the technique outlined in our previous report entitled, Performance Considerations in the Maintenance Phase of Large-Scale Software Systems. This technique enables maintenance personnel to incorporate performance considerations in their criteria for selecting the types and locations of software modifications to be made. After the maintenance changes have been implemented, this technique can also be useful to the retesting effort of the system by identifying which performance requirements must be reverified to insure that they have not been violated by the maintenance activity. This technique is applicable to all types of large-scale software systems possessing performance requirements, including multiprocessing systems. In the development of this technique, mechanisms for the propagation of performance changes from one part of the system to another are identified. Performance attributes and critical software sections are also identified. GRA

N80-28079# National Technical Information Service, Springfield, Va.
INTERACTIVE COMPUTER GRAPHICS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Mar. 1980
Brian Carrigan Apr. 1980 208 p Supersedes NTIS/PS-79/0278 and NTIS/PS-78/0223
(PB80-807738; NTIS/PS-79/0278; NTIS/PS-78/0223)
Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography containing 201 abstracts addressing hardware and software implementation for interactive graphics systems is prestented. The bibliography includes applications in a variety of fields. GRA

N80-28080# National Technical Information Service, Springfield, Va.
INTERACTIVE COMPUTER GRAPHICS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Feb. 1980
Brian Carrigan Apr. 1980 274 p Supersedes NTIS/PS-79/0280; NTIS/PS-78/0224

(PB80-807746; NTIS/PS-79/0280; NTIS/PS-78/0224) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography citing 267 abstracts from worldwide literature on computer hardware and computer software implementation of interactive graphics systems is given. Included are applications in a variety of fields. GRA

N80-28081# Michigan State Univ., East Lansing. Dept. of Commerce.
EVALUATION OF PROJECTION ALGORITHMS
Guatum Biswas, Anil K. Jain, and Richard Dubes Sep. 1979 55 p refs
(Grant NSF ENG-76-11936)
(PB80-163702) Avail: NTIS HC A04/MF A01 CSCL 09B

Several linear and nonlinear mapping algorithms for the projection of patterns from a high dimensional space to two dimensions are studied. These two dimensional representations allow a quick visual observation of the data set under consideration. A combination of two popular mapping algorithms - Sammon's mean square error technique and the Triangulation method - is proposed to overcome the limitations in the individual algorithms. Some factors which described the goodness of a projection are described, and a comparison is made of six of these algorithms by running them on four data sets. The results obtained are calculated and their significance is discussed. GRA

N80-28082# National Bureau of Standards, Washington, D.C.
USING ANS FORTRAN Final Report
Gordon Lyon, ed., Frances E. Holberton, J. Larmouth (Salford Univ., England), and M. D. McIlroy (Bell Telephone Labs., Inc., Murray Hill, N.J.) Mar. 1980 109 p refs
(Grant NSF DCR-75-045443)
(PB80-168545; LC-80-600009) Avail: NTIS HC A06/MF A01 CSCL 09B

This FORTRAN volume presents, in order: a set of quick and clear reference charts for ANS FORTRAN 66 syntax; observations on using only standard FORTRAN 66 featurs; instructions on circumventing and extending FORTRAN 66 with the least harm; an appraisal of the new FORTRAN 77 in terms of FORTRAN 66 constructs. Although the chapters comprise much material that has appeared in other technical memoranda or published articles, heavily recast sections have been re-referenced. The four chapters address programmers concerned with FORTRAN transportability, managers engaged in programming standards, and other practitioners interested in system influences upon languages. Since the text touches upon several general programming aspects (input/out, storage allocation, storage lifetime and protection, control structures), the volume's appeal will extend beyond the immediate FORTRAN community. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N80-28083 California Univ., Berkeley.
COMPUTER NETWORKS: A MARTINGALE APPROACH Ph.D. Thesis
Jean Camille Walrand 1979 94 p
Avail: Univ. Microfilms Order No. 8014920

The results presented concern networks of queues which can be modelled as a continuous time Markov chain. An abstract model is developed and used to derive the filtering equations satisfied by the conditional probability distribution of the state of the network given the past of an observed set of flows. This approach yields a simple proof of the loop criterion for single class Jacksonian networks. A probabilistic interpretation of a necessary condition for a given flow in a multi-class Jacksonian network in equilibrium to be Poisson is also derived and used to show that the loop criterion does not apply to those networks. The properties of interconnected Markov chains are discussed and applied to mixed networks built from quasi-reversible nodes. It is shown that the quasi-reversibility and the product form for mixed networks follow from the results for open networks. The transit time of a customer on a path of a multiclass Jacksonian network is analysed. It is proved that if a path permits no overtaking, then the sojourn times of a customer in the nodes of that path are mutually independent and have the same distribution as in a single M/M/1 queue with same expected input rate. Examples show that the no overtaking condition cannot be relaxed in general. Dissert. Abstr.

N80-28084 State Univ. of New York at Buffalo.
THE INDEPENDENCE OF CONTROL STRUCTURES IN ABSTRACT PROGRAMMING SYSTEMS Ph.D. Thesis
Gregory Anthony Riccardi 1980 157 p
Avail: Univ. Microfilms Order No. 8016240

An instance of a control structure is a mapping which takes one or more programs into a new program whose behavior is based on that of the original programs. An instance of a control structure is effective if it is effectively computable. In order to study the interrelationships of control structures, abstract programming systems (numberings of the partial recursive functions) are considered, in which some control structures, effective or otherwise, are present, but others are not. The techniques of recursive function theory, including recursion theorems, priority arguments, and Blum complexity theory to prove the independence of certain control structures in abstract programming systems are discussed. For example, the following results were obtained. In effective numberings of the partial recursive functions, the one-one effective Kleene recursion theorem and the one-one effective (partial) if-then-else control structure are independent, but together, they yield all effective control structures. In any effective numbering, the effective Kleene form of the double recursion theorem yields all effective control structures. In effective numberings, the effective Rogers' fixed point form of the recursion theorem need not yield the control structure delay, effective or otherwise; hence, it does not yield the Kleene form of the recursion theorem. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-28085 Ohio State Univ., Columbus.
TIME-VARYING QUEUES REQUIRING SECONDARY SERVICE MECHANISMS FOR PRIMARY SERVERS Ph.D. Thesis
James Joseph Mager 1980 232 p
Avail: Univ. Microfilms Order No. 8015902

These systems involve customers being served by primary servers. However, after an initial service phase, the primary servers may require the use of secondary servers in order to serve the customer. This differs from the general network problem in that the primary server accompanies the customer (or his request) to the second system. The primary servers may have to wait, along with the customer of his request, for a secondary server to be free. A third phase of service may be provided by the primary servers after consultation with secondary servers. Both system A and system B are studied under time-varying arrival and service rates as well as time-varying primary and secondary service conditions. Arrival and service rates are approximated as fitted step functions. This makes these parameters constant over each interval of time. Dissert. Abstr.

N80-28086 Purdue Univ., Lafayette, Ind.
APPROXIMATE SOLUTIONS OF QUEUEING NETWORK MODELS OF COMPUTER SYSTEMS Ph.D. Thesis
Gianfranco Balbo 1979 408 p
Avail: Univ. Microfilms Order No. 8015424

Queueing network models of current computing systems are often too complex to satisfy the decomposability conditions which yield exact analytical solutions. Approximation methods for the solution of nondecomposable queueing network models of computer systems are discussed. The objective of these approximation methods is to adjust the parameters of a product form model in search of a best fit to the original system. It was discovered that corresponding to an arbitrary queueing network, there is an equivalent decomposable model whose queue length distributions are identical to those of the original system. This result means that product form based approximation methods

are, in principle, perfectly accurate, i.e., it assures the existence of an equivalent decomposable model sought by these techniques. The equivalence principle produces also a clearer understanding of existing approximation schemes and leads to improvements. Existing approximation methods and their variations are compared using a benchmark of 24 models representing a wide range of behaviors. Patterns of good and poor behavior are revealed for each one of these techniques. Dissert. Abstr.

N80-28087 Purdue Univ., Lafayette, Ind.
THE OPTIMIZATION OF QUERY PROCESSING ON DISTRIBUTED DATABASE SYSTEMS Ph.D. Thesis
Alan Raymond Hevner 1979 276 p
Avail: Univ. Microfilms Order No. 8015464

A detailed cost model of distributed query processing is developed and two optimization objectives, response time and total time are defined. The problem of finding a minimal cost processing strategy for any given distributed query is proved to be NP-hard. For a special class of queries, optimization algorithms are presented that derive minimal response time and minimal total time processing strategies. The techniques found in these optimal algorithms are used as a basis to develop effective heuristics that find efficient processing strategies for general queries. The heuristic algorithms, Algorithm GENERAL and Algorithm FAST, compare favorably with other proposed optimization algorithms in terms of complexity and quality of derived processing strategies. To evaluate the performance of distributed query optimization methods in a multiprocessing environment, a hybrid simulation model of a distributed base system is designed. The results of two query studies using the model show the importance of optimizing distributed queries. The relative performance of several proposed optimization algorithms is seen to be similar. Dissert. Abstr.

N80-28088 Purdue Univ., Lafayette, Ind.
VARIANCE REDUCTION TECHNIQUES FOR THE SIMULATION OF QUEUEING NETWORKS Ph.D. Thesis
James Reed Wilson 1979 212 p
Avail: Univ. Microfilms Order No. 8015542

The aims of this research are the formulation, implementation, and experimental assessment of procedures for applying selected combinations of a variance reduction technique (VRT) together with a confidence interval estimation technique (CIET) in the simulation of queueing networks. These procedures are designed to improve the efficiency of system performance estimators derived from a simulation experiment by exploiting auxiliary information contained in concomitant variables that are observed during the course of the experiment. For this purpose, a class of standardized service time variates are defined on the work stations of a queueing network. A version of the central limit theorem is established for these standardized variates in the context of a general class of regenerative queueing networks. This result constitutes the foundation for the development of post stratified sampling schemes as well as control variate schemes which are specially adapted to CIETs based on independent replications and on the theory of regenerative stochastic processes. The validation of these four VRT/CIET combinations is performed in an analytically tractable closed Jackson queueing system. The evaluation phase is carried out in three similar systems incorporating real-world features that are difficult or impossible to treat analytically; these features include priority scheduling, open and closed customer classes, general service times, and blocking due to capacity constraints. On the basis of the experimental results, guidelines are formulated for the effective application of the developed procedures in practical queueing simulations. Dissert. Abstr.

N80-28089# Brown Univ., Providence, R. I. Div. of Engineering.
CONTROL OF NONLINEAR SYSTEMS Final Progress Report, 1 Jan. 1975 - 31 Dec 1979
Allan E. Pearson 26 Feb. 1980 22 p refs
(Grant AF-AFOSR-2793-75; AF Proj. 2304)
(AD-A083963; AFOSR-80-0252TR; FPR-5) Avail: NTIS HC A02/MF A01 CSCL 12/1

The research falls under six main categories: feedback stabilization methods for linear systems, including time varying, discrete, continuous, differential-delay and linear systems subject to average power constraints; controllability for a class of nonlinear systems; minimum energy regulators for commutative bilinear systems; control laws for certain aerospace applications; least squares parameter identification for linear and nonlinear systems; and signal reconstruction. These results are summarized for each catagory. GRA

N80-28090# Wisconsin Univ. - Madison. Mathematics Research Center.
ON HOMOGENEITY AND ON-LINE-OFF-LINE BEHAVIOR IN M/G/1 QUEUEING SYSTEMS
Raymond M. Bryant Feb. 1980 42 p refs
(Contract DAAG29-75-C-0024)
(AD-A083827; MRC-TSR-2045) Avail: NTIS HC A03/MF A01 CSCL 09/2

Operational analysis replaces certain classical queueing theory assumptions. We also state dual results for inter-arrival times in G/M/1. Finally, we consider the relationship between the operational quantities S(n) and the mean service time in M/G/1. This relationship is shown to depend on the form of the service time distribution. It follows that using operational analysis to predict the performance of an M/G/1 queueing system will be most successful when the service time is exponential. Simulation evidence is presented which supports this claim. GRA

N80-28091# Adaptronics, Inc., McLean, Va.
INVESTIGATION INTO ADAPTIVE CONTROL OF A SLIP-CAST, REACTION-BONDED SILICON-NITRIDE PROCESS VIA ADAPTIVE LEARNING NETWORK MODELING Final Technical Report, 31 Jan. - 30 Sep. 1979
Dixon Cleveland, Peter M. Garafola, Basil A. Decina, and Anthony N. Muccairdi 30 Nov. 1979 97 p refs
(Contract MDA903-79-C-0186; DARPA Order 3799)
(AD-A083730; ADI-REF-542) Avail: NTIS HC A05/MF A01 CSCL 07/1

A program was conducted to model the modulus of rupture (MOR) strength using Adaptive Learning Networks (ALN's) for aircraft engine components produced by a slip-cast, reaction-bonded, silicon-nitride production process. The primary objectives of the work were to identify key process variables and to predict optimum values for those variables as a guide for further experimentation. Nonlinear models have been synthesized that predict MOR with an average error of about 4 ksi over a range from 18.6 to 47.8. The manufacturing and analysis work done to date has demonstrated the feasibility of modeling the slip-cast RBSN process with the Adaptive Learning Network methodology and is viewed as the first iteration in the optimization procedure which is ultimately aimed at finding those manufacturing conditions which will produce the strongest, most consistent material strengths. GRA

N80-28092# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
PROCEDURAL ATTACHMENT
Luc Steels 30 Aug. 1979 22 p refs Sponsored in part by ARPA
(Contract N00014-75-C-0643)
(AD-A084637; AI-M-543) Avail: NTIS HC A02/MF A01 CSCL 09/4

A frame-based reasoning system is extended to deal with procedural attachment. Arguments are given why procedural attachment is needed in a symbolic reasoner. The notion of an infinitary concept is introduced. Conventions for representing procedures and a control structure regulating their execution is discussed. Examples from electrical engineering and music illustrate arithmetic constraints and constraints over properties of strings and sequences. GRA

N80-28093# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
USING PARALLEL PROCESSING FOR PROBLEM SOLVING
William A. Kornfeld Dec. 1979 49 p refs
(Contract N00014-75-C-0522)
(AD-A084638; AI-M-561) Avail: NTIS HC A03/MF A01 CSCL 09/4

Parallel processing as a conceptual aid in the design of programs for problem solving applications is developed. A

pattern-directed invocation language known as ETHER is introduced. ETHER embodies two notions in language design: activities and viewpoints. Activities are the basic parallel processing primitive. Different goals of the system can be pursued in parallel by placing them in separate activities. Language primitives are provided for manipulating running activities. Viewpoints are a generalization of context mechanisms and serve as a device for representing multiple world models. A number of problem solving schemes are developed making use of viewpoints and activities. It will be demonstrated that many kinds of heuristic search that are commonly implemented using backtracking can be reformulated to use parallel processing with advantage in control over the problem solving behavior. The semantics of ETHER are such that things as deadlock and race conditions that plague many languages for parallel processing cannot occur. The programs presented are quite simple to understand. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-28094 Kansas State Univ., Manhattan.
COLLOCATION METHODS FOR ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
Glen W. Wittekind 1979 86 p
Avail: Univ. Microfilms Order No. 8015279

Collocation methods are presented for solving elliptic partial differential equations defined over a rectangular region. The approximating space is the tensor product of two piecewise polynomial spaces, each of C(1) continuity and arbitrary order. The theory and computational results indicate that the C(1) continuity with Gauss-Legendre collocation points has a distinct advantage over other choices. Dissert. Abstr.

N80-28095 Purdue Univ., Lafayette, Ind.
STRUCTURAL PARAMETER IDENTIFICATION OF MEMBER CHARACTERISTICS IN A FINITE ELEMENT MODEL Ph.D. Thesis
James Kimberly Sprandel 1979 487 p
Avail: Univ. Microfilms Order No. 8015522

A methodology developed to identify member characteristics in a general, user definable finite element model for which joint characteristics may be explicitly modeled. Bayes parameter estimates were obtained using time domain response data from either forced vibration, imposed base motion or snapback testing. The structural excitation was measured and interval estimates were obtained. Dissert. Abstr.

N80-28096*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE PRIMER VECTOR IN LINEAR, RELATIVE-MOTION EQUATIONS
Jan. 1980 28 p refs
(NASA-TM-81111; JSC-16332) Avail: NTIS
HC A03/MF A01 CSCL 12A

Primer vector theory is used in analyzing a set of linear, relative-motion equations - the Clohessy-Wiltshire equations - to determine the criteria and necessary conditions for an optimal, N-impulse trajectory. Since the state vector for these equations is defined in terms of a linear system of ordinary differential equations, all fundamental relations defining the solution of the state and costate equations, and the necessary conditions for optimality, can be expressed in terms of elementary functions. The analysis develops the analytical criteria for improving a solution by (1) moving any dependent or independent variable in the initial and/or final orbit, and (2) adding intermediate impulses. If these criteria are violated, the theory establishes a sufficient number of analytical equations. The subsequent satisfaction of these equations will result in the optimal position vectors and times of an N-impulse trajectory. The solution is examined for the specific boundary conditions of (1) fixed-end conditions, two-impulse, and time-open transfer; (2) an orbit-to-orbit transfer; and (3) a generalized rendezvous problem. A sequence of rendezvous problems is solved to illustrate the analysis and the computational procedure. Author

N80-28097# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
CHEMEQ: A SUBROUTINE FOR SOLVING STIFF ORDINARY DIFFERENTIAL EQUATIONS Interim Report
T. R. Young, Jr. 26 Feb. 1980 50 p refs
(zf43451001)
(AD-A083545; AD-E000395; NRL-MR-4091) Avail: NTIS
HC A03/MF A01 CSCL 09/2

A FORTRAN subroutine (CHEMEQ) which employs the Selected Asymptotic Integration Method (SAIM) for solving the stiff ordinary differential equations associated with reactive flow problems is described and documented. The SAIM algorithm identifies the stiff equations for treatment with a stiffly stable method. The remaining equations are treated with a standard classical method. The algorithm is a very low-overhead method which is particularly efficient when coupled with fluid dynamic calculations. It also gives significant reductions in computational costs for model development. The algorithm, its implementation, the FORTRAN code, the internal variables, and the argument lists are discussed and documented. The application of CHEMEQ to a test problem is also provided as an example. GRA

N80-28098# Wisconsin Univ. - Madison. Mathematics Research Center.
COMPUTER CALCULATION OF MECHANISMS INVOLVING INTERMITTENT MOTIONS
B. Noble and H. S. Hungs Dec. 1979 43 p refs
(Contract DAAG29-75-C-0024)
(AD-A083809; MRC-TSR-2026) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This paper deals with a simple computational approach to the analysis of dynamical systems involving intermittent motion in which the velocities involved can be discontinuous due to impulsive forces, impact, mass capture, and mass release. The sequence of these events may not be known ahead of time, and may in fact be one of the things we wish the computer to determine. The dynamical equations are formulated using a logical function method due to P. Ehle. The resulting system of ordinary differential equations with discontinuous coefficients is integrated using a standard computer code in regions where the coefficients are continuous. When discontinuities occur, jump conditions across the discontinuity are used to express the new velocities in terms of the old, and the ordinary differential equation solver is simply restarted with new initial conditions. To illustrate the simplicity of the approach, the method is applied to a dynamical system of ten masses considered by Ehle. The computer code and numerical results are included. GRA

N80-28099# Wisconsin Univ. - Madison. Mathematics Research Center.
THE BOLTZMAN EQUATION WITH A SOFT POTENTIAL. PART 2: NONLINEAR, SPATIALLY-PERIODIC
Russel Caflisch Jan. 1980 28 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-78-09525; NSF MCS-76-07039)
(AD-A083813; MRC-TSR-2031-PT-2) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The results of part 1 are extended to include linear spatially periodic problems - solutions of the initial value are shown to exist and decay like exp(lambda t to the beta power)). Then the full nonlinear Boltzmann equation with a soft potential is solved for initial data close to equilibrium. The nonlinearity is treated as a perturbation of the linear problem, and the equation is solved by iteration. GRA

N80-28100# Wisconsin Univ. - Madison. Mathematics Research Center.
FORCED OSCILLATIONS OF NONLINEAR HAMILTONIAN SYSTEMS. 2
Ivar Ekeland Dec. 1979 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A083812; MRC-TSR-2030) Avail: NTIS
HC A03/MF A01 CSCL 12/1

We study periodic solutions of the nonlinear Hamiltonian system with n degrees of freedom, the Hamiltonian H being

convex and super quadratic in both variables, and the forcing terms being T-periodic with mean value zero. We prove that, if these forcing terms lie within bounds which we explicitly compute, system (H) has some T-periodic solution, which we also locate explicitly. GRA

N80-28101# Wisconsin Univ. - Milwaukee. Mathematics Research Center.
COINCIDENT BIFURCATION OF EQUILIBRIUM AND PERIODIC SOLUTIONS OF EVOLUTION EQUATIONS Technical Summary Report
Michael Shearer. Dec. 1979. 27 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A083810; MRC-TSR-2027) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Bifurcation of equilibrium and periodic solutions of nonlinear evolution equations is considered in the neighbourhood of an equilibrium solution for which the corresponding linear problem admits both non-zero equilibrium and non-constant periodic solutions. These solutions of the linear problem are related to those of the nonlinear equation by deriving bifurcation equations possessing a simple symmetry property. This results in a simplification of the bifurcation analysis, illustrated by a discussion of two important special cases exhibiting secondary bifurcation of periodic solutions. GRA

N80-28102# Wisconsin Univ. - Madison. Mathematics Research Center.
HIGH ORDER DIFFERENCE METHODS FOR QUASILINEAR ELLIPTIC BOUNDARY VALUE PROBLEMS ON GENERAL REGIONS
Klaus Boehmer. Feb. 1980. 47 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A083824; MRC-TSR-2042) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Stability and convergence for a difference method for quasilinear elliptic boundary value problems are proved. Asymptotic expansions of the discretization error, basic for Richardson extrapolation, are established. The general theory of discrete Newton methods and iterated defect corrections via neighboring problems and Pereyra's deferred corrections are used to derive different high order methods. Some special cases and computational problems are pointed out and numerical tests are included. GRA

N80-28103# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
EXTREME VALUE THEORY FOR CONTINUOUS PARAMETER STATIONARY PROCESSES
M. R. Leadbetter. Mar. 1980. 42 p. refs.
(Contract N00014-75-C-0809)
(AD-A083802; MM-SER-1276) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The central distributional results of classical extreme value theory are obtained, under appropriate dependence restrictions, for maxima of continuous parameter stochastic processes. In particular we prove the basic result (here called Gnedenko's Theorem) concerning the existence of just three types of non-degenerate limiting distributions in such cases, and give necessary and sufficient conditions for each to apply. The development relies, in part, on the corresponding known theory for stationary sequences. The general theory given does not finiteness of the number of upcrossings of any level x. However when the number per unit time is a.s. finite and has a finite mean mu(x), it is found that the classical criteria for domains of attraction apply when mu(x) is used in lieu of the tail of the marginal distribution function. The theory is specialized to this case and applied to give the general known results for stationary normal processes (for which mu(x) may or may not be finite). A general Poisson convergence theorem is given for high level upcrossings, together with its implications for the asymptotic distributions of r-th local maxima. GRA

N80-28104# Wisconsin Univ. - Madison. Mathematics Research Center.
A SIMPLE DERIVATION OF GLASSMAN'S GENERAL N FAST FOURIER TRANSFORM Technical Summary Report
Warren E. Ferguson, Jr. Dec. 1979. 21 p. refs.
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A083811; MRC-TSR-2029) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A simple derivation of Glassman's general N fast Fourier transform, and corresponding FORTRAN program, is presented. This fast Fourier transform is based upon a representation of the discrete Fourier transform matrix as a product of sparse matrices. GRA

N80-28105# Wisconsin Univ. - Madison. Mathematics Research Center.
CONVERGENT APPROXIMATIONS IN PARABOLIC VARIATIONALLY INEQUALITIES. 1: ONE PHASE STEFAN PROBLEMS Technical Summary Report
Joseph W. Jerome. Jan. 1980. 25 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A083814; MRC-TSR-2032) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Many physical phenomena are modelled by inequalities rather than equations. In this report we examine a dynamic, or parabolic inequality, which characterizes the change of phase of a substance, e.g., ice melting, under certain assumptions. We obtain rates of convergence for certain approximation schemes which separately discretize time and space. The rates, as well as one of the schemes, appear to constitute new results in a subject which is still rather undeveloped. Subsequent investigations are also contemplated for inequalities related to different physical models. GRA

N80-28106# Wisconsin Univ. - Madison. Mathematics Research Center.
EQUILIBRIA OF THE CURVATURE FUNCTIONAL AND MANIFOLDS OF NONLINEAR INTERPOLATING SPLINE CURVES
Michael Golomb and Joseph W. Jerome. Nov. 1979. 70 p. refs.
(Contract DAAG29-75-C-0024; Grant NSF MPS-74-02292)
(AD-A083807; MRC-TSR-2024) Avail: NTIS
HC A04/MF A01 CSCL 12/1

The mathematical formulation of curve fitting by mechanical splines, i.e., thin, flexible, elastic beams passing through freely rotating sleeves anchored at fixed locations, is studied in this report. These are called elastica or nonlinear spline curves. As contrasted with the mathematically idealized splines, which have proven to be of considerable utility and concerning which much information is available, the nonlinear splines are relatively poorly understood. The writers are attempting to understand and systematically construct these curves. Computer graphics obtained by other workers suggest remarkable efficiency of the elastica for curve fitting. This is perhaps not too surprising since the nonlinear spline represents an equilibrium position of a thin beam. GRA

N80-28107# Wisconsin Univ. - Madison. Mathematics Research Center.
A NONLINEAR VOLTERRA EQUATION IN VARIABLE DOMAIN
Hedy Attouch and Alain Damlamian. Dec. 1979. 11 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A083829; MRC-TSR-2028) Avail: NTIS
HC A02/MF A01 CSCL 12/1

We prove the existence and uniqueness of a strong solution of a nonlinear heat flow equation governing the temperature in a homogeneous material with memory when the temperature outside of a smooth time dependent domain Omega(t) is prescribed. GRA

N80-28108# Wisconsin Univ. - Madison. Mathematics Research Center.
CONTINGENT DERIVATIVES OF SET-VALUED MAPS AND SOLUTIONS TO NONLINEAR INCLUSIONS AND DIFFERENTIAL INCLUSIONS
Jean Pierre Aubin. Feb. 1980. 92 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A083826; MRC-TSR-2044) Avail: NTIS
HC A05/MF A01 CSCL 12/1

We use the Bouligand contingent cone to a subset K of a Hilbert space at x an element of K for defining contingent

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derivatives of a set-valued map, whose graphs are the contingent cones to the graph of this map, as well as the upper contingent derivatives of a real valued function. We develop a calculus of these concepts and show how they are involved in optimization problems solving equations F(x) = 0 and/or inclusions 0 = F(x). They also play a fundamental role for generalizing the Nagumo theorem on flow invariance and for generalizing the concept of Liapunov functions for differential equations and/or differential inclusions. GRA

N80-28109# Wisconsin Univ., Madison. Mathematics Research Center.

OPTIMAL SIMPLEX TABLEAU CHARACTERIZATION OF UNIQUE AND BOUNDED SOLUTIONS OF LINEAR PROGRAMS

O. L. Mangasarian. Jan. 1980. 20 p. refs.
(Contract DAAG29-75-C-0024)
(AD-A083816; MRC-TSR-2034) Avail: NTIS HC A02/MF A01 CSCL 12/1

Uniqueness and boundedness of solutions of linear programs are characterized in terms of an optimal simplex tableau. Let M denote the submatrix in an optimal simplex tableau with columns corresponding to degenerate optimal dual basic variables. A primal optimal solution is unique if and only if there exists a nonvacuous nonnegative linear combination of the rows of M corresponding to degenerate optimal primal basic variables which is positive. The set of primal optimal solutions is bounded if and only if there exists a nonnegative linear combination of the rows of M which is positive. When M is empty the primal optimal solution is unique. GRA

N80-28110# Wisconsin Univ., Madison. Mathematics Research Center.

NEW ALGORITHMS FOR NONLINEAR LEAST SQUARES AND BAYESIAN PARAMETER ESTIMATION

Warren E. Stewart and Jan P. Sorensen. Feb. 1980. 27 p. refs.
(Contract DAAG29-75-C-0024; Grant NSF ENG-76-24368)
(AD-A083819; MRC-TSR-2037) Avail: NTIS HC A03/MF A01 CSCL 12/1

Some new algorithms are presented for fitting mathematical models to multiple-response experiments. These algorithms give estimates of the parameters in a user-defined predictor model, and also estimate the parameters of a Gaussian model of the observational error distribution. The development is based on Bayes' theorem, and provides a natural extension of known least-squares estimation methods. Allowance is made for missing values of responses, which occur frequently in practical work. GRA

N80-28111# Wisconsin Univ., Madison. Mathematics Research Center.

MOVING WEIGHTED AVERAGE SMOOTHING EXTENDED TO THE EXTREMITIES OF THE DATA, REVISION

T. N. E. Greenville. Nov. 1979. 55 p. refs. Revised.
(Contract DAAG29-75-C-0024)
(AD-A083808; MRC-TSR-2025-Rev) Avail: NTIS HC A04/MF A01 CSCL 12/1

The use of a symmetrical moving weighted average of 2m - 1 terms to smooth equally spaced observations of a function of one variable does not yield smoothed values of the first m and the last m observations, unless additional data beyond the range of the original observations are available. By means of analogies to the Whittaker smoothing process and some related mathematical concepts, a natural method is developed for extending the smoothing to the extremities of the data as a single overall matrix vector operation having a well defined structure, rather than as something extra grafted on at the ends. GRA

N80-28112# Maryland Univ., College Park. Dept. of Computer Science.

REGION REPRESENTATION: QUADTREE-TO-RASTER CONVERSION

Hanan Samet. Jun. 1979. 28 p. refs.
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084288; TR-768) Avail: NTIS HC A03/MF A01 CSCL 12/1

An algorithm is presented for obtaining a raster representation for an image given its quadtree. For each raster row the algorithm visits the appropriate nodes in the quadtree and, for each such node, outputs a run of length equal to the width of the corresponding block. Each block's node is visited as many times as it is high. Analysis of the algorithm reveals that its execution time is proportional to the sum of the heights of the blocks comprising the image. The total number of terminal and non-terminal nodes visited by the algorithm is also computed and shown to be a function of the number of maximal black and white blocks in the image. This means that the algorithm's execution time is directly proportional to the complexity of the image. GRA

N80-28113# Maryland Univ., College Park. Computer Science Center.

COMPUTING THE EULER NUMBER OF IMAGE FROM ITS QUADTREE

Charles R. Dyer. May 1979. 17 p. refs.
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084289; TR-769) Avail: NTIS HC A02/MF A01 CSCL 12/1

An algorithm is presented which computes the Euler number, i.e., the number of components minus the number of holes, of a binary image represented by the quadtree. The local property counting techniques used with an array representation are generalized to counting local node configurations in a quadtree. The average worst case running time of the algorithm is proportional to the product of the number of nodes representing the components and the logarithm of the image diameter. GRA

N80-28114# Maryland Univ., College Park. Dept. of Computer Science.

A DISTANCE TRANSFORM FOR IMAGES REPRESENTED BY QUADTREES

Hanan Samet. Jul. 1979. 41 p. refs.
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084290; TR-780) Avail: NTIS HC A03/MF A01 CSCL 12/1

The concept of distance used in binary array representations of images is adapted to a quadtree representation. The Chessboard distance metric is shown to be particularly suitable for the quadtree. A Chessboard distance transform for a quadtree is defined as the minimum distance in the plane from each BLACK node to the border of a WHITE node. An algorithm is presented which computes this transform by only examining the BLACK node's adjacent and abutting neighbors and their progeny. Analysis of the algorithm shows that its average execution time is proportional to the number of leaf nodes in the quadtree. GRA

N80-28115# Maryland Univ., College Park. Computer Vision Lab.

FITTING MOSAIC MODELS TO TEXTURES

Narendra Ahuja and Azriel Rosenfeld. Jul. 1979. 33 p. refs.
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084291; TR-789) Avail: NTIS HC A03/MF A01 CSCL 12/1

Mosaic image models are defined by random geometric processes. Various properties of the patterns generated by such models can be predicted. Using these properties, we can fit the models to real images, and thus obtain insights into the structure of these images. GRA

N80-28116# Maryland Univ., College Park. Computer Vision Lab.

SHAPE SEGMENTATION USING RELAXATION, 2

Wallace S. Rutkowski. Jul. 1979. 26 p. refs.
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084292; TR-793) Avail: NTIS HC A03/MF A01 CSCL 12/1

The work begun in (1) on the application of relaxation to ambiguous shape segmentation is extended to include curve linking and gap filling. A chain coded input image is broken into segments based on a measure of local curvature. Gap completions linking pairs of segments are then proposed and represented in a graph structure. A second graph, whose nodes consist of paths in the above graph, is constructed, and the nodes of the second graph are probabilistically classified as various object parts.

Relaxation is then applied to increase the probability of mutually supporting classifications, and decrease the probability of unsupported decisions. A modified relaxation process using information about the size, spatial position, and orientation of the object parts yielded a high degree of disambiguation. GRA

N80-28117# Maryland Univ., College Park. Dept. of Computer Science.
REGION REPRESENTATION: QUADTREES FROM BINARY ARRAYS
Hanan Samet. May 1979. 14 p. refs.
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A084287; TR-767) Avail: NTIS. HC A02/MF A01. CSCL 12/1

An algorithm is presented for constructing a quadtree from the array representation of a binary image. The algorithm examines each pixel in the image once and only once. In addition, as the tree is constructed, only maximal sized nodes are ever created. Thus the algorithm never requires temporary nodes. The execution time of the algorithm is equal to the number of pixels in the image. The amount of space, in addition to that necessary for the final quadtree, is proportional to the log of the image diameter. GRA

N80-28118# Minnesota Univ., St. Paul. Dept. of Applied Statistics.
GENERALIZING THE ITERATIVE PROPORTIONAL FITTING PROCEDURE
Michael M. Meyer. Apr. 1980. 44 p. refs.
(Contract N00014-78-C-0151)
(AD-A084429; TR-371) Avail: NTIS. HC A03/MF A01. CSCL 12/1

The Iterative Proportional Fitting Procedure (IPFP) can be viewed as a method for maximizing the likelihood for certain loglinear models or equivalently for minimizing the Kullback-Leibler information between two probability densities. Both of these viewpoints lead to natural generalizations of the classical IPFP. We examine the generalizations, and with the aid of the theory, explore a practical example of expanding a contingency table. GRA

N80-28119# North Carolina Univ. at Chapel Hill. Dept. of Statistics.
DEPENDENT RELEVATIONS
N. L. Johnson. Research Triangle Park, N.C. Army Res. Office. Mar. 1980. 13 p. refs.
(Contract DAAG29-77-C-0035; Grant AF-AFOSR-3673-78)
(AD-A084543; MMS-1273; ARO-14778.10-M) Avail: NTIS. HC A02/MF A01. CSCL 12/1

Krakowski (1973) introduced the concept of the relevation, which is the conditional distribution of a random variable sub 2, given that it exceeds an independent random variable x sub 1. This is relevant to failure time distributions when replacement is made from an aging stock. We develop analysis appropriate to relevation for dependent variables, and suggest it might be relevant if there is batch-to-batch variation, producing association between lifetimes of initial and replacement components. GRA

N80-28120# Texas A&M Univ., College Station. Inst. of Statistics.
MODERN EMPIRICAL STATISTICAL SPECTRAL ANALYSIS
Emanuel Parzen. May 1980. 29 p. refs.
(Contract N00014-78-C-0599)
(AD-A084142; TR-N-12) Avail: NTIS. HC A03/MF A01. CSCL 12/1

This paper has two aims: to provide perspectives on the diverse paths of analysis which are available in 1980 to estimate the spectrum of an observed time series, and to describe proposals for optimal statistical spectral estimation procedures which combine autoregressive spectral estimators and log spectral estimators. It is proposed that empirical statistical spectral analysis should be an adaptive procedure for forming an iterative spectral estimator (an iterative estimator is one composed of estimators obtained in different steps of the analysis). There are three parts: (1). Basic concepts of time series spectral analysis; (2) entropy distances, autoregressive spectral estimators and log spectral estimators; and (3) an outline of empirical spectral analysis. GRA

N80-28121# Texas Univ. at Austin. Center for Cybernetic Studies.
GENERALIZED NETWORK APPROACHES FOR SOLVING LEAST ABSOLUTE VALUE AND TCHEBYCHEFF REGRESSION PROBLEMS
Darwin Klingman and John Mote (Analysis, Research and Computation, Inc., Austin, Tex.). Dec. 1979. 42 p. refs.
(Contract N00014-78-C-0222)
(AD-A084284; CCS-365) Avail: NTIS. HC A03/MF A01. CSCL 12/1

This paper studies two classes of bivariate regression analysis problems that can be formulated and solved quite efficiently as generalized network flow problems. GRA

N80-28122# Virginia Univ., Charlottesville. Dept. of Applied Mathematics and Computer Science.
ANALYSIS OF COMPUTATIONAL METHODS FOR NONLINEAR PARABOLIC DIFFERENTIAL SYSTEMS. Final Report
R. Leonard Brown. Apr. 1980. 59 p. refs.
(Grant AF-AFOSR-0024-79)
(AD-A084236; UVA/525629/AMC80/101; AFOSR-80-0340TR) Avail: NTIS. HC A04/MF A01. CSCL 12/1

Many important problems in fluid dynamics, among other areas, are modeled by nonlinear parabolic differential systems with initial values given in one independent variable, x, and boundary values in the remaining dependent variables. Hyperbolic systems can sometimes be treated as a special case. For example, the inviscid flow case of the Navier-Stokes equations is a hyperbolic system, while the viscous flow case is elliptical. A survey of currently used numerical methods is in Richtmeyer and Morton. In subsonic flow cases, the nonlinear terms are small enough to be ignored, but these terms must be included in supersonic and hypersonic flow. These numerical calculations usually involve a finite difference mesh over the boundary value problem variables, resulting in a space discretization matrix equation which for the nonlinear system varies at each step in x, the independent variable representing time in the dynamic case or one of the space variable for the steady state case. Then this nonlinear system is solved as an initial value problem in x. The initial value problem is usually solved by a one step implicit method for reasons of cost and stability. Some methods based on finite element methods for the boundary value problem can be used, but successful methods are only available for the linear cases, such as subsonic flow problem. GRA

N80-28123# Naval Research Lab., Washington, D. C.
DIRECT ELLIPTIC EQUATION SOLVERS WITH LOW MEMORY REQUIREMENTS
M. R. Schoeberl. 13 Mar. 1980. 21 p. refs.
(RR0330244)
(AD-A084557; AD-E000406; NRL-MR-4191) Avail: NTIS. HC A02/MF A01. CSCL 12/1

Several simple modifications of the Lindzen-Kuo, Gaussian elimination algorithms for solving elliptic differential equations are derived. These modifications greatly decrease the auxiliary memory requirements thus making this method suitable for solving elliptic equations over large grids. GRA

N80-28124# Lincoln Lab., Mass. Inst. of Tech., Lexington.
APPLICATION OF LINEAR PREDICTION TO MULTICLASS SEQUENTIAL DISCRIMINATION
Charles W. Therrien. 19 Dec. 1979. 37 p. refs.
(Contract F19628-80-C-0002)
(AD-A084272; TN-1979-63; ESD-TR-308) Avail: NTIS. HC A03/MF A01. CSCL 17/7

A linear predictive form of classifier is described for the sequential discrimination of target signatures. The classifier implements a Generalized Sequential Probability Ratio Test (GSPRT) which allows for multiple classes of target signatures. Forms of the classifier for both noncoherent and coherent signatures are described. Flow charts are included for convenience of implementation. GRA

N80-27341# Ferranti Ltd., Bracknell (England). Computer Systems.
APPLICATIONS OF MICROPROCESSORS IN AIR TRAFFIC
David L. Stoddart *In* AGARD Air Traffic Management: Civil/Mil. Systems and Technol. Feb. 1980 10 p refs (For primary document see N80-27324 18-04)
Avail: NTIS HC A13/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-28125 California Univ., Berkeley.
RATES OF CONVERGENCE FOR ESTIMATION AND TESTING IN MULTINOMIAL DISTRIBUTIONS Ph.D. Thesis
Kenneth Henry Sutrick 1979 181 p
Avail: Univ. Microfilms Order No. 8014900

Various problems involving the multinormal distribution are presented. An asymptotic power comparison between the likelihood ratio test and a class of chi squares tests is demonstrated. An estimation of a single parameter is given and expansion for the estimators and their mean square error are given. It is shown that there are other estimation procedures which have the same properties as minimum chi square and maximum likelihood estimates. Dissert. Abstr.

N80-28126 Florida State Univ., Tallahassee.
AN INVESTIGATION OF OUTLIER DEFINITION AND THE IMPACT OF THE MASKING PHENOMENON ON SEVERAL STATISTICAL OUTLIER TESTS Ph.D. Thesis
Patricia Little Fisher 1980 165 p
Avail: Univ. Microfilms Order No. 8014123

The problem of statistical outliers is examined. Different possible approaches to outlier identification are discussed, and the highlights of the development of outlier tests and the competing methods of multiple outlier detection, consecutive and block procedures, are explained. The masking problem, which hinders effective application of the consecutive procedures, is described, as are several other problems which complicate the outlier issue for the research practitioner. Dissert. Abstr.

N80-28127 Maryland Univ., College Park.
A MONTE CARLO APPROACH TO THE SAMPLING ERROR OF ESTIMATES OF THE GENERALIZABILITY STATISTICS FROM A TWO FACET COMPLETELY CROSSED GENERALIZABILITY STUDY Ph.D. Thesis
James Anthony DiStefano 1979 159 p
Avail: Univ. Microfilms Order No. 8016346

A Monte Carlo approach was used to study the sampling error of estimates of the generalizability coefficient and errors DELTA and delta from a two facet (three factor) completely crossed generalizability study, systematically varying the number of levels of each facet sampled and the population variance component configuration. Estimates were obtained by the analysis of variance. All negative component estimates were set equal to zero. Generalizability coefficients computed with negative variances set equal to zero were compared with coefficients computed by including negative variance estimates. Ten variance component configurations were selected. Within each variance component, sampling error was investigated using eight (P,I,J) sampling plans. It is shown that much smaller sample sizes could be used in configurations having large persons components and small interactions. It was also shown that for sample sizes less than 100 generalizability coefficients computed with negative variance estimates unchanged provided a more accurate estimate of the universe value of the generalizability coefficient. Dissert. Abstr.

N80-28128 North Carolina Univ. at Chapel Hill.
SAMPLING REPRESENTATIONS AND APPROXIMATIONS FOR CERTAIN FUNCTIONS AND STOCHASTIC PROCESSES Ph.D. Thesis
Muhammad Kamel Habib 1979 99 p
Avail: Univ. Microfilms Order No. 8014204

Finite sampling approximations are derived for certain functions and processes which are not bandlimited, as well as bounds on the approximation errors. Also derived are sampling representations for bounded linear operators acting on certain classes of bandlimited functions and processes; these representations enable one to reconstruct the image of a function (or a process) under a bounded linear operator using the samples of the function (or the process) rather than the samples of the image. Sampling representations for distributions and random distributions are obtained. Dissert. Abstr.

N80-28129 State Univ. of New York, Buffalo.
MODELING AND INVESTIGATION OF PERIODIC PHENOMENA USING TECHNIQUES OF TIME SERIES ANALYSIS Ph.D. Thesis
Jessica Pollner 1980 241 p
Avail: Univ. Microfilms Order No. 8016232

Periodic autoregressive models as a means of modeling and analyzing time series was investigated. The theory of both univariate and multivariate times series was applied and extended to periodic processes, with particular attention focused on autoregressive models. The periodic autoregressive model led to the consideration of estimators, easily implemented algorithms and data analytic applications. Regression models were proposed and investigated as additional model types for analyzing periodic processes. An attempt was made to extend the association of regression models and univariate autoregressive schemes to that of periodic autoregressions. Dissert. Abstr.

N80-28130 Temple Univ., Philadelphia, Pa.
ON PROBABILITY DISTRIBUTIONS INVOLVING THE STIRLING NUMBERS Ph.D. Thesis
Ramalingam Shanmugam 1979 68 p
Avail: Univ. Microfilms Order No. 8014511

The maximum likelihood and the minimum variance unbiased and the bayesian estimators of the poisson probabilities were compared. Expressions for the bias, and the mean square error were derived, and expressed in terms of the Stirling numbers of the second kind. All three estimators are shown to be consistent. Dissert. Abstr.

N80-28131 California Univ., Berkeley.
RECURSIVE ESTIMATION IN TIME SERIES MODELS Ph.D. Thesis
Knut Kristian Aase 1979 162 p
Avail: Univ. Microfilms Order No. 8014589

An adaptive estimation principle is considered for both standard and nonstandard time series models. General nonlinear, non-Markovian, continuous processes are considered and several optimality properties are shown to hold for the resulting estimator, using Ito's stochastic calculus. A number of applications are discussed, possible extensions are indicated, and Monte Carlo simulations are used throughout to guide the directions taken and to support the theoretical findings. Dissert. Abstr.

N80-28132# Missouri Univ. - Columbia. Dept. of Statistics.
MAXIMUM LIKELIHOOD ESTIMATION OF THE SURVIVAL FUNCTIONS OF STOCHASTICALLY ORDERED RANDOM VARIABLES
Richard L. Dykstra Mar. 1980 26 p refs
(Contract N00014-78-C-0655)
(AD-A083903; TR-91) Avail: NTIS HC A03/MF A01 CSCL 12/1

Many times populations exist which logically must satisfy a stochastic ordering requirement. Nevertheless, estimates of these populations may not bear out this stochastic ordering because of the inherent variability of the observations. This paper will consider the problem of finding maximum likelihood estimates of stochastically ordered survival functions for the cases (1) one survival being fixed in advance and (2) estimating both survival functions when the data includes censored observations. A numerical example is handled in detail to illustrate the solution to this problem. GRA

N80-28133# Wisconsin Univ. - Madison. Mathematics Research Center.
SINGULARLY PERTURBED EQUATIONS IN THE CRITICAL CASE

A. B. Vasileva and V. F. Butuzov. Feb. 1980. 161 p. refs. Transl. into ENGLISH from Russian monograph, 1978.
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-00907)
(AD-A083821; MRC-TSR-2039) Avail: NTIS HC A08/MF A01 CSCL 12/1

This monograph is a sequel to the authors' work 'Asymptotic Expansions of Solutions of Singularly Perturbed Equations', Nauka, 1973. It considers cases in which the characteristic equation has zero roots. In the book many applications are given to concrete physical problems including a detailed examination of several problems in kinetics, in the theory of semiconductors, in numerical difference schemes, etc. The usual mathematical preparation of an engineer is sufficient for understanding the results. Author (GRA)

N80-28134# Minnesota Univ., St. Paul. Dept. of Applied Statistics.
CONTINGENCY TABLES
Stephen E. Fienberg. Feb. 1980. 32 p. refs. Submitted for publication.
(Contract N00014-78-C-0600)
(AD-A084262; TR-369) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned primarily with the use of loglinear models for the analysis of contingency table data. An introduction to multivariate statistical analysis is presented and the topic is placed in an historical perspective. Examples which illustrate some of the methods of analysis are described. The basic statistical theory associated with maximum likelihood estimation and loglinear models is outlined and the results are applied to the examples. The paper concludes with a guide to some recent applications of loglinear and contingency table modelling, and to computer programs for contingency table analysis. GRA

N80-28135# Brown Univ., Providence, R. I. Center for Dynamical Systems.
OPTIMAL STATIONARY LINEAR CONTROL OF THE WIENER PROCESS Interim Report
Vaclav E. Benes (Bell Telephone Labs, Murray Hill) and Ioannis Karatzas (Columbia Univ.). 29 Feb. 1980. 33 p. refs. Present at the Conf. on Stochastic Processes and Their Applications, Evanston, Ill., Aug. 1979.
(Grant AF-AFOSR-3063-76; AF Proj. 2304)
(AD-A084350; AFOSR-80-0338TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper we consider the problem of stationary control of the stochastic differential equation where (W sub t) is a Wiener process on an underlying probability space. Two kinds of cost are involved in this problem. First, one pays Phi (zeta sub t) per unit time for being in the wrong state zeta sub t; secondly, one pays u sub t per unit time for using the control law u sub t. The control problem is to choose a law so as to minimize the average expected total cost. It is proved that the optimal law can be explicitly described and its performance characterized in terms of the cost function. GRA

N80-28136# Arizona State Univ., Tempe. Coll. of Education.
AN ANOMALY IN THE PEARSON PRODUCT-MOMENT CORRELATION COEFFICIENT Interim Report
Robert C. Haygood and Vernon S. Gerlach. Dec. 1978. 10 p. refs.
(Grant AF-AFOSR-2900-76; AF Proj. 2313)
(AD-A084354; TR-81229; AFOSR-80-0333TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

An anomalous condition in the use of the Pearson product-moment correlation coefficient is reported in which decreasing variance of one or both variables is associated with increased absolute value of the coefficient, contrary to popular expectation. The reasons for this are discussed, along with a recommendation for a change in the method of presenting restriction-of-range phenomena in statistical instruction. GRA

N80-28137# Naval Postgraduate School, Monterey, Calif.
A PREDICTION INTERVAL FOR A FIRST ORDER GAUSSIAN MARKOV PROCESS
Toke Jayachandran and T. S. Murthy. Apr. 1980. 25 p. ref.
(RR0000110)
(AD-A084094; NPS53-80-002) Avail: NTIS HC A02/MF A01 CSCL 12/1

A mathematical model of coupled heat and moisture flow in soils has been developed. The model includes algorithms for phase change of soil moisture and frost heave, and several types of boundary and initial conditions are permitted. The finite element method of weighted residuals Galerkin procedure was chosen to simulate the spatial regime and the Crank-Nicholson method was used for the time domain portion of the model. To facilitate evaluation of the model, the heat and moisture fluxes were essentially 'decoupled' moisture flux was then simulated accurately, as were heat flux and frost penetration. The coupled model was used to simulate frost penetration and frost heave in a laboratory test. Comparison of the simulated and experimental data illustrates the importance of unsaturated hydraulic conductivity. It is one parameter which is difficult to measure and for which only a few laboratory test results are available. Therefore, unsaturated hydraulic conductivities calculated in the computer model may be a significant source of error in calculations of frost heave. The algorithms incorporating effects of surcharge and overburden was evaluated. Time dependent frost penetration and frost heave in laboratory specimens were closely simulated with the model. GRA

N80-28138# Naval Postgraduate School, Monterey, Calif.
A GENERAL MIXTURE-TRUNCATION METHOD FOR GENERATING BIVARIATE RANDOM VARIABLES FROM UNIVARIATE GENERATORS M.S. Thesis
Myong Ho Shin (Korean Air Force). Mar. 1980. 172 p. refs.
(AD-A084474) Avail: NTIS HC A08/MF A01 CSCL 12/1

This thesis deals with the generation of bivariate random variables with identical marginal distributions and specified correlation coefficients. Many schemes have been put forward for different cases; they almost always involve computing the inverse probability distribution of the marginal distributions or exploiting special properties of the random variables in question. A simple mixture-truncation method is put forward here to generate bivariate distributions with any marginal distribution from univariate generators. GRA

N80-28139# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Statistics.
RANDOM COVERAGE OF A CIRCLE WITH APPLICATION TO A SHADOWING PROBLEM
M. Yadin and S. Zacks. 15 May 1980. 23 p. refs.
(Contract N00014-80-C-0325; NR Proj. 042-276)
(AD-A084357; VPI-TR-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

The coverage problem on the circle is considered from the shadowing process point of view. A random number of shadow arcs are distributed on a circle. The length of each arc is a random variable which depends on the random diameter of a shadowing disk and its random location. Formulae are derived for the numerical determination of the moments of the measure of vacancy of arcs on the circle. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-28140 California Univ., Berkeley.
A POINT MAPPING STUDY OF DYNAMICAL SYSTEMS Ph.D. Thesis
Henryk Flashner. 1979. 184 p.
Avail: Univ. Microfilms Order No. 8014677

A method to obtain an approximation for period to period mapping of multidimensional periodic systems is proposed. It is shown that the method can be applied to a large class of dynamical systems governed by differential equations with periodically varying coefficients. The proposed method is based on the Runge-Kutta algorithm for solving a set of ordinary differential equations. The only limitation of the method is the size of computer memory needed to store the various terms of the point mapping. Computer programs implementing the proposed method to one and two degree of freedom systems are given. The programs

are used to compute the point mapping of two example dynamical systems with periodically varying coefficients. Application of the method to obtain an approximation of the Strutt diagram of the Mathieu equation is given. Dissert. Abstr.

N80-28141 California Univ., Berkeley.
A SYSTEMATIC APPROACH FOR THE DESIGN AND ANALYSIS OF DISTRIBUTED COMPUTER SYSTEMS Ph.D. Thesis
Gary Shiu-Fan Ho 1979 168 p
Avail: Univ. Microfilms Order No. 8014735

A systematic approach for the design and analysis of computer systems is presented. A top down development approach for computer systems, and some analysis techniques for system performance and system deadlocks are developed. Dissert. Abstr.

N80-28142 Illinois Univ. at Chicago Circle, Chicago.
ALGORITHMS FOR SOLVING SOME UNDISCOUNTED STOCHASTIC GAMES Ph.D. Thesis
Jerzy Andrzej Filar 1980 118 p
Avail: Univ. Microfilms Order No. 8014224

Zero-sum stochastic games are studied with finite state and action spaces in which payoffs are undiscounted. In fact, payoffs will be evaluated according to a limiting expected average criterion. Such a criterion is meaningful only if both players expect the game to continue indefinitely and if discounting of payoffs is inappropriate. All of the undiscounted games studied here are constrained by some natural restrictions on strategic possibilities of the players. In addition to being mathematically expedient, the assumptions made about the games studied are easily verifiable and preserve the competitive nature of undiscounted stochastic games. The following main results are presented: (1) A finite-step algorithm is given which solves any undiscounted stochastic game in which one player controls the transitions (i.e., probability transitions are functions of the actions of one player only). The value and optimal stationary strategies for both players can be found by this method. (2) For an undiscounted game in which payoffs and transition probabilities lie in the same ordered Archimedean field and in which one player controls transitions in some states while the other player controls transitions in remaining states, a constructive proof of the existence of the value and of optimal stationary strategies for both players is given. Dissert. Abstr.

N80-28143# Operating Systems, Inc., Woodland, Calif.
SATELLITE AND MISSILE DATA GENERATION FOR AIS Final Technical Report, 1 Sep. 1978 - 31 Aug. 1979
Georgette M. Silva and Christine A. Montgomery Griffiss AFB, N.Y. RADC Dec. 1979 194 p refs
(Contract F30602-78-C-0274; AF Proj. 4594)
(AD-A084326; OSI-R79-037; RADC-TR-79-314) Avail: NTIS HC A09/MF A01 CSCL 09/4

The effort described specifically addressed the problem of deriving indicator and descriptor data from the narrative text portions of a class of intelligence messages dealing with events related to missile and satellite launchings used for input to the Advanced Indicator System (AIS) data base. The introductory section briefly discusses the intelligence problem which OSI's event processing technology intends to solve, summarizes the technology developed under this contract, and presents the conclusions drawn on the basis of the results obtained. Section 2 offers a summary of OSI's methodological approach to the analysis and description of event reports. This methodology, initially developed on the basis of messages dealing with air activities, was, under this contract, extended to cover reports of events involving missile and satellite launchings and related events. Section 3 describes the Missile and Satellite domains, and presents the results of their analysis in terms of a domain definition. The discussion includes a characterization of the event report in terms of its component messages; a list of the message types encountered in the domains under consideration; a list of the event types identified together with their descriptor system, and a definition of the sublanguage in terms of its vocabulary and syntax. Section 4 focuses on the implementation of OSI's message text analysis system, MATRES II. It briefly reviews the principles underlying OSI's event processing technology and offers an overview of MATRES. GRA

N80-28144# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
APPLICATION OF BEST LINEAR UNBIASED PREDICTION TO INTERPOLATION OF RANDOM FIELDS AND TO NETWORK DESIGN
Andre Cabannes Apr. 1980 34 p refs
(Contract N00014-75-C-0555)
(AD-A083656; TR-17) Avail: NTIS HC A03/MF A01 CSCL 12/2

The practical problem of monitoring air pollutant concentration over a geographical area, or of estimating the mining resources in a region or a field can both be formulated as a problem of interpolation of random field. Given a real-valued random field (Z(X);x an element of R to the m power) the basic problem is to interpolate Z over an area A from measurements taken at n stations x1 ,x2, ,xn, when the distribution of Z is only partially specified. The second problem is the choice of the network of stations. After deriving the form of the best linear unbiased predictor of Z we prove a general updating theorem which is useful both practically to quicken the computation of the new estimated map, and theoretically to study the problem of network design. Then we use this theorem to prove that when Z is a smooth random field (essentially differentiable in quadratic mean) the variance of estimation error of Z(x) is a discontinuous function of the arguments x1,x2,...,xn. We discuss the practical consequences of this result in the design of networks of stations. GRA

N80-28145# Texas Univ. at Austin. Center for Cybernetic Studies.
A PRIMAL SIMPLEX VARIANT FOR THE MAXIMUM FLOW PROBLEM
Fred Glover (Colorado Univ., Boulder), Darwin Klingman, John Mote (Analysis, Research, and Computation, Inc., Austin, Tex.), and David Whitman (Analysis Research, and Computation, Inc., Austin, Tex.) Dec. 1979 47 p refs
(Contracts N00014-78-C-0222; DOT-OST-70074)
(AD-A084282; CCS-362) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper presents a number of specialized implementations of the primal simplex algorithm for the maximum flow problem. Computational results indicate that some of these variants are both faster and require less computer storage than our best implementation of the classic labeling algorithm for maximum flow problems. GRA

N80-28146# Texas Univ. at Austin. Center for Cybernetic Studies.
SOLUTION APPROACHES FOR NETWORK FLOW PROBLEMS WITH MULTIPLE CRITERA
Darwin Klingman and John Mote (Systems Analyst, Analysis, Research and Computation, Inc.) Dec. 1979 41 p refs
(Contract N00014-78-C-0222)
(AD-A084283; CCS-363) Avail: NTIS HC A03/MF A01 CSCL 12/2

A network variant of the multicriteria linear programming problem is presented. The primal simplex multicriteria algorithm first developed by Yu and Zeleny is specialized to handle the simple basis structure of the multicriteria uncapacitated transshipment problem. Specifically, the basis tree representation and updating techniques that have proven to be successful for single criterion network flow problems are used to substantially reduce the computational effort required for the multicriteria simplex algorithm. The fundamental theoretical results for the general multicriteria linear programming problem are presented followed by a brief review of the relevant aspects of the network basis structure. Next, the specialized multicriteria primal simplex algorithm for the uncapacitated transshipment problem is presented and a small example problem is given. Then a network variant of the surrogate criterion linear programming approach is presented. For sake of illustration, the shortest path problem is used as the class of networks to be solved. However this approach can be easily extended to any of the other classes of network flow problems. In this section an interactive solution procedure is described that involves both the decision maker and the computer at each stage. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-28147 State Univ. of New York at Buffalo.
MEASUREMENTS OF THE TEMPERATURE DEPENDENT DIAMAGNETISM OF LIQUIDS Ph.D. Thesis
Richard Keith Kunze 1979 179 p
Avail: Univ. Microfilms Order No. 8016207

Measurements of temperature dependence of the diamagnetism of various liquids performed using a high precision (10 to the 10th power SI) superconducting magnetic susceptometer are reported and discussed. A microprocessor-based signal processing system was developed allowing the elimination of systematic error due to the background signal from the quartz sample holder and due to linear output drift. Partly to evaluate the temperature regulation of this prototype susceptometer, a measurement of the change in volume susceptibility at the well-studied gel to liquid crystal phase transition of dipalmitpyphosphatidylcholine vesicle dispersions was performed. The observed change is consistent with the known density change of the phospholipid bilayer and the assumption that the mass susceptibility of the system is constant through the transition. The measurements of methanol, acetic acid, deuterium oxide, chloroform, acetone, carbon tetrachloride, carbon disulfide, cyclohexane, and nitrobenzene indicate that hydrogen bonding is not a necessary condition for temperature dependent diamagnetism in liquids. Dissert. Abstr.

N80-28148# Pittsburgh Univ., Pa. Learning Research and Development Center.
REPRESENTATION OF PHYSICS KNOWLEDGE BY EXPERTS AND NOVICES
Michelene T. Chi, Paul J. Feltovich, and Robert Glaser 21 Mar. 1980 68 p refs
(Contract N00014-78-C-0375; NR Proj. 157-421)
(AD-A084452; TR-2) Avail: NTIS HC A04/MF A01 CSCL 12/2

The studies reported here investigate the representation and organization of physics knowledge in experts and novices. Four experiments investigate the existence of schemata for physics problems, qualitative and quantitative differences in schemata types used by experts and novices, differences in the content of these schemata, and features in the physics problems that activate problem representations. Results obtained from problem sorting tasks and protocol analysis reveal that novices and experts begin with specifiably different problem representations depending on the structure of their knowledge. The initial representation and subsequent approach to problem solution used by experts is based on physics principles abstracted from a problem, while novices base their representation and approaches on the problem's literal features. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-28149 Pennsylvania State Univ., University Park.
AN INVESTIGATION OF THE LOW-FREQUENCY SOUND FIELD OF A REVERBERANT ENCLOSURE AND THE EFFECTS OF DIGITAL ELECTRONIC FEEDBACK Ph.D. Thesis
John Baptist Ochs 1980 220 p
Avail: Univ. Microfilms Order No. 8015825

Low frequency fluctuation of the characteristics of the sound field was investigated in comparion to those characteristics at high frequency. Electronic feedback, using a single Finite Impulse Response (FIR) filter was implimented to beneficially change the degree of diffusion to increase the useful frequency range of reverberant enclosures for sound power measurements. This investigation included a computer model study and a experimental study in a model enclosure of the frequency-by-frequency fluctuation of the time-averaged spatial mean squared pressure as as it relates to sound power measurements; the normalized spatial variance, the probability density function and the cumulative distribution function of time-averaged squared pressure normalized to the spatially averaged cross correlation coefficient; and the vector intensity. The data from both the computer model and the experimental model showed that the feedback implemented did not significantly affect the diffusion of the sound field. Dissert. Abstr.

N80-28150*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TIME-OF-DAY CORRECTIONS TO AIRCRAFT NOISE METRICS
Sherman Clevenson, ed. and William T. Shepherd, ed. (FAA) Jun. 1980 81 p Workshop held in Hampton, Va., 11-12 Mar. 1980; sponsored by NASA and DOT
(NASA-CP-2135; FAA-EE-80-3; L-13779) Avail: NTIS HC A05/MF A01 CSCL 20A

The historical and background aspects of time-of-day corrections as well as the evidence supporting these corrections are discussed. Health, welfare, and economic impacts, needs a criteria, and government policy and regulation, are also reported. For individual titles, see N80-28151 through N80-28152.

N80-28151*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
HISTORICAL DEVELOPMENT OF NOISE EXPOSURE METRICS
William J. Galloway *In* NASA. Langley Res. Center Time-of-Day Corrections to Aircraft Noise Metrics Jun. 1980 p 7-18 (For primary document see N80-28150 18-71)
Avail: NTIS HC A05/MF A01 CSCL 20A

Some of the historical events that led to the introduction of night penalties are reported with emphasis on what happens with different kinds of day/night operations when night pentalties are employed. These effects are considered in terms of the difference between a nighttime weighting cumulative measure of noise exposure verses simply not using any night weighting at all, in decibles. R.C.T.

N80-28152*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESEARCH PERSPECTIVE: TIME-OF-DAY EFFECTS ON NOISE ANNOYANCE
James M. Fields *In its* Time-of-Day Corrections to Aircraft Noise Metrics Jun. 1980 p 19-30 (For primary document see N80-28150 18-71)
Avail: NTIS HC A05/MF A01 CSCL 20A

Some of the complications encountered in researching time-of-day effects on noise annoyance are reported. A conceptual framework for further research is provided. Some of the implications for the research methods that should be used are suggested. R.C.T.

N80-28153# Watkins and Associates, Lexington, Ky.
ASSESSMENT OF THE ENVIRONMENTAL COMPATIBILITY OF DIFFERING HELICOPTER NOISE CERTIFICATION STANDARDS Final Report
Richard G. Edwards, Alvin B. Broderson, Roger W. Barbour, Donald F. McCoy, and Charles W. Johnson Jun. 1979 67 p refs
Prepared in cooperation with Kentucky Univ., Lexington
(Contract DOT-FA78WA-4194)
(AD-A080525; FAA-AEE-79-13) Avail: NTIS HC A04/MF A01 CSCL 01/2

Areas having the heaviest helicopter activity in the U.S. were visited and environmental noise measurement made in order to evaluate the impact of possible relaxed noise emission standards

for helicopters restricted to remote regions. Measurement results showed that an average of 10 flyovers per hour produced a one hour energy-averaged sound level (Leq) of 54.5 dBA, a level 2.5 dBA above ambient. An average of 34 events per hour adjacent to heliports produced a one-hour Leq of 63.1 dBA, which was 13.3 dBa above ambient. If emission levels were increased by 10 dBA, projected Leq values of 57.0 and 71.2 dBA resulted for the flyover and heliport conditions, respectively. Sixty-four percent of those responding to a questionnaire stated that they had not experienced a problem from helicopter noise. The degree to which the remaining respondents were bothered ranged from (slightly) to (very annoyed) with no significant preference for either category. GRA

N80-28154# Naval Surface Weapons Center, White Oak, Md.
SURFACE WAVES AND ANOMALOUS SOUND ABSORPTION Final Report
Ronald L. Kligman 1 Jan. 1980 51 p refs
(SF43452702)
(AD-A083844; NSWC-TR-79-481) Avail: NTIS HC A04/MF A01 CSCL 20/1

A theoretical model of surface waves in equilibrium with acoustic waves at a fluid-fluid interface is developed. Modifications to the usual pressure and particle velocity boundary conditions lead to a dispersion relation for the waves of the coupled system. An expression for the total reflection coefficient is found. The ratio of acoustic energy absorbed due to reflection from the interface to the incident wave energy is calculated making use of the previously obtained reflection coefficient. GRA

N80-28155# Army Construction Engineering Research Lab., Champaign, Ill. Environmental Div.
TRUE-INTEGRATING ENVIRONMENTAL NOISE MONITOR AND SOUND-EXPOSURE LEVEL METER. VOLUME 4: MECHANICAL CONSTRUCTION AND ELECTRICAL CHECK OUT Final Report
A. J. Averbuch and R. Brown Mar. 1980 47 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A083321; CERL-TR-N-41-Vol-4) Avail: NTIS HC A03/MF A01 CSCL 20/1

This volume gives the assembly, adjustment, and checkout procedures necessary to construct a U.S. Army Construction Engineering Research Laboratory (CERL) True-Integrating Environmental Noise Monitor and Sound-Exposure Level Meter. It describes the monitor's mechanical layout, wiring guidelines, adjustments to components to bring various circuits into tolerance, and steps for verifying the correct operation of the monitor. Also included are test programs to be executed by the internal microprocessor to exercise the internal circuit to help checkout or repair. GRA

N80-28156# Army Construction Engineering Research Lab., Champaign, Ill.
TRUE-INTEGRATING ENVIRONMENTAL NOISE MONITOR AND SOUND-EXPOSURE LEVEL METER. VOLUME 3: MICROPROCESSOR PROGRAM AND DATA INTERFACE DESCRIPTION Final Report
A. J. Averbuch and L. M. Little Mar. 1980 175 p
(DA Proj. 4A7-62720-A-896)
(AD-A083320; CERL-TR-N-41-Vol-3) Avail: NTIS HC A08/MF A01 CSCL 20/1

This report describes the internal microprocessor program used to operate the U.S. Army Construction Engineering Research Laboratory (CERL) True-Integrating Environmental Noise Monitor and Sound-Exposure Level Meter. Several data interface accessories are also described; complete program listings are included. GRA

N80-28157# Wyle Labs., Inc., El Segundo, Calif.
CORRECTION PROCEDURES FOR AIRCRAFT NOISE DATA. VOLUME 1: PSEUDOTONES Final Report
R. Rackl Dec. 1979 210 p refs
(Contract DOT-FA78WA-4143)
(AD-A081962; WR-79-9-Vol-1; FAA/EE-80-1-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 20/1

Pseudotones are spectral irregularities due to ground reflections which can cause tone corrections in the calculation of Effective Perceived Noise Level which are not generated by the aircraft itself. Several analytical (reflection theory, lower cutoff frequency for tone corrections) and instrumentation (ground and pole microphones) methods were investigated which remove the pseudotones. In support of this study, a substantial number of aircraft noise measurements were obtained and analyzed in detail; these data are also summarized in the report. GRA

N80-28158# Wyle Labs., Inc., El Segundo, Calif.
CORRECTION PROCEDURES FOR AIRCRAFT NOISE DATA. VOLUME 2: BACKGROUND NOISE CONSIDERATIONS Final Report
L. Sutherland, J. Parkinson, and D. Hoy Dec. 1979 115 p
(Contract DOT-FA78WA-4143)
(AD-A082011; WR-79-9-Vol-2; FAA-EE-80-1-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 20/1

The impact of background noise on the value of PNL, PNLT, and the resulting EPNL noise metric in aircraft certification to FAR Part 36 is examined in this report, the second in a series of reports on aircraft noise measurement correction procedures. Procedures to remove background noise effects from data measured in the form of one-third octave band sound pressure levels for jet and large propeller aircraft, or data in the form of A-weighted noise levels for light propeller driven aircraft, are defined. After evaluating various techniques for different ratios of signal-to-background noise, one simple correction method for turbojet/turbofan aircraft noise is proposed. The recommended method consists of applying an energy correction, up to a maximum of -10 dB, for that portion of the background noise spectra dominated by energy-adding or predetection background noise. For the remaining portion of the background noise spectra, the non-additive postdetection background noise floor tends to mask out bands very close to or below this noise floor. A simple spectrum extrapolation procedure is recommended in this case. Another background noise correction method for light propeller aircraft noise is also proposed. This procedure simply involves application of an energy correction to the 'as measured' A-weighted aircraft signal using the A-weighted background noise level. Procedures are also suggested for measuring the background noise level in order to account for the randomness of the fluctuating background noise level. GRA

N80-28159# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE EFFECTS OF HIGH LEVEL INFRASOUND
Daniel L. Johnson Feb. 1980 16 p refs presented at Conf. on Low Freq. Noise and Hearing, Aalborg, Denmark, 7-9 May 1980 Submitted for publication
(AF Proj. 7321; AF Proj. 7184)
(AD-A081792; AMRL-TR-80-13) Avail: NTIS HC A02/MF A01 CSCL 06/19

This paper will attempt to survey the current knowledge on the effects of relative high levels of infrasound on humans. While this conference is concerned mainly about hearing, some discussion of other physiological effects is appropriate. Such discussion also serves to highlight a basic question, 'Is hearing the main concern of infrasound and low frequency exposure, or is there a more sensitive mechanism'. It would be comforting to know that the focal point of this conference is indeed the most important concern. Therefore, besides hearing loss and auditory threshold of infrasonic and low frequency exposure, four other effects will be provided. These are performance, respiration, annoyance, and vibration. GRA

N80-28160# Utah Univ., Salt Lake City. Dept. of Mathematics.
TRANSIENT ACOUSTIC WAVE PROPAGATION IN AN EPSTEIN DUCT Summary Report
Calvin H. Wilcox Nov. 1979 50 p refs
(Contract N00014-76-C-0276)
(AD-A083484; TR-36) Avail: NTIS HC A03/MF A01 CSCL 20/1

Transient acoustic wave propagation is analyzed for the case of an unlimited plane-stratified fluid having constant density and sound speed c (y) at depth y given by the Epstein profile 1/c squared (y) + K sech squared (y/H) + L tanh (y/H) + M. The acoustic potential is a solution of the wave equation Dt squared u-c squared (y) (D1 squared u + D2 squared u + Dy squared u) = f(t,x,y) where x = (x sub 1, x sub 2) are horizontal coordinates

and f(t,x,y) characterizes the wave sources. The principle results show that u is the sum of a free component, which behaves like a diverging spherical wave for large t, and a guided component which is approximately localized in a region abs. val. (y-y sub o) < or = h and propagates outward in horizontal planes like a diverging cylindrical wave. M.G.

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-28161 California Univ., Los Angeles.
STUDIES IN INTRAMOLECULAR MOTION Ph.D. Thesis
Paul Richard Stannard 1980 137 p
Avail: Univ. Microfilms Order No. 8016046

Five self contained articles written for scientific journals that all deal with the dynamical behavior of an isolated molecule in an excited energy state are presented. The first differs from the rest however, and examines the effect of coupling between vibrational levels belonging to different Born-Oppenheimer electronic states. The remaining four articles are all concerned with the Local Mode Model of molecular vibrations (in only one electronic state). Both the Local Mode (LM) and the better known Normal Mode (NM) model seek to separate the complicated many dimensional vibrational motion of a polyatomic molecule into a superposition of one dimensional oscillations. The question of which is the best zeroth-order description is examined and qualitative and quantitative criteria are introduced. A calculation to compare the effectiveness of NM and LM approximations in describing the fundamental absorptions in water is described along with the question of molecular symmetry in a LM picture. The effect of breakdown of separability on intramolecular dynamics, in glyoxal, water and benzene is explained.
Dissert. Abstr.

N80-28162 Pittsburgh Univ., Pa.
STUDIES IN THE IONIZATION OF ATOMS AND IONS BY PHOTONS Ph.D. Thesis
David John Botto 1979 206 p
Avail: Univ. Microfilms Order No. 8015291

Three aspects of the ionization of atoms and ions by photons are discussed. (1) Analytic expression previously derived for neutral atoms are employed to describe inner shell nonrelativistic dipole photoeffect cross sections for positively charged atomic ions. The simple dependence of these cross sections on nuclear charge Z and ionic charge Z results from scaling. (2) A numerical calculation of the radiative corrections to the atomic photoeffect is performed for the K shell of a hydrogenlike atom to lowest order in radiation field assuming the polarization of the electron and photon are not observed. Dependence of these corrections on the photon energy and the detector's energy resolution are discussed. (3) A survey of the present status of the theory and experiment for Compton scattering is given. The validity of the various theoretical approaches is discussed. A formalism for the calculation of Compton scattering cross sections in a relativistic partial wave expansion in a central potential is developed. Dissert. Abstr.

N80-28163 California Univ., Berkeley.
MULTIPHOTON DISSOCIATION OF POLYATOMIC MOLECULES Ph.D. Thesis
Peter Anfaenger Schulz 1979 138 p
Avail: Univ. Microfilms Order No. 8014823

The dynamics of infrared multiphoton excitation and dissociation of SF6 was investigated under collision free conditions by a crossed laser-molecular beam method. In order to understand the excitation mechanism and to elucidate the requirements of laser intensity and energy fluence, a series of experiments were carried out to measure the dissociation yield dependences on energy fluence, vibrational temperature of SF6, the pulse duration of the CO2 laser and the frequency in both one and two laser experiments. Translational energy distributions of the SF5 dissociation product measured by time of flight and angular distributions and the dissociation lifetime of excited SF6 as inferred from the observation of secondary-dissociation of SF5 into SF4 and F during the laser pulse suggest that the dynamics of dissociation of excited molecules is dominated by complete energy randomization and rapid intramolecular energy transfer on a nanosecond timescale, and can be adequately described by RRKM theory. Dissert. Abstr.

N80-28164 California Univ., Berkeley.
MULTIPHOTON PROCESSES IN ISOLATED ATOMS AND MOLECULES Ph.D. Thesis
Aasmund Sveinung Sudbo 1979 160 p
Avail: Univ. Microfilms Order No. 8014899

The theory of coherent excitation of a multilevel quantum mechanical system is developed. Damping of the system is taken into account by the use of a density matrix formalism. General properties of the wave function and/or the density matrix are discussed. The physical implications for the behavior of the system are described, together with possible applications of the formalism, including the infrared multiphoton excitation of molecules, and optical pumping in alkali atoms. Experimental results on the infrared multiphoton dissociation of molecules are presented followed by a discussion of the general features of this process. The experimental results were obtained using a crossed laser and molecular beam method, and the emphasis is on determining the properties of the dissociating molecule and the dissociation products. The dissociation process is shown to be described very well by the standard statistical theory (RRKM theory) of unimolecular reactions, a brief presentation of which is also included. Dissert. Abstr.

N80-28165 California Univ., Berkeley.
LASER INDUCED FLUORESCENCE OF TRAPPED MOLECULAR IONS Ph.D. Thesis
Frederick Joseph Grieman 1979 251 p
Avail: Univ. Microfilms Order No. 8014713

An experimental apparatus for obtaining the optical spectra of molecular ions is described. The experimental technique includes the use of three dimensional ion trapping, laser induced fluorescence, and gated photon counting methods. In the laser induced fluorescence technique employed in this experiment the ions, after being stored and mass selected, are interrogated by an intense, narrow bandwidth dye laser pulse ten nanoseconds in duration. Any subsequent fluorescence is not dispersed but is detected by a bare photomultiplier tube. The signals is further enhanced by signal averaging which is accomplished using an on-line minicomputer. The computer also controls the progress of the experiment and normalizes the fluorescence signal with respect to laser power and ion density which are monitored throughout the experiment. The result is a fluorescence excitation spectrum which in many instances contains the same information as an absorption spectrum. The spectra of the molecular ions studied by this experimental technique are presented.
Dissert. Abstr.

N80-28166 California Univ., Berkeley.
CROSSED BEAM STUDIES OF FULL AND HALF COLLISIONS Ph.D. Thesis
Randal Kenneth Sparks 1979 171 p
Avail: Univ. Microfilms Order No. 8014889

The results of two experiments performed on very high resolution crossed molecular beams apparatus are discussed. The first experiment, photofragmentation of methyl iodide, is deconvoluted to yield vibrational state distributions for the recoiling methyl fragment. These distributions are then analyzed in terms of half-collision models and Franck-Condon factors. The second experiment, a full-collision example, is the reaction of F atoms with H2 and D2. Laboratory angular and velocity distributions for both systems are obtained at several energies. Center-of-mass product distributions are calculated and discussed in terms of recently predicted state dependent resonance phenomena for the reaction. The design of the apparatus is also discussed.
Dissert. Abstr.

N80-28167*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TABLES OF TRANSITION PROBABILITIES AND BRANCHING RATIOS FOR ELECTRIC DIPOLE TRANSMISSIONS BETWEEN ARBITRARY LEVELS OF HYDROGEN-LIKE ATOMS

Kazem Omidvar Jun. 1980 35 p refs
(NASA-TM-80682) Avail: NTIS HC A03/MF A01 CSCL 20H

Branching ratios in hydrogen-like atoms due to electric-dipole transitions are tabulated for the initial principal and angular momentum quantum number n, lambda, and final principal and angular momentum quantum numbers n, lambda. In table 1, transition probabilities are given for transitions n, lambda, yields n, where sums have been made with respect to lambda. In this table, 2 < or = n' < or = 10, o < or = lambda' < or = n'-1, and 1 < or = n < or = n'-1. In addition, averages with respect to lambda' and sums with respect to n, and lifetimes are given. In table 2, branching ratios are given for transitions n' lambda' yields n, where sums have been made with respect to lambda. In these tables, 2 < or = n' < or = 10, 0 < or = lambda', < n'-1, and 1 < or = n < or = n'-1. Averages with respect to lambda' are also given. In table 3, branching ratios are given for transitions n' lambda' yields in lambda, where 1 < or = n < or = 5, 0 < or = lambda < or = n-1, n < n' < or = 15, and 0 < or = lambda' < or = n(s), where n(s), is the smaller of the two numbers n'-1 and 6. Averages with respect to lambda' are given. Author

N80-28168# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
LOW ENERGY X-RAY AND ELECTRON INTERACTIONS WITHIN MATTER Interim Scientific Report, 1 Oct. 1978 - 30 Sep. 1979
Burton L. Henke Mar. 1980 65 p refs
(Grant AF-AFOSR-0027-79; AF Proj. 2301)
(AD-A083962; AFOSR-80-0294TR) Avail: NTIS HC A04/MF A01 CSCL 20/8

This research program is concerned with the physics and the application of low energy X-ray and associated electron interactions. It has been concentrated upon the sub-kilovolt energy region where the need has been greatest for the development of efficient and precise spectroscopic methods, for the measurement of fundamental interaction cross sections, and for the basic theoretical modeling of certain important X-ray and electron interaction processes as, for example, X-ray induced photoemission and fluorescence. This work is applied to two areas of considerable present importance and need: the development of high efficiency spectroscopic methods that can be effectively applied to the diagnostics of high temperature plasmas - particularly as generated by high power pulsed lasers, electron or ion beams and by exploding wires, for which high temporal resolution as well as high spectral resolution is needed; and the testing and application of high-efficiency low-energy fluorescent spectroscopic measurement and analysis for valence and molecular orbital electron energy state studies, for the solid state characterization of surfaces, and for studies of the effects of radiation damage. GRA

N80-28169# Washington Univ., Seattle. Dept. of Chemistry.
GAS SURFACE VIBRATIONAL ENERGY TRANSFER IN THE TRANSIENT REGION OF A LOW PRESSURE UNIMOLECULAR REACTION
B. D. Barton, D. F. Kelley, and B. S. Rabinovitch 31 Mar. 1980 24 p refs
(Contract N00014-75-C-0690)
(AD-A083944; TR-15) Avail: NTIS HC A02/MF A01 CSCL 07/4

The Variable Encounter Method was applied to the study of the transient region in vibrational accommodation of reacting cyclopropane at surfaces. Collision efficiency declines with rise of temperature. Surface collisions are more efficient than binary gas phase encounters but declines with rise of temperature. The results agree with an independent earlier study we have made on cyclopropane-d2. GRA

N80-28170# Rockwell International Science Center, Thousand Oaks, Calif.
GROWTH OF HgCdTe BY MODIFIED MOLECULAR BEAM EPITAXY (MBE) Semiannual Technical Report, 1 Sep. 1979 - 29 Feb. 1980
J. T. Cheung Mar. 1980 33 p refs
(Contract MDA903-79-C-0188; DARPA Order 3704)
(AD-A083799; SC5202.6SA) Avail: NTIS HC A03/MF A01 CSCL 07/4

An investigation was made on the deposition of HgCdTe thin film on CdTe by irradiating the bulk source material with high power laser pulses. The morphological features and stoichiometric composition depend very strongly on the laser characteristics and the scanning rate. Under very high power operation, the dominant deposition process is the condensation of micron size molten globules 'blown-off' from the source material. At lower power level, the film formation is largely due to the deposition of small molecular clusters. Compositional analysis of the film showed that the CdTe end of the alloy evaporated congruently, whereas the HgTe and end suffered some loss of Hg. The amount of Hg loss could be reduced by varying the laser power and the scanning rate. N-type films up to 2 microns thick were deposited in this manner and photoconductive devices were fabricated and measured. We have also made a detailed mass spectrometric study of the evaporant composition under different conditions. A model on the evaporation mechanism formulated from such information will be discussed. GRA

N80-28171# JAYCOR, Alexandria, Va.
AXIAL AND RADIAL COMPRESSION OF ION BEAMS Final Report, 15 Jan. 1979 - 26 Feb. 1980
Shyke A. Goldstein and Paul F. Ottinger Mar. 1980 109 p refs
(Contract N00173-79-C-0420)
(AD-A083702; JAYCOR-TPD200-80-003-FR) Avail: NTIS HC A06/MF A01 CSCL 20/8

The present report concentrates on the physics of propagating intense ion beams in plasma channels. In particular, the theoretical aspects are studied of the possible effects during ion beam transport on the structure of electromagnetic fields in the plasma. The ion orbits were solved for different classes of plasma channels including bumpy ones in order to evaluate the sensitivity of beam losses due to channels that deviate from idealistic shapes. The consideration of different plasma instabilities, the hydrodynamic motion of the plasma, propagation in filamentary channels and beam energy losses put realistic limits on how much ion current can be propagated using the simple steady plasma channel concept. Axial bunching of the beam (via time dependent voltage ramping of the ion diode) was analyzed and found to be a sound concept as long as no more than an order of magnitude pulse compression is attempted. The radial compression is viable on a small scale in tapered channels (giving a factor of 2 increase in current density) and on a large scale if self magnetic fields fully penetrate the media (giving rise to an order of magnitude increase in ion beam current density). Further theoretical investigation on the details of the above mechanisms are presently in progress including new plasma channel schemes that help to push upwards the limits on the ion currents. GRA

N80-28172# SRI International Corp., Menlo Park, Calif. Molecular Physics Lab.
INELASTIC COLLISIONS OF EXCITED ATOMS Final Report, Oct. 1976 - Mar. 1980
Michael J. Coggiola 29 Apr. 1980 108 p refs
(Contract N00014-76-C-0118)
(AD-A084524; SRI-MP-80-50) Avail: NTIS HC A06/MF A01 CSCL 07/4

The interaction of metastable rare gas atoms with ground state atoms is being investigated in the energy range from several eV to several keV. Emphasis is on collisional ionization and collisional excitation transfer. Additional work examines the details of the charge transfer reaction used to produce the fast metastable beams. GRA

N80-28173# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
PHOTOCHEMICAL CONSEQUENCES OF INTERCHROMOPHORIC INTERACTIONS Final Report, 15 Oct. 1975 - 1 Feb. 1980
Harry Morrison 5 May 1980 4 p
(Grants DAAG29-79-G-0009; DAAG29-76-G-0066)
(AD-A084712; ARO-13088.9-C; ARO-16012.4-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

This constitutes the final technical report on a project which has dealt with the photochemical and photophysical consequences

of interaction between two or more nonconjugated functional groups in an organic molecule. GRA

N80-28174# California Univ., Berkeley. Dept. of Chemistry.
CROSSED MOLECULAR BEAM STUDY OF THE REACTIONS OF OXYGEN AND FLUORINE ATOMS Annual Report, Jan. 1979 - Feb. 1980
Yuan T. Lee 1 Mar. 1980 36 p refs
(Contract N00014-75-C-0671)
(AD-A084255; UC-75-C-0671-80) Avail: NTIS
HC A03/MF A01 CSCL 07/4

Rapid developments in the study of oxygen reaction chemistry occurred as it is succeeded in obtaining an O(1D) beam source and commenced investigating the dynamics of several important reactions of O(3P) and O(1D). In the reaction of O(3P) with C6H6 and C6D6, two competing channels, one producing a stabilized addition complex and the other forming radical products C6H5O - H has been identified. Studies of the effects of collision energy and of deuteration were used to clarify the reaction mechanism. The reaction of O(3P) with another aromatic hydrocarbon toluene, results in competition between two substitution channels, loss of H atom and loss of CH3. In contrast to the O - C6H6 reaction, no stabilized oxygen-toluene adduct was observe. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-28175# Battelle Pacific Northwest Labs., Richland, Wash.
ASSESSMENT OF EFFECTIVENESS OF GEOLOGIC ISOLATION SYSTEMS. TEST CASE RELEASE CONSEQUENCE ANALYSIS FOR A SPENT FUEL REPOSITORY IN BEDDED SALT
J. R. Raymond, F. W. Bond, C. R. Cole, R. W. Nelson, A. E. Reisenauer, J. F. Washburn, N. A. Norman (Bechtel National, Inc.), P. A. Mote (Bechtel National, Inc.), and G. Segol (Bechtel National, Inc.) Jan. 1980 82 p refs
(Contract EY-76-C-06-1830)
(PNL-2782) Avail: NTIS HC A05/MF A01

Geological and geohydrologic data for the Paradox Basin were used to simulate movement of ground water and radioactive contaminants from a hypothetic nuclear reactor spent fuel repository after an assumed accidental release. The pathlines, travel times and velocity of the ground water from the repository to the discharge locale (river) were determined after the disruptive event by use of a two dimensional finite difference hydrologic model. The concentration of radioactive contaminants in the ground water was, calculated along a series of flow tubes by use of a one dimensional mass transport model which takes into account convection, dispersion, contaminant/media interactions and radioactive decay. For the hypothetical site location and specific parameters used in this demonstration, it is found that Iodine-129 is the only isotope reaching the Colorado River in significant concentration. This concentration occurs about 8.0 x 10 to the 5th power years after the repository has been breached. DOE

74 OPTICS

Includes light phenomena.

N80-28176 Rochester Univ., N. Y.
MEASUREMENT OF STRONGLY REFRACTING, THREE-DIMENSIONAL INDEX DISTRIBUTIONS Ph.D. Thesis
Glen Walden Johnson 1980 167 p
Avail: Univ. Microfilms Order No. 8014330

Procedures for specifying a general class of optical systems were developed and incorporated into a computer program. Provisions are included for tracing rays through regions having inhomogeneous refractive indices. For this purpose, a vector form of the Runge-Kutta-Nystrom integration technique was applied. The first of two examples discusses the design of a series of lenses from a glass whose refractive index is described by an axial, Guassian distribution. The second example explores several potential sources of error in the measurement of gradient index fibers where the direction of the probing light is perpendicular to the fiber's optical axis. A homodyne, modified Mach-Zehnder interferometer was built to measure gradient index samples by probing the sample over a range of angles about the gradient direction. Two types of measurements of a gradient index lens blank, having a Gaussian index distribution, are presented. First, a wavefront map of the blank reveals imperfections in the gradient. Second, a series of measurements are made that are analyzed by simulating the test conditions. Dissert. Abstr.

N80-28177 Cornell Univ., Ithaca, N. Y.
OPTICAL PROPERTIES AND SOLAR SELECTIVITY OF METAL-INSULATOR COMPOSITE FILMS Ph.D. Thesis
Harold Gene Craighead 1980 192 p
Avail: Univ. Microfilms Order No. 8015657

The results of an experimental study of metal-insulator composite films are described. A description of the entire process of sample production, characterization, experimental examination and ultimate demonstration of an application is included. The problem considered was to measure the optical constants of metal insulator-composite materials and check the applicability of effective medium-composite materials and check the applicability of effective medium theories in predicting their optical properties. With this knowledge, there was also the goal of designing and fabricating efficient and durable solar photothermal absorber surfaces. The method used for controlled coevaporation of microscopically segregated metal-insulator composites is described. With this technique many different composites were produced; the most notable ones were Ni/Al2O3, Au/Al2O3, Au/MgO, Ag/MgO and Pt/Al2O3. Dissert. Abstr.

N80-28178 California Inst. of Tech., Pasadena.
PHASE CONJUGATE OPTICS: ON THE THEORY, OBSERVATION, AND UTILIZATION OF TEMPORALLY-REVERSED WAVEFRONTS AS GENERATED VIA NONLINEAR OPTICAL PARAMETRIC INTERACTIONS Ph.D. Thesis
David Mort Pepper 1980 330 p
Avail: Univ. Microfilms Order No. 8014305

Theoretical and experimental aspects as well as potential applications in the field of coherent optics known as Phase Conjugate Optics (PCO). The ability of PCO to correct for image modal dispersion in optical waveguides as well as the use of PCO to perform real time coherent image processing and nonlinear microscopy is discussed. Temporal-frequency domain applications of PCO analyzed include the use of a nearly degenerate four-wave mixing process as a narrowband, wide field-of-view optical filter, capable of an amplified bandpass. The ability of a PCO interaction to renarrow (transform limited) optical pulses which have been temporally spread due to propagation through (group velocity) dispersive channels is analyzed. A potential application of PCO in the field of nonlinear laser spectroscopy is presented. Specifically, the scattering of a probe photon off a two-photon coherent state (created in a three-level atomic system) is shown to yield a conjugate replica. Dissert. Abstr.

N80-28179# Oregon Graduate Center for Study and Research, Beaverton.
WAVE PROPAGATION IN PARTICULATE MEDIA Annual Summary Report, 1 Sep. 1979 - 15 Apr. 1980
Richard A. Elliott 18 Apr. 1980 11 p
(Contract N00014-79-C-0897)
(AD-A083742) Avail: NTIS HC A02/MF A01 CSCL 20/6

Progress in developing techniques for producing well characterized scattering media from dielectric liquid emulsions and the design of equipment to measure their optical properties and their effect on laser pulse propagation are outlined. GRA

N80-28180# Brown Univ., Providence, R. I. Div. of Engineering
REMOTE OPTICAL CONTROL AND SWITCHING IN OPTICAL FIBER LINKS Final Technical Report, 1 Oct.

1977 - 30 Sep. 1978
R. V. Gauthier and A. V. Nurmikko Griffiss AFB, N.Y. RADC Jan. 1980 46 p refs
(Contract F19628-78-C-0009; AF Proj. 0176)
(AD-A083659; RADC-TR-79-346) Avail: NTIS HC A03/MF A01 CSCL 20/6

In this project work, means were considered to achieve high-speed (GHz) switching and modulation in integrated optical circuits, suitable for fiber optics applications. In particular, design and performance criteria were calculated for a planar coupled optical channel device, electro-optically switched by synchronous electrical signals propagating along an asymmetric coplanar waveguide stripline. Design was also executed for several of the components in the laboratory although full integration was not completed within the project period. GRA

N80-28181# Fairleigh Dickinson Univ., Teaneck, N.J. Dept. of Physics.
DETERMINATION OF THE OPTICAL CONSTANTS OF HIGHLY ABSORBING MATERIALS IN THE INFRARED REGION Final Report, 1 May 1978 - 30 Jun. 1979
K. D. Moeller and V. P. Tomaselli Aberdeen Proving Ground, Md. Army Armament Research and Development Command Feb. 1980 37 p
(Contract DAAK10-77-C-0121)
(AD-A083883; AD-E410244; FDU-2; ARCSL-CR-80024) Avail: NTIS HC A03/MF A01 CSCL 20/6

The behavior of electromagnetic waves in ideal lossless dielectrics is used to generate expressions for the reflection coefficients. Strongly absorbing dielectrics are considered and methods for evaluating their optical constants are presented. The effect of polarized infrared radiation on measured reflected intensities is detailed. Anisotropic materials and their particular measurement problems are discussed. Application to powder spectroscopy of highly absorbing materials is made. A summary of experimental results is presented. GRA

N80-28182# ITT Electro-Optical Products Div., Roanoke, Va.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR RUGGEDIZED TACTICAL FIBER OPTIC CABLE Quarterly Progress Report, 1 Jul. - 30 Sep. 1979
R. Hoss and L. Ptaschek 26 Oct. 1979 86 p refs
(Contract DAAK80-79-C-0789)
(AD-A084191; CORADCOM-79-0789-1; QPR-1) Avail: NTIS HC A05/MF A01 CSCL 20/6

This report covers the first quarter of the Manufacturing Methods and Technology Program for Ruggedized Tactical Fiber Optic Cable. The scope of this quarter's effort, as reported herein, includes the following tasks and achievements: (1) cable process optimization: selection and ordering of polyurethanes for cable jackets, and fabrication and optical testing of the first engineering sample; (2) facilitization: high speed strander setup and operation, extruder setup, and fiber optic measurement station design; and (3) secondary performance milestones: 1st sample cable induced attenuation measurements. In addition to reporting progress on these milestones the report covers any revisions or improvements in process, equipment, tooling manufacturing flow and specifications. Key personnel on the program are identified. The program milestones for the next quarter are listed. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-28183 State Univ. of New York at Buffalo.
MHD CHANNEL FLOW AND HEAT TRANSFER IN A TIME-DEPENDENT SPATIALLY VARYING MAGNETIC FIELD Ph.D. Thesis
Subramani Rajaram 1980 282 p
Avail: Univ. Microfilms Order No. 8016238

The problem of fluid flow and heat transfer in the entrance region of a parallel plate channel under the influence of a magnetic field was studied. The magnetic field is not restricted to be steady and uniform but could be nonuniform or time-dependent and arbitrarily inclined to the channel axis. In addition, the wall conductivity is arbitrary. The problem is formulated in a way for the magnetic induction equation so that it is similar to the vorticity transport equation. Boundary layer simplications were not made and the complete Navier-Stokes equations were considered. The formulation of the problem enables all of the equations to be written in a single form. The heat transfer problem was classified into the constant wall temperature and constant wall heat flux problems. The complete energy equation with volumetric heat generation is considered. The problem has been solved for the case where velocity is already fully developed as temperature starts developing and for the simultaneous development of velocity and temperature. The effect of increasing the magnetic field is to enhance heat transfer. The problem is studied for a uniform and inclined field. The effect of increasing the inclination of the field is also to increase heat transfer at the walls due to a flattening of the velocity profiles. This effect is predominant for higher Peclet and Prandtl numbers. Dissert. Abstr.

N80-28184 California Univ., Los Angeles.
EXPERIMENTAL INVESTIGATION OF THE ANOMALOUS SKIN EFFECT AND COMPUTER SIMULATION OF THE COLLISIONLESS INTERCHANGE INSTABILITY Ph.D. Thesis
Heinz Goede 1980 188 p
Avail: Univ. Microfilms Order No. 8015979

The penetration of low frequency (omega << omega sub pe) electromagnetic waves into a uniform, collisionless, gaseous plasma is experimentally investigated. Measurements of the radial spatial decay of the oscillating magnetic field are used to obtain values of the skin depth. For fixed plasma density and temperature, field penetration is observed to remain constant until the frequency of the electromagnetic wave is low enough for electron thermal effects to become important. The enhanced penetration that occurs at this point is attributed to the well known anomalous skin effect that has been measured in solid state plasmas. In addition, a computer simulation study of the interchange instability in a two-dimensional, collisionless, zero-beta plasma is presented. Of particular interest is to examine whether compressional effects of a plasma immersed in an inhomogeneous magnetic field can lead to the stabilization of the interchange mode for parallel plasma pressure and magnetic field gradients as predicted by ideal magnetohydrodynamic theory. The simulation results indicate that, while stable states with plasma density and magnetic field gradients in the same direction exist, the fluid stability condition is not an optimistic one. Dissert. Abstr.

N80-28185 Cornell Univ., Ithaca, N. Y.
THE EQUILIBRIUM AND COMPRESSION OF ION RINGS Ph.D. Thesis
David Allan Larrabee 1980 251 p
Avail: Univ. Microfilms Order No. 8015698

The equilibrium properties of ion rings and their behavior during compression is discussed. The equations describing nonrelativistic ion rings are discussed in general terms. A commonly used model for ring equilibria, the exponential rigid rotor, is examined in detail numerically. It is concluded that this model does not adequately describe the expected equilibrium in reactor-type systems where the aspect ratio of the rings is small, (e.e., the ring is fat) due to the presence of untrapped particles. This is shown numerically by comparing this model with a model of the same form but without the untrapped particles. Dissert. Abstr.

N80-28186 California Univ., Berkeley.
INSTABILITIES OF A MAGNETIZED PLASMA DRIVEN BY A VELOCITY RING OR A DENSITY GRADIENT Ph.D. Thesis
Jae Koo Lee 1979 149 p
Avail: Univ. Microfilms Order No. 8014774

The interaction of magnetized monoenergetic ions (a ring in velocity space) with a homogeneous Maxwellian target plasma is studied. Numerical studies using linear Vlasov theory and the results of computer simulations are presented. The velocity-ring-driven instability is classified into three distinct regimes based on the beam density relative to the plasma density relative to the plasma density, where physical mechanisms, dispersion diagrams and maximum growth rates are quite different, adding

to previously known results. The ring-plasma instability is studied through electrostatic and electromagnetic simulations, treating the ring ions as particles and the target plasma (ions and electrons) as linearized fluids. Simulation results follow very closely the predictions of the linear Vlasov theory and provide extensive information on nonlinear features such as beam spreading, slowing down, and saturation, some of which are in agreement with analytic explanations. Dissert. Abstr.

N80-28187 California Univ., Berkeley.
A STUDY OF THE GENERAL PLASMA CHARACTERISTICS OF A HIGH POWER, MULTIFILAMENT ION SOURCE Ph.D. Thesis
Kurt Francis Schoenberg 1979 137 p
Avail: Univ. Microfilms Order No. 8014871

Results of steady state measurements, obtained via a pulsed electrostatic probe data acquisition system, and fluctuation measurements, obtained via a broadband digital spectral analysis system, are presented. It is concluded that: (1) source electron distribution function consists of a bulk component of thermalized electrons comprising 90% to 97% of the total electron population, plus a nonthermal high energy tail which is a monotonically significant electron population at energy values 10 to 15 eV above maximum cathode fall; (2) source plasma fluctuations are caused by ion acoustic waves, initially excited by a current driven instability at the thermionic cathode; and (3) fluctuation spectral energy density is highly nonthermal and exhibits a resonant profile set by the periodic multifilament structure in the source plasma chamber, indicating an interaction between filaments and the ion waves. Dissert. Abstr.

N80-28188 California Univ., Berkeley.
EQUILIBRIUM AND STABILITY IN STRONGLY INHOMOGENEOUS PLASMAS Ph.D. Thesis
Harry Elliot Mynick 1979 222 p
Avail: Univ. Microfilms Order No. 8014826

In some confinement schemes of current interest, for example in conventional and field-reversed mirrors, and in the Tormac sheath, the parameter eta, defined as the ratio of ion gyroradius to the plasma scale length perpendicular to the magnetic field, may take on appreciable values, as large as 1/3. Formalisms appropriate to the study of such strongly inhomogeneous plasmas are developed and applied, for three general aspects of plasma behavior. Each of these three topics is studied using Hamiltonian formalism, which greatly aids in expressing results in a general and concise manner. The formalism is phrased in terms of variational principle which, in addition to serving as a labor-saving device in parameter regimes where use of a finite-order differential equation is an adequate approximation to the full nonlocal mode equation, also permits the derivation of valid dispersion equations when the problem is fully nonlocal in character. Dissert. Abstr.

N80-28189 Cornell Univ., Ithaca, N. Y.
PRODUCTION AND INVESTIGATION OF A MULTI-AMPHERE POSITRON SOURCE Ph.D. Thesis
Gerald Louis Ferrentino 1980 141 p
Avail: Univ. Microfilms Order No. 8015671

The influence of collective effects on the generation and acceleration of positrons at high current densities is examined and a plasma diagnostic method is demonstrated from an appropriately designed multi-ampere positron source. The source developed has a known energy and angular spread, with a current density of several amperes per square centimeter. A positron current of approximately 15 amperes was produced by bombarding a tantalum target with a pulsed intense relativistic electron beam (IREB). The measured electron-to-positron-conversion yield agreed quantitatively with published low-current values. In a second experiment, the collective acceleration of positrons was investigated by installing a special target assembly that allowed a portion of the unneutralized IREB into air (P approximately less than 100 millitorr) in the vicinity of the positrons. Substantial changes in the positron-energy spectrum and a 60-fold increase of positron signal were observed. Discussions of pair-production, experimental apparatus, and beam-plasma interactions are included. Dissert. Abstr.

N80-28190 California Univ., Berkeley.
NONLINEAR WAVE EVOLUATION IN VLASOV PLASMA. A LIE TRANSFORM Ph.D. Thesis
John Robert Cary 1979 291 p
Avail: Univ. Microfilms Order No. 8014628

Nonlinear wave evolution in Vlasov plasma is analyzed using the Lie transform, a powerful mathematical tool which is applicable to Hamiltonian systems. A useful relation between the ponderomotive Hamiltonian (the kinetic generalization of the ponderomotive potential) and the linear susceptibility of Vlasov plasma, a general formula for the second order, self consistent quasistatic density perturbation produced by a wave packet. For a plasma with one species of single charged ions this formula includes kinetic effects and applies to both magnetized and unmagnetized plasma. Lie transform theory is then applied to two problems, the first of which is to find the nonlinear wave equation that governs waves in unmagnetized plasma. The calculation shows that the self Faraday rotation effect is comparable to the self precession effect. This fact implies that a measurement of the polarization rotation acquired by a nonlinear electromagnetic wave in passing through a plasma does not determine the self-generated quasistatic magnetic field. The second problem considered is the propagation of a test wave in the system consisting of a plasma and a large amplitude electromagnetic wave. Dissert. Abstr.

N80-28191# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CURRENT-CARRYING PLASMA IN FERROMAK
Kazunari Ikuta Apr. 1980 16 p refs
(IPPJ-458) Avail: NTIS HC A02/MF A01

The unique nature of the magnetic configuration of current-carrying plasma in ferromak is demonstrated and compared with the stellarator configuration. The presence of magnetic islandes in the ferromak configuration is suggested. J.M.S.

N80-28192# Nagoya Univ. (Japan). Inst. of Plasma Physics.
REFLECTION OF OBLIQUE ELECTRON THERMAL MODES IN AN INHOMOGENOUS PLASMA
T. Ohnuma (Tohoku Univ.), T. Watanabe (Hiroshima Univ.), and H. Sanuki Apr. 1980 12 p refs
(IPPJ-457) Avail: NTIS HC A02/MF A01

In an inhomogeneous magnetoplasma, reflection of an oblique electron thermal mode radiated from a local source is investigated experimentally and theoretically near the electron plasma frequency layer. The experimental observation of reflection in the lower plasma density region rather than the electron plasma frequency layer is found to be in qualitative accord with the theoretical reflection, which is obtained from a kinetic theory in an inhomogeneous magnetoplasma. The reflection of the thermal mode is also compared with that of an electromagnetic mode at the electron plasma frequency layer. Author

N80-28193*# National Aeronautics and Space Administration, Washington, D. C.
COMPTOMIZATION AND RADIATION SPECTRA OF X-RAY SOURCES. CALCULATION OF THE MONTE CARLO METHOD
L. A. Pozdnyakov, I. M. Sobol, and R. A. Sonyayev Jun. 1980 10 p refs Transl. into ENGLISH of "Komptonizatsiya i Spektra Izlucheniya Rentgenogskikh Istochnikov. Raschety Metoda Monte Karlo", Rept. Pr-447 Acad. of Sci. USSR, Moscow, 1978 12 p Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-76181; Pr-447) Avail: NTIS HC A02/MF A01 CSCL 20I

The results of computations of the Comptomization of low frequency radiation in weakly relativistic plasma are presented. The influence of photoabsorption by iron ions on a hard X-ray spectrum is considered. Author

N80-28194# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RESONANT INTERACTION OF SOLITONS AND ZAKHAROV-SHABAT THEORY
Fujio Kako and Nobuo Yajima Apr. 1980 11 p refs
(IPPJ-456) Avail: NTIS HC A02/MF A01

Resonant interaction of solitons is studied in detail for the Kadomtsev-Petviashvili equation. Resonance solutions are discussed in the framework of the Zakharov-Shabat theory. The

breakdown of the Zakharov-Shabat theory associated with the soliton-resonance is not essential and can be avoided. Author

N80-28195# Nagoya Univ. (Japan). Inst. of Plasma Physics.
COMPARATIVE STUDY OF ENERGY ACCOUNTING FOR HEAVY ION FUSION WITH VARIOUS DRIVER ACCELERATORS
S. Kawasaki (Kanazawa Univ.) and A. Miyahara. Apr. 1980. 18 p. refs.
(IPPJ-454) Avail: NTIS. HC A02/MF A01.

Typical designs of driver heavy ion accelerator systems are compared with regard to their 'energy payback time' versus 'cost of construction'. The detailed analyses show that the energy investment for the construction of the Heavy Ion Fusion power station is somewhat smaller than the energy produced by the station in its lifetime, in spite of the large scale of its hardware. The situation could be more favorable than, or at least comparable with, the case of magnetically confined fusion. L.F.M.

N80-28196# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SURFACE STUDY OF FUSION RESEARCH IN UNIVERSITIES LINKAGE ORGANIZATION
Akira Miyahara. Apr. 1980. 41 p. refs. Presented at the Japan-US Joint Seminar Mater. Res. Effects in the Fusion Environ., Argonne, Ill., 7-10 Jan. 1980.
(IPPJ-455) Avail: NTIS. HC A03/MF A01.

Progress in surface studies for the nuclear fusion research is reported emphasizing studies on the surface process and the surface damage. In the case of the surface process studies, recycling of hydrogen isotopes, desorption of gaseous light impurities, sputtering, blistering, arcing, and other surface processes are main concerns. On the other hand, for the surface damage studies, the problems are defined by the conceptual fusion reactor design study. These are classifications of the damage mechanism, the superposition of multiple damage effects, the study of modified surfaces produced by plasma irradiation and the surface erosion rate. J.M.S.

N80-28197# Nagoya Univ. (Japan). Inst. of Plasma Physics.
HEAT TRANSPORT DUE TO THE COLLISIONLESS TEARING INSTABILITIES
I. Katanuma. May 1980. 36 p. refs.
(IPPJ-461) Avail: NTIS. HC A03/MF A01.

Collisionless tearing instabilities and the associated electron heat transport are investigated by using a two-and-one-half dimensional particle simulation code. It is shown that a collisionless drift tearing instability saturates at a low amplitude and turns into a nonlinear pure tearing instability. The electron internal energy profile is flattened within the magnetic island. The electron heat conductivity obtained from the heat flow across the singular surface is proportional to W(4) in the linear phase and to (dW/dt)W squared in the nonlinear phase of the tearing instability. Here W is the half width of the magnetic island. A theoretical model to explain these results is also presented. Author

N80-28198# Nagoya Univ. (Japan). Inst. of Plasma Physics.
INTERACTION OF ION-ACOUSTIC SOLITONS IN TWO-DIMENSIONAL SPACE
Fujio Kako and Nobuo Yajima. Apr. 1980. 36 p. refs.
(IPPJ-459) Avail: NTIS. HC A03/MF A01.

Nonlinear evolutions of a two dimensional ion-acoustic wave system are studied analytically and numerically. The solution describing the resonant interaction of three solitons in two-dimensional space is obtained under the approximation of long wavelength and small but finite amplitude. Numerical solutions reveal an importance of soliton resonances in nonlinear developments of two dimensional ion acoustic waves. Author

N80-28199# Naval Research Lab., Washington, D. C. Plasma Physics Div.
STEADY STATE MAGNETIC DIFFUSION FROM RESISTIVE INTERCHANGE MODES
Wallace M. Manheimer. 5 Mar. 1980. 10 p. refs.
(AD-A083915; NRL-MR-4173) Avail: NTIS. HC A02/MF A01. CSCL 20/9.

It is shown that a likely nonlinear state for resistive interchange modes is one in which velocity vortex structure is balanced in Ohmic dissipation. Macroscopically this is manifested as magnetic diffusion and anomalous energy transport. The results are discussed and compared with recent experiments. GRA

N80-28200# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
ACCURATE ANALYTIC APPROXIMATIONS AND NUMERICAL SOLUTIONS FOR THE STRUCTURE OF QUASI-STATIC LASER DRIVEN ABLATION LAYERS
Joseph H. Orens. 29 Feb. 1980. 23 p. refs. Sponsored in part by DOE.
(AD-A083913; NRL-MR-4167) Avail: NTIS. HC A02/MF A01. CSCL 20/9.

Time dependent simulations of a laser driven accelerating shell and ablation layer have shown the presence of long lived quasi-static density and pressure profiles. This paper models the equilibrium solutions for a laser ablation layer both analytically and numerically and develops a detailed understanding of the nature of this flow. Such a model enables the calculation of the quantitative dependence of the shell thickness and acceleration, the peak density, velocity, and temperature of the shell, the width of the Rayleigh-Taylor region, and the distance to the critical surface on the total plasma mass, the critical density, and the absorbed and reflected laser flow. GRA

N80-28201# Saint Louis Univ., Mo. X-ray Optics Lab.
CATOPTRICAL X-RAY OPTICAL SYSTEM FOR USE IN LASER-FUSION DIAGNOSTICS. Annual Technical Report, 1 Oct. 1978 - 31 Sep. 1979
James F. McGee. Dec. 1979. 31 p. refs.
(Grant AF-AFOSR-3480-78; AF Proj. 2301)
(AD-A084688; AFOSR-80-0334TR) Avail: NTIS. HC A03/MF A01. CSCL 20/8.

A compound X-ray imaging device is being developed as an aid in the diagnostics of the laser fusion implosion process which involves a pellet of the order of 100 microns in diameter. Ideally, both temporal and spacial information is being sought. This report deals mainly with the removal of spherical aberration from a single X-ray optical element by means of a surface figure which is described by a polynomial of third order and higher. Such an X-ray focuSing element would be useful in an X-ray Streak camera for obtaining temporal information. Combinations of other higher-order surfaces and aperture stops will be used in a compound imaging-device in the attainment of spacial information with sub-micron resolution. Attention is given to the generation and testing of such high-order surfaces. A specially designed surface generator and lapping machine is described. GRA

N80-28202# Massachusetts Inst. of Tech., Cambridge. National Magnet Lab.
LASER-PRODUCED PLASMAS AND RADIATION SOURCES. Final Report, 1 Jul. 1975 - 30 Sep. 1979
D. W. Scudder and Hernan C. Praddaude. 31 Jan. 1980. 168 p. refs.
(Contract F44620-76-C-0002; AF Proj. 2301)
(AD-A084201; AFOSR-80-0335TR) Avail: NTIS. HC A08/MF A01. CSCL 20/9.

The research performed under this program has covered a broad range of subjects involving laser interaction with both gaseous and solid target laser plasmas, and with development of plasma diagnostic techniques suitable for our laser-produced plasmas. Included are detailed descriptions of research activities during fiscal years 1978 and 1979. These include a study of stimulated Brillouin scattering in transverse magnetic fields; development of X-ray diagnostics including X-ray continuum measurements, spectroscopy, and imaging techniques and their use in studying solid target plasmas; development of a fast schlieren photography system; and a theoretical study of nonlinear scattering techniques for plasma diagnostics. GRA

N80-28203# Berkeley Research Association, Calif.
A POWER MODEL FOR PLASMA CONVECTION. Final Report, 1 Jan. 1978 - 31 Mar. 1979
Joseph B. Workman, S. Y. Chu, and John R. Ferrante. 1 Apr. 1979. 63 p. refs.
(Contract DNA001-78-C-0092)
(AD-A084653; AD-E300766; PD-BRA-79-201; DNA-4927F) Avail: NTIS. HC A04/MF A01. CSCL 20/9.

A model for simulating the convection of plasma microstructure has been constructed. Labeled 'striation convection,' the procedure is based on the conservation of the square of plasma density or 'plasma power'. The model is driven by a previously developed gradient drift microstructure model. Integrated with other plasma numerical routines, simulation results for several two dimensional F-layer scenarios are presented. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-28204 Cornell Univ., Ithaca, N. Y.
PULSED NMR AND ZERO SOUND MEASUREMENTS IN SUPERFLUID HELIUM-THREE Ph.D. Thesis
Russell Whitney Giannetta 1979 136 p
Avail: Univ. Microfilms Order No. 8015672

Pulsed nuclear magnetic resonance experiments were performed in the A and B phases of superfluid 3He, at pressures of 23 and 27 Bar. Measurements of H3-B spin susceptibility, He3-A dipole frequency, and nonlinear frequency shifts in both phases all agree well with previous measurements. Additional, unexplained spin motions in H3-B were also observed. Spin relaxation studies are consistent with those of Corrucini and Osheroff and Webb in He3-A, but differ considerably in H3-B. Using large angle RF pulses, anomalous frequency shifts were observed, whose persistence indicated new, metastable resonances in He3-A. The measurements are in excellent agreement with those of Bozler et. al. The soliton lattice model of Bruinsma and Maki is discussed and compared with the experimental results. In most respects, the model accurately fits the data. Preliminary results of zero sound measurements in H3-B are also discussed. At low pressures, evidence is presented for a separation of pair-breaking and collective mode contributions to 10 MHz zero sound attenuation. Moreover, the oscillations in attenuation with temperature, first observed by Paulson and Wheatley were observed. Finally, measurements of sound attenuation and velocity at 50 MHz revealed unexpected structure as a function of temperature. Dissert. Abstr.

N80-28205 California Univ., Berkeley.
EXPERIMENTAL STUDIES OF EXCITED METALLIC PHASES IN STRESSED GERMANIUM Ph.D. Thesis
John Elson Furneaux 1979 156 p
Avail: Univ. Microfilms Order No. 8014689

Various experimental aspects of the strain-confined electron hole liquid (SCEHL),which forms when photoexcited carriers flow into a strain potential well created by suitably inhomogeneously stressing Ge, are discussed. The formation process for the SCEHL was examined by time-resolved Alfven wave resonance experiments. The distortion of the SCEHL by a static magnetic field was discovered and studied. Simultaneous infrared imaging and Alfven wave resonance experiments led to the discovery of this magnetostriction of the SCEHL. Further studies using an infrared vidicon and an image scanning apparatus demonstrated that the magnetostriction is caused by the recombination current which is necessary to keep the SCEHL at a constant density even though electron hole pairs within it recombine. The externally applied magnetic field deflects these currents causing an induced magnetic moment and a magnetic contribution to the energy. The total energy of the SCEHL is then minimized by a distortion of the liquid drop usually into an oblate spheroidal shape about the magnetic axis. In addition, the de Haas-van Alfven like magneto-oscillatory luminescence and the equilibrium properties of SCEHL were studied. Dissert. Abst.

N80-28206 California Univ., Berkeley.
DETERMINATION OF MORPHOLOGY AND ELECTRONIC STRUCTURE IN SOLIDS WITH 20-1000 eV RADIATION Ph.D. Thesis
David Robert Denley 1979 171 p
Avail: Univ. Microfilms Order No. 8014650

The absorption in the extended region of the spectra (EXAFS) is discussed as a technique for structural analysis for: the L sub 2, 3 edge in Ti, the K-edge in microcrystalline, polycrystalline, and monochromator graphite; and the fluorine K-edge of the polymer polyvinylidene fluoride PVF sub 2). The first experiment to use photoyield spectroscopy for an EXAFS structural analysis from a surface is discussed for a surface of oxidized aluminum. The near threshold absorption spectra for the Ti L-edges, the Ag M sub 4, 5, the graphite C K-edge, and the C K-edge in PVF sub 2 are discussed with respect to their electronic structure. An attempt to show that the absorption is paralleled in the symmetry allowed component of the empty density of states is fairly successful. Additional complications are found to arise from atomic like matrix element effects, large variations in the hole lifetime, and excitonic effects. Examples from the L-edge photoyield of Fe and Cu are also considered. The electronic structure analysis of surfaces and interfaces is discussed using the system GaAs/Ge. Dissert. Abstr.

N80-28207 Cornell Univ., Ithaca, N. Y.
TUNABLE FAR-INFRARED RADIATION GENERATED BY A JOSEPHSON JUNCTION Ph.D. Thesis
Richard Keith Elsley 1977 173 p
Avail: Univ. Microfilms Order No. 8015770

Point contact Josephson junctions were used to generate tunable monochromatic far infrared radiation. The radiation is found to be monochromatic to within the ability to resolve (0.07/cm) and tunable from 2/cm to at least 20/cm and possibly 50/cm. The junctions are in the form of a point contact between two pieces of niobium foil. The foil surfaces guide the radiation away from the contact in a relatively non-resonant manner, allowing the frequency to be tuned merely by varying the DC voltage applied to the junction. The radiation was frequency analyzed using a far infrared interferometer and the radiation's linewidth was resolved. Transmission spectroscopy using the junction source was performed on absorption lines in solids at frequencies from 8/cm to 20/cm and the results compared to measurements made by other means. The performance of the junction source was compared to an equivalent circuit model which predicts power output, linewidth, and harmonic content of the radiation. Dissert. Abstr.

N80-28208 Ohio State Univ., Columbus.
THE PHASE DIAGRAM AND MAGNETIZATION OF SUPER FLUID 3HE Ph.D. Thesis
Jan David Feder 1980 193 p
Avail: Univ. Microfilms Order No. 8015875

The procedure and results of a series of experiments designed to measure the phase boundaries and the magnetization of the superfluid phases of (3)He are described. Measurements were performed at five pressures below the polycritical pressure of 21.5 bar. Magnetization data were obtained from continuous wave nuclear magnetic resonance spectra by integrating the absorption signals. Phase boundaries were determined from the magnetization discontinuities induced by the phase transitions. The magnetization results were found to be in close agreement with the predictions of Bardeed-Cooper-Schrieffer theory suitably-corrected for Fermi liquid effects except at the lowest pressures (0 and 3 bar), where the data indicate a non linear magnetization vs. field relation. The data were reduced to yield the latent heat at the A - B transition, the molar volume difference in the two superfluid phases, and the zero field difference in the Gibbs potentials of the two phases. The Gibbs potential difference were extrapolated to the T approaches T sub c limit to extract the zero field difference in the specific heats of the A and B phases at T sub c. The specific heat results were compared with the predictions of weak coupling theory, and with two strong coupling theories. Dissert. Abstr.

N80-28209 Cornell Univ., Ithaca, N. Y.
A MONTE CARLO STUDY OF CRYSTALLIZATION AND CRYSTALLINE ORDER IN SIMPLE TWO-DIMENSIONAL SYSTEMS Ph.D. Thesis
Robert Charles Gann 1979 150 p
Avail: Univ. Microfilms Order No. 8015773

Monte Carlo simulation, lattice dynamics in the harmonic approximation, and solution of the hypernetted chain integral equation were used to study the classical, two dimensional, one component plasma. The solid phase shows directional long-range order. In the solid phase, positional long-range order is lost as

the thermodynamic limit is approached. The results of the calculation of the thermodynamic functions and the one and two particle distribution functions are presented. The results are compared to the system of particles interacting via an inverse twelfth-power potential. Dissert. Abstr.

N80-28210 Princeton Univ., N. J.
DYNAMICAL SYMMETRY BREAKING IN LATTICE GAUGE THEORIES Ph.D. Thesis
Benjamin Svetitsky 1980 97 p
Avail: Univ. Microfilms Order No. 8015408

Dynamical breaking of chiral symmetry in quantum chromodynamics defined on a spatial lattice is investigated. The formulation respects chiral symmetry by employing a long range gradient for the fermion field. In the strong-coupling limit all states with non zero electric flux are at very high energy, so that the set of degenerate ground states is comprised of all fermionic configurations which are color singlets site by site. An effective Hamiltonian is derived for the 'mesons' in perturbation theory about this limit. Color and flavor are shown to be inessential and the U(1) guage theory is considered with one flavor of four component fermions. The effective Hamiltonian is that of an antiferromagnet whose symmetry group is determined by the dimensionality of space. It is shown that if all but nearest neighbor interactions is dropped the resulting SU(4) antiferromagnet realizes some or all of its symmetry generators in Nambu-Goldstone mode. It is hypothesized that this physics survives when one breaks the SU(4) with non nearest neighbor terms, and this is checked for the one dimensional theory with an explicit block-spin calculation. Dissert. Abstr.

N80-28211 California Univ., Berkeley.
ELECTRON SPECTROSCOPY STUDIES OF CLEAN OXIDE SURFACES, CHEMISORBED MOLECULES AND PHOTO-ASSISTED SURFACE PROCESSES Ph.D. Thesis
Wei Jen Lo 1979 210 p
Avail: Univ. Microfilms Order No. 8014781

Various surface analytic techniques were used to characterize the surface properties of TiO2 and SrTiO3. The chemisorption of molecules on these surfaces and the photo-induced effects on the adsorbed molecules were also examined. Surface chemical composition, electronic properties, and concentration of Ti(3) ions as well as the dissociation of water into hydrogen and oxygen at the solid-gas interface were among the topics studied. Dissert. Abstr.

N80-28212 California Univ., Berkeley.
ELECTRONS ON THE SURFACE OF LIQUID HELIUM Ph.D. Thesis
David Kay Lambert 1979 118 p
Avail: Univ. Microfilms Order No. 8014769

Spectroscopic techniques were used to study transitions of electrons between bound states in the potential well near a helium surface. The charge density distribution of electrons on the surface was independently obtained from electrical measurements. The interaction of the bound state electrons with the surface of liquid helium and local disorder in the positions of electrons on the surface were examined. Results indicate that the distribution of charge on the helium surface is appreciable only within a 'charge pool' that does not in general cover the entire surface and that the distribution of charge in the charge pool can be obtained from electrostatics. Dissert. Abstr.

N80-28213 California Univ., Berkeley.
X-RAY ABSORPTION STUDIES OF GRAPHITE INTERCALATES AND METAL-AMMONIA SOLUTIONS Ph.D. Thesis
Alan Spence Robertson 1979 245 p
Avail: Univ. Microfilms Order No. 8014858

The features in the region near the onset of the K-shell absorption edge, which has been termed X-Ray Absorption Edge Spectroscopy (XAES), are transitions into the unoccupied molecular orbitals or metallic bands of the element being studied. On the high energy side of the absorption edge, the oscillatory portion of the absorption coefficient, which has been labelled Extended X-Ray Absorption Fine Structure (EXAFS), can be analyzed to provide a local radial distribution function around the element being studied. The As-F distances obtained for AsF3 and AsF5 gas are both in excellent agreement with electron diffraction data (within 0.004 A). A superior measurement which is significantly shorter than the accepted value of the bond distance in an undistorted AsF6-octahedra is reported. Both the XAES and EXAFS data presented support the hypothesis that the AsF5 oxidizes graphite upon intercalation to produce AsF6-and AsF3 intercalant species. Changes in the Rb K-edge features which are consistent with the known properties of Rb-NH3 are correlated with conductivity and delocalization of the solvated electons. In the XAES region, the Rb-N bond distance and the relative number of nitrogen atoms in the first shell are measured. Dissert. Abstr.

N80-28214 California Univ., Berkeley.
SUPERCONDUCTOR INSULATOR SUPERCONDUCTOR QUASIPARTICLE TUNNEL JUNCTIONS AS MICROWAVE RECEIVERS Ph.D. Thesis
Tek-Ming Shen 1979 107 p
Avail: Univ. Microfilms Order No. 8014875

The rapid onset of quasiparticle tunneling current in superconductor insulator-superconductor junctions at voltages above 2 delta/e, used for millimeter wave heterodyne mixing is discussed. Junctions with 2 micron diameter and R sub N = 50 omega have little capacitive shunting at the signal frequency of 36 GHz. Because there is no series resistance, residual capacitance can be tuned out. Single sideband conversion efficiencies of 0.16 and mixer noise temperatures as low as T sub M < or = 14K = 8h nu/k have been observed. The results are compared with shot noise limited mixer theory. Photon assisted tunneling effects are seen which indicate the approach to photon noise-limited operation. The quantum theory of mixing is reviewed and an intuitive picture illustrating the physical significance of the quantum theory is presented. The experimental results are in good agreement with computer simulations using shot noise limited quantum theory. The theoretical model an ideal switch mixer has been experimentally explored and its mixing performance in the quantum limit is investigated. Fundamental limits of a heterodyne mixer using tunneling devices and possible future developments are discussed. Dissert. Abstr.

N80-28215 Cornell Univ., Ithaca, N. Y.
PROPERTIES OF SUPERCONDUCTOR-NORMAL METAL-SUPERCONDUCTOR MICROBRIDGES Ph.D. Thesis
John Michael Warlaumont 1980 174 p
Avail: Univ. Microfilms Order No. 8015749

The fabrication and electrical measurement of short, high resistance (R is approximately 1 ohm) superconductor-normal metal-superconductor microbridges is described. The small (length and width as small as 200 nm), planar structures were produced using electron beam lithography and ion beam etching. Lead-copper-lead structures were primarily studied; other materials were also briefly investigated. The small cross section of the bridges resulted in a uniform current distribution in the bridges at all temperatures, thus enabling the experimental determination of the critical current versus temperature relation for all temperatures between T sub c and 0.05 T sub c, where T sub c is the transition temperature of the electrodes. This experimental I sub c (t) relation was found to agree with theoretical predictions based on Usadel's equations. This successful fit of theory to experiment produced a reduced length, l, for each sample; the sample had reduced lengths ranging from 8.2 to 30. The low-voltage current-voltage (I-V) characteristics were studied in detail. It was found that these I-V curves could be characterized by a temperature independent relaxation time tau sub eff; this relaxation time was observed to be proportional to l(2). Dissert. Abstr.

N80-28216 California Univ., Berkeley.
THE DETERMINATION OF ELECTRONIC STATES IN CRYSTALLINE SEMICONDUCTORS AND METALS BY ANGLE-RESOLVED PHOTOEMISSION Ph.D. Thesis
Kenneth Alan Mills 1979 149 p
Avail: Univ. Microfilms Order No. 8014810

Angle-resolved photoemission (ARP) spectroscopy for the detailed experimental investigation of band structures, and its application to both semiconducting and metallic single crystals is examined. Attention is focussed primarily on the actual electromagnetic excitation process; both direct and indirect

transitions are discussed, as are final-state dependent effects, and the influence of parameters such as radiative polarization temperature, sampling depth, and experimental geometry. Variable photon energy spectra are used to map conduction bands for the sigma and sigma' directions in GaAs, and the results are compared with theory. As concerns crystalline metals, the (111) fade of Au and Pt, and the (100) and (110) faces of Ag, are studied in detail using high-resolution variable photon energy ARP. Special attention is paid to final-state-induced spectral features, and consideration of both the energy and intensity behavior of such features leads to the construction of a simple physical picture which both explains the observed phenomena and provides a justification for the use of a quasi-free-electron final state dispersion. Dissert. Abstr.

N80-28217 California Univ., Berkeley.
SURFACE PROPERTIES OF ANTIFERROMAGNETIC METALS AND ALLOYS Ph.D. Thesis
Gustavo Jose Mata 1979 61 p
Avail: Univ. Microfilms Order No. 8014799

Some aspects of the surface properties of antiferromagnetic metals are examined which exhibit a periodic variation of the electronic spin density (a spin-density wave). In particular, the possibility that a spin-density wave might exist at the surface of an otherwise paramagnetic metal is addressed. A phenomenological theory is developed to describe the behavior of the amplitude of a spin-density wave (order parameter) when the electron-electron interaction is enhanced in the immediate vicinity of the surface. The free energy of the system under consideration is taken to be a local functional of the order parameter. The analysis shows that for a range of the parameters in the free energy functional, spin-density waves may appear at the surface and decay into a paramagnetic bulk. The parameters of the phenomenological theory are explicitly calculated for a model system and expressions are obtained which involve its microscopic properties. With the help of these expressions the theory is applied to chromium and the chromium-rhenium alloys. Results suggest that surface spin-density waves may exist in these materials at temperatures above the transition temperature corresponding to the bulk. Dissert. Abstr.

N80-28218 California Univ., Berkeley.
INTERACTIONS IN SOLIDS Ph.D. Thesis
Andrei Manoliu 1979 62 p
Avail: Univ. Microfilms Order No. 8014795

The attractive interaction between a magnetic monopole and a ferromagnetic domain was calculated. The complete calculation which includes effects of anisotropy and exchange, gives a result for the interaction energy (referred to the pole at infinity) which is ten percent lower than that obtained by the methods of images. A monopole of unit charge, g = (137/2)e, is found to be attracted by iron, and the interaction energy is about 50 meV. The interaction between phonons and the carriers in the electron-hole drop formed in germanium by optical pumping is discussed. This interaction accounts for the slowing force on the drops in the cloud in their motion to the point of maximum stress in inhomogeneously stressed samples of germanium. The interaction between the large drop, formed in inhomogeneously stressed germanium, and microwave radiation was calculated. It is shown that under steady microwave pumping and steady state illumination the drop heats up above its critical temperature releasing carriers into the crystal. Dissert. Abstr.

N80-28219 Miami Univ., Fla.
ENERGY TRANSPORT IN HARMONIC LATTICES Ph.D. Thesis
Stephen Landers Linn 1979 64 p
Avail: Univ. Microfilms Order No. 8014174

One and two dimensional oscillator systems are constructed so that individual oscillators are bound to their home positions and coupled to nearest neighbors by linear forces; both systems are treated for the case of weak coupling. The two dimensional system has a tensor binding force that does not permit it to be decoupled into two noninteracting sytems. Segments and strips are treated as thermodynamic systems in contact with a heat bath and Gaussian initial probability densities are used to compute correlations. Expressions for entropy and temperature are computed by relating initial system and bath variances to equilibrium temperature. Asymptotic relations for 'temperature' are found that show the degree of coupling between dimensions affects the rate of approach to equilibrium, but only through the coefficient of time and not its power. Both systems approach equilibrium as +/-1 rather than +/-1/2 as predicted by continuum theory. Dissert. Abstr.

N80-28220# Missouri Univ. -Rolla. Dept. of Physics.
OPTICAL STUDIES OF THE INTERFACE STATES AT GaAs-METAL SCHOTTKY BARRIER JUNCTIONS Final Report, 1 Oct. 1975 - 29 Sep. 1978
Robert J. Bell, Ralph W. Alexander, Jr., and Gerald P. Alldredge 1980 35 p refs
(Grant AF-AFOSR-2938-76)
(AD-A083758; AFOSR-80-2938TR) Avail: NTIS
HC A03/MF A01 CSCL 20/12

The goal of the proposed research was to study surface states at GaAs metal Schottky barrier junctions and the effects of oxygen exposure on the surface states using both optical and electrical measurements with the goal of correlating the optical and electrical results. The correlation could not be achieved because the optical measurements were unsuccessful in detecting the surface states. From the electrical measurements, the following results were obtained: oxygen-exposure before the metallization with Al produces a large increase in the surface density of states peaking about 0.28 eV above the Fermi level; Al-GaAs diodes metallized without oxygen exposure had ideality factors of n equal to less than 1.1; Ag-GaAs diodes with oxygen exposure also show a surface state density peaking about 0.3 eV above the Fermi level. However, the surface state density is considerably lower than for oxygen-exposed AlGaAs diodes; Au-GaAs diodes with oxygen exposure show a surface state density which peaks about 0.45 eV above the Fermi level. Again, this density is considerably lower; from the above, oxygen at a GaAs-metal interface plays an important role in determining the surface state density. The theoretical part of this study to calculate electronic energies at GaAs surface was also unsuccessful. GRA

N80-28221# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
HIGH RESISTIVITY MOLECULAR BEAM EPITAXIAL AlGaAs FOR DEVICE APPLICATIONS Annual Report, 1 May 1978 - 30 Apr. 1979
R. D. Fairman, D. L. Miller, and W. A. Hill Feb. 1980 45 p refs
(Contract N00014-78-C-0370)
(AD-A083778; ERC41006.2AR) Avail: NTIS
HC A03/MF A01 CSCL 07/4

AlGaAs molecular beam epitaxial (MBE) layers suitable for device application, are studied and the results are discussed. Analysis includes Van der Pauw and Hall measurements, photoluminescence, sheet resistance, photoinduced current transient spectroscopy (PITS), secondary ion spectroscopy, and capacitance-voltage profiling. All indications are that high quality buffer layers of AlGaAs and active layers of GaAs can be produced by MBE which can yield devices of exceptional performance. GRA

N80-28222# Michigan Univ., Ann Arbor. Dept. of Chemistry.
INCOHERENT DETECTION OF ULTRASONIC USING THIN FILM AMORPHOUS SEMICONDUCTORS Final Report, 1 Apr. 1976 - 1 Jun. 1979
A. H. Francis Wright-Patterson AFB AFML Nov. 1979 50 p refs
(Contract F33615-76-C-5240; AF Proj. 2306)
(AD-A083285; AFML-TR-79-4170) Avail: NTIS
HC A03/MF A01 CSCL 20/12

Thin film ultrasonic detectors have been fabricated from amorphous germanium. The detectors are insensitive to phase and function as sensitive power detectors for ultrasonic waves. Due to the mode of operation of the detectors, their usefulness is limited to the temperature range 1.5 - 77 K. The dependence of the sensitivity of the devices upon the structural and electrical characteristics of the a-Ge material has been investigated experimentally. It was found that useful performance is obtained only when electrical conduction is by a variable range hopping mechanism. GRA

N80-28223# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
PREPARATION AND CHRACTERIZATION OF INFRARED MATERIALS Final Report, 1 Jan. 1977 - 31 Dec. 1979
August F. Witt 1 Apr. 1980 8 p refs
(Grant AF-AFOSR-3202-77; AF Proj. 2306)
(AD-A084324; AFOSR-80-0414TR) Avail: NTIS
HC A02/MF A01 CSCL 07/4

The primary objectives of this research program were: (A) in broad terms, to advance the established processing techniques for growth of IR materials and to improve crystalline perfection and composition control achievable in single crystals to beyond the state of the art and in (B) specific terms: (growth of n-type InSb single crystals with uncontrolled microsegregation variations reduced to less than 10%, growth of heavily doped (Bi) InSb single crystals with optimized composition control, and (3) growth of InSb macro-superlattices, suitable for spin-flip Raman laser structures. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-28224 Purdue Univ., Lafayette, Ind.
A FIBER BUNDLE APPROACH TO UNIFIED FIELD THEORY Ph.D. Thesis
Lawrence Michael Beyl 1979 121 p
Avail: Univ. Microfilms Order No. 8015428

It is shown that the Einstein, Maxwell, and Dirac equations are special cases of a fiber-bundle approach to unified field theory when based on the gauge transformations of the group SU(4/N). This group is rearranged into a modified SU(2,2/N) group which directly contains Dirac generators in the supersymmetry or Femi part, and is shown to contain the direct product, of SU(2,2) and SU(N) and U(1) in its commuting or Bose part. The action is constructed based on the curvature of the fiber-bundle and is invariant, under space-time coordinate changes and gauge transformations, when integrated over spacetime and group space. A finite change in the gauge, potentials allows the lower spin 0 and spin 1/2 components to enter. Minor changes in the theory allows different chiral contributions to occur in the Dirac equation, favoring left or right handed interactions. No restrictions are given which determine this relationship, but a choice is made to demonstrate the presence of the Dirac equation. The scaling requirements on the electromagnetic and Dirac actions fixes the size of the contribution from the Weyl action for gravity. It is found to be approximately 10 to the 65th power weaker than Einstein's gravitational action and therefore this approach avoids the problems associated with the R + R(2) Lagrangian. Dissert. Abstr.

N80-28225 Purdue Univ., Lafayette, Ind.
PHASE EQUILIBRIUM OF LIGHT GASES AND HEAVY HYDROCARBONS AT ELEVATED TEMPERATURES AND PRESSURES Ph.D. Thesis
James John Simnick 1979 352 p
Avail: Univ. Microfilms Order No. 8015518

A flow type vapor-liquid equilibrium (VL) apparatus was constructed which enabled measurements to be taken at conditions up to 400 C and 250 atm. Hydrocarbon superambient vapor pressures, binary mixture VLE of light gases with hydrocarbons, and ternary mixture VLE were measured. An augmented hard core equation of state, named the BACK equation, was developed to model the phase behavior of such systems. The BACK equation is efficient in that only three constants are required for most pure fluid behavior description. These constants reflect the hard core volume, interaction energy, and shape of a molecule. Extension to modeling mixture behavior with the BACK equation was made upon introducing mixing rules for the three pure fluid constants. Van der Waals type rules employing one binary energy interaction parameter were determined to be the best precipition. An additional binary hard core volume interaction parameter was found to be necessary for mixtures containing hydrogen. Using the VLE data from this research and from the literature, these parameters were determined for a large number of binary mixtures containing hydrocarbons with methane, carbon dioxide, hydrogen sulfide, or hydrogen. Dissert. Abstr.

N80-28226 California Univ., Berkeley.
A MATHEMATICAL STUDY OF THE NON-RELATIVISTIC LIMIT IN QUANTUM MECHANICS Ph.D. Thesis
Ross Joseph Cirincione 1979 62 p
Avail: Univ. Microfilms Order No. 8014637

Many articles on the nonrelativistic limit in quantum mechanics have been concerned with the convergence of the Dirac equation itself to the Schrodinger (Pauli) equation as c, the speed of light, tends to infinity. The convergence of the solution of the Dirac equation is rigorously analyzed in terms of semi-groups and spectral projections. An abstract Dirac equation with relatively bounded potentials is presented and the convergence of its solution is determined with the aid of a generalization of the Trotter-Kato theorem. Similar results are determined for the convergence of the solution of the Klein-Gordon equation and for an abstract version of this equation. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-28227# Clemson Univ., S.C. Dept. of Mathematical Sciences.
STATISTICAL METHODS IN SOLE SOURCE CONTRACT NEGOTIATION
K. T. Wallenius 19 Nov. 1979 23 p refs Submitted for publication
(Contract N00014-75-C-0451; NR Proj. 047-202)
(AD-A083983; N111; TR-327) Avail: NTIS
HC A02/MF A01 CSCL 05/1

A scenario is described which involves ill-defined elements of conflict and cooperation: the acquisition of military systems by the Department of Defense (DoD) from large corporations. Current practices lead to situations in which DoD must deal with a sole source and thus forego savings which might be realized from competition between contractors. In order to deal with this situation, the Armed Services Procurement Regulations (ASPR) prescribes procedures which must be employed in the analysis and negotiation of sole source price proposals. These time-consuming procedures generate enormous proposal backlogs for government price analysts who, because of time pressure, may not be able to do a sufficiently thorough and accurate analysis upon which to base their negotiation position. This analysis paralysis also causes payment delays which, in turn, force contractors to borrow working capital and suffer capital costs. It is clearly in the best interests of all parties to expedite the processing of these proposals. This has been accomplished by developing statistical sampling and estimation techniques which, unlike some classical procedures, are not vulnerable to exploitation through the use of clever padding strategies. GRA

N80-28228# National Technical Information Service, Springfield, Va.
DATA BASE MANAGEMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Mar. 1980
Brian Carrigan Apr. 1980 103 p Supersedes NTIS/PS-79/

0384; NTIS/PS-78/0328
(PB80-808165; NTIS/PS-79/0384; NTIS/PS-78/0328) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The advent of on-line systems and the increasing problems of file organization, file maintenance, and file structures of data bases has required the study and development of data base management systems. This bibliography of Federally funded research cites the development of software packages and implementation of data base management systems into various information systems. This updated bibliography contains 96 abstracts, 87 of which are new entries to the previous edition. GRA

N80-28229# National Technical Information Service, Springfield, Va.
DATA BASE MANAGEMENT. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
Brian Carrigan Apr. 1980 258 p Supersedes NTIS/PS-79/0385; NTIS/PS-78/0329
(PB80-808173; NTIS/PS-79/0385; NTIS/PS-78/0329) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The advent of on-line systems and the increasing problems of file organization, file maintenance, and file structures of data bases have resulted in the study and development of data base management systems. This bibliography of worldwide literature cites research on the development of software packages and the implementation of data base management systems into various information systems. This updated bibliography contains 251 abstracts, 66 of which are new entries to the previous edition. GRA

N80-28230# National Technical Information Service, Springfield, Va.
DATA BASE MANAGEMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - 1978
Brian Carrigan Apr. 1980 262 p
(PB80-808157) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The advent of on-line systems, and the increasing problems of file organization, file maintenance, and file structures of data bases, has required the study and development of data base management systems. This bibliography of Federally funded research cites the development of software packages and implementation of data base management systems into various information systems. Also cited are guidelines for use in optimizing and modelling data bases. This updated bibliography contains 255 abstracts, none of which are new entries to the previous edition. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-28231 California Univ., Los Angeles.
APPLYING BEHAVIORAL ABSTRACTION TO INFORMATION SYSTEM DESIGN AND INTEGRITY Ph.D. Thesis
Nancy Gail Leveson 1980 152 p
Avail: Univ. Microfilms Order No. 8016007

The practicality and usefulness of defining information systems using behavioral abstraction is explored. The meaning or semantics of the data is defined in the manner of an abstract data type, that is, by the definition of the operations on objects. Preserving the integrity, or correctness, of an object is defined preserving its abstract invariant. Thus specifying integrity involves both specifying the abstract invariant (the static characteristics) and the legal operations specified by pre and post conditions (the behavioral characteristics) which preserve this invariant. A method for verifying the integrity specification of an information system by proving that the abstract operations preserve the invariant and a practical means for enforcing integrity lead naturally from the integrity specification technique. It can be proved that the implementations of the operations are correct with respect to the abstraction, inserting assertions into the implementations when necessary for run-time checking. A well-structured, disciplined methodology, for information system design which supports the use of such techniques as top-down design, information hiding, and code sharing is presented along with the formal specification method. Dissert. Abstr.

N80-28232 California Univ., Los Angeles.
SECURITY IN DATA BASE MANAGEMENT SYSTEMS Ph.D. Thesis
Deborah Downs 1980 229 p
Avail: Univ. Microfilms Order No. 8015964

Several proposed methods of supplying security in data base management systems (DBMS) are examined and conclusions are drawn concerning their suitability. A design for a certifiable, value independent, data secure, DBMS kernel is described. The DBMS kernel supports data security by identifying the data correctly at the domain level and providing a certifiable direct mapping from the logical name of the data (used in the protection data and the user's request) to the physical identity (used at the access method level). Using this basic kernel design a retrofit of the DBMS kernel was developed for Ingres, a relational DBMS. Also included is an abstract model for value independent, data secure DBMSs which can be used as a basis for certifying a DBMS kernel. In order to support the secure DBMS a data secure operating system is needed which allows only the DBMS read access to the data base and the DBMS kernel read and write access. Access to the data base by other processess is prohibited. The data secure operating system must also supply a secure process environment to the DBMS kernel. A correct operating system is needed in order to retrieve exactly the data requested by the DBMS kernel and also only certified operating system code can be included in the DBMS kernel's process space. Dissert. Abstr.

N80-28233 California Univ., Berkeley.
EVALUATION AND ENHANCEMENT OF THE PERFORMANCE OF RELATIONAL DATABASE MANAGEMENT SYSTEMS Ph.D. Thesis
Paula Birdwell Hawthorn 1979 213 p
Avail: Univ. Microfilms Order No. 8014726

In order to determine the performance characteristics of a standard data base system, the performance of the relational data management system INGRES in analyzed. A benchmark analysis technique is used for the performance evaluation. The results show that the performance characteristics of two query types; data-intensive queries and overhead-intensive quries, are so different that it may be difficult to design a single architecture to optimize the performance of both types. Significant sequentially of reference was found in the data-intensive queries. It is shown that back-end data management machines may be cost effective only for data-intensive queries. It is proposed that the best method of distributing the processing of the overhead-intensive query is through the use of intelligent terminals. It is shown that there is significant locality of reference in the multi relation queries. The performance of the INGRES system is compared to estimated performance of serveral database machines. It is found that for significant classes of queries and standard system provides the most cost-effective processing of the queries. Dissert. Abstr.

N80-28234 Washington Univ., Seattle.
ACCESS PATH OPTIMIZATION IN MULTIDIMENSIONALLY ACCESSED DATABASE FILES Ph.D. Thesis
Georges Spiridon Nicolas 1979 153 p
Avail: Univ. Microfilms Order No. 8012200

A general access path model for multidimensionally accessed data base fields is developed. This model is capable of characterizing a large class of file organizations. Three principal access path structures are identified and then used to model a general file organization. This organization supports the multidimensional key access feature and includes all the basic file organizations as special cases. A cost function based on both storage and time costs is developed. This cost function quantitatively measures the performance of the data base system and can also be used to evaluate the efficiency of the various classical file organizations.

Optimization techniques which minimize the cost function by producing an optimal design based on the file organization are developed. The general cost problem is first transformed into a set of three simpler cost problems through a series of decomposition and reduction steps. These simpler cost problems are defined as linear integer programming (LIP) models with binary valued variables. Dissert. Abstr.

N80-28235 California Univ., Berkeley.
A SYSTEMATIC APPROACH TO THE MANAGEMENT OF DATA ON DISTRIBUTED DATA BASES Ph.D. Thesis
Benjamin Wan-Sang Wah 1979 313 p
Avail: Univ. Microfilms Order No. 8014919

Data management issues in particular the query decomposition, the file placement, the task scheduling, and the hardware support issues are analyzed and a unified approach is provided to design data management strategies on distributed data bases. Two complementary techniques are developed in query decomposition so that nondecomposable queries which require the use of multiple files can be decomposed into multiple sub-queries which require the use of a single file. By showing that the file placement problem and the facility location problem are isomorphic, many results derived in one problem can be applied to solve the other problem. Further, some results derived in one problem can be shown to be weaker than the corresponding results derived in the other problem. The task scheduling problem for a distributed system is shown to be NP-complete. However, an optimal average algorithm is developed for a restricted class which minimizes the expected completion time for a set of random requests. In the hardware support issue, the design of an associative memory which is capable of equality, proximity, threshold, and extremum searches is investigated. Dissert. Abstr.

N80-28236# Computer Corp. of America, Cambridge, Mass. Research Div.
SPATIAL DATA MANAGEMENT SYSTEM Quarterly Research and Development Technical Report, 1 Jun. - 31 Aug. 1979
Mark Friedell, David Kramlich, Christopher F. Herot, and Richard Carling 31 Aug. 1979 44 p refs Original contains color illustrations
(Contract MDA903-78-C-0122; ARPA Order 3487)
(AD-A083948) Avail: NTIS HC A03/MF A01 CSCL 05/2

This technical report describes work completed on a prototype Spatial Data Management System (SDMS). The Graphical Display of Data presents an overview of the icon creation mechanisms currently included in SDMS. Icon creation is the facility by which graphical representations of symbolic data are automatically produced. These graphical representations are referred to as 'icons'. Section two includes detailed discussions of the icon creation features added to the system: Secondary data a mechanism by which information in multiple relations or tuples may be presented in a single icon, and a subicons mechanism that allows the appearance of a portion of an icon to be described independently of its parent icon. GRA

N80-28237# Battelle Columbus Labs., Ohio.
MECHANICAL PROPERTIES DATA CENTER Annual Report, 1 Jan. - 31 Dec. 1979
Harold Mindlin, Harold Hucek, and Ross Gubiotti Mar. 1980 60 p
(Contract DLA900-79-C-0539)
(AD-A083123; AMMRC-TR-80-8) Avail: NTIS HC A04/MF A01 CSCL 05/2

This report summarizes MPDC activities for the period 1 January 1979 through 31 December 1979, a total of 12 months, under Contract DLA900-79-C-0539. It provides a summary of the scope, objectives and organization of MPDC, its information processing products, and services, and a discussion of management objectives. The report focuses on the start up of MPDC and the conversion of the mechanical properties data base to the Battelle data base management system engendered by the change of contractors. GRA

N80-28238# California Univ., Los Angeles. School of Management.
AN ARCHITECTURE FOR INFORMATION SYSTEMS MANAGEMENT
Bennet P. Lientz and Myles Chen May 1980 36 p
(Contract N00014-75-C-0266; NR Proj. 049-345)
(AD-A084545) Avail: NTIS HC A03/MF A01 CSCL 05/1

There has been an increased effort in general management and information systems management to organize information systems and computer activities to respond to organization requirements on a more effective and efficient basis. A model of the current information systems architecture is developed and evaluated. Requirements for a new architecture are determined based on user, manager, and technology needs. An information systems organization architecture is then developed. The architecture is related to Nolan's organizational stages of growth, decision support systems, and information resource management. Implementation and several examples of application are discussed. GRA

N80-28239# National Technical Information Service, Springfield, Va.
USER NEED IN DOCUMENTATION AND INFORMATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Mar. 1980
Mary E. Young Apr. 1980 220 p Supersedes NTIS/PS-79/0407; NTIS/PS-78/0431
(PB80-807910; NTIS/PS-79/0407; NTIS/PS-78/0431) Avail: NTIS HC $30.00/MF $30.00 CSCL 05B

Reports on meeting the needs of the information sciences user in the most direct and specific war are cited, including methods used to determine those needs and measures taken to fulfill them in application to educational resources, data bases, data management, library networks, photographic recording systems, technical information centers, and consulting services. This updated bibliography contains 213 abstracts, 50 of which are new entries to the previous edition. GRA

N80-28240# California Univ., Davis. Dept. of Electrical and Computer Engineering.
IMAGE CODING: REPORT OF A WORKSHOP
V. Ralph Algazi, ed. Sep. 1979 189 p refs Workshop held at Boulder, Colo., 14-16 Dec. 1977
(Grants NSF ENG-77-09121; NSF ENG-78-11521)
(PB80-164817; SIPL-79-5; NSF/RA-790300) Avail: NTIS HC A09/MF A01 CSCL 09D

The state-of-the art in fundamental and applied areas of image coding is addressed. Objectives focus on the following areas: (1) a broad and critical assessment of the state of knowledge in image coding and the trends in image transmission and decoding; (2) a description of the areas of research and experimentation needed for a systematic understanding and implementation of image coding; and (3) a determination of the needed future research both to provide fundamental knowledge and for the use of recent technological advances in image coding. Major emphases is placed on the human observer, image as data sources, the theoretical basis of image coding, a survey of image encoders, and a survey of applications and implementations. GRA

N80-28241# Executive Office of the President, Washington, D. C. Office of Administration.
REPORT OF THE ADVISORY COMMITTEE ON INFORMATION NETWORK STRUCTURE AND FUNCTIONS FOR THE EXECUTIVE OFFICE OF THE PRESIDENT
Feb. 1980 64 p refs
(PB80-165673) Avail: NTIS HC A04/MF A01 CSCL 05B

An information network proposed for the Executive Office of the President (EOP) is described. The EOP information Network is defined as consisting of all nonmission oriented information processing and data communication services along with supporting software and hardware systems that are centrally administered and common to the EOP user community. This network is moreover viewed as a center of stability or city plan, which permits the orderly evolution of EOP information systems along any one of several diverse alternatives, as dictated by technology, user needs, and the increasing trends toward resource decentralization. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-28242# Committee of Conference (U. S. Congress).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1980 11 p Rept. to accompany S. 2240 presented by the Comm. of Conf. at the 96th Congr., 2nd Sess., 27 Jun. 1980
(HR-Rept-96-1142; GPO-64-512) Avail: US Capitol, House Doc. Room

A summary of the adjustments made to the original amendment concerning the FY-81 appropriations to NASA for research and development, construction of facilities, and research and program management is given. The points in disagreement between the House and Senate autorizations, and the committee of conference resolutions are outlined. M.G.

N80-28243# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1981, VOLUME 4
Washington GPO 1980 852 p Hearings on H.R. 6413 before the Subcomm. on Space Sci. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 111, 5-7, 11, 14-16, 18 Feb. 1980
(GPO-61-147) Avail: Subcomm. on Space Sci. and Appl.

Budget requests for space transportation systems and their operations are examined with particular emphasis on the shuttle main engine and thermal protection system. LANDSAT technology and its effect on the AgRISTARS project are discussed as well as progress in the development of solar electric propulsion and electric hybrid automobiles. The international solar polar mission, continued support for other space missions, and the tracking and data relay satellite systems are also considered. A.R.H.

N80-28244# General Accounting Office, Washington, D. C. International Div.
US ENERGY ASSISTANCE TO DEVELOPING COUNTRIES: CLARIFICATION AND COORDINATION NEEDED Report to the Congress
28 Mar. 1980 72 p
(PB80-162720; ID-80-7) Avail: NTIS HC A04/MF A01 CSCL 05D

An assessment of U.S. energy assistance to developing countries is given. Primary Federal agencies involved include the Departments of State and Energy, the International Development Cooperation Agency, and the Agency for International Development. Energy assistance activities could be improved with the establishment of comprehensive U.S. policy, clarification of the roles and relationships of the agencies, and better coordination among involved agencies and international organizations. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-28245*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM Final Report
P. Montalenti and R. Piccolo 21 Sep. 1979 143 p refs
(Contract JPL-955197)
(NASA-CR-163219; JPL-9950-330) Avail: NTIS HC A07/MF A01 CSCL 13F

In order to meet project requirements and be competitive in the 1985 market, the proposed six-passenger vehicle incorporates a high power type Ni-Zn battery, which by making electric-only traction possible, permits the achievement of an optimized control strategy based on electric-only traction to a set battery depth of discharge, followed by hybrid operation with thermal primary energy. This results in a highly efficient hybrid propulsion subsystem. Technical solutions are available to contain energy waste by reducing vehicle weight, rolling resistance, and drag coefficient. Repoacing new 1985 full size vehicles of the conventional type with hybrids of the proposed type would result in a U.S. average gasoline saving per vehicle of 1,261 liters/year and an average energy saving per vehicle of 27,133 MJ/year. A.R.H.

N80-28246*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLES DEVELOPMENT PROGRAM. APPENDIX A: MISSION ANALYSIS AND PERFORMANCE SPECIFICATION STUDIES, VOLUME 1 Final Report
M. Traversi and L. A. C. Barbarek (Illinois Inst. of Technology) 20 Apr. 1979 157 p
(Contract JPL-955187)
(NASA-CR-163220; JPL-9950-330) Avail: NTIS HC A08/MF A01 CSCL 13F

Applicable data was categorized and processed according to vehicle usage and trip parameters with consideration of payload (cargo, people, size) and driving cycles. A mission that maximizes the fuel potential savings for the total 1985 vehicle fleet was selected. Mission requirements that have a bearing on conventional and hybrid vehicle performance and characteristics were identified and formulated and a reference ICE vehicle was selected that meets or exceeds all requirements while maintaining within applicable constraints. Specifications for vehicle performance were established based on mission requirements, mission related vehicle characteristics, and fuel consumption. A.R.H.

N80-28247*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM, APPENDIX A. MISSION ANALYSIS AND PERFORMANCE SPECIFICATION STUDIES. VOLUME 2: APPENDICES Final Report
M. Traversi and L. A. C. Barbarek (Illinois Inst. of Technology) 18 May 1979 83 p
(Contract JPL-955187)
(NASA-CR-163221; JPL-9950-330) Avail: NTIS HC A05/MF A01 CSCL 13F

A handy reference for JPL minimum requirements and guidelines is presented as well as information on the use of the fundamental information source represented by the Nationwide Personal Transportation Survey. Data on U.S. demographic statistics and highway speeds are included along with methodology for normal parameters evaluation, synthesis of daily distance distributions, and projection of car ownership districutions. The synthesis of tentative mission quantification results, of intermediate mission quantification results, and of mission quantification parameters are considered and 1985 in place fleet fuel economy data are included. A.R.H.

N80-28248*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIX B: TRADE-OFF STUDIES, VOLUME 1 Final Report
M. Traversi and R. Piccolo 11 Jun. 1980 131 p
(Contract JPL-955187)
(NASA-CR-163222; JPL-9950-330) Avail: NTIS HC A07/MF A01 CSCL 13F

Tradeoff study activities and the analysis process used are described with emphasis on (1) review of the alternatives; (2) vehicle architecture; and (3) evaluation of the propulsion system alternatives; interim results are presented for the basic hybrid vehicle characterization; vehicle scheme development; propulsion system power and transmission ratios; vehicle weight; energy consumption and emissions; performance; production costs; reliability, availability and maintainability; life cycle costs, and operational quality. The final vehicle conceptual design is examined. A.R.H.

N80-28249*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TEAM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIX C: PRELIMINARY DESIGN DATA PACKAGE, VOLUME 1 Final Report
R. Piccolo 31 Jul. 1979 259 p
(Contract JPL-955187)
(NASA-CR-163223; JPL-9950-330) Avail: NTIS HC A12/MF A01 CSCL 13F

The methodology used for vehicle layout and component definition is described as well as techniques for system optimization and energy evaluation. The preliminary design is examined with particular attention given to body and structure; propulsion system; crash analysis and handling; internal combustion engine; DC motor separately excited; Ni-Zn battery; transmission; control system; vehicle auxiliarries; weight breakdown, and life cycle costs. Formulas are given for the quantification of energy consumption and results are compared with the reference vehicle. A.R.H.

N80-28250*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIX B: TRADE-OFF STUDIES. VOLUME 2: APPENDICES Final Report
M. Traversi and R. Piccolo 15 Jun. 1979 51 p
(Contract JPL-955187)
(NASA-CR-163224; JPL-9950-330) Avail: NTIS HC A04/MF A01 CSCL 13F

The SPEC '78 computer program which consists of mathmmatical simulations of any vehicle component and external environment is described as are configuration alternatives for the propulsion system. Preliminary assessments of the fundamental characteristics of the lead-acid and sodium-sulfur batteries are included and procedures are given for estimating the cost of a new vehicle in mass production. A.R.H.

N80-28251*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TEAM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIX C: PRELIMINARY DESIGN DATA PACKAGE. VOLUME 2: APPENDICES Final Report
R. Piccolo 11 Sep. 1979 124 p
(Contract JPL-955187)
(NASA-CR-163225; JPL-9950-330) Avail: NTIS HC A06/MF A01 CSCL 13F

The design, development, efficiency, manufacturability, production costs, life cycle cost, and safety of sodium-sulfur, nickel-zinc, and lead-acid batteries for electric hybrid vehicles are discussed. Models are given for simulating the vehicle handling quality, and for finding the valuve of: (1) the various magnetic quantities in the different sections in which the magnetic circuit of the DC electric machine is divided; (2) flux distribution in the air gap and the magnetization curve under load conditions; and (3) the mechanical power curves versus motor speed at different values of armature current. A.R.H.

N80-28252*# Fiat Research Center, Orbassano (Italy).
PHASE 1 OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIX D: SENSITIVITY ANALYSIS Final Report
M. Traversi 3 Jul. 1979 50 p
(Contract JPL-955187)
(NASA-CR-163226; JPL-9950-330) Avail: NTIS HC A03/MF A01 CSCL 13F

Data are presented on the sensitivity of: (1) mission analysis results to the boundary values given for number of passenger cars and average annual vehicle miles traveled per car; (2) vehicle characteristics and performance to specifications; and (3) tradeoff study results to the expected parameters. A.R.H.

N80-28253*# North Carolina Science and Technology Research Center, Research Triangle Park.
A REGIONAL TECHNOLOGY TRANSFER PROGRAM Final Report, 1 Jan. - Dec. 1979
31 Dec. 1979 37 p
(Contract NASw-3055)
(NASA-CR-163360) Avail: NTIS HC A03/MF A01 CSCL 05B

The proliferation of online searching capabilities among its industrial clients, changes in marketing staff and direction, use of Dun and Bradstreet marketing service files, growth of the Annual Service Package program, and services delivered to clients at the NASA funded North Carolina Science and Technology Research Center are described. The library search service was reactivated and enlarged, and a survey was conducted on the NC/STRC Technical Bulletin's effectiveness. Several quotations from clients assess the overall value of the Center's services. A.R.H.

N80-28254*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PRELIMINARY RESULTS OF STEADY STATE CHARACTERIZATION OF NEAR TERM ELECTRIC VEHICLE BREADBOARD PROPULSION SYSTEM
Noel B. Sargent Jul. 1980 10 p
(Contract EC-77-A-31-1011)
(NASA-TM-81546; DOE/NASA/1011-31; E-502) Avail: NTIS HC A02/MF A01 CSCL 13F

The steady state test results on a breadboard version of the General Electric Near Term Electric Vehicle (ETV-1) are discussed. The breadboard was built using exact duplicate vehicle propulsion system components with few exceptions. Full instrumentation was provided to measure individual component efficiencies. Tests were conducted on a 50 hp dynamometer in a road load simulator facility. Characterization of the propulsion system over the lower half of the speed-torque operating range has shown the system efficiency to be composed of a predominant motor loss plus a speed dependent transaxle loss. At the lower speeds with normal road loads the armature chopper loss is also a significant factor. At the conditions corresponding to a cycle for which the vehicle system was specifically designed, the efficiencies are near optimum. M.G.

N80-28255*# Eaton Engineering and Research Center, Southfield, Mich.
SMALL PASSENGER CAR TRANSMISSION TEST-CHEVROLET 200 TRANSMISSION Final Report
M. P. Bujold Mar. 1980 381 p
(Contracts DEN3-124; EC-77-A-31-1044)
(NASA-CR-159835; DOE/NASA/0124-1; ERC-L1B-79168) Avail: NTIS HC A17/MF A01 CSCL 13F

The small passenger car transmission was tested to supply electric vehicle manufacturers with technical information regarding the performance of commerically available transmissions which would enable them to design a more energy efficient vehicle. With this information the manufacturers could estimate vehicle driving range as well as speed and torque requirements for specific road load performance characteristics. A 1979 Chevrolet Model 200 automatic transmission was tested per a passenger car automatic transmission test code (SAE J651b) which required drive performance, coast performance, and no load test conditions. The transmission attained maximum efficiencies in the mid-eighty percent range for both drive performance tests and coast performance tests. Torque, speed and efficiency curves map the complete performance characteristics for Chevrolet Model 200 transmission. L.F.M.

N80-28256# Lea (N. D.) and Associates, Inc., Washington, D.C.
DESCRIPTION AND TECHNICAL REVIEW OF THE DUKE UNIVERSITY AUTOMATED PEOPLE/CARGO TRANSPORTATION SYSTEM Final Report
H. A. Theumer and C. P. Elms Jul. 1979 139 p
(Contract DOT-UT-80025)
(PB80-159734; UMTA-IT-06-0188-79-2) Avail: NTIS HC A07/MF A01 CSCL 13F

The installation of the automated people/cargo transportation system at Duke University in Durham, North Carolina is reviewed. A description of the technical subsystems as well as the designed operation are included; specifications of performance, reliability, and maintainability are reviewed; and system development and implementation are summarized. Where important, the review of technical subsystems includes applicability, modifications and/or improvements for application in an urban environment. GRA

N80-28257# Transportation Research Board, Washington, D.C.
AERIAL SURVEYS, GEOMETRICS, SURFACE DRAINAGE, ECOLOGICAL IMPACTS AND SAFETY APPURTENANCES
Mary McLaughlin, ed. 1979 65 p refs
(PB80-162233; TRB/TRR-736; LC-80-13136;
ISBN-0-309-02991-0) Avail: NTIS HC A04/MF A01; Hardcopy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

Various aspects of highway and rail transportation are discussed. Facilities design, hydrology and hydraulics, and environmental design are among the topics covered. J.M.S.

N80-28258# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
NATIONAL CRASH SEVERITY STUDY STATISTICS Special Report, Jan. 1977 - Mar. 1978
Leda Ricci Oct. 1979 113 p
(Contract DOT-HS-8-01944)
(PB80-16040; UM-HSRI-79-80; DOT-HS-805227) Avail: NTIS HC A06/MF A01 CSCL 13L

Statistical data from accidents investigated in seven geographical areas within the continental United States is presented. The accidents were selected so that the aggregate of the areas closely resembles the urbanization distribution of the entire country. Within each area a stratified sampling plan was used to gather detailed information on passenger cars (and their occupants) in crashes severe enough to require that the vehicles be towed from the scene. The combined investigations presented account for 6,626 crashes, 8,616 towed vehicles, 14,491 vehicle occupants, and 485 fatalities. The tables and figures were generated using a computer file of national crash severity study data and represent only a very broad treatment of the data. GRA

N80-28259# National Academy of Sciences - National Research Council, Washington, D. C. Committee for Joint U.S./USSR Academy Study of Fundamental Science Policy.
SYSTEMS FOR STIMULATING THE DEVELOPMENT OF FUNDAMENTAL RESEARCH Final Report
1979 773 p refs
(Grant NSF SRS-74-21141)
(PB80-162316; NSF/SRS-7421141) Avail: NTIS HC A99/MF A01 CSCL 05A

A series of parallel investigations by U.S. and Soviet specialists on science policy in the two countries in the area of fundamental research is documented. The first two essays present surveys of the national systems for stimulating the development of fundamental research, while subsequent paired case studies treat decision making in the development of a unique scientific facility; organizational mechanisms for initiating new fundamental research projects; development of major scientific centers; using the results of fundamental research in applied problems; and retrospective analysis of the state of fundamental research in the two countries. GRA

N80-28260 Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
ANAEROBIC-ACTIVATED CARBON FILTERS FOR THE REMOVAL OF REFRACTORY AND TOXIC ORGANIC COMPOUNDS IN WASTEWATER Technical Completion Report, Oct. 1977 - Sep. 1979
Makram T. Suidan, Wendall H. Cross, Madeline Fong, John W. Calvert, and Khalique A. Khan Nov. 1979 179 p refs
(PB80-164254; ERC-08-79; W80-04205; OWRT-A-077-GA(1))
Avail: NTIS HC A09/MF A01 CSCL 13B

An anaerobic filter with granular activated carbon was developed and tested for the effective and energy efficient treatment of waste water containing phenolic compounds. Two identical experimental reactors consisting of four jacketed columns and three clarifiers connected in series were tested. Each column had a reversible recirculation pump for the recirculation of the aqueous contents around each individual reactor. Granular activated carbon served as a media for microbial attachment, substrate concentration, and polarization. A feed substrate flow rate of 2 ml/min giving a total empty bed contact time of 46.48 hours was used with a recirculation flow rate of 50 ml/min. Two phenolic compounds, catechol and o-cresol, were tested at different organic loading rates in the reactors. GRA

N80-28261# Westinghouse Research and Development Center, Pittsburgh, Pa.
PROGRAMMABLE ASSEMBLY RESEARCH TECHNOLOGY TRANSFER TO INDUSTRY, PHASE 2 Quarterly Report
R. G. Abraham, R. J. S. Stewart, T. Csakvary, L. Y. Shum, C. Ho, W. L. Rogers, A. Meyerhoff, and R. S. Wilks Jun. 1979 60 p
(Grant NSF ISP-78-18773)
(PB80-164809; NSF/RA-790393; QR-2) Avail: NTIS HC A04/MF A01 CSCL 13H

The preliminary layout design of the end bell subassembly portion of the pilot experimental adaptable-programmable-assembly system is discussed. The design of the software for the supervisory computer and vision system is reviewed. Experiments with all small motor parts led to a final design concept for a programmable belt feeder. Benchtop tests using a special fixture and tool reduced the risk of automatic wich insertion into the end bell bearing bore. Experimentation with reflected lighting instead of backlighting using end bells and dust caps is described. Also, a large portion of graphic and tabular material is presented. GRA

N80-28262# ASL Engineering, Inc., Santa Barbara, Calif.
IDENTIFICATION OF SUPERIOR ENERGY-ABSORBING MATERIALS FOR SCHOOL BUS INTERIORS. VOLUME 1: SUMMARY REPORT Final Report, 3 Aug. 1977 - 30 Jun. 1979
Lonney S. Pauls Jan. 1980 49 p 3 Vol.
(Contract DOT-HS-7-01664)
(PB80-165269; DOT-HS-805370-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 13F

The problem of identifying and selecting superior energy absorbing materials for school bus interiors was approached by developing material selection criteria to be applied to superior energy absorbing materials currently on or nearing the market. The established material selection criteria gives consideration to: (1) high temperature performance (i.e., igniteability, flame spread, smoke emissions and toxicity, (2) shock attenuation (compliance to injury criteria), (3) energy absorption, and (4) general design (e.g., cost and weight effectiveness, environmental and vandal resistiveness, etc.). Materials were evaluated and screened, using this established criteria, and a set of preferred materials tested experimentally to verify their compliances to these criteria. Tests included flammability, dynamic drop and sled impact tests. GRA

N80-28263# ASL Engineering, Inc., Santa Barbara, Calif.
IDENTIFICATION OF SUPERIOR ENERGY-ABSORBING MATERIALS FOR SCHOOL BUS INTERIORS. VOLUME 2: TECHNICAL REPORT Final Report, 3 Aug. 1977 - 30 Jun. 1979
Lonney S. Pauls Jan. 1980 106 p refs 3 Vol.
(Contract DOT-HS-7-01664)
(PB80-165277; DOT-HS-805271-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 13F

Pass/fail criteria for flammability, smoke emissions, toxicity, energy absorption, and shock attenuation were developed for use in the selection of padding core and cover materials for crashworthy bus interiors. The materials selected were examined

for high temperature performance characteristics and vandalism resistance. Drop tests conducted to determine the impact on the torso, knee, and head and face of the 6 yr. old child as well as on the 50% adult male are analyzed. A.R.H.

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-28264 Arizona Univ., Tucson.
LOW SURFACE BRIGHTNESS SPIRAL GALAXIES Ph.D. Thesis
William Romanishin 1980 174 p
Avail: Univ. Microfilms Order No. 8015591

An observational overview of a sample of low surface brightness (LSB) spiral galaxies is presented. The sample galaxies were chosen to have low surface brightness disks and indications of spiral structure visible on the Palomar Sky Survey. Photographic surface photometry, HII region spectrophotometry, long-slit spectra and neutral hydrogen 21 cm radio observations are documented for a selection of the sample galaxies. The findings indicate that the average disk central surface brightness of the LSB galaxies is 22.88 magnitude/arcsec2 in the B passband. The average disk scale length is about 4 kpc, almost as large as for a sample of giant late-type systems. From broadband color measurements of the old stellar population, a low average stellar metallicity, on the order of 1/5 solar is inferred. The spectra and optical colors of the HII regions in the LSB galaxies indicate a lack of hot ionizing stars compared to HII regions in other late type galaxies. The average surface mass density is less than half that of a sample of normal late-type spirals. The average LSB galaxy neutral hydrogen mass to blue luminosity ratio is about 0.6, significantly higher than in a sample of normal late-type galaxies. Dissert. Abstr.

N80-28265 California Univ., Berkeley.
STELLAR EXTREME ULTRAVIOLET SPECTROSCOPY Ph.D. Thesis
Roger Frank Malina 1979 162 p
Avail: Univ. Microfilms Order No. 8014793

The feasibility of stellar extreme ultraviolet (EUV) spectroscopy is analysed. A stellar EUV spectrometer was built to carry out the observations; its design, fabrication and performance are described at length. The instrument was launched on a sounding rocket and the observation targets were the stars HZ 43, Capella and Arcturus. HZ 43 was detected from 170 A to 500 A with a 15 A resolution. The spectrum observed was marked by a prominent absorption edge of 225 A + or - 15 A with a ratio F sub lambda (230 A)/F sub lambda (220 A) = 0.51 + or - 0.13. The upper limit on the equivalent width of emission and absorption lines was 10 A. The discontinuity observed in HZ 43 is attributed to absorption at the 228 A Lyman edge of singly ionized helium. The required photospheric helium surface density is 0.00001 < or = < 0.00003 for a T sub eff = 60,000 K, as derived by comparison with existing photospheric models. If this interpretation is correct, it provides the first determination of the helium abundance in a DA white dwarf. Dissert. Abstr.

N80-28266 Cornell Univ., Ithaca, N. Y.
AIRBORNE INFRARED SPECTROSCOPY OF IONIZED HYDROGEN REGIONS AND THE GALACTIC CENTER Ph.D. Thesis
John Francis McCarthy 1980 212 p
Avail: Univ. Microfilms Order No. 8015710

Observations from a ten channel liquid helium cooled grating spectrometer developed for astronomical observations in the 16 to 30 microns region are discussed. Ten bright galactic ionized hydrogen regions have been surveyed for line radiation at 18.7 micron from the (3)P sub 2 to (3)P sub 1 transition in the ground state of doubly ionized sulfur. The 16 to 30 microns continuum spectrum of the galactic center, Sgr A West, has been measured, and the region has been mapped at 19 and 28 microns with 30 in. resolution. In the continuum spectra, a broad depression centered on 18 microns is attributed to absorption by cold silicate dust grains in the line of sight. The [SIII] 18.7 microns line was detected in nine galactic HII regions (Orion, M17, M8, NGC 6357, NGC 2024, W3, W33, W49, and W51) and mapped in M17. Comparison with the data shows good agreement for Orion, M17, and M8. In NGC 6357 the observed flux is higher than expected, perhaps because of an overabundance of sulfur. In all other cases, the observed flux is lower than expected, and dust extinction is the most plausible explanation for the discrepancy. Dissert. Abstr.

N80-28267 Princeton Univ., N. J.
HI SHELLS IN THE GALAXY Ph.D. Thesis
Esther Ming Hu 1980 76 p
Avail: Univ. Microfilms Order No. 8015122

A search was made for HI shells in the 21 cm maps for the absolute value of b > 10 degrees. A filter in the velocity dimension was used to enhance shell features over background gas. Positions, expansion velocities, column densities, and angular extents were measured for the 50 shells that were discovered. Incorporating distance estimated, masses, and kinetic energies were estimated for the shells. The distribution of HI shells was compared with the distribution of other large scale features in the galaxy: HI shell structures are found to correlate with the positions of radio continuum loops, I, II, and III and to show little relation to the distribution of O and B stars. It is concluded that HI shells correspond to supernova events in the gaseous disk. The shells may be modeled in three ways: (1) supernova remnants occurring in clouds; (2) imploded clouds in the over pressured cavities of remnants; and (3) swept out clouds within more extended supernova remnants. Dissert. Abstr.

N80-28268 California Univ., Berkeley.
A 346 GHz HETERODYNE RECEIVER AND ITS USE IN OBSERVATIONS OF CARBON MONOXIDE IN INTERSTELLAR CLOUDS Ph.D. Thesis
Neal Rider Erickson 1979 166 p
Avail: Univ. Microfilms Order No. 8014666

The design and construction of a receiver for use at a frequency of 346 GHz is described. The mixer's frequency response extends from 260-350 GHz with nearly constant sensitivity, with a system noise temperature of 3400 K at 318 GHz. When used on the 60 inch telescope on Mt. Lemmon, the J = 3 yields 2 line of CO at 346 GHz was detected in 9 sources, but pointing and baseline problems caused much of the data to be unreliable. A 14 point map was obtained of Orion A and is compared to the 1 yields 0 spectra. In the case of the central region of Orion A the similarity of the spectra is quite striking. This receiver is used to make observations in the 260-282 GHz retion using a 4.9 m telescope. Molecules observed included HCN, HCO(+), N2H(+), SO2, HC3N, H2CO and HNC. These observations established that the 1mm region is very rich in spectral lines of moderate strength, and that further observations in the submillimeter range should be quite productive. Dissert. Abstr.

N80-28269 California Univ., Berkeley.
INFRARED FINE-STRUCTURE LINE EMISSION FROM THE GALACTIC CENTER Ph.D. Thesis
John Howard Lacy 1979 156 p
Avail: Univ. Microfilms Order No. 8014767

A spectrometer optimized for detection of single emission and absorption lines from astronomical sources, in the 8 to 13 micron atmospheric window is described. Observations have been made from the galactic center source Sgr A West. These observations show a complex array of small ionized gas clouds in the central few pc of the Galaxy. Ne II (12.8 microns) emission from these sources has been both spatially and spectrally resolved. Sensitive searches were made for Ar III, S IV, and Ar V emission to determine the level of ionization of the clouds. The velocities

of the clouds indicate the presence of approximately 6 million solar mass within 1 pc of the galactic center and suggest that about half of that may be in the form of a massive central black hole. Consideration of possible means of binding individual clouds leads to the conclusion that they are freely expanding and so must be generated at a rate of approximately 1 cloud/1000 yr. Models are proposed to explain the creation, ionization, and ultimate fate of the clouds. Possible further observations which may prove or disprove the existence of a black hole are discussed. Dissert. Abstr.

N80-28270 Princeton Univ., N. J.
BROADBAND PHOTOMETRY OF GALAXIES IN TWO DISTANT CLUSTERS WITH A CHARGE-COUPLED DEVICE CAMERA Ph.D. Thesis
Marshall William Bautz 1980 142 p
Avail: Univ. Microfilms Order No. 8016163

Observations from the direct imaging channel of the Princeton Charge Coupled Device spectrometer directed toward four color broadband photometry of two distant clusters of galaxies are discussed. Data reduction techniques were developed to extract photometric information from small images of low surface brightness. These techniques were applied to obtain broadband colors in the spectral range between 5000 and 9000 Angstroms down to a limiting apparent visual magnitude of about 21.5. The observed colors show no evidence for the presence of substantial numbers of young blue stars. There is some evidence for an anomalously broad distribution of color in the spectral range between 7000 and 9000 Angstroms. Dissert. Abstr.

N80-28271*# Texas Univ., Austin.
OBSERVATIONS OF EMISSION LINES IN M SUPERGIANTS Final Report
David L. Lambert 1 Aug. 1979 5 p refs
(Grant NsG-5005)
(NASA-CR-163359) Avail: NTIS HC A02/MF A01 CSCL 03A

Copernicus observations of Mg 2 h and k emission lines from M giants and supergiants are described. Supergiants with extensive circumstellar gas shells show an asymmetric k line. The asymmetry is ascribed to superimposed lines of Fe 1 and Mn 1. The Mg 2 line width fit the Wilson-Bappu relation derived from observations of G and K Stars. Results of correlated ground-based observations include (1) the discovery of K 1 fluorescent emission from the Betelgeuse shell; (2) extimates of the mass-loss rates; and (3) the proposal that silicate dust grains must account for the major fraction of the Si atoms in the Betelgeuse shell. Author

N80-28272*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SOLAR EXTREME ULTRAVIOLET TELESCOPE AND SPECTROGRAPH FOR SPACE SHUTTLE. VOLUME 1: INVESTIGATION AND TECHNICAL PLAN
Werner M. Neupert Nov. 1978 58 p refs
(NASA-TM-80643) Avail: NTIS HC A04/MF A01 CSCL 03A

A scientific investigation of heating and mass transport in the solar corona that is currently planned for a future Shuttle/Spacelab flight is outlined. The instrument to be used is a near-normal incidence grating spectrograph fed by a grazing incidence Wolter Type 2 telescope. A toroidal grating design provides stigmatic images of the corona up to 8 arc min in extent over the spectral region from 225 A to 370 A. Spatial resolution of at least 2 arc sec and spectral resolution of 0.050 A is achievable throughout the central 4 arc min field or view. Primary scientific data are recorded on Schumann-type film. An H-alpha slit jaw monitor and zero order extreme ultraviolet monitor are also planned to support instrument operation. M.G.

N80-28273*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IUE OBSERVATIONS OF A LUMINOUS M SUPERGIANT THAT EXHIBITS INTENSE CONTINUUM IN THE FAR ULTRAVIOLET
A. G. Michalitsianos, M. Kafatos, and R. W. Hobbs Apr. 1980 21 p refs Submitted for publication
(NASA-TM-80681) Avail: NTIS HC A02/MF A01 CSCL 03A

Observations of the late type M supergiant TV Gem (M1 Iab) reveal strong UV continuum between 1200 A and 3200 A. The continuum is essentially featureless with the exception of a number of broad absorption features in the short wavelength spectra range. An absorption feature centered around 1400 A could be due to Si IV absorption found typically in spectra of middle B type stars. UV emission from this star is unexpected because earlier ground-based observations give no indication of a possible association with an early companion or circumstellar ionized nebulosity. A B9 or A1 III - IV type star approximately 2 to 3 magnitudes fainter than the M star could explain the level of UV continuum observed, but a fully self consistent explanation that includes the B-V color index of TV Gem is not as yet possible. The continuum flux dependence with wavelength in the UV spectral range could be attributed to a high energy source such as an accretion disc. It is suggested TV Gem is a good candidate for HEAO-2 (Einstein) satellite observations because a high energy object in close proximity to the M star would likely be a source of soft X-ray emission. A.R.H.

N80-28274# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
INFRARED STUDIES OF AFGL SOURCES Final Report, Sep. 1976 - Sep. 1979
Robert D. Gehrz, John A. Hackwell, and Gary L. Grasdalen Hanscom AFB, Mass. AFGL 14 Apr. 1980 59 p refs Sponsored in part by NSF and ONR
(Contract F19628-76-C-0271; AF Proj. 7670)
(AD-A084713; AFGL-TR-79-0274) Avail: NTIS HC A04/MF A01 CSCL 03/1

The data acquired during the past three years from a promising base upon which to build a statistically complete analysis of the infrared objects populating our galaxy. Wyoming observations have also provided insight into the nature of new, and in some cases bizarre, classes of infrared sources which were discovered by the AFGL infrared survey. Many of these objects appear to represent important phases in the ongoing process of stellar birth and death. GRA

N80-28294# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DETERMINATION OF ASTRONOMICAL COORDINATES AT THE KLOPPENHEIM SATELLITE OBSERVATION STATION USING THE CIRCUMZENITHAL ASTROLABE VUGTK; FOR THE PERIOD 1972 TO 1975 [ASTRONOMISCHE KOORDINATENBESTIMMUNGEN AUF DER SATELLITENBEOBACHTUNGSSTATION KLOPPENHEIM MIT DEM ZIRKUMZENITAL VUGTK IN DEN JAHREN 1972 BIS 1975]
Gerhard Soltau *In its* Activities of the Kloppenheim Satellite Obs. Station 1979 p 19-27 refs In GERMAN; ENGLISH summary (For primary document see N80-28292 18-99)
Avail: NTIS HC A04/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-28275 Cornell Univ., Ithaca, N. Y.
STAR CLUSTERS CONTAINING MASSIVE, CENTRAL BLACK HOLES: EVOLUTION CALCULATIONS Ph.D. Thesis
Alan Bruce Marchant 1980 84 p
Avail: Univ. Microfilms Order No. 8015709

Detailed, two dimensional simulations of star cluster evolution are discussed. A Monte-Carlo method is adapted to simulate the development with time of isolated star clusters. Clusters which evolve on relaxation timescales are treated with and without central black holes. The method is applied to follow the development and core collapse of an initial Plummer-model cluster without a central black hole. By extending this calculation to later dynamical stages, it is shown that core collapse occurs in a smooth, homological fashion with continual 'evaporation' of stars from the core into the developing halo. Three calculations of cluster re-expansion are presented each begining with the

insertion of a black hole at the center of a highly collapsed cluster core. Each case is characterized by a different value of initial black hole mass or black hole accretion efficiency for the consumption of debris from disrupted stars. The various re-expansion behaviors are interpreted in terms of simple quasi-static balance between cusp heating are interpreted and conduction of the heat through the core and into the halo. It is found that for the special cases examined here substantial, but not catastrophic, growth of the central black hole may accompany core re-expansion. Dissert. Abstr.

N80-28276 Ohio State Univ., Columbus.
THE DISTRIBUTION OF G5-K5 STARS IN A REGION AT THE SOUTH GALACTIC POLE Ph.D. Thesis
Raymond Charles McNeil 1980 250 p
Avail: Univ. Microfilms Order No. 8015908

An objective prism survey (dispersion 580 A/mm at H gamma) of more than 2200 late type stars is documented for an 81 square degree region at the south galactic pole (SGP). The limiting magnitude of the survey is V = 13(m)5. The objective prism classifications, photographic apparent visual magnitudes, and plate positions determined for the program stars are presented in the form of a catalog. The data are then used to discuss the distribution of the G5-M dwarfs and to derive, analytically, the space density distribution of the G5-M giants to a z-distance of 2000 parsecs. The percentage of dwarfs observed in the survey is about the same or slightly higher than the percentage found for magnitudes brighter than V approximates 11(m)5. The rate of increase in the number of dwarfs per half-magnitude interval with increasing magnitude is not great enough to be consistent with a uniform density distribution at the SGP, however. Dissert. Abstr.

N80-28277 Cornell Univ., Ithaca, N. Y.
ON THE STABILITY AND DYNAMICS OF DISK GALAXIES: CONSIDERATIONS ON THE AXISYMMETRIC BACKGROUND Ph.D Thesis
Robert Grant Hohlfield 1980 141 p
Avail: Univ. Microfilms Order No. 8015678

The stability and dynamics of the axisymmetric mass profile of disk galaxies are considered. A detailed treatment fo flat disk equilibria supported principally by rotation is given. The theory of the integral equations relating rotation curves and mass surface densities is extended. Computer programs are developed which treat the computational difficulties or relating mass surface densities and rotation curves for these galaxies. An analytic family of rotation curves and corresponding mass surface density profiles is derived which is appropriate for the representation of the flat rotation curves. The hypothesis that the dark matter at large galactocentric distances (implied by the existence of flat rotation curves) is in the form of late spectral-type stars is studied and tested. The Nyquist stability technique is generalized to a global stability technique for the study of galactic stability problems. The axisymmetric global stability problem of a flat disk of stars is reduced to the character of an eigenvalue problem, and the nature of the nonaxisymmetric global stability problem is indicated. Finally, the negative mass instability of flat galactic disks is studied in detail. Dissert. Abstr.

N80-28278 Florida Univ., Gainesville.
A NEUTRAL HYDROGEN SURVEY OF BLUE COMPACT GALAXIES Ph.D. Thesis
David Gordon 1979 157 p
Avail: Univ. Microfilms Order No. 8016535

The 21 cm neutral hydrogen line observations of 99 compact galaxies, most of the blue or very blue, are reported. Of these, 72 are detected in HI. These systems are found to be richer in HI than late type galaxies of the Hubble sequence and also to have higher surface luninosities. Approximately half of these blue compact systems are bluer than the bluest late type galaxies. Their HI velocity profiles are often narrow and single peaked, most often for the lower luminosity systems. However, the evidence suggests that the compact galaxies are rotating disk systems, perhaps with a strong central concentration of HI. The observations also indicate that at least some of these systems are quite extensive in their overall HI dimensions. It is possible that these HI rich, blue compact galaxies are old systems which have not yet completed their collapse out of the intergalactic medium. Primordial gas may be condensing into their central regions and could be the source of gas for intermittent, brief bursts of star formation. Dissert. Abstr.

N80-28279*# National Aeronautics and Space Administration, Washingt ., D. C.
NATURE OF TYPE 1 SUPERNOVAE
I. S. Shklovskiy Jun. 1980 37 p refs Transl. into ENGLISH of "O Prirode Sverhnovykh i Tipa", Rept. Pr-395 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-42 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76238; Pr-395) Avail: NTIS HC A03/MF A01 CSCL 03B

The nature of type 1 supernovae (SN 1) is discussed through a comparison of observational evidence and theoretical perspectives relating to both type 1 and 2 supernovae. In particular two hypotheses relating to SN 1 phenomenon are examined: the first proposing that SN 1 are components of binary systems in which, at a comparatively late stage of evolution, overflow of the mass occurs; the second considers pre-SN 1 to be recently evolved stars with a mass greater than 1.4 solar mass (white dwarfs). In addition, an explanation of the reduced frequency of flares of SN 1 in spiral galaxies as related to that in elliptical galaxies is presented. M.G.

N80-28280*# National Aeronautics and Space Administration, Washington, D. C.
NEW METHOD FOR DETERMINING THE DISTANCES TO CERTAIN EXTRAGALACTIC RADIO SOURCES
Yu. A. Kovalev Jun. 1980 15 p refs Transl. into ENGLISH of "Novyy Metod Operdeleniya Rasstoyaniy do Nekotorykh Vnegalkticheskikh Radiostochnikov", Rept. Pr-325 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-15 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76209; Pr-325) Avail: NTIS HC A02/MF A01 CSCL 03B

The structural evolution of variable radio sources is examined in the Hedgehog model. It is shown that the time evolution of the angular separation of two components is described by the ellipse equation. Author

N80-28281# Aerospace Corp., El Segundo, Calif. Engineering Group.
AN ANALYTICAL INTEGRATION OF THE AVERAGED EQUATIONS OF VARIATION DUE TO SUN-MOON PERTURBATIONS AND ITS APPLICATION Final Report, Oct. 1978 - Mar. 1979
C. C. Chao Oct. 1979 46 p refs
(Contract F04701-79-C-0080)
(AD-A083231; TR-0080(5473-03)-1; SD-TR-80-12) Avail: NTIS HC A03/MF A01 CSCL 20/3

The perturbed variations of the motion of Earth satellites due to the Sun and the moon are derived from a singlely averaged disturbing function. A first-order solution is obtained by analytically integrating the equations of variation including J2, J2-squared, J3, and J4. The literal expansions are carried out by computer in terms of classical elements. The secular part of the first order solution is included in the reference orbit. The orbits of the Sun and the Moon are assumed circular, and the motion of the moon is converted to the earth equatorial system with certain approximations. Results based on the GPS (Global Positioning System) satellites compare favorably with numerical integration for time spans of up to three years. An algorithm applying the first order solution has been developed to achieve the desired strategy of orbit maintenance for the GPS Phase 3 system. The analytical solutions provide insight into the long term (10 yr) variations of the orbit elements of GPS satellites. GRA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-28282 Texas A&M Univ., College Station.
ON THE PERIODICITIES OF SATURN'S REFLECTIVITY IN THE VISIBLE Ph.D. Thesis
James Robert Johnson 1979 113 p
Avail: Univ. Microfilms Order No. 8011960

Periodogram analysis of Saturn images from 1924 to 1965 revealed an 11 year periodicity in Saturn's yellow reflectivity. A periodicity of 7 years was also seen which may be evidence of seasonal variations. Trends in the 11 year peak over the various latitude regions support evidence that a fundamental difference existed in 1977 in the absorbing particle layer, between the south polar region and equatorial zone. It is proposed that the aerospace layers are chiefly responsible for the periodic changes in the yellow reflectivity. The most urgent problem, requiring a solution for Saturn studies, is the identity of the absorbing particles and their photochemical products. Dissert. Abstr.

N80-28283 Cornell Univ., Ithaca, N. Y.
PHOTOMETRIC PROPERTIES OF CARBONACEOUS CHONDRITES AND RELATED MATERIALS Ph.D. Thesis
Linda Susan French 1980 265 p
Avail: Univ. Microfilms Order No. 8015668

Absolute reflectance spectra and limb darkening parameters were measured for one member of each of the three major petrologic types of carbonaceous chondrites: Orgueil (C1), Murchison (C2), and Allende (C3) over the wavelength range from 0.25 to 1.15 microns. The spectra of carbonaceous chondrites are flat throughout the visible and near-infrared. At some critical wavelength the reflectance begins decreasing rapidly into the ultraviolet. The limb darkening behavior of all three meteorites was analyzed according to Minnaert's law. All show some limb darkening, with values of k = 0.55-0.58 near opposition. Viking Orbiter images taken near opposition indicate the satellites are limb darkened; after correction for smearing, limb darkening parameters of 0.55-0.65 for the satellites are derived which are consistent with those of carbonaceous chondrites. The bright patches on Deimos are approximately 30% brighter than the surrounding material, a value consistent with the reflectances measured for different particle sizes of Murchison. Dissert. Abstr.

N80-28284 Pittsburgh Univ., Pa.
LIGHT SCATTERING IN A SPHERICAL PLANETARY ATMOSPHERE, WITH APPLICATIONS TO VENUS Ph.D. Thesis
David Lee Wallach 1979 114 p
Avail: Univ. Microfilms Order No. 8015333

The single-scattering reflectance was derived for a planet with a spherically uniform distribution of scatterers whose density decreases exponentially with altitude with a scale height small compared with the radius of the planet. Using a power series expansion and retaining terms to second order one can integrate the resulting expression on a programmable calculator. The planar atmosphere was found to apply for angles of incidence and exit smaller than 84. When the angles are larger than 84, it was shown that the single scattering solution could be reduced to an equivalent Lommel-Seeliger problem by using effective values of incidence and exit angles. The active zone, where most of the contribution to the brightness occurs was found to be a small region of the atmosphere in that the atmosphere can be approximated as locally planar. First-order corrections for multiple-scattering and non-isotropic scattering can then be made using the palnar expressions with an adjusted geometry. The results were applied to some of the Marinar 10 pictures of the terminator and limb of Venus. Dissert. Abstr.

N80-28285*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYNOPTIC OBSERVATIONS OF JUPITER'S RADIO EMISSIONS: AVERAGE STATISTICAL PROPERTIES OBSERVED BY VOYAGER
J. K. Alexander, T. D. Carr (Florida Univ., Gainesville), J. R. Thieman (ORI, Inc., Silver Spring, Md.), J. J. Schauble (Florida Univ. Graduate Center, Eglin AFB), and A. C. Riddle (Cooperative Inst. for Research in Environmental Science, Boulder, Colo.) Jun. 1980 43 p refs Submitted for publication
(NASA-TM-80717) Avail: NTIS HC A03/MF A01 CSCL 03B

Observations of Jupiter's low frequency radio emissions collected over one month intervals before and after each Voyager encounter were analyzed. Compilations of occurrence probability, average power flux density and average sense of circular polarization are presented as a function of central meridian longitude, phase of Io, and frequency. The results are compared with ground based observations. The necessary geometrical conditions are preferred polarization sense for Io-related decametric emission observed by Voyager from above both the dayside and nightside hemispheres are found to be essentially the same as are observed in Earth based studies. On the other hand, there is a clear local time dependence in the Io-independent decametric emission. Io appears to have an influence on average flux density of the emission down to below 2 MHz. The average power flux density spectrum of Jupiter's emission has a broad peak near 9 MHz. Integration of the average spectrum over all frequencies gives a total radiated power for an isotropic source of 4 x 10 to the 11th power W. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-28286*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. SOLAR ACTIVITY PREDICTION OF SUNSPOT NUMBERS, PREDICTED SOLAR RADIO FLUX
Gordon G. Johnson and Samuel R. Newman Feb. 1980 42 p refs
(NASA-TM-81109; JSC-16390; Rept-80-FM-8) Avail: NTIS HC A03/MF A01 CSCL 03B

A solar activity prediction technique for monthly mean sunspot numbers over a period of approximately ten years from February 1979 to January 1989 is presented. This includes the predicted maximum epoch of solar cycle 21, approximately January 1980, and the predicted minimum epoch of solar cycle 22, approximately March 1987. Additionally, the solar radio flux 10.7 centimeter smooth values are included for the same time frame using a smooth 13 month empirical relationship. The incentive for predicting solar activity values is the requirement of solar flux data as input to upper atmosphere density models utilized in mission planning satellite orbital lifetime studies. E.D.K.

N80-28287*# Stanford Univ., Calif. Inst. for Plasma Research.
CORONAL HEATING BY STOCHASTIC MAGNETIC PUMPING
P. A. Sturrock and Y. Uchida (Tokyo Astronomical Observatory) Jun. 1980 19 p refs Submitted for publication
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-163356; SU-SUIPR-809) Avail: NTIS HC A02/MF A01 CSCL 03B

Recent observational data cast serious doubt on the widely held view that the Sun's corona is heated by traveling waves (acoustic or magnetohydrodynamic). It is proposed that the energy responsible for heating the corona is derived from the free energy of the coronal magnetic field derived from motion of the 'feet' of magnetic field lines in the photosphere. Stochastic motion of the feet of magnetic field lines leads, on the average, to a linear increase of magnetic free energy with time. This rate of energy input is calculated for a simple model of a single thin flux tube. The model appears to agree well with observational data if the magnetic flux originates in small regions of high magnetic field strength. On combining this energy input with estimates of energy loss by radiation and of energy redistribution by thermal conduction, we obtain scaling laws for density and

temperature in terms of length and coronal magnetic field strength. Author

N80-28288*# Lockheed Missiles and Space Co., Palo Alto, Calif.
ROCKET STUDIES OF SOLAR CORONA AND TRANSITION REGION Final Report, Mar. 1976 - Aug. 1979
L. W. Acton, E. C. Bruner, Jr., W. A. Brown, and R. A. Nobles Sep. 1979 55 p refs
(Contract NAS2-9181)
(NASA-CR-160001) Avail: NTIS HC A04/MF A01 CSCL 03B

The XSST (X-Ray Spectrometer/Spectrograph Telescope) rocket payload launched by a Nike Boosted Black Brant was designed to provide high spectral resolution coronal soft X-ray line information on a spectrographic plate, as well as time resolved photo-electric records of pre-selected lines and spectral regions. This spectral data is obtained from a 1 x 10 arc second solar region defined by the paraboloidal telescope of the XSST. The transition region camera provided full disc images in selected spectral intervals originating in lower temperature zones than the emitting regions accessible to the XSST. A H-alpha camera system allowed referencing the measurements to the chromospheric temperatures and altitudes. Payload flight and recovery information is provided along with X-ray photoelectric and UV flight data, transition camera results and a summary of the anomalies encountered. Instrument mechanical stability and spectrometer pointing direction are also examined. A.R.H.

N80-27745# Physikalisch-Meteorologisches Observatorium, Davos (Switzerland).
THE SOLAR CONSTANT AND ITS SPECTRUM
C. Froelich *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 91-94 refs
(For primary document see N80-27733 18-42)
Avail: NTIS HC A10/MF A01

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-28289*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE X-RAY SPECTRUM OF QSO 0241+622
D. M. Worrall, E. A. Boldt, S. S. Holt, and P. J. Serlemitsos Feb. 1980 27 p refs Submitted for publication
(NASA-TM-80645) Avail: NTIS HC A03/MF A01 CSCL 03B

Proportional counters on the OsO-8 spacecraft measured the X-ray spectrum of QSR 0241+622 in the range 2-50 keV. The best power law fit has a proton spectral index and 90 percent errors gamma = 1.93 (+0.5, -0.3) and low energy absorption consistent with reported gas column densities, but a thermal bremsstrahlung form with temperature 13.1 keV cannot be excluded. No indication of spectral variability is found in three observations of the source with HEAO-A2, although a possible 15-30 percent intensity change over a period of 6 months was observed. The quasar is similar to 3C 273 in the proportion of energy emitted in various bands, excluding the radio, if reported radiation above 50 keV from its direction is indeed associated with QSO 0241+622. The two quasars are compared and possible energy generation scenarios are discussed. Implications concerning quasar contributions to the diffuse background are discussed. A.R.H.

N80-28290*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HEAO A-2 SURVEY OF ABELL CLUSTERS AND THE X-RAY LUMINOSITY FUNCTION
J. D. McKee, R. F. Mushotzky, E. A. Boldt, S. S. Holt, F. E. Marshall, S. H. Pravdo, and P. J. Serlemitsos Apr. 1980 42 p refs Submitted for publication
(Contract NAS8-33346)
(NASA-TM-80680) Avail: NTIS HC A03/MF A01 CSCL 03B

The HEAO A-2 all sky data base was surveyed for 2-10 KeV X-ray emission from the 225 Abell clusters og galaxies listed in Abell's (1958) catalof which are of distance class four or less, and are within the fraction of the sky surveyed completely by Abell. Thirty-two identifications of clusters with X-ray sources were made, for which 2-10 KeV fluxes and 90% error boxes are presented. Twelve of these identification are new. The X-ray luminosity function was derived for this statistically complete sample and the best exponential fit was found to be f(L) = 20.2 x 10 to the minus 8 power exp (-l(44)/1.9) per cu Mpc 2-10 KeV. The relationship between X-ray luminosity and richness was examined and a correlation was found for richness classes 0, 1, and 2. The relationship of X-rau luminosity, Bautz-Morgan type, and Rood-Sastry type was examined. It was found that BM type I's and RS type cD and B have the greatest average luminosity. The contribution of clusters to the X-ray background was calculated from the luminosity function and was found to be 5%, and with 90% certainty, less than 8% in the 2-10 KeV band pass. A.R.H.

N80-28291# National Technical Information Service, Springfield, Va.
COSMIC RAYS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Mar. 1980
Brian Carrigan Apr. 1980 82 p Supersedes NTIS/PS-79/0387; NTIS/PS-78/0406
(PB80-807647; NTIS/PS-79/0387; NTIS/PS-78/0406) Avail: NTIS HC $30.00/MF $30.00 CSCL 04A

Measurement techniques, isotopic composition, distribution, intensity, anisotropy, and sources of cosmic rays are covered in the citations. This updated bibliography contains 75 abstracts, 22 of which are new entries to the previous edition. GRA

99 GENERAL

N80-28292# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
[ACTIVITIES OF THE KLOPPENHEIM SATELLITE OBSERVATION STATION]
Hansdieter Grosse and Gerhard Soltau 1979 10 p refs In GERMAN; ENGLISH summary
(Ser-B-230) Avail: NTIS HC A04/MF A01

The activities of the Kloppenheim satellite observation station are described. The determination of the station's position in longitude, latitude, and astronomical azimuth subsequent to its participation in the West European Satellite Triangulation Network and the verification of the measurement constancy of a circumzenithal astrolabe relative to the determination of astronomical coordinates, are discussed. For individual titles, see N80-28293 through N80-28294.

N80-28293# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE KLOPPENHEIM SATELLITE OBSERVATION STATION: DETERMINATION OF LONGITUDE, LATITUDE, AND ASTRONOMICAL AZIMUTH WITH THE PASSAGE INSTRUMENT Ap 70 [SATELLITENBEOBACHTUNGSSTATION KLOPPENHEIM BESTIMMUNG VON LAENGE, BREITE UND AZIMUTH MIT DEM PASSAGEINSTRUMENT Ap 70] c43
Hansdieter Grosse *In its* Activities of the Kloppenheim Satellite Obs. Station 1979 p 5-19 refs In GERMAN; ENGLISH summary (For primary document see N80-28292 18-99)
Avail: NTIS HC A04/MF A01

The Kloppenheim satellite observation station is a participant in the activities of the West European Satellite Triangulation Network. As such its astronomical coordinates had to be determined. The determination of the longitude and latitude as well as of the astronomical azimuth of the reference station are described. The procedure of automatic registration of the time contacts was used for the longitude and azimuth. Author (ESA)

N80-28294# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

DETERMINATION OF ASTRONOMICAL COORDINATES AT THE KLOPPENHEIM SATELLITE OBSERVATION STATION USING THE CIRCUMZENITHAL ASTROLABE VUGTK; FOR THE PERIOD 1972 TO 1975 [ASTRONOMISCHE KOORDINATENBESTIMMUNGEN AUF DER SATELLITENBEOBACHTUNGSSTATION KLOPPENHEIM MIT DEM ZIRKUMZENITAL VUGTK IN DEN JAHREN 1972 BIS 1975] c89

Gerhard Soltau *In its* Activities of the Kloppenheim Satellite Obs. Station 1979 p 19-27 refs In GERMAN; ENGLISH summary (For primary document see N80-28292 18-99)

Avail: NTIS HC A04/MF A01

The verification of the astronomical system of longitudes of the Federal Republic of Germany, performed in 1973/74, at the Kloppenheim station is described. Longitudes and latitudes were determined in measurement sets for a period of several years by means of the circumzenithal astrolabe VUGTK-CSSR. The results are shown. The coordinate values, obtained at different external conditions, do not show ascertainable systematics. They provide an excellent constancy for the measuring system.

Author (ESA)

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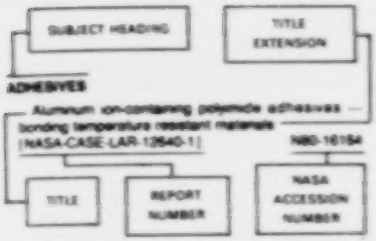

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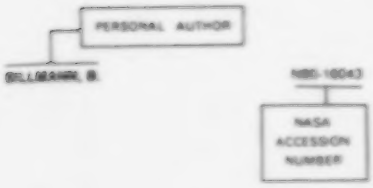

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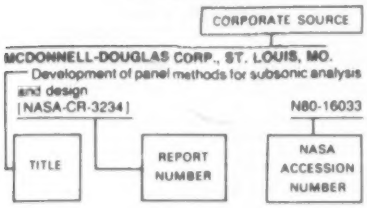

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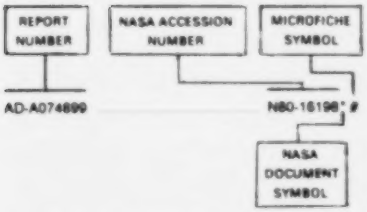

Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

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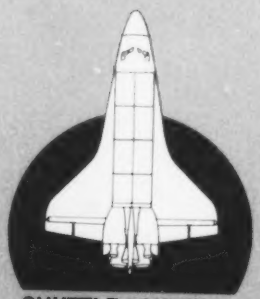

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STAR is categorized by 10 major subject divisions divided into 74 specific subject categories and one general category/division. The major subject divisions are listed in the Table of Contents, together with a note for each that defines its scope and provides any cross-references. For example:

AERONAUTICS

Includes aeronautics (general), aerodynamics, air transportation and safety, aircraft communications and navigation, aircraft design, testing and performance, aircraft instrumentation, aircraft propulsion and power, aircraft stability and control, and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces, and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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02 AERODYNAMICS 2513

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 2517

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For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 2521

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 2522

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 2524

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

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Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

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For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

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20 SPACECRAFT PROPULSION AND POWER 2533
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For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 2534
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 2534
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 2538
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For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 2542
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For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 2553
Includes vacuum technology; control engineering; display engineering; and cryogenics.

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Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 2561
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For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 2566
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For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

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39 STRUCTURAL MECHANICS 2576
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GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

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Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 2590

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 2601

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 2604

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 2608

Includes weather forecasting and modification.

48 OCEANOGRAPHY 2610

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

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Includes genetics.

52 AEROSPACE MEDICINE 2612

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 2615

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 2615

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

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62 COMPUTER SYSTEMS 2618

Includes computer networks.

63 CYBERNETICS 2619

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64 NUMERICAL ANALYSIS 2620

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65 STATISTICS AND PROBABILITY 2621

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 2622

Includes mathematical modeling; network analysis, and operations research.

67 THEORETICAL MATHEMATICS 2622

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

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Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2637
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82 DOCUMENTATION AND INFORMATION SCIENCE 2637
Includes information storage and retrieval technology; micrography; and library science.
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83 ECONOMICS AND COST ANALYSIS 2638
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2638
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
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SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
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89 ASTRONOMY 2639
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2639
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2640
Includes planetology; and manned and unmanned flights.
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92 SOLAR PHYSICS 2640
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2641
Includes cosmic radiation; and inner and outer earth's radiation belts.
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GENERAL

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Note: N.A. means that no abstracts were assigned to this category for this issue.

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NASA ACCESSION NUMBER → N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif. ← CORPORATE SOURCE

TITLE → STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

PUBLICATION DATE

AUTHOR → D. J. Mourey 3 Sep. 1979 409 p. refs

AVAILABILITY SOURCE

CONTRACT OR GRANT → (Contract NAS1-15624)

REPORT NUMBER → (NASA-CR-159149) Avail: NTIS HC A18/MF A01

CSCL 01C ← COSATI CODE

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AIRCRAFT/STORE INTERFACE TECHNOLOGY
C.M. Connell, U.S. Dept. of Defense, Air Force, Armament Lab., *Eglin Air Force Base, Florida* 32542 (DF646990)

Air Force function - standard aircraft/store electrical interfaces. Deficiency - currently, there is little aircraft/store electrical interoperability. Electrical interfaces are designed on a case-by-case basis with little resulting standardization. Objective - generate the technology required to apply new multiplexing techniques to future aircraft/store interfaces. How work contributes - the results of this effort will contribute to the design of a standard aircraft/store interface. This interface, when implemented, can remove one of the major obstacles to interoperability between aircraft and stores.

Problems inherent in a multiplexed interface will be studied and solutions proposed. Promising interfacing concepts will be investigated by developing hardware and software in-house for simulations and applications analyses. Fiber optics, microprocesser, VLSI and NEXTED BUS concepts will be implemented and tested.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0002, NONLINEAR INTERFERENCE DETECTION
T.E. Baustert, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF930370)

The objective of this in-house effort is to determine and extend the current state-of-the-art in hardware and measurement techniques capable of locating the sources of nonlinear interference generators on-board CCC aircraft.

The approach to be taken will include a literature search to determine what has been done by the DOD and industry in the area of locating nonlinear generators of interference. A hand-held sensitive field intensity meter is being procured for test and evaluation. If necessary, the unit will be modified to improve its sensitivity and selectivity. Once a suitable piece of hardware is available, measurements will be performed on vehicles and aircraft for the purpose of developing suitable measurement techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

1.0003, WORKLOAD PROBLEM ASSESSMENT
L.C. Butterbaugh, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142930)

This effort supports the test and evaluation function of the Air Force. Advancements in crew station technology and mission concepts has significantly altered the crew workload associated with performing a mission. Existing technical means of assessing crew workload have not kept pace with the changes in workload. The objective of this effort is to maintain a working level familiarity with workload assessment technology and investigate potential methodologies relative to workload measurement and prediction. Such knowledge will provide the necessary understanding of operational crew workload problems and identify crew system interface areas requiring study. More efficient pursuit of workload assessment methodologies will be realized.

Literature searches of technical libraries and review of aircraft accident reports. Pilot opinion survey of aircrews in the operational commands (TAC, SAC, MAC, etc.). Promising workload assessment methodologies will be previewed for feasibility through limited-effort investigations conducted within the branch.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, STORE SEPARATION METHODOLOGY INVESTIGATION AND IMPROVEMENT
C.L. Dyer, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144150)

Part of the Air Force's mission is to deliver ordnance safely and accurately. The opportunity exists to enhance the utility of contractor developed store separation prediction programs. The objective of work to be performed is to provide an extensively validated design tool to assess the effects of store separation on aircraft safety and to predict the initial perturbations of stores as they are being separated from aircraft. This work will have a payoff in reducing self-inflicted damage from stores and in reducing cost associated with flight and wind tunnel tests in store certification programs, and it will allow store separation to be factored into design of both stores and aircraft.

The approach will be to exercise methods developed under contract and to compare their predictions with existing wind tunnel and flight test data. These comparisons will point out places where methods need improvement, and through the process of making comparisons it will become apparent where the methods could be implemented in a much more user oriented way. These improvements will be accomplished in-house if at all possible.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, STABILITY AND CONTROL DATA DISCREPANCIES IDENTIFICATION
S.F. Lash, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143300)

This work unit supports TPO 3, flight control, and major thrust FG02D3, aircraft stability and control prediction. Specifically, it addresses the problem area involving the differences observed between predicted and actual flight characteristics. The objective of this effort is to identify discrepancies observed during aircraft development programs between predicted values of stability and control parameters and those measured in flight. The results of this effort will be used to formulate a specific investigation of the test and analysis methods used to predict stability and control characteristics, which, will result in a more accurate mathematical representation of predicted aircraft dynamics.

Information will be obtained on several recent and ongoing aircraft development programs to identify situations where values of the stability and control parameters used for dynamic analysis and piloted simulation have led to misleading estimates

of actual flight characteristics. Following problem identification and selection, aerodynamic data, piloted simulation time histories, flight test time histories, and operational experience will be evaluated to document discrepancies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, FLAT PANEL SELF-HEALING VERTICAL SITUATION DISPLAY
J.R. Pastor, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144540)

This work unit supports TP03. Criteria is required which defines a font set and sizes which will be fail-safe and fail-redundant with a specified level of probability due to pilot perception. The objective is to establish this criteria for matrix addressed alphanumerics which can be used to define limits in font variables for a matrix addressed format which is fail-safe and/or fail-redundant and self-healing. This can then be combined with hardware fail probabilities to predict useful life of new aircraft display systems.

Conduct a preliminary analysis based on the Riley and Barbato discrete element degradation experiments and on Euclidian distances from Goble. This effort will scope the modes and ranges of random and linear degradation to be experimentally evaluated. Define experiments, complete them and complete report establishing criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, LOADS FACILITY EVALUATION
T.F. Sabick, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143810)

There is currently no facility in the free world in which the survivability of aircraft structures can be evaluated in a realistic flight loaded condition and subjected to actual ballistic impacts. This testing is necessary to determine the structural degradation of ballistically damaged aircraft components. The objective of this effort is to provide the on-site support necessary for the installation and initial evaluation of a flight load simulation system in the Aircraft Survivability Research Facility. The data produced in this effort will be used to improve the battle-damaged structure analysis code and thereby improve survivability design studies and vulnerability assessments.

The load reaction frame and associated instrumentation and control components that comprise the flight loads simulation system will be installed in the ASRF. Evaluation and checkout will be performed utilizing replica wing specimens. Of the five replica specimens that will be used, three will have structural members removed to simulate ballistic damage. When this initial evaluation stage is complete an actual A-10 aircraft wing will be installed and tested using a typical foreign anti-aircraft round as the threat. A detailed comparison between the battle damage structure analysis code prediction and the actual wing response will then be performed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, AIRCRAFT/STORE AERODYNAMIC HEATING
T.E. Durrenberger, U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center, *Arnold Air Force Station, Tullahoma, Tennessee* 37389 (DF626610)

To develop an in-house capability for analytically predicting fields of aero-thermodynamic and transport properties required in aerodynamic heating analyses of USAF airframe/store bodies of concern to the AFATL, over existing/anticipated operational flight envelopes. These fields of properties, along with specific geometrical and thermal property specifications of the airframe/store bodies under consideration are required to determine transient thermal responses and steady state temperatures, i.e., temperature fields throughout the bodies.

Investigate existing capability for analytically predicting aerothermodynamic (velocities, viscosities, temperatures, etc.) and transport (effective convective heat transfer coefficients) air properties. Using these techniques, develop a method whereby fields of the above-mentioned properties may be predicted for surfaces of selected USAF airframe/store bodies over a range of flight envelopes. This effort is confined to the aero-thermodynamics of adiabatic compression and viscous heating-transient thermal responses of airframe/store bodies are not intended for inclusion hereunder.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CRYSTAL CHEMISTRY
M. O'Keeffe, Arizona State University, School of Liberal Arts, Dept. of Chemistry, *Tempe, Arizona* 85281 (DMR78-09197)

The ultimate goal of this project is to obtain an improved understanding of structure and bonding in inorganic solids. General structural and bonding principles are sought that will (a) enable one to rationalize and organize the enormous body of structural data already extant; (b) serve as guides to predicting the existence, structure, and properties of new inorganic solids; and, (c) help to integrate the chemistry of solids with the rest of inorganic chemistry. A major intermediate goal is obtaining a better understanding of the importance of cation-cation nonbonded interactions in determining crystal structure and stability. The program includes synthesis and structure determination of oxides and nitrides of beryllium, silicon, aluminum, gallium, and phosphorus. Included are ceramics of silicon, aluminum, oxygen and nitrogen (the 'sialon' refractories) that are important in high temperature and solar energy applications. The occurences of extended defects and ordered intermediate phases also are being explored in order to gain a fuller understanding of the structure, stability, and reactivity of these compounds.

Disorder in crystals is investigated with emphasis on sublattice melting. Finally, means of simplifying the descriptions of complicated crystal structures are being sought.

This is a continuation of work supported under DMR 72-03246. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0002, NONLINEAR ELECTROMAGNETIC SCATTERING TECHNIQUES FOR THE DETECTION AND CHARACTERIZATION OF CLOSED CRACKS
A.J. Bahr, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF053920; F49620-79-C-0005)

AF function - metal aircraft structures and turbine engine components are subject to failure by the growth of small cracks and defects introduced by fatigue and other deformation processes. Deficiency - fatigue commences immediately upon the fabrication and use of the metal article and there are inadequate nondestructive evaluation (NDE) techniques available to reject that component when catastrophic failure is imminent. Objective - the objective of this research is to develop an NDE technique capable of detecting small closed cracks on metal surfaces. How work contributes - detecting small cracks will allow parts to be rejected before catastrophic failure occurs.

Nonlinear interactions of microwave energy incident upon metal surfaces will be studied. The magnitude, source and mechanism of such interactions will be correlated with physical (strength-related) parameters of the metal surface. Closed surface cracks will be introduced, characterized and related to the nonlinear interactions in order to assess the utility of this technique for NDE applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, MOLECULAR BEAM STUDIES OF TRANSLATIONAL TO VIBRATIONAL-ROTATIONAL ENERGY TRANSFER BETWEEN ATOMS AND MOLECULES
Y.T. Lee, University of California, Berkeley Campus, School of Letters & Science, Dept. of Chemistry, *Berkeley, California* 94720 (CHE75-20121 A02)

A specialized crossed molecular beam machine with a high resolution, high sensitivity velocity analyzer will be constructed and used for the investigation of energy transfers between atoms and molecules.

The new velocity analyzer is based on the detection of metastable rare gas atoms rather than ions. The high sensitivity, high resolution and low background are accomplished in the time-of-flight velocity analysis by decoupling the gating and excitation processes.

With this new machine, anisotropy of interaction potential will be investigated from the differential rotational excitation cross-sections as well as the translational to vibrational-rotational energy transfer processes between rare gas atoms and polyatomic molecules.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, SPECTROSCOPIC STUDIES OF MOLECULAR RELAXATION KINETICS

G.W. Scott, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Chemistry, *Riverside, California* 92502 (CHE76-01318 A02)

Dr. Scott will experimentally study radiationless transitions subsequent to excitation of specific vibronic and ground state vibrational levels of small aromatic molecules in macroscopically homogeneous samples. He will use the techniques of picosecond spectroscopy to monitor the molecular relaxation phenomena. He plans to obtain detailed kinetic behavior of specific excited states on the picosecond time scale and measure, in contrast to previous work, all competitive relaxation processes including intersystem crossing, internal conversion, vibrational relaxation, and fast photochemistry. This detailed kinetic information will test basic theoretical understanding of these processes and provide insight into these processes in more complex systems. New picosecond laser techniques will be used to accomplish these goals.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0005, THEORETICAL STUDIES OF SCATTERING DYNAMICS AND INTERMOLECULAR FORCES

H.S. Taylor, University of Southern California, School of Letters Arts & Sciences, Dept. of Chemistry, *3551 University Ave., Los Angeles, California* 90007 (CHE76-15656 A02)

Taylor plans to pursue a broad program of research in atomic and molecular physics and chemistry. Areas of interest include: (1) extensions of many-body theory to new problems concerning electron impact ionization, inelastic scattering and elastic scattering; (2) the use of many-body effective potentials in the calculation of intermolecular forces and in pseudopotentials for two electrons; (3) studies of molecular systems that dissociate to states of atoms or ions with very short lifetimes; and (4) development of a classical method for simulation of quantum atom molecule scattering problems. This work is a continuation of that currently supported by Foundation grant GP-30710X.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, SURVEILLANCE - BEHAVIOR OF INORGANIC MOLECULAR SOLIDS SUBJECTED TO MAGNETIC FIELDS AND TO LIGHT

E.R. Bernstein, Colorado State University, School of Science, Dept. of Chemistry, *Fort Collins, Colorado* 80523 (DN675016; N00014-75-C-1179)

Solid state devices such as transistors and radiation detectors are widely used in the Navy in communication, energy conversion, and surveillance. Molecular crystals, such as the inorganic molecular crystals to be investigated here, interact strongly with light and with magnetic fields and are therefore excellent candidates for use in solid state devices. It is the purpose of this research to investigate the interactions among the molecules and the energy transfer processes in inorganic molecular crystals with a view toward producing improved solid state devices.

Optical and zero field paramagnetic resonance techniques are being used in an investigation of intermolecular interactions, energy transfer mechanisms, and exciton kinetics in inorganic molecular crystals. environmental effects on molecular energy levels within the crystals will be characterized. The molecules chosen for investigation include rare earth and actinide borohydrides and borazine (which has physical properties similar to those of benzene). A low temperature, high resolution zero field paramagnetic resonance investigation of ground and excited states of f electron crystals will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0007, MAGNETIZATION OF THIN MAGNETIC FILMS

D.B. Dove, State University System of Florida, University of Florida, School of Engineering, Dept. of Materials Science & Engineering, *220 Black Hall, Gainesville, Florida* 32611 (ENG76-24176)

This program is concerned with the investigation of the magnetization response of thin permalloy film segments of interest in connection with magnetic bubble propagation and logic circuits. The approach to be taken is both theoretical and experimental. The analytical method of analyzing film bar segments using a series formulation to solve the shape demagnetizing field problem will be extended to a variety of circuit element shapes. Measurements will be made using domain observations and using a small spot Kerr effect probe. Of particular concern is the resolution of the question whether it is valid to treat the magnetic material simply as a magnetic continuum or whether domain structure must be explicitly taken into account in evaluating film response to applied fields or bubble fields.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

3.0008, BROMINE REACTIONS OF ATMOSPHERIC INTEREST

M. Kaufman, Emory University, School of Arts & Sciences, Dept. of Chemistry, *1364 Clifton Rd. N.E., Atlanta, Georgia* 30322 (ATM77-16673)

Because of the relatively weak bond of HBr, very little atmospheric bromine exists in this form. As a result, tropospheric washout of bromine is relatively inefficient, and compared to chlorine, bromine shows enhanced transport to the stratosphere. Stratospheric bromine is a very efficient ozone-removing catalyst, also due to its reduced tendency to form non-catalytically active HBr. In order to better evaluate the effect of Br on the stratospheric ozone layer, this research will measure, in the laboratory, rate constants of a number of reactions important in the bromine catalytic cycle. These include Br plus O3 yields BrO plus O2, the basic ozone-removing reactions and Br plus H2O2 yields HBr plus HO2 and Br plus HO2 yields HBr plus O2, probably the two most important HBr-forming reactions. These measurements will be performed over the temperature range of interest for stratospheric computer modeling, namely 200-300 degrees K.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

3.0009, STABLE ISOTOPE FRACTIONATION IN NATURE

R.N. Clayton, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (EAR74-19038 A03)

This is a continuation of research supported under NSF grant GA-22711 and Amendment #1.

This project involves measurement of the isotopes of oxygen and other elements in natural materials. Specific projects include: (1) oxygen in meteorites; (2) oxygen in terrestrial sediments; (3) nitrogen isotopes in meteorites and terrestrial rocks;

(4) laboratory measurement of isotopic fractionation at high temperatures. The results will be applicable to a wide variety of important geological problems including: chemical processes during formation of the solar system; sources, materials, and formation of terrestrial shales and deep-sea sediments; significance of nitrogen in geological processes; and accurate measurement of the temperatures of formation of terrestrial rocks.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

3.0010, MAGNETIC, SPECTROSCOPIC, AND ELECTRICAL PROPERTIES OF MOLTEN SALTS

N.H. Nachtrieb, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (CHE78-12487)

This project is in the Structural Chemistry and Thermodynamics program, in the subarea of properties of the liquid state. The Principal Investigator will study solutions of metals in molten salts in order to improve our understanding of electrons in dielectric media, and the nature of the metal-insulator transition. The techniques to be used include magnetic susceptibility, electron spin resonance, vapor pressure measurement, optical spectroscopy, nuclear resonance, and thermoelectric power measurements. The measurements will be made as a function of metal concentration, to vary the electron density, and will be used to test current views of electronic behavior and electronic states in disordered systems.

This research is a continuation of that currently supported by Foundation Grant, CHE-7500680.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

3.0011, QUANTUM MECHANICAL STUDIES OF THE COUPLING BETWEEN ELECTRONIC AND VIBRATIONAL STATES

R.J. Silbey, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (CHE78-07515)

Professor Silbey will conduct research aimed at increasing theoretical understanding of processes involving interactions of solids with energy or of solid surfaces with molecules.

Research in molecular energy transfer in solids will focus on development of the theory of energy transport, including coupling between vibrational modes, vibrational relaxation, and many trapping sites. Problems to be treated are (a) the derivation of macroscopic equation governing transport from microscopic models; (b) the inclusion of both acoustic and optical modes; (c) the possibility of 'hot' transport; (d) the description of experiments on energy transport in highly mixed crystals.

In research on interactions between high and low frequency modes, Professor Silbey will apply his theories on exciton-vibration and electron-vibration coupling to the study of excited state Jahn-Teller systems which are coupled to other electronic states.

Studies will be made of models of adsorption, particularly on the effects of a nearby metal surface on the interaction between atoms. The angular dependence of the potential between linear or planar molecules and metal surfaces will be examined theoretically. Self-consistent calculations will be made of work function and surface dipole barriers and the effects of steps and ledges on electronic densities near surfaces.

This grant renews support of a research program currently supported under NSF Grant CHE-7508184.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

3.0012, HIGH-RESOLUTION PROFILING AS A MEANS OF STUDYING FUNDAMENTAL PARAMETERS IN THE INDUCTIVELY COUPLED PLASMA

S.R. Koirtyohann, University of Missouri, Columbia Campus, School of Arts & Sciences, Dept. of Chemistry, *130 Jesse Hall, Columbia, Missouri* 65201 (CHE77-22915 A01)

Dr. Koirtyohann is studying emissions from the various regions of the inductively-coupled plasma (ICP) to understand some of the fundamental parameters involved in its operation. Although this plasma is rapidly becoming an important and analytically useful spectroscopic source, very little is known about its mechanism of operation or about the reactions undergone by analyte or sample matrix in the various regions of the plasma. Detailed profiling of atomic, ionic, and molecular emissions of the ICP will allow the full analytical potential of this source to be realized and many pitfalls in methods of development to be avoided.

Dr. Koirtyohann is using an improved method for source profiling recently developed in his laboratory which consists of a photo-diode array placed vertically near the exit slit of a stigmatic monochromator to produce a profile at a given wavelength for a complete horizontal or vertical section of the source. The resolution is better than 0.1 mm and the measurement can be made in a matter of minutes.

This profiling method is being used to study zones of intense emission, atomization and ionization processes, and distributions of temperature, analyte, and electron density within the plasma.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

3.0013, LABORATORY AND OBSERVATIONAL SPECTROSCOPIC STUDIES OF MOLECULES AND PROCESSES OF ASTROPHYSICAL INTEREST

W.H. Smith, Washington University, School of Arts & Sciences, Dept. of Chemistry, *4559 Scott Ave., St. Louis, Missouri* 63130 (AST78-12799)

This research is aimed at the elucidation and discovery of molecular spectra of species known or believed to be of substantial importance in a number of astrophysical objects, including the atmospheres of the major planets (e.g., CH4, NH3, and H2) and the diffuse interstellar clouds and comets (e.g. CH2 ion, HeH ion, H2O ion, and H3O ion). The stable species will be investigated with laser photoacoustic spectroscopy at high spectral resolution and S/N using as little as 10 to the minus 4th power of the material required by conventional methods. The spectra of the molecular ions will be investigated with laser methods, using in some cases Fourier transform spectrometers. Great sensitivity is achieved by these methods, with estimated levels of 10 to the 2nd power to 10 to the 6th power species per cc being detectable. This research represents a continuation of that currently supported by Foundation Grant AST 77-06050.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

3.0014, AB INITIO CALCULATIONS OF MOLECULAR ENERGY SURFACES

G.A. Gallup, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Chemistry, *Lincoln, Nebraska* 68508 (CHE76-17567 A01)

Gallup and coworkers will calculate molecular potential energy surfaces using an ab initio modified valence bond procedure. Initial emphasis is on determining nonreactive region interactions of H2-F, a system important in chemical laser research. Extension of these calculations to include the systems H2-C, H2-N, H2-O, and H2-S will provide information bearing upon astrophysical problems. In addition to studies on these triatomic systems, previous H2-H2 calculations will be extended to regions governing vibrational excitations. Longer range plans include calculations of H2-F in reactive regions.

The investigators are examining the use of the Hellman-Feynman theorem to improve the efficiency of energy surface calculations. Gradients in the energy calculated with this theo-

rem can, in ideal cases, provide information for use in conjunction with energies for the accurate determination of analytic representations of surfaces.

This research will provide accurate, analytic energy surfaces for molecular dynamics calculations, as well as produce useful qualitative insights into the nature of interacting systems and their wave functions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0015, PREDICTION OF TC PHASE STABILITY OF SUPERCONDUCTING COMPOUNDS

E.S. Machlin, Columbia University, School of Engineering, Dept. of Metallurgy, *351 Engineering Ter., New York, New York* 10027 (DMR77-08667 A01)

This is a continuation of a study on the effect of alloying elements on the phase stability of the stoichiometric A15 structure for binary and pseudo-binary systems of superconducting interest, which are unstable at stoichiometric composition. The pair potential model is used to develop equations for the energy as a function of composition and order. The free energy functions are employed to determine whether the application of pressure can stabilize the temperature range over which the stoichiometric composition is stable, and to determine which ternary alloying additions and how much is necessary to stabilize the A15 structures in potentially high Tc superconducting systems. To date, a correlation has been found between Tc and the minimum force constant for oscillation of an atom on a chain site with respect to its stationary nearest atoms, in the family of crystal structures containing such continuous chains of atoms but which are not in close packed planes. During the renewal period, this correlation will serve as a design procedure to identify candidate super-high Tc materials. In addition, similar correlations will be sought having potential for prediction of Tc for other families of structures characterized by electron coupling to a unique phonon mode. The ionicity modified pair potential model will be used to characterize the defects likely to affect Tc in the A15 and homologous structures, and to develop pair potential models for the Nb5Ge3 structures. These models will be used to ascertain how to bias the relative stability in favor of the A15 structure in the Nb-Ge system. This is a renewal of NSF DMR74-22493.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0016, ULTRASONICALLY STIMULATED ACOUSTIC EMISSION

D.N. Beshers, Columbia University, School of Mines, Dept. of Metallurgy, *Broadway & W. 116th St., New York, New York* 10027 (DMR77-05214 A01)

This is a continuation of studies of dynamic plasticity within solid materials by analysis of the harmonic spectrum generated by ultrasonic stimulation. The information derived from the spectrum analysis is correlated with mechanical property data and metallographic determination of the microstructure. The method, developed studying brass, will be extended to several more complex single-phase and two-phase body-centered cubic and face-centered cubic alloys. The results obtained will be used to develop a quantitative model of dynamic events which occur during the plastic deformation of metallic materials. This is a renewal of NSF grant DMR75-03236.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0017, ELECTRIC FIELD EFFECT ON MOBILITY OF GLASS CONSTITUENTS

M. Tomozawa, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Materials Engineering, *110 8th St., Troy, New York* 12181 (DMR78-00727)

It is well established that the electrical conduction in conventional oxide glasses is due to alkali ions such as sodium. However, precise information regarding the behavior of such ions--their positions, number of 'free' ions, their mutual interactions, their free energy--is not well established. There is a possibility that the weak electrolyte theory is applicable to glass conductivity, and the aim of this research will be to experimentally test the theory by studying high purity glasses. Specifically the direct current conductivity and sodium diffusion coefficient in GeO2, SiO2, and PbO-SiO2 glasses will be measured as a function of alkali impurity at various temperatures. By comparing the experimental data with the electrolyte theory, the applicability of the theory to glasses will be examined and various thermodynamic quantities such as dissociation constant and activity coefficient of alkali ions will be determined. These quantities are valuable in understanding electrical and dielectric phenomena, ion-exchange process as well as ion-cluster (pair and triple ion) formation in glasses.

This is a continuation of research initiated under NSF Grant DMR73-02536A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0018, SUPPORT OF THE MATERIALS RESEARCH CENTER

C.S. Smith, University of North Carolina, Chapel Hill Campus, Materials Research Center, *Chapel Hill, North Carolina* 27514 (DMR76-80683 A01)

Work will be continued on the preparation and uses of chemically modified surfaces and on synthesis of high conductivity materials. This award will permit the completion of the research under way and an orderly transition of the most promising work to other support.

This award is a continuation of DMR76-80583.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0019, FUEL EVALUATION AND DEVELOPMENT

P.C. Hayes, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF462070)

To evaluate and characterize aircraft fuels produced from petroleum as well as those from sources such as coal liquids and shale oil, to develop and characterize synthetic fuels for specific missile systems, to provide essential support in fuels technology to ASD, operational commands, and other DOD agencies.

State-of-the-art laboratory techniques will be used for characterizing synthetic fuels as well as distillate fuels produced from petroleum, coal and shale oil. Evaluation techniques for characterizing fuels will be developed or improved as needed. Selected materials will be characterized and submitted to other organizations for testing, i.e., AFAMRL and AFML for toxicology and material compatibility testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0020, CHEMICAL VAPOR DEPOSITION AND CRYSTAL GROWTH OF A15 SUPERCONDUCTING MATERIALS

K.E. Spear, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Ceramic Science, *116 Deike Bldg., University Park, Pennsylvania* 16802 (DMR78-10054)

This work is a continuation of fundamental research on the synthesis and characterization of A15 superconducting materials such as niobium-germanium (Nb3Ge), vanadium-silicon (V3Si), and vanadium-germanium (V3Ge). These studies will provide the fundamental thermodynamic and phase equilibria information necessary for the successful synthesis of these technologically important materials. The objective is to obtain a basic understanding of thermodynamic properties and phase equilibria pertinent to synthesis of these materials by vapor phase growth and growth from the melt.

The major emphasis will be on synthesis via chemical vapor deposition. Quantitative models will be developed for predicting deposit compositions, deposition rates and deposit morphologies. The major characterization techniques will be x-

ray diffraction for phase identification and to measure lattice parameter as a function of stoichiometry.

This grant is a continuation of research initiated under NSF Grant DMR75-05813.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0021, INTERNAL-STATE ENERGY DISTRIBUTIONS IN THE PRODUCTS OF REACTIONS INVOLVING ELECTRONICALLY EXCITED ATOMS

W.H. Breckenridge, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Chemistry, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (CHE77-07603 A01)

A special apparatus for dynamical studies of the dissipation of energy in collisions of short-lived electronically excited atoms with small molecules is being constructed. Excited atoms will be created by pulses from an excitation laser, and the initial internal-state energy distributions of chemical or energy-transfer products of the collisions of the excited atoms with quencher molecules will be determined by the laser-induced fluorescence technique under essentially collision-free conditions.

Quenching processes of a wide variety of excited atoms and molecular quenchers will be studied with the proposed apparatus. Initial experiments will be concentrating on the quenching of excited states of Li, Be, and Mg by the simplest molecular quenchers: H2, HD, and D2. Such experiments will provide detailed dynamical information which can be subjected to detailed theoretical interpretation due to the relative simplicity of the potential surfaces involved.

This work is a continuation of that currently supported by Foundation grant, CHE 7512851.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0022, INTERSTELLAR ASTRO-CHEMISTRY

E. Herbst, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Chemistry, *Ewell Hall, Williamsburg, Virginia* 23185 (AST79-04529)

The program consists of a study of interstellar astrochemistry. Three areas of activity are involved: Theoretical studies of low temperature chemical processes in interstellar clouds; an expansion of dense cloud modelling calculations to include more complex molecules; and a new look at the onset of dust condensation in novae and other objects. The study will look at the rates at which the chemical reactions producing complex molecules proceed under the physical conditions in interstellar clouds, the possible branching of the reaction paths to form alternative molecules, and the forward and backward balance of the reactions. The question of whether the theory can explain enough about the formation of the 15 to 20 observed complex molecules in a typical cloud lifetime or whether other processes are needed will be examined. In addition, the formation of condensation centers and growth rates of dust particules will be studied. There are now many experimental results against which the results of these studies can be compared.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

3.0023, A PRECISION DILATOMETER STUDY OF QUENCHED METALS AND ALLOYS

P. Wilkes, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Mineral & Metallurgical Engineering, *Madison, Wisconsin* 53706 (DMR76-04730 A01)

This is a continuation of a basic study of select quenched metals and alloys, using an ultrahigh sensitivity capacitance micrometer, with demonstrated sensitivity of less than 1 A and a long term stability of less than 20 A. This technique is being used to determine the vacancy volume of nickel where the enthalpy (Ef) and vibrational entropy (Sf) for vacancy formation are known. It will also be used to determine Ef and Sf on quenched gold and dilute gold alloys. This is a renewal of NSF Grant DMR76-04730.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0024, SOLIDIFICATION STUDIES OF ALLOYS IN MONOTECTIC AND EUTECTIC SYSTEMS

A. Hellawell, University of Wisconsin, Milwaukee Campus, School of Engineering & Applied Science, Dept. of Materials Engineering, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (DMR79-08820)

This is a fundamental investigation of the solidification of binary and ternary alloys. The objective is to improve the understanding of the mechanisms of isothermal and monovariant reactions. The first area of research involves monotectic reactions in which conditions permit coupled growth. The alloys to be investigated are Al-In, Cu-Pb, Sn-S and In-S. Transparent organic materials will also be studied to move directly observe what happens at the continuous growth front in hypermonotectic alloys. Monotectic alloys Cu-Pb, Ai-In, Sn-S with fibrous composite structures will be examined by X-ray and electron diffraction methods to determine the presence or absence of preferred epitaxial orientations between the phases. Very careful directional solidification studies of cast iron of variable silicon contents will be undertaken to observe the freezing rates and temperature gradients at which there is a transition from grey to white iron. The interfacial under-cooling will also be measured. The morphological and crystallographic complexities of fine graphite will be investigated employing optical, transmission electron and scanning microscopic techniques.

This is a continuation of research previously supported under NSF Grant DMR77-11293. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0025, RELATIONSHIPS BETWEEN STRUCTURE AND STABILITY OF METALLIC GLASSES

F. Abeles, Universite de Paris, *Paris, France* (DF053520; AFOSR-78-3701)

AF function - advances in control and communications depend directly upon the reliability and performance of electromagnetic devices which are in large measure dependent upon solid state materials with special and unique properties and behavior. Opportunity - metallic glasses provide a new class of amorphous materials with unusual semiconducting, magnetic optical, mechanical and chemical properties. However, the relationship between electronic structure and the stability of these amorphous alloys needs better understanding of their thermodynamic and physical characteristics. Objective - specifically, the objective of this research is to conduct a fundamental investigation of the electronic structure of some typical amorphous metallic alloys as a function of their composition based on the interpretation and analysis of their optical and electrical properties. Semi-transparent thin films of binary and ternary alloys will be prepared by controlled codeposition of such constituents as Au, Ag, Pd, Ge, Si, Cu, under ultra-high vacuum. Measurements will be performed in situ at any temperature between 10K and 400K. How work contributes - amorphous alloys provide a new class of electromagnetic materials for applications in electronic communications and control. A thorough and fundamental understanding of their unique properties and characteristics will be important for new device concepts and applications.

The relationships between the electronic structure of some metallic alloys and their glass-forming ability as a function of composition will be investigated by a thorough analysis of their optical and electrical properties. Alloys between a noble or transition metal and Ge or Si will be considered. The sample will be uncontaminated thin films, prepared by co-evaporation on cold substrates over the whole composition range and submitted in situ, to controlled heat treatments in order to modify their atomic structure and determine the stability of the different forms. The sample atomic structure at each annealing stage will be deduced from electron diffraction and electron microscopy

experiments, combined with in-situ resistance measurements. The complex dielectric constant will be accurately determined for each form at the same (low) temperature from in-situ reflectance and transmittance measurements and analyzed in terms of intra- and inter-band contributions. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, LIGHTWEIGHT HYDROGEN MASER FREQUENCY STANDARD

H.E. Peters, Sigma Tau Standards Corp., *Tuscaloosa, Alabama* (DF905420; F19628-79-C-0104)

The objective of this effort is to design and construct laboratory prototype, lightweight, small size, low-cost, hydrogen maser frequency standards. Potential applications include improved precise navigation, tracking, satellite and space systems, and secure communication networks.

Specific feature of this investigation is a novel design approach utilizing electrode structures placed circumferentially and around the atomic storage bulb of a hydrogen maser. These electrodes concentrate and orient the oscillating magnetic field and enhance the quality factor in such a way that oscillating properties of these masers are comparable to conventionally constructed masers of much larger size.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0002, ENGINEERING RESEARCH INITIATION - WAVE DIAGNOSTICS FOR A QUASI-CW TOKAMAK

P.M. Bellan, California Inst. of Technology, School of Engineering, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (ENG78-05784)

A new toroidal plasma research device currently being constructed at Caltech will be used to study wave behavior in a very high repetition rate TOKAMAK-type plasma. The quasi-continuous wave nature of this plasma will permit use of certain signal averaging techniques for the first time on a TOKAMAK plasma that will allow study of wave propagation in TOKAMAKs in much more detail than has previously been possible. Initial experiments on the device will examine (a) propagation of lower hybrid waves in TOKAMAKs; (b) mode conversion of Bernstein waves to electromagnetic modes at the upper hybrid layer; and (c) self-excited plasma modes.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0003, VERY-LOW-FREQUENCY PROBING OF THE MAGNETOSPHERE FROM VOSTOK STATION, ANTARCTICA

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DPP78-18316)

The Stanford University Very-Low-Frequency Group will provide a Winter-Over Exchange Scientist at the USSR station at Vostok, Antarctica, for 1979, 1980, and 1981. While at Vostok, the U.S. Exchange Scientist will operate VLF, micropulsation, riometer, and electric field instruments for several U.S. programs there.

Logistic support is required to transport the U.S. Exchange Scientist and his equipment and supplies to Vostok Station during the austral summers of 1978/1979, 79/80, and 80/81.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

4.0004, DYNAMICS OF LARGE SYSTEMS

T.R. Kane, Stanford University, School of Engineering, Dept. of Applied Mechanics, *Stanford, California* 94305 (ENG77-04449 A01)

The research program will investigate the dynamics of large structural systems, such as those encountered in the study of human motion, and in problems involving the motions of flexible space vehicles and road vehicles.

The objective is to facilitate both the formulation of the governing equations and the extraction of useful information from these equations, and to apply these general concepts to selected specific problems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0005, DESIGN AND IMPLEMENTATION OF MULTI-INPUT ADAPTIVE SIGNAL EXTRACTORS

W.A. Gardner, University of California, Davis Campus, School of Engineering, Dept. of Electrical Engineering, *Davis, California* 95616 (DF055250; F49620-79-C-0086)

AF function - digital signal processing for such applications as radar, telemetry, and communications. Deficiency - increasingly stringent requirements in communications, reconnaissance, and flight control among others, create corresponding demands in the area of signal processing. The high costs in size, weight and power have to be reduced, while speed and accuracy of the processors have to be improved. Objective - improvements in signal extraction performance, in the cost of implementation, and speed of operation of digital filters. How work contributes - the results of this research could be directly usable in the design of future Air Force electronics equipment.

The concepts of adaptive noise cancellation will be generalized to the area of adaptive signal extraction. The method depends on having two or more filter stages with appropriate feedback and variable or adaptive gains. Residue arithmetic will be exploited for speed and accuracy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, STUDY OF UNSTEADY HYDRO- AND AERODYNAMICS OF LIFTING SURFACE OF HIGH ASPECT RATIO WITH CURVED CENTER LINE

H.K. Cheng, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (ENG75-21425)

An unsteady lifting surface theory will be developed for platforms of high aspect ratio, taking into account the sweep and the curvature of the center (lifting) line. The resulting formulation reveals significant departure from the classical theory in three-dimensional (3-D) effects in the form of strong local corrections and in the influence of the far wake. A fundamental feature brought out unambiguously by the general theory is the self-averaging effect of the high-frequency components incuding those in the unit Strouhal number range; namely, the 3-D effect contributed by the far wake, which depends (globally) on the spanwise circulation distribution, averages itself out to zero (or to a negligible quantity), as soon as the wavelength (based on the frequency and the flow speed) is short compared with the wing span. However, the local 3-D corrections associated with the sweep and curvature remain important in all frequency ranges. Specific areas of investigation are: 1) 3-D effects on lift, moment, thrust, propulsive efficiency and wake energy, and their control. 2) Analysis in the lower frequency ranges. 3) Computations by vortex-lattice and other numerical methods to verify accuracy of theory and to explore its potential for correlating unsteady wind data.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0007, OIR SURFACE STATE NOISE IN SI

C.T. Sah, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 En-*

gineering Hall, Urbana, Illinois 61801 (DF902990; F19628-77-C-0138)

AF function - signal processing and communication. Deficiency/opportunity - the presence of interface (surface) states which degrade the efficiency of the charge transfer process and increase the noise of CCD and related device structures basic to advanced signal processing circuitry. Objective - to minimize and control the effects of interface states on device operation through the development of circuit models for the noise generators in these devices. How research contributes - the analysis and measurement of noise spectral data will allow the construction of appropriate circuit models and increased understanding of the origin of the interface states will aid in minimizing and controlling device effects through processing modifications or design changes.

To take and analyze noise data in MOS transistor and CCD-like structures in order to understand the origin of the interface states and to develop detailed circuit models to describe the L/F noise generator in the equivalent circuit models of these devices. Noise measurements spectra as a function of bias conditions, frequency, temperature and interface surface state density will be taken and analyzed by high-speed automatic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0008, DESIGN ANALYSIS AND CRITICAL COMPONENT DEVELOPMENT FOR ADVANCED GAS TURBINE ENGINE TURBINES

J. Fagan, General Motors Corp., *4700 W. 10th St., Indianapolis, Indiana* 46206 (DF462590; F33615-77-C-2091)

Develop technology for a variable geometry turbojet engine complement high specific flow/high stage loading compressors, provide a basis for high performance with recognized durability and life cycle cost controls.

Use proven analysis and design techniques to define and address limiting turbine technologies. Transfer projected engine usage data into useful test planning and design information to account for system development variability on system life-cycle cost trade-offs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0009, LYMAN-ALPHA SOURCES FOR PLASMA STUDIES

D.W. Koopman, University of Maryland, College Park Campus, Inst. for Fluid Dynamics & Applied Mathematics, *College Park, Maryland* 20742 (ENG75-02618 A01)

This program will continue research directed toward investigating the properties of coherent ultraviolet light sources obtained by frequency conversion of ruby and other long-wavelength sources. Emphasis will be placed on conversion mechanisms based on frequency-tripling and two-photon resonant mixing in rare gases. The work will be directed first to the generation of Lyman-alpha radiation (1215 A) using tripling of a dye laser source in krypton. This will be followed by an investigation of two-photon resonance in rare gases to achieve improved conversion efficiency.

This is a continuation of research previously supported under NSF grant ENG-7502618.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Chemical & Process Engineering

4.0010, THEORY AND COMPUTATION OF SINGULAR OPTIMAL CONTROLS

W.F. Powers, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (ENG77-16660)

This research deals with problems, such as the choice of the trajectory for the space shuttle, in which use of fuel or similar resources must be minimized. The principal investigator deals with the theory and the computational practice of the treatment of such problems and of the special difficulties (the so-called 'singularities') that must be overcome in their solution. It is an unusually successful and useful line of research.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0011, RESEARCH INITIATION - EXCITATION SPECTROSCOPY OF SEMICONDUCTORS IN THE INFRARED

S.A. Lyon, Princeton University, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *Box 430, Princeton, New Jersey* 08540 (ENG79-08420)

Ths program combines research on the excitation spectroscopy of semiconductors in the infrared with work on color center lasers. The major thrust of the program lies in the spectroscopy area with initial emphasis placed on understanding the excited state spectra of excitons bound to shallow impurities in silicon. The study of excited states of bound excitons in silicon for deeper impurities and isoelectronic traps is also of interest. Nonradiative recombination centers are being investigated using excitation spectroscopy. A color center laser is the excitation source for the spectroscopic studies and the laser itself is the object of research. It is intended to develop a system in which a semiconductor diode laser replaces the currently used ion laser as a pump source for the color centers.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0012, COHERENT ANTI-STOKES RAMAN SCATTERING IN A WAVEGUIDE

R.B. Miles, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (ENG78-11524)

Optical waveguiding techniques are being applied to spectroscopic measurements on adsorbed species and constituents of electric discharges. The technique is based on coherent anti-Stokes Raman scattering and involves use of a tunable dye laser and a frequency doubled neodymium doped yttrium-aluminum-garnet laser. The adsorbed species measurements involve pyridine adsorbed to alumina slabs that form the walls of a tapered waveguide. The discharge work involves the diagnostics of fast recombining plasma-excited species in a hollow waveguide containing a pulsed transverse electric discharge.

This is a continuation of research previously supported under NSF grant ENG-7709283.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0013, ROTOR HEAT TRANSFER

M.G. Dunn, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF464430; F33615-79-C-2075)

Measure the heat transfer to a full turbine stage using a shock tube as the hot gas source.

Fabricate the test section and instrumentation designed under a previous program and perform verification of technique testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0014, INVESTIGATION OF ROTATING STALL & TURBINE HEAT TRANSFER IN AXIAL FLOW TURBOMACHINERY

G. Ludwig, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF451440; F33615-76-C-2092)

The objectives of this program are to improve understanding of rotating stall, surge and noise in axial flow compressors, to improve and demonstrate a prototype rotating stall control system for a J-85 engine, to apply transient testing techniques to the measurement of heat transfer rates to turbine engine components.

A combined theoretical and experimental approach will be utilized. The theoretical studies will include continued development of a unified aerodynamic-acoustic analysis of compressor flows as well as extending the stability theory to include vari-

able annulus area, lower hub to tip ratios and supersonic rotors. The experimental work will include rotating cascade testing, J-85 engine testing, shock tunnel tests and environmental testing of Area B at WPAFB to determine what, if any, CRF reingestion problems exist.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0015, EXPENDABLE GASIFIER
H. Due, Teledyne CAE, *1330 Laskey Rd., Toledo, Ohio* 43612 (DF459100; F33615-76-C-2055)

Complete the design of an expendable gasifier which is applicable as the core of either a 230 hp jet fuel starter, a 230 pound thrust turbojet, or a 500 pound thrust turbofan engine for a remotely piloted vehicle.

Modify the existing design to obtain an optimum configuration, fabricate and extensively test the optimum configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0016, RAMJET FLUID DYNAMICS
J.E. Drewry, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458790)

The objective of this effort is to conduct experimental and analytical studies of fluid dynamic and chemical kinetic phenomena related to advanced ramjet propulsion systems, with particular emphasis on the sudden-expansion dump combustor.

Experimental studies of non-reacting and reacting combustor flowfields will be performed using an axisymmetric sudden-expansion dump combustor test configuration. Detailed measurements of total pressure, static pressure and gas species concentrations will be made within the combustion chamber for various combustor geometries and inlet conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0017, J-79 B/AL FOD IMPACT TRANSIENT ANALYSIS
T.G. Fecke, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF460190)

The objective of this program is to establish a foreign object damage (FOD) transient stress analysis prediction model. Computer support services shall be required to conduct an in-house transient analytical simulation of starlings impacting J-79 B/Al composite blades.

The composite blades shall be modeled utilizing the NASTRAN finite-element computer program due to the availability of a transient analyses capability. Stress/strain failure modes of the composite blades will be identified. Two-dimensional bird impact loading functions developed from paralleling J-79 B/Al contractual studies shall be input to the finite element model as a function of the chord distance and impact time. The actual three-dimensional J-79 B/Al blade will be modeled using NASTRAN and both isotropic and orthotropic material property models of the blade shall be analyzed. The experimental data obtained under the FOD improvement program being completed at General Electric shall be used for comparisons with the finite-element analytical results to define the reliability of these analytical methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0018, TURBINE ENGINE LUBRICANT RESEARCH
H.A. Smith, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451270)

Establish basic parameters of turbine engine lubricant degradation from which new and improved methods and guidelines for assessing and defining the performance capability of current and advanced high temperature lubricant can be made. Correlate the physical and chemical characteristics of wear particles with the mechanisms of wear occurring in turbine engine lubrication systems. Investigate and develop monitoring techniques for lubricant systems. Investigate foaming characteristics of turbine lubricants and the effects of find filtration on lubricant foaming as well as other lubricant properties.

Develop and utilize analytical methods of analyses for correlating lab evaluations and full scale engine experience. Study wear mechanisms through ferrography and other lube wear metal analysis techniques satisfactory for field use.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0019, EVALUATION OF METAL/GAS CELLS FOR AEROSPACE POWER SOURCES
D.R. Warnock, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF456340)

To characterize the voltage, thermal and cycle-life performance of metal-gas (especially nickel-hydrogen) cells, constructed in-house and also developed under contractual programs. To provide in-house support to contractual hybrid (metal-gas) cell technology development programs.

Design and construct NiH2 cells in-house. Obtain contractually supplied NiH2 cells of various designs. Evaluate these cells to determine their performance characteristics and cycle-life under various cycling profiles. Determine the thermal characteristics of lightweight cells under cycling load in a simulated space environment. Test thermal model NiH2 battery for proposed space flight experiment. Perform studies of metal gas technology applications and develop applicable computer models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0020, AFAPL SENIOR INVESTIGATOR PROGRAM
J.D. Pinson, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF461700; F33615-77-C-2069)

The objective of the AFAPL senior investigator program is to obtain assistance in solving complex and persistent problems involving airbreathing propulsion (turbine engine and ramjet engine), aviation fuels and lubrication, fire protection, and related systems and materials.

A separate and specific task is established to perform work for each individual area of study when a need is identified. Principal investigator is responsible for assigning a senior investigator to perform each task.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0021, LASER RADAR DESIGN STUDY
J. Buckley, General Electric Co., *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DF581690; F19628-78-C-0204)

AF function - vehicle tracking, trajectory prediction, interception. Deficiency - insufficient information on a timely basis of the atmospheric density and variations in density at altitudes ranging from 8 to 30 kilometers as is required for advanced reentry systems. Objective - the development of a satellite-borne laser radar system capable of providing near real-time, remote density measurements at stratospheric altitudes and below. How research contributes - the laser radar system will provide near real-time measurements of the total density of the probed regions of the atmosphere as determined from the Rayleigh scattered laser light. Such data are of value to the Air Weather Service in support of strategic missile system.

A design study will be carried out to investigate and provide solutions for problems related to the design of a laser radar system for measuring atmospheric densities at stratospheric altitudes. Ultimately hardware developed from this design study will be proposed for flight on the space shuttle system through the space test program. The laser radar system will measure atmospheric density by detection of the Rayleigh back-scattered signal produced by a laser transmitter.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0022, NONLINEAR HUMAN OPERATOR MODEL IDENTIFICATION FROM OPERATING RECORDS

B.K. Colburn, Texas A & M University, College Station Campus, School of Engineering, Dept. of Electrical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (DF055370; F49620-79-C-0091)

AF function - an important factor in the design of present and future military weapons delivery systems is the trade-off between machine (computer) control and human operator action. This is especially true of high performance Air Force jet aircraft such as the F-16. Deficiency - with the advent of control configured vehicles (CCV) digital fly-by-wire (DFBW) control systems, the flight/fire control task requirements of the pilot have increased significantly, requiring determination of the limits of pilot control. One way this can be accomplished is by obtaining validated human operator models which can provide prediction of the closed-loop flying qualities under stressed pilot control. Objective - whereas previous work by other investigators generally regarded the human as linear and time-invariant, the proposed research deals with use of the model reference adaptive systems (MRAS) approach to nonlinear operator model identification using only a single input (visual display)-single output (aircraft joy stick motion) type measurement signals. Based on previous work by the principal investigator on MRAS model identification it is proposed to apply the MRAS approach to nonlinear operator models based on operating records of man-in-the-loop simulations. How research contributes - results will provide insight as to the adequacy of the linear optimal control model for tracking tasks in CCV configured aircraft.

The general MRAS identifier will be implemented into a general simulator form in software suitable for processing recordings of specific pilot operating records obtainable at the Air Force Flight Dynamics Laboratory, and the existing program will be adapted into a flexible package that will allow inclusion of general nonlinearities. Parameterized nonlinear pilot models will be generated and results will be compared to those available from the optimal control model (OCM) approach using the same data. Results will be used to determine whether any nonlinear responses affect the resulting closed-loop (man plus machine) flying qualities, as well as whether the linear time invariant OCM is adequate for tracking tasks in new CCV configured aircraft. Results of computer data evaluation tasks requiring usage of digital computation will be in the form of human operator models for different operating records along with a comparison of the equivalent OCM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, AIRCRAFT DIGITAL INPUT CONTROLLED HYDRAULIC ACTUATION & CONTROL SYSTEM

G. Raymond, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF461320; F33615-77-C-2034)

The objective of this program is to establish and demonstrate hydraulic actuation system techniques that respond directly to digital input commands. The techniques will be applicable to continuous duty actuation functions such as air induction, engine inlet vanes, engine after-burner nozzles and flight controls.

A potential DEHA aircraft application will be selected aimed at establishing performance and design criteria. An analysis of promising advanced hydraulic actuation techniques implementing multimode electronic digital inputs, will be conducted to establish its applicability to future aircraft. Based on these results, a full scale DEHA prototype will be designed, fabricated and tested to verify compliance to performance and durability requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0024, RESONANCE IN WEAKLY NONLINEAR SYSTEMS

J. Kevorkian, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF055900; F49620-79-C-0141)

AF function - aerospace vehicle stability. Opportunity - useful approximate analytic solution of certain nonlinear equations of motion seem attainable. Objective - a parametric understanding of phenomena involving resonance in weakly nonlinear systems. How work contributes -by improving design techniques.

The technique of multiple time (or space) scales, originated by Professor Kevorkian, is one of the most powerful ways to obtain uniform asymptotic expansions of differential and integral equations. It involves introducing slow and fast time variables to obtain a hierarchy of simpler equations for the expansion coefficients. It is proposed to attempt to extend the applicability of this technique to resonance phenomena for weakly nonlinear ordinary and partial differential systems with slowly varying parameters. Conditions for sustained resonance and the change in value of an adiabatic invariant across resonance are examples of topics to be considered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0025, THE THERMAL CONDUCTIVITY OF OXYGEN FROM 1000 DEGREES K TO 4400 DEGREES K

H.N. Powell, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Mechanical Engineering, *Madison, Wisconsin* 53706 (ENG78-22662)

The objective of this research is to develop further the method of shock perturbation for the measurement of the thermal conductivities of high temperature gases. This method is the only one yet developed which can be applied to diatomic and polyatomic species at temperature ranges where chemical dissociation and the activation of vibrational and electronic modes of energy storage become important. After further verifying the validity of the method, it is used to obtain the thermal conductivities of oxygen in the temperature range from 1000 degrees K to 4400 degrees K where depending on the pressure the gas may be up to 54 percent dissociated. The pressure range covered in the study is from 0.8 to 6 atmospheres.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0026, RECOMBINATION IN SOLAR CELL MATERIALS

P. Landsberg, University of Southampton, *Southampton, England, United Kingdom* (DF462090; AFOSR-77-3437)

Investigate, in detail, the theory and effects of multiphon emission-recombination and phonon assisted Auger recombination of minority carriers in solar cell semiconductor materials.

Review theoretical and experimental information on recombination in semiconductors. Develop multiphon and phonon assisted Auger recombination models correlate with known behavior. Correlate MP and PA Auger with phonon degradation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, ON THE KATABATIC WIND IN ANTARCTICA

G. Wendler, University of Alaska, College Campus, Geophysical Inst., *Bunnel Memorial Bldg., College, Alaska* 99735 (DPP77-26379)

Three automatic weather stations will be installed between Dome Charlie and Dumont D'Urville, Antarctica, during the austral summer of 1978/79. The meteorological data gathered by these stations during 1979 and 1980 will be used to investigate the katabatic wind phenomenon which is believed to strongly influence the climate of Antarctica.

Logistics support is required for one person during the austral summer of 1978/79.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0002, COLLABORATIVE RESEARCH ON PRE-SURGE CHANGES IN THE DYNAMICS OF A SURGE-TYPE GLACIER

W.D. Harrison, University of Alaska, College Campus, School of Mathematics, Dept. of Physics, *Bunnel Memorial Bldg., College, Alaska* 99735 (EAR76-22500 A01)

This is a continuation of research supported under NSF Grant EAR76-22463.

This project is a continuation of collaborative research between the University of Washington and the University of Alaska on the surge-type Variegated Glacier, St. Elias Mountains, Alaska. Studies will include continued monitoring on changes in surface elevation and velocity, extension of measurements of ice thicknesses by radio echo sounding, measurements of mass balance and winter velocity in firn area by means of buried magnetic markers, and initiation of time lapse photography of the glacier. Surface measurements will be used to estimate sliding velocity of the glacier and to pinpoint the initial location of fast motion preceding the next surge. Studies to date suggest that the next surge could be as early as 1981. Information on the dynamics of the glacier as the anticipated increases in velocity develop will be useful in understanding the causes for glacial surging.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0003, EXPERIMENTAL INVESTIGATION OF THE RELATIONSHIP BETWEEN ATMOSPHERIC ABSORPTION AND CLOUD NUCLEUS CONCENTRATION

S.A. Twomey, University of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (ATM77-11462)

Clouds are the main reflectors of incoming solar radiation and any influence of pollution on cloud reflectance has possible climatic importance. Theoretical studies indicate two opposing such influences -an increase in reflectance with pollution due to increasing drop concentration in clouds, and a decrease in reflectance with pollution due to increased absorption within the clouds. The present proposal proposes a measurement program in which simultaneous measurements of cloud-nucleating particles and bulk particulate absorption are to be made at a field site in Southern Arizona, following which the experimentally derived data will be applied in numerical computations of cloud reflectance and of the cloud contribution to planetary albedo.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Atmospheric Sciences

5.0004, CHATANIKA ELECTRIC FIELD STUDIES

R.R. Vondrak, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF582310; F19628-79-C-0038)

AF function - satellite communication, navigation systems. Deficiency - inadequate knowledge of ambient electric fields causing effects which seriously degrade AF systems at high latitudes. Objective - to determine the electrodynamic state of the high latitude ionosphere. How research contributes - improve knowledge of physical processes affecting the high latitude ionosphere leading to realistic predictive models of ionospheric irregularities and circulating current systems.

Correlative data from the Chatanika incoherent scatter radar facility located at 65 degrees N latitude and the Air Force S3-2 satellite is analyzed and studied to determine the ambient electric field configuration, currents and height integrated conductivity in relation to ionospheric features such as diffuse aurora, discrete arcs and the plasma trough.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0005, INVESTIGATIONS OF PARTICLE BOMBARDMENT OF THE POLAR ATMOSPHERE

R.R. Brown, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (ATM78-09366)

This grant is for further support of investigations of electron precipitation at high magnetic latitudes. These investigations will involve balloon flights carrying x-ray detectors from Sondre Stromfjord, Greenland (75 degrees magnetic latitude) in the summer months of 1979 and 1980 as well as studies of ionospheric absorption from electron precipitation using riometer data from high latitude sites.

The balloon flights will be conducted by the University of California, with the assistance and cooperation of Danish scientists from the Technical University of Denmark. The Danish group will provide supporting data from their extensive chain of riometers and magnetometers in Greenland. The balloon observations will be examined for temporal and spectral variations from electrons that originate deep in the magnetotail, during nighttime hours, and electrons precipitated from the cleft region during daytime hours.

The study of ionospheric absorption associated with electron precipitation events will be carried out at Berkeley using data from the riometer chain in Greenland as well as riometers established for the International Magnetospheric Study (IMS). Of particular interest in this study will be the role of the interplanetary magnetic field in controlling absorption events at sites in the cleft region.

SUPPORTED BY U.S. National Science Foundation,
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of Atmospheric Sciences

5.0006, RIVER PROFILES AND DRAINAGE-BASIN GEOMORPHOLOGY

R.L. Shreve, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Geology, *405 Hilgard Ave., Los Angeles, California* 90024 (EAR76-22469 A01)

This research involves theoretical investigation of the development of river profiles and drainage basins in relation to the transported sediment supplied by the river beds and adjacent hill slopes. The empirical formulas that have been used to calculate such quantities as flow resistance, channelwidth, and sediment transport in a river will be refined by adding terms to reflect erosion in the channel network as a whole, relationships among different parts of the entire drainage system, and the non-uniform size of particles in the load. The evolution of river profiles will be calculated to show response to changes in such things as base level, sediment production, discharge, and gradient, as caused by tectonic activity or climatic fluctuations. Also investigated will be local features including arroyo cutting, terrace formation, and response to damming. The calculated development of profiles will be compared with attributes of known rivers and an analysis will be made of the concepts of local equilibrium and the graded river.

The study will attempt to refine mathematical treatments of river profile development that have been based on simplified assumptions and on empirical equations developed from observations of limited segments of drainage basins. The study should provide a useful approach for field studies of regional geomorphic history.

SUPPORTED BY U.S. National Science Foundation,
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of Earth Sciences

5.0007, PARTICLE PRECIPITATION EFFECTS ON THE MIDDLE ATMOSPHERE AND PALEOATMOSPHERE

S.V. Venkateswaran, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Atmospheric Science, *405 Hilgard Ave., Los Angeles, California* 90024 (ATM77-24843)

The objective of this research is to investigate the role played by energetic particle precipitation on the chemistry and dynamics of the stratosphere and mesosphere. Specific topics include: 1. identifying the mechanisms responsible for relativistic radiation belt electron precipitation and establishing their relative roles as ionizing energy sources for the upper atmosphere; 2. developing zonally averaged models for the mesospheric circulation which can be used to study atmospheric response to

various classes of precipitation; 3. investigating the paleomagnetic modification of the terrestrial ozone layer, particularly during periods of geomagnetic reversals; and 4. exploring potential mechanisms which may provide a causal link between solar or geomagnetic disturbances and the weather.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0008, CUMULUS CLOUDS, MESOSCALE CONVECTIVE SYSTEMS AND THEIR INTERACTIONS

W.R. Cotton, Colorado State University, School of Arts Humanities & Social Sciences, Dept. of Atmospheric Science, *Fort Collins, Colorado* 80523 (ATM76-83361 A01)

The South Park Area Cumulus Experiment (SPACE) is designed to study and describe cumulus clouds and their interactions with each other, the mesoscale, and the synoptic scale. The objective of the study is to use these data to develop a numerical simulation which accurately predicts the genesis, movement and precipitation intensity of cumulus cloud systems for given synoptic and mesoscale features. The numerical simulation should be suitable for use in improved prediction of cumulus and mesoscale weather phenomenon and to evaluate possible modification techniques for precipitation enhancement and severe storm abatement. The field experiment is located in South Park, Colorado, so as to utilize the cumulus genesis area created by the Mosquito Range located on the western boundary of the park and the large flat park to the east of the range to study the initiation and growth of clouds and their subsequent movement.

The field measurements program, to be conducted in summer of 1977, is model interactive and to date has made significant progress in understanding cloud initiation, cloud growth, cloud microphysics, and climatological aspects of cloud translation and propagation. This research would build on these studies with the primary focus of the research being the measurement, description, and the development of a data set from which models of cumulus scale and mesoscale interactions can be developed and verified.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0009, ARCTIC PROPAGATION ENVIRONMENT ANALYSIS

C.M. Rush, U.S. Dept. of Commerce, *Boulder, Colorado* (DF583350)

AF function - communications and detection. Deficiency - prediction and real time specification of the arctic ionosphere. Objective -provide a detailed a 4 dimensional, (3-D plus time) description of the ionospheric auroral environment.

An environmental data base existing at AFGL will be analyzed in a comprehensive case studies to enhance the understanding of the arctic propagation environment. The effort will be significantly enhanced during the OTH tests in FY80 and 81 with data input from 16 ground stations, several satellites and airborne experiments. The data will be analyzed to produce the best possible description of the ionospheric/auroral environment and of magnetic activity during the test periods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0010, GAMMA-RAY SPECTROMETRY IN URANIUM EXPLORATION

J.S. Duval, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9790-01708)

STATES TO WHICH PROJECT PERTAINS: Texas, Wyoming, Washington, California, Arizona, Colorado.

During the current fiscal year we will be obtaining aerial gamma-ray data over seven small areas in the states of Washington, Wyoming, California, Arizona, and Colorado. A significant part of the fiscal year will be spent on the data reduction and interpretation of these data.

In a continuing effort to improve our use of the color images of the radiometric data we will be producing new images of high quality radiometric data in Texas and Wyoming. Some of the color manipulation techniques developed by Gary Raines of the U.S.G.S. will be applied in an attempt to remove some of the subjective aspects of the interpretation of the color images.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0011, AMBIENT AIR QUALITY SURVEY

K. Zeller, U.S. Environmental Protection Agency, *401 M St. S.W., Washington, District of Columbia* 20460 (DF407440)

To measure air quality levels near selected Air Force bases under a wide variety of meteorological conditions. Measurements will be used to (1) determine the local impact and compliance with Federal ambient air quality standards, and (2) to define accuracy limits for the computerized USAF/Argonne National Laboratory Air Quality Assessment Model (AQAM).

Study will be joint USAF/EPA/USN/FAA/DOE project, with EPA providing principal investigator. Phase I includes studies to determine optimum sampling locations, and a background investigation of atmospheric chemistry analytical techniques and of data acquisition and evaluation systems and techniques. Phase II includes performing ambient air quality measurements at Williams AFB, Arizona, utilizing five continuous monitoring stations. One complete year of acceptable data will be obtained. A second year of data collection is planned for a large naval air station. Measured data will then be compared with theoretical data predicted by the AQAM in project 19005A18.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

5.0012, TRANSIENT SCATTERING BY HYDROMETEORS

J.J. Stephens, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Meteorology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (ATM77-07758)

The objective of this research is the theoretical and computational examination of scattering of electromagnetic waves in the presence of various hydrometeors, mostly drops of ice and water. Though the complete solution for a sphere is available, its complexity thwarts a ready physical understanding of the diffraction process. It has been demonstrated by others that if the incident radiation is approximated by a (normalized) delta function then the scattered field of illumination is the impulse response. The latter description permits the isolation of several field contributions stemming from different interactions. This, in turn, permits a more direct physical interpretation than is otherwise possible. The primary application of these results is to the scattering signatures produced by meteorological radar.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0013, AEROSOL TRANSPORT OVER THE EQUATORIAL NORTH ATLANTIC OCEAN AS RELATED TO WEATHER, CLIMATE AND LAND USE IN NORTH AFRICA

J.M. Prospero, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., *4600 Rickenbacker Cswy., Miami, Florida* 33149 (ATM76-02198)

An aerosol collection and atmospheric turbidity network at six stations around the equatorial Atlantic is being established to collect and measure the aerosol output from North Africa. The objectives of this program are: (1) to identify the source areas of the mineral aerosol components, and the meteorological and climatological factions affecting their generation and transportation, (2) to determine if the increased aerosol output during the period 1968-1974 was derived from normally arid and/or desert

use practices by the continued long-term measuring of aerosol transport from North Africa during a period of reduced drought conditions; and (3) to measure the mass transport of mineral aerosols to the oceans.

SUPPORTED BY U.S. National Science Foundation,
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of Atmospheric Sciences

5.0014, GLOBAL ATMOSPHERIC MEASUREMENTS EXPERIMENT ON TROPOSPHERIC AEROSOLS AND GASES (GAMETAG)

D.D. Davis, Georgia Inst. of Technology, School of Geophysical Sciences, *Atlanta, Georgia* 30332 (ATM76-81487 A02)

Using the NCAR (National Center for Atmospheric Research) Electra as a sampling platform, a global sampling effort will be initiated which will involve the measurement of over 50 atmospheric species and meteorological parameters on a simultaneous basis. Recognizing both the importance of chemically coupled atmospheric species and the strong interaction between chemistry and meteorology, the GAMETAG (Global Atmospheric Measurements Experiment on Tropospheric Aerosols and Gases) program is to be a joint effort among meteorologists, cloud physicists, and atmospheric chemists. Project GAMETAG calls for a seven-year project which is to be divided into two phases of two and five years duration. Phase I of the project, the objective of this grant, will have as its primary objective the elucidation of the importance of the hydroxyl free radical to tropospheric chemistry. In addition, there are two secondary objectives for Phase I: (1) an assessment of the global tropospheric budgets for halocarbons, ozone, and sulfur, carbon, and nitrogen species; and (2) a minor effort aimed at assessing the levels and types of natural tropospheric aerosols.

At least two major GAMETAG flights per year are scheduled. These flights, during the first two years of the program, are expected to span a global latitude range of 75 degrees N to 55 degrees S and a longitude range of 165 degrees to 30 degrees in the Western Hemisphere. The general sampling plan for GAMETAG will include representative transit flights into Polar, Tropical, and Transition air masses which have been modified both by continents and oceans and by large-scale ascent and descent.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Atmospheric Sciences

5.0015, TECHNIQUES FOR PREDICTING OUTPUT FOR SPATIALLY VARIED WATERSHED SYSTEMS

D.L. Chery, U.S. Dept. of Agriculture, R.B. Russell Agricultural Research Center, *P.O. Box 5677, Athens, Georgia* 30604 (0045409; 7902-20810-004)

OBJECTIVE: Investigate techniques for making output predictions for large spatially varied watershed systems having different management practices and temporal inputs.

APPROACH: Test channel flow routine of a developed mathematical watershed model (WATSHED) with channel flow data from the SEA Little River watershed. Simple predictive mathematical models can be statistically fit to the response of a complex distributed watershed model or derived from specific input-output manipulations of the complex model. Further investigations of these strategies will be made. Enhance the watershed model (WATSHED) by including subsurface flow component. Parameters of watershed models may be quantified by remote sensing technologies, and the use of LANDSAT data in a prediction procedures for plant potential water demand within a watershed will be investigated. Assess watershed model prediction accuracy with respect to the needs and uses of such predictions.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research
Office, Athens Georgia Area

5.0016, A DOPPLER RADAR/AIRCRAFT STUDY OF PLANETARY BOUNDARY LAYER GROWTH

P.H. Hildebrand, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (ATM76-24236)

An experimental study of planetary boundary layer (PBL) growth dynamics is proposed. The experiment will use gust-probe equipped aircraft and Doppler radars to measure the temperature, humidity and air motion characteristics of the PBL several times a day on several days. The days will be chosen so as to minimize the disturbing effects of fronts or deep convection.

An aircraft will be used to drop radar signal reflecting chaff and to measure the means and fluctuations of temperature, humidity, and momentum as a function of height above ground. These data will be used to evaluate the turbulent energy balance equation for the PBL and to calculate the spectra, cospectra, and fluxes of heat, humidity and momentum. These calculations will be used to evaluate the relative importance of various sources and sinks of energy within the growing PBL. The results of currently existing numerical PBL models will be compared with this experiment.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0017, STATUS OF HARDWOOD REGENERATION IN INDIANA

P.E. Pope, Purdue University, Agricultural Experiment Station, McIntire Stennis Program, *Executive Bldg., West Lafayette, Indiana* 47907 (0073339; IND059045)

OBJECTIVE: Identify and map the forest resources for the State of Indiana with respect to location, forest type, physiographic region, soil type, and topographic position; determine the effect of site conditions and management practices in natural oak stands on the development of advanced oak regeneration; determine the effect of soil type, site condition and prior vegetation cover on the success of planted black walnut, yellow poplar and red oak seedlings.

APPROACH: The forest resource located on color IR LANDSAT images and classified by forest type, soil type and physiographic region. Once the resource is classified, the status of advanced natural oak reproduction will be determined for each major site-type classification with respect to associate species composition, density and position. Superimposed on this site-type classification will be four types of forest management. Planted hardwood seedlings are also important in reforestation. A survey of the hardwood plantings across the state will be conducted to determine the contribution of planted hardwoods to the future forest resources. Soil-site investigations should reveal the conditions most favorable for successful hardwood plantings.

PROGRESS: Preliminary data suggests that in natural oak stands with site index 70 or greater, advanced oak reproduction is (1) inadequate or absent in unmanaged stands and (2) sparse and inadequate in stands periodically thinned to not less than 60 m(2)/ha basal area. At present data are not adequate to evaluate advance oak reproduction in stands which have been burned or grazed. Survey of hardwood plantations indicated poor survival and slow growth on 70% of the sites investigated. Sites associated with successful plantations were characterized by deep but well-drained soils. Weed control was commonly practiced by the landowner. An attempt to discover the reasons for planting failure led to an investigation of new techniques for hardwood planting, including individually container grown seedlings, inoculation with mycorrhizae forming fungi, manipulation of seedling nutrition, and site preparation including chemical weed control. The project as initially described will be revised to reflect this new research emphasis. Presently studies are underway to determine the effects of container grown seedlings on survival and growth. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative
Research Office, Indiana

5.0018, PIEZOELECTRIC ACCELEROMETER FOR SPACE SHUTTLE TEST

D.H. Fryklund, Accumetrics Corp., *Cambridge, Massachusetts* (DF583520; F19628-79-C-0095)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be predicted with sufficient accuracy. Objective - direct measurement of atmospheric density by satellite-borne accelerometers. Correlation of these results is made with other satellite data and with solar-geophysical parameters to develop improved atmospheric models. How research contributes - permits accurate determination of Air Force satellite ephemerides and development of accurate density forecasting techniques.

A satellite triaxial piezoelectric accelerometer will be designed, fabricated, tested and calibrated. The instrument will be flown on one of the space transportation system orbital flight tests scheduled for flight in December 1979. The purpose of the instrument is to provide information on the orbital acceleration environment. In addition to monitoring the magnitude and frequency distribution of onboard generated accelerations, aero-dynamic drag effects will be measured. Atmospheric density is directly proportional to drag. NASA has modified the flight test timeline to turn the instrument on during periods of interest to AFGL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, STRATOSPHERIC AEROSOL MEASUREMENTS

H.A. Miranda, Epsilon Lab. Inc., *Bedford, Massachusetts* 01730 (DF583610; F19628-79-C-0130)

AF function - environmental impact of stratospheric flight operations and optical propagations through the stratosphere such as surveillance, guidance, communications and target acquisition. Deficiency - information currently extant on aerosol particle distributions and employed as inputs by the modelling community may be grossly in error insofar as the stratosphere, and possibly even parts of the troposhere, is concerned. Objective - conduct two balloon-borne measurements of aerosol size distributions and altitude profiles to confirm the earlier initial measurements are accurate and do in fact represent a new, correct description of the aerosols. How research contributes - these measurements will definitely increase the confidence in the technique and provide sufficient new data to enable modellers to incorporate the aerosol results into AF models for environmental assessments and optical propagation studies.

The existing, unique, aerosol counter will be prepared for balloon flights to be launched from Holloman Air Force Base in April 1980. Specific flight profiles consisting of a rise to maximum altitude, descent to 60,000 ft., rise to maximum altitude followed by termination will be used to investigate possible balloon wake contamination and to obtain redundant altitude profiles for verification. The raw data is to be analyzed using the laboratory calibrations and the data presented in graphs and tabular format.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, DIFFUSION OF STRATOSPHERIC POLLUTION

J.L. Larson, Hycor Inc., *1 Gill St., Woburn, Massachusetts* 01801 (DF582730; F19628-79-C-0028)

Small frangible canisters are packaged into a dispensing system that can release smoke in a controlled manner a known distance below a balloon platform. The puff history, after release, is observed by TV and camera systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, INCOHERENT-SCATTER STUDIES AT MILLSTONE HILL DURING THE INTERNATIONAL MAGNETOSPHERE STUDY 1976-79

J.V. Evans, Massachusetts Inst. of Technology, Lincoln Lab., *244 Wood St., Lexington, Massachusetts* 02173 (ATM75-22193 A02)

This grant funds the operation of the Millstone Hill incoherent-scatter radar facility to conduct measurements and analyses of physical parameters of the upper atmosphere and ionosphere. Particular investigations being pursued include: 1. Detailed measurements of the temperature and wind structure in the lower thermosphere, to better understand tidal effects and temporal variations there. 2. Work with NASA combining the Millstone Hill data with NASA satellite data to develop a more accurate model of the atmosphere above 100 km. 3. Studies of dynamical processes in the atmosphere, including neutral winds, plasma diffusion along magnetic field lines, electric fields, and magnetic storms.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0022, WIND TUNNEL GERDIEN SHOCK WAVE STUDIES

M. Finston, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF582600; F19628-79-C-0059)

AF function - communication and radar survivability of Air Force systems such as AAB NCP, AWACS, BMEWS, OTH-B and DSP under naturally disturbed and nuclear environments. Deficiency or opportunity - total ion species concentrations are required to improve models that will predict VLF to VHF radar and communications propagation characteristics during quiet and disturbed atmospheric conditions. Objective - accurate calibration of rocket-borne Gerdien condensers used to measure total charge density. How research contributes - accurate total ion density measurements depend on careful calibration of the mass flow through the Gerdien condenser under simulated flight conditions. The Gerdien data together with the mass spectrometer relative ion species concentration data will be used to determine absolute ion species concentrations to be used for model inputs.

Calibration data on the Gerdien will be obtained using the Arnold Engineering Development Center 10 V chamber. Mass flow calibration and boundary layer growth along the vehicle will be studied at high density altitudes (70 km to 90 km) and Mach numbers from 3.0 to 3.5.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, LARGE-SCALE OSCILLATORY AND CONVECTIVE MOTIONS ON THE SUN

R.C. Altrock, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580780)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to measure large-scale oscillatory (global pulsations) and convective (giant cells) motions on the solar surface and to develop theoretical models to explain these phenomena, which, if they exist, would provide information about the structure and behavior of the solar interior, and its influence on surface phenomena. How research contributes - several observations have suggested the existence of large-scale motions which have their origin deep within the sun. It is necessary to verify and provide more details of these motions and the resultant transfer of energy and magnetic fields from the interior to the surface, since theoreticians believe that these motions determine the nature of the solar activity cycle. Statistical fluctuations in this 22 year cycle probably determine the strength, lifetime, and frequency of hydromagnetic storms in individual active centers, which in turn cause the well-known solar induced environmental disturbances.

Observations made with the Sacramento Peak tower telescope diode array, echelle spectrograph, and universal birefringent filter, will be analyzed and compared with theoretical models developed under contract, to determine the nature of energy transport through the solar atmosphere, and the interac-

tion between magnetic fields and material motions, both in active sunspot centers and in quiet regions on the sun.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, AIR LAUNCHED BALLOON TECHNIQUES

A.S. Carten, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580610)

AF function - advanced balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency or opportunity - present vehicles have limited altitude and payload capabilities. Objective - to develop an all weather operational lighter-than-air (LTA) vehicle or platform to put high altitude sensors and communications relays on station quickly and on short notice over battle theaters. How research contributes - this work involves in-house studies and investigations leading to the design, fabrication and test of an advanced prototype air-launched balloon system (ALBS). When the goals of this research are achieved it will be possible for the Air Force to deploy and inflate in mid-air, automatically and quickly, LTA platforms capable of supporting payloads of at least 200 lbs for 24 hours at altitudes of 70,000 ft or better. This capability will enhance the effectiveness of Air Force missions whose mode of operation requires the rapid availability of low cost substitute aerial platforms for communications relays like those presently carried on space satellite systems. TAC ROC 305-75 points up the need for such a substitute and specifically mentions LTA platforms.

The basic design configuration of the cryogenically-inflated ALBS has been worked out under IHWU 66651101, in which scientific balloons were chosen as the primary drop vehicles. Using data from that program, a more sophisticated, aircraft-oriented version of the system will be developed under IHWU 76591101 which will meet the stringent standards required of aircraft-borne equipment. To accomplish this goal the parachute system tested and refined during FY77 at the National Parachute Test Range will be adapted to the new hardened version of the ALBS and subjected to qualification tests at the NPTR in FY78-79. The ALBS balloon design will be modified as required to reflect any needed design improvements identified in the IHWU 66651101 test program. Also, the ALBS cryogenic gas storage and heat storage transfer unit used on that program will be redesigned by NBS, as a single dewar of the required capacity and a model of this design will be procured in FY78 for the planned test series. When the new aircraft-qualified system is assembled it will be launched early in FY80 over the WSMR at 25,000 ft. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, IONOSPHERIC MONITORING TECHNIQUE REFINEMENT

W.N. Hall, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580960)

AF function - communications, surveillance and navigation at high altitudes. Deficiency or opportunity - ground-based ionospheric and geophysical data inputs to the space environmental support system (SESS) are being squeezed by increasing costs and decreasing resources. Objective - to develop methods to transform remote ground-based ionospheric and geophysical measurements into forms suitable for convenient, automatic use by SESS and Air Force systems. How research contributes - automation of the functions of AF and contractor observers would reduce the cost of acquiring ground-based ionospheric and geophysical data inputs to SESS. Automation would counteract recent cost increases, prevent further loss of ground-based data sources, and increase the quantity and quality of ionospheric and geophysical data input to SESS.

The procedures used by the observers for reducing and reporting SESS data will be defined and analyzed. Analytical algorithms for automating the data reduction will be developed by computer simulation. The analytical algorithms will then be adapted for implementation in firmware in mini- or microcomputer systems. A SESS data communicator (SESSDAC) prototype will be developed under AFGL laboratory director's fund project ILIR8B. This will be a parallel effort to develop a hardware system for implementation of the analytical algorithms. The prototype will be applicable for use at all AWS sites reporting SESS data to AFGWC. The use of existing sensor systems, comm links, and data message formats will minimize the effort by AWS to utilize the automatically analyzed SESS data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, NORTHERN LATITUDE PLASMASPHERIC VARIABILITY

J.J. Klobuchar, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580870)

AF function - time delays in satellite navigation detection and tracking systems. Deficiency - the day-to-day variability of the ionosphere and the unknown contribution of the plasmasphere are not adequately represented by current models which have errors of up to 25 percent RMS. The plasmasphere can contribute greatly to this variability. Objective - determine the variability of plasmaspheric electron content in the northern latitudes, its correlation for pairs of stations and the extent to which it can be predicted or associated with other geophysical parameters. How research contributes - the contribution of the plasmasphere to total time delay produced on satellite radar and navigation systems can be large. The unknown behavior of the day-to-day variability of the total time delay is the greatest remaining error source in models of range error used by ADCOM in satellite detection radars and in the single frequency mode of the NAVSTAR/GPS satellite navigation system.

Using data already available from three northern mid-latitude stations, and additional data to be taken at a station near the peak of the equatorial anomaly, the day to day variability of the plasmaspheric electron content will be examined to determine the correlation between pairs of stations. Comparisons will also be made with other geophysical parameters to attempt to find the source of this variability from monthly average behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, HF RECEIVER AND TRANSMITTER DEVELOPMENT

H. Laping, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582780)

AF function - advance balloon systems for surveillance, reconnaissance, communications telemetry, command, environmental research. Deficiency - the existing equipment was designed in the early 60's. Reliability and age was starting to become a problem. Objective -design, develop and flight test an HF command receiver and data transmitter incorporating the latest solid state devices and modern filter technique. These components will be included in a standard balloon control instrument package to enhance reliability and system power source uniformity. How research contributes - with a standard flight control system that has been advanced to the state-of-the-art, the current need for special control systems on many of the balloon research flights will be reduced or eliminated. This will result in both dollar and manpower savings. The use of an HF command and data system is not limited to line of sight balloon flights.

A dual channel, dual conversion, narrow bandwidth HF command receiver incorporating the latest integrated circuits and transistors will be designed, bread-boarded and tested in-house by AFGL personnel. Also, an 8 watt HF data transmitter meeting all FCC specifications will be designed, bread-boarded and tested in-house. The transmitter will be able to withstand any voltage standing wave ratio with stable frequency output. In conjunction with the transmitter a matching network will be designed to transform the antenna impedances to 50 ohms so that the transmitter can be used with any length of 50 ohm coaxial cable and tedious tune-up procedures will be eliminated. From the in-house design, final flight models will be developed and tested under contract. The final units will be integrated into a standard balloon flight instrument and flight tested by AFGL

personnel. A technical report will be the end product of the IHWU.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, FEASIBILITY OF AUTOMATING TACTICAL WEATHER OBSERVATIONS

E. Moroz, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583000)

AF function - launch and recovery of aircraft in tactical environment. Deficiency - AF lacks capability to obtain meteorological measurements important to tactical air operations and to automate them. Objective - to investigate application of meteorological sensors for tactical operations and to determine the feasibility of automating standard tactical AF weather observing equipment. How development contributes - investigation will provide an assessment of the potential for automating tactical weather information.

The availability of instruments and techniques for determining weather parameters such as visibility and cloud height for AF tactical operations will be determined. Methods of automating the operation of standard tactical weather equipment such as the AN/TMQ-15-wind measuring set, AN/TMQ-20-temperature/humidity measuring system and the Army's remote automatic weather system (RAWS) will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, DETERMINATION OF STRATOSPHERIC WINDS AND TURBULENCE AS A FUNCTION OF LATITUDE USING PHOTOS OF SMOKE TRAILS

A.F. Quesada, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581160)

AF function - to gain quantitative understanding of stratospheric dynamics needed to predict environmental effects of AF aircraft and missile operations in and through the stratosphere. Deficiency -reliable prediction of emission effects from supersonic aircraft and missile operations is not available due to paucity of measurements of parameters that determine transport processes in the stratosphere. Objective - to measure parameters that characterize stratospheric dynamics in order to develop models that will accurately predict dispersal rates and residence times of materials injected into the stratosphere. How research contributes - will provide the data to define and model transport mechanisms.

Photographic observations of upper atmosphere or stratospheric smoke releases provide data relevant to the physical state and motion of the stratosphere or lower thermosphere. Of special interest are smoke trail positions, drifts, and growth, from which ambient winds, wind shears and divergences are determined by photographic triangulation. The results of these studies provide improved physical models of the atmosphere in the natural and disturbed state, as well as data on winds, wind shears and turbulence at supersonic aircraft operating altitudes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, STATISTICAL ATMOSPHERIC OPTICAL MODELS AND WEATHER

E.P. Shettle, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583110)

AF function - reconnaissance, communications, surveillance, guidance, target acquisition and tracking. Deficiency - the performance of any electrooptical system looking through the atmosphere is significantly degraded by atmospheric light scattering and absorption. Therefore, it is dependent in a complex way on the variability of the state of the atmosphere in the theater of operation. Objective - develop operational models of the atmospheric effects on the propagation of optical/IR radiation, especially the properties of the atmospheric particulates, and the scattering properties of the atmosphere. How research contributes - development of such models of the atmospheric aerosol properties will lead to an improved ability to model and predict the effects of the atmosphere on the performance of E/O systems. Examples of such effects include the modeling of the slant path contrast reduction which limits the operational capability of precision guided munitions, or predicting the probability of detecting laser systems from off-axis scattering of the laser beam.

Develop or update models of the atmospheric aerosol optical properties based on such inputs as the experimental efforts under this project (7670), and the analysis and correlation studies carried out under CWU 762111AF. These new models will include an optical climatology of Europe and statistical characterization of the properties of atmospheric aerosols and their relation to meteorological conditions. The models will be refined for use in optical propagation programs such as LOWTRAN or the contrast transmission computer codes. These models with the propagation codes can be used to derive nomograms or analytic expressions for the prediction of atmospheric effects on E/O systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, SCATHA LOW ENERGY PLASMA ANALYSIS

M. Smiddy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583230)

AF function - surveillance, communication, navigation and spacecraft charging. Deficiency - inadequate knowledge of the electrical properties of the magnetosphere and of the interaction of a satellite with the environmental plasma at synchronous altitudes. Objective - to determine the role of low energy particles in spacecraft charging at synchronous altitudes. How research contributes - permits improved military space vehicle design for communication and surveillance systems. Provides understanding of dynamical processes in the magnetosphere and contributes to the understanding and solution of spacecraft charging problems.

The data from low energy sensors flown aboard the SCATHA, P78-2 satellite will be analyzed and synthesized to distinguish the major sources of low energy particle flow to, and from the vehicle. The effects that ion/electron gun operation and spacecraft eclipse conditions have on the vehicle potential will be determined. Special coordinated studies will be carried out to investigate current flow and vehicle charging in disturbed conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, ATMOSPHERIC RESPONSE TO LATITUDINAL VARIATION OF TURBULENCE

S.P. Zimmerman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582860)

AF function - communications, satellite surveillance and satellite orbit prediction. Deficiency - inadequate knowledge of the upper atmosphere, particularly its response to natural and man-made disturbances. Objective - to measure turbulent transfer coefficients in the atmosphere and to develop improved theoretical neutralionic model atmospheres. How research contributes - following solar proton events and nuclear detonations, radio communications are interrupted and missiles and satellites are lost from radar view. Improved models that can predict ionospheric perturbation effects can aid in the improvement of communications and tracking of vehicles. Improved models of the neutral atmosphere will result in more accurate predictions of system satellite ephemerides.

The latitudinal variation of measured turbulence, in conjunction with atmospheric pressure gradients and gravitational forces, controls the behavior of the mean mass motion in the thermosphere. This in turn affects the in situ variations of the neutral constituents as well as the ionic species which are also controlled by the earth's magnetic field. To examine the atmospheric response to these stimuli and to other perturbations such ion turbulence, a three-dimensional model of the structure and dynamics of the mesosphere and thermosphere will be developed. Concurrent with this effort, an existing one-dimensional neutral ionic atmospheric model will be used to examine ther-

mospheric effects of turbulence over northern latitudes and over the equator.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, THE ASSEMBLY AND CATALOGING OF MICHIGAN RESOURCE DEVELOPMENT DATA

W.J. Kimball, Michigan State University, School of Natural Resources, Dept. of Resource Development, *323 Natural Resources Bldg., East Lansing, Michigan* 48824 (0059362; MICL01093)

OBJECTIVE: Identify appropriate resource planning and development procedures for Michigan; assemble and catalog pertinent Michigan land use information along with other information relating to resource situations and uses, and conduct a pilot project which will explore the potential use of remote sensing data as a guide for land use analysis and planning.

APPROACH: Data assembled in 1966 on county and district land use patterns in Michigan will be updated. Multiple-sensing prints for Sumpter township in Wayne County (available at the Willow Run Laboratories) will be analyzed and the findings will be used for land use planning purposes. Emphasis also will be given to the continued assembly, cataloging and development of Michigan resource development data.

PROGRESS: Numerous units of state government were contacted for new data toward updating the County and Regional Factbooks. Cooperative arrangements were completed with the Michigan Office of Intergovernmental Relations for updating the three Michigan Upper Pennisula regional factbooks. Exploration is underway for further county and regional data assembly and distribution possibilities. Various personnel involved in this project and two other related Department of Resource Development research projects are considering combining the three in a general project which might be titled 'Developmental Data for Local and Regional Decision Making.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Michigan

5.0034, NAVY ENVIRONMENT - SIMULATIONS OF OCEANOGRAPHIC FLUCTUATIONS IN THE NORTH PACIFIC OCEAN

S. Jacobs, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (DN223750; N00014-76-C-0141)

Large-scale long-term variability in the temperature structure of the upper ocean has a pronounced effect on acoustic propagation conditions and hence on our surveillance systems. The objective of this project is to develop a dynamic ocean model using numerical techniques which will simulate and forecast the sea surface temperature, transport, and surface heat balance resulting from large scale atmospheric heat flux anomalies in the North Pacific Ocean. This project is an integral part of the North Pacific Experiment (NORPAX).

Because observed atmospheric data are used to 'drive' the ocean forecasting model, it is necessary to compile, analyze, and condense appropriate information such as solar radiation, humidity, air-sea temperature differences, surface winds, etc. The ocean forecasting model itself utilizes fundamental hydrodynamic principles and is programmed for a computer. Because observed oceanic data is used to test the model, it is necessary to compile appropriate information.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0035, THE FORMATION, MAINTENANCE, AND CLIMATIC EFFECTS OF WEST COAST SEA STRATUS

J.W. Telford, University of Nevada, System Office, Desert Research Inst., Atmospheric Sciences Center, *Reno, Nevada* 89507 (ATM77-16321)

The objective of this research is to use an instrumented aircraft to gather cloud microphysical properties and radiative fluxes of stratus clouds so as to examine in detail the latest models and thinking related to the formation and persistence of ocean stratus and fog.

Special emphasis will be made on the role of radiation and cloud top mixing processes on the development and persistence of these clouds.

During the initial stages of this program, the efforts will be primarily to install, calibrate, and test the performance of cloud physics and radiation instruments aboard the DRI research aircraft.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0036, AN INVESTIGATION OF ELECTRIC FIELDS IN THE TIME-DEPENDENT MAGNETOTAIL

C.H. Murphy, Kean College of New Jersey, Graduate School, Dept. of Earth & Planetary Environment, *Morris Ave., Union, New Jersey* 07083 (ATM78-11763)

The research supported here is an extension of work carried out under NSF Grant ATM75-17342#1. The objective of the research is to obtain a clearer understanding of the temporal behavior of the electric field in the earth's magnetotail. Of special interest is the induced electric field and its relationship to electric fields produced by charge separation.

It is recognized that the magnetotail is a composite of several different modes of current conduction, and the role of the electric field in driving these currents varies. Hence, the temporal behavior of the electric field may well be different in the various regions of the magnetotail.

This work proposes to study the major current modes in the tail and solve them for the time-dependent case. Previous work on a simple neutral sheet model has added considerable insight to this approach. All systems will be solved self-consistently so that neither the induced or charge separation components of the electric field will be ignored.

After the separate elements of the tail current system have been studied, it will be necessary to tie them together in a reasonable fashion to simulate to total tail current. This synthesis will be done in the context of a model that will allow the variation of the electric field in the tail to be related to conditions external to the magnetosphere, i.e., solar influences.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0037, SOME DYNAMIC AND RADIATIVE EFFECTS OF THE SAHARAN AIR LAYER - A CONCLUSION

T.N. Carlson, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (ATM76-14518 A01)

The objective of this research is to complete a project that studied the effect on the atmosphere of Saharan dust outbreaks during the GARP Atlantic Tropical Experiment (GATE). The first and completed phase of this project was devoted to an analysis of solar radiation and aerosol measurements, a determination of the radiative properties of the aerosol, and a description of the large scale aerosol mass loading during several Saharan dust outbreaks using satellite visible brightness measurements. In this final phase the net (solar and infrared) aerosol heating rates will be estimated. The balanced vertical motions will be computed, both with and without radiative forcing, from large-scale wind analyses for three case studies in order to describe the effects of the Saharan air layer and dust on the overall dynamics of the tropical atmosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

5.0038, NAVY ENVIRONMENT - RADIANCE AND POLARIZATION OF LIGHT IN THE OCEAN

G.N. Plass, Texas A & M Research Foundation, Dept. of Oceanography, *Faculty Exchange Box H, College Station, Texas* 77843 (DN123231; N00014-75-C-0537)

Optical systems designed for remote sensing and surveillance, submarine detection and communication, search recovery operations, and sea floor inspection requirements are all critically dependent on a thorough understanding of the optical properties of sea water and the nature of the background illumination in the ocean. This task will examine and model the radiance and polarization of light in the ocean.

Monte Carlo and matrix operator techniques are used to calculate theoretical models of photon interactions from natural sunlight and artificial sources for coupled atmosphere-ocean systems. Scattering and absorption by aerosols, hydrosols, atmospheric and water molecules; reflection and refraction at the atmosphere-water surface; surface wave effects; and polarization effect are all included in the numerical models. These calculations predict the effect of wavelength solar angle, hydrosol size, and ocean waves on the distribution of the intensity and polarization of light in the ocean.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0039, FRONTS AND CYCLOGENESIS OVER THE GULF OF MEXICO

W.K. Henry, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Meteorology, *College Station, Texas* 77843 (ATM76-22282)

The major objective of this research is the compilation of a synoptic climatology of fronts for the Gulf of Mexico. Such a compilation, drawing upon data from North, Central and South America, would provide an improved formulation of synoptic events in the Gulf. Particular emphasis will be given to type of front, distributions of observed cloud and weather, the existence and nature of cyclogenesis, and the return flow problem. The results are expected to make a contribution to both synoptic meteorology and weather forecasting.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0040, THE LATITUDINAL DISTRIBUTION OF IONOSPHERIC ABSORPTION

H.J. Chivers, Utah Higher Education System, Utah State University, Graduate School, *Main Bldg., Room 132, Logan, Utah* 84321 (ATM76-17762)

This grant will support a program of analysis of the data from the latitudinal chain of riometers to be operated in Alaska during the period of the International Magnetospheric Study (IMS). This network of stations already exists in a primitive form and is about to be expanded to higher latitudes with improved instrumentation so that high-quality digital records will be obtained. Since the new riometers which will be used will have a fast response time, emphasis will be placed on the analysis of the fine structure of auroral absorption events. Recent studies of absorption events recorded with the Alaskan chain have shown that there are probably two significant components to each absorption event. These components tend to move at different velocities in the latitudinal direction, and, in fact, the components have been observed to move in opposite directions. These movements can be related to corresponding movements in the magnetosphere following solar disturbances and the movements have been used to derive a value for the electric field of the magnetosphere. The main result expected will be to show to what extent the short period variations of absorption take part in the complex latitudinal motion of absorption. In addition, a class of fast isolated events associated with relativistic electron precipitation has been identified, and these can be used in conjunction with observations using the Chatanika radar facility to investigate magnetosphere dynamics. This award represents a small but important part of the coordinated activities to be performed under the IMS.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0041, RESEARCH IN ANTARCTIC METEOROLOGY

W. Schwerdtfeger, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DPP77-04506 A02)

This project is a continuation of NSF Grant Number DPP 7704506. It involves research into four aspects of the synoptic meteorology of Antarctica, using historical data, present-day U.S. and foreign synoptic observation, and satellite measurements. The research will focus initially on the tropospheric moisture transport into East Antarctica and on the atmospheric driving forces of the Weddell Sea gyre, then continuing into an investigation of strong terrain-induced surface winds and cold-air jets in the atmospheric boundary layer. No logistics support required since no field work will be done.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0042, OPERATE GOOSE BAY IONOSPHERIC OBSERVATORY

J. Kelsey, Canadian Commercial Corp., *Hull, Quebec, Canada* (DF582450; F19628-79-C-0035)

AF function - Air Weather Service (Military Airlift Command) space environmental support system (SESS). Communications, surveillance, and navigation at high latitudes. Deficiency - natural disturbance in ionosphere and upper atmosphere which affect AF systems are inadequately known. Real time input data essential to SESS. Objective - operate and maintain the Goose Bay Ionospheric Observatory (GBIO). Analyze SESS data and report to Global Weather Central (AFGWC). How research contributes -the research data provided by the contractor to AFGL is essential in understanding ionospheric, magnetospheric, and upper atmospheric processes which impact existing and proposed AF and other defense systems. Real time SESS input data is essential to AWS support of SESS customers. GBIO data will be used in the systems performance test of the 4141 over-the-horizon experimental radar system (ERS).

The contractor provides technical personnel to operate and maintain ionospheric vertical and backscatter digital ionosondes, magnetometers, riometers, radio polarimeters, and satellite signal monitoring systems. Data analysis reduce real time ionospheric and geophysical data and report these data to AFGWC for SESS. GBIO will be used to evaluate methods and systems for automation of the analysis and reporting of SESS data. An ionogram communicator will be installed to transmit digital ionograms in real time to the 4141 ERS receive/operations site in Maine.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, OAS DISPLAY SIMULATION

P. Narveson, Sperry Rand Corp., *P.O. Box 2529, Phoenix, Arizona* 85002 (DF325440; F33615-79-C-0524)

This contract will develop simulated offensive avionics system (OAS) display formats. These are necessary to perform an evaluation of the phase I OAS controls and displays proposed for the avionics update to the B-52G/H in response to SAC-ROC 6-75.

A programmable display generator system (PDGS) was obtained from Sperry Flight Systems through Boeing Wichita Company under a previous contract. This hardware is an upgrade to hardware now being used by Boeing for similar simulations and is architecturally comparable to the radar scan converter and display electronics unit being designed for the aircraft. The Boeing software will be modified (because the instructions sets are different on their PDGS vs. AMRL's) and extended (to include additional formats not needed by Boeing that are required for Phase I OAS evaluation).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0002, MAN/MACHINE INTERFACE MODEL
H.R. Jex, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF325150; F33615-79-C-0519)

Vibration environments encountered in some aircraft mission profiles can seriously degrade the performance of essential aircrew tasks. The amount of degradation in performance is influenced by the manner in which the crewman is interfaced with his controls and displays. The objective of this contract is to provide designers with the tools for optimally selecting seat-back angles, display viewing angles and distance, arm rest and control stick arrangements, and other interface variables so as to minimize the deleterious effects of vibration on task performance such as tracking and aiming.

The approach under this contract is to utilize computer modeling and display techniques to determine what would otherwise require expensive and time consuming experimentation with a variety of cockpit mock-up configurations on complex vibration facilities. The contractor will deliver a user-oriented computer programming package that will demonstrate such interface optimization methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0003, DEVELOPMENT OF DESIGN CRITERIA FOR RAPID PRE-EJECTION CREW RESTRAINT
L.J. Specker, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322370)

Injuries resulting from exposure to aerodynamic forces during emergency escape using open ejection seats are a major problem. The solution requires both ejection seat stability and limb restraint and both are interrelated, i.e., the lack of one will aggravate the other. The restraint system must provide complete protection during escape but not encumber the crewmen during normal flight and thus compromise the mission. Furthermore, in multiplace aircraft restraint must be quickly and automatically applied on pilot command to properly preposition and protect crewmen who are not prepared to eject. The objective of this research is to define design criteria for mechanisms which will automatically position and restrain crewmen in an optimum body posture for safe emergency escape. The criteria will include minimum actuation times, maximum retraction forces and velocities, and body segment restraint sequencing timing.

Experiments will be conducted using a special test fixture consisting of an ejection seat mockup and a system of hydraulically actuated devices which can independently or sequentially retract shoulder straps, lap belt arm restraint, and leg restraint. Volunteer subjects will be automatically restrained utilizing varying initial body positions and retraction speeds. Retraction force-time histories, impact forces and body segment accelerations and trajectories will be measured during each test. Data collected during these tests will be studied using a mathematical model of the human body, the restraint system, and the retraction device. The mathematical analysis will permit a parametric analysis of the restraint system design criteria and prediction of injury modes as well as performance of the protection system under adverse flight conditions. The resulting design criteria and analysis will be provided to the aeronautical systems division for incorporation into system development specifications and the AFSC design handbook series.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0004, ADVANCED DISPLAY CONCEPTS
H.L. Task, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325530)

This work unit will examine recently evolved technology for potential application to new display approaches that take advantage of reduced weight, improved form factor, increased field-of-view or any of the myriad of such factors as can contribute to improving the interface of displayed information to the operator. The effort is partially aimed at establishing techniques that can be applied by ASD to the development of an operational helmet mounted display (HMD) in the post-1980 time frame. Efforts will be directed toward exploitation of advanced technology. Specific emphasis will be placed upon alternatives to panel mounted displays for the cockpit environment.

A comprehensive technical survey will be made to include fiber optics, image conduits, various image sources and any other promising technologies that appear applicable. Laboratory work will be conducted to examine the utility of selected survey results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0005, SELECTION FOR NAVIGATOR TRAINING
H.E. Jensen, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234220)

Identification of characteristics of superior navigators in operational roles, investigation of experimental cognitive and non-cognitive measures, the recommendation of improvements in the UNT screening battery.

Newly revised navigator training program will be reviewed. Approximately 300 UNT candidates will be administered a battery of psychomotor, perceptual, and information processing tests as well as the AFOQT. These measures will be examined in light of subjects' performance in UNT, CCTS, and in an operational role. Exit interviews will be conducted with those who are dismissed from either UNT or CCTS and aircraft assignment preferences will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0006, DEVELOPMENT OF A READING ABILITIES TEST FOR AF PERSONNEL
J.J. Mathews, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF232980)

To develop, validate and norm two forms of a standardized diagnostic reading/comprehension test. The target population will include enlisted, officer, and civilian AF personnel. The test will be cross-referenced with several commercial instruments. The stability of reading skill improvements overtime will be assessed. This work, in part, supports an AF/DA program to make Air Force publications more comprehensible.

Technically-oriented, multiple-choice test items will be developed and pre-tested. Separate scales for comprehension, vocabulary, and interpretation or generalization will be devised. Two levels of the test may be needed to cover the range of abilities in the population. One would be a high school version with a reading grade level (RGL) average of about 11 and a range of 4 to 14. This would be appropriate for most enlisted personnel. A college version would have an average RGL of about 14 and a range of 9 to 17. This would be appropriate for measuring officers' RGLs. Initial RGL estimates of enlisted personnel will be based on commercial tests and ASVAB scores. Preliminary data will also be obtained for officers on a commercial test. The AF reading test developed will be validated against technical training and officer training programs. Norms will be developed from cross-sections of enlisted, officer, and DAF civilian personnel. Reading evaluations will be performed for BMT remedial reading classes and comparisons will be made between RGLA of airmen in BMT and at two and four year points of initial service. Milestones - reading test item development, 1 Apr 77 to 1 Nov 77, obtaining commercial tests, 1 May 77 to 1 Oct 77, testing on commerical tests, 1 Oct 77 to 1 Jan 78, AF test assembly and printing, 1 Oct 77 to 1 May 78, commercial test-ASVAB analysis, 1 Jan 78 to 1 Mar 78, draft first tech report, 15 Feb 78 to 1 May 78, AF test validation, 1 May 78 to 1 Dec 78, AF test norming, 1 May 78 to 1 Apr 79, BMT reading evaluation, 1 Jan 78 to 1 Mar 79, 2 yr, 4 yr reading evaluation 1 Jun 78 to 1 May 79, draft final tech report 1 Mar 79 to 1 Sep 79.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0007, CONDUCT FIELD VALIDATION OF NOISEMAP

P. Oncley, Man Acoustics & Noise Inc., *Seattle, Washington* 98103 (DF324650; F33615-79-C-0513)

NOISEMAP is the computerized noise prediction procedure that forms the cornerstone of the USAF air installation compatible use zone (AICUZ) program. The AICUZ program is used by the Air Force to bed down new weapons systems, select facility sites, evaluate existing operations and determine the land use compatibilities of all USAF bases with the neighboring communities. The objective of this contract is to further assess through long-term field measurements the overall ability of NOISEMAP to predict the yearly averaged noise environments produced by aircraft operations for the wide variety of missions and airbase locations within the Air Force as a whole. In cases of extreme controversy or litigation over environmental assessments for AF operations, these long-term field measurements will provide further evidence of the ability of NOISEMAP to predict the noise environments from AF operations.

This contract is to conduct long-term field measurements of total noise exposure at several locations around one or two USAF bases and compare these measured values with those predicted by NOISEMAP. This effort will be accomplished as follows: (1) the contractor shall develop a written plan delineating the exact number, location and schedule of rationale for each, (2) this plan will be submitted to AMRL for review and final written approval before any measurements are made, (3) the contractor will conduct the long-term measurements of total noise exposure and analyze the field data in accordance with the approved plan, (4) the contractor will submit a final report presenting the acquired data, comparisons with the NOISEMAP predicted values and final conclusions about NOISEMAP's overall effectiveness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, THE DYNAMICS OF GRAVITATING SYSTEMS

C. Hunter, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Mathematics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (MCS77-28148)

Continuation of MCS-7506177. This research deals with five problem areas concerning the dynamics of galaxies: 1) calculating large scale modes of oscillation of disc galaxies, 2) the stability of galaxies, 3) the underlying structure of galaxies, and the significance of approximate integrals of motion, 4) a re-examination of the bending of otherwise flat galaxies, and 5) the dynamics of the process of fragmentation by which groups of stars may be formed.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0002, CLIMATIC DATA COMPACTION AND RETRIEVAL

P.N. Somerville, State University System of Florida, University of Central Florida, School of Arts & Sciences, Dept. of Mathematical Sciences, *P.O. Box 25000, Orlando, Florida* 32816 (DF248890; F19628-77-C-0080)

AF function - support weather sensitive Air Force and Army missions. Deficiency - current military mission planning requires a more expeditious recall of basic climatic probabilities than is presently available. Development - apply statistical theory and computer methods to the climatic records. How development contributes - will contribute to a military capability to expeditiously assess the climatic influence on a mission and avoid underestimations of risk of operation anywhere worldwide.

The approach is statistical, to adapt analytical models and algorithmic computer methods, so that they can be used to compress historical records of weather events. Retrieval of information is made in probability terms. Weather elements to be investigated will include ceiling, visibility, winds and precipitation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXPERIMENTAL AND THEORETICAL STUDIES OF LATTICE DYNAMICS

J.B. Page, Arizona State University, School of Liberal Arts, Dept. of Physics, *Tempe, Arizona* 85281 (DMR77-06809 A01)

Continuation of research supported by DMR 75-10414.

The research proposed consists of a number of experimental and theoretical projects in the following four areas: (1) High-pressure Brillouin scattering studies of molecular crystals, particularly the disordered-partially ordered phase transitions in KCN and NaCN. (2) Correlation spectroscopy studies on biological systems, concentrating on diffusion of macromolecules, reorientation phenomena of lattice defects possessing electric and elastic dipoles, and elementary excitations in an analog of the Wigner crystals. (3) Theoretical studies of the anharmonic properties of very low frequency impurity-induced phonon resonances. The initial concern will be anharmonic effects on defect-host coupling and isotopic frequency shifts. Effects of temperature, applied stresses and applied electric fields will then be studied. An investigation of defect-induced ferroelectric phase transitions will also be made. (4) Impurity-induced resonance Raman scattering. The general theory of resonance Raman scattering from impurities having strongly phonon-broadened electronic absorption bands will be studied with respect to the validity of the Born-Oppenheimer and Condon approximations. Ab initio calculations of F center electron-phonon coupling coefficients will be carried out and used as a basis for calculating K band, L band and multi-phonon contributions to the Raman spectra. Studies will also be made of resonance Raman scattering from systems having well-resolved vibronic structure in the optical absorption bands.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, EXPERIMENTAL OSCILLATOR STRENGTHS IN HIGHLY IONIZED ATOMS

S. Bashkin, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (PHY78-09138)

This grant will support an experimental program in atomic physics research at the University of Arizona. The proposed experiments involve determination of experimental oscillator strengths (transition probabilities) of the lowest-lying n equals O transitions in highly-charged ions with one or two electrons outside closed shells. The particular ions to be studied are: Li-like Kr plus 33 and Rh plus 42, Be-like Kr plus 32 and Rh plus 41, Cu-like Br plus 6 and Kr plus 7, and Zn-like Br plus 5 and Kr plus 6. The oscillator strengths will be obtained from beam-foil mean-like and wavelength measurements performed at the University of Arizona Van de Graaff Laboratory and at the University of California Lawrence Berkeley Laboratory Super-HILAC. The purpose of these experiments is to provide data to test fundamental theory: 1) general calculational technique in the case of the Cu- and Zn-like systems and 2) accurate relativistic calculations of atomic wave functions in the case of the three and four electron systems. In the latter case, relativistic effects play a major role rather than constituting a small perturbation. Further, the scientific measurements proposed are of immediate, direct interest in both astrophysical studies (solar flares) and the controlled thermonuclear fusion program.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0003, EXPERIMENTAL RELATIVITY BY DAYTIME ASTROMETRY AT SCLERA

H.A. Hill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (PHY77-08200 A01)

Research will continue on measurements of the low-frequency solar oscillations discovered recently, and on the definition of the sun's edge. In parallel, the daytime tracking of stars and planets will continue, to determine the gravitational deflection of light passing close to the sun.

This work is a continuation of that currently supported under NSF grant PHY75-11190 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0004, PROPERTIES OF CONDUCTION ELECTRONS IN METALS

R.W. Stark, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DMR77-03683 A01)

This research program will be directed to experimental studies of lifetimes and Fermi surface effects for electronic transport in pure or nearly pure metals. The first of these studies relates to experiments on electron quantum states having very long quantum state lifetime in magnesium. The now well understood electron quantum interference effect in magnesium will be used to measure the effect of electron-electron and electron-phonon scattering on the quantum state lifetime. Also, this effect will be used to investigate alloy effects in the concentration (C) range of 0.1 ppm less than C less than 20 ppm. Another ramification of the very long quantum state lifetime for electrons in pure magnesium which will be investigated is Pippard's magnetic band structure generated by magnetic breakdown for critical directions of the magnetic field. The second principal area of research centers around measurements of the de Hass-van Alphen effect in ferromagnetic nickel. The basic measurements of the de Haas-van Alphen spectrum for nickel will be completed in order to determine the complete Fermi surface. Also, the effective cyclotron masses will be determined on this surface. This latter data will be used to determine the two spin densities-of-states for nickel as well as obtain information about the many-body electron magnon renormalization effects.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, CONFIGURATION-DEPENDENT PROPERTIES OF POLYMERIC CHAINS

P.J. Flory, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (DMR76-20638 A02)

This study falls in the general area of configurational statistics of chain molecules. This is a renewal of NSF Grant DMR73-07655. The focus has shifted somewhat from the treatment of characteristics such as the average mean square distance (R2) and the average square of the radius of gyration (S2) that represent the long polymeric chain as a whole to properties having a more local character. The study might be divided into three parts.

Part I of the study concerns the formation of cyclic molecules from acyclic chains. The peculiar dependence of the cyclization tendency on ring size has long been known and experimental results are available on a number of systems. Explanations will be sought for the conformation characteristics of the acyclic chain sequence and in the statistical probability that the ends of the sequence meet in a conformation with their terminal bonds in acceptable mutual orientation.

Part II comprises investigations of optical anisotropy -depolarized light scattering, electric birefringence and strain birefringence - of oligomers and polymers. These methods are sensitive to conformation and to stereochemical structure.

Part III will explore the use of synchrotron X-radiation, uniquely available in high intensity at the Stanford Synchrotron Radiation Facility, for small-angle scattering studies on polymer solutions. Initial work will be directed at the intermediate range of scattering wave vectors, (4 pi over lambda) sin (theta over 2) equals 0.01 to 0.5, suitable for probing correlations between relatively short sequences of the chain.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0006, LINEAR AND NONLINEAR OPTICAL EFFECTS IN LIQUID CRYSTALS

Y.R. Shen, University of California, Berkeley Campus, School of Engineering, Dept. of Physics, *Berkeley, California* 94720 (DMR78-18826)

Lasers are devices capable of producing extremely high intensity pulses or beams of light. Some lasers can produce pulses so intense that they are capable of melting steel or of other effects called 'second order effects'. Liquid crystals, on the other hand, have extraordinary electrical and optical properties, as evidenced in their use as temperature indicators (a small change in temperature produces a change in color) and as LCD (liquid crystal display) devices (where an electric field changes the optical properties). The thrust of Professor Shen's work is to examine the interaction between the very intense fields generated by laser light and the liquid crystals. The extent of interaction can be subtly varied by changing the temperature of, or static fields appled to, the liquid crystals, facilitating obtaining information on both liquid crystals and the nature of interactions with very intense light.

Research, supported under DMR 76-19843, on linear and nonlinear optical effects in liquid crystals is being continued with a new set of experiments involving stimulated Raman and Brillouin scattering, wavelength dispersion of optical-field-induced ordering, self-focusing in active medium, second harmonic generation, optical-field-induced transitions, and/or alloying effects. The results should give a better understanding of properties of liquid crystals, of the general features of various nonlinear optical effects, of the characteristics of phase transitions, and of impurity and alloying effects on materials.

This is a continuation of work supported by DMR76-19843. It is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, ELECTRONIC STRUCTURE AT INTERFACES

S. Schultz, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR77-22781 A01)

This experimental research program is a continuation and extension of work initiated under grant DMR-7424361. Experiments will be done to further our understanding of electron spin dynamics in metals using the microwave transmission technique as a probe of the interface properties of metals. A new long-term project in semiconductor-related research will be initiated. The initial experiments are designed to study the spin transport and electronic properties of the metal semiconductor interface over a broad range of semiconducting properties. Particular attention will be paid to the high dopant regime which yields ohmic contacts. Basic experiments relating to the interface properties of a photovoltaic cell will also be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, NONLINEAR MIXING SPECTROSCOPY OF CONDENSED MEDIA

M.D. Levenson, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR77-11326 A01)

The experimental investigations of the nonlinear optical properties of condensed matter previously supported by NSF grant DMR-7614881 will be further developed and extended in new directions. The three-frequency coherent Raman spectrometer will be upgraded and its unique capabilities exploited to extract the signatures characteristic of specific physical processes while rejecting the artifacts generally present in the coherent anti-Stokes (CARS) technique and the Raman-induced Kerr

effect (RIKES) technique. Topics for detailed study include: resonance effects in the Raman and electronic contributions to the nonlinear susceptibility tensor; relaxation effects in inhomogeneously broadened one- and two-photon electronic transitions on the picosecond and sub-picosecond time scale; and spatial dispersion in the effective third-order nonlinear susceptibility tensors in crystals lacking a center of inversion symmetry and in other systems in the region of a phase transition.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0009, NMR STUDY OF AN ADSORBED GAS SYSTEM

R.J. Rollefson, Wesleyan University, School of Liberal Arts & Sciences, Dept. of Physics, *Middletown, Connecticut* 06457 (DMR74-23110 A01)

This is a continuation of work funded under DMR74-23110. An NMR study will be made of adsorbed 3He films on highly uniform substrates of MgO. The range of temperature and coverage will be extended. Adsorbate dynamics will be examined in the various phases and in transitions between phases.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0010, RELATIVISTIC AND EXCHANGE EFFECTS IN NONMETALLIC COMPOUNDS

D.E. Ellis, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics & Chemistry, *633 Clark St., Evanston, Illinois* 60201 (DMR77-22646)

The relativistic Dirac-Slater one-electron theory will be generalized to include exchange polarization of open shell systems in a self-consistent framework. This theory will provide a simple unified treatment of spin-orbit and orbital polarization effects. Computational methods, which have been developed for atoms and molecules, will be applied to study the energy levels, charge and magnetization densities for nonmetallic compounds of the heavy transition metals and rare earths. The theoretical results will be compared with Mossbauer isomer shift and hyperfine data, photoelectron spectra, and neutron magnetic form factors.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0011, EXPERIMENTAL STUDIES OF MAGNETIC AND DENSITY WAVE INSTABILITIES

P.M. Horn, University of Chicago, School of Physical Sciences, Dept. of Physics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (DMR78-20601)

Experiments will be carried out on a number of systems which undergo magnetic and density wave instabilities. Some one-dimensional magnetic chain compounds will be examined by x-ray scattering techniques to look for a 'Spin Peierls' transition in which the magnon-phonon interaction gives rise to a density wave. X-ray scattering experiments will also be used to study the liquid-solid phase diagram for adsorbed monolayers of krypton and xenon on graphite surfaces. The results will be compared with the predictions of well-known two dimensional models.

Specific heat and magnetic susceptibility experiments will be carried out on iron chloride-cobalt chloride mixtures to examine critical point instabilities. Iron chloride is an antiferromagnet with spins which point along the crystalline c-axis while in cobalt chloride, the spins lie in the plane perpendicular to the c-axis.

This is a renewal of work previously supported by DMR 7514360, the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0012, SYNCHROTRON RADIATION STUDIES OF IMPURITIES INTERACTING WITH METALS

C.P. Flynn, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR77-27942)

A dual beam differential absorption apparatus will be built to make efficient use of large photon fluxes available from synchrotron storage rings in the study of the properties of materials. Initial research applications of the new equipment will be concerned with impurities interacting with metals. Impurities in metals, on metal surfaces, and at interfaces between two materials will be investigated. The photon absorption will reveal phenomena associated with chemical shifts of core levels, crystal field splitting of atomic states in the material, and the response of the electron liquid to the excited center. These areas have strong relevance to alloy properties, chemical catalysis by material surfaces and to adhesion phenomena.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0013, THE CEPHEID AND RR LYRAE DISTANCE SCALES - A COLLABORATIVE INVESTIGATION BY PURDUE U. AND THE U. TEXAS AT AUSTIN (ABBREV)

T.J. Moffett, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (AST76-20841 A01)

A new method will be used to calibrate the classical cepheid distance scale and the period-luminosity relation. Simultaneous photometric and spectroscopic observations will be made of these variable stars. The photometry will be used to determine the variation in angular diameter with phase. The spectroscopic and photometric measurements will be used to give the distance and the mean linear radius of each variable. A similar program will be carried out on the RR-Lyrae variable stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

8.0014, NEAR-RESONANT CHARGE TRANSFER IN HIGHLY EXCITED ATOMS

K.B. MacAdam, University of Kentucky, College of Arts & Sciences, Dept. of Physics & Astronomy, *Limestone & Euclid, Lexington, Kentucky* 40506 (PHY78-00923)

This new project in atomic physics will study the charge-transfer interactions between highly excited sodium atoms and helium atoms. In this project in the study of atomic collisions, experiments on near resonant charge transfer in high excited (Rydberg) atoms will be performed. Atomic sodium, selectively excited by lasers to high-lying s or d states, will form the target for bombardment by He plus ions in the energy 100-5000 eV. Helium atoms, neutralized into correspondingly high-lying Rydberg states by charge transfer, would be analyzed by field ionization and optical methods. Cross sections would be studied as a function of initial- and final-state principal and angular-momentum quantum numbers, beam energy, and energy defect, with the experimental method allowing considerable freedom to select these parameters at will. The results would have implications for energy transfer in lasers and plasma and for astrophysical studies of hot galactic regions.

This is the first 12 months of a 2-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0015, MOLECULAR BEAM EPITAXY FOR TERNARY SEMICONDUCTOR DEVICES

A.H. Clark, University of Maine, Orono Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *36 Winslow Hall, Orono, Maine* 04473 (ENG76-14393 A02)

This program is concerned with the use of molecular beam epitaxy (MBE) for fabrication of ternary semiconductor devices. Initial efforts are on films of CuInSe2 on bulk substrates of the same material. Continuing efforts will concentrate on: (1) pro-

duction of materials and devices by homo-epitaxy of CuInSe2 and CuInTe2, (2) hetero-epitaxy of CuInSe2 on CdS, and (3) controlled growth of poly-crystalline CuInSe2 and CuInTe2 on various substrates.

Films are characterized in situ using electron diffraction and Auger analysis. In addition, resistivity, Hall effect, photoconductivity, optical constants, and photoluminescence are studied on materials and devices produced by MBE system.

This is a continuation of research previously supported under NSF grant ENG-7614393.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

8.0016, PHOTOPRODUCTION OF PIONS FROM COMPLEX NUCLEI

E.C. Booth, Boston University, School of Liberal Arts, Dept. of Physics, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (PHY77-14903)

A program of meson photoproduction studies will be continued at the MIT Bates Electron Linear Accelerator, in collaboration with scientists from MIT and other institutions. (a) Coherent, threshold-region neutral pion production total cross sections will be measured to investigate the reaction mechanism and the interaction between the produced pion and the residual nucleus. (b) The photoproduction of charged and neutral pions and of protons will be studied with moderate energy resolution in the region of the 3-3 resonance. (c) The above studies will be extended, subject to detailed design and feasibility studies, to high-resolution studies of neutral photo pion angular distributions and to a study of the energy dependence of multiparticle production. This work is a continuation of that performed under Foundation grant PHY76-15850.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0017, INDUCED FLUORESCENCE MICROSCOPY WITH COLLIMATED PROTON BEAMS

P. Horowitz, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PCM77-09376 A02)

It is proposed to continue studies with, and development of, the scanning 2 MeV external proton-beam microprobe. Briefly, the technique is capable of generating two-dimensional maps of the distribution of selected elements, even at trace concentrations, in a sample maintained in air or in a special environmental state, e.g. frozen and hydrated. Improvements include: a) sophisticated data collection allowing background subtraction, b) employing electromagnetic beam focussing for higher intensity and resolution, c) adding simultaneous high-resolution optical microscopy, d) employing wavelength-dispersive detectors (in addition to the present energy-dispersive detector) for improved performance in the low atomic number domain, and e) construction of a flexible frozen specimen chamber, for continuation of our kidney studies. It is proposed to apply the microprobe, as its capabilities continue to improve, to studies of kidney function, occupational toxins, living tissues, enzyme localization, the role of zinc in sperm maturation and neurological disorders.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Physiology Cellular & Molecular Biology

8.0018, GRAPHITE INTERCALATION COMPOUNDS AND THE ELECTRONIC STRUCTURE OF GRAPHITE

M.S. Dresselhaus, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-10858)

This program will be a continuation of research on the electronic properties of intercalated graphite compounds, a class of materials with very high electrical conductivities - approaching that of copper. The objective will be to understand the high conductivity in terms of the electronic structure and microstructure. Compounds will be prepared by intercalation with alkali metal donors and halogen acceptors.

The electronic structure will be studied using the magnetoreflection technique to obtain quantitative information on: (1) the electronic levels for the interior graphite layers, (2) the carrier density in the interior graphite layers, and (3) the effective mass of mobile carriers. Infrared spectroscopy, x-ray diffraction and electron microscopy techniques will be used to determine chemical composition and to study the microstructure of the intercalated compounds.

This research will be a continuation of studies initiated under NSF Grant DMR76-12226.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0019, LUMINESCENCE STUDIES OF DEFECTS IN LONE-PAIR SEMICONDUCTORS

M. Kastner, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-00836)

The models of Anderson, of Street and Mott, and of Kastner, Adler and Fritzsche explain qualitatively many of the electronic and optical properties of chalcogenide amorphous semiconductors. In particular, luminescence and related experiments seem to indicate well-defined defects in glasses which have the property that electrons on these defects possess a negative effective correlation energy because of strong electron-photon interaction. However, recent experiments indicate that a widely accepted model of the luminescence mechanism is inadequate. For example, Hudgens and Kastner, utilizing a new experimental technique, fatigue spectroscopy, showed that neutral excitations diffuse large distances in chalcogenide glasses. Experiments are underway to study the spatial diffusion and energy transfer processes in chalcogenide glasses. When combined with work on time-dependent spectroscopy of the luminescence, funded separately, a deeper and more quantitative picture of the luminescence and luminescence fatigue processes will emerge. Special attention is given to the structure of the defects involved in luminescence and fatigue, and development of experiments to demonstrate directly the sign of the effective correlation energy.

This is a continuation of work supported by DMR 76-11972. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, EXPERIMENTAL NUCLEAR SCIENCE

F.D. Becchetti, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY78-07754)

An experimental program to investigate clustering phenomena in nuclei with direct transfer reactions will be carried out at a number of accelerator facilities. These data will provide quantitative tests of current theoretical models of nuclear clustering. Related work involving nucleosynthesis and nuclear stability will also be done.

This work represents a continuation of that currently supported under Foundation grant PHY76-00287.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, STRONG INTERACTIONS WITHIN THE FRAMEWORK OF THE TOPOLOGICAL EXPANSION

C.E. Jones, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (PHY78-09619)

Research will be done in theoretical physics to further our understanding of the elementary particles. The research program will study the properties of the strong interactions and their relation to a fundamental quark structure. The basis for this study will be the so-called Topological Expansion (TE) of scattering amplitudes. Such an expansion gives successive ap-

proximations to unitarity depicted as diagrams with increasingly complex topologies. The first approximation in the TE is the planar amplitude, in terms of which all the higher topological contributions are constructed. Within the context of this technique, several specific projects will be carried out.

This work is a continuation of that currently supported under NSF grant PHY-7614438 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0022, PROPERTIES OF DISORDERED MATERIALS AND PHASE TRANSITIONS

P.L. Leath, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR78-10813)

Theoretical research in condensed matter physics will be carried out. The main emphasis will be on calculations of the properties of disordered materials and phase transitions. The topics to be investigated include: (1) The critical behavior of dilute magnets at percolation threshhold. These calculations will be extended from two dimensions, where they have not yet been tried. (2) The nature of clusters in the percolation problem with short range order will be studied, because of their importance to real disordered materials. (3) The formation of energy band tails in the density of states of highly disordered materials. Previous Monte Carlo sampling studies have shown that 'ramified' (i.e., branch-like) clusters occur with greater probability than compact ones. The question of whether these clusters play an important role in energy band tails will be examined.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0023, STATISTICAL MECHANICS

J.L. Lebowitz, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (PHY78-15920)

Research in theoretical physics supported under NSF grant PHY77-22302 will be continued on a broad program of basic research in statistical mechanics of equilibrium and non-equilibrium phenomena. Particular emphasis will be given to the study of phase transitions in equilibrium systems and of stationary non-equilibrium states carrying currents, e.g., a steady heat flux.

Another area of interest is the so called 'transition from regular to irregular behavior' in dynamical systems. This phenomenon appears to be a general characteristic of a large class of non-linear systems occurring both in Hamiltonian and in (forced) dissipative systems. It has relevance in the first case to problems in chemical kinetics and various types of accelerators and in the latter case to fluid turbulence.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0024, MEASUREMENTS OF FORBIDDEN REFLECTIONS IN GERMANIUM AND SILICON USING SYNCHROTRON RADIATION

B.W. Batterman, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR78-11636)

X-rays scattered by bonding electrons in diamond, silicon and germanium will be used to determine the spatial distribution of these bonding electrons. These experiments are of interest to many in solid state physics who are concerned with the detailed electronic behavior and location in these semiconductors. X-rays are reflected from crystals in certain well defined directions which are determined by the lattice spacing, the x-ray wave length and the direction of the incident x-ray beam. Some reflections are forbidden by the atomic arrangements in the crystal, but are weakly allowed because of the asymmetric distribution of charge about the atoms and due to the anharmonic motion of the core electrons about their equilibrium position. Observations of these forbidden electrons can lead to a much more precise determination of the electronic spatial distribution in the bonds between atoms. These results can be compared to the calculated charge distributions. Synchrotron radiation from the Cornell Electron Storage Ring (CESR) will be used as an x-ray source for this experiment and will make considerable improvement in experimental accuracy possible.

This is a continuation of the research supported by DMR-7302384.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, STRUCTURE OF DISORDERED SYSTEMS DETERMINED BY FREQUENCY DERIVATIVE X-RAY DIFFRACTION

N.J. Seewchik, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (DMR77-28542)

Standard X-ray diffraction techniques will be extended by the development of frequency modulation x-ray diffraction methods. This will add the dimension of elemental tunability--the ability to observe the contributions of a particular element to the scattering of the x-rays. The ability to observe a particular element arises from the fact that near the characteristic absorption edge of that element, the derivative of the scattered x-ray intensity with respect to the x-ray frequency is dominated by the interference of x-rays about that element. The Fourier transforms of such derivative data yield directly the radial distribution of neighboring atoms about that element. This method will be applied to the study of amorphous materials to demonstrate the potentials and limitations of the technique.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, THERMOELECTRIC EFFECTS IN METALS AND ALLOYS

P.L. Taylor, Case Western Reserve University, Graduate School, Dept. of Physics, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (DMR78-22461)

Research previously supported by DMR7602368.

A theoretical study will be undertaken on the thermoelectric properties of metals and alloys, with emphasis on the behavior of simple metals at low temperatures. The thermoelectric coefficients are sensitive to a number of scattering effects whose influence is not felt in other transport properties, and so the relative importance of a variety of these many-body effects on the Seebeck coefficient will be studied. Initially some previous calculations of the consequences of the electron-phonon interaction will be extended within the framework of a simple model of an isotropic metal. Following these model studies a computer calculation will be undertaken of a more realistic set of systems, in which anisotropy will be included, and to which applied magnetic fields may be added. The first metals to be studied numerically will be the cubic crystals potassium and aluminum. Potassium is of interest in that some controversy attends the interpretation of many of its transport properties; aluminum is an appropriate choice for investigation among the polyvalent metals in that its wave functions and band structure have already received extensive study.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, SECONDARY FERROIC CRYSTALS

R.E. Newnham, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Geosciences, *116 Deike Bldg., University Park, Pennsylvania* 16802 (DMR74-21596 A01)

This research will be a fundamental study aimed at understanding secondary ferroic switching in quartz. The ferroic (twinning) studies will concentrate on ferrobielastic and ferroelastoelectric switching. Static measurements will include deter-

mination of the nature of the coercive stress in a ferrobielastic and determination of the nature of ferroelastoelectric switching. Kinetics of switching will be studied by correlated visual, acoustic and electric observations. Some effort will be directed toward studying switching under stresses thermally induced by laser heating the surface of crystals. These basic studies will be of benefit to the design of devices such as electromechanical filters, transducers, and frequency controllers.

This is a renewal of NSF Grant DMR74-21596.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, TRANSPORT AND THERMODYNAMIC PROPERTIES OF MAGNETIC AND NEARLY MAGNETIC SYSTEMS

T.W. Mihalisin, Temple University, School of Liberal Arts, Dept. of Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (DMR76-16433 A02)

In most metals and alloys, the arrangement of atoms about each other has a profound effect on the magnetic and electronic properties of the material. The connection between the atomic arrangement and the physical properties of the material is the basis for much of solid state physics. This research will use transport and thermodynamic measurements to systematically investigate the role of crystalline electronic fields, the Kondo effect, valence fluctuations, magnetic order and spin fluctuations in a number of rare earth intermetallic compounds and alloys. Many of these effects are present simultaneously in the same material and must be sorted out in order to interpret the interesting properties near magnetic critical temperatures. A variety of experimental techniques will be employed including specific heat, thermal expansion, magnetization, resistivity, thermal conductivity and ultrasonic attenuation.

This research was previously supported under DMR-7616433.

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Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0029, CRITICAL PHENOMENA AND PHASE TRANSITIONS

D.M. Jasnow, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DMR76-19443 A01)

Research previously supported by DMR76-19443.

Theoretical research in condensed matter physics will be carried out. Among the problems to be investigated will be the application of renormalization techniques to non-uniform systems. This will include the evaluation of the order parameter profile between two coexisting phases, in order to examine the nature of the interface separating the phases.

Also, problems in the area of polymer dynamics will be studied. For example, the question of the interplay between 'excluded volume' forces and hydrodynamic interactions will be studied, in order to determine the spectrum of relaxation times for a polymer in a solvent.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, HIGH-FREQUENCY ULTRASONIC WAVE AND PHONON PROPAGATION IN DIELECTRICS

C. Elbaum, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR77-12249 A01)

This research was previously supported by DMR75-14761.

Research on phonon propagation and scattering in condensed matter will be carried out. The investigation will be in four areas: (1) Kapitza resistance: the heat pulse technique will be used to measure the reflection coefficient of phonons incident on an interface between silicon and solid helium at high pressure. Microscopic calculations of phonon transmission across interface will be performed for a number of simplified models of the surface region. (2) Accurate measurements of the velocity of roton second sound will be made in order to understand roton-roton interactions. (3) The mechanical and ultrasonic properties of solid helium will be studied by deforming it plastically in unconstrained shear. These deformation experiments will be followed by studies, using ultrasonic means, of the subsequent evolution of crystal defect behavior. (4) The propagation of ultrasonic waves in metallic glasses at low temperatures will be investigated and subsequently their thermal and electrical properties. Special emphasis will be directed to understanding the differences in the ultrasonic response of these glasses as compared with that of insulating glasses as well as crystalline metals and dielectrics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, MILLIKELVIN STUDIES OF SOLID HELIUM-3 MAGNETIC EFFECTS AND SUPERCONDUCTING AMORPHOUS TRANSITION METALS

W.P. Kirk, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (DMR78-10808)

An experimental study will be made at low temperature of the unusual magnetic and nuclear spin ordering effects in solid helium-3. Nuclear magnetic resonance techniques will be used to obtain more accurate measurements of the magnetic susceptibility at various molar volumes. The magnetic properties of solid helium-3 will be studied at interfaces of magnetic materials. The use of submillikelvin cooling techniques and nuclear magnetic resonance techniques will be extended to the study of amorphous transition metals. These studies are important to the clarification of the behavior of quantum solids and to understanding the properties of metallic glasses.

This is a continuation of work funded under DMR76-09807.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, INVESTIGATION OF ELECTRON PRECIPITATION ASSOCIATED WITH VLF ACTIVITY AT SIPLE STATION, ANTARCTICA

W.R. Sheldon, University of Houston, School of Arts & Sciences, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DPP76-22135 A01)

Four SuperArcas rockets will be launched from Siple Station, Antarctica, during the austral summer of 1978-79 as part of an intensive study of magnetospheric wave-particle interactions taking place at Siple during that period.

The SuperArcas rocket payload, an X-ray flux experiment, will be parachute deployed near 85 km altitude, providing approximately 15 minutes of data above 30 km. The X-ray measurements will provide flux and spectra information about electrons precipitation as a result of very-low-frequency wave-particle interactions. These measurements will be correlated with those made from balloons (at 30 km), Nike-Tomahawk rockets (at 150-250 km), and ground-based detectors.

Logistics support for four scientists at Siple Station during austral summer 1978/79.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div. of Polar Programs

8.0033, TOPICS IN THE PHYSICS OF FLUIDS - PHASE TRANSITIONS TO A STATE OF LOWER SYMMETRY

J.B. Swift, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR7611426A01)

Research previously supported by DMR 76-11426. The research will be primarily concerned with the problem of dynamical phenomena near phase transitions to states displaying spatial structure. Several problems having to do with this topic will be investigated, including dynamics near the nematic-smectic-C transition of a liquid crystal and dynamics near the Lifshitz

point of a liquid crystal. Also the dynamics near the paramagnetic helicoidal transition in isotropic models of magnetic systems, and acoustic attenuation near a critical point, will be studied.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, DYNAMICAL INSTABILITIES AND THE TRANSITION TO TURBULENCE IN CLASSICAL AND QUANTUM FLUID FLOWS

H.L. Swinney, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR78-10779)

This is a continuation of research previously supported by NSF grant DMR-7611033.

Time-dependent instabilities and the transition to turbulence will be investigated experimentally in two systems: a classical fluid contained between concentric cylinders with the inner cylinder rotating, and a quantum fluid, superfluid helium. The latter system will be studied for two configurations, thermal, counterflow, where the normal and superfluid components flow in opposite directions, and superfluid flow, where the normal fluid is at rest. These experiments will be performed in a new laser light scattering laboratory to be established at the University of Texas at Austin. In both experiments the temporal and spatial dependence of the local velocity in the fluids will be measured by the technique of laser Doppler velocimetry. Computer records of the velocity data will be Fourier-transformed to obtain velocity power spectra, and these data will be complemented by flow visualization photographic studies. The measurements in helium will provide the first local probe of turbulence in a quantum fluid. The proposed experiments on both systems should lead to new insights into time-dependent instabilities and should stimulate and guide new theoretical developments.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, INTERACTING EXCITATIONS IN CONDENSED MATTER

J. Ruvalds, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR77-13167 A01)

Research previously supported by DMR-72-02972.

Theoretical research on interacting excitations in various phases of condensed matter will be carried out. The following topics will be emphasized: (1) Quantum Liquids: The strong hybridization the He3 quasi particles with the phonon-roton branch in He3-He4 mixtures will be calculated. Also the effective He3-He4 coupling will be computed in search of the possible formation of a new superfluid phase in the mixtures. (2) Plasmon Excitations: Plasmon lifetimes in metals will be calculated and recent plasmon anomalies observed in electron loss measurements will be investigated. (3) Phonon Coupling and Phase Transitions: The connection between phonon coupling and certain structural phase instabilities will be considered with emphasis on metal hydrides which exhibit unusual superconducting properties. Of primary concern will be the role of anharmonicity in the phonon softening and its relation to the observed superconductivity at high temperatures.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, STRUCTURE OF PHYSICALLY ADSORBED LAYERS

S.C. Fain, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR77-26931)

Rare gas overlayers adsorbed on graphite are under investigation in a number of laboratories as model systems for the study of phase transitions and critical phenomena in quasi two-dimensional systems. Lower dimensional systems are important for testing theories of critical phenomena and cooperative phenomena in condensed matter. The structure of physically adsorbed monolayers and multilayers on solid-state surfaces will be studied by high-resolution, low-current, low-energy electron diffraction (LEED). The orientational epitaxy of out-of-registry Ar monolayers on graphite and the substrate-overlayer distance of in-registry Kr monolayers on graphite will be studied. These results will permit direct tests of theoretical models of solid monolayers physically adsorbed on the basal plane of graphite single-crystals. An improved LEED-Auger apparatus for higher-resolution LEED and coverage measurements at lower temperatures will be built for use in these experimental studies.

This research was previously supported under DMR-7422168.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, TRICRITICAL PHENOMENA AND STATISTICAL MECHANICS

E.K. Riedel, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR77-12676 A01)

Research begun under NSF Grant No. DMR 76-01070 will be continued and extended. Theoretical studies on the statistical mechanics of phase transitions and critical phenomena will be undertaken. Two types of problems will be studied in this general area: 1) scaling field approach to critical phenomena, and 2) model calculations. The scaling field research will be concerned with the completion of work on the basic formalism, the development and perfection of the calculational techniques, and tests through applications to specific systems. Model calculations will be performed for 1) phase transitions in quasi-two-dimensional systems, 2) percolation and critical phase transitions in systems with random defects, and 3) the structure of the interface between ordered phases.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0038, MOLECULAR ADSORPTION AND SURFACE REACTIONS, COMBINING INFRARED REFLECTION-ADSORPTION SPECTROSCOPY WITH OTHER SURFACE TECHNIQUES

R.G. Greenler, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Physics, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (DMR76-82937 A01)

Infrared spectroscopy is used by the Principal Investigator as a tool for investigating the nature of molecular adsorption and reactions that take place on metal surfaces. The method of reflection-adsorption spectroscopy has been developed to the point where it can give measurable infrared bands from only a few percent of an adsorbed monolayer of CO (carbon monoxide). This technique is combined, in the same ultra-high vacuum system, with the instrumentation necessary to look at adsorption on a metal single crystal using LEED (Low Energy Electron Diffraction), Auger electron spectroscopy, mass-analyzed thermal desorption, and surface potential measurements. With these techniques the adsorption of CO, H2 (hydrogen) and other gases on various metal crystal faces are examined. Reflection-adsorption spectroscopy, along with mass-analyzed thermal desorption and Auger spectroscopy will be used also to study adsorption on evaporated metal films as well as metal-oxide catalyzed reactions of olefins. Finally, transmission spectroscopy will permit investigation of a small-particle effect on the spectra of molecules adsorbed on small metal particles supported on silica or alumina. The expected results may modify the interpretation of spectra obtained by other workers in a wide variety of infrared studies.

This is a continuation of research supported under DMR73-02346. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0039, SPECIAL FOREIGN CURRENCY AWARD FOR STUDY OF THE A-DEPENDENCE OF INCLUSIVE PROCESSES & ASSOCIATED MULTIPLICITY
P. Zielinski, Instytut Badan Jadrowych, *Swierk, Poland* (INT76-84354)

The award is for the support of a study of the A-dependence of inclusive processes using an M-6 focussing spectrometer facility and a neutral pi meson detector. For each inclusive event detected, the associated charge particles will also be detected and their angles measured. The purpose of the study is to explore general features of the space-time development of production processes over a wide kinematic region and also to answer specific questions raised by models to explain present data on multiparticle production in nuclei. Presently there is no single model which explains in a quantitative or qualitative manner all the features of hadron-nucleus collisions at high energies. These investigations, in addition to exposing new phenomena in the almost unexplored field of high energy interactions of elementary particles with nuclei, should significantly contribute to the understanding of the basic properties of nuclear matter.

The study will be conducted in collaboration with Professor Wit Busza of MIT and study groups at Brown University, Providence, RI, Fermi National Accelerator Laboratory, Batavia, IL, and the University of Bari, Italy.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SOLAR ATMOSPHERIC DYNAMICS
S.T. Wu, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (ATM77-22484)

This grant will support the study of the following two problems: (1) Dynamics of the Solar Magnetic Field: Namely, what are the role and basic mechanisms of the change of magnetic field in the solar atmosphere and flares? and (2) Dynamics of Transients: Namely, what are the fundamental physical processes governing the observed transient phenomena in the solar atmosphere and wind?

In achieving these objectives, emphasis will be placed on the study of macroscopic dynamics so that the results will provide rational bases for the interpretation of observations. In addition, supplemental examinations will be considered on the physical processes affecting macroscopic dynamics, such as, the interaction between radiation and fluid motions (radiative hydrodynamics) and the interactions between particles and fields (plasma physics).

The specific objective of this work is to understand solar flares and the broader area is to further our understanding of magnetized plasma in the astrophysical context.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0002, A HIGH RESOLUTION ECHELLE SPECTROGRAPH FOR ASTRONOMICAL SPECTROSCOPY
B.L. Lutz, Lowell Observatory, *P.O. Box 1269, Flagstaff, Arizona* 86001 (AST77-20606)

Funds will be provided for the construction of a high resolution Cassegrain Echelle Spectrograph for use with the 72 inch Perkins reflector at Lowell Observatory in Flagstaff, Arizona. The design of the instrument will be based on the Mark III version of the Smithsonian Institution's Mount Hopkins Cassegrain Echelle Spectrograph. This design has proven to be highly versatile and efficient for numerous observational projects and is ideally suited for moderate sized telescopes. The instrument will be designed to utilize modern detectors over the entire optical wavelength range and to take advantage of the broad wavelength coverage provided by the two-dimensional array of the Echelle format.

Observations to be made with this instrument include high resolution studies of planetary atmospheres, spectroscopy of interstellar clouds, and abundance studies of the atmospheres of late-type stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0003, INFRARED STUDIES OF STAR FORMATION
R.I. Thompson, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST78-20393)

This research will be devoted to a program of investigation of the protostellar and pre-main sequence states of star formation. Infrared spectroscopy will be used to obtain information on the properties of these objects. Such objects are often hidden at visible wavelengths by the surrounding dust. Because of this, often the only direct evidence on the properties of a protostellar object comes from infrared emission lines of hydrogen. It has been found that disks of material surround some newly forming stars. The properties of such disks will be studied. It has been suggested that these disks may be the site of planetary formation. The T Tauri stars are another type of pre-main sequence object. They have a variable light output. Many of these stars are surrounded by circumstellar dust shells. There are a number of problems associated with interpreting the phenomena observed from these stars. Information over as broad a wavelength band as possible is extremely useful in analyzing the physical properties of such systems. The facilities of the Steward Observatory will be used to carry out simultaneous optical and infrared monitoring of these stars.

Infrared emission lines due to molecular hydrogen have now been detected in the nucleus of a Seyfert galaxy. Since molecular hydrogen is observed in star formation regions of our own galaxy, it may be that star formation is taking place in external galaxies. Other galaxies will be observed in order to determine the extent of extragalactic molecular hydrogen emission. It may then be possible to determine star formation sites in external galaxies which are obscured from sight at visible wavelengths.

This is a continuation of research previously supported under NSF grant AST77 20369.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0004, A SENSITIVE NEAR-INFRARED PHOTOGRAPHIC SKY SURVEY
E.R. Craine, University of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (AST76-19832 A01)

A wide-angle, high-resolution photographic survey of the entire northern sky will be carried out in near infrared wavelengths at high sensitivity (very deep limiting magnitudes). In the past, photography of this type was severely constrained by very slow photographic emulsions. A new and innovative approach will be used by applying the technology of high-gain, red-sensitive electronic image intensifiers to the problem of survey photography. The survey will be comparable in resolution to the widely used, shorter wavelength National Geographic Society-Palomar Observatory Sky Survey (NGS-PSS). The near infrared region of the spectrum will be used to avoid hydrogen emission features which 'black out' large regions of the sky on the NGS-PSS red plates. Huge new regions of the 'infrared' sky which have never been seen before will be investigated scientifically. In addition, the survey will 'look' through dust regions which obscure much of the galactic plane. The survey will provide an exciting new look at our galaxy and universe and will serve as a valuable complement for existing sky surveys undertaken at other wavelengths for problems of galactic and extragalactic astronomy.

This is a continuation of research done under grant AST 76-19832.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0005, A SPECTROPOLARIMETER FOR THE LICK OBSERVATORY IMAGE TUBE SCANNER

J.P. Miller, University of California, Santa Cruz Campus, Graduate School, Dept. of Astronomy, *Santa Cruz, California* 95060 (AST78-19753)

The image tube scanner (ITS) of the Lick Observatory 120-inch Shane reflector is a highly productive instrument. It is used to obtain flux-calibrated spectra of astronomical objects. This grant will provide funds to support the addition of a polarimeter to the image tube scanner. The polarimeter will make it possible to simultaneously measure the polarization in both the sky and object at the full spectral resolution of the image tube scanner, making the device the only one of its kind on a large telescope. With this polarimeter it will be possible to make highly accurate polarization measurements with system noise reduced to an extremely low level. The instrument will be made available to all users of the 120-inch telescope. It will be used for research on quasi-stellar objects, Seyfert galaxies and related objects.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, STELLAR STRUCTURE AND EVOLUTION

J.P. Cox, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (AST77-23182 AO1)

Support is for continuation of studies in basic stellar structure and evolution. The second year of the grant will consider mainly the radial and nonradial stability of stars in various stages of evolution and other kinds of objects, including the sun. Associated investigations will include some effects of rotation.

Some areas of high energy astrophysics will be explored, such as the transport of X-rays in energy and space through circumstellar gas, and properties of X-ray sources in general.

Prior support was by NSF grant AST77-23182.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, RADIO ASTRONOMICAL STUDIES OF THE SOLAR SYSTEM

J.W. Warwick, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (AST76-81577 A01)

The University of Colorado group will examine the radio emissions from the sun and planets in the meter and decameter wavelength range. Observations of Jupiter will be emphasized during the period when the two Voyager spacecraft are near that planet, to maximize the potential for a better description of the complex radio emissions and for an understanding of the underlying physical mechanism.

A compressive receiver designed and constructed under prior support will be used with antennas at the Colorado Radio Astronomy Observatory near Nederland, Colorado to: 1) Obtain high-speed radio spectral observations of the solar and Jupiter radio emissions (frequency range: 1 to 80 MHz; bandwidth: 50 KHz; minimum time per spectrum: 100 microsecs; mode: interferometer or polarimeter; poorest detectable flux density: the galactic flux density). 2) Analyze these data alongside in situ observations from the Voyager spacecraft encountering Jupiter in March and July, 1979.

Prior support was by NSF grant AST 76-81577.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0008, MAPPING THE CHEMICAL PROPERTIES OF THE GALACTIC HALO BY PHOTOGRAPHIC AND PHOTOELECTRIC METHODS (ABBREV)

A. Sandage, Carnegie Institution of Washington, *1530 P St. N.W., Washington, District of Columbia* 20005 (AST78-00534)

A television guiding system will be installed on the 100 inch (2.5M) Mt. Wilson telescope of the Hale Observatories. The television system will store, integrate, and display the viewing field. The television system will allow remote operation of the telescope. The astronomer will not have to be located at the Newtonian or Cassegrain platform. The television guiding system will enable the astronomer to pick out the desired objects he wishes to observe and guide the telescope from a remote, convenient data room and thus the telescope will be used more efficiently.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, BINARY STAR SPECKLE INTERFEROMETRY

H.A. McAlister, Georgia State University, School of Arts & Sciences, Dept. of Physics, *33 Gilmer St. S.E., Atlanta, Georgia* 30303 (AST78-01743)

Support is for a program of binary star speckle interferometry with the 4-meter and 2.1-meter telescopes at Kitt Peak National Observatory to yield diffraction limited measures of the position angles and separations of close binary systems. The program includes spectroscopic, astrometric, spectrum, occultation and close visual binaries as well as stars suspected to be binary by indirect or incomplete evidence. The minimum resolvable separation of 0.03 arc-second with the 4-meter telescope offers a significant increase in sensitivity to new binaries. Observations of spectroscopic and astrometric binaries will permit the determination of new entries into the empirical mass-luminosity relation for stars, of fundamental importance to stellar astrophysics and evolution. Secondary goals include the improvement of existing binary star orbits, new orbits for systems that are difficult or impossible to observe by other techniques, and the search for planetary mass perturbations in the orbits of nearby visual binaries.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, ASTRONOMICAL DETECTOR DEVELOPMENT

T.B. McCord, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (AST76-81803 A01)

This grant will provide funds to enable silicon target (ST) vidicon and intensified silicon vidicon (SIT) image acquisition systems which have been developed at the Massachusetts Institute of Technology to be adapted to auxiliary instrumentation of the 2.24 meter telescope of the Mauna Kea Observatory of the University of Hawaii.

These systems will be used for a number of scientific programs at the Mauna Kea Observatory. These programs include observations of the ultraviolet emission features in T Tauri-type stars, the structure of the atmospheres of the major planets, line profiles in early type stars, and investigations of certain characteristics of galaxies and quasi-stellar objects.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, MORPHOLOGICAL INVESTIGATIONS OF STELLAR SPECTRA AND CLUSTERS OF GALAXIES

W.W. Morgan, University of Chicago, School of Physical Sciences, Dept. of Astronomy & Astrophysics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (AST76-21710 A01)

This project will provide funds for completion of the Revised MK Atlas for Stars Earlier than the Sun by Morgan, Abt

and Tapscott. This includes continued development of the spectral classification system. A few photographic sets of the new Atlas will be prepared; a printed edition will follow when the master negatives are completed.

A program aimed at classification of approximately 1000 stars on this revised system will be initiated. The Atlas consists almost exclusively of individual stars whose spectra define certain reference points in the two-dimensional spectral type luminosity-class diagram. Before effective use can be made of the Atlas, it will be necessary to produce a body of spectral types, determined by means of these standard stars, in such a manner that each frequently-used classification cell will contain at least ten stars.

Preparation of a General Catalog of cD Galaxies will begin. This will be a catalogue of clusters of galaxies containing supergiant cD galaxies, huge elliptically shaped galaxies frequently found in or near the centers of clusters of galaxies.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0012, NUCLEUS-NUCLEUS INTERACTIONS AT HIGH ENERGIES

W.V. Jones, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (PHY77-01083)

A study of heavy nuclei interacting in nuclear emulsion is in progress. Data already exist in emulsions which were exposed to cosmic radiation in a balloon flight at a latitude corresponding to a geomagnetic cut-off of 1.5 GeV/nucleon. A second exposure to a beam of iron nuclei, 2.1 GeV/nucleon, is planned. The combination of the two exposures will enable measurements of nucleus-nucleus interaction events over a continuous range of energies up to 80 GeV/nucleon.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

10.0013, INTERSTELLAR REDDENING IN THE SOLAR NEIGHBORHOOD

C.L. Perry, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (AST77-04056)

The mapping of the dust component of the interstellar medium using observations of stars in the solar neighborhood will be carried out. A network of approximately 3,600 stars has been established with the intent that the stars act as probes in space for the detection of individual dust clouds. The use of uvby beta photometry in conjunction with empirical calibrations will yield precise color excesses and absolute magnitudes.

The data collection process will be completed and the analysis will then be done. This study should then yield answers for such questions as: 1) The relative importance of reddening by discrete clouds versus a diffuse intercloud medium, 2) The space density of such clouds, 3) The linear sizes of the clouds, 4) The approximate distances of the clouds, and 5) Estimates of their masses.

Furthermore, it is anticipated that this investigation will be the basis of other programs such as a polarization of study of the galactic magnetic field in the solar vicinity.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0014, COMPOSITION AND CARBON-14 CONTENT OF GAS IN ICE AT THE ANTARCTIC METEORITE SITES

E.L. Fireman, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (DPP78-05730)

Meteorites have been found in the ice at the edges of the antarctic ice sheet in recent years. These meteorites fell on the ice sheet tens of thousands of years ago and are now exposed in areas where the ice is being lost by melting and sublimation. The history of these meteorites may be deduced by their interrelationship with the ice. This proposed project will analyze gas in ice samples collected at the antarctic sites where the meteorites are found. The N2, O2, Ar, and CO2 contents, isotopic compositions, and the carbon-14 radioactivity will be measured. The combination of the age and composition of the gas in the ice with the fall times of the collected meteorites is a new source of information for glaciology, atmospherics, and meteoritics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

10.0015, THE INTERACTIONS OF ENERGETIC PARTICLES WITH THE SOLAR WIND - A THEORETICAL STUDY

L.A. Fisk, University System of New Hampshire, University of New Hampshire, Graduate School, *Durham, New Hampshire* 03824 (ATM79-08353)

This grant funds a broad-based program of theoretical studies into energetic-particle interactions with the solar wind. The work to be undertaken includes: (1) the extension of current numerical models for the solar modulation of galactic cosmic rays to include the effects of curvature and gradient drifts, (2) the use of solar and cosmic-ray data, and the above numerical model, to develop a more realistic model for the causes of solar-cycle variations in the galactic cosmic ray flux, and (3) the development of a more reliable theory for the propagation of low-rigidity particles. The overall aim is to understand the interaction of the sun with energetic particles as a function of the solar cycle.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0016, PREPARATION OF FINDING CHARTS FOR A CATALOG OF STARS WITH LARGE PROPER MOTIONS

H. Albers, Vassar College, Graduate School, Dept. of Astronomy, *Raymond Ave., Poughkeepsie, New York* 12601 (AST77-14166 A01)

Stars of large proper motion are almost always relatively close to the sun. A few stars at greater distances may show large proper motions due to their unusually rapid motion through space. Both kinds are of interest in determining the stellar population of the solar neighborhood. The fainter objects are stars of low luminosity, including red main sequence, subdwarf, and white dwarf stars. These furnish information about the faint end of the luminosity function near the sun.

A catalog of stars over the whole sky with proper motions greater than 0.5 seconds of arc per year has been compiled by Willem Luyten at the University of Minnesota from his extensive researches and all published sources. The catalog contains positions, magnitudes, colors, and motions for all the stars known at present to fall within this limit. Support by this award will permit finding charts to be made so that they can be published together with the statistical data. It is planned to provide finding charts for all stars except those already in standard catalogs so that the published catalog will be of maximum value to the observational astronomer. The charts will be done by the principal investigator, Dr. Henry Albers, at the University of Minnesota, working in collaboration with Dr. Luyten.

Prior support was by NSF grant AST 77-14166.

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of Astronomical Sciences

10.0017, IMPROVEMENT IN THE QUALITY OF ASTRONOMY AND SCIENCE EDUCATION THROUGH THE USE OF AN OPTICAL OBSERVATORY

S.C. Danford, University of North Carolina, East Carolina University, Graduate School, *Greenville, North Carolina* 27835 (SER77-05882)

The proposing organization, the Three College Observatory of Greensboro, North Carolina, which is a consortium consisting of The Univ. of North Carolina at Greensboro, North Carolina A & T State University, and Guilford College, presents a project with the purpose of improving education in astronomy.

The proposal is based on the belief that a significant improvement in science education in general and instruction in astronomy in particular will be accomplished by the use of modern observational equipment.

An optical observatory containing a 24-inch telescope and a television camera system will be employed to provide astronomy students with day-to-day class contact with the telescope. A video tape library of common astronomical objects as seen through the telescope will be used to supplement class lectures in introductory astronomy courses. Equipping the telescope with a 4 x 5 astronomical camera will provide opportunity for numerous student research projects at an advanced undergraduate level. When not engaged in project activities, the proposed telescope may be used as a community resource. Viewing nights for local residents could be scheduled on a regular basis and the television system used to provide video tapes of astronomical objects to local TV stations.

Project evaluation will be conducted with the assistance of an outside evaluator working with the project staff during the first and third summers of the project.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div. of Science Education Resources Improvement

10.0018, ANALYSIS OF DATA FROM THE MAGNETOSPHERE AND SOLAR WIND

A.J. Dessler, Rice University, Graduate School, Dept. of Space Physics & Astronomy, *6100 Main St., Houston, Texas* 77001 (ATM77-12619 A01)

This grant will support an investigation of a limited number of specific, well-defined questions relating to the physics of the earth's magnetosphere, through an extensive and coordinated program of theoretical development and analysis of data from a variety of past and present satellite and ground-based experiments. This program will involve a large measure of cooperation among several American and European scientific institutions and will contribute in a significant way towards the overall objectives of the International Magnetospheric Study (IMS).

The research is directed towards answering the following three fundamental questions: (1) How does the solar wind control the electric potential drop across the polar cap that drives magnetospheric convection; (2) What mechanisms are responsible for the injection and acceleration of solar-wind plasma at the magnetopause; and (3) What are the relationships among magnetospheric convection patterns, auroral morphology, particle precipitation patterns, and field-aligned currents.

Theoretical research on the above topics has advanced to a stage where several significant observational tests are necessary and feasible. Several other crucial tests will become feasible during the period of the IMS, given a modest level of effort in refining and applying existing theory. The intent is to provide a balanced program of coordinated data analysis and theoretical development that will complement and enhance the data-acquisition programs of the IMS.

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01 AERONAUTICS (GENERAL)

N80-28295* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Jun. 1980 152 p
(NASA-SP-7037(123)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 529 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in May 1980. Author

N80-28296*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPREHENSIVE ANALYTICAL MODEL OF ROTORCRAFT AERODYNAMICS AND DYNAMICS. PART 1: ANALYSIS DEVELOPMENT
Wayne Johnson Jun. 1980 442 p refs Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif. 2 Vol.
(NASA-TM-81182; AVRADCOM-TR-80-A-5-Pt-1; A-8100) Avail: NTIS HC A19/MF A01 CSCL 01B

Structural, inertia, and aerodynamic models were combined to form a comprehensive model of rotor aerodynamics and dynamics that is applicable to a wide range of problems and a wide class of vehicles. A digital computer program is used to calculate rotor performance, loads, and noise; helicopter vibration and gust response; flight dynamics and handling qualities; and system aeroelastic stability. The analysis is intended for use in the design, testing, and evaluation of rotors and rotorcraft, and to be a basis for further development of rotary wing theories. A.R.H.

N80-28297*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPREHENSIVE ANALYTICAL MODEL OF ROTORCRAFT AERODYNAMICS AND DYNAMICS. PART 2: USER'S MANUAL
Wayne Johnson Jul. 1980 97 p Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif. 2 Vol.
(NASA-TM-81183; AVRADCOM-TR-80-A-6-Pt-2; A-8101) Avail: NTIS HC A05/MF A01 CSCL 01B

The use of a computer program for a comprehensive analytical model of rotorcraft aerodynamics and dynamics is described. The program calculates the loads and motion of helicopter rotors and airframe. First the trim solution is obtained, then the flutter, flight dynamics, and/or transient behavior can be calculated. Either a new job can be initiated or further calculations can be performed for an old job. E.D.K.

N80-28298*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPREHENSIVE ANALYTICAL MODEL OF ROTORCRAFT AERODYNAMICS AND DYNAMICS. PART 3: PROGRAM MANUAL
Wayne Johnson Jun. 1980 155 p Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
(NASA-TM-81184; AVRADCOM-TR-80-A-7; A-8102) Avail: NTIS HC A08/MF A01 CSCL 01B

The computer program for a comprehensive analytical model of rotorcraft aerodynamics and dynamics is described. This analysis is designed to calculate rotor performance, loads, and noise; the helicopter vibration and gust response; the flight dynamics and handling qualities; and the system aeroelastic stability. The analysis is a combination of structural, inertial, and aerodynamic models that is applicable to a wide range of problems and a wide class of vehicles. The analysis is intended for use in the design, testing, and evaluation of rotors and rotorcraft and to be a basis for further development of rotary wing theories. Author

N80-28299# Battelle Columbus Labs., Ohio.
THE GENERAL AVIATION DYNAMICS MODEL. VOLUME 3: SYSTEMS MANUAL Final Report, 2 Sep. 1977 - 30 May 1979
M. A. Duffy and J. H. McCreery Jul. 1979 313 p
(AD-A085007; FAA-AVP-79-8-Vol-3) Avail: NTIS HC A14/MF A01 CSCL 01/3

Under this contract, the model was updated based on data through 1976 and the results were presented in a two volume technical document covering the current model development efforts and all prior work done by Battelle. Volume 3, Systems Manual, provides a thorough description of the computer software aspects of the model. This includes a complete listing of the program, an example of a batch run of the model, a user handbook for the NUCLEUS programming language, and a user's guide for running the model interactively. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-28300* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SYSTEM FOR USE IN CONDUCTING WAKE INVESTIGATION FOR A WING IN FLIGHT Patent
Paul F. Bikle, inventors (to NASA) and Lawrence C. Montoya Issued 15 Jul. 1980 9 p Filed 28 Feb. 1979 Supersedes N79-17797 (17 - 09, p 1069)
(NASA-Case-FRC-11024-1; US-Patent-4,212,199; US-Patent-Appl-SN-015983; US-Patent-Class-73-861.66; US-Patent-Class-73-180; US-Patent-Class-73-182; US-Patent-Class-73-861.65) Avail: US Patent and Trademark Office CSCL 01A

A system supported by a wing in flight is described which

has a reference total pressure port in spaced relation with a wake as the wake is generated by the wing, a reference static pressure port supported in spaced relation with the wake, and a probe adapted to be displaced along an accurate path through the wake including a total pressure port and static pressure ports. A differential pressure transducer and a pressure switching device are interposed between the ports and the transducer is provided for selectively connecting pairs of the ports to the transducer in opposed relation, whereby a single transducer is utilized to obtain differential pressure measurement for the wake with enhanced accuracy.

Official Gazette of the U.S. Patent and Trademark Office

N80-28301# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

TURBULENT FLOWS IN AN IDEALIZED WING-BODY JUNCTION Ph.D. Thesis - London Univ.

Ibrahim Mohamed Mohamed Aly Shabaka and P. Bradshaw. Apr. 1979. 421 p. refs. Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Dec. 1980 or Jan. 1981.

Avail: NTIS. HC A18/MF A01.

The interaction between the two boundary layers in the corner of an idealized wing body junction was investigated using an uncambered wing of constant thickness downstream of a half elliptic nose fixed to the tunnel floor to simulate the body surface. The lateral skewing of streamlines in the tunnel floor boundary layer, caused by the wing leading edge, induces streamwise vorticity in the corner region. The results show that this induced vortex overwhelms the stress-induced secondary flow over the entire region of measurement (about 25 wing thicknesses downstream of the leading edge). Regions where the body-oriented and wing-oriented shear stresses attain negative values were detected. Eddy-viscosity or mixing-length models are unsuitable for treating the present type of flow. The two dimensionality and local equilibrium of the inner layers of the body and wing boundary layers are not affected by the presence of the streamwise vortex except very near to the wing leading edge and in the vicinity of the corner. The ratio between the shear stress and the turbulent kinetic energy is constant over the flow except close to the corner. A.R.H.

N80-28302*# Atmospheric Science Associates, Bedford, Mass.

CALCULATION OF WATER DROP TRAJECTORIES TO AND ABOUT ARBITRARY THREE-DIMENSIONAL BODIES IN POTENTIAL AIRFLOW Final Report

Hillyer G. Norment. Washington: NASA. Aug. 1980. 83 p. refs.

(Contract NAS3-22199)

(NASA-CR-3291) Avail: NTIS. HC A05/MF A01. CSCL 20D.

Calculations can be performed for any atmospheric conditions and for all water drop sizes, from the smallest cloud droplet to large raindrops. Any subsonic, external, non-lifting flow can be accommodated; flow into, but not through, inlets also can be simulated. Experimental water drop drag relations are used in the water drop equations of motion and effects of gravity settling are included. Seven codes are described: (1) a code used to debug and plot body surface description data; (2) a code that processes the body surface data to yield the potential flow field; (3) a code that computes flow velocities at arrays of points in space; (4) a code that computes water drop trajectories from an array of points in space; (5) a code that computes water drop trajectories and fluxes to arbitrary target points; (6) a code that computes water drop trajectories tangent to the body; and (7) a code that produces stereo pair plots which include both the body and trajectories. Code descriptions include operating instructions, card inputs and printouts for example problems, and listing of the FORTRAN codes. Accuracy of the calculations is discussed, and trajectory calculation results are compared with prior calculations and with experimental data. Author

N80-28303*# De Havilland Aircraft Co. Ltd., Downsview (Ontario).

PHASE 1 WIND TUNNEL TESTS OF THE J-97 POWERED, EXTERNAL AUGMENTOR V/STOL MODEL

D. B. Garland. Jul. 1980. 101 p. refs.

(Contract NASw-2797)

(NASA-CR-152255; DHC-DND-79-4) Avail: NTIS. HC A06/MF A01. CSCL 01A.

Test results are presented for a large scale, external augmentor V/STOL model in a 40 ft by 80 ft wind tunnel. The model was powered by a GE J97 engine and featured longitudinal ejectors alongside and external to the fuselage together with an augmentor flap on the low aspect ratio, double-delta wing. A static thrust augmentation ratio of 1.60 was measured for the fuselage augmentor at a nozzle pressure ratio of 3.0 and a nozzle exhaust gas temperature of 700 C. At forward speed the model showed a strong positive lift interference due to the augmentor flap, and a marked absence of negative lift interference due to the fuselage augmentor jet system. The nose-up moment of the fuselage augmentor inlet flow was approximately cancelled by a 60 deg deflection of the augmentor flap. An assessment of the thrust and drag components to allow the prediction of transition performance of aircraft designs based on the present conceptual model was made. Lateral tests showed strong but well ordered effects of power. L.F.M.

N80-28304*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

WATER-TUNNEL AND ANALYTICAL INVESTIGATION OF THE EFFECT OF STRAKE DESIGN VARIABLES ON STRAKE VORTEX BREAKDOWN CHARACTERISTICS

Neal T. Frink and John E. Lamar. Aug. 1980. 92 p. refs.

(NASA-TP-1676; L-13254) Avail: NTIS. HC A05/MF A01. CSCL 01A.

A systematic water-tunnel study was made to determine the vortex breakdown characteristics of 43 strakes. The strakes were mounted on a 1/2-scale model of a Langley Research Center general research fighter fuselage model with a 44deg leading-edge-sweep trapezoidal wing. The analytically designed strake shapes provided examples of the effects of the primary design parameters (size, span, and slenderness) on vortex breakdown characteristics. These effects were analyzed in relation to the respective strake leading-edge suction distributions. Included were examples of the effects of detailed strake planform shaping. It was concluded that, consistent with the design criterion, those strakes with leading-edge suction distributions which increase more rapidly near, and have a higher value at, the spanwise tip of the strake produce a more stable vortex. Author

N80-28305*# Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.

STUDY OF BOUNDARY-LAYER TRANSITION USING TRANSONIC-CONE PRESTON TUBE DATA Semiannual Progress Report, Jan. - Jun. 1980

T. D. Reed and P. M. Moretti. Jun. 1980. 99 p. refs.

(Contract NsG-2396)

(NASA-TM-81103) Avail: NTIS. HC A05/MF A01. CSCL 01A.

The laminar boundary layer on a 10 degree cone in a transonic wind tunnel was studied. The inviscid flow and boundary layer development were simulated by computer programs. The effects of pitch and yaw angles on the boundary layer were examined. Preston-tube data, taken on the boundary-layer-transition cone in the NASA Ames 11 ft transonic wind tunnel, were used to develope a correlation which relates the measurements to theoretical values of laminar skin friction. The recommended correlation is based on a compressible form of the classical law-of-the-wall. The computer codes successfully simulates the laminar boundary layer for near-zero pitch and yaw angles. However, in cases of significant pitch and/or yaw angles, the flow is three dimensional and the boundary layer computer code used here cannot provide a satisfactory model. The skin-friction correlation is thought to be valid for body geometries other than cones. A.R.H.

N80-28306*# Pratt and Whitney Aircraft Group, East Hartford, Conn.

ANALYTICAL MODELS FOR USE IN FAN INFLOW CONTROL STRUCTURE DESIGN. INFLOW DISTORTION AND ACOUSTIC TRANSMISSION MODELS Interim Report

M. R. Gedge. Dec. 1979. 160 p. refs.

(Contract NAS1-15085)

(NASA-CR-159189; PWA-5580-32) Avail: NTIS. HC A08/MF A01. CSCL 01A.

Analytical models were developed to study the effect of flow contraction and screening on inflow distortions to identify

qualitative design criteria. Results of the study are that: (1) static testing distortions are due to atmospheric turbulence, nacelle boundary layer, exhaust flow reingestion, flow over stand, ground plane, and engine casing; (2) flow contraction suppresses, initially, turbulent axial velocity distortions and magnifies turbulent transverse velocity distortions; (3) perforated plate and gauze screens suppress axial components of velocity distortions to a degree determined by the screen pressure loss coefficient; (4) honeycomb screen suppress transverse components of velocity distortions to a degree detetmined by the length to diameter ratio of the honeycomb; (5) acoustic transmission loss of perforated plate is controlled by the reactance of its acoustic impedance; (6) acoustic transmission loss of honeycomb screens is negligible; and (7) a model for the direction change due to a corner between honeycomb panels compares favorably with measured data. L.F.M.

N80-28307*# Mississippi State Univ., Mississippi State.
AN APPROXIMATE FACTORIZATION SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR TRANSONIC FLOW USING BODY-FITTED COORDINATES WITH APPLICATION TO NACA 64A010 AIRFOILS
G. Kyle Copper. Aug. 1980. 120 p. refs.
(Grant NGR-25-001-055)
(NASA-CR-163376) Avail: NTIS. HC A06/MF A01. CSCL 01A.

The implementation of the approximate factorization algorithm and its ability to efficiently and accurately describe transonic flow about an NACA 64A010 airfoil section is examined. The approximate factorization algorithm is developed from the nondimensional, conservative, vectorized Navier-Stokes equations expressed in curvilinear coordinates. Equations of state and transport coefficient relations appropriate to atmospheric air are appended to close the system of partial differential equations. An algebraic turbulence model is also incorporated into the equation set. This algorithm was verified by investigating the flow about an NACA 64A010 airfoil at 0, 2, and 3.5 deg angle of attack for free-stream conditions of 2,000,000 Reynolds number and 0.8 Mach number. Overall results were in good qualitative agreement with wind tunnel data sets. However, while nondimensional times of six were attained, numerical difficulties prevented any case from reaching a true steady state. M.G.

N80-28308*# Analytical Methods, Inc., Bellevue, Wash.
AN ANALYSIS METHOD FOR MULTI-COMPONENT AIRFOILS IN SEPARATED FLOW
B. M. Rao, F. A. Duorak, and B. Maskew. Aug. 1980. 43 p. refs.
(Contract NAS1-25729)
(NASA-CR-159300) Avail: NTIS. HC A03/MF A01. CSCL 01A.

The multi-component airfoil program (Langley-MCARF) for attached flow is modified to accept the free vortex sheet separation-flow model program (Analytical Methods, Inc.-CLMAX). The viscous effects are incorporated into the calculation by representing the boundary layer displacement thickness with an appropriate source distribution. The separation flow model incorporated into MCARF was applied to single component airfoils. Calculated pressure distributions for angles of attack up to the stall are in close agreement with experimental measurements. Even at higher angles of attack beyond the stall, correct trends of separation, decrease in lift coefficients, and increase in pitching moment coefficients are predicted. Author

N80-28309*# Cambridge Hydrodynamics, Inc., Mass.
DRAG REDUCTION EFFECTS IN TURBULENT BOUNDARY LAYERS OVER WAVY WALLS. Final Report
R. Balasubramanian and Steven A. Orszag. Aug. 1980. 42 p. refs.
(Contract NAS1-15754)
(NASA-CR-159305; CHI-41) Avail: NTIS. HC A03/MF A01. CSCL 01A.

Two dimensional incompressible flow over wavy surfaces are analyzed numerically by spectral methods. Algorithms for periodic flows (Fourier modes in the periodic flow direction and Chebycheff modes in the normal direction), and inflow-outflow boundary conditions (Chebycheff modes used in both directions) are described. Results obtained using both codes are reported for laminar flows. Comparisons with known theoretical and experimental results are made. Author

N80-28310# Flow Research, Inc., Kent, Wash.
THREE-DIMENSIONAL FLOW CALCULATION BASED ON EQUIVALENCE RULE. Final Report
Mohamed Hafez. Nov. 1979. 6 p.
(Contract N00014-76-C-0880)
(AD-A085245) Avail: NTIS. HC A02/MF A01. CSCL 20/4.

Transonic flows around three dimensional configurations are calculated based on the artificial compressibility method. The transonic nonlinear mixed-type equation is treated as if it were elliptic, and the artificial viscosity is added implicitly through modifying the density. Thus, standard discretization techniques and standard iterative procedures are applicable. The output of the full three dimensional code are compared to the results of numerical implementation of two asymptotic theories, transonic equivalence rule and transonic lifting line. While the analytical asymptotic theories are limited to low or high aspect ratio configurations, it is found that the numerical algorithms based on these concepts can be employed efficiently in a wider range than the range where the asymptotic theories are strictly valid. GRA

N80-28311# Douglas Aircraft Co., Inc., Long Beach, Calif.
STUDIES ON THREE-DIMENSIONAL BOUNDARY LAYERS ON BODIES OF REVOLUTION. PART 2: THREE-DIMENSIONAL LAMINAR BOUNDARY LAYERS AND THE OK OF ACCESSIBILITY. Final Report, 15 Sep. 1978 - 15 Dec. 1978
Tuncer Cebeci, A. A. Khattab, and Keith Stewartson. Apr. 1980. 66 p. refs.
(Contract N60921-78-C-0158; WR02302003)
(AD-A085159; MDC-J8716) Avail: NTIS. HC A04/MF A01. CSCL 20/4.

An investigation is carried out into the structure of the laminar boundary layer originating from the forward stagnation point of a prolate spheroid at incidence in a uniform stream, assuming that the external velocity distribution is given by attached potential theory. The principal new results of the study are: (1) a new transformation of the body coordinates is devised which facilitates the computation of the solution near the nose; (2) two variations of the standard box method of solving the equations are devised to enable solutions to be computed in regions of cross-flow reversal; (3) whereas in two dimensional flows the effect of the boundary layer approaching separation on the external flow may be represented by a blowing velocity, in the present study we find that this is only true near the windward line of symmetry; (4) the boundary layer over the whole of the spheroid cannot be computed in an integration from the forward stagnation point; and (5) For alpha = or - 15 deg the accessible region on the leeward side of the OK is largely determined by the external streamline through the OK. GRA

N80-28312# Naval Ship Research and Development Center, Bethesda, Md.
AERODYNAMIC CHARACTERISTICS OF THE CLOSE-COUPLED CANARD AS APPLIED TO LOW-TO-MODERATE SWEPT WINGS. VOLUME 3: TRANSONIC-SUPERSONIC SPEED REGIME. Final Report, 1970 - 1974
David W. Lacey. Dec. 1979. 184 p. refs.
(WF14142109)
(AD-A085065; DTNSRDC-79/003) Avail: NTIS. HC A09/MF A01. CSCL 20/4.

An analysis of the effects of canard shape, position, and deflection on the aerodynamic characteristics of two general research models having leading edge sweep angles of 25 and 50 degrees is presented. The analysis summarizes findings of three experimental transonic wind-tunnel programs and one supersonic wind-tunnel program conducted at this Center between 1970 and 1974. The analysis is based on four canard geometries varying in planform from a 60 degree delta to a 25 degree swept wing, high aspect ratio canard. The canards were tested at several positions and deflected from -10 to + 10 degrees. In addition, configurations consisting of a horizontal tail and a canard with horizontal tails are analyzed. Results of the analysis indicate that the canard is effective in increasing lift and decreasing drag at Mach numbers from subsonic to high transonic speeds by

delaying wing separation. The effectiveness of the canard is, however, decreased with increasing Mach number. At supersonic speeds the canard has little or no favorable effects on lift or drag. It is further shown that the horizontal tail is a superior trimming device than the close-coupled canard at low-to-moderate angles of attack and that a configuration consisting of canard, wing, and horizontal tail is superior in performance, to either canard or horizontal tail at high angles of attack. GRA

N80-28313# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
SUPPRESSION OF AERODYNAMICALLY INDUCED CAVITY PRESSURE OSCILLATIONS. Final Technical Report, Feb. 1975 - May 1979
Leonard L. Shaw. Nov. 1979. 62 p. refs.
(AF Proj. 2401)
(AD-A084897; AFFDL-TR-79-3119) Avail: NTIS HC A04/MF A01 CSCL 20/4

A flight test program was performed to gain further insight into the phenomenon of flow-induced cavity pressure oscillations and to evaluate the effectiveness of suppression concepts in eliminating or reducing the pressure oscillations. The cavities tested were rectangular with approximate dimensions of 17 inches long, 8.5 inches deep, and 8.75 inches wide and were instrumented with microphones, static pressure ports, and a thermocouple. The flight speeds ranged from Mach number 0.6 to 1.3 at pressure altitudes of 3,000, 20,000, and 30,000 feet. The suppression devices included leading edge spoilers and deflectors and trailing edge ramps and deflectors. Several combinations of these were tested. The results indicate that the flow induced pressure oscillations in a cavity of the dimensions tested and for the speed range tested can be significantly reduced with leading edge spoilers in conjunction with a trailing edge ramp. Reductions as large as 30 dB were achieved for the predominant model frequency for a one-third octave band. Other combinations of the suppression devices afforded some reduction, but the spoiler ramp combination proved most effective. GRA

N80-28314# Illinois Univ. at Urbana-Champaign. Mechanical Engineering Lab.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF MULTIPLE DUCTED STREAMS WITH A PERIODIC OR A STEADY SUPERSONIC DRIVER FLOW. M.S. Thesis. Final Report, 1976-1980
H. L. Petrie and A. L. Addy. Jan. 1980. 170 p. refs.
(Grant DAAG29-76-G-0200)
(AD-A084786; UILU-ENG-80-4002; ARO-13737.2-EX) Avail: NTIS HC A08/MF A01 CSCL 20/4

An experimental and theoretical investigation of a supersonic-subsonic, two dimensional planar, constant area ejector with a periodically pulsed or a steady driver flow is discussed. A large scale fluidic oscillator was developed to partially pulse the driver flow at frequencies up to 250 Hz. A wide range of ejector flow conditions were experimentally investigated with three values of ejector mixing duct length-to-width ratios. Driver flow frequencies of 142 Hz and 250 Hz were used in the ejector experiments and a complete set of steady driver flow experiments was conducted. A one dimensional, quasi-steady control volume analysis was successfully employed to model these ejector flows. Unsteady ejector flows were found to be modeled well by the quasi-steady analysis. Both steady and unsteady ejector flow performance parameters were accurately predicted by the one dimensional analysis with the exception of the pressure recovery characteristics observed. Experimentally determined compression ratios were about 25% lower than predicted by the analysis. The pulsation of the driver flow was found to have little effect on ejector operation. GRA

N80-28315# Illinois Univ. at Urbana-Champaign. Mechanical Engineering Lab.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF TRANSONIC FLOW IN THE THROAT REGION OF ANNULAR AXISYMMETRIC, SUPERSONIC NOZZLES. Ph.D. Thesis
J. C. Dutton and A. L. Addy. Jan. 1980. 188 p. refs.
(Contract DAAG29-79-C-0184; Grant DAAG29-76-G-0200)
(AD-A084787; UILU-ENG-80-4001; ARO-13737.1-EX; ARO-16719.1-E) Avail: NTIS HC A09/MF A01 CSCL 20/4

An integrated theoretical and experimental investigation of flow in the throat region of unconventional, annular, supersonic nozzles was conducted. The theoretical analysis consists of the formulation and development of an approximate series expansion solution to the inviscid, irrotational governing equations. The resulting solution provides a direct means of analyzing the throat flowfields in a variety of two dimensional nozzle configurations including axisymmetric, annular, and planar nozzles. A major advantage of the solution is the speed and reliability of its numerical implementation, making feasible parametric studies and iterative calculations. GRA

N80-28316# Lockheed-Georgia Co., Marietta.
ACQUISITION AND APPLICATION OF TRANSONIC WING AND FAR-FIELD TEST DATA FOR THREE-DIMENSIONAL COMPUTATIONAL METHOD EVALUATION. VOLUME 1. Final Report, May 1978 - Aug. 1979
B. L. Hinson and K. P. Burdges. Mar. 1980. 217 p. refs.
(Contract F49620-78-C-0068; AF Proj. 2307)
(AD-A085258; LG80ER0012-Vol-1; AFOSR-80-0421TR) Avail: NTIS HC A10/MF A01 CSCL 20/4

A comprehensive program to acquire high Reynolds number transonic experimental data on three advanced technology wings of aspect ratio from 2.8 to 8.0, specifically for evaluation of three dimensional computational methods, was accomplished. The wings were tested over a wide range of conditions, isolated wings and in the presence of a simple fuselage in high, mid, and low wing configurations on a unique test apparatus in the Lockheed-Georgia compressible flow wind tunnel. The unique test apparatus included provisions for removal of the wind tunnel boundary layer and measurements of far-field pressures for evaluation of wind tunnel wall interference. A unique technique for evaluation of wind tunnel wall interference was developed and applied to the data. Selected three dimensional transonic computational methods were compared with the test data. A Full potential code, FLO-22, was found to give excellent agreement with experiment for all three wings, while a small disturbance solution provided acceptable agreement only for the high aspect ratio wing. GRA

N80-28317# Lockheed-Georgia Co., Marietta.
ACQUISITION AND APPLICATION OF TRANSONIC WING AND FAR-FIELD TEST DATA FOR THREE-DIMENSIONAL COMPUTATIONAL METHOD EVALUATION. VOLUME 2, APPENDIX B: EXPERIMENTAL DATA. Final Report, May 1978 - Aug. 1979
B. L. Hinson and K. P. Burdges. Mar. 1980. 750 p.
(Contract F29620-78-C-0068; AF Proj. 2307)
(AD-A085259; LG80ER0012-Vol-2; AFOSR-80-0422TR) Avail: NTIS HC A99/MF A01 CSCL 20/4

This volume contains an extensive set of experimental pressure data for wings A, B, and C. This includes data for all isolated wing and wing/fuselage configurations. No far-field pressure data, however, are included. GRA

N80-28318# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Mechanical, Industrial and Aerospace Engineering.
CALCULATION OF HIGH SPEED INLET FLOWS USING THE NAVIER-STOKES EQUATIONS. VOLUME 1: DESCRIPTION OF RESULTS. Final Report, Apr. 1978 - Sep. 1979
Doyle D. Knight. Wright-Patterson AFB, Ohio: AFFDL. Feb. 1980. 121 p. refs. Presented at 18th AIAA Aerospace Sci. Meeting, Pasadena, Calif., Jan. 1980.
(Contract F33615-78-C-3008; AF Proj. 2307)
(AD-A084789; AFFDL-TR-79-3138-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 21/5

A set of computer programs has been developed to calculate the flowfield in two dimensional mixed-compression high speed inlets. The full mean compressible Navier-Stokes equations are utilized, with turbulence represented by an algebraic eddy viscosity model which incorporates a relaxation correction. A curvilinear body-oriented coordinate system is employed to allow handling of arbitrary inlet contours. Boundary layer bleed is incorporated. The numerical algorithm of MacCormack is employed to solve the Navier-Stokes equations. A variety of techniques are incorporated to improve code efficiency, including time-splitting of the finite-difference operators, automatic mesh-splitting, and

a separate algorithm for the treatment of the viscous sublayer portion of the turbulent boundary layers. The numerical codes have been successfully applied to the calculation of a variety of flows including shock-boundary layer interaction on a flat plate (including both unseparated and separated cases), and three different simulated high speed inlet configurations. In all cases, good agreement was obtained with the experimental data. GRA

N80-28319# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Mechanical, Industrial and Aerospace Engineering.
CALCULATION OF HIGH SPEED INLET FLOWS USING THE NAVIER STOKES EQUATIONS. VOLUME 2: USER'S AND PROGRAMMER'S GUIDE Final Report, Apr. 1978 - Sep. 1979
Doyle D. Knight Wright-Patterson AFB, Ohio AFFDL Feb. 1980 138 p refs
(Contract F33615-78-C-3008; AF Proj. 2307)
(AD-A084790; AFFDL-TR-79-3138-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 21/5

A series of four computer programs used to compute the flowfield within a two dimensional, mixed compression, high speed, aircraft inlet are documented. a brief description is presented of the physical problem and the mathematical model. The numerical methods are discussed and the limitations of the approach are indicated. A brief summary of the four programs is presented together with the general sequence of application. The coordinate system programs are discussed in detail with emphasis on the pertinent criteria for successful implementation. The details of the Navier-Stokes code employed for solution of the inlet flowfield are presented. In addition, the details of a simple utility program used to interpolate flow filed data are discussed. E.D.K.

N80-28320# Aeronautical Research Inst. of Sweden, Stockholm. Dept. of Aerodynamics.
A PRELIMINARY WIND TUNNEL STUDY OF WINDMILL WAKE DISPERSION IN VARIOUS FLOW CONDITIONS, PART 7
Per-Henrik Alfredsson and Jan-Ake Dahlberg 12 Oct. 1979 74 p refs 6 Vol.
(Contract SWEDBESD-5061-012)
(FFA-AU-1499-Pt-7) Avail: NTIS HC A04/MF A01

Measurements of the wake development behind a small rotating model of a wind turbine unit were carried out. The ambient flow conditions were varied by using turbulence grids, a simulated atmospheric boundary layer, and by placing the model near a smooth wall. Mean velocity and turbulence profiles for the different flow conditions were also calculated. The measurements were also analyzed with respect to the decay of the center line velocity defect and the inflow of mass into the wake. Photographs of the vortex structure behind the wind turbine model are presented. Author (ESA)

N80-28321# Aeronautical Research Inst. of Sweden, Stockholm. Dept. of Aerodynamics.
A PRELIMINARY EVALUATION OF A MODEL PROPOSED BY P. LISSAMANN FOR THE WAKE BEHIND A ROTOR IN A TURBULENT FLOW, PART 11
Fritz H. Bark 12 Oct. 1979 37 p refs 6 Vol.
(Contract SWEDBESD-5061-012)
(FFA-AU-1499-Pt-11) Avail: NTIS HC A03/MF A01

Results from a slightly modified version of a theoretical model for the wake behind a rotor in a turbulent flow are compared with experimental results obtained in a wind tunnel. It is shown that the model gives results in excellent agreement with the experiments in the far wake if the upstream flow contains grid generated turbulence. For the case without any grid generated turbulence, the agreement is not satisfactory. This discrepancy may partly be caused by difficulties in estimating the momentum loss accurately enough from the experiments. The momentum loss enters the model as a parameter. In the near wake, the model gives even less satisfactory results, independent of the turbulence level in the upstream flow. Author (ESA)

N80-28322# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A CORRELATION OF MACH 7 BOUNDARY LAYER TRANSITION DATA FROM THE LOUGHBOROUGH GUN TUNNEL
E. R. Bergstrom Oct. 1979 37 p refs
(Grant SRC-B/RG/3323.2)
(TT-7904) Avail: NTIS HC A03/MF A01

A direct correlation of boundary layer transition Reynolds number with freestream aerodynamic noise for all Mach 7 flat plate and cylinder gun tunnel data is presented. An original speculative correlation in which the tunnel noise levels were estimated by a semi-empirical method is compared with a few fully measured data. Both data groups are shown to align to within the limitations imposed by the noise estimation method thereby suggesting some validity in the correlation form. In restating the transition correlations, corrections and additions to earlier gun tunnel noise measurements and the semi-empirical method are presented. Author (ESA)

N80-28323# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
EXPANSIONS IN SERIES OF CHEBYSHEV POLYNOMIALS OF A FUNCTION OCCURRING IN LINEAR UNSTEADY AERODYNAMIC THEORY
D. E. Davies London Aeron. Res. Council Jul. 1979 70 p refs Supersedes RAE-TR-77110; ARC-37998
(ARC-R/M-3840; BR73032; RAE-TR-77110; ARC-37998)
Avail: NTIS HC A04/MF A01; HMSO £12 PHI

In linearized unsteady aerodynamics the function s sub n (alpha), defined as the integral from zero to infinity of ((e sup - i alpha u) / (u squared + 1) sup n + 1/2) du for n > or = 1, has to be evaluated for many values of alpha. Expansions of functions in terms of series of Chebyshev polynomials can be used for rapid evaluation of the functions. A procedure to obtain such expansions of s sub n (alpha) is considered for all real alpha and all integer n > or = zero. Numerical values of the coefficients of the series of Chebyshev polynomials obtained with a FORTRAN program are given. The leading coefficients are shown to twelve significant decimal digits. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-28324# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
MICROPHYSICAL PROPERTIES OF ARTIFICIAL AND NATURAL CLOUDS AND THEIR EFFECTS ON UH-1H HELICOPTER ICING Final Report, Jan. - Mar. 1979
Grady W. Wilson and Ralph Woratschek Aug. 1979 102 p refs
(AD-A084633; USAAEFA-78-21-2) Avail: NTIS HC A06/MF A01 CSCL 01/3

Natural and artificial icing tests were conducted from 22 January to 22 February 1979 in the vicinity of St. Paul, MN with follow-on natural tests conducted from 26 February to 21 March 1979 in the vicinity of Syracuse, NY. A total of 6.7 hours were flown in the artificial environment and 7.8 hours in the natural environment. Artificial conditions were tested at liquid water content (LWC) range of 0.25 to 0.90 gm/m to the 3rd power with a temperature range of -10 to -20 C. Natural conditions were encountered at LWC range of 0.06 to 0.23 gm/m to the 3rd power and a temperature range of -2.5 to -22 C. Tests were conducted to determine the feasibility of operational deployment of a partial ice protection system consisting of electrothermally heated windshields, a sensitive outside air temperature (OAT) system, a LWC indicator and associated electrical changes. The test aircraft was a JUH-1H helicopter equipped with electrothermally decided blades as a safety device and laser nephelometers which were used to quantify the microphysical properties of the test environment. It was determined that the artificial environment (Helicopter Icing Spray System (HISS)) was not an adequate simulation in its present configuration. This was due in part to the large droplet size, heterogeneous characteristic of the plume and concentration of

large droplets in the lower portion of the plume. It was also determined that the partial ice protection system did not increase the operational capability of the UH-1H helicopter and that LWC is not an adequate indication of icing severity. GRA

N80-28325# Technology, Inc., San Antonio, Tex. Life Sciences Div.
PROCEDURAL TESTS OF ANTI-G PROTECTIVE DEVICES. VOLUME 1: PROCEDURAL TESTS FOR ANTI-G VALVES Final Report, 1 Oct. 1976 - 30 Jun. 1978
Roy W. Thompson, Carmen E. Galvan, Paul E. Love, and Arnold G. Krueger Dec. 1979 169 p 2 Vol.
(Contract F33615-77-C-0610; AF Proj. 7930)
(AD-A084792; SAM-TR-79-30-Vol-1) Avail: NTIS HC A19/MF A01 CSCL 06/17

In the first volume of the two in this study report, the instrumentation, data recording, and computerized data analysis techniques for acceleration response and performance studies are described in detail. The results of performance testing of 5 anti-G valves are reported. GRA

N80-28326# Office of Technology Assessment, Washington, D. C.
IMPACT OF ADVANCED AIR TRANSPORT TECHNOLOGY. PART 1: ADVANCED HIGH-SPEED AIRCRAFT
William E. Howard Apr. 1980 115 p refs
(OTA-T-112-Pt-1) Avail: NTIS HC A06/MF A01

The economic, environmental, energy, societal and safety impacts of advances in high-speed aircraft technology were examined to determine the potential benefits of advanced supersonic transport aircraft and the justification for Federal funding to support development of this technology. Results indicate that: the long term prospects for advanced supersonic transports are significant and real; the uncertainties, specifically, fuel price and availability, noise, and market size, are also significant and real, and the potential threat from foreign competitors appears tempered by the same research uncertainties. Other significant results are reported. DOE

N80-28327# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Direction Etudes.
AIRCRAFT SAFETY [SECURITE DU VEHICLE AERIEN]
P. Toulouse Paris 13 Apr. 1979 21 p ref In FRENCH; ENGLISH summary
(SNIAS-792-111-105) Avail: NTIS HC A02/MF A01

The way in which air transportation risks are identified from both experience and analysis is described. The probabilistic approach used to decrease the likelihood of occurrence of accidents and to minimize their consequences is also described. Author (ESA)

N80-28328# Societe Nationale Industrielle Aerospatiale, Paris (France).
SUPERSONIC TRANSPORT: THE PAST, PRESENT AND THE FUTURE [LE TRANSPORT SUPERSONIQUE: LE PASSE, LE PRESENT ET L'AVENIR]
22 Apr. 1979 18 p In FRENCH
(SNIAS-792-111-107) Avail: NTIS HC A02/MF A01

The history of the Concorde project is presented. Attention is drawn to certain miscalculations in estimating the time necessary for its development and realization. Attention is also drawn to differences between financial, economic and social conditions prevailing at the time when it was conceived and today, notably concerning the potential market (initially the sale of several hundred models was envisaged) and environmental and ecological pressures. Author (ESA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft, air navigation systems (satellite and ground based), and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N80-28329*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ALGORITHM FOR FIXED-RANGE OPTIMAL TRAJECTORIES
Homer Q. Lee and Heinz Erzberger Jul. 1980 86 p refs
(NASA-TP-1565; A-8003) Avail: NTIS HC A05/MF A01 CSCL 17G

An algorithm for synthesizing optimal aircraft trajectories for specified range was developed and implemented in a computer program written in FORTRAN IV. The algorithm, its computer implementation, and a set of example optimum trajectories for the Boeing 727-100 aircraft are described. The algorithm optimizes trajectories with respect to a cost function that is the weighted sum of fuel cost and time cost. The optimum trajectory consists at most of a three segments: climb, cruise, and descent. The climb and descent profiles are generated by integrating a simplified set of kinematic and dynamic equations wherein the total energy of the aircraft is the independent or time like variable. At each energy level the optimum airspeeds and thrust settings are obtained as the values that minimize the variational Hamiltonian. Although the emphasis is on an off-line, open-loop computation, eventually the most important application will be in an on-board flight management system. E.D.K.

N80-28330*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
ANALYTICAL METHODOLOGY FOR DETERMINATION OF HELICOPTER IFR PRECISION APPROACH REQUIREMENTS
Anil V. Phatak Jul. 1980 124 p refs
(Contract NAS2-10291)
(NASA-CR-152367) Avail: NTIS HC A06/MF A01 CSCL 17G

A systematic analytical approach to the determination of helicopter IFR precision approach requirements is formulated. The approach is based upon the hypothesis that pilot acceptance level or opinion rating of a given system is inversely related to the degree of pilot involvement in the control task. A nonlinear simulation of the helicopter approach to landing task incorporating appropriate models for UH-1H aircraft, the environmental disturbances and the human pilot was developed as a tool for evaluating the pilot acceptance hypothesis. The simulated pilot model is generic in nature and includes analytical representation of the human information acquisition, processing, and control strategies. Simulation analyses in the flight director mode indicate that the pilot model used is reasonable. Results of the simulation are used to identify candidate pilot workload metrics and to test the well known performance-work-load relationship. A pilot acceptance analytical methodology is formulated as a basis for further investigation, development and validation. Author

N80-28331# National Aviation Facilities Experimental Center, Atlantic City, N. J.
FLIGHT EVALUATION OF A RADAR CURSOR TECHNIQUE AS AN AID TO AIRBORNE RADAR APPROACHES Interim Report, Jul. - Aug. 1979
J. Perez Mar. 1980 38 p
(AD-A084015; FAA-NA-80-8; FAA-RD-80-18) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report presents preliminary results of a flight test evaluation of a radar cursor technique to be used as an aid in acquiring and tracking the desired ground track during airborne radar approaches. The test was performed using a Sikorsky CH-53A helicopter on loan from NASA and based at NAFEC. The airborne radar system used was a BENDIX RDR-1400A modified to electronically produce a radar cursor display of course error. Airborne radar approaches were made to an offshore

and an airport test environment located within a 60 nautical mile radius of NAFEC. Systems Control, Inc. (SCI), provided contractor services in the areas of test planning, data reduction, and final report preparation. The specific purpose of the test was to evaluate the practical utility of the radar cursor as an aid to performing airborne radar approaches. The preliminary conclusion of this test was that the use of the radar cursor improved course acquisition and ground tracking significantly with pilotage errors and total system cross-track errors reduced by one-half or better. The radar cursor technique showed potential in reducing airspace requirements for airborne radar approaches. SCI is presently completing data reduction and analysis and will publish a final report in the near future. GRA

N80-28332# Naval Electronic Systems Engineering Activity, St. Inigoes, Md.
CERTIFICATION TEST PROCEDURES FOR AIRCRAFT APPROACH CONTROL, AN/SPN-41, REVISION
1 May 1979 66 p
(AD-A084385; NESEA-79-30-22-Rev.; NESEA-022-106A-Rev) Avail: NTIS HC A04/MF A01 CSCL 17/9

Aircraft Approach Control AN/SPN-41, composed of shipboard and airborne equipments, can be used as an independent landing aid or as a Mode 1 monitor on AN/SPN-42A equipped carriers. In order to satisfactorily accomplish this monitoring, each piece of equipment must operate within allowable tolerances. These tests are designed to provide the criteria for initial and periodic checks of the system to ensure operation within acceptable limits. There are three categories of certification tests. Category 1 tests are the basic equipment tests. Category 2 tests are pierside flights to check the system alignment and correlation of the AN/SPN-41 with the AN/SPN-42A and the Fresnel Lens Optical Landing System (FLOLS). Category 3 tests are the at-sea flight tests using aircraft equipped to record data. GRA

N80-28333# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
SAZEL: A COMPUTER PROGRAM TO FIND SUN AZIMUTH AND ELEVATION
Edward F. Brown Apr. 1980 46 p refs
(AD-A085020; AD-E400414; ARLCD-TR-79010) Avail: NTIS HC A03/MF A01 CSCL 09/2

A computer program, SAZEL, is presented which computes the Sun azimuth and elavation angle from an observer's geographic location, local mean time, and calendar date. The method of computing the Sun azimuth and elevation angle is discussed in detail and in application. GRA

N80-28334# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GENERATION OF THE DISCRETE ADDRESS BEACON SYSTEM (DABS) NETWORK COVERAGE MAP Final Report
David Reiner 20 Mar. 1980 61 p refs
(Contracts F19628-78-C-0002; DOT-FA72WAI-261)
(AD-A085129; FAA-RD-80-39) Avail: NTIS HC A04/MF A01 CSCL 17/7

This paper describes the technique of designing the network management coverage map files necessary to coordinate a network of DABS sensors. First, the concept of the DABS network is defined, and the functions of Network Management are briefly described, as they relate to the coverage map. Then, the rationale for the coverage map is given together with definitions of the map structure and the information required in the file. Implementation of these definitions is illustrated in terms of a specific example: a network of four DABS sensors in the Washington, D.C. area. As configured, each of the sensors provides service to only one of four ATC facilities (three TRACONs and one ARTCC). The resulting map generation process illustrates not only the general principles but also the significant effects of ATC control area geometry and ATARS requirements. Finally, the procedure required for automated map generation is defined. This procedure assumes the use of an interactive computer display terminal and is applicable to any sensor network and ATC facility configuration. GRA

N80-28335# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DISCRETE ADDRESS BEACON SYSTEM (DABS) INSTALLATION AND SITING CRITERIA Final Report
R. G. Sandholm 29 Jan. 1980 36 p refs
(Contract DOT-FA72WAI-261; FAA Proj. 052-241-04)
(AD-A085178; FAA-RD-80-40) Avail: NTIS HC A03/MF A01 CSCL 17/7

This paper provides information on site-associated phenomena that affect the proper operation of a DABS sensor and therefore warrant serious consideration when siting a sensor. The DABS-related discussion is intended to be a supplement to the ATCRBS siting criteria presented in the FAA Primary/Secondary Terminal Radar Siting Handbook. The paper discusses siting criteria as they relate to the DABS sensor antenna system, as opposed to the ATCRBS hogtrough antenna, and importantly, addresses those characteristics of the surrounding environment that are crucial to proper DABS/ATARS surveillance. GRA

N80-28336# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DISCRETE ADDRESS BEACON SYSTEM (DABS) FUNCTIONAL DESCRIPTION Final Report
V. A. Orlando and P. R. Drouilhet Apr. 1980 105 p refs
(Contract DOT-FA72WAI-261; FAA Proj. 052-241-04)
(AD-A085169; ATC-42A) Avail: NTIS HC A06/MF A01 CSCL 17/7

This document provides a functional description of the Discrete Address Beacon System (DABS), a combined secondary surveillance radar (beacon) and ground-air-ground data link system capable of providing the aircraft surveillance and communications necessary to support ATC automation in future traffic environments. DABS is capable of common-channel interoperation with the current ATC beacon system, and may be implemented at low user cost over an extended ATCRBS-to-DABS transition period. In supporting ATC automation, DABS will provide the surveillance and communication performance required by the Automatic Traffic Advisory and Resolution Service (ATARS), the reliable communications needed to support data link services, and the capability of operating with a terminal or enroute, radar digitizer-equipped, ATC surveillance radar. GRA

N80-28337# Mitre Corp., McLean, Va. Metrek Div.
DISCRETE ADDRESS BEACON SYSTEM/AUTOMATED TRAFFIC ADVISORY AND RESOLUTION SERVICE/AIR TRAFFIC CONTROL OPERATIONAL SYSTEM DESCRIPTION Final Report
J. E. Dieudonne and R. W. Lautenschlager Apr. 1980 121 p refs
(Contract DOT-FA80WA-4370)
(AD-A085180; MTR-79W00436; FAA-RD-80-42) Avail: NTIS HC A06/MF A01 CSCL 17/7

This document describes the Discrete Address Beacon System (DABS) sensor and the collocated Automatic Traffic Advisory and Resolution Service (ATARS) function relative to their interactions with the Air Traffic Control (ATC) facilities. A general description of the Terminal and En Route ATC facility modifications for integration with the initial deployment of DABS sensors is provided. The document discusses: the characteristics and use of the surveillance data, the exchange of messages between the ATC facility by means of the DABS air-ground data link and some potential applications, the interaction between ATARS and the ATC facility, and the exchange of information between DABS and the ATC facility relative to status and control information. The actions performed by the DABS sensor are summarized, the messages involved in the transactions between DABS and the ATC facility are described and the actions by the ATC facility are discussed. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-28338* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
A PILOTED SIMULATOR ANALYSIS OF THE CARRIER LANDING CAPABILITY OF THE QUIET SHORT-HAUL

RESEARCH AIRCRAFT
Dennis W. Riddle Jul. 1980 41 p refs
(NASA-TM-78508; A-7528) Avail: NASA Ames Res. Center, Moffett Field, Calif. 94035 CSCL 01C

A moving-base carrier landing simulation was conducted to evaluate the carrier landing capability of the Quiet Short-Haul Research Aircraft. Statistical results show that for an optimized approach configuration utilizing direct lift control, landings to a full stop can be safely executed (without use of arresting gear) with 40% of the landing deck remaining and without exceeding 50% of the design touchdown sink rate. Even under adverse sea state and wind conditions, the maximum allowable touchdown sink rate and minimum touchdown pitch attitude limits were never exceeded. Using the optimized approach configuration, successful go-arounds can be executed at any time during the approach, even when into the landing flare maneuver. L.F.M.

N80-28339*# Rensselaer Polytechnic Inst., Troy, N. Y. Composite Structural Program.
COMPOSITE STRUCTURAL MATERIALS Semiannual Report, Sep. 1979 - Apr. 1980
George S. Ansell, Robert G. Loewy, and Stephen E. Wiberley Jun. 1980 152 p refs Sponsored in part by AFOSR
(Grant NGL-33-018-003)
(NASA-CR-163377; SAR-38) Avail: NTIS HC A08/MF A01 CSCL 01C

The use of filamentary composite materials in the design and construction of primary aircraft structures is considered with emphasis on efforts to develop advanced technology in the areas of physical properties, structural concepts and analysis, manufacturing, and reliability and life prediction. The redesign of a main spar/rib region on the Boeing 727 elevator near its actuator attachment point is discussed. A composite fabrication and test facility is described as well as the use of minicomputers for computer aided design. Other topics covered include (1) advanced structural analysis methods for composites; (2) ultrasonic nondestructive testing of composite structures; (3) optimum combination of hardeners in the cure of epoxy; (4) fatigue in composite materials; (5) resin matrix characterization and properties; (6) postbuckling analysis of curved laminate composite panels; and (7) acoustic emission testing of composite tensile specimens. A.R.H.

N80-28340*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PARAMETRIC STUDY OF MODERN AIRSHIP PRODUCTIVITY
Mark D. Ardema and Kenneth Flarg Jul. 1980 52 p refs
(NASA-TM-81151; A-7993) Avail: NTIS HC A04/MF A01 CSCL 01C

A method for estimating the specific productivity of both hybrid and fully buoyant airships is developed. Various methods of estimating structural weight of deltoid hybrids are discussed and a derived weight estimating relationship is presented. Specific productivity is used as a figure of merit in a parametric study of fully buoyant ellipsoidal and deltoid hybrid semi-buoyant vehicles. The sensitivity of results as a function of assumptions is also determined. No airship configurations were found to have superior specific productivity to transport airplanes. L.F.M.

N80-28341*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A PILOT'S ASSESSMENT OF HELICOPTER HANDLING-QUALITY FACTORS COMMON TO BOTH AGILITY AND INSTRUMENT FLYING TASKS
Ronald M. Gerdes Jul. 1980 20 p refs
(NASA-TM-81217; A-8263) Avail: NTIS HC A02/MF A01 CSCL 01C

A series of simulation and flight investigations were undertaken to evaluate helicopter flying qualities and the effects of control system augmentation for nap-of-the-Earth (NOE) agility and instrument flying tasks. Handling quality factors common to both tasks were identified. Precise attitude control was determined to be a key requirement for successful accomplishment of both tasks. Factors that degraded attitude controllability were improper levels of control sensitivity and damping, and rotor system cross coupling due to helicopter angular rate and collective pitch input. Application of rate command, attitude command, and control input decouple augmentation schemes enhanced attitude control and significantly improved handling qualities for both tasks. The NOE agility and instrument flying handling quality considerations, pilot rating philosophy, and supplemental flight evaluations are also discussed. L.F.M.

N80-28342# Textron Bell Helicopter, Fort Worth, Tex.
CONCEPTUAL DESIGN OF A HELICOPTER COMPOSITE TRUSS TAIL BOOM Final Report
David A. Gallien Apr. 1980 118 p
(Contract DAAK51-78-C-0016; DA Proj. 1L1-62209-AH-76)
(AD-A085132; USAAVRADCOM-TR-80-D-8) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report presents the results of a conceptual study of a helicopter composite truss tail boom. The study included the following tasks: design criteria, material properties, truss design and analysis, manufacturing techniques, and fabrication and ballistic testing. The results of the study indicate that a composite truss is a viable concept for a ballistically tolerant tail boom. GRA

N80-28343# Boeing Vertol Co., Philadelphia, Pa.
HEAVY LIFT HELICOPTER: PROTOTYPE TECHNICAL SUMMARY Final Report, Jan. 1973 - Aug. 1975
Apr. 1980 356 p refs
(Contract DAAJ01-71-C-0840)
(AD-A085290; D301-10323-1; USAAVRADCOM-TR-80-D-11)
Avail: NTIS HC A16/MF A01 CSCL 01/3

This report summarizes the Heavy Lift Helicopter (HLH) Prototype program. The program was designed to demonstrate, in the actual flight environment, the capabilities of HLH components previously developed by Boeing Vertol under the Advanced Technology Components (ATC) effort. Design, fabrication, and assembly of one prototype HLH was 90 percent completed. An advanced aluminum honeycomb airframe, landing gear, and subsystems not included in the ATC effort were designed and fabricated. Limited laboratory tests were conducted to assure airworthiness of the prototype aircraft. Mockups were constructed of the crew compartment and aft area. A description of the aircraft, discussion of the tests conducted, and weight and performance data are presented. A list of references containing detailed documentation of the program is appended. GRA

N80-28344# Lockheed-Georgia Co., Marietta.
PERIPHERAL JET AIR CUSHION LANDING SYSTEM SPANLOADER AIRCRAFT, VOLUME 1 Final Report, Jul. - Dec. 1979
J. W. Moore, L. Barnett, B. T. Farmer, E. E. McBride, B. I. Reynolds, and R. E. Stephens Wright-Patterson AFB, Ohio AFFDL Dec. 1979 154 p refs
(Contract F33615-79-C-3029; AF Proj. 2404)
(AD-A085203; LG79ER0177-Vol-1; AFFDL-TR-79-3152-Vol-1)
Avail: NTIS HC A08/MF A01 CSCL 01/2

Inherent in the design optimization of wing span-distributed load (spanloader) aircraft is the lack of ground operational down bending load reaction capability of the wing structure. It is necessary to provide a means to react these down bending loads if the wing structural weight is minimized. Recent studies have provided wide tread landing gears as a means to react these down bending loads, limiting the operational capability of the aircraft where the tread width exceeds most existing airport taxiway or runway widths. This study examines the feasibility of replacing the wide tread gear with a peripheral jet air cushion landing system (PJ-ACLS) in combination with a minimum tread (75 feet) width gear. The PJ-ACLS is located adjacent to the wing tip and is used primarily as wing down bending load reaction device. The minimum tread width gear is retained to simplify takeoff and landing procedures and to reduce the magnitude of the lift required from the PJ-ACLS. GRA

N80-28345# Lockheed-Georgia Co., Marietta.
PERIPHERAL JET AIR CUSHION LANDING SYSTEM SPANLOADER AIRCRAFT, VOLUME 2 Final Report, Jul. - Dec. 1979
J. W. Moore, L. Barnett, B. T. Farmer, E. E. McBride, B. I. Reynolds, and R. E. Stephens Wright-Patterson AFB, Ohio AFFDL Dec. 1979 298 p refs

(Contract F33615-79-C-3029; AF Proj. 2404)
(AD-A085117; LG79ER0177-Vol-2; AFFDL-TR-79-3152-Vol-2)
Avail: NTIS HC A13/MF A01 CSCL 01/2

The output of a computerized peripheral jet cushion landing system performance program is presented. The input matrix evaluated is as follows: cushion length (%b/2); cushion load or lift (%GW); jet toe-in angle (theta) degrees; and jet thickness (t) inches. These input data are evaluated for the baseline Spanloader configuration where cushion and landing gear are reduced by 40 inches to represent a configuration which incorporates a flat bottom airfoil shape. R.C.T.

N80-28346# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Directions Etudes.
TRANSPARENT MATERIALS FOR CIVIL AIRCRAFT [OBJET: TRANSPARENTS POUR AVIONS CIVILS]
Frustie Paris 26 Mar. 1979 33 p In FRENCH Presented at Assoc. Aeron. et Astronautique de France/ONERA Conf., 29 Mar. 1979
(SNIAS-792-111-108) Avail: NTIS HC A03/MF A01

The characteristics required for both windshields and port windows subsonic and supersonic aircraft are described. The following subjects are treated: nature of materials and systems used, quality requirements (pressure and impact resistance, optical properties, endurance, defrosting possibilities, weight, resistance to abrasion manufacturing techniques and heat treatments. The evolution that has taken place over recent years in the design of such systems and in the materials used is discussed together with experience with A 300 B material and future developments expected in this field. Author (ESA)

N80-28347# Societe Nationale Industrielle Aerospatiale, Marignane (France.) Div. Helicopteres.
IMPACT OF MODERN MATERIALS ON THE DEVELOPMENT OF HELICOPTERS [IMPACTS DES MATERIAUX MODERNES SUR LE DEVELOPPEMENT DES APPAREILS A VOILURES TOURNANTES]
G. Petit and F. dAmbra Paris 1979 35 p In FRENCH
(SNIAS-792-210-123) Avail: NTIS HC A03/MF A01

The modern materials (plastics, composite materials, etc.) currently used in the construction of helicopters are presented. A review is given of the main objectives sought by the contractor: reduction of mass and costs, and improving performance and operational characteristics. Emphasis is given to the special techniques and procedures (both design and industrial manufacturing phases) employed together with the quality control and operational behavior studies performed. Author (ESA)

N80-28348# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE FLIGHT MECHANICS PANEL SYMPOSIUM ON THE USE OF COMPUTERS AS A DESIGN TOOL
Siegfried N. Wagner (Hochschule der Bundeswehr, Munich) Mar. 1980 21 p refs Symp. presented at Munich, 3-6 Sep. 1979
(AGARD-AR-158; ISBN-92-835-1353-3) Avail: NTIS HC A02/MF A01

The application of computer technology to aircraft design is considered. Specific topics covered include specifications and assessment of requirements; computer aided design and computer graphics; computational aerodynamics and design; structural analysis and design; and propulsion and systems design. The primary conclusions are that the human being still plays a critical role during all steps of computerized aircraft design and that remarkable progress has been made in many areas related to aircraft design because of recent developments in computer hardware and software. However, there are still areas where the designer has to relay rely on wind tunnel and structural testing. The computer has reduced the routine workload of the engineer to save time for creative work, but there is still a need for faster and larger computers that will probably incorporate new architectures. J.M.S.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-28349*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL EVALUATION OF HEAD-UP DISPLAY FORMATS
J. M. Naish and Donna L. Miller (Informatics, Inc., Palo Alto, Calif.) Jul. 1980 78 p refs
(NASA-TP-1550; A-7970) Avail: NTIS HC A05/MF A01 CSCL 01D

Three types of head-up display format are investigated. Type 1 is an unreferenced (conventional) flight director, type 2 is a ground referenced flight path display, and type 3 is a ground referenced director. Formats are generated by computer and presented by reflecting collimation against a simulated forward view in flight. Pilots, holding commercial licenses, fly approaches in the instrument flight mode and in a combined instrument and visual flight mode. The approaches are in wind shear with varied conditions of visibility, offset, and turbulence. The displays are equivalent in pure tracking but there is a slight advantage for the unreferenced director in poor conditions. Flight path displays are better for tracking in the combined flight mode, possibly because of poor director control laws and the division of attention between superimposed fields. Workloads is better for the type 2 displays. The flight path and referenced director displays are criticized for effects of symbol motion and field limiting. In the subjective judgment of pilots familiar with the director displays, they are rated clearly better than path displays, with a preference for the unreferenced director. There is a fair division of attention between superimposed fields. Author

N80-28350# Intermetrics, Inc., Dayton, Ohio.
DIGITAL AVIONICS INFORMATION SYSTEM (DAIS): MISSION SOFTWARE Final Report, 23 Jun. 1975 - 28 Feb. 1979
W. H. Vandever, Jr., S. F. Stanten, P. Y. Williams, D. A. Flanders, S. Z. Stein, S. E. Adams, and N. Eastridge Wright-Patterson AFB, Ohio AFWAL Feb. 1980 153 p refs
(Contract F33615-75-C-1181; AF Proj. 2092)
(AD-A085136; AFWAL-TR-80-1003) Avail: NTIS HC A08/MF A01 CSCL 09/3

The significance of this research and development to the Air Force is the demonstration of the applicability of modern software techniques and methodology to the generation of sophisticated, flexible avionics software with excellent life cycle costs and easy maintainability. The DAIS Mission Software was coded in J73/I and based its structure upon the relocatability concepts known as Higher Order Software (HOS). GRA

N80-28351# Sikorsky Aircraft, Stratford, Conn.
ADVANCED SUBSYSTEM STATUS MONITOR Final Report, Oct. 1978 - Oct. 1979
J. McGee and H. Harper Apr. 1980 262 p
(Contract DAAK51-78-C-0023; DA Proj. 1L1-62209-AH-76)
(AD-A085135; SER-510025; USAAVRADCOM-TR-80-D-5)
Avail: NTIS HC A12/MF A01 CSCL 01/3

Five tasks were completed toward the design of an advanced Subsystem Status Monitor that will reduce crew workload during the monitoring of helicopter subsystems: (1) analysis of parameters currently monitored in the UH-60A, CH-47C, OH-58C, and AH-1G Army helicopters, and recommendation of information requirements for these helicopters; (2) development of prioritization, logic, and display formats for the presentation of subsystem information on multi-function electronic displays for the above-mentioned helicopters; (3) preliminary design of system architectures incorporating state-of-the-art, near-term and long-term technologies into an advanced Subsystem Status Monitor; (4) evaluation of preliminary designs to determine predicted impacts on flight safety, workload, reliability and maintainability, survivability and vulnerability, aircraft space and volume, aircraft weight, and life cycle costs; (5) design of keyboard and associated

display formats for the following peripheral functions: checklist presentation, performance calculation, and load monitoring. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-28352*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OFF-DESIGN CORRELATION FOR LOSSES DUE TO PART-SPAN DAMPERS ON TRANSONIC ROTORS
William B. Roberts, James E. Crouse, and Donald M. Sandercock Jul. 1980 24 p refs
(NASA-TP-1693; E-309) Avail: NTIS HC A02/MF A01 CSCL 21E

Experimental data from 10 transonic fan rotors were used to correlate losses created by part-span dampers located near the midchord position on the rotor blades. The design tip speed of these rotors varied from 419 to 425 m/sec, and the design pressure ratio varied from 1.6 to 2.0. Additional loss caused by the dampers for operating conditions between 50 and 100 percent of design speed were correlated with relevant aerodynamic and geometric parameters. The resulting correlation predicts the variation of total-pressure-loss coefficient in the damper region to a good approximation. Author

N80-28353*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PERFORMANCE ESTIMATION FOR HIGHLY LOADED SIX AND TEN BLADE PROPELLERS COMBINED WITH AN ADVANCED TECHNOLOGY TURBOSHAFT ENGINE
Shelby J. Morris, Jr. Jun. 1980 22 p refs
(NASA-TM-81840) Avail: NTIS HC A02/MF A01 CSCL 21E

Performance estimations, weights, and scaling laws for the six blade and ten blade highly loaded propellers combined with an advanced turboshaft engine are presented. These data are useful for aircraft mission studies using the turboprop system. Comparisons are made between the performance of post 1980 technology turboprop propulsion systems and the performance of both a current technology turbofan and a post 1990 technology turbofan. Author

N80-28354# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
IS THE JOINT AIR FORCE/NAVY ALTERNATE ENGINE PROGRAM WORKABLE? GAO THINKS NOT, AS PRESENTLY STRUCTURED
9 May 1980 34 p
(AD-A084709; GAO/PSAD-80-40) Avail: NTIS HC A03/MF A01 CSCL 21/5

This report describes the joint Air Force/Navy alternate engine program and discusses the need to (1) identify program objectives and (2) structure the program on a realistic basis that avoids taking overly ambitious steps under the guise of a modification program. The report also suggests that the program as presently conceived may not satisfy the directive of the Defense Appropriations Conference Committee and perhaps should be terminated. Our review of the joint services' alternate engine program is part of an overall review of the Department of Defense's acquisition process for aircraft gas turbine engines. The alternate engine program is one of the first derivative fighter engine programs initiated under the Air Force's new concept for engine development. GRA

N80-28355# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REMOTE SENSING OF TURBINE ENGINE GASES Final Report, 15 Jul. 1978 - 30 Sep. 1979
Aram Morradian, Dennis K. Killinger, and Norman Menyuk 30 Sep. 1979 84 p refs
(Contract F19628-78-C-0002)
(AD-A084544; ESD-TR-79-319; AFESC/ESL-TR-80-09) Avail: NTIS HC A05/MF A01 CSCL 20/5

This document is the final report for a laser remote sensing research program. The research conducted was designed to develop and demonstrate laser remote sensing techniques for monitoring jet aircraft exhaust gases. This effort was part of a larger program to develop remote sensing techniques for environmental monitoring and tactical detection and discrimination. The specific tasks which were performed consisted of the following: (1) development of an improved repetition rate miniature CO2 TEA laser and incorporation into a differential-absorption LIDAR(DIAL) system, (2) laboratory demonstration of the frequency-doubled CO2 TEA laser system by differential-absorption measurements of known gas samples (CO and NO), and (3) initial field feasibility demonstration of laser remote detection of CO in vehicular exhaust (automobile, tractor mower and Skycrane helicopter) at ranges up to 2.5 km. Each of these tasks is described in detail in the following sections of this report. In addition, supportive documentation is included in the accompanying appendices. GRA

N80-28356# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF FUEL ADDITIVES ON PLUME OPACITY OF A SUBSCALE TURBOJET TEST CELL WITH A RAMJET TYPE DUMP COMBUSTOR M.S. Thesis
Thomas Richard Darnell Dec. 1979 77 p refs
(AD-A084516) Avail: NTIS HC A05/MF A01 CSCL 21/5

An initial investigation was conducted into the effects of metallic based fuel additives on smoke reduction in turbojet test cells. Experiments were conducted on a one-eighth scale turbojet test cell with a ramjet type pump-combustor. Measurements of particle sizes and concentrations were made using light transmittance at two wavelengths. Particulate samples were collected and examined with a scanning electron microscope. Increased combustor temperatures and fuel additives appeared to affect particle size and concentration primarily downstream of the engine exhaust. Recommendations are made for experimental technique improvements which are required to improve the quality of data. GRA

N80-28357# ARO, Inc., Arnold Air Force Station, Tenn.
DEVELOPMENT AND TESTING OF A RESONANCE SOURCE GAS FILTER CORRELATION SPECTROMETER Final Report, Aug. - Sep. 1979
C. J. Fisher and R. J. Bryson AEDC May 1980 26 p refs
(AD-A084396; AEDC-TR-79-98) Avail: NTIS HC A03/MF A01 CSCL 14/2

The development and testing of a resonance source gas filter correlation spectrometer for carbon monoxide concentration measurement in high temperature, possibly acoustically and optically noisy combustion systems are described. The instrument incorporates a microwave-excited, low-pressure carbon monoxide plasma radiation source. The operation, calibration, and modeling of the instrument response as well as application to the measurement of CO concentration in the exhaust of a jet engine combustor are described. The report concludes with suggestions for the further use and development of the instrument. GRA

N80-28358# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Aerospace Power Div.
COMPUTER SIMULATION OF AUXILIARY POWER SYSTEMS Final Technical Report, 1 Jul. 1974 - 30 Nov. 1979
Daniel J. Gurecki Mar. 1980 66 p refs
(AF Proj. 3145)
(AD-A084858; AFAPL-TR-79-2118) Avail: NTIS HC A04/MF A01 CSCL 10/2

A digital computer program for the analysis of Auxiliary Power Units (APUs) has been developed. It analyzes the thermodynamics of each component, compressor, combustor, and turbine with regards to basic performance parameters and bleed leakage flows. On the first pass, the code solves the available horsepower from the APU on the basis of input component pressure ratio and efficiencies. On the second pass, the component performance is solved to satisfy the desired design shaft horsepower of the APU. This code is called APU code. GRA

N80-28359# Naval Postgraduate School, Monterey, Calif.
A COMPARISON OF SOLID FUEL RAMJET FLOW CHARACTERISTICS AND COMBUSTION BEHAVIOR M.S. Thesis
Brian Andrew Binn Dec. 1979 83 p refs Sponsored by Naval Weapons Center
(AD-A085064) Avail: NTIS HC A05/MF A01 CSCL 21/5

An experimental investigation was conducted to determine if there is a relationship between the cold flow characteristics of velocity, pressure distribution, and turbulence intensity and the reacting flow performance and combustion characteristics of a solid fuel ramjet. The effects of configuration and air flow changes on the above characteristics were examined. Average regression rates and combustion efficiencies were not significantly affected by changes in configuration. These variations in test conditions significantly affected the center-line turbulence intensity but not the near-wall turbulence intensity in cold flow. The use of bypass resulted in decreases in regression rate and efficiencies for all cases. Attainable performance appears to be most strongly related to near-wall turbulence intensity/mixing and to the amount of fuel reaching the aft mixing chamber. GRA

N80-28360# Brandeis Univ., Waltham, Mass. Dept. of Physics.
CRUISE MISSILE ENGINE PROGRAM. CONTRACT DATA REQUIREMENTS LIST SEQUENCE NUMBER 90. QUALIFICATION TEST REPORT. VOLUME 25: COMPONENT OIL RESERVOIR F-1-7-WR-102 AND F107-WR-400 CRUISE MISSILE ENGINES Final Report, 15 Aug. 1976 - 31 Dec. 1979
Stephan Berko May 1980 7 p refs
(Grants DAAG29-76-G-0320; DAAG29-77-G-0186)
(AD-A085301; ARO-1394.7-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

The research performed under these grants involved the development and application of the positron annihilation technique to defect studies in metals. The experiments performed during the last three years divide into three categories: (1) the study of the applicability of the simple trapping model to positron annihilation in pure lead as a function of temperature; (2) the study of vacancy-impurity interactions in Pb(Cd) and Pb(Tl) alloys, in order to test the excitonic model of 'fast diffusion' of some impurities in Pb; and (3) the design and testing of multidetector angular correlation setup to perform momentum density measurements in metals with hydrogen, in order to study the role of hydrogen in the electronic structure of pure materials. GRA

N80-28361# DyTec Engineering, Inc., Huntington Beach, Calif.
REVIEW OF TURBOFAN-ENGINE COMBUSTION AND JET-NOISE RESEARCH AND RELATED TOPICS Final Report
Alan H. Marsh and Gary L. Blankenship Jan. 1980 125 p refs
(AD-A085176; DYTEC-7936; FAA-RD-80-16) Avail: NTIS HC A06/MF A01 CSCL 21/5

In the early 1970s, internal sources of noise in jet engines were identified as being potentially strong enough to affect the levels of jet-aircraft noise at the Far Part 36 noise-certification points. These internal sources have a broadband spectrum and are not related to the rotating turbomachinery components within the engine. A review of the status of jet- and core-engine noise research was held at FAA Headquarters in the Fall of 1974. Subsequent to that status review, the FAA sponsored additional studies of combustion noise. Also, during this period, a significant study of jet noise produced by high-velocity jets was conducted under the initial sponsorship of DOT, and than of FAA. The high-velocity jet-noise study included extensive analytical and experimental investigations of jet-noise suppressors as well as studies of the effects of forward motion on jet-engine noise. In February 1977, the FAA and the DOT held a second conference at FAA Headquarters to review the status of jet- and combustion-noise research. The conference was attended by representatives from Government and industry and presentations were made of contracted and independent research studies. This report reviews the research findings presented at the February 1977 Jet/Combustion-Noise Research Conference as well as subsequent to the conference through June 1979. GRA

N80-28362# Solar Turbines International, San Diego, Calif.
DEVELOPMENT AND EVALUATION OF PROCESSES FOR DEPOSITION OF Ni/Cr-AlY (MCrAlY) COATINGS FOR GAS TURBINE COMPONENTS Final Report, 1 Nov. 1976 - 1 Sep. 1978
L. Hsu, W. G. Stevens, and A. R. Stetson Wright-Patterson AFB, Ohio AFML Sep. 1979 154 p refs
(Contract F33615-76-C-5379; AF Proj. 7312)
(AD-A085197; SR79-R-4571-1B; AFML-TR-79-4097) Avail: NTIS HC A08/MF A01 CSCL 21/5

The controlled composition reaction sintered MCrAlY process was developed as a cost effective, non-line-of-sight (LOS) alternative to the physical vapor deposition (PVD) coating process. The technique was developed for coating complex clustered airfoil configurations and the mechanical, thermal shock, and environmental properties of the coatings were evaluated relative to commercially available PVD coatings. The controlled composition reaction sintered process can be either LOS or non-LOS, depending on geometry. The former consists of slurry spraying the CoNiCrAlY powder onto the cleaned part followed by reaction sintering in a controlled activity aluminized pack. The latter utilizes an electrophoretic fluidized bed approach to nickel-base alloys. Full densification of the CoNiCrAlY coating was achieved. However, the coating had greater porosity on cobalt-base X-40 alloy. J.M.S.

N80-28363# Gates Learjet Corp., Wichita, Kans.
ENGINE INLET ANTI-ICING SYSTEM EVALUATION PROCEDURE Final Report
Allyn Heinrich, Richard Ross, and Nick Ganesan Jan. 1980 143 p refs
(Contract DOT-FA76WA-3852)
(AD-A085179; FAA-RD-80-50) Avail: NTIS HC A07/MF A01 CSCL 21/5

The objectives of this work were to develop a procedure for predicting and evaluating the performance of engine inlet anti-icing systems for compliance with FAR 25 ice protection requirements without conducting flight tests in natural icing conditions. This must include consideration of water droplet impingment, collection efficiency, internal and external heat transfer, and mass transfer of the impinging water. The method of approach for developing these procedures was to survey current analysis methods involving physical theory and empirical methods and then to develop a computerized model for use in anti-icing system performance analysis. Icing wind tunnel tests were conducted using a three dimensional nacelle test model to aid in the procedure development. A typical engine-inlet anti-icing system was evaluated with the computer model in a variety of icing environments and operational conditions and compared with icing wind tunnel test results. Correlation between performance predictions and wind tunnel test results was found to have good agreement within the spectrum of conditions that were practicable in the wind tunnel. GRA

N80-28364# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EXHAUST EMISSIONS CHARACTERISTICS FOR A GENERAL AVIATION LIGHT-AIRCRAFT AVCO LYCOMING 0-320/IO-320-DIAD PISTON ENGINE Final Report
Eric E. Becker Apr. 1980 125 p refs
(FAA Proj. 201-521-100)
(AD-A084933; FAA-NA-79-45) Avail: NTIS HC A06/MF A01 CSCL 13/2

The Avco Lycoming 0-320/IO-320-DIAD engine (S/N889-X) was tested at the National Aviation Facilities Experimental Center (NAFEC) to develop an exhaust emissions data base. This data base consists of current production baseline emissions characteristics, lean-out emissions data, effects of leaning-out the fuel schedule on cylinder head temperatures, and data showing ambient effects on exhaust emissions and cylinder head temperatures. The engine operating with its current full-rich production fuel schedule could not meet the proposed Environmental Protection Agency (EPA) standard for carbon monoxide (CO) under sea level standard-day conditions. The engine did, however, meet the proposed EPA standards for unburned hydrocarbons (HC) and oxides of nitrogen (NO(x)) under sea level standard-day conditions. The results of engine testing under different ambient conditions are also presented, and these results show a trend

toward higher levels of emissions output for CO and HC under warm or hot day conditions while producing slightly lower levels of NO(x). GRA

N80-28365# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
CUMULATIVE DAMAGE FRACTURE MECHANICS UNDER ENGINE SPECTRA Final Report, 1 Sep. 1977 - 31 Jan. 1980
J. M. Larsen, B. T. Schwartz, and C. G. Annis, Jr. Jan. 1980 234 p refs
(Contract F33615-77-C-5153; AF Proj. 2420)
(AD-A084934; PWA-FR-11844; AFML-TR-79-4159) Avail: NTIS HC A11/MF A01 CSCL 21/5

An empirically based mathematical model and computer code capable of predicting cumulative damage effects on fatigue crack growth in engine disks has been developed for Waspaloy (PWA 1007) and IN100 (PWA 1073). The computing software segregates a complex loading mission, applies a multi-parameter interpolation procedure to determine cycle-by-cycle crack growth, and performs a specimen life calculation. The model was developed from a broad matrix of tests of both materials, and a number of auxiliary investigations were conducted to examine the range of applicability of the model. GRA

N80-28366# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
OVERLAY COATINGS FOR GAS TURBINE AIRFOILS
Donald H. Boone Dec. 1979 34 p refs Presented at AGARD Lectures, Lisbon, 19 Mar. 1980 and Athens, Greece and Ankara, Turkey, 19 Apr. 1980 Submitted for publication
(Contract W-7405-eng-28; DE-AC03-78ET-12293)
(LBL-10322) Avail: NTIS HC A03/MF A01

The present understanding of the degradation modes associated with gas turbine operation under a variety of conditions is reviewed as a preliminary to defining the needs of protective airfoil coatings and processing techniques. These requirements and present coating procedures are briefly described as an introduction to the need for overlay type coatings in general and electron beam (EB) evaporation processed coatings in particular. A discussion of the features of production EB coaters is followed by a detailed description of the individual coating processing steps involved. While most are identical to other coating procedures, a few are significantly different and are discussed in detail. A review of the understanding of current overlay coating compositions and their use-experience is followed by a brief discussion of future directions in overlay coating processing and compositions including electron beam physical vapor deposition (EB-PVD) applied ceramics. DOE

N80-28367# National Technical Information Service, Springfield, Va.
TURBINE BLADES: EROSION AND CORROSION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
Guy E. Habercom, Jr. May 1980 191 p Supersedes NTIS/PS-79/0148; NTIS/PS-78/0144
(PB80-810112; NTIS/PS-79/0148; NTIS/PS-78/0144) Avail: NTIS HC $30.00/MF $30.00 CSCL 21E

Hostile environments to which turbine blades are exposed (i.e., liquid metals, high temperature, chemicals, etc.) are a direct cause of turbine parts erosion and/or corrosion. These Government sponsored research reports describe sources of erosion/corrosion of turbine blades and suggest methods to eliminate or alleviate the problems. This updated bibliography contains 184 abstracts, 19 of which are new entries to the previous edition. GRA

N80-28368# National Technical Information Service, Springfield, Va.
TURBINE BLADES: EROSION AND CORROSION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Feb. 1980
Guy E. Habercom, Jr. May 1980 228 p Supersedes NTIS/PS-79/0149; NTIS/PS-78/0145
(PB80-810120; NTIS/PS-79/0149; NTIS/PS-78/0145) Avail: NTIS HC $30.00/MF $30.00 CSCL 21E

Hostile environments to which turbine blades are exposed (i.e., liquid metals, high temperature, chemicals, etc.) are a direct cause of turbine parts erosion and/or corrosion. These reports, gathered in a worldwide literature survey, describe sources of erosion/corrosion of turbine blades and suggest methods to eliminate or alleviate the problems. This updated bibliography contains 221 abstracts, 26 of which are new entries to the previous edition. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-28369*# United Technologies Research Center, East Hartford, Conn.
ANALYTICAL DESIGN AND EVALUATION OF AN ACTIVE CONTROL SYSTEM FOR HELICOPTER VIBRATION REDUCTION AND GUST RESPONSE ALLEVIATION
R. B. Taylor, P. E. Zwicke, P. Gold, and W. Miao Jul. 1980 165 p refs Prepared in cooperation with Sikorsky Aircraft, Stratford, Conn.
(Contract NAS2-10121)
(NASA-CR-152377) Avail: NTIS HC A08/MF A01 CSCL 01C

An analytical study was conducted to define the basic configuration of an active control system for helicopter vibration and gust response alleviation. The study culminated in a control system design which has two separate systems: narrow band loop for vibration reduction and wider band loop for gust response alleviation. The narrow band vibration loop utilizes the standard swashplate control configuration to input controller for the vibration loop is based on adaptive optimal control theory and is designed to adapt to any flight condition including maneuvers and transients. The prime characteristics of the vibration control system is its real time capability. The gust alleviation control system studied consists of optimal sampled data feedback gains together with an optimal one-step-ahead prediction. The prediction permits the estimation of the gust disturbance which can then be used to minimize the gust effects on the helicopter. E.D.K.

N80-28370*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
EXPLORATORY PILOTED SIMULATOR STUDY OF THE EFFECTS OF WINGLETS ON HANDLING QUALITIES OF A REPRESENTATIVE AGRICULTURAL AIRPLANE
Marilyn E. Ogbury and Philip W. Brown Apr. 1980 44 p refs
(NASA-TM-81817) Avail: NTIS HC A03/MF A01 CSCL 01C

The effects on handling qualities of adding winglets to a representative agricultural aircraft configuration during swath-run maneuvering were evaluated. Aerodynamic data used in the simulation were based on low-speed wind tunnel tests of a full scale airplane and a subscale model. The Cooper-Harper handling qualities rating scale, supplementary pilot comments, and pilot vehicle performance data were used to describe the handling qualities of the airplane with the different wing-tip configurations. Results showed that the lateral-directional handling qualities of the airplane were greatly affected by the application of winglets and winglet cant angle. The airplane with winglets canted out 20 deg exhibited severely degraded lateral directional handling qualities in comparison to the basic airplane. When the winglets were canted inward 10 deg, the flying qualities of the configuration were markedly improved over those of the winglet-canted-out configuration or the basic configuration without winglets, indicating that proper tailoring of the winglet design may afford a potential benefit in the area of handling qualities. L.F.M.

N80-28371*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
A MATHEMATICAL REPRESENTATION OF AN ADVANCED HELICOPTER FOR PILOTED SIMULATOR INVESTIGATIONS OF CONTROL SYSTEM AND DISPLAY VARIATIONS
Edwin W. Aiken Jul. 1980 51 p refs
(NASA-TM-81203; AVRADCOM-TM-80-A-02; A-8194) Avail: NTIS HC A04/MF A01 CSCL 01C

A mathematical model of an advanced helicopter is described. The model is suitable for use in control/display research involving piloted simulation. The general design approach for the six degree of freedom equations of motion is to use the full set of nonlinear gravitational and inertial terms of the equations and to express the aerodynamic forces and moments as the reference values and first order terms of a Taylor series expansion about a reference trajectory defined as a function of longitudinal airspeed. Provisions for several different specific and generic flight control systems are included in the model. The logic required to drive various flight control and weapon delivery symbols on a pilot's electronic display is also provided. Finally, the model includes a simplified representation of low altitude wind and turbulence effects. This model was used in a piloted simulator investigation of the effects of control system and display variations for an attack helicopter mission. L.F.M.

N80-28372*# Virginia Polytechnic Inst. and State Univ., Blacksburg Dept. of Aerospace and Ocean Engineering.
ACTIVE DAMPING OF MODAL VIBRATIONS BY FORCE APPORTIONING Final Report, Jun. 1978 - Jun. 1980
William L. Hallauer, Jr. Jun. 1980 48 p refs
(Grant NsG-1526)
(NASA-CR-163396) Avail: NTIS HC A03/MF A01 CSCL 01C

Force apportioning, a method of active structural damping based on that used in modal vibration testing of isolating modes by multiple shaker excitation, was analyzed and numerically simulated. A distribution of as few forces as possible on the structure is chosen so as to maximally affect selected vibration modes while minimally exciting all other modes. The accuracy of numerical simulations of active damping, active damping of higher-frequency modes, and studies of imperfection sensitivity are discussed. The computer programs developed are described and possible refinements of the research are examined. A.R.H.

N80-28373*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. Flight Research Lab.
A SUMMARY OF JOINT US-CANADIAN AUGMENTOR WING POWERED-LIFT STOL RESEARCH PROGRAMS AT THE AMES RESEARCH CENTER, NASA, 1975-1980
W. S. Hindson (National Research Council of Canada, Ottawa) and G. Hardy Jul. 1980 64 p refs Presented at Canadian Aeron. Inst. Meeting, Ottawa, 25-26 Mar. 1980
(NASA-TM-81215; LTR-FR-75) Avail: NTIS HC A04/MF A01 CSCL 01C

Several different flight research programs carried out by NASA and the Canadian Government using the Augmentor Wing Jet STOL Research Aircraft to investigate the design, operational, and systems requirements for powered-lift STOL aircraft are summarized. Some of these programs considered handling qualities and certification criteria for this class of aircraft, and addressed pilot control techniques, control system design, and improved cockpit displays for the powered-lift STOL approach configuration. Other programs involved exploiting the potential of STOL aircraft for constrained terminal-area approaches within the context of present or future air traffic control environments. Both manual and automatic flight control investigations are discussed, and an extensive bibliography of the flight programs is included. Author

N80-28374# Scientific Systems, Inc., Cambridge, Mass.
GLOBAL STABILITY AND CONTROL ANALYSIS OF AIRCRAFT AT HIGH ANGLES OF ATTACK Annual Technical Report, 1 Jun. 1978 - 31 May 1979
Raman K. Mehra and James V. Carroll Aug. 1979 348 p refs
(Contract N00014-76-C-0780)
(AD-A084938; ONR-CR-215-245-3; ATR-3) Avail: NTIS HC A15/MF A01 CSCL 20/4

High angle-of-attack phenomena have been of interest to aerodynamicists, aircraft designers, pilots and control system analysts ever since the advent of modern high performance aircraft. Due to the concentration of inertia along the fuselage, the modern jet fighters are highly susceptible to poststall departures and spin. In spite of extensive design effort, modern aircraft still inadvertently enter spins which sometimes result in loss of life and/or property. Extensive wind-tunnel testing and radio-controlled flight testing has been done over the last 20 years to gain a better understanding of the dynamic instabilities at high angles-of-attack. A basic problem has existed in interpreting these data and in making predictions of aircraft dynamic behavior so as to achieve close agreement with flight test data. Most of the work on this project involved a study of the second aircraft model, the F-4. A detailed description of modeling this aircraft, correlation time history runs, and a high angle-of-attack analysis utilizing equilibrium and bifurcation surfaces, is included in this report. The equilibrium spin regimes were found to be rather insensitive to aerosurface control deflections, a result consistent with observed performance. Studies were conducted as well in the stall/post-stall/spin entry regime, a control synthesis approach was initiated, and thrust effects were analyzed. GRA

N80-28375# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Flight Control Div.
FLYING QUALITIES DESIGN REQUIREMENTS FOR SIDE-STICK CONTROLLERS Final Report, Oct. 1978 - Aug. 1979
G. Thomas Black and David J. Moorehouse Oct. 1979 186 p refs
(AF Proj. 2403)
(AD-A085085; AFFDL-TR-79-3126) Avail: NTIS HC A09/MF A01 CSCL 01/2

Five flight test experiments using the variable stability NT-33A were sponsored by AFWAL/FIGC from May 1977 to June 1979, conducted by students of the Air Force Test Pilot School. This data has been correlated with previously published flying qualities information to form guidance on design of sidestick controllers. Preferred force and deflection gradients are indicated. There is an apparent influence of short-period frequency and roll mode time constant on the preferred sidestick characteristics. The results presented and discussed are for fighter configurations and tasks. The very limited amount of data on transport airplanes is discussed. The implications to the flying qualities specification are discussed, but it is concluded that there is insufficient data to formulate requirements. Data from the AFTPS experiments is presented in appendices to this report. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-28376# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
APPLICATION OF ON-LINE COMPUTER TECHNIQUES TO MEASUREMENT AND CONTROL IN A MULTIPLE-JET WIND TUNNEL
Eric Gordon Hartwell May 1980 81 p refs Sponsored by National Research Council of Canada
(UTIAS-TN-221; ISSN-0082-5263) Avail: NTIS HC A05/MF A01

The control and measurement system for a boundary layer simulation wind tunnel was automated. A digital computer was used to control the positioning of a hot wire probe in the tunnel, to measure the mean velocity, and to adjust the velocity profile by setting the flow conditions at the upstream jet grid. The use of the system was demonstrated by measuring certain aspects of the tunnel characteristics, and by automating the power law velocity profile setup procedure. E.D.K.

N80-28377*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ASSESSMENT OF THE FUTURE ROLES OF THE NATIONAL TRANSONIC FACILITY AND THE LANGLEY TRANSONIC DYNAMICS TUNNEL IN AEROELASTIC AND UNSTEADY AERODYNAMIC TESTING
Perry W. Hanson Jun. 1980 52 p refs

(NASA-TM-81839) Avail: NTIS HC A04/MF A01 CSCL 14B

The characteristics and capabilities of the two tunnels, that relate to studies in the fields of aeroelasticity and unsteady aerodynamics are discussed. Scaling considerations for aeroelasticity and unsteady aerodynamics testing in the two facilities are reviewed, and some of the special features (or lack thereof) of the Langley Research Center Transonic Dynamics Tunnel (TDT) and the National Transonic Facility (NTF) that will weigh heavily in any decisions conducting a given study in the two tunnels are discussed. For illustrative purposes a fighter and a transport airplane are scaled for tests in the NTF and in the TDT, and the resulting model characteristics are compared. The NTF was designed specifically to meet the need for higher Reynolds number capability for flow simulation in aerodynamic performance testing of aircraft designs. However, the NTF can be a valuable tool for evaluating the severity of Reynolds number effects in the areas of dynamic aeroelasticity and unsteady aerodynamics. On the other hand, the TDT was constructed specifically for studies and tests in the field of aeroelasticity. Except for tests requiring the Reynolds number capability of NTF, the TDT will remain the primary facility for tests of dynamic aeroelasticity and unsteady aerodynamics. L.F.M.

N80-28378# Naval Postgraduate School, Monterey, Calif.
ANALYSIS AND TESTING TO IMPROVE THE FLOW FROM THE PLENUM OF A SUBSONIC CASCADE WIND TUNNEL M.S. Thesis
Richard Carl Moebius Mar. 1980 133 p refs
(AD-A084471) Avail: NTIS HC A07/MF A01 CSCL 14/2

The original design of the plenum and bellmouth contraction arrangement of a subsonic cascade test facility did not produce sufficiently uniform flow conditions at the bellmouth exit plane. Pneumatic measurements revealed sizeable blade-to-blade variations in velocity and flow angle. A finite element numerical analysis of the inviscid flow field was carried out which both confirmed the need for and guided the design of a modification to the bellmouth contraction from the plenum. Following the modifications, in which the original contraction was changed to two two dimensional contractions in series, and a program of development tests, acceptably small variations in velocity and flow angle were measured at the bellmouth exit plane. GRA

N80-28379# Seville Research Corp., Pensacola, Fla.
DEVELOPMENT OF SIMULATOR INSTRUCTIONAL FEATURE DESIGN GUIDES Interim Report
Paul W. Caro, Lawrence D. Pohlmann, and Robert N. Isley Oct. 1979 74 p refs
(Contract F49620-77-C-0112; AF Proj. 2313)
(AD-A084428; SEVILLE-TR-79-12; AFOSR-80-0345TR) Avail: NTIS HC A04/MF A01 CSCL 05/9

A project to develop guides for the design of simulator instructional features is described. Twelve instructional features, e.g., record/playback, automatic demonstration, and freeze, appropriate to a fighter/attack type aircraft simulator were identified. Information concerning each feature was obtained through observation of simulator instructional activities and review of training requirements and practices. The types of pilots likely to undergo training in a fighter/attack aircraft were examined to identify learner related simulator design requirements. A guide format was developed that would permit organization of pertinent information in a manner useful to simulator design personnel. The guides were reviewed by personnel involved in the development of both aircraft and non-aircraft simulators and were judged useful as a mechanism for clarifying design requirements, communicating between training and simulator design personnel, highlighting design shortfalls, and clarifying simulator testing requirements. GRA

N80-28380# General Applied Science Labs., Inc., Westbury, N. Y.
R2D2: A FORTRAN PROGRAM FOR TWO-DIMENSIONAL CHEMICALLY REACTING, HYPERTHERMAL, INTERNAL FLOWS. VOLUME 1: METHOD OF ANALYSIS Final Report, May 1978 - Sep. 1979
John Erdos, Gabriel Miller, Robert Ray, and Gertrude Weilerstein Wright-Patterson AFB, Ohio AFFDL Jan. 1980 50 p refs
(Contract F33615-78-C-3016; AF Proj. 2404)
(AD-A085225; GASL-TR-254-Vol-1; AFFDL-TR-79-3162-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 20/4

The theoretical formulation and method of analysis employed in the development of the FORTRAN program R2D2 is described. The program is capable of solving the two dimensional (planar or axisymmetric) internal flow of a chemically reacting and/or vibrationally excited mixture of gases in a nonequilibrium or equilibrated state. The local Mach number at the entrance and exit stations of the duct may be either subsonic or supersonic, although an arc-driven expanding flow, consisting of a subsonic reservoir, a transonic throat, and a supersonic expansion, is presumed to be the configuration of primary interest. Discontinuites in wall slope are admissible. The axisymmetric formulation includes a swirl component of velocity, in addition to the axial and radial components, which may be significant in swirl-stabilized arc facilities. The current version of R2D2 incorporates a thermochemical data package for an 8 species, 10 chemical reaction model of high temperature air, including ionization and vibrational excitation. However, the number of species and reactions is only limited by considerations of computer storage and running time, which can be formidable. GRA

N80-28381# Naval Civil Engineering Lab., Port Hueneme, Calif.
TRAFFIC TESTING OF A FIBERGLASS-REINFORCED POLYESTER RESIN SURFACING FOR RAPID RUNWAY REPAIR Final Report, Oct. 1978 - Sep. 1979
P. S. Springston Feb. 1980 44 p refs
(YF60536001)
(AD-A085288; CEL-TN-1572) Avail: NTIS HC A03/MF A01 CSCL 01/5

This report documents traffic tests of a fiberglass-reinforced polyester resin (FRP) membrane, conducted at the Rapid Runway Repair Test Facility of the Air Force Engineering and Services Center at Tyndall Air Force Base, Fla. The membrane functions primarily as a trafficable cap, preventing foreign object damage to aircraft, over a backfilled bomb crater. The membrane also reduces rutting, from rolling aircraft wheels, in a 24 in. thick crushed limestone base course overlaying backfilled debris. In the tests, applied traffic consisted of 150 and 20 coverages of load carts simulating F-4 and C-141 aircraft main gears, respectively. Experimentally recorded soil strain and surfacing deflection data are compared with predictions formulated previously, in which the finite element method of structural analysis was used. Recommendations are provided for further evaluation necessary for the certification of the concept for rapid runway repair. GRA

N80-28382# Dayton Univ., Ohio.
DESCRIPTION OF THE AFAMRL VIBRATION FACILITIES Interim Technical Report, 9 Apr. 1979 - 31 Jan. 1980
Louis A. Muhic Wright-Patterson AFB, Ohio AMRL Apr. 1980 28 p refs
(Contract F33615-79-C-0509; AF Proj. 7231)
(AD-A085164; UDR-TR-80-31; AFAMRL-TR-80-41) Avail: NTIS HC A03/MF A01 CSCL 14/2

The purpose of this report is to provide a general description and the capabilities of several unique vibration facilities located at the Biodynamic Effects Branch of the Biodynamics and Bioenginaering Division of the Air Force Aerospace Medical Research Laboratory at Wright-Patterson Air Force Base, Ohio, 45433. All of these devices are currently maintained under Government contract by the Univerisity of Dayton Research Institute. This report specifically deals with the following devices: (1) SIXMODE Motion Simulator; (2) Vertical Accelerator; (3) Combined Noise and Vibration Facility; and (4) C-5 Electrodynamic Vibration System. Reference should be made to the bibliography at the end of this report for technical reports dealing with specific capabilities and examples of experiments conducted on these devices. GRA

N80-28383# Open Univ., Milton (England). Energy Research Group.
THE THIRD LONDON AIRPORT: TO BUILD OR NOT TO BUILD
David Crabbe Jul. 1979 30 p refs
(ERG-029) Avail: NTIS HC A03/MF A01; Secr. Energy Res. Group, Milton Keynes, England

A statistical analysis of London air cargo and passenger traffic, a study of previously made traffic forecasts, and an examination of existing airport capacity were made. It is concluded that the primary traffic handling problem in the area is passenger throughput, not aircraft movements. Past forecasts of airport requirements have consistently overestimated growth in passenger traffic. Economic conditions foreseen for the 1980's demand flexibility, and there is no requirement whatsoever for a third airport development plan in the London area in the foreseeable future. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-28384*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
ULTIMATE INTRINSIC-COERCIVITY SAMARIUM-COBALT MAGNET: AN EARTH-BASED FEASIBILITY STUDY FOR SPACE-SHUTTLE MISSIONS Technical Report, 1 Oct. 1979 - 30 Apr. 1980
Dilip K. Das, Kaplesh Kumar, Robert T. Frost (General Electric Co., Philadelphia), and C. W. Chang (General Electric Co., Philadelphia) May 1980 39 p
(Contract NAS8-33607)
(NASA-CR-161517; R-1386) Avail: NTIS HC A03/MF A01 CSCL 22A

Techniques for containerless melting and solidification of the samarium-cobalt alloy without excessive oxidation were developed. The rationale for extending these experiments in a weightless environment is also discussed. The effect of oxygen content from 0.15 to 0.63 weight percent and grain size in the range of 2 to 10 micrometers has been examined on arc-plasma-sprayed SmCo5 magnets. Contrary to expectations, the larger grain sizes tended to improve the coercivities. This was attributed to an increase in homogeneity resulting from higher temperature treatments used to produce larger grain size. No significant differences in coercivity were observed on the basis of oxygen content in the range examined. It is expected that more meaningful data on the relationship between oxygen content and coercivity will be seen when the oxygen content can be lowered to less than 0.1 weight percent. A.R.H.

N80-28385*# National Aeronautics and Space Administration, Washington, D. C.
SPACE PROSPECTS
Jun. 1980 35 p refs Transl. into ENGLISH of "Prospective Spatiale", Rept. CNES, Paris, 12 Mar. 1980 p 1-30 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre National d'Etudes Spatiales
(Contract NASw-3199)
(NASA-TM-76228) Avail: NTIS HC A03/MF A01 CSCL 22A

A strategy for keeping the Common Market's space effort independent of and competitive with NASA and the space shuttle is discussed. Limited financing is the chief obstacle to this. Proposals include an outer space materials processing project and further development of the Ariane rocket. A manned space program is excluded for the foreseeable future. Author

N80-28386*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A SUMMARY OF MAJOR NASA LAUNCHES, 1 OCTOBER 1958 - 31 DECEMBER 1979
Frank Jarrett Jul. 1980 201 p Revised
(NASA-TM-81106; KHR-1-Rev) Avail: NTIS HC A10/MF A01 CSCL 22A

Major NASA launches conducted under the direction of the John F. Kennedy Space Center (or its precursors) are listed within broad categories. Individual launches are summarized in chronological order under each category. The mission name, launch date/time, launch vehicle, NASA code, and site/pad are identified as well as the degree of success of the mission. A.R.H.

N80-28387# Research Inst. of National Defence, Stockholm (Sweden).
THE 175 DAYS IN SALYUT 6 AND OTHER RUSSIAN SPACE NEWS [175 DYGN I 'SALJUT-6' OCH ANDRA AKTUELLA SOVJETISKA RYMDHAENDELSER]
Astrid Rundkwist Oct. 1979 52 p refs In SWEDISH
(FOA-C-30176-F4) Avail: NTIS HC A04/MF A01

Descriptions of the activities of the two cosmonauts and the experiments they performed were taken from the Soviet press. Other Soviet space experiments are reviewed, including the satellites Ekran, Raduga, and Molniya, as well as cooperation between the Soviet Union and Sweden and India. Author (ESA)

N80-28388# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
ASTRONAUTICS: CIVILIAN AND MILITARY ACTIVITIES
Harry O. Ruppe 1979 12 p refs Presented at 30th IAF Congr., Munich, 16-22 Sep. 1979
(TUM-LRT-TB-79/4) Avail: NTIS HC A02/MF A01

The space programs of the United States and the Soviet Union are compared in terms of numbers of spacecraft launched, costs as a percentage of gross national product, absolute costs, and numbers of civilian versus military spacecraft. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-28389*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLIGHT MECHANICS/ESTIMATION THEORY SYMPOSIUM
Arthur J. Fuchs, ed. Washington 1980 260 p refs Symp. held at Greenbelt, Md., 17-18 Oct. 1979
(NASA-CP-2123) Avail: NTIS HC A12/MF A01 CSCL 22A

Methods of determining satellite orbit and attitude parameters are considered. The Goddard Trajectory Determination System, the Global Positioning System, and the Tracking and Data Relay Satellites are among the satellite navigation systems discussed. Satellite perturbation theory, orbit/attitude determination using landmark data, and star measurements are also covered. For individual titles, see N80-28390 through N80-28401.

N80-28390*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIFFERENTIAL CORRECTION CAPABILITY OF THE GTDS USING TDRSS DATA
S. Y. Liu (Computer Sciences Corp.), D. G. Soskey (Computer Sciences Corp.), and J. Jacintho *In its* Flight Mech./Estimation Theory Symp. 1980 p 5-25 refs (For primary document see N80-28389 19-13)
(Contract NAS5-24300)
Avail: NTIS HC A12/MF A01 CSCL 22A

A differential correction (DC) capability was implemented in the Goddard Trajectory Determination System (GTDS) to process satellite tracking data acquired via the Tracking and Data Relay Satellite System (TRDRSS). Configuration of the TDRSS is reviewed, observation modeling is presented, and major features of the capability are discussed. The following types of TDRSS data can be processed by GTDS: two way relay range and Doppler measurements, hybrid relay range and Doppler measurements, one way relay Doppler measurements, and differenced one way relay Doppler measurements. These data may be combined with conventional ground based direct tracking data. By using Bayesian weighted least squares techniques, the software allows the simultaneous determination of the trajectories of up to four different satellites - one user satellite and three relay satellites. In addition to satellite trajectories, the following parameters can be optionally solved: for drag coefficient, reflectivity of a satellite for solar radiation pressure, transponder delay, station position, and biases. J.M.S.

N80-28391*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF THE EFFECTS OF STATE TRANSITION

MATRIX APPROXIMATIONS
Janet A. May *In its* Flight Mech./Estimation Theory Symp. 1980 p 29-48 refs (For primary document see N80-28389 19-13)
Avail: NTIS HC A12/MF A01 CSCL 22A

The effects of using an approximate state transition matrix in orbit estimation are investigated. The approximate state transition matrix results when higher order geopotential terms in the equations of motion are ignored in the formation of the variational equations. Two methods of orbit estimation are considered: the differential correction procedure (DC) and the extended Kalman filter (EKF). The system used for the study is the Research & Development version of the Goddard Trajectory Determination System. The effects of the approximation are analyzed on a number of orbits. These orbits of various inclinations and semimajor axes. Other parameters studied include geopotential models and DC arc length. J.M.S.

N80-28392*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
TARGETING WITH FIXED PROPELLANT LOAD
Gera S. Gedeon *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 51-63 (For primary document see N80-28389 19-13)
Avail: NTIS HC A12/MF A01 CSCL 22A

The inertial upper stage (IUS) for the space shuttle operation employs solid rocket stages with fixed, propellant loadings. This means that, if for a given mission the satellite weight is less than the maximum, the IUS will deliver higher delta V's than required. One way to waste the excess capability in order to achieve the desired orbit would be to execute a nonoptimal transfer which would require higher than maximum delta V's. An algorithm is presented which defines takeoff points on the parking orbit and the injection points on the orbit for which transfer orbits require a fixed delta V sub 1 and a fixed delta V sub 2 (defined by the satellite weight). It is assumed that both the parking and the target orbit are elliptical. This allows the use of the same algorithm for guidance. The transfer orbit achieved by the erroneous delta V sub 1 is regarded as a new parking orbit and the new transfer problem is solved by assuming a delta, delta V sub 1. The maximum value of delta, delta V sub 1 is the delta V sub 1 variation and its minimum value is the one which still yields a solution by the algorithm. The delta V sub errors are regarded as orbit injection errors and compensated in the usual way. J.M.S.

N80-28393*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
A SEMIANALYTICAL SATELLITE THEORY FOR WEAK TIME-DEPENDENT PERTURBATIONS
P. Cefola, W. McClain, L. Early, and A. Green *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 67-91 (For primary document see N80-28389 19-13)
Avail: NTIS HC A12/MF A01 CSCL 22A

The modifications of the semianalytical satellite theory required to include these 'weak' time dependent perturbations are described. The new formulation results in additional terms in the short periodic variations but does not change the averaged equations of motion. Thus the m monthly terms are still included in the averaged equations of motion. This contrasts with the usual approach for the strongly time dependent perturbations in which the m monthly (or m daily, if tesseral harmonics are being considered) terms would be eliminated from the averaged equations of motion and included in the short periodics computation. Numerical test results for the GPS case obtained with a numerical averaging implementation of the new theory demonstrate the accuracy improvement. J.M.S.

N80-28394*# Aerospace Corp., El Segundo, Calif.
PHASE 1 NAVSTAR/GPS EPHEMERIS AND SPACE VEHICLE CLOCK PERFORMANCE SUMMARY
Albert B. Bierman *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 93-136 refs (For primary document see N80-28389 19-13)
Avail: NTIS HC A12/MF A01 CSCL 22A

The Navstar/Global Positioning System (GPS) is considered. The issue of control segment accuracy in predicting space vehicle (SV) clock and ephemeris states for broadcast to the user community is addressed. Both the highly precise ephemeris and clock prediction data blocks and the less precise (but longer period of utility) almanac data block are evaluated. J.M.S.

N80-28395*# Computer Sciences Corp., Sunnyvale, Calif.
AUTONOMOUS SATELLITE ORBIT DETERMINATION DURING THE DEVELOPMENT PHASES OF THE GLOBAL POSITIONING SYSTEM
Joan B. Dunham *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 137-156 refs (For primary document see N80-28389 19-13)
(Contract NAS5-24300)
Avail: NTIS HC A12/MF A01 CSCL 22A

An onboard navigation system was developed to aid the design and evaluation of algorithms used in autonomous satellite navigation with Global Positioning System (GPS) data. The performance of the algorithms designed for a GPS Receiver/Processor Assembly (R/PA) intended for LANDSAT-D was investigated during the development phases of the GPS (four to six satellites in the constellation). This evaluation emphasized the effects on the orbit determination accuracy of the expected user clock errors, GPS satellite visibility, force model approximations, and state and covariance propagation approximations. Results are presented giving the sensitivity of orbit determination accuracy to these constraints. Author

N80-28396*# Business and Technological Systems, Inc., Seabrook, Md.
A PRECISION RECURSIVE ESTIMATE FOR EPHEMERIS REFINEMENT (PREFER)
Bruce Gibbs *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 157-176 refs (For primary document see N80-28389 19-13)
Avail: NTIS HC A12/MF A01 CSCL 22A

A recursive filter/smoother orbit determination program was developed to refine the ephemerides produced by a batch orbit determination program (e.g., CELEST, GEODYN). The program PREFER can handle a variety of ground and satellite to satellite tracking types as well as satellite altimetry. It was tested on simulated data which contained significant modeling errors and the results clearly demonstrate the superiority of the program compared to batch estimation. J.M.S.

N80-28397*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
APPLICATION OF OPTIMUM SMOOTHING FOR IMAGE DISTORTION CORRECTION
Ronald A. Werner *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 177-198 refs (For primary document see N80-28389 19-13)
Avail: NTIS HC A12/MF A01 CSCL 22A

Optimum linear smoothing is utilized to estimate certain distortions in LANDSAT-D images. Measurements that are processed by the smoother consist of designated control of point locations within the images. Image distortions that are estimated by the smoother are those induced by LANDSAT-D satellite navigation errors and slowly varying attitude and sensor alignment uncertainties. Preliminary results indicate that optimum smoothing produces substantially more accurate distortion estimates than optimum filtering and that optimum smoothing may reduce the number of control points needed to yield desired image correction accuracy. Author

N80-28398*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
OPTIMAL LARGE ANGLE MANEUVERS WITH SIMULTANEOUS SHAPE CONTROL/VIBRATION ARREST
James D. Turner and John L. Junkins *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 201-214 refs (For primary document see N80-28389 19-13)
Avail: NTIS HC A12/MF A01 CSCL 22A

A relaxation method is demonstrated which reliably solves the nonlinear two point boundary value problem which arises when optimal control theory is applied to determination of large angle maneuvers of flexible spacecraft. The basic ideas are summarized and several idealized maneuvers are determined. The emphasis is upon demonstrating the basic ideas and practical aspects of the methodology. J.M.S.

N80-28399*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBIT/ATTITUDE ESTIMATION FOR THE GOES SPACECRAFT USING VAS LANDMARK DATA
H. Sielski (Computer Sciences Corp.), D. Hall (Computer Sciences Corp.), R. Nankervis, and D. Koch. *In its* Flight Mech./Estimation Theory Symp. 1980 p 217-249 refs (For primary document see N80-28389 19-13)
Avail: NTIS HC A12/MF A01 CSCL 22A

A software system is described which provides for batch least squares estimation of spacecraft orbit, attitude, and camera bias parameters using image data from the Geostationary Operational Environmental Satellites (GOES). The image data are obtained by the Visible and Infrared Spin Scan Radiometer (VISSR) Atmospheric Sounder (VAS). The resulting estimated parameters are used for absolute image registration. Operating in the Digital Equipment Corporation (DEC) PDP-11/70 computer, the FORTRAN system also includes the capabilities of image display and manipulations. An overview of the system is presented as well as some numerical results obtained from observations taken by the SMS-2 satellite over a 3 day interval in August 1975. Author

N80-28400*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ONBOARD IMAGE CORRECTION
D. R. Martin, A. S. Smaulon, and A. S. Hamon. *In* NASA. Goddard Space Flight Center. Flight Mech./Estimation Theory Symp. 1980 p 241-250 refs (For primary document see N80-28389 19-13)
Avail: NTIS HC A12/MF A01 CSCL 22A

A processor architecture for performing onboard geometric and radiometric correction of LANDSAT imagery is described. The design uses a general purpose processor to calculate the distortion values at selected points in the image and a special purpose processor to resample (calculate distortion at each image point and interpolate the intensity) the sensor output data. A distinct special purpose processor is used for each spectral band. Because of the sensor's high output data rate, 80 M bit per second, the special purpose processors use a pipeline architecture. Sizing has been done on both the general and special purpose hardware. J.M.S.

N80-28401*# Scientific Programming and Applied Mathematics, Inc., Middleton, Wis.
INCORPORATION OF STAR MEASUREMENTS FOR THE DETERMINATION OF ORBIT AND ATTITUDE PARAMETERS OF A GEOSYNCHRONOUS SATELLITE: AN ITERATIVE APPLICATION OF LINEAR REGRESSION
Dennis Phillips. *In* NASA. Goddard Space Flight Center. Flight Mech./Estimation Theory Symp. 1980 p 251-261 (For primary document see N80-28389 19-13)
Avail: NTIS HC A12/MF A01 CSCL 22A

Currently on NOAA/NESS's VIRGS system at the World Weather Building star images are being ingested on a daily basis. The image coordinates of the star locations are measured and stored. Subsequently, the information is used to determine the attitude, the misalignment angles between the spin axis and the principal axis of the satellite, and the precession rate and direction. This is done for both the 'East' and 'West' operational geosynchronous satellites. This orientation information is then combined with image measurements of earth based landmarks to determine the orbit of each satellite. The method for determining the orbit is simple. For each landmark measurement one determines a nominal position vector for the satellite by extending a ray from the landmark's position towards the satellite and intersecting the ray with a sphere with center coinciding with the Earth's center and with radius equal to the nominal height for a geosynchronous satellite. The apparent motion of the satellite around the Earth's center is then approximated with a Keplerian model. In turn the variations of the satellite's height, as a function of time found by using this model, are used to redetermine the successive satellite positions by again using the Earth based landmark measurements and intersecting rays from these landmarks with the newly determined spheres. This process is performed iteratively until convergence is achieved. Only three iterations are required. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters, and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-28402*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FRICTION EVALUATION OF UNPAVED, GYPSUM-SURFACE RUNWAYS AT NORTHRUP STRIP, WHITE SANDS MISSILE RANGE, IN SUPPORT OF SPACE SHUTTLE ORBITER LANDING AND RETRIEVAL OPERATIONS
Thomas J. Yager and Walter B. Horne. Jun. 1980 77 p refs (NASA-TM-81811) Avail: NTIS HC A05/MF A01 CSCL 09E

Friction measurement results obtained on the gypsum surface runways at Northrup Strip, White Sands Missile Range, N. M., using an instrumented tire test vehicle and a diagonal braked vehicle, are presented. These runways were prepared to serve as backup landing and retrieval sites to the primary sites located at Dryden Flight Research Center for shuttle orbiter during initial test flights. Similar friction data obtained on paved and other unpaved surfaces was shown for comparison and to indicate that the friction capability measured on the dry gypsum surface runways is sufficient for operations with the shuttle orbiter and the Boeing 747 aircraft. Based on these ground vehicle friction measurements, estimates of shuttle orbiter and aircraft tire friction performance are presented and discussed. General observations concerning the gypsum surface characteristics are also included and several recommendations are made for improving and maintaining adequate surface friction capabilities prior to the first shuttle orbiter landing. Author

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters, manned orbital laboratories, reusable vehicles, and space stations.

N80-28403 Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Subdiv. Systemes.
DESIGN AND DESIGN VERIFICATION OF THE ARIANE LAUNCHER GUIDANCE AND CONTROL SYSTEM
Huy-Phong Nguyen. Paris 1979 8 p Presented at 8th Intern. Federation of Automatic Control (IFAC) Symp. on Automatic Control in Space, Oxford, 2-6 Jul. 1979
(SNIAS-792-422-119) Avail: Issuing Activity

The guidance and control system of Ariane is presented including main characteristics, design goals and functional structures. Tests aimed at verifying both the ability of the design to meet the specifications and the plausibility of data on which the system's design is based are described. Author (ESA)

N80-28404*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE PROCESSING APPLICATION ROCKET PROJECT, SPAR 5 Final Report
F. Reeves, comp. and D. Schaefer, comp. Aug. 1980 271 p refs
(NASA-TM-78275) Avail: NTIS HC A12/MF A01 CSCL 22B

Post flight results and analysis are presented on the following experiments: 'Agglomeration in Immiscible Liquids', 'Contained Polycrystalline Solidification in Low G', 'The Direct Observation of Dendrite Remelting and Macrosegregation in Casting', and 'Uniform Dispersion by Crystallization'. An engineering report on the performance of the SPAR Black Brant rocket is also included. Much useful data and information were accumulated for directing and developing experimental techniques and investigations toward

an expanding commercially beneficial program of materials processing in the coming shuttle era. L.F.M.

N80-28405*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ATTITUDE STABILITY OF SPINNING SATELLITES
T. K. Caughey. 15 Jul. 1980. 67 p. refs.
(Contract NAS7-100)
(NASA-CR-163364; JPL-Pub-80-46) Avail: NTIS
HC A04/MF A01 CSCL 22B

Some problems of attitude stability of spinning satellites are treated in a rigorous manner. With certain restrictions, linearized stability analysis correctly predicts the attitude stability of spinning satellites, even in the critical cases of the Liapunov-Poincare stability theory. L.F.M.

N80-28406*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
LSST SYSTEM ANALYSIS AND INTEGRATION TASK FOR AN ADVANCED SCIENCE AND APPLICATION SPACE PLATFORM. Final Report
Jul. 1980. 112 p. refs.
(Contract NAS8-33592)
(NASA-CR-161528; MDC-G8533) Avail: NTIS
HC A06/MF A01 CSCL 22B

To support the development of an advanced science and application space platform (ASASP) requirements of a representative set of payloads requiring large separation distances selected from the Science and Applications Space Platform data base. These payloads were a 100 meter diameter atmospheric gravity wave antenna, a 100 meter by 100 meter particle beam injection experiment, a 2 meter diameter, 18 meter long astrometric telescope, and a 15 meter diameter, 35 meter long large ambient deployable IR telescope. A low earth orbit at 500 km altitude and 56 deg inclination was selected as being the best compromise for meeting payload requirements. Platform subsystems were defined which would support the payload requirements and a physical platform concept was developed. Structural system requirements which included utilities accommodation, interface requirements, and platform strength and stiffness requirements were developed. An attitude control system concept was also described. The resultant ASASP concept was analyzed and technological developments deemed necessary in the area of large space systems were recommended. A.R.H.

N80-28407# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SYMMETRIC MISSILE DYNAMIC INSTABILITIES: A REVIEW. Final Report
Charles H. Murphy. Mar. 1980. 42 p. refs.
(DA Proj. 1L1-61102-AH-43)
(AD-A085022; AD-E400440; ARBRL-TR-02228) Avail: NTIS
HC A03/MF A01 CSCL 16/2

Dynamic instabilities observed for symmetric missiles and projectiles arise from a large variety of causes. These include unstable linear damping moments, and different nonlinear in-plane and out-of-plane damping moments for nonspinning re-entry vehicles, nonlinear Magnus moments for spinning missiles, and internal resonance with moving payload components. If aerodynamic trim is present, linear spin-yaw resonance can occur as well as nonlinear subharmonic motions and a number of other limit motions. This report gives a complete survey of these possibilities with a number of actual case histories. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations, and rescue techniques.

For related information see *also 03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-28408*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
MCC LEVEL C FORMULATION REQUIREMENTS. SHUTTLE TAEM GUIDANCE AND FLIGHT CONTROL, STS-1 BASELINE
Gilbert L. Carman and Moises N. Montez. Jun. 1980. 85 p. ref. Supersedes JSC-11786
(NASA-TM-81100; JSC-16523; JSC-11786) Avail: NTIS
HC A06/MF A01 CSCL 22B

The TAEM guidance and body rotational dynamics models required for the MCC simulation of the TAEM mission phase are defined. This simulation begins at the end of the entry phase and terminates at TAEM autoland interface. The logic presented is the required configuration for the first shuttle orbital flight (STS-1). The TAEM guidance is simulated in detail. The rotational dynamics simulation is a simplified model that assumes that the commanded rotational rates can be achieved in the integration interval. Thus, the rotational dynamics simulation is essentially a simulation of the autopilot commanded rates and integration of these rates to determine orbiter attitude. The rotational dynamics simulation also includes a simulation of the speedbrake deflection. The body flap and elevon deflections are computed in the orbiter aerodynamic simulation. A.R.H.

N80-28409*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 5: DESCENT CYCLE 3. APPENDIX D: GRTLS SIX DEGREE OF FREEDOM MONTE CARLO DISPERSION ANALYSIS
Moises N. Montez. Jul. 1980. 120 p. refs.
(NASA-TM-81101; JSC-14483-App-D;
Rept-78-FM-51-Vol-5-App-D) Avail: NTIS HC A06/MF A01
CSCL 22A

The results of a six degree of freedom (6-DOF) nonlinear Monte Carlo dispersion analysis for the latest glide return to landing site (GRTLS) abort trajectory for the Space Transportation System 1 Flight are presented. For this GRTLS, the number two main engine fails at 262.5 seconds ground elapsed time. Fifty randomly selected simulations, initialized at external tank separation, are analyzed. The initial covariance matrix is a 20 x 20 matrix and includes navigation errors and dispersions in position and velocity, time, accelerometer bias, and inertial platform misalinements. In all 50 samples, speedbrake, rudder, elevon, and body flap hinge moments are acceptable. Transitions to autoland begin before 9,000 feet and there are no tailscrapes. Navigation derived dynamic pressure accuracies exceed the flight control system constraints above Mach 2.5. Three out of 50 landings exceeded tire specification limit speed of 222 knots. Pilot manual landings are expected to reduce landing speed by landing farther downrange. L.F.M.

N80-28410*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
PLAID EVALUATION OF VISUAL ACCESS FOR PDP BERTHING AND DEPLOYMENT
Jeri W. Brown. Apr. 1980. 45 p.
(NASA-TM-81102; JSC-16653) Avail: NTIS
HC A03/MF A01 CSCL 22A

Tests were performed to evaluate visual access for berthing and deployment of the Plasma Diagnostic Package (PDP) in Space Transportation 4 Flight (STS-4). The Panel Layout Automated Interactive Design (PLAID), a 3-D computer graphics package, was used to construct models of the PDP, pallet, orbiter payload bay, the Remote Manipulator System (RMS), and other relevant elements to represent the STS-4 configuration. Several different assemblies were made, each one representing a snapshot of the PDP during berth/deploy maneuvers. Thirty-six views were produced during this test. L.F.M.

N80-28411*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
PROXIMITY OPERATIONS ANALYSIS: RETRIEVAL OF THE SOLAR MAXIMUM MISSION OBSERVATORY
Jerry A. Yglesias (McDonnell Douglas Technical Services Co., Inc., Houston). Apr. 1980. 41 p. refs.
(NASA-TM-81104; JSC-16411) Avail: NTIS
HC A03/MF A01 CSCL 22A

Retrieval of the solar maximum mission (SMM) observatory is feasible in terms of orbiter primary reaction control system (PRCS) plume disturbance of the SMM, orbiter propellant consumed, and flight time required. Man-in-loop simulations will be required to validate these operational techniques before the verification process is complete. Candidate approach and flyaround

techniques were developed that allow the orbiter to attain the proper alinement with the SMM for clear access to the grapple fixture (GF) prior grappling. Because the SMM has very little control authority (approximately 14.8 pound-foot-seconds in two axes and rate-damped in the third) it is necessary to inhibit all +Z (upfiring) PRCS jets on the orbiter to avoid tumbling the SMM. A profile involving a V-bar approach and an out-of-plane flyaround appears to be the best choice and is recommended at this time. The flyaround technique consists of alining the +X-axes of the two vehicles parallel with each other and then flying the orbiter around the SMM until the GF is in view. The out-of-plane flyaround technique is applicable to any inertially stabilized payload, and, the entire final approach profile could be considered as standard for most retrieval missions. L.F.M.

N80-28412*# IBM Federal Systems Div., Houston, Texas.
FLIGHT SOFTWARE MEMORY SIZING AND CPU LOADING ESTIMATES
May 1980 12 p refs
(Contract NAS9-14444)
(NASA-CR-160732) Avail: NTIS HC A02/MF A01 CSCL 09B

Estimates of the AP101 memory and central processing unit (CPU) requirements for the space shuttle orbiter are presented. The resource estimates reflect OASCAB approved change requests for Release 18 and Release 19. Memory sizes are presented in 32 bit full words. CPU loading is listed by percentage. Memory and CPU information was obtained from actual AP101 code where available, and from estimates provided by flight software development programmers. L.F.M.

N80-28413*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SURVEY OF LOAD METHODOLOGIES FOR SHUTTLE ORBITER PAYLOADS
J. C. Chen, J. A. Garba, M. Salama, and M. Trubert 15 Jun. 1980 105 p refs
(Contract NAS7-100)
(NASA-CR-163381; JPL-Pub-80-37) Avail: NTIS HC A06/MF A01 CSCL 22B

Loads methods currently being used to design shuttle orbiter payloads are summarized. Methods used for the design of payloads launched by expendable launch vehicles are described in historical perspective. Experiences gained from expendable launch vehicle payloads are used to develop methodologies for the space shuttle orbiter payloads. The objectives for the development of a new methodology for the shuttle payloads are to reduce the cost and schedule for the payload load analysis by decoupling the payload analysis from the launch vehicle to the maximum extent possible. Methods are described for payload member load estimation or obtaining upper bounds for dynamic loads, as well as load prediction or calculating actual transient member load time histories. Author

N80-28414*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
POWER SYSTEM INTERFACE AND UMBILICAL SYSTEM STUDY Final Report
7 Jul. 1980 112 p refs
(Contract NAS8-33707)
(NASA-CR-161521; LMSC-D758183) Avail: NTIS HC A06/MF A01 CSCL 22B

System requirements and basic design criteria were defined for berthing or docking a payload to the 25 kW power module which will provide electrical power and attitude control, cooling, data transfer, and communication services to free-flying and Orbiter sortie payloads. The selected umbilical system concept consists of four assemblies and command and display equipment to be installed at the Orbiter payload specialist station: (1) a movable platen assembly which is attached to the power system with EVA operable devices; (2) a slave platen assembly which is attached to the payload with EVA operable devices; (3) a fixed secondary platen permanently installed in the power system; and (4) a fixed secondary platen permanently installed on the payload. Operating modes and sequences are described. A.R.H.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-28415*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
ORBIT IMU ALIGNMENT: ERROR ANALYSIS
R. W. Corson Aug. 1980 42 p
(NASA-TM-81030; JSC-16758; Rept-80-FM-39) Avail: NTIS HC A03/MF A01 CSCL 20A

A comprehensive accuracy analysis of orbit inertial measurement unit (IMU) alignments using the shuttle star trackers was completed and the results are presented. Monte Carlo techniques were used in a computer simulation of the IMU alignment hardware and software systems to: (1) determine the expected Space Transportation System 1 Flight (STS-1) manual mode IMU alignment accuracy; (2) investigate the accuracy of alignments in later shuttle flights when the automatic mode of star acquisition may be used; and (3) verify that an analytical model previously used for estimating the alignment error is a valid model. The analysis results do not differ significantly from expectations. The standard deviation in the IMU alignment error for STS-1 alignments was determined to be 68 arc seconds per axis. This corresponds to a 99.7% probability that the magnitude of the total alignment error is less than 258 arc seconds. Author

N80-28416# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.
AFGL BALLOON TELEMETRY FACILITY Instrumentation Papers. Final Report
Arthur A. Giannetti and J. Craig Erickson 23 Jan. 1980 24 p
(AF Proj. 6665)
(AD-A084811; AFGL-TR-80-0029; AFGL-IP-284) Avail: NTIS HC A02/MF A01 CSCL 09/6

This paper describes the recently modernized permanent and mobile facilities for recovering and processing PCM and FM telemetry data from balloon-borne scientific experiments and engineering tests at Air Force Geophysics Laboratory, Detachment 1, Holloman Air Force Base, New Mexico. Mobile units are run either as stand-alone ground stations for launches from remote launch sites, or with telephone communications link to extend the operable range from the permanent ground station on Holloman AFB. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control, and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-28417*# Lockheed Aircraft Corp., Palo Alto, Calif.
GYRODAMPERS FOR LARGE SPACE STRUCTURES
J. N. Aubrun and G. Margulies Feb. 1979 107 p refs
(Contract NAS1-14887)
(NASA-CR-159171) Avail: NTIS HC A06/MF A01 CSCL 22B

The problem of controlling the vibrations of a large space structures by the use of actively augmented damping devices distributed throughout the structure is addressed. The gyrodamper which consists of a set of single gimbal control moment gyros which are actively controlled to extract the structural vibratory energy through the local rotational deformations of the structure, is described and analyzed. Various linear and nonlinear dynamic simulations of gyrodamped beams are shown, including results

on self-induced vibrations due to sensor noise and rotor imbalance. The complete nonlinear dynamic equations are included. The problem of designing and sizing a system of gyrodampers for a given structure, or extrapolating results for one gyrodamped structure to another is solved in terms of scaling laws. Novel scaling laws for gyro systems are derived, based upon fundamental physical principles, and various examples are given. A.R.H.

N80-28418*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
AN ASSESSMENT OF THE READINESS OF ABLATIVE MATERIALS FOR PREFLIGHT APPLICATION TO THE SHUTTLE ORBITER
Stephen S. Tompkins, William D. Brewer, Ronald K. Clark, Claud M. Pittman, and Kay L. Brinkley. Jul. 1980. 62 p. refs
(NASA-TM-81823) Avail: NTIS HC A04/MF A01 CSCL 22B

The shuttle orbiter relies primarily on a reusable surface insulation (RSI) thermal protection system (TPS). The RSI is very efficient in its thermal performance; however, the RSI tile system has shown poor mechanical integrity. The state-of-the-art of the ablative TPS is reviewed, and an assessment made of the ablator's readiness for use on the shuttle orbiter. Unresolved technical issues with regard to the ablative TPS are identified. Short time, highly focused analytical and experimental programs were initiated to: (1) identify candidate ablation materials; (2) assess the data base for these materials; (3) evaluate the need and kind of waterproof coating; (4) calculate thermal and other stresses in an ablator tile; (5) identify an acceptable ablator/RSI tile joint filler; and (6) assess the sensitivity of the ablator to sequential heat pulses. Results from some of these programs are discussed. L.F.M.

N80-28419# Aerospace Corp., El Segundo, Calif. Engineering Group.
PROCEEDINGS OF SYMPOSIUM ON WIRE APPLICATIONS IN SPACECRAFT Final Report
Syed M. Alvi and Leonard Katzin. Dec. 1979. 338 p. refs
Conf. held in Los Angeles, 8-9 May 1979
(Contract F04701-79-C-0080)
(AD-A084525; TR-0080(5902-04)-1; SD-TR-80-20) Avail: NTIS HC A15/MF A01 CSCL 09/1

Hundreds of pounds of wire are used in a spacecraft and this wire is installed into the product almost exclusively by human hands. As such, workmanship is as important as the modern technological advances in materials processes and engineering in wiring a product. These proceedings present a large variety of papers covering almost every aspect of importance to spacecraft wiring. The symposium format was tutorial, and each paper was written as somewhat of a text of its respective subject. The papers can be grouped into the following subjects: Specifications; Testing of wires; Wire preparation; Cables and harnesses; Wire-wound components; Wire joining techniques; Interconnection techniques; Rework and repair techniques; Design considerations; and New concepts and needs. GRA

N80-28420# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
THE DYNAMICS OF RIGID BODY IN THE SPACE PLASMA Environmental Research Papers
Peter J. L. Wildman. 28 Aug. 1979. 36 p. refs. Submitted for publication
(AF Proj. 2311; AF Proj. 7661)
(AD-A084806; AFGL-TR-79-0201; AFGL-ERP-673) Avail: NTIS HC A03/MF A01 CSCL 22/3

A time-dependent technique, in conjunction with the boundary-fitted coordinates system, is applied to solve a gas-only one-phase flow and a fully-coupled, gas-particle two-phase flow inside nozzles with small throat radii of curvature, steep wall gradients, and submerged configurations. The emphasis of the study has been placed on one- and two-phase flow in the transonic region. Various particle size and particle mass fractions have been investigated in the two-phase flow. The salient features associated with the two-phase nozzle flow compared with those of the one-phase flow are illustrated through the calculations for a JPL nozzle configuration, for the Titan III solid rocket motor nozzle, and for the submerged nozzle configuration utilized in the Inertial Upper Stage (IUS) solid rocket motor. GRA

N80-28421# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
CHARGING OF A SPINNING SPACECRAFT Environmental Research Papers
A. G. Rubin and K. H. Bhavnavi. 29 Oct. 1979. 17 p. refs
(AF Proj. 7661)
(AD-A084807; AFGL-TR-79-0261; AFGL-ERP-682) Avail: NTIS HC A02/MF A01 CSCL 22/3

It has become possible to calculate the effects of spin rate on charging only since the advent of the NASCAP three dimensional computer simulation code. These spin effects are surveyed here for the first time. There is not only a dramatic difference in potential distribution between a three-axis stabilized and a spinning satellite, but also the case of slow spin at 1 rpm is shown to constitute a distinct intermediate case, asymptotic to the rapid spin case but with appreciable voltage modulation around the spin equator. GRA

N80-28422# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
LARGE SPACE STRUCTURE CHARGING DURING ECLIPSE PASSAGE Air Force Surveys in Geophysics
David M. Gauntt. 15 Jan. 1980. 39 p. refs
(AF Proj. 7661)
(AD-A084810; AFGL-TR-80-0022; AFGL-AFSG-420) Avail: NTIS HC A03/MF A01 CSCL 22/3

Much work has been developed to the study of the differential charging of geosynchronous spacecraft, primarily that charging caused by injection events and uneven illumination of isolated surfaces. However, as the lack of illumination in the penumbra eliminates the latter problem, little attention has been paid to charging during eclipse passage. For a sufficiently large structure (length greater than 1 km), the gradient of illumination in the penumbra is large enough to contribute significantly to differential charging. In this paper, three main subjects will be discussed: (1) the causes of charging at geosynchronous altitudes; (2) a simple model of the plasma from which the differential charging equations can be derived; and (3) the results of a computer program based on these equations, together with several theoretically fit sets of equations to approximate the results. GRA

N80-28423# Parker (Lee W.), Inc., Concord, Mass.
TIME-DEPENDENT COMPUTER MODEL OF PLASMA SPACE CHARGE INTERACTIONS WITH A FINITE-CYLINDRICAL SPACECRAFT Final Report, 1 Apr. 1978 - 30 Sep. 1979
Lee W. Parker. 31 Dec. 1979. 88 p.
(Contract F19628-78-C-0149; AF Proj. 7661)
(AD-A084892; AFGL-TR-80-0018) Avail: NTIS HC A05/MF A01 CSCL 09/2

A computer program has been developed for the study of the time-dependent behavior of the sheaths and charging effects of spacecraft with finite-cylinder ('pillbox') geometry. The behavior of ions and electrons is simulated by following representative computer particles in time. During each time step the particles are moved, their space charge is computed, and the electric potential distribution is updated. The development is original. A number of sample runs show that current collection and space charge behavior can be computed as functions of time. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-28424*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE TIME-SPACE RELATIONSHIP OF THE DATA POINT (PIXELS) OF THE THEMATIC MAPPER AND MULTISPECTRAL SCANNER OR THE MYTH OF SIMULTANEITY

Frederick Gordon, Jr. Jul. 1980 29 p. refs
(NASA-TP-1715; Rept-80F5121) Avail: NTIS
HC A03/MF A01 CSCL 14B

A simplified explanation of the time space relationships among scanner pixels is presented. The examples of the multispectral scanner (MSS) on Landsats 1, 2, and 3 and the thematic mapper (TM) of Landsat D are used to describe the concept and degree of nonsimultaneity of scanning system data. The time aspects of scanner data acquisition and those parts of the MSS and TM systems related to that phenomena are addressed. E.D.K.

N80-28425*# Sperry Flight Systems, Phoenix, Ariz.
LABORATORY EVALUATION OF THE POINTING STABILITY OF THE ASPS VERNIER SYSTEM
Jun. 1980 66 p.
(Contract NAS1-15008)
(NASA-CR-159307; Rept-5121.5869.6.1-5) Avail: NTIS
HC A04/MF A01 CSCL 14B

The annular suspension and pointing system (ASPS) is an end-mount experiment pointing system designed for use in the space shuttle. The results of the ASPS Vernier System (AVS) pointing stability tests conducted in a laboratory environment are documented. A simulated zero-G suspension was used to support the test payload in the laboratory. The AVS and the suspension were modelled and incorporated into a simulation of the laboratory test. Error sources were identified and pointing stability sensitivities were determined via simulation. Statistical predictions of laboratory test performance were derived and compared to actual laboratory test results. The predicted mean pointing stability during simulated shuttle disturbances was 1.22 arc seconds; the actual mean laboratory test pointing stability was 1.36 arc seconds. The successful prediction of laboratory test results provides increased confidence in the analytical understanding of the AVS magnetic bearing technology and allows confident prediction of in-flight performance. Computer simulations of ASPS, operating in the shuttle disturbance environment, predict in-flight pointing stability errors less than 0.01 arc seconds.
Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-28426*# Battelle Columbus Labs., Ohio.
EVALUATION OF SPACE SHUTTLE MAIN ENGINE BEARINGS FROM HIGH PRESSURE OXYGEN TURBOPUMP 9008 Final Report
K. F. Dufrane and J. W. Kannel. 11 Jul. 1980 32 p. refs
(Contract NAS8-33576)
(NASA-CR-161516) Avail: NTIS HC A03/MF A01 CSCL 21H

Two used turbopump mainshaft support bearings were examined to determine steps needed to achieve turbopump lifetimes of 27,000 seconds. The two bearings, which had been run in a high pressure oxygen turbopump, are angular contact ball bearings, applied as a preloaded pair, locked to the shaft, inner race rotating, with the outer races unrestrained axially. Examination showed that both bearings had been subjected to overloads, leading to fatigue spalling on the races and balls and advanced retainer wear. This is clear evidence of unintended high internal loads in the high pressure oxygen pump which would lead to complete bearing failure and extensive secondary pump damage. Action must be taken to reduce the applied bearing loads or to incorporate bearings of sufficient size to withstand the high loads. L.F.M.

N80-28427*# Rocketdyne, Canoga Park, Calif.
ORBIT TRANSFER VEHICLE ENGINE STUDY, PHASE A EXTENSION. VOLUME 1: EXECUTIVE SUMMARY Final Report
30 Jun. 1980 61 p. 3 Vol.
(Contract NAS8-32996)
(NASA-CR-161514; RI/RD80-155-1-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 21H

A 1980 state-of-the-art advanced expander engine was configured that delivers near-optimum payload-performance and exhibits the simplicity, reliability, and life characteristics required of the OTV mission. Engine optimization studies indicate that the performance of the conventional expander cycle engine can be improved substantially through combustion chamber surface area enhancement, thermal enhancement, turbine regeneration, and power cycle efficiency enhancement procedures. The 20K lb. thrust staged combustion engine can be adapted to operate at extended periods in the 1 to 2K lb. thrust regime. The study results indicate that long-life, high performnce operation in the low thrust mode can be achieved with minimum modifications (kitting) of the engine. Although the main contribution to mission success and crew safety stems from propulsion system redundancy, significant reliability can be gained from engine component redundancy, specific engine design features ensuring safety and reliability, including an engine health monitoring system, and from a total program approach to safety and reliability, such as that presently applied to the space shuttle. A.R.H.

N80-28428*# Rocketdyne, Canoga Park, Calif.
ORBIT TRANSFER VEHICLE ENGINE STUDY, PHASE A EXTENSION. VOLUME 2A: STUDY RESULTS Final Report
30 Jun. 1980 213 p. refs 3 Vol.
(Contract NAS8-32996)
(NASA-CR-161515; RI/RD80-155-2-Vol-2-A) Avail: NTIS
HC A10/MF A01 CSCL 21H

Engine trade studies and systems analyses leading to a baseline engine selection for advanced expander cycle engine are discussed with emphasis on: (1) performance optimization of advanced expander cycle engines in the 10 to 20K pound thrust range; (2) selection of a recommended advanced expander engine configuration based on maximized performance and minimized mission risk, and definition of the components for this configuration; (3) characterization of the low thrust adaptation requirements and performance for the staged combustion engine; (4) generation of a suggested safety and reliability approach for OTV engines independent of engine cycle; (5) definition of program risk relationships between expander and staged combustion cycle engines; and (6) development of schedules and costs for the DDT&E, production, and operation phases of the 10K pound thrust expander engine program.
A.R.H.

N80-28429*# Aerojet Liquid Rocket Co., Sacramento, Calif.
DUAL NOZZLE AERODYNAMIC AND COOLING ANALYSIS STUDY Monthly Progress Report, 1 May - 30 Jun. 1980
G. M. Meagher. 10 Jul. 1980 25 p. ref.
(Contract NAS8-33553)
(NASA-CR-161525; BMPR-33553-M-10) Avail: NTIS
HC A02/MF A01 CSCL 21H

Geometric, aerodynamic flow field, performance prediction, and heat transfer analyses are considered for two advanced chamber nozzle concepts applicable to Earth-to-orbit engine systems. Topics covered include improvements to the dual throat aerodynamic and performance prediction program; geometric and flow field analyses of the dual expander concept; heat transfer analysis of both concepts, and engineering analysis of data from the NASA/MSFC hot-fire testing of a dual throat thruster model thrust chamber assembly. Preliminary results obtained are presented in graphs. A.R.H.

N80-28430# Northeastern Univ., Boston, Mass. Electronics Research Lab.
COMMAND CONTROL CONSOLES FOR SOUNDING ROCKET PAYLOADS Interim Report
Richard L. Morin. Dec. 1979 24 p. refs
(Contract F19628-76-C-0152; AF Proj. 2123)
(AD-A084097; SCIENTIFIC-3; AFGL-TR-80-0019) Avail: NTIS
HC A02/MF A01 CSCL 17/2

Presented is a summary of the design and development of a command control system. The objective is a real-time command and monitor console for payload functions in sounding rockets.

Payload requirements, console configurations, ground support interfaces, and test results for a specific experimental payload application are described in this report. GRA

N80-28431# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYSIS OF CRYODEPOSIT MIXTURES Final Report, 1 Oct. 1977 - 1 Sep. 1979
K. F. Palmer, J. A. Roux, and B. E. Wood. AEDC, Arnold AFS, Tenn. May 1980. 30 p. refs.
(AD-A084548; AEDC-TR-79-80) Avail: NTIS HC A03/MF A01 CSCL 20/6

This work was concerned with the infrared (IR) spectroscopic analysis of the optical properties of cryodeposits and other materials that are important in plume contamination and related studies. The assumption that IR-active molecular band strengths in a material are directly proportional to molecular band species concentrations is incorporated in a method for the calculation of species mole fractions, which is presented along with the results of an analysis of existing AEDC cryodeposit data. The agreement of the calculated mole fractions with those obtained from chemical analysis was within 15 percent for binary component cryodeposits, but much worse for multicomponent cryodeposits. During the search for an explanation of the discrepancies, it was found that the accuracies of the densities of the cryodeposits were as crucial as those of the band strengths, and that the above assumption must be modified, in a yet unknown manner, for materials where there is a large degree of hydrogen bonding. Also, it was noted that in mole fraction determinations the use of absorption index values alone is limited to materials having at most one IR-inactive molecular species. However, the identity of IR-inactive species, which must be known in the calculation, must be available from techniques other than IR spectroscopy. A method using molar refractivities for analyzing materials with two or more IR-inactive species is outlined. GRA

N80-28432# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.
FREE AIR FLUME OVERPRESSURE FOR 2.75 INCH ROCKET MOTORS MARK 40 AND MARK 66
Robert Bergman and Donald Davis. 13 Mar. 1980. 22 p.
(AD-A084478; DRSMI/RL-80-8) Avail: NTIS HC A02/MF A01 CSCL 19/7

Testing was conducted to determine the free air blast overpressure of the 2.75 inch rocket motors, MARK 40 and MARK 66. Data were collected for single and ripple firings of both type of rockets. 'Pressure maps' were generated to display the results. GRA

N80-28433# Army Natick Research and Development Command, Mass.
RETROROCKET SOFT LANDING OF AIRDROPPED CARGO Technical Progress Report, Oct. 1978 - Oct. 1979
William R. Nykvist. Dec. 1979. 70 p. refs.
(DA Proj. 1L1-62210-D-283)
(AD-A085220; Natick/TR-80/011) Avail: NTIS HC A04/MF A01 CSCL 01/3

A retrorocket soft landing system for airdropped cargo is described and mathematically analyzed. Solid propellant rockets and fixed height ground sensing, previously used in the experimental Parachute Retrorocket Airdrop System (PRADS), are assumed for this system. Seventeen variables affecting the load impact velocity are defined and used to write the one-body equations of motion for the system. A computer is used to generate 500 constrained random values for each independent variable, to calculate the impact velocity for 500 cases by solving the equations of motion, and to statistically analyze the results. It is concluded that 95% of the soft landings can be expected to have impact velocities between 2.0 and 3.4 m/s (6.1 and 10.3 ft/s). GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-28434# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
KINETICS AND MECHANISM OF METAL-CARBONYL-CATALYZED HYDROGENATION OF AROMATIC HYDROCARBON MODELS FOR COAL CONSTITUENTS Ph.D. Thesis
Tibor T. Derencsenyi and Theodore Vermeulen. Sep. 1979. 231 p. refs.
(Contract W-7405-eng-48)
(LBL-9777) Avail: NTIS HC A11/MF A01

Homogeneous catalytic hydrogenation of anthracene by Mn2(CO)8(PBu3)2 and cyclohexene by RhCl(PPh3)3 were studied, and mechanisms for both reactions are presented. The manganese operates by two competing steps, the formation of a trihydride and an anthracene-manganese complex reacting to produce 9,10-dihydroanthracene, whereas the rhodium forms a dihydride-olefine-rhodium complex whose decomposition is the rate determining step. Substitution of the phosphine ligands on Mn2(CO)8(PBu3)2 show that the rate of anthracene hydrogenation is dependent on the nature of the ligand. The rate did not correlate with the basicity of the phosphine, but additivity effects were noted which led to an excellent correlation of the rate with P-31 NMR shift of the phosphine oxide. This correlation is shown to be a novel linear free-energy relationship that may be extended to other metal complexes for the purposes of describing catalytic activity and the mechanistic details of reactions, such as oxidative addition of hydrogen, cis-trans equilibrium, and ligand exchange. DOE

N80-28435# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
ELECTRON OXIDATION OF AROMATIC MOLECULES AND RELATED DELOCALIZED ELECTRON SOLIDS
Francis Louis Tanzella. Jan. 1980. 108 p. refs.
(Contract W-7405-eng-48)
(LBL-10478) Avail: NTIS HC A06/MF A01

Pyrolysis of C6F6AsF6, C5F5NAsF6 and CF3C6F5AsF6 yields an equimolar mixture of the parent fluorocarbon and an isomer specific cyclohexadiene. A mechanism for this decomposition involving F(-) transfer from anion to cation is discussed. Hydrolysis of C10F6AsF6 yields an equimolar mixture of C10F8 and an isomer specific quinone C10F6O2. Mechanism involving OH(-) attack on the cation is presented. Benzene reacts with AsF5 to give (C6H5)2AsF2(+)AsF6(-) which then reacts quantitatively with CsF to give (C6H5)2AsF3 and CsAsF6. Interaction of (C6H5)2AsF3 with AsF5 reconstitutes the fluoroarsonium salt. Variable temperature 19FNMR studies show ph2AsF3 to be a rigid trigonal bipyramid, with the phenyl groups in equatorial positions, to 71 C. Interaction of benzene with O2AsF6 or C6F6AsF6 yields a mixture of (C6H5)2AsF2(+)AsF6(-) and a poly(p-phenylene) salt. A mechanism involving initial electron oxidation of benzene to give the radical cation intermediate C6H6(+)AsF6(-) is proposed. The moderate electrical conductivity of the polyphenylene salt indicates that it is a delocalized electron solid. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N80-28436*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
SELECTED NASA RESEARCH IN COMPOSITE MATERIALS AND STRUCTURES
1980. 237 p. refs. Presented at the 2d Ind. Rev. of the NASA Aircraft Energy Efficiency (ACEE) Composite Programs, Seattle, 11-13 Aug. 1980.
(NASA-CP-2142; L-13915) Avail: NTIS HC A15/MF A01 CSCL 11D

Various aspects of the application of composite materials to aircraft structures are considered. Failure prediction techniques, buckling and postbuckling research, laminate fatigue analysis, damage tolerance, high temperature resin matrix composites and electrical hazards of carbon fiber composites are among the topics discussed. For individual titles, see N80-28437 through N80-28442.

N80-28437*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FAILURE PREDICTION TECHNIQUES FOR COMPRESSION LOADED COMPOSITE LAMINATES WITH HOLES
Martin M. Mikulas, Jr. *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 1-33 refs (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

The degree of notch sensitivity of composites in compression and whether their failures can be predicted over a wide range of plate and hole sizes. The notch sensitivity of composites is investigated by comparing actual failure loads of laminates with circular holes, with the extreme failure that would be expected from an ideal notch insensitive material and from an ideal notch sensitive material. The predictability question is addressed by applying the point stress failure criterion to a wide range of plate widths and hole sizes and comparing with available experimental data. The severity of impact is explored by comparing strength reductions resulting from impact with those resulting from comparable size circular holes. Finally, comparison is made of the differences to be expected from the effects of cracks and circular holes on failure strength. J.M.S.

N80-28438*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BUCKLING AND POSTBUCKLING RESEARCH ON FLAT AND CURVED COMPOSITE PANELS
James H. Starnes, Jr. *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 35-78 refs (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

Progress in the development of verified design technology for generic advanced-composite structural components loaded in compression is reported. Generic structural configurations material systems and load ranges of interest for a given application were investigated using structural procedures, structural analysis procedures, and laboratory testing of structural specimens. Both flat and curved composite compression panels that are designed either to be buckling resistant or to have postbuckling strength depending on the expected application of the panels were considered. J.M.S.

N80-28439*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF A LAMINATE FATIGUE ANALYSIS
George L. Roderick, T. K. OBrien (Army Aviation Research and Development Command), and John D. Whitcomb. *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 79-106 (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

A fatigue analysis technique developed to predict damage growth in notched laminates is described. Features of the analysis include: criteria to relate matrix failure to cyclic stresses in and between plies; correlation of delamination growth with strain-release rate; and in-plane shear modulus change is related to cyclic shear stresses. A simplified finite element model is used to determine stresses in laminates that contain matrix damage. Failure criteria are integrated with the finite element model to form the fatigue analysis. J.M.S.

N80-28440*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DAMAGE TOLERANCE RESEARCH ON COMPOSITE COMPRESSION PANELS
Marvin D. Rhodes. *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 107-142 refs (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

The damage tolerance of composites was investigated. Results show that severe degradation in material strength may occur due to impact damage and that reduced strain allowables should be considered to compensate for possible impact damage. The mechanisms of failure involved in impact so that local damage will be reduced and arrest of propagating fracture initiated at impact locations are examined. Compression strength reductions for damage due to impact by a 1.27 cm diameter spherical projectile in thick laminates representative of wing skin panels are presented. Also discussed are the results of concepts recently evaluated to improve damage tolerance. These concepts range from improvements at the materials level to advanced structural configurations designed to arrest or limit the growth of propagating fractures. The results indicate that substantial improvements in the damage tolerance of graphite-epoxy composite structures can be achieved through the proper combination of materials and structural design. J.M.S.

N80-28441*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HIGH TEMPERATURE RESIN MATRIX COMPOSITES FOR AEROSPACE STRUCTURES
John G. Davis, Jr. *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 143-182 refs (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

Accomplishments and the outlook for graphite-polyimide composite structures are briefly outlined. Laminates, skin-stiffened and honeycomb sandwich panels, chopped fiber moldings, and structural components were fabricated with Celion/LARC-160 and Celion/PMR-15 composite materials. Interlaminar shear and flexure strength data obtained on as-fabricated specimens and specimens that were exposed for 125 hours at 589 K indicate that epoxy sized and polyimide sized Celion graphite fibers exhibit essentially the same behavior in a PMR-15 matrix composite. Analyses and tests of graphite-polyimide compression and shear panels indicate that utilization in moderately loaded applications offers the potential for achieving a 30 to 50 percent reduction in structural mass compared to conventional aluminum panels. Data on effects of moisture, temperature, thermal cycling, and shuttle fluids on mechanical properties indicate that both LARC-160 and PMR-15 are suitable matrix materials for a graphite-polyimide aft body flap. No technical road blocks to building a graphite-polyimide composite aft body flap are identified. J.M.S.

N80-28442*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN INVESTIGATION OF POSSIBLE ELECTRICAL HAZARDS OF CARBON FIBER COMPOSITES
Robert J. Huston. *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 183-234 refs (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

Results of an assessment of the public risk associated with the release of carbon fibers from crash-fire accidents of civil aircraft having carbon composite structures are presented. The overall national impact is shown to be extremely low in 1983. Personal injury is found to be extremely unlikely. Based on these findings, the risk of electrical failure from carbon fibers should not prevent the exploitation of composites in aircraft, and additional protection of aircraft avionics to guard aginst carbon fibers is unnecessary. J.M.S.

N80-28443*# Avco Corp., Lowell, Mass. Special Materials Div.
DEVELOPMENT OF A FIRE TEST FACILITY FOR GRAPHITE FIBER-REINFORCED COMPOSITES
J. G. Alexander. Jun. 1980 48 p refs
(Contract NAS1-15511)
(NASA-CR-159193) Avail: NTIS HC A03/MF A01 CSCL 11D

A number of modifications were added to the Model 25 facility to make it specifically applicable for composite material screening tests. Most significant was the development of hardware for trapping fibers released during test and isolating them for quantitative measurement. Capability was added for increasing test section velocities and increasing the range of air/fuel ratios available from very rich to very lean. A provision was added for agitation of the test specimen and the combustion gases by a pulsating gas supply. A variety of specimen configurations was evaluated by an extensive series of tests on a graphite-epoxy reference composite which is representative of material currently used in advanced aircraft. A standard test technique and specimen configuration were established which was satisfactory for the reference composite. A test program was then performed on several alternate composite materials to

verify the validity of the test method for relative evaluation of a variety of composite materials. R.C.T.

N80-28444*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPERTIES OF PMR POLYIMIDE COMPOSITES MADE WITH IMPROVED HIGH STRENGTH GRAPHITE FIBERS
Raymond D. Vannucci 1980 18 p refs Proposed for presentation at 12th Natl. SAMPE Tech. Conf., Seattle, 7-9 Oct. 1980
(NASA-TM-81557; E-518) Avail: NTIS HC A02/MF A01 CSCL 11D

High strength, intermediate modulus graphite fibers were obtained from various commercial suppliers, and were used to fabricate PMR-15 and PMR-2 polyimide composites. The effects of the improved high strength graphite fibers on composite properties after exposure in air at 600 F were investigated. Two of the improved fibers were found to have an adverse effect on the long term performance of PMR composites. The influence of various factors such as fiber physical properties, surface morphology and chemical composition were also examined. R.C.T.

N80-28445*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POLAR SYMMETRY IN THREE-DIMENSIONAL ANALYSIS OF LAMINATES WITH ANGLE PLIES
I. S. Raju and John H. Crews, Jr. Jul. 1980 7 p refs
(NASA-TM-81852) Avail: NTIS HC A02/MF A01 CSCL 11D

An improved procedure for the three dimensional finite element analysis of an angle ply laminate with a circular hole is discussed. The procecure exploits polar symmetry and is the basis for a new finite element computer code. For the broad class of laminates that contain angle plies, this code requires only one half as much computing capacity as conventional codes. R.C.T.

N80-28446*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CARBON FIBER COUNTING
Richard A. Pride Jun. 1980 17 p refs
(NASA-TM-80117) Avail: NTIS HC A02/MF A01 CSCL 11D

A method was developed for characterizing the number and lengths of carbon fibers accidentally released by the burning of composite portions of civil aircraft structure in a jet fuel fire after an accident. Representative samplings of carbon fibers collected on transparent sticky film were counted from photographic enlargements with a computer aided technique which also provided fiber lengths. R.C.T.

N80-28447*# National Aeronautics and Space Administration, Washington, D. C.
METHODS FOR AN INVESTIGATION OF THE EFFECT OF MATERIAL COMPONENTS ON THE MECHANICAL CHARACTERISTICS OF GLASS-FIBER-REINFORCED PLASTICS
H.-O. Willax Apr. 1980 14 p Transl. into ENGLISH from VDI-Z (West Germany), v. 118, no. 4, 1976 p 178-182 Original language document announced as A76-22348 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Karlsruhe Univ., West Germany
(Contract NASw-3199)
(NASA-TM-75785) Avail: NTIS HC A02/MF A01 CSCL 11D

The materials used in the production of glass reinforced plastics are discussed. Specific emphasis is given to matrix polyester materials, the reinforcing glass materials, and aspects of specimen preparation. Various methods of investigation are described, giving attention to optical impregnation and wetting measurements and the gravimetric determination of the angle of contact. Deformation measurements and approaches utilizing a piezoelectric device are also considered. R.C.T.

N80-28448# California Univ., San Diego, La Jolla. Dept. of Applied Mechanics and Engineering Sciences.
MECHANICS OF COMPOSITE MATERIALS Final Report, Jul. 1977 - Jun. 1979
G. A. Hegemier Dec. 1979 19 p refs
(Contract F49620-76-C-0024; AF Proj. 2307)
(AD-A084547; AFOSR-80-0319TR) Avail: NTIS HC A02/MF A01 CSCL 11/4

The primary objective was to construct viable micromechanical continuum models to predict the following response measures of composite materials subject to thermomechanical process: (1) global and local stress, deformation, and diffusive (thermal and/or moisture) fields; (2) failure modes and damage accumulation; and (3) residual properties of damaged composites. Additional objectives included the development of associated variational principles from which the continuum models might be transformed to finite element form, and the performance of case studies in an effort to validate the modeling process. The model construction methodology employed is based upon the mixture theory with microstructure concept. Accordingly, all global properties are determined from the composite geometry, and the properties of the microcomponents and the microcomponents interfaces. Such as theoretical framework allows a considerable improvement in modeling capability, and provides a simulation tool that allows one to rationally guide material development and selection. In addition, and in contrast to direct micromodeling by finite difference or finite element methods, it furnishes a very efficient and inexpensive computation tool. GRA

N80-28449# University Coll. of North Wales, Bangor. School of Physical and Molecular Sciences.
PREPARATION AND PROPERTIES OF A STABLE METALLIC FERROFLUID Final Report
S. R. Hoon, S. W. Charles, and J. Popplewell Feb. 1980 101 p refs
(Grant DA-ERO-77-G-037; DA Proj. 1T1-61102-BH-57)
(AD-A084447) Avail: NTIS HC A06/MF A01 CSCL 20/3

The aim of this research work has been to characterize the properties of suspensions of small single domain iron particles in mercury. These ferromagnetic liquids have been stabilized against diffusional growth by tin, antimony, and sodium additives. That the tin, antimony, and sodium associate themselves with the iron particles to form coatings is strikingly shown in this report by resistivity and latent heat of melting experiments. GRA

N80-28450# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Lab.
SPECTRAL EMISSIVITY AT HIGH TEMPERATURES Annual Report, 1 Feb. - 31 Jan. 1980
R. E. Taylor, D. P. DeWitt, and P. E. Johnson Apr. 1980 14 p refs
(Grant AF-AFOSR-3280-77; AF Proj. 2308)
(AD-A085297; TPRL-216) Avail: NTIS HC A02/MF A01 CSCL 11/4

Progress on the development work on the Spectral Emissometer used in conjunction with the high temperature multiproperty apparatus is described. The emissometer has been demonstrated to yield state-of-the-art accuracy for the spectral emissivity in the 1.5 to 15 micrometer range above 1300 K for opaque solids. Both electrically conducting and opaque insulating samples of high technological interest have been studied. The present work was aimed primarily at increasing sensitivity to allow measurements at lower temperatures and to provide the basis for investigating semi-transparent materials. GRA

N80-28451# Lockheed-California Co., Burbank.
THE EFFECT OF ENVIRONMENT ON THE COMPRESSIVE STRENGTHS OF LAMINATED EPOXY MATRIX COMPOSITES Final Report, 15 Aug. 1977 - 28 Sep. 1979
K. N. Lauraitis and P. E. Sandorff Wright-Patterson AFB, Ohio AFML Dec. 1979 417 p refs
(Contract F33615-77-C-5140; AF Proj. 2419)
(AD-A085167; LR-28508-8; AFML-TR-79-4179) Avail: NTIS HC A18/MF A01 CSCL 11/4

The program was designed to assess the effects of temperature and absorbed moisture on the static compression behavior of epoxy matrix composites under loading conditions wherein the dominant failure modes are those which occur in structural applications. Compression test fixtures providing varying degrees of geometrical constraint were employed in order to conduct a complete series of column tests ranging from perfectly elastic to fully restrained. Two graphite/epoxy materials were evaluated, T300/5208 and AS/3501-5A. Both longitudinal and transverse

orientations of three specimen types, a 0-degree unidirectional, a quasi-isotropic and a 67%-0-degree laminate were evaluated at four temperatures, -54 C (-65 F), 22 C (72 F), 93 C (200 F) and 135 C (275 F) after exposure to one of two environmental conditions: dry, (22 C (72 F) and 40% R. H.) and wet (82 C (180 F) and 90% R.H.). Both materials were characterized under static-tension and shear loading and Tg, thermal expansion and moisture distributions were determined. Analytical procedures for predicting the column buckling behavior under various conditions were developed. Elastic buckling of the laminates investigated were relatively unaffected by moisture and temperature. The inelastic buckling curve revealed a drop due to moisture and temperature which was dependent upon material and laminate type. GRA

N80-28452# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

SHEAR MODULI OF ORTHOTROPIC COMPOSITES Final Report, 1 Jun. 1978 - 1 Oct. 1979

N. J. Pagano Mar. 1980 16 p refs

(AF Proj. 2419)

(AD-A084975; AFML-TR-79-4164) Avail: NTIS HC A02/MF A01 CSCL 11/4

The elasticity solution for a circular cylindrical body possessing rectilinear orthotropy under pure torsion is used to define an experimental approach to determine the shear moduli of orthotropic composites. Attention is focused on the transverse shear modulus of a unidirectional composite, which is not routinely measured in the characterization procedure. This property, as well as the longitudinal shear modulus, can be determined from the same specimen, which consists of transversely oriented unidirectional fiber reinforcement. The simulation of the theoretical displacement boundary conditions and failure tests are also discussed. GRA

N80-28453# General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.

ADL-4D6: A SILICA/SILICA COMPOSITE FOR HARDENED ANTENNA WINDOWS

J. Brazel and R. Fenton 30 Dec. 1976 10 p refs Presented at the 13th Electromagnetic Window Symp., Atlanta, 20-23 Sep. 1976

(AD-A084883; Doc-76SDR049) Avail: NTIS HC A02/MF A01 CSCL 11/4

A silica/silica composite designated 'ADL-4D6' has been developed at GE/RESD for advanced missile shock-resistant antenna window applications. It is based on RESD's 'Omniweave' 4 D reinforcement system using high purity fused silica fibers, densified to 1.6 gm/cc by repeated infiltration with an aqueous suspension of colloidal silica. This paper describes an improved fabrication process, from both the performance and cost standpoint, and summarizes mechanical, thermal and electrical design data. The results of flyer plate testing show a spall threshold of 7300-8000 taps for a 1 inch thickness, the highest spall resistance (hardening) of any known inorganic dielectric material. Minimum flexure strenghts of 5000 psi and 1.0% strain to failure have been achieved. ADL-4D6 can thus be considered a 'ductile ceramic'. GRA

N80-28454# Sandia Labs., Albuquerque, N. Mex. Systems Safety Technology Div.

THEORY FOR LAMINATED PLATES WITH A THROUGH-THE-THICKNESS CRACK

E. P. Chen 1980 20 p refs Presented at the Intern. Conf. on Fracture, Cannes, France, 29 Mar. 1980

(Contract EY-76-C-04-0789)

(SAND-80-0748C; CONF-800357-1) Avail: NTIS HC A02/MF A01

The flexural response of a laminated plate with a through the thickness crack was considered in this investigation. A laminated plate theory of the Reissner type was developed to treat this problem. For demonstration purposes, the theory was applied to a balanced symmetric laminate which contains a through the thickness central crack. The stress intensity factor for the crack is determined and the influences of the various material and geremetric parameters on the stress intensity factor are discussed. DOE

N80-28455# Oak Ridge National Lab., Tenn.

SYNTHESIS AND ELECTRONIC APPLICATIONS OF OXIDE-METAL EUTECTIC COMPOSITES

J. D. Holder, J. K. Cochran, D. N. Hill, A. T. Chapman, and G. W. Clark 1980 34 p refs Presented at Verbunderkstoffe 1980, Kontanz, West Germany, 17 Apr. 1980 Prepared in cooperation with Georgia Inst. of Technology, Atlanta

(Contract W-7405-eng-26)

(CONF-800457-1) Avail: NTIS HC A03/MF A01

Important developments in the synthesis of oxide metal eutectic composites and the composite application in the continuing development of field emitters are reviewed. Known metal oxide-metal binary and ternary eutectic systems are listed. The synthesis, electrical conductivity, thermodynamics, and applications are discussed. DOE

N80-28456# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Subdiv. Systemes.

RELATIONSHIP BETWEEN THE INTERNAL ARCHITECTURE AND PROPERTIES OF CARBON-CARBON MATERIALS WITH EXAMPLES OF APPLICATIONS [RELATION ENTRE L'ARCHITECTURE INTERNE ET LES PROPRIETES D'UN CARBONE-CARBONE ET EXEMPLE DE REALISATIONS]

J. P. Slonina (Le Carbone Lorraine, France) and J. L. Chareire Paris 28 Feb. 1979 16 p In FRENCH Presented at Conf. on Strength and Structure in Carbons and Graphites, Bath, England, 4-6 Apr. 1979

(SNIAS-792-422-114) Avail: NTIS HC A02/MF A01

A brief description is given of the liquid and gaseous methods used to fabricate such materials. Internal architecture parameters are defined: general directions of fibers, way in which fibers are grouped, and nature and density of fibers and substrates. The effect of the highly anisotropic characteristics of graphite crystals in providing strong high performance materials is discussed. Examples of applications are cited. Author (ESA)

N80-28457# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Subdiv. Systemes.

CALCULATION OF GLASS-EPOXY PRESSURE VESSELS TAKING INTO ACCOUNT GEOMETRICAL AND RHEOLOGICAL NONLINEARITIES

Gilles Bourdeau 1979 10 p refs In FRENCH; ENGLISH summary Presented at DGRST Colloq. sur les Mater. Composites, Saclay, France, Jun. 1979

(SNIAS-792-422-117) Avail: NTIS HC A02/MF A01

Calculations performed by a computer model of finite elements using isoparametric elements are described. At the beginning of calculation, the composite's mechanical characteristics are supplied by Tsai's formulation. The model takes into account two types of nonlinearities: geometrical nonlinearity and composite rheological nonlinearity. Geometrical nonlinearity is treated in the simplest manner. The structure is subject to delta P sub 1 pressure, from resulting displacements a deformed structure is obtained and is subject to a new delta P sub 2 increment. The importance of delta P sub i depends upon the nonlinear behavior of the studied structure. Rheological nonlinearity is caused by an epoxy failure. When displacements resulting from a delta P sub i are known, strains, stresses and a failure criterion are computed for every node. As soon as the failure criterion value is greater than 1 for one node in any element, an epoxy failure is assumed in the whole element. Author (ESA)

N80-28458# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Establissement d'Aquitaine.

SOME NEW TECHNOLOGIES DEVELOPED BY SNIAS AQUITAINE [QUELQUES NOUVELLES TECHNOLOGIES DEVELOPPEES A LA SNIAS AQUITAINE]

J. C. Cantagrel and Y. Grenie Paris 1979 9 p In FRENCH Presented at Conf. on Journees du Verre Textile et des Plastiques Renforces, 28 Mar. 1979

(SNIAS-792-430-103) Avail: NTIS HC A02/MF A01

Some very high performance composite materials (carbon, glass and Kevlar filaments) developed to meet the requirements of the latest generation of ballistic motors are described. Emphasis is given to the procedures employed in their manufacture (preparation of substrates, densification with organic resins). The fabrication and utilization of reinforced phenolic foam are also discussed. Author (ESA)

N80-28459# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Establissement d'Aquitaine.
USE OF COMPOSITE MATERIALS FOR UNDERWATER STRUCTURES [LES MATERIAUX COMPOSITES AU SERVICE DES STRUCTURES SOUS-MARINE]
Max Popot (Aerospatiale Establissement d'Aquitaine) Paris 1979 11 p refs In FRENCH Presented at Oceanexpo Conf., Oct. 1977
(SNIAS-792-430-105) Avail: NTIS HC A02/MF A01

The excellent characteristics of coiled filament envelopes when subjected to internal pressures indicate that similar performances might be achieved for envelopes subject to external pressures. The study program conducted is presented. Comparisons are made between performances achieved with modern composites and classical materials. Some specific examples are presented including tests carried out on cylindrical shells. Suggestions are made to adapt such materials to these applications. Author (ESA)

N80-28460# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
TRANSVERSE MICROCRACKING IN CELION 6000/PMR-15 GRAPHITE-POLYIMIDE Interim Report
J. Steven Mills, Carl T. Herakovich, and John G. Davis, Jr. (NASA Langley Research Center) Dec. 1979 131 p refs
(Grant NGR-47-004-129)
(PB80-169626; VPI-E-79-35; IR-17) Avail: NTIS HC A07/MF A01 CSCL 11D

The effects of room temperature tensile loading and five thermal loadings, in the range -320 F (-196C) to 625F (330CC), upon the development of transverse microcracks (TVM) in Celion 6000/PMR-15 graphite-polyimide laminates were investigated. Microcracks were observed using a replicating technique, microscopy and X-ray. The mechanical or thermal load at which microcracking initiates and the ply residual stresses were predicted using laminate analysis with stress- and temperature-dependent material properties. GRA

N80-28461# National Technical Information Service, Springfield, Va.
BORON REINFORCED COMPOSITES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Apr. 1980
Diane M. Cavagnaro May 1980 262 p Supersedes NTIS/PS-79/0476; NTIS/PS-78/0357
(PB80-810138; NTIS/PS-79/0476) Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

The bibliography cites Federally funded research on boron fibers and boron compounds used as reinforcing material in composites. Included are studies on fabrication, testing, uses, and structural and mechanical properties. This updated bibliography contains 255 abstracts, 19 of which are new entries to the previous edition. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography, combustion theory, electrochemistry, and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-28462 Research Inst. of National Defence, Stockholm (Sweden).
ANALYTICAL LUMINESCENCE: A BIBLIOGRAPHY [LUMINESCENSANALYS. EN SAMMANSTAELLNING AV LITTERATUR]
Gunilla Eriksson, Pia Hallin, Thomas Olsson, and Anders Thore Dec. 1979 19 p refs In SWEDISH
(FOA-C-40106-B2) Avail: Issuing Activity

A literature search was performed in the areas of chemiluminescence and bioluminescence form the point of view of detection and protection techniques in biological warfare. Citations are grouped under: luciferase; bacterial luminescence; bacteriology; microbial biomass assays; immunoassay; and phagocytes. Author (ESA)

N80-28463*# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF THE FEASIBILITY OF CARS MEASUREMENTS IN SCRAMJET COMBUSTION
John A. Shirley, Robert J. Hall, and Alan C. Eckbreth Jul. 1980 93 p refs
(Contract NAS1-15491)
(NASA-CR-159280; R79-954390-13) Avail: NTIS HC A05/MF A01 CSCL 21B

Results are presented of analytical and experimental investigations to determine the feasibility of using coherent anti-Stokes Raman Spectroscopy (CARS) to measure temperature and species concentration in supersonic combustion experiments. The CARS spectra of H2O, O2 and H2 were measured in laboratory flames. Computer code calculated spectra agree very well with the measured spectra. Temperature, and O2 and H2 concentration profiles have been determined from CARS spectra in a laboratory H2 air flat diffusion flame. Temperature measurements agree with radiation corrected thermocouple measurements within 5 to 10 percent, depending on species concentration. The feasibility of measuring O2 concentrations up to 10 percent, from the spectral shape was demonstrated. H2 concentrations determined from CARS intensities agree with spontaneous Raman measurements within a factor of two. Finally, a conceptual design was formulated for diagnostics in the Langley Research Center scramjet combustion facility. Author

N80-28464*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
INVESTIGATION OF THE FREE FLOW ELECTROPHORETIC PROCESS Final Report
Ronald A. Weiss, J. W. Lanham, D. W. Richman, and C. D. Walker Jun. 1980 19 p
(Contract NAS8-33713)
(NASA-CR-161523; MDC-E2275) Avail: NTIS HC A02/MF A01 CSCL 07D

The effects of gravity on the free flow electrophoretic process was demonstrated. The free flow electrophoresis chamber used to demonstrate the effects of gravity on the process was of a proprietary design. This chamber was 120 cm long, 16 cm wide, and 0.15 cm thick. Flow in this chamber was in the upward direction and exited through 197 outlets at the top of the chamber. During electrophoresis a stream of sample was injected into the flow near the bottom of the chamber and an electrical field was applied across the width of the chamber. The field caused a lateral force on particles in the sample proportional to the inherent charge of the particle and the electric field strength. Particle lateral velocity was then dependent on the force due to viscous drag which was proportional to particle size and particle shape dependent. R.C.T.

N80-28465# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 6: SPHERICAL DIFFUSION FLAMES
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 35 p refs (Contract DAAG29-79-C-0121)
(AD-A084430; TR-108; ARO-15882.17-M) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report is Chapter VI of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. Spherical diffusion flames are discussed with a view to application to the burning fuel drop. Emphasis is on establishing ignition and extinction conditions. GRA

N80-28466# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 8: THREE-DIMENSIONAL FLAMES
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 31 p refs (Contract DAAG29-79-C-0121)
(AD-A084431; TR-110; ARO-15882.18-M) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report is Chapter 8 of the twelve in forthcoming research monograph on the mathematical theory of laminar combustion.

A theory of three-dimensional flames is developed, showing the key roles played by slow variation and near equidiffusion. The basic equation of slowly varying flames is developed, while near-equidiffusional flames are shown to lead to moving-boundary problems of Stefan type. The notion of flame stretch is investigated. GRA

N80-28467# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 10: EFFECTS OF SHEAR AND STRAIN
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 36 p refs
(Contract DAAG29-79-C-0121)
(AD-A084432; ARO-15882.19-M-Ch-10; TR-112-Ch-10) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report is Chapter 10 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. The effect of flow nonuniformities on a flame is investigated by first considering simple shear and strain, and then general straining motion. Evidence for the supposed connection between flame stretch and extinction is found to be mixed. GRA

N80-28468# AeroChem Research Labs., Inc., Princeton, N. J.
IONIC MECHANISMS OF CARBON FORMATION IN FLAMES Annual Report, 1 Jan. - 31 Dec. 1979
H. F. Calcote and D. B. Olson Mar. 1980 39 p refs
(Contract F49620-77-C-0029; AF Proj. 2308)
(AD-A084675; AeroChem-TP-399; AFOSR-80-0322TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

The objective of this program is to establish a chemical mechanism of soot formation which will serve as a basis for practical solutions to the smoke problem in jet engines. An experimental program is currently underway at AeroChem to study soot formation in premixed laminar flames to test proposed chemical mechanisms, in particular the hypothesis that soot nucleates on chemically formed ions whose growth is thermochemically favored and proceeds by very rapid ion-molecule reactions. Mass spectrometric measurements of positive ion concentration profiles in rich and sooting acetylene and benzene flames show many similarities and some distinct differences. As sooting is approached by increasing the equivalence ratio, the concentration of large ions with mass greater than 300 grows rapidly. GRA

N80-28469# Pennsylvania State Univ., University Park. Dept. of Chemistry.
MOLECULAR DYNAMICS OF MIXED-METAL CLUSTERS. (C-13) AND (H-1) NMR STUDIES OF H2FeRu2(CO)13, AND H2FeRuOs2(CO)13 Interim Report
Wayne L. Gladfelter and Gregory L. Geoffroy 25 Apr. 1980 38 p refs
(Contract N00014-77-C-0417; NR Proj. 053-645)
(AD-A084356; TR-7) Avail: NTIS HC A03/MF A01 CSCL 07/4

Variable temperature H and carbon 13 NMR spectra of H2FeRu3(CO)13, H2FeRu2Os(CO)13, and H2FeRuOs(CO)13 have been measured and interpreted in view of three distinct fluxional processes. In the lowest temperature process the bridging and terminal carbonyls bound to Fe undergo localized exchange. The second process involves migration of the carbonyls around the face of the tetrahedral cluster that contains the bridging carbonyls. The highest temperature process involves a subtle reorganization of the metal framework. GRA

N80-28470*# Army Missile Command, Redstone Arsenal, Ala.
LASER-SUPPORTED COMBUSTION WAVE IGNITION IN HYDROGEN
R. W. Conrad, C. E. Pyles, E. L. Roy, and D. W. Mangum Oct. 1979 33 p refs Prepared for NASA Marshall, Huntsville, Ala.
(NASA-CR-163320; AD-A084265; DRSMI/RH-80-1) Avail: NTIS HC A03/MF A01 CSCL 20/9

Laser-supported combustion waves were generated in hydrogen at 45 psia. Propagation velocities were inferred from radiometric measurements and compared with values for air, adjusted (according to Raizer's method) for differences in the physical properties of air and hydrogen. Coarse measurements of the radiant power in the visible region were made and compared with air plasmas produced by both pulsed and continuous wave (CW) carbon dioxide lasers. GRA

N80-28471# National Bureau of Standards, Washington, D.C. Surface Science Div.
HYDROGEN SPILL-OVER ON ALUMINA: A STUDY BY INFRARED SPECTROSCOPY
R. R. Cavanagh and J. T. Yates, Jr. May 1980 16 p refs
(Contracts N00014-80-F-0008; N00014-79-F-0008)
(AD-A084853; TR-19) Avail: NTIS HC A02/MF A01 CSCL 20/6

Infrared spectroscopy has been used to monitor the exchange of D2(g) with OH groups chemisorbed on Al2O3. It has been shown that near 300 K, the rate of the exchange process is rapid in the presence of supported Rh particles on the Al2O3. A qualitative model for hydrogen 'spillover' is presented in which dissociative adsorption of dihydrogen by the metal is a key step. It is shown that CO chemisorption on the supported Rh leads to a marked reduction in the 'spillover' rate due to site blockage on the Rh. This is consistent with recent studies of behavior of the CO and H coadsorbed on Rh(111). GRA

N80-28472# National Bureau of Standards, Washington, D.C. Surface Science Div.
TEMPERATURE EFFECTS ON THE INFRARED SPECTRUM OF CHEMISORBED CO
P. R. Antoniewicz (Tex. Univ., Austin), R. R. Cavanagh, and John T. Yates, Jr. May 1980 21 p refs
(Contracts N00014-80-F-0008; N00014-79-F-0008)
(AD-A084851; TR-17) Avail: NTIS HC A02/MF A01 CSCL 20/6

The temperature dependence of the infrared spectrum of CO chemisorbed on Rh supported by Al2O3 has been measured. A shift in the CO stretching frequency of 1.4 x 1/100 cm K-1 to higher frequency is observed on cooling. An electrodynamic model of the surface interactions is presented. The model accounts for both the magnitude and direction of the observed shift. GRA

N80-28473# Dayton Univ., Ohio.
NON-AQUEOUS ELECTRODE RESEARCH Interim Technical Report, 1 Oct. 1978 - 25 Oct. 1979
R. G. Keil, J. R. Hoenigman, W. E. Moddeman, T. N. Wittberg, and J. A. Peters Mar. 1980 76 p refs
(Contract F33615-77-C-3156)
(AD-A085154; UDR-TR-79-104; AFWAL-TR-80-2018) Avail: NTIS HC A05/MF A01 CSCL 07/4

This report describes work carried out in the second 13 months of a 33 month contract to characterize the passive films formed on anodes commonly used in non-aqueous battery cells, and to identify cell reaction products formed at the carbon cathode commonly used in these cells. GRA

N80-28474# California Univ., Irvine Dept. of Chemistry.
ULTRAVIOLET ABSORPTION CROSS SECTIONS OF HO2 NO2 VAPOR Final Report, Sep. 1978 - Dec. 1979
Luisa T. Molina and Mario J. Molina Apr. 1980 32 p refs
(Contract DOT-FA78WA-4248)
(AD-A084915; FAA-EE-80-07) Avail: NTIS HC A03/MF A01 CSCL 07/5

The ultraviolet absorption cross sections for gas phase HO2 NO2 have been measured between 190 and 330 nm, at 298 K and 1 atm total pressure. The HO2 NO2 vapor was prepared in a flowing N2 stream in the presence of H2O, H2O2, HNO3, and NO2. The composition of the mixture was established by visible and infrared absorption spectroscopy and by chemical titration after absorption in aqueous solutions. The experimental uncertainty (one standard deviation) ranges from 5% at 200 nm to 30% at 330 nm, and mainly falls in the 10% range. The solar photodissociation rate in the troposphere and lower stratosphere is estimated to be about ten to the -5th power/sec for 0 deg solar zenith angle. GRA

N80-28475# Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.
GAS CHROMATOGRAPHY-MASS SPECTROMETRY FACILITY: RECENT IMPROVEMENTS AND APPLICATIONS

Nelson M. Frew and Richard M. Sando Mar. 1980 93 p refs
(Contracts N00014-66-C-0241; N00014-74-C-0262;
EE-77-5-02-4256; Grants NSF OCE-74-22781; NSF OCE-76-08696; NSF OCE-74-09991; NSF OCE-77-26084; NSF GC-44224; EPA-R-80390; EPA-R-804215)
(AD-A084826; WHOI-79-26) Avail: NTIS HC A05/MF A01 CSCL 07/4

Marine organic and organic geochemical studies require the best available performance in trace analysis of organic compounds in environmental samples. This report briefly outlines some of the recent improvements in the experimental capabilities of the Chemistry Department Gas Chromatography/Mass Spectrometry Facility (GC/MS Facility) from a user-oriented and non-technical viewpoint. These improvements include principally the interfacing of high performance glass capillary columns with Finnigan 1015 and 3200 quadrupole mass spectrometers, and the adaptation of the latter for use with selective chemical ionization (CI) techniques. Some of the new capabilities available using combined glass capillary GC/EI-MS and CI-MS are illustrated with examples from research in several areas of marine organic chemistry. These include studies of volatile organics in seawater, the distributions of various lipid class compounds in marine phytoplankton, sediments and particulate matter, and the behavior of anthropogenic pollutants in natural and artificial marine ecosystems. GRA

N80-28476# Indiana Univ. at Bloomington. Dept. of Chemistry.
CORRECTION OF QUENCH ERRORS IN ANALYTICAL FLUORIMETRY THROUGH USE OF TIME RESOLUTION
Gary M. Hieftje and Gilbert R. Haugen 27 May 1980 21 p refs Submitted for publication
(Contract N00014-76-C-0838; Grant GM-24473)
(AD-A085130; TR-25) Avail: NTIS HC A02/MF A01 CSCL 07/5

Varying concentrations of quenching agents can cause serious errors in analytical fluorimetry. The origin of these errors is an unexpected change in the quantum efficiency for the observed luminescence. In this paper, it is recalled that quantum efficiency can be expressed as the ratio of an observed luminescence decay time to the decay time which would be observed in the absence of quenchers. Because this latter quantity is a constant for any particular fluorophore, quantum efficiency variations can be compensated through measurement of the decay time. For such measurements, the time-correlated single photon technique was employed and measured luminescence values were taken both from averaged photon count rates and from integrated fluorescence decay plots. Division of these values by measured luminescence lifetimes produced values which were independent of quencher concentration. Systems studied were quinine bisulfate quenched with chloride ion and 1-pyrenebutyric acid quenched by iodide. GRA

N80-28477# Ad-Ex International, Portola Valley, Calif.
EFFICIENT MATRIX CORRECTION IN X-RAY FLUORESCENCE SPECTROMETRY
Rolf Plesh and B. Thiele 11 Dec. 1979 18 p refs Transl. into ENGLISH of Anal. Chim. Acta (West Germany), vol. 112, 1979 p 75-82
(PNL-TR-375) Avail: NTIS HC A02/MF A01

The SPECTRA 310 program for matrix correction in X-ray fluorescence spectrometry allows concentrations as well as intensities of the matrix elements to be included in the correction factors. Alongside an existing testing system, this allows the efficiency of the correction method to be estimated and the quality of standards to be assessed. A program for trace analysis improves general analysis in the trace range, and a test program allows conclusions to be made about the statistical precision of the analytical equipment used. DOE

N80-28478# Missouri Univ.-Rolla. Materials Research Center.
CHEMICAL AND PHYSICAL STABILITY OF REFRACTORIES FOR USE IN COAL GASIFICATION Quarterly Progress Report, 1 Nov. 1979 - 31 Jan. 1980
Abbas Fakhr and Delbert E. Day 31 Jan. 1980 29 p
(Contract EY-76-S-02-2904)
(COO-2904-15; QPR-15) Avail: NTIS HC A03/MF A01

The dependence of the chemical reactions occurring in the cement bond portion of the castables upon the degree of saturation was determined for pure steam and the DOE atmosphere. Boehmite, C4A3H3 and calcite are the major components formed. Only the amount of boehmite varied significantly with the degree of saturation. A linear relationship exists between the percent saturation and the amount of boehmite up to 70% saturation. Above 70%, the amount of boehmite is nearly constant and independent of the degree of saturation. The minimum percent saturation required to form boehmite varied from 10% to 30% according to the atmosphere and pressure. Mechanical properties (namely flexural strength) also varied with the percent saturation. Those parts of the specimens exposed to greater than 50% saturated atmosphere were appreciably stronger (2 to 3 times). The relative severity of the corrosion of several refractory castables by either liquid or saturated vapor was determined for pure steam, the DOE atmosphere, and CO-steam atmospheres. The thermal expansion data obtained for the castables after exposure to above mentioned atmospheres and conditions are summarized. DOE

N80-28479# Pennsylvania State Univ., University Park. Dept. of Chemistry.
DEVELOPMENT OF INSTRUMENTAL METHODS OF ANALYSIS OF SULFUR COMPOUNDS IN COAL PROCESS STREAMS Quarterly Technical Progress Report, Oct. - Dec. 1979
Joseph Jordan Jan. 1980 25 p refs
(Contract EF-77-S-01-2710)
(FE-2710-9; QR-9) Avail: NTIS HC A02/MF A01

Capabilities for constructing multidimensional Pourbaix Diagrams were expanded. Algorithms were developed for the generation of abundance profiles and for delineating thermodynamic stability domains of polysulfur moieties, which contain several atoms of sulfur per molecule. Mechanisms of electrooxidation of thiosulfate and of dibenzothiophene were investigated. Under judiciously controlled experimental conditions, these electrode reactions proceed with 100% current efficiency at glassy carbon anodes. They provide a sound theoretical basis for dependable electroanalytical methods applicable to the determination of S2O3(-) and of dibenzothiophene in coal conversion process streams and products. The systematic search for specific reagents, amenable to the determination of sulfur contaminants by thermometric enthalpy titration and by direct injection enthalpimetry, was continued. DOE

N80-28480# Argonne National Lab., Ill. Chemical Engineering Div.
DIATOMACEOUS EARTH AND ACTIVATED BAUXITE USED AS GRANULAR SORBENTS FOR THE REMOVAL OF SODIUM CHLORIDE VAPOR FROM HOT FLUE GAS
Sheldon H. D. Lee and William M. Swift Jan. 1980 39 p refs
(Contract W-31-109-eng-38)
(ANL/CEN/FE-79-18) Avail: NTIS HC A03/MF A01

Diatomaceous earth and activated bauxite were tested as granular sorbents for use as filter media in granular bed filters for the removal of gaseous alkali metal compounds from the hot (800 C) flue gas of pressurized fluidized bed combustion (FBC). Tests were performed at atmospheric pressure, using NaCl vapor transported in relatively dry simulated flue gas of PFBC. Either a fixed bed combustor or a high temperature sorption test rig was used. The effects of sorbent bed temperature, superficial gas velocity, gas hourly space velocity, and NaCl vapor concentration in flue gas on the sorption behavior of these two sorbents and their ultimate sorption capacities were determined. Both diatomaceous earth and activated bauxite were found to be very effective in removing NaCl vapor from flue gas. Preliminary cost evaluations showed that they are economically attractive as granular sorbents for cleaning alkali vapor from simulated flue gas. DOE

N80-28481# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
COMBUSTION RESEARCH, FISCAL YEAR 1979
Mar. 1980 62 p refs Submitted for publication
(Contract W-7405-eng-48)
(LBL-10416) Avail: NTIS HC A04/MF A01

The chemical and physical processes which are important

in utilizing new fuels while limiting pollutant formation are examined along with reduction of fire hazards associated with energy generation and conservation technologies. Principal program areas include the interaction of fluid mechanical turbulence and combustion, pollutant formation and destruction processes, physical and chemical diagnostic techniques for combustion research, theoretical and computational modeling of combustion processes, combustion processes in engines, flame propagation, and fire safety. Thirty combustion research programs are identified and described briefly. DOE

N80-28482# Delaware Univ., Newark. Dept. of Chemical Engineering.
DEVELOPMENT OF UNIQUE CATALYSTS FOR HYDRODENITROGENATION OF COAL-DERIVED LIQUIDS Quarterly Report, 15 Sep. - 15 Dec. 1978
James R. Katzer, Alvin B. Stiles, and Harold Kwart. 1 Mar. 1979. 122 p. refs.
(Contract EI-78-S-01-3297)
(FE-3297-1; QR-1) Avail: NTIS. HC A06/MF A01

Four experimental runs were made; two used decahydroquinoline as reactant and two runs were made using orthoethylaniline and quinoline-N-oxide respectively. The decahydroquinoline runs indicate that the carbon-nitrogen bond scission is not thermal but clearly catalytic. Important findings resulted from the run using oethylaniline and future runs will help define reaction pathways. Quinoline-N-oxide was rapidly deoxygenated to form quinoline under the conditions tested. Future runs will be conducted in the absence of hydrogen to avoid deoxidation of quinoline-N-oxide and to find out whether carbon-nitrogen bond scission can be promoted by the addition of oxygen to the quinoline molecule. A review paper has been prepared that reviews the existing chemistry and technology for hydrodenitrogenation of synthetic feedstocks and heavy petroleum liquids. It projects what should be a more effective means and more rational basis for the design and development of more active and more selective catalysts for hydrodenitrogenation and attempts some speculations on potentially fruitful direction to be followed in both catalyst and process development. DOE

N80-28483# Oak Ridge National Lab., Tenn.
TRITIUM PERMEABILITY OF STRUCTURAL MATERIALS AND SURFACE EFFECTS ON PERMEATION RATES
J. T. Bell, J. D. Redman, and H. F. Bittner. 1980. 19 p. refs. Presented at Tritium Tech. in Fission, Fusion and Isotopic Appl., Dayton, Ohio, 29 Apr. 1980
(Contract W-7405-eng-26)
(CONF-800427) Avail: NTIS. HC A02/MF A01

An attempt was made to minimize tritium release from a given system by two primary efforts. First, a compatible containment material which frequently also will be the structural material was selected. This effort included films and barriers that were compatible with the structural material. Second and sometimes more important, the surface chemistry of material was such that it continuously impeded tritium permeation. DOE

N80-28484# Sandia Labs., Albuquerque, N. Mex. Tube Development Div.
METAL TRITIDES HELIUM EMISSION
Leonard C. Beavis. Feb. 1980. 36 p. refs.
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-0645) Avail: NTIS. HC A03/MF A01

The data obtained from samples in the early (low helium concentration) release stage are presented. The samples discussed include those at room temperature of titanium, zirconium, scandium, and erbium tritides. Results of the stoichiometry effect measurements on erbium tritide films are included. In addition, details of the effects of the grain size, storage temperature, and thermal ramp on helium emissions from erbium tritide films are given. Measurements of the helium release from single crystal scandium-0.4 tritium are described. DOE

N80-28485# Massachusetts Inst. of Tech., Oak Ridge, Tenn. School of Chemical Engineering.
SEPARATION OF WATER-ETHANOL MIXTURE BY SORPTION
W. A. Schumacher and V. W-S. Hwa. Jan. 1980. 16 p. refs.
(Contract W-7405-eng-26)
(ORNL/MIT-298) Avail: NTIS. HC A02/MF A01

An experimental investigation was performed which examined sorption as a means for recovering anhydrous ethanol from water-ethanol mixtures. Adsorption isotherms were obtained at ambient temperature for two sorbents: a styrene-divinylbenzene copolymer manufactured by Rohm & Haas (Amberlite XAD-4) and Linde molecular sieve (No. 4966-77). Both sorbents appeared to reach a saturation level of ethanol on the sorbent for the range of ethanol concentration considered (0 to 12 wt % ethanol). The Linde sieve was more effective than the Rohm & Haas copolymer for the removal of ethanol from dilute solutions. DOE

N80-28486# Oak Ridge National Lab., Tenn.
THERMOCHEMICAL WATER-SPLITTING CYCLES BASED UPON REACTIONS OF CERIUM- AND ALKALINE EARTH PHOSPHATES
P. R. Robinson and C. E. Bamberger. 1979. 5 p. refs. Presented at 2nd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10 Dec. 1979
(Contract W-7405-eng-26)
(CONF-791204-35) Avail: NTIS. HC A02/MF A01

Cerium(4) oxide, CeO_2, reacts with derivatives of phosphoric acid, metaphosphate salts, and pyrophosphate salts at 600 to 1000 C to produce oxygen and cerium(3) phosphates. The cerium(3) phosphates are oxidized to CeO_2 by steam at 700 to 1200 C in the presence of alkaline earth oxides, carbonates, or halides. These two sets of reactions form the basis for a family of thermochemical cycles based upon the redox couple Ce(4)/(3). DOE

N80-28487# Universite Scientifique et Medicale de Grenoble (France). Lab. de Spectrometric Physique.
[ACTIVITIES OF THE PHYSICAL SPECTROMETRY LABORATORY] Activity Report, Jan. 1977 - Apr. 1979 [LABORATOIRE DE SPECTROMETRIE PHYSIQUE. RAPPORT D'ACTIVITE JANVIER 1977 A AVRIL 1979]
1979. 116 p. refs. In FRENCH
Avail: NTIS. HC A06/MF A01

The work conducted during the reporting period is outlined in the following areas: atomic and molecular physics, spectroscopy of molecular solids, nuclear magnetic resonance in condensed matter, theoretical activities, the Mossbauer effect, phase transitions in solids, semiconductors and electrochemistry, polymer studies, optics of solids, surface studies, and crystalline structures. Author (ESA)

N80-28488# Los Alamos Scientific Lab., N. Mex.
TRACE ELEMENT CHARACTERIZATION OF COAL WASTES Annual Progress Report, 1 Oct. 1977 - 30 Sep. 1978
E. M. Wewerka, J. M. Williams, L. E. Wangen, J. P. Bertino, and P. L. Wanek. Jun. 1979. 94 p. refs. Sponsored by EPA and DOE
(PB80-166150; LA-7831-PR; EPA-600/7-79-144; AR-3) Avail: NTIS. HC A05/MF A01. CSCL 07D

The efficacy of several control options to treat coal wastes at the preparation plant or during disposal was investigated. The research revealed that calcining is one of the more effective and permanent means of treating high sulfur coal wastes before disposal to decrease, quite dramatically, the release of environmentally undesirable pollutants into the drainages from disposal sites. Co-disposal of the coal wastes with lime or limestone to neutralize the acid drainage and contain soluble aqueous contaminants within the waste site is also a promising control. Other experiments examined the feasibility of using natural sealants (e.g., clays, soils, calcite, and cements) to isolate the disposal site from its immediate environment. Various trade offs for these control options are discussed in terms of contaminant reduction, complexity, permanency, and cost. GRA

N80-28489# National Bureau of Standards, Washington, D.C. National Measurement Lab.
THE DEVELOPMENT OF AN AQUEOUS TRACE ORGANIC STANDARD REFERENCE MATERIAL FOR ENERGY RELATED APPLICATIONS: INVESTIGATION OF THE AQUEOUS SOLUBILITY BEHAVIOR OF POLYCYCLIC AROMATIC HYDROCARBONS Interim Report, Nov. 1976 - May 1978
Willie E. May. Feb. 1980. 90 p. refs.

(PB80-169352; EPA-600/7-80-031) Avail: NTIS
HC A05/MF A01 CSCL 07D

The development of a generator column technique for the production of standard reference materials for polynuclear aromatic hydrocarbons (PAH's) in water is discussed. The extent of the rate of the dissolution of energy based PAH's and their persistance in the aquatic environment is assessed. GRA

N80-28490# Little (Arthur D.), Inc., Cambridge, Mass.
PREPARATION OF STANDARDS FOR VALENCE STATE MEASUREMENT BY X-RAY FLUORESCENCE Final Report
Edward T. Peters and Kenneth T. Menzies Jan. 1980 43 p
(Contract EPA-68-02-2750)
(PB80-169238; EPA-600/2-80-025) Avail: NTIS
HC A03/MF A01 CSCL 07D

A total of 40 single state and 13 multistate standards were prepared by dust generation and collection on polycarbonate filters. The prepared samples and valence states include sulfur (0, +4, +6, -2), vanadium (0, +4, +5), and chromium (+3, +6). At least three standards were prepared for each valence state, with mass concentration of the valence state element in the range 1 to 50 micrograms/sq cm. The prepared samples were coated with a thin layer of nitrocellulose by a wicking procedure to provide a protective coating and to prevent loss of material. Representative samples were analyzed for the uniformity of the deposit, mean particle size and stability in air, and X-ray irradiation. GRA

N80-28491# Georgia Univ., Athens. Dept. of Chemistry
NEW LIQUID CHROMATOGRAPHIC DETECTION SYSTEM FOR ENVIRONMENTAL POLLUTANTS Final Report, Jan. 1976 - Dec. 1978
L. A. Carreira and L. B. Rogers Feb. 1980 74 p refs
(Grant EPA-R-804155-03-0)
(PB80-166911; EPA-600/4-80-015) Avail: NTIS
HC A04/MF A01 CSCL 07D

Resonance enhanced coherent anti-Stokes Raman spectrometry (CARS) was demonstrated as a specific identification system for liquid chromatography for water pollution identification. Liquid chromatographic preconcentration and separation and computer control of the liquid chromatograph/ultraviolet visible/CARS were undertaken. Observations useful in relating experimental variables in the preconcentration step to the recovery of a given species were made. A system consisting of a liquid chromatograph, a scanning ultraviolet visible spectrometer and the CARS was automated using a minicomputer. Column selection, flow rate, and solvent composition were monitored and controlled. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion, and metallurgy.

N80-28492* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HEAT TREAT FIXTURE AND METHOD OF HEAT TREATING Patent
Charles S. Beuyukian (Rockwell International Corp., Downey, Calif.), Robert M. Heisman (Rockwell International Corp., Downey, Calif.), Cyrus C. Haynie (Rockwell International Corp., Downey, Calif.), and Emil P. Ruppe, inventors (to NASA) (Rockwell International Corp., Downey, Calif.) Issued 15 Jul. 1980 4 p
Filed 23 Mar. 1979 Supersedes N79-25197 (17 - 16, p 2104)
Sponsored by NASA
(NASA-Case-LAR-11821-1; US-Patent-4,212,690;
US-Patent-Appl-SN-023501; US-Patent-Class-148-131;
US-Patent-Class-266-119; US-Patent-Class-266-249;
US-Patent-Class-266-274) Avail: US Patent and Trademark Office CSCL 11F

A heat treating fixture is disclosed in which the shape of the metal specimen is maintained by cold rolled steel support plates. Glide sheets of stainless steel, coated with boron nitride, in contact with each face of the metal specimens, allow for lateral expansion of the metal specimens without binding. Grooved support bars separate the glide sheets from the upper and lower support plates and allow flow of quenching fluid to the metal specimen.
Official Gazette of the U.S. Patent and Trademark Office

N80-28493 California Univ., Berkeley
DIRECT DECOMPOSITION OF AUSTENITE IN Fe-C-V ALLOYS THROUGH ISOTHERMAL TRANSFORMATION Ph.D. Thesis
Yoshinao Mishima 1979 95 p
Avail: Univ. Microfilms Order No. 8014813

Isothermal austenite decomposition was investigated in Fe-0.2C-1V-0.5Mn and Fe-0.1C-0.5V-0.5Mn alloys. Both alloys exhibited C-curve austenite decomposition kinetics which were analogues to the pearlite transformation at temperatures above the bainite transformation region. In the C-curve regime, austenite decomposed into ferrite and vanadium carbide (VC) with two different carbide morphologies. It was determined by transmission electron microscopy that the morphology of VC was either as discrete particles, fibers or both. The VC morphology was found to be dependent on the composition of the alloy, isothermal transformation temperature, and austenization temperature. The associated mechanical properties were measured with emphasis being placed on Charpy impact behavior. It was found that the impact toughness of the austinite decomposition product was strongly dependent on VC morphology despite the fact that the tensile properties were relatively insensitive to it. The factors which control the VC morphology are discussed. Dissert. Abstr.

N80-28494 California Univ., Berkeley
MICROSTRUCTURE, MECHANICAL PROPERTIES AND TWO-BODY ABRASIVE WEAR RESISTANCE IN STEELS Ph.D. Thesis
Nareshchandra Jitendrakmur Kar 1979 180 p
Avail: Univ. Microfilms Order No. 8014754

A base secondary hardening steel (Fe0.4C2Mo0.25V) and its alloy modifications (2%Cr, 2%Cr - 3%Ni) were investigated using conventional quenching and tempering treatments and isothermal transformation in the vicinity of M sub s temperatures followed by tempering to the secondary hardening range. The mechanical properties, microstructure (using transmission electron microscopy) and two body abrasive wear resistance of the different heat treated variants were evaluated. Secondary hardening in the quenched and tempered microstructure was related to the rate of replacement of primary Fe3C by Mo2C carbides. Low toughness at the seconary hardening peak because of the presence of interlath cementite was eliminated by alloy modification, to give high hardness high toughness on secondary hardening. Dissert. Abstr.

N80-28495 Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique des Materiaux
HOT STRESS CORROSION OF TITANIUM ALLOYS BY CHLORIDES Final Report [ETUDE DE LA CORROSION SOUS TENSION A CHAUD DES ALLIAGES DE TITANE PAR LES CHLORURES]
Gilles Lapasset Jan. 1978 37 p refs In FRENCH
(Contract DGRST-75-7-0990)
Avail: Issuing Activity

The mechanisms occurring in TA 6V with salt deposits at between 350 and 400 C were studied, together with the effects of water, hydrogen and oxygen. The electrochemical processes taking place were elucidated as well as the phenomena associated with the initiation and progression of cracks. The advantages of heat cycling are mentioned. Author (ESA)

N80-28496 Foerenade Fabriksverken, Linkoeping (Sweden). Materials Lab.
EFFECT OF SOLID LUBRICANT PWA 474 ON THE FATIGUE STRENGTH OF TITANIUM ALLOY Ti-6Al-4V
Gunnar Burman 20 Apr. 1978 18 p
(Contract FMV-FMO-82302-76-000-00-005)
(FFV-R-9581-0189-2) Avail: Issuing Activity

The protective effect of the solid lubricant PWA 474 on wear and fatigue properties of titanium alloy Ti-6Al-4V was studied. Wear was effected by shoulders clamped to the specimen during the fatigue testing. Results indicate that Woehler diagrams for the two specimen series can be plotted. The solid lubricant at high fatigue levels (fracture before 600,000 cycles) extended

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the testing time to rupture 3 to 4 times. The fatigue limit for solid lubricant coated specimens lies 50% above the fatigue limit of unlubricated specimens. Determination was made of the friction coefficient of solid lubricant surfaces and pure titanium surfaces. The friction coefficient is 0.12 to 0.15 for solid lubricant (solid lubricant and 0.35 to 0.40 for titanium) titanium. Author (ESA)

N80-28497# Royal Aircraft Establishment, Farnborough (England).
THE DIFFUSION OF WATER VAPOUR IN HUMID AIR INTO THE ADHESIVE LAYER OF BONDED METAL JOINTS
Walter Althof. Feb. 1980. 71 p. refs. Transl. into ENGLISH of "Die Diffusion des Wasserdampfes der Feuchten Luft in die Klebschichten von Metallklebungen" DFVLR-FB-79-06 Deutsche forschungs und Versuchsanstalt Fuer Luft und Raumfahrt, West Germany, 1979
(RAE-Lib-Trans-2038; BR74940) Avail: NTIS HC A04/MF A01

The variation of moisture content with time and environment was determined for five aircraft structural adhesives by weighing cured bulk adhesive specimens and laminates before and after extended exposure in six climates. The coefficient of diffusion was calculated according to Fick's theory. The correlation between the moisture content in the adhesive at saturation and the atmospheric humidity was estimated. Several formula were established to calculate the time dependent distribution of moisture in adhesive laminates. Control tests confirmed the applicability of the formula, where the adhesive was not altered by the environment. R.C.T.

N80-28498*# National Aeronautics and Space Administration, Washington, D. C.
PHASE TRANSITIONS IN THE ORDERED COMPOUND TiAl AND IN ALLOYS HAVING IT AS A BASE
I. A. Zelenkov and E. N. Martynchuk. May 1980. 11 p. refs. Transl. into ENGLISH from Metallofiz. (USSR), no. 50, 1974 p. 99-103. Original language doc. announced as A74-40461. Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Kiev Inst. of Civil Aviation Engineers.
(Contract NASw-3199)
(NASA-TM-75827) Avail: NTIS HC A02/MF A01 CSCL 11F

The combined effect of alloying and heat treatment on the order-disorder transition in TiAl of stoichiometric composition was investigated. It is concluded from the data obtained that the TiAl 1 to TiAl 2 transition is a phase transition of the second kind. A phase transition was observed in TiAl of equiatomic composition in the 450-550 C temperature range. The introduction of niobium into the ordered compound TiAl of stoichiometric composition, instead of titanium or aluminum atoms, leads to partial softening. In this case, the effect of niobium atoms on softening of the alloys was greater when the niobium was introduced in place of aluminum atoms. R.C.T.

N80-28499*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
MATERIALS FOR ADVANCED TURBINE ENGINES. VOLUME 1: POWER METALLURGY RENE 95 ROTATING TURBINE ENGINE PARTS Final Report
W. R. Pfouts, C. E. Shamblen, J. S. Mosier, R. E. Peebles, and R. W. Gorsler. Jun. 1979. 358 p. 2 Vol.
(Contract NAS3-20074)
(NASA-CR-159802; R79AEG416-Vol-1) Avail: NTIS HC A16/MF A01 CSCL 11F

An attempt was made to improve methods for producing powder metallurgy aircraft gas turbine engine parts from the nickel base superalloy known as Rene 95. The parts produced were the high pressure turbine aft shaft for the CF6-50 engine and the stages 5 through 9 compressor disk forgings for the CFM56/F101 engines. A 50% cost reduction was achieved as compared to conventional cast and wrought processing practices. An integrated effort involving several powder producers and a major forging source were included. R.C.T.

N80-28500# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF MULTIPLE WELD REPAIRS ON THE FATIGUE RESISTANCE OF WELDED ALUMINUM ALLOY 5083-0 M.S. Thesis
John R. Panico. Dec. 1979. 59 p. refs.
(AD-A084379) Avail: NTIS HC A04/MF A01 CSCL 11/6

This work follows that of Lt. G. R. Speight, USCG, on the general microstructural and mechanical property effects of multiple weld repairs in 5083-0 aluminum, and extends the previous study in to the area of fatigue. The essential observation made is that multiple weld repairs do not significantly affect the fatigue resistance of the material. Microstructural changes in the base metal do not alter crack initiation and propagation characteristics, failure being confined to the weld filler material. GRA

N80-28501# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
MICROSTRUCTURAL EFFECTS AND FATIGUE LIFE PREDICTION OF NOTCHED AND UN-NOTCHED Ni BASE SUPERALLOYS AT ELEVATED TEMPERATURES Final Report, 1 Jan. 1976 - 31 Dec. 1979
Stephen D. Antolovich. Apr. 1980. 54 p. refs.
(Grant AF-AFOSR-2952-76)
(AD-A084436; AFOSR-80-0341TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

The LCF(Low Cycle Fatigue) behavior of Ni base superalloys was studied both for smooth and notched test bars. The primary research material was Rene 80 which finds application in turbine blades used in the temperature range of 650-982 C (1200-1800 F). The smooth bar LCF behavior was studied in the as-heat treated condition and also after exposure for 100h at 982 C, either under a stress of 97 MPa (14 ksi) or OMPa. Test conditions included continuous cycling at different strain rates as well as 90 second hold periods at either maximum or minimum strain. The primary test temperatures were 871 C (1600 F) and 982 C (1800 F). It was found that prior exposure greatly reduces the fatigue life. Since these experiments tend to duplicate actual engine conditions, use of data obtained using as heat treated specimens may be very non conservative to predict lives of actual components. The test results correlated very well with a model for LCF which is based on the concept that cracks initiate at a critical combination of oxide depth and stress. The notch LCF problem was also studied. A computer model for calculating local stresses and strains was developed. In addition to the Rene 80 studies, some initial smooth bar LCF studies were carried out using Rene 77. GRA

N80-28502# Army Materials and Mechanics Research Center, Watertown, Mass. Materials Research Div.
BALLISTIC DAMAGE CHARACTERISTICS AND FRACTURE TOUGHNESS OF LAMINATED ALUMINUM 7049-T73 AND TITANIUM 6Al-4V ALLOYS Final Report
Charles F. Hickey, Jr. and Albert A. Anctil. Mar. 1980. 19 p. refs. Sponsored in part by Naval Air Systems Command.
(DA Proj. 1L1-62105-AH-84)
(AD-A084698; AMMRC-MS-80-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

The degradation of metal laminate structural properties resulting from damage by 12.7 mm API projectiles fired at 1600 feet per second were defined. Two materials (Al-7049 and Ti-6Al-4V laminates) were measured ranging from 0.100 to 0.400 inch in normal thickness. Results indicate that laminate thickness over the range studied has little or no effect on the fracture toughness of either Al-7049 or Ti-6Al-4V. The ballistic penetration mechanism for both alloys was by petalling and in general the damage increased as a function of laminate thickness. R.C.T.

N80-28503# Rockwell International Corp., Thousand Oaks, Calif.
FINE GRAIN ALUMINUM SUPERPLASTICITY Final Report, 29 Sep. 1978 - 31 Mar. 1979
C. H. Hamilton. Feb. 1980. 66 p. refs.
(Contract DAAK10-78-C-0424; DA Proj. 1L1-62105-AH-84)
(AD-A084692; AD-E400400; SC5187.13FR; ARSCD-CR-80001) Avail: NTIS HC A04/MF A01 CSCL 20/1

Fine grained 7475 aluminum alloy sheet was evaluated for its superplastic properties and potential for superplastic forming. The sheet alloy was specially processed by the ALCOA Technical Laboratory utilizing procedures prescribed by the contractor to achieve a fine grain size. The grain size measurements on this sheet alloy after complete recrystallization revealed a short

transverse dimension of 7.8 microm and longitudinal and long transverse dimension of 14 microm. Subsequent grain growth studies showed that this fine grain size developed is quite stable at temperatures as high as 516 C. High temperature testing was conducted over the temperature range of 427 C to 516 C in order to establish the strain rate sensitivity of flow stress, strain hardening characteristics, and total elongation capabilities. Superplastic forming tests were also conducted utilizing commonly used gas pressure forming methods. Small demonstration parts were formed over a range of strain rates and thinning characteristics evaluated. Metallographic evaluation of tensile test specimens and formed parts revealed the tendency of the alloy to form internal voids, or cavities, at large strains. The cavitation appears to be sensitive to the conditions of deformation, being minimized at the higher temperature and lower strain rate. GRA

N80-28504# Universal Energy Systems, Inc., Dayton, Ohio.
SURFACE CHARACTERIZATION OF CHEMICALLY TREATED TITANIUM AND TITANIUM ALLOYS Interim Report, 1 May - 30 Nov. 1979
Alain A. Roche. Wright-Patterson AFB, Ohio. AFWAL. Feb. 1980. 180 p. refs.
(Contract F33615-79-C-5129)
(AD-A084171; AFWAL-TR-80-4004) Avail: NTIS. HC A09/MF A01. CSCL 11/6

A thorough knowledge of adherend surfaces is necessary to adequately evaluate adhesive bond joint performance. Auger Electron Spectroscopy (AES), Secondary Ion Mass Spectroscopy (SIMS), Scanning Electron Microscopy (SEM), and X-Ray Photoelectron Spectroscopy (XPS) were used to characterize the surface topography (roughness, selective etching) composition (relative concentration of alloyed element on surface, contaminated overlayer...) chemical state (titanium or alloy surface oxide, oxy-fluoride...) and oxide thickness of different chemically treated titanium alloys. Seven alloys and the metal were conditioned with seven different chemical treatments. Data from each treated alloy has been compiled to show physical and chemical effects of each treatment on each alloy. GRA

N80-28505# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL STUDY OF DROPWISE CONDENSATION ON VERTICAL DISCS. M.S. Thesis
Kevin Patrick Perkins. Dec. 1979. 92 p. refs.
(AD-A085052) Avail: NTIS. HC A05/MF A01. CSCL 11/3

Three hydrophobic coating systems were tested for their ability to promote permanent dropwise condensation of steam at 21 KPa (3 psia). The coatings used were: (1) Nedox, a Teflon coating that uses a porous nickel substrate to improve adhesion, (2) Sputtered Teflon, and (3) C-6 fluorocepoxy, a protective coating developed for naval aircraft. Copper-nickel discs, 32 mm in diameter, were tested with all three coatings. In addition, copper and titanium discs were tested with the sputtered Teflon coating. Coating thickness was varied from 0.08 to 25.0 microns. The coatings tested provided only moderate improvements in heat transfer. The 0.08 micron coating of sputtered Teflon on copper-nickel provided only a 58% improvement in the heat transfer coefficient over filmwise. A chemically promoted specimen tested in the same experimental apparatus gave a 500% improvement in the heat transfer coefficient. All coatings tested showed surface deterioration after two to ten hours of testing, and none would be considered a practical permanent promoter of dropwise condensation. GRA

N80-28506# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION INTO THE INFLUENCE OF THERMO-MECHANICAL PROCESSING ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF HIGH-STRENGTH ALUMINUM-MAGNESIUM ALLOYS. M.S. Thesis
William Goodwin Speed. Dec. 1979. 42 p. refs.
(AD-A085051) Avail: NTIS. HC A03/MF A01. CSCL 11/6

Microstructures and mechanical properties resulting from thermomechanical processing of high magnesium (Mg) content aluminum-magnesium (Al-Mg) alloys were investigated in this research. Warm rolling processes, intended to refine both grain size and second phase Al3Mg2 (beta) particle size, were conducted for alloy compositions of 10.2 weight % Mg, 10.2 weight % Mg plus 0.5 weight % copper (Cu) and 12.1 weight % Mg. Solution treatment, hot upset forging, resolutioning and rapid cooling provided initial microstructural homogenization. Subsequent warm rolling was employed to refine the microstructure. The effect of warm rolling parameters of beta particle size and distribution was of particular concern. By warm rolling an alloy containing 10.2 % Mg plus 0.5 % Cu at 250 C, an ultimate tensile strength of 565 MPa (82000 psi), with 11.5% elongation, was achieved with the added advantage of a strength to density ratio higher than present equivalent-strength alloys, such as 7075 T6. GRA

N80-28507# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
RAPID SOLIDIFICATION OF A MODIFIED 7075 ALUMINUM ALLOY BY ULTRASONIC GAS ATOMIZATION. Technical Report, 1978 - 1979
V. Anand, A. J. Kaufman, and N. J. Grant. 24 Mar. 1980. 15 p. refs. Presented at the 2d Intern. Conf. on Rapid Solidification Processing: Principles and Technol., Reston, Va., 23-26 Mar. 1980.
(Contract N00014-78-C-0385; ARPA Order 3558)
(AD-A085141) Avail: NTIS. HC A02/MF A01. CSCL 11/6

Variables associated with ultrasonic gas atomization of aluminum alloys to attain rapid solidification at rates of about ten to the 4th power to ten to the 5th power K/s are discussed. Both structures and properties of some of the alloys produced are shown. GRA

N80-28508# Surrey Univ., Guildford (England). Dept. of Metallurgy and Materials Technology.
STRUCTURE AND BEHAVIOUR OF GRAIN AND PHASE BOUNDARIES. Final Report, Jan. 1978 - Jan. 1980
P. J. Goodhew and Z. H. Luklinska. Apr. 1980. 25 p. refs.
(Grant DA-ERO-78-G-001; DA Proj. 1T1-61102-BH-57)
(AD-A084880) Avail: NTIS. HC A02/MF A01. CSCL 20/2

Thin film bicrystals have been created using gold, silver, palladium and platinum epitaxially grown single crystals. Low angle twist boundaries in all systems consisted of orthogonal sets of lattice dislocations, with character in agreement with the O-lattice theory and earlier less general predictions. High angle boundaries in the Au-Pt system were seen to relax into dislocation networks at temperatures in excess of 600 deg. However, the dislocation directions and spacings could not be interpreted in terms of CSL and NCSL relaxations. All the experiments were rendered more difficult than anticipated because of the difficulties of making the continuous flat single crystals. A critique of the general method of thin film welding for the study of grain boundaries is included. GRA

N80-28509# Harco Corp., Medina, Ohio.
EVALUATION OF CATHODIC PROTECTION CRITERIA. Final Report, Jul. 1978 - Apr. 1979
Bernard Husock. Dec. 1979. 89 p. refs.
(Contract F08635-77-C-0248; AF Proj. 2104)
(AD-A084783; AFESC/ESL-TR-79-14) Avail: NTIS. HC A05/MF A01. CSCL 13/8

This report summarizes the results of a study undertaken to provide an in-depth evaluation of four principal cathodic protection (CP) criteria used for underground and underwater metallic structures. All of the criteria considered make use of structure-to-soil potential measurements. The intent of the report is to provide the background necessary for selecting the proper criterion for a given situation and to remove the misconceptions which often arise. Guidance is provided for correct placement of the reference electrode with respect to the structure being investigated, and for determining how many potential measurements are sufficient. Explanations are given concerning the various voltage (IR) drops which are encountered and instruction is given on how those IR drops are to be considered. It must be understood that there are too many variables to allow for general, all-inclusive statements regarding criteria for cathodic protection. Each application must be reviewed individually using the experience from other similar applications together with the information in this report. GRA

N80-28510# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
LOCALIZED CORROSION AND STRESS CORROSION CRACKING BEHAVIOR OF AUSTENITIC STAINLESS STEEL

WELDMENTS CONTAINING RETAINED FERRITE Annual Progress Report, 1 Jun. 1979 - 31 Mar. 1980
W. F. Savage and D. J. Duquette. Mar. 1980. 9 p. refs.
(Contract DE-AS02-76ER-02462)
(COO-2462-6) Avail: NTIS HC A02/MF A01

Pitting tests performed on single phase 304 stainless steel alloys and autogeneous weldments containing retained delta ferrite as a second phase show that the presence of delta ferrite decreases localized corrosion resistance with pits initiating preferentially at delta ferrite gamma austenite interphase boundaries. This increased susceptibility is reversible with elevated temperature heat treatments which revert the metastable ferrite phase to the equilibrium austenite phase. These experiments indicate that pitting tendency for both single phase and two phase alloys is controlled by the physical properties of the passive films which are naturally forced. The results of the SCC experiments show that, for two phase alloys at temperatures from 20 C to 290 C, the ferrite phase also significantly affects stress corrosion resistance. The addition of SO4/sup - / to chloride containing environments has a marked inhibitive effect on SCC. DOE

N80-28511# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
IRRADIATED TYPE 304 SS BEND TEST DUCTILITY
H. D. Garkisch. 1980. 6 p. refs. Presented at the Am. Nucl. Soc. Ann. Meeting, Las Vegas, Nev., 8 Jun. 1980.
(Contract DE-AC15-76CL-02395)
(CONF-800607-28) Avail: NTIS HC A02/MF A01

A series of tests was performed to determine the available bending deformation capability and ductility of preirradiated Type 304 stainless steel (SS) for core applications. This material was tested under conditions at which it exhibits less ductility than Type 316 SS or other stainless steels currently under considerations for core applications. Tensile testing of Type 304 SS with specimens from EBR-II ducts which were irradiated to fluences between 5 to 10 x 10 to the 22nd power n/sq cm (E > 0.1 MeV) revealed a significant reduction of uniform elongation and total elongation but smaller decreases in reduction of area. These specimens fail with significant but very localized necking. The ductility of this material decreases with decreasing strain rate if the test temperature is above the irradiation temperature. A large reduction in ductility is caused by a change from a transgranular to an intergranular fracture mode. DOE

N80-28512# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
MECHANICAL AND PHYSICAL PROPERTIES OF IRRADIATED TYPE 348 STAINLESS STEEL
J. M. Beeston. 1980. 45 p. refs. Presented at the 10th Intern. Symp. on Effects of Radiation on Mater., Savannah, 3 Jun. 1980.
(Contract EY-76-C-07-1570)
(CONF-800609-1) Avail: NTIS HC A03/MF A01

A type 348 stainless steel in-pile tube irradiated to a fluence of 3 x 10 to the 22nd power n/sq cm E > 1 MeV (57 dpa), was destructively examined. The service had resulted in a maximum total creep of 1.8% at the high fluence. The metal temperature ranged between 623 K and 652 K, hence the thermal creep portion of the total was negligible. Total creep was greater than anticipated from creep data for austenitic stainless steels irradiated in other reactors. The service-induced changes of mechanical and physical properties were examined; the possibility of adverse effects of both these changes and the greater total creep on the prospective service life of other tubes was assessed. DOE

N80-28513# Illinois Univ., Urbana. Nuclear Engineering Program.
HELIUM-INDUCED BLISTERING AND VOLUME SWELLING IN NICKEL. Ph.D. Thesis
George Robert Fenske. 1979. 185 p. refs.
(Contract DE-AS02-76ET-52040)
(COO-2218-148) Avail: NTIS HC A08/MF A01

The mechanisms involved in blistering were examined by observing the microstructure of the implanted region using transmission electron microscopy. The volume swelling was measured as a function of the implant depth. The investigation revealed factors important in understanding the mechanisms involved in blister formation. First, measured skin thicknesses was compared with the location of the maximum volume swelling. This demonstrated that the skin separates at the peak swelling depth, not at the end of the swelling profile. Second, the assumptions that were used to predict skin thicknesses were examined. This revealed that the differences between predicted and measured skin thicknesses at low energies can be attributed to: failure to account for volume swelling in the skin, using a Gaussian approximation to the range profile, or one generated with a Monte-Carlo code, and uncertainties in the electronic stopping powers. DOE

N80-28514# Argonne National Lab., Ill. Materials Science Div.
DEVIATION OF LONGITUDINAL AND SHEAR WAVES IN AUSTENITIC STAINLESS STEEL WELD METAL
D. S. Kupperman and K. J. Reimann. 1980. 16 p. refs. Presented at 3rd Intern. Conf. on Nondestructive Evaluation in the Nucl. Industry, Salt Lake City, 11-13 Feb. 1980.
(Contract W-31-109-eng-38)
(CONF-800231-2) Avail: NTIS HC A02/MF A01

One of the difficulties associated with the ultrasonic inspection of stainless steel weld metal is the deviation of the ultrasonic beams. This can lead to errors in determining both the location and size of reflectors. The present paper compares experimental and theoretical data related to beam steering for longitudinal and shear waves in a sample of 308 SS weld metal. Agreement between predicted and measured beam deviations is generally good. Reasons for discrepancies are discussed. DOE

N80-28515# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
HYDROGEN ASSISTED FRACTURE OF SENSITIZED TYPE 304L AUSTENITIC STAINLESS STEEL
G. R. Caskey, Jr. 1980. 25 p. refs. Presented at 109th Am. Inst. of Met. Engrs. Meeting, Las Vegas, Nev., 24-28 Feb. 1980.
(Contracts EY-76-C-09-0001; DE-AC09-76SR-00001)
(DP-MS-79-61; CONF-800205-5) Avail: NTIS HC A02/MF A01

Sensitized specimens of Type 304L stainless steel were tensile tested in atmospheres of hydrogen and helium at high pressure, and in air at ambient pressure. Comparison tensile tests were made with solution annealed specimens of Type 304L stainless steel in the same atmosphere. When both specimens were tested in high pressure hydrogen, the sensitized specimens had greater loss in ductility and increased tendency to intergranular fracture. For the sensitized specimens, plastic strain to failure (epsilon/sub p/ = ln A/A/sub f/) in hydrogen at 69 MPa was reduced by 60 to 70% in comparison to similar tests in helium. In addition, a notch with a stress concentration factor of about 3 reduced plastic strain an additional 50 to 60%. In all cases, the nominal tensile strength of Type 304L stainless steel was increased by the notch. There was no evidence of intergranular failure in notched specimens of solution-annealed Type 304L stainless steel tested in high pressure hydrogen environments. DOE

N80-28516# Battelle Pacific Northwest Labs., Richland, Wash.
FUNDAMENTALS OF CORROSION CONTROL DESIGN
Lyle D. Perrigo and George A. Jensen. Mar. 1979. 17 p. refs. Presented at Western Corrosion Seminar, Pomona, Calif., 1-3 May 1979; sponsored by Western Regional Div., Natl. Assoc. of Corrosion Engrs. Revised. Submitted for publication.
(Contract EY-76-C-06-1830)
(BNWL-SA-5289-Rev.; CONF-7905147-1) Avail: NTIS HC A02/MF A01

The development of corrosion control design principles and practice is discussed. It is concluded that by applying simple and straightforward principles to the design of systems, buildings and equipment, operational corrosion problems may be reduced or avoided. These corrosion control design principles are concerned with promoting the use of orientation, layout, and configuration to avoid the holdup of solutions, abrupt flow changes, impingement and stagnant areas. Climatic conditions and terrain are important siting considerations in reducing atmospheric corrosion of buildings and facilities. A determined effort is needed to broaden the understanding of anticorrosion design measures and principles

because these are not widely known and recognized by designers and architects. DOE

N80-28517# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
COORDINATION CHEMISTRY OF METAL SURFACES AND METAL COMPLEXES
Earl L. Muetterties. Dec. 1979. 17 p. refs. Presented at the Intern. Congr. on Catalysis, Tokyo, 30 Jun. - 4 Jul. 1980.
(Contract W-7405-eng-48; Grant NSF CHE-79-03933)
(LBL-10308; CONF-800615-1) Avail: NTIS HC A02/MF A01

The coordination chemistry of two isometric molecules, acetonitrile and methyl isocyanide, was characterized for (1) single crystal nickel surfaces as a function of crystallography and surface composition, (2) nickel catalyst surfaces, and (3) molecular mononuclear and polynuclear metal complexes. Conditions were established for the catalytic isomerization of methyl isocyanide to acetonitrile within these nickel surface and molecular complex regimes. The acetonitrile and methyl isocyanide chemistry between the surface and molecular complex areas is compared. DOE

N80-28518# Netherlands Organization for Applied Scientific Research TNO, Delft.
FAILURE ANALYSIS
Apeldoorn, Netherlands. Metaalinst. TNO. 1979. 13 p. Original contains color illustrations.
Avail: NTIS HC A02/MF A01

Brief case histories on metal structures are presented. The following structures are included: an aircraft wheel; an oil storage tank; a drilling platform; a gas turbine; aluminum light standards; and a towbar. Author (ESA)

N80-28519# Foerenade Fabriksverken, Linkoeping (Sweden). Materials Lab.
FRETTING TESTS OF TITANIUM ALLOY Ti-6Al-4V WITH SHOT-PEENED AND SOLID LUBRICANT COATED SURFACES
Gunnar Burman. 28 Feb. 1979. 16 p. ref.
(Contract FMV-FMO-82302-78-000-00-019)
(FFV-R-9581-0316-1) Avail: NTIS HC A02/MF A01

Specimens of Ti-6Al-4V titanium alloy were fatigue tested under fretting conditions. Two groups of specimens were tested, one containing shot-peened specimens and the other containing specimens that were shot-peened and coated with the solid lubricant PWA 474. Rotary bending fatigue tests were performed. Under fretting conditions, the fatigue limit for shot-peened specimens was 235 N/sq mm, while the corresponding value for shot-peened and solid lubricant coated specimen was 480 N/sq mm. The fatigue limit for the latter group of specimens approaches that of material unaffected by fretting. It is shown that shot-peening combined with solid lubricant coating drastically improves the fatigue strength of the material under the fretting conditions used in this investigation. Author (ESA)

N80-28520# National Technical Information Service, Springfield, Va.
CRYOGENIC PROPERTIES OF ALUMINUM AND ALUMINUM ALLOYS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
Brian Carrigan. Apr. 1980. 159 p. Supersedes NTIS/PS-79/0507; NTIS/PS-78/0511.
(PB80-809593; NTIS/PS-79/0507; NTIS/PS-78/0511) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Citations of Federally funded research include studies on the cryogenic properties of aluminum and its alloys used in superconducting machinery, magnets, space technology, and nuclear reactors. Electrical properties, fatigue, deformation, and welds are included. This updated bibliography contains 153 abstracts, 8 of which are new entries to the previous edition. GRA

N80-28521# National Technical Information Service, Springfield, Va.
CRYOGENIC PROPERTIES OF ALUMINUM AND ALUMINUM ALLOYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
Brian Carrigan. Apr. 1980. 128 p. Supersedes NTIS/PS-78/0512.
(PB80-809601; NTIS/PS-79/0508; NTIS/PS-78/0512) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Reports of worldwide research on aluminum and its alloys in liquefied gas tanks, superconducting devices, pressure vessels, and spacecraft components are cited. Studies on welds, fracture, and mechanical properties are included. This updated bibliography contains 122 abstracts, 21 of which are new entries to the previous edition. GRA

N80-28522# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
MECHANISM OF SO2 AND H2SO4 AEROSOL ZINC CORROSION Final Report, 9 May - 9 Jun. 1979
Alan B. Harker, Florian B. Mansfeld, Dennis R. Strauss, and Dwight D. Landis. Jan. 1980. 42 p. refs.
(Contract EPA-68-02-2944)
(PB80-167018; EPA-600/3-80-018) Avail: NTIS HC A03/MF A01 CSCL 07D

The physical variables controlling the SO2 and H2SO4 induced corrosion of zinc were investigated. Relative humidity, temperature, air flow velocity, flow turbulence, aerosol size range, and pollutant concentration were controlled. Corrosion measurements were made through the use of an atmospheric corrosion monitor. The results show that the principal factors controlling pollutant induced corrosion are relative humidity, the rate of pollutant flux to the surface, and the chemical form of the pollutant. Sulfur dioxide was observed to induce a higher corrosion rate in the zinc than H2SO4 on a molecule for molecule basis. The overall results indicate that under most ambient conditions SO2 induced corrosion damage will dominate over H2SO4 effects. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-28523 Washington State Univ., Pullman.
SYNTHESIS, STRUCTURE AND PROPERTIES OF ORGANOMETRIC MONOMERS AND POLYMERS Ph.D. Thesis
Russell Samuel Williams. 1980. 126 p.
Avail: Univ. Microfilms Order No. 8015170

The relationship between bulk properties of thermoset organotin polymers and structural changes due to various methods of bonding tri-n-butyltin esters to the polymer matrix is examined. Two synthetic methods were explored to prepare such polymers. In the first, tri-n-butyltin (TBT) esters of compounds such as 4,4'bis(4-hydroxyphenyl) pentanoic acid were prepared and then condensed with epichlorohydrin to give a TBT modified diepoxide. In the second synthesis, the formation of undesirable byproducts could be avoided by chemically binding the TBT moiety to amine curing agents. Several organometallic compounds were synthesized including tri-n-butyltin esters of glycine, 4-aminobutanoic, 6-aminohexanoic, 11-aminoundecanoic, and 3,5-diaminobenzoic acids. DGEBA was cured either with these amines individually (as in the case if TBT 3,5-diaminobenzoate) or in combination with other multifunctional amines. Mechanical testing indicated a dependence of strength, modulus, toughness, and glass transition depending on the location of the TBT moiety in relation to the polymer backbone. Dissert. Abstr.

N80-28524*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERIZATION OF PMR-15 POLYIMIDE COMPOSITION IN THERMO-OXIDATIVELY EXPOSED GRAPHITE FIBER COMPOSITES
William B. Alston. 1980. 19 p. refs. Proposed for Presentation at 12th Natl. SAMPE Tech. Conf., Seattle, 7-9 Oct. 1980.
(NASA-TM-81565; AVRADCOM-TR-80-C-10; E-527) Avail: NTIS HC A02/MF A01 CSCL 09C

The contributions of individual resin components to total resin weight loss in 600 F air aged Celion 6000/PMR-15 polyimide composites were determined from the overall resin weight loss in the composite by chemically separating the PMR-15 matrix resin into its monomeric components. The

individual resin components were also analyzed by spectroscopic techniques in order to elucidate curing and degradation mechanisms of the PMR-15 matrix resin. The isothermal weight loss of the individual resin components during prolonged 600 F thermo-oxidative aging of the composite was correlated to the changes observed in the Fourier Transform infrared spectra and Fourier Transform nuclear magnetic resonance spectra of the individual resin components. The correlation was used to identify the molecular site of the thermo-oxidative changes in PMR-15 polyimide matrix resin during 600 F curing the prolonged 600 F thermo-oxidative aging. Author

N80-28525# De Soto, Inc., Des Plaines, Ill.
WATERBORNE POLYMERIC FILMS Interim Report, 15 Sep. 1978 - 15 Sep. 1979
A. J. Tortorello and R. T. Gearon Wright-Patterson AFB, Ohio AFML Dec 1979 109 p refs
(Contract F33615-78-C-5096; AF Proj. 2422)
(AD-A084838; AFML-TR-79-4192) Avail: NTIS HC A06/MF A01 CSCL 11/3

Air Force Materials Laboratory contract proposed the development of a high performance water based polymer system to function as a pigment binding vehicle for military aircraft coatings. Screening studies on numerous commercially available aqueous resin systems enabled a ranking based on clear-film performance. A few resins were identified as displaying performance approaching the established criteria. Aqueous polyurethanes, aqueous acrylic solution polymers, and epoxy emulsions exhibited near acceptable fluid resistance and flexibility. One member of the class of water reducible alkyds exceeded the performance of other resins in this class. The selected resins were subjected to pigmentation studies. Primer formulations using strontium chromate pigment were prepared and evaluated. Topcoat formulations with rutile titanium dioxide were also prepared and evaluated. Results of clear and pigmented film studies indicate that the class of aqueous polyurethane dispersions would be most likely to meet the required fluid resistance and flexibility. Aqueous acrylic solution polymers successfully resisted the test fluids but flexibility was lacking. GRA

N80-28526# Albany International Corp., Dedham, Mass.
KEVLAR PROPERTIES INVESTIGATION HIGH SPEED ABRASION RESISTANCE Final Report, 13 Feb. 1978 - 31 Jan. 1980
Stephen L. Goodwin and Norman J. Abbott AFWAL Wright-Patterson AFB, Ohio Feb 1980 169 p refs
(Contract F33615-78-C-3406; AF Proj. 2402)
(AD-A085155; AFWAL-TR-80-3004) Avail: NTIS HC A08/MF A01 CSCL 11/9

Kevlar has acquired a reputation for poor abrasion resistance. Replacement of nylon parachute materials with Kevlar has been hampered by Kevlar's reputation. However, abrasion testing of these materials under conditions designed to simulate parachute deployment had never been performed. A test procedure was designed to simulate the high speed rubbing of Kevlar and nylon webbings, braids and ribbons against themselves and a common abrasive surface under various conditions of loading at speeds ranging from 20 to 240 fps. Evaluation of abrasive damage was based upon strength loss for each material at each test condition. Extensive testing of both Kevlar and nylon materials showed conclusively that Kevlar's resistance to abrasive damage sustained due to high speed rubbing was superior to that of nylon. Investigation of the effects of many test parameters on strength loss due to abrasive damage showed that Kevlar relative to nylon was much less affected by test speed and normal force due to its superior thermal stability. GRA

N80-28527# Chemetal Corp., Pacoima, Calif.
INVESTIGATION OF CNTD SILICON NITRIDE ON COMPLEX SHAPES Final Report, 1 Jul. 1978 - 1 Jul. 1979
Robert A. Holzl 6 Feb 1980 76 p refs
(Contract F33615-78-C-5161)
(AD-A085153; AFML-TR-79-4219) Avail: NTIS HC A05/MF A01 CSCL 11/3

The project reported on herein represents an attempt to extend the technique of CVD to the efficient, economical, one step coating of complex shapes. A limitation in state of the art CVD processing is that planar of axisymmetric shapes are required if coatings having uniform thickness and consistent properties are desired. It was therefore proposed to design, build and test a deposition chamber in which a complex shape such as a turbine blade or vane could be reproducibly and evenly coated on all surfaces in one operation. The present report describes the rationale for the chamber design, experiments leading to the demonstration of its capabilities, and the characterization of the resulting Si_3N_4 coatings which were deposited on RBSN turbine vanes. A complete description of the chamber and ancillary equipment is given. GRA

N80-28528# Union Carbide Corp., Tarrytown, N.Y.
ORGANOSILANE POLYMERS. 3: BLOCK COPOLYMERS
J. P. Wesson and T. C. Williams Apr. 1980 21 p refs
(Contract N00014-75-C-1024)
(AD-A085202; TR-79-1-3) Avail: NTIS HC A02/MF A01 CSCL 11/9

Block copolymers made by coupling chloro and lithio terminated diorganosilylene oligomers were soluble in common solvents and deposited coherent films from solutions. Copolymer UV spectra showed a red shift in absorption maxima attributed to increased silicon chain length and phenyl-silicon spine interaction. GRA

N80-28529# Utah Univ., Salt Lake City.
APPLICATION OF RATE THEORY TO ACCELERATED DURABILITY TESTING OF STRUCTURAL ADHESIVES Final Report, summer 1978
William L. Hufferd Mar 1980 74 p refs
(Contract F33615-72-C-5003)
(AD-A085142; AFML-TR-79-4199) Avail: NTIS HC A04/MF A01 CSCL 11/1

The application of absolute reaction rate theory concepts is explored as a scientific basis for establishing an accelerated testing methodology for adhesive bonded joints. Primary attention is given to the effects of time, moisture, temperature and load history. Some of the more dominant processes occurring during cure and aging of epoxy resin adhesives are identified and potential techniques for separating and monitoring the associated activation energies of these mechanisms with aging, environment and load history are discussed. Suggestions are also made for incorporating aging effects into appropriately rigorous constitutive models. GRA

N80-28530# Naval Civil Engineering Lab., Port Hueneme, Calif.
LIGHTWEIGHT CONCRETE USING POLYMER-FILLED AGGREGATE FOR OCEAN APPLICATIONS: AN EXPLORATORY INVESTIGATION Final Report, Sep. 1978 - Sep. 1979
Harvey H. Haynes and Wulf V. Eckroth Dec 1979 30 p refs
(ZF61512001)
(AD-A085287; CEL-TN-1765) Avail: NTIS HC A03/MF A01 CSCL 11/2

A lightweight concrete specially suited for deep ocean applications was tested for its strength properties and compared to similar regular lightweight concrete. The new concrete used lightweight aggregate particles (expanded shale) which were filled with a polymeric material. The polymer-filled aggregate (PFA) was conventionally mixed with portland cement and water to make the lightweight concrete. Four concrete mixes were tested. In general, the PFA concrete, compared to regular lightweight concrete, has an equal unit weight in a seawater saturated condition and exhibited increases in compressive strength of 26%, split tensile strength of 4%, elastic moduli of 4% and an equal Poisson's ratio. The strongest mix for PFA concrete had a compressive strength of 6,580 psi, compared to 5,200 psi for regular lightweight concrete, at an age of 28 days under continuous fog curing. Both mixes have a weight savings of 40%, compared to that of normal weight concrete in a submerged, saturated condition. A discussion of cost is presented and shows that the in-place structural cost of PFA concrete would be about 30% greater than normal concrete. GRA

N80-28531# Effects Technology, Inc., Santa Barbara, Calif.
LOCALIZED DEFORMATION AND FRACTURE OF TRANSPARENT CERAMICS
William F. Adler and Timothy W. James Mar 1980 93 p refs

(Contract N00014-76-C-0744; ONR Proj. 471)
(AD-A085133; ETI-CR80-758) Avail: NTIS HC A05/MF A01 CSCL 11/2

The objective of this research is to understand and model the deformation and fracture response of materials exposed to water drop collisions. Due to the inherent complexity of the erosive response of materials exposed to a multiple water drop environment, this investigation concentrated on a very idealized water drop impact condition: the normal impact of a spherical water drop on a plane surface. Impact experiments were conducted in a specially designed ballistic range facility capable of producing spherical water drop impacts on materials at impact velocities from 200 to 850/ms. A reproducible, controlled, and well-characterized impact condition is necessary if an accurate assessment of the material's response is to be established and this requirement has been satisfied within this program. The water drop impact damage on single crystal and polycrystalline calcium fluoride was also investigated. Some general observations are made with regard to the form of the fractures in extruded, hot-pressed, and press-forged calcium fluoride. GRA

N80-28532# Rensselaer Polytechnic Inst., Troy, N. Y.
PROPERTIES OF GLASSES WITH HIGH WATER CONTENT Progress Report, 15 Jun. 1979 - 29 Feb. 1980
Minoru Tomozawa and Edward Bruce Watson. Mar. 1980. 12 p. refs.
(Contract DE-AC02-79ER-10453)
(DOE/ER-10453/01) Avail: NTIS HC A02/MF A01

In this initial stage of the research on glasses with high water content, the hydrothermal units were constructed and several water bearing sodium silicate glasses were prepared. Preliminary measurements were also made on thermal, mechanical, and electrical properties of these glasses. Several unique features were revealed. For example, the electrical resistivity increases substantially with water content suggesting a possibility of preparing chemically durable glasses with large amounts of water. DOE

N80-28533# Associated Technical Services, Inc., Glen Ridge, N. J.
POLYMERIZATION IN SHOCK COMPRESSION
L. V. Babare (Academy of Science, USSR), A. N. Dremin (Academy of Science, USSR), S. V. Pershin (Academy of Science, USSR), and V. V. Yakovlev (Academy of Science, USSR). Apr. 1980. 18 p. refs. Transl. into ENGLISH of Russian conf. paper, Moscow 1970 p 239-257. Presented at 1st Intern. Symp. on Explosive Cladding, Moscow, 1971. Sponsored by DOE. Prepared for Sandia Labs., Albuquerque, N. Mex.
(SAND-80-6006) Avail: NTIS HC A02/MF A01

A fairly wide range of liquid and crystalline monomers was subjected to polymerization (up to pressures of 100 kbar), and the range in which the process occurs with some of them was established. It was shown that polymerization occurs both with polymers polymerizing under ordinary conditions by the radical or the ionic mechanism, and that it can take place at a double or triple bond, as well as with ring opening. Under specific conditions of shock compression, polymerization can be accomplished with compounds normally difficult or impossible to polymerize. It was shown that polymerization takes place within a few milliseconds, at pressures at which the density of the monomer reaches that of the polymer. The effect of pressure in shock compression and the number of reflected waves on the yield and length of the resulting polymeric chain was studied. Conductivity was observed in the region of polymerizing pressures. It was found that the action of the shock wave does not rest mainly on thermal effects but is determined by the specific nature of the shock loading. DOE

N80-28534# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).
THE WEATHERING OF PLASTIC MATERIALS IN THE TROPICS. PART 3: THE EVALUATION OF A SOLAR RADIATION CONCENTRATION DEVICE (EMMA) AS A MEANS OF ACCELERATING THE WEATHERING OF PLASTICS
London. HMSO. Jun. 1979. 34 p. refs.
(BR68706) Avail: NTIS HC A03/MF A01

An experiment was conducted in Phoenix to compare the rate of natural weathering with that for exposure on EMMA (equatorial mount with mirror for acceleration), a device which increases the intensity of solar radiation. The materials exposed were low density polyethylene and polyacetal. An acceleration factor of about two was found for both materials. Author (ESA)

N80-28535# National Technical Information Service, Springfield, Va.
FRACTURE OF CERAMICS. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1977 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980. 208 p. Supersedes NTIS/PS-79/0307; NTIS/PS-78/0264.
(PB80-809825; NTIS/PS-79/0307; NTIS/PS-78/0264) Avail: NTIS HC $30.00/MF $30.00 CSCL 11B

Citations of research on ceramic fracture in relation to fabrication, microstructure, mechanical properties, tests, and composition are covered in this bibliography. Reports include ceramic use in rocket components, gas turbines, nuclear reactors and structural parts. This updated bibliography contains 201 abstracts, 59 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling, and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N80-28536* National Aeronautics and Space Administration. Pasadena Office, Calif.
SILICONE CONTAINING SOLID PROPELLANT Patent
Kumar N. R. Ramohalli, inventor (to NASA) (JPL). Issued 1 Jul. 1980. 4 p. Filed 16 Oct. 1978. Supersedes N79-10224 (17 - 01, p 0030)
(NASA-Case-NPO-14477-1; US-Patent-4,210,474; US-Patent-Appl-SN-951830; US-Patent-Class-149-19.2; US-Patent-Class-149-19.9; US-Patent-Class-149-20) Avail: US Patent and Trademark Office CSCL 21I

The addition of a small amount, for example 1% by weight, of a liquid silicone oil to a metal containing solid rocket propellant provides a significant reduction in heat transfer to the inert nozzle walls. Metal oxide slag collection and blockage of the nozzle are eliminated and the burning rate is increased by about 5% to 10% thus improving ballistic performance.

Official Gazette of the U.S. Patent and Trademark Office

N80-28537# Naval Surface Weapons Center, White Oak, Md.
SYNTHESIS OF ENERGETIC MATERIALS AT HIGH PRESSURE. Annual Technical Report, FY 1979
William M. Koppes and Horst G. Adolph. Mar. 1980. 36 p. refs.
(RR0240201)
(AD-A084800) Avail: NTIS HC A03/MF A01 CSCL 19/1

The utility of a high pressure technique to effect the trimerization of fluorodinitroacetonitrite to the corresponding triazine has been investigated. Whereas fluorodinitroacetonitrile has resisted previous ambient pressure attempts at trimerization with a variety of catalysts, it was found to form triazines quite readily when subjected to 1 GPa pressures in the presence of certain primary alcohols and phenols. However, the triazines formed contained a mixture of fluorodinitromethyl and alkoxy or aryloxy substituents, apparently as a consequence of competition between $CF(NO_2)_2$ and ROH for elimination in the cyclization steps, or of nucleophilic displacement of $CF(NO_2)_2$ by ROH in the initial triazine product. A study was made of the effect of ROH acidity on product composition with the finding that mixed triazines formed in all cases in which reaction occurred. An alternative mechanisms for triazine formation from nitriles was postulated to account for some novel observations made during this work. Our results indicate that tris (fluorodinitromethyl) triazine must be highly susceptible to nucleophilic attack with displacement of at least one $CF(NO_2)_2$ group, and would thus be subject to easy hydrolysis. GRA

N80-28538# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
GRAIN MODIFICATION ADDITIVES FOR TNT AND ITS COMPOSITIONS. A PRELIMINARY SCREENING VIA SUPPRESSION OF SUPERCOOLING
S. Portnoy Jun. 1980 20 p refs
(AD-A085019; AD-E400426; ARLCD-MR-8001) Avail: NTIS HC A02/MF A01 CSCL 19/1

A preliminary search for alternatives to 2,2',4,4',6,6'-hexanitrostilbene, as grain modification additives for TNT and its compositions, has been made. Screening of candidate additives was based upon the determination, via differential scanning calorimetry (DSC), of the suppression of supercooling by 0.5% of additive. A cast of good quality was obtained with 5-nitrobarbituric acid trihydrate. GRA

N80-28539# Crew Systems Consultants, Yellow Springs, Ohio.
FLIGHT TEST RESULTS OF THE USE OF ETHYLENE GLYCOL MONOMETHYL ETHER (EGME) AS AN ANTI-CARBURETOR ICING FUEL ADDITIVE Final Report
Richard L. Newman Jul. 1979 66 p
(Contract DOT-FA78WA-4165)
(AD-A084960; TR-79-9; FAA-AWS-79-1) Avail: NTIS HC A04/MF A01 CSCL 21/4

Flight test results of Ethylene Glycol Monomethyl Ether (EGME) show that EGME reduces the formation of carburetor ice during cruise power, and that the effectiveness of EGME reduces as the throttle is closed. Based on these results, EGME should not be considered as an anti-carburetor icing fuel additive in lieu of carburetor heat. GRA

N80-28540# Naval Surface Weapons Center, White Oak, Md.
DDT BEHAVIOR OF POROUS PROPELLANT MODELS AND POROUS SAMPLES OF COMMERCIAL PROPELLANTS
Donna Price and Richard R. Bernecker 13 Mar. 1980 45 p refs
(ZR0130901)
(AD-A084906; NSWC/TR-80-65) Avail: NTIS HC A03/MF A01 CSCL 21/9

A number of binary mixtures, components of which are propellant ingredients, were examined in steel walled tubes for their DDT behavior at 60-70% theoretical maximum density (TMD). Several commercial propellants and one 4 component, composite model were also examined. A number of compositional effects were noted and reported. Some propellants, at high porosity, showed reaction not detectable by our ionization probes. For propellants which exhibited transition at 70% TMD in our apparatus, the range in predetonation column length (l) was 103-170 mm and in relative time to detonation, 76-247 micro. GRA

N80-28541# Whittaker Corp., North Hollywood, Calif. Shock Hydrodynamics Div.
PROJECTILE IMPACT IGNITION CHARACTERISTICS OF PROPELLANTS Final Report, 1 Sep. 1976 - 30 Nov. 1979
W. H. Andersen May 1980 24 p refs
(Contract DAAG29-76-C-0063)
(AD-A085254; Rept-3420-FARO-14396.10-E) Avail: NTIS HC A02/MF A01 CSCL 21/9

The results of an investigation of the projectile impact ignition characteristics of propellants are described. Impact tests were conducted on a single, double and triple base propellant, and a deflagratable composite explosive. The tests were conducted by firing different diameter, flat-nosed brass projectiles into small cylinders of the propellant at various velocities and observing the impact reaction by various sensors. The general behavior of the four materials to impact was the same. The critical impact velocity necessary to induce a sustained reaction in a propellant decreased with increasing projectile diameter. The nature of the reaction depended on the diameter. At small diameters, the induced reaction was always detonation; whereas at the largest diameter the reaction was deflagration, whose intensity increased with increasing impact velocity. A higher critical velocity then again resulted in detonation. A model based on the view that the ignition and reaction in an impacted (shocked) propellant are independent processes was postulated to explain the results. The critical velocity for inducing ignition was consistent with the critical energy concept. GRA

N80-28542# Badger Plants, Inc., Cambridge, Mass.
ASPECTS OF COMMERCIALIZING COAL-DERIVED METHANOL FUELS IN THE UNITED STATES, 1985 TO 2000. VOLUME 1: MARKET EVALUATION
Mar. 1980 173 p refs
(Contract EX-76-C-01-2416)
(FE-2416-44-Vol-1) Avail: NTIS HC A08/MF A01

The prospects of coal derived fuels are evaluated only for those segments of the electric utility and automotive sectors considered most likely to provide markets for such fuels in the near term. The commitment of the electric utility industry to the use of methanol as a peakload turbine fuel is predicted upon both future and price supply. Results indicate that methanol appears to be an acceptable replacement gas turbine fuel and that the technical problems should be solvable. DOE

N80-28543# Badger Plants, Inc., Cambridge, Mass.
ASPECTS OF COMMERCIALIZING COAL-DERIVED METHANOL FUELS IN THE UNITED STATES, 1985 TO 2000. VOLUME 2: APPENDIX
Mar. 1980 231 p refs
(Contract EX-76-C-01-2416)
(FE-2416-44-Vol-2) Avail: NTIS HC A02/MF A01

Various aspects of the commercializing of methanol fuel and synthetic gasoline in the United States during the period 1985 to 2000 are evaluated. Major emphasis is placed on electric utility industry and the automotive sector. Competing alternative fuels are also reported. R.C.T.

N80-28544# Air Products and Chemicals, Inc., Allentown, Pa.
LIGHTWEIGHT METAL HYDRIDES MATERIALS DEVELOPMENT Final Report
Apr. 1980 42 p
(Contract EY-76-C-02-0016)
(DOE/CS-0016/T1) Avail: NTIS HC A03/MF A01

A four month program was initiated with the following objectives: (1) to define the products of the hydriding reaction of the Mg5Al8/H2 system (phase 1), and (2) explore the roles and functions of Ni as a catalyst for hydriding the Mg5Al8 system (Phase 2). Phase 1 results indicated that the hydrided alloy rearranges the form pockets of MgH2 and Al, no ternary hydride was formed. Additional evidence was obtained to support our hypothesis that the disproportionation of Mg5Al8 may be the rate limiting step for the hydrogen absorption reaction. In Phase 2 three forms of Ni incorporation were considered. The data showed that Ni does not significantly increase the rate of hydrogen absorption for the Mg5Al8/Ni systems. However, Ni does enhance the rate of hydrogen desorption, suggesting there are different rate limiting steps for absorption and desorption. Further work in the area of Ni-catalysis is warranted to increase the odds of developing a workable, light weight, hydride system exhibiting attractive desorption kinetics. DOE

N80-28545# Delaware Univ., Newark. Dept. of Chemical Engineering.
DEVELOPMENT OF UNIQUE CATALYSTS FOR HYDRODENITROGENATION OF COAL-DERIVED LIQUIDS Quarterly Report, 15 Dec. 1978 - 15 Mar. 1979
James R. Katzer, Alvin B. Stiles, and Harold Kwart 15 May 1979 31 p
(Contract ET-78-S-01-3297)
(FE-3297-2; QR-2) Avail: NTIS HC A03/MF A01

Experimental runs using decahydroquinoline, o-ethylaniline, and aniline as reactants were made. Results from decahydroquinoline runs show that carbon-nitrogen bond scission occurs by a catalytic route; it is not thermal. Strong Bronsted acid sites do not crack carbon-nitrogen bond; carbon-nitrogen bond scission must therefore occur on other sites on the catalyst. Hydrodenitrogenation of anilines clearly shows kinetic behavior characteristic of hydrogenation including positive order dependence on hydrogen pressure and an activation energy between that for hydrogenation and that for cracking; yet the primary product appears to be the fully aromatic ring. Hydrodenitrogenation of aniline and o-ethylaniline was studied over a presulfided Ni-Mo/Al2O3 catalyst, and a reaction network was determined for aniline hydrodenitrogenation. Aniline hydrodenitrogenation appears to involve partial hydrogenation of the benzene ring to reduce

aromatic resonance with the nitrogen atom reducing the C-N bond strength and facilitating elimination of NH3. DOE

N80-28546# Delaware Univ., Newark. Dept. of Chemical Engineering.
DEVELOPMENT OF UNIQUE CATALYSTS FOR HYDRODE-NITROGENATION OF COAL-DERIVED LIQUIDS Quarterly Report, 15 Mar. - 15 Jun. 1979
James R. Katzer, Alvin B. Stiles, and Harold Kwart 1 Aug. 1979 57 p
(Contract ET-78-S-01-3297)
(FE-3297-3; QR-3) Avail: NTIS HC A04/MF A01

Experimental runs using decahydroquinoline and quinoline as reactants were made. The nature of catalytic function responsible for carbon-nitrogen bond session was studied using decahydroquinoline over a set of catalysts. The catalysts tested include catalysts with Co, Ni, Mo impregnated on silica-alumina or gamma-alumina. The results showed that the rate of nitrogen removal and highest for Mo on gamma-alumina catalyst. Several catalysts with the objective to develop uniquely new hydrogenation catalysts that will selectively coordinate the nitrogen atom and remove it without hydrogenating the entire ring thereby reducing hydrogen consumption, were prepared. The catalysts chosen were aluminum borate and aluminum borate phosphate, impregnated with 4 wt % nickel. Preliminary results showed that 4 wt % Ni on aluminum borate catalyst gives a marked increase in nitrogen removal in quinoline. DOE

N80-28547# Los Alamos Scientific Lab., N. Mex.
ALTERNATIVE GAS WORKSHOP Final Report
Glenda Cremer, comp. Mar. 1980 58 p refs Workshop held at Los Alamos, N. Mex., 5-6 Sep. 1979
(Contract W-7405-eng-36)
(LA-8155-C; CONF-7909133) Avail: NTIS HC A04/MF A01

Basic research needs in the development of seven categories of unconventional and nonconventional gas resources were reviewed. The categories reviewed were Devonian shales, western tight gas sands, methane from coal beds, geopressured brines, methane hydrates, abiogenic methane, and other geological environments. The principal recommendations of the workshop groups are presented. DOE

N80-28548# Air Products and Chemicals, Inc., Allentown, Pa.
CRYOGENIC METHANE SEPARATION/CATALYTIC HY-DROGASIFICATION PROCESS ANALYSIS Interim Report
A. A. Cassano, M. F. Hilton, and T. C. Li 15 May 1979 96 p refs
(Contract ET-78-C-01-3044)
(FE-3044-T6) Avail: NTIS HC A05/MF A01

Attractive combinations of acid gas removal and cryogenic methane separattion for both the catalytic coal gasification and the hydrogasification processes are suggested. A screening process was undertaken to define the most promising integration scheme for each gasification process. This information, combined with present capabilities in acid gas processes and cryogenic separation, allowed preparation of process designs and cost estimates for each of the integrated schemes. DOE

N80-28549# Ames Lab., Iowa.
MATERIALS FOR COAL LIQUEFACTION
Tom E. Scott Oct. 1979 71 p refs Presented at the 4th Ann. Conf. on Mater. for Coal Conversion and Utilization, Gaithersburg, Md., 9-11 Oct. 1979, sponsored by DOE, Electric Power Research Inst., NBS and Gas Research Inst.
(Contract W-7405-eng-82)
(ISM-246; CONF-791014-1) Avail: NTIS HC A04/MF A01

An attempt is made to summarize the failures already experienced, most of which are highly visible such as erosion or corrosion. Problems which are not failures but bear on cost effectiveness as well as potential problems which might effect reliability and safety are indicated. The efforts being made to solve these problems are cited and some future directions for consideration are suggested. It is shown that solutions to problems uncovered in pilot plant scale operations may not suffice in commercial scale plants. On the other hand, some pilot plant problems may be eliminated or mitigated in large components for commercial plants. DOE

N80-28550# Chevron Research Co., Richmond, Calif.
REFINING AND UPGRADING OF SYNFUELS FROM COAL AND OIL SHALES BY ADVANCED CATALYTIC PROCESSES Quarterly Report, Apr. - Jun. 1979
R. F. Sullivan and D. J. Rear Jul. 1979 79 p
(Contract EX-76-C-01-2315)
(FE-2315-40) Avail: NTIS HC A05/MF A01

Pilot plant results for a two stage hydrocracker are presented. It is shown that H-coal whole process product can be hydrotreated to make a jet fuel similar to the jet fuel from SRC-2 whole process product. DOE

N80-28551# Engineering Societies Commission on Energy, Inc., Washington, D. C.
SURVEY OF WORLD COAL ENERGY STUDIES AND INTERNATIONAL COAL MINING RESEARCH
T. A. Boyce Dec. 1979 80 p
(Contract EF-77-C-01-2468-012)
(FE-2468-68) Avail: NTIS HC A05/MF A01

An international monitoring task was undertaken with emphasis on monitoring the awareness of international energy programs. The findings of the monitoring activities are summarized with respect to the following: world coal energy studies; international coal mining research; and world coal trade. DOE

N80-28552# Germantown Labs., Inc., Philadelphia, Pa.
INVESTIGATION OF FUELS CONTAINING COAL-OIL-WATER EMULSIONS FIRE TUBE TEST APPARATUS Quarterly Report, 1 Jan. - 31 Mar. 1980
Norman H. Cherry and Charles S. Stokes Jan. 1980 12 p
(Contract DE-AC22-77ET-10634)
(DOE/ET-10634/T1; QR-10) Avail: NTIS HC A02/MF A01

The fire tube test apparatus was checked out and is ready for the combustion test series. The stack gas analysis equipment was calibrated and operational procedures evaluated for data acquisition. In conjunction with the fire tube test apparatus, a commercial scale size Gaulin emulsifier (100 gallons/hour) was set up and evaluated. DOE

N80-28553# Filtrol Corp., Los Angeles, Calif.
DEVELOPMENT OF NEW CATALYSTS FOR COAL LIQUIDS REFINING Quarterly Report, 1 Jul. - 30 Sep. 1979
I. Schwager Oct. 1979 27 p refs
(Contract ET-78-C-01-2595)
(FE-2595; QR-3) Avail: NTIS HC A03/MF A01

Base line catalyst testing conditions for hydrotreating SRC-2 fuel oil blend were determined: temperature, 750 F; pressure, 1,000 psig; LHSV, 1 ml/ml-hr; and H2 flow rate, 5000 SCF/bbl. At these conditions the average values for HDN and HDS with the commercial Filtrol catalyst HPC-40 (Ni-Mo on gamma alumina) are 88 + or - 2 and 89 + or - 2%, respectively. With Filtrol HP-6 (Co-Mo on gamma alumina) the HDN and HDS values are 78 and 92%, respectively. Hydrotreating catalyst testing on a series of exploratory catalysts, with different metals loadings and support properties, was initiated. Nickel-molybdenum catalysts appear to be more active for HDN, whereas, Co-Mo catalysts appear to be more active for HDS. Both Ni-W and Co-W catalysts appear to be less active than their Ni- and Co-Mo counterparts. Pilot Plant batches of silica alumina, silica alumina magnesia, and silica alumina zirconia gels were prepared. Exploratory cracking, hydrocracking, and hydrotreating catalysts are being produced in preparation for activity testing. DOE

N80-28554# Lummus Co., Bloomfield, N. J.
DEVELOPMENT RESEARCH PROGRAM FOR CLEAN INDUSTRIAL AND TRANSPORTATION FUELS FROM COAL Final Report, Sep. 1976 - Mar. 1979
H. D. Schindler and R. H. Long Dec. 1979 171 p refs
(Contract EF-76-C-01-2514)
(FE-2514-31) Avail: NTIS HC A08/MF A01

The potential performance of single axis tracking parabolic trough solar collectors as a function of optical energy distribution and receiver size was calculated for eleven sites using typical meteorological year input data. A simulation based on the SOLTES code was developed which includes the three dimensional features of a parabolic trough and calculates the thermooptical tradeoffs. The capability of the thermooptical model was confirmed by the comparison of calculated results with the experimental results

from an all day test of a parabolic trough. The results indicate a potential performance superiority of a north-south horizontal axis trough and, in addition, a high quality (optical error sigma sub system less than or equal to 0.007 radian) collector should be of the same geometric design for all of the sites investigated and probably for all regions of the country. DOE

N80-28555# Worcester Polytechnic Inst., Mass.
KINETICS AND MECHANISMS OF CATALYTIC HYDROLIQUEFACTION AND HYDROGASIFICATION OF LIGNITE Quarterly Report, Jul. - Sep. 1979
Alvin H. Weiss and Wilmer L. Kranich 25 Oct. 1979 8 p
(Contract EF-77-S-01-2702)
(FE-2702-8) Avail: NTIS HC A02/MF A01

Several successful runs on hydrogenation of a 20% slurry of lignite in anthracene oil were made at 425 C in a CSTR. At constant concentration of unconverted coal solids, the rate of reaction appears from very limited data to be independent of hydrogen pressure over a total pressure range of 800 to 1600 psig. Rate also appears to be independent of concentration of Co-Mo catalyst over the range of 0.8% to 2.0% of total charge. If these results can be reproduced and extended, this may indicate that over these ranges, hydrogen is supplied and activated by the catalyst at a rate well in excess of that at which it can be utilized by the slower hydroliquefaction reactions. DOE

N80-28556# Oklahoma State Univ., Stillwater. School of Chemical Engineering.
CATALYSTS FOR UPGRADING COAL-DERIVED LIQUIDS Quarterly Report, 1 Jan. - 31 Mar. 1980
Billy L. Crynes 15 Apr. 1980 18 p
(Contract DE-AC01-79ET-14876)
(DOE/ET-14876/2) Avail: NTIS HC A02/MF A01

Construction of the new trickle-bed reactor was completed and one experiment was conducted. The experimental run was made using a Pamco coal-derived liquid containing 0.40% sulfur and 0.95% nitrogen. The catalyst utilized was HDN-30, Ni-Mo-Al2O3. Run conditions were at 399 C (750 F), 1500 psig and space times up to two hours. Sample analyses are not yet available from this experiment. Two runs were completed in the Catalyst Life Test Unit (CLTU) utilizing a liquid containing 50% Synthoil and 50% Raw Anthracene oil. This fluid has a 0.54% sulfur and 1.21% nitrogen. Two Ni-MoAl2O3 catalysts were used - Shell-324, and H-Oil. Both experiments were terminated prematurely because of equipment malfunction. Sample analyses are not yet available from these two experiments. DOE

N80-28557# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
FORMATION AND CONTROL OF FUEL-NITROGEN POLLUTANTS IN CATALYTIC COMBUSTION OF COAL-DERIVED GASES Quarterly Technical Progress Report, 15 Mar. - 15 Jun. 1979
F. V. Bracco, C. Bruno, D. A. Santavicca, J. H. Semler, and P. M. Walsh 1 Jul. 1979 53 p refs
(Contract EF-77-S-01-2762)
(FE-2762-8) Avail: NTIS HC A04/MF A01

A review was made of the available data on amounts of nitrogen containing impurities present in coal derived low and medium Btu gases. A summary was made of the most complete of the existing models for catalytic combustor operation. A summary of the theoretical and experimental work on ammonia conversion to NO sub x in catalytic combustion of low and medium-Btu gases is given in this report. Experimental investigations were made of carbon monoxide and medium Btu gas combustion in the presence of platinum supported on a monolithic Cordierite substrate. Axial profiles substrate temperature, gas temperature, and stable species concentrations were measured at different gas velocities and equivalence ratios. Computed axial and radial gas temperature and carbon monoxide concentration profiles inside a catalyst channel during carbon monoxide combustion are presented. The integrated carbon monoxide profiles at the catalyst outlet are compared with the experimentally measured values. A possible approach to minimizing ammonia to SO/sub x/ conversion in catalytic combustion of coal derived gases is presented. DOE

N80-28558# Utah Univ., Salt Lake City. Dept. of Mining, Metallurgical and Fuels Engineering.
APPLIED RESEARCH AND EVALUATION OF PROCESS CONCEPTS FOR LIQUEFACTION AND GASIFICATION OF WESTERN COALS Quarterly Progress Report, Apr. - Jun. 1979
Wendell H. Wiser Oct. 1979 88 p refs
(Contract EX-76-C-01-2006)
(FE-2006-16) Avail: NTIS HC A05/MF A01

Problems in four general areas are considered: evaluation of process concepts in relation to liquefaction and gasification of coal; catalysis studies of fundamental importance in liquefaction and gasification of coal; studies of fundamental principles involved in processes for liquefaction and gasification of coal; and properties of coal and coal conversion products, of significance in liquefaction and gasification of coal. Research highlights are: (1) A reaction pathway for hydrodeoxygenation of oxygen containing species is proposed based on studies of model compounds. Reaction pathways that can lead to coke formation and catalyst deactivation and identified; (2) Studies on the hydrodesulfurization of thiophene support the Kolbe mechanisms; and (3) Preasphaltenes produced at low conversions were characterized. The heteroatom content is similar to that of the original coal and less than that of asphaltenes and oils. The carbon aromaticity is 0.6 to 0.7, but the molecules contain only 1-2 aromatic rings per condensed ring system. DOE

N80-28559# Los Alamos Scientific Lab., N. Mex.
CADMIUM-CADMIUM CARBONATE CYCLE FOR THE THERMOCHEMICAL PRODUCTION OF HYDROGEN
C. F. V. Mason and M. G. Bowman 1980 14 p refs Presented at the 3d World Hydrogen Energy Conf., Tokyo, 23 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-579; CONF-800616-3) Avail: NTIS HC A02/MF A01

A means of thermally decomposing water using cadmium, cadmium oxide and cadmium carbonate is described. Experimental emphasis is placed on the hydrogen producing step which consists of reacting cadmium with water and carbon dioxide to produce cadmium carbonate and hydrogen. The cycle is completed by decomposing the carbonate, first to the oxide, and then to the metal. Laboratory studies show that hydrogen is evolved slowly in relatively high yields (57 to 65%), but, when produced in the presence of ammonium chloride, both the yield and rate are increased (72% in 0.5 hr). The figure of merit of the cycle is 78% with a probability of some decrease resultant from the ammonium chloride reaction. DOE

N80-28560# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
ALTERNATIVE PROCESS SCHEMES FOR COAL CONVERSION Progress Report, 1 Jun. - 31 Aug. 1979
Michael J. Sansone and Vi-Duong Dang Oct. 1979 24 p refs
(Contract EY-76-C-02-0016)
(BNL-51117; PR-3) Avail: NTIS HC A02/MF A01

To obtain pipeline grade methane, it is necessary to develop economical methods of separating methane from hydrogen and/or carbon monoxide mixtures. The hydrogen and carbon monoxide are then recycled in the process. Several separation technologies such as absorption/stripping, cryogenic, clathrate formation were examined. An absorption/stripping process calculation using propane as the absorption solvent for separation of methane from hydrogen and carbon monoxide was performed. Detailed material and energy balances for the process as well as the dimensions of the absorber and the stripper are reported. Other major pieces of equipment such as heat exchangers, pumps, and compressors were evaluated in order to determine the equivalent electrical energy of the process as approximately 13550 cal(e)/gm-mole methane produced. The purity of methane in the final stream is 96% by volume at 100 F and 1000 psi. The present process appears to be a potential working process for methane separation in large quantity. DOE

N80-28561# SRI International Corp., Menlo Park, Calif. Materials Research Lab.
SHIFT CONVERSION AND METHANATION IN COAL GASIFICATION: BENCH-SCALE EVALUATION OF A

SULFUR RESISTANT CATALYST Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
B. J. Wood, D. Sheridan, J. G. McCarty, and H. Wise 18 Jan. 1980 16 p refs
(Contract ET-78-C-01-3240; SRI Proj. PYU-7930)
(FE-3240-T4) Avail: NTIS HC A02/MF A01

A bench-scale, long term study is in progress of the deactivation rate of a new methanation catalyst which in earlier laboratory measurements demonstrated both higher specific methanation activity and resistance to sulfur poisoning. The measurements are carried out in two parallel, fixed-bed reactors one of which contains Ir/Ni/Al2O3 and the other Ni/Al2O3. The deactivation rates were examined in terms of the loss in conversion with exposure time to the syn gas mixture, the change in temperature distribution along the axis of the catalyst bed, and the breakthrough of hydrogen sulfide in the product stream. For the same mass of catalyst and Al2O3 diluent the Ir/Ni/Al2O3 samples exhibited a considerably longer life than Ni/Al2O3. After 800 hours of operation the Ni/Al2O3 has lost nearly 99 percent of its initial activity, while the activity loss amounts to only 25 percent in the case of Ir/Ni/Al2O3. DOE

N80-28562# Sandia Labs., Albuquerque, N. Mex. Thermal Processes Div.
INSTRUMENTATION AND PROCESS CONTROL DEVELOPMENT FOR IN SITU COAL GASIFICATION Quarterly Report, Sep. - Nov. 1979
Robert E. Glass, ed. Apr. 1980 25 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0482; QR-20) Avail: NTIS HC A02/MF A01

The second phase of the Hanna 4 in situ coal gasification test, Hanna 4-B, which was initiated on April 20, 1979, was completed on October 4, 1979. Sandia National Laboratories provided support by fielding and monitoring diagnostic and remote monitoring instrumentation techniques. During the final gasification stage, 765 tons of coal were reacted involving 17,000 cubic feet. The Hoe Creek 3 experiment began on August 15, 1979, and was terminated on October 10, 1979. The purpose of the experiment was to test the drilled borehole linking concept. Sandia National Laboratories' involvement consisted of fielding and monitoring both an inverted thermocouple and a surface electrical resistivity network. The inverted thermocouple was successfully tested and provided thermal data from beneath the burn zone. A real time analysis procedure for the electrical resistivity technique was implemented at Hoe Creek 3. Unfortunately, there was insufficient change in the data for this to have been a useful diagnostic. Efforts are continuing to identify the reason for this lack of response. DOE

N80-28563# Energy Resources Co., Inc., Cambridge, Mass.
FEASIBILITY OF ALTERNATIVES FOR SURFACE UTILIZATION OF COAL WASTES Final Technical Report, 29 Jul. 1979
J. Gushue Jul. 1979 287 p refs
(Contract ET-78-C-01-3105)
(FE-3105-1) Avail: NTIS HC A13/MF A01

The feasibility of using coarse coal refuse in combination with power plant fly ash to form subbase coarse material for roadway construction is evaluated for the Monogalia County region in northern West Virginia. On the basis of technical, environmental, and economic factors, it is concluded that using coal refuse/fly ash material for roadway subbase construction is feasible in the study area. The key technical and environmental considerations are related to the compaction characteristics of the material. Chemical and physical testing of the material to establish properties, in place performance, and optimum refuse/fly ash blends followed by proper mixing, handling and compaction during construction results in a strong, environmentally benign subbase course. Maximum usage of coal refuse/fly ash (3/1 ratio) on the 127 miles of new roadway planned through 1985 would utilize about 2.3 million tons of an estimated 7.5 million tons of refuse to be generated in the study area. DOE

N80-28564# Los Alamos Scientific Lab., N. Mex.
INTERFACING PRIMARY HEAT SOURCES AND CYCLES FOR THERMOCHEMICAL HYDROGEN PRODUCTION
Melvin G. Bowman 1980 11 p refs Presented at World Hydrogen Energy Conf., Tokyo, 23-26 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-500; CONF-800616-2) Avail: NTIS HC A02/MF A01

Advantages cited for hydrogen production from water by coupling thermochemical cycles with primary heat include the possibility of high efficiencies. These can be realized only if the cycle approximates the criteria required to match the characteristics of the heat source. Different types of cycles may be necessary for fission reactors, for fusion reactors or for solar furnaces. Very high temperature processes based on decomposition of gaseous H2O or CO2 appear impractical even for projected solar technology. Cycles based on CdO decomposition are potentially quite efficient and require isothermal heat at temperatures that may be available from solar furnaces of fusion reactors. Sulfuric acid and solid sulfate cycles are potentially useful at temperatures available from each heat source. Solid sulfate cycles offer advantages for isothermal heat sources. All cycles under development include concentration and drying steps. Novel methods for improving such operations would be beneficial. DOE

N80-28565# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
INTEGRATED SOLAR RECEIVER/BIOMASS GASIFIER RESEARCH
C. Benham, P. Bergeron, G. Bessler, and M. Bohn Nov. 1979 9 p refs Presented at the Users Assoc. Solar Fuels Workshop, Albuquerque, N. Mex. 28-29 Nov. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-333-507; CONF-791143-6) Avail: NTIS HC A02/MF A01

Processes for producing liquid fuels from olefin rich pyrolysis gases obtained from fast pyrolysis of biomass are being developed. In the Diebold process the biomass, carried by steam, is blown through an entrained bed gasifier. The olefins are then separated from the rest of the reaction products and polymerized thermally to gasoline; the other gases are used as fuel for the process. The Kuester process uses a fluidized bed gasifier and a catalytic Fischer-Tropsch reactor which converts the olefins, hydrogen, and carbon monoxide into n-propanol and paraffinic hydrocarbons. The advantages over the Diebold process are shorter residence time and elimination of the gas separation requirement. One disadvantage is the low octane rating of the fuel. As part of the solar thermal program at the Solar Energy Research Institute (SERI), an entrained bed reactor/receiver for fast pyrolysis of biomass is being developed for use with either the Diebold or Kuester process. DOE

N80-28566# Chem Systems Research Center, Fairfield, N.J.
DEVELOPMENT OF ALCOHOL-BASED SYNTHETIC TRANSPORTATION FUELS FROM COAL-DERIVED SYNTHESIS GASES Quarterly Report, 14 Sep. - 14 Dec. 1979
8 Apr. 1980 68 p refs
(Contract DE-AC22-79ET-14858)
(DOE/ET-14858/T1; QR-1) Avail: NTIS HC A04/MF A01

Chem Systems is carrying out an experimental program for the conversion of coal-derived synthesis gases to a mixture of C1-C4 alcohols. The objectives are to develop a catalyst and reactor system for producing a mixture of C1-C4 alcohols, which we call Alkanol fuel, to be used as a synthetic transportation fuel and assess the technical and economic feasibility of scaling the process concept to a commercial-scale application. Some of the accomplishments made were: (1) a small (75cc) fixed-bed, plug-flow, vapor phase reaction system was set up and operated utilizing catalyst bed dilution with inert media to help limit the large exotherm associated with the synthesis gas conversion reactions; (2) a total of fifteen catalysts containing varying amounts of Cu, Co, Zn, Cr and K were prepared and seven of these catalysts were tested; (3) identification of one promising catalyst composition which has resulted in a 30% conversion of carbon monoxide per pass (synthesis gas had a 3.5 H2/CO ratio) with a carbon selectivity to alcohols of about 80%. DOE

N80-28567# Chem Systems Research Center, Fairfield, N.J.
LIQUID-PHASE METHANOL Final Report, Dec. 1979
M. Sherwin and D. Blum Dec. 1979 245 p Sponsored by Electric Power Research Inst.
(EPRI Proj. 317-2)
(EPRI-AF-1291) Avail: NTIS HC A11/MF A01

The concept of this reactor involves carrying out the synthesis of methanol in an ebullated bed of catalyst in the presence of an inert liquid heat carrier. Work was carried out on laboratory, continuous bench-scale, and a process development unit. DOE

N80-28568# Sandia Labs., Albuquerque, N. Mex. Explosives Testing Organization 1533.
PRELIMINARY EXPERIMENTS USING LIGHT-INITIATED HIGH EXPLOSIVE FOR DRIVING THIN FLYER PLATES
R. A. Benham. Feb. 1980. 36 p. refs
(Contract EY-76-C-04-0789)
(SAND-79-1847) Avail: NTIS HC A03/MF A01

Light-initated high explosive silver acelytide - silver-nitrate (SASN) was used produce simulated X-ray blow-off impulse loading on reentry vehicles to study the system structural response. SASN can be used to accelerate thin flyer plates to high terminal velocities which in turn, can deliver a pressure pulse that can be tailored to the target material. This process is important for impulse tests where both structural and material response is desired. The theories used to calculate the dynamic state of the flyer plate prior to impact are summarized. Data from several experiments are presented which indicate that thin flyer plates can be properly accelerated and that there are predictive techniques available which are adequate to calculate the motion of the flyer plate. Recommendations are made for future study that must be undertaken to make the SASN flyer plate techniques usable. DOE

N80-28569# Midwest Research Inst., Golden, Colo.
CONVERSION SYSTEM OVERVIEW ASSESSMENT. VOLUME 3: SOLAR THERMAL/COAL OR BIOMASS DERIVED FUELS
R. J. Copeland. Feb. 1980. 33 p. refs
(Contract EG-77-C-01-4042)
(SERI/TR-35-078-Vol-3) Avail: NTIS HC A03/MF A01

The conversion of synthetic fuels with solar thermal heat is discussed. The method is a hybrid combination of solar energy with either coal or biomass. A preliminary assessment of this technology is made by calculating the cost of fuel produced as a function of the cost of coal and biomass. It is shown that within the projected ranges of coal, biomass, and solar thermal costs, there are conditions when solar synthetic fuels with solar thermal heat will become cost competitive. DOE

N80-28570# Energy and Environmental Analysis, Inc., Arlington, Va.
TECHNICAL AND ECONOMIC FEASIBILITY OF ALTERNATIVE FUEL USE IN PROCESS HEATERS AND SMALL BOILERS
Feb. 1980. 300 p.
(Contract DE-AC01-79EI-10547)
(DOE/EIA-10547/01) Avail: NTIS HC A14/MF A01

The technical and economic feasibility of using fuels other than oil and natural gas in combustors not regulated by the Powerplant and Industrial Fuel Use Act of 1978 (FUA) was evaluated. The impact of several measures to encourage the substitution of alternative fuels in these combustors was analyzed. The primary processes in which significant fuel savings can be achieved were identified. The combustors evaluated comprise approximately 45% of the fuel demand projected in 1990. These uses would account for more than 3.5 million barrels per day equivalent fuel demand in 1990. DOE

N80-28571# Department of Energy, Washington, D. C. Office of Transportation Programs.
ALTERNATIVE FUELS, FUEL ADDITIVES AND RELATED DEVICES FOR HIGHWAY VEHICLES: R, D AND D PROPOSAL GUIDELINES
Apr. 1980. 25 p.
(DOE/CS-0154) Avail: NTIS HC A02/MF A01

A technology is described which will help decrease U.S. dependence on and eventually replace petroleum as a major fuel resource. Alternative fuels, fuel additives, and engine/vehicle hardware that relate specifically to alternative fuel(s) handling and management are emphasized. Test data requirements for alternative fuels, fuel additives, extenders, and alternative fuel and related devices and systems are presented. A summary of submission requirements is also included. DOE

N80-28572# New Zealand Energy Research and Development Committee, Auckland.
THE POTENTIAL OF ENERGY FARMING FOR TRANSPORT FUELS IN NEW ZEALAND
G. S. Harris, M. L. Leamy, T. Fraser, J. B. Dent, W. A. N. Brown, W. B. Earl, and T. W. Fookes. Aug. 1979. 130 p. refs
Prepared in cooperation with Dept. of Scientific and Industrial Research, New Zealand and Soil Bureau, Forest Research Inst., Lincoln Coll., Canterbury Univ., and Waikato Univ.
(PB80-154248; Rept-46) Avail: NTIS HC A07/MF A01 CSCL 21D

The main economic aspects or energy farming are discussed. A set of guidelines are considered along which it is believed energy farming should or could be developed. Environmental and social factors associated with energy farming implementation are also considered. GRA

N80-28573# New Zealand Energy Research and Development Committee, Auckland.
THE POTENTIAL OF ENERGY FARMING FOR TRANSPORT FUELS IN NEW ZEALAND, APPENDICES
G. S. Harris, M. L. Leamy, T. Fraser, J. B. Dent, W. A. N. Brown, W. B. Earl, T. W. Fookes, and J. Gilbert. Aug. 1979. 134 p. refs. Prepared in cooperation with Dept. of Scientific and Industrial Res., New Zealand, Soil Bureau, Forest Res. Inst., Lincoln Coll., Canterbury Univ., and Waikato Univ.
(PB80-154255; Rept-46-App) Avail: NTIS HC A07/MF A01 CSCL 21D

The inventory of land suitable for the growth of crops necessary for biomass energy production is considered. Suitability prescriptions for mapping the distribution of resources needed for this process are presented. R.C.T.

N80-28574# Office of Technology Assessment, Washington, D. C.
ALTERNATIVE ENERGY FUTURES. PART 1: THE FUTURE OF LIQUEFIED NATURAL GAS IMPORTS
Mar. 1980. 133 p.
(PB80-173552; OTA-E-110) Avail: NTIS HC A07/MF A01 CSCL 21D

Worldwide availability of natural gas for U.S. import as liquefied natural gas is discussed with respect to projected U.S. gas demand, alternative North American oil and gas resources, and the security of foreign supplies. Sections on LNG project structure, cost, and financing are included. Observations about balance of payment impacts and public exposure to financial risk are also reported. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-28575# Societe Nationale Industrielle Aerospatiale, Paris (France). Dept. Analyse de la Valeur.
VALUE ANALYSIS AND OPTIMUM COST DESIGN PRINCIPLES APPLIED BY SNIAS [L'ANALYSE DE LA VALEUR ET LE PRINCIPE CONCEPTION POUR UN COUT OPTIMUM (C.C.O.) APPLIQUEE A L'AEROSPATIALE]
Robert Tassinari. 1979. 16 p. In FRENCH. Presented at 1st Congr. Natl. pour l'Anal. de la Valeur, Paris, 29-30 Mar. 1979
(SNIAS-792-501-104) Avail: NTIS HC A02/MF A01

The optimum cost method derived from the United States design-to-cost considerations was successfully exploited by the SNIAS. This method is based on training personnel to perform the necessary analysis. A group leader is given the responsibility of: (1) establishing performance, costs and delivery times; (2) evaluating the financial bases of the program (above all the life cycle and production costs); (3) breaking down the work into different tasks together with associated costs; and (4) organizing operational groups to study the different tasks and their implementation. Specific examples are given. Author (ESA)

N80-28576# Research Inst. of National Defence, Stockholm (Sweden).

SIMULATED ACCIDENTS IN THE HANDLING OF PHOSGENE AT KENOGARD AIR BASE, SWEDEN [MODELLHAVERIER VID FOSGENHANTERING VID KENOGARD AB I SUNDSVALL]
Gunnel Dreborg, Lars Frankenberg, Edvard Karlsson, and Kenneth Nyren Dec. 1979 42 p refs In SWEDISH
(FOA-A-40030-C1) Avail: NTIS HC A03/MF A01

Scenarios were prepared for activities following a leak in a phosgene processing facility. Diffusion and toxicity levels were compared for various distances for two cases. The influence of weather conditions on the severity of an accident was considered. It is concluded that an accident involving phosgene would be no worse than one involving chlorine. Author (ESA)

N80-28577# Earthquake Engineering Research Inst., Berkeley, Calif.
OPTIMAL DESIGN OF LOCALIZED NONLINEAR SYSTEMS WITH DUAL PERFORMANCE CRITERIA UNDER EARTHQUAKE EXCITATIONS
M. A. Bhatti Jul. 1979 110 p refs
(Grant NSF ENV-76-04264)
(PB80-167109; UCB/EERC-79/15; NSF/RA-790395) Avail: NTIS HC A06/MF A01 CSCL 13M

A formulation is presented for earthquake resistant design of localized nonlinear systems. Based upon the current design criteria, two levels of performance constraints are imposed as follows. For small earthquakes which occur frequently, the structure is constrained to remain elastic with no structural damage. For a large earthquake, the structure can undergo inelastic deformations at known locations of nonlinearities, with limited damage. The problem is formulated as a min-max problem, and a general strategy to transcribe it to the canonical form of a nonlinear programming problem is given. An algorithm of the feasible directions type is given to solve the resulting nonlinear programming problem. The general techniques are applied to the design of nonlinear energy-absorbing devices, which are part of an earthquake isolation system for many types of buildings. Several design problems with different performance criteria are considered and the results compared to see the effect of these different criteria. Comparison is also made with results reported earlier with only one level of constraints. The results clearly show the effectiveness of the present approach with dual performance criteria over the conventional single criterion approach. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-28578* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SCANNABLE BEAM FORMING INTERFEROMETER ANTENNA ARRAY SYSTEM Patent
Julius A. Kaiser, Jr., inventor (to NASA) Issued 15 Jul. 1980 6 p Filed 14 May 1979 Supersedes N79-26252 (17 - 17, p 2249)
(NASA-Case-GSC-12365-1; US-Patent-4,213,131; US-Patent-Appl-SN-039031; US-Patent-Class-343-844; US-Patent-Class-343-100SA; US-Patent-Class-343-854) Avail: US Patent and Trademark Office CSCL 20N

An antenna array is described which comprises three interferometer pairs of antenna elements with selected spacings made to form a single beam which is readily scannable. All spatial frequencies generated by a signal and intercepted by the array are derived from a signal processing technique applied to the array. The array samples space in the spatial frequency domain while the signal processing technique utilizes real time convolution of functions in the spectral frequency domain. Summation of the appropriate spatial frequencies is equivalent to a Fourier transform operation, yielding the location of the signal source in space. Resolution and freedom from interference of the interferometer system is equal to that of a fully filled array of the same aperture size containing element spacings of one half wavelength. An antenna array system comprising four antenna elements forming six interferometer pairs with a resolution equal to that of a sixteen element array with spacings of one half wavelength is described, as well as other multiples of one quarter wavelength of partial multiples of a wave length.

Official Gazette of the U.S. Patent and Trademark Office

N80-28579 City Univ. of New York, N. Y.
DELTA MODULATION SYSTEMS FOR VOICE COMMUNICATION Ph.D. Thesis
Vaman Rao Dhadesugoor 1980 165 p
Avail: Univ. Microfilms Order No. 8014963

The performance of the Song Voice Adaptive Delta Modulator (SVADM) and the Continuously Variable Slope Delta Modulator (CVSD) in terms of dynamic range, sampling rate and channel errors are compared. The use of SVADM and CVSD as source encoders in packet voice networks, the digital silence detection algorithm and the performance of the network are presented. The performance of the network was evaluated subjectively for both the fixed packet size scheme as well as the variable packet size scheme. The parameters employed for subjective evaluation are packet size, silence detection algorithm, bit rate and packet loss rate. In addition, a new concept of variable rate delta modulator is presented. Dissert. Abstr.

N80-28580 Johns Hopkins Univ., Baltimore, Md.
ADAPTIVE NOISE FEEDBACK CODING OF SPEECH IN SYSTEMS WITH NONADAPTIVE PREDICTORS Ph.D. Thesis
Richard Paul Bastian 1980 129 p
Avail: Univ. Microfilms Order No. 8014258

Two solutions for the adaptive feedback filter evolve from minimizing a frequency weighted output noise-to-signal ratio, one quite general and the other from assuming white quantizing noise. The general solution suggests a sequential adaptation, and subsequently a sequential lattice filter is used in simulations because it guarantees stability. The white noise solution is used to predict the theoretical variation of the signal to noise ratio with the amount of noise shaping. Computer simulations show good agreement with the theoretical model. Most importantly, both solutions exhibit subjective improvements over (DPCM) coders, which are special cases of adaptive noise feedback coders. Hence DPCM coders can be improved, without increasing the bit rate, by using adaptive feedback filters. The simulations also show these improvements depend on the number of quantizer levels. Dissert. Abstr.

N80-28581# Indian Space Research Organization, Ahmedabad. Space Applications Center.
SATELLITE INSTRUCTIONAL TELEVISION EXPERIMENT. TELEVISION COMES TO VILLAGE: AN EVALUATION OF SITE
Binod C. Agrawal Bangalore, India Oct. 1978 107 p refs
(ISRO-SAC-TR-09-78) Avail: NTIS HC A06/MF A01

The design and conclusions of India's satellite instructional television experiment (SITE) are presented and discussed. The socio-cultural changes triggered by the introduction of satellite TV were the central interest of the investigation. Seven villages, one each from six clusters and Kheda, about 20 to 30 km away from an urban centre and least contaminated by urban influence were selected. The field work was divided into three phases: pre-SITE, during-SITE, and post-SITE. Anthropological field methods were the main tools of data collection. The data were analyzed at two levels: household and village. Instructional, recreational, and children's programs were broadcast. Results indicate that, due to TV exposure, a number of innovations were adopted. Also, viewers' attendance was found to be intimately linked to agricultural and religious activity cycles of the village. The major implications which can be drawn to provide planning inputs for future national satellite based TV systems are summarized addressing problems in program type, schedules, and language differences. M.G.

N80-28582*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BEAMED MICROWAVE POWER TRANSMITTING AND RECEIVING SUBSYSTEMS RADIATION CHARACTERISTICS

Richard M. Dickinson 15 Jun. 1980 77 p refs
(Contract NAS7-100)
(NASA-CR-163362; JPL-Pub-80-11) Avail: NTIS HC A05/MF A01 CSCL 20N

Measured characteristics of the spectrum of typical converters and the distribution of radiated Radio Frequency (RF) energy from the terminals (transmitting antenna and rectenna) of a beamed microwave power subsystem are presented for small transmitting and receiving S-band (2.45 GHz) subarrays. Noise and harmonic levels of tube and solid-state RF power amplifiers are shown. The RF patterns and envelope of a 64 element slotted waveguide antenna are given for the fundamental frequency and harmonics through the fifth. Reflected fundmanetal and harmonic patterns through the fourth for a 42 element rectenna subarray are presented for various dc load and illumination conditions. Bandwidth measurements for the waveguide antenna and rectenna are shown. Author

N80-28583*# Axiomatix, Los Angeles, Calif.
SHUTTLE ORBITER KU-BAND RADAR/COMMUNICATIONS SYSTEM DESIGN EVALUATION. DELIVERABLE TEST EQUIPMENT EVALUATION Interim Report
Robert G. Maronde 31 Jul. 1980 32 p
(Contract NAS9-15795)
(NASA-CR-160761; R8007-5) Avail: NTIS HC A03/MF A01 CSCL 17B

The Ku-band test equipment, known as the Deliverable System Test equipment (DSTE), is reviewed and evaluated. The DSTE is semiautomated and computer programs were generated for 14 communication mode tests and 17 radar mode tests. The 31 test modules provide a good cross section of tests with which to exercise the Ku-band system; however, it is very limited when being used to verify Ku-band system performance. More detailed test descriptions are needed, and a major area of concern is the DSTE sell-off procedure which is inadequate. L.F.M.

N80-28584# Morgenthaler (Frederick R.), Wellesley, Mass.
THEORETICAL STUDIES OF MICROSTRIP ANTENNAS. VOLUME 1: GENERAL DESIGN TECHNIQUES AND ANALYSES OF SINGLE AND COUPLED ELEMENTS Final Report, Apr. 1978 - Jul. 1979
Frederick M. Morgenthaler Sep. 1979 61 p refs 2 Vol.
(Contract DOT-TSC-15364)
(AD-A075480; FAA-EM-79-11-1-Vol-1; DOT-TSC-FAA-79-21-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 09/5

Volume 1 of Theoretical Studies of Microstrip Antennas deals with general design techniques and analyses of single and coupled radiating elements. Specifically, we review and then employ an important equivalence theorem that allows a pair of vector potentials, A-bar and A-bar-star to be calculated from fields tangential to any surface enclosing all currents and charges. These potentials serve to calculate the far fields, from which radiation conductance and pattern can be obtained. For rectangular microstrip patch antennas, we develop novel approximations so as to include the effects of currents induced on the ground planes by fringing fields. Coupling between two patches sharing the same substrate and ground plane, or else employing separate ones stacked one above the other, is also considered by means of a novel approximation that helps provide physical insight with respect to field patterns, coupling between patches and the like. As an important by product of this work, several new approxiamte formulas are obtained that very accurately predict the electrical characteristics of microstrip transmission lines of arbitrary width and substrate thickness when the dielectric constant of the substrate is also arbitrary. Volume 2 of this report is devoted to the analysis and synthesis of multiresonant elements with emphasis on dual frequency operation of rectangular microstrip patch antennas with or without external matching networks. GRA

N80-28585# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
E AND F LAYER H.F. VOLUME BACKSCATTER REFLECTIVITIES Final Technical Report, 15 Dec. 1977 - 31 Dec. 1979
Edward N. Richards and William C. McComish Feb. 1980 42 p refs
(Contract F19628-78-C-0036; AF Proj. 2305)
(AD-A084835; BC-SDAL-79-2; RADC-TR-80-25) Avail: NTIS HC A03/MF A01 CSCL 17/9

H.F. radar backscatter data from an OTH radar site in northern Maine have been processed to produce estimates of E and F layer volume backscatter reflectivities. Nighttime returns were selected from the months of September and October and were sorted into evening and midnight time segments for active and quiet days. The reflectivities were analyzed for dependence on geomagnetic coordinates, as well as for dependence on frequency and auroral conditions. The frequency dependence through the 8-19 MHz range was very strong, while no clear geomagnetic correlation could be established. GRA

N80-28586# New Mexico State Univ., Las Cruces. Physical Science Lab.
ANALYSIS OF MONOPULSE TRACKER ANTENNA PERFORMANCE IN A MULTIPATH ENVIRONMENT
K. R. Carver and T. F. Bush Apr. 1980 99 p refs
(Contract DAAD07-79-C-0008; DA Proj. 1L1-62111-AH-71)
(AD-A085131; ERADCOM/ASL-CR-80-0008-2; QSD-1366)
Avail: NTIS HC A05/MF A01 CSCL 17/9

This report summarizes the results of a study of monopulse tracking antenna performance at low angles. The objectives of this study were two-fold: (1) to investigate the multipath effects of surface roughness and soil moisture on the elevation accuracy of a monopulse tracker, particularly at low angles. This includes the antenna beam shape characteristics such as beamwidth, roll-off rate and sidelobe level; and (2) to determine which, if any, realizable antenna designs might yield a significant improvement in tracking accuracy down to about 5 deg, keeping in mind logistics requirements for a light weight portable antenna. Although this study did not initially constrain itself to previous practical antenna sizes such as the GMD, PLUSS, etc., it was recognized that the optimum antenna selected would need to eventually consider size and weight factors. Therefore the previously measured performance characteristics of the GMD and PLUSS antennas were reviewed and included in a comparative performance evaluation. There are two basic findings presented herein: (1) in order to track in elevation down to 5 deg, a sum-pattern 3 dB beam-width of 5 deg and a -40 dB sidelobe level is required; and (2) this performance can be best obtained from a microstrip antenna array using graphite-epoxy struss technology. GRA

N80-28587# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
THE POLARIZABILITIES OF APERTURES OF ARBITRARY SHAPE
Ephraim E. Okon and Roger F. Harrington Mar. 1980 117 p refs
(Contract N00014-76-C-0225)
(AD-A084832; TR-80-2; TR-12) Avail: NTIS HC A06/MF A01 CSCL 20/3

The integral equations for the electric and magnetic polarizabilities of small apertures of arbitrary shape in a conducting screen are solved by the method of moments. Solutions are obtained by a subdomain method using the Gordon-Hall and Zienkiewicz-Phillips subdivision techniques. The method is illustrated by application to apertures of many shapes, such as circles, squares, semicircles, triangles, annular sectors, circle with tangents, hexagons, and ellipses. GRA

N80-28588# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
MAGNETIC DISTURBANCE STATISTICS FROM A SINGLE STATION Q INDEX APPLIED TO AN ACTUAL OTH-B RADAR SITUATION Environmental Research Papers
B. S. Dandekar 18 Dec. 1979 41 p refs
(AF Proj. 4643)
(AD-A084808; AFGL-TR-79-0296; AFGL-ERP-687) Avail: NTIS HC A03/MF A01 CSCL 17/9

Due to the systematic diurnal motion of the auroral oval, the Q values of magnetic activity derived from a single station are not directly usable to determine the expected degree of auroral activity. To remove the diurnal effects from a single station

data base, which leads in daytime to an under estimation of the Q index, an empirical set of detrending factors was determined for the Sodankyla Q data base. These factors show that the probability that a given level of magnetic activity will be exceeded for a given duration is underestimated by up to a factor of 2 in the least sensitive daytime sector. The detrended data base has been analyzed to determine the probability that a given Q value is exceeded for a selected duration. This analysis has been done for durations up to 12 hr separately for the night and daytime detrended data bases. The results are very similar and confirm that the detrending has been successfully accomplished. Finally the individual and cumulative probabilities that a given Q is exceeded for a selected duration (periods from 0.25 to 24 hr) have been established for the fully detrended data base. To interpret the results in their effect on the Over-the-Horizon Experimental Radar System, the distribution of probabilities has been modulated with the dynamics of the auroral oval by use of the Starkov equation (1969). This permits the assessments of the probability that a fixed location in the radar coverage area is under the auroral oval. GRA

N80-28589# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PROPERTIES OF THE LINEAR POLARIZATION BISTATIC SCATTERING MATRIX
Gregory E. Heath. 10 Mar. 1980. 18 p. refs
(Contract F19628-80-C-0002)
(AD-A085054; TN-1980-7; ESD-TR-79-336) Avail: NTIS
HC A02/MF A01 CSCL 17/9

When the plane containing the transmitter and receiver lines of sight is used as the polarization reference plane, the scattering matrix characterizing linearly polarized bistatic scattering from plane-symmetric targets exhibits scattering geometry symmetries which can be exploited to reduce the time and expense in obtaining bistatic scattering data from static range measurements and theoretical or computer calculations. In this report the linear polarization symmetry relations are derived and used to determine the minimum number of measurements needed for the complete characterization of target scattering. GRA

N80-28590# Harry Diamond Labs., Adelphi, Md.
USE OF A PARALLEL PLATE TRANSMISSION LINE TO CALIBRATE A FIBER-OPTIC COUPLED MAGNETIC FILED SENSOR
Andrew A. Cuneo, Jr. and James L. Lofius. Jan. 1980. 17 p. refs. Sponsored by Army Material Development and Readiness Command
(AD-A085201; HDL-TM-80-11) Avail: NTIS
HC A02/MF A01 CSCL 17/6

It is vitally important to accurately measure the field components of a simulated electromagnetic pulse (EMP), to determine both the waveshape and the amplitude of the electromagnetic test environment. A parallel plate transmission line is used to calibrate a magnetic field sensor as well as to determine the field enhancement factor when the sensor is mounted on the compact transmitter of an optical electronic data-link system. The transmitter is coupled to the recording instrumentation by means of a fiber-optic cable rather than an RF cable, thus eliminating a spurious signal pickup source. Some comments are also made on the use of enhancement factors for magnetic field sensors mounted on cubical boxes. GRA

N80-28591# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
INTEGRATED OPTIC SIGNAL PROCESSORS FOR WIDEBAND RADAR SYSTEMS. Technical Report, 15 Jul. 1978 - 30 Jan. 1980
Chen S. Tsai. May 1980. 36 p. refs
(Contract DASG60-78-C-0122)
(AD-A085008; ATR-2) Avail: NTIS HC A03/MF A01 CSCL 17/9

The general objective of this research is to explore the potential of integrated acoustooptic (AO) technology with application to wideband radar systems. The potential of AO devices for real-time processing of wideband radar signals has been well recognized. Accordingly, implementation of AO signal processors using integrated optic techniques constitutes one of the most important on-going R and D activities. The major objectives of this research are to carry out research on integrated acoustooptic signal processing including pulse compression, convolution, and correlation. Thus specific tasks of the research are: (1) to further explore guided-wave AO pulse compressors and convolvers, and (2) to initiated research on guided-wave AO correlators. GRA

N80-28592# Naval Underwater Systems Center, New London, Conn. Surface Ship Sonar Systems Dept.
SOME WINDOWS WITH VERY GOOD SIDELOBE BEHAVIOR: APPLICATION TO DISCRETE HILBERT TRANSFORM
Albert H. Nuttall. 9 Apr. 1980. 39 p.
(ZR0000101)
(AD-A085032; NUSC-TR-6239) Avail: NTIS
HC A03/MF A01 CSCL 17/9

Some of the windows presented by Harris -- Proc. IEE, Jan. 78 -- are not correct in terms of their reported peak sidelobes and optimal behavior. We present corrected plots of Harris windows and also derive additional windows with very good sidelobes and optimal behavior under several different constraints. These plots enable the reader to select a window to suit his requirements, in terms of bias due to near-by sidelobes and bias due to distant sidelobes. An application of the new windows to a technique for calculating the discrete Hilbert transform is presented. GRA

N80-28593# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
A MATHEMATICAL ANALYSIS OF POLARIMETRIC PHASE AND AMPLITUDE WITH FREQUENCY AGILITY FOR RADAR TARGET ACQUISITION
P. Martin Alexander. 24 Sep. 1979. 44 p. refs
(AD-A084857; DRSMI-T-79-92) Avail: NTIS
HC A03/MF A01 CSCL 17/9

Target models have been used to generate a mathematical analysis of the output voltage from a frequency agile radar with polarimetric processing. The purpose of the investigation was to determine the usefulness of such a system for target acquisition. It is shown that frequency agility provides a frequency spectrum at the output which is characteristic of the major reflecting centers illuminated by the radar. Polarimetric processing is not required to obtain this information. It is shown that each pair of individual reflectors contributes a frequency to the Fourier transformed signal. For a linearly frequency modulated waveform, this frequency depends on the difference in radar range between the two reflectors, the bandwidth of the transmitter, and the repetition period of the LFM waveform. GRA

N80-28594# Analysis and Technology, Inc., North Stonington, Conn.
ANALYSIS OF SIDE-LOOKING AIRBORNE RADAR PERFORMANCE IN THE DETECTION OF SEARCH AND RESCUE TARGETS. Interim Report, Jan. 1978 - Mar. 1980
N. C. Edwards, Jr., T. J. Mazour, G. L. Hover, and S. R. Osmer. Mar. 1980. 100 p. refs
(Contract DOT-CG-81-79-2038)
(AD-A085182; USCG-D-31-80; CGR/DC-2/80) Avail: NTIS
HC A05/MF A01 CSCL 17/9

Since September 1978 side-looking airborne radar (SLAR) detection data has been gathered in conjunction with visual detection experiments conducted by the U.S.C.G. R D Center. These are the first in a series of experiments designed to improve search planning guidance contained in the National Search and Rescue Manual. HC-130 aircraft, equipped with either the Airborne Oil Surveillance System (AOSS) or SLAR/radar image processor (SLAR/RIP) configuration of the AN/APS-94D SLAR, conducted controlled searches for life rafts, small boats, and 41 to 95 foot Coast Guard vessels in Block Island Sound or open ocean. Through the use of a microwave ranging system and SLAR data, the positions of searchers and targets were accurately reconstructed to facilitate the verification of detections on SLAR films or video tape. These data were used to evaluate the effects of environmental and controllable parameters on SLAR detection of the various target types. While the size of the data base did not permit conclusive, quantitative assessment of the effect which each parameter had on SLAR detection performance, general trends, in system performance were identified. Of the 11 parameters which were investigated, preliminary indications are that wind speed, image background, sea state, precipitation,

altitude, antenna polarization, target size/composition, and lateral range all may significantly influence SLAR detection of search and rescue targets. Further data collection and analysis is planned to quantify the effects of these and any other significant parameters on SLAR performance. GRA

N80-28595# Auburn Univ., Ala. Engineering Experiment Station.
INVESTIGATION OF COMPLEX ANGLE PROCESSING TO REDUCE INDUCED ANGLE POINTING ERRORS Final Technical Report, 10 Dec. 1976 - 15 Sep. 1978
David G. Burks and Edward Graf 1 Oct. 1979 208 p refs
(Contract DAAK40-77-C-0022)
(AD-A085263; AN-EE-0022) Avail: NTIS HC A10/MF A01 CSCL 17/9

This work is an analysis of the effect of a tangent ogive radome on the pointing accuracy of a monopulse radar that employs an aperture antenna. The incident fields at the antenna are found by a ray tracing procedure. The theory of monopulse radar and the transmission and reflection properties of planar dielectric slabs are presented. Two orthogonal polarization states which can be combined to produce an arbitrarily polarized incident field are considered. The antenna can be scanned in two angular directions and radar pointing error is presented for both these angles as a function of antenna scan angle and polarization of the incident field. A method that can be used to compensate for radome induced error is presented. Complex angle processing for the purpose of pointing angle reduction was investigated. GRA

N80-28596# Naval Postgraduate School, Monterey, Calif.
RADIO FREQUENCY SPECTRUM MANAGEMENT M.S. Thesis
Edward Joseph Sujdak, Jr. Mar. 1980 129 p refs
(AD-A085063) Avail: NTIS HC A07/MF A01 CSCL 17/2

This thesis is a study of radio frequency spectrum management as practiced by agencies and departments of the Federal Government. After a brief introduction to the international agency involved in radio frequency spectrum management, the author concentrates on Federal agencies engaged in frequency management. These agencies include the National Telecommunications and Information Administration (NTIA), the Interdepartment Radio Advisory Committee (IRAC), and the Department of Defense (DoD). Based on an analysis of Department of Defense frequency assignment procedures, recommendations are given concerning decentralizing military frequency assignment by delegating broader authority to unified commanders. This proposal includes a recommendation to colocate the individual Service frequency management offices at the Washington level. This would result in reduced travel costs, lower manpower requirements, and a common tri-Service frequency management data base. GRA

N80-28597# Hughes Research Labs., Malibu, Calif.
INTELLIGENT BANDWITH COMPRESSION Final Report, 1 Nov. 1978 - 31 Jul. 1979
D. Y. Tseng, B. L. Bullock, K. E. Olin, R. K. Kandt, and J. D. Olsen (Hughes Aircraft Co., Fullerton, Calif.) Feb. 1980 115 p refs
(Contract DAAK70-78-C-0148)
(AD-A085184) Avail: NTIS HC A06/MF A01 CSCL 17/2

The feasibility of a 1000:1 bandwidth compression ratio for image transmission has been demonstrated using image-analysis algorithms and a rule-based controller. Such a high compression ratio was achieved by first analyzing scene content using auto-cueing and feature-extraction algorithms, and then transmitting only the pertinent information consistent with mission requirements. A rule-based controller directs the flow of analysis and performs priority allocations on the extracted scene content. The reconstructed bandwidth-compressed image consists of an edge map of the scene background, with primary and secondary target windows embedded in the edge map. The bandwidth-compressed images are updated at a basic rate of 1 frame per second, with the high-priority target window updated at 7.5 frames per second. The scene-analysis algorithms used in this system together with the adaptive priority controller are described. Results of simulated 1000:1 band width-compressed images are presented. A video tape simulation of the Intelligent Bandwidth Compression system has been produced using a sequence of video input from the data base. GRA

N80-28598# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Science.
A SIMPLIFIED THEORY OF ELF PROPAGATION IN ITS EARTH-IONOSPHERE TRANSMISSION LINE AND ITS WORLDWIDE APPLICATION, SUPPLEMENT
Henry G. Booker 1980 14 p refs
(Contract N00014-78-C-0682)
(AD-A085208) Avail: NTIS HC A02/MF A01 CSCL 20/14

The NOSC computer program has confirmed that non-reciprocity in the ELF band is not introduced in the refracting stratum near the bottom of the ionosphere. It is introduced higher up where the direction of phase propagation is almost vertical. It has been determined that the effect of a slightly off-vertical angle for the direction of phase propagation in the ionosphere in the ELF band does in fact cause the non-reciprocity obtained by Pappert and Moler (1974). The electromagnetic reason for this has been identified and is described below. The fact that off-vertical angles of less than a degree for the direction of phase propagation have noticeable effects raises the question of how precisely the stratification of the ionosphere may be assumed to be horizontal. GRA

N80-28599# TRW Defense and Space Systems Group, Redondo Beach, Calif.
CHARGE COUPLED DEVICES IN SIGNAL PROCESSING SYSTEMS, VOLUME 5 Final Report, Oct. 1973 - Dec. 1979
P. A. Allen, J. M. Anderson, F. G. Hamilton, W. H. Huber, M. Penberg, T. A. Zimmerman, R. Nicas, and N. Schneier Dec. 1979 313 p refs
(Contract N00014-74-C-0068)
(AD-A084829) Avail: NTIS HC A14/MF A01 CSCL 09/1

This report provides a comprehensive treatment of the entire digital charge coupled device (DCCD) program. The design history, starting from SSI logic circuits and continuing through MSI and LSI multipliers and adders, is discussed. The process development is traced from the early metal gate P-channel process to the final double poly n-channel process. Results of radiation testing on DCCD circuits is presented. Several computer aided design techniques are described which were developed during the course of the program. Finally, other programs related to and resulting from this effort are described. GRA

N80-28600# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
A MAXIMAL FLOW APPROACH TO DYNAMIC ROUTING IN COMMUNICATION NETWORKS
Mario Jodorkovsky and Adrian Segall May 1980 120 p refs
(Contracts N00014-75-C-1183; N00014-77-C-0532)
(AD-A085160; LIDS-R-988) Avail: NTIS HC A06/MF A01 CSCL 17/2

This work presents a new approach for building the feedback solution for the minimum delay dynamic message routing problem for single destination networks. The approach fully exploits the special structure of the constraint matrices obtained in the dynamic state space model suggested in previous works, by transforming every linear program arising from the necessary conditions, into a maximal weighted flow problem. Taking advantage of several properties concerning the networks corresponding to the linear programming problems, all theorems regarding certain simplifying characteristics of the feedback solution that apply in the case of single destination networks with all unity weightings in the cost functional are reproved in a simplified and more straightforward manner. A compact algorithm for the construction of the feedback solution is presented, the algorithm being implementable on networks of reasonable size. A method for obtaining all solutions of the linear programming problems required by the algorithm, based on the application of linear programming techniques in networks is provided. The method is implemented by a computer program and several examples are run to test its applicability. GRA

N80-28601# Naval Postgraduate School, Monterey, Calif.
PERFORMANCE OF A DIGITAL DATA TRANSMISSION SYSTEM USING MATCHED FILTER PROCESSING OF AN

AUXILIARY SIGNAL FOR SYNCHRONIZATION M.S. Thesis
Serdar Yurdakul and Sedat Santurk Dec. 1979 64 p refs
(AD-A085152) Avail: NTIS HC A04/MF A01 CSCL 17/2

In digital communication, coherent systems are used in order to provide small probability of error with small signal-to-noise ratios. In this report a digital communication system (transmitter and receiver) is presented which uses noncoherent carrier demodulation and coherent bit recovery utilizing an integrate-and-dump detector. The synchronization (timing) pulses for this detector are derived from the response of a matched filter to the low level synchronization signal transmitted with high level data modulated carrier. This system is designed, built and tested; noise is added to simulate the channel. Probability of error versus signal-to-noise ratio curves are plotted to obtain system performance. GRA

N80-28602# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE COMMUNICATION CAPABILITIES OF THE OPARS FLIGHT PLANNING SYSTEM FOR VARIOUS LEVELS OF DEMAND M.S. Thesis
Kenneth L. Smith Mar. 1980 53 p refs
(AD-A084902) Avail: NTIS HC A04/MF A01 CSCL 17/2

Through the Optimum Path Aircraft Routing System (OPARS) Fleet Numerical Oceanography Center (FNOC) has committed itself to providing a computerized flight planning service remotely accessible via dial-up communications lines. The question arises as to whether the proposed number of telephone lines will be adequate to provide a level of service previously provided by the Lockheed Jetplane system. This study provides a detailed analysis of the response delays for the OPARS flight plan system. In addition, estimates are given of communication requirements when various levels of demand prevail, and under conditions in which the FNOC computer is busy or idle. GRA

N80-28603# Atlantic Research Corp., Alexandria, Va.
COMMUNICATIONS-ELECTRONIC INTRASYSTEM ELECTROMAGNETIC INTERFERENCE MEASUREMENT TECHNIQUES AND INSTRUMENTATION Quarterly Report, 21 Dec. 1979 - 20 Mar. 1980
Lester E. Polisky and John Savage May 1980 72 p refs
(Contract DAAK80-79-C-0786)
(AD-A085161; CORADCOM-79-0786-3; QR-3) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report presents the results obtained during the third quarter of the Communications-Electronics Intrasystem Electromagnetic Interference Measurement Techniques and Instrumentation Project. The period covered was 21 Dec. 1979 to 20 March 1980. The major effort in the third quarter consisted of completing the broadband measurement technique description and initiating the evaluation of MIL-STD-461A techniques. GRA

N80-28604# Mississippi Univ., University. Dept. of Electrical Engineering.
ANTENNA ANALYSES: OBJECTS NEAR ANTENNAS AND MICROSTRIP ANTENNAS Final Report, Jun. 1978 - Dec. 1979
Chalmers M. Butler Feb. 1980 10 p refs
(Grant DAAG29-76-G-0285)
(AD-A084843; ARO-14107.7-ELX) Avail: NTIS HC A02/MF A01 CSCL 09/5

In this report the research work encompassed two classes of antenna analyses. One was an investigation of the effects of a nearby object upon an antenna and its performance and the other was a study of the center-fed, circular microstrip antenna. GRA

N80-28605# City Coll. of the City Univ. of New York. Communications Systems Lab.
RESEARCH ON ADAPTIVE DELTA MODULATORS Final Report, Mar. 1978 - Oct. 1979
V. R. Dhadesugoor, C. Ziegler, D. L. Schilling, M. Dressler, and S. Davidovici 1 Oct. 1979 86 p refs
(Contract MDA903-78-C-0182; ARPA Order 3534)
(AD-A085115; ARPA-FR-1) Avail: NTIS HC A05/MF A01 CSCL 17/2

This report summarizes our results of Voice encoding and video encoding using adaptive delta modulation. Topics include: packet loss, algorithm adaptation, variable rate algorithms, silence detection algorithms, design of a packet voice transmission system, slow-scan video encoding, packet destruction and frame-change detection. GRA

N80-28606# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
DIELECTRIC ANTENNAS FOR MILLIMETER-WAVE APPLICATIONS Interim Report
S. Kobayashi, R. Lamde, R. Mittra, and S. Ray May 1980 67 p refs
(Grant DAAG29-77-G-0111)
(AD-A085302; UIEM-80-3; UILU-ENG-80-2543; ARO-14686.8-EL) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report describes the results of an investigation of dielectric-based antennas for millimeter wavelengths. Two types of antennas have been studied, viz., uniform and tapered dielectric rod antennas of rectangular cross-section which radiate in the endfire direction; and dielectric rods with discontinuities which perform as frequency scannable leaky-wave antennas. Experimental and theoretic design information and measured data on radiation pattern of both types of antennas are provided in the paper. GRA

N80-28607# Naval Underwater Systems Center, New London, Conn. Surface Ship Sonar Systems Dept.
ELASTIC WAVE PROPAGATION INHOMOGENEOUS LOSSY MEDIA WITH SPECIAL REFERENCE TO POWDERS
Geoffrey Roy Akers 28 Apr. 1980 151 p refs
(AD-A085262; NUSC-TR-6265) Avail: NTIS HC A08/MF A01 CSCL 20/11

Elastic wave propagation in actual fact is the transport of energy in a medium that acts as a sink for this energy. Engineering and physical applications rely upon an understanding of the wave propagation process to model systems and describe the physical world, and, as such one desires to broaden his knowledge of the actual propagation process in real inhomogeneous media. In this work, on examines the vector wave equation developed for an anisotropic, inhomogeneous lossy medium with a set of (effective) Lame: constants derived from microscopic considerations of the medium and develops a composite loss function, L, to account for the energy loss mechanisms that occur as the wave propagates. This loss function is incorporated into the general equations of motion and series solutions for bulk, and surface waves in the inhomogenous lossy medium are derived. The displacement fields are examined over the frequency regime in the near and far field for the waves. The effective Lame: parameters are included in the solution, and their contribution, as well as the frequency contribution to the wave field is seen. Higher orders of scattering and diffraction are seen as well as the an harmonicites and nonlinear effects of losses. These effects may be observed in the general wavefield description. Also the effect of losses on the dispersion behavior is observed as a frequency shift of the wave. GRA

N80-28608# Utah State Univ., Logan. Dept. of Mathematics.
RAYLEIGH-BLOCH WAVE EXPANSIONS FOR DIFFRACTION GRATINGS, 1
Calvin H. Wilcox Mar. 1980 75 p refs
(Contract N00014-76-C-0276; NR Proj. 041-370)
(AD-A084939; TR-37) Avail: NTIS HC A04/MF A01 CSCL 20/14

Plane diffraction gratings with period 2 pi lying in a strip 0 - y - h in the x,y-plane are studied. A Rayleigh Bloch (R-B) wave for a grating is the response Psi sub - (x,y,p,q) to a plane wave 1/2 pi exp(i(px-qy)) incident from y - h (p eta R, q - 0). The paper presents a construction of R-B waves and a proof that (psi sub - (x,y,p,q)/p eta R, q - 0) is a complete orthogonal family in L(2)(G) in the sense of the Plancherel theory. GRA

N80-28609# ITT Gilfillan, Inc., Van Nuys, Calif.
TACTICAL RADAR TECHNOLOGY STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Technical Report
Ronald Rosien, Leo Cardone, David Hammers, Albert Klein, and Edward Nozawa Griffiss AFB, N.Y. RADC Mar. 1980 27 p

2 Vol.
(Contract F30602-79-C-0026; AF Proj. 4506)
(AD-A084839; RADC-TR-80-48-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report presents results of a study to identify new technology required to provide advanced multi-threat performance capabilities in future tactical surveillance radar designs. A baseline design with optional subsystem characteristics has been synthesized to provide both functional and operational survivability in a dynamic and hostile situation postulated for the post 1985 time frame. Comparisons have been made of available technology with that required by the new baseline design to identify new technology requirements. Recommendations are presented for critical new technology programs including estimates of technical risks, costs and required development time. GRA

N80-28610# ITT Gilfillan, Inc., Van Nuys, Calif.
TACTICAL RADAR TECHNOLOGY STUDY, VOLUME 2 Final Technical Report
Ronald Rosien, Leo Cardone, David Hammers, Robert Klein, and Edward Nozawa Griffiss AFB, N.Y. RADC Mar. 1980 247 p 2 Vol.
(Contract F30602-79-C-0026)
(AD-A084885; RADC-TR-80-48-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 17/9

Technology required to provide advanced multithreat performance capabilities in future tactical surveillance radar designs is identified. The results of steps leading to the identification of such technology are summarized. The steps include: an analysis of current threats and those expected in 1990s; a determination of the functions, operations, and missions of the TACS and its sensors and the environment in which they operate; and formulating a baseline advanced tactical radar against which current and future technology can be evaluated. The baseline ATR system synthesized meets the mission and threat requirements of the post 1985 era. This multiple function radar combines an antenna/transmitter with advanced signal processing techniques to automatically track and report targets in a heavy ECM environment. E.D.K.

N80-28611# Princeton Univ., N. J. Plasma Physics Lab.
PHASED WAVEGUIDE ARRAY WITH FIXED TUNING ELEMENTS
R. W. Motley, S. Bernabei, W. M. Hooke, and F. J. Paoloni Apr. 1980 24 p refs
(Contract EY-76-C-02-3073)
(PPPL-1651) Avail: NTIS HC A02/MF A01

The waveguide grill excites both penetrating lower hybrid waves and surface plasma waves. Quarter wavelength tuning elements attached to the sides of a twin waveguide are shown to reduce the surface wave component by a factor about of 3. DOE

N80-28612# Fondazione Ugo Bordoni, Rome (Italy).
COST MINIMIZATION OF A SPARE TRANSMITTING MEDIA NETWORK [MINIMIZZAZIONE DEL COSTO DI UNA RETE DI MEZZI TRANSMISSIVI DI RISERVA]
Ugo Mocci and Giacomo Ravaioli Dec. 1978 44 p refs In ITALIAN
(FUB-39-1978) Avail: NTIS HC A03/MF A01

The mathematical formulation used to determine the minimum cost network that can bypass the blocked branch in the case of failure of only one transmitting element each time is described. A limited cost spare network was specified, for which the network availability is maximum. It is shown in two examples that by limiting the cost of the spare network to 20% it is possible to solve service interruption in 48% and 62% of the cases, respectively. Author (ESA)

N80-28613# Fondazione Ugo Bordoni, Rome (Italy).
CALCULATION OF ATTENUATION AND PHASE SHIFT BY UNIT LENGTH DUE TO RAIN CONSISTING OF ELLIPSOIDAL DROPS [CALCOLO DELLA ATTENUAZIONE E DELLO SFASAMENTO PER UNITA' DI LUNGHEZZA DOVUTI A PIOGGIA COSTITUITA DA GOCCE ELLISSOIDALI]
Dario Maggion May 1978 54 p refs In ITALIAN
(FUB-43-1978) Avail: NTIS HC A04/MF A01

The physical models of electromagnetic wave diffusion for spherical and ellipsoidal rain drops are used to determine attenuation coefficients and phase shift in the range frequency between 10 and 100 GHz for several polarization conditions. The results are presented in table form as a function of rain parameters and frequency. Author (ESA)

N80-28614# Fondazione Ugo Bordoni, Rome (Italy).
RESEARCH PROGRAM ON THE RADIO PROPAGATION AT FREQUENCIES ABOVE 10 GHz: HYDROMETEOROLOGICAL DATA IN ITALY [PROGRAMMA DI RICERCA SULLA RADIOPROPAGAZIONE A FREQUENZE SUPERIORI A 10 GHz: DATI IDROMETEOROLOGICI NEL TERRITORIO NAZIONALE]
Francesco Barbaliscia and Francesco Fedi Jul. 1978 37 p refs In ITALIAN
(FUB-44-1978) Avail: NTIS HC A03/MF A01

An analysis of hydrometeorological data acquisition systems was performed to define the experimental work program. Data of the number of events and their average duration for several stations are presented. It is shown that the time distribution of rain is of primary importance for telecommunication networks, implying that time resolution, used up till now, is not sufficient. Author (ESA)

N80-28615# Fondazione Ugo Bordoni, Rome (Italy).
PERFORMANCE OF AN ATTENUATION MEASURING SYSTEM AT 11 AND 17.8 GHz [PRESTAZIONI DEL SISTEMA DI MISURA DELL'ATTENUAZIONE DI TRATTA A 11 E 17.8 GHZ]
Francesco Fedi and Piergiorgio Migliorini Dec. 1978 25 p refs In ITALIAN
(FUB-45-1978) Avail: NTIS HC A02/MF A01

The link attenuation due to rain was measured over a period of 3 years in an experimental link of 9.5 km length. The instrumentation used in the tests is described. It is concluded that the measuring error is 0.4 dB for 11 GHz and 0.45 dB for 17.8 GHz. Some other perturbations that were observed are not considered related to the measuring system. Author (ESA)

N80-28616# Fondazione Ugo Bordoni, Rome (Italy).
CUMULATIVE DISTRIBUTION FUNCTION OF THE ATTENUATION CAUSED BY THE RAIN OVER A LENGTH OF 9.5 KM AT 11 AND 17.8 GHz [FUNZIONI DI DISTRIBUZIONE CUMULATIVA DELL'ATTENUAZIONE DOVUTA A PIOGGIA SU UNA TRATTA DI 9.65 KM A 11 E 17.8 GHZ]
Francesco Fedi and Piergiorgio Migliorini Dec. 1978 40 p refs In ITALIAN
(FUB-46-1978) Avail: NTIS HC A03/MF A01

Two experiments with vertical polarization and one with horizontal polarization were performed through 120 rain events between 1974 and 1977. It is shown that the attenuation due to rain increases with frequency and is larger for horizontal polarization. It is also concluded that several years of observation are needed to define with statistical significance the attenuation for time fractions below 30 minutes per year. The relationship between the Q factor and the time fraction is described, showing that this relationship is independent of the frequency or polarization. Author (ESA)

N80-28617# Fondazione Ugo Bordoni, Rome (Italy).
ESTIMATION METHODS OF ATTENUATION AND CROSS-POLARIZATION DUE TO RAIN AND MULTIPLE PATHS AND EVALUATION OF THE EFFICIENCY OF PATH DIVERSITY AND SPACE DIVERSITY [METODI DI PREVISIONE DI ATTENUAZIONE E CROSS-POLARIZZAZIONE DOVUTE A PIOGGIA E CAMMINI MULTIPLE E VALUTAZIONE DELL'EFFICACIA DELLA DIVERSITA' DI PERCORSO E DI SPAZIO]
Angelo Bernardini (Rome Univ.) and Dario DiZenobio Dec. 1978 51 p refs In ITALIAN
(FUB-47-1978) Avail: NTIS HC A04/MF A01

A model to characterize the behavior of radio links in the 19 GHz band subjected to rain in the transmitting path is discussed. The methods for evaluation of the attenuation and cross-polarization due to rain are described and used for modeling the system behavior. The design of radio links using path diversity and space diversity between receiving antennas vertically distanced

is examined, and expressions are presented which describe the fading improving factors as a function of design variables.
Author (ESA)

N80-28618# Fondazione Ugo Bordoni, Rome (Italy).
NUMERICAL TRANSMISSION SYSTEM OF THE 5TH ORDER ON COAXIAL CABLE 2.6/9.5 mm: EVALUATION OF SOME CHARACTERISTIC LINE SYSTEM PARAMETERS USING REGENERATIVE AND HYBRID TYPE SOLUTIONS [SISTEMA DI TRANSMISSIONE NUMERICA DEL QUINTO ORDINE GERARCHICO SU CAVO COASSIALE 2.6/9.5 MM: VALUTAZIONE DI ALCUNI PARAMETRI CARATTERISTICI DEL SISTEMA DI LINEA CON SOLUZIONI SIA DI TIPO PURAMENTE RIGENERATIVO CHE DI TIPO IBRIDO]
Luigi Giacomelli (Rome Univ.) and Aldo Roveri (Rome Univ.) Dec. 1978 40 p refs In ITALIAN
(FUB-48-1978) Avail: NTIS HC A03/MF A01
The design of a 5th order pulse code modulation system at a binary rate of 840 M bit/s (equivalent to 11,520 telephonic circuits) is discussed, in order to provide complementary alternatives to the 60 MHz frequency division multiplexing system being adopted by the Italian telecommunication network. Tables are presented showing relevant parameters for several design alternatives for both purely regenerative and hybrid systems.
Author (ESA)

N80-28619# Fondazione Ugo Bordoni, Rome (Italy).
RELIABILITY OF COMMUNICATION NETWORKS [SULL'AFFIDABILITA' DELLE RETI DI COMMUNICAZIONE]
Maurizio Decina (Rome Univ.) May 1979 33 p refs In ITALIAN
(FUB-3-1979) Avail: NTIS HC A03/MF A01
Criteria based upon traffic or upon the connectivity of a communications network for evaluating its reliability were examined. The traffic-based criteria were studied for circuit switching networks and for message or packet switching networks. The problem of the synthesis of reliable networks was also analyzed.
Author (ESA)

N80-28620# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
CALCULATION OF APERTURE AND FAR-FIELD DISTRIBUTIONS FROM MEASUREMENTS IN THE FRESNEL ZONE OF LARGE REFLECTOR ANTENNAS
C. A. M. Geus and J. Dijk Aug. 1978 90 p refs
(TH-78-E-87; ISBN-90-6144-087-4) Avail: NTIS HC A05/MF A01
Aperture fields and radiation patterns from Fresnel field measurements of both amplitude and phase distributions radiated by large reflector antennas were calculated. A microwave measurement system based on the concept of microwave complex holograms was introduced. Equations for the Fresnel field of a large reflector antenna on a spherical surface were derived, and the transformations necessary to calculate aperture and far fields given. The cross-polarization properties in the Fresnel zone were investigated. For small boresight angles the copolarized and cross polarized field distributions were shown to be independent of copolarized and cross polarized aperture fields respectively. It is shown that an antenna test range of about 15 times the diameter of the reflector is necessary to carry out Fresnel field measurements. Equations defining the angular test interval and the sampling distance were derived.
Author (ESA)

N80-28621# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
REDUCING THE NUMBER OF COMPUTATIONS IN STACK DECODING OF CONVOLUTIONAL CODES BY EXPLOITING SYMMETRIES OF THE ENCODER
A. J. Vinck and A. J. P. dePaepe Sep. 1978 47 p refs Sponsored in part by Netherlands Organization for Advancement of Pure Research (ZWO)
(TH-78-E-90; ISBN-90-6144-090-4) Avail: NTIS HC A03/MF A01
A method of decoding of convolutional codes is described, where the decoding algorithm looks for an information-vector correction sequence, that must be added to the inverse of the received data vector sequence. This is in contrast with the usual method, tries to estimate the information vector sequence directly. Both methods are equally complex for a maximum likelihood (ML) decoder. In sequential decoding, with hard as well as with soft decisions, symmetries of the code can be exploited to reduce the number of computations and hence, the erasure probability. This is illustrated by simulation results. The method is similar to the use of state space symmetries of the syndrome former to obtain a reduction in the exponential rate of growth of the hardware of a Viterbi-like syndrome decoder.
Author (ESA)

N80-28622# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
DIPOLE SCATTERING OF ELECTROMAGNETIC WAVES PROPAGATING THROUGH A RAIN MEDIUM
C. A. vanDuin Jan. 1979 48 p refs
(TH-79-E-93; ISBN-90-6144-093-9) Avail: NTIS HC A03/MF A01
The propagation of a plane linearly polarized monochromatic electromagnetic wave through a rain medium was studied theoretically. The presence of the rain medium causes damping and depolarization of the incident wave. The depolarization effects are a consequence of the anisotropy of the rain medium: raindrops are not spherical. Axisymmetric oblate spheroidal raindrops were assumed. A dipole model was used to describe the scattering and absorption of the wave traveling through the medium. It is shown that the scattering problem described can be reduced to a first order differential equation. Numerical data for the complex forward scattering amplitudes of a linearly polarized wave incident on an axisymmetric water drop at different frequencies and computation of the relevant quantities.
Author (ESA)

N80-28623# National Technical Information Service, Springfield, Va.
SPREAD SPECTRUM COMMUNICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
William E. Reed Apr. 1980 131 p Supersedes NTIS/PS-79/0494; NTIS/PS-78/0489
(PB80-809726; NTIS/PS-79/0494; NTIS/PS-78/0489) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B
The bibliography cites Federally-funded research on the techniques, equipment, and applications of spread spectrum communications. Topics include pseudonoise modulation, coding, signal processing, synchronization, antijamming, interference rejection, antennas, and the use of surface acoustic wave technology. Applications include satellite, television, secure communication, multiples, and multiple access system. This updated bibliography contains 124 abstracts, 25 of which are new entries to the previous edition.
GRA

N80-28624# National Technical Information Service, Springfield, Va.
SPREAD SPECTRUM COMMUNICATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1980
William E. Reed Apr. 1980 170 p Supersedes NTIS/PS-79/0495; NTIS/PS-78/0490
(PB80-809734; NTIS/PS-79/0495; NTIS/PS-78/0490) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B
Research reports from worldwide literature are cited on the techniques, equipment, and applications of spread spectrum communications. Topics include pseudonoise modulation, coding, signal processing, synchronization, antijamming interference rejection, antennas, and the use of surface acoustic wave technology. Applications include satellite, secure communication, multiplex:, and multiple access systems. This updated bibliography contains 163 abstracts, 45 of which are new entries to the previous edition.
GRA

N80-28625# National Technical Information Service, Springfield, Va.
ANTENNA ARRAYS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Apr. 1980
William E. Reed Apr. 1980 168 p Supersedes NTIS/PS-79/0318; NTIS/PS-78/0310
(PB80-809742; NTIS/PS-79/0318; NTIS/PS-78/0310) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

A bibliography containing 161 abstracts concerning the use of antenna arrays in the fields of radar, communications, radio astronomy, navigation, electronic countermeasures, and spacecraft is presented. Topics include design, antenna radiation patterns, mathematical models, and performance. GRA

N80-28626# National Technical Information Service, Springfield, Va.
ANTENNA ARRAYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
William E. Reed Apr. 1980 261 p Supersedes NTIS/PS-79/0319; NTIS/PS-78/0311
(PB80-809759; NTIS/PS-79/0319; NTIS/PS-79/0311) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

A bibliography containing 254 abstracts concerning antenna arrays is given. Topics include design, propagation, antenna radiation patterns, mathematical analysis, signal processing, and interference rejection. GRA

N80-28627# Institute for Telecommunication Sciences and Aeronomy, Boulder, Colo.
PROPAGATION EFFECTS OF AN INTERVISIBILITY MEASUREMENT SYSTEM OPERATING IN THE SHF BAND
E. J. Haakinson, E. J. Violette, and G. A. Hufford Feb. 1980 138 p refs Sponsored in part by Army Combat Developments Experimentation Command, Ft. Ord, Calif.
(PB80-167471; NTIA/Rept-80/35) Avail: NTIS HC A07/MF A01 CSCL 14B

A study was conducted to determine the limiting propagation effects on the performance of a microwave system that could be used to detect the optical visibility to one another of two vehicles, separated by up to 10 km, in irregular, obstructed terrain. The study had four objectives: (1) to demonstrate what effects signal variability has on the intervisibility decision process; (2) to identify the possible sources of the signal variability and to estimate the magnitude of each source's contribution to the total variability; (3) to obtain propagation loss data, over various types of terrain and obstructed paths, which could be used to predict received signal variability due to propagation over similar paths; and (4) to use the measured data to determine the performance of simulated intervisibility measurement system. A measurement system was prepared and sent to Ft. Hunter Liggett, CA, where propagation path loss was measured over several selected paths of varying lengths, varying path geometrics, and varying amounts of vegetation and rock outcroppings. GRA

N80-28628# Mitre Corp., McLean, Va. Metrek Div.
DEVELOPMENT OF AN EXPERIMENTAL SPREAD SPECTRUM MARITIME COMMUNICATION SYSTEM, PHASE 1
Walter C. Scales Jul. 1979 75 p refs
(Contract DO-A01-78-3108)
(PB80-169881; MTR-79W00217; MA-RD-940-80005) Avail: NTIS HC A04/MF A01 CSCL 17B

This report summarizes the results of the first phase of an investigation of a spread spectrum technique for maritime applications. Potential applications include distress signaling via satellite, remote monitoring of ship performance, and 'orderwire' signaling for future maritime satellite communication systems. The specific approach developed under this contract provides for low power, low data rate transmission through a maritime communications satellite. The receiver designed for this application uses a matched filter based on charge transfer devices. A baseband receiver was demonstrated during the first project phase. The second phase, which is now approaching completion, will encompass extension of the hardware to an intermediate frequency and testing via satellite. GRA

N80-28629# Federal Communications Commission, Washington, D. C. Office of Plans and Policy.
APPENDICES TO REPORT OF THE UHF TASK FORCE Final Report
Raymond M. Wilmotte 1979 195 p refs 2 Vol.
(PB80-164429) Avail: NTIS HC A09/MF A01 CSCL 17B

Several articles are presented which address various problems in ultrahigh frequency communications inlcuding the interaction of decision makers and analysts, speech and television bandwidth reduction, compandored single sideband, the introduction of marketplace forces for the development of spectrum efficiency, spectrum requirements for civil maritime and aeronautical services, and determining preferences for UHF allocations. GRA

N80-28630# Federal Communications Commission, Washington, D. C. Office Plans and Policy.
FINAL REPORT OF THE UHF TASK FORCE Final Report
Raymond M. Wilmotte Sep. 1979 54 p 2 Vol.
(PB80-164437) Avail: NTIS HC A04/MF A01 CSCL 17B

The major services in the ultrahigh frequency band-television, civil maritime, civil aeronautics, and land mobile, are analyzed with respect to the expected demand to the end of the century and the spectrum space that each would require to meet this demand as well as that of new services likely to emerge. The capacity of the communication system would depend on the development of spectrum saving procedures and technology. Just as important and just as difficult would be the means for their introduction into the national telecommunication system. Whatever process was developed, it would have to be flexible to meet unexpected fluctuations and have some leeway to grow in the first few years of the next century. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-28631 Pittsburgh Univ., Pa.
ARC-CIRCUIT INTERACTION INCLUDING THE EFFECT OF PRE-CURRENT ZERO ARC INSTABILITY Ph.D. Thesis
Avelino Juan Gonzalez 1979 162 p
Avail: Univ. Microfilms Order No. 8015379

A computer arc model is developed which is capable of predicting the point of arc instability and simulate the subsequent current chop. It can also determine the level of current chopped and the response of the system to the phenomenon. The model is inserted in a computer algorithm which uses the conductance of the arc and the nodal equations of the electrical system to which the interrupter is connected to compute the arc voltage and current at every time interval. The level of current chopped (i sub ch) at different values of the line-side breaker capacitance CG is determined. The resulting graph of 1 sub ch vs CG is compared to results obtained experimentally, which qualitatively verifies the validity of the model. A theoretical comparison is made between connecting the capacitance from the line-side breaker terminal to ground versus connecting the same value of capacitance directly across the breaker contacts. The model predicted no significant difference in arc stability between the two configurations. However, pertaining to the transient recovery voltage (TRV) the position of line-side breaker capacitance CG produced less severe TRVs at low values of capacitance when compared to the same capacitance connected across the gap. The converse was true at higher values of capacitance. Dissert. Abstr.

N80-28632 Ohio State Univ., Columbus.
THE ANALYSIS OF THE R.F. FIELD RESPONSE OF SOLID WIRES EXCITED BY LASER INDUCED ENDCAP CURRENTS Ph.D. Thesis
Kenneth Robert Demarest 1980 97 p
Avail: Univ. Microfilms Order No. 8015866

A technique for calculating the current and field response of an end excited monopole is presented. This formulation is a variation of the Fourier transform technique and models the dipole (the monopole and its ground plane image) as a member of an infinite, periodic array (of sufficient spacing to negate coupling effects) of identically excited wires. The array geometry is divided into two distinct regions, and complete field expansions are constructed that satisfy the appropriate boundary and source conditions of each region. Solutions are obtained by requiring

these expansions to satisfy the necessary boundary conditions along the extended wire surfaces through the use of a Fourier Galerkin matching technique. Wire responses as calculated by this technique are presented which demonstrate their basic characteristics as a function of critical wire and source parameters. Special attention is drawn to the current response in the end regions and its dominance by the currents incident from the source filament. Calculated transient responses are also presented and shown to exhibit excellent agreement with measured responses. Dissert. Abstr.

N80-28633 Oklahoma State Univ., Stillwater.
WAVEFORM EFFECTS ON THE OPERATION OF THE PARALLEL-BRIDGE RECTIFIER SYSTEM AND THE FIELD
Ph.D. Thesis
Altaf-UR Rahman 1979 169 p
Avail: Univ. Microfilms Order No. 8013041

The influence of nonsinusoidal (especially flat topped) source voltage waveforms on the operation of the parallel bridge rectifier system (PBRS) and the field modulated generator system (FMGS), leading to the development of some practical design guidelines for the FMGS. Emphasis is given to the following: (1) the effect of rectangular pulse source voltage waveform on the operation of the PBRS; (2) the effect of trapezoidal source voltage waveform on the operation of the PBRS with bridge-input capacitors; (3) some practical design guidelines; and (4) the validity of the theoretical results. Dissert. Abstr.

N80-28634 Purdue Univ., Lafayette, Ind.
RESISTOR CONDUCTOR INTERFACE IN THICK FILM
Ph.D. Thesis
Dinesh Tandan 1979 158 p
Avail: Univ. Microfilms Order No. 8015526

Intermigration of conducting phases at the resistor-conductor was studied using the scanning electron microscope (SEM). The interfaces between both Au and Pt frit bonded conductors (containing lead borosilicate glass of composition 63 w/o PbO -25 w/o B2O3 - 12 w/o SiO2) and resistors made with RuO2 and the same lead borosilicate glass were considered for normal firing temperature and time. It was observed that the overlap region of conducting phases was equal to or less than 3 microns, which was about the sensitivity of the instrument. The microstructural changes at the resistor-conductor interface during firing were observed using a hot stage microscope. It was observed that the conductor pad shrinks during firing, and that glass flows out of the pad and into the interface region between the resistor body and the conductor pad producing a segregation region on the resistor side of the resistor-conductor interface. Dissert. Abstr.

N80-28635*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PHOTOCAPACITIVE IMAGE CONVERTER Patent Application
William E. Miller, Arden Sher (Coll. of William and Mary, Williamsburg, Va.), and Yuan Huai Tsuo (Coll. of William and Mary, Williamsburg, Va.) 20 Jun. 1980 14 p
(NASA-Case-LAR-12513-1; US-Patent-Appl-SN-161256) Avail: NTIS HC A02/MF A01 CSCL 09A

Apparatus is described for converting a radiant energy image into corresponding electrical signals including an image converter. The image converter includes a substrate of semiconductor material, an insulating layer on the front surface of the substrate and an electrical contact on the back surface of the substrate. A series of parallel transparent conductive stripes is on the insulating layer with a processing circuit connected to each of the conductive stripes for detecting the modulated voltages generated. In a first embodiment of the invention, a modulated light stripe, perpendicular to the conductive stripes scans the image converter. The resulting modulated signals generated on the conductive stripes are detected by the processing circuits to produce signals that represent the image focused on the image converter. In a second embodiment of the invention a second insulating layer is deposited over the conductive stripes, and a second series of parallel transparent conductive stripes perpendicular to the first series is on the second insulating layer. A different frequency current signal F sub n is applied to each of the second series of conductive stripes, and a modulated image is applied to the image converter. The resulting signals detected by the processing circuits represent the image. NASA

N80-28636*# Auburn Univ., Ala. Dept. of Electrical Engineering.
EVALUATION OF INDUCTION MOTOR PERFORMANCE USING AN ELECTRONIC POWER FACTOR CONTROLLER
Final Report
21 Jun. 1978 55 p
(Contract NCA8-00128)
(NASA-CR-161506) Avail: NTIS HC A04/MF A01 CSCL 09A

The concept of reducing the losses in an induction motor by electronically controlling the time interval between the zero crossing of the applied voltage and the zero crossing of the armature current was evaluated. The effect on power losses and power factor of reducing the applied sinusoidal voltages below the rated value was investigated experimentally. The reduction in power losses was measured using an electronic controller designed and built at MSFC. Modifications to the MSFC controller are described as well as a manually controlled electronic device which does not require that the motor be wye connected and the neutral available. Possible energy savings are examined. A.R.H.

N80-28637*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE DEVELOPMENT OF A STEPPED FREQUENCY MICROWAVE RADIOMETER AND ITS APPLICATION TO REMOTE SENSING OF THE EARTH
Richard F. Harrington Jun. 1980 181 p refs
(NASA-TM-81847) Avail: NTIS HC A09/MF A01 CSCL 09C

The design, development, application, and capabilities of a variable frequency microwave radiometer are described. This radiometer demonstrated the versatility, accuracy, and stability required to provide contributions to the geophysical understanding of ocean and ice processes. A closed-loop feedback method was used, whereby noise pulses were added to the received electromagnetic radiation to achieve a null balance in a Dicke switched radiometer. Stability was achieved through the use of a constant temperature enclosure around the low loss microwave front end. The Dicke reference temperature was maintained to an absolute accuracy of 0.1 K using a closed-loop proportional temperature controller. A microprocessor based digital controller operates the radiometer and records the data on computer compatible tapes. This radiometer exhibits an absolute accuracy of better than 0.5 K when the sensitivity is 0.1 K. The sensitivity varies between 0.0125 K and 1.25 K depending upon the bandwidth and integration time selected by the digital controller. Remote sensing experiments were conducted from an aircraft platform and the first radiometeric mapping of an ocean polar front; exploratory experiments to measure the thickness of lake ice; first discrimination between first year and multiyear ice below 10 GHz; and the first known measurements of frequency sensitive characteristics of sea ice. L.F.M.

N80-28638*# Hughes Aircraft Co., Culver City, Calif.
QUANTITATIVE OPTICAL SCANNING TESTS OF COMPLEX MICROCIRCUITS Final Report, Feb. 1978 - Jan. 1980
J. J. Erickson Mar. 1980 119 p
(Contract NAS8-32665)
(NASA-CR-161522; HAC-1476) Avail: NTIS HC A06/MF A01 CSCL 09C

An approach for the development of the optical scanner as a screening inspection instrument for microcircuits involves comparing the quantitative differences in photoresponse images and then correlating them with electrical parameter differences in test devices. The existing optical scanner was modified so that the photoresponse data could be recorded and subsequently digitized. A method was devised for applying digital image processing techniques to the digitized photoresponse data in order to quantitatively compare the data. Electrical tests were performed and photoresponse images were recorded before and following life test intervals on two groups of test devices. Correlations were made between differences or changes in the electrical parameters of the test devices. A.R.H.

N80-28639# Purdue Univ., Lafayette, Ind. Turner Lab. for Electroceramics.
THE EFFECTS OF SUBSTRATE COMPOSITION OF THICK FILM CIRCUIT RELIABILITY Final Report, 1 Feb. 1979 - 31 Jan. 1980
R. W. Vest 28 Feb. 1980 118 p refs
(Contract N00019-79-C-0240)
(AD-A084261) Avail: NTIS HC A06/MF A01 CSCL 09/1

The dissolution of an alumina substrate (AlSiMag 614) into the glass phase of a thick film resistor during firing was found to markedly increase the viscosity, and to decrease the surface tension and density of the glass. These changes in glass properties cause an increase in the sheet resistance and a decrease in the TCR of the resistors. The minor constituents in the substrate were found to exert a larger effect on glass properties than their concentration (4%) suggests. The models for microstructure development and charge transport in thick film resistors were modified in order to accommodate the effect of the resistor-substrate interaction. The results of this study led to specific recommendations for quality control of substrate chemistry, and for composition of resistor glasses. GRA

N80-28640# Harry Diamond Labs., Adelphi, Md.
FLUERICS 41: SINGLE-SIDED CONTROL PORT CHARACTERISTICS OF LAMINAR PROPORTIONAL AMPLIFIERS FOR ARBITRARY INPUT LOADING
R. Michael Phillipi and Tadeusz M. Drzewiecki Feb. 1980 30 p
(DA Proj. 1L1-61102-AH-44)
(AD-A084180; HDL-TR-1901) Avail: NTIS HC A03/MF A01 CSCL 13/7

This report presents a technique for analytically predicting single-sided control port characteristics of a laminar proportional amplifier (LPA) with arbitrary input circuits at the opposite control using calculable differential characteristics. Specific cases dealt with include a constant pressure at the opposite control, a constant flow at the opposite control, and a series and shunt flow resistance at the opposite control. Experiments using amplifiers at various aspect ratios (height-to-width ratio of supply nozzle) and supply pressures, which imply a large range of LPA resistance, show a maximum error of 11 percent between actual and computed single-sided control port flow resistance. GRA

N80-28641# Harry Diamond Labs., Adelphi, Md.
CHARACTERISTICS OF OROTRON OSCILLATION AND AMPLIFICATION. 2: LINEAR BUNCHING THEORY
Richard P. Leavitt, Clyde A. Morrison, and Donald E. Wortman Mar. 1980 22 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A084714; HDL-TR-1898) Avail: NTIS HC A02/MF A01 CSCL 09/5

A linear theory of bunching in the orotron is derived in which the electron beam evolves in time via the Boltzmann equation. The theory is used to derive the power radiated by an electron beam subjected to a general longitudinal electric field. It is then specialized to the case of the orotron, in which the electric field is quasi-periodic. The starting current, I sub s, and the electronic tuning transconductance, df/dV, are calculated from the theory. These results are evaluated for the planned Harry Diamond Laboratories orotron experiment at 75 gigahertz and are found to be I sub s = 34.5 milliamperes and df/dV = 0.31 megahertz/volt. GRA

N80-28642# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ELECTROOPTICAL DEVICES Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1979
Charles E. Hurwitz 30 Sep. 1979 30 p refs
(Contract F19628-80-C-0002; AF Proj. 2306; AF Proj. 4600)
(AD-A084410; ESD-TR-79-279) Avail: NTIS HC A03/MF A01 CSCL 09/3

The current objectives of the electrooptical device program are (1) to perform life tests on GaInAsP/InP Double-heterostructure (DH) diode lasers operating in the 1.0 to 1.3 micrometer wavelength region and analyze the degradation mechanism; and (2) to fabricate and study avalance photodies of similar composition GaInAsP operating in the same wavelength region. Self-sustained pulsations in light output, similar to those occurring in AlGaAs lasers, were studied in GaInAsP DH lasers. In marked contrast of observations for AlGaAs lasers, the rate of incidence of the pulsations is much lower and their occurrence does not appear to be increased by aging. The pulsations appear to be related to defects originating in the growth process or subsequent fabrication procedures. Substantial increase in avalance gain and reduction of dark current have been achieved in a modified version of the inverted-mesa GaInAsP/InP avalance photodiode structure. Dark currents as low as 1.5 nA at half the breakdown voltage and photocurrent gans as high as 700 have been measured. Implantation of the donors Se, Si, And C and the acceptors Cd, Mg, and Be from room temperature to 200 C were studied. The sample temperature during implantation is to have a pronounced effect on the electrical characteristics of the resulting layers. Electron concentrations in excess of 10 to the 19th power per cc were achieved. GRA

N80-28643# Magnavox Government and Industrial Electronics Co., Fort Wayne, Ind.
ELECTRONICALLY TUNABLE AMPLIFIER Final Technical Report, Apr. 1978 - Apr. 1979
Winston A. Council Mar. 1980 59 p
(Contract F30602-78-C-0152; AF Proj. 0174)
(AD-A084089; RADC-TR-80-77) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report describes a research effort intended to determine the feasibility of combining high power solid state amplifier and electronically tunable resonator technology. This new technology would be applicable to the design and fabrication of high power electronically tunable amplifiers capable of frequency agile operation in the UHF range. The primary goal of the effort was to determine if the RF power from twelve 100 watt solid state amplifier modules could be combined in the electric field of an electronically and/or mechanically tuned cavity resonator, to produce/kilowatt of continuous output power. Testing of the experimental model showed that efficient RF power combining could be obtained in a mechanically tuned cavity where the length of the coaxial inner element was varied to change the frequency. Summing with the electronic tuning technique (PIN diode switched loops) was inefficient and distortion of the RF field by the tuning loops within the cavity precludes tuning and summing at the same time. GRA

N80-28644# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL STUDY OF SELF-SCANNING PHOTODIODE ARRAY M.S. Thesis
Carlos J. G. Martins Dec. 1979 61 p refs
(AD-A084519) Avail: NTIS HC A04/MF A01 CSCL 14/3

An experimental study of a new series of Solid State image sensor arrays was conducted, operating in a photon flux integration mode. The operation of a P-N junction photodiode is analyzed, and boundary conditions to operate the device are presented. The origin of the switching noise as the predominant noise source is verified. Some applications are developed. GRA

N80-28645# Texas A&I Univ., Kingsville. Dept. of Electrical Engineering.
AN ADAPTIVE PREDICTOR FOR DATE COMPRESSION Final Report
Michael Hankamer 31 Mar. 1980 78 p refs
(Grant AF-AFOSR-0074-79; AF Proj. 2304)
(AD-A084217; AFOSR-80-0418TR) Avail: NTIS HC A05/MF A01 CSCL 09/4

The problem of predicting the nth sample of a periodically stationary random sequence (digitized electrocardiogram using a set of L prior samples was considered. The entropy of the source was calculated using a Markov source model to find that entropy decreases rapidly with source order. The linear least mean square estimator was also derived and computer simulated. R.C.T.

N80-28646# RCA Advanced Technology Labs., Camden, N. J.
ANALOG-BINARY PROGRAMMABLE TRANSVERSAL FILTER Final Technical Report, 30 Sep. 1977 - 30 Jun. 1979
J. R. Tower and L. D. Elliott Griffiss AFB, N.Y. RADC Feb. 1980 43 p
(Contract F19628-77-C-0263; AF Proj. 4600)
(AD-A084346; RADC-TR-79-331) Avail: NTIS HC A03/MF A01 CSCL 09/5

This Final Technical Report on the Analog-Binary Programmable Transversal Filter program emphasizes the testing of the TC1235 CCD correlator device. The Interim Technical Report for this program contained a statement of the program objectives, a general description of the analog-binary correlator, and a detailed design description of the correlator device. The objective of this program was to develop a programmable CCD (Charge-Coupled Device) circuit capable of correlating a variety of binary-coded waveforms. This analog-binary correlator stores a binary waveform as a reference, and then compares newly arriving signals to the reference waveform. In general, the signal is a binary code that has been corrupted in the transmission channel so that upon arrival at the receiver, it really has an analog character (i.e., the amplitude varies continuously). Analog-binary correlation techniques have an important advantage over purely digital approaches. If the analog signal is directly compared to the reference, only a single correlation channel is required, whereas a digital correlator requires a separate channel for each bit of resolution in the analog-to-digital converter. Thus, a reduction in parts count, with attendant improvements in size, cost and reliability, is realized with the CCD correlator. GRA

N80-28647# Watkins-Johnson Co., Scotts Valley, Calif. Cathode-Ray Tube Dept.
HIGH CONTRAST CRT Final Technical Report, 1 Jan. 1977 - 30 Jun. 1979
Norman H. Lehrer and Glenn A. Holmquist Feb. 1980 128 p refs
(Contract DAAB07-77-C-2639; DA Proj. 1L1-62705-AH-94)
(AD-A084687; DELET-TR-77-2639-F) Avail: NTIS
HC A07/MF A01 CSCL 09/1

This program developed a CRT fabrication technology incorporating La2O2S:Tb and La2O2S:Eu thin film phosphor coated faceplates backed with a nonreflecting coating. The resulting color CRT is superior to existing monochromatic CRT's in high ambient light conditions. GRA

N80-28648# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
MILLIMETER-WAVE SELF-MIXING InP AND GaAs GUNN OSCILLATORS
Samuel Dixon Jun. 1979 28 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A085026; DELET-TR-79-4) Avail: NTIS
HC A03/MF A01 CSCL 09/5

Self-oscillating mixers in both dielectric and waveguide cavities have been investigated in the 60 GHz frequency range. The devices consist of negative resistance diodes of GaAs and InP material coupled to waveguide cavities or high resistivity dielectric cavities such as silicon or Al2O3. Experimental measurements show that these devices have a sensitivity in the order of -80dBm with the intermediate frequency at 60 MHz and an IF bandwidth of 120 MHz. Applications are suggested based on minimum detectable signal and RF power capabilities for systems requiring small size and low cost. GRA

N80-28649# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
CAUSAL AND TELEOLOGICAL REASONING IN CIRCUIT RECOGNITION
Johan De Kleer Sep. 1979 219 p refs
(Contract N00014-75-C-529; Grant NSF MSC-77-04828)
(AD-A084802; AI-TR-529) Avail: NTIS HC A10/MF A01
CSCL 09/5

This thesis presents a theory of human-like reasoning in the general domain of designed physical systems, and in particular, electronic circuits. One aspect of the theory, causal analysis, describes how the behavior of individual components can be combined to explain the behavior of composite systems. Another aspect of the theory, teleological analysis, describes how the notion that the system has a purpose can be used to aid this causal analysis. The theory is implemented as a computer program, which, given a circuit topology, can construct by qualitative causal analysis a mechanism graph describing the functional topology of the system. This functional topology is then parsed by a grammar for common circuit functions. Ambiguities are introduced into the analysis by the often several possible mechanisms which might describe the circuit's function. These are disambiguated by teleological analysis. The requirement that each component be assigned an appropriate purpose in the functional topology imposes a severe constraint which eliminates all of the ambiguities. Since both analyses are based on heuristics, the chosen mechanism is a rationalization of how the circuit functions, and does not guarantee that the circuit actually does function. This type of coarse understanding of circuits is useful for analysis, design and troubleshooting. GRA

N80-28650# Naval Air Engineering Center, Lakehurst, N.J. Ground Support Equipment Dept.
INTEGRATED CIRCUIT TESTER EVALUATION STUDY Final Report, Jan. 1977 - Sep. 1978
P. Stevens 5 Mar. 1980 111 p refs
(AD-A084961; GIDEP-E150-0590; NAEC-MISC-92-0380)
Avail: NTIS HC A06/MF A01 CSCL 09/5

The primary AIMD test requirements for a small, inexpensive, commercially available, digital IC tester could be met by only one tester. This was the Automatic Fault Isolation Tester (AFIT) model 2050 manufactured by Testline Co. Many other testers were available that had the basic testing capability but were outside the price constraints or that were edge board testers. Bed-of-nails testers were not considered for AIMD use. The AFIT was submitted for technical and User Evaluations and demonstrated that it could detect faulty IC's on PC boards not coated with a conformal moisture-proofing compound. This fault detection ability was demonstrated for both the in-circuit and out-of-circuit modes of operation. GRA

N80-28651# Rockwell International Corp., Cedar Rapids, Iowa. Collins Telecommunications Products Div.
TRANSCEIVER MULTIPLEXERS TD-1288/GRC AND TD-1289/GRC Annual Report, 1 Oct. 1978 - 30 Sep. 1979
D. Penner and J. Dean Mar. 1980 23 p
(Contract DAAB07-77-C0193)
(AD-A085156; CORADCOM-77-0193-6; AR-2;
Rept-523-0769373-00121D-2) Avail: NTIS
HC A02/MF A01 CSCL 17/2

This annual report summarizes the activity on the VHF Transceiver Multicoupler for the year ending 30 September 1979. During the previous report period, the 2 channel and 5 channel multiplexers with an expanded upper frequency range of 88 MHz were developed. In addition to the expanded frequency range, a filter simulator was developed to substitute for any filter module in an unused channel. During this report period, final testing on the engineering models was completed and the design was finalized. Any resulting changes or discrepancies with the drawing package were then updated to insure conformance by the production models. Final assembly of the production units was begun in April with the first units being delivered to the engineering test area in June for the start of the engineering design test (qualification test). Results of this test are summarized. GRA

N80-28652# Southwest Research Inst., San Antonio, Tex.
FEDERAL EVALUATION OF LIGHTNING TRACKING SYSTEMS (FELTS) Final Report, 1 May 1979 - 31 May 1980
R. L. Johnson May 1980 44 p refs
(Contract N00014-79-C-0223)
(AD-A084791) Avail: NTIS HC A03/MF A01 CSCL 17/3

A side-by-side performance evaluation of two lightning tracking systems was done at Kennedy Space Center, Florida during the period 1 June-13 July 1979. The competing systems were manufactured by Lightning Location and Protection Inc., (LLP) and by Atlantic Scientific Corp. (ASC). Although the ASC system satisfied a preliminary performance test, it was observed that the device required continuing modification by the manufacturer. The LLP system experienced two hardware failures during this period, but otherwise operated 24 hours daily in an automatic unattended data acquisition mode. Because of the continuing developmental effort required on the ASC device, it was determined that the operational evaluation of this system was premature. GRA

N80-28653# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
SOME MODIFICATIONS TO NEWTON'S METHOD FOR THE DETERMINATION OF THE STEADY STATE RESPONSE OF

NONLINEAR CIRCUITS Ph.D. Thesis
Francis Benedict Grosz, Jr. Aug. 1979 140 p refs
(Contracts DAAB07-72-C-0259; N00014-79-C-0424; Grant DAAG29-78-G-0016)
(AD-A085256; R-856; UILU-ENG-78-2249) Avail: NTIS HC A07/MF A01 CSCL 09/3

Many methods have become available recently for the determination of the steady state response of nonlinear circuits. The Newton method of Trick, Aprille and Colon is one of the more widely available methods. However, in certain cases, the method fails to converge to a steady state solution. Three modifications to the Newton method to increase convergence reliability or speed are proposed. The implementation of these modifications is discussed. Several example circuits are given and the results compared. Some guidelines for the use of these modified methods are also given. GRA

N80-28654# Varian Associates, Beverly, Mass.
SFD-261 CROSSED-FIELD AMPLIFIER MANUFACTURING TECHNOLOGY PROGRAM, SUPPLEMENT Final Report
R. A. LaPlante and F. E. Trojan 16 May 1980 37 p
(Contract N00123-77-C-1019)
(AD-A085044; Rept-22-3040-FNL-Suppl) Avail: NTIS HC A03/MF A01 CSCL 09/5

Qualifications tests performed on ten crossed field amplifiers are reported. Findings regarding tube failures and corrective measures taken are included. E.D.K.

N80-28655# Varian Associates, Beverly, Mass.
SFD-261 CROSSED-FIELD AMPLIFIER MANUFACTURING TECHNOLOGY PROGRAM Final Report, Aug. 1977 - Sep. 1979
R. A. LaPlante and F. E. Trojan 28 Sep. 1980 108 p
(Contract N00123-77-C-1019)
(AD-A085043; Rept-22-3040-FNL) Avail: NTIS HC A06/MF A01 CSCL 09/5

The objective of the MT program is to demonstrate improved production techniques by a pilot production run of ten (10) tubes to meet performance specification and system compatibility criteria under production line conditions. The SFD-261 is a microwave amplifier used to increase the power level of pulses of energy by a factor of 20. It is used in the Aegis AN/SPY-1 radar transmitter. A single ship's complement without spares is seventy-six. Its internal parts are made from high purity copper and many are complex and involve high precision. Most of the fabrication is by precious metal brazing in hydrogen or in vacuum. Modest production rates (10 to 30 units per month) presently restrict the amount of automation which can be effectively applied. Nearly 30 design changes were made without altering performance significantly. Self-jigging techniques permitted assembly by lower skill levels. A 'one-shot' vacuum braze for the cathode produced significant cost and equipment reduction. If the selling price of the standard design is normalized at 100, the price of the MT design is now 57. GRA

N80-28656# Southern California Edison Co., Rosemead. Research and Development Div.
EPRI/SCE TESTING AND EVALUATION OF ELECTRIC WORK VEHICLES: JET 500, VOLKSWAGEN TYPE 2, DAUG TYPE GM2, AND BATTRONIC MINIVAN
R. K. McCluskey and J. L. Arias Dec. 1979 91 p
(EPRI Proj. 1136-1)
(EPRI-EM-1245) Avail: NTIS HC A05/MF A01

During the first 11 months of the EPRI/SCE Electric Vehicle Project, four electric vehicles (EVs) were tested and evaluated: the Jet Industries Electra-Van Model 500, the Volkswagen (VW) Type 2 Electrotransporter, a VW Type GM2 Transporter with DAUG electric drive, and the Battronic Minivan. The project emphasized road testing of these vehicles to acquire data on their useful driving range, performance, and reliability. Each vehicle was driven more than 1000 miles along SCE-selected test routes to determine the effects of different terrains (level, slight grades, and steep grades), traffic conditions (one, two, three, and four stops/mile and freeway), and payload. The vehicle component failures that occurred during testing are itemized and described briefly, and assessments of expected field reliability are made. Other vehicle characteristics and measurements of interest are presented. The data base on these test vehicles is intended to provide the reader an overview of the real world performance that can be expected from present day state-of-the-art EVs. DOE

N80-28657# California Univ., Livermore. Lawrence Livermore Lab.
ELECTROMAGNETIC PROPULSION: DRAG AND EROSION MODELING
A. C. Buckingham 25 Apr. 1980 10 p refs Presented at 16th AIAA-SAE-ASME Joint Propulsion Conf., Hartford, Conn., 30 Jun. - 2 Jul. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83721; CONF-800620-1) Avail: NTIS HC A02/MF A01

The history of candidate projectile material response is traced sequentially from start of motion. The analysis includes sliding friction with projectile deformation, followed, where appropriate, by liquid metal and multiphase erosive viscous interface layer development, heat, mass, and momentum transport, and subsequent launch ballistics calculations incorporating the influence of these physical considerations. Several preferred candidate materials and sabot/projectile configurations emerge from these computational studies. DOE

N80-28658# Fondazione Ugo Bordoni, Rome (Italy).
DESIGN OF DIRECTIONAL COUPLERS BETWEEN DIFFERENT OPEN STRUCTURES [PROGETTO DI ACCOPPIATORI DIREZIONALI TRA STRUTTURE APERTE DIFFERENTI]
Franco Bertolani, Gabriele Falciasecca (Bologne Univ.), and Daniele Zambelli (Bologne Univ.) Dec. 1978 29 p refs In ITALIAN
(FUB-42-1978) Avail: NTIS HC A03/MF A01

The electromagnetic coupling between millimeter waves travelling through waveguides by means of openings in the metallic wall separating both guides, was studied. The effect of the opening on the configuration of the field of each guide was also investigated. A mathematical model was developed for the design of directional couplers between different structures and the corresponding computer program. Author (ESA)

N80-28659# Atomic Weapons Research Establishment, Aldermaston (England).
A QUICK METHOD FOR CALCULATING TEMPERATURES ARISING FROM EXTENDED MICROCIRCUIT HEAT SOURCES
D. J. Dean London HMSO Jan. 1980 27 p refs
(AWRE-O-42/79; BR72025) Avail: NTIS HC A03/MF A01; HMSO, London 1 PHI

A series summation computation method is presented, suitable for pocket calculators, by which the state of convergence (SOC), in terms of maximum possible error, is calculated at each stage in the summation, thus enabling the calculation to be terminated as soon as the required accuracy has been obtained. An application is shown in thermal design. Author (ESA)

N80-28660# National Technical Information Service, Springfield, Va.
PHASE SHIFTERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun. 1977 - Apr. 1980
William E. Reed May 1980 208 p Supersedes NTIS/PS-79/0492; NTIS/PS-78/0470
(PB80-810062; NTIS/PS-79/0492; NTIS/PS-78/0470) Avail: NTIS HC $30.00/MF $30.00 CSCL 09C

The bibliography cites Federally-funded research on the design, performance, and utilization of phase shifters and phase shift circuits. The types include ferrite, semiconductor, digital, and voltage controlled. Applications cover phased arrays, microwave equipment, surface acoustic wave devices, strip transmission lines, phases shift keyers, signal processors, and control equipment. This updated bibliography contains 20 abstracts. GRA

N80-28661# National Technical Information Service, Springfield, Va.
PHASE SHIFTERS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1973 - 1977
William E. Reed May 1980 228 p
(PB80-810070) Avail: NTIS HC $30.00/MF $30.00 CSCL 09C

The bibliography cites worldwide research on the design, performance, and utilization of phase shift circuits. Citations cover

ferrite, semiconductor, digital, and voltage controlled shifters. The applications include phased arrays, microwave equipment, surface acoustic wave devices, strip transmission lines, phase shift keyers, signal processors, and control equipment. This updated bibliography contains 221 abstracts, none of which are new entries to the previous edition. GRA

N80-28662# National Technical Information Service, Springfield, Va.
PHASE SHIFTERS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Apr. 1980
William E. Reed. May 1980. 102 p. Supersedes NTIS/PS-79/0493; NTIS/PS-78/0471.
(PB80-810088; NTIS/PS-79/0493; NTIS/PS-78/0471) Avail: NTIS. HC $30.00/MF $30.00. CSCL 09C
The bibliography cites worldwide research on the design, performance, and utilization of phase shifters and phase shift circuits. Citations cover ferrite, semiconductor, digital, and voltage controlled shifters. The applications include phase arrays, microwave equipment, surface acoustic wave devices, strip transmission lines, phase shift keyers, signal processors, and control equipment. This updated bibliography contains 95 abstracts, 39 of which are new entries to the previous edition. GRA

N80-28663# National Bureau of Standards, Washington, D.C. National Engineering Lab.
CHARACTERIZATION OF ELECTRICALLY SMALL RADIATING SOURCES BY TESTS INSIDE A TRANSMISSION LINE CELL
Ippalapalli Sreenivasiah, David C. Chang, and Mark T. Ma. Feb. 1980. 71 p. refs. Prepared in cooperation with Colorado Univ., Boulder.
(PB80-169931; NBS-TN-1017) Avail: NTIS. HC A04/MF A01. CSCL 09E
An electrically small radiating source of arbitrary nature may be modeled by an equivalent dipole system consisting of three orthogonal electric dipoles and three orthogonal magnetic dipoles, each excited with arbitrary phase. An experimental procedure for determining the emission characteristics of such an equivalent dipole system by tests inside a single mode transmission line cell is described. Some experimental results are presented. GRA

N80-28664# National Technical Information Service, Springfield, Va.
BAND PASS FILTERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Feb. 1977 - Apr. 1980
William E. Reed. Apr. 1980. 249 p. Supersedes NTIS/PS-79/0300 and NTIS/PS-78/0215.
(PB80-809676; NTIS/PS-79/0300; NTIS/PS-78/0215) Avail: NTIS. HC $30.00/MF $30.00. CSCL 09E
A bibliography containing 242 abstracts addressing the design, fabrication, characterization, and application of band pass filters is presented. Radiofrequency, digital, acoustic surface wave, and X-ray filters are included. GRA

N80-28665# National Technical Information Service, Springfield, Va.
BAND PASS FILTERS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Feb. 1980
William E. Reed. Apr. 1980. 241 p. Supersedes NTIS/PS-79/0302; NTIS/PS-78/0216.
(PB80-809684; NTIS/PS-79/0302; NTIS/PS-78/0216) Avail: NTIS. HC $30.00/MF $30.00. CSCL 09E
The bibliography cites worldwide research on the design, fabrication, characterization, and application of band pass filters. Radiofrequency, electric, digital, and acoustic surface wave filters are included. Optical filters are excluded. This updated bibliography contains 234 abstracts, 102 of which are new entries to the previous edition. GRA

N80-28666# National Technical Information Service, Springfield, Va.
BEAM LEAD MICROELECTRONICS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
William E. Reed. Apr. 1980. 94 p. Supersedes NTIS/PS-79/0389 and NTIS/PS-78/0368.
(PB80-808348; NTIS/PS-79/0389; NTIS/PS-78/0368) Avail: NTIS. HC $30.00/MF $30.00. CSCL 09E
The technology and application of beam lead devices are treated in these Federally-sponsored research reports. Topics include design, fabrication, bonding, packaging, testing, and radiation hardening. This updated bibliography contains 85 abstracts, 4 of which are new entries to the previous edition. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-28667# Defence Research Establishment Suffield, Ralston (Alberta).
DIE SWELL FOR NEWTONIAN FLUIDS
C. L. Chenier and G. A. Hill. May 1980. 28 p. refs.
(AD-A085199; DRES-TN-477) Avail: NTIS. HC A03/MF A01. CSCL 20/8
The swelling and shrinking of Newtonian jets issuing from circular orifices or slits has been examined. Equations predicting die swell ratio and downstream flow characteristics are developed. The scatter of experimental data has been studied and the factors contributing to this phenomenon are presented. The die swell ratios and jet shapes versus Reynolds numbers for Newtonian liquids are empirically shown. GRA

N80-28668# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
EXPERIMENTAL INVESTIGATION OF THREE-DIMENSIONAL SHOCK WAVE TURBULENT BOUNDARY LAYER INTERACTION: AN EXPLORATORY STUDY OF BLUNT FIN-INDUCED FLOWS Final Report, Jun. 1976 - Dec. 1979
David S. Dolling and Seymour M. Bogdonoff. Mar. 1980. 75 p. refs.
(Grants DAAG29-76-G-0269; DAAG29-78-G-0140)
(AD-A084768; MAE-1468; ARO-14026.2-EX) Avail: NTIS. HC A04/MF A01. CSCL 20/4
An experimental study of three dimensional (3 D) shock wave turbulent boundary layer interaction has been carried out. Interactions generated by fin models having sharp and hemi-cylindrically blunted leading edges have been studied. The emphasis in this particular study was twofold. First, the influence of incoming turbulent boundary layer thickness delta on the streamwise, spanwise and vertical scaling of the interaction was examined. Turbulent boundary layers varying in thickness from .127 cm (.05 in.) to 2.27 cm (0.89 in.) were used. In addition, a study has been conducted to examine the effects of the ratio D/delta (where D is the blunt fin leading edge diameter) on the interaction properties and scaling. Second, an investigation has been started to examine the unsteady shock wave-boundary layer structure and the resulting high frequency, large amplitude pressure fluctuations which occur ahead of and around the blunt fin leading edge. This is an area which in the past has been largely ignored, yet has important implications, since it is not clear that any mean surface property or flowfield measurements have any real physical significance. To date, measurement techniques and computer software have been developed and exploratory measurements made in the undisturbed turbulent boundary layer and also on the plane of symmetry ahead of the blunt fin. GRA

N80-28669# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYSIS OF THE FLOW INTERACTIONS BETWEEN LARGE WATER DROPLETS AND AIR IN DROPLET ACCELERATION NOZZLES Final Report, Oct. 1978 - Sep. 1979
P. A. Kessel. AEDC. May 1980. 46 p. refs.
(AD-A085114; AEDC-TR-79-97) Avail: NTIS. HC A03/MF A01. CSCL 20/4
The conditions under which large drops, on the order of

150 micron in diameter, are formed from high velocity liquid jets and their subsequent behavior in high velocity airstreams are discussed. The quasi-one dimensional equations for fully coupled two phase turbulent flow of a noncondensable gas with evaporating droplets in a convergent-divergent nozzle are formulated. Droplet performance predictions for the Dust Erosion Tunnel (DET) are reviewed in the light of existing two phase flow test data. Criteria for the aerodynamic design of a droplet acceleration nozzle that would inhibit droplet breakup are developed and used for studying the performance of a droplet acceleration nozzle in the AEDC High Enthalpy Arc Tunnel (HEAT) test facility (H-1) and the DET facility. The conclusion is that although acceleration of large drops without breakup is feasible, many problems will have to be solved to obtain high droplet velocities with large droplets. GRA

N80-28670# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A PRELIMINARY INVESTIGATION OF THE SINGULAR BEHAVIOR OF FLUIDS NEAR A SLIDING CORNER Final Report

Patrick J. Roache and Csaba K. Zoltani Mar. 1980 18 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A084983; AD-E430433; ARBRL-TR-02226) Avail: NTIS HC A02/MF A01 CSCL 20/4

This paper describes the application of a semidirect method to the calculation of the flow near a sliding corner. On a set of successively refined grids the Navier-Stokes equations modeling the steady state viscous, incompressible, low Reynolds number flow are solved in terms of the vorticity and stream function in Cartesian coordinates for a slab geometry. The calculated flow field allows preliminary estimates of the nature of the flow at the sliding corner. GRA

N80-28671# Pennsylvania State Univ., University Park. Applied Research Lab.

TRANSITION NOISE: THE ROLE OF FLUCTUATING DISPLACEMENT THICKNESS

G. C. Lauchle 27 Mar. 1980 39 p refs
(Contract N00024-79-C-6043)
(AD-A085103; ARL/PSU-TM-80-41) Avail: NTIS HC A03/MF A01 CSCL 20/4

The role of the fluctuating wall shear stress on the noise generated by incompressible boundary-layer transition was recently analyzed. The solutions of that analysis suggest that the shear stress mechanism generates hydrodynamic sound weakly in comparison say to the sound generated by a fully developed turbulent boundary layer flow. Because boundary-layer transition is a very unstable and non-steady flow, it is expected that other acoustic mechanisms exist. This paper examines one other; namely, that of the fluctuating boundary layer displacement thickness which is expected to occur as turbulent bursts are created and convected over the surface. The analysis shows that a weak monopole sound source occurs, and at low subsonic flow velocities, this source generates significant acoustic energy. Comparisons of the theoretical predictions with available experimental data support this conclusion. GRA

N80-28672# Pennsylvania State Univ., University Park. Applied Research Lab.

NONLINEAR ACOUSTIC WAVE INTERACTIONS IN LAYERED MEDIA M.S. Thesis

David Marvin Yeager 6 Mar. 1980 109 p refs
(Contract N00024-79-C-6043)
(AD-A085185; TM-80-32) Avail: NTIS HC A06/MF A01 CSCL 20/1

The conversion efficiency of parametric amplification in fluids is low because of the low dispersivity. A discontinuous change in phase velocity at the boundary of a waveguide introduces dispersion, which in turn affects conversion efficiency. It is the purpose of this thesis to develop from first principles an analytical model which may be used to numerically predict the conversion efficiency of a flat-plate, acoustic waveguide given the physical parameters of the system. In order to quantify weak, finite-amplitude interactions in the guide, the linear behavior of the system must first be analyzed. This is accomplished using Green's functions. Once the linear characteristics have been determined, nonlinear phenomena are investigated; both analytically and numerically via digital computer graphics. The physical parameters in the numerical examples were chosen to correspond with materials used in previously published experimental work using cylinders rather than flat plates. GRA

N80-28673# Air Force Academy, Colo. Research Lab.

AN INVESTIGATION OF UNSTEADY FLOW SEPARATION Final Report, Sep. 1975 - Sep. 1979

M. S. Francis, J. E. Keesee, J. P. Retelle, G. E. Sisson, and J. D. Lang Mar. 1980 91 p refs
(AF Proj. 2307)
(AD-A085083; SRL-TR-80-0009) Avail: NTIS HC A05/MF A01 CSCL 20/4

The results of experiments in which an unsteady flow was generated on the surface of an airfoil immersed in an incompressible freestream are discussed. Measurements of the velocity and vorticity fields and the surface pressure distribution generated by oscillations of a fence-type spoiler located on one surface of the airfoil has confirmed the presence of a dynamically evolving vortex-like structure bearing a close resemblance to the one encountered in classical dynamic stall. The growth and development of the shear layer region is characterized through iso-vorticity contour maps at select phase points during the motion cycle. A detailed description of flow field behavior is provided over a range of dimensionless spoiler frequencies and freestream Reynolds numbers. The correlation of these results with corresponding surface pressure measurements is also presented. GRA

N80-28674# California Univ., Livermore. Lawrence Livermore Lab.

FEM SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR VORTEX SHEDDING

Philip M. Gresho, Robert L. Lee, and Craig D. Upson Jan. 1980 18 p refs Presented at 3d Intern. Conf. on Finite Elements in Water Resources, Oxford, Miss., 19-23 May 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83925; CONF-800515-2) Avail: NTIS HC A02/MF A01

Results from three variations on a simple 4 node element (bilinear velocity and piecewise constant pressure) are compared with those from a higher order element (9 node biquadratic velocity and 4 node bilinear pressure) on the same problem and on the same grid. DOE

N80-28675# Battelle Pacific Northwest Labs., Richland, Wash.

VARIABLE THICKNESS TRANSIENT GROUND-WATER FLOW MODEL. VOLUME 3: PROGRAM LISTINGS

A. E. Reisenauer Dec. 1979 236 p
(Contract EY-76-C-06-1830)
(PNL-3160-3) Avail: NTIS HC A11/MF A01

The Assessment of Effectiveness of Geologic Isolation Systems (AEGIS) program is developing and applying the methodology for assessing the far-field, long term post closure safety of deep geologic nuclear waste repositories. AEGIS is being performed by Pacific Northwest Laboratory (PNL) under contract with the Office of Nuclear Waste Isolation (ONWI) for the Department of Energy (DOE). One task within AEGIS is the development of methodology for analysis of the consequences (water pathway) from loss of repository containment as defined by various release scenarios. Analysis of the long term, far-field consequences of release scenarios requires the application of numerical codes which simulate the hydrologic systems, model the transport of released radionuclides through the hydrologic systems to the biosphere, and, where applicable, assess the radiological dose to humans. Hydrologic and transport models are available at several levels of complexity or sophistication. Model selection and use are determined by the quantity and quality of input data. Model development under AEGIS and related programs provides three levels of hydrologic models, two levels of transport models, and one level of dose models (with several separate models). This is the third of 3 volumes of the description of the VTT (Variable Thickness Transient) Groundwater Hydrologic Model - second level (intermediate complexity) two dimensional saturated groundwater flow. DOE

N80-28676# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT AND UTILIZATION OF A TWO-DIMENSIONAL MODEL OF TRANSIENT FLUID FLOW IN A GENERIC REPOSITORY (OGRE)
John A. Korver 10 Oct. 1979 61 p refs
(Contract W-7405-eng-48)
(UCID-18650) Avail: NTIS HC A04/MF A01

An existing time-dependent numerical model (OGRE) has been modified to examine the time frames associated with repressuring the formation rocks surrounding a generic nuclear waste repository following the operational period when wastes are being stored. The model is two dimensional in the vertical plane, and assumes that the entire regime is saturated, but the repository is at one atmosphere during the operational period. For the physical and geometric parameters assumed, the results of a simulation of the time necessary to repressurize the formation after the operational period was 421.5 years. These results were in close agreement with a steady-state calculation performed by Golder Associates, Inc., in 1977. The fact that the time-dependent model results were close to the steady-state calculation resulted from the use (in the model) of a very small compressibility value, which caused the simulation to reach a steady-state condition in a relatively short time. Based on these studies, the magnitude of the system (water plus matrix) compressibility is of great importance in determining whether the time for repressurization can be determined from analytical methods or requires the use of a time-dependent numerical model. DOE

N80-28677# California Univ., Livermore. Lawrence Livermore Lab.
TWO-DIMENSIONAL GAS FLOW IN AN ELECTRODE ASSEMBLY
Gordon W. Hamilton and G. W. Willmann 8 Apr. 1980 25 p refs
(Contract W-7405-eng-48)
(UCID-18568) Avail: NTIS HC A02/MF A01

The interface between a source of positive or negative ions and a multichannel MEQALAC accelerator is the low energy beam transport (LEBT) consisting of a lattice of quadrupole focusing electrodes transporting the beam while the gas pressure is reduced from the high pressure ion source to the low pressure accelerator. Gas emitted from the ion source flows through the LEBT electrode lattice to a pumping volume. The two dimensional gas flow is analyzed to ascertain the gas densities throughout the LEBT and to design the system so that only a small fraction of the ion beam is lost by gas collisions. The analysis uses the fact that the gas flow rate is proportional to the density gradient if the mean free path of the low pressure gas is greater than the interelectrode spacing. The practical result is to determine the maximum width of the LEBT so that the beam loss by gas collisions is tolerable. The maximum width is a function of beam density, gas efficiency, and electrode spacing. The beam current per unit length of module will be somewhat greater than 75 mA/cm. Electrode dimensions should be chosen to fit the characteristics of the ion source. DOE

N80-28678# Beet Sugar Development Founuation, Fort Collins, Colo.
EVAPORATION BY MECHANICAL VAPOR RECOMPRESSION Technical Progress Report, 1 Jan. - Apr. 1980
Clair H. Iverson and Glenn E. Coury 1980 87 p refs
(Contract DE-AC03-79CS-40208)
(BSDF-38-2Q-80) Avail: NTIS HC A05/MF A01

Progress in the development of a study of the application of the technologies of mechanical vapor recompression and falling film evaporation as applied to the beet sugar industry is reported. Progress is reported in the following areas: technical literature search; report on visit to European factories using these technologies; energy balance studies of factories offered by the industry as candidates for the demonstration plants; and report on energy balance studies and the recommendations as to the site for the demonstration plant. DOE

N80-28679# Scientific Translation Service, Santa Barbara, Calif.
POSSIBILITIES FOR THE DETERMINATION OF THE HEAT TRANSFER PROCESS BETWEEN NUCLEAR FUEL RODS AND THE COOLING MEDIUM IN A SODIUM-COOLED REACTOR DURING OPERATION
F. Mitzel Aug. 1979 52 p refs Transl. into ENGLISH of "Moglichkeiten zur Bestimmung des Warmeuberganges zwischen nuklearen Brennstaben und dem Kuhlmittel ineinem natriumgekuhlten Reaktor wahrend des Betriebes", rept. KFK 2619, Inst. fur Neutronenphysik und Reaktortechnik, Karlsruhe, W. Germany, Jun. 1978 45 p. Sponsored by DOE
(DOE-tr-142; KFK-2619) Avail: NTIS HC A03/MF A01

In order to improve the safety, the surveillance, and economy of sodium cooled reactors it is desirable to obtain a more precise knowledge of the heat transfer between the fuel and the coolant. Different possibilities were investigated to determine the corresponding heat transfer coefficient by measuring the pertinent transfer functions. The result was the following: the heat transfer coefficient can be determined with reasonable accuracy at the KNK 11 and the SNR by means of small pseudo-stochastic power oscillations. These power oscillations must be artificially induced but do not require an interruption of the normal plant operation. DOE

N80-28680# National Technical Information Service, Springfield, Va.
HEAT PIPES. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Mar. 1979
William E. Reed Apr. 1980 254 p
(PB80-809940) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Theory, design, fabrication, testing, and operation of heat pipes are presented in these Federally-sponsored research reports. Applications are described in the areas of heating and air conditioning, power generation, electronics cooling, spacecraft, nuclear reactors, cooling engines, and thermodynamics. This updated bibliography contains 247 abstracts, none of which are new entries to the previous edition. GRA

N80-28681# National Technical Information Service, Springfield, Va.
HEAT PIPES. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1979 - Apr. 1980
William E. Reed Apr. 1980 77 p Supersedes NTIS/PS-79/0298; NTIS/PS-78/0302
(PB80-809957; NTIS/PS-79/0298; NTIS/PS-78/0302) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Theory, design, fabrication, testing, and operation of heat pipes are presented in these Federally sponsored research reports. Applications are described in the areas of heating and air conditioning, power generation, electronics cooling, spacecraft, nuclear reactors, cooling engines, and thermodynamics. This updated bibliography contains 70 abstracts, all of which are new entries to the previous edition. GRA

N80-28682# National Technical Information Service, Springfield, Va.
HEAT PIPES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1977 - Mar. 1979
William E. Reed Apr. 1980 215 p
(PB80-809965) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Research reports covering the thermodynamics, design, fabrication, and applications of heat pipes are cited from worldwide literature. Applications are described in the areas of electronics cooling, spacecraft thermal control, heat exchangers, heating and refrigeration, and waste heat utilization. This updated bibliography contains 208 abstracts, none of which are new entries to the previous edition. GRA

N80-28683# National Technical Information Service, Springfield, Va.
HEAT PIPES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1979 - Mar. 1980
William E. Reed Apr. 1980 132 p Supersedes NTIS/PS/0299; NTIS/PS-78/0304
(PB80-809973; NTIS/PS-79/0299; NTIS/PS-78/0304) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Research reports covering the thermodynamics, design, fabrication, and applications of heat pipes are cited from worldwide literature. Applications are described in the areas of electronics cooling, spacecraft thermal control, heat exchangers, heating and

refrigeration, and waste heat utilization. This updated bibliography contains 125 abstracts, all of which are new entries to the previous edition. GRA

N80-28684# National Technical Information Service, Springfield, Va.
CAVITY FLOW. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1971 - Mar. 1980
Guy E. Habercom, Jr. May 1980 267 p Supersedes NTIS/PS-79/0259; NTIS/PS-78/0188
(PB80-810146; NTIS/PS-79-0259; NTIS/PS-78/0188) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Reports are cited on shallow and deep configurations, holes, cutouts, hollows, notches, gaps, orifices, flaps, and steps. Applications include bomb bays, aerodynamic windows, microwave cavitites, resonators, diffusers, laser cavities, and jets. This updated bibliography contains 260 abstracts, 29 of which are new entries to the previous edition. GRA

N80-28685# National Technical Information Service, Springfield, Va.
FLOW VISUALIZATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1977 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 208 p Supersedes NTIS/PS-79/0480; NTIS/PS-78/0426
(PB80-809577; NTIS/PS-79/0480; NTIS/PS-78/0426) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Major studies concerning flow visualization for wind tunnel, water tunnel, and shock tube testing are cited. The visualization methods described include the use of smoke, water vapor, dyes, oils, bubbles, phase change paints, and particles. While many of these studies cover flow visualization techniques for specific applications, they are included because of their applicability to various research problems. This updated bibliography contains 202 abstracts, 63 of which are new entries to the previous edition. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-28686* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DUAL ACTING SLIT CONTROL MECHANISM Patent
Gustav L. Struthoff, inventor (to NASA) (Rensselaer Polytechnic Inst.) Issued 15 Jul. 1980 4 p Filed 8 Sep. 1978 Supersedes N78-32399 (16 - 23, p 3081) Sponsored by NASA
(NASA-Case-LAR-11370-1; US-Patent-4,213,051; US-Patent-Appl-SN-940689; US-Patent-Class-250-457; US-Patent-Class-250-491; US-Patent-Class-250-513) Avail: US Patent and Trademark Office CSCL 14B

A dual acting control system for mass spectrometers is described, which permits adjustment of the collimating slit width and centering of the collimating slit while using only one vacuum penetration. Coaxial shafts, each with independent vacuum bellows are used to independently move the entire collimating assembly or to adjust the slit dimension through a parallelogram linkage.
Official Gazette of the U.S. Patent and Trademark Office

N80-28687* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VISIBLE AND INFRARED POLARIZATION RATIO SPECTROREFLECTOMETER Patent
Carmen E. Batten, inventor (to NASA) Issued 1 Jul. 1980 11 p Filed 28 Jul. 1978 Spersedes N78-32398 (16 - 24, p 3179)
(NASA-Case-LAR-12285-1; US-Patent-4,210,401; US-Patent-Appl-SN-929087; US-Patent-Class-356-369; US-Patent-Class-356-244) Avail: US Patent and Trademark Office CSCL 14B

The instrument assists in determining the refractive index and absorption index, at different spectral frequencies, of a solid sample by illuminating the sample at various angles in incidence and measuring the corresponding reflected intensities at various spectral frequencies and polarization angles. The ratio of the intensity of the reflected light for parallel polarized light to that for perpendicular polarized light at two different angles of incidence can be used to determine the optical constants of the sample. The invention involves an apparatus for facilitating the utilization of a wide variety of angles of incidence. The light source and polarizing element are positioned on an outer platform; the sample is positioned on an inner platform. The two platforms rotate about a common axis and cooperate in their rotation such that the sample is rotated one degree for every two degrees of rotation of the light source. This maintains the impingement of the reflected light upon the detector for any angle of incidence without moving or adjusting the detector which allows a continuous change in the angle of incidence.
Official Gazette of the U.S. Patent and Trademark Office

N80-28688 Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
DEVELOPMENT OF AN ELECTROMAGNETIC PARTICLE ACCELERATOR [ENTWICKLUNG EINES ELEKTROMAGNETISCHEN TEILCHENBESCHLEUNIGERS]
P. Lell and H. Kuczera Jun. 1978 16 p refs In GERMAN (TUM-RT-KB-78/2) Avail: Issuing Activity

The electromagnetic accelerator works for the speeds up to several hundred. With the aid of a driver, particles in the range of 10 to the minus 6th power were accelerated up to few millimeters. The tests show high accuracy and reliability. This accelerator can work in high vacuum (free of impurities) because it does not need a gaseous medium for the transfer of the energy to the particle. Automation of the driver and of the particle transport is possible, and a computer simulation is described.
Author (ESA)

N80-28689*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
PROCUREMENT SPECIFICATION COLOR GRAPHIC CAMERA SYSTEM
G. E. Prow Jun. 1980 12 p
(Contract NAS9-15800)
(NASA-CR-160763; JSC-16738; LEMSCO-15122) Avail: NTIS HC A02/MF A01 CSCL 14E

The performance and design requirements for a Color Graphic Camera System are presented. The system is a functional part of the Earth Observation Department Laboratory System (EODLS) and will be interfaced with Image Analysis Stations. It will convert the output of a raster scan computer color terminal into permanent, high resolution photographic prints and transparencies. Images usually displayed will be remotely sensed LANDSAT imager scenes. L.F.M.

N80-28690*# Utah Univ., Salt Lake City. Geospace Sciences Lab.
FIBER RING OPTICAL GYROSCOPE (FROG) Final Report
31 Dec. 1979 62 p refs
(Contracts NAS7-100; JPL-954936)
(NASA-CR-163387; Publ-79-014) Avail: NTIS HC A04/MF A01 CSCL 14B

The design, construction, and testing of a one meter diameter fiber ring optical gyro, using 1.57 kilometers of single mode fiber, are described. The various noise components: electronic, thermal, mechanical, and optical, were evaluated. Both dc and ac methods were used. An attempt was made to measure the Earth rotation rate; however, the results were questionable because of the optical and electronic noise present. It was concluded that fiber ring optical gyroscopes using all discrete components have many serious problems that can only be overcome by discarding the discrete approach and adapting an all integrated optic technique that has the laser source, modulator, detector, beamsplitters, and bias element on a single chip. L.F.M.

N80-28691# Pacific Missile Test Center, Point Mugu, Calif. Weapons Instrumentation Div.

UNRECORDED WIDEBAND INSTRUMENTATION REFERENCE TAPE FEASIBILITY STUDY: FREQUENCY RESPONSE RESULTS
D. R. Hust 26 Mar. 1980 68 p
(W06040000)
(AD-A084102; PMTC-TP-80-05) Avail: NTIS
HC A04/MF A01 CSCL 14/3

An investigation was conducted to determine signal response variations when a variety of wideband instrumentation magnetic tapes is used on a cross section of recorder/reproducer systems. Data for the investigation were collected by transmitting a set of eight sample test tapes to participating data recording/reproducing facilities for the purpose of making data measurements. Data collected represent measurements made with 16 different recorder/reproducer systems at 11 different testing facilities located throughout the United States. The data-collection process involved approximately 2 years of testing. The originating/coordinating facility was the Pacific Missile Test Center, Point Mugu, California. The test results indicated the following: all of the sample test tapes exhibited bidirectional performance within the limits of measurement repeatability; overall system stability was better at the low-band regions than in the upper-band regions, and the overall relative frequency response of the sample test tapes did not change appreciably during the 2 year investigative period. The most significant result of the test measurements is that at least 90% of the frequency response values were within + or - 2.0 dB at all frequencies. Machine stability factors such as azimuth, equalizer, and gain changes had more effect on data variability than did magnetic tape or tape speed. The use of a reference tape system is recommended as a method to assure that relative frequency response variations will be less than or equal to + or - 2.0 dB. GRA

N80-28692# ARO, Inc., Arnold Air Force Station, Tenn.
ELECTRO-OPTICAL PRESSURE-MEASUREMENT TECHNIQUES Final Report, 1 Oct. 1978 - 30 Sep. 1979
H. T. Bentley, III and P. J. Murphy AEDC May 1980 40 p refs
(AD-A084697; AEDC-TR-79-92) Avail: NTIS
HC A03/MF A01 CSCL 14/2

An investigation of the potential application of electrooptical techniques for the measurement of surface pressure distributions was conducted, and several candidate methods were reviewed. The most promising technique utilizes the optical and mechanical properties of a reflective circular membrane. The characteristics of an ideal membrane are analyzed with respect to membrane tension, static pressure, and dynamic membrance response. GRA

N80-28693# Accumetrics Corp., Cambridge, Mass.
APPLIED RESEARCH AND DEVELOPMENT OF TRIAXIAL PIEZOELECTRIC (PZL) ACCELEROMETER SYSTEMS OF IMPROVED DESIGN Final Report, Mar. 1977 - Jun. 1979
Donald H. Fryklund Hanscom AFB, Mass. AFGL Jun. 1979
41 p
(Contract F19628-77-C-0163)
(AD-A084762; AFGL-TR-79-0101) Avail: NTIS
HC A03/MF A01 CSCL 14/2

Refinements in the accelerometer system used in the falling-sphere atmospheric density measuring system have been implemented. These include a redesigned Z-axis amplifier chain, range scale changes in the X and y axis amplifier outputs to provide overlap, and a new temperature monitor circuit. The squib initiation circuit and squib holder bushing has been redesigned for greater reliability. Calibration has been improved by the use of a specially-designed function generator. Five systems were fabricated. Three systems were flown at Kwajalein, M.I. and Red Lake, Canada. GRA

N80-28694# Environmental Research Inst. of Michigan, Ann Arbor. Radar and Optics Div.
COMPUTER GENERATED HOLOGRAPHIC OPTICS Final Report, 1 Apr. 1977 - 31 Mar. 1980
James R. Fienup May 1980 24 p refs
(Contract DAAG29-77-C-0017)
(AD-A085219; ERIM-128600-12-F; ARO-14582.2-EL) Avail: NTIS HC A02/MF A01 CSCL 20/6

The goal of this research was to theoretically and experimentally investigate the use of computer-generated holograms in the design and fabrication of holographic optical elements (holographic lenses or diffraction optics). Conventional design of holographic lenses had previously been limited to spherical recording beams, and more recently to recording beams formed by conventional optical systems. The utilization of computer-generated holograms in the recording beams allows a completely arbitrary specification of the recording wavefronts in the hologram plane, making possible a hologram lens of higher performance (lower aberrations) than previously possible. We refer to an interferometrically recorded hologram lens having a computer-generated hologram in a recording beam as a computer-originated holographic lens. We studied the basic limitations of computer-generated holograms, and integrated the analysis of computer-generated holograms and computer-originated holographic optical elements into ERIM:s holographic optical analysis and design (HOAD) ray-tracing computer program. In addition, we designed, fabricated, and tested an optical system using a computer-generated hologram and a computer-originated holographic lens. GRA

N80-28695# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
THE CALIBRATION OF SOLAR RADIATION MEASURING INSTRUMENTS Final Report
Raymond J. Bahn and John C. Nakos Nov. 1979 237 p refs
(Contract EM-78-S-04-5336)
(ALO-5336-T1) Avail: NTIS HC A11/MF A01

A review of solar radiation measurement of instruments and some types of errors is given; and procedures for calibrating solar radiation measuring instruments are detailed. An appendix contains a description of various agencies who perform calibration of solar instruments and a description of the methods they used at the time this report was prepared. DOE

N80-28696# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. Loft Experimental Measurements Branch.
EVALUATION OF INSTALLED INSTRUMENTATION FOR LIQUID LEVEL MEASUREMENTS
J. P. Adams, V. E. Flitton, and L. D. Goodrich 20 Dec. 1979
53 p refs
(Contract EY-76-C-07-1570)
(EGG/LTR-LO-87-79-128; USNRC-P-394) Avail: NTIS
HC A04/MF A01

An evaluation is presented of the capability of several installed LOFT instruments to measure liquid level. This evaluation was accomplished by comparing thermocouples, neutron detectors, and differential pressure transducers with the LOFT liquid level transducers. A brief discussion of a heated differential thermocouple liquid level transducer is also presented. DOE

N80-28697# National Physical Lab., Teddington (England). Div. of Electrical Science.
A SLOW SCAN INTERFEROMETER FOR THE MIDDLE INFRARED REGION 4000-400 cm-1
J. W. Fleming and J. H. King Aug. 1979 25 p refs
(NPL-DES-56) Avail: NTIS HC A02/MF A01

The development of a slow scan mid-IR interferometric spectrometer covering the region .00025 to .0015 cm is described. Presently, the system has demonstrated a resolution of 1 cm, but it is hoped to improve this by a factor of 10 at a later stage. Factors limiting the performance of the spectrometer are analyzed, and the next stages required to improve resolution and performance are discussed. Author (ESA)

N80-28698# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
DEVELOPMENT OF AN ELECTROMAGNETIC ACCELERATOR
P. Lell, H. Kuczera, and E. Igenbergs Aug. 1978 14 p refs
(TUM-LRT-KB-78/6) Avail: NTIS HC A02/MF A01

A hypervelocity launcher is described which can accelerate projectiles with diameters between 0.1 and 1 mm to velocities in the range of 20 km/s. This launcher was developed to simulate micrometeorid impact; and consists of a coaxial accelerator and a compressor coil. The positive side of a capacitor bank is connected to the center electrode, which is separated by an insulating plug from the annular electrode. After the discharge switch is activated, an aluminium foil evaporates and generates

an aluminium plasma. The discharge current density from the center electrode to the annular electrode interacts with the azimuthal magnetic field around the center electrode and accelerates the plasma axially. After the plasma has entered the compressor coil, a discharge between the center electrode tip and the compressor coil builds up. The current in the compressor coil generates a magnetic field, which interacts with the plasma flow. This results in a compression and an axial acceleration of the plasma in the compressor coil. Author (ESA)

N80-28699# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
CRYOGENIC SYSTEM OF THE 390 kg GRAVITATIONAL DETECTOR
U. Giovanardi, V. Iafolla, I. Modena (Rome Univ.), P. Napoleoni, B. Pavan, F. Ricci (Rome Univ.), and S. Ugazio. Jul. 1979. 15 p. refs.
(LPS-79-6) Avail: NTIS HC A02/MF A01
The basic operating principles of a Weber type gravitational antenna are briefly described, along with the problems of developing a continuously operating cryogenic cooling system. The aluminum bar antenna with a piezoelectric ceramic transducer are maintained at liquid helium temperature. Author (ESA)

N80-28700# National Technical Information Service, Springfield, Va.
SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY: FLOW VISUALIZATION AND MEASUREMENT. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980. 251 p. Supersedes NTIS/PS-79/0503; NTIS/PS-78/0412.
(PB80-809783; NTIS/PS-79/0503; NTIS/PS-78/0412) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E
Worldwide engineering research of Schlieren and shadowgraph photography techniques for flow measurement and visualization is presented. Included are studies on flames, combustion, and aerodynamic configurations. This updated bibliography contains 244 abstracts, 23 of which are new entries to the previous edition. GRA

N80-28701# National Technical Information Service, Springfield, Va.
SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY: GENERAL STUDIES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980. 150 p. Supersedes NTIS/PS-79/0505; NTIS/PS-78/0413.
(PB80-809791; NTIS/PS-79-0505; NTIS/PS-78/0413) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E
Aspects of Schlieren and shadowgraph photography are covered in this bibliography of worldwide engineering research. Techniques, equipment, and applications are reviewed for studying shock waves, combustion, acoustic waves, ballistics, and heat flow. This updated bibliography contains 143 abstracts, 24 of which are new entries to the previous edition. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-28702# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
CHEMICAL LASER SYSTEMS. Final Report, 1 Apr. 1977 - 31 Mar. 1979
Terrill A. Cool. 31 Mar. 1979. 106 p. refs. Submitted for publication.
(Grant AF-AFOSR-3258-77; AF Proj. 2303)
(AD-A085264; AFOSR-80-0423TR) Avail: NTIS HC A06/MF A01 CSCL 20/5
The major effort undertaken was a thorough spectroscopic study of the products of reactions of yttrium and scandium atoms with halogen molecules. These studies have shown that chemiluminescence for these reaction systems does not originate from electronically excited monohalide molecules as suggested by previous investigators, but instead arises from electronically excited metal dihalide molecules, $MX2^*$. Excitation spectra from the monohalides of yttrium and scandium were recorded with the laser-induced fluorescence method. Spectroscopic constants and radiative lifetimes were determined for several previously unobserved electronic states. An evaluation of the chemiluminescence from chemical reactions initiated in PH3/N2O mixtures was performed. GRA

N80-28703# Naval Postgraduate School, Monterey, Calif.
A MODEL FOR LASER PRODUCED MATERIALS SURFACE EVAPORATION M.S. Thesis
Geoffrey Lance Travers. Mar. 1980. 73 p. refs.
(AD-A084903) Avail: NTIS HC A04/MF A01 CSCL 20/5
This study is to assess the feasibility of using a laser's radiation to remove masses on the order of milligrams from a target surface and to form a vapor jet which could then serve as the conducting channel in a giant power pulse discharge. A model based on an energy balance is presented which predicts the mass removed and the pressure, density and temperature of the material as it propagates from the target surface as functions of the pulse time and the absorbed power density. Combinations of laser pulse time and power density are considered for which the surface temperature remains low enough in order to avoid cut-off by a plasma plume in front of the target surface. A model of adiabatic jet expansion is presented to predict the radial expansion of the vapor plume as it propagates in the axial direction. Temperature, pressure and density are predicted after radial expansion using the model of adiabatic jet expansion. These models predict, theoretically, that the desired masses and limits on vapor plume expansion can be achieved using relatively low power densities for the proposed experiment. GRA

N80-28704# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
AERO-OPTICS AT SHORTER WAVELENGTHS Progress Report, Dec. 1979 - Mar. 1980
Allen E. Fuhs. Mar. 1980. 30 p. refs. Presented at the Flow Control Workshop, Kirtland AFB, N. Mex., 10-12 Mar. 1980.
(Contract AFOSR MIPR-80-MP-084)
(AD-A085104; NPS67-80-003) Avail: NTIS HC A03/MF A01 CSCL 20/5
Using the optical system equation, the impact of a change in wavelength is determined. The rms phase variation at output aperture is critical and must be reduced by an amount equivalent to reduction in wavelength. If turret size is scaled with wavelength, the distortion due to the inviscid flow remains constant. Decreased wavelength offers the flexibility of greatly reduced turret weight, volume, and aerodynamic drag. Multiple turrets become feasible on an aircraft. The distortion due to the turbulent boundary layer becomes magnified by reduction of wavelength, however, if the turbulent boundary layer originates on the turret and if the turret is scaled, the boundary layer thickness decreases. Distortion becomes less significant in this case. GRA

N80-28705# University of Southern California, Los Angeles. Dept. of Chemistry.
THE CASE OF TWO REACTIVE AND INTERCOMMUNICATING EXCITED STATES
Arthur W. Adamson, Robert C. Kukuda, and R. Tom Walters. May 1980. 27 p. refs.
(Contract N00014-76-C-0548)
(AD-A084978; TR-11) Avail: NTIS HC A03/MF A01 CSCL 07/4
The exact kinetics of a pulsed laser experiment producing two potentially reactive and potentially intercommunicative states is examined in detail, with special reference to aqueous Cr(en) sub 3(3-). The various possible regimes of rate constant values in all cases but one lead to physically questionable absolute values. The acceptable regime is that in which the first doublet thexi state is directly chemically reactive. A challenge to the reading of earlier results on the monitoring of the rate of appearance of the primary photoproduct is discussed, and dismissed. GRA

N80-28706# Oak Ridge National Lab., Tenn. Solid State Div.

MELTING BY PULSED LASER IRRADIATION
J. Narayan and C. W. White. 1979. 5 p. refs. Presented at Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 26 Nov. 1979.
(Contract W-7405-eng-26)
(CONF-791112-59) Avail: NTIS. HC A02/MF A01

The phenomenon of melting produced by pulsed ruby laser gamma = 0.694 micro m) irradiation was investigated. Removal of dopant precipitates, dislocations and loops during laser irradiation provided clear evidence of melting. The depth of melting was determined as a function of laser parameters (energy density and pulse duration) from the thickness of defect free regions and lengths of reoriented dislocation segments. DOE

N80-28707# Oak Ridge National Lab., Tenn. Solid State Div.
MACROSCOPIC THEORY OF PULSED LASER ANNEALING
R. F. Wood, J. C. Wang, G. E. Giles, and J. R. Kirkpatrick. Dec. 1979. 19 p. refs. Submitted for publication.
(Contract W-7405-eng-26)
(CONF-791112-54) Avail: NTIS. HC A02/MF A01

Radiation from high-power Q-switched lasers was used to anneal the lattice damage caused by ion implantation, diffuse surface deposited dopant films, recrystallized doped amorphous films deposited on substrates, and remove precipitates present after conventional high temperature dopant diffusion. All of these processes were studied in terms of models based on macroscopic diffusion equations for heat and mass transport, cast in a finite difference form to allow for the temperature and spatial dependence of the thermal conductivity, absorption coefficient, reflectivity, and other quantities. Results of calculations on silicon with the models show that the near surface region of a sample can melt and stay molten for times of the order of 100 nsec during which dopant diffusion in the liquid state and nonequilibrium segregation during ultrarapid recrystallization are sufficient to explain the major features of the experimental results. DOE

N80-28708# KMS Fusion, Inc., Ann Arbor, Mich.
ENGINEERING ASPECTS OF CRYOGENIC LASER-FUSION TARGETS
D. Musiniski, T. M. Henderson, R. J. Simms, T. R. Pattinson, and R. B. Jacobs (Jacobs (R. B.) Associates, Inc., Boulder, Colo.) 6 Jun. 1979. 33 p. refs. Presented at Cryog. Eng. Conf., Madison, Wis., 21 Aug. 1979. Submitted for publication.
(Contracts DE-AC08-78DP-40030; ES-77-C-02-4149; EY-76-C-02-2709; ED-78-C-08-1598)
(KMSF-U-907; CONF-790815-36) Avail: NTIS. HC A03/MF A01

Most current laser-fusion targets consist of hollow spherical glass shells which have been filled with a mixture of gaseous deuterium-tritium fuel. Theoretical considerations suggest that optimum yields can be obtained from these targets if the fuel is condensed as a uniform liquid or solid layer on the inner surface of the glass shell at the time it is irradiated. In principle, this can be accomplished in a straightforward way by cooling the target below the condensation or freezing point of the fuel. In practice, cryogenic targets can appear in routine laser experiments only when the necessary cryogenic technology is reliably integrated into experimental target chambers. Significant progress was made recently in this field. The scientific basis and the various engineering features of a system which has allowed the successful irradiation of uniform solid-fuel-layer targets are discussed. DOE

N80-28709# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
LASER TRIGGERED SPARK GAP USING FIBER OPTIC TRANSMISSION
H. C. Harjes. 12 Dec. 1979. 79 p. refs.
(Contract W-7405-eng-48)
(UCRL-15202; SR-1) Avail: NTIS. HC A05/MF A01

The use of an optical fiber in a laser triggering system is described. The fiber transmits a high power ruby laser pulse which triggers a high voltage spark gap. The spark gap is a gas switch on a water dielectric Blumlein generator which is pulse charged by a three stage Marx bank. Typical operating parameters for the spark gap are: 2 cm gap, 2700 Torr pressure, Ar-N2 gas mixture, and a charging voltage of 200 kV. The single strand, 1 mm, quartz, optical fiber is selected specifically for high power transmission capability. Laser pulses of 4 MW are coupled into and transmitted by the fiber with no observed damage. The overall optical system transmission efficiency is 62%. The triggering performance of the system is excellent in that switching delays of less than 10 ns and subnanosecond jitters are measured. DOE

N80-28710# Naval Weapons Center, China Lake, Calif.
CO2-LASER POLISHING OF FUSED SILICA SURFACES FOR INCREASED LASER DAMAGE RESISTANCE AT 1.06 MICRONS
P. A. Temple, David Milam (California Univ., Lawrence Livermore Labs., Livermore), and W. Howard Lowdermilk (California Univ., Lawrence Livermore Labs., Livermore). 3 Apr. 1980. 9 p. refs. Presented at the Boulder Damage Conf., Boulder, Colo., 30 Oct. 1979.
(Contract W-7405-eng-48)
(UCRL-84247; CONF-7910130-2) Avail: NTIS. HC A02/MF A01

Bare fused silica surfaces were prepared by subjecting the mechanically polished surface to a rastered CW CO2 laser beam. Analysis shows that this processing causes: (1) removal of a uniform layer of fused silica; and (2) a probable refusing or healing of existing subsurface fractures. The fused silica removal rate is found to be a function of the laser intensity and scan rate. These surfaces are seen to have very low scatter and to be very smooth. In addition, they exhibited entrance surface damage thresholds at 1.06 microns and 1 nsec, which are substantially above those seen on the mechanically polished surface. When damage does occur, it tends to be at a few isolated points rather than the general uniform damage seen on the mechanically polished part. In addition to the damage results, an observational technique used for viewing these surfaces is discussed which employs dark field illumination. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-28711* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CIRCUMFERENTIAL SHAFT SEAL. Patent
Lawrence P. Ludwig, inventor (to NASA). Issued 15 Jul. 1980. 4 p. Filed 31 Mar. 1976. Supersedes N76-20488 (14-11, p. 1394).
(NASA-Case-LEW-12119-1; US-Patent-4,212,477; US-Patent-Appl-SN-672219; US-Patent-Class-277-193; US-Patent-Class-277-153; US-Patent-Class-277-224) Avail: US Patent and Trademark Office. CSCL 11A

A circumferential shaft seal is described which comprises two sealing rings held to a rotating shaft by means of a surrounding elastomeric band. The rings are segmented and are of a rigid sealing material such as carbon or a polyimide and graphite fiber composite.

Official Gazette of the U.S. Patent and Trademark Office

N80-28712 Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Energitique.
EXTENSION OF THE OPERATING RANGE OF A HIGH COMPRESSION RATIO CENTRIFUGAL COMPRESSOR Final Report [ELARGISSEMENT DU DOMAINE DE FONCTIONNEMENT D'UN COMPRESSEUR CENTRIFUGE A TAUX DE COMPRESSION ELEVE]
Yves Ribaud. Aug. 1979. 76 p. refs. In FRENCH.
(Contract DGRST-76-7-0590)
Avail: Issuing Activity

The performance and behavior of a heavy gas compressor of simple technological design were investigated. An existing compressor with a compression ratio of 8 was converted into a compressor with an extended operating range with a compression ratio of 4. It was not possible to significantly improve the performance of the compressor. Basic calculations are given for the development of a compressor capable of fulfilling the required

objectives (wide operating range, high performance).
Author (ESA)

N80-28713*# Boeing Aerospace Co., Seattle, Wash.
CABLES AND CONNECTORS FOR LARGE SPACE SYSTEM TECHNOLOGY (LSST) Final Report
W. G. Dunbar Apr. 1980 104 p refs
(Contract NAS8-33432)
(NASA-CR-161423) Avail: NTIS HC A06/MF A01 CSCL 13E

The effect of the environment and extravehicular activity/remote assembly operations on the cables and connectors for spacecraft with metallic and/or nonmetallic structures was examined. Cable and connector philosophy was outlined for the elctrical systems and electronic compartments which contain high-voltage, high-power electrical and electronic equipment. The influence of plasma and particulates on the system is analyzed and the effect of static buildup on the spacecraft electrical system discussed. Conceptual cable and connector designs are assessed for capability to withstand high current and high voltage without danger of arcs and electromagnetic interference. The extravehicular activites required of the space station and/or supply spacecraft crew members to join and inspect the electrical system, using manual or remote assembly construction are also considered.
A.R.H.

N80-28714*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF SUPPLY CONDITIONS ON FILM THICKNESS IN LUBRICATED HERTZIAN CONTACTS
G. Dalmaz and M. Godet May 1980 27 p refs Transl. into ENGLISH from Mec. Materiaux Elec. (France), no. 296-297, Aug. - Sep. 1974 p 25-34 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by National Inst. for Applied Sciences, Lyon
(Contract NASw-3198)
(NASA-TM-75782) Avail: NTIS HC A03/MF A01 CSCL 13I

A generalization of the hydrodynamic expression for Hertzian contacts is described and various methods for calculating the thickness of the oil film winter steady-state, isothermal conditions are given. This is important for engineering applications such as gears and bearings because these results are closer to real operating conditions. Theories of lubrication are discussed, and the mathematics involved are presented using approximately 30 equations and 13 figures. For lubricated, linear, elliptical or point Hertzian contacts it is demonstrated how to calculate the thickness of the oil film at the center of the contact for steady-state isothermal conditions.
L.F.M.

N80-28715*# Stanford Univ., Calif. High-Energy Physics Lab.
SUPERCONDUCTING BEARINGS FOR APPLICATION IN CRYOGENIC EXPERIMENTS IN SPACE Final Report
C. W. F. Everitt and Paul W. Worden, Jr. Jun. 1980 65 p refs
(Contract NAS8-32605)
(NASA-CR-161526) Avail: NTIS HC A04/MF A01 CSCL 13I

Linear superconducting magnetic bearings suitable for use in a proposed orbital equivalence principle experiment and for general application in space were developed and tested. Current flows in opposite directions in adjacent superconducting wires arranged parallel to the axis of a cylinger. This configuration provides maximum stiffness radially while allowing the test mass to move freely along the cylinder axis. In a space application, the wires are extended to cover the entire perimeter of the cylinder; for the earth-based tests it was desirable to use only the bottom half. Control of the axial position of the test mass is by small control coils which may be positioned inside or outside the main bearing. The design is suitable for application to other geometries where maximum stiffness is desired. A working model scaled to operate in a 1-g environment was perfected approximate solutions for the bearings were developed. A superconducting transformer method of charging the magnets for the bearing, and a position detector based on a SQUID magnetometer and associated superconducting circuit were also investigated.
A.R.H.

N80-28716*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
KINEMATIC CORRECTION FOR ROLLER SKEWING
Michael Savage (Akron Univ.) and Stuart H. Loewenthal Oct. 1980 46 p refs Proposed for presentation at 16th Bien. Mech. Conf., Beverly Hills, Calif., 29 Sep. - 1 Oct. 1980; sponsored by ASME
(NASA-TM-81564; E-526) Avail: NTIS HC A03/MF A01 CSCL 13I

A theory of kinematic stabilization of rolling cylinders is developed for high-speed cylindrical roller bearings. This stabilization requires race and roller crowning to product changes in the rolling geometry as the roller shifts axially. These changes put a reverse skew in the rolling elements by changing the rolling taper. Twelve basic possible bearing modifications are identified in this paper. Four have single transverse convex curvature in the rollers while eight have rollers with compound transverse curvature composed of a central cylindrical band of constant radius surrounded by symmetric bands with both slope and transverse curvature.
Author

N80-28717*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
SURFACE TEMPERATURES AND GLASSY STATE INVESTIGATIONS IN TRIBOLOGY Annual Report
Scott Bair and Ward O. Winer Jul. 1980 125 p refs
(Grant NsG-3106)
(NASA-CR-163389) Avail: NTIS HC A06/MF A01 CSCL 20K

Measurements were made of the limiting shear stress for two naphthenic oils of differing molecular weight and three blends of the lower molecular weight oil and polymers of differing molecular weight. All reached the same limiting shear stress for the same temperature and pressure; although the polymer solutions reduced the limiting shear stress by about fifteen percent. A falling body viscometer was constructed to operate to 230 C and to 0.6 GPa and another was constructed to extend the pressure range to 1.1 GPa. A concentrated contact simulator was developed which allows recording of the traction force while the slide-roll ratio is continuously varied and the rolling speed is maintained essentially constant. Measurement of lubricant minimum film thickness of elliptical EHD contacts of various aspect ratios were made by optical interferometry. The experimental data were thirty percent greater than that predicted by the Hamrock and Dowson model. Preliminary development of the application of a scanning infrared radiation system to a tribological system was completed.
L.F.M.

N80-28718# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Materials Integrity Branch.
THE EVALUATION OF SOME THREADED INSERTS Final Report, Jan. 1975 - Mar. 1978
Alton W. Brisbane Oct. 1979 175 p refs
(AF Proj. 2418)
(AD-A085070; AFML-TR-78-107) Avail: NTIS HC A08/MF A01 CSCL 13/5

This report presents: (1) fatigue data for 7075-T73 aluminum alloy plate containing threaded inserts; (2) the results of tests for determining the tensile load required to pull threaded insert out of the parent material; (3) the torque required to lock and unlock a bolt threaded into the insert; and (4) the susceptibility of the insert to corrosion when threaded into the parent material and exposed to a corrosive media. The types of threaded inserts evaluated consisted of solid wall bushings, helical coils, and the solid wall self-tapping bushings.
GRA

N80-28719# Northrop Corp., Des Plaines, Ill. Defense Systems Div.
METAL-CERAMIC SEALS Final Technical Report, 15 Feb. 1978 - 15 Jun. 1979
Yeldez Amer and Gunther Dohler Wright-Patterson AFB, Ohio AFAL Oct. 1979 124 p refs
(Contract F33616-78-C-1405; AF Proj. 2002)
(AD-A084860; AFAL-TR-79-1106) Avail: NTIS HC A06/MF A01 CSCL 11/2

This program describes the results obtained during a one year study program on high power microwave and millimeter wave windows. The objective of this program was to investigate

the applicability of a new ceramic metalization process to the fabrication of waveguide windows. The new metallization process, developed recently by Northrop, consists in sputtering a Ti-Mo-Cu Layer onto the ceramic and has shown to exhibit extremely high bond strength, reliability and very low thermal barriers and rf losses when compared to the classical Mo-Mn metallization. Three types of rf windows were fabricated, mainly for I/J band applications: circular windows, rectangular waveguide windows and coaxial windows. The advantages of the Ti-Mo-Cu metallization process as compared to the classical Mo-Mn process have been quantitatively defined, and excellent results have been obtained. The rf losses have been found to be excellent if cusil is used as brazing alloy, and extremely low thermal barriers have been measured. The use of Au/Cu brazing alloys results in higher reliability under thermal cycling conditions, but increases drastically the rf losses. GRA

N80-28720# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
MECHANICAL ARM CONTROL
Richard C. Waters Oct. 1979 23 p refs
(Contracts N00014-75-C-0643; N00014-77-C-0389)
(AD-A084820; AI-M-549) Avail: NTIS HC A02/MF A01 CSCL 13/3

This paper discusses three main problems associated with the control of the motion of a mechanical arm: (1) transformation between different coordinate systems associated with the arm, (2) calculation of detailed trajectories for the arm to follow, and (3) calculation of the forces which must be applied to the joints of the arm in order to make it move along a specified path. Each of the above problems is amenable to exact solution. However, the resulting equations are, in general, quite complex and difficult to compute. This paper investigates several methods for speeding up this calculation, and for getting approximate solutions to the equations. GRA

N80-28721# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MATERIALS RESEARCH FOR ADVANCED INERTIAL INSTRUMENTATION. TASK 2: GAS BEARING MATERIAL DEVELOPMENT BY SURFACE MODIFICATION OF BERYLLIUM Technical Report, 1 Oct. 1978 - 30 Sep. 1979
D. Das, K. Kumar, E. Wettstein, and J. Wollam Oct. 1979 70 p refs
(Contract N00014-77-C-0388)
(AD-A084780; R-1330; TR-2) Avail: NTIS HC A04/MF A01 CSCL 17/7

The purpose of this program is to produce an adherent, low friction and wear resistant coating on a beryllium surface by in-situ formation of boride or borides of beryllium, with this goal being pursued via two distinct avenues of approach, i.e., diffusion, and ion implantation. This report covers a period of roughly one year since October 1978. In the portion of the work which features diffusion from a solid boron source, it is now determined that the cause of earlier failures in producing bonded boride to beryllium substrates was due to formation of an oxide layer at the interface. Other significant accomplishments in the study of reactive diffusion process during this period are: (1) thin (about 1 micrometer) and uniform films of as yet unidentified hard beryllium borides have been produced by chemical vapor deposition which are highly adherent with a strong potential for high wear resistance as indicated by its resistance to conventional polishing procedures; (2) development of a successful technique of producing well bonded Be-B diffusion couples by hot isostatic pressing; and (3) production of solid gamma boron by Arc Plasma Spraying suitable for fabrication Be-gamma B diffusion couples, which is not available otherwise. For the process of boriding by ion implantation, the feasibility of attaining very high (40 and 60 a/o) boron concentrations in the near-surface of beryllium has been demonstrated. Sample format and procedures have been devised which will provide the largest amount of information for the least investment of time in the ion implantation equipment. GRA

N80-28722# Naval Research Lab., Washington, D. C.
FAILURE ANALYSIS OF ROLLER CHAIN DRIVES
F. R. Stonesifer, H. L. Smith, and D. A. Meyn 4 Apr. 1980 27 p ref
(AD-A084989; AD-E000422; NRL-MR-4202) Avail: NTIS HC A03/MF A01 CSCL 20/11

Results from the NAVSEA sponsored task to analyze failures of a roller-chain drive are reported. Several unexpected failures had occurred after relatively short exposure to sea water. This led to an inspection of the broken parts and fracture surfaces in an effort to determine causes of failure. The static breaking strength and fatigue life of the chain were determined by laboratory tests. Both optical and scanning electron micrographs were used in the analysis. Results show tensile overloading to be the principal cause of failure. However stress corrosion cracking may have reduced the useful life of the case hardened roller-chain pins. Modifications to improve the integrity of the system are recommended. GRA

N80-28723# Sandia Labs., Albuquerque, N. Mex.
HYDROGEN ACTUATED PUMP
C. J. M. Northrup and A. A. Heckes 1980 20 p refs Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, Colo., 7 Apr. 1980
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1656C; CONF-800402-10) Avail: NTIS HC A02/MF A01

Hydrogen was used as the motive fluid in a novel water pump. The principle of operation of the pump was that a metal hydride may be heated to decompose the hydride to produce a metal alloy and hydrogen at elevated pressure. The high pressure hydrogen expanded as it moved a flexible but impermeable diaphragm to produce a displacement capable of doing work. When the metal alloy powder was cooled the hydrogen was reabsorbed at the low (or expanded) pressure to return the system to its original condition. A laboratory prototype pump is shown and its thermal efficiency discussed. In practice, the laboratory prototype had a thermal efficiency of 2.4% and with simple design improvements is calculated to be capable of an efficiency of 5%. DOE

N80-28724# Encotech, Inc., Schenectady, N.Y.
WORLDWIDE SURVEY OF CURRENT EXPERIENCE BURNING RESIDUAL AND CRUDE OILS IN GAS TURBINES Final Report
B. O. Buckland, F. H. Kindl, and H. Lukas Dec. 1979 87 p refs
(EPRI-AF-1243) Avail: NTIS HC A05/MF A01

Owners of gas turbines burning residual fuel were surveyed to identify operating problems, costs, and general owners' reaction to burning residual fuel. Owners were contacted by mail and personal visits and the results are summarized. The general conclusion is that residual oil is a practical fuel for gas turbines. It is also indicated that capital and operating costs will be higher and extra attention to system design is required as compared with distillate operation. When the cost differential between distillate and residual (or crude) fuel justifies it, residual is a practical alternative. DOE

N80-28725# Shaker Research Corp., Ballston Lake, N. Y.
ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GUIDE. PART 5: DYNAMIC ANALYSIS OF INCOMPRESSIBLE FLUID BEARINGS Interim Report, 15 Sep. 1977 - 15 Jan. 1978
Paul E. Allaire, John C. Nicholas, Edgar J. Gunter, and Coda H. T. Pan Wright-Patterson AFB, Ohio AFAPL Mar. 1980 95 p refs
(Contract F33615-76-C-2038; AF Proj. 3048)
(AD-A085106; SRC-78-TR-35-Pt-5; AFAPL-TR-78-6-Pt-5) Avail: NTIS HC A05/MF A01 CSCL 13/9

This report gives the equilibrium position, bearing coefficients, friction torque, and oil flow for plain journal, multilobe, and tilting pad journal bearings. For multilobe bearings, various combinations of preload, number of pads, and load direction are evaluated. Tilting pad bearings are analyzed for various combinations of length to diameter ratio, preload, number of pads, and load direction. GRA

N80-28726# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH-TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Quarterly Report, Apr. - Jun. 1979

1979 207 p refs
(Contract EX-76-C-01-1806)
(FE-1806-67) Avail: NTIS HC A10/MF A01

Progress in a program for developing a gas turbine for use in a combined-cycle power plant using coal-derived gas fuel combusted at temperature from 2600 F to 3000 F is reported. Information is included on component design and testing, system design and performance analyses, and updating the previous combined-cycle studies to evaluate the commercial viability of the turbine system. DOE

N80-28727# Turbodyne Corp., Wellsville, N.Y. Steam Turbine Div.
RESEARCH AND DEVELOPMENT OF IMPROVED EFFICIENCY SMALL STEAM TURBINES (IESST), PHASE 1 Technical Progress Report, 16 Apr. - 31 Dec. 1979
D. M. Choate and A. H. Tuttle Jan. 1980 39 p
(Contract DE-AC03-79ET-15428)
(DOE/ET-15428/T2) Avail: NTIS HC A03/MF A01

Product statistical bulletins of the National Electrical Manufacturers Association and Turbodyne's shipment records over a 10 year period were researched to determine quantities installed and to define general parameters of design. Engineering studies were conducted to determine the optimum turbine design to meet the defined design parameters. Two conceptual designs plus an added variation of one design were completed together with designs of gearing required to provide speeds compatible with driven equipment speeds. The calculated performance of the recommended design and currently available small steam turbines were compared and a life cycle cost analysis was conducted to determine the economic competitiveness of the new design. DOE

N80-28728# Societe Nationale Industrielle Aerospatiale, Paris (France).
HIGH PRESSURE GAS STORAGE CAPACITIES. EXAMPLE OF A SOLUTION USING FILAMENT WINDINGS [CAPACITIES POUR STOCKAGE DE GAZ A HAUTE PRESSION. EXEMPLES DE SOLUTION UTILISANT LE BOBINAGE FILAMENTAIRE]
A. Phan and J. Lamalle 1979 19 p refs In FRENCH Presented at Journees du Verre Textile et des Plastiques Renforces Conf., 1978
(SNIAS-792-430-104) Avail: NTIS HC A02/MF A01

The work described is based on the use of epoxy resin fiber glass. Economic factors affecting the choice of materials are discussed. Specific examples are treated; the physical nature of the windings are described together with the results obtained. The study demonstrates that a substantial reduction in mass, and an enhanced level of safety can be assured at a competitive cost by storing gases in this way. Author (ESA)

N80-28729# Societe Nationale Industrielle Aerospatiale, Cannes (France).
CENTRIFUGAL REGULATOR FOR CONTROLLING DEPLOYMENT RATES OF DEPLOYABLE ELEMENTS
J. C. Vermalle Paris 1979 10 p
(SNIAS-792-440-102) Avail: NTIS HC A02/MF A01

The requirements, design and performance of a centrifugal regulator aimed at limiting deployment rates of deployable elements is described. This mechanism which uses centrifugal force to produce friction of studs, was designed, manufactured, and tested to the specifications for the International Ultraviolet Explorer (IUE) solar array. Author (ESA)

N80-28730# Societe Nationale Industrielle Aerospatiale, Paris (France).
THE GLUING OF METALS [LE COLLAGE DES METAUX]
Georges Jube 1979 20 p In FRENCH Presented at Journees Jules Jarry Conf., Paris, Jun. 1979
(SNIAS-792-502-102) Avail: NTIS HC A02/MF A01

The principles and advantages of gluing metallic parts are discussed and reviewed. Practical aspects of the technique are discussed and the structures for which this technique is most useful are presented (e.g., optimized surface: honeycombed structures). The limits of the technique are examined; in certain cases, the forces to which the parts to be joined will be subjected render such methods inapplicable. The long term behavior of glued joints seems to be more influenced by the properties of the underlying metals than the behavior of the joint itself. Corrosion and aging are also discussed. The evolution of the technique and the state-of-the-art are presented. Author (ESA)

N80-28731# General Electric Co., Whetstone (England). Reactor Equipment Ltd.
INVESTIGATION OF PE16 WELDS WITH REDUCED TENSILE STRENGTH Final Report
G. Rowden Jun. 1979 15 p refs
(REL/R(79)24) Avail: NTIS HC A02/MF A01

A large body of tensile data were analyzed and a mean reduced tensile strength for the PE16/PE 16 weld test joint of 56.5 tsi with an estimated population standard deviation of 2.25 tsi was established. Tensile fractures were examined and it is shown that they contained mixed trans and intergranular fracture, increased amounts of intergranular fracture tending to produce the lower strength levels. Weld metal defects found on some of the early fractures have not had a significant effect on joint properties. Some minor changes to the welding technique were made, but in general, the investigation has confirmed the adequacy of the established welding and inspection techniques. It is concluded that there is no reason to question the serviceability of installed tie bars. Author (ESA)

N80-28732# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
COMBINED EFFECTS OF PERIODIC AND STOCHASTIC LOADS ON THE FATIGUE OF WIND TURBINE PARTS, PART 6
Andre Raab (Sikob AB) 29 Oct. 1979 60 p refs 6 Vol.
(Contract SWEDBESD-5061-012)
(FFA-AU-1499-Pt-6) Avail: NTIS HC A04/MF A01

Selected topics on simulation of turbulence and fatigue evaluation of wind turbines are presented. The importance of correct application of random loads and the mathematical description of nonstationary processes (general theory) are discussed. The two point cross spectra of turbulence, with regard to shear flow in the boundary layer of the Earth and to the inclination of wind gusts, is determined. The two point correlation functions of turbulence when these points are situated on rotating blades is evaluated. The discrete form of the correlation functions giving the correlation matrix and the properties of this matrix in the case of band limited processes are given. Band limited, Gaussian, multivariate random processes, having a prescribed correlation matrix, are simulated with the aid of Choleski's algorithm. The application of the described theory to the evaluation of fatigue in the case of wind turbines is shown. Author (ESA)

N80-28733# Saab-Scania, Goteberg (Sweden).
A TEST OF THE TORQUE LOSS OF A PLATFORM AXIS AT OSCILLATING MOVEMENTS
Ragnar Persson 16 Aug. 1979 17 p refs
(SAAB-RRK-79-58) Avail: NTIS HC A02/MF A01

The oscillating movements of the elevation axis of a pointing platform were measured with respect to temperature gradients, amount of axial displacement during temperature cycling, average torque loss and torque loss ripple for movements 45, 15, 25, and 15 deg. The bearing support and preload were based upon the use of an O-ring as the main load carrying element. Thus, there will be no sliding of inner or outer rings of the bearings and consequently no need for lubrication for that purpose, only the bearings themselves were lubricated. The O-ring side of the bearing system showed a very low temperature gradient between inner and outer bearing rings, in the intervals of the temperature cycling when temperature was steadily rising or falling. A temperature gradient less than 5 deg was found over the bearing with the O-ring, compared to 10 deg over the conventionally supported bearing. An average torque loss of 0.1 Nm, an average torque loss ripple of less than 0.05 Nm and a peak torque loss ripple of less than 0.15 Nm were measured. Author (ESA)

N80-28734# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
HYDROCARBON FORMATION AND OXIDATION IN SPARK-IGNITION ENGINES. VOLUME 1: SUMMARY Final Report, Sep. 1976 - Aug. 1979

John B. Heywood, James C. Keck, and Joe M. Rife. Jan. 1980. 44 p. Sponsored in part by General Motors Research Labs., Warren, Mich.
(PB80-166085; MIT-EL-80-003) Avail: NTIS HC A03/MF A01 CSCL 21B

The key results and conceptual findings are summarized from a three year research program on hydrocarbon formation and oxidation mechanisms in spark ignition engines. Major emphasis is given to the following: laminar flame quenching experimental and alalytical studies; quench layer studies in a spark ignition engine using a rapid acting gas sampling valve; flow visualization studies in a transparent engine to determine quench layer and quench crevice gas motion; studies of heat transfer, mixing and hydrocarbon oxidation in the exhaust port. GRA

N80-28735# Transportation Systems Center, Cambridge, Mass.
PERFORMANCE CHARACTERISTICS OF 1977 GENERAL MOTORS 350 CID ENGINE. Final Report
Joseph Boziuk. Feb. 1980. 48 p.
(PB80-170012; DOT-TSC-NHTSA-80-11; DOT-HS-805222) Avail: NTIS HC A03/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1977 GM 350 CID engine to determine fuel consumption and emissions (hydrocarbons, carbon monoxide, and oxides of nitrogen) at steady state engine operating modes. The objective of the test was to obtain engine performance data for estimating fuel consumption and emissions for varied engine service and duty and to provide basic engine characteristic data required for the TSC Vehicle Simulator (VEHSIM). GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques, and quality control.

N80-28736# Clemson Univ., S.C. Dept. of Mathematical Sciences.
DISTRIBUTION-FREE TOLERANCE BOUNDS FOR THE LIFETIME OF AN M-OUT-OF-K SYSTEM OF COMPONENTS
K. M. Lal Saxena. Sep. 1979. 19 p. refs.
(Contract N00014-75-C-0451; ONR Proj. 047-202)
(AD-A084899; N109; TR-323) Avail: NTIS HC A02/MF A01 CSCL 14/4

Distribution-free tolerance bounds are obtained for the life time of an m-out-of-k system of unlike components. It is assumed that the life time distributions of the k components belong to a stochastically order family of distributions. Two criteria are used to determine the tolerance bounds. These criteria are extensions of the criteria used in a single population literature. GRA

N80-28737# Battelle Columbus Labs., Ohio. Tactical Technology Center.
A QUALITY CONTROL DATA MANAGEMENT SYSTEM. Final Report, Jun. 1977 - Feb. 1978
M. B. Neher and R. E. Heffelfinger. 28 Feb. 1978. 113 p.
(Contract DAAK40-73-C-0142)
(AD-A084896; BATT-CDIR-1-2; DRXTH-TD-CR-80069) Avail: NTIS HC A06/MF A01 CSCL 09/2

A laboratory quality control system has been programmed for the Hewlett-Packard 3384 Computer used in Installation Restoration analytical chemistry laboratories. GRA

N80-28738# Central Electricity Generating Board, Harrogate (England). Scientific Services Dept.
THE IN-SITU ULTRASONIC EXAMINATION OF LARGE GENERATOR ROTORS
A. J. M. Lichnowski. Jul. 1979. 12 p.
(TDB-330) Avail: NTIS HC A02/MF A01

A technique is described for carrying out an ultrasonic examination of the body of a large generator rotor. The test is conducted from the outer surface of the rotor using an inspection device which manipulates within the internal annular space of the machine between the rotor and the stator. The inspection procedures and the three components of the inspection device (the articulation unit, the sensing unit, and the jacking mechanism) are described. Author (ESA)

N80-28739# National Technical Information Service, Springfield, Va.
RELIABILITY: MATHEMATICAL TECHNIQUES. CITATIONS FROM THE NTIS DATA BASE. Progress Report, Jun. 1977 - Apr. 1980
George W. Reimherr. Apr. 1980. 106 p. Supersedes NTIS/PS-79/0451; NTIS/PS-78/0439.
(PB80-809486; NTIS/PS-79/0451; NTIS/PS-78/0439) Avail: NTIS HC $30.00/MF $30.00 CSCL 14D

The cited reports discuss reliability prediction using mathematical techniques. Topics covered include statistical analysis, fault tree analysis, life testing, failure analysis, and mathematical models as applied to reliability prediction. This updated bibliography contains 99 abstracts, 20 of which are new entries to the previous edition. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-28740# Materials Research Labs., Melbourne (Australia).
A HIGH-SENSITIVITY POTENTIAL-DROP TECHNIQUE FOR FATIGUE CRACK GROWTH MEASUREMENTS
Graham Clark. Aug. 1979. 37 p. refs.
(MRL-R-755; AR-001-837) Avail: NTIS HC A03/MF A01

The design features of a highly sensitive and accurate system for monitoring the growth of fatigue cracks in laboratory specimens of various geometries are described. The system is based on the potential-drop method which utilizes the electrical resistance changes associated with fatigue crack growth through the specimen cross-section to detect crack length increments of a few micrometers. The technique is suitable for automation, and tests may be completed with a minimum amount of operator interference. A computer-based data-processing method is described, and the performance of the system in measuring both absolute crack length and crack growth rate is evaluated. A.R.H.

N80-28741# National Mechanical Engineering Research Inst., Pretoria (South Africa). Special Projects Div.
PROTOTYPE OF WIRE BREAK DETECTOR
L. Stawiszynski. Aug. 1979. 41 p.
(CSIR-ME-1626; ISBN-0-7988-1464-0) Avail: NTIS HC A03/MF A01

Fracture of a single wire in wire rope fatigue testing cannot be detected by visual observation and usually is discovered only by terminating the test and unravelling the test specimen to allow a count of the broken wires. The Wire Break Detector (WBD) was designed and developed to allow detection and counting of wire fractures without interrupting the fatigue testing. When a fracture occurs in a single wire of a rope test specimen, a shock is generated and the impact is transmitted to the end fittings. By having accelerometers placed at both the upper and lower end fittings, these shocks can be measured and recorded allowing a determination of the fracture location. Details of the WBD design with auxiliary counters and displays are presented. L.F.M.

N80-28742*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
CONTROL-STRUCTURE INTERACTION IN A FREE BEAM
S. K. Shrivastava and R. C. Ried. May 1980. 17 p. refs.
(NASA-TM-81029; JSC-16699) Avail: NTIS HC A02/MF A01 CSCL 20K

A simple energy approach to study the problem of control structure interactions in large space structures is presented. For the illustrative case of a free-free beam, the vibrational energy imparted during operation of constant, step, and pulsed thrusters is found in a nondimensional closed form. Then based

on a parametric study, suggestions are made on the choice of parameters to minimize the control structure interactions. The study of this simple system provides physical insight and understanding for more complex systems. Author

N80-28743*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BOLT-BEARING FATIGUE OF A GRAPHITE/EPOXY LAMINATE
Jonn H. Crews, Jr. Jul. 1980 27 p refs Presented at ASTM Specialist Symp. on Joining of Composite Mater., Minneapolis, 15-16 Apr. 1980
(NASA-TM-81851) Avail: NTIS HC A03/MF A01 CSCL 20K

Graphite/epoxy laminates were tested under bolt-bearing loads for a range of bolt clampup torques and for several test conditions involving water. High clampup torque improved both the static strength and fatigue limit by about 100 percent compared to a simple pin-bearing case, which had no through-the-thickness constraint. The static strength improvement was explained in terms of failure modes. Bolt clampup also influenced the hole elongation that developed before failure. For both the static and fatigue tests, the hole elongations were much larger for the low-torque clampup. Tests in water degraded static bearing strength only slightly, but reduced the fatigue limit about 40 percent below that for tests conducted in air. Author

N80-28744# Brown Univ., Providence, R. I.
PLASTIC DEFORMATION AND FRACTURE OF STEEL UNDER DYNAMIC LOADING Final Report, 15 Dec. 1976 - 31 Jan. 1980
R. J. Clifton and J. Duffy May 1980 11 p refs
(Grant DAAG29-77-G-008)
(AD-A084949; ARO-14363.3-E) Avail: NTIS HC A02/MF A01 CSCL 11/6

The authors summarize their research effort during the grant period. Included is a comprehensive study relating dynamic plasticity and fracture initiation through experiments on 1020 hot rolled steel and 1018 cold rolled steel. A comparison of values of K sub Ic obtained using the method developed by Brown University and the instrumented precracked Charpy test is given as well as a finite element of the specimen configuration used in the dynamic plasticity experiments utilizing a torsional Kolsky bar. An experimental investigation into the formation of shear bands in low carbon steel including the measurement of the temperature rise during the formation of the shear band as well as the derivation of a criterion for predicting shear band formation is reported. Further, the details of the development of a plate impact experiment designed to attain strain rates of ten to the 5th power per s up to strains of 10% and pressures of more than 10k bar are also reported. GRA

N80-28745# Battelle Columbus Labs., Ohio.
DYNAMIC FRACTURE TOUGHNESS PARAMETERS FOR HY-80 AND HY-130 STEELS AND THEIR WELDMENTS Interim Report
G. T. Hahn (Vanderbilt Univ.) and M. F. Kanninen Aug. 1979 42 p refs
(Contract N00014-77-C-0576)
(AD-A085194) Avail: NTIS HC A03/MF A01 CSCL 11/6

Lower bound dynamic fracture toughness parameters for HY-80 and HY-130 steel and their weld metals are identified. Specific values of the parameters K sub Id and K sub Im obtained from direct measurements are reported together with estimates inferred from the large body of Charpy energy, nil ductility transition temperature and dynamic tear energy measurements. The emphasis is on reasonable lower bound values at 30 F, the lowest anticipated service temperature, for use in elastodynamic analyses of crack growth initiation, propagation, and arrest in ship structures. For these conditions, it has been found that the ratio K sub Id/RHO sub Y is approximately sq root of 1 in. Consequently, HY-80 plate appears to be substantially more resistant to fracture under dynamic loading than are the other three grades examined. GRA

N80-28746# Naval Postgraduate School, Monterey, Calif.
THE INFLUENCE OF THERMOMECHANICAL PROCESSING AND HEAT TREATMENT ON THE FATIGUE RESISTANCE AND FRACTOGRAPHIC CHARACTERISTICS OF A HIGH-CARBON BEARING STEEL M.S. Thesis
Ik Sik Chung Dec. 1979 121 p refs
(AD-A085060; NPS-69-79-012) Avail: NTIS HC A06/MF A01 CSCL 11/6

This study examined the effects of thermomechanical processing and subsequent conventional heat treatment on microstructure and fatigue in AISI 52100 steel. The thermomechanical processing techniques are essentially those described by Sherby and his co-workers at Stanford University. Previous research by that group and at the Naval Postgraduate School has demonstrated that a wide range of ferrite matrix grain sizes and carbide particle distributions can be obtained in this steel. Studies parallel with this are examining the subsequent heat treatment response of these structures and also the fracture toughness attainable. In this study on fatigue, it was found that both the fatigue life at a given cyclic stress and the endurance limit were improved by processing to produce an ultra-fine grained ferrite-carbide microstructure prior to heat treatment. Improvement in fatigue resistance was especially pronounced when the material was heat treated to fine Bainitic, rather than Martensitic microstructures. These improvements are postulated to result from changes in crack propagation mode and improved resistance to fatigue crack propagation. GRA

N80-28747# SRI International Corp., Menlo Park, Calif.
SRI PUFF 8 COMPUTER PROGRAM FOR ONE-DIMENSIONAL STRESS WAVE PROPAGATION, VOLUME 2 Final Report, Sep. 1977 - Aug. 1978
L. Seaman and D. R. Curran Mar. 1980 340 p refs
(Contract DAAK11-77-C-0083)
(AD-A084995; AD-E430434; ARBRL-CR-00420) Avail: NTIS HC A15/MF A01 CSCL 20/11

SRI PUFF is a Lagrangian finite difference computer program for calculating one-dimensional stress wave propagation through solid, liquid, gaseous, and porous materials. The calculational procedure is the standard leapfrog method of von Neumann and Richtmyer using artificial viscosity to smooth shock fronts. Planar, cylindrical, and spherical flow are treated. The constitutive relations include the standard Mie-Grueneissen equation of state and elastic, plastic (Mises or Coulomb) work-hardening deviator stress relations with thermal softening. Other pressure relations provided are a polytropic gas for explosives, GRAY and Philco-Ford three-phase equations of state, and a tabular pressure-volume relations. Special deviator stress models include the standard viscoelastic model, a Bauschinger model, dislocation models, and a nonlinear work-hardening model. Ductile and brittle fracture and shear banding are provided by nucleation and growth models. Porous materials may be represented by the Seaman-Linde model, Holt model, Herrmann P-alpha model, a cap plasticity model, and variable modulus model, or by a linear viscous void compacting model. The code is constructed for easy insertion of additional material models. The number of extra variables required for each cell for a material model can be specified in the input deck. This manual includes many sample problems, a derivation of the flow equations, discussion of material models, and an outline of other aspects of wave propagation calculation. GRA

N80-28748# Martin Marietta Labs., Baltimore, Md.
THE DELAYED FRACTURE OF ALUMINUM ALLOYS
Joseph R. Pickens, Dave Venables, and John A. S. Green May 1980 45 p refs
(Contract N00014-74-C-0277)
(AD-A085137; MML-TR-80-19C) Avail: NTIS HC A03/MF A01 CSCL 11/6

The stress corrosion cracking (SCC) of high purity Al-Zn-Mg alloys has been studied in terms of the effects on SCC susceptibility of: bulk chemistry, bulk microstructure, oxide film chemistry, and oxide film morphology. For alloys having equivalent solute content (wt. % Zn - wt. % Mg), higher bulk concentrations of magnesium lead to slightly increased susceptibility in acetic-acid-brine solution. Interrupted quenching failed to produce a microstructure exhibiting reduced SCC susceptibility. Preliminary results indicate that an oxide stripping procedure, that removes the magnesium-rich oxide film formed during heat treating, and replaces it with an amorphous alumina film, decreases SCC susceptibility. Porosity in the original castings caused data to be

scattered, so new porosity-free materials have been acquired and the oxide film studies will be repeated. GRA

N80-28749# Maryland Univ., College Park.
SURFACE EFFECTS ON PLASTIC DEFORMATION Annual Report, 1 May 1979 - 30 Apr. 1980
R. J. Arsenault and I. R. Kramer 14 May 1980 19 p
(Contract N00014-79-C-0392)
(AD-A085140; ONR-TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 20/11

The present computer simulation study of the dislocation distribution near the surface is based upon a modified one-dimensional dislocation model which considers the line tension of a dislocation loop, and the image forces. If the dislocations are generated from a surface source and move by thermal activation over randomly distributed short range barriers, an inverse pile-up is created. A dislocation density gradient exists up to a depth of approximately 60 micrometers, for a total of twenty dislocations generated. During unloading, the last few dislocations generated leave the crystal rapidly, and within three hours to two weeks the dislocation density gradient essentially disappears (depending upon the parameters used). This is in agreement with the experimental results. GRA

N80-28750# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
STABILITY OF A THICK ELASTIC PLATE UNDER THRUST
K. W. Sawyers and R. S. Rivlin Mar. 1980 52 p refs Sponsored in part by NSF
(Contract N00014-76-C-0235)
(AD-A085113; CAM-100-34) Avail: NTIS HC A04/MF A01 CSCL 20/11

When a rectangular plate of incompressible neo-Hookean elastic material is subjected to a thrust, bifurcations of the flexural or barreling types become possible at certain critical values of the compression ratio. The states of pure homogeneous deformation corresponding to these critical compression ratios are states of neutral equilibrium. Their stability is investigated on the basis of an energy criterion, without restriction on the thickness of the plate. The critical state corresponding to the lowest order flexural mode is found to be stable (unstable) if the aspect ratio (thickness/length) is less (greater) than about 0.2. Agreement with the classical Euler theory is established in the limiting case of small aspect ratio. GRA

N80-28751# Battelle Columbus Labs., Ohio.
DYNAMIC CRACK PROPAGATION IN PRECRACKED CYLINDRICAL VESSELS SUBJECTED TO SHOCK LOADING Interim Report
C. H. Popelar, P. C. Gehlen, and M. F. Kanninen Aug. 1979 9 p refs Prepared in cooperation with Ohio State Univ., Columbus
(Contract N00014-77-C-0576)
(AD-A085196) Avail: NTIS HC A02/MF A01 CSCL 20/11

Previous work has shown that a speed-independent dynamic fracture toughness property can be used in an elastodynamic analysis to describe crack initiation and unstable propagation under impact loading. In this paper, a further step is taken by extending the analysis from simple laboratory test specimens to treat more realistic crack-structure geometries. A circular cylinder with an initial part-through wall crack subjected to an impulsive loading on its inner surface is considered. The crack is in a radial-axial plane and has its length in the axial direction long enough that a state of plane strain exists at the center of the crack. Crack growth initiation and propagation through the wall is then calculated. It is found that, once initiated, crack propagation will continue until the crack penetrates the wall. Crack arrest within the wall does not appear to be possible under the conditions considered in this paper. GRA

N80-28752# Naval Postgraduate School, Monterey, Calif.
SURFACE DISPLACEMENT MEASUREMENTS, STRAIN AND VIBRATIONAL ANALYSIS USING SPECKLE METROLOGY TECHNIQUES M.S. Thesis
Alan Bernard Lerchbacker Mar. 1980 154 p refs
(AD-A085145) Avail: NTIS HC A08/MF A01 CSCL 17/8

Double-exposure specklegrams were made of aluminum 2024-T4 rectangular plates. The double-exposure speckle technique was applied to the aluminum plate to measure in-plane translation and rotation and out-of-plane tilt. Strain and vibrational analyses were also conducted. The vibrational results were compared with results previously obtained using double-exposure time average holography to ascertain their applicability to Naval Engineering. Background in Fourier transforms, wave theory, Fraunhofer diffraction theory, and other areas of physical optics were investigated to enhance the development of speckle metrology techniques. Results of the experiments indicate that speckle metrology, used in conjunction with holography, has significant potential for Naval Engineering applications. Further research is required to develop these techniques. These procedures currently are being utilized extensively in the aerospace industry and automotive research and development areas. GRA

N80-28753# Battelle Columbus Labs., Ohio. Applied Solid Mechanics Section.
WHITHER DYNAMIC FRACTURE MECHANICS Interim Report
M. F. Kanninen May 1980 26 p refs Presented at the 2nd Intern. Conf. on Numerical Methods in Fracture Mech., Swansea, Wales, 6-11 Jul. 1980
(Contract N00014-77-C-0576)
(AD-A085195) Avail: NTIS HC A03/MF A01 CSCL 20/11

The experimental basis for the necessity of a dynamic characterization of crack run/arrest events is reviewed. Current anomalies in the use of linear elastodynamic treatments, apparent geometry and load rate dependence of the dynamic fracture toughness property, are discussed. A review of concurrent work in plastic fracture mechanics is given as a possible basis for circumventing these anomalies. GRA

N80-28754# Pisa Univ. (Italy). Inst. of Aeronautics.
THE FATIGUE CRACK GROWTH UNDER VARIABLE AMPLITUDE LOADING IN BUILT-UP STRUCTURES Annual Technical Report, Sep. 1978 - Oct. 1979
A. Salvetti, G. Cavallini, and L. Lazzeri Nov. 1979 87 p refs
(Grant DA-ERO-78-G-107; DA Proj. 1T1-61102-BH-57)
(AD-A084936; ATP-1) Avail: NTIS HC A05/MF A01 CSCL 21/11

The object of this investigation is the development of a reliable procedure for evaluating the growth of a crack in a built-up structure under realistic loading conditions. To this end, tests have been conducted on stiffened and unstiffened panels to monitor the growth of a crack both under constant and variable amplitude loads. The test data has been evaluated on the basis of a deep theoretical analysis which has allowed us to reach significant results on the following main topics: influence of the fastener flexibility and stringer-sheet friction forces on fatigue crack propagation in stiffened panels, reliability of existing methods for predicting the growth of a crack under loading conditions in plain sheets. GRA

N80-28755# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
CRACK-TIP FIELDS FOR FAST FRACTURE OF AN ELASTIC-PLASTIC MATERIAL Interim Report
J. D. Achenbach, M. F. Kanninen, and C. H. Popelar (Ohio State Univ., Columbus) Dec. 1979 32 p refs Prepared in cooperation with Battelle Columbus Labs, Ohio
(Contracts N00014-76-C-0063; N00014-77-C-0576)
(AD-A085261) Avail: NTIS HC A03/MF A01 CSCL 20/11

An asymptotic analysis of the near-tip fields is given for transient crack propagation in an elastic-plastic material. The material is characterized by J2 flow theory together with a bilinear effective stress-strain curve. Both plane stress and plane strain conditions have been considered. Explicit results are given for the order of the crack-tip singularity, the angular position at which unloading occurs, and the angular variation of the near-tip stresses, all as functions of the crack-tip speed and the ratio of the slopes of the two portions of the bilinear stress-strain relation. GRA

N80-28756# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects Div.
COMPARISON WITH STRAIN GAGE DATA OF CENTRIFUGAL STRESSES PREDICTED BY FINITE ELEMENT

ANALYSIS ON THE DOE/SANDIA 17 m DARRIEUS TURBINE
Robert A. Watson Feb. 1980 20 p refs
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1990) Avail: NTIS HC A02/MF A01

By the use of strain gages, the blade structural response to purely centrifugal loading was measured on the DOE/Sandia 17 m Darrieus rotor. The measurements obtained are compared with MARC-H nonlinear finite element stress predictions. It was necessary to include gravitational effects in the finite element model to explain certain asymmetries in the data. The model with gravitational effects shows good agreement with the data. Examination of results suggests that refinement of the model to include more structural detail in the region where the blade joins the tower would probably enhance the accuracy of the model. DOE

N80-28757# Argonne National Lab., Ill.
CHARACTERIZATION OF IMPACT FRACTURE OF BRITTLE SOLID-WASTE FORMS
W. J. Mecham, L. J. Jardine, R. H. Pelto, and M. J. Steindler 1979 13 p refs Presented at Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 27-30 Nov. 1979
(Contract W-31-109-eng-38)
(CONF-791112-50) Avail: NTIS HC A02/MF A01

A methodology for analyzing particle size distributions obtained in impact testing of brittle waste form materials. The methodology includes: (1) a linear two parameter ognormal correlation of the weight fraction less than any given size; (2) a mathematical function of the two lognormal parameters to determine the total surface area in terms of a dimensionless shape factor; and (3) a surface energy constant to predict the anticipated increase of surface area from the known energy absorbed in the impact of the brittle material. Preliminary measurements are given for impacted simulated glass specimens. The analysis is used as an example of the methodology. These results are also compared with reanalyzed impact test data reported previously. DOE

N80-28758# Sandia Labs., Albuquerque, N. Mex.
CURRENT PROBLEMS IN THE FINITE DIFFERENCE SOLUTION OF STRESS WAVES
W. Herrmann Feb. 1980 36 p refs Presented at Workshop on Nonlinear Waves Solids, Chicago Circle, Ill., 21-23 Mar. 1977; sponsored by AFOSR and NSF
(Contracts EY-76-C-04-0789; AT(29-1)-789)
(SAND-80-0190) Avail: NTIS HC A03/MF A01

The current state-of-the-art in finite difference calculations of nonlinear stress wave propagation in solids is outlined with special emphasis on the solution of large scale engineering problems. Considerations of computer resource economics show that one dimensional calculations of even exceedingly complex problems can be performed at small cost on small computers. Very complex two dimensional calculations can be performed, but may require the largest computers and entail significant costs. Three dimensional calculations which resolve details of stress waves are orders of magnitude beyond the capabilities of present and near term computers, although three dimensional solutions can be useful for quasi-steady problems or problems where detailed resolution is not necessary. Computational costs can be reduced by further development of finite difference methods, although order of magnitude improvement required for a real enhancement of capability is expected to require the development of methods quite different from those in use at this time. DOE

N80-28759# Bettis Atomic Power Lab., West Mifflin, Pa.
ACCEPT: A THREE-DIMENSIONAL FINITE ELEMENT PROGRAM FOR LARGE DEFORMATION ELASTIC-PLASTIC-CREEP ANALYSIS OF PRESSURIZED TUBE (LWBR/AWBA DEVELOPMENT PROGRAM)
D. N. Hutula and B. E. Wiancko Mar. 1980 135 p refs
(Contract DE-AC11-76PN-00014)
(WAPD-TM-1383) Avail: NTIS HC A07/MF A01

ACCEPT, a three dimensional finite element computer program for analysis of large deformation elastic-plastic-creep response of Zircaloy tubes subjected to temperature, surface pressures, and axial force is described. A twenty mode, tri-quadratic, isoparametric element is used along with a Zircaloy materials model. A linear time-incremental procedure with residual force correction is used to solve for the time-dependent response. The program features an algorithm which automatically chooses the time step sizes to control the accuracy and numerical stability of the solution. A contact-separation capability allows modeling of interaction of reactor fuel rod cladding with fuel pellets or external supports. DOE

N80-28760# Battelle Pacific Northwest Labs., Richland, Wash.
PROGRESS TOWARD ACOUSTIC EMISSION CHARACTERIZATION FOR CONTINUOUS MONITORING REACTOR PRESSURE VESSELS
P. H. Hutton, E. B. Schnenk, and R. J. Kurtz 1979 7 p refs Presented at the Intern. Symp. on Methods of Nondestructive Testing of Mater. and Their Appl. in Nucl. Eng., Saarbrucken, West Germany, 17 Sep. 1979
(Contract EY-76-C-06-1830)
(PNL-SA-7746; CONF-7909132-1) Avail: NTIS HC A02/MF A01

The feasibility of detecting and analyzing flaw growth in an operating reactor vessel using acoustic emission (AE) data is evaluated. A preliminary AE flaw growth relationship was developed encompassing six variables. This model relates AE count and energy to fatigue crack driving force delta K. Pattern recognition was examined as a means of distinguishing crack growth AE from other acoustic signals with encouraging results. The program is moving into hardware implementation of relationships for testing and refinement by monitoring tests in heavy section specimens and subscale structures. The hardware system will become a reactor monitor prototype. DOE

N80-28761# Societe Nationale Industrielle Aerospatiale Les Mureaux (France). Subdiv. Systemes.
MECHANICAL CHARACTERIZATION (HOOKE MATRIX AND STRENGTH) OF THREE-DIMENSIONAL SILICAPHENOLIC CYLINDERS [CARACTERISATION MECANIQUE (MATRICE DE HOOKE ET RESISTANCE A RUPTURE) DE CYLINDRES EN TROIS DIMENSIONS SILICE-RESINE PHENOLIQUE]
J. P. Dumont Paris 1979 18 p refs In FRENCH; ENGLISH summary Presented at DGRST Colloq. sur les Mater. Composites, Saclay, France, 18-22 Jun. 1979 Sponsored by CEA
(SNIAS-792-422-118) Avail: NTIS HC A02/MF A01

A method for the mechanical evaluation (Hooke matrix and strength) of 30 silicaphenolic cylinders is presented. A statistical model is fitted to a set of tests on specimens cut from cylinders with different weave parameters. Given the three fiber volume fractions, the model predicts the mean and minimum mechanical properties of 3DQP material. Author (ESA)

N80-28762# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
TRBASIS: A PROGRAM MODULE FOR TRANSIENT MODAL ANALYSIS OF LINEAR STRUCTURES, PART 1
Peter Stehlin Oct. 1979 56 p refs 6 Vol.
(Contract FMV-FFL-82223-78-003-21-001)
(FFA-HU-2125-Pt-1) Avail: NTIS HC A04/MF A01

An integrated program module of the BASIS 3 structural analysis code which performs transient analyses of linear structures is described. A summary of the theoretical relations on which the code is based is given. The operation of the program module is explained and illustrated by examples. The program is written for CDC computers. As far as the use of the program is concerned it is assumed that the reader is already familiar with the data card input to the BASIS 3 code and that he has some working knowledge of the CDC SCOPE or NOS operating systems. Author (ESA)

N80-28763# Earthquake Engineering Research Inst., Berkeley, Calif.
THE 3D TRUSS BAR ELEMENT (TYPE 1) FOR THE ANSR-2 PROGRAM
Digambar Mondkar, P. and Graham H. Powell Nov. 1979 18 p refs
(Grant NSF ENV-76-04262)
(PB80-169709; UCB/EERC-79/29; NSF/RA-790361) Avail: NTIS HC A02/MF A01 CSCL 13M

A three dimensional, inelastic, large displacement truss element developed for the ANSR-2 program is described. The element characteristics and a computer program user's guide are included. GRA

N80-28764# California Univ., Richmond. Earthquake Engineering Research Center.
BEAM-COLUMN ELEMENT 3D (TYPE 2-PARALLEL ELEMENT THEORY) FOR THE ANSR-2 PROGRAM
Ali Riahi, Graham H. Powell, and Digambar P. Mondkar. Dec. 1979. 35 p. refs.
(Grant NSF ENV-76-04262)
(PB80-167216; UCB/EERC-79/31; NSF/RA-790363) Avail: NTIS. HC A03/MF A01' CSCL 13M
A three dimensional inelastic beam column element is described. A description of the element characteristics, theoretical formulation and a computer program user's guide is also given. GRA

N80-28765# Earthquake Engineering Research Inst., Berkeley, Calif.
BEAM-COLUMN ELEMENT 2D (TYPE 5-PARALLEL ELEMENT THEORY) FOR THE ANSR-II PROGRAM
Dennis G. Row, Graham H. Powell, and Digambar P. Mondkar. Dec. 1979. 33 p. ref.
(Grant NSF ENV-76-04262)
(PB80-167224; UCB/EERC-79/30; NSF/RA-79-362) Avail: NTIS. HC A03/MF A01. CSCL 13M
A two-dimensional inelastic beam-column element developed for the ANSR-2 program is described. A description of the element characteristics and the computer program user's guide are included. GRA

42 GEOSCIENCES (GENERAL)

N80-28766*# State Univ. of New York at Albany.
GLOBAL TECTONIC STUDIES: HOTSPOTS AND ANOMALOUS TOPOGRAPHY
Kevin Burke, W. S. F. Kidd, S. DeLong, Richard L. Thiessen, Rosemary Carosella, and T. R. McGetchin. 1979. 83 p. refs.
(Grant NsG-5274)
(NASA-CR-163391) Avail: NTIS. HC A05/MF A01. CSCL 08G
Volcanic activity on Earth and its secular variations are compared with that on other terrestrial planets. Activity at divergent, transform, and convergent plate margins is described with particular emphasis on hot spots and flood basalts. The timing and causing of uplifting above 500 meters, which in not associated with either plate boundaries or the normal nonplate margin edges of continents is considered with particular focus on the Guyana Highlands in southern Venezuela and western British Guiana, and the Brazilian Highlands in the central, eastern, and southern parts of the country. The mode and mechanism of plateau uplifting and the re-elevation of old mountain belts and subsidence of intra-continental basins are also discussed. A.R.H.

N80-28767# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
GEOELECTRICAL AND GEOMAGNETICAL MEASUREMENTS AT LAACHER SEE (EIFEL) [GEOELEKTRISCHE UNE GEOMAGNETISCHE MESSUNGEN AM LAACHER SEE (EIFEL)]
N. Kloecker and G. Musmann. 1979. 27 p. refs. In GERMAN. Sponsored by Bundesmin. fuer Forsch. u. Technol. and Comm. of European Communities.
(GAMMA-35) Avail: NTIS. HC A03/MF A01.
Magnetic field and geoelectrical resistivity measurements taken at the Laacher See, in an ancient volcanic region of Germany are presented. Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N80-28768*# Tennessee Univ. Space Inst., Tullahoma. Remote Sensing Div.
DIGITAL LANDSAT DATA ANALYSIS OF TENNESSEE Final Report, 1 Dec. 1978 - 31 Jan. 1980
F. Shahrokhi, Principal Investigator and Asif Kahn. 28 Mar. 1980. 56 p. ERTS.
(Contract NAS8-33218)
(E80-10130; NASA-CR-161424) Avail: NTIS. HC A04/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-28769*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT SPECIFICATION FOR CCIT6A PROCESSOR PROGRAM
W. P. White, Principal Investigator. Aug. 1978. 68 p. ERTS. (Contract NAS9-15200)
(E80-10168; NASA-CR-160597; LEC-12303; JSC-14368) Avail: NTIS. HC A04/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-28770*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR LACIE FORMATTED DOT CARDS IN EOD-LARSYS
P. J. Aucoin, Jr. and Jeannie Gor, Principal Investigators. Apr. 1978. 26 p. ERTS.
(Contract NAS9-15200)
(E80-10169; NASA-CR-160650; LEC-12154; JSC-13972) Avail: NTIS. HC A03/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-28771*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE YIELD ESTIMATION SUBSYSTEM (YES) OPERATIONAL ROBERTSON PHENOLOGICAL MODEL
K. Williams, Principal Investigator. Jun. 1977. 118 p. ERTS.
(E80-10170; NASA-CR-160680; LEC-10743; JSC-12941) Avail: NTIS. HC A06/MF A01. CSCL 02C
There are no author-identified significant results in this report.

N80-28772*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
AS-BUILT DESIGN SPECIFICATION FOR THE I-100 TAPE READ CONSOLIDATION PROGRAM (FULOI)
T. R. Kell, Principal Investigator. Jul. 1977. 74 p. ERTS.
(Contract NAS9-15200)
(E80-10171; NASA-CR-160596; LEC-9925-Rev-A; JSC-11848-Rev-A) Avail: NTIS. HC A04/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-28773*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE BRAZIL AND CHINA MONTHLY DATA BASES
K. Williams, Principal Investigator. May 1977. 20 p. ERTS.
(Contract NAS9-15200)
(E80-10172; NASA-CR-160677; LEC-10573; JSC-12892) Avail: NTIS. HC A02/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-28774*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
FINAL DESIGN SPECIFICATION FOR EOD-LARSYS/STATISTICS AND DATA TRANSFORMATION PROCESSORS MODIFICATION
Cheevon Bo-Linn, Principal Investigator Mar. 1978 325 p ERTS
(Contract NAS9-15200)
(E80-10173; NASA-CR-160630; LEC-12030; JSC-13921)
Avail: NTIS HC A14/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28775*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR EOD-LARSYS PROCEDURE 1
B. E. Wills, C. T. Gardner, and P. J. Aucoin, Jr., Principal Investigators Oct. 1977 307 p ERTS
(Contract NAS9-15200)
(E80-10174; NASA-CR-160626; LEC-11293; JSC-13143)
Avail: NTIS HC A14/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28776*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR LACIE PHASE 3 AUTOMATIC STATUS AND TRACKING SYSTEM
D. L. Smith, J. L. Allison, J. M. Everette, and C. C. DeValcourt, Principal Investigators Jun. 1977 158 p ERTS
(Contract NAS9-15200)
(E80-10175; NASA-CR-160672; LEC-10419-Rev-A; JSC-12743-Rev-A) Avail: NTIS HC A08/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28777*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR LARSYS PROCEDURE 1 FOLLOW-ON
P. J. Aucoin, Jr., Principal Investigator Oct. 1977 9 p ERTS
(Contract NAS9-15200)
(E80-10176; NASA-CR-160627; LEC-11298; JSC-13144)
Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28778*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR EOD-LARSYS/STATISTICS AND DATA TRANSFORMATION PROCESSORS MODIFICATION
Cheevon Bo-Linn, Principal Investigator Oct. 1977 48 p ERTS
(Contract NAS9-15200)
(E80-10177; NASA-CR-160628; LEC-11357; JSC-13665)
Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28779*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATION: FINAL DESIGN SPECIFICATION FOR DOT DATA BASE UPDATE DECK CONVERSION PROGRAM (DOTDEC)
Jeannie Gor, Principal Investigator Jul. 1977 29 p ERTS
(Contract NAS9-15200)
(E80-10178; NASA-CR-160647; LEC-10969; JSC-12656)
Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28780*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
FINAL DESIGN SPECIFICATION FOR ERIPS FIELDS DATA BASE DECK CONVERSION
Cheevon Bo-Linn, Principal Investigator Aug. 1977 41 p ERTS
(Contract NAS9-15200)
(E80-10179; NASA-CR-160646; LEC-10960; JSC-12655)
Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28781*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DETAILED DESIGN SPECIFICATION FOR THE YIELD ESTIMATION SUBSYSTEM DATA MANAGEMENT SYSTEM (YESDAMS)
T. G. Phillips, R. L. Davenport, R. F. Hansen, and K. F. Williams, Principal Investigators Jul. 1977 107 p ERTS
(Contract NAS9-15200)
(E80-10180; NASA-CR-160623; LEC-11110; JSC-13064)
Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28782*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
MODIFICATIONS TO THE CLASY PROGRAM
B. McCray, Principal Investigator Apr. 1977 102 p ERTS
(Contract NAS9-15200)
(E80-10181; NASA-CR-160673; LEC-10481; JSC-12602)
Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28783*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATIONS: MARQTY1.FTN, CAMDATA1.FTN
M. A. Mendlowitz, Principal Investigator Aug. 1978 25 p ERTS
(Contract NAS9 15200)
(E80-10182; NASA-CR-160593; LEC-12376) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28784*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR DOT DATA BASE UPDATE DECK CONVERSION PROGRAM (DOTDEC)
Jeannie Gor, Principal Investigator Jun. 1977 8 p ERTS
(Contract NAS9-15200)
(E80-10183; NASA-CR-160681; LEC-10790; JSC-12958)
Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28785*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR PRODUCTION FILM CONVERTER GAINS AND BIASES PROGRAM (PFCGAB)
C. T. Gardner, Principal Investigator Nov. 1977 182 p ERTS
(Contract NAS9-15200)
(E80-10184; NASA-CR-160638; LEC-11678; JSC-13822)
Avail: NTIS HC A09/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28786*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LACIE/PHASE 3 ADJUSTABLE CROP CALENDAR (ACC) CONFIGURATION CONTROL PROCEDURES MANUAL
K. Williams, Principal Investigator Jun. 1977 16 p ERTS
(Contract NAS9-15200)
(E80-10186; NASA-CR-160682; LEC-10800; JSC-12963)
Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28787*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
RECOMMENDATIONS AND COMMENTS CONCERNING DOCUMENTATION ON THE MICROWAVE ACTIVE SPECTROMETER SYSTEMS
W. A. Rosenkranz and D. P. Pounds, Principal Investigators Jun. 1977 127 p refs ERTS
(Contract NAS9-15200)
(E80-10187; NASA-CR-160679; LEC-10715; JSC-12946)
Avail: NTIS HC A07/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28788*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
FUNCTIONAL DESIGN SPECIFICATION FOR ENHANCEMENT OF THE AUTOMATIC STATUS AND TRACKING SYSTEM SOFTWARE
D. K. McCarley, J. M. Everette, and K. P. Eckel, Principal Investigators Sep. 1977 60 p ERTS
(Contract NAS9-15200)
(E80-10190; NASA-CR-160624; LEC-11199; JSC-13110)
Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28789*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
A DISCRIMINANT APPROACH TO PARAMETER ESTIMATION IN THE LINEAR MODEL WITH UNKNOWN VARIANCE-COVARIANCE MATRIX
C. R. Hallum (NASA. Johnson Space Flight Center) and M. D. Pore, Principal Investigators 1977 10 p refs Presented at the Ann. Meeting of the Am. Statist. Assoc., Chicago, 15-18 Aug. 1977 ERTS
(Contract NAS9-15200)
(E80-10192; NASA-CR-160676; LEC-10532; JSC-13036)
Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28790*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LACIE FIELD MEASUREMENTS DATA ACQUISITION SUMMARY REPORT, 1975 - 1976 CROP YEAR
Jan. 1977 29 p ERTS
(Contract NAS9-15200)
(E80-10193; NASA-CR-160645; LEC-9970; JSC-11882) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28791*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
USER'S GUIDE: LARGE AREA CROP INVENTORY EXPERIMENT (LACIE) PHASE 3 PDP 11/45 AUTOMATIC STATUS AND TRACKING SYSTEM
C. C. deValcourt, Principal Investigator Jun. 1977 49 p ERTS
(Contract NAS9-15200)
(E80-10194; NASA-CR-160642; LEC-10148-Rev-A; JSC-12535-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28792*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
A STATISTICAL TEST PROCEDURE FOR DETECTING MULTIPLE OUTLIERS IN A DATA SET
R. S. Chhikara, Principal Investigator and A. H. Feiveson Nov. 1978 18 p refs ERTS
(Contract NAS9-15200)
(E80-10195; NASA-CR-160599; LEC-12910; JSC-14594)
Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28793*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION OF THE CAMS/CAS INTERFACE TAPE REPORT GENERATION PROGRAM FOR LACIE 6A
W. A. Holley, Principal Investigator Oct. 1977 63 p ERTS
(Contract NAS9-15200)
(E80-10196; NASA-CR-160625; LEC-11292; JSC-13142)
Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28794*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN FOR ENHANCEMENT OF THE AUTOMATIC STATUS AND TRACKING SYSTEM SOFTWARE
D. K. McCarley, Principal Investigator and L. D. Dornell Feb. 1978 146 p ERTS
(Contract NAS9-15200)
(E80-10197; NASA-CR-160631; LEC-11882; JSC-13894)
Avail: NTIS HC A07/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-28795*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR HISTORICAL DAILY DATA BASES FOR TESTING ADVANCED MODELS
B. Jeun and K. Williams, Principal Investigators Jan. 1978 76 p ERTS
(Contract NAS9-15200)
(E80-10198; NASA-CR-160675; LEC-10572-Rev-A; JSC-12891-Rev-A) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28796*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR LARSYS PROCEDURE 1
B. E. Wills, C. T. Gardner, and P. J. Aucoin, Jr., Principal Investigators Apr. 1977 145 p ERTS
(Contract NAS9-15200)
(E80-10199; NASA-CR-160671; LEC-10417; JSC-12742)
Avail: NTIS HC A07/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28797*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION OR PDP 11/45 ACCURACY ASSESSMENT SYSTEM
C. W. Ahlers, Principal Investigator Dec. 1977 190 p ERTS
(Contract NAS9-15200)
(E80-10200; NASA-CR-160632; LEC-11358-Rev-A; JSC-13666-Rev-A) Avail: NTIS HC A09/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28798*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO INTERFEROMETRY: TECHNIQUES FOR GEODESY
Jul. 1980 474 p refs Conf. held in Cambridge and Westford, Mass., 19-21 Jun. 1979
(NASA-CP-2115) Avail: NTIS HC A20/MF A01 CSCL 08E
Progress in the development and application of radio interferometry as a tool for geophysical research is reported and discussed. Among the topics reviewed are: Surveys of is the Seventies, Movements, Terrestrial and Celestial, Degrees Kelvin and Degrees of Phase, the Mark 3 VLBI System, Waves of the Future and other Emissions, and Adherence and Coherence in Networks, and Plans. For individual titles, see N80-28799 through N80-28846.

N80-28799*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

GEODETIC MEASUREMENTS WITH A MOBILE VLBI SYSTEM
Arthur E. Niell, E. Scott Claflin, T. G. Lockhart, Peter F. MacDoran, D. D. Morabito, K. M. Ong, and George M. Resch *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 3-7 (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 08E

The Project ARIES 9 meter transportable antenna was used as one element of very long baseline interferometer (VLBI) to begin monitoring locations of six sites in California relative to large diameter fixed antennas at the NASA Deep Space Network, Goldstone, California, and at the Caltech Owens Valley Radio Observatory, Big Pine, California. An accuracy of about 6 cm in the horizontal components was demonstrated by comparison with measurements of the National Geodetic Survey. The root of mean square scatter of the lengths of the baselines between any pair of antennas was about 3 cm except for the Goldstone-JPL (Pasadena) baseline. In the period August 1974 to August 1977 the length of this baseline increased by 15 + or - 5 cm as JPL moved westward relative to Goldstone at the rate of 6 + or - 2 cm/year. The baseline lengths were unaffected by the uncertainties of UT1, polar motion, and tropospheric water vapor, which are the limitations to present three dimensional vector accuracies. R.E.S.

N80-28800*# National Geodetic Survey, Rockville, Md.
NOS/NGS ACTIVITIES TO SUPPORT DEVELOPMENT OF RADIO INTERFEROMETRIC SURVEYING TECHNIQUES
William E. Carter, J. F. Dracup, L. D. Hothem, Douglas S. Robertson, and W. E. Strange *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 9-22 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

National Geodetic Survey activities towards the development of operational geodetic survey systems based on radio interferometry are reviewed. Information about the field procedures, data reduction and analysis, and the results obtained to date is presented. R.E.S.

N80-28801*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG BASELINE VECTOR DETERMINATIONS AND INTERCOMPARISONS
Curtis A. Knight (Northeast Radio Observatory Corp., Westford Mass. Haystack Observatory) *In its* Radio Interferometry Jul. 1980 p 23-26 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

The East Coast very long baseline interferometry (VLBI) group has performed about 60 experiments over the last 10 years in the process of developing and exploiting advanced VLBI techniques. Of those, the most recent 14 experiments are briefly described. R.E.S.

N80-28802*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR MOTION AND UT1: COMPARISON OF VLBI, LUNAR LASER, SATELLITE LASER, SATELLITE DOPPLER, AND CONVENTIONAL ASTROMETRIC DETERMINATIONS
Douglas S. Robertson, Thomas A. Clark, Robert J. Coates, Chopo Ma, James W. Ryan, Brian E. Corey, Charles C. Counselman, III, Robert W. King, Irwin I. Shapiro, Hans F. Hinteregger et al *In its* Radio Interferometry Jul. 1980 p 33-44 ref Prepared in cooperation with National Geodetic Survey, Rockville, Md., MIT, Cambridge, Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory and Computer Sciences Corp., Greenbelt, Md. (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

Very long baseline interferometry observations made with a 3900 km baseline interferometer (Haystack Observatory in Massachusetts to Owens Valley Observation in California) were used to estimate changes in the X-component of the position of the Earth's pole and in UT1. These estimates are compared with corresponding ones from lunar laser ranging, satellite laser ranging, satellite Doppler, and stellar observations. R.E.S.

N80-28803*# Naval Research Lab., Washington, D. C.
A REVIEW OF CONNECTED ELEMENT RADIO INTERFEROMETRY DIRECTED AT ESTABLISHING AN ALMOST INTERNAL REFERENCE FRAME
Kenneth J. Johnston *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 45-61 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 03A

The present status of connected element radio interferometry towards establishing an accurate grid of positions of extragalactic radio sources is reviewed. Many of the problems being encountered are, in general, also faced by very long baseline interferometry. Author

N80-28804*# Naval Observatory, Washington, D. C.
THE USNO/NRL GREEN BANK INTERFEROMETER PROGRAM Progress Report
William J. Klepczynski, George H. Kaplan (Naval Research Lab., Washington, D.C.), D. D. McCarthy, F. J. Josties, R. L. Branham, Kenneth J. Johnston (Naval Research Lab., Washington, D.C.), and John S. Spencer *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 63-70 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

Application of the connected-element radio interferometer of the National Radio Astronomy Observation in Green Bank, West Virginia to the determination of improved source coordinates, astronomical constants, and variations in Earth rotation parameters is discussed. It is concluded that because of the brevity and discontinuity of the data so far no reliable conclusions regarding the accuracy of the data can be drawn. R.E.S.

N80-28805*# York Univ., Toronto (Ontario). Dept. of Physics.
GEODETIC LONG BASELINE INTERFEROMETRY RESEARCH IN CANADA
R. B. Langley (MIT, Cambridge), William T. Petrachenko, and Wayne H. Canon *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 71-87 refs Sponsored in part by National Research Council of Canada (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

The objectives and results of several studies using the Canadian long baseline interferometry system (LBI) are presented. The precision of measurements from radio telescopes at the Algonquin Radio Observatory (ARO), Lake Traverse, Ontario, the Owens Valley Radio Observatory (OVRO), Big Pine, California; and the Chilbolton Observatory (CHIL), Chilbolton, England, is discussed. Also, since LBI is insensitive to the uncertainty in the geocentric gravitational constant, it is a very useful technique for determining the scales of the coordinate systems used by other precise techniques. Beginning in May 1977, a number of LBI observing sessions were accompanied by simultaneous satellite Doppler observations. The baseline components obtained from the satellite Doppler observations were compared to the LBI values. The weighted mean scale bias of the NSWC 9Z-2 satellite Doppler coordinate system relative to the LBI system was found to be 0.42 + or - 0.05 PPM. The weighted mean difference in the origin of longitude was found to be 0.87 sec + or - 0.01 while the difference in declination origin was found to be 0.06 sec + or - 0.01. R.E.S.

N80-28806*# Naval Research Lab., Washington, D. C.
PHASE COHERENT VLBI USING A SATELLITE LINK
William B. Waltman, S. H. Nkowles, J. L. Yen (Toronto Univ.), D. N. Fort (Herzberg Inst. of Astrophysics, Ottawa, Ontario), G. W. Swenson, Jr. (Illinois Univ.), Wayne H. Cannon (York Univ., Toronto, Ontario), and John Galt (Herzberg Inst. of Astrophysics, Penticton, British Columbia) *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 89-94 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

The results from experiments using the Hermes (formerly CTS) communications satellite to provide a local oscillator and data link between two antennas are presented. The techniques used to compensate for the satellite motion and translation oscillator are described. Plans for a series of three station experiments to measure UT and polar motion using the ANIK-B satellite to synchronize the local oscillators are discussed. R.E.S.

N80-28807*# Uppsala Univ. (Sweden). Inst. of Geophysics.
SCANDINAVIA STUDIES OF RECENT CRUSTAL MOVEMENTS AND THE SPACE GEODETIC BASELINE NETWORK
Allen Joel Anderson. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 97-106 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

A brief review of crustal movements within the Fenno-Scandia shield is given. Results from postglacial studies, projects for measuring active fault regions, and dynamic ocean loading experiments are presented. The 1979 Scandinavian Doppler Campaign Network is discussed. This network includes Doppler translocation baseline determination of future very long baseline interferometry baselines to be measured in Scandinavia. Intercomparison of earlier Doppler translocation measurements with a high precision terrestrial geodetic baseline in Scandinavia has yielded internal agreement of 6 cm over 887 km. This is a precision of better than 1 part in to the 7th power. R.E.S.

N80-28808*# York Univ., Toronto (Ontario). Dept. of Physics.
THE MEASUREMENT OF EARTH ROTATION ON A DEFORMABLE EARTH
Wayne H. Cannon. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 109-144 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

Until recently, the methods of geodetic positioning on the Earth were limited to a precision of roughly one part in 10 to the 6th power. At this level of precision, the Earth can be regarded as a rigid body since the largest departure of the Earth from rigidity is manifested in the strains of the Earth tides which are of the order of one part in 10 to the 7th power. Long baseline interferometry is expected to routinely provide global positioning to a precision of one part in 10 to the 8th power or better. At this level of precision, all parts of the Earth's surface must be regarded as being, at least potentially, in continual motion relative to the geocenter as a result of a variety of geophysical effects. The general implications of this phenomenon for the theory of the Earth's rotation is discussed. Particular attention is given to the question of the measurement of the 'Earth's rotation vector' on a deformable Earth. R.E.S.

N80-28809*# New South Wales Univ., Sydney (Australia). School of Surveying.
CRUSTAL DEFORMATION AT VERY LONG BASELINE INTERFEROMETRY SITES DUE TO SEASONAL AIR-MASS AND GROUND WATER VARIATIONS
A. Stolz and Douglas R. Larden (Colorado Univ., Boulder). *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 145-151 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

The seasonal deformation normal to the Earth's surface was calculated at stations involved or interested in very long baseline interferometry (VLBI) geodesy and at hypothetical sites in Australia and Brazil using global atmospheric pressure data, values for groundwater storage, and load Love numbers deduced from current Earth models. It was found that the annual range of deformation approached the centimeter level measuring potential of the VLBI technqiue at Greenbank, Haystack, and the Brazil site. R.E.S.

N80-28810*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOPHYSICAL AND ASTRONOMICAL MODELS APPLIED IN THE ANALYSIS OF VERY LONG BASELINE INTERFEROMETRY
Chopo Ma, James W. Ryan, and Bruce R. Schupler (Computer Sciences Corp., Greenbelt, Md.) *In its* Radio Interferometry Jul. 1980 p 153-159 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

Very long baseline interferometry presents an opportunity to measure at the centimeter level such geodetic parameters as baseline length and instantaneous pole position. In order to achieve such precision, the geophysical and astronomical models used in data analysis must be as accurate as possible. The Mark-3 interactive data analysis system includes a number of refinements beyond conventional practice in modeling precession, nutation, diurnal polar motion, UT1, solid Earth tides, relativistic light deflection, and reduction to solar system barycentric coordinates. The algorithms and their effects on the recovered geodetic, geophysical, and astrometric parameters are discussed. R.E.S.

N80-28811*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI MEASUREMENTS OF RADIO SOURCE POSITIONS AT THE JET PROPULSION LABORATORY
George H. Purcell, Jr., John L. Fanselow, J. B. Thomas, E. J. Cohen, David H. Rogstad, O. J. Sovers, L. J. Skjerve, and D. J. Spitzmesser. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 165-172 refs (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 03A

The results of approximately 1300 observations of 67 radio sources are presented. Most of the measurements were made at the stations of the Deep Space Network in California, Spain, and Australia at wavelengths of 13.1 and 3.6 cm, between 1971 and 1978. The formal errors in the derived source positions are generally in the neighborhood of 0.01 seconds of arc and the positions agree fairly well with those previously published. E.D.K.

N80-28812*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A VERY LONG BASELINE INTERFEROMETRY SKY SURVEY **c53**
Robert A. Preston and D. D. Morabito. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 173-179 refs (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 08E

A systematic very long baseline interferometry (VLBI) sky survey, undertaken to find a suitable set of compact celestial radio sources from which a more complete VLBI reference frame can be constructed, discussed. The survey was conducted by searching known celestial radio sources for compact components by means of VLBI observations. Baseline lengths were about 7 x 10 to the 7th power RF wavelengths (lambda = 13.1 cm), so the spatial wavelengths being sampled by the interferometer were generally on the order of a few milliarcseconds. Hence, the radio sources detected have a measurable portion of their total flux density contained in components that are no more than a few milliarcseconds in angular extent. Existing information of radio sources were used as clues to source size. E.D.K.

N80-28813*# Naval Research Lab., Washington, D. C.
ASTRONOMY USING BASIC MARK 2 VERY LONG BASELINE INTERFEROMETRY
John H. Spencer, William B. Waltman, Kenneth J. Johnston, and D. C. Backer (California Univ., Berkeley). *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 181-186 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 03A

Two experiments were performed in April and September 1976 to determine precise positions of radio sources using conventional Mark 2 VLBI techniques. Four stations in the continental United States observed at a wavelength of 18 cm. The recording bandwidth was 2 MHz. The preliminary results using analyses of fringe rate and delay are discussed and the source positions compared with the results of other measurements. E.D.K.

N80-28814*# California Univ., Berkeley. Radio Astronomy Lab.
DIFFERENTIAL RADIO ASTRONOMY OF GALACTIC OBJECTS
D. C. Backer. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 187-192 ref (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 03A

A differential astrometry technique is discussed. An improved

proper motion and a parallax limit for pulsar 1929 + 10 is presented as well as a limit on the space velocity of the enigmatic object in SgrA. E.D.K.

N80-28815*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.

SOURCE STRUCTURE CORRECTIONS TO THE GEODETIC VERY LONG BASELINE INTERFEROMETRY OBSERVABLES

William D. Cotton. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 193-197 (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 08E

Why source structure affects VLBI observations and how source structure corrupts the geodetic observables are discussed. Evidence is presented which shows that corrections for source structure are possible and necessary for centimeter level accuracy VLBI measurements. E.D.K.

N80-28816*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

HYDROGEN MASER FREQUENCY STANDARD

Robert F. C. Vessot. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 203-221 refs (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 20E

The fundamental theoretical limitations of the maser, systematic processes that cause instability, and some aspects of recently designed masers are described. A design for field use that has evolved from the development of the space borne maser is presented. The performance of this type of maser is close to theoretical limits imposed by thermal noise. Further developments of smaller masers for space and terrestrial use and recent work on masers operating at low temperatures is also discussed. E.D.K.

N80-28817*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE PERFORMANCE OF NASA RESEARCH HYDROGEN MASERS

Victor S. Reinhardt and Lauren J. Rueger (APL, Laurel, Md.) *In its* Radio Interferometry Jul. 1980 p 223-240 (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 20E

Field operable hydrogen masers based on prior maser designs are presented. These units incorporate improvements in magnetic shielding, lower noise electronics, better thermal control, and have a microprocessor for operation, monitoring, and diagnostic functions. They are ruggedly built for transportability and ease of service anywhere in the world. E.D.K.

N80-28818*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ULTRA-LOW-NOISE MICROWAVE AMPLIFIERS

Robert C. Clauss and David L. Trowbridge. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 241-254 refs (For primary document see N80-28798 19-43)

(Contract NAS7-100)

Avail: NTIS HC A20/MF A01 CSCL 09A

The highlights of 20 years of maser use and development are presented. Masers discussed include cavity, traveling wave, K band, and S band. Noise temperatures measured since 1960 are summarized. Use of masers in the Deep Space Network is presented. Costs associated with the construction of masers systems are given. E.D.K.

N80-28819*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.

PHASE AND GROUP DELAY CALIBRATION OF A VERY LONG BASELINE INTERFEROMETER BY EAST COAST VLBI GROUP

Alan E. E. Rogers. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 255-261 (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 14B

Precisely timed pulses injected into the input of each receiver are used to calibrate the phase and group delay through each interferometer terminal. The short duration pulses are generated at a 1 MHz rate directly from the output of the frequency standard. The pulses are injected into the receiver at a level low enough to produce less than one percent increase in system temperature, yet can be extracted during processing with a high enough signal to noise ratio to determine the phase of the calibration rails within 1 degree in 1 second of integration. The calibration system also includes precise cable measurement electronics and a pulse echo for clock synchronization. E.D.K.

N80-28820*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

USE OF A DIGITAL TONE EXTRACTOR FOR REAL-TIME PHASE ANALYSIS

Elliott Sigman and Gary S. Parks. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 263-267 (For primary document see N80-28798 19-43)

(Contract NAS7-100)

Avail: NTIS HC A20/MF A01 CSCL 14B

A digital tone extractor which monitors the phase integrity of a VLBI recording system in real time was developed. The digital tone extractor monitors phase calibrator tones injected at the antenna and tracks their phase as a function of time. It is capable of maintaining 0.001 cycle phase accuracy over the course of a VLBI experiment in accordance with the accuracy requirements of centimeter VLBI work. This real time VLBI system monitor is a safeguard against most instrumental breakdowns and operator errors. E.D.K.

N80-28821*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CONSIDERATIONS IN THE PLACEMENT OF PHASE CALIBRATION TONES

Lawrence E. Young. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 269-274 (For primary document see N80-28798 19-43)

(Contract NAS7-100)

Avail: NTIS HC A20/MF A01 CSCL 14B

In the use of tones to calibrate unwanted instrumental phases for very long baseline interferometry experiments, certain problems exist which are related to the placement of these phase calibrator tones. (1) A bias exists in an analytically generated stopping function used during correlation if its frequency satisfies the following condition: f = (f sub s)x(m)/n, where f sub s = sampling frequency, m = any integer, and n = any odd integer. (2) Due to the quantized representation of sine waves in the stopping function, odd harmonics of the fundamental frequencies are generated. Several mechanisms are available through which these harmonics can cause errors in the residual phase extracted from the recorded tones. (3) When multiple tones are injected into a pass band, intermodulation products can occur. The magnitude of these effects is discussed along with strategies designed to avoid them. E.D.K.

N80-28822*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE SENSITIVITY OF A VERY LONG BASELINE INTERFEROMETER

Alan E. E. Rogers (Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory). *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 275-281 refs (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 14B

The theoretical sensitivity of various methods of acquiring and processing interferometer data are compared. It is shown that for a fixed digital recording capacity one bit quantization of single sideband data filtered with a rectangular bandpass and sampled at the Nyquist rate yields the optimum signal to noise ratio. The losses which result from imperfect bandpass, poor image rejection, approximate methods of fringe rotation, fractional bit correction, and loss of quadrature are discussed. Also discussed is the use of the complex delay function as a maximum likelihood fringe estimator. Author

N80-28823*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MARK 3 SYSTEM OVERVIEW

T. A. Clark. *In its* Radio Interferometry Jul. 1980 p 285-290 refs (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 08E

The Mark 3 very long baseline interferometry (VLBI) system, comprising a complete end to end VLBI system optimized for both high accuracy geodesy and radio astronomy, is described. The data flow, the data base handler system, and the field station component and configurations are briefly discussed. The use of mobile and transportable stations allows measurements to be taken from a large number of sites with relatively few sets of equipment. Fixed stations form a long term reference network for tying together the measurements with the mobile and transportable stations. M.G.

N80-28824*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AUTOMATION OF THE MARK 3 FIELD SYSTEM

N. R. Vandenberg, T. A. Clark, L. N. Foster (Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory), A. R. Whitney, and G. Lampe. *In its* Radio Interferometry Jul. 1980 p 291-295 (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 14B

The software and hardware components which will enable hands off operation are described. The operation of the field system begins with the scheduling of observations. An interactive program, SKED, provides displays of mutual visibility, automatic calculation of telescope slewing times, and the ability to list and edit the schedule. The output of SKED is a schedule file containing commands in the Standard Notation for Astronomy Procedures (SNAP) language which the field system uses for controlling events during the experiment. The most important features of SNAP include sophisticated time sequencing of events, automatic logging of all commands and responses, and the ability to define often used sequences of commands as procedures. A control program, BOSS, running in an HP 1000 minicomputer, reads the SNAP commands from a schedule file and interprets them in terms of commands and requests to devices. Interactive command input is possible through the operator's display terminal. Communication with all of the Mark 3 electronics modules is done via a small general purpose interface board (a microprocessor based ASCII transceiver) which has been installed in each module. Additional devices are controlled and monitored using the IEEE 488 General Purpose Interface Bus. M.G.

N80-28825*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MICROWAVES TO MEGABITS

A. E. E. Rogers (Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory). *In its* Radio Interferometry Jul. 1980 p 297-304 (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 14B

Receiver and terminal characteristics of the Mark 3 very long baseline interferometry system are described in some detail. The Mark 3 system has 14 IF to video converters, each with built in synthesized local oscillators which have a range of 100 to 500 MHz covered in 10 kHz steps. In the normal wideband continuum mode, all 14 upper and all 14 lower sideband video outputs (each with 2 MHz bandwidth) are recorded with a total data rate of 112 Mbits/sec. In geodetic observations, two IF bands are simultaneously recorded from a dual band (S/X) receiver. M.G.

N80-28826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MARK 3 WIDEBAND DIGITAL RECORDER IN PERSPECTIVE

Hans F. Hinteregger (Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory). *In its* Radio Interferometry Jul. 1980 p 305-316 (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 14E

The tape recorder used for the Mark 3 data acquisition and processing system is compared with earlier very long baseline interferometry recorders. Wideband 33-1/3 kbpi digital channel characteristics of instrumentation recorders and of a modern video cassette recorder are illustrated. Factors which influenced selection of the three major commercial components (transport, heads, and tape) are discussed. A brief functional description and the reasons for development of efficient signal electronics and necessary auxiliary control electronics are given. The design and operation of a digital bit synchronizer is illustrated as an example of the high degree of simplicity achieved. M.G.

N80-28827*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.

MARK 3 CORRELATOR HARDWARE AND SOFTWARE

Alan R. Whitney. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 317-325 (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 14B

The Mark 3 correlator system is described in some detail. The correlator system is based on a modular philosophy. Each correlator module independently processes the data from one track pair. Therefore, 28 modules are necessary to complete a full one baseline processor and 84 modules for a full 3 baseline processor. Each correlator module has two interfaces: (1) data and clock from each of the two tracks to be correlated and (2) Computer Automated Measurement and Control (CAMAC) dataway interface to the computer. The processor is organized around the IEEE CAMAC standard architecture, housing 15 correlator modules in each of 6 crates. This allows one pass processing of a full 3 baseline 28 track observation or a 6 baseline (4 station) 14 track observation. The correlator architecture allows easy expansion for up to 8 stations. The computer system is an HP 1000 system utilizing a 16 bit minicomputer with disc and tape peripherals. The processing software is also organized in a modular fashion with many independent but cooperative programs controlling the operation of the Mark 3 processor. Processing time through the correlator is normally real time or faster, with graphics displays providing real time monitor and control of the processing operation. M.G.

N80-28828*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.

CORRELATOR COMPUTER INTERFACE AND MODULE IMPLEMENTATION: MARK 3 PROCESSOR

Edwin F. Nesman. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 327-328 (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 09B

Two hardware aspects of the Mark 3 correlator are briefly described. The first area concerns the choice of interface to the controlling minicomputer and the second area concerns the implementation of the correlator module. Multiple computer automated measurement and control (CAMAC) modules and a single large CAMAC module were considered as possible packaging forms for the correlator. The large CAMAC module approach was chosen because of the difficulty in partitioning the correlator with minimum interconnections, the fabrication economy of a single large planar assembly, and the desire to minimize the number of modules. M.G.

N80-28829*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MARK 3 VLBI SYSTEM: TROPOSPHERIC CALIBRATION SUBSYSTEMS

G. M. Resch. *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 329-332 (For primary document see N80-28798 19-43)

(Contract NAS7-100)

Avail: NTIS HC A20/MF A01 CSCL 14B

Tropospheric delay calibrations are implemented in the Mark 3 system with two subsystems. Estimates of the dry component of tropospheric delay are provided by accurate barometric data from a subsystem of surface meteorological sensors (SMS). An estimate of the wet component of tropospheric delay is provided by a water vapor radiometer (WVR). Both subsystems interface directly to the ASCII Transceiver bus of the Mark 3 system and are operated by the control computer. Seven WVR's under construction are designed to operate in proximity to a radio telescope and can be commanded to point along the line-of-sight to a radio source. They should provide a delay estimate that is accurate to the + or - 2 cm level. M.G.

N80-28830*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.

MARK 3 REAL-TIME FRINGE DETECTION SYSTEM

J. I. Levine and A. R. Whitney. *In* NASA. Goddard Space

Flight Center Radio Interferometry Jul. 1980 p 333-336 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

A RAM memory built into the Mark 3 decoder module allows the capture of 1 Megabit of data. Data may be collected either in real time or from a pre-recorded tape. Once collected, the data may be retrieved using a standard EIA serial data link. The data may be transmitted to a remote computer for cross correlation processing with similar data from other stations to verify fringes in real time. The data may also be analyzed by a local computer to verify phase calibration, bandpass, format, etc., during a Mark 3 observing session. Author

N80-28831*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE MARK 3 DATA BASE HANDLER
James W. Ryan, Chopo Ma, and Bruce R. Schupler (Computer Sciences Corp., Greenbelt, Md.) *In its* Radio Interferometry Jul. 1980 p 337-346 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 05B

A data base handler which would act to tie Mark 3 system programs together is discussed. The data base handler is written in FORTRAN and is implemented on the Hewlett-Packard 21MX and the IBM 360/91. The system design objectives were to (1) provide for an easily specified method of data interchange among programs, (2) provide for a high level of data integrity, (3) accommodate changing requirments, (4) promote program accountability, (5) provide a single source of program constants, and (6) provide a central point for data archiving. The system consists of two distinct parts: a set of files existing on disk packs and tapes, and a set of utility subroutines which allow users to access the information in these files. Users never directly read or write the files and need not know the details of how the data are formatted in the files. To the users, the storage medium is format free. A user does need to know something about the sequencing of his data in the files but nothing about data in which he has no interest. M.G.

N80-28832*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MARK 3 INTERACTIVE DATA ANALYSIS SYSTEM
James W. Ryan, Chopo Ma, and Bruce P. Schupler (Computer Sciences Corp., Beltsville, Md.) *In its* Radio Interferometry Jul. 1980 p 347-353 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 05B

The interactive data analysis system, a major subset of the total Mark 3 very long baseline interferometry (VLBI) software system is described. The system consists of two major and a number of small programs. These programs provide for the scientific analysis of the observed values of delay and delay rate generated by the VLBI data reduction programs and product the geophysical and astrometric parameters which are among the ultimate products of VLBI. The two major programs are CALC and SOLVE. CALC generates the theoretical values of VLBI delay rate as well as partial derivatives based on apriori values of the geophysical and astronometric parameters. SOLVE is a least squares parameters estimation program which yields the geophysical and astrometric parameters using the observed values by the data processing system and theoretical values and partial derivatives provided by CALC. SOLVE is a highly interactive program in which the user selects the exact form of the recovered parameters and the data to be accepted into the solution. M.G.

N80-28833*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
WATER VAPOR AS AN ERROR SOURCE IN MICROWAVE GEODETIC SYSTEMS: BACKGROUND AND SURVEY OF CALIBRATION TECHNIQUES
E. S. Claflin and G. M. Resch *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 357-361 (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 08E

Water vapor as an error source in radio interferometry systems is briefly examined. At microwave frequencies, the delay imposed by tropospheric water vapor becomes a limiting error source for high accuracy geodetic systems. The mapping of tropospheric induced errors into 'solved-for' parameters depends upon baseline length and observing strategy. Simulation analysis (and experience) indicates that in some cases, errors in estimating tropospheric delay can be magnified in their effect on baseline components. The various techniques by which tropospheric water can be estimated or measured are surveyed with particular consideration to their possible use as a calibration technique in support to very long baseline interferometry experiments. The method of remote sensing using a microwave radiometer seems to be the most effective way to provide an accurate estiamte of water vapor delay. M.G.

N80-28834*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
THE ESTIMATION OF THE PROPAGATION DELAY THROUGH THE TROPOSPHERE FROM MICROWAVE RADIOMETER DATA
J. M. Moran and B. R. Rosen *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 363-376 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 09F

The uncertainity in propagation delay estimates is due primarily to tropospheric water, the total amount and vertical distribution of which is variable. Because water vapor both delays and attenuates microwave signals, the propagation delay, or wet path length, can be estimated from the microwave brightness temperature near the 22.235 GHz transition of water vapor. The data from a total of 240 radiosonde launches taken simultaneously were analyzed. Estimates of brightness temperature at 19 and 22 GHz and wet path length were made from these data. The wet path length in the zenith direction could be estimated from the surface water vapor density to an accuracy of 5 cm for the summer data and 2 cm for winter data. Using the brightness temperatures, the wet path could be estimated to an accuracy of 0.3 cm. Two dual frequency radiometers were refurbished in order to test these techniques. These radiometers were capable of measuring the difference in the brightness temperature at 30 deg elevation angle and at the zenith to an accuracy of about 1 K. In August 1975, 45 radiosondes were launched over an 11 day period. Brightness temperature measurements were made simultaneously at 19 and 22 GHz with the radiometers. The rms error for the estimation of wet path length from surface meteorological parameters was 3.2 cm, and from the radiometer brightness temperatures, 1.5 cm. M.G.

N80-28835*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MICROWAVE RADIOMETRY AS A TOOL TO CALIBRATE TROPOSPHERIC WATER-VAPOR DELAY
G. M. Resch and E. S. Claflin *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 377-384 refs (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 09F

Microwave radiometers were used to measure the emission line due to the water vapor molecules of atmospheric emission. Four separate field tests were completed which compared radiometers to other techniques which measure water vapor. It is shown that water vapor induced delay can be estimated with an accuracy of plus or minus 2 cm for elevation angles above 17 degrees. R.C.T.

N80-28836*# Bonn Univ. (West Germany). Geodetic Inst.
PHASE VERSUS DELAY IN GEODETIC VLBI
James Campbell *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 385-397 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

The conditions for the applicability of the phase observable in very long baseline interferometry are discussed and examples of adequate observation programs are given. These considerations apply in particular to the Mark 2 system, which is already in operation at many observatories. R.C.T.

N80-28837*# Massachusetts Inst. of Tech., Cambridge.
PHASE DELAY ASTROMETRY AND ITS GEODETIC APPLICATIONS
J. J. Wittels *In* NASA. Goddard Space Flight Center Radio

Interferometry Jul. 1980 p 399-402 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

The accuracy inherent in the fringe phase in the determination of source positions was calculated. It is shown that accuracy can be utilized by applying differencing techniques in order to circumvent such systematic effects as clock drift and delay due to the propagation media. R.C.T.

N80-28838*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE EMISSION RADIO INTERFEROMETRIC EARTH SURVEYING (SERIES)
P. F. MacDoran *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 403-408 (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 08B

Existing satellite radio emissions of the global positioning system were exploited as a resource for cost effective high accuracy geodetic measurements. System applications were directed toward crustal dynamics and earthquake research.R.C.T.

N80-28839*# Massachusetts Inst. of Tech., Cambridge.
BACKPACK VLBI TERMINAL WITH SUBCENTIMETER CAPABILITY
C. C. Connselman, III, I. I. Shapiro (Draper (Charles Stark) Lab., Inc.), R. L. Greenspan, and D. B. Cox, Jr. (Draper (Charles Stark) Lab., Inc.) *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 409-414 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

Backpack portable equipment was developed to measure vector baseline from approximately 1 km to 100 km in length with subcentimeter to few centimeter accuracy. The equipment design features as well as the instrumentation specifications are discussed. It is shown that the unit has the following advantages: it is simple in concept; it is reliable in unattended operation; and it is inexpensive (less than $15,000 per unit). R.C.T.

N80-28840*# Netherlands Foundation for Radio Astronomy, Dwingelo.
THE EUROPEAN VLBI NETWORK
R. T. Schilizzi *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 417-423 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

The capabilities of the European very long baseline interferometry (VLBI) network are summarized. The range of baseline parameters, sensitivities, and recording and other equipment available are included. Plans for upgrading the recording facilities and the use of geostationary satellites for signal transfer and clock synchronization are discussed. R.C.T.

N80-28841*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
NASA GEODETIC APPLICATIONS OF THE MARK 3 VLBI SYSTEM
Robert Coates *In its* Radio Interferometry Jul. 1980 p 425-433 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

The Mark 3 very long baseline interferometer system was used in monitoring the following geodetic phenomena: the regional deformation and strain accumulation related to large earthquakes in the plate boundary region of the western United States; contemporary relative plate tectonic motions of the North American, Pacific, South American, Eurasian, and Australian Plates; the internal deformation of continental and oceanic lithospheric plates with particular emphasis on North America and the Pacific; the rotational dynamics of the Earth and their possible correlation to earthquakes, plate motions, and other geophysical phenomena; and motions and deformation occurring in regions of high earthquake activity. R.C.T.

N80-28842*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
ON THE VLBI-SATELLITE LASER RANGING IRON TRIANGLE INTERCOMPARISON EXPERIMENT
Yehuda Bock, Ivan I. Mueller, and Erricos Pavlis *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 435-445 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

Simulations were performed to determine the suitability of the proposed station locations. The criterion was a comparison among the possible station configuration of the standard deviations of baseline and Earth rotation parameters estimated from a least squares covariance analysis. Only the relative magnitudes of the standard deviations were addressed in the analysis. Only random errors were assumed and no provision was made for systematic effects. The Iron Triangle, consisting of the stations at Westford (Haystack), Massachusetts, Owens Valley, California, and Ft. Davis, Texas, was regarded as the structure of the proposed network with options to incorporate either the Goldstone, California, or Green Bank, West Virginia, station or both. It was decided to include the Richmond, Florida, station in the analysis since it offered more North-South separation and therefore could strengthen the geometry of the network especially in the recovery of Earth rotation parameters. R.C.T.

N80-28843*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK CAPABILITIES FOR RADIO INTERFEROMETRY
J. L. Fanselow *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 447-450 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

The very long baseline interferometry capability as well as the planned capability of the deep space network (DSN) are described. Major emphasis is placed on the following: VLBI development; operational VLBI for DSN calibration; and VLBI for spacecraft navigation. R.C.T.

N80-28844*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE JET PROPULSION LABORATORY/CALIFORNIA INSTITUTE OF TECHNOLOGY BLOCK 2 VLBI PROCESSOR
D. H. Rogtad *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 451-454 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

A multistation, multichannel cross correlation processor using the 250 k bit to 4 M bit recording format is discussed. The design is modular, using bit sliced microprocessors to perform the routine calculations for phase and delay on a per station basis, as well as for fractional bit shift correction and Fourier transformation of the correlation coefficients on a per baseline basis. R.C.T.

N80-28845*# National Geodetic Survey, Rockville, Md.
PROJECT POLARIS: A REPORT Status Report
W. E. Carter *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 455-460 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

The project was proposed to meet the developing demands for higher resolution and accuracy polar motion and Earth rotation data to support modern geodynamic studies. The basis for the selection of radio interferometry, rather than lunar or artifical satellite laser ranging or Doppler satellite tracking, is described. R.C.T.

N80-28846*# York Univ., Toronto (Ontario).
PLANS FOR PHASE COHERENT LONG BASELINE INTERFEROMETRY FOR GEOPHYSICAL APPLICATIONS USING THE ANIK-B COMMUNICATIONS SATELLITE
W. H. Cannon, W. T. Petrachenki, J. L. Yen (Toronto Univ.), J. A. Galt, W. B. Waltman, S. H. Knoweles (NRL, Washington, D.C.), and J. Popelar (Department of Energy, Mines and Resources, Ottawa, Canada) *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 461-480 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

A pilot project to establish an operational phase stable very long baseline interferometer (VLBI) for geophysical studies is

described. Methods for implementation as well as practical applications are presented. R.C.T.

N80-28847*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE REMOTE SENSING FACILITY FOR OCEANOGRAHIC APPLICATIONS Final Report
R. H. Evans, S. S. Kent, and J. B. Seidman 1 Jul. 1980 76 p refs
(Contract NAS7-100)
(NASA-CR-163363; JPL-Pub-80-40) Avail: NTIS HC A05/MF A01 CSCL 08C

The project organization, design process, and construction of a Remote Sensing Facility at Scripps Institution of Oceanography at LaJolla, California are described. The facility is capable of receiving, processing, and displaying oceanographic data received from satellites. Data are primarily imaging data representing the multispectral ocean emissions and reflectances, and are accumulated during 8 to 10 minute satellite passes over the California coast. The most important feature of the facility is the reception and processing of satellite data in real time, allowing investigators to direct ships to areas of interest for on-site verifications and experiments. L.F.M.

N80-28848*# National Aeronautics and Space Administration, Washington, D. C.
DESCRIPTION OF TEXTS OF AUXILIARY PROGRAMS FOR PROCESSING VIDEO INFORMATION. PART 2: SUODH PROGRAM OF AUTOMATED SEPARATION OF QUASIHOMOGENEOUS FORMATIONS
V. I. Borisenko and L. S. Chesalin Jun. 1980 13 p refs Transl. into ENGLISH of "Opisaniye i Teksty Vspomogatel'nykh Programm obrabotki Videoinformatsii: Chast 2: Programma SUODH Avtomatizirovannogo Vydeleniya Kvaziodnoroykh Obrazovaniy", Rept. Pr-397 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-15 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76239; Pr-397) Avail: NTIS HC A02/MF A01 CSCL 09B

The algorithm, block diagram, complete text, and instructions are given for the use of a computer program to separate formations whose spectral characteristics are constant on the average. The initial material for operating the computer program presented is video information in a standard color-superposition format. A.R.H.

N80-28849# Lockheed Missiles and Space Co., Palo Alto, Calif.
MULTIDIMENSIONAL TIME DEPENDENT STRUCTURE AND MECHANISMS FOR NON-LTE CO2 INFRARED EMISSIONS AND 4.3 MICROMETERS AURORA Final Report, 1 Jun. 1976 - 31 Jul. 1979
J. B. Kumer 31 Aug. 1979 191 p refs Sponsored in part by DNA
(Contract F19628-76-C-0209)
(AD-A084940; AFGL-TR-79-0224) Avail: NTIS HC A09/MF A01 CSCL 17/5

The effort was concerned with development of a two dimensional time dependent radiation transport model of the CO2 4.3 micrometer aurora. Predictions of spatial structure in aurorai nadir radiance, and experimental concepts for verification were addressed. Nadir radiance gradients in the CO2 4.3 micrometer aurora are predicted to be comparable to those in the 2.7 micrometer aurora even though the DC component of the former is approx. 10 times brighter. A rocket borne arc over flown cryogenically cooled tilting etalon spectrometer in series with CO2 absorption cell wheel is shown to be the optimum experiment to provide verification. The modelling facility is also used to estimate the 4.3 micrometer signal levels that might be observed in the electron gun mother-sensor module daughter spatial EXCEDE experiment and to delineate emission mechanisms for that experiment. A detailed investigation of the CO2 4.3 micrometer zenith radiance data obtained under undisturbed night time conditions on 4/11/74 revealed compelling evidence for the existence of an OH airglow related mechanism for producing structured CO2 4.3 micrometer radiance under undisturbed night time conditions. Detailed LWIR CO2 emission earthlimb synthetic spectra that are pumped by structured mechanisms such as aurora, airglow and fluorescence are also presented. GRA

N80-28850# Potomac Research, Inc., Baileys Crossroads, Va.
MAP COORDINATE CONVERSION Final Report, Dec. - Mar. 1978
H. O. Eberhart Mar. 1978 112 p Revised
(Contract DAAK11-77-C-0112)
(AD-A084822; STR-IR78.01) Avail: NTIS HC A06/MF A01 CSCL 08/5

This set of twelve FORTRAN subroutines will convert the coordinates of a point given in geographic, military, state planar, or Universal Transverse Mercator form to coordinates represented in a second form chosen from the four coordinate types. GRA

N80-28851# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Advanced Technology Div.
DIGITAL IMAGE TECHNOLOGY 1980: EMERGING PRODUCTION APPLICATIONS Final Report
Marshall B. Faintich 5 Mar. 1980 19 p ref Submitted for publication Original contains color illustrations
(AD-A085163) Avail: NTIS HC A02/MF A01 CSCL 08/2

The Defense Mapping Agency Aerospace Center has developed a program to exploit digital image technology for the advancement of mapping, charting, and geodesy. Primary investigations include image processing, analysis, and display techniques, and computer image generation. A dramatic impact has been made in the ability to produce, analyze, and validate various digital data bases produced by the Defense Mapping Agency by applying state-of-the-art digital image technology concepts to the development of new interactive prototype and production systems. GRA

N80-28852# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT, SAN JOAQUIN EXPERIMENTAL RANGE
Janet Bonner, comp. and Marrianne Moskowitz, comp. 1980 56 p
(PB80-169295) Avail: NTIS HC A04/MF A01 CSCL 08F

Photographs and images of the San Joaquin experimental range and adjacent areas available from the U.S. Geological Survey (USGS) are listed. LANDSAT, Skylab, NASA aircraft, and USGS photographs are included in the listing. Computer listings of data are provided by the EROS Data Center which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

N80-28853# Virginia Dept. of Highways and Transportation, Richmond. Aerial Safety Section.
AEROTRIANGULATION CONTROL OF LARGE SCALE PHOTOGRAPHY FROM SMALL SCALE PHOTOGRAPHY Final Report
George W. Habel, Jr. 26 Oct. 1979 49 p Sponsored by Federal Highway Administration
(PB80-161524; FHWA-VA-79-1) Avail: NTIS HC A03/MF A01 CSCL 14E

Tests were conducted to determine if a simultaneous adjustment of high and low altitude photography would yield results superior to either scale when used alone. These tests also offered an excellent opportunity to test the metric qualities of two different cameras and the relative metric qualities of black and white and color film. It was concluded that using a simultaneous adjustment is a good photogrammetric practice under certain circumstances. It was also found that the RC-10 camera normally gave a flatter bridge than the RC-8, and there was no appreciable difference in the metric qualities of the black and white and color film used in these tests. GRA

N80-28854# Idaho Univ., Moscow. Water Resources Research Inst.
ION EXCHANGE RECOVERY OF COBALT AND COPPER FROM BLACKBIRD MINE DRAINAGE
K. A. Prisbrey, J. F. Williams, and H. Lee Jan. 1980 30 p refs Presented at the Ann. AIME Meeting, Las Vegas, Nev.,

24-28 Feb. 1980
(PB80-166457; W80-04296; OWRT-A-067-IDA(1)) Avail: NTIS HC A03/MF A01 CSCL 07D

Approximately 300 ppm copper and 50 ppm cobalt flow in a 400 gallon per minute acid mine drainage stream named Bucktail Creek from the Blackbird Mine near Cobalt, Idaho in the Salmon National Forest. Bucktail Creek is part of the Panther Creek drainage. Salmon, Steelhead and other aquatic life are destroyed up to twenty miles downstream from the heavy metal contamination. Ion exchange resin beads contaminants to less than 0.1 ppm cobalt and copper. Equilibrium and kinetic data are extracted from laboratory tests for cobalt and copper loading. Field tests using fluidized ion exchange demonstrate the feasibility of this strategy to reduce contaminants. The advantages of the fluidized systems are discussed and compared to other alternatives. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-28855 Ohio State Univ., Columbus.
A NEW PROBABILISTIC SIMULATION TECHNIQUE FOR MULTIPLE ENERGY STORAGE DEVICES FOR ELECTRIC UTILITY GENERATION SYSTEM EXPANSION PLANNING MODELS Ph.D. Thesis
Brian Manhire 1980 338 p
Avail: Univ. Microfilms Order No. 8015903

A computationally feasible probabilistic production cost model is described which is capable of evaluating the impact on the operating cost of an electric utility of multiple energy storage technologies such as pumped storage hydroelectric, storage batteries, cryogenic storage, flywheels, and gas turbines utilizing compressed air storage. The model is capable of simulating the complex interactions of individual units of each storage technology with the remaining units, both storage and nonstorage, of the power system. Operating characteristics of the various energy storage technologies including forced outage rates, cycle efficiencies, fuel characteristics, and storage capability constraints are considered in the model as well as differences between these characteristics among individual units within each storage technology. The model is oriented toward the Wien Automatic System Planning Package, a widely used generation system expansion planning model. It is also able to simulate individually, multiple generating units whose energy use is preassigned.
Dissert. Abstr.

N80-28856# Vanjas Research, Inc., Timonium, Md.
COMPARATIVE STUDY OF THE ENERGY CHARACTERISTICS OF POWERED HAND TOOLS. PART 2: INVESTIGATION REPORTS Final Report
[1980] 254 p
(Contract EY-77-C-03-1731)
(SAN/1731-T2) Avail: NTIS HC A12/MF A01

The results of a theoretical analysis and a field test program to determine the relative energy efficiencies of different types of powered hand tools are presented. Grinders, drills, and nutrunners powered by hydraulic fluid, compressed air, 60 Hz single phase electricity, three phase 180 Hz electricity, three phase 360 Hz electricity, and in the case of flexible shaft tools, three phase 60 Hz power were analyzed and tested. The work included the determination of the energy use of the total system including air compressors and frequency converters where appropriate. Distribution system losses were also considered. Pneumatic tools, the most popular tools in industry, were found to use between five and fifteen times more energy than the various electrically powered tools, to do the same work.
E.D.K.

N80-28857# Gulf Research and Development Co., Pittsburgh, Pa.
REFINERY ENERGY PROFILE Final Report
R. W. Maier, W. P. Olivent, D. L. Brandt, and T. G. Golden
Jan. 1979 301 p
(Contracts DE-AC05-77CS-05262; EY-77-C-05-5262)
(ORO-5262-5-Suppl) Avail: NTIS HC A14/MF A01

A technique for preparing energy profiles at any refinery was developed. Analysis of Gulf's Alliance refinery profiles showed that about 75% of the energy leaving the refinery was lost from two areas: heater stacks (25%) and air and waster cooled heat exchangers (50%). Further analysis led to estimates of the amount of energy potentially recoverable from these two areas. Total refinery energy consumption would be cut up to 6% if all heaters could be economically modified using existing technology to operate at arbitrarily selected control points of 10% excess air and 350 F stack temperature. Comsumption would be cut up to another 19% if technology could be developed to economically recover all heat currently being rejected above 200 F in air and water cooled heat exchangers. If this same picture holds true for all U.S. refineries, a potential would exist for saving up to 350,000 barrels of crude per day in the U.S. However, due to the technical and economic considerations that must be applied to each heater and exchanger, the actual savings would be limited to some fraction of this potential.
E.D.K.

N80-28858# Washington State Univ., Pullman.
COMPARISON OF COAL-FIRED POWER SYSTEMS IN WASTE HEAT APPLICATIONS IN TACOMA, WASHINGTON M.S. Thesis
Jeremy Robertson 1979 237 p refs
(Contract EE-77-S-05-5516)
(TID-29379) Avail: NTIS HC A11/MF A01

The use of the waste stream of heat produced as a by-product of electrical power generation in a coal fired power plant is analyzed. Efficiency gains in the utilization of waste heat, and environmental impact and economic costs are compared for two types of plants supplying waste heat and for a conventional energy supply system that does not make use of waste heat. Small scale modular integrated utility systems plants are compared with a large power plant. The basis of comparision of systems is investment in an equivalent 300 MW of installed capacity. Power plant technologies are described for all systems as are alternative modes of operation. Waste heat utilization is concluded to be advantageous in efficiency of energy conversion as well as in impacts borne, and is economically competitive in most circumstances. Garden apartments as an end use are clearly superior in all categories to single dwellings.
E.D.K.

N80-28859*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. Energy Technology Operation.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 2: ANALYTICAL APPROACH Final Report
H. E. Gerlaugh, E. W. Hall, D. H. Brown, R. R. Priestley, and W. F. Knightly May 1980 106 p refs
(Contract DEN3-31)
(NASA-CR-159766; DOE/NASA/0031-80-2; GE80ET010-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 10B

The use of various advanced energy conversion systems were compared with each other and with current technology systems for their savings in fuel energy, costs, and emissions in individual plants and on a national level. The ground rules established by NASA and assumptions made by the General Electric Company in performing this cogeneration technology alternatives study are presented. The analytical methodology employed is described in detail and is illustrated with numerical examples together with a description of the computer program used in calculating over 7000 energy conversion system-industrial process applications. For Vol. 1, see N80-24797.
R.E.S.

N80-28860*# Spectrolab, Inc., Sylmar, Calif.
COPLANAR BACK CONTACTS FOR THIN SILICON SOLAR CELLS Final Report, Jul. 1978 - Dec. 1979
Jay W. Thornhill and W. E. Sipperly Mar. 1980 36 p refs
(Contract NAS3-21251)

(NASA-CR-159811) Avail: NTIS HC A03/MF A01 CSCL 10A

A process for fabricating 2 to 3 mil wraparound solar cells was formulated. Sample thin wraparound cells were fabricated using this process. The process used a reinforced perimeter construction to reduce the breakage that occurs during handling of the wafers. A retracting piston post was designed and fabricated to help minimize the breakage that occurs during the screen printing process. Two alternative methods of applying the aluminum back surface field were investigated. In addition to the standard screen printed back surface field, both spin-on and evaporated aluminum techniques were researched. Neither spin-on nor evaporated aluminum made any noticeable improvement over the screen printing technique. A fine screen mesh was chosen for the application of the aluminum paste back surface field. The optimum time and temperature for firing the aluminum turned out to be thirty seconds at 850 C. The development work on the dielectric included looking at three dielectrics for the wraparound application. Transene 1000, Thick Film Systems 1126RCB and an in house formulation 61-2-2A were all tested. Cells with pre-dielectric thickness of 3.0-0-3.5 mils using Transene 1000 as the wraparound dielectric and the procedure outlined above showed an average efficiency of 10.7 percent. Thinner cells were fabricated, but had an unacceptable yield and efficiency. R.E.S.

N80-28861*# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.

INSTALLATION GUIDELINES FOR SOLAR HEATING SYSTEM, SINGLE-FAMILY RESIDENCE AT WILLIAM OBRIEN STATE PARK, STILLWATER, MINNESOTA

May 1980 187 p Sponsored in part by DOE

(Contract NAS8-32093)

(NASA-CR-161480) Avail: NTIS HC A09/MF A01 CSCL 10B

Installation procedures for the single family residential solar heating system at the William O'Brien State Park, Stillwater, Minnesota, are presented. The system is a solar-assisted, hydronic-to-warm-air system with solar-assisted domestic water heating. It is composed of the following major components: liquid cooled flat plate collectors; water storage tank; passive solar-fired domestic water preheater; electric hot water heater; heat pump with electric backup; solar hot water coil unit; tube-and-shell heat exchanger, three pumps, and associated pipes and valving in an energy transport module; control system; and air-cooled heat purge unit. Installer guidelines are provided for each subsystem and includes testing and filling the system. Information is also given on the operating procedures, controls, caution requirements and routine and schedule maintenance. R.E.S.

N80-28862*# General Dynamics/Convair, San Diego, Calif.

STUDY OF POWER MANAGEMENT TECHNOLOGY FOR ORBITAL MULTI-100KWe APPLICATIONS. VOLUME 2: STUDY RESULTS Final Report

J. W. Mildice 15 Jul. 1980 293 p 3 Vol.

(Contract NAS3-21757)

(NASA-CR-159834-Vol-2; GDC-ASP-80-015) Avail: NTIS HC A13/MF A01 CSCL 10B

The preliminary requirements and technology advances required for cost effective space power management systems for multi-100 kilowatt requirements were identified. System requirements were defined by establishing a baseline space platform in the 250 KE KWe range and examining typical user loads and interfaces. The most critical design parameters identified for detailed analysis include: increased distribution voltages and space plasma losses, the choice between ac and dc distribution systems, shuttle servicing effects on reliability, life cycle costs, and frequency impacts to power management system and payload systems for AC transmission. The first choice for a power management system for this kind of application and size range is a hybrid ac/dc combination with the following major features: modular design and construction-sized minimum weight/life cycle cost; high voltage transmission (100 Vac RMS); medium voltage array < or = 440 Vdc); resonant inversion; transformer rotary joint; high frequency power transmission line > or = 20 KHz); energy storage on array side or rotary joint; fully redundant; and 10 year life with minimal replacement and repair. J.M.S.

N80-28863*# Hughes Aircraft Co., El Segundo, Calif. Technology Div.

CONCEPTUAL DESIGN STUDY OF CONCENTRATOR ENHANCED SOLAR ARRAYS FOR SPACE APPLICATIONS. 2kW Si AND GaAs SYSTEMS AT 1 AU Final Report

20 Mar. 1980 55 p

(Contracts NAS7-100; JPL-955194)

(NASA-CR-163046; HAC-E3256; JPL-9950-377) Avail: NTIS HC A04/MF A01 CSCL 19A

The effect of concentration level on the specific power for a deployable, thin, gallium arsenide cell array in geosynchronous orbit for 10 years in conjunction with a two dimensional flat plate trough concentrator (V trough) and also with a multiple flat plate concentrator was investigated as well as the effects for a conventional silicon cell array on a rigid substrate. For application to a thin GaAs array at 1 AU for 10 years, the V trough produces a 19% benefit in specific power and a dramatic reduction in array area, while the multiple flat plate collector design is not only of no benefit, but is a considerable detriment. The benefit it achieves by reducing array area is duplicated by the 2D design. For the silicon array on a rigid substrate, improvement in performance due to a concentrator with ordinary mirror coating is quite small: 9% increase in specific power, and 13% reduction in array area. When the concentrator mirrors are coated with an improved cold mirror coating, somewhat more significant results are obtained: 31% specific power improvement; and 27% area reduction. In both cases, a 10 year exposure reduces BOL output by 23%. A.R.H.

N80-28864*# Westinghouse Research and Development Center, Pittsburgh, Pa.

SILICON WEB PROCESS DEVELOPMENT Annual Report, Apr. 1979 - 1980

C. S. Duncan, R. G. Seidensticker, J. P. McHugh, F. E. Hill, M. E. Skutch, J. M. Driggers, and R. H. Hopkins 30 Jun. 1980 171 p refs

(Contract JPL-954654)

(NASA-CR-163386; DOE/JPL-954654-80/11; JPL-9950-378) Avail: NTIS HC A08/MF A01 CSCL 10A

A barrier crucible design which consistently maintains melt stability over long periods of time was successfully tested and used in long growth runs. The pellet feeder for melt replenishment was operated continuously for growth runs of up to 17 hours. The liquid level sensor comprising a laser/sensor system was operated, performed well, and meets the requirements for maintaining liquid level height during growth and melt replenishment. An automated feedback loop connecting the feed mechanism and the liquid level sensing system was designed and constructed and operated successfully for 3.5 hours demonstrating the feasibility of semi-automated dendritic web growth. The sensitivity of the cost of sheet, to variations in capital equipment cost and recycling dendrites was calculated and it was shown that these factors have relatively little impact on sheet cost. Dendrites from web which had gone all the way through the solar cell fabrication process, when melted and grown into web, produce crystals which show no degradation in cell efficiency. Material quality remains high and cells made from web grown at the start, during, and the end of a run from a replenished melt show comparable efficiencies. E.D.K.

N80-28865*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SOLAR/HYDROGEN SYSTEMS ASSESSMENT. VOLUME 1: SOLAR/HYDROGEN SYSTEMS FOR THE 1985 - 2000 TIME FRAME Final Report

R. W. Foster (Escher: Foster Tech. Associates, Inc.), R. R. Tison (Escher: Foster Tech. Associates, Inc.), W. J. D. Escher (Escher: Foster Tech. Associates, Inc.), and J. A. Hanson 2 Jun. 1980 149 p refs 2 Vol.

(Contracts NAS7-100; JPL-955492)

(NASA-CR-163392; JPL-9950-379) Avail: NTIS HC A07/MF A01 CSCL 10B

Opportunities for commercialization of systems capable of producing hydrogen from solar energy were studied. The hydrogen product costs that might be achieved by the four selected candidate systems was compared with the pricing structure and practices of the commodity gas market. Subsequently, product cost and market price match was noted to exist in the small

user sector of the hydrogen marketplace. Barriers to and historical time lags in, commercialization of new technologies are reviewed. Recommendations for development and demonstration programs designed to accelerate the commercialization of the candidate systems are presented. R.E.S.

N80-28866*# Midwest Research Inst., Kansas City, Mo.
THERMAL ENERGY STORAGE SYSTEMS USING FLUIDIZED BED HEAT EXCHANGERS Final Report, Jan. 1979 - Jan. 1980
Tom Weast and Larry Shannon Jun. 1980 209 p
(Contracts DEN3-96; EC-77-A-31-1034)
(NASA-CR-159868; DOE/NASA/0096-1) Avail: NTIS
HC A10/MF A01 CSCL 10C

A rotary cement kiln and an electric arc furnace were chosen for evaluation to determine the applicability of a fluid bed heat exchanger (FBHX) for thermal energy storage (TES). Multistage shallow bed FBHX's operating with high temperature differences were identified as the most suitable for TES applications. Analysis of the two selected conceptual systems included establishing a plant process flow configuration, an operational scenario, a preliminary FBHX/TES design, and parametric analysis. A computer model was developed to determine the effects of the number of stages, gas temperatures, gas flows, bed materials, charge and discharge time, and parasitic power required for operation. The maximum national energy conservation potential of the cement plant application with TES is 15.4 million barrels of oil or 3.9 million tons of coal per year. For the electric arc furnance application the maximum national conservation potential with TES is 4.5 million barrels of oil or 1.1 million tons of coal per year. Present time of day utility rates are near the breakeven point required for the TES system. Escalation of on-peak energy due to critical fuel shortages could make the FBHX/TES applications economically attractive in the future. E.D.K.

N80-28867# Naval Research Lab., Washington, D. C. Marine Technology Div.
OTEC COLD WATER PIPE DESIGN FOR PROBLEMS CAUSED BY VORTEX-EXCITED OSCILLATIONS Final Report
Owen M. Griffin 14 Mar. 1980 148 p refs Sponsored in part by NOAA
(AD-A084555; AD-E000413; NRL-MR-4157) Avail: NTIS
HC A07/MF A01 CSCL 13/11

Vortex-excited oscillations of marine structures result in reduced fatigue life, large hydrodynamic forces and induced stresses, and sometimes lead to structural damage and to destructive failures. The cold water pipe of an OTEC plant is nominally a bluff, flexible cylinder with a large aspect ratio (L/D length/diameter), and is likely to be susceptible to resonant vortex-excited oscillations. The objective of this report is to survey recent results pertaining to the vortex-excited oscillations of structures in general and to consider the application of these findings to the design of the OTEC cold water pipe. Practical design calculations are given as examples throughout the various sections of the report. This report is limited in scope to the problems of vortex shedding from bluff, flexible structures in steady currents and the resulting vortex-excited oscillations. The effects of flow non-uniformities, surface roughness of the cylinder, and inclination to the incident flow are considered in addition to the case of a smooth cylinder in a uniform stream. Emphasis is placed upon design procedures, hydrodynamic coefficients applicable in practice, and the specification of structural response parameters relevant to the OTEC cold water pipe. There are important problems associated with the shedding of vortices from cylinders in waves and from the combined action of waves and currents, but these complex fluid/structure interactions are not considered in this report. GRA

N80-28868# Westinghouse Electric Corp., Pittsburgh, Pa.
RIBBON GROWTH OF SINGLE CRYSTAL GaAs FOR SOLAR CELL APPLICATION Interim Technical Report, 15 Aug. 1978 - 15 Aug. 1979
Theresa A. Gould, Raymond G. Seidensticker, and Robert Mazelsky Wright-Patterson AFB, Ohio AFAPL 30 Nov. 1979 65 p refs
(Contract F33615-78-C-2031; AF Proj. 3145)
(AD-A084831; AFAPL-TR-79-2094) Avail: NTIS
HC A04/MF A01 CSCL 10/2

This report describes the first 12 months of a program to develop GaAs dendritic web. Liquid encapsulation with B2O3 is used to suppress As vaporization from the melt. Standard web growth system design and experimental techniques which have been developed at Westinghouse for Si web are also utilized for the GaAs program. Critical optimization of thermal geometry is achieved with computerized thermal modeling. Dendritic growth and web buttoning of GaAs have been observed in the current program. Web crystals have not yet been produced, however, a piece of primitive web material has been recovered from the system. The growth behavior and the morphology of GaAs dendrites, buttons, and web material are analogous to the results obtained from successful Si and Ge web growth systems. The thermal modeling results also indicate that the liquid encapsulated GaAs system is suitable for web growth. GRA

N80-28869# Naval Surface Weapons Center, White Oak, Md.
THERMOELECTRIC MATERIALS FOR SOLAR ENERGY CONVERSION Final Report, Aug. - Dec. 1978
J. F. Goff and J. R. Lowney 1 Feb. 1979 22 p refs Presented at 14th Intersol. Energy Conversion Eng. Conf., Boston, 5 Aug. 1979
(AD-A084948; NSWC/TR-79-247) Avail: NTIS
HC A02/MF A01 CSCL 10/2

The thermoelectric efficiency index of N-type beta-SiC has been calculated by use of the Goff-Lowney integral formulation. The scattering parameters were estimated by fitting the thermoelectric power and electrical conductivity data of Golikova, et al. The parasitic photon thermal conductivity was calculated theoretically by use of the theory of Devyatkova, et al, while the lattice thermal conductivity was treated parametrically. The results indicate that there exists an optimum carrier concentration of approximately 2 x ten to the 20th power/ccm and that the efficiency is still increasing at 2000K. GRA

N80-28870# Pittsburgh Univ., Pa. Dept. of Chemistry.
STUDY OF MATERIALS HAVING SIGNIFICANCE FOR HIGH ENERGY MAGNET PRODUCTION AND HYDROGEN STORAGE Final Report, 1 Mar. 1977 - 29 Feb. 1980
W. E. Wallace 15 May 1980 23 p refs
(Grant DAAG29-77-G-0110)
(AD-A084943; ARO-14517.31-MS) Avail: NTIS
HC A02/MF A01 CSCL 09/1

A summary is given of work dealing with the development of new permanent magnet materials and new materials for hydrogen storage. The work is reported in detail in 39 publications which have appeared or will appear in the open literature. These include 10 reviews of the subject matter of the program. Among the most significant findings are the following: (1) hydrogen in rare earth and actinide intermetallics behaves as if it were anionic; (2) hydrogenation can either 'switch off' or 'switch on' ferromagnetism, depending on the system; (3) the superconductor Th7Fe3 is converted into a ferromagnet when hydrogenated; (4) the mechanism of hydrogen uptake has been thoroughly elucidated; (5) Er2Co17 and Yb2Co17-based systems have been identified as potentially useful permanent magnet materials; (5) Cr substitution for Co in Sm2Co17 has a powerful beneficial effect on anisotropy. GRA

N80-28871# Eureka Advance Science Corp., Bloomington, Ill. Advance Science Div.
ADVANCED THERMAL BATTERIES Interim Report, 15 Sep. 1978 - 15 Sep. 1979
David M. Ryan Mar. 1980 165 p
(Contract F33615-77-C-3147; AF Proj. 3145)
(AD-A085193; AFWAL-TR-80-2017) Avail: NTIS
HC A08/MF A01 CSCL 10/3

The feasibility of building thermal batteries with cells composed of an anode of LiAl alloy, a cathode of a heavy metal chloride, and a NaAlCl4 electrolyte has been demonstrated. During the further investigation of this system some interesting problems have developed and had to be studied. The particle size growth of the catholyte developed into a major storage problem. MoCl5 was found to form a volatile catholyte which is not suited for thermal battery use. As a result of this problem other catholyte materials were experimented with. CuCl2 is the most successful alternate to MoCl5. Some alternate binder

materials have been investigated: kaolin clay, Illinois Mineral Amorphous Silica, and magnesia. Some alternate electrolytes have been investigated including NaAlCl4 (containing 52 m/o AlCl3), LiAlCl4 and KCl-LiCl. This work indicates that each material has unique properties which lend themselves to a particular application. Among the alternate cathode materials experimented with are CrCl3, a number of heavy metal oxides, fluorocarbon, TiS2, TiS3, and sulfur. Some alternate process investigated have been freon blending, adding materials to the anode, cell and battery desiccation and filling batteries with an inert atmosphere. GRA

N80-28872# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

A STUDY OF AIRCRAFT NiCd BATTERY STATE-OF-CHARGE MEASUREMENT BY PHASE METER Interim Report

Michael R. Martinelli, Stanley W. Mayer, and Charles C. Badcock 30 Apr. 1980 35 p refs

(Contract F04701-79-C-0080)

(AD-A084935; TR-0080(5970-01)-2; SD-TR-80-24) Avail: NTIS HC A03/MF A01 CSCL 10/3

Experiments were performed to determine if the phase angle between alternating voltage and current could be used to predict, within a probable error of 5 percent, the state of charge of vented NiCd aircraft batteries. A 22 A hr, 19 cell Gulton type MS24497-4 battery and several individual cells from that battery were tested in these experiments. The battery was charged for various lengths of time at 11 amperes to obtain a range of state of charge. Battery phase angle and individual cell phase angles were measured with a Hewlett-Packard HP-3575A gain-phase meter at frequencies of 350, 100, 35, 17.5, and 11 Hz; and the cells were discharged at 11 amperes to 0.1 V (1.9 V for the battery) to determine their state of charge in ampere-hours of capacity. The phase-angle, state-of-charge data were subjected to second-order polynomial curve fitting by means of least-squares analysis. The probable errors obtained from the least-squares analyses were used to judge the quality of measured correlation between phase angle and state of charge. The results for the individual cells were, on the whole, quite poor, although two of the individual cells tested achieved the stated goal of a probable error of 5 percent for the correlation between phase angle and state of charge. The 19 cell battery gave the best results with a probable error of 3.8 percent measured at 11 Hz. GRA

N80-28873# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

PHASE METER MEASUREMENT OF STATE OF CHARGE FOR SATELLITE NiCd CELLS, A PRELIMINARY STUDY Interim Report

Michael R. Martinelli, Stanley W. Mayer, and Charles C. Badcock 30 Aug. 1979 31 p refs

(Contract F04701-78-C-0079)

(AD-A084907; TR-0079(4970-10)-3; SAMSO-TR-79-93) Avail: NTIS HC A03/MF A01 CSCL 10/3

Experiments were performed to determine if the phase angle between alternating voltage and current could be used to predict, within a probable error of 5%, the state of charge of seven individual sealed (General Electric model 10AB08 NiCd) cells and a battery consisting of the seven cells in series. The cells were charged for various lengths of time at 0.8 A to obtain a range of state of charge; their phase angles were measured with a Hewlett-Packard HP3575A gain-phase meter at 35 Hz; and they were discharged at 5 A 0.1 V to determine their state of charge in ampere-hours of capacity. The phase angle state-of-charge data were subjected to second-order polynomial curve fitting by means of least-squares analysis. The probable errors obtained from the least-squares analysis were used to judge the quality of the measured correlation between phase angle and state of charge. In order to determine how the correlation might be affected through cell use, the four extensively cycled cells with more than 3700 charge-discharge cycles and three cells with less than 40 such cycles were tested. The effect of temperature on the correlation was also studied. GRA

N80-28874# Sandia Labs., Albuquerque, N. Mex. Geothermal Research Div.

MAGMA ENERGY: A FEASIBLE ALTERNATIVE

John L. Colp Mar. 1980 22 p refs

(Contract EY-76-C-04-0789)

(SAND-80-0309) Avail: NTIS HC A02/MF A01

A short review of the work performed in connection with the Magma Energy Research Project is provided. Results to date suggest that boreholes will remain stable down to magma depths and engineering materials can survive the downhole environments. Energy extraction rates are encouraging. Geophysical sensing systems and interpretation methods require improvement, however, to clearly define a buried magma source. DOE

N80-28875# Oak Ridge National Lab., Tenn.

PLASMA-SPRAYED COATINGS FOR VERY HIGH TEMPERATURE SOLAR ABSORBERS

James M. Schreyer, Richard A. Hays (White Sands Missile Range), Charles R. Schmitt (Oak Ridge Y-12 Plant), and Darrell Farwell (White Sands Missile Range) 1979 10 p Presented at the 2d Am. Electroplaters Soc. Symp. on Coating for Solar Collectors, St. Louis, 16 Oct. 1979

(Contract W-7405-eng-26)

(CONF-791021-3) Avail: NTIS HC A02/MF A01

Plasma-sprayed coatings on steel plates were tested at temperatures from 200 C to 1000 C. Analysis of the specimens before and after testing showed erbium dodecaboride, yttrium hexaboride, titanium diboride, and chromium oxide to be stable above 600 C. A heat balance on the water cooled specimens of these coatings showed 71% to 97% heat recovery efficiency. DOE

N80-28876# Sandia Labs., Albuquerque, N. Mex.

ANALYSIS OF THE INFLUENCE OF GEOGRAPHY AND WEATHER ON PARABOLIC TROUGH SOLAR COLLECTOR DESIGN

George W. Treadwell, Norman R. Grandjean, and Frank Biggs Mar. 1980 28 p refs

(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)

(SAND-79-2032) Avail: NTIS HC A03/MF A01

The potential performance of single-axis tracking parabolic trough solar collectors as a function of optical energy distribution and receiver size was calculated for eleven sites using typical meteorological year input data. A simulation based on the SOLTES code was developed which includes the three dimensional features of a parabolic trough and calculates the thermo-optical tradeoffs. The capability of the thermo-optical model was confirmed by the comparison of calculated results with the experimental results from an all day test of a parabolic trough. The results from this eleven site analysis indicate a potential performance superiority of a north-south horizontal axis trough and, in addition, a high quality collector should be of the same geometric design for all of the sites investigated and probably for all regions of the country. DOE

N80-28877# California Univ., Livermore. Lawrence Livermore Lab.

EFFECT OF A HEATED ATMOSPHERE ON THE EMITTANCE OF BLACK CHROME SOLAR COLLECTOR PIPE SURFACES

Thomas A. Reitter and Warren H. Giedt (California Univ., Davis) 21 Mar. 1980 6 p refs Presented at Am. Section of Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2-6 Jun. 1980

(Contract W-7405-eng-48)

(UCRL-83506; CONF-800604-6) Avail: NTIS HC A02/MF A01

The total hemispherical emittance of the surfaces of solar collectors pipes was measured in the temperature range 100 to 300 C before and after exposure to heated humid or dry air atmosphere. The first exposure to heated air lowered the emittance of black chrome surface about 20%. Similar exposure increased the emittance of bare steel significantly, but had no effect on a nickel surface. Subsequent exposures to heated dry or humid air lowered the emittance of the black chrome surfaces by lesser amounts in what appeared to be a limiting process. In all cases, the emittance of the black chrome surfaces increased strongly with temperature. A possible explanation for the lowering of the black chrome emittance is the oxidation and subsequent outgassing of carbon contaminants in the black chrome coating. DOE

N80-28878# Sandia Labs., Albuquerque, N. Mex. Electromechanical Subsystems Dept.
MULTIPLE-TANK HIGH TEMPERATURE STORAGE SUBSYSTEM Summary Report
Robert A. Randall Feb. 1980 34 p
(Contract EY-76-C-04-0789)
(SAND-79-2056) Avail: NTIS HC A03/MF A01

The design, construction, installation, and testing of a multiple-tank thermal energy storage subsystem at the Midtemperature Solar Systems Test Facility located in Sandia Laboratories, Albuquerque, New Mexico are described. Included are the design requirements and a description of the subsystem. Also discussed are the test procedures and test results to evaluate thermal performance. System costs are listed. Subsequent tests are planned to evaluate control techniques and logic. DOE

N80-28879# Electric Power Research Inst., Palo Alto, Calif.
ELECTRIC UTILITY SOLAR ENERGY ACTIVITIES: 1979 SURVEY Special Report, Dec. 1979
Robin Furness Dec. 1979 217 p
(EPRI-ER-1299-SR) Avail: NTIS HC A10/MF A01

The results of surveys to determine the scope of solar energy projects sponsored by electric utilities in the United States are presented. It contains brief descriptions of 735 projects being conducted by 180 utility companies. Also included are an index of projects by category, a statistical summary, a list of participating utilities with information contacts and addresses, a list of utilities with projects designated by category, a list of utilities organized by state, and a list of available reports on utility-sponsored projects. DOE

N80-28880# Alabama Univ. in Huntsville. Johnson Environment and Energy Center.
SOLAR ENERGY FOR BUILDINGS HANDBOOK
David L. Christensen Oct. 1979 268 p
(Contracts EG-77-S-05-5362; DE-AC05-77ET-20170)
(ORO-5362-T1) Avail: NTIS HC A12/MF A01

This handbook contains presentation materials and supporting text suitable for presentations, education, short courses, etc., for general audiences, as well as government officials and members of the building trade. The following are discussed: conservation, solar energy, economics, obstructions, and the future. DOE

N80-28881# Hughes Research Labs., Malibu, Calif.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN-FILM SOLAR CELLS Quarterly Technical Progress Report, 27 Apr. - 27 Jul. 1979
Kenneth Zanio Oct. 1979 30 p refs
(Contract ET-78-C-01-3412)
(DSE-3412-T3; QTPR-3) Avail: NTIS HC A03/MF A01

Indium phosphide films were prepared on (100) InP substrates by the planar reactive deposition technique in the temperature range 220 C to 260 C and growth rates of about 1 micron/hr, complete single-crystal epitaxy was achieved. The onset of the single-crystal to polycrystalline transition at 245 C is characterized by a mosaic structure. Parallel studies to eventually passivate the grain boundaries in polycrystalline films were undertaken. A 5HCl:3HNO3:4HF etch was found to preferentially attack 90% of the grain boundaries in bulk polycrystalline InP wafers. Canyons with depths greater than 10 micron and widths less than 1 micron were the most common form of attack. Although the etch had no effect on simple twin boundaries, preferential attack was observed at interfaces formed by multiple twinning events. DOE

N80-28882# Department of Energy, Washington, D. C. Office of Technology Impacts.
ENVIRONMENTAL DATA ENERGY TECHNOLOGY CHARACTERIZATIONS: COAL
Apr. 1980 172 p refs Supersedes DOE/EV-0061/3
(DOE/EV-0074; DOE/EV-0061/3) Avail: NTIS HC A08/MF A01

The activities leading to the conversion of coal to electricity consist of coal mining and beneficiation, coal transport, electric power generation, and power transmission. To enhance the usefulness of the material presented, resource requirements, energy products, and residuals for each activity area are normalized in terms of 10 to the 12th power Btus of energy produced. Thus, the total effect of producing electricity from coal can be determined by combining the residuals associated with the appropriate activity areas. Emissions from the coal cycle are highly dependent upon the type of coal consumed as well as the control technology assigned to the activity area. Each area is assumed to be equipped with currently available control technologies that meet environmental regulations. DOE

N80-28883# Carnegie-Mellon Univ., Pittsburgh, Pa.
RECENT DEVELOPMENTS IN THE FOAM OTEC SYSTEM
Clarence Zener, Alberto Molini, Tomlinson Fort, Jr, John Fetkovich, and Martin Greenstein 1979 7 p refs Presented at the 6th OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract EG-77-S-02-4459)
(CONF-790631-15) Avail: NTIS HC A02/MF A01

In the foam open cycle OTEC system warm water literally lifts itself several hundred feet. In preliminary experiments the foam behavior seemed to depend in a capricious manner upon the temperature of the incoming water, the pressure of the spray condenser, and the foam mass flow rate. Through a combination of analysis and experiment, an equation which governs the steady state rise of a foam column was developed. This equation correctly predicts the effects upon the foam behavior of all controllable parameters. These parameters include, in addition to those mentioned above, the diameter and height of the foam column. It is shown that foam generated in an appropriate manner flows laminarly rather than turbulently and has defined drag function. This drag function decreases as the inverse square of the column diameter. DOE

N80-28884# General Electric Co., Schenectady, N. Y. Corporate Research and Development.
REGENERATIVE FLYWHEEL ENERGY STORAGE SYSTEM
Edward L. Lustanader, Ivan H. Edelfelt, Donald W. Jones, Allan B. Plunkett, Eike Richter, and Fred G. Turnbull [1979] 34 p refs
(Contract W-7405-eng-48)
(UCRL-13982-Rev-1) Avail: NTIS HC A03/MF A01

The development, fabrication, and testing of a regenerative flywheel energy storage and recovery system for a battery/flywheel electric vehicle of the 3000 lb class are described. The vehicle propulsion system was simulated on a digital computer in order to determine the optimum system operating strategies and establish a calculated range improvement over a nonregenerative, all-electric vehicle. Fabrication of the inductor motor, flywheel, power conditioner, and system control are described. Test results of the system operating over the SAE J227a Schedule D driving cycle are given and are compared to the calculated value. The flywheel energy storage system consists of a solid rotor, synchronous, inductor-type, flywheel drive machine electrically coupled to a dc battery electric propulsion system through a load commutated inverter. The motor/alternator unit is coupled mechanically to a small steel flywheel which provides a portion of the vehicle's accelerating energy and regenerates the vehicle's braking energy. DOE

N80-28885# Argonne National Lab., Ill. Energy and Environmental Systems Div.
HEAT-PUMP-CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEM DEVELOPMENT SUMMARY
J. M. Calm Feb. 1980 127 p refs
(Contract W-31-109-eng-38)
(ANL/CNSV-7) Avail: NTIS HC A07/MF A01

An introduction to district heating systems employing heat pumps to enable use of low temperature energy sources is presented. These systems operate as thermal utilities to provide space heating and may also supply space cooling, service water heating, and other thermal services. Otherwise wasted heat from industrial and commercial processes, natural sources including solar and geothermal heat, and heat stored on an annual cycle from summer cooling may be effectively utilized by the systems described. More than one quarter of the energy consumed in the United States is used to heat and cool buildings and to heat service water. Natural gas and oil provide approximately 83% of this energy. The systems described show potential to reduce net energy consumption for these services by 20 to 50% and to allow fuel substitution with less scarce resources not practical in smaller, individual building systems.

Seven studies performed for the system development phase are summarized. DOE

N80-28886# Nuclear Regulatory Commission, Washington, D. C.
STATEMENT OF POSITION OF THE UNITED STATES DEPARTMENT OF ENERGY IN THE MATTER OF PROPOSED RULEMAKING ON THE STORAGE AND DISPOSAL OF NUCLEAR WASTE (WASTE CONFIDENCE RULING)
15 Apr. 1980 749 p refs
(DOE/NE-0007) Avail: NTIS HC A99/MF A01

The degree of assurance that radioactive waste can be safely disposed of is assessed. The determination of when such disposal or off-site storage will be available is discussed, as well as whether wastes can be safely stored on-site past license expiration until off-site disposal/storage is available. DOE

N80-28887# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
MASS TRANSFER DEPOSITS IN LITHIUM-TYPE 316 STAINLESS STEEL THERMAL-CONVECTION LOOPS
P. F. Tortorelli and J. H. DeVan 1980 16 p refs Presented at 2d Intern. Conf of Liquid Metal Technol. for Energy Systems, Richland, Wash., 20 Apr. 1980
(Contract W-7405-eng-26)
(CONF-800401-6) Avail: NTIS HC A02/MF A01

In spatially nonisothermal flowing liquid metal systems, selected constituents of the containment materials characteristically dissolve into the liquid metal in the hotter zones and are deposited in the colder areas. The accumulation of deposits is often a more serious problem than dissolution because of attendant flow restrictions and, in reactor applications, the aggregation of radioactive species in the coolant circuits. Accordingly, the deposition processes in lithium-type 316 stainless steel thermal convection loops is studied. The morphology and composition of deposits varied with loop operating time. Initially, chromium rich dendritic crystals formed in the colder region of a loop, but later the deposits changed in structure and contained significant amounts of nickel and iron. Deposition rates were also measured as a function of time and temperature and were correlated with the above observations. A plug extracted from one loop consisted of an aggregate of chromium rich crystals. DOE

N80-28888# Aluminum Co. of America, New Kensington, Pa. Alcoa Labs.
DESIGN AND FABRICATION OF A LOW COST DARRIEUS VERTICAL AXIS WIND TURBINE SYSTEM, PHASE 1
22 Jun. 1979 345 p refs
(Contract EM-78-C-04-4272)
(ALO-4272-T2) Avail: NTIS HC A15/MF A01

The Sandia 17 m was used as the background machine from which design information was drawn. By concentrating the modifications on an existing design, emphasis was focused on component cost reduction rather than selection of optimal configuration or operating modes. The resulting design is a stretched version of the Sandia 17 m preserving the same rotor diameter and many other good features, but lighter in weight, larger in capacity, and anticipated to be more cost effective. DOE

N80-28889# Ehrenkrantz Group, New York, N. Y.
ACTIVE SOLAR ENERGY SYSTEM DESIGN PRACTICE MANUAL
Stephen D. Weinstein Oct. 1979 222 p Prepared in cooperation with Mueller Associates, Inc., Baltimore, Md.
(Contract EG-77-C-01-2522)
(SOLAR/0802-79/01) Avail: NTIS HC A10/MF A01

This manual is divided into liquid and air systems. The following are covered: collectors, collector arrays, mounting and support, storage, dampers, leakage concerns, safety and protection, and other equipment. DOE

N80-28890# Electric Power Research Inst., Palo Alto, Calif.
MANUAL AND PROGRAMMABLE CALCULATOR METHODS FOR SIZING SOLAR ENERGY SYSTEMS
Robert S. Barlow Dec. 1979 79 p refs
(EPRI-ER-1282-SR) Avail: NTIS HC A05/MF A01

The important characteristics, features, and limitations of manual methods and programmable calculator software for sizing active or passive solar energy systems and predicting their performance are described. The intent is to provide utilities with useful information that will facilitate sound choices of solar calculation methods to be used in responding to the National Energy Act. The major issues relating to manual solar calculation methods are discussed. General information on each method is given in easily used matrices. Critical reviews, as well as sources and costs, are given in a one page summary for each method. An effort is made to identify those methods that will be most useful, and overall conclusions are included. DOE

N80-28891# Los Alamos Scientific Lab., N. Mex.
ENERGY SAVINGS OBTAINABLE THROUGH PASSIVE SOLAR TECHNIQUES
J. Douglas Balcomb 1980 13 p refs Presented at the Intern. Congr. on Bldg. Energy Management, Povoa de Varzim, Portugal, 12-16 May 1980
(Contract W-7405-eng-36)
(LA-UR-80-746; CONF-800524-1) Avail: NTIS HC A02/MF A01

A survey of passive solar heating experience, especially in the US, is provided. Design approaches are reviewed and examples shown. Misconceptions are discussed. Advantages are listed. The Los Alamos program of performance simulation and evaluation is described and a simplified method of performance estimation is outlined. DOE

N80-28892# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
REVIEW OF THE CURRENT STATUS OF THE WIND ENERGY INNOVATIVE SYSTEMS PROJECTS
Irwin E. Vas Mar. 1980 77 p refs
(Contract EG-77-C-01-4042)
(SERI/TP-635-469) Avail: NTIS HC A05/MF A01

Information is presented concerning theoretical and experimental studies on giromill turbines; diffuser augmented turbines; tornado turbines; electrofluid dynamic generators; Madaras rotors; the vortex augmented turbines; and cooling tower thermodynamic cycles. DOE

N80-28893# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
LONG-TERM AVERAGE PERFORMANCE BENEFITS OF PARABOLIC TROUGH IMPROVEMENTS
Randy Gee, Harry W. Gaul, David Kearney, and Ari Rabl Mar. 1980 40 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-632-439) Avail: NTIS HC A03/MF A01

Various technology advancements in improving the long term average performance of parabolic trough concentrating collectors were analyzed. The performance benefits of improvements are determined as a function of operating temperature for north-south, east-west, and polar mounted parabolic troughs. The results are presented graphically to allow a quick determination of the performance merits of particular improvements. Substantial annual energy gains are shown to be attainable. Of the improvements evaluated, the development of stable back-silvered glass reflective surfaces offers the largest performance gain for operating temperatures below 150 C. Above 150 C, the development of trough receivers that can maintain a vacuum is the most significant potential improvement. The reduction of concentrator slope errors also has a substantial performance benefit at high operating temperatures. DOE

N80-28894# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
ANALYSIS OF SOLAR COLLECTOR ARRAY SYSTEMS USING THERMOGRAPHY
Anthony Eden Jan. 1980 50 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-351-494) Avail: NTIS HC A03/MF A01

The use of thermography to analyze large solar collector array systems under dynamic operating conditions is discussed. Thermographic techniques as well as equipment to determine temperature distributions, flow patterns, and air blockages in solar collectors are emphasized. The results illustrate the

capabilities of infrared analysis as an analysis tool and operation and maintenance procedure when applied to large arrays. Thermographic analysis of most collector systems showed temperature distributions that indicated balanced flow patterns with both the thermographs and the hand held unit. In three significant cases, blocked or broken collector arrays, which previously had gone undetected, were discovered. DOE

N80-28895# Boeing Aerospace Co., Seattle, Wash.
EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS: Cu/SUB 2-X/Se
R. A. Mickelsen, J. M. Stewart, and W. S. Chen Feb. 1980 17 p refs
(Contract DE-AC04-79ET-23005)
(DOE/ET-23005-T3; QTPR-3) Avail: NTIS HC A02/MF A01

The feasibility of using Cu/sub 2-x/Se as a semiconductor material for the low cost production of photovoltaic solar cells was investigated. The Cu/sub 2-x/Se films were produced by coevaporation from individually monitored Cu and Se vapor sources. With a substrate temperature of 170 C, single phase cubic Cu/sub 2-x/Se films were produced. These films had a direct band gap of 2.2 eV and an indirect band gap of 1.4 eV. Both front wall and back wall cells were made. A theoretical computation on the thin film Cu/sub 2-x/Se/CdS cell has indicated an achievable efficiency of greater than 10%. DOE

N80-28896# Oak Ridge National Lab., Tenn. Solid State Div.
CHARACTERIZATION OF ION IMPLANTED, LASER ANNEALED SILICON FOR SOLAR CELL APPLICATIONS
C. W. White 1979 6 p refs Presented at the Am. Nucl. Soc. Meeting, San Francisco, 12 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791103-82) Avail: NTIS HC A02/MF A01

Ion implanted silicon was efficiently annealed using very fast pulses of laser radiation. A wide variety of analytical techniques were used to determine the physical and electrical properties of ion implanted silicon crystals which were annealed using the output of a pulsed ruby laser (energy density approximately 1.5 J/cu cm, 1.5 x 10 to the minus 9th power per sec pulse duration time). Ion channeling measurements and transmission electron microscopy show that there are no extended defects remaining in the implanted region after laser annealing even when the region is made amorphous by implantation. Ion channeling measurements were used to show that dopants occupy electrically active substitutional sites in the lattice after laser annealing even when the dopant concentration greatly exceeds the equilibrium limit of solid solubility. Results are reported. DOE

N80-28897# Oak Ridge National Lab., Tenn.
LASER PROCESSING OF POLYCRYSTALLINE SILICON SOLAR CELLS
R. T. Young, R. F. Wood, J. Narayan, and C. W. White 1979 8 p refs Presented at the Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 26 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791112-55) Avail: NTIS HC A02/MF A01

Ion implantation and pulsed laser annealing were used to produce well controlled dopant regions in polycrystalline Si. Because of the short duration of the laser radiation and because the near surface region of the samples melt, grain boundary diffusion and segregation were eliminated. Solar cells fabricated from cast polycrystalline Si by this technique resulted in open circuit voltages as high as 560 mv and efficiencies as high as 11.6%. DOE

N80-28898# SRI International Corp., Menlo Park, Calif. Engineering Sciences Lab.
LOW-COST PROCESS FOR P-N JUNCTION-TYPE SOLAR CELL Quarterly Technical Progress Report, 1 Dec. 1979 - 29 Feb. 1980
John B. Mooney, Daniel D. Cubicciotti, and Clayton W. Bates, Jr. (Stanford Univ.) Mar. 1980 46 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T32; QTPR-2) Avail: NTIS HC A03/MF A01

Spray pyrolysis of CuinS2 was studied. The concentration of copper and sulfur in the spray solutions were increased so as to increase the copper content of the films to the stoichiometric level. Although Auger analysis indicates that this was successful, X-ray microanalysis has identified the growth of copper-rich crystals on the surfaces of the deposit. Heat treatment in H2S did not improve the stoichiometry. The copper-rich crystals were also found on a sample sprayed from a solution with no excess copper. Heterojunctions of glass/SnO2(Sb)/CdS/CdTe/carbon (Cu)/Ag-In were prepared with a number of methods used to restrict the junction. The various devices failed to exhibit a diode characteristic or a photoresponse. DOE

N80-28899# SRI International Corp., Menlo Park, Calif. Engineering Sciences Lab.
LOW-COST PROCESS FOR p-N JUNCTION-TYPE SOLAR CELL Quarterly Technical Progress Report, 1 Sep. - 1 Dec. 1979
John B. Mooney Dec. 1979 30 p
(Contract EG-77-C-01-4042)
(SRI-8833-16; QTPR-1) Avail: NTIS HC A03/MF A01

An apparatus was built for the spray pyrolysis of uniform films over areas up to 3 x 4 inches. Procedures were established for the deposition of uniform films of CuInS2. The oxygen content of the films was significantly reduced by substituting nitrogen for air as a propellant and adding a chamber around the spray apparatus to exclude air. Analysis of the films by Auger spectrometry showed that the Cu/In ratio was not uniform throughout the film. While the bulk was nearly stoichiometric, the surface was deficient in copper. Sintered layers of chlorine doped CdTe were prepared. The layers were adherent to the substrate and were about 80 percent of theoretical density. Sintered layers were treated with a copper dipping technique and with graphite. Photoresponse was not observed in the copper treated samples, but a slight photoresponse was observed with graphite. DOE

N80-28900# Oak Ridge National Lab., Tenn. Solar and Special Studies Section
ROOF OVERHANG DESIGN FOR SOLAR CONTROL
Paul R. Barnes 1979 15 p refs Presented at the 4th Natl. Passive Solar Energy Conf., Kansas City, Kas., 3 Oct. 1979
(Contract W-7405-eng-26)
(CONF-791022-15) Avail: NTIS HC A02/MF A01

Design formulas are developed for both fixed and extendable overhangs as a function of window height, geographic latitude, and solar altitude. The extendable overhang is adjusted seasonally. Design parameters are suggested for near optimum solar control in direct gain passive systems. A method of estimating the effect of an overhang on solar gain is also developed. Examples of the solar performance for both fixed and adjustable overhangs are presented for 36 deg N latitude. DOE

N80-28901# Pennsylvania Univ., Philadelphia.
POLYACETYLENE, (CH)/SUB X/, AS AN EMERGING MATERIAL FOR SOLAR CELL APPLICATIONS Technical Progress Report, Oct. - Dec. 1979
A. J. Heeger and A. G. MacDiarmid 14 Feb. 1980 25 p refs
(Contract DE-AC04-79ET-23002)
(DOE/ET-23002/T7; QPR-3) Avail: NTIS HC A02/MF A01

Initial studies of p-n heterojunctions formed between undoped trans CH sub x and n-Cds are reported. The junctions were characterized by measurements of current vs voltage, capacitance vs voltage, and photovoltaic response spectra. The results are analyzed in terms of the standard heterojunction equations. It is concluded that undoped as-grown films of trans CH sub x are p-type with a residual acceptor concentration of 2 x 10 to the 18th power per cu cm, and that in spite of the complex fibril morphology the semiconductor properties can be inferred by treating CH sub x as an effective homogeneous medium. Detailed studies of the photovoltaic response at energies below the energy gap for CH sub x imply the existence of a well defined, deep trapping state in polyacetylene with an energy near the center of the gap. DOE

N80-28902# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
COST-EFFECTIVE WAYS TO IMPROVE THE FABRICATION AND INSTALLATION OF SOLAR HEATING AND COOLING SYSTEMS FOR RESIDENCES Final Report, 1 Jun. 1977 -

30 Sep. 1978
Sanford B. Thayer, Peter Jacobs, and Norman Weaver Oct. 1978 134 p refs
(Contract EG-77-S-02-4520)
(COO-4520-1) Avail: NTIS HC A07/MF A01

A study investigating cost effective ways of improving fabrication and installation of residential solar energy heating systems is documented. The study entailed on-site observation of twelve installations focusing on the phase of mounting and manifolding of solar collectors. Time lapse photography and work measurement techniques were employed to record these installations. Generic collector types studied included air and liquid panels both internally and externally manifolded. Principal findings of the study synthesized from field observations, analysis of photographic data, time studies, and discussion with installation personnel and manufacturers' representatives are presented in the technical report. DOE

N80-28903# Carnegie-Mellon Univ., Pittsburgh, Pa. Physics Dept.
FOAM OTEC SYSTEM
Clarence Zener and Martin Greenstein Jul. 1979 21 p Presented at the 6th OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract EG-77-S-02-4459)
(CONF-790631-13) Avail: NTIS HC A02/MF A01

An attempt was made to incorporate the main features of a foam Ocean Thermal Energy Conversion system. These features included foam generation, foam rise, foam breaking, and finally separation of liquid and vapor. Our foam generator formed foam at rates as high as would be desired in a commercial plant, approximately 1 gram/cu cm/sec. The rise of the foam, accompanied by a drop in temperature, was as expected by theory. The foam breaking, and the subsequent separation of liquid and vapor, presented no problem. The dominant role played by the wall drag in the 4 diameter, 30 high column was totally unexpected. Experiments were consistent, however, with a very simple expression for the variation of the drag coefficient with the foam parameters of mass flow rate and density. For the large diameter columns envisioned for commercial plants, wall drag will play only a minor role. Likewise, the large surfactant concentration (approximately 1000 ppM) required to maintain complete foam-stability to the top of the column was unexpected. DOE

N80-28904# Carnegie-Mellon Univ., Pittsburgh, Pa.
THERMALLY INDUCED FLOW OF HIGH EXPANSION AQUEOUS FOAM IN A VERTICAL PIPE
Martin Greenstein and Clarence Zener 1979 39 p ref Presented at the 6th OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract EG-77-S-02-4459)
(CONF-790631-14) Avail: NTIS HC A03/MF A01

Foam was generated by air injection into an aqueous surfactant solution. Cooling from about 25 C to about 15 C, the foam flowed through a 30' high, 4' diameter glass column. At the top of the column, an alcohol drip broke the foam. A cold water direct contact condenser backed by a rotary vacuum pump eliminated the air and water vapor released from the ruptured foam cells. A differential equation involving a single empirical parameter described the flow. The dependence of this parameter on flow rate indicated that the foam flow had a dissipative loss similar to that of laminar flow of liquids in pipes. DOE

N80-28905# Boston Univ., Mass. Dept. of Chemistry.
ORGANIC PHOTOCHEMICAL STORAGE OF SOLAR ENERGY Progress Report, 1 Feb. 1979 - 31 Jan. 1980
Guilford Jones, II Feb. 1980 17 p refs
(Contract EG-77-S-02-4380)
(COO-4380-3) Avail: NTIS HC A02/MF A01

The quenching of fluorescent sensitizers by isomerizable substrates results in the formation of excited complexes. These sensitizer substrate pairs are highly polarized, leading to changes in bond order for the substrates. For several substrates this perturbation results in efficient valence isomerization. Isomerization observed on irradiation of charge transfer complexes of isomerizable substrates is consistent with a similar exciplex - template mechanism. The energy transfer mechanism of photosensitization was studied by measuring the temperature dependence of quantum yield for isomerization of dimethyl norbornadiene-2,3-dicarboxylate sensitized by benzanthrone. From temperature and quencher concentration profiles quenching constants were obtained which are consistent with an endoergic triplet energy transfer mechanism. The thermal upconversion of the low energy triplet of benzanthrone results in a threefold increase in isomerization quantum yield over a 90 deg temperature range. DOE

N80-28906# Ueland and Junker, Architects and Planners, Philadelphia, Pa.
SOLAR ATRIUM: A HYBRID SOLAR HEATING AND COOLING SYSTEM Technical Progress Report, 19 Jun. - 19 Sep. 1979
Mark Ueland 28 Sep. 1979 10 p
(Grant EG-77-G-04-4135)
(ALO-4135-T1; TPR-8) Avail: NTIS HC A02/MF A01

The design, construction, and monitoring of an innovative concept of solar heating and cooling called solar atrium is described. The solar atrium concept is adaptable to residences and smaller commercial and institutional buildings. It is designed to be constructed of materials and equipment that are economical and readily available. Cost effectiveness of installation and operation is a primary design objective. The solar atrium incorporates the large glass areas of the earlier houses and adds facilities for heat storage and control of heat losses through glass. DOE

N80-28907# RCA Labs., Princeton, N. J. Energy Systems Research Labs.
THIN-FILM POLYCRYSTALLINE SILICON SOLAR CELLS Final Report, 11 Sep. 1978 - 10 Sep. 1979
B. W. Faughnan Nov. 1979 75 p refs
(Contract DE-AC03-78ET-20562)
(DOE/ET-20562/4; PRRL-79-CR-48) Avail: NTIS HC A04/MF A01

The effect of grain boundaries on the performance of solar cells fabricated on Wacker Silso polycrystalline silicon substrates is studied. Efficiencies of 8% (no antireflection coating) were obtained (11.2% with AR coating). This is 20% lower than the efficiency obtained for identically fabricated single crystal cells. This reduction can be accounted for as follows: 4% reduction in V sub oc due to grain boundaries, 8% reduction in J sub sc due to a lower minority carrier diffusion length inside the grains. Quantum efficiency measurements were made with a 150 micron diameter light spot inside grains and across grain boundaries, permitting a determination of L sub n inside a grain (L sub n = 75 microns for Wacker Silso). Laser scans were obtained at lambda = 0.633 micron and at 1.15 microns. Some grain boundaries are shown to be electrically inactive. Active grain boundaries were also observed by a novel liquid-crystal technique. DOE

N80-28908# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
LOW-COST PHOTOVOLTAIC CELL MOUNT STUDY Final Report
Albuquerque, N. Mex. Sandia Labs. Mar. 1980 65 p
(Contract EY-76-C-04-0789)
(SAND-80-7006) Avail: NTIS HC A04/MF A01

The development of a low cost photovolatic concentrator cell mount is described. A technical and economic evaluation of five representative cell laydown techniques is given with the final goal being a determination of which was most promising from a cost performance basis. The five considered designs are representative of currently employed or proposed laydown techniques: (1) flexible adhesive hold down of the cell; (2) soldering the cell to a metallized alumina wafer; (3) soldering the cell to a plasma-sprayed copper and alumina substrate; (4) soldering the cell to a plasma-sprayed alumina/copper laminated substrate; and (5) soldering the cell to a metallized porcelain wafer. Tabular summaries are given for the economic and technical performance of each mounting technique. Conclusions are made concerning which design is most cost effective and comments on manufacturing and technical considerations of each mount are presented. Also, tests of an innovative heat dissipation system for passively cooling solar cells employing a reflux cooler panel based on the heat pipe concept are described. DOE

N80-28909# Los Angeles City Dept. of Water and Power, Calif.
SUN VALLEY PHOTOVOLTAIC POWER PROJECT, PHASE 1 Final Report, 1 Jun. 1978 - 28 Feb. 1979
Frank R. Goodman, Jr. Mar. 1980 166 p refs
(Contract ET-78-C-04-4281)
(ALO-4281-1) Avail: NTIS HC A08/MF A01

An application experiment was devised for fabrication installation, operation, and evaluation of a concentrating photovoltaic system for direct conversion of sunlight to electricity. The photovoltaic system was connected to an electric motor load and to an electric utility system. Provisions were made to allow the motor load to be supplied with power from either the photovoltaic system or the utility system. When the demand of the motor load was low, the photovoltaic system delivered excess power to the utility system for use elsewhere. Thus, the experimental installation was designed with sufficient flexibility to enable several modes of operation to be evaluated. DOE

N80-28910# Institute of Gas Technology, Chicago, Ill.
ELECTROCHEMICAL PHOTOVOLTAIC CELLS, PROJECT 65021
Peter G. P. Ang and Anthony F. Sammells Oct. 1979 35 p refs
(Contracts EG-77-C-01-4042; XP-9-8002-5)
(DSE-4042-TB) Avail: NTIS HC A03/MF A01

The photoelectrochemical performance of single crystal MoSe2 and GaAs, polycrystalline CdSe, and cells with RbAg4I5 solid electrolyte were evaluated. The MoSe2 electrode exhibited very good photoresponse in electrolytes containing Br(-)/Br2 redox couple. The photopotential and photocurrent were larger in acid than in alkaline electrolyte. A power conversion efficiency of about 5% was achieved under 200 mW cucm3 xenon light illumination in the acid medium. The catalytic activity of a platinized platinum electrode toward Br(-) redox couple was also better in acid electrolyte than in alkaline electrolyte. Higher current densities were obtained in the acid medium. The NoSe2 was found to have good stability in acid and alkaline electrolytes, however, it will be necessary to protect the electrolyte against evaporation of the bromine, oxidation by air, or photodecompositions. DOE

N80-28911# Commission of the European Communities, Brussels (Belgium).
ENERGY. APPLICATION OF SOLAR ENERGY IN DWELLINGS: A TECHNICAL AND ECONOMICAL ANALYSIS FOR THE EUROPEAN COMMUNITY
1980 183 p refs
(EUR-6669) Avail: NTIS (US sales only) HC A09/MF A01

The technical possibilities and economical limitations of solar heating systems for the application in swimming pools, hot water preparation, space heating and air conditioning were investigated. This analysis was performed for dwellings with special consideration of the climatic differences in each community. The computer program, which was used for solar system calculations, and all mathematical models, for technical and economical analysis were elucidated. In the technical and economical analysis, the most suitable solar system sizes for each community was determined. Four types of solar collectors were investigated. The single glass selective collector proved to be the most cost effective collector in all the above applications, provided the the additional cost for the selective coating is not more than 20 DM/cu. From the results of the analysis certain recommendations were derived, which can improve the rapid implementation of solar heating systems into the market. DOE

N80-28912# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N. Mex.
CONCENTRATING SOLAR COLLECTOR TEST RESULTS
Vernon E. Dudley and Robert M. Workhoven 1980 5 p refs Presented at the Am. Sect. of the Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2 Jun. 1980 Prepared in cooperation with Sandia Labs., Albuquerque, N. Mex.
(Contract EY-76-C-04-0789)
(SAND-80-0801C; CONF-800604-5) Avail: NTIS HC A02/MF A01

Some of the results obtained from three years of testing concentrating solar collectors at Sandia National Laboratories are summarized. Efficiency and thermal loss test data is for 16 collectors from 11 different manufacturers. DOE

N80-28913# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Chemical Engineering.
DESIGN OF LAND-BASED, FOAM OTEC PLANTS FOR BOTTOMING CYCLES
A. E. Molini, C. Zener, and T. Fort, Jr. 1979 6 p refs Presented at 6th OTEC Conf., Washington, D.C., 19 Jun. 1979 Prepared in cooperation with Univ. of Puerto Rico, Mayaguez
(Contract EG-77-S-02-4459)
(CONF-790631-17) Avail: NTIS HC A02/MF A01

The Foam Energy Recovery Open Cycle System (FEROCS) at a 1 MW to 10 MW scale is described. A structural design was initiated for a unit 380 ft high visualized as an inverted, vertical, reinforced concrete U tube of 36 ft I.D. and walls 11 in. thick. The structure is feasible based on present construction practices with reinforced concrete in Puerto Rico. It would cost approximately $1.4 million and consume 3800 cu yds of concrete and 860 tons of reinforcing steel. To accelerate the demonstration of FEROCS, it is proposed to utilize artifically created temperature differences that can be readily obtained between industrial thermal effluents, for example flue gases at greater than 250 F from fossil fuel fired steam generating plants, as the heat source and ambient air as the heat sink. Results are presented of a study made conceptualizing the process using different scrubbing-working fluids. DOE

N80-28914# Sandia Labs., Albuquerque, N. Mex. Exploratory Batteries Div.
MODIFIED Li/SO2 CELLS FOR LONG-LIFE APPLICATIONS
Samual C. Levy 1980 14 p refs Presented at the 20th Power Sources Conf., Atlantic City, 9 Jun. 1980
(Contract EY-76-C-04-0789)
(SAND-79-2292C; CONF-800612-2) Avail: NTIS HC A02/MF A01

A 6 year test program to evaluate an ambient-temperature Li primary battery was initiated on cells from two manufacturers. Three modes of premature failure were observed in Li/SO2 cells: corrosion of the lithium-to-can contact, corrosion of the glass in the glass-to-metal seal in the header, and corrosion at the Al-Ta weld in the positive lead. Potential fixes for each of these failure modes were incorporated into cells from two suppliers, and accelerated tests of these cells have begun. DOE

N80-28915# Variflex Corp., Washington, D.C.
WORLDWIDE TRANSPORTATION/ENERGY DEMAND, 1975-2000: REVISED VARIFLEX MODEL PROJECTIONS
Robert U. Ayres and L. W. Ayres Mar. 1980 176 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-79/45740/1) Avail: NTIS HC A09/MF A01

The salient features of the transportation energy relationships that characterize the world of 1975 are reviewed, and worldwide (34 countries) long-range transportation demand by mode to the year 2000 is reviewed. A worldwide model is used to estimate future energy demand for transportation. Projections made by the forecasting model indicate that in the year 2000, every region will be more dependent on petroleum for the transportation sector than it was in 1975. Trends are highlighted and areas for further investigation are suggested. Forecast methodology and model output are described in detail. DOE

N80-28916# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
FUNDAMENTAL HEAT TRANSFER PROCESSES RELATED TO PHASE CHANGE THERMAL STORAGE MEDIA
E. M. Sparrow and J. W. Ramsey Mar. 1980 15 p refs
(Contract DE-AC02-79ER-10343)
(DOE/ER-10343/1) Avail: NTIS HC A02/MF A01

Fundamental heat transfer processes which occur in phase change thermal storage systems are investigated. Four problems were investigated, two involving freezing and two involving melting. It was found that under certain operating conditions, freezing can be drastically retarded and even terminated by natural convection. Under other operating conditions, the dominance of natural convection in the freezing process ultimately gives way

to a freezing mode controlled by heat conduction in the solidified material. By taking account of geometrical and thermal symmetry, the relationship between freezing about a single vertical tube and about an array of vertical tubes was established. The melting studies were focused on determining quantitative data for the heat transfer coefficients in two basic phase-change systems. One of these is an array of horizontal tubes and the other is a single vertical tube. The experiments involved parametric variations of the heating rate and of the degree of subcooling of the melting solid. DOE

N80-28917# Ad-Ex International, Portola Valley, Calif.
METAL-AIR BATTERY WITH REPLACEABLE ANODES
Nov. 1979 7 p Transl. into ENGLISH of Yugoslavian Technical Report Sponsored by DOE Prepared for California Univ., Livermore, Lawrence Livermore Lab.
(UCRL-Trans-11533) Avail: NTIS HC A02/MF A01

A technique for the replacement of anodes in a metal (aluminum, magnesium, etc.)-air battery with consumable electrodes is described. In order to maintain a constant distance between the anode and cathode, the battery must be designed so that, by use of a spring, for example, one of the electrodes is pushed toward the other in such a way that it is constantly pressed down against a distance gage (spacer) that is inserted between them. This invention solves both the problem of anode replacement and the problem of maintaining a constant distance in a very simple fashion. DOE

N80-28918# Electric Power Research Inst., Palo Alto, Calif.
ENERGY ECONOMIC PROJECTIONS FOR THE 1979 OVERVIEW
Louise D. Cleary Sep. 1979 130 p refs
(EPRI-PS-79-5-LD) Avail: NTIS HC A07/MF A01

Each year the EPRI Planning Staff publishes an overview to the 5 year research and development program plan. This report elaborates on and documents key energy demand and supply, economic, and financial issues analyzed in the Overview and Strategy 1980-1984 Research and Development Program Plan, EPRI-1141-PS. The report begins with a summary and expansion of energy and economic issues presented in the planning factors section of the Overview keyed to ETA-MACRO and WEM results. It is followed by an alternative view on the benefits of R and D planning. Next, key assumptions used in the models are outlined. Finally, sensitivity cases explore the implications of a moratorium on the construction of new nuclear plants in the US. Copies of the ETA-MACRO computer input and output from the Overview scenarios are available. DOE

N80-28919# Department of Energy, Washington, D. C. Office of Current Reporting.
INTERNATIONAL ENERGY INDICATORS
Elizabeth K. Bauer, ed. Mar. 1980 30 p
(DOE/IA-0001T/3(80)) Avail: NTIS HC A03/MF A01

For the international sector, a table of data is first presented followed by corresponding graphs of the data for the following: (1) Iran: crude oil capacity, production, and shut in, 1974 to February 1980; (2) Saudi Arabia (same as Iran); (3) OPEC (ex-Iran and Saudi Arabia): capacity, production, and shutin, 1974 to January 1980; (4) non-OPEC Free World and US production of crude oil, 1973 to January 1980; (5) oil stocks: Free World, US, Japan, and Europe (landed), 1973 to 1979; (6) petroleum consumption by industrial countries, 1973 to October 1979; (7) USSR crude oil production, 1974 to February 1980; (8) Free World and US nuclear generation capacity, 1973 to January 1980. For the United States, the same data format is used for the following: US imports of crude oil and products 1973 to January 1980; landed cost of Saudi Arabia crude oil in current and 1974 dollars, 1974 to October 1979; US trade in coal, 1973 to 1979; summary of US merchandise trade, 1976 to January 1980; and US energy/GNP ratio (in 1972 dollars), 1947 to 1979. DOE

N80-28920# Brookhaven National Lab., Upton, N. Y. Electrochemical Technology Group.
FUEL CELL APPLIED RESEARCH: ELECTROCATALYSIS AND MATERIALS Quarterly Report, 1 Jul. - 30 Sep. 1978
S. Srinivasan, H. S. Isaacs, W. E. OGrady, H. Olender, L. J. Olmer, K. Daube, and K. V. Kordesch Jun. 1979 30 p refs
(Contract EY-76-C-02-0016)
(BNL-51053) Avail: NTIS HC A03/MF A01

The electrocatalysis of the formic acid and methanol oxidation reactions at underpotentially deposited metal surfaces at 25 C was investigated. The test electrode was a smooth polycrystalline platinum disc, on which a metal Bi, Cd, Pb or Tl was underpotentially deposited (UPD) by potential cycling in 1 N HClO. The organic reactant (HCOOH or CH3OH) was added to this electrolyte so that its concentration was 0.26 M. Cyclic voltammograms were recorded on the Pt (control) and on the UPD test electrodes at a sweep rate of 50 mV/sec in the potential range of 0 to 1.45 V/RHE. Overpotentials in solid electrolyte fuel cells were also studied. Alternating and direct current techniques were used to determine the impedance characteristics at the platinum-yttria stabilized zirconia interface in the regions of potentials where the oxygen evolution and reduction reactions take place. DOE

N80-28921# Ad-Ex International, Portola Valley, Calif.
ALUMINUM-AIR BATTERY
A. Despic (Belgrade Univ.), D. Drazic (Belgrade Univ.), and S. Zecevic Nov. 1979 12 p refs Transl. into ENGLISH from Yugoslavian Report
(UCRL-Trans-11536) Avail: NTIS HC A02/MF A01

Aluminum alloyed with small amounts (less than 0.1%) of In, Ga, and Tl in an aluminum air battery with 2M NaCl as the electrolyte is reported. The tested laboratory model of the battery with a total weight of about 500 g operated at a total current of 8 A (j = 30 mA/cu cm) and a voltage of about 1 V for 7 hours. Replacing the electrolyte increased the discharge time severalfold, with the number of replacements depending on the selected initial thickness of the Al anode. It is shown that optimizing the design permitted up to 500 Wh/kg to be attained with periodic replacement of the electrolyte, or about 100 Wh/kg without replacement of the electrolyte. A number of suitable uses for this battery, especially for special purpose batteries, are suggested. DOE

N80-28922# Ad-Ex International, Portola Valley, Calif.
NEW RESULTS IN DEVELOPMENT OF ALUMINUM-AIR BATTERIES WITH A NEUTRAL ELECTROLYTE
D. M. Drazic, A. R. Despic, S. Zecevic, L. Jovanovic, and L. Gajic Nov. 1979 11 p refs Transl. into ENGLISH from Yugoslavian Report
(UCRL-Trans-11532) Avail: NTIS HC A02/MF A01

The electrochemistry of Al anodes in 2M NaCl was investigated. The anode was shifted up and down mechanically at various amplitudes and frequencies. It was found that anodes made from commercial grade Al (99.5%) were less suitable than those made from pure Al (99.99%) due to the presence of Cu impurity; if the use of pure Al is to be avoided, some way to neutralize the harmful effects of the impurity must be found. The amount of Al that can dissolve in the electrolyte, and thus the lifetime of the battery, depends on the dynamic conditions in the battery; during vibration of the battery the electrolyte can hold up to 0.18 g/ml without passivation of the anode. This result indicates that a 10 kW battery with an interelectrode distance of 5 mm can continually discharge with a current density of 50 mA/sq cm for 6 hours. If sufficiently thick anodes were used, it could then be prepared for a new discharge cycle simply by replacement of the electrolyte. DOE

N80-28923# Ad-Ex International, Portola Valley, Calif.
ANODIC BEHAVIOR OF Al AND THE ALLOYS Al-In AND Al-In-Ga IN ALUMINUM-AIR BATTERIES
D. M. Drazic (Belgrade Univ.), A. R. Despic (Belgrade Univ.), and S. K. Zecevic Nov. 1979 12 p refs Transl. into ENGLISH from Yugoslavian Report
(UCRL-Trans-11534) Avail: NTIS HC A02/MF A01

The anodic behavior of aluminum and the alloys Al-In and Al-In-Ga was tested under the operating conditions of aluminum-air batteries. The tests were conducted in an aqueous solution of 2 M NaCl, and the results obtained were compared with the results obtained from a special test of these alloys as the anode in a standard electrochemical cell. Significant results and observations are reported. DOE

N80-28924# Martin Marietta Aerospace, Denver, Colo.
INTERNALLY INSULATED THERMAL STORAGE SYSTEM

DEVELOPMENT PROGRAM. Final Report
Dec. 1979. 172 p. refs.
(Contract EY-76-C-04-0789)
(SAND-80-8175; MCR-79-1389) Avail: NTIS HC A08/MF A01

A cost effective thermal storage system for a solar central receiver power system using molten salt stored in internally insulated carbon steel tanks was defined. The program was divided into five tasks: (1) testing of internal insulation materials in molten salt; (2) preliminary design of storage tanks, including insulation and liner installation; (3) thermal analysis of internally insulated thermocline tanks; (4) optimization of the storage configuration; and (5) definition of a subsystem research experiment to demonstrate the system. DOE

N80-28925# Rockwell International Corp., Golden, Colo. Energy Systems Group.
ALTOS-MODEL 88 WIND TURBINE GENERATOR. FAILURE ANALYSIS
K. K. Higashi and M. J. Carr. 18 Jun. 1979. 20 p.
(Contract DE-AC04-76DP-03533)
(RFP-3035/3533/79-10) Avail: NTIS HC A02/MF A01

The failure of the Altos wind turbine generator is investigated. A brittle failure of a hub was caused by the combination of a poor quality (porous) casting and a sharp corner in a machined keyway. DOE

N80-28926# Rockwell International Corp., Golden, Colo. Energy Systems Group.
ALTOS-MODEL 88 WIND TURBINE GENERATOR. PERFORMANCE REPORT. Interim Report
K. K. Higashi. Jul. 1979. 13 p.
(Contract DE-AC04-76DP-03533)
(RFP-3033/3533/79-4) Avail: NTIS HC A02/MF A01

A wind turbine generator was tested in terms of its performance under conditions which it is likely to be subjected while in normal use. All instruments used during the testing were maintained in calibration and accordance with Rocky Flats calibration procedures. DOE

N80-28927# Sandia Labs., Albuquerque, N. Mex.
ACCELERATED AGING OF THERMALLY ACTIVATED BATTERIES WHICH UTILIZE THE Li(Si)/LiCl-KCl/FeS2 SYSTEM
Jimmie Q. Searcy and Patricia A. Neiswander. 1980. 23 p. refs. Presented at the 29th Power Sources Conf., Atlantic City, 9 Jun. 1980.
(Contract EY-76-C-04-0789)
(SAND-80-5080C; CONF-800612-1) Avail: NTIS HC A02/MF A01

A number of Li(Si)/FeS2 thermally activated batteries were developed for applications that require high reliability and a shelf life of twenty-five years. An accelerated aging study was undertaken to determine the feasibility of achieving the requirements. Deleterious chemical reactions were identified that could affect performance and reliability during the twenty-five year shelf life. The approach used was to accelerate the aging of batteries by storage at elevated temperature, and then to examine and analyze materials from some batteries, while discharging others. A battery design that used no organic materials (except for those in an electrical match) was chosen in order to minimize the number of possible deleterious reactions. The reaction of Li(Si) with water outgassed from the various battery parts was the only effect deleterious to shelf life that was noted. DOE

N80-28928# Ueland and Junker, Architects and Planners, Philadelphia, Pa.
SOLAR ATRIUM: A HYBRID SOLAR HEATING AND COOLING SYSTEM. Technical Progress Report, 19 Dec. 1978 - 19 Mar. 1979
Mark Ueland. 19 Mar. 1979. 11 p.
(Contract EG-77-G-04-4135)
(DOE/CS-34135/6; TPR-6) Avail: NTIS HC A02/MF A01

The design, construction and monitoring of an innovative concept of solar heating and cooling are described. The concept is adaptable to residences and smaller commercial and institutional buildings. It is designed to be constructed of materials and equipment that are economical and readily available. Progress on construction is reported. DOE

N80-28929# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Dept. Satellites.
THE SNIAS MAGNETIC BEARING WHEEL. [LES ROUES A PALIERS MAGNETIQUES DE L'AEROSPATIALE]
Claude Rouyer. Paris. 1979. 21 p. In FRENCH. Presented at Colloq. PROSPACE, Moscow, 10-14 Sep. 1979.
(SNIAS-792-421-101) Avail: NTIS HC A02/MF A01

The use of the magnetic bearing for momentum and reaction wheels in satellites is discussed. A description of the specifications and characteristics required is given. The principles of magnetic bearings are given and a specific model is presented. A comparison is made between the advantages and disadvantages of ball and magnetic type bearings. Space and terrestrial application (such as energy storage and recuperation) are foreseen. Author (ESA)

N80-28930# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Dept. Etudes Speciales.
PASSIVE RADIALLY CENTERED MAGNETIC SUSPENSION FOR HIGH VELOCITY ROTORS. [SUSPENSION MAGNETIQUE A CENTRAGE RADIAL PASSIF POUR ROTORS A GRANDE VITESSE]
Pierre C. Poubeau. Paris. 1979. 28 p. refs. In FRENCH. Presented at SEE Conf. Journees d'Etudes pour les Nouveaux Mater. Magnetiques, Grenoble, 20-21 Apr. 1978.
(SNIAS-792-422-109) Avail: NTIS HC A03/MF A01

A suspension system developed for the attitude governing flywheels of satellites is presented. Samarium cobalt magnetic crown pieces assure centering; a single servomechanism stabilizes the axial equilibrium of the rotor. Friction problems are eliminated in this system which enables velocities to be achieved that are only limited by the centrifugal forces experienced by the rotor material. This system is thus associated with rotors made of composite materials. Author (ESA)

N80-28931# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
A PARAMETRIC STUDY OF 1000 MWe COMBINED CLOSED CYCLE MHD/SYSTEM ELECTRICAL POWER GENERATING PLANTS
A. J. Geuijes and D. Kleyn. Dec. 1978. 60 p. refs.
(TH-78-E-91; ISBN-90-6144-091-2) Avail: NTIS HC A04/MF A01

A parametric study was carried out for different closed noble gas MHD cycles coupled to a direct coal-fired combustion system (and in most cases to a steam bottoming plant). For the description of the components, black-box models were used. The influence of the choice of the most important design parameters on the total system efficiency was quantified, and the performance of systems compared with different configuration. The so-called topping-cycle makes the best system with an efficiency of 52% for a base case. A parametric study was done with respect to channel properties to find an optimal system efficiency for both supersonic and subsonic channels as part of a topping-cycle. The generator properties were calculated according to a quasi one dimensional model. Author (ESA)

N80-28932# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
MOMENTUM THEORY ANALYSIS OF UNCONVENTIONAL WIND EXTRACTION SCHEMES, PART 10
Marten T. Landahl. Stockholm. Aeron. Res. Inst. of Sweden. 12 Oct. 1979. 23 p. refs. 6 Vol.
(Contract SWEDBESD-5061-012)
(ASRL-TR-194-2-Pt-10; FFA-AU-1499-Pt-10) Avail: NTIS HC A02/MF A01

A momentum theory analysis was carried out for idealized wind energy extraction devices under the assumption of uniform wake velocity. The wind energy extraction problem was analyzed on the basis of some simple idealized flow models which demonstrate that the 'Bertz limit' can be exceeded with the aid of some unconventional extraction schemes. However, to what extent such schemes could be realized in actual engineering designs is not discussed. It is shown that by deflecting the flow through the extractor, it is theoretically possible to extract a

power per unit frontal area of the extractor which is considerably (by about a factor of two) higher than that given by the simple actuator disk model. Author (ESA)

N80-28933# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
SAFETY OF WIND ENERGY CONVERSION SYSTEMS (WECS): PRELIMINARY STUDY
Sigge Eggwertz, Ingemar Carlsson (LUTAB Ingenjorsbryaa AB), Anders Gustafsson, Christer Lundemo, Bjorn Montgomerie, and Sven-Erik Thor 18 Nov. 1979 138 p refs
(Contract SWEDBESD-5061-101)
(FFA-HU-2126) Avail: NTIS HC A07/MF A01

A safety study to provide information on the risks inherent in a Wind Energy Conversion System (WECS) to the general public in the surrounding area as well as to the operator personnel is presented. Land based large scale turbine systems with horizontal axes situated in sparsely populated areas are considered. The study is intended to serve as a preliminary manual for safety analysis of WECS. An overall description of the system, statistical information concerning loads and strength properties of materials considered, and a discussion of geometrical tolerances are included. Formulas and procedures to be employed in the risk analysis are presented, followed by comments on acceptable risk levels. The consequences of components failures are also considered. A dynamic analysis of separating objects is performed. Critical events are listed, while safety systems, inspection, and repairs are discussed. Author (ESA)

N80-28934# New England River Basins Commission, Boston, Mass.
POTENTIAL FOR HYDROPOWER DEVELOPMENT AT EXISTING DAMS IN NEW ENGLAND. VOLUME 1: PHYSICAL AND ECONOMIC FINDINGS AND METHODOLOGY Final Report
Jan. 1980 181 p
(PB80-169121; HP-1-80/1) Avail: NTIS HC A09/MF A01 CSCL 10B

The potential for hydropower development at existing dams in New England was investigated. The extent to which New England's dependence on foreign oil could be reduced through expansion of hydropower at existing dams is quantified in terms of energy and costs. A synopsis of the study methodology is presented. GRA

N80-28935# New England River Basins Commission, Boston, Mass.
POTENTIAL FOR HYDROPOWER DEVELOPMENT AT EXISTING DAMS IN NEW ENGLAND. VOLUME 2: USER'S MANUAL Final Report
Jan. 1980 141 p
(PB80-169139; HD-1-80/2) Avail: NTIS HC A07/MF A01 CSCL 10B

The computer program HYELEC and its subroutines HYDPOT and ECOPOT is presented. HYELEC stores information relating to the hydropower potential of dams and can perform screening and ranking operations on these dams according to selected criteria pertaining to engineering practicability and economic feasibility. The computer language, the use of program control variables, and the sequence of events required for program operation are described. GRA

N80-28936# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
AN INVESTIGATION OF WIND LOADS ON SOLAR COLLECTORS Final Report
H. W. Tieleman, R. E. Akins, and P. R. Sparks Jan. 1980 169 p refs
(Contract EO-A01-78-3605)
(PB80-158744; VPI-E-80-1) Avail: NTIS HC A08/MF A01; also available in set of 3 reports HC E14, PB80-158736 CSCL 10A

A wind-tunnel study of a series of model solar collector installations (flat-plate collectors) immersed in a thick turbulent shear layer was undertaken in order to determine design wind loads on such installations. Wind tunnel measurements were made of the mean and fluctuating pressures on a model of a single flat-plate collector which was a component of different multi-panel installations. The pressures were spatially integrated over the top and bottom surface of the single collector separately. GRA

N80-28937# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
AN INVESTIGATION OF WIND LOADS ON SOLAR COLLECTORS. APPENDIX 1: DATA LISTING FOR TOP AND BOTTOM OF COLLECTOR Final Report
H. W. Tieleman, R. E. Akins, and P. R. Sparks Jan. 1980 312 p refs
(Contract EO-A01-78-3605)
(PB80-158751; VPI-E-80-1-App-1) Avail: NTIS HC A14/MF A01; also available in set of 3 reports HC E14, PB80-158736 CSCL 10A

A wind-tunnel study of a series of model solar-collector installations (flat-plate collectors) immersed in a thick turbulent shear layout was undertaken in order to determine design wind loads on such installations. The complete results of all wind tunnel model tests are presented in tabular and graphical form. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-28938 Greater London Council (England).
HEAVY METALS IN TERRESTRIAL ECOSYSTEMS: A BIBLIOGRAPHY
E. C. Goodliffe, comp. Nov. 1978 27 p refs
(ISBN-7168-1061-1) Copyright. Avail: Greater London Council, London £1.75

An annotated bibliography was compiled which includes metal pollution from industrial sources, road traffic sources, the biological/ecological consequences of heavy metal pollution, and heavy metals in soils. Author (ESA)

N80-28939*# University of Central Florida, Orlando.
A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEMS AT JOHN F. KENNEDY SPACE CENTER. VOLUME 3, PART 1: ICHTHYOLOGICAL SURVEY OF LAGOONAL WATERS Final Report
F. F. Snelson, Jr. Jul. 1980 436 p refs
(Contract NAS10-8986)
(NASA-CR-163122; KSC-TR-51-2-Vol-3-Pt-1) Avail: NTIS HC A19/MF A01 CSCL 13B

Ichthyological species in the Indian River lagoonal system likely to be affected by NASA's aerospace activities at the Kennedy Space Center were surveyed. The importance of the fish found to inhabit the waters in the area is analyzed. A.R.H.

N80-28940*# University of Central Florida, Orlando.
A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEMS AT JOHN F. KENNEDY SPACE CENTER. VOLUME 3, PART 2: ICHTHYOLOGICAL STUDIES, SAILFIN MOLLY REPRODUCTION STUDY Final Report
F. F. Snelson, Jr. Jul. 1980 182 p refs
(Contract NAS10-8986)
(NASA-CR-163122; KSC-TR-51-2-Vol-3-Pt-2) Avail: NTIS HC A09/MF A01 CSCL 13B

The applicability of monitoring populations of Poccilia latipinna (sailfin molly) and its reproductive efforts as reliable indicators of environmental effects of aerospace activities in the Kennedy Space Center area was investigated. Results show that the sailfin molly experiences drastic fluctuations in population and reproductive success and is not an appropriate factor for monitoring to establish perturbations of the environment due to space transportation system related activities. A.R.H.

N80-28941*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GROUND CLOUD HYDROGEN CHLORIDE MEASUREMENTS FROM THREE TITAN LAUNCHES AT THE KENNEDY

SPACE CENTER DURING 1978 AND 1979
Daniel I. Seabacher, Robert B. Lee, III, and Joseph J. Mathis Jun. 1980 48 p refs
(NASA-TM-81830) Avail: NTIS HC A03/MF A01 CSCL 13B

Total hydrogen chloride and gaseous hydrogen chloride concentrations were measured in the exhaust cloud produced at three Titan 3 launches at the Kennedy Space Center in March 1978, December 1978, and November 1979 to determine the degree of hydrogen chloride partitioning in a solid rocket exhaust cloud between gaseous hydrogen chloride and hydrochloric acid aerosol as a function of ambient relative humidity. Moderately low relative humidity conditions were present during a daytime launch on Mar 25, 1978, and high relative humidity conditions were present during a nighttime launch on December 13, 1978. Gaseous hydrogen chloride concentrations and meteorological data, as a function of time after launch, are presented. Hydrogen chloride is present in both the gaseous and aerosol phase in the exhaust cloud. Total HCl concentrations ranged from 18 parts per million by volume (ppm) several minutes after launch down to 1 ppm after the cloud stabilization period, depending on the meteorological conditions. Gaseous HCl concentrations ranged from 2 to 3 ppm several minutes after launch to less than 1 ppm after cloud stabilization. These measured concentrations indicated significant HCl aerosol formation. L.E.M.

N80-28942*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGNING COMMUNITY SURVEYS TO PROVIDE A BASIS FOR NOISE POLICY
James M. Fields Jun. 1980 24 p refs Presented at 99th Acoustical Soc. of Am. Meeting, Atlanta, 21-25 Apr. 1980
(NASA-TM-80110) Avail: NTIS HC A02/MF A01 CSCL 13B

After examining reports from a large number of social surveys, two areas were identified where methodological improvements in the surveys would be especially useful for public policy. The two study areas are: the definition of noise indexes and the assessment of noise impact. Improvements in the designs of surveys are recommended which would increase the validity and reliability of the noise indexes. Changes in interview questions and sample designs are proposed which would enable surveys to provide measures of noise impact which are directly relevant for public policy. Author

N80-28943*# National Aeronautics and Space Administration, Washington, D. C.
DISTURBANCE CAUSED BY AIRCRAFT NOISE
R. Josse Apr. 1980 14 p Transl. into ENGLISH from Cah. du Centre Sci. et Tech. du Batiment (Paris), Rept. 100, Cah. 689, Jun. 1969 p 46-51 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75474) Avail: NTIS HC A02/MF A01 CSCL 13B

Noise pollution caused by the presence of airfields adjacent to residential areas is studied. Noise effects on the sleep of residents near airports and the degree of the residents noise tolerance are evaluated. What aircraft noises are annoying and to what extent the annoyance varies with sound level are discussed. L.F.M.

N80-28944*# National Aeronautics and Space Administration, Washington, D. C.
REACTION OF THE FRENCH POPULATION TO THE SUPERSONIC BANG
J. Bremond May 1980 16 p Transl. into ENGLISH from Rev. Med. Aeronaut. et Spatiale (France), v. 13, no. 51, 1974 p 208-213 Original language document announced as A75-17371 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by French Army Research Div.
(Contract NASw-3199)
(NASA-TM-75487) Avail: NTIS HC A02/MF A01 CSCL 13B

A discussion of a survey dealing with the supersonic bang is presented. Topics include the position the bang has in today's pollution, annoyance caused by the bang and its dependence on sociological and psychological variables, and whether or not the perception of the ban is objective. Other questions raised are whether the frequency of exposure to the bang has an influence on attitudes and does the sensitivity to or annoyance from the bang have a linear increase with the frequency. E.D.K.

N80-28945*# National Aeronautics and Space Administration, Washington, D. C.
THE NUISANCE DUE TO THE NOISE OF AUTOMOBILE TRAFFIC: AN INVESTIGATION IN THE NEIGHBORHOODS OF FREEWAYS
Claude Lamure and Michel Bacelon Apr. 1980 29 p refs Transl. into ENGLISH from Cah. du Centre Sci. et Tech. du Batiment (France), no. 88, Oct. 1967, Cah. 762 p 1-12 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Centre Scientifique et Technique du Batiment, France
(Contract NASw-3198)
(NASA-TM-75812) Avail: NTIS HC A03/MF A01 CSCL 13B

An inquiry was held among 400 people living near freeways in an attempt to determine the characteristics of traffic noise nuisance. A nuisance index was compiled, based on the answers to a questionnaire. Nuisance expressed in these terms was then compared with the noise level measured on the most exposed side of each building. Correlation between the nuisance indexes and the average noise levels is quite good for dwellings with facades parallel to the freeway. At equal noise levels on the most exposed side, the nuisance given for these latter dwellings is lower than for others. Author

N80-28946*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANNOYANCE DUE TO MULTIPLE AIRPLANE NOISE EXPOSURE
Clemans A. Powell Aug. 1980 42 p refs
(NASA-TP-1706; L-13710) Avail: NTIS HC A03/MF A01 CSCL 13B

A laboratory study was conducted to investigate the annoyance effects of multiple aircraft noise exposure in which 250 subjects judged the annoyance of half-hour periods of airplane noise simulative of typical indoor home exposures. The variables of the aircraft noise exposure were the peak noise level of flyovers, which was constant within each period, and the number of flyovers. Each subject judged 5 of the possible 25 factorial combinations of level and number. Other variables investigated included the experience of the test subjects in making annoyance judgments and their home exposure to airplane noise. The annoyance judgments increased with both noise level and number of flyovers. The increased annoyance produced by doubling the number of flyovers was found to be the equivalent of a 4 to 6 db increase in noise level. The sensitivity of the subjects to changes in both noise level and number of flyovers increased with laboratory experience. Although the means of the annoyance judgments made in the laboratory were found to decrease with the subjects' home exposure to aircraft noise, the subjects' sensitivities to changes in both level and number were unaffected by their home exposure. Author

N80-28947# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Dec. 1979 218 p refs
(Contract DE-AC01-79CS-30027)
(SOLAR/0010-79/12) Avail: NTIS HC A10/MF A01

Environmental information collected at each of the sites for the reporting month are tabulated. Data included are insolation, temperature, wind, and relative humidity. These data are for use in determining the thermal performance of the solar systems. (MHR). DOE

N80-28948# Boyce Thompson Inst. for Plant Research Inc., Ithaca, N. Y.
EFFECTS OF SULFUR DIOXIDE AND NITROGEN DIOXIDE ON VEGETATION Progress Report, 1 Apr. - 30 Sep. 1979
L. H. Weinstein, D. C. McCune, D. C. MacLean, J. A. Laurence, R. G. Amundson, Ruth Alscher-Herman, Patrick Hughes, and Allen Renwick Oct. 1979 11 p

(Contracts DE-AS02-77EV-04368; EE-77-S-02-4368)
(DOE/EV-04368/3) Avail: NTIS HC A02/MF A01

Progress in research on the effects of sulfur dioxide and nitrogen dioxide on plants is presented. Specific areas of investigation include: effects of NO2 on the phytotoxicity of SO2; interactions of air pollutants, plants and plant pathogens; effects of SO2 on plant-insect interactions; mode of action and metabolism of SO2 in plants. DOE

N80-28949# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
IMPACT OF REDUCED VENTILATION ON INDOOR AIR QUALITY IN RESIDENTIAL BUILDINGS
James V. Berk, Craig D. Hollowell, James H. Pepper, and Rodger A. Young Mar. 1980 21 p refs Presented at the Air Pollution Control Assoc. Ann. Meeting, Montreal, Canada, Jun. 1980
(Contract W-7405-eng-48)
(LBL-10527; EEB-Vent-80-5; CONF-800608-2) Avail: NTIS HC A02/MF A01

A research program being conducted to determine the extent to which low ventilation rates are compatible with good indoor air quality is described. Overall indoor, air quality is influenced by air-exchange rates, types of appliances and building materials used, and occupant activities. From the numerous indoor air pollutants studied, four are receiving considerable attention in the context of potential health risks associated with energy conservation. Field monitoring studies in energy efficient residential buildings have demonstrated that in some cases these indoor generated pollutants exceed outdoor air quality standards in houses having air-exchange rates of less than 0.5 air changes per hour. The results of our research suggest that further studies, designed to include a broader range of infiltration rates and occupancy conditions are needed before establishing energy efficient infiltration standards for residential buildings. DOE

N80-28950# California Univ., Berkeley. Lawrence Berkeley Lab. Naval Biosciences Lab.
EFFECTS OF ENERGY CONSERVATION MEASURES ON AIR HYGIENE IN PUBLIC BUILDINGS Final Report
R. L. Dimmick and H. Wolochow Feb. 1980 62 p refs
(Contract W-7405-eng-48)
(LBL-10553; EER-Vent-80-2) Avail: NTIS HC A04/MF A01

Scientific, technical, and material support are provided regarding sampling, assay, and data analysis of the airborne bacterial content of hospitals and educational facilities. The magnitude of change in the numbers of airborne microbes are estimated as a function of ventilation practice. R.C.T.

N80-28951# Centre d'Etudes Phytosociologiques et Ecologiques, Montpellier (France). Dept. d'Ecologie Generale.
A CONTRIBUTION TO THE ECOLOGICAL ANALYSIS OF THE ARID ZONES OF TUNISIA WITH THE HELP OF SPATIAL REMOTE-SENSING DATA: ARZOTU EXPERIMENT Final Report, 1975-1978
Dec. 1978 239 p refs In FRENCH; ENGLISH summary Sponsored by CNES Prepared in cooperation with Institut National de la Recherche Agronomique, Gabes Tunisia and Office de la Recherche Scientifique et Technique Outre-Mer, Yaounde, Cameroon Original contains color illustrations
Avail: NTIS HC A11/MF A01

The processing and thematic interpretation of LANDSAT data acquired during 1972 and 1973 and during the 1975 to 1977 period are discussed. During the last period the investigations were completed with ground observations. Small-scale cartography of ecological zones, land uses, desert conditions as well as large-scale mapping were partially achieved. The usefulness of spatial-temporal data in regional modeling was demonstrated. The results obtained give a comprehensive view of the potential for employing such techniques is the arid zones of the Northern Sahara. Author (ESA)

N80-28952# Institut de Recherche de Transports, Bron (France). Centre d'Evaluation et de Recherches des Nuisances.
POLLUTION BY AIRCRAFT TRAFFIC. POLLUTION FORECAST MODEL IN THE VICINITY OF AIRPORTS. APPLICATION TO VARIOUS AIRPORTS: ORLY AND ROISSY-EN-FRANCE
Jean Delsey, Robert Joumard, and Gerard Peri (Societe Comex, Marseille, France) 1979 14 p refs
Avail: NTIS HC A02/MF A01

The differential equation of pollutant turbulent diffusion is numerically resolved for airports after some simplifications. The hypotheses which led to wind and diffusivity formulas are indicated. Data are given for calculating the different parameters, particularly those of aircraft pollutant emissions depending on different types of aircraft. The model is operational for any airport and shows the importance of meteorological factors. Author (ESA)

N80-28953# Royal Netherlands Meteorological Inst., De Bilt.
NETWORK FOR THE DETERMINATION OF THE CHEMICAL COMPOSITION OF PRECIPITATION IN THE NETHERLANDS: ANNUAL SURVEY, 1978 Annual Report [MEETNET VOOR BEPALING VAN DE CHEMISCHE SAMENSTELLING VAN DE NEERSLAG IN NEDERLAND]
1979 45 p refs In DUTCH; ENGLISH summary Prepared in cooperation with Rijksinstituut voor de Volksgezondheid, Bilthoven, Netherlands
(KNMI-156-1) Avail: NTIS HC A03/MF A01

The 12 stations, which began operating in 1978, test conductivity, pH, and the concentrations of NH4, Na, K, Ca, Mg, F, Cl, NO3 and SO4. The analytical methods are described, and data collected for the year given. Author (ESA)

N80-28954# Environmental Sciences Research Lab., Research Triangle Park, N.C.
SCHEME FOR ESTIMATING DISPERSION PARAMETERS AS A FUNCTION OF RELEASE HEIGHT Progress Report, Jul. 1977 - Jun. 1979
John S. Irwin Oct. 1979 68 p refs
(PB80-169436; EPA-600/4-79-062) Avail: NTIS HC A04/MF A01 CSCL 13B

A generalized scheme is presented for estimating atmospheric pollutant dispersion parameters as a function of release height. The scheme incorporates results from various studies, and once it is more practically structured it will prove useful for characterizing dispersion from tall sources in a variety of situations. The generalized scheme was developed particularly, Gaussian plume modeling; therefore, it is restricted to modeling applications having flat terrain and having steady-state meteorological conditions. GRA

N80-28955# Radian Corp., Austin, Tex.
INVESTIGATION OF NO2/NOx RATIOS IN POINT SOURCE PLUMES Final Report, Dec. 1978 - Dec. 1979
J. P. Blanks, E. P. Hamilton, III, B. R. Epright, and N. A. Nielsen Feb. 1980 74 p refs
(Contract EPA-68-02-2608)
(PB80-169550; EPA-600/7-80-036) Avail: NTIS HC A04/MF A01 CSCL 13B

The relationship of ground level NO2 concentration to NOx emission (NO2/ NOx ratio) in plume for six large power plants in the Chicago area was investigated using a photostationary state reactive Gaussian plume model. The level of NOx control required to meet a probable short term NO2 national ambient air quality standard was assessed. The major uncertainty of a earlier study was its assumption of uniform, fixed NO2/NOx ratios of 0.5 (summer) and 0.25 (winter). The previous study indicated that most of the six plants could meet a 500 microgram/cu m short-term NO2 standard using NOx combustion modification techniques (50% NOx control); this study indicates NOx flue gas treatment technology (90% control) may be required on these plants to meet a 750 microgram/cu m standard, and most certainly for 500 micrograms/cu m. GRA

N80-28956# SRI International Corp., Menlo Park, Calif.
COMPUTER MODELING OF SIMULATED PHOTOCHEMICAL SMOG Final Report, Sep. 1977 - Aug. 1979
D. G. Hendry, A. C. Baldwin, and D. M. Golden Feb. 1980 222 p refs
(Contract EPA-68-02-2427)
(PB80-169675; EPA-600/3-80-029) Avail: NTIS HC A10/MF A01 CSCL 04A

Efforts to develop chemical kinetic mechanisms to describe the formation of photochemical smog are discussed. Detailed mechanisms for the atmospheric reactions of toluene, m-xylene,

propene, ethene, formaldehyde, and acetaldehyde were constructed from available experimental and chemical kinetic data. These mechanisms were used to simulate smog chamber data from air pollution research centers. GRA

N80-28957# Shell Development Co., Houston, Tex.
MULTIMAX: AN AIR DISPERSION MODELING PROGRAM FOR MULTIPLE SOURCES, RECEPTORS, AND CONCENTRATION AVERAGES Final Report
J. H. Moser Aug. 1979 197 p refs
(PB80-170178; NTIS/DF-80/003A) Avail: NTIS HC A09/MF A01 CSCL 04A

A complete update of the computer program MULTIMAX is given. The original computer program was developed on a Univac 1110 computer; a number of machine dependent features of the software were utilized in order to attain maximum flexibility of the program from a user's standpoint. In 1978, the Tennessee Valley Authority modified the Univac 1110 version of MULTIMAX so that it would run on IBM 360/370 computers. The major additions to this user's manual are appendices which discuss input formats for the IBM program version, certain machine dependent features of the programs and show example inputs and outputs for the Univac and the IBM versions. GRA

N80-28958# North Dakota State Dept. of Health, Bismarck. Div. of Environmental Research.
THE LONG-TERM EFFECTS OF TRACE ELEMENTS EMITTED BY ENERGY CONVERSION OF LIGNITE COAL Final Report
Martin R. Schock, William W. Morrison, and Gene A. Christianson Jul. 1979 274 p refs
(Contract OWRC-10773210)
(PB80-168867) Avail: NTIS HC A12/MF A01 CSCL 13B

Results from a two year project, concerning effects of selected elements upon the ecosystem surrounding a 675 megawatt coal fired electrical generating facility are reviewed. The project involved the collection of coal, stack fly ash, aerosol, surface water, snow, sediments, soil, and vegetation samples for analysis of element concentrations. A modified atmospheric transport and deposition computer model was developed and used to predict ground level air concentrations and development of elements from the burning of lignite coal. The results of the project provide evidence of enrichment of certain elements in aerosols, snow, water, soil surface, and vegetation. GRA

N80-28959# Rockwell International Corp., Crave Couer, Mo. Environmental Monitoring and Services Center.
REGIONAL AIR POLLUTION STUDY: GAS CHROMATOGRAPHY LABORATORY OPERATION Final Report
G. Cardwell Jan. 1980 139 p refs
(Contract EPA-68-02-2093)
(PB80-169691; EPA-600/4-80-006) Avail: NTIS HC A07/MF A01 CSCL 07D

A gas chromatography laboratory was set up to analyze air samples collected in Teflon bags and stainless steel tanks. Samples were analyzed for total hydrocarbons, methane, CO, and C2-C10 hydrocarbons. A total of 455 samples, including replicates, were analyzed during the summer and fall of 1976. Many samples were collected at 12 of the Regional Air Monitoring Systems (RAMS) sites to yield data on spatial and temporal distributions of hydrocarbons. Additional sampling was performed to study ethylene contamination in and around RAMS stations. Quality control audits indicated good system performance during the study. Replicate samples indicated good reproducibility for samples stored for as long as six days in the Teflon bags. GRA

N80-28960# North Dakota State Dept. of Health, Bismarck. Div. of Environmental Research.
THE LONG-TERM EFFECTS OF TRACE ELEMENTS EMITTED BY ENERGY CONVERSION OF LIGNITE COAL. VOLUME 2: TECHNICAL APPENDICES Final Report
William W. Morrison, Martin R. Schock, and Gene A. Christianson Jul. 1979 211 p
(Contract OWRC-10773210)
(PB80-168875) Avail: NTIS HC A10/MF A01 CSCL 07D

A two year project concerning effects of selected elements upon the ecosystem surrounding a 675 megawatt coal fired electrical generating facility, was completed. This involved the collection of coal, stack fly ash, aerosol, surface water, snow, sediments, soil, and vegetation samples for analysis of element concentrations. A modified atmospheric transport and deposition computer model was developed and used to predict ground level air concentrations and development of elements from the burning of lignite coal. The results provide evidence of enrichment of certain elements in aerosols, snow, water, soil surface, and vegetation. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-28961 Institut d'Aeronomie Spatiale de Belgique, Brussels.
DETECTION OF POSITIVE IONS IN THE STRATOSPHERE Ph.D. Thesis - Ghent Univ. [DETECTIE VAN POSITIEVE IONEN IN DE STRATOSFEER]
D. Nevejans 1979 229 p refs In DUTCH; ENGLISH summary
(Aeronomica-Acta-A-210-1979) Avail: Issuing Activity

A balloon-borne mass spectrometer experiment for the detection of ions in the stratosphere D-region was performed. The vacuum apparatus, mass filter, ion detection and mass selection systems are described. The stratospheric ion population was simulated for calibration. At 35 km (5.1 mbar), the natural ions could be classified into at least two groups of hydrates. One group can be related with high probability to the proposed proton hydrates, while a second series seem to be hydrates of an unknown ion with a mass of 41 A.M.V. Author (ESA)

N80-28962*# Denver Univ., Colo. Dept. of Physics.
STUDIES OF THE EARTH-LIMB ABSORPTIONS IN THE NEAR ULTRAVIOLET Final Report
David G. Murcray Apr. 1980 7 p
(Grant NsG-1557)
(NASA-CR-163370) Avail: NTIS HC A02/MF A01 CSCL 04A

The use of solar occultation techniques as a means of obtaining data on the photochemistry of the ozone layer was investigated. A spectrometer equipped with a photomultiplier detector and associated electronics necessary to amplify the output of the detector up to a level suitable for on-board recording and also for telemetering to the ground, was packaged with a solar telescope and flown by balloon in order to obtain solar spectra in the region between 3080 A and 3100 A with a resolution of close to 0.05 A. Data reduction techniques required to remove solar OH lines from atmospheric OH line spectra are described as well as the instrument package. A.R.H.

N80-28963*# General Electric Co., Philadelphia, Pa. Space Div.
ATMOSPHERIC LIDAR MULTI-USER INSTRUMENT SYSTEM DEFINITION STUDY Final Report
R. V. Greco, ed. Washington, D.C. NASA Aug. 1980 343 p refs
(Contract NAS1-15476)
(NASA-CR-3303) Avail: NTIS HC A15/MF A01 CSCL 04A

A spaceborne lidar system for atmospheric studies was defined. The primary input was the Science Objectives Experiment Description and Evolutionary Flow Document. The first task of the study was to perform an experiment evolutionary analysis of the SEED. The second task was the system definition effort of the instrument system. The third task was the generation of a program plan for the hardware phase. The fourth task was the supporting studies which included a Shuttle deficiency analysis, a preliminary safety hazard analysis, the identification of long lead items, and development studies required. As a result of the study an evolutionary Lidar Multi-User Instrument System (MUIS) was defined. The MUIS occupies a full Spacelab pallet and has a weight of 1300 kg. The Lidar MUIS laser provides a 2 joule frequency doubled Nd:YAG laser that can also pump a tuneable dye laser wide frequency range and bandwidth. The

MUIS includes a 1.25 meter diameter aperture Cassegrain receiver, with a moveable secondary mirror to provide precise alignment with the laser. The receiver can transmit the return signal to three single and multiple photomultiple tube detectors by use of a rotating fold mirror. It is concluded that the Lidar MUIS proceed to program implementation. L.F.M.

N80-28964# Magnetic Observatory, Hermanus (South Africa).
MAGNETIC OBSERVATIONS AT SANAE 1977 - 1978
1979 95 p
(CSIR-MAG-B19; ISBN-0-7988-1631-7) Avail: NTIS HC A05/MF A01

The variations of the magnetic elements declination, horizontal intensity, and vertical intensity were recorded by a magnetometer consisting of a set of La Cour variometers, incorporated into an electronic feedback system which was designed to hold the reflected light beams from the variometers in fixed positions on three separate photocells. The value of the compensating magnetic field needed to hold each light beam in a fixed position was recorded by a digital meter. The output of the system was recorded digitally on punched paper tape, System 1, and in analogue form on a strip chart, System 2. The data presented are those obtained from the System 1 digital output, supplemented where necessary from the System 2 strip chart. E.D.K.

N80-28965*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Space Sciences Lab., Science and Engineering.
NASA/MSFC FY-80 ATMOSPHERIC PROCESSES RESEARCH REVIEW
Robert E. Turner, comp. Jun. 1980 167 p refs Review held at Huntsville, Ala., 3-5 Jun. 1980
(NASA-CP-2145) Avail: NTIS HC A08/MF A01 CSCL 04A

Three general areas of research were discussed: Global Weather, Upper Atmosphere, and Severe Storms and Local Weather. Research project summaries, in narrative outline form, stating objectives, significant accomplishments, and recommendations for future research are presented. L.F.M.

N80-28966# Science Applications, Inc., La Jolla, Calif.
ROSCOE MANULA, VOLUME 14C: FURTHER DENSITY PROFILES OF SELECTED ATMOSPHERIC SPECIES Final Report, 1 Jan. 1976 - 30 Jun. 1979
Benjamin F. Myers 30 Jun. 1979 120 p refs
(Contract DNA001-76-C-0194)
(AD-A084640; AD-E300760; SAI-78-604-LJ-2B-Vol-14C; DNA-3964F-14C-Vol-14C) Avail: NTIS HC A06/MF A01 CSCL 04/1

Profiles and models of ambient atmospheric species are presented for water, ozone, methane, carbon monoxide, hydroxyl and hydroperoxyl radicals, hydrogen atoms, nitrous and nitric oxides, nitrogen atoms (N and N(2D)), and excited atomic oxygen (O(1D)). This report greatly extends and partly revises volume 14b which pertained only to midlatitude density profiles of H2O, O3, CO2, NO2, NO, N, O, and O2(a1 delta G). GRA

N80-28967# Ohio State Univ., Columbus. Dept. of Geodetic Science.
CONCEPTS IN GEODETIC REFERENCE FRAMES Interim Report
Helmut Moritz Hanscom AFB, Mass. AFGL Oct. 1979 65 p refs
(Contract F19628-79-C-0075; AF Proj. 7600)
(AD-A084099; DGS-294; SCIENTIFIC-2) Avail: NTIS HC A04/MF A01 CSCL 08/5

The report reviews conceptual aspects and problems arising in a precise definition of reference frames for the purpose of geodesy and geodynamics. The concepts: physical, conventional, and average system are introduced. Inertial systems are discussed from the point of view of classical mechanics and of the theory of relativity. The concept of celestial pole, which plays a fundamental role in a precise definition of precession, nutation and polar motion, is reviewed in some detail. A section is devoted to tidal effects, which should be removed from the coordinates. Finally, various definitions of terrestrial reference systems are compared. GRA

N80-28968# Naval Research Lab., Washington, D. C.
RECENT COMPUTATIONAL STUDIES OF THE EQUATORIAL ELECTROJET Interim Report
M. J. Keskinen 24 Mar. 1980 21 p refs Presented at Cornell-NASA Workshop on the Equatorial Ionosphere, Ithaca, N.Y., 22-23 Oct. 1979
(RR0330244)
(AD-A084554; AD-E000404; NRL-MR-4195) Avail: NTIS HC A02/MF A01 CSCL 04/1

A brief review of recent computational studies of the E-region equatorial electrojet is presented. Agreement and discrepancies between numerical simulation studies and both theory and experiment are given. Some outstanding problems are identified and new experiments suggested. GRA

N80-28969# Lowell Univ., Mass.
AUTOMATIC IONOSPHERIC PARAMETER EXTRACTION FROM DIGITAL IONOGRAM DATA Interim Report
S. Smith, B. W. Reinisch, J. S. Tang, and K. Bibl Hanscom AFB, Mass. AFGL Nov. 1979 66 p refs
(Contract F19628-78-C-0085; AF Proj. 4643)
(AD-A084101; ULRF-404/CAR; SCIENTIFIC-1; AFGL-TR-80-0102) Avail: NTIS HC A04/MF A01 CSCL 04/1

The development of techniques to automatically extract the ionospheric ionization parameters of foF2, M(3000), fmin, and ftEs from digital ionograms have become feasible with the advent of advanced digital sounders. From digital ionogram data of the Digisonde 128PS the six most significant echoes for each frequency are extracted in the Geomonitor. They are further processed in the Automatic Parameter Evaluation program (A.P.E.) to determine the main echo height for each frequency. The program takes into consideration the frequency continuity of the reflection height, multiple hop reflection heights, rate of change of slope and the physical properties of the ionogram such as foE's dependence on the solar zenith angle. The output data are mathematically smoothed to produce a refined ionogram. From this refined ionogram the A.P.E. program determines the four ionospheric parameters. In a study of 1500 ionograms the automatically evaluated ionogram parameters are compared with the manually scaled values and the differences are analyzed statistically. Also some case studies are discussed concentrating on the reasons for larger deviations. The program has been written considering the future possibility of implementation in a microcomputer which can integrate the functions of the Geomonitor, as well as a True Height Analysis program. GRA

N80-28970# Lowell Univ., Mass. Center for Atmospheric Research.
NEAR AND FAR WING PRESSURE BROADENING THEORY FOR APPLICATION TO ATMOSPHERIC ABSORPTION Final Report, Oct. 1976 - Nov. 1979
R. W. Davies, R. R. Gamache, and B. A. Oli Feb. 1980 65 p refs
(Contract F19628-77-C-0053; AF Proj. 2310)
(AD-A084116; ULRF-406/CAR; AFGL-TR-80-0062) Avail: NTIS HC A04/MF A01 CSCL 04/1

A new theory of far wing pressure broadening is presented. The theory rigorously satisfies the Fluctuation-Dissipation Theorem, and includes all possible line coupling effects. The starting point of the theory rests on the observation that far wings are determined by the binary collision approximation in its most naive form. The theory is then developed in terms of two-body T-matrix of scattering theory. Results of near wing calculations of halfwidths and pressure shifts for H2O-N2 and H2O-H2O are briefly summarized. GRA

N80-28971# Germantown Labs., Inc., Philadelphia, Pa.
CHEMICAL RELEASE PAYLOADS: STRATOSPHERIC WIND MEASUREMENT Final Report, 15 Jan. 1979 - 31 Jan. 1980
Charles S. Stokes, William J. Murphy, and Alan D. Kershner 31 Jan. 1980 21 p
(Contract F19628-79-C-0057; AF Proj. 6687)
(AD-A084100; AFGL-TR-80-0073) Avail: NTIS HC A02/MF A01 CSCL 22/2

This report covers work performed on a series of chemical payload launches on sounding rockets, which were launched from

Punto Lobos, Peru during October, 1979. These operations included design, fabrication, assembly and launch services for chemical payloads containing trimethyl aluminum (TMA) or titanium tetrachloride (TiCl4) - methanol/water. GRA

N80-28972# BDM Corp., Monterey, Calif.
AN AIRCRAFT STUDY OF TURBULENCE DISSIPATION AND TEMPERATURE STRUCTURE FUNCTION IN THE UNSTABLE MARINE ATMOSPHERIC SURFACE LAYER
C. W. Fairall (Naval Postgraduate School) 17 Mar. 1980 34 p refs
(Contract N00014-78-C-0204)
(AD-A084387; BDM/M-004-80) Avail: NTIS HC A03/MF A01 CSCL 04/1

The dissipation rate of turbulent kinetic energy, sigma, and the temperature structure function parameter, C sub T squared, were measured over water from the near surface (Z = 3m) to the top of the boundary layer. The near surface values of sigma and C sub T squared were used to calculate the velocity and temperature Monin-Obukhov scaling parameters. The unstable data were used to evaluate the feasibility of extrapolating the values of sigma and C sub T squared as a function of height with empirical scaling formulae. The dissipation rate scaling formula of Wyngaard et al. (1971a) gave a very good fit to an average of the sigma data for Z - Z sub i - 100. Although the C sub T squared data obeyed a (cube root of Z to the 4th power) height dependence for 0.1 Z sub i - Z - 0.5 Z sub i, the scaling formula of Wyngaard et al. (1971b) disagreed with the average C sub T squared by as much as 50%. At this point it is not clear if the discrepancy is a unique property of the marine boundary layer or if it is simply some unknown instrumental or analytic property. GRA

N80-28973# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.
ATMOSPHERIC ATTENUATION OF MILLIMETER AND SUBMILLIMETER WAVES: MODELS AND COMPUTER CODE Environmental Research Papers, Interim Report
Vincent J. Falcone, Jr., Leonard W. Abreu, and Eric P. Shettle 15 Oct. 1979 75 p refs
(AF Proj. 7679)
(AD-A084485; AFGL-TR-79-0253; AFGL-ERP-679) Avail: NTIS HC A04/MF A01 CSCL 04/1

Atmospheric attenuation of millimeter and submillimeter waves is calculated for clear, fog, cloud and rain atmospheres. The frequency range considered is 1-1000 GHz. The clear atmospheres transmission spectra is calculated by a computer efficient algorithm of AFGL's HITRAN code. This new code is called FASCODE-1. The hydrometeor attenuation of fog, clouds and rain (precipitation), calculated by Mie scattering is addend to FASCODE-1. Models of fog, clouds and rain typical of mid-latitude temperate regions are used in calculations of transmission and attenuation. GRA

N80-28974# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
NUMERICAL STUDIES ON A GLOBAL BAROTROPIC VORTICITY EQUATION MODEL OF THE ATMOSPHERE Final Report
Samuel Y. K. Yee and Ralph Shapiro 12 Dec. 1979 33 p refs
(AF Proj. 2310)
(AD-A084487; AFGL-TR-79-0295; AFGL-ERP-686) Avail: NTIS HC A03/MF A01 CSCL 04/1

Numerical experiments have been designed to study the suitability of certain numerical methods commonly used in the numerical modeling of the atmosphere. Specifically, we conducted experiments to address the following: (1) What effect does a Shapiro-type filter have on the results of a numerical time-integration? (2) What are the capabilities and limitations of numerical approximations such as second-order finite-difference approximations in numerical time-integrations? The Shapiro filter is found to be very effective in the removal of computation noise and is therefore useful for insuring computational stability in a long-term time-integration. For dynamically stable flows, numerical errors due to truncation and round-off are amplified by the dynamics of the stable system. Numerical methods such as second order finite-difference approximations, together with a Shapiro-type filter, are adequate in yielding approximate solutions to the modeling differential equations. For dynamically unstable flows, numerical errors are amplified as part of the dynamics of the unstable system. The use of finite-difference approximations may yield solutions which bear no resemblance whatsoever to the true solution of the differential equations. It is postulated that interactions among long wave computational modes and physical modes in a numerical model may prove to be another major obstacle in the numerical prediction of an unstable flow. GRA

N80-28975# Air Force Geophysics Lab., Hanscom AFB, Mass.
AN ALGORITHM FOR DETERMINING THE BOUNDARY OF AURORAL PRECIPITATION USING DATA FROM THE SSJ/3 SENSORS Environmental Research Paper
David A. Hardy and Richard MacKeen 24 Jan. 1980 41 p refs
(AF Proj. 7601)
(AD-A084482; AFGL-TR-80-0028; AFGL-ERP-693) Avail: NTIS HC A03/MF A01 CSCL 04/1

In support of the Global Weather Central of the Air Weather Service, computer techniques were developed to determine, in near real time, the equatorward boundary of the auroral oval using the data from the SSJ/3 sensors flown on board the DMSP satellites. The boundary is determined on both the morning and evening sides of the oval and in both northern and southern auroral zones. Three tests are used in the boundary determination, one on the evening side and two on the morning side of the auroral oval. On the evening side of the auroral zone, since low energy particles always are observed at the lowest latitude, the boundary is determined by testing the summed counts in the six channels of the SSJ/3 detector convering the energy range from 110 e V to 1000 e V. The boundary is chosen when the summed counts exceed 30 for 3 successive seconds. The data are always tested as a function of increasing magnetic latitude. On the morning side, high energy electrons are always observed first. Since the channels measuring high energy electrons may be contaminated by penetrating particles from the ring belts, two tests are required. E.D.K.

N80-28976# Air Force Geophysics Lab., Hanscom AFB, Mass.
ARCHIVE DATA TAPES OF THE AFGL MAGNETOMETER NETWORK
David J. Knecht 20 Sep. 1979 26 p ref
(AF Proj. 7601)
(AD-A084483; AFGL-TR-79-0212; AFGL-SR-224) Avail: NTIS HC A03/MF A01 CSCL 08/14

All data returned by the data-collection stations of the AFGL magnetometer network are recorded automatically on a series of magnetic tapes referred to as the Archive tapes. On these tapes, data are reordered, to effect grouping by instrument and compressed, to minimize the amount of tape used, but are otherwise in raw form and unedited. This report describes the format and content of these tapes with sufficient precision and detail that a prospective user can, if necessary, access the data without further guidance or instruction. Conversion factors and decoding schemes are specified to permit conversion of the data to the usual physical units. Comments and suggestions are included to facilitate subsequent cleaning and editing processes. GRA

N80-28977# Aerospace Corp., El Segundo, Calif. Guidance and Control Div.
SINGLE-LAYER REFRACTION CORRECTION MODEL Final Report
D. W. Whitcombe 15 Nov. 1979 49 p refs
(Contract F04701-79-C-0080)
(AD-A084634; TR-0080(5450-01)-1; SD-TR-80-19) Avail: NTIS HC A03/MF A01 CSCL 17/9

A single layer tropospheric refraction model is developed for use in real time with C-band and X-band radars when tracking satellites or powered rocket vehicles above the troposphere (approx. 25 km). Corrections for range and elevation angle are provided that are usable for all elevation angles above the horizon. GRA

N80-28978# Science Applications, Inc., La Jolla, Calif.
ROSCOE MANUAL, VOLUME 14A-1, AMBIENT AT-

MOSPHERE. MAJOR AND MINOR NEUTRAL SPECIES AND IONOSPHERE Final Report, 1 Jan. 1976 - 30 Jun. 1979
Daniel A. Hamlin and Melvin R. Schoonover 30 Jun. 1979 221 p
(Contract DNA001-76-C-0194)
(AD-A084993; AD-E300781; SAI-78-604-LJ; DNA-396F-1A-4) Avail: NTIS HC A10/MF A01 CSCL 04/1

The ROSCOE-Radar ambient atmosphere model has been extensively revised to provide (a) major atmospheric properties and species densities corresponding to either a code-generated or (optional) user-specified latitude- and season-dependent temperature profile below 120-km altitude, (b) an increase from 10 to 19 minor species profiles (O, O(1d), (a1 triangle g), O sub 3, N(4S), N2D), N(2P), NO, NO sub 2, N sub 2 O, CO sub 2, CO, CH sub 4, H sub 2 O, H, AR, and HE), with some of them having complex dependencies on latitude (or even geographic position in the case of water below 5-km altitude), local apparent time, fractional season-year, and solar decimetric flux, (c) (optional) user-specified water-vapor profile, and (d) an ionosphere with e, O-, NO-, O-2, and N-2 as ionized species (more than 90 km). GRA

N80-28979# Boston Univ., Mass. Dept. of Astronomy.
SHORT TERM PERIODICITIES IN IONOSPHERIC TOTAL ELECTRON CONTENT Annual Scientific Report, 1 Oct. 1978 - 30 Sep. 1979
Kenneth H. Schatten and Michael Mendillo AFGL Hanscom AFB, Mass. Mar. 1980 53 p refs
(Contract E19628-77-C-0270; AF Proj. 4643)
(AD-A084756; ACBU-SER-III-13; AR-2; AFGL-TR-80-0096) Avail: NTIS HC A04/MF A01 CSCL 04/1

Short-term variability of the ionospheric F-region has been studied using total electron content (TEC) data from several North American sites. Specific attention was given to lunar-induced periodicities in TEC and to a general treatment of changes in TEC associated with variations in the height of the F-region (hmF2). In both cases, simple analytical expressions were derived from statistical analysis of the large TEC and hmF2 data bases. These relations are appropriate for updates to model predictions of average conditions during daytime hours. A study of the 'geomagnetic ordering' of TEC variability showed that real-time predictive methods can reduce up to 50% of the normal variability. A preliminary analysis of solar wind sector boundary effects suggested that sector components may order some F-region variability, though the specific relations between these effects and the geomagnetic ordering results remain to be clarified. GRA

N80-28980# Naval Research Lab., Washington, D. C.
NUMERICAL EXPERIMENTS ON THE STRATOSPHERIC-TROPOSPHERIC DYNAMICAL INTERACTION Interim Report
Winston C. Chao (Sci. Appl., Inc., McLean, Va.), Mark R. Schoeberl, and Darrell F. Strobel 11 Apr. 1980 21 p refs
(ZF52551001)
(AD-A084985; AD-E000419; NRL-MR-4209) Avail: NTIS HC A02/MF A01 CSCL 04/2

Numerical experiments with the UCLA-NEPRF tropospheric weather forecast model were performed to test the influence of stratospheric conditions which are representative of sudden warmings on tropospheric weather. Stratospheric conditions were represented by imposed vertical velocities at the upper boundary. An externally forced stratospheric disturbance as large as a sudden warming was found to generate an observable response in sea level pressure with a time constant of the order of a day. The numerical results are interpreted with the aid of an analytical model based on the linearized shallow water equation. GRA

N80-28981# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.
TROPOSPHERIC STRATOSPHERIC TURBULENCE AND VERTICAL DIFFUSIVITIES Final Environmental Research Paper
S. P. Zimmerman and E. A. Murphy 14 Jan. 1980 20 p refs
(AF Proj. 6690)
(AD-A084809; AFGL-TR-80-0020; AFGL-ERP-691) Avail: NTIS HC A02/MF A01 CSCL 04/1

The determination of winds and temperature by rawinsonde allows us to calculate the Richardson number, a measure of atmospheric instability. From this, we can then determine the turbulent atmospheric parameters, diffusivity (K), rate of heat deposition (epsilon), and the vertical turbulent intensity (-w2=). Comparison of these data, for the spring periods, with contours of residual stratospheric radioactivity demonstrate that, at the tropopause, the isocountours of turbulent diffusivity accurately follow the isodensity contours of the residual radioactivity. We also demonstrate that the rapid cessation of the turbulent diffusivity accurately predicts the level of the tropopause. GRA

N80-28982# Edgerton, Germeshausen and Grier, Inc., Los Alamos, N. Mex.
PLASMA BOUNDARY LAYER AND MAGNETOPAUSE LAYER OF THE EARTH'S MAGNETOSPHERE
Timothy Eric Eastman Jun. 1979 264 p refs
(Contract W-7405-eng-36)
(LA-7842-T) Avail: NTIS HC A12/MF A01

Explorer 43 satellite observations of the plasma boundary layer (PBL) and magnetopause layer (MPL) of the Earth's magnetosphere indicate that plasma in the low latitude portion of the PBL is supplied primarily by direct transport of magnetosheath plasma across the MPL. This transport process is relatively widespread over the entire sunward magnetospheric boundary. DOE

N80-28983# Hawaii Univ., Honolulu. Dept. of Meteorology.
PROJECT AHUPUA'A: SOLAR METEOROLOGICAL FIELD MEASUREMENTS ON THE ISLAND OF HAWAII, SUMMER 1978. 3: TRADE WIND INTERACTIONS WITH LOCAL WINDS IN SOUTH KOHALA
Thomas A. Schroeder Feb. 1980 68 p refs
(Contract DE-AC03-79ET-20184)
(UHMET-79-05) Avail: NTIS HC A04/MF A01

Instrumented vans monitored meteorological elements related to solar energy in the leeward South Kohala district of the Island of Hawaii between 23 and 28 June 1978. This phase of Project Ahupua'a concentrated on sea breeze circulations and their interactions with synoptic scale winds. Supplementary data were collected as in previous phases. In addition, visual observations were made from Anaehoomalu Beach and from an automobile traversing the transect. Daily weather conditions were documented by ground-based photography. The study period was characterized by abnormally high tropospheric moisture content and passage of significant tradewind disturbances. Local weather variability was greater than in earlier phases of project Ahupua'a. Sea breeze intrusion was frequent below 300 m MSL, but occurred at higher elevations only in response to significant synoptic systems. Diurnal variations of measured parameters were strong and reflected diminished sea breeze influence above 300 m. Heating of lava surfaces drives local circulations through two opposing physical processes. Surface pressure gradients support sea breeze development while vertical transport of horizontal (trade wind) momentum creates intense downslope flows. DOE

N80-28984# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
ELECTRODYNAMICS OF ATMOSPHERES [ELECTRODYNAMIQUE DES ATMOSPHERES]
M. Blanc, ed. and R. Gendrin, ed. May 1978 186 p refs in FRENCH Presented at Colloq. d'Electrodyn. des Atmospheres, Londe-les-Maures, France, 23-26 May 1977
(CRPE-NT-57) Avail: NTIS HC A09/MF A01

The following topics are presented: general elements of electrodynamics, neutral magnetic layers, convection in the dipole domain of the terrestrial magnetosphere, specific problems related to the magnetosphere of Jupiter, convection in mean latitudes (the atmospheric dynamo), electrojets, and abnormal behavior of plasma in the atmospheric circuit. Author (ESA)

N80-28985# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
INFLUENCE OF DIFFUSE SOLAR RADIATION ON STRATOSPHERIC CHEMISTRY
G. Fiocco (Rome Univ.) Nov. 1979 34 p refs Presented at Ozone Adv. Study Inst. Aldeia das Acoteias, Faro, Portugal, 2-12 Nov. 1979 Sponsored by CNR and Comm. of European Communities

(LPS-79-14) Avail: NTIS HC A03/MF A01

The diffuse effects of the component of solar radiation on stratospheric structure and composition because of photodissociation and heating are considered. The basic relevant aspects of radiative transfer theory are introduced. Recent analyses and calculations concerning the photodissociation and heating rates, which include the effects of the diffuse field, and their application to atmospheric models are reviewed. The results indicate that molecular multiple scattering should always be included in photodissociation calculations if accuracies of the order of a few percent are desired. The variable part of the diffuse field due to surface albedo, clouds, and aerosols can be responsible for large fluctuations in the thermal structure and composition of the stratosphere. Author (ESA)

N80-28986# Royal Netherlands Meteorological Inst., De Bilt.
SEISMOLOGICAL BULLETIN OF THE SEISMOGRAPH STATIONS IN THE NETHERLANDS, VOLUME 61, 1973
1979 119 p
(KNMI-108-61) Avail: NTIS HC A06/MF A01

The instruments, with their operating environment and characteristics, in use at the three stations are described, and seismological data presented for all events measured during 1973. The character of the daily microseismic activity is shown. Author (ESA)

N80-28987# Royal Netherlands Meteorological Inst., De Bilt.
SEISMOLOGICAL BULLETIN OF THE SEISMOGRAPH STATIONS IN THE NETHERLANDS, VOLUME 62, 1974
1979 109 p
(KNMI-108-62) Avail: NTIS HC A06/MF A01

The instruments, with their operating environment and characteristics, in use at the three stations are described, and seismological data presented for all events measured during 1974. The character of the daily microseismic activity is shown. Author (ESA)

N80-28988# Oulu Univ. (Finland). Dept. of Physics.
OBSERVATIONS OF JOULE AND PARTICLE HEATING AND FIELD-ALIGNED ION VELOCITY IN THE HIGH-LATITUDE IONOSPHERE
T. Nygren and L. Jalonen Nov. 1978 27 p refs Sponsored in part by Finnish Academy of Science
(Rept-67/1978; ISBN-951-42-0657-6; ISSN-0356-1852) Avail: NTIS HC A03/MF A01

Simultaneous measurements of Joule and particle heating and field aligned ion velocities carried out using the Chatanika (L = 5.6) incoherent scatter radar are presented. Joule heating bursts of 5 - 10 mW/sq m were found to occur throughout the afternoon and night hours. Precipitation heating rates of 2 - 7 mW/sq m were observed in the postmidnight sector. Mostly positive (antiparallel to the geomagnetic field ion velocities were seen in the F region, reaching maximum values of 50 - 75 m/s after local midnight. On one occasion negative daytime velocities were observed during a period of low F region electron density. The possible mechanisms maintaining the measured ion velocities are discussed. Author (ESA)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-28989 Royal Netherlands Meteorological Inst., De Bilt. Centrale Weerdienst.
EXAMPLES OF THE PRACTICAL USE OF CROSS-SECTIONS [ENKELE VOORBEELDEN VAN PRAKTISCH GEBRUIK VAN DWARSDOORSNEDEN]
J. Vinke 1979 39 p refs In DUTCH
(KNMI-V-332) Avail: NTIS HC A03

The use of potential wet bulb temperatures for frontal analysis and the use of cross sections in operational forecasting are discussed. Examples of weather situations are given to show correlations between 850 mb wet bulb temperatures and cross sections with synoptic surface charts, the 500 mb flow, and satellite photographs. Author (ESA)

N80-28990*# Oregon State Univ., Corvallis. Climatic Research Inst.
ESTIMATING MONTHLY-AVERAGED AIR-SEA TRANSFERS OF HEAT AND MOMENTUM USING THE BULK AERODYNAMIC METHOD
Steven K. Esbensen and Richard W. Reynolds Jul. 1980 35 p refs
(Grants NsG-5308; NSF ATM-77-26406)
(NASA-CR-163045) Avail: NTIS HC A03/MF A01 CSCL 04B

Air-sea transfers of sensible heat, latent heat, and momentum are computed from twenty-five years of middle-latitude and subtropical ocean weather ship data in the North Atlantic and North Pacific using the bulk aerodynamic method. The results show that monthly-averaged wind speeds, temperatures, and humidities can be used to estimate the monthly-averaged sensible and latent heat fluxes computed from the bulk aerodynamic equations to within a relative error of approximately 10%. The estimate of monthly-averaged wind stress under the assumption of neutral stability are shown to be within approximately 5% of the monthly-averaged non-neutral values. Author

N80-28991*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PRELIMINARY LOOK AT AVE-SESAME 3 CONDUCTED ON 25-26 APRIL 1979
Steven F. Williams (Texas A and M Univ.), Nicholas Horvath (Texas A and M Univ.), and Robert E. Turner Jun. 1980 50 p ref
(NASA-TM-78282) Avail: NTIS HC A03/MF A01 CSCL 04B

General weather conditions, including synoptic maps, radar reports, satellite photographs, precipitation areas and amounts, and a summary of severe weather reports are presented. These data provide researchers a preliminary look at conditions during the AVE-SESAME 3 period. L.F.M.

N80-28992*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
TROPICAL CYCLONE INTENSITIES FROM SATELLITE MICROWAVE DATA Final Annual Report, 1 Apr. 1979 - 31 Mar. 1980
Thomas H. VonderHaar and Stanley Q. Kidder (Illinois Univ., Urbana) Jul. 1980 114 p refs
(Grant NsG-5258)
(NASA-CR-163390) Avail: NTIS HC A06/MF A01 CSCL 04B

Radial profiles of mean 1000 mb to 250 mb temperature from the Nimbus 6 scanning microwave spectrometer (SCAMS) were constructed around eight intensifying tropical storms in the western Pacific. Seven storms showed distinct inward temperature gradients required for intensification; the eighth displayed no inward gradient and was decaying 24 hours later. The possibility that satellite data might be used to forecast tropical cyclone turning motion was investigated using estimates obtained from Nimbus 6 SCAMS data tapes of the mean 1000 mb to 250 mb temperature field around eleven tropical storms in 1975. Analysis of these data show that for turning storms, in all but one case, the turn was signaled 24 hours in advance by a significant temperature gradient perpendicular to the storm's path, at a distance of 9 deg to 13 deg in front of the storm. A thresholding technique was applied to the North Central U.S. during the summer to estimate precipitation frequency. Good agreement was found between gage measurements and satellite estimates, except in Minnesota where a large number of lakes probably biased the estimates. A.R.H.

N80-28993# Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
WIND FLOW NEAR THE SURFACE OVER NONUNIFORM TERRAIN Final Report, Nov. 1972 - May 1980
Ernest W. Peterson 9 May 1980 14 p refs
(Grants DAHC04-74-G-0038; DAAG29-77-G-0043)
(AD-A084711; ARO-11797.1-EN; ARO-14440.9-GS) Avail: NTIS HC A02/MF A01 CSCL 04/2

The OSU/Riso Project is an ongoing study of air flow near the ground over complex terrain. The study combines field observations, data analysis, and theoretical modelling in order to assess and understand the effects of terrain features on the mean flow and turbulence structure in the lower portion of the planetary boundary layer. The method of approach is to choose sites with horizontal scales of less than several hundred meters which have a distinctive inhomogeneity but whose boundary conditions are otherwise relatively simple so that there is some hope of constructing theoretical models, to instrument the site as fully as possible to measure the relevant details of the flow, to conduct observations over a long enough period of time to obtain a clear record of the characteristics of the flow, and then to analyze the accumulated data, reconcile the observations with our theoretical constructs, and finally to improve the theory. GRA

N80-28994# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
DIGITAL IMAGING RESEARCH FOR METEOROLOGICAL APPLICATIONS Final Report, 1 Sep. 1976 - 31 Jul. 1979
Thomas A. Brubaker, Thomas H. VonderHaar, Gregory C. Smith, and Marvin Brown 22 Feb. 1980 182 p refs
(Grant DAAG29-76-G-0324)
(AD-A084366; ARO-13971.7-GS) Avail: NTIS HC A09/MF A01 CSCL 05/8

Planning for this joint research on digital imaging by electrical engineers and atmospheric scientists began in early 1976. At that time the use of digital solid state memory under small computer control to refresh a CRT to produce a 'digital image' was in its infancy. Our research focused on the design, procurement, test, demonstration and meteorological research use of the new system. It was very successful and has received national and international acclaim. Several papers were published under sponsorship of this grant and are listed in an Appendix. This Final Report includes complete details of the research on both hardware and software aspects of the system. This research has already lead to the design and research use of the next generation of digital imaging systems. GRA

N80-28995# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
PRECIPITATION ESTIMATION FOR MILITARY HYDROLOGY
Bruce T. Miers Apr. 1980 31 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A085192; ERADCOM/ASL-TR0054) Avail: NTIS HC A03/MF A01 CSCL 04/2

The military hydrologist has been given the responsibility for river stage and flood forecasting, soil trafficability, and weather observations pertinent to hydrologic problems in the battlefield area forward of Division command elements. In tactical situations, the emplacement and monitoring of gages or sensors in hostile territory are not practical; therefore, the military hydrologist must rely on indirect means of estimating precipitation. This report reviews current methods of estimating precipitation (models, radar, satellite) and presents six case studies of precipitation estimation using geostationary operational environmental satellite imagery. It is concluded that the military hydrologist (in the 1980's) can best meet his requirements through the use of calibrated weather radar. GRA

N80-28996# Oregon State Univ., Corvallis. Dept. of Atmospheric Science.
VEGETATION AS AN INDICATOR OF HIGH WIND VELOCITY Final Report, 15 Jun. 1978 - 14 Jun. 1979
E. Wendell Hewson, John E. Wade, and Robert W. Baker Jun. 1979 50 p refs
(Contract EY-76-F-06-2227)
(RLO-2227-T24-79/1) Avail: NTIS HC A03/MF A01

Techniques for using two widely distributed species of coniferous trees, Douglas fir and Ponderosa pine, as aids in wind power prospecting are described. The need for the research, the effects of wind on trees, development of the indices of wind deformation and calibration of these indices to the mean annual wind speed are discussed. Results indicate trees can be used to estimate mean annual wind speed and these estimates, although subject to some uncertainty, are sufficiently sensitive to be used as an initial criterion for ranking potential sites in terms of wind power potential prior to instrumention with anemometers. DOE

N80-28997# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: THE PLAN AND IMPLEMENTATION PROGRAMME, 1980 TO 1983
Jul. 1979 55 p Presented at 8th WMO Congr., Geneva, Apr. - May 1979 and 31st WMO Executive Comm., Geneva, May - Jun. 1979
(WMO-535; ISBN-92-63-10535-9) Avail: NTIS HC A04/MF A01

The plan and the various supporting resolutions of the 8th World Meteorological Congress are presented. The basic purpose of the global observing system has been reviewed and clarified, and the part of the plan dealing with the global data processing system, and global telecommunication system are updated. Two additional parts of the plan include the monitoring scheme of the operation of the world weather watch, and guidance on priorities for furthering the world weather watch. Author (ESA)

N80-28998# Royal Netherlands Meteorological Inst., De Bilt.
YEARBOOK A: METEOROLOGY, VOLUME 130 Annual Report, 1978
1979 73 p refs In DUTCH and ENGLISH
(KNMI-97-130) Avail: NTIS HC A04/MF A01

Daily observations and summaries of monthly and yearly data taken at 45 meteorological stations in the Netherlands during 1978 are presented. The location and elevation of each station and the instruments used, are given. Author (ESA)

N80-28999# Royal Netherlands Meteorological Inst., De Bilt. Operationele Dienst.
WEATHER FORECASTING FOR THE CONSTRUCTION AND BUILDING INDUSTRY DURING THE WINTER 1978-1979 [RAPPORT BETREFFENDE DE WEERBERICHTGEVING VOOR DE BOUWNIJVERHEID IN DE WINTER 1978-1979]
J. J. Allan, A. P. A. Kleintjes, and D. M. vanderWoude 1979 32 p In DUTCH
(KNMI-V-330) Avail: NTIS HC A03/MF A01

The technical and organizational aspects of issuing forecasts for the construction industry are described, including the equipment required, forecast accuracy, and user acceptance. Weather data for the period are presented. Author (ESA)

N80-29000# National Technical Information Service, Springfield, Va.
HAIL: METEOROLOGY, DAMAGE, PREVENTION, AND FORECASTING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Mar. 1980
Robena J. Brown Apr. 1980 72 p Supersedes NTIS/PS-79/0310; NTIS/PS-78/0257
(PB80-809692; NTIS/PS-79/0310; NTIS/PS-78/0257) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

A bibliography containing 65 abstracts addressing hail storms, hail formation, hail damage, and warning systems is presented. Atmospheric and cloud physics associated with hail, storm tracking storm forecasts, and meteorological instruments are covered. Studies on meteorological fronts and storms which accompany hail, and methods to modify these systems, are also cited. GRA

N80-29001# National Academy of Sciences - National Research Council, Washington, D. C. Climate Research Board.
CARBON DIOXIDE AND CLIMATE: A SCIENTIFIC ASSESSMENT
Jul. 1979 35 p refs Sponsored in part by Office of Science and Technology Policy, Washington, D.C.
(PB80-175250) Avail: NTIS HC A03/MF A01 CSCL 04B

Atmospheric concentrations of carbon dioxide are steadily increasing, and these changes are linked with man's use of fossil fuels and exploitation of the land. Since carbon dioxide plays a significant role in the heat budget of the atmosphere, it is reasonable to suppose that continued increases would affect climate. These concerns have prompted a number of investigations of the implications of increasing carbon dioxide. Their consensus has been that increasing carbon dioxide will lead to a warmer Earth with a different distribution of climatic regimes. In view

of the implications of this issue for national and international policy planning, the Office of Science and Technology Policy requested the National Academy of Sciences to undertake an independent critical assessment of the scientific basis of these studies and the degree of certainty that could be attached to their results. GRA

N80-29002# Military Academy, West Point, N. Y. Science Research Lab.
CHEMISTRY OF PRECIPITATION FROM SEQUENTIALLY SAMPLED STORMS Final Report, Oct. 1976 - Sep. 1978
J. K. Robertson, T. W. Dolzine, and R. C. Graham Jan. 1980 129 p refs
(PB80-166994; EPA-600/4-80-004) Avail: NTIS HC A07/MF A01 CSCL 04B

Sequential sampling techniques and applications to collect precipitation are reviewed. Chemical data for samples collected by an intensity-weighted sequential sampling device in operation at the U.S. Military Academy, West Point, New York from October 1976 to April 1978 are presented and discussed. The problem of dry deposition is explored. An intensity-weighted sequential sampler that excludes dry deposition is presented. The experiments show that intensity-weighted sequential sampling is a viable technique for monitoring the rapid changes in precipitation chemistry within a storm. Complete chemical data are needed from individual storms to evaluate intensity related scavenging. GRA

N80-29003# National Weather Service, Salt Lake City, Utah. Western Region.
MISINTERPRETATIONS OF PRECIPITATION PROBABILITY FORECASTS
Allan H. Murphy (Oregon State Univ.), Sarah Lichtenstein (Decision Research), Baruch Fischoff (Decision Research), and Robert L. Winkler (Indiana Univ.) Feb. 1980 23 p refs
(PB80-174576; NOAA-TM-NWS-WR-149; NOAA-80030701) Avail: NTIS HC A02/MF A01 CSCL 04B

A study of 79 residents of Eugene, Oregon who completed a questionnaire designed to investigate their understanding of probability of precipitation (PoP) forecasts is summarized. Results indicate that the event in question frequently is misunderstood, with both tranditional precipitation forecasts and PoP forecasts experiencing similar levels of event misinterpretation. Moreover, most respondents revealed a preference for the use of probabilities to express the uncertainty inherent in pracipitation forecasts. GRA

N80-29004# Commerce Dept., Washington, D.C. Weather Modification Advisory Board.
NATIONAL WEATHER MODIFICATION POLICIES AND PROGRAMS: A REPORT TO THE PRESIDENT AND THE CONGRESS
Nov. 1979 150 p refs
(PB80-175821; NOAA-80022011) Avail: NTIS HC A07/MF A01 CSCL 04B

The National Weather Modification Policy Act of 1976 (P.L. 94-490), reproduced as appendix A, directed the Secretary of Commerce to conduct a comprehensive study of the status of weather modification science and technology and to submit to the President and the Congress a report on the findings, conclusions, and recommendations of the study. This is the report prepared pursuant to that Congressional directive. Modification of the weather is scientifically possible. If it is done reliably and with predictable results, society would benefit substantially, both economically and by saving of lives. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-29005*# National Aeronautics and Space Administration, Washington, D. C.
NASA OCEANIC PROCESSES PROGRAM: STATUS REPORT, FISCAL YEAR 1980
Jul. 1980 160 p
(NASA-TM-80233) Avail: NTIS HC A08/MF A01 CSCL 08C

Goals, philosophy, and objectives of NASA's Oceanic Processes Program are presented as well as detailed information on flight projects, sensor developments, future prospects, individual investigator tasks, and recent publications. A special feature is a group of brief descriptions prepared by leaders in the oceanographic community of how remote sensing might impact various areas of oceanography during the coming decade. L.F.M.

N80-29006# Naval Postgraduate School, Monterey, Calif.
STATISTICAL PROPERTIES OF OCEAN WAVE GROUPS M.S. Thesis
Arthur Ronald Nelson Mar. 1980 134 p refs
(AD-A084378) Avail: NTIS HC A07/MF A01 CSCL 08/3

Individual wave groups were identified by an analysis of digitized wave records. The analysis technique is based on a comparison between short-term variance and wave record variance. Once wave groups were identified, wave parameters of interest were then derived. Analysis was performed on 338 wave records obtained from a Waverider buoy covering a wide range of height, period, and steepness. Statistical relationships between the parameters obtained were determined for all wave groups, and for selected extreme wave groups. It was found that as the relative energy of the group increases the number of wavers per group increases, and the average group period approaches the spectral peak period. Wave steepness was shown, however, not to depend upon the group energy. Groups from low steepness wave records tend to contain larger numbers of waves. It was also shown that the height of the single highest wave in a group tends to approximate the significant height of the wave record. GRA

N80-29007# Naval Civil Engineering Lab., Port Hueneme, Calif.
A THIN FILM THERMAL SENSOR FOR MEASURING OCEAN CURRENTS Interim Report, Jul. 1976 - Jul. 1979
T. R. Kretschmer, B. C. Streets, and A. P. Smith Nov. 1979 43 p refs
(AD-A085286; CEL-TN-1564) Avail: NTIS HC A03/MF A01 CSCL 20/13

A thin film thermal sensor is being developed to improve U.S. Navy capabilities for measuring ocean current profiles. Using the sensor, current velocity is determined by measuring the resistance changes in each of four platinum films positioned on the surface of the cylindrical sensor substrate. Development of this device into a practical ocean going tool has involved overcoming substrate fragility, water leakage problems, and biofouling contamination. A high strength ceramic substrate has been selected to improve ruggedness. New coating systems to prevent water penetration into the sensor are being developed and evaluated. An electrolytic hypochlorite generation technique has been developed to prevent biofouling indefinitely on the sensor surface. Tests have shown the sensor produces repeatable results in the laboratory and agrees well with commercial current meter measurements during ocean testing. GRA

N80-29008# Brookhaven National Lab., Upton, N. Y.
SPAR BUOY OCEANOGRAPHIC TELEMETRY SYSTEM OPERATIONAL MODIFICATIONS
E. Divis, T. Hopkins, V. Pfeiffer, and D. Carlson Dec. 1979 13 p ref
(Contracts EY-76-C-02-0016; DE-AC02-76CH-00016)
(BNL-51139) Avail: NTIS HC A02/MF A01

The mechanical and electronic performance of the Spar Buoy System, SBOTS (Spar Buoy Oceanographic Telemetry System), is evaluated with special reference to modifications and repairs that have enhanced the probability of continued success, both in operational deployment and data recovery. To invest the SBOTS system with a reliability which would anticipate all possible hazards would be desirable, although impossible; as an adjunct to this goal, a brief description of the repairs, modifications, and changes which were initiated to increase reliability during deployment is presented. DOE

N80-29009# Woods Hole Oceanographic Institution, Mass.
CALCULATION OF MEAN SEASONAL SEA SURFACE ELEVATION FIELDS OVER THE NORTH ATLANTIC CONTINENTAL SHELF AND SLOPE USING HISTORICAL HYDRO-

STATION DATA
James H. Churchill Feb. 1980 93 p refs
(Contract DE-AC02-79EV-10005)
(PB80-170707; WHOI-80-9) Avail: NTIS HC A05/MF A01 CSCL 08C

The calculation and results of a coastal elevation field model are presented. Seasonal mean sea surface elevation fields were calculated over the shelf slope region off the east coast of North America north of Cape Hatteras by applying the model to a grid of averaged sigma-t's at standard depths. The sigma-t grid was calculated using a data base of approximately 30,000 hydrographic stations. Difficulties involved with the numerical implementation of the model and economizing adaptations to the WHOI-NODC data processing program, OCCOMP, are discussed. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-29010*# National Aeronautics and Space Administration, Washington, D. C.
ELECTROENCEPHALOGRAPHIC CHANGES IN ALBINO RATS SUBJECTED TO STRESS
J. Mercier, G. Assouline, and J. Fondarai Apr. 1980 8 p ref Transl. into ENGLISH from OMPT Rend. Soc. Biol. (France), v. 161, no. 7, Jun. 1967 p 1639-1641 Presented at Marseilles Biol. Soc. Meeting, 20 Jun. 1967 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Med. and Pharm. Fac. of Marseilles
(Contract NASw-3199)
(NASA-TM-76118) Avail: NTIS HC A02/MF A01 CSCL 06C

Twenty one albino Wistar rats were subjected to stress for 7 hours. There was a significant difference in the slopes of regression lines for 7 nonulcerous rats and those for 14 ulcerous rats. Nonulcerous rats subjected to stress showed greater EEG curve synchronization than did ulcerous rats. If curve synchronization can be equated to a relaxed state, it may therefore be possible to explain the protective action of hypnotics, tranquilizers and analgesics on ulcers. Author

N80-29011*# Miami Univ., Coral Gables, Fla. Inst. for Molecular and Cellular Evolution.
FROM INANIMATE MATTER TO LIVING SYSTEMS
Sidney W. Fox 27 May 1980 33 p refs
(Grant NGR-10-007-008)
(NASA-CR-163372) Avail: NTIS HC A03/MF A01 CSCL 06C

Since the early part of this century, the Genesis account of the origin and evolution of life has been explained as an extrapolation of astronomical and geochemical processes. The essence of the answer to date is a protoreproductive protocell of much biochemical and cytophysical competance. The processes of its origin, molecular ordering, and its functions are described. A crucial understanding is that of the nonrandomness of evolutionary processes at all stages (with perhaps a minor statistical component). In this way, evolution conflicts with statistical randomness; the latter is a favorite assumption of both scientific and creationistic critics of the proteinoid theory. The principle contribution of the proteinoid theory to the understanding of general biology is to particularize the view that evolutionary direction is rooted in the shapes of molecules, in stereochemistry. After molecules of the right kind first assembled to protocells, life in its various stages of evolution was an inevitable consequence. It is molecules that continue to assemble as part of living process and, in the role of enzymes, continue to direct life cycle of the cell. A.R.H.

N80-29012*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF HYPODYNAMIA ON THE STRUCTURE OF THE INTRAORGANIC BLOOD VESSELS AND THE CAPACITY OF THE BLOOD STREAM IN THE DIAPHRAGM OF WHITE RATS
A. I. Gerus May 1980 11 p refs Transl. into ENGLISH from Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk (USSR), no. 3, 1974 p 94-98 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76140) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of hypodynamia on the vascular system of white rats with diaphragm deprivation was investigated. Morphological changes in the intraorganic blood stream of the diaphragm were determined. The capacity of the intraorganic vascular flow within the diaphragm muscles was established. R.E.S.

N80-29013*# National Aeronautics and Space Administration, Washington, D. C.
GENETIC CHANGES INDUCED BY SPACE FLIGHT FACTORS IN BARLEY SEEDS ON SOYUZ-5 AND SOYUZ-9 CRAFT
N. I. Nuzhdin and R. L. Dozortseva Jul. 1980 17 p refs Transl. into ENGLISH from Zh. Obshch. Biol. (USSR), v. 33, no. 2, 1972 p 336-346 Translation was announced as N70-23662 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76281) Avail: NTIS HC A02/MF A01 CSCL 06C

Air-dry seeds of the barley Zimujuschij moscowskyi of the 1969 harvest were taken into space onboard the spaceships Soyuz-5 and Soyuz-9. A cytological study of the mitoses in meristemic cells in rootlet terminals revealed that space flight factors (SFF) in nonirradiated seeds induced about 3% of aberrant cells. After irradiation the effect of SFF increased over two-fold. Although the radio protectors ensured the seeds against from the SFF-induced damage either in irradiated or nonirradiated seed cells which is inconsistent with the previously obtained data. L.F.M.

N80-29014*# National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.
RESPONSE OF SELECTED PLANT AND INSECT SPECIES TO SIMULATED SOLID ROCKET EXHAUST MIXTURES AND TO EXHAUST COMPONENTS FROM SOLID ROCKET FUELS
William W. Heck (Department of Agriculture), William M. Knott, Edward P. Stahel (North Carolina State Univ.), John T. Ambrose (North Carolina State Univ.), James N. McCrimmon (North Carolina State Univ.), Madeleine Engle (North Carolina State Univ.), Louse A. Romanow (North Carolina State Univ.), Alan G. Sawyer (North Carolina State Univ.), and James D. Tyson (North Carolina State Univ.) Aug. 1980 158 p refs
(NASA-TM-74109; KSC-TR-51-1) Avail: NTIS HC A08/MF A01 CSCL 06C

The effects of solid rocket fuel (SRF) exhaust on selected plant and and insect species in the Merritt Island, Florida area was investigated in order to determine if the exhaust clouds generated by shuttle launches would adversely affect the native, plants of the Merritt Island Wildlife Refuge, the citrus production, or the beekeeping industry of the island. Conditions were simulated in greenhouse exposure chambers and field chambers constructed to model the ideal continuous stirred tank reactor. A plant exposure system was developed for dispensing and monitoring the two major chemicals in SRF exhaust, HCl and Al203, and for dispensing and monitoring SRF exhaust (controlled fuel burns). Plants native to Merritt Island, Florida were grown and used as test species. Dose-response relationships were determined for short term exposures of selected plant species to HCl, Al203, and mixtures of the two to SRF exhaust. R.E.S.

N80-29015*# National Aeronautics and Space Administration, Washington, D. C.
ULCERS IN RESTRAINED RATS: STUDY OF PROTECTIVE SUBSTANCES
L. Buche and D. Gallaire May 1980 21 p refs Transl. into ENGLISH from Arch. Sci. Physiol. (France), v. 21, no. 4, 1967 p 537-552 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Pharmacology Inst.
(Contract NASw-3199)
(NASA-TM-76184) Avail: NTIS HC A02/MF A01 CSCL 06C

The genesis of ulcers in restrained rats is discussed through an investigation of the relationship between the protective effects of nervous system effectual substances examined vis-a-vis ulcers in restrained rats and their elective or secondary pharmacologic effects. The substances used were capable of either peripheral parasympatholytic, sympatholytic, ganglioplegic, spasmolytic effects or central, hypnotic, tranquilizing, neuroleptic, analgesic effects. The regular and considerable protection observed with parasympatholytics (atropine sulfate, benzylonium bromide, dihexyverine, J.L. 1344) and a ganglioplegic (pentamethonium) is a function of their anticholinergic properties. It is of less importance with dibenamine, a sympatholytic action on the adrenergic receptors. Among the central depressive substances tested (hypnotics, tranquilizers, neuroleptics, analgesic), phenobarbital at a nonhypnotic dose, and dextromoramide at a nonanalgesic dose, show antiulcerous effects, which are found with chlorpromazine only at cataleptogenic doses. M.G.

N80-29016*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF CERTAIN PSYCHOPHARMACOLOGICAL PREPARATIONS ON ADAPTATION UNDER STRESS CONDITIONS
A. V. Stanishevskaya and L. N. Mezentseva. Jun. 1980. 7 p. refs. Transl. into ENGLISH from Farakol. Toksikol. (USSR), v. 40, no. 1, 1977 p 9-12. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76185) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments staged on rats demonstrated that the formation of pathological states caused by stress and accompanied by the development of ulcerative lesion of the gastric mucosa are associated with the degree of the catecholamines level drop in the mesencephalon and hypothalamus. The application of seduxen and also of combinations consisting of L-DOPA with seduxen, or with an L-adrenoblocking agent pyroxan tends to reduce the frequency of developing alcerative lesions of the stomach. The protective effect produced by the combination of L-DOPA with an L-adrenoblocking agent pyroxan is barred by an additional administration of an B-adrenoblocking agent, inderal. Author

N80-29017# Wyoming Univ., Laramie. Dept. of Zoology and Physiology.
PARAMECIUM TETRAURELIA: PRESCREEN FOR HAZARDOUS AGENTS
J. Smith-Sonneborn, C. Herr, and E. VanKirk. 1979. 37 p. refs.
(Contract DE-AC02-77EV-04477)
(DOE/EV-04477/1) Avail: NTIS HC A03/MF A01

The ciliated protozoan, paramecia, is proposed as a eukaryote model system for use in short term screening assays for detection of mutagenic/carcinogenic and hazardous agents. The approach utilizes two assays: the mutagenic and photodynamic systems. DOE

N80-29018# WIL Research Labs., Inc., Cincinnati, Ohio.
TERATOLOGIC EFFECTS OF LONG-TERM EXPOSURE TO DIESEL EXHAUST EMISSIONS (RATS) Progress Report, 15 Sep. 1978 - 7 Feb. 1979
Kathleen M. Werchowski, Vincent W. Chaffee, and G. Bruce Briggs. Jan. 1980. 41 p.
(Contract EPA-68-03-2652)
(PB80-159965; EPA-600/1-80-010) Avail: NTIS HC A03/MF A01 CSCL 06T

The potential for diesel exhaust emissions to produce malformations in rat fetuses was investigated. The rats were exposed by the inhalation route to a 10% concentration of diesel exhaust emissions in inhalation chambers on days 6 through 15 of gestation. (Methods used conform to the guideline developed by the Food and Drug Administration for evaluating teratogenic effects in rats.) The results of the exposure of pregnant rats indicate that diesel exhaust emissions have no effect upon normal development of rat fetuses. Diesel exhaust emissions did not effect any of the parameters evaluated to assess maternal toxicity nor total number of fetuses born. GRA

N80-29019# WIL Research Labs., Inc., Cincinnati, Ohio.
TERATOLOGIC EFFECTS OF LONG-TERM EXPOSURE TO DIESEL EXHAUST EMISSION (RABBITS) Progress Report, 19 Dec. 1978 - 25 May 1979
Kathleen M. Werchowski, Stephen P. Henne, and G. Bruce Briggs. Jan. 1980. 49 p.
(Contract EPA-68-03-2652)
(PB80-168529; EPA-600/1-80-011) Avail: NTIS HC A03/MF A01 CSCL 06T

The potential for diesel exhaust emissions to produce malformation in rabbit fetuses was evaluated. The pregnant does were exposed by the inhalation route to a 10% concentration of diesel exhaust emissions in inhalation chambers on days 6 through 18 of gestation (Methods used conform to the guideline developed by the Food and Drug Administration for evaluating teratogenic effects in rabbits.) The results of the exposure of pregnant rabbits indicate that diesel exhaust emissions have no effect upon the nornal development of rabbit fetuses. Diesel exhaust emission did not effect any of the parameters evaluated to assess maternal toxicity nor total number of fetuses born. GRA

N80-29020# Michigan State Univ., East Lansing. Inst. of Water Research.
AN EMPIRICAL STUDY OF FACTORS AFFECTING BLUE-GREEN VERSUS NONBLUE-GREEN ALGAL DOMINANCE IN LAKES Project Completion Report, 1 Oct. 1978 - 30 Sep. 1979
Kenneth H. Reckhow and Jonathan T. Simpson. Feb. 1980. 108 p. refs.
(Contract DI-14-34-0001-9024)
(PB80-169311; W80-04441; OWRT-A-102-MICH(3)) Avail: NTIS HC A06/MF A01 CSCL 06C

Exploratory data analysis techniques were applied to 90 north temperate lakes included in the EPA National Eutrophication Survey to examine empirical relationships between: (1) the chemical and physical variables that affect algal dominance in lakes; and (2) the dominant algal type. Single variable box plots and bivariate-discriminant plots document the importance of the inorganic nitrogen concentration and hydraulic detention time in determining blue-green versus nonblue-green algal dominance in eutrophic lakes. The multivariate statistical technique of discriminant analysis was also applied to 68 high, alkalinity lakes in the data set to: (1) further identify variable relationships; and (2) construct a simple predictive model for algal dominance. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-29021* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Jul. 1980. 53 p.
(NASA-SP-7011(208)) Avail: NTIS HC A04 CSCL 06E

This bibliography lists 138 reports, articles, and other documents introduced into the NASA scientific and technical information system in Jun. 1980. Author

N80-29022# National Electrical Engineering Research Inst., Pretoria (South Africa).
CHANGES IN THE QRS COMPLEX OF THE ELECTROCARDIOGRAM DURING SLEEP AND EXERCISE M.S. Thesis - Pretoria Univ.
John Nicholas Amoore. May 1979. 178 p. refs.
(CSIR-ELEK-167) Avail: NTIS HC A09/MF A01

Changes in the QRS complex in normal healthy individuals during sleep were identified and studied in order to determine whether they are due to alteration in the cardiac signal or in the transfer function. A knowledge of the mechanism of the changes could provide useful information on the nature of sleep. The following conclusions were reached: (1) The surface ECG is a function of both the electrical activity of the heart and the transfer of the signals to the body surface. (2) An analysis of the transfer function extends the usefulness of the ECG. (3) Three modes of R and S amplitude changes occur during sleep.

The abrupt change in mean value, the beat by beat variability of the amplitudes and the gradual change of mean amplitude may assist the analysis of sleep. (4) The response of the QRS waveform to inspiration has two components, namely a step response caused by movement of the heart with the diaphragm, and a transient response possibly caused by ventricular volume changes. (5) The amplitudes of the R and S waves change in a defined pattern during exercise. (6) Changes of the R and S wave amplitudes may reflect changes in left ventricular end diastolic volume. R.E.S.

N80-29023*# GARD, Inc., Niles, Ill.
DESIGN, FABRICATION AND TESTING OF A DUAL CATALYST AMMONIA REMOVAL SYSTEM FOR A URINE VCD UNIT Final Report
P. Budinikas Jun. 1980 43 p ref
(Contract NAS2-10237)
(NASA-CR-152372) Avail: NTIS HC A03/MF A01 CSCL 06B

A three-man capacity catalytic system for the recovery of water from urine was designed, constructed, and tested. It was designed to operate with feed streams containing high concentrations of urine vapor and only 5 to 7% of oxygen for the oxidation of ammonia and volatile organic vapor.It can operate either in a flow-through or a recycle mode and is capable of accepting the urine vapor produced by a vapor compression distillation evaporator. Testing consisted of short preliminary and optimization test, an endurance test of 74 hours continuous operation, and recycle tests using both air and oxygen. The system was designed for a urine processing rate of 0.86 liters/hr; however, it was tested at rates up to 1.2 liter/hr. Untreated urine evaporated by an electrically heated evaporator was used. The quality of the recovered water meets the U.S. Drinking Water Standards, with the exception of a low pH. Accumulation of solids in the urine sludge is reduced to approximately 65% of the anticipated value. L.F.M.

N80-29024*# Houston Univ., Clear Lake, Tex.
ASTRONAUT TRAINING MANUAL Final Report
Eugene A. Coleman 30 Jun. 1980 251 p refs
(Contract NAS9-15642)
(NASA-CR-160758) Avail: NTIS HC A12/MF A01 CSCL 05I

Scientific information from previous space flights, space medicine, exercise physiology, and sports medicine was used to prepare a physical fitness manual suitable for use by members of the NASA astronaut population. A variety of scientifically valid exercise programs and activities suitable for the development of physical fitness are provided. Programs, activities, and supportive scientific data are presented in a concise, easy to read format so as to permit the user to select his or her mode of training with confidence and devote time previously spent experimenting with training routines to preparation for space flight. The programs and activities included were tested and shown to be effective and enjoyable. E.D.K.

N80-29025*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF RESTRICTED MOBILITY ON RNA CONTENT AND NUCLEOTIDE COMPOSITION AND ON PROTEIN CONTENT IN MOTONEURONS OF SPINAL CORD ANTERIOR HORNS
A. V. Gorbunova Jun. 1980 7 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 199, no. 4, 1971 p 976-979 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Med. and Biol. Problems, USSR Min. of Public Health
(Contract NASw-3198)
(NASA-TM-76190) Avail: NTIS HC A02/MF A01 CSCL 06S

An investigation into the effect of hypokinesia on the ribonucleic acid (RNA) content, the nucleotide composition, and dynamics of protein content in the motoneuron of the rat spinal cord anterior horns is described. Methodology and findings are presented. The study results showed that the nucleotide composition of the total cellular RNA at all the studied periods of hypokinesia remained unchanged and is characteristic for the cytoplasmic, high polymer ribosomal RNA. This means that with a change in the functional state of the neuron the newly formed RNA of the nerve cell has the same composition of bases as the original RNA that belongs to the ribosomal type. Author

N80-29026*# National Aeronautics and Space Administration, Washington, D. C.
RNA CONTENT IN SPINAL CORD MOTONEURONS DURING HYPOKINESIA
A. V. Gorbunova Jun. 1980 9 p refs Transl. into ENGLISH from Tsitologiya (USSR), v. 13, no. 1, Jan. 1971 p 83-87 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by USSR Ministry of Public Health
(Contract NASw-3198)
(NASA-TM-76200) Avail: NTIS HC A02/MF A01 CSCL 06S

The effect of a diminished motor activity of rats upon the ribonucleic and (RNA) content in a single isolated motoneuron of frontal of their spinal cord was studied. Within a 1 to 30 day exposure of rats to the hypokinetic conditions, RNA content was found to decrease on the 1st, 3rd, and 5th day and to return to the initial level by the 7th day. No changes in RNA content were observed during the subsequent stages of the experiments. The volume of the nerve cells declined on the 3rd and 5th day, whereas RNA concentration reduced on the 1st, 3rd, 5th, and 30th day. L.F.M.

N80-29027# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A COMPUTER IMPLEMENTATION OF A THEORY OF HUMAN STEREO VISION
W. E. L. Grimson Jan. 1980 62 p refs
(Contract N00014-75-C-0643; Grant NSF MCS-77-07569)
(AD-A084696; AI-M-565) Avail: NTIS HC A04/MF A01 CSCL 06/16

Recently, Marr and Poggio (1979) presented a theory of human stereo vision. An implementation of that theory is presented, and consists of five steps. (1) The left and right images are each filtered with masks of four sizes that increase with eccentricity; the shape of these masks is given by the laplacian of a Gaussian function. (2) Zero-crossings in the filtered images are found along horizontal scan lines. (3) For each mask size, matching takes place between zero-crossings of the same sign and roughly the same orientation in the two images, for a range of disparities up to about the width of the mask's central region. Within this disparity range, Marr and Poggio showed that false targets pose only a simple problem. (4) The output of the wide masks can control vergence movements, thus causing small masks to come into correspondence. In this way, the matching process gradually moves from dealing with large disparities at a low resolution to dealing with small disparities at a high resolution. (5) When a correspondence is achieved, it is stored in a dynamic buffer, called the 2 1/2 dimensional sketch. To support the sufficiency of the Marr-Poggio model of human stereo vision, the implementation was tested on a wide range of stereograms from the human stereopsis literature. The performance of the implementation is illustrated and compared with human perception. As well, statistical assumptions made by Marr and Poggio are supported by comparison with statistics found in practice. Finally, the process of implementing the theory has led to the clarification and refinement of a number of details within the theory; these are discussed in detail. GRA

N80-29028# Wayne State Univ., Detroit, Mich. Ergonomics Research Lab.
A TECHNIQUE FOR ESTABLISHING TRUE LEVELS OF MUSCLE STRENGTH EXERTION Final Report, 1 Jun. 1979 - 31 Jan. 1980
K. H. E. Kroemer and W. S. Marras Jan. 1980 85 p refs
(Contract F49620-79-C-0109; AF Proj. 2313)
(AD-A083576; AFOSR-80-0263TR) Avail: NTIS HC A05/MF A01 CSCL 06/16

Experiments were performed with 20 female and 20 male subjects in order to determine indicators of whether the subjects performed maximal or submaximal isometric strength exertion. The exertion tested were elbow flexion, finger flexion, knee flexion and knee extension. The only performance measures used were analog recordings of the strength scores exerted on a static dynamometer. The following was found: (1) The variability of

tests scores in repeated exertion is not a viable indicator of the actual portion of individual strength exerted. (2) The buildup phase of strength exertion is a reliable indicator of the force level to be attained. The steeper the strength formation curve, the stronger the following muscle strength exertion. GRA

N80-29029# Oak Ridge National Lab., Tenn. Health and Environmental Studies Program.
CHEMICAL IDENTIFIED IN HUMAN BIOLOGICAL MEDIA: A DATA BASE, VOLUME 1, PART 1, RECORDS 1-1580 Annual Report, Oct. 1979
M. Virginia Cone, comp., Margaret F. Baldauf, comp., Fay M. Martin, comp., and John T. Ensminger, comp. Mar. 1980 314 p. refs
(Contract W-7405-eng-26)
(ORNL/EIS-163/V1-P1; APR-1) Avail: NTIS HC A14/MF A01

A comprehensive data base of chemicals identified in human biological media (tissues and body fluids) is presented in two volumes. The data base in given in this volume in tabular form and arranged alphabetically by CAS 'preferred chemical name'. R.E.S.

N80-29030# Oak Ridge National Lab., Tenn. Health and Environmental Studies Program.
CHEMICALS IDENTIFIED IN HUMAN BIOLOGICAL MEDIA: A DATA BASE, VOLUME 1, PART 2, RECORDS 1-1580 Annual Report, Oct. 1979
M. Virginia Cone, comp., Margaret F. Baldauf, comp., Fay M. Martin, comp., and John T. Ensminger, comp. Mar. 1980 816 p. refs
(Contract W-7405-eng-26)
(ORNL/EIS-163/V1-P2; APR-1) Avail: NTIS HC A99/MF A01

A comprehensive data base of chemicals identified in human biological media (tissues and body fluids) is presented in two volumes. Introductory material, references, appendices, indices, and a chemical directory are given in this volume as a user guide to the data base. R.E.S.

N80-29031# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
INITIAL STUDY ON THE EFFECTS OF TRANSFORMER AND TRANSMISSION LINE NOISE ON PEOPLE. VOLUME 1: ANNOYANCE. Final Report
K. S. Pearsons, R. L. Bennett, and S. A. Fidell. Dec. 1979 114 p. refs. Sponsored by DOE. 3 Vol.
(EPRI-EA-1240-Vol-1; EPRI-RP852-Vol-1) Avail: NTIS HC A06/MF A01

The relative annoyance of transmission line and transformer noise along with shaped noise and other environmental noises was evaluated in a laboratory setting. Thirty-two test subjects made paired comparisons of the annoyance of 19 signals under free field listening conditions. The study shows that transformer noise is about 10 decibles more acceptable than transmission line noise and thus casts doubt on the general validity of the A-weighted sound level index as a predictor of the relative noise annoyance of transformer noise as compared to transmission line corona noise. The inadequacy of the dBA as a unit for assessing certain types of relative noise evaluation is confirmed. DOE

N80-29032# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
INITIAL STUDY ON THE EFFECTS OF TRANSFORMER AND TRANSMISSION LINE NOISE ON PEOPLE. VOLUME 2: SLEEP INTERFERENCE. Final Report
R. D. Horonjeff, R. L. Bennett, and S. R. Teffeteller. Dec. 1979 68 p. refs. Sponsored by Electric Power Research Inst. 3 Vol.
(EPRI-EA-1240-Vol-2; EPRI-RP852-Vol-2) Avail: NTIS HC A04/MF A01

The relative awakening potential of four different sounds (a transformer, transmission line, window air conditioner, and distant traffic) was evaluated in a behavioral awakening study conducted in peoples' own homes. Fourteen participants in the Los Angeles, California area each participated in the experiment for a three week period. The results of the study indicate that the transformer, air conditioner, and traffic sounds would all awaken essentially the same proportion of the test population when presented at the same A-weighted sound level. The transmission line around, however, had to be presented at a level 10 dB(A) less than the other sounds to awaken an equivalent proportion of the population. DOE

N80-29033# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
INITIAL STUDY ON THE EFFECTS OF TRANSFORMER AND TRANSMISSION LINE NOISE ON PEOPLE. VOLUME 3: COMMUNITY REACTION. Final Report
S. A. Fidell, S. R. Teffeteller, and K. S. Pearsons. Dec. 1979 61 p. refs. 3 Vol.
(EPRI-EA-1240-Vol-3; EPRI-RP852-Vol-3) Avail: NTIS HC A04/MF A01

A social survey intended to assess reactions to exposure to noise emissions of overhead electric power transmission lines and power transformers was conducted in Southern California. A structured questionnaire was administered by personal interview to a purposive sample of about 400 people residing at 17 sites along power line rights-of-way and in neighborhoods adjacent to transformer substations in urban areas. Estimates of the proportion of the American population exposed to noise of different levels from power lines and transformers were developed by analyses of several information sources. Acoustic measurements were made at all interviewing sites to assess the contributions of these low level electrical noise sources to overall background noise environments. DOE

N80-29034# Oak Ridge National Lab., Tenn. Industrial Safety and Applied Health Physics Div.
HEALTH EFFECTS OF LOW LEVEL RADIATION
John A. Auxier. 1980 13 p.
(Contract W-7405-eng-26)
(DOE/TIC-11176) Avail: NTIS HC A02/MF A01

The health and environmental effects of low level radiation are reviewed. Emphasis is placed on effects on bone marrow and incidence of leukemia. Dose response curves are presented. DOE

N80-29035# CarboMedics, Inc., San Diego, Calif.
STUDIES OF CARBON-SURFACED POLYMERIC, METALLIC AND CERAMIC BIOMATERIALS. Annual Report, 1 Apr. 1978 - 31 Mar. 1979
A. D. Haubold and H. S. Shim. Dec. 1979 71 p. refs.
(Contract N01-HV-4-2928)
(PB80-168859) Avail: NTIS HC A04/MF A01 CSCL 06B

Carbon-surfaced composite biomaterials were investigated in order to: (1) determine whether thin carbon films that have physical and chemical properties similar to those of LTI carbon also confer the biochemical properties of LTI carbon to the coated composites, and (2) determine if the carbon-surfaced composites possess the necessary engineering properties for use in prosthetic devices. It was found that the strain to failure of carbon films on polymeric substrates is on the order of 4 to 5%. Failure of the carbon coating always coincided with the onset of plastic deformation in the substrate. The adhesion of the thin coatings is greater than the bulk strength of the polymer. GRA

N80-29036# National Technical Information Service, Springfield, Va.
AIRCRAFT SONIC BOOM: BIOLOGICAL EFFECTS. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1964 - Apr. 1980
Elizabeth A. Harrison. May 1980 89 p. Supersedes NTIS/PS-79/0190. NTIS/PS-78/0120
(PB80-810310; NTIS/PS-79/0190; NTIS/PS-78/0120) Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

The selected abstracts of research reports cover the effects of sonic booms on humans, animals, birds, and fish. Discussions of biophysics, psychoacoustics, stress, and auditory tolerances are presented, along with materials on startle responses, disturbance, and compression wave reactions. This updated bibliography contains 82 abstracts. GRA

N80-29037# National Technical Information Service, Springfield, Va.
HYPOTHERMIA. CITATIONS FROM THE NTIS DATA BASE

Progress Report, 1964 - May 1980
Elizabeth A. Harrison May 1980 257 p Supersedes NTIS/PS-79/0533; NTIS/PS-78/0517
(PB80-180528; NTIS/PS-79/0533; NTIS/PS-78/0517) Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

The selected abstracts cover high pressure narcosis, organ preservation, hyperbaric conditions, thermal homeostasis, thermoregulation, cold stress, cold tolerance, physiological effects and cold water immersion as related to hypothermia. This updated bibliography contains 250 abstracts. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-29038 Flying Personnel Research Committee, London (England)
RESEARCH ABSTRACTS IN THE BEHAVIOURAL SCIENCES, 1971 TO 1975: A BIBLIOGRAPHY
Oct. 1979 55 p
(FPRC-Memo-259; BR70999) Copyright. Avail: Issuing Activity

Abstracts of 122 papers representing work completed by the Royal Air Force between 1971 and 1975 are presented. Subjects studied include: general psychology; group and interpersonal processes; military structure and political processes; personal attitudes and evaluation; aviation medicine; physiological psychology and psychopharmacology; stress and performance; flight simulation; human factors and equipment design; ergonomics of both air traffic control systems; and map design. Author (ESA)

N80-29039# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE EFFECT OF A PREDICTIVE WIND SHEAR CHART ON PILOT LANDING PERFORMANCE
Eric Nick Sotowka Apr. 1980 92 p refs Sponsored by National Research Council of Canada
(UTIAS-TN-220; ISSN-0082-5263) Avail: NTIS HC A05/MF A01

A fixed base aircraft simulator limited to providing only the longitudinal equations of motion was used to study the effect of a predictive wind shear chart on landing performance through wind shear. It was found that the introduction of the predictive wind shear chart alone did not significantly alter the pilot's landing performance. Training as to wind shear effect and limited coaching combined with the presence of the predictive shear display did however improve pilot ability to maintain the aircraft on the desired flight path with little effect on airspeed control. This inability to improve airspeed control might not be an indication of poor pilot performance but suggests the adoption of another airspeed performance criterion. The overreaction of pilots to a novel wind shear (that was slightly different from those used in training flights) when the wind shear chart was available to them indicates that although better glide slope control can be achieved, care will have to be exercised when introducing a predictive shear display to the general aviation field. R.E.S.

N80-29040# Analytics, Inc., Willow Grove, Pa.
DECISION AIDS FOR NAVAL AIR ASW Technical Report, Aug. 1978 - Aug. 1979
Wayne W. Zachary 15 Mar. 1980 136 p refs
(Contract N00014-78-C-0743; NR Proj. 199-003)
(AD-A085134; Rept-1398-A) Avail: NTIS HC A07/MF A01 CSCL 15/7

This report examines the applicability of a variety of decision aiding techniques to operation decision situations encountered in Naval Air Anti-Submarine Warfare (ASW). Decisions performed by the Tactical Coordinator (TACCO) in the three major Navy air ASW platforms, P-3C, S-3A, and LAMPS MK-III, are examined and synthesized into six decision making situations. These six situations are lost contact reacquisition, contact classification/verification, on-station search, localization, surveillance tracking, and attack planning. They represent distinct decision making contexts in which specific mission objectives are sought. A method for prioritizing these decision situations for decision and construction is developed and applied. A survey of numerous decision aids and a detailed analysis of 15 military decision aids results in the development of a six category taxonomy of decision aiding techniques. Possible combinations of techniques that could be applied to aid each of the decision situations are determined by matching the decision aiding techniques from the taxonomy to the detailed descriptions of the decision situations. The matching of techniques to situations is facilitated by the development of a descriptive framework for the decision situations. The categories in this framework are chosen so as to uncover the aspects of the situations most amenable to decision aiding by the techniques in the taxonomy. GRA

N80-29041# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. Clinical Research Div.
AUTOMATED PSYCHOLOGICAL STRESS DETECTION IN AN ENTRY PORTAL SYSTEM Final Report
Jerry G. Davis, Jack A. Loeppky, and Michael D. Venters Oct. 1979 35 p refs
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-80-7026) Avail: NTIS HC A03/MF A01

The application of automatic psychological stress detection to persons entering a secured facility through an entry portal is discussed. The numerous technical considerations in transducing the required physiological signals are presented. The major methods that a psychologically stressed person might utilize in an attempt to evade detection are also discussed. The prime evasionary method of drug intervention is given added emphasis. The hardware requirements for a typical installation are presented. DOE

N80-29042# Institut de Recherche de Transports, Bron (France). Centre d'Evaluation et de Recherche des Nuisances.
EFFECTS OF AIRCRAFT NOISE ON SLEEP: AN IN-SITU EXPERIENCE
M. Vallet, J. M. Gagneux, and F. Simonet 1979 10 p refs Presented at 3d Intern. Congr. on Noise as a Public Health Problem Sponsored by Min. de l'Environ. and Direc. de l'Aviation Civile
Avail: NTIS HC A02/MF A01

Electroencephalogram data and bedroom noise levels were recorded during four consecutive nights for 40 men living near the Roissy Airport in Paris questionnaire about sleep quality was administered each morning. All subjects had lived in the same location before the opening of the airport, and had been exposed to the noise for at least a year. The immediate effects of each noise event were noted and an analysis made of sleep structure. For the noisiest nights, total sleep decreased as the noise increased sleep induction latency increased with the noise index, and stage three and four sleep increase were noted. Author (ESA)

N80-28812*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A VERY LONG BASELINE INTERFEROMETRY SKY SURVEY
Robert A. Preston and D. D. Morabito *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 173-179 refs (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 08E

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-29043*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM: ANALYSIS OF STS-1
G. J. Steines Jul. 1980 38 p refs
(NASA-TM-81032; JSC-16730; Rept-80-FM-36) Avail: NTIS

HC A03/MF A01 CSCL 06K

The capability of the orbiter environmental control and life support system (ECLSS) to support vehicle cooling requirements in the event of cabin pressure reduction to 9 psia was evaluated, using the Orbiter versions of the shuttle environmental consumables usage requirement evaluation (SECURE) program, and using heat load input data developed by the spacecraft electrical power simulator (SEPS) program. The SECURE model used in the analysis, the timeline and ECLSS configuration used in formulating the analysis, and the results of the analysis are presented. The conclusion which may be drawn drom these results, is summarized. There are no significant thermal problems with the proposed mission. There are, however, several procedures which could be optimized for better performance: setting the cabin HX air bypass and the interchanger water bypass to the zero flow position is of questionable efficacy; the cabin air pressure monitoring procedure should be re-evaluated; and the degree of equipment power down specified for this analysis and no problems were noted. A.R.H.

N80-29044# Naval Postgraduate School, Monterey, Calif.
THE ADVANTAGE OF THE COLOR-CODE MODALITY VERSUS ALPHANUMERIC AND SYMBOL CODE M.S. Thesis
Henning Hoops Mar. 1980 68 p refs
(AD-A084383) Avail: NTIS HC A04/MF A01 CSCL 05/8

This study describes an experiment designed to investigate potential advantages and/or disadvantages of color-coding relative to symbol - or alphanumeric-codes. Performance was evaluated in terms of reaction time and the number and type of errors made. The stimuli used in the experiment were the letters: E, F, N, U, the colors: red, yellow, green, blue, and the symbols: square, triangle, circle, and cross. They stood for enemy, friendly, neutral, and unknown forces, respectively. The analysis of the data obtained from the experiment suggested that the color and symbol-codes were significantly better than the alphanumeric-code with respect to the number of errors. The reaction time of the color-code was shortest, followed by the symbol-code with reaction time for the alphanumerics being longest. GRA

N80-29045# Donrich Research, Inc., West Palm Beach, Fla.
DETERMINATION OF THE IMPACT OF DIGITAL DATA BROADCAST ON FLIGHT TECHNICAL ERROR Final Report
Donald W. Richardson Feb. 1980 85 p refs
(Contract DOT-FA01-80-P-85745)
(AD-A085177; F-80-01; FAA/RD-80-35) Avail: NTIS HC A05/MF A01 CSCL 05/9

This report documents the data reduction and analysis of existing flight test data regarding the digital data broadcast system (DDBS) concept of automating cockpit data input procedures in an area navigation environment. Particular attention is paid to the statistical quantification of the impact of the DDBS concept on pilot steering performance, mainly flight technical error (FTE). Results of this analysis indicate that DDBS significantly reduces both pilot blunder rate and FTE, for both the enroute and approach phases of flight. GRA

N80-29046# National Technical Information Service, Springfield, Va.
PROTECTIVE CLOTHING: ARCTIC AND TROPICAL ENVIRONMENTS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1980
Edith Kenton Apr. 1980 126 p Supersedes NTIS/PS-79/0436; NTIS/PS-78/0371
(PB80-809635; NTIS/PS-79/0436; NTIS/PS-78/0371) Avail: NTIS HC $30.00/MF $30.00 CSCL 06Q

A bibliography containing 120 abstracts concerning clothing for environmental protection in extreme climates is given. Fabrics and textiles, insulating methods, physiological and psychological responses of users, mobility and dexterity of wearers, care of specialized clothing, and human factors involved are specifically addressed. GRA

N80-29047# National Technical Information Service, Springfield, Va.
PROTECTIVE CLOTHING: SURVIVAL, AIRCRAFT, AND COMBAT ENVIRONMENTS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Edith Kenton Apr. 1980 230 p Supersedes NTIS/PS-79/0438; NTIS/PS-78/0373
(PB80-809650; NTIS/PS-79/0438; NTIS/PS-78/0373) Avail: NTIS HC $30.00/MF $30.00 CSCL 06Q

A bibliography containing 224 abstracts is presented addressing the design, testing, and evaluation of protective apparel for pilots in various conditions of climate and gravity, for military personnel in combat conditions, for persons in special circumstances of exposure and survival, such as the ocean environment, and for other aviation personnel. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-29048*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
FUNCTIONAL SPECIFICATION OF THE PERFORMANCE MEASUREMENT (PM) MODULE
Jeffrey E. Berliner Jul. 1980 77 p refs
(Contract NAS1-15192)
(NASA-CR-159301) Avail: NTIS HC A05/MF A01 CSCL 09B

The design of the Performance Measurement Module is described with emphasis on what the PM Module would do, and what it would look like to the user. The PM Module as described could take several man-years to develop. An evolutionary approach to the implementation of the PM Module is presented which would provide an operational baseline PM Module within a few months. Author

N80-29049# Naval Postgraduate School, Monterey, Calif.
DATA BASE MANAGEMENT SYSTEM FOR MICROCOMPUTERS M.S. Thesis
Amrun Sehan and Timbul Maruap Sihombing Dec. 1979 113 p refs
(AD-A085036) Avail: NTIS HC A06/MF A01 CSCL 09/2

Many of the existing data base management systems have been developed for large applications such as big business. However other applications such as small businesses can also benefit from the managerial information which can be provided by a computer data base. This thesis develops a stand-alone data base management system using a microcomputer with floppy disk auxiliary storage and the UCSD PASCAL software package. This system has the capability to create, update, delete and insert information, and to respond to user inquiries. Because of the limited storage capacity and relatively slow access speeds of floppy disks, the system will only satisfy small applications.

However, the advent of compatible hard disk systems for microcomputers will enable the system to be used for significantly larger applications. GRA

N80-29050# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
TEST GENERATION FOR MICROPROCESSORS Ph.D. Thesis
Satish Mukund Thatte May 1979 176 p refs
(Contracts N00014-79-C-0424; DAAB07-72-C-0259; DAAG29-78-C-0016)
(AD-A085078; R-842; UILU-ENG-78-2235) Avail: NTIS HC A09/MF A01 CSCL 09/2

The goal of this report is to develop test generation procedures for testing microprocessors in a user environment. Classical fault detection methods based on the gate and flip-flop level or on the state diagram level description of microprocessors are not suitable for test generation. The problem is further compounded by availability of a large variety of microprocessors. They differ widely in their organization, instruction repertoire, addressing modes, data storage and manipulation facilities, etc. In this report, a general graph-theoretic model for microprocessors is developed at the register transfer level. Any microprocessor can be easily modeled using information only about the instruction set and the functions performed by it. This information is easily available in the user's manual. A fault model is developed on a functional level quite independent of the implementation details. The effects of faults in the fault model are investigated at the level of the graph-theoretic model. Test generation procedures are proposed which take the microprocessor organization and the instruction set as parameters and generate tests to detect all the faults in the fault model. The complexity of the test sequences measured in terms of the number of instructions is given. Our effort in generating tests for a real microprocessor and evaluating their fault coverage is described. GRA

N80-29051# Atomic Weapons Research Establishment, Aldermaston (England).
COST EFFECTIVE MULTICHANNEL DATA LOGGING USING THE COMMODORE PET MICROCOMPUTER
J. L. Adelus London HMSO Dec. 1979 21 p ref
(AWRE-O-54/79; BR71525) Avail: NTIS HC A02/MF A01; HMSO, London £1 PHI

A multichannel data logger based on the Commodore PET microcomputer and the ADAM 12 data aquisition module was been devised. The system described incorporates 8 differential channels of 0 to 10 V each and the PET is capable of scanning these at speeds in excess of 40 channels per second when programmed in BASIC. The major hardware components are described including their electrical interconnections, and the necessary driver software. Basic component costs are listed; and compare favorably with complete systems that are commercially available. Author (ESA)

N80-29052# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
BASPL: A FINITE ELEMENT POSTPROCESSOR, PART 8
S. Merazzi and M. Flueck 12 Oct. 1979 39 p refs Sponsored in cooperation with EPFL Lab. d'Anal. des Contraintes 6 Vol.
(Contract SWEDBESD-5061-012)
(FFA-AU-1499-Pt-8) Avail: NTIS HC A03/MF A01

A short user guide to the BASPL finite element postprocessor program is presented. The program is designed for easy postprocessing of results from nonlinear finite element analysis, such as that for wind turbine blades. The program has three main features (selective printer output, deformation shape, and flat contour) as well as a function plot. The function plot offers possibilities such as load displacement and displacement time diagrams. Author (ESA)

N80-29053# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
LINE NUMBERS MADE CHEAP
Paul Klint Jun. 1979 11 p refs Submitted for publication
(MC-IW-112/79) Avail: NTIS HC A02/MF A01

A technique is described for run-time line number administration to be used for implementations of high-level languages. Under suitable circumstances, this method requires absolutely no overhead, in either time or space, during execution of the program. Author (ESA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-29054*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
EVALUATION OF VERIFICATION AND TESTING TOOLS FOR FORTRAN PROGRAMS
Kathryn A. Smith Jul. 1980 24 p refs
(NASA-TM-80205; L-13665) Avail: NTIS HC A02/MF A01 CSCL 09B

Two automated software verification and testing systems were developed for use in the analysis of computer programs. An evaluation of the static analyzer DAVE and the dynamic analyzer PET, which are used in the analysis of FORTRAN programs on Control Data (CDC) computers, are described. Both systems were found to be effective and complementary, and are recommended for use in testing FORTRAN programs. L.F.M.

N80-29055# Stanford Univ., Calif. Systems Optimization Lab.
THE IMPLEMENTATION OF A LAGRANGIAN-BASED ALGORITHM FOR SPARSE NONLINEAR CONSTRAINTS
B. A. Murtagh (New South Wales Univ.) and M. A. Saunders Jan. 1980 55 p refs Presented at the 10th Intern. Symp. on Mathematical Programming, Montreal, 27-31 Aug. 1979
(Contracts DAAG29-79-C-0110; DE-AS03-76SF-00326; Grants NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A084825; SU-SOL-80-1; ARO-16470.9-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

An algorithm is described for solving large-scale nonlinear programs whose objective and constraint functions are smooth and continuously differentiable. The algorithm is of the augmented Lagrangian type, involving a sequence of sparse, linearly constrained subproblems whose objective functions include a modified Lagrangian term and a modified penalty function. The algorithm has been implemented in a general purpose FORTRAN code called MINOS/AUGMENTED. The system is intended for use on problems whose Jacobian matrix is sparse. (Such problems usually include a large set of purely linear constraints.) The bulk of the data may be assembled using a standard linear-programming matrix generator. Function and gradient values for all nonlinear terms are supplied by two user-written subroutines. Some aspects of the implementation are described in detail, and computational results are given for some nontrivial test problems. Assuming convergence occurs, the work involved is comparable to the solution of a moderate number of linear programs of similar size. GRA

N80-29056# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
SURFACE PERCEPTION FROM LOCAL ANALYSIS OF TEXTURE AND CONTOUR Ph.D. Thesis
Kent A. Stevens Feb. 1980 125 p refs Revised
(Contract N00014-75-C-0643; Grant NSF MCS-77-07569)
(AD-A084803; AI-TR-512-Rev) Avail: NTIS HC A06/MF A01 CSCL 06/4

The visual analysis of surface shape from texture and surface contour is treated within a computational framework. The aim of this study is to determine valid constraints that are sufficient to allow surface orientation and distance (up to a multiplicative constant) to be computed from the image of surface texture and of surface contours. The report is in three parts. Part 1 consists of a review of major theories of surface perception, a discussion of vision as computation and of the nature in which three dimensional information is manifest in the image, and a study of the representation of local surface orientation. Part 2 reconsiders the familiar (texture gradient). Part 3 examines our preception of surface contours. It is shown that surface contours are strong sources of information about local surface shape. GRA

N80-29057# Naval Postgraduate School, Monterey, Calif.
NPS-PASCAL: A MICROCOMPUTER-BASED IMPLEMENTATION OF THE PASCAL PROGRAMMING LANGUAGE M.S. Thesis
Konrad Stephen Tinius Mar. 1980 222 p refs
(AD-A085042) Avail: NTIS HC A10/MF A01 CSCL 09/2
NPS-PASCAL is a student research project at the Naval Postgraduate School, the goal of which is the implementation of the PASCAL programming language on a microcomputer system. NPS-PASCAL will consist of two programs, a compiler which produces intermediate code, and an interpreter, which will interpret the intermediate code, or a translator, which will produce target machine code. NPS-PASCAL is designed to conform to the requirements of the PASCAL Standard, as defined by the British Standards Institute/International Standards Organization Working Draft/3. The compiler program, the subject of this thesis, performs the lexical, syntactic and semantic analysis of a PASCAL program. NPS-PASCAL is written in INTEL's PL/M-80 programming language and executes on the CP/M operating system. GRA

N80-29058# Sandia Labs., Albuquerque, N. Mex.
COMPARISON OF SOFTWARE WHICH SOLVES SYSTEMS OF NONLINEAR EQUATIONS
Kathie L. Hiebert Mar. 1980 50 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0181) Avail: NTIS HC A03/MF A01
Eight readily available FORTRAN codes that solve nonlinear systems of equations are compared. The eight codes are C05NAF, BRENT, HYBRD, NS01A, QN, SOSNLE, ZONE, AND ZSYSTM. General information about the codes, such as methods implemented, return criteria, calling sequence, return status information, storage requirements, print options, and other special features is included. The main emphasis of the testing is the robustness of the code. Information on the efficiency of the codes (function evaluation counts and time) is presented. The conclusions are based on the robustness of both the individual codes and the methods that they implement. The state of the art of software that solves systems of nonlinear equation (i.e., identifies areas in which the codes perform well and areas that need improving) is defined and the conclusions based on robustness and the other information (efficiency measurements, storage requirements, and special features) provide the user a guide in choosing the most appropriate code for his needs. DOE

N80-29059# Sandia Labs., Albuquerque, N. Mex. Numerical Mathematics Div.
LEAST SQUARES FITTING OF DISCRETE DATA BY POLYNOMIALS IN SEVERAL VARIABLES
Richard J. Hanson Apr. 1980 14 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0197) Avail: NTIS HC A02/MF A01
The problem of least squares fitting k-dimensional data by polynomials is considered. This polynomial is represented as a linear combination of products of one dimensional Chebyschev polynomials. Suggestions about a numbering or subscripting convention are given as well as a review of appropriate solution methods for the resulting (large) least squares system. DOE

N80-29060# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
COMPRESSION OF BINARY IMAGES BY BLOCK CODING [COMPRESSION D'IMAGES BINAIRES PAR CODAGE EN BLOC]
Joachim Woelk Jul. 1979 137 p refs In FRENCH Sponsored in part by Min. des Affaires Etrangeres de France
(ENST-D-79018) Avail: NTIS HC A07/MF A01
The suitability of different codes for the compression of high entropy black and white images (written texts, route maps, etc.) was studied. It is concluded that error correcting codes are suitable for small compressions. Transition codes are the simplest and the most promising of the codes studied. Author (ESA)

N80-29061# Fondazione Ugo Bordoni, Rome (Italy).
USE OF THE SIMULA LANGUAGE IN TELEPHONIC TRAFFIC SIMULATIONS [IMPIEGO DEL LINGUAGIO SIMULA NELLE SIMULAZIONI DI TRAFFICO TELEFONICO]
Enrico Boccalaro and Davide Grillo Nov. 1978 32 p refs In ITALIAN
(FUB-41-1978) Avail: NTIS HC A03/MF A01
The use of the SIMULA language is demonstrated by discussing its application to a telephone network model. The SIMULA component blocks, each corresponding to a different activity, are detailed. The coding requirements for the simulation of telephonic networks are discussed. It is shown that the model described by using this language is flexible and easily adaptable to the representation of complex telephonic systems. Author (ESA)

N80-29062# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
SOME ISSUES IN INTERACTIVE PROGRAMMING REVISITED
Jan vandenBos, Johan Ero, Paul tenHagen, Rens Kessener, Henk Oudshoorn, Rinus Plasmeijer, Marleen Sint, Joop vanderStar, Jan Stroet, and Arthur Veen Jul. 1979 9 p refs Submitted for publication
(MC-IW-113/79) Avail: NTIS HC A02/MF A01
Topics in the intersecting fields of graphics standards, input tools and interactive programs are discussed, and some clarifying definitions and principles developed. The recently proposed Core standard would be affected in the area of facilities for echoing, prompting and higher level input functions. Author (ESA)

N80-29063# Northeastern Forest Experiment Station, Broomall, Pa.
MISSING: A COMPUTER PROGRAM FOR THE MAXIMUM LIKELIHOOD ESTIMATES OF THE PARAMETERS OF THE MULTIVARIATE LINEAR MODEL WITH INCOMPLETE MEASUREMENTS Final Technical Report
Stanford L. Arner and Donald W. Seegrist 1980 24 p refs
(PB80-165681; ; NEFES-80-63; FSGTR-NE-56) Avail: NTIS HC A02/MF A01 CSCL 09B
A computer program that obtains maximum likelihood estimates of the parameters of a multivariate linear model in which all variates may not be measured on each experimental unit is described. The variates can be: (1) repeated measurements on the same characteristic; (2) different characteristics; or (3) a mixture of repeated measurements and different characteristics. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N80-29064# Mitre Corp., Bedford, Mass.
MODELS OF LOCAL COMPUTER NETWORKS
Carl Tropper Apr. 1980 154 p refs
(Contract F19628-79-C-0001)
(AD-A085282; MTR-3783; ESD-TR-80-111) Avail: NTIS HC A08/MF A01 CSCL 17/2
This paper presents a discussion of analytical and simulation models of locally distributed computer networks that makes use of ring or bus technology. The section of the paper devoted to ring architectures focuses on models of the Pierce, Newhall, and DLCN rings. The emphasis in the bus section of the paper is on the modeling of access protocols. GRA

N80-29065# National Technical Information Service, Springfield, Va.
AEROSPACE COMPUTER SYSTEMS: AVIONICS APPLICATIONS, CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Mar. 1980
Brian Carrigan May 1980 154 p Supersedes NTIS/PS-79/0313; NTIS/PS-78/0289
(PB80-810179; NTIS/PS-79/0313; NTIS/PS-78/0289) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B
Studies of computer hardware and supporting software for aircraft applications are cited. The bibliography includes research on onboard data processing equipment as well as navigation and guidance computers. This updated bibliography contains

147 abstracts, 56 of which are new entries to the previous edition. GRA

N80-29066# National Technical Information Service, Springfield, Va.
AEROSPACE COMPUTER SYSTEMS: SPACE AND GUIDED MISSILES APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Mar. 1980
Brian Carrigan May 1980 160 p Supersedes NTIS/PS-79/0315; NTIS/PS-78/0290
(PB80-810187; NTIS/PS-79/0315; NTIS/PS-78/0290) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography containing 152 abstracts addressing computer hardware and supporting software for spacecraft and guided missile applications is presented. Onboard data processing equipment, telemetering data processing, and navigation and guidance computers are considered. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-29067*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
CONFERENCE ON AUTOMATED DECISION-MAKING AND PROBLEM SOLVING, THE THIRD DAY: ISSUES DISCUSSED
Walter W. Hawkins, Jack E. Pennington, and L. Keith Baker Jun. 1980 13 p refs Conf. held at Hampton, Va., May 1980
(NASA-TM-81846) Avail: NTIS HC A02/MF A01 CSCL 09B

A conference held at Langley Research Center in May of 1980 brought together university experts from the fields of Control Theory, Operations Research, and Artificial Intelligence to explore current research in automation from both the perspective of their own particular disciplines and from that of interdisciplinary considerations. Informal discussions from the final day of the those day conference are summarized. L.F.M.

N80-29068# Naval Postgraduate School, Monterey, Calif.
DIFFUSION APPROXIMATIONS FOR THE COOPERATIVE SERVICE OF VOICE DATA MESSAGES M.S. Thesis
J. P. Lehoczky and D. P. Gaver Feb. 1980 42 p refs
(AD-A085126; NPS55-80-007) Avail: NTIS HC A03/MF A01 CSCL 17/2

A probability model is presented for a set of communication channels that share the service of data and voice transmissions. A diffusion-theoretic approximation is derived, utilizing new results of Burman (1979). It is shown that the data queue (which is of low priority relative to voice) is approximated by a Wiener process. GRA

N80-29069# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
DESIGN OF OPTIMAL SYSTEMS WITH LOW SENSITIVITY TO SMALL TIME DELAYS Ph.D. Thesis
Mahmoud El-Sayed Sawan Jun. 1979 112 p refs
(Contract N00014-79-C-0424; Grant AF-AFOSR-3633-78)
(AD-A085076; DC-27; UILU-ENG-78-2239; R-846) Avail: NTIS HC A06/MF A01 CSCL 12/1

The work in this thesis is an addition to the study of trajectory sensitivity of optimal control systems. The parameter with respect to which sensitivity is studied is a small undesirable time delay that might occur in a system designed nominally with zero delays. A design strategy is proposed to guarantee low sensitivity of optimal control systems. A numerical algorithm is presented to solve the resulting necessary conditions of optimality. It is applied to a practical example. Encouraging results are obtained. GRA

N80-29070# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
OUTPUT FEEDBACK POLE-PLACEMENT IN THE DESIGN OF COMPENSATORS FOR SUBOPTIMAL LINEAR QUADRATIC REGULATORS M.S. Thesis
William Edward Hopkins, Jr. Jun. 1979 143 p refs
(Contracts N00014-79-C-0424; EX-76-C-01-2088; Grant AF-AFOSR-3633-78)
(AD-A085075; DC-847; UILU-ENG-78-2240; R-847) Avail: NTIS HC A07/MF A01 CSCL 09/3

Based on a modified output regulator problem, a design oriented methodology is presented for the construction of output feedback compensators retaining L(1 < or = 1 < or = n) optimal eigenvectors from a reference state feedback regulator. Viewing L as a design parameter, it is known that in the case L = r this requires a dynamic compensator of dimension L-r whose parameters are determined in function of the solution of an associated output feedback pole-placement problem. Using an iterative dyadic pole-placement procedure, an algorithm is given which determines the solution of this pole-placement problem without a priori assumptions on the compensator dimension. The methodology is also extended to the class of stabilizable systems and the required compensator is shown to possess a separation property. Finally the design methodology is illustrated by three nontrivial examples. GRA

N80-29071# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
DECOMPOSITION OF TIME-SCALES IN LINEAR SYSTEMS USING DOMINANT EIGENSPACE POWER INTERACTIONS AND MATCHED ASYMPTOTIC EXPANSIONS
R. G. Phillips and P. V. Kokotovic Oct. 1979 121 p refs
(Contract N00014-79-C-0424; Grant AF-AFOSR-3633-78)
(AD-A085260; DC-31; R-861; UILU-ENG-78-2254) Avail: NTIS HC A06/MF A01 CSCL 12/1

Many control theory concepts are valid for any system order, however, their actual use is limited to low order models. Large scale systems result not only in a formidable amount of computation, but also in ill-conditioned initial and two point boundary value problems. The interaction of fast and slow phenomena in high order systems results in stiff numerical problems which require expensive integration routines. The singular perturbations approach to decomposing fast ad slow phenomena involves using a time-scale separation technique. In this case, a reduced order 'steady state' and 'boundary layer' solutions are obtained from a high order model. Control designs and simulations for the high order model are then carried out on the reduced order subsystems. GRA

N80-29072# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
DECENTRALIZED CONTROL AND MULTICRITERION DECISION MAKING Ph.D. Thesis
Peter Michael Walsh Dec. 1979 93 p refs
(Contract DAAG29-78-C-0016; N00014-79-C-0424)
(AD-A085205; DC-32; UILU-ENG-78-2258; R-865) Avail: NTIS HC A05/MF A01 CSCL 12/1

This report examines issues arising from the presence of conflicting goals among decentralized controllers. Of primary interest is the role that the Stackelberg strategy can play in the decentralized control problem. A sampled data Stackelberg coordination scheme is developed in which both conceptual and computational issues are dealt with. Conditions which are sufficient for guaranteeing the existence of a stabilizing Stackelberg equilibrium solution are derived for a simple form of the Stackelberg strategy. Also, the role that the information structure can play in the decentralized control problem is demonstrated and a form of the Stackelberg strategy is developed for designing improved information structures. GRA

N80-29073# Oak Ridge National Lab., Tenn. Chemistry Div.
PROGRAMMING METHODOLOGY OF ARTIFICIAL INTELLIGENCE
Carroll K. Johnson 1980 16 p refs Presented at the Intern. Winter School on Crystallographic Computing, Bangalore, India, 4 Jan. 1980
(Contract W-7405-eng-26)
(CONF-800122-1) Avail: NTIS HC A02/MF A01

Some of the non-numerical methods developed in the branch of computer science known as artificial intelligence (AI) were designed specifically for the task of encoding empirical rules of good judgment into a form suitable for machine reasoning. The production-rule technique, one of the principal AI programming

techniques currently used in the knowledge engineering area of AI is summarized. An illustrative application involving the interpretation of protein electron-density maps is also described. DOE

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-29074*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE UNIQUE DETERMINATION OF DENSITY FROM HIGH-ORDER POTENTIALS
G. G. Johnson Aug. 1980 23 p refs
(NASA-TM-81031; JSC-16771; Rept-80-FM-42) Avail: NTIS HC A02/MF A01 CSCL 12A

The existence of higher-order potentials is postulated, and that the density function can be determined from this set of potentials is demonstrated. Moreover, it is shown that there is a one-to-one correspondence between such potentials and the density function, provided it is continuous. Finally, it is noted that this demonstration includes a method of constructing the density function from the set of potentials as well as indicating how to approximate the density from incomplete knowledge of the potentials. F.O.S.

N80-29075*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SMOOTHING FILTERS
William H. Lear Jul. 1980 58 p
(NASA-TM-81033; JSC-16700; Rept-80-FM-32) Avail: NTIS HC A04/MF A01 CSCL 12A

The improvement of accuracy in using the smoothing filter instead of the Kalman filter is discussed. Factors of improvement for velocity errors of up to four are shown for position measurements. Smoothing equations are presented, and it is shown that smoothing equations for the smoothing filter appear to be stable. F.O.S.

N80-29076# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
MINIMUM DISTANCE AND ROBUST ESTIMATION
William C. Parr and William R. Schucany 5 Oct. 1979 42 p refs
(Contract N00014-75-C-0439)
(AD-A085183; TR-136) Avail: NTIS HC A03/MF A01 CSCL 12/1

Robust and consistent of the location parameter of an asymmetric distribution and general, non-location and scale parameter estimation problems have been vexing problems in the history of robustness studies. The minimum distance (MD) estimation method is shown to provide a heuristically reasonable mode of attack for these problems which also leads to excellent robustness properties. Both asymptotic and Monte Carlo results for the familiar case of estimation of the location parameter of a symmetric distribution support this proposition, showing MD-estimators to be competitive with some of the better estimators thus far proposed. GRA

N80-29077# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
A COMPUTER PROGRAM FOR ESTIMATION OF THE WEIBULL INTENSITY FUNCTION AND FOR THE CRAMER-VON MISES GOODNESS OF FIT TEST, REVISED
Edward F. Belbot Apr. 1980 71 p refs Revised
(DA Proj. 1R7-65706-M-541)
(AD-A085112; AMSAA-TR-279-Rev) Avail: NTIS HC A04/MF A01 CSCL 12/1

This report describes the structure and use of a digital computer program written in Standard FORTRAN, which can be used to obtain the maximum likelihood estimates of the parameters of the Weibull intensity function. The program also performs the Cramer-Von Mises goodness of fit test. GRA

N80-29078# Center for Naval Analyses, Alexandria, Va. Operations Evaluation Group.
THE LAGUERRE TRANSFORM
J. Kielson (Rochester Univ.), W. Nunn, and U. Sumita (Rochester Univ.) May 1980 125 p refs
(AD-A085100; OEG-PP-284) Avail: NTIS HC A06/MF A01 CSCL 12/1

A novel transform is presented which maps continuum functions (such as probability distributions) into discrete sequences and permits rapid numerical calculation of convolutions, multiple convolutions, and Neumann expansions for Volterra integral equations. The transform is based on the Laguerre polynomials, associated Laguerre functions, and their convolution properties. Part 1 of this paper deals with functions having support only on (0 infinity). The resulting unilateral Laguerre transform finds applications in convolution of such functions, inversion of Laplace transform, and in solution to renewal and related Volterra integral equations. Part 2 of this paper deals with functions having support on (-infinity, infinity) via a bilateral Laguerre transform which is an extension of the unilateral transform. Applications of this technique include convolution of such functions and analysis of the Lindley process. Part 1 has been published in Applied Mathematics and Computation and part 2 has been submitted for publication in that journal. GRA

N80-29079# Florida State Univ., Tallahassee.
CALCULATION OF STATE PROBABILITIES FOR A STOCHASTIC LANCHESTER COMBAT MODEL
L. Billard Nov. 1979 34 p refs
(Contract N62271-79-M-2395)
(AD-A085125; NPS55-79-029) Avail: NTIS HC A03/MF A01 CSCL 12/1

Lanchester (1914) presented his original combat model between two forces in a deterministic framework. Here, it is shown how the underlying state probabilities of a stochastic analogue of Lanchester's model can be calculated. GRA

N80-29080# Naval Postgraduate School, Monterey, Calif.
A FREQUENCY DOMAIN ANALYSIS OF THE LINEAR DISCRETE KALMAN FILTER M.S. Thesis
Walter Jeremiah Costello Mar. 1980 100 p refs
(AD-A085058) Avail: NTIS HC A05/MF A01 CSCL 12/2

The linear discrete Kalman filter was analyzed using a frequency domain approach. Process and measurement noise covariances are shown to be critical design parameters which, together with the assumed prior state and covariance estimates, completely determine the gain schedule of the linear Kalman filter. Several relevant design techniques are illustrated and discussed. The concepts of smoothing and sharpening are demonstrated. Extensions to adaptive, non-linear, and non-parametric filtering are briefly discussed, as are applications to inventory management, estimation of time varying mean functions, and multiple regression. GRA

N80-29081# Illinois Univ. at Urbana-Champaign. Applied Computation Theory Group.
NEW RESULTS ON PLANAR TRIANGUALTIONS M.S. Thesis
Peter D. Gilbert Jul. 1979 49 p refs
(Contracts N00014-79-C-0424; DAAB07-72-C-0259; DAAG-29-78-C-0016; Grant NSF-MCS76-17321)
(AD-A085016; ACT-15; UILU-ENG-78-2243) Avail: NTIS HC A03/MF A01 CSCL 12/1

Several new results in planar triangulations are presented. In particular, an O(N sq log N) time worst-case algorithm for the construction of the 'greedy' triangulation is presented, an improvement over the previously best-known construction in time O(N cu). The minimum weight triangulation (MWT) of a simple N-vertex polygon is shown to be constructible in time O(N cu). A local property of MWTs is proved, a side result of which is that the shortest edge between a pair of points must be in a MWT. Also, it is shown that the Delaunay Triangulation is not 'approximately optimal', and that the ratio of the total length of the Delaunay Triangulation of N points to that of the MWT can be large as roughly N/2. GRA

N80-29082# Argonne National Lab., Ill. Applied Mathematics Div.

TOWARDS SENSIBLE FLOATING-POINT ARITHMETIC
W. J. Cody 1980 8 p refs Presented at COMPCON, San Francisco, 25 Feb. 1980
(Contract W-31-109-eng-38)
(CONF-800201-7) Avail: NTIS HC A02/MF A01

Efforts to promote the development of high-quality transportable numerical software show that few, if any, of the floating-point arithmetic systems in existing computers are completely satisfactory for serious numerical computation. Examination of the defects in these systems leads to specifications for a sensible floating-point system from a numerical analyst's viewpoint. DOE

N80-29083# California Univ., Livermore. Lawrence Livermore Lab.
GEARS: A PACKAGE FOR THE SOLUTION OF SPARSE, STIFF ORDINARY DIFFERENTIAL EQUATIONS
Andrew H. Sherman (Toronto Univ.) and Alan C. Hindmarsh Mar. 1980 12 p refs Presented at SIAM Intern. Conf. on Elec. Power Problems: The Mathematical Challenge, Seattle, 18-20 Mar. 1980
(Contract W-7405-eng-48)
(UCRL-84102; CONF-800334-1) Avail: NTIS HC A02/MF A01

A package of FORTRAN subroutines designed to solve stiff systems of ordinary differential equations of the form $dy/dt = f(y,t)$, where the Jacobian matrices are large and sparse is described. The integrator is based on the stiffly stable methods due to GEAR, and this approach leads to a sparse system of nonlinear equations at each time step. These are solved with a modified Newton iteration, using one of two separate sparse matrix packages to solve the sparse linear equations that arise. Issues that affected the design of the package, and a numerical example to illustrate the effectiveness of the package are included. DOE

N80-29084# California Univ., Livermore. Lawrence Livermore Lab.
USE OF A GENERAL NONLINEAR LEAST-SQUARES CURVE FITTING PROGRAM WITH NONCLOSED FORM RELATIONSHIPS
A. E. Abey 26 Dec. 1979 23 p ref
(Contract W-7405-eng-48)
(UCID-18506) Avail: NTIS HC A02/MF A01

A use for GNLS, a general nonlinear least-squares curve fitting program, is presented. In this use, GNLS determines a set of best parameters for relationships that cannot be written in closed form. This program can be useful for experimenters who need to determine experimental parameters by fitting nonclosed-form relationships to experimental data. Two examples are given to indicate how GNLS can be used for this type of problem. DOE

N80-29085# California Univ., Livermore. Lawrence Livermore Lab.
COMPARISON OF SEVERAL CONSERVATIVE FORMS FOR FINITE ELEMENT FORMULATIONS
Robert L. Lee, Philip M. Gresho, Steven T. Chan, and Robert L. Sani (NOAA, Boulder, Colo.) Oct. 1979 12 p refs Presented at 3d Intern. Conf. on Finite Element in Flow Problems, Banff, Alberta, 10-13 Jun. 1980
(Contract W-7405-eng-48)
(UCRL-82868; CONF-800613-2) Avail: NTIS HC A02/MF A01

Why the advective form for the primitive variable formulation of the inviscid Boussinesq (or Navier-Stokes) equations is nonconservative and how several potentially useful conservative formulations can be generated is demonstrated. Several forms are considered which conserve the following quantitites individually or in combinations: total energy, temperature (enthalpy), temperature squared, or none of the above (advective form). Finally the numerical performance and stability of these various formulations are compared via numerical solutions of the time dependent, inviscid equations of motion employing the finite element method. DOE

N80-29086# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Construction Metallique Section.
INTRODUCTION TO THE BOUNDARY INTEGRAL EQUATION METHOD
Rudy Beeckman Dec. 1979 29 p refs Presented at Seminar on Machine Mech., Ghent Sponsored by Inst. pour l'Encouragement de la Rech. Sci. dans l'Ind. et l'Agr. (IRSIA)
(CRIF-MT-133) Avail: NTIS HC A03/MF A01

The mathematical background for the boundary integral equation method and its situation among other methods of (numerical) analysis is summarized. The method is discussed with respect to its application to the classical problem of the equilibrium of an isotropic elastic body. R.C.T.

N80-29087# National Technical Information Service, Springfield, Va.
WALSH FUNCTIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Brian Carrigan May 1980 115 p Supersedes NTIS/PS-79/0539; NTIS/PS-78/0508
(PB80-810385; NTIS/PS-79/0539; NTIS/PS-78/0508) Avail: NTIS HC $30.00/MF $30.00 CSCL 09D

A bibliography containing 107 abstracts is presented addressing multidisciplinary applications of Walsh functions in signal processing. Emphasis is placed on the use of Walsh functions in information theory, pattern recognition, image processing, data processing, and data transmission. The necessary software and numerical analysis are cited. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-29088*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLES TILL FAILURE OF SILVER-ZINC CELLS WITH COMPLETING FAILURES MODES: PRELIMINARY DATA ANALYSIS
Steven M. Sidik, Harold F. Leibecki, and John M. Bozek 1980 48 p refs Presented at Ann. Meeting of the Am. Statist. Assoc., Houston, Tex., 11-14 Aug. 1980
(NASA-TM-81556; E-517) Avail: NTIS HC A03/MF A01 CSCL 14D

One hundred and twenty nine cells were run through charge-discharge cycles until failure. The experiment design was a variant of a central composite factorial in five factors. Preliminary data analysis consisted of response surface estimation of life. Batteries fail under two basic modes: a low voltage condition and an internal shorting condition. A competing failure modes analysis using maximum likelihood estimation for the extreme value life distribution was performed. Extensive diagnostics such as residual plotting and probability plotting were employed to verify data quality and choice of model. Auhtor

N80-29089# Princeton Univ., N. J. Dept. of Statistics.
A BIWEIGHT APPROACH TO THE ONE-SAMPLE PROLEM
Karen Kafadar Nov. 1979 39 p refs
(Grant DAAG29-76-G-0298)
(AD-A084817; TR-151-SER-2; ARO-14244.11-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

A (t)-like statistic, replacing the classical mean by a biweight in the numerator and the sample variance by a corresponding variance term in the denominator that modifies that used by Gross is proposed and evaluated for its efficiency in constructing confidence intervals in stretched-tailed situations. For the case of many samples of common population width, the method of borrowing estimates of the variance of the numerator via root-mean-squares is considered. The one-sample bi-weight-(t) is shown, via Monte Carlo simulations, to be very efficient for samples of moderate sizes (in terms of expected length of the confidence interval), and combining variance estimates in the denominator is useful when the underlying distribution of the sample is not extremely long-tailed. GRA

N80-29090# Florida State Univ., Tallahassee. Dept. of Statistics.
EXTREME POINTS OF THE CLASS OF DISCRETE DECREAS-

ING FAILURE RATE AVERAGE LIFE DISTRIBUTIONS
Naftali A. Langberg, Ramon V. Leon, James Lynch, and Frank Proschan Apr. 1980 15 p refs
(Contract DAAG29-79-C-0158; Grant AF-AFOSR-3678-78)
(AD-A084796; FSU-Statistics-M541; ARO-16773.11-M; ARO-TR-D-46) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that the class of discrete decreasing failure rate average (discrete DFRA) life distributions is a convex set. The extreme points of this class are then obtained. Finally this report shows how to represent any discrete DFRA life distribution as a mixture of these extreme points. GRA

N80-29091# Naval Postgraduate School, Monterey, Calif.
AN EXAMINATION OF THE PERFORMANCE OF TWO ACCEPTANCE DECISION RULES FOR CURTAILED WALD SEQUENCE SAMPLING PLANS M.S. Thesis
Bambang Murgiyanto Mar. 1980 64 p refs
(AD-A085059) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper examines the implications on acceptance sampling decisions when the Wald Sequential Probability Ratio (SPR) Sampling process is curtailed. Two procedures are proposed to determine the stopping rules. The first procedure uses the scope of the least-square fitted line compared with the slope of the boundary lines of a Wald SPR Sampling Plan. The second procedure uses the relative position of the last observation between the rejection acceptance lines to determine the stopping rules. Computer programs are used to simulate the sampling process, proving estimates of operating characteristic points. GRA

N80-29092# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiaues et Spatiaux.
RAPID ESTIMATION OF THE THREE PARAMETERS OF A WEIBULL LAW [ESTIMATION RAPIDE DES TROIS PARAMETRES D'UNE LOI DE WEIBULL]
Robert Attuly and Christian Bertin Paris 1979 30 p In FRENCH Presented at 37th Tech. Meeting of Avionics Panel on Avionics Reliability, its Tech. and Related Disciplines, Ankara, 9-13 Apr. 1979
(SNIAS-792-422-113) Avail: NTIS HC A03/MF A01

The estimation of the three parameters of the Weibull law is a delicate operation especially with small samples. The maximum likelihood method leads to a system of equations requiring extensive calculations. The saturation method proposed employs the quasi-exhaustivity of a small amount of data associated with the sample and provides results similar to those obtained with the maximum likelihood method. It has however the following advantages: ease of use (graphical or analytical procedures), the sample size is taken into consideration, and only results related to the sample are stored in a memory. The considerations developed lead to a tetra-parametric law by simultaneously generalizing the Weibull Gamma and normal laws. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-29093# Naval Postgraduate School, Monterey, Calif.
REPRESENTATION OF DISCRETE OPTIMIZATION PROBLEMS BY DISCRETE DYNAMICS PROGRAMS
Douglas R. Smith Feb. 1980 31 p refs
(RR0000110)
(AD-A085062; NPS52-80-004) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper investigates the conditions under which a discrete optimization problem can be formulated as a dynamic program. Following the terminology of (Karp and Held 1967), a discrete optimization problem is formalized as a discrete decision problem and the class of dynamic programs is formalized as a sequential decision process. Necessary and sufficient conditions for the representation in two different senses of a discrete decision problem by a sequential decision process are established. In the first sense (a strong representation), the set of all optimal solutions to the discrete optimization problem is obtainable from the solution of the functional equations of dynamic programming. In the second sense (a weak representation), a nonempty subset of optimal solutions is obtainable from the solution of the functional equations of dynamic programming. It is shown that the well known principle of optimality corresponds to a strong representation. A more general version of the principle of optimality is given which corresponds to a weak representation of a discrete decision problem by a sequential decision process. We also show that the class of strongly representable discrete decision problems is equivalent to the class of sequential decision processes which have cost functions satisfying a strict monotonicity condition. Also a new derivation is given of the result that the class of weakly representable discrete decision problems is equivalent to the class of sequential decision processes which have a cost function satisfying a monotonicity condition. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-29094# California Univ., Los Angeles. Dept. of System Science.
THE STABILITY AND STABILIZABILITY OF INFINITE DIMENSIONAL LINEAR SYSTEMS VIA LIAPUNOV'S DIRECT METHOD Ph.D. Thesis
Alan Paul Ross Jul. 1979 114 p refs
(Grants AF-AFOSR-0053-79; NSF ENG-75-11879; AF Proj. 2304)
(AD-A085299; UCLA-ENG-8005; AFOSR-80-0439TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

This dissertation attempts to extend to infinite dimensional linear systems in a Hilbert space some of the stability and stabilizability results that have been obtained for finite dimensional systems using the direct method of Liapunov. The familiar finite dimensional applications of Liapunov's direct method to the stability and stabilizability of linear systems involve the existence of certain positive matrices which satisfy some form of algebraic Riccati equation. Former extensions of these results to infinite dimensional systems in Hilbert space apply exclusively to exponential (uniform asymptotic) stability. Recently, recognizing that exponential stability is a very strong property to expect of some physical systems, some attention has been paid to weaker forms of stability. This thesis generalizes the results of Liapunov's direct method to infinite dimensional systems in a manner that addresses these weaker forms of stability. This is accomplished by developing the distinct concepts of nonnegative, positive, and strictly positive operators. The resulting stability and stabilizability theorems are stated in terms of weak stability, but they are shown to be applicable, in many cases, to strong and exponential stability as well. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-29095*# DyTec Engineering, Inc., Long Beach, Calif.
ATMOSPHERIC TURBULENCE EFFECTS ON AIRCRAFT NOISE PROPAGATION
Robert L. Chapkis Jun. 1979 55 p refs
(Contract NAS1-15321)
(NASA-CR-159325; DyTec-7924) Avail: NTIS HC A04/MF A01 CSCL 20A

The Brown and Clifford model for the apparent sound attenuation cuased by atmospheric turbulence was reviewed and extended. Calculations, based on the model, were made for the predicted sound attenuation for a tower-mounted loudspeaker-type sound source and for an airplane sound source. The important parameters in the model are identified and discussed. A model for sound fluctuations is also presented and a practical experimental program to validate the models described. A.R.H.

N80-29096*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE ELEVENTH ANNUAL PRECISE

TIME AND TIME INTERVAL (PTTI) APPLICATION AND PLANNING MEETING
Schuyler C. Wardrip, ed. 1979 703 p refs Meeting held in Greenbelt, Md., 27-29 Nov. 1979; sponsored by NASA. Goddard Space Flight Center, Naval Electronics Systems Command, Naval Research Lab., Naval Observatory, and Defense Communications Agency
(NASA-CP-2129) Avail: NTIS HC A99/MF A01 CSCL 14B

Thirty eight papers are presented addressing various aspects of precise time and time interval applications. Areas discussed include: past accomplishments; state of the art systems; new and useful applications, procedures, and techniques; and fruitful directions for research efforts. For individual titles, see N80-29097 through N80-29131.

N80-29097*# Defense Communications Engineering Center, Reston, Va.
SUGGESTED ATTRIBUTES FOR TIMING IN A DIGITAL DCS
Harris A. Stover *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 15-29 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A set of suggested attributes for a timing capability for the Defense Communication System which must be capable of supporting full-scale warfare in addition to peacetime needs are presented. Reasons for each attribute are given. R.E.S.

N80-29098*# National Bureau of Standards, Boulder, Colo. Frequency and Time Standards Group.
IMPACT OF IMPROVED CLOCKS AND OSCILLATORS ON COMMUNICATIONS AND NAVIGATION SYSTEMS Special Report
Samuel R. Stein *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 31-39 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A technology assessment of independent precision clocks and oscillators, which are one way of obtaining timing information in distributed systems, is presented. The reliability of the clocks is discussed along with the problem areas which are affecting research and development. Problem areas discussed include: device specifications, production costs, standards, and the use of custom made devices. R.E.S.

N80-29099*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE TIME TRANSFER VIA TDRSS AND APPLICATIONS
Andrew R. Chi *In its* Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 45-64 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The satellite time transfer terminal design concept for the Tracking and Data Relay Satellite System (TDRSS) and the application of the time signal in autonomously operated spacecraft clock are presented. Some pertinent TDRSS parameters and corrections for the propagation delay measurement as well as the time code used to transfer the time signal are given. R.E.S.

N80-29100*# Naval Research Lab., Washington, D. C.
TIMING AND FREQUENCY CONSIDERATIONS IN THE WORLDWIDE TESTING OF A SPREAD SPECTRUM COMMUNICATION SYSTEM
D. G. Woodring, Stephen A. Nichols, and Roger Swanson (AFAL, Wright-Patterson AFB, Ohio) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 65-78 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

During 1978 and 1979, an Air Force C-135 test aircraft was flown to various locations in the North and South Atlantic and Pacific Oceans for satellite communications experiments. A part of the equipment tested on the aircraft was the SEACOM spread spectrum modem. The SEACOM modem operated at X band frequency from the aircraft via the DSCS II satellite to a ground station. For data to be phased successfully, it was necessary to maintain independent time and frequency accuracy over relatively long periods of time (up to two weeks) on the aircraft and at the ground station. To achieve this goal, two Efratom atomic frequency standards were used. The performance of these frequency standards as used in the spread spectrum modem is discussed, including the effects of high relative velocity, synchronization and the effects of the frequency standards on data performance is discussed. The aircraft environment, which includes extremes of temperature, as well as long periods of shutdown followed by rapid warmup requirements, is also discussed. R.E.S.

N80-29101*# National Bureau of Standards, Boulder, Colo.
LIMITATIONS ON LONG-TERM STABILITY AND ACCURACY IN ATOMIC CLOCKS
David J. Wineland *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 81-112 refs Sponsored in part by AFOSR (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The limits to accuracy and long term stability in present atomic clocks are examined. Recent proposals for new frequency standards are discussed along with the advantages and disadvantages of frequency standards based on such ideas as laser transitions, single atoms, and atom cooling. The applicability of some of these new techniques to existing standards is examined. R.E.S.

N80-29102*# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
THE PERFORMANCE OF PRIMARY Cs BEAM CLOCKS USING QUADRUPOLE AND HEXAPOLE DEFLECTION SYSTEMS. CONSEQUENCES FOR TIME KEEPING
Gerhard Becker *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 113-143 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Since 1978 the time-and-frequency standard CS1 of the Physikalisch-Technische Bundesanstalt (PTB) has operated continuously as a 'primary clock'. Its uncertainty (7.1 to the negative 15th power) is considerably smaller than that of the other existing primary standards. The CS1 is equipped with a combination of quadrupole and hexapole magnets and uses a longitudinal C-field. Consequences of utilizing primary clocks of this quality for the generation of the International Atomic Time Scale TAI are discussed. Author

N80-29103*# European Space Agency, Toulouse (France).
THE LASSO EXPERIMENT
Bernard Serene (CNES, Toulouse, France) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 145-170 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

An international coordinated experimental assessment of a system which promises to provide a synchronization of clocks bound to time and frequency standard laboratories, with an accuracy of one nanosecond using existing or near ground-based laser stations via a geostationary satellite (SIRIO-2) is detailed. The system performance and the technical details concerning the on-board equiment, the ground segment, and the operational configuration are discussed. Finally, the future prospects of the LASSO experiment and possible implementations are examined together. M.G.

N80-29104*# National Bureau of Standards, Boulder, Colo.
SOME IMPLICATIONS OF RECIPROCITY FOR TWO-WAY CLOCK SYNCHRONIZATION
James L. Jespersen *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 171-184 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The difficulties related to propagation perturbances in one-way and two-way methods for the synchronization of remote clocks are defined, and a possible means of circumventing these problems

in the two-way method is suggested. In the two-way method, if signals are launched from two sources, A and B, then the two signals arriving at A and B will be displaced in arrival time by an amount that is equal to the difference in launch times of the two signals. Thus, the only condition to comparing clocks is that the medium be isotropic. The practice implementation of this is explored theoretically, in some detail, with respect to the Loran-C navigation system. M.G.

N80-29105*# Bureau International de l'Heure, Paris (France).
EVOLUTION OF THE INTERNATIONAL ATOMIC TIME TAI COMPUTATION
Michel Granveaud *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 185-196 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The computation of the International Atomic Time (TAI), a worldwide time reference, is briefly examined. The types of atomic clocks, computation procedures, and time intercomparison between clocks utilizing navigation satellites are addressed. Changes in the system would essentially depend on the improvement of the atomic clocks. M.G.

N80-29106*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HYDROGEN MASER IMPLEMENTATION IN THE DEEP SPACE NETWORK AT THE JET PROPULSION LABORATORY
Paul F. Kuhnle *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 197-210 (For primary document see N80-29096 19-70)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 14B

The Frequency Standard Test Laboratory and its activities are described. The test laboratory has the capability to measure the frequency stability of five frequency standards including environmental parameters. Nine frequency standards may be evaluated simultaneously upon completion of the current instrumentation expansion program. Frequency stability measurements and environmental data on five H-masers are presented. M.G.

N80-29107*# Naval Observatory, Washington, D. C.
TIME DISSEMINATION: AN UPDATE
Kenneth Putkovich *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 213-233 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A brief description of some of the improvements in the generation and dissemination of precise time and time interval at the U.S. Naval Observation are described. Details on some of the newer hardware developed for this purpose are presented. Data from tests of two of the more significant items, a small portable clock with performance approaching that of larger units and a GPS Time Transfer Unit capable of time transfer to an accuracy of less than 100 nanoseconds, are also given. M.G.

N80-29108*# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
TIME TRANSFER WITH THE NAVSTAR GLOBAL POSITIONING SYSTEM
Ben D. Roth, William Klepczynski (Naval Observatory), and R. Glen Hall (Naval Observatory) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 235-254 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The NAVSTAR global positioning system (GPS) was evaluated and tested in terms of performance. A variety of operational and technical issues were addressed which characterize the performance of the system. The precision and accuracy of the transfer of GPS time to the static user were measured and a base of information was developed that would support and expediate efforts to develop and evaluate specialized user equipment to exhibit the operational GPS's precision timing characteristics. R.C.T.

N80-29109*# Naval Research Lab., Washington, D. C.
PRECISE TIME AND TIME INTERVAL (PTTI) MEASUREMENTS FROM THE NAVIGATION TECHNOLOGY SATELLITES AND THE GPS NAVSTAR-4 SATELLITE
James A. Buisson, Thomas McCaskill, B., O. Jay Oaks, M. M. Jeffries, and S. B. Stebbins *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 255-281 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A time domain estimate for the NAVSTAR-4 SV clock offset was obtained for each SV pass over the GPS monitor sites, using a smoothed reference ephemeris, with corrections for ionospheric delay, tropospheric delay, earth rotation and relativistic effects. Conversion from the time domain to the frequency domain was made using the two sample Allan Variance; sigma-tau plots used to identify the noise processes. Estimates of flicker and white frequency noise for the NAVSTAR-4 rubidium frequency standard were obtained. The contribution of the reference ground clocks and other error sources to the frequency stability estimates were also considered. R.C.T.

N80-29110*# National Bureau of Standards, Boulder, Colo.
TIME RECOVERY MEASUREMENTS USING OPERATIONAL GOES AND TRANSIT SATELLITES
Roger E. Beehler, D. D. Davis, J. V. Cateora, A. J. Clements, J. A. Barnes, and E. Mendez-Quinones *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 283-312 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Results of regular monitoring of both the GOES and TRANSIT timing signals over a number of months at the National Bureau of Standards (NBS), Boulder, Colorado are presented. The TRANSIT results include an analysis of how received timing accuracy and stability are affected by: (1) averaging over varying numbers of satellite passes; (2) averaging over different combinations of the five available satellites; (3) using several independent receivers of the same type; and (4) application of published corrections to the received data. Based on monitoring experience to date at NBS, some pros and cons of using each of the available operational systems are discussed. Updated information on recent improvements incorporated into the GOES time code generation and monitoring system at Wallops Island, Virginia is also included. E.D.K.

N80-29111*# Radio Research Labs., Tokyo (Japan).
T AND F COMPARISONS VIA BROADCASTING SATELLITE AND NAVIGATION TECHNOLOGY SATELLITE
Y. Saburi, Yoshiyuki Yasuda, S. Kobayashi, and T. Sato *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 315-328 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The preliminary time/frequency dissemination experiments were made using the BSE. In order to establish the technique of the doppler shift canceling, the phase control servo including the satellite link and the precompensating frequency control using the measured values or using the orbital data of the satellite are tested. The amount of the residual doppler shift at the control station can be reduced to the order of 1 part in 10 to the 12th power or less by use of the first and the second methods. The method using the orbit data is expected to give a control capability of a few parts in 10 to 11th power. Thus, the maximum value of the doppler shift at the farther most place of the country is estimated to be + or - 2 x 10 to the -10 power without any correction. The experiment of the international time comparison via the NTS 1 was made for about one year since October 1978. The data of time difference between UTC(USNO) and UTC(RRL) are in good agreement with those via the portable clock of the USNO. By applying the correction for ionospheric delay the standard deviation of the data can be reduced to about one-half. E.D.K.

N80-29112*# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ONE WAY TIME TRANSFER VIA METEOSAT CAPABLE OF 30 (ns ACCURACY
Klemens Nottarp, Wolfgang Schlueter, and Udo Huebner (Physik. Tech. Bundesanstalt, Brunswick, West Germany) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 329-342 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The METEOSAT ranging signal's available every 3 hours for about 1.5 minutes, its phase is measured against the second pulses of the station clocks. A system study shows that the accuracy obtainable could be in the order of 30 ns. The receiver unit consists of a 2 m diameter fixed antenna, a low noise broadband receiver, and a phase tracker and demodulator. The overall costs will be less than $20,000 US. E.D.K.

N80-29113*# Institut de Recherche de l'Hydro-Quebec, Varennes.
TIME DISSEMINATION IN THE HYDRO QUEBEC NETWORK
G. Missout, Warren LeFrancois, and Louis LaRoche *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 343-350 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The ever increasing complexity of electrical networks combined with the increasing cost of power losses during a network failure has led public utilities to become equipped with more powerful and precise tools for pinpointing the causes of such a fault. Hydro Quebec has developed and is now using a time dissemination system which uses a modified IRIG B code transmitted on its own telecommunication network. The reasons for using such a system and the way it was carried out are discrete. Author

N80-29114*# Istituto Elettrotecnico Nazionale, Torino (Italy).
TIME CODED DISTRIBUTION VIA BROADCASTING STATIONS
S. Leschiutta, V. Pettiti, and E. Detoma (Bendix Field Engineering Corp., Columbia, Md.) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 351-361 Sponsored by the Consiglio Nazl. delle Ric. Italy (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The distribution of standard time signals via AM and FM broadcasting stations presents the distinct advantages to offer a wide area coverage and to allow the use of inexpensive receivers, but the signals are radiated a limited number of times per day, are not usually available during the night, and no full and automatic synchronization of a remote clock is possible. As an attempt to overcome some of these problems, a time coded signal with a complete date information is diffused by the IEN via the national broadcasting networks in Italy. These signals are radiated by some 120 AM and about 3000 FM and TV transmitters around the country. In such a way, a time ordered system with an accuracy of a couple of milliseconds is easily achieved. Author

N80-29115*# National Bureau of Standards, Boulder, Colo.
VOICE ANNOUNCEMENTS OF TIME: A NEW APPROACH
J. Jespersen, G. Kamas, and M. Weiss *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 363-384 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A technique for generating voice time announcements was investigated. Equipment to convert time codes from several different sources into voice announcements was developed. The major emphasis was directed toward demonstrating the technical feasibility of the approach as well as cost effective implementation. R.C.T.

N80-29116*# National Physical Lab., New Delhi (India).
A STUDY OF TIME DISSEMINATION VIA SATELLITE IN INDIA
B. S. Mathur, P. Banerjee, P. C. Sood, Mithlesh Saxena, Nand Kumar, A. K. Suri, C. L. Jain (Space Applications Centre, Ahmedabad, India), and K. Kumar (Space Applications Centre, Ahmedabad, India) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 387-402 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A simultaneous two way clock synchronization experiment between three Earth stations, was performed and improvements over the technique earlier attempted in which transmit/receive roles of the two stations were alternated at regular intervals, were studied. Time signals via two modes high frequency and satellite were critically monitored and analyzed. This time format was modified to include the additional information about time of the day in year, month, day, hour, minute and second as well as DUT1 in BCD code and was disseminated via the satellite. These signals were decoded, displayed and studied. Some preliminary work on time transfer via TV using direct satellite broadcast, was also conducted. R.C.T.

N80-29117*# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
ADVANCES IN THE STABILITY OF HIGH PRECISION CRYSTAL RESONATORS
Arthur Ballato and John R. Vig *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 403-440 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Advances in technology directed toward minimizing the temporal changes in frequency of crystal resonators are described. Specific emphasis is placed on reducing their susceptibility to temperature, acceleration, and other environmental effects. R.C.T.

N80-29118*# Frequency Electronics, Inc., New Hyde Park, N.Y.
GALILEO QUARTZ CLOCK
Martin Block, Marvin Meirs, M. Rosenfeld, and Peter C. Garriga (Hughes Aircraft Co., El Segundo, Calif.) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 441-455 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A quartz oscillator for use in the Galileo experiment (orbiter and Probe) for Jupiter mission 1982 are described. This oscillator has achieved significant performance breakthroughs by the use of an SC cut, double rotated, crystal in a titanium dewar flask. Some of the performance parameters as well as the design feature of the oscillator are presented. R.C.T.

N80-29119*# Ecole Nationale Superieure de Mecanique et des Microtechniques, Besancon (France).
INITIAL RESULTS ON 5 MHz QUARTZ OSCILLATORS EQUIPPED WITH BVA RESONATORS
Raymond J. Besson and Donald A. Emmons (Frequency and Time Systems, Inc., Danvers, Mass.) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 457-469 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The techniques of fabricating BVA resonators are discussed in terms of aging, amplitude-frequency effect, and acceleration sensitivity. Results on 5 MHz resonators concerning aging versus drive level, reduced amplitude-frequency effect, frequency and phase stability performance, and frequency retrace following power interruption are presented. It is indicated that a zero aging rate is possible at a drive level which depends on the qaurtz material used. For natural AT quartz, a level of 70 to 90 micro W appears to be optimum, and for SC quartz approximately 160 micro W. R.C.T.

N80-29120*# Naval Research Lab., Washington, D. C. E. O. Hulbert Center for Space Research.
TIME TRANSFER VIA SATELLITE-LINK RADIO INTERFEROMETRY
Stephen H. Knowles, W. B. Waltman, J. L. Yen (Toronto Univ.),

W. H. Cannon (York Univ., Toronto), W. Petrachenko (York Univ., Toronto), N. W. Broten (National Research Council, Ottawa), C. Costain (National Research Council, Ottawa), D. H. Fort (National Research Council, Ottawa), J. A. Galt (National Research Council, Penticton), J. A. Popelar (Dept. of Energy, Mines and Resources, Ottawa) et al. *In* NASA. Goddard Space Flight Center. Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting. 1979. p 471-481. refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Very long baseline interferometry using natural radio sources was investigated as a possible time transfer method. Antennas were linked using a synchronous communications satellite instead of the customary independent frequency standards and tape recorders. A successful preliminary time transfer was performed using a wideband data link that was accurate at the 100 nanosecond level, and frequency standards were compared to a part in 10 to the minus thirteenth power over a 24 hour period using a phase coherent satellite link. The narrow band phase coherent link method is potentially capable of timing accuracy of 10 picoseconds, and frequency comparison accuracy of 10 to the minus sixteenth power, and is in addition economical of spectrum usage. R.C.T.

N80-29121*# National Service of Metrology, Delft (Netherlands).
COMPARISON OF DIFFERENT TIME SYNCHRONIZATION TECHNIQUES
Robert Kaarls and G. deJong. *In* NASA. Goddard Space Flight Center. Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting. 1979. p 485-498. refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The plans to set up an international TV synchronization network between four locations are discussed. A feasibility study was conducted between two of the locations and significant results are reported. R.C.T.

N80-29122*# National Research Council of Canada, Ottawa (Ontario).
TWO-WAY TIME TRANSFER VIA GEOSTATIONARY SATELLITES NRC/NBS, NRC/USNO AND NBS/USNO VIA HERMES AND NRC/LPTF (FRANCE) VIA SYMPHONIE
C. C. Costain, J. S. Boulanger, H. Daams, D. W. Hanson (NBS, Boulder), Roger E. Beehler (NBS, Boulder), A. J. Clemets (NBS, Boulder), D. D. Davis (NBS, Boulder), W. J. Klepczynski (USNO, Washington, D.C.), Lester B. Veenstra (COMSAT Labs., Clarksburg, Md.), and J. Kaiser (COMSAT Labs., Clarksburg, Md.). *In* NASA. Goddard Space Flight Center. Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

In most of the experiments, 1 pps pulses of the station atomic clocks were exchanged between the partners, and a cubic equation was fitted to the 1000 to 2000 second measurements. The equations were exchanged and substracted to obtain the time difference of the stations. The standard deviation in the fit of the equations varied, depending on conditions, from 1.5 ns to 16 ns. For the last month of the Hermes experiment, a 1 MHz signal was used, giving a standard deviation of 0.18 ns. The comparison of the time scales via satellite and via Loran-C (BIH Circular D) show clearly that some Loran-C links are very good, but that the NBS link varies by 1 micron s. Via the satellite the frequencies of the time scales can be compared with an accuracy of 2 x 10 to the minus 14 power. A.R.H.

N80-29123*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SIRIO-1 TIMING EXPERIMENT
E. Detoma and S. Leschiutta (Istituto Elettrotecnico Nazionale 'G. Ferraris', Torino, Italy). *In its* Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting. 1979. p 521-556. refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A time synchronization experiment was performed between two ground stations located in the northern and in the central part of Italy. The rf communication channels used are in the SHF region, with the uplink carrier at 18 GHz and the downlink at 12 GHz. One way and two way techniques were evaluated. Two modes of operation were tested in the two way technique: sequential, time multiplexed, signal transmission on the same communication channel; and simultaneous transmission using separate communication channel. In the sequential mode of operation, range and doppler measurements provided by the timing signals were used to account for the satellite motion. A low cost, versatile, time transfer unit (TTU) was designed, to generate the timing signals and the functions (RF carrier and receiver switching, time tagging of the data, etc.) required to perform automatic time synchronization and data acquisition with a minimum of external components. A.R.H.

N80-29124*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
DEMONSTRATION OF REMOTE CLOCK MONITORING BY VLBI WITH THREE BASELINE CLOSURES
Craig M. Cheetham, W. J. Hurd, J. W. Layland, George A. Madrid, and Thomas P. Yunck. *In* NASA. Goddard Space Flight Center. Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting. 1979. p 557-576. refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The capability of very long baseline interferometry (VLBI) to monitor the stability of remotely located hydrogen maser frequency standards has been demonstrated by a series of experiments conducted between Deep Space Stations in Australia, Spain, and California. The measured stabilities of the clock systems, over approximately 10 day intervals, were 1 to 3 parts in 10 to the 13th power, with the instabilities due to the oscillators, the clock distribution systems, the receiving system delays, and the VLBI measurement error. Experiments were conducted independently using two different systems (BLOCK 0 and WBDAS). Later comparison shows agreement on the order of 1 part in 10 to the 13th power. Closure was demonstrated on three separate occasions to 33, 10, and 13 ns with an error uncertainty of + or - 42 ns. The results represent an important consistency check on VLBI measurements. A.R.H.

N80-29125*# Jet Propulsion Lab., La Canada, Calif.
TRAVELING CLOCK VERIFICATION OF VLBI SYNCHRONIZATION
Larry E. Young. *In* NASA. Goddard Space Flight Center. Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting. 1979. p 577-583. ref (For primary document see N80-29096 19-70)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 14B

Four experiments are described which involved measurements of clock offsets at two DSN stations. Both VLBI and traveling clock measurements were performed and the agreement between the two methods was within about 6 ns for all four comparisons. Author

N80-29126*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EARLY RESULTS FROM A PROTOTYPE VLBI CLOCK MONITORING SYSTEM
Thomas P. Yunck and George A. Madrid. *In* NASA. Goddard Space Flight Center. Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting. 1979. p 585-598. refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Four sets of experiments were conducted to measure the relative epoch offsets between atomic clocks in California, Australia, and Spain by means of very long baseline interferometry (VLBI). The experiments were conducted using an incomplete R & D VLBI system with a number of inherent limitations. The results indicate that the measurement objective of epoch offset to 10 nanoseconds will be met. Tables show the measured offset, the residual to fit, and the square root Allan variance. Graphs show the rate change and the rate reset. A.R.H.

N80-29127*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SOURCE STRUCTURE ERRORS IN THE SYNCHRONIZATION OF CLOCKS BY RADIO INTERFEROMETRY
J. B. Thomas. *In* NASA. Goddard Space Flight Center. Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl.

and Planning Meeting 1979 p 599-616 (For primary document see N80-29096 19-70)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 14B

Radio interferometry has the potential of synchronizing clocks across intercontinental distances with accuracies better than one nanosecond. One of the potential error sources in such determinations is the spatial structure of the natural radio sources that provide the reference signals. Due to their extent, the effective position of these sources can vary as a function of the length and orientation of the baseline vector joining the two antennas. If they are not corrected, such variations can lead to errors in clock synchronization. The theory of structure corrections is presented and specific examples are given to illustrate the nature and size of the effect. A.R.H.

N80-29128°# National Bureau of Standards, Boulder, Colo.
PROSPECTS FOR ADVANCES IN MICROWAVE ATOMIC FREQUENCY STANDARDS
Fred L. Walls *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 618-648 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Traditional standards based on rubidium, cesium and hydrogen have been greatly refined over the past decade, such that the frequency stability of the current generation of devices is generally limited by those basic concepts on which they are based. Future advances in frequency stability will principally come from changes in the concepts on which the standards are based, and only secondarily from more careful engineering of the old concepts. The fundamental limitations in these standards are considered and the important conceptual and component advances which could have a major impact on future performance of these standards are indicated. A very promising new class of microwave standards based on ion storage techniques is examined. A.R.H.

N80-29129°# Frequency and Time Systems, Inc., Danvers, Mass.
CLOCK PERFORMANCE, RELIABILITY AND COST INTERRELATIONSHIPS
Martin W. Levine *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 643-655 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Problems encountered by clock manufacturers in attempting to supply reasonably priced, reliable clocks for critical aerospace applications arise from the inherent technical difficulties of designing and fabricating equipment to provide performance at the limits of the state of the art in demanding environments. The difficulties are compounded by inconsistent and unstandardized specification practices, and by an emphasis on initial acquisition costs, rather than on life cycle costs. Conventional parts stress analyses, which do not provide a useful indication of the reliability of a clock, lead to increased parts costs for high performance aerospace clocks without comensurate benefits in improved reliability or performance. The characterization of clocks in terms of the mean time between resynchronizations, facilitates the estimation of life cycle costs and provides a means to evaluate clocks in a realistic fashion for specific systems applications. A.R.H.

N80-29130°# Beijing Inst. of Radio Metrology and Measurements (China).
THE FREQUENCY AND TIME STANDARD AND ACTIVITIES AT THE BEIJING INSTITUTE OF RADIO METROLOGY AND MEASUREMENTS
Hong-Tang Wang *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 657-683 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Three kinds of frequency measuring systems are described: frequency comparison, phase comparison, and time comparison. With the help of the portable cesium clock in determining the time delay between two stations, a time synchronization experiment was conducted using the Symphonie satellite. A result with an accuracy of 30 ns and an uncertainty of about 10 ns was obtained. Another experiment, applying the television pulse technique for time synchronization, yielded a result with an error of about 0.5 mu s in 24 hours. In order to measure the short term frequency stability of crystal oscillators or other frequency sources, a rubidium maser atomic frequency standard was developed as well as a short term stability measuring system. A.R.H.

N80-29131°# National Inst. of Metrology, Beijing (China).
RECENT PROGRESS OF THE RESEARCH WORK ON FREQUENCY AND TIME AT THE NIM
Huang Bingying *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 685-688 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Chinese activities reported include (1) research and development on the primary cesium beam standard and the high precision crystal oscillator; (2) keeping the atomic time and calibrating frequency standards; (3) determining methods for transferring the standard frequency at the highest precision. The primary beam installation gives an accuracy of 1.2 x 10 to the minus 12 power (1 sigma). Improvements are being made to attain an uncertainity goal of the order of 10 to the minus 13 power. Two experiments conducted are described. One involved standard frequency transfer via TV color subcarrier; the other involved time synchronization via Symphonie satellite. The best results are the random fluctuation of direct measurement data is 1 sigma sub r (RMS) = 10 ns, and the absolute error of clock synchronization is 1 sigma sub A (RMS) = 30 ns. A.R.H.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-29132°# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREDICTION OF UNSUPPRESSED JET ENGINE EXHAUST NOISE IN FLIGHT FROM STATIC DATA
James R. Stone 1980 26 p refs Presented at 6th Aeroacoustics Conf., Hartford, Conn., 4-6 Jun. 1980; sponsored by AIAA
(NASA-TM-81537; E-491) Avail: NTIS HC A03/MF A01 CSCL 20A

A methodology developed for predicting in-flight exhaust noise from static data is presented and compared with experimental data for several unsuppressed turbojet engines. For each engine, static data over a range of jet velocities are compared with the predicted jet mixing noise and shock-cell noise. The static engine noise over and above the jet and shock noises is identified as excess noise. The excess noise data are then empirically correlated to smooth the spectral and directivity relations and account for variations in test conditions. This excess noise is then projected to flight based on the assumption that the only effects of flight are a Doppler frequency shift and a level change given by 40 log (1 - m sub 0 cos theta), where M sub 0 is the flight Mach number and theta is the observer angle relative to the jet axis. M.G.

N80-29133°# National Aeronautics and Space Administration, Washington, D. C.
RESEARCH: AIRCRAFT NOISE REDUCTION IN FRANCE
Marc Pianko Jun 1980 17 p refs Transl. into ENGLISH from Voies Aviation Civile (France), 1979 p 31-34 Original language document was announced as A80-21962 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75832) Avail: NTIS HC A02/MF A01 CSCL 20A

In 1967 the French aeronautics industry began extensive research in the field of noise abatement. Substantial progress is shown for both supersonic and subsonic transports as well as for helicopters. L.F.M.

N80-29134# Pennsylvania State Univ., University Park. Applied Research Lab.
AN EXPERIMENTAL ANALYSIS OF THE BASIC PHENOMENA INVOLVED IN MODERN DIFFRACTION THEORIES Ph.D. Thesis
Mark Stiles Lang 21 Jan. 1980 454 p refs
(Contract N00024-79-C-6043)
(AD-A084937; ARL-PSU-TM-80-43) Avail: NTIS HC A20/MF A01 CSCL 20/1

This study utilizes direct experimental techniques to analyze the basic scattering mechanisms that are important to modern diffraction theories. The efforts are intended to supplement and guide the development of theoretical models by exploring parameter ranges and configurations that are intuitive extensions of the cases handled by current prediction techniques. A broad program of experimental investigation of rigid three dimensional scatterers is presented. The thin prolate spheroids is used as a basic model for scattering from smoothly curved bodies. Baffles, cylinders, cones, and cone variants serve for an examination of edges and tips of various orders. In addition to standard pulse measurements with gated receivers, some data are obtained by a holographic imaging technique. The results show that the backscattered pressure from smoothly curved bodies is determined almost exclusively by specular effects, even at wavelengths that are relatively large compared to the appropriate dimensions of the scatterers. Small changes in or additions to the smooth surface, however, modify both the amplitude and directivity of the scattering. The Freedman theory of echo formation is carefully derived, and its predictions are compared with applicable experimental results. GRA

N80-29135# Texas Univ. at Austin. Applied Research Labs.
CHARACTERISTICS OF THE ARL:UT MOVING SOURCE VERTICAL LINE ARRAY PROPAGATION MODEL (OBERON)
Terry L. Foreman and Susan G. Payne 5 Mar. 1980 37 p refs
(Contract N00014-78-C-0329)
(AD-A084824; ARL-TM-80-5) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report describes a moving source vertical line array model based on normal mode theory. A stationary vertical line array consisting of omnidirectional receiver elements is insonified by a point time harmonic source moving with constant speed and direction. The acoustic field generated by the source is computed using normal mode theory with Doppler corrections. The computer model computes beam spectra and features array steering, shading, and Doppler effects such as line shifting and broadening. GRA

N80-29136# Georgetown Univ., Washington, D.C. Dept. of Physics.
NONSPECULAR ULTRASONIC EFFECTS FOR LAYERED MEDIA AND SECOND HARMONICS IN LAMB WAVES Technical Report, 16 Jul. 1979 - 1 Apr. 1980
Noal G. Brower, Douglas Himberger, J. A. McClure, Walter G. Mayer, K. W. Ng, and D. K. Ngoc Apr. 1980 38 p refs
(Contract N00014-78-C-0584)
(AD-A084964; GUUS-04802; TR-2) Avail: NTIS HC A03/MF A01 CSCL 20/1

Theoretical and experimental evidence is given to explain reflectivity and transmissivity of bounded ultrasonic beams impinging on flat solid thin and thick plates immersed in water. Effects are described which have to be considered when high amplitude ultrasonics is used or when the liquid-solid combination differs significantly from the usual metal-water combination of reflecting media. GRA

N80-29137# Illinois Univ. at Urbana-Champaign.
THEORY OF GUIDED ACOUSTIC WAVES IN PIEZOELECTRIC CRYSTALS
Supriyo Datta Jul. 1979 82 p refs
(Contracts DAAG29-78-C-0016; N00014-79-C-0424)
(AD-A085035; R-849; UILU-ENG-78-2242) Avail: NTIS HC A05/MF A01 CSCL 20/1

A non-iterative variational technique for solving the acoustic field equations is applied to three different boundary conditions, namely, a free surface, an edge and a surface with periodic discontinuities. A perturbation approach to surface wave scattering by periodic discontinuities is also developed and used to obtain both the elastic and the piezoelectric scatter matrix of a single electrode in a periodic array directly from the material parameters of the substrate and the electrodes. This scatter matrix accurately predicts the response of surface wave filters, transducers and reflectors. GRA

N80-29138# Research Inst. of National Defence, Stockholm (Sweden).
THE IMPORTANCE OF THE TRANSMISSION CAPACITY OF THE SEA IN HYDROACOUSTIC SYSTEM DESIGN. PART A: UNDERWATER COMMUNICATION [BETYDELSEN AV HAVETS TRANSMISSIONSEGENSKAPER VID KONSTRUKTION AV HYDROAKUSTIKA SYSTEM. A: UNDERVATTENSKOMMUNIKATION]
Tore Pontelius Oct. 1979 29 p refs In SWEDISH
(FOA-C-30167-E2) Avail: NTIS HC A03/MF A01

The classical theory of wave transmission is discussed as it applies to the design of hydroacoustic systems. Time and frequency variability are studied using the concept of point scattering, and with a model of a communication channel. The properties of scattering functions are analyzed in the context of diversity. A model system using actual data is described. Errors, coding considerations, and civilian applications are mentioned. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-29139 California Univ., Berkeley.
SINGLE ELECTRON ATTACHMENT AND STRIPPING CROSS SECTIONS FOR RELATIVISTIC HEAVY IONS Ph.D. Thesis
Henry Joseph Crawford 1979 88 p
Avail: Univ. Microfilms Order No. 8014641

The results of a Bevalac experiment to measure the single electron attachment and stripping cross sections for relativistic (0.5 < beta < 0.95)C, Ne, and Ar ions passing through thin solid targets ranging in atomic number from 4(Be) to 79(Au) are reported. Magnetic analysis was used to separate the single electron, N sub 1, and fully stripped, N sub 0, ion beams emerging from the targets. Separate counters measured the number of ions in each charge state. The ratios N sub 1/N sub 0 for different target thicknesses were fit to a simple growth curve to yield electron attachment and stripping cross sections. The data are compared to relativistic extrapolations of available theories. Clear evidence for two separate attachment processes, radiative and non-radiative, is found. Data are compared to a recently improved formulation for the stripping cross sections. Dissert. Abstr.

N80-29140# Washington Univ., Seattle. Dept. of Physics.
COHERENT SPECTROSCOPY ON SINGLE ATOMIC SYSTEM AT REST IN FREE SPACE, NO. 3 Annual Report, 1 Aug. 1979 - 31 Jul. 1980
Hans Dehmelt Apr. 1980 8 p
(Contract N00014-77-C-0556; Grant NSF PHY-78-08562; NR Proj. 407-003)
(AD-A084395; AR-3) Avail: NTIS HC A02/MF A01 CSCL 07/4

Electric resonances from three isotopes of the Mg+ ion stored in a miniaturized Paul rf trap have now been observed. The feasibility of our laser fluorescence observation and cooling schemes has been demonstrated on the Ba+ and mono-ion oscillator thereby cooled to << 0.1 K. GRA

N80-29141# Georgia State Univ., Atlanta.
THEORETICAL STUDIES OF THE INTERACTION OF RADIATION WITH MATTER Final Report, 1 Sep. 1974 - 31 Dec. 1979
Steven T. Manson 29 Feb. 1980 13 p refs
(Grants DAHC04-74-G-0217; DAAG29-77-G-0063)
(AD-A084911; ARO-1132.14-P; ARO-14560.6-P) Avail: NTIS

HC A02/MF A01 CSCL 07/4

Work on the interaction of radiation with matter is described. In particular photoabsorption by ions and excited states is discussed, along with positive ion properties. Born approximation results for EDST charged particle impact ionization of atoms. The relevance of these areas to various applied areas such as radiation protection and safety, X-ray laser schemes and effects, nuclear pumped lasers, and IR detection is pointed out. GRA

N80-29142# California Univ., Berkeley. Lawrence Berkeley Lab.

HEAVY ION COLLISIONS

Philip J. Siemens. Dec. 1979. 38 p. refs. Presented at Intern. Conf. on High Energy Phys. and Nucl. Struct., Vancouver, Canada, 13 Aug. 1979. Submitted for publication.

(Contract W-7405-eng-48)

(LBL-9595; CONF-790847-17) Avail: NTIS

HC A03/MF A01

The status of research into collisions of nuclei at high energy is reviewed. Reactions and products are classified, spectator matter is discussed and then the thermalization of participant matter is considered at some length. Finally, disintegration of the hot matter is addressed. A - 20 and 40 projectiles of 250 to 1050 MeV/A are employed to illustrate the major points. DOE

N80-29143# Kansas State Univ., Manhattan. Dept. of Physics.

ELECTRON TRANSFER IN ION-ATOM COLLISIONS

C. D. Lin. 1979. 8 p. refs. Presented at 5th Intern. Seminar on Ion-Atom Collisions, Tokai-Mura, Japan, 6-7 Sep. 1979. Sponsored in part by Alfred P. Sloan Foundation.

(Contract DE-AC02-79ER-10514)

(COO-10514-2; CONF-790950-3) Avail: NTIS

HC A02/MF A01

Theoretical development in the understanding of electron transfer processes is reviewed. K-K electron transfer processes are studied for projectiles (nuclear charge Z/sub B/) and targets (nuclear charge Z/sub A/) in which Z/sub A/ and Z/sub B/ range from Z/sub A/ much greater than Z sub/ B/ to Z/sub A/ approximately Z/sub B/, over the energy range 0.1 - v/v sub e/ - 2. DOE

N80-29144# California Univ., Livermore. Lawrence Livermore Lab.

THEORY OF ATOMIC MOTION IN RESONANT RADIATION Ph.D. Thesis

Richard Joseph Cook. Mar. 1980. 138 p. refs.

(Contract W-7405-eng-48)

(UCRL-52925) Avail: NTIS HC A07/MF A01

Atomic motion in resonant and near resonant electromagnetic radiation was investigated theoretically beginning with atomic motion in a resonant standing light wave and isotope separation by selective photodeflection. The Schroedinger equation for atomic motion in a resonant standing wave was solved in the limit of short atom-field interaction time. It is shown that (1) momentum transfer from the field to the atom in a standing wave proceeds at the rate of induced absorption-emission processes rather than at the spontaneous rate characteristic of momentum transfer in a plane running wave, (2) a narrow beam of two level atoms is split by the amplitude gradient of a resonant electromagnetic wave, and (3) an exact solution to the Schroedinger equation for atomic motion in a resonant standing wave can be written in terms of Mathieu functions. Ehrenfest-Bloch formalism is generalized to take account of laser phase fluctuations and the associated finite linewidth of laser radiation and the influence on atomic motion of quantum-mechanical fluctuations of the radiation force is investigated. DOE

N80-29145# Los Alamos Scientific Lab., N. Mex.

ELECTRON EXCITATION COLLISION STRENGTHS FOR POSITIVE ATOMIC IONS: A COLLECTION OF THEORETICAL DATA

A. L. Merts, J. B. Mann, W. D. Robb, and N. H. Magee. Mar. 1980. 227 p. refs.

(Contract W-7405-eng-36)

(LA-8267-MS) Avail: NTIS HC A11/MF A01

Data on theoretical and experimental cross sections for electron impact excitation of positive atomic ions are presented to update and correct a preliminary manuscript which was used during an Atomic Data Workshop on Electron Excitation of Ions held at Los Alamos in November 1978. The current status of quantitative knowledge of collisional excitation collision strengths is shown for highly stripped ions where configuration mixing, relativistic and resonance effects may be important. The results show a reasonably satisfactory state for first row isoelectronic ions and indicate that a considerable amount of work remains to be done for second row and heavier ions. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-29146# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

WAVE-PARTICLE INTERACTIONS ON RELATIVISTIC ELECTRON BEAMS Summary Report, 31 Dec. 1971 - 1 Jun. 1980

Ira B. Bernstein and Jay L. Hirshfield. 16 May 1980. 4 p. ref.

(Contract N00014-79-C-0588; NR Proj. 020-043)

(AD-A085055; Rept-2) Avail: NTIS HC A02/MF A01 CSCL 20/9

Summaries are provided on the following topics: Linearized Theory including Axial Magnetic Field; Non-Linear Theory; Quasi-Linear Theory; and Single Particle Theory for Free Electron Laser with a Strong Axial Field. GRA

N80-29147# Ballistic Research Labs., Aberdeen Proving Ground, Md.

PROFILE: A GENERAL CODE FOR FITTING ION BEAM ANALYSIS SPECTRA

A. Niiler, R. Birkmire, and J. Gerrits. Apr. 1980. 60 p. refs.

(DA Proj. 1L1-61102-AH-43)

(AD-A084984; AD-E430441; ARBRL-TR-02233) Avail: NTIS HC A04/MF A01 CSCL 09/2

A general program for analyzing energy distributions of particles scattered in ion beam experiments has been developed. This program uses numerical integration methods to model elastic scattering and nuclear reaction spectra from known cross sections, energy loss data and assumed depth concentration profiles of surface constituents. Direct comparison of the predicted and experimental distributions yields detailed, quantitative information about these depth concentration profiles in a complicated surface. The program is capable of analyzing all hydrogen or helium ion elastically scattered distributions and the (d,p) nuclear reaction peaks due to carbon, nitrogen, and oxygen. Analysis of the elemental concentration profiles of the surfaces of three different samples is discussed. GRA

N80-29148# Spire Corp., Bedford, Mass.

DIELECTRIC GUIDE CONTROLLED COLLECTIVE ION ACCELERATION Final Report

Kirtland AFB, N. Mex. AFWL. Feb. 1980. 52 p. refs.

(Contract F29601-77-C-0081; AF Proj. 2301)

(AD-A084994; AD-E200467; FR-60015; AFWL-TR-77-248) Avail: NTIS HC A04/MF A01 CSCL 20/7

Experiments performed at Spire and NRL have demonstrated dielectric guide controlled collective ion acceleration. Control of the phenomenon has been established by varying the electron beam parameters or guide geometry. Specifically, it has been shown that: total electron current must exceed the space charge limit; increasing electron current density increases the ion energy; a minimum electron current density is required; increasing guide length (assuming the electron beam can propagate to the end) increases ion energy; increasing guide radius at constant electron current decreases ion energy; and, the energy or charge deposited per unit area of wall controls the velocity of propagation of the electron beam front and therefore the energy of the ions. NRL VEBA results showed that dielectric guide controlled collective ion acceleration is

effective at higher electron beam energies; an electron beam with current pinched on axis is more efficient for ion acceleration; and molding the surface of the guide can control the beam front velocity. GRA

N80-29149# Battelle Memorial Inst., Columbus, Ohio. Office of Nuclear Waste Isolation.
WASTE ISOLATION PERFORMANCE ASSESSMENT: A STATUS REPORT
H. C. Burkholder Nov. 1979 31 p refs
(Contract EY-76-C-06-1830)
(ONWI-60) Avail: NTIS HC A03/MF A01

The assessment of system performance following emplacement of the waste is a key activity in the development of nuclear waste isolation systems. The assessment results provide a technical basis for decisions concerning site selection, repository design selection, engineered barrier selection, and system acceptability, and they bear directly on the central issue of nuclear waste isolation: Do the proposed isolation systems sufficiently protect humans from the waste. The performance assessment problem, general approaches to its solution, and the status of the development, validation, and application of performance assessment technology are described. DOE

N80-29150# Battelle Pacific Northwest Labs., Richland, Wash. Ecological Sciences Dept.
RADIOLOGICAL ASPECTS OF SEA BED DUMPING IN THE DEEP OCEANS
W. L. Templeton 1979 19 p refs Presented at 3rd NEA Seminar on Marine Radioecology, Tokyo, 1-5 Oct. 1979
(Contract EY-76-C-06-1830)
(PNL-SA-8011; CONF-791050-2) Avail: NTIS HC A02/MF A01

A recent radiological assessment of the dumping of packaged radioactive wastes on the seabed is discussed and some environmental aspects of the United States Department of Energy program are described. The feasibility of the emplacement of contained radioactive wastes within the deep ocean sediments is examined. DOE

N80-29151# Hanford Engineering Development Lab., Richland, Wash.
ROLE OF SPENT FUEL CHARACTERIZATION IN THE DEVELOPMENT OF SAFE REPOSITORIES
R. L. Fish, R. B. Davis, and D. A. Cantley Aug. 1979 25 p Presented at the 1st Ann. ONWI Inform. Meeting, Columbus, Ohio, Oct. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1890-FP; CONF-791033-8) Avail: NTIS HC A02/MF A01

Destructive and nondestructive testing methods for characterizing spent nuclear fuels are briefly described. Incorporation of these descriptions into the more comprehensive spent fuel performance prediction model aids in the overall licensing of repositories for permanent disposal of the spent fuel waste form. DOE

N80-29152# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT AND SPACE NUCLEAR SAFETY AND FUELS PROGRAM Progress Report, Jan. 1980
W. J. Maraman, comp. Apr. 1980 25 p
(Contract W-7405-eng-36)
(LA-8311-PR) Avail: NTIS HC A02/MF A01

Results from continuing investigations related to the use of 238PuO2 in radioisotopic power systems are reported. The two programs involved are the general purpose heat source development and space nuclear safety and fuels. A flow apparatus was constructed and used to measure the permeation of air through the fine-weave, pierced fabric 3D graphite. Results show that the graphite does not appear to provide a major barrier to the flow of air into the interior of the heat source module. Results from terrestrial and aquatic environmental tests are also given. M.G.

N80-29153# Brookhaven National Lab., Upton, N. Y.
NONLINEAR INTERACTION OF COLLIDING BEAMS IN PARTICLE STORAGE RINGS
J. C. Herrera and M. Month 1979 23 p Presented at Intern. Conf. on Nonlinear Dyn., New York, 17-21 Dec. 1979
(Contract EY-76-C-02-0016)
(BNL-27390; CONF-791240-1) Avail: NTIS HC A02/MF A01

When two beams of high energy particles moving in opposite directions are brought into collision, a large amount of energy is available for the production of new particles. However, to obtain a sufficiently high event rate for rare processes, such as the production of the intermediate vector boson large beam currents are also required. Under this circumstance, the high charge density of one beam results in a classical electromagnetic interaction on the particles in the other beam. This very nonlinear space charge force, caled the beam-beam force, limits the total circulating charge and, thereby, the ultimate performance of the colliding ring system. The basic nature of the beam-beam force is discussed, indicating how it is quite different in the case of continuous beams, which cross each other at an angle as compared to the case of bunched beams which collide head-on. Some experimental observations on the beam-beam interaction in proton-proton and electron-positron beams are reviewed and interpreted. DOE

N80-29154# Nebraska Univ., Lincoln. Dept. of Chemistry.
HIGH ENERGY HALOGEN ATOM REACTIONS ACTIVATED BY NUCLEAR TRANSFORMATIONS Progress Report, 15 Feb. 1979 - 14 Feb. 1980
Edward P. Rack Feb. 1980 41 p refs
(Contract EY-76-S-02-1617)
(COO-1617-63) Avail: NTIS HC A03/MF A01

High energy reactions of halogen atoms or ions, activated by nuclear transformations, are studied in gaseous, high pressure, and condensed phase saturated and unsaturated hydrocarbons, halomethanes and other organic systems. Results in six areas of investigation are discussed including: (1) reactions of iodine with alkenes and alkynes activated by radiative neutron capture and isometic transition in low pressure gaseous systems; (2) the gas-to-condensed phase transition in halogen high energy chemistry; (3) systematics of halogen hot atom reactions; (4) mathematical and computer simulation studies of caging events within an ice lattice are being investigated; (5) cyclotron-produced chlorine and fluorine hot atoms substitution reactions with molecules possessing a single chiral center; and (6) the applications of high energy techniques and concepts to neutron activation analysis for trace elements and trace molecule determinations in biological systems. DOE

N80-29155# Battelle Memorial Inst., Columbus, Ohio. Office of Nuclear Waste Isolation.
DISPOSAL OF SPENT NUCLEAR FUEL
Dec. 1979 72 p refs
(Contract EY-76-C-06-1830)
(ONWI-59) Avail: NTIS HC A04/MF A01

The mined geologic disposal of spent nuclear fuel from Pressurized Water Reactors and Boiling Water Reactors is addressed. Although some fuel processing options are identified, the isolation of spent fuel in the form in which it is removed from the reactor is emphasized. The characteristics of the waste management system and research which relate to spent fuel isolation are discussed. The differences between spent fuel and processed high level wastes which impact the waste isolation system are defined and evaluated for the nature and extent of that impact. Other waste forms and programs such as geologic exploration, site characterization, and licensing which are generic to all waste forms are also discussed. All evidence to date indicates that there is no reason, based on safety considerations, that spent fuel should not be disposed of as a waste. DOE

N80-29156# National Academy of Engineering, Washington, D. C.
THE OUTLOOK FOR NUCLEAR POWER Final Report
David L. Bazelon, Harvey Brooks, Earnest F. Gloyna, Wolf Hafele, and Willis M. Hawkins Nov. 1979 81 p refs Presented at the Tech. Sess. of the Ann. Meeting of the Natl. Acad. Eng., Washington, D.C., 1 Nov. 1979
(PB80-175755; NAE-AMTS-1979; LC-80-80730; ISBN-0-309-03039-0) Avail: NTIS HC A05/MF A01 CSCL 18I

Papers by authors from backgrounds in law, the aerospace industry, energy modeling, and engineering, focusing on several aspects of nuclear power attempt to present a balanced assessment of nuclear power and its role in the nation's energy future. Topics covered are: need for nuclear power worldwide including risks and benefits; technological improvements in the operation, safety, and reliability of nuclear power facilities; comparison to space program experience and commercial aircraft experience; problem of nuclear waste management; and projections of future world energy supply and demand and the role of nuclear power. GRA

74 OPTICS

Includes light phenomena.

N80-29157*# Hughes Research Labs., Malibu, Calif.
INTEGRATED OPTIC WAVEGUIDE DEVICES Final Report
O. Glenn Ramer May 1980 64 p
(Contracts NAS7-100; JPL-955291)
(NASA-CR-163388) Avail: NTIS HC A04/MF A01 CSCL 20F

Integrated optic waveguide circuits with a phase bias and modulator on the same chip were designed, fabricated, and tested for use in a fiber-optic rotation sensor (gyro) under development. Single mode fiber-optic pigtails were permanently coupled to the four ports of the chip. The switch format was based on coherent coupling between waveguides formed in Z-cut LiNbO3. The control of the coupling was achieved by electro-optically varying the phase propagation constants of each guide. Fiber-to-chip interfacing required the development of appropriate fixturing and manipulation techniques to achieve the close tolerance needed for high coupling efficiency between a fiber with an approximately 5 micron m core and a channel guide with a roughly 2 micron m by 5 micron m cross section. Switch and chip performance at 0.85 micron m is discussed as well as potential improvements related to insertion loss reduction, switching voltages, and suppression of Li2O out-diffusion. A.R.H.

N80-29158# Colorado Univ. at Boulder Electromagnetics Lab.
A HYBRID METHOD FOR PARAXIAL BEAM PROPAGATION IN MULTIMODE OPTICAL WAVEGUIDES
David C. Chang and Edward F. Kuester Jan. 1980 36 p refs
(Grant DAAG29-78-G-0173)
(AD-A084748; SR-54; ARO-15632.3-EL) Avail: NTIS
HC A03/MF A01 CSCL 20/6

A hybrid (non-ray, non-modal) method for computing the fields of a paraxial beam propagating in a multimode waveguide (parallel-plate or dielectric slab) at large axial distances is presented. The method is based on the Fourier and Fresnel self-imaging properties of these waveguides, and is capable of high accuracy. The method is much more efficient than ray or mode approaches, while giving complete field information which coupled-powers equations do not provide. GRA

N80-29159# Spectronics, Inc., Richardson, Tex.
LOW COST FIBER OPTIC MODULE DEVELOPMENT PROGRAM Final Report, Aug. 1978 - Sep. 1979
Ben R. Elmer and Gary R. Mangus Wright-Patterson AFB, Ohio AFAL Dec. 1979 77 p refs
(Contract F33615-78-C-1490; AF Proj. 6096)
(AD-A084882; AFAL-TR-79-1216) Avail: NTIS
HC A05/MF A01 CSCL 20/6

This document is the final report of a development program to design, fabricate, test, and deliver approximately 50 sets of transmitter and receiver modules to transmit data via fiber optic bundles at data rates of 10KB/s to 10MB/s. The modules' inherent characteristics are displayed using block diagrams with each important element of the diagram described. The design, testing, test results, and assembly of the modules are included. Also included are the application sections written to inform users of the characteristics of the modules. GRA

N80-29160# Battelle Pacific Northwest Labs., Richland, Wash.
HIGH THROUGHPUT DIMENSIONAL MEASUREMENTS WITH ELECTRO-OPTICS
K. L. Swinth, R. A. Walker, and N. G. Nedrow 1979 15 p refs Presented at 23rd Ann. Intern. Symp. of the Soc. of Phot. Instrumentation Engr., San Diego, Calif., 27 Aug. 1979 Sponsored in part by U.S. Army
(Contract EY-76-C-06-1830)
(PNL-SA-7737; CONF-790838-5) Avail: NTIS
HC A02/MF A01

The profile monitor was developed to measure part dimensions with a standard deviation of 0.0001 inch at a throughput rate of 1200 parts/minute. It is one measurement system on an advanced high speed inspection system designed to monitor the production of cartridge cases. The profile monitor is an electro-optic system that utilizes fiber optics to project an image of the case onto charged-coupled device image sensors. Measurements are made for five different case dimensions: (1) head thickness, (2) head diameter, (3) extractor groove diameter, (4) gas seal length, and (5) total length. The profile monitor consists of five major elements: the case gauging fixture, the optical system including an illumination source and computer. Electronics consist of the diode array and driver, thresholding circuit, measurement timing logic and data buffers. DOE

N80-29161# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
OPTICAL HETERODYNE RECEPTION FOR A FREE-AIR LASER LINK [RECEPTION OPTIQUE HETERODYNE POUR UNE LIAISON LASER A L'AIR LIBRE: INTERET ET DIFFICULTES DE MISE EN OEUVRE]
Mondher Attia and Philippe Gallion Sep. 1979 102 p refs In FRENCH
(ENST-D-79017) Avail: NTIS HC A06/MF A01

The theoretical and practical aspects of the different elements of a free-space laser transmission/reception system are presented and the corresponding schemas are given. The characteristics of this mode of propagation and the properties of the transmitting medium (atmospheric turbulence) were studied. The following topics are covered: modulators, photodetection and the advantages of heterodyne reception, gas lasers, multimode/single mode conversion, and frequency stability. Author (ESA)

N80-29162# National Bureau of Standards, Washington, D.C. National Engineering Lab.
CONTRIBUTIONS TO COLOR SCIENCE Final Report
Deane B. Judd and David L. MacAdams, ed. Sep. 1979 765 p refs Prepared in cooperation with Rochester Univ., N.Y.
(PB80-174568; NBS-SP-545; LC-76-600132) Avail: NTIS
HC A99/MF A01 CSCL 20F

The contents of this collection include some of the major contributions to such areas as the measurement and specification of color, spectrophotometry, color appearance and spacing, and color vision. Each paper is preceded by an introduction which provides general commentary on the article and explains the terminology used. Some introductions also direct the reader to related articles in the collection and point out significant developments, such as international agreements. GRA

N80-29163# National Bureau of Standards, Gaithersburg, Md. National Engineering Lab.
AN ASSESSMENT OF THE BACKSCATTER TECHNIQUES AS A MEANS FOR ESTIMATING LOSS IN OPTICAL WAVEGUIDES
B. L. Danielson Feb. 1980 88 p refs Sponsored in part by Aerospace Guidance and Metrology Center, Newark AFS, Ohio and Army Communications Command, Ft. Monmouth, N.J.
(PB80-170533; NBS-TN-1018) Avail: NTIS
HC A05/MF A01 CSCL 20F

Some of the problems associated with determining the accuracy of the backscatter technique as it is applied to the estimation of attenuation in optical waveguides are addressed. The basic theoretical assumptions involved in optical time domain reflectometry are reviewed. The effect on calculated loss values resulting from a departure from these assumptions is then examined. Computer modeling permits numerical comparison between the direct (insertion) method of measuring attenuation and several methods of estimating attenuation from analysis of backscatter data. Numerous examples are given of physical effects which can produce discrepancies in attenuation values. Also,

some experimental comparisons are made between backscatter derived and directly measured attenuation values in step and graded index optical waveguides. GRA

N80-29164# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.
COLORIMETRY OF FLUORESCENT SPECIMENS: A STATE-OF-THE-ART REPORT Final Report
Fred W. Billmeyer, Jr. Oct. 1979 49 p refs Sponsored in part by Occupational Safety and Health Administration, Washington, D.C.
(PB80-165590; NBS-GCR-79-185) Avail: NTIS HC A03/MF A01 CSCL 20F
There is a complicating overlapping wavelength region in which both excitation and emission take place. Conformance to better color specifications requires irradiation by a source identical to CIE standard daylight illuminant D65, but existing instrument daylight simulators provide a widely discrepant range of results. Calculation methods are described allowing these results to be converted to those for D65 by computation. Instrument modifications and accompanying material standards are proposed for direct measurements corresponding to D65 irradiation. A proposed field test method and instrument are described. Recommendations for implementing these techniques are made for both short-term and long-term time frames. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-29165 Paris XI Univ., Orsay (France). Inst. d'Electronique Fondamentale.
PRELIMINARY STUDY OF A CARBON ION BEAM (55 MeV) GENERATED PLASMA Final Report [ETUDE PRELIMINAIRE D'UN PLASMA PRODUIT PAR UN FAISCEAU D'IONS CARBONE DE 55 MEV]
Louis Wartski Jul. 1978 23 p ref In FRENCH; ENGLISH summary Presented at the 1st Intern. Symp. on Nucl. Induced Plasmas and Nucl. Pumped Lasers, Orsay, 23-25 May 1978 Submitted for publication
(Contract DGRST-76-7-1439)
Avail: NTIS HC A02
A 0.5NA carbon 12.5 ion beams from a Van de Graaff accelerator was used to simulate a nuclear induced plasma. Gaseous targets in the form or variable pressure (10 to a few hundred torr) pure neon and helium-neon mixtures were used. Classical diagnostic measurements (Langmuir probe, microwave cavity, optical spectroscopy) were made on the plasma generated. It was possible to determine the electron density, temperature and distribution functions of the plasma. Author (ESA)

N80-29166# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
FORCE-FREE ANALYTICAL THREE-DIMENSIONAL TOROIDAL MHD-EQUILIBRIA OF ARBITRARY CROSS SECTION
Ferdinand F. Cap Jun. 1980 21 p refs
(UNICP-FSP-80/1) Avail: NTIS HC A02/MF A01
The equation curl vector B = gamma vector B describing force free MHD equilibria is solved in three dimensional rotational coordinates for a torus with arbitrary cross section. An analytical three dimensional and an axisymmetric two dimensional example is given for a torus of circular cross section. M.G.

N80-29167# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EFFECTS OF IMPURITY IONS ON THE ANOMALOUS DIFFUSION DUE TO THE DISSIPATIVE TRAPPED ION INSTABILITY
Akiyoshi Hatayama and Masatada Ogasawara (Keio Univ.) Jun. 1980 37 p refs
(IPPJ-468) Avail: NTIS HC A03/MF A01
The anomalous diffusion coefficient is evaluated by using renormalized perturbation theory for the turbulent collision. Two cases are investigated for light impurity ions, one in the plateau regime and the other in the banana regime. Time evolution of wave spectrum is solved numerically and then the saturated values of the diffusion coefficients are determined, by taking the density gradient of the impurity in the same direction as that of the bulk plasma. Even with a small concentration of the impurity the diffusion coefficient takes a smaller value for both regime cases. M.G.

N80-29168# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STOCHASTICITY OF PHASE TRAJECTORY OF A CHARGED PARTICLE IN A PLASMA WAVE
Akihiko Murakami, Yasuyuki Nomura, and Hiromu Momota Jun. 1980 48 p refs
(IPPJ-464) Avail: NTIS HC A03/MF A01
Stochastic behavior of charged particles in finite amplitude plasma waves is examined by means of particle simulations under the condition that Chirikov's criterion is broken down. The process of growing the stochastic region is clarified and accordingly the width of the stochastic region is discussed. Discussions on the effects of higher order resonances are also presented. Author

N80-29169# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NUMERICAL STUDY OF LHRF-HEATING IN A TOKAMAK
Tsuyoshi Imai (Japan Atomic Energy Research Inst., Ibaraki), Masao Okamoto, and Takashi Nagashima (Japan Atomic Energy Research Inst., Ibaraki) Jun. 1980 35 p refs
(IPPJ-467) Avail: NTIS HC A03/MF A01
By use of a one dimensional Tokamak transport simulation code, numerical estimations are performed of the experimental results of lower hybrid range of frequency heating in JFT-2 Tokamak. The coupling of a launched electromagnetic wave to a plasma, and propagation and absorption of the wave are considered within the framework of linear theory and the resultant energy deposition is incorporated into the transport code. The result of simulation gives the maximum heating efficiency of the value of 2-3 eV/kW, when the turning point of lower hybrid wave is located near the center of the plasma column, whereas the experiment obtains 1-1.5 eV/kW. Dependences of the heating efficiency on the phase difference between adjacent waveguides and on the density are calculated. It is found that the density dependence is contrary to that of the experiment. The importance of two dimensional propagation and the nonlinear absorption of waves are indicated. M.G.

N80-29170# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANALYSIS FOR PRODUCTION OF FAST IONS IN LASER-IRRADIATED TARGET. 1: IN PLANE TARGET (AFFECTION OF ELECTROSTATIC INSTABILITY)
Hiroyuki Murakami (Metropolitan Coll. of Technology), Shigeo Kawata (Tokyo Inst. of Technology), and Keishiro Niu (Tokyo Inst. of Technology) May 1980 30 p refs 2 Vol.
(IPPJ-465-1) Avail: NTIS HC A03/MF A01
The current density of fast ions which are extracted from a laser irradiated target is analyzed in relation with the current density of fast electrons in a plane and steady framework. The sheath formed by fast electrons plays the extraction mechanism of fast ions from the target. It is pointed out that the two-stream type of instability occurring in the target plays a role in determining the sheath structure and hence the current density of fast ions. M.G.

N80-29171# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANALYSIS FOR PRODUCITON OF FAST IONS IN LASER-IRRADIATED TARGET. 2: IN SPHERICAL TARGET
Hiroyuki Murakami (Metropolitan Coll. of Technology), Shigeo Kawata (Tokyo Inst. of Technology), and Keishiro Niu (Tokyo Inst. of Technology) May 1980 30 p refs 2 Vol.
(IPPJ-466-2) Avail: NTIS HC A03/MF A01
An analysis is given for the current density of fast ions which are extracted from a laser-irradiated spherical target. The thermal spread in velocity of fast electrons being taken into account, the sheath potential formed around the target to extract fast ions is obtained by solving the Poisson equation. The current density of fast ions is directly correlated with the velocity distribution function of fast electrons and the effective frequency of collisions between fast electrons and the target plasma. Author

N80-29172# Nagoya Univ. (Japan). Inst. of Plasma Physics.
LOWER HYBRID HEATING EXPERIMENTS IN JIPP T-2
K. Ohkubo Jun. 1980 11 p refs Presented at the Intern. Conf. on Plasma Phys., Nagoya, Japan, Apr. 1980
(IPPJ-469) Avail: NTIS HC A02/MF A01

Lower hybrid heating carried out in Tokamak and stellarator plasmas is described. The parametric instability and enhancement of the current-driven ion cyclotron instability is observed. In Tokamak, an effective ion heating as high as 120 eV with input power of 120 kW is obtained. In stellarator, the heating efficiency becomes 1 eV/kW at a power of less than 50 kW and above this level the efficiency decreases. The hybrid device and diagnostic methods are described. M.G.

N80-29173# Nagoya Univ. (Japan). Inst. of Plasma Physics.
AN OPTIMIZATION OF FUSION PLASMA PARAMETERS
Hiromu Momota, Yukihiro Tomita, and Yasuyuki Nomura May 1980 123 p refs
(IPPJ-460) Avail: NTIS HC A06/MF A01

The point of enhancement of the plasma Q value Q sub p (fusion power/injection power) and the radiation parameter psi sub r ((charged particles' fusion power radiation power)/fusion power), and optimum plasma conditions are examined. Fusion fuels considered are for D-T, catalyzed D-D, p-(11)B, and p-(6)Li fusion plasmas. Basic equations for optimizations are the energy and particle balance equations and the charge neutrality condition in each fusion plasma. For catalyzed D-D fusion plasmas, results show a remarkable dependence on the plasma beta value. The radiation parameter can be enhanced through the refuelling of fusion produced tritium after transmutation into helium-3. With regard to p-(11)B and p-(6)Li fusion plasmas, the maximum attainable Q sub p is found to be less than unity, and the resultant psi sub r is negative. A case where niobium is present in a fusion plasma as an impurity is also examined. The acceptable niobium concentration is shown for various fusion fuels and operation conditions of fusion plasmas. M.G.

N80-29174# Nagoya Univ. (Japan). Inst. of Plasma Physics.
GENERALIZED GELFAND-LEVITAN EQUATION AND VARIATIONAL RELATIONS OF THE KAUP-NEWELL EQUATION
T. Kawata and J. Sakai May 1980 29 p refs
(IPPJ-463) Avail: NTIS HC A03/MF A01

The generalized Gelfand-Levitan integral equation is derived for solving the inverse problem of Kaup-Newell eigenvalue problem, which makes it possible to solve the derivative nonlinear Schroedinger equation, etc. by the inverse Fourier spectral transform. By this integral equation, the variation of potentials is obtained as a functional of that of scattering data. The inverse functional relation is also given by perturbing the Kaup-Newell equation as to potentials. For both functionals the contribution from the discrete spectrum is obtained and the completeness of squared eigenfunctions is naturally derived. M.G.

N80-29175# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
NUMERICAL STUDY OF OPTICAL RAY RETRACING IN LASER-PLASMA BACKSCATTER
R. H. Lehmberg and K. A. Holder 1 Apr. 1980 51 p refs
(AD-A084987; AD-E000423; NRL-MR-4192) Avail: NTIS HC A04/MF A01 CSCL 20/9

Optical ray retracing in stimulated Brillouin backscatter from laser produced plasmas is studied numerically, using a 2 D propagation code (BOUNCE). This code treats steady state behavior in the strong damping limit, and includes self focusing effects. Ray retracing phenomena are grouped into two limiting cases. In the 'whole beam' limit, the pump field at the lens has a broad spatial profile that can be focused to a long narrow waist within the plasma. This geometry selectively amplifies only those initial noise components that are propagating back along the axis, where the net gain is highest. The simulations show that such effects exhibit a pronounced threshold due to self focusing, and disappear when the focal width becomes comparable to the length of the gain medium. In the opposite limit, where the pump radiation at the lens is dominated by small scale transverse structure, the backscatter can reproduce this structure in detail (i.e., exhibit wavefront reversal) when the far field of the pump produces an interference pattern in the plasma. The plasma then behaves as an active volume hologram as it amplifies the backward-propagating random noise fields. M.G.

N80-29176# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Physics.
STUDY OF THE ANATOMY OF THE X-RAY AND NEUTRON PRODUCTION SCALING LAWS IN THE PLASMA FOCUS (PARTICLE ENERGY SPECTRUM AND OPTIMIZATION CRITERIA) Final Technical Report, 1 Oct. 1978 - 30 Sep. 1979
V. Nardi, W. H. Bostick, and W. Prior Nov. 1979 41 p refs
(Grant AF-AFOSR-2754-75; AF Proj. 2301)
(AD-A084967; SIT-P2002-1179; AFOSR-80-0411TR) Avail: NTIS HC A03/MF A01 CSCL 20/8

Optimum conditions for plasma focus operations have been experimentally analyzed in terms of (A) The fine structure of the axial-current channel during maximum of compression. (B) Correlation coefficient, for neutron yield n (by D2 discharges) and the multiplicity of the electron beam pulses; (C) Different values of the electrode voltage. The current distribution near the axial plasma column during the explosive decay of the column has been monitored and correlated with the electron beam production. Plasma focus discharges by our mode of operation generate high-intensity neutron beams (approximately 100,000 amp) with a > or approximate 300 keV-peaked spectrum and electron beams, with an energy distribution similarly peaked at 300-400 keV. The energy spectrum is determined by two independent methods (time of flight and target-damage data). The spectrum varies from shot to shot but the main features are observed in all discharges. In each discharge we observe (on a time interval of 100-300 nanosec) a sequence of beam pulses (1-10), with the same multiplicity of the peak in the rate of change (dI/dt) of the electrode current I. The filamentary structure of the electron beam and the internal structure of the filament have been analyzed with a space resolution better than approximately 1 micrometers. GRA

N80-29177# Kansas State Univ., Manhattan. Dept. of Nuclear Engineering.
CONCEPTUAL DESIGN OF A COMMERCIAL TOKAMAK HYBRID REACTOR FUELING SYSTEM
Kenneth D. Matney, Hermann J. Donnert, and Tien-Fang Yang (MIT) Dec. 1979 60 p refs
(Contracts DE-AC02-77ET-51010; EG-77-C-02-4231)
(DOE/ET-51010/6; WFPS-TME-79-032) Avail: NTIS HC A04/MF A01

The relative merits of the cold-fueling concept are compared with those of the hot-fueling concept, that is, fueling where the electron is below 1 eV is compared with fueling where the electron temperature exceeds 100 eV. It is concluded that cold-fueling seems to be somewhat more free of drawbacks than hot-fueling. Possible implementation of the cold-fueling concept is exploited via frozen pellet injection. Several methods of achieving frozen pellet injection are discussed and the light-gas-gun approach is chosen from these possibilities. A modified version of the ORNL neutral gas shielding model is used to simulate the pellet injection process. From this simulation, the penetration depth dependent velocity requirement is determined. Finally, with the velocity requirement known, a gas pressure requirement for the proposed conceptual design is established. The cryogenic fuel injection and fuel handling systems are discussed. A possible way to implement the conceptual device is examined along with the attendant effects on the total system. DOE

N80-29178# Los Alamos Scientific Lab., N. Mex.
RESISTIVE G-MODES AND BALLOONING
R. Y. Dagazian, J. P. Mondt, and R. B. Paris (Association Euratom-CEA, Fontenay-aux-Roses, France) 1980 12 p Presented at the Workshop on Optimization of Toroidal Confinement, Hiroshima, 14-17 Apr. 1980
(Contract W-7405-eng-36)
(LA-UR-80-738; CONF-800435-1) Avail: NTIS HC A02/MF A01

A unified theory of the linear stability of the Roberts and Taylor type of resistive interchange and ballooning is presented. The effects of both parallel and perpendicular viscosity as well

as of finite shear and finite beta are included in a MHD treatment of the problem. Kinetic effects are also studied. The hybrid kinetic model with Vlasov ions and guiding center electrons was appropriately generalized to allow for electron-ion collisions. The geometry is that of a plane slab with magnetic shear. DOE

N80-29179# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PERFORMANCE OF A PLASMA JET IGNITER
B. Cetegen, K. Y. Teichman, F. J. Weinberg, and A. K. Oppenheim Jan. 1980 42 p refs Presented at the SAE Automotive Eng. Congr. and Exposition, Detroit, 25 Feb. 1980
(Contract W-7405-eng-48; Grant NSF ENG-78-12372)
(LBL-10365; CONF-800202-3) Avail: NTIS HC A03/MF A01

Experimental and analytical procedures that were developed to determine the performance of a jet igniter with particular emphasis on the fluid mechanic effects are described. The results are based on high speed schlieren cinematography of the combustion process in a cylindrical bomb, and simultaneous pressure transducer measurements. The penetration depth is shown to be proportional to the square root of the characteristic length, the ratio of the volume of igniter cavity to its orifice area. The capability to ignite lean mixtures is demonstrated by the repeatibility of results attained with the use of methane-air mixtures at an equivalence ratio of 0.6, initially at atmospheric pressure and room temperature. While the laminar burning velocity was well within the range reported in the literature, the corresponding turbulent burning velocity was about three times greater, the ratio between the two remaining nearly constant throughout the process. DOE

N80-29180# Los Alamos Scientific Lab., N. Mex.
ZERO DIMENSIONAL PLASMA MODEL AND THE STUDY OF THE INITIAL PERFORMANCE OF THE ZT-40 EXPERIMENT
S. Ortolani (Padova Univ.) Feb. 1980 46 p refs
(Contract W-7405-eng-36)
(LA-8261-MS) Avail: NTIS HC A03/MF A01

The initial performance of the ZT-40 experiment was studied by a zero dimensional plasma model. A computer code (ZCODEX) was written on the PDP-10 to solve the equations of the model. The code was written by adding other equations and terms to the OXYALU code. The main features of the model are summarized, some aspects of how to use the code are described, some results obtained in simulating the ZT-40 experimental performance are discussed. The model is essentially an extension of time dependent impurity radiation calculations. The code, written on the PDP-10, is similar to the one written in Padua on the IBM computer. DOE

N80-29181# Kanner (Leo) Associates, Redwood City, Calif.
NUMERICAL MODELLING OF THE COMPRESSION OF A TOROIDAL PLASMA BY A QUASISPHERICAL LINER
V. A. Gasilov (Adacemy of Sciences, USSR), V. M. Goloviznin (Academy of Sciences, USSR), R. Kh. Kurtmullaev (Academy of Sciences, USSR), V. N. Semonov (Academy of Sciences, USSR), N. V. Sosnin (Academy of Sciences, USSR), V. F. Tishkin (Academy of Sciences, USSR), A. P. Favorskii (Academy of Sciences, USSR), and M. Yu. Shashkov (Academy of Sciences, USSR) 1980 37 p refs Transl. into ENGLISH of Russian preprint "Chislennoe Modelirovanie Kompressii Torodialnoi Plazmy Kvazisfericheskim Lainerom", Akademii Nauk SSSR, Moscow, Inst. Prikladnoi Matematiki, 1979 Prepared for Los Alamos Scientific Lab.
(Contract W-7405-eng-36)
(LA-TR-80-3) Avail: NTIS HC A03/MF A01

The problem of the dynamics of a heavy profiled envelope, compressing a compact plasma toroid with a frozen-in magnetic field, is resolved numerically. It is shown that, by the successful profiling of velocity at the initial moment, such a mode of compression of the plasma may be achieved, that, starting from some time, the form of the cavity under the liner is close to quasispherical. In this mode, the compression coefficient may reach 1000. DOE

N80-29182# Ad-Ex International, Portola Valley, Calif.
TRANSVERSE CONFINEMENT OF HIGH-PRESSURE PLASMA IN A CORRUGATED MAGNETIC FIELD
S. L. Musher (Academy of Science, USSR) and M. D. Spektor (Academy of Science, USSR) Nov. 1979 25 p refs Transl. into ENGLISH from preprint no. 94, Novosibirsk, 1979 Submitted for publication Sponsored by DOE Prepared for California Univ., Lawrence Livermore Lab., Livermore
(UCRL-Trans-11527) Avail: NTIS HC A02/MF A01

The confinement of a high pressure plasma in a multimirror magnetic configuration with a corrugated metallic shell is studied analytically and numerically. Equations that describe the dynamics of a dense plasma in a corrugated magnetic field are derived and it is shown that the structure of the magnetic field lines is preserved when the hot plasma expands transversely, and that the energy lifetime tau sub perpendicular is of order R(2)/chi (where chi is Bohm's thermal diffusivity). DOE

N80-29183# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.
BLANKET DESIGN STUDY FOR A COMMERCIAL TOKAMAK HYBRID REACTOR (CTHR)
D. L. Chaplin, L. Green, A. Y. Lee, M. E. Culbert, and J. L. Kelly Sep. 1979 129 p refs
(Contract EG-77-C-02-4544)
(WFPS-TME-79-021) Avail: NTIS HC A07/MF A01

The results are presented of a study on two blanket design concepts for application in a commercial Tokamak hybrid reactor. Both blankets operate on the U-Pu cycle and are designed to achieve tritium self-sufficiency while maximizing the fissile fuel production within thermal and mechanical design constraints. The two blanket concepts that were evaluated were: (1) a UC fueled, stainless steel clad and structure, helium cooled blanket; and (2) a UO2 fueled, zircaloy clad, stainless steel structure, boiling water cooled blanket. Two different tritium breeding media, Li2O and LiH, were evaluated for use in both blanket concepts. The use of lead as a neutron multiplier or reflector and graphite as a reflector was also considered for both blankets. DOE

N80-29184# Kansas State Univ., Manhattan. Dept. of Chemistry.
EXPERIMENTAL INVESTIGATION OF THE CHEMISTRY OF EXCITED STATES OF RARE GASES Final Report, 15 Oct. 1978 - 14 Oct. 1979
D. W. Setser Feb. 1980 11 p refs
(Contract EY-76-S-02-2807)
(COO-2807-19) Avail: NTIS HC A02/MF A01

The status of photosensitized studies of reactions of Xe(p-3(2)) and Kr(p-3(1)) with fluorine, chlorine, bromine, and iodine donors is reported. Results for KrCl and KrF are summarized. DOE

N80-29185# General Atomic Co., San Diego, Calif.
PRELIMINARY RESULTS OF NONCIRCULAR PLASMA EXPERIMENTS IN DOUBLET 3
Tihiro Ohkawa Feb. 1980 17 p refs Presented at Intern. School of Plasma Phys. Workshop, Varenna, Italy, 27 Aug. - 8 Sep. 1979 Submitted for publication
(Contract DE-AT03-76ET-51011)
(GA-A-15801) Avail: NTIS HC A02/MF A01

Preliminary results of noncircular plasma experiments in doublet plasmas with high-Z limiters are described. Electron energy confinement and maximum plasma density are in agreement with standard circular Tokamak empirical scaling laws. Chromium and molybdenum appear to be the dominant high-Z contaminants while carbon appears to dominate low-Z contaminants. High-Z impurity radiation does not appear to dominate the central power balance. DOE

N80-29186# Fom-Instituut voor Atoom- en Molecuulfysica, Amsterdam (Netherlands).
THE ENERGY CONFINEMENT IN HIGH-DENSITY TOKAMAKS
D. C. Schram (Eindhoven Univ., Netherlands) and F. C. Schueller Sep. 1979 45 p refs Sponsored by EURATOM and Nederland Organization voor Zuiver-Wetenschappelijk Onderzoek (ZWO)
(Rept-77-104) Avail: NTIS HC A03/MF A01

A method based on the assumption that the experimental profiles can be approximated by Gaussians is presented. Analytic expressions for various plasma quantities as a function of the radius are given. The ohmic power input is compared with the power transported by ion heat conduction for a typical discharge

in Alcator. This comparison shows that, within the radius of interest for confinement properties, the plateau-ion heat conduction is the major loss mechanism. Author (ESA)

N80-29187# Fom-Instituut voor Atoom- en Molecuulfysica, Amsterdam (Netherlands).
LOW-FREQUENCY MODES WITH HIGH TOROIDAL MODE NUMBERS: A GENERAL FORMULATION
F. Pegoraro and T. J. Schep Sep. 1979 63 p refs Sponsored by EURATOM, Nederland Organization voor Zuiver-Wetenschappelijk Onderzoek (ZWO) and Scuola Normale Superiore, Pisa, Italy
(Rept-77-119) Avail: NTIS HC A04/MF A01

Low frequency waves with high toroidal mode numbers in an axisymmetric toroidal configuration are studied. In particular, the relationship between the periodicity constraints imposed by the geometry, magnetic shear and the spatial structure of eigenmodes is investigated. By exploiting the radial translational invariance and the poloidal periodicity of the gyro-kinetic and Maxwell equations, the two dimensional problem can be converted into a one dimensional one and the mode structure can be expressed in terms of a single extended poloidal variable. This representation is used in the description of electromagnetic modes with phase velocities larger than the ion thermal velocity and with frequencies below the ion gyro-frequency. Trapped particle curvature and compressional effects are retained. The dispersion equations for drift modes and Alfven-type modes are given in general geometry and simplified solutions are presented in the configuration of a double periodic plane slab. Author (ESA)

76 SOLID-STATE PHYSICS

includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-29188 California Univ., Berkeley.
DENSITY VARIATION IN THE ELECTRON-HOLE LIQUID IN STRESSED GERMANIUM AND SILICON Ph.D. Thesis
Susan Mary Kelso 1979 411 p
Avail: Univ. Microfilms Order No. 8014758

The variation in electron hole pair density in the electron-hole liquid (EHL) in stressed Ge and Si was investigated. First, the variation of the density and other properties of the EHL was studied theoretically as a function of uniaxial stress in both Ge and Si. Second, the variation of the density with position was studied both theoretically and experimentally in the strain confined electron hole liquid (SCEHL) in Ge. The properties of the strain confined EHL were determined from measurements of the recombination luminescence with spatial, time, and spectral resolution, as a function of excitation level, magnetic field, temperature, and stress. The compression of the SCEHL at higher excitation levels was investigated in detail. It is shown theoretically that the density should vary with position, with the magnitude of the variation increasing with drop size. Dissert. Abstr.

N80-29189 Cornell Univ., Ithaca, N. Y.
A STUDY OF THE STRUCTURAL PROPERTIES OF METALLIC SYSTEMS. 1: METALLIC HYDROGEN. 2: CORE-POLARIZATION AND THE STRUCTURE OF SIMPLE METALS Ph.D. Thesis
Kin Keung Mon 1980 127 p
Avail: Univ. Microfilms Order No. 8015712

Upper bounds for the ground state energies of liquid and solid phases of metallic hydrogen and metallic deuterium were calculated with variational methods and Monte Carlo techniques. At four densities (r_s = 0.8, 1.2, 1.36, and 1.488) crystalline phases are clearly preferred in the sense that the energy difference when compared to the liquid is in excess of the errors inherent in the numerical procedures. At a fifth density, (r_s 1.6), the energy differences between solid and liquid phases are smaller than these errors. Liquid simple metals such as Ga and Sn have static structure factors S(k) that appear to depart appreciably from the predictions of standard central force models of liquid structure. They are shown to be a consequence of corresponding structure introduced into the effective ion-ion interaction by the inclusion of dynamically screened fluctuating dipole interactions between ion cores. A calculation of the effective ion-ion potential therefore requires a knowledge of the frequency dependent ionic and electron gas polarizabilities and the one-electron pseudopotential. Model potentials based on reasonable estimates of all of these are used in conjunction with simulation (Monte Carlo) methods to show that the structural anomalies can indeed be attributed to corepolarization effects. Dissert. Abstr.

N80-29190*# Duke Univ., Durham, N. C. Center for Solid-State Power Conditioning and Control.
RESEARCH ON DESIGN FEASIBILITY OF HIGH-POWER LIGHT-WEIGHT dc-TO-dc CONVERTERS FOR SPACE POWER APPLICATION Semiannual Status Report, period ending 31 May 1980
Thomas G. Wilson 31 May 1980 47 p refs
(Grant NsG-3157)
(NASA-CR-163375; SASR-6) Avail: NTIS HC A03/MF A01 CSCL 20L

The development of 5 kW converters with 100 kHz switching frequencies, consisting of two submodules each capable of 2.5 kW of output power, is discussed. Two semiconductor advances allowed increased power levels. Field effect transistors with ratings of 11 A and 400 V were operated in parallel to provide a converter output power of approximately 2000 W. Secondly, bipolar power switching transistor was operated in conjunction with a turn-off snubber circuit to provide converter output power levels approaching 1000 W. The interrelationships between mass, switching frequency, and efficiency were investigated. Converters were constructed for operation at a maximum output power level of 200 W, and a comparison was made for operation under similar input/output conditions for conversion frequencies of 20 kilohertz and 100 kilohertz. The effects of nondissipative turn-off snubber circuitry were also examined. Finally, a computerized instrumentation system allowing the measurement of pertinent converter operating conditions as well as the recording of converter waveforms is described. M.G.

N80-29191*# Rockwell International Science Center, Thousand Oaks, Calif.
THE 3-5 SEMICONDUCTOR SOLID SOLUTION SINGLE CRYSTAL GROWTH Annual Report, 6 Apr. 1979 - 15 Mar. 1980
E. R. Gertner May 1980 50 p refs
(Contract JPL-955352)
(NASA-CR-163395; JPL-9950-380; SC5210.24AR) Avail: NTIS HC A03/MF A01 CSCL 20L

Techniques used for liquid and vapor phase epitaxy of gallium indium arsenide are described and the difficulties encountered are examined. Results show that the growth of bulk III-V solid solution single crystals in a low gravity environment will not have a major technological impact. The float zone technique in a low gravity environment is demonstrated using cadmium telluride. It is shown that this approach can result in the synthesis of a class of semiconductors that can not be grown in normal gravity because of growth problems rooted in the nature of their phase diagrams. A.R.H.

N80-29192# Princeton Univ., N. J.
FREE SURFACE PROPERTIES OF 3-5 COMPOUND SEMICONDUCTOR SURFACES Final Report, 1 Apr. 1974 - 31 Mar. 1980
A. Kahn Jun. 1980 20 p refs
(Grants DAHC04-74-G-0133; DAAG29-77-G-0116)
(AD-A085303; ARO-11671.18-EL; ARO-14710.12-EL) Avail: NTIS HC A02/MF A01 CSCL 20/12

Studies of free compound semiconductor surfaces as well as gas-solid and metal-solid interaction are summarized. An experimental and theoretical analysis of the GaAs(110) surface reconstruction was conducted and applied to three additional compounds: InSb, InP and ZnTe. Attempts were made to relate the type and the magnitude of the surface reconstruction of these materials to the covalent-ionic character of the bonding. Knowledge of the atomic reconstructions of these surfaces was used to investigate the reactivity of semiconductor surfaces (GaAs(110)) with gas (oxygen) and metal (aluminum) atoms. These multicomponent systems are at the center of the author's

essays to understand the chemistry of these surfaces and its relationship with their atomic reconstruction. Using Low Energy Electron Diffraction (LEED) as the principal tool to investigation, structural information has been obtained which correlates chemical and electronic information obtained by other surface analysis techniques. GRA

N80-29193# Naval Research Lab., Washington, D. C. Radiation-Matter Interaction Branch.
USING THE BINARY-COLLISION CASCADE SIMULATION CODE MARLOWE ON THE ASOC
G. P. Mueller 20 Mar. 1980 4 p
(RR0120141)
(AD-A084988; AD-E000421; NRL-MR-4193) Avail: NTIS HC A02/MF A01 CSCL 20/2

The binary-collision cascade simulation code MARLOWE is used to study the effects of irradiations on crystalline materials. We modified the IBM version of MARLOWE to run on the Texas Instruments ASC at NRL. This report outlines the changes made in the code and details how NRL users can access the code. GRA

N80-29194# Army Electronics Research and Development Command, Fort Monmouth, N. J.
QUARTZ CRYSTAL FABRICATION FACILITY Final Report, 1 Apr. 1977 - 30 Sep. 1979
R. J. Ney May 1980 65 p refs
(Contract DE-AC04-76DP-00656)
(AD-A084788; ERADCOM-HH610964CPW3/02A) Avail: NTIS HC A04/MF A01 CSCL 13/8

The report describes the design and operation of a five chamber, interconnected vacuum system, which is capable of cleaning, plating, and sealing precision quartz crystal units in ceramic flatpack enclosures continuously in a high vacuum environment. The production rate design goal was 200 units per eight hour day. A unique nozzle beam gold deposition source was developed to operate for extended periods of time without reloading. The source puts out a narrow beam of gold typically in the order of 2 1/2 deg included cone angle. Maximum deposition rates are in the order of 400 a/min at 5.5 in. 'throw' distance used. Entrance and exit air lock chambers expedite the material throughput, so that the processing chambers are at high vacuum for extended periods of time. A stainless steel conveyor belt, in conjunction with three vacuum manipulators, transport the resonator components to the various work stations. Individual chambers are normally separated from each other by gate valves. The crystal resonators, mounted in flatpack frames but unplated, are loaded into transport trays in a lid-frame-lid sequency for insertion into the system and exit as completed crystal units. The system utilizes molybdenum coated ball bearings at essentially all friction surfaces. The gold sources and plating mask heads are equipped with elevators and gate valves, so that they can be removed from the system for maintenance without exposing the chambers to atmosphere. GRA

N80-29195# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
A STUDY OF FLICKER NOISE IN MOSFETS Final Report, 16 Mar. 1979 - 15 Mar. 1980
A. VanderZiel May 1980 13 p refs
(Contract DAAG29-79-C-0078)
(AD-A085278; ARO-16441.4-EL) Avail: NTIS HC A02/MF A01 CSCL 09/1

Work accomplished and published between March 1979 and March 1980 involving the high-frequency excess noise and flicker noise in GaAs MESFETs, the high-frequency excess noise and flicker noise in MOSFETs, noise in triodelike JFETs, and noise in two MOSFET types made by the DMOS process is reviewed. GRA

N80-29196# Illinois Univ. at Chicago Circle, Chicago. Dept. of Physics.
PHOTOLYTIC PRODUCTION OF EXCITED STATES AND COLLISIONAL PHENOMENA FOR LASER FUSION APPLICATIONS
R. T. Hawkins and C. K. Rhodes Dec. 1979 137 p refs
(Contracts DE-AS08-78DP-40025; ED-78-S-08-1603)
(NVO-1603-2) Avail: NTIS HC A07/MF A01

The development and use of high spectral brightness rare gas halogen sources are discussed. At 248 nm, a source whose spectral width and beam divergence approach the fundamental limits of physical optics is described. This device is clearly scalable to terawatt power levels. Such high brightness devices can be readily utilized to examine a broad range of atomic and molecular phenomena pertinent to laser development. These studies include state specific kinetic processes, excited state photoionization, electron collisional mechanisms, and a variety of multiquantum processes. DOE

N80-29197# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
MICROSTRUCTURE DEVELOPMENT AND INTERFACE STUDIES IN THICK FILM CONDUCTOR SYSTEMS Ph.D. Thesis
V. K. Nagesh Dec. 1979 147 p refs
(Contract W-7405-eng-48)
(LBL-9274) Avail: NTIS HC A07/MF A01

A Thick film conductor system which used acid treated (.01N HCl) lead borosilicate glass particles with chemically coated metal (silver) film was developed. Using only 40 wt% metal (silver), sheet resistivities as low as 45 milliohms/sq were obtained in this system. Detailed study of the microstructure development was done. Effect of the acid treatment of the glass particles prior to the metal coating was analyzed. The X-ray photoelectron spectra studies showed preferential leaching of lead and boron from the surface of the glass. Good bonding between silver film and the glass was attributed to the oxidation of silver (to form Ag(+)) in the presence of oxygen and H(+) ions on the glass surface (from acid treatment) and subsequent diffusion of Ag(+) into the glass to form a continuous chemical interface. A model to predict sheet resistivities of the new thick film conductors was developed. DOE

N80-29198# National Technical Information Service, Springfield, Va.
IMPATT DIODES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
William E. Reed Apr. 1980 203 p Supersedes NTIS/PS-79/0296; NTIS/PS-78/0380
(PB80-808322; NTIS/PS-79/0396; NTIS/PS-78/0380) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

Government sponsored research reports are cited covering the design, characterization, and applications of IMPATT diodes. Topics include reliability, power handling, properties, noise, fabrication, and radiation effects. The use of silicon and gallium arsenide IMPATT diodes for microwave generation and amplification is included. This updated bibliography contains 182 abstracts, 14 of which are new entries to the previous edition. GRA

N80-29199# National Technical Information Service, Springfield, Va.
IMPATT DIODES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Mar. 1980
William E. Reed Apr. 1980 178 p Supersedes NTIS/PS-79/0398; NTIS/PS-78/0381
(PB80-808330; NTIS/PS-79/0398; NTIS/PS-78/0381) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

Research reports covering the design, characterization, and applications of IMPATT diodes are cited from worldwide research. Topics include reliability, power handling, properties, noise, fabrication, and mathematical analysis. The use of silicon and gallium arsenide IMPATT diodes for microwave generation and amplification are included. This updated bibliography contains 171 abstracts, 63 of which are new entries to the previous edition. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-29200 Pennsylvania State Univ., University Park.
THERMODYNAMIC AND MOLECULAR PROPERTIES IN HIGH TEMPERATURE GASEOUS SYSTEMS Ph.D. Thesis
David Louis Drapco 1980 159 p
Avail: Univ. Microfilms Order No. 8015793

The structure and thermodynamic properties of high temperature vapors were investigated. Vapor pressures of Tl2Cl2(g) were measured relative to TlCl(g) by Knudsen effusion mass spectrometry in the temperature range 543 to 615 K. Absolute pressures were determined by comparison with the known vapor pressure of TlCl(g). Thermodynamic functions were also determined for TlCl(g) and Tl2Cl2(g) based upon recent spectroscopic data.
Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-29201# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
OPEN-LOOP SOLUTIONS FOR THE DYNAMIC ROUTING PROBLEM
Samuel Shats and Adrian Segall May 1980 49 p refs
(Contracts N00014-75-C-1183; N00014-77-C-0532)
(AD-A085109; LIDS-R-992) Avail: NTIS HC A03/MF A01 CSCL 12/2

This work deals with the problem of obtaining an open-loop solution to the minimum delay dynamic routing problem. The dynamic routing problem is stated using a dynamic model suggested in previous works. This work uses some previously known properties of the optimal solution and formulates the routing problem as a cubic optimization problem. In general such problems are very hard to solve; however, the specific problem at hand is finally formulated as a nonconvex quadratic program by using its special structure. Two different approaches, based on the latter representation of the problem, are proposed: (a) utilization of existing methods for solving nonconvex quadratic programs, (b) development of a special purpose algorithm. The algorithm is developed for single destination networks with unity weightings in the cost functional, and it finds the optimal solution by solving a series of linear programs. The algorithm is based on a series of specially developed theorems. These theorems provide use with new insight into the behaviour of the dynamic routing in networks. The method is implemented by a computer program and several examples are run to test its applicability.
GRA

N80-29202# Federal Coordinating Council for Science, Engineering and Technology, Washington, D. C.
A RESEARCH AND DEVELOPMENT MANAGEMENT APPROACH: REPORT OF THE COMMITTEE ON APPLICATION OF OMB CIRCULAR A7-76 TO R AND D
31 Oct. 1979 105 p refs
(PB80-170053) Avail: NTIS HC A06/MF A01 CSCL 05A

The general policy of the Government is established to buy the products and services it needs and to provide them, using Government resources, only on an exception basis. The need for research and development activities as a Government function is recognized through the inclusion of an 'in-house core capability' in the area of research development and testing. It is also recognized that additional guidance is required to apply the policy to research and development activities and an interagency committee under the auspices of the Federal Coordinating Council for Science, Engineering and Technology was established to study the issues and recommended guidelines for consistent and uniform agency implementation.
GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-29203# General Accounting Office, Washington, D. C. Program Analysis Div.
THE NATIONAL SCIENCE FOUNDATION'S MANAGEMENT INFORMATION SYSTEM: A STATUS REPORT
8 Apr. 1980 77 p
(AD-A084753; GAO/PAD-80-7) Avail: NTIS HC A05/MF A01 CSCL 05/1

The review of the current status of the National Science Foundation's management information system and its plans for making needed improvements focuses on identifying changes planned or in process, quality controls, user satisfaction, and cost. Reliability problems, including inaccurate and incomplete data and slow response time at computer terminals, seriously impair the system's effectiveness and frustrate its users. Recommendations for management and technical improvements made by a Foundation consultant 3 years ago have not been carried out. September 1979 study of system performance also pointed out the need for many system improvements. The Foundation can increase system reliability by improving quality control, system response time, long-range planning, performance evaluation, and administrative management. The Foundation also should determine users' needs, and establish specific, quantified goals and target dates for correcting deficiencies.
GRA

N80-29204# Naval Postgraduate School, Monterey, Calif.
ON-LINE REAL-TIME MANAGEMENT INFORMATION SYSTEMS AND THEIR IMPACT UPON USER PERSONNEL AND ORGANIZATIONAL STRUCTURE IN AVIATION MAINTENANCE ACTIVITIES M.S. Thesis
Benjamin A. Bayma, Jr. Dec. 1979 97 p refs
(AD-A085111) Avail: NTIS HC A05/MF A01 CSCL 15/7

The introduction of a new technology into an organization can significantly impact the organization's effectiveness. Some possible effects on user personnel and organizational structure during and after the implementation of an on-line real-time computer-based management information system are explored in this thesis. The organizational structure and Management Information Service (MIS) users within aviation maintenance activities are identified. The possible impact on the informal and formal decision-making structures within these activities is predicted using a contingency model. Possible implementation strategies to minimize that impact and maximize the probability of MIS implementation success are investigated. The Naval Aviation Logistics Command Management Information System (NALCOMIS) is used as a vehicle to predict possible implementation impacts and strategies. The NALCOMIS Project Manager and his staff are provided with a partial list of possible problems areas to be aware of during NALCOMIS implementation.
GRA

N80-29205# Battelle Columbus Labs., Ohio. Tactical Technology Center.
EVALUATION OF DATA MANAGEMENT FOR INSTALLA-

TION RESTORATION Final Report, Jun. 1977 - Feb. 1978
T. J. Thomas and G. J. Kovacs 28 Feb. 1978 53 p refs
(Contract DAAK40-73-C-0142)
(AD-A084777; BATT-CDIR-1-1; DRXTH-TD-CR-80067) Avail: NTIS HC A04/MF A01 CSCL 09/2

An external evaluation of the Data Management Program for the Operations of the Installation Restoration program is presented. Specific recommendations are made for the improvement of the Data Management Program. These recommendations cover management of the data log books, extra data fields to input error estimates, data, and free-form comments, system input stability, and required data sampling plans. In addition, a review of contaminant models is presented. Finally, a weakness in the quality control is presented, and a management information system is discussed. GRA

N80-29206# Executive Office of the President, Washington, D. C. Office of Administration.
TOWARD AN INFORMATION EFFICIENT EXECUTIVE OFFICE OF THE PRESIDENT
15 Feb. 1980 75 p refs
(PB80-167406) Avail: NTIS HC A04/MF A01 CSCL 05B

The political/policy decision making process is examined in terms of more efficient use of available information. The organization of the information to be accessed and improved support services are among the topics discussed. The role of the information processing systems in providing support services and automation of clerical activities are considered. J.M.S.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-29207# Fondazione Ugo Bordoni, Rome (Italy).
MINIMUM COST FLOW IN AN ORIENTED GRAPH [FLUSSO DI COSTO MINIMO IN UN GRAFO ORIENTATO]
Giancarlo Pesamosca Mar. 1979 12 p refs In ITALIAN Presented at Intern. Conf. on Nonlinear Optimization and Appl., l'Aquila, 18-20 Jun. 1979
(FUB-4-1979) Avail: NTIS HC A02/MF A01

A procedure to determine minimum cost flow for arbitrary cost functions is presented. The procedure is derived as an improvement to Klein's, which is limited to linear or convex cost functions. However, determination of an absolute minimum is not guaranteed for the cases of nonlinear or concave functions. Author (ESA)

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-29208# Department of Energy, Washington, D. C. Office of Transportation Programs.
CHARGE OF THE FUTURE: AN INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES
Sep. 1979 75 p
(DOE/CS-0107) Avail: NTIS HC A04/MF A01

The past history and present development of electric vehicles are described. The Congressional focus on electric and hybrid vehicles and their reappraisal in light of environmental and energy concerns are addressed. In the near term, electric vehicles are neither intended nor expected to compete directly with internal combustion engine vehicles. DOE

N80-29209# Sandia Labs., Albuquerque, N. Mex.
STRATEGY FOR ASSESSING THE TECHNICAL, ENVIRONMENTAL AND ENGINEERING FEASIBILITY OF SUBSEA-BED DISPOSAL
D. R. Anderson, H. Herrmann, J. Kelly, and D. M. Talbert 1980 32 p refs Presented at 2nd Intern. Ocean Disposal Symp., Woods Hole, Mass., 15 Apr. 1980
(Contract EY-76-C-04-0789)
(SAND-79-2245C; CONF-800420-2) Avail: NTIS HC A03/MF A01

The strategy and management techniques used in the development of the US Subseabed Disposal Program (SDP) for possible disposal of both high-level waste and spent fuel are presented. The various components which make up the SDP strategy and management techniques are addressed. These include high-level waste and spent fuel disposal program and the position that the SDP occupies within that program; the technical and administrative tools which are employed to facilitate the day-to-day operation of the SDP; the current studies and future plans for addressing the legal, political, and international uncertainties that must be resolved prior to the time the SDP reaches the final engineering phases. DOE

N80-29210# Societe Nationale Industrielle Aerospatiale, Paris (France). Div. Systemes Balistiques et Spatiaux.
AEROSPACE TECHNOLOGY TRANSFER [RETOMBEES DE TECHNOLOGIE SPATIALES]
Didier Compard 3 Sep. 1979 36 p In FRENCH Presented at AFAS Ann. Congr. 'La Conquete de l'Espace', Tregastel, France, Sep. 1979
(SNIAS-792-422-112) Avail: NTIS HC A03/MF A01

The French policy for technology transfer from the aerospace industry is outlined. Some significant and promising candidates include: energy storage, electricial and magnetic components, medical equipment, and composite materials (carbon-carbon). Author (ESA)

N80-29211# Transportation Research Board, Washington, D.C.
TECHNOLOGY TRANSFER, THE RESEARCH PROCESS, AND CREATING A PRODUCTIVE ENVIRONMENT
W. L. Garrison, Robert C. Crawford, Al B. Linhares, George F. Linsteadt, Milton P. Criswell, James F. Shamblin, Dean Anklan, Dale E. Peterson, Robert P. Schmitt, and Edward A. Beimborn 1979 58 p refs
(PB80-173875; TRB/TRR-738; ISBN-0-309-02993-7; LC-80-12980; ISSN-0361-1981) Avail: NTIS HC A04/MF A01 PC also available from Transportation Research Board, 2101 Constitution Ave., NW., Washington, D.C. CSCL 13B

Several views of technology transfer and research and their effective utilization with an emphasis on transportation technology are presented. Federal, state, and local programs and activities for transportation technology transfer are examined. Also, the effectiveness of a research program, the role of management support for research, and the development of multidisciplinary research programs is addressed. GRA

N80-29212# Executive Office of the President, Washington, D. C.
BASIC AUTOMOTIVE RESEARCH IN THE DEPARTMENT OF TRANSPORTATION
Feb. 1980 29 p
(PB80-170020) Avail: NTIS HC A03/MF A01 CSCL 05A

Institutional and administrative arrangements necessary for the Dept. of Transportation to participate in the Industry/Government Cooperative Automotive Research Program are described. GRA

N80-29213# Baldwin (Fred D.), Carlisle, Pa.
THE NATIONAL CENTER FOR APPROPRIATE TECHNOLOGY: AN EVALUATION AT THE END OF ITS SECOND PROGRAM YEAR
Fred D. Baldwin and Laurence F. Kinney 30 Jun. 1979 87 p
(PB80-166184; CSA-LN-2414) Avail: NTIS
HC A05/MF A01 CSCL 05A

Management of the National Center for Appropriate Technology (NCAT) is evaluated. During its first year, NCAT built up a competent technical staff and launched some promising in-house work, but otherwise largely dissipated its small resources, even after allowance was made for the inevitability of start up problems. During its second year, however, it has made a remarkable recovery, in part by adopting more conventional priorities and management methods. In several areas, it is still spreading its resources too thinly. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-29214 Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
HIGH ENERGY X-RAY OBSERVATION OF THE X-RAY BINARY 4U1700-37
W. Pietsch, W. Voges, C. Reppin, J. Truemper, E. Kendziorra (Tuebingen Univ., West Germany), and R. Staubert (Tuebingen Univ., West Germany) Oct. 1979 19 p refs Submitted for publication Sponsored in part by Deut. Forschungsgemeinschaft
(MPI-PAE/Extraterr-157; ISSN-0340-8922) Avail: Issuing Activity

During a 54 hr balloon flight from Alice Springs, Australia, on November 22-24, 1978 the X-ray binary 4U1700-37/HD153919 was observed in the energy range 20-180 keV for about two hours on each of three consecutive days. During one observation when the source was in binary eclipse no X-rays were detected from the source region. Flare type variability was seen up to a factor of 25, on time scales of minutes to hours. The source shows a thermal bremsstrahlung spectrum with a temperature kT = 28 keV which does not change significantly during the outbursts. This behavior is discussed in terms of current models for the accretion onto nonmagnetic neutron stars. Author (ESA)

N80-29215# Lowell Observatory, Flagstaff, Ariz.
LOWELL PROPER MOTIONS 19: PROPER MOTION SURVEY IN THE SOUTHERN HEMISPHERE WITH THE 13 INCH PHOTOGRAPHIC TELESCOPE OF THE LOWELL OBSERVATORY
H. L. Giclas 10 Jul. 1979 10 p refs
(Grant NSF AST-77-25117)
(Lowell-Bull-165-Vol-8) Avail: NTIS HC A02/MF A01

A catalog including 174 stars having proper motions greater than 0.19 sec/year is presented. The position angle, blue magnitude, and star color are also indicated. The plate region is designated G158 ii and centered at RA 00(h)12(m).4 Dec -9 deg 51 min. M.G.

N80-29216# Lowell Observatory, Flagstaff, Ariz.
LOWELL PROPER MOTION SURVEY: SUMMARY CATALOG OF GD AND GR STARS PROPER MOTION SURVEY WITH THE 13 INCH PHOTOGRAPHIC TELESCOPE OF THE LOWELL OBSERVATORY
H. L. Giclas, R. Burnham, Jr., and N. G. Thomas 17 Mar. 1980 50 p refs
(Grant NSF AST-77-25117)
(Lowell-Bull-166-Vol-8) Avail: NTIS HC A03/MF A01

A summary catalog listing 1712 white dwarf suspects and 504 very red stars all with proper motions < 0.20 sec/year is presented. The proper motion is given in seconds of arc per year for motion greater than 0.06 sec/year. Motion 0.06 sec/year or less is designated slight; and the position angle is rounded to the nearest 5 degrees. Motion 0.03 sec/year or less is also indicated. Estimates of the blue magnitude, star colors, photometry, and spectral type (if determined) are given. M.G.

N80-29217*# Harvard Univ., Cambridge, Mass.
HIGH RESOLUTION IMAGING AT LARGE TELESCOPES
P. Nisenson, R. Stachnik, C. Papaliolios, and Adelaide Hewitt, ed. May 1980 18 p refs Presented at the Kitt Peak Natl. Obs. Conf. on Opt. and Infrared Telescopes for the 1990's, Proc., Vol. 1, Tucson, Ariz., 7-12 Jan. 1980
(Grant NGR-22-007-228; Contract F19628-78-C-0026)
(NASA-CR-163393) Avail: NTIS HC A02/MF A01 CSCL 03A

Image recovery at a resolution limited only by diffraction is now possible at large telescopes. The theory of speckle image reconstruction is explained and the current status of a video recording and digitization system for the reconstruction procedure is described. Potential applications of the process when used with very large telescopes are discussed. The constraints on telescope design imposed by these techniques are listed. A.R.H.

N80-29218*# California Univ., Berkeley. Dept. of Astronomy.
ULTRAVIOLET OBSERVATIONS OF M32, A COSMOLOGICAL COMPARISON Final Report
Hyron Spinrad Jun. 1980 10 p refs
(Grant NsG-5360)
(NASA-CR-163371) Avail: NTIS HC A02/MF A01 CSCL 03A

The average spectral energy distribution for a sample of 3200 A. Spectral synthesis indicates that elliptical galaxies are most likely older than 9 Gyrs. The ultraviolet flux is consistent with a population of red horizontal branch stars, as those present in metal-rich globular clusters. Data for distant (Z approximately 1) first ranked cluster galaxies show indications of spectral evolution. Author

N80-29219*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ADVANCED X-RAY ASTROPHYSICS FACILITY (AXAF): SCIENCE WORKING GROUP REPORT
May 1980 182 p
(NASA-TM-78285) Avail: NTIS HC A09/MF A01 CSCL 03A

The Advanced X-Ray Astrophysics Facility (AXAF) mission concept is examined from a scientific viewpoint. A brief description of the development of X-ray astronomy and a summary description of AXAF, the scientific objectives of the facility, a description of representative scientific instruments, requirements for X-ray ground testing, and a summary of studies related to spacecraft and support subsystems, are included. E.D.K.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-29220*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
EXOSPHERIC PERTURBATIONS BY RADIATION PRESSURE. 2: SOLUTION FOR ORBITS IN THE ECLIPTIC PLANE
Joseph W. Chamberlain 1980 20 p refs Sponsored in part by NSF
(Grant NsG-7043)
(NASA-CR-163373) Avail: NTIS HC A02/MF A01 CSCL 03B

The instantaneous rates of change for the orbital elements eccentricity, longitude of perigee from the Sun, and longitude from the Sun of the ascending node are integrated simultaneously

for the case of the inclination i = 0. The results confirm the validity of using mean rates when the orbits are tightly bound to the planet and serve as examples to be reproduced by the complicated numerical solutions required for arbitrary inclination. Strongly bound hydrogen atoms escaping from Earth due to radiation pressure do not seem a likely cause of the geotail extending in the anti-sun direction. Instead, radiation pressure will cause those particles' orbits to deteriorate into the Earth's atmosphere. A.R.H.

N80-29221# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
BACKSTREAMING IONS OUTSIDE THE EARTH'S BOW SHOCK AND THEIR INTERACTION WITH THE SOLAR WIND
C. Bonifazi, A. Egidi, G. Moreno, and S. Orsini. Jun. 1979. 36 p. refs. Submitted for publication.
(LPS-79-9) Avail: NTIS. HC A03/MF A01.

Plasma data supplied by the satellite ISEE 2 has confirmed the existence in the solar wind of two different ion populations (referred to as reflected and diffuse) backstreaming from the Earth's bow shock. The two populations have similar bulk velocities and flux densities, but quite different temperatures. In addition, the diffuse ions strongly interact with the solar wind, producing fluctuations in the distribution of the proton velocities, while the reflected ions do not disturb significantly the incoming solar wind. The origin of the two ion populations is discussed. The results seem to favor a model which explains the appearance of the diffuse population as the result of an interaction of the reflected ions with the solar wind. Author (ESA)

N80-29222# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
HIGH TIME RESOLUTION OBSERVATIONS OF THE SOLAR WIND IN THE EARTH'S FORESHOCK REGION
V. Formisano, S. Orsini, C. Bonifazi, A. Egidi, and G. Moreno. Oct. 1979. 22 p. refs. Submitted for publication.
(LPS-79-13) Avail: NTIS. HC A02/MF A01.

The interaction of the solar wind with ions backstreaming from the Earth's bow shock was studied at high time resolution using the solar wind experiment on the ISEE 2 satellite. It was found that the bulk velocity of the solar wind oscillates, both in magnitude and direction, with typical periods of one minute in presence of the 'diffuse' ion population. Oscillations of comparable periods were also observed in the angular distribution and energy spectrum of the diffuse ions. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology, and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design, Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-29223*# Howard Univ., Washington, D. C.
OH AND NH EMISSION STUDIES OF COMET KOHOUTEK
Final Report
C. K. Kumar. [1980]. 11 p. refs.
(Contract NsG-5021)
(NASA-CR-160005) Avail: NTIS. HC A02/MF A01. CSCL 03B.

A 30 inch flat mirror was used with the solar telescope of the Kitt Peak National Observatory to obtain the integrated disc spectrum of the Sun between the wavelengths of 3000A and 4000A at a resolution of about two hundred thousand. The data obtained were used to calculate the intensities of the fluorescent lines of the OH radical in comets. The results were compared with those obtained using the center of the disc spectrum only. The wavelength of the reference point and the dispersion from which the wavelength of other points can be obtained are presented in tabular form. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-29224*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
THE DISTRIBUTION OF MAXIMUM TEMPERATURES OF CORONAL ACTIVE REGION LOOPS
E. B. Mayfield and R. G. Teske (Michigan Univ., Ann Arbor). 15 May 1980. 37 p. refs.
(Contract NAS8-33112)
(NASA-CR-161527; ATR-80(7813)-1) Avail: NTIS. HC A03/MF A01. CSCL 03B.

The emission measure distribution across the range 4.5 < log T < 6.5 was derived for several coronal active regions by combining EUV line fluxes with broadband X-ray fluxes. The distributions of the maximum temperature was then derived using a numerical model. It is shown that the emission measure distribution can be represented over the full range 5.6 log Tm < 6.5 by the superposition of simple loop models, if the models incorporate a substantial rise in their individual emission measure distributions near the maximum temperature. The unresolved loops may have substantial area ratios, since it is this ratio that fixes the extent of the rise in the emission measure distribution. Since the bulk of the emission measure is then contributed from the loop tops, the distribution of maximum temperatures has approximately the same shape as does the integrated emission measure distributions. The EUV and X-ray data used were obtained by from two separate experiments on ATM/Skylab. A.R.H.

N80-29225# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
PROPERTIES OF MAGNETOHYDRODYNAMIC TURBULENCE IN THE SOLAR WIND
M. Dobrowolny, A. Mangeney (Observatoire de Meudon), and P. L. Veltri (Cosenza Univ.). Jan. 1979. 27 p. refs.
(LPS-79-1) Avail: NTIS. HC A03/MF A01.

Using incompressible magnetohydrodynamics, information on the nature of the MHD turbulence observed in the trailing edges of high velocity streams in the solar wind was derived. This turbulence is characterized to a good degree, by the absence of nonlinear wave interactions. The turbulence is a mixture of modes with polarization of Alfvenic and slow magnetosonic types. A theoretical model of MHD turbulence, satisfying some observational constraints, is used to calculate a variance matrix and interpret the main results of the minimum variance analysis of magnetic data. Author (ESA)

N80-29226# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
HIGH-SPEED SOLAR WIND STREAMS AND GALACTIC COSMIC RAY MODULATION
N. Iucci (Rome Univ.), M. Parisi, M. Storini, and G. Villoresi. Jun. 1979. 32 p. refs. Sponsored by Italian National Research Council.
(LPS-79-10) Avail: NTIS. HC A03/MF A01.

Two classes of fast solar wind streams are identified: quiet streams, coming from near equatorial holes, the stream interface is in the initial phase, followed by low proton density, quiet interplanetary magnetic field with constant polarity and proton temperature following the wind speed time profile; perturbed streams, coming from active regions producing type 4 solar flares, for which the previous requirements are not satisfied. Superposed epoch analyses applied to solar wind speed and neutron monitor intensity show that during the highspeed streams presumably coming from coronal holes the cosmic ray intensity is depressed; the time behavior of this depression follows the time profile of the wind speed to be determined. The perturbed streams are accompanied by Forbush decreases whose amplitude and time behavior are not directly related to the speed increase. Author (ESA)

N80-29227# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE CHEMICAL COMPOSITION OF THE SUN
G. Moreno and C. Bonifazi. Nov. 1979. 62 p. refs.

best copy available

(LPS-79-15) Avail: NTIS HC A04/MF A01

The present status of knowledge of the Sun's chemical composition is reviewed. Photospheric, chromospheric and coronal abundances of the different elements are first studied separately and then compared to check the chemical homogeneity of the solar atmosphere. Photospheric abundances are also compared with those of the carbonaceous chondrites to get information on the chemical composition of the primordial nebula from which the solar system originated. Author (ESA)

N80-29228# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 425, JANUARY 1980. PART 1: PROMPT REPORTS. DATA FOR DECEMBER 1979, NOVEMBER 1979
Helen E. Coffey, ed. Jan. 1980 157 p.
(PB80-166218; SGD-425-Pt-1; NOAA-80022801) Avail: NTIS HC A08/MF A01 CSCL 03B

In addition to an index for 1979, this prompt report provides data for December 1979 on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, solar wind measurements, infrared interplanetary magnetic field polarities, mean solar magnetic field, coronal holes, and Boulder Geomagnetic Substorm Log. It also provides data for November 1979 on: daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar emission, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N80-29229# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 425, JANUARY 1980. PART 2: COMPREHENSIVE REPORTS. DATA FOR JULY 1979
Helen E. Coffey, ed. Jan. 1980 38 p.
(PB80-166226; SGD-425-Pt-2; NOAA-80022802) Avail: NTIS HC A03/MF A01 CSCL 03B

In addition to an index for 1979, this issue of comprehensive reports provides data for July 1979 on: solar radio emission, energetic solar particles, and plasma and solar X-ray radiation. The miscellaneous data includes the coronal holes and spacecraft observations for November 1979, cosmic rays for September 1979, and geomagnetic indices for October 1979. GRA

N80-29230# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 422, OCTOBER 1979, PART 1 (PROMPT REPORT) Data Report, Sep. - Aug. 1979
Helen E. Coffey. Oct. 1979 183 p.
(PB80-174527; SGD-422-Pt-1; NOAA-79112302) Avail: NTIS HC A09/MF A01 CSCL 03B

This prompt report provides data for September 1979 on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observation, coronal holes, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, and Boulder Geomagnetic Substorm Log. It also provides data for August 1979 on: daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N80-29231# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 422, OCTOBER 1979, PART 2 (COMPREHENSIVE REPORTS) Data Report, Feb. 1979 - Apr. 1979
Helen E. Coffey, ed. 15 Aug. 1980 96 p.
(PB80-174535; SGD-422-Pt-2; NOAA-79112303) Avail: NTIS HC A05/MF A01 CSCL 03B

This comprehensive report provides data for April 1979 on: solar radio emission, energetic solar particles and plasma, and solar X-ray radiation. The data for February 1979 consists of: solar flares, synoptic charts, and abbreviated calendar record. The miscellaneous data includes daily solar indices, solar radio emission for July and August 1979, solar wind measurement, for August 1979, geomagnetic indices July 1979, and regional flare index for January 1979. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-29232 Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrisch Physik.
COMPTON SCATTERING MODEL FOR THE GAMMA RAY EMISSION OF NGC 4151
K. Pinkau. Nov. 1979 20 p. refs. Submitted for publication (MPI-PAE/Extraterr-159) Avail: Issuing Activity

It is shown that electron lifetimes against Compton losses in NGC 4151 are 2-3 weeks and thus sufficiently large to allow burst-like injection of electrons. Electron pile-up accurately explains the observed gamma ray spectrum and cut-off. The total energy content of the burst must then have been of the order of 10 to the 51st power ergs. If this model is correct, the gamma ray spectrum must be highly time variable. Author (ESA)

N80-29233# Magnetic Observatory, Hermanus (South Africa).
HERMANUS NEUTRON MONITOR DATA, 1978
1979 55 p.
(CSIR-MAG-D13; ISBN-0-7988-1625-2) Avail: NTIS HC A04/MF A01

Corrected and uncorrected Hermanus neutron monitor data are presented in tabular form. In addition, barometric pressure, graphs of corrected Potchefstroom and Hermanus monitor data, and the ratio Potchefstroom corrected counts/Hermanus corrected counts are given. The Hermanus 12 NM 64 monitor consists of two separate neutron monitor piles: a 3 NM pile with additional paraffin wax shielding and a regular 9 NM. The monitor is located at an elevation of 26 meters above mean sea level and geographic coordinates of lat. 34 deg 25 min S., long. 19 deg 13 min E. M.G.

N80-29234*# National Aeronautics and Space Administration, Washington, D. C.
QUASARS: ACTIVE NUCLEI OF YOUNG GALAXIES
B. V. Komberg. 29 May 1980 20 p. refs. Transl. into ENGLISH of "Kvazary - Aktivnyye Yadra v Molodykh Galaktikakh". Rept. Pr-358 Acad. of Sci. USSR, Moscow, 1977 25 p. Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76233; Pr-358) Avail: NTIS HC A02/MF A01 CSCL 03B

The hypothetical properties of 'young' galaxies and possible methods of observing them are discussed. It is proposed that star formation first takes place in the central regions of protogalaxies which may appear as quasar-like objects. An evolutionary scheme is outlined in which the radio quasars are transformed in time into the nuclei of radio galaxies. Author

N80-29235*# National Aeronautics and Space Administration, Washington, D. C.
DETERMINATION OF THE TIME OF OCCURRENCE OF GAMMA FLARES AT DIFFERENT POINTS IN SPACE
B. L. Novak. Jun. 1980 16 p. refs. Transl. into ENGLISH of "Opredeleniye Vremeni Proskhozhdeniya Gamma-Vspleskom Raznykh Tochek Kosmicheskogo Prostranstva". Rept. Pr-352 Acad. of Sci. USSR, Moscow, 1977 16 p. Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3199)
(NASA-TM-76236; Pr-352) Avail: NTIS HC A02/MF A01 CSCL 03B

The problem of determining the time of occurrence of gamma flares at different points in space is considered. This problem arises in the localization of sources of gamma flares by the triangulation method using several spacecraft. A study is made of different methods for determining the time at which the flare reaches the spacecraft and algorithms are given for estimating their accuracy. Results of processing the model information are also given. L.F.M.

N80-29236# Los Alamos Scientific Lab., N. Mex. Nuclear Chemistry Group.
LUNAR RADIONUCLIDE RECORDS OF AVERAGE SOLAR-COSMIC-RAY FLUXES OVER THE LAST TEN MILLION YEARS
Robert C. Reedy 21 Mar. 1980 44 p refs Presented at the Lunar and Planetary Inst. Topical Conf. on the Ancient Sun, Boulder, Colo., Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-928; CONF-7910123-4) Avail: NTIS HC A03/MF A01

Because changes in solar activity can modify the fluxes of cosmic-ray particles in the solar system, the nature of the galactic and solar cosmic rays and their interactions with matter are described and used to study the ancient Sun. The use of cosmogenic nuclides in meteorites and lunar samples as detectors of past cosmic ray variations are discussed. Meteorite records of the history of the galactic cosmic rays are reviewed. The fluxes of solar protons over various time periods as determined from lunar radionuclide data are presented and examined. The intensities of solar protons emitted during 1954 to 1964 (11 year solar cycle number 19) were much larger than those for 1965 to 1975 (solar cycle 20). Average solar proton fluxes determined for the last one to ten million years form lunar AL-26 and Mn-53 data show little variation and are similar to the fluxes for recent solar cycles. DOE

N80-29237# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
COSMIC RAY NM-84 NEUTRON MONITOR DATA-6, JANUARY - DECEMBER 1977 (ROME, ITALY)
G. Villoresi, N. L. Zangrilli, A. Felici, F. Re, and F. Signoretti Jan. 1979 30 p refs Prepared in cooperation with Rome Univ., Italy
(LPS-79-2) Avail: NTIS HC A03/MF A01

Pressure-corrected data from the Rome neutron monitor and barometric pressure data are given in tabular form for the year 1977, together with the graphs of the corrected intensity. Details on the devices employed, operational mode and data handling are given. Author (ESA)

N80-29238# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
COSMIC RAY NM-84 NEUTRON MONITOR DATA-7, JANUARY - DECEMBER 1978 (ROME, ITALY)
G. Villoresi, N. L. Zangrilli, A. Felici, F. Re, and F. Signoretti Mar. 1979 32 p refs Prepared in cooperation with Rome Univ., Italy
(LPS-79-4) Avail: NTIS HC A03/MF A01

Pressure-corrected data from the Rome neutron monitor and barometric pressure data are given in tabular form for the year 1978, together with the graphs of the corrected intensity. Details on the devices employed, operational mode and data handling are given. Author (ESA)

N80-29239# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE COSMIC RAY STORM OF FEBRUARY 16, 1978
N. Iucci (Rome Univ.), M. Parisi, M. Storini, G. Villoresi, and N. L. Zangrilli Jun. 1979 16 p refs Sponsored by Italian National Research Council
(LPS-79-8) Avail: NTIS HC A02/MF A01

During the Forbush decrease of February 14, 1978 a huge cosmic ray decrease lasting 10 hours was observed by neutron monitoring stations. A detailed analysis, performed on data of numerous neutron monitors, shows that this event was a bidirectional anisotropy with a cosmic ray density gradient being from a plane tilted 30 deg with respect to the Earth equator, the interplanetary magnetic field should be perpendicular to that plane. Author (ESA)

99 GENERAL

N80-29240# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
[GERMAN AEROSPACE RESEARCH ACTIVITIES FOR 1978] Annual Report
1979 161 p refs In GERMAN Original contains color illustrations
Avail: NTIS HC A08/MF A01

Research activities are outlined in the following areas: transportation and communication systems; aerospace technology; solar energy; aerospace materials; aerodynamics; data processing; meteorology; and Spacelab collaboration. Author (ESA)

N80-29241# National Bureau of Standards, Washington, D.C.
DIMENSIONS/NBS, VOLUME 64, NO. 1, FEBRUARY 1980
Feb. 1980 29 p refs
(PB80-169527; NBS-DIM-64/1) Avail: NTIS HC A03/MF A01 CSCL 14B

Major technical developments, works in progress, major speeches, and statements by Bureau management, and a list of NBS publications are presented. Topics covered include: (1) the use of standard reference materials to assure quality and provide equity for consumers and producers; (2) computer models of energy and economic systems for operations research; (3) attaining improved values of fundamental physical constants such as gas constants, Rydberg constant, and electron-photon mass ratio; (4) gas standard reference materials for emissions testing of heavy duty motor vehicles; (5) eddy current imaging system; (6) calculating atomic properties; and (7) the resolution of photon-recoil components of the visible line spectral line. A.R.H.

N80-29242# National Bureau of Standards, Washington, D.C.
DIMENSIONS/NBS, VOLUME 64, NO. 2, MARCH 1980
Mar. 1980 40 p refs
(PB80-169535; NBS-DIM-64/2) Avail: NTIS HC A03/MF A01 CSCL 14B

Methods for evaluating symbols to determine the effectiveness of pictograms in communication are described. The interactions between the chemistry of metals and the biology of microorganisms are examined in an effort to develop antifouling paints for ship hulls. Methods for more rapid measurements and for process control in the production of semiconductors for very large scale integration are also considered. Other topics covered include gamma ray measurements, using polarized electrons to study surface magnetism, measuring the organic constituents of human serum, and the NBS industrial furnace facility. A.R.H.

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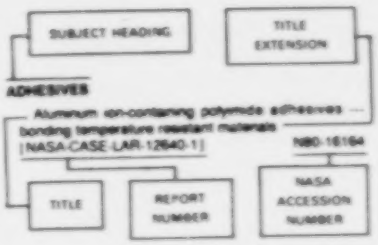

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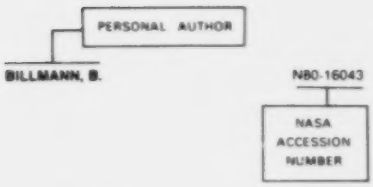

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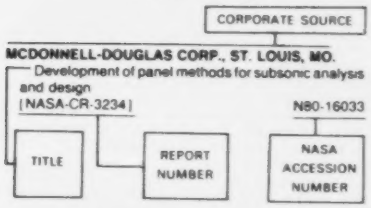

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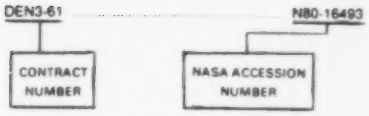

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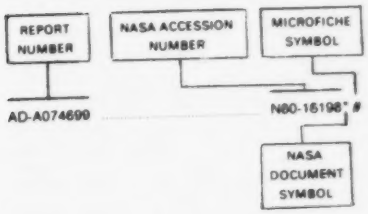

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AFAPL-TR-79-2118 ..... N80-28358 #

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AFESC/ESL-TR-80-09 ..... N80-28355 #

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AFGL-ERP-686 ..... N80-28974 #
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AFGL-ERP-691 ..... N80-28981 #
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AFWAL-TR-80-2017 ..... N80-28871 #
AFWAL-TR-80-2018 ..... N80-28473 #
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AFWL-TR-77-248 ..... N80-29148 #

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AI-TR-512-REV ..... N80-29056 #
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ALO-4135-T1 ..... N80-28906 #
ALO-4272-T2 ..... N80-28668 #
ALO-4281-1 ..... N80-28909 #
ALO-5336-T1 ..... N80-28695 #

AMMRC-MS-80-1 ..... N80-28502 #

AMSAA-TR-279-REV ..... N80-29077 #

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ANL/CNSV-7 ..... N80-28885 #

APR-1 ..... N80-29029 #
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AR-001-837 ..... N80-28740 #

ARBRL-CR-00420 ..... N80-28747 #

ARBRL-TR-02226 ..... N80-28670 #
ARBRL-TR-02228 ..... N80-28407 #
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ARO-TR-D-46 ..... N80-29090 #

ARO-1132.14-P ..... N80-29141 #
ARO-1394.7-MS ..... N80-28360 #
ARO-11671.18-EL ..... N80-29192 #
ARO-11797.1-EN ..... N80-28993 #
ARO-13737.1-EX ..... N80-28315 #
ARO-13737.2-EX ..... N80-28314 #
ARO-13971.7-GS ..... N80-28994 #
ARO-14026.2-EX ..... N80-28668 #
ARO-14107.7-ELX ..... N80-28604 #
ARO-14244.11-M ..... N80-29089 #
ARO-14363.3-E ..... N80-28744 #
ARO-14440.9-GS ..... N80-28993 #
ARO-14517.31-MS ..... N80-28870 #
ARO-14560.6-P ..... N80-29141 #
ARO-14582.2-EL ..... N80-28694 #
ARO-14686.8-EL ..... N80-28606 #
ARO-14710.12-EL ..... N80-29192 #
ARO-15632.3-EL ..... N80-29158 #
ARO-15882.17-M ..... N80-28465 #
ARO-15882.18-M ..... N80-28466 #
ARO-15882.19-M-CH-10 ..... N80-28467 #
ARO-16441.4-EL ..... N80-29195 #
ARO-16470.9-M ..... N80-29055 #
ARO-16719.1-E ..... N80-28315 #
ARO-16773.11-M ..... N80-29090 #

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ATR-80(7813)-1 ..... N80-29224* #

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AVRADCOM-TR-80-C-10 ..... N80-28524* #

AWRE-O-42/79 ..... N80-28659 #
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BATT-CDIR-1-1 N80-29205 #
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BC-SDAL-79-2 N80-28585 #

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CAM-100-34 N80-28750 #

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CSIR-MAG-B19 N80-29064 #

CSIR-MAG-D13 N80-29233 #

CSIR-ME-1626 N80-28741 #

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DOE/CS-34135/8 N80-28928 #

DOE/EIA-10547/01 N80-29570 #

DOE/ER-10343/1 N80-28916 #
DOE/ER-10453/01 N80-28532 #

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DOE/ET-14876/2 N80-28556 #
DOE/ET-15428/T2 N80-28727 #
DOE/ET-20562/4 N80-28907 #
DOE/ET-23002/T7 N80-28901 #
DOE/ET-23005-T3 N80-28895 #
DOE/ET-51010/6 N80-29177 #

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DOE/EV-0074 N80-28882 #
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DOE/EV-04477/1 N80-29017 #

DOE/IA-0001T/3(80) N80-28919 #

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DOT-TSC-NHTSA-80-11 N80-28735 #

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DRSMI/RL-80-6 N80-28432 #

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DYTEC-7936 N80-28361 #

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E-491 N80-29132* #
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E-526 N80-28716* #
E-527 N80-28524* #

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EER-VENT-80-2 N80-28960 #

EGG/LTR-LO-87-79-128 N80-28696 #

ENST-D-79017 N80-29161 #
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EPA-600/1-80-011 N80-29019 #
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EPA-600/3-80-018 N80-28522 #
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NASA-TM-81840 ..... N80-28353* #

NASA-TM-81846 ..... N80-29067* #
NASA-TM-81847 ..... N80-28637* #
NASA-TM-81851 ..... N80-28743* #
NASA-TM-81852 ..... N80-28445* #

NASA-TP-1550 ..... N80-28349* #
NASA-TP-1565 ..... N80-28329* #
NASA-TP-1676 ..... N80-28304* #
NASA-TP-1693 ..... N80-28352* #
NASA-TP-1706 ..... N80-28946* #
NASA-TP-1715 ..... N80-28424* #

NATICK/TR-80/011 ..... N80-28433 #

NBS-DIM-64/1 ..... N80-29241 #
NBS-DIM-64/2 ..... N80-29242 #

NBS-GCR-79-185 ..... N80-29164 #

NBS-SP-545 ..... N80-29162 #

NBS-TN-1017 ..... N80-28663 #
NBS-TN-1018 ..... N80-29163 #

NEFES-80-63 ..... N80-29063 #

NESEA-79-30-22-REV. ..... N80-28332 #
NESEA-022-106A-REV ..... N80-28332 #

NOAA-TM-NWS-WR-149 ..... N80-29003 #

NOAA-79112302 ..... N80-29230 #
NOAA-79112303 ..... N80-29231 #
NOAA-80022011 ..... N80-29004 #
NOAA-80022801 ..... N80-29228 #
NOAA-80022802 ..... N80-29229 #
NOAA-80030701 ..... N80-29003 #

NPL-DES-56 ..... N80-28697 #

NPS-69-79-012 ..... N80-28746 #

NPS52-80-004 ..... N80-29093 #
NPS55-79-029 ..... N80-29079 #
NPS55-80-007 ..... N80-29068 #
NPS67-80-003 ..... N80-28704 #

NRL-MR-4157 ..... N80-28867 #
NRL-MR-4192 ..... N80-29175 #
NRL-MR-4193 ..... N80-29193 #
NRL-MR-4195 ..... N80-28968 #
NRL-MR-4202 ..... N80-28722 #
NRL-MR-4209 ..... N80-28980 #

NSF/RA-79-362 ..... N80-28765 #
NSF/RA-790361 ..... N80-28763 #
NSF/RA-790363 ..... N80-28764 #
NSF/RA-790395 ..... N80-28577 #

NSWC/TR-79-247 ..... N80-28869 #
NSWC/TR-80-65 ..... N80-28540 #

NTIA/REPT-80/35 ..... N80-28627 #

NTIS/DF-80/003A ..... N80-28957 #

NTIS/PS-78/0120 ..... N80-29036 #
NTIS/PS-78/0144 ..... N80-28367 #
NTIS/PS-78/0145 ..... N80-28368 #
NTIS/PS-78/0188 ..... N80-28684 #
NTIS/PS-78/0215 ..... N80-28664 #
NTIS/PS-78/0216 ..... N80-28665 #
NTIS/PS-78/0257 ..... N80-29000 #
NTIS/PS-78/0264 ..... N80-28535 #
NTIS/PS-78/0289 ..... N80-29065 #
NTIS/PS-78/0290 ..... N80-29066 #
NTIS/PS-78/0302 ..... N80-28681 #
NTIS/PS-78/0304 ..... N80-28683 #
NTIS/PS-78/0310 ..... N80-28625 #
NTIS/PS-78/0368 ..... N80-28666 #
NTIS/PS-78/0371 ..... N80-29046 #
NTIS/PS-78/0373 ..... N80-29047 #
NTIS/PS-78/0380 ..... N80-29198 #
NTIS/PS-78/0381 ..... N80-29199 #
NTIS/PS-78/0412 ..... N80-28700 #
NTIS/PS-78/0413 ..... N80-28701 #
NTIS/PS-78/0426 ..... N80-28685 #
NTIS/PS-78/0439 ..... N80-28739 #
NTIS/PS-78/0470 ..... N80-28660 #
NTIS/PS-78/0471 ..... N80-28662 #
NTIS/PS-78/0489 ..... N80-28623 #
NTIS/PS-78/0490 ..... N80-28624 #
NTIS/PS-78/0508 ..... N80-29087 #
NTIS/PS-78/0511 ..... N80-28520 #
NTIS/PS-78/0512 ..... N80-28521 #
NTIS/PS-78/0517 ..... N80-29037 #
NTIS/PS-79-0259 ..... N80-28684 #
NTIS/PS-79-0505 ..... N80-28701 #
NTIS/PS-79/0148 ..... N80-28367 #
NTIS/PS-79/0149 ..... N80-28368 #
NTIS/PS-79/0190 ..... N80-29036 #
NTIS/PS-79/0298 ..... N80-28681 #
NTIS/PS-79/0299 ..... N80-28683 #
NTIS/PS-79/0300 ..... N80-28664 #
NTIS/PS-79/0302 ..... N80-28665 #
NTIS/PS-79/0307 ..... N80-28535 #
NTIS/PS-79/0310 ..... N80-29000 #
NTIS/PS-79/0311 ..... N80-28626 #
NTIS/PS-79/0313 ..... N80-29065 #
NTIS/PS-79/0315 ..... N80-29066 #
NTIS/PS-79/0318 ..... N80-28625 #
NTIS/PS-79/0319 ..... N80-28626 #
NTIS/PS-79/0389 ..... N80-28666 #
NTIS/PS-79/0396 ..... N80-29198 #
NTIS/PS-79/0398 ..... N80-29199 #
NTIS/PS-79/0436 ..... N80-29046 #
NTIS/PS-79/0438 ..... N80-29047 #
NTIS/PS-79/0451 ..... N80-28739 #
NTIS/PS-79/0476 ..... N80-28461 #
NTIS/PS-79/0480 ..... N80-28685 #
NTIS/PS-79/0492 ..... N80-28660 #
NTIS/PS-79/0493 ..... N80-28662 #
NTIS/PS-79/0494 ..... N80-28623 #
NTIS/PS-79/0495 ..... N80-28624 #
NTIS/PS-79/0503 ..... N80-28700 #
NTIS/PS-79/0507 ..... N80-28520 #
NTIS/PS-79/0508 ..... N80-28521 #
NTIS/PS-79/0533 ..... N80-29037 #
NTIS/PS-79/0539 ..... N80-29087 #

NUSC-TR-6239 ..... N80-28592 #
NUSC-TR-6265 ..... N80-28607 #

NVO-1603-2 ..... N80-29196 #

N109 ..... N80-28736 #

OEG-PP-284 ..... N80-29078 #

ONR-CR-215-245-3 ..... N80-28374 #

ONR-TR-80-1 ..... N80-28749 #

ONWI-59 ..... N80-29155 #
ONWI-60 ..... N80-29149 #

ORNL/EIS-163/V1-P1 ..... N80-29029 #
ORNL/EIS-163/V1-P2 ..... N80-29030 #

ORNL/MIT-298 ..... N80-28485 #

ORNL/SUB-79/45740/1 ..... N80-28915 #

ORO-5262-5-SUPPL ..... N80-28857 #
ORO-5362-T1 ..... N80-28880 #

OTA-E-110 ..... N80-28574 #

OTA-T-112-PT-1 ..... N80-28326 #

OWRT-A-067-IDA(1) ..... N80-28854 #
OWRT-A-102-MICH(3) ..... N80-29020 #

PB80-154248 ..... N80-28572 #
PB80-154255 ..... N80-28573 #
PB80-158744 ..... N80-28936 #
PB80-158751 ..... N80-28937 #
PB80-159965 ..... N80-29018 #
PB80-161524 ..... N80-28853 #
PB80-164429 ..... N80-28629 #
PB80-164437 ..... N80-28630 #
PB80-165590 ..... N80-29164 #
PB80-165681 ..... N80-29063 #
PB80-166085 ..... N80-28734 #
PB80-166150 ..... N80-28488 #
PB80-166184 ..... N80-29213 #
PB80-166218 ..... N80-29228 #
PB80-166226 ..... N80-29229 #
PB80-166457 ..... N80-28854 #
PB80-166911 ..... N80-28491 #
PB80-166994 ..... N80-29002 #
PB80-167018 ..... N80-28522 #
PB80-167109 ..... N80-28577 #
PB80-167216 ..... N80-28764 #
PB80-167224 ..... N80-28765 #
PB80-167406 ..... N80-29206 #
PB80-167471 ..... N80-28627 #
PB80-168529 ..... N80-29019 #
PB80-168859 ..... N80-29035 #
PB80-168867 ..... N80-28958 #
PB80-168875 ..... N80-28960 #
PB80-169121 ..... N80-28934 #
PB80-169139 ..... N80-28935 #
PB80-169238 ..... N80-28490 #
PB80-169295 ..... N80-28852 #
PB80-169311 ..... N80-29020 #
PB80-169352 ..... N80-28489 #
PB80-169436 ..... N80-28954 #
PB80-169527 ..... N80-29241 #
PB80-169535 ..... N80-29242 #
PB80-169550 ..... N80-28955 #
PB80-169626 ..... N80-28460 #
PB80-169675 ..... N80-28956 #
PB80-169691 ..... N80-28959 #
PB80-169709 ..... N80-28763 #
PB80-169881 ..... N80-28628 #
PB80-169931 ..... N80-28663 #
PB80-170012 ..... N80-28735 #
PB80-170020 ..... N80-29212 #
PB80-170053 ..... N80-29202 #
PB80-170178 ..... N80-28957 #
PB80-170533 ..... N80-29163 #
PB80-170707 ..... N80-29009 #
PB80-173552 ..... N80-28574 #
PB80-173875 ..... N80-29211 #
PB80-174527 ..... N80-29230 #
PB80-174535 ..... N80-29231 #
PB80-174568 ..... N80-29162 #
PB80-174576 ..... N80-29003 #
PB80-175250 ..... N80-29001 #
PB80-175755 ..... N80-29156 #
PB80-175821 ..... N80-29004 #
PB80-180526 ..... N80-29037 #
PB80-808322 ..... N80-29198 #
PB80-808330 ..... N80-29199 #
PB80-808348 ..... N80-28666 #
PB80-809486 ..... N80-28739 #
PB80-809577 ..... N80-28685 #
PB80-809593 ..... N80-28520 #
PB80-809601 ..... N80-28521 #
PB80-809635 ..... N80-28046 #
PB80-809650 ..... N80-29047 #
PB80-809676 ..... N80-28664 #
PB80-809684 ..... N80-28665 #
PB80-809692 ..... N80-29000 #
PB80-809726 ..... N80-28623 #
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PB80-809742 ..... N80-28625 #
PB80-809759 ..... N80-28626 #
PB80-809783 ..... N80-28700 #
PB80-809791 ..... N80-28701 #
PB80-809825 ..... N80-28535 #
PB80-809940 ..... N80-28680 #
PB80-809957 ..... N80-28681 #
PB80-809965 ..... N80-28662 #
PB80-809973 ..... N80-28683 #
PB80-810062 ..... N80-28660 #
PB80-810070 ..... N80-28661 #
PB80-810088 ..... N80-28662 #
PB80-810112 ..... N80-28367 #
PB80-810120 ..... N80-28368 #
PB80-810138 ..... N80-28461 #
PB80-810146 ..... N80-28684 #
PB80-810179 ..... N80-29065 #
PB80-810187 ..... N80-29066 #
PB80-810310 ..... N80-29036 #
PB80-810385 ..... N80-29087 #

PMTC-TP-80-05 ..... N80-28691 #

PNL-SA-7737 ..... N80-29160 #
PNL-SA-7746 ..... N80-28760 #
PNL-SA-8011 ..... N80-29150 #

PNL-TR-375 ..... N80-28477 #

PNL-3160-3 ..... N80-28675 #

PPPL-1651 ..... N80-28611 #

PR-3 ..... N80-28560 #
PR-352 ..... N80-29235* #
PR-358 ..... N80-29234* #
PR-397 ..... N80-28848* #

PRRL-79-CR-48 ..... N80-29007 #

PUBL-79-014 ..... N80-28690* #

PWA-FR-11844 ..... N80-28365 #

PWA-5580-32 ..... N80-28306* #

QPR-3 ..... N80-28901 #
QPR-15 ..... N80-28478 #

QR-1 ..... N80-28482 #
QR-1 ..... N80-28566 #
QR-2 ..... N80-28545 #
QR-3 ..... N80-28546 #
QR-3 ..... N80-28553 #
QR-3 ..... N80-28603 #
QR-9 ..... N80-28479 #
QR-10 ..... N80-28552 #
QR-20 ..... N80-28562 #

QSD-1366 ..... N80-28586 #

QTPR-1 ..... N80-28899 #
QTPR-2 ..... N80-28898 #
QTPR-3 ..... N80-28881 #
QTPR-3 ..... N80-28895 #

R-842 ..... N80-29050 #
R-846 ..... N80-29069 #
R-847 ..... N80-29070 #
R-849 ..... N80-29137 #
R-856 ..... N80-28653 #
R-861 ..... N80-29071 #
R-865 ..... N80-29072 #
R-1330 ..... N80-28721 #
R-1386 ..... N80-28384* #

RADC-TR-79-331 ..... N80-28646 #
RADC-TR-80-25 ..... N80-28585 #
RADC-TR-80-48-VOL-1 ..... N80-28609 #
RADC-TR-80-48-VOL-2 ..... N80-28610 #
RADC-TR-80-77 ..... N80-28643 #

RAE-LIB-TRANS-2038 ..... N80-28497 #

RAE-TR-77110 ..... N80-28323 #

REL/R(79)24 ..... N80-28731 #

REPT-2 ..... N80-29146 #
REPT-22-3040-FNL ..... N80-28655 #
REPT-22-3040-FNL-SUPPL ..... N80-28654 #
REPT-46 ..... N80-28572 #
REPT-46-APP ..... N80-28573 #
REPT-67/1978 ..... N80-28988 #
REPT-77-104 ..... N80-29186 #
REPT-77-119 ..... N80-29187 #
REPT-78-FM-51-VOL-5-APP-D ..... N80-28409* #
REPT-80-FM-32 ..... N80-29075* #
REPT-80-FM-36 ..... N80-29043* #
REPT-80-FM-39 ..... N80-28415* #
REPT-80-FM-42 ..... N80-29074* #
REPT-80F5121 ..... N80-28424* #
REPT-523-0769373-00121D-2 ..... N80-28651 #
REPT-1366-A ..... N80-29040 #
REPT-3420-FARO-14396.10-E ..... N80-28541 #
REPT-5121.5869.6.1-5 ..... N80-28425* #

RFP-3033/3533/79-4 ..... N80-28926 #
RFP-3035/3533/79-10 ..... N80-28925 #

RI/RD80-155-1-VOL-1 ..... N80-28427* #
RI/RD80-155-2-VOL-2-A ..... N80-28428* #

RLO-2227-T24-79/1 ..... N80-28996 #

R79-954390-13 ..... N80-28463* #
R79AEG416-VOL-1 ..... N80-28499* #
R8007-5 ..... N80-28583* #

SAAB-RRK-79-58 ..... N80-28733 #

SAI-78-604-LJ ..... N80-29978 #
SAI-78-604-LJ-2B-VOL-14C ..... N80-28968 #

SAM-TR-79-30-VOL-1 ..... N80-28325 #

SAMSO-TR-79-93 ..... N80-28873 #

SAN/1731-T2 ..... N80-28656 #

SAND-79-0645 ..... N80-28484 #
SAND-79-1658C ..... N80-28723 #
SAND-79-1847 ..... N80-28568 #
SAND-79-1990 ..... N80-28756 #
SAND-79-2032 ..... N80-28876 #
SAND-79-2056 ..... N80-28878 #
SAND-79-2245C ..... N80-29209 #
SAND-79-2292C ..... N80-28914 #
SAND-80-0181 ..... N80-29058 #
SAND-80-0190 ..... N80-28758 #
SAND-80-0197 ..... N80-29059 #
SAND-80-0309 ..... N80-28874 #
SAND-80-0482 ..... N80-28562 #
SAND-80-0748C ..... N80-28454 #
SAND-80-0801C ..... N80-28912 #
SAND-80-5080C ..... N80-28927 #
SAND-80-6006 ..... N80-28533 #
SAND-80-7006 ..... N80-28908 #
SAND-80-7028 ..... N80-29041 #
SAND-80-8175 ..... N80-28924 #

SAR-38 ..... N80-28339* #

SASR-6 ..... N80-29190* #

SCIENTIFIC-1 ..... N80-28969 #
SCIENTIFIC-2 ..... N80-28967 #
SCIENTIFIC-3 ..... N80-29430 #

SC5187.13FR ..... N80-28503 #
SC5210.24AR ..... N80-29191* #

SD-TR-80-19 ..... N80-28977 #
SD-TR-80-20 ..... N80-28419 #
SD-TR-80-24 ..... N80-28872 #

SER-510025 ..... N80-28351 #

SERI/TP-333-507 ..... N80-28565 #
SERI/TP-635-469 ..... N80-28892 #

SERI/TR-35-078-VOL-3 ..... N80-28569 #
SERI/TR-351-494 ..... N80-28894 #
SERI/TR-632-439 ..... N80-28893 #

SEVILLE-TR-79-12 ..... N80-28379 #

SGD-422-PT-1 ..... N80-29230 #
SGD-422-PT-2 ..... N80-29231 #
SGD-425-PT-1 ..... N80-29228 #
SGD-425-PT-2 ..... N80-29229 #

SIT-P2002-1179 ..... N80-29176 #

SNIAS-792-111-105 ..... N80-28327 #
SNIAS-792-111-107 ..... N80-28328 #
SNIAS-792-111-108 ..... N80-28346 #
SNIAS-792-210-123 ..... N80-28347 #
SNIAS-792-421-101 ..... N80-28929 #
SNIAS-792-422-109 ..... N80-28930 #
SNIAS-792-422-112 ..... N80-29210 #
SNIAS-792-422-113 ..... N80-29092 #
SNIAS-792-422-114 ..... N80-28456 #
SNIAS-792-422-117 ..... N80-28457 #
SNIAS-792-422-118 ..... N80-28761 #
SNIAS-792-422-119 ..... N80-28403
SNIAS-792-430-103 ..... N80-28458 #
SNIAS-792-430-104 ..... N80-28728 #
SNIAS-792-430-105 ..... N80-28459 #
SNIAS-792-440-102 ..... N80-28729 #
SNIAS-792-501-104 ..... N80-28575 #
SNIAS-792-502-102 ..... N80-28730 #

SOLAR/0010-79/12 ..... N80-28947 #
SOLAR/0802-79/01 ..... N80-28880 #

SR-1 ..... N80-28709 #
SR-54 ..... N80-29158 #

SRC-78-TR-35-PT-5 ..... N80-28725 #

SRI-9833-16 ..... N80-28698 #

SRL-TR-80-0009 ..... N80-28673 #

SR79-R-4571-18 ..... N80-28362 #

STR-IR78.01 ..... N80-28850 #

SU-SOL-80-1 ..... N80-29055 #

TDB-330 ..... N80-28738 #

TH-78-E-87 ..... N80-28620 #
TH-78-E-90 ..... N80-28621 #
TH-78-E-91 ..... N80-28931 #
TH-79-E-93 ..... N80-28622 #

TID-29379 ..... N80-28658 #

TM-80-32 ..... N80-28672 #

TN-1980-7 ..... N80-28589 #

TPR-6 ..... N80-28928 #
TPR-8 ..... N80-28906 #

TPRL-216 ..... N80-28450 #

TR-2 ..... N80-28721 #
TR-2 ..... N80-29136 #
TR-7 ..... N80-28489 #
TR-11 ..... N80-28705 #
TR-12 ..... N80-28587 #
TR-17 ..... N80-28472 #
TR-19 ..... N80-28471 #
TR-25 ..... N80-28476 #
TR-37 ..... N80-28608 #
TR-79-1-3 ..... N80-28528 #
TR-79-9 ..... N80-28539 #
TR-80-2 ..... N80-28587 #
TR-108 ..... N80-28465 #
TR-110 ..... N80-28466 #
TR-112-CH-10 ..... N80-28467 #
TR-136 ..... N80-29076 #
TR-151-SER-2 ..... N80-29089 #
TR-323 ..... N80-28736 #
TR-0079(4970-10)-3 ..... N80-28873 #
TR-0080(5450-01)-1 ..... N80-28977 #
TR-0080(5902-04)-1 ..... N80-28419 #
TR-0080(5970-01)-2 ..... N80-28872 #

TRB/TRR-736 ..... N80-29211 #

TT-7904 ..... N80-28322 #

TUM-LRT-KB-78/6 ..... N80-28698 #

TUM-LRT-TB-79/4 ..... N80-28388 #

TUM-RT-KB-78/2 ..... N80-28698

UCB/EERC-79/15 ..... N80-28577 #
UCB/EERC-79/29 ..... N80-28763 #
UCB/EERC-79/30 ..... N80-28765 #
UCB/EERC-79/31 ..... N80-28764 #

UCID-18506 ..... N80-29084 #
UCID-18568 ..... N80-28677 #
UCID-18650 ..... N80-28676 #

UCLA-ENG-8005 ..... N80-29094 #

UCRL-TRANS-11527 ..... N80-29182 #
UCRL-TRANS-11532 ..... N80-28922 #
UCRL-TRANS-11533 ..... N80-28917 #
UCRL-TRANS-11534 ..... N80-28923 #
UCRL-TRANS-11536 ..... N80-28921 #

UCRL-13982-REV-1 ..... N80-28684 #
UCRL-15202 ..... N80-28709 #
UCRL-52925 ..... N80-29144 #
UCRL-82868 ..... N80-29085 #
UCRL-83508 ..... N80-28877 #
UCRL-83721 ..... N80-29657 #
UCRL-83925 ..... N80-29674 #
UCRL-84102 ..... N80-29083 #
UCRL-84247 ..... N80-28710 #

UDR-TR-79-104 ..... N80-28473 #
UDR-TR-80-31 ..... N80-28362 #

UHMET-79-05 ..... N80-28983 #

UIEM-80-3 ..... N80-28606 #

UILU-ENG-78-2235 ..... N80-29050 #
UILU-ENG-78-2239 ..... N80-29069 #
UILU-ENG-78-2240 ..... N80-29070 #
UILU-ENG-78-2242 ..... N80-29137 #
UILU-ENG-78-2243 ..... N80-29091 #
UILU-ENG-78-2249 ..... N80-28853 #
UILU-ENG-78-2254 ..... N80-29071 #
UILU-ENG-78-2258 ..... N80-29072 #
UILU-ENG-80-2543 ..... N80-28806 #
UILU-ENG-80-4001 ..... N80-28315 #
UILU-ENG-80-4002 ..... N80-28314 #

ULRF-404/CAR ..... N80-28969 #
ULRF-406/CAR ..... N80-28970 #

UNICP-FSP-80/1 ..... N80-29166 #

US-PATENT-APPL-SN-015983 ..... N80-28300*
US-PATENT-APPL-SN-023501 ..... N80-28492*
US-PATENT-APPL-SN-039031 ..... N80-28578*
US-PATENT-APPL-SN-161256 ..... N80-28635* #
US-PATENT-APPL-SN-672219 ..... N80-28711*
US-PATENT-APPL-SN-929087 ..... N80-28687*
US-PATENT-APPL-SN-940689 ..... N80-28686*
US-PATENT-APPL-SN-951830 ..... N80-28536*

US-PATENT-CLASS-73-180 ..... N80-28300*
US-PATENT-CLASS-73-182 ..... N80-28300*
US-PATENT-CLASS-73-861.65 ..... N80-28300*
US-PATENT-CLASS-73-861.66 ..... N80-28300*
US-PATENT-CLASS-148-131 ..... N80-28492*
US-PATENT-CLASS-149-19.2 ..... N80-28536*
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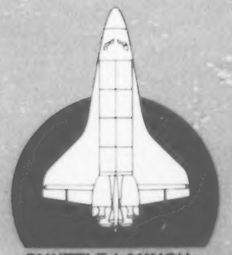

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>
> Includes aeronautics (general), aerodynamics, air transportation and safety, aircraft communications and navigation, aircraft design, testing and performance, aircraft instrumentation, aircraft propulsion and power, aircraft stability and control, and research and support facilities (air).
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07 AIRCRAFT PROPULSION AND POWER 2651

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13 ASTRODYNAMICS 2662

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18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 2667

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26 METALLIC MATERIALS **2676**

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **2679**

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **2680**

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) **2683**

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **2685**

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING **2690**

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER **2695**

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY **2699**

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS **2701**

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING **2709**

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **2715**

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **2716**

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) **N.A.**

43 EARTH RESOURCES 2720

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 2725

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 2736

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 2739

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 2742

Includes weather forecasting and modification.

48 OCEANOGRAPHY 2746

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 2746

Includes genetics.

52 AEROSPACE MEDICINE 2753

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 2755

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 2756

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 2758

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 2759

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 2763

Includes computer networks.

63 CYBERNETICS 2763

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 2764

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 2768

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 2770

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 2771

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

70 PHYSICS (GENERAL) 2771

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 2771
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 2773
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 2773
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 2775
Includes light phenomena.

75 PLASMA PHYSICS 2776
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 2778
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 2781
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2781
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2782
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2783
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2783
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2784
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2786
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2787
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2788
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2789
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2789

Note: N.A. means that no abstracts were assigned to this category for this issue.

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PERSONAL AUTHOR INDEX I-57
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REPORT/ACCESSION NUMBER INDEX I-83

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NASA ACCESSION NUMBER

N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif

CORPORATE SOURCE

TITLE

STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

PUBLICATION DATE

AUTHOR

D. J. Mourey 3 Sep 1979 409 p refs

(Contract NAS1-15624)

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CONTRACT OR GRANT

(NASA-CR-159149) Avail: NTIS HC A18/MF A01

CSCL 01C

COSATI CODE

REPORT NUMBER

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AN EXPERIMENTAL INVESTIGATION OF THE BEHAVIOR OF SUB-GRID SCALE MOTIONS IN TURBULENT SHEAR FLOW
B.J. Cantwell, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (NAG 2-21)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0002, RESEARCH AND TRAINING IN COMPUTATIONAL TURBULENCE FLOW SIMULATION
W.C. Reynolds, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (NAG 2-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0003, A STUDY OF METHODS FOR IMPROVING CAPACITY AT MAJOR AIRPORTS
A. Kanafani, University of California, Berkeley Campus, School of Engineering, Dept. of Civil Engineering, *Berkeley, California* 94720 (NAG 2-19)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0004, GAS MIXTURE REACTIONS
D. Kley, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (BDJ42787)

PROJECT OBJECTIVE: Design, construct and test various instruments to measure critical reaction and photodissociation rates in the atmosphere by means of reactions of sunlight on gas mixtures.

CURRENT YEAR PLAN: Complete design and construction of instruments: a) to detect H2O in the stratosphere, b) to measure O2 photodissociation, and c) to measure O3 photodissociation. Fly balloons with instruments a) and b). Heavy machine shop use anticipated.

PROGRESS REPORT: Laboratory tests on instruments a) and b) were performed and found satisfactory enough to justify building of flight instruments.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

1.0005, EFFECT OF EXTERNAL FLOW IN EXISTING TURBULENCE
M.S. Uberoi, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Aerospace Engineering Sciences, *1200 University Ave., Boulder, Colorado* 80302 (NAG 1-59)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0006, MEAN VELOCITIES AND REYNOLDS STRESSES IN A JUNCTURE FLOW
H.M. McMahon, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (NAG 1-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0007, LOAD TRANSFER SYSTEMS IN SLIP-FORMED RIGID PAVEMENTS
E.J. Barenberg, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Civil Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DOT-FH-11-8474 (MOD #4))

Longitudinal construction joints in rigid pavements is a major source of maintenance activity. Construction of longitudinal joints with load transfer systems using slip form pavers is a difficult construction operation which leads to a lowering in the overall quality of pavement construction. The purpose of this study is to design and validate alternate load transfer systems which can be constructed using slip form pavers without the usual construction problems. Alternate joint systems are being tested under field and laboratory conditions to determine which joint load transfer systems are most cost-effective.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0008, SENSOR FAILURE DETECTION AND CONTROL SYSTEM ACCOMMODATION
G.G. Leininger, Purdue University, School of Aeronautics & Astronautics, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NAG 3-17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0009, A STUDY OF METHOD TO PREDICT AND MEASURE THE TRANSMISSION OF SOUND THROUGH THE WALLS OF LIGHT AIRCRAFT
M.J. Crocker, Purdue University, School of Mechanical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (NAG 1-58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0010, LOW-SPEED, HIGH-LIFT AERODYNAMICS
W.D. James, Iowa State University of Science & Technology, School of Engineering, Dept. of Aerospace Engineering, *496 Town Engineering Bldg., Ames, Iowa* 50011 (NAG 2-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0011, AERODYNAMIC STALL ALLEVIATION RESEARCH
R.W. Vangunst, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (NAG 1-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, ANALYSIS OF TRANSONIC FLOW PAST HELICOPTER ROTORS
D.A. Caughey, Cornell University, Ithaca Campus, Sibley School of Aerospace & Mechanical Engineering, Dept. of Mechanical & Aerospace Engineering, *Ithaca, New York* 14850 (NAG 2-13)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0013, SUBSONIC WING/FUSELAGE AERODYNAMIC STUDY
G.M. Gregorek, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautics & Astronautics, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 2-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0014, COORDINATION AND CONTROL OF MULTIPLE-ARMED MANIPULATION SYSTEMS
C.A. Klein, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 1-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0015, STUDY OF ALTITUDE TRANSITION IN AIRCRAFT ENERGY CLIMBS
H.J. Kelly, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace Engineering, *Blacksburg, Virginia* 24061 (NAG 1-52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0016, SPACE SHUTTLE WINDWARD SIDE VISCOUS FLOWFIELD PREDICTIONS
C.H. Lewis, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace Engineering, *Blacksburg, Virginia* 24061 (NAG 1-53)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, SOLAR POWER SATELLITE FLEXIBLE SYSTEM CONTROL ASSESSMENT - ANALYSIS
M.J. Balas, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Mechanical Engineering Aeronautic Engin & Mechanics, *110 8th St., Troy, New York* 12181 (NAS 9-16053)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, STUDY OF PERMEABILITY OF POLYMERIC MATERIALS TO CONDENSABLE GASES AND ORGANIC LIQUIDS
I.G. Dillon, Tuskegee Inst., School of Arts & Sciences, Dept. of Chemistry, *Tuskegee Institute, Alabama* 36088 (NAG10-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

3.0002, ATMOSPHERIC CHEMISTRY OF HYDRAZINES
J.N. Pitts, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Chemistry, *Riverside, California* 92502 (DF336510; F08635-78-C-0307)

To investigate the gas phase reactions of selected hydrazines in the polluted and natural troposphere, including kinetic and mechanistic studies. The research is being conducted in support of the environmental quality assessment function of the Air Force. This function is currently deficient with regard to necessary detailed kinetic knowledge of the atmospheric reactions of hydrazine based fuels. This work will provide data essential to an accurate assessment of the environmental fate of these fuels in support of the space transportation system and F-16 for mission accomplishment and readiness.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

3.0003, THE INTERACTION OF ELECTRONS WITH ATOMS AND MOLECULES - FUNDAMENTAL THEORIES AND PROCESSES
H.S. Taylor, University of Southern California, School of Letters Arts & Sciences, Dept. of Chemistry, *3551 University Ave., Los Angeles, California* 90007 (CHE79-10583)

This grant supports research under the Quantum Chemistry Program for theoretical investigations of scattering and energy transfer processes. Three principal areas will be pursued. All of them are concerned with electrons leaving, scattering from, or binding to atoms and molecules. One area is the further application of that form of many body theory developed by Professor Taylor to inelastic excitation and ionization of atoms and molecules by electron impact. Because of a recent and successful application of this theory to elastic electron-helium atom scattering over wide ranges of energy and angle, it is possible to extend the inelastic electron-helium work to higher accuracy. Another area is the interpretation of experiments in which electrons are scattered from atoms and molecules. In particular, new mechanisms will be explored for electronic-vibrational energy transfer. The last area deals with complex coordinate methods as applied to short-lived resonant atomic and molecular systems, to photoionization, and to electron scattering. New theoretical methods will be developed and tested first on model problems and then on atomic and molecular systems.

This is a renewal of research currently supported by NSF grant CHE7910583 to the University of Southern California.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, CHARACTERIZATION OF METAL AGGREGATES
J.L. Gole, Georgia Inst. of Technology, School of Chemistry, *225 North Ave. N.W., Atlanta, Georgia* 30332 (CHE79-09075)

This research is in the area of quantum chemistry. Small metal aggregates Mn, specifically Nan, Sbn, Cun, and Agn, where n varies from 2 to 4, will be studied using laser fluorescent techniques. The modes of characterization will include excitation and photoluminescence spectroscopy as well as laser induced atomic fluorescence. The vibrational and rotational structure of bound states will be analyzed. Photoionization will be used to determine the behavior of ionization potential with cluster size for species of mass less than 400 amu. Experimental

studies will be supplemented with quantum chemical calculation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0005, OXIDE SURFACES OF TITANIUM ADHERENDS

J. Venables, Martin Marietta Corp., Martin Marietta Laboratories, *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DN890172; N00019-79-C-0294)

Investigate the oxides on titanium adherends prepared by various techniques for the purpose of providing understanding, guidelines and recommendations for pretreating titanium.

Investigate the morphology, crystal structure, chemical composition and failure mechanisms of oxides formed on titanium using surface sensitive techniques such as scanning transmission electron microscopy (STEM) and Auger-ESCA (electron spectroscopy for chemical analysis).

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0006, DUCTILITY OF POLYCRYSTALLINE NICKEL ALUMINUM

E.M. Schulson, Dartmouth College, Thayer School of Engineering, Dept. of Materials Science, *P.O. Box 833, Hanover, New Hampshire* 03755 (NAG 3-13)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0007, LASER MASS SPECTROMETRY - VIBRONIC/MASS SPECTROSCOPY VIA MULTIPLE PHOTON IONIZATION OF POLYATOMIC MOLECULES

R.B. Bernstein, Columbia University, Undergraduate School, Dept. of Chemistry, *Broadway & W. 116th St., New York, New York* 10027 (CHE78-25187)

This research is in the area of Quantum Chemistry; it involves molecular beam techniques. Dr. Bernstein plans to design and construct a laser mass spectrometer (LAMS) to make possible fundamental studies of vibronic/mass spectroscopy via multiple photon ionization (MPI). The LAMS technique combines the specificity of MPI vibronic spectroscopy with the generality of the mass spectrometric method. The new instrument will be used to investigate the basic process of multiple photon excitation, ionization, and, most important, fragmentation of polyatomic molecules. Several series of prototype molecules with different, archetypical electronic structures are to be investigated. The goal is to gain a detailed understanding of the mechanism of the stepwise absorption of visible (and UV) photons by polyatomic molecules, which lead ultimately to ionization and dissociation into charged and neutral fragments. The ionization-fragmentation NPI pattern also provides important information necessary for the unambiguous interpretation of 'conventional' ion current NPI spectra, as obtained in gas cells. The laser mass spectrometer (LAMS) can be used as a research instrument (i.e., to measure vibronic energy levels and investigate the electronic structures of excited states of molecules and radicals) as well as an analytical tool (i.e., for the identification of chemical compounds, analysis of mixtures and isotopic assay). Numerous applications of LAMS to basic chemistry are to be explored.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, EVALUATION OF REDUCED POLLUTION CORROSION PROTECTION SYSTEMS

C.J. Staebler, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (R804331-01; B610B-145)

OBJECTIVE: To evaluate reduced pollution corrosion protection systems as viable alternatives to presently used higher polluting systems.

APPROACH: Parameters for applying reduced-pollution coatings on typical aerospace and metal finishing industry substrates will be optimized. The coating systems will be comprehensively evaluated to establish confidence procedures, processing requirements coating life, and operating costs of selected coating systems will also be determined.

PROGRESS: Results obtained so far indicate there is considerable potential for replacing such high polluting systems as organic solvent paints, cyanide cadmium and copper plating, and hexavalent chromium plating with less polluting systems as well as testing of new systems such as water-reduced paints, powder coatings, strippable coatings and maskants, paint strippers and metallic coatings.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

3.0009, INFLUENCE OF COBALT ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF MAR M-247

R.D. Maier, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NAG 3-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0010, CONSTITUTIVE EQUATIONS FOR ANALYSIS AND DESIGN OF TURBINE ENGINE HOT SECTION COMPONENTS

A. Mendelson, Case Western Reserve University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *University Cir., Cleveland, Ohio* 44106 (NAG 3-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0011, MICROSTRUCTURE AND FATIGUE BEHAVIOR OF RHEOCAST IN-100

D. Apelian, Drexel University, School of Engineering, Dept. of Metallurgical Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NAG 3-14)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0012, OXIDATION OF LIQUID LUBRICANTS AND ITS RELATIONSHIP TO CHEMICAL CHANGES DURING ELASTOHYDRODYNAMIC AND BOUNDARY LUBRICATION

E.E. Klaus, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Chemical Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NAG 3-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0013, LABORATORY KINETIC STUDIES OF ATMOSPHERIC REACTIONS

J.P. Heicklen, Pennsylvania State University, University Park Campus, School of Science, Dept. of Chemistry, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (ATM79-09169)

Laboratory data on the rates and mechanisms of chemical reactions are key inputs into models of troposphere and stratosphere. The objective of this research is to obtain data on three important classes of reactions: (1) formation and decay kinetics of CX2ClO2NO2 (X equals H, F, Cl, Br); (2) reactions of peroxy radicals with NOx and SO2; and (3) photolysis of aldehydes. The first of these reactions may be important as a temporary sink for Cl in the stratosphere, and the second and third are important chemical processes in the troposphere. Flash photolysis and kinetic spectroscopy techniques will be used in the experiments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

3.0014, CONSTITUTIVE MODELS FOR CYCLIC PLASTICITY AND CREEP BEHAVIOR OF SUPERALLOYS AT HIGH TEMPERATURE
W.E. Haisler, Texas A & M University, College Station Campus, School of Engineering, Dept. of Aerospace Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAG 3-31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0015, CARBON-13 NMR ANALYSIS OF SHALE OILS AND SHALE OIL DERIVED JET FUELS
W.O. Ursenbach, Utah Higher Education System, University of Utah, School of Science, Dept. of Chemistry, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NAG 3-27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, CONCEPTUAL DESIGN OF SCUBBING SYSTEMS FOR ROCKET MOTORS
S. Calvert, Air Pollution Technology Inc., *4901 Morena Blvd., Suite 402, San Diego, California* 92117 (68-02-2145; F617X-783250)

OBJECTIVE: Conduct an engineering study and design of methods for scrubbing the exhaust of static-tested solid rockets, particularly of hydrogen chloride and hydrogen fluoride gases, and prepare cost analyses for application to rockets with thrusts between 20 KW and 2 MN.

APPROACH: Provide comprehensive design criteria for scrubbing systems for controlling emissions from test firing rocket motors.

PROGRESS: EPA#EPA-600/7-78-057 NTIS#PB282-255/AS Design Criteria for Rocket Exhaust Scrubbers. Harry F. Bacharika, & Seymour Calvert, Mar 78. Report gives results of an engineering study & design of methods for scrubbing the exhaust of static-tested solid rockets. The best process for removing gas was found to be a gas atomized spray scrubber, using the power supplied by the rocket to atomize the scrubbing liquid.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

4.0002, REMOTE CONTROL HOVERCRAFT/VEHICLES TO PLUG/VIEW HAZARDOUS LEAKS
P.E. Wolven, Oxnard City Government, *206 W. 2nd St., Oxnard, California* 93030 (R805365; B610B-00212)

OBJECTIVE: Design, develop, demonstrate remotely controlled airborne vehicle or hovercraft (not helicopter) type to provide TV view of hazardous situations and, possibly, plug leaks, turn valves, etc.

APPROACH: Review state of art, assess power requirements, airborne time period definition, assemble and test prototype (Phase I), evaluate, construct and demonstrate engineering model.

PROGRESS: Prototype completed, testing underway.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

4.0003, DENSITY MEASUREMENT IN AIR WITH A SATURABLE ABSORBING SEED GAS
D. Baganoff, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NAG 2-36)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0004, DEVELOPMENT OF MODELS FOR NONLINEAR FRACTURE PROCESSES
F.W. Smith, Colorado State University, School of Engineering, Dept. of Mechanical Engineering, *Fort Collins, Colorado* 80523 (NAG 3-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0005, CLOUD PREDICTION AND RADIATION MODIFICATION EFFECTS OF POLLUTANTS FROM ENERGY PRODUCTION
R.F. Pueschel, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (D9-E693-EG; W833 -0037)

OBJECTIVE: Determine the chemical and physical characteristics of power plant plumes which lead to regional visibility and air quality (SO2 and fine particulates) deterioration over the long term; determine and verify long-range transport trajectories.

APPROACH: Conduct aircraft measurements of fine particulate aerosols from various power plants and groups of power plants, and assist in mapping pollutants concentrations (SO2 and fine particulates) due to various power plants and sets of power plants.

PROGRESS: The following points have been demonstrated from the evaluation of three field projects: (a) found no instance where the horizontal profile of particles and gases follow Gaussian distributions; (b) the horizontal profile extent of the plume is much in excess of that predicted by plume dispersion models; (c) fine particles are generated at rates of 10 to the fifteenth power to 10 to the seventeenth power per second; (d) the power plant plumes are guided to a degree by the topography of the underlying terrain.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Office of Environmental Processes & Effects Research

4.0006, RADIOFREQUENCY RADIATION EFFECTS ON EXCITABLE TISSUES
E.C. Burdette, Georgia Inst. of Technology, Engineering Experiment Station, Systems & Techniques Laboratory, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF054830; F49620-79-C-0055)

AF function - Air Force operating environments expose personnel to a wide variety of potential hazards which may limit or degrade man's ability to perform effectively. Current methods are not adequate to assess the biological effects of single, sequential or long-term exposure to electromagnetic radiations (EMR). Fundamental data on the bioeffects of microwaves are necessary for the establishment and maintenance of adequate EMR safety criteria. Deficiency - very little is known about cellular level bioeffects of electromagnetic radiation. Although non-thermal effects of EMR on cardiac and neuronal tissue have been suggested, no hard experimental evidence exists upon which an accurate assessment of bioeffects on excitable tissues can be based. Objective - the objective of the proposed research is to determine if pulsed microwave radiation alters normal physiological functions of cardiac cell aggregates. How research contributes - data obtained from these experiments will enable more accurate reappraisal of Air Force and occupational personnel exposure standards for microwave radiation. This research will support and contribute to RO 1.8.1.2, electromagnetic radiation.

An exposure system will be designed to provide proper dosimetry of EMR for exposure of cardiac cell aggregates (CCA). Following dosimetry and thermal alteration studies, cardiac aggregate clusters will be exposed to both continuous wave and at least four pulsed-wave EMR conditions using an exposure frequency of 2450 mHz and two absorbed power levels. The effect of EMR on CCA's will be evaluated using the following parameters: beat rate, maximum diastotic potential, action potential duration, slope of pacemaker potential, maximum upstroke velocity and threshold potential alterations. These cellular interactions are the initiating activity for macroscopic-level functions. The aggregates offer not only a sensitive system in which to

study fundamental effects, but also a means by which these effects may be related to gross responses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, FINITE STRAIN CREEP AND CREEP CRACK GROWTH ANALYSIS
S.N. Atluri, Georgia Inst. of Technology, School of Engineering Science & Mechanics, *Atlanta, Georgia* 30332 (NAG 3-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0008, ARTIFICIAL INTELLIGENCE AND HUMAN ERROR PREVENTION
R.T. Chien, University of Illinois, Urbana Champaign Campus, School of Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (FA79-WA-4360)

Basic research on the conceptual design of an on-board intelligent computer system is being carried out. The system will do intelligent monitoring and diagnosis of an aircraft and its operations. A knowledge base encompassing all aspects of flight knowledge is being organized and will be used with a problem solver for planning and execution of procedures.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0009, AN EXPERIMENTAL INVESTIGATION OF UNSTEADY TURBULENT BOUNDARY LAYERS 15780-E
R.R. Ramaprian, University of Iowa, School of Engineering, Dept. of Mechanics & Hydraulics, *Jessup Hall, Iowa City, Iowa* 52240 (DA0G8968; DAAG29-79-G-0017)

To experimentally investigate the structure and behavior of turbulent boundary layers in the presence of sinusoidally oscillating freestream. Relevance - the research is relevant to the analysis and ultimate modification of helicopter dynamic stall and then to the design and control of linkage loads on helicopter blades.

The study will be performed in an oscillatory-flow water tunnel in which both amplitude and frequency of oscillation as well as the mean velocity can be varied. In addition to mean and fluctuation velocities, details of the turbulence structure will be measured.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0010, STATIC AND DYNAMIC NON LINEAR ANALYSIS WITH SUBSTRUCTURE MODELS
R.H. Dodds, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Mechanical Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 3-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0011, DESIGN OF VARIABLE STRUCTURE CONTROL SYSTEMS
S.H. Wang, University of Maryland, College Park Campus, School of Engineering, Dept. of Electrical Engineering, *College Park, Maryland* 20742 (NAG 1-27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0012, ELECTROCHEMICAL EVALUATION OF THE ELECTRONIC AND TRANSPORT PROPERTIES OF SILICON
R.D. Rauh, E I C Corp., *55 Chapel St., Newton, Massachusetts* 02158 (DAR79-17409)

The purpose of this research is to demonstrate an electrochemical method to evaluate electronic and transport properties of silicon. The technique makes use of the Schottky-type barrier which forms between semiconductors and certain redox electrolytes. The electrical and optical properties of such a barrier can be employed to determine doping densities, as well as carrier diffusion lengths, lifetimes and mobilities. Presently, it is necessary to fabricate metal-semiconductor Schottky diodes to make such measurements, a process which is time-consuming, destructive and requires high-vacuum preparative techniques. Hence, successful completion of the proposed research could lead to substantial facilitation of quality control in Si device fabrication.

In order to make electrochemical measurements on Si, electrolytes must be developed to stabilize its surface against passivating oxidation, a problem which is addressed in the Phase I feasibility research. Also in Phase I, an analysis of the C-V behavior of the Si electrode in these stabilizing electolytes is proposed, which yields the doping density and demonstrates the general utility of the approach. In Phase II, the method is expanded to cover a wider range of optical and electrical measurements, and practical modifications of the measurement apparatus are considered.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Applied Research

4.0013, IMAGING ALL-SKY PHOTOMETER
R.H. Eather, Keo Consultants, *Newton, Massachusetts* (R; F19628-76-C-0168)

AF function - communications and detection. Deficiency - understanding effects both of precipitating particle and non-particle produced ionospheric disturbances which degrade communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by means of auroral spectral emission features measured with a sensitive T.V. system. How research contributes -provides a new and powerful technique for large-scale and high time resolution auroral measurements. Coordination with other simultaneous measurements from the AFCRL Airborne Ionospheric Observatory, NKC-135 aircraft, number 53131, will allow comprehensive measurements of ionospheric response to substorms over subauroral, auroral and polar cap domains.

Design, develop and construct an ultra-high-sensitivity, low-light-level T.V. system capable of wavelength discrimination, all-sky viewing and signal processing to accurately measure auroral emissions in the visible region of the spectrum.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0014, DEVELOPMENT OF SINGLE MODE, HIGH TEMPERATURE CONTINUOUS WAVE (CW) PLUMBUM-STANNUM-TELLURIUM (PBSNTE) LASER DIODES
C.G. Fonstad, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 1-48)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0015, ADVANCED STRESS ANALYSIS OF TURBINE ENGINE STRUCTURES
T.H. Pian, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 3-33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0016, RESEARCH ON VISUAL VESTIBULAR INTERACTION AND ITS APPLICATION TO FLIGHT SIMULATION
L.R. Young, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 2-12)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0017, REMOTE SENSING OF OCEAN SURFACE AND ICE CONDITIONS USING MICROWAVES
R.E. McIntosh, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Electrical Engineering, *Amherst, Massachusetts* 01002 (NAG 1-54)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0018, PHOTOELECTROLYSIS OF WATER WITH SURFACE MODIFIED METAL OXIDE ELECTRODES
M. Tomkiewicz, City University of New York, Brooklyn College, School of Science, Dept. of Chemistry, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (NAG 1-44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0019, PROPOSAL STRUCTURAL DYNAMICS STUDIES FOR FAN/TURBINE DESIGN
R.G. Loewy, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Mechanical Engineering, *110 8th St., Troy, New York* 12181 (NAG 3-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0020, VIBRATION ANALYSIS OF TURBINE ENGINE BLADES
A.W. Leissa, Ohio State University, Columbus Campus, School of Engineering, Dept. of Engineering Mechanics, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 3-36)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0021, ZERO MODULES AND INVERSE SYSTEM DESIGN
B. Wyman, Ohio State University, Columbus Campus, School of Engineering, Dept. of Engineering Graphics, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 2-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0022, DIGITAL TELEVISION SIMULATION FACILITY
S.C. Kwatra, University of Toledo, School of Engineering, Dept. of Electrical Engineering, *2801 W. Bancroft St., Toledo, Ohio* 43606 (NAG 3-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0023, ULTRASONIC RANGING FOR THE OCULOMETER
W.J. Guy, Lafayette College, Undergraduate School, Dept. of Electrical Engineering, *Easton, Pennsylvania* 18042 (NAG 1-45)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0024, A STUDY OF SOLAR ENERGY RADIO FREQUENCY GENERATION DEVICES
J.W. Freeman, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (NAG 3-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0025, THE DEVELOPMENT OF THE MINICOMPUTER/GLOBAL BUS INTERFACE FOR THE FINITE ELEMENT MACHINE
J.H. Aylor, University of Virginia, School of Engineering & Applied Science, Dept. of Electrical Engineering, *Garrett Hall, Charlottesville, Virginia* 22903 (NAG 1-43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0026, NUMERICAL ALGORITHMS FOR FINITE ELEMENT COMPUTATIONS ON ARRAYS OF MICROPROCESSORS
J.M. Ortega, University of Virginia, School of Engineering & Applied Science, Dept. of Applied Mathematics & Computer Science, *Garrett Hall, Charlottesville, Virginia* 22903 (NAG 1-46)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0027, RADIATION VIEWFACTOR ANALYSIS
A.F. Emery, University of Washington, School of Engineering, Dept. of Mechanical Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (NAG 1-41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, SEASAT PROGRAM - USE OF SEASAT DATA TO INVESTIGATE CONNECTIONS BETWEEN SEA-SURFACE TEMPERATURES AND METEOROLOGICAL FACTORS
S.A. Bowling, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (7-925; MO-A01-78-00-4321)

OBJECTIVE: The use of SEASAT-A SMMR sea-surface temperature and wind speed data to examine the immediate effect of meteorological events, especially cyclone passages on sea-surface temperatures in the Gulf of Alaska/Aleutian area.

APPROACH: The SMMR data will be processed by differencing of temperatures obtained at different times to obtain maps of cooling/heating rates, which will then be compared both with SMMR-derived wind speeds and with conventional meteorological data. Conventional meteorological data will be used to select three periods during winter 1978-79, during fall, mid-winter and early spring. SMMR geophysical data tapes will be obtained during these periods, as well as IR imagery, if available. Major emphasis will be on patterns of temperature change relative to the positions of major meteorological features, and identification of those which are consistent enough to have a high probability of being real.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0002, AGGREGATE FORMATION AND AEOLIAN ACTION ON MARS
D. Krinsley, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NAGW 24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0003, PLANETARY AND MARS GEOMORPHOLOGY
M.C. Malin, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NAGW 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0004, SEASAT PROGRAM - INTEGRAL INVERSION OF SEASAT - COMPARISON OF DERIVED SWELL AMPLITUDES & RMS WAVEHEIGHT WITH SURFACE TRUTH (ABBREV)

B.J. Lipa, S R I International, Remote Measurements Laboratory, *333 Ravenswood Ave., Menlo Park, California* 94025 (7-923; MO-AO1-78-00-4319)

OBJECTIVE: Develop a integral inversion technique which when applied to Seasat Altimeter data will give the functional form of the ocean surface height probability density.

APPROACH: The derived probability functions will be interpreted in terms of swell amplitude and from waveheight of wind-derived waves. These results will then be compared with surface truth measurements obtained in the Joint Air-Sea Interaction (JASIN) experiment and the Gulf of Alaska experiment.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0005, A PROPOSAL TO USE TIROS-N AVHRR DATA FOR MEASUREMENTS OF ATMOSPHERIC AEROSOLS

M. Griggs, Science Applications Inc., Remote Sensing Division, *1200 Prospect St., La Jolla, California* 92037 (8-683; MO-A01-78-00-4092)

OBJECTIVE: Develop a technique to infer atmospheric aerosol particle concentration over the earth's oceans using measurements of reflected solar radiation from the Advanced Very High Resolution Scanning Radiometer (AVHRR) on the TIROS-N series of satellites. Use this technique to produce maps of aerosol particle concentration.

APPROACH: During the first year, methods to simplify the mathematical representation of the relationship between reflected radiance and aerosol concentration for different viewing and solar zenith angles will be studied. Theoretical computations of the radiance of radiation reflected from the ocean and atmosphere at a particular wavelength, for solar zenith and satellite viewing angles expected for TIROS-N, and for aerosol particle concentrations varying from none to ten times normal, will be performed and analyzed. Simpler methods will be developed from this analysis.

Subsequent studies using coincident measurements of reflected radiance and aerosol concentration at several locations on the earth will test the validity of the mathematical representation and provide an empirical means of adjusting the expressions for better accuracy.

If these study results are positive, the technique will be developed into an operational product.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0006, SEASAT PROGRAM - EVALUATION OF OPEN OCEAN MEASUREMENTS BY THE SEASAT-A SYNTHETIC APERTURE RADAR DURING THE 1978 JOINT AIR-SEA INTERACTION

A.M. Peterson, Stanford University, Center for Radar Astronomy, *Stanford, California* 94305 (7-922; MO-AO1-78-00-4318)

OBJECTIVE: The extensive wind and wave measurement to be made during the Joint Air-Sea Interaction (JASIN) experiment will be utilized to evaluate the measurement of ocean wave directional spectra by the SEASAT-A SAR. Information will be obtained concerning the range of ocean wavelengths and observational parameters over which reliable measurements of directional spectra can be made using SAR images, the dominant radar wave/ocean wave interaction mechanism(s) which allow SAR to image long wavelength ocean waves and then effects of local winds on SAR images.

APPROACH: The SEASAT-A/JASIN collaborative research effort will include SAR data collection for the JASIN area; SAR images formation, including geometric and focussing corrections; SAR image processing; comparison of SAR and surface measurements sigma (k, Omega); and evaluation of SEASAT-SAR measurements of sigma. The principal conclusion to be drawn from the data comparison is over what range of observational parameters, and wind and wave conditions, can SEASAT SAR images be used to provide meaningful estimates of the ocean wave directional spectrum.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0007, AERIAL PHOTO SPECIFICATIONS FOR FORESTRY

R.N. Colwell, University of California, Berkeley Campus, Agricultural Experiment Station, Dept. of Forestry & Conservation, *Berkeley, California* 94720 (0010844; CA-F#-FRU-1329)

OBJECTIVE: Determine, for forested areas, the type of aerial photography from which information essential in the practice of forestry can be most accurately and readily extracted.

APPROACH: The work will be designed so as to permit a determination of the relative ease and accuracy with which forest composition, vigor, density, size, age structure, and land features can be recognized on photography taken with various film-filter combinations, at various scales, and at various times of the day and year. Spectrophotometric analyses of the objects and conditions to be identified will first be made, in order to select the film-filter combinations which theoretically will provide the best photographic tone or color contrasts. Aerial photography of representative forest areas will then be flown with the selected film-filter scale combinations at various times of day and year. Through photo interpretation, estimates will be made from each set of photos as to forest conditions existing within the test areas. The accuracy of the interpretations will be determined by field checking, so that the specifications for optimum forest photography can be formulated.

PROGRESS: In June, 1978, multiband photography was obtained from an altitude of 21,000 meters above the terrain through the use of a NASA U-2 Aircraft as it flew over our remote sensing test sites in Mendocino County, Calif. The following 3 film-filter combinations were employed: Panchromatic film with a Wratten 12 filter; Infrared Ektachrome film with a Wratten 89B filter; and Aerial Ektachrome film with an HF-2 filter. For this purpose 3 identical cameras were operated simultaneously, each having a 12-inch focal length and a 9' x 18' negative size. From a light aircraft operated at 500 meters above the terrain we also took simultaneous photography of selected portions of the area, using the same 3 film-filter combinations. From our comparative interpretations of these 3 combinations we conclude that: (1) The Infrared Ektachrome photography is superior for (a) mapping fuel conditions in brushfields and selecting the specific areas within which fuel modification measures might best be employed such as prescribed burning, mechanical removal of brush, chemical control of brush and drill seeding following brush removal. (Text Abridged)

SUPPORTED BY California State Government

5.0008, RECENT STUDIES IN CLOUD PHYSICS & THEIR RELEVANCE FOR A BETTER UNDERSTANDING OF AIRCRAFT ICING

H.R. Pruppacher, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Atmospheric Sciences, *405 Hilgard Ave., Los Angeles, California* 90024 (NAG 4-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

5.0009, HIGH PRESSURE COSMOCHEMISTRY APPLIED TO MAJOR PLANETARY INTERIORS

D.J. Stevenson, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Earth & Space Sciences, *405 Hilgard Ave., Los Angeles, California* 90024 (NAGW 41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0010, MEASUREMENTS OF KEY BIOGEOCHEMICAL GASES AND THEORETICAL STUDIES IN ATMOSPHERIC CHEMISTRY

R.J. Cicerow, University of California, San Diego Campus, Graduate School, Dept. of Chemistry, *P.O. Box 109, La Jolla, California* 92037 (NAGW 45)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0011, RESEARCH RELATIVE TO IMPROVEMENTS IN BENCHMARK STABILITY FOR PRECISION TILT MEASUREMENTS OF CRUSTAL DYNAMICS

J. Berger, University of California, San Diego Campus, Inst. of Geophysics & Planetary Physics, *8602 La Jolla Shores Dr., La Jolla, California* 92038 (NAG 5-11)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0012, MODELING THE RELATIONS OF LAND USE/LAND COVER TO RESOURCE DEMANDS

C. Clayton, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NAG 2-20)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0013, PRIME AGRICULTURAL LAND MONITORING AND ASSESSMENT COMPONENT OF THE CALIFORNIA INTEGRATED REMOTE SENSING SYSTEM

J.E. Estes, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NAG 2-24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0014, REMOTE SENSING OF PHYTOPLANKTON - REFLECTANCE SPECTROSCOPY OF MARINE BACTERIA AND COLLOIDS

D.A. Kiefer, University of Southern California, School of Letters Arts & Sciences, Dept. of Biological Sciences, *3551 University Ave., Los Angeles, California* 90007 (7-717; 04-7-158-44123 MOD. NO.1)

OBJECTIVES: (1) To investigate the quantitative relationship between bacteria and colloids in the ocean and the spectral characteristics (color variations) of the water as seen from a spacecraft; and (2) to provide ship and scientific technical support during the Nimbus G/CZCS (Coastal Zone Color Scanner) post-launch experiment in February-March 1979.

APPROACH: (1) Current laboratory investigations into the relationship between changes in the diffuse spectral reflectance of the ocean and the presence of particles less than 1.0 micron in diameter (marine bacteria and colloids) will be extended by the use of reflectance spectroscopy. Specifically, the absorption and backscattering coefficients for common marine bacteria and isolated marine colloids will be determined from samples of southern California coastal waters. The bacteria will be concentrated using differential filtration techniques, whereas the colloids will be concentrated by ultra-filtration methods. (2) University of Southern California will provide a 110-foot research vessel, the R/V Velero IV, together with scientific/technical personnel, to conduct a 20-day cruise of southern California coastal waters. The measurements to be made, which include chlorophyll A and pheophytin A concentration, sea temperature, and phytoplankton nutrients, are not only to provide surface truth during Nimbus G/CZCS overflights, but are to be used to extend the utility of the satellite data to times and places where surface truth is lacking. NESS scientists will be aboard to collect concurrent optical and particle size distribution data.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0015, COMPARATIVE PLANETARY AERONOMY - VENUS STUDIES

S. Kumar, University of Southern California, School of Letters Arts & Sciences, Dept. of Astronomy, *3551 University Ave., Los Angeles, California* 90007 (NAGW 57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0016, METEOROLOGICAL OBSERVATIONS

L.O. Grant, Colorado State University, Agricultural Experiment Station, Dept. of Atmospheric Science, *Fort Collins, Colorado* 80523 (0009900; COL00104)

OBJECTIVE: Obtain meteorological data at the Colorado Experiment Station. Establish the climatology and climatological changes at the observing point. Obtain meteorological data to assist in aircraft flight forecasting by the National Flight Control System.

APPROACH: Complete observations are taken at 7:00 am and 7:00 pm MST. Airway observations are made 12 times each day on odd hours. The data are relayed by TWX to the Weather Bureau in Denver for dissemination via teletype.

PROGRESS: Meteorological observations are made at the University Weather Station to support agricultural and engineering research and to assist in operational aspects of flight forecasting by the U.S. Weather Bureau. Weather observations have been made at this station since 1873, and continuously since 1887. Parameters observed include: sky conditions, present weather, pressure, earth temperature, soil temperatures, humidity, wind, radiation, dew and frost deposition and evaporation during ice-free seasons. Complete observations are made twice daily at 7 a.m. and 7 p.m. MST. Airways observations are made 12 times daily on all odd number hours. All of the station records from 1890 to 1972 have now been transferred to computer tapes. The compilation of a comprehensive climatology based on the availability of the computer tapes has been deposited with the Colorado State Climatology Office. A limited observation setup at the Foothills location in cooperation with the Colorado State Forest Service and the Department of Atmospheric Science allows contrast between the foothills and main campus sites as well as providing forest fire weather data and data related to foothills grazing lands. The findings include daily operational and bench mark meteorological observations.

SUPPORTED BY Colorado State Government

5.0017, REMOTE SENSING FOR RENEWABLE NATURAL RESOURCE INVENTORY AND LAND MANAGEMENT EVALUATION

R.C. Aldrich, U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest & Range Experiment Station, *240 W. Prospect St., Fort Collins, Colorado* 80521 (0045934; RM-4155)

OBJECTIVE: Improve, develop, and implement remote sensing technology for increased efficiency of renewable resource inventory and to provide procedures to land management planners on use of remote sensing for resource management.

APPROACH: Remote sensing technology will be developed by: Developing procedures to apply current remote sensing technology for multipurpose resource inventories, providing procedures for detecting and monitoring change in forest and rangelands, and developing efficient and effective procedures to normalize remote sensing data.

SUPPORTED BY U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest & Range Experiment Station

5.0018, SOLAR EXTINCTION RADIOMETRY

A. Goldman, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (NAG 1-56)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0019, BALLOON-BORNE SPECTROMETER MEASUREMENTS OF ULTRAVIOLET VISIBLE SOLAR LIMB EXTINCTION

D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (NAG 1-57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0020, REMOTE SENSING OF ESTUARINE DETRITAL FLOW AND SURFACE WATER PRODUCTIVITY

V. Klemas, University of Delaware, School of Marine Studies, Dept. of Geography, *Lewes, Delaware* 19958 (R/B-7)

OBJECTIVES: To develop and apply remote sensing techniques to map synoptically over large areas, the form and magnitude of detritus and chlorophyll contributions from the marsh to the estuarine and coastal environment. Two techniques will be investigated and results compared with surface measurements: 1. Eigenvector analysis of multi-spectral digital imagery to map the concentration and flow of detritus and chlorophyll. 2. Airborne laser fluorosensing of the chlorophyll as an indicator of surface water productivity.

The surface measurements will include the dry weights and ash-free dry weights of the particulate material for three different size fractions, and the DOC and POC content of the filtrate and filtered materials. The flux of organic materials will be determined by incorporating both concentrations and water volume transports for the flood and ebb of each tidal cycle.

ANTICIPATED BENEFITS: This work will help evaluate the potential and real contribution of salt marsh ecosystems to the marine environment by providing synoptic data on the distribution and flow of detritus and chlorophyll from the marsh into the estuaries and coastal waters. It will help provide answers to these questions: What are the form and mangitude of detritus contribution and subsequent fate of detritus in the estuarine-coastal environment? How do such detritus contributions influence life processes and dynamics of the estuarine environment?

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0021, DEVELOPMENT OF AN AIRBORNE LASER PHOTOFRAGMENTATION

D.D. Davis, Georgia Inst. of Technology, School of Geophysical Sciences, *Atlanta, Georgia* 30332 (NAG 1-50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0022, RESEARCH ON REMOTE SENSING AND GEOLOGIC STUDIES OF THE LUNAR CRUST

B.R. Hawke, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (NAGW 42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0023, REMOTE SENSING OF IOWA'S AGRICULTURAL AND FORESTRY RESOURCES

R.E. Carlson, Iowa State University of Science & Technology, Iowa Agricultural & Home Economics Experiment Station, Dept. of Agronomy, *Beardshear Hall, Ames, Iowa* 50010 (0064179; IOW01997)

OBJECTIVE: Refine and improve remote sensing-photo interpretation procedures relating to Iowa's natural resources in problems dealing with classification and inventory of agricultural and forest lands and the detection of adverse stresses in these ecosystems.

APPROACH: Standard photo-interpretive procedures and new technology, as available, will be incorporated to extract information from existing and proposed aerial imagery to develop classification schemes to inventory soils, crops, forest land and the extent of diseases in crops and trees at selected test sites in Iowa. It is anticipated that the information extracted at test sites can be extended to areas not physically examined on the ground, but covered by aerial imagery. Basically, we hope to consolidate our expertise from different fields to maximize the information with respect to agriculture available from remote sensors.

PROGRESS: FORESTRY: Extensive analysis of a wide spectrum of photographic imagery has led the investigators to endorse Conventional Color Imagery as the most ideal base for interpreting the optimum range of vegetation and habitat features. The diagnostic opportunities by changes in the appearance of forest communities and individual species as recorded by conventional color photographic sensors owing to phenological events is exploited to greatest advantage. The chance success of tree recognition from film types relying primarily on spectral analysis has been reduced by investigating and recording the temporal dates of phenological events for the 16 forest communities predominant in the Iowa landscape and the dominant individual species characteristic of each. Selected stero photographs will be presented for interpreter use that captures unique temporal signatures for each forest community during critical event periods and forms the backbone of the Interpretive Keys for Forest Community Analysis Using Low Altitude Conventional Color Aerial Photography. CORN: Data collection describing soybean growth and development under different soil moisture conditions continued in 1978 after the drought plagued 1977. These data are being assembled to develop a new soybean model or to test existing soybean models. Seven cultivars of differing maturity were tested in 1978 and all responded to supplemental irrigation.

SUPPORTED BY Iowa State Government

5.0024, COUPLING OF THE NITROGEN-OXYGEN X AND SULFUR OXYGEN X CYCLES IN THE TROPOSPHERE

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0025, EFFECTS OF MINING AND LAND RECLAMATION ON HYDROLOGY OF SOUTHEASTERN KANSAS

A.M. Diaz, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Lawrence, Kansas* 66044 (KS 77-081)

Effects of past and present mining of coal, lead, and zinc in southeastern Kansas has caused degradation of streams draining the mined areas. Quantitative measures of the degradation and identification of source areas are needed to assess the effectiveness of pollution-control measures, the possible need for changes in mining and reclamation procedures, and design of a long-term quality-monitoring network in southeastern Kansas.

The objectives of this project are to apply the extensive water-quality data being collected in Project KS 76-076 and remotely sensed data from aircraft and LANDSAT to (1) identification from computer-enhanced imagery of point-source areas where poor-quality water discharges from old shaft mines, strip pits, collapsed areas, spoil embankments, and reclaimed areas, (2) evaluation of land-reclamation effects on water quality by analyzing areal and temporal changes in vegetative vigor in reclaimed areas, (3) establishment of a continuing monitoring program using computer-enhanced imagery to detect anomalies associated with acid drainage, and (4) use of results from above activities to design an improved long-term water-quality-sampling network for the mining area in southeastern Kansas.

Remote-sensing techniques will be used to obtain data for analysis with signal-enhancement systems and digital densitometers to discriminate differences in water quality, degrees of vegetative vigor, and 'hot spots' in mined areas vs. natural areas. The analyses will aid identification of sources of stream-quality degradation related to drainage from shaft mines, stripped areas, collapsed underground workings, and coal-processing activities. Photography and imagery will be obtained repetitively from aircraft and, as appropriate, from LANDSAT for comparison to water-quality data from Project KS 76-076. Additional ground-truth data will be collected in anomolous areas identified from the remotely sensed data. Finally, the data will be used to design a long-term quality-monitoring network in southeastern Kansas.

Multispectral-remote sensing data were obtained by the contractor, Daedalus Enterprises. Concomitant ground-level data were obtained from field measurements and chemical analyses of water samples from 30 sites in Cherry Creek. Preliminary review and analysis was begun for the remote sensing data. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0026, ELECTRON POSITIVE ION INTERACTION

R.J. Henry, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (NAGW 48)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0027, SEASAT PROGRAM - RESEARCH APPLICATIONS WITH TROPICAL CYCLONE DATA SETS

R.C. Gentry, General Electric Co., Management & Technical Services, *5030 Herzel Pl., Beltsville, Maryland* 20705 (7-931; MO-AO1-78-00-4323)

OBJECTIVES: Use wind, temperature and moisture measurements from SMMR and SASS, together with all other available data sets taken over three tropical cyclones, to evaluate usefulness of SEASAT-A for hurricane observations. Compare value of this full data set with requirements for making hurricane forecasts.

APPROACH: SEASAT data will be obtained on a moderate disturbance, a tropical storm and a tropical cyclone of full hurricane intensity. All three cases will be selected to insure maximum data availability, but the full hurricane case would further cover periods when the geosynchronous satellite is operating in the limited scan mode for the storm area and the NOAA Research Flight Center has one or more of its aircraft gathering data in the storm at low levels. Data from all sources will be intercompared in order to assess data validity and to set limits on probable errors in the various types of data. These data would then be used to study the structure and energetics of the three storms of varying intensity.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0028, EVALUATION OF NEW REMOTE SENSING INSTRUMENTATION OF AGRONOMIC CROPS

J.H. Elgin, U.S. Dept. of Agriculture, Federal Research Office, Plant Genetics & Germplasm Inst., Field Crops Lab., *Bldg. 001, Room 335, Beltsville, Maryland* 20705 (0044246; 1108-20100-003)

OBJECTIVE: Undertake cooperative research with NASA scientists in identifying optimum parameters for making equipment recommendations for satellites and space shuttle. Develop remote sensing and monitoring techniques on agronomic crops.

APPROACH: In consultation with NASA scientists, develop field cropping systems for remote sensing reflectance experiments. Detailed agronomic data will be collected for all cropping systems and correlations with NASA remotely sensed spectral measurements will be determined. Based on results of this research, recommendation for new remote sensing equipment will be made.

PROGRESS: Extensive small plot plantings of wheat, soybeans, corn, and alfalfa, as well as some large field plantings of corn, soybeans, and wheat, were made in 1978. Agronomic data pertaining to stage of crop development, crop cover, plant height, disease and insect damage, drought stress, and crop yields were taken weekly or as appropriate. Concurrent with the collection of the agronomic data, NASA personnel monitored the plots with remote sensing equipment, including a small hand-held, two-band (IR and RED) radiometer, a larger truck-mounted spectroradiometer, and a truck-mounted microwave sensor. Although analyses of most data are incomplete, preliminary indications show that the increase in green vegetative tissues of all crops can be 'tracked' with the IR and RED radiances from the hand-held radiometer, and that these measurements can be related to yield.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Beltsville Agricultural Research Center

5.0029, EVALUATION OF NEW REMOTE SENSING INSTRUMENTATION ON AGRONOMIC CROPS

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OBJECTIVE: Develop remote sensing techniques to predict crop yield and to detect plant stress for use in early warning. Develop a cooperative research effort with NASA scientists in identifying optimum parameters for monitoring agronomic crops and for making instrumentation recommendations for satellites and space shuttle.

APPROACH: In cooperation with NASA scientists, develop field cropping systems for studying remote sensing reflectance under controlled experimantation. Collect detailed agronomic data for all cropping systems and correlate with spectral measurements. Based on results of this research, recommendations for new remote sensing instrumentation and utilization of remotely sensed data will be made.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Beltsville Agricultural Research Center

5.0030, VOLCANIC IMPACT ON STRATOSPHERIC AEROSOL CHEMISTRY

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0031, A PROGRAM TO DEVELOP REMOTE SENSING EXCELLENCE

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0032, EXPERIMENTAL STUDIES OF THE SOURCES OF ATMOSPHERIC GASES

M.B. McElroy, Harvard University, Cambridge Campus, School of Engineering, Dept. of Engineering & Applied Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAG 1-55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0033, APPLICATION OF TELEOPERATORS TO UNDERSEA TASKS

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OBJECTIVES: To develop improved techniques for performing a variety of undersea manipulation and sensing tasks, tasks which are largely unpredictable, by means of teleoperation a submersible with general purpose arms, hand and video/sonar/tactile sensors which are servocontrolled by a human operator on the surface.

This research would: provide a framework for matching present undersea tasks and available teleoperator tools, especially with respect to economic trade-offs with use of human divers; provide 'baseline' demonstrations and performance data of human controlled teleoperation in specific candidate tasks; develop new techniques for computer augmentation of teleoperators for primitive reflexive control, where the laboratory demonstration of teleoperator sensing and manipulation of a non-

cable tethered submersible have all communication and control through a sonic link.

Because of the fatality rate and the high dollar cost of human divers or manned submersibles, and because of increasing requirements to deep operations, telemanipulation promises significant safety and economic advantages.

ANTICIPATED BENEFITS: Our analysis and laboratory demonstrations should be useful to the undersea operation companies, oil companies, manufacturers of undersea exploration and construction equipment and to the U.S. Government in assessing the usefulness of computer aided teleoperators for a variety of undersea tasks. We will request these companies and agencies to review our work and confer with us.

Further, we plan to collaborate with Harbor Branch Foundation and Woods Hole Oceanographic Institute on demonstrations of our techniques on actual diving equipment.

IDENTIFIED BENEFITS TO DATE: A verbal taxonomy of tasks and variables has been developed through the survey of existing data, the conferring with many experts and practitioners, and the visiting of facilities both in the U.S. and abroad.

This project has provided master's thesis research for two students and a bachelor's for a third, and has contributed to the Ph.D. work of a fourth.

A laboratory manipulator has been refurbished and interfaced with a computer for use in demonstrating techniques that are being developed. Associated analyses have been completed. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0034, THERMAL HISTORIES OF LUNAR ROCKS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0035, HYDROLOGIC-OCEANOGRAPHIC INTERRELATIONS

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Geophysical and drilling programs are being developed to evaluate the potential value of energy resources on the outer continental shelf (OCS) for lease sales and to appraise the environmental impact of development. At the inner margin of the OCS lies the arbitrarily defined coastal zone which includes strand line, estuaries, bays, rivers and contiguous land areas adjacent to the coast. At present one-half of the U.S. population lives in the coastal zone and 80% is projected for the year 2000. Thus, the need for an interdisciplinary study is obvious.

The position of the transition zone between fresh and salt water in coastal aquifers is an important initial boundary condition required for predictive mathematical modeling of salt-water intrusion. A technical objective is to investigate water circulations between the ocean, estuaries and bays and the underlying permeable strata and observe the various phenomena of groundwater discharge such as submarine springs. A second objective is to provide liaison with the Geologic Division, USGS, in OCS investigations. Identification of the seaward extension of aquifers and geologic formations in OCS drill holes will aid (1) in evaluating the energy and mineral resources of the OCS, (2) in appraising the impact of OCS resource development on environmental values of the coastal zone, (3) in fixing the position of the fresh-salt transition zone in ground water for predictive mathematical model studies of salt-water intrusion.

Investigation of water, energy, and mineral resources is accomplished by correlating chemical, thermal, turbidity, and remote sensing observations of surface and ground waters with geologic and bathymetric features of the OCS and coastal zone determined by geophysical surveys and exploratory drilling. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0036, MARS - MINERALOGY OF THE SURFACE MATERIALS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0037, SEASAT PROGRAM - BATHYMETRY AND BOTTOM TOPOGRAPHY MAPPING

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OBJECTIVE: The investigation is concerned with the application of the SEASAT Synthetic Aperture Radar (SAR) to measure ocean wavelengths undergoing wave refraction and relating these changes to the presence of islands, shoals, and water depth.

APPROACH: Examine SEASAT SAR data collected over the Gulf of Alaska and select an SAR pass that has noticeable wave refraction present. The radar-equipped Canadian Convair 580 aircraft will also collect data over the Gulf of Alaska test site. A clear water test site in the Carribean will be selected for targets of opportunity. Selected portions of two acquired SEASAT passes will be digitized, and geometry and radiometric distortions in the SEASAT data will be corrected digitally. The data will be reduced into bathymetry maps using an oceanographically acceptable wave refraction model and the results will be compared to all available sea truth. The SAR image output data is to be corrected optically for geometric effects. Image data will be corrected optically to enhance wave trains and obtain spectra at selected locations; these data would then be reduced into a bathymetry map and compared.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0038, HORIZONTAL MAPPING OF THE THERMAL STRUCTURES OF THE MESOSPHERE AT 85 AND 97 KILOMETERS

J.W. Meriwether, University of Michigan, Ann Arbor Campus, Graduate School, *Rackham Bldg., Ann Arbor, Michigan* 48104 (NAGW 32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0039, CONDENSATION NUCLEI MEASUREMENTS IN THE STRATOSPHERE FOR THE NASA ACE PROGRAM

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0040, REMOTE SENSING APPLICATIONS TO FOREST, WATER AND RANGELAND RESOURCE MANAGEMENT

M.P. Meyer, University of Minnesota, St. Paul Campus, School of Forestry, Dept. of Forest Resources, *301 Green Hall, St. Paul, Minnesota* 55108 (0023512; MIN-42-037)

OBJECTIVE: Significantly improve the data-gathering and analysis capabilities of research scientists, planners and managers in forest, water and rangeland resources development fields.

APPROACH: Definition of the problem - final selection on basis of need and potential for ultimate application to greatest number of users and/or resource values (relative cost-effectiveness). Design of project - accomplished, insofar as possible, in cooperation with interested, potential users; equipment package, timing selection of vegetation stage, overflight plan, coordination w/ground cooperators and ground truth needs definition and plans for collection and final analysis. Overflights/ground truth - image interpretation; image enhancement/analysis where

appropriate. Data analysis - review with, and possible assistance to adaptation by, the Cooperator-Users' report/publication.

PROGRESS: Habitat mapping of 64,000 ha. of coastal portions of Alaska were completed using 35mm CIR photos to analyze key areas and establish trend analyses. CIR 1:36,000 metric camera and small format photography were used to map 84,400 ha. of vegetation of the Miss. Riv. Headwaters. Classification of the wetlands of the 720,000 ha. TC Metro Area was accomplished with 1:24,000 CIR; these data used to test the capabilities of various other scales of CIR photography and digitally processed LANDSAT data. The status of change of the water surfaces and vegetation 1939-present on 43,300 ha. of Upper Miss. and Lower St. Croix Rivers determined by airphoto comparisons and field investigations. Color 35mm long focal length leaf-off vertical photography was tested to assess recreation developments on forested lakeshores. The applicability of 1:12,000 Cibachrome airphotos as a data base for vegetation management and Dutch Elm Disease detection is being tested in Duluth. Vegetation types of 80,800 ha. of forest peatlands in Minn. are being classified with 1:15,840 B and W airphotos supported by 35mm multi-camera multi-scale 35mm CIR transects and plots.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Minnesota

5.0041, DEVELOPMENT OF REMOTE SENSING EXPERIENCE AT THE UNIVERSITY OF MISSOURI-COLUMBIA

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0042, MEASUREMENT OF THE DIURNAL VARIATION OF THE RADICALS IN THE UPPER ATMOSPHERE

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0043, EQUILIBRIUM CONDENSATION OF PLANETARY MATERIALS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0044, A STUDY OF THE MARTIAN FRETTED TERRAINS-LIGHTLY CRATERED TERRAINS BOUNDARY

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0045, SEASAT PROGRAM - GEODETIC STUDIES WITH SEASAT-A

M. Talwani, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (7-927; MO-AO1-78-00-4324)

OBJECTIVE: To examine altimeter data in the 100-200 km wavelength range for studying geoid anomalies related to specific geological and tectonic features, and finally to map oceanographic anomalies.

APPROACH: Gravimetric geoids will be constructed in the western North Atlantic and in the western Pacific for comparison with SEASAT-A data. These data are based on all available gravity data which have been carefully checked and are expected to yield the most accurate gravimetric geoids in those areas. Comparison between altimeter-determined sea surface heights and the gravimetric geoid will be used in estimating the sea surface topography attributed respectively to oceanographic phenomena and to gravity variations. The time varying part of sea surface topography may also be determined. The association of the geoid with several morphological and tectonic features of the world's oceans will then be established and refined; attempts will also be made to interpret the geoid undulation in geological and geophysical terms.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0046, RARE GASES IN METEORITES

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0047, RESPONSE OF SELECTED PLANT SPECIES TO SIMULATED EXHAUST MIXTURES/COMPONENTS FROM SOLID ROCKET FUELS

J.L. Apple, University of North Carolina, North Carolina State University, U.S. Dept. of Agriculture Federal Research Office, Air Pol Plant Growth & Development Research, *Raleigh, North Carolina* 27607 (0043024; 7092-20790-004-A(2))

OBJECTIVE: Develop a system to expose test plants to simulated exhaust of solid rocket motors. Develop a system for dispensing and monitoring component chemicals of solid rocket exhaust (HCl and Al(2)O(3)). Determine dose-response curves for single and multiple acute exposures of selected plant species, using injury and biomass as the prime response measures.

APPROACH: Exhaust exposures will be simulated by modifying present field chambers. Operation of the system assumes that the diameter and length of a solid rocket fuel 'bar' can be determined for a given length of burn and total pollutant loading. Twenty selected plant species will be screened to 4 concentrations of HCl or Al(2)O(3) for one hour. Based on results 8 species will be further screened using at 4 X 4 factorial design (concentration X time) for both materials. From these results selected plants will be screened using simulated exhaust systems. Plant injury, changes in leaf area, and changes in biomass will be determined.

PROGRESS: Greenhouse exposure chambers were built and tested for use with HCl gas and Al(2)O(3) particle. A controlled burn facility was designed and tested for exposing plants to fuel exhaust. Twenty-three native species, eight horticultural species (15 cv) and three agronomic species (8 var) were studied in at least one phase of this project. The injury threshold for a one hr exposure to HCl ranged fom less than 5 ppm to greater than 40 ppm. A few sensitive plants were injured in 10 min by 10 ppm of HCl. The horticultural and agronomic plants were most sensitive, the native were intermediate and the citrus were most tolerant to HCl. The Al(2)O(3) did not injure any of the plant either alone or in combination with HCl. Plant were about as sensitive to the fuel exhaust as to HCl, based on the HCl exhaust concentration. Mature valencia orange trees, Citrus sinensis, were sprayed with hydrochloric acid solutions of pH 2.0, 1.0, or 0.5 at the full-bloom stage or when new fruit was 0.5-1.5 cm in diameter and compared with a pH 7.8 control. The threshold pH for visible symptoms on flowers, leaves, petioles, stems and immature fruit was near 2.0. Injury was moderate at pH 1.0 and was severe at pH 0.5. The pH 2.0 solution did not affect the set and retention of new fruit. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Mid Atlantic Area

5.0048, THE INFRARED SPECTRAL ANALYSIS OF CF2CL2: APPLICATION TO ATMOSPHERIC DETECTION AND ABUNDANCE MEASUREMENTS FOR PLANNED IN-SITE EXPERIMENTS

R.J. Nordstrom, Case Western Reserve University, School of Engineering, Dept. of Electrical Engineering & Applied Physics, *University Cir., Cleveland, Ohio* 44106 (NAGW 31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0049, AUTOMATED MEASUREMENTS OF CALIBRATED CONCENTRATIONS (CO, CH4, AND CO2) AT SAMOA AND TASMANIA

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0050, TEST OF THE LANDSAT-DATA COLLECTION SYSTEM IN THE SUSQUEHANNA RIVER BASIN

J.V. Funt, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *228 Walnut St., Harrisburg, Pennsylvania* 17108 (PA 73-051)

The potential use of earth orbiting satellite data relay systems for flood warning has not been well explored.

The objective of this project is to test the earth resources technology satellite-data collection system on key stream gages in the Susquehanna River Basin for flood warning.

Four data collection platforms will be field installed on stream gauges in the basin. Data relayed from the gauges will be provided to the Susquehanna River Basin Commission and the National Weather Service's River Forecast Center in Harrisburg.

Data collection platforms were installed at nine gauging stations in the Susquehanna River Basin for relaying data through the GOES satellite. Data collection platforms were operated at four gauging stations in the Susquehanna River Basin using the LANDSAT satellite to relay the data.

The operation of the LANDSAT data collection system will continue. The operation of the GOES data collection system will continue.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0051, CENTER FOR OCEAN MANAGEMENT STUDIES

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OBJECTIVES: The Center for Ocean Management Studies was created in the fall of 1976 for the purpose of promoting effective coastal and ocean management. The center identifies ocean management issues, holds workshops and conferences to discuss these issues, and develops recommendations and programs to resolve them.

ANTICIPATED BENEFITS: Activities of the Center encourage better utilization of the resources in the ocean economic zone and the coastal zone. This is achieved by providing a forum of the discussion of ocean management problems and ways of resolving them. In addition, conferences, workshops, and seminars educate professionals and the public on ocean management issues. Better informed citizens will assure wiser management of the coastal and ocean resources.

IDENTIFIED BENEFITS TO DATE: It is too early to assess benefits, however the following progress is reported: The Center has encouraged interdisciplinary communication within the University through its. 'inhouse' lectures, workshops, and newsletter. Its working committees on Fisheries Management, Coastal Zone Management, Marine Pollution, Multiple Resource Use, and Remote Sensing have provided a mechanism for the development of interdisciplinary programs within the University on these issues. The Center has also acted as liaison between the University and other institutions. At the regional and national levels, the Center has provided forums at which representatives from academic institutions, government agencies and private enterprises have discussed marine management problems such as: Oil spills, Estuarine/Shelf Coupling, Fisheries Management, Coastal Information Systems and Formulating Marine Policy.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0052, SEDIMENT TRANSPORT AND DEPOSITIONAL PATTERNS IN SELECTED COASTAL LAGOONS AND SALT PONDS, SOUTHERN R.I.

J.C. Boothroyd, University of Rhode Island, School of Arts & Sciences, Dept. of Geology, *Kingston, Rhode Island* 02881 (R/CL-4)

OBJECTIVES: The overall purpose of the proposed study is to define by field measurements some geologic parameters of the following Rhode Island coastal lagoons and salt ponds: 1) Ninigret/Green Hill complex; 2) Trustom; 3) Card; and 4) Pt. Judith/Potter complex.

The parameters to be determined are: 1) pathways of sediment influx into the lagoons/ponds; 2) modes of transport of sediment into the lagoons/ponds; 3) modes of transport of sediment within the lagoons/ponds; and 4) depositional sites of the sediment.

This information would be developed into a sediment transport and depositional model that would be available to workers in other disciplines and aid in resource management of the lagoon and pond system.

ANTICIPATED BENEFITS: The results of this effort integrated with the other proposals attempts to develop an understanding of coastal pond dynamics such that objective management decision can be made.

IDENTIFIED BENEFITS TO DATE: It is too early to identify benefits. The following progress is reported: Oblique aerial photography and geologic mapping at a scale of 1:6,000 has identified about 50 separate depositional environments in and around Ninigret/Green Hill and Pt. Judith/Potter Ponds. These can be divided into several groups of depositional environments with major deposition within the tidal-delta systems. Very little coarse-grained (sand) deposition is occurring presently in other areas of the ponds except as a subtidal lobe due to catastrophic overwash processes into Ninigret Pond behind the East Beach barrier spit. Hydrography station results indicate the same sort of sand movement pattern.

The depositional environments co-related well with the submerged macrophyte occurrence patterns of Harlin and Thorne-Miller in Ninigret Pond; and with the modeling results of Spaulding in Pt. Judith Pond.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0053, COASTAL ZONE MANAGEMENT AND MARINE ADVISORY SERVICE APPLICATIONS OF REMOTE SENSING

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OBJECTIVES: 1. Prepare a Coastal Zone User's Manual of remote sensing for coastal management and marine advisory service personnel that: a) Summarizes existing sensors, sensor platforms and remote sensing data products applicable to the coastal zone. b) Identifies oceanographic and coastal variables which have been quantified in the past using remotely sensed data. 2. Sponsor a workshop directed primarily at the New York and New England coastal management and marine advisory service communities to: a) Obtain feedback from these potential remote sensing users as to what their data needs are in the area of management and advisory services. b) Provide for an exchange of information between potential suppliers and potential users of remote sensing data in the coastal regions. c) Critique and amend the manual prepared in item (1). 3. Define an interface which will encourage coastal managers and marine advisory specialists to become users of remotely sensed data.

ANTICIPATED BENEFITS: 1. Improved marine advisory and coastal planning capabilities as a result of improved

access to a large and growing data base. 2. Introduction of the New York/New England coastal communities to the potentials of remote sensing, the sources of such data and the specialists who interpret these data.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0054, EVALUATION OF LANDSAT DATA FOR DISASTER ASSESSMENT AND PLANNING

D. Moore, South Dakota State University, Remote Sensing Inst., *Brookings, South Dakota* 57006 (AID/OFDA-147-79-03)

The purpose of this study is to evaluate the effectiveness of including LANDSAT data in flood disaster assessment operations.

In July, 1978, a disaster occurred in the Blue Nile Basin, Sudan, where rainfall in excess of 40 cm per day fell for three consecutive days. This resulted in severe flooding of parts of the Blue Nile and Gezira Provinces which include a flat sedimentary clay plain with little internal or surface drainage. The major damages were to recently planted cotton and millet crops and to irrigation canals of the Gezira Irrigation Scheme.

LANDSAT data were collected within two weeks after the peak of the flood. Historic LANDSAT data were available for temporal analysis. Technical assistance to conduct visual analyses of standard and enhanced photographic products plus digital analyses on man-machine interactive systems is being provided by OFDA under contract with the Remote Sensing Institute (RSI, South Dakota State University, Brookings, S.D.). Ground data provided through the Government of Sudan will be used to verify and update the interpretations from LANDSAT data. Recommendations to OFDA and similar organizations for the use of space technology will be documented by RSI concerning the type of data, viable analysis procedures, expected accuracies, and the use of remote sensing from LANDSAT in disaster assessment planning. The results of this investigation will be presented at the Fourteenth International Symposium on Remote Sensing of Environment sponsored in Costa Rica by the University of Michigan in April, 1979.

Research techniques have been developed to assess the spatial extent and levels of damage to the Gezira Irrigation Scheme. Evaluation of the use of LANDSAT for simulated disaster assessment operations will continue for several months at which time a paper will be prepared for delivery at the Symposium in Costa Rica.

SUPPORTED BY U.S. International Development Cooperation Agency, Agency for International Development

5.0055, REMOTE SENSING OF SO2 EFFECTS ON VEGETATION

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OBJECTIVE: To test, refine, and develop remote sensing instrumentation and techniques for monitoring the visible, previsual, and extravisual effects of SO2 emissions from fossil fuel electric generating stations on terrestrial vegetation.

APPROACH: Obtain low and high altitude color, color infrared, multi-spectral scanning, ground-truth, and spectral reflectance data.

PROGRESS: The above data is being obtained for effects on soybeans and mixed southern pine-deciduous hardwood timber stands in the vicinities of the Shawnee, Widows Creek, Johnsonville, and Colbert steam plants for both manual and automated interpretations, and (for spectral reflectance data) in the field and laboratory to calibrate the aerial sensors.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Office of Environmental Processes & Effects Research

5.0056, REMOTE SENSING FOR LAND RESOURCE MANAGEMENT WITH RANGELAND EMPHASIS

R.H. Haas, Texas A & M University, College Station Campus, Agricultural Experiment Station, Dept. of Range Science, *College Station, Texas* 77843 (0062471; TEX01978)

OBJECTIVE: Investigate the use of remote sensing for inventorying rangelands and other natural ecosystems for local and regional resource management. Evaluate the use of aircraft and spacecraft sensor data for monitoring the effects of weather and management on short-term range feed conditions and long-term successional changes in vegetation. Acquire basic information on reflectance characteristic of natural vegetation systems for cataloging phenological effects. Evaluate the cost-effectiveness of potential remote sensing applications.

APPROACH: Sequential, multispectral imagery will be obtained from rangelands with known management treatments. Existing and new aerial photography will be evaluated for observable differences in reflectance characteristics and compared with 'ground truth' data collected at selected sites. Terrestrial and aerial photography, as well as vegetation data and existing soils information will be used to evaluate satellite imagery for monitoring seasonal changes in vegetation conditions. Various types of remote sensing data will be evaluated as new information sources for practical application to the management of rangelands and other natural ecosystems.

PROGRESS: Research is being conducted on the use of remote sensing for inventorying rangelands and other natural ecosystems in Texas. Emphasis is given to evaluating the use of aircraft and spacecraft sensor data for monitoring the effects of management practices and weather conditions on short-term range feed conditions and long-term successional vegetation changes. A major effort is concentating on developing applications for large-scale color and color infrared aerial photography and LANDSAT data in managing University of Texas Lands in West Texas. A NASA supported study has been completed and indicates that of LANDSAT data products, the Transformed Vegetation Index (TVI-6) is an effective quantitative estimator of green biomass at critical seasons of the year. LANDSAT digital data analysis provide an effective tool for the regional monitoring of 'range readiness' and for monitoring seasonal and long-term drought on a regional basis. A study on the 'Evaluation of LANDSAT MSS data for classifying and characterizing natural vegetation on a regional basis' has determine that the most quantitative relationships between reflectance measurements and rangeland vegetation parameters occur in spring and fall. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Texas

5.0057, SEASAT PROGRAM - SOIL MOISTURE/SCATTEROMETER/SAR CORRELATION

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OBJECTIVE: To determine the range of the scattering coefficients (sigma o) received from SAR for all field conditions from dry to saturated and compare SAR AND 1.6 gHz scatterometer sigma o values over the same field conditions. The results are expected to aid in the evaluation of the SEASAT-SAR's sensitivity to differences in soil moisture.

APPROACH: In order to establish the influence of soil moisture on data collected by the SEASAT SAR, three major categories of data will be obtained: ground samples, aircraft 1.6 gHz scatterometer sigma o values, and digitized SAR imagery. Data analysis will be directed toward the following major considerations: 1. Is the influence of soil moisture differences a major factor in the interpretation of the SEASAT SAR imagery? 2. How well does the SAR data correlate to measured soil moisture differences? 3. How well does the SAR data correlate to scatterometer data?

CURRENT PLANS AND/OR PROGRESS: Complete negotiations and execute a contract by Sepember 30, 1978.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0058, REMOTE SENSING FOR IMPROVED SOIL AND CROP MANAGEMENT

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OBJECTIVE: Develop procedures for spectrally measuring plant stresses due to nutritional status, salinity, soil moisture, temperature, pollutants, drainage conditions, and soil edaphic factors on fruit, vegetable, and field crops and rangeland; apply remotely sensed plant and soil condition information to improve their management.

APPROACH: Thermal patterns will be sensed with scanners and radiation thermometers to develop freeze prediction equations, assess damage to sugarcane and other crops, develop cold protection systems and schedule irrigations. Color infrared photography and ground truth will be related to the health and yield of sugarcane, sorghum, citrus, and other crops. Laboratory and/or field spectral reflectance measurements, made periodically on normal and stressed crops and different crop genera, species, and cultivars, will be related to chlorophyll, water content, ground cover, and other factors to determine optimum wavelengths for detecting particular conditions and species' specific responses. Models describing the interaction of light with plant canopies and soils will be developed.

PROGRESS: A growth regulator (Pix - a registered trademark) increased near-infrared and decreased visible light reflectance of cotton leaves. Pix at 15 g a.i./ha increased the CO(2) assimilated by cotton leaves. Photo- and LANDSAT-estimated areas of silverleaf sunflower had good percentage agreements (9.1 and 9.5%, respectively). Leaf visible light reflectance of 5 of 7 rangeland species decreased as N concentration decreased. Optical constants (infinite reflectance, absorption coefficient, scattering coefficient were calculated for 7 weeds species. The shadow distribution pattern was different in plants with large, flat leaves oriented to intercept maximum amount of sunlight (sunflowers) from the pattern of narrow, curved leaves (corn and sorghum). A light absorption model (LAM) for vegetative canopies has been devised from the Suits' reflectance model. Wheat plant reflectances at the peaks (1.65 and 2.20 Mum) between water absorption bands differed more from the reflectance of bare soil early in the season and at maturity than did the other wavelengths. Reflectance in the near-infrared plateau (0.75 to 1.35 Mum) became the same as bare soil after the wheat lost its green color at maturity.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Subtropical Texas Area

5.0059, AGRICULTURAL APPLICATIONS OF SATELLITE ACQUIRED EARTH OBSERVATIONS

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OBJECTIVE: Develop and test rapid and timely methods for handling, analyzing, and applying satellite data to agricultural problems over large areas.

APPROACH: Relate satellite indicators of plant residue amount in a wheat-fallow rotation to wind and water erosion susceptibility of soils. Utilize earth surface temperatutes from NOAA-(SMS AND GOES) and NASA-(HCMM and LANDSAT C) to: Estimate soil temperatures suitable for planting advisories, determine vegetative ground cover, and estimate soil water conditions and/or evapotranspiration rates. Identify crops and land uses, measure crop acreages, and classify various soil and crop condition categories in the ARS wheat yield prediction effort and joint ARS-SCS wind erosion effort. Merge the spectral indicators of biomass, growing conditions, and stresses with physiological model outputs to improve estimates of grain (sorghum, wheat) maturity date and probable yields on the Great Plains. Inventory rangeland and estimate the harvestable forage. Investigate techniques for distinguishing plants and plant residues from the variable soil background that can aid automated soil mapping and crop discrimination.

PROGRESS: The hectarages of 5 land-use categories (grassland, mixed brush rangeland, saline rangeland, cropland, water) were successfully estimated using a LANDSAT color image enlarged to a 1:100,000 scale. A multitemporal classification strategy was developed and applied to a 1500-ha area. Atmospheric radiative transfer theory produced LANDSAT estimates of rangeland plant reflectances that are as accurate as those from the Exotech spectroradiometer. Wheat residue, necessary for soil erosion control, was significantly related to a soil brightness index derived from LANDSAT data at 5 sites near Akron, CO. Grain yields were significantly reduced when either 23, 43, or 63% of the leaf area was removed from the plant at half-bloom. A computer procedure was developed to scale rectify thermal satellite data to a 20-second-resolution rectangular coordinate map. Computerized techniques have been developed to extract satellite observed surface temperatures from each of 24 weather stations located in the HCMM test site and to provide surface temperature profiles from 48 areas that range from the Gulf of Mexico to 240 km inland. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Subtropical Texas Area

5.0060, GRANULE ARMOR ON SAND DUNES

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0061, ATMOSPHERIC DISTRIBUTION OF WATER VAPOR AND AEROSOLS BY WIND SYSTEMS AND TURBULENT FLUXES

G.L. Wooldridge, Utah Higher Education System, Utah State University, Agricultural Experiment Station, Dept. of Soil Science & Biometeorology, *Main Bldg., Room 104, Logan, Utah* 84321 (0062929; UTA00403)

OBJECTIVE: Measure airflow patterns in complex terrain. Calculate aerosol dispersion patterns. Prepare graphic representations of circulation features. Prepare profiles of water vapor and momentum fluxes in the atmosphere. Improve numerical models of dispersion in complex terrain. Continue the development of parameterization of vertical aerosol fluxes.

APPROACH: Airflow and aerosol dispersion patterns will be derived from pilot balloon, superpressure balloon, and tethered balloon flights tracked optically and carrying temperature transponders. The tracking data will be statistically analyzed to derive diffusivity coefficients. These (parametric) coefficients will be incorporated into one-, two-, and three-dimensional models of aerosol convection and dispersion. Temperature data will be analyzed to calculate heat fluxes in the lower atmosphere.

PROGRESS: Field investigations of air circulation patterns, dispersion parameters, and air temperature structure were completed over three mountain slope regions of Northern and Central Utah. The investigations used pilot balloons and superpressured mylar (constant volume) balloons carrying temperature transponders. The balloons were optically tracked over distances of several kilometers at progressively higher elevations up to altitudes of 2000 meters above the surface. The trajectories of the balloons have been traced on horizontal projections and related to the underlying terrain features. Vertical cross sections of the trajectories have been prepared, again with the underlying terrain shown; the temperatures telemetered from the sondes have been converted to potential temperatures and displayed along the trajectories. These in turn have been analyzed and are serving for calculations of atmospheric stability and potential energy. Diffusivity coefficients for different levels in the atmosphere have been calculated from the balloon tracking data. Most of the flights represent neutral or unstable atmospheric structure, and indicate the high capability of dispersion that exists on mountain slopes during periods of strong radiative warming. The diffusivity coefficients have been used to construct a one-dimensional model of coefficients as a function of atmospheric stability, surface roughness, and the geostrophic wind.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Utah

5.0062, HYDROLOGIC INTERPRETATIONS BASED ON HEAT-FLUX ANALYSES AND THE APPLICATION OF REMOTELY SENSED INFORMATION

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Aside from thermal loading stemming from powerplant operations, little has been done to assess man's influence on the thermal patterns of natural streams. Near stream environmental changes due to man's activities may adversely impact stream ecology by altering stream temperatures. In addition to stream-temperature problems, evaluation of remote sensing instrumentation as a method of detecting sources of thermal pollution, sedimentation, and erosion in large water bodies as well as current circulation has obvious application to a wide variety of hydrologic problems.

(A) to isolate and evaluate the effect of man-imposed changes on stream-temperature patterns; (B) identify stream-temperature patterns under a variety of climatic regimens; (C) to assess near shore current patterns in Lake Ontario using turbidity plumes as tracers; (D) to evaluate the utility of the LANDSAT III thermal imager as a means of detecting thermal plumes in the Lake; and (E) to continue work in defining the utility of remotely sensed land-use information as a means of improving streamflow estimates.

Pairs of watercourses consisting of a 'control' stream (one under essentially natural conditions) and one or more streams that have been altered by man's activities have been instrumented in selected basins of the northeast U.S. Comparisons on 'altered' stream and its control should reveal the effects of environmental changes on water-temperature patterns. High-altitude photographs and LANDSAT imagery will be used to detect transitory hydrologic phenomena such as heat and turbidity plumes, shoreline erosion, and ground-water inflow to streams.

Cooling water discharge at the rate of 30 m**3/s and flowing as a surface jet orthogonal to the shoreline produced a thermal plume in Lake Ontario that extended 1km offshore and was 2km in width in August 1978. The thermal plume created by the power plant located 19 miles northeast of Rochester, N.Y., changes shape rapidly in response to wind speed and direction. It is anticipated that the 10 degrees C rise in temperature above ambient lake levels created by the heated power plant discharge will be detectable by the HCMM satellite.

To continue field operations at the Ginna power plant for the purpose of detailing both thermal and turbidity plume dynamics under a variety of seasonal conditions. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0063, WATER RESOURCES DIVISION SATELLITE DATA RELAY PROJECT

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There is a rapidly developing satellite data transmission technology that may provide the Water Resources Division with an economical means for collecting and disseminating in real time data from remote sampling sites. Tests of the NASA LANDSAT and NOAH/NESS GOES data collection system have demonstrated the feasibility of mating USGS field instruments with field radios and routinely relaying the data. Yet to be determined are final specifications for an operational system, cost, benefits, and the feasibility of using a commercial service.

The objectives are to test and evaluate the performance characteristics of LANDSAT, GOES, Comsat General, and subsequently available satellite data systems as potential operational tools. The results of these test will be used to design and implement an operational satellite data telemetry system to support the collection of hydrologic data.

A number of LANDSAT DCS experiments have been conducted and will continue. The GOES-DCS was tested in 1976-77 and will continue to be tested through 1978. The Comsat General 11 site demonstrations ends June 19, 1978. A follow up on Comsat General pilot project involving 101 sites is expected to be tested in early 1979. This project will have overall responsibility for the program of testing these systems. The program will consist of technical coordination and direction from the project leader in Reston. Computer software support is being developed in the WRD Automatic Data Section.

LANDSAT and GOES are operational. The number of LANDSAT DCPs has decreased to 30. The GOES DCPs are slowly increasing and now stand at 110. The Comsat General 11 site demonstration has been successfully completed. The computer software development has been progressing with the assistance of contractor support.

LANDSAT and GOES DCS activities will continue to receive support from this project. WRD will be continuing to support changes in the GOES system so that DCP problems can be detected automatically and data can be sent directly from NESS to the USGS MULTICS computer in Reston. Plans are also being considered to test a hydrologic data service from a commercial source.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0064, PAST AND PRESENT SHORELINE TRENDS OF THE MID-ATLANTIC COAST AND WAVE ADVISORY SERVICES

V. Goldsmith, Virginia Inst. of Marine Sciences, Dept. of Geological Oceanography, *Gloucester Point, Virginia* 23062 (R/PP-1)

OBJECTIVES: Previous compilations of historical shoreline changes indicate large spatial and temporal variations in erosion and accretion even for areas only a few km apart. This proposed study will attempt to delineate this local variability by analysis of long-term beach profiles and data from aerial photography. Comparison of these data with historical data for the same areas will show if past shoreline trends are similar to present trends. An attempt to verify this comparison by delineating areas of greater vulnerability to storms will be performed with current storms. These data will be checked against weather forecaster's erosion reports, and comparison will then be made to past trends. Methodology will be developed for identifying areas of historical storm vulnerability, defining standard storms and using hindcasts for wave model input. In addition, assistance will be provided to J. Fisher (Clemson Univ.) and S. Nnaji (Univ. of Va.) in development of a comprehensive shoreline management model for the National Park Service and Wave Advisory Services will be provided to U.S. Army Corps of Engineers (Baltimore), State of Ohio, and others.

ANTICIPATED BENEFITS: These data, delineating areas of accreting and eroding shorelines, both presently and historically, will be extremely useful in planning the expanding use of the coastal zone. This information will be provided to all Federal, State and local planning and management agencies in the mid-Atlantic region. Attempts will be made to include these agencies as early as possible in order to obtain their advice on format of final product. An example of this usage is the comprehensive shoreline management model being developed by Fisher and Nnaji (based on these data) for the National Park Service to aid in their long-term management regarding the shoreline placement of buildings, parking lots, roads, etc. Knowledge of expected shoreline changes and their economic effect is considered by them to be essential for efficient management.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0065, POLAR ICE REMOTE SENSING

W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 70-064)

One of the fastest varying large-scale features on the earth's surface is sea ice. Theoretical studies show that the ice canopy in polar regions to be of major importance in (1) determining the global heat balance, and (2) determining the vapor flux of water into temperate regions. In order to test the developing numerical models of polar regions it is necessary to acquire sequential large-scale synoptic data over polar regions. Remote sensing especially in frequencies in the microwave range, appear to offer the best change of obtaining these data.

As Principal Investigator for Sea Ice for NASA and the Space Craft Oceanography Center-NOAA, we will design polar remote sensing experiments using NASA and other agency remote sensing aircraft and satellites. Aircraft and satellite experiments will be coordinated with necessary ground truth net-

works for the remote sensing systems. The basic premise for these plans will be to develop the correct remote sensing means to acquire data that will be useful in testing numerical models of sea ice and glacier ice.

The Project Office will continue work on the AIDJEX data. The members will also participate in and direct the fall and spring NASA remote sensing flights for SEASAT and Nimbus-G experiments and will analyze data collected by the satellites, aircraft, surface experiments, and the Canadian surface and aircraft experiments. The work with GISS on sea ice models for global climate models will continue. We will also be working with the Conservation Division in Alaska on problems of offshore structures and ice and environmental hazards applications of the data. Dr. Campbell will continue his tenure on the glaciology panel and ad hoc committee on ice forces and offshore structures and a high level NASA committee for space applications.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0066, LONG TERM VIKING LANDER METEOROLOGY MISSION OPERATIONS AND ANALYSIS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0067, CHANNEL MORPHOLOGY AND SEDIMENTATION IN PHEASANT BRANCH NEAR MIDDLETON

W.R. Krug, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Madison, Wisconsin* (WI 77-084)

Severe channel and bank erosion in Pheasant Branch and accelerated sediment deposition in both Pheasant Branch Marsh and Lake Mendota are occurring within the basin. Accelerated degradation is occurring in the basin because channel was straightened in the 1930's for a drainage program and the basin is rapidly becoming urbanized. Bank erosion is encroaching on public and private property in the city of Middleton requiring expensive channel-protection measures. Lake deposition has become so severe as to require expensive routine dredging for aesthetic and navigational purposes.

The objective of the project is (1) to evaluate streamflow, sediment transport, and channel morphology in Pheasant Branch basin; (2) to relate these hydrologic charcteristics to land-use practices; (3) to provide a method of evaluating the effect that future changes in land-use practices will have on Pheasant Branch; and (4) to provide ground truth data for calibration of remote-sensing imagery as a tool in monitoring nonpoint pollution.

During the five-year project the following items will be completed for Pheasant Branch basin: (1) evaluate the headwater erosion and stream-channel morphology; (2) analyze effects of urbanization on stream-channel morphology, sediment transport, and delta formations; (3) project changes in channel geometry, streamflow, and sediment transport; (4) delineate between stream-channel and upland erosion; (5) identify critical areas of erosion and suggest required management practices; and (6) supply cooperator with sediment transport, streamflow, sediment-source, and channel-geometry data for remote-sensing imagery calibration.

Compared 1971 and 1977 channel surveys. Surveyed additional cross-sections at sites throughout basin. Installed additional recording rain gage at western edge of basin.

Continue monitoring streamflow and sediment at gaging stations. Resurvey 1977 channel cross-sections. Calibrate Middleton storm-water management model and use for various development conditions. Do bed material survey.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0068, REMOTE SENSING OF THE GREEN BAY WATERSHED TO ESTIMATE THE IMPACT OF LAND DEVELOPMENT ON THE BAY'S WATER QUALITY

F. Scarpace, University of Wisconsin, Madison Campus, Inst. for Environmental Studies, *Agriculture Hall, Madison, Wisconsin* 53706 (R/GB-9)

OBJECTIVE: To use remote sensing data in a hydrological runoff model to assess nonpoint source pollution in Green Bay and to predict the effects of future land development on the Bay's water quality. Specifically: 1. To develop techniques for mapping land cover from digitized multispectral aerial imagery for use in a hydrological runoff model. 2. To demonstrate the viability of the above technique in selected Green Bay watershed areas. 3. To utilize the resultant data in: a) an existing Wisconsin Department of Natural Resources model for use in the 208 Water Quality Program and, b) several streamflow-water quality models developed by the U.S. Geological Survey.

ANTICIPATED BENEFITS: This information will be of direct benefit to state and local agencies managing the Green Bay area as well as other Sea Grant investigators studying the nonpoint source pollution problem in Green Bay (see R/GB-8). Both the Wisconsin Department of Natural Resources and the U.S. Geological Survey will cooperate on the project and, if it is successful, will probably apply the techniques to their other ongoing programs. These techniques should have nationwide application in studies of the contribution of land use and development to water quality degradation.

IDENTIFIED BENEFITS TO DATE: 1. Contact has been established with the city of Green Bay's Engineering Department, Brown County Highway Commission and local representatives of the Wisconsin DNR. 2. Selected three diverse subwatersheds in the Green Bay area as test sites and established monitoring stations on all three sites. These will become operational by mid-March. 3. Preliminary photointerpretation of existing imagery of the sites was carried out.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0069, INTERPRETATION OF RESULTS FROM THE PIONEER VENUS NET RADIOMETER EXPERIMENT

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0070, PRECIPITATION RATES FROM WAVE AND INFRARED RADIOMETRY AND USE OF SEASAT-A DATA TO DETERMINE HURRICANE PRECIPITATION (ABBREV)

J.A. Weinman, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (7-924; MO-AO1-78-00-4320)

OBJECTIVE: SEASAT-A SMMR data will be used to demonstrate the remote determination of rainfall rates by microwave radiometry. The proposed study will build upon experience gained in the analysis of NIMBUS-5 ESMR data, and an important objectve will be to utilize the SMMR data to monitor rainbands in hurricanes during the course of their evolution.

APPROACH: Develop rainfall analysis procedures taking advantage of SMMR multispectral microwave imagery supplemented mainly by infrared experience. Obtain ground truth from digitized radars, such as in the D-Radex and those in operational NWS networks which provide VIP displays. Raingage network data will be obtained for ground truth to check the rainfall rates inferred from SEASAT-A observations. Rainfall distributions from SEASAT-A will be tracked as hurricanes develop and travel westward across the Atlantic Ocean. The analysis will be extended to include the effects of capillary waves and foam.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0071, CARBONYL SULFIDE - AN ANALYSIS OF MEASUREMENT TECHNIQUES AND DETERMINATION OF THE STRATOSPHERIC PROFILE

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, LIVER CELLS - A MODEL SYSTEM FOR STUDIES ON METABOLISM IN SPACE

M.E. Tolbert, Tuskegee Inst., School of Arts & Sciences, Dept. of Biology, *Tuskegee Institute, Alabama* 36088 (NAG 2-22)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0002, MODULAR AUTOMATED ENZYME ACTIVITY ANALYZER SYSTEM

J. Fox, Caltronics Industries Inc., *Solana Beach, California* 92075 (DF324370; F33615-78-C-0625)

To develop a fully automated modular system with operator controlled multi-variable parameters for assay of intracellular enzyme activity. This system will be used to develop methods that provide additional diagnostic tools in the detection and treatment of incipient disease. These methods will directly support the USAF Aeromedical Consultation Service and the heart program for determining risk, and will also provide additional criteria for screening enlistees for the Air Force.

A multi-source solicitation will be sent to civilian companies for the design, fabrication and delivery of a modular system. Cost-effective design will incorporate 3 detector components presently in use in the clinical pathology branch for the measurement of optical density, fluorescence and luminescence. The modules to be fabricated are: sampler, flow cell, flow cell filter, analong-to-digital interface, and microprocessor. The purchase request package has been submitted and we are awaiting receipt of proposals.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0003, INSULIN RESISTANCE IN ANIMALS EXPOSED TO WEIGHTLESSNESS IN SPACEFLIGHT - EFFECT OF EXERCISE TRAINING

G.M. Reaven, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NAS 2-10512)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, MONKEY METABOLISM, BODY COMPOSITION AND CARDIOVASCULAR FUNCTION IN WEIGHTLESSNESS, EXPERIMENT NO. 781-061

N. Pace, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physiology & Anatomy, *Berkeley, California* 94720 (NAS 2-10499)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, SCALE RELATIONSHIPS IN MAMMALIAN METABOLISM IN WEIGHTLESSNESS, EXPERIMENT NO. 781-310

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0006, LIFE SCIENCE EXPERIMENT ARC 781-127, EFFECT OF ZERO-GRAVITY ON BIOCHEMICAL AND METABOLIC PROPERTIES OF SKELETAL MUSCLE

K.M. Baldwin, University of California, Irvine Campus, California College of Medicine, Dept. of Physiology, *Irvine, California* 92664 (NAS 2-10522)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, EVOKED RESPONSE MEASURES OF RESOURCE ALLOCATION - EFFECTS OF PRIMARY TASK LOADS

L.F. Elfner, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Psychology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (DF055090; AFOSR-79-0097)

AF function - as part of a workload measurement research plan of the Air Force, it is necessary to develop, test, and apply a standard technology for predicting and evaluating crew performance with implications for equipment design and work allocation. Deficiency -designers do not yet have at their disposal standard methodologies which allow them to answer crucial operational questions such as optimum crew composition, optimum distribution of tasks, duties, and responsibilities to crew members, and optimum allocation of functions and tasks to the person, machine, and computer. Objective - the proposed research will extend previous studies of allocation of information processing resources under various stressful workloads which relate to airborne piloting tasks. How research contributes - the primary and secondary tasks to be studied in a proposed workload paradigm will closely simulate the control and monitoring task of a pilot. The study of sequence effects within a given a priori probability in a proposed uncertainty task should allow for the parametric study of resource allocation in the workload paradigm and thereby contribute to the goal of establishing a standardized methodology for workload measurement.

The research will assess the utility of employing event related potentials (ERP) in a procedure that simulates the control and monitoring tasks of a pilot. The amplitudes of the P-3 component of the ERP, which is known to reflect active processing of information, will be measured to provide an index of the resource demands of the flight simulation task. Critical testing will be made of the hypothesis that as primary task difficulty increases there will be a decrease in the amplitude of the P-3, that is, there will be lesser amounts of information processing on the secondary task when greater resource demands are placed on the primary flight simulation task. A primary task to be defined at a reasonable level of difficulty will be performed in a link trainer, and the evoked responses to target stimuli will be the dependent measure on a secondary task. Also, an experimental study of the effect of random versus fixed inter-stimulus intervals in an uncertainty task will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0008, LIFE SCIENCE EXPERIMENT - CELL-TO-CELL COMMUNICATIONS IN SPACE

W.R. Loewenstein, University of Miami, School of Medicine, Dept. of Physiology & Biophysics, *1400 N.W. 10th Ave., Box 520875, Coral Gables, Florida* 33152 (NAS 2-10524)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0009, CARDIOVASCULAR ADAPTATION OF WHITE RATS TO DECREASED GRAVITY OF SPACE SHUTTLE/SPACELAB INFLIGHT CONDITIONS, EXPERIMENT ARC 781-248

V.P. Popovic, Emory University, School of Medicine, Dept. of Physiology, *1364 Clifton Rd. N.E., Atlanta, Georgia* 30322 (NAS 2-10527)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, THE ROLE OF GRAVITY PERCEPTION IN THE ESTABLISHMENT OF THE DORSAL VENTRAL AXIS OF THE AMPHIBIAN EGG

G.M. Malacinski, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Zoology, *Memorial Hall, Bloomington, Indiana* 47401 (NAGW 60)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0011, LIFE SCIENCES FLIGHT EXPERIMENT - RENAL & MUSCULO-SKELETAL RESPONSES TO WEIGHTLESSNESS AND READAPTATION TO NORMAL GRAVITATION FORCES IN RATS

X.J. Musacchia, University of Louisville, School of Arts & Sciences, Dept. of Biology, *129 E. Broadway, Louisville, Kentucky* 40202 (NAS 2-10510)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0012, MECHANICAL STRESS ON SOFT TISSUE MATERIAL PROPERTIES

R.W. Little, Michigan State University, School of Osteopathic Medicine, Dept. of Biomechanics, *Soil Science Bldg., East Lansing, Michigan* 48824 (DF325050; F33615-79-C-0514)

To investigate the tensile strength characteristics of the soft tissues of the musculoskeletal system, particularly the ligaments responsive to spinal loading; to determine the effects of biological prestress, vibration and aging on soft tissue material properties; and to develop data for a biomechanical model to test the effects of mechanical forces on the ligamentous apparatus of the spine and appendicular joints leading to the establishment of human exposure limits and development of protective measures for aircrew personnel.

A three-year multiphase investigation will be undertaken using mainly nonhuman primates as subjects. The first phase will determine the material property characteristics of the ligamentous apparatus of the body as a function of various amounts of deformation and strain rates; then identify the flexor and extensor muscle groups and compare their strength characteristics in rhesus monkey, baboon, chimpanzee and man. the second phase will involve in-depth study of the prestress state of ligaments, tendons, etc., and include quantitative measurement of prestress in these tissues, role of prestress to soft tissue loading response, and effect on prestress of vibrational forces. The third phase will identify the fatigue characteristics of ligaments, tendons and muscles under cyclic loading. Scanning electron microscopic studies will be used to identify morphologic changes. The last phase will be concerned with the development of quantitative relationships characterizing observed soft tissue material properties and incorporating observed mechanisms and levels of failure. This analytic formulation shall allow extrapolation of results to provide predictions of response and injury in mechanical stress environments and lead to the establishment or refinement of biodynamic exposure limits.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, INVESTIGATION OF THE NEGATIVE GEOTROPIC RESPONSE IN GEOSENSITIVE PULVINI OF THE OAT PLANT (AVENA SATIVA)

P.B. Kaufman, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Biological Sciences, *Ann Arbor, Michigan* 48104 (NAGW 34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0014, A GROUND-BASED COMPARATIVE STUDY OF THE EFFECTS OF WEIGHTLESSNESS ON THE DEVELOPMENT OF AMPHIBIAN EGGS

G.W. Nace, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Biological Sciences, *Ann Arbor, Michigan* 48104 (NAGW 29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0015, NEW DESIGN CONCEPTS FOR O2 DELIVERY TO AIRCREW

R. Beale, Fluid Power Controls, *St. Paul, Minnesota* (DF325620; F33615-79-C-0618)

Adequate delivery of breathing oxygen to aircrew members is limited by functional performance characteristics of the hardware design of oxygen delivery components in current use. Crew members of high performance aircraft in particular require breathing gas to be delivered within narrower limits with respect to oxygen concentration, and over a wider range with respect to inspiratory rate of flow, than current hardware allows. This effort will explore new design concepts for the delivery of breathing gas which meet those requirements and which have high potential for practical application in flight.

Hardware design concepts to include microelectronic and pneumatic control systems will be simulated and quantitatively analyzed with respect to functional performance characteristics which satisfy both physiological requirements and limitations of the operational environment. Major consideration will be given to high system reliability and low production cost in the design of potential production models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0016, INVESTIGATION ON THE EFFECTS OF HYPOGRAVITY ON SOME CRITICAL CELLULAR EVENTS IN PLANT DEVELOPMENT

A.D. Krikorian, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Biology, *Stony Brook, New York* 11790 (NAS 2-10520)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0017, LIFE SCIENCE EXPERIMENT ARC 781-127, CORRELATION OF MACRO- AND MICROCIRCULATORY ALTERATIONS DURING WEIGHTLESSNESS

P.M. Hutchins, Wake Forest University, School of Arts & Sciences, Dept. of Biology, *Reynolda Station, Winston Salem, North Carolina* 27109 (NAS 2-10523)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0018, THE MECHANICS OF LONG BONE FRACTURES

A.S. Greenwald, Cleveland Clinic Foundation, *9500 Euclid Ave., Cleveland, Ohio* 44106 (DF055610; F49620-79-C-0112)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces which included flail and impact. These forces are of special significance in relation to the incidence of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. Despite design improvements on ejection seats, dislodging of the limbs occur frequently when the body is ejected into the windblast. The resulting 'flail injuries' are the dislocation of major articulating joints and various long bone injuries. Deficiency - this research effort will investigate the mechanics of long bone fractures. Studies relevant to the fracture mechanisms of whole bone tissue under combined states of loading and at high loading rates have not been reported in the literature. Objective - this research program will elucidate the configuration of fracture patterns, conduct a fracture site analysis, qualify loading rate effects, investigate predictive analytical models for long bones and define the association of the operational environment and the magnitudes of loading states occur-

ring therein. How research contributes - this effort directly supports RO 1.7.1, 'Criteria for Limb Flail Injury Prevention.'

This effort will be conducted by the following approaches: (a) Determine fracture pattern definition of long bones under singular and combined states of loading, including tension, compression, torsion and bending modes. (b) Develop long bone fracture site analysis. (c) Determine the effects of loading rates on resistance and energy absorption to fracture under combined states of loading. (d) Identify the effects of impact loading on long bones. (e) Formulate mathematical models to predict the behavior of long bones under singular and combined loading states. (f) Evaluate comparatively the effectiveness of methods of internal fixation in preventing refracture by a similar loading mechanism. (g) Define the operational environment in which singular and combined states and rates of loading to upper and lower extremity long bones exist, so as to insure the relevance of the laboratory investigations to that environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0019, MICROBIAL ECOLOGY OF EXTREME ENVIRONMENTS - ANTARCTIC DRY VALLEY YEASTS AND GROWTH IN SUBSTRATE-LIMITED HABITATS

H.S. Vishniac, Oklahoma State University, School of Arts & Sciences, Dept. of Microbiology & Medical Technology, *Agricultural Hall, Stillwater, Oklahoma* 74075 (NAGW 26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0020, MECHANISM(S) UNDERLYING FLUID VOLUME SHIFTS IN ZERO GRAVITY (EXPERIMENT ARC 781-207)

H.L. Stone, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Physiology & Biophysics, *Box 26901, Oklahoma City, Oklahoma* 73190 (NAS 2-10526)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0021, LIFE SCIENCE EXPERIMENT ARC 781-285, ANGIOTENSIN RELATED CHANGES IN BODY HYDRATION

W.B. Severs, Pennsylvania State University, Milton S. Hershey Medical Center, School of Medicine, Dept. of Pharmacology, *500 University Dr., Hershey, Pennsylvania* 17033 (NAS 2-10521)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0022, REGULATION OF ERYTHROPOIESIS IN MICE DURING SPACEFLIGHT, EXPERIMENTS ARC 781-011, 781-012

C.D. Dunn, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Biology, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS 2-10528)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0023, LIFE SCIENCE EXPERIMENT, ARC 781-288, ADAPTIVE CHARACTERISTICS OF ENZYMES OF NITROGEN METABOLISM IN MAMMALS DURING SPACEFLIGHT

J.W. Campbell, Rice University, School of Natural Sciences, Dept. of Biology, *6100 Main, Houston, Texas* 77001 (NAS 2-10519)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0024, MEASUREMENT OF RFR TEMPERATURE DISTRIBUTIONS IN BIOLOGICAL STRUCTURES

J.C. Burr, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF320730)

Air Force personnel are required to work in environments which may require exposure to radiofrequency radiation (RFR) on an intermittent or periodic basis. This energy may be produced by a variety of emitters whose characteristics vary in frequency and mode. An extensive biotechnology base is necessary to assure continued maximum safety while allowing essential mission operations.

It is not feasible to experimentally quantify every combination of frequency, exposure duration, pulse characteristic, etc., which may be encountered. Theoretical calculations and computer modeling can provide an expedient means for hazard estimation when based on sound experimental data. Existing models which predict power distribution patterns in the head will be tested experimentally utilizing phantoms, cadavers, and specially implanted experimental animals. Predicted values from the model will be compared to in vivo measurements with subsequent refinement of model inputs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, STATISTICAL TOOLS FOR FITNESS-TO-FLY-DETERMINATION

P.L. Brockett, University of Texas, Austin Campus, Graduate School, *200 W. 21st, Austin, Texas* 78712 (DF324330; F33615-78-C-0623)

Coronary artery disease (CAD) is a major cause of ineffective time and disability retirement in the Air Force, and has been implicated in aircraft accidents. Thus, early diagnosis and prevention of CAD in aircrew members is of importance to the Air Force. Several clinical factors (serum cholesterol levels, blood pressure, ECG changes, etc.) are known to be associated with an incresed risk of CAD in human subjects. This workunit focuses on the development of mathematical equations which numerically relate risk factors to the occurrence of CAD in flying personnel such that these equations can actually be used in early disease diagnosis and prevention at significant cost savings to the Air Force.

There are at least three different types of information that can be looked for in a flyer's medical history- 1. A possible trend over time that indicates greater and greater risk of failure compared to the risk of the general population, 2. A stable abnormality that can be verified by repeated observation of a minor shift away from the population norm, and 3. A recent change compared to an individual's prior stable condition that corresponds to changes suggesting increased risk of failure. As a first step to incorporating these three features into a single probability estimate, the Cox proportional hazard model will be generalized to a log-linear model based on trend measures, location parameters and recent shock indicators that are orthogonal in form. A second approach reduces the dimensionality of the problem by using time series analysis to predict the future state of the individual's signs. Then the usual 'snapshot' techniques such as Cox's model or discriminant analysis can be used on this 'virtual' observation to establish the probability of failure and the effect of each covariate.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, THE EFFECT OF STRESS ON HUMAN BLOOD PLATELETS

J.N. George, University of Texas, Health Science Center at San Antonio, South Texas Medical School, Dept. of Medicine, *7703 Floyd Curl Dr., San Antonio, Texas* 78284 (NAG 9-5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0027, INFLUENCE OF SPACEFLIGHT ON CYTOGENETICS AND MUTAGENICITY

J.D. Fabricant, University of Texas, Medical Branch at Galveston, Graduate School, *Galveston, Texas* 77550 (NAS 2-10513)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0028, CENTRAL OTOLITHIC MECHANISMS IN NON-HUMAN PRIMATES
A.A. Perachio, University of Texas, Medical Branch at Galveston, Graduate School, *Galveston, Texas* 77550 (NAG 2-26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0029, ANATOMICAL AND ELECTROPHYSIOLOGICAL STUDIES OF THE EFFECTS OF WEIGHTLESSNESS ON THE VESTIBULAR APPARATUS OF THE GERBIL
M.J. Correia, University of Texas, Medical Branch at Galveston, School of Medicine, Dept. of Otolaryngology, *300 University Blvd., Galveston, Texas* 77550 (NAS 2-10502)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0030, NAVY ENVIRONMENT - NEUROPATHOLOGY OF CENTRAL NERVOUS SYSTEM FOLLOWING IMPACT INJURY
F.J. Unterharnscheidt, Rehabilitationsklinik Loipl, *Bischofswiesen, Berchtesgaden, Federal Republic of Germany* (DN875545; N00014-78-C-0800)

The Naval Aerospace Medical Research Laboratory Detachment, New Orleans (NAMRL/DET) is conducting experiments to determine human dynamic response to impact acceleration as part of an aircraft impact injury prevention program. This work unit is concerned with a study of the effects of impact-acceleration on the nervous system.

This research will be performed in conjunction with the U.S. Navy research effort. Experimental procedures will be performed at NAMRL/D. Neuropathological tissue will be sent to the Rehabilitationsklinik Loipl. The contractor will be responsible for the preparation of micro-and macropathological examination of these specimens.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, THE NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS BY THE METHOD OF LINES
B.H. Edwards, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Mathematics, *208 Tigert Hall, Gainesville, Florida* 32601 (NAG 1-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0002, RESEARCH IN NUMERICAL ALGORITHMS FOR THE FINITE ELEMENT MACHINE
W.E. McBride, Western Illinois University, School of Arts & Sciences, Dept. of Mathematics, *900 W. Adams St., Macomb, Illinois* 61455 (NAG 1-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0003, A TENSOR-PRODUCT FINITE ELEMENT ALGORITHM FOR NAVIER-STOKES SOLUTIONS AT LARGE REYNOLDS NUMBERS
A.J. Baker, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Mathematics, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAG 1-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0004, A RETARGETABLE PATH PASCAL SYSTEM FOR IMPLEMENTATION ON CONCURRENT PROGRAMS ON 16-BIT MICROCOMPUTERS
R.F. Mathis, Old Dominion University, School of Sciences & Health Professions, Dept. of Computer Science, *P.O. Box 6173, Norfolk, Virginia* 23508 (NAG 1-47)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXTINCTION OF LASER RADIATION BY SMALL PARTICLES
D.R. Huffman, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DN790029; N00019-77-C-0293)

The objective is to study absorption and scattering of laser radiation in the 10 micron spectral region as a countermeasure to the effects of such radiation.

A combination of related theoretical and experimental studies are proposed to help determine the most efficient method for extinction of CO2 laser radiation by small particles. The two major systems are (1) very small silicate particles where absorption dominates, and (2) hollow glass spheres, where scattering is expected to dominate.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

8.0002, RENEWED SYNOPTIC OBSERVATIONS AND RESEARCH ON BASIC PROPERTIES OF THE SOLAR CYCLE
S.F. Martin, California State University & Colleges, California State University, Northridge Campus, School of Science & Mathematics, Dept. of Physics, *18111 Nordhoff St., Northridge, California* 91324 (NAGW 27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0003, THEORY OF INTERACTION EFFECTS IN TRANSPARENT MATERIALS EXPOSED TO INTENSE INFRARED RADIATION
M. Sparks, Pacific Sierra Research Corp., *Santa Monica, California* 90404 (DF054850; F49620-79-C-0061)

AF function - high energy laser technology is finding wide application in future Air Force systems. Opportunity - both in the production of intense radiation and in the hardening of certain critical components to this radiation, the interactions of photons with matter is of extreme importance. Electrical breakdown in solids is an important basic problem because it is one of the simplest properties of solids that is not understood, and it is an important practical problem because optical and electrical breakdown limits the operation of so many electrical and optical devices. Objective - the general purpose of this research is to solve the fundamental problems of the interactions of infrared radiation with matter. More specifically, the objective is to establish a tenable theory of high-power laser damage to semiconductor and optical materials, and to compare the electron-avalanche breakdown process in dielectric materials with such other breakdown processes as multiphonon, tunneling, Raman, Brillouin, self-focusing, macroscopic-inclusion, and microscopic cluster-inclusion damage processes in order to determine under what conditions the electron-avalanche process dominates. The emphasis will be on infrared damage to semiconductor andoptical materials. How work contributes - there is a high probability of solving the problem of explaining and predicting optical and electrical breakdown in solids. The impact of a successful theory would be two-fold. It would make a significant contribution to the theory of solids and it would be of practical importance to the operation and performance of high power semiconductor and optical devices and allow the predetermination of

whether window materials can be improved to increase their high-power laser damage threshold.

The approach to the solution of the electron-avalanche-breakdown problem will be first to describe a transport theory that incorporates such physical processes as the large-quantum processes - the photon-electron-phonon process, in which an electron is accelerated with the accompanying annihilation of a photon and the creation of annihilation of a phonon, and inter-conduction-band transitions - in addition to such previously considered processes as the Seitz luck-electron process. Specific steps include checking the preliminary transport equation that does not include large-quantum processes solving the equation for a few selected cases. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, MAGNETOSPHERIC PLASMA PHYSICS

C.F. Kennel, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (ATM78-19958)

This research program concerns the dynamics of the magnetic field of the earth and its interaction with particles and fields from the sun. The major aims are: (1) to understand magnetic reconnection, to integrate it into magnetospheric theories, and - something of general significance - to understand the acceleration of energetic particles in reconnection events; (2) to understand the global response of the magnetosphere to time-dependent events in the solar wind; and (3) to understand the role of plasma turbulence in the earth's magnetosphere, with a special emphasis on electrostatic waves.

The effort supported here will be theoretical in nature and will be performed by a team of researchers from the Departments of Physics, Astronomy, Geophysics and Atmospheric Sciences at the University of California, Los Angeles.

The overall aim of the work is to use plasma theory to increase our knowledge of magnetospheric dynamics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0005, ROTATIONAL COHERENT ANTI-STOKES RAMAN SPECTROSCOPY (CARS) APPLICATIONS

R.K. Chang, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (NAG 1-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0006, MOSSBAUER STUDIES OF TERNARY SUPERCONDUCTORS

C.W. Kimball, Northern Illinois University, School of Liberal Arts & Sciences, Dept. of Physics, *DeKalb, Illinois* 60115 (DMR78-09773)

This is a continuation of research sponsored under grant DMR7618371.

Many strong coupled superconductors have anomalous phonon properties. The physical basis of these unusual phonon properties, such as mode softening and anharmonic effects, which correlate with high transition temperatures, Tc's, is of importance to the understanding of the interactions responsible for high Tc's. The principal thrust of this research is a systematic study of lattice and electronic properties of high Tc ternary compounds, e.g. Chervel phases and A15 intermetallic compounds, by means of the Mossbauer effect. Correlation of these data with the results of other physical measurements will aid in clarifying the role of phonon spectra in the enhancement of Tc.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, MATERIAL PROPERTIES AND PHENOMENA AT VERY LOW TEMPERATURES

J.B. Ketterson, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics, *633 Clark St., Evanston, Illinois* 60201 (DMR78-11771)

This is a continuation of work sponsored under DMR-7621370. An experimental study will be made of the properties of helium-3 and nuclear ordering in solid helium-3. A nuclear cooling cryostat will be constructed and longitudinal and transverse sound characteristics will be studied in superfluid helium-3. The magnetic properties of solid helium-3 will be examined. Sound propagation studies of liquid crystals will be continued. Transition metals will be examined at ultra-low temperatures for the existence of superconductivity. This work is important for understanding quantum solids and fluids and the low-temperature behavior of metals and liquid crystals.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, MAGNETISM IN TRANSITION-METAL ALLOYS AND RARE-EARTH COMPOUNDS

J.S. Kouve, University of Illinois, Chicago Circle Campus, School of Liberal Arts & Sciences, Dept. of Physics, *601 S. Morgan St., Chicago, Illinois* 60680 (DMR78-12777)

This is a continuation of research previously supported under DMR-7622305.

In studies of magnetic materials, one of the areas of current interest is the determination of the critical concentration of magnetic atoms, needed for the system to become magnetically ordered. In this project, specific heat measurements will be carried out in high magnetic fields in order to study and characterize local magnetic effects (magnetic clusters, paramagnons) in alloys such as Pd-Ni and Ni-Cu near their critical compositions for ferromagnetism. Similar measurements will be carried out to determine the local exchange and anisotropy fields in mictomagnetic alloys such as Cu-Mn. A further experimental study of higher order (biquadratic) exchange interactions in single crystals of selected rare-earth compounds, such as HoSB and PrAg, will be carried out.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, THEORETICAL AND LIDAR STUDIES OF DYNAMICAL INFLUENCES IN THE ATMOSPHERIC SODIUM LAYER

C.F. Sechrist, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (ATM78-12308)

Since the 1930's we have known of the presence of significant concentrations of sodium in the upper atmosphere near mesospheric altitudes. Questions remain as to sodium sources and sinks. Recently, improvements in dye lasers have made ground based time continuous altitude profiles practicable for sodium near the 80-100 km altitude range. Much enthusiasm is mounting over the potential of such data in the sodium transport dominated region, to trace dynamical features through this difficult to diagnose altitude region.

This grant funds operation of the Urbana sodium lidar. Research under this grant will include: theoretical studies of the sodium layer detailed structure, using a computer model; use of signal processing techniques to enhance the sodium-layer profile data; laser system improvements; receiver system improvements; and correlative measurements involving near simultaneous meteor-radar winds and sodium lidar experiments, in order to study the influence of neutral atmospheric wave motions on sodium layer structure.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0010, COLLISIONAL INTENSITY AND BROADENING EFFECTS ON ATOMIC SPECTRAL LINES

J.F. Keilkopf, University of Louisville, School of Arts & Sciences, Dept. of Physics, *129 E. Broadway, Louisville, Kentucky* 40202 (PHY78-18862)

This project in atomic physics will study the broadening and modification of intenstiy of atomic spectral lines by neutral atom collisions. In particular, collision-induced transitions involving highly excited states will be measured. This will lead to an experimental determination of interatomic potentials for the interaction of excited atoms and neutral unexcited perturbers, and will afford a comparison with theoretical predictions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0011, PLASMA HEATING, LIGHT SCATTERING AND SPECTROSCOPY

H.R. Griem, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (PHY78-00973)

Research will continue, directed on various problems in plasma turbulence and in thermal fluctuations of dense equilibrium plasmas, with special emphasis on diagnostics. These problems are of a basic nature and have a number of applications to other fields, ranging from astronomy to magnetic and inertial fusion research.

This work represents a continuation of that currently supported by Foundation grant PHY76-24454.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0012, SOLID-STATE PHYSICS STUDIES WITH POSITRONS

S. Berko, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR76-24376 A01)

Solid-state physics research using positron annihilation techniques previously supported by NSF grant DMR73-02563 A03 will be continued. The research program consists of two projects: a) electronic momentum density measurements using a newly built 64 counter two-dimensional angular correlation apparatus, and b) slow positron interaction studies with solid surfaces. Under project a) the Fermi surfaces and the electronic band structure of disordered as well as of some ordered alloys, and the electronic momentum densities in ferromagnetic metals will be investigated. In the slow positron beam experiments (project b), an ultrahigh vacuum system will be built to allow the study of well-specified surfaces. The formation of positronium by slow positrons at metal surfaces, the physics of positron work-function and positron emission from solid surfaces, as well as slow positron scattering will be studied experimentally. The parameters of the electronic dipole barrier at metal surfaces will be determined from these experiments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, CORONAL PLASMA PROCESSES - HEATING AND ENERGETIC BALANCE OF CLOSED CORONAL STRUCTURES

G.S. Vaiana, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAGW 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0014, ELECTRON ENERGY LOSS SPECTROSCOPY OF GALLIUM ARSENIDE AND OTHER MATERIALS

M. Weiler, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF056110; F49620-79-C-0176)

AF function - advances in command, control and communications depends directly upon the reliability and performance of electromagnetic devices which are in large measure dependent upon the solid state electromagnetic materials of special and unique properties and behavior. Opportunity - electron energy loss spectroscopy (ELS) provide a timely opportunity to develop technique for mapping the conduction band structure of crystalline materials to gain new insight into the nature of localized electronics, excitations, and to probe the nature of charge transfer in intercalated compounds and the formation of interface states, and to gain the knowledge needed to realize the potential of ELS as a powerful analytical tool for submicron structures. Objective - to significantly advance the scientific understanding of electronic processes in condensed matter. To provide experimental information which relates specific features of the electronic band structure to their locations in the Brillouin zone and thereby understand such phenomena as hot-electron behavior and charge density waves. How work contributes - GaAs is used to construct many devices, such as FET's avalanche diodes, and Gunn oscillators, whose operation depends on or is limited by electrons in the secondary conduction band minima. A knowledge of the Brillouin zone location, energy and curvatures at these minima, and at the immediate maxima, as well as the gaps at the maxima to the next higher conduction bands, should have a major impact on future development of these devices as well as for GaAs quaternary compounds.

Construct a new electronic energy loss spectrometer which will have the capability of measuring electronic excitations in thin bulk samples at high resolution over a wide range of energy loss and momentum transfer. Study interband transitions in GaAs for momentum transfer along different crystalline directions. Map the dispersion of the conduction band and to locate the energies and positions in the Brillouin zone of the secondary conduction band minima. Study the momentum-dependence of the intensity of single-particle and collective energy losses which provides information on the structure and degree of localization of the electronic states in crystalline and amorphous materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0015, HIGHLY EXCITED ATOMS

D. Kleppner, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF034500; F44620-72-C-0057)

AF function - this research effort is concerned with the investigation of very high lying atomic levels. These states of are great interest because of their large polarizabilities and stark shifts, low ionization potentials and large dimensions. This study of highly excited atoms can lead to new techniques for detecting millimeter and infrared radiation for application to communications and plasma diagnostics, for example. Opportunity - this study of single highly excited atomic states presents opportunities for studying a variety of phenomena involving atoms and radiation, including: photoionization processes, tunneling phenomena in static and oscillating fields, and resonance phenomena. It also permits the study of collision in highly excited species and of level crossing dynamics which are important in many inelastic atomic and molecular collisions. Objective - the goal of this effort is to complete the study of field ionization in alkali one-electron systems, and to investigate field ionization in hydrogen. Contribution - work on highly excited atoms is a very active field. The process of tunneling in an electric field of a one-electron atom has been observed in detail and the measured rates were found to be in serious disagreement with hydrogenic theory. The continuing effort will investigate tunneling in alkalies, particularly on effects of level mixing. Other work will include experiments on the Landau-Zever effect, and the creation of Rydberg states of hydrogen, and a theoretical study of tunneling in alkalies.

The study of field ionization of sodium has shown that the theory developed for hydrogen is totally inadequate to deal with most levels of other one-electron atoms. A comprehensive theory for field ionization of a one-electron system in a non-Coulombic system is needed and will be pursued in this effort. In parallel with this, the experimental investigation of field ionization rates will be extended. Ionization rates for Rydberg states of hydrogen will be measured. Fine structure effects break

the exact symmetry of the non-relativistic model and lead to level mixing effects which may play a major role in the ionization process. Many inelastic collision processes in diatomic molecular processes are explained simply in terms of non-adiabatic transitions at level anticrossings, caused by the relative motion of the atoms. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0016, ELECTRONIC PROPERTIES OF METALS, SEMI-METALS, AND ALLOYS DOWN TO ULTRALOW TEMPERATURES

P.A. Schroeder, Michigan State University, School of Natural Sciences, Dept. of Physics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (DMR78-07892)

This is a continuation of the research program on electron transport properties of metals, alloys and semiconductors previously supported by NSF grant DMR-7501584 A02. While some measurements will be done over a wide temperature range, the main thrust will be in the ultralow temperature region, extending the present low temperature limit of approximately 30mK for resistivity measurements down to approximately 5mK. The other main thrust will be to extend measurements in high magnetic fields from the 1-4K region to the region of approximately 100mK. Also, a precision current comparator will be used in an attempt to reach a precision of 1 in 10 to the 7th power in resistivity measurements. This will permit definitive studies of the controversial temperature-dependent resistivities of the alkali and noble metals and of deviations from Matthiessen's role in aluminum and silver based alloys. Work on thermoelectric effects in noble and alkali metals and in tungsten, palladium and platinum will continue in order to identify processes for ultralow temperature anomalies occurring in several of these. New areas of investigation include: the effect of the crystal electric field and hyperfine coupling on transport behavior; transport properties of amorphous metals and alloys; and electrical response of algae cells.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, A PHOTOIONIZATION MASS SPECTROMETER STUDY OF CARBON VAPOR

G.H. Rayborn, University of Southern Mississippi, School of Science & Technology, Dept. of Physics, *Hattiesburg, Mississippi* 39401 (NAG 1-49)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0018, HIGH-FIELD NUCLEAR ACOUSTIC RESONANCE STUDIES OF SINGLE-CRYSTAL METALS, INSULATORS, AND SEMICONDUCTORS

R.K. Sundfors, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR76-80158 A01)

A series of experiments on single-crystal transition metals with known concentrations of hydrogen, on other pure noncubic metal single crystals, on pure germanium, and on the alkali bromides will be continued. Nuclear acoustic resonance (NAR) using both dynamic quadrupole coupling and dynamic Alpher-Rubin coupling will be employed where possible as the experimental technique. High magnetic fields up to 85 kilogauss in the temperature range from 4.2 K to 300 K will be used with on-line computer signal averaging and data analysis. The NAR dynamic quadrupole coupling and Alpher-Rubin coupling lineshapes, linewidths, and line positions of Ta181 will be studied in single-crystal tantalum as a function of hydrogen concentration and temperature in both the alpha and alpha plus beta phases. The H1 linewidths and line positions will also be studied if the resonance proves observable in tantalum. Extensions of these studies are planned for V, Nb, and Pd. NAR lineshape, linewidth, and line-position studies will be carried out at the highest magnetic fields in single-crystal Be and Mg. NAR studies using dynamic quadrupole coupling of Ge73 in pure germanium single crystal to determine lineshapes, linewidths, and the components of the tensor S relating electric field gradients to elastic strain will be carried out. Finally, NAR dynamic quadrupole coupling studies of the alkali bromides to determine the components of the tensor S observable at anion and cation nuclear positions will be done.

This is ths first year of a two-year continuing grant. Research initiated under NSF Grant No. DMR73-07629.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, MAGNETISM AND PHONON PROPAGATION IN METALS AND AMORPHOUS MAGNETS

T.R. Carver, Princeton University, School of Natural Sciences, Dept. of Physics, *Box 430, Princeton, New Jersey* 08540 (DMR78-15268)

Experimental research in the general area of magnetism and phonon interactions in condensed matter systems which previously was supported by NSF grant DMR-7618667 will be continued. The microwave magnetic resonance transmission techniques which were originally invented at Princeton will be developed further for studies of the critical exponents for the magnetic phase transitions in copper-nickel alloys and in iron. The studies will be done as a function of composition. Also, the technique will be used as a probe for magnetic phase transitions by a new method for generating and transmitting microwave phonons in the anomalous skin depth region of metals.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, ATOMIC INTERACTIONS WITH ELECTRONS AND FIELDS IN GROUND AND EXCITED STATES

B. Bederson, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (PHY77-28127)

A two-year research program will use atomic beam techniques for the study of interactions between atoms, electrons, radiation and applied electric fields. The principal aims are to perform increasingly rigorous tests of collision theory as applied to simple atomic and molecular systems, and to explore new methods for extracting information from collision experiments.

The atomic beam recoil technique will be used to perform electron scattering measurements of total cross sections for the 32P 3/2 state of sodium, 'superelastic' differential and total cross sections, 32P 3/2 -yields 32S 1/2, 'superelastic' differential cross sections with spin preparation and analysis after scattering for specific magnetic substates of the above reaction, and elastic scattering for 32P 3/2 m with and without spin analysis.

An additional goal of the proposed research concerns the measurements of atomic and molecular polarizabilities.

This is a continuation of work supported by NSF Grant PHY74-03999 A03.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, MICROPARTICLE CONCENTRATIONS IN RECENT POLAR ICE

R.I. Gayley, State University of New York, Buffalo Campus, School of Natural Sciences & Mathematics, Dept. of Physics, *3435 Main St., Buffalo, New York* 14214 (DPP78-18796)

Ice sheets are repositories of both precipitation and fallout of meteorites and microparticles. The precipitation is a record of the temperature of formation by year, and an entrapment of air of past atmospheres. The meteorites are records of the development of our solar system while microparticles are detailed records of atmospheric processes. Ice cores from the Greenland and Antarctic ice sheets will be studied for their microparticle content using innovative methods of extraction. Considerable ice cores are presently available for this research and no new cores need to be collected at this time. The goal of this study is to obtain new data on the content of atmospheric dust in recent

(past 100 years) ice and to determine if there exists a direct relationship between climate nd the burden of atmospheric dust.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

8.0022, PLASMA STABILITY THEORY
A. Simon, University of Rochester, School of Engineering & Applied Science, Dept. of Mechanical & Aerospace Sciences, *260 Crittenden Blvd., Rochester, New York* 14627

This theoretical project studies the behavior of plasma to determine the conditions under which instability sets in, and the effect of nonlinearities in saturating the growth. The nonlinear theory emphasizes the threshold regime where there are only one or a few unstable modes. Calculations of the saturated state are carried out in realistic geometry, and every attempt is made to make comparisons with laboratory experiments, so as to verify the validity of existing theory. Results can suggest stabilization techniques. The linear program has concentrated on evaluating the influence of various effects on plasma stability in Tokamak and other geometries for the parameter ranges relevant to present and future devices.

SUPPORTED BY U.S. Dept. of Energy

8.0023, TRAILING-EDGE FLOWS AND THEIR INFLUENCE ON AIRFOIL NOISE
T.H. Hodgson, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Raleigh, North Carolina* 27607 (NAG 1-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0024, DETERMINATION OF NEUTRON CROSS SECTIONS & RESONANCE PARAMETERS FOR THE STABLE TELLURIUM ISOTOPES, FOR THALLIUM 205 & FOR THE OSMIUM ISOTOPES
R.R. Winters, Denison University, School of Liberal Arts, Dept. of Physics, *Box 239, Granville, Ohio* 43023 (EY-76-S-02-2696)

Problems with the errors to be assigned to the neutron sensitivity of the Total Energy Detectors at the ORELA capture facility continue to prove troublesome. Even so, the analysis of the tellurium capture cross section data continues and is expected to be completed by the end of the summer 1978.

The neutron capture and total cross sections will be measured and/or analyzed for the osmium isotopes 186, 187, and 188. These cross sections are of importance in the understanding of nucleosynthesis in stellar interiors.

In order to obtain better estimates of the parity assignments for some of the resonances in the 205 Tl plus n reaction, a series of elastic scattering cross section measurements will be made at ORELA using a separated 205 Tl target.

RESULTS: 51V(n,gamma): a) 139 resonances analyzed 2.5-215 keV using the modified least squares fitting code, LSFIT. b) S- and p- wave strength functions measured. c) The radiative widths for the s-wave resonances shown to be very large with wide fluctuations about their means. d) Paper submitted to Phys. Rev. C. 208Pb: a) 24 resonances analyzed and radiative widths determined for 13 of these. b) Two previously unreported resonances at 43.29 and 47.26 keV found. c) Paper published in The Astrophysical Journal 217, 1977.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0025, THE DYNAMICS OF FIRST AND SECOND ORDER TRANSITIONS
J.D. Gunton, Temple University, School of Liberal Arts, Dept. of Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (INT78-06976)

This award will support Professor James D. Gunton of Temple University in Philadelphia for a period of two years in a program of cooperative research in theoretical physics with Professor Kyozi Kawasaki of Kyushu University in Japan. Professor Gunton will make two trips to Japan to work with Professor Kawasaki's research group, which is very strong in the field of phase transitions. Their collaboration will bring together complementary research skills in theoretical physics and is expected to be unusually productive.

The project involves a study of the dynamical properties associated with first and second order phase transitions using theoretical and mathematical models, and is an extension of theories recently developed by Professors Gunton and Kawaski involving perturbation and renormalization group techniques. This research will have applications to the dynamics of multicomponent fluid systems, a subject of current experimental research interest in atmospheric science and industrial chemistry.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0026, STUDIES IN THE CLASSICAL RELATIVISTIC DYNAMICS OF PARTICLES AND FIELDS
P. Havas, Temple University, School of Liberal Arts, Dept. of Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (INT77-21692)

This award to Temple University makes it possible for Dr. Peter Havas of that institution, Dr. John Stachel of Boston University and Dr. Ivor Robinson of the University of Texas at Dallas to carry out their 'Studies in the Classical Relativistic Dynamics of Particles and Fields' in cooperation with their Mexican colleagues. The Mexican CONACYT has made a parallel grant to Dr. Jerzy F. Plebanski of the IPN and Dr. S. Hacyan of the UNAM in Mexico City.

Interparticle forces depending on the two-particle Poincare invariants, rather than the interparticle distance, and the fields that might be constructed from them will be examined. Several aspects of relativistic hydrodynamics will be considered. These include the study of approximately Poincare-invariant post-Newtonian hydrodynamic theories and relativistic hydrodynamics based upon strings, rather than points, as in the usual hydrodynamics. Complex extensions of Poincare and conformal transformations will be used to generate new solutions containing 'new' conserved quantities from 'old' solutions of Maxwell's equations. The work on exact solutions of Einstein's field equations will be continued. Techniques related to the extension of the idea of Hertz potentials to general relativity will be of particular importance. These studies are relevant to many fields such as elementary particle physics and astrophysics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0027, COOPERATIVE RESEARCH IN STATISTICAL MECHANICS - NEW CALCULATIONS OF VIRIAL AND TRANSPORT COEFFICIENTS
S.Y. Larsen, Temple University, School of Liberal Arts, Dept. of Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (INT78-08782)

This grant provides travel and related costs that will enable Dr. Sigurd Larsen of Temple University to collaborate with Drs. M. Berrondo and A. Noyola of the Mexican Petroleum Institute in research on theoretical problems in statistical mechanics. These types of calculations are basic for understanding the properties of gases composed of simple atoms and molecules and of their deviations from ideal gas behavior.

The research will concentrate on the calculation of the equation of state (virial coefficients) and the transport properties of light molecules, as well as inelastic cross sections and rearrangement collisions for these molecules. This includes an approach to the evaluation of the 2nd virial coefficient based on the calculation of poles of the S matrix in the complex wave number plane and an extension of this to the quantum mechanical calculation of 3rd virial coefficients. Other problems that will be considered are nonanalyticities in h of the transport co-

efficients for hard spheres and nonspherical effects in the 2nd virial coefficient of the helium atom-hydrogen molecule system.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0028, SILICON SUPERLATTICES - THEORY AND APPLICATION TO SEMICONDUCTOR DEVICES
J.A. Moriarty, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (NAG 1-33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0029, MONOLAYER PHYSICS
J.G. Dash, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR7822697)

The research proposed here is a continuation of the work sponsored under Grant DMR7623939.

The program consists of studies of monolayer films adsorbed on uniform solid surfaces at low temperatures. Experiments are designed to prepare practical examples of two-dimensional matter and investigate the thermodynamic properties of their phases and phase transitions. In addition, studies will be undertaken to explore the behavior of thin multilayer films and the approach to bulk phase. The experimental work involves a variety of techniques, several of which are under development. This research is important for an increased understanding of the fundamental role which reduced dimensionality has in the occurrence of various kinds of long-range order in physical systems of interest to condensed matter scientists.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, SOIL INTERPRETATIONS AND SOCIOECONOMIC CRITERIA FOR LAND USE PLANNING
J.G. McColl, University of California, Berkeley Campus, Agricultural Experiment Station, Dept. of Soils & Plant Nutrition, *Berkeley, California* 94720 (0062686; CA-B#-SPN-2848-RR)

OBJECTIVE: Determine biophysical and socioeconomic factors that influence non-urban land use. Organize and deliver existing bio-physical and socioeconomic land related data needed for land-use policy making and planning. Identify and develop critically needed data and interpretations for land-use policy making and planning; develop and evaluate alternatives to overcome soil limitations affecting land-use and environmental degradation.

APPROACH: A case study of Calaveras Co., CA, is underway. Changes in land-use between 1944-69 are being documented using aerial photographs, and soil-vegetation survey maps. Associations between soil characteristics and specific land-use are being investigated, as are filter fields for urban septic tank systems in unsuitable foothill soils.

PROGRESS: Documentation of soil information and land use changes in Calaveras Co., CA, is continuing using aerial photographs. A computer-based system integrates information in the California Soil-Vegetation Survey Reports with land-use criteria; it will be used to determine optimal land-use. Nitrogen-fixation in crop plants is also being studied.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, California

9.0002, NASA/HUD HOUSING AT CAPE CANAVERAL TO DEMONSTRATE FUTURE EXPERIENCE IN HOUSING SYSTEMS AND THEIR OPERATION
Unknown, U.S. National Aeronautics & Space Admin., *600 Independence Ave. S.W., Washington, District of Columbia* 20553 (IAA-H-XXX)

To develop a plan for building with NASA a demonstration house in Washington, D.C. Materials, system and components are to be selected from knowledge of the most advanced technology now available, or expected to be available in the next few decades, for logical projection into housing of the future outstanding A and E firms known for innovation and use of new technology will be selected for development of the program. An achievable goal such as a 'self sustaining house' will be selected as the total concept or theme of the program. Technology transfer to housing design and construction from the space, transportation, computer, medicine, communications and other industries are planned to be demonstrated to the extent possible with today's knowledge and prediction capabilities.

SUPPORTED BY U.S. Dept. of Housing & Urban Development, Office of Policy Development & Research

9.0003, SUPPORT FOR MIST AT JSC
Unknown, Northrop Services Inc., *P.O. Box 34416, Houston, Texas* 77034 (H-2853)

Operation and testing at the MIUS Integration and Test Facility located on the NASA, Johnson Space Center, Clear Lake, Texas, with DOE (ERDA, Conservation) support funding. HUD is arranging with NASA and DOE for turnover of the facility to the DOE. This allows for continued operation and maintenance. NASA is turning over a computer and data system to DOE.

SUPPORTED BY U.S. Dept. of Housing & Urban Development, Office of Policy Development & Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, STUDY OF THE HOTTEST WHITE DWARFS FROM THE PALOMER-GREEN STUDY
R.F. Green, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAG 5-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0002, NEW SEEING-LIMITED STUDIES OF EMISSION NEBULAE
E.R. Craine, University of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (NAG 5-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0003, RESEARCH ON LONG EXPOSURE OBSERVATIONS OF EXTRAGALACTIC OBJECTS
W.L. Sargent, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 5-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0004, INVESTIGATION OF STELLAR CHROMOSPHERIC AND CORONAL ACTIVITY
H. Zirin, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 8-304)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0005, INVESTIGATION OF THE VARIABILITY IN THE X-RAY EMISSIONS OF EXTRAGALACTIC SOURCES
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 5-27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0006, SPECTRAL VARIABILITY OF ACCRETING DEGENERATE DWARFS
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 5-28)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0007, IMPROVED POSITIONS OF HEAO-1 LOW-ENERGY X-RAY SOURCES (ABBREV)
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-301)

Improved positions of HEAO-1 low energy X-ray sources, an X-ray and optical study of nearby Seyfert 2 and emission line galaxies, and correlation of coronal and chromospheric activities with binary period.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0008, A SOFT X-RAY OBSERVATION OF PROCYON AND THE CORONAE OF BOOTES
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-303)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0009, THE NATURE OF DWARF NOVAE AND RELATED SYSTEMS
M. Lampton, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAGW 44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0010, RADIOACTIVE TRANSFER EFFECTS IN QUASI-STELLAR OBJECT EMISSION LINE CLOUDS
R.C. Canfield, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (NAGW 30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0011, THE ROTATION AND INTERNAL FLUID DYNAMICS OF THE SUN
A.S. Endal, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (NAG 5-13)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0012, OPTICAL SPECTROSCOPE STUDIES OF IDENTIFICATION OF HIGH GALACTIC LATITUDE HIGH ENERGY ASTRONOMICAL OBSERVATORY-B X-RAY SOURCES
A.S. Wilson, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Astronomy, *College Park, Maryland* 20742 (NAG 8-307)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0013, COLLABORATIVE STUDIES OF SOLAR-TYPE AND OTHER CORONAE FROM HIGH ENERGY ASTRONOMICAL OBSERVATORY-B
R. Rosner, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAG 8-302)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0014, RESEARCH PROGRAM ENCOMPASSED BY SPACE ENGINEERING
R.H. Miller, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAGW 21)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

10.0015, FEASIBILITY AND DEVELOPMENT STUDY OF A MERCURIC IODIDE SOLID STATE SPECTROMETER FOR ADVANCED X-RAY ASTROPHYSICS FACILITY
G.R. Ricker, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAGW 14)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0016, OPTICAL OBSERVATIONS OF HIGH ENERGY ASTRONOMICAL OBSERVATORY-B OBJECTS
D.E. Mook, Dartmouth College, School of Arts & Sciences, Dept. of Astronomy, *P.O. Box 833, Hanover, New Hampshire* 03755 (NAG 8-305)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0017, RADIATIVELY COOLING CLUSTERS
L.L. Cowie, Princeton University, School of Natural Sciences, Dept. of Astronomy, *Box 430, Princeton, New Jersey* 08540 (NAG 8-306)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0018, X-RAY EMISSION FROM BROAD-LINE RADIO GALAXIES USING HEAO-2 & A SEARCH FOR X-RAY EMISSION FROM NEARBY QUASI-STELLAR OBJECTS (ABBREV)
T. Matilsky, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Astronomy, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (NAG 8-309)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0019, AIRGLOW AND AURORAL STUDIES OF THE EARTH'S IONOSPHERE
M.A. Biondi, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (ATM78-27598)

This grant funds a program of twilight and night airglow observations using passive optical techniques - chiefly Fabry-Perot (FP) interferometers, tilting filter photometers and multichannel mapping photometers. At Laurel Ridge Airglow Observatory, Pennsylvania (LRAO) continuing measurements of mid-latitude thermospheric wind vectors and temperatures will provide information on scale sizes of upper atmospheric ciruclation cells and flow patterns. The data will also be correlated with simultaneous measurements by another researcher (G. Hernandez) at Fritz Peak Observatory (Colorado) during geomagnetic quiet and storm periods. The LRAO neutral wind data will also be used to test the models by which Millstone Hill incoherent

scatter measurements of ionospheric parameters are used to infer neutral motions. A new infrared FP observing He I 1.083 microns in twilight will be used to study the helium escape and high-altitude wind vectors and temperatures. At Arecibo Observatory, Puerto Rico, participation will continue in the IME (ionospheric modification experiments), correlating IME-produced changes in 630.0 nm and 557.7 nm atomic oxygen emission intensity with backscatter radar and ionosonde data to infer changes in the airglow atomic collision processes and to test the theories of electron acceleration by RF-induced plasma instabilities.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0020, ANALYSIS OF AURORAL DATA OBTAINED BY SOUNDING ROCKETS AND GROUND-BASED OBSERVATORIES

H.R. Anderson, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (ATM78-21761)

This grant supports analysis of auroral data obtained by a sounding rocket and by simultaneously operating ground stations. The sounding rocket was launched from Poker Flat, Alaska, in March 1978, and measured electron and proton velocity spectra, vector magnetic field perturbations, vector electric field and the electric field's frequency spectrum from 0 to 10 MHz. Simultaneous measurements were made by the Alaska meridian chain of observatories and by the Chatanika radar. With these data, the following studies will be carried out; 1) Comparison of calculated with measured upward moving electron flux. 2) Calculation of auroral photon emission from measured electron flux and comparison with observations. 3) Compare measured horizontal electric fields with that derived from measured Birkeland currents. 4) Compare values of electric fields, currents and conductivity derived from the rocket data with those obtained from the Chatanika radar to give a self-consistent model of auroral arcs.

The overall aim is to quantify certain aspects of auroral precipitation in order to understand the origin of the aurora.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0021, X-RAY OBSERVATIONS OF SOUTHERN HIGH-RED SHIFT CLUSTERS

C.L. Sarazin, University of Virginia, School of Arts & Sciences, Dept. of Astronomy, *Garrett Hall, Charlottesville, Virginia* 22903 (NAG 8-308)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

GENERAL

11.0001, NEUROSCIENTIFIC AND BIOCYBERNETIC MODELS OF RELEVANCE FOR THE DESIGN AND DEVELOPMENT OF INTELLIGENT MACHINES

P. Suppes, Stanford University, School of Humanities & Sciences, Dept. of Philosophy, *Stanford, California* 94305 (NAGW 6)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Aeronautics & Space
Technology

11.0002, PREPARATION OF NASA WHITE SANDS TEST FACILITY CAPABILITIES BROCHURE

K. Guard, New Mexico State University, Las Cruces Campus, Graduate School, *University Park, Las Cruces, New Mexico* 88003 (NAS 9-95504)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-29243* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 124
Jul. 1980 130 p
(NASA-SP-7037(124)) Avail: NTIS HC $15.00 CSCL 01A
This bibliography, lists 450 reports, articles, and other documents introduced into the NASA scientific and technical information system in June 1980. Author

N80-29244*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
CONTROL-SYSTEM TECHNIQUES FOR IMPROVED DEPARTURE/SPIN RESISTANCE FOR FIGHTER AIRCRAFT
Luat T. Nguyen, William P. Gilbert, and Marilyn E. Ogburn Aug. 1980 69 p refs
(NASA-TP-1689; L-13453) Avail: NTIS HC A04/MF A01 CSCL 01C
Some fundamental information on control system effects on controllability of highly maneuverable aircraft at high angles of attack are summarized as well as techniques for enhancing fighter aircraft departure/spin resistance using control system design. The discussion includes: (1) a brief review of pertinent high angle of attack phenomena including aerodynamics, inertia coupling, and kinematic coupling; (2) effects of conventional stability augmentation systems at high angles of attack; (3) high angle of attack control system concepts designed to enhance departure/spin resistance; and (4) the outlook for applications of these concepts to future fighters, particularly those designs which incorporate relaxed static stability. R.C.T.

N80-29245*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
SUBSONIC AIRCRAFT: EVOLUTION AND THE MATCHING OF SIZE TO PERFORMANCE
Laurence K. Loftin, Jr. Aug. 1980 445 p refs
(NASA-RP-1060; L-13367) Avail: NTIS HC A19/MF A01 CSCL 01B
Methods for estimating the approximate size, weight, and power of aircraft intended to meet specified performance requirements are presented for both jet-powered and propeller-driven aircraft. The methods are simple and require only the use of a pocket computer for rapid application to specific sizing problems. Application of the methods is illustrated by means of sizing studies of a series of jet-powered and propeller-driven aircraft with varying design constraints. Some aspects of the technical evolution of the airplane from 1918 to the present are also briefly discussed. Author

N80-29246# CACI, Inc. - Federal, Arlington, Va.
AVIATION COMPONENT REPAIR PROGRAM ANALYSIS, VOLUME 1 Final Report
Mar. 1980 65 p
(Contract N00014-80-C-0097)
(AD-A086060) Avail: NTIS HC A04/MF A01 CSCL 15/5
Depot repair of aviation repairable components supports the flight operations of the U.S. Navy and Naval Reserve Aircraft. In order to determine an appropriate measure of effectiveness which could be used to assess the impact of the component repair program, several statistical analyses were performed comparing financial and other data related to the Aviation Component Repair Program, data in aviation related programs and various effectiveness measures. GRA

N80-29247# Cost Analysis Improvement Group, Washington, D.C.
AIRCRAFT OPERATING AND SUPPORT COST DEVELOPMENT GUIDE
15 Apr. 1980 23 p
(AD-A085854) Avail: NTIS HC A02/MF A01 CSCL 14/1
This document provides guidelines for preparing and presenting estimates of operating and support (O S) costs to the OSD Cost Analysis Improvement Group (CAIG) and the Defense Systems Acquisition Review Council (DSARC). These guidelines are intended to achieve consistent and effective preparation and documentation of major system O S cost estimates. This guide updates and expands the CAIG 'Cost Development Guide for Aircraft Systems' originally published in May 1974. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-29248# National Inst. for Aeronautics and Systems Technology, Pretoria (South Africa).
A BASIC COMPUTER PROGRAM FOR THE EVALUATION OF THE INVISCID VELOCITY DISTRIBUTION ALONG BODIES OF REVOLUTION IN AXIAL FLOW
R. A. Streather Oct. 1979 25 p refs
(CSIR-NIAST-79/116; ISBN-0-7988-1432-1) Avail: NTIS HC A02/MF A01
A rapid method is developed for calculating the velocity distribution along the surface of arbitrary bodies of revolution in inviscid flow. The method is programmed in BASIC for local operation on the Tektronix 4051 computer or for more rapid operation on the CDC Cyber 174 computer. Comparison is made with the exact potential flow solution for an ellipsoid of revolution and with experimental wind tunnel results for an aircraft fuselage. R.K.G.

N80-29249*# Grumman Aerospace Corp., Bethpage, N.Y.
TOWARDS COMPLETE CONFIGURATIONS USING AN EMBEDDED GRID APPROACH Final Report
Charles W. Boppe Washington, D.C. Jul. 1978 19 p refs
(Contract NAS1-14732)

(NASA-CR-3030) Avail: NTIS HC A02/MF A01 CSCL 01A

A new approach to simulating transonic flow about transport configurations is briefly outlined. The methods embedded grid scheme provides a high degree of computational resolution coupled with geometric flexibility for future applications to complex shapes. Calculations presented illustrate aspects of transonic transport design including fuselage design, determination of wing control surface deflection effectiveness, and wing design. Author

N80-29250*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE EFFECT OF THROAT CONTOURING ON TWO-DIMENSIONAL CONVERGING-DIVERGING NOZZLES AT STATIC CONDITIONS

Mary L. Mason, Lawrence E. Putnam, and Richard J. Re Aug. 1980 70 p refs

(NASA-TP-1704; L-13591) Avail: NTIS HC A04/MF A01 CSCL 01A

An experiment was conducted at static conditions to determine the internal performance effects of nozzle throat contouring, the result of increasing the circular-arc throat radius. Five nonaxisymmetric converging-diverging nozzles were tested at nozzle pressure ratios up to 9.0. Data are presented as internal thrust ratios, discharge coefficients, and static-pressure distributions. Comparisons of internal performance data for the five nozzles show that throat contouring increases the value of discharge coefficient but has no significant effect on internal thrust ratio except in cases of internal flow separation. To illustrate the use of the two dimensional converging-diverging (2-D C-D) nozzle data base, a two dimensional inviscid theory was applied to the five configurations. The generally good agreement of data with theoretical results indicates that two-dimensional inviscid theory can be successfully applied to the prediction of 2-D C-D nozzle internal flow. Author

N80-29251*# Stanitz (John D.), University Heights, Ohio.

GENERAL DESIGN METHOD FOR THREE-DIMENSIONAL POTENTIAL FLOW FIELDS. 1: THEORY Final Report

John D. Stanitz Washington, D.C. Aug. 1980 82 p refs

(Contract NAS3-21605)

(NASA-CR-3288) Avail: NTIS HC A05/MF A01 CSCL 01A

A general design method was developed for steady, three dimensional, potential, incompressible or subsonic-compressible flow. In this design method, the flow field, including the shape of its boundary, was determined for arbitrarily specified, continuous distributions of velocity as a function of arc length along the boundary streamlines. The method applied to the design of both internal and external flow fields, including, in both cases, fields with planar symmetry. The analytic problems associated with stagnation points, closure of bodies in external flow fields, and prediction of turning angles in three dimensional ducts were reviewed. R.C.T.

N80-29252# Army Research and Technology Labs., Moffett Field, Calif.

DYNAMIC STALL ON ADVANCED AIRFOIL SECTIONS

W. J. McCroskey, K. W. McAlister, L. W. Carr, S. L. Pucci, O. Lambert (Service Technique des Construction Aeronautiques, Paris), and R. F. Indergand (Mather AFB, Calif.) May 1980 26 p refs Presented at the 36th Annual Forum of the Am. Helicopter Soc., Washington, D.C., May 1980

(AD-A085809) Avail: NTIS HC A03/MF A01 CSCL 01/2

The dynamic stall characteristics of eight airfoils have been investigated in sinusoidal pitch oscillations over a wide range of two dimensional unsteady flow conditions. The results provide a unique comparison of the effects of section geometry in a simulated rotor environment. Important differences between the various airfoils were observed, particularly when the stall regimes were penetrated only slightly. Under these circumstances, the profiles that stall gradually from the trailing edge appear to offer an advantage. However, all of the airfoils tended increasingly toward leading-edge stall when both the severity of dynamic stall and the free-stream Mach number increased. In all cases, the parameters of the unsteady motion appear to be more important than airfoil geometry for configurations that are appropriate for helicopter rotors. GRA

N80-29253*# Aerospace Systems, Inc., Burlington, Mass.

STEADY, OSCILLATORY, AND UNSTEADY SUBSONIC AERODYNAMICS, PRODUCTION VERSION 1.1 (SOUSSA-P 1.1). VOLUME 2: USER/PROGRAMMER MANUAL

Scott A. Smolka, Robert D. Preuss, Kadin Tseng, and Luigi Morino Jun. 1980 184 p refs

(Contract NAS1-14977)

(NASA-CR-159131) HC A09/MF A01 CSCL 01A

A user/programmer manual for the computer program SOUSSA P 1.1 is presented. The program was designed to provide accurate and efficient evaluation of steady and unsteady loads on aircraft having arbitarary shapes and motions, including structural deformations. These design goals were in part achieved through the incorporation of the data handling capabilities of the SPAR finite element Structural Analysis computer program. As a further result, SOUSSA P possesses an extensive check-point/ restart facility. The programmer's portion of this manual includes overlay/subroutine hierarchy, logical flow of control, definition of SOUSSA P 1.1 FORTRAN variables, and definition of SOUSSA P 1.1 subroutines. Purpose of the SOUSSA P 1.1 modules, input data to the program, output of the program, hardware/software requirements, error detection and reporting capabilities, job control statements, a summary of the procedure for running the program and two test cases including input and output and listings are described in the user oriented portion of the manual. R.K.G.

N80-29254*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A COMPUTER PROGRAM FOR THE DESIGN AND ANALYSIS OF LOW-SPEED AIRFOILS

Richard Eppler (Stuttgart Univ., West Germany) and Dan M. Somers Aug. 1980 145 p refs

(NASA-TM-80210; L-12937) Avail: NTIS HC A07/MF A01 CSCL 01A

A conformal mapping method for the design of airfoils with prescribed velocity distribution characteristics, a panel method for the analysis of the potential flow about given airfoils, and a boundary layer method have been combined. With this combined method, airfoils with prescribed boundary layer characteristics can be designed and airfoils with prescribed shapes can be analyzed. All three methods are described briefly. The program and its input options are described. A complete listing is given as an appendix. Author

N80-29255*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ANALYSIS OF TRANSONIC SWEPT WINGS USING ASYMPTOTIC AND OTHER NUMERICAL METHODS

H. K. Cheng, S. Y. Meng, R. Chow (Grumman Aerospace Corp., Bethpage, N.Y.), and R. Smith May 1980 31 p refs Presented at the 18th AIAA Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980 Prepared in cooperation with Univ. of Southern California, Los Angeles

(Contract N00014-75-C-0520; NR Proj. 061-192)

(NASA-TM-80762; AD-A085587; USCAE-138) Avail: NTIS HC A03/MF A01 CSCL 20/4

Asymptotic theories for high-aspect-ratio wings transonic flow developed recently show that the three dimensional (3-D) mixed-flow calculations may be reduced to solving a set of 2-D problems at each span station. For wings with surfaces generated from a single airfoil shape, local similutude exists in the 3-D flow structure, permitting the problems to be solved once for all span stations. This paper reviews this theoretical development. The essential elements in the theory will be identified. Their relationship to the lifting-line theory and related classical methods are discussed. Examples of similarity solutions are demonstrated for high subcritical and slightly super-critical component flows; comparisons with relaxation solutions to a full potential equation are made. The study also examines the adequacy of the existing full-potential computer code. Outstanding problems remaining for subsequent development are discussed. GRA

N80-29256# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DEVELOPMENT AND APPLICATION OF A SUBSONIC

TRIANGULAR VORTEX PANEL M.S. Thesis
John C. Sparks Jun. 1980 86 p refs
(AD-A085595; AFIT/GAE/AE/80J-1) Avail: NTIS
HC A05/MF A01 CSCL 20/4

Paneling methods are approximate techniques for solving flow problems over wings and bodies. Vortex panels are used to model flow over wings and other lifting surfaces. The author develops a triangular vortex panel having a vorticity distribution that can vary in magnitude and direction. This panel is used to predict the pressure distribution on a rectangular and a sweptback wing in subsonic flow. Lift distributions obtained compare favorably to Anderson's solution and wind tunnel results except near the wing tip. In this region, the distribution will spike before satisfying the Kutta condition imposed at the tip. Possible remedies for the tip problem are discussed. GRA

N80-29257# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Ramjet Engineering Div.
CALCULATION TECHNIQUES FOR INVISCID TWO-DIMENSIONAL SUPERSONIC AIRFLOW Final Report, Sep. 1977 - Dec. 1978
M. Brian Bergsten Sep. 1979 135 p refs
(AF Proj. 3012)
(AD-A085327; AFAPL-TR-79-2023) Avail: NTIS
HC A07/MF A01 CSCL 20/4

Techniques for calculating the change in properties of inviscid supersonic airflow passing over or through various two dimensional bodies are discussed in this report. Low supersonic (M less than 4) airflows and high supersonic (M greater than 4) airflows are considered separately. Flow phenomena considered include normal shock waves, oblique shock waves, insentropic expansions, and conical shock waves for cones at zero degrees angle of attack. The adjustments required for swept wings are also discussed. Printouts of computer subroutines designed to carry out the described calculation procedures are included in an appendix to the report. Examples describing the use of the calculation techniques and computer subroutines for a swept wing, and for two typical ramjet inlets are included. A final appendix includes charts that can be used as calculation aids for airflows at Mach numbers up to 4. GRA

N80-29258# ARO, Inc., Arnold Air Force Station, Tenn.
BOUNDARY LAYER MEASUREMENTS ON SLENDER BLUNT CONES AT FREE-STREAM MACH NO. 8 Final Report, 21-25 Sep. 1979
L. G. Siler and J. C. Donaldson AEDC Dec. 1979 59 p refs
(AF Proj 2300)
(AD-A085712; AEDC-TSR-79-V71) Avail: NTIS
HC A04/MF A01 CSCL 20/4

Boundary layer profiles and surface conditions were measured on a slender cone with various nose bluntnesses with a laminar boundary layer and with the wall temperature in a state of equilibrium. The measurements were made at a free-stream Mach number of 8 for unit Reynolds numbers from 1.3 to 3.5 million per foot. Surveys were made using a hot-wire anemometer and total temperature and pressure probes. Descriptions of the test apparatus, procedures, and techniques used are given in this report. GRA

N80-29259# Transportation Systems Center, Cambridge, Mass.
GROUND WIND VORTEX SENSING SYSTEM CALIBRATION TESTS Final Report, Apr. 1971 - Nov. 1972
T. E. Sullivan and D. C. Burnham Feb. 1980 85 p refs
(AD-A085647; TSR-FAA-80-4; FAA-RD-80-13) Avail: NTIS
HC A05/MF A01 CSCL 14/2

This report describes the collection of data related to the calibration of two systems for detecting and tracking aircraft wake vortices. The systems tested were the propeller anemometer Ground Wind Vortex Sensing System and the Pulsed Acoustic Vortex Sensing System. The data were analyzed and the location of the vortices as determined with these systems were compared with the vortex location as determined photographically. The tests were conducted at the Federal Aviation Administration's National Aviation Facilities Experimental Center, in Atlantic City, N. J. GRA

N80-29260# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ALGORITHM FOR ESTIMATING AERODYNAMIC STATIC MOMENTS OF LONG ROD PENETRATORS AT 2 LESS THAN M LESS THAN 5
William F. Donovan May 1980 49 p
(DA Proj. 1L1-62618-AH-80)
(AD-A086095; AD-E430468; ARBRL-MR-03020) Avail: NTIS
HC A03/MF A01 CSCL 20/4

Estimation of the aerodynamic normal force and static moment of a given class of flight vehicles is demonstrated with reference to AMCP 706-280, which in turn derives from the classic British work 'Wings'. By means of linearized algebraic reduction, a transmutation permits the designer to quickly evaluate the effects of variation on the flight system. GRA

N80-29261# Pennsylvania State Univ., University Park. Applied Research Lab.
A METHOD OF CORRECTING FOR THE EFFECTS OF THE SIDEWALL BOUNDARY LAYER IN TWO DIMENSIONAL AIRFOIL TESTING
Paul P. Jacobs, Jr. 31 Mar. 1980 157 p refs
(Contract N00024-79-C-6043)
(AD-A086079; ARL/PSU/TM-80-44) Avail: NTIS
HC A08/MF A01 CSCL 20/4

This thesis presents the results of a hydrofoil force balance design study in which the influence of sidewall boundary layers on two dimensional force measurements is emphasized. Past problems encountered with the present hydrofoil force balance at the Applied Research Laboratory of The Pennsylvania State University are reviewed in order to provide background information for the present study and a two phase test program designed to identify those factors associated with the presence of sidewall boundary layers which can influence two dimensional force measurement in water tunnels and wind tunnels is presented. GRA

N80-29262# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
TRANSONIC AIRFOILS: THE DESIGN OF A SUPERCRITICAL WING FOR TRANSPORT AIRCRAFT Final Report, Oct. 1978
Guenter Krenz Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 85 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-11; PR-2) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 17,45

As part of the Airbus A 300 B10 (A310) development program, the design and wind tunnel characterization of four supercritical wings in a transonic flow are reported on. Wind tunnel measurements made on airfoil profiles are analyzed. Results are used in the choice of a wing configuration for a full scale model to be subjected to further transonic wind tunnel tests. Model construction and data collection schemes are discussed. Transonic flow theory is also considered. At present, the influence of the engine assembly on the wing configuration and its flow field has yet to be satisfactorily calculated. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-29263# Aeronautical Research Labs., Melbourne (Australia).
THE STRENGTH OF OCCUPANT RESTRAINT SYSTEM IN LIGHT AIRCRAFT: AN EXPERIMENTAL EVALUATION
S. R. Sarrailhe Feb. 1979 40 p
(ARL-Struc-Rept-375; AR-001-600) Avail: NTIS
HC A03/MF A01

The cabins and restraint systems of three cyclone-damaged light aircraft were tested statically to determine the strength of the restraint system in the cabin. It was found that most restraining components were much stronger than demanded by the 9 g requirement and it was considered that only minor improvements

would be needed to ensure 25 g capability. Seats were not as strong as the restraints and their behavior under crash load conditions requires further investigation. Author

N80-29264# Federal Aviation Administration, Washington, D. C.
FIRST COMMUTER AIR CARRIER SAFETY SYMPOSIUM
Jan. 1980 253 p. Symp. held at Washington, D.C., 16-17 Jan. 1980
(AD-A085628) Avail: NTIS HC A12/MF A01 CSCL 01/2

This is the first commuter air carrier safety symposium held by the FAA. The objective is to review the significant problems which are inseparable from safety issues. Most of the accidents which have occurred in the last several years have involved recurring contributing factors, in operations, maintenance, and training, and most are truly avoidable. The program is directed toward a listening session and regulatory overview; the industry presented its perspectives with reliability, and air-worthiness; human factors considerations in accident prevention; and the prospects of, or needs for, airport and airway development for commuter service. GRA

N80-29265# Battelle Columbus Labs., Ohio.
EVALUATION OF SAFETY PROGRAMS WITH RESPECT TO THE CAUSES OF AIR CARRIER ACCIDENTS
T. M. Connor and C. W. Hamilton. Jan. 1980 257 p. refs
(Contract DOT-FA77WA-4072)
(AD-A085347; FAA-ASP-80-1) Avail: NTIS HC A12/MF A01 CSCL 13/12

The objective of this study was to determine the extent to which the FAA safety programs were aligned with the causes of air carrier accidents. The data base used in this study consisted of a total of 760 air carrier accident records compiled by the National Transportation Safety Board (NTSB) from 1966 through 1975. Analysis of these records was made with respect to NTSB-cited cause/factors. FAA programs implemented during the study time period and pertaining to safety were also included in this study. Conclusions of this study are: (1) no substantive change is required with respect to mechanical safety programs, (2) broader investigation into the integration of environmental programs with human factors programs is required, (3) new program initiatives addressing human error problems in behavior terms are required. GRA

N80-29266# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
THE CURRENT ROLE OF ALCOHOL AS A FACTOR IN CIVIL AIRCRAFT ACCIDENTS
Leonard C. Ryan and Stanley R. Mohler (Wright State Univ.) May 1980 13 p. refs
(AD-A086261; FAA-AM-80-4) Avail: NTIS HC A02/MF A01 CSCL 01/2

Ethyl alcohol continues as a serious adverse factor in general aviation flight safety. According to FAA figures, the level of alcohol-associated general aviation fatal accidents has remained relatively static at a 16% general level since 1969. A recent survey of the attitudes of pilots toward alcohol and flying reveals a lack of appreciation among one-third of the pilots concerning the adverse effects of alcohol and safe flight. A renewed pilot education program on alcohol and flight safety appears indicated. GRA

N80-29267# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
ACTIVE BCAS PERFORMANCE IN A GARBLE ENVIRONMENT
Edmund J. Koenke. 24 Jan. 1980 50 p. refs
(AD-A086046; FAA-EM-80-1) Avail: NTIS HC A03/MF A01 CSCL 01/2

A basic design tool has been developed which includes the principal BCAS design parameters, namely, transmitter power, receiver sensitivity, aircraft density, closure rate, degarble capability, and interrogation rate. This tool can be directly applied to the evaluation of alternative BCAS design concepts as well as for parametric design studies. Results of a comparison between an ATCRBS/DABS BCAS and an ATCRBS only BCAS are presented leaving little doubt concerning the performance advantage offered by the inclusion of the DABS link for evasive maneuver coordination. It must be emphasized that neither of the BCAS systems analyzed in this report are representative of the accitive BCAS defined in the draft National Standard for active BCAS. GRA

N80-29268# Ultrasystems, Inc., Irvine, Calif.
FLUID CONTAMINATION OF AIRCRAFT-CABIN AIR AND BREATHING OXYGEN Final Report, 19 Jun. 1978 - 19 Jun. 1979
K. L. Paciorek, J. H. Nakahara, and R. H. Kratzer. Dec. 1979 53 p.
(Contract F33615-78-C-0612; AF Proj. 7930)
(AD-A085818; SN-8331-F; SAM-TR-79-34) Avail: NTIS HC A04/MF A01 CSCL 01/3

From different manufacturers, a series of lubricating oils (MIL-L-7808), hydraulic fluids (MIL-H-5606), and heat-transfer fluids (MIL-C-47220) were obtained to test their potential for contaminating aircraft breathing air and oxygen. No significant differences were detectable in the compositions of lubricating oils and hydraulic fluids, irrespective of the origin, including fluids recovered after service in an aircraft. The two heat-transfer fluids of interest were single compounds. Under normal operating conditions, the hydraulic and heat-transfer fluids afforded minimal quantities of products. The lubricating oils volatized to a large degree; the mists consisted essentially of unchanged starting materials. Tests simulating line rupture with fluid spilling onto a hot, 450 C (850 F), metal surface in the presence of air resulted in excessive fluid degradiation. In all instances, significant quantities of hydrocarbons, carbonyls, and alcohols were produced. Among these, the highly toxic formaldehyde, acrolein, formic acid, and formates were found and quantitated. GRA

N80-30013# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario)
HUMAN FACTORS IN HIGH-SPEED LOW-LEVEL ACCIDENTS: A 15 YEAR REVIEW
R. C. Rud and D. F. Leben. *In* AGARD High-Speed, Low-Level Flight Mar. 1980 6 p. refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30015# Bureau of Medicine and Surgery (Navy), Washington, D. C.
NAVAL AVIATION WATER SURVIVAL PROGRAM
Wilton McIntosh. *In* AGARD High-Speed, Low-Level Flight Mar. 1980 3 p. refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30016# Martin-Baker Aircraft Co. Ltd., Denham (England).
HIGH-SPEED, LOW-LEVEL FLIGHT SURVIVAL ON EJECTION
M. A. A. Hobbs. *In* AGARD High-Speed, Low-Level Flight Mar. 1980 2 p. (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30017# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MINIMIZING THE SEQUENCED DELAY TIME FOR ESCAPE FROM HIGH-SPEED, LOW-LEVEL FLIGHT PROFILES
James H. Raddin, Jr., Lawrence J. Specker, and James W. Brinkley. *In* AGARD High-Speed, Low-Level Flight Mar. 1980 12 p. refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30018# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
LOW LEVEL, ADVERSE ATTITUDE ESCAPE USING A VERTICAL SEEKING EJECTION SEAT
John J. Tyburski, Georg D. Frisch (Naval Aerospace Medical Research Lab., New Orleans, La.), and Louis A. Daulerio. *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p. refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-29269# ECON, Inc., Princeton, N. J.
THE ALLOCATION OF RUNWAY SLOTS BY AUCTION. VOLUME 1: EXECUTIVE SUMMARY Final Report
F. M. Sand and M. L. Balinski 15 Apr. 1980 50 p refs 3 Vol.
(Contract DOT-FA79WA-4374)
(AD-A085739; FAA-AVP-80-3-Vol-1) Avail: NTIS
HC A03/MF A01 CSCL 01/2

The allocation of runway slots at the high-density airports by means of an auction is studied. Previous approaches to slot auctions have not allowed for the interdependency of slot values to the air carriers; a single slot for a landing of an aircraft is likely to be of little value without a corresponding slot for a subsequent take-off of that aircraft. A Slot Exchange Auction is designed, its theoretical properties and practical implementation discussed. It is shown to allow the slot market to reach an efficient equilibrium under competitive conditions. The Airline Management Game is used to create a simulation test of the Slot Exchange Auction and its associated continuous market, the slot exchange. GRA

N80-29270# ECON, Inc., Princeton, N. J.
THE ALLOCATION OF RUNWAY SLOTS BY AUCTION. VOLUME 2: THE AIRLINE MANAGEMENT GAME AND SLOT AUCTION TESTING Final Report
F. M. Sand and M. L. Balinski Apr. 1980 178 p refs Prepared in cooperation with Flight Transportation Associates, Cambridge, Mass. 3 Vol.
(Contract DOT-FA79WA-4374)
(AD-A085438; FAA-AVP-80-3-Vol-2) Avail: NTIS
HC A09/MF A01 CSCL 01/2

A specific mechanism for allocating slots between competing air carriers based on a sequential auction procedure is analyzed. The mechanism is shown to achieve an efficient slot solution where one exists. In case there is no efficient solution, it is proposed that the slot market remain open continuously throughout the six months of operations so that air carriers can exchange slots on the open slot market in order to improve the balance between slot allocations and flight schedules. The continuous slot exchange has the additional advantage that it allows changes in the allocation of scarce runway capacity in response to changing economic and air transportation conditions. J.M.S.

N80-29271# ECON, Inc., Princeton, N. J.
THE ALLOCATION OF RUNWAY SLOTS BY AUCTION. VOLUME 3: THEORY AND TECHNICAL ISSUES FOR IMPLEMENTATION Final Report
F. M. Sand and M. L. Balinski Apr. 1980 87 p refs 3 Vol.
(Contract DOT-FA79WA-4374)
(AD-A085455; AVP-80-3-Vol-3) Avail: NTIS
HC A05/MF A01 CSCL 01/2

In order to evaluate the viability of the slot exchange auction and subsequent continuous slot exchange, an interactive computer simulation of actual slot auctions was conducted using the Airline Management Game. The scenario included 5 competing airlines and 17 airports with 3 of them being capacity-limited. Hourly quotes for the airports were established based on the airport activity profiles obtained in the base case. The participants were instructed to maximize short-run airline profits using a fixed fleet of aircraft and fixed fares, but free choice of routes and schedules. The schedules were assumed to operate for six months at a time. The Airline Management Game is outlined, and the experimental design, the bidding rules, and the results and analyses of the evaluation exercise are included. The testing of the slot allocation methods is demonstrated. The test was inconclusive in regard to convergence to equilibrium and the economic efficiency and equitability of the slot exchange method. J.M.S.

N80-29272# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
WIND FACTOR SIMULATION MODEL: USER'S MANUAL Final Report
Roger C. Whiton and Patrick L. Herod Apr. 1980 66 p
(AD-A085486; USAFETAC/TN-80/002) Avail: NTIS
HC A04/MF A01 CSCL 09/2

User instructions and a concise description are provided for a Wind Factor Simulation Model (WFSM). The WFSM is a fast, economical module designed to reside as a collection of subroutines within the user's larger simulation model. The WFSM, upon call by the user, produces mean overall climatological wind factors for great circle routes between arbitrary man overall climatological wind factors for great circle routes between arbitrary points 'A' and 'B' (specified by latitude and longitude) anywhere on the globe. The WFSM produces wind factors in any of three modes (calm wind case, 90 percent worst case, and the mean wind case), for either of two altitudes (25,000 ft and 35,000 ft) for any of four seasons of the year. In addition, the model can provide great circle distance between points 'A' and 'B'. From this information and known airspeed, the user can calculate ground speed and adjusted flying time between 'A' and 'B'. Software solves the equation of a great circle. Program listing and flow chart are included. GRA

N80-29273# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
SYSTEMS RESEARCH AND DEVELOPMENT SERVICE REPORT OF R AND D ACTIVITY
Nathan Aronson, Gary R. Rowland, Donald L. Scheffler, James P. Dugan, and Parker E. Harris, Jr. May 1980 189 p refs
(AD-A085629; FAA-RD-80-54) Avail: NTIS
HC A09/MF A01 CSCL 17/7

Recent achievements and results expected in the near future are discussed in 26 technical papers covering the following areas: terminal information processing; metering and spacing for automated radar terminal systems; electronic tabular display systems; en route minimum safe attitude warning function integrated with the current NASA automation system; en route display recording/playback; airport surface detection equipment surveillance radar; digital radar for air traffic control terminal areas; discrete address beacon system link applications; moving target detectors; automatic traffic advisory and resolution service; beacon collision avoidance system; airport security systems; bomb and explosives detection; air transport cockpit alerts/warning systems; helicopter development program; LORAN-C development; wind shear program; head-up displays for civil aviation; systems characterizing thunderstorms for safe aircraft operations; automation of aviation weather observations; computer generated voice response; automated route forecasts; and the FAA remote terminal system frequency assignment model. A.R.H.

N80-29274# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
WIND FACTOR SIMULATION MODEL: MODEL DESCRIPTION Final Report
Roger C. Whiton and Patrick L. Herod Apr. 1980 38 p refs
(AD-A085733; USAFETAC/TN-80/001) Avail: NTIS
HC A03/MF A01 CSCL 17/7

A simplified, small and efficient Wind Factor Simulation (WFSM) is developed for inclusion in a Military Airlift Command (MAC) airlift system simulation called COLOSSUS. The WFSM calculates climatological wind factors by Sawyer's equivalent headwind technique for arbitrary great circle routes at specified altitudes for any of four seasons in any of three wind options. This technique is combined with the mathematics of great circle navigation in a constellation of seven FORTRAN subprograms. In the WFSM, a simulated aircraft is navigated along a great circle route between any two points on the globe. Involved in the mathematics of the navigation is solving the equation of a great circle. This equation is sometimes transcendental. In those cases, Newton's iterative method for the solution of nonlinear algebraic equations is used. The WFSM also calculates the great circle distance in nautical miles and the initial heading in degrees of any two points whose latitude and longitude are known. GRA

N80-29275# Westinghouse Electric Corp., Baltimore, Md.
FAR FIELD MONITOR FOR INSTRUMENT LANDING SYSTEMS, PHASES 1 AND 2 Interim Report
R. More, J. C. Bradley, and B. Newman. Nov. 1979. 318 p. refs.
(Contract DOT-FA75WA-3689)
(AD-A079663; FAA-RD-79-7023) Avail: NTIS
HC A14/MF A01 CSCL 17/7

This report describes a study performed to determine the nature of scattering of ILS radiated signals by objects on the airport property. These included both taxiing and overflying aircraft. The interaction of this scattered energy with the direct radiation was studied to determine the derogating effects of ILS guidance. This resulted in the development of four system level concepts for detecting glide path derogation. One technique, the Vector DDM, was selected as being most practical from a sensitivity, reliability, and cost point-of-view. GRA

N80-29276# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DISCRETE ADDRESS BEACON SYSTEM (DABS) BASELINE TEST AND EVALUATION Interim Report, Jun. - Sep. 1979
M. Holtz, W. Swanseen, M. Karlin, R. Spadea, and D. Fisher. Apr. 1980. 142 p. refs.
(FAA Proj. 034-241-510)
(AD-A085585; FAA-NA-79-52; FAA-RD-80-36) Avail: NTIS
HC A07/MF A01 CSCL 17/7

Tests and evaluation (T E) were conducted principally to determine baseline performance characteristics of the Discrete Address Beacon System (DABS) sensor employing the software and associated parameter values as delivered by Texas Instruments (TI), Incorporated in June 1979. A secondary objective was to highlight those areas where changes in system parameters, made necessary by the maturing of the DABS/Automatic Traffic Advisory and Resolution Service (ATARS) system concept, would require further study and test prior to issuance of the Technical Data Package (TDP). Simulation techniques, targets of opportunity, and DABS transponder-equipped aircraft were used. The DABS sensor test program was accomplished with an Air Traffic Control Radar Beacon System (ATCRBS) 5 foot antenna having a 2.4 deg beam width, and the DABS sensor transmitter power output and effective beam width values as delivered by the contractor. Data reduction and analysis tools developed by the National Aviation Facilities Experimental Center (NAFEC) were used to determine sensor performance characteristics and to highlight areas for further analysis. It was concluded that, with few exceptions, the DABS engineering model in the implementation tested performed in compliance with or exceeded the requirements as defined in the DABS Engineering Requirements (FAA-ER-240-26). Those exceptions are discussed in the body of the report along with recommendations for further activity. GRA

N80-29277# Mitre Corp., Bedford, Mass.
LORAN NAVIGATION SYSTEM
J. L. Howard. May 1980. 84 p. refs.
(Contract F19628-79-C-0001)
(AD-A085646; M79-206; ESD-TR-80-121) Avail: NTIS
HC A05/MF A01 CSCL 17/7

LORAN is a highly accurate source of positioning information that can also be used for precision time reference. This report presents an overview of the LORAN navigation system for the general reader. Basic system characteristics and relationships provide a background in LORAN navigation and signal processing that applies to LORAN receivers in current use. Data for available LORAN transmitter chains are included with the report. GRA

N80-29278# Boston Coll., Chestnut Hill, Mass.
SIGNAL DETECTION/ANALYSIS OF IONOSPHERIC AND GROUND WAVE PROPAGATION Final Report, 1 Jul. 1975 - 30 Sep. 1977
William C. McComish. Griffiss AFB, N.Y. RADC. 1 Apr. 1978. 47 p. refs.
(Contract F19628-76-C-0006; AF Proj. 2305)
(AD-A085757; BC-SDAL-78-1; RADC-TR-78-198) Avail: NTIS
HC A03/MF A01 CSCL 17/7

The theory and application of various types of analysis and data processing for both ionospheric HF signal propagation and groundwave LF propagation are discussed with particular emphasis on the maximum entropy estimator method, its derivation and application to data from the Doppler arrival angle spectral measurements (DAASM) program and to the sea backscatter measurements from the Ava-Dexter HF radar facility of Rome Air Development Center. Efforts to extract the most information regarding radar refraction and electron density profiles from a survey of vertical incidence ionograms, using existing techniques and programs, are also examined. GRA

N80-29279# Performance Measurement Associates, Inc., Vienna, Va.
DATA ANALYSIS METHODOLOGY FOR DAY/NIGHT INFLIGHT TACTICAL NAVIGATION Final Report, 8 Aug. 1977 - 19 Mar. 1979
Edward M. Connelly and Robert F. Comeau. Sep. 1979. 127 p.
(Contract DAHC19-77-C-0042; DA Proj. 2Q2-63743-A-772)
(AD-A082731; PMA-7-79; ARI-TR-411) Avail: NTIS
HC A07/MF A01 CSCL 17/7

Low-level helicopter navigation, both at night and during the day, is an essential portion of the Army's mission. Navigation performance, defined as the probability of navigating along a prescribed route or route segment without deviation, is a function of many factors including map type, terrain type, and time of day. Determining the effects of these factors is important for predicting performance of Army navigators, identifying factors critical to navigation, evaluating the probability of navigation success along a route, and developing training aids. The research reported here analyzed low-level flight experiment data to develop that information. This report contains results of the analyses of helicopter low-level navigation data, (a) to determine the probability of navigation success along a route as a function of terrain type, (b) to develop a means of determining route difficulty, and (c) to develop a method of scoring student performance. The FORTRAN computer programs and the navigation data base used in the analysis are also documented. GRA

N80-29280# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TEST AND EVALUATION OF THE AIRPORT SURVEILLANCE RADAR (ASR)-8 WIND SHEAR DETECTION SYSTEM, PHASE 2 Interim Report, Apr. - Dec. 1979
D. L. Offi, W. Lewis, T. Lee, and A. DeLaMarche. May 1980. 41 p. refs.
(AD-A086045; FAA-NA-80-17; FAA-RD-80-21) Avail: NTIS
HC A03/MF A01 CSCL 17/9

A wind shear detection system developed by the Wave Propagation Laboratory to operate with the Federal Aviation Administration (FAA) Airport Surveillance Radar (ASR)-8 was installed and is being tested at the FAA Technical Center. Second phase tests compared radar with aircraft and tower winds, evaluated the wind shear measurement capability under various weather conditions, and investigated the effectiveness of a simple two azimuth pointing strategy and system capabilities and limitations. Results showed the system to be compatible with and to operate satisfactorily with the ASR-8. The processing and spectral display of clear air and precipitation returns is feasible. The accuracy of agreement between radar-measured winds and components of the aircraft-measured winds in both radially oriented flights and runway offset flights, using a two azimuth pointing technique, was examined. Radar versus tower wind agreement was also examined. Potentially dangerous wind shears associated with weather during these tests were detectable. Certain system limitations also have been defined and considered. It is recommended that tests continue to complete definition of and demonstrate capabilities in all weather situations. GRA

N80-29281# Transportation Systems Center, Cambridge, Mass.
INTERFERENCE AND NOISE IN AND ADJACENT TO THE LORAN-C SPECTRUM AT AIRPORTS Final Report, Sep. - Dec. 1979
Peter G. Mauro. May 1980. 96 p. refs. Prepared for FAA, Washington, D.C.
(AD-A086043; TSC-FAA-80-8; FAA-RD-80-53) Avail: NTIS
HC A05/MF A01 CSCL 17/7

Electrical noise and interference in the LORAN-C frequency band was measured at two rural airports in Vermont and a

major airport in Boston, Mass. The purpose of the test program was to determine the potential interfering sources that could affect the proper operation of the radio navigational system, LORAN-C, when it is used for non-precision approaches and terminal and en route navigation. Although no significant interference was observed, several continuous wave transmissions were identified in the frequency band adjacent to the LORAN-C band. GRA

N80-29282# Transportation Systems Center, Cambridge, Mass.
VISUAL CONFIRMATION OF VOICE TAKEOFF CLEARANCE (VICON) ALTERNATIVE STUDY Final Report, May - Dec. 1979
Robert S. Yatsko May 1980 61 p refs Prepared for FAA, Washington, D.C.
(AD-A086080; TSC-FAA-80-2, FAA-RD-80-44) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report presents the results of a program undertaken to study potential alternatives to the VICON (Visual Confirmation of Voice Takeoff Clearance) system which has undergone operational field tests at Bradley International Airport, Windsor Locks, Connecticut since October 1979. The tests are scheduled for completion in March 1980. This report presents alternatives from two different viewpoints, namely, those alternatives that can improve certain key components of the existing VICON System, and those proposing entirely different concepts than the current concept. GRA

N80-29283# Naval Weapons Center, China Lake, Calif. Weapons Dept.
STANDOFF RANGE IMPROVEMENT OF ELECTRO-OPTICAL TELEVISION GUIDANCE SYSTEMS Interim Report, period ending FY 1974
Marc L. Moulton Jan. 1980 20 p
(AD-A085197; NWC-TP-6161) Avail: NTIS
HC A02/MF A01 CSCL 17/7

A technique for increasing the maximum range at which a target can be identified and acquired (standoff range) by a television electro-optical guidance system when used under hazy atmospheric conditions has been developed and flight-tested. The standoff range increase is obtained by extending and limiting the spectral response of the television camera to near infrared and incorporating electronic contrast enhancement to increase the target contrast. This method provides increased standoff range by factors from 2 to 4. GRA

N80-29284# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ACTIVE BEACON COLLISION AVOIDANCE SYSTEM TEST BED FOR 1978 LOS ANGELES FLIGHTS Progress Report, Jul. 1976 - Aug. 1978
Maurice Cohen and Charles Richardson May 1980 19 p ref
(AD-A086241; FAA-NA-79-12) Avail: NTIS
HC A02/MF A01 CSCL 01/2

This document describes the test bed configuration of the Federal Aviation Administration (FAA)/air traffic control radar beacon system/Discrete Address Beacon System (ATCRBS/DABS) active mode beacon collision avoidance System (BCAS). BCAS is a ground-independent, air-to-air system activated by eliciting replies from surrounding altitude-reporting transponders within a 32 nautical mile radius. The BCAS provides a positive climb or dive command to the pilot 30 seconds prior to any possible collision. The BCAS also advises the pilot of all aircraft with marginally safe separation. Feasibility flight tests of the test bed configuration were conducted at the National Aviation Facilities Experimental Center (NAFEC), Atlantic City, N.J., Washington, D.C., and Los Angeles, California, from 1976 through 1978. The test bed included the multilevel power interrogation capability referred to as 'whisper-shout', intended to segregate responding aircraft transponders to distribute the computer processing workload and reduce garble. GRA

N80-29285# Federal Aviation Administration, Washington, D. C. Office of Aviation Policy.
A METHOD FOR ADMINISTRATIVE ASSIGNMENT OF RUNWAY SLOTS Final Report
Kenneth E. Gesinger Jun. 1980 53 p
(AD-A086118; FAA-AVP-80-5) Avail: NTIS
HC A04/MF A01 CSCL 17/7

Federal Aviation Regulations set quotas (upper limits) on the number of operations per hour at each of four major U.S. air carrier airports: Washington National, New York LaGuardia, Chicago O'Hare International and New York Kennedy International. The reservation for one of these operations is referred to as a 'runway slot'. The runway slots designated for scheduled air carriers are periodically assigned to the various carriers in advance and airline schedules are built around them. How many slots each airline gets is determined by mutual agreement among the airlines through airline scheduling committees. These committees might be abolished and their function might have to be performed by the Federal Aviation Administration (FAA). This report presents a method for administratively assigning slots to the airlines. It is based on observations made of the scheduling committees. The major difference is that in the scheduling committees, decisions are made in order to get unanimous consent; in the administrative procedure, decisions are made to maximize a measure of passenger service. GRA

N80-29286# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
PERSHING PII INERTIAL MEASUREMENT UNIT CALIBRATION TREND STUDY
H. V. White Mar. 1980 90 p
(AD-A085944; DRSMI/RG-80-20) Avail: NTIS
HC A05/MF A01 CSCL 17/7

This report presents an overview of calibration data taken from Advanced Development Program Inertial Measurement Units. Behavior of calibration parameters is examined and worst/best performers are identified. Time trends are investigated by the method of linear least squares regression. Continued surveillance of parameters, determination of the effects of ill-behaved parameters on alignment and flight performance, and minimization of time required to perform a calibration are tasks to be performed during the Engineering Development program. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-29287*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL EXPERIMENTS ON DIVERGENCE OF FORWARD-SWEPT WINGS
Rodney H. Ricketts and Robert V. Doggett, Jr. Aug. 1980 49 p refs
(NASA-TP-1685; L-13549) Avail: NTIS HC A03/MF A01 CSCL 01C

An experimental study to investigate the aeroelastic behavior of forward-swept wings was conducted in the Langley Transonic Dynamics Tunnel. Seven flat-plate models with varying aspect ratios and wing sweep angles were tested at low speeds in air. Three models having the same planform but different airfoil sections (i.e., flat-plate, conventional, and supercritical) were tested at transonic speeds in Freon 12. Linear analyses were performed to provide predictions to compare with the measured aeroelastic instabilities which include both static divergence and flutter. Six subcritical response testing techniques were formulated and evaluated at transonic speeds for accuracy in predicting static divergence. Two 'divergence stoppers' were developed and evaluated for use in protecting the model from structural damage during tests. Author

N80-29288# Aeronautical Research Labs., Melbourne (Australia).
WESSEX HELICOPTER/SONAR DYNAMICS STUDY ARL PROGRAM DESCRIPTION AND OPERATION
N. V. Williams, C. R. Guy, and N. E. Gilbert Feb. 1979 38 p refs
(ARL-Aero-Note-385; AR-001-603) Avail: NTIS
HC A03/MF A01

A computer program, representing the dynamic behavior in

flight of the Wessex MK.31B helicopter and its antisubmarine warfar (ASW) sonar equipment, is described. The program is intended for operation on a PDP 10 computer and is written in CSMP 10 (ARL) simulation language. Instructions for setting up a particular simulated flight maneuver are given, together with details of program verification. Author

N80-29289# Naval Air Systems Command, Washington, D. C.
DESIGNING ON-CONDITION TASKS FOR NAVAL AIRCRAFT
1 Mar. 1980 50 p
(AD-A085450) Avail: NTIS HC A03/MF A01 CSCL 01/3

Contents: Preventive Maintenance Processes, A History of the 'On Condition' Maintenance Process, A Comparison of Benefits; Non-Destructive Inspection and Testing -- Current Commercial Practice, Future Opportunities; Applications -- Structures, Powerplants, Examples; Designing an 'On-Condition' Task and Measuring Results -- Designing an 'On-Condition' Task, Measuring Results. GRA

N80-29290# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
MECHANICAL BEHAVIOR OF AIRFRAME MATERIALS Final Report, 1 Jan. 1976 - 31 Dec. 1979
J. A. Wert, N. E. Paton, and J. C. Chesnutt Mar. 1980 46 p refs
(Contract F44620-76-C-0025; AF Proj. 2306)
(AD-A085844; SC5053.6FR; AFOSR-80-0451TR) Avail: NTIS HC A03/MF A01 CSCL 01/3

This is the final report for a program which was initiated in 1976 to systematically evaluate the influence of hydrogen on mechanical properties of alpha titanium alloys. In the second year of the program (1977), the effort was extended to include work on the properties of fine grain aluminum alloys. Both segments of the extended program have yielded promising results which are summarized in this report. Among the more important results have been a demonstration of high sustained-load cracking rates and an acceleration of fatigue crack propagation rates by tensile hold periods in Ti-6Al containing modest amounts of hydrogen. The study of fine grain aluminum alloys has demonstrated a marked increase in exfoliation corrosion resistance in 7075 Al with fine equiaxed grain, as compared to standard commercial products. Both of these observations have important implications for the structural efficiency of Ti and Al alloys as airframe materials. GRA

N80-29291# Naval Air Development Center, Warminster, Pa. Aircraft and Crews Systems Technology Directorate.
A TIME RESPONSE APPROACH TO EQUIVALENT AIRCRAFT DYNAMICS Interim Report, Oct. 1978 - Sep. 1979
J. M. Stifel Sep. 1979 81 p refs
(WF41400000)
(AD-A085873; NADC-79231-60) Avail: NTIS HC A05/MF A01 CSCL 01/1

An analytical investigation into the basic equivalent of high-order and reduced-order aircraft dynamics is presented. The need to consider system response to inputs represented by points in the Laplace domain is explained in terms of the ability of a damped sinusoid series to the model general aperiodic pilot inputs. The region of concern in the Laplace domain is related to pilot response time by the time to the initial peak of a single damped sinusoid inputs. Several representative high-order systems and their lower order equivalents are examined for similarity of time response. A new approach for equivalent systems application is suggested based on matching time responses over the Laplace domain region. Implications of the analysis to present methods of applying equivalent systems and to suggested pilot compensation criteria are examined. The analysis leads to the conclusion that equivalent system parameters are variables dependent on Laplace domain location and that the success of current methods depend on that variation being negligible. The further conclusion is reached that if equivalent system parameters are allowed to vary, artificial time delays are unnecessary and undesirable in achieving time response similarity. GRA

N80-29292# McDonnell Aircraft Co., St. Louis, Mo.
THE EFFECTS OF GROUND WALL-JET CHARACTERISTICS ON FOUNTAIN UPWASH FLOW FORMATION AND DEVELOPMENT Final Technical Report, 15 Feb. - 15 Jun. 1980
Donald R. Kotansky and Lloyd W. Glaze 15 Jun. 1980 80 p refs
(Contract N00014-79-C-0130)
(AD-A086127; ONR-CR212-261-1F) Avail: NTIS HC A05/MF A01 CSCL 20/4

An experimental program was conducted to investigate the effects of ground wall jet characteristics on two-jet fountain upwash flow formation and development. Variations in wall jet properties were generated through parametric variations in nozzle pressure ratio and jet impingement angle. Hot film anemometer measurements of the wall jet and fountain upwash flow fields resulted in the determination of fountain upwash formation momentum recovery coefficients, fountain upwash inclination and spreading characteristics, and fountain upwash mass entrainment characteristics. The data obtained in this investigation provides empirical information required for an analytical model of fountain inclination developed during this study. This analytical model is compatible with a methodology and software for the prediction of multiple jet V/STOL aircraft ground surface flow fields previously developed for the Naval Air Development Center and later modified for the NASA Ames Research Center. GRA

N80-29293# Dreyfuss-Pellman Corp., Stamford, Conn.
NON-CONTACTING ELECTRO-OPTICAL CONTOURING OF HELICOPTER ROTOR BLADES Final Report
Marc G. Dreyfuss and Arnold Pellman Dec. 1979 47 p
(Contract DAAK50-78-C-0024)
(AD-A085820) Avail: NTIS HC A03/MF A01 CSCL 01/3

Non-contact contour measurements of helicopter rotor blades to accuracies of 0.001 inch are possible via rangefinding by triangulation employing electro-optical techniques. A prototype of a portion of such a system has been built and tested. The result of these tests indicate that the construction of the full prototype system is feasible and desirable. GRA

N80-29294# Army Research and Technology Labs., Moffett Field, Calif. Aeromechanics Lab.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF AEROELASTIC COUPLINGS ON AEROMECHANICAL STABILITY OF A HINGELESS ROTOR HELICOPTER
William G. Bousman 1980 14 p refs Presented at the Ann. Forum of the Am. Helicopter Soc., Washington, D.C., May 1980
(AD-A085819) Avail: NTIS HC A02/MF A01 CSCL 20/4

A 1.62 m diameter rotor model was used to investigate aeromechanical stability, and the results were compared to theory. Configurations tested included: (1) a nonmatched stiffness rotor as a baseline, (2) the baseline rotor with negative pitch-lag coupling, (3) the combination of negative pitch-lag and structural flap-lag coupling on the baseline rotor, (4) a matched stiffness rotor, and (5) a matched stiffness rotor with negative pitch-lag coupling. The measured lead-lag regressing mode damping of the five configurations agreed well with theory, but only the matched stiffness case with negative pitch-lag coupling was able to stabilize the air resonance mode. Comparison of theory and experiment for the damping of the body modes showed significant differences that may be related to rotor inflow dynamics. GRA

N80-30020# Department of the Air Force, Edwards AFB, Calif. F-16 Combined Test Force.
THE OPERATIONAL ROLES OF THE F-16
Robert C. Ettinger *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 18 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30021# French Air Force, Paris. Bureau des Programmes de Materiel.
OPERATIONAL MISSIONS AND CONCEPTUAL DESIGN OF THE MIRAGE 2000
Jacques Guillou *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 5 p In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30022# Royal Air Force, London (England).
THE CAPABILITIES AND OPERATIONAL ROLES OF ROYAL AIR FORCE TORNADOES
H. M. Archer *In* AGARD Operational Roles, Aircraft Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-29295*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A HEAD-UP DISPLAY FORMAT FOR APPLICATION TO TRANSPORT AIRCRAFT APPROACH AND LANDING
Richard S. Bray Jul. 1980 42 p
(NASA-TM-81199; A-8180) Avail: NTIS HC A03/MF A01 CSCL 01D

A head up display (HUD) format used in simulator studies of the application of HUD to the landing of civil transport aircraft is described in detail. The display features an indication of the aircraft's instantaneous flightpath that constitutes the primary controlled element. Discrete ILS error and altitude signals are scaled and positioned to provide precise guidance modes when tracked with the flightpath symbol. Consideration is given to both the availability and nonavailability of inertial velocity information in the aircraft. Author

N80-29296# Westinghouse Research and Development Center, Pittsburgh, Pa.
MINIATURE ACTIVE MATRIX DISPLAY Final Report, 31 Dec. 1977 - 30 Jul. 1978
J. Murphy and L. J. Sienkiewicz 30 Jul. 1978 75 p
(Contract DAAK70-77-C-0140)
(AD-A085768) Avail: NTIS HC A04/MF A01 CSCL 17/2

The purpose of this research is to take a step toward the development of a miniature flat panel display system in order to replace the miniature CRT now found in Helmet Mounted Displays. This research further attempts to advance projected uses in hand-held and weapon mounted target acquisition devices. The flat panel display would result in reductions in system size, volume, weight, power, voltage and cost relative to a CRT system. In addition, new system configurations would be possible as a result of the compactness of the flat panel system. Flat displays using solid state electronics and various display media have already been developed as commercial products. In most of these, discrete light emitting or modulating elements are electronically addressed and activated. However, when high resolution is required, the large number of such elements results in difficult problems relating to element addressing, electrical connections, duty cycle, and power requirements. Over the past seven years, an intensive program at Westinghouse on the development of thin film transistor (TFT) circuits has made it possible to incorporate active circuitry within each display element, and has made it further possible to provide addressing with peripheral scanner circuitry in the same planar substrate as the display. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-29297*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) COMPOSITE NACELLE TEST REPORT. VOLUME 2: ACOUSTIC PERFORMANCE
D. L. Stimpert Nov. 1979 124 p refs 2 Vol.
(Contract NAS3-18021)
(NASA-CR-159472; R78AEG-574-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 21E

High bypass geared turbofan engines with nacelles forming the propulsion system for short-haul passenger aircraft were tested for use in externally blown flap-type aircraft. System noise levels for a four-engine, UTW-powered aircraft operating in the powered lift mode were calculated to be 97.2 and 95.7 EPNdB at takeoff and approach, respectively, on a 152.4 m (500 ft) sideline compared to a goal of 95.0 EPNdB. A.R.H.

N80-29298*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING ENGINE COMPOSITE FAN BLADE: PRELIMINARY DESIGN TEST REPORT
May 1975 63 p
(Contract NAS3-18021)
(NASA-CR-134846; R75AEG411) Avail: NTIS HC A04/MF A01 CSCL 21E

Results of tests conducted on preliminary design polymeric-composite fan blade for the under the wing (UTW) OCSEE engine are presented. During this phase of the program a total of 17 preliminary OCSEE UTW composite fan blades were manufactured for various component tests including frequency characteristics, strain distribution, bench fatigue, dovetail pull, whirligig overspeed and whirligig impact. All tests were successuflly completed with the exception of whirligig impact tests. Improvements in local impact capability are being evaluated for the OCSEE blade under other NASA and related programs. Author

N80-29299*# General Electric Co., Cincinnati, Ohio.
ACOUSTIC PERFORMANCE OF A 50.8-cm (20-INCH) DIAMETER VARIABLE-PITCH FAN AND INLET. VOLUME 2: ACOUSTIC DATA Final Report
K. R. Bilwakesh, A. Clemons, and D. L. Stimpert Nov. 1979 495 p refs 2 Vol.
(NASA-CR-135118; R77AEG229-Vol-2) Avail: NTIS HC A21/MF A01 CSCL 21E

Results from acoustic tests on a 50.8 cm (20 inch) QCSEE Under-the-Wing (UTW) engine, variable pitch fan and inlet simulator are tabulated. Tests were run in both forward and reverse thrust mdoes with a bellmouth inlet, five accelerating inlets (one hardwall and four treated), and four low Mach number inlets (one hardwall and three treated). The 1/3 octave-band acoustic data are presented for the model size on the measured 5.2 m (17.0 ft) arc and also data scaled to full QCSEE size 71:20 on a 152.4 m (500 ft) sideline. A.R.H.

N80-29300*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRCRAFT RESEARCH AND TECHNOLOGY FOR FUTURE FUELS
Jul. 1980 229 p refs Symp. held in Cleveland, Ohio, 16-17 Apr. 1980
(NASA-CP-2146; E-398) Avail: NTIS HC A11/MF A01 CSCL 21E

The potential characteristics of future aviation turbine fuels and the property effects of these fuels on propulsion system components are examined. The topics that are discussed include jet fuel supply and demand trends, the effects of refining variables on fuel properties, shekle oil processing, the characteristics of broadened property fuels, the effects of fuel property variations on combustor and fuel system performance, and combuster and fuel system technology for broadened property fuels. For individual titles, see N80-29301 through N80-29330.

N80-29301*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUTURE AVIATION FUELS OVERVIEW
Gregory M. Reck *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 1-4 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

The outlook for aviation fuels through the turn of the century is briefly discussed and the general objectives of the NASA Lewis Alternative Aviation Fuels Research Project are outlined. The NASA program involves the evaluation of potential characteristics of future jet aircraft fuels, the determination of the effects of those fuels on engine and fuel system components, and the development of a component technology to use those fuels. M.G.

N80-29302*# Department of Energy, Washington, D. C.
OUTLOOK FOR ALTERNATIVE ENERGY SOURCES
Michael E. Card *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 5-9 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Predictions are made concerning the development of alternative energy sources in the light of the present national energy situation. Particular emphasis is given to the impact of alternative fuels development on aviation fuels. The future outlook for aircraft fuels is that for the near term, there possibly will be no major fuel changes, but minor specification changes may be possible if supplies decrease. In the midterm, a broad cut fuel may be used if current development efforts are successful. As synfuel production levels increase beyond the 1990's there may be some mixtures of petroleum-based and synfuel products with the possibility of some shale distillate and indirect coal liquefaction products near the year 2000. M.G.

N80-29303*# United Air Lines, Inc., Chicago, Ill.
CURRENT JET FUEL TRENDS
Paul P. Campbell *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 11-14 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Data concerning the properties of commercial jet fuels during the period between 1974 and 1979 are discussed. During this period the average aromatics content of fuels increased from 16% to 17.5%. It is evident that the arrival of Alaska North Slope crude in 1977 had a significant impact upon the aromatics content of jet fuel supply at West Coast points with less effect upon the entire United States domestic market. This increase in aromatics has not been accompanied by a corresponding reduction in burning quality as measured by smoke point. There has been a reduction of .6 smoke point on the average. Looking at hydrogen content as a measure of burning quality, the all refinery average calculated hydrogen for 1978 was approximately 13.7%. The relationship between hydrogen content and aromatics content shows a slope of .043% reduction in hydrogen for 1% increase in aromatics. M.G.

N80-29304*# Boeing Commercial Airplane Co., Seattle, Wash.
AVIATION FUELS OUTLOOK
Albert M. Momenthy *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 15-24 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Options for satisfying the future demand for commercial jet fuels are analyzed. It is concluded that the most effective means to this end are to attract more refiners to the jet fuel market and encourage development of processes to convert oil shale and coal to transportation fuels. Furthermore, changing the U.S. refineries fuel specification would not significantly alter jet fuel availability. M.G.

N80-29305*# California Univ. at Los Angeles. School of Engineering and Applied Science.
A METHODOLOGY FOR LONG-RANGE PREDICTION OF AIR TRANSPORTATION
Mohammad B. Ayati and J. Morley English *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 25-30 refs Presented at the SAE Intern. Air Transportation Meeting, Cincinnati, 20-22 May 1980 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 01C

A framework and methodology for long term projection of demand for aviation fuels is presented. The approach taken includes two basic components. The first was a new technique for establishing the socio-economic environment within which the future aviation industry is embedded. The concept utilized was a definition of an overall societal objective for the very long run future. Within a framework so defined, a set of scenarios by which the future will unfold are then written. These scenarios provide the determinants of the air transport industry operations and accordingly provide an assessment of future fuel requirements. The second part was the modeling of the industry in terms of an abstracted set of variables to represent the overall industry performance on a macro scale. The model was validated by testing the desired output variables from the model with historical data over the past decades. M.G.

N80-29306*# Exxon Research and Engineering Co., Linden, N.J.
EFFECT OF REFINING VARIABLES ON THE PROPERTIES AND COMPOSITION OF JP-5
Martin Lieberman and William F. Taylor *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 31-39 (For primary document see N80-29300 20-07) (Contract N00140-78-C-1491)
Avail: NTIS HC A11/MF A01 CSCL 21D

Potential future problem areas that could arise from changes in the composition, properties, and potential availability of JP-5 produced in the near future are identified. Potential fuel problems concerning thermal stability, lubricity, low temperature flow, combustion, and the effect of the use of specific additives on fuel properties and performance are discussed. An assessment of available crudes and refinery capabilities is given. M.G.

N80-29307*# Douglas Aircraft Co., Inc., Santa Monica, Calif.
FUEL/ENGINE/AIRFRAME TRADEOFF STUDY, PHASE 1
A. T. Peacock *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 41-47 Sponsored by AF (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

The effects of broadening the specifications for JP-4 and JP-8 fuels on the performance and cost of all USAF aircraft presently using JP-4 as well as those expected to be introduced into the force structure by 1983 are investigated. Test results indicated that there was no impact on engine performance, turbine durability, and coking, however there was a small maintenance cost increase as a result of a small combustor life decrease. Using JP-4 as standard fuel will avoid the use of high demand middle distillate fuels and give producers flexibility. Extensive use of JP-8 in the United States will increase middle distillate demand and cause a slight increase in engine hot-section maintenance. It is also concluded that the maximum allowable freeze point of JP-4 or JP-8 cannot be increased without degrading system performance and safety as critical conditions are approached. M.G.

N80-29308*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
MILITARY JET FUEL FROM SHALE OIL
Edward N. Coppola *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 49-57 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Investigations leading to a specification for aviation turbine fuel produced from whole crude shale oil are described. Refining methods involving hydrocracking, hydrotreating, and extraction processes are briefly examined and their production capabilities are assessed. M.G.

N80-29309*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUELS CHARACTERIZATION STUDIES
Gary T. Seng, Albert C. Antoine, and Francisco J. Flores *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 59-65 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Current analytical techniques used in the characterization of broadened properties fuels are briefly described. Included are liquid chromatography, gas chromatography, and nuclear magnetic resonance spectroscopy. High performance liquid chromatographic ground-type methods development is being approached from several directions, including aromatic fraction standards development and the elimination of standards through removal or partial

removal of the alkene and aromatic fractions or through the use of whole fuel refractive index values. More sensitive methods for alkene determinations using an ultraviolet-visible detector are also being pursued. Some of the more successful gas chromatographic physical property determinations for petroleum derived fuels are the distillation curve (simulated distillation), heat of combustion, hydrogen content, API gravity, viscosity, flash point, and (to a lesser extent) freezing point. M.G.

N80-29310*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTION TECHNOLOGY OVERVIEW
Richard W. Niedzwiecki *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 67-73 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

An overview of combustor technology developments required for use of broadened property fuels in jet aircraft is presented. The intent of current investigations is to determine the extent to which fuel properties can be varied, to obtain a data base of combustion - fuel quality effects, and to determine the trade-offs associated with broadened property fuels. Subcomponents of in-service combustors such as fuel injectors and liners, as well as air distributions and stoichiometry, are being altered to determine the extent to which fuel flexibility can be extended. Finally, very advanced technology consisting of new combustor concepts is being evolved to optimize the fuel flexibility of gas turbine combustors. M.G.

N80-29311*# General Electric Co., Fairfield, Conn.
EXPERIMENTAL COMBUSTOR STUDY PROGRAM
John M. Kasper and Edward E. Ekstedt *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 75-82 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

Advanced combustor concepts are evaluated as a means of accommodating possible future broad specification fuels. The three advanced double annular combustor concepts consisted of (1) a concept employing high pressure drop fuel nozzles for improved atomization, (2) a concept with premixing tubes in the main stage, and (3) a concept with the pilot stage on the inside and the main stage on the sideout, which is the reverse of the other two concepts. All of the advanced concepts show promise for reduced sensitivity to fuel hydrogen content. Some hardware problems were encountered, but these problems could be quickly resolved if refinement tests were conducted. The design with the premixing main stage was selected for a parametric test because of its low NOx emissions level, carbon free dome, and very low dome temperatures which were essentially independent of fuel type. The other advanced designs also had low done temperatures. The premixing dome design liner temperatures exhibited less sensitivity to fuel type than did the base-line combustor, although more sensitivity than observed for concept 1. The inner liner hot spot and the observed smoke results for the premixing design suggest that the fuel-air mixture was not as uniform as desired. M.G.

N80-29312*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
FUEL CHARACTER EFFECTS ON THE J79 AND F101 ENGINE COMBUSTION SYSTEMS
Thomas A. Jackson *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 83-93 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

The effects of select fuel property variations on two major engine classifications are summarized. Thirteen refined and blended fuels were used which exhibited significant variations in hydrogen content, aromatic type, initial boiling point, final boiling point, and viscosity. Trends were very similar but the degree of fuel sensitivity was not constant. For both systems the dominant fuel property during high pressure operation was found to be fuel hydrogen content. For operation at low pressure test points the fuel volatility and viscosity became the dominant fuel properties for both systems. Aromatic type and final boiling point did not significantly affect combustion data. Correlations of other fuel properties with these and other performance parameters are presented. E.D.K.

N80-29313*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA BROADENED-SPECIFICATION FUELS COMBUSTION TECHNOLOGY PROGRAM
James S. Fear *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 95-98 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

The broadened-Specification Fuels Combustion Technology program's purpose is to evolve and demonstrate the technology required to enable current and next generation high-thrust, high-bypass-ratio turbofan engines to use fuels with broadened properties and to verify the evolved technology in full scale engine tests. The three phases of the program are combustor concept screening, combustor optimization testing, and engine verification testing. Constraints for designing combustion systems are outlined and problems to be expected in the use of broadened properties fuels are listed. E.D.K.

N80-29314*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
AIR FORCE FUEL MAINBURNER/TURBINE EFFECTS PROGRAMS
Thomas A. Jackson *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 99-103 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

A program for the determination of fuel property effects on aircraft gas turbine engine mainburners and turbines is discussed. The six engines selected as test candiates are the J79, J85, J57, TF30, TF39, and F100. Fuels election is the responsibility of the contractors with two fuels as exceptions. The petroleum JP-4 is to be used as a baseline in all tests. The shale JP-4 is to be used in nearly all tests. Fuel properties are to be correlated with combustion system performance paramters. In addition, life predictions are to be made for combustor and turbine hardware. These predictions are to be based on a typical mission for each system, measured metal temperatures and temperature gradients, and oxidation/corrosion effects. E.D.K.

N80-29315*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
THE BROADENED-SPECIFICATION FUELS COMBUSTION TECHNOLOGY PROGRAM AT PRATT AND WHITNEY AIRCRAFT
Robert P. Lohmann *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 105-108 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

The impact of the use of broadened specification fuels on combustor design was investigated. Particular emphasis was placed on establishing the viability of various combustor modifications to permit the use of broadened specification fuels while meeting exhaust emissions and performance specifications and maintaining acceptable combustor operational and durability characteristics. Three different combustor concepts will be evaluated. Various design modifications on the operating capability of each of the combustor concepts with experimental referee broadened specification Fuel. The modifications that were evaluated included perturbations of the combustor airflow schedules to alter local stoichiometry and residence time histories revisions to the fuel injectors, and variations in liner cooling including the use of thermal barrier coatings and/or advanced cooling concepts. R.C.T.

N80-29316*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
NASA/GENERAL ELECTRIC BROAD-SPECIFICATION FUELS COMBUSTION TECHNOLOGY PROGRAM, PHASE 1
Willard J. Dodds *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 109-113 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

The use of broad specification fuels in aircraft turbine engine combustion systems was examined. Three different combustor design concepts were evaluated for their ability to use broad specification fuels while meeting several specific

emissions, performance, and durability goals. These combustor concepts covered a range from those having limited complexity and relatively low technical risk to those having high potential for achieving all of the program goals at the expense of increased technical risk. R.C.T.

N80-29317*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUELS RESEARCH: COMBUSTION EFFECTS OVERVIEW
John B. Haggard, Jr. *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 115-116 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

The effects of broadened property fuels on gas turbine combustors were assessed. Those physical and chemical properties of fuels that affect aviation gas turbine combustion were isolated and identified. Combustion sensitivity to variations in particular fuel properties were determined. Advanced combustion concepts and subcomponents that could lessen the effect of using broadened property fuels were also identified. R.C.T.

N80-29318*# Purdue Univ., Lafayette, Ind.
ATOMIZATION OF BROAD SPECIFICATION AIRCRAFT FUELS
J. G. Skifstad and A. H. Lefebvre *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 117-124 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

The atomization properties of liquid fuels for the potential use in aircraft gas turbine engines are discussed. The significance of these properties are addressed with respect to the ignition and subsequent combustion behavior of the fuel spray/air mixture. It is shown that the fuel properties which affect the atomization behavior (viscosity, surface tension, and density) are less favorable for the broad specification fuels as compared to with those for conventional fuels. R.C.T.

N80-29319*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANTIMISTING KEROSENE
Harold W. Schmidt *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 125-130 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

The antimisting additive ((FM-9) was tested in terms of its propulsion systems performance. The effect of the additive on engine operation was evaluated, operating problems were identified, the adaptability of engines to antimisting kerosene was assessed, and the potential viability of this fuel for use in present and future fan jet engines was determined. R.C.T.

N80-29320*# Massachusetts Inst. of Tech., Cambridge.
SOOT FORMATION AND BURNOUT IN FLAMES
B. Prado, J. D. Bittner, K. Neoh, and J. B. Howard *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 131-137 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

The amount of soot formed when burning a benzene/hexane mixture in a turbulent combustor was examined. Soot concentration profiles in the same combustor for kerosene fuel are given. The chemistry of the formation of soot precursors, the nucleation, growth and subsequent burnout of soot particles, and the effect of mixing on the previous steps were considered. R.C.T.

N80-29321*# Exxon Research and Engineering Co., Linden, N.J.
FUEL PROPERTY EFFECTS IN STIRRED COMBUSTORS
In NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 139-146 Sponsored by DOE (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

Soot formation in strongly backmixed combustion was investigated using the jet-stirred combustor (JSC). This device provided a combustion volume in which temperature and combustion were uniform. It simulated the recirculating characteristics of the gas turbine primary zone: it was in this zone where mixture conditions were sufficiently rich to produce soot. Results indicate that the JSC allows study of soot formation in an aerodynamic situation revelant to gas turbines. R.C.T.

N80-29322*# Southwest Research Inst., San Antonio, Tex.
EFFECT OF FUEL MOLECULAR STRUCTURE ON SOOT FORMATION IN GAS TURBINE COMBUSTION
D. W. Naegeli and C. A. Moses *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 147-152 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

The effect of fuel variations at the same hydrogen content on the formation of soot in a gas turbine combustor was studied. Six fuels were burned to a combustor over a matrix of about 50 test conditions with test conditions ranging over 500-1800 kPa (5-18 atm) pressure and 500-1000 K burner inlet temperature; fuel-air ratios were varied from 0.008-0.024. Flame radiation measurements were made through a sapphire window toward the end of the primary zone. The hydrogen content of the six test fuels ranged from 12.80 to 12.88%. Five fuels emphasized hydrocarbon types: (mono, di, and tricyclic), naphthenes (decalin) and partially hydrogenated aromatics (tetralin); the sixth fuel emphasized final boiling point. R.C.T.

N80-29323*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDIES OF COMBUSTOR SENSITIVITY TO ALTERNATIVE FUELS
Francis M. Humenik *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 153-160 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

Combustion problems associated with using alternative fuels ground power and aeropropulsion applications were studied. Rectangular sections designed to simulate large annular combustor test conditions were examined. The effects of using alternative fuels with reduced hydrogen content, increased aromatic content, and a broad variation in fuel property characteristics were also studied. Data of special interest were collected which include: flame radiation characteristics in the various combustor zones; the correponding increase in liner temperature from increased radiant heat flux; the effect of fuel bound nitrogen on oxides of nitrogen (NO sub x) emissions; and the overall total effect of fuel variations on exhaust emissions. R.C.T.

N80-29324*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUELS RESEARCH: FUEL THERMAL STABILITY OVERVIEW
Stephen M. Cohen *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 161-168 ref (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

Alternative fuels or crude supplies are examined with respect to satisfying aviation fuel needs for the next 50 years. The thermal stability of potential future fuels is discussed and the effects of these characteristics on aircraft fuel systems are examined. Advanced fuel system technology and design guidelines for future fuels with lower thermal stability are reported. R.C.T.

N80-29325*# United Technologies Research Center, East Hartford, Conn.
EXPERIMENTAL STUDY OF TURBINE FUEL THERMAL STABILITY IN AN AIRCRAFT FUEL SYSTEM SIMULATOR
Alexander Vranos and Pierre J. Marteney *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 169-179 ref (For primary document see N80-29300 20-07)
(Contract NAS3-21593)
Avail: NTIS HC A11/MF A01 CSCL 21D

The thermal stability of aircraft gas turbines fuels was investigated. The objectives were: (1) to design and build an aircraft fuel system simulator; (2) to establish criteria for quantitative assessment of fuel thermal degradation; and (3) to measure the thermal degradation of Jet A and an alternative fuel. Accordingly, an aircraft fuel system simulator was built and the coking tendencies of Jet A and a model alternative fuel (No. 2 heating oil) were measured over a range of temperatures, pressures, flows, and fuel inlet conditions. R.C.T.

N80-29326*# Naval Air Propulsion Test Center, Trenton, N.J.
DETERMINATION OF JET FUEL THERMAL DEPOSIT RATE USING A MODIFIED JFTOT
C. J. Nowack and R. J. Delfosse *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 181-184 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Three fuels having different breakpoint temperatures were studied in the modified jet fuel thermal oxidation tester. The lower stability fuel with a breakpoint of 240 C was first stressed at a constant temperature. After repeating this procedure at several different temperatures, an Arrehenius plot was drawn from the data. The correlation coefficient and the energy of activation were calculated to be 0.97 and 8 kcal/mole respectively. Two other fuels having breakpoint temperatures of 271 C and 285 C were also studied in a similar manner. A straight line was drawn through the data at a slope equivalent to the slope of the lower stability fuel. The deposit formation rates for the three fuels were determined at 260 C, and a relative deposit formation rate at this temperature was calculated and plotted as a function of the individual fuel's breakpoint temperatures. R.C.T.

N80-29327*# Colorado School of Mines, Golden.
MECHANISMS OF NITROGEN HETEROCYCLE INFLUENCE ON TURBINE FUEL STABILITY
Stephen R. Daniel and Jonathan H. Worstell *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 185-193 (For primary document see N80-29300 20-07) (Contract NsG-3122)
Avail: NTIS HC A11/MF A01 CSCL 21D

Lewis bases were extracted from a Utah COED syncrude via ligand exchange. Addition of this extract to Jet A at levels as low as 5 ppm N produced deterioration of stability in both JFTOT and accelerated storage tests (7 days at 394 K with 13:1 air to fuel ratio). Comparable effects on Jet A stability were obtained by addition of pyridine and quinoline, while pyrrole and indole were less detrimental at the same concentration level. The weight of deposit produced accelerated storage tests was found to be proportional to the concentration of added nitrogen compound. Over the narrow temperature range accessible with the experimental method, Arrhenius plots obtained by assuming specific rate to be proportional to the weight of material deposited in seven days exhibit greater slopes in the presence of those nitrogen compounds producing the greater deposition rates. It is shown that despite variation in appearance the elemental composition and spectral characteristics of the deposits are unaffected by addition of the nitrogen compounds. The linearity of the Arrhenius plots and of a plot of Arrhenius slope versus intercept for all the compounds suggests a constancy of mechanism over the range of temperature and heterocycles studied. R.C.T.

N80-29328*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUEL SYSTEM TECHNOLOGY OVERVIEW
Robert Friedman *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 195-203 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

Fuel system research and technology studies are being conducted to investigate the correlations and interactions of aircraft fuel system design and environment with applicable characteristics of the fuel. Topics include: (1) analysis of in-flight fuel temperatures; (2) fuel systems for high freezing point fuels; (3) experimental study of low temperature pumpability; (4) full scale fuel tank simulation; and (5) rapid freezing point measurement. E.D.K.

N80-29329*# Boeing Military Airplane Development, Seattle, Wash.
HIGH-FREEZING-POINT FUEL STUDIES
Frederick F. Tolle *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 205-219 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Considerable progress in developing the experimental and analytical techniques needed to design airplanes to accomodate fuels with less stringent low temperature specifications is reported. A computer technique for calculating fuel temperature profiles in full tanks was developed. The computer program is being extended to include the case of partially empty tanks. Ultimately, the completed package is to be incorporated into an aircraft fuel tank thermal analyser code to permit the designer to fly various thermal exposure patterns, study fuel temperatures versus time, and determine holdup. E.D.K.

N80-29330*# Lockheed-California Co., Burbank.
LOW TEMPERATURE FUEL BEHAVIOR STUDIES
Francis J. Stockemer *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 221-233 refs (For primary document see N80-29300 20-07)
(Contract NAS3-20814)
Avail: NTIS HC A11/MF A01 CSCL 21E

Aircraft fuels at low temperatures near the freezing point. The principal objective was an improved understanding of the flowability and pumpability of the fuels in a facility that simulated the heat transfer and temperature profiles encountered during flight in the long range commercial wing tanks. R.C.T.

N80-29331*# TRW, Inc., Cleveland, Ohio.
TUNGSTEN WIRE/FeCrAlY MATRIX TURBINE BLADE FABRICATION STUDY
P. Melnyk and J. N. Fleck Dec. 1979 99 p refs
(Contract NAS3-20391)
(NASA-CR-159788; TRW-ER-8101) Avail: NTIS HC A05/MF A01 CSCL 21E

The objective was to establish a viable FRS monotape technology base to fabricate a complex, advanced turbine blade. All elements of monotape fabrication were addressed. A new process for incorporation of the matrix, including bi-alloy matrices, was developed. Bonding, cleaning, cutting, sizing, and forming parameters were established. These monotapes were then used to fabricate a 48 ply solid JT9D-7F 1st stage turbine blade. Core technology was then developed and first a 12 ply and then a 7 ply shell hollow airfoil was fabricated. As the fabrication technology advanced, additional airfoils incorporated further elements of sophistication, by introducing in sequence bonded root blocks, cross-plying, bi-metallic matrix, tip cap, trailing edge slots, and impingement inserts. Author

N80-29332*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF PERFORMANCE DETERIORATION OF THE CF6/JT9D, HIGH-BYPASS RATIO TURBOFAN ENGINES
Joseph A. Ziemianski and Charles M. Mehalic 1980 22 p refs Proposed for presentation at the 56th AGARD Propulsion and Energetics Symp. on Turbine Engine Testing, Turin, 29 Sep. - 3 Oct. 1980 and SAE Aerospace Congr., Los Angeles, 13-16 Oct. 1980
(NASA-TM-81552; E-511) Avail: NTIS HC A02/MF A01 CSCL 21E

The aircraft energy efficiency program within NASA is developing technology required to improve the fuel efficiency of commercial subsonic transport aricraft. One segment of this program includes engine diagnostics which is directed toward determining the sources and causes of performance deterioration in the Pratt and Whitney Aircraft JT9D and General Electric CF6 high-bypass ratio turbofan engines and developing technology for minimizing the performance losses. Results of engine performance deterioration investigations based on historical data, special engine tests, and specific tests to define the influence of flight loads and component clearances on performance are presented. The results of analysis of several damage mechanisms that contribute to performance deterioration such as blade tip rubs, airfoil surface roughness and erosion, and thermal distortion are also included. The significance of these damage mechanisms on component and overall engine performance is discussed. A.R.H.

N80-29333*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION OF THE WARM CORE TURBINE FACILITY RECENTLY INSTALLED AT NASA LEWIS RESEARCH CENTER

W. J. Whitney, R. G. Stabe, and T. P. Moffitt 1980 18 p refs Proposed for presentation at Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by Am. Soc. of Automotive Engrs. (NASA-TM-81562; E-524) Avail: NTIS HC A02/MF A01 CSCL 21E

The two net facilities were installed and operated at their design, or rated conditions. The important feature of both of these facilities is that the ratio of turbine inlet temperature to coolant temperature encountered in high temperature engines can be duplicated at moderate turbine inlet temperature. The limits of the facilities with regard to maximum temperature, maximum pressure, maximum mass flow rate, turbine size, and dynamometer torque-speed characteristics are discussed. Author

N80-29334# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

NOISE SUPPRESSION IN JET INLETS Final Technical Report, 1 Feb. 1979 - 31 Jan. 1980

Ben T. Zinn, William L. Meyer, and Brady R. Daniel Feb. 1980 57 p refs

(Contract F49620-77-C-0066; AF Proj. 2307)

(AD-A085403; AFOSR-80-0452TR) Avail: NTIS HC A04/MF A01 CSCL 21/5

This research program was concerned with the development of an analytical technique, based on an integral representation of the external solutions of the Helmholtz equation, for the prediction of the sound radiated from complicated, acoustically lined, axisymmetric bodies having complex sound sources. The purpose of this research program was to generate efficient computer codes for the prediction of the sound radiated from acoustically lined jet engine inlets. In the experimental tests two geometrical configurations were studied, a straight duct and a jet engine inlet. Both of these configurations were tested with hard walls and the straight duct was tested with an acoustic liner consisting of a matrix of Helmholtz resonators. It was found that very good agreement was obtained for the hard walled configurations while there were some discrepancies with the lined wall case. It is conjectured that this discrepancy in some of the lined wall results is mainly due to the particular liner theory used to calculate the effective admittance of the liner. GRA

N80-29335# Solar Turbines International, San Diego, Calif.

COMPLEX, PRECISION CAST COLUMBIUM ALLOY GAS TURBINE ENGINE NOZZLES COATED TO RESIST OXIDATION Final Report, 2 Aug. 1976 - 2 Aug. 1979

Lulu Hsu and W. G. Stevens Apr. 1980 144 p refs

(Contract DAAG46-76-C-0053)

(AD-A086128; SR80-R-4444-25; USAAVRADCOM-TR-80-F-2) Avail: NTIS HC A07/MF A01 CSCL 11/6

The objectives of this program were to produce investment cast single vane nozzle segments in C129Y alloy (NB-10HF-10W-0.3Y) and to coat these vanes with the NS-4 (50W-20Mo-15Ti-10V) silicide coating. Initially, both cored and solid vane segments were specified but due to problems experienced in the consumable arc process, cored vanes were deleted from the program scope. Several problems developed. The electrode material supplied was low in yttrium, which might have contributed to the poor fluidity during arc melt and incomplete fill of thin walled sections. The solid nozzles and round test bars were acceptable and were used in coating processing and testing. Process specifications for both slurry spray and dip applications of the NS-4 modifier were prepared. Tensile and stress rupture tests of coated specimens displayed exceptional properties at elevated temperatures and showed superiority to cobalt-base vane alloys. Isothermal oxidation lives in excess of 5500 hours (at 760 and 1093 C) were exhibited by NS-4 coated C129Y specimens. In rig testing, under the severe thermal cycles and profiles imposed, the airfoil specimens typically survived about 100 Hours. GRA

N80-29336# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

F101 CENTRAL INTEGRATED TEST SUBSYSTEM EVALUATION Final Technical Report, 2 Apr. - 31 Dec. 1979

C. T. Vincent and C. A. Arulf Feb. 1980 137 p

(Contract F33615-79-C-2022; AF Proj. 3066)

(AD-A086130; R79AEG622; AFWAL-TR-80-2002) Avail: NTIS HC A07/MF A01 CSCL 21/5

Existing B-1/F101 flight data were used to determine the technical application and results of the diagnostic and monitoring systems utilized in the CITS. Contractor's analyses performed in support of the B-1 program provide the starting point for this program. The CTIS functions investigated were (1) fault detection and isolation, (2) flight readiness status, (3) LCF and time at temperature counting, and (4) trend data acquisition. The data evaluation had four objectives: (1) Determine how well the B-1/F101 diagnostic and monitoring requirements/goals were met; (2) establish the rates of false indication; (3) categorize the maintenance actions taken on the basis of CITS inputs; and (4) determine the effectiveness of the trending program. In addition, the effectiveness of the F101 CITS parameter and data sampling rates was determined. Continuous recorded CITS data were used to evaluate usage tracking parameters and their effectiveness in determining maintenance actions. GRA

N80-29337# Calspan Advanced Technology Center, Buffalo, N.Y. Aerodynamic Research Dept.

NUMERICAL STUDIES OF THE RADIATION CONDITION AT THE INLET OF A TRANSONIC COMPRESSOR BLADE ROW Final Report, 26 Oct. 1978 - 25 Feb. 1980

William J. Rae and Gregory F. Homicz Apr. 1980 37 p refs

(Contract N00019-78-C-0603)

(AD-A085978; CALSPAN-6432-A-1) Avail: NTIS HC A03/MF A01 CSCL 20/4

Finite-difference calculations of the flow in a transonic compressor blade row were carried out, using a radiation boundary condition at a plane upstream of the blades. These results show essentially no difference from a comparable set that were done using a uniform-flow approximation as the inlet boundary condition. GRA

N80-29338# ARO, Inc., Arnold Air Force Station, Tenn.

FLOW QUALITY FOR TURBINE ENGINE LOADS SIMULATOR (TELS) FACILITY Final Report, 1 Oct. 1978 - 1 Sep. 1979

R. J. Schulz Jun. 1980 38 p refs

(AD-A086084; AEDC-TR-79-83) Avail: NTIS HC A03/MF A01 CSCL 21/5

A study was made to define the flow quality in air inlets used to support engine testing in the proposed Turbine Engine Loads Simulator Facility (TELS). The study showed that inlets could be designed that would produce separation-free flow for the worst case of crossflow induced by TELS rotation. The severity of recirculated exhaust gas ingestion by the inlet was estimated using a finite-difference numerical simulation of the engine and its exhaust deflector. Finally, a method was devised for defining the performance of a representative engine, the Pratt and Whitney F100 engine. The possible effects of inlet flow nonuniformity on engine performance in TELS were detailed. GRA

N80-29339# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Metals and Ceramics Div.

SOFT BODY IMPACT OF CANTILEVER BEAMS Interim Technical Report, Oct. 1977 - Jul. 1979

Jeffry D. Sharp Mar. 1980 76 p refs

(AF Proj. 2418)

(AD-A086049; AFML-TR-79-4169) Avail: NTIS HC A05/MF A01 CSCL 21/5

Damage incurred by gas turbine engine fan blades due to foreign object ingestion is of great concern to both manufacturers and the agencies that purchase such products. Of particular interest is the response of a structure impacted by a soft body, such as a bird. As a result, efforts have been made in the last several years to understand the dynamic behavior of blade-like structures under impact loading. A great deal of information is available concerning the hard body impact problem. However, the soft body impact problem has not yet been investigated as thoroughly. This study experimentally and analytically investigates the stress/time response of a cantilever beam subjected to impact loading from a soft object. Results from several different analytical models employing the Euler-Bernoulli Beam Theory are compared to experimental data, and the validity of each model is assessed. The effects of structural damping, beam dimensions and the Timoshenko Theory parameters are discussed and conclusions as to their importance are drawn. It was determined that a cantilever beam impacted by a soft body can be accurately

modeled as a forced vibration problem using the Euler-Bernoulli Theory and linear modal analysis with damping. In addition, it was shown that large structures can be linearly scaled down for impact testing without affecting the results. GRA

N80-29340# ARO, Inc., Arnold Air Force Station, Tenn.
DEVELOPMENT OF A NONINTERFERENCE TECHNIQUE FOR MEASUREMENT OF TURBINE ENGINE COMPRESSOR BLADE STRESS Final Report, 1 Jul. 1976 - 30 Dec. 1978
P. E. McCarty and J. W. Thompson, Jr. AEDC Jun. 1980 47 p refs
(AD-A086170; AEDC-TR-79-78) Avail: NTIS HC A03/MF A01 CSCL 21/5

A noninterference technique for measuring stress in compressor blades of turbine engines is being developed to alleviate disadvantages associated with conventional strain-gage measurement systems. This technique utilizes blade tip deflection measurements and special data processing algorithms to infer local blade stress. A prototype noninterference processing system for inferring blade stress from a single compressor stage, from blade vibrations nonintegral to engine speed has been developed. Blade stress amplitude and spectral information are displayed on conventional strain-gage-type displays with which the blade stress analyst is intimately familiar. The prototype system has been checked by comparison with existing recorded strain-gage test data sampled to simulate blade tip deflection measurements. GRA

N80-29341*# National Materials Advisory Board, Washington, D. C.
RELIABILITY OF CERAMICS FOR HEAT ENGINE APPLICATIONS Final Report
1980 151 p refs Sponsored in part by NASA
(Contract MDA903-78-C-0038)
(NASA-CR-163435; PB80-182678; NMAB-357) Avail: NTIS HC A08/MF A01 CSCL 21E

The advantages and disadvantages associated with the use of monolithic ceramics in heat engines are discussed. The principle gaps in the state of understanding of ceramic material, failure origins, nondestructive tests as well as life prediction are included. R.C.T.

N80-29342# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
CERAMICS FOR TURBINE ENGINE APPLICATIONS
Mar. 1980 353 p refs In ENGLISH; partly in FRENCH Presented at the 49th Meeting of the AGARD Struct. and Mater. Panel, Cologne, 8-10 Oct. 1979
(AGARD-CP-276; ISBN-92-835-0261-2) Avail: NTIS HC A16/MF A01

Advances in high temperature materials technology and/or the design and fabrication approaches to use them to increase the performance or durability, or to reduce the cost of turbine engines are assessed. One specific approach investigated involves high temperature ceramics and the associated design technology for using brittle materials in automobile engines and electric power generators. The design, fabrication, and testing of actual components are reported and the results are evaluated for aerospace applications. For individual titles, see N80-29343 through N80-29366.

N80-29343# General Electric Co., Lynn, Mass. Aircraft Engine Group.
BENEFITS OF CERAMICS TO GAS TURBINES
Arnold Brooks and Albert I. Bellin *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 25 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The potential areas of benefit of structural ceramics in advanced propulsion engines for manned and short-life, unmanned aircraft applications are addressed. Ceramic characteristics such as rupture strength, creep, oxidation and corrosion are viewed in the perspective of advanced metal alloys. For various engine elements, operating regimes are indicated in which ceramics are anticipated to have benefits over metal parts. Considerations of cooling requirements, contours and tolerances, clearances and contacts, inspection and proof tests are discussed and their impact on engine performance, durability, and cost are assessed. For parts such as turbine blades and vances, bearings, combustors and flame-holders, establishment of benefit for ceramics is dependent upon the engine size. An example is presented for a ceramic turbine blade which shows that for conventional scaling, the probability of part survival decreases as engine size increases due to the brittle, statistical, volume dependent characteristics of the material. In general, as engine size increases, the design approaches and the degree of benefit for various ceramic parts will be modified and/or a size limit will be reached. Within the ceramic payoff regime, low cost relative to metal parts is anticipated to be a significant benefit. J.M.S.

N80-29344# Army Materials and Mechanics Research Center, Watertown, Mass.
CERAMICS FOR SMALL AIRBORNE ENGINE APPLICATIONS
R. Nathan Katz and Edward M. Lenoe *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 13 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The likelihood for successful application of ceramics to several classes of airborne engines with different duty cycles is assessed. The general design criteria and associated key materials and requirements for generic engines for limited, APU, and man-rate helicopter use are addressed. Materials, processes, design approaches, and reliability considerations appropriate to each generic engine category are briefly discussed. A scenario for a least risk strategy for the introduction of ceramics into airborne engines will presented. Key issues in materials research and development are identified. J.M.S.

N80-29345# Noel Penny Turbines Ltd., Toll Bar End (England). Engineering Analysis Dept.
REQUIREMENTS FOR MATERIALS FOR LAND VEHICLE GAS TURBINES
D. F. Moss *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 11 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The requirements for land-vehicle power plants are discussed. It is shown how engine concepts and working cycles are being developed, and how improvements in materials will contribute to making the gas turbine a major competitor in this field. J.M.S.

N80-29346# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TECHNOLOGIES FOR USE OF CERAMICS IN TURBOENGINES
Serge Boundigues and Georges Fratacci (Direction des Recherches, Etude et Techniques, Paris) *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 13 p In FRENCH; ENGLISH summary (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The problems raised by the introduction of ceramics in aircraft engines are discussed from two view points, adaptation of technological solutions used for metals, and concept of aerodynamics and turbine technology adapted to ceramic materials. After an aerothermodynamic justification of the contrarotative solutions proposed, several formulas of turbines integrated in a complete engine are presented. The aerodynamic loads, temperature, stresses, batch fabrication, and fixation on the disc circumference are determined for the blades. The stress level, the possibility of fretting with fibers, and the thermal insulation are determined for the discs. Ideas on the adaptation of the classical formulas to ceramics are presented along with, in particular, a technique reducing pressure losses upstream and downstream of a ceramics heat exchanger. J.M.S.

N80-29347# AiResearch Mfg. Co., Phoenix, Ariz.
SILICON NITRIDE TURBINE BLADE DEVELOPMENT
F. Blake Wallace, John E. Harper, Carl R. Dins, David W. Richerson, and Harry L. Kington *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 12 p (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

Hot-pressed silicon nitride (HPSN) rotor blades were developed as part of a two stage turbine. Program activities are described including design optimization to minimize steady-state

and vibratory stress, material characterization, attachment tests, manufacturing process development, inspection, proof tests, turbine-rig development, and engine tests. This program demonstrates for the first time that ceramics can withstand the severe environment imposed on gas turbine rotating components, and that the potential for engines with increased efficiency and decreased use of strategic materials can be realized. J.M.S.

N80-29348# Ford Motor Co., Dearborn, Mich. Engineer and Research Staff.

DUO-DENSITY CERAMIC TURBINE ROTOR: CONCEPTS, MATERIALS PROCESSES AND TEST RESULTS

R. R. Baker and A. F. McLean *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 19 p refs Sponsored in part by DARPA, DOE and Army Materials and Mechanics Research Center (For primary document see N80-29342 20-07)

Avail: NTIS HC A16/MF A01

The duo-density ceramic turbine rotor concept utilizes the high strength of hot pressed silicon nitride in the simple-shaped hub and adequately high strength of reaction bonded silicon nitride for the complex-shaped blades which can be readily formed by injection molding or slip casting. Design concepts, materials and fabrication process for making duo-density rotors are presented including recent developments in Ford's hot press/press bonding process. Background and status of the Ford/DARPA rotor testing program is presented including cold spin test and hot spin test results on duo-density rotors. Recommendations are presented for follow-on work. Author

N80-29349# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.

DEVELOPMENT OF AN INTEGRAL CERAMIC BLADE-METAL DISK WITH CIRCUMFERENTIAL BLADE ATTACHMENT

S. A. McLeod, B. H. Walker, and M. I. Mendelson *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 10 p refs Sponsored by DARPA (For primary document see N80-29342 20-07)

Avail: NTIS HC A16/MF A01

The development of a hydrid turbine rotor by attaching hot-pressed Si3N4 airfoils to a wrought AF2-1DA superalloy disk using the GATORIZING forging process is summarized. An approach for fabricating low cost ceramic airfoils (platformless blades) is discussed. The ceramic blade rotors were hot spin tested at 750 rev/s (45,000 rpm) and 1505 K blade temperature, which were representative of small gas turbine engine conditions. J.M.S.

N80-29350# Daimler-Benz A. G., Stuttgart (West Germany).

INVESTIGATIONS OF A HOT-PRESSED SILICON NITRIDE TURBINE ROTOR

Eberhard Tiefenbacher *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 9 p (For primary document see N80-29342 20-07)

Avail: NTIS HC A16/MF A01

The development of turbine wheels consisting of hot-pressed silicon nitride is reported. The preliminary tests carried out to examine the thermal shock characteristics of hot-pressed silicon nitride are described. An explantation of the aerodynamic design and calculation of the turbine wheel is included. Reference is also made to turbine wheel manufacturing and the results of tests carried out so far. J.M.S.

N80-29351# Naval Air Systems Command, Washington, D. C. Materials and Processes Branch

CERAMICS IN ROLLING ELEMENT BEARINGS

Charles F. Bersch *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 6 p refs (For primary document see N80-29342 20-07)

Avail: NTIS HC A16/MF A01

The feasibilty of using hot pressed silicon nitride (HPSN) for rolling elements and for races in ball bearings and roller bearings is explored. The HPSN offers opportunities to allenviate many current bearing problems including DN and fatigue life limitations, lubricant and cooling system deficiencies, and extreme environment demands. The history of ceramic bearings and the results of various element tests, bearing tests in rigs and bearing tests in a turbine engine are reviewed. The advantages and problems associated with the use of HPSN in rolling element bearings are discussed. Author

N80-29352# United Kingdom Atomic Energy Authority, Springfields (England). Springfields Nuclear Power Development Labs.

THE FABRICATION AND PROPERTIES OF REFEL SILICON CARBIDE IN RELATION TO GAS TURBINE COMPONENTS

P. Kennedy *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 13 p refs (For primary document see N80-29342 20-07)

Avail: NTIS HC A16/MF A01

The REFEL silicon carbide was developed as a canning material for high temperature nuclear reactor fuel, because of its high temperature stability, its oxidation resistance and its thermal stress and thermal shock resistance, and the reliability of the manufacturing process and the consistency of the product were established at an early stage in the development. The gas turbine engine is analogous to the nuclear reactor in that the same material characteristics are required and fabrication processes have now been developed which enable most gas turbine components to be formed from REFEL silicon carbide effectively and with a minimum of machining. The material is shown to peform satisfactorily in most stator applications and to be superior to other available ceramic materials for combustors. In the properties of REFEL silicon carbide are discussed, the fabrication processes are outlined and some of the published test data is reviewed. J.M.S.

N80-29353# Westinghouse Research and Development Center, Pittsburgh, Pa.

STATIONARY CERAMIC COMPONENT CONSIDERATIONS FOR LARGE INDUSTRIAL COMBUSTION TURBINES

R. J. Bratton and K. L. Rieke (Westinghouse Combustion Turbine Systems Div., Concordville, Pa.) *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 8 p refs (For primary document see N80-29342 20-07)

Avail: NTIS HC A16/MF A01

Major R&D efforts underway in the United States to improve the performance of industrial combustion turbines are reviewed. The major goals are improved system reliability, capability for fuel flexibility and reduced emissions. Other goals desired are improved efficiency and decreased equipment cost. Design studies have shown that significant performance advantages can be achieved if ceramics can be made to perform reliably. Since stationary ceramic components are likely to find first application in industrial turbine systems, initial efforts will be directed to their development. For the near term, the development of a low emission combustion system that meets regulations for industrial turbines burning heavy fuels has a high priority. Hot-wall combustion systems to help meet the desired performance goals are considered. J.M.S.

N80-29354# Solar Turbines International, San Diego, Calif.

DEVELOPMENT OF CERAMIC NOZZLE SECTION FOR SMALL RADIAL GAS TURBINE

J. C. Napier and J. P. Arnold *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 10 p refs Prepared in cooperation with Army Mobility Equipment Research and Development Command, Ft. Belvoir, Va. (For primary document see N80-29342 20-07)

Avail: NTIS HC A16/MF A01

Ceramics not only offer improved gas turbine performance through higher turbine inlet temperature but can increase engine life because of improved hot and erosion resistance. Development work leading to engine test of both erosion-resistant and high temperature ceramic nozzle concepts is described. The first nozzle concept employs ceramic vane sections and demonstrated a ten to one-hundred fold hot end life improvement under erosive conditions in engine tests. The second concept was engine demonstrated and offers high erosion resistance as well as the capability of operating at elevated turbine inlet temperatures. Work on ceramics manufacturing methods for cost reduction with the goal of providing economic incentives for ceramics in production turbines is described. Author

N80-29355# Volkswagen A.G., Wolfsburg (West Germany). Research and Development Div.

DEVELOPMENT OF A CERAMIC TURBINE NOZZLE RING
H. Burfeindt, M. Langer, and P. M. Stuart (PMS Analysis AG, Zurich) *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 8 p refs Sponsored in part by The German Ministry of Science and Technology (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The way in which experimental testing and finite element design analysis have contributed to the understanding of the special problems associated with the use of ceramic materials in a turbine nozzle is described. During the design analysis two problem areas, the shrouds and the trailing edge, were immediately revealed. The design of an optimized nozzle ring resulted in a reduction of the high stresses in these two areas down to a level acceptable for ceramic materials currently available such as silicon nitride or silicon carbide. E.D.K.

N80-29356# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
DEVELOPMENT OF COMBUSTORS OF CERAMIC MATERIALS
G. Kappler, G. Langel, and L. Schindhelm *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 12 p refs Sponsored in part by The German State Dept. for Research and Technology (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

Following early feasibility tests of various ceramic materials in hot environments, a research program was initiated to develop ceramic combustors for gas turbine applications. The design of the first ceramic combustors was based on experience with metallic flame tubes. Since test results showed that conventionally designed cylindrical combustors fracture during steady operating conditions at combustor exit temperatures above 1000 K, conical flame tubes were developed. Conical combustors which are more suited to ceramic material requirements were manufactured from Si3N4 and siliconized SiC and subjected to cyclic tests. The test results and their evaluation are reviewed. Combustors made from hot pressed silicon carbide have completed long duration cyclic tests at chamber pressures of 4.9 bar, the cyclic temperature variation adjusted at the combustor outlet being 1065 K to 1355 K. A combustor flame tube was installed in a vehicular gas turbine engine operating at 1250 K turbine inlet temperature to improve the technology of ceramic combustor design and to gain experience with ceramic combustor behavior. E.D.K.

N80-29357# Lucas Aerospace Ltd., Burnley (England). Fabrications Dept.
SOME EXPERIENCE IN THE DESIGN AND EVALUATION OF CERAMIC COMBUSTION CHAMBERS
G. Sedgwick *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 15 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The design, component evaluation, and combustion testing of a small reverse flow annular combustion chamber constructed in silicon nitride is reviewed. Initially heat transfer assessments were made of the temperature levels which components would reach during combustion testing and a thermal test program was formulated which enabled loadings well in excess of those estimated for the actual flame tube environment to be imposed upon specimen components. From calculated thermal stresses, values for the probabilities of survival were obtained using a brittle failure analysis based on a Weibull distribution and a volume flow weakest link hypothesis. A subsequent program of combustion tests carried out on a pressure rig culminated in operation at a chamber exit temperature of 1762 K. A pipe combustion chamber program is also described using a monolithic construction in silicon carbide, in which failure modes are presented and analyzed. E.D.K.

N80-29358*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATE-OF-THE-ART SiAlON MATERIALS
Sunil Dutta *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 15 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The state of the art of SiAlONs is examined. The review includes work on phase relations, crystal structure, synthesis, fabrication, and properties of various SiAlONs. The essential features of compositions, fabrication methods, and microstructure are reviewed. High temperature flexure strength, creep, fracture toughness, oxidation, and thermal shock resistance are discussed. These data are compared to those for some currently produced silicon nitride ceramics to assess the potential of SiAlON materials for use in advanced gas turbine engines. E.D.K.

N80-29359# Annawerk Keramische Betriebe G.m.b.H., Roedental (West Germany). Ceranox Div.
PRESSURELESS SINTERING OF SILICON CARBIDE
Ernst Gugel and Gerhard Leimer *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 16 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The stage of development of silicon carbide is reported with respect to the parameters influencing the sintering process, the properties achieved and the forming possibilities for gas turbine components. A comprehensive literature survey is attached. E.D.K.

N80-29360# Allmanna Svenska Elektriska A. B., Robertsfors (Sweden). High Pressure Lab.
HIP SILICON NITRIDE
Hans T. Larker *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 4 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

Hot isostatic pressing (HIP) is being developed as a manufacturing process for intricately shaped fully dense silicon nitride parts. The process promises to combine the most attractive features of both the reaction bonding and the hot pressing processes. An encapsulation system compatible with silicon nitride under the HIP conditions was developed. Hubs with protruding blades and airfoils with trailing edges as thin as 0.3 mm were made. It is considered feasible to develop the process to high production and to attractive processing costs. E.D.K.

N80-29361# California Univ., Berkeley. Materials Science and Mineral Engineering.
NONDESTRUCTIVE FAILURE PREDICTION IN CERAMICS
A. G. Evans *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 20 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The prediction of failure of a ceramic component can be made using nondestructive methods for detecting and characterizing the fracture critical defects. The accept/reject decision based on the nondestructive measurement requires a probabilistic analysis of both the measurement and fracture processes. The general approach for quantitative failure prediction in ceramics using nondestructive methods of defect characterization is described. The current state of knowledge as it impinges on the quantitative failure prediction issue is reviewed. E.D.K.

N80-29362# General Electric Co., Schenectady, N. Y. Ceramics Branch
FRACTURE STATISTICS DESIGN AND APPLICATION
C. A. Johnson *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 16 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The use of ceramics for load bearing structural components requires a detailed understanding of the variability in flaw size and the resulting scatter and size dependence of fracture strength. The quantitative description of these effects is known as fracture statistics. Distribution functions approximating the fracture behavior of brittle materials are discussed with emphasis on the Weibull distribution. In the application of fracture statistics as an aid for design of structural components, several factors may introduce errors in the resulting failure analysis. One such source of error, the presence of multiple flaw distributions, is discussed and illustrated. Author

N80-29363# Admiralty Marine Technology Establishment, Holton Heath (England).
REACTION-BONDED, SiAlON AND CVD Si3N4 CERAMICS FOR ENGINEERING APPLICATIONS
D. J. Godfrey *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 6 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

Recent developments in the development of reaction bonded (RBSN), chemical vapor deposited, and SiAlON and related silicon nitride ceramics are reviewed in relation to their possible application in engines. Factors which affect the strength of RBSN include nitriding conditions, powder size, and reaction promoting impurities. Significant variations in thermal conductivity have been observed. Oxidative degradation of strength can be serious and oxide impregnation can reduce it. Chemical vapor deposited Si3N4 materials had disappointing strengths and were difficult to apply thickly over large areas, although recently progress was made. Basic scientific research on SiAlON and related materials has continued to elucidate their often complex nature, but recent activity has concentrated successfully on the metal cutting and processing applications of sintered SiAlONs, rather than optimizing them for engine applications. E.D.K.

N80-29364# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Institut fuer Bauweisen- und Konstruktionsforschung.
COMPRESSION LOADED CERAMIC TURBINE ROTOR
R. Kochendoerfer. *In* AGARD. Ceram. for Turbine Eng. Appl. Mar. 1980. 19 p. refs (For primary document see N80-29342 20-07)
Avail: NTIS. HC A16/MF A01

The most attractive properties of fiber reinforced materials, high strength to density ratio combined with high stiffness to density ratio, can be utilized with maximum benefit. However, this group of materials does not allow high temperature application. Therefore, in the proposed design the center core of the turbine wheel which is exposed to the hot gas flow is surrounded by a concentrical cooling ring, both kept under compression up to the design speed by a composite ring combination. Cold spin test results of fiber reinforced rings made of carbon epoxy, boron aluminum, and carbon/carbon are presented as well as cold spin test results of a possible wheel/shaft connection and of compression loaded rotors. E.D.K.

N80-29365# Politecnico di Milano (Italy).
OXIDATION AND HOT CORROSION BEHAVIOR OF SINTERED NITROGEN CERAMICS
P. L. Cavallotti, N. Ducati, and P. C. Martinengo. *In* AGARD. Ceram. for Turbine Eng. Appl. Mar. 1980. 8 p. refs. Prepared in cooperation with Fiat Research Center, Turin (For primary document see N80-29342 20-07)
Avail: NTIS. HC A16/MF A01

A preliminary study on oxidation and corrosion of some types of nitrogen ceramics based on hot pressed (HPSN), reaction bonded (RBSN), reaction bonded and sintered (RBSSN), and pressu eless sintered (PSSN) compacts was completed. These materials were also tested in the presence of contaminants on the temperature range of 1170 to 1470 K. The gravimetric results indicate a more highly qualified resistance of RBSSN when compared with RBSN and PSSN samples; HPSN samples are corroded at somewhat lower rates possibly as a result of the very high density of the samples. E.D.K.

N80-29366# Fiat Research Center, Turin (Italy).
DEVELOPMENT IN SINTERED SILICON NITRIDE
E. Campo and P. C. Martinengo. *In* AGARD. Ceram. for Turbine Eng. Appl. Mar. 1980. 8 p. refs (For primary document see N80-29342 20-07)
Avail: NTIS. HC A16/MF A01

The most attractive process for Si3N4 production, to avoid the reaction bonding and hot pressing problems, would be one which enables high performance and complexity of shape simultaneously. A pressureless sintering process was studied and developed, and various grades of Si3N4 were produced. Sintering aids employed for commercial Si3N4 powders and also to sinter reaction bonded silicon nitride were MgO and Y2O3. The process and the characterization of these sintered Si3N4 materials particularly in respect to structure and mechanical properties are described. E.D.K.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-29367*# Grumman Aerospace Corp., Bethpage, N.Y.
ROCKETS FOR SPIN RECOVERY
R. D. Whipple. Aug. 1980. 70 p. refs
(Contract NAS1-15348)
(NASA-CR-159240) Avail: NTIS. HC A04/MF A01. CSCL 01C

The potential effectiveness of rockets as an auxiliary means for an aircraft to effect recovery from spins was investigated. The advances in rocket technology produced by the space effort suggested that currently available systems might obviate many of the problems encountered in earlier rocket systems. A modern fighter configuration known to exhibit a flat spin mode was selected. An analytical study was made of the thrust requirements for a rocket spin recovery system for the subject configuration. These results were then applied to a preliminary systems study of rocket components appropriate to the problem. Subsequent spin tunnel tests were run to evaluate the analytical results. R.K.G.

N80-29368*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
SIMULATOR RESULTS OF AN F-14A AIRPLANE UTILIZING AN AILERON-RUDDER INTERCONNECT DURING CARRIER APPROACHES AND LANDINGS. Progress Report, Jan. 1979 - Feb. 1980
Wendell W. Kelly and Philip W. Brown. May 1980. 92 p. refs
(NASA-TM-81833) Avail: NTIS. HC A05/MF A01. CSCL 01C

A piloted simulator study was conducted to evaluate an aileron rudder interconnect (ARI) control system for the F-14A airplane in the landing configuration. Effects on pilot performance and handling characteristics were investigated. Two ARI configurations were tested and compared to the standard F-14 fleet control system. A nonlinear aerodynamic model of the F-14 was used in conjunction with a six degree of freedom motion base simulator. The evaluation task, which utilized three subject pilots, consistent of a night carrier approach and landing. Both ARI configurations produced improved pilot performance and pilot ratings when compared to the standard control system. Sideslip due to adverse yaw as considerably reduced by the ARI systems and heading control was more stable and precise. Lateral deviation from centerline was reduced during the approach and lateral touchdown dispersion on the carrier deck was reduced with the ARI control systems. Author

N80-29369*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
SINGLE-STAGE ELECTROHYDRAULIC SERVOSYSTEM FOR ACTUATING ON AIRFLOW VALVE WITH FREQUENCIES TO 500 HERTZ
John A. Webb, Jr., Oral Mehmed, and Carl F. Lorenzo. Aug. 1980. 35 p. refs
(NASA-TP-1678; E-252) Avail: NTIS. HC A03/MF A01. CSCL 01C

An airflow valve and its electrohydraulic actuation servosystem are described. The servosystem uses a high-power, single-stage servovalve to obtain a dynamic response beyond that of systems designed with conventional two-stage servovalves. The electro-hydraulic servosystem is analyzed and the limitations imposed on system performance by such nonlinearities as signal saturations and power limitations are discussed. Descriptions of the mechanical design concepts and developmental considerations are included. Dynamic data, in the form of sweep-frequency test results, are presented and comparison with analytical results obtained with an analog computer model is made. R.K.G.

N80-29370# Army Research and Technology Labs., Moffett Field, Calif. Aeromechanics Lab.
RESULTS OF A SIMULATOR INVESTIGATION OF CONTROL SYSTEM AND DISPLAY VARIATIONS FOR AN ATTACK HELICOPTER MISSION

Edwin W. Aiken and Robert K. Merrill May 1980 25 p refs Presented at 36th Ann. Natl. Forum of the AHS, Washington, D.C., May 1980
(AD-A085812) Avail: NTIS HC A02/MF A01 CSCL 01/2

A piloted simulator experiment designed to assess the effects on overall system performance and pilot workload of variations in control system characteristics and display format and logic for a nighttime attack helicopter mission is described. The simulation facility provided a representation of a helmet-mounted display image consisting of flight-control and fire-control symbology superimposed on the background video from a simulated forward-looking infrared sensor. Control systems ranging from the baseline stability and control augmentation system to various hover augmentation schemes were investigated together with variations in the format and logic of the superimposed symbology. Selected control system and display failures were also simulated. The results of the experiment indicate that the baseline control/display system is unsatisfactory without improvement for the evaluation task which included a hovering target search and acquisition. Significant improvements in pilot rating were achieved by both control system and display variations. GRA

N80-29371# Rockwell International Corp., Anaheim, Calif. Autonetics Strategic Systems Div.
FEASIBILITY STUDY B-1 POWER CONTROLLER Final Report, Aug. - Nov. 1979
C. E. Young Warminster, Pa. NADC Nov. 1979 95 p
(Contract N62269-79-C-0294)
(AD-A086166; NADC-79134-60) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report documents the feasibility of modifying and repackaging the Solid State Power Controller (SSPC) developed for the B-1 to meet the performance and configuration requirements for Advanced Aircraft Electrical System (AAES). The effort included an analysis of the applicability of the B-1 monolithic and pass elements, and the application of advance developments to meet the volumetric constraints of NADC-30-TS-7602. GRA

N80-29372# Naval Postgraduate School, Monterey, Calif.
A METHODOLOGY FOR DETERMINING COMMAND, CONTROL, AND COMMUNICATIONS (C3) REQUIREMENTS FOR REMOTELY PILOTED VEHICLES (RPVs) AND UNMANNED DRONE AIRCRAFT M.S. Thesis
John Harvey Newton Mar. 1980 70 p refs
(AD-A085927) Avail: NTIS HC A04/MF A01 CSCL 17/2

This work describes and illustrates a method for determining command, control, and communications (C3) requirements for remotely piloted aircraft (RPA). The effort was limited to airborne platforms and investigation of the following issues: manned versus unmanned aircraft; unmanned aircraft as RECON/DESIGNATION platform; unmanned aircraft as weapon delivery platform; C3 requirements for unmanned aircraft; and unmanned aircraft system cost effectiveness. Warsaw Pact forces will be led and employed according to Soviet operational doctrine which calls for offensive operations with highly mobile, deeply echeloned, and numerically superior land forces, supported by air and sea power. This massive enemy threat indicates a requirement that the maximum number of forces be detected, identified, and destroyed prior to engaging friendly forces. Destruction of enemy forces can be accomplished with artillery, attack helicopters, and close air support, if those targets can be identified and located with sufficient accuracy for timely targeting. GRA

N80-29373# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
OPEN LOOP GUST ALLEVIATION Final Report, Aug. 1978
Manfred Buchstaller, Hugo Kozakiewicz, Rolf Menzl, Wolfgang Reuter, Johannes Schroeder, Siegfried Stauber, and Horst Wuennenberg Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-10) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22.90

Previous results, the effectiveness of two alternative gust alleviation concepts, and the technical preacticability of an intended test program were examined. The two concepts are a control system using an elevator alone and a combined system of open and closed loop control. The results examined show that a gust alleviation of 30% is possible with the elevator alone while superposition of the open and closed loop principles improves the pure open loop system, especially at higher frequencies. The practicability study shows that there are neither major technical nor certification problems concerning the realization of a flight test program with the DO 28 TNT as a test aircraft. The symmetrical activation of the ailerons as lift flaps can be realized without feedback to the pilot's control column by a central electrically driven actuator within the fuselage. Elevator control is realized by the trimming spindle. In this case there is a certain feedback to the control column. Signal processing is done digitally. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-29374# Aeronautical Research Labs., Melbourne (Australia).
A PROPOSAL FOR AERODYNAMICALLY ACTUATED SELF STREAMLINING SUBSONIC WIND TUNNEL WALLS
N. Pollock Jun. 1979 27 p refs
(ARL-Aero-Note-392; AR-001-739) Avail: NTIS HC A03/MF A01

An arrangement is described which ensures that solid flexible two dimensional subsonic wind tunnel walls will automatically and continuously assume a shape approximating an unconstrained streamline under the action of a model pressure field. Such a tunnel wall would minimize interference. Each wall consists of a streamwise tensioned membrane with a series of pressure tappings. These pressure tappings communicate with a number of flexible bellows which apply appropriate local forces to the membrane. Methods covering the extension of this concept to a three dimensional configuration are also discussed. Author

N80-29375# Naval Civil Engineering Lab., Port Hueneme, Calif.
FIBERGLASS-REINFORCED PLASTIC SURFACING FOR RAPID RUNWAY REPAIR BY NAVAL CONSTRUCTION Interim Report, Nov. 1978 - Apr. 1979
P. S. Springston Oct. 1979 50 p
(YF53536091)
(AD-A085357; CEL-TN-1563) Avail: NTIS HC A04/MF A01 CSCL 13/3

This report documents exploratory research conducted to develop a preliminary concept for repairing bomb damaged runways with prefabricated fiberglass-reinforced plastic membranes. The membranes would function as trafficable caps over backfilled craters. A structural analysis has been completed using the finite element method and a design is presented for a membrane to be traffic-tested under simulated F-4 aircraft wheel loads at the Rapid Runway Repair Test Facility of the Air Force Engineering and Services Center/Research Division at Tyndall AFB, Florida. Methods for joining panels to form large membranes and a tiedown method are discussed. A general concept for rapid runway repair by the Naval Construction Forces using table-of-allowance (P25 and P31) equipment is presented. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-29376*# Grumman Aerospace Corp., Bethpage, N.Y.
SYSTEMS DEFINITION STUDY FOR SHUTTLE DEMONSTRATION FLIGHTS OF LARGE SPACE STRUCTURES. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jul. 1979 29 p 3 Vol.

(Contract NAS8-32390)
(NASA-CR-161534; DRD-MA-04-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

The development of large space structure technology is discussed, with emphasis on space fabricated structures which are automatically manufactured in space from sheet-strip materials and assembled on-orbit. Definition of a flight demonstration involving an Automated Beam Builder and the building and assembling of large structures is presented. L.F.M.

N80-29377*# Grumman Aerospace Corp., Bethpage, N.Y.
SYSTEMS DEFINITION STUDY FOR SHUTTLE DEMONSTRATION FLIGHTS OF LARGE SPACE STRUCTURES. VOLUME 2: TECHNICAL REPORT Final Report
Jul. 1979 220 p 3 Vol.
(Contract NAS8-32390)
(NASA-CR-161535; DRD-MA-04-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 22A

The development of large space structure (LSS) technology is discussed, with emphasis on space fabricated structures which are automatically manufactured in space from sheet-strip materials and assembled on-orbit. It is concluded that an LSS flight demonstration using an Automated Beam Builder and the orbiter as a construction base, could be performed in the 1983-1984 time period. The estimated cost is $24 million exclusive of shuttle launch costs. During the mission, a simple space platform could be constructed in-orbit to accommodate user requirements associated with earth viewing and materials exposure experiments needs. L.F.M.

N80-29378*# Grumman Aerospace Corp., Bethpage, N.Y.
SYSTEMS DEFINITION STUDY FOR SHUTTLE DEMONSTRATION FLIGHTS OF LARGE SPACE STRUCTURES. VOLUME 3: THERMAL ANALYSES Final Report
Jul. 1979 80 p 3 Vol.
(Contract NAS8-32390)
(NASA-CR-161536; DRD-MA-04-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 22A

The development of large space structure technology is discussed. A detailed thermal analysis of a model space fabricated 1 meter beam is presented. Alternative thermal coatings are evaluated, and deflections, stresses, and stiffness variations resulting from flight orientations and solar conditions are predicted. L.F.M.

N80-29379# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
INTERSTELLAR FLIGHT: WHEN? [INTERSTELLARER FLUG: WANN?]
H. O. Ruppe Jun. 1979 29 p In GERMAN
(TUM-RT-KB-79/3) Avail: NTIS HC A03/MF A01

The possibility of interstellar flight is discussed in connection with project Daedalus. Fabrication of fuel pellets for the drive system is proposed, using Helium 3 obtained from the atmosphere of Jupiter. Author (ESA)

N80-29380# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
SPACEFLIGHT AS AN INFLUENCE ON HUMANITY [RAUMFAHRT FUER DIE MENSCHHEIT]
H. O. Ruppe Jun. 1979 26 p In GERMAN
(TUM-RT-KB-79/4) Avail: NTIS HC A03/MF A01

The application of spaceflight to the solution of some problems of society is discussed. The time scale extends to the end of the present century. Emphasis is placed on the use of satellites of the LANDSAT type for resource exploration, and military security. Commercial applications of space technology are mentioned. Author (ESA)

N80-29381# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
SPACEFLIGHT IN THE YEAR 2000 [RAUMFAHRT IM JAHRE 2000]
H. O. Ruppe Jun. 1979 45 p In GERMAN
(TUM-RT-KB-79/5) Avail: NTIS HC A03/MF A01

The economic and technical aspects of space flight in the near future are discussed. Industrial activity in space in areas such as pharmaceuticals and semiconductors is mentioned, as is the possibility of disposing of nuclear waste in space. Author (ESA)

N80-29382# Hamburg Univ. (West Germany). Lehrstuhl fuer Ingenieurwissenschaften.
PREPARATION OF ALLOYS WITH SPECIFIC PHYSICAL PROPERTIES UNDER ZERO GRAVITY CONDITIONS Final Report
Hans Ahlborn and Henning Richter Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 48 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-15) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9.65

Based on a study of the literature, possibilities offered by Spacelab for preparation of new or the improvement of conventional materials with specific physical properties were studied. For hard magnetic materials, the lack of thermal convection in space would allow for the preparation of longer and more perfect elongated single domain particles (ESD crystals), the improvement of transcrystallization processes in the fabrication of AlNiCo magnets, and for an undisturbed unidirectional eutectic solidification favoring the production of Mn-Bi as well as superconducting alloys. Crucible free melting of AlNiCo alloys and of Sm-Co alloys could improve their magnetic properties, too. The mixture stability expected in space experiments will allow for the preparation of composite materials with homogeneous distributed second phases for use as electric contact materials and for superconducting materials based on the proximity effect. The expected homogeneous distribution components formed in montectic alloys in the liquid state would also make possible, in the case of Al-Pb alloys, the testing of their properties as bearing materials. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories, and orbit and launching dynamics.

N80-29383*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ENTRY GUIDANCE AND ENTRY AUTOPILOT (STS-1 BASELINE)
J. C. Harpold and Oliver Hill Aug. 1980 126 p refs Supersedes JSC-11746
(NASA-TM-81034; JSC-16515; JSC-11746) Avail: NTIS HC A07/MF A01 CSCL 22A

Preliminary entry guidance and autopilot software formulations, for use in the Mission Control Center (MCC) entry processor, are presented. The MCC requirements are met by a definition of coordinate systems, a list of parameter definitions for the software formulations, a description of the entry guidance detailed formulation requirements, a description of the detailed autopilot formualtion requirements, a description of the targeting routine, and a set of formulation flow charts. L.F.M.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities, ground support equipment, mobile transporters, and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters, manned orbital laboratories, reusable vehicles, and space stations.

N80-29384 Indian Academy of Sciences, Bangalore.
THE ARYABHATA PROJECT
U. R. Rao, ed. and K. Kasturirangan, ed. 1979 229 p refs Repr. from Proc. of the Indian Acad. of Sci., Sect. C: Eng. Sci (Madras), v. 1, 1978 p 117-343
Copyright. Avail: Issuing Activity

The design and performance of the Aryabhata satellite and its ground support systems is described. The satellite communications, power supply, stabilization, and thermal control systems are individually examined. Tracking and orbit computations and the results of on-board experiments are also discussed. For individual titles, see N80-29385 through N80-29402.

N80-29385 ISRO Satellite Centre, Peenya, Bangalore (India).
AN OVERVIEW OF THE ARYABHATA PROJECT
U. R. Rao *In* Indian Acad. of Sci. The Aryabhata Proj 1979 p 1-17 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

An overview of the basic features of the Aryabhata satellite, associated ground stations, and a brief account of the fabrication, testing and (in-orbit) performance of the satellite is given. Results of some of the technological experiments carried out in Aryabhata are also briefly described. Aryabhata was successfully launched into a near-earth orbit on 19 April 1975, from a USSR Cosmodrome. The primary objective of Aryabhata was to establish the indigenous capability in satellite technology. Aryabhata, weighing 358 kg, was quasispherical in shape, and had body-mounted solar cells and Ni-Cd chemical batteries as primary power sources. Other features of the spacecraft include power control systems, passive thermal control system, PCM/FM/PM telemetry system transmitting data at 256 bits/s in real time and 2560 bits/s in the stored mode, PDM/AM/AM telecommand system, cold gas spin stabilisation system with nutation damper, and a number of sensors. The satellite also included three scientific experiments-one on X-ray astronomy, the second for observing solar neutrons and gamma rays and the third on aeronomy.
M.G.

N80-29386 ISRO Satellite Centre, Peenya, Bangalore (India).
THE STABILISATION SYSTEM
P. S. Goel, P. N. Srinivasan, and N. K. Malik *In* Indian Acad. of Sci. The Aryabhata Proj 1979 p 19-27 ref (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The design, philosophy, specifications, and the dynamics of the Aryabhata stabilization system are presented along with the qualification and performance evaluation tests of the components and subsystems. Also, the in-orbit performance of the stabilization system is discussed. The attitude stabilization of Aryabhata was accomplished by spinning it about its axis of maximum moment of inertia. The spin stabilization ensures satisfactory thermal control, uniform power generation through the body mounted solar panels, and the scan capability for the scientific payloads. To bring down the nutation of the spinning spacecraft to a value well within the specified limits, a fluid-in-tube damper was also provided.
M.G.

N80-29387 ISRO Satellite Centre, Peenya, Bangalore (India).
THE POWER SYSTEM
S. Y. Ramakrishnan, R. S. Mathur, M. Subramanian, T. Kanthimathinathan, Sudershan Jarpangal, S. T. Venkataramanan, and N. I. Savalgi *In* Indian Acad. of Sci. The Aryabhata Proj 1979 p 29-40 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The power system for Aryabhata satellite is described in detail. The Aryabhata power system consists of solar panels using n/p radiation protected silicon cells, a Ni-Cd storage battery, a solar array voltage limiter, a power control unit which functions as a battery controller, power conditioning regulators, converters, and protective devices which serve mainly as load interface units. The in-orbit performance of the power system is dealt with, highlighting the probable reasons for the failure of one of the bus-lines of the power system.
M.G.

N80-29388 ISRO Satellite Centre, Peenya, Bangalore (India).
THE THERMAL CONTROL SYSTEM
H. N. Murthy, V. K. Kaila, V. Prasad, D. R. Bhandari, H. Bhojaraj, and P. P. Gupta *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 41-56 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The design, analysis, and performance of the thermal control system of Aryabhata is discussed. A passive thermal control system, using flat absorber-AK-512 black paint for the outer surface of the satellite and a combination of solar reflector-AK-512 white pain and mechanical polishing for the inner surfaces, was employed to maintain the temperature of all the electronics subsystems onboard the satellite within the specified limits of 0 C and 40 C during the operational life of the satellite. The in-flight temperature data obtained from sixteen temperature sensors onboard the satellite was compared with the theoretically predicted temperature values and the agreement was good for all electronic subsystems housed within the framework of the satellite. The observed deviations in temperature for the tape recorder, proportional counter package, and gas bottles of the spin-up system are attributed to the assumptions made for the mathematical model. It has been found that by improving these approximations, the deviations could be reduced to negligible values.
M.G.

N80-29389 ISRO Satellite Centre, Peenya, Bangalore (India).
ATTITUDE AND TEMPERATURE SENSORS
G. A. Kasiviswanathan (INSAT Proj. Office, Bangalore, India), V. P. V. Varadarajulu, P. R. Venkateswaran, and T. K. Alex *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 57-68 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The sensors used in the Aryabhata satellite for attitude determination and thermal control are described in some detail. Solar aspect sensors and a triaxial magnetometer were used for attitude reconstruction of the spin axis. A spin angle clock was used for sectoring the scan field of the equatorially-mounted X-ray experiment package. A set of thermistors placed at various locations of the satellite provided information on the thermal behavior of the satellite.
M.G.

N80-29390 ISRO Satellite Centre, Peenya, Bangalore (India).
THE TELEMETRY SYSTEM
D. V. Raju, R. K. Rajangam, P. S. Rajyalakshmi, C. N. Venkateshaiah, R. Seshaiah, V. Nalanda, S. R. Nagaraj, and R. Sivaswamy *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 69-78 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The telemetry system employed in Aryabhata is described. The telemetry link provides a means for monitoring diagnostic and other parameters for efficient and controlled operation of the satellite besides transmitting data pertaining to the three scientific experiments. A time multiplexed pulsed code modulation (PCM) system was used along with a parallel redundant system which could be switched on by using gorund commands. The system utilized a 128 word, 8 bits per word format. The PCM signal frequency modulates a 22 kHz + or - 7.5% subcarrier which was given to the transmitter for phase modulation of the main carrier. The qualification tests and in-orbit performance of the telemetry system are also described.
M.G.

N80-29391 ISRO Satellite Centre, Peenya, Bangalore (India).
THE COMMUNICATION SYSTEM
M. K. Saha (INSAT Proj. Office, Bangalore, India), V. Gopal Rao, N. Manthian, S. Kalyanaraman, and M. L. Sastry *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 79-88 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The salient features of system design considerations for both uplink and downlink, subsystem details, and the in-orbit performance of the communication system for Aryabhata are discussed. The communication system comprises the telemetry link at 137.44 MHz and the telecommand link at 148.25 MHz. The onboard system consists of two telemetry transmitters and two

telecommand receivers both coupled to a common antenna via a hybrid coupler unit, which isolates the command receiver from the telemetry transmitter. A stable telemetry carrier frequency of 137.44 MHz is also used for tracking. Telemetry data in pulse coded modulation are frequency-modulated on a subcarrier frequency of 22 kHz and the composite signal phase modulates the carrier to provide interference-free reception in narrow band carrier tracking systems. For reliability of the onboard system the principle of parallel redundancy is used. The telecommand is an amplitude modulated system. The received signals at the satellite antenna after detection by receivers are fed to a command decoder for the execution of command operations. M.G.

N80-29392 ISRO Satellite Centre, Peenya, Bangalore (India).
THE TELECOMMAND SYSTEM
R. Ashiya, J. P. Gupta, Y. K. Singla, D. Venkataramana, A. Bhaskaranarayana, U. N. Das, and R. V. Seshadri *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 89-104 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The system design, specifications, and performance of both the ground and onboard segments of the telecommand system system developed for the spacecraft Aryabhata are described. Particular attentiona is given to the command decoder and the command control units. The operations performed by the telecommand system include energising various subsystems, tape recorder operations, spin-up of satellite, phased operation of experiments, and switching over to redundant system during emergency/failure of main units. M.G.

N80-29393 ISRO Satellite Centre, Peenya, Bangalore (India).
ANTENNA SYSTEMS FOR THE ARYABHATA MISSION
S. P. Kosta, S. Pal, P. K. Reddy, V. K. Lakshmeesha, K. N. S. Rao, K. N. Shamanna, V. Mahadevan, V. S. Rao, and L. Nicholas *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 105-118 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The onboard ground antenna system employed in the Aryabhata mission for telemetry and telecommand operations are described. The onboard antenna system common to telemetry and telecommand frequencies consists of four monopoles fed in turnstile configuration and generates a near isotropic pattern with worst dips of the order of -10 dB over approximately 0.2% of the total radiation sphere area. The ground antenna system consists of a high gain (16 dB) telecommand antenna and a telemetry array of eight medium gain Yagis (gain 22 dB). Author

N80-29394 ISRO Satellite Centre, Peenya, Bangalore (India).
THE TRACKING SYSTEM
M. K. Saha, S. Kalyanaraman, S. N. Prasao, R. N. Tyagi, T. K. Jayaraman, M. Sambasiva Rao, and S. G. Basu *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 119-133 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The satellite tracking system was used for Aryabhata. The total system consists of (1) an interferometry system to measure the direction cosine angles of the satellite with respect to the ground station, (2) a tone-ranging system to measure the range of the satellite and (3) a Doppler system to measure the range rate of the satellite. The system accuracies obtained were plus or minus 10 feet of an arc in the direction cosine angles, plus or minus 1.0 km in the range and plus or minus 6.6 m/s in the range rate. R.C.T.

N80-29395 ISRO Satellite Centre, Peenya, Bangalore (India).
THE STRUCTURE
A. V. Patki *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 135-150 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The design, analysis and testing methods of the Aryabhata satellite structure are briefly presented. The general requirements and constraints which formed the basis of the design of the structure are explained. The theoretical and experimental studies conducted to evaluate the structural behaviour under various environmental loads expected during ground operations and during flight are also described. The salient features of the fabrication procedures and the details of physical parameters are presented. The structure is evaluated on the basis of the results of ground tests and the flight performance. R.C.T.

N80-29396 ISRO Satellite Centre, Peenya, Bangalore (India).
SYSTEM INTEGRATION
V. A. Thomas, M. N. Sathyanarayan, V. R. Katti, A. A. Bokil, N. R. Dathathri, G. Mohanakrishnan, K. Pattabhiraman, K. Goswami, T. L. Danabalan, and I. Selvaraj *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 151-162 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The various aspects of satellite integration are discussed. A detailed plan is given for both mechanical and electrical integration of Aryabhata, elucidating the integration procedures and practices which were evolved to cater to the various types of interface requirements between the different onboard subsystems as well as between the spacecraft and the rocket carrier. R.C.T.

N80-29397 ISRO Satellite Centre, Peenya, Bangalore (India).
THE GROUND CHECKOUT SYSTEM
Tarsem Singh, A. D. Dharma, O. P. Sapra, V. R. Pratap, K. A. Narayanan, S. Subbiah, J. V. Ingle, A. S. Bhamavati, and B. K. Shamaprakash *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 163-173 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The ground checkout system used for testing the Aryabhata from integration stage to launch from Cosmodrome in USSR is described. Introduction and design details are followed by brief descriptions of the system elements and test philosophy. R.C.T.

N80-29398 ISRO Satellite Centre, Peenya, Bangalore (India).
ORBIT COMPUTATIONS
R. S. Bhat and C. K. Rajasingh *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 175-186 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

Orbital information for Aryabhata was computed and made available for telemetry and tracking schedules and for mission analysis. Taking an available state-vector once in a week from USSR, the orbital computations were made for the first four months using a numerical integration procedure. During the later period of the mission, an analytical method was adopted to reduce the computer time. Aryabhata, in a near circular orbit at 600 km and having an inclination of 50.68 deg, experienced a constant atmospheric drag due to which the semimajor axis decayed by about 0.5 km in one year. The nodal regression rate, due to asphericity of the earth, was almost constant at 4.632 deg/day. The inclination remained constant throughout the year. Author

N80-29399 ISRO Satellite Centre, Peenya, Bangalore (India).
A STATISTICAL ANALYSIS OF WEIGHT AND COST PARAMETERS OF SPACECRAFT WITH SPECIAL REFERENCE TO ARYABHATA
P. N. Pathak *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 187-196 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The available data on the weights of several NASA and ESRO spacecraft were statistically analysed using the regression analysis technique and empirical relationships of the type W sub T = AW sub x (beta) have been established, where W sub T is the total weight of the spacecraft, W sub x is the weight of one of its chosen subsystems and A and beta are constants for the chosen subsystem. It is found that the weight data of Aryabhata show a fairly good fit with these empirical relationships. Further, using an established statistically derived relationship for NASA satellites, involving the cost of a spacecraft and its weight parameters, it is found that the cost of Aryabhata is much lower than that of other NASA satellites of comparable weight. The implications of these results are briefly discussed. R.C.T.

N80-29400 Tata Inst. of Fundamental Research, Bombay (India).
AN EXPERIMENT TO DETECT ENERGETIC NEUTRONS AND GAMMA RAYS FROM THE SUN
M. V. K. AppaRao, S. V. Damle, R. R. Daniel, G. S. Gokhale, George Joseph, R. U. Kundapurkar, and P. J. Lavakare *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 197-203 refs

(For primary document see N80-29384 20-15)
Avail: Issuing Activity

A payload for the detection and measurement of high energy neutrons and gamma rays from the sun was flown onboard the first Indian satellite Aryabhata. The payload system for this neutron-gamma experiment was designed for detecting energetic neutrons in the energy range 10-500 MeV and gamma rays in the energy range 0.2-20 MeV. The details of the design of the payload, various tests carried out on it as well as the preliminary in orbit performance are presented. Author

N80-29401 Physical Research Lab., Ahmedabad (India).
THE AERONOMY EXPERIMENT
S. Prakash, B. H. Subbaraya, V. Kumar, P. N. Pareek, J. S. Shirke, R. N. Misra, K. Goswami (ISRO Satellite Centre), R. S. Singh, and A. Ranerjee (National Physical Lab., New Delhi, India) *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 205-213 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The experiments described here were flown on Aryabhata and were mainly designed to study the global distribution of suprathermal electrons, ionosphere-magnetosphere coupling, the F region anomaly and the hydrogen geocorona. The experiments consisted of a retarding potential analyser and two ultraviolet ion chambers. The former was designed for the measurement of the flux of suprathermal electrons in the Earth's atmosphere while the latter was for measuring the intensity of the resonantly scattered hydrogen Lyman alpha (1216 angstroms) and photoelectronically excited OI (1304 angstroms) emissions. Author

N80-29402 ISRO Satellite Centre, Peenya, Bangalore (India).
THE X-RAY ASTRONOMY EXPERIMENT
U. R. Rao (Physical Research Lab.), K. Kasturirangan, Y. K. Jain, Arun Batra, V. Jayaraman, R. A. Ganage, D. P. Sharma, and M. S. Radha *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 215-227 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

One of the scientific experiments onboard Aryabhata was designed to detect and measure celestial X-rays in the energy range 2.5 - 1550.0 keV. The payload systems comprising proportional counter and scintillation counter telescopes were intended for observations in the pointed and scan modes respectively for investigating the emission properties of celestial X-ray sources. The details of these telescopes, their inflight performance as well as the nature of the data obtained during the first few orbits are presented. R.C.T.

N80-29403 Academy of Sciences (USSR), Moscow. Inst. for Space Research.
A GEOSYNCHRONOUS PROBE FOR EXTRAECLIPTIC STUDIES OF THE SOLAR WIND AND FOR ASTROPHYSICAL INVESTIGATIONS
V. M. Balebanov, A. E. Balikhin, O. L. Vaisberg, V. B. Zhuravlev, A. N. Matveev, G. A. Mersov, and V. S. Troshin 1979 17 p refs
(D-279) Copyright. Avail: NTIS HC A02

The concept of a probe being launched into a heliocentric orbit is examined. To accommodate solar wind experiments the orbital plane must be inclined to the ecliptic plane. The orbital parameters of the probe are chosen basically the same as those of the Earth, while the launching procedure provides a synchronous orbital motion of the probe with the Earth. It is shown that this orbit provides a unique opportunity to fix the direction of the probe Earth baseline in inertial space. The probe is to be spin stabilized; a possible hardware configuration is discussed. The spin axis of the probe and the lines of sight of the astrophysical equipment are to be colinear with the probe Earth baseline, thus allowing for the combination astrophysical and out-of-ecliptic experiments. It is also shown that the proposed spin stabilization of the probe can be achieved using only optical solar sensors and very simple logic. The axis of the radio communication antenna, being parallel to the spin axis, provides continuous communication with the Earth. Author (ESA)

N80-29404# RAND Corp., Santa Monica, Calif.
A PRELIMINARY ANALYSIS OF THE EFFECT OF WORK-AROUNDS ON SPACE SYSTEM PERFORMANCE AND PROCUREMENT REQUIREMENT: A PROPOSAL Interim Report
Gary Parish and William Sollfrey Mar. 1980 33 p
(Contract F49620-77-C-0023)
(AD-A085644; RAND/N-1260-AF) Avail: NTIS HC A03/MF A01 CSCL 22/2

This note identifies a factor that appears to have been neglected in explaining the discrepancy between predicted and observed satellite lifetimes in orbit. This factor--extension of satellite life through ingenious 'work-around' corrections--is not represented in current satellite replenishment models. The note explores the effect of this omission on various measures of system performance, develops an analytical method of incorporating these work-arounds in replenishment models, and derives an initial estimate of the required parameters from a convenient data base. Incorporating the effect of work-arounds dramatically improves system performance and lowers procurement requirements. GRA

N80-29405# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PERFORMANCE OF MULTIPLE SATELLITE SYSTEMS WITH COMMON DOWNLINK FREQUENCY HOPPING PATTERNS
Jeannine Mosely 29 Feb. 1980 32 p refs
(Contract F19628-80-C-0002; AF Proj. 2487; AF Proj. 2028)
(AD-A085590; TN-1980-14; ESD-TR-80-18) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report considers a situation in which more than one satellite transmitting frequency-hopped signal is in view of a given terminal. If it is desired that the satellites use the same frequency hopping pattern for ease of acquisition and handover, then a receiver which is in range of more than one satellite may encounter interference. This interference is analyzed for a generalized system of two satellites modelled after the LES-8/9 system. Upperbounds for the probability of error are derived for receivers using a square-law combining rule. This expression is evaluated for the LES-8/9 system, using two different downlink codes. It is seen that the choice of code makes a significant difference in system performance, and that with a suitably chosen code, two satellites may use the same frequency hopping pattern without significant performance degradation. GRA

N80-29406# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
AN ELEVATOR IN SPACE [MIT DEM FAHRSTUHL INS ALL]
H. O. Ruppe Jun. 1979 25 p In GERMAN
(TUM-RT-KB-79/6) Avail: NTIS HC A02/MF A01

A geostationary shaft satellite is proposed which is vertically stabilized in the Earth's gravitational field. The shaft is prolonged above and below the satellite so that it stays in stable equilibrium; the prolongation is continued until the inferior branch reaches the Earth's surface. The base is fixed and masses are attached to the superior branch so that the 'ladder' is stretched with the help of centrifugal force. In principle an elevator could then be installed in this tower. Author (ESA)

N80-29407# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Hauptabteilung Raumfahrtprogramme.
CONCEPTUAL STUDY OF A EUROPEAN REMOTE SENSING SATELLITE WITH COMBINED OPTICAL AND MICROWAVE PAYLOAD Final Report
Wolfgang Gilg, E. Achtermann, K.-L. Bitzer, K. Ernsberger, K.-H. Fabiunke, G. Lehn, W. Schuler, W. Trogus, E. Velten, M. Westphal et al. Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 110 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with DFVLR, Oberpfaffenhofen, West Germany
(BMFT-FB-W-79-18) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22.70

The concept of a European remote sensing satellite (ERDSAT) launched by ARIANE and carrying a model payload, consisting of a synthetic aperture radar and an optical multispectral scanner with nine channels for land applications or coastal zone missions is characterized. The mission goal of ERDSAT is based on European user requirements where a strong need for optical and microwave sensor operation on board the same satellite in a simultaneous or sequential mode is expressed. A data collection system is

included. The proposed satellite is three-axes-stabilized and has a Sun-synchronous, near polar circular orbit at 750 km altitude. The selected configuration separates payload module and bus module. A thermostable carbon fiber grating structure constitutes the central framework of the satellite. Each major subsystem is housed in a separate compartment and can be integrated and tested individually. First mass estimates result in 450 kg for the payload and 880 kg for the bus. The maximum power needed is 1750 W (for 6 minutes, three times a day), which is provided by a 1330 W solar array and two batteries. Author (ESA)

N80-29408# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY ON NOSE CONE DEVELOPMENT Final Report
Rainer Henkel, Gerhard Maier, Helmut Meier, and Walter Schnieder Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 64 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-W-79-20; ISSN-0170-1339) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13

In response to a demand for a universal nose cone design for sounding rocket applications various split type nose cones with different separation mechanisms, presently available on the market, were studied. The study includes a comparison of different construction principles regarding minimal disturbance and spin reduction on takeoff. Results show that a nose cone for universal application is not a reasonable concept, since the requirements vary too greatly depending on the mission. Author (ESA)

N80-29409# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
INTRODUCTION TO THE VARIOUS LAWS OF MISSILE GUIDANCE
K. Becker Aug. 1979 89 p refs In GERMAN; ENGLISH summary
(FFM-285) Avail: NTIS HC A05/MF A01

The success of a missile attacking a target is essentially dependent on the guidance principle adopted. Some typical missile control schemes are discussed and their advantages and disadvantages are shown. Strategies considered are the pre-computed course, line of sight guidance, pursuit guidance, constant bearing guidance, proportional navigation, and some modern strategies based on optimal control. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-29410*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM. CONSUMABLES AND THERMAL ANALYSIS
G. Steines (McDonnell Douglas Technical Services Co.) Aug. 1980 32 p refs
(NASA-TM-81035; JSC-16720; Rept-80-FM-33) Avail: NTIS HC A03/MF A01 CSCL 22B

The Environmental Control and Life Support Systems (ECLSS)/thermal systems analysis for the Space Transportation System 1 Flight (STS-1) was performed using the shuttle environmental consumables usage requirements evaluation (SECURE) computer program. This program employs a nodal technique utilizing the Fortran Environmental Analysis Routines (FEAR). The output parameters evaluated were consumable quantities, fluid temperatures, heat transfer and rejection, and cabin atmospheric pressure. Analysis of these indicated that adequate margins exist for the nonpropulsive consumables and related thermal environment. Author

N80-29411*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER ELECTRICAL EQUIPMENT UTILIZATION BASELINE
Aug. 1980 790 p
(JSC-12561; Rept-77-FM-2-Rev-5; NASA-TM-81125) Avail: NTIS HC A99/MF A01 CSCL 22B

The baseline for utilization of Orbiter electrical equipment in both electrical and Environmental Control and Life Support System (ECLSS) thermal analyses is established. It is a composite catalog of Space Shuttle equipment, as defined in the Shuttle Operational Data Book. The major functions and expected usage of each component type are described. Functional descriptions are designed to provide a fundamental understanding of the Orbiter electrical equipment, to insure correlation of equipment usage within nominal analyses, and to aid analysts in the formulation of off-nominal, contingency analyses. L.F.M.

N80-29412*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SCHEDULING ALGORITHM FOR MISSION PLANNING AND LOGISTICS EVALUATION (SAMPLE). VOLUME 1: USER'S GUIDE
Edwin Dupnick and Diana Wiggins (Lockheed Electronics Co., Inc., Houston, Tex.) Feb. 1980 41 p 3 Vol.
(NASA-TM-8114; JSC-16395-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

An interactive computer program for automatically generating traffic models for the Space Transportation System (STS) is presented. Information concerning run stream construction, input data, and output data is provided. The flow of the interactive data stream is described. Error messages are specified, along with suggestions for remedial action. In addition, formats and parameter definitions for the payload data set (payload model), feasible combination file, and traffic model are documented. R.C.T.

N80-29413*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SCHEDULING ALGORITHM FOR MISSION PLANNING AND LOGISTICS EVALUATION (SAMPLE). VOLUME 2: MISSION PAYLOADS SUBSYSTEM DESCRIPTION
Edwin Dupnick and Diana Wiggins (Lockheed Electronics Co., Inc., Houston, Tex.) Feb. 1980 182 p
(NASA-TM-81115; JSC-16395-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 22A

The scheduling algorithm for mission planning and logistics evaluation (SAMPLE) is presented. Two major subsystems are included: The mission payloads program; and the set covering program. Formats and parameter definitions for the payload data set (payload model), feasible combination file, and traffic model are documented. R.C.T.

N80-29414*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ET LOX MODAL SURVEY ANALYSIS AND TEST ASSESSMENT
R. L. McComas May 1980 32 p
(NASA-TM-78287) Avail: NTIS HC A03/MF A01 CSCL 22B

The results are presented of the analysis and modal test of the liquid oxygen tank and intertank of the space shuttle external tank. The analytical models, test article, and support hardware are described. Frequency and damping are compared on a mode-by-mode basis. The data assessment clearly confirms the validity of the analytical model and establishes a high level of confidence that the methodology will accurately predict modal characteristics of flight configurations. Author

N80-29415*# Rocket Research Corp., Redmond, Wash.
INCREASED CAPABILITY GAS GENERATOR FOR SPACE SHUTTLE APU. DEVELOPMENT/HOT RESTART TEST REPORT
7 Jul. 1980 95 p
(Contract NAS9-16002)
(NASA-CR-160764; Rept-80-R-695) Avail: NTIS HC A05/MF A01 CSCL 22B

The design, fabrication, and testing of an increased capability gas generator for use in space shuttles are described. Results show an unlimited hot restart capability in the range of feed pressures from 400 psi to 80 psi. Effects of vacuum on hot restart were not addressed, and only beginning-of-life bed

conditions were tested. No starts with bubbles were performed. A minimum expected life of 35 hours or more is projected, and the design will maintain a surface temperature of 350 F or more. L.F.M.

N80-29416*# ARO, Inc., Arnold Air Force Station, Tenn.
SPACE SHUTTLE ORBITER SILTS POD FLOW ANGULARITY AND AERODYNAMIC HEATING TESTS (OH-102A AND OH-400) Final Report, Oct. 1978 - Oct. 1979
K. W. Nutt AEDC Nov. 1979 52 p refs Sponsored by NASA. Johnson Space Flight Center
(NASA-CR-163326; AD-A086195; AEDC-TSR-79-V70) Avail: NTIS HC A04/MF A01 CSCL 20/4

Heat transfer, flow field, and oil flow tests were conducted on a 0.0175 scale model of the space shuttle orbiter. The tests were conducted at Mach 8. The objective of the tests was to determine the aerodynamic heating distribution on the orbiter SILTS tail configuration and to obtain flow field total pressure and total temperature measurements at the location of the leading edge of the vertical tail. The tests were conducted at free-stream Reynolds numbers ranging from 0.5 to 3.7 million per ft. The model angle of attack was varied from -5 to 5 deg and from 30 to 40 degrees. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-29417*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS OF SPACE SHUTTLE ORBITER ENTRY DYNAMICS FROM MACH 10 TO MACH 2.5 WITH THE NOVEMBER 1976 FLIGHT CONTROL SYSTEM
Richard W. Powell and Howard W. Stone Aug. 1980 163 p
(NASA-TP-1667; L-13344) Avail: NTIS HC A08/MF A01 CSCL 22B

A six-degree-of-freedom simulation analysis was performed for the space shuttle orbiter entry from Mach 10 to Mach 2.5 with realistic off-nominal conditions using the flight control system referred to as the November 1976 Integrated Digital Autopilot. The off-nominal conditions included: (1) aerodynamic uncertainties in extrapolating from wind tunnel of flight characteristics, (2) error in deriving angle of attack from onboard instrumentation, (3) failure of two of the four reaction control-system thrusters on each side (design specification), and (4) lateral center-of-gravity offset. Many combinations of these off-nominal conditions resulted in a loss of the orbiter. Control-system modifications were identified to prevent this possibility. Author

N80-29418*# Old Dominion Univ., Norfolk, Va. Dept. of Mathematical Sciences.
PRELIMINARY INVESTIGATIONS INTO THE ACTIVE CONTROL OF LARGE SPACE STRUCTURES: SOLUTION OF THE TIMOSHENKO BEAM EQUATIONS BY THE METHOD OF CHARACTERISTICS Final Report, 15 Feb. 1976 - 15 Aug. 1980
John Tweed Aug. 1980 197 p refs
(Grant NsG-1279)
(NASA-CR-163408) Avail: NTIS HC A09/MF A01 CSCL 22B

An algorithm was developed and incorporated into a computer program for solving the damped, Timoshenko beam equations with free-free boundary conditions and prescribed initial data. A number of special cases are considered and, where appropriate, comparisons are made with known results. A.R.H.

N80-29419*# California Univ., San Diego, La Jolla. Center for Astrophysics and Space Sciences.
ANALYSIS OF DIFFERENTIAL AND ACTIVE CHARGING PHENOMENA ON ATS-5 AND ATS-6 Final Report, May 1977 - Dec. 1979
R. C. Olsen and E. C. Whipple, Jr. 30 Jul. 1980 154 p refs
(Grant NsG-3150)
(NASA-CR-163433; UCSD-CASS-80-1) Avail: NTIS HC A08/MF A01 CSCL 22B

Spacecraft charging on the differential charging and artificial particle emission experiments on ATS 5 and ATS 6 were studied. Differential charging of spacecraft surfaces generated large electrostatic barriers to spacecraft generated electrons, from photoemission, secondary emission, and thermal emitters. The electron emitter could partially or totally discharge the satellite, but the mainframe recharged negatively in a few 10's of seconds. The time dependence of the charging behavior was explained by the relatively large capacitance for differential charging in comparison to the small spacecraft to space capacitance. A daylight charging event on ATS 6 was shown to have a charging behavior suggesting the dominance of differential charging on the absolute potential of the mainframe. Ion engine operations and plasma emission experiments on ATS 6 were shown to be an effective means of controlling the spacecraft potential in eclipse and sunlight. Elimination of barrier effects around the detectors and improving the quality of the particle data are discussed. R.K.G.

N80-29420# Aerospace Corp., El Segundo, Calif. Lab. Operations.
LIFT-DISPERSION CONTROL OF SPINNING REENTRY VEHICLES Interim Report
D. H. Platus 10 Apr. 1980 41 p refs
(Contract F04701-79-C-0080)
(AD-A085457; TR-0080(5940-02)-1; SD-TR-80-22) Avail: NTIS HC A03/MF A01 CSCL 16/3

A control system is described that will limit cross-range dispersion of spinning reentry vehicles caused by lift variations. The controls consist of small trim flaps or reaction jets that utilize information derived from strapdown motion sensors to minimize lift nonaveraging. Because epicyclic oscillations in angle of attack do not cause dispersion, only the phasing of complex angle-of-attack motion must be controlled to minimize the net transverse velocity that would otherwise result from lift variations. This requires relatively little control energy compared with a system that would trim the vehicle at zero angle of attack. A simple control law is derived that specifies minimum feedbacks required, and the open- and closed-loop vehicle response to impulsive disturbance moments is demonstrated. GRA

N80-29421# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
ACOSS FOUR (ACTIVE CONTROL OF SPACE STRUCTURES) THEORY, VOLUME 1 Final Technical Report, 24 Jul. 1978 - 31 Dec. 1979
Robert R. Strunce, Daniel R. Hegg, Jiguan G. Lin, and Timothy C. Henderson Griffiss AFB, N.Y. RADC Apr. 1980 68 p refs 2 Vol.
(Contract F30602-78-C-0268; ARPA Order 3654)
(AD-A085654; R-1338-Vol-1; RADC-TR-80-78-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 22/2

The objective of the research reported here was to develop the theoretical and analytical tools to support the successful implementation of active vibration control of large flexible spacecraft. Parallel efforts in theory and applications were initiated. For the theoretical effort, several representative design methods

were selected for careful study focusing on an examination of the theoretical basis for each method and potential difficulties associated with their use in reduced-order large space structure controller design. The methods initially selected are characterized by constant-gain output feedback, the simplest form of active multivariable control; (1) modal decoupling, (2) pole assignment, (3) optimal output feedback, (4) suboptimal output feedback, and (5) stochastic optimal output feedback. A performance comparison of specific designs with these methods was made. Extensions to the published Kosut methods of suboptimal output feedback are developed, as well as the details of an algorithm necessary for a numerical solution. GRA

N80-29422# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
ACOSS FOUR (ACTIVE CONTROL OF SPACE STRUCTURES) THEORY. VOLUME 2: APPENDIX Final Technical Report, 24 Jul. 1978 - 31 Dec. 1979
Robert R. Strunce, Daniel R. Hegg, Jiguan G. Lin, and Timothy C. Henderson Griffiss AFB, N.Y. RADC Apr. 1980 64 p 2 Vol.
(Contract F30602-78-C-0268; ARPA Order 3654)
(AD-A085816; R-1338-Vol-2-App; RADC-TR-80-78-Vol-2)
Avail: NTIS HC A04/MF A01 CSCL 22/2

This is the Charles Stark Draper Laboratory, Inc., final technical report on its Actively Controlled Structures Theory Study. The objective of the research reported here was to develop the theoretical and analytical tools to support the successful implementation of active vibration control of large flexible spacecraft. Parallel efforts in theory and applications were initiated. For the theoretical effort, several representative design methods were selected for careful study focusing on an examination of the theoretical basis for each method and potential difficulties associated with their use in reduced-order large space structure controller design. The methods initially selected are characterized by constant-gain output feedback, the simplest form of active multivariable control; (1) Modal Decoupling, (2) Pole Assignment, (3) Optimal Output Feedback, (4) Suboptimal Output Feedback, and (5) Stochastic Optimal Output Feedback. A performance comparison of specific designs with these methods was made. Extensions to the published Kosut methods of suboptimal output feedback are developed, as well as the details of an algorithm necessary for a numerical solution. Techniques and conditions are developed for reduction of control (observation) spillover by placement of actuators (sensors), by synthesis of the actuator (sensor) influences, and by compensation of actuators (sensors). GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-29423# Aerospace Corp., El Segundo, Calif. Engineering Group.
ONE- AND TWO-PHASE NOZZLE FLOWS Final Report, Jan. 1978 - Jan. 1980
I-Shih Chang 31 Jan. 1980 64 p refs
(Contract F04701-79-C-0080)
(AD-A085806; TR-0080(5901)-01-1; SD-TR-80-26) Avail: NTIS HC A04/MF A01 CSCL 21/8

A time-dependent technique, in conjunction with the boundary-fitted coordinates system, is applied to solve a gas only one phase flow and a fully coupled, gas-particle two phase flow inside nozzles with small throat radii of curvature, steep wall gradients, and submerged configurations. The emphasis of the study has been placed on one and two phase flow in the transonic region. Various particle size and particle mass fractions have been investigated in the two phase flow. The salient features associated with the two phase nozzle flow compared with those of the one phase flow are illustrated through the calculations for a JPL nozzle configuration, for the Titan 3 solid rocket motor nozzle, and for the submerged nozzle configuration utilized in the Inertial Upper Stage (IUS) solid rocket motor. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N80-29424 Tennessee Univ., Knoxville.
ANISOTROPIC TENSILE AND NOTCHED BEND PROPERTIES OF AN Al-Al3Ni DIRECTIONALLY SOLIDIFIED FIBER REINFORCED COMPOSITE Ph.D. Thesis
Dennis Wayne Hetzner 1980 191 p
Avail: Univ. Microfilms Order No. 8018481

Eutectic alloy ingots having dimensions of approximately 1/2' x 4' x 4' were directly solidified. The tensile strength of the composite was found to vary in a manner similar to that predicted for mechanically formed fiber reinforced composites. The fracture modes were also similar to those predicted for mechanically formed fiber reinforced composites. The notched bend strength of the composite was found to decrease for fiber orientations up to 45 deg and then remain constant for fiber orientations from 45 deg to 90 deg. In all cases fracture was initiated by the cracking of large Al3Ni blades within cell boundaries. Dissert. Abstr.

N80-29425 Illinois Univ. at Urbana-Champaign.
MICROSTRUCTURE AND MICROCHEMISTRY OF TITANIUM CARBIDE COATED CEMENTED CARBIDES Ph.D. Thesis
Nirmal Kumar Sharma 1980 97 p
Avail: Univ. Microfilms Order No. 8017981

A microchemical and microstructural analysis of TiC coated cemented carbides was performed using a variety of contemporary microanalytical techniques: Auger electron spectroscopy; STEM X-ray microchemical analysis; and electron energy loss spectroscopy. As most of the analytical techniques used are in their infancy for quantitative analysis, it was necessary to develop special procedures for quantitation and interpretation of the data obtained. A quantitative formalism was developed using single crystals and binary carbide mixtures of known composition to obtain quantitative microchemical information of every few atomic layers between TiC coatings and cemented carbide substrates. The procedure when applied to the interface between cemented carbides and TiC coatings obtained by chemical vapor deposition, activated reactive evaporation and dc biased radio frequency sputtering showed loss of carbon in all cases. Each interface revealed a different degree of decarburization and intermixing, and all of them lacked the desired low decarburization and high intermixing. Dissert. Abstr.

N80-29426 Illinois Univ. at Urbana-Champaign.
LOW-TEMPERATURE DENSIFICATION OF LEAD ZIRCONATE TITANATE WITH VANADIUM PENTOXIDE ADDITIONS Ph.D. Thesis
Dale Edward Wittmer 1980 157 p
Avail: Univ. Microfilms Order No. 8018217

The addition of 0.1 to 6.0 w/o V2O5 to lead zirconate bitanate (PZT) ceramics promoted rapid densification below 975 C; thereby eliminating the need for PbO atmosphere control. The base PZT, Pb(Zr0.53 Ti0.47)O3, was prepared by coprecipitation from mixed oxides and butoxides. The V2O5 was incorporated as mill additions to the precalcined base PZT, as batch additions to the PZT during the coprecipitation process, and as mill additions to a commercially available PZT powder. Densification rates were enhanced by the additions of V2O5. Densities greater than 98% of theoretical were obtained in approximately 15 minutes of 960 C for additions of 0.1 to 1.0 w/o V2O5 addition and were at least comparable to the base PZT. Indications are that accelerated densification is due to a combined surface activated liquid phase mechanism. It was proposed that the V2O5 becomes incorporated into the surface layers of the oxide powders during mixing or in the coprecipitation process. Dissert. Abstr.

N80-29427 Rice Univ., Houston, Tex.
FATIGUE DAMAGE IN A WC-NICKEL CEMENTED CARBIDE COMPOSITE Ph.D. Thesis
Eric F. Drake 1980 85 p
Avail: Univ. Microfilms Order No. 8018045

A model WC-Ni cemented carbide was designed to investigate the response of this type of composite to compressive cyclic loading. The material's monotonic stress-strain behavior was studied in the compressive range, revealing considerable microstrain plasticity and rapid strain-hardening characteristic of this composite family. Specimens were mechanically conditioned at 20 Hz for one million cycles using a zero-compression zero sinusoidal program in stress control. Peak stress was varied in increments from zero to 1900 MPa, where failure was observed. Bulk hardness, residual stress state, and fracture toughness were monitored as a function of cyclic stress. Only modest shifts in bulk behavior were observed. On a local scale, fatigue effects on dislocation density and structure were found in the binder phase by transmission electron microscopy. As cyclic stress levels were raised, favorably oriented grain-boundary-ledge dislocation sources were activated, leading to precipitate-free bands of intense slip. Dissert. Abstr.

N80-29428 Akron Univ., Ohio.
THE ROLE OF RUBBER-PLASTIC ADHESION IN THE REINFORCEMENT OF ELASTOMER COMPOSITES Ph.D. Thesis
Tsung-I Chen 1980 152 p
Avail: Univ. Microfilms Order No. 8017436

Polymeric fillers, such as polystyrene, poly(methyl methacrylate) and polyacenaphthylene, were prepared by emulsion polymerization. The filler elastomer adhesion as indicated by 'dewetting' on stretching, was measured by volume changes in the case of SBR filled with polymeric fillers, the increase in volume was a linear function of the extension ratio (lambda), within the range studied (lambda = 3 approximately 4). At the same volume fraction, the smaller size fillers showed a lower degree of dewetting than the large size filler. An adsorbed layer of soap on the filler particles reduced the volume changes and improved the adhesion, and thus raised the tensile strength of the filled rubber. Uniaxial stress-strain measurement showed that the hysteresis of the filled vulcanizates was related to the particle size, the nature of surface at the interface and the Young's modulus of the filler. A linear increase in volume with respect to extension ratio was found to occur at low extension ratio (lambda < 4) in elastomeric triblock copolymers. At higher extension ratio, the volume changed more rapidly. Dissert. Abstr.

N80-29429*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THERMAL EXPANSION OF COMPOSITES USING MOIRE INTERFEROMETRY
David E. Bowles (Virginia Polytech. Inst. and State Univ., Blacksburg), Daniel Post (Virginia Polytech. Inst. and State Univ., Blacksburg), Carl T. Herakovich (Virginia Polytech. Inst. and State Univ., Blacksburg), and Darrel R. Tenny Aug. 1980 149 p refs
(Grant NGR-47-004-129)
(NASA-TM-80788; VPI-E-80-19; IR-20) Avail: NTIS HC A07/MF A01 CSCL 11D

An experimental technique for precise measurement of the thermal response of fiber-reinforced composite materials uses moire interferometry with fringe multiplication which yield a sensitivity of 833 nm (32.8 mu in.) per fringe. Results from the technique are compared with those obtained from electrical resistance strain gages, and also those predicted from classical lamination theory. Temperature dependent coefficients of thermal expansion for composite materials subjected to thermal cycling in the temperature range of 297 K (75 F) to 422 K (300 F) were determined for four laminate configurations ([0], [90], [0/+ or - 45/90] sub s and [0/90/+ or - 45] sub s) of T300/5208 graphite epoxy, and ranged from -0.107 mu epsilon K/1 (-0.059 mu epsilon deg F/-) for the [0] laminate to 32.18 mu epsilon K/1 (17.88 mu epsilon F/1) for the [90] laminate. Moisture was found to greatly influence the thermal response of a quasi-isotropic laminate, resulting in hysteresis and residual compressive strain as the moisture content was reduced. Comparisons between moire and strain gage measurements were inconclusive with both techniques giving consistent but systematically different results. Differences of as much as 29% were observed. A.R.H.

N80-29430*# Fiber Materials, Inc., Biddeford, Maine.
FABRICATION AND EVALUATION OF LOW FIBER CONTENT ALUMINA FIBER/ALUMINUM COMPOSITES Final Report
J. E. Hack and G. C. Strempek 18 Jun. 1980 72 p refs
(Contract NAS3-21371)
(NASA-CR-159517; AMDL-0001) Avail: NTIS HC A04/MF A01 CSCL 11D

The mechanical fabrication of low volume percent fiber, polycrystalline alumina fiber reinforced aluminum composites was accomplished. Wire preform material was prepared by liquid-metal infiltration of alumina fiber bundles. The wires were subsequently encapsulated with aluminum foil and fabricated into bulk composite material by hot-drawing. Extensive mechanical, thermal and chemical testing was conducted on preform and bulk material to develop a process and material data base. In addition, a preliminary investigation of mechanical forming of bulk alumina fiber reinforced aluminum composite material was conducted. Author

N80-29431*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POTENTIAL RELEASE OF FIBERS FROM BURNING CARBON COMPOSITES
Vernon L. Bell Jul. 1980 52 p refs
(NASA-TM-80214) Avail: NTIS HC A04/MF A01 CSCL 11D

A comprehensive experimental carbon fiber source program was conducted to determine the potential for the release of conductive carbon fibers from burning composites. Laboratory testing determined the relative importance of several parameters influencing the amounts of single fibers released, while large-scale aviation jet fuel pool fires provided realistic confirmation of the laboratory data. The dimensions and size distributions of fire-released carbon fibers were determined, not only for those of concern in an electrical sense, but also for those of potential interest from a health and environmental standpoint. Fire plume and chemistry studies were performed with large pool fires to provide an experimental input into an analytical modelling of simulated aircraft crash fires. A study of a high voltage spark system resulted in a promising device for the detection, counting, and sizing of electrically conductive fibers, for both active and passive modes of operation. Author

N80-29432*# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
STATISTICAL ASPECTS OF CARBON FIBER RISK ASSESSMENT MODELING
Donald Gross, Douglas R. Miller, and Richard M. Soland Jul. 1980 127 p refs
(Contract NsG-1556)

(NASA-CR-159318) Avail: NTIS HC A07/MF A01 CSCL 11D

The probabilistic and statistical aspects of the carbon fiber risk assessment modeling of fire accidents involving commercial aircraft are examined. Three major sources of uncertainty in the modeling effort are identified. These are: (1) imprecise knowledge in establishing the model; (2) parameter estimation; and (3) Monte Carlo sampling error. All three sources of uncertainty are treated and statistical procedures are utilized and/or developed to control them wherever possible. A.R.H.

N80-29433*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

INFLUENCE OF EXCESS DIAMINE ON PROPERTIES OF PMR POLYIMIDE RESINS AND COMPOSITES

Francis I. Hurwitz 1980 15 p refs Proposed for presentation at 12th Natl. SAMPE Tech. Conf., Seattle, 7-9 Oct. 1980

(NASA-TM-81580; E-550) Avail: NTIS HC A02/MF A01 CSCL 11D

By varying the stoichiometry of the reactants in the preparation of PMR polyimide resin, changes occur in molecular weight distribution which influence the rheological properties and thus the processabilibty of the resin, as well as the mechanical properties of the composite. The influence of 1-10 percent molar excess MDA on the molecular weight distribution and rheological properties of an imidized PMR system were exposed. Molecular weight distribution is characterized by gel permeation chromatography of the imidized molding compound; shear viscosity is related to changes in average molecular weight. The thermo-oxidative stability at 600 F, glass transition temperature, flexural and interlaminar shear properties of PMR polyimide/Celion 6000 graphite fiber composites are compared as a function of the percent excess MDA in the monomer reactant mixture. A.R.H.

N80-29434# Washington Univ., St. Louis, Mo. Materials Research Lab.

STRENGTH DEGRADATION OF ARAMID-FIBER/EPOXY COMPOSITES Final Report

Edward M. Wu Apr. 1980 50 p refs

(Contract DAAG46-75-C-0081; DA Proj. 1T1-62105-AH-84) (AD-A085670; AMMRC-TR-80-19) Avail: NTIS HC A03/MF A01 CSCL 11/4

The moisture absorption kinetics for Kevlar 49 epoxy have been measured for four environmental conditions. The strength degradation for the composite has been systematically measured by six experiments for each of the four states. The tensor polynomial strength coefficients are generalized to represent the strength degradation for the moisture absorbed states. Due to the big difference between tensile and compressive strength for Kevlar 49 composites, analytical representation of the failure surface requires a third-order tensor polynomial. Four additional biaxial experiments are needed to provide the necessary data. The degree of fiber-controlled strength degradation is different from the degradation of matrix-controlled strength, which causes the failure surface to shift and deform. This shift should also be characterized by a third-order tensor polynomial. GRA

N80-29435# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.

UTILITY OF PROBABILITY DENSITY FUNCTION CURVE AND F-MAPS IN COMPOSITE MATERIAL INSPECTION Annual Report

Joseph L. Rose, Yi H. Jeong, and Michael J. Avioli 13 Feb. 1980 25 p refs

(Contract N00014-77-C-0607)

(AD-A085803; AR-1) Avail: NTIS HC A02/MF A01 CSCL 11/4

The subject of probability density function analysis, an important topic in statistical analysis, is studied in detail in this paper for its utility in nondestructive testing. In addition to the mathematical concepts and analysis, several sample problems in composite material inspection are presented. An F-map, or feature map, presentation is also presented that gives us a new way to examine composite materials. A probability density function basically gives us a plot of the number of times that a particular feature is recorded versus the feature valve itself, a feature being defined as a specific item related to an ultrasonic waveform, possibly center frequency, attenuation at a particular frequency, etc. Probability density function curves are also used to set threshold values in producing an F-map. Sample problems in a graphite polyimide structure and a boron aluminum material are covered. GRA

N80-29436# Atomic Energy Research Establishment, Harwell (England). Non-destructive Testing Centre.

NONDESTRUCTIVE EXAMINATION OF COMPOSITE MATERIALS: A SURVEY OF EUROPEAN LITERATURE Final Technical Report, Oct. 1979 - Feb. 1980

William N. Reynolds May 1980 89 p

(Contract DAAJ37-79-C-0553; DA Proj. 1T1-61102-BH-57)

(AD-A086165) Avail: NTIS HC A05/MF A01 CSCL 11/4

The references corresponding to the nondestructive examination of fibre reinforced composite materials have been retrieved from the Harwell NDT Centre information system and all those relating to European work have been examined. This has produced a comprehensive list of techniques used and of institutions and companies which have so far played an active part in the field. Apart from the relatively few industries which have met the need to develop testing procedures for composite materials in production or use, a much larger number of universities and research organizations have carried out fundamental studies of the problems involved which enable some calculations to be drawn about the outstanding difficulties. These include some useful reviews of the subject. In addition, samples of composite materials have been included in some general testing programmes, and references to a number of these are included. GRA

N80-29437# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

FAILURE ANALYSIS OF COMPOSITE LAMINATES WITH FASTENER HOLE Final Report, 15 Sep. 1978 - 1 Aug. 1979

Som R. Soni Mar. 1980 49 p refs

(AD-A085858; AFWAL-TR-80-4010) Avail: NTIS HC A03/MF A01 CSCL 11/4

Stress and strength analysis of composite laminates with a through the thickness circular hole, under uniaxial tensile load has been conducted. The hole is filled with a rigid core simulating a bolt. As a representation of the force at the bolted joint, displacement boundary conditions are applied to the rigid core. The stress analysis is based on treating the laminate as a homogeneous plate using finite element technique. The strength analysis is based on the tensor polynomial failure criterion applied to each constituent ply orientations. The ultimate laminate failure strength is based on the last ply failure stress. The resulting predictions of strength are found to be conservative as compared to experimental values. GRA

N80-29438# McDonnell Aircraft Co., St. Louis, Mo. Structural Research Dept.

COMPRESSION FATIGUE LIFE PREDICTION METHODOLOGY FOR COMPOSITE STRUCTURES: LITERATURE SURVEY Interim Report, Oct. 1979 - Jan. 1980

C. R. Saff Jun. 1980 77 p refs

(Contract N62269-79-C-0214)

(AD-A086062; NADC-78203-60) Avail: NTIS HC A05/MF A01 CSCL 11/4

This report summarizes literature concerning static strength and fatigue analysis of bolted jointed in composite materials. The literature survey was a portion of the first Task of the Navy Contract N62269-79-C-0214, 'Compression Fatigue Life Prediction Methodology for Composite Structures'. The objective of this program is to develop a fatigue life prediction methodology that will improve design efficiency, facilitate structural certification and provide guidelines for service life management. This survey provides a basis for formulation of the experimental and analytical programs to be performed in later tasks. GRA

N80-29439# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

METAL MATRIX COMPOSITE BONDING CHARACTERISTICS AND IMPACT PROPERTIES Final Report, 1 Mar. 1977 - 29 Feb. 1980

Robert G. Carlson 30 Apr. 1980 47 p refs

(Contract F49620-77-C-0067; AF Proj. 2306)

(AD-A085853; R80AEG345; AFOSR-80-0453TR) Avail: NTIS HC A03/MF A01 CSCL 11/4

This research program objective is to develop an understanding of the surface characteristics and bond behavior in metal matrix composites as related to the impact properties. The initial part of this program addresses itself to bonding of aluminum foils with different surface treatments. Scanning electron micrographs revealed the presence of A1/Fe compounds. Following this, extensive efforts were directed at identifying an etchant to remove such heterogeneous phase identified to be an aluminum iron compound, Al3Fe. After an extensive literature review, three chemical etchants were selected, the aluminum alloy foils were chemically tested, and the etched foils were evaluated by scanning electron microscopy. Single layered monotapes were then formed and evaluated by bond integrity testing (BIT). Following this, further studies were performed on evaluation of hybrid metal/metal foil combinations consisting of aluminum alloy foils against titanium or stainless steel foils. The study was next directed at fabrication of single-ply boron/aluminum panels and then in formation of hybrid titanium/aluminum/boron (TAB) and stainless steel/aluminum/boron (SAB) single-ply panels. GRA

N80-29440# Queen Mary Coll., London (England). Dept. of Materials.

ENVIRONMENTAL FAILURE OF ADHESIVE BONDING IN COMPOSITES Final Annual Report, Sep. 1978 - Dec. 1979

E. H. Andrews, Ho Ping Sheng, H. A. Majid, and C. Vlautos Mar. 1980 21 p refs

(Contract DA-ERO-78-G-118; Da Proj. 1T1-61102-BH-04)

(AD-A085878; FAR-1) Avail: NTIS HC A02/MF A01 CSCL 11/4

The adaptation of the Andrews-Stevenson (A-S) adhesion test, previously used for epoxy to metal adhesive systems, for epoxy-to-glass bonds has been achieved for epoxy resins having relatively low T sub g's (e.g. Epikote 828, T sub g = 71 C). Partial success has been achieved for high T sub g resins (e.g. SP250). This adaptation has required considerable sophistication of test-piece geometry to prevent thermal contraction stresses shattering the glass substrates during specimen preparation. The effect of water immersion at 80 C for various periods of time has been studied for the system Epikote 828 pyrex glass in the absence of coupling agents. The fracture mode becomes increasingly cohesive as immersion time increases and the peak in the curve of fracture energy versus crack speed falls progressively. Using Andrews' generalized theory, the adhesive fracture energy theta can be separated into its interfacial energy and dissipative components. GRA

N80-29441# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.

REDUCTION OF ELASTIC MODULI OF FIBER COMPOSITES BY FATIGUE CRACK ACCUMULATION

T. Gottesman, Zvi Hashin, and M. A. Brull 15 Apr. 1980 18 p refs

(Contract N00014-78-C-0544)

(AD-A085995; TR-4) Avail: NTIS HC A02/MF A01 CSCL 11/4

The problem of reduction of elastic moduli of unidirectional fiber composites due to parallel cracks, either parallel or normal to fibers, is considered on the basis of variational techniques. Expressions for effective elastic moduli are given for the case of a small number of non-interacting cracks. It is shown that these are upper bounds on effective elastic moduli for the case of arbitrary distributions of parallel cracks. Lower bounds for Young's moduli for special parallel crack distributions are also constructed. In addition, the 'self consistent scheme' approximation is also applied to the present problem. The problem treated is of significance for fatigue damage of fiber composites since such damage consists primarily of formation of such cracks. Experimental determination of moduli reduction due to cyclic stress (wearout) can thus provide a measure of the number of cracks formed. GRA

N80-29442# Executive Office of the President, Washington, D. C. Office of Science and Technology Policy.

CARBON/GRAPHITE COMPOSITE MATERIAL STUDY Annual Report, 1979

15 Mar. 1980 67 p

(PB80-175235; AR-2) Avail: NTIS HC A04/MF A01 CSCL 11E

Progress is reported by NASA, DOT, DOD, OSHA, and NIOSH in assessing the potential effects of accidentally released carbon fibers on electronic equipment in aircraft, surface vehicles, commercial institutions, and households as well as on power generation and distribution facilities. The impact on municipal solid waste disposal facilities is also considered along with methods for environmental monitoring and for determining health related problems in industries. The modification of carbon/graphite fibers and the use of alternate materials is discussed. A market analysis of U.S. manufacturers is included. A.R.H.

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-29443 Arizona Univ., Tucson.

THE CHARACTERIZATION OF BONDED PHASES FOR HIGH PERFORMANCE LIQUID CHROMATOGRAPHY Ph.D. Thesis

Klaus John Stetzenbach 1980 169 p

Avail: Univ. Microfilms Order No. 8017813

The physical and chemical nature of chemically bonded phases used in high performance liquid chromatography were studied. These bonded phases were characterized by a variety of chromatographic and nonchromatographic experiments. The nonchromatographic techniques included C-13 nuclear magnetic resonance and batch extraction methods. The role played by the bonded phase as well as the mobile phase in determining the retention characteristics of the stationary phase were determined. The retention of solute molecules on bonded phases was found to be a function of the chain length of the bonded phase, the chemical nature of the bonded molecule, and the type of organic modifier used in the mobile phase. The energetics of the solute stationary phase interactions was determined by the differential enthalpy and was found to be indicative of a partitioning process between two liquid phases. Results show that the stationary phase consists of the bonded molecule as well as trapped mobile phase. The composition of this ternary mixture is a function of the type and amount of bonded material and the type and amount of organic modifier used in the mobile phase. Dissert. Abstr.

N80-29444 Michigan Univ., Ann Arbor.

OPTICAL EMISSION SPECTROSCOPY OF UNIFORM AEROSOL DROPLETS IN A HYBRID FLAME/ARC EXCITATION SOURCE Ph.D. Thesis

Charles Ernest Schmidt 1980 209 p

Avail: Univ. Microfilms Order No. 8017361

Plasma jets and gas stabilized arcs are investigated for dc arc emission spectroscopy. Gas stabilized arcs utilize gas streams to shape the dc discharge maintained between two sharp rod electrodes. Low Ar cooling gas flow rate (1.3 l/min) results in a larger more diffuse plasma. At 3.9 l/min the plasma is smaller and the bent arc conduction channel is visable. Gas flow rates determine the aerosol-plasma compatibility. Aerosol penetration of the discharge is achieved with a hybrid excitation source which combines a cylindrical N2O/C2H2 flame with the Elliot bent arc. Solution is introduced into the flame as discrete, uniform, monodisperse droplets 40 to 90 microns in diameter. The flame, operated at oxidant/fuel ratio of about 2, desolvates, atomizes, accelerates, and directs the solution aerosol. The system is operated to produce a cone of vaporizing/emitting analyte atoms inside the arc plume about 1 to 3 mm above the arc conduction channel. Line-to-background ratios of about 10 are found as compared to values less than 1 when the analyte atom cone is located below the arc apex. Analytical curves are linear for concentrations between 100 and 0.5 ppm. Detection limits are in the low ppb range. Dissert. Abstr.

N80-29445 Michigan Univ., Ann Arbor.
DEVELOPMENT AND EVALUATION OF COHERENT RAMAN SPECTROSCOPY IN THE CONDENSED PHASE Ph.D. Thesis
Gary Patrick Ritz 1980 189 p
Avail: Univ. Microfilms Order No. 8017347

The development and evaluation of two coherent Raman techniques (coherent anti-Stokes Raman spectroscopy and ac-coupled inverse Raman spectroscopy) is discussed. Also, a detailed description of a microprocessor-controlled data acquisition system for pulsed laser spectroscopy is given. From the basic theory behind the nonlinear response of matter to intense electric fields, the generation of coherent anti-Stokes Raman spectroscopy (CARS) is derived in order to describe its drawbacks and unusual effects. Particular attention is paid to the aqueous solution detection limits of CARS, which are about 100 times higher than those obtained by spontaneous Raman. The ac-coupled inverse Raman spectroscopy technique is shown to give spectra which are exactly analogous to spontaneous Raman spectra. Suitable experimental conditions for this technique are discussed and aqueous solution detection limits only 5 times higher than those for spontaneous Raman spectroscopy are demonstrated. Theoretical calculations indicate that detection limits 50 times lower than spontaneous Raman limits may be achieved using refined procedures and apparatus. Dissert. Abstr.

N80-29446 Duke Univ., Durham, N. C.
CHEMICALLY REVERSIBLE COVALENTLY BONDED STATIONARY PHASES FOR LIQUID CHROMATOGRAPHY Ph.D. Thesis
Susan Marshall 1980 150 p
Avail: Univ. Microfilms Order No. 8017146

Four polyazanaphthalene chemically bonded stationary phases were synthesized and characterized. A series of bonded phases, in which the number of nitrogen atoms increase from one (quinoline) to three (1,3,8-triazanaphthalene), was studied with a two fold objective: (1) to study a new family of potential charge-transfer acceptors for incorporation into a bonded phase; and (2) to develop a chemically bonded stationary phase in which the selectivity of the bonded phase could be varied through chemically reversible modification of the bonded organic moiety. Chemical reversibility of the bonded phase was achieved via pH modification of the mobile phase. In order to clarify the pH dependent behavior of the chemically bonded polyazanaphthalene stationary phases, the pH dependent solution in the four bonded phases, model compounds of the bonded organic moieties were synthesized. Dissert. Abstr.

N80-29447 State Univ. of New York at Stony Brook.
PHASE TRANSITIONS IN FeS AT HIGH-TEMPERATURES AND HIGH PRESSURES Ph.D. Thesis
Hubert Ellis King, Jr. 1979 192 p
Avail: Univ. Microfilms Order No. 8009601

The results of single crystal X-ray diffraction electrical resistivity and 37FE Mossbauer spectra measurement across several polymorphic transitions of FeS at elevated temperatures and pressures are given. In addition, a tentative pressure temperature phase diagram for FeS is presented. Room temperature 57FE Mossbauer spectra were measured on powdered samples enclosed with a diamond cell at pressures up to 142 kbar. Two transitions were observed. The 34 kbar transition results in a decrease in the magnetic exchange interaction with a negligible change in electron distribution. The 67 kbar transition causes a substantial redistribution of electrons and destroys the magnetic ordering. X-ray diffraction measurements show that at both the 140 C transition and the 34 kbar one, troilite transforms to a MnP-type structure. Refinement of the structures before and after the transition show that the MnP-type structure is less distorted than that of troilite. However, the high pressure MnP-type structure is more distorted than the one at high temperature. At higher temperatures, the MnP-type structure undergoes a second order transition to a NiAs type structure. Electrical resistivity measurements show that transition, FeS becomes a high resistance metal with nearly temperature independent resistivity. Dissert. Abstr.

N80-29448 Rice Univ., Houston, Tex.
DESIGN AND DEVELOPMENT OF GENERALIZED APPARATUS TO STUDY THE PHASE AND VOLUMETRIC BEHAVIOR OF PURE COMPONENTS AND MIXTURES AT ADVANCED TEMPERATURES AND PRESSURES, AND ANALYTICAL EXAMINATION OF THE RESULTING OBSERVATIONS Ph.D. Thesis
Pervaiz Nasir 1980 179 p
Avail: Univ. Microfilms Order No. 8018073

A generalized apparatus was designed and developed to measure high temperature high pressure vapor liquid equilibrium (VLE) gas solubility, and pressure volume temperature (PVT) data for compounds and mixtures which are of interest in coal liquefaction processes. The heart of the apparatus was a novel variable volume equilibrium cell which consisted of a precision positive displacement pump in which the pump cylinder itself was utilized as the equilibrium cell. VLE data on H2 Tetralin systems were measured at 150, 189.6, and 268.7 C. The pressure range was 19.5 to 321.43 atm. The solubility of H2 in m 2-epthylanthraquinone was measured at 150 to 224.6 C. Compressibility factors were measured for benzene at 158.56, 181.58, and 202.64 C. The saturated molar volumes at each temperature were obtained from the intersection of each isotherm with the respective vapor pressure. Dissert. Abstr.

N80-29449 Michigan Univ., Ann Arbor.
MODIFICATION OF THE CATALYTIC PROPERTIES OF IRON AS DETERMINED BY MOESSBAUER SPECTROSCOPY Ph.D. Thesis
Shrihari Vassudeva Borcar 1980 209 p
Avail: Univ. Microfilms Order No. 8017223

The techniques of conversion electron Moessbauer spectroscopy (CEMS) and Transmission Moessbauer Spectroscopy (TMES), were used in heterogeneous catalysis research to study the influence of metallic additives to Fe. Two separate studies were conducted with CEMS, one dealing with Fe57/Fe56/quartz film sandwiches, and the other dealing with Fe, Fe-Pd, Fe-Au thin films. The TMES study was used to determine the extent of bimetallic cluster formation in supported bimetallic systems. The reactions studied were NH3 decomposition, NO decomposition and NO reduction by H2. Dissert. Abstr.

N80-29450 Rice Univ., Houston, Tex.
AN ANALYSIS OF MELTING WITHIN A HORIZONTAL CYLINDRICAL ENCLOSURE Ph.D. Thesis
Dianne Wheatley Nicholas 1980 95 p
Avail: Univ. Microfilms Order No. 8018077

The melting process for a phase change material in which the solid density is greater than that of the liquid was examined. The effect of unequal densities on the shape and location of the solid liquid interface for a system within a horizontal cylindrical enclosure was investigated. This model offered a solution for the coupled conduction and interface balance equations for the three problems of constant wall temperature, constant heat flux, and constant heat transfer coefficient imposed at the cylinder surface. The numerical method of finite difference was used to solve the system of governing equations. In the solution of the conduction equation, the implicit alternating direction technique was implemented. It is proposed that the heavier solid phase drops to the base of the cylinder as it melts, and maintains a position antisymmetric with respect to the cylindrical axis. To check the validity of this, experimental tests were made in which the interface position was photographed at selected time intervals. These photographs indicated that the mathematical model is physically justified. Dissert. Abstr.

N80-29451 Catholic Univ. of America, Washington, D. C.
COMPOSITION AND TEMPERATURE DEPENDENCE OF SHEAR VISCOSITY OF HYDROCARBON MIXTURES Ph.D. Thesis
Mohammad Adel Hadadi 1980 106 p
Avail: Univ. Microfilms Order No. 8018359

The effects of temperature and composition on the shear viscosities of blends of hydrocarbons of the type found in jet fuel kerosenes was investigated. The combined temperature composition dependence of viscosities of five pure C10 hydrocarbons and their different mixtures and of binary C10-C14 hydrocarbon system were studied, and the results evaluated. Dissert. Abstr.

N80-29452 Michigan Univ., Ann Arbor.
INSTRUMENTATION FOR COHERENT RAMAN SPECTROSCOPY Ph.D. Thesis
David Joseph Wallan 1980 157 p
Avail: Univ. Microfilms Order No. 8017395

The design and construction of a pulsed dye laser for coherent anti-Stokes Raman spectroscopy (CARS) experimentation as well as the fundamental principles involved in such a project are presented. The laser is a Hansch configuration for transverse nitrogen laser pumping. It includes an intracavity polarizer, beam expanding telescope and diffraction grating end reflector. Typical output powers are about 15 kW, with a spectral bandwidth of about 0.05 nm. The CARS peak height ratios, variable bandshapes, band interference effects and polarized spectra are shown and their relationship to spontaneous Raman spectroscopy is discussed. The complex concentration dependence of CARS signal intensity is also demonstrated using aqueous KNO3 solutions. A concentration series from 2.6 M down to a detection limit of 0.05M is used to show a linear calibration curve at low concentrations and a square law dependence for more concentrated solutions. Dissert. Abstr.

N80-29453 Connecticut Univ., Storrs.
AN ESR STUDY OF RADICALS IN A ZEOLITE MATRIX Ph.D. Thesis
David Edward Audette 1979 180 p
Avail: Univ. Microfilms Order No. 8017011

Electron Spin Resonance (ESR) studies were done on simple olefinic compounds adsorbed in cation exchanged synthetic zeolites, primarily cerium exchanged Y type zeolite. It was observed that a low concentration of olefin gave rise to additional hyperfine structure. However, this fine structure was not resolvable when the concentration was increased. Studies of the time dependence of this fine structure indicate complex radicals are formed by radical reaction. Due to characteristic differences in ESR structure, which were related to the olefin structure, one can rule out radical-zeolite interaction as the cause of the fine structure. Measurements on the quantity of radicals produced from known amounts of adsorbed olefin were made to determine the extent of radical reaction or interaction. Some radical structures were proposed as possible explanations for the spectra observed but the actual structure could not be conclusively assigned. Dissert. Abstr.

N80-29454 Florida State Univ., Tallahassee.
MAGNETIC CIRCULAR DICHROISM OF METAL OXIDES ISOLATED IN NOBLE GAS MATRICES Ph.D. Thesis
David Hinton Powell 1979 193 p
Avail: Univ. Microfilms Order No. 8016573

The diatomic oxides of Groups 4B and 5B were isolated by condensation of a molecular beam of the monoxides with rare gases at 14 K. Zero field absorbance (ZFA) and magnetic circular dichroism (MCD) spectra were obtained for all six molecules. The results obtained for TiO, ZrO and HfO were analyzed. An apparatus for the preparation of rare gas matrices containing high temperature metal oxides was constructed. The ZFA and MCD spectra were obtained using a computer controlled system, and data were stored on magnetic tape cassettes. The ZFA spectra were obtained using a double beam technique employing a single detector, two light beams modulated at different frequencies, and two lock in amplifiers. The MCD spectra were obtained using a low field electromagnet (5500 gauss), a photoelastic modular, and a feedback circuit which controlled the detector gain to correct for variations in the background light intensity. Dissert. Abstr.

N80-29455 Connecticut Univ., Storrs.
THE APPLICATION OF COUPLED CHROMATOGRAPHY TO THE ANALYSIS OF ANTIOXIDANTS IN POLYOLEFINS Ph.D. Thesis
Robert Bernard Walter 1980 193 p
Avail: Univ. Microfilms Order No. 8017036

An extractionless method for the analysis of multicomponent stabilized systems in polyolefins is described. The technique involves coupling preparative exclusion chromatography with analytical high performance liquid solid chromatography. The literature on lifetime prediction of antioxidant efficacy in polymers is critically reviewed. Methods employed for analyzing antioxidants are presented, with a compilation of previous liquid chromatographic applications. Dissert. Abstr.

N80-29456 Connecticut Univ., Storrs.
FUNDAMENTAL STUDIES OF THE EFFECT OF VARIOUS STRESSES ON THE MOLECULAR WEIGHT AND THE MOLECULAR WEIGHT DISTRIBUTION OF POLYOLEFINS Ph.D. Thesis
Chaisagna Taeratanachai 1979 217 p
Avail: Univ. Microfilms Order No. 8017064

Factors affecting the precision of high temperature gel permeation chromatography were analyzed by comparison of results from various chromatographs. The instrumentation, experimental procedure and method of calibration were evaluated. Ultrahigh molecular weight polymers were tested for thermal stability during high temperature operation. The effect of permeation process and shear degradation in the column were determined. The combined effects of thermal and shear stresses on the molecular weight and the molecular weight distribution from extrusion experiments were carried out by high temperature gel permeation chromatograph. Aged cables that failed in service with various length of time due to the combined effects of electrical and environmental stresses were examined. Measurements of the molecular weight and comparison were made for the controlled cable samples and the cables that failed in service to elucidate the change in the internal structure of polyolefins during the course of degradation. Dissert. Abstr.

N80-29457 Illinois Univ., Urbana-Champaign.
PICOSECOND STUDIES OF UNIMOLECULAR REACTIONS Ph.D. Thesis
Kevin Konrad Smith 1980 273 p
Avail: Univ. Microfilms Order No. 8017985

The construction of an apparatus which allows resolution of events on the picosecond timescale was investigated. The streak camera was used as the primary detector. Video detection was used to detect signals from the streak camera. A two dimensional digitizer was used to acquire the data from the video detector. This data was then fed to a microcomputer which stores, analyzes and displays the digitized signals. Use of a computer interactive with the two dimensional digitizer allowed large signal to noise enhancements. Dissert. Abstr.

N80-29458 Lawrence Univ., Appleton, Wis.
GAS-CHROMATOGRAPHIC CHARACTERIZATION OF ADSORBENT CELLULOSE SURFACES Ph.D. Thesis
Peter August Mazurak 1979 161 p
Avail: Univ. Microfilms Order No. 8017863

An approach for characterizing adsorbent surfaces based on direct use of gas chromatographic retention data was studied. A surface adsorption index (SAI) was defined as the difference in retention volumes between large and very small injections of adsorbate on an adsorbent packed column. Mechanisms of absorbate transport along the column are considered and it is shown that the proposed SAI values should be predominately influenced by sorbate-surface interactions. The general behavior of surface adsorption indices was investigated and SAI characterization of a surface was compared with results of thermodynamic analyses of adsorption isotherms. Results have shown SAI values to be strongly dependent on adsorbate-adsorbent interactions. The SAI values were found to be directly proportional to adsorbent mass and specific surface area. These indices were independent of carrier gas flow rate, density of column packing, or column length as long as the column diameter remained constant. Temperature dependence was neither linear nor logarithmic since various thermal factors influenced transport of different concentrations of adsorbate along the column. Dissert. Abstr.

N80-29459 Illinois Univ., Urbana-Champaign.
RAMAN SPECTROSCOPY OF DENSE FLUIDS. TEMPERATURE AND PRESSURE EFFECTS ON VIBRATIONAL RELAXATION, MOLECULAR-REORIENTATION AND SPECTRAL FREQUENCIES Ph.D. Thesis
Paul Theodore Sharko 1980 157 p
Avail: Univ. Microfilms Order No. 8017980

This work reports measurements of the Raman spectra of the Si-CH3 and C-H stretching modes of tetramethylsilane, the C-H stretching mode of fluoroform, and the C = O stretching

mode of acetone. All spectra were measured under independently varied conditions of temperature and pressure. The isotropic spectra of tetramethylsilane were measured at temperatures from 0 to 100 C and at pressures up to 4000 bar. It was found that the spectral widths of the Si-CH3 stretching mode are determined by a dephasing mechanism of vibrational relaxation but the widths of the C-H stretching mode are determined by inhomogeneous vibrational broadening. The pressure and temperature dependence of vibrational frequency are also tabulated and are found to follow a trend similar to that seen in other molecules. Both polarized and depolarized spectra of fluoroform were taken from 0 to 100 C and at pressures up to 2000 bar. The pressure and temperature dependence of the isotropic spectral widths were found to agree well with the predictions of the vibrational dephasing mechanism. Dissert. Abstr.

N80-29460# Materials Research Labs., Melbourne (Australia).
THE DENSITY OF SEAWATER: SOME PRACTICAL RELATIONSHIPS
Daniel J. Whelan. May 1980. 22 p. refs.
(MRL-TN-437; AR-002-158). Avail: NTIS. HC A02/MF A01.

Traditionally, the density of seawater as a function of temperature and salinity at atmospheric pressure is discussed in terms of the density function, Sigma-T. Some simplified mathematical relationships are presented from which changes in Sigma-T can be predicted from changes in temperature and salinity. However, density is also affected by pressure and an accurate treatment of the density of seawater within a deep ocean water mass requires a more sophisticated approach. One such treatment and the results obtained from it are outlined. A.R.H.

N80-29461*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SPECTROSCOPIC STUDY OF INTERMEDIATES IN THE CONDENSATION OF REFRACTORY SMOKES: MATRIX ISOLATION EXPERIMENTS SiO
Raj K. Khanna (Maryland Univ., College Park), David D. Stranz (Maryland Univ., College Park), and D. Donn. [1980]. 28 p.
(Grant NsG-5172)
(NASA-TM-81128). Avail: NTIS. HC A03/MF A01. CSCL 07D.

The infrared and Raman spectra of N2 matrix isolated silicon oxides are investigated. The vibrational frequencies of SiO, Si2O2, and Si3O3 were identified and assigned on the basis of normal coordinate analyses. Heating the solid to 50 K (evaporating the matrix) leaves a residue whose infrared spectrum is identical to that of a smoke condensed at ambient temperatures. Further heating of the sample to 500 K leads to significant changes in the band shapes. Investigations of the infrared spectra at several stages of the diffusion process result in the proposal of a mechanism for the transition from molecular properties to those of the residue (bulk) material, which is characterized as Si2O3. M.G.

N80-29462*# Maryland Univ., College Park. Dept. of Chemistry.
ABSORPTION AND RESONANCE RAMAN SPECTRA OF Pb2, Pb3 AND Pb4 IN XENON MATRICES
David D. Stranz and Raj K. Khanna. [1980]. 16 p. refs.
(Grant NsG-5172)
(NASA-CR-163428). Avail: NTIS. HC A02/MF A01. CSCL 07D.

Lead metal was vaporized and trapped in solid xenon at 12K. Electronic absorption and resonance Raman spectra were recorded of the resulting matrix, which was shown to contain Pb2, Pb3, and possibly Pb4 molecular species. The vibrational frequency for Pb2 is determined to be 108/cm for the ground state, with a dissociation energy of 82000/cm. Ad3h symmetry is indicated for the Pb3 species, with nu sub 1 = 117/cm and nu sub 2 = 96 /cm. The existence of Pb4 is suggested by a fundamental and overtone of 111/cm spacing. Author

N80-29463*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE SPECTRAL OPACITY OF TRIATOMIC CARBON MEASURED IN A GRAPHITE TUBE FURNACE OVER THE 280 TO 600 nm WAVELENGTH RANGE
Walter L. Snow and William L. Wells. Jul. 1980. 24 p. refs.
(NASA-TM-81837). Avail: NTIS. HC A02/MF A01. CSCL 07D.

The opacity of linear triatomic carbon (C3) was measured in a graphite tube furnace from 280 to 600 nm to supplement the earlier measurements of Brewer and Engelke. The spectral cross section was estimated from the opacities using temperature profiles determined pyrometrically and a revised heat of formation delta H = 198 kcal/mole). The cross section was found to be nonnegligible over the range 300 to 500 nm and the electronic oscillator strength based on the total cross section estimate was 0.02. Author

N80-29464# Rome Air Development Center, Griffiss AFB, N.Y.
ELECTROLYTIC SEPARATION OF AL3Ni FIBERS FROM THE EUTECTIC ALLOY, AlAl3Ni
Kenneth P. Quinlan and Joseph J. Hutta. Dec. 1979. 25 p. refs.
(AF Proj. 2306)
(AD-A085569; RADC-TR-79-329). Avail: NTIS. HC A02/MF A01. CSCL 07/4.

An electrolytic procedure was developed to remove the trialuminum nickel fibers from the aluminum matrix in the eutectic alloy, Al-Al3Ni. The procedure consists of electrolyzing the aluminum matrix at potentials ranging from -0.8 to -0.5 volt (vs. S.C.E.) in a 1M potassium hydroxide electrolyte. Scanning electron photomicrographs showed that the separated Al3Ni fibers are intact. Anodic polarization studies with aluminum-nickel alloys illustrated that the presence of nickel protects aluminum from oxidation. Studies with a special fabricated platinum electrode demonstrated that the Al3Ni fibers are not oxidized within the potential range of -0.8 to -0.5 volt (vs. S.C.E.) in a 1M potassium hydroxide electrolyte. This decreased rate of oxidation of aluminum in the Al3Ni fibers is correlated with the low rate of diffusion of the aluminum in the Al3Ni orthorhombic crystals. The procedure does not require the stringent conditions as in other methods of producing Al3Ni fibers from eutectic alloys. The method has the additional advantage of being applicable to a continuous process where the fibers can be removed and the electrolyte replenished. GRA

N80-29465# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.
MULTICOLOR ELECTROCHROMIC DOT-MATRIX DISPLAY INVESTIGATION. Final Report, 1 Jul. 1979 - 31 Mar. 1980
M. M. Nicholson, F. A. Pizzarello, and T. J. LaChapelle. Jun. 1980. 51 p. refs.
(Contract N00014-79-C-0434)
(AD-A085453; C80-325/501). Avail: NTIS. HC A04/MF A01. CSCL 07/4.

The feasibility of multicolor electrochromic dot-matrix displays based on lutetium diphthalocyanine was investigated on the premise that integrated matrix drive electronics for such devices will become available in several years. A 3 x 3 inch display panel with switchable 5 x 7 dot characters was attractive and clearly legible at 24 lpi. Viewing was hardly impaired when a metal mesh overlay simulating the appearance of matrix drive circuitry was placed in registry with the dot pattern. Color resolution and memory were demonstrated for adjacent red/green, blue/green, and red/blue areas in the matrix. Current and charge transients were recorded for constant-voltage pulses applied to areas representing 2 to 16 dots. Time constants of 10 to 20 ms were typical of the green-to-red electrochromic transition. An effective capacitance of approximately 1000 microform/sq cm arose from the electrochemical reaction of the dye film. Also associated with that process was an area resistance, usually less than 25 ohms sq cm. Further development of multicolor electrochromic dot-matrix displays is recommended. GRA

N80-29466# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
X-RAY PHOTOELECTRON SPECTROSCOPIC STUDIES OF ELECTRODE SURFACES. Final Report, 14 Jan. 1977 - 14 Dec. 1979
Nicholas Winograd. 15 Apr. 1980. 19 p. refs.
(Grant AF-AFOSR-2974-76; AF Proj. 2303)
(AD-A085311; AFOSR-80-0420TR). Avail: NTIS

HC A02/MF A01 CSCL 07/4

Emphasis is on the development of X-ray photoelectron spectroscopy (XPS) in characterizing electrochemical reaction mechanisms. The advantages of XPS to the study of electrode surfaces are the depth sensitivity to most metals is quite high with the escape length of the emitted electrons occurring only through 10-20A of the sample surface. The measured binding energies are sensitive to the oxidation state of the metal atom. Under potential deposition for the silver and copper on platinum electrodes have been examined by both XPS and Auger spectroscopy. A combination of XPS and secondary ion mass spectrometry (SIMS) was designed and connected with two satellite vacuum systems via a set of magnetically driven transfer device. This configuration allowed each technique to have its own chamber for electrode preparation. High energy ion beams were investigated for use in the ion implantation of various substrates aimed at creating new materials with unusual properties. Initial studies were focused on use of copper, silver, and gold ion beams directed toward silicon dioxide and graphite. GRA

N80-29467# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.

NITROGEN ISOELECTRONIC TRAPS IN GALLIUM ARSENIDE PHOSPHIDE AND ALUMINUM GALLIUM ARSENIDE Ph.D. Thesis

Donald James Wolford, Jr. Nov. 1979. 404 p. refs.

(Contract N00014-79-C-0424)

(AD-A085314; R-862; UILU-ENG-78-2255) Avail: NTIS HC A18/MF A01 CSCL 07/4

The results presented here form the basis for reinterpreting N-trap luminescence in GaAs sub 1-x P sub x and Al sub x Ga sub 1-x As. Previously the luminescence of these centers in ternary alloys was attributed to NN pairs. For the isolated N center, only one bound state was identified, and that corresponded to the A-line in GaP (or AlAs). On the basis of the new data, it is now clear that dominant emission (termed N sub x) is due not to NN pairs but to isolated N and previously ignored phonon coupling. Furthermore, in GaAs sub 1-x P sub 1-x it is found an additional shallow bound state associated largely with the gamma sub 1 band minimum is found. GRA

N80-29468# Eagle-Picher Co., Joplin, Mo. Couples Dept.

CADMIUM ELECTRODE INVESTIGATION Final Report, 16 Jul. - 4 Dec. 1979

Erwin Buck. Mar. 1980. 12 p. refs.

(Contract F33615-79-C-2056; AF Proj. 3145)

(AD-A085669; AFWAL-TR-80-2008) Avail: NTIS HC A02/MF A01 CSCL 07/4

Methods for improving the loading and utilization of active material in electrochemically impregnated cadmium electrodes were studied using sweep voltametry and galvanostatic pulse impregnation. Loading levels and utilization were found to decrease with cycling when the potentiostatic pulse method was used and impregnation times beyond one hour resulted in unacceptable surface loading. The use of galvanostatic pulse impregnation appeared to offer greater promise; however, solution composition, temperature and the pulse regime remain to be optimized. Several areas are recommended for further study including understanding of the cathodic processes, the economics of the counter electrode, solution pH control, definition of the process parameters and the effect of plaque pore morphology on loading efficiency. GRA

N80-29469# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.

ELECTRICAL CONDUCTIVITY AND INFRARED RADIOMETRY OF STEAM Special Publication, Jul. 1977 - Sep. 1978

Hugh R. Carlson. Apr. 1980. 33 p. refs. Supersedes ARCLS-TM-79006

(DA Proj. 1T1-61101-A-91A)

(AD-A085714; AD-E410262; ARCLS-SP-80006; ARCLS-TM-79006) Avail: NTIS HC A03/MF A01 CSCL 07/4

In-house laboratory independent research investigations of molecular clustering in water vapor included careful measurements of the electrical and infrared radiometric properties of steam and steam-humidified air. These measurements showed that 10 to the 6th power to 10 to the 7th power ions per cubic centimeter are present in steam or in steam-generated water vapor compared to 100 to 300 ions per cubic centimeter in water vapor under normal ambient conditions. These data, combined with infrared spectral observations of steam, are giving new insights into the understanding of the vapor-liquid phase transition in water. The results are important in meteorology, weather and climatology, and they have military implications. GRA

N80-29470# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE DETAILED MODELING OF PREMIXED, LAMINAR STEADY-STATE FLAMES TO OBTAIN VALIDATED REACTION NETWORKS. 1: OZONE

Joseph M. Heimerl and Terence P. Coffee. Apr. 1980. 51 p. refs.

(DA Proj. 1L1-61102-AH-43)

(AD-A085722; AD-E430448; ARBRL-TR-02239) Avail: NTIS HC A04/MF A01 CSCL 21/2

We have employed species dependent input coefficients for the test case ozone in a one dimensional model of a premixed, laminar steady-state flame. Convenient expressions for the input coefficients are developed. These coefficients are based on independent measurements, i.e., no arbitrary parameters are used in this model. The governing equations are solved using a relaxation technique and the partial differential equation package, PDECOL, developed by Madsen and Sincovec. Species and temperature profiles and the burning velocities are found over the range of initial ozone mole fraction of 0.25 to 1.00. The computed burning velocities are no more than 30% greater than the measurements of Streng and Grosse. Comparison with the computed results of Warnatz shows agreement within plus or minus 12%, even though he used quite different expressions for some of the kinetic coefficients. These differences are manifest in the atomic oxygen and temperature profiles at an initial ozone mole fraction of unity. A comparison of the model profiles indicates a need for measurements of ab initio calculations for the rate coefficient for the reaction O3 + O yields 2 O2 at temperatures in the range 1500-2000 K. GRA

N80-29471# California Inst. of Tech., Pasadena. Chemistry and Chemical Engineering Div.

FUNDAMENTAL PROCESSES OCCURRING AT ELECTRODES Final Report, 1 May 1977 - 30 Apr. 1980

Fred C. Anson. Jan. 1980. 9 p. refs.

(Grant DAAG29-77-G-0092)

(AD-A086071; ARO-14577.3-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

The research program in electrochemistry reported here has concentrated on electrode kinetic studies at low ionic strengths, on methods for attaching molecules to electrode surfaces and on the electrochemical responses obtained from reactants confined to electrode surfaces. Brief summaries of the results obtained in each area are given. GRA

N80-29472# Virginia Polytechnic Inst. and State Univ., Blacksburg.

DEVELOPMENT AND APPLICATION OF ANALYTICAL TECHNIQUES TO CHEMISTRY OF DONOR SOLVENT LIQUEFACTION Quarterly Progress Report, Mar. - May 1979

A. M. Squires, H. C. Dorn, L. T. Taylor, J. G. Dillard, and P. R. Rony. Sep. 1979. 34 p. refs.

(Grant EF-77-G-01-2696)

(FE-2696-T4; QPR-7) Avail: NTIS HC A03/MF A01

Major effort concentrated on separation studies of small model compounds and selected fractions of coaly matter via gel permeation chromatography in tetrahydrofuran (THF), chloroform (CHCl3) and pyridine solvents. Molecular weights were determined for materials totally excluded and totally permeated in four soft gels which differ in percent cross-linking. A large number of compounds especially N-alkylated anilines exhibit a nonsize exclusion mechanism of separation. Exclusion limits in pyridine appears to be considerably greater than in THF or CHCl3 for n-alkanes. Results with these soft gels were compared with data obtained on rigid gels. The feasibility of nuclear magnetic

resonance (NMR) for the liquid chromatographic detection, functional group analysis via F-19 NMR of select coaly fractions, and liquefaction experiments in our micro-autoclave reactor are discussed. DOE

N80-29473# Pittsburgh Univ., Pa.
HYDROGEN DISTRIBUTION AND TRANSFER IN COAL HYDROGENATION SYSTEMS Quarterly Report, Dec. 1979 - Feb. 1980
S. H. Chiang and G. E. Klinzing. Mar. 1980. 9 p.
(Contract DE-AC22-80PC-30014)
(DOE/PC-30014/1) Avail: NTIS HC A02/MF A01

Development of an in-situ H2 probe and experimental data of equilibrium distribution and rate of transfer of hydrogen in coal hydrogenation systems is proposed. Specific topics discussed include: (1) a thin nickel-membrane probe for in-situ hydrogen measurement; (2) equilibrium solubility data for hydrogen in coal liquids; (3) dynamic behavior and rate of hydrogen transfer in coal liquids and to examine the rate limiting steps of the process; (4) the physical/chemical effect due to the addition of coal on the equilibrium distribution of hydrogen in coal liquids; and (5) the rate of transfer of hydrogen between the gas phase and the condensed phase (which contains coal liquids and dissolved coal). DOE

N80-29474# Westgate Research Corp., Los Angeles, Calif.
AN INVESTIGATION INTO THE CHEMISTRY OF THE UV-OZONE PURIFICATION PROCESS
Eriks Lertis. 8 Feb. 1980. 218 p. refs.
(Grant NSF ENV-76-24652)
(PB80-174394; NSF/RA-800023) Avail: NTIS HC A10/MF A01 CSCL 07D

The synergistic effect of ozone and UV light in the decomposition of organic compounds in water is studied. The nature and quantities of oxidation products by ozonation, UV-ozonation, and hydroxyl radical oxidation were assessed to understand the UV-ozonation mechanism. Nitrobenzene was selected as the primary model compound. This model compound followed an identical sequence of reactions in both O3 and UV/O3 oxidation via mono-, di-, and trihydroxylation of the benzene ring; the major stable intermediates were oxalic acid, formic acid, and glyocal. The ratios of O-, M-, and p-R-phenols produced by ozonation and UV-ozonation of nitrobenzene and chlorobenzene were almost identical. Various mono-, di-, tri-, and tetra-substituted benzene derivatives were studied using the oxidation regimes. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-29475 Rice Univ., Houston, Tex.
THE SINGLE CRYSTAL ELASTIC CONSTANTS OF THE TANTALUM-TUNGSTEN ALLOY SYSTEM FROM 4.2 TO 300 Ph.D. Thesis
Charles Edward Anderson. 1980. 149 p.
Avail: Univ. Microfilms. Order No. 8018028

The three single crystal independent elastic constants c sub 11, c sub 12, and c sub 44 were measured over the temperature range 4.2 K to 300 K for tantalum, tungsten and five intermediate alloys. Anomalies were found for the shear constant c sub 44 as functions of both temperature and composition. These appear to be interrelated. A similar, but less pronounced effect was found for the shear constant C prime as a function of temperature at about the same composition as for c sub 44. These anomalies were centered at approximately 50 percent tungsten. The interatomic force constants for nearest and second nearest neighbors were calculated. The Debye temperatures were calculated using the Kubic Harmonics method. The dependence upon c sub 44 for the Debye temperature calculations is reflected upon the results. No calorimetric data was available for comparison. The Ta-W system was found to be isotropic to within about 5% from 50% tungsten to pure tungsten. The system also shows a remarkable adherence to the Cauchy relation if the long range forces are considered. Dissert. Abstr.

N80-29476 Michigan Univ., Ann Arbor.
FRACTURE TOUGHNESS OF AISI M2 HIGH-SPEED STEEL AND CORRESPONDING MATRIX TOOL STEEL Ph.D. Thesis
Chongmin Kim. 1980. 115 p.
Avail: Univ. Microfilms. Order No. 8017294

The influence of microstructural variations on the fracture toughness of two tool steels with compositions 6%W-5%Mo-4%Cr-2%V-0.8%C (AISI M2 high speed steel) and 2%W-2.75%Mo-4.5%Cr-1%V-0.5%C (VASCO MA) was investigated. Samples of the two steels were heat treated to produce a wide range of microstructure, hardness, and fracture toughness values. In the as-hardened condition, the M2 steel has a higher fracture toughness than the MA steel, although the latter steel is softer. In the tempered condition, the MA steel has a higher fracture toughness than M2. When the hardening temperature is below 1095 C (2000 F), tempering of both steels causes embrittlement. Tempering results in a reduction of fracture toughness as well as hardness. The fracture toughness of both steels was found to be enhanced by increasing the grain size. Tempering temperature has no effect on the fracture toughness of M2 and MA steels as long as the fuel tempered hardness of the steels is constant. There is a temperature of austenitization for each tool steel after which the retained austenite content in the as quenched samples is a maximum. An analytical procedure for estimating volume fractions of carbides was developed. Dissert. Abstr.

N80-29477 Case Western Reserve Univ., Cleveland, Ohio.
CARBURIZATION OF LOW CARBON STAINLESS STEEL CASTING SURFACES Ph.D. Thesis
Pedro Canete Sigala. 1980. 144 p.
Avail: Univ. Microfilms. Order No. 8013832

Procedures to minimize the carbon absorption at the surface of low carbon stainless steel castings produced in mold with organic binders were investigated. The amount of carbon pickup was determined at the surface of CF3M stainless steel castings poured in step block molds with thicknesses of one to three inches, six inch cube blocks with various inserts and one inch thick valve castings produced in shell molds. The organic binders studied included alkyd-resin, shell molds with phenolic resin, furan and baked core oil. The carbon absorption was measured primarily by metallographic procedures with a few checks of carbon content at layers of 0.005 inch increments below the surface. The corrosion tests were conducted with boiling 65 weight percent nitric acid as the standard Huey test except that the cast surface was tested in both the as cast and solution condition. Dissert. Abstr.

N80-29478 Carnegie-Mellon Univ., Pittsburgh, Pa.
CONTRIBUTION TO THE PHYSICAL CHEMISTRY OF METAL-GAS AND METAL-ALUMINA INTERFACES Ph.D. Thesis
Bernard Michel Gallois. 1980. 318 p.
Avail: Univ. Microfilms. Order No. 8017452

The sessile drop method was used to investigate the energetics of metal gas and metal alumina interfaces. The surface tensions and the densities of Ag-Au-Cu alloys were determined from their liquidus temperatures to 1108 C. Surface tension minima, which are indicative of ordering phenomena found in the limiting binaries Ag-Cu and Ag-Au and in the two pseudobinary sections, investigated which correspond to atomic ratios of gold to silver equal to 0.4 and 2.5. A graphical method to determine relative adsorptions from thermochemical data and from surface tension isotherms was developed. Dissert. Abstr.

N80-29479 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE EFFECT OF DEFECTS ON THE FATIGUE CRACK INITIATION PROCESS IN TWO P/M SUPERALLOYS Ph.D. Thesis
John Michael Hyzak. 1980. 248 p.
Avail: Univ. Microfilms. Order No. 8017454

The effect of defect size, shape, and population on the fatigue initiation process in two high strength P/M superalloys, AF 115 and AF2 IDA were investigated. The specific alloy heats tested had contrasting defect populations: the AF 115 alloy contained a large population of spherical pores, and a lesser number of elliptical ceramic inclusions and plate like hafnium oxide inclusions, and the AF2 IDA material contained only a small population of the elliptically shaped inclusions. Strain

controlled fatigue tests were performed on uniform section specimens at 760 C, 649 C, and 22 C using both continuously cycling and cyclic dwell waveforms. The results indicate that at high strain ranges the track propagation phase of fatigue life was most critical and therefore, defect size and population were most important. At the lower strain ranges, the initiation phase of life was more critical in the overall fatigue process and defect shape was shown to be of primary concern. Dissert. Abstr.

N80-29480 Stanford Univ., Calif.
THE INFLUENCE OF GRAIN BOUNDARY SEGREGATION AND CAVITY FORMATION OF HIGH-TEMPERATURE FRACTURE OF SILVER AND COPPER Ph.D. Thesis
Tai-Gang Nieh 1980 134 p
Avail: Univ. Microfilms Order No. 8016855

The effects of grain boundary segregation and cavity formation on high temperature fracture of silver and copper were investigated. The thermodynamic and kinetic conditions for water vapor bubble formation in pure metals were reviewed. The technique of implanting water vapor bubbles in metals has proven to be a very useful tool for the study of intergranular cavity growth in metals at elevated temperatures. The tensile and creep properties of oxygen free and oxygen saturated polycrystalline copper were studied in the temperature range 25 C to 500 C. It is shown that oxygen increases the yield strength by a factor of 2 or 3, by solid solution hardening, and for coarse grained copper, causes a severe embrittlement, particularly under creep conditions. Both direct and indirect evidence indicates that the embrittlement is caused by the segregation of oxygen to the grain boundaries in copper, thus promoting grain boundary decohesion and intergranular fracture. Dissert. Abstr.

N80-29481 Illinois Univ. at Urbana-Champaign.
EFFECTS OF SURFACE OXIDATION ON VACANCY DEFECTS IN BETA NICKEL-ALUMINUM ALLOYS Ph.D. Thesis
Arvind Parthasarathi 1980 146 p
Avail: Univ. Microfilms Order No. 8018197

Transmission electron microscopy and Auger electron spectroscopy were used to make observations of the oxidation process in beta-NiAl alloys annealed under controlled conditions of temperature and oxygen partial pressure. Binary Ni-Al alloys, with nominally 47.5, 50.4 and 52.5 at. % Al, were examined. The Auger spectroscopy analysis showed that the predominant oxide formed on these alloys is Al_2O_3, with a possible thin intermediate layer of spinel. Bulk oxidation experiments indicate that the oxide grows by outward diffusion of cations to the oxide/gas interface. As a result of this diffusion, a counter-flow of vacancies occurs, and these vacancies are injected into the substrate. The vacancy injection results in formation and growth of existing vacancy dislocation loops and internal voids in thin foil samples. Vacancy loop growth rates increase with annealing time and also increase as the oxygen partial pressure is increased in accordance with a vacancy injection model. This vacancy injection takes place in the alloys tested here, at temperatures above about 600 C, even in ultra vacuum annealing atmospheres. An exception was found in the case of samples annealed at T = 850 C in UHV. Dissert. Abstr.

N80-29482 Pittsburgh Univ., Pa.
ANALYSIS AND MEASUREMENT OF SEGREGATION IN DIRECTIONALLY SOLIDIFIED NICKEL BASE SUPERALLOY Ph.D. Thesis
Ramasamy Sellamuthu 1980 293 p
Avail: Univ. Microfilms Order No. 8015384

Microsegregation and macrosegregation were examined in hafnium modified Mar-M200 superalloy. Microsegregation, measured by eutectic fraction was determined as a function of cooling rates. Macrosegregation, measured by eutectic fraction and local alloy content, was determined in regions of abrupt reductions in cross-section in directionally solidified cylinders. A plane front solidification technique was used to determine the partition ratio of several of the alloy elements in the nickel base superalloy. Explanations of the microsegregation and macrosegregation behavior were developed based on theories developed, originally, for less complex alloys and the fundamental data determined herein. With regard to the normal range of directional solidification conditions, it is shown that variations in the amount of eutectic are the result of macrosegregation. Dissert. Abstr.

N80-29483 Illinois Univ., Urbana-Champaign.
TRIBOLOGY AND MICRO-CHEMISTRY OF SPUTTER DEPOSITED COMPOSITE COATINGS ON HONED STEEL SUBSTRATES Ph.D Thesis
Lawrence Ching-Yu Wu 1980 151 p
Avail: Univ. Microfilms Order No. 8018219

The tribology and microchemistry of TiO_2-TiC composite coatings on chemically honed steel substrates was investigated. The primary wear resistant coatings (TiC) were deposited by radio frequency sputtering using a dc substrate bias and the solid lubricant coatings (TiO_2) were deposited in an Ar and O_2 mixed RF glow discharge. Chemically honed steel substrates which consisted of a checkerboard of raised squares separated by 1.5 micrometers m deep channels were prepared by photolithographic and masking techniques. A pin on disc apparatus was used to measure friction and wear characteristics of composite coatings. The composite coating chemistry was analyzed by Auger electron spectroscopy (AES): in addition, AES was used to characterize the wear transfer mechanism between steel and the composite coating. Dissert. Abstr.

N80-29484 Illinois Univ., Urbana-Champaign.
A MODEL FOR JOINING THE FATIGUE CRACK INITIATION AND PROPAGATION ANALYSES Ph.D. Thesis
Wen-Ching Chen 1980 126 p
Avail: Univ. Microfilms Order No. 8017920

An analytical model for nonarbitrarily defining the crack initiation length of a notched member on basis of the minimum total life estimate (Life-calculation method) is proposed. The crack initiation length is not a fixed value, as usually assumed, but varies with stress level (or life) notch size, notch geometry, and material. The partitioning of crack initiation life and crack propagation life is achieved using this model. An interpretation of fatigue notch size effect and a powerful means for numerically determining Neuber and Peterson parameters is provided. Dissert. Abstr.

N80-29485 Carnegie-Mellon Univ., Pittsburgh, Pa.
PHASE TRANSFORMATIONS AND PROPERTIES OF Ti-10V-2Fe-3Al Ph.D. Thesis
Thomas Walter Duerig 1980 304 p
Avail: Univ. Microfilms Order No. 8017451

The phase transformations, tensile properties and fatigue propagation resistance of the relatively new metastable Beta titanium alloy (Ti10V-2Fe-3A) are reported. The alternate omega reaction, the growth of isothermal omega, the precipitation of alpha and the stress assisted martensitic transformation from Beta to alpha double prime (orthorhombic) are considered. All of these reactions are discussed both in mechanistic terms, and in terms of processing history. The tensile properties of Ti-10V-2Fe-3Al in both the aged and unaged conditions are then discussed in view of the above phase transformations. Lastly, the fatigue crack propagation rate in high strength conditions of Ti-10V-2Fe-3Al is described as a variable of microstructure and stress intensity. It is shown that the primary microstructural variables are the alloy's primary alpha content, the extent of recrystallization, the omega phase, and the fine secondary alpha. Dissert. Abstr.

N80-29486 Kentucky Univ., Lexington.
THE SINTERING OF A SILICA SUPPORTED NICKEL CATALYST Ph.D. Thesis
Hai-Ku James Kuo 1980 162 p
Avail: Univ. Microfilms Order No. 8018247

The sintering behavior of a silica supported nickel catalyst was studied by following the changes in the average particle size and particle size distribution (PSI) function. Sintering of the supported nickel catalyst was carried out in nitrogen and hydrogen atmospheres at temperatures from 500 to 800 C for times varying from 1 to 100 hrs. An X-ray single profile analysis method has been employed to measure the average particle sizes, lattice microstrains and PSD functions of the supported nickel catalyst from the Ni(200) diffraction profiles. The PSD functions determined from the X-ray single profile analysis method were compared to those determined from transmission electron microscopy and an excellent agreement was obtained. Very

good agreement was also found when the PSDs were fitted to the lognormal distribution functions. Dissert. Abstr.

N80-29487# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
STRUCTURE AND PROPERTIES OF RAPIDLY SOLIDIFIED 2000 SERIES Al-Li ALLOYS
N. J. Grant, S. Kang, and W. Wang 20 May 1980 23 p refs Presented at the Intern. Conf. on Aluminum Lithium Alloys, Stone Mountain, Ga., 19-20 May 1980
(Contract N00014-78-C-0385; ARPA Order 3558)
(AD-A085354) Avail: NTIS HC A02/MF A01 CSCL 11/6

The literature appears convincing that of the Al-Li alloys, Al-Cu-Li provides stronger alloys than does Al-Mg-Li. Yet, such earlier studies were based on ingot technology where segregation problems could conceivably have worsened actual comparisons. Further, the phase diagrams for these two ternary systems are poorly known, especially if significant additions of Mn, Cd, Cr, Ti, Zr and other elements are made. In fact the Al-Cu-Mg-Li quaternary based on the 2024 alloy gave some rather excellent combinations of strength and toughness when the alloys were made from rapidly solidified (RS) particulates. Continuing alloy development, structure refinement, and property assessments, based on RS technology, are the basis of this study. Both 2020 and 2024 base alloys are being prepared by RS powder technology (ultrasonic gas atomization with quench rates of ten to the 4th power to ten to the 5th power K/s); lithium contents from about 1 to 3 weight percent are being studied at several different ratios of Cu to Li. Phase identification studies are being planned but only preliminary data are available. Mechanical properties (smooth bar tension tests) appear excellent for the Al-Cu-Li alloys, significantly better than for the 2024 base alloy. Notch toughness tests are still a problem even though improvements are being made. GRA

N80-29488# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DEVELOPMENT OF ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWDERS FOR AEROSPACE STRUCTURAL APPLICATIONS Interim Technical Report, 5 Sep. 1979 - 4 Feb. 1980
R. E. Lewis, I. G. Palmer, D. D. Crooks, H. Paris (Aluminum Co. of America), F. Billman (Aluminum Co. of America), E. A. Starke, Jr. (Georgia Inst. of Tech.), A. Gysler (Georgia Inst. of Tech.), E. E. Underwood (Georgia Inst. of Tech.), and R. Crooks (Georgia Inst. of Tech.) Mar. 1980 86 p refs
(Contract F33615-78-C-5203; ARPA Order 3417; AF Proj. 3417)
(AD-A085651; LMSC-D686125) Avail: NTIS HC A05/MF A01 CSCL 11/6

Advanced aluminum alloys are being developed that will provide majors payoffs in terms of weight savings for new aerospace structures. The two property goals are: (1) a 30 percent increase in modulus of elasticity-to-density ratio, and (2) a 20 percent increase in modulus of elasticity-to-density ratio plus a 20 percent increase in strength-to-density ratio, when compared to Al 7075-T76 and without a significant loss in other properties important for structural applications. The program is organized into three phases: (1) a fundamental alloy and process development study; (2) scale-up of two best alloys and (3) evaluation of mill product forms. GRA

N80-29489# Wisconsin Univ. - Milwaukee. Dept. of Physics.
ELECTROMIGRATION AND THERMOMIGRATION IN METALS Final Report, 30 Jun. 1976 - 31 Dec. 1979
Richard S. Sorbello 15 Feb. 1980 8 p refs
(Grant AF-AFOSR-3082-76; AF Proj. 2306)
(AD-A085524; AFOSR-80-0401TR) Avail: NTIS HC A02/MF A01 CSCL 20/17

The object of this research was to investigate theoretically the driving force for electromigration and thermomigration in metals. The driving force for electromigration was shown to be equal to the local electric field accompanying electron transport. The force was determined from the linear response expression of Kumar and Sorbello using both the Green's function formalism and the Kohn-Luttinger formalism. Corrections to previous force expressions were derived. The effects of atomic configuration on electromigration was investigated within a pseudoatom picture. Application was made to lattice distortion, fast-diffusers, grain boundaries and isotope effects. Calculations were made of the driving force in liquid-metal alloys and were found to be in agreement with experiment. The Kohn-Luttinger formalism was applied to electromigration in an inversion layer. The driving force for thermomigration was examined. A linear-response expression was derived for the electronic component of the driving force. GRA

N80-29490# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
STRESS CORROSION RESISTANCE OF 7010-T73651 Progress Report
L. A. Biggs Washington 16 Apr. 1980 14 p refs
(ZF61542001)
(AD-A086150; NADC-80038-60) Avail: NTIS HC A02/MF A01 CSCL 11/6

A 7010-T73651 Aluminum Alloy was compared to 7050-T73651 in stress corrosion and exfoliation tests. Results of a 30 day alternate immersion test in 3 1/2 percent NaCl indicate that 7010-T73651 has a threshold stress of 35 ksi (240 MPa) and is resistant to exfoliation. The threshold stress for cracking of the 7050-T73651 was 45 ksi (310 MPa). GRA

N80-29491# Oak Ridge National Lab., Tenn. Chemical Technology Div.
IODINE ADSORPTION ON STEEL IN HELIUM
M. F. Osborne and R. B. Briggs 1979 8 p refs Presented at the ANS Winter Meeting, San Francisco, 11-16 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791103-83) Avail: NTIS HC A02/MF A01

The equilibrium loading of iodine on low chromium alloy steel as functions of iodine partial pressure, temperature, and metal surface conditions were measured. Desorption rates as functions of temperature and He purity were found and the hazards of iodine release as related to licensing and operation were studied. DOE

N80-29492# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
CORROSION IN LITHIUM-STAINLESS STEEL THERMAL-CONVECTION SYSTEMS
P. F. Tortorelli, J. H. DeVan, and J. E. Selle 1980 22 p refs Presented at the 2d Intern. Conf. of Liquid Metal Technol. for Energy Systems, Richland, Wash., 20 Apr. 1980
(Contract W-7405-eng-26)
(CONF-800401-1) Avail: NTIS HC A02/MF A01

The corrosion of types 304L and 316 austenitic stainless steel by flowing lithium was studied in thermal convection loops operated at 500 to 650 C. Both weight and compositional changes were measured on specimens distributed throughout each loop and were combined with metallographic examinations to evaluate the corrosion processes. The corrosion rate and mass transfer characteristics did not significantly differ between the two austenitic stainless steels. Addition of 500 or 1700 wt ppM N to purified lithium did not increase the dissolution rate or change the attack mode of type 316 stainless steel. Adding 5 wt % Al to the lithium reduced the weight loss of this steel by a factor of 5 relative to a pure lithium-thermal-convection loop. DOE

N80-29493# National Technical Information Service, Springfield, Va.
FERROUS METAL CASTING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Apr. 1979
William E. Reed Apr. 1980 234 p
(PB80-808455) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

An updated bibliography is presented containing 161 abstracts. Major emphasis is placed on: iron and steel continuous casting; die and precision casting. R.C.T.

N80-29494# National Technical Information Service, Springfield, Va.
FERROUS METAL CASTING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, May 1979 - Apr. 1980
William E. Reed Apr. 1980 167 p Supersedes NTIS/PS-79/0475; NTIS/PS-78/0288

(PB80-808462; NTIS/PS-79/0475; NTIS/PS-78/0288) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Worldwide research is cited on iron and steel continuous casting, die casting, and precision casting. Studies on molds, mold release agents, shrinkage, solidification, defects, and additives are included. This updated bibliography contains 161 abstracts, all of which are new entries to the previous edition. GRA

N80-29495# National Technical Information Service, Springfield, Va.

FERROUS METALS CASTING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980

William E. Reed Apr. 1980 274 p Supersedes NTIS/PS-79/0473; NTIS/PS-78/0287

(PB80-808477; NTIS/PS-79/0473; NTIS/PS-78/0287) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Federally sponsored research includes casting processes, heat treatment, quality control, solidification, microstructure, mechanical properties, additives, and purification. Studies are included on casting and its involvement in scrap reuse, air pollution, and tool manufacture. This updated bibliography contains 266 abstracts, 23 of which are new entries to the previous edition. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-29496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CASTABLE HIGH TEMPERATURE REFRACTORY MATERIALS Patent Application

I. Zaplatynsky, inventor (to NASA) Filed 30 Jul. 1980 5 p

(NASA-Case-LEW-13080-1; US-Patent-Appl-SN-173521) Avail: NTIS HC A02/MF A01 CSCL 07D

A method is disclosed for fabricating chemically inert ceramic bodies that are both highly refractory and porous. A paste is formed by mixing alumina grain having uniform particle size with colloidal silica that is stabilized with ammonia. After drying, the cast body has sufficient green strength to be handled, and it is transferred to a furnace for curing. A green body prepared in this fashion does not undergo shrinkage during curing nor during prolonged subsequent heating. NASA

N80-29497# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.

DEVELOPMENT OF HARD ELASTIC SOLIDS FROM GLASSY POLYMERS Interim Report

Abdelsamie Moet, Igor Palley, and Eric Baer 10 Jun. 1980 56 p refs

(Contract N00014-75-C-0795)

(AD-A085804; TR-10) Avail: NTIS HC A04/MF A01 CSCL 11/9

High impact polystyrene (HIPS) has been processed into a specific microstructure which exhibited the hard elastic behavior previously restricted to crystalline polymers. Unidirectionally stacked profuse crazes formed in uniaxially elongated HIPS reproduced morphologies resembling the row nucleated structures of stacked lamellar aggregates bridged by extended fibrils. Films in this form possess repeated high recovery from large extension without rapture. Stress-Strain and stress-relaxation tests performed in air and in a variety of liquids in addition to thermoelastic experiments indicate that this novel material has identical characteristics to that of hard elastic crystalline polymers. The time-independent component of elastic recovery was found to be an energy driven process which originates largely from surface forces. Our results confirm that the recovery process of elastic HIPS, like crystalline systems, is composed of an instantaneous component in addition to time-dependent healing mechanism. The first was found to be energetic in nature whereas the second remained conformational (entropic). A structural model is presented which explains the observed mechanical and structural data. The model is based on the reversible extensive formation of fresh surface of the craze (or interlamellar) fibrillar material giving rise to the elastic restorative force. Time-dependent 'healing' stems from the conformational character maintained by the subfibrils. Stress-induced sorption and release of liquid, a newly discovered property, is also discussed. GRA

N80-29498# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Nonmetallic Materials Div.

HIGH TEMPERATURE REACTIVE THERMOPLASTIC AROMATIC POLYIMIDES Final Report, Oct. 1978 - Dec. 1979

B. A. Reinhardt and F. E. Arnold Apr. 1980 37 p refs

(AF Proj. 2419)

(AD-A085596; AFWAL-TR-80-4013) Avail: NTIS HC A03/MF A01 CSCL 11/9

A series of high molecular weight aromatic enyne polyimides were prepared by the condensation of various aromatic dianhydrides with (E)-33'-(1-buten-3-ynylene) dianiline (I). The polymers were soluble in low boiling solvents and exhibited intrinsic viscosities as high as 0.7 with glass transition temperatures ranging from 200-265 C. The new thermoplastic materials have the capability to become lightly crosslinked when thermally treated during a stimulated high temperature thermoforming process. Thermal treatment diminishes the various solvent-induced problems inherent in linear polymeric materials, as well as advances the glass transition temperature. Copolymers were also prepared using 1,3-bis(amino-phenoxy) benzene and (I) in an effort to obtain various percentages of enyne along the polymer backbone and therefore control the degree of crosslinking. Selected copolymer compositions are currently being evaluated as thermoplastic composite materials with improved solvent resistance. GRA

N80-29499# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

MOLECULAR COMPOSITES: RODLIKE POLYMER REINFORCING AND AMORPHOUS POLYMER MATRIX Final Report, Oct. 1978 - Jun. 1979

G. Husman, T. Helminiak, M. Wellman, W. Adams, D. Wiff (Dayton Univ.), and C. Benner (Dayton Univ.) May 1980 35 p refs

(AF Proj. 2303)

(AD-A086149; AFWAL-TR-80-4034) Avail: NTIS HC A03/MF A01 CSCL 11/4

The concept of molecular composites utilizing rod-like aromatic heterocyclic polymers as reinforcements in coil-like heterocyclic polymer matrices has been demonstrated. A series of polymer films, prepared by vacuum casting from various solutions of rod-like polymer, amorphous polymer, and solvent, were fabricated and tested. Morphological studies of these films were conducted using X-ray diffraction and scanning electron microscopy. The results of the morphology studies showed pronounced structure and definite evidence of the ordering of the rod-like polymer. In some cases, a second phase or conglomeration was evidenced. Analysis of the scanning electron microscopy pictures indicated that the second phase was itself a composite of rod-like and amorphous polymer. The mechanical testing showed significant increases in tensile modulus and strength with only ten percent rod-like polymer in the matrix; this was especially true after stretching of the film had been performed. Analytical equations developed for composite materials were used to calculate theoretical properties of the conglomerates and rods. All results and conclusions are presented in detail in this report. GRA

N80-29500# Erlangen-Nuremberg Univ. (West Germany). Lehrstuhl Glas und Keramik.

THERMAL DIFFUSION IN GLASS MELTS UNDER ZERO GRAVITY CONDITIONS: STUDIES UNDER ONE g Final Report

Rainer Stoephasius, Helmut A. Schaeffer, Gerhard Tomandl, Gerd Helland, and Heinrich Engelke Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1979 25 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-08) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 4.85

The effect of thermal diffusion as characterized by the Soret coefficient, was investigated in glasses and glass melts. A

cylindrical sample of a sodium-potassium-silicate glass was exposed to a radial temperature gradient of 800 K/cm for periods of from 3 to 20 days. concentration profiles of potassium, measured by electron microprobe, indicate that potassium is depleted at the hot end and enriched at the cold end. Electroneutrality requires the sodium concentration profile to the opposite that of potassium. The case of stationary thermal diffusion was not achieved. Therefore, the differential equation was solved numerically for the nonstationary case. The calculated concentration profiles can be fitted to the experimental curves satisfactorily by assuming a mean Soret coefficient of S sub K = -0.0005/K. Due to the relatively low temperatures, convective effects apparently play only a minor role. The determination of the Soret coefficients of ions of low mobility such as Rb(+), Cs(+), and alkaline Earth ions requires higher temperatures and therefore zero gravity conditions to prevent convective perturbations. Author (ESA)

N80-29501# Siemens A.G., Munich (West Germany). Geschaeftsbereich Weitverkehrssysteme.
INVESTIGATION OF CARBON FIBER REINFORCED PLASTICS FOR HIGH FREQUENCY COMPONENTS Final Report
Walter Altmann, Hans Georg Kerzl, and Ottmar Schweizer. Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979. 51 p. refs. In GERMAN; ENGLISH summary. Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-16) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 10.30

High frequency components used in satellite subunits are usually made of metal alloys (e.g., Invar) to meet requirements with respect to thermal characteristics. The disadvantage of these materials is the relatively high specific weight. An investigation to determine whether a suitable alternative material is available for the manufacture of diplexer filters for satellite applications was conducted. When initial tests with carbon fiber reinforced plastics from Canada showed satisfactory results, products on the German market were studied to determine their suitability. Analysis of the mechanical properties and chemical characteristics of available domestic and foreign materials show that German material in its present stage of development is satisfactory for filter construction. Nonetheless, the poor reproducibility of thermal shock test results, interpreted from holographic interferometric measurements, indicates the need for further improvement of deformation properties. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-29502*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME ADVANTAGES OF METHANE IN AN AIRCRAFT GAS TURBINE
Robert W. Graham and Arthur J. Glassman. 1980. 18 p. refs. Proposed for presentation at Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by ASAE
(NASA-TM-81559; E-520) Avail: NTIS HC A02/MF A01 CSCL 21D

Liquid methane, which can be manufactured from any of the hydrocarbon sources such as coal, shale biomass, and organic waste considered as a petroleum replacement for aircraft fuels. A simple cycle analysis is carried out for a turboprop engine flying a Mach 0.8 and 10, 688 meters (35,000 ft.) altitude. Cycle performance comparisions are rendered for four cases in which the turbine cooling air is cooled or not cooled by the methane fuel. The advantages and disadvantages of involving the fuel in the turbine cooling system are discussed. Methane combustion characteristics are appreciably different from Jet A and will require different combustor designs. Although a number of similar difficult technical problems exist, a highly fuel efficient turboprop engine burning methane appear to be feasible. A.R.H.

N80-29503# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT LGM-30 F AND G STAGE 1, PHASE G. SERIES 8, TP-H-1011 Semiannual Report
John A. Thompson. Apr. 1980. 135 p. refs.
(AD-A085630; MANCP-438(80)) Avail: NTIS HC A07/MF A01 CSCL 21/8

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 F and G First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMWRM Project M04046C-WNL01529. The data from this test period are combined with data from previous testing and entered into the G085 computer for storage, analysis and regression analysis. From the statistical analysis of all data tested to date (fourteen years for F and G), significant degradation of the propellant does not appear likely for at least two years past the oldest data point. Each point on the regression plot represents the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot or group of regression plots. The data range at any age can be found by suitable inquiry of the G085 system. GRA

N80-29504# Ad-Ex International, Portola Valley, Calif.
EXPERIMENTAL STUDIES OF SOME REGULARITIES IN THE UNDERGROUND GASIFICATION OF INCLINED COAL SEAMS
M. K. Revva and E. V. Kreinin. Mar. 1980. 19 p. refs. Transl. into ENGLISH from Probl. Podzemn. Gazifikatsii v Kuzbasse USSR (Kemerovo), no. 2, 1967 p 143-153. Sponsored by DOE. Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11585) Avail: NTIS HC A02/MF A01

Under natural conditions, the participation of underground water in the gasification process is considerably above the optimum level, and in cola seams 1 and 2 m thick is characterized by a specific water inflow of 1500 to 2500 kg/ton, and by a moisture content of 250 to 400 g/cum in the gas. The combustion heat of the gas in coal seams 1 and 2 m thick (especially in the first case) therefore is significantly below 1000 kcal/cu m under such conditions. The decrease in the combustion heat of the gas with decreasing coal seam thickness is explained by the obvious increase in heat losses to the surrounding rock mass. An increase in the amount of underground water lowers the calorific value still further. The efficiency of gasification of coal seams 8.5, 2, and 1 m thick gradually decreases, being 65 to 70, 55 to 60, and 45 to 50%, respectively. Thus, as the thickness of the coal seam being gasified decreases, one must reduce the involvement of influent underground water in the gasification process. This can be accomplished by increasing the efficiency of the drying of the coal seam being gasified, or by intensifying the gasification process. DOE

N80-29505# General Atomic Co., San Diego, Calif.
SOLAROIL PROJECT. PHASE 1: PRELIMINARY DESIGN REPORT
G. Baccaglini, J. Bass, J. Neill, V. Nicolayeff, and F. Openshaw. Mar. 1980. 439 p. refs.
(Contract DE-AC03-79CS-30308; GA Proj. 3315)
(GA-A-15823) Avail: NTIS HC A19/MF A01

The Solar Thermal Enhance Oil Recovery (Solar Oil) Plant is designed to demonstrate that using solar thermal energy is technically feasible and economically viable in enhanced oil recovery. The plant uses the fixed mirror solar concentrator to heat high thermal capacity oil to 322 C (611 F). The hot fluid is pumped from a hot oil storage tank (20 min capacity) through a once through steam generator which produces 4.8 MPa (700 psi) steam at 80% quality. The plant net output, average over 24 hr/day for 365 day/yr, is equivalent to that of a 2.4 MW (8.33 x 10 to the 6 power Btu/hr) oil fired steam generator having a 88% availability. The net plant efficiency is 57.3% at equinox noon, a 30%/yr average. The plant will be demonstrated at an oilfield site near Oildale, California. DOE

N80-29506# Aerojet Energy Conservation Co., Sacramento, Calif.
STUDY OF GELLED LNG Final Technical Report

M. I. Rudnicki, J. A. Cabeal, L. C. Hoffman, R. A. Newton, R. K. Schaplowsky, and E. M. VanderWall Jan. 1980 150 p refs
(Contract EP-78-C-03-2057)
(DOE/EV-02057/T2) Avail: NTIS HC A07/MF A01

Research involved the characterization of gelled LNG (GELNG) with respect to process, flow, and use properties and an examination of the degree of safety enhancement attainable by gelation. The investigation included (1) an experimental examination of gel properties and gel safety characteristics as well as (2) an analytical study involving the economics and preliminary design of an industrial scale gelation system. The safety-related criterion for successful application of gelled LNG is the substantial reduction of the Maximum Distance to the Lower Flammability Limit, MDLFL. This will be achieved by first, gel-inhibition of the hydrodynamic pooling and spreading of the spill, and second, the suppressed thermal transport properties of the GELNG relative to those of LNG. The industrial scale gelation study evaluated a design capable of producing 11,000 gallons (LNG tank truck) of gel in two hours. The initial assumption that gelation would provide a practical means to enhance safety is supported by the results of this study. Larger scale, comparative spill tests of LNG and GELNG are now required to confirm the safety aspects of use of the gelled material. DOE

N80-29507# Department of Energy, Grand Forks, N. Dak. Grand Forks Energy Technology Center.
EFFECT OF OPERATING CONDITIONS ON PRODUCTION OF LIGHT HYDROCARBON GASES IN SLAGGING FIXED-BED COAL GASIFICATION
Jacquelyn K. Olson and Harold H. Schobert 1980 10 p refs
(GFETC/RI-80/2) Avail: NTIS HC A02/MF A01

Light hydrocarbon gases - methane through butane - produced during the slagging fixed bed gasification of lignites and subbituminous coals were determined by cryogenic oven gas chromatography using Chromsorb 102 columns. Changing gasification parameters to increase gas residence time, by increasing pressure or decreasing oxygen feed rate, increased the amount of these gases formed. The increased formation of the light hydrocarbons arose from breakdown of coal tars, since the additional amount of gaseous hydrocarbons corresponded well with an observed decrease in tar formation. DOE

N80-29508# Amoco Oil Co., Naperville, Ill. Research and Development Dept.
CATALYST DEVELOPMENT FOR COAL LIQUEFACTION Final Report, Feb. 1978 - Feb. 1979
D. K. Kim, R. J. Bertolacini, J. M. Forgac, R. J. Pellet, K. K. Robinson, and C. V. McDaniel (Grace (W. R.) and Co., Columbia, Md.) Nov. 1979 355 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 408-1; EPRI Proj. 408-2)
(EPRI-AF-1233) Avail: NTIS HC A16/MF A01

Catalysts were developed for liquefaction of high sulfur Eastern coal. A higher severity aging test was employed to ensure that results in the Amoco pilot plant would translate to H-coal operation. Catalyst ranking at the higher severity conditions remained unchanged. The criticality of the bimodal pore distribution was clearly demonstrated with cobalt molybdena catalysts prepared on two essentially identical aluminas but one having essentially no macropore volute. The absence of macropore volume resulted in rapid catalyst deactivation. The liquefaction catalysts were characterized on the basis of reactivity. DOE

N80-29509# SRI International Corp., Menlo Park, Calif.
SHIFT CONVERSION AND METHANATION IN COAL GASIFICATION: BENCH-SCALE EVALUATION OF A SULFUR RESISTANT CATALYST Quarterly Progress Report, 1 Jan. - 31 Mar. 1980
B. J. Wood, D. Sheridan, J. G. McCarty, C. M. Ablow, and H. Wise 15 Apr. 1980 18 p refs
(Contract ET-78-C-01-3240; SRI Proj. PYU-7930)
(FE-3240-T5) Avail: NTIS HC A02/MF A01

The long term bench scale study previously reported a demonstrated degree of improvement in specific methanation activity, lifetime, and sulfur resistance exhibited by the over a commercial catalyst (Ni/Al2O3). However, quantitative interpretation of the results by measurements of H2S-breakthrough was obscured by the interaction of the particulate alumina diluent with the sulfur poison in the feed stream. To assess the magnitude of this perturbation by the diluent, a series of experimental measurements was performed in smaller reactors containing the catalyst samples without any diluent added to the catalyst bed. In these experiments the decline in the rates of methane production and CO conversion, and the appearance of H2S in the product stream were monitored. DOE

N80-29510# Bechtel International Corp., San Francisco, Calif.
PRODUCTION OF SYNTHETIC LIQUIDS FROM COAL, 1980 - 2000. PRELIMINARY STUDY OF POTENTIAL IMPEDIMENTS Final Report
Dec. 1979 264 p refs
(Contract ET-78-C-01-3137)
(FE-3137-T1) Avail: NTIS HC A12/MF A01

Potential impediments for the 3 million barrels per day (MMBPD) scenario were identified in the following areas: engineering manpower; manual labor, certain materials and equipment, and plant permits and licenses. Chemical engineers working in this area must be increased by one-third by 1985. Pipefitters, pipefitters-welders, boilermakers, boilermaker-welders and electricians will be in short supply. In certain regions of the country, 30 to 80 percent of the available manpower in some of these trades will be required by the 3 MMBPD coal liquids program. The availability of 34 categories of material and equipment was assessed in order to identify potential impediments. The following categories appear to be potentially critical for the 3 MMBPD program: draglines, heat exchangers, pressure vessels, centrifugal compressors, and alloy and stainless steel valves. DOE

N80-29511# Battelle Columbus Labs., Ohio.
CARBOHYDRATE CROPS AS A RENEWABLE RESOURCE FOR FUELS PRODUCTION. VOLUME 3: JUICE PRESERVATION
D. J. Fink, B. R. Allen, J. H. Litchfield, and E. S. Lipinsky 29 Jan. 1980 40 p refs
(Contract W-7405-eng-92)
(BMI-2031-Vol-3) Avail: NTIS HC A03/MF A01

Polysaccharide hydrolysis was investigated as a means for preserving mixed sugar solutions obtained from crops such as sweet sorghum. Experiments conducted were directed to achieve concentration of (1) pure sugar solutions by hydrolysis of purified starch; (2) genuine sugar crop juice by hydrolysis of purified starch; (3) pure sugar solutions by hydrolysis of genuine biomass starch; and (4) pure sugar solutions by hydrolysis of cellulosic materials. Inhibition of the cellobiase component of the cellulase preparation was observed in the experiments. Results demonstrate the feasibility of one approach to the preparation of concentrated, microbiologically stable sugar syrups starting with sweet sorghum juice. DOE

N80-29512# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
BIOMASS LIQUEFACTION EFFORTS IN THE UNITED STATES
Sabri Ergun Feb. 1980 23 p
(Contract W-7405-eng-48)
(LBL-10456) Avail: NTIS HC A02/MF A01

Research programs being conducted in the biomass liquefaction are summarized. The facilities in Albany, Oregon and at LBL are described and flowcharts are included. The reactions occuring during these processes are explained. Properties of the oil produced are described. DOE

N80-29513# Suntech, Inc., Marcus Hook, Pa. Research and Engineering Div.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR THE CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE FUELS Quarterly Technical Progress Report, Apr. - Jun. 1979
A. Schneider, E. J. Hollstein, E. J. Janoski, and E. G. Scheibel Oct. 1979 28 p
(Contract EX-76-C-01-2306)
(FE-2306-38; QTPR-9) Avail: NTIS HC A03/MF A01

Continuous dimethylformamide (DMF)-heptane extractions of solvent refined coal-2 (SRC-2) were conducted. The data confirm

that the extraction column can be operated at suitable conditions to remove any desired amount of coal liquids as extract product. Countercurrent operation of the 33 stage, three inch, baffled, Scheibel extraction column gives exceptionally high throughputs with the DMF-heptane system. Results indicate that: (1) the raffinate products of the 25 to 27% extractions contain 90 wt % aromatic, 0.4 wt % nitrogen, and 0.3 wt % oxygen; (2) hydrodenitrogenation of the raffinate product proceeds at a rate six times faster than nonextracted SRC-2 C to yield a product possibly suitable as a hydrocracker or fluid catalytic cracker feed; and (3) the extract products of the 25% to 27% extractions contain 8 wt % oxygen and 2.5 wt % nitrogen. GRA

N80-29514# Suntech, Inc., Marcus Hook, Pa. Research and Engineering Div.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR THE CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE FUELS Quarterly Technical Progress Report, Jan. - Mar. 1979
A. Schneider, E. J. Hollstein, E. J. Janoski, and E. G. Scheibel May 1979 46 p
(Contract EX-76-C-01-2306)
(FE-2306-35; QTPR-8) Avail: NTIS HC A03/MF A01

The feasibility of continuous deep liquid extraction of coal liquids with dimethylformamide (DMF)-heptane is demonstrated. It is concluded that the use of DMF-heptane is more practical than aqueous tailored to remove any desired amount of coal liquids. The extraction procedure as practiced with either DMF or aqueous methanol does not remove all basic nitrogenous material but successfully removes the phenolic material. Attempts to hydrorefine the highly phenolic extract product causes the evolution of much methane at relatively low temperatures. Catalytic hydrodeoxygenation follow first order kinetics. DOE

N80-29515# Pennsylvania State Univ., University Park. Dept. of Chemistry.
INSTRUMENTAL ANALYSIS OF SULFUR COMPOUNDS IN COAL PROCESS STREAMS Quarterly Technical Progress Report, Apr. - Jun. 1979
Joseph Jordan Jul. 1979 27 p refs
(Contract EF-77-S-01-2710)
(FE-2710-7) Avail: NTIS HC A03/MF A01

A synopsis of progress is presented. Sulfate and thiosulfate yielded well-defined differential pulse polarograms at the dropping mercury electrodes. Differential pulse voltammetry of benzothiophene at a rotated glassy carbon disk anode yielded peak signals which were proportional to concentration in a range between 0.00004 M and 0.002 M. Injection of bisulfide samples into an excess of the reagent hydroxmercury benzoate produced temperature increments which provided a linear measure of HS concentration in a range between 50 and 5000 ppM. The feasibility of the determination of SO2 by differential pulse voltammetry at a rotated glassy carbon cathode has been demonstrated in synthane by-product waste water samples. Interfering sulfides were successfully removed by prior precipitation as CdS. Tridimensional Pourbaix Diagrams were applied to predict mole fractions of sulfur moieties in four process stream samples. The hypothetical assignments were drastically at variance with the experimentally measured ratios. DOE

N80-29516# Mitre Corp., McLean, Va.
ENVIRONMENTAL DATA ENERGY TECHNOLOGY CHARACTERISTICS: SYNTHETIC FUELS
Apr. 1980 102 p refs
(Contract EX-76-C-10-3876)
(DOE/EV-0073) Avail: NTIS HC A06/MF A01

The transformation of the energy in coal and oil shale into a more useful form is described in terms of major activity areas in the synthetic fuel cycles, that is, in terms of activities which produce either an energy product or a fuel leading to the production of an energy product in a different form. The activities discussed are coal liquefaction, coal gasification, in-situ gasification, and oil shales. These activities represent both well-documented and advanced activity areas. The former activities are characterized in terms of actual operating data with allowance for future modification where appropriate. Emissions are assumed to conform to environmental standards. The advanced activity areas examined are those like coal liquefaction and in-situ retorting of oil shale. For these areas, data from pilot or demonstration plants were used where available; otherwise, engineering studies provided the data. DOE

N80-29517# Gulf Research and Development Co., Pittsburgh, Pa.
INVESTIGATION OF MECHANISMS OF HYDROGEN TRANSFER IN COAL HYDROGENATION Quarterly Progress Report, Jan. - Mar. 1979
D. C. Cronauer, R. G. Ruberto, and D. C. Young May 1979 20 p ref
(Contracts EX-76-C-01-2305; E(49-18)-2305)
(FE-2305-33) Avail: NTIS HC A02/MF A01

The analytical approach to determine the conversion of coal and/or asphaltenes to pentane soluble product (oils) was modified to limit co-solvent effects. To simulate products obtained during the initial stage of liquefaction, hydrogen transfer experiments were done asphaltenes prepared from the low severity liquefaction of Kentucky 9/14 and Illinois No. 6 coals with SRC-2 solvent. The preparation of these asphaltenes was carried out at mild liquefaction conditions of 375 C and 400 C at space times of 5 and 12 minutes. The asphaltenes were used in making an extensive number of hydrogen transfer experiments with various solvents, temperatures and reaction times. The runs were made in the 9 ml micro-reactor which is immersed in a heated sand bath. The average heat-up time is about 2.2 to 2.5 minutes. DOE

N80-29518# California Univ., Berkeley. Lawrence Berkeley Lab.
CATALYTIC BIOMASS LIQUEFACTION
Sabri Ergun, Carlos Figueroa, Cihan Karatas, Larry Schaleger, Manu Seth, James Wrathall, and Nasser Yaghoubzadeh Feb. 1980 9 p ref Presented at the 10th Thermochem. Conversion Contractors' Meeting, Berkeley, Calif., 12-13 Feb. 1980
(Contract W-7405-eng-48)
(LBL-10667; CONF-800234-1) Avail: NTIS HC A02/MF A01

The development of pumpable, concentrated biomass slurries and a bench-scale continuous tubular reactor for liquefaction is addressed. Three tasks are specifically discussed: the preparation of biomass slurries; characterization and flow properties of concentrated slurries; and the construction of biomass liquefaction process engineering unit. DOE

N80-29519# National Technical Information Service, Springfield, Va.
HYDROGEN PRODUCTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - May 1980
Diane M. Cavagnaro May 1980 208 p Supersedes NTIS/PS-79/0541
(PB80-810476; NTIS/PS-79/0541) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The cited reports include studies on the manufacturing of hydrogen by electrolysis, coal gasification and other techniques. They cover both experimental research and production on the industrial scale. Although most of the reports are on production methods, economic studies are also included. This updated bibliography contians 200 abstracts, 56 of which are new entiries to the previous edition. GRA

N80-29520# Office of Technology Assessment, Washington, D. C.
THE DIRECT USE OF COAL. VOLUME 2, PART A: WORKING PAPERS, APPENDICES 1-4
Nov. 1979 463 p refs
(PB80-184518; OTA-E-86A-Vol-2-Pt-A-App-1-4) Avail: NTIS HC A24/MF A01 CSCL 13B

The contents include: (1) selection topics in estimating future energy deamand and supply, (2) rethinking the scale of coal-fired electric generation: technological and institutional consideration, (3) residential and commercial uses of coal, (4) coal cleaning and desulfurization, (5) direct utilization of coal: fuel gas desulfurization, and (6) miners and operators collective bargaining in coal. GRA

N80-29521# Office of Technology Assessment, Washington, D. C.

THE DIRECT USE OF COAL. VOLUME 2, PART B: WORKING PAPERS, APPENDICES 7-9
Dec. 1979 605 p refs
(PB80-184526; OTA-E-86B-Vol-2-Pt-B-App-7-9) Avail: NTIS HC A99/MF A01 CSCL 13B

The contents include: (1) environmental considerations for increased coal utilization; (2) transport and fate of sulfur and other air pollutions; and (3) prediction and review of air pollution health effects from direct coal combustion. GRA

N80-29522# Office of Technology Assessment, Washington, D. C.
THE DIRECT USE OF COAL. VOLUME 2, PART C: WORKING PAPERS, APPENDICES 10-14
Dec. 1979 542 p refs
(PB80-184534; OTA-E-86C-Vol-2-Pt-C-App-10-14) Avail: NTIS HC A23/MF A01 CSCL 13B

The contents include: (1) effects on plants of sulfur pollutants from coal combustions; (2) coal mine health; (3) social and economic impacts of coal production in the eastern United States; (4) impacts of coal development of Western communities; and (5) public attitudes toward coal-fired power plants. GRA

N80-29523# Office of Technology Assessment, Washington, D. C.
THE DIRECT USE OF COAL. VOLUME 2, PART D: WORKING PAPERS, APPENDICES 15-17
Dec. 1979 425 p refs
(PB80-184542; OTA-E-86D-Vol-2-Pt-D-App-15-17) Avail: NTIS HC A18/MF A01 CSCL 13B

The present state of the Federal coal leasing policy is examined. Abuses and problems associated with prior leasing policies and recent congressional amendments are examined and a number of reforms are suggested. Laws applicable to air emissions from the direct use of coal are cited along with the Surface Mining Control and Reclamation Act of 1977. J.M.S.

N80-29524# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
PEAT AS A FUEL AT THE PROPOSED CENTRAL MARINE POWER COMPANY 600 MW PLANT, VOLUME 1 Final Report
William J. Jones Dec. 1979 184 p refs Sponsored in part by Central Maine Power Co.
(PB80-175185; MIT-EL-79-012-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 10B

The findings and recommendations resulting from an exploratory assessment of the technical feasibility of using peat instead of coal are presented. The economic and institutional issues that may be involved as a result of such a substitution are considered. It is intended for a broad spectrum of readers. GRA

N80-29525# Environmental Protection Agency, Ann Arbor, Mich. Technology Assessment and Evaluation Branch.
GASOHOL TEST PROGRAM
Richard Lawrence Feb. 1980 39 p
(PB80-171226; EPA-AA-TAEB-79-4B) Avail: NTIS HC A03/MF A01 CSCL 21D

A request for a waiver to permit use of ten percent ethanol in gasoline (gasohol) was considered by EPA-Mobile Source Enforcement Division. Ten vehicles were tested on two gasoline fuels and three gasohol fuels and three vehicles on the five fuels plus other fuels containing methyl tertiary butyl ether and tertiary butyl alcohol, other fuel additives for which waivers were requested. More extensive emission data on two test vehicles was obtained. Since completion of the tests, EPA has acted to allow the use of ten percent ethanol in gasoline. Future control of this or other fuel additives is authorized under Section 211 of the 1977 Amendments to the Clean Air Act. GRA

N80-29526# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
PREPARATION AND STABILITY OF EMULSIONS OF METHANOL IN AUTOMOTIVE DIESEL OIL
C. G. McCormack Oct. 1979 35 p refs
(PB80-169162; CSIR-CENG-294; ISBN-0-7988-1730-5) Avail: NTIS HC A03/MF A01 CSCL 21D

Short term emulsification of up to 20% methanol in diesel oil (stability lasting a few hours) is feasible but the emulsifiers successful in this respect are costly and have to be applied in relatively high concentrations. No emulsifier was found which produces an emulsion with long term stability; mutual solubilities of the various components and solubility changes with temperature were identified as the most important causes. It is unlikely that an emulsifier will be found which produces stable temperature insensitive emulsions of methanol in diesel oil. Even if such an emulsifier exists the required amount and costs are expected to be prohibitive in a fuel application. GRA

N80-29527# New Mexico Inst. of Mining and Technology, Socorro.
COORDINATING FOSSIL FUEL RESEARCH IN NATURAL GAS RECOVERY
1979 29 p
(PB80-169469) Avail: NTIS HC A03/MF A01 CSCL 08I

Projects that range from studying the State's fossil fuel resources to developing new methods for expanded exploration, improving production techniques, and developing programs which best utilize these resources are reviewed. GRA

N80-29528# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PREDICTING METHANE FERMENTATION BIODEGRADABILITY Final Report
J. A. Chandler and W. J. Jewell Mar. 1980 254 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-09038-1) Avail: NTIS HC A12/MF A01

Fifteen substrates, representing a wide range of cell soluble, cell wall and cell wall lignin contents, were batch fermented at 35 C for 120 days. Daily gas production was measured for the first 90 days of the fermentation period. Both initial and fermented substrate solids underwent fiber analyses to determine their exact composition and to measure extent of biodegradation achieved after 120 days. Based on batch fermentation and fiber analyses results, four models predicting substrate biodegradable fraction were constructed and evaluated. Predicting biodegradability based on volatile solids lignin content was found to be the superior model. The analyses required by this model can be completed within one day. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-29529 Oregon Univ., Eugene.
A MICROSCOPIC APPROACH TO SUPERFLUID FLOW IN HELIUM-2 Ph.D. Thesis
Zaka Ullah Khan 1980 106 p
Avail: Univ. Microfilms Order No. 8017887

The vortices in superfluid helium are considered in the context of metastability of rotational flow and also through an investigation of creation of vortices in an ideal superfluid flow. The model of an ideal Bose gas initially in rotation with respect to a cylindrical container at rest having a localized roughness on the wall is considered. The solution for the time evolution of an initial state containing one, two and three vortices each of unit circulation is obtained by solving time dependent Schrodinger equation. The convergent results obtained indicate that a vortex present initially inside the container describes a trajectory which eventually reaches the cylinder wall for all ranges of values considered for a perturbation strength parameter. Once the vortex reaches the wall it disappears continuously as the node changes into a 'dimple in the wave function' which disappears continuously as a function of time. Solution of the time dependent Gross-Pitaevski equation, shows that a vortex present initally close to the wall moves away from it slowing down almost exponentially. So in this model of the interacting Bose gas the vortex describes a trajectory that never reaches the wall and hence corresponds to a metastable state. The vortex formation due to an effect of a protuberance from the wall bounding a semi-infinite plane is also studied. Dissert. Abstr.

N80-29530# Naval Civil Engineering Lab., Port Hueneme, Calif.
CONCRETE SANDWICH CONSTRUCTION FOR ENERGY CONSERVATION Final Report, Oct. 1975 - Sep. 1978
John R. Keeton Mar. 1980 19 p refs
(ZF5751001)
(AD-A085446; CEL-TN-1574) Avail: NTIS HC A02/MF A01 CSCL 13/13

An abbreviated research study on use of shrinkage-compensating expansive concrete in sandwich-type wall and roof panels containing insulation at mid-thickness is described. The use of expansive concrete is shown to be a technically viable concept for eliminating shrinkage cracking, thus preventing moisture penetration which can reduce insulation effectiveness, cause deterioration of the insulating material, and accelerate steel corrosion. Embeddable resistance strain gages proved to be reliable for measuring expansion and subsequent shrinkage of the experimental panels. As a result of this study, a comprehensive research program is proposed for experimental verification of design and field control measures that will permit the use of shrinkage-compensating cement mortars in sandwich panel construction. GRA

N80-29531# California Univ., Los Angeles. Dept. of Physics.
A STUDY OF PERSISTENT CURRENTS IN SUPERFLUID He-4 Ph.D. Thesis Interim Report
Roset Khosropour Talaghany Mar. 1980 121 p refs
(Contract N00014-75-C-0246; NR Proj. 384-302)
(AD-A085767; TR-40) Avail: NTIS HC A06/MF A01 CSCL 20/13

Decay of saturated persistent currents in superleaks in contact with bulk superfluid helium has been studied using Doppler shifts of the acoustic modes of an annular resonator partially packed with superleak. The two acoustic modes are an interpolated first-fourth sound and a modified second sound. Decay of such currents have been measured at 1.35 degrees K for annuli 10, 20, 40, 60, 80, 90, 95 and 100 percent filled with superleak. The main result which is somewhat surprising, is that the saturated persistent current and its fractional decay rate varies only slightly with superleak depth and the average decay rate is about 2.5% per decade. Another phenomena which was also studied is the Doppler shift of gravity waves in a partially packed powder. The velocity of gravity waves is about three orders of magnitude smaller than the fourth sound velocity in a similar geometry. Thus it seemed appropriate to use its Doppler shift for measuring small persistent currents. A theoretical study of the problem showed that the gravity waves are not Doppler shifted in the presence of a persistent current in superleak, however the waves are still Doppler shifted by the persistent currents in the free region. Experiments support the theoretical prediction, and also indicate the existence of a small current of about 8 millimeters per second in the free region. GRA

N80-29532# Naval Civil Engineering Lab., Port Hueneme, Calif.
SOLAR HEATING OF BUILDINGS AND DOMESTIC HOT WATER
Edward R. Durlak May 1980 182 p refs
(AD-A085815; CEL-TR-877) Avail: NTIS HC A09/MF A01 CSCL 13/1

This report presents design criteria and cost analysis for methods for the sizing and justification of solar heat collectors for potable water heaters and space heaters. Sufficient information is presented to enable engineers to design solar space and water heating systems or conduct basic feasibility studies preparatory to design of large installations. Both retrofit and new installations are considered. This report has been substantially revised from the previous edition Beck and Field, 1977. However, most of the revision is in Section 2.0, where more material of an exploratory nature has been added. Section 3.0, which contains the calculation method and worksheets, is largely the same, except that the economic analysis has been revised and new tables have been added to provide a self-contained source of meteorological data and collector test data. GRA

N80-29533# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
MINIMIZING MAXIMUM LATENESS IN A TWO-MACHINE OPEN SHOP
E. L. Lawler (California Univ., Berkeley), J. K. Lenstra, and A. H. G. Rinnooy-Kan (Erasmus Univ.) Sep. 1979 15 p refs Submitted for publication
(Grant NSF MCS-76-17605)
(MC-BW-112/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The problem of scheduling independent jobs in a two machine open shop so as to minimize the maximum lateness with respect to due dates for the jobs is considered. Each job consists of two operations, one of length a sub j which is to be executed on machine M sub 1 and one of length b sub j which is to be executed on machine M sub 2. There is no restriction on the order in which the operations of a job are to be performed, hence the term open shop. For the case in which preemption is allowed, a linear time algorithm is presented. For the nonpreemptive case, NP-hardness is established. Author (ESA)

N80-29534# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SIMPLIFIED ENERGY DESIGN ECONOMICS: PRINCIPLES OF ECONOMICS APPLIED TO ENERGY CONSERVATION AND SOLAR ENERGY INVESTMENTS IN BUILDINGS Final Report
Harold E. Marshall, Rosalie T. Ruegg, and Forest Wilson Jan. 1980 57 p
(PB80-179245; NBS-SP-544) Avail: NTIS HC A04/MF A01 CSCL 13A

Economic analysis techniques for evaluating alternative energy conservation investments in buildings are presented. Life cycle cost, benefit cost, savings to investment, payback, and rate of return analyses are explained and illustrated. The procedure for discounting is described for a heat pump investment. Formulas, tables of discount factors, and detailed instructions are provided to give all information required to make economic evaluations of energy conserving building designs. GRA

N80-29535# Missouri Univ. -Rolla. Dept. of Civil Engineering.
INVESTIGATION OF THE EFFECT OF 3-D PARAMETRIC EARTHQUAKE MOTIONS ON STABILITY OF ELASTIC AND INELASTIC BUILDING SYSTEMS
Franklin Y. Cheng and Prasert Kitipitayangkul Aug. 1979 397 p refs
(Grant NSF ENV-75-18372)
(PB80-176936; NSF/RA-790399; Rept-79-10; Rept-1) Avail: NTIS HC A17/MF A01 CSCL 13M

The effect of interacting, three dimensional ground motions on the response behavior of elastic and inelastic building systems is investigated. The building systems may have elevator cores, floor diaphragms, and shear walls of reinforced concrete as well as steel beams, columns, and bracings. The stiffness matrices are derived from the Ramberg-Osgood hysteresis model for steel and Takeda's model for concrete. The geometric matrix is formulated for the second-order effect on large deflections. The interacting forces on the yielding surfaces of the members are included. A computer program, INRESB-3D, has been comprehensively developed for achieving efficiency in both computation and data preparation. A total of 26 numerical examples were studied for various low-rise and high-rise building systems, which show that an interacting ground motion can significantly increase internal forces, nodal displacements, ductilities, and seismic input and dissipated energy. The large ductilities and the excessive permanent deformations induced by a coupling motion exhibit severe local damage and thus diminish the serviceability of a structure. GRA

N80-29536# Missouri Univ. -Rolla. Dept. of Civil Engineering.
INRESB-3D: A COMPUTER PROGRAM FOR INELASTIC ANALYSIS OF REINFORCED CONCRETE STEEL BUILDINGS SUBJECTED TO 3-DIMENSIONAL GROUND MOTIONS
Franklin Y. Cheng and Prasert Kitipitayangkul Aug. 1979 105 p
(Grant NSF ENV-75-18372)
(PB80-176944; NSF/RA-790400; Rept-2; Rept-79-11) Avail: NTIS HC A06/MF A01 CSCL 13M

A user's guide is presented for the computer program, INRESB-3D, for analyzing elastic and inelastic building systems subjected to the simultaneous input of static loads and multicom-

ponent earthquake motions, which can be applied in any direction of the structural plane. The building systems may have elevated cores, floor diaphragms, and shear walls of reinforced concrete, as well as beams, columns, and bracings. The computer program was developed to achieve efficiency in both computation and data preparation. The output solutions include the static results of member forces and nodal displacements, as well as the dynamic results of member forces, nodal displacements, ductility factors, excursion ratios, seismic input energies, dissipated energies, and the options of plotting some of the dynamic results. GRA

N80-29537# Swedish Council for Building Research, Stockholm.
REPORTING FORMAT FOR THERMAL PERFORMANCE OF SOLAR HEATING AND COOLING SYSTEMS IN BUILDINGS
Per Isakson (Royal Inst. of Tech.), William Kennish (TPI, Inc.), and Egil Ofverholm (Royal Inst. of Tech.) Feb. 1980 60 p refs
(PB80-175375; D1-1980; ISBN-91-540-3157-5) Avail: NTIS HC A04/MF A01 CSCL 13A

The performance of solar testing and cooling systems and the cost effectiveness of these systems is considered. Common procedures for predicting, measuring, and reporting the thermal performance of systems and methods for designing economical, optimized systems are discussed. GRA

N80-29538# National Bureau of Standards, Washington, D.C.
REPORT OF THE 64TH NATIONAL CONFERENCE ON WEIGHTS AND MEASURES
Harold F. Wollin, ed., Louis E. Babeoq, ed., and Ann P. Heffernan, ed. Mar. 1980 316 p refs Conf. held at Portland, Oreg., 23-27 Jul. 1979
(PB80-175128; NBS-SP-566; LC-26-27766) Avail: NTIS HC A14/MF A01 CSCL 14B

Major issues discussed at this conference include metric conversion in the United States, particularly the conversion of gasoline dispensers, problems relating to the quantity fill of packaged commodities especially as affected by moisture loss and statistical approach to package checking. Federal grain inspection, and a legal metrology control system are also discussed. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-29539* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COLLAPSIBLE CORRUGATED HORN ANTENNA Patent
Donald E. Barthlome, inventor (to NASA) Issued 9 May 1978 6 p Filed 20 May 1977 Supersedes N77-24339 (15 - 15, p 1976) Sponsored by NASA
(NASA-Case-LAR-11745-1; US-Patent-4,089,004; US-Patent-Appl-SN-799025; US-Patent-Class-343-786) Avail: US Patent and Trademark Office CSCL 09C

A horn antenna that is readily collapsible while not in use is described. A number of different sized annular metal rings are arranged in a sequence such that each ring is larger than the one that precedes it in the sequence. A number of thin flexible electrically conductive members attach successive metal rings together physically and connect them together electrically. Each flexible conductive member is attached to make electrical contact between the outside surface of a metal ring and the inside surface of an adjacent metal ring in the sequence.
Official Gazette of the U.S. Patent and Trademark Office

N80-29540 Rice Univ., Houston, Tex.
OPTIMAL ESTIMATION FOR BANDLIMITED SIGNALS Ph.D. Thesis
Dean Paul Kolba 1979 123 p
Avail: Univ. Microfilms Order No. 8018062

The desired estimate is based on a finite number of time samples taken from a measurement interval of length TM. With no additional information, the estimate is based on these samples alone. When the signal is bandlimited with normalized bandwidth beta, this provides additional information which is used to improve the estimate by extrapolating the signal. The effectiveness of this extrapolation is limited to an interval of length TL is approximately TM/2 beta. Various bandlimited estimation methods surveyed do not make explicit use of the effective extrapolation limit TL. An estimation method for bandlimited signals is described which does incorporate the interval TL into the problem formulation. Estimation with inexact data is considered. Sensitivity of the bandlimited estimation methods to errors in the data is discussed. Estimation with smoothing is utilized in reducing the effects of this noise. A recursive algorithm for the calculation of the new estimation method is described. The estimates are computed using discrete prolate spheroidal sequences. A FORTRAN program implementing the new handlimited estimation method is presented. Dissert. Abstr.

N80-29541 Maryland Univ., College Park.
APPLICATIONS OF PICOSECOND PHOTOCONDUCTIVITY IN SEMICONDUCTORS Ph.D. Thesis
Paul Sze-Ngai Mak 1979 192 p
Avail: Univ. Microfilms Order No. 8016979

The propagation of millimeter waves at 94 GHz in silicon waveguides was optically controlled by photo induced carriers in the waveguide. Phase shifts as high as 300 deg/cm of millimeter waves were observed accompanied by less than 1 dB insertion loss. Optoelectronic switching and gating in silicon waveguides were achieved. Picosecond photoconductivity switching in CdS(0.5)Se(0.5) was investigated using a standard pulse line charger configuration. Electric impulse of variable duration ranging from one to a few nanoseconds were produced by illuminating the semiconductor sample with a single green laser pulse. The photoconductive lifetime of the charge carriers was also measured. An optical detector that can measure picosecond pulsewidth of a light pulse was constructed of seven pieces of CdS(0.5)Se(0.5) crystals which exhibited two photon conductivity effect when illuminated by 1.06 micron optical radiation. The measured correlation curve yielded a pulsewidth of 10 picoseconds with a contrast ratio of 28:1. Dissert. Abstr.

N80-29542 British Broadcasting Corp., Kingswood (England). Engineering Div.
THE USE OF THE 26 MHz BAND FOR SATELLITE BROADCASTING
G. J. Phillips and P. Knight Jul. 1980 12 p refs
(BBC-RD-1980/5) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The existing top hf band (25.6 -- 26.1 MHz) might be more effectively used than at present for international broadcasting if transmissions from satellites were permitted. Although the World Administrative Radio Conference, Geneva, 1979 did not extend the use of the band in this way, a useful record is given of the technical studies made in the preparation for the Conference. Propagation factors which would limit such a service are examined, and it is found that signals from a geostationary satellite could reach a large area around the subsatellite point (up to ±50 deg relative longitude and latitude) for a high percentage of time, day and night. Curves are presented also for two cases of a sub-synchronous satellite. Estimates for the RF transmitter power required vary from 1 to 5 kW depending on the orbit and whether narrow band frequency modulation is used in place of conventional amplitude modulation. Author

N80-29543*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
COMPLEMENTARY CROSS-SLOT PHASED ARRAY ANTENNA Patent Application
Haynes Ellis, Jr., inventor (to NASA) (Rockwell International Corp., Downey, Calif.) Filed 25 Jul. 1980 14 p Sponsored by NASA
(NASA-Case-MSC-18532-1; US-Patent-Appl-SN-172099) Avail: NTIS HC A02/MF A01 CSCL 09C

A flush mounting, cavity-backed, dual orthogonal slot antenna is described in which improved radiation pattern characteristics are obtained by making the spiral slot pattern elliptical in the

aperture plane. Coaxial split-tube baluns are used to drive the junctions between corresponding slot pairs. Optional cavity dielectric is provided and a drive coupling arrangement includes a four port compartor hybrid having sum and difference ports respectively, for alternate excitation to produce a single lobe or a double lobe pattern with null. Switching appratus is provided to connect a common terminal to either of the ports. NASA

N80-29544*# Texas Instruments, Inc., Dallas. Equipment Group.
REPORT FOR SIMULTANEOUS, MULTIPLE INDEPENDENTLY STEERED BEAM STUDY FOR AIRBORNE ELECTRONICALLY STEERABLE PHASED ARRAY (AESPA) PROGRAM Final Report
May 1978 129 p
(Contract NAS8-32627)
(NASA-CR-161394; EM-911-05-78) Avail: NTIS HC A07/MF A01 CSCL 20N

Design concepts of an array for the formation of multiple, simultaneous, independently pointed beams for satellite communication links were investigated through tradeoffs of various approaches which were conceived as possible solutions to the problem. After the preferred approach was selected, a more detailed design was configured and is presented as a candidate system that should be given further consideration for development leading to a preliminary design. This array uses an attenuator and a phase shifter with every element. The aperture excitation necessary to form the four beams is calculated and then placed across the array using these devices. Pattern analysis was performed for two beam and four beam cases with numerous patterns being presented. Parameter evaluation shown includes pointing accuracy and beam shape, sidelobe characteristics, gain control, and beam normalization. It was demonstrated that a 4 bit phase shifter and a 6 bit, 30 dB attenuator were sufficient to achieve adequate pattern performances. The phase amplitude steered multibeam array offers the flexibility of 1 to 4 beams with an increase in gain of 6 dB if only one beam is selected. R.K.G.

N80-29545# Indian Space Research Organization, Bangalore.
TOTAL ELECTRON CONTENT DATA COLLECTED DURING ATS-6 RADIO BEACON EXPERIMENTS IN INDIA, AUGUST 1975 TO JULY 1976
Dec. 1978 88 p
(ISRO-SN-07-78) Avail: NTIS HC A05/MF A01

Total electron count data from ATS 6 beacon transmission are presented in tabular form. The data sheets include the following: satellite used; frequencies used; technique employed; geographic latitude and longitude of the subionospheric point at the mean field height; elevation angle at the observing station; conversion factor use; and mean field height. Guidelines for data sheet format are included. E.D.K.

N80-29546*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Electrical Hybrid Vehicle System.
AN ASSESSMENT OF INDUCTIVE COUPLING ROADWAY POWERED VEHICLES
K. O. Leschly, A. Feinberg, R. Heft, and G. Warren 15 Aug. 1980 263 p refs
(Contracts NAS7-100; EM-78-I-01-4209)
(NASA-CR-163437; JPL-Pub-79-115) Avail: NTIS HC A12/MF A01 CSCL 17B

The technical concept underlying the roadway powered vehicle system is the combination of an electrical power source embedded in the roadway and a vehicle-mounted power pickup that is inductively coupled to the roadway power source. The feasibility of such a system, implemented on a large scale was investigated. Factors considered included current and potential transportation modes and requirements, economics, energy, technology, social and institutional issues. These factors interrelate in highly complex ways, and a firm understanding of each of them does not yet exist. The study therefore was structured to manipulate known data in equally complex ways to produce a schema of options and useful questions that can form a basis for further, harder research. A dialectical inquiry technique was used in which two adversary teams, mediated by a third-party team, debated each factor and its interrelationship with the whole of the known information on the topic. Author

N80-29547# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
DEICING A SATELLITE COMMUNICATION ANTENNA: SPECIAL REPORT
Ben Hanamoto, John J. Gagnon, and Blanchard Pratt Apr. 1980 17 p
(AD-A085397; CRREL-SR-80-18) Avail: NTIS HC A02/MF A01 CSCL 22/12

Ice buildup on communication antenna dishes begins to cause signal reception problems when the thickness exceeds 0.64 cm (0.25 in.). CRREL's copolymer coating, which reduces the adhesive force between ice and the coated surface, was tested on antenna dish panels to facilitate ice removal. A combination of the copolymer coating and heat proved to be an effective method of removing ice from the panel. GRA

N80-29548# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SATNET DEVELOPMENT AND OPERATION PLURIBUS SATELLITE IMP DEVELOPMENT REMOTE SITE MAINTENANCE INTERNET DEVELOPMENT MOBILE ACCESS TERMINAL NETWORK Progress Report, 1 Feb. - 30 Apr. 1980
R. D. Bressler May 1980 45 p
(Contracts MDA903-76-C-0252; N00039-78-C-0405; N00039-79-C-0386; MDA903-80-C-0353; DAHC15-69-C-0179; F08606-73-C-0027; F08606-75-C-0032; MDA903-76-C-0213; ARPA Order 3214; ARPA Order 3151)
(AD-A085807; BBN-4399) Avail: NTIS HC A03/MF A01 CSCL 17/2

This quarterly technical report describes work on the development of and experimentation with packet broadcast by satellite; on development of Pluribus Satellite IMP; on a study of the technology of Remote Site Maintenance; on the development of Internetwork monitoring; and on shipboard satellite communications. GRA

N80-29549# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF ADAPTIVE ANTENNA ARRAYS ON BROADBAND SIGNALS M.S. Thesis
William Artman Riski Jun. 1980 164 p refs
(AD-A085708; AFIT/GE/EE/80-4) Avail: NTIS HC A08/MF A01 CSCL 09/5

This paper develops a complex baseband model for an adaptive array with N isotropic elements and T tapped delay lines behind each element. Three aspects of arrays are represented: spatial and temporal propagation delays and the weighting coefficients. The model is used to determine the steady state effect of arrays on wideband signals. Optimum weights are calculated based on the noise covariance matrix produced by single and multiple narrowband jammers and single broadband jammers. It is shown that discrete spectral lines can be used to model a broadband jammer. For a jammer with 4% f0 bandwidth, this approximation yields a correlation function which is accurate to within 0.53%. For a linear, equally spaced adaptive array the output consists of the input signal and its first time derivative. This first derivative distortion is reduced by the addition of tapped delay lines only when the noise environment contains broadband jammers. This performance improvement is quantified by increased null depth. The improvement, for a 4% f0 bandwidth jammer, was 6.2 db with a jammer located at 10 degrees and 2.5 db for a jammer at 50 degrees. GRA

N80-29550# Rome Air Development Center, Griffiss AFB, N.Y.
ANTENNA TECHNOLOGY FOR SPACE BASED RADAR. PART 1: SUBARRAYING FEEDS BANDWIDTH, LOW SIDELOBE PERFORMANCE AND SUBARRAY NULLING
Robert J. Mailloux Feb. 1980 19 p refs
(AF Proj. 4600)
(AD-A085568; RADC-TR-79-358) Avail: NTIS HC A02/MF A01 CSCL 17/9

This brief analysis outlines the features of a subarraying system with amplitude control circuits at the feed array face. The analysis treats the idealization of the lens feed as a continuous aperture, and includes the assumption that the cylindrical lens back face is in the far field of the array feed. The analysis includes the effect of truncation at the main array, and demonstrates that the high sidelobes of the conventional sin

x/x subarray illumination, when truncated, are primary contributors to high grating lobe levels under certain circumstances. The proposed correction for these truncation effects is to produce a low sidelobe subarray illumination at the main aperture by controlling the feed array taper. Numerical results show the effectiveness of this subarraying technique for controlling the array far sidelobes and grating lobe levels, and for producing wide band null troughs within the subarray pattern. GRA

N80-29551# Rome Air Development Center, Griffiss AFB, N.Y.
DETECTION OF RADAR SIGNAL MODULATIONS INDUCED BY TARGET AIRCRAFT STRUCTURAL VIBRATIONS
John F. Lennon. Sep. 1979. 59 p. refs.
(AF Proj. 2305)
(AD-A085570; RADC-TR-79-247) Avail: NTIS
HC A04/MF A01 CSCL 17/9

The possibility of aircraft identification using radar signal modulations induced by target airframe vibrations is analyzed. Emphasis is placed on detectability of the signal modulation, but attention is given to dependence on the angle of incidence since a major concern is identification at angles where engine effects are not observable. The approach is to compare the strength of the backscatter modulation relative to the unmodulated signal from the aircraft. Since it is the modulation of the signal that is significant, and not the exact radar cross section, a simple wire model representation of the aircraft is used. The radar backscatter results at 7 MHz and 28 MHz are calculated using a modified method-of-moments solution. The method employs successive static electromagnetic scattering solutions from a target where the position of the wing has been changed between calculations. The results are considered as discrete samples of the continuous, modulated signal. The power of the modulation is then estimated by determining the relative power spectra of the modulated signal. An approach that explicitly derives continuous time dependent scatter is included. This uses a simple crossed dipole theory with wing dipole oscillations. The dipole model, however, requires external information on the location of the appropriate scattering centers along the dipoles. Since this is incident angle dependent, the model becomes cumbersome. GRA

N80-29552# SRI International Corp., Menlo Park, Calif.
BINARY ERROR RATES FOR A TWO-COMPONENT SCINTILLATION CHANNEL Progress Report, 1 Jan. - 31 Aug. 1979
Steven C. Johnson and Charles L. Rino. 31 Aug. 1979. 51 p. refs.
(Contract DNA001-77-C-0038)
(AD-A085579; AD-E300786; DNA-5071T) Avail: NTIS
HC A04/MF A01 CSCL 17/2

This report describes a procedure for calculating the bit error rates for binary transmission through a two-component multiplicative channel of the type that has been proposed to represent the transionospheric channel. This procedure is then used to calculate the probability of error for several cases of interest that are not represented by commonly used Gaussian models. The non-Rician/ Raleigh channel primarily affects the phase of the signal. Thus, the major impact is on coherent systems in a fast-fading environment. In all cases, however, the effects of non- Rician and non- Gaussian fading are small when compared with a Rician or Gaussian channel with comparable fading levels. GRA

N80-29553# JAYCOR, Del Mar, Calif.
ASPECTS OF LATE-TIME STRIATION BEHAVIOR AND SATELLITE COMMUNICATION EFFECTS Final Report, 22 Dec. 1976 - 31 Jan. 1979
S. Robert Goldman and Jacob L. Sperling. 1 Feb. 1979. 121 p.
(Contract DNA001-76-C-0186)
(AD-A085577; AD-E300793; J78-2005-TR; DNA-4923)
HC A06/MF A01 CSCL 17/2

This report is a study of aspects of plasma wave turbulence relevant to late-time striation behavior and satellite communication effects. These include: (1) basic theory of particle diffusion due to quasi-neutral plasma modes; (2) forms for the diffusion coefficients of linear and nonlinear mode properties; (3) relevance to E x B gradient-drift modes in the absence of other modes; (4) diffusion due to drift-dissipative turbulence; (5) characterization of the diffusion coefficient from drift-dissipative modes in computer simulations; (6) observational aspects of drift-dissipative waves relevant to in-situ measurement and scintillation; (7) discussion of some selected experimental situations and phenomena such as the BUARO release, STRESS, and three meter backscatter; and (8) survey of additional density-gradient instabilities possibly relevant to anomalous diffusion under HANE conditions. The study suggests that modes other than the E x B mode can contribute to striation dynamics at high altitudes. Possible experimental tests of the relationship of plasma turbulence and striation evolution are described. GRA

N80-29554# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
ANALYSIS OF ANTENNA RADOMES BY RAY TECHNIQUES. PART 1: POINT SOURCE Final Report
S. W. Lee, V. Jamnejad, M. S. Sheshadri, and R. Mittra. May 1980. 81 p. refs.
(Contract N00019-79-C-0281)
(AD-A085329; UIEM-80-2; UILU-ENG-80-2542) Avail: NTIS
HC A05/MF A01 CSCL 17/9

A new method for attacking the radome problem is presented in this report. It improves the standard radome analyses in the two aspects: the description of the incident field, and the curvature of the radome surface as explained below. The radome is normally situated in the near-field zone of the antenna, which may be a horn, a slot, or an array. Taking into consideration the finite antenna size, we approximately replace it by an array of discrete point sources, each of which radiates a spherical wave. This approximation is different from that used in conventional techniques in which the incident field from the antenna is approximately represented by a spectrum of plane waves, instead of spherical waves. In calculating the wave transmission through the radome, the curvature of the radome is invariably ignored in conventional analyses. Our approach, however, does treat the radome as a curved surface by calculating the transmission of a spherical wave via ray techniques. In this part of the report, only the point source situated inside the radome is studied. Extensive numerical results show that the curvature of the radome may significantly modify the field transmitted through the radome. This modification cannot be accounted for by conventional radome analysis. GRA

N80-29555# Naval Oceanographic Office, Bay St. Louis, Miss.
ATLANTIC AND MEDITERRANEAN TABLES OF COMMUNICATION STATION AZIMUTHS AND LORAN-C STATION AZIMUTHS AND DISTANCES
Nov. 1979. 427 p. Supersedes NOO-SP-272
(AD-A085307; NOO-SP-272-1; NOO-SP-272) Avail: NTIS
HC A19/MF A01 CSCL 17/3

The tables in SP-272-1 are designed for users of the Navy Communications Stations and Loran-C Stations. The tables give azimuths to communication and Loran-C stations, and distances to Loran-C stations. Index diagrams of coverage of the various tables are provided. GRA

N80-29556# SRI International Corp., Menlo Park, Calif.
TROTT COMPUTER PROGRAM FOR TWO-DIMENSIONAL STRESS WAVE PROPAGATION, VOLUME 3 Final Report, Sep. 1977 - Aug. 1978
L. Seaman and D. R. Curran. Aberdeen Proving Ground, Md. ARRADCOM. Apr. 1980. 150 p. refs.
(Contract DAAK11-77-C-0083)
(AD-A085766; AD-E430455; ARBRL-CR-00428) Avail: NTIS
HC A07/MF A01 CSCL 20/11

TROTT is a Lagrangian finite-difference computer program for calculating two dimensional stress wave propagation through solid, porous, and composite materials. The stress waves may be caused by impact, detonation of an explosive, or a prescribed velocity. The calculational procedure is the standard leapfrog method of von Neumann and Richtmyer, using artificial viscosity to smooth shock fronts. Quadrilateral or triangular cells are used. The momentum relations are derived by treating the cells as finite elements. Axisymmetric or planar flow can be handled. The constitutive relations include the standard Mie-Gruneisen equation-of-state and elastic-plastic, work-hardening deviator stress relations. A polytropic gas and detonating flow relations are provided for explosives. Ductile and brittle fracture and

shear banding are provided by nucleation and growth models. Porous materials can be represented by a cap plasticity model. A model for layered composites is also present. The code is constructed for easy insertion of additional material models. The number of extra variables required for each cell for a material model can be specified on an input card. This manual includes many sample problems, a derivation of the flow equations, and a discussion of material models. GRA

N80-29557# Naval Ocean Systems Center, San Diego, Calif.
IONOSPHERIC PROFILES FOR PREDICTING NIGHTTIME VLF/LF PROPAGATION. DETERMINATION OF AN EFFECTIVE (EXPONENTIAL) MODEL FOR USE IN DESIGN AND DEPLOYMENT OF RESOURCES FOR COMMUNICATION AND NAVIGATION Final Report, Jan. 1974 - Sep. 1979
J. A. Ferguson 25 Feb. 1980 81 p refs Prepared for Defense Communications Agency, Washington, D.C. and Coast Guard, Washington, D.C.
(AD-A085399; NOSC/TR-530) Avail: NTIS HC A05/MF A01 CSCL 20/14

The regression analysis of ionospheric profiles from the literature fails to show the high ionospheric variability that is observed in the propagation measurements. Neither does it show the rapid transition in altitude between high and middle latitudes. The measured propagation data are more directly related to the MEECN and Omega system requirements for predicting vlf and lf field strengths. Profiles are suggested on the basis of the analysis of these data. GRA

N80-29558# Sperry Research Center, Sudbury, Mass.
SPACE-TIME INTEGRAL EQUATION APPROACH TO DIELECTRIC TARGETS Final Technical Report, 1 Jan. - 30 Sep. 1979
C. L. Bennett, H. Mieras, and R. Lyons Griffiss AFB, N.Y. RADC Mar. 1980 73 p refs
(Contract F30602-79-C-0060; AF Proj. 4506)
(AD-A085743; SRC-CR-79-81; RADC-TR-79-356) Avail: NTIS HC A05/MF A01 CSCL 20/3

This report describes the extension of the space-time integral equation approach to scattering from dielectric solids. The theory of the space-time integral equation approach is presented and verified by comparison with the classical solution for scattering from a sphere. The technique and solution for scattering from a complex target consisting of wings on a fuselage are presented based on a model closely resembling a Tomahawk missile. Experimental verification of the calculations is provided by time domain scattering range response measurements on a variety of targets. GRA

N80-29559# TRW Defense and Space Systems Group, Redondo Beach, Calif.
HIGH FREQUENCY MODEM FOR ADVANCED NARROWBAND DIGITAL VOICE TERMINAL Final Report
M. Adler Mar. 1980 17 p
(Contract N00014-77-C-0580)
(AD-A085984; TRW-32191) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report describes the software developed for the HF MODEM for the ANDVT contract. The transmitter and the receiver are described. GRA

N80-29560# Sperry Gyroscope Co., Great Neck, N.Y. Sperry Div.
RADAR RESOURCES ALLOCATION STUDY Interim Report, 1 Oct. 1978 - 30 Sep. 1979
F. J. Scire and W. R. Hanley Jan. 1980 159 p
(Contract F19628-78-C-0228; AF Proj. 4600)
(AD-A086121; SG-4253-1143; RADC-TR-79-339) Avail: NTIS HC A08/MF A01 CSCL 17/9

This interim report defines an advanced technology phased array baseline radar with potential for automatically allocating its resources according to a preselected set of algorithms. Performance data of the radar, operating in a minimally adverse environment, has been generated both mathematically and from the simulation runs of integrated radar, clutter and target math models. GRA

N80-29561# Pacific-Sierra Research Corp., Santa Monica, Calif.
ELF PROPAGATION IN THE PRESENCE OF NONSTRATIFIED IONOSPHERIC DISTURBANCES Final Report, May 1979 - Feb. 1980
E. C. Field, Jr., S. J. Gayer, and B. P. Dambrosio Jun. 1980 50 p refs
(Contract N00014-79-C-0452)
(AD-A086129; PSR-1013) Avail: NTIS HC A03/MF A01 CSCL 20/14

This report analyzes the propagation of the TEM-ELF waveguide mode when the ionosphere is not stratified. It treats strong localized ionospheric disturbances by recasting the lateral wave equation as a two dimensional integral equation, and applies a specially developed algorithm to obtain numerical solutions. The quasi-full wave results show that a localized ionospheric disturbance behaves like a converging cylindrical lens filling a narrow aperture. Lateral diffraction and focusing, ignored in treatments that do not fully account for transverse ionospheric structure, cause the ELF signal to exhibit a pattern of maxima and minima on the line normal to the path passing through the center of the disturbance. As expected, the focusing/diffraction effects diminish when the transverse dimension of the disturbance exceeds the width of the first Fresnel zone - typically, several megameters. The analysis models widespread inhomogeneities, such as within the polar cap or at the day/night terminator, as semiinfinite regions separated by diffuse boundaries; it then derives full-wave analytic expressions for the reflection of the TEM mode. Mode reflection is found to significantly affect an ELF signal in two actual situations: first, when receivers are on great circle paths that are nearly tangential to the disturbed polar cap - in which case shadow zones and interference patterns can occur; and second, when signals are incident on the day/night terminator (from the day side) at angles exceeding about 75 deg - in which case the signals are affected by a phenomenon analogous to total internal reflection. Reflection is found to be unimportant if the boundary thickness exceeds about one-sixth of a wavelength. GRA

N80-29562# Ohio State Univ., Columbus. ElectroScience Lab.
A HYBRID MOMENT METHOD: GTD TECHNIQUE FOR ANALYSIS OF ANTENNAS MOUNTED ON OR NEAR CURVED SURFACES
Lee W. Henderson and Gary A. Thiele Apr. 1980 68 p refs
(Contract N00014-78-C-0049)
(AD-A086074; ESL-710816-7) Avail: NTIS HC A04/MF A01 CSCL 09/5

A hybrid technique which will analyze thin wire scatterers in the presence of a large conducting body is presented. This technique is quite general and applicable to a large class of problems. Two specific cases were chosen to demonstrate the usefulness of this approach. The first example given is of two piecewise sinusoidal dipoles arbitrarily positioned near an infinite, perfectly conducting cylinder. The second example provides a method for analyzing antennas mounted on the cylinder, such as a monopole. This solution is obtained as a perturbation of image theory. GRA

N80-29563# Airborne Instruments Lab., Deer Park, N.Y.
ANALYSES FOR MULTISTATIC GEOMETRIC IMAGE Final Technical Report, 18 Apr. - 19 Oct. 1979
J. S. Prichard, R. A. Baker, and W. J. Capiti Feb. 1980 71 p
(Contract F30602-79-C-0137; AF Proj. 2305)
(AD-A085866; E034-1; RADC-TR-80-18) Avail: NTIS HC A04/MF A01 CSCL 17/9

Polar format storage of two dimensional monostatic synthetic aperture radar (SAR) data (gathered in the stretch-spotlight mode of operation) allows matched two dimensional Fourier transform processing; it eliminates range walk, allowing maximum size field of view for a given resolution or finest resolution for a given size field of view. In a bistatic SAR system, iso-range and iso-Doppler contours are orthogonal only for zero bistatic angle. The range gradient diminishes as the bistatic angle is increased. When polar format storage is used, these effects result in increasing smearing (defocusing) and geometric distortion of the imagery as the bistatic angle is increased. Hence, such formatting is not matched to two dimensional transform processing. A solution to the bistatic SAR image processing problem is provided by a

new technique called coherent unskewing and reconstitution logic (Curl). The matched processing performance of the Curl technique is demonstrated using computer simulation of received data from a bistatic SAR system with two dimensional geometry. The resulting imagery is sharply focused and is totally free of geometric distortion. GRA

N80-29564# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
EFFICIENT ENCODING AND DECODING OF SPEECH Quarterly Progress Report, 1 Feb. - 30 Apr. 1980
M. Berouti, M. Krasner and J. Makhoul. May 1980. 39 p. refs.
(Contract MDA904-79-C-0411)
(AD-A085972; BBN-4384; QPR-2) Avail: NTIS HC A03/MF A01 CSCL 09/4

We report on continued research to improve the APC algorithm. The issue of system stability as a function of the linear prediction filter is discussed and a method for improving performance presented. The issue of computational complexity is also addressed. A new filter that reduces the computational load of the algorithm is designed for use in the resampling operations. GRA

N80-29565# Arinc Research Corp., Annapolis, Md.
FAA COMMUNICATIONS COST MODEL PROGRAM DOCUMENTATION: REVISED
W. Kolb, R. Tanke, and I. Gershkoff. Apr. 1980. 88 p.
(Contract DOT-FA77WA-4018)
(AD-A086020; Rept-1339-01-702174-Rev; FAA-ASP-80-7) Avail: NTIS HC A05/MF A01 CSCL 17/2

The FAA Communications Cost Model is a computer program designed to answer management questions dealing with long-term, national-level communications planning issues. Therefore, the program is purposely directed toward estimating long-term macro-level (as opposed to near-term, micro-level) communications costs. The algorithms used emphasize cause-and-effect relationships (rather than direct extrapolation of cost data) to predict costs. This report documents the communications model computer program. It includes a description of model equations, functional flow charts, and the program listings. It should be used in conjunction with the revised FAA Communications Model User's Guide for a comprehensive understanding of the computer software. The edition supersedes the issue dated May 1979. GRA

N80-29566# New Mexico State Univ., Las Cruces. Physical Science Lab.
ON THE ANALYTICAL INVERSION OF LIDAR RETURNS FROM AN INHOMOGENEOUS ATMOSPHERE
James D. Klett. White Sands Missile Range, N. Mex.: Army Electron. Res. and Develop. Command. Apr. 1980. 51 p. refs.
(Contract DAAD07-79-C-0008; DA Proj. 1L1-62111-AH-71)
(AD-A085922; ERADCOM/ASL-CR-80-0008-3) Avail: NTIS HC A04/MF A01 CSCL 17/8

A new analytical method is presented for extracting attenuation and backscatter coefficients in an inhomogeneous atmosphere from the return signal of a monostatic, single wavelength lidar system. The inversion method can be applied using only information contained in the signal itself and, in sharp contrast to a well known related analytical inversion method, it is relatively tolerant of various characteristic errors and uncertainties. Inversion examples for a variety of conditions are presented and discussed. GRA

N80-29567# Naval Research Lab., Washington, D. C. Target Character. Branch.
AN ANALYTICAL STUDY OF RADAR RETURNS IN THE PRESENCE OF A ROUGH SEA SURFACE Interim Report
H. R. Raemer. 12 Mar. 1980. 96 p. refs.
(SF1214191)
(AD-A086157; AD-E000437; NRL-8369) Avail: NTIS HC A05/MF A01 CSCL 17/9

The analytical study described in this report was originally undertaken in an attempt at a theoretical explanation of certain experimental results on radar return from ship targets corrupted by sea return. The analysis, like a number of previous treatments of this problem, is based on the classical perturbation approach credited to S. O. Rice. It assumes small fluctuations ('capillary waves') superposed on a large-scale 'sea swell'. Certain cross-correlation functions of the radar return are calculated. The radar-target system geometry is modeled, allowing for consideration of various antenna beam patterns, pulse shapes, sea-swell geometries and discrete targets on or near the sea surface. Terms beyond first order (second and third) are included in order to explain cross-polarization effects, which have been observed experimentally. Limited results on fourth-order terms are also obtained. However, when the analysis is carried only to fourth order and these terms are averaged, they do not contribute to the cross-polarization and their effect is seen only if specular returns are present. GRA

N80-29568# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EVALUATION OF THE AVIATION WEATHER AND NOTAM SYSTEM (AWANS) Final Report, Aug. 1975 - Sep. 1976
Hugh D. Milligan and Bruce L. Rosenberg. Jun. 1979. 51 p.
(AD-A086167; FAA-NA-79-13; FAA-RD-79-46) Avail: NTIS HC A04/MF A01 CSCL 17/2

This activity was conducted to ascertain the operational effectiveness of an experimental system in providing automation capabilities geared to flight service station application. Primary consideration was given to the man-machine relationship and the efficacy of the data and presentation formats made available to the specialist through the system. Maintenance, technical, and software aspects were not specifically addressed. Results of the study indicate that the automated system provides textual and graphic data in a form suitable for use in preflight and in-flight briefing modes. Further, the equipment configurations under study contained one which was acceptable, though not deemed optimal, by the specialists. This acceptability included the display size, character size and font, graphic and textual products, communications equipment, console design, and associated equipment layout. GRA

N80-29569# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A PHASE CORRECTION SYSTEM TO IMPROVE THE QUALITY OF A WIDEBAND CHIRP SIGNAL
Buchanan Loesch. 5 Feb. 1980. 24 p.
(Contract F19628-80-C-0002; AF Proj. 649L)
(AD-A086050; TN-1980-8; ESD-TR-79-303) Avail: NTIS HC A02/MF A01 CSCL 17/4

A phase correction circuit which significantly improves the linearity of a wideband (hundreds of MHz) chirp signal has been constructed and tested. This correction circuit is applicable to a chirp generator in which a digital system is used to compute the phase of the chirp signal once each clock cycle, and the chirp signal bandwidth is then restricted to appreciably less than the clock frequency, analog frequency multiplication is then used to obtain the required bandwidth. The circuit described here corrects the high frequency phase errors which are present after the multiplication process. GRA

N80-29570# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
CIRCULARLY POLARIZED MEASUREMENTS OF RADAR BACKSCATTER FROM TERRAIN Contract Report, Aug. 1978 - Aug. 1979
E. A. Wilson, D. R. Brunfeldt, Fawwaz T. Ulaby, and J. C. Holtzman. Feb. 1980. 235 p. refs.
(Contract DAAK70-78-C-0121)
(AD-A086002; CRINC/RSL-TR-393-1; ETL-0201) Avail: NTIS HC A11/MF A01 CSCL 17/9

This report documents the design changes to the University of Kansas MAS 8-18/35 scatterometer system required to incorporate a circular polarization capability and a subsequent backscatter measurement program. The modifications enable the MAS 8-18/35 system to acquire both linear (HH, HV, VV) and circular (RR, RL, LL) radar backscatter data over its entire operating range of 8-18 GHz and 35 GHz. The measurement program described herein consisted of measurements of the backscatter coefficient, as a function of the angle of incidence (0-80) at selected frequencies in the 8-18 GHz range using circular polarization. Targets studied included coniferous and deciduous trees, wet and dry asphalt and concrete and bare and plowed ground at various moisture conditions. Coniferous and decidu-

ous tree measurements were taken in both August and November so that seasonal changes could be observed. GRA

N80-29571# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
QUANTIZATION EFFECTS ON DIGITAL MTI. M.S. Thesis
Yu-Hong Kwong. Jan. 1980. 65 p. refs. Sponsored in part by AF.
(Contract DAAG29-78-C-0016; N00014-79-C-0424)
(AD-A085886; R-868; UILU-ENG-80-2201) Avail: NTIS HC A04/MF A01 CSCL 17/9

The processing of digital signals is rapidly approaching a dominant role in both communication and radar systems. However, the physical origin of many information-bearing signals is intrinsically analog and continuous-time in nature. Therefore, an effective interface between the analog and digital worlds is of significant importance in modern signal-processing. Very often the quality of analog-to-digital (A/D) conversion is the critical limiting factor in over-all system performance. GRA

N80-29572# AEG-Telefunken, Heilbronn (West Germany). Serienprodukte A.G.
SMALL SIGNAL AND NOISE MODELING OF UHF DEVICES. Final Report
Michael Ohler. Bonn: Bundesmin. fuer Forsch. u. Technol. Dec. 1979. 76 p. refs. In GERMAN; ENGLISH summary. Sponsored by Bundesministerium fuer Forschung und Technologie.
(BMFT-FB-T-79-65; ISSN-0340-7608) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16

Methods for the measurement and computer simulation of small signal and noise parameters in the frequency range from 100 to 1300 MHz were developed. Bipolar p-n-p transistors in the common base configuration in 'JEDEC TO 50' casings were primarily investigated. By the application of the correlation matrix method it was possible to analyze the noise behavior of complex equivalent circuits. The computer programs used make it possible to deal with computational and application problems. However, the noise parameters of transistors with high resistivity collector regions cannot be accurately determined by indirect methods since the collector charging time could not be measured with sufficient accuracy. Author (ESA)

N80-29573# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
RADAR TECHNICAL TERMINOLOGY
E. Hanle. May 1979. 55 p. In GERMAN; ENGLISH summary.
(FFM-269a) Avail: NTIS HC A04/MF A01

A glossary of radar related terms is presented. The format consists of the German term, its definition, and its English translation. The glossary is intended as a standardized reference text. Author (ESA)

N80-29574# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
ON INTEGRATING DATA PROCESSING IN SYSTEMS OF NETTED SENSORS
G. vanKeuk. Nov. 1978. 29 p. In GERMAN; ENGLISH summary.
(FFM-280) Avail: NTIS HC A03/MF A01

The scope and inherent problems of target data processing when sensor networks are involved are considered. The study is restricted to radar, sonar, and surface acoustic sensors. A distinction is made between the electronic signal processing of sensor output and the task of integrating the digital output of a variable system of distributed sensors. Both cases are discussed in terms of network software and examples of network analysis are given. Author (ESA)

N80-29575# National Technical Information Service, Springfield, Va.
INFORMATION AND COMMUNICATION THEORY. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1978 - Mar. 1980
Brian Carrigan. Apr. 1980. 195 p. Supersedes NTIS/PS-79/0441; NTIS/PS-78/0387.
(PB80-807860; NTIS/PS-79/0441; NTIS/PS-78/0387) Avail: NTIS HC $30.00/MF $30.00 CSCL 09D

This bibliography cites Government sponsored research information and communication theory, including coding, decoding, and transmission of signals. Individual studies are cited on radio, television, and digital communication systems. Pure theory is also included. This updated bibliography contains 187 abstracts, 78 of which are new entries to the previous edition. GRA

N80-29576# National Technical Information Service, Springfield, Va.
BEAM LEAD MICROELECTRONICS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE. Progress Report, 1970 - Mar. 1980
William E. Reed. Apr. 1980. 157 p. Supersedes NTIS/PS-79/0390; NTIS/PS-78/0369.
(PB80-808355; NTIS/PS-79/0390; NTIS/PS-78/0369) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

Research reports from worldwide literature are cited which treat with the technology and applications of beam lead devices. Topics include chip interconnections, design, fabrication, bonding, packaging, and testing. This updated bibliography contains 151 abstracts, 16 of which are new entries to the previous edition. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid State Physics*.

N80-29577 Ohio Univ., Athens.
ANALYSIS OF FIRST AND SECOND ORDER BINARY QUANTIZED DIGITAL PHASE-LOCKED LOOPS FOR IDEAL AND WHITE GAUSSIAN NOISE
Paul Raymond Blasche. 1980. 126 p.
Avail: Univ. Microfilms. Order No. 8016637

Specific configurations of first and second order all digital phase-locked loops were analyzed for both ideal and additive white Gaussian noise inputs. A design for a hardware digital phase locked loop capable of either first or second order operation was examined along with appropriate data obtained from testing of the hardware loop. All parameters chosen for the analysis and the design of the digital phase locked loop were consistent with an application to an Omega navigation receiver although neither the analysis nor the design were limited to this application. Ideal inputs were considered for both first and second order digital phase locked loops with the objective of classifying the time response of the loops. For both loops it was found that the phase error response was given by a nonlinear difference equation for which no direct solution was found. Partial response characteristics of the phase error were determined for both the first and second order loops when the frequency of the input signal is identical to that of the loop's quiescent frequency. Dissert. Abstr.

N80-29578 Stanford Univ., Calif.
DIELECTRIC ISOLATION TECHNOLOGY FOR BIPOLAR AND MOS INTEGRATED CIRCUITS. Ph.D. Thesis
Phillip William Barth. 1980. 235 p.
Avail: Univ. Microfilms. Order No. 8016808

Dielectric isolation technology based on preferential chemical etching techniques resulted in device quality silicon layers as thin as one micrometer. Layers were fabricated by use of a doping dependent etch (hydrofluoric, nitric, and acetic acids in a ratio of 1:3:8, concentrated reagents) which removed the bulk of a thick, heavily doped starting wafer, and stopped at a doping level of one times ten to the eighteenth atoms per cubic centimeter, leaving a lightly doped thin layer of single crystal silicon. This layer was supported by a thick substrate of deposited polycrystalline silicon, with an intervening insulator, for fabrication of dielectrically isolated integrated circuits. The dielectrically isolated silicon layers were comparable to bulk silicon wafers in terms of mobility, carrier lifetime, fixed surface charge density,

and fast surface state density. The good quality of these layers permitted the fabrication of both bipolar and MOS (metal oxide semiconductor) integrated circuits. Dissert. Abstr.

N80-29579 Michigan Univ., Ann Arbor.
SENSITIVITIES OF BIPOLAR JUNCTION TRANSISTOR ELECTRICAL PARAMETERS TO PROCESSING VARIABLES Ph.D. Thesis
Hassan Saeed Abdulkarim 1980 213 p
Avail: Univ. Microfilms Order No. 8017208

Variations and sensitivities of bipolar junction transistor (BJT) electrical parameters to processing variables were examined. The functional dependence of those sensitivities on the processing schedule employed was estimated. Some design criteria or guidelines that should be followed to reduce the sensitivities of electrical parameters and to minimize yield loss were determined. The BJT parameters considered were electrical parameters of the Ebers-Moll and hybrid-pi models, as well as some device parameters that were useful for the characterization of processing results. The processing variables considered were time and temperature for each of the processing steps of the double diffusion method, physical constants that influence the impurity distribution in silicon, and device dimensions. In evaluating the impurity atom distribution, the diffusion coefficient was assumed to be independent of impurity concentration and the superposition model was assumed for the interaction of the two oppositely charged impurities. In evaluating the electrical parameters, use of a one dimensional model and the modified Moll-Ross relations were assumed to be adequate in relating variations in electrical characteristics to variations in processing variables and physical properties. Dissert. Abstr.

N80-29580 Michigan Univ., Ann Arbor.
DIGITAL SIMULATION OF PERMANENT-MAGNET MOTORS USING FINITE ELEMENT ANALYSIS Ph.D. Thesis
Samir Qasim Fakhru 1980 240 p
Avail: Univ. Microfilms Order No. 8017257

The determination of magnetostatic fields in permanent-magnet motors is investigated. Variational finite-element formulation as well as sparse matrix procedures are used to perform an accurate magnetic field mapping of this type of motor. Results are used to obtain torque and force components acting on the rotor of the permanent magnet motor. Variational formulations of the two dimensional magnetostatic problem are performed utilizing both vector-potential and scalar-potential approaches. Boundary conditions were taken into account. Simulation studies indicate that the scalar-potential approach performs the solution task with greater accuracy than the vector-potential approach. The effect of sparse matrix procedures on the solution cost is also emphasized. Dissert. Abstr.

N80-29581 Stanford Univ., Calif.
MODELING AND CHARACTERIZATION OF SHORT-CHANNEL DOUBLE-DIFFUSED MOS TRANSISTORS Ph.D. Thesis
Donald Charles DAvanzo 1980 216 p
Avail: Univ. Microfilms Order No. 8016816

The performance of short-channel double-diffused MOS transistors was examined through extensive modeling and characterization of DMOS and VMOS transistors. Two dimensional numerical simulations reveal several second-order effects which influence short-channel device performance. The effects include a shortening of the effective electrical channel length due to the nonuniform channel profile and horizontal electric fields and significant depletion and inversion of channel charge by large horizontal fields resulting in lower threshold voltages and higher output conductances. These effects are incorporated into an analytical model based on a two transistor equivalent circuit. The key feature of the model is the use of an exponential profile approximation and a geometrical partitioning of channel charge which allow the incorporation of nonuniform profile and two dimensional field effects. The analytical model is used to simulate DMOS and VMOS enhancement-depletion inverters and to compare their performance to conventional NMOS inverters. The results imply that the double-diffused technologies are superior to conventional NMOS for masked channel lengths greater than 3.0 microns. For shorter channel lengths, velocity saturation dominates the drain characteristics so that maximum driving currents and propagation delays converge for all three technologies. Dissert. Abstr.

N80-29582 Rice Univ., Houston, Tex.
ADAPTIVE NONLINEAR IMAGE RESTORATION BY A MODIFIED KALMAN FILTERING APPROACH Ph.D. Thesis
Sarah Ann Rajala 1980 108 p
Avail: Univ. Microfilms Order No. 8018062

An adaptive nonlinear Kalman-type filter is presented for the restoration of two dimensional images degraded by general image formation system degradations and additive white noise. A vector difference equation model is used to model the degradation process. The object plane distribution function is partitioned into disjoint regions based on the amount of spatial activity in the image, and difference equation models are used to characterize the object plan distribution function. It is shown that each of the regions can be uniquely characterized by their second order statistics. The autocorrelation function for each region is then used to determine the coefficients of the difference equation model for each region. Recursive estimation techniques are applied to a composite difference equation model. Dissert. Abstr.

N80-29583*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ACTIVE NOTCH FILTER NETWORK WITH VARIABLE NOTCH DEPTH, WIDTH AND FREQUENCY Patent Application
James M. Black, inventor (to NASA) Filed 25 Jul. 1980 13 p
(NASA-Case-FRC-11055-1; US-Patent-Appl-SN-172098) Avail: NTIS HC A02/MF A01 CSCL 09A

An active notch filter having independently adjustable notch frequency, width, and depth is provided by three equal capacitors connected in series with an operational amplifier (connected in a voltage follower configuration), a potentiometer across the series connected capacitors for notch depth adjustment, and a potentiometer (for notch frequency connected across the center capcitor); with its tap connected to receive a voltage feedback signal from a variable voltage divider comprised of another potentiometer for notch width. Adjusting the voltage dividing potentiometer will independently set the notch width, and adjusting the tap on the potentiometer across the center capacitor will independently adjust the notch frequency of the filter. A second operational amplifier connected in a voltage follower configuration may be used to connect the voltage divider output to the adjustable tap of the potentiometer across the center capacitor. NASA

N80-29584*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SUPERCONDUCTING GYROCON FOR HIGH POWER HIGH EFFICIENCY MICROWAVE GENERATOR/AMPLIFIER APPLICATION Patent Application
Huan-Chun Yen, inventor (to NASA) (JPL) Filed 18 Jul. 1980 17 p
(Contract NAS7-100)
(NASA-Case-NPO-14975-1; US-Patent-Appl-SN-171927) Avail: NTIS HC A02/MF A01 CSCL 09A

The superconducting gyrocon includes an electron gun, a deflection cavity, means for coupling RF energy into the deflection cavity, an output cavity, and an output coupler for removing energy from the output cavity. The inner surface of the deflection cavity and the inner surface of the output cavity or resonator is formed of a superconducting material such as Nb3Sn, lead, or niobium. The two cavities are submerged in liquid helium in order to maintain the superconducting material at a temperature of approximately 4 degrees Kelvin. Characteristics of the thus cooled superconducting material minimizes RF losses within the gyrocon, and allows the power gain of a conventional gyrocon to be increased from approximately 13 db to 54 db, and its efficiency from 82 percent to 92 percent. NASA

N80-29585# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
A REVIEW OF THE SCIENCE AND TECHNOLOGY OF CATHODES FROM THE VIEWPOINT OF SPACECRAFT TWT APPLICATIONS Interim Report
Gary W. Stupian 1 Jun. 1980 77 p refs

(Contract F04701-79-C-0080)
(AD-A085778; TR-0080(5970-03)-2; SD-TR-80-37) Avail: NTIS HC A05/MF A01 CSCL 09/1

The current state-of-the-art of cathode science and technology is summarized, with emphasis on the types of cathode now used, or with potential use, in U.S. Air Force communication satellites. The intent is that this report be a stand-alone discussion of cathode construction and of the basic physics of electron emission. Emphasis is placed on thermionic cathodes; however, one nonthermionic emitter, the field emitter, is discussed briefly. For the thermionic emitters, the barium (calcium and strontium) oxide cathode and dispenser cathodes (based on barium) are discussed, along with variant types of the oxide and dispenser cathodes. Thorium-based cathodes and lanthanum hexaboride cathodes are also described. Some of the available data on cathode failure modes and cathode lifetime are included. Electron emission from solids has been studied with varying intensity since the last century, and the present discussion, because of the scope of the subject, of course is incomplete. Extensive literature references are given. GRA

N80-29586# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
DESIGN AND ANALYSIS OF NMOS OPERATIONAL AMPLIFIER WITH DEPLETION LOADS M.S. Thesis
Richard Dean Davis. Aug. 1979. 55 p. refs.
(Contract N00014-79-C-0424; Grant NSF ENG-78-11758)
(AD-A085313; R-857; UILU-ENG-78-2250) Avail: NTIS HC A04/MF A01 CSCL 09/5

The MOS transistor has become the building block for LSI digital circuits in recent years. Its small device size and high fabrication yield have made it particularly attractive. Recently, however, the application of MOS technology to analog circuits has been studied. One particularly useful analog circuit is the operational amplifier. The ability to fabricate an all MOS operational amplifier on an LSI chip can increase the flexibility of many signal processing tasks, such as filtering, D/A and A/D conversion. In addition, the amplifier would be compatible with other MOS circuit elements. In this thesis a single channel NMOS operational amplifier with depletion loads is designed. Computer simulation using the SPICE circuit analysis program is used as a design aid and to evaluate the final design, as this lends itself easily to the study of parameter variations within the circuit. Of particular interest is the method of internal frequency compensation of the amplifier leading to design criteria for several small signal parameters. These small signal parameters are directly related to device geometry and DC bias conditions. Other characteristics and performance criteria of the amplifier are also discussed. GRA

N80-29587# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
A FULLY MACROSCOPIC DESCRIPTION OF BOUNDED SEMICONDUCTORS WITH AN APPLICATION TO THE Si-SiO2 INTERFACE
M. G. Ancona and H. F. Tiersten. May 1980. 52 p. refs.
(Contract N00014-76-C-0368; NR Proj. 318-009)
(AD-A085674; TR-31) Avail: NTIS HC A04/MF A01 CSCL 20/12

A fully macroscopic description of semiconductors is presented which includes the boundary conditions at the surface of the semiconductor that are required for consistency with the usual diffusion-drift current equations. As in all field theories, e.g., electromagnetism, both the boundary conditions and the differential equations are obtained from the same governing integral forms. The new boundary conditions relate the jump discontinuities in the chemical potentials across the interface to the forces exerted by the lattice on the charge carries which prevent the carriers form leaving the solid. The expressions for the forces in the static case are found and the values of the material surface coefficients appearing therein are obtained from quasistatic MOS C-V measurements for some particular Si-SiO2 interfaces. GRA

N80-29588# Aerospace Corp., El Segundo, Calif.
MICROWAVE SQUID A/D CONVERTERS Interim Report
Arnold H. Silver, John P. Hurrell, Yeong-Du Song, and David C. Pridmore-Brown. 5 Jun. 1980. 36 p.
(Contract F04701-79-C-0080)
(AD-A085897; TR-0080(5732)-1; SD-TR-80-34) Avail: NTIS HC A03/MF A01 CSCL 09/3

This document reports progress on the demonstration of an analog-to-digital converter using Josephson junction SQUID circuits. The projected performance envisions an aperture time limit of 0.25 (x 10 times 10 to the minus 12) sec with the Pb alloy junction technology. The status of junction fabrication and circuit simulations are reported. GRA

N80-29589# Illinois Univ. at Urbana-Champaign. Applied Computation Theory Group.
THE CUBE-CONNECTED-CYCLES: A VERSATILE NETWORK FOR PARALLEL COMPUTATION
Franco P. Preparata and Jean Vuillemin. Nov. 1979. 31 p. refs. Prepared in cooperation with Paris-Sud Univ., Orsay (France)
(Contracts N00014-79-C-0424; DAAG29-78-C-0016; Grant NSF MCS-78-13642)
(AD-A085846; ACT-20; UILU-ENG-80-2206) Avail: NTIS HC A03/MF A01 CSCL 09/5

We introduce an interconnection pattern of processing elements, the cube-connected-cycles (CCC), which can be used as a general purpose parallel processor. Because its design complies with present technological constraints, the CCC can also be used in the layout of many specialized large scale integrated circuits (VLSI). By combining the principles of parallelism and pipelining, the CCC can emulate the cube-connected machine and the perfect shuffle with no significant degradation of performance but with a more compact structure. We describe in detail how to program the CCC for efficiently solving a large class of problems, which includes Fast-Fourier-Transform, sorting, permutations, and derived algorithms. GRA

N80-29590# Honeywell, Inc., Hopkins, Minn. Defense Systems Div.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR THE 10 kHZ TAPE-AUTOMATED BONDED HYBRID MICROCIRCUIT OSCILLATOR Final Report
Bernard E. Goblish. Dec. 1979. 112 p.
(Contract DAAG39-78-C-0010)
(AD-A085973; HDL-CR-79-010-1; HONEYWELL-2730-41637) Avail: NTIS HC A06/MF A01 CSCL 19/1

A Manufacturing Methods and Technology (MM & T) program was conducted on a 10 kHz hybrid microcircuit oscillator for use in electronic time fuzes. The oscillator which was originally developed under contract DAAG39-77-C-0056, uses tape-automated bonding (TAB) techniques to eliminate the use of individually bonded wires. The processes and achievable production rates were investigated and a total of approximately 2000 circuits were built. Recommendations are made for the equipment to be used for volume production of the oscillator. GRA

N80-29591*# Franklin Research Center, Philadelphia, Pa. Power Information Center.
SUMMARY OF THE PROCEEDINGS OF THE SUPERCONDUCTIVITY TECHNICAL EXCHANGE MEETING
16 Apr. 1980. 165 p. Conf. held at Washington, D.C., 16 Apr. 1980
(Contract NASw-3219)
(AD-A085974; PIC-ELE-SC209/1) Avail: NTIS HC A08/MF A01 CSCL 20/3

Contents: Large Superconductive Magnets; Superconductivity Activities at LASL; Superconductivity Studies at Argonne National Laboratory; CFFF MHD Magnet at Argonne National Laboratory; MHD Superconducting Magnets; Fermilab's Energy Saver; LCP and 12 Tesla Programs at ORNL; Division of Electric Energy System's Superconductivity Program; Development of Standards for Practical Superconductors; Casting of Dendritic Cu-Nb Alloys for Superconducting Wire; Review of Recent Developments of Multifilamentary Nb3Sn by 'in Situ' and Cold Powder Metallurgy Processes; Superconducting Magnet Facility at NRL; Airborne Superconductor Applications; High Pressure Synthesis Program at Benet Weapons Laboratory Watervliet Arsenal; CuCl: Stability and Exciton Population Percursive to Anomalous

Diagmagnetism; Navy Superconductive Machinery Development Program; and Superconducting Materials Program at NRL. GRA

N80-29592# Raytheon Co., Quincy, Mass. Industrial Components Operation.

MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING (MM AND TE) PROGRAM FOR THE ESTABLISHMENT OF PRODUCTION TECHNIQUES FOR HIGH DENSITY THICK FILM CIRCUITS USED IN CRYSTAL OSCILLATORS, VOLUME 1 Final Report, 8 Aug. 1976 - Aug. 1979

R. Michel Zilberstein. Apr. 1980. 210 p. refs.
(Contract DAAB07-76-C-8119)
(AD-A086022; DELET-TR-76-8119F-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 09/5

Production techniques have been established for a thick film hybrid Microelectronic 17-22 MHz, temperature compensated, voltage controlled quartz crystal oscillator. The program requirements, the plans for meeting those requirements, the technical approach pursued and the technical work accomplished are described. The program was subdivided into an engineering phase and a production phase. The engineering phase consisted of the following steps: the breadboard analysis of the TCVCXO electrical design; the configuration design of the TCVCXO module; the detailed layout design of the hybrid microcircuity used in the TCVCXO module; the detailed design of piece parts to be used to seal the hybrid microcircuits and to encapsulate the modules; the establishment of process flow plans to produce the modules; and the selection, characterization, and procurement of component parts and materials required for the production of the TCVCXO modules. The production phase involved the development of tooling and manufacturing techniques needed to achieve the program requirements; and the delivery of completed modules in accordance with the program schedule. GRA

N80-29593# RCA Corp., Princeton, N. J. Microwave Technology Center.

DUAL-GATE MESFET VARIABLE-GAIN CONSTANT-OUTPUT POWER AMPLIFIER Final Report, 18 Sep. 1978 - 17 Mar. 1980

Mahesh Kumar. Apr. 1980. 78 p. refs.
(Contract N00173-78-C-0227)
(AD-A085830; PRRL-80-CR-12) Avail: NTIS HC A05/MF A01 CSCL 09/5

Phase 1 of this study proved the feasibility of the variable-gain, constant-output power amplifier from the chosen approach by demonstrating a breadboard model. During phase 2, the development of the final packaged amplifier with improved performance, the following tasks were completed: (1) a dual-gate FET amplifier was redesigned to obtain more gain (10 dB) over the band; (2) a video amplifier was designed and developed for higher gain (40 dB); and (3) circulators were eliminated to reduce the size of the amplifier. This amplifier was demonstrated to operate over a 3 GHz band (4.5 to 7.5 GHz) and to provide an output power of 3 + or - 2 dBm over its entire dynamic range of -45 to 0 dBm of input power. The linear ACG amplifier developed under this program has the following key features. (1) It preserves amplitude modulation of the incoming signal. (2) It can perform normal AGC function under a multiple-pulse condition. This characteristic may prove to be very useful for handling multiple threats. (3) It is very versatile. It can provide separate ports to facilitate output power level adjustment and input signal detection and monitoring. (4) It has very fast response. The rise time and fall time of this amplifier are better than 15 ns which is limited by the measurement systems. GRA

N80-29594# Siemens-Allis, Inc., Portland, Oreg.

ICE-RELEASE COATING FOR DISCONNECT SWITCHES Final Report

J. L. Mundon. Mar. 1980. 42 p. Sponsored by Electric Power Research Inst.
(EPRI-EL-1330) Avail: NTIS HC A03/MF A01

Several coatings for ice release, heat dissipation, thermal cycling, and outdoor weathering properties were evaluated. The coating having the most desired performance were applied to full scale switch components. The full scale switches were tested for ice performance and heat dissipation and the results were compared with those on identical switches with uncoated components. The coating chosen for application to switch components was installed on several switches for field evaluation during the winter of 1979 and 1980. It was offered for commercial application for installation to existing switch installations. Results indicate that the coating also exhibits excellent heat dissipation properties and may be used to improve heat dissipation of switch blades and other components. The coating material is unaffected by sunlight; it is a two component, Teflon-filled polyurethane that is available from two sources. The material is currently used for a variety of purposes, such as: aircraft wing and leading edge areas, hydrofoils, conveyor chutes and many others. Light gray in color, it is an excellent heat dissipator and matches the gray insulators used with most switches. DOE

N80-29595# Texas Univ. at Austin. Center for Electromechanics.

DETAILED DESIGN, FABRICATION AND TESTING OF AN ENGINEERING PROTOTYPE COMPENSATED PULSED ALTERNATOR Final Report

W. L. Bird, Jr. and Herbert H. Woodson. Mar. 1980. 211 p. refs.
(Contract W-7405-eng-48)
(UCRL-15213) Avail: NTIS HC A10/MF A01

The design, fabrication, and test results of a prototype compensated pulsed alternator are discussed. The prototype compulsator is a vertical shaft single phase alternator with a rotating armature and salient pole stator. The machine is designed for low rep rate pulsed duty and is sized to drive a modified 10 cm Beta amplifier. The load consists of sixteen 15 mm x 20 mm x 112 cm long xenon flashlamps connected in parallel. The prototype compulsator generates an open circuit voltage of 6 kV, 180 Hz, at a maximum design speed of 5400 rpm. At maximum speed, the inertial energy stored in the compulsator rotor is 3.4 megajoules. DOE

N80-29596# National Physical Lab., Teddington (England). Div. of Computer Science.

ELECTRONIC COMPUTERS AND TELEPHONE EXCHANGES

T. H. Flowers. Jan. 1980. 20 p.
(NPL-DNACS-24/80) Avail: NTIS HC A02/MF A01

A retrospective on the telephone, with emphasis on development of digital methods, is presented. Starting with its invention in 1876, major breakthroughs in transmission and switching circuitry are reviewed. The thermionic valve (1917), the Eccles-Jordan trigger circuit (1921), copper oxide rectifiers (1920's), and the gas-tube binary counter (1931) are highlighted. The evolution of logic design in telephone exchanges and the interaction this had with electronic computers is then traced up to the appearance of COLOSSUS, a specialized electronic computer used for cryptanalysis (1943). Author (ESA)

N80-29597# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.

DEVELOPMENT OF AN ELECTROMAGNETIC PELLET-ACCELERATOR

E. Igenbergs, H. Kuczera, and P. Lell. Mar. 1979. 50 p. refs.
(Contract F-E-10-284)
(TUM-RT-TB-79/1) Avail: NTIS HC A03/MF A01

A simple electromagnetic accelerator was developed and tested. The primary and secondary circuits (the driver) were investigated analytically and experimentally. Optimum values and configuration for the primary and secondary coils were derived in a model. Experiments were conducted to verify these values. A qualitative agreement is obtained, but the experiments reveal that some disregarded mechanisms in the model lead to lower velocities or higher diameters of the driver. Many photographs were taken of the accelerated drivers and projectiles. Different methods for the measurement of the velocity were applied and tested. A special Doppler-radar method was used. This method is shown suitable for the continuous measurement of the velocity of projectiles in the 1 mm diameter range and having velocities up to 1 km/sec. It is suggested that this electromagnetic accelerator could be used as an injector for deuterium pellets. Author (ESA)

N80-29598# Siemens A.G., Munich (West Germany). Research Lab.

LARGE SCALE INTEGRATED MOS CIRCUITS WITH NARROW STRUCTURES: INVESTIGATION OF SEMICONDUCTOR EFFECTS Final Report

Hartmut Boroffka Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 43 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-67; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8.85

Laboratory work was undertaken in order to attain better reverse current quality in MOS devices. Results show that attention must be paid to the condition of the back side of the slices where impurities may be gettered. The proper preparation of the back side gives carrier life times of 300 microsec which are reproducible. The subthreshold current behavior starts to be substantially influenced by the gate length if the gate length is shorter than a certain value, e.g., approximately 3 microns for 4 ohms cm substrate material. After implanting boron for threshold voltage adjustment and annealing at 500 C the reverse current is enhanced by more than one order of magnitude. Varying the annealing temperature a minimum for the reverse current is found after annealing at 800 C, while the original values of implanted samples are roughly reached. A generally applicable mathematical procedure was also developed allowing the prediction of the behavior of a given device structure. Results show that the surface generation current decreases monotonically with decreasing gate length. Author (ESA)

N80-29599# Techniache Hochschule, Aachen (West Germany). Inst. of Semiconductor Electronics.

AUTOMATED HIGH RESOLUTION ELECTRON BEAM LITHOGRAPHY: BASIC INVESTIGATIONS ON PHYSICS AND ALIGNMENT OF SEMICONDUCTOR MICROSTRUCTURES Final Report

Hermann-Josef Geelen, Dieter Leers, Bodo Meusemann, and Dieter Stephani Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 68 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-69; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14.30

A computer controlled lithographic method for the etching of microcircuits onto a silicon wafer was studied and optimized. The direct exposure electron beam microfabricator adopted, as well as the modifications which were made in hardware and software in order to fulfill the requirements of direct material removal and alignment for multilevel devices are described. In addition, the automatic alignment algorithm, the development of appropriate reference marks, the behavior of different types of resists, and calculations according to the Monte Carlo model of backscattered electrons and their influence on process precision are presented. Author (ESA)

N80-29600# Philips Zentrallaboratorium G.m.b.H., Hamburg (West Germany). Roehren- und Halbleiterwerke.

MEASUREMENT TECHNIQUES FOR INTEGRATED HIGH FREQUENCY CIRCUITS Final Report

Peter Draheim Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 98 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-75) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.60

In an approach to submicron geometries, measurement methods for capacitors of capacitance smaller than 1 pF and for X modulation were developed. Together with these techniques, a process for implementing a p-n isolated high frequency transistor in a DIL 16 assembly mounted on a ceramic substrate was considered. Test results show that this air isolation process gives transistors with a transient frequency of 9 Ghz, the geometry of the transistor emitters is 2 microns. Furthermore, by modification of the p-n isolation process, Schottky ringmixers (cutoff frequency > 8 GHz) and tunable diodes were realized. The possibility of combining high frequency transistors, Schottky ringmixers, and/or tunable diodes in one chip thus follows. Author (ESA)

N80-29601# AEG-Telefunken, Backnang (West Germany). Fachbereich Weitverkehr und Kabeltechnik.

UNIVERSAL BUILDING BLOCKS FOR TANTALUM THIN FILM TECHNOLOGY Final Report, Dec. 1978

Wernfried Bonk, Hermann Gnesinger, and Gerhard Ketterer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 167 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-76) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 34.85

From a single amplifier RC filter, configuration circuits accomplishing the typical second degree transfer functions such as lowpass, highpass, bandpass, allpass, and band reject are derived and optimized with respect to sensitivity. The introduction of an additional amplifier leads to a filter concept for higher pole-Q s. The individual filter circuits are combined in highly versatile standard building blocks which can be adjusted to a specific application by means of trimming resistors and approriate external interconnections. Tantalum film technology was used in developing the hardware of the building blocks. Resistors were made of TaN and TaON. For the capacitors beta-Ta was used initially as the basic material. Later on N-doped Ta was introduced due to its superior properties. Results meet the design objectives for the thin film network being small size, high precision, and good temperature, as well as longterm stability. Author (ESA)

N80-29602# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.

MOS-LSI DEVELOPMENT PROBLEMS Final Report, Sep. 1977

Karl Arnold, Helmut Gueckel, Hans Eberhard Longo, Horst Panholzer, Peter Rademeyer, Erich Rosshaupter, Juergen Schaedel, and Jacobus W. Scholtens Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 61 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-80) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12.60

Process engineering problems related to the development of CMOS gates and P-type MOS gates are studied. Existant manufacturing techniques are evaluated and improved as to yield, cost, and production time. Also improved is the quality of the MOS integrated circuits which are fabricated using these processes. Main results center on changes in cleaning procedures, the use of 3 in. instead of 2 in. silicon wafers for photolithography, ion implantation, metallization, and process control to stabilize electric parameters of the integrated circuits. Author (ESA)

N80-29603# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Munich (West Germany). Inst. fuer Festkoerpertechnologie.

SEMICONDUCTOR TECHNOLOGY OF ION IMPLANTED SILICON DEVICES Final Report, Mar. 1978

Josef Goetzlich, Anton Heuberger, Helmut Kranz, Bernd Schubert, and Franz Soller Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 91 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-81) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18.90

The influence of ion implantion on various processes in the production of bipolar silicon devices was investigated. Results show that the oxidation behavior of ion implanted silicon layers exhibits an enhancement of the oxidation rate depending on ion species, ion energy, and ion dose. An evaluation of the segregation coefficient of As at the SiO2/Si interface demonstrates that segregation stronly affects the oxidation rate. Evaluation of the profile of knocked-on oxygen and nitrogen atoms from SiO2 and Si3N4 layers on silicon substrates shows that the dose of the knocked-on atoms is approximately as high as the dose of the primary ions if the thickness of the layer corresponds to the projected range of the implanted ions. Measurements of the pipe density of n-p-n structures in epitaxial layers with implanted subcollectors shows that arsenic as a subcollector dopant causes fewer cristallographic defects than antimony. The use of experimental results on oxidation rate and segregation coefficient for the development of silicon devices by means of process modeling is discussed. Author (ESA)

N80-29604# National Technical Information Service, Springfield, Va.
CHARGE TRANSFER DEVICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jul. 1977 - Feb. 1980
William E. Reed Apr. 1980 211 p Supersedes NTIS/PS-79/0295; NTIS/PS-78/0307 2 Vol.
(PB80-809916; NTIS/PS-79/0295; NTIS/PS-78/0307) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

The technology, design, fabrication, and applications of charge transfer devices are presented in the cited research reports. Applications include imaging, signal processing, detectors, filters, amplifiers, and memory devices. This updated bibliography contains 107 abstracts, all of which are new entries to the previous edition. GRA

N80-29605# National Technical Information Service, Springfield, Va.
CHARGE TRANSFER DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1978 - Mar. 1979
William E. Reed Apr. 1980 163 p 2 Vol.
(PB80-809924) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

Research reports from worldwide literature are cited which cover the technology, design, fabrication, and applications of charge transfer devices. Applications include image devices, signal processors, amplifiers, filters, and memory devices. This updated bibliography contains 157 abstracts, none of which are new entries to the previous edition. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-29606 Stanford Univ., Calif.
STABILITY IN SPHERICAL SYSTEMS. 1: HYDRODYNAMIC STABILITY OF THIN, SPHERICALLY CONCENTRIC FLUID SHELLS. 2: GLOBAL STABILITY OF TRANSIENT DROP EXTRACTION Ph.D. Thesis
John Frederick Patzer, II 1980 129 p
Avail: Univ. Microfilms Order No. 8016859

Two studies of hydrodynamic stability in spherical systems were conducted. The first considers the problem of thin film stability in spherically concentric fluid shells by means of the traditional linear hydrodynamic stability theory. Experimental observations confirmed that the critical thickness at rupture is independent of the hydrodynamic interfacial stress condition. However, film thicknesses at rupture were about five times greater than predicted due to nonspherical concentricity of the fluid phases in the experiment. The second study uses the nonlinear method of energy to examine the stability of transport in a drop characterized by an impulsive change in boundary temperature or concentration. Instabilities driven by interfacial n gradients are considered for two diffusive base states: the stagnant spherical drop model proposed by Newman and the circulating drop model of Kronig and Brink. Stability curves generated clearly show the presence of an onset time and a decay time for the disturbances. Comparison with limited available experimental data shows that qualitative prediction based upon the theory are observed experimentally. Dissert. Abstr.

N80-29607 Rice Univ., Houston, Tex.
A NUMERICAL STUDY OF NONLINEAR VISCOELASTIC FLOW AND NONISOTHERMAL POWER-LAW FLOW Ph.D. Thesis
Yow-Think Lin 1980 110 p
Avail: Univ. Microfilms Order No. 8018066

The energy equation for power law fluids is solved under various circumstances including a temperature dependent viscosity, viscous dissipation and heat convection across streamlines induced by the abrupt change of boundary temperature and subsequent velocity field rearrangement. In addition to the numerical solutions given, an analytical approximation method for the Graetz-Nusselt problem is also presented for comparison. This method divides the domain sections for which two corresponding solutions, approximated by polynomials, are solved by a thermal boundary layer theory and an integral method respectively. These two approximate solutions are then matched at the intersection to give a continuous and consistent temperature profile. Although the analytical solutions application is limited to the case with a temperature independent viscosity, this simple analysis is believed to be better than the previous methods available in the literature. Dissert. Abstr.

N80-29608 Houston Univ., Tex.
FLUID MECHANICS AND HEAT TRANSFER IN A FLUIDIZED COUNTER CURRENT BED Ph.D. Thesis
Partha Pratim Maitra 1979 192 p
Avail: Univ. Microfilms Order No. 8014106

The transfer of heat to a fluidized bed from larger and/or denser particles passed continuously downwards through the bed and removed from below was investigated. The research focuses on the mass holdup of the descending particles and the maximum attainable flow rates of these particles. An experimental apparatus was designed and constructed to obtain mass holdup and limiting flow rate data for several pairs of particles. The effects of the air flow rate, and of the feed rate, diameter and density of the descending particles on their holdup was investigated. The limiting feed rate for the descending particles was also determined and fitted by an empirical equation. Experiments were conducted in a two dimensional test bed to elucidate the mechanism of descent and the interaction between bubbles and the descending particles. Dissert. Abstr.

N80-29609 Illinois Univ. at Urbana-Champaign.
STUDY OF TURBULENT STRUCTURE CLOSE TO A WALL USING CONDITIONAL SAMPLING TECHNIQUES Ph.D. Thesis
Kenneth Kailung Lau 1980 159 p
Avail: Univ. Microfilms Order No. 8017967

Experiments were carried out in which the velocity at a number of locations in the fluid was measured simultaneously with the measurement of the two components of the fluctuating velocity gradient at the wall sx and sz. Using multiple-point measurements and conditional sampling both the kinematics and the dynamics of the wall eddies could be studied. Results confirm that counterrotating eddies in the wall region do exist; but rather than being the dominant flow structure, they exist only for short periods during transition between inflow and outflow. These profiles are in excellent agreement with our proposed idealized eddy pattern and the temporal development of these profiles shows that eddy evolution is influenced by the dynamics of flow in the spanwise direction. Simultaneous measurements using hot film probe in the fluid indicate that the direction of propagation of the wall flow is from the outer region. This is in contrast to suggestions that secondary flow is initiated by an instability at the wall. Positive shear layers are frequently encountered and negative shear layers can be present when fluid near the wall has a higher momentum content than fluid away from the wall. Dissert. Abstr.

N80-29610 Columbia Univ., New York.
A THEORECTICAL DISSERTATION ON THE CHARACTERISTICS OF THE FORCED CONVECTION ELECTRIC CATHODE PLASMA ARC Ph.D. Thesis
John Eugene Fink 1980 119 p
Avail: Univ. Microfilms Order No. 8016948

A mathematical model for a forced convection electric cathode plasma arc is presented. The geometry of the system to be analyzed is based on a technique which has demonstrated the capability of having a gas stream injected into the core of the arc column around a cathode electrode with a high degree of penetration without affecting the arc stability. The analysis consists of assuming the plasma arc to be a continuous fluid and solving simultaneously the conservation equations of mass, momentum, energy, and charge using a finite difference iteration scheme. The form of the charge conservation equation is derived from the divergence of the current density being zero for a steady state condition. The charge equation was based upon the most

complete current density expression to date and includes terms for ohmic, thermoelectric, and self magnetic current densities. Fundamental knowledge about the relationships and variations of heat transfer, fluid flow, electric, magnetic, and radiation phenomena within the plasma arc was obtained. The results produced include the distributions of the characteristic temperature, velocity, electrical, and magnetic intensity of the plasma arc for the fluid convection cathode system. Dissert. Abstr.

N80-29611 Illinois Univ. at Urbana-Champaign.
THE BLAST WAVE PRODUCED BY BURSTING SPHERES WITH SIMULTANEOUS OR DELAYED EXPLOSION OR IMPLOSION OF THE CONTENTS Ph.D. Thesis
Shirish Ambadas Shimpi 1980 238 p
Avail: Univ. Microfilms Order No. 8017983

High effective normal burning velocities are required to produce damaging blast waves. Constant velocity explosions have much higher peak overpressures than constant velocity implosions except near the center of the source where the reflected waves from an implosion cause high peak overpressures. A bursting sphere with immediate explosion of the contents produces a lead wave which is totally bursting sphere related with a secondary combustion wave which always trails the lead wave for low flame velocities. For the corresponding implosion case with sphere burst, the implosion process contributes to the peak overpressures even for relatively low flame velocities. It was noted that accelerating flames whether implosive or explosive, show that the maximum overpressure generated by such flames is no higher than that generated by a constant velocity flame which travels through the entire source region at the maximum velocity reached when the acceleration process ceases. The energy scaled impulse versus energy scaled radius show far field equivalency for all the cases considered. Dissert. Abstr.

N80-29612 Michigan Univ., Ann Arbor.
STUDY OF TURBULENT STRUCTURE WITH HOT-WIRES SMALLER THAN THE VISCOUS LENGTH Ph.D. Thesis
Lalit Kumar Sharma 1980 174 p
Avail: Univ. Microfilms Order No. 8017364

Measurements of the mean velocity profile and streamwise turbulence intensity profile are reported with the small U probes. Comparison of the turbulent intensity data with larger probes shows that the smaller probes measure more energy due to their better spatial resolution. The data measured by the small probes are also analyzed to determine the burst frequency at various distances from the wall and at two Reynolds numbers. The results show that the burst frequency scaled with respect to the wall parameters is less a function of Reynolds number than the burst frequency scaled with respect to the outer flow variables. To obtain more quantitative information regarding the turbulence structure, measurements are reported with two small U probes. From the correlation coefficient deduced from the measured data, it concluded that the turbulence structure increases in size in both the spanwise and transverse direction as the distance from the wall increases. Dissert. Abstr.

N80-29613 Georgia Inst. of Tech., Atlanta.
AN INTEGRAL-REPRESENTATION APPROACH FOR TIME-DEPENDENT VISCOUS FLOWS Ph.D. Thesis
Yehia M. Attia Rizk 1980 163 p
Avail: Univ. Microfilms Order No. 8018156

Numerical solutions for the laminar, incompressible flow around a two dimensional solid body are developed and presented. The equations of motion are formulated in the unsteady form. The body is assumed to impulsively start and the desired solution is obtained by forward marching in time. The present scheme is based on portioning the problem into a kinematic part and a kinetic part through the use of the vorticity and velocity as the dependent variables. The flow field is divided into two regions; an inner region immediately adjacent to the body and an outer region far from the body. An integral relation for the kinetic part is developed and it is combined with an available integral relation for the kinematic part to solve for the vorticity and velocity in the inner region. Finite differences techniques are used to solve the equations of motion in the outer region. The validity of the method is demonstrated by solving the flow over a flat plat at zero angle of attack and the flow around a circular cylinder. The numerical results obtained from the method are compared with available data and other numerical solutions. Dissert. Abstr.

N80-29614 Tennessee Univ., Knoxville.
NOSE-TIP TRANSITION STUDIES IN AN AEROBALLISTIC RANGE: A FEASIBILITY INVESTIGATION Ph.D. Thesis
John Thomas Miller 1973 288 p
Avail: Univ. Microfilms Order No. 8018488

Conventional optical flow-field observations are shown to have applicability only up to model velocities of 4500 ft/sec. At this velocity the bow shock image merges with the model silhouette so that flow-field details cannot be visible between the bow shock and the model surface. Satisfactory agreement is shown between ballistic range data and wind tunnel data at similar conditions. Heat transfer distribution measurements are used to deduce the location of boundary layer transition at realistic test velocities of 12,800 to 18,500 ft/sec. The significant results include larger than expected turbulent heating rates and boundary later transition locations further forward than would be predicted from lower velocity test data. Experimental heat transfer distributions are obtained from the thermal response of the test model surface to aerodynamic heating. Techniques developed to determine in-flight model surface temperatures include a surface melting technique and the use of a photoelectric pyrometer device. Dissert. Abstr.

N80-29615 Illinois Univ. at Urbana-Champaign.
HEAT TRANSFER IN LAMINAR SOLID-FLUID SUSPENSION FLOW Ph.D. Thesis
Chang Wook Sohn 1980 169 p
Avail: Univ. Microfilms Order No. 8017986

Effective thermal conductivities of neutrally buoyant concentrated polyethylene suspensions in silicone oil and kerosene mixture, and polystyrene suspensions in silicone oil and freon 113 mixture were measured in a rotating Couette flow apparatus. Contrary to the case of single phase fluid, effective thermal conductivity was observed to be shear dependent when the particle Peclet numbers are high. Measured particle volume fractions were psi = 0.15 and 0.30 for the suspensions of polyethylene beads (2.9 mm in diameter), and psi = 0.15 for the suspensions of polystyrene beads (0.3 mm in diameter). The case for psi = 0 (single phase liquid mixture only) was also measured in various shear rates to show the independence of thermal conductivity of single phase fluid on shear rates. The dependence of conductivity on particle Peclet number appeared to approach a power law relationship for the range of high Peclet numbers (Pe sub d > 300). Dissert. Abstr.

N80-29616 Rice Univ., Houston, Tex.
HIGHER ORDER DIFFERENTIAL APPROXIMATION OF RADIATIVE ENERGY TRANSFER IN A CYLINDRICAL GRAY MEDIUM Ph.D. Thesis
James K. D. Higenyi 1980 147 p
Avail: Univ. Microfilms Order No. 8018056

The spherical harmonics method is applied to develop and solve approximate differential equations of radiative transfer in an emitting, absorbing, isotropically scattering, and gray medium. Boundary conditions of Marshak type consistent with a particular approximation are derived and used in the solutions. Three types of thermal conditions for the medium are considered: radiative equilibrium, uniform heat generation and a parabolic internal heat generation. Two higher order approximations, P3 and P5 approximations, are formulated and solved for one dimensional problems: the medium is bounded by concentric or hollow cylindrical surfaces. Numerical results exhibit great improvement for the P3 approximation over the P1 approximation and a less rapid improvement for the P5 approximation. An axially symmetric problem is also analysed. In this case, only the P1 approximation is considered for a gray medium within a finite hollow or finite concentric cylindrical enclosure. Dissert. Abstr.

N80-29617 Arizona State Univ., Tempe.
HEAT TRANSFER CHARACTERISTICS OF THE TWO-PHASE CLOSED THERMOSYPHON (WICKLESS HEAT PIPE) INCLUDING DIRECT FLOW OBSERVATION Ph.D. Thesis
Frank Edward Andros 1980 367 p
Avail: Univ. Microfilms Order No. 8018463

The two phase closed thermosyphon is a heat transfer device

capable of transferring large quantities of heat from a source to a sink by taking advantage of the high heat transfer rates associated with the evaporation and condensation of a working fluid within the device. For small and intermediate fill quantities, four basic flow regimes were observed in the evaporator section of the thermosyphon during steady state operation with Freon 113 and ethanol: (1) a smooth continuous film with surface evaporation; (2) the breakdown of the smooth continuous film into a series of rivulets; (3) a wavy film with unstable rivulets; and (4) a wavy film with bubble nucleation occurring in the unstable rivulets. A fifth condition which was observed with all fluids was a dry out (heat transfer limit) where some portion of the evaporator ceases to be cooled effectively by the falling film and rivulets, resulting in a wall temperature excursion or critical condition. Three types of dry out were observed. In addition to the visual device used, a stainless steel tubular opaque device was fabricated and is heat transfer characteristics evaluated using Freon 113 as a working fluid. Dissert. Abstr.

N80-29618 Illinois Univ. at Urbana-Champaign.
EXPERIMENTAL AND MODELING STUDIES OF TWO-POINT STOCHASTIC STRUCTURE IN TURBULENT PIPE FLOW Ph.D. Thesis
Yassin Abdel-Rahim Hassan 1980 209 p
Avail: Univ. Microfilms Order No. 8017949

Large scale eddies of turbulent structure far from the wall region were studied in a vertical fully developed water pipe flow (D = 10.16 cm). The turbulent structure was investigated using space and space time correlations. The axial and radial velocity components were obtained simultaneously at two points in the flow field with two hot film anemometers x-probes. Departure of these two point correlations from isotropic behavior was modeled in terms of axisymmetric tensor forms, in which the turbulence is characterized by two scalar quantities defined by four free parameters which are related to the correlation length scales. Conditional averages of the velocity components were measured for both time delay and spatial separation. Comparisons of these conditional averages with their computed linear and second order nonlinear estimates, utilizing the mean square stochastic error approximation, showed good agreement. Linear estimation combined with the time series was used to produce a typical sequence of conditional eddy patterns which show strong resemblance with turbulence structures from flow visualization studies. Dissert. Abstr.

N80-29619 Engineering Sciences Data Unit, London (England).
MEAN FLUID FORCES AND MOMENTS ON RECTANGULAR PRISMS: SURFACE-MOUNTED STRUCTURES IN TURBULENT SHEAR FLOW
1980 22 p
(ESDU-80003; ISBN-0-85679-285-3; ISSN-0141-4003; ISSN-0141-397X) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161

Means for estimating the mean forces and moments induced by a turbulent shear flow on surface mounted rectangular prisms are provided. A typical application is to a rectangular building or tower in the natural wind, but the data can also be used with fluids other than air. This information is required when estimating, for example, the along wind response of a building block to turbulence at the maximum design wind speed as detailed. In this case however, the response due to other excitation mechanisms, such as vortex shedding and galloping, should also be investigated. ESDU

N80-29620 Stanford Univ., Calif.
JOULE HEATING EFFECTS IN THE ELECTRODE WALL BOUNDARY LAYER OF MHD GENERATORS Ph.D. Thesis
Richard Kent James 1980 209 p
Avail: Univ. Microfilms Order No. 8016835

Two models were examined that are suitable for large scale magnetohydrodynamic (MHD) generator calculations. The first model was an integral model using 1/7th power profiles and accounted in an approximate manner for electron nonequilibrium and for the effects of near wall Joule heating. The second model was a full two dimensional boundary layer model, including solution of the electron continuity equation. Comparisons of predictions between the two models generally showed good agreement. Measurements were performed of temperature and electron number density profiles on a laboratory scale MHD generator. Comparisons between calculations from the two dimensional theory and measurments for cases without current generally showed good agreement when the turbulence model properly accounted for effects of free stream turbulence. Measurements of electron number density profiles indicated that some degree of nonequilibrium existed near the wall, but the effect was small. Dissert. Abstr.

N80-29621 Catholic Univ. of America, Washington, D. C.
THE MEASUREMENT OF DISPERSIVE WAVES WITH A REAL-TIME WAVE VECTOR ANALYZER Ph.D. Thesis
Carl Anthony Cascio 1980 123 p
Avail: Univ. Microfilms Order No. 8018345

A parallel input/serial output charge coupled device (CCD) was introduced which provides a simplified real time electronics package that is capable of sampling and then delaying the signals from an array of sensors. The device was operated as an eight channel beamformer sampling at rates up to 1 MHz with time delays ranging from 1 to 800 microseconds. An accelerometer array formed a wave vector filter whose spatial properties were controlled by the selection of a master clock frequency. A real time wave vector analyzer was then created by following the output of the CCD beamformer with a set of 1/3 octave filters that allowed the wave number to be varied from 25 to 125. The dispersive nature of the wave propagation in the plate was resolved by assuming a reasonable formulation of the dispersion and then creating a simple algorithm to generate the clock frequencies appropriate to an-angular display of the wave vector response. Using a line array the steerable wave vector analyzer was shown to accurately localize a vibration source for three levels of damping in the plate. Dissert. Abstr.

N80-29622*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TURBULENT STRUCTURES IN WALL-BOUNDED SHEAR FLOWS OBSERVED VIA THREE-DIMENSIONAL NUMERICAL SIMULATORS
A. Leonard Jul. 1980 30 p refs Presented at Turbulence Conf.: The Role of Coherent Structures in Modeling of Turbulence and Mixing, Madrid, 25-27 Jun. 1980
(NASA-TM-81219; A8280) Avail: NTIS HC A03/MF A01 CSCL 20D

Three recent simulations of tubulent shear flow bounded by a wall using the Illiac computer are reported. These are: (1) vibrating-ribbon experiments; (2) study of the evolution of a spot-like disturbance in a laminar boundary layer; and (3) investigation of turbulent channel flow. A number of persistent flow structures were observed, including streamwise and vertical vorticity distributions near the wall, low-speed and high-speed streaks, and local regions of intense vertical velocity. The role of these structures in, for example, the growth or maintenance of turbulence is discussed. The problem of representing the large range of turbulent scales in a computer simulation is also discussed. R.K.G.

N80-29623*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TOWARD THE USE OF SIMILARITY THEORY IN TWO-PHASE CHOKED FLOWS
R. C. Hendericks, J. V. Sengers (Maryland Univ., College Park), and R. J. Simoneau 1980 12 p refs Proposed for presentation at Winter Ann. Meeting of the ASME, Chicago 16-21 Nov. 1980
(NASA-TM-81568) Avail: NTIS HC A02/MF A01 CSCL 20D

Comparison of two phase choked flows in normalized coordinates were made between pure components and available data using a reference fluid to compute the thermophysical properties. The results are favorable. Solution of the governing equations for two LNG mixtures show some possible similarities between the normalized choked flows of the two mixtures, but the departures from the pure component loci are significant. Author

N80-29624*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY RESULTS FROM A FOUR-WORKING SPACE, DOUBLE-ACTING PISTON, STIRLING ENGINE CONTROLS MODEL

Carl J. Daniele and Carl F. Lorenzo 1980 17 p refs Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980

(Contract EC-77-A-31-1040)

(NASA-TM-81569; DOE/NASA/1040-17; E-534) Avail: NTIS HC A02/MF A01 CSCL 20D

A four working space, double acting piston, Stirling engine simulation is being developed for controls studies. The development method is to construct two simulations, one for detailed fluid behavior, and a second model with simple fluid behaviour but containing the four working space aspects and engine inertias, validate these models separately, then upgrade the four working space model by incorporating the detailed fluid behaviour model for all four working spaces. The single working space (SWS) model contains the detailed fluid dynamics. It has seven control volumes in which continuity, energy, and pressure loss effects are simulated. Comparison of the SWS model with experimental data shows reasonable agreement in net power versus speed characteristics for various mean pressure levels in the working space. The four working space (FWS) model was built to observe the behaviour of the whole engine. The drive dynamics and vehicle inertia effects are simulated. To reduce calculation time, only three volumes are used in each working space and the gas temperature are fixed (no energy equation). Comparison of the FWS model predicted power with experimental data shows reasonable agreement. Since all four working spaces are simulated, the unique capabilities of the model are exercised to look at working fluid supply transients, short circuit transients, and piston ring leakage effects. Author

N80-29625# Ohio State Univ., Columbus. The Aeronautical and Astronautical Research Lab.

FLUID DYNAMICS OF MULTIPLE NOZZLE ARRAYS AND RADIAL FLOW DIFFUSERS Final Report, 1 Oct. 1977 - 31 Dec. 1979

S. L. Petrie and J. D. Lee Apr. 1980 28 p

(Grant AF-AFOSR-2956-76; AF Proj. 2307)

(AD-A085672; AFOSR-80-0456TR; OSURF-784336) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report summarizes the theoretical and experimental research dealing with the fluid dynamical interactions in free shear layers and diffuser-ejectors. The objectives of this research were (a) to provide characterization of the fluid dynamical mixing layers typical of those in supersonic transfer lasers and in mixing gas dynamic lasers, and (b) to examine the mixing and induction characteristics of ejectors capable of providing pressure ratios typical of those associated with radial flow laser diffusers. GRA

N80-29626# Montana State Univ., Bozeman. Supersonic Wind Tunnel Lab.

NECESSARY CONDITIONS FOR TRANSITION IN A FREE SHEAR LAYER Scientific Report, 1 Aug. 1979 - 31 Jan. 1980

Anthony Demetriades Feb. 1980 57 p refs

(Contract F49620-79-C-0210; AF Proj. 2307)

(AD-A085514; SWT-80-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

A necessary condition for the preservation of turbulence has been utilized to predict laminar-turbulent transition in free shear, or mixing, layers. Following earlier applications in wakes and boundary layers, the condition is expressed in terms of a threshold turbulence Reynolds number which can be computed if the turbulence properties of the post-transitional flow are known. Assuming that the latter are those reported for self-similar flows, general rules for transition in all major types of shear flows are drawn. Numerical computations are presented for arbitrary homogeneous free shear layer transition identified as the most forward permissible turbulence onset location. Transition is found to move downstream very rapidly as the fast-stream Mach number is increased and the speed ratio is decreased, and less rapidly as the slow stream is heated. Agreement with available transition data is qualitatively good but quantitatively fair, which is ascribed to missing information about the shear layer turbulence and the observed tendency of available transition data to depend on the Reynolds number. GRA

N80-29627# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.

NUMERICAL SOLUTION OF THE AZIMUTHAL-INVARIANT THIN-LAYER NAVIER-STOKES EQUATIONS Final Report

Charles J. Nietubicz, Thomas H. Pulliam, and Joseph L. Steger Mar. 1980 37 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A085716; AD-E430444; ARBRL-TR-02227) Avail: NTIS HC A03/MF A01 CSCL 20/4

A numerical procedure is developed for a two dimensional azimuthal (or planar) invariant form of the thin-layer Navier-Stokes equations. The governing equations are generalized over the usual two dimensional and axisymmetric formulations by allowing non zero velocity components in the azimuthal direction. The equations are solved with an implicit approximate factorization finite-difference scheme. Inviscid and viscous results are presented for both external and internal flows, for spinning and non-spinning bodies. GRA

N80-29628# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

LASER VELOCIMETER MEASUREMENTS IN TURBULENT AND MIXING FLOWS, PART 2 Interim Report, 1 Oct. 1978 - 15 Dec. 1979

Warren H. Stevenson, H. Doyle Thompson, Robin Bremmer, and Timothy Roesler Wright-Patterson AFB, Ohio AFAPL Mar. 1980 75 p refs

(Contract F33615-77-C-2010; AF Proj. 2308)

(AD-A085344; AFAPL-TR-79-2009-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 20/4

An experimental and analytical study of subsonic flow over a rearward facing step is reported. A major emphasis of the work is the investigation of bias errors in mean velocities obtained from laser doppler velocimeter (LDV) measurements in such highly turbulent flows. Optical alignment of the specially designed LDV used in the study is described in detail. An analysis of the biasing problem is presented and preliminary measurements which appear to confirm previously predicted velocity bias errors are reported. Results of a computer model developed to describe the flow are presented together with preliminary static pressure measurements made in the flow facility. GRA

N80-29629# Colorado School of Mines, Golden.

EXPERIMENTAL DESIGN FOR HYDRAULIC TRANSPORT RESEARCH FACILITY Final Technical Report

Robert R. Faddick, ed. Dec. 1979 170 p refs

(Contract ET-78-S-01-3274)

(FE-3274-1) Avail: NTIS HC A08/MF A01

A research program was to be defined for the operation of the newly constructed Hydraulic Transport Research Facility (HTRF). The program was to be designed to obtain engineering data for the design of efficient, economical, and reliable new coal hydraulic haulage systems from the mine face to the wash plant. The research program was to be completed in the shortest feasible time and at the lowest operating cost. A five year experimental design consisting of three phases was developed. After a two month calibration period, Phase 1 (first year) tests all three pipeline diameters with both a washed and unwashed coal at varying slurry concentrations. Head losses, deposition velocities, and exploratory work on flow transients constitute the test program. Phase 2 (second year) allows for implementation of the data logger for examination of particle size distribution and flow transients. Phase 2 (next three years) comprises a definitive study on transients, particle size, and studies different coals and coal-refuse mixtures. New technology is also to be examined. It is recommended that a separate analytical team be from the current contractor team to coordinate the data generated by the HTRF and develop it for industry's use. DOE

N80-29630# Oak Ridge National Lab., Tenn.

COMPUTER MODEL FOR SELECTIVE FLOW MEASURING STRUCTURES IN OPEN CHANNELS

M. J. Hickey 1980 5 p refs Presented at the UCC-ND and GAT Waste Management Seminar Program, Portsmouth, Ohio, 22 Apr. 1980

(Contract W-7405-eng-26)

(CONF-800416-7) Avail: NTIS HC A02/MF A01

Quantifying various pollutants in natural waterways has

received increased emphasis with more stringent regulations issued by the Environmental Protection Agency (E.P.A.). Measuring natural stream flows presents a magnitude of problems, the most significant is the type of structure needed to measure the flows at the desired level of accuracy. A computer model designed to select a structure to best fit the engineer's needs is under development. This model, given the pertinent boundary conditions, will pinpoint the structure most suitable, if one exists. This selection process greatly facilitates the old selection process of trial and error. DOE

N80-29631# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
NONSTATIONARY FILTRATION IN PARTIALLY SATURATED POROUS MEDIA
C. J. vanDuyn and L. A. Peletier. May 1979. 36 p. refs. Submitted for publication.
(MC-TW-189/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4.

From the mathematical formulation of a one dimensional flow through a partially saturated porous medium, a nonlinear free boundary problem is posed, the boundary being between the saturated and the unsaturated regions in the medium. In particular, an equation which is parabolic in the unsaturated part of the domain and elliptic in the saturated part is obtained. Existence, uniqueness, a maximum principle, and regularity properties are proved for weak solutions of a Cauchy-Dirichlet problem in the cylinder (x,t) : 0 < or = X < or = 1, T > or = 0 and the nature, in particular the regularity, of the free boundary is discussed. Finally, it is shown that solutions of a large class of Cauchy-Dirichlet problems converge towards a stationary solution as t tends to infinity. Estimates are given for this rate of convergence. Author (ESA)

N80-29632# National Technical Information Service, Springfield, Va.
CAVITATION: CAVITATION FLOW. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1974 - Apr. 1980
Guy E. Habercom, Jr. May 1980. 261 p. Supersedes NTIS/PS-79/0327; NTIS/PS-78/0258.
(PB80-810567; NTIS/PS-79/0327; NTIS/PS-78/0258) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D.

Reports on general aspects of cavitating flow are included. A wide range of theoretical, analytical, and experimental information is presented involving mathematical analysis, computer programs, and testing. Topics include marine engineering, hydrodynamic and aerodynamic configurations, symmetric and nonaxisymmetric shapes, and measuring technology. Data is given on surface piercing struts, helical inducers, pumps, liquid metal systems, and venturi tubes. Applications include dam outlets and spillways, vertical conduits, deep rock drilling, heat pipe stability, water entry, and liquid croygenic systems. Discussions are made of flow characteristics, noise, nucleate boiling, perturbation problems, and allied subjects. This updated bibliography contains 253 abstracts. GRA

N80-29633# National Technical Information Service, Springfield, Va.
CAVITATION: HYDROFOILS. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1964 - Apr. 1980
Guy E. Habercom, Jr. May 1980. 202 p. Supersedes NTIS/PS-79/0328; NTIS/PS-78/0259.
(PB80-810575; NTIS/PS-79/0328; NTIS/PS-78/0259) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D.

Studies are presented on the cavitation characteristics of various classes of hydrofoils such as fully submerged, ventilated, high speed, supercavitating, and jet flapped. Surface piercing struts are studies. Test facilities, models, and test methods are described. Lift, drag, oscillation, flutter, heaving, hydroelasticity, and loading are discussed. Other topics include entrainment, bubbles, unsteady forces, flow fields, sea states, cavitation noise, mathematical models, and boundary layers, along with investigations of hydrofoil craft performance. This updated bibliography contains 194 abstracts, 9 of which are new entries to the previous edition. GRA

N80-29634# Hawaii Univ., Honolulu. Sea Grant Coll. Program.
BUBBLE NUCLEATION IN SUPERSATURATED FLUIDS
Thomas D. Kunkle. Dec. 1979. 124 p. refs.
(Grants NOAA-04-3-158-29; NOAA-04-5158-17; NOAA-04-6-158-44026; NOAA-04-6-158-44114; NOAA-04-7-158-44129)
(PB80-184773; UNIHI-SG-TR-80-01; NOAA-80040710) Avail: NTIS HC A06/MF A01 CSCL 06A.

An introduction to the physics of bubbles is followed by an outline of the theory of homogeneous nucleation. The results of an experimental program in which transparent gelatin was used to stabilize bubbles against floatation are reported. The existing models of cavitation nuclei are classified into four major groups, and each group is briefly discussed. The principal thesis that the cavitation nuclei present in common fluids consist of spherical gas phases encased in monomolecular skins of surface-active molecules is advanced. The surface-active material forming the skin of the nuclei observed in gelatin is shown to be similar to several commonly occurring surfactants, namely the saturated lecithins and phosphatidylethanolamines. The application of the results to the study of decompression sickness is explored. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-29635*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW INTENSITY X-RAY AND GAMMA-RAY IMAGING SPECTROMETER. Patent Application
Lo I. Yin, inventor (to NASA). Filed 30 Jul. 1980. 29 p.
(NASA-Case-GSC-12587-1; US-Patent-Appl-SN-173524) Avail: NTIS HC A03/MF A01 CSCL 14B.

An imaging spectrometer includes a shield which is opaque to visible light and tranparent to X-ray or gamma-ray photons, and a scintillator which converts the X-ray or gamma-ray photons to visible-light photons. An input fiber optics plate guides the visible light pohotons in the same spatial position to photo-cathode which coverts them to photoelectrons. A chevron, curved, or Z configuration microcahannel plate amplifier, operated far below saturation, but capable of a 10 to the 4th to 10 to the 7th power gain, receives the photoelectrons and intensifies them. The intensified electrons are then converted back to visible-light photons by an output phosphor screen. An output fiber optics plate guides the visible-lifght photons in the same spatial position to a digitizing video camera and a digital information processor which indicates the spatial position, number, and efficient energy of the incoming X-ray or gamma ray photons. NASA

N80-29636*# Information and Control Systems, Inc., Hampton, Va.
A PARAMETRIC STUDY OF ALIASING ERROR FOR A NARROW FIELD OF VIEW SCANNING RADIOMETER. Final Report
Nesim Halyo and Steven T. Stallman. Washington, D.C. Aug. 1980. 81 p. refs.
(NASA-CR-3294; FR-47801) Avail: NTIS HC A05/MF A01 CSCL 14B.

Starting from the general measurement equation, it is shown that a NFOV scanner can be approximated by a spatially invariant system whose point spread function depends on the detector shape and angular characteristics and electrical filter transfer function for given patches at the top of the atmosphere. The radiometer is modeled by a detector, electrical filter, analog to digital converter followed by a reconstruction filter. The errors introduced by aliasing and blurring into a reconstruction of the input radiant exitance are modeled and analyzed for various detector shapes, sampling intervals, electrical filters and scan types. Quantitative results on the errors introduced are presented showing the various tradeoffs between design parameters. The

results indicate that proper selection of detector shape coupled with electrical filter can reduce aliasing errors significantly.
Author

N80-29637*# Applied Science Associates, Inc., Apex, N. C.
WALLOPS WAVEFORM ANALYSIS OF SEASAT-1 RADAR ALTIMETER DATA Final Report
George S. Hayne Jul. 1980 44 p refs
(Contract NAS6-2810)
(NASA-CR-156869) Avail: NTIS HC A03/MF A01 CSCL 05B

Fitting a six parameter model waveform to over ocean experimental data from the waveform samplers in the SEASAT-1 radar altimeter is described. The fitted parameters include a waveform risetime, skewness, and track point; from these can be obtained estimates of the ocean surface significant waveheight, the surface skewness, and a correction to the altimeter's on board altitude measurement, respectively. Among the difficulties encountered are waveform sampler gains differing from calibration mode data, and incorporating the actual SEASAT-1 sampled point target response in the fitted wave form. There are problems in using the spacecraft derived attitude angle estimates, and a different attitude estimator is developed. Points raised in this report have consequences for the SEASAT-1 radar altimeter's ocean surface measurements are for the design and calibration of radar altimeters in future oceanographic satellites. Author

N80-29638# TriTec, Inc., Columbia, Md.
DEVELOPMENT OF A FLUIDIC GAS CONCENTRATION SENSOR Final Report
George E. Stevens and Maurice F. Funke Adelphi, Md. ERADCOM 16 Jun. 1980 60 p refs Sponsored in part by U.S. Geological Survey
(Contract DAAG39-78-C-0103)
(AD-A085777; HDL-CR-80-103-1) Avail: NTIS HC A04/MF A01 CSCL 13/7

This document is the final report of a program to design, test, and evaluate the performance of fluidic gas concentration sensing systems and their component parts for monitoring CxHy and H2S on offshore platforms. This program consisted of investigating three major portions of a systems: Gas Sensors, Chemical Processors and Sensor System. Three candidate fluidic sensors (Resistor Bridge Sensor, Vortex Sensor, Jet Edge Resonator Oscillator Sensor) were evaluated for use in the sensor system. The resistor bridge sensor was chosen as the most appropriate. Several chemical processors were evaluated for each gas sensing system. Palladium coated alumina was chosen for the CxHy system and lead acetate was chosen for the H2S systems. GRA

N80-29639# Naval Research Lab., Washington, D. C.
MAGNETO-OPTIC MATERIALS FOR BIASING RING LASER GYROS Interim Report
G. A. Prinz, J. J. Krebs, W. G. Maisch, and D. W. Forester 14 Apr. 1980 47 p refs
(Contracts N00019-80-WR-01055; WF-21234601)
(AD-A085476; AD-E000425; NRL-MR-4198; IR-2) Avail: NTIS HC A03/MF A01 CSCL 20/6

A series of new materials including alloys of transition metals (Fe, Co) with rare earths (Gd, Tb) have been fabricated and characterized. Analysis is provided of ellipsometric techniques used to obtain the magneto-optic properties. An improved definition of Figure-of-Merit for transverse Kerr effect mirror application. GRA

N80-29640# Harris Corp., Melbourne, Fla. Government Communication Systems Div.
WIDEBAND HOLOGRAPHIC DIGITAL RECORDING AND REPRODUCTION, PHASE 4 Final Technical Report, 28 Sep. 1978 - 15 Jun. 1979
L. M. Ralston and C. A. Shuman Feb. 1980 244 p refs
(Contract F30602-78-C-0344; AF Proj. 4594)
(AD-A086265; RADC-TR-80-15) Avail: NTIS HC A11/MF A01 CSCL 14/5

This study effort evaluates potential improvements to the performance of the Wideband Recorder (WBR) system. These potential improvements are in the areas of bit error rate (BER), data packing density, and system optical power efficiency. Improvements to corrected BER which can be obtained by deeper interleaving of the recorded codewords are described and data from experiments simulating this process are documented. A potential data packing density increase from a modification of the intensity profile of the recording beam is described and experimental results are presented. A reduction in raw BER which can be obtained by reduced data crosstalk is predicted, and the results of testing a new, low-crosstalk Acousto-Optic Page Composer (multichannel optical modulator) are presented. Finally a modification to the system's optical path which can reduce the optical power required for data recording is discussed. GRA

N80-29641# Sandia Labs., Albuquerque, N. Mex. Thermomechanical and Physical Research Div.
LABORATORY SYSTEM FOR TRANSIENT DIGITAL DATA RECORDING AND PROCESSING: HARDWARE AND SOFTWARE
David A. Benson and Gary D. Miller Feb. 1980 98 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0354) Avail: NTIS HC A05/MF A01

A digital data acquisition system designed to record and process transient signals for the Dynamic Heating Facility is described. It uses four commercial waveform recorder units to monitor up to 10 separate signal lines. An interface and file processor device was developed which permits rapid interactive transfer and labeling of data from these recorders. The data are permanently stored as disk files in the laboratory microcomputer. From these disk files, information can be rapidly transferred to the central computer via NOS. There, detailed analysis of the data as well as plotting and listing of reduced data can be efficiently carried out. This report presents procedures and software for the entire file transfer sequence through the interface and file processor, the lab microcomputer and through a companion FORTRAN IV processor program on NOS. Hardware developed for the interface and file processor system is also described.
DOE

N80-29642# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF A HELIUM GAS FILLING DEVICE FOR ASTRONOMICAL EXPERIMENTS Final Report, Dec. 1978
Bernd Hinderer, Hubert Koch, and Klaus Thalheimer Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 58 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-12) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 11,75

A gas pumping device useful for cyclic filling of optical analyzers up to a defined pressure was designed, manufactured, and successfully tested after fundamental investigations of different concepts and their components. The three development phases are described in detail. The final design of the breadboard model is based on the requirements of an astronomic sounding rocket experiment essentially demanding pressurization of a previously evacuated volume within an appointed time.
Author (ESA)

N80-29643# Bonn Univ. (West Germany). Inst. fuer Astrophysik und Extraterrestrische Forschung.
INVESTIGATIONS ON THE LAYOUT OF A He(+) RESONANCE CELL Final Report
Hans Georg Hamacher Bundesmin. fuer Forsch. u. Technol. Oct. 1979 100 p refs In GERMAN; ENGLISH summary
(Contract BMFT-WRT-1074/1076)
(BMFT-FB-W-79-14) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20,60

A resonance cell working with singly charged helium ions as resonant absorbers is proposed as an instrument for the high resolution analysis of helium-2 304 A radiation. Methods to ionize helium in a helium resonance cell are investigated. It is found that only ionization by energetic electrons promises the realization of sufficiently high ion densities for an effective modulation of the helium-2 304 A radiation. High frequency ionization is shown to be much more effective than ionization by static-field-accelerated electrons. Two types of resonance cells were built, one for a capacitive and one for an inductive high frequency energy coupling. The latter type of cell is demonstrated superior for the purpose of reaching high ion densities. Realized

ion densities above 30 billion/cu cm, yielding a 5 to 10% modulation of the helium-2 304 A radiation traversing the cell are reported. Possibilities to improve the technical layout of the cells that were tested experimentally are discussed.

Author (ESA)

N80-29644# National Technical Information Service, Springfield, Va.
APPLICATIONS OF HOLOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Apr. 1980
Brian Carrigan May 1980 67 p Supersedes NTIS/PS-79/0566; NTIS/PS-78/0561
(PB80-810674; NTIS/PS-79/0566; NTIS/PS-78/0561) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

The bibliography covers studies on the applications of holography in such areas as photographing high-speed particles, nondestructive testing of material defects, strain analysis, microscopy, interferometry, vibration measurement, and medical diagnosis. This updated bibliography contains 59 abstracts, 42 of which are new entries to the previous edition. GRA

N80-29645# National Technical Information Service, Springfield, Va.
APPLICATIONS OF HOLOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - 1980
Brian Carrigan May 1980 257 p
(PB80-810666) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

The bibliography covers studies on the applications of holography in such areas as photograping high-speed particles, nondestructive testing of material defects, strain analysis, microscopy, interferometry, vibration measurement, and medical diagnosis. This updated bibliography contains 249 abstracts, none of which are new entries to the previous edition. GRA

N80-29646# National Technical Information Service, Springfield, Va.
HOLOGRAPHIC THEORY AND RECORDING TECHNIQUES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Brian Carrigan May 1980 259 p Supersedes NTIS/PS-79/0601; NTIS/PS-78/0582
(PB80-810716; NTIS/PS-79/0601; NTIS/PS-78/0582) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E

The topics cited include holographic recording techniques, theory, equipment, and materials. Among the techniques cited are color holography, X-ray holography, high speed holography, and motion picture holography. Photographic materials, films, emulsions, and equipment for recording and information storage are covered. Techniques for image motion compensation, image deblurring, wave-front reconstruction, and resolution are also cited. This updated bibliography contains 251 abstracts, 17 of which are new entries to the previous edition. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-29647 Maryland Univ., College Park.
STUDY OF THE INTENSITY-DEPENDENT NONLINEAR INDEX AND ITS APPLICATION TO SOLIDS AND LIQUIDS Ph.D. Thesis
John William VanLaak 1979 237 p
Avail: Univ. Microfilms Order No. 8017190

Intense picosecond sideband radiation of about 10 KW/100 cm was observed from a mode locked Nd:glass laser and found to be temporally coincident with the 1.05 microns laser pulses that produce them. The mechanism produc g the sidebands was identified to be self phase modulation of electronic origin. The temporal synchronization of the sideband and 1.06 microns pulses was utilized to generate upconverted radiation from 440 to 450 nm at about 1 KW/100 cm in ADP. Sum frequency generation in potassium pentaborate (RB5) was observed for three different optical mixing experiments and shown to agree with theory. Radiation was observed at the fourth and fifth harmonics of the 1.06 microns light from the mode locked Nd:glass laser. The upconverted power is shown to agree with the predicted value within experimental error. The optical Kerr constants of a variety of liquids was determined by inducing birefringence in them using a high power Q switched Nd:glass laser and observing enhanced signal from a He-Ne laser through crossed polarizers. Comparison of the measured and calculated Kerr constants show satisfactory agreement. Dissert. Abstr.

N80-29648 Illinois Univ., Urbana-Champaign.
VISIBLE-SPECTRUM INDIUM GALLIUM PHOSPHIDE ARSENIDE HETEROSTRUCTURE LASERS Ph.D. Thesis
Raymond Chin 1980 124 p
Avail: Univ. Microfilms Order No. 8017921

The growth, fabrication, and luminescence characteristics of wide-gap In(1-x)Ga(x)P(1-z)As(z) double heterojenction lasers and of single and multiple quantum well lasers are examined. The problems related to the substrate GaAs(1-y)P(y) used in visible laser diode work such as surface cross hatch structure and lattice parameters variation are examined. Comparisons are made between the active layers of DH structures grown from Ga rich melts and high arsenic concentration in rich melts. The specific difficulties related to each melt type are discussed, as well as growth temperature effects. The effects of lattice mismatch between the GaAs(1-y)P(y) substrate and the In(1-x)Ga(x)P epitaxial layers are studied, providing correlations between the photoluminescence intensity, surface features, and lattice mismatch. Data are presented for various visible spectrum double heterojunction lasers with different heterobarrier heights. Limitations upon the compositions which can be employed in DH lasers are discussed in terms of the direct indirect transition. Preliminary results from single and multiple quantum well lasers with high energy gaps are examined, as well as the method of growing them. Dissert. Abstr.

N80-29649 Georgia State Univ., Atlanta.
APPLICATION OF DOUBLE TORSION TEST TO INVESTIGATION OF THE FRACTURE BEHAVIOR OF CAST IRON Ph.D. Thesis
Deepak Kumar Verma 1980 206 p
Avail: Univ. Microfilms Order No. 8018157

The double torsion test can yield valid fracture toughness values provided all the experimental conditions outlined are satisfied such as avoiding torsional warping of plates, avoiding 'end effects', maintaining plane strain conditions, avoiding deep top and bottom grooves for thicker specimens, suitably modifying the standard calibration equation, avoiding excessive brinelling at loading points and proper machining of specimens. The double torsion test may be utilized to obtain valuable information upon the effects of as-cast section size and composition on the fracture toughness of gray cast ions. Both as-cast section size and carbon equivalent exert profound effects upon fracture toughness. Along with the effects of inoculation, those of as-cast section size and carbon equivalent, may be rationalized on the basis of coarseness and volume fracture of the weak graphite flakes present in the structure. The Hornbogen-Motz model may be applied with reasonable success to estimating the fracture toughness values. Knowing the eutectic cell of gray ions, the fracture toughness can be predicted with reasonable confidence. Dissert. Abstr.

N80-29650 Arizona Univ., Tucson.
INFRARED INTERFEROMETRIC SYSTEMS Ph.D. Thesis
Osuk Young Kwon 1980 181 p
Avail: Univ. Microfilms Order No. 8017755

Infrared interferometric systems using a CO2 laser operating at a wavelength of 10.6 micrometers were investigated. Specific systems developed were the infrared laser unequal path interferometer (IRLUP), the IRLUPI with infrared computer generated hologram, the infrared common path interferometers such as the infrared point diffraction interferometer, and the infrared scatterplate interferometer. The above interferometers produce interferograms of equal optical path difference (OPD). Other types of common interferometers which provide interferometers of differential OPD were also developed. They are infrared lateral shearing interferometers, a germanium plane parallel plate, the Ronchi ruling, and the double grating lateral shearing interferometer. A pyroelectric vidicon was employed as an ac infrared detector with proper intensity modulation techniques. Chopping, panning, and phase variation of the interferogram

modulated the interference pattern effectively for various types of interferometers. Germanium and zinc selenide optics were used for lenses and beamsplitters. A He-Ne gas laser was installed parallel to the CO2 beam for the ease of initial aligment. Test interferograms are shown using each interferometer.

Dissert Abstr.

N80-29651 Stanford Univ., Calif.
STUDIES OF LASER RESONATORS AND BEAM PROPAGATION USING FAST TRANSFORM METHODS Ph.D. Thesis
Shinan-Chur Sheng 1980 149 p
Avail: Univ. Microfilms Order No. 8016863

The quasi-fast Hankel transform (FHT) algorithm is improved and tested for beam propagation calculations in cylindrical coordinates in order to develop an efficient method for the numerical computation of optical diffraction effects. Accuracy criteria are established and relationships between optical Fresnel number and numerical sampling parameters are found. Extensive application of this propagation scheme to resonator eigenmode analysis is carried out. The analytic solutions of the perturbed Quassian modes of an unbalanced antiresonant ring laser cavity are studied by perturbation theory. This resonator has the property of exhibiting transverse mode selection even with infinite diameters for all mirrors and apertures. Second harmonic generation in nonlinear materials with beam diffraction, pump depletion, and arbitrary beam profiles all taken into consideration are investigated. Numerical calculations are done with the use of the FHT in cylindrical coordinates, and fast fourier transforms in rectangular coordinates. Theory is confirmed with an experiment using an unstable resonator Nd: YAG output beam pumping KDP crystal.

Dissert. Abstr.

N80-29652*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HETERODYNE SYSTEMS AND TECHNOLOGY, PART 1
Aug. 1980 266 p refs Intern. Conf. held at Williamsburg, Va., 25-27 Mar. 1980 2 Vol.
(NASA-CP-2138-Pt-1; L-13849) Avail: NTIS HC A12/MF A01 CSCL 20E

Various aspects of optical heterodyning are considered. Topics covered heterodyning throughout the electromagnetic spectrum including detectors, local oscillators, tunable diode lasers, astronomical systems, and environmental sensors, with both active and passive systems represented. For individual titles, see N80-29653 through N80-29671.

N80-29653*# Columbia Univ., New York. Columbia Radiation Lab.
THE PHYSICS OF HETERODYNE DETECTION IN THE FAR-INFRARED: TRANSITION FROM ELECTRIC-FIELD TO PHOTON-ABSORPTION DETECTION IN A SIMPLE SYSTEM
Malvin Carl Teich *In* NASA Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 1-10 refs (For primary document see N80-29652 20-36)
(Contract DAAG29-79-C-0079)
Avail: NTIS HC A12/MF A01 CSCL 20E

The history of heterodyne detection is reviewed from the radiowave to the optical regions of the electromagnetic spectrum with emphasion the submillimeter/far infrared. The transition from electric field to photon absorption detection in a simple system is investigated. The response of an isolated two level detector to a coherent source of incident radiation is calculated for both heterodyne and video detection. When the processes of photon absorption and photon emission cannot be distinguished, the relative detected power at double- and sum-frequencies is found to be multiplied by a coefficient, which is less than or equal to unity, and which depends on the incident photon energy and on the effective temperature of the system.

J.M.S.

N80-29654*# California Univ., Berkeley. Dept. of Physics.
INFRARED HETERODYNE SPECTROSCOPY IN ASTRONOMY
Albert Betz *In* NASA Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 11-22 refs (For primary document see N80-29652 20-36)
(Grant NGR 05-003-452)
Avail: NTIS HC A12/MF A01 CSCL 20E

A heterodyne spectrometer was constructed and applied to problems in infrared astronomical spectroscopy. The instrument offers distinct observational advantages for the detection and analysis of individual spectral lines at Doppler-limited resolution. Observations of carbon dioxide in planetary atmospheres and ammonia in circumstellar environments demonstrate the substantial role that infrared heterodyne techniques will play in the astronomical spectroscopy of the future.

J.M.S.

N80-29655*# Massachusetts Inst. of Tech., Cambridge. Department of Electrical Engineering and Computer Science.
NEW PbSnTe HETEROJUNCTION LASER DIODE STRUCTURES WITH IMPROVED PERFORMANCE
C. G. Fonstad, D. Kasemset, H. H. Hsieh, and S. Rotter *In* NASA Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 23-32 refs (For primary document see N80-29652 20-36)
(Grants NSG-1413; NSF DMR-76-80895)
Avail: NTIS HC A12/MF A01 CSCL 20E

Several recent advances in the state-of-the-art of lead tin telluride double heterojunction laser diodes are summarized. Continuous Wave operation to 120 K and pulsed operation to 166 K with single, lowest order transverse mode emission to in excess of four times threshold at 80 K were achieved in buried stripe lasers fabricated by liquid phase epitaxy in the lattice-matched system, lead-tin telluride-lead telluride selenide. At the same time, liquid phase epitaxy was used to produce PbSnTe distributed feedback lasers with much broader continuous single mode tuning ranges than are available from Fabry-Perot lasers. The physics and philosophy behind these advances is as important as the structures and performance of the specific devices embodying the advances, particularly since structures are continually being evolved and the performance continues to be improved.

J.M.S.

N80-29656*# General Motors Research Labs., Warren, Mich.
ADVANCES IN TUNABLE DIODE LASER TECHNOLOGY
Wayne Lo *In* NASA Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 33-44 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

The improvement of long-term reliability, the purification of mode properties, and the achievement of higher-temperature operation were examined. In reliability studies a slow increase in contact resistance during room temperature storage for lasers fabricated with In-Au or In-Pt contacts was observed. This increase is actually caused by the diffusion of In into the surface layer of laser crystals. By using a three layered structure of In-Au-Pt or In-Pt-Au, this mode of degradation was reduced. In characterizing the mode properties, it was found that the lasers emit in a highly localized, filamentary manner. For widestripe lasers the emission occurs near the corners of the junction. In order to achieve single-mode operation, stripe widths on the order of 8-10 micrometers are needed. Also, it was found that room temperature electroluminescence is possible near 4.6 micrometers.

J.M.S.

N80-29657*# Fujitsu Labs. Ltd., Tokyo (Japan). Kansai Research Center.
LONG WAVELENGTH PbSnTe LASERS WITH CW OPERATION ABOVE 77 K
Koji Shinohara, Mitsuo Yoshikawa, Michiharu Ito, and Ryuiti Ueda *In* NASA Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 45-54 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

Lead tin telluride diode lasers with emission wavelengths of 6 to 9 micrometers easily operate continuously at temperatures above 77K. These lasers have the Pb(1-y) Sn(y) TE/Pb(1-y) Te/Pb(1-y) Sn(y) Te/PbTe (substrate), (x > y) double heterostructure. To prepare this structure by LPE, the growth temperature must be below 600 C to suppress diffusion of the tin during the epitaxial growth. When the heterojunctions are formed by the usual LPE method, the junction boundaries become irregular in the case for the lasers with wavelengths of over 10 micrometers at 77K. The mechanism by which the heterojunction boundaries become irregular is cleared and a new LPE method which prevents the irregularity is explained. The lasers prepared from the wafers

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grown by the new method have demonstrated CW operation at wavelengths longer than 10 micrometers above liquid nitrogen temperature. J.M.S.

N80-29658*# Perkin-Elmer Corp., Norwalk, Conn.
WIDELY TUNABLE (PbSn)Te LASERS USING ETCHED CAVITIES FOR MASS PRODUCTION
Matthew D. Miller. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 1. Aug. 1980. p 55-61. refs (For primary document see N80-29652 20-36)
(Contract NAS1-14996)
Avail: NTIS. HC A12/MF A01. CSCL 20E

Lead salt diode lasers are being used increasingly as tunable sources of monochromatic infrared radiation in a variety of spectroscopic systems. These devices are particularly useful, both in the laboratory and in the field, because of their high spectral brightness (compared to thermal sources) and wide spectral coverage (compared to line-tunable gas lasers). While the primary commercial application of these lasers has been for ultrahigh resolution laboratory spectroscopy, there are numerous systems applications, including laser absorbtion pollution monitors and laser heterodyne radiometers, for which diode lasers have great potential utility. Problem areas related to the wider use of these components are identified. Among these are total tuning range, mode control, and high fabrication cost. A fabrication technique which specifically addresses the problems of tuning range and cost, and which also has potential application for mode control, is reported. J.M.S.

N80-29659*# Laser Analytics, Inc., Lexington, Mass.
RELIABILITY IMPROVEMENTS IN TUNABLE Pb1-xSnxSe DIODE LASERS
Kurt J. Linden, Jack F. Butler, Kenneth W. Nill, and Robert E. Reeder. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 1. Aug. 1980. p 63-78. refs (For primary document see N80-29652 20-36)
Avail: NTIS. HC A12/MF A01. CSCL 20E

Recent developments in the technology of Pb-salt diode lasers which have led to significant improvements in reliability and lifetime, and to improved operation at very long wavelengths are described. A combination of packaging and contacting-metallurgy improvements has led to diode lasers that are stable both in terms of temperature cycling and shelf-storage time. Lasers cycled over 500 times between 77 K and 300 K have exhibited no measurable changes in either electrical contact resistance or threshold current. Utilizing metallurgical contacting process, both lasers and experimental n-type and p-type bulk materials are shown to have electrical contact resistance values that are stable for shelf storage periods well in excess of one year. Problems and experiments which have led to devices with improved performance stability are discussed. Stable device configurations achieved for material compositions yielding lasers which operate continuously at wavelengths as long as 30.3 micrometers are described. J.M.S.

N80-29660*# Lockheed Missiles and Space Co., Palo Alto, Calif.
LONG WAVELENGTH Pb(1-X)Sn(X)Se AND Pb(1-x)Sn(X)Te DIODE LASERS AS LOCAL OSCILLATORS
E. R. Washwell. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 1. Aug. 1980. p 79-95. refs (For primary document see N80-29652 20-36)
(Contract DAAG60-76-C-0061)
Avail: NTIS. HC A12/MF A01. CSCL 20E

A breadboard heterodyne receiver is described which was used to establish the characteristics of lead salt diode lasers pertinent to their use as local oscillators using laser devices operating in the 15-25 micrometer spectral region. Heterodyne detection efficiency is directly correlated with the transverse mode structure and emphasizes the necessity of stable lowest order mode operation for lasers when used as local oscillators. The results obtained indicate that the continued development of these lasers provide suitable local oscillators for a variety of applications. J.M.S.

N80-29661*# Perkin-Elmer Corp., Norwalk, Conn.
DIAGNOSTICS AND CONTROL OF WAVENUMBER STABILITY AND PURITY OF TUNABLE DIODE LASERS RELEVANT TO THEIR USE AS LOCAL OSCILLATORS IN HETERODYNE SYSTEMS
S. Poultney, D. Chen, G. Steinberg, F. Wu, A. Pires, M. D. Miller, and M. McNally. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 1. Aug. 1980. p 97-128. refs (For primary document see N80-29652 20-36)
Avail: NTIS. HC A12/MF A01. CSCL 20E

Initial operation of the tunable diode lasers (TDL) showed that it was not possible to adjust the wavenumber to one selected a priori in the TDL tuning range. During operation, the operating point would change by 0.1/cm over the longer term with even larger changes occurring during some thermal cycles. Most changes during thermal cycling required using lower temperatures and higher currents to reach the former wavenumber (when it could be reached). In many cases, an operating point could be selected by changing TDL current and temperature to give both the desired wavenumber and most of the power in a single mode. The selection procedure had to be used after each thermal cycling. Wavenumber nonlinearities of about 10% over a 0.5 cm tuning range were observed. Diagnostics of the single mode selected by a grating monochromator showed wavenumber fine structure under certain operating conditions. The characteristics due to the TDL environment included short term wavenumber stability, the instrument lineshape function, and intermediate term wavenumber stability. J.M.S.

N80-29662*# Old Dominion Univ., Norfolk, Va. Dept. of Physics.
EXCESS NOISE IN Pb(1-x)Sn(X)Se SEMICONDUCTOR LASERS
Charles N. Harward and Barry D. Sidney. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 1. Aug. 1980. p 129-142. refs (For primary document see N80-29652 20-36)
Avail: NTIS. HC A12/MF A01. CSCL 20E

The noise characteristics of the TDL were studied for frequencies less than 20 kHz. For heterodyne applications, the high frequency (> 1 MHz) characteristics are also important. Therefore, the high frequency noise characteristics of the TDL were studied as a part of a full TDL characterization program which has been implemented for the improvement of the TDL as a local oscillator in the LHS system. It was observed that all the devices showed similar high frequency noise characteristics even though they were all constructed using different techniques. These common high frequency noise characteristics are reported. J.M.S.

N80-29663*# Airborne Instruments Lab., Melville, N.Y. AIL Div.
FINE WAVELENGTH ID FOR TUNABLE LASER LOCAL OSCILLATORS
M. G. Savage and R. C. Augen. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 1. Aug. 1980. p 143-152. refs (For primary document see N80-29652 20-36)
Avail: NTIS. HC A12/MF A01. CSCL 20E

A wavelength ID device which consists of an electronic show that the etalon has a finesse F > 30 which is maintainable for several days. These tests also demonstrate that the etalon system is capable of resonance frequency stability during similar time periods. With currently available coatings, this level of performance is achievable over an optical bandwidth delta lambda = 3 micrometers centered at lambda = 10 micrometers. J.M.S.

N80-29664*# National Aeronautics and Space Administration, Washington, D.C.
A REVIEW OF THE NASA/OAST CRYOGENIC COOLERS TECHNOLOGY PROGRAM
J. G. Lundholm, Jr. and Allan Sherman (NASA. Goddard Space Flight Center, Greenbelt, Md.). *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 1. Aug. 1980. p 153-170. refs (For primary document see N80-29652 20-36)
Avail: NTIS. HC A12/MF A01. CSCL 20L

Low and ultra low temperature cryogenic cooler systems for future space missions include mechanical, solid cryogen, gas adsorption, superfluid helium, helium-3, and magnetic (adiabatic demagnetization) coolers. Operating lifetimes required vary from a few weeks for a Shuttle/Spacelab mission to as long as nine years for missions to the outer planets. Temperature requirements

vary from tens to tenths of kelvin. At the higher temperature, cooling loads for detectors, instruments and associated shields may be as high as 15 watts. The general requirements for low and ultra low temperature and techniques that can be employed to achieve these temperatures at expected heat loads are discussed. The NASA Centers involved in the R & T efforts and the type of cooler systems on which they are focusing their effort are considered as well as the thrust of R & T effort for each cooler type. Projected missions that will use the technology are identified. A.R.H.

N80-29665*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ATMOSPHERIC STUDIES AND APPLICATIONS WITH INFRARED HETERODYNE DETECTION TECHNIQUES
Robert T. Menzies. *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 171-179 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

With the advent of stable, cw infrared lasers with moderate output power capabilities in the mid 1960's came the idea of using heterodyne detection, a mature radio frequency technique, in the infrared. This technique was first applied in radar and communications applications; however, it became apparent that infrared lasers and heterodyne detection techniques would be useful in a number of atmospheric measurement applications. The level to which these techniques are being put to use in field measurements is shown using two developed flight instruments as examples. J.M.S.

N80-29666*# Airborne Instruments Lab., Melville, N. Y.
INFRARED HETERODYNE RADIOMETER FOR AIRBORNE ATMOSPHERIC TRANSMITTANCE MEASUREMENTS
J. M. Wolczok, R. A. Lange, and A. J. DiNardo. *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 181-197 refs (For primary document see N80-29652 20-36)
(Contract F29601-76-C-0045)
Avail: NTIS HC A12/MF A01 CSCL 20E

An infrared heterodyne radiometer (IHR) was used to measure atmospheric transmittance at selected hydrogen fluoride (2.7 micrometer) and deuterium fluoride (3.8 micrometer) laser transitions. The IHR was installed aboard a KC-135 aircraft for an airborne atmospheric measurements program that used the sun as a backlighting source for the transmission measurements. The critical components are: a wideband indium antimonide (InSb) photomixer, a CW HF/DF laser LO, a radiometric processor, and a 1900 K blackbody reference source. The measured heterodyne receiver sensitivity (NEP) is 1.3 x 10 to the -19th power W/Hz, which yields a calculated IHR temperature resolution accuracy of delta I sub S/-3 sub S = 0.005 for a source temperature of 1000 K and a total transmittance of 0.5. Measured atmospheric transmittance at several wavelengths and aircraft altitudes from 9.14 km (30,000 ft) to 13.72 km (45,000 ft) were obtained during the measurements program and have been compared with values predicted by the AFGL Atmospheric Line Parameter Compilation. J.M.S.

N80-29667*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT AND PERFORMANCE OF A LASER HETERODYNE SPECTROMETER USING TUNABLE SEMI-CONDUCTOR LASERS AS LOCAL OSCILLATORS
D. Glenar (Pennsylvania State Univ., University Park), T. Kostiuk, D. E. Jennings, and M. J. Mumma. *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 199-208 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

A diode laser based IR heterodyne spectrometer for laboratory and field use was developed for high efficiency operation between 7.5 and 8.5 microns. The local oscillator is a PbSSe tunable diode laser kept continuously at operating temperatures of 12-60 K using a closed cycle cooler. The laser output frequency is controlled and stabilized using a high precision diode current supply, constant temperature controller, and a shock isolator mounted between the refrigerator cold tip and the diode mount. Single laser modes are selected by a grating placed in the local oscillator beam. The system employs reflecting optics throughout to minimize losses from internal reflection and absorption, and to eliminate chromatic effects. Spectral analysis of the diode laser output between 0 and 1 GHz reveals excess noise at many diode current settings, which limits the infrared spectral regions over which useful heterodyne operation can be achieved. System performance has been studied by making heterodyne measurements of etalon fringes and several Freon 13 (CF3Cl) absorption lines against a laboratory blackbody source. Preliminary field tests have also been performed using the Sun as a source. Author

N80-29668*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ATMOSPHERIC SOLAR ABSORPTION MEASUREMENTS IN THE 9-11 MICRON REGION USING A DIODE LASER HETERODYNE SPECTROMETER
Charles N. Harward (Old Dominion Univ., Norfolk, Va.) and James M. Hoell, Jr. *In its* Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 209-220 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

A tunable diode laser heterodyne radiometer was developed for ground based measurements of atmospheric solar absorption spectra in the 9 to 12 micron spectral range. The performance and operating characteristics of this tunable infrared heterodyne radiometer (TIHR) is discussed along with recently measured heterodyne solar absorption spectra in the 10 to 11 micron spectral region. J.M.S.

N80-29669*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SENSITIVITY STUDIES AND LABORATORY MEASUREMENTS FOR THE LASER HETERODYNE SPECTROMETER EXPERIMENT
Frank Allario, Stephen J. Katzberg, and Jack C. Larsen (Systems and Applied Science Corp.) *In its* Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 221-239 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

Several experiments involving spectral scanning interferometers and gas filter correlation radiometers (ref. 2) using limb scanning solar occultation techniques under development for measurements of stratospheric trace gases from Spacelab and satellite platforms are described. An experiment to measure stratospheric trace constituents by Laser Heterodyne Spectroscopy, a summary of sensitivity analyses, and supporting laboratory measurements are presented for O3, ClO, and H2O2 in which the instrument transfer function is modeled using a detailed optical receiver design. J.M.S.

N80-29670*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A 163 MICRON LASER HETERODYNE RADIOMETER FOR OH: Progress Report
H. M. Pickett and T. L. Boyd. *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 241-248 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

A 163 micron (1.836 THz) radiometer developed for airplane and/or balloon platforms is described. The laser local oscillator is a CO2 pumped methanol laser operating at a frequency which is approx. 1 GHz from the J = 3/2 - 1/2 transition of OH. The laser is used directly as a local oscillator or is translated in frequency to closer coincidence with the OH emission, depending on achieved detector IF bandwidth. Frequency translation techniques which are described are diode mixing and a method of single sideband generation using an external Stark modulated gas cell. The photoconductive mixer used is a strained Ge crystal, doped with Ga, originally used as an incoherent detector. The uniaxial strain on the Ga doped Ge crystal shifts the threshold for photoconduction from 100/cm to frequencies as low as 50/cm. These detectors are currently being characterized as mixers in the laboratory. Of particular interest are the effect of local oscillator power and strain on IF, bandwidth, detector impedance, and conversion loss. Preliminary results of these tests are described and compared with theoretical expectations. J.M.S.

N80-29671*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HETERODYNE DETECTION OF THE 752.033-GHz H2O ROTATIONAL ABSORPTION LINE
G. F. Dionne, J. F. Fitzgerald, T-S. Chang, M. M. Litvak, and H. R. Fetterman. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 1. Aug. 1980. p. 249-262. refs. Sponsored by Army. Prepared in cooperation with Lincoln Lab., MIT, Lexington. (For primary document see N80-29652 20-36)
Avail: NTIS. HC A12/MF A01. CSCL 20E

A tunable high resolution two stage heterodyne radiometer was developed for the purpose of investigating the intensity and lineshape of the 752.033 GHz rotational transition of water vapor. Single-sideband system noise temperatures of approximately 45,000 K were obtained using a sensitive GaAs Schottky diode as the first stage mixer. First local oscillator power was supplied by a CO2 laser pumped formic acid laser (761.61 GHz), generating an X-band IF signal with theoretical line center at 9.5744 GHz. Second local oscillator power was provided by means of a 3 GHz waveguide cavity filter with only 9 dB insertion loss. In absorption measurements of the H2O taken from a laboratory simulation of a high altitude rocket plume, the center frequency of the 752 GHz line was determined to within 1 MHz of the reported value. A rotational temperature 75 K, a linewidth 5 MHz and a Doppler shift 3 MHz were measured with the line-of-sight intersecting the simulated-plume axis at a distance downstream of 30 nozzle diameters. These absorption data were obtained against continuum background radiation sources at temperatures of 1175 and 300 K. J.M.S.

N80-29672*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HETERODYNE SYSTEMS AND TECHNOLOGY, PART 2
Aug. 1980. 321 p. refs. Conf. held in Williamsburg, Va., 25-27 Mar. 1980.
(NASA-CP-2138-Pt-2; L-13849) Avail: NTIS
HC A14/MF A01. CSCL 20E

Various aspects of optical heterodyning are covered including active and passive systems, local oscillators, tunable diode lasers, detectors and related systems. For individual titles, see N80-29673 through N80-29693.

N80-29673*# Honeywell Electro-Optics Center, Lexington, Mass.
SOME n-p (Hg,Cd)Te PHOTODIODES FOR 8-14 MICROMETER HETERODYNE APPLICATIONS
James F. Shanley and Chris T. Flanagan. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 2. Aug. 1980. p. 263-280. refs. (For primary document see N80-29672 20-36)
Avail: NTIS. HC A14/MF A01. CSCL 20E

The results describing the dc and CO2 laser heterodyne characteristics of a three element photodiode array and single element and four element photodiode arrays are presented. The measured data shows that the n(+)-p configuration is capable of achieving bandwidths of 475 to 725 MHz and noise equivalent powers of 3.2 x 10 to the minus 20th power W/Hz at 77 K and 1.0 x 10 to the minus 19th power W/Hz at 145 K. The n(+)-n(-)-p photodiodes exhibited wide bandwidths (approximately 2.0 GHz) and fairly good effective heterodyne quantum efficiencies (approximately 13-30 percent at 2.0 GHz). Noise equivalent powers ranging from 1.44 x 10 to the minus 19th power W/Hz to 6.23 x 10 to the minus 20th power W/Hz were measured at 2.0 GHz. R.C.T.

N80-29674*# Societe Anonyme de Telecommunications, Paris (France).
CONCEPTUAL DESIGN AND APPLICATIONS OF HgCdTe INFRARED PHOTODIODES FOR HETERODYNE SYSTEMS
Michel B. Simeix and Henry Hoffheimer (ELTEK Corp., Larchmont, N.Y.). *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 2. Aug. 1980. p. 281-295. refs. (For primary document see N80-29672 20-36)
Avail: NTIS. HC A14/MF A01. CSCL 20E

The significance of HgCdTe photodiodes are discussed relative to their existance in heterodyne detection systems operating in the 9 to 11 micrometer CO2 laser wavelength region. Their successful fabrication as well as the physical properties of the materials are described. The implementation of controlled industrial processes are reported with emphasis on the yield of predictable and repeatable detector characteristics to the discriminating systems, demands for high cutoff frequencies, quantum efficiency, and reliability. The most salient production steps and diode characteristics are presented. Measured results from production units are also given. R.C.T.

N80-29675*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPARATIVE PERFORMANCE OF HgCdTe PHOTODIODES FOR HETERODYNE APPLICATION
Herbert R. Kowitz. *In its* Heterodyne Systems and Technol., Pt. 2. Aug. 1980. p. 297-308. refs. (For primary document see N80-29672 20-36)
Avail: NTIS. HC A14/MF A01. CSCL 20E

The use of photodiodes as optical photomixers in laser heterodyne spectroscopy systems is discussed. The quantum efficiency of the photodiodes is reported with the emphasis on its effect on the system's signal to noise ratio. The measurement techniques used to determine photodiode dc and heterodyne quantum efficiencies are described. The theory behind the measurements as well as actual measurements data for two HgCdTe photodiodes are presented. R.C.T.

N80-29676*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EXTENDING THE OPERATING TEMPERATURE, WAVELENGTH AND FREQUENCY RESPONSE OF HgCdTe HETERODYNE DETECTORS
David L. Spears. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 2. Aug. 1980. p. 309-325. refs. Sponsored in part by DARPA and AF. (For primary document see N80-29672 20-36)
Avail: NTIS. HC A14/MF A01. CSCL 20E

Near ideal optical heterodyne performance was obtained at GHz IF frequencies in the 10 micrometer wavelength region with liquid nitrogen cooled HgCdTe photodiodes. Heterodyne NEP's as low as 2.7 x 10 to the minus 20th power W/Hz at 100 MHz, 5.4 x 10 to the minus 20th power W/Hz at 1.5 GHz, and 9.4 x 19 to the minus 20th power W/Hz at 3 GHz were achieved. Various physical phenomena which occur within a photodiode and affect heterodyne operation were examined in order to assess the feasibility of extending the operating temperature, wavelength, and frequency response of these HgCdTe photomixers. R.C.T.

N80-29677*# Airborne Instruments Lab., Melville, N. Y.
INFRARED HETERODYNE RECEIVERS WITH IF RESPONSES APPROACHING 5 GHz
J. M. Wolczok and Bud J. Peyton. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 2. Aug. 1980. p. 327-340. refs. Sponsored by DOE. (For primary document see N80-29672 20-36)
Avail: NTIS. HC A14/MF A01. CSCL 20E

Specialized coherent 10.6 micrometer infrared receivers were developed with infrared frequency responses approaching 5 GHz. Carbon dioxide lasers were employed for these applications because of their availability, stability, and high average power levels. Heterodyne receivers which employ extrinsic photoconductive Ge:Cu(Sb) mixers were developed for measurements of carbon dioxide laser scattering to determine: (1) the drive lower hybrid wave density fluctuations; and (2) the plasma ion temperature of the dense Tokamak plasmas. R.C.T.

N80-29678*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FAR INFRARED HETERODYNE SYSTEMS
Peter E. Tannenwald. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 2. Aug. 1980. p. 341-352. refs. Sponsored in part by Army and AF. (For primary document see N80-29672 20-36)
Avail: NTIS. HC A14/MF A01. CSCL 20E

Three far infrared detectors, the InSb hot electron bolometer, the GaAs Schottky diode and the Josephson point contact junction, were incorporated as mixers into sensitive heterodyne systems. The performances of existing heterodyne receivers/radiometers using these detectors are described and compared. Other applications of submillimeter heterodyne techniques are discussed. R.C.T.

N80-29679*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BULK SUBMILLIMETER-WAVE MIXERS: STRAIN AND SUPERLATTICES
Marvin M. Litvak and Herbert M. Pickett *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 353-363 refs (For primary document see N80-29672 20-36)
Avail: NTIS HC A14/MF A01 CSCL 20E

Strained germanium crystals, doped with gallium, were used as heterodyne mixers at THz frequencies, with infrared bandwidths approaching a GHz. The mixer performance (conversion loss and mixer noise) was analyzed in terms of nonlinearities associated with acceptor levels and with relaxation rates of free holes. Comparison was made with similar mixers employing low lying donor levels in high purity GaAs and with hot electron InSb mixers. R.C.T.

N80-29680*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTICAL CONSIDERATIONS IN INFRARED HETERODYNE SPECTROMETER DESIGN
T. Kostiuk, Michael J. Mumma, and D. Zipoy (Maryland Univ., College Park) *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 365-372 refs (For primary document see N80-29672 20-36)
Avail: NTIS HC A14/MF A01 CSCL 20E

The optical design considerations for optimization of sensitivity, tunability, and versatility of an infrared heterodyne spectrometer are discussed using the GSFC CO2 laser heterodyne spectrometer optical front end as an example. Problems related to the coherent nature of the laser local oscillator beam (e.g., interference effects at edges of optical elements and at the beam combining beamsplitter) are described and proper beamsplitter design discussed. Optimum matching to the telescope is discussed. The severe effects of large central obscuration on the coherent telescope efficiency are described and steps to partially recover the lost system sensitivity are proposed. Measurements made with the GSFC 48 inch telescope (linear obscuration rate = 0.5) and the KPNO McMathe telescope (no obscuration) are given as examples. J.M.S.

N80-29681*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RF SPECTROMETERS FOR HETERODYNE RECEIVERS
David Buhl and Michael J. Mumma *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 373-383 refs (For primary document see N80-29672 20-36)
Avail: NTIS HC A14/MF A01 CSCL 20E

Several types of spectrometers developed for radio astronomy receivers which utilize RF filters, multiple oscillators and mixers, digital autocorrelators and acoustic/optic devices are considered. The RF spectrometer developed at GSFC to provide wide bandwidths (greater than 1 GHz) as well as high resolution (5 MHz) is described. The 128 channel filter bank is divided into high and low resolution sections. The high resolution section is tunable by providing a second mixer ahead of the filter bank. This is necessary because infrared receivers which use gas lasers as local oscillators are only tunable to specific laser frequencies. To compensate for astronomical Doppler shifts and molecule frequency differences a second local oscillator and mixer is needed. A diagram of the RF section of the filter bank is shown. The RF spectrometer is shown to be the best means of achieving ultra-wide bandwidths for infrared heterodyne receivers. For high resolution with a large number of channels, the acousto/optical spectrometer is the principle instrument, particularly for balloon or space flight applications. J.M.S.

N80-29682*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ACOUSTO-OPTIC SPECTROMETER FOR RADIO ASTRONOMY
Gordon Chin, David Buhl, and Jose M. Florez *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 385-397 refs (For primary document see N80-29672 20-36)
Avail: NTIS HC A14/MF A01 CSCL 20E

A prototype acousto-optic spectrometer which uses a discrete bulk acoustic wave Itek Bragg cell, 5 mW Helium Neon laser, and a 1024 element Reticon charge coupled photodiode array is described. The analog signals from the photodiode array are digitized, added, and stored in a very high speed custom built multiplexer board which allows synchronous detection of weak signals to be performed. The experiment is controlled and the data are displayed and stored with an LSI-2 microcomputer system with dual floppy discs. The performance of the prototype acousto-optic spectrometer obtained from initial tests is reported. J.M.S.

N80-29683*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MICROWAVE TUNABLE LASER SOURCE: A STABLE, PRECISION TUNABLE HETERODYNE LOCAL OSCILLATOR
Glen W. Sachse *In its* Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 399-415 refs (For primary document see N80-29672 20-36)
Avail: NTIS HC A14/MF A01 CSCL 20E

The development and capabilities of a tunable laser source utilizing a wideband electro-optic modulator and a CO2 laser are described. The precision tunability and high stability of the device are demonstrated with examples of laboratory spectroscopy. Heterodyne measurements are also presented to demonstrate the performance of the laser source as a heterodyne local oscillator. With the use of five CO2 isotope lasers and the 8 to 18 GHz sideband offset tunability of the modulator, calculations indicate that > 50 percent spectral coverage in the 9 to 12 micron region is achievable. The wavelength accuracy and stability of this laser source is limited by the CO2 laser and is more than adequate for the measurement of narrow Doppler-broadened line profiles. The room-temperature operating capability and the programmability of the microwave tunable laser source are attractive features for its in-the-field implementation. Although heterodyne measurements indicated some S/N degradation when using the device as a local oscillator, there does not appear to be any fundamental limitation to the heterodyne efficiency of this laser source. Through the use of a lower noise-figure traveling wave tube amplifier and optical matching of the output beam with the photomixer, a substantial increase in the heterodyne S/N is expected. M.G.

N80-29684*# Aerospace Corp., Los Angeles, Calif. Electronics Research Lab.
SUBMILLIMETER LOCAL OSCILLATORS FOR HETERODYNE SPECTROSCOPY
Edward J. Danielewicz, Jr. *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 417-447 refs Sponsored by DOE (For primary document see N80-29672 20-36)
Avail: NTIS HC A14/MF A01 CSCL 20E

The major technological innovations in continuous wave (CW) submillimeter sources which are specifically suitable for application as local oscillators in heterodyne systems are reviewed. A description of the various sources is given which underscores the general principles and operating features for each type of device. Particular emphasis is placed on CW optically pumped lasers, which have had a dramatic impact as widely available sources of narrow linewidth coherent radiation. The state-of-the-art is summarized for these lasers and performance data are presented for several local oscillator packages. Optically pumped lasers are then compared and contrasted with other competing sources such as backward wave oscillators, IMPATT diodes, and Josephson junctions. By comparing their advantages and limitations for use as local oscillators, the potential applications of these different sources are projected. The prospects for increased tunability, reliability, and scalability are briefly considered, and several novel techniques for generating partially tunable radiation using Schottky diode mixers or CW Raman lasers are highlighted. M.G.

N80-29685*# Phoenix Corp., McLean, Va.
SUB mm LASER LOCAL OSCILLATORS: DESIGN CRITERIA AND RESULTS
Gerhard A. Koepf *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 449-460 refs (For primary document see N80-29672 20-36)
(Contract NAS5-26030)

Avail: NTIS HC A14/MF A01 CSCL 20E

Diagnostic results are given of the spectral features and the power conversion efficiency of submillimeter (SMM) laser local oscillators. Several criteria are obtained for the design of frequency stable and efficient smm lasers for local oscillator applications. Finally, a design is described and results on the power output and power and frequency stability are given. The mode pattern is very close to a Gaussian profile so that efficient coupling to a quasioptical mixer is possible. The laser provides sufficient output power at a large number of lines to drive the mixer into the low conversion loss regime. Radiometric integration times of several minutes with a spectral resolution of 1 MHz will be possible. With present state-of-the-art Schottky mixers and low noise preamplifiers a radiometric temperature resolution of a few K can be expected over a spectral range from 500 to 900 GHz. M.G.

N80-29686*# National Aeronautics and Space Administration. Goddard Space Flight Center, Groenbelt, Md.

DESIGN CONSIDERATIONS FOR OPTICAL HETERODYNE RECEIVERS: A REVIEW

John J. Degnan *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 461-486 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The current state of knowledge concerning optical heterodyne receivers is reviewed. Following a discussion of noise processes in the heterodyne receiver and the manner in which sensitivity is increased through time integration of the detected signal, an expression for the mean square signal current is derived by mixing a coherent local oscillator with a partially coherent, quasimonochromatic source. Then the manner in which the IF signal calculation can be transferred to any convenient plane in the optical front end of the receiver is demonstrated. Using these techniques, a relatively simple equation is obtained for the coherently detected signal from an extended incoherent source and applied to the heterodyne detection of an extended thermal source and to the backscatter lidar problem where the antenna patterns of both the transmitter beam and heterodyne receiver must be taken into account. Finally, the detection of a coherent source is considered and, in particular, a distant point source such as a star or laser transmitter in a long range heterodyne communications system is discussed. M.G.

N80-29687*# Hughes Aircraft Co., Culver City, Calif.

MIXING EFFICIENCY IN HETERODYNE SYSTEMS

David Fink *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 487-494 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

How the spatial distributions of the signal and local oscillator fields affect the heterodyne signal to noise ratio is examined for both a single detector and an array of detectors. For an array, the distribution of gain among the intermediate frequency (i.f.) amplifiers is included. The emphasis is on understanding why the distributions are important and what is the key to maximizing the signal to noise ratio in any system. It is shown that for a single detector, the highest signal to noise ratio is obtained with a local oscillator (LO) distribution the same as that of the signal. For an array, the product of the i.f. gain times the LO field at each detector has the same distribution as that of the signal field. M.G.

N80-29688*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SPATIAL FREQUENCY RESPONSE OF AN OPTICAL HETERODYNE RECEIVER

Carl L. Fales and Don M. Robinson *In its* Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 495-510 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The principles of transfer function analysis are applied to a passive optical heterodyne receiver to obtain the modulation transfer function (MTF). MTF calculations are performed based on an optical platform which is imaging vertically varying profiles at worst case shuttle orbit altitudes. An analysis of the derogatory effects of sampling (aliasing) and central obscurations on both resolution and heterodyne efficiency is given. It is found that the cascading property of MTF analysis must be carefully applied since the coherent transfer function of the optical receiver and that due to the local oscillator-detector combination are not separable but are related by the convolution of their products. Application of these results to the specific case of a space-lab type optical heterodyne receiver shows that resolutions of the order of 1.5-2.0 Km are possible for worst-case type orbital scenarios. Further, comparison of obscured-type receivers (e.g., Cassegrains) with unobscured receivers shows that both resolution and efficiency are severely degraded in an obscured-type receiver and consequently should not be used for a passive heterodyne detection scheme. M.G.

N80-29689*# Laser Development Corp., Lexington, Mass.

HIGH PRESSURE GAS LASER TECHNOLOGY FOR ATMOSPHERIC REMOTE SENSING

Ali Javan (MIT, Cambridge) *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 511-528 refs Sponsored in part by NSF (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The development of a fixed frequency chirp-free and highly stable intense pulsed laser made for Doppler wind velocity measurements with accurate ranging is described. Energy extraction from a high pressure CO2 laser at a tunable single mode frequency is also examined. M.G.

N80-29690*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN AIRBORNE DOPPLER LIDAR

Charles A. DiMarzio *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 529-540 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

A pulsed CO2 Doppler Lidar, developed for airborne measurements of atmospheric wind fields, is described. In-flight tests show that the device can be successfully utilized in the detection and measurement of mountain-wave turbulence and wind shear, and in the generation of time histories of wind-field variations in smooth flight. This Lidar is in the process of being configured for measurement of the atmospheric flow fields surrounding severe convective storms. M.G.

N80-29691*# Lincoln Lab., Mass. Inst. of Tech., Lexington.

SURFACE RELIEF STRUCTURES FOR MULTIPLE BEAM LO GENERATION

Wilfrid B. Veldkamp *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 541-556 refs Sponsored by the AF (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

Linear and binary holograms for use in heterodyne detection with 10.6 micron imaging arrays are described. The devices match the amplitude and phase of the local oscillator to the received signal and thus maximize the system signal to noise ratio and resolution and minimize heat generation on the focal plane. In both the linear and binary approaches, the holographic surface-relief pattern is coded to generate a set of local oscillator beams when the relief pattern is illuminated by a single planewave. Each beam of this set has the same amplitude shape distribution as, and is collinear with, each single element wavefront illuminating array. M.G.

N80-29692*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DIAL WITH HETERODYNE DETECTION INCLUDING SPECKLE NOISE: AIRCRAFT/SHUTTLE MEASUREMENTS OF O3, H2O, AND NH3 WITH PULSED TUNABLE CO2 LASERS

Philip Brockman, Robert V. Hess, Leo D. Staton, and Clayton H. Bair *In its* Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 557-567 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

A parametric analysis of DIAL sensitivity with heterodyne detection is presented and comparisons with direct detection are discussed. Examples are given for monitoring vertical distributions of O3, H2O, and NH3 using a ground-, aircraft-, or shuttle-based pulsed tunable CO2 laser DIAL system. Results

indicate that maximum sensitivity at minimum laser energy per measurement requires multiple pulse operation with the energy per pulse selected so that the measured photon rate is approximately equal to the detector IF bandwidth. Measurement sensitivities can be maximized and interference effects minimized by fine adjustment of measurement frequencies using the tunability of high pressure lasers. The use of rare isotope lasers minimizes loss due to CO2 atmospheric absorption. M.G.

N80-29693*# Youngstown State Univ., Ohio.
HETERODYNE SIGNAL-TO-NOISE RATIOS IN ACOUSTIC MODE SCATTERING EXPERIMENTS
William R. Cochran. *In* NASA. Langley Res. Center. Heterodyne Systems and Technol., Pt. 2. Aug. 1980 p 569-572 refs (For primary document see N80-29672 20-36)
Avail: NTIS HC A14/MF A01 CSCL 20E

The relation between the signal to noise ratio (SNR) obtained in heterodyne detection of radiation scattered from acoustic modes in crystalline solids and the scattered spectral density function is studied. It is shown that in addition to the information provided by the measured frequency shifts and line widths, measurement of the SNR provides a determination of the absolute elasto-optical (Pockel's) constants. Examples are given for cubic crystals, and acceptable SNR values are obtained for scattering from thermally excited phonons at 10.6 microns, with no external perturbation of the sample necessary. The results indicate the special advantages of the method for the study of semiconductors. M.G.

N80-29694# Committee on Commerce, Science, and Transportation (U. S. Senate).
LASER TECHNOLOGY: DEVELOPMENT AND APPLICATIONS
Washington GPO 1980 273 p refs Hearings before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation, 96th Congr., 1st and 2nd Sess., 12 and 14 Dec. 1979, 8 and 12 Jan. 1980
(GPO-59-826) Avail: Subcommittee on Science, Technology and Space

An overview of developments and applications in laser technology is given with emphasis on peaceful uses of high energy laser technology. Space vehicle propulsion, remote sensing from space to monitor the Earth's atmosphere, oceans, and land masses, communications with very high data rates over interplanetary distances, and isotope separation and fusion to improve generation of electrical power are among the topics discussed. Potential military applications of high energy lasers weapons discussed include instaneous kill of hostile targets, such as ballistic missiles, and strategic bombers. J.M.S.

N80-29695# Avco-Everett Research Lab., Mass.
EXCIMER LASER RESEARCH Quarterly Report, 16 Nov. 1978 - 15 Feb. 1979
J. H. Parks 15 Feb. 1979 42 p refs
(Contract N00014-75-C-0063; DARPA Order 1806)
(AD-A085519) Avail: NTIS HC A03/MF A01 CSCL 20/5

This quarterly report describes experimental investigations of interhalogen molecules. These molecules are under consideration to achieve high power scalable laser action in the near UV and visible portion of the spectrum. The report includes a description of fluorescence experiments for these molecules and an analysis of formation kinetics. A theoretical model has been developed to describe the excited ion-pair state structure of the interhalogens. The predictions of this theory are borne out by fluorescence experiments. GRA

N80-29696# Avco-Everett Research Lab., Mass.
EXCIMER LASER RESEARCH Final Technical Report, 15 Aug. 1974 - 29 Sep. 1979
J. H. Parks 1979 150 p refs
(Contract N00014-75-C-0063; DARPA Order 1806)
(AD-A085520) Avail: NTIS HC A07/MF A01 CSCL 20/5

This final report describes theoretical and experimental investigations of the rare gas monohalides, halogens, mercury monohalides and interhalogen molecules. These molecules show great promise for achieving high power scalable laser action in the near UV and visible portion of the spectrum. The report includes a description of fluorescence and lasing experiments for these molecules; an analysis of formation kinetics; and theoretical calculations of rare gas metastable photoionization and the mercury halide radiative lifetimes. A theoretical model has been developed to describe the excited ion-pair state structure of the rare gas halides and interhalogens. The predictions of this theory are borne out by fluorescence experiments. GRA

N80-29697# New Mexico Inst. of Mining and Technology, Socorro. Geophysical Research Center.
THE CLOUD EFFECTS PHASE OF THE LASER INDUCED LIGHTNING INVESTIGATION Final Report
C. B. Moore, D. N. Holden, and James Griswold Apr. 1980 48 p refs
(Grant AF-AFOSR-3722-78; AF Proj. 2310)
(AD-A085345; AFOSR-80-0454TR) Avail: NTIS HC A03/MF A01 CSCL 04/1

A mountain-top laboratory facility has been established in central New Mexico for studies of the effects of high powered lasers on the ionization of the air and on the possible triggering of lightning from thunderclouds overhead. A net of electric field meters and another one with television cameras and video recorders have been established for determinations of the nature of normal and of triggered lightning in the operational area. A special electric field meter is carried beneath a captive balloon to heights of about 600 m above the facility and measured the electric fields there for the entire life of several storms. The field strengths aloft were as much as 6 fold greater than those observed at the surface; the field changes after lightning did not show the characteristic reversal caused by the corona produced space charge and the field after lightning recovered with a linear increase until lightning occurred again. Monitoring of electric fields aloft therefore provide a better choice of the optimum times for a lightning triggering attempt. As part of the 1979 field work, lightning discharges were induced twice by the use of wire-trailing French rockets fired into thunderclouds over the Magdalena Mountains. As a result, interesting measurements of the breakdown process were obtained using AF Weapons Laboratory electromagnetic sensors. Magnetic field derivative signals in excess of 17 Teslas/second were observed in one of the triggered discharges. GRA

N80-29698# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
RESEARCH IN LASER PROCESSES Semiannual Report, 1 Aug. 1978 - 31 Jan. 1979
A. V. Phelps and A. C. Gallagher 8 Feb. 1980 18 p refs
(Contract N00014-76-C-0123; ARPA Order 2683)
(AD-A085805) Avail: NTIS HC A02/MF A01 CSCL 20/5

Measurements have been made of the electrical and optical properties of electrical discharges in Mg-Xe mixtures at moderate current densities (50-100 A/cm to the 2nd power) and high Xe pressures (1 to 5 atmospheres). Preliminary analyses indicate a rather low electron and excitation temperature resulting from unexplained large energy losses. Efforts to obtain the high excitation temperatures required for efficient, high power excimer laser operation will continue. An experiment is being designed to provide effective rate coefficients for electron excitation and deexcitation of excited mercury atoms so as to provide data necessary for the modeling of the contribution of these states to the production of upper laser levels and to the growth of ionization and instabilities in discharge excited lasers. This experiment will use laser induced perturbation of the excited state densities and optical observation of the relaxation of excited state densities. GRA

N80-29699# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPARISON OF CONTROL METHODS IN A FREQUENCY STABILIZED LASER M.S. Thesis
Robert D. Luzitano Jan. 1980 140 p refs
(AD-A085707; AFIT/GE/EE/80-2) Avail: NTIS HC A07/MF A01 CSCL 20/5

The purpose of this research is to compare two types of control methods that can be used to frequency stabilize a laser. The first method uses a single piezoelectric transducer (PZT) to control the cavity length of a helium-neon laser. The second method employs dual PZT controllers of different lengths so that a fast response time can be achieved with the benefit of a large dynamic range. Two variations of the first method are compared to the second method. The first variation uses an

integrator with gain as a compensator in electronic feedback control loop and is designed using steady state analysis. The second variation uses a more sophisticated compensator that is designed using frequency analysis. Frequency analysis is also used in the compensator design for the second method. Each compensator is tested in a laser control loop and the results of each method are compared. GRA

N80-29700# Chicago Univ., Ill.
THERMALLY PRODUCED POPULATION INVERSIONS AND THEIR CONSEQUENCES Final Report, 1 Jan. 1977 - 18 Jan. 1980
R. Stephen Berry 30 May 1980 7 p refs
(Grant DAAG29-77-G-0080)
(AD-A086072; ARO-14493.1-C) Avail: NTIS HC A02/MF A01 CSCL 20/5

Alkali halide molecules dissociated by shock waves in gases exhibit population distributions far from equilibrium. The kinetics of the subsequent chemical relaxation have been worked out and the rate coefficients have been determined for many of these ionic molecules. In some cases, the nonequilibrium populations are highly inverted, and in at least two systems, the inverted population has been used to produce light amplification (lasing action) with spectral lines in the visible region. GRA

N80-29701# AEG-Telefunken, Frankfurt am Main (West Germany). Forschungsinst.
LEAD CHALCOGENIDE DIODE LASERS Final Report
Roland Grisar, Axel Heime, Harald Matthes, Horst Preier, and Wolfgang Riedel Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 136 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-66; ISSN-0340-7608) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 34.85

An infrared diode laser emitting in the spectral range from 4 to 8 microns was developed. An attempt to increase the operational temperature by using double hetero-structures was made. The refining of diode materials, crystal growth (Pb S(1-X) Se(X) and Pb(1-X) Sn(X) Se), and the diode technology of laser structures are reported. The laser casing is described and operating tests are outlined for different cooling techniques. Successful results are shown for continuous wave operation with a liquid nitrogen cooler and for pulsed operation using a Peltier cooler. Finally, laser applications in spectroscopy are discussed. Author (ESA)

N80-29702# National Technical Information Service, Springfield, Va.
RADIATION DAMAGE OF LASER MATERIALS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Brian Carrigan May 1980 226 p Supersedes NTIS/PS-79/0514; NTIS/PS-78/0516
(PB80-810419; NTIS/PS-79/0514; NTIS/PS-78/0516) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

Laser beam damage to laser materials such as optical glass, glass fibers, alkali metal halides, metals, mirrors, optical coatings, dielectrics, semiconductors, and matrix materials is studied. The majority of these citations concern infrared laser damage to infrared optical materials. This updated bibliography contains 217 abstracts, 10 of which are new entries to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-29703* National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR SLICING SILICON WAFERS Patent
Earl R. Collins, inventor (to NASA) (JPL) Issued 4 Mar. 1980 6 p Filed 16 Oct. 1978 Supersedes N79-10245 (17 - 01, p 0033) Sponsored by NASA
(NASA-Case-NPO-14406-1; US-Patent-4,191,159; US-Patent-Appl-SN-951828; US-Patent-Class-125-21; US-Patent-Class-83-820) Avail: US Patent and Trademark Office CSCL 13I

An improved system is described which has at least one endless band saw blade that is characterized by a continuously regenerated cutting edge and is unidirectionally driven along a pair of courses extended in mutual parallelism through a cutting station located near the midportion of the courses. The blade is supported at the cutting station by pairs of guides continuously rotated through less than 360 deg of angular displacement during each cutting operation in order to continuously regenerate the blade supporting surfaces of the guide. Blade wobble is thus substantially eliminated. Official Gazette of the U.S. Patent and Trademark Office

N80-29704*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS FOR SEQUENTIALLY TRANSPORTING CONTAINERS Patent Application
Jerry L. Hudgins, inventor (to NASA) Filed 11 Jul. 1980 20 p
(NASA-Case-MFS-23846; US-Patent-Appl-SN-168944) Avail: NTIS HC A02/MF A01 CSCL 13I

An apparatus for transferring and manipulating a plurality of containers in a sequence is disclosed including a mechanical manipulator arm having a gripping device which automatically picks up a container at a fixed pickup position and transfers it to a processing station. At a processing station, the container is loaded with silicon wafers and thereafter returned to the pickup and return station. A plurality of the containers may be processed in sequence from the fixed pickup position by providing a movable carriage upon which container pedestal platforms are supported, at least one of which is an elevator platform. Sensing switches may be provided for sensing movements of the arm, carriage, and elevator platform whereby the entire apparatus may be controlled automatically avoiding the need to handle the wafers manually to reduce the possibility of contamination. NASA

N80-29705*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD FOR MILLING AND DRILLING GLASS Patent Application
Stephen H. Rice, inventor (to NASA) Filed 30 Jun. 1980 13 p
(NASA-Case-GSC-12636-1; US-Patent-Appl-SN-173520) Avail: NTIS HC A02/MF A01 CSCL 13H

A process is disclosed for machining glass in which a rotating carbide working surface is placed under minimum pressure against an area of glass to be worked. Concurrently, the region between the working surface and the area of glass is wetted with a lubricant consisting essentially of a petroleum carrier, a complex mixture of esters, and a complex mixture of naturally occurring aromatic oils. NASA

N80-29706*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROTORDYNAMIC INSTABILITY PROBLEMS IN HIGH-PERFORMANCE TURBOMACHINERY
1980 463 p refs Conf. held at College Station, 12-14 May 1980; sponsored by Texas A and M Univ., Louisville Univ., and AROD
(NASA-CP-2133; E-413) Avail: NTIS HC A20/MF A01 CSCL 13I

Diagnostic and remedial methods concerning rotordynamic instability problems in high performance turbomachinery are discussed. Instabilities due to seal forces and work-fluid forces are identified along with those induced by rotor bearing systems. Several methods of rotordynamic control are described including active feedback methods, the use of elastometric elements, and the use of hydrodynamic journal bearings and supports. For individual titles, see N80-29707 through N80-29733.

N80-29707*# Phillips Petroleum Co. Europe-Africa, London (England).
FIELD EXPERIENCES WITH ROTORDYNAMIC INSTABILITY IN HIGH-PERFORMANCE TURBOMACHINERY
H. E. Doyle *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 3-13 (For

primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Two field situations illustrate the consequences of rotordynamic instability in centrifugal compressors. One involves the reinjection of produced gas into a North Sea oil formation for the temporary extraction of crude. The other describes on-shore compressors used to deliver natural gas from off-shore wells. The problems which developed and the remedies attempted in each case are discussed. Instability problems resulted in lost production, extended construction periods and costs, and heavy maintenance expenditures. The need for effective methods to properly identify the problem in the field and in the compressor design stage is emphasized. M.G.

N80-29708*# Southwest Research Inst., San Antonio, Tex.
FIELD VERIFICATION OF LATERAL-TORSIONAL COUPLING EFFECTS ON ROTOR INSTABILITIES IN CENTRIFUGAL COMPRESSORS
J. C. Wachel and F. R. Szenasi *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 15-34 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Lateral and torsional vibration data obtained on a centrifugal compressor train which had shaft instabilities and gear failures is examined. The field data verifies that the stability of centrifugal compressors can be adversely affected by coincidence of torsional natural frequencies with lateral instability frequencies. The data also indicates that excitation energy from gear boxes can reduce stability margins if energy is transmitted either laterally or torsionally to the compressors. The lateral and torsional coupling mechanisms of shaft systems is discussed. The coupling mechanisms in a large industrial compressor train are documented and the potential effect on rotor stability is demonstrated. Guidelines are set forth to eliminate these potential problems by minimizing the interaction of torsional and lateral responses and their effect on rotor stability. M.G.

N80-29709*# Mechanical Technology, Inc., Latham, N. Y.
PRACTICAL EXPERIENCE WITH UNSTABLE COMPRESSORS
Stqan B. Malanoski *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 35-43 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01

Using analytical mathematical modeling techniques for the system components, an attempt is made to gauge the destabilizing effects in a number of compressor designs. In particular the overhung (or cantilevered) compressor designs and the straddle-mounted (or simply supported) compressor designs are examined. Recommendations are made, based on experiences with stable and unstable compressors, which can be used as guides in future designs. High and low pressure compressors which operate well above ttheir fundamental rotor-bearing lateral natural frequencies can suffer from destructive subsynchronous vibration. Usually the elements in the system design which contribute to this vibration, other than the shafting and the bearings, are the seals (both gas labyrinth and oil breakdown bushings) and the aerodynamic components. M.G.

N80-29710*# Ingersoll-Rand Co., Easton, Pa.
ANALYSIS AND IDENTIFICATION OF SUBSYNCHRONOUS VIBRATION FOR A HIGH PRESSURE PARALLEL FLOW CENTRIFUGAL COMPRESSOR
R. G. Kirk, J. C. Nicholas, G. H. Donald, and R. C. Murphy *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 45-63 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The summary of a complete analytical design evaluation of an existing parallel flow compressor is presented and a field vibration problem that manifested itself as a subsynchronous vibration that tracked at approximately 2/3 of compressor speed is reviewed. The comparison of predicted and observed peak response speeds, frequency spectrum content, and the performance of the bearing-seal systems are presented as the events of the field problem are reviewed. Conclusions and recommendations are made as to the degree of accuracy of the analytical techniques used to evaluate the compressor design. M.G.

N80-29711*# Allis-Chalmers Mfg. Co., Milwaukee, Wis.
SUBSYNCHRONOUS INSTABILITY OF A GEARED CENTRIFUGAL COMPRESSOR OF OVERHUNG DESIGN
J. H. Hudson and L. J. Wittman *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 67-83 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The original design analysis and shop test data are presented for a three stage (poster) air compressor with impellers mounted on the extensions of a twin pinion gear, and driven by an 8000 hp synchronous motor. Also included are field test data, subsequent rotor dynamics analysis, modifications, and final rotor behavior. A subsynchronous instability existed on a geared, overhung rotor. State-of-the-art rotor dynamics analysis techniques provided a reasonable analytical model of the rotor. A bearing modification arrived at analytically eliminated the instability. M.G.

N80-29712*# Bently Nevada Corp., Minden.
THE PARAMETERS AND MEASUREMENTS OF THE DESTABILIZING ACTIONS OF ROTATING MACHINES, AND THE ASSUMPTIONS OF THE 1950'S
Donald E. Bently *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 95-106 (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The measurability of destabilizing actions is demonstrated for a rotor built to produce a forward circular, self excited malfunction (gas whip). It is argued that the continued use of past modeling technqiues is unfortunate in that it has led to the use of inappropriate words to express what is happening and a lack of full understanding of the category of forward circular whip instability mechanisms. M.G.

N80-29713*# Kobe Steel Ltd. (Japan).
ASYNCHRONOUS VIBRATION PROBLEM OF CENTRIFUGAL COMPRESSOR
Takeshi Fujikawa, Naotsugi Ishiguro, and Mitsuhiko Ito *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 109-118 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

An unstable asynchronous vibration problem in a high pressure centrifugal compressor and the remedial actions against it are described. Asynchronous vibration of the compressor took place when the discharge pressure (Pd) was increased, after the rotor was already at full sppeed. The typical spectral data of the shaft vibration indicate that as the pressure Pd increases, pre-unstable vibration appears and becomes larger, and large unstable asynchronous vibration occurs suddenly (Pd = 5.49MPa). A computer program was used which calculated the logarithmic decrement and the damped natural frequency of the rotor bearing systems. The analysis of the log-decrement is concluded to be effective in preventing unstable vibration in both the design stage and remedial actions. M.G.

N80-29714*# Louisville Univ., Ky. Mechanical Engineering Dept.
TESTING OF TURBULENT SEALS FOR ROTODYNAMIC COEFFICIENTS
Dara W. Childs, John B. Dressman, and S. Bart Childs *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 121-138 refs Prepared in cooperation with Texas A and M Univ., College Station (For primary document see N80-29706 20-37)
(Grant NsG-3200)
Avail: NTIS HC A20/MF A01 CSCL 13I

A test program developed for dynamic testing of straight and convergent-tapered seals, with the capability of separately determining both direct and cross-coupled stiffness, damping, and added mass coefficients is described. The test apparatus causes the seal journal to execute small-eccentricity centered circular orbits within its bearings. Dynamic measurements are made and recorded of the seal-displacement-vector components, and of the pressure field. The pressure field is integrated to

yield seal reaction force components. The displacement and force vector components are analyzed via a generalized Newton-Raphson procedure to yield the desired seal dynamic coefficients. Representative test data are provided and discussed. M.G.

N80-29715*# Kobe Univ. (Japan). Engineering Dept.
EVALUATION OF INSTABILITY FORCES OF LABYRINTH SEALS IN TURBINES OR COMPRESSORS
Tkuakuzo Iwatsubo *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 139-167 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The effects of a force induced by the labyrinth seal on the stability of rotor systems and the factors of the seal which affect the stability are investigated. In the analysis, it is assumed that the fluid in the seal is steady and that the rotor is set vertically in order to avoid the effects of gravity force. The force induced by the seal is expressed in terms proportional to the velocity and displacement of the rotor and is deduced to that expression for the oil film force in journal bearings. That force is taken into account in the equations of motion; then the stability of the system is discussed by energy concept. The force induced by the labyrinth seal always makes the rotor system unstable, and the tendency is marked when seal leakages are small. The resonance point of the rotor system is also affected by the labyrinth seal (the resonance point of the rotor system is removed by the seal leakages). The force induced by the labyrinth seal was measured by using a water-tunnel experimental system which was designed to measure the labyrinth seal force by using the similarity between gas and liquid flow theory. M.G.

N80-29716*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DAMPING IN RING SEALS FOR COMPRESSIBLE FLUIDS
David P. Fleming *In its* Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 169-188 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

An analysis is presented to calculate damping in ring seals for a compressible fluid. Results show that damping in tapered ring seals (optimized for stiffness) is less than that in straight bore ring seals for the same minimum clearance. Damping in ring seals can promote fractional frequency whirl and can, thus, be detrimental. Thus, tapered seals can benefit rotor and seal stability by having lower damping as well as higher stiffness. Use of incompressible results leads to large errors. Author

N80-29717*# Stuttgart Univ. (West Germany). Institut fuer Thermische Stroemungsmaschinen.
FLOW INDUCED SPRING COEFFICIENTS OF LABYRINTH SEALS FOR APPLICATION IN ROTOR DYNAMICS
H. Benckert and J. Wachter *In* NASA. Lewis Res. Center Rotodyn. Instability Probl. in High-Performance Turbomachinery 1980 p 189-212 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Flow induced aerodynamic spring coefficients of labyrinth seals are discussed and the restoring force in the deflection plane of the rotor and the lateral force acting perpendicularly to it are also considered. The effects of operational conditions on the spring characteristics of these components are examined, such as differential pressure, speed, inlet flow conditions, and the geometry of the labyrinth seals. Estimation formulas for the lateral forces due to shaft rotation and inlet swirl, which are developed through experiments, are presented. The utilization of the investigations is explained and results of stability calculations, especially for high pressure centrifugal compressors, are added. Suggestions are made concerning the avoidance of exciting forces in labyrinths. M.G.

N80-29718*# Hitachi Ltd., Tsuchiura (Japan). Mechanical Engineering Research Lab.
HYDRAULIC FORCES CAUSED BY ANNULAR PRESSURE SEALS IN CENTRIFUGAL PUMPS
T. Iino and H. Kaneko *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 213-225 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The hydraulic forces caused by annular pressure seals were investigated. The measured inlet and exit loss coefficients of the flow through the seals were much smaller than the conventional values. The results indicate that the damping coefficient and the inertia coefficient of the fluid film in the seal are not affected much by the rotational speed or the eccentricity of the rotor, though the stiffness coefficient seemed to be influenced by the eccentricity. R.C.T.

N80-29719*# California Inst. of Tech., Pasadena.
A TEST PROGRAM TO MEASURE FLUID MECHANICAL WHIRL-EXCITATION FORCES IN CENTRIFUGAL PUMPS
C. E. Brennen, A. J. Acosta, and T. K. Caughey *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 229-247 refs (For primary document see N80-29706 20-37)
(Contract NAS8-33108)
Avail: NTIS HC A20/MF A01 CSCL 13I

The details of a test program for the measurement of the unsteady forces on centrifugal impellers are discussed. Various hydrodynamic flows are identified as possible contributors to these destabilizing forces. R.C.T.

N80-29720*# Technical Univ. of Denmark, Copenhagen.
EFFECT OF FLUID FORCES ON ROTOR STABILITY OF CENTRIFUGAL COMPRESSORS AND PUMPS
Jorgen Colding-Jorgensen *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 249-265 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

A simple two dimensional model for calculating the rotordynamic effects of the impeller force in centrifugal compressors and pumps is presented. It is based on potential flow theory with singularities. Equivalent stiffness and damping coefficients are calculated for a machine with a vaneless volute formed as a logarithmic spiral. It is shown that for certain operating conditions, the impeller force has a destablizing effect on the rotor. R.C.T.

N80-29721*# Cornell Univ., Ithaca, N. Y.
NON-SYNCHRONOUS WHIRLING DUE TO FLUID-DYNAMIC FORCES IN AXIAL TURBO-MACHINERY ROTORS
Shan Fu Shen and Vinod G. Mengle *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 267-284 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The role of fluid forces acting on the blades of an axial turborotor with regards to whirling was analyzed. The dynamic equations were formulated for the coning mode of an overhung rotor. The exciting forces due to the motion were defined through a set of rotor stability derivatives, and analytical expressions of the aerodynamic contributions were found for the case of small mean stream deflection, high solidity and equivalent flat plate cascade. For a typical case, only backward whirl was indicated when the phase shifting of the rotor wake effect was ignored. A parametric study of the dynamic stability boundary reveals that a reduction in blade stagger angle, mass flow rate, fluid density and an increase in stiffness and external damping are all inducive for improved stability. R.C.T.

N80-29722*# Turbo Research, Inc., Lionville, Pa.
VIBRATION EXCITING MECHANISMS INDUCED BY FLOW IN TURBOMACHINE STAGES
William E. Thompson *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 285-302 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The quasisteady computer analysis of the perturbated centrifugal impeller passage flow was reviewed. A total of 115 stage calculations were used to define the fluid damping coefficient, delta sub fluid. Results indicate that the average total damping coefficient per stage needed for stability is delta sub total > 1.85. R.C.T.

N80-29723*# Technische Universitaet, Munich (West Germany). Institut fuer Thermische Kraftanlagen.
SELF-EXCITED ROTOR WHIRL DUE TO TIP-SEAL LEAKAGE FORCES
B. Leie and H.-J. Thomas *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 303-316 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The limitations in the performance of turbomachines which arise as a result of selfexcited vibration were investigated. Bearing forces, elastic hysteresis, and forces from fluid flow through clearances were considered as possible origins. A theoretical evaluation was made to determine the dependence of the forces form the leakage losses and from rotating flow in radial gaps. R.C.T.

N80-29724*# Tokyo Univ. (Japan).
FLUID FORCES ON ROTATING CENTRIFUGAL IMPELLER WITH WHIRLING MOTION
Hidenobu Shoji and Hideo Ohashi *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 317-328 refs Sponsored in part by the Japanese Ministry of Education and by Hitachi Ltd. (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Fluid forces on a centrifugal impeller, whose rotating axis whirls with a constant speed, were calculated by using unsteady potential theory. Calculations were performed for various values of whirl speed, number of impeller blades and angle of blades. Specific examples as well as significant results are given. R.C.T.

N80-29725*# Heriott-Watt Univ., Edinburgh (Scotland). Mechanical Engineering Dept.
LIMIT CYCLES OF A FLEXIBLE SHAFT WITH HYDRODYNAMIC JOURNAL BEARINGS IN UNSTABLE REGIMES
R. David Brown and Henry F. Black *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 331-343 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

A symmetric 3 mass rotor supported on hydrodynamic bearings is described. An approximate method of representing finite bearings is used to calculate bearing forces. As the method sums forces from a number of independent circular lobes lemon 3 and 4 lobe bearings are taken into account. The calculations are based on an axial groove bearing. Linear analysis precedes nonlinear simulation of some unstable conditions. The demonstration of small limit cycles suggests that necessarily flexible rotors e.g., helicopter tail rotors, may be practical without either tilt pad bearings or external dampers. R.C.T.

N80-29726*# Sussex Univ., Brighton (England). School of Engineering and Applied Sciences.
ON THE ROLE OF OIL-FILM BEARINGS IN PROMOTING SHAFT INSTABILITY: SOME EXPERIMENTAL OBSERVATIONS
R. Holmes *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 345-357 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The occurrence of oil whirl instability in rigid and flexible rotor systems was investigated. The effect of various bearing parameters on the oil whirl frequency and amplitude of rigid and flexible shafts supported on fluid film bearings was also studied. R.C.T.

N80-29727*# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
EXPERIMENTAL RESULTS CONCERNING CENTRIFUGAL IMPELLER EXCITATIONS
J. M. Vance and F. J. Landadio *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 361-367 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The effect of working fluid on the dynamics of an impeller with radial vanes was investigated. The impeller was supported vertically from a very flexible quill shaft in order to produce a low critical speed, and to allow the fluid dynamic effects on the impeller to predominate. The shaft was supported from ball bearings, so that there was no possibility of oil whip from fluid film bearings as a destabilizing influence. The impeller was run both in the atmosphere, and submerged in working fluids contained in a cylindrical housing, open at the top. Variable speed was obtained with a dc gearmotor drive unit. The speed was measured with a proximity probe pulse tachometer and electronic digital counter. R.C.T.

N80-29728*# Massachusetts Inst. of Tech., Cambridge.
PHYSICAL EXPLANATIONS OF THE DESTABILIZING EFFECT OF DAMPING IN ROTATING PARTS
Stephen H. Crandall *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 369-382 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The destabilizing effect of rotating damping was investigated. When the rotation was faster than the whirl, rotating damping drags the orbiting particle forward. When stationary damping was also present, the stability borderline was readily determined by balancing the backward and forward drags. A key notion was that a forward whirl at rate omega a sub n with respect to stationary axes appears to be a backward whirl at rate Omega - omega sub n with respect to a system rotating supercritically at rate Omega. The growth rate of unstable whirls (or the decay rate of stable whirls was readily estimated by a simple energy balance. R.C.T.

N80-29729*# Politechnika Lodzka (Poland).
PARAMETRIC INSTABILITIES OF ROTOR-SUPPORT SYSTEMS WITH APPLICATION TO INDUSTRIAL VENTILATORS
Zdzislaw Parszewski, Tanusz Krodkiemski, and Krzysztof Marynowski *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 383-400 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Rotor support systems interaction with parametric excitation is considered for both unequal principal shaft stiffness (generators) and offset disc rotors (ventilators). Instability regions and types of instability are computed in the first case, and parametric resonances in the second case. Computed and experimental results are compared for laboratory machine models. A field case study of parametric vibrations in industrial ventilators is reported. Computed parametric resonances are confirmed in field measurements, and some industrial failures are explained. Also the dynamic influence and gyroscopic effect of supporting structures are shown and computed. R.C.T.

N80-29730*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
INSTABILITY THRESHOLDS FOR FLEXIBLE ROTORS IN HYDRODYNAMIC BEARINGS
Paul E. Allaire and Ronald D. Flack *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 403-427 refs (For primary document see N80-29706 20-37)
(Grant NsG-3177; Contract DE-AC01-79ET-13151; Grant RC-A-77-6C)
Avail: NTIS HC A20/MF A01 CSCL 13I

Two types of fixed pad hydrodynamic bearings (multilobe and pressure dam) were considered. Optimum and nonoptimum geometric configurations were tested. The optimum geometric configurations were determined by using a theoretical analysis and then the bearings were constructed for a flexible rotor test rig. It was found that optimizing bearings using this technique produces a 100% or greater increase in rotor stability. It is shown that this increase in rotor stability is carried out in the absence of certain types of instability mechanisms such as aerodynamic crosscoupling. However, the increase in rotor stability should greatly improve rotating machinery performance in the presence of such forces as well. R.C.T.

N80-29731*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
STABILIZATION OF AERODYNAMICALLY EXCITED TURBOMACHINERY WITH HYDRODYNAMIC JOURNAL

BEARINGS AND SUPPORTS

Lloyd E. Barrett and Edgar J. Gunter *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 429-452 refs (For primary document see N80-29706 20-37)
(Grant NsG-3105; Contracts DAAG29-77-C-0009; EF-76-S-01-2479)
Avail: NTIS HC A20/MF A01 CSCL 13I

A method of analyzing the first mode stability and unbalance response of multimass flexible rotors is presented whereby the multimass system is modeled as an equivalent single mass modal model including the effects of rotor flexibility, general linearized hydrodynamic journal bearings, squeeze film bearing supports and rotor aerodynamic cross coupling. Expressions for optimum bearing and support damping are presented for both stability and unbalance response. The method is intended to be used as a preliminary design tool to quickly ascertain the effects of bearing and support changes on rotor-bearing system performance. R.C.T.

N80-29732*# Mechanical Technology, Inc., Latham, N. Y.
USE OF ELASTOMERIC ELEMENTS IN CONTROL OF ROTOR INSTABILITY

Anthony J. Smalley *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 453-465 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The dynamic characteristics of elastomeric supports are discussed. Stiffness and damping characteristics for elastomers of various geometries including O-rings, buttons loaded in compression, and rectangular elements loaded in shear are presented. The effects of frequency, temperature, and amplitude are illustrated, as well as the effects of material and geometry. Empirical design methods are illustrated, and several examples are presented where elastomers have successfully controlled both synchronous and nonsynchronous vibrations. R.C.T.

N80-29733*# Virginia Univ., Charlottesville.
FEASIBILITY OF ACTIVE FEEDBACK CONTROL OF ROTORDYNAMIC INSTABILITY

James W. Moore, David W. Lewis, and John Heinzman *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 467-476 (For primary document see N80-29706 20-37)
(Contract DE-AC01-79ET-13151)
Avail: NTIS HC A20/MF A01 CSCL 13I

Some of the considerations involved in the use of feedback control as a means of eliminating or alleviating rotordynamic instability are discussed. A simple model of a mass on a flexible shaft is used to illustrate the application of feedback control concepts. R.C.T.

N80-29734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICATION OF OPTIMIZED-DESIGN TAPERED-ROLLER BEARINGS TO 2.4 MILLION DN

Richard J. Parker and Stanley I. Pinel Aug. 1980 18 p refs Sponsored in part by Industrial Tectonics, Inc., Compton, Calif.
(NASA-TP-1714; E-270) Avail: NTIS HC A02/MF A01 CSCL 13I

The performance of 120.65 mm (4.75 in.) bore high speed design, tapered roller bearings was investigated at shaft speeds to 20,000 rpm (2.4 million DN) under combined thrust and radial load. The test bearing design was computer optimized for high speed operation. Temperature distribution bearing heat generation were determined as a function of shaft speed, radial and thrust loads, lubricant flow rates, and lubricant inlet temperature. The high speed design, tapered roller bearing operated successfully at shaft speeds up to 20,000 rpm under heavy thrust and radial loads. Bearing temperatures and heat generation with the high speed design bearing were significantly less than those of a modified standard bearing tested previously. Cup cooling was effective in decreasing the high cup temperatures to levels equal to the cone temperature. Author

N80-29735*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FILM THICKNESS FOR DIFFERENT REGIMES OF FLUID-FILM LUBRICATION

Bernard J. Hamrock 1980 14 p refs Presented at lecture series at Lulea, Sweden, 24 Jul. - 16 Aug. 1980
(NASA-TM-81550; E-508) Avail: NTIS HC A02/MF A01 CSCL 11H

Film thickness equations are provided for four fluid-film lubrication regimes found in elliptical contacts. These regimes are isoviscous-rigid; viscous-rigid; elastohydrodynamic lubrication of low-elastic-modulus materials (soft EHL), or isoviscous-elastic; and elastohydrodynamic lubrication of high-elastic-modulus materials (hard EHL), or viscous-elastic. The influence or lack of influence of elastic and viscous effects is the factor that distinguishes these regimes. The results are presented as a map of the lubrication regimes, with film thickness contours on a log-log grid of the viscosity and elasticity for three values of the ellipticity parameter. E.D.K.

N80-29736# Mechanical Technology, Inc., Latham, N. Y.
THE DEVELOPMENT OF AN AUTOMATED ROLLER INSPECTION SYSTEM USING NONCONTACTING SENSORS Final Report, Nov. 1977 - Feb. 1979

Martin W. Eusepi Wright-Patterson AFB, Ohio AFAL Nov. 1979 189 p refs
(Contract F33615-77-C-3142)
(AD-A085740; MTI-79TR60; AFAL-TR-79-2076) Avail: NTIS HC A09/MF A01 CSCL 13/9

An automated computer oriented inspection for measuring the dimensional characteristics of high DN bearing rollers has been designed. The system is based on the use of non contacting miniature capacitance probes having a sensitivity of 1000 volts/in. and a line scan camera employing photo diodes combined with an enlarging lens system to provide a 40 x 10 to the -6 in./count sensitivity. The automated inspection system design is based on the results of a laboratory investigation of gaging techniques and the performance evaluation of non automated breadboard versions of the system. GRA

N80-29737# GARD, Inc., Niles, Ill.
ACOUSTIC EMISSION WELD MONITOR SYSTEM: DATA ACQUISITION AND INVESTIGATION Final Report, Oct. 1978 - Sep. 1979

R. A. Groenwald, T. A. Mathieson, and C. T. Kedzior (Army Tank-Automotive Research and Development Command, Warren, Mich.) Oct. 1979 71 p
(Contract DAAK30-78-C-0123)
(AD-A085518; TARADCOM-TR-12468) Avail: NTIS HC A04/MF A01 CSCL 17/1

The standard weld inspection techniques of radiography and ultrasonics have intrinsic disadvantages. The new technology of acoustic emission (AE) has shown an applicability to weld inspection which could overcome such disadvantages. This program is directed at utilizing acoustic emission as a weld monitoring technique on a specific Army welding application. The reported work is phase 1 of an Army program to develop a microprocessor based Acoustic Emission Weld Monitor (AEWM) for the purpose of in-process monitoring of armor plate welding. The intended use of this AEWM is to monitor the production welding performed in the fabrication of heavy armored vehicles. The objectives of this phase are to: (a) perform laboratory MIG welding of armor plate with controlled induction of critical flaws; (b) collect acoustic emission data generated during the welding; (c) perform a data analysis to correlate the recorded AE data with flaw presence; and (d) predict the accuracy with which AE is able to detect and locate the weld flaws as well as discriminate between flaw types. GRA

N80-29738# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
A REVIEW OF ADVANCED VEHICULAR DIESEL RESEARCH AND DEVELOPMENT PROGRAMS WHICH HAVE POTENTIAL APPLICATION TO STATIONARY DIESEL POWER PLANTS Final Report, 1 Mar. - 1 Dec. 1979

Andrew W. Kaupert Wright Patterson AFB, Ohio AFWAL Mar. 1980 83 p refs
(AF Proj. 3145)
(AD-A085601; AFWAL/PO-79-036; AFWAL-TR-80-2014) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report, prepared for the Aerospace Power Division, Aero

Propulsion Laboratory, Wright-Patterson AFB, reviews, assesses, and summarizes the research and development status of advanced diesel engine/vehicular component technologies, and identifies those systems which may have application to diesel power plants utilized as stationary engine power sources. GRA

N80-29739# Cornell Univ., Ithaca, N. Y. Dept. of Structural Engineering.
NUMERICAL SOLUTIONS FOR COUPLED MAGNETOMECHANICS Interim Technical Report, 1 Feb. 1979 - 31 Jan. 1980
Kuan-Ya Yuan, Francis C. Moon, and John F. Abel 1 Feb. 1980 87 p refs
(Contract N00014-79-C-0224)
(AD-A085747; Rept-80-5) Avail: NTIS HC A05/MF A01 CSCL 20/3

This technical report describes the accomplishments of the first year of a research project directed toward developing numerical methods for the coupled analysis of forces, currents, and stresses in thin elastic structures exposed to time-dependent magnetic fields. To date research has focused on the response of flat plates to steady state harmonic and pulsed fields. A stream function for the induced eddy currents is used to reduce the three dimensional electromagnetic problem to an integro-differential equation in two dimensions. GRA

N80-29740# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
TOWING RESISTANCE Final Report
25 Jun. 1980 6 p
(AD-A086144; TOP-2-2-605) Avail: NTIS HC A02/MF A01 CSCL 13/6

Describes procedures for determining vehicle power losses attributable to the suspension system and vehicle braking effect available for descending grades. Discusses vehicle preparation, instrumentation, data reduction, and data presentation. Applicable to wheeled and tracked vehicles. GRA

N80-29741# Barnes and Reinecke, Inc., Elk Grove, Ill.
STEAM ENGINE ANALYSIS Final Technical Report
William G. Allbach, Merle J. Smith, and Robert F. Wenshutonis Jun. 1979 141 p
(Contract ET-77-C-01-8917)
(FE-8917-2) Avail: NTIS HC A07/MF A01

Familiarization, cost, and thermodynamic analysis were made of a prototype Rankine cycle steam engine intended for application in an underground vehicle. The cost analysis was made, by direction, for the material and direct labor based on a single prototype steam engine extended to lots of 100 units and 500 units annually. The conclusions derived from the familiarization and the cost analysis are that the cost is higher than alternate vehicle power systems, the design and configuration is not in a state of reproductibility and maintainability, and must be reconfigured for cost reduction. The thermodynamic analysis of the effect of the steam power plant upon the mine environment indicates that the steady state temperature in the mine entry air downstream of the steam powered vehicle would increase significantly while the steam engine is operating, unless the ventilation air flowrate is increased above the minimum 9000 CFM requirement. DOE

N80-29742# California Univ., Livermore. Lawrence Livermore Lab.
WELDING STAINLESS STEELS FOR STRUCTURES OPERATING AT LIQUID HELIUM TEMPERATURE
Charles E. Witherell 18 Apr. 1980 68 p refs Presented at the 61st Ann. Meeting of the Am. Welding Soc., Los Angeles, 14 Apr. 1980
(Contract W-7405-eng-48)
(UCRL-83863; CONF-800462-1) Avail: NTIS HC A04/MF A01

A three year study was conducted to determine the feasibility of producing heavy section welds having usable levels of strength and toughness at 4.2 K for fabrication of these structures in Type 304LN plate. Seven welding processes were evaluated. Test weldments in full thickness plate were made under severe restraint to simulate that of actual structures. Type 316L filler metal was used for most welds. Welds deposited under some conditions and which solidify as primary austenite have exhibited intergranular embrittlement of 4.2 K. This is believed to be associated with grain boundary metal carbides or carbonitrides precipitated during reheating of already deposited beads by subsequent passes. Weld deposits which solidify as primary delta ferrite appear immune. Through use of fully austenitic filler metals of low nitrogen content under controlled shielded metal arc welding conditions and through use of filler metals solidifying as primary delta ferrite where only minimum residuals remain to room temperature, welds of Type 316L composition have been made with 4.2 K yield strength matching that of Type 304L plate and acceptable levels of soundness, ductility and toughness. DOE

N80-29743# California Univ., Livermore. Lawrence Livermore Lab.
HOLOGRAPHIC NONDESTRUCTIVE EVALUATION OF SPHERICAL/KEVLAR/EPOXY PRESSURE VESSELS
Donald M. Boyd and Bruce W. Maxfield 23 May 1979 16 p refs Presented at the 29th Meeting of the Mech. Failure Prevention Group, Gaithersburg, Md., 23-25 May 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84280; CONF-7905151-1) Avail: NTIS HC A02/MF A01

Three spherical kevlar/epoxy pressure vessels were evaluated using holographic interferograms provide information on the failure modes, displacement profile, and possible fiber damage. The holograms show a symmetric anisotropic displacement pattern even though the vessels failed due to a leak in the aluminum mandrels. The presence of a biconvex fringe pattern found during the testing of vessel three is believed to indicate matrix crazing. This information is useful for burst type failure analysis. Holographic interferometry was shown to supply information on the characteristics of kevlar/epoxy pressure vessels under stress. DOE

N80-29744# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
THE EFFICIENCY OF ELECTROTHERMICALLY HEATED HYDRAZINE GENERATORS [LEISTUNGSVORHERSAGE ELEKTROTHERMISCH AUFGEHEIZTER HYDRAZINTRIEBWERKE]
D. Hayn, M. Braitinger, and R. H. Schmucker (Bayern-Chemie G.m.b.H., Ottobrunn, West Germany) Aug. 1978 35 p refs In GERMAN
(TUM-RT-KB-78/5) Avail: NTIS HC A03/MF A01

Improvement of the performance of hydrazine engines by increasing the enthalpy of the decomposition products using an electrical heater was studied. The increase in efficiency is limited by the maximum temperature permitted in the combustion chamber and by the energy transformation in the expansion jet. Theoretical and experimental results are compared. Author (ESA)

N80-29745# Rocket Research Corp., Seattle, Wash.
USE OF SODIUM AZIDE IN GAS GENERANTS FOR INFLATABLE RESTRAINT SYSTEM INFLATORS Final Report
Eckart W. Schmidt and Dorothy J. Day 22 Aug. 1979 119 p refs
(PB80-170038; RRC-79-ES-105A; AOPA-1001-Rev-A) Avail: NTIS HC A06/MF A01 CSCL 13L

The chemistry and hazard aspects of sodium azide are considered with respect to its use as a constituent in gas generants for inflatable automotive occupant restraint system inflators. It is concluded that the benefit-to-risk-ratio of lives saved and injuries avoided by inflatable restraints versus accidental poisonings by gas generant chemicals is so many orders of magnitude above 1.0 that the use of toxic chemicals in inflators appears to be justified. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-29746*# Sperry Univac, St. Paul, Minn.
STUDY OF INTERMITTENT FIELD HARDWARE FAILURE DATA IN DIGITAL ELECTRONICS
Edward J. ONeill and James R. Halverson Jun. 1980 68 p refs
(Contract NAS1-15574)
(NASA-CR-159268) Avail: NTIS HC A04/MF A01 CSCL 14D

The collection and analysis of data concerning intermittent dailures in digital devices was performed using data from a computer design for shipboard usage. The failure data consisted of actual field failures classified by failure mechanisms and their likelihood of having been intermittent, potentially intermittent, or hard. Each class was studies with respect to computer operation in the ranges of 0 to 2,000 hours, 0 to 5, hours, and 0 to 10,000 hours. The study was done at the computer level as well as the microcircuit level. Results indicate that as age increases, the quasi-intermittent failure rate increases and the mean time to failure descreases. E.D.K.

N80-29747# Aeronautical Research Labs., Melbourne (Australia).
ULTRASONIC CAUSTICS IN NONDESTRUCTIVE EVALUATION
P. A. Doyle Jul. 1979 22 p refs
(ARL-Mat-111; AR-001-747) Avail: NTIS HC A02/MF A01

Caustics formed in the field diffracted by defects are explored theoretically as a possible approach to the inverse scattering problem for ultrasonic nondestructive evaluation. The case of crack-like defects is considered in detail using the geometrical theory diffraction. The involute of the far field caustic reproduces the projection of the crack edge in the incident beam direction for a plane incident wavefront. This purely geometrical inversion is carried out for the astroid and its involute, the elliptical edge. For a general edge shape, the complete inversion requires one further length measurement which may be carried out in some cases by further experiments with caustics. Useful limitations on the possible shapes of caustics are explained on the basis of catastrophe theory. Calculations show that the inherent intensity level change and width over which it occurs for a typical ultrasonic caustic are adequate for observation. Some discussion is given of experimental requirements, as well as of caustics formed in the near field of a crack and of those formed by voids and inclusions. Caustics may prove to be a useful adjunct to ultrasonic imaging systems for the inspection of fatigue cracks. E.D.K.

N80-29748# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Structures Lab.
DEVELOPMENT OF PROCEDURES FOR NONDESTRUCTIVE TESTING OF CONCRETE STRUCTURES. REPORT 2: FEASIBILITY OF SONIC PULSE-ECHO TECHNIQUE
A. Mitchell Alexander Apr. 1980 30 p refs
(AD-A085598; WES-MP-C-77-11-2) Avail: NTIS HC A03/MF A01 CSCL 13/13

A sonic pulse-echo system has been developed that will measure the length of long, thin concrete members such as piles and detect discontinuities within the members. A longitudinal pulse is introduced into the concrete at a surface by mechanical impact, and the echo time is measured using the time base of an oscilloscope. The velocity of the longitudinal wave is determined initially on a known length of similar concrete. In situ pile lengths up to 70 ft have been measured successfully in soil with low damping characteristics. The system successfully measured the lengths of three drilled piers and detected the location of flaws in the piers incorporated by design at the University of Texas at Austin. Measurements of thin slabs were found to be more difficult than measurements of piles. Because reflections of echoes in thin sections are of much higher frequency, elastic pulses containing higher frequencies must be introduced into the concrete. Research should continue in an effort to provide a pulse-echo system that will be capable of nondestructive evaluation of all geometries of Civil Works structures. An ultrasonic unit of low frequency and high energy level should be designed to improve resolution above that of a sonic system for thin sections. GRA

N80-29749# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
FLAW CLASSIFICATION IN WELDED PLATES WITH A MICROPROCESSOR CONTROLLED FLAW DETECTOR
Annual Report
Joseph L. Rose, J. Bruce Nestleroth, and Edward G. Poplawski 22 Feb. 1980 35 p refs
(Contract N00014-77-C-0607; NR Proj. 064-583)
(AD-A085755; AR-1) Avail: NTIS HC A03/MF A01 CSCL 13/13

The purpose of this paper is to manifest that a microprocessor, when utilized in connection with an ultrasonic flaw detector, can reliably regulate an ultrasonic inspection process. By virtue of several concentrated laboratory trials and accompanying analysis with the microprocessor-flaw detector combination, it will be demonstrated that dependable, speedy, and cost effective flaw detection is within the realm of reality. Specifically, this particular study focuses on the microprocessor controlled evaluation of steel plates. While it is true that the overall procedure employed here involved itself with flaw classification in one area (welds in steel plates), it will become apparent that applications are not restricted to steel plates. Cognizant of this fact, this paper will also provide insight into other areas pertinent to the study. GRA

N80-29750# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.
QUANTITATIVE NONDESTRUCTIVE EVALUATION
Dallas G. Smith and John A. Schaeffel, Jr. Oct. 1979 175 p refs
(AD-A085945; DRSMI/RL-TR-80-6) Avail: NTIS HC A08/MF A01 CSCL 11/4

This manual has been prepared primarily for the non-NDE specialist. Its aim is to increase understanding of NDE capabilities among those involved in structural design and fracture mechanics calculations, and to provide physical details pertaining to most of the important NDE techniques. Since NDE has been so actively applied in the aerospace industry most of the application examples discussed are related to aerospace structures; however the basic ideas apply to any structure containing fracture critical components. The introduction discusses the relationship of fracture mechanics and quantitative NDE. The present practice of NDE, including military specifications, airplane inspection manuals, and inspector training are discussed next. The 'big five' methods of NDE - liquid penetrant, magnetic particle, ultrasonic inspection, eddy current, and radiography - are introduced as well as certain advanced inspection methods - methods still undergoing development. The state-of-the-art, the sensitivity and reliability, of various methods along with the statistical analysis for determining flaw detection probability and confidence levels is presented. Excerpts from two actual airplane inspection manuals are included in the appendix to illustrate the degree to which instructions to inspectors are detailed and specified. GRA

N80-29751# Harry Diamond Labs., Adelphi, Md.
LASER SYSTEM FOR THE DETECTION OF FLAWS IN SOLIDS
Ronald J. Wellman May 1980 35 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A086124; HDL-TR-1902) Avail: NTIS HC A03/MF A01 CSCL 14/2

An investigation of a laser flaw detection system has been conducted. The technique replaces the piezoelectric transducers used in conventional flaw detection systems with an optical system incorporating a pair of lasers. One laser generates a high-power pulse that strikes the test sample and generates a short-pulse acoustic wave in the sample. The second laser is used in an interferometer that monitors the surface motion. The advantages of this system over conventional techniques are its speed and flexibility. Since the system is remote, i.e., no physical contact is necessary, the sample could be optically scanned very rapidly. Also, there is no limitation on the size or shape of the test object as there might be with conventional methods. GRA

N80-29752# National Technical Information Service, Springfield, Va.
INFRARED TECHNIQUES FOR NONDESTRUCTIVE TESTING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1980
Guy E. Habercom, Jr. May 1980 146 p Supersedes NTIS/PS-79/0520; NTIS/PS-78/0359
(PB80-810559; NTIS/PS-79/0520; NTIS/PS-78/0359) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Fundamental principles of nondestructive testing and inspection by use of infrared devices are investigated in these reports gathered from a worldwide literature survey. Tire flaws, electronic circuit defects, and flaws in bonded surfaces are among the applications research. This updated bibliography contains 138 abstracts, 28 of which are new entries to the previous edition. GRA

N80-29753# National Technical Information Service, Springfield, Va.
INFRARED TECHNIQUES FOR NONDESTRUCTIVE TESTING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Guy E. Habercom, Jr. May 1980 125 p Supersedes NTIS/PS-79/0519; NTIS/PS-78/0358
(PB80-810542; NTIS/PS-79/0519; NTIS/PS-78/0358) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Fundamental principles of nondestructive testing and inspection, by using of infrared devices, are investigated in these research reports. Tire flaws, electronic circuit defects, and flaws in bonded surfaces are among the applications researched. This updated bibliography contains 117 abstracts, 7 of which are new entries to the previous edition. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-29754 Connecticut Univ., Storrs.
DETERMINATION OF DYNAMIC STRUCTURAL STRESSES FROM EXPERIMENTAL AND MODAL ANALYSES Ph.D. Thesis
Michael Anthony Tucchio 1980 107 p
Avail: Univ. Microfilms Order No. 8017060

A methodology to determine the dynamic stresses in a structure from a few measured accelerations is presented. It is shown that while the technique is theoretically correct, it is subject to limitations due to inaccuracies in current accelerometer technology. The theory of the method is developed and checked both analytically and experimentally. A closed form solution for a simply supported beam with suddenly applied end moment and a finite element solution for a single bay frame with suddenly applied concentrated load are used to provide the analytical support. Base excitation for a cantilever beam and a multibay frame are used in the experimental verification. Dissert. Abstr.

N80-29755 Drexel Univ., Philadelphia, Pa.
TWO-DIMENSIONAL CALCULATION OF EXPLOSIVE-METAL INFORMATION PROBLEMS Ph.D. Thesis
Sheng Chih Hung 1980 121 p
Avail: Univ. Microfilms Order No. 8017858

A computer code for solving two dimensional explosive metal interaction problems is developed. Details of the theory, the finite difference formulation, the numerical solution technique, and a sample problem are presented. The metal is represented by a thin shell, capable of developing both membrane forces and bending moments. In a sample problem of an axisymmetric liner accelerated by an explosive charge, the output data of this program compares well to the two dimensional computer code EPIC. The EPIC computer code typically requires 10 times more computational time to simulate the same problem than this computer code. It is concluded that this computer code reduces the cost of calculations significantly and it is suitable for preliminary design studies of metal explosive interaction problems. Dissert. Abstr.

N80-29756 Illinois Univ., Urbana-Champaign.
VARIATIONAL PRINCIPLES IN FINITE ELASTICITY WITH APPLICATIONS Ph.D. Thesis
Sang Jin Lee 1980 70 p
Avail: Univ. Microfilms Order No. 8017970

A variational principle of the complementary energy type is derived. Trial functions for the actual deformation gradient are used in the formulation of the principle. Corresponding principles for elastic bodies subject to kinematical constraints such as incompressibility are formulated. The same approach can be used to obtain variational principles for infinitesimal deformations superposed on a known finite elastic deformation of an elastic body. For some deformations, the principle becomes an extremum principle and it can be used in conjunction with the principle of minimum potential energy. The principles are applied to the problem of the all around finite extension of a plane sheet with a circular hole and accurate estimates for the stress resultant at the outer edge for various extensions are obtained. The finite extension and torsion of an elastic cylinder is treated and bounds on the strain energy per unit length are obtained for elliptical cylinders of neo-Hookean material with axes in the ratios of 2:1 and 4:1. The bounds lead to reliable estimates for the twisting moment and the axial force. Dissert. Abstr.

N80-29757 Alfred Univ., N.Y.
THE EFFECT OF ELECTRIC FIELDS ON CRACK PROPAGATION IN GLASS Ph.D. Thesis
Mark George Schwabel 1978 70 p
Avail: Univ. Microfilms Order No. 8017488

Electric fields were applied to soda-lime glass specimens in which cracks were propagated by a fixed end, constant displacement straining device. At 23 C and 50 C in a dried air environment, the position and shape of the crack tip were monitored optically. Alternating and direct current fields of 1000 and 10,000 volts/cm were applied through aluminum electrodes which were plated on the specimen surfaces. The electrode geometries were arranged to provide electric fields which were parallel and perpendicular to the fracture generated surface. Information relevant to glass slow crack growth theories was provided. Healing of glass fracture surfaces formed by slow crack growth is inconsistent with the widely accepted Charles-Hilling theory of stress corrosion to explain environmentally assisted slow crack growth in glass. A more general theory of environment assisted slow crack growth by surface energy reduction is shown to be sufficient to explain observed slow crack growth behavior. Dissert. Abstr.

N80-29758 Engineering Sciences Data Unit, London (England).
FATIGUE STRENGTH OF STEEL CONED DISC SPRINGS
1980 16 p
(ESDU-80004; ISBN-0-85679-282-9; ISSN-0141-4089) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161

Basic fatigue data are presented on which to assess the endurance of steel coned disc springs, and, to estimate the location of failure within a stack and the point on each spring at which a fatigue crack is likely to initiate. The results of the research may be applied to springs for valves, forging dies, machine tools, pneumatic equipment, and testing apparatus. The research is limited to a series combination of identical steel coned disc springs in a wide range of geometries with cone angles of less than 15 degrees, ratio of external to internal diameter less than 5, and in which no spring is deflected through the flat position. ESDU (GRA)

N80-29759 Catholic Univ. of America, Washington, D. C.
MODE CONVERSION AND RESONANCE SCATTERING OF ELASTIC WAVES FROM A CYLINDRICAL, FLUID-FILLED CAVITY Ph.D. Thesis
Sheldon Gerald Solomon 1980 97 p
Avail: Univ. Microfilms Order No. 8018456

Mode conversion and scattering of compressional and shear waves from cylindrical cavities were studied by performing partial wave expansions of the incident and scattered fields. A mathematical analysis, supported by extensive numerical

calculations, shows that each partial wave spectrum consists of a smooth background identical to that of an empty cavity and a series of resonance terms associated with the eigenvibrations of the cavity's fluid interior. Resonance scattering of elastic waves is shown to occur when circumferential waves are excited in the fluid interior of the cavity. The resonances which appear in successive normal modes of vibration of the cavity are related through a common feature of the scattering amplitude known in modern physics as a Regge pole. The scattering matrix for the cavity is defined and its unitary and symmetry properties are discussed. Argand diagrams of the trajectories of the S matrix elements in the complex plane are shown to have certain easily recognized features which are associated with the cavity resonances. Dissert. Abstr.

N80-29760 Connecticut Univ., Storrs.
A NUMERICAL MODEL FOR THREE DIMENSIONAL THERMAL STRESS ANALYSIS INCLUDING PHASE CHANGE CAPABILITY BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Calvin Kin-Fun Lai 1979 342 p
Avail: Univ. Microfilms Order No. 8017024

A general numerical model for doing three dimensional thermal stress analysis with the added capability of solving phase change problems has been developed. The model uses the finite element formulation in both the thermal and stress analysis. The analyses can be uncoupled to solve either the heat transfer problem or the stress problem independently. By direct application of the equations of elasticity and the variational principle to an assumed displacement function, a constant strain finite element is developed. In transient thermal analysis, the finite element formulation is developed by the variational method. Included in both the thermal and stress analyses are terms to accommodate nonlinear material behavior, initial states of stress and strain, and moving boundary conditions. Applying the moving heat flux boundary condition to simualte the welding arc, the model has been used to predict the transient thermal mechanical response of a welding process. The result is presented. Dissert. Abstr.

N80-29761 California Univ., Davis.
INVESTIGATION OF FUNDAMENTAL ASPECTS OF SUPERPLASTICITY Ph.D. Thesis
Adi Arieli 1979 231 p
Avail: Univ. Microfilms Order No. 8016734

A three dimensional deformation mechanism map is developed and introduced. Additional possible applications of this deformation mechanism map, such as evaluation and prediction of the creep life, are discussed. A model for the rate controlling mechanism in superplasticity is also presented. The proposed model is shown to be consistent with the microstructural and mechanical observations of superplasticity and is capable of predicting all of the microstructural, topographical and phenomenological characteristics of the superplastic flow. It is shown that many contradictory results reported in the literature of superplasticity can be reconciliated and/or explained by the proposed model. Dissert. Abstr.

N80-29762*# Massachusetts Inst. of Tech., Cambridge.
FINITE-STRAIN LARGE-DEFLECTION ELASTIC-VISCOPLASTIC FINITE-ELEMENT TRANSIENT RESPONSE ANALYSIS OF STRUCTURES
Jose J. A. Rodal and Emmett A. Witmer Jul. 1979 567 p refs
(Grant NGR-22-009-339)
(NASA-CR-159874; ASRL-TR-154-15) Avail: NTIS HC A24/MF A01 CSCL 20K

A method of analysis for thin structures that incorporates finite strain, elastic-plastic, strain hardening, time dependent material behavior implemented with respect to a fixed configuration and is consistently valid for finite strains and finite rotations is developed. The theory is formulated systematically in a body fixed system of convected coordinates with materially embedded vectors that deform in common with continuum. Tensors are considered as linear vector functions and use is made of the dyadic representation. The kinematics of a deformable continuum is treated in detail, carefully defining precisely all quantities necessary for the analysis. The finite strain theory developed gives much better predictions and agreement with experiment than does the traditional small strain theory, and at practically no additional cost. This represents a very significant advance in the capability for the reliable prediction of nonlinear transient structural resposes, including the reliable prediction of strains large enough to produce ductile metal rupture. E.D.K.

N80-29763*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NOTCH SENSITIVITY OF SPACE SHUTTLE TILE MATERIALS
J. C. Newman, Jr. Jul. 1980 17 p ref
(NASA-TM-81854) Avail: NTIS HC A02/MF A01 CSCL 20K

Tests were conducted at room temperature to determine the notch sensitivity of the thermal protection tile for the space shuttle. Two types of RSI tile were studied: LI-900 and LI-2200. Three point bend specimens were cut from discarded tiles in the in-plane (ip) and through-the-thickness (ttt) directions. They were tested with or without a sharp notch. The LI-900 (ip and ttt) specimens were not very notch sensitive, but the LI-2200 (ip and ttt) specimens were. The LI-2200 material showed about a 35 percent reduction in strength due to the presence of the notch. This reduction in strength should be considered in the design of mechanically fastened tile concepts. Author

N80-29764*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PHOTOELASTIC TESTS ON MODELS OF THERMAL PROTECTION SYSTEM FOR SPACE SHUTTLE ORBITER
R. Prabhakaran (Old Dominion Univ., Norfolk, Va.) and Paul A. Cooper Aug. 1980 18 p refs
(NASA-TM-81866) Avail: NTIS HC A02/MF A01 CSCL 20K

The thermal protection system (TPS) of the space shuttle orbiter vehicle, consisting of ceramic tile/adhesive/strain isolator pad/adhesive/aluminum substructure, was modeled photoelasticity. A highly sensitive photoelastic material was used in the models to show the nature of the stress-transfer between the strain isolation pad (SIP) and the ceramic tile through the RTV-adhesive layer. Isochromatic fringe patterns were obtained for models subjected to tension and combined tension and bending. Tests indicated that the load-transfer between the SIP and the photoelastic material occurred at discrete locations causing stress concentrations in the photoelastic material. Stress concentration factors of the order of 1.9 were measured, but as the observed photoelastic response was an integrated effect through the model thickness, the local stress concentration factors at the SIP/tile interface could be even higher. Author

N80-29765*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUBSTRUCTURE PROCEDURE FOR INCLUDING TILE FLEXIBILITY IN STRESS ANALYSIS OF SHUTTLE THERMAL PROTECTION SYSTEM
Gary L. Giles Aug. 1980 12 p refs
(NASA-TM-81864) Avail: NTIS HC A02/MF A01 CSCL 20K

A substructure procedure to include the flexibility of the tile in the stress analysis of the shuttle thermal protection system (TPS) is described. In this procedure, the TPS is divided into substructures of (1) the tile which is modeled by linear finite elements and (2) the SIP which is modeled as a nonlinear continuum. This procedure was applied for loading cases of uniform pressure, uniform moment, and an aerodynamic shock on various tile thicknesses. The ratios of through-the-thickness stresses in the SIP which were calculated using a flexible tile compared to using a rigid tile were found to be less than 1.05 for the cases considered. Author

N80-29766*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME SPACE SHUTTLE TILE/STRAIN-ISOLATOR-PAD SINUSOIDAL VIBRATION TESTS
Robert Miserentino, Larry D. Pinson, and Sumner A. Leadbetter Jul. 1980 27 p refs
(NASA-TM-81853) Avail: NTIS HC A03/MF A01 CSCL 20K

Vibration tests were performed on the tile/strain-isolator-pad system used as thermal protection for the space shuttle orbiter

Experimental data on normal and in-plane vibration response and damping properties are presented. Three test specimens exhibited shear type motion during failures that occurred in the tile near the tile/strain-isolator-pad bond-line. A dynamic instability is described which has large in-plane motion at a frequency one-half that of the nominal driving frequency. Analysis shows that this phenomenon is a parametric response. Author

N80-29767*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
APPLICATION OF FULLY STRESSED DESIGN PROCEDURES TO REDUNDANT AND NON-ISOTROPIC STRUCTURES
Howard M. Adelman, Raphael T. Haftka, and Uri Tsach. Jul. 1980. 35 p. refs.
(NASA-TM-81842) Avail: NTIS HC A03/MF A01 CSCL 20K

An evaluation is presented of fully stressed design procedures for sizing highly redundant structures including structures made of composite materials. The evaluation is carried out by sizing three structures: a simple box beam of either composite or metal construction; a low aspect ratio titanium wing; and a titanium arrow wing for a conceptual supersonic cruise aircraft. All three structures are sized by ordinary fully-stressed design (FSD) and thermal fully stressed design (TFSD) for combined mechanical and thermal loads. Where possible, designs are checked by applying rigorous mathematical programming techniques to the structures. It is found that FSD and TFSD produce optimum designs for the metal box beam, but produce highly non-optimum designs for the composite box beam. Results from the delta wing and arrow wing indicate that FSD and TFSD exhibits slow convergence for highly redundant metal structures. Further, TFSD exhibits slow oscillatory convergence behavior for the arrow wing for very high temperatures. In all cases where FSD and TFSD perform poorly either in obtaining nonoptimum designs or in converging slowly, the assumptions on which the algorithms are based are grossly violated. The use of scaling, however, is found to be very effective in obtaining fast convergence and efficiently produces safe designs even for those cases when FSD and TFSD alone are ineffective. Author

N80-29768*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
EFFECTS OF SUBSTRATE DEFORMATION AND SIP THICKNESS ON TILE/SIP INTERFACE STRESSES FOR SHUTTLE THERMAL PROTECTION
Charles P. Shore and Ramon Garcia. Jul. 1980. 21 p. refs.
(NASA-TM-81855) Avail: NTIS HC A02/MF A01 CSCL 20K

A nonlinear analysis was used to study the effects of substrate deformation characteristics and strain isolator pad (SIP) thickness on TILE/SIP interface stresses for the space shuttle thermal protection system. The configuration analyzed consisted of a 5.08 cm thick, 15.24 cm square tile with a 12.7 cm square SIP footprint bordered by a 1.27 cm wide filler bar and was subjected to forces and moments representative of a 20.7 kPa aerodynamic shock passing over the tile. The SIP stress deflection curves were obtained after a 69 kPa proof load and 100 cycles conditioning at 55 kPa. The TILE/SIP interface stresses increase over flat substrate values for zero to peak substrate deformation amplitudes up to 0.191 cm by up to a factor of nearly five depending on deformation amplitude, half wave length, and location. Stresses for a 0.23 cm thick SIP found to be up to 60 percent greater than for a 0.41 cm thick SIP for identical loads and substrate deformation characteristics. A simplified method was developed for approximating the substrate location which produces maximum TILE/SIP interface stresses. E.D.K.

N80-29769# Naval Postgraduate School, Monterey, Calif.
ON COMBINATIONS OF RANDOM LOADS
D. P. Gaver and D. A. Jacobs. Jan. 1980. 51 p. refs.
(AD-A085489; NPS55-80-006) Avail: NTIS HC A04/MF A01 CSCL 13/13

Structures are subject to changing loads from various sources. In many instances these loads fluctuate in time in an apparently random fashion. Certain loads vary rather slowly (called constant loads); other loads occur more nearly as impulses (shock loads). Suppose that the stress put on the structure by various loads acting simultaneously can be expressed as a linear combination of the load magnitudes. In this paper certain simple but somewhat realistic probabilistic load models are given and the resulting probabilistic model of the total stress on the structure caused by the loads is considered. The distribution of the first time until the stress on the structure exceeds a given level x, and the distribution of the maximum stress put on the structure during the time interval (0,t) are studied. Asymptotic properties are also given. It is shown that the asymptotic properties of the maximum stress are related to those of the maxima of a sequence of dependent random variables. Classical extreme value type results are derived under proper normalization. GRA

N80-29770# Army Materials and Mechanics Research Center, Watertown, Mass. Process Development Div.
ON ADIABATIC SHEAR BAND DETERMINATIONS BY SURFACE OBSERVATIONS. Final Report
Michael R. Staker. Mar. 1980. 12 p. refs.
(DA Proj. 1L1-62105-AH-84)
(AD-A085627; AMMRC-TR-80-6) Avail: NTIS HC A02/MF A01 CSCL 11/6

Two cracking mechanisms, adiabatic shear band cracking and ductile dimpled shear cracking, have been observed in hollow, right circular cylinders of AISI 4340 steel, which were explosively expanded in a quick-stop containment apparatus. It is concluded that distinction of cracking mechanisms cannot be made without the use of metallographic sectioning, as the external appearances of both types of cracks are identical. These exploding cylinder results demonstrate the inaccuracies associated with determining the presence or density of adiabatic shear bands only from surface observations. GRA

N80-29771# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapons Systems Lab.
A WIDE RANGE K EXPRESSION FOR THE C-SHAPED SPECIMEN
J. A. Kapp, J. C. Newman, and J. H. Underwood. Mar. 1980. 20 p. refs. Presented to ASTM Taskgroup E24.01.05, Pittsburgh, 30 Oct. 1979. Submitted for publication.
(AD-A085719; AD-E440068) Avail: NTIS HC A02/MF A01 CSCL 11/6

A new expression has been developed to calculate K for the C-shaped specimen over a wider range of specimen parameters, namely a/W, X/W, and r sub 1/r sub 2 than had previously been available. The rationale used to derive the expression was to utilize known stress intensity factor solutions for short and deep cracks to develop a nondimensional form of K which approaches finite values as a/W goes to both zero and one. Numerical K solution results from prior work were then nondimensionalized to this form with the finite limiting values, and the dependent of K on a/W was determined by multi-variable, linear regression. The final expression agrees with the numerical K solutions within plus or minus 1.0% for .45 less than or equal to a/W less than or equal to .55 for all r sub 1/r sub 2 and X/W of either 0 or .5; within plus or minus 1.5% for .2 less than or equal to a/W less than or equal to 1 for all r sub 1/r sub 2 and X/W equal to 0 or .5; and within about plus or minus 3% for .2 less than or equal to a/W less than or equal to 1 for all r sub 1/r sub 2 and 0 less than or equal to X/W less than or equal to 1. The accuracy of this expression will allow expanded use of the C-shaped specimen for R-curve determination and fatigue crack growth rate tests. GRA

N80-29772# Aeronautical Research Associates of Princeton, Inc., N. J.
A CONTINUUM THEORY OF EQUILIBRIUM OF IRREVERSIBLE PROCESSES IN SOLIDS. Final Report, 15 Apr. 1976 - 31 Jan. 1979
Thomas B. McDonough. Jan. 1979. 106 p. refs.
(Contract N00014-76-C-0809)
(AD-A085800; ARAP-395) Avail: NTIS HC A06/MF A01 CSCL 20/11

A theory is presented to describe the coupled thermal and mechanical behavior of solids which exhibit irreversibility. The developments presented are restricted to definitions and analyses of 'equilibrium states'. The foundations of the theory embody the following assumptions: (1) the local equilibrium state is fully

characterized by three state variables - i.e., the deformation gradient, the entropy density, and a substate variable, (2) a caloric equation of state and stress and temperature relations exist, (3) there is a bounded stable equilibrium region in state-space, (4) a stable equilibrium state satisfies a statement of static stability, and (5) an 'equilibrium process' may be represented by a continuous path in the stable equilibrium region. The meaning of 'equilibrium state' is clarified by considering global (static) stability. Two types are defined and analyzed: Global Adiabatic Stability and Global Adiabatic Mechanical Stability with Fixed Boundary. An equivalence between the latter and the definition of equilibrium state is proven. Several ideas for the further development of this theory are discussed in the concluding section. GRA

N80-29773# Missouri Univ. -Rolla. Dept. of Engineering Mechanics.

RESPONSE OF NONLINEAR STRUCTURAL PANELS SUBJECTED TO HIGH INTENSITY NOISE Final Report, 18 Jun. - 20 Aug. 1979

Chuh Mei (Old Dominion Univ., Norfolk, Va.) Wright-Patterson AFB, Ohio AFWAL Mar. 1980 56 p refs

(Contract F49620-79-C-0169; AF Proj. 2401)

(AD-A085638; AFWAL-TR-80-3018) Avail: NTIS HC A04/MF A01 CSCL 20/11

Lightweight aircraft structures exposed to a high intensity noise environment can fatigue fail prematurely if adequate consideration is not given to the problem. Design methods and design criteria for sonic fatigue prevention have been developed based on analytical and experimental techniques. Most of the analytical work was based upon small deflection or linear structural theory which did not agree with the experimental results. A large deflection geometrical nonlinearity was incorporated into the analysis methods for determing the structural response to high intensity noise. Using the Karman-Herrman large deflection equations for rectangular plates, a single mode Galerkin approximation, the nonlinear differential equations of motion were obtained. The method of equivalent linearization was used to solve the nonlinear equations for mean square displacement, mean square stresses and nonlinear frequencies at various acoustic loadings for rectangular panels. Comparisons with experimental results are presented. The results obtained agreed with the experimental results however, additional test data are needed for an adequate quantitative comparison. GRA

N80-29774# Maryland Univ., College Park. Dept. of Aerospace Engineering.

AN EXTENDED METHOD SOLUTION FOR A PULSE LOADED THIN PLATE Interim Report

Bruce K. Donaldson and N. B. Starkey Apr. 1980 12 p refs

(Contract N00014-76-C-0872)

(AD-A085649; AE-80-1) Avail: NTIS HC A02/MF A01 CSCL 20/3

This paper deals with a new extension of a weighted residual method of analysis called the extended field method. The extended field method is applied for the first time to the problem of the transient vibration of a uniformly thin elastic plate. Numerical results have been obtained which validate the analysis procedure and show better solution convergence than is obtainable by standard methods of analysis for the same number of degrees of freedom. Further studies are necessary to obtain still better convergence. GRA

N80-29775# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

STRESS ANALYSES OF OD NOTCHED THICK-WALLED CYLINDERS SUBJECTED TO INTERNAL PRESSURE OR THERMAL LOADS

J. A. Kapp and G. A. Pelegi Feb. 1980 49 p refs

(DA Proj. 1L1-61102-AH-42)

(AD-A086110; AD-E440069; ARLCB-TR-80005) Avail: NTIS HC A03/MF A01 CSCL 20/11

Finite element stress analysis has been performed to determine the effects of two OD notch configurations in a cylinder subjected to internal pressure, or containing autofrettage residual stress. The effects on the residual stresses were determined by simulating these stresses with active temperature loads. The results show that the deeper of the two notch configurations is far more severe resulting in a maximum stress concentration factor of 2.9. The shallower notch has a maximum stress concentration factor of 2.0. An additional result is that by introducing notches in autofrettaged cylinders a significant amount of the residual stresses are relieved which indicates that smaller applied pressures can be contained by these cylinders, than in smooth cylinders before yielding occurs. The results also show that the possibility of OD initiated fatigue failure is greatly increased. GRA

N80-29776# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Aeronautical and Astronautical Engineering.

FINITE ELEMENT METHOD OF STRESS ANALYSIS OF NONAXISYMMETRIC CONFIGURATIONS Final Report, Mar. 1976 - Dec. 1978

Adam R. Zak and James N. Craddock Apr. 1980 140 p refs

(Contract DAAD05-76-C-0743)

(AD-A086113; AD-E430467; ARBRL-CR-00423) Avail: NTIS HC A07/MF A01 CSCL 20/11

A finite element method of analysis is developed for structural configurations which are derived from axisymmetric geometries but contain definite nonaxisymmetric features in the circumferential direction. The purpose of the present analysis is to develop a method which will take into consideration the fact that the stress and strain conditions in these geometries will be related to the corresponding axisymmetric solution. The analysis is developed in terms of a cylindrical coordinate system r, phi, and z. As the first step of the analysis, the geometry is divided into several segments in the r-phi plane. Each segment is then divided into a set of quadrilateral elements in the r-z plane. The axisymmetric displacements are obtained for each segment by solving a related axisymmetric configuration. A perturbation analysis is then performed to match the solutions at certain points between the segments, and obtain the perturbation displacements for the total structure. The total displacement is then the axisymmetric displacement plus the perturbation displacement. The stresses and strains are then calculated at any desired point once the total displacements are known. The method is then applied to several examples to illustrate the accuracy of the method. The method of analysis is developed in two versions. The first version is for elastic, orthotropic materials. The second method is for elastic-plastic materials with a kinematic strain hardening model. As in the case of the elastic version, the second version also allows for orthotropic properties and the yield criterion is based on the Hill's yield function which reduces in the limit to von Mises-Hencky for isotropic materials. GRA

N80-29777# California Univ., Los Angeles. Dept. of Materials.

ACOUSTIC EMISSION ARISING FROM PLASTIC DEFORMATION AND FRACTURE

Kanji Ono May 1980 42 p refs Presented at the Joint Meeting of ASA and ASJ, Spec. Session of Acoustic Emission, Honolulu, Hawaii, 1 Dec. 1978

(Contract N00014-75-C-0419)

(AD-A086263; TR-80-02) Avail: NTIS HC A03/MF A01 CSCL 20/11

This paper reviews current status of acoustic emission signal detection methods, theoretical analysis of acoustic emission sources and acoustic emission behavior of materials arising from plastic deformation and fracture. Recent developments in quantitative signal detection and transducer characterization are considered. Several theories of acoustic emission sources are summarized and one based on dislocation theory by Malen and Bolin is extended to provide a relation between the inelastic displacement at a source to the peak voltage output of a resonant transducer. Models of acoustic emission from plastic deformation are presented. A new model for continuous acoustic emission is developed on the basis of the modified Malen-Bolin theory. Predictions of the model are discussed in conjunction with recent studies on acoustic emission behavior as a function of test temperature and of heat treatment. Finally, acoustic emission due to cracking is evaluated, especially in relation to amplitude distribution analysis of burst-type emission. GRA

N80-29778# Brown Univ., Providence, R. I. Dept. of Engineering.
COMPARISON OF EXPERIMENT AND THEORY FOR ELASTIC-PLASTIC PLANE STRAIN CRACK GROWTH
L. Hermann and J. R. Rice Feb. 1980 39 p refs Presented at the Conf. on Micromech. of Crack Extension, Cambridge, England, 31 Mar. 1980 Submitted for publication
(Contract EY-76-S-02-3084)
(COO-3084-76; CONF-800358-1) Avail: NTIS HC A03/MF A01

Recent theoretical results on elastic-plastic plane strain crack growth and experimental results for crack growth in a 4140 steel in terms of the theoretical concepts are reviewed. The theory is based on a recent asymptotic analysis of crack surface opening and strain distributions at a quasi-statically advancing crack tip in an ideally plastic solid. The analysis is incomplete in that some of the parameters which appear in it are known only approximately, especially at large scale yielding. Nevertheless, it suffices to derive a relation between the imposed loading and amount of crack growth, prior to general yielding, based on the assumption that a geometrically similar near tip crack profile is maintained during growth. The resulting predictions for the variation of J with crack growth are found to fit well to the experimental results obtained on deeply cracked compact specimens. DOE

N80-29779# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
MECHANICAL AND PLASTIC BEHAVIOR IN CASE OF RUPTURE [MECHANIK UND STOFFVERHALTEN BEI BRUCHVORGAENGEN]
J. H. Argyris, W. Aicher, J. Doltsinis, H. J. Ertelt, G. Kierner, and K. A. Schneider 1979 141 p refs In GERMAN
(Contract DFG-AR-44/31)
(ISD-257; ISSN-0170-6071) Avail: NTIS HC A07/MF A01

Analytical work on nonlinear rupture mechanics is presented. Experiments, techniques of measurement of extension, the measurement on a specimen with rupture, and the behavior of the material in case of stationary and nonstationary fracture extension are shown. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-29780*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
USER DOCUMENTATION EOD-LARSYS EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM
R. T. Minter, B. E. Wills, and C. T. Gardner, Principle Investigator Jul. 1977 521 p refs Revised ERTS
(Contract NAS9-15200)
(E80-10188; NASA-CR-160617; LEC-3984-Rev-4; JSC-12504-Rev-4) Avail: NTIS HC A22/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29781*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
AS-BUILT DESIGN SPECIFICATION FOR METRO DATA EDIT PROGRAM
E. L. Wilson, Principal Investigator Dec. 1976 43 p ERTS
(Contract NAS9-15200)
(E80-10201; NASA-CR-160620; LEC-9888; JSC-11838) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29782*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION OF THE CAM/CAS INTERFACE TAPE REPORT GENERATION PROGRAM FOR LACIE 7
K. P. Eckel, Principal Investigator Mar. 1978 123 p ERTS
(Contract NAS9-15200)
(E80-10203; NASA-CR-160629; LEC-12022; JSC-13917; LEC-11292) Avail: NTIS HC A06/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29783*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION OF THE CAMS/CAS INTERFACE TAPE REPORT GENERATION PROGRAM
W. A. Holley, Principal Investigator Feb. 1977 69 p ERTS
(Contract NAS9-15200)
(E80-10204; NASA-CR-160619; LEC-9882; JSC-12560) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29784*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR SECONDARY ERROR SOURCES MULTI-TEMPORAL BAYES CLASSIFIER
P. J. Aucoin, Jr., Principal Investigator Dec. 1977 13 p ERTS
(Contract NAS9-15200)
(E80-10205; NASA-CR-160636; LEC-11677; JSC-13823) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29785*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR EQUIPROBABLE BLOCKS DENSITY ESTIMATORY/CLASSIFIER/DOT SELECTOR
P. J. Aucoin, Jr., Principal Investigator Dec. 1977 19 p ERTS
(Contract NAS9-15200)
(E80-10206; NASA-CR-160637; LEC-11676; JSC-13824) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29786*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE CAMS IMAGE-100 HYBRID SYSTEM. VOLUME 1: SYSTEM DESIGN
L. E. Giddings, Principal Investigator Aug. 1977 322 p ERTS 2 Vol.
(Contract NAS9-15200)
(E80-10207; NASA-CR-160644; LEC-10822-Vol-1; JSC-13030-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29787*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE CAMS IMAGE-100 HYBRID SYSTEM. VOLUME 2: DETAILED FLOW CHARTS AND PROGRAM LISTINGS
L. E. Giddings, Principal Investigator Aug. 1977 397 p ERTS 2 Vol.
(Contract NAS9-15200)
(E80-10208; NASA-CR-160683; LEC-10822-Vol-2-Pt-2; JSC-13030-Vol-2-Pt-2) Avail: NTIS HC A17/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29788*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT SPECIFICATION FOR CCIT7 PROCESSOR PROGRAM
W. P. White, Principal Investigator Nov. 1978 64 p ERTS
(Contract NAS9-15200)
(E80-10209; NASA-CR-160598; LEC-12518; JSC-14554)
Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29789*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
FINAL DESIGN SPECIFICATION FOR LARSYS MODIFICATION/FISHER F-DISTRIBUTION THRESHOLDING
R. M. Rodriguez, Principal Investigator Dec. 1976 61 p ERTS
(Contract NAS9-15200)
(E80-10210; NASA-CR-160648; LEC-9963; JSC-11864) Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29790*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
FINAL DESIGN SPECIFICATION FOR EOD-LARSYS/DATA TRANSFORMATION PROCESSOR MODIFICATION
J. K. Rowland, Principal Investigator Apr. 1977 112 p ERTS
(Contract NAS9-15200)
(E80-10211; NASA-CR-160678; LEC-10662; JSC-12917)
Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29791*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
FINAL DESIGN SPECIFICATION FOR EOD-LARSYS PROCEDURE 1 FOLLOW-ON
P. J. Aucoin, Jr., Principal Investigator Dec. 1977 44 p ERTS
(Contract NAS9-15200)
(E80-10213; NASA-CR-160635; LEC-11618; JSC-13817)
Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29792*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATION: AS-BUILT DESIGN SPECIFICATION FOR GENERALIZED LINEAR MODEL ANALYSIS OF VARIANCE PROGRAM (GLMAOV)
Jeannie S. Gor, Principal Investigator Mar. 1978 57 p ERTS
(Contract NAS9-15200)
(E80-10214; NASA-CR-160649; LEX-12085; JSC-13945)
Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29793*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR LACIE FORMATTED DOT CARDS IN EOD-LARSYS
P. J. Aucoin, Jr. and Jeannie S. Gor, Principal Investigators Dec. 1977 14 p ERTS
(Contract NAS9-15200)
(E80-10215; NASA-CR-160639; LEC-11703; JSC-13837)
Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29794*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR BOUNDARY DETECTION AND REGISTRATION PROGRAM (BDARP1)
D. P. McKay and F. Collen, Principal Investigators Aug. 1977 116 p ERTS
(Contract NAS9-15200)
(E80-10217; NASA-CR-160621; LEC-11074; JSC-13055)
Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29795*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE YIELD ESTIMATION SUBSYSTEM (YES) MONTHLY YIELD DATA BASE AND SUPPORTING PROGRAMS
D. Cook and C. Siemons, Principal Investigators Feb. 1977 124 p ERTS
(Contract NAS9-15200)
(E80-10218; NASA-CR-160641; LEC-10034; JSC-12537)
Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29796*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATION: MARQUIS2.FTN
Maury A. Mendlowitz, Principal Investigator Dec. 1977 26 p ERTS
(Contract NAS9-15200)
(E80-10220; NASA-CR-160622; LEC-11092; JSC-13145)
Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29797*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
OPERATIONAL CHANGES FOR THE KANSAS STATE UNIVERSITY WHEAT MODEL
R. L. Davenport, Principal Investigator Dec. 1977 30 p ERTS
(Contract NAS9-15200)
(E80-10223; NASA-CR-160633; LEC-11393; JSC-13813)
Avail: NTIS HC A03/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-29798*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Oct. - Dec. 1979
Helen N. Paley, Anne B. Kahle, and Stuart E. Matsh, Principal Investigators May 1980 4 p HCMM
(Contract NAS7-100)
(E80-10229; NASA-CR-163334) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29799*# Geological Survey, Denver, Colo.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, Mar. - May 1980
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Jun. 1980 5 p Sponsored by NASA HCMM
(E80-10230; NASA-CR-163335) Avail: NTIS HC A02/MF A01 CSCL 08B
The author has identified the following significant results. Two night-time thermal images of the Powder River Basin, Wyoming distinctly show a major thermal feature. This feature is substantially coincident with a drainage divide and the southward facing slope appears cooler, suggesting a lower thermal inertia. An initial examination of regional geologic maps provides no clear evidence to suggest what type of geologic feature or structure may be present, although it can be noted that its northeastern end passes directly through Lead, South Dakota where the Homestake Gold Mine is located.

N80-29800*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Jan. - Mar. 1980

Helen N. Paley and Anne B. Kahle, Principal Investigators. May 1980. 4 p. HCMM.
(Contract NAS7-100)
(E80-10231; NASA-CR-163336) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-29801*# Eastman Kodak Co., Rochester, N. Y.
ADVANCED SOLID STATE EARTH RESOURCES SATELLITE STUDY. Final Report
30 Jun. 1980. 70 p. refs. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS.
(Contract NASw-3375)
(E80-10232; NASA-CR-163337; RC-00221) Avail: NTIS HC A04/MF A01 CSCL 22B
There are no author-identified significant results in this report.

N80-29802*# Washington Univ., St. Louis, Mo. Center for Development Technology.
PROGRAM ON STIMULATING OPERATIONAL PRIVATE SECTOR USE OF EARTH OBSERVATION SATELLITE DATA. Technical Progress Status Report, 15 Jan. - 15 Jun. 1980
Lester F. Eastwood, Jr., Jerry Foshage, Guillermo Gomez, Becky Kirkpatrick, Barry Konig, Bret Smith, Robert Stein, Francis Vithayathil, and Katherine Warner, Principal Investigators. 15 Jun. 1980. 125 p. refs. ERTS.
(Contract NASw-3331)
(E80-10233; NASA-CR-163338) Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-indentified significant results in this report.

N80-29803*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR A MERGING PROGRAM FOR FORMATTED IMAGE DATA FILES
P. J. Aucoin, Jr., Principal Investigator. May 1978. 32 p. ERTS.
(Contract NAS9-15200)
(E80-10234; NASA-CR-160714; LEC-12373; JSC-14289) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29804*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF TOTAL DRY-MATTER ACCUMULATION IN WINTER WHEAT
Compton J. Tucker, Brent N. Holben, James H. Elgin, Jr. (Agricultural Research Center, Beltsville, Md.), and James E. McMurtrey, III, Principal Investigators (Agricultural Research Center, Beltsville, Md.). Jan. 1980. 28 p. refs. Submitted for publication. ERTS.
(E80-10235; NASA-TM-80631) Avail: NTIS HC A03/MF A01 CSCL 02C
The author has identified the following significant results. Red and photographic-infrared spectral data collected on 21 dates over the growing season with a hand-held radiometer was quantitatively correlated with total dry-matter accumulation in winter wheat. The spectral data were found to be highly related to vigor and condition of the plant canopy. Two periods of drought stress and subsequent recovery from it were readily apparent in the spectral data. Simple ratios of the spectral data compensated for variations in solar intensities and, when integrated over the growing season, explained 79% of the variation in total above-ground accumulation of dry matter.

N80-29805*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
USER MANUAL FOR THE EARTH OBSERVATIONS DIVISION R AND D TO OLPARS DOT DATA CONVERSION
R. Nugent, Principal Investigator. Apr. 1980. 30 p. refs. ERTS.
(Contract NAS9-15800)
(E80-10236; NASA-CR-160666; LEMSCO-14848; JSC-16665) Avail: NTIS HC A03/MF A01 CSCL 09B
There are no author-identified significant results in this report.

N80-29806*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
USE OF LANDSAT DATA FOR RIVER AND LAKE ICE ENGINEERING STUDIES
Dorothy K. Hall, Principal Investigator. Apr. 1980. 14 p. refs. Submitted for publication. ERTS.
(E80-10237; NASA-TM-80686) Avail: NTIS HC A02/MF A01 CSCL 08L
There are no author-identified significant results in this report.

N80-29807*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROJECT DEVELOPMENT PLAN FOR THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)
J. J. Carney and J. A. Vitellaro, Principal Investigators. Oct. 1978. 14 p. ERTS.
(Contract NAS9-15200)
(E80-10238; NASA-CR-160720; LEC-12856; JSC-14579) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29808*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEST PLAN FOR THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)
J. J. Carney and J. A. Vitellaro, Principal Investigators. Oct. 1978. 16 p. ERTS.
(Contract NAS9-15200)
(E80-10239; NASA-CR-160721; LEC-12857; JSC-14578) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29809*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PRELIMINARY DESIGN SPECIFICATION FOR THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)
J. M. Everette, D. K. McCarley, and K. P. Eckel, Principal Investigators. Oct. 1978. 43 p. ERTS.
(Contract NAS9-15200)
(E80-10240; NASA-CR-160719; LEC-12838; JSC-14577) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29810*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR AREAS ADDED TO THE MONTHLY BASES OF TEXAS, MINNESOTA AND USSR
K. Williams, Principal Investigator. Mar. 1977. 22 p. ERTS.
(Contract NAS9-15200)
(E80-10241; NASA-CR-160707; LEC-10353; JSC-12708) Avail: NTIS HC A02/MF A01 CSCL 03B
There are no author-identified significant results in this report.

N80-29811*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
AS-BUILT DESIGN SPECIFICATION FOR THE INDIA MONTHLY DATA BASE
K. Williams, Principal Investigator. Feb. 1977. 20 p. ERTS.
(Contract NAS9-15200)
(E80-10264; NASA-CR-160643; LEC-10253; JSC-12582) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29812*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR A LIST PROCESSING SYSTEM

C. L. Horton, C. W. Ahlers, and P. J. Aucoin, Jr. Aug. 1978 77 p ERTS
(Contract NAS9-15200)
(E80-10265; NASA-CR-160717; LEC-12696; JSC-14457) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29813*# Texas A&M Univ., College Station. Remote Sensing Center.
DEVELOPMENT AND EVALUATION OF SCATTEROMETER DATA PROCESSING ALGORITHMS Final Report
Richard W. Newton, Principal Investigator and Billy V. Clark Aug. 1979 153 p refs ERTS
(Contract NAS9-14875)
(E80-10266; NASA-CR-160577; RSC-3337) Avail: NTIS HC A08/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29814*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
PIXEL LABELING BY SUPERVISED PROBABILISTIC RELAXATION
D. A. Landgrebe, Principal Investigator, J. A. Richards, and P. H. Swain Feb. 1980 18 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10267; NASA-CR-160697; SR-PO-00454; LARS-022580) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-29815*# California Univ., Santa Barbara.
USE OF COLLATERAL INFORMATION TO IMPROVE LANDSAT CLASSIFICATION ACCURACIES Semiannual Progress Report, Oct. 1979 - Mar. 1980
Alan H. Strahler and John E. Estes, Principal Investigators Mar. 1980 75 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NsG-2377)
(E80-10268; NASA-CR-163340) Avail: NTIS HC A04/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-29816*# National Environmental Satellite Service, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 24 Jun. 1980 3 p Sponsored by NASA HCMM
(E80-10269; NASA-CR-163341) Avail: NTIS HC A02/MF A01 CSCL 08L
The author has identified the following significant results. The HCMM thermal data are useful for monitoring estuarine surface thermal patterns. Estuarine thermal patterns, are, under certain conditions, indicative of the surface tidal current circulation patterns. Under optimum conditions, estuaries as small as the Cooper River (i.e., approximately 100 sq km) can be monitored for tidal/thermal circulation patterns by HCMM-type IR sensors.

N80-29817*# Phoenix Corp., McLean, Va.
IMPROVED DEFINITION OF CRUSTAL ANOMALIES FOR MAGSAT DATA Quarterly Report
25 Jun. 1980 3 p ERTS
(Contract NAS5-25882)
(E80-10270; NASA-CR-163342; QR-3) Avail: NTIS HC A02/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-29818*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
IMPROVEMENT OF THE EARTH'S GRAVITY FIELD FROM TERRESTRIAL AND SATELLITE DATA Status Report No. 16, 1 Jan. 1979 - 30 Jun. 1980
Jul. 1980 5 p ERTS
(Grant NGR-36-008-161; OSURF Proj. 783210)
(E80-10271; NASA-CR-163343) Avail: NTIS HC A02/MF A01 CSCL 08E
There are no author-identified significant results in this report.

N80-29819*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
SAMPLING OF RECTANGULAR REGIONS
George Terrell, Principal Investigator Jun. 1980 16 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10272; NASA-CR-160730; SR-LO-00460; LEMSCO-14806; JSC-16362) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-29820*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
SOME APPROACHES TO OPTIMAL CLUSTER LABELING OF AEROSPACE IMAGERY
C. B. Chittineni, Principal Investigator May 1980 56 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10273; NASA-CR-160690; SR-LO-00440; LEMSCO-14597; JSC-16355) Avail: NTIS HC A04/MF A01 CSCL 20C
There are no author-identified significant results in this report.

N80-29821*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
EOD SYSTEMS AND FACILITIES WORKLOAD REQUIREMENTS FORECAST
W. A. Stevens and J. A. Vitellaro, Principal Investigators Apr. 1977 175 p ERTS
(Contract NAS9-15200)
(E80-10277; NASA-CR-160708; LEC-10522; JSC-12881) Avail: NTIS HC A08/MF A01 CSCL 05A
There are no author-identified significant results in this report.

N80-29822*# Stanford Univ., Calif. Dept. of Applied Earth Sciences.
GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A (HEAT CAPACITY MAPPING MISSION) Technical Report, 1 Oct. - 31 Dec. 1979
R. J. P. Lyon and A. E. Prelat, Principal Investigators 31 Dec. 1979 5 p HCMM
(Contract NAS5-24232)
(E80-10279; NASA-CR-163345) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-29823*# Cornell Univ., Ithaca, N. Y. Remote Sensing Program.
CORNELL UNIVERSITY REMOTE SENSING PROGRAM Semiannual Status Report, 1 Dec. 1979 - 31 May 1980
Ta Liang, Principal Investigator and Warren R. Philipson Jun. 1980 100 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NGL-33-010-171)
(E80-10280; NASA-CR-163346) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29824*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
COMPOSITION AND ASSEMBLY OF A SPECTRAL DATA BASE FOR CORN AND SOYBEAN MULTICROP SEGMENTS
M. H. Trenchard, M. L. Sestak, and M. C. Kinsler, Principal Investigators Jun. 1980 338 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10281; NASA-CR-160726; AR-10-00407; LEMSCO-14250; JSC-13723) Avail: NTIS HC A15/MF A01 CSCL 20C

There are no author-identified significant results in this report.

N80-29825*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THEMATIC MAPPER STUDIES BAND CORRELATION ANALYSIS
Stephen G. Ungar and Richard Kiang Apr. 1976 28 p
(NASA-TM-80716) Avail: NTIS HC A03/MF A01 CSCL 08B

Spectral data representative of thematic mapper candidate bands 1 and 3 to 7 were obtained by selecting appropriate combinations of bands from the JSC 24 channel multispectral scanner. Of all the bands assigned, only candidate bands 4 (.74 mu to .80 mu) and 5 (.80 mu to .91 mu) showed consistently high intercorrelation from region to region and time to time. This extremely high correlation persisted when looking at the composite data set in a multitemporal, multilocation domain. The GISS investigations lend positive confirmation to the hypothesis, that TM bands 4 and 5 are redundant. R.K.G.

N80-29826*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SEASAT. VOLUME 3: GROUND SYSTEMS Final Report
E. Pounder, ed. 15 Jun. 1980 200 p refs
(Contract NAS7-100)
(NASA-CR-163442; JPL-Pub-80-38-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 05B

The Seasat Project was a feasibility demonstration of the use of orbital remote sensing for global ocean observation. The satellite was launched in June of 1978 and was operated successfully until October 1978. A massive electrical failure occurred in the power system, terminating the mission prematurely. The ground systems using during the mission life are discussed. Descriptions of the operating organization, the system elements, and the testing program are included. The various phases of the mission: launch and orbit insertion; cruise; and calibration are discussed. A special section is included on the orbit maneuver activites. Operations during the satellite failure are reviewed and summarized. R.K.G.

N80-29827*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SEASAT. VOLUME 4: ATTITUDE DETERMINATION Final Report
Alfred J. Treder 1 Jul. 1980 166 p refs
(Contract NAS7-100)
(NASA-CR-163943; JPL-Pub-80-38-Vol-4) Avail: NTIS HC A08/MF A01 CSCL 05B

The Seasat project was a feasibility demonstration of the use of orbital remote sensing for global ocean observation. The satellite was launched in June 1978 and was operated successfully until October 1978. A massive electrical failure occurred in the power system, terminating the mission prematurely. The actual implementation of the Seasat Attitude Determination system and the contents of the attitude data files generated by that system are documented. The deviations from plan caused by the anomalous Sun interference with horizon sensors, inflight calibration of Sun sensor head 2 alignment and horizon sensor biomass, estimation of yaw interpolation parameters, Sun and horizon sensor error sources, and yaw interpolation accuracy are included. Examples are given of flight attitude data from all modes of the Orbital Attitude Control System, of the ground processing effects on attitude data, and of cold cloud effects on pitch, and roll data. R.K.G.

N80-29828# Electromagnetic Systems Labs., Inc., Sunnyvale, Calif.
IMAGE TRANSFORMATION STUDY Semiannual Technical Report, 1 Oct. 1979 - 30 Apr. 1980
Robert Devich, F. Weinhaus, L. Martin, D. Collier, G. Kiremidjian, A. Silvestri, D. Mcguirk, B. Gleaton, and R. LaPado 30 May 1980 75 p refs
(Contract MDA903-80-C-0108; ARPA Order 3854)
(AD-A086070; ESL-PR339; SATR-1) Avail: NTIS HC A04/MF A01 CSCL 14/5

The purpose of the Image Transformation Study is to develop techniques for converting oblique aerial photography to the ground level viewing perspectives that would be seen by an observer as he moves around within the imaged area. This report documents the first six months of the investigation. GRA

N80-29829# Maryland Univ., College Park. Computer Vision Lab.
A METHOD FOR FINDING PAIRS OF ANTI-PARALLEL STRAIGHT LINES
Ann Scher, Michael Shneier, and Azriel Rosenfeld Dec. 1979 22 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A086086; TR-845) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method of pairing anti-parallel straight lines is presented and discussed. The pairing is based on the distance between the lines, the amount by which they overlap, and on whether or not other lines are interposed. Examples are shown of applying the method to high-resolution aerial photographs. Results indicate that cultural features such as roads and buildings can be extracted and that a significant reduction in the complexity of the image description can be obtained. GRA

N80-29830# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
INTERACTIVE DIGITAL TERRAIN DATA DISPLAYS Interim Report, period ending 1 Mar. 1980
Richard A. Berg 25 Feb. 1980 12 p Presented at ACSM/ASP Natl. Convention, St. Louis, 14 Mar. 1980
(AD-A085940) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Defense Mapping Agency produces and maintains cartographic digital data bases in support of military flight simulation and aeronautical operations. These data bases include terrain elevations over various geographic areas, stored in grids of varying intervals. In order to have effective management of these digital data bases, it is necessary to display them quickly, in a format which permits human comprehension of the information. An Image Manipulation Station (IMS) has been developed for this purpose. It is a color display processor interfaced to a minicomputer, magnetic tape drive and disk storage device. The IMS reads digital terrain elevations from magnetic tape, manipulates the data with software and displays various images of the information. The programs generate an image with the general appearance of topographic relief. Shaded relief and anaglyph stereo views can be added to further enhance the image. Color views are also generated for analysis purposes. Because the data base and the displayed image are congruent, an analyst can point to a position in the image and display the corresponding terrain elevation values on a CRT terminal. The IMS satisfies quality control requirements in a timely and inexpensive way. It allows the analyst to view the digital data quickly and positively to ensure that a data tape generated for distribution to field users is complete, free of discontinuities and covers the required geographic area. GRA

N80-29831# North Dakota Water Resources Research Inst., Fargo.
PHYSICAL PROPERTIES OF SOIL MOISTURE Technical Completion Report, Jul. 1976 - Sep. 1979
James W. Harrell, Jr. and Francis L. Howell Dec. 1979 40 p refs Prepared in cooperation with North Dakota Univ., Grand Forks
(Contract DI-14-34-0001-8036)
(PB80-175367; W80-04606; OWRT-A-051-NDAK(3)) Avail: NTIS HC A03/MF A01 CSCL 08M

Proton nuclear magnetic resonance and diffusion coefficient measurements were used to study the mobility of sorbed water

in Na- and Ca-montmorillonite, Na- and Ca-hectorite, and untreated kaolin. The montmorillonite and hectorite were saturated by adding a two molar chloride salt solution of either Na or Ca followed by three cycles of shaking, centrifuging, and pouring off the supernatant. Two hydrating methods were used. In the first, samples were saturated and air dried while in the second, saturated samples were equilibrated at a fixed moisture tension. Sample measurements taken include relaxation rate, pulse gradient diffusion, and tritium diffusion. GRA

N80-29832# Geological Survey, Tallahassee, Fla. Water Resources Div.
EVALUATION OF REMOTE HYDROLOGIC DATA-ACQUISITION SYSTEMS, WEST-CENTRAL FLORIDA
J. F. Turner, Jr. and W. M. Woodham Feb. 1980 71 p refs
(PB80-176951; USGS/WRD/WRI-80/020;
USGS/WRI-79/102) Avail: NTIS HC A04/MF A01 CSCL 08H

An evaluation of the hydrologic applications of a land line and tow satellite data relay systems operated during 1977-78 in the Southwest Florida Water Management District is presented. These systems were tested to evaluate operational and reliability characteristics. Telephone lines were used to relay data in the land line system, and the Geostationary Operational Environmental Satellite (GOES) and were used in the satellite system. The land system was tested for a period of 15 months at a streamflow site. Accurate data were obtained 94 percent of the time during the period. Data losses were attributed to telephone line interference, low battery voltage, and vandalism. The GOES system was tested at a rainfall site for a 17 month period. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-29833 Centec Corp., Fort Lauderdale, Fla.
THE COATING INDUSTRY: ENERGY SAVINGS WITH VOLATILE ORGANIC COMPOUND EMISSION CONTROL
Washington, D.C. DOE 1979 111 p refs
(TID-28706) Copyright. Avail: Issuing Activity

Technical and economic data are presented to enable engineers and managers in the coating industry to evaluate the energy-conservation opportunities for installation of solvent emission-control systems. Although the properties of the solvents vary considerably, the information will serve to improve the ability of the engineer to make quick estimations of energy savings, energy rates, economics, and performance of control systems and heat-recovery options. Emphasis is directed to a discussion of add-on devices, such as thermal and catalytic incineration. Extensive graphics and illustrations show energy use, and economics; these are supplemented by calculations to be used by each plant to determine site-specific data. Author

N80-29834* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NATURAL TURBULENCE ELECTRICAL POWER GENERATOR Patent
David C. Grana and Richard T. Wilem, inventors (to NASA) Issued 4 Mar. 1980 5 p Filed 3 Mar. 1978 Supersedes N78-22468 (16 - 13, p 1719)
(NASA-Case-LAR-11551-1; US-Patent-4,191,893;
US-Patent-App-SN-883090; US-Patent-Class-290-53;
US-Patent-Class-310-30) Avail: US Patent and Trademark Office CSCL 10B

An energy conversion apparatus is disclosed in which a stator, fixed to a watertight housing, is coupled to a rotor by a helical spring which suspends the rotor from the housing. Natural turbulence of a fluid, such as water or air, causes acceleration of the housing, and hence, acceleration of the stator. Inertia of the rotor, coupled to the stator through the helical spring and the housing, causes relative motion, both longitudinal and rotational, between the stator and the rotor. The rotational motion between the rotor, and the stator is used to generate electrical current. Official Gazette of the U.S. Patent and Trademark Office

N80-29835* National Aeronautics and Space Administration. Pasadena Office, Calif.
INDUCED JUNCTION SOLAR CELL AND METHOD OF FABRICATION Patent
Joseph Maserjian (JPL), Shy Shiun Chern (JPL), and Seung P. Li, inventors (to NASA) (JPL) Issued 16 May 1978 9 p Filed 15 Jun. 1976 Sponsored by NASA
(NASA-Case-NPO-13786-1; US-Patent-4,090,213;
US-Patent-Appl-SN-696374; US-Patent-Class-357-30;
US-Patent-Class-357-52; US-Patent-Class-357-91;
US-Patent-CLass-148-1.5) Avail: US Patent and Trademark Office CSCL 10A

An induced junction solar cell is fabricated on a p-type silicon substrate by first diffusing a grid of criss-crossed current collecting n+ stripes and thermally growing a thin SiO_2 film, and then, using silicon-rich chemical vapor deposition (CVD), producing a layer of SiO_2 having inherent defects, such as silicon interstices, which function as deep traps for spontaneous positive charges. Ion implantation increases the stable positive charge distribution for a greater inversion layer in the p-type silicon near the surface. After etching through the oxide to parallel collecting stripes, a pattern of metal is produced consisting of a set of contact stripes over the exposed collecting stripes and a diamond shaped pattern which functions as a current collection bus. Then the reverse side is metallized.
Official Gazette of the U.S. Patent and Trademark Office

N80-29836 Florida Univ., Gainesville.
DEVICE PHYSICS FOR ENGINEERING DESIGN OF HEAVILY DOPED REGIONS IN pn-JUNCTION SILICON SOLAR CELLS Ph.D. Thesis
Muhammed Ayman Shibib 1979 203 p
Avail: Univ. Microfilms Order No. 8016581

A quantitative study of the physical mechanism underlying the anomalously large recombination current experimentally observed in heavily doped regions of silicon pn-junction solar cells and bipolar transistors is presented. The study includes a comparison of theoretical predictions with a variety of experimental observations in heavily doped silicon and silicon devices. A major conclusion is that the simplest physical model that adequately describes the heavily doped regions must include Fermi-Dirac statistics, and phenomenological excess intrinsic carrier density (or deficit impurity concentration), Auger recombination in the bulk, and recombination at the surface. These mechanisms are incorporated in a first order model useful in the design of silicon pn-junction solar cells. The accuracy of the first order model is supported by comparing its results with the results of more detailed models and of a numerical analysis of the problem. Experimental data are presented that are consistent with the predictions of the first order model and of the numerical solution. Dissert. Abstr.

N80-29837 Stanford Univ., Calif.
MARKET PENETRATION OF ENERGY SUPPLY TECHNOLOGIES Ph.D. Thesis
Robert James Condap 1980 131 p
Avail: Univ. Microfilms Order No. 8016814

Techniques to incorporate the concepts of profit-induced growth and risk aversion into policy-oriented optimization models of the domestic energy sector are examined. After reviewing the pertinent market penetration literature, simple mathematical programs in which the introduction of new energy technologies is constrained primarily by the reinvestment of profits are formulated. The main results involve the convergence behavior of technology production levels under various assumptions about the form of the energy demand function. Next, profitability growth constraints are embedded in a full-scale model of U.S. energy-economy interactions. A rapidly convergent algorithm is developed to utilize optimal shadow prices in the computation of profitability for individual technologies. Allowance is made for additional policy

variables such as government funding and taxation. The result is an optimal deployment schedule for current and future energy technologies which is consistent with the sector's ability to finance capacity expansion. Dissert. Abstr.

N80-29838# Booz-Allen and Hamilton, Inc., Bethesda, Md.
ALTERNATIVE METERING PRACTICES. IMPLICATIONS FOR CONSERVATION IN MULTIFAMILY RESIDENCES
Jun. 1979 222 p
(Contract EC-77-C-03-1693)
(HCP/M1693-03) Avail: NTIS HC A10/MF A01

Comparisons are made of utility bills in multifamily residences where master meters and individual meters are used. Empirical evidence indicates that tenants who are made financially responsible for the energy they use, as in cases with individual or submetering, will consume less energy than tenants in a master situation. For electricity, the average savings are 15 to 20 percent. For gas, the savings are significantly less. The long-term impact of prohiting master meters is analyzed with regard to energy conservation, cost, and development of alternative energy sources for multifamily dwellings. L.F.M.

N80-29839# Department of Energy, Washington, D. C. Energy Information Administration.
CHARACTERISTICS OF THE HOUSING STOCK AND HOUSEHOLDS: PRELIMINARY FINDINGS FROM THE NATIONAL INTERIM ENERGY CONSUMPTION SURVEY
1 Oct. 1979 52 p
Avail: NTIS HC A04/MF A01

Results from a national interim energy consumption survey designed to provide information related to energy consumption by the residential sector are presented. Information on energy use was collected at the household level. A representative (national) sample of households was selected in the 48 contiguous states plus the District of Columbia. The data on actual energy consumption was obtained from fuel records maintained by the household's fuel suppliers. Four sets of tables described the households and housing units including the general structural features of the units; household inventories of major appliances; heating equipment and the distribution of fuels used for space heating, water heating, and cooling; and socioeconomic characteristics. M.G.

N80-29840# Alaska State Div. of Energy and Power Development, Anchorage.
MINIMIZING CONSUMPTION OF EXHAUSTIBLE ENERGY RESOURCES THROUGH COMMUNITY PLANNING AND DESIGN. DEVELOPMENT OF PROCEDURES FOR APPLICATION DURING PUBLIC FACILITIES PROCUREMENT PROCESS. PHASE 2: EXTENSION Final Report
Feb. 1979 151 p
(Contract EX-76-C-06-2332)
(RLO-2332-3) Avail: NTIS HC A08/MF A01

The State of Alaska's Division of Energy and Power Development conducted a study of energy conservation measures that can be incorporated in public facilities and a new community such as that proposed for the State capital, should it be relocated. The process by which such facilities are procured was revised to incorporate analysis of energy conservation measures and the control of their incorporation. Supporting procedures were also developed. Author

N80-29841# Department of Energy, Washington, D. C.
STANDBY ENERGY CONSERVATION PLAN NO. 2: BUILDING TEMPERATURE RESTRICTIONS PLAN
Feb. 1980 47 p refs
(DOE/EV-0049/1) Avail: NTIS HC A03/MF A01

The environmental impacts of the proposed building temperature restrictions plan are analyzed. The plan would result in fuel and energy savings which could be diverted to other areas. Environmental impacts, with emphasis on air quality, were analyzed and found to result in a very minor improvement in air quality. Public health impacts are also minimal, and although some individuals may experience discomfort, it can be minimized by adjustments in clothing. The change in temperature is insufficient to have any significant impact on persons suffering from most diseases. A.R.H.

N80-29842*# National Aeronautics and Space Administration, Washington, D. C.
SATELLITE POWER SYSTEMS (SPS): CONCEPT DEVELOPMENT AND EVALUATION PROGRAM: PRELIMINARY ASSESSMENT
DOE Sep. 1979 19 p refs Sponsored by DOE
(NASA-TM-81142; DOE/ER-0041) Avail: NTIS HC A02/MF A01 CSCL 10A

A preliminary assessment of a potential Satellite Power System (SPS) is provided. The assessment includes discussion of technical and economic feasibility; the effects of microwave power transmission beams on biological, ecological, and electromagnetic systems; the impact of SPS construction, deployment, and operations on the biosphere and on society; and the merits of SPS compared to other future energy alternatives. L.F.M.

N80-29843*# National Aeronautics and Space Administration, Pasadena Office, Calif.
AUTOMOTIVE ABSORPTION AIR CONDITIONER UTILIZING SOLAR AND MOTOR WASTE HEAT Patent Application
Zenon Popinski, inventor (to NASA) (JPL) Filed 30 Jul. 1980 15 p
(Contract NAS7-100)
(NASA-Case-NPO-15183; US-Patent-Appl-SN-173519) Avail: NTIS HC A02/MF A01 CSCL 10A

An absorption cycle air conditioning system for use as a space cooling system in an electrically powered motor vehicle is disclosed. The system is of a lightweight design and has a capability for achieving vehicular space cooling with minimal attendant power requirements. The system is adapted to utilize solar and motor waste heat. J.M.S.

N80-29844# National Aeronautical Lab., Bangalore (India)
A HORIZONTAL AXIS SAIL WINDMILL FOR USE IN IRRIGATION
S. K. Tewari, Ningaiah, D. V. V. Subramanyam, and A. C. Samraj
Mar. 1979 22 p refs
(NAL-TN-54) Avail: NTIS HC A02/MF A01

Some basic considerations in the design and development of a horizontal axis windmill, intended primarily for irrigation in small farms from shallow open wells are described. This windmill has six triangular sails sweeping a circle of 10 meters in diameter, and is an adaptation from Greek sail windmills. For the construction of this windmill, all efforts are made to use materials and parts readily available in the hardware market except for the gear boxes. The cost of material and parts is approximately $900 which excludes cost of machining and fabrication charges. Preliminary performance tests indiate a pumping rate of 6000 to 11,000 liters/hour over a head of 6.85 meters in wind speeds of 10 to 16 km/hr. Author

N80-29845*# General Dynamics/Convair, San Diego, Calif.
STUDY OF POWER MANAGEMENT TECHNOLOGY FOR ORBITAL MULTI-100KWe APPLICATIONS. VOLUME 3: REQUIREMENTS
J. W. Mildice 15 Jul. 1980 37 p refs 3 Vol.
(Contract NAS3-21757)
(NASA-CR-159834; GDC-ASP-80-015) Avail: NTIS HC A03/MF A01 CSCL 10B

Mid to late 1980's power management technology needs to support development of a general purpose space platform, capable of suplying 100 to 250 KWe to a variety of users in low Earth orbit are examined. A typical, shuttle assembled and supplied space platform is illustred, along with a group of payloads which might reasonably be expected to use such a facility. Examination of platform and user power needs yields a set of power requirements used to evaluate power management options for life cycle cost effectivness. The most cost effective ac/dc and dc systems are evaluated, specifically to develop system details which lead to technology goals, including: array and transmission voltages, best frequency for ac power transmission, and advantages and disadvantages of ac and dc systems for this application. System and component requirements are compared with the state-of-the-art to identify areas where technological development is required. Author

N80-29846*# Travis-Braun and Associates, Inc., Dallas, Tex.
SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT OFFICE BUILDING, ONE SOLAR PLACE, DALLAS, TEXAS Final Report
Jun. 1980 123 p
(Contract EG-77-A-01-4093)
(NASA-CR-161483) Avail: NTIS HC A06/MF A01 CSCL 10B

A solar heating on cooling system is described which is designed to provide 87 percent of the space heating needs, 100 percent of the potable hot water needs and is sized for future absorption cooling. The collection subsystem consists of 28 solargenics, series 76, flat plate collectors with a total area of 1,596 square feet. The solar loop circulates an ethylene glyco water solution through the collectors into a hot water system exchanger. The water storage subsystem consists of a heat exchanger, two 2,300 gallon concrete hot water storage tanks with built in heat exchangers and a back-up electric boiler. The domestic hot water subsystem sends hot water to the 10, 200 square feet floor area office building hot water water fixtures. The building cold water system provides make up to the solar loop, the heating loop, and the hot water concrete storage tanks. The design, construction, cost analysis, operation and maintenance of the solar system are described. R.C.T.

N80-29847*# Dallas Independent School District, Tex.
SOLAR HEATING AND DOMESTIC HOT WATER SYSTEM INSTALLED AT NORTH DALLAS HIGH SCHOOL Final Report
May 1980 106 p
(Contract EM-78-F-01-5204)
(NASA-CR-161482) Avail: NTIS HC A06/MF A01 CSCL 10B

The solar energy system located at the North Dallas High School, Dallas, Texas is discussed. The system is designed as a retrofit in a three story with basement, concrete frame high school building. Extracts from the site files, specification references for solar modification to existing building heating and domestic hot water systems, drawings, installation, operation and maintenance instructions are included. R.C.T.

N80-29848*# Citizens Mutual Savings and Loan Association, Leavenworth, Kans.
SOLAR HEATING AND COOLING SYSTEM INSTALLED AT LEAVENWORTH, KANSAS Final Report
Jun. 1980 318 p
(EM-78-F-01-5193)
(NASA-CR-161484) Avail: NTIS HC A14/MF A01 CSCL 10B

A solar heating and cooling is described which is designed to furnish 90 percent of the overall heating load, 70 percent of the cooling load and 100 percent of the domestic hot water load. The building has two floors with a total of 12,000 square feet gross area. The system has 120 flat-plate liquid solar panels with a net area of 2,200 square feet. Five 3 ton Arkla solar assisted absorption units provide the cooling, in conjunction with a 3,000 gallon chilled water storage tank. Two 3,000 gallon storage tanks are provided with one designated for summer use, whereas both tanks are utilized during winter. R.C.T.

N80-29849*# Stephens Coll., Columbia, Mo. Building and Grounds Dept.
SOLAR SPACE HEATING FOR THE VISITORS CENTER, STEPHENS COLLEGE, COLUMBIA, MISSOURI Final Report
Jun. 1980 310 p
(Contract EG-77-A-01-4084)
(NASA-CR-161485) Avail: NTIS HC A14/MF A01 CSCL 10B

The solar energy system located at the Visitors' Center on the Stephens College Campus, Columbia, Missouri is discussed. The system is installed in a four-story, 15,000 square foot building. The solar energy system is an integral design of the building and utilizes 176 hydronic flat plate collectors which use a 50 percent water ethylene blycol solution and water-to-water heat exchanger. Solar heated water is stored in a 5,000 gallon water storage tank located in the basement equipment room. A natural gas fired hot water boiler supplies hot water when the solar energy heat supply fails to meet the demand. The designed solar contribution is 71 percent of the heating load. R.C.T.

N80-29850*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION. SEASONAL REPORT FOR COLT PUEBLO, PUEBLO, COLORADO Contractor Report, Feb. 1979 - Jan. 1980
Jun. 1980 93 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161493) Avail: NTIS HC A05/MF A01 CSCL 10B

The Colt-Pueblo solar energy system, designed to provide space heating and hot water preheating, is described and its operational performance for a 12 month period from February 1979 through January 1980 is evaluated. The space heating subsystem met 31 percent of the measured space heating load which was close to the expected 34 percent solar fraction. Although the hot water solar fraction was 79 percent, the overall energy saving capability was reduced because of the low hot water demand. The measured heating subsystem performance would have improved considerably if the uncontrolled losses primarily from transport piping could have been reduced to an inconsequencital level. Fossil energy savings of 70.31 million BTUs are estimated. L.F.M.

N80-29851*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION. SEASONAL REPORT FOR SEECO LINCOLN, LINCOLN, NEBRASKA Contractor Report, Apr. 1979 - Mar. 1980
Jun. 1980 71 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161495) Avail: NTIS HC A04/MF A01 CSCL 10B

The Solar Engineering and Equipment Company (SEECO) Lincoln solar energy system, designed for space heating only, is described and its operational performance for a 12 month period from April 1979 through March 1980 is evaluated. The system met 27 percent of the space heating load; however, system losses into the heated space from the storage bin and ductwork were significant. Reducing these losses would add appreciably to the system's efficiency. Net fossil energy savings were 11.31 million BTUs. L.F.M.

N80-29852*# Communications Satellite Corp., Clarksburg, Md.
THIN n-i-p RADIATION-RESISTANT SOLAR CELL FEASIBILITY STUDY Final Report
J. F. Allison, R. A. Arndt, and A. Meulenberg, Jr. Jun. 1980 70 p refs
(Contract NAS3-21280)
(NASA-CR-159871) Avail: NTIS HC A04/MF A01 CSCL 10A

Silicon solar cells were fabricated to verify the predictions that: (1) thin n(+)pp(+) cells can provide high values of open circuit voltage even when high resistivity base material (> 1000 omega-cm) is used; (2) cells with good p(+) back contacts will display an increase in open circuit voltage with decreasing cell thickness; and (3) high quality, thin, high resistivity, solar cells can be made using processing compatible with conventional practice. Analysis of I-V and spectral response measurements of these cells confirmed theoretical predictions and thereby pointed to voltages beyond the near 600 mV obtained in this study. Author

N80-29853*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR CONTEMPORARY NEWMAN, NEWMAN, GEORGIA Contractor Report, Jun. 1979 - Apr. 1980
Jun. 1980 80 p Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161494) Avail: NTIS HC A05/MF A01 CSCL 10A

A hot solar heating and hot water system's operational performance from June 1979 through April 1980 is evaluated. Solar energy satisfied 42 percent of the total measure load (hot water plus space heating), which was somewhat higher than the solar fraction of 32 percent. When system losses into the heating space from duct leaks and storage are included, the

heating solar fraction increases from 42 to 64 percent. Net electrical energy savings were 5.47 million BTUs. L.F.M.

N80-29854*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM ECONOMIC EVALUATION: IBM SYSTEM 2, TOGUS, MAINE Final Report
Jul. 1980 95 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161510) Avail: NTIS HC A05/MF A01 CSCL 10A

The economic analysis of the solar energy system, is developed for Torgus and four other sites typical of a wide range of environmental and economic conditions in the continental United States. This analysis is accomplished based on the technical and economic models in the f-chart design procedure with inputs taken on the characteristics of the installed system and local conditions. The results are expressed in terms of the economic parameters of present worth of system cost over a projected twenty year life, life cycle savings, year of positive savings and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables is also investigated. Results demonstrate that the solar energy system is economically viable at all of the five sites for which the analysis was conducted. Author

N80-29855*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR FERN LANSING, LANSING, MICHIGAN Contractor Report, Apr. 1979 - Mar. 1980
Jun. 1980 87 p Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161491) Avail: NTIS HC A05/MF A01 CSCL 10A

A solar space heating and hot water system's operational performance from April 1979 through March 1980 is evaluated. Solar energy satisfied 15 percent of the total measured load (hot water plus space heating). Net savings were approximately 21 million BTUs. L.F.M.

N80-29856*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR IBM SYSTEM 1B, CARLSBAD, NEW MEXICO Contractor Report, Apr. 1979 - Mar. 1980
Jul. 1980 75 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161508) Avail: NTIS HC A04/MF A01 CSCL 10A

A hot solar heating and hot water system's operational performance from April 1979 through March 1980 is evaluated. The space heating and hot water loads were near expected values for the year. Solar energy provided 43 percent of the space heating and 53 percent of the hot water energy. The system did not meet the total system solar fraction design value of 69 percent because of a combination of higher estimated space heating load than was actually encountered and the apportioning of solar energy between the space heating and the domestic hot water loads. System losses and high building temperatures also contributed to this deviation. Total net savings were 23.072 million BTUs. Most of the energy savings came during the winter months, but hot water savings were sufficient to justify running the system during the summer months. L.F.M.

N80-29857*# Honeywell, Inc., Minneapolis, Minn. Technology Strategy Center.
ACTIVE HEAT EXCHANGE SYSTEM DEVELOPMENT FOR LATENT HEAT THERMAL ENERGY STORAGE Final Report
R. T. LeFrois and A. K. Mathur Apr. 1980 226 p
(Contract DEN3-38)
(NASA-CR-159727, DOE/NASA/0038-80/2; HI-79188) Avail: NTIS HC A11/MF A01 CSCL 10C

Five tasks to select, design, fabricate, test and evaluate candidate active heat exchanger modules for future applications to solar and conventional utility power plants were discussed. Alternative mechanizations of active heat exchange concepts were analyzed for use with heat of fusion phase change materials (PCMs) in the temperature range of 250 to 350 C. Twenty-six heat exchange concepts were reviewed, and eight were selected for detailed assessment. Two candidates were selected for small-scale experimentation: a coated tube and shell heat exchanger and a direct contact reflux boiler. A dilute eutectic mixture of sodium nitrate and sodium hydroxide was selected as the PCM from over 50 candidate inorganic salt mixtures. Based on a salt screening process, eight major component salts were selected initially for further evaluation. The most attractive major components in the temperature range of 250 to 350 C appeared to be NaNO3, NaNO2, and NaOH. Sketches of the two active heat exchange concepts selected for test are given. R.K.G.

N80-29858*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Solar Thermal Power Systems.
ELECTROCHEMICAL ENERGY STORAGE SYSTEMS FOR SOLAR THERMAL APPLICATIONS
S. Krauthamer and H. Frank 1 Mar. 1980 119 p refs Revised
(Contracts NAS7-100; DE-AI01-79ET-20307)
(NASA-CR-163432; JPL-Pub-79-95-Rev-1; DOE/JPL-1060/30-Rev-1) Avail: NTIS HC A06/MF A01 CSCL 10C

Existing and advanced electrochemical storage and inversion/conversion systems that may be used with terrestrial solar-thermal power systems are evaluated. The status, cost and performance of existing storage systems are assessed, and the cost, performance, and availability of advanced systems are projected. A prime consideration is the cost of delivered energy from plants utilizing electrochemical storage. Results indicate that the five most attractive electrochemical storage systems are the: iron-chromium redox (NASA LeRC), zinc-bromine (Exxon), sodium-sulfur (Ford), sodium-sulfur (Dow), and zinc-chlorine (EDA). A.R.H.

N80-29859*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
URBAN SOLAR PHOTOVOLTAICS POTENTIAL: AN INVENTORY AND MODELLING STUDY APPLIED TO THE SAN FERNANDO VALLEY REGION OF LOS ANGELES
G. L. Angelici, N. A. Bryant, R. K. Freta, and S. Z. Friedman 15 Aug. 1980 47 p refs
(Contract NAS7-100)
(NASA-CR-163436; JPL-PUB-80-43) Avail: NTIS HC A03/MF A01 CSCL 10A

Procedures for analyzing the potential of solar photovoltaic collectors to meet energy requirements in a metropolitan region are described and a modeling effort is applied to the San Fernando Valley region of Los Angeles. The procedure involves a series of steps designed to produce maps and tabulations revealing the amount of rooftop area available for establishing solar collectors and the proportion of energy requirement that could be potentially supplied by solar photovoltaics within each of the 533 mainline feeder service areas in the study area. For the sixty five square mile study area, the results showed that, with half the available flat and south facing roofs used and assuming the availability of energy storage, 52.7 percent of the actual kWh energy requirements could have been met in 1978 using photovoltaic collectors. Hourly, daily, weekly, and monthly fluctuations in potential supply and actual loads and recommendations of avenues for further research are discussed. Some further potential applications of the modeling technique are suggested. Author

N80-29860*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Solar Thermal Power Systems.
HIGH TEMPERATURE THERMAL ENERGY STORAGE IN STEEL AND SAND
Robert H. Turner 15 Dec. 1979 93 p Sponsored by NASA and DOE
(NASA-CR-159708; DOE/NASA/0100-79/1; JPL-PUB-80-35) Avail: NTIS HC A05/MF A01 CSCL 10C

The technical and economic potential for high temperature (343 C, 650 F) thermal energy storage in hollow steel ingots, pipes embedded in concrete, and for pipes buried in sand was evaluated. Because it was determined that concrete would separate from pipes due to thermal stresses, concrete was replaced by sand, which is free from thermal stresses. Variations of the steel ingot concept were not cost effective compared to the

sand-pipe approach, therefore, the sand-pipe thermal storage unit (TSU) was evaluated in depth to assess the approximate tube spacing requirements consistent with different system performance characteristics and also attendant system costs. For large TSUs which do not require fast response times, the sand-pipe approach offers attractive possibilities. A pipe diameter about 9 cm (3.5 in) and pipe spacing of approximately 25 cm (10 in), with sand filling the interspaces, appears appropriate. Such a TSU system designed for 8 hours charge/discharge cycle has an energy unit storage cost (CE) of $2.63/kWhr-t and a power unit storage cost (Cp) of $42/kW-t (in 1977 dollars). A.R.H.

N80-29861*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

INTERGENERATIONAL EQUITY AND CONSERVATION

Richard P. Otoole and A. L. Walton 15 Jun. 1980 28 p refs
(NASA-CR-163434; JPL-Pub-80-49) Avail: NTIS
HC A03/MF A01 CSCL 10B

The issue of integenerational equity in the use of natural resources is discussed in the context of coal mining conversion. An attempt to determine if there is a clear-cut benefit to future generations in setting minimum coal extraction efficiency standards in mining is made. It is demonstrated that preserving fossil fuels beyond the economically efficient level is not necessarily beneficial to future generations even in terms of their own preferences. Setting fossil fuel conservation targets for intermediate products (i.e. energy) may increase the quantities of fossil fuels available to future generations and hence lower the costs, but there may be serious disadvantages to future generations as well. The use of relatively inexpensive fossil fuels in this generation may result in more infrastructure development and more knowledge production available to future generations. The value of fossil fuels versus these other endowments in the future depends on many factors which cannot possibly be evaluated at present. Since there is no idea of whether future generations are being helped or harmed, it is recommended that integenerational equity not be used as a factor in setting coal mine extraction efficiency standards, or in establishing requirements. R.K.G.

N80-29862*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RAPPORTEUR REPORT: MHD ELECTRIC POWER PLANTS

George R. Seikel 1980 17 p Presented at 7th Intern. Conf. on MHD Elec. Power Generation, Cambridge, Mass. 16-20 Jun. 1980
(Contract EF-77-A-01-2674)
(NASA-TM-81554; DOE/NASA/2674-12; E-516) Avail: NTIS
HC A02/MF A01 CSCL 10B

Five US papers from the Proceedings of the Seventh International Conference on MHD Electrical Power Generation at the Massachusetts Institute of Technology are summarized. Results of the initial parametric phase of the US effort on the study of potential early commercial MHD plants are reported and aspects of the smaller commercial prototype plant termed the Engineering Test Facility are discussed. The alternative of using a disk geometry generator rather than a linear generator in baseload MHD plants is examined. Closed-cycle as well as open-cycle MHD plants are considered. A.R.H.

N80-29863*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GAS PHASE OXIDATION DOWNSTREAM OF A CATALYTIC COMBUSTOR

James S. Tien (Case Western Reserve Univ.) and David N. Anderson 1979 13 p refs Presented at 13th Middle Atlantic Regional Meeting of the ACS, West Long Branch, N.J., 19-23 Mar. 1979
(Contract EC-77-A-31-1040)
(NASA-TM-81551; DOE/NASA/1040-16; E-512) Avail: NTIS
HC A02/MF A01 CSCL 10A

Effect of the length available for gas-phase reactions downstream of the catalytic reactor on the emission of CO and unburned hydrocarbons was investigated. A premixed, prevaporized propane/air feed to a 12/cm/diameter catalytic/reactor test section was used. The catalytic reactor was made of four 2.5 cm long monolithic catalyst elements. Four water cooled gas sampling probes were located at positions between 0 and 22 cm downstream of the catalytic reactor. Measurements of unburned hydrocarbon, CO, and CO2 were made. Tests were performed with an inlet air temperature of 800 K, a reference velocity of 10 m/s, pressures of 3 and 600,000 Pa, and fuel air equivalence ratios of 0.14 to 0.24. For very lean mixtures, hydrocarbon emissions were high and CO continued to be formed downstream of the catalytic reactor. At the highest equivalence ratios tested, hydrocarbon levels were much lower and CO was oxidized to CO2 in the gas phase downstream. To achieve acceptable emissions, a downstream region several times longer than the catalytic reactor could be required. R.K.G.

N80-29864# Army Construction Engineering Research Lab., Champaign, Ill.

INVESTIGATION OF METHODS TO PREDICT THERMAL STRATIFICATION AND ITS EFFECT ON SOLAR ENERGY SYSTEM PERFORMANCE

B. J. Sliwinski May 1980 33 p refs
(DA Proj 4A7-61102-AT-23)
(AD-A086051; CERL-SR-E-160) Avail: NTIS
HC A03/MF A01 CSCL 10/2

This report describes a study to identify characteristics which induce thermal stratification in liquid thermal storage, and to evaluate solar energy system performance as a function of the degree of stratification. It was determined that for efficient use of thermal stratification it was necessary to (1) introduce hot fluid at the top of the liquid storage tank to add cold fluid at the bottom of the tank, (2) with a cylindrical tank, have a length/diameter ratio equal to or greater than 2.0, (3) use mathematical correlations to determine allowable fluid inlet velocities and temperatures, and (4) use storage tank material that has a thermal conductivity less than that of the storage fluid. The mathematical correlations described in this report allow stratification occurrence to be predicted and can be used to estimate the sharpness of the thermocline based on tank inlet and outlet conditions, fluid properties, and storage tank geometry. GRA

N80-29865# Spire Corp., Bedford, Mass.

DEVELOPMENT OF RECRYSTALLIZATION AND THIN-FILM SOLAR CELL PROCESSES Final Report, 1 Oct. 1977 - 30 Sep. 1978

Stanley J. Solomon May 1979 148 p refs
(Contract EG-77-C-01-4106)
(DSE-4106-T4) Avail: NTIS HC A07/MF A01

The culmination of the recrystallization effort was demonstrating grains broader than the 30 micrometer film in which they were regrown. This proof of principle was accomplished by means of a two step thermal process that consisted of large area pulsed electron beam melting followed by small area heating in a moving dc electron beam. The pulsed beam treatment reduced the three dimensional disorder of the initial submicrometer crystallite silicon film to one characterized by submicrometer cross section, full film thickness, columnar crystallites. The swept beam treatment allowed coalescence of these columnar crystallites, through directional freezing, in the melt path of the beam. The results of the studies on junction formation in 3-5 materials show that low energy ion implantation is a potentially viable alternative to liquid or vapor phase epitaxy in the fabrication of GaAs solar cells. Further, the technical feasibility of pulsed electron beam activation of ion implanted junctions in GaAs was demonstrated. The concept of forming front-layer windows of GaP and AlGaAS on GaAS by high dose ion implantation is shown to be technically feasible. DOE

N80-29866# Sandia Labs., Albuquerque, N. Mex. Radiant Heat Div.

SANDIA LABORATORIES RADIANT HEAT FACILITY

P. H. Adams, J. T. Nakos, and B. G. Strait Feb. 1980 88 p refs
(Contract EY-76-C-04-0789)
(SAND-79-2182) Avail: NTIS HC A05/MF A01

The capabilities and limitations of the Radiant Heat Facility are described along with the two main types of testing equipment, i.e., quartz lamps and graphite resistor heater arrays. The data acquistion capabilities and instrumentation techniques are outlined, and a short discussion of the theory of radiation heat transfer is presented. DOE

N80-29867# Brookhaven National Lab., Upton, N. Y. Solar Technology Group.

GROUND COUPLED SOLAR HEAT PUMP RESEARCH PROGRAM IN THE UNITED STATES

Philip D. Metz 1980 5 p refs Presented at the 5th Ann. Heat Pump Technol. Conf., Stillwater, Okla., 14-15 Apr. 1980

(Contract EY-76-C-02-0016)

(BNL-27383; CONF-800451-1) Avail: NTIS HC A02/MF A01

The ground coupling research program funded by the Systems Development Division of the Office of Solar Applications of the US Department of Energy studies the use of the Earth as a heat source/sink or storage element for solar heat pump space conditioning systems. The goal of this research program is to determine the feasibility of ground coupling, and if feasibility is confirmed, to create handbooks which facilitate widespread application of ground coupling. The research program is outlined and the research projects currently in progress and how they fit into the program are described. Progress toward the program goal is evaluated. DOE

N80-29868# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

ENVIRONMENTAL CONSTRAINTS ON GEOTHERMAL ENERGY

R. B. Craig 1979 8 p refs Presented at the Intern Conf. on Energy Use Management, Los Angeles, 22 Oct. 1979

(Contract W-7405-eng-26)

(ORNL-1310; CONF-791009) Avail: NTIS HC A02/MF A01

The environmental impacts of DOE's major geothermal programs and more than 15 projects at specific sites have been assessed. Site characteristics conducive to potentially severe environmental impacts and which tend to recur at site after site were identified. These characteristics are discussed. DOE

N80-29869# Idaho National Engineering Lab., Idaho Falls.

HYDROTHERMAL ENERGY: A SOURCE OF ENERGY FOR ALCOHOL PRODUCTION

R. R. Stiger 1980 11 p Presented at the Alcohol Alternative Conf., Chicago, 1 May 1980

(Contracts EY-76-C-07-1570; DE-AC07-76ID-01570)

(CONF-800526-1) Avail: NTIS HC A02/MF A01

A small scale (1 gal/hr) biomass-to-alcohol still was built at the Raft River Geothermal Site to investigate difficulties in geothermal assisted biomass conversion. The unit was successfully operated, producing 95% (190 proof) ethanol from sugar beet juice. The unit was designed and built in less than eight weeks from surplus equipment using commercially available design information. This small scale still demonstrated that 95% ethanol can be produced from sugar beet beer containing 8 to 10% alcohol using geothermal energy and present commercial technology. The geothermal energy and present commercial technology. The geothermal resource provided both an energy source and process water. Recently, a study was completed to analyze the economic feasibility of producing ethanol from potatoes, wheats, and sugar beets using geothermal resources available in the Raft River Region of Idaho. The study concluded that a 20 million gallon per year facility can be built that will supply alcohol at $1.78 per gallon using geothermal energy. DOE

N80-29870# Solar Turbines International, San Diego, Calif.

DEVELOPMENT OF POLYIMIDE MATERIALS FOR USE IN SOLAR ENERGY SYSTEMS Final Report, 1 Aug. 1978 - 31 Jul. 1979

A. L. Wilcoxson, U. A. Sorathia, and J. Gagliani 1980 61 p refs

(Contracts EM-78-C-04-5305; DE-AS04-78CS-35305)

(DOE/CS-35305/T2) Avail: NTIS HC A04/MF A01

A program to optimize and characterize improved insulation materials for solar energy systems is described. Two separate and distinct products have been studied, a lightweight flexible insulating foam and a high density, rigid, load bearing insulating foam. These products are derived from a polyimide resin, the formulations and processes for which were developed under NASA-JSC sponsored programs. These materials are nonburning and do not emit measurable quantities of smoke or toxic by-products. Candidate resins were selected on the basis of cost, expected foam insulating and weatherability properties and ease of production. Critical characterization parameters were established for the flexible insulating foam in the form of environmental exposure resistance, thermal conductivity and hydrolytic stability. Studies initiated to improve the exposure resistance included additive studies, using reinforcements and UV absorbers, and postcure and densification studies. Optimum resin formulations, foam densities and foam structures were identified on the basis of the exposure, thermal conductivity, and microwave testing. DOE

N80-29871# American Science and Engineering, Inc., Cambridge, Mass.

DEVELOPMENT OF A SECOND GENERATION CONCENTRATING TRACKING SOLAR COLLECTOR Final Report, 19 Jun. - 31 Oct. 1979

31 Mar. 1980 10 p

(Contract EM-78-C-04-4275)

(ASE-4524) Avail: NTIS HC A02/MF A01

Results are presented of testing done on the Second Generation Concentrating Tracking Solar Collector. This includes testing of both the single tube collector shown in Figure 1 and the 4' x 8' collector shown in Figure 2. The testing was performed between April 1979 and February 1980 under various conditions. Air conditions included clear air, haze and smog, and ambient temperature varied widely. The diversity of testing conditions provided a realistic evaluation of collector performance. DOE

N80-29872# Midwest Research Inst., Golden, Colo. Solar Thermal Research Branch.

ANALYSIS OF THE OMNIUM G RECEIVER

Mark Bohn Mar. 1980 31 p refs

(Contract EG-77-C-01-4042)

(SERI/TR-631-387) Avail: NTIS HC A03/MF A01

A thermal analysis of the Omnium-G receiver is presented and the technique is shown to be generally applicable to solar thermal receivers utilizing a directly heated thermal mass. The thermal loss coefficient, including reradiation losses, is calculated and shown to agree quite well with the experimentally measured thermal loss coefficient. The rate of heat transfer to the working fluid is also analyzed and the analysis is used to show that the Omnium-G receiver is well matched to the water/steam working fluid because the steam outlet temperature is almost the same as the receiver temperature. A general procedure for calculating receiver performance is presented. With this procedure, the energy delivery to any working fluid, the delivered temperature of the working fluid, and the pressure drop through the receiver can be determined. An example of the calculation is also presented. DOE

N80-29873# University of Southern California, Los Angeles. Dept. of Materials Science.

LOW COST SOLAR CELLS BASED ON AMORPHOUS SILICON ELECTRODEPOSITED FROM ORGANIC SOLVENTS Technical Quarterly Progress Report, 1 Mar. - 31 May 1979

F. A. Kroger 1980 31 p

(Contract EY-76-S-03-0113)

(SAN-0113-040-T7; TQPR-3) Avail: NTIS HC A03/MF A01

Electrolysis experiments were carried out using tetra ethyl ortho silicate plus propylene carbonate or 1-chloropropane or acetic acid or formamide and ammonium hexafluorosilicate plus formamide. These experiments yielded deposits which vary in color between white and black with greyish white, light or dark brown as intermediate colors depending on the deposition conditions. Energy dispersive X-ray analysis in the scanning electron microscope indicated the deposits to contain large concentrations of silicon; infrared absorption and reflection studied showed bands characteristics of Si-O, Si-Cl or Si-F vibrations and this indicates the presence of these elements in the films. Determination of carrier type in doped deposits by hot point probe method was not successful. DOE

N80-29874# Midwest Research Inst., Golden, Colo. Photovoltaic Advanced Silicon Div.

MIS AND SIS SOLAR CELLS ON POLYCRYSTALLINE SILICON

Gary Cheek and Robert Mertens (Catholic Univ. of Leuven, Belgium) Feb. 1980 29 p refs

(Contract EG-77-C-01-4042)
(SERI/TR-311-493) Avail: NTIS HC A03/MF A01

MIS and SIS structured solar cells are receiving much attention in the photovoltaic community. Seemingly, these cells could be a viable alternative to thermally diffused p-n junctions for use on thin-film polycrystalline silicon substrates. This review describes MIS/SIS structured solar cells and the possible advantages of these structures for use with thin-film polycrystalline silicon. The results of efficiency calculations are presented. Also addressed are lifetime stability and fabrication techniques amenable to large scale production. Finally, the relative advantages and disadvantages of these cells and the results obtained are presented. DOE

N80-29875# California Univ., Livermore. Lawrence Livermore Lab.
REACTIVELY SPUTTERED THIN FILM Cu/sub x/S/CdS PHOTOVOLTAIC DEVICES Final Progress Report, 1 Oct. 1978 - 30 Sep. 1979
L. D. Partain, G. A. Armantrout, J. H. Yee, J. Y. Leong, and D. OKubo 2 Apr. 1980 162 p refs
(Contract W-7405-eng-48)
(UCID-18592) Avail: NTIS HC A08/MF A01

Properties not explained by standard theory are well modeled by space-charge-limited current analysis. Extension of the SEM electron beam induced current techniques coupled with the material fabrications obtained with sputtering allowed rather complete characterizations of thin film devices for the first time. These included the minority and majority carrier transport parameters and the optical properties and indicated that unanticipated parameters determine performance and control repeatability and should establish device stability limits. The junction region losses of minority carrier current are identified as a dominant effect of heat treatment and actual junction collection efficiency values are quantified. Sputtering allowed free standing, polycrystalline Cu/sub x/S films to be formed on glass for clear determinations of charge transport and optical properties in addition to providing a highly planar geometry on the CdS substrates required for the SEM studies. DOE

N80-29876# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
DESIGN OF A PHOTOVOLTAIC SYSTEM FOR A SOUTHWEST ALL-ELECTRIC RESIDENCE
E. M. Mehalick, G. Obrien, G. F. Tully, J. Johnson, and J. Parker Apr. 1980 220 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7056) Avail: NTIS HC A14/MF A01

The grid connected residential photovoltaic system for the Southwest is designed to meet both space conditioning requirements and all conventional electrical load requirements for an all-electric residence. The system is comprised of two major subsystems, the solar array and the power conditioning subsystem (PCS). An 8 kW peak photovoltaic array been designed for the house. The 93 square meters solar array uses a shingle solar cell module in a highly redundant series/parallel matrix. The photovoltaic generated power is supplied to a 10kVA power conversion subsystem which is controlled to track the solar array maximum power operating point and feed the 240 Vac output power directly to the house loads or back to the utility when excess power is generated. The photovoltaic power is isolated from the utility by a 15 kVA transformer. The house design and subsystem specifications are given in detail. DOE

N80-29877# Commission of the European Communities, Ispra (Italy). Joint Research Center.
STANDARD PROCEDURES FOR TERRESTRIAL PHOTOVOLTAIC PERFORMANCE MEASUREMENTS: SPECIFICATION NO. 101
1979 40 p
(EUR-6423EN) Avail: NTIS HC A03/MF A01

Since the response of a solar cell is wavelength-dependent, its performance is significantly affected by the spectral energy distribution of the radiation, which in the case of natural sunlight varies with location, weather, time of year, and time of day. If the irradiance is measured with a thermopile-type radiometer, which is not spectrally selective, rated power measurements can vary by as much as 15% from day to day at the same place. The procedures are designed to minimize such discrepancies by relating the performance to a standard terrestrial solar spectral energy distribution, hereafter referred to as standard sunlight. This is done by measuring irradiance with a reference solar cell or module which has been calibrated at 25 + or -2 C in terms of short circuit current per unit of standard sunlight irradiance by an approved Solar Cell Calibration Agency. The reference cell automatically takes account of variation in spectral distribution. If the performance of a cell, module or array is related to a known standard sunlight distribution, it is possible to compute within a reasonable tolerance its performance in light or any other known spectral energy distribution. DOE

N80-29878# European Space Research and Technology Center, Noordwijk (Netherlands).
EUROPEAN TECHNOLOGY APPLICABLE TO SOLAR POWER SATELLITE SYSTEMS (SPS)
H. Stoewer 1979 24 p refs Presented at the 30th Congr. of the Intern. Astronautical Federation, Munich, 16 Sep. 1979
(INKA-Conf-79-378-046; CONF-7909124-1; IAF-79-174) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The Solar Power Satellite System (SPS) stands for a concept which is intended to collect energy in Earth orbit, transmit it to the Earth and convert it on the ground into electric energy. This paper summarizes European space technology activities that might have potential for application in a possible future Solar Power Satellite System (SPS) program. Before a decision in favor of or against an SPS development program can be made, several critical technology areas must be investigated in order to assess with a reasonable degree of confidence the potential benefits, cost and development risks associated with an SPS. Existing and developing European space technologies are compared with the expected requirements of a study assessment and early key technology verification investigations for SPS concept. It is shown that a number of existing European space technologies and the results of current development efforts apply well to this. However, very substantial advances in almost all technological areas will be necessary before a prudent decision for implementation of an SPS can be made. DOE

N80-29879# Motorola, Inc., Phoenix, Ariz. Solar Energy Dept.
THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS Final Report, 25 Sep. 1978 - 25 Sep. 1979
K. R. Sarma, M. J. Rice, R. Legge, R. W. Gurtler, and W. C. Ramsey 1 Dec. 1979 93 p refs
(Contract ET-78-C-03-2207)
(SAN-2207-T4) Avail: NTIS HC A05/MF A01

Methods of depositing thin polycrystalline silicon films, utilizing an energy beam, for producing solar cells capable of meeting long range economic and performance objectives are discussed. Progress is reported in detail on the (1) investigation of the energy beam as a means for efficient, high-rate deposition of polysilicon films; (2) development of temporary, reusable substrates for polysilicon deposition; (3) subsequent grain enhancement of self-supporting thin silicon films through laser recrystallization; and (4) demonstration of at least 10 percent efficient solar cells fabricated on these grain enhanced silicon films. DOE

N80-29880# General Accounting Office, Washington, D. C.
THE 20 PERCENT SOLAR ENERGY GOAL: IS THERE A PLAN TO ATTAIN IT?
E. B. Staats 31 Mar. 1980 15 p refs
(EMD-80-64) Avail: General Accounting Office, Washington, D.C.

The Administration's efforts, primarily those of the Department of Energy, to attain the goal of meeting 20% of the Nation's energy needs from solar resources by the year 2000 are reviewed. It was observed that while the President called for several legislative initiatives and the creation of a Solar Subcommittee, actions on them are underway, but none have yet been finalized. DOE

N80-29881# Brookhaven National Lab., Upton, N. Y.
PHOTOVOLTAIC/THERMAL HYBRID PROJECTS
Edward A. Kush. 1980. 5 p. refs. Presented at the Ann. DOE Active Solar Heating and Cooling Contractors' Rev. Meeting, Incline, Nev., 26-28 Mar. 1980
(Contracts EY-76-C-02-0016; DE-AC02-76CH-00016)
(BNL-27669) Avail: NTIS HC A02/MF A01

Systems which utilize a combination of photovoltaic and thermal collection in the same solar collectors (PV/T Systems) can have advantages over PV or thermal only systems in that the cost effectiveness of the collectors and their support structure may be improved, active cooling may allow the cells to run at lower temperatures-hence higher conversion efficiency, and space limitations on side by side collectors can be avoided. Evaluation of such systems requires formulation and assessment of collector concepts, power conditioning, storage, and control strategies, and their interactions when combined into a total system. Systems with flat plate PV/T collectors and vapor compression heat pump driven by the photovoltaic electric output are considered along with PV/T concentrating collectors and their potential applications, particularly to solar driven absorption chillers. DOE

N80-29882# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
USER EVALUATION STUDY OF PASSIVE SOLAR RESIDENCES
Sharyn Towle. Mar. 1980. 6 p. Presented at the 4th Natl. Passive Solar Energy Conf., Kansas City, Kas., 3-5 Oct. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-63-350; CONF-791022-16) Avail: NTIS HC A02/MF A01

The readiness of various passive solar energy techniques for commercialization and market potential for residential applications is assessed. The preliminary findings of a market assessment study designed to document user experiences with passive solar energy are discussed. Owners and builders of passive solar homes were interviewed and asked to comment on personal experiences with their homes. DOE

N80-29883# Suntek Research Associates, Corte Madera, Calif.
ENGINEERING DESIGN FOR THERMOCRETE CENTRAL STORAGE UNITS FOR LOW TEMPERATURE SOLAR APPLICATION. Final Report
1979. 11 p. refs.
(Contract DE-AC02-78CS-34702)
(DOE/CS-34702/4) Avail: NTIS HC A02/MF A01

The overall objective was to produce a set of value-engineered blueprints for mass-produced modular phase-change thermal storage units. As a result of the failure of Thermocrete samples during thermal evaluation, DOE project management and Suntek agreed that work on Thermocrete should be stopped at the end of September 1978, and that work should commence on incorporating Heat Mirror transparent insulation into windows and skylights. Since work on Thermocrete was stopped at approximately 20 percent complete, no blueprints were produced nor were any firm conclusions reached. The technical report outlines briefly the status of each section of work statement when the project was stopped. DOE

N80-29884# Oak Ridge National Lab., Tenn. Solar and Special Studies Station.
PASSIVE SOLAR HEATING AND NATURAL COOLING OF AN EARTH-INTEGRATED DESIGN
Paul R. Barnes and Hanna B. Shapira. 1980. 7 p. refs. Presented at the Natl. Tech. Conf. on Earth Sheltered Building Design Innovations, Oklahoma City, 18 Apr. 1980
(Contract W-7405-eng-26)
(CONF-800449-1) Avail: NTIS HC A02/MF A01

The Joint Institute for Heavy Ion Research is being designed with innovative features that will greatly reduce its energy consumption for heating, cooling, and lighting. A reference design has been studied and the effects of extending the overhang during summer and fall, varying glazing area, employing RIB, and reducing internal heat by natural lighting have been considered. The use of RIB and the extendable overhang increases the optimum window glazing area and the solar heating fraction. A mass-storage wall which will likely be included in the final design has also been considered. A figure of merit for commercial buildings is the total annual energy consumption per unit area of floor space. A highly efficient office building in the Oak Ridge area typically uses 120 to 160 kW hr/m sq. The Joint Institute reference design with natural lighting, an annual average heat pump coefficient of performance (COP) equal to 1.8, RIB, and the extendable overhang uses 71 kWhr/m sq. This figure was determined from NBSLD simulation corrected for the saving from RIB. DOE

N80-29885# Brookhaven National Lab., Upton, N. Y. Electrochemical Technology Group.
FUEL CELL APPLIED RESEARCH: ELECTROCATALYSIS AND MATERIALS. Quarterly Report, 1 Oct. - 31 Dec. 1978
S. Srinivasan, H. S. Isaacs, J. McBreen, W. E. Ogrady, H. Olender, L. J. Olmer, E. J. Taylor, C. Y. Yang, and G. P. Wirtz. Jul. 1979. 36 p. refs.
(Contract EY-76-C-02-0016)
(BNL-51072) Avail: NTIS HC A03/MF A01

Investigations were carried out on the sintering of carbon supported platinum catalysts in phosphoric acid at 150 C over a 3500 hour period. The most significant result was that the sintering rate was five times slower for these electrodes as compared with unsupported platinum electrodes. After aging the electrodes for 1200 h, attempts were made to regenerate the active areas of one of the electrodes by cycling at 100 V/s in various voltage envelopes between -0.1 V and 1.1 V. These treatments were unsuccessful for regeneration of the activity. A ring-disc electrode investigation of oxygen reduction in 85 percent phosphoric acid was carried out. Work included determination of the Tafel parameters, oxygen diffusivity, reaction order, and the extent of peroxide formation. Also, solid electrolyte fuel cells were studied. A cell was designed and fabricated for measurement of oxygen diffusion in interconnection materials. Both transient and steady methods are being used and diffusivity as well as concentration of diffusing species can be obtained. The cell is being calibrated by measuring oxygen diffusion in nickel foils of various thickness. Oxygen ion transport in In2O3, an oxygen electrode material, was also investigated using the oxide as a membrane, but leakage at the edges of cells prevented direct measurements. DOE

N80-29886*# Argonne National Lab., Ill. Integrated Assessments and Policy Evaluations Group.
PRELIMINARY COMPARATIVE ASSESSMENT OF LAND USE FOR THE SATELLITE POWER SYSTEM (SPS) AND ALTERNATIVE ELECTRIC ENERGY TECHNOLOGIES
D. E. Newsom and T. D. Wolsko. Apr. 1980. 26 p. refs. Sponsored by NASA
(Contract W-31-109-eng-38)
(NASA-CR-163327; DOE/ER-0054) Avail: NTIS HC A03/MF A01 CSCL 10A

A preliminary comparative assessment of land use for the satellite power system (SPS), other solar technologies, and alternative electric energy technologies was conducted. The alternative technologies are coal gasification/combined-cycle, coal fluidized-bed combustion (FBC), light water reactor (LWR), liquid metal fast breeder reactor (LMFBR), terrestrial photovoltaics (TPV), solar thermal electric (STE), and ocean thermal energy conversion (OTEC). The major issues of a land use assessment are the quantity, purpose, duration, location, and costs of the required land use. The phased methodology described treats the first four issues, but not the costs. Several past efforts are comparative or single technology assessment are reviewed briefly. The current state of knowledge about land use is described for each technology. Conclusions are drawn regarding deficiencies in the data on comparative land use and needs for further research. DOE

N80-29887*# Argonne National Lab., Ill. Integrated Assessment and Policy Evaluation Group.
SELECTION OF ALTERNATIVE CENTRAL-STATION TECHNOLOGIES FOR THE SATELLITE POWER SYSTEM (SPS) COMPARATIVE ASSESSMENT
Michael E. Samsa. Apr. 1980. 19 p. Sponsored by NASA
(Contract W-31-109-eng-38)
(NASA-CR-163328; DOE/ER-0052) Avail: NTIS HC A02/MF A01 CSCL 10A

An important effort is the Satellite Power System (SPS) comparative Assessment is the selection and characterization of alternative technologies to be compared with the SPS concept.

The ground rules, criteria, and screening procedure applied in the selection of those alternative technologies are summarized. The final set of central station alternatives selected for comparison with the SPS concept includes: (1) light water reactor with improved fuel utilization, (2) conventional coal combustion with improved environmental controls, (3) open cycle gas turbine with integral low Btu gasifier, (4) terrestrial photovoltaic, (5) liquid metal fast breeder reactor, and (6) magnetic confinement fusion. DOE

N80-29888# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.

ELECTRIC UTILITIES AND RESIDENTIAL SOLAR SYSTEMS

Robert Bright and Harry Davitian Apr. 1980 17 p ref Proposed for presentation at the 1980 Ann. Meeting of the Am. Sect., Intern. Solar Energy Soc. Conf., 2 Jun. 1980 Submitted for publication

(Contracts EY-76-C-02-0016)

(BNL-27711; CONF-800604-21) Avail: NTIS

HC A02/MF A01

The long-run incremental cost (LRIC) of providing electricity for solar heating and hot water systems is estimated for three utilities using a utility capacity expansion model and compared to the cost of providing electricity to electric-only systems. It is found that the LRIC for solar backup is no more than the LRIC of electricity used for purely electric heating and hot water devices and also no more than the incremental cost of normal load growth. For the three utilities, there appears to be little basis for rate distinctions between solar devices using electric backup and electric only heating and hot water devices. Off-peak storage heating and hot water devices have a much lower LRIC than the standard systems. Compared to average cost pricing, incremental cost pricing offers considerable benefits to customers using solar and electric heat and hot water, especially if a separate lower rate is adopted for off-peak storage devices. Substantial savings in the use of oil and gas fuels can be achieved if residences using these fuels convert to solar systems, savings not necessarily achievable by a shift, instead, to electric systems. DOE

N80-29889# Sandia Labs., Albuquerque, N. Mex.

SURVEY OF SELECTIVE SOLAR ABSORBERS AND THEIR LIMITATIONS

D. M. Mattox 1980 25 p refs Presented at the Intern. Conf. on Mater. for Photothermal Energy Conversion, Corsica, France, 6 May 1980

(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)

(SAND-79-2371C; CONF-800530-1) Avail: NTIS

HC A02/MF A01

A number of selective absorber coating systems with high solar absorptance exist which may be used in the mid-temperature range. Some of the systems are more chemically and thermally stable than others. Unfortunately, there are large gaps in the stability data for a large number of the systems. In an inert environment, the principal degradation mechanisms are interdiffusion between the layers or phases and changes in surface morphology. These degradation mechanisms would be minimized by using refractory metals and compounds for the absorbing layer and using refractory materials or diffusion barriers for the underlayer. For use in a reactive environment, the choice of materials is much more restrictive since internal chemical reactions can change phase compositions and interfacial reactions can lead to loss of adhesion. For a coating process to be useful, it is necessary to determine what parameters influence the performance of the coating and the limits to these parameters. This process sensitivity has a direct influence on the production process controls necessary to produce a good product. Experience with electroplated black chrome has been rather disappointing. Electroplating should be a low cost deposition process but the extensive bath analysis and optical monitoring necessary to produce a thermally stable product for use to 320 C has increased cost significantly. DOE

N80-29890# Sandia Labs., Albuquerque, N. Mex.

DESIGN AND PERFORMANCE OF AN 11 kW SOLAR ARRAY SIMULATOR

D. R. Smith, George A. OSullivan, and Frances K. OSullivan 1980 6 p refs Presented at the Power Electron. Spec. Conf., Atlanta, 17 Jun. 1980 Prepared in cooperation with Abacus Controls, Inc., Somerville, N. J.

(Contract EY-76-C-04-0789)

(SAND-80-0873C; CONF-800624-2) Avail: NTIS

HC A02/MF A01

A solar array simulator combines a high efficiency switching regulator, a high performance series regulator, and a low power analog adjustable I-V generator to duplicate the static and dynamic characteristics of photovoltaic cells operated in series parallel combinations. Both voltage and current feedback are used to control the switching and series regulators. Stability of the series regulator over a wide range of load time constants is achieved by a compensation technique. Current voltage and transient response characteristics of the simulator are presented. The device was also operated into a 10 kW inverter designed for photovoltaic applications. DOE

N80-29891# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

SCREENING METHOD FOR WIND ENERGY CONVERSION SYSTEMS

Robert D. McConnell Mar. 1980 6 p refs Presented at Am. Sect. of the Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2-6 Jun. 1980

(Contract EG-77-C-01-4042)

(SERI/TP-731-649; CONF-800604-19) Avail: NTIS

HC A02/MF A01

A screening method is presented for evaluating wind energy conversion systems (WECS) logically and consistently. It is a set of procedures supported by a data base for large conventional WECS. The procedures are flexible enough to accommodate concepts lacking cost and engineering detail, as is the case with many innovative wind energy conversion systems (IWECS). The method uses both value indicators and simplified cost estimating procedures. Value indicators are selected ratios of engineering parameters involving energy, mass, area, and power. Cost mass ratios and cost estimating relationships were determined from the conventional WECS data base to estimate or verify installation cost estimates for IWECS. These value indicators and cost estimating procedures are shown for conventional WECS. An application of the method to a tracked vehicle airfoil concept is presented. DOE

N80-29892# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

NATIONAL SOLAR OPTICAL MATERIALS PROGRAM PLAN: AN OVERVIEW

Keith D. Masterson Mar. 1980 6 p refs Presented at Los Angeles Tech. Symp., North Hollywood, Calif., 4-7 Feb. 1980; sponsored by Soc. of Photo-Opt. Instrumentation Engr.

(Contract EG-77-C-01-4042)

(SERI/TP-641-619; CONF-800207-3) Avail: NTIS

HC A02/MF A01

A coordinated national program is being formulated to adapt and develop optical materials to support a goal of meeting 20% of our national energy needs with solar by the year 2000. The program contains elements covering absorber, reflector, and transmitter materials but no photovoltaic materials. These elements include research on glass and polymer materials for glazing and reflector components, environmental testing, and long-term reliability modeling. Program subelements that support R and D and encourage commercialization of new products are also discussed. An overview of the proposed funding levels is presented. DOE

N80-29893# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

BIOLOGICAL SOLAR CELL

Michael Seibert and A. Frederick Janzen (Photochemical Research Associates, Inc., London, Ontario) Apr. 1980 8 p refs Presented at the Am. Sect. of the Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2-6 Jun. 1980

(Contract EG-77-C-01-4042)

(SERI/TP-623-656; CONF-800604-16) Avail: NTIS

HC A02/MF A01

Recent reports have demonstrated the possibility of employing photoactive, biological membrane components in photoelectrochemical cells. Present studies have led to the attachment of a

much simpler biological complex, the bacterial photosynthetic reaction center isolated from Rhodopseudomonas sphaeroides, directly onto a SnO2 semiconductor electrode. Light induced photovoltages and photocurrents not attributable to Dember effects were observed in photoelectrochemical cells employing reaction center coated, SnO2 working electrodes. Such reaction center electrodes may serve as model systems for future organic photovoltaic devices. DOE

N80-29894# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SUMMARY OF SOLAR EXPERIENCE WITH THE SOILING OF OPTICAL SURFACES
Patrick J. Call Feb. 1980 15 p refs Workshop held in Denver, 16-17 Jul. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-334-478) Avail: NTIS HC A02/MF A01

The results of a workshop held on July 16-17, 1979 to discuss available experimental data, current and planned experimental investigations, directly applicable optical principles, and relevant theory are summarized. The summary is in terms of the magnitude of effects on various types of systems and the effects of location, surface properties, and natural/artificial removal. The economics of prevention, tolerance, and removal are also summarized. DOE

N80-29895# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
OVERVIEW OF THICK-FILM TECHNOLOGY AS APPLIED TO SOLAR CELLS
K. Firor and S. Hogan Jan. 1980 8 p refs Presented at the Electron. Component Conf. of the IEEE, 28-30 Apr. 1980
(Contract EG-77-C-01-4042)
(SERI/TP-331-541; CONF-800421-3) Avail: NTIS HC A02/MF A01

The use of thick film technology in solar cell development is discussed in some detail. Screen printing as an alternate to more expensive, high vacuum techniques in several of the production steps during the manufacture of silicon solar cells is discussed. Screen printing is fairly well established as a means of providing electrical contact to a cell and for the formation of a back surface field. Under investigation are the possibilities of non-noble metal contacts and protective and antireflective coatings applied to solar cells by the use of screen printing. The fabrication of the active layers of a solar cell, using thick film inks made up of 2 to 6 semiconductors is also addressed. DOE

N80-29896# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
CHEMICAL VAPOR DEPOSITION OF THIN-FILM POLYCRYSTALLINE Si FOR LOW-COST SOLAR CELLS Quarterly Technical Progress Report, 23 Jul. - 2 Nov. 1979
Ralph P. Ruth, William I. Simpson, Lavada A. Moudy, and Jane J. J. Yang Nov. 1979 35 p refs
(Contract DE-AC03-79ET-23045)
(DOE/ET-23045/1; QTPR-1) Avail: NTIS HC A03/MF A01

A research program conducted for the purpose of developing thin-film polycrystalline Si solar cells on low cost substrate materials, using chemical vapor deposition (CVD) techniques to prepare the films and vapor growth doping, thermal diffusion, or ion implantation to produce the required p-n junctions is discussed. An existing Si CVD reactor system is used for the investigations and its design features are discussed. System background doping concentrations and Si film growth rate uniformity were determined, and general film quality typical of the system and the reactants in use was established, including the properties of Si-on-saphire films prepared during the course of the initial investigations. These results are described in detail. A working curve for growth of boron-doped p type Si films was established for film growth at about 1000 C, covering the concentration range 1 x 10 to the 16th power to 3 x 10 to the 19th power per cu cm. DOE

N80-29897*# PRC Energy Analysis Co., McLean, Va.
SOME QUESTIONS AND ANSWERS ABOUT THE SATELLITE POWER SYSTEM (SPS)
Jan. 1980 46 p refs Sponsored by NASA
(Contract DE-AC01-79ER-10041)
(NASA-CR-163329; DOE/ER-0049/1) Avail: NTIS HC A03/MF A01 CSCL 10A

Progress in the evaluation of the concept of obtaining significant amount of electrical energy from space through the Satellite Power System is reported. The Concept Development and Evaluation Program plan is described including: systems definition, environmental assessment, societal assessment, and comparative assessment. DOE

N80-29898# Lockheed Missiles and Space Co., Palo Alto, Calif.
AMORPHOUS THIN FILMS FOR SOLAR CELL APPLICATION Final Technical Report, 15 Mar. 1979 - 29 Feb. 1980
A. D. Jonath, W. W. Anderson, J. L. Crowley, H. F. MacMillan, F. A. Junga, J. F. Knudsen, K. M. Monahan, and J. A. Thornton Mar. 1980 69 p refs
(Contract DE-AC03-79ET-23040)
(DOE/ET-23040/4; LMSC-D766003) Avail: NTIS HC A04/MF A01

Magnetron sputtering, a deposition method in which magnetic confinement of a plasma encourages high deposition rates at low working gas partial pressures, is under investigation as a candidate production technology for large scale manufacture of high efficiency, thin film amorphous silicon solar photovoltaic cells. The approach uses two dc magnetron geometries: (1) a low-cost planar magnetron (PM) system for exploratory and detailed examination of deposition parameter space; and (2) a cylindrical magnetron (CM) system, scalable to production sizes, for deposition of homogeneous films over large areas. Detailed descriptions of these two systems are included. Amorphous silicon films and device structures were sputtered in both PM and CM systems under a wide range of deposition conditions using both doped and undoped sputter targets. Measured electrical and optical film properties indicate that control over a wide range of conductivity, photoconductivity, conductivity activation energy, and optical and infrared absorption behavior is achievable. DOE

N80-29899# Ueland and Junker, Architects and Planners, Philadelphia, Pa.
SOLAR ATRIUM: A HYBRID SOLAR HEATING AND COOLING SYSTEM Technical Progress Report, 19 Sep. - 19 Dec. 1979
Mark Ueland 28 Dec. 1979 11 p refs
(Grant EG-77-G-04-4135)
(ALO-4135-T2; TPR-9) Avail: NTIS HC A02/MF A01

A program of applied research was developed for the design, construction, and monitoring of an inovative concept of solar heating and cooling called solar atrium. The solar atrium concept is adaptable to residences and smaller commercial and institutional buildings. It is designed to be constructed of materials and equipment that are economical and readily available. Cost effectiveness of installation and operation is a primary design objective. Progress in construction and instrumentation is listed. DOE

N80-29900*# Department of Energy, Washington, D. C. Office of Energy Research.
SATELLITE POWER SYSTEM (SPS) FY 79 PROGRAM SUMMARY
Jan. 1980 200 p refs
(NASA-CR-163479; DOE/ER-0037) Avail: NTIS HC A09/MF A01 CSCL 10A

The Satellite Power System (SPS) program a joint effort to develop an initial understanding of the technical feasibility, the economic practicality, and the social and environmental acceptability of the SPS concept is discussed. This is being accomplished through implementation of the Concept Development and Evaluation Program Plan which is scheduled for completion by the end of FY 1980. This Program Summary not only covers FY 1979 but includes work completed in FY 1977 and FY 1978 in order to give a comprehensive picture of the DOE involvement in the SPS concept development and evaluation process. DOE

N80-29901# General Electric Co., Philadelphia, Pa. Space Div.
DYNAMIC ISOTOPE POWER SYSTEM (DIPS) APPLICATIONS STUDY. VOLUME 1: SUMMARY Final Report
Nov. 1979 64 p 3 Vol.

(Contract ET-78-C-01-3267)
(DOE/ET-3267/1-Vol-1; GESD-79DS4228-Vol-1) Avail: NTIS HC A04/MF A01

The Nuclear Integrated Multimission Spacecraft is designed for communications, surveillance, navigation, and meteorological missions. This study assesses the attributes of the Dynamic Isotope Power System for this spacecraft. These attributes include cost, system, mission compatibility, and survivability. DOE

N80-29902# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.
SOLAR POND STUDIES, PHASE 3 M.S. Thesis. Semiannual Progress Report
Howard C. Bryant and Markus Karl Rothmeyer 10 Jan. 1980 126 p refs
(Contract EY-77-S-04-3977)
(ALO-3977-5; SAPR-5) Avail: NTIS HC A06/MF A01

The diffusion equation for salt gradient solar ponds was modified to include the Soret effect. The contribution of the Soret effect to the diffusion flux of salt is shown to be on the order of 4% in the winter and 28% in the summer for the UNM NaCl solar pond. The traditional stability criterion for solar ponds remains practically unchanged by the Soret effect. However, the contribution of nonconstant properties seems to be significant. Saturated solar ponds are described by a system of differential equations which include the Soret effect, the formation, and redissolving of crystals. The analytical solutions of this system are given for the steady-state and constant properties. A laboratory experiment using KNO3 confirms the existence of a stable saturated gradient. Temperatures of up to 90 C and temperature gradients of up to 2 C/cm were used in the experiment without any sign of convective layers. DOE

N80-29903# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
HUMAN COMFORT AND AUXILIARY CONTROL CONSIDERATIONS IN PASSIVE SOLAR STRUCTURES
Wayne Place, Ronald Kammerud, Brandt Andersson, Benay Curtis, William Carroll, Craig Christensen, and Mark Hannifan Apr. 1980 9 p refs Presented at the Intern. Congr. on Building Energy Management, Povoa de Varzim, Portugal, 12-16 May 1980 Prepared in cooperation with Midwest Research Inst., Golden, Colo.
(Contract W-7405-eng-48)
(LBL-10034; CONF-800524-3) Avail: NTIS HC A02/MF A01

Energy consumption and human comfort implications of various passive solar and energy conservation strategies are investigated for single family, one story, slab on grade residences in Albuquerque, NM and Washington, DC. The building energy analysis computer program BLAST is used to perform annual dynamic heating and cooling load calculations for a building in which the glazing area, glazing location, and thermal mass are varied systematically. The impacts on building performance of forced flow ventilative cooling and nighttime and weekday thermostat setpoint adjustments are investigated. The results indicate that the annual heating and cooling loads are highly sensitive to glazing area, glazing location, and thermostatic controls. Annual cooling loads are substantially reduced by increased thermal mass in the walls. In contrast, annual heating loads are fairly insensitive to increased thermal mass in the walls, unless very large areas of south glazing are involved. DOE

N80-29904# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
OVERVIEW-ABSORPTION/RANKINE SOLAR COOLING PROGRAM
Michael Wahlig, Al Heitz, and Barbara Boyce Mar. 1980 5 p Presented at the Ann. DOE Active Solar Heating and Cooling Contractors' Rev. Meeting, Incline Village, Nev., 26-28 Mar. 1980
(Contract W-7405-eng-48)
(LBL-10770; CONF-800340-7) Avail: NTIS HC A02/MF A01

The tasks being performed in the absorption and Rankine program areas run the gamut from basic work on fluids to development of chillers and chiller components, to field and reliability testing of complete cooling systems. In the absorption program, there are six current and five essentially completed projects. In the Rankine program, there are five current projects directly supported by DOE, and three projects funded through and managed by NASA/MSFC (Manned Space Flight Center, Huntsville, Alabama). The basic features of these projects are discussed. The systems under development in five of these current projects were selected for field testing in the SOLERAS program, a joint US-Saudi Arabian enterprise. Some technical highlights of the program are presented. DOE

N80-29905# Brown, Boveri und Cie, A.G., Heidelberg (West Germany). Zentrales Forschungslab.
DEVELOPMENT OF SODIUM SULFUR BATTERIES Final Report
Roland Bauer, Wilfried Fischer, Wilhelm Haar, Bernd Hartmann, Herbert Kleinschmager, Henner Meinhold, and Gert Weddigen Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 126 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-60; ISSN-0340-7608) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 26.05

The principal problems in the development of sodium sulfur batteries are essentially solved now that a 10 kWhr experimental battery was tested successfully. Extrapolation of the experimental results permits the conclusion that the properties necessary for application can be defined. The beta-alumina solid electrolyte was optimized with respect to electrical conductivity and lifetime. The sulfur electrode was improved with respect to sulfur utilization and the cathode current collector case with respect to corrosion resistance. Cells of the type being used in an experimental battery (60 to 90 Whr/kg depending on charge/discharge time) were cycled up to 350 times. Capacity declined 3 to 30% during this time, the rate being dependent on casing material. The energy density of cells optimized with respect to weight amounts to about 165 Whr/kg. The first results achieved with the 10 kWh experimental battery are in accordance with results obtained with single cells. Higher energy density, higher lifetime, and better thermal insulation must be achieved. Author (ESA)

N80-29906# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DEVELOPMENT OF HIGH TEMPERATURE RESISTANT, SOLAR ABSORBER SURFACES Final Report
Werner Scherber and Guenther Dietrich Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 113 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-70; ISSN-0340-7608) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 23.55

Preparation techniques for selective coatings on high temperature solar collectors and their economic use were investigated by reproducing and improving known methods as well as developing alternative types of selective coatings. All samples were evaluated applying uniform criteria. The transfer of laboratory results to large area deposition is demonstrated to be feasible for a coating suitable for absorber temperatures up to 400 C. In-service results for prototypes of selective coated central receiver tubes produced and installed in a 10 kW solar power station in Cairo, Egypt are discussed. Author (ESA)

N80-29907# Battelle Inst., Frankfurt am Main (West Germany).
DEVELOPMENT OF A CADMIUM SELENIDE THIN FILM SOLAR CELL Final Report
Dieter Bonnet Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 87 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-72; ISSN-0340-7608) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18.50

A project aimed at developing a CdSe MIS thin film solar cell was conducted. Fourteen materials were studied with regard to their suitability as I-layers. Two of these compounds, i.e., ZnSe and SbSe, were found to result in cells with relatively high photovoltage and high photocurrent. The preparation procedure for 2 micron thick active CdSe film was optimized

with respect to all essential parameters. Commercial, nominally very pure CdSe material from six manufacturers was found either to be unsuited or to lead to properties greatly varying from batch to batch. The best reproducible results were obtained with a material directly synthesized from elements which are commercially available in highly pure form. Tests show that experimental cells achieve efficiencies of 4.5%. Short circuit densities of more than 25 mA/cu cm, given incident solar radiation of 100 mW/cu cm, and open circuit voltages around 600 mV are realized. Further enhancement of the photovoltage up to 700 or 800 mV seems possibly by suitable doping of the CdSe layer and compensation of the doping near the surface. This as well as an enhancement of the fill factor from 55% to 70% could increase the cell efficiency to 9 or 10%. Author (ESA)

N80-29908# Deutsche Automobilgesellschaft m.b.H., Esslingen (West Germany). Forschungslab.
NICKEL HYDROGEN CELL DEVELOPMENT CENTERED ON POSITIVE ELECTRODES WITH HIGH CAPACITY PER UNIT AREA FOR LOAD LEVELING AND TRACTION APPLICATIONS Final Report
Guenter Gutmann and Rolf Linkohr Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 108 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-74) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22.70

Scale-up of single cell storage batteries to adapt the system to electric vehicle and load leveling applications was pursued. The development of a low cost Ni/H2 cell making use of positive electrodes of high capacity per unit area (70 to 120 mAhr/cu cm), for orbiting satellites and super to sealed Ni/Cd cells in energy density and reliability is considered. Results from a heat management study reveal that under traction conditions, cell size must be restriced to 120 Ahr. Feasibility of cells with nonhydrophobic negatives together with positives of 100 to 120 mAhr/cu cm was shown experimentally, best performance data being obtained with 2.2 to 2.6 cu cm/Ahr of electrolyte for a one to two hour discharge rate. Results for two 130 Ahr cells show the limits of thermal capability as built; without additional cooling only 87 percent of the capacity of positives inserted can be taken from the cells. An energy density of 47 Whr/kg is demonstrated at the two to five hour discharge rate. Self discharge is found to be about 8 percent per day. According to materials savings and the reduction in number of stack parts achieved by the cell design, costs are cut to about half that of designs now in use. Author (ESA)

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-29909 Maryland Univ., College Park.
COMPOSITION OF PARTICULATE TRACE ELEMENTS IN PLUMES FROM INDUSTRIAL SOURCES Ph.D. Thesis
Mark Small 1979 463 p
Avail: Univ. Microfilms Order No. 8016999

Relative abundances of many elements attached to particles were determined for emissions from three types of industrial sources: copper smelters, a lime kiln and an integrated iron and steel works. Plume samples were collected with an instrumented light aircraft and analyzed by instrumental neutron activation analysis and atomic absorption for up to forty elements. Chemical-element balances were used to estimate contributions from each of these sources to the total suspended particulate material of several urban centers. Air filter samples from plumes of five copper smelters in southeastern Arizona were analyzed for 37 elements. Abundances of many volatile and chalcophilic elements were found to be greatly enriched compared to the crustal abundance pattern for those elements. Crustal enrichment factors, relative to Al, of up to 75 million were observed. Among the five smelters studied, concentrations relative to copper for many elements varied by as much as two orders of magnitude. These unique relative abundance patterns permitted the determination of particulate material from specific smelters in ambient air. Dissert. Abstr.

N80-29910 Stanford Univ., Calif.
MODELING AND ANALYSIS OF AIR QUALITY DATA Ph.D. Thesis
Cyril Daniel Grivet 1980 176 p
Avail: Univ. Microfilms Order No. 8016824

Air pollution was monitored in the San Francisco Bay Area at some 30 stations. The data collected was intended to be representative of air pollution in the whole air basin. It was also assumed that the manner in which these data were summarized and reported was appropriate for comparisons with air quality standards. The variations in pollution levels with time and location were assessed in order to gauge the representativity of air pollution data collected. Meteorology was an obvious factor of these variations so that the statistical interplay between pollution and weather was first investigated. This investigation was limited to oxidant, the worst pollutant in the Bay Area, and to the months of July and August, the worst months for oxidant pollution. It was actually the logarithm of the oxidant level which was used, for statistical reasons. There were eight weather variables available to summarize the meteorology of the Bay Area: temperature, wind, speed, percentage sunshine and stability at various locations. The linear effect of the weather on pollution was gauged through regressions. Dissert. Abstr.

N80-29911*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF CONVERSATION INTERFERENCE ON ANNOYANCE DUE TO AIRCRAFT NOISE
Kelli F. Key and Clemans A. Powell Aug. 1980 38 p refs
(NASA-TP-1712; L-13709) Avail: NTIS HC A03/MF A01 CSCL 13B

The annoyance and interference effects of aircraft flyover noise on face to face conversation were investigated. Twenty 5 minute sessions, each composed of three flyovers, were presented to each of 20 pairs of female subjects in a simulated living room. Flyovers varied in peak noise level (55-79 dB, A-weighted) and spectrum (low or high frequency components). Subjects engaged in conversation for 10 sessions and in reverie for the other 10 sessions, and completed subjective ratings following every session. Annoyance was affected by noise level, but was not significantly different for the two activities of reverie and conversation. A noise level of 77 db was found unacceptable for conversation by 50 percent of the subjects. Conversation interference was assessed by incidence of increased vocal effort and/or interruption of conversation during flyovers. Although conversation interference increased with noise level, the conversation interference measures did not improve prediction of individual annoyance judgments. Author

N80-29912# Department of Energy, Washington, D. C. Office of Technology Impacts.
ENVIRONMENTAL DATA, ENERGY TECHNOLOGY CHARACTERIZATIONS: GEOTHERMAL
Apr. 1980 41 p refs
(DOE/EV-0077) Avail: NTIS HC A03/MF A01

Two hydrothermal convective systems are discussed: vapor dominated and liquid dominated. The following topics are covered for each: characteristics, constraints, resource consumption, environmental considerations, and economic data. DOE

N80-29913# Environmental Protection Agency, Kansas City, Mo.
ENVIRONMENTAL EVALUATION OF GASOHOL PRODUCTION AND HEALTH EFFECTS
J. W. Mandia Oct. 1979 58 p Presented at the Environmental Evaluation Gasohol Production and Health Effects Seminar, Kansas City, Mo., 27 Jun. 1979 Prepared in cooperation with EPA, Cincinnati, Ohio
(EPA-907/9-79-005; CONF-7906160) Avail: NTIS HC A04/MF A01

Fermentation methods in the production of ethanol from cellulosic biomass are described. The environmental impacts of these processes are discussed. Problems in the disposal of residues of fermentation processes are also discussed. Emissions from the combustion of gasohol are tabulated. Advantages in the use

of gasohol vs gasoline are presented. Farm production of ethanol from agricultural residues is also discussed. DOE

N80-29914*# New Mexico Univ., Albuquerque. Technology Application Center.
ACID RAIN. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1975 - Apr. 1980
Mary K. Callagher May 1980 19 p Sponsored in part by NASA and NTIS
(NASA-CR-163324; PB80-810773) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

A bibliography containing 67 citations from international literature describing acid precipitation and its effects on the environment is presented. Topics covered include: air pollution, pollution monitoring, atmospheric composition, meteorological parameters and ecosystems. GRA

N80-29915# Gulf Research and Development Co., Chestwick, Pa.
EFFECT OF AMBIENT TEMPERATURE ON VEHICLE EMISSIONS AND PERFORMANCE FACTORS. APPENDIX C: GAS CHROMATOGRAPHIC RESULTS Final Report
R. S. Spindt, R. E. Dizak, R. M. Stewart, and A. P. Meyer Sep. 1979 837 p 2 Vol.
(Contract EPA-68-03-2530)
(PB80-173784; EPA-460/3-79-006C-App-C) Avail: NTIS HC A99/MF A01 CSCL 13B

Results of exhaust emissions (regulated and unregulated) and fuel economies associated with fourteen selected vehicles tested at ambient temperatures ranging from 0 F (18 C) to 110 F (43 C) using the various test procedures are presented. Separate analyses were made for each of the three phases of the Federal Test Procedure. The major components by group as well as the results on 75 individual peaks typically found are summarized. While many of the peaks represent individual compounds, others represent two or more compounds that were not separated. The total parts per million carbons (ppmc) by flame ionization detector is reported along with the total ppmc obtained by summing the gas chromatographic results. GRA

N80-29916# Gulf Research and Development Co., Chestwick, Pa.
EFFECT OF AMBIENT TEMPERATURE ON VEHICLE EMISSIONS AND PERFORMANCE FACTORS. APPENDIX A: TEST RESULTS FOR ALL VEHICLES. APPENDIX B: PLOTS OF EXHAUST GAS CATALYST OUT TEMPERATURES Final Report
R. S. Spindt, R. E. Dizak, R. M. Stewart, and W. A. P. Meyer Sep. 1979 501 p refs 2 Vol.
(Contract EPA-68-03-2530)
(PB80-173776; EPA-460/3-79-006B-App-A/B) Avail: NTIS HC A21/MF A01 CSCL 13B

Both the 1975 Federal Test Procedure and the Highway Fuel Economy Test must be conducted at ambient temperatures from 68 F (20 C) to 86 F (30 C). Since cars in service must start and run over a much broader temperature range than this, 14 selected vehicles were tested at ambient temperatures ranging from 0 F (-18 C) to 100 F (43 C) to determine how well the various car age groups and emission control technologies available today would perform at the more extreme temperatures. It was also desired to know how the use of a car's air conditioner would affect exhaust emissions and fuel economies. The results of exhaust emissions (regulated and unregulated) and fuel economies are tabulated. GRA

N80-29917# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
EVALUATION OF THE REAL-TIME AIR-QUALITY MODEL USING THE RAPS (REGIONAL AIR POLLUTION STUDY) DATA BASE. VOLUME 1: OVERVIEW Final Report, 1 Oct. 1977 - 1 Apr. 1979
Ronald E. Ruff Feb. 1980 30 p refs 4 Vol.
(Contract EPA-68-02-2770)
(PB80-178346; Rept-6868-FR-Vol-1;
EPA-600/4-80-013A-Vol-1) Avail: NTIS HC A03/MF A01; also available in set of 4 reports HC E12 as PB80-178338 CSCL 04A

The theory and programming of statistical tests for evaluating the Real-Time Air-Quality Model (RAM) using the Regional Air Pollution Study (RAPS) data base are fully documented. Moreover, the tests are generally applicable to other model evaluation problems. An overview of the tests, displays, software, and application of the resulting statistical package are presented. GRA

N80-29918# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
EVALUATION OF THE REAL-TIME AIR-QUALITY MODEL USING THE RAPS (REGIONAL AIR POLLUTION STUDY) DATA BASE. VOLUME 2: STATISTICAL PROCEDURES Final Report, 1 Oct. 1977 - 1 Apr. 1979
Harold S. Javitz and Ronald E. Ruff Feb. 1980 57 p refs 4 Vol.
(Contract EPA-68-02-2770)
(PB80-178353; Rept-6868-FR-Vol-2;
EPA-600/4-80-013B-Vol-2) Avail: NTIS HC A04/MF A01; also available in set of 4 reports HC E12 as PB80-178338 CSCL 04A

The tests considered for evaluating air quality simulation models in general and those that would be useful in evaluating the RAM are presented. The capability of the RAM to predict sulfur dioxide (SO2) concentrations was of particular interest. Specific tests for both intermediate and final evaluations are recommended, with accompanying descriptions of formats, plots, and procedures to establish confidence limits. Discussion focuses on the mathematics, procedures, and interpretation of the individual tests; their relevance to the project objectives; and possible trade offs among tests. GRA

N80-29919# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
EVALUATION OF THE REAL-TIME AIR-QUALITY MODEL USING THE RAPS (REGIONAL AIR POLLUTION STUDY) DATA BASE. VOLUME 3: USER'S GUIDE Final Report, 1 Oct. 1977 - 1 Apr. 1979
Ronald E. Ruff, Hisao Shigeishi, and Rodney H. Allen (Comp-Aid, Inc., Research Triangle Park, N.C.) Feb. 1980 141 p refs 4 Vol.
(Contract EPA-68-02-2770)
(PB80-178361; Rept-6868-FR-Vol-3;
EPA-600/4-80-013C-Vol-3) Avail: NTIS HC A07/MF A01; also available in set of 4 reports HC E12 as PB80-178338 CSCL 04A

The software used in the statistical tests for evaluating the RAM is presented. Six statistical tests are described, with attention to the programming philosophy behind them. Also presented is a review of the auxiliary software that sort, retrieve, format, and display the data. GRA

N80-29920# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
EVALUATION OF THE REAL-TIME AIR-QUALITY MODEL USING THE RAPS (REGIONAL AIR POLLUTION STUDY) DATA BASE. VOLUME 4: EVALUATION GUIDE Final Report, 1 Oct. 1977 - 1 Apr. 1979
Ronald E. Ruff Feb. 1980 59 p refs 4 Vol.
(PB80-178379; Rept-6868-FR-Vol-4;
EPA-600/4-80-013D-Vol-4) Avail: NTIS HC A04/MF A01; also available in set of 4 reports HC E12 as PB80-178338 CSCL 04A

The application and interpretation of the statistical programs, particularly with regard to use on the RAM is discussed. In general, there is no set procedure for evaluating an air quality model because of the different reasons for evaluating models and many subjective decisions to be made during the process. However, guidelines are presented to cover a wide variety of evaluation needs, with attention to data preparation, classification, analysis, selection and application of tests, and interpreation of results. Several methods of diagnosing causes of poor model performance are discussed and some sample program outputs are also provided. GRA

N80-29921# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
ADVANCED COMBUSTION SYSTEMS FOR STATIONARY

GAS TURBINE ENGINES. VOLUME 1: REVIEW AND PRELIMINARY EVALUATION Final Report, Dec. 1975 - Sep. 1976
Stanley A. Mosier and Robert M. Pierce Jan. 1980 49 p refs 2 Vol.
(Contract EPA-68-02-2136)
(PB80-175599; FR-11405-Vol-1; EPA-600/7-80-017A-Vol-1)
Avail: NTIS HC A03/MF A01 CSCL 13B

Duty cycles were analyzed to identify current and projected dominant operating modes and requirements of stationary gas turbine engines. These analyses indicate that as compression ratios and turbine inlet temperatures are increased to improve thermal efficiency, uncontrolled NOx emissions can be expected to double in 10 years and triple in 20 years. An extensive survey was made of candidate combustor concepts, and an analytical study was made from which those concepts considered to have significant potential for reducing production of NOx were identified. An initial compilation of 26 combustor design concepts was assembled, indicating potential for controlling NOx from clean fuels and/or fuels containing significant amounts of bound nitrogen. GRA

N80-29922# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
ADVANCED COMBUSTION SYSTEMS FOR STATIONARY GAS TURBINE ENGINES. VOLUME 2: BENCH SCALE EVALUATION Final Report, Sep. 1976 - Jan. 1978
Robert M. Pierce, Stanley A. Mosier, Clifford E. Smith, and B. S. Hinton Jan. 1980 384 p ref 2 Vol.
(Contract EPA-68-02-2136)
(PB80-175607; FR-11405-Vol-2; EPA-600/7-80-017B-Vol-2)
Avail: NTIS HC A16/MF A01 CSCL 13B

Results from the testing program identified two design approaches capable of significant emission reduction. A staged centertube design, relying on burner operation near the lean blowout limit, gave low NOx and CO emissions on clean no. 2 fuel oil, but was ineffective for fuels containing bound nitrogen. A rich-burn/quick-quench (RB/QQ) design, producing a fuel-rich primary zone and quickly quenching the effluent from that region to the high overall excess air conditions required by the gas turbine cycle, successfully controls NOx from both thermal and fuel-bound sources while maintaining low CO emissions for high thermal efficiency. The RB/QQ concept was selected for scaleup to full size hardware. GRA

N80-29923# TRW, Inc., Redondo Beach, Calif.
RESIDUAL OXIDANTS REMOVAL FROM COASTAL POWER PLANT COOLING SYSTEM DISCHARGES: FIELD EVALUATION OF SO2 ADDITION SYSTEM Final Report, Jan. - Nov. 1979
K. Scheyer and G. Houser Mar. 1980 42 p refs
(Contract EPA-68-02-2613)
(PB80-170764; EPA-600/7-80-049) Avail: NTIS HC A03/MF A01 CSCL 13B

Samples of unchlorinated, chlorinated, and dechlorinated cooling water were obtained at Pacific Gas and Electric's Potrero power plant in San Francisco. An amperometric titrator was used for field analysis of total oxidant residual (TOR) and free oxidant residual (FOR). Analytical results, plant operating data, and laboratory experiments were used to evaluate the dechlorination system. Major conclusions include: (1) the dechlorination system studied showed effective removal of residual oxidants from chlorinated sea water used in the power plant cooling systems; (2) the dechlorination system proved reliable (no measurable oxidant residual was found at the effluent outfall); and (3) due to the effectiveness of the dechlorination system in removing all measurable oxidant residual, average and maximum levels of dechlorination cannot be determined. GRA

N80-29924# Systems Applications, Inc., San Rafael, Calif.
MODELING OF SIMULATED PHOTOCHEMICAL SMOG WITH KINETIC MECHANISMS, VOLUME 1 Final Report, Jul. 1978 - Sep. 1979
G. Z. Whitten, J. P. Killus, and H. Hogo Feb. 1980 364 p refs
(Contract EPA-68-02-2428)
(PB80-175102; EF79-124-Vol-1; EPA-600/3-80-028A) Avail: NTIS HC A16/MF A01 CSCL 07E

Mechanisms that describe the formation of photochemical smog are developed using a computer modeling technique directed toward the simulation of data collected in two smog chambers: an indoor chamber and a dual outdoor chamber. The results of simulating 164 different experiments are presented. Individual compounds for which specific experiments were simulated and mechanisms developed include the following: formaldehyde, acetaldehyde, ethylene, propylene, butane, and toluene. The mechanisms reported describe the decay of the precursor organic compound, formation and decay of secondary organic compounds, conversion of nitrogen oxides, formation of nitrates, and the appearance and decay of ozone. GRA

N80-29925# Ohio State Univ., Columbus. Dept. of Chemistry.
KINETIC STUDIES OF SIMULATED POLLUTED ATMOSPHERES Final Report, Jan. 1976 - Apr. 1979
Jack G. Calvert Jan. 1980 281 p refs
(Grant EPA-R-804348)
(PB80-176787; EPA-600/2-80-024) Avail: NTIS HC A13/MF A01 CSCL 04A

The kinetics and reaction mechanisms of several important atmospheric contaminants, SO2, formaldehyde, nitrous acid, and the nitrosamines, were assessed to help quantify some key aspects of the chemistry of polluted atmospheres. The reactions and lifetimes of excited sulfur dioxides with various atmospheric components including hydroxyl, hydroperoxy, and methylperoxy radicals were studied. These data and other published rate data were reviewed and evaluated. The photolysis of formaldehyde was investigated as a major source of hydroperoxyl radicals, and a quantitative evaluation made of its apparent first order rate constants at various solar zenith angles. The absolute extinction coefficients for nitrous acid were determined, and estimates made of the rates of hydroxyl radical generation in the troposphere by photolysis of nitrous acid. Long path Fourier transform infrared spectroscopy was used to help evaluate the potential for nitrosamine formation in the polluted atmosphere. GRA

N80-29926# Kansas Water Resources Research Inst., Manhattan.
SOLUBILITY OF SELECTED MAJOR AND MINOR ELEMENTS FROM COAL AND FLY ASH ACCUMULATIONS Completion Report, Jul. 1977 - Sep. 1979
D. A. Kposick and Ernest E. Angino Mar. 1980 29 p
(PB80-175334; W80-04604; OWRT-A-087-KAN-1) Avail: NTIS HC A03/MF A01 CSCL 13B

Different fly and bottom ashes, representing four coal producing areas of the United States were used in leaching experiments for Ca, Mg, Na, K, Fe, Mn, Zn, Cu, Pb, and Cd and the potential for contamination of ground and surface water supplied by these elements. Both fly ash and bottom ash are formed by the thermal decomposition or dehydration of inorganic impurities in coal and vary with the type of coal used. Many factors affect leachate characteristics such as coal preparation methods, method and efficiency of combustion, method of disposal, particle morphology, and others. GRA

N80-29927# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. foer Vattenbyggnad
DESCRIPTION AND VALIDATION OF THE CTH-URBAN RUNOFF MODEL
Viktor Arnell 1980 193 p refs
(PB80-181480; SER-A-5; ISSN-0348-1050) Avail: NTIS HC A09/MF A01 CSCL 13B

The structure, function, and validation of the CTH-Urban Runoff Model are described. It is a design/analysis model and includes the processes of infiltration, surface depression storage, overland flow, gutter flow, pipe flow, and retention storage. Infiltration is calculated by Horton's equation and depression storage supply is calculated by an exponential relationship. Overland flow and pipe flow are calculated according to a kinematic wave theory and the outflow from the retention basin is a function of the water depth in the basin. The CTH-Model was validated by simulation of the runoff for 10-20 measured rainfalls in each of six urban residential areas. GRA

N80-29928# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

ENERGY/ENVIRONMENT 4: PROCEEDINGS OF THE NATIONAL CONFERENCE ON THE INTERAGENCY ENERGY/ENVIRONMENT R AND D PROGRAM Decision Series
Francine S. Jacoff, Elinor Voris, and Gary M. Sitek Oct. 1979 311 p refs Conf. held in Washington, D.C., 7-8 Jun. 1979 (Contract EPA-68-01-2934)
(PB80-177942; EPA-600/9-79-040) Avail: NTIS HC A14/MF A01 CSCL 13B

An update of interagency research programs in particular areas, including health effects, transport processes and ecological effects, mining methods and reclamation, control technology and integrated technology assessment is given. GRA

N80-29929# Environmental Protection Agency, Las Vegas, Nev. Exposure Assessment Div.
LEAD PARTICLES IN THE GREAT SMOKEY MOUNTAINS BIOSPHERE RESERVE Interim Report
G. B. Wiersma, C. W. Frank (Iowa Univ.), K. W. Brown, and C. I. Davidson (Carnegie-Mellon Univ.) Jan. 1980 19 p refs
(PB80-170004; EPA-600/4-80-002) Avail: NTIS HC A02/MF A01 CSCL 13B

Remote air monitoring using 0.45 micrometer millipore filters at eight remote sites in the Great Smokey Mountains National Park has shown that lead particulates are contributing to the contamination of this designated biosphere reserve. Analytical results of these filters by atomic absorption spectrophotometry, X-ray fluorescence, and scanning electron microscopy showed that lead air concentrations varied frm a high of 141 ng/cu m to low of 18.9 ng/cu m. The spherical shape of the lead particulates indicates that the moieties were formed by high temperature processes, such as by internal combustion engines. Also, the small particulate size may indicate long range transport and subsequent deposition from urban and/or industrialized areas. GRA

N80-29930# Wisconsin Univ. - Madison. Sea Grant Coll. Program.
THE INVISIBLE MENACE: CONTAMINANTS IN THE GREAT LAKES Annual Report
Christine Kohler, Whitney Gould, and Warren Downs Mar. 1980 66 p refs
(PB80-181662; WIS-SG-80-133; NOAA-80041107) Avail: NTIS HC A04/MF A01 CSCL 13B

During the past three years, special attention was given to the activities related to toxic substances. Sea Grant's many other programs and research projects, ranging from aquaculture and policy studies to diving physiology and ocean engineering, are profiled later in this report. GRA

N80-29931# California Univ., Berkeley. Statewide Air Pollution Research Center.
PHOTOCHEMICAL OXIDANT AIR POLLUTION EFFECTS ON A MIXED CONIFER FOREST ECOSYSTEM Final Report
R. N. Kickert, J. R. McBride, P. R. Miller, C. P. Ohmart, O. C. Taylor, ed., R. J. Arkley, D. L. Dahlsten, F. W. Cobb, Jr., J. R. Parmeter, Jr, R. F. Luck et al Jan. 1980 215 p refs
(Contract EPA-68-03-2442)
(PB80-176779; EPA-600/3-80-002) Avail: NTIS HC A10/MF A01 CSCL 06F

Effects for the year 1976-1977 are presented. Subsystems which received greatest attention during this study were: major free species response to oxidant dose, tree population dynamics, tree growth, moisture dynamics, soil chemical and physical properties, tree mortality relative to disease, insects and other factors, epidemiology of forest tree pathogens with emphasis on Fomes annosus, cone and seed production, tree seedling establishment, litter production and litter decomposition relative to microfloral decomposer populations. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-29932 Michigan Univ., Ann Arbor.
INCOHERENT SCATTERING OF RADAR WAVES IN THE AURORAL IONOSPHERE Ph.D. Thesis
R. S. Venkat Raman 1980 251 p
Avail: Univ. Microfilms Order No. 8017343

The effects of such nonMaxwellian ion velocity distributions on the spectrum of radiation incoherently scattered by the ionosphere are systematically studied in terms of the parameter(s) responsible for the formation of these nonMaxwellian ion velocity distributions. The region of the ionosphere of interest is restricted to altitudes above about 150 km where the various ion neutral collision frequencies are very small compared to the ion gyrofrequency. It is found that the shape of the incoherent scatter spectrum depends on the magnitude of the dc electric field, the electron to ion temperature ratio, and phi - the angle between the radar probing direction and the magnetic field. For a given nonzero value of phi and constant electron ion temperature ratio, the shape of the incoherent scatter spectrum departs increasingly from the characteristic Maxwellian spectral shape (assuming the electron and ion distribution to be Maxwellian) as the electric field increases. The departures from the Maxwellian spectral shape also become more prominent as the angle between the line of sight and the magnetic field increases. Dissert. Abstr.

N80-29933 Rice Univ., Houston, Tex.
JICAMARCA RADAR MEASUREMENTS OF WINDS AND TURBULENCE IN THE STRATOSPHERE Ph.D. Thesis
Daniel Alfred Fleisch 1980 108 p
Avail: Univ. Microfilms Order No. 8018050

A series of 48 hour experiments performed quarterly in 1977 to study radar returns from the lower stratosphere are described. Current theories of stratospheric scatter of radio waves are presented and the radar equation pertinent to the large array at Jicamarca, Peru is derived. Observational and data reduction techniques are discussed. Experimental results concerning scattered power, mean wind velocities, and velocity fluctuations are presented. It is found that isotropic turbulent scatter is not the only scattering mechanism operating in the stratosphere, and modifications to the radar equation which arise from turbulent rolls or thin layers of refractive index variation are needed. Mean winds measured by radar are comparable to those determined by rawinsonde ascent. Velocity oscillations of approximately 5 minute periods are interpreted as buoyancy oscillations with 2 km horizontal wavelength and phase velocity of 6 m/s. Tidal oscillations with periods of 24 and 12 hours are also observed. Suggestions for future measurements at Jicamarca and other institutions are offered. Dissert. Abstr.

N80-29934 Rice Univ., Houston, Tex.
SIMULTANEOUS GROUND AND ROCKET BASED MEASUREMENTS OF ELECTRIC FIELDS AND CURRENTS IN AN AURORAL ARC Ph.D. Thesis
Robert Melvin Robinson 1980 143 p
Avail: Univ. Microfilms Order No. 8018086

A Terrier-Malemute sounding rocket was launched into a stable, premidnight auroral arc carrying a cesium vapor magnetometer, electrostatic curved-plate electron energy analyzers, and two sets of Langmuir double probes. Simultaneous line-of-sight velocity and electron density measurements were made during the flight by Chatanika radar operating in an elevation scan mode in the magnetic meridian. Data from the magnetometer indicated that a broad region of eastward current flowed within the diffuse aurora equatorward of the arc, while westward current flowed within the arc itself. The field aligned current was downward in the diffuse aurora and uniformly upward in a 100 km wide region which contained the arc. The double probe measured a 40 mV/m northward electric field just equatorward of the arc. Within the arc the northward electric field was zero. The tangential component of the electric field was 7 mV/m and was constant across the arc boundaries. The simultaneous measurements enabled the association of the aurora with large scale regions in the magnetosphere. They also showed the construction of a self consistent perpendicular current system for the arc involving a time varying neutral wind. Dissert. Abstr.

N80-29935 Michigan Univ., Ann Arbor.
DIRECT MEASUREMENTS OF OZONE AND NITROGEN

DIOXIDE PHOTOLYSIS RATES IN THE ATMOSPHERE Ph.D. Thesis
Russell Robert Dickerson 1980 214 p
Avail: Univ. Microfilms Order No. 8017246

All atmospheric chemistry, including stratospheric ozone chemistry and tropospheric smog chemistry, is powered by photolysis reactions. Models of the atmosphere demand accurate, reliable photolysis rates which are often unavailable from calculations. The design, development, chemistry and results of flow actinometers used to measure atmospheric photolysis rates directly, and electronic UV photometers designed or modified to give a response directly related to photolysis rates are described. These photometers measured albedos of many surfaces at altitudes from 0.6 km. While natural surfaces such as vegetation and oceans have a UV albedo near zero, dense clouds and snow have an albedo near one. With increasing altitude, molecular, and particulate scattering often increase the effective albedo with respect to photolysis rates. The effective albedo over the ocean is 7% at 0.05 km and 25 to 45% at 5.0 km for varying amounts of haze. The rate of photolysis of ozone to O(1D), is measured in a flow of ozone in nitrous oxide. The rate of NO2 photolysis is measured in a flow of NO2 in air or O2. Direct photolysis rate measurements indicate a strong zenith angle dependence.
Dissert. Abstr.

N80-29936 Stanford Univ., Calif.
WATER DISPERSION AND ABSORPTION IN PARTIALLY SATURATED ROCKS Ph.D. Thesis
John Wesley DevilbissMunoz 1980 140 p
Avail: Univ. Microfilms Order No. 8016819

Results from laboratory experiments suggest that the ratio of compressional to shear acoustic wave amplitude is a practical and useful diagnostic for underground steam. The compressional to shear wave propagation velocity ratio is also an indicator of partial pore saturation but the changes expected for this parameter are shown to be small in sedimentary regimes although it may be useful in volcanic or igneous intrusive geological provinces. The large changes in the amplitude ratio are such that the measurement of the velocity ratio will be difficult in partially saturated rocks in situ. Compressional and shear waves propagation velocities have been measured accurately at a temperature of 150 degrees centigrade with respect to varying degrees of saturation. It was found that the variations of compressional wave propagation velocities agree qualitatively with published theories of wave propagation in rocks. The variations of shear wave propagation velocities indicate that at the frequency of the measurements the effective shear modulus is sensitive to the presence of water in the pores. This has not been recognized experimentally or quantitatively in theory in the past. The magnitude of the change in effective shear modulus of the rock was found to vary with the permeability of the sample suggesting a possible fluid flow mechanism for the effect. Nevertheless, another mechanism, viscous shear relaxation, also can explain the phenomenon.
Dissert. Abstr.

N80-29937 Columbia Univ., New York.
THE NATURE OF THE EARTHQUAKE FOCUS AS INFERRED FROM BODY-WAVE OBSERVATIONS Ph.D. Thesis
John Lord Boatwright 1979 220 p
Avail: Univ. Microfilms Order No. 8016901

A class of kinematic rupture models is constructed to approximate numerical and analytical solutions to the dynamic problem of shear fracture. These models incorporate self-similar rupture growth, a range of stopping behavior and causal healing, which propagates into the interior of the rupture areas at the compressional wave velocity. The far field body waves radiated by these models are analyzed to determine simple techniques for estimated source dimension and dynamic stress drop. The effects of rupture velocity and rupture geometry on the directivity of the body wave pulse shapes are also investigated. These results are applied to the analysis of two high stress drop earthquakes which occurred beneath Shumagin Islands, Alaska, and of a multiply recorded aftershock of the 1975 Oroville, California earthquake. The stopping phases radiated by the Oroville aftershock are analyzed in order to investigate the unmodelled complexity of the rapture. The combination of the results from these two techniques provides the most detailed description of rupture ever obtained for a moderate-sized earthquake.
Dissert. Abstr.

N80-29938 Illinois Univ. at Urbana-Champaign.
APPLICATIONS OF HYDROGRAPH TRANSFORMATION TO HYDRODYNAMIC PROBLEMS INFLUENCED BY GRAVITATION Ph.D. Thesis
Taeyoung Han 1980 138 p
Avail: Univ. Microfilms Order No. 8017947

The hydrodynamic problems influenced by gravitation were examined through hodograph transformations. It was found that even with strong influence of the gravitational field, the stream function can be solved in the hodograph plane through numerical calculations. The velocity function of free streamlines must be determined through iterations and it was also found that this iterative process is rapidly convergent. Favorable agreement of the results with the experimental data substantiates the fact that this method is effective in dealing with flow problems strongly influenced by gravitation. The idea of subdividing the hodograph and matching their boundary values along the cut can be extended to problems with more complicated configurations.
Dissert. Abstr.

N80-29939# Indian Space Research Organization, Bangalore.
SPACE SCIENCE RESEARCH IN INDIA. PART 1: EARTH'S ENVIRONMENT AND GEOMAGNETISM
P. Sharma, D. P. Sharma, M. S. Narayanan, and S. K. Mattoo Oct. 1978 176 p refs
(ISRO-SR-06-78) Avail: NTIS HC A09/MF A01

Space science research activities being conducted at various institutions in India are reported and important scientific results obtained since 1965 are summarized. All branches of aeronomy and astronomy (including astrophysics) studied either by ground-based or spaceborne techniques are considered as well as theoretical/analytical studies. Categories covered include: meteorology; atmospheric emissions; D-region; E-region; F-region and topside ionosphere; total electron content of the ionosphere; ionospheric scintillations; ionospheric drifts; gravity waves and travelling ionospheric disturbances; lunar tidal variations; radio communications; geomagnetism; and the Earth's magnetosphere.
A.R.H.

N80-29940*# Texas Univ. at Dallas, Richardson. Center for Space Sciences.
THE RELATIONSHIPS BETWEEN HIGH LATITUDE CONVECTION REVERSALS AND THE ENERGETIC PARTICLE MORPHOLOGY OBSERVED BY THE ATMOSPHERE EXPLORER
R. A. Heelis, J. D. Winningham, W. B. Hanson, and J. L. Burch (Southwest Research Inst., San Antonio, Tex.) [1980] 33 p refs
(Contract NAS5-11407; Grant NsG-5085)
(NASA-CR-163429) Avail: NTIS HC A03/MF A01 CSCL 04A

Simultaneous measurements of the auroral zone particle precipitation and the ion convection velocity by Atmosphere Explorer show a consistent difference between the location of the poleward boundary of the auroral particle precipitation and the ion convection reversal. The difference of about 1.5 degrees of invariant latitude is such that some part of the antisunward convection lies wholly within the auroral particle precipitation region. The nature of the convection reversals within the precipitation region suggests that in this region the convection electric field is generated on closed field lines that connect in the magnetosphere to the low latitude boundary layer. Author

N80-29941*# Naval Research Lab., Washington, D. C. Center for Space Research.
F REGION ABOVE KAUI: MEASUREMENT, MODEL, MODIFICATION
C. Y. Johnson, G. W. Jolander, E. S. Oran, T. R. Young, P. A. Bernhardt, and A. V. daRosa 18 Mar. 1980 43 p refs Prepared in cooperation with Johns Hopkins Univ., Laurel, Md. and Stanford Univ., Calif.
(Grant NGR-05-020-001; Contract N00173-77-C-0091; RR0330204)
(NASA-CR-163318; AD-A084556; AD-E000403; NRL-MR-4186) Avail: NTIS HC A03/MF A01 CSCL 04/1

Prior to an explosive chemical release, a rocket-borne ion mass spectrometer and dual-frequency beacon measured the ion composition and electron content of the undisturbed F region above Kauai, Hawaii. These results are compared to a detailed calculation of ionospheric ion densities. Considerable H2O outgassing produced measurable 18(+) (H2O) and 19(+) (H3O) currents which together with O(+) current were used to determine the H3O(+) H2 O(+) dissociative recombination rate ratio. The explosive event at 283 km swept clean a 1 km radius region. The boundary of the ionic void was characterized by a steep gradient in the ion density. Results for the first 60's after the event are presented which show changes in ambient ion species 14(+), 16(+), 30(+) and 32(+), new reactant species 15(+), 17(+), 18(+), 19(+), 27(+) and 46(+), and evidence of ionic depletion by sweeping. GRA

N80-29942# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
FOURIER SERIES ON SPHERES: A GEOMETRIC PERSPECTIVE Environmental Research Papers. Interim Report
Samuel V. K. Yee 15 Jan. 1980 16 p refs
(AD-A084484; AFGL-TR-80-0021; AFGL-ERP-692) Avail: NTIS HC A02/MF A01 CSCL 04/1

A new function for the Fourier decomposition of a scalar function on spheres is derived from geometric considerations. The function is amenable to fast transforms and is useful as a basis function in spectral simulation and prediction global atmospheric flows. This new expression is shown to belong to a family of such expressions that consists of two other known members. A brief comparison is made among the three in the family. GRA

N80-29943# Naval Research Lab., Washington, D. C.
PLUMEX 1: COINCIDENT RADAR AND ROCKET OBSERVATIONS OF EQUATORIAL SPREAD
E. P. Szuszczewicz, R. T. Tsunoda, R. Narcisi, and J. C. Holmes 17 Mar. 1980 28 p refs Sponsored by Defense Nuclear Agency and AFOSR
(RR0330244)
(AD-A085472; AD-E000430; NRL-MR-4201) Avail: NTIS HC A03/MF A01 CSCL 04/1

Coordinated measurements of equatorial spread-F conducted during July 1979 at the Kwajalein Atoll have yielded the first definitive space and time coincident radar and rocket observations of small scale irregularities and large scale plasma depletions. The results have shown that: (a) within a large-scale topside F-layer depletion radar backscatter energy is at a level much lower than that observed on the depletion's topside. The same is true of 'in situ' irregularity observations, and (b) ion composition within a topside depletion can provide signatures of its bottomside source domain and estimates of average maximum vertical drift velocity. For long-lived depletions, molecular ion signatures (NO(+) and O2(+)) can be lost while bottomside levels of N(+) can be maintained when O(+) approximately equals N sub e much greater than NO(+) - O2(+), and finally, (c) large scale fluctuations of O(+) accompanied by a near-constant level of NO(+) and O2(+) on the bottomside F-layer gradient suggests that neutral atmospheric turbulence is not a major source for bottomside ionospheric plasma irregularities. GRA

N80-29944# Logicon, Inc., Lexington, Mass.
ANALYTIC REPRESENTATION OF THE JACCHIA 1977
James N. Bass Hanscom AFB, Mass. AFGL 25 Jan. 1980 14 p refs
(Contract F19628-78-C-0209; AF Proj. 9993)
(AD-A085781; SR-2; AFGL-TR-80-0037) Avail: NTIS HC A02/MF A01 CSCL 04/1

Modified Jacchia-Walker temperature profiles are developed to accurately represent the Jacchia 1977 temperature profiles above 125 km. The diffusive equilibrium equations are analytically integrable for these profiles, greatly reducing the need for tabular storage of solutions. GRA

N80-29945# Lockheed Missiles and Space Co., Palo Alto, Calif.
FLUORESCENCE EXPERIMENT AND AURORAL DATA EVALUATION TO IMPROVE PREDICTION OF NUCLEAR ATMOSPHERIC INFRARED BACKGROUND Final Report, 2 Feb. 1978 - 28 Feb. 1979
J. B. Kumer and T. C. James 28 Feb. 1979 117 p refs
(Contract DNA001-78-C-0082)
(AD-A085724; AD-E300789; LMSC-D0673384; DNA-4906F) Avail: NTIS HC A06/MF A01 CSCL 04/1

The report documents coordinated laboratory and data evaluation research efforts which are relevant to the DNA program for developing capability to predict nuclear enhanced atmospheric infrared background radiance. The laboratory effort involves the use of a dye laser pumped LiNb03 optical parametric oscillator in order to produce a tunable source of intense 2.7 micron light for the purpose of laboratory simulation of the infrared effects of solar or nuclear illumination of the atmosphere. The source is used to excite the specie CO2(101) which can re-radiate at 2.7 micron via 101 yields 000 or at 4.3 micron via 101 yields 100, the latter process is predicted to be a major nuclear effect at 4.3 micron under certain conditions since theoretically it is predicted to occur more often than the former by ratio 20:1. A primary purpose of our laboratory effort was to confirm this prediction, our initial results place a lower limit of 10:1 on the branching ratio. This low precision result can be enhanced by utilizing simple techniques that were not within the scope of the initial effort, namely by the use of (1) well documented techniques for improving laser frequency stability, (2) a cooled 2.7 micron filter mounted in the detector dewar, (3) a multiple pass fluorescence cell, and (4) faster electronics for recording the 2.7 micron signal. Implementation of these techniques should improve the precision of the measurement by more than 2 orders of magnitude. Additionally, the initial effort has demonstrated the applicability of the laser source and peripheral vacuum and electronic equipment for the high precision measurements of quenching and vibration transfer rate coefficients. GRA

N80-29946# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
STUDIES OF TRANSIONOSPHERIC SCINTILLATION USING ORBITING SATELLITE DATA Scientific Report, Jul. 1979 - Jul. 1980
Stanley Brittain Quinn, Jr. Hanscom AFB, Mass. AFGL Apr. 1980 73 p refs
(Contract F19628-78-C-0195; AF Proj. 4643)
(AD-A085448; UILU-ENG-80-2539; AFGL-TR-80-0092; SR-2) Avail: NTIS HC A04/MF A01 CSCL 04/1

Multi-frequency studies of transionospheric radio signals fluctuations are facilitated by the DNA Wideband Satellite Experiment run by SRI International. Mutually coherent signals were recorded at equatorial, mid-latitude and auroral stations. Results including statistical parameters of the received signals as well as what they reveal about the ionosphere are discussed. Correlations and power spectra of the signals are also computed. GRA

N80-29947# SRI International Corp., Menlo Park, Calif.
HIGH-LATITUDE SCINTILLATION MORPHOLOGY, ALASKAN SECTOR Topical Report, 1 May 1976 - 1 Apr. 1978
Stephen J. Matthews and Charles L. Rino 1 Oct. 1979 53 p refs
(Contract DNA001-77-C-0220)
(AD-A086222; AD-E300808; DNA-5131T) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report describes the auroral-zone scintillation morphology as deduced from two years of observations made at Poker Flat, Alaska, using the DNA Wideband satellite. The data confirm that magnetic activity is the principal factor in determining the level of both nighttime and daytime auroral-zone scintillation. No systematic seasonal variation in activity was found, although the second year (1977-1978) showed a significant increase in overall activity when compared with the first year (1976-1977). This increase is correlated with the general increase in solar activity, with the approach of the expected solar cycle maximum around 1980. The average latitudinal distribution of the nighttime scintillation activity shows a pronounced enhancement at the point where the propagation path intercepts the local L shell. The scintillation enhancement is more prominent in the phase scintillation data; this has been attributed primarily to a geometrical effect, although there is evidence of a columnar F-region source that has contributed as well. GRA

N80-29948# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.
MODELS FOR THE AEROSOLS OF THE LOWER ATMOSPHERE AND THE EFFECTS OF HUMIDITY VARIATIONS ON THEIR OPTICAL PROPERTIES Environmental Research Paper
Eric P. Shettle and Robert W. Fenn 20 Sep. 1979 94 p refs (AF Proj. 7670)
(AD-A085951; AFGL-TR-79-0214; AFGL-ERP-676) Avail: NTIS HC A05/MF A01 CSCL 04/1

Aerosol models have been developed for the lower atmosphere. These models are representative of conditions found in rural, urban, and maritime air masses. The changes in the aerosol properties with variations in the relative humidity are discussed. To describe the aerosol optical properties in the extreme of 100 percent relative humidity, several fog models are presented. For each model the coefficients for extinction, scattering, and absorption, the angular scattering distribution, and other optical parameters have been computed for wavelengths between 0.2 and 40 microns. These aerosol models are presented together with a review of their experimental basis. The optical properties of these models are discussed and some comparisons of the model with experimental measurements are presented. GRA

N80-29949# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
A METHOD TO PREDICT THE PARAMETERS OF A FULL SPECTRAL DISTRIBUTION FROM INSTRUMENTALLY TRUNCATED DATA Environmental Research Paper
Robert O. Berthel 7 Jan. 1980 47 p refs
(AF Proj. 6670; AF Proj. 2310)
(AD-A085950; AFGL-TR-80-0001; AFGL-ERP-689) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report describes a method of correcting measured hydrometeor distributions that are deficient in large-size particles because of instrument truncation. The corrective technique is developed with the analysis of experimental data and the application of the exponential-distribution function. A discussion is presented on the power-function equations used to define hydrometeor environments and the application of the corrected spectra to these mathematical relationships. Equations are presented for the real-time analysis of truncated distribution to provide estimates of the non-truncated spectra. GRA

N80-29950# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Freiburg (West Germany). Inst. fuer Physikalische Weltraumforschung.
SOUNDING ROCKET PROGRAM IN AERONOMY: ELECTRON DENSITY EXPERIMENT BASED ON THE DISPERSIVE DOPPLER EFFECT Final Report
Logar Unger Bonn Bundesmin. fuer Forsch u. Technol. Nov. 1979 67 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-19) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13.65

The electron content between a transmitter on the ground and a receiver on a rocket was accurately determined. Different approaches to applying this technique were examined. The importance of the noise situation onboard the rocket as a decisive factor in selecting the type of receiver was emphasized. Applying modulation at the ground transmitter and using a rather low first frequency, the device was able to give the slant range to the receiver on board as well as the electron content down to electron densities of about 10 million/cu cm. Measured electron density profiles were measured including one obtained during winter anomaly conditions and one during a proton event. The hardware on board the rocket and on the ground as well as the computer program (ALADDIN) used to process the radio signals are also described in detail. Author (ESA)

N80-29951# International Meteorological Inst., Stockholm (Sweden).
[RESEARCH ACTIVITIES IN METEOROLOGY IN SWEDEN FROM JULY 1978 TO JUNE 1979] Annual Report
Nov. 1979 31 p refs
(AR-78-79) Avail: NTIS HC A02/MF A01

Research continuing or completed in 1979 is reported in dynamic meteorology, climatology, and geophysical fluid mechanics as well as atmospheric chemistry and atmospheric physics. Noteworthy results in the modeling of moisture, condensation, cloud formation and dissipation are discussed. Information on the chemical composition of the atmosphere is given. Aeronomy research results are also described. Author (ESA)

N80-29952# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SOLAR-TERRESTRIAL PREDICTIONS PROCEEDINGS. VOLUME 2: WORKING GROUP REPORT AND REVIEWS
Richard F. Donnelly, ed. Dec. 1979 747 p refs Conf. held at Boulder, Colo., 13-17 Apr. 1979
(PB80-183361; NOAA-80040404-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 04A

The main results of the workshop and the recommendations of the working groups are presented. Three types of papers are included: (1) working group reports; (2) topical review papers; and (3) reviews of the needs for predictions by groups that use solar-terrestrial predictions. Predictions for satellite and power-system applications because of their increasing importance are emphasized. Chapter 1 discusses in depth the solar-terrestrial environment problems for spacecraft. Chapter 2 discusses the needs for solar-terrestrial predictions. Chapter 3 discusses radio communication predictions. Chapter 4 discusses solar-activity predictions. Chapter 5 discusses predictions of magnetospheric disturbances including solar-wind and magnetosphere interactions. Chapter 6 discusses ionospheric predictions. The final chapter discusses the potential for predicting climate or weather effects of solar activity. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-29953 Rice Univ., Houston, Tex.
THUNDERCLOUD ELECTRIC FIELD SOUNDINGS WITH INSTRUMENTED FREE BALLOONS Ph.D. Thesis
Mark Edward Weber 1980 134 p
Avail: Univ. Microfilms Order No. 8018091

A Balloon Electric Field Sensor released into a thunderstorm, measured the electric vector and wind profile. During a major portion of its ascent, the instrument was in an intense updraft, with a maximum vertical wind component of about 15 m/sec. Horizontal flow, at 10 to 15 m/sec towards the northeast, was encountered above 700 m (msl). The electric vector indicated that the balloon rose through an 800 m thick region of positive charge in the lower portion of the cloud. Above this, negative charge extended from 5200 m to 8200 m (msl). Intense horizontal electric field components were imputed to a volume of negative charge, situated near 6700 m (msl) where the rainfall rate was only about 3 mm/hr. Lightning subsequently discharged this volume. The cloud contained positive charge above 8200 m. Electrical corona, induced in pointed rods affixed to a radiosonde, was measured as the sonde rose through a thundercloud on 21 July 1978. Strong fields and charge of both polarities were encountered. An abrupt decline in upwards directed corona current as the instrument passed through the cloud's upper surface may have resulted from a negative screening layer. Dissert. Abstr.

N80-29954 Texas A&M Univ., College Station.
NUMERICAL MODELING OF A ROTATING CUMULONIMBUS CLOUD Ph.D. Thesis
David Ray Smith 1979 130 p
Avail: Univ. Microfilms Order No. 8011999

The processes leading to the extreme concentration of vorticity that accompany the formation of a tornado were investigated. A nonprecipitating cloud with rotation induced in the outer half of its domain was constructed to study the concentration and vertical propagation of available vorticity in a rotating mesoscale convective system. A precipitating cloud was also generated with the same characteristics of the previous cloud except the autoconversion process was activated to produce precipitation size hydrometeors. Significant results are reported. Dissert. Abstr.

N80-29955 State Univ. of New York at Albany.
A COMPARATIVE DIAGNOSTIC STUDY OF EAST COAST CYCLOGENESIS UNDER WEAK VERSUS STRONG SYNOPTIC-SCALE FORCING Ph.D. Thesis
Vito Pagnotti 1980 164 p
Avail: Univ. Microfilms Order No. 8016704

Two cases of East-Coast cyclogenesis and related east-of-Appalachian ridging--one under weak, the other strong, synoptic-scale forcing--are diagnostically compared: they form a continuum of six time periods from 0000 GMT, 22 December 1970, to 1200 GMT, 24 December 1970. A set of objective analysis schemes is used to produce grid-point analyses of observed data with a one degree latitude-longitude horizontal resolution and a 100 mb vertical resolution. The SUNYA version of Krishnamurti's balance model is modified for ten levels and applied to the data to obtain fields of vertical motion. Total and some partitioned fields of nonlinear balanced vertical motion, as well as those of cumulative hourly precipitation and moisture flux, are presented. Correlation coefficients for kinematic versus balance-model omegas are generated. In addition, various energy parameters computed using the total balance-model omegas are presented. Dissert. Abstr.

N80-29956 State Univ. of New York at Albany.
CLEAR-AIR SEEDING Ph.D. Thesis
Andrew Garold Detwiler 1980 212 p
Avail: Univ. Microfilms Order No. 8017642

An investigation is made into the prospects for nucleating widespread ice particle clouds in clear air for the purpose of moderating surface temperature extremes and modulating atmospheric convection. Using aircraft contrails as a model, it appears that on many occasions ice particle clouds can be nucleated in clear areas of the upper troposphere that will decrease the outgoing planetary infrared radiation by perhaps twice that amount, at the earth's surface. It is possible to promote the development of much more widespread cloudiness than a typical contrail by using aircraft to release large numbers of ice nuclei so that orders of magnitude more ice particles are created per unit length of flight path than are created in normal contrails. Opportunities also exist for clear air seeding near the surface in cold climates. Investigations into suitable ice nuclei, synoptic weather conditions, and seeding schemes are presented. The radiative properties of cirrus clouds are discussed. Dissert. Abstr.

N80-29957 Rice Univ., Houston, Tex.
INFRASONIC THUNDER: EXPLAINED Ph.D. Thesis
Jerry Lynn Bohannon 1980 67 p
Avail: Univ. Microfilms Order No. 8018034

The existence of infrasonic pulses induced by lightning within thunderclouds is firmly established from experimental observation. The observed waveform has a compressive pulse followed by a rarefactive pulse. It is shown that these infrasonic pulses are wholly electrostatic in origin and arise out of the interaction of the large space charges inside thunderclouds. The positive part of the pulse is due to the relaxation of the mutual attraction of the negative charge layer and the positive shielding layer beneath it during a lightning event. The negative portion of the pulse is due to the reduction in the mutual repulsion of the charged cloud particles in the negative charge storage layer. A series of calculations, done with spherical charges, is presented that describes the changes in the electrostatic potential energy in a simple thundercloud as the result of the partial neutralization of the stored charge by a lightning flash. These calculations are used to demonstrate that two competing theories, ohmic heating of the air within the charge storage region and rapid charge separation, cannot explain the amplitude of the initial positive excursion in the infrasonic waveform. Dissert. Abstr.

N80-29958 Rice Univ., Houston, Tex.
THE ROTATIONAL DYNAMICS OF ATMOSPHERIC ICE: ELECTRICAL AND AERODYNAMIC TORQUES Ph.D. Thesis
Andrew John Weinheimer 1980 132 p
Avail: Univ. Microfilms Order No. 8018092

The rotational motion of atmospheric ice particles is analyzed to determine the conditions under which the particles align with atmospheric electric fields. The particle shapes are approximated by prolate and oblate spheroids and may be treated as conductors or dielectrics, depending on the speed of the rotation in relation to the electric response times. At low Reynolds numbers, the electrical torque is opposed by a Stokes drag torque. The resulting equation of motion is that of a damped pendulum oscillator. At higher Reynolds numbers, the electrical torque competes with an aerodynamic torque which itself attempts to produce an alignment of the ice crystals not necessarily compatible with that for the electrical torque. The dynamics of a spectrum of ice particle shapes and sizes in a wide range of electric fields is examined. Numerical values are obtained for the relevant characteristic times and torque ratios, and the different dynamical regimes are delineated. It is found that electric fields of at least 1 kV/m, or perhaps 10 kV/m, are required to produce significant alignment. Dissert. Abstr.

N80-29959 Wyoming Univ., Laramie.
STATISTICAL DISTRIBUTION OF WAVE HEIGHTS AND PERIODS FOR HURRICANE WAVES Ph.D. Thesis
Elizabeth Yang Chen 1979 144 p
Avail: Univ. Microfilms Order No. 8018001

Water level elevations recorded during hurricanes Carla (1961) and Camille (1969) are utilized for the statistical analysis of the probability distributions for wave heights and periods. It is found that the Rayleigh distribution under the narrow band assumption, can describe the observed wave height distribution very well at low and moderate wave heights. The deviations from the Rayleigh distribution at higher waves may be compensated for by empirical corrections. A detailed analysis of the 'bump-count' waves leads to a basic procedure for characterizing the conditional distribution for wave period given the height. A good approximation to this conditional law is a normal density, truncated on the left at period associated with breaking waves of that heat. Two significant characteristics observed for an empirical study of the periods associated with the larger wave heights in hurricanes are: (1) the average period, regarded as a function of wave height, seem to be roughly constant for heights greater than the significant wave height, and (2) the standard deviation of wave period of these waves decreases with increasing wave height. Dissert. Abstr.

N80-29960 Florida Univ., Gainesville.
PROPERTIES OF LIGHTNING DERIVED FROM TIME SERIES ANALYSIS OF VHF RADIATION DATA Ph.D. Thesis
Pedro Luis Rustan, Jr. 1979 386 p
Avail: Univ. Microfilms Order No. 8016578

Lightning properties are derived by correlating three dimensional VHF source locations, characteristics of the VHF (30 to 50 MHz) radiation, and electric field intensity (0.1 Hz to 1.5 MHz). The discharge initiation, propagation, overall geometry, and charge magnitude and location for the various phases of both cloud-to-ground and intracloud lightning are studied. Four cloud-to-ground and three intracloud flashes, all selected randomly are analyzed. The three dimensional source locations presented for the different phases of lightning discharges were obtained using a computerized technique which allows a large amount of data to be analyzed quickly. Dissert. Abstr.

N80-29961 Tennessee Univ., Knoxville.
ATMOSPHERIC TURBULENCE SIMULATION TECHNIQUES WITH APPLICATION TO FLIGHT Ph.D. Thesis
Show-Tien Wang 1980 173 p
Avail: Univ. Microfilms Order No. 8018503

Statistical modeling of atmospheric turbulence is discussed. The statistical properties of atmospheric turbulence, in particular the probability distribution, the spectra, and the coherence are reviewed. Different atmospheric turbulence simulation models are investigated and appropriate statistical analyses are carried out to verify their validity. The models for simulation are incorporated into a computer model of aircraft flight dynamics. Statistical results of computer simulated landings for an aircraft having characteristics of a DC-8 are reported for the different turbulence simulation techniques. The significance of various degrees of sophistication in the turbulence simulation techniques on the landing performance of the aircraft is discussed. Dissert. Abstr.

N80-29962# Indian Meteorological Dept., New Delhi.
THE MONSOON EXPERIMENT MONEX
P. K. Das Bangalore, India Indian Space Research Organ.

Sep. 1979 12 p
(ISRO-SN-08-79) Avail: NTIS HC A02/MF A01

A subprogram of the Global Atmospheric Research Program, the monsoon experiment popularly known as MONEX was designed to study the contribution of the monsoons in different parts of the world to the Earth's atmosphere. Data were collected by ships and/or aircraft from India, the U.S.S.R., the United States, and France as well as by GOES and METEOSAT satellites and balloon-borne sondes. Of particular interest was the radiation balance of the Earth-atmosphere system. The results which are expected to become available when all the data are analyzed and studied are outlined as well as the implications for India. A.R.H.

N80-29963*# New York Univ., N. Y.
MOUNTAIN WINDS (REVISITED)
Eugene Isaacson and Gideon Zwas [1980] 30 p refs
(Grant NsG-5034)
(NASA-CR-163406) Avail: NTIS HC A03/MF A01 CSCL 04B

The prediction of extremely high wind speeds, at ground level on the downstream side of a mountain range, is possible by solving the initial value problem for a two-layered nonlinear shallow water model of the atmosphere. Three different numerical methods are described to find the solutions which may involve shocks: (1) the vonNeumann-Richtmyer artificial viscosity method, (2) a filtering scheme, and (3) a hybrid method. Author

N80-29964*# Texas A&M Univ., College Station. Dept. of Meteorology.
A PRELIMINARY ASSESSMENT OF THE ACCURACY OF SELECTED METEOROLOGICAL PARAMETERS DETERMINED FROM NIMBUS 6 SATELLITE PROFILE DATA Final Report
James R. Scoggins and Gray Petti Washington, D.C. Aug. 1980 43 p refs
(Contract NAS8-31773)
(NASA-CR-3308) Avail: NTIS HC A03/MF A01 CSCL 04B

Published rms errors in rawinsonde data and discrepancies between satellite and rawinsonde profile data for temperature, dewpoint temperature, mixing ratio, and wind speed. Satellite rms errors were found to be 2 to 3 times as large as those for rawinsonde data. Gradients of the preceding parameters were computed for both rawinsonde and satellite data and compared with means and near extreme values computed from the AVE 2 and AVE 4 experiments. In all cases, it was found that satellite data can be used to determine with relatively good accuracy the near extreme gradients but not those whose value does not exceed the average. Synoptic charts were prepared to show that patterns of temperature could be determined with relatively good accuracy, while those of dew point were not as good as those for temperature. Winds represented by cloud motion vectors (satellite winds) were compared with rawinsonde winds, and it was found that large gaps exist in satellite values for a given pressure level and that errors in the satellite determined concluded that satellite profile data are very useful in synoptic analysis, particularly in data sparse regions as well as regions where near extreme gradients exist in the measured parameters. R.K.G.

N80-29965*# University of Central Florida, Orlando. Dept. of Mathematics and Statistics.
CLOUD COVER MODELS DERIVED FROM SATELLITE RADIATION MEASUREMENTS Final Report
Steven J. Bean and Paul N. Somerville 14 Nov. 1979 38 p refs
(Contract NAS8-33071)
(NASA-CR-161490) Avail: NTIS HC A03/MF A01 CSCL 04B

Using daily measurement of day and night infrared and incoming and absorbed solar radiation obtained from a TIROS satellite over a period of approximately 45 months, and integrated over 2.5 degree latitude-longitude grids, the proportion of cloud cover over each grid each day was derived for the entire period. For each of four three-month periods, estimates a and b of the two parameters of the best-fit beta distribution were obtained for each grid location. The (a,b) plane was divided into a number of regions. All the geographical locations whose (a,b) estimates were in the same region in the (a,b) plane were said to have the same cloud cover type for that season. For each season, the world was thus divided into separate cloud cover types. Using estimates of mean cloud cover for each season, the world was again divided into separate cloud cover types. The process was repeated for standard deviations. Thus for each season, three separate cloud cover models were obtained using the criteria of shape of frequency distribution, mean cloud cover, and variability of cloud cover. The cloud cover statistics were derived from once-a-day, near-local-noon satellite radiation measurements. Author

N80-29966# Naval Oceanography Command Center/Joint Typhoon Warning Center, Guam.
TROPICAL CYCLONE MINIMUM SEA LEVEL PRESSURE: MAXIMUM SUSTAINED WIND RELATIONSHIP
Olaf M. Lubeck and John D. Shewchuk Apr. 1980 16 p refs
(AD-A085330; NAVOCEANCOMC/JTWG-TN-880-1) Avail: NTIS HC A02/MF A01 CSCL 04/2

This paper investigates empirical relationships between maximum sustained surface winds and minimum sea-level pressure in western North Pacific tropical cyclones. The empirical equation developed by Atkinson and Holliday (1977) is reviewed and evaluated using 13 independent cases collected since the original study. New relationships were developed using the original dependent data set in Atkinson and Holliday and were tested also against the 13 independent cases. These new relationships were based on different assumptions for reducing observed peak wind gusts to one-minute sustained surface winds. There were no significant differences between the original Atkinson and Holliday relationship and the new relationships. Introducing environmental pressure and latitude as additional predictors did not improve the pressure-wind relationship. GRA

N80-29967# Air Weather Service, Scott AFB, Ill.
FORECASTERS GUIDE ON AIRCRAFT ICING
Mar. 1980 60 p refs
(AD-A085490; AWS-TR-80-001; AWS-Manual-105-39) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report presents information on aircraft icing that forecasters can use in forecasting and briefing for aircraft operations. It covers the atmospheric conditions that are favorable for aircraft icing and also how different aircraft types affect the potential for icing. GRA

N80-29968# Air Force Environmental Technical Applications Center, Scott AFB, Ill. Air Weather Service.
CLOUD COVER AND VISIBILITY CLIMATOLOGY FOR THE PHILLIPINES Final Report
Daniel E. Mitchell May 1980 14 p Sponsored in part by Defense Mapping Agency
(AD-A085525; USAFETAC/PR-80/001) Avail: NTIS HC A02/MF A01 CSCL 04/2

This report provides cloud cover and visibility climatology for 19 locations in the Philippines. The mean number of days with total cloud amount less than or equal to one-tenth and visibility greater than or equal to 6 miles for each month and by hours of the day are provided for each location. GRA

N80-29969# Geo-Atmospherics Corp., Lincoln, Mass.
CLOUD/ICING/VISIBILITY ANALYSIS SYSTEM (CIVAS) AND FORECAST DEVELOPMENT PLAN
Wayne D. Mount, B. Richard Fow, and Bruce D. Mount Apr. 1980 74 p refs
(Contract DAAD07-79-C-0089; DA Proj. 1L1-62111-AH-71) (AD-A085530; ERADCOM/ASL-CR-80-0089-123) Avail: NTIS HC A04/MF A01 CSCL 04/2

Geo-Atmospherics Corporation previously developed atmospheric models, meteorological data interpretation techniques, and computer software to provide a Cloud/Fog/Analysis System (CFAS) and Cloud/Fog Application Routines (CFAR). The CFAS assimilates the four-dimensional distribution of weather information by taking into account type, age, and location of meteorological observations to perform an objective analysis to specify each weather variable on a moveable three-dimensional array of grid points. This data base generated by CFAS can be used individually or its parts analyzed to tailor operational products to a given application. Our CFAR was developed to interrogate the CFAS data base, extract, analyze, and display a map of each chosen

parameter, i.e., sky cover, ceiling, visibility, precipitation, severe weather, cloud base, cloud top, and cloud amounts within nine different layers extending from the surface to 3000 meter altitude, the highest level of interest to Army aviation. These techniques have been expanded to develop a Cloud/Icing/Visibility Analysis System (CIVAS) to deduce the three-dimensional distribution of clouds, aircraft icing threat, and visibility, on a horizontal grid scale of 5 km. GRA

N80-29970# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
ESTIMATION OF LATERAL AND ROTATIONAL CLOUD DISPLACEMENT FROM SATELLITE PICTURES
Uwe L. Haass and Thomas A. Brubaker Hanscom AFB, Mass. AFGL Oct. 1979 18 p refs Presented at the Workshop on Computer Analysis of Time-Varying Imagery, Philadelphia, 5-6 Apr. 1979
(Contract F19628-78-C-0207; Grant DAAG29-76-G-0324; AF Proj. 6670)
(AD-A085810; AFGL-TR-79-0287; SR-1) Avail: NTIS HC A02/MF A01 CSCL 04/2

Weather forecasting in the mesoscale range often remains problematic due to the rapid changes. With the advance of high-resolution imaging techniques, satellite pictures taken in short time intervals can be employed to improve interpretation and prediction of atmospheric situations by analyzing cloud motion and size parameters. Knowledge of these parameters allows estimation of wind fields as well as the establishment of time series in order to model the cloud development and extrapolate from past observations. Our objective is to find estimators that reveal not only information on lateral (x-y) displacement, but also on rotation of clouds. These estimators should perform well for a variety of meteorological conditions. Currently, a variety of cloud displacement estimators are competing for computational convenience and versatility in application (1-6). Our work concentrates on methods applying the Inner Product (popularly called cross-correlation) since we hope to combine a mathematically elegant theory with efficient strategies for application. GRA

N80-29971# Arizona Univ., Tucson.
MULTIWAVELENGTH LIDAR STUDY OF FOG
B. M. Herman and R. M. Schotland May 1980 36 p refs
(Contract DAAG29-76-D-0100; DA Proj. 1L2-62111-AH-71)
(AD-A086143; ERADCOM/ASL-CR-80-0100-1) Avail: NTIS HC A03/MF A01 CSCL 04/2

A study has been conducted to define quantitatively the range and accuracy of multispectral lidar techniques for remotely sensing the visibility and liquid water content of various types of fogs. The results indicate that the penetration of the lidar pulse into the fog is limited to a few hundred meters due to the severe attenuation of the pulse by the fog. Methods to obtain extinction, backscatter and total liquid water content are also discussed. GRA

N80-29972# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
SOUNDING ROCKET PROGRAM IN AERONOMY: METEOROLOGICAL EVALUATION OF THE WINTER ANOMALY; CAMPAIGN IN SPAIN DURING 1975/76 Final Report
Barbara Naujokat, Karin Petzoldt, Juergen Knittel, Karin Labitzke, and Ernst Klinker Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 84 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-13) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 17.25

It is assumed that one of the causes of the winter anomaly in ionospheric absorption is found in the conditions associated with transport and temperature. Therefore, the circulation in the stratosphere and mesosphere at a height of from 20 to 80 km was examined during the Western European winter anomaly campaign of 1975/76. Results show that the development of planetary waves in space and time, the related horizontal and vertical motions, and their effect on the temperature of the mesopause region have to be considered in order to understand the absorption behavior at a particular location. Author (ESA)

N80-29973# Royal Netherlands Meteorological Inst., De Bilt. Meteorologisch Onderzoek.
DESCRIPTION OF SOME PROPERTIES OF THE HUMIDITY ANALYSIS SCHEME IN USE AT THE EUROPEAN CENTRE FOR MEDIUM RANGE WEATHER FORECASTS
Jan vanMaanen 1979 33 p refs Sponsored by European Centre for Medium Range Weather Forecasts
(KNMI-V-334) Avail: NTIS HC A03/MF A01

The objective humidity analysis used in a medium range numerical weather forecasting computer program was investigated. The accuracy of this scheme and its validity for a numerical forecast was evaluated in two independent ways. First, the weighting function used in the correction method was modified and the results analyzed. Second, the influence of varying the initial moisture field parameter on the forecast was studied. Results indicate that the absolute quality of variations of the weighting function cannot be estimated because of fundamental uncertainty in the true atmospheric state. Regarding specification of initial humidity, it is confirmed essential to numerical forecasting, especially in connection with predictions of rainfall intensity and cloudiness. Author (ESA)

N80-29974# National Weather Service, Silver Spring, Md. Office of Hydrology.
A METHODOLOGY FOR POINT-TO-AREA RAINFALL FREQUENCY RATIOS
Vance A. Myers and Raymond M. Zehr Feb. 1980 182 p refs
(PB80-180102; NOAA-TR-NWS-24; NOAA-80032111) Avail: NTIS HC A09/MF A01 CSCL 04B

A procedure is developed for calculating geographically fixed depth-area ratios from dense networks of recording precipitation gages. These ratios are needed to reduce published point precipitation frequencies to areal values. GRA

N80-29975# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
SUMMARY OF GREAT LAKES WEATHER AND ICE CONDITIONS, WINTER 1977 - 1978
R. A. Assel, D. E. Boyce, J. Wartha, and F. E. Keyes Dec. 1979 137 p refs
(PB80-179203; NOAA-TM-ERL-GLERL-26; NOAA-80032001)
Avail: NTIS HC A07/MF A01 CSCL 04B

The winter of 1977-78 was the 12th coldest since 1850. The north westerly flow aloft during this winter directed anticyclonic centers to the west and south of the Great Lakes Region, bringing the greatest negative air temperature departure from normal ever recorded on the southern lakes. Ice began forming in the shallows of the Great Lakes in late November. Lake St. Clair was virtually frozen over by early January. The remainder of the Great Lakes neared maximum areal ice extent from mid-February to early March; Lake Superior was 82% covered, Lake Michigan 52%, Lake Huron 89%, Lake Erie 100%, and Lake Ontario 57%. Spring breakup began in mid-March. The bulk of the ice was gone by April 26, but ice was observed as late as May 11 in eastern Lake Erie. GRA

N80-29976# Eddy (Amos), Inc., Norman, Okla.
AN INVESTIGATION OF SATELLITE-RADAR CORRELATION FUNCTIONS Final Report, 1 Feb. 1979 - 29 Feb. 1980
Louis A. Hembree Mar. 1980 213 p refs
(Contract DI-9-07-85-V0024)
(PB80-176001) Avail: NTIS HC A10/MF A01 CSCL 04B

The problems of combining the radar and satellite data sets through the use of space time correlation fields are addressed. These correlation fields represent the storm structure as implied by the observed data. The correlation fields are modeled using a four dimensional Gaussian damped cosine function whose parameters reflect the storm characteristics. Several Montana convective storm complexes have been studied to determine the correlation fields which are required for the application of optimum interpolation objective analysis and for the classification of the storms. It is shown that suitable correlation fields can be obtained with respect to the autocorrelation fields; however, a more general correlation model may be required for the cross-correlation fields. GRA

N80-29977# Alaska Univ., Fairbanks. Inst. of Marine Science.
RECENT FLUCTUATIONS IN METEOROLOGICAL AND OCEANOGRAPHIC PARAMETERS IN ALASKA WATERS
H. J. Niebauer. Feb. 1980. 40 p. refs.
(Grants NOAA-04-8-MO1-187; NSF DPP-76-23340)
(PB80-186406; ASGR-79-12; IMS-79-2; NOAA-80042203)
Avail: NTIS. HC A03/MF A01. CSCL 04B

In the last few years, especially since 1970, there were extraordinary variations in the shortterm climate over the North Pacific that are hypothesized to cause variations in oceanographic conditions such as sea temperature and ice coverage in Alaskan waters. Some of the relatively large-surface and 700 mb (3000 m) winds and ice coverage and their interrelationships are outlined. The study areas are the shelf regions of the Gulf of Alaska from Sitka to Kodiak and the southeastern Bering Sea. The time span considered is approximately the early 1960s to the present. GRA

N80-29978# National Weather Service, Silver Spring, Md. Office of Technical Services, Communications Div.
NOAA/NWS CATALOGUE OF METEOROLOGICAL BULLETINS
Jan. 1980. 241 p.
(PB80-183684; NOAA-80042405) Avail: NTIS. HC A11/MF A01. CSCL 04B

Communications Handbook No. 6, the NOAA/NWS Catalog of Meteorological Bulletins, is a three section references manual. Section 1 contains all meteorological bulletins originated at KWBC, sorted by bulletin heading. Section 2 contains foreign meteorological bulletins which are distributed domestically. Section 3 contains aviation oriented meteorological bulletins which are available from the FAA Request-Reply System. A description of the bulletins, the approximate time of transmission, generation, observation or valid time and the code used is listed for each entry. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-29979 Washington Univ., Seattle.
INITIAL-VALUE PROBLEMS IN STRATIFIED SHEAR FLOWS Ph.D. Thesis
Jerre Eugene Bradt. 1979. 145 p.
Avail: Univ. Microfilms. Order No. 8013498

The stability of steady state solutions in geophysical fluid flows is addressed through qualitative analysis and quantitative examples. The inviscid linear stability theory of stratified shear flows and the solution of the stability problem using normal modes and Fourier-Laplace transforms are discussed. Two numerical examples are used to illustrate the relationship of various physical parameters to the stability of the system and to trace the development of the instability for short, intermediate, and long times. The examples are (1) a two layer fluid of infinite extent with application to the air-sea interface and (2) a two layer fluid having a free surface and finite depth with application to a salt wedge estuary. The initial value problem is solved using a power series expansion for short times, superposition of modes for intermediate times, and asymptotic analysis for long times. The asymptotic expansion applicable in nonconservative systems is compared with the approximate solution using ray techniques, which are valid in conservative systems, and analytic continuation of the eigenvalues into the complex wavenumber plane. Dissert. Abstr.

N80-29980# Naval Research Lab., Washington, D. C. Radar Techniques Branch.
OBSERVATION BY HF RADAR OF THE PHILLIPS RESONANCE MECHANISM FOR GENERATION OF WIND WAVES Interim Report
D. B. Trizna, R. W. Bogle, J. C. Moore, and C. M. Howe. 14 Mar. 1980. 40 p. refs.
(RR0210141)
(AD-A085473; AD-E000426; NRL-8386) Avail: NTIS. HC A03/MF A01. CSCL 08/3

Measurements are reported of directional ocean wave spectra made over 80 deg of viewing angle by an HF radar, operating in the surface wave mode in an area 22.5 km north of San Clemente Island, California. Ten azimuths from 280 to 360 deg true bearing were simultaneously measured for ten wave frequencies ranging from 0.14 Hz (75-m waves) to 0.35 Hz (13-m waves). A Waverider buoy was used to measure omnidirectional energy in the region, and first-order radar Bragg lines were used to determine the spreading of wave energy with angle. Data are presented in which a bimodal spectrum was present: an attenuated spectrum with wave components to 0.10 Hz from a storm at sea at 270 deg bearing, and a transient local wind spectrum, stronger in amplitude at the higher frequencies, with wave cutoff near 0.14 Hz, and running from 315 deg bearing. Just after the onset of local winds, the westerly spectrum fit a cosine squared spread at the lowest measured frequencies. With the development of local wind which blew at a 12 to 14 knot speed for a period of 12 h, the wave spectrum spread about the wind direction as cosine thirty second at the lowest frequencies measured, 0.14 Hz, and cosine sixty-fourth at the highest frequencies measured, 0.35 Hz. For 0.28 Hz waves, the Phillips resonance mechanism for wave generation is proposed to explain the twin peaks in amplitude observed, equally spaced either side of the wind direction. These were dominant for the earliest measurement period, and still major contributions for later measurement periods. GRA

N80-29981# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
DEVELOPMENT OF CONSISTENT NATURAL ENVIRONMENT PARAMETER SETS FOR COMBATANT CAPACITY ASSESSMENT (CCA) Final Report
Wah T. Lee and Susan L. Bales. Mar. 1980. 47 p. refs.
(AD-A085571; DTNSRDC/SPD-0795-02) Avail: NTIS. HC A03/MF A01. CSCL 04/2

In order to design and model some combat systems, it may be necessary to consider joint distributions of two or more natural environment parameters. This can be accomplished by simultaneous sampling of various natural environment parameters. A major part of the investigation reported herein is the development of wind generated significant wave height as a function of latitude for the Northern Hemisphere, however, a joint sampling of other surface and atmospheric parameters is also included. GRA

N80-29982# Washington Univ., Seattle. Dept. of Oceanography.
A SEASONAL AND SPATIAL SUMMARY OF OCEANOGRAPHIC DATA FROM THE NORTHEASTERN TROPICAL PACIFIC (DOMES REGION), SUMMER 1975 AND WINTER 1976
M. D. Ohman, E. Ozturgut, and R. J. Ozretich. Sep. 1979. 125 p. refs.
(Contract NOAA-03-6-022-35101)
(PB80-184484; REF-M79-53; SR-91; NOAA-80042301) Avail: NTIS. HC A06/MF A01. CSCL 08J

Upper water column data are presented from two series of cruises to the northeastern tropical Pacific conducted as part of the DOMES (Deep Ocean Mining Environmental Study) project. The data selected include hydrographic data, dissolved chemical constituents, biochemical parameters, phytoplankton pigments and primary production rates, and suspended particulate concentrations. Tabular summaries and histograms of data values are presented for four depth zones: the surface mixed layer, the pycnocline, bottom of the pycnocline to 4000 m, and 4000-1000 m. Statistically detectable spatial heterogeneity exists across the DOMES region, although the variables which best indicate this heterogeneity are different above and below the pycnocline. To a lesser extent, seasonal differences are also detected. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-29983 Louisiana State Univ., New Orleans.
BLOOD FLOW TO ADIPOSE TISSUES IN THE MALE

SPRAGUE-DAWLEY RAT Ph.D. Thesis
Barbara Jean Maron 1980 214 p
Avail: Univ. Microfilms Order No. 8018275

The differences in adipocyte size among adipose depots in the male Sprague Dawley rat were studied with respect to their effect on blood flow. Blood flow was also examined within adipose depots to detect how it might vary with an increase of both adipocyte size and animal body size (age). In addition, since adipose tissue serves different metabolic functions of the body during the fed and fasted states, the effect of nutritional status on adipose tissue blood flow was studied. Results are presented. Dissert. Abstr.

N80-29984 New York Univ., N. Y.
VESTIBULAR COMPENSATION IN THE RAT: A MODEL FOR MOTOR LEARNING Ph.D. Thesis
Kerry Dee Walton 1980 290 p
Avail: Univ. Microfilms Order No. 8017600

A global picture of the changes in neuronal activity underlying the acquisition and retention of vestibular compensation (VC). Brain stem and cerebellar nuclear levels was obtained using 2-deoxy-D-glucose. The distribution of glucose uptake at these sites was determined in normal, uncompensated, compensated, and 3-acetylpyridine decompensated animals. Results indicate that the asymmetries following hemidabyrinthectomy reflect an imbalance in the activity of the vestibular nuclei (VN) and that compensation results from the restoration of balance. In uncompensated and decompensated animals the VN ipsilateral to the lesion were significantly less active than the contralateral VN. In compensated animals, VN activity was the same on the both sides, the level being close to or higher than normal. Thus, VC is accompanied by an increase in activity in the ipsilateral VN. Author

N80-29985 California Univ., Davis.
EFFECT OF ACCELERATION ON CIRCULATORY AND RESPIRATORY FUNCTION IN THE DOMESTIC FOWL Ph.D. Thesis
Sue Carol Walgenbach 1979 123 p
Avail: Univ. Microfilms Order No. 8016790

The respiratory and circulatory function was examined in chickens exposed to high sustained G sub z (exposure to fields greater than 6 G for 15 seconds: HGS sub z) Acceleration tolerance was determined for cocks exposed to + 6, +8, +10, and - 12 G sub z. Acceleration tolerance time was found to be hyperbolically related to the field strength (G). Blood gases in chickens during HSG sub z exposure showed that chickens, unlike mammals, had near normal PaO2 and PaCO2. Forced ventilation of centrifuging chickens with oxygen increased PaO, a response not found mammals. Ventilation of one lung with air produced near normal PaO2 and PaCO, at 1 G, but in HGS sub z gave low PaO, as observed in spontaneously breathing mammals. Ventilation did not extend all tolerance times suggesting circulatory impairments are principally responsible for acceleration tolerance limitations. Expired PICO2) during oxygen ventilation indicated that cardiac output decreased during HSG sub z, even down to zero for several seconds; after HSG sub z, expired PICO2) increased, indicating that oxygen debt and metabolism perfusion inequalities were developed during HSG sub z. Dissert. Abstr.

N80-29986 Kentucky Univ., Lexington.
THE NEURAL CONTROL OF THE CORONARY CIRCULATION DURING BEHAVIORAL STRESS IN CONSCIOUS DOGS Ph.D. Thesis
George Edward Billman 1980 181 p
Avail: Univ. Microfilms Order No. 8018226

Experiments were performed on eight (3 female, 5 male) mongrel dogs during classical aversive conditioning. The conditioning paradigm consisted of two 30 second tones; one was paired with a one second pulsed DC shock, the other was nonreinforced. The subjects were chronically instrumented to measure aortic pressure, left ventricular pressure, and left circumflex coronary blood flow. The data were analyzed with multifactorial analysis of variances and Newman's-Keul's multiple range test. Results indicate that the coronary vascular response to stress consisted of two components: an initial alpha adrenergic vasoconstriction followed by a more complex vasodilation, which was mediated by metabolites released secondarily to increases in heart rate and inotropic state. The vasodilation may also involve a reactive hyperemic response to the initial vasoconstriction or perhaps a reflex withdrawal of alpha receptor tonus. Dissert. Abstr.

N80-29987 Florida Technological Univ., Orlando.
A COMPARATIVE STUDY IN MOLECULAR AGING: ALTERATIONS TO THE NUCLEIC ACIDS OF CELLS OF A REPRESENTATIVE PLANT, INVERTEBRATE AND VERTEBRATE ANIMAL OF VARIOUS AGES Ph.D. Thesis
Charles David Allen Polson 1979 93 p
Avail: Univ. Microfilms Order No. 8016621

The DNA of three tissues of Mus musculus, wild type and short lived vestigial wing mutant of Drosophila melanogaster and cotyledons of bush beans, Phaseolus vulgaris, was examined for age related fragmentation, formation of single stranded gaps, and decrease in RNA genes. Agarose gel electrophoresis showed that no DNA fragmentation occurred in wild type or vestigial wing Drosophila, or in DNA from mouse brain and heart. Mouse liver appeared to possess a large fragment in both ages tested; thus, no age related change occurred. Phaseolus cotyledon DNA possessed a fragment of approximately 3.5 megadaltons in both imbibed seeds and 12 day old cotyledons. Therefore, there was no age related increase in DNA fragmentation. Results indicate that DNA fragmentation, formation of single-stranded gaps, and loss of RNA genes are not of universal occurrence in aging organisms. Dissert. Abstr.

N80-29988 American Univ., Washington, D. C.
INTERACTION OF ELECTROMAGNETIC ENERGY WITH ABSORPTIVE MATERIAL BY THERMALLY INDUCING ELASTIC STRESS WAVES Ph.D Thesis
Kenneth John Oscar 1980 225 p
Avail: Univ. Microfilms Order No. 8017445

Rats were exposed to 1.3 or 2.8 gHz, pulsed or continuous wave (CW) microwave energy. Exposure time, incident power, and microwave pulse characteristics were varied. Local cerebral blood flow, blood volume, and blood-brain barrier permeability experiments were performed with several different, quantitative, radioactive isotope techniques with measurement by brain homogenization and liquid scintillation counting. It was confirmed that low power microwaves could alter the uptake of small molecular weight saccharides in the blood-brain barrier of rats. It was further learned that the permeability increases occurred for small but not large molecular weight saccharides. The rises returned to normal after 24 hours and were of greatest magnitude in the medulla, cerebellum, and hypothalamus. The relationship between the magnitude of the increase and the pulse characteristics of the microwaves were determined. Other pertinent observation and results are reported. Dissert. Abstr.

N80-29989# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
BIOMEDICAL RESEARCH, DEVELOPMENT AND ENGINEERING AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Annual Report, 1 Oct. 1978 - 30 Sep. 1979
Oct. 1979 74 p refs
(PB80-175268; JHU/APL/MQR-79) Avail: NTIS HC A04/MF A01 CSCL 06B

The Medical Institutions of The Johns Hopkins University and The Johns Hopkins University and The Johns Hopkins University Applied Physics Laboratory have developed a vigorous collaborative program of biomedical research, development, and systems engineering. An important objective of the program is to apply the expertise in engineering, the physical sciences, and systems analysis acquired by APL in defense and space research and development to problems of medical research and health care delivery. This program has grown to include collaboration with many of the clinical and basic science departments of the medical divisions. Active collaborative projects exist in ophthalmology, neurosensory research and instrumentation development, cardiovascular systems, patient monitoring, therapeutic and rehabilitation systems, clinical information systems, and clinical engineering. This application of state-of-the-art technology has contributed to advances in many areas of basic medical research and in clinical diagnosis and therapy through improvement of instrumentation, techniques, and basic understanding. GRA

N80-29990# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
HIGH-SPEED, LOW-LEVEL FLIGHT: AIRCREW FACTORS
David H. Glaister, ed. (Royal Air Force Inst. of Aviation Medicine) Mar. 1980 321 p refs In ENGLISH and FRENCH Presented at the Aerospace Med. Panel's Meeting, Lisbon, 22-26 Oct. 1979
(AGARD-CP-2670; ISBN-92-835-0263-9) Avail: NTIS HC A14/MF A01

Factors effecting aircrews during high speed, low level flight are addressed. Specific topics include ride quality and the effect of the physical environment; thermal effects; vibration effects; cockpit design and aircrew workload; and escape and survival. Particular attention is paid to ride bumpiness and the influence of airframe design and control strategy, the effects of vibration on vision, and the problems and potential uses of helmet mounted sights and displays. For individual titles, see N80-29991 through N80-30018.

N80-29991# Royal Air Force, Farnborough (England).
RIDE-BUMPINESS AND THE INFLUENCE OF ACTIVE CONTROL SYSTEMS **c54**
J. G. Jones *In* AGARD High-Speed, Low-Level Flight Mar. 1980 16 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The influence of aircraft design and control strategy on aircraft disturbances stressful to aircrew in high-speed, low-altitude flight is discussed. Standard methods for assessing ride quality are briefly reviewed. In addition, a technique is described that combines time-plane characteristics of response with frequency-plane features usually defined in terms of power spectra. This method, which has been developed as a tool for assessing the dynamic response of aircraft in turbulence, may provide useful additional information for human factors work. The technique leads in particular to a 'characteristic signature', in the time plane, of the aircraft response to gusts. In determining the dependence on aircraft dynamics of this characteristic energy pattern emphasis is placed on the concept of signal 'increments' or 'differences', in contrast to the sinusoidal components of Fourier analysis. It is perhaps relevant that the role of signal differences in time or space is also stressed in classical work on the mechanisms of human sensory perception. M.G.

N80-29992# Amt fuer Wehrgeophysik, Traben-Trarbach (West Germany).
INFLUENCES OF GEOPHYSICAL FACTORS (METEOROLOGICAL AND TOPOGRAPHICAL) ON THE PILOT-AIRCRAFT-SYSTEM IN HIGH SPEED LOW LEVEL FLIGHT (HSLLF) **c54**
Karl Krames *In* AGARD High-Speed, Low-Level Flight Mar. 1980 46 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The effects of interaction between atmosphere, lithosphere, and biosphere on low level high speed flight are discussed along with particular examinations of visibility, wind, thunderstorms, and sleet and hailstones. Since geophysical hazards are at their maximum in low levels, it follows that an extreme reaction ability of the man-machine system in that domain is an absolute requirement. The primary function of geophysical information consists in assessing those flight routes and flight levels presenting minimum potential hazards to the accomplishment of the individual military mission. The use of terrain data bases offers an optimal approach in achieving a high degree of resolution on the basis of 95-by-150-m-grid. The inclusion of weather, vegetation, and surface data will ensure detailed flight information. M.G.

N80-29993# British Aerospace Aircraft Group, Preston (England).
DEVELOPMENT IN HIGH-SPEED LOW-LEVEL FLIGHT: THE PILOT'S VIEWPOINT **c54**
J. J. Lee *In* AGARD High-Speed, Low-Level Flight Mar. 1980 3 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Developments in aviation technology during the last one and a half decades leading to significant benefits to high speed low level flight are briefly reviewed. It is concluded that the human characteristics of sensitiveness to stimuli, reaction time, strength/stamina, and adaptability have remained virtually unchanged in evolution terms and will remain a constant in flight assessment. Given the requirements of the mission and the scenario, the areas where development can be applied to improve mission success still remain firmly in the fields of performance, handling, guidance/navigation and vehicle design characteristics. M.G.

N80-29994# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
BIOTECHNOLOGY CHALLENGES PRESENT IN OPERATIONAL HIGH-SPEED LOW-LEVEL FLIGHT **c53**
Roy L. DeHart *In* AGARD High-Speed, Low-Level Flight Mar. 1980 6 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Operational stressors in high speed low level flight (HSLL) are identified for the mission scenarios of the B-52, F-111, and the A-10 aircraft. It is concluded that there exists a common technology need requiring contributions from the aerospace medical practitioner which becomes evident in discussing the aircraft in their respective HSLL combat missions. Continued development of automated systems integrating components within the cockpit affecting aircraft controls and weapons delivery systems is required. The specialist in aerospace medicine must ensure that sophisticated systems do in fact offload peripheral tasks of the pilot and increase his performance and ability to successfully accomplish the mission in a high threat combat environment. In addition, it is evident opportunities are available for biotechnology to improve or develop systems providing required information to the aircrew member in a method or format which permits him to remain heads-up and eyes-out-of the cockpit. M.G.

N80-29995# Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris (France).
THERMIC PROBLEMS PRESENTED BY HIGH-SPEED, LOW-LEVEL FLIGHT [PROBLEMES THERMIQUES POSES PAR LE VOL A GRANDE VITESSE ET A BASSE ALTITUDE] **c52**
J. Timbal and J. Colin *In* AGARD High-Speed, Low-Level Flight Mar. 1980 7 p refs In FRENCH (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

In certain cases, high speed flight at low altitude is likely to create conditions which surpass the tolerance limits of pilots. The physical factors of the environment as well as their effects on performance have been the subject of numerous studies. One method of predicting the period of heat tolerance is presented and discussed. The important part played by the humidity of the air and the physical activity of the pilot is demonstrated. The prevention of climatic inconveniences requires the use of relatively simple means which must be put into effect before flight. During the course of flight, prevention implies that the inconveniences were predicted during the design of the aircraft. The problem of risk associated with thermal loads is discussed under three principles: evaluating thermal ambience, evaluating human tolerance, and increasing the tolerance. Transl. by A.R.H.

N80-29996# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
EFFECTS ON PERFORMANCE OF THERMAL STRAIN ENCOUNTERED DURING HIGH-SPEED, LOW-LEVEL FLIGHT **c52**
T. M. Gibson, J. R. Allan, C. J. Lawson, and R. G. Green *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The effects of thermal strain on pilot performance during high speed, low level flight are examined through flight simulator testing. Each subject carried out two replicate experiments in which he was first heated to a deep body temperature of 37.5 C, then alternately heated and cooled twice between deep body temperature limits of 37.9 and 38.5 C, and finally cooled to 37.5 C. Core temperatures and skin temperatures were monitored. The results demonstrate that differences in performance on the flight simulator can be produced by heating or cooling the skin at the same level of deep body temperature. These differences do not exist at deep body temperatures of 37.5 C, but at core temperatures between 37.9 and 38.5 C, performance

during heating is worse than during cooling. Above the critical core temperature (i.e., above 37.5 C), skin temperature is a more important determinant of performance than the absolute level of deep body temperature; it is, however, impossible to exclude possible effects on performance of direction and rate of change of both core and skin temperatures. It is clear that the thermal strain encountered by aircrew in routine high speed, low level flight in warm conditions could cause a reduction in the operational capability of the aircrew. The situation will be exacerbated by anything that increases the thermal strain such as the wearing of more insulative protective clothing, higher work rates and repeated sorties separated by inadequate time for thermal recovery. M.G.

N80-29997# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.

AIRCREW HEAT STRESS DURING HIGH-SPEED, LOW-LEVEL FLIGHT **c52**

Richard F. Stribley and Sarah A. Nunneley *In* AGARD High-Speed, Low-Level Flight Mar. 1980 5 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

An overview of the problems related to aircrew heat stress during high speed low level flight is given. Physiological heat exchange mechanisms in the cockpit environment and the performance consequences of heat stress are examined. Current cockpit cooling systems designs are assessed and suggestions are made for the design of man-oriented cockpit cooling. M.G.

N80-29998# Laboratoire Central de Biologie Aerospatiale, Paris (France).

QUANTIFYING THE AGRESSION GENERATED BY LOW FREQUENCY VIBRATIONS [ESSAI DE QUANTIFICATION DE L'AGRESSION ENGENDREE PAR LES VIBRATIONS DE BASSE FREQUENCE] **c54**

P. Quandieu, P. Borredon, J. C. Rouhet, and L. Pellieux *In* AGARD High-Speed, Low-Level Flight Mar. 1980 17 p refs In FRENCH (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

From a biomechanical viewpoint, man can be considered as a deformable solid under the effect of mechanical stimulation such that as provoked by flight at high speed and low altitude. A physiological response to physical stimulation results and muscular mass struggles against the deformation imposed. According to the degree of muscle tension, the vibratory response of the subject is a phase displacement in relation to the oscillation which gives birth to movement. The final deformation is the result of mechanical action and physiological reaction. A baboon was used in laboratory tests to demonstrate magnitude of the mechanical capability to account for the behavior of a subject exposed to vibrations. A loads transducer and an accelerometer were placed at the point where force was applied in order to determine the effective mass (the complex relation of dynamic force to the acceleration). With the help of measurements obtained totally outside the body, it was possible to record an eminently variable dynamic behavior the whole length of the same vibration. The importance of the variations obtained on the parameters considered provides hope for using the method to examine the total behavior of man exposed to vibrations. Transl. by A.R.H.

N80-29999# Naval Aerospace Medical Research Lab., New Orleans, La.

A METHOD FOR STUDYING HUMAN BIODYNAMIC RESPONSES TO WHOLE-BODY Z-AXIS **c52**

J. C. Guignard, C. L. Ewing, G. C. Willems, W. Anderson, W. H. Muzzy, III, D. J. Thomas, and P. L. Majewski *In* AGARD High-Speed, Low-Level Flight Mar. 1980 7 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

The methodology used as well as some illustrative results obtained in current experiments to determine the transmissibility of mechanical vibration to major axial segments (pelvis, upper torso, head) of the seated human body vibrated in the z-axis are presented. Factors influencing transmissibility are mentioned and the importance of controlling such factors in experimental determinations of the human biodynamic response to vibration is discussed. The methodology described, adapted from established use in human impact studies, includes the use of standardized anatomical coordinate systems for data reference, which is essential to the meaningful comparison of responses measured in different subjects or in different conditions of vibration. R.C.T.

N80-30000# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fer Flugmedizin.

HEAD MOVEMENTS INDUCED BY VERTICAL VIBRATIONS **c52**

L. Vogt, E. Schwartz, and H. Mertens *In* AGARD High-Speed, Low-Level Flight Mar. 1980 14 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

Eleven subjects were vibrated on a shake-table in the frequency range of 2 Hz to 19 Hz to assess the complex head motion induced by z-axis mechanical vibration. Acceleration amplitude was sinusoidal and held constant at 0.35 g (rms). Each subject was given two trials; one sitting relaxed without a backrest; the other leaning against a backrest with a 12 deg inclination from the vertical. Head motion was recorded with a special television camera (x-y tracker) by pursuing a target painted on the temporal part of the subject's forehead. This instrument continuously records the horizontal and vertical coordinates of the tracked point and gives the output as analogues voltages. For each frequency and experimental condition the vertical and horizontal motion of the tracking target was related to the displacement of the shake-table. The results are given as different transmissibility curves for vertical and horizontal head motion. When relating horizontal to vertical transmissibility it becomes obvious that, without a backrest, at the resonant frequency the horizontal transmissibility is about 75 percent of the vertical transmissibility. When using a backrest horizontal transmissibility is reduced to about 35 percent of the vertical transmissibility. R.C.T.

N80-30001# Royal Aircraft Establishment, Farnborough (England).

THE EFFECT OF RECLINED SEATING ON THE TRANSMISSION OF LINEAR VIBRATION TO THE HEAD **c54**

Mary E. Johnston *In* AGARD High-Speed, Low-Level Flight Mar. 1980 14 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

The transmission of vibration to the heads of subjects seated in a Mk 10B ejection seat exposed to vibration within the frequency range 2-25 Hz was measured. Measurements were made for the seat conventionally mounted (back angle 20 deg to the vertical) and reclined for seat back angles of 30 deg., 45 deg., and 60 deg. to the vertical. The seat was vibrated using a swept sine wave technique in either the vertical or lateral direction. Head motion in each of the three head anatomical orthogonal linear axes (G sub x, G ub y, G sub z) was measured on a bite bar fitted with accelerometers. Ten subjects were used, each fitted with a standard Mk 2/3 flying helmet. The results indicate that for a given input, particularly in the lateral axis, head motion increases considerably when the head is in contact with the rest. Also head motion both against and off the rest increases as the seat back angle to the vertical is increased. Such increases in vibration to the head are very uncomfortable and could well lead to a performance decrement for a visual task. R.C.T.

N80-30002# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

THE EFFECTS OF AIRCRAFT VIBRATION ON VISION **c54**

G. R. Barnes *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

Movements of the head resulting from aircraft vibration were investigated in terms of their effects on visual performance. Major emphasis was placed on the limitations in the response of the pursuit reflex and the vestibulo-ocular reflex. The following analyses were conducted in order to assess: (1) the frequency characteristics of the vestibulo-ocular and pursuit reflexes; (2) the ability of subjects to suppress reflex vestibular eye movements which become inappropriate when viewing a helmet-mounted display; (3) the effect of relative movement between the eye and the viewed object on visual performance.

and (4) the biodynamic response of the head during vibration which gives rise to stimulation of the vestibular system. The results are discussed in an attempt to estimate the effects of aircraft vibration on visual performance. R.C.T.

N80-30003# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF 3-25 Hz VIBRATION ON THE LEGIBILITY OF NUMERIC LIGHT EMITTING DIODE DISPLAYS **c54**
Mary E. Johnston and John H. Wharf *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The effects of 3-25 Hz2 sinusoidal vibration at an rms acceleration level of 2.5 m/s2 in both the vertical and lateral axes on the performance of a reading task are described. The task was to read aloud numeric characters presented on a yellow high luminance light emitting diode display which was designed for the military cockpit. Random numbers were presented on the display in sets of four changed every 3 s. The subjects were each fitted with a MK 2/3 flying helmet and strapped into an Mk 10B ejection seat which was mounted on the same vibration platform as the display. Tests were conducted with the subject's head held both against and just off the head rest. The results indicate that reading performance is affected most by lateral vibration, when the head is against the head rest. Maximum errors occurred for lateral vibration frequencies of 15-16 Hz which is shown to correspond to the probable onset of overlapping nodal images due to head vibration. R.C.T.

N80-30004# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
THE EFFECT OF TURBULENCE ON HELMET MOUNTED SIGHT AIMING ACCURACIES **c53**
N. O. Tatham *In* AGARD High-Speed, Low-Level Flight Mar. 1980 4 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The effects of the turbulence associated with high speed, low level flight on the accuracies achievable with helmet mounted sighting equipment were assessed. In-flight analysis were conducted during trials in a Canberra aircraft, flying straight and level at 350 km, 250 ft. Laboratory analysis were conducted using a two axis vibration rig driven by vibration data recorded from the same Canberra aircraft to provide simulated turbulence. Aiming accuracies were obtained for collimated targets fixed in space in the simulation, and for both collimated targets fixed to the airframe and ground targets in flight. The results obtained show a good correlation between aiming errors achieved in flight and those obtained from the simulation, and demonstrate that the aiming errors consist mainly of a low frequency random motion which increases with vibration level. In addition, various techniques were investigated to overcome the errors involved in order to enable fine aiming to be performed with the helmet sight. R.C.T.

N80-30005# Naval Aerospace Medical Research Lab., New Orleans, La.
CLINICAL MEDICAL EFFECTS OF HEAD AND NECK RESPONSE DURING BIODYNAMIC STRESS EXPERIMENTS **c52**
D. J. Thomas, C. L. Ewing, P. L. Majewski, and N. S. Gilbert *In* AGARD High-Speed, Low-Level Flight Mar. 1980 15 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Volunteers were subjected to various degrees of impact acceleration. The directions of applied acceleration were -X (front to back), +Y (right to left), and -X+Y (45 degrees between -X and +Y). The major categories of symptoms were neck pain, headache, restraint related musculoskeletal symptoms, and syncope. A few special cases had findings which required clinical evaluation and followup. The type, extent, duration, and severity of the symptoms were related in some cases to the direction peak acceleration, and acceleration duration. R.C.T.

N80-30006# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPERATIONAL ASPECTS OF GUIDANCE AND CONTROL ADVANCES VERSUS PILOT WORKLOAD FOR LOW ALTITUDE, HIGH SPEED FLIGHT **c54**
Morris A. Ostgaard *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Some of the characteristics of the human operator and their similarity to guidance and control functions are discussed. It is shown that the operator's characteristics as a controller depend on four kinds of variables: control task variables, which include the system inputs and all the system elements external to the operator; environmental variables such as ambient illumination, temperature, vibration, etc.; operator centered variables such as training, fatigue, motivation; and procedural variables such as instructions, practice, order of presentation relating to a given task. When these variables are essentially time stationary or invariant over an interval of interest, the operator vehicle system can be modeled as a quasilinear system much the same as standard servo loops. R.C.T.

N80-30007# Fraunhofer-Inst. fuer Informations- und Datenverarbeitung, Karlsruhe (West Germany).
TV OPERATOR PERFORMANCE IN REAL TIME AIR-TO-GROUND RECONNAISSANCE MISSIONS UNDER TASK-LOADING CONDITIONS **c53**
H. Mutschler *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs Sponsored by the German Federal Ministry of Defense (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The detection performance of a black-and-white-TV operator in real time reconnaissance missions was determined by the parameters of the RPV-system, the scene, and the task. A series of 6 experiments were performed with 19 untrained subjects who had to find military vehicles in static ground scenes displayed on a TV screen. The scenes were presented only shortly, for 1 to 10 secs. This corresponds to a speed of about 50 to 500 km/h at a nonoverlapping frame rate. The subjects pointed to located targets with a light-pen. Analysis of variance indicate that the detection rate is influenced by: (1) scene parameters which consititute the conspicuity of a target in a natural scene, such as global context, contrast and local context; (2) short presentation times of less than 3 secs; (3) system parameters such as resolution and image segmentation; and (4) number of targets. Detection rate decreases if the task is to mark all targets and detection rate increases if the task is only to indicate those scenes which contain at least one target. The false alarm rate decreases with the number of sessions the subjects took part in and was finally at low level. Taking the confidence level expressed into account proved to increase the detection-false alarm ratio remarkably. Search times were nearly equal to presentation times from 1 to 5 secs only. The search times for the 50% detection rate decreased from 4 secs in the first experiment to 2 secs in the last one. R.C.T.

N80-30008# Marconi Avionics Ltd., Rochester (England). Airborne Display Div.
THE INFLUENCE OF THE DESIGN OF DISPLAYS ON COCKPIT WORKLOAD **c54**
R. H. Holmes *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The problems involved in designing display and controls for high speed low level aircraft are discussed with the emphasis on the reduction of cockpit workload. Some modern display techniques are also described. R.C.T.

N80-30009# Marconi Avionics Ltd., Rochester (England). Airborne Display Div.
COLOUR DISPLAYS: THEIR AVAILABILITY, PERFORMANCE AND APPLICATION TO IMPROVED CREW EFFICIENCY **c54**
D. W. Hussey *In* AGARD High-Speed, Low-Level Flight Mar. 1980 12 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The use of advanced technology in the form of multifunction electronic displays, processors, sophisticated sensors, and other automated pilot aids are discussed. Guidelines are suggested which are to be used in determining how color is used to enhance the presentation of information. R.C.T.

N80-30010# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
HELMET-MOUNTED DEVICES IN LOW-FLYING HIGH-SPEED AIRCRAFT **c54**
D. N. Jarrett *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Two separate simulation studies are described. The first assesses the amount of movement occurring between the pilot's helmet and his eyes. The second concerns the legibility of information presented on an experimental LED matrix display. It is concluded that aircraft vibration does not cause significant helmet movement in comparison with natural voluntary head motion, and that the degrading effect of aircraft vibration on the legibility of displayed information could be counteracted using a brighter display. E.D.K.

N80-30011# Naval Air Development Center, Warminster, Pa.
THE ROLE OF HELMET MOUNTED DISPLAYS IN HIGH-SPEED LOW-LEVEL FLIGHT **c54**
Gloria Twine Chisum *In* AGARD High-Speed, Low-Level Flight Mar. 1980 5 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

During critical phases of flight operations the requirement for shifts of gaze between the environment outside the cockpit and the interior of the cockpit is a problem which can be eased by the development of an effective helmet mounted display capable of presenting sensor and aircraft position and condition information. In both fixed wing and rotary wing aircraft, a head out of the cockpit attitude is considered to be highly desirable. An effective helmet mounted display is one which is comfortable to use, does not degrade normal visual functioning, can present the required information, and does not increase crew fatigue due to weight and bulk. The general design concerns regarding helmet mounted displays apply to those to be used in a high speed, low level environment. Some of the design parameters take on special significance, however, in high speed low level flight. E.D.K.

N80-30012# Naval Air Systems Command, Washington, D. C.
RESEARCH FOR VISUAL ENHANCEMENT FOR HIGH SPEED LOW LEVEL FLIGHT SPONSORED BY THE NAVAL AIR SYSTEMS COMMAND **c52**
H. Rosenwasser, Gloria Twine Chisum (NADC, Warminster, Pa.), J. J. Kulik (Naval Training Equipment Center), M. L. Wolbarsht (Duke Univ.), M. M. Cohen (NADC, Warminster, Pa.), and A. Lewis (Cornell Univ.) *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs (For primary document see N80-29990 20-51)
(Contracts N00019-78-C-0431; N00019-78-C-3036)
Avail: NTIS HC A14/MF A01

Apart from engineering considerations, the proper emphasis of the various parameters of visual displays in high speed low level flight depends upon the knowledge of the physiological variables in the visual system. Psychophysical tests can best be interpreted in conjunction with a detailed examination of the physiological function of the visual system. A summary of programs is given to show progress in this approach. E.D.K.

N80-30013# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
HUMAN FACTORS IN HIGH-SPEED LOW-LEVEL ACCIDENTS: A 15 YEAR REVIEW **c03**
R. C. Rud and D. F. Leben *In* AGARD High-Speed, Low-Level Flight Mar. 1980 6 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The Canadian Forces introduced the CF 104G into Squadron Operation in 1963 and since that time these aircraft have operated in the high speed, low level environment in both the strike/reconnaissance and tactical support roles. Fifty seven accidents involving these aircraft are reviewed with regard to cause factors. Marginal weather appears to be the one most significant factor contributing to low level, high speed accidents; however, several human factors such as visual contrast problems, fatigue, stress, reaction time, mission completion syndrome, inattention, and task overload were identified. Aspects of accidents which typify human factors problems are described. Suggested possible preventive measures are outlined. E.D.K.

N80-30014# Naval Aerospace Medical Research Lab., New Orleans, La.
CREW STATION ASSESSMENT USING THE BIOMAN MODELING SYSTEM **c54**
Georg D. Frisch, Louis A. Daulerio, and Michael Schultz *In* AGARD High-Speed, Low-Level Flight Mar. 1980 16 p refs Prepared in cooperation with NADC, Warminster, Pa. (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The use of the Bioman modeling system in evaluating the physical compatability of crew members with crew stations under emergency egress conditions is demonstrated and the usefulness of this approach as both a design and evaluation criteria is illustrated. Validated results from F-18 aircraft investigations based both on ejection tower and human physiological acceptance tests are presented to demonstrate the evaluation process of a given crew station. Furthermore, these results are contrasted against those obtained from the A-4 and F-14 and the relative propensity of direct impact injuries are discussed. E.D.K.

N80-30015# Bureau of Medicine and Surgery (Navy), Washington, D. C.
NAVAL AVIATION WATER SURVIVAL PROGRAM **c03**
Wilton McIntosh *In* AGARD High-Speed, Low-Level Flight Mar. 1980 3 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The very nature of naval aviation requires that the majority of operation flights be conducted overwater. The missions vary from operations in the immediate vicinity of aircraft carriers and shore bases to single aircraft flights hundreds of miles form the nearest land. Each situation presents unique problems in terms of required survival equipment and length of time to rescue. Major revisions to the Naval Aviation Water Survival Program are presently underway. The Training curricula are being standardized and water survival instructors are to be extensively trained to conduct the training. Aviation life support systems are being modified to provide automatic life preserver inflation and parachute divestment. New water training devices are being procured and training is to be conducted in the devices with the same configuration of life support equipment with which the aircrew members fly. E.D.K.

N80-30016# Martin-Baker Aircraft Co. Ltd., Denham (England).
HIGH-SPEED, LOW-LEVEL FLIGHT SURVIVAL ON EJECTION **c03**
M. A. A. Hobbs *In* AGARD High-Speed, Low-Level Flight Mar. 1980 2 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The history of work on high speed low level ejection is presented. Current bay practices and a look into the future are also discussed. E.D.K.

N80-30017# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MINIMIZING THE SEQUENCED DELAY TIME FOR ESCAPE FROM HIGH-SPEED, LOW-LEVEL FLIGHT PROFILES **c03**
James H. Raddin, Jr., Lawrence J. Specker, and James W. Brinkley *In* AGARD High-Speed, Low-Level Flight Mar. 1980 12 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The time delay that occurs between the actuation of an escape system and the actual initiation of the ejection catapult acceleration separate the crew from an aircraft is one of the critical factors in the design of escape systems for high speed low level (HSLL) flight conditions. This delay may preclude what could otherwise be a successful escape from certain HSLL profiles. The purpose of this paper is to examine the significance of current operational delay times and describe techniques to minimize the delays. Operational through-the-canopy ejection data are presented to assess the risk of injury incurred in eliminating the delay time altogether. Experimental data from tests with human volunteers are presented to demonstrate the potential for significantly reducing the time required for upper torso retraction. Finally the implications of available aeromedical

evidence are elevated in the definition of the most promising approaches to minimize the time required for a HSLL escape sequence. E.D.K.

N80-30018# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
LOW LEVEL, ADVERSE ATTITUDE ESCAPE USING A VERTICAL SEEKING EJECTION SEAT **c03**
John J. Tyburski, Georg D. Frisch (Naval Aerospace Medical Research Lab., New Orleans, La.), and Louis A. Daulerio *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Recent advances in the development of a maximum performance ejection seat (MPES) with a vertical seeking capability address the need for safe escape from aircraft at low altitude, high speed, and extreme adverse attitude conditions. The performance specifications of this system, as presently envisioned, provide safe egress from an inverted aircraft at airspeeds of 0 through 600 knots and altitudes as low as 50 feet above ground level (AGL). The data base and techniques to be used to predict the occupant response consist of instrumented ejection tests, mathematical simulations, and graphical analysis of tests results. Consideration is also given to the occupant's anthropomorphic properties and physical restrictions such as initial position and seat configuration. The applicability and efficacy of utilizing biodynamic response simulation and other techniques, not only as a design tool in the evaluation of the physical compatibility of man and ejection system, but also in the evaluation of the ejection system performance are demonstrated. E.D.K.

N80-30019# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
OPERATIONAL ROLES, AIRCREW SYSTEMS AND HUMAN FACTORS IN FUTURE HIGH PERFORMANCE AIRCRAFT
P. F. Iampietro, ed. Mar. 1980 97 p refs Partly in ENGLISH and FRENCH Presented at the Aerospace Med. Panels Specialist Meeting, Lisbon, 22-26 Oct. 1979
(AGARD-CP-266; ISBN-92-835-0262-0) Avail: NTIS HC A05/MF A01

The understanding of the operational characteristics of high performance aircraft in relationship to the operator's physiological, cognitive, psychomotor and perceptual capabilities is investigated. Relationships between man and machine are discussed in order to identify any biotechnology research deficiencies and establish appropriate selection, training, and assignment criteria for future high performance aircraft. For individual titles, see N80-30020 through N80-30028.

N80-30020# Department of the Air Force, Edwards AFB, Calif. F-16 Combined Test Force.
THE OPERATIONAL ROLES OF THE F-16 **c05**
Robert C. Ettinger *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 18 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The F-16 weapons system is described from its design features to its cockpit displays and controls. The multirole capacity of the F-16 is illustrated by description of the weapons delivery systems, aircraft performance, and weapons carriage capability. Typical operational missions from NATO bases in F-16 European participating countries over Central and Northern Europe are discussed in detail. E.D.K.

N80-30021# French Air Force, Paris. Bureau des Programmes de Materiel.
OPERATIONAL MISSIONS AND CONCEPTUAL DESIGN OF THE MIRAGE 2000 **c05**
Jacques Guillou *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 5 p In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The Mirage 2000 program was established to assure the replacement of all versions of the Mirage 2 aircraft. Intended for defense and aerial superiority, the first Mirage 2000 version must have the capability to intercept hostile bodies at very high altitude, to destroy hostile bodies penetrating at low altitude, and to engage in close combat with weapons equal to those on the test pursuit aircraft of its generation. The SNECMA M 53 engine will be used with a delta wing configuration and electric flight controls. The capacity for maneuverability of the Mirage 2000 marks a fundamental progress in relation to the preceeding aircraft and will lead to new combat techniques. Transl. by A.R.H.

N80-30022# Royal Air Force, London (England).
THE CAPABILITIES AND OPERATIONAL ROLES OF ROYAL AIR FORCE TORNADOES **c05**
H. M. Archer *In* AGARD Operational Roles, Aircraft Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The concept of producing a multirole aircraft designed to meet the complexities of a number of roles was reached only after extensive computer analysis had shown the way ahead. For the RAF, the air-to-ground task and the air-to-air task calls for differing operating capabilities, but Tornado can meet these requirements. In its IDS version, the aircraft is able to effectively carry out the roles of counter-air, interdiction, close air support, maritime attack, and reconnaissance. Moreover, it is able to do so at very high speed and very low altitude, regardless of weather. The ADV on the other hand uses its powerful long range multitarget radar, advanced avionics with computerized mission planning, and automatic attack features, together with its missile armament, to make it the most effective interceptor available for the air defence of the UK's large strategic area. Backing this very wide range of capabilities, is a comprehensive maintenance system of support, designed from the outset to optimize fault diagnosis, and keep the aircraft ready to fly with the minimum delay. E.D.K.

N80-30023# French Air Force, Bretigny sur Orge. Centre d'Essais en Vol.
WEAPONS SYSTEMS OF THE MIRAGE 2000: MAN MACHINE INTERFACE [LE SYSTEME D'ARMES DU MIRAGE 2000 INTERFACE HOMME MACHINE] **c54**
G. Varin *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 15 p In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The multipurpose role of the Mirage 2000 aircraft led to the design of a very complex weapon system which includes navigation, automatic pilot, radar, and countermeasures. The use of such a system which already saturates the pilot in combat aircraft actually in service could be still more difficult in the Mirage 2000. In face, considering the maneuverability qualities of the aircraft, which is largely augmented by electric flight control, the Air Army could introduce new combat techniques which would be more trying and more constraining for the pilot. In order to best utilize the capabilities of the Mirage 2000, an important integration effort was made at the cabin level to realize the best compromise in the presentation of parameters and of the controls at the pilot station: displays highly adapted to each flight phase, multiplexed control, and synthetic representation of tactical situations. Transl. by A.R.H.

N80-30024# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
TORNADO - AIRCREW SYSTEMS **c54**
E. P. Beck (Royal Navy) *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 7 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

Aspects of the aircrew equipment assembly (AEA) for Tornado, including the cabin environment, the escape system, personal equipment and associated supply systems, and survival equipment are considered. The size rolls and integration of preproduction standard items comprising the various AEAs are validated, unforseen man/seat/cockpit incompatibilities are identified, limitations to be imposed on the aircrew population acceptable for Tornado on account of critical anthropometric dimensions are defined, and proposed aircrew drills for strapping-in, emergency ground egress, etc., are refined. E.D.K.

N80-30025# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Reconnaissance and Weapon Delivery Div.
INFORMATION TRANSFER FOR IMPROVED PILOT PERFORMANCE **c53**
Robert N. Lutter *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The missile intercept confidence factor (MICF) concept was developed to provide the pilot with information about the engagement dynamics of an air-to-air missile engagement. It attempts to account for the critical parameter target maneuver by bounding the possible aerodynamic boundaries, by calculating upper and lower boundary limits. A no-escape target maneuver is utilized to establish the lower boundary and the current maneuver is used for the upper boundary. The MICF factor relates the pilot's position relative to these two boundaries and a minimum range boundary. As an interceptor varies its position within the missile launch envelope boundaries, the MICF varies between a value of zero to one and presents the pilot with an indication of the increasing/decreasing goodness of his launch condition. The MICF allows the pilot to be interactive with the fire control system. Through an assessment of the tactical situation, the pilot can determine whether to accept a low confidence launch or to maneuver to a more favorable launch position. E.D.K.

N80-30026# Panavia Aircraft G.m.b.H., Munich (West Germany). Flight Operations.
HUMAN FACTORS ASPECTS IN HIGH SPEED LOW LEVEL FLIGHT **c54**
James L. Dell *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 4 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

Human factors aspects of high speed, low level flying are discussed. There is a direct relationship between crew comfort and operational efficiency. The following areas of comfort are discussed: flying clothing; combined harness, arm, leg, and head restraints; helmets; anti-g protection; ejector seats; cockpit conditioning; cockpit layout; noise aspects; and ride comfort. Other topics include workload and workload sharing, physiological and psychological aspects, spatial disorientation, and detachment phenomenon. E.D.K.

N80-30027# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
ADDRESSING HUMAN FACTOR OPTIONS IN CONCEPTUAL DESIGN **c54**
Philip V. Kulwicki *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 15 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The interplay of human factors technology with systems design disciplines during the conceptual phase of development is discussed. Such design features as a full bubble canopy for unobscured vision, fly by wire primary flight control system, modified ejection seat position for better comfort and G-relief and the hands-on-throttle-and-stick concept for improved subsystem management are examples of the benefits of addressing human factor options in conceptual design. E.D.K.

N80-30028# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).
HUMAN FACTORS IN MIRAGE 2000 MISSIONS [FACTEURS HUMAINS DES MISSIONS DU MIRAGE 2000] **c54**
Henri Vieillefond *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p refs In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

Like modern aircraft, the Mirage 2000 is characterized essentially by a great degree of controllability, an aptitude to perform at high altitude, and a lessening of the pilot's workload. These three essential characteristics require that the pilot adapt to his aircraft. The great controllability implies very brutal variations of intense accelerations which the pilot must endure. Toleration of repeated accelerations is still poorly understood, especially over a long period, consequently pilot selection must be rigorous. The physiopathological effects of high altitude are better known and effective protection can be proposed. The chances of mission success are real only if the pilot has at his disposal a comfortable environment, which involves ergonometric studies of the seat, of controls, of protective equipment, and of cabin ventilation.
Transl. by A.R.H.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-30029 Stanford Univ., Calif.
INTERACTION OF RESPONSES TO ACOUSTIC AND ELECTRIC STIMULI AT THE AUDITORY CORTEX Ph.D. Thesis
Hugh Sherbon Lusted 1980 82 p
Avail: Univ. Microfilms Order No. 8016846

The interaction of tone pips and electrical pulses to the auditory nerve was studied. The evoked cortical response to each type of stimulus was recorded from the primary auditory cortex of barbiturate anesthetized cats. The stimuli were then delivered in time delayed pairs where the interstimulus interval was within the refractory period of the evoked response (typically 50 msec) to either stimulus alone. The amplitude of the cortical response to the trailing stimulus was compared with its single stimulus amplitude as the frequency of the tone pips was changed from 250 through 40 kHz. Results are reported. Dissert. Abstr.

N80-30030 Duke Univ., Durham, N. C.
THE STRUCTURE OF FIBRINOGEN AND ITS INTERMOLECULAR ASSOCIATIONS Ph.D. Thesis
Walter Earle Fowler 1980 120 p
Avail: Univ. Microfilms Order No. 8017140

Fibrinogen was prepared by shadowing with platinum in the conventional manner and by a novel technique of negative staining, which has not previously been used with fibrinogen. With the electron microscope, images were obtained that show a single consistent structure for the fabrinogen molecule in both types of preparations, conforming the trinocular model for fibrinogen. Plasmin degradation products of fibrinogen were examined in the electron microscope using the same preparatory techniques and the structures of these proteolytic fragments were related to the trinodular structure of the intact molecule. This work demonstrates structurally the sequence of events which occurs during the proteolysis of fibrinogen and also allows the well known effects of the various fragments on fibrin polymerization to be interpreted in structrural terms. The mechanism of fibrin polymerization was studied by many different techniques, but the location of intermolecular contact sites on the trinodular molecule and the packing arrangement of these molecules in the fibrin fiber are not known. Fibrinogen dimers were studied in the electron microscope using the same techniques that we developed for the study of single fibrinogen molecules and it was determined that their mode of association is end to end and linear. Evidence is presented that this intermolecular contact and arrangement are the same within the fibrin fiber.
Dissert. Abstr.

N80-30031# Systems Research Labs., Inc., Dayton, Ohio.
EFFECTS OF BACKGROUND ILLUMINATION AND TARGET CONTRAST ON FLASHBLINDNESS RECOVERY TIME
David C. Smedley and Diana R. Nelson Wright-Patterson AFB, Ohio AMRL Apr. 1979 18 p refs
(Contract F00615-76-C-5001)
(AD-A071906; AMRL-TR-79-30) Avail: NTIS HC A02/MF A01 CSCL 06/16

Seven subjects were shown a series of Landolt Cs with gaps oriented one of eight compass directions. After a randomly occurring flash, the subjects were asked to identify the gap orientation of the target. A tungsten halogen lamp was used as the flash source. The duration was 100 msec and the luminance was 60000 foot lamberts. Five background luminances (16,62,120,230, and 575 foot lamberts) and four target contrast

ratios (0.1,0.2,0.3 and 0.5) were used in this experiment. Results show recovery times at the 0.1 contrast level differ significantly from those obtained at the other levels regardless of background. Recovery times on the 16 foot lambert background level were significantly different from all other backgrounds regardless of contrast. There were no differences between recovery times at the other constrast levels or background luminances. Author

N80-30032# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
ACCELERATION AND PERFORMANCE MODELING WORKSHOP
Ensor Rodriguez-Lopez, ed., James H. Veghte, ed., and Patricia M. Lewandowski, ed. Dec. 1979 38 p refs Conf. held at Washington, D.C., 14-17 May 1979
(Contract F33615-78-C-0501; AF Proj. 7231)
(AD-A083700; AMRL-TR-79-111) Avail: NTIS
HC A03/MF A01 CSCL 06/19

A workshop, sponsored by the Aerospace Medical Research Laboratory, was held to exchange current knowledge in the area of accleration and performance modeling and to provide future guidance. Representatives from the Air Force, US Navy Medical Research Laboratories as well as distinguished academicians participated in this workshop. Two current modeling approaches were presented and provided the basis of later discussions. The participants responses to this effort in this area were favorable and future topics for another meeting were discussed. GRA

N80-30033# SRI International Corp., Arlington, Va.
ON THE INTERACTION OF NON-IONIZING RADIATION WITH PEOPLE
Malvin A. Ruderman and Gordon J. MacDonald Mar. 1980 47 p refs
(Contract MDA903-78-C-0086; ARPA Order 2504)
(AD-A082538; SRI-JSR-79-14) Avail: NTIS
HC A03/MF A01 CSCL 06/18

This report examines the physical basis for many of the thermal and non-thermal interactions between microwaves and the human body. Although a microwave beam incident on the human body dissipates, on the average, about the same amount of heat as does normal metabolism, it can actually dissipate considerably more heat in certain local regions of the body because of strong beam focusing effects (e.g., within the brain), flow of induced currents through small, constricted areas of the body (e.g., ankle, neck) and differences in electrical properties among body tissues. Since relatively large heat dissipation can occur on a local level, it would appear more rational to determine a maximum permissive radiation exposure in terms of maximum allowed dissipation in a specific sensitive part of the body rather than, as is presently done, in terms of external beam intensity (the present U.S. standard is 10 milliwatts/sq cm). For non-thermal processes, no special biological process or structure has been identified as likely to be especially sensitive to microwave fields or frequencies. The experimental results designed to explore the non-thermal effect of microwaves were studied. The results of all experiments purporting to demonstrate a significant non-thermal biological effect have been disputed. In fact, very few experiments in the entire field have ever been replicated; a situation which should be rectified. GRA

N80-30034# Kentucky Univ., Lexington.
RESPONSE OF THE CARDIOVASCULAR SYSTEM TO VIBRATION AND COMBINED STRESSES Final Report, 1 Oct. 1978 - 30 Sep. 1979
Charles F. Knapp Nov. 1979 52 p refs
(Contract F49620-79-C-0034; AF Proj. 2312)
(AD-A081879; AFOSR-80-0203TR) Avail: NTIS
HC A04/MF A01 CSCL 06/19

Cardiovascular regulation of acceleration-induced pressure and flow disturbances entails a complex pattern of afferent and efferent neural activity. The global nature of the stress in the levels applied invokes a response from both low and high pressure sensory areas as well as possible mechano-vestibular mechanisms. In this light, it was felt that the dual activation of both peripheral and cardiac efferent activity in response to acceleration stress would disguise the contribution from either mechanisms separately and for that reason a preparation was sought which would allow for delineation of these reactions. As a result, a canine chronic preparation that included a surgically denervated heart thereby permitting a detailed analysis of the peripheral vascular contribution to barostatic regulation has been developed. GRA

N80-30035# Old Dominion Univ., Norfolk, Va. Performance Assessment Lab.
PHYSIOLOGICAL INFLUENCES UPON THE WORK PERFORMANCE OF MEN AND WOMEN Final Report, 1 Nov. 1977 - 31 Dec. 1979
Glynn D. Coates, Raymond H. Kirby, Nancy K. Eberhardt, and Sarah J. Miller Dec. 1979 121 p refs
(Grant AF-AFOSR-3512-78; AF Proj. 2312)
(AD-A081947; ITR-79-22; AFOSR-80-0201TR) Avail: NTIS
HC A06/MF A01 CSCL 06/19

The synthetic-work methodology of the Multiple Task Performance Battery (MTPB) was employed in a series of studies designed to determine the effects of 48 hours of continuous work and sleep loss on the work performance of four groups of female subjects and one group of male subjects. The specific female groups were defined in the design by a factorial combination of the phase of the menstrual cycle at the beginning of the sleep-loss period (i.e., Menstrual vs Mid-Cycle) and whether or not the subjects were using contraceptive pills (i.e., Pill vs Normally Cycling). The performances of these four groups of female subjects were compared with those of a group of male subjects who performed the tasks of the MTPB under identical conditions; comparisons were performed during training, during a baseline period, during the sleep-loss, continuous-work period, and during a post-recovery period. An extension of these studies subsequently compared the performances of two groups of female subjects (i.e., Normally Cycling and Pill) for an additional five weeks under normal work conditions; the purpose of this extension was to assess the effects of the phases of the menstrual cycle on work performance. GRA

N80-30036# Texas Univ. Health Science Center, San Antonio.
EFFECTS OF INSPIRED OXYGEN ON THE METABOLISM OF PULMONARY SURFACTANT Final Report, Jun. 1977 - Sep. 1979
Richard J. King, Marita King, and Helen Martin Oct. 1979 31 p refs
(Grant AF-AFOSR-3323-77; AF Proj. 2312)
(AD-A082006; AFOSR-80-0178TR) Avail: NTIS
HC A03/MF A01 CSCL 06/16

Exposure to 100% oxygen at 1 atm. pressure has compromising effects on the ability of the lung to carry out gas exchange. The initial stages of injury include decreases in lung compliance, fluid accumulation in interstitial and alveolar spaces, and alveolar atelectasis. It is unknown whether pulmonary surfactant undergoes compositional or functional changes prior to or during the observed pathophysiology. Such alterations, if occurring, would interfere with normal physiological function and could exacerbate other effects of the environmental challenge. In order to better define alterations in surfactant that may result from breathing enriched concentrations of oxygen we exposed pathogen-free Wistar rats to 100% oxygen for 48 hours. In separate experiments we injected 3H-palmitate into rats and followed its incorporation and metabolism in the DSPC of Type 2 cells, alveolar surfactant, and alveolar macrophages. The results indicated that the DSPC moved from Type 2 cells to the alveolus, and at least part was ingested by alveolar macrophages. Overall metabolic flux was unchanged in animals exposed to oxygen. We conclude that breathing 100% oxygen for 48 hours has direct effects on the amount of surfactant in the lung, but probably no effect on the metabolic pathways which regulate its phospholipid composition. These differences probably occur because of metabolic changes in catabolic processes associated with the clearance of surfactant. GRA

N80-30037# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
RADIOFREQUENCY RADIATION AND LIVING TISSUE: THEORETICAL STUDIES Interim Report, Jan. 1978 - May 1979
Richard A. Albanese and Earl L. Bell Dec. 1979 44 p refs
(AF Proj. 7757)
(AD-A085952; SAM-TR-79-41) Avail: NTIS
HC A03/MF A01 CSCL 06/18

Basic mechanisms whereby radiofrequency electromagnetic radiation can interact with living tissue were investigated. An elementary statistical physics model of tissue, viewed as a chemical mixture, was considered, followed by a nonquantum physics analysis of macromolecular motion in an electromagnetic field. These studies of basic mechanisms suggest that radiofrequency electromagnetic radiation may be important in its effect on living tissue without causing significant tissue-temperature rises. GRA

N80-30038*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ASSESSMENT OF THE EFFECTS OF THE ZERO GRAVITY ENVIRONMENT ON THE HEALTH AND SAFETY OF SPACE WORKERS
18 Feb. 1980 17 p refs
(Contract DE-AI02-79CH-10025)
(NASA-TM-81122; DOE/CH-10025) Avail: NTIS HC A02/MF A01 CSCL 06S

A review was conducted of currently available information relating to adverse effects to the health and safety that space power system (SPS) space workers may experience. Currently available information on the responses of humans to space flight is somewhat limited and was obtained under conditions which are grossly different from conditions to be experienced by future space workers. The limitations in information and differences in conditions were considered in the assessment of potential health and safety hazards to the SPS space workers. The study did not disclose any adverse effects that would result in long term deviations to the medical physiological health of space workers so long as proper preventive or ameliorating action were taken. DOE

N80-30039# National Technical Information Service, Springfield, Va.
BIONICS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Apr. 1980
Brian Carrigan May 1980 138 p Supersedes NTIS/PS-79/0568; NTIS/PS-78/0550
(PB80-810641; NTIS/PS-79/0568; NTIS/PS-78/0550) Avail: NTIS HC $30.00/MF $30.00 CSCL 06D

Recent advances in visual information processing, electronic models of nerve cells, and biological sonar systems are discussed in these citations. Theory and applications are included, along with computerized simulation and signal processing. Electrophysiology and modelling of the central nervous system are also included. This updated bibliography contains 132 abstracts, 12 of which are new entries to the previous edition. GRA

N80-30040*# New Mexico Univ., Albuquerque. Technology Application Center.
CIRCADIAN RHYTHMS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Jan. 1980
George E. Zollars Apr. 1980 42 p Sponsored by NASA and NTIS
(NASA-CR-163323; PB80-809908) Avail: NTIS HC $30.00/MF $30.00 CSCL 06D

A bibliography containing citations to the international literature concerning circadian rhythms is presented. Topics covered are sleep, body temperature, work-rest cycles, hormone metabolisms, and human physiological responses to various activity cycles. GRA

N80-29995# Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris (France).
THERMIC PROBLEMS PRESENTED BY HIGH-SPEED, LOW-LEVEL FLIGHT [PROBLEMES THERMIQUES POSES PAR LE VOL A GRANDE VITESSE ET A BASSE ALTITUDE]
J. Timbal and J. Colin *In* AGARD High-Speed, Low-Level Flight Mar. 1980 7 p refs In FRENCH (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-29996# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
EFFECTS ON PERFORMANCE OF THERMAL STRAIN ENCOUNTERED DURING HIGH-SPEED, LOW-LEVEL FLIGHT
T. M. Gibson, J. R. Allan, C. J. Lawson, and R. G. Green *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-29997# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
AIRCREW HEAT STRESS DURING HIGH-SPEED, LOW-LEVEL FLIGHT
Richard F. Stribley and Sarah A. Nunneley *In* AGARD High-Speed, Low-Level Flight Mar. 1980 5 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-29999# Naval Aerospace Medical Research Lab., New Orleans, La.
A METHOD FOR STUDYING HUMAN BIODYNAMIC RESPONSES TO WHOLE-BODY Z-AXIS
J. C. Guignard, C. L. Ewing, G. C. Willems, W. Anderson, W. H. Muzzy, III, D. J. Thomas, and P. L. Majewski *In* AGARD High-Speed, Low-Level Flight Mar. 1980 7 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30000# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fer Flugmedizin.
HEAD MOVEMENTS INDUCED BY VERTICAL VIBRATIONS
L. Vogt, E. Schwartz, and H. Mertens *In* AGARD High-Speed, Low-Level Flight Mar. 1980 14 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30005# Naval Aerospace Medical Research Lab., New Orleans, La.
CLINICAL MEDICAL EFFECTS OF HEAD AND NECK RESPONSE DURING BIODYNAMIC STRESS EXPERIMENTS
D. J. Thomas, C. L. Ewing, P. L. Majewski, and N. S. Gilbert *In* AGARD High-Speed, Low-Level Flight Mar. 1980 15 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30012# Naval Air Systems Command, Washington, D. C.
RESEARCH FOR VISUAL ENHANCEMENT FOR HIGH SPEED LOW LEVEL FLIGHT SPONSORED BY THE NAVAL AIR SYSTEMS COMMAND
H. Rosenwasser, Gloria Twine Chisum (NADC, Warminster, Pa.), J. J. Kulik (Naval Training Equipment Center), M. L. Wolbarsht (Duke Univ.), M. M. Cohen (NADC, Warminster, Pa.), and A. Lewis (Cornell Univ.) *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs (For primary document see N80-29990 20-51)
(Contracts N00019-78-C-0431; N00019-78-C-3036)
Avail: NTIS HC A14/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-30041# Naval Aerospace Medical Research Lab., Pensacola, Fla.
A REVIEW OF DYNAMIC VISUAL ACUITY Interim Report
Tommy R. Morrison Mar. 1980 28 p refs
(MF51524004; MR0410103)
(AD-A085860; NAMRL-Monograph-28) Avail: NTIS HC A03/MF A01 CSCL 06/16

In many everyday situations relative motion exists between human beings and the visual information which they must acquire and resolve in order to perform their tasks successfully. In particular, tasks, such as flying aircraft, driving automobiles and

other vehicles, and resolving moving information presented via visual displays, impose a requirement on the human operator to process moving information. Since Dynamic Visual Acuity (DVA) is a critical visual skill involved in performing such visual tasks, the present review was undertaken in order to better understand the visual skill and to provide a basis for continuing research in this area. GRA

N80-30042# Human Engineering Labs., Aberdeen Proving Ground, Md.
HUMAN PERFORMANCE: PSYCHOLOGICAL AND SEX DIFFERENCES, A SELECTED BIBLIOGRAPHY
Gerald A. Hudgens and Linda L. Torsani-Fatkin Feb. 1980 163 p
(AD-A085824) Avail: NTIS HC A08/MF A01 CSCL 05/10

The bibliography is a compilation of 1571 references dealing with, or related to, the effects of sex differences on human performance. The material is organized into four categories: An Overview of Sex Differences, Physiological Sex Differences, Sex Differences in Cognitive and Motor Abilities, and Sex Differences in Personality. The time period covered is roughly from the 1930's into 1979. An index of first authors is included. GRA

N80-29994# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
BIOTECHNOLOGY CHALLENGES PRESENT IN OPERATIONAL HIGH-SPEED LOW-LEVEL FLIGHT
Roy L. DeHart *In* AGARD High-Speed, Low-Level Flight Mar. 1980 6 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30004# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
THE EFFECT OF TURBULENCE ON HELMET MOUNTED SIGHT AIMING ACCURACIES
N. O. Tatham *In* AGARD High-Speed, Low-Level Flight Mar. 1980 4 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30007# Fraunhofer-Inst. fuer Informations- und Datenverarbeitung, Karlsruhe (West Germany).
TV OPERATOR PERFORMANCE IN REAL TIME AIR-TO-GROUND RECONNAISSANCE MISSIONS UNDER TASK-LOADING CONDITIONS
H. Mutschler *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs Sponsored by the German Federal Ministry of Defense (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30025# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Reconnaissance and Weapon Delivery Div.
INFORMATION TRANSFER FOR IMPROVED PILOT PERFORMANCE
Robert N. Lutter *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-30043*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRESSURE SUIT JOINT ANALYZER Patent Application
Hubert C. Vykukal and Bruce Webbon, inventors (to NASA) Filed 11 Jul. 1980 13 p
(NASA-Case-ARC-11314-1; US-Patent-Appl-SN-168943) Avail: NTIS HC A02/MF A01 CSCL 06Q

A measurement system for simultaneously measuring torque and angular flexure in a pressure suit joint. One end of a joint under test is held rigid, and a torque transducer is pivotably supported on the other movable end of the joint. A potentiometer is attached to the transducer by an arm. The wiper shaft of the potentiometer is gripped by a reference arm that rotates the wiper shaft the same angle as the flexure of joint. A signal, generated by the potentiometer, is representative of the joint flexure angle, and a compensation circuit coverts the output of the transducer to a signal representative of joint torque. NASA

N80-30044# Technology, Inc., San Antonio, Tex. Life Sciences Div.
PROCEDURAL TESTS FOR ANTI-G PROTECTIVE DEVICES. VOLUME 2: G-SENSITIVITY TESTS Final Report, 1 Oct. 1976 - 30 Jun. 1978
Roy W. Thompson, Carmen E. Galvin, James E. Allred, Paul E. Love, and Larry J. Meeker Dec. 1979 203 p
(Contract F33615-77-C-0610; AF Proj. 7930)
(AD-A085982; SAM-TR-79-31-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 06/11

In this volume, an examination of anti-G valve failures is reported, as well as the results of 9 short term investigation dealing with acceleration protection equipment and studies on the USAFSAM Human Centrifuge. These studies involved: the CWU-9/P undergarments; the Statham PM131TC pressure transducer; the Ready Pressure Anti-G valve; the ALAR 'High flow' and 'Special' anti-G valves; accelerometer calibration, continuous ECG recording; control-center data distribution; closed-loop centrifuge control; and the Medilog recorder. GRA

N80-30045# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THERMAL AND ACCELERATION EFFECTS ON AIRCREW MEMBERS IN CHEMICAL DEFENSE GEAR Technical Report, Nov. 1978 - Jan. 1979
Ronald E. Yates, Clyde R. Replogle, and James H. Veghte Jan. 1980 36 p refs
(AF Proj. 6893)
(AD-A086026; AFAMRL-TR-79-71) Avail: NTIS HC A03/MF A01 CSCL 06/19

An experiment was conducted to determine the combined thermal and acceleration effects on aircrew members in chemical defense protective gear in a simulated air-to-ground mission. The subject flew two sorties per day in the Dynamic Environment Simulator. The environmental conditions simulated were typical of a 95th percentile hot summer central European day. Most of the responses seen in the subjects can be attributed to the thermal stress caused by the hot temperatures and the heavy protective clothing. GRA

N80-30046# Essex Corp., Alexandria, Va.
HUMAN ENGINEERING DESIGN CRITERIA FOR MODERN CONTROL/DISPLAY COMPONENTS AND STANDARD PARTS Final Report
David R. Eike, Thomas B. Malone, Stephen A. Fleger, and Jimmie H. Johnson May 1980 171 p refs
(Contract DAAK40-79-C-0144)
(AD-A086139; DRSMI/RS-CR-80-1) Avail: NTIS HC A08/MF A01 CSCL 05/8

A study was conducted to identify requirements for modification of MIL-STD-1472B to include human engineering design criteria for modern controls and displays; and to reduce the incidence of requests for waiver of MIL-STD-1472 resulting from unavailability of standard parts. Recommended changes are presented with rationales and references. GRA

N80-29991# Royal Air Force, Farnborough (England).
RIDE-BUMPINESS AND THE INFLUENCE OF ACTIVE CONTROL SYSTEMS
J. G. Jones *In* AGARD High-Speed, Low-Level Flight Mar. 1980 16 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-29992# Amt fuer Wehrgeophysik, Traben-Trarbach (West Germany).
INFLUENCES OF GEOPHYSICAL FACTORS (METEOROLOGICAL AND TOPOGRAPHICAL) ON THE PILOT-AIRCRAFT-SYSTEM IN HIGH SPEED LOW LEVEL FLIGHT (HSLLF)
Karl Krames *In* AGARD High-Speed, Low-Level Flight Mar. 1980 46 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-29993# British Aerospace Aircraft Group, Preston (England).
DEVELOPMENT IN HIGH-SPEED LOW-LEVEL FLIGHT: THE PILOT'S VIEWPOINT
J. J. Lee *In* AGARD High-Speed, Low-Level Flight Mar. 1980 3 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-29998# Laboratoire Central de Biologie Aerospatiale, Paris (France).
QUANTIFYING THE AGRESSION GENERATED BY LOW FREQUENCY VIBRATIONS [ESSAI DE QUANTIFICATION DE L'AGRESSION ENGENDREE PAR LES VIBRATIONS DE BASSE FREQUENCE]
P. Quandieu, P. Borredon, J. C. Rouhet, and L. Pellieux *In* AGARD High-Speed, Low-Level Flight Mar. 1980 17 p refs In FRENCH (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30001# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF RECLINED SEATING ON THE TRANSMISSION OF LINEAR VIBRATION TO THE HEAD
Mary E. Johnston *In* AGARD High-Speed, Low-Level Flight Mar. 1980 14 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30002# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
THE EFFECTS OF AIRCRAFT VIBRATION ON VISION
G. R. Barnes *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30003# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF 3-25 Hz VIBRATION ON THE LEGIBILITY OF NUMERIC LIGHT EMITTING DIODE DISPLAYS
Mary E. Johnston and John H. Wharf *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30006# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPERATIONAL ASPECTS OF GUIDANCE AND CONTROL ADVANCES VERSUS PILOT WORKLOAD FOR LOW ALTITUDE, HIGH SPEED FLIGHT
Morris A. Ostgaard *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30008# Marconi Avionics Ltd., Rochester (England). Airborne Display Div.
THE INFLUENCE OF THE DESIGN OF DISPLAYS ON COCKPIT WORKLOAD
R. H. Holmes *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30009# Marconi Avionics Ltd., Rochester (England). Airborne Display Div.
COLOUR DISPLAYS: THEIR AVAILABILITY, PERFORMANCE AND APPLICATION TO IMPROVED CREW EFFICIENCY
D. W. Hussey *In* AGARD High-Speed, Low-Level Flight Mar. 1980 12 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30010# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
HELMET-MOUNTED DEVICES IN LOW-FLYING HIGH-SPEED AIRCRAFT
D. N. Jarrett *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30011# Naval Air Development Center, Warminster, Pa.
THE ROLE OF HELMET MOUNTED DISPLAYS IN HIGH-SPEED LOW-LEVEL FLIGHT
Gloria Twine Chisum *In* AGARD High-Speed, Low-Level Flight Mar. 1980 5 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30014# Naval Aerospace Medical Research Lab., New Orleans, La.
CREW STATION ASSESSMENT USING THE BIOMAN MODELING SYSTEM
Georg D. Frisch, Louis A. Daulerio, and Michael Schultz *In* AGARD High-Speed, Low-Level Flight Mar. 1980 16 p refs Prepared in cooperation with NADC, Warminster, Pa. (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30023# French Air Force, Bretigny sur Orge. Centre d'Essais en Vol.
WEAPONS SYSTEMS OF THE MIRAGE 2000: MAN MACHINE INTERFACE [LE SYSTEME D'ARMES DU MIRAGE 2000 INTERFACE HOMME MACHINE]
G. Varin *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 15 p In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30024# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
TORNADO - AIRCREW SYSTEMS
E. P. Beck (Royal Navy) *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 7 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30026# Panavia Aircraft G.m.b.H., Munich (West Germany). Flight Operations.
HUMAN FACTORS ASPECTS IN HIGH SPEED LOW LEVEL FLIGHT
James L. Dell *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 4 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30027# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
ADDRESSING HUMAN FACTOR OPTIONS IN CONCEPTUAL DESIGN
Philip V. Kulwicki *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 15 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30028# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).
HUMAN FACTORS IN MIRAGE 2000 MISSIONS [FACTEURS HUMAINS DES MISSIONS DU MIRAGE 2000]
Henri Vieillefond *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p refs In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-30047 Oklahoma Univ., Norman.
A NEW METHOD FOR REALIZING PARALLEL PROCESSING MACHINES USING MULTIPLE-VALUED LOGIC Ph.D. Thesis
Monte Paul Tull 1980 212 p
Avail: Univ. Microfilms Order No. 8016936

The application of r-valued logic for the development of logic circuits that function as m identical but independent q-valued logic circuits, r = q(m), is explored. The resulting machine exhibits inferent parallelism wherein the logic values of the m sub-machines are multiplexed within the r levels of the multiple-valued logic, and the r-valued memory elements simultaneously store the logic states of the m machines. Multiple-valued digital circuits and systems processing these attributes are said to be state integrated and logic multiplexed. For the case q = 2, (m) identical binary machines can be combined into one r-valued r = 2 (m) machine that provides the same functions as a parallel binary machines. Further, given a single binary logic circuits, either combinational or sequential, m copies of the circuit can be constructed directly in a 2 (m) logic system. Each binary sub-circuit operates in parallel and independently of the other m-1 sub-circuits. To aid the sequential circuit design process, a new multiple-valued memory element is developed that simultaneously stores information for the independent binary sub-machines.

Dissert. Abstr.

N80-30048 Maryland Univ., College Park.
AN EXPERIMENTAL INVESTIGATION OF COMPUTER PROGRAM DEVELOPMENT APPROACHES AND COMPUTER PROGRAMMING METRICS Ph.D. Thesis
Robert William Reiter, Jr. 1979 152 p
Avail: Univ. Microfilms Order No. 8016993

Three programming environments were compared: individual programming under an ad hoc approach; team programming under an ad hoc approach; and team programming under a disciplined methodology. This disciplined methodology combined the use of reading, and chief programmer team organization. Data was obtained for a large number of automatable software metrics characterizing the software development process and the developed software product. The results reveal several statistically significant differences among the programming environments on the basis of the metrics. These results are interpreted as demonstrating the advantages of disciplined team programming in reducing software development costs relative to ad hoc approaches and improving software product quality relative to undisciplined team programming.

Dissert. Abstr.

N80-30049 Illinois Univ. at Urbana-Champaign.
MULTIPROCESSORS: DISCUSSION OF SOME THEORETICAL AND PRACTICAL PROBLEMS Ph.D. Thesis
David Alejandro PaduaHaiek 1980 133 p
Avail: Univ. Microfilms Order No. 8018194

Three problems in the design and use of multiprocessors were studied. A multiprocessor organization with the capability of executing both array and scalar instructions was outlined. The design of the processor/memory interconnection network was analyzed. Compiler algorithms for the translation of sequential programs into parallel programs suitable for execution in a multiprocessor were evaluated. Some theoretical problems were surveyed with respect to the fact that the allocation of processors to a paralled program is a time consuming operation.

Dissert. Abstr.

N80-30050*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RECONFIGURING REDUNDANCY MANAGEMENT Patent Application
Hendrik C. Gelderloos, inventor (to NASA) (Honeywell, Inc., St. Petersburg, Fla.) Filed 30 Jul. 1980 21 p Sponsored by NASA
(NASA-Case-MSC-18498-1; US-Patent-Appl-SN-173518) Avail: NTIS HC A02/MF A01 CSCL 09B

Input singals from sensors in a redundancy management system are provided redundantly in parallel so that a primary control signal may be selected. Median value signals from groups of three sensors are detected in median value selectors of selection filters. The detected median value signals are then also compared in a subtractor/comparator to determine whether any of them exceeds the others by an amount greater than the signal level for a failed sensor. If so, the lowest level detected medium value signal is sent as the primary control signal.

NASA

N80-30051# United Technologies Research Center, East Hartford, Conn.
MICROPROCESSOR REQUIREMENTS FOR IMPLEMENTING MODERN CONTROL LOGIC Final Technical Report, 1 Mar. 1979 - 29 Feb. 1980
Robert W. Guile, James R. Krodel, and Florence A. Farrar Apr. 1980 87 p refs
(Contract F49620-79-C-0078; AF Proj. 2304)
(AD-A085994; UTRC/R80-944590-1; AFOSR-80-0443TR)
Avail: NTIS HC A05/MF A01 CSCL 09/2

A demonstration of the use of microprocessors for implementing linear quadratic Gaussian (LQG) control was conducted. The demonstration consisted of simulating linear system dynamics on an analog computer and implementing LQG control and estimation dynamics on a microprocessor. Two cases were studied -- a single input second order system and a four input fifth order system. The second order system was controlled using an Intel 8080 8-bit microprocessor and fifth order system was controlled using a 16-bit Digital Equipment Corp LSI 11/2 microprocessor. Key requirements addressed include microprocessor requirements for: (1) word size; (2) computational capability, including arithmetic and input/output operations; and (3) memory requirements. The requirements were compared against predicted requirements made using previously developed analytic techniques. The implementation involved developing general purpose algorithms required for implementing LQG control and estimation. These algorithms consisted of matrix/vector multiplication, vector addition and input/output service routines. The same algorithms were employed in both the second order and the fifth order demonstration.

GRA

N80-30052# Harris Corp., Melbourne, Fla. Government Communications Systems Div.
MULTIPLE MICROPROCESSOR SYSTEM (MMS) DESIGN STUDY, VOLUME 3 Final Report
Griffiss AFB, N.Y. RADC Mar. 1980 36 p
(Contract F30602-78-C-0114; AF Proj. 2529)
(AD-A086245; RADC-TR-80-33-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 09/2

This is a dasign for a Multiple Microprocessor System (MMS) to be built as part of the System Architecture Evaluation Facility (SAEF) being developed at RADC. The MMS was designed to be used in the modeling of a wide range of multiprocessor configurations for the purpose of evaluating their suitability to unique Air Force data processing requirements.

GRA

N80-30053# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
MULTIHEAD AND MULTITAPE REAL TIME TURING MACHINES
Paul M. B. Vitanyi Jun. 1979 14 p refs Submitted for publication

(MC IW-111/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam (Netherlands)

Previous results which show that a k-head tape unit can be simulated in real time by a 4k-4 tape Turing machine are reviewed. It is observed that 2 tape Turing machines are more powerful in real time than 1 tape Turing machines. Furthermore, more read-write heads are shown to yield additional power in real time. Specifically, it follows that a 4k-3 head tape unit is more powerful than a [illegible] tape unit in real time. It is shown that k+1-head tape [illegible] more powerful in real time than k-head tape units. Closs[illegible] questions are investigated for classes of languages accepted [illegible] real time Turing machines with k one-head tape or one k-head tape. Author (ESA)

N80-30054# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.

COMPUTER SCIENCE AND TECHNOLOGY: APPLICATION OF MEASUREMENT CRITERIA IN THE SELECTION OF INTERACTIVE COMPUTER SERVICE. Final Report

Paul D. Amer. Apr. 1980. 95 p. refs.

(PB80-177645; NBS-SP-500-58; LC-80-600035) Avail: NTIS HC A05/MF A01 CSCL 09B

The data analysis component of the computer service selection process is addressed. A computer service selection model is presented and three binary type selection procedures applicable in the measurement phases of that model are given. As a result of employing these procedures, those services that perform below the performance level can be eliminated or penalized depending on whether the performance specification is mandatory or desirable in nature. The procedures explicitly specify prior to measurement an appropriate selection rule and/or the number of test measurements required in a comparision effort to attain a given level in statistical confidence in the results. Data from a case study are analyzed to illustrate application of the selection procedures. GRA

N80-30055# Maryland Univ., College Park. Dept. of Computer Science.

COMPUTER SCIENCE AND TECHNOLOGY: DATA ABSTRACTION, DATABASES, AND CONCEPTUAL MODELLING. AN ANNOTATED BIBLIOGRAPHY. Final Report

Michael L. Brodie. May 1980. 91 p. Sponsored by NBS.

(PB80-183833; NBS-SP-500-59; LC-80-600052) Avail: NTIS HC A05/MF A01 CSCL 09B

A bibliography containing 350 entries on issues within the area of conceptual modelling of dynamic systems of complex data is given. The entries are from recent work in the areas of database management, programming languages, artificial intelligence, and software engineering. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-30056 Stanford Univ., Calif.

LANGUAGE AND ENVIRONMENT FOR MULTI-LEVEL SIMULATION. Ph.D. Thesis

Dwight Douglass Hill. 1980. 185 p.

Avail: Univ. Microfilms. Order No. 8016830

A methodology is proposed for modeling and simulating computer systems. It makes use of a language called 'ADLIB' for specifying the behavior of computer subsystems, and a special environment called 'SABLE' for modeling their interactions. The ADLIB language is designed to be compatible with existing computer languages, since it is a superset of PASCAL. The SABLE environment accepts topological specifications written in a standard format, and uses them to allocate and interconnect the functional units described in ADLIB. This union of behavioral and structural design specifications makes it possible to apply type checking to hardware design. Ramifications of this are discussed for automatically detecting design errors at the interfaces between components. Language constructs are presented that can effectively model both synchronous and asynchronous systems to any degree of accuracy. In addition, a mechanism supporting the concurrent simulation of multiple levels of abstraction is developed. Several examples illustrate the description and simulation of systems ranging from distributed computer networks to individual logic gates. Dissert. Abstr.

N80-30057 Carnegie-Mellon Univ., Pittsburgh, Pa.

GEOMETRIC TRANSFORMS FOR FAST GEOMETRIC ALGORITHMS. Ph.D. Thesis

Kevin Quentin Brown. 1979. 156 p.

Avail: Univ. Microfilms. Order No. 8012772

The use of geometric transforms as algorithmic tools for constructing fast geometric algorithms is discussed. Several geometric problems whose solutions illustrate the use of geometric transforms are described. These include fast algorithms for interseting half-spaces, constructing Voronoi diagrams, and computing the Euclidean diameter of a set of points. For each of the major transforms a set of heuristics is included. Dissert. Abstr.

N80-30058 New York Univ., N. Y.

AN IMPLEMENTATION FOR GYVE: A LANGUAGE FOR CONCURRENT PROCESSING. Ph.D. Thesis

Jeanine Marietta Meyer. 1980. 627 p.

Avail: Univ. Microfilms. Order No. 8017579

A design for implementing a programming language, called GYVE for specifying groups of concurrent processes such as operating systems is presented. Important features of GYVE include compile time protection checking, explicit scheduling of processes and a dynamic destroy function. A detailed review of most of the constructs of GYVE is given as well as methods of how various features could be modified so as to ease the implementation and/or increase performance in certain situations. One such feature concerns accessing of shared objects. The syntactic and semantic phases of a GYVE compiler as well as the runtime structures and procedures required for execution of output from the compiler are specified. Dissert. Abstr.

N80-30059 Auburn Univ., Ala.

A CODE-BASED MODEL FOR PREDICTING PATH FAULTS IN COBOL PROGRAMS. Ph.D. Thesis

Robert Francis Roggio. 1980. 228 p.

Avail: Univ. Microfilms. Order No. 8018179

A static analyzer was developed to specifically identify infeasible paths (source code to which there is no logical path) in COBOL programs that are currently operational on B3500/B3700/B4700 computer systems. By exercising the static analyzer on over 500 COBOL source programs, data were drawn and a large data base was constructed to support further analysis of the problem. Simple linear as well as multiple variable models based on fourteen program characteristics were used for indicating path faults in COBOL programs. By applying the models to existing COBOL programs, it was possible to determine those programs that would benefit from the expenditure of resources for static analysis in attempts to improve overall system reliability. Dissert. Abstr.

N80-30060*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SCHEDULING ALGORITHM FOR MISSION PLANNING AND LOGISTICS EVALUATION (SAMPLE). VOLUME 3: THE GREEDY ALGORITHM

Edwin Dupnick and Diana Wiggins (Lockheed Electronics Co., Inc., Houston, Tex.) Feb. 1980. 37 p.

(NASA-TM-81116; JCS-16395-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 09B

The functional specifications, functional design and flow, and the program logic of the GREEDY computer program are described. The GREEDY program is a submodule of the Scheduling Algorithm for Mission Planning and Logistics Evaluation (SAMPLE) program and has been designed as a continuation of the shuttle Mission Payloads (MPLS) program. The MPLS uses input payload data to form a set of feasible payload combinations; from these, GREEDY selects a subset of combinations (a traffic model) so all payloads can be included without redundancy. The program also provides the user a tutorial option so that he can choose an alternate traffic model in case a particular traffic model is unacceptable. M.G.

N80-30061*# Colorado Univ. at Boulder.
FLIGHT SOFTWARE REQUIREMENTS AND DESIGN SUPPORT SYSTEM Final Report
William E. Riddle and Bryan Edwards. Aug. 1980. 18 p.
(Grant NsG-1638)
(NASA-CR-163425) Avail: NTIS HC A02/MF A01 CSCL 09B

The desirability and feasibility of computer-augmented support for the pre-implementation activities occurring during the development of flight control software was investigated. The specific topics to be investigated were the capabilities to be included in a pre-implementation support system for flight control software system development, and the specification of a preliminary design for such a system. Further, the pre-implementation support system was to be characterized and specified under the constraints that it: (1) support both description and assessment of flight control software requirements definitions and design specification; (2) account for known software description and assessment techniques; (3) be compatible with existing and planned NASA flight control software development support system; and (4) does not impose, but may encourage, specific development technologies. An overview of the results is given. R.K.G.

N80-30062*# Colorado Univ. at Boulder. Dept. of Computer Science.
FUNCTIONAL SPECIFICATIONS OF THE ANNULAR SUSPENSION POINTING SYSTEM, APPENDIX A
Bryan Edwards. Jan. 1980. 22 p.
(Grant NsG-1638)
(NASA-CR-163419; CU-CS-171-80-APP-A; RSSM/99-App-A) Avail: NTIS HC A02/MF A01 CSCL 09B

The Annular Suspension Pointing System is described. The Design Realization, Evaluation and Modelling (DREAM) system, and its design description technique, the DREAM Design Notation (DDN) is employed. R.K.G.

N80-30063*# Colorado Univ. at Boulder. Dept. of Computer Science.
TOOLS TO AID THE SPECIFICATION AND DESIGN OF FLIGHT SOFTWARE, APPENDIX B
Guy Bristow. Jan. 1980. 11 p. refs.
(Grant NsG-1638)
(NASA-CR-163420; CU-CS-168-80-App-B; RSSM/97-App-B) Avail: NTIS HC A02/MF A01 CSCL 09B

The tasks that are normally performed during the specification and architecture design stages of software development are identified. Ways that tools could perform, or aid the performance, of such tasks are also identified. Much of the verification and analysis that is suggested is currently rarely performed during these early stages, but it is believed that this analysis should be done as early as possible so as to detect errors as early as possible. R.K.G.

N80-30064*# Colorado Univ. at Boulder. Dept. of Computer Science.
SOFTWARE DEVELOPMENT TOOLS: A BIBLIOGRAPHY, APPENDIX C.
William E. Riddle. Jun. 1980. 13 p.
(Grant NsG-1638)
(NASA-CR-163421; CU-CS-183-80-App-C; RSSM/103-App-C) Avail: NTIS HC A02/MF A01 CSCL 09B

A bibliography containing approximately 200 citations on tools which help software developers perform some development task (such as text manipulation, testing, etc.), and which would not necessarily be found as part of a computing facility is given. The bibliography comes from a relatively random sampling of the literature and is not complete. But it is indicative of the nature and range of tools currently being prepared or currently available. R.K.G.

N80-30065*# Colorado Univ. at Boulder. Dept. of Computer Science.
SOFTWARE DEVELOPMENT ENVIRONMENTS: PRESENT AND FUTURE, APPENDIX D
William E. Riddle. 1980. 8 p. refs. Repr. from the Proc. Intern. Computer Technol. Conf., Aug. 1980. 8 p. Presented at the Intern. Computer Technol. Conf., San Francisco, Aug. 1980.
(Grant NsG-1638)
(NASA-CR-163426; RSSM/96-App-D) Avail: NTIS HC A02/MF A01 CSCL 09B

Computerized environments which facilitate the development of appropriately functioning software systems are discussed. Their current status is reviewed and several trends exhibited by their history are identified. A number of principles, some at (slight) variance with the historical trends, are suggested and it is argued that observance of these principles is critical to achieving truly effective and efficient software development support environments. Author

N80-30066*# Colorado Univ. at Boulder.
AN ASSESSMENT OF DREAM, APPENDIX E
William E. Riddle. 1980. 32 p. refs. Repr. from Software Eng. Environ. (Amsterdam), 1980. 32 p.
(Grant NsG-1638)
(NASA-CR-163422; RSSM/100-App-E) Avail: NTIS HC A03/MF A01 CSCL 09B

The design realization, evaluation and modelling (DREAM) system is evaluated. A short history of the DREAM research project is given as well as the significant characteristics of DREAM as a development environment. The design notation which is the basis for the DREAM system is reviewed, and the development tools envisioned as part of DREAM are discussed. Insights into development environments and their production are presented and used to make suggestions for future work in the area of development environments. A.R.H.

N80-30067*# Colorado Univ. at Boulder. Dept. of Computer Science.
SOFTWARE DEVELOPMENT ENVIRONMENT, APPENDIX F
William E. Riddle. Oct. 1980. 12 p. Presented at the COMPSAC 80 Panel, Chicago, Oct. 1980.
(Grant NsG-1638)
(NASA-CR-163423; CU-CS-182-80-App-F) Avail: NTIS HC A02/MF A01 CSCL 09B

The current status in the area of software development environments is assessed. The purposes of environments, the types of environments, the constituents of an environment, the issue of environment integration, and the problems which must be solved in preparing an environment are discussed. Some general maxims to guide near-term future work are proposed. R.K.G.

N80-30068*# Colorado Univ. at Boulder. Dept. of Computer Science.
SOFTWARE DEVELOPMENT ENVIRONMENTS: A BIBLIOGRAPHY, APPENDIX G
William E. Riddle. Jun. 1980. 10 p.
(Grant NsG-1638)
(NASA-CR-163424; CU-CS-184-80-App-G; RSSM/104-App-G) Avail: NTIS HC A02/MF A01 CSCL 09B

A bibliography containing approximately 100 citations on software development environments is given. The bibliography comes from a relatively random sampling of the literature and is not complete. R.K.G.

N80-30069# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Computer Science.
DIALOG: A SIMULA CLASS FOR WRITING INTERACTIVE PROGRAMS
Richard J. Orgass and Robert E. Porter. 14 Oct. 1979. 28 p.
(Grant AF-AFOSR-0021-70; AF Proj. 2304)
(AD-A085516; VPI-SU-TM-79-3A) Avail: NTIS HC A03/MF A01 CSCL 09/2

A SIMULA class containing procedures for easily writing programs that interact with a user by asking questions at run time and which dynamically name and open files at run time is described. The class uses properties of IBM SIMULA that are not available in other implementations. It also depends on the EBCDIC character codes rather than ASCII but it is assumed that a user's terminal is an ASCII terminal. This revised report describes a number of extensions of DIALOG. While most programs using the old version will work correctly with the new version, there are many enhancements and users are advised to reread all Sections 3 to 9. GRA

N80-30070# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Computer Science.

CONVERTING DEC-10 SIMULA PROGRAMS TO CMS SIMULA

Richard J. Orgass 30 Jul. 1979 11 p

(Grant AF-AFOSR-0021-79; AF Proj. 2304)

(AD-A085517; VPI-SU-TM-79-7; AFOSR-80-0447TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This note reports on the writer's experience moving DEC-10 SIMULA programs to CMS and executing the programs with CMS SIMULA. The languages implemented by the two compilers is the same and this makes the transfer of SIMULA programs very easy. In contrast, it is very difficult to transfer FORTRAN programs from a DEC-10 to CMS. The two main sources of difficulty in transferring programs are the differences in the character set and file system of the two systems and the fact that CMS lacks many of the capabilities that TOPS-10 users take for granted. The directions for moving DEC-10 SIMULA programs to IBM SIMULA that are provided with release 3 refer to older versions of IBM SIMULA and it is now possible to preserve most of the separately compiled classes and procedures while moving programs to CMS SIMULA. GRA

N80-30071# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.

TOWARDS A THEORY FOR ABSTRACT DATA TYPES Ph.D. Thesis

Deepak Kapur Jun. 1980 255 p refs

(Contract N00014-75-C-0661; Grant NSF MCS-74-21892)

(AD-A085877; MIT/LCS/TR-237) Avail: NTIS HC A12/MF A01 CSCL 09/2

A rigorous framework for studying immutable data types having nondeterministic operations and operations exhibiting exceptional behavior is developed. The framework embodies the view of a data type taken in programming languages, and supports hierarchical and modular structure among data types. The central notion in this framework is the definition of a data type. An algebraic and behavioral approach for defining a data type is developed which focuses on the input-output behavior of a data type as observed through its operations. The definition of a data type abstracts from the representational structure of its values as well as from the multiple representations of the values for any representational structure. A hierarchical specification language for data types is proposed. A deductive system based on first order multi-sorted predicate calculus with identity is developed for abstract data types. A correctness criterion is proposed for an implementation coded in a programming language with respect to a specification. It is defined as a relation between the semantics of an implementation and the semantics of a specification. It does not require a correct implementation to have the maximum amount of nondeterminism specified by a specification. A methodology for proving correctness of an implementation is developed which embodies the correctness criterion. GRA

N80-30072# Army Engineer Topographic Labs., Wright-Patterson AFB, Ohio.

ADVANCED FEATURE SYMBOLIZATION FOR THREE-DIMENSIONAL VIEWS Technical Report, Jun. - Jul. 1979

Brian J. Cullis Apr. 1980 53 p

(AD-A085872; ETL-0223) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report documents initial research into the development of line-drawn symbols for point features in tactical terrain computer graphics. In this report, 21 significant point features for aircraft in tactical operations were selected for study. Symbols were designed for these 21 point features, with primary emphasis placed upon enhancing rapid user recognition, minimizing computer drawing time and computer storage requirements. Three candidate computer storage strategies, X-Y Absolute, Starburst and Run-Length-Starburst, were evaluated. The most efficient storage strategy for these symbols was the X-Y Absolute technique. The symbols were digitized, and software was developed to plot them in conjunction with existing three-dimensional terrain view software. GRA

N80-30073# General Electric Co., Arlington, Va. Information Systems Programs.

MEASUREMENT AND EXPERIMENTATION IN SOFTWARE ENGINEERING

Bill Curtis 30 Apr. 1980 63 p refs

(Contract N00014-79-C-0595)

(AD-A085827; TR-80-388200-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

The contributions of measurement and experimentation to the state-of-the-art in software engineering are reviewed. The role of measurement in developing theoretical models is discussed, and concerns for reliability and validity are stressed. Current approaches to measuring software characteristics are presented as examples. In particular, software complexity metrics related to control flow, module interconnectedness, and Halstead's Software Science are critiqued. The use of experimental methods in evaluating cause effect relationships is also discussed. Example programs of experimental research which investigated conditional statements and control flow are reviewed. The conclusion argues that advances in software engineering will be related to improvements in the measurement and experimental evaluation of software techniques and practices. GRA

N80-30074# California Univ., Livermore. Lawrence Livermore Lab.

IMPROVED MONOTONE PIECEWISE CUBIC INTERPOLATION ALGORITHM

F. N. Fritsch 1 Apr. 1980 34 p refs Submitted for publication

(Contract W-7405-eng-48)

(UCID-18620) Avail: NTIS HC A03/MF A01

A modification of Butland's formula for derivative values that define a monotone piecewise cubic interpolant to monotone data is presented. The algorithm preserves the simplicity of Butland's method while producing visually pleasing curves comparable to the original Fritsch-Carlson algorithm. DOE

N80-30075# Oak Ridge National Lab., Tenn. Computer Science Div.

INTERACTIVE VARPO (INVAR), A NONLINEAR LEAST SQUARES PROGRAM

J. E. Rall and R. E. Funderlic May 1980 99 p refs

(Contract W-7405-eng-26)

(ORNL/CSD-55) Avail: NTIS HC A05/MF A01

An interactive program developed for solving either linear or nonlinear least squares problems is described. The program is designed for use from a remote computer terminal, and provides the user with on-line feedback and the opportunity to make changes or corrections during execution of the program. The program has been run on the DEC10 System. The least squares method used takes special advantage of the structure of the model equation by treating the unknown parameters as linear or nonlinear depending on how they appear in the model. Initial estimates need to be provided only for the nonlinear parameters. The program is especially designed for use by people with a minimal knowledge of FORTRAN programing. However, a FORTRAN subroutine, which defines the model, must be supplied by the user. DOE

N80-30076# California Univ., Berkeley. Lawrence Berkeley Lab.

INTERACTIVE COMPUTER GRAPHICS DISPLAYS FOR HIERARCHICAL DATA STRUCTURES

D. F. Cahn and C. V. Murano May 1980 12 p refs Presented at the American Society for Information Service Mid-Year Meeting, Pittsburgh, Pa., 15 May 1980

(Contract W-7405-eng-48)

(LBL-10247; CONF-800529-1) Avail: NTIS HC A02/MF A01

A subroutine was developed as an aid to user visualization and manipulation of hierarchically structured data systems such as thesauri. In the present configuration, a thesaurus term and its primary and secondary conceptual manipulation of hierarchically structured data systems such as thesauri. In the present configuration, a thesaurus term and its primary and secondary conceptual neighbors are presented to the user in tree graph form on a CRT; the user then designates, via light pen or keyboard, any of the neighbors as the next term of interest and receives a new display centered on this term. By successive specification of broader, narrower, and related terms, the user can course

rapidly through the thesaurus space and refine his search file. At any stage, he deals with a term-centered, conceptually meaningful picture of a localized portion of the thesaurus, and is freed from the artificial difficulties of handling the traditional alphabetized thesaurus. Intentional limitation of the associative range of each display frame, and the use of color, case, and interconnecting vectors to encode relationships among terms, enhance interpretability of the display. DOE

N80-30077# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
DIMENSIONAL REDUCTION VARIANT OF KHACHIAN'S ALGORITHM FOR LINEAR PROGRAMMING PROBLEMS
Philip C. Jones and Earl S. Marwil [1980] 20 p refs
(Contract EY-76-C-07-1570)
(IDO-1570-T36) Avail: NTIS HC A02/MF A01

A technique for dimensional reduction is combined with Khachian's algorithm and another acceleration technique to solve linear programing problems. The method yields exact rather than approximate solutions, and provides a natural procedure for determining infeasibility. DOE

N80-30078# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
GOTO STATEMENTS: SEMATICS AND DEDUCTION SYSTEMS
A. deBruin Jun. 1979 55 p refs Submitted for publication
(MC-IW-74/79) Avail: NTIS HC A04/MF A01; Stichting Math. Centrum, Amsterdam FL 6

A simple language containing goto statements is presented together with denotational and operational semantics for it. Equivalence of these semantical descriptions is proven. Furthermore, soundness and completeness of a Hoare-like proof system for the language is shown via two steps. First, a proof system is given and validity is defined using a variant of direct semantics. In this case soundness and completeness proofs are relatively easy. After that, a proof system is given which is more in the style of program proving using jumps and functions. Validity in this system is defined through continuation semantics. This validity definition is then related to validity in the first system, and using this correspondence, soundness and completeness for the second system is proven. Author (ESA)

N80-30079# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
A FAST GARBAGE COMPACTION ALGORITHM
H. B. M. Jonkers Mar. 1979 21 p refs Submitted for publication
(MC-IW-107/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A compaction algorithm for variable size storage elements is described for use in a compacting garbage collector. Under certain plausible assumptions on the structure of these storage elements, the algorithm requires no space overhead and is faster than any compaction algorithm published to date. It scans the area to be compacted twice, but examines pointers only once. Author (ESA)

N80-30080# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
SPACE-BOUNDED COMPLEXITY CLASSES AND ITERATED DETERMINISTIC SUBSTITUTION
Peter R. J. Asveld Apr. 1979 24 p refs Submitted for publication
(MC-IW-108/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The effect on space complexity is investigated for a language family K extended by means of iterated lambda free deterministic substitution to the family eta (K). If each language in K is accepted by a one way nondeterministic mulitape Turing machine within space S(n) > or = log N, then eta (K) is included in NSPACE(S(n)). Thus, for each monotonic space bound S(n) > or = N, the inclusion K as a subclass within NSPACE (S(n)) implies that eta (K) is also included in NSPACE(S(n)). An implication similar to the latter one also holds for DSPACE(S(n)). Consequently, some well-known space-bounded complexity classes such as the families of nondeterministic context sensitive languages, of two nondeterministic nonerasing stack automation languages, and PSPACE are abstract family of languages closed under intersection and iterated lambda free deterministic substitution. On the other hand, no space-bounded complexity class which includes DSPACE(log n) is closed under controlled iterated lambda free nondeterministic substitution. Author (ESA)

N80-30081# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
ON CONTROLLED ITERATED GSM MAPPINGS AND RELATED OPERATIONS
Peter R. J. Asveld Aug. 1979 14 p refs Submitted for publication Sponsored by Netherlands Organization for Advancement of Pure Science
(MC-IW-114/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Families of languages generated iterated generalized sequential machine (GSM) mappings, iterated finite substitutions, and iterated homomorphisms are considered. The relation between iterated finite substitutions (homomorphisms) and (deterministic) tabled context independent Lindenmayer systems is discussed. Author (ESA)

N80-30082# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
CORRECTNESS THEORIES AND PROGRAM EQUIVALENCE
J. A. Bergstra (Leiden Univ.), J. Tiuryn (Warsaw Univ.), and J. V. Tucker Sep. 1979 37 p refs Submitted for publication Sponsored by Netherlands Organization for Advancement of Pure Science
(MC-IW-119/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The mathematical concept that a programming language semantics can be sensibly determined by proof rules for the before-after assertions required true of programs in the language was investigated. It is shown that the theory of program correctness based on first order logic can in a natural way specify the basic semantical concept of program equivalence in the case of programs terminating throughout any given class of data structures, but that diverging programs require rather delicate investigations into the associated classes. Author (ESA)

N80-30083# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
MODULAR PROGRAMMING FOR MULTICOMPUTER SYSTEMS
W. Gruenewald Mar. 1979 81 p refs In GERMAN; ENGLISH summary
(FFM-277) Avail: NTIS HC A05/MF A01

A task-oriented modular programming scheme was tried out on a multi-minicomputer system. As a test problem, a simulation system involving 30 tasks was microprogrammed, the simulation being handled by microprocessors. Results show the value of a task oriented approach to sequential programming and processing in terms of software resource management by the operating system. Problems in parallel processing do not arise. Multiple machine intercommunication is considered. However, further analysis of communication language structure is still needed to optimize system efficiency. Author (ESA)

N80-30084# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
DIGITAL IMAGE RESTORATION
K. vonderHeide Aug. 1979 82 p refs In GERMAN; ENGLISH summary
(FFM-286) Avail: NTIS HC A05/MF A01

A deterministic parametric approach to digital image reconstruction and enhancement, which avoids the use of Fourier transformations, was investigated. The image restoration problem is handled on the basis of the method of least squares. Both object intensity and the point spread function were modeled as stochastic processes. A simple positivity constraint was introduced and a dynamic data smoothing algorithm was used. Some test measurements from numerical simulations were reconstructed as one dimensional images after implementing the method in an ALGOL program. The program was only intended to show the validity of this method and was not optimized for run time. Author (ESA)

N80-30085# Software Management Consultants, Torrance, Calif.
SOFTWARE TOOL TAXONOMY ANNOTATED BIBLIOGRAPHY
Donald J. Reifer and Harold A. Montgomery 1 Dec. 1979 38 p Prepared in cooperation with SoHaR Inc., Los Angeles, Calif.
(Contract NB79-SBCA-0273)
(PB80-176902; SMC-SOH-79-0001; NBS-GCR-80-199) Avail: NTIS HC A03/MF A01 CSCL 09B

A literature search was conducted to identify source material useful in the development of a software tool taxonomy. The findings are organized into three parts. Twelve articles which deal with taxonomies are summarized. Each article is abstracted and evaluated in terms of its strengths and weaknesses. An annotated bibliography of 30 articles which survey, compare and/or report experience with tools is included and 197 references which were reviewed during the investigation are listed. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N80-30086*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MACHINE INTELLIGENCE AND ROBOTICS: REPORT OF THE NASA STUDY GROUP. EXECUTIVE SUMMARY
Sep. 1979 23 p
(NASA-CR-163380; JPL-730-51) Avail: NTIS HC A02/MF A01 CSCL 09B

A brief overview of applications of machine intelligence and robotics in the space program is given. These space exploration robots, global service robots to collect data for public service use on soil conditions, sea states, global crop conditions, weather, geology, disasters, etc., from Earth orbit, space industrialization and processing technologies, and construction of large structures in space. Program options for research, advanced development, and implementation of machine intelligence and robot technology for use in program planning are discussed. A vigorous and long-range program to incorporate and keep pace with state of the art developments in computer technology, both in spaceborne and ground-based computer systems is recommended. J.M.S.

N80-30087# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
A COUPLING DEVICE OF THE FFM-1 MULTICOMPUTER SYSTEM
W. Langer Apr. 1979 50 p refs In GERMAN; ENGLISH summary
(FFM-278) Avail: NTIS HC A03/MF A01

The hardware of a computer coupler which is installed in a multi-minicomputer system is described. This device allows any combination of connections between the computers to be made. In order to achieve automatic system operation, the coupler is also equipped with fully user programmable operation modes. Author (ESA)

N80-30088# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
FUNCTION MODULES OF THE FFM-MULTICOMPUTER SYSTEM
W. Jansen Jun. 1979 52 p refs In GERMAN; ENGLISH summary
(FFM-282) Avail: NTIS HC A04/MF A01

The hardware of task-specific function modules in a multi-minicomputer system is described. These modules have to perform object functions in the experimental, homogeneous network. They support the operating system kernel which is programmed into each autonomous computer of the multicomputer system. Additionally, timer modules are described. They are used to measure task run times for the specific programs and to control the exact timing of the tasks. Author (ESA)

N80-30089# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
THE FFM-MULTICOMPUTER SYSTEM: SYSTEM GUIDE
W. Bauer Jun. 1979 120 p refs In GERMAN; ENGLISH summary
(FFM-283) Avail: NTIS HC A06/MF A01

The implementation of the operating system kernel of a multi-minicomputer system is explained. The kernel hardware is only briefly discussed. Emphasis is on the concepts and the code necessary to microprogramming the operating system. They consist of the routines for task and processor management, for machine message intercommunication, and for the handling of 'supervisor calls'. A complete listing of documentation relevant to this system is also provided. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-30090 Stanford Univ., Calif.
OPTIMAL ESTIMATION AND CONTROL OF LINEAR TIME-INVARIANT SYSTEMS WITH UNCERTAIN PARAMETERS Ph.D. Thesis
Victor Shenkar 1980 253 p
Avail: Univ. Microfilms Order No. 8016864

The systems under investigation are linear time-invariant ones, with uncertain parameters assumed to be a random vector with known statistics. The quadratic integral criterion is averaged with respect to the uncertain parameter statistics, and then used as an optimization object. Two existing sensitivity methods are reviewed, and a more accurate method is suggested. Some considerations concerning stability, in the presence of uncertain parameters, are made. The necessary conditions for optimal control laws of a regulator, estimator and compensator, in the presence of uncertain parameters, are given. The uncertain parameters are assumed to have a small range of variations, and the so-called small-sensitivity analysis is conducted. Closed-form solutions for linearized optimal gains of a regulator, estimator and compensator are found and some important insight into the sensitivity analysis gained. A computer program, based on the established theory, is developed and applied to solve some illustrative examples. Dissert. Abstr.

N80-30091# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
AN AVERAGING METHOD FOR STOCHASTIC APPROXIMATIONS WITH CONSTANT PARAMETERS: SMALL PARAMETER VALUES
H. J. Kushner Mar. 1980 24 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-77; NSF ENG-77-12946)
(AD-A085831) Avail: NTIS HC A02/MF A01 CSCL 12/1

Stochastic approximations with constant gain coefficients and dependent noise and nonlinear or even 'discontinuous dynamics' have many applications in control, automata and communication theory. When the gain coefficient is small, an asymptotic theory is developed which gives much information on the character of the paths and errors. The method involves both 'averaging' and 'stability' ideas. The ideas are outlined. An example which illustrates the basic ideas and techniques is given. GRA

N80-30092# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
NON-UNIQUENESS IN SINGULAR OPTIMAL CONTROL
J. Grasman Mar. 1979 8 p refs Submitted for publication
(MC-TW-188/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Singular optimal control problems of linear, time invariant n-dimensional dynamic systems, having performance index represented by a symmetric positive semidefinite matrix, are investigated. A finite dimensional linear state space is denoted and the system is assumed controllable. The control vector u has its values in a linear m-dimensional space and u(t) is assumed to be continuous for t > zero. It is shown that there exists a class of linear singular optimal control problems with a non-unique singular arc. The problems in this class have a controllability subspace in which the trajectories may vary without affecting the performance index. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-30093 New Mexico State Univ., University Park.
A REAL-TIME SOLUTION TECHNIQUE FOR STIFF LINEAR DIFFERENTIAL SYSTEMS Ph.D. Thesis
Karl H. Agar 1980 96 p
Avail: Univ. Microfilms Order No. 8017439

The problem of obtaining real time solutions via digital computational hardware for stiff, linear, time-invariant system models, suitable for hardware in the loop application is addressed. A solution technique that is A-stable and suitable to real time processing, requiring very few sequential arithmetic steps is discussed. The method is capable of handling arbitrary stiffness within the numerical capacity of the hardware employed and requires no model scaling. The solution technique is a considerable departure from conventional differential equation solvers in that it lays the theoretical foundation for taking advantage of desk top type general purpose computers in conjunction with a special purpose digital processor implementing algorithms based on the trapezoidal rule. Dissert. Abstr.

N80-30094 Illinois Univ. at Urbana-Champaign.
A COMPOSITE ALGORITHM FOR MIXED INTEGER CONSTRAINED NONLINEAR OPTIMIZATION Ph.D. Thesis
Daniel Bryan Fox 1980 232 p
Avail: Univ. Microfilms Order No. 8017937

A composite optimization algorithm applicable to mixed integer, constrained, nonlinear problems was developed. Significant modifications were made to this algorithm including the incorporation of a unidimensional search procedure and the use of an improved method to treat constraints. Additional features of the composite algorithm include acceleration strategies, a decomposition approach, and a discrete grid algorithm. The components of the composite algorithm were tested on problems primarily selected to represent engineering design optimization applications. The performance of the methods was compared to some existing techniques. The results indicate that the algorithms obtain superior solutions and in most cases are more efficient than existing techniques. The success of the algorithm on problems of engineering design optimization indicates a wide area of potential application. Dissert. Abstr.

N80-30095*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A COMPUTER PROGRAM FOR DETERMINING TRUNCATION ERROR COEFFICIENTS FOR RUNGE-KUTTA METHODS
M. Kathleen Horn Jul. 1980 27 p refs
(NASA-TM-81143; JSC-16429; Rept-80-FM-13) Avail: NTIS HC A03/MF A01 CSCL 12A

The basic structure of a program to generate the truncation error coefficients for Runge-Kutta (RK) methods is reformulated to reduce storage requirements significantly and to accommodate variable dimensioning. This FORTRAN program, SUBROUTINE RKEQ, determines truncation error coefficients for RK algorithms for orders 1 through 10 and extends the order of coefficients through 12 with the 11th- and 12th-order terms determined following the patterns used to establish the lower order coefficients. Both subroutines (the original and RKEQ) are also written to treat RK m-fold methods which utilize m known derivatives of f to increase the order of the algorithm. Setting m = 0 gives the classical RK algorithm. M.G.

N80-30096# Wisconsin Univ. - Madison. Dept. of Statistics.
BOUNDS FOR OPTIMAL CONFIDENCE LIMITS FOR SERIES SYSTEMS
Bernard Harris (Wisconsin Univ., Milwaukee) and Andrew P. Soms May 1980 11 p refs
(Contracts N00014-79-C-0321; DAAG29-75-C-0024)
(AD-A085741; UWIS-DS-80-611) Avail: NTIS HC A02/MF A01 CSCL 12/1

Lindstrom-Madden type approximations to the lower confidence limit on the reliability of a series system are theoretically justified by extending and simplifying the results of Sudakoc (1973). Applications are made to Johns (1976) and Winterbottom (1974). Numerical examples are presented. GRA

N80-30097# Naval Postgraduate School, Monterey, Calif.
A MIXED EXPONENTIAL TIME SERIES MODEL NMEARMA (P,Q)
A. J. Lawrance (Birmingham Univ., England) and P. A. W. Lewis Mar. 1980 18 p refs
(Contract N00014-80-WR-00054; RR0000110)
(AD-A085316; NPS55-80-012) Avail: NTIS HC A02/MF A01 CSCL 12/1

A first-order stochastic difference equation with random coefficients is shown to have a solution which makes the marginal distribution of the stationary sequence generated by the equation a convex mixture of two exponential distributions. This Markovian process should be broadly applicable in stochastic modelling in operations analysis. Moreover it can be extended quite simply to a mixed exponential process with mixed pth-order autoregressive and qth-order moving average correlation structure. Coupling of the processes to model multivariate situations is also discussed. GRA

N80-30098# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CONFIDENCE BOUNDS FOR THE LINEAR MODEL OF INTRODUCTION TO G-INVERSE
Kali S. Banerjee May 1980 31 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A086094; AD-E430459; ARBRL-IR-02241) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper explains the use of Scheffe's theorem on simultaneous confidence bounds in the context of linear hypothesis model of less than the full rank. In paving the background, some results on the uniqueness of estimates in the theory of singular designs are brought together in a compact form in this report with a brief explanatory introduction to the solution of linear equations as related to the computation of a g-inverse. GRA

N80-30099# Yale Univ., New Haven, Conn. Dept. of Statistics.
TESTS FOR JOINT NORMALITY IN TIME SERIES
Francis J. Anscombe and Ho-lan H. Chang May 1980 13 p refs
(Contract N00014-75-C-0563)
(AD-A085885; TR-47) Avail: NTIS HC A02/MF A01 CSCL 12/1

The well-known methods for analysis of time series, whether in the time domain or in the frequency domain, for fitting parametric structures, for regression, for forecasting, all involve second-moment statistics. If all variables are jointly normally distributed in stationary sequences, simple first and second moments contain all the information. If not, there is the possibility that some of the needed information is not contained in the statistics used. When a random sequence is other than stationary and jointly normal, it may sometimes equally well be described and thought of as stationary but not jointly normal (which is the terminology used here) or as nonstationary. GRA

N80-30100# Society for Industrial and Applied Mathematics, Philadelphia, Pa.
MATHEMATICAL METHODS IN THE ATMOSPHERIC SCIENCES AND RELATED COMPUTATIONAL METHODS Final Report
I. Edward Block Nov. 1979 4 p Symp. held in Denver, 12-14 Nov. 1979
(Grant AF-AFOSR-0119-79; AF Proj. 2304)
(AD-A086242; AFOSR-80-0479TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The program consisted of twelve invited lecturers, two von Karman prize recipients, and one hundred thirty-three contributed papers and poster presentations. The program was organized into three symposia: Mathematical Methods in the Atmospheric Sciences, Computational Methods in Partial Differential Equations, and Adaptive Methods for Scientific Computation. The Symposium on Mathematical Methods in the Atmospheric Sciences was held on Monday, November 12. The atmospheric and related sciences provide an abundant source of problems in applied mathe-

matics. Often problems in these areas are characterized by their extensive use of computing resources. Those attending realized they could make substantial contributions not only to the analysis of these problems, but also to the efficient use of computing in solving them. GRA

N80-30101# Washington Univ., Seattle. Dept. of Mathematics.
INTERVAL GRAPHS, CHRONOLOGICAL ORDERINGS, AND RELATED MATTERS Ph.D. Thesis
Dale John Skrien May 1980 137 p refs
(Contract N00014-67-A-0103; NR Proj. 044-353)
(AD-A086224; TR-71) Avail: NTIS HC A07/MF A01 CSCL 12/1

This paper is concerned with special interval representations of interval graphs. The basic notion is that of a chronological ordering of an interval graph, which is an equivalence class of interval representations of the graph in question. Consider a reference set P = (I sub 1 ..., (I sub n, r sub 1, ..., r) whose points are to be associated with the respective left and right endpoints of interval representations of a graph having n nodes. Among the questions that are considered in this paper, and are answered both mathematically and algorithmically, are the following: Given an interval graph G with n nodes, which linear orderings on P sub n arise from interval representations of G> Given a partial ordering of P sub n, when can it be expanded to a linear ordering associated with an interval representation of G?, How many chronological ordering does a given interval graph have? The theorems and algorithms are applicable to a variety of seriation problems. GRA

N80-30102# New York Univ., N. Y. Magnetic-Fluid Dynamics Div.
SIMILARITY SOLUTIONS OF SYSTEMS OF PARTIAL DIFFERENTIAL EQUATIONS USING MACSYMA Interim Report
P. Rosenau and J. L. Schwarzmeter Oct. 1979 26 p refs
(Contract EY-76-C-02-3077; Grant AF-AFOSR-2881-76; AF Proj. 2304)
(AD-A086207; MF-94; COO-3077-160; AFOSR-80-0485TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A Code has been written to use the algebraic computer system MACSYMA to generate systematically the infinitesimal similarity groups corresponding to systems of quasi-linear partial differential equations. The infinitesimal similarity groups can be used to find exact solutions of the partial differential equations. In an example from fluid mechanics, the similarity method using the computer code reproduces immediately a solution obtained from dimensional analysis. GRA

N80-30103# Maryland Univ., College Park. Computer Science Center.
THE BEHAVIOR OF A MULTIPLICITY INDEPENDENT ROOT-FINDING SCHEME IN THE PRESENCE OF ERROR
G. W. Stewart Apr. 1980 8 p refs
(Contract N00014-76-C-0391)
(AD-A086192; TR-890) Avail: NTIS HC A02/MF A01 CSCL 12/1

A derivative free scheme has been proposed that permits root finding methods, such as the secant method to perserve high order convergence when the root in question is multiple. In this note it is shown that the scheme can fail to achieve the maximum accuracy that is attainable at a fixed precision of computations. GRA

N80-30104# Stanford Univ., Calif. System Optimization Lab.
A PROJECTED LAGRANGIAN ALGORITHM FOR NONLINEAR L (SUB 1) OPTIMIZATION
Walter Murray and Michael L. Overton Feb. 1980 40 p refs
(Contracts DAAG29-79-C-0110; DE-AC03-76SF-00326; DE-AC03-76ER-72018; Grants NSF MCS-78-111986; NSF MCS-79-26009)
(AD-A086162; SU-SOL-80-4; ARO-16470.10-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

The nonlinear l sub 1 problem is an unconstrained optimization problem whose objective function is not differentiable everywhere, and hence cannot be solved efficiently using standard techniques for unconstrained optimization. The problem can be transformed into a nonlinearly constrained optimization problem, but it involves many extra variables. We show how to construct a method based on projected Lagrangian methods for constrained optimization which requires successively solving quadratic programs in the same number of variables as that of the original problem. Special Lagrange multiplier estimates are used to form an approximation to the Hessian of the Lagrangian function, which appears in the quadratic program. A special line search algorithm is used to obtain a reduction in the l sub 1 objective function at each iteration. Under mild conditions the method is locally quadratically convergent if analytical Hessians are used. GRA

N80-30105# Michigan Univ., Ann Arbor. Dept. of Mathematics.
A FINITE ELEMENT METHOD FOR FIRST ORDER HYPERBOLIC SYSTEMS Interim Report
Mitchell Luskin 1980 47 p refs
(Contract F49620-79-C-0149; AF Proj. 2304)
(AD-A085981; AFOSR-80-0427TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A new finite element method is proposed for the numerical solution of a class of initial-boundary value problems for first order hyperbolic systems in one space dimension. An application of our procedure to a system modeling gas flow in a pipe is discussed. Asymptotic error estimates are derived in the L sq norm in space. GRA

N80-30106# Sandia Labs., Albuquerque, N. Mex. Fluid Mechanics and Heat Transfer Div.
FINITE ELEMENT ANALYSIS OF CONVECTIVE HEAT TRANSFER IN A POROUS MEDIUM
David K. Gartling 1979 10 p refs Presented at the 3d Intern. Conf. on Finite Element in Flow Problems, Banff, (Canada), 10 Jun. 1980
(Contract EY-76-C-04-0789)
(SAND-79-1374C; CONF-800613-3) Avail: NTIS HC A02/MF A01

A numerical procedure based on the Galerkin form of the finite element method is developed for the solution of isothermal and non-isothermal flow problems in porous materials. The methodology is demonstrated by application to the classic free convection problem of a saturated porous layer heated from below. Results are presented for steady state flows at low Rayleigh numbers and for an interesting transient flow at a higher Rayleigh number. DOE

N80-30107# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
COMPLEXITY OF LOCATION PROBLEMS ON NETWORKS
Antoon Kolen May 1979 20 p refs
(MC-BW-107/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2.88

The theory of computational complexity is briefly discussed, showing the existence of a class of NP-complete problems which are equivalent in the sense that none is known to be solvable in polynomial time. There is also a class of NP-hard problems for which it is conjectured that no polynomial time algorithm exists. Some well-known location problems, namely, the p-center problem (with mutual communication), the simple (capacited) plant location problem, and the maximal covering problem are then considered. It is shown that all these problems are NP-hard. Author (ESA)

N80-30108# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
ALGEBRAIC SPECIFICATIONS OF COMPUTABLE AND SEMICOMPUTABLE DATA STRUCTURES
J. A. Bergstra (Leiden Univ.) and J. V. Tucker Aug. 1979 27 p refs Submitted for publication Sponsored by Netherlands Organization for Advancement of Pure Science
(MC-IW-115/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Theoretical issues relating to algebraic specification methods for data structures are addressed. Results are obtained which show that every computable data structure possesses a special kind of finite, equational hidden functions specification and that every semicomputable data structure possesses a special kind of finite, equational hidden sorts specification. Author (ESA)

N80-30109# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
DERIVATIVES OF PROGRAMS
J. W. deBakker and J. I. Zucker Sep. 1979 18 p refs Submitted for publication Sponsored by Netherlands Organization for Advancement of Pure Science
(MC-IW-116/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The notions of upper and lower derivations of a recursive (nondeterministic) program are defined and used to characterize termination for such a program in terms of the well foundedness of a function with respect to a predicate. This extends earlier work on induction rules and proofs of termination to the case of nested recursions, formulated in terms of a least fixed point construct. It is shown how this characterization can be interpreted as stating that a recursive procedure always terminates if it exhibits neithe global nor local nondetermination. Author (ESA)

N80-30110# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE STRUCTURE OF AN ADAPTIVE MULTI-LEVEL ALGORITHM
P. W. Hemker May 1979 20 p refs Submitted for publication Sponsored by Netherlands Organization for Advancement of Pure Science
(MC-NW-65/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2.88

The structure of multilevel adaptive algorithms is explained. Their recursive character is exposed by means of the formal language ALGOL 68. The basic structure is given in two forms: course grid corrections to fine grids, and fine grid corrections to coarse grids. The latter description is shown more convenient for the treatment of fully automatic adaptive grids. A full approximation storage, full multigrid algorithm is described, then used in an ALGOL 68 procedure for the solution of boundary value problems with adaptive mesh refinements. Author (ESA)

N80-30111# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
TABLES OF THE FIRST 15,000 ZEROS OF THE RIEMANN ZETA FUNCTION TO 28 SIGNIFICANT DIGITS, AND RELATED QUANTITIES
H. J. J. teRiele Jun. 1979 160 p refs
(MC-NW-67/79) Avail: NTIS HC A10/MF A01; Stichting Math. Centrum, Amsterdam FL 19

A table of the imaginary parts of the first 15,000 zeros rho sub N of the Riemann zeta function, zeta (s), in the critical strip, with an accuracy of 28 significant digits, is given. Moreover, two additional tables of the related quantities 1/the absolute value rho sub N zeta prime (rho sub N), and arg (rho sub N zeta prime (rho sub N)) are given to 10 significant digits. Calculations involve (1) a separation and a zero finding procedure, combined with Gram's law; (2) application of the Reimann-Siegel formula; (3) improvement of the accuracy with the Newton process, which entails (4) substitution of the Euler-MacLaurin formula for the Riemann-Siegel computation of zeta (s). A FORTRAN program on a CDC Cyber 73/173 computer system was used. Author (ESA)

N80-30112# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE TREATMENT OF TIME DEPENDENT BOUNDARY CONDITIONS IN SPLITTING METHODS FOR PARABOLIC DIFFERENTIAL EQUATIONS
B. P. Sommeijer, P. J. vanderHouwen, and J. G. Verwer Jun. 1979 28 p refs Submitted for publication
(MC-NW-68/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A class of splitting method for two-space dimensional parabolic partial differential equations are investigated in reference to the fact that splitting methods usually exhibit a drop in accuracy if boundary conditions become time dependent. A boundary value correction is discussed for the Laplace equation with Dirichlet conditions, then is generalized for a wide class of initial boundary value problems. A numerical comparision is made between the alternating direction implicit method and the locally one-dimensional method as applied to problems with Dirichlet boundary conditions and non-Dirichlet boundary conditions. Results show that when the time-integration error dominates, the accuracy of the locally one-dimensional method decreases. On the other hand, accuracy was satisfactory, for Dirichlet conditions, with a modified version of the alternating direction implicit method. Author (ESA)

N80-30113# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
THE CALCULATION OF EIGENVECTORS AND INVARIANT SUBSPACES
M. Louter-Nool Aug. 1979 46 p refs
(MC-NW-69/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5

The algebraic eigenvalue problem of real general matrices, especially of matrices having multiple eigenvalues, is considered. The Schur-decomposition method as a stable method for calculating eigenvalues is chosen. The vectors v sub 1, v sub 2, ..., v sub r are said to span an invariant subspace of A of order r if v sub 1, v sub 2, ..., v sub r are linearly independent and Av sub i (i = 1, 2, ..., r) lies in that same subspace. An algorithm to determine these vectors is given and elucidated. Finally, some PASCAL procedures (with numerical results) for the calculation of eigenvalues of a real, possibly defective and/or derogatory matrix as well as for the calculation of the corresponding eigenvectors and invariant subspaces are presented, along with a theorem on the perturbation of eigenvalues. Author (ESA)

N80-30114# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ANALYSIS OF NUMERICAL METHODS FOR SOLVING SECOND KIND VOLTERRA EQUATIONS BY IMBEDDING TECHNIQUES
P. H. M. Wolkenfelt, P. J. vanderHouwen, and C. T. H. Baker (Manchester Univ.) Sep. 1979 26 p refs Submitted for publication
(MC-NW-71/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The properties of a wide class of numerical methods for second kind Volterra integral equations with an arbitrary smooth, nonlinear, kernel function are examined. For the analysis, the imbedding of the integral equation in a differential equation containing one parameter is proposed. The solution of the integral equation is then related to the solution of the differential equation and this connection suggests a technique for deriving numerical methods, many of which prove to be classical. This connection, is thoroughly explored. Author (ESA)

N80-30115# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE INTERNAL STABILITY OF EXPLICIT m-STAGE RUNGE-KUTTA METHODS FOR LARGE m-VALUES
P. J. vanderHouwen and B. P. Sommeijer Sep. 1979 18 p refs Submitted for publication
(MC-NW-72/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Explicit, m-stage Runge-Kutta methods are derived for which the maximal stable integration step per right hand side evaluation is proportional to m when applied to semidiscrete parabolic initial boundary value problems. The internal stability behavior of these methods is compared with that of similar Runge-Kutta methods proposed in the literature. Both by analysis and by numerical experiments it is shown that the value of m in the schemes proposed is not restricted by internal instabilities. Author (ESA)

N80-30116# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
A NOTE ON SOME METHODS FOR REGRESSION ANALYSIS WITH INCOMPLETE OBSERVATIONS
R. D. Gill Jan. 1979 16 p refs Submitted for publication
(MC-SW-65/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Some related proposals for estimating regresssion coefficients with incomplete experimental observations are discussed. The proposals include 'approximate standard errors' for the estimators. It is shown that the estimators of the regression coefficients are consistent under fairly weak conditions, but that only under rather strong ones can be usual (asymptotic) tests

of significance be validly based on the estimated coefficients and the computated standard deviations. The covariate-sequence of assuming a random or fixed specification for the covariates are also discussed. Author (ESA)

N80-30117# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
THE NUMERICAL COMPUTATION OF SPECIAL FUNCTIONS BY USE OF QUADRATURE RULES FOR SADDLE POINT INTEGRALS: GAMMA FUNCTIONS, MODIFIED BESSEL FUNCTIONS, AND PARABOLIC CYLINDER FUNCTIONS
N. M. Temme Nov. 1978 58 p refs
(MC-TW-183/78) Avail: NTIS HC A04/MF A01; Stichting Math. Centrum, Amsterdam FL 7

Quadrature rules were used for the computation of special functions. The functions considered were the Euler gamma function, modified Bessel functions, and parabolic cylinder functions. The starting point was an integral, the quadrature method used for evaluating the integral being the trapezoidal rule. The range of the parameters was chosen such that in the saddle point integrals used, the procedure was not disturbed for some combinations of the variables of the function. It is shown that in the saddle point analysis of the Bessel Functions and the parabolic cylinder functions more than one saddle point of integrand can be considered. The computer programs used are given as ALGOL 60 procedures for the integral representations. Author (ESA)

N80-30118# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
A SINGULAR BOUNDARY VALUE PROBLEM ARISING IN A PRE-BREAKDOWN GAS DISCHARGE
O. Diekmann, D. Hilhorst, and L. A. Peletier Jun. 1979 36 p refs Submitted for publication
(MC-TW-174/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The nonlinear two point boundary value problem epsilon XY double prime + (g(x)-y) prime = 0, y(0) = 0, y(R) = k, where g is a given function is considered. It is proven that the probelem has a unique solution. The limiting behavior of this solution as R approaches infinity and as epsilon decreases to zero is studied. It is shown how a so called prebreakdown discharge in an ionized gas between two electrodes can be described by an equation of this form, leading to a physical interpretation of the mathematical results. Author (ESA)

N80-30119# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
A FRACTIONAL INTEGRAL OPERATOR CORRESPONDING TO NEGATIVE POWERS OF A SECOND ORDER PARTIAL DIFFERENTIAL OPERATOR
I. G. Sprinkhuizen-Kuyper Jun. 1979 47 p refs Submitted for publication
(MC-TW-191/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A fractional integral operator is derived for which the partial differential operator plays a role similar to that of ordinary differentiation (d/dx) with respect to the fractional integral of Riemann-Liouville. An application is given to the Koornwinder polynomials (a class of orthogonal polynomials in two variables). Also, an operator is obtained which has the Jacobi functions of order 1/2 (NU-1), -1/2 as its eigenfunctions. Author (ESA)

N80-30120# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
ON THE NONEXISTENCE OF A (57, 14, 1) STRONGLY REGULAR GRAPH
H. A. Wilbrink and A. E. Brouwer Dec. 1978 8 p
(MC-ZW-121/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

It is shown that a strongly regular graph with parameters n = 57, k = 14, lambda = 1, mu = 4 (10,1) - eigenvalues: 1*14, 38*2, 18*(-5); (1,-1)-eigenvalues: 1*28, 38*(-5), 18*9y does not exist. To this effect, an inductive proof is established. Author (ESA)

N80-30121# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
APPROXIMATION OF HARMONIC FUNCTIONS
Bjoern E. J. Dahlberg 1979 13 p refs
(CTH-Math-1979-10) Avail: NTIS HC A02/MF A01

Let u be harmonic in a bounded Lipschitz domain D with a regular boundary. The problem of when it is possible to find functions f sub j whose gradients are measures of bounded variation in D, such that D sup (the absolute value of (f-f sub j)) tends to infinity as j tends to infinity, is studied. Results prove that this approximation is always possible if u is the Poisson integral of a function f, belonging to L sup p (sigma), p > or = 2, where sigma denotes the surface measure of partial differentiation in D. An example is also given which shows that this result does not extend to p < 2. Author (ESA)

N80-30122# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ON THE SPECTRA AND STABILITY OF PERIODIC DIFFERENTIAL EQUATIONS
B. J. Harris Feb. 1978 54 p refs
(Math-Res-124) Avail: NTIS HC A04/MF A01

A Floquet theory is derived for the periodic Dirac equations of relativistic quantum mechanics within a crystal. This theory is used to obtain a relationship between the spectra of certain linear operations on a Hilbert space and the stability regions associated with the Dirac equations. R.C.T.

N80-30123# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ON AN INEQUALITY OF WIRTINGER
B. J. Harris Feb. 1978 10 p refs
(Math-Res-125) Avail: NTIS HC A02/MF A01

Wirtinger's inequality is stated as a complex valued function F defined and absolutely continuous on the closed interval 0, 2 pi such that F prime belongs to L squared 0, 2 pi while, firstly, F(0) = F(2 pi), and secondly, the integral from zero to 2 pi of F(X) dx = zero. Thus the integral from zero to 2 pi of (the absolute value squared (F prime (X))) dx > or = the integral from zero to 2 pi of (the absolute value squared (F(X))) dx. Proofs involving operator theory are considered. An elementary, operator theory proof of a slightly more general inequality is then developed. Author (ESA)

N80-30124# Loughborough Univ. of Technology (England). Dept. of Mathematics.
SOME PERFORMANCE TRIALS AND MODIFICATIONS TO A RATIONAL LINE SEARCH AND A CHEBYSHEV LINE SEARCH
G. A. Evans Mar. 1979 33 p refs
(Math-Res-138) Avail: NTIS HC A03/MF A01

Given a line search, the problem of how to obtain the accurate local minimum with a minimum of objective function evaluations is studied. The Powell quadratic line search is introduced as a reference. Two other line search algorithms, the rational function approach and the Chebyshev-based numerical differentiator, are considered in comparison. Data on efficiency was obtained by replacing the quadratic line search, for which results are known, by each of the other methods. A set of well known test functions was used. Performance test results show that the algorithms using a rational fit are comparable with the quadratic fit of Powell. The Chebyshev method in its current form falls short of the other two algorithms in efficiency. Author (ESA)

N80-30125# Trent Polytechnic, Nottingham (England). Dept. of Mathematical Sciences.
ON AN ALTERNATIVE FORM OF SYSTEM MATRIX FOR DELAY-DIFFERENTIAL SYSTEMS
M. G. Frost and C. Storey (Loughborough Univ. of Technology) Apr. 1979 32 p refs
(Math-Res-139) Avail: NTIS HC A03/MF A01

A form of system matrix over the set of real numbers, corresponding to a delay-differential system, is considered. The possiblity of decomposing a system matrix of this form, using an associated form of a transformation of similarity is also taken into account. To what extent the controllability and observability of such systems depends on the decoupling factors of the system

matrix is examined. Finally, various types of controllability for systems corresponding to system matrices of this form are discussed in connection with previously established concepts of (real numbers) sup n controllability and function space null controllability. Author (ESA)

N80-30126# Trent Polytechnic, Nottingham (England). Dept. of Mathematical Sciences.
ANOTHER FORM OF SYSTEM MATRIX ASSOCIATED WITH DELAY-DIFFERENTIAL SYSTEMS
M. G. Frost and C. Storey (Loughborough Univ. of Technology) Aug. 1979 20 p refs
(Math-Res-142) Avail: NTIS HC A02/MF A01

Various kinds of controllability as well as necessary and sufficient conditions for these types of controllability are defined for a form of system matrix over the set of real numbers, corresponding to a delay differential system. Various types of observability are also defined. To what extent controllability and observability depend on the decoupling factors and zeros of a system matrix of this form is discussed. Of particular interest are system matrices which have delay only in the state as well as system matrices which have delay only in the control term in the input state relationship. Finally, conditions under which associated forms of transformations of similarity exist between these types of system matrices are determined. Author (ESA)

N80-30127# National Bureau of Standards, Washington, D.C. National Engineering Lab.
NUMERICAL SOLUTION OF LINEAR DIFFERENCE EQUATIONS Final Report
Daniel W. Lozier Mar. 1980 170 p refs
(PB80-169980; NBSIR-80-1976) Avail: NTIS HC A08/MF A01 CSCL 12A

Consider a given inhomogeneous linear difference equation summation, s=0 to 1 (d sub s); (r)y(r +S)=g(r) where 1 = or greater than 2 and r = 0,1,2,... . Suppose y is a solution of this equation and u,v are solutions of the homogeneous form such that, as r approaches infinity, u(r)/v(r), y(r)/v(r), and u(r)/y(r) all approach 0. Under these circumstances algorithms for the computation of y based on forward or backward recurrence are numerically unstable. Stable algorithms are based on approximating y(r) by the solutions of a certain sequence of boundary value problems which are shown to be equivalent to two initial value problems of order j and 1-j by factorization of the difference operator. The solution of the problem of order j is obtained by forward recurrence; the other solution is obtained by backward recurrence. GRA

N80-30128# National Geodetic Survey, Rockville, Md.
FEASIBILITY STUDY OF THE CONJUGATE GRADIENT METHOD FOR SOLVING LARGE SPARSE EQUATION SETS
Lothar Grundig Feb. 1980 27 p refs
(PB80-180235; NOAA-TR-NOS-82; NGS-13; NOAA-80032805) Avail: NTIS HC A03/MF A01 CSCL 12A

The effectiveness of various conjugate gradient methods for solving large sparse equation sets is analyzed. The use of conjugate gradient algorithms in geodetic surveys is considered. Some typical nets were used and compared with a direct solution algorithm. Results indicate that this method is well suited for constrained adjustments of triangulation networks, but not for free adjustments. No benefits were derived from preconditioning, which only increased the solution time. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-30129 American Univ., Washington, D. C.
TESTING THE EQUALITY OF THE MEANS OF TWO NORMAL DISTRIBUTIONS WHEN THE SAMPLES ARE TRUNCATED Ph.D. Thesis
Nancy Greene Berman 1980 91 p
Avail: Univ. Microfilms Order No. 8017446

Given a pair of random samples from normal populations that is truncated on the left a different points, the problem is to find a statistic for testing the null hypothesis that the underlying means of the two populations are equal, assuming the variances and truncation points are known. The likelihood ratio method was selected as proving the best test for this problem. The estimator for the mean of a single population is given as a rational polynomial approximation to the solution of the maximum likelihood equation. The estimator for the joint mean under the null hypothesis is approximated by a linear combination of the individual estimators weighted by the ratio of their variances. Both estimators are shown to be asymptotically normal and Monte Carlo procedures are used to determines the required sample size for convergence to normality for a range of truncation points. The asymptotic normality of the estimators led to consideration of an alternate test statistic derived from the usual normal theory, namely the difference of the sample estimators from each population. This statistic was shown by simulation to fit a standard normal distribution over the same range of values that were tested for the likelihood statistic. Dissert. Abstr.

N80-30130 Arizona State Coll. Flagstaff.
ROBUSTNESS OF MANOVA UNDER HETEROGENEITY OF VARIANCE AND CORRELATION Ph.D. Thesis
Robert Wayne Ceurvorst 1980 196 p
Avail: Univ. Microfilms Order No. 8017701

This Monte Carlo investigation was designed to unravel the effects of heterogeneity of variance and heterogeneity of correlation on Type 1 error rates in multivariate analysis of variance (MANOVA). Error rates of Roy's largest root, the Hotelling-Lawley trace, Pillai's trace, and Wilks' likelihood ratio and the power of Box's homoscedasticity criterion were examined in cases containing heterogeneity of variance and/or heterogeneity of correlation with two or three dependent variables, two, three, or six groups, and 18, 60, or 180 degrees of freedom for error (dfe). Error rates increased as the degree of heterogeneity and the number of groups increased and as dfe decreased. With two groups and 60 or more dfe, MANOVA was robust regardless of the degree of heterogeneity. Otherwise, MANOVA was most robust when correlations varied across groups but variances did not. When heterogeneity of variance was present, error rates were lowest when the groups with the largest variance had the largest correlation(s). Pillai's trace was generally the best criterion under all four types of heterogeneity and especially when all eigenvalues were larger in one population, which was generally the most serious type of heterogeneity as far as Type 1 errors are concerned. Dissert. Abstr.

N80-30131 Michigan Univ., Ann Arbor.
DESIGN EFFECTS FOR MULTIVARIATE CATEGORICAL INTERACTIONS Ph.D. Thesis
James Michael Lepkowski 1980 329 p
Avail: Univ. Microfilms Order No. 8017307

Two approaches to the examination of design effects of multivariate categorical interactions are developed. Analytic expressions for design effects in terms of simple random sample variances, subclass correlations, and design effects for proportions are given. The expressions are examined under a variety of assumptions about the values of the parameters that can be expected in practice, and models for the design effects of interaction measures are developed. Measures of cross homogeneity are proposed to explain the effects of covariation between characteristics across clusters on design effect for multivariate data. The second approach is an empirical examination of design effects for interaction measures for two survey data sets. Empirically, average design effects for the interaction statistic are less than average design effects of the proportions comprising the statistics and hence on the average closer to one. Average design effects for interaction statistics are different from one, often substantial homogeneities. Dissert. Abstr.

N80-30132 Florida State Univ., Tallahassee.
POPULATION DENSITY ESTIMATION USING LINE TRANSECT SAMPLING Ph.D. Thesis
John Anthony Ondrasik 1979 102 p
Avail: Univ. Microfilms Order No. 8016565

Density estimation techniques suitable for both inverse and combined sampling plans were developed. In H, both a parametric and a nonparametric estimate for the population density were

developed using the inverse sampling approach. It is shown that a primary advantage of estimation using inverse sampling is the fact that these estimates can be expressed as the product of two independent random variables. This representation not only enables us to obtain the expected value and variance of our estimates easily, but also leads to a simple criterion for sample size determination. A parametric density estimate that is suitable for the combined sampling method was also derived. This estimate is shown to be asymptotically unbiased. An approximation to the variance of this estimate was also calculated. The density estimates developed were based on the assumption that the sightings of animals are independent events. This assumption was relaxed and an estimation procedure was developed using inverse sampling that applied to clustered populations (those populations composed of small groups or clusters of objects).
Dissert. Abstr.

N80-30133 Carnegie-Mellon Univ., Pittsburgh, Pa.
ASYMPTOTIC DISTRIBUTIONS OF M-ESTIMATORS IN NON-STANDARD CASES Ph.D. Thesis
Gabriel Peter Pei 1980 93 p
Avail: Univ. Microfilms Order No. 8017458

An M estimator may be viewed as a functional, the location of a minimum, on the space of sample paths for a stochastic process over the parameter space. Under regularity conditions, the normalized process converge weakly to a nonstationary Gaussian process. The asymptotic distribution of the normalized M estimator is the distribution of this functional at the limiting stochastic process. When the usual regularity conditions hold, the sample paths of the limiting process are parabolas passing through the origin, each having the same second derivative. The M estimator is asymptotically normal with rate of convergence 1/sq rt of n. Nonstandard limiting behavior may occur if these conditions are violated. In certain problems the rate of convergence is found to be 1/sq root of (k log n) although the process remains parabolic. Faster rates of convergence occur in other examples where the limit sample paths are not parabolas. The resulting asymptotic distribution of the M estimator is nonnormal in these cases. A general theorem is given, which unifies these regular and nonregular results. Dissert. Abstr.

N80-30134 Kentucky Univ., Lexington.
OPTIMAL ALLOCATION OF RESOURCES TO REDUCE PRODUCT OR PROCESS VARIABILITY; A COMPARISON OF SOME DESIGNS TO ESTIMATE THE ALLOCATION PARAMETERS AND THE VARIANCE COMPONENTS Ph.D. Thesis
Jeffrey Howell Schwartz 1980 143 p
Avail: Univ. Microfilms Order No. 8018263

Assuming the variance to be reduced is the sum of variance components, optimal reduction entails optimally allocating a limited resource to reduce each component. Two specific variance reduction function (VFR) types, an exponential-type VRF and a step-type VRF, are defined. For both VRF types, the solution to the optimal allocation problem is obtained. The solutions are valid for an arbitrary number of variance components. To investigate the effect, on optimal reduction, of variance component estimation and experimental design, a three stage nested model is adopted and a simulation study carried out. The simulation, together with asymptotic results, is used to compare the designs with respect to variance component estimation. Tables of the mean variance, bias, and MSE of the estimates are presented. Asymptotic variance-covariance matrices are derived. Numerical values of the determinant, trace, and adjusted trace are calculated and tabulated. Equivalence of two formulations of asymptotic variance is demonstrated. An overall design comparison summary table, including asymptotic and simulation results, variance reduction and variance component estimation results, is presented. Dissert. Abstr.

N80-30135# Naval Research Lab., Washington, D. C.
PROPERTIES OF CROSS-ENTROPY MINIMIZATION Interim Report
J. E. Shore and R. W. Johnson 1 Apr. 1980 40 p refs
(RR0140941)
(AD-A085471; AD-E000431; NRL-MR-0941) Avail: NTIS HC A03/MF A01 CSCL 09/4

The principle of minimum cross-entropy (minimum directed divergence, minimum discrimination information) provides a general method of inference about an unknown probability density when there exists a prior estimate of the density and new information in the form of constraints on expected values. Previous work has shown that cross-entropy minimization can be characterized axiomatically by a small set of consistency axioms. Our purpose in this paper is to collect in one place and prove various fundamental properties of cross-entropy minimization. We include examples, and we discuss general analytic and computational methods of finding minimum cross-entropy probability densities. An interesting aspect of the results presented in this paper is the interplay between properties of cross-entropy minimization as an inference procedure and properties of cross-entropy as an information measure. Cross-entropy's well-known and unique properties as an information measure in the case of arbitrary probability densities are extended and strengthened when one of the densities involved is the result of cross-entropy minimization. For example, cross-entropy does not in general satisfy a triangle relation involving three arbitrary probability densities. But in certain important cases involving densities that result from cross-entropy minimization, cross-entropy satisfies triangle inequalities and triangle equalities. GRA

N80-30136# Massachusetts Univ., Amherst. Lab. of Psychometric and Evaluative Research.
BAYESIAN ESTIMATION IN THE ONE PARAMETER LATENT TRAIT MODEL
Hariharan Swaminathan and Janice A. Gifford Mar. 1980 52 p refs
(Contract N00014-79-C-0039; NR Proj. 150-427)
(AD-A085993; LR-106; RR-80-1) Avail: NTIS HC A04/MF A01 CSCL 12/1

When several parameters are to be estimated simultaneously, and when both structural and incidental parameters have to be estimated, a Bayesian solution to the estimation problem may be appropriate. This is the case in latent trait models, where the 'structural' parameters are item parameters, while the 'incidental parameters' are ability parameters since these increase without bound as the numbers of examinees is increased to provide stable estimates of the item parameters. Bayesian estimates for the parameters in the one-parameter latent trait model were obtained for two cases: (1) conditional estimation of ability (for those situations when items are previously calibrated), and (2) joint estimation of item and ability parameters. For each of the two cases, a simulation study was carried out to study the efficacy of the two Bayesian procedures described and to compare the Bayesian estimates with the comparable maximum likelihood estimates. GRA

N80-30137# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
STOCHASTIC SYSTEMS AND THE PROBLEM OF STATE SPACE REALIZATION
J. C. Willems and J. H. Vanschuppen Jun. 1979 35 p refs
Presented at NATO Advanced Study Inst. and AMS Summer Sem. in Applied Math. on Algebraic and Geometric Methods in Linear System Theory, Cambridge, Mass., 18-29 Jun. 1979
Submitted for publication
(MC-BW-108/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4.21

An exposition of an approach to the problem of stochastic realization theory is presented. The concept of splitting relations and splitting random variables is introduced. How one can construct all minimal splitters for Gaussian random vectors is shown in detail. The relevant definitions of (autonomous) stochastic dynamic systems, of stochastic realization theory, and of white noise representation, as they arise naturally in this context are then introduced. The case of Gaussian random processes is worked out in detail. An example, a zero mean stationary Gaussian process defined on a probability space, is examined, concentrating on state space realizations of the form $y(t) = f(x(t))$ with x a Markov process. Results show that there is no unique (up to linear equivalence) minimal realization of stochastic finite dimensional stationary Gaussian processes. Author (ESA)

N80-30138# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
APPROXIMATIONS FOR THE STEADY STATE PROBABILI-

TIES IN THE MULITISERVER M/G/c QUEUE
H. C. Tijms (Vrije Univ., Amsterdam), M. H. vanHoorn, and A. Federgruen Jul. 1979 28 p refs Submitted for publication (MC-BW-109/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

For the multiserver queue with Poisson arrivals and general service times, various approximations for the steady state probabilities of the queue size are presented. These approximations are computed from numerically stable recursion schemes which can be easily applied in practice. Numerical experience reveals that the approximations are very accurate with errors typically below 5%. For the delay probability the various approximations result either in the widely used Erlang delay probability or in an approximation which improves in many cases the Erlang delay probability approximation. Author (ESA)

N80-30139# National Climatic Center, Asheville, N. C.
A NOTE ON A GAMMA DISTRIBUTION COMPUTER PROGRAM
Grady F. McKay, Danny C. Fulbright, and Grady F. McKay Mar. 1980 89 p refs
(PB80-184013; NOAA/TM/EDIS-28; NOAA-80041001) Avail: NTIS HC A05/MF A01 CSCL 12A

The computer program for the gamma (Pearson Type III) distribution function is described and its applicability is discussed. The FORTRAN 4 program for this function: (1) provides the analytic solution to a set of data; (2) gives the probabilities of exceeding or not exceeding arbitray amount; (3) indicates the amounts exceeded or not exceeded for arbitary probabilities; (4) provides options to use the biased or unbiased estimates of the maximum likelihood or Thom estimators or to use moment estimators; (5) provides options to provide confidence bands and intervals in tabular and/or graphical forms; and (6) provides for computer output to microfilm or drum and/or flatbed plotters. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-30140 Stanford Univ., Calif.
PLANNING WITH CONSTRAINTS Ph.D. Thesis
Mark Jeffrey Stefik 1980 242 p
Avail: Univ. Microfilms Order No. 8016868

A combination approach to problem solving, termed constraint posting, that uses constraints to make the interactions between subproblems explicit is introduced. It shows how constraints can be dynamically formulated and propagated during hierarchical planning, and used to coordinate the solutions of nearly independent subproblems. Using this technique, under-constrained subproblems are temporarily combined to form well constrained larger problems. Constraint posting achieves efficiency by substituting constraint propagation for computationally expensive backtracking. Dissert. Abstr.

N80-30141# Brown Univ., Providence, R. I. Center for Dynamical Systems.
OPTIMAL EXIT PROBABILITIES AND DIFFERENTIAL GAMES Interim Report
Wendell H. Fleming and Chun-Ping Tsai (Oklahoma Univ., Norman) Jan. 1980 58 p refs
(Grants AF-AFOSR-3063-76; NSF 76-07261; AF Proj. 2304) (AD-A085931; AFOSR-80-0428TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

The problem is to control the drift of a Markov diffusion process in such a way that the probability that the process exits from a given region D during a given finite time interval is minimum. An asymptotic formula for the minimum exit probability when the process is nearly deterministic is given. This formula involves the lower value of an associated differential game. It is related to a result of Ventsel and Freidlin for nearly deterministic, uncontrolled diffusions. GRA

N80-30142# Brown Univ., Providence, R. I. Center for Dynamical Systems.
PARAMETER ESTIMATION AND IDENTIFICATION FOR SYSTEMS WITH DELAYS Interim Report
H. T. Banks, J. A. Burns, and E. M. Cliff Nov. 1979 88 p refs Prepared in cooperation with Virginia Polytechnic Inst. and State Univ., Blacksburg
(Contract DAAG29-79-C-0161; Grants AF-AFOSR-3092-76; DAAG29-78-G-0125; NSF MCS-79-05774)
(AD-A085929; AFOSR-80-0403TR) Avail: NTIS HC A05/MF A01 CSCL 12/2

Parameter identification problems for delay systems motivated by examples from aerodynamics and biochemistry are considered. The problem of estimation of the delays is included. Using approximation results from semigroup theory, a class of theoretical approximation schemes is developed and two specific cases ('averaging' and 'spline' methods) are shown to be included in this treatment. Convergence results, error estimates, and a sample of numerical findings are given. GRA

N80-30143# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
THE GAUSS-MARKOV APPROXIMATION SCHEME FOR IDENTIFICATION OF MULTIVARIABLE DYNAMIC SYSTEMS THROUGH REALIZATION THEORY: AN EXPLICIT APPROACH
A. K. Hajdasinski (Central Mining and Designing Office) Aug. 1979 108 p refs Sponsored in part by Stichting voo Zuiver Wetenschappelijk Onderzoek (ZWO)
(TH-78-E-88; ISBN-90-6144-088-2) Avail: NTIS HC A06/MF A01

How dynamic, linear, time invariant systems can be described in terms of the Hankel representation (H model). The H model and Markov parameters description of a system is then considered. Results of digital simulations are examined showing minimal variances in the Markov parameters as compared to a least squares estimation and an estimation using a sample covariance matrix. The use of the Ho-Kalman algorithm, based on a pseduo-inversion and singular valve decomposition method, to filter noisy Markov parameters is also explained. Author (ESA)

N80-30144# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
THE GLOBAL ERROR APPROACH TO THE CONVERGENCE OF CLOSED LOOP IDENTIFICATION, SELF TUNING REGULATORS, AND OF SELF TUNING PREDICTORS
A. Niederlinski (Politechnic Slaska, Poland) Sep. 1978 37 p refs
(TH-78-E-89; ISBN-90-6144-089-0) Avail: NTIS HC A03/MF A01

The global error is the identification error expressed as a function of unknown system parameters, model parameters, and external system inputs. It provides a convenient tool to test mean-square convergence for a number of complicated estimation problems. It is shown, how the global error approach can be used to give a simple explanation of well-known closed loop system models is shown. A self tuning regulation is analyzed for the general case of a difference equation model. A stationary time series to be predicted N-steps ahead is described and a unique solution for the predictor parameters is found which correspond to the optimum prediction parameters. Author (ESA)

N80-30145# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
CHARACTERIZING PROPERTIES OF THE VALUE FUNCTION FOR STOCHASTIC GAMES
S. H. Tijs (Catholic Univ., Nijmegen, Netherlands) and O. J. Vrieze Jul. 1979 19 p refs Submitted for publication
(MC-BW-110/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The axiomatic characterization of the value function of two-person zero-sum games in normal form is extended to dynamic games. Special attention is given to the value function of discounted two-person zero-sum stochastic games. Furthermore, value functions for stochastic games with arbitrary evaluation rules and general state as well as action spaces are examined. The characterizing axioms are indicated by the terms objectivity, monotony, and sufficiency (or symmetry) for both players. The concept of a superfluous action is used for a player in a state of the game. Such an action can be ignored by a player without

his being punished, since the value of the game remains invariant. It is also shown that the characterizing axioms are mutually independent. Author (ESA)

N80-30146# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
COMPLEXITY OF VEHICLE ROUTING AND SCHEDULING PROBLEMS
J. K. Lenstra and A. H. G. Rinnooy-Kan (Erasmus Univ.) Aug. 1979 14 p refs Submitted for publication
(Grant NSF MCS-76-17605)
(MC-BW-111/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The complexity of a class of vehicle routing and scheduling problems is investigated. Known NP-hardness results are reviewed and results on the worst case performance of fast approximation algorithms to solve this class of problems are compiled. It is demonstrated that almost all vehicle routing and scheduling problems are NP-hard and hence unlikely to be solvable in polynomial time. Nevertheless considerable differences in complexity within the class of NP-hard problems is evident. Further developments on the interface of mathematical programming and complexity theory are suggested as promising. Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-30147# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
FACTORIZATION INDICES AT INFINITY FOR RATIONAL MATRIX FUNCTIONS
P. A. Fuhrmann (Ben Gurion Univ. of the Negev) and J. C. Willems (Mathematics Inst., Groningen, Netherlands) Sep. 1979 17 p refs Submitted for publication
(MC-BW-113/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The Wiener Hopf factorizations at infinity of a transfer function are studied. Then, the corresponding factorization indices are related to the reachability indices of a feedback equivalent, feedback irreducible system. Results are used to point out some interesting relations between the factorization indices of operator theory. By using purely algebraic methods the analysis is carried over an arbitrary field. Given a strictly proper rational matrix function G, a minimal realization Sigma=(A,B,C,) of G is constructed. The reachability indices of (A,B) with the left factorization of G are identified. The factorization indices of G itself are associated with the reachability indices of an associated feedback irreducible system feedback equivalent to G. Author (ESA)

N80-30148# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A NEWMAN-PENROSE TYPE FORMALISM FOR SPACE-TIMES WITH TORSION
S. Jogia and J. B. Griffiths Jun. 1979 30 p refs Sponsored in part by United Kingdom Scientific Research Council
(Math-Res-140) Avail: NTIS HC A03/MF A01

The Newman-Penrose formalism, in which the curvature of space-time is represented in terms of spin coefficients, is extended to include the possibility of an asymmetric connection. No particular equations of motion are assumed. In accordance with the spin coefficient approach these are included only in applications. The full set of equations extending over the Ricci identities, the contortion identities, and the Bianchi identities are given. The formalism presented is therefore applicable to all theories which consider the Riemann-Cartan space-time U sub 4, such as certain problems in Einstein-Cartan theory and other theories of gravitation that include torsion. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-30149 New York Univ., N. Y.
SPIN PRECESSION IN A HOMOGENEOUS GRAVITATIONAL FIELD Ph.D. Thesis
George K. Klein 1980 100 p
Avail: Univ. Microfilms Order No. 8017567

A basic framework is presented for the study of a stationary beam of particles falling in a homogeneous gravitational field, which is also consistent with the Theory of Relativity. A geometrical approach for the homogeneous gravitational field is given, emphasizing its main physical features, and in accordance with relativity in which this field is interpreted as the field apparently experienced by a uniformly accelerated observer (Born-Motion). The stationary beam of particles is studied in both the nonrelativistic approximation, and the relativistic. The so-called 'Quasi-Thomas' precession of the spin of the particle in a homogeneous gravitational field is calculated. The differences with the regular Thomas precession are discussed and illustrated with space-time diagrams. Some numerical estimates are given. The beam is then studied in the wave picture for Dirac particles. The precession of the spin obtained, agrees with the result given by the particle picture. The translationary motion is discussed as well as the problem of a homogeneous electric field. Dissert. Abstr.

N80-30150# Materials Research Labs., Melbourne (Australia).
A 10 MEGANEWTON (1000 tonf) FORCE STANDARD
E. Raymond Harrison and Frederick J. Brown Mar. 1980 14 p refs
(MRL-R-768; AR-002-418) Avail: NTIS HC A02/MF A01

Calibration of a force-testing machine allows it to be used as a 10-MN force standard for the testing of elastic-force calibrating devices to an accuracy of 0.2 per cent, this limitation being caused by friction of the machine's ram. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-30151 Columbia Univ., New York.
NOISE TRANSMISSION THROUGH STIFFENED PANELS Ph.D. Thesis
Mario Slazak 1980 103 p
Avail: Univ. Microfilms Order No. 8017472

An analytical study is presented to predict low frequency noise transmission through stiffened panels into cavity backed enclosures. Noise transmission is determined by solving the acoustic wave equation for the interior noise field and stiffened panel equations for vibrations of the stiffened panel. The dynamic behavior of the panel is determined by the transfer matrix procedure. Also presented is a transfer matrix development for stiffened sandwich panels. Results include comparisons between theory and experiment, noise transmission due to boundary layer turbulence, and noise transmission through the sidewall of an aircraft. Dissert. Abstr.

N80-30152 Stanford Univ., Calif.
TRANSMITTED SOUND FIELD DUE TO AN IMPULSIVE LINE ACOUSTIC SOURCE BOUNDED BY A RIGID PLATE FOLLOWED BY A VORTEX SHEET Ph.D. Thesis
Toshiki Miura 1980 85 p
Avail: Univ. Microfilms Order No. 8016849

The transmitted sound field is composed of two waves in both the steady-state and initial value problems. One is the wave scattered from the edge of the plate which is associated with the bow wave and the instability wave. These bow waves and instability waves exist in the downstream sectors. The other is the wave transmitted through the vortex sheet which is also associated with the instability wave. This instability wave exists

in a downstream sector, but if the line source is close to the rigid plate it is blocked by the plate and does not appear. The transmitted sound field can be divided into three regions. The first one is the region where the incident wave is shaded by the plate and only the waves scattered from the plate edge exist. In the second region there exist the waves transmitted through the vortex sheet in addition to the scattered waves from the edge of the plate. The third region is the transition region between the two regions just described. In this region the waves transmitted through the vortex sheet can be heard partially depending on its wave number. The asymptotic nature of this region is the same as that of the second region.

Dissert. Abstr.

N80-30153 Stanford Univ., Calif.
ACOUSTIC IMAGING WITH GRATING ACOUSTIC SCANNERS Ph.D. Thesis
Wen-Hsien Chen 1980 229 p
Avail: Univ. Microfilms Order No. 8016813

The development and application of grating acoustic scanners (GAS) are described, which employ scattering of either a surface acoustic wave (SAW) or a longitudinal acoustic wave from a mechanical grating to produce a focused and scanned beam of longitudinal bulk acoustic wave. To evaluate the performance of the SAW GAS, three scanners with operating frequencies at 2.3 MHz, 3.3 MHz, and 100 MHz were built and tested. A modified grating acoustic scanner using bulk acoustic waves instead of surface acoustic waves is also studied. Two features of these devices not available with other types of electronically scanned devices are: (1) extreme simplicity in construction and operations, and (2) scalability to very high frequencies, with corresponding very high resolution. They can be operated in the frequency range of a few MHz for nondestructive testing or nondestructive evaluation of materials and medical diagnosis applications. They may also be operated in the frequency range of a few GHz for acoustic microscopy applications. A scheme for electronically steering an acoustic beam over an angle greater than 70 deg in a tellurium dioxide crystal is presented.

Dissert. Abstr.

N80-30154*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL TECHNIQUES IN LINEAR DUCT ACOUSTICS Status Report
K. J. Baumeister 1980 23 p refs Proposed for presentation at Winter Ann. Meeting of ASME Chicago, 17-21 Nov. 1980 (NASA-TM-81553; E-513) Avail: NTIS HC A02/MF A01 CSCL 20A

Both finite difference and finite element analyses of small amplitude (linear) sound propagation in straight and variable area ducts with flow, as might be found in a typical turboject engine duct, muffler, or industrial ventilation system, are reviewed. Both steady state and transient theories are discussed. Emphasis is placed on the advantages and limitations associated with the various numerical techniques. Examples of practical problems are given for which the numerical techniques have been applied. A.R.H.

N80-30155*# Boeing Commercial Airplane Co., Seattle, Wash.
ANALYTICAL INVESTIGATION OF FAN TONE NOISE DUE TO INGESTED ATMOSPHERIC TURBULENCE Final Report
Ulrich W. Ganz Washington, D.C. NASA Aug. 1980 151 p refs
(Contract NAS1-15085)
(NASA-CR-3302) Avail: NTIS HC A08/MF A01 CSCL 20A

The atmospheric turbulence involved in the fan noise generation is evaluated with an existing model for the atmospheric turbulence and an extended version of an existing model concerned with the effects of a flow contraction on convected turbulence. Fan tone noise due to ingested atmospheric turbulence is evaluated with existing fan noise models. The results indicate that the difference in fan narrowband noise due to atmospheric turbulence between static and flight landing approach conditions is in the order of 30 dB. It is concluded that fan noise due to atmospheric turbulence is insignificant in flight conditions for the fans used in the current high bypass ratio engines. The difference in fan narrowband noise between the two conditions is primarily due to the low intensity of the turbulence involved in fan noise generation in flight conditions. Fan noise due to atmospheric turbulence in static conditions should be reduced below the flight fan broadband noise levels which is best achieved with a reduction in the intensity of the fan inflow turbulence. Such a reduction can be obtained with the use of an inflow control device, low wind velocities, small surface roughness in the test stand environment, and large engine axis height above the ground. Peak sound power levels for fan tone noise due to ingested turbulence occur for transverse integral scales in the order of 25% of the rotor blade spacing in the fan tip region. Author

N80-30156# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy.
INM INTEGRATED NOISE MODEL, VERSION 2: PROGRAMMER'S GUIDE
Thomas Connor and Robert Hinckley Sep. 1979 130 p Supersedes FAA-EQ-78-03
(Contract DOT-PPA-FA-865)
(AD-A079622; FAA-AEE-79-10; FAA-EQ-78-03) Avail: NTIS HC A07/MF A01 CSCL 20/1

This document contains information on the procedures to implement the Integrated Noise Model (INM), Version 2 into a computer system. The INM is a collection of computer programs which can calculate the aircraft noise environment in the vicinity of an airport. The INM is available from the FAA in the form of a magnetic tape. INM Version 2 supersedes Version 1 which was released in January 1978. This document replaces FAA Integrated Noise Model, Version 1, Computer Installation Instructions: (Report No. FAA-EQ-78-03). GRA

N80-30157# Wyle Labs., Inc., El Segundo, Calif.
CORRECTION PROCEDURES FOR AIRCRAFT NOISE DATA. VOLUME 4: TONE PERCEPTION Final Report
D. N. May and E. E. Watson Feb. 1980 75 p refs
(Contract DOT-FA78WA-4143)
(AD-A083075; WR-79-9-Vol-4; FAA-EE-80-1-Vol-4) Avail: NTIS HC A04/MF A01 CSCL 20/1

The existing tone correction procedure in the Effective Perceived Noise Level (EPNL) calculation procedure required for aircraft certification under Part 36 of the Federal Aviation Regulations was compared with other tone correction procedures, including the SAE Aerospace Recommended Practice 1071 and a multitone procedure due to Kryter and Pearsons. Different amounts of tone correction (level-weightings) and varying degrees of tone correction at different times in the flyover (time-weightings) were also explored. Also studied was a measure of spectral fluctuation, developed by NASA and known as spectral change. The research was limited to considering revisions within the framework of one-third octave, 0.5 second interval analysis, since such revisions can be quite easily implemented. The various tone correction noise metrics were tested against subjective judgements furnished by NASA of the noise from a range of propjet, turbojet, low and high bypass ratio turbofan, and supersonic commercial aircraft. It was found that a revision based on spectral change could, after further development, be a means to improve the accuracy of the EPNL metric. However, the success of the various other potential revisions depended on the characteristics of the data base tested. It was shown that research into improved metrics should be based on experimental plans which account for the correlations among the noise variables and the presence of any interactions. A separate, psychoacoustical pilot experiment was also performed into the effects of pseudotones on judged noisiness. (Pseudotones are low frequency tones introduced into a measured spectrum by ground reflections near the microphone. GRA

N80-30158# Pennsylvania State Univ., University Park. Applied Research Lab.
ACOUSTICAL SCATTERING FROM THE IMPEDANCE COVERED STRAIGHT EDGE AND WEDGE, THE EXACT THEORY
E. J. Skudrzyk Jan. 1975 187 p refs
(Contract N00017-73-C-1418)
(AD-A086003; ARL/PSU/TM-75-01) Avail: NTIS HC A09/MF A01 CSCL 20/1

The analytic extension of the Fourier integral from the half space to wedge-like spaces leads to Sommerfeld type integrals.

Theorems derived by Malyuzhinets in conjunction with new methods of handling Fourier Laplace integrals make it possible to apply the boundary conditions to the integrand to determine the integrand function and thus to determine the solution from the boundary conditions. The resulting Malyuzhinets functions can then be closely approximated by simple expressions for real and complex arguments. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-30159 California Univ., Davis.
THEORY OF ATOMIC MOTION IN RESONANT RADIATION Ph.D. Thesis
Richard Joseph Cook 1979 135 p
Avail: Univ. Microfilms Order No. 8011745

The Schroedinger equation for atomic motion in a resonant standing wave was solved in the limit of short atom-field interaction time. It is shown that momentum transfer from the field to the atom in a standing wave proceeds at the rate of induced absorption emission processes rather than at the spontaneous rate characteristic of momentum transfer in a plane running wave. It is shown that a narrow beam of two level atoms is split by the amplitude gradient of a resonant electromagnetic wave (optical Stern Gerlach effect). The influence on atomic motion of quantum mechanical fluctuations of the radiation force is investigated. It is shown that fluctuations of the radiation force result from interaction of the fluctuating atomic dipole moment with the applied field as well as from random recoils accompanying spontaneous emission. Atomic motion in the fluctuating radiation force is described by a Fokker Planck equation, and this equation is used to show that quantum fluctuations place a lower bound on the temperature achievable by radiation cooling, and lead to finite, often short, confinement times for atoms in radiation traps. Dissert. Abstr.

N80-30160 Yale Univ., New Haven, Conn.
THEORY OF LONG RANGE INTERATOMIC FORCES Ph.D. Thesis
Peter Robert Fontana 1960 118 p
Avail: Univ. Microfilms Order No. 8018249

General methods for calculating the electrostatic interaction energies between atoms in ground and excited states suggested by the theory of angular momentum are investigated. In developing these, the effects of spin-orbit coupling on the interaction energies are included. The classical interaction energy between two atoms is written as a contraction of irreducible tensors which permits the calculation of the general term for any multipole order. The formalism is first applied to the interaction of noble gas and alkali atoms in their ground states. The theory is then extended to describe the interaction of alkali atoms in arbitrary excited states. The use of a coupled representation is valid only as long as the electrostatic interaction is a true perturbation on the system. To investigate the transition from a representation in which spin effects are neglected to the one which includes the spin-orbit coupling correctly, a more general perturbation method is formulated. Attention is also given to the interaction energies between an alkali atom in the first excited and another one in a higher excited state. Dissert. Abstr.

N80-30161 Rice Univ., Houston, Tex.
COLLISIONAL PHENOMENA BETWEEN ELECTRONS AND HIGH RYDBERG ATOMS Ph.D. Thesis
Greg William Foltz 1980 220 p
Avail: Univ. Microfilms Order No. 8018052

A fraction of the atoms in a ground state sodium beam was optically excited (using lasers) to well defined, high Rydberg states (principal quantum numbers chosen around 40). Subsequent to their production the Rydberg atoms were allowed to interact with 25 eV electrons for a specified time interval following which the collision products were detected. The electrons are produced in a beam which is crossed at right angles with the sodium beam. Important collision processes are electron impact ionization of the Rydberg atom, and electron Rydberg atom interactions in which the quantum state of the atom is changed (state changing collisions). Results are presented for an observed state changing process which is identified as angular momentum state changing only (no change in the value of the principal quantum number). Problems which prevented the measurement of electron impact ionization cross sections are discussed. Results from studies of the process of electric field ionization to Rydberg atoms (used to detect the atoms), and the effects of background (300 K) radiation (from the chamber walls, for example) on Rydberg atoms are included. Dissert. Abstr.

N80-30162*# Xavier Univ. of Louisiana, New Orleans.
THE MULTISTATE IMPACT PARAMETER METHOD FOR MOLECULAR CHARGE EXCHANGE IN NITROGEN Final Report
Juliette W. Ioup Washington, D.C. Aug. 1980 33 p refs
(Grant NsG-1361)
(NASA-CR-3307) Avail: NTIS HC A03/MF A01 CSCL 20H

The multistate impact parameter method is applied to the calculation of total cross sections for low energy charge transfer between nitrogen ions and nitrogen molecules. Experimental data showing the relationships between total cross section and ion energy for various pressures and electron ionization energies were obtained. Calculated and experimental cross section values from the work are compared with the experimental and theoretical results of other investigators. E.D.K.

N80-30163# Georgia Univ., Athens.
STUDY OF MATTER CURRENT EFFECTS IN TWO-BODY INELASTIC COLLISIONS M.S. Thesis
M. K. Rulison 1979 70 p refs
(Contracts DE-AS09-76ER-00946; EY-76-S-09-0946)
(DOE/ER-00946/4) Avail: NTIS HC A04/MF A01

The proposed experimental test of the matter current idea consists of determining the spin rotation parameter, R, in polarized elastic meson-proton scatterings. The measurement of R usually requires a second scattering of the recoil proton off a known analyzer such as C. The purpose of this work is to offer another method by which the hadronic matter current effect can be detected. Instead of elastic scattering, the two-body inelastic scattering process in which the final state hyperon is unstable against weak decay is considered. By observing the angular distribution of the decay products the rotation parameter, R, may be inferred. DOE

N80-30164# Oak Ridge National Lab., Tenn.
HOLLOW CATHODE FOR POSITIVE ION SOURCES
D. E. Schechter, J. Kim, and C. C. Tsai 1979 11 p refs
Presented at the 8th Symp. of Eng. Probl. of Fusion Res., San Francisco, 10 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791102-152) Avail: NTIS HC A02/MF A01

Development to incorporate hollow cathodes into high power ion sources for neutral beam injection systems is being pursued. Hollow tube LaB6 type cathodes were constructed and tested in several ion source configurations. Results of testing include arc discharge parameters of > 1000 and 500 amps for 0.5 and 10 second pulse lengths, respectively. Details of cathode construction and additional performance results are discussed. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-30165 Maryland Univ., College Park.
NONLINEAR ELECTROSTATIC ION CYCLOTRON WAVES Ph.D. Thesis
James Richard Myra 1979 118 p
Avail: Univ. Microfilms Order No. 8016986

The nonlinear physics associated with finite amplitude,

coherent, electrostatic ion cyclotron waves is studied analytically. A perturbation scheme is utilized to derive the lowest order nonlinear corrections to the linear wave. To determine the effect of the nonlinear particle orbits on the ion cyclotron wave, the Vlasov equation for the ions is solved to third order in the wave amplitude. A nonlinear equation for the propagation of a wave packet in a stable plasma is derived and the slowly varying modulation envelope of the wave is shown to obey a nonlinear Schrudinger equation when the frequency of the wave is sufficiently close to a multiple of the cyclotron frequency. The dominant nonlinearity is then related to a nonlinear shift in the effective gyrofrequency of the ions. For ion cyclotron waves modulated along the field lines and in time, analysis reveals an additional smaller nonlinearity arising from the parallel ponderomotive force on the ions. The case of an unstable plasma, with coherent cyclotron waves driven by the free energy of a cold ion beam directed along the magnetic field, is also considered. The nonlinear frequency shift is shown to be the dominant stabilization mechanism acting on a short time scale when the beam energy density is large compared to the thermal energy density of the background plasma. Dissert. Abstr.

N80-30166# Naval Research Lab., Washington, D. C. Plasma Physics Div.
COLLECTIVE ACCELERATION WITH ROTATING RELATIVISTIC ELECTRON BEAMS
D. N. Spector, K. A. Gerber, R. A. Mahaffey (Sachs/Freeman Assoc., Inc., Bladensburg, Md.), R. A. Meger (JAYCOR, Alexandria, Va.), and J. D. Sethian. 11 Apr. 1980. 14 p. refs.
(RR011094 1)
(AD-A085475; AD-E000429; NRL-MR-4151) Avail: NTIS HC A02/MF A01 CSCL 20/9
Observation of accelerated protons during the injection of rotating relativistic electron beams into neutral hydrogen (50 mTorr to 400 mTorr) indicated that ions from the beam-formed plasma are trapped and accelerated by a potential well at the beamfront. Measurements show that the number of accelerated protons decreases as the beamfront velocity is increased. Moreover, at a given velocity, the number accelerated is relatively insensitive to the neutral gas pressure. GRA

N80-30167# Cornell Univ., Ithaca, N. Y. Lab. of Plasma Studies.
COLLECTIVE ION ACCELERATION. Final Report, 15 Jan. 1979 - 14 Jan. 1980
John A. Nation. 1980. 198 p. refs.
(Contract F44620-75-C-0054; AF Proj. 2301)
(AD-A085312; AFOSR-80-0440TR) Avail: NTIS HC A09/MF A01 CSCL 20/7
Work was conducted on the excitation of slow cyclotron and slow space charge waves in a plasma beam. Observations were made when a planar electron beam was propagated through a strip line. The beam was guided by a homogeneous magnetic field and the excitation achieved with a zero frequency pump wave. Both the space charge and cyclotron waves were excited in the 20-30 GHz interaction and the cyclotron wave in the 70 GHz range. For the first time, independent measurements were made of the effects on growth rate of the homogeneous guide field and the rippled field. Experiments were conducted on the proof-of-principle for a space charge wave accelerator. A large amplitude space charge wave was grown on an electron beam. Phase velocities of 0.25 c, and accelerating fields of 60kV/cm were obtained. GRA

N80-30168# Los Alamos Scientific Lab., N. Mex.
USDOE RADIOACTIVE WASTE INCINERATION TECHNOLOGY: STATUS REVIEW
Leon C. Borduin and Anibal L. Taboas (DOE, Albuquerque, N. Mex.). 1980. 40 p. refs. Presented at the 2d DOE Environ. Control Symp., Reston, Va., 17 Mar. 1980.
(Contract W-7405-eng-36)
(LA-UR-80-692; CONF-800334-5) Avail: NTIS HC A03/MF A01
An introduction to incineration concerns and an overview of the prominent radwaste incineration processes being developed within DOE are presented. Brief process descrptions, status and goals of individual incineration systems, and planned or potential applications are also included. Development efforts continue and significant results are available for the nuclear community and the general public to draw on in planning. DOE

N80-30169# URS/Blume (John A.) and Associates, San Francisco, Calif.
CONSIDERATIONS FOR DEVELOPING SEISMIC DESIGN CRITERIA FOR NUCLEAR WASTE STORAGE REPOSITORIES
G. Norman Owen, Peter I. Yanev, and Roger E. Scholl. Apr. 1980. 69 p. refs.
(Contract DE-AC08-76DP-00099)
(JAB-00099-128) Avail: NTIS HC A04/MF A01
The development of seismic design criteria for the underground structures of repositories is addressed. An initial step in the development of seismic design criteria for the underground structures of repositories is the development of performance criteria, or minimum standards of acceptable behavior. A number of possible damage modes are identified for the operating phase of the repository; however, no damage modes are foreseen that would perturb the long-term function of the repository, except for the possibility of increased permeability within the rock mass. Subsequent steps in formulating acceptable seismic design criteria for the underground structures involve the quantification of the design process. The necessity of specifying the form of ground motion that would be needed for seismic analysis and the procedures that may be used for making ground motion predictions are discussed. Further, analytic concerns including rock properties, failure criteria, modeling techniques, seismic hardening criteria for the host rock mass, and probabilistic considerations are examined. DOE

N80-30170# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
HIGH LEVEL NUCLEAR WASTE
J. L. Crandall. 1980. 40 p. Presented at the 17th Ann. Symp. of the Am. Soc. of Mech. Engr., Idaho Falls, Idaho, 29 May 1980.
(Contract DE-AC09-76SR-00001)
(DP-MS-80-39; CONF-800535-1) Avail: NTIS HC A03/MF A01
The DOE Division of Waste Products through a lead office at Savannah River is developing a program to immobilize all US high-level nuclear waste for terminal disposal. DOE high-level wastes include those at the Hanford Plant, the Idaho Chemical Processing Plant, and the Savannah River Plant. Commercial high-level wastes, for which DOE is also developing immobilization technology, include those at the Nuclear Fuel Services Plant and any future commercial fuels reprocessing plants. The first immobilization plant is to be the Defense Waste Processing Facility at Savannah River, scheduled for 1983 project submission to Congress and 1989 operation. Waste forms are still being selected for this plant. Borosilicate glass is currently the reference form, but alternate candidates include concretes, calcines, other glasses, ceramics, and matrix forms. DOE

N80-30171# Oak Ridge National Lab., Tenn.
OVERVIEW OF NUCLEAR FUEL CYCLE
J. O. Blomeke. 1979. 32 p. Presented at the ANS Student Chapter Seminar, College Station, Texas, 5-9 Nov. 1979.
(Contract W-7405-eng-26)
(CONF-791185-3) Avail: NTIS HC A03/MF A01
A broad, general look is given at the fuel cycle from an overall perspective. Covered are: boiling water reactors and pressurized water reactors fuel characteristics, U mining and milling, enrichment, fuel fabrication, spent fuel reprocessing, handling and shipment, etc. Results of the International Fuel Cycle Evaluation are summarized. DOE

N80-30172# Oak Ridge National Lab., Tenn.
DISPOSAL OF RADIOACTIVE WASTES
J. O. Blomeke. 1979. 38 p. Presented at ANS Student Chapter Seminar, College Station, Tex., 5-9 Nov. 1979.
(Contract W-7405-eng-26)
(CONF-791185-2) Avail: NTIS HC A03/MF A01
Radioactive waste management and available disposal requirements options are discussed. The possibility of beneficial utilization of radioactive wastes is covered. Methods of interim storage of transuranium wastes are listed. Methods of shipment of low level and high level radioactive wastes are presented.

Various methods of radioactive waste disposal are discussed.
DOE

N80-30173# Union Carbide Corp., Oak Ridge, Tenn. Engineering Div.
MANAGEMENT OF SOLID WASTE
W. T. Thompson and L. H. Stinton 18 Apr. 1980 21 p
(Contract W-7405-eng-26)
(ORNL/ENG/INF-80/1; CONF-800416-2) Avail: NTIS
HC A02/MF A01

Compliance with the latest regulatory requirements addressing disposal of radioactive, hazardous, and sanitary solid waste criteria in the selection, design, and operation of solid waste management facilities. Due to the state of flux of these regulatory requirements from EPA and NRC, several waste management options were of solid waste. The current regulatory constraints and the design and operational requirements for construction of both storage and disposal facilities for use in management of DOE-ORO solid waste are highlighted. Capital operational costs are included for both disposal and storage options.
DOE

N80-30174# Gilbert/Commonwealth, Reading, Pa.
STATE OF THE ART REVIEW OF RADIOACTIVE WASTE VOLUME REDUCTION TECHNIQUES FOR COMMERCIAL NUCLEAR POWER PLANTS
Apr. 1980 256 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-79/13837/2) Avail: NTIS HC A12/MF A01

The state of the art of volume reduction techniques is reviewed for low level liquid and solid radioactive wastes produced as a result of: (1) operation of commercial nuclear power plants, (2) storage of spent fuel in away-from-reactor facilities, and (3) decontamination/decommissioning of commercial nuclear power plants. The types of wastes and their chemical, physical, and radiological characteristics are identified. Methods used by industry for processing radioactive wastes are reviewed and compared to the new techniques for processing and reducing the volume of radioactive wastes. A detailed system description and report on operating experiences follow for each of the new volume reduction techniques. In addition, descriptions of volume reduction methods presently under development are provided
DOE

N80-30175# Department of Energy, Washington, D. C.
SPENT FUEL SHORTAGE: FACTS BOOKLET
Apr. 1980 66 p refs
(DOE/NE-0005) Avail: NTIS HC A04/MF A01

In October 1977, the Department of Energy (DOE) announced a spent nuclear fuel policy where the Government would, under certain conditions, take title of and store spent nuclear fuel from commercial power reactors. The policy is intended to provide spent fuel storage until final disposition is available. The DOE has programs for providing safe, long-term disposal of nuclear waste. The spent fuel storage program is one element of waste management and complements the disposal program. The costs for spent fuel services are to be fully recovered by the Government from the utilities. This will allow the utilities to confidently consider the costs for disposition of spent fuel in their rate structure. The United States would also store limited amounts of foreign spent fuel to meet nonproliferation objectives. This booklet summarizes information on many aspects of spent fuel storage.
DOE

74 OPTICS

Includes light phenomena.

N80-30176 Carnegie-Mellon Univ., Pittsburgh, Pa.
COHERENT OPTICAL PROCESSING OF PASSIVE SIGNALS Ph.D. Thesis
Bhagavatula Venkata Krishna Vijaykumar 1980 245 p
Avail: Univ. Microfilms Order No. 8017456

The dynamic range, resolution and nonlinear response of the data planes in an optical processor affect the performance of an optical correlator. These system issues are addressed for the passive signal processing problem assuming random variable signals. It is shown that quantization is of no concern for random signal and a new parameter, space blur bandwidth product is introduced to describe resolution effects. A unified discussion of how optical processors can operate on the complex valued data typical of several passive signal estimation applications is also included. Two passive signal processing applications (adaptive phased array radar and passive ambiguity surface generation for sonar) are then described. Two coherent optical processing systems for these applications are presented, experimental data are included, and a statistical analysis of the results in systems is provided.
Dissert. Abstr.

N80-30177 Arizona Univ., Tucson.
SIMULATION OF SPECTRAL RADIANCE OF A DYNAMIC INFRARED SOURCE Ph.D Thesis
Marija Strojnik Scholl 1980 310 p
Avail: Univ. Microfilms Order No. 8017768

An infrared source with spatially and temporally variable radiance is designed. It can be to simulate any other infrared source simultaneously in two wavelenght bands. The theoretical analysis of the real and simulator source is performed to define the design parameters. A series of the concepts are evaluated for their potential as in infrared sources. A three dimensional heat transfer computer program is used to predict the thermal behavior of the prototype glassy carbon waffle target. Tests are performed on this target on this target which shown that its thermal and radiation properties are in agreement with its predicted behavior. Glassy carbon waffle source is a good infrared radiator which can be used repeatedly at high temperatures. Measurements are described which show that the uniformity in the surface temperature can be maintained even when a scanning laser beam is used to deposit the energy on the target surface. The target surface is described analytically as a low pass filter. Its time constant it shown on depend analytically as a low pass filter. Its time constant it shown to depend on the target material and the temperature distribution in the target.
Dissert. Abstr.

N80-30178# Aerospace Corp., El Segundo, Calif. Astrophysics Lab.
INTERFERENCE PATTERNS PRODUCED BY A MACH-ZEHNDER INTERFEROMETER AND A MULTILINE HF LASER Interim Report
R. W. F. Gross, J. G. Coffer, E. B. Turner, R. A. Chodzko, and W. R. Warren, Jr. 10 Apr. 1980 22 p refs
(Contract F04701-79-C-0080; DARPA Order 3646)
(AD-A085409; TR-0080(5764)-2; SD-TR-80-17) Avail: NTIS
HC A02/MF A01 CSCL 20/6

The fringe pattern produced by a Mach-Zehnder interferometer illuminated with the light from a hydrogen fluoride (HF) laser operating on a large number of laser lines was investigated. Emphasis was placed on the intensity variations of the infrared fringes that are observed when one element of the interferometer is translated, thereby changing the length of one optical path. An intensity maximum similar to 'white-light fringes' is observed when the two arms of the interferometer have equal optical lengths. The experimental results are compared with numerically predicted fringe patterns calculated from the spectral content of the illuminating laser beam. A method is suggested for actively controlling the phases of a number of parallel HF laser amplifiers in high-power phased-array devices.
GRA

N80-30179# ITT Electro-Optical Products Div., Roanoke, Va. Products Div.
SINGLE-MODE BEND EVALUATIONS, ADDENDUM
G. Salisbury 15 May 1980 31 p
(Contract N00173-78-C-0196)
(AD-A085405; ITT-80-20-08-Add) Avail: NTIS
HC A03/MF A01 CSCL 20/6

This test is designed to find the bend-induced losses of four fibers. Three of these fibers are of the high numerical aperture (NA) design, and one fiber is of the low NA design.
GRA

N80-30180# University of Southern California, Los Angeles.
WAVEGUIDE STUDIES FOR FIBER OPTICS AND OPTICAL SIGNAL PROCESSING APPLICATIONS Final Technical Report, 11 Sep. 1977 - 10 Sep. 1979
Elsa Garmire Griffiss AFB, N.Y. RADC Apr. 1980 115 p
refs

(Contract F19628-77-C-0221; AF Proj. 2306)
(AD-A086115; RADC-TR-80-82) Avail: NTIS
HC A06/MF A01 CSCL 20/6

This report describes investigations of waveguide components for use in multimode fiber optics and in optical signal processing. Measurements of beam expansion and polarization properties of distributed Bragg deflectors are described. Measurements of the characteristics of DBR lasers are detailed, with emphasis on those properties which are relevant to their use as sources to couple to the waveguide beam expander. Studies of the mechanisms for loss in LiNbO3 waveguides are described and techniques to reduce the waveguide loss in LiNbO3 modulators are outlined. Finally, preliminary experiments on electro-thermal diffusion in LiNbO3 are described. GRA

N80-30181# Itek Corp., Lexington, Mass. Optical Systems Div.
HIGH BANDWIDTH, FINE RESOLUTION DEFORMABLE MIRROR DESIGN Final Report
Ralph E. Aldrich, Jeffrey H. Everson, and Nedo P. Albertinetti
Kirtland AFB AFWL Mar. 1980 80 p
(Contract F29601-78-C-0060)
(AD-A086089; AD-E200495; ITEK-8432; AFWL-TR-79-5)
Avail: NTIS HC A05/MF A01 CSCL 20/6

This report describes the design, fabrication and testing of five candidate actuator types to achieve a deformable mirror capable of 6 microns dilatation at 1.5 kV. The actuator types are the coherent stack, bimorph, tube, multilayer and the honeycomb. GRA

N80-30182# Science Applications, Inc., La Jolla, Calif.
REAL-TIME APPLICATIONS OF OPTICAL SIGNAL PROCESSING TO COMMAND AND CONTROL COMMUNICATIONS Final Technical Report, Apr. 1978 - Sep. 1979
W. Stoner, E. Garber, F. Horrigan, G. Collins, and J. Phelps
Griffiss AFB, N.Y. RADC Apr. 1980 56 p refs
(Contract F19628-78-C-0117; RZ512340)
(AD-A086081; RADC-TR-80-86) Avail: NTIS
HC A04/MF A01 CSCL 20/6

The program reported on in this final report was directed towards development of real-time optical signal processing for C3 and radar applications. Specifically, these applications were A/D conversion, spread spectrum code acquisition and decoding, and clutter rejection in look-down radar. In the context of these applications and through discussions with RADC/ET, technical goals were framed, such as a goal of A/D conversion at 1 Ghz. New optical signal processing techniques were conceived to meet the technical goals. These new approaches include a noncoherent kaleidoscope system for A/D conversion, and a noncoherent optical correlation technique which accommodates the bipolar and complex-valued signals encountered in spread spectrum communications and in radar. During the course of our program, determinations were made of the specific hardware best suited for the testing and demonstration of these novel approaches. These determinations were made by theoretical calculations and by consulting with the literature. Experimental tests of many subsystems, such as the noncoherent correlator optics and acousto-optic Bragg cells for introducing signals into the correlator in real-time, were tested at RADC/ET. Investigations were also made of computer generated holograms for use as pupil masks in the noncoherent correlator. GRA

N80-30183# Itek Corp., Lexington, Mass. Optical Systems Div.
RESEARCH AND DESIGN OF A PROM COHERENT OPTICAL PROCESSOR Final Technical Report, 25 Sep. 1979 - 7 Mar. 1980
Francis J. Corbett, Richard A. Tuft, W. Faccenda, R. Copper, and A. Rux 10 Apr. 1980 51 p refs
(Contract DAAK70-79-C-0164)
(AD-A085992; ITEK-9565-62; ETL-0219) Avail: NTIS
HC A04/MF A01 CSCL 17/8

This program produced a design for a coherent optical image processor utilizing a PROM(s). The PROM Coherent Optical Processor or PCOP is a subsystem of the USAETL Hybrid (Optical/Digital) Image Processor. The design and supporting analysis tasks are detailed in the report. The purpose of development of this processor is to evaluate automatic image feature extraction algorithms. The PCOP is a two PROM Fourier plane filter processor which operates in the following manner. The first PROM is the input image plane. Imagery is scaled through a lens system and then manipulated in intensity space at the input PROM. The image transform is taken next in the processing sequence and then filtered at the second PROM. Filters are generated with a laser optical scanner. The reconstructed image is produced on a charge integrating camera and displayed on a CRT. Image quality and data throughput were determined and the PCOP design was made to insure the output quality was compatible with the USAETL program objectives. GRA

N80-30184# Army Missile Command, Redstone Arsenal, Ala. Directed Energy Directorate.
A SIMPLE METHOD FOR TREATING DIFFRACTIVE PROPAGATION FROM A LASER WITH DIAGNOSTIC OPTICS
R. W. Jones, J. C. Nixon, and J. F. Perkins 19 Nov. 1979 14 p refs
(AD-A085871; DRSMI/RH-80-2) Avail: NTIS
HC A02/MF A01 CSCL 20/3

The diffractive propagation of a complex laser beam through a multi-element optical system is considered. It is shown that the problem can be easily reduced to propagation of a quasi-collimated laser beam in free space through a distance d sub eff determined by successive applications of a simple lens equation. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-30185 Columbia Univ., New York.
A NUMERICAL STUDY OF THE INITIAL DYNAMICS IN TORMAC Ph.D. Thesis
Ahmet Y. Aydemir 1980 232 p
Avail: Univ. Microfilms Order No. 8016898

A single fluid magnetohydrodynamic (MHD) code was used to study the initial plasma dynamics in Tormac, an experimental device which attempts to confine plasma in a toroidal two pole cusp field. The code is in two dimensions and includes classical electrical conductivity and a constant heat conductivity. Results of the simulations indicate that the external fields in Tormac are such that, starting with some reasonable initial conditions, the plasma never reaches the desired equilibrium state. It initially forms two horn like structures attached to a main body of plasma, which help the plasma get further away from the desired configuration. Eventually, most of the plasma ends up near the inner wall, with a temperature in the range of 10 electron volts. To improve the plasma behavior, various changes in the initial conditions and boundary values were tried. Altering the boundary values led to improvements by eliminating some of the external currents and delaying in time of some of the others, it was possible to implode the plasma to a configuration very similar to the desired cusp equilibrium. However, after this initial phase, the plasma flows along the open poloidal field lines towards the cusp region, and the top and bottom walls of the device. The plasma is too cold, and thus too collisional, to support any pressure anisotropy necessary for such mirror confinement. Dissert. Abstr.

N80-30186 Columbia Univ., New York.
SPECTROSCOPIC STUDY OF TURBULENT HEATING IN THE HIGH BETA TOKAMAK TORUS 2 Ph.D. Thesis
George E. Georgiou 1980 143 p
Avail: Univ. Microfilms Order No. 8016952

Visible spectroscopy, involving line profile and line intensity measurements, was used to study the turbulent heating of the rectangular cross-section high beta Tokamak Torus 2. In antiparallel operation, the turbulent E-fields maximize in the region of maximum induced poloidal skin current. The resulting high beta Tokamak plasma, has an intially peaked radial ion temperature profile (approximately 180 eV at that plasma center for 25 GW

antiparallel heating power). Within approximately 10 micron sec, the He 2 determined ion temperature becomes nearly spatially flat, and then decreases slowly in time. However, the frequency of the turbulence increase at lower (approximately 12 GW) anti-parallel heating power. In parallel bias field operation, the induced skin current is lower by roughly a factor of 5 and measureable turbulence does not develop. The He 2-determined ion temperature at 25 GW parallel heating power is comparable to that at 12 GW anti-parallel operation. The measured line profiles also indicate a macroscopic poloidal circulation of plasma ions, which is charged and mass independent. Dissert. Abstr.

N80-30187 Michigan Univ., Ann Arbor.
RADIATION TRANSPORT IN DENSE PLASMAS Ph.D. Thesis
Steven Alan Freije 1980 167 p
Avail: Univ. Microfilms Order No. 8017264

A radiation transport model for line radiation is developed for inclusion in a magnetohydrodynamic computer code. The transport model combines escape and transmission probability theory for optically thin (tau > 1) or strongly absorbing (sigma sub A > sigma sub 5) regions with Eddington theory in optically thick, scattering dominated regions. The magnetohydrodynamic code models one dimensional cylindrically symmetric Z-pinch or exploding wire plasma, solving the MHD equations in the Lagrangian frame. A laser heated aluminum exploding wire plasma is considered. The non-equilibrium exploding wire plasma is considered. The nonequilibrium atomic rate equations are solved to obtain the effective charge of the plasma and the transparent line emission which is used as the source function in the radiation transport model. Simulations with and without radiation transport are compared. The addition of the radiation transport calculations causes a decrease in emission. The emission decreases slightly for an optically thin plasma to as much as 2 to 5 times for an optically thick plasma. The decrease is due to self absorption during transport. Other effects of self absorption on plasma dynamics are discussed. Dissert. Abstr.

N80-30188 Tannessee Univ., Knoxville.
TIME-RESOLVED X-RAY ENERGY SPECTROMETRY AS A PLASMA DIAGNOSTIC METHOD FOR THE OAK RIDGE TOKAMAKS Ph.D Thesis
George Richard Dyer 1980 222 p
Avail: Univ. Microfilms Order No. 8018477

The X-ray emission spectrum from a Tokamak plasma is presented, and the complicating effects of plasma-detector geometry, plasma temperature and density profiles, and impurity radiation are analyzed. The necessary data collection system is described, and the consequences of finite energy resolution, pulse pileup, and other deleterious effects are investigated. Results of these considerations are combined in a procedure to calculate electron temperature (T) and Z effective ion charge (Z) from X-ray energy data and plasma density information, and to estimate the accuracy and reliability of the derived values. The computational procedure is applied to five different classes of Tokamak discharges and the results are compared with T and Z values independently derived through a Thomson-scattering diagnostic. These comparisons show that, in general, agreement between the X-ray diagnostic and accepted techniques is good, and demonstrate the advantages of a time-resolved measurement capable of spanning an entire discharge. Dissert. Abstr.

N80-30189 Maryland Univ., College Park.
PLASMA WAVE STUDIES WITH A WIDE BANDWIDTH SAMPLING CORRELATOR Ph.D. Thesis
Bernard J. Leikind 1979 118 p
Avail: Univ. Microfilms Order No. 8016725

An auto- or crosscorrelator based on a sampling principle is described. By periodically taking extremely short samples of the high frequency wideband input signal its spectrum is compressed and transferred to a frequency band where it can be more easily manipulated. The correlator operates by taking samples in pairs with a controlled delay time between the samples in a pair. Each pair is multiplied and many such products averaged to obtain the value of the correlation function for that particular delay time. If the width of the sample is very short, the bandwidth of the correlator is extremely large. Two studies have been made to evaluate the utility of this correlator for plasma wave studies. In the first study, the correlator was operated as an RF interferometer and the dispersion properties of wave on a magnetized plasma column were investigated. On the basis of the measurements the waves were identified as Trivelpiece-Gould modes. In the second study, the correlator was applied to study the plasma wave turbulence produced by the interaction of an electron beam and a plasma. From the measured cross correlation functions a number of properties of the turbulent waves were deduced. Dissert. Abstr.

N80-30190 Michigan Univ., Ann Arbor.
EXPERIMENTAL STUDY OF PARAMETRIC INSTABILITIES DRIVEN BY FINITE EXTENT LOWER HYBRID WAVES IN A PLASMA Ph.D Thesis
James Everell Stevens 1980 208 p
Avail: Univ. Microfilms Order No. 8017373

The parametric decay of a lower hybrid wave into a lower hybrid sideband and a nonresonant low frequency quasimode was observed in a linear magnetized plasma device. The dispersion properties of this process were measured in a realistic geometry for lower hybrid wave heating. Investigation of the wavenumber versus frequency of the sideband decay waves showed that the parallel wavenumber component of the sideband was different depending on whether the sideband group velocity was in the same or opposite direction to the pump wave. The threshold electric field was measured by a calibrated RF double probe and found to agree with theory. A continuous transition from ion-acoustic mode to quasimode decay spectra was observed to varying the plasma density or pump wave frequency. The results, displayed on contour plots, show the wide range of unstable wavenumbers and frequencies for the nonresonant (quasimode) decay process. The number of e-foldings of the decay waves were calculated, based on a model of convective saturation. Dissert. Abstr.

N80-30191 Florida Univ., Gainesville.
ATOMIC EMISSION AND ATOMIC FLUORESCENCE SPECTROMETRY IN INDUCTIVELY COUPLED PLASMA Ph.D. Thesis
Seifollah Nikdel 1979 242 p
Avail: Univ. Microfilms Order No. 8016562

Molecular emission spectra of native species (OH, NO, and NH) in the argon inductively coupled plasma (ICP) were studied as a function of height in the plasma, input power, and adjacent environment to the plasma. Similar studies were carried out with an ICP into which was introduced moderately concentrated solutions of elements forming stable monoxides, such as SC, Y, Gd, and Lu. The characteristics of the emission line profiles of Ca, Zn, and Mg show that self absorption, while present, is not severe and that self reversal is absent in the observation zones commonly used for analytical measurements. The use of the ICP as excitation source in flame atomic fluorescence spectrometry permitted low limits of detection to be achieved with a simple experimental set up. The reduction of spectral interference observed in ICP emission is demonstrated for the determination of zinc in unalloyed copper. The atomic and ionic fluorescences of iron, tin, barium, and indium excited by flashlamp and nitrogen laser pumed pulsed dye lasers in the ICP were studied. Noise sources were investigated and detectability is compared to the techniques of ICP emission and laser excited atomic fluorescence spectrometry. Dissert. Abstr.

N80-30192 Stanford Univ., Calif.
MEASUREMENTS OF CONDUCTIVITY NONUNIFORMITIES AND FLUCTUATIONS IN COMBUSTION MHD PLASMAS Ph.D. Thesis
Ralph Martin Kowalik 1980 203 p
Avail: Univ. Microfilms Order No. 8016842

Diagnostics for the characterization of electrical conductivity nonuniformities in combustion magnetohydrodynamic (MHD) plasmas were developed. An initial characterization of nonuniformities in the Stanford M-2 linear generator was obtained and recommendations were made concerning the use of the diagnostics in practical MHD generator configurations. A laser induced fluorescene (LIF) diagnostic for nonintrusive measurements of local conductivity fluctuations was developed. This diagnostic and other line of sight averaged optical nonuniformity diagnostics were successfully demonstrated in several experiments

in the Standford M-2 combustion systems. Results were used to characterize the nonuniformities in the M-2 system and to compare and evaluate the diagnostics. Conductivity nonuniformities were found to be predominantly streamers which had relatively long length scales of the order of 1 m in the axial flow direction. Shortest transverse length scales of the order of 0.1 m were found perpendicular to the flow direction. A combination of LIF and plasma luminosity diagnostics is recommended for future characterizations of conductivity uniformities in combustion MHD plasmas. Dissert. Abstr.

N80-30193# Naval Weapons Center, China Lake, Calif. Research Dept.
SPECTRA OF PRESSED DISKS OF ALKALI HALIDE WHISKER CRYSTALS INCORPORATING FOREIGN IONS
Marian E. Hills and Allen L. Olsen. Apr. 1980. 15 p. refs.
(AD-A085963; NWC-TP-6185) Avail: NTIS
HC A02/MF A01 CSCL 07/4

Alkali halide whisker crystals of KCl, KBr, KI, and NaCl were grown readily by allowing aqueous solutions of the salts to pass through porous glass. Whisker crystals of alkali halides doped with MnO4(-), ClO4(-) and ClO3(-) were also grown; not all dopants were used with all host lattices. The whisker crystals may be pressed into disks suitable for obtaining optical spectra. The absorption bands in the spectra of disks pressed from doped whisker crystals were sharper than the spectra of disks pressed from a mechanical mixture of the alkali halide and the dopant. The versatility of the porous glass technique for the growth of whisker crystals is clearly demonstrated. GRA

N80-30194# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
ELECTRON CONDUCTIVITY IN COMBUSTION PLASMAS Final Report, Oct. 1977 - Oct. 1979
L. C. Pitchford and E. C. Beaty. Wright-Patterson AFB, Ohio AFWAL. Mar. 1980. 41 p. refs.
(MIPR-FY1455-79-00609; AF Proj. 2308)
(AD-A086018; AFWAL-TR-80-2019) Avail: NTIS
HC A03/MF A01 CSCL 20/9

The major uncertainty in the calculation of the conductivity in certain plasmas representative of those produced as combustion products in MHD generators is due to the uncertainty in the low energy momentum transfer cross sections for electron scattering in water vapor. The most reliable values of such low energy cross sections are those deduced from electron swarm experiments. The determination of cross sections from swarm experiments involves solving the Boltzmann equation for the electron energy distribution function using some assumed trial set of cross sections. Certain integrals of the distribution function yield the quantities measured in swarm experiments, such as drift velocities and diffusion coefficients. By comparing the calculated values of these measurable quantities with those found experimentally, it is possible to reach useful conclusions about the trial set of cross sections. An iterative procedure can then allow deduction of a set of cross sections which is consistent with swarm observations. The low energy cross sections are thus determined and are some of the most reliable available. GRA

N80-30195# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
BASIC MIRROR STUDIES, TASK 1. BASIC TOKAMAK STUDIES, TASK 2. Annual Progress Report
L. D. Smullin, G. Bekefi, and M. Porkolab. 1979. 14 p.
(Contract DE-AC02-78ET-53076)
(DOE/ET-53076/1) Avail: NTIS HC A02/MF A01

Research progress is reported for each of the following areas: (1) building equipment, (2) RF heating, (3) interspectroscopy, (4) gas puff, (5) mm collective scattering, (6) UV spectroscopy, (7) soft x radiation, (8) charge exchange, and (9) Thomason scattering. DOE

N80-30196# California Univ., Livermore. Lawrence Livermore Lab. National MFE Computer Center.
DYNAMICAL DETERMINATION OF OHMIC STATES OF A CYLINDRICAL PINCH
D. D. Schnack. Apr. 1980. 6 p. refs. Presented at the REP Workshop, Albuquerque, N. Mex., 28 Apr. - 2 May 1980
(Contract W-7405-eng-48)
(UCRL-84302) Avail: NTIS HC A02/MF A01

The dual problems of generation and sustainment of the reversed axial field are studied. It is shown that, if a cylindrical plasma is initially in an axisymmetric state with a sufficient degree of paramagnetism, field reversal can be attained by mode activity of a single helicity. The initial paramagnetism may be due to the method of pinch formation, as in fast experiments, or to a gradual altering of the pitch profile resulting from a succession of instabilities. Furthermore, if the total current is kept constant and energy loss and resistivity profiles are included in an ad hoc manner, one finds that the final steady state of the helical instability can be maintained for long times against resistive diffusion without the need for further unstable activity. These states, which possess zero order flow and possibly reversed axial field, represent steady equilibria which simultaneously satisfy force balance and Ohm's law, and are termed Ohmic states. DOE

N80-30197# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
[RESEARCH ACTIVITIES OF THE INSTITUTE FOR PLASMA RESEARCH] Annual Report, 1978 [FORSCHUNGSBERICHT 1978]
1979. 49 p. refs. In GERMAN
Avail: NTIS HC A03/MF A01

Activities in the following areas are described: waves and plasma heating, plasma simulation, high tension belt pinch, laser experiments, and plasma focusing. Author (ESA)

N80-30198# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
THE DISPERSION RELATION OF ELECTROTHERMAL WAVES IN A NONEQUILIBRIUM MAGNETOHYDRODYNAMIC PLASMA
P. Massee. Dec. 1978. 27 p. refs.
(TH-78-E-92; ISBN-90-6144-092-0) Avail: NTIS
HC A03/MF A01

The experimental verification of the dispersion relation for electrothermal waves is described. The theoretical derivation of this relation as presented differs from the usual approach as the experiment requires an analysis in terms of real frequency and complex wave number. In the experiment, values for electron temperature of up to 2400 K and for electron density of up to 700 exa/cu cm were realized. The properties of the heavy particle gas were not characteristic for the situation in a closed cycle magnetohydrodynamic generator since electrothermal waves are essentially a property of the electron gas only. Hence, the waves were excited artificially in the stable regime so that they were damped, which set high requirements on the measuring technique. The ratio of the amplitudes at two successive double probes was measured as well as the phase shift between the two signals. Experimental results which are discussed and compared with theoretical predictions, show reasonably good agreement for the ratio of amplitides. However, measurements of the phase shift show little agreement with theoretical predictions, a fact for which no explanation can be given. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-30199 South Carolina Univ., Columbia.
SURFACE TOPOGRAPHY AND RUTHERFORD BACKSCATTERING. Ph.D. Thesis
Ulrich Bill. 1979. 104 p.
Avail: Univ. Microfilms Order No. 8011220

The influence of surface topography on the energy distribution of particles scattered from a sample is studied in a general review and investigated for specific cases. Although there is no one-to-one relationship, the general features of the surface topography are reflected in the specific shape of the spectrum: (1) periodic surface profiles lead to yield oscillations in the spectrum. The oscillation length is directly related to the wavelength of the surface structure and the shape is related to

the type of surface undulations irradiated; (2) in case of a random surface, statistical properties such as the standard deviation from the mean level, and the correlation between surface affect the spectral shape in a specific way. These results were achieved using both analytical and computer calculations. For periodic surfaces, the yield oscillations extend over the whole spectrum and a conservation rule applies to each oscillation. For the random surfaces, the energy spectrum is most affected near maximum energy and the yield is balanced considering the whole spectrum. Dissert. Abstr.

N80-30200 Illinois Univ., Urbana-Champaign.
THERMAL VACANCIES AND PHASE SEPARATION IN BCC MIXTURES OF HELIUM-3 AND HELIUM-4 Ph.D. Thesis
Benedick Andrew Fraass 1980 287 p
Avail: Univ. Microfilms Order No. 8017938

Thermal vacancy concentrations in crystals of (3)He-(4) He mixtures are determined from accurate measurements of the temperature dependence of the X-ray lattice parameter. An X-ray diffractometer-position sensitive detector system is used to make measurements of the absolute lattice parameter of the helium crystals with an accuracy of 300 ppm, and measurements of changes in lattice parameter to better than 60 ppm. The phase separation of the concentrated (3)He-(4) He mixtures were studied in detail with the X-ray measurements. Vacancy concentrations in crystals with 99%, 51%, 28%, 12%, 0% (3)He were determined. The vacancy data in the nearly pure (3)He crystals confirm previous X-ray results from pure (3)He are reported, along with study of vacancies in bcc (4)He. The vacancy concentrations in the 51% and 28% (3)He mixed crystals are found to be as large as 5%. Phase separation was studied in mixed crystals with concentrations of 51%, 28%, and 12% (3)He and melting pressures between 3.0 and 6.1 MPa. The pressure dependence of T sub c, the phase separation temperature for a 50% mixture, is found to be linear: dT sub c = -34 mdeg/MPa. Dissert. Abstr.

N80-30201 Florida State Univ., Tallahassee.
HIGH-TEMPERATURE SERIES EXPANSION TECHNIQUE FOR SYSTEMS WITH COMPLICATED ENERGY LEVELS Ph.D. Thesis
James Wray Johnson 1980 110 p
Avail: Univ. Microfilms Order No. 8016867

An approach to the high-temperature series expansion which is applicable to systems with complicated energy level schemes such as magnetic systems with crystal-field anisotropy of arbitrary strength is formulated. This approach is compared with the original Green's function formulation and the advantage of the present technique is discussed. The approach is applied to the spin-one hard axis Heisenberg ferromagnet and the first four terms in the high temperature series expansion for the free energy, the magnetic susceptibility, and the specific heat are obtained. The formula obtained for the free energy of the spin-one hard-axis ferromagnet also describes spin-one systems with rhombic anisotropy and reduces to the spin-one ferromagnet with an easy-axis anisotropy and to the spin-one simple Heisenberg systems by setting the appropriate matrix elements equal to zero. The method can be extended to treat systems with spin greater than one with general crystal field symmetry. The calculation of higher order terms is rendered tractable using the approach developed here. Dissert. Abstr.

N80-30202 Illinois Univ., Urbana-Champaign.
THE EFFECT OF HYDROSTATIC PRESSURE ON THE IONIC CONDUCTIVITY OF SOME CRYSTALS WITH THE FLUORITE STRUCTURE Ph.D Thesis
James Michael Oberschmidt 1980 180 p
Avail: Univ. Microfilms Order No. 8018192

The ionic conductivity of CaF2, SrF2, BaF2, CdF2, SrCl2, PbF2, PbCl2, PbBr2 and PbI2 was studied at pressures up to 0.6 GPa and temperatures up to near the melting point. The activation volumes for extrinsic vacancy motion were obtained from the effect of pressure on the conductivity of doped and oxygen contaminated samples. The formation volumes of intrinsic defects were calculated from measured activation volumes at high temperatures. The defect formation volumes are found to be uniformly small and consistent with the dominance of Frenkel defects in all cases except PbCl2 and PbBr2, where large formation volumes were observed, indicating Schottky defects. High pressure phase transitions in PbF2, SrCl2 and PbI2 were observed by the change in sample resistance across the transition. The temperature dependence of the ionic conductivity was studied in all of the above materials. Good agreement with published results is obtained except in the cases of PbCl2 and PbBr2. The differences in those two cases are attributed to differences in the fitting procedure used to analyze the data. A large frequency dependence of the measured conductivity at high temperatures is found to exist in all crystals with the fluorite structure. Dissert. Abstr.

N80-30203 Stanford Univ., Calif.
PROPERTIES OF SUPERCONDUCTING WEAK LINKS Ph.D. Thesis
Peter Fowler Michelson 1980 187 p
Avail: Univ. Microfilms Order No. 8016848

Predictions of the resistively shunted junction model for high frequency applications of Josephson junctions are reviewed along with a discussion of phenomena predicted by the microscopic tunneling theory and relaxation models based on time-dependent Ginzburg-Landau theory. Particular attention is focused on the phase-dependent conductivity: the so called cos phi conductance. The discrepancy between theory and experiment in this regard is discussed and suggestions are made about how this discrepancy may be resolved. Microwave reflection measurements on a point-contact in a microwave resonator are described. The data are consistent with the relatively shunted junction model including a phase-dependent conductance with a negative sign. The d.c. 1 to 5 characteristics have also been measured at finite voltage and certain features of these characteristics are discussed. Dissert. Abstr.

N80-30204 Connecticut Univ., Storrs.
SCATTERING OF PHONONS BY POINT DEFECTS IN SOLIDS AND ITS EFFECTS ON THE THERMAL CONDUCTIVITY Ph.D. Thesis
Charles Andriantomanga Ratsifaritana 1979 112 p
Avail: Univ. Microfilms Order No. 8017045

The relation between thermal conductivity and phonon scattering by defects in nonstoichiometric solids (carbides, tim tellurides) and in solids subject to radiation damage is examined. A number of approaches are used to derive an explicit expression of the low frequency scattering relaxation rate. The perturbation theory is first applied in the continuum limit. The Green's function method is applied to a simple cubic crystal in the nearest neighbor approximation: satisfactory agreement with the two previous approaches is obtained for the low frequency region. No low-lying resonance mode was found, suggesting that the observed indentation in the thermal conductivity curves of some irradiated crystal should be accounted for by some other phenomena. The effect of the distortion is also investigated for both the continuum and the discrete models. The main contribution is found to arise from the inner linkages: distortion effects can therefore be disregarded in the case of the vacancy because these linkages are missing. Finally, the expression of the relaxation rate is utilized to explain and interpret some thermal conductivity data of solids believed to contain vacancies. Dissert. Abstr.

N80-30205 Catholic Univ. of America, Washington, D. C.
THERMAL FLUCTUATION EFFECTS FAR FROM THE CRITICAL TEMPERATURE Ph.D. Thesis
Talat Fawzy Refai 1980 194 p
Avail: Univ. Microfilms Order No. 8018348

Measurements of thermal fluctuations in superconductors at temperatures far from the critical temeprature t sub c, and measurements that use thermal fluctuations to probe the nonequilibrium dynamics of a superconductor are reported. Fluctuations that cause a superconductor to switch to the dissipative state and those that cause it to switch back to the superconductor state are measured. These unique measurements allowed: (1) experimental confirmation of the theory of Langer, Ambegaokar, McCumber, and Halpern (LAMH) where t sub c was not an adjustable parameter; (2) verification of the LAMH model far from t sub c; (3) experimental confirmation of the relation between current and transition probability that was predicted in the LAMH model; (4) confirmation that the Lamda model developed by Peters, Wolf, and Rachford (PWR) to explain the dynamics on the nonequilibrium region can be extended to

explain fluctuation effect; and (5) the most direct measurement to date of the nature of the decay of the dissipative region in a weak link. These measurements show that the region recovery exponentially in time as proposed in the Lamda model.

Dissert. Abstr.

N80-30206 Connecticut Univ., Storrs.
INFLUENCE OF DEFECTS ON THE ULTRASONIC ATTENUATION OF DIELECTRIC CRYSTALS Ph.D. Thesis
Victor Lawrence Taylor 1980 237 p
Avail: Univ. Microfilms Order No. 8017052

Anharmonic interactions among lattice waves limit the phonon mean free path and give rise to both the ultrasonic attenuation and the thermal resistivity of dielectric solids. Lattice defects influence both of these properties by further reducing the phonon mean free path. The ultrasonic attenuation is interpreted in terms of the Landau-Rumer theory at low temperatures and the Akhieser theory at higher temperatures, the transition between the two regimes being at about 40 to 50 K. An apparatus is described for measuring acoustic attenuation over a wide temperature range. The attenuation data were corrected for nonparallelism, and finite sample width using theoretically derived correction functions. The attenuation is consistent with previous measurements at different frequencies. It appeared that cooling to low temperatures caused extensive defects which contributed to the residual attenuation and which could be removed only partly by annealing at room temperature. Such defects were also clearly evident from the thermal conductivity, which was well below the boundary scattering or Casmir limit at low temperatures. Dissert. Abstr.

N80-30207 Stanford Univ., Calif.
EXCITED STATE DYNAMICAL PROCESSES IN MOLECULAR CRYSTALS: OPTICAL COHERENCE EXPERIMENTS Ph.D. Thesis
Donald Edward Cooper 1980 134 p
Avail: Univ. Microfilms Order No. 8016815

A dye laser system was constructed to perform photon echo experiments. It consisted of an acousto-optically modelocked and Q-switch Nd:YAG laser synchronously pumping a cavity dumped dye laser. The result was a high power tunable single pulse at 200 Hz. The photon echo experiments were performed on dilute mixed crystals of pentacence in a naphthalene host at 1.4 K, and homogeneous linewidths of 10 to 40 MHz were measured. A concentration dependent component of the linewidth was observed and a model is presented which attributes this to modulation of the guest-guest intermolecular interactions by acoustic phonons. At lowest concentrations a residual linewidth is observed in addition to that due to lifetime broadening and this is attributed to phonon modulation of the guest-host van der Waals interaction. All echo decays were exponential, implying that the homogeneous line is Lorentzian. A theoretical discussion of spin orbit coupling in exciton systems is presented.

Dissert. Abstr.

N80-30208# IBM Watson Research Center, Yorktown Heights, N.Y.
SPECTROSCOPIC STUDIES OF THE ELECTRONIC STRUCTURE OF METAL-SEMICONDUCTOR AND VACUUM-SEMICONDUCTOR INTERFACES Final Report, 1 Oct. 1976 - 31 Oct. 1979
Dean E. Eastman 24 Mar. 1980 37 p refs
(Contract F44620-76-C-0041; AF Proj. 2306)
(AD-A085673; AFOSR-80-0455TR) Avail: NTIS HC A03/MF A01 CSCL 20/12

The electronic structure and properties of semiconductor interfaces including both vacuum-semiconductor and metal-semiconductor interfaces as well as relevant metal and semiconductor materials have been investigated under this contract. The emphasis is on elucidating the electronic properties of these materials and their interfaces, e.g., metal-semiconductor Schottky barriers, which are of far reaching importance in such semiconductor devices as MOSFETS, CCD devices, photovoltaic devices, etc. Extensive studies of the electronic structure of semiconductor surfaces and interfaces and related metal surfaces as a function of surface preparation, doping, thickness of adsorbed overlayer, etc. has been performed. GRA

N80-30209# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Electronic Technology Div.
CHARACTERIZATION OF 3-5 COMPOUND SEMICONDUCTOR DEVICE MATERIALS Final Report, 1 Jul. 1975 - 1 Oct. 1979
D. C. Reynolds Feb. 1980 36 p refs
(AF Proj. 2306)
(AD-A085565; AFWAL-TR-80-1016) Avail: NTIS HC A03/MF A01 CSCL 20/12

The objective of this task has been the electrical, optical, and magneto-optical characterization of the intrinsic and extrinsic properties of compound semiconductors, primarily from the III-V group of materials. Photoluminescent techniques were used to identify both the intrinsic and extrinsic properties of the materials. Intrinsic properties such as energy band gaps, effective mass parameters, refractive indices, dielectric functions, exciton binding energies and lattice vibration frequencies were determined. Extrinsic properties including activation energies of foreign impurities, binding energy of excitons to foreign impurities and the energies of complexes were established. Transport measurements were used to measure carrier mobilities and electrical conductivity as well as carrier concentrations. These measurements as a function of temperature make it possible to determine the number of donors (N sub D) and the number of acceptors (N sub A) and therefore the compensation ratio in the material. Local vibrational mode spectroscopy was used as a characterization tool to identify specific impurities such as C and Si in GaAs. From the vibrational energy the site location of the impurity can be determined. These characterization techniques have been very successful in evaluating the quality of materials and have been very helpful to the crystal growing program which has been successful in growing very high quality materials. GRA

N80-30210# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
ELECTRICAL PROPERTIES AND PHOTOLUMINESCENCE OF GERMANIUM-IMPLANTED GALLIUM ARSENIDE M.S. Thesis
Siv-Sing Chan Dec. 1979 55 p refs
(Contracts N00014-76-C-0806; N00014-79-C-0424)
(AD-A085891; R-872; UILU-ENG-80-2204) Avail: NTIS HC A04/MF A01 CSCL 20/12

The data presented show that Ge-implanted GaAs has a complex amphoteric behavior which is controlled by the implantation dose, implantation temperature and anneal temperature. Annealing was performed with R.F. plasma deposited Si3N4 as the encapsulant. Implantations at -100 C resulted in p-layers while those performed at 100 C and above resulted in n-layers regardless of the dose and anneal temperature. Room temperature implants resulted in p- or n-layers depending on the combination of dose and anneal temperature. Electrical activation and carrier mobilities in the implanted layers were low. Low temperature (6 K) photoluminescence indicated that a significant amount of residual damage remained after annealing. Carrier concentration profiles in implanted layers and junction characteristics of Ge-implanted GaAs planar diodes are also presented. GRA

N80-30211# Colorado State Univ., Fort Collins. Dept. of Physics.
MAGNETORESISTANCE MOBILITY PROFILING OF MESFET CHANNELS
J. R. Sites and H. H. Wieder Apr. 1980 19 p refs
(Contract N00014-76-C-0976; RR021203)
(AD-A086078; SF-27) Avail: NTIS HC A02/MF A01 CSCL 20/12

Magnetoresistance provides a straightforward, nondestructive technique for determining the carrier mobility in the conducting channel of field effect transistors (FETs) over their full range of operation. The analysis is well suited to the typical FET geometry. The technique is illustrated here by a comparative study of GaAs depletion mode FET devices. GRA

N80-30212# RCA Labs., Princeton, N. J.
DEVELOPMENT OF 1.0- TO 1.4-MICROMETER HETEROJUNCTION LEDs Final Technical Report, 17 Apr. 1978 - 16 Mar. 1979
G. H. Olsen, Michael Ettenberg, C. J. Nuese, and Dan Botez Griffiss AFB, N. Y. RADC Apr. 1980 64 p refs

(Contract F19628-78-C-0105; AF Proj. 4600)
(AD-A086082; PRRL-79-CR-18; RADC-TR-80-11) Avail: NTIS HC A04/MF A01 CSCL 09/1

Both VPE and LPE InGaAsP/InP edge- and surface-emitting LEDs have been fabricated and tested under the present contract. Table 1 contains a summary of the results. Although the surface emitter provides greater total power, its halfwidth is considerably larger than that of the edge emitter. This increases pulse dispersion and reduces the amount of power that can be coupled into an optical fiber. The experimental conditions for the vapor-phase growth of InGaAsP and InP alloy are described. Detailed growth procedures are specified and plots of alloy composition, bandgap, lattice parameter and doping levels vs growth parameters are included. Modulation rates close to 100 MHz have been measured for 1.27 micron edge-emitting LEDs. Fall times on the order of 10 ns for (90 to 10% response) also have been obtained. Over fifty edge emitting VPE 1.27 micron heterojunction LEDs have been fabricated from numerous wafers. External power efficiencies equal to or greater than 0.3% were routinely measured, with maximum efficiencies on the order of 0.7% (from one edge). Wafer-to-wafer reproducibility of power efficiencies has now been demonstrated with both the LPE and VPE growth techniques. GRA

N80-30213# Maine Univ., Orono. Dept. of Physics and Astronomy.
LATTICE GAS MODELS FOR CHEMISORPTION ON STEPPED SURFACES
P. Kleban Jun. 1980 15 p refs
(Contract N00014-79-C-0441; NR Proj. 392-032)
(AD-A086075; TR-2) Avail: NTIS HC A02/MF A01 CSCL 20/2

We consider the theory of chemisorption on stepped surfaces for systems for which a lattice gas in thermodynamic equilibrium is an appropriate model. Using statistical mechanics we demonstrate that by comparing LEED (Low Energy Electron Diffraction) results for flat and stepped substrates one can determine the change in adsorption energy at terrace edges. Thus one can answer the important question of whether adatoms bind more or less strongly at this kind of defect site. We also examine some new and interesting features of LEED spot shapes and integrated intensity behavior for adsorption on stepped substrates when the overlayer is partially disordered. In a companion paper, we consider O on a certain stepped W(110) surface. We demonstrate there, via Monte Carlo calculations, that the binding energy is less strong on either terrace edge for this particular adsorbate, surface and defect. GRA

N80-30214# Varian Associates, Palo Alto, Calif.
INVESTIGATION OF InP TECHNOLOGY Final Technical Report, 1 Aug. 1978 - 1 Aug 1979
George A. Antypas Griffiss AFB, N.Y. RADC Jan. 1980 33 p refs
(Contract F19628-77-C-0141; AF Proj. 2306)
(AD-A086012; RADC-TR-79-330) Avail: NTIS HC A03/MF A01 CSCL 20/12

The reaction rate for the synthesis of high-purity InP has been increased to 2.5 cm/day by increasing the reservoir temperatures to 460 C and 1040 C for P and In respectively. Characterization of the material by van der Pauw and photoluminescence measurements indicates the same background carrier concentration as that prepared at lower temperatures and therefore lower rates. Zero dislocation density n(+) S-doped and p(+) Zn-doped InP single crystals can be prepared routinely by LEC. GRA

N80-30215# General Electric Co., Schenectady, N. Y.
ALUMINUM NITRIDE CRYSTAL GROWTH Final Report, 1 Nov. 1978 - 31 Oct. 1979
G. A. Slack Dec. 1979 [illegible] p refs
(Contract F49620-78-C-0[illegible]21; AF Proj. 2306)
(AD-A085932; SRD-80-056; AFOSR-80-0424TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report summarizes the progress made during the year in growing single crystals of AlN from precursors prepared by the reaction of high purity aluminum droplets with ammonia. Crystal growth was achieved by vapor phase transport and sublimation. A new scheme for preparation of AlN from metal-organics is proposed. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-30216# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON THE ROLE OF THE SECOND LAW OF THERMODYNAMICS IN MECHANICS OF MATERIALS
P. M. Naghdi Oct. 1979 16 p refs
(Contract N00014-75-C-0148; NR Proj. 064-436)
(AD-A085563; UCB/AM-79-3) Avail: NTIS HC A02/MF A01 CSCL 20/13

This paper summarizes the recent work of Green and Naghdi concerning the thermomechanics of dissipative materials, the main features of which are: (a) The introduction of a conservation law for entropy which holds for all materials, (b) the use of the energy equation as an identity for all processes, thereby leading to restrictions on constitutive equations, and (c) the development of an inequality representing a mathematical interpretation of a statement of the second law of thermodynamics. GRA

N80-30217# Army Missile Command, Redstone Arsenal, Ala. Research Directorate.
RECENT ADVANCES IN COOPERATIVE PHENOMENA AND MATTER FIELD INTERACTIONS
D. W. Howgate, C. M. Bowden, C. A. Coulter (Alabama Univ., University), and C. C. Sung (Alabama Univ. in Huntsville) Jan. 1980 34 p refs Presented at the Vavilov Conf. on Coherent and Nonlinear Optics, Novosibirsk, USSR, 20-22 Jun. 1979
(AD-A085946; DRSMI/RR-80-2) Avail: NTIS HC A03/MF A01 CSCL 20/10

Recent breakthroughs in the areas of swept-gain superradiance, laser induced chemistry, and optical bistability led to a braod program which encompasses and is relevant to the major areas of specialization in coherent cooperative effects being undertaken at universities under Government sponsorship. In addition to the obvious applications, a deeper and more profound understanding of advanced directed radiation and phase changes in matter/light interactions was developed through the appropriate utilization of basic first principles and the in-depth analysis and study of coherent cooperative behavior. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-30218# Decisions and Designs, Inc., McLean, Va.
QVAL AND GENTREE: TWO APPROACHES TO PROBLEM STRUCTURING IN DECISION AIDS
Jonathan J. Weiss Apr. 1980 157 p refs
(Contract N00014-79-C-0068; ARPA Order 3668)
(AD-A086059; TR-80-3-97) Avail: NTIS HC A08/MF A01 CSCL 09/2

Decision analysis is a technology which offers the decision maker a logical structure for solving a specific problem. Through the process of decision analysis, the decision maker may select from several options the one that best suits his/her needs. In practical applications, most decision analytic techniques require a specially trained decision analyst and a sizeable amount of time and expense. This report describes two computer-assisted decision aids which are designed to perform preliminary decision analyses in the absence of a professional decision analyst and for a restricted set of decision problems. The first decision aid, QVAL (Quick Evaluation), has been implemented on an IBM 5110 portable computer and is ready for operation on an experimental basis. QVAL is an interactive program designed to probe the user's memory for a complete set of attributes together with the scores and weights for a consistent evaluation of a set of options. The second decision aid, GenTree (Generic Tree Structuring), is still in the planning stage, but promises to be very valuable in storing experience and knowledge gained while working on problems and applying it to guide the analysis of subsequent ones. By utilizing prior knowledge stored in the GenTree database, this decision aid would approximate the performance of a decision analyst on familiar problem types. In contrast, QVAL would more resemble the performance of the decision analyst on a completely new application area. With the continuing progress being made in the fields of artificial intelligence and interactive computer graphics, more sophisticated computer-assisted decision aids of this nature may be designed. GRA

N80-30219# Honeywell Systems and Research Center, Minneapolis, Minn.
DECENTRALIZED CONTROL Final Report, 1 Jul. 1978 - 30 Dec. 1979
E. D. Jensen May 1980 34 p refs
(Contract N00014-78-C-0511)
(AD-A085956; HONEYWELL-80SRC36) Avail: NTIS HC A03/MF A01 CSCL 12/1

A conceptual model of decentralized control for computer systems is presented. The model is founded on the principle that an activity at any particular level of abstraction is decentralized if there is no unique lowerlevel entity which enforces a consistent view of the activity state on the entities involved in that activity. Three factors are presented to determine how decentralized the control of an individual resource is: the number of controllers of a resource, the extent that each controller is involved in every control activity, and the parity of the controllers: authority. Two factors are presented to determine the decentralization of system-wide control: the number of controllers involved in each instance of multilateral management and the number of resources involved in each instance of multilateral management. Physical communication issues are discussed which effect the logical decentralization of control. Communication is considered to consist of the production and manifestation of signals. The observability of signals is the practical difference between the signal production and manifestation. Three factors of signal observability are presented: completeness, coherence, and latency. GRA

N80-30220# Massachusetts Inst. of Tech., Cambridge.
THE INTRODUCTION OF FEEDBACK INTO A HIERARCHICAL PRODUCTION PLANNING SYSTEM
Stephen C. Graves Mar. 1980 31 p refs
(Contract N00014-75-C-0556)
(AD-A085833; TR-177) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper proposes and tests a framework for decomposing a large scale production planning problem, modeled as a mixed-integer linear program. We interpret this decomposition in the context of Hax and Meal's hierarchical framework for production planning. The procedure decomposes the production planning problem into two subproblems which correspond to the aggregate planning subproblem and a disaggregation subproblem in the Hax-Meal framework. The linking mechanism for these two subproblems is an inventory consistency relationship which is priced out by a set of Lagrange multipliers. The best values for the multipliers are found by an iterative procedure which may be interpreted as a feedback mechanism in the Hax-Meal framework. At each iterative, the procedure finds both a lower bound on the optimal value to the production planning problem and a feasible solution from which an upper bound is obtained. Our computational tests show that the best feasible solution found from this procedure is very close to optimal. For thirty-six test problems the percentage deviation from optimality never exceeds 4.4%, and the average percentage deviation is 2.2%. Twenty-seven of the test problems are mixed-integer linear programs with 240 zero-one variables, while nine test problems have 480 zero-one variables. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-30221 Michigan Univ., Ann Arbor.
A COMBINED COMMUNICATION NETWORK DESIGN AND FILE ALLOCATION FOR DISTRIBUTED DATABASES Ph.D. Thesis
Nicholas George Khabbaz 1980 160 p
Avail: Univ. Microfilms Order No. 8017291

The combined problem of communication network design and file allocation for distributed databases is addressed. The network topologies are restricted to be maximally connected and of minimal diameter. A model is proposed to find an optimal communication network and allocation of files that minimize the total cost of file storage and of the communication channels. The model takes into consideration network reliability, file availability, and communication delay constraints. It was shown that the network reliability constraint puts a lower bound, kappa sub m, on the network connectivity kappa, the file availability constraints put lower bounds on the number of copies of each file, and the delay constraints put lower bonds on the channel capacities. A heuristic algorihtm to solve the model is then described and some results are presented. The results show that, in some cases, the optimal solution is obtained when kappa = kappa sub m. In other cases, however, increasing kappa results in the reduction of the total cost, and the improvement of both the network reliability and the file availability. Dissert. Abstr.

N80-30222# Naval Research Lab., Washington, D. C.
MINIMUM CROSS-ENTROPY PATTERN CLASSIFICATION AND CLUSTER ANALYSIS
John E. Shore and Robert M. Gray 10 Apr. 1980 26 p refs
(AD-A086158; AD-E000434; NRL-MR-4207) Avail: NTIS HC A03/MF A01 CSCL 09/4

This paper considers the problem of classifying an input vector of measurements by a nearest-neighbor rule applied to a fixed set of vectors. The fixed vectors are sometimes called characteristic feature vectors, codewords, cluster centers, models, reproductions, etc. The nearest neighbor rule considered uses a non-Euclidean, information-theoretic distortion measure that is not a metric, but that nevertheless leads to a classification method that is optimal in a well defined sense and is also computationally attractive. Furthermore, the distortion measure results in a simple method of computing cluster centroids. Our approach is based on cross-entropy minimization (also called minimum discrimination information or minimum directed divergence), and can be viewed as a refinement of a general classification method due to Kullback. The refinement exploits special properties of cross-entropy that hold when the probability densities involved happen to be minimum cross-entropy densities. The approach is a generalization of a recently-developed speech coding technique. GRA

N80-30223# Massachusetts Inst. of Tech., Cambridge. Nuclear Science Lab.
FEASIBILITY STUDY OF NETWORKS Final Report, Jul. 1974 - Dec. 1979
Elizabeth J. Campbell and Muriel S. Kannel 15 Dec. 1979 20 p refs
(Contract DE-AC02-76ER-02487)
(DOE/ER-02487/7) Avail: NTIS HC A02/MF A01

Experiments were performed at various ERDA installations

on the ARPANET in using the networks for offloading large calculations and obtaining access to unique hardware and software. Performance statistics were collected and cost comparisons, made. Both the benefits and barriers of networking were analyzed. The value of electronic mail, teleconferencing, and other forms of computer aided communication was also investigated. The study demonstrated that resource sharing via networks can provide small computer installations access to computer facilities not available on site. However, it is not adequate substitute for an on-site computer. There must be enough computing power locally to service the average load. Certain types of computations are effectively done on the network. Use of the network is most feasible for access to powerful processors and large memories or to unique hardware such as vector processor. DOE

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-30224# Committee on Science and Technology (U. S. House).
DOE AUTHORIZATION, 1981, VOLUME 2
Washington GPO 1980 720 p Hearings before the Subcomm. on Energy Res. and Production of the Comm. on Sci and Technol., 96th Congr., 2nd Sess., no. 114, 5, 7, 12, 13 Feb. and 4 Mar. 1980
(GPO-61-774-Vol-2) Avail: Subcommittee on Energy Research and Production

Testimony given on the Department of Energy's budget request for fiscal year 1981 is presented. An overview of the Nation's nuclear energy programs is given. Emphasis is placed on energy production from nuclear power to meet electrical energy needs for the remainder of the century. Nuclear plant safety and reliability, nuclear waste disposal and management, light water reactor technology, advanced fission technology, breeder reactor technology, spent fuel storage and reprocessing, and advanced isotope separation technology are among the topics discussed. J.M.S.

N80-30225# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1981, VOLUME 5
Washington GPO 1980 1164 p Hearings on H.R. 6413 before the Subcomm. on Space Sci. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 18, 20, 21, 26 Feb., 7-10, 31 Mar. 1980
(GPO-61-213-Vol-5) Avail: Subcommittee on Space Science and Applications

Testimony given on the cooperative energy programs being conducted by NASA for the Department of Energy is presented in light of the budget request for fiscal year 1981. Solar energy activities including small dispersed solar system applications and bioenergy as well as ocean thermal energy conversion, solar augmented desalination systems, and solar ranking applications are discussed. Coal preparation and conversion technologies are also considered. These technology options include coal gasification and liquefaction processes, coal gasifier congeneration systems, and coal fired energy conversion systems. Concepts that would extend the use of advanced systems based in space are examined, including the satellite power systems, orbiting reflectors, and lunar based power plants. The NASA support to the DOE in the solar programs areas of solar heating and cooling, wind energy, solar cells-photovoltaic conversion systems, and high temperature thermal conversion systems is highlighted. J.M.S.

N80-30226# Committee of Conference (U. S. Congress).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1981
Washington, D.C. GPO 1980 5 p
(Pub-Law-96-316; GPO-59-139) Avail: US Capitol, Senate Document Room

The congressional act authorizing appropriations to the National Aeronautics and Space Adminstration for research and development, construction of facilities, and research and program management is presented. A breakdown of allocations to specific projects is provided, and expenditure provisions are outlined. M.G.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-30227 Columbia Univ., New York.
ALTERATION AND ADAPTION AS DECISION-MAKING CRITERIA FOR THE TRANSFER OF TECHNOLOGY
Ph.D. Thesis
Hyo Joon Hahm 1978 187 p
Avail: Univ. Microfilms Order No. 8016957

The patterns of transfer of technology are discussed. It is suggested that the effective transfer of technology is directly related to the capability of the technology recipient to (1) alter the imported technology to conform to defined local conditions; (2) to adapt itself to that technology; or (3) both. Criteria for the effective transfer of technology (alteration and adaptation) are identified and their importance is demonstrated. Dissert. Abstr.

N80-30228*# Ford Motor Co., Dearborn, Mich.
REGENERATOR MATRIX PHYSICAL PROPERTY DATA
C. A. Fucinari May 1980 51 p refs
(Contracts DEN3-8; EC-77-A-31-1044)
(NASA-CR-159854; DOE/NASA/0008-80/11) Avail: NTIS HC A04/MF A01 CSCL 05A

Among several cellular ceramic structures manufactured by various suppliers for regenerator application in a gas turbine engine, three have the best potential for achieving durability and performance objectives for use in gas turbines, Stirling engines, and waste heat recovery systems: (1) an aluminum-silicate sinusoidal flow passage made from a corrugated wate paper process; (2) an extruded isosceles triangle flow passage; and (3) a second generation matrix incorporating a square flow passage formed by an embossing process. Key physical and thermal property data for these configurations presented include: heat transfer and pressure drop characteristics, compressive strength, tensile strength and elasticity, thermal expansion characteristics, chanical attack, and thermal stability. A.R.H.

N80-30229*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A LABORATORY FACILITY FOR ELECTRIC VEHICLE PROPULSION SYSTEM TESTING
Noel B. Sargent 1980 11 p refs Presented at Intern. Congr. of Transportation, Dearborn, Mich., 15-17 Sep. 1980; sponsored in cooperation with Vehicle Technology Society and IEEE, Society of Automotive Engineers, and Inst. of Electrical Engineers
(NASA-TM-81574; DOE/NASA/1011-32; E-544) Avail: NTIS HC A02/MF A01 CSCL 13F

The road load simulator facility located at the NASA Lewis Research Center enables a propulsion system or any of its components to be evaluated under a realistic vehicle inertia and road loads. The load is applied to the system under test according

to the road load equation: F(net) = K1F1 + K2F2V + K3 sq V + K4(dv/dt) + K5 sin theta. The coefficient of each term in the equation can be varied over a wide range with vehicle inertial representative of vehicles up to 7500 pounds simulated by means of flywheels. The required torque is applied by the flywheels, a hydroviscous absorber and clutch, and a drive motor integrated by a closed loop control system to produce a smooth, continuous load up to 150 horsepower. A.R.H.

N80-30230*# Office of Science and Technology, Washington, D. C.
WHAT CAN BE DONE TO IMPROVE INTERGOVERNMENTAL SCIENCE AND TECHNOLOGY
Paul R. Brockman 2 Jan. 1979 49 p
(NASA-TM-81123; PB80-170491) Avail: NTIS
HC A03/MF A01 CSCL 05L

Science and technology can make a more significant contribution to state and local governments than they are now making. That is a major conclusion to be drawn from the views of more than 130 individuals who are involved as leaders in current efforts to apply science and technology to state and local needs. These views are expressed in response to a questionnaire administered by the staff of the Office of Science and Technology Policy in the Executive Office of the President in the Fall of 1978. GRA

N80-30231# Vought Corp., Dallas, Tex.
AIRTRANS URBAN TECHNOLOGY PROGRAM, PHASE 2. VOLUME 1: CONTROL SYSTEM IMPROVEMENTS Final Report
J. N. Beberstein, J. F. Robinson, W. A. Scott, and D. F. Sellers Oct. 1979 63 p refs
(PB80-175193; UMTA-TX-06-0020-79-2-Vol-1) Avail: NTIS
HC A04/MF A01 CSCL 13F

The control system improvements incorporated in the P40 vehicle and the AIRTRANS supervisory data system software additions for dual block occupancy alarm features and P40 passenger vehicle identity are described. Under the control system improvements, the objectives were to continue development of the longitudinal velocity control systems as embodied in a new third generation Vehicle Control and Electronics Unit; implement improved functional design features in the areas of data communications, directional reversability, dual side doors, automatic test and checkout capability, built-in manual control, slip/slide detection, supervisory data system software and improved entrainment capability. Significant progress in the AIRTRANS control system's area is demonstrated in simulation, laboratory tests, and guideway evaluation. GRA

N80-30232# Vought Corp., Dallas, Tex.
AIRTRANS URBAN TECHNOLOGY PROGRAM, PHASE 2. VOLUME 2: IMPROVED PASSENGER COMMUNICATION Final Report
Richard S. Jacobsen and Conrad M. Schultz Oct. 1979 54 p refs
(PB80-175201; UMTA-TX-06-0020-79-3-Vol-2) Avail: NTIS
HC A04/MF A01 CSCL 13P

The primary objectives were to design, build, and demonstrate: (1) an onboard television surveillance system; (2) a programmable audio-announcement unit; (3) a dynamic graphic system; and (4) a time-to-arrival display unit for passenger stations. All of these systems were built and successfully demonstrated as part of the operation of a prototype urban Automated Guideway Transit vehicle in the Dallas/Fort Worth AIRTRANS system. GRA

N80-30233# Municipal Environmental Research Lab., Cincinnati, Ohio. Wastewater Research Div.
COMPUTER-AIDED SYNTHESIS OF WASTEWATER TREATMENT AND SLUDGE DISPOSAL SYSTEMS Inhouse Report, Feb. - Oct. 1978
Lewis A. Rossman Dec. 1979 162 p refs
(PB80-174220; EPA-600/2-79-158) Avail: NTIS
HC A08/MF A01 CSCL 13B

A computerized system synthesis model called EXEC/OP is described that can aid the designer in the preliminary stages of the system design process. The various features of the model are discussed and a number of sample design problems that illustrate its versatility are presented. R.C.T.

N80-30234# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
ASSESSMENT OF INTEGRATED URBAN ENERGY OPTIONS
Gerald D. Pine Feb. 1979 236 p refs
(PB80-173644; MIT-EL-79-021) Avail: NTIS
HC A11/MF A01 CSCL 13A

An initial comparison is carried out for the following residential space and water heating options: electric resistance heating, electrically driven heat pumps, distribution of condenser temperature water combined with heat pumps to extract heat at the point of use, district heating via hot water from a combined heat-electric utility energy source, and individual gas furnaces. This comparison indicates that district is potentially competitve with conventional technologies for new urban areas. Base case urban models, economic assumptions, and distribution networks are defined and a computer program is developed to select optimum pipe sizes for the networks and to calculate life cycle costs. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-30235 Harvard Univ., Cambridge, Mass.
FAR-INFRARED OBSERVATIONS OF THE GALACTIC PLANE REGION SOUTHWEST OF M17 Ph.D. Thesis
Mark Terence Stier 1980 201 p
Avail: Univ. Microfilms Order No. 8018160

A 7.5 square degree region of the galactic plane near l = 13.5 deg was surveyed with the Center for Astrophysics/University of Arizona 1.02 m balloon-borne telescope and a l aremin resolution 40 to 250 photometer. Forty-three far-infrared sources were detected. Comparison of the far-infrared and radio continuum flux densities of seventeen HII regions in the surveyed area indicates that dust does not significantly alter their ionization structure. Several of the far-infrared sources are not also strong radio continuum sources and may be late-O or early-B stars embedded in the M17SW giant molecular cloud. The W33 complex was resolved into several far-infrared sources for the first time. The far-infrared peak near the maser source W33A, a source probably at an early stage of stellar evolution, is unresolved with the l are min beam and has a bolometric luminosity of 1.6 x 100,000. Dissert. Abstr.

N80-30236 Harvard Univ., Cambridge, Mass.
ARRAY PHOTOMETRY OF ELLIPTICAL GALAXIES Ph.D. Thesis
Robert Williams Leach 1979 164 p
Avail: Univ. Microfilms Order No. 8018159

Photometry is presented for elliptical galaxies based on images obtained with a new photometric array camera consisting of 100 x 100 silicon diodes. Laboratory measurements and observations of standard astronomical objects at the telescope illustrate the performance of the camera. Observations of the rotation of position angle of the isophotes in a sample of nearby elliptical galaxies are interpreted as being caused by projection effects acting on triaxial ellipsoids with substantial ellipticity gradients. The ellipticity and position angle properties of the first-ranked galaxies in a sample of nearby Abell clusters are derived and shown to be consistent with those of the nearby ellipticals. Synthesized aperture magnitudes are derived for this

sample of Abell cluster galaxies. This establishes the ability of the instrument to make absolute photometric measurements and reproduces the observed dispersion in absolute magnitude. Finally, no significant correlations are found among seven observables in a sample of nearby ellipticals except for those among absolute magnitude, effective radius, and velocity dispersion; these are caused by the constraint of a constant mass to light ratio for the galaxies. Dissert. Abstr.

N80-30237 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
DESIGN PROBLEMS OF LARGE, SPACE, MIRROR RADIO TELESCOPES
A. S. Gvamichava, V. I. Buyakas, N. S. Kardashev, N. P. Melnikov, A. G. Sokolov, G. S. Tsarevsky, and V. I. Usyukin 1979 25 p refs
(D-282) Copyright. Avail: NTIS HC A02

The development of radio astronomical techniques using millimeter wavelengths for astrophysical and other applied investigations is discussed. Specifically, orbital mirror antennas with a parabolic or spherical shape are considered. The choice of an optimal structural frame, either partially or wholly self deployed so as to minimize spacecrew EVA, is studied. Design effects on reflection surface precision are taken into account. The control simulation of a spherical mirror model composed of single-type modules interconnected by links, some of which are adjustable, is presented. Author (ESA)

N80-30238 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ON SUBMILLIMETER PHOTOMETRY OF MOLECULAR DUST CLOUDS AND OTHER GALAXIES
G. B. Sholomitsky 1979 20 p refs
(P-278) Copyright. Avail: NTIS HC A02

Estimates of submillister radiation fluxes at 350 micron wave lengths from dark, molecular dust clouds and from other galaxies were obtained based on radio spectroscopic data and on empirical correlation between CO and submillimeter continuum otptical depths. The expected level of emission is shown to be measurable with existing ground based telescopes. The importance of such observations is discussed. Photometric equipment with cryogenically cooled bolometers were developed for observations in the 350, 460, and 650 micron atmospheric windows, as well as in the infrared, by means of the 6m telescope and of a 70 cm telescope. Furthermore, it is shown that the photometers can be supplemented by polarimetric units for future submillimeter linear polarization measuraments. Much attention is given to thorough spectral filtering, without which high quality photometric observations in the submillimeter range are impossible. Author (ESA)

N80-30239 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
CURVATURE RADIATION OF RELATIVISTIC PARTICLES IN THE MAGNETOSPHERE OF PULSARS: THEORY
V. V. Ochelkov and V. V. Usov 1979 39 p refs
(Pr-508) Copyright. Avail: NTIS HC A03

The curvature radiation of charged relativistic particles in a dipole magnetic field is considered, taking into account the possibility of radiation reabsorption by the emitting particles themselves. The calculations are carried out for emanating particles with monoenergetic power spectra. The frequency and angular dependencies of the curvature radiation flow between the magnetic axis and the line of sight is determined. The calculated results can be used for interpreting data from pulsar observations. Author (ESA)

N80-30240*# Illinois Univ., Urbana. Astronomy Dept.
ILLINOIS OCCULTATION SUMMARY, 1. 1977 - 1978
Richard Radick and David Lien 19 Feb. 1980 31 p refs
(Grant NGR-14-005-176; Contract DE-AC02-76ER-03077)
(NASA-CR-163407) Avail: NTIS HC A03/MF A01 CSCL 03A

Instrumentation and data acquisition techniques used to record lunar occultations at the University of Illinois Prairie Observatory are described. Tables and graphs summarize data from 64 events which include 30 observations of stars brighter than 7th magnitude, 40 reappearances, 4 angular diameter measurements, 8 observations of binary stars, and 6 observations which may indicate multiplicity. A.R.H.

N80-30241*# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.
THE RATE OF MASS LOSS AND VARIATIONS IN THE WIND FROM THE BE STAR DELTA CENTAURI
Theodore P. Snow, Jr., William R. Oegerle (Princeton Univ. Observatory, N.J.), and Ronald S. Polidan (Princeton Univ. Observatory, N.J.) [1980] 19 p refs
(Contract NAS5-23576; Grant NsG-5355)
(NASA-CR-163427) Avail: NTIS HC A02/MF A01 CSCL 03A

Copernicus ultraviolet scans of the Be star delta Centauri obtained in 1976 and 1979, show a significant variation in the Si III lambda 1206 profile. The strong asymmetry that was present in 1976 had disappeared by 1979. The Si IV lambda 1400 doublet was also asymmetric in 1976, but was not observed in 1979. A quantitative fit of the line shapes to theoretical wind profiles shows that the mass-loss rate in 1976 was 2 x 10 to the minus 8th power/yr, and that the rate of mass loss in Si III was at least one order of magnitude less in 1979. It is not possible to determine whether the variation represented an overall change in the lass-loss rate, or whether it was due to a change in the ionization balance. The profile fitting procedure resulted in the adoption of assumed underlying photospheric Si III and Si IV profiles, and the equivalent widths measured from these profiles are most consistent with T sub eff between 30,000 and 35,000 K, somewhat hotter than implied by the spectral classification normally assigned to this star. The ultraviolet photospheric line widths, coupled wit published theoretical analyses of rotational gravitational darkening, imply an intrinsic equatorial velocity of about 310 km/sec and an angle of inclination of the rotational axis to the line of sight of i is less than or equal to 44 deg. Author

N80-30242*# Cambridge Univ. (England). Inst. of Astronomy.
EXTRAGALACTIC H 2 REGIONS IN THE UV: IMPLICATIONS FOR PRIMEVAL GALAXIES AND QUASARS
David L. Meier, W. K. Kellogg (California Inst. of Technology, Pasadena), and Roberto Terlevich [1980] 14 p refs
(Grants NsG-5384; NSF AST-78-21453)
(NASA-CR-163430) Avail: NTIS HC A02/MF A01 CSCL 03A

Three extragalactic regions of rapid star formation with red shifts great enough to separate the L alpha region from geocoronal L alpha were observed with the IUE satellite. Only the low metal abundance object had detectable L alpha emission. L alpha is therefore expected to be weak or absent in collapsed primeval galaxies. The detected object has a L alpha H beta identical to that of quasars. Author

N80-30243# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany). Koenigstuhl.
LIQUID HELIUM COOLED INFRARED TELESCOPE FOR ASTRONOMICAL AND ATMOSPHERIC MEASUREMENTS ON BOARD SPACELAB Final Report
Dietrich Lemke, Gustave Klipping (Max-Planck-Gesellschaft, Berlin), and Norbert Roemisch (DFVLR, Cologne) Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 19 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-17) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 3.60

As a complement to the large infrared telescope on board Spacelab (LIRTS), a smaller liquid helium cooled infrared telescope for observation in the far infrared is scheduled for flight on the Spacelab D4 mission in 1983 for use in a combined study comprising both astrophysical and aeronomical measurements. The telescope is described as well as the cooling system which presents the possibility of studying fundamental aspects of helium 2 physics. Author (ESA)

N80-30244# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
SIMULTANEOUS DETERMINATION OF THE COMPONENTS OF VERTICAL DECLINATION, (xi AND eta, USING A PRISM

ASTROLABE. PART 4: OBSERVATIONS IN THE NOERDLINGER RIES DURING 1970 [SIMULTANBESTIMMUNGEN DER LOTABWEICHUNGSKOMPONENTEN XI UND ETA MIT DEM PRISMENASTROLABIUM. 4: BEOBACHTUNGEN IM NOERDLINGER RIES IM JAHR 1970]
Adolf Roedde 1979 86 p refs In GERMAN; ENGLISH summary
Original contains color illustrations
(Ser-B-237-PT-4; ISSN-0071-9196) Avail: NTIS
HC A05/MF A01

Astronomic determinations of longitude and latitude, performed simultaneously using a Ni-2 astrolabe, at 12 stations on a meridian profile across the Noerdlinger Ries are reported. The declinations of the vertical for the star system RE 1950 were calculated using a computer program and are given in tabular form. Author (ESA)

N80-30245# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany)
SIMULTANEOUS DETERMINATION OF THE COMPONENTS OF VERTICAL DECLINATION, xi AND eta, USING A PRISM ASTROLABE. PART 5D: OBSERVATIONS ALONG 48 DEG LATITUDE DURING 1974 [SIMULTANBESTIMMUNGEN DER LOTABWEICHUNGSKOMPONENTEN XI UND ETA MIT DEM PRISMENASTROLABIUM. 5D: BEOBACHTUNGEN IM 48 BRIETENGRAD IM JAHR 1974]
Adolf Roedde 1979 117 p refs In GERMAN; ENGLISH summary
(Ser-B-238-Pt-5D; ISSN-0071-9196) Avail: NTIS
HC A06/MF A01

Astronomic determinations of longitude and latitude performed simultaneously using a Ni-2 astrolabe at 17 stations on a geoid profile along 48 deg latitude are reported. The declinations of the vertical for the star system RE 1950 were calculated using a computer program and are given in tabular form. Author (ESA)

N80-30246# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany)
SIMULTANEOUS DETERMINATION OF THE COMPONENTS OF VERTICAL DECLINATION, xi AND eta, USING A PRISM ASTROLABE. PART 5E: OBSERVATIONS ALONG 48 DEG LATITUDE DURING 1963 [SIMULTANBESTIMMUNGEN DER LOTABWEICHUNGSKOMPONENTEN XI UND ETA MIT DEM PRISMENASTROLABIUM. 5E: BEOBACHTUNGEN IM 48 BREITENGRAD IM JAHRE 1963]
Adolf Roedde 1979 63 p refs In GERMAN; ENGLISH summary
(Ser-B-239-Pt-5E; ISSN-0071-9196) Avail: NTIS
HC A04/MF A01

Astronomic determinations of longitude and latitude performed simultaneously using a Ni-2 astrolabe at 13 stations on a geoid profile along 48 deg latitude are reported. The declinations of the vertical for the star system RE 1950 were calculated using a computer program and are given in tabular form. Author (ESA)

N80-30247# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany)
SIMULTANEOUS DETERMINATION OF THE COMPONENTS OF VERTICAL DECLINATION, xi AND eta, USING A PRISM ASTROLABE. PART 5F: OBSERVATIONS ALONG 48 DEG LATITUDE DURING 1975 [SIMULTANBESTIMMUNGEN DER LOTABWEICHUNGSKOMPONENTEN XI AND ETA MIT DEM PRISMENASTROLABIUM. 5F: BEOBACHTUNGEN IM 48 BREITENGRAD IM JAHRE 1975]
Adolf Roedde 1979 86 p refs In GERMAN; ENGLISH summary
(Ser-B-240-Pt-5F; ISSN-0071-9196) Avail: NTIS
HC A05/MF A01

Astronomic determinations of longitude and latitude performed simultaneously using a Ni-2 astrolabe at nine stations on a geoid profile along 48 deg latitude are reported. The declinations of the vertical for the star system RE 1950 were calculated using a computer program and are given in tabular form. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-30248# Florida Univ., Gainesville.
AN ANALYSIS OF THE ROSSITER EFFECT IN ALGOL-TYPE ECLIPSING BINARY SYSTEMS. Ph.D. Thesis
Laurence William Twigg 1979 217 p
Avail: Univ. Microfilms Order No. 8016589

An analysis of the Rossiter effect is used in order to determine the rate of stellar equatorial rotational velocities for the primary components of 19 Algol type eclipsing binary systems. In addition, analyses of the associated light curves and determination of new absolute parameters were carried out for these systems. Further, the radii of possible ring structures existing around the primary components in several systems were determined. Finally, evidence is presented indicating that for several suspect systems no extra light is present at second and third contact, unlike the results of an analysis of Y Psc. It is suggested that the inclusion of rotation effects on the stellar figures removes the need for such extra light. Dissert. Abstr.

N80-30249 State Univ. of New York, Stony Brook.
ANISOTROPIC SUPERFLUIDITY IN NEUTRON STARS AND STRONG-COUPLING EFFECTS IN SUPERFLUID 3He Ph.D. Thesis
James Avery Sauls 1980 159 p
Avail: Univ. Microfilms Order No. 8017748

The minima of the general Ginzburg-Landau functional for 3P2 pairing was found. Estimates of the strong coupling effects in neutron matter indicates that the strong coupling functional remains in the same region of parameter space as the BCS functional. Studies of the effect of a magnetic field on the anisotropic neutron superfluid show that in a strong magnetic field the pairing state has an angle dependent energy gap with a mode along the field direction. Methods of homotopy theory are used to determine the topologically stable line defects allowed by 3P2 order parameters. The form of the order parameter in the core region observed implies that neutron vortices have a magnetic moment directed along the vortex line. Normal state transport coefficients and superfluid strong coupling effects in liquid helium 3 were determined by integrals quadratic in the quasiparticle scattering amplitude. With a parameterization of the potential scattering models for the scattering amplitude, all properties of interest can be calculated analytically. The model scattering amplitude can be fitted to any or all the measured quantities with minimum computational effort. Dissert. Abstr.

N80-30250 Rice Univ., Houston, Tex.
ISOTOPIC ANOMALIES FROM NUCLEAR PROCESSES IN STARS. Ph.D. Thesis
Marlene Dziczkaniec 1980 181 p
Avail: Univ. Microfilms Order No. 8018048

Specific nucleosynthetic environments are examined as the sources for the anomalous xenon observed in meteorite samples. A simplified nuclear network is used to allow rapid estimation of isotopic abundance over a wide range of stellar conditions. In the zone of oxygen burning outside a stellar core that is in the silicon burning phase of energy generaton, photodisintegration of xenon seed isotopes is shown to be a potential source of an overabundance of the p-isotopes of xenon. The result Xe-124/Se-126 1 can be otained if theoretical calculations systematically overestimate photoalpha emission rates of certain p-isotopes of elements in the xenon region of the chart of the nuclides. Anomalies to the abundance of the heaviest xenon isotopes are shown to be a possible consequence of neuron capture reactions during explosive carbon burning in a supernova. Isotopic abundance signatures in the elements krypton, tellurium and osmium that are correlated with anomalous xenon are shown to be a plausible result of nuclear processing in the same environments that may produce anomalous xenon. The relative abundance of L-129 associated with anomalous xenon is also examined, and predictions for anomalies in other elements are given. Dissert. Abstr.

N80-30251# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
SUBMILLIMETER LINES OF INTERSTELLAR MOLECULES
V. D. Gromov. 1979. 16 p. refs.
(Pr-515). Copyright. Avail: NTIS. HC A02.

The calculated frequencies are given for submillimeter rotational lines of the molecules HCN, HNC, HCO(+), and N2H(+) with wavelengths of more than 250 microns as well as for lines of the molecules CH3OH, HDO, and HNCO with wavelengths of 330 to 375 microns. The intensity of the interstellar submillimeter line emission of the Ori A (KL) nebula is also estimated in the 350 micron atmospheric transparency window. Author (ESA)

N80-30252 Oklahoma Univ., Norman.
NON-LTE EFFECTS IN SUPERNOVA ENVELOPES Ph.D. Thesis
Andrew Neil Feldt. 1980. 89 p.
Avail: Univ. Microfilms. Order No. 8016927.

The Sobolev method was applied to the statistical rate equations for multi-level representations of singly ionized silicon and neutral hydrogen for various models of supernova envelopes. The physical models are based on the power law models of Branch (1977). The electron temperature in the envelope is taken as isothermal or as decreasing outward in the envelope as derived for a gray, spherical atmosphere. Radiation is treated for two cases. In the dilute case, the radiation field is simply the dilute photospheric radiation except when the continuum becomes optically thick where it is replaced by the diffuse radiation field in the approximation given by Castor and Van Blerkom (1970). In the discontinuous opacity case, the size of the photosphere is allowed to extend indefinitely for frequencies greater than some transition frequency. Thus, some lines and continua are treated in the dilute case while others see only the local radiation. In all cases the resulting source functions and line optical depths are compared to those obtained by less detailed calculations with good agreement. Dissert. Abstr.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-30253 Rice Univ., Houston, Tex.
TWO MODELS FOR ISOTOPIC VARIATIONS IN THE LUNAR REGOLITH Ph.D. Thesis
James R. Ray. 1980. 103 p.
Avail: Univ. Microfilms. Order No. 8018083.

Two independent models are presented which attempt to account for large, apparently secular, isotopic variations recorded in lunar samples. To explain the observed long-term increase of 15N/14N, the first model considers the consequences of a 'spike' contamination of the Sun's outer convective zone which material greatly enhanced in 14N. The second model takes note of observational evidence from the Apollo 16 site which indicates that even though TiO2-rich samples from other sites show a long-term increase of 3He/4He, TiO2-poor samples do not. Lunar atmospheric He is ultimately responsible for secular isotopic variations. In order for atmospheric He to have been an important source of trapped lunar gas, the ancient solar wind flux must have been about 100 times greater than now. The different He isotopic records of TiO2-rich and poor samples can be explained if ancient atmospheric He ions were implanted with larger energies than contemporary solar wind ions. Dissert. Abstr.

N80-30254 Rice Univ., Houston, Tex.
A FINITE-ELEMENT MODEL OF LUNAR THERMAL EVOLUTION Ph.D. Thesis
Soman Chacko. 1980. 167 p.
Avail: Univ. Microfilms. Order No. 8018040.

An attempt is made to model the thermal history of a self gravitating moon. Since the Rayleigh number at the end of the accretionary stage is supercritical, thermal convection in the Moon is likely to have occurred as early as 4.6 billion years ago. A combination of the Stokes equation of viscous flow and the heat transfer equation is solved using the finite element method. The numerical code used is a modification of Gartling's NACHOS, a general purpose code for transient, two dimensional incompressible fluid flow problems. The effects of melting, viscous dissipation, and adiabatic gradient are included. The convection pattern is dominated by a L-2 mode and viscosity is the predominant factor in controlling the nature of the thermal evolution. Partial melting is observed very early in the Moon's history, which could be related to the formation of the lunar basalt maria. The present day lithospheric thickness of the model is about 600 km and core-mantle temperatures are close to 1600 K. Surface heat flux is 15.3 mW/sq m, higher than the steady state value by about 12 percent. Dissert. Abstr.

N80-30255 Academy of Sciences (USSR), Moscow. Inst. for Space Research.
VENERA 11 AND 12: SCIENTIFIC EXPERIMENTS
V. G. Istomin, L. V. Ksanfomaliti, V. I. Moroz, L. M. Mukhin, G. S. Narimanov, and V. G. Perminov. 1979. 33 p. refs.
(D-280). Copyright. Avail: NTIS. HC A03.

Studies made by the Venera 11 and 12 descenders as well as the characteristics of the onboard instruments are discussed. The payloads of both descenders were identical. These consist of a mass spectrometer for studying the minor components of the atmosphere, a gas spectrometer for studying the chemical composition of the atmosphere, and an optical spectrophotometer for studying adsorption and scattering of sunlight in the cloud layer and in the atmosphere of Venus. Also part of each payload are a superlong wave GROZA radioreceiver--spectroanalyzer for detecting lightning in the atmosphere, an X-ray fluorescent spectrometer for analyzing the aerosol content, a nephelometer for studying the microphysical properties of aerosol particles, and instruments for measuring temperature and pressure changes relative to spacecraft attitude. Author (ESA)

N80-30256 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
THE POSSIBILITIES OF STUDYING THE INTERNAL STRUCTURE OF THE EARTH'S GROUP OF PLANETS WITH THE GEOPHYSICAL TECHNIQUES FROM SPACE VEHICLES
G. A. Skuridin, A. G. Ivanin, and I. N. Galkin. 1979. 42 p. refs.
(D-281). Copyright. Avail: NTIS. HC A03.

Space technology presently allows for the use of a variety of geophysical techniques in the study of the internal structure of planets; however, the validity of these techniques in constructing reliable quantitative models of planetary structure is not equivalent. Taking into account difficulties in delivering geophysical instruments to the planet surface, the aims (elucidating planetary evolution) and problems posed in obtaining appropriate data are assessed. Emphasis is placed on seismology as being most promising. Lunar seismic results are examined. Author (ESA)

N80-30257 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ON THE CHEMICAL COMPOSITION OF THE VENUS TROPOSPHERE AND CLOUD LAYER. CONSIDERATION OF VENERA 11 AND 12 AS WELL AS PIONEER VENUS MEASUREMENTS
V. A. Krasnopolsky and V. A. Parshev. 1979. 24 p. refs.
(Pr-514). Copyright. Avail: NTIS. HC A02.

Data from chemical composition measurements made by Venera and Pioneer Venus probes are compared with the results of calculations of thermochemical equilibrium in the Venus lower atmosphere. The difficulties inherent in the assumption of the existence of considerable amounts of molecular oxygen are mentioned. The identification of aerosol substances in clouds using phase equilibrium methods is discussed. Some sulfur and chlorine compounds found in Venus clouds are considered. Author (ESA)

N80-30258 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
VENERA 9 AND 10: SPECTROSCOPY OF SCATTERED RADIATION IN THE CLOUD COVER OF THE VENUS

ATMOSPHERE
V. A. Krasnopolsky 1979 22 p refs
(Pr-523) Copyright Avail: NTIS HC A02

Spectroscopic observations on the planet limb were used to determine the main characteristics of aerosols in the cloud cover of the Venus atmosphere. In the height range 70 to 100 km particle radii vary from 1 to 0.1 or 0.2 microns, particle number density is from 100 to 0.1/cu cm, while mass loading is from (10 to the minus 9) to (10 to the minus 15) g/cu cm. The sulfuric acid mixing ratio is found to be from (10 to the minus 6) to (5 X 10 to the minus 9). The eddy mixing coefficient is equal to 10,000 sq cm/sec at 70 to 75 km and increases to 1,000,000 or 10,000,00 sq cm/sec at 90 to 100 km. The spectroscopic thresholds for seven components at various heights are also shown. Author (ESA)

N80-30259# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ON THE NATURE OF OBSTACLES TO SOLAR WIND NEAR VENUS AND MARS. ON THE PECULIARITIES OF SOLAR WIND INTERACTION WITH THE ATMOSPHERES OF THESE PLANETS
T. K. Breus and K. I. Gringauz 1979 32 p refs
(Pr-533) Copyright Avail: NTIS HC A03

Recent data obtained by the Soviet Venera and Mars spacecraft is used to compare typical features of the regions of solar wind interaction with Venus and with Mars. Similarities and differences in the interaction are identified. Venus is seen as presenting a smaller obstacle to the solar wind than Mars as the Venus bow shock is closer to the planet. Analysis of experimental data indicates that the Venus ionosphere and its induced magnetic field are decisive in bow shock formation effecting solar wind flow around the planet, while for Mars it is the intrinsic field of the planet which decelerates the solar wind. Author (ESA)

N80-30260# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
LOW ENERGY ELECTRONS IN THE VENUS OPTICAL UMBRA DETECTED BY VENERA 9 AND 10. THE SOURCE OF THE NIGHT IONOSPHERE: COMPARISON WITH THE PIONEER VENUS SATELLITE MEASUREMENTS
K. I. Gringauz, M. I. Verigin, and T. K. Breus 1979 17 p refs
(Pr-534) Copyright Avail: NTIS HC A02

Analyses of Venera 9 and 10 electron flux measurements in the Venus optical umbra are used to show that the detected flux rate is sufficient to ionize the neutral atmosphere of the planet and thus create its night ionosphere. These calculations are based on simultaneous measurements in nine cases from the Venera 9 and 10 spacecraft of the electron density profiles made at 140 km height by the radio occultation technique. Electron flux spectra are compared with Pioneer Venus quadrupole mass spectrometer data and a correlation is drawn taking into account the effect of oxygen atoms on the height variation of ionizing electrons. Author (ESA)

N80-30261°# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HISTORY OF THE MASS OF MERCURY
R. A. Lyttleton 1 Aug. 1980 35 p refs
(Contract NAS7-100)
(NASA-CR-163438; JPL-Pub-80-44) Avail: NTIS HC A03/MF A01 CSCL 03B

A historical investigation reveals that Newcomb omitted to complete the calculation for the mass of mercury which would have given 8,405,291(-1), but instead arbitrarily adopted a value of 6,000,000(-1). This baseless figure 6000000(-1) became generally accepted and adopted in subsequent attempts to improve the mass. That only small changes have emerged is likely to be no more than a consequence of relying on a least squares process. Reduction of the Mercury mass to 9,000,000(-1) would alter theoretical angular positions of Venus by less than inherent observational errors, but the theoretical distances would be changed by amounts probably capable of detection by radar means. M.G.

N80-30262# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
THE HELIOS MICROMETEOROID EXPERIMENT: SOLAR PROBE HELIOS A AND B EXPERIMENT 10. Final Report
Eberhard Gruen, Hugo Fechtig, Peter Gammelin, Jochen Kissel, Siegfried Auer, Gunter Braun, Bernd-Klaus Dalmen, Hagen Dietzel, and Hans-Joachim Hoffman. Bonn: Bundesmin. fuer Forsch. u. Technol. Oct. 1979 243 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-09) Avail: NTIS HC A11/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 50.60

The micrometeoroid experiment on board Helios makes possible the in-situ detection of interplanetary dust particles. The experiment consists of two sensors which are inclined differently with respect to the equatorial plane of the spacecraft. It is based on the plasma production resulting from the impact of fast particles (V > or = 1 Km/sec) on a solid target. The instrument characteristics are discussed. Micrometeoroids are measured in the mass range from (10 to the -16) g to (10 to the -8)g and in the speed range from 2 km/sec to 50 km/sec. Additionally, the direction of impact is determined with an accuracy of + or - 60 deg. The particle charge is measured in the range from (10 to the - 14) to (10 to the -12) Coulomb. The ion composition of the impact plasma is mass analyzed with a time of flight spectrometer in the range 15 to 70 amu. The mass resolution is M/Delta M approximately 10. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-30263 Maryland Univ., College Park.
PLASMA PROPERTIES AND RADIATION SIGNATURES OF CURRENT DRIVEN ACTIVE REGION LOOPS ON THE SUN Ph.D. Thesis
Loukas Vlahos 1979 179 p
Avail: Univ. Microfilms Order No. 8017191

The average plasma density in the coronal part of a loop is higher than in its surroundings but the ratio of the plasma kinetic pressure to magnetic pressure is less than one. These loop-like magnetic field lines may act as the energy transport lines from the internal layers of the Sun's photosphere to the chromosphere and the corona where the energy is stored and suddenly released or slowly dissipated. The photospheric disturbances which are associated with steady currents along the potential magnetic field lines were studied in order to identify the radiation signatures of the current density and its profile as well as the size of the loop in which the current flows. Three basic phenomena in which the current supposedly plays an important role are examined: the sudden release of energy in small loop-like structures (flares); the heating of loops of different sizes by anomalous current dissipation; and the sudden erosion of large scale loops (coronal transients). It is concluded that (1) the current driven from the fluid motions in the photosphere can, under certain conditions, trigger the tearing mode instability in a finite volume at the top of a small loop which may result in a sudden local heating and a transient electron acceleration; (2) the heating of a loop by 'anomalous' dissipation of currents is not feasible if the currents are driven from the photosphere and (3) it appears that under certain conditions the current flowing along a very large loop can force a loop upwards. Dissert. Abstr.

N80-30264 Arizona Univ., Tucson.
LONG PERIOD SOLAR OSCILLATIONS: A SEISMOLOGICAL AND INTERCOMPARATIVE STUDY Ph.D. Thesis
Thomas Preston Caudell 1980 104 p
Avail: Univ. Microfilms Order No. 8017752

The subject of global solar oscillations is addressed. These oscillations are observed as fluctuations in the diameter of the Sun. A diameter is determined by a mathematical solar edge definition at the Senta Catalina Laboratory for Experimental Relativity by Astrometry (SCLERA) instrument. The oscillations have periods ranging from a few minutes to several hours and have amplitudes measured in millionths of a solar radius. These small amplitudes are observable only due to the unique properties of the edge definition. The properties of the observed solar

oscillations are determined from the data; their statistical significance and repeatability are then tested. The possibility of using the observed oscillations as a seismic tool for understanding the solar interior and its motions is explored.
Dissert. Abstr.

N80-30265 Catholic Univ. of America, Washington, D. C.
THE EXTREME ULTRAVIOLET STRUCTURES OF SOLAR ACTIVE REGIONS Ph.D. Thesis
Kenneth Paul Dere 1980 158 p
Avail: Univ. Microfilms Order No. 8017720

The extreme ultraviolet emissions from solar active regions are analyzed to determine their temperatures, densities, pressures, emission measures, flow velocities and structures. The accuracy and limitations of the diagnostic techniques were evaluated. It is found that the active region structures are well correlated with the inferred and observed magnetic fields and that the electron pressure of the plasma is essentially constant over a wide range of temperatures. Cool (10 to the 5th power K < or = T < or = 10 to the 6th power K) loop structures are shown to be composed of unresolved filaments. Static and steady flow one dimensional hydrodynamical models of active region loops were constructed and used to interpret the observations. Both models require a loop cross section that diverges with height. This was found by comparing the static model with observed emission measures and the steady flow model with the observed flow velocities. No local heating was found to be needed in the transition zone. Transition zone downflows in active regions indicate a mass loss from the overlying coronal structures for which there is no known supply.
Dissert. Abstr.

N80-30266 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
DUMBBELL DISTRIBUTION OF SUPERTHERMAL SOLAR WIND ELECTRONS FROM PROGNOZ 7 OBSERVATIONS
V. V. Temny and O. L. Vaisberg 1979 17 p refs
(Pr-499) Copyright. Avail: NTIS HC A02

Results from plasma spectrometer on board the PROGNOZ 7 satellite show the strong angular anisotropy of superthermal solar wind electrons on the arrival of an interplanetary shock wave. During the event, axis of the dumbbell angular distribution of electrons was oriented parallel to the interplanetary magnetic field projection and onto the scanning plane of the narrow angle electron spectrometer. Maximum temperatures of an anisotropic component of about 1,000,000 K were recorded with the magnetic field line both along and antiparallel to the component. The steady state behavior of the anisotropic electron component was observed for about 30 hours while the interplanetary magnetic field line was directed approximately perpendicular to the Sun. The arguments for an exospheric origin of the anisotropic component are discussed.
Author (ESA)

N80-30287*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFLUENCE OF MAGNETIC PRESSURE ON STELLAR STRUCTURE: A MECHANISM FOR SOLAR VARIABILITY
Kenneth H. Schatten and Andrew S. Endal (Louisiana State Univ., Baton Rouge) [1980] 14 p refs
(NASA-TM-81129) Avail: NTIS HC A02/MF A01 CSCL 03G

A physical mechanism is proposed that couples the Sun's dynamo magnetic field to its gravitational potential energy. The mechanism involves the isotropic field pressure resulting in a lifting force on the convective envelope, thereby raising its potential energy. Decay of the field due to solar activity allows the envelop to subside and releases this energy, which can augment the otherwise steady solar luminosity. Equations are developed and applied to the Sun for several field configurations. The best estimate model suggests that uniform luminosity variations as large as 0.02% for half a sunspot cycle may occur. Brief temporal variations or the rotation of spatial structures could allow larger excursions in the energy released.
M.G.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-30268 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
VARIATION OF EXTRAGALACTIC SOURCES IN THE dm RANGE. SCINTILLATIONS ON THE INTERSTELLAR STRUCTURE OF LOOPS, SPURS, AND RIDGES
N. Y. Shapirovskaja 1979 33 p refs
(Pr-504) Copyright. Avail: NTIS HC A03

Data on the variability of extragalactic sources in the dm range are interpreted in terms of a hypothesis of scintillations on the inhomogeneities of interstellar structures in the galaxy. The behavior of a scintillation index in the wide frequency band 0.325 to 2.7 GHz is explained by the theory of scintillations on the large irregularities in the weak focusing regime at the boundary of the strong focusing regime. A finite angular source size (due to scattering in the interstellar medium) and self absorption of an emitted scintillating component at the low frequency end of the observed band are taken into account.
Author (ESA)

N80-30269 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
SPHERICAL ACCRETION ONTO COMPACT X-RAY SOURCES WITH PREHEATING: NO THERMAL LIMIT FOR THE LUMINOSITY
G. S. Bisnovatyi-Kagan and S. I. Blinnikov (Moscow Univ.) 1979 21 p refs
(Pr-526) Copyright. Avail: NTIS HC A02

Numerical solutions for sperically symmetrical accretion were obtained for the case of optically thin flow with X-ray preheating. The asymptotes of the solutions were investigated. It is found that for any efficiency of the energy release, including that typical of accretion onto neutron stars, solutions exist for any luminosity below the Eddington limit. This proves that there is no thermal limit for accretion.
Author (ESA)

99 GENERAL

N80-30270# Department of Defense, Washington, D. C.
THE FY 1981 DEPARTMENT OF DEFENSE PROGRAM FOR RESEARCH, DEVELOPMENT AND ACQUISITION, FEBRUARY 1980
1 Feb. 1980 319 p Presented at 96th Congr., Second Sess., Washington, D.C., Feb. 1980
(AD-A086014) Avail: NTIS HC A14/MF A01 CSCL 05/1

The challenge ahead is formidable. We are behind quantitatively in deployed equipment and are falling further behind because of disparities in equipment production rates. While we are still ahead in defense technology, we are in danger of losing that advantage because of massive Soviet spending in defense R D. But we also have some distinctive advantages: a superior technological base, a competitive industry with greater productivity, and allies with a substantial industrial capability. In order to meet the formidable challenge we face, our investment strategy must fully exploit these substantial advantages. Our overriding near term need is to get on with the modernization of our forces. Our technology is of little to our armed forces when it is not embodied in operational equipment. Most of our ground forces weapon systems now deployed, our main battle tank, our armored personnel carrier, our air defense gun missile, our attack helicopter were developed during the fifties and entered production in the sixties. As a consequence they simply do not incorporate current technology, and they provide maintenance and support problems created by their age.
GRA

N80-30271# Department of Defense, Washington, D. C.
THE DEPARTMENT OF DEFENSE STATEMENT ON THE

SCIENCE AND TECHNOLOGY PROGRAM

Arden L. Bement, Jr. 5 Mar. 1980 66 p

(AD-A086015) Avail: NTIS HC A04/MF A01 CSCL 05/1

Requirements that must be addressed by technical solutions include: improved reliability (which is 'designed-in' and 'manufactured-in' not just 'tested-in'); life extension and durability of costly military hardware; conservation, substitution, and recycling technologies for critical materials; increased productivity and reduced manufacturing costs in our defense industrial base; the capability to substitute synthetic fuels for petroleum-based fuels; and improved human engineering to better match operational demands of new equipment to training and readiness levels. Advanced Technology Developments and the Manufacturing Technology Program provide great potential for meeting these requirements and accordingly deserve stronger emphasis in the future than is represented in our FY 1981 budget request. GRA

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Typical Subject Index Listing

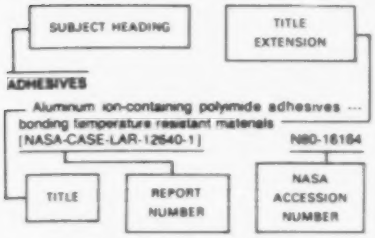

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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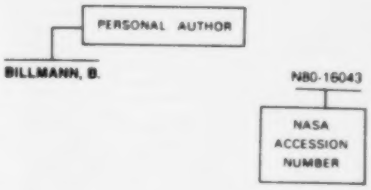

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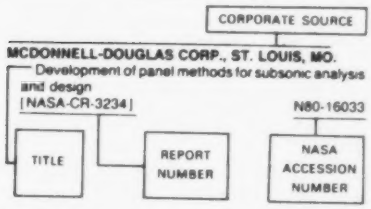

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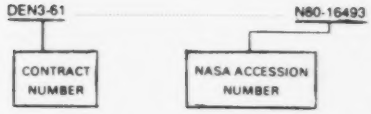

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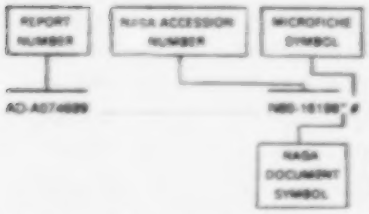

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For related information see also *Astronautics*.

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Includes aircraft simulation technology.

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Includes cockpit and cabin display devices; and flight instruments.

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07 AIRCRAFT PROPULSION AND POWER 2797

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

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For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

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19 SPACECRAFT INSTRUMENTATION **2806**

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20 SPACECRAFT PROPULSION AND POWER **2807**

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

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Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) **2815**

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **2815**

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **2817**

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS **2820**

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Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **2829**

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For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

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Includes land and global communications; communications theory; and optical communications.

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Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2931
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2931
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2933
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2934
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2935
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2935
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2936
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2936

Note: N.A. means that no abstracts were assigned to this category for this issue.

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COSATI CODE

N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey 3 Sep. 1979 409 p refs
(Contract NAS1-15624)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01
CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, NON-PERSONAL, QUICK REACTION, ENGINEERING AND TECHNICAL SERVICES

S.V. Bourgeois, Lockheed Missiles & Space Co. Inc., *4800 Bradford Dr., Huntsville, Alabama* 35807 (68-02-2614; F610A-790450)

OBJECTIVE: Provide technical support.

PROGRESS: D. Richard Sears, Air Pollutant Emission Factors for Military and Civil Aircraft. PB-292 520/4BE EPA/450/3-78/117 Oct. 78. Using data supplied by the U.S. Navy, U.S. Air Force, USEPA Office of Mobile Source Air Pollution Control as well as published information, tables of military aircraft fuel characteristics, aircraft classifications, military and civil times in mode, engine, modal emission rates, and aircraft emission factors per landing/takeoff cycle are calculated and combined.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

1.0002, NASA/LEWIS RESEARCH CENTER COMPUTATIONAL STRUCTURES APPRENTICESHIPS

R.H. Gallagher, University of Arizona, School of Engineering, Dept. of Civil Engineering & Engineering Mechanics, *Tucson, Arizona* 85721 (NAG 3-45)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0003, FUNDAMENTAL CHARACTERISTICS OF SPANWISE BLOWING

T. Dansby, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DN890157; N00019-79-C-0103)

Increasing the lift capability of a finite wing by spanwise blowing has been under active consideration since 1968. However, most of the investigations have been concerned with exploring applications with the concept, rather than oriented toward gain of an understanding of the fundamental relationship involved. As a result, it has not been possible to extrapolate the results obtained in one application to a different application. The objective of this work is to determine the fundamental relationships governing the behavior and effectivity of spanwise blowing.

A series of wind tunnel test will be conducted on a floor-mounted semi-span model. Test parameters will include variations in lifting surface geometry such as incidence, sweep and section shape, and variations in nozzle parameters such as nozzle diameter, pressure ratio, location and orientation. Detailed flow visualization, surface pressure and force data will be obtained. These data, along with existing data, will be analyzed and correlations performed in order to produce a unified theory of spanwise blowing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0004, SPIN SCAN GLOBAL AUREOLA IMAGING INSTRUMENT EXPERIMENT FOR DYNAMICS EXPLORER PHASE III

L.A. Frank, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (NAS 5-25689)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0005, PROPELLER PROPULSION INTEGRATION PHASE II

A.G. Bennett, Mississippi State University, School of Engineering, Dept. of Aerophysics & Aerospace Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (NAG 3-56)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0006, THE FEASIBILITY OF PERFORMING IN-FLIGHT MEASUREMENTS OF AIR FLOW TRANSITION AND BOUNDARY LAYERS USING A HOT WIRE ANEMOMETRY SYSTEM

G. Kousourou, City University of New York, Queensborough Community College, Undergraduate School, Dept. of Electrical Technology, *56th & Springfield Aves., Bayside, New York* 11364 (NAG 4-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

1.0007, EFFECTS OF ICE FORMATION ON 2-D AERODYNAMIC SHAPES

G.M. Gregorek, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautics & Astronautics, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 3-28)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0008, NASA LERC/AKRON UNIVERSITY GRADUATE COOPERATIVE FELLOWSHIP PROGRAMS

A.L. Simon, University of Akron, School of Engineering, Dept. of Civil Engineering, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NAG 3-50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0009, ANALYTICAL STUDY OF THE COMPRESSIBLE THREE-DIMENSIONAL FLOW IN TURBINE SCROLLS

A.A. Hamed, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NAG 3-52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0010, EXPERIMENTAL STUDY OF RADIAL TURBINE SCROLLS
W. Tabakoff, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NAG 3-26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0011, GUST RESPONSE OF WIDE-BODIED JET AIRCRAFT INCLUDING AUTOPILOT STUDIES
J.H. Goldberg, Villanova University, School of Engineering, Dept. of Mechanical Engineering, *Villanova, Pennsylvania* 19085 (NAS 1-16095)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, AIRFRAME/PROPELLER PROPULSION INTEGRATION ANALYSES
S.J. Miley, Texas A & M University, College Station Campus, School of Engineering, Dept. of Aerospace Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAG 2-25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, THE APPLICATION OF PROBABILISTIC DESIGN THEORY TO HIGH TEMPERATURE LOW CYCLE FATIGUE
P.H. Wirsching, University of Arizona, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Tucson, Arizona* 85721 (NAG 3-41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0002, MOLECULAR COMPLEXES PRODUCED IN LAYERED TRANSITION ELEMENT DICHALCOGENIDES BY INTERCALATION OF ADDUCTS
J.V. Acrivos, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (DMR77-09033)

The dynamics of intercalating donor adducts in between the layers of transition element dichalcogenides is being investigated in order to obtain a relationship between chemical composition and the bulk electromagnetic properties of the solid. The experimental program utilizes nuclear magnetic resonance, X-ray, and thermophysical methods. It is dedicated to characterizing how cooperative phenomena and the lattice instabilities in systems of lower dimensionality affect the chemical reactivity of gases adsorbed on the basal planes and/or inserted in between the metallic or semimetallic layers of transition element dichalcogenides.

The purpose of the work is to determine the variables controlling the physicochemical properties in systems of lower dimensionality so that new materials may be designed.

This is a continuation of research supported under DMR74-11752.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0003, MOLECULAR PHENOMENA IN THE ELECTRET STATE
M. Kasha, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Chemistry, *205 Wildwood Dr., Tallahassee, Florida* 32306 (INT78-08503)

This award makes it possible for Dr. M. Kasha to carry out a cooperative research program with Dr. Sergio Mascarenhas of the Institute of Physics and Chemistry of the University of Sao Carlos, Brazil. They will work on elucidating the properties of electrets (electrostatic analogs of magnets) and their influence on molecular electronic phenomena.

They will prepare solid films which will serve as substrates for included molecules and will study changes in the phenomena of the included molecules with the production of the electret state. The work will concentrate on 1) absorption color changes, 2) intersystem crossings and radiationless transitions, and 3) decay times of triplet states, in the electret state. The research should have an impact in several areas of applied biophysics and image-forming technology.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

3.0004, THE CHARACTERIZATION OF SODIUM THALLIUM TYPE AND RELATED COMPOUNDS VIA TRANSPORT, OPTICAL, AND MECHANICAL PROPERTIES
J.O. Brittain, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science & Engineering, *633 Clark St., Evanston, Illinois* 60201 (DMR76-17157)

The work will undertake the characterization of the intermetallic compounds of sodium-thallium (NaTl)-type and related compounds by transport, mechanical, structural and optical measurements. These measurements should provide information about the electronic states, the ionic motion and the nature of the defects in the materials. The specific research objectives are: (1) to characterize the defect state as a function of stoichiometry via x-ray diffraction and electron microscopy; (2) electronic conductivity, Hall effect and magnetoresistance will be determined as a function of stoichiometry (defect state); (3) microscopic atomic motion will be studied via nuclear magnetic resonance and amplitude independent internal friction; (4) chemical-ionic transport and lithium activity via electrochemical techniques; (5) optical properties will be correlated with the electronic, the defect state and the ionic conduction properties; and (6) a correlation will be attempted between mechanical properties and amplitude dependent internal friction.

The goal of this research is to increase the knowledge of the NaTl-type materials in order to enhance desirable mechanical, structural and mass transport characteristics. This study would be the first general scientific characterization of this family of intermetallic compounds. The knowledge gained would be significant for the various groups currently involved in materials problems associated with energy conversion technology, particularly in the area of anodes for high specific energy batteries.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0005, EXPERIMENTAL EVALUATION CRITERIA FOR CONSTITUTIVE MODELS OF TIME-DEPENDENT CYCLIC PLASTICITY
J.F. Martin, Michigan State University, School of Engineering, Dept. of Metallurgy Mechanics & Materials Sciences, *Engineering Bldg., East Lansing, Michigan* 48824 (NAG 3-51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0006, COOPERATIVE RESEARCH ON THE MAGNETIC STRUCTURE AND INTER-ATOMIC DISTANCES IN RARE EARTH TRANSITION METAL ALLOYS
W.J. James, University of Missouri, Rolla Campus, Center for Materials Research, Dept. of Chemistry, *103 Parker Hall, Rolla, Missouri* 65401 (INT78-26549)

The award supports exchange of personnel for basic research in materials science between the Graduate Center for Materials Research and Chemistry, University of Missouri, and the Louis Neel Laboratory of Magnetism of the CNRS, Grenoble, France. The project takes place within the framework of the U.S.-France Cooperative Science Program of the National

Science Foundation (NSF) and the French National Center for Scientific Research (CNRS).

The project objective is to determine the magnetic structure and inter-atomic distances between magnetic atoms in a variety of rare earth transition metal alloys. The primary goal is to relate the structure of these alloys to their magnetic and electric properties. The project involves extensive use of precision lattice parameter X-ray, neutron diffraction, and high field magnetic flux studies. Compounds of the R6M23 phase will be studied, in which R represents a rare earth or mixture of rare earths - such as yttrium or thorium - and M represents a transition metal with differing composition of iron, manganese or aluminum. These compounds will be studied at normal and cryogenic temperatures, and at various compositions. The work may yield significant contributions to the understanding of, and possibilities of, synthesizing crystals of alloys having magnetic and superconducting properties.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

3.0007, THE ROLE OF COBALT IN NICKEL BASE SUPERALLOYS

J.K. Tien, Columbia University, School of Engineering & Applied Science, Dept. of Metallurgy, *Broadway & W. 116th St., New York, New York* 10027 (NAG 3-57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0008, ADSORPTION, SEGREGATION AND REACTIONS AT METAL SURFACES

J.M. Blakely, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR76-23537 A01)

Experimental research concerned with the structure and binding of adsorbed and segregated layers on solids, direct surface-vapor reactions, and surface catalyzed reactions previously supported by NSF grant DMR75-23647 will be continued. Specific projects to be carried out include: a study of the segregation and bonding of carbon atoms to transition metal surfaces and the effect of ordered adsorbed structures on surface reaction rates; a study of the mechanisms of adsorption and oxide formation on group II divalent metals (Be, Mg, Zn), and; a study of the interaction of halogens with silver single crystal surfaces with reference to surface catalyzed reactions and surface photographic processes.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Behavioral & Neural Sciences

3.0009, STRESS GENERATION IN THERMALLY GROWN OXIDE SCALES

R.D. Maier, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NAG 3-49)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0010, EVOLUTION AND ADHERANCE OF OXIDE FILMS FORMED ON NICKEL-ALUMINUM AND NICKEL-CHROMIUM-ALUMINUM ALLOYS

R.D. Maier, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NAG 3-58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0011, CRACK INITIATION AND EARLY PROPAGATION UNDER THERMO-MECHANICAL LOADING

S.S. Manson, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NAG 3-46)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0012, THE HOT CORROSION OF METALS AND ALLOYS BY FUSED SALTS

R.A. Rapp, Ohio State University, Columbus Campus, School of Engineering, Dept. of Metallurgical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (INT77-17720)

This award provides travel and subsistence costs to allow Dr. Robert A. Rapp of Ohio State University to visit and collaborate with Professor Kazuhiro Goto and his associates at the Tokyo Institute of Technology in the study of chemical and electrochemical aspects of hot corrosion of alloys. This project has been approved under the U.S.-Japan Cooperative Science Program and funds for participation of Japanese scientists will be provided by the Japan Society for the Promotion of Science. Basic support for the domestic phase of this research has been provided through NSF grant DMR77-15575. Rapp will direct studies of base metals and alloys coated with thin layers of the fused salts Na_2SO_4 and Na_2CO_3 at elevated temperatures in contact with reactive gases, the redox potential of a corroding electrode and the basicity of the salt film, during hot corrosion attack on a metal, and simultaneous monitoring of the electrochemical corrosion current and the gravimetric changes during hot corrosion of metals by thin fused salt coatings. Professor Goto's group will carry out studies of the electrochemistry of the oxygen reduction step on various metal and oxide electrodes in Na_2SO_4 and Na_2CO_3. It is expected that the fundamental studies of the pulse-electrochemistry of anodic polarization of metals and the dissolution and diffusion of oxygen in Na_2SO_4 and Na_2CO_3 in Tokyo will, with the experimentation at Ohio State University, allow a detailed mechanism for hot corrosion to be developed.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

3.0013, PRELIMINARY STATIC IMPACT TESTING OF BORON ALUMINIUM COMPOSITE TIP PANELS

S.J. Bless, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (NAS 3-22353)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0014, APPLY SPECIAL COATINGS TO ELECTROPHORESIS COLUMNS AND MEASURE ANTI-ELECTROOSMOSIS VALUES OF COATED COLUMNS AND PREDICT TEST RESULTS

J.W. Vanderhoff, Lehigh University, School of Arts & Sciences, Dept. of Chemistry, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (NAS 9-16071)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

3.0015, INVESTIGATION INTO THE ROLE OF NAC DEPENDENCY ON OXIDE AND METAL SUBSTRATES IN THE INITIATION OF HOT CORROSION

N. Birks, University of Pittsburgh, School of Engineering, Dept. of Metallurgical & Materials Engineering, *402 Engineering Hall, Pittsburgh, Pennsylvania* 15213 (NAG 3-44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

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3.0016, HOT TENSILE TESTS OF INCONEL 718 MICROFISSURING OF EB WELDS IN INCONEL 718
R.G. Thompson, Clemson University, School of Engineering, Dept. of Materials Engineering, *Rhodes Research Bldg., Clemson, South Carolina* 29631 (NAS 8-33524)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

3.0017, SOLID STATE CHEMISTRY OF DEFECT SITES IN FLUORITE CRYSTALS
J.C. Wright, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Chemistry, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DMR79-06788)

Fluorite materials occupy a prominent position in the understanding of solid state chemistry, and in the control defects exert on that chemistry. Experiments that relate to solid state defect chemistry of fluorites include diffusion; dielectric loss and relaxation; thermal, electrical, and ionic conductivity; color center formation; and photochromaticity. Some fluorites also undergo transition to a superionic state at high temperatures and others can become semiconductors after reduction. Despite the excellent agreement that has existed between theory and experiment for many years, there have been several experiments that have been in marked disagreement with the existing theories.

Laser spectroscopy and electron paramagnetic resonance (EPR) spectroscopy are being used in this project to measure the absolute concentrations of all the defect sites that result when lanthanide ions are introduced into CaF_2. Measurements are made as a function of the temperature of the crystal before quenching and of the lanthanide concentration. These measurements provide a detailed description of all defect equilibria. They are then compared with a new model for the defect equilibria which postulates a covalent interaction betweem fluoride interstitial ions and clusters. This model is marked departure from the commonly accepted model since it predicts the equilibria are controlled by clustering phenomena instead of a simple pairing between defects.

First year of a three-year continuing grant; renewal of work supported by DMR77-17765.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, INVESTIGATION OF DEGRADATION PROCESS OF INSULATING MATERIALS
C.V. Doreswamy, Tuskegee Inst., School of Engineering, Dept. of Electrical Engineering, *Tuskegee Institute, Alabama* 36088 (NAG 8-5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0002, SIZE AND VELOCITY DISTRIBUTIONS OF PARTICLES AND DROPLETS IN SPRAY COMBUSTION SYSTEMS
E.D. Hirleman, Arizona State University, School of Engineering & Applied Sciences, Dept. of Mechanical Engineering, *Tempe, Arizona* 85281 (DN975361; N00014-79-C-0363)

The objective of this research program is to perform in-situ, simultaneous measurements of sizes and velocities of individual particles and droplets in spray combustion systems and to study the effect of particle distribution on heterogeneous combustion processes. The results of this theoretical and experimental research program are needed for combustor modeling studies, and for nozzle and exhaust flow characteristics to provide understanding and enhancement of future jet engine design.

Design and application end of a new laser technique will be made to charaterize fuel spray droplet properties in a cold flow system, with following effort directed to hot flow and practical combustion systems. The method utilizes two parallel Gaussian laser beams separated by a known spacing with particles traversing the two beams being scattered with fluorescing laser radiation to a photosensitive detector. The detected signature from an individual particle is analyzed to determine two velocity components and the incident intensity history.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0003, COMBUSTION AND POLLUTANT EMISSIONS CHARACTERISTICS OF COAL-DERIVED LIQUID FUELS
C.T. Bowman, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DN975359; N00014-79-C-0318)

The objective of this research program is to investigate and measure key combustion and pollutant emission characteristics of hydrocarbon fuels which are representative of coal-derived liquid fuels. This information is essential in the design of efficient and clean combustors utilizing such fuels and ultimately should lead to improved propulsion systems for naval aircraft and weaponry applications.

Experiments will be carried out using a laminar, one-dimensional monodisperse hydrocarbon aerosol-air flame. Combustion rates will be determined by measurement of droplet burnout rate, the rates of evolution of CO, CO2, and the rate of increase of temperature; pollutant formation and destruction rates will be determined from measured no and soot concentrations - all by advanced laser-based diagnostic and isokinetic probe techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, ION BEAM MICROTEXTURING OF SURFACES
R.S. Robinson, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (NAG 3-43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0005, MAGNETIC AND OPTICAL PROPERTIES OF DOPED YTTRIUM ION GARNET
S. Geller, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Electrical Engineering, *1200 University Ave., Boulder, Colorado* 80302 (INT77-15142)

This award will support cooperative research between the Universities of Colorado and Rome. The work to be supported is concerned with yttrium iron garnets (known commercially as YIG) and used, for instance, in lasers and light switching devices. The main thrust of the work is to prepare new compositions of these crystals by adding controlled amounts of desired impurity atoms, and to characterize the magnetic and spectroscopic properties of the new materials. The goal of the work is to understand in a fundamental way how such dopants alter the properties of these substances.

The work in Rome is mainly on the magneto-optical properties, and the work in Colorado is primarily on the magnet properties, materials preparation and X-ray diffraction investigations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

4.0006, DYNAMIC CHARACTERISTICS OF LINEAR HYDROSTATIC GAS BEARINGS
C.R. Watkins, Howard University, School of Engineering, Dept. of Mechanical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAG 5-25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0007, MECHANISMS OF LEAN LIMIT EXTINCTION
C.K. Law, Northwestern University, Evanston Campus, Technological Inst., Dept. of Mechanical Engineering, *633 Clark St., Evanston, Illinois* 60201 (NAG 3-53)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0008, IMPACT OF MICROPROCESSORS ON EMC
B.J. Leon, Purdue University, Purdue Research Foundation, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (R; F30602-75-C-0082)

The objective of this effort is to allocate 30,000 dollars to Purdue University under the RADC post-doctoral program. This effort is to determine the impact of the increasing use of microprocessors/microcomputers on the electromagnetic compatability of Air Force systems. Topics of concern are: assessment of the state-of-the-art of microprocessors/microcomputers vis-a-vis Air Force requirements, survey of present and future Air Force usage, assessment of the potential of microprocessors/microcomputers as an aid in EMC control (i.e., preprogrammed filter tuning, frequency management devices, etc.), and development of recommendations for research efforts which would provide system designers with the information required to account for the EMC impact of microprocessors/microcomputers (microsystems) in Air Force systems.

The approach is (1) state-of-the-art of 'microsystems'/Air Force requirements, (2) survey of present and future Air Force usage, e.g., Air Force digital flight control system, digital avionics information system, (3) determination of EMC problems relative to 'microsystems' chip, package, leads, associated circuits under both static and dynamics conditions, (4) applicability of classical EMC fixes, i.e., shielding, filtering, etc, (5) examination of potential of 'microsystems' for EMC control applications, and (6) future studies to implement guidelines for system designers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0009, ZERO MODULES AND INVERSE SYSTEM DESIGN
M.K. Sain, University of Notre Dame, School of Engineering, Dept. of Electrical Engineering, *Notre Dame, Indiana* 46556 (NAG 2-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0010, DATA FLOW COMPUTER ARCHITECTURE
J.B. Dennis, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (MCS75-04060 A01)

This project continues to explore and evaluate computer systems capable of direct, highly parallel execution of programs expressed in data flow representations. Program representations based on the data flow concept expose the concurrency of program fragments for exploitation by computers of appropriate architecture and provide an attractive form of base language for the modular construction of well-structured programs. This research has yielded proposals for highly parallel computation processors for three levels of data flow language: a language suitable for simple signal processing computations; an intermediate language, containing conditional and iterative constructs; and a complete data flow representation on the level of Algol, incorporating procedures and data structures. Processors to implement these languages have been developed around the principles of Packet Communication Architecture: each processor is composed of units which communicate through the transmission of information packets, and delays in packet transmission do not affect correct operation of the system. Methods to analyze the characteristics of such processors in terms of design, performance, and applications have been developed, and further work is necessary in these areas.

This research grant will support: further exploration of the architectural principles of Packet Communication Systems, such as data flow processors; the feasibility of such processors in terms of cost, performance, structure, programmability, fault-tolerance, and implementation technologies; and an investigation of the application of data flow computers to such significant problems areas as air traffic control, numerical weather forecasting, and signal processing. This is a renewal of Grant No. DRC75-04060.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

4.0011, THE INFLUENCE OF GYROSCOPIC FORCES OF THE DYNAMIC BEHAVIOR AND FLUTTER OF ROTATING BLADES
F. Sisto, Stevens Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *Castle Point Station, Hoboken, New Jersey* 07030 (NAG 3-47)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0012, PULSE CODE MODULATION DECODER, MODEL GIAF-2
B.G. Gammill, New Mexico State University, Las Cruces Campus, Graduate School, *University Park, Las Cruces, New Mexico* 88003 (NAS 6-3087)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0013, DESIGN, FABRICATE AND TEST PRIME FOCUS FEEDS FOR PARABOLIC EARTH STATION ANTENNAS FOR THE 12 GHZ BROADCAST SATELLITE SERVICE
R.E. Collins, Case Western Reserve University, School of Engineering, Dept. of Electrical Engineering & Applied Physics, *University Cir., Cleveland, Ohio* 44106 (NAS 3-22342)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0014, FLUCTUATING SHEAR FLOWS
G.D. Catalano, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142670)

This effort supports the development of the airborne pointing and tracking systems and advanced laser aerodynamic applications. The problem area to be addressed is that very little velocity information is presently available concerning the fluctuating shear flows over open ports in airborne applications. This information will aid in the design of the open ports. The technical objective of the work is to obtain a more precise understanding of the large scale structure of turbulence present in the fluctuating shear flows. The data generated will contribute to the effectiveness of future combat aircraft containing radiation subsystems for projection and detection in passive and active roles.

Develop a laser doppler velocimeter (LDV) which can measure turbulent velocity fields in subsonic, transonic, and supersonic fluid regimes. Make measurements in a two dimensional jet with the LDV and compare those measurements with data obtained from a hot wire anemometer. After the accuracy and reliability of the LDV has been established, probe the turbulent flow over an open port. Emphasis will be placed on measuring statistical properties which will lend visibility to the large scale turbulent structure of the flow field. Supplement this experimental investigation with a theoretical analysis of dusty gas flows. Several flow configurations will be analyzed including stagnation regions, wavy walls, and backward facing steps.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0015, SELF ADAPTIVE SOLUTIONS STRATEGIES
J. Padovan, University of Akron, School of Engineering, Dept. of Mechanical Engineering, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NAG 3-54)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0016, HELICOPTER TRANSMISSION RELIABILITY MODEL
M. Savage, University of Akron, School of Engineering, Dept. of Mechanical Engineering, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NAG 3-55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0017, SPECIAL FOREIGN CURRENCY AWARD (INCLUDING EGYPTIAN CURRENCY) FOR THE STUDY OF APPLICATION OF REMOTE SENSING TECHNIQUES (ABBREV)
M.A. Hady, Oklahoma State University, School of Engineering, Dept. of Civil Engineering, *Engineering N., Stillwater, Oklahoma* 74074 (INT71-01736 A06)

This proposal details the second phase of a current four-year project which started in Dec. 1975, for the applications of modern remote sensing techniques to regional and national resources development projects in Egypt, under the grant OIP71-01736 A04. Results were published in 15 papers presented in International Conferences, as well as 14 technical reports. The work conducted represents great advances in the applications of LANDSAT and aircraft remote sensing technology to investigation of natural resources, large irrigation, power generation, agriculture projects and environmental studies. Also, basic scientific theories and certain unique problems in the areas of geology, groundwater and soils have evolved.

The second phase program will continue to demonstrate the full utilization of the capabilities of remote sensing techniques, whether from satellites or aircraft, in major development projects in Egypt, apart from the basic scientific research and advancement of the working techniques themselves. Also, special emphasis will be given to the phenomena of desertification and desert development and encroachment on the agricultural areas on the fringes of the Western Desert of Egypt. Full utilization of the newly installed Multispectral Data Analysis System (M-DAS) and the recently acquired high-ceiling Beech King (A-200) aircraft will be achieved.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

4.0018, STUDY TO EVALUATE THE USE OF AN OPTICAL PATTERN RECOGNITION SYSTEM
D. Casasent, Carnegie Mellon University, Carnegie Inst. of Technology, Dept. of Electrical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (NAS 1-16125)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0019, SPACE SHUTTLE MAIN ENGINE FUEL TURBOPUMP INTERSTAGE SEAL TEST PROGRAM
M. McDermott, Texas A & M University, College Station Campus, School of Engineering, Dept. of Mechanical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAS 8-33716)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0020, X-RAY TOPOGRAPHY STUDY OF COMPLEX SILICONE MICROCIRCUITS
P.L. Parker, Texas A & M University, College Station Campus, School of Engineering, Dept. of Electrical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAS 8-33519)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0021, SPACE FLIGHT DESIGN AND DEVELOPMENTAL STUDIES
H.E. Blackwell, Texas Southern University, School of Arts & Sciences, Dept. of Physics, *3201 Wheeler Ave., Houston, Texas* 77004 (NAG 9-6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0022, INVESTIGATION FOR SEARCH AND RESCUE DOPPLER PROCESSOR DEVELOPMENT
S.G. Wilson, University of Virginia, School of Engineering & Applied Science, Dept. of Electrical Engineering, *Garrett Hall, Charlottesville, Virginia* 22903 (NAS 5-26011)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0023, NIMBUS TYPE PRESSURE MODULAR DRIVE
Unknown, University of Oxford, *S. Parks Rd., Oxford, England, United Kingdom* (NASW 3301)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, MATRIX PHASES OF CARBONACEOUS CHONDRITES
P.R. Buseck, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe Arizona* 85281 (NAG 9-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0002, OPERATIONAL APPLICATIONS OF SATELLITE SNOWCOVER OBSERVATIONS AND DCS OPERATIONS IN THE ARIZONA TEST SITE
H.H. Schumann, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Phoenix, Arizona* (AZ 75-041)

The LANDSAT, NOAA, and SMS/GOES satellite imagery will be the primary source of repetitive remote-sensing data over central Arizona for obtaining snow-covered areas on the Salt and Verde River watersheds. These data will be supplemented by repetitive aerial surveys and supporting ground-truth relayed by the ERTS DCS. The ERTS data collection platforms will relay hydrologic and meteorological data from key locations to aid in interpretation of the imagery and to demonstrate the ability of satellite telemetry systems to furnish timely and meaningful hydrologic information for use by water management.

A. To evaluate repetitive satellite imagery together with aerial surveys in an attempt to develop an operational capability in Arizona for using satellite imagery for mapping the distribution of snowcover on the Salt and Verde River watersheds. B. To develop techniques and procedures for systematic monitoring of snowcover and moisture conditions using remote sensor methods together with the use of the ERTS data collection system to relay ground truth data in near real-time.

The ERTS-1 and NOAA-2 imagery will be the primary source of repetitive remote-sensing data over central Arizona for obtaining snow-covered areas on the Salt and Verde River watersheds.

Report written and reviews taken care of.

Submit report for approval to NASA.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0003, TERRAIN MODELS FOR OPTIMUM SAR SENSOR CONFIGURATION & FOR EXPLORATION OF GLOBAL NON-RENEWABLE RESOURCES (ABBREV)

H.C. MacDonald, University of Arkansas, Fayetteville Campus, School of Arts & Sciences, Dept. of Geology, *Fayetteville, Arkansas* 72701 (NAG 9-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0004, MEASUREMENT OF SOIL MOISTURE USING REMOTE SENSING MULTISENSOR TRANSFER TECHNIQUES

W.P. Waite, University of Arkansas, Fayetteville Campus, School of Engineering, Dept. of Electrical Engineering, *Fayetteville, Arkansas* 72701 (NAG 5-20)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0005, REMOTE SENSING FOR SOIL SURVEY AND LAND USE

J.E. Cipra, Colorado State University, School of Agricultural Sciences, Dept. of Agronomy, *Fort Collins, Colorado* 80523 (0079694; COL00139)

OBJECTIVE: Investigate the use of remote sensing technology in soil survey and land inventory through innovative survey and interpretation techniques, as an aid to accelerating the Colorado Soil survey program. Coordinate the use of remote sensing technology within National Cooperative Soil Survey in the state of Colorado.

APPROACH: An area in Colorado which has an active soil survey in progress will be selected in collaboration with the State Soil Scientist. LANDSAT imagery will be obtained and initial computer analysis will be performed. Image products will be delivered to the field survey Party Chief, and SCS personnel will be briefed on the characteristics and possible ways of using the products. The field party will evaluate the image products and suggest changes as appropriate. Additional research involving the use of ground information, image contrast stretching, and other computer analysis techniques will be investigated as appropriate. A central focus throughout the project will be to develop and test techniques in remote sensing which will make an immediate, positive contribution to the field soil survey program.

SUPPORTED BY Colorado State Government

5.0006, REMOTE SENSING AS A SOURCE OF DATA FOR STATE AND LOCAL AGENCIES

E. Maxwell, Colorado State University, School of Forestry & Natural Resources, Dept. of Earth Resources, *Fort Collins, Colorado* 80523 (0073828; COL00016)

OBJECTIVE: Compare remote sensing to more conventional modes of data collection; determine data adequacy and cost-effectiveness of various methods of processing remote sensing data; work with various state agencies to determine data needs and to evaluate opportunities to meet data needs with remote sensing methods; evaluate organizations and equipment for possible use in providing the state with the image processing capabilities.

APPROACH: This project will be carried out by maintaining close working relations with interested state and local agencies. Specific problem areas identifiable at this time include: Drought assessment, conversion of ag land, monitoring agricultural production, mapping land use and obtaining ag statistics on an annual basis as a problem alert system. Various remote sensing systems and data processing methods will be considered for each application.

PROGRESS: The analysis of center pivot irrigation (CPI) systems was completed and a report was issued. It was determined that a single LANDSAT image was not adequate to accurately count CPI systems. Images from two or three dates during the growing season are needed if the count is to be within 10 to 15% of the total. All of the installations will not be seen on LANDSAT. The accuracy of land-use and vegetation mapping from computer analysis of LANDSAT data was analyzed for vegetation maps produced on another project. This study of accuracy or vertification procedures was only partly funded by project 0016. The data analyzed were from the Piceance Basin region in Northwest Colorado. This type of analysis will help state agencies assess the usefulness of remote sensing data. Achieving a high degree of correspondence between the meaning or interpretation of land cover classes is a major problem which must be overcome if meaningful evaluations are to be made. Research has begun on the use of multitemporal LANDSAT digital data to detect changes in land cover. Specifically, we are attempting to detect urban encroachment onto agricultural land over two to five-year periods. To date, we have statistically analyzed LANDSAT digital data of urban and agricultural areas over a six-month period (May though October) to determine the optimum date(s) and most informative LANDSAT spectral band(s) for separating urban agricultural spectral signatures.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Colorado

5.0007, THEORETICAL WAVE AND TURBULENCE

J. Weinstock, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8DJ40822)

PROJECT OBJECTIVE: Conduct theoretical research on waves and turbulence which occur in the earth's atmosphere and their effect on atmospheric transport. Such processes include gravity waves, mass, charge, energy transport and eddy diffusion. They greatly influence pollution dispersal and meteorological predictions.

CURRENT YEAR PLAN: 1. Deduce turbulence parameters in the lower atmosphere from Sunset Radar data. 2. Use Noxon's observations of airglow fluctuations to study dynamics in the mesosphere and thermosphere. 3. Continue comprehensive theory of turbulence in stably stratified atmospheres. 4. Determine contribution of gravity waves to atmospheric transport above 30 km. 5. Nonlinear theory of shear-flow instability. 6. Initiate study of the influence of planetary waves on transport in the stratosphere.

PROGRESS REPORT: 1. Developed theory that determines oxygen distribution and gravity wave characteristics in the lower thermosphere from fluctuations of airglow emissions. 2. Determined the contribution of turbulence to vertical transport in the stratosphere. 3. Completed work on Lagrangian theory of turbulent diffusion. 4. Completed 'three-point' method for solving problems in homogeneous turbulence. 5. Began comprehensive theory of turbulence in a stably stratified atmosphere. Determined influence of bouyancy on vertical transport.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0008, GRAVITY MEASUREMENTS IN SUPPORT OF LONG BASELINE GEODESY

J.H. Whitcomb, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Geological Sciences, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-21)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0009, MODELING OF TECTONOPHYSICAL DISTORTION FROM MEASUREMENTS OF LONG-BASELINE GEODETIC DATA AND OTHER

J.H. Whitcomb, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Geological Sciences, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-22)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0010, EVALUATION OF REMOTE-DATA ACQUISITION SYSTEMS IN WEST-CENTRAL FLORIDA

W.M. Woodham, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tampa, Florida* (FL 76-263)

Increasing number of developments on waterfront property that is subject to frequent and severe flooding and demands being placed on available water resources in west-central Florida require current hydrologic information on existing ground and surface water conditions in the Southwest Florida Water Management District. Current hydrologic data must be available for water managers to protect local and regional water resources. Current data needs include water levels of key lakes and over developed well field areas, and monitoring extreme flow conditions.

Objectives include acquisition, testing, and evaluation of a telemeter system composed of satellite and land-line telemeters. Results obtained in this evaluation will be used as a basis for developing a large-scale telemeter system for the Southwest Florida Water Management District.

Battery powered digital telemeters will be obtained and operated at key data stations. Six telemeters will be operated via GOES Satellite, two by LANDSAT Satellite, and one by telephone line. Telemetry data will be processed on the Survey computer system and a locally owned minicomputer. Operational characteristics of the system will be evaluated and a brief report prepared.

Network stations installed and operated during year include 5 additional GOES Satellite Convertible Data Collection platforms (CDCP). A total of 6 CDCP's, 2 LANDSAT, and 1 land line telemeter were operational by end of FY78. Telemetry data is continuing to be evaluated and report is in review process.

Continue evaluation of data from present network and prepare a final report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0011, STUDY ENTITLED SOIL RADAR RESPONSE STUDY

W.J. Steinway, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAS10-9757)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

5.0012, MEASUREMENT OF SOIL USING REMOTE SENSING ACTIVE MICROWAVE TECHNIQUES

F.T. Ulaby, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Electrical Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 5-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0013, CONDUCT SHORT COURSES IN REMOTE SENSING

C.A. Whitehurst, Louisiana State University, Agricultural & Mechanical College, School of Engineering, Dept. of Mechanical Engineering, *University Station, Baton Rouge, Louisiana* 70803 (NAS13-142)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0014, TECHNOLOGY TRANSFER TO SUB-STATE LEVELS OF GOVERNMENT

C.A. Whitehurst, Louisiana State University, Agricultural & Mechanical College, School of Engineering, Dept. of Mechanical Engineering, *University Station, Baton Rouge, Louisiana* 70803 (NAS13-148)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0015, DEVELOPMENT AND APPLICATION OF PHOTOGRAPHIC TECHNIQUES OF REMOTE SENSING

G. Cooper, University of Maine, Orono Campus, Agricultural Experiment Station, Dept. of Botany & Plant Pathology, *Winslow Hall, Orono, Maine* 04469 (0071745; ME08494)

OBJECTIVE: Explore the use and efficiency of photographic remote sensing in low intensity soil surveys. Develop the use of aerial photographic ocean and estuary surveys on the Maine Coast. Accumulate, as a result of ongoing research, material for a remote sensing atlas of Maine's herbaceous vegetation. Explore various aspects of disease problems in apples and blueberries using aerial photographic techniques.

APPROACH: All objectives are being explored using existing research land and personnel. All photography is low level and intended to expand the work already underway. Except for underwater detail, as in objective 2, the work is concentrated on the use of black and white and color infrared imagery.

PROGRESS: 1. Cooperative work with the Soil Conservation Service has moved forward to research in the 'big woods' area and will be continued by that agency. 2. Progress on surveying clear cut operations for tree regeneration has been successful and the U.S.F.S. will continue the work. 3. Preliminary work on blueberries is very promising and will probably be contintued. 4. Development of infrared video is underway and will be continued. 5. Methodology has been studied on the survey of marine algae and looks promising. May be continued. 6. Field and aerial surveys of 'Land Fill' dumps indicates potential use in surveying for toxic materials.

SUPPORTED BY Maine State Government

5.0016, FOREST VOLUME TABLES USING AERIAL PHOTOGRAPHY

T.B. Brann, University of Maine, Orono Campus, School of Forest Resources, McIntire Stennis Program, *302 Boardman Hall, Orono, Maine* 04473 (0074826; ME09616)

OBJECTIVE: Adapt existing Volume Tables for Maine to reflect current merchantable use of trees. Develop volume tables based on aerial photography techniques.

APPROACH: Volume tables for commercial species will be constructed for tree diameter classes of 1 to 40 inches, and utilization limits as small as 1 inch. Volume tables will be correlated with aerial photograph measurements to provide aerial volume tables for Maine cover types. Optical dendrometry measurement techniques will be used to obtain data describing stem form for each species under study. Tree taper functions will be developed using current statistical techniques. Volume tables to any minimum diameter limit will be generated using the above taper functions. Application of aerial photograph measurement to classify stands by Diameter class, height class and volume class. Intensive ground verification will be correlated with photograph measurements during the aerial volume table development process.

PROGRESS: The stem analysis data essential to the construction of a flexible system of volume prediction equations for spruce and fir was collected. A Fortran IV computer program was completed which calculates, from stem analysis data, the total stem cubic volume and merchantable cubic volume to any designated top limit diameter. A Fortran IV computer program which solves from the non-linear regression coefficients of total stem volume and merchantable volume ratio equations has also been completed. The first set of volume tables (spruce and fir) will be completed in early fall.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Maine

5.0017, INTERPRETATION AND DELINEATION OF THE EARTH'S GRAVITY FIELD

B.D. Marsh, Johns Hopkins University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAG 5-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0018, PETROLOGIC AND GEOPHYSICAL STUDY OF THE SOURCE OF LONG WAVELENGTH CRUSTAL MAGNETIC ANOMALIES

B.D. Marsh, Johns Hopkins University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAG 5-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0019, RELATING THEMATIC MAPPER BANDS TO AGRONOMICS VARIABLES FOR SOYBEANS AND CORN

C.J. Fan, Morgan State University, Graduate School, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NAG 5-12)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0020, EVALUATION OF THE QUALITY OF RAINFALL INTENSITY ESTIMATES

N. Knox, Morgan State University, Graduate School, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NAG 5-14)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0021, SATELLITE ALTIMETRY

B. Chovitz, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey, Geodetic Research & Development Lab., *6001 Executive Blvd., Rockville, Maryland* 20852 (836910A5)

Measurements of altitude to the ocean surface from a satellite will provide, in the first approximation, information on the shape of the geoid assuming that sea level corresponds to the geoid, and in the second approximation information on tides, currents, salinity, and sea state which are deviations of sea level from an equipotential surface. The first use of satellite altimetry will therefore be geodetic and serve as a basis for the later oceanographic applications. The altimetry will provide direct dense measurements of geoidal heights on a global scale not possible by any other means. It will also aid in improving the figure of the Earth as a whole in combination with other data.

Technical objective is to carry out analyses and provide computer programs in anticipation of data to be received from satellite altimetry. These programs not only handle altimetry, but provide a precise ephemeris of the satellite, which is required to exploit the precision of the altimetry.

Task is of ongoing nature. It is anticipated that a continuously improving flow of data from successive NASA satellites will be forthcoming through this decade. Technical reports of progress will be issued when significant results have been achieved.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey

5.0022, AFOS FORECAST APPLICATIONS - AFOS-ERA VERIFICATION

H.R. Glahn, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8C27026)

OBJECTIVE: To develop an automated system to collect, archive, and verify both NWS official forecasts and MOS forecasts.

APPROACH: Locally a program will be implemented at a WSFO to collect the official forecasts, MOS forecasts, and verifying observations for selected stations in that forecast area. This collected set of forecasts and obs will be 1) stored for local statistical routines to access, 2) available for display by the forecaster, and 3) transmitted on the NDC to NWSH. Centrally a computer program will be implemented on the IBM 360/195 to accept input from WSFO's and produce a national verification summary. A system will be developed to permanently archive these forecasts.

PROGRESS: The coding of the local collation program is complete, and testing of this software has started. The program to produce verification summaries was completed. Preliminary plans for a permanent archive system were developed.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0023, SYSTEMS DEVELOPMENT AND EXPERIMENTATION - DATA ACQUISITION

R.C. Lee, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, *8060 13th St., Silver Spring, Maryland* 20910 (8C27035)

TECHNICAL OBJECTIVE: To interface automated data acquisition systems to AFOS.

APPROACH: Analyze the interface requirements for automated data acquisition systems (AHOS/T, RADAP, AMOS, RAMOS and Upper Air) in terms of data loading, transmission time and line cost. Develop a network design and specify types and quantity of lines, data compression techniques and collection points. Add data collection capabilities to the detailed forecast area designs.

PROGRESS: Data acquisition study has been completed and communication requirements for data acquisition sites are defined as follows: 1. AHOS-T data collection should be done by AFOS automated WSO's utilizing the direct distance dialing (DDD) system. 2. In the AFOS era, ADAS sites will be utilized to collect data from RAMOS sites and for ad hoc collections from AHOS-T sites. WATS lines will be used in both cases. 3. ADAS sites and RADAP will interface with the AFOS network via 2400 bps dedicated lines using ADCCP. 4. Data from many Upper Air sites will be collected via a communications line that will be shared with either a collocated RADAP system or an AFOS terminal.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Development Div.

5.0024, TERMINAL WEATHER PREDICTION - MEDIUM-RANGE AVIATION FORECASTING

R.G. Miller, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8D5905)

TECHNICAL OBJECTIVE: To develop and implement new and improved automated techniques for the prediction of aviation weather elements at terminals.

APPROACH: The basic method used is the application of Model Output Statistics (MOS). Generalized operator prediction equations for regional areas or, when possible, single-station prediction equations are developed from a record of numerical model output. These statistical prediction equations are then used with operational numerical model predictions to produce automated forecasts.

PROGRESS: An improved medium-range forecast system, with several innovative features, became operational in FY 1977. Automated probability forecasts for six categories each of ceiling and visibility are routinely available for 233 U.S. terminals four times each day on request/reply teletypewriter circuits. We now provide an early aviation guidance package to field forecasters approximately 2 hr sooner than the previous system allowed.

The new features of our improved system are: (a) Monthly climatological variables, interpolated to daily values, are used as predictors. (b) Prediction equations for ceiling were developed simultaneously with those for cloud amount to improve the consistency between forecasts of these two elements. (c) Three-category combined ceiling/visibility forecasts, used at NMC as guidance for their products, are extracted from the six-category forecasts. This procedure makes the two types of terminal forecasts consistent with each other. (d) Threshold probabilities are used to transform the probability forecasts into a 'best' category type. This feature improves the bias characteristics of the lower category forecasts which were seriously underestimated in the previous system.

Work began on testing two new statistical techniques for producing terminal weather forecasts based on numerical model

output. The first, Transnormalized Regression Probability (TRP) is a version of linear regression. The second new technique is a modification of the Regression Estimate of Event Probability (REEP) procedure. It is a nonlinear multivariate method known as Discrete Likelihood Functions (DLF).

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0025, DATA AUTOMATION - AUTOMATIC METEOROLOGICAL OBSERVING SYSTEM (AMOS IV)
R.R. Reynolds, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Equipment Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8AA8602)

OBJECTIVE: To totally automate the surface weather observation.

APPROACH: Procure sub-system (to reduce in-house design requirements). Develop software to automate basic parameters. Incorporate ceilometer, visibility and present weather sensors.

PROGRESS: Version 1.0 software and hardware running at T&ED. This version processes temperature, dewpoint, winds, pressure and visibility, and accepts limited remarks. It does not provide for quality control of the data, however.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0026, RESEARCH OF PENUMBRAL SURGES AND THEIR PHYSICAL RELATIONSHIPS TO SOLAR FLARES
E.J. Schmadl, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NAG 5-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0027, RESEARCH OF SEA-AIR-LAND INTERACTION IN CLIMATE MODELING
F. Baer, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Meteorology, *College Park, Maryland* 20742 (NAG 5-26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0028, RESEARCH RELATIVE TO THE DEVELOPMENT OF HYDROLOGIC MODELS FOR REMOTE SENSING TECHNOLOGY
R.M. Ragan, University of Maryland, College Park Campus, School of Engineering, Dept. of Civil Engineering, *College Park, Maryland* 20742 (NAG 5-9)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0029, RESEARCH ON THEORIES FOR MICROWAVE REMOTE SENSING FLOW
J.A. Kong, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-16)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0030, SEISMICITY AND ACTIVE TECTONICS OF THE ANDES AND THE ORIGIN OF THE ALTIPLANO
P. Molnar, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-19)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0031, UPPER MANTLE HETEROGENEITY - COMPARISON OF REGION SOUTH OF AUSTRALIA WITH THE PHILIPPINE BASIN
C. Brown, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (NAG 5-18)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0032, OCEANIC EDDY HEAT AND MOMENTUM FLUXES AT THE CONTINENTAL MARGIN
D.B. Haidvogel, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (NAG 5-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0033, COMPREHENSIVE RESOURCE INVENTORY AND EVALUATION SYSTEM (CRIES)
R.D. Vlasin, Michigan State University, Agricultural Experiment Station, Dept. of Resource Development, *New Administration Bldg., East Lansing, Michigan* 48823 (0074507; MICL01285H)

OBJECTIVE: Develop an overall analytical framework for assessing agricultural planning options for LDC's. Develop appropriate training materials for transfer of methodologies. Develop technique for creating geographic computer-based information. Develop linear programming models for LDC's. Develop information system for large-area agricultural analysis.

APPROACH: Secure relevant economic data on agricultural sector of LDC's. Develop appropriate data for geographic information system (country-wide). Develop data for agricultural data information system. Obtain land use data (if necessary) from advanced remote sensing technology. Develop analytical model (linear program) for policy analyses. Involve in-country counterparts in all phases of study and training.

PROGRESS: Methods of creating geographic information files developed and tested for resource assessment in developing countries. Installation of geographic information system installed in Dominican Republic, in support of analytical model for assessing national policy issues in agricultural sector. First generation analytical system installed in Dominican Republic. Evaluation of light-aircraft photography for crop stress monitoring begun. Sugar cane rust is object of study in the Dominican Republic. Preliminary findings indicate the color-infrared imagery accurately reflects plant stress; current efforts aimed at isolating and factoring causes of stress (rust infection, drainage, nutrient deficiency, etc.). Operational techniques being developed for this type of monitoring technique. National and cover/use inventory begun in Syria. Data is being assembled in support of analytical model development, similar to work in the Dominican Republic.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Michigan

5.0034, LAND-USE MAPPING IN DIGITAL FORMAT FROM AIR PHOTOS
C.E. Olson, University of Michigan, Ann Arbor Campus, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0067794; MICY00040-F)

OBJECTIVE: Develop an interactive, digital, storage and retrieval system for land-cover data extracted from air photos. Complete land-cover mapping of Washtenaw Co., Mich., in this digital format.

APPROACH: A one hectare grid based on the UTM coordinate system is used as the matrix for land-cover data. Also included is a four-level expansion of the classification system in USGS Circular 671, and demographic, transportation, and soil permeability data. The classification scheme includes 150 forest classes. All data inputs are based on human interpretation of existing air photos.

PROGRESS: The LIGMALS software package was found to be too inflexible to handle the data retrieval needs of the user community. Needed modifications have been identified. This project has been terminated. Future work will be performed under a different state project.

SUPPORTED BY Michigan State Government

5.0035, REMOTE SENSING OF YIELD OF FOREST PLANTATIONS

C.E. Olson, University of Michigan, Ann Arbor Campus, School of Natural Resources, Fisheries Forestry & Wildlife Program, *Ann Arbor, Michigan* 48104 (0072439; MICY00098-F)

OBJECTIVE: Determine if yield of forest plantations can be determined from remote sensor data; How such remote-sensing data can be economically introduced into managemnet and harvesting decisions.

APPROACH: A review of industrial forest plantation practices will be made in the South (North Carolina, Tennessee, and Texas), Lake States (Michigan), and Pacific Northwest (Washington-Oregon) to determine the critical factors affecting plantation yield. These factors, including initial survival, growth rates, and damage due to insects or disease, will be compared with proven and probable remote sensing capabilities. From this comparison we expect to identify those variables amenable to evaluation through remote sensing techniques. An attempt will be made to develop a regression model that will permit integration of known site data (e.g., soils, precipitation, and temperature) with remote sensor data to predict yield at rotation age, and to refine that prediction as additional data becomes available. We plan to work with the Weyerhaeuser Company and Packaging Corporation of America to identify how best to integrate such yield predictions into operational management processes. Approval of both firms has been obtained.

PROGRESS: Counts of surviving trees in three-year old pine plantations made from 1:200, 1:2400, and 1:3600 scale color and color-IR photographs decreased when the number of trees in the sample plots exceeded 300. Accuracy was greatest for all seven interpreters when plot size was adjusted so that each plot included 100 to 200 possible tree locations.

SUPPORTED BY Michigan State Government

5.0036, FOREST RESOURCE MANAGEMENT APPLICATIONS OF MEDIUM- TO HIGH-ALTITUDE COLOR INFRARED AERIAL PHOTOGRAPH

T.M. Lillesand, University of Minnesota, St. Paul Campus, School of Forestry, McIntire Stennis Program, *301 Green Hall, St. Paul, Minnesota* 55108 (0064373; MIN-42-050)

OBJECTIVE: Improve the efficiency of forest land managers through the determination of the best type and the cost-effectiveness of medium and high altitude infrared color aerial photography for forest resource surveys and forest land management.

APPROACH: A forested area in Northern Minnesota will be photographed using standard forestry aerial photography and various types of smaller scale color infrared aerial photography. Selected forest survey and forest management information needs which can be determined from aerial photographs will be interpreted by locally experienced trained professional forest aerial photo interpreters. The results of the interpretations will be analyzed by statistical means as well as interpreter reaction. At the same time, data on the costs of the two types of aerial photography will be determined. A benefit-cost approach will be used to determine the optimum type of photography for forest survey and management purposes. In addition to the project interpreters, all possible local, on-the-ground, land managers will be given copies of the photography to evaluate in their own terms.

PROGRESS: The preparation of an experimental forest fuel type map of Isle Royale National Park was undertaken using 23x23 cm format 1:15,840 scale color infrared aerial photography. Small format 35mm and 70mm CIR was successfully used to improve classification accuracy in areas with poor quality metric camera coverage. A major effort toward the development of computer image processing capabilities for aerial film (CIR in particular) was initiated: (a) specialized sensitometric equipment was purchased, developed and activated; (b) other available specialized digitizing equipment at U of Minn. was identified and evaluated; (c) initial computer programs were developed and tested; (d) ties with the existing operation at U of Wisc. were established; and (e) transfer of software from Syracuse U and U of Wisc. to U of Minn. were initiated.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Minnesota

5.0037, FOREST RESOURCE MANAGEMENT APPLICATIONS OF DIGITAL IMAGE PROCESSING

T.M. Lillesand, University of Minnesota, St. Paul Campus, School of Forestry, Dept. of Forest Resources, *301 Green Hall, St. Paul, Minnesota* 55108 (0079696; MIN-42-038)

OBJECTIVE: Determine the need for and form of radiometric calibration of forest resource photography; determine the form and evaluate the utility of digitized photography in forest type mapping and insect and disease assessment; improve, as appropriate, the integration of conventional photointerpretation, densitometric analysis of digitized aerial and space photography, and automated analysis of LANDSAT data for forestry applications: and define the technological form and measure the costs and benefits of merging digital remote sensing procedures with conventional interpretation techniques.

APPROACH: Photograph test area at multiple altitudes using color infrared film under a range of atmospheric conditions. Sensitometrically calibrate photographs and develop model to compensate for atmospheric effects and film processing variations. Digitize photography using a scanning microdensitometer and film processing variations. Digitize photography using type mapping. Perform similar analysis using digital LANDSAT data. In both cases, integrate 'manual' interpretation to guide the computer mapping efforts. Assess the benefits of using digitized photographs, LANDSAT data, and conventional interpretation (first separately, then jointly) in terms of forest cover classification accuracy, as measured by field verification. Compare costs of various methodologies.

SUPPORTED BY Minnesota State Government

5.0038, IAFHE REMOTE SENSING LABORATORY

M.P. Meyer, University of Minnesota, St. Paul Campus, School of Forestry, Dept. of Forest Resources, *301 Green Hall, St. Paul, Minnesota* 55108 (0065906; MIN-42-033)

OBJECTIVE: Provide remote sensing applications advice and operational support to the various departments in the institute of Agriculture, Forestry and Home Economic and Agricultural Experiment Station, University of Minnesota.

APPROACH: Within the scope of facilities and personnel available: Provide training in remote sensing applications on an individual, team or group workshop basis; make available all possible remote sensing equipment and instrumention, along with laboratory working space, to interested users; assist in overflight planning, airphoto procurement and image interpretation; provide limited overflight services with small format (35mm, 70mm) single and multipcamera aerial photography; assist in equipment design and operational technique development.

PROGRESS: Completed and published a 35mm aerial photography operational manual. Cooperatively with Dept. of Agr. Engr., a system of color 35mm vertical serial photography an image analysis was developed and successfully tested for assessing powerline structure impact upon agriculture land use in the Dakotas, Nebraska, Iowa, Minnesota and Wisconsin. A trial series of color and CIR overflights was initiated on Univ. Agr. Expt. Sta. branch stations to determine uses of sequential aerial photography in station management and research.

SUPPORTED BY Minnesota State Government

5.0039, SYSTEMATIZED PROCEDURE FOR MAPPING URBAN LAND USE

B.O. Benn, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (31584(2))

OBJECTIVE: The objective of this study is to evaluate the feasibility of mapping urban land use by systematic procedures applied to digital multispectral scanner data. Emphasis will be placed on providing data needed for flood runoff and flood damage assessment calculations. The procedures will allow rapid determination of the areal extent of urban lands and to some extent the types of urban land uses. They will also enable rapid updating of land-use data bases to show changes in land use and the locations and extent of recent urbanization.

APPROACH: A literature search will be conducted to examine previous applications of multispectral scanner data to urban land-use mapping, and to establish through anticipated

users, urban land-use categories pertinent to Corps flood damage assessment and flood plain information needs. Image classification techniques such as those available at NSTL, EROS data center, and major universities will be screened to select those with the most potential for discriminating the desired urban land-use classes based on the spectral and spatial character or urban terrain features. The selected image classification techniques, in conjunction with concepts such as the use of supplemental data, hierarchical classification, and seasonal reflectance variations will be applied to Landsat and thematic mapper type imagery of the Memphis, Tennessee, area. A detailed urban land-use data base recently compiled by the WES will be used to evaluate the performance of the image classification techniques for mapping the desired urban land-use categories. A final report will be prepared to document results of the study and to provide guidance for the use of recommended procedures. This work addresses mission problem statements nos. 2-1-54, 2-1-61, and 2-1-106.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

5.0040, CHARACTERIZATION OF VEGETATION AND DRAINAGE IN STRIP MINED LANDS UTILIZING REMOTE SENSING TECHNIQUES

C.J. Johannsen, University of Missouri, Columbia Campus, Agricultural Experiment Station, Dept. of Agronomy, *130 Jesse Hall, Columbia, Missouri* 65201 (0071419; MO-684-15-20)

OBJECTIVE: Characterize vegetation and drainage patterns of representative stripped mined areas to evaluate reclamation methods. Extend information to larger areas by remote sensing techniques. Provide information in format usable by reclamation authorities.

APPROACH: Study sites will be selected from three different surface mining stages: Pre-1950, 1950-1972. (Surface mining law passed) and 1972 to present. Study sites will be flown at different seasons of the year to evaluate surface cover. Current photography using four film types plus previous photography will document revegetation success. Random 1000 M(2) quadrants will be ground truthed identifying specie composition and density. Photographs will be digitized and analyzed by computer utilizing pattern recognition techniques. Assessment will be made of vegetation desity. LANDSAT images will also be analyzed over selected areas. Drainage patterns and their influence on reclamation methods will be evaluated. Results will be provided to Extension Service personnel to be utilized in educational programs as well as work by State Reclamation Commission.

PROGRESS: Remote sensing images and data were used to study surface vegetation identification, vegetation biomass and drainage patterns on coal strip mined land in Central Missouri. Methodologies were developed and used for accurate, timely and useful applications of remotely gathered data from monitoring coal surface mining reclamation activities. Vegetation cover was verified at randomly located quadrats on the mine sites. Reference standards were thus established for the analysis and classification for both area metering and digital image methods. Although the computer system is more versatile, both methods are rapid and higly accurate (85-90%). Nine additional mine sites were studied for further comparison of the effects of plant productivity, species diversity and density to the remotely sensed classification. A computer based technique was developed for assessing the extent of reestablished vegetation. Color infrared aerial photographs of the sites were scanned and converted into digital format. Methodology developed offers a reasonable compromise between manual phot interpretation and automatic machine processing strategies for determining vegetative ground cover from remotely sensed data. Aerial photography was also used. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Missouri

5.0041, CHARACTERIZATION OF PROPERTIES OF STRIP MINE SPOILS AS RELATED TO REMOTE SENSING MEASUREMENTS

C.J. Johannsen, University of Missouri, Columbia Campus, Agricultural Experiment Station, Dept. of Agronomy, *130 Jesse Hall, Columbia, Missouri* 65201 (0073683; MO00354-1)

OBJECTIVE: Characterize the available plant nutrient status of pre-mined overburden layers and the resultant mined spoils determining their necessities for selected plant species. Determine rate and control of pyrite oxidation in overburden layers. Characterize vegetative responses and hydrologic conditions by remote sensing techniques.

APPROACH: Study sites will be selected from three active surface coal mines in Central Missouri. Soil samples will be obtained from the different geologic layers in the high wall cuts. The rate of pyrite oxidation to sulfuric acid at various pH, EL and O(2), also nutrient levels will be determined. The necessity for lime and plant nutrients in reclaiming mined spoil areas will be determined by soil tests and field plot techniques. Vegetative cover and densities will be determined for all plots and check areas. Correlations will be made of vegetative responses with responses measured on color infrared film. Hydrology aspects of vegetative and topographic patterns will be determined from aerial photography. Results will be provided to Extension Service personnel to be utilized in educational programs and to the Missouri Land Reclamation commission for use in their programs.

PROGRESS: Five field research plots have been established in spoil and topsoil conditions on coal strip mined land in two Missouri counties. Soil nutrient status was characterized, incremental soil amendments added and forage and row crops planted. Approximately 500 additional soil samples have been taken for further analysis and comparison. Pre-mined high wall samples were taken to study pH, pyrite oxidation and heavy metal occurrence. Research to determine the exact source of overburden sulfur has been completed and the first years results of subsurface gasses on the plots have been analyzed. Several sets of panchromatic aerial photographs representing a wide range of dates were analyzed for drainage patterns and erosional features. Maps were generated and brought to a common scale. Correlation between remotely sensed data and surface observations were delayed due to poor growing conditions in all plots. Fall reseeding and mulching of forages was accomplished. Mulch has proved to be very important to seed germination and soil moisture retention. The major fertility deficit as noted by soil tests was phosphorus. Acidity also posed a significant threat. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Missouri

5.0042, INCORPORATION OF LANDSAT TECHNOLOGY INTO FARMERS INFORMATION SYSTEM BEING DEVELOPED BY NASA AND THE MISSOURI FARMERS ASSOCIATION

C.J. Johanssen, University of Missouri, Columbia Campus, School of Agriculture, Dept. of Agronomy, *130 Jesse Hall, Columbia, Missouri* 65201 (NAS13-140)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0043, LUNAR AND PLANETARY SURFACE DYNAMICS AND EARLY HISTORY

C.M. Hohenberg, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (NAG 9-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0044, FOREST STAND MAPPING AND EVALUATION ON THE STATE AND PRIVATE LANDS IN MONTANA

F.L. Gerlach, University of Montana, School of Forestry, McIntire Stennis Program, *Missoula, Montana* 59801 (0075184; MONZ07801)

OBJECTIVE: Determine the variability of forest stands delineated from high altitude panchromatic aerial photography. Determine the accuracy with which ground conditions can be correlated to delineate stand classes. Determine the reliability of using the current Montana Forest Survey inventory data for assigning forest resource attributes to delineated stand classes.

APPROACH: Stands will be mapped from 176,000 panchromatic air photos, delineating stand height, canopy cover density, photo tone and texture, topographic exposure, watershed stream order, slope angle and position, and elevation. Random sample points will be selected, visited and measured. Photo and ground data will be compared with Forest survey data.

PROGRESS: A study unit of approximately 29,000 acres was selected, equivalent to the Virginia Peak Quadrangle (USGS 7 1/2 minute topographic series) in Meagher and Park Counties, Montana. Photo-interpretation criteria for stand classifications were developed and applied to high altitude (1:76,000) panchromatic aerial photography. Forest stand delineations annoted directly on film diapositives were mapped using a Kelsh plotter. The resulting map forms an overlay controlled to the Virginia Peak Quadrangle. Fifty-one field samples locations were randomly generated and located on medium altitude color photography. Of the 51 sample locations, 17 were selected randomly for field visitation. At each location, five forest stand sample plots were established. Data were collected on individual tree measurements, general stand characteristics, habitat type phase, and terrian description. A computer processing routine for field work analysis was initiated. A forest stand map of the 29,000 acre Virginia Peak unit has bee completed, and a preliminary assessment made of the variability of the stand classifications. Further field sampling is required to determine the accuracy with which ground conditions can be correlated to the delineated stand classes, and to determine the reliability of using Montana forest survey data for assigning attributes to the delineated stand classes.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Montana

5.0045, REMOTE SENSING APPLICATIONS FOR THE ANALYSIS AND MANAGEMENT OF RENEWABLE NATURAL RESOURCES

P.T. Tueller, University of Nevada, Reno Campus, Agricultural Experiment Station, Dept. of Renewable Natural Resources, *Reno, Nevada* 89507 (0067967; NEV00614)

OBJECTIVE: Investigate remote sensing techniques for application to natural resources management including range, forestry, wildlife, watershed, outdoor recreation and crop agriculture. Test techniques for vegetation mapping, wetland inventory, range condition and trend, erosion evaluation, and economic value. Assess site biomass and production, land use mapping and classification. Conduct resource inventories and serve as a repository for remote sensing data.

APPROACH: Various scales (1:600 to 1:1,000,000) of color and color infrared film types along with actual ground data, densitometers, and field averaging spectrographs will be used to identify phenomena relative to subjects being investigated. Accepted and experimental techniques and procedures will be used and evaluated. Computerized imagery from Land Set 1 and 11 will be evaluated. In all cases application will be emphasized.

PROGRESS: Large scale 70 mm color aerial photography in stereo pairs has been shown to be a valuable supplementary tool for natural resources studies. At scales between 1:600 and 1:500 we have shown the feasibility for species identification on range and forest sites followed by determination of plant cover, plant density, range condition and trend, plant biomass and erosion, including off-rod vehicle use. At somewhat larger scales (1:5,000-1:15,000) the 70 mm format provides a low-cost medium for mapping range and forest sites. Dichotomous photo interpretation keys for mapping vegetation have been completed and tested for examples or the major plant communities in Nevada. The data is being prepared for publication. Emphasis on the project has now turned to digital analysis of the LANDSAT computer compatible tapes. An interactive software is being acquired for analysis and interpretation of natural resource features, including range condition mapping and range trend monitoring. Algorithmics will be used that allow a combination of both supervised and unsupervised theme extraction.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Nevada

5.0046, USE OF AIRCRAFT SPECTRORADIOMETRY TO DETERMINE WATER QUALITY

H.L. McKim, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (31583)

OBJECTIVE: To quantitatively assess water quality parameters in fresh and salt water regimes utilizing aircraft spectroradiometer data and to conduct laboratory tests to determine spectral bands of interest for quantitative and qualitative measurement of water quality data to meet Corps of Engineers requirements.

APPROACH: A prototype 500-channel aircraft spectroradiometer instrument with a 10 Angstrom units spectral resolution will be used in the study to assess water quality parameters in fresh and salt water systems. The instrument provides a digital tape read-out for 500 channels ranging from the visible (0.42 microns) to the near infrared wavelengths (1.0 micron) for a minimal 60 by 60 ft. area. Laboratory testing to determine spectral bands of interest will be conducted with the airborne spectroradiometer instrument. The results will be compared to field tests in FY 78 run. Aircraft spectroradiometer flights over selected test site areas will be accomplished in conjunction with ground truth data acquisition. Analysis of the high resolution multispectral data will be used to qualitatively and quantitatively assess water quality parameters, especially turbidity, based on correlation to field measurements.

In addition, the GISS theoretical model will be run with data taken in 1978. Spectral response curves will be generated based on varying the size, optical properties and density of particulate matter. Results from the 1978 aircraft flight analyses and laboratory experiments will be compared to conventional techniques. A cost-effective comparison between conventional techniques and aircraft spectroradiometry to assess quality parameters in fresh and salt water will be made. Procedures to assess water quality will be made for use by Corps of Engineers Division. District personnel will be developed.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0047, REMOTE SENSING APPLICATIONS TO LAND USE AND NATURAL RESOURCES IN NEW HAMPSHIRE

P.E. Bruns, University System of New Hampshire, University of New Hampshire, Inst. of Natural & Environmental Resources, *Pettee Hall, Durham, New Hampshire* 03824 (0067211; NH00232-S)

OBJECTIVE: Develop a master set of stereograms of forest stands and other natural resource features for the 1974 flight of southern New Hampshire, and other readily available imagery that would act as keys for photo interpreters. Develop aerial volume tables in cubic feet for softwood, hardwood and mixed stands with application to timber stands both local and in northern New England generally. Develop methodology for extracting information on long-term forest land use trends for planning purposes based on successive flights (over time) of aerial photography.

APPROACH: Application of aerial photography to recognition and classification of a variety of forest stands and other land features such as agricultural, cultural, forest, geologic and soils; application of aerial photographic measurement to the evaluation of commercial forest stands as to wood volume, diameter class and stand height; test and further develop classification systems for use on successive flights to determine quantitative data on the extent of changes in forest cover and land use.

PROGRESS: Computer printouts with reliable geographic location of forest, wetlands, and the agricultural-open land complex resulted from the work in Dover, New Hampshire, with indication that other signatures can be developed and used to produce output yielding broad land-use classification from LANDSAT data. Digitized high-altitude infrared photography used as input data for the local DEC-10 digital computer yields preliminary output indicating that a typical smaller research installation such as ours should be able to develop land-use signatures from such data that can be used locally on a research basis or on larger systems on a production basis. With software improvement of incorporation of a more sophisticated classifier (in prog-

ress) the current system has potential to produce reliable and more detailed land classification than currently available through LANDSAT. A small format camera system and aerial mount have been acquired. Preliminary results indicate that it may be a practical tool for forest survey, inventory, and monitoring in areas of complex small ownership land holdings.

SUPPORTED BY New Hampshire State Government

5.0048, INTEGRATE REMOTE SENSING AND NATURAL RESOURCE MONITORING IN NEW HAMPSHIRE
P.E. Bruns, University System of New Hampshire, University of New Hampshire, Inst. of Natural & Environmental Resources, *Pettee Hall, Durham, New Hampshire* 03824 (0079163; NH00232)

OBJECTIVE: Improve the monitoring of natural resources in New Hampshire by integrating three types of remote sensing data sources; small format (35 mm) photography, high altitude infrared photography and LANDSAT (satellite) data, into an effective, low cost and universally applicable informational system incorporating the application of automated data processing.

APPROACH: Small format photography will be obtained and used to develop large-scale photo interpretation keys for forest and other natural resource applications. Computer programs and hardware utilizing high altitude infrared photographs (LANDSAT) and magnetic tape (EROS) signatures will be developed and tested on forest and land cover classifications in Dover, New Hampshire. The three systems of remote sensing will be incorporated into a single multisensor multistage sampling procedure and tested to determine if lower cost along with information accuracy can be achieved.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New Hampshire

5.0049, ASSESSMENT OF GEOPHYSICAL ALGORITHMS AND REGIONAL APPLICATION OF DATA
V.E. Delnore, Rutgers the State University of New Jersey, New Brunswick Campus, Agricultural Experiment Station, Dept. of Meteorology & Physical Oceanography, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (0079114; NJ00280)

OBJECTIVE: Develop remote sensing instruments for measurement of near-surface winds and differentiating of sea-ice types.

APPROACH: Participate in calibration and flight testing of instruments.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New Jersey

5.0050, RESEARCH RELATIVE TO THE EFFECT OF SUBDUCTION ZONES ON THE LOW-ORDER OF THE GEOID
W.F. Haxby, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (NAG 5-33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0051, FINITE ELEMENT RESEARCH OF THE SURFACE STRAIN FIELD ADJACENT TO THE SAN ANDREAS FAULT
D.L. Turcotte, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Geological Sciences, *Ithaca, New York* 14850 (NAG 5-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0052, THEORETICAL INVESTIGATION OF THE MECHANICS OF STRIKE SLIP FAULTING IN AN ANELASTIC EARTH
H.J. Melosh, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (NAG 5-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0053, MONITORING STREAM SEDIMENT LOADS THROUGH MULTISPECTRAL AERIAL PHOTOGRAPHY
T.M. Lillisand, Syracuse University, State University of NY Col. of Environmental Sci. & Forestry, McIntire Stennis Program, *Syracuse, New York* 13210 (0066319; NYZ-107-0-008)

OBJECTIVE: To develop a multispectral photographic remote sensing system to facilitate measurement of sediment production in forested areas.

APPROACH: Simultaneous acquisition of multiple exposure aerial photographs, in situ reflectance measurements and suspended solids samples will be made. Photographs will be procured with a 4-camera bank of motor-driven 70 mm Hasselblad cameras. Microdensitometric measurements at image point positions associated with each ground sampling point will be extracted from the photography. Models will be developed enabling estimations of sediment concentrations from image density observations. Concentration maps will be generated using electronic image analysis equipment.

PROGRESS: Simultaneous acquisition of aerial photography and water sampling continued into the Fall of 1975. Analysis of water samples was carried on concurrently with sampling. Film analysis was initiated during the water sampling period but only in a 'first look' basis. Further film analysis, method development and statistical testing was carried out. Results indicate a good correlation exists between suspended solids (sediment load) and relative film exposures. The methodology used to monitor stream sediment loads was demonstrated using color aerial photography (Chapin 1976); however, further refinement of the procedures is necessary. Concurrent studies using LANDSAT 1 satellite data were not completed during the reporting period.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New York

5.0054, ATMOSPHERIC HALOCARBONS
P.L. Hanst, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab., *Research Triangle Park, North Carolina* 27711 (G603A-AF-004)

OBJECTIVE: Assess the impact of fluorocarbons and other halogenated organics on stratospheric ozone levels; manage and conduct research to characterize the air in various locations, to provide insight into future atmospheric problems.

APPROACH: Combine laboratory experimental measurements, through the use of specialized instrumentation, e.g., long path infrared absorption, with theoretical modeling work; collect samples of halocarbons by aircraft to provide vertical profiles from the earth's surface into the stratosphere.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0055, CHARACTERIZATION OF GASEOUS EMISSIONS FROM STATIONARY SOURCES BY REMOTE SENSING
W.F. Herget, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab., Emissions Measurement & Characterization Div., Special Techniques Group, *Research Triangle Park, North Carolina* 27711 (G712B-BD-017)

OBJECTIVES: Use ground-based remote sensing methods to determine species identity and concentration of gaseous pollutants emitted by point and extended area stationary sources; determine optimum spectral regions for monitoring specific pollutants.

APPROACH: Longpath high-resolution infrared spectroscopy will be used in absorption and emission to determine the spectral characteristics of gaseous pollutants emitted by a variety of sources. Laboratory spectra of various species will be obtained to assist in species identification and concentration determinations. Long path gas-filter correlation methods will also be used.

CURRENT PLANS/PROGRESS: Measurements using a grating spectrometer have been made at coal-burning power plants, incinerators, gas purification plants and carbon black plants. The grating spectrometer has been replaced with a Four-

ier transform spectrometer to greatly increase spectral resolution and sensitivity. A variety of sources will be studied in future years.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0056, AIRCRAFT TURBINE EMISSION MEASUREMENTS

W.F. Herget, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab., Emissions Measurement & Characterization Div., Special Techniques Group, *Research Triangle Park, North Carolina* 27711 (G712B-BA-041)

OBJECTIVES: Determine reasons for apparent discrepancy between NO concentrations in jet engine exhausts as determined by non-extractive electrooptical methods and by extractive probe methods.

APPROACH: Several types of non-extractive electrooptical instruments and probe systems will be used to measure NO concentrations in heated cells and in flat-flame burners. Experiments will be conducted to determine which type of measurement gives the most accurate results and to determine the reasons for differences between the results obtained by the different methods.

CURRENT PLANS/PROGRESS: This two-year program is to be jointly funded by the EPA, Navy, NASA, Air Force and FAA, with the FAA acting as the lead agency. A procurement document has been prepared and contract is expected to be awarded during FY 77.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0057, NEOTECTONICS OF PAKISTAN

R.D. Lawrence, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Geology, *126 Agricultural Hall, Corvallis, Oregon* 97331 (NAG 9-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0058, GOES SATELLITE RESEARCH PROJECT, JUNIATA RIVER BASIN, PA.

C.D. Kauffman, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *228 Walnut St., Harrisburg, Pennsylvania* 17108 (PA 76-075)

An automated hydrologic data collection processing system is needed to provide users with processed data which is essentially real time and independent of manually collected data tapes.

To evaluate the Geostationsary Operational Environmental Satellite (GOES) System, determine the reliability of the convertible data collection platform (CDCP) and associated hardware, and demonstrate usefulness of data processing through the system. Select 20 sites for upcoming COMSAT General proposed pilot project and brief cooperators and District personnel on the COMSAT system.

To install CDCP's on water level sensors at nine of 14 gaging stations currently being operated in the basin and attempt to manage the stations based on data coming through the GOES system. Develop viable analysis and processing techniques using GOES-collected data. Meet with COMSAT personnel and cooperators for exchange of information regarding the COMSAT system operational features, site selection, and data format, needs, and availability.

All CDCP's were returned twice for factory modification and installed in the field. Data was monitored almost daily. Six technicians were trained in CDCP operation. An unpublished report on CDCP operation for a one-year period was completed and submitted to the Chief, Data Relay project. Data for five COMSAT DCP's was monitored almost daily for an eight-month period after which DCP's and associated hardware were removed. A performance report was prepared by COMSAT General and a performance summary was prepared by the Chief, Data Relay project.

Continue to evaluate the geostationary operational environmental satellite (GOES) system, determine the reliability of the convertible data collection platform (CDCP) and associated hardware, and demonstrate usefulness of data processing through the system. Meet with COMSAT personnel and cooperators to select 20 sites for upcoming proposed COMSAT General pilot project. Perform necessary field reconnaissance at each site.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0059, REMOTE SENSING AND MULTISAMPLING IN MONITORING CHANGES IN FOREST CONDITIONS IN THE COASTAL PLAIN

W.A. Shain, Clemson University, Agricultural Experiment Station, Dept. of Forestry, *Long Hall, Clemson, South Carolina* 29631 (0079113; SCZ00051-FR)

OBJECTIVE: Determine the feasibility of utilizing estimates of timber volume on the ground and on aerial photographs to inventory timber volumes from satellite imagery.

APPROACH: One satellite scene of the upper coastal plain of South Carolina (approximately 700,000 acres) comprises the study area. Color infrared aerial photographs will be taken of this area in sample strips. Ground samples will be systematically located and measured in the same area covered by the aerial photos. Using the COMTAL plotter at Georgia Tech, the study area will be delineated into land use types. Those acreages containing timber volume will be correlated to ground volumes to provide a potential timber inventory from satellite imagery.

SUPPORTED BY South Carolina State Government

5.0060, EVALUATION OF DOMESTIC INFORMATION SYSTEM FOR STATE GOVERNMENT APPLICATION

D.J. Cowen, University of South Carolina, School of Arts & Sciences, Dept. of Geography, *Admin. Bldg., Room 115, Columbia, South Carolina* 29208 (NAS13-144)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0061, IRRIGATION MANAGEMENT WITH REMOTE SENSING

J.L. Heilman, South Dakota State University, School of Engineering, Dept. of Agricultural Engineering, *Brookings, South Dakota* 57006 (NAG 5-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0062, APPLICATION OF SATELLITE AND AIRCRAFT DATA TO HYDROLOGY

G.K. Moore, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Sioux Falls, South Dakota* (CR 73-196)

Remote sensing has considerable potential for hydrologic studies, particularly in the visible, infrared, and microwave parts of the spectrum. It offers new information and new tools to the hydrologist and can reduce the field work necessary in conventional studies. Research, testing, and development are needed to obtain operational procedures, however.

(1) Conduct research on the applications of remote sensing to ground-water occurrence, surface drainage characteristics, and water color and turbidity. Develop application examples. (2) Develop enhancement and interpretation procedures for remote sensing imagery and digital data, using both manual and computer processing. (3) Train and consult with other hydrologists on feasibility tests and operational uses of remote sensing. (4) Originate, plan, and coordinate programs and projects in remote sensing.

(1) Analyze existing data for hydrologic information; develop procedures for information extraction. Evaluate effects of atmosphere and soil and vegetation cover. (2) Evaluate existing procedures for manual and digital processing. Determine need and utility of new procedures. (3) Conduct training courses and briefings. (4) Work with WRD, EROS, and NASA personnel to originate and coordinate remote sensing applications to hydrologic problems.

Two training courses in Hydrologic Remote Sensing were conducted for WRD personnel; an abbreviated course was given in Tehran, Iran. A formal paper on physical water quality was prepared and given in Manila, Philippines; an informal paper on ground-water exploration was given in Hyderabad, India. Two new training exercises were prepared, and eight training lectures were documented. An informal talk was given to Colorado Water Congress. Training in digital processing was given to two people from one district. Research was begun on the enhancement of current patterns in rivers and estuaries.

Conduct 1-2 training courses in hydrologic remote sensing. Continue research on current patterns in rivers and estuaries and prepare a formal paper on results. Prepare paper summarizing principles of remote sensing for ground-water exploration. Begin research on relationship of source areas to streamflows. Document additional training lectures.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0063, REMOTE SENSING TECHNIQUES FOR WATER RESOURCE PREDICTION AND MANAGEMENT

B.J. Blanchard, Texas A & M University, College Station Campus, Agricultural Experiment Station, Dept. of Agricultural Engineering, *College Station, Texas* 77843 (0072159; TEX06252)

OBJECTIVE: Select and evaluate appropriate remote sensing devices and techniques for use in measuring watershed parameters associated with watershed runoff prediction models. Develop improved watershed runoff models based on remote sensing measurements.

APPROACH: Existing and newly developed systems in remote sensing will be studied to determine the applicability of each system for measuring or mapping either single parameters, such as soil moisture, land use, etc. or combined parameters represented by watershed runoff coefficients. Results of these tests will be used to develop watershed runoff models using remote sensing data as input. The new models will then be tested on measured watersheds to demonstrate their applicability.

PROGRESS: Data have been collected to develop multivariate spectral prediction schemes for measurement of soil moisture and vegetative cover using visible, infrared, thermal and microwave sensors. Other ground data sets were collected to correlate soil moisture and watershed runoff coefficients with microwave data from the SEASAT SAR imaging radar (1.6 gHz frequency). Techniques developed in 1977 for estimation of an antecedent precipitation index by use of the Nimbus 5 passive microwave system (ESMR) are being tested on a large region of the southern grain plains. Results from this test for a three-year time period are anticipated within six months. Results from an experiment using active microwave systems repeatedly over six fields where soil moisture was measured showed that a time series of soil moisture in the near surface soils can be obtained with airborne active microwave. Data from this experiment are now being studied to define the improvement in estimation that can be obtained by using two wavelengths in the microwave region to estimate soil moisture. Lysimeter measurements have been made to establish a basis for development of a soil moisture model that will use only remotely sensed data as input.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Texas

5.0064, INVESTIGATION OF REMOTE SENSING TECHNIQUES FOR MEASURING SOIL MOISTURE

R.W. Newton, Texas A & M University, College Station Campus, School of Agriculture, Dept. of Plant & Soil Science, *College Station, Texas* 77843 (NAG 5-31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0065, REMOTE SENSING IN AGRICULTURE

N.L. Powell, Virginia Polytechnic Inst. & State University, School of Agricultural & Life Sciences, Dept. of Agronomy, *Blacksburg, Virginia* 24061 (0065075; VA-0312724)

OBJECTIVE: Use multi-spectral sensing techniques identify plant canopies of various stages of development, determine plant vigor, evaluate plant communities for effects of plant stress, determine the optimum wavelength regions for specific signatures of crop and soil conditions, utilize data processing devices, including computer software, analyze data and provide appropriate maps and other results, develop a system of remote sensing useful for agriculture.

APPROACH: Utilizing aerial platforms, remote sensing overflights with camera and multi-band sensor systems will be conducted on controlled agricultural experiment stations and farms in the Chesapeake Bay region. Detailed ground truth data of soil and crop parameters will be correlated with the multispectral imagery.

PROGRESS: The system design and implementation of an automatic agricultural weather data collection network was completed. Information obtained from this network will be used to develop crops management models for the major agronomic crops of Virginia. Planting dates, irrigation, pest control, harvest dates, etc. are types of management decisions to be included in the models. Aerial flights were conducted over the peanut growing region to monitor the development and spread of Cylindrocladium black rot (CBR) and Sclerotinia blight (SB) in peanut fields. Results of imagery analysis indicate that CBR caused a minimum problem for peanut growers while SB caused significant yield reductions in some fields.

SUPPORTED BY Virginia State Government

5.0066, REMOTE SENSING APPLICATIONS TO LAND RESOURCE INVENTORY

B.E. Frazier, Washington State University, College of Agriculture, Dept. of Agronomy & Soils, *Pullman, Washington* 99163 (0070070; WNP00323)

OBJECTIVE: Determine suitability of LANDSAT-based information for land resource inventories. Develop subclasses to the Anderson land use classification that have utility as a data base for local planners. Evaluate other remote sensing systems and techniques for potential application to land resource studies as they become available.

APPROACH: An investigation of LANDSAT-based information products for rural land use applications will be conducted using Whatcom Co. data. Functional subclasses of the Anderson system will be devised. Photo interpretation and satellite imagery interpretation techniques will be developed to isolate required categories. Evaluate new systems as they become available for public use i.e., remote sensing instruments, e.g., thermal energy detectors developed for military use.

PROGRESS: Investigation of aerial photography as a means of documenting sediment source areas and management practices has shown that implement patterns from chisel plowing, harrowing, drilling and combining were visible with the unaided eye. Furrow spacing was measurable in all cases except with harrowing photographed at 1/8000 scale. The predominant erosion feature, (rills) were visible at all scales with the unaided eye. More were seen on 1/2000 scale images than on any other scale. Minimum rill widths of 38 mm were measured on 1/2000 scale CIR images of bare soil with a 50X pocket microscope. Larger widths were necessary to measure rills at smaller scales. Best results determining rill density were obtained with a zoom stereoscope. Eighty-five percent of those seen on ground photos were counted on CIR aerial photos at 1/2000 scale. A proposal has been written to investigate the relationships between rill patterns seen on aerial photographs and sediment yield. Appointment to NASA sponsored Remote Sensing Science Council was accepted and a joint meeting with the Conference of Remote Sensing Educators was attended. The International Soil Science Society Congress was attended.

SUPPORTED BY Washington State Government

5.0067, ANALYSIS OF THREE-DIMENSIONAL THUNDERSTORM MODEL OUTPUT IN TERMS OF GEOSYNCHRONOUS SATELLITE OBSERVATIONS

R.E. Schlesinger, University of Wisconsin, Madison Campus, Graduate School, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAG 5-23)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0068, COMPUTER-AIDED IDENTIFICATION & CLASSIFICATION OF VEGETATION ON THE APOSTLE ISLANDS USING REMOTE SENSING
T.M. Bonnicksen, University of Wisconsin, Madison Campus, School of Natural Resources, Dept. of Forestry, *Agriculture Hall, Madison, Wisconsin* 53706 (0079658; WIS02438)

OBJECTIVE: Identify, classify and digitally map, using a scanning densitometer and associated computer software, the vegetation cover-states on Bear and surrounding Islands from a 1:120,00 color I.R. transparency. Determine the accuracy of the digital vegetation cover-state maps by comparing the digital map for Bear Island with a hand drawn map that is verified with ground data. Evaluate the potential of using computer-aided vegetation mapping techniques for the management of vegetation in national parks and reserves.

APPROACH: A NASA (RB-57F) high altitude (small scale) 1:120,000 false-color infrared transparency of the Apostle Islands has been scanned at 50 mu intervals in each of four wavelength bands. Digitized data on spectral reflectance values obtained by scanning were processed with computer programs designed to classify these values using a modified clustering technique. The accuracy of the digital display map will be determined by comparing it with the hand drawn map of vegetation cover-states on Bear Island.

SUPPORTED BY Wisconsin State Government

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, LIFE SCIENCE FLIGHT EXPERIMENT - PULMONARY BLOOD FLOW
D.M. Wiberg, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of System Science, *405 Hilgard Ave., Los Angeles, California* 90024 (NAS 9-16047)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0002, THERMOREGULATION IN PRIMATES IN THE SPACE ENVIRONMENT, EXPERIMENT NO. 781-039
C.A. Fuller, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Biology, *Riverside, California* 92502 (NAS 2-10536)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, TISSUE FLUID SHIFTS AND MUSCLE FUNCTION IN HUMANS DURING WEIGHTLESSNESS
A.R. Hargens, University of California, San Diego Campus, School of Medicine, Dept. of Surgery, *P.O. Box 109, La Jolla, California* 92093 (NAS 9-16039)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0004, EFFECT OF WEIGHTLESSNESS ON THE FLUID PHYSIOLOGY OF THE INNER EAR
A.F. Ryan, University of California, San Diego Campus, School of Medicine, Dept. of Surgery, *P.O. Box 109, La Jolla, California* 92093 (NAS 9-16033)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0005, LIFE SCIENCE FLIGHT EXPERIMENT - PULMONARY FUNCTION DURING WEIGHTLESSNESS
J.B. West, University of California, San Diego Campus, School of Medicine, Dept. of Medicine, *P.O. Box 109, La Jolla, California* 92093 (NAS 9-16037)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0006, LIFE SCIENCE FLIGHT EXPERIMENT - INSULIN AND GLUCOSE METABOLISM IN MAN
D.L. Searle, University of California, San Francisco Campus, Graduate School, *551 Parnassus Ave., San Francisco, California* 94122 (NAS 9-16038)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0007, HUMAN 1, 25 DIHYDROXY VITAMIN D3 CALCITONIN & PARATHORMONE LEVELS DURING THE DEVELOPMENT OF OSTEOPOROSIS (ABBREV)
C. Arnaud, University of California, San Francisco Campus, School of Medicine, Dept. of Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NAS 9-16027)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0008, LIFE SCIENCE FLIGHT EXPERIMENT - SURFACE CHEM BUBBLE FORMATION
J.F. D'Arrigo, University of Hawaii System, Manoa Campus, John A. Burns School of Medicine, Dept. of Physiology, *2444 Dole St., Pacific Biomedical Res. Ctr., Honolulu, Hawaii* 96822 (NAS 9-16048)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0009, LIFE SCIENCE EXPERIMENT - RESPONSE TO MYOTATIC REFLEX
G.L. Gottlieb, Rush University, College of Health Sciences, Dept. of Physiology, *Chicago, Illinois* 60612 (NAS 9-16035)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0010, INFLUENCES OF MECHANICAL VIBRATION OF PLANT GROWTH AND DEVELOPMENT UNDER HYPOGRAVITY CONDITIONS
C.A. Mitchell, Purdue University, School of Agriculture, Dept. of Horticulture, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NAS 2-10514)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0011, LIFE SCIENCE FLIGHT EXPERIMENT
P.K. Bhagat, University of Kentucky, School of Engineering, Dept. of Mechanical Engineering, *Limestone & Euclid, Lexington, Kentucky* 40506 (NAS 9-16034)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0012, CLINICAL OPHTHALMIC ULTRASOUND IMPROVEMENTS
P.A. Piro, Johns Hopkins University, School of Medicine, Dept. of Ophthalmology, *725 N. Wolfe St., Baltimore, Maryland* 21205 (NAS 5-26085)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

6.0013, LIFE SCIENCE FLIGHT EXPERIMENT
W.G. Walker, Johns Hopkins University, School of Medicine, Dept. of Medicine, *725 N. Wolfe St., Baltimore, Maryland* 21205 (NAS 9-16030)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0014, FLUID AND ELECTROLYTE HOMOSTASIS DURING SPACEFLIGHT (ELUCIDATION OF MECHANISMS IN A PRIMATE)
M.C. Moore Ede, Harvard University, Boston Campus, School of Medicine, Dept. of Physiology, *25 Shattuck St., Boston, Massachusetts* 02115 (NAS 2-10547)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0015, EVALUATION OF ENGINEERED FOODS FOR CELSS (CLOSED ECOLOGICAL LIFE SUPPORT SYSTEM)
M. Karel, Massachusetts Inst. of Technology, School of Science, Dept. of Nutrition & Food Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAS 9-16008)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0016, FEBRILE RESPONSES DURING SPACEFLIGHT, EXPERIMENT NO. 781-242
M.J. Kluger, University of Michigan, Ann Arbor Campus, Medical School, Dept. of Physiology, *1335 E. Catherine St., Ann Arbor, Michigan* 48104 (NAS 2-10534)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0017, STUDY OF EFFECTS ON SPACE TRAVEL ON MAMMALIAN GRAVITY RECEPTORS, EXPERIMENT NO. 781-238
M. Ross, University of Michigan, Ann Arbor Campus, Medical School, Dept. of Anatomy, *1335 E. Catherine St., Ann Arbor, Michigan* 48104 (NAS 2-10535)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0018, LIFE SCIENCE FLIGHT EXPERIMENT - IN-FLIGHT STUDY OF CARDIOVASCULAR DECONDITIONING DEFINITION PHASE
L. Farhi, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (NAS 9-16042)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0019, APPLICATION OF THE AUTOMATIC DATA ACQUISITION AND CONTROL SYSTEMS TO BIOMEDICAL EXPERIMENTS
P.R. Juhasz, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325480)

The Aerospace Medical Research Laboratory is responsible for definition of human acceleration exposure limits and body kinematic response properties which are required for development of aircraft emergency escape systems and impact protection equipment such as body restraints and energy attenuating devices. This effort includes test and evaluation of new protective systems developed by the Aeronautical Systems Division. These requirements have led to the development of complex experimental facilities, instrumentation and analytical techniques necessary to accomplish experimentation with volunteer subjects and their surrogates. An automatic data acquisition and control system (ADACS) has been developed (work unit 72311613) to provide rapid data collection, analysis, and to achieve the degree of experimental control required when human subjects are used. The objective of this work unit is to adapt and extend the capabilities of the ADACS to meet the unique requirements associated with specific facility control development efforts and new data analysis approaches.

The approach will be 1. Develop control software to assure that human subjects will not be exposed to unintentionally high acceleration, 2. Perform the necessary hardware interfacing to new equipment to complement the control system, 3. Optimize the signal to noise ratio through appropriate analog and digital filtering, 4. Adapt optimal estimation state space analysis to biodynamic experiments and 5. document the results of the effort. An understanding of unique AMRL impact experimentation technology is necessary for this effort, thus, making an in-house approach cost effective.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0020, LDF-79-8 BRAIN OXYGEN MOD AND SUBJECTS (LDF 79-8)
A.T. Kissen, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325410)

To identify and evaluate the relationship between retinal function (as demonstrated by the electroretinogram) and brain tissue oxygenation under conditions of hypoxic hypoxia and acceleration in the nonhuman primate.

The study will be accomplished in two phases. In Phase I we intend to accomplish a static test validation of novel and newly acquired ERG electrodes in the rhesus monkey. Either by use of an altitude chamber or manipulation of breathing gas mixtures, the animals will be exposed to a hypoxic hypoxia condition and the electroretinogram will be analyzed to establish the precise nature of the response to cerebral anoxia. Phase II will provide brain tissue, p02 and (previously undocumented) electroretinogram data obtained from the fully conscious nonhuman primate exposed to acceleration. The approach described will provide a basis for establishing the agreement or difference in the response of histogenetically related tissue to an environmental stress. The funding for this work unit will be placed in work unit 68930433 (contract F33615-79-C-0050, contractor, SRL).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0021, MODELS FOR INJURY MECHANISMS AND CRITERIA DEVELOPMENT
R.R. Rasmussen, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325080)

Several mathematical/computer models have been developed or assembled for the predictive analysis of human body response to various mechanical stresses typically encountered in flight operations. While the dynamic response predictive capabilities of these models have been demonstrated, their application to the prediction of injury has not been adequately exploited. This effort seeks to develop injury prediction capabilities for these models based on the dynamic response predictions of the models and failure criteria gathered from experimental and accident data.

The head-spine, articulated total body and thoracic dynamics models currently being used by the biodynamics and bioengineering division will be the primary models applied to this effort. Injury mechanisms identified from Air Force flight operation cases and consistent with current or potential model response outputs will be analytically described and appropriate computer algorithms prepared and incorporated into the main model structures. Injury or failure criteria for each mechanism will be statistically compiled and used as input to the modified models to allow prediction of probability of injury for a specified dynamic event. Structures of primary concern in this effort are the head-spine complex, the thorax and the long-bone joints of the body.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0022, EFFECTS OF VARIOUS ACOUSTIC EXPOSURES ON HUMAN AUDITORY PROCESSES
M.R. Stephenson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325090)

The objective of this work unit is to identify responses of the human auditory system to various acoustic stimuli. The stimuli include (a) long duration (8 hours or greater) exposures to continuous, intermittent and impulse noise, (b) communica-

tion signals during ground or inflight conditions and (c) any additional acoustic signal for which there arises an operational requirement to define its effects on man's auditory system. Once responses to various stimuli are defined, the results will be used to quantify the hearing damage risk and/or their effect on man's ability to communicate in the subject noise environment. This effort will benefit the subject noise environment. This effort will benefit the SG, ASD Life Support SPO, base safety and medical personnel, and the US EPA.

The approach will involve (a) laboratory measurements of acoustic signals under AF communication devices, (b) field measurements under AF communication devices and (c) exposure of human subjects under laboratory conditions to various acoustic signals. Data will be analyzed in the laboratory to identify operational situations with hearing damage risk potential, factors contributing to the problem and possible remedies. This is a consolidation and coordination of effort previously accomplished under work units 72310802, 72310803, and 72310806. semiannual review was accomplished 30 Sep 78 in conjunction with the preparation of the technical management review.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0023, HEARING PROTECTOR EVALUATION PERFORMANCE AND METHODOLOGY
M.R. Stephenson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325100)

AMRL/BBA is responsible for evaluating personal hearing protectors, helmets, ground communication headsets and inflight communication headsets for use in AF hazardous noise environments. The objective of this work unit is to (a) maintain an ongoing program of investigating hearing protection performance of the above mentioned devices and (b) maintain current methodological procedures and evaluate potential methodologies for determining hearing protector effectiveness, to comply with current AF and national standards for sound attenuation measurements.

Human subjects will be employed in the laboratory evaluation of a hearing protector's sound attenuation characteristics as measured by the American National Standard Institute (ANSI) real ear attenuation at threshold (REAT) method. Hearing protectors submitted to determine their acceptability or suitability as devices meriting inclusion on the AF qualified products list (QPL) will be evaluated in accordance with the requirements of MIL SPEC 38268B. Results of these and other evaluations will be used to formulate recommendations to the Office of the AF Surgeon General concerning potential application for widespread or special purpose AF use. Data will be processed and prepared in formats consistent with general methods used by the scientific community as well as the AF for estimation of noise reduction in operational situations. Should the methodology for evaluating hearing protectors change, or should the requirements specified for AF evaluations be modified, then appropriate experimental analyses will be accomplished to evaluate and implement the most suitable procedure. This work unit is a consolidation of effort from work units 72310804 and 72310805, for purposes of increased management effectiveness, and does not constitute a new research effort. Semiannual review was accomplished 30 Sep 78 in conjunction with the preparation of the TMR.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0024, LIFE SCIENCE EXPERIMENT
D.E. Herron, University of Akron, Graduate School, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NAS 9-16043)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0025, LIFE SCIENCE FLIGHT EXPERIMENT - ISOMETRIC EXERCISE PERFORMANCE UNDER ZERO-GRAVITY CONDITIONS - DEFINITION PHASE
J.S. Petrofsky, Wright State University, School of Medicine, Dept. of Physiology, *Colonel Glenn Hwy., Dayton, Ohio* 45431 (NAS 9-16041)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0026, CARDIOVASCULAR DECONDITIONING WITH BIOCHEMICAL & HISTOLOGICAL INDICES OF MUSCLE FUNCTION FOLLOWING ZERO-GRAVITY EXPOSURE (ABBREV)
R.T. Dowell, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Physiology & Biophysics, *Box 26901, Oklahoma City, Oklahoma* 73190 (NAS 2-10529)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0027, LIFE SCIENCE FLIGHT EXPERIMENT - PROTEIN METABOLISM
T.P. Stein, University of Pennsylvania, School of Medicine, Dept. of Surgery, *36th & Hamilton Walk, Philadelphia, Pennsylvania* 19174 (NAS 9-16031)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0028, LIFE SCIENCE FLIGHT EXPERIMENT
B.S. Chriswell, Baylor College of Medicine, School of Medicine, *1200 Moursund Ave., Houston, Texas* 77025 (NAS 9-16029)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0029, LIFE SCIENCE FLIGHT EXPERIMENT
R.R. Martin, Baylor College of Medicine, School of Medicine, Dept. of Medicine, *1200 Moursund Ave., Houston, Texas* 77025 (NAS 9-16040)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0030, REGIONAL COOLING
S.A. Nunneley, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF325130)

The project will explore the physiological advantages and limitations of regional cooling, particularly the head and thorax. These areas were selected because they (1) allow practical garment integration, (2) represent 33 percent of body surface area (3) are resistant to cold-induced vasconstriction, and (4) are subject to solar heating in the cockpit. A possibility that requires examination is that head or neck cooling may produce paradoxical effects with the body shutting down its defenses against heat.

The effects of regional cooling will be evaluated using a computer model to select critical combinations of metabolic rate and external environment, then validating the predictions by means of tests on human subjects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0031, UPGRADED INFLIGHT PHYSIOLOGICAL/ENVIRONMENTAL DATA ACQUISITION SYSTEM
D.G. Powell, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324510)

Current Air Force flying operations expose aircrew members to stressful and potentially hazardous environments. To build a data base on these environmental conditions and correlate them with physiological responses, it is desirable to develop instrumentation capable of collecting these data during actual inflight conditions. It is necessary to develop a total system which

will take the data from the collection point all the way through limited field processing to detailed laboratory processing, analyses, and plotting.

This work unit is established to coordinate with the U.S. Navy Pacific Missile Test Center in their development of a combination inflight physiological data acquisition system and miniature environmental monitor (IFPDAS/MEM), as well as associated data reduction systems, sensor systems, and software development. The work unit includes previously separate work units 7930-10-11 (upgraded IFPDAS) and 7930-10-12 (upgraded MEM). The IFPDAS/MEM will be a micro-circuited, battery-operated, man- or console-mounted data collection device which records analog and digital data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0032, BIOCHEMICAL EVALUATION OF CARDIAC STRESS RESULTS FROM ACCELERATION

R.J. Reyes, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324520)

Appraisal of the physiologic 'cost' of stress from acceleration (plus gz), while highly desirable, is technically difficult. Where there is much to indicate that a plus gz resulting from high performance aircraft impose physiologic loads on the flyer, quantitative evaluation needs to be further elucidated.

Post plus gz biochemical evaluation appears to be promising. A urinary battery of determinations (catecholamines, 17-hydroxysteroids, various electrolytes and certain nitrogenous metabolites) will be measured which relate to autonomic, endocrine and metabolic activities. These studies will ultimately lead to plasma analysis of these constitutents which may result in a more immediate qualitation of stress.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0033, LIFE SCIENCE FLIGHT EXPERIMENT - CARDIOVASCULAR ADAPTATION

C.G. Blomquist, University of Texas, Health Science Center at Dallas, Southwestern Medical School, Dept. of Internal Medicine, *5323 Harry Hines Blvd., Dallas, Texas* 75230 (NAS 9-16044)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NUMERICAL DIFFERENTIATION AND INTERPOLATION PROCEDURE WITH ERROR ESTIMATES FOR NON-EXACT DATA

R.E. Bozeman, Morehouse College, School of Arts & Sciences, Dept. of Mathematics, *223 Chestnut St. S.W., Atlanta, Georgia* 30314 (NAG 8-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

7.0002, RETURN ON AUTOMATIC DATA PROCESSING INVESTMENT

L. Roquemore, Southern University Agricultural & Mechanical College, Baton Rouge Campus, College of Sciences, Dept. of Computer Science, *Southern Branch P.O. Box 9674, Baton Rouge, Louisiana* 70813 (NASW 3344)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Management Operations

7.0003, RESEARCH IN PROBLEM SOLVING SYSTEMS

J. Minker, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Computer Science, *College Park, Maryland* 20742 (NAG 1-51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0004, DOMESTIC INFORMATION DISPLAY SYSTEM - CONCEPT STUDY

E. Teicholz, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Mathematics, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAS 5-25989)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0005, NUMERICAL METHODS FOR PHASE PLANE PROBLEMS IN ORDINARY DIFFERENTIAL EQUATIONS

R.J. McLeod, New Mexico State University, Las Cruces Campus, School of Arts & Sciences, Dept. of Mathematics, *University Park, Las Cruces, New Mexico* 88003 (NAG 2-23)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, SHORT-RANGE ORDERING STUDIES USING SCANNING TRANSMISSION ELECTRON MICROSCOPY

J.M. Cowley, Arizona State University, School of Liberal Arts, Dept. of Physics, *Tempe, Arizona* 85281 (DMR77-21843)

A high resolution scanning transmission electron microscope (STEM) will be used for the study of short-range ordering of atoms in nonstoichiometric oxides and sulfides and in various amorphous materials. Modifications of the instrument and the addition of new systems for data collection will also be undertaken to further enhance its capabilities. For some nonstoichiometric oxides and sulfides which show tendencies for the formation of superlattices having very large periodicities, the nature of the atomic disorder and the origins of the ordering energies will be sought in terms of local perturbations of the crystal structure and local strain fields. For amorphous semiconductors and glasses the form of the local atomic clusters will be studied.

Developments of the theory of STEM imaging of crystals and computing methods for determining intensity distributions in images and electron diffraction patterns will accompany the experimental observations and investigations will be made of the statistics of atom correlations in two-dimensional projections of limited three-dimensional distributions.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, LOW-TEMPERATURE RESEARCH IN LIQUID HELIUM

R.E. Packard, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (DMR76-82934 A01)

Research done under this grant will be a continuation of research begun under NSF Grant No. DMR73-02461. The work involves two main projects: vortex photography and ultralow-temperature research on 3He. A technique has been developed to photographically record the positions of quantized vortex lines in superfluid helium. Both the dynamics of vortex motion and the equilibrium distribution will be studied. The 3He work is done in a nuclear demagnetization refrigerator. Experiments

to study the flow properties and magnetic relaxation properties of the low-temperature phases of 3He will be performed.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0003, REACTION KINETICS OVER SURFACES OF SOLIDS

H. Suhl, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR77-24957)

This research was previously supported by DMR-7624178.

The characterization of simple surface reactions in terms of solid-state parameters will be extended to the cases in which phonons provide the principal energy exchange mechanism. Also, the so-called transmission coefficient of absolute rate theory will be expressed in terms of substrate response functions. A study of adsorption equilibria in relation to substrate properties is to be carried out with a view to separating out substrate effects on the partition function of the activated complex from substrate effects on the pre-exponential factor. A study is to be made of the possibilities for inducing oscillatory reactions over surfaces at will, by coupling to transport phenomena in the substrate. Under previous grants, magneto-catalytic anomalies were explained and a particular one, the initial anomalous oxidation rate of nickel near its Curie point, was both calculated and observed. Under the present grant it is planned to determine if the anomaly can be used as an indicator for studying the details of more advanced stages of the oxidation process. Also, it is planned to attack some long-standing mysteries in catalysis, for example the compensation effect, the extreme sensitivity of certain reactions to rather small applied magnetic fields, anomalous behavior of transport coefficients as a function of adsorbate, etc. Also, coupling between substrate transport properties and adsorbates are to be examined for possible technological uses.

First year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF LIQUID DOUBLE DROP DYNAMICS - PRELIMINARY DESIGN FOR SPACE SHUTTLE EXPERIMENTS

J.P. Vanyo, University of California, Santa Barbara Campus, School of Engineering, Dept. of Mechanical & Environmental Engineering, *Santa Barbara, California* 93106 (NAG 2-27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0005, LASER HOLOGRAPHIC INTERFEROMETRY FOR AERODYNAMICS

R.L. Perry, University of the Pacific, School of Liberal Arts, Dept. of Physics, *3601 Pacific, Stockton, California* 95204 (NCA 2-588001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0006, ATOMIC HYDROGEN ROCKET ENGINE

R.D. Etters, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (NAG 3-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0007, DYNAMICS OF MOLECULES IN CRYSTALS AND ON SURFACES

N.S. Gillis, Colorado State University, School of Science, Dept. of Physics, *Fort Collins, Colorado* 80523 (DMR76-18738 A01)

Research previously supported by DMR76-18738.

Theoretical research in condensed matter physics will be carried out. The main thrust of the work will be in the areas of the dynamics of motion of molecules in crystals and on surfaces. This will involve an investigation of the rotational excitations of molecules in these environments as well as the coupling of the rotational molecular motions with one another and with other degrees of freedom of these systems, such as phonons. Two specific areas will be studied: (1) Structural phase transitions in molecular solids, particularly the family of the inorganic azides. (2) Rotational motion of substitutional impurities of molecular nitrogen in rare gas matrices.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, DYNAMICS OF LIQUID STRUCTURE

T.A. Litovitz, Catholic University of America, School of Arts & Sciences, Dept. of Physics, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (DMR77-14555 A01)

This systematic investigation is aimed at discovering the nature of the elementary processes that govern translational molecular motions and structural dynamics in relatively simple liquids. The basic approach is to take advantage of the time-dependent information about the relative motion of molecules that can be inferred from the interaction-induced components of the infrared absorption and depolarized Rayleigh scattering spectra, and from molecular dynamics computer simulation experiments. Molecular dynamics computations are used to 'calibrate' each experiment by performing them on a model system whose dynamics are known. Time correlation functions of quantities that depend on interparticle separations are investigated rather than just molecular positions. In this way one expects to be able to isolate a new facet of the dynamics of structural breakup in liquids which is revealed when one looks at the motion of the particles from the reference frame of their drifting environments rather than from a laboratory-fixed viewpoint.

This is a continuation of research supported under DMR 76-17514. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, TWO PHOTON EXCITATION AS A TOOL FOR ATMOSPHERIC AND KINETIC INVESTIGATION

J.B. Halpern, Howard University, Graduate School of Arts & Sciences, Dept. of Physics, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAG 5-17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0010, OPTICAL PROPERTIES OF SOLIDS

L.L. Chase, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DMR78-09426)

Experimental investigations of light scattering and laser spectroscopy of solids previously supported by NSF grant DMR-7609091 will continue. The studies will concentrate on the two problem areas: (1) Impurity-induced Raman scattering measurements of coupled electronic and vibrational excitations for impurities with degenerate, or nearly degenerate, ground states; (2) Two-photon absorption and induced absorption studied of excitons and exciton interactions in wide band-gap semiconductors. In addition, light scattering studies of impurity-induced ferroelectric phase transitions in $KTaO_3$, primarily at low impurity concentrations will be initiated. These studies of optical scattering in solids using laser radiation are directed toward providing an improved understanding of electronic and vibrational dynamical effects in insulators and wide band gap semiconductors.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, TURBULENCE IN TRANSIENT SOLAR PHENOMENA

M.A. Cross, Grambling State University, School of Arts & Sciences, Dept. of Physics, *Grambling, Louisiana* 71245 (NAG 8-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0012, CRYSTAL STRUCTURE AND CATALYTIC PROPERTIES OF NOBLE METAL-RARE EARTH ALLOYS

W.E. Collins, Southern University Agricultural & Mechanical College, Baton Rouge Campus, College of Sciences, Dept. of Physics, *Southern Branch P.O. Box 9674, Baton Rouge, Louisiana* 70813 (NAG 8-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0013, SURFACE REFLECTION SPECTROSCOPY

H.D. Drew, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (DMR79-09064)

Optical spectroscopy can give useful and sometimes unique information about the electronic structure of interfaces. Surface reflectance spectroscopy can be applied to such practically important cases as the solid-electrolyte interface and the solid-gas phase interface. These cannot be probed by the powerful electron spectroscopies (such as ultraviolet photoemission spectroscopy) which require high vacuum. Changes in reflectance due to the addition of monolayer films, however, are very small and difficult to measure. Moreover, the classical interpretation of the data in terms of a uniform thin layer with a characteristic dielectric function has been questioned. In previous work a sensitive difference spectrometer was developed that is suitable for scanning measurements over the spectral range from 0.1-11 eV using a rotating sample configuration. Theoretical expressions were derived relating the changes in reflectance to certain averages of the dielectric function of the system.

In the present grant period, well characterized systems such as hydrogen and xenon on tungsten (100) are being studied. The results are being compared with those from the electron spectroscopies. Theoretical investigations are made into the electrodynamics of the vacuum-metal interface and the electronic structure of chemisorbed layers. In particular, the effects of local field corrections on the optical properties of the interface are being examined.

Renewal of work supported by DMR76-82128.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0014, STATISTICAL MECHANICS AND THE MANY-BODY PROBLEM

F.Y. Wu, Northeastern University, College of Arts & Sciences, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR78-18808)

Research previously supported under DMR7620643.

The phenomena of order-disorder transition through the consideration of model systems in lattice statistics will be investigated. Specific problems proposed for study include the percolation process, the Ashkin-Teller and the Potts models, phase transition in HC, a two-layer Ising system, and exact renormalization group transformation for the Ising model. Emphases will be on exact and rigorous results, and the interrelationship between the various lattice models. In the many-body theory the off-diagonal matrix elements for inhomogeneous systems will be evaluated. The magnetic properties of a many-electron system will also be studied.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, POLARIZED NEUTRON SCATTERING BY SPIN WAVES IN FERROMAGNETIC MATERIALS

J.B. Sokoloff, Northeastern University, School of Liberal Arts, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR79-06371)

A preliminary inelastic neutron scattering experiment on nickel with polarized neutrons indicated magnon scattering for neutrons polarized against the sample magnetization for temperatures above 0.9 Tc (curie temperature), in violation of the conventional Stoner theory of magnetism in metals based on the random phase approximation. These measurements on nickel will be extended to other neutron wavevectors and applied magnetic fields, in conjunction with complementary theoretical work, to study the microscopic structure of magnetization fluctuations or droplets. Such fluctuations are believed to be described by some form of soliton theory, and the results may provide a direct check on such theories. These studies will be extended to other metallic ferromagnets, as well as one and two dimensional ferromagnets, which are described by the localized spin model of magnetism.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, MILLIMETER MICROWAVE SPECTROSCOPY OF HIGH-PURITY METALS

G.L. Dunifer, Wayne State University, School of Liberal Arts, Dept. of Physics, *4841 Cass Ave., Detroit, Michigan* 48202 (DMR72-00181 A01)

Investigations of the microwave properties of metals begun under NSF Grant GH-39825 will be continued. The transmission of microwaves at 80GHz through thin plates of pure metal under conditions of varying magnetic field strength, orientation, and temperature will be measured. A careful study of spin wave excitations in the conduction electrons of aluminum will be carried out for samples of optimum thickness and orientation to obtain accurate measurements of the relevant Landau Fermi-Liquid Parameters. The Conduction Electron Spin Resonance (CESR) and possible spin wave excitations of copper and silver will be examined to obtain information at high microwave frequencies on g-anisotropy of the Fermi surface and exchange interactions among the conduction electrons. Finally, an extensive study of the alkali metals will be made, including a search for new physical effects which should occur only at millimeter microwave frequencies.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, INTERFACE AND DEPTH INHOMOGENEITY BY ELLIPSOMETRY

N.M. Bashara, University of Nebraska, Lincoln Campus, School of Engineering & Technology, Dept. of Electrical Engineering, *Lincoln, Nebraska* 68508 (DMR76-19048 A01)

Internal reflection ellipsometry (IRE), a relatively new technique, will be used to study the solid-solid interface and defect profiles in single crystal hemicylinders of silicon and gallium arsenide and an insulating overlay such as silicon dioxide. This technique has excellent potential in the semiconductor industry as a nondestructive means of assuring homogeneity of and measuring gradients in composition and defect content.

A second part of the program will be to further extend at-the-surface ellipsometry on epitaxial layers of phosphorus on silicon to correlate with assumed profile models. An ancillary portion of the project will be to use internal reflection ellipsometry at liquid-liquid interfaces in order to develop simplified IRE procedures. An extension of the theory of IRE will be made to anisotropic liquid-liquid interfaces with the intent of ultimately applying it to solids.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, THEORETICAL SOLID-STATE PHYSICS
E. Abrahams, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR76-23330 A01)

Research in theoretical solid-state physics carried out under grant DMR72-03230 will be continued. In particular, the program will be directed toward three general problems: (1) Transport coefficients of the normal Fermi liquid will be calculated by extending Eliashberg's theory to include finite temperature corrections. (2) The coupling of electrons to sound waves in piezoelectric materials will be studied, including the effect of this coupling on transport properties. (3) Research on dynamical phenomena near the lambda transition in liquid helium will be continued.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, PURCHASE OF A HIGH POWER UV ARGON LASER FOR CW OPERATION
H.Z. Cummins, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DMR79-05534)

Funds are granted for the acquisition of UV argon-pump laser capable of continuous-wave operation in the 4400-5000A wavelength range with a tunable dye laser. This apparatus will be used to study resonant Brillioun scattering in cadmium sulfide and other semiconductors with particular emphasis on effects related to interacting exciton-polaritons at high pumping intensities.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, EXPERIMENTAL STUDIES AT LOW TEMPERATURE
D.H. Douglass, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (DMR78-10260)

This is a continuation of work sponsored under DMR-7621622. An experimental study will be made of synthesis and properties of superconducting transition metal compounds. Studies will be made of sputtered transition metal carbides and of various chromium alloys. A new program will be initiated to study the properties of materials at low temperature. An experimental study of second sound in a single crystal of sapphire will be initiated. Measurement of internal friction in crystals of silicon and sapphire will be made. This work is important for understanding the process of synthesis of high-temperature superconducting materials.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, ATOMIC SCATTERING FROM SOLIDS II
E.D. Thompson, Case Western Reserve University, School of Engineering, Dept. of Electrical Engineering & Applied Physics, *University Cir., Cleveland, Ohio* 44106 (DMR79-01658)

Research previously supported by DMR7681184.

Molecular-solid surface scattering calculations, including both elastic and inelastic effects, will be performed, and, from the results and comparisons with experimental data, the dynamical interactions between the molecule and the solid surface will be ascertained. These dynamical interactions are fundamental to understanding such phenomena as physical adsorption, catalytic reactivity, surface viscous drag, and energy transfer. Surface structure analysis from atomic scattering will be carried out for silicon and other semiconductor materials as data become available.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, DIAMOND II A RESISTIVITY, DIELECTRIC CONSTANT, AND TANGENT DELTA FROM 10GHZ-100GHZ AS WELL THERMAL CONDUCTIVITY FROM 0 TO 500 DEGREES C
D. Hazony, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (NAG 3-24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0023, FERROMAGNETIC RESONANCE IN COMPLEX MAGNETIC SYSTEMS
P.E. Wigen, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DMR78-10300)

The magnetic properties of materials at solid surfaces and of thin films are often quite different from the properties in bulk samples. This is an active area of solid physics which may lead to new phenomena or new electronic structures. Ferromagnetic spinwave resonance will be used to investigate a variety of magnetic interactions in thin films of Yttrium Iron Garnet (YIG). Magnetic interactions of the YIG surface with magnetic metals will be investigated. In particular, recent theories predict that vanadium metal will have an antiferromagnetic surface layer, two or three atomic layers thick. The YIG surface is very sensitive to the onset of such interactions and will be used to study this effect. The exchange coefficient in magnetically diluted sublattices will be studied and compared with recent theories.

This research was previously supported under DMR-7614450.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0024, RADIATION-INDUCED DEFECTS IN ALKALINE-EARTH OXIDES
L.E. Halliburton, Oklahoma State University, Agricultural Experiment Station, Dept. of Physics, *107 Whitehurst Hall, Stillwater, Oklahoma* 74075

The various trapping sites for radiation-induced oxygen interstitials are being investigated in single crystals of MgO. Following neutron irradiation, the samples are examined by electron spin resonance (ESR) and electron-nuclear double resonance (ENDOR). By eliminating the oxygen interstitial trapping sites, the build-up of radiation damage within oxide materials can be prevented. This will allow their electronic and structural integrity to be maintained in hostile environments.

SUPPORTED BY Oklahoma State Government

8.0025, FRACTIONAL CIRCULAR POLARIZATION FROM WHITE DWARFS AND PULSAR RADIATION
N.V. Swamy, Oklahoma State University, Agricultural Experiment Station, Dept. of Physics, *107 Whitehurst Hall, Stillwater, Oklahoma* 74075

The model of a charged non-relativistic oscillator does not explain the observed fractional circular polarization in the radiation from white dwarfs. The contribution from the intrinsic magnetic moment of the charged particle as well as from relativistic effects has been studied. Regarding pulsar radiation, modification of the arrival times of different frequency components in the radiation from pulsars due to the presence of magnetic charges has been studied using a plasma fluid approach.

SUPPORTED BY Oklahoma State Government

8.0026, COLLABORATIVE RESEARCH ON NUCLEAR PHYSICS AT INTERMEDIATE ENERGIES
L.W. Swenson, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Physics, *126 Agricultural Hall, Corvallis, Oregon* 97331 (PHY76-82333 A03)

Experiments will be conducted at the Los Alamos Meson Physics Facility (LAMPF) and at the TRIUMF cyclotron in Vancouver.

At LAMPF, the pion beam will be used to continue studies of particles emitted from the nucleus in coincidence with inelas-

tically scattered pions to try to understand what are the processes which initially occur when pions interact with nuclei. When the high-resolution EPICS spectrometer is completed, studies of elastic and inelastic scattering of positive and negative pions from nuclei will be conducted with special attention to studies of proton and neutron densities in the nuclear surface. Studies of X-rays emitted by muonic atoms will be conducted to obtain information on nuclear shapes in the mass-190 region. A study will be conducted to measure neutrons and protons emitted in muon capture on nuclei; the proton spectra are expected to give information on the importance of charge-exchange processes at medium energies.

At TRIUMF, a variety of experiments will utilize the special features of that accelerator-polarized protons, energy variability and high duty factor. These will include elastic and inelastic scattering of 200-550 MeV protons, proton-proton bremsstrahlung and coincidence studies of muonic atoms.

This work is a continuation of work supported by the Foundation under grant PHY76-82333.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0027, THEORETICAL RESEARCH IN SOLID-STATE PHYSICS

J.R. Schrieffer, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DMR77-23420)

Theoretical research in condensed matter physics previously supported by NSF grant DMR-7681602 will be continued. The primary focus of this research will be in the area of surface physics. The emphasis, however, will be shifted from application of many-body theories to accurately handle exchange and correlation effects in the strongly inhomogenous electron systems encountered in surface physics problems. The one-electron methods will be improved, particularly in relation to interpreting experimental work with surface spectroscopics. Also, nonlinear excitations in lattices and coupled electron-lattice systems will be investigated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, NUCLEAR STRUCTURE AND NUCLEAR REACTIONS

B.L. Cohen, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY77-24134)

This proposed action will support the operation of the laboratory and the research program in nuclear structure and reaction studies. In addition, some work in nuclear applications and energy-related research will be supported. The nuclear physics program is a healthy mix consisting of some continuing productive programs and some work in new directions. Perhaps the most obvious example of a new area is the proposed research in weak interactions which will test the fundamental conserved vector current (CVC) theory of beta-decay. The studies of heavy-ion fusion and total reaction cross sections are also new areas which are of considerable interest in heavy-ion physics. Work will also continue in areas which have proved particularly fruitful in the past. For example, the pioneering work on quadrupole moment measurements of the first excited states of many nuclei will be extended to look at higher moments in samarium isotopes and to examine the quadrupole moments of excited bands. Studies of the nuclear continuum, a region which has generally received little attention until recently, will also be extended, possibly with the use of heavier ions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0029, STUDIES OF THE PHYSICS AND CHEMISTRY OF THE TERRESTRIAL ATMOSPHERE

E.C. Zipf, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (NAG 6-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

8.0030, THEORETICAL STUDY OF ELECTRON-ELECTRON INTERACTIONS AMONG THE CONDUCTION ELECTRONS IN SOLIDS

J.J. Quinn, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR78-08556)

Research previously supported by DMR7401454.

Theoretical research in solid-state physics will be carried out. Topics which will be investigated will include: (1) The electronic properties of semiconducting surface space charge layers. These systems exhibit intrinsically interesting phenomena and are of technological interest for the development of MOSFET devices. (2) The normal modes of a semi-infinite solid, such as surface phonons and plasmons. These have an effect on such experimental surface probes as Raman scattering and attenuated total reflection. (3) Electron-hole scattering in semimetals and semiconductors, which is an important mechanism for understanding the conductivity in these materials.

This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, CODEPOSITION FACILITY FOR AMORPHOUS TRANSITION METAL ALLOYS

D.G. Naugle, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (DMR78-10900)

A facility for making multicomponent amorphous superconducting alloys and for making in-situ measurements will be developed. This facility consists of a high vacuum chamber, a liquid helium cryostat, a superconducting magnet, electron beam deposition-equipment and the equipment necessary to monitor the vacuum and composition of the atmosphere. Thin films of amorphous metals will be made so that a wide range of experiments can be done to explore their unusual properties. The effect of the method of preparation on the physical properties will be examined.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, ADMINISTRATIVE SUPPORT FOR THE SOLAR POWER SATELLITE CONCEPT EVALUATION RESOURCE ANALYSIS WORKSHOP

R.E. Thomas, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (NAS 9-16059)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

8.0033, DYNAMIC AND COLLECTIVE EFFECTS IN PARAELECTRIC AND PARAELASTIC SYSTEMS

B.G. Dick, Utah Higher Education System, University of Utah, School of Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR77-25773)

Several theoretical problems connected with orientable ions in ionic crystals will be studied: (1) Development of strong coupling polaron theory of phonon assisted tunneling of paraelectric-paraelastic defects. (2) Study of the various processes which produce Arrhenius-like transition rates for systems. (3) Interference effects in transitions between tunneling as opposed to directed states. (4) Cooperative phenomena in mixed alkali halide-cyanide crystals. (5) Phonon scattering from tunneling defect systems with more than two sites, with strong defect-lattice interaction, and the relaxation of the Condon approximation. (6)

A simple tunneling-optical dichroism based theory for Raman scattering of tunneling defects.
Research previously supported by DMR73-02516.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, THE NUCLEATION, GROWTH, AND IN-SITU OXIDATION OF MICROSCOPIC CRYSTALLITES OF TRANSITION METALS ON REFRACTORY OXIDE SUBSTRATES
J.T. Dickinson, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (NCC 2-69)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, SOIL INTERPRETATIONS AND SOCIOECONOMIC CRITERIA FOR LAND USE PLANNING
G.A. Nielsen, Montana State University, Agricultural Experiment Station, Dept. of Plant & Soil Science, *Bozeman, Montana* 59715 (0074442; MONB00377)

OBJECTIVE: Determine biophysical and socioeconomic factors that influence non-urban land use. Organize and deliver existing biophysical and socioeconomic land related data needed for land-use policy making and planning. Identify and develop critically needed data and interpretations for land-use policy making and planning; develop and evaluate alternatives to overcome soil limitations affecting land-use and environmental degradation.

APPROACH: Prepare a county resource inventory handbook to optimize the use of land resource data. Compile State General Soil Maps and develop a computer-graphic system that identifies land-use potentials. Focus effort on the effects of soil temperature and moisture regimes on soil use and test models for predicting these regimes.

PROGRESS: The Montana Land Resources Demonstration Project is investigating the use of remote sensing imagery to determine land use and cover information. This project, a cooperative effort of Montana's Department of Natural Resources, Department of Revenue, Montana State University, and NASA uses LANDSAT multispectral scanner digital imagery. The output will identify the following land uses: irrigated and dryland agriculture, range, saline seep, water, and wetlands. Statistical analyses relating land use to location variables will be feasible. A Montana Land Use Map (1:1,000,000 scale) is being prepared from color composite photos utilizing LANDSAT multispectral bands 4, 5, and 7 (green, red, infrared). Digitally enhanced LANDSAT imagery is being analyzed by ground truth in Southwestern Montana to determine its usefulness for planning. A computer graphic system containing 18 soil, climatic, geologic, and vegetative parameters is being used to help guide research programs. It was used to help select the location for a new research center and to locate agricultural areas similar to Montana's six existing research centers. A 1:1,000,000 scale map of Montana showing 'Areas Where Summer Fallow May Not Be Recommended' was compiled based on soil water holding capacity and early spring soil moisture. It was printed in newspapers throughout Montana to reach appropriate crop producers. The Blue Ribbons 208 Areawise Planning Organization in Southwestern Montana is charged with enhancing water quality.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Montana

9.0002, SOIL INTERPRETATIONS AND SOCIOECONOMIC CRITERIA FOR LAND USE PLANNING
W.R. Butcher, Washington State University, College of Agriculture, Dept. of Agricultural Economics, *Pullman, Washington* 99163 (0072194; WNP00366)

OBJECTIVE: Determine biophysical and socioeconomic factors in influencing non-urban land use. Organize and deliver existing bio-physical and socioeconomic land related data needed for land use policy making and planning. Develop critically needed data and interpretations for land use, policy making and planning; develop and evaluate alternatives to overcome soil limitations and environmental degradation.

APPROACH: Available studies will be utilized to assess the likelihood of shortages in the national and international markets the Washington agricultural lands might serve and then applied to the concept of social opportunity costs to assess possible gains and losses not reflected in market prices. An analysis will be made of aerial photos taken at time intervals to identify and tabulate land conversions and relate these to levels of population and economic activity in order to establish and estimate functional relationships linking the demand for land to independent variables and prepare estimates of future levels of demand for agricultural land. Users and developers of converted lands within a specific area will be interviewed to devise developer and land user criteria models and both the economic and social costs and benefits will be estimated. A set of policy alternatives will be developed from secondary sources, and the results of the study and probable response to these policies will be estimated.

PROGRESS: Analysis of costs for 20 housing developments in Clark County, Washington showed costs to be lowest and profits highest for small (4 lots or less) developments within urban areas. Lowest profits were for small rural developments because of large land requirements per lot and the high costs of providing water, sewerage, access and other services to a small number of dispersed residences. Among more conventional subdivisions, costs per lot tended to be lower for large lot developments and for larger subdivisions, up to 60 lots. Neither cost nor selling prices were related to distance from the central business district. Total costs of development and urban services would be much less if developments were closely grouped on small lots. A survey of land buyers, sellers and owners will be conducted in January and February and an analysis made of effects on the land market.

SUPPORTED BY Washington State Government

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, THE X-RAY PROPERTIES OF WELL-STUDIED INTERMEDIATE AND LARGE RED SHIFT QUASI-STELLAR OBJECTS - A PILOT STUDY
P.A. Strittmatter, University of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (NAG 8-321)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0002, X-RAY OBSERVATIONS OF T TAURI STARS
W.D. Decampli, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 8-322)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0003, LOCATION OF HIGH ENERGY ASTRONOMICAL OBSERVATORY-A2 SOFT X-RAY SOURCES, MAP DIFFUSE FEATURES NEAR GALACTIC CENTERS (ABBREV)
G.P. Garmire, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 8-324)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0004, INVESTIGATION OF STELLAR CHROMOSPHERIC AND CORONAL ACTIVITY
H. Zirin, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 8-313)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0005, A STUDY OF THE SIZE AND COMPOSITION OF INTERSTELLAR GRAINS
A.B. Walker, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (NAG 8-325)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0006, OBSERVATION OF RICH GALAXY CLUSTER ON HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATOR PROGRAM
J.I. Silk, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-311)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0007, EXTENDED GASEOUS HALOS OF GALAXIES AND GASEOUS HALOS OF EXTENDED RADIO GALAXIES
J.I. Silk, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-320)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0008, HIGH RESOLUTION X-RAY, OPTICAL AND RADIO IMAGERY OF PARKS 0837-12
H. Spinrad, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-333)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0009, EVOLUTION OF FE ABUNDANCE IN CLUSTERS OF GALAXIES
W.J. Welsh, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-312)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0010, X-RAY OBSERVATIONS OF RADIO BURSTING QUASARS NRAL0140 AND NRA0530 ON THE HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATOR PROGRAM
A.P. Marscher, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (NAG 8-315)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0011, X-RAY EMISSION FROM STARS & PRESENCE OF A STELLAR WIND & STELLAR ROTATION RATE & CORONAE IN 3 PECULIAR LATE-TYPE STARS (ABBREV)
J.L. Linsky, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 8-334)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0012, X-RAY EMISSION FROM NORMAL AND PECULIAR A STARS WITH THE EINSTEIN OBSERVATORY AND SEARCH FOR SOFT X-RAY VARIABILITY IN OB STARS
T.P. Snow, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 8-327)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0013, SUPPORT OF THE GEOPHYSICS RESEARCH BOARD (GRB), AND THE COMMITTEE ON SOLAR-TERRESTRIAL RESEARCH (CSTR) (ABBREV)
P.J. Hart, National Academy of Sciences, National Research Council, *2101 Constitution Ave. N.W., Washington, District of Columbia* 20418 (EAR79-01089)

This award will continue the operations of the Geophysics Research Board and one of its committees, the Commmittee on Solar-Terrestrial Research (CSTR) of the National Academy of Sciences for one period commmencing January 1, 1979. The board, operating primarily through its committees, develops and coordinates U.S. contributions to international geophysical programs such as the programs of the Special Committee of Solar-Terrestrial Physics (SCOSTEP) and the Inter-Union Commission of Geodynamics. It conducts studies in major areas of the geophysical sciences and cooperates with the various committees and unions of the International Council of Scientific Unions. Close liaison is maintained with government agencies actively participating in the execution of the domestic programs. The CSTR includes the committee itself, the Panel on the International Magnetospheric Study (IMS), and a working group on the Middle Atmosphere Program (MAP). The CSTR was established to plan and coordinate programs in solar-terrestrial relationships, to keep under review the status of U.S. research in this field, and to develop recommendations on the national solar-terrestrial research programs and the international coordination of such programs. It conducts studies broadly dealing with solar-terrestrial physics. Through the CSTR IMS panel and MAP working group, it provides advice, planning, and recommendations regarding U.S. participation in the IMS and MAP. Provision is made in this award for one meeting each of the CSTR, the IMS panel, and the MAP working group, and one additional meeting of a subgroup of the CSTR, IMS panel and AMP working group.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

10.0014, DISTANT ABELL CLUSTERS DISCOVERED AS X-RAY SOURCES BY HIGH ENERGY ASTRONOMICAL OBSERVATORY-A-1 & OBSERVATIONS OF IC 3576 & NGC 4410 A/B
M.P. Ulmer, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *633 Clark St., Evanston, Illinois* 60201 (NAG 8-326)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0015, INVESTIGATION OF X-RAY SPECTRA OF ACCRETING NON-MAGNETIC DEGENERATE DWARFS
D.Q. Lamb, University of Illinois, Urbana Champaign Campus, School of Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (NAG 8-310)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0016, OLD SUPERNOVA REMNANTS & STUDY OF YOUNG SUPERNOVA REMNANTS CASSIOPEIA A & TYCHO OF HIGH ENERGY ASTRONOMICAL OBSERVATORY (ABBREV)
J.R. Dickel, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (NAG 8-317)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0017, X-RAY & OPTICAL PROPERTIES OF S-TYPE MARKARIAN GALAXIES - SIMULTANEOUS PHOTOMETRIC & SPECTROSCOPIC OBSERVATIONS OF X PERSEI
S.L. Mufson, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Astronomy, *Memorial Hall, Bloomington, Indiana* 47401 (NAG 8-331)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0018, X-RAY STUDY OF ELLIPTICAL AND SO GALAXIES WITH COMPACT NUCLEAR RADIO
A.S. Wilson, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Astronomy, *College Park, Maryland* 20742 (NAG 8-329)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0019, SECULAR VARIATIONS IN PULSAR TEMPERATURES
G. Greenstein, Amherst College, School of Liberal Arts, Dept. of Astronomy, *Box 65, Amherst, Massachusetts* 01002 (NAG 8-330)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0020, AN X-RAY STUDY OF AM CANUM VENATICORUM (A STAR)
J. Patterson, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Astronomy, *Ann Arbor, Michigan* 48104 (NAG 8-318)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0021, SEARCH FOR DECREASE IN RADIO PULSAR X-RAY LUMINOSITY DURING RADIO NULLS
A.F. Cheng, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Astronomy, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (NAG 8-328)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0022, X-RAY IMAGING OBSERVATIONS OF H II REGION MOLECULAR CLOUD COMPLEXES USING HIGH ENERGY ASTRONOMICAL OBSERVATORY-B
M. Simon, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (NAG 8-332)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0023, EXPERIMENTAL STUDIES OF GRAVITATION
D.H. Douglass, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (PHY77-07315 A02)

Research will continue on the design and operation of gravitational wave detectors of greatly increased sensitivity. A conventional room-temperature detector has been improved, and will continue in operation to search for signals at a level of 1 GPU. The feasibility study on dielectric detectors will be completed, and a small silicon crystal will be used as an antenna. Future work will include construction and use of a large (100 kg) crystal cryogenic detector which is expected to have a sensitivity in the range of 10 to the minus 3rd power to 10 to the minus 7th power GPU.

This work is a continuation of that currently supported under NSF grant number PHY72-04755 A05.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

10.0024, PHOTOMETRY, SPECTROSCOPY AND INTERFEROMETRY OF IRREGULAR GALAXIES
G.H. de Vaucouleurs, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST7808744)

A comprehensive photometric spectroscopic and interferometric study of late-type spirals and irregular galaxies, particularly of the magellanic type will be carried out. This is a relatively neglected field of optical extragalactic astronomy (excepting the Magellanic Clouds themselves), but one which is of special interest to radio astronomers because of the high hydrogen content of this class of galaxies, leading to a high rate of star formation, an abundance of supergiant stars and, in some sense, a rapid rate of evolution. The complex structure and internal motions of these irregular, often asymmetric systems is also a challenge to theories of galaxy formation and dynamics.

The expected results of this project would provide observations for most of the nearest and/or largest Magellanic irregulars and related late-type systems listed in the article by de Vaucouleurs and Freeman in Vistas in Astronomy, Volume 14 (1922). The DDO dwarfs detected at 21 cm. need to be observed. Information on the structure and morphology, luminosity and stellar density distributions, total magnitudes and effective diameters, colors, stellar and galaxian luminosity functions, distances and space density, H II regions and H emission, rotation, velocity dispersion and other motions, total masses and comparisons with H I data will be provided.

The tools and techniques for such a comprehensive study have been developed and are available to us at McDonald Observatory or through our associates. This is a continuation of research done under grant AST 75-22900 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0025, ASTROMETRIC STUDIES OF NEARBY STARS FROM THE SOUTHERN HEMISPHERE
P.A. Ianna, University of Virginia, Leander McCormick Observatory, *Garrett Hall, Charlottesville, Virginia* 22903 (INT77-21525)

Under this new award, work will continue for two years on a cooperative program begun in January, 1976, with the Australian National University's Mount Stromlo and Siding Spring Observatory for the determination of the trigonometric parallaxes and proper motions of nearby, astrophysically important stars in the Southern Hemisphere. Since the inception of the program, a total of 984 photographic plates of 71 star fields have been obtained. In the coming year, approximately 100 stars will be added to the program, including 15 bright, late-type giants to aid in luminosity calibration problems. The work to date has taken place under grant OIP 75-22605 in the first year and renewal INT 75-22605 A01 in the second.

Parallax and proper motions of nearby stars are important in determining distances and motions that permit astronomers to derive true luminosity and, with other data, the masses of stars in double star systems. Motions furnish data for understanding the structure of the Milky Way and astrometric measures also supply the yardstick for calibration of the cosmic distance scale.

The photographic observations, which focus on white dwarfs and other stars of low luminosity, are obtained with the Mt. Stromlo 66-cm refractor and subsequently measured and reduced at the University of Virginia's observatory. A special effort is being made to coordinate the photographic observa-

tions of a small sample of stars accessible to both McCormick and Mt. Stromlo. The program affords a unique opportunity for detailed data comparison between a Northern and a Southern Hemisphere refractor and an astrometric reflector to investigate sources of accidental and systematic errors in stellar parallaxes. D.S. Mathewson has replaced O.J. Eggen as the Australian principal investigator.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

10.0026, X-RAY EMISSION FROM OPTICALLY QUIET RADIO SOURCES, LACERTAE OBJECTS & BRIGHT OPTICALLY SELECTED QUASARS (ABBREV)
S.L. Odell, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Physics, *Blacksburg, Virginia* 24061 (NAG 8-314)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0027, A STUDY OF SOFT X-RAY ABSORPTION BY DENSE INTERSTELLAR CLOUDS UNDER THE HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATOR PROGRAM
W.L. Kraushaar, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAG 8-319)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

GENERAL

11.0001, OPERATION OF THE LEWIS RESEARCH CENTER VISITOR INFORMATION CENTER
M.R. Lewis, California State University & Colleges, California State University, Chico Campus, Graduate School, *Chico, California* 95929 (NAS 3-22172)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

11.0002, COMPARATIVE EVALUATION OF WORKLOAD ESTIMATION TECHNIQUES IN PILOTING TASKS
W.W. Wierwille, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Industrial Engineering & Operations Research, *Blacksburg, Virginia* 24061 (NAG 2-17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-30272 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
MULTILINGUAL AERONAUTICAL DICTIONARY
1980 896 p In ENGLISH, FRENCH, DUTCH, GERMAN, GREEK, ITALIAN, PORTUGUESE, TURKISH, SPANISH, and RUSSIAN (LC-77-93566; ISBN-92-835-01666-7) Avail: NTIS HC $123.50; Distributed In North America by NTIS, 5285 Port Royal Road, Springfield, Va., USA and Distributed Outside North America by AGARD, 7 rue Ancelle, 92200 Neuilly sur Seine, France

A multilingual dictionary to aid scientists, engineers, and translators in the field of aeronautics was developed. The dictionary contains an alphabetical list of English terms, accompanied by English language definitions and translations of each term into the nine other languages. Nine alphabetical lists of terms in the languages other than English are included, each term accompanied by a reference number, keyed to its English language equivalent. A list of English acronyms, abbreviations, and symbols is also included, each accompanied by its expansion in English. J.M.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-30273*# McDonnell-Douglas Research Labs., St. Louis, Mo.
COMBINED LINEAR THEORY/IMPACT THEORY METHOD FOR ANALYSIS AND DESIGN OF HIGH SPEED CONFIGURATIONS Final Report
D. Brooke and D. V. Vondrasek Washington NASA Sep. 1980 34 p refs
(Contract NAS1-15535)
(NASA-CR-3314) Avail: NTIS HC A03/MF A01 CSCL 01A

Pressure distributions on a wing body at Mach 4.63 are calculated. The combined theory is shown to give improved predictions over either linear theory or impact theory alone. The combined theory is also applied in the inverse design mode to calculate optimum camber slopes at Mach 4.63. Comparisons with optimum camber slopes obtained from unmodified linear theory show large differences. Analysis of the results indicate that the combined theory correctly predicts the effect of thickness on the loading distributions at high Mach numbers, and that finite thickness wings optimized at high Mach numbers using unmodified linear theory will not achieve the minimum drag characteristics for which they are designed. R.K.G.

N80-30274*# Johns Hopkins Univ., Laurel, Md.
BANK-TO-TURN CONTROL TECHNOLOGY SURVEY FOR HOMING MISSILES
Frederick W. Riedel Sep. 1980 42 p refs
(NASA Order L-75242)
(NASA-CR-3325) Avail: NTIS HC A03/MF A01 CSCL 01A

The potential advantages of bank-to-turn control are summarized. Recent and current programs actively investigating bank-to-turn steering are reviewed and critical technology areas concerned with bank-to-turn control are assessed. Author

N80-30275# Tufts Univ., Medford, Mass. Dept. of Electrical Engineering.
PAYLOADS USED IN FIRST THREE DATA-GATHERING BAMM FLIGHTS
Alvin H. Howell Jan. 1980 30 p
(Contract F19628-77-C-0047; AF Proj. 6665)
(AD-A086839; AFGL-TR-80-0109; SR-3) Avail: NTIS HC A03/MF A01 CSCL 04/1

Payloads were configured for, and used in, three successful data-gathering balloon flights for the Balloon Altitude Mosaic Measurements (BAMM) program. All were significantly different, and each worked as planned. A radiometer and a TV camera were carried on Flight 1, and an interferometer was added for Flights 2 and 3. Recovery was by ground impact for the first two flights, but the third was snatched from the air by helicopter. GRA

N80-30276# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directories.
AN ANALYTICAL SOLUTION OF LIFT LOSS FOR A ROUND PLANFORM WITH A CENTRAL LIFTING JET
K. T. Yen 10 Mar. 1980 38 p refs
(WR02302000)
(AD-A086669; NADC-80057-60) Avail: NTIS HC A03/MF A01 CSCL 20/4

An analysis of the lift for a round planform fitted with a centrally-located round jet is presented. The pressure distribution over the lower surface of the planform is solved analytically by matching an inner viscous solution with an outer potential solution. By comparing the calculated pressure distributions with NACA experimental data, satisfactory agreement has been obtained, although the planforms are not exactly the same. In addition, Wyatt's formula for the lift loss is found to be essentially valid, but only under limited conditions, and an improved formula is suggested. Additional works, both experimental and theoretical, needed to solve the lift loss problem are discussed with recommendations. GRA

N80-30277# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
EXPERIMENTAL STUDY OF THREE-DIMENSIONAL SHOCK WAVE TURBULENT BOUNDARY LAYER INTERACTION: SCALING OF SHARP AND BLUNT FIN-INDUCED FLOWFIELDS Final Report, 4 May 1978 - 3 May 1980
David S. Dolling and Seymour M. Bogdonoff Jul. 1980 61 p refs
(Contract N60921-78-C-0068; WR02302003)

(AD-A086875; MAE-1483) Avail: NTIS HC A04/MF A01 CSCL 20/4

An experimental study of three dimensional (3-D) shock wave turbulent boundary layer interaction has been carried out. Interactions generated by fin models having sharp and hemicylindrically blunted leading edges have been studied. Tests have been made using incoming turbulent boundary layer varying in thickness in the ratio of about 4:1. Extensive surface property measurements have been made on the test surface on which the incoming boundary layer developed and on the fin itself. All of these tests were carried out at a nominal freestream Mach number of 3, a freestream unit Reynolds number of about 63 million per meter, and under approximately adiabatic wall conditions. The emphasis in the study reported on in this paper was on two main areas. First, to determine the key geometric and/or flow parameters controlling the overall scaling and characteristics of both blunt and sharp fin-induced interactions. Second, to identify the conditions under which both blunt and sharp fins induced interactions have the same local scale and characteristics. GRA

N80-30278# Ballistic Research Labs., Aberdeen Proving Ground, Md.

EFFECT OF NEAR-ZERO SPIN ON INSTABILITY OF CONTROLLED PROJECTILES IN ASCENDING OR DESCENDING FLIGHT Final Report

Charles H. Murphy May 1980 21 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A086775; AD-E430473; ARBRL-MR-03023) Avail: NTIS HC A02/MF A01 CSCL 19/4

Lloyd and Brown have shown that constant-amplitude horizontal and vertical side forces applied to a spinning projectile can cause dynamic instability. A subsequent ARRADCOM report (AD-A072808) removed some of the limitations of the Lloyd-Brown work and gave somewhat more general results. Unfortunately, these results were applied in the report to a case for which they were unsuitable; a nonspinning statically stable missile. The present report derives correct results for the zero-spin case and shows that the results of the earlier report are valid for spin rates greater than about five times the resonant spin value. GRA

N80-30279# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

QUANTITATIVE MEASUREMENTS OF THE EFFECTS OF VARIATIONS IN PANEL METHOD COMPUTER PROGRAMS Final Report

Wilson C. Obi Jan. 1980 155 p refs

(WF41400000)

(AD-A086358; NADC-80029-60) Avail: NTIS HC A08/MF A01 CSCL 20/4

Panel distributions have been characterized independently in terms of computable and controllable parameters. Thus, a methodology has been developed which will permit a conclusive establishment of the sensitivities of paneling parameters to aerodynamic estimation quality for a wide variety of paneling codes. It has been demonstrated that the global performance (input-output relationships, precision, and accuracy) of a panel method computer program can be established through calibration. Application of the sensitivity analysis developed herein to SURAIR (a Woodward constant pressure panel method derivative) has shown that it is possible to increase estimation accuracy without the commonly expected increase in computation cost. GRA

N80-30280# Tufts Univ., Medford, Mass. Dept. of Electrical Engineering.

NEW HARDWARE FOR TETHERED BALLOONS

Alvin H. Howell Jan. 1980 17 p

(Contract F19628-77-C-0047; AF Proj. 6665)

(AD-A086836; AFGL-TR-80-0108; SR-2) Avail: NTIS HC A02/MF A01 CSCL 01/3

Three hardware items have been produced which should be useful in tethered balloon operations. They are: a self contained balloon valve, called a smart valve, which can be used in a hostile environment; a general purpose tetrahedron, which simplifies balloon let-up when multiple tethers are employed; and quick acting coupling; which speed up the launch procedure. GRA

N80-30281# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.

COMPARISON OF WIND TUNNEL AND FLIGHT TEST MEASUREMENTS OF STATIC AERODYNAMIC LOADING OF A CAPTIVE STORE Final Report, 18 Jun. 1976 - 31 Aug. 1978

R. E. Dix and G. R. Mattasits AEDC Jul. 1980 117 p Sponsored by Air Force

(AD-A087237; AEDC-TR-79-9) Avail: NTIS HC A06/MF A01 CSCL 01/1

A coordinated series of experiments was conducted in three wind tunnels and in flight to measure the static aerodynamic loading of a MK 83 store attached to the bottom center station of a triple ejector rack mounted on the left inboard pylon of an F-4 aircraft. Fundamental agreement between wind tunnel and inflight loads data was demonstrated over a range of angle of attack from -2 to 6 deg and a Mach number range from 0.6 to 0.9. Differences that were noted were thought to be attributable either to improper store-to-aircraft alignment or to poor definition of inertial loads during maneuvering flight. GRA

N80-30282# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

STUDY OF AN EDGE VORTEX BY MEANS OF ULTRASOUND IN A CLOSE FIELD BEHIND A RECTANGULAR WING IN A WIND TUNNEL Thesis [UNTERSUCHUNGEN VON RANDWIRBELN MITTELS ULTRASCHALL IM NAHBEREICH HINTER EINEN RECHTECKFLUEGEL IM WINDKANAL]

Rolf H. Engler Aug. 1979 120 p refs In GERMAN

(MPIS-11/1979; ISSN-0436-1199) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21.45

The development of an edge vortex in a close field behind a rectangular wing was studied by means of alterations of short utrasonic impulses. A spoiler was then fixed on the pressure side of the experimental wing. The influence of the small spoiler and of the fixation angle was examined. Author (ESA)

N80-30283# Messerschmidt-Boelkow G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.

A THEORETICAL INVESTIGATION OF THE SHOCK LOCATION ON AN AXISYMMETRIC BODY AND ON A TWO DIMENSIONAL AIRFOIL IN TRANSONIC FLOWS AFFECTED BY AXIAL PRESSURE GRADIENTS AND SHIFTS IN PRESSURE LEVEL

Richard Kleebaur 22 Jun. 1979 70 p refs In GERMAN; ENGLISH summary

(MBB-FE-124/S/PUB/9) Avail: NTIS HC A04/MF A01

The influence of pressure deviation on shock locations due to interference free, transonic wind tunnel flows was investigated. A finite element computer program was used to determine the shift in shock location on an axisymmetric body and on a two dimensional airfoil due to deviations in the static pressure level and due to axial pressure gradients in the theoretical model of a wind tunnel flow. Wall pressure measurements in a transonic wind tunnel enabled a comparison to be made between an experimentally determined shift and a calculated shift in shock location as affected by wall interference and with increasing Reynolds number. The result for the axisymmetry body shows that about half of the rearward shift of the shock, with increasing Reynolds number, can be attributed to inerference measured on the wall of the wind tunnel. The calculations for the two dimensional case showed the high sensitivity of the shock location with deviations caused by interference free wind tunnel flow. Lack of wall pressure measurements prevented a quantitative correlation with Reynolds numbers for this case. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-30284# Naval Weapons Center, China Lake, Calif. Ordnance Systems Dept.

STORE SEPARATION TRAJECTORY ANALYSIS Progress Report, 1972 - 1978
Arthur R. Maddox Jan. 1980 25 p refs
(ZF32300000)
(AD-A086704; NWC-TP-6067) Avail: NTIS
HC A02/MF A01 CSCL 19/4

A series of store drops was made at moderate to high subsonic speeds with the same configuration on the center position of a triple ejector rack on an F-4 inboard pylon. The data were compared with wind tunnel and mathematical simulations. Both estimation techniques predicted the general nature of the motion, especially at low speeds, but failed to predict a minor collision observed at high speed. GRA

N80-30285# Army Aviation Research and Development Command, St. Louis, Mo. Applied Technology Lab.
INVESTIGATION OF HELICOPTER WIRE STRIKE PROTECTION CONCEPTS Technical Memorandum, Aug. - Nov. 1979
LeRoy T. Burrows Jun. 1980 51 p
(DA Proj. 1L1-62209-AH-76)
(AD-A086857; USAAVRADCOM-TM-80-D-7) Avail: NTIS
HC A04/MF A01 CSCL 01/2

In-flight wire strikes pose a serious threat to low-level helicopter operations. Tests were conducted to determine the suitability for U.S. Army helicopter applications of the Canadian Wire Strike Protection System (WSPS), developed by Bristol Aerospace Limited. The WSPS consists of fuselage-mounted upper and lower cutters and a windshield centerpost deflector with a sawtooth cutter. Using the NASA/Langley Research Center Crash Impact Dynamics Facility, an OH-58A fitted with the WSPS was subjected to pendulum swing tests in which the helicopter struck fixed cables at approximately 40 knots airspeed. The system demonstrated the capability to easily sever 10,000 pound strength 3/8 inch steel messenger cable, 50-pair copper communications cable, and 0.419 inch high power transmission lines, including multiple arrays of those cables. Data acquired indicated that the wire impact/deflection/cutting sequence would not have a significant effect on helicopter performance, control crew functioning, or blade flapping. Installation of the WSPS on the entire Army tactical helicopter fleet is recommended. An additional test of a device to deflect wires past the helicopter skid gear, vertical stabilizer, and tail rotor was conducted. A 7/8 inch tubular steel deflector was designed and fabricated. The device proved to be inadequate. It was concluded that a skid gear deflector is not a practical OH-58A retrofit from a cost and weight standpoint. GRA

N80-30286# Transportation Systems Center, Cambridge, Mass.
VORTEX ADVISORY SYSTEM. VOLUME 1: EFFECTIVENESS FOR SELECTED AIRPORTS Final Report, Sept. - Dec. 1977
J. N. Hallock May 1980 122 p refs
(AD-A086982; TSC-FAA-80-11-1-Vol-1;
FAA-RD-80-62-1-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 17/7

The Vortex Advisory System (VAS) is based on wind criterion--when the wind near the runway end is outside of the criterion, all interarrival Instrument Flight Rules (IFR) aircraft separations can be set at 3 nautical miles. Five years of wind data have been obtained for 20 airports. By comparing the VAS wind criterion to the 5 years of wind data, the percentages of time that interarrival separations can be reduced at the 20 airports have been found. The percentages are given on an hourly and a monthly basis. Volume 2 (to be published at a later date) will examine the VAS effectiveness at Chicago O'Hare (ORD) with respect to the length of the intervals during which reduced separations might have been used. GRA

N80-30287# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
LIGHT TWIN-ENGINE AIRCRAFT ACCIDENTS FOLLOWING ENGINE FAILURES Special Study, 1972 - 1976
13 Dec. 1979 89 p refs
(PB80-177306; NTSB-AAS-79-2) Avail: NTIS
HC A05/MF A01 CSCL 01B

Data collected during the investigation of 477 light-twin aircraft accidents from 1972 through 1976 which involved engine failure or malfunction were studied. Pilot handbooks and other sources which provide information on engine-out performance and emergency procedures in light-twins were reviewed. A limited number of interviews with pilots and instructors were conducted. FAA training regulations were also studied. A major conclusion reached is that many of these accidents involved a lack of pilot proficiency in managing a light-twin after loss of power in one engine. Four recommendations are made to the FAA for corrective action and one previously made recommendation is reiterated. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-30288# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va. Flight Training and Aviator Selection.
TACTICAL NIGHT TERRAIN FLIGHT NAVIGATION Final Report
James A. Bynum and Garvin L. Holman Sep. 1979 49 p refs
(DA Proj. 2Q2-63743-A-772)
(AD-A086458; ARI-RR-1226) Avail: NTIS HC A03/MF A01 CSCL 01/2

This report documents two experiments which were conducted to determine the training required to improve tactical night terrain flight aircrew performance. These experiments sought, specifically, to identify critical factors which should be included in a program of instruction for tactical night terrain flight navigation training with unaided vision. In the first experiment a passive navigation task was used to establish an altitude which would provide adequate training with a safety margin, the types of terrain or other features which should be used for checkpoint identification, and the effect of daylight exposure to a route on subsequent navigation performance. Using Experiment 1 as a building block, Experiment 2 tested the effects on active navigation performance of light level, type of map, and order in which light level was experienced. Multiple step-wise linear regression was used to determine associations among the variables and provided an accounting of the variance attributable to each variable of interest. It was concluded that unaided vision navigation is possible at illumination levels as low as .0002 foot candles. Instructional programs must consider restrictions to visibility, map type, proper preflight planning, adequate dark adaptation, a standardized intra-cockpit phraseology, and should use natural terrain features with vertical relief for checkpoint identification. GRA

N80-30289# Analytic Sciences Corp., Reading, Mass.
DEVELOPMENT OF LORAN-C DATA COLLECTION AND ANALYSIS PROCEDURES Final Report, Dec. 1979 - Feb. 1980
Leon M. DePalma, Edward A. Sohoen, and Stephen F. Donnelly Mar. 1980 174 p refs
(Contract DOT-FA79WA-4271)
(AD-A086683; TASC-TR-1021-1; FAA-RD-80-48) Avail: NTIS
HC A08/MF A01 CSCL 17/7

A unified data collection and analysis plan to support NAFEC and the FAA in the assessment of Loran-C as either a replacement for or supplement to the current network of VOR/DMEs is presented. This effort focused on four specific areas: Developing mathematical models of temporal variations in Loran-C signal phase and amplitude; Developing data collection procedures to enable an assessment of the accuracy and adequacy of proposed models; Defining a data analysis plan that will enable maximum

use of the data collected in identifying parameters of the proposed models and cause and effect relationships of Loran-C temporal variations; and Defining a plan for the design of a data management system for the storage and maintenance of collected data and an efficient interface for the data analysis programs. The plans and models provide the necessary structure for the data collection and analysis effort anticipated to commence early in 1980. Subsequent analysis of the Loran-C data will validate the models and dictate any modifications of the plans. GRA

N80-30290# Naval Postgraduate School, Monterey, Calif.
POSITION DETERMINATION WITH LORAN-C TRIPLETS AND THE HEWLETT-PACKARD HP-67/97 PROGRAMMABLE CALCULATORS
Rex H. Shudde. Mar. 1980. 55 p. refs.
(NR Proj. 128-217)
(AD-A086823; NPS55-80-010) Avail: NTIS
HC A04/MF A01 CSCL 17/7

This report presents an algorithm and HP-67/97 programs for position determination with Loran-C chains. Operational data cards are prepared in advance for Loran-C triplets. Position determination is performed using a single program card and an appropriate operational data card. GRA

N80-30291# Naval Postgraduate School, Monterey, Calif.
AN ALGORITHM FOR POSITION DETERMINATION USING LORAN-C TRIPLETS WITH A BASIC PROGRAM FOR THE COMMODORE 2001 MICROCOMPUTER
Rex H. Shudde. Mar. 1980. 38 p. refs.
(NR Proj. 128-217)
(AD-A086790; NPS55-80-009) Avail: NTIS
HC A03/MF A01 CSCL 17/7

An algorithm for position determination using Loran-C triplets and an implementation of the algorithm in the BASIC language of the Commodore 2001 microcomputer are presented. Modifications of the geodesic direct solution and reverse solution algorithms of P. D. Thomas are also presented; these modifications eliminate all the special positioning and quadrant determination requirements of the original algorithms. GRA

N80-30292# Coast Guard, Washington, D.C.
COMMUNICATIONS REQUIREMENTS FOR A LORAN-C POSITION MONITORING SYSTEM FOR VTS VALDEZ, ALASKA Final Report
T. M. Drown. Jun. 1980. 46 p. refs.
(AD-A087199; USCG-D-36-80) Avail: NTIS
HC A03/MF A01 CSCL 17/7

The Coast Guard is investigating alternative means to provide increased surveillance capability in its Vessel Traffic Service (VTS) at Valdez, Alaska. The requirement is to extend active position monitoring of ships throughout Prince William Sound. One method of surveillance is to transmit Loran-C time differences from each ship to VTS Valdez for display and storage. This document defines the requirements for a Loran-C position monitoring system using the existing VHF-FM communication network. GRA

N80-30293# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
POWER LINE CARRIER RADIATION AND THE LOW-FREQUENCY AERONAUTICAL RADIO COMPASS Final Report
William A. Kissick. May 1980. 137 p. refs.
(Contract DOT-FA79WAI-023)
(AD-A087126; FAA-RD-80-31) Avail: NTIS
HC A07/MF A01 CSCL 17/3

The power line carrier is a telecommunication technique widely used by the power utilities for communication and telemetry. This system uses the power lines as a propagation medium and operates largely in the LF band. Potential for interference to an aeronautical radio compass operating in the 190-535 kHz aeronautical radio-navigation band exists. The purpose of this work was to examine that potential for interference. Laboratory measurements of radio compass receivers were made. These results indicate that 44 to 54 dBu of undesired signal or an undesired-to-desired signal ratio of 4 to 10 dB was required to cause measurable radio compass bearing errors, depending on the type of receiver. An airplane equipped with a spectrum analyzer/data recording system was used to make power line carrier radiation measurements over two selected power lines in Tennessee. The results indicate that, for the limited measurements taken, radio compass bearing errors could be caused by power line carrier radiation for an injected carrier power of 4 W. The distance and height dependence of the power line carrier radiation is discussed. GRA

N80-30294# National Technical Information Service, Springfield, Va.
AIR TRAFFIC CONGESTION AND CAPACITY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Guy E. Habercom, Jr. Jun. 1980. 194 p. Supersedes NTIS/PS-79/0594; NTIS/PS-78/0598
(PB80-811052; NTIS/PS-79/0594; NTIS/PS-78/0598)
Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 01E

Present and predicted air traffic density and capacity, both enroute and in airport environments, is analyzed in these research reports. Terminal area scheduling, runway queueing, and airspace regulation are discussed. This updated bibliography contains 186 abstracts, 14 of which are new entries to the previous edition. GRA

N80-30295# National Ocean Survey, Rockville, Md. Coastal Mapping Div.
FORMULAS FOR POSITIONING AT SEA BY CIRCULAR, HYPERBOLIC, AND ASTRONOMIC METHODS
James Collins. Feb. 1980. 36 p. refs.
(PB80-184757; NOAA-TR-NOS-81; NOAA-80040101) Avail: NTIS HC A03/MF A01 CSCL 17G

Today's positioning of a vessel is accomplished by using either hyperbolic (LORAN), circular (Raydist), celestial, or satellite navigation systems. The use of these systems with onboard computers often has created problems for the navigator and computer programmer ships' positions. This report is an attempt to clarify and simplify the formulas and procedures required to correctly compute the position of a vessel on the high seas. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see *also 18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N80-30296*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
CRASH TESTS OF FOUR IDENTICAL HIGH-WING SINGLE-ENGINE AIRPLANES
Victor L. Vaughan, Jr. and Robert J. Hayduk. Aug. 1980. 70 p. refs.
(NASA-TP-1699; L-13076) Avail: NTIS HC A04/MF A01 CSCL 01C

Four identical four place, high wing, single engine airplane specimens with nominal masses of 1043 kg were crash tested at the Langley Impact Dynamics Research Facility under controlled free flight conditions. These tests were conducted with nominal velocities of 25 m/sec along the flight path angles, ground contact pitch angles, and roll angles. Three of the airplane specimens were crashed on a concrete surface; one was crashed on soil. Crash tests revealed that on a hard landing, the main landing gear absorbed about twice the energy for which the gear was designed but sprang back, tending to tip the airplane up to its nose. On concrete surfaces, the airplane impacted and remained in the impact attitude. On soil, the airplane flipped over on its back. The crash impact on the nose of the airplane, whether on soil or concrete, caused massive structural crushing of the forward fuselage. The livesable volume was maintained in both the hard landing and the nose down specimens but was not maintained in the roll impact and nose down on soil specimens. Author

N80-30297# Douglas Aircraft Co., Inc., Huntington Beach, Calif.
EVALUATION OF THE IMPACT OF TOWING DC-9 TRANSPORT AIRPLANES AT BOSTON-LOGAN AIRPORT Final

Report, Sep. 1978 - Oct. 1979
E. A. Hoover May 1980 121 p
(Contract DOT-FA78WA-4198)
(AD-A086864; FAA-NA-80-23) Avail: NTIS
HC A06/MF A01 CSCL 01/2

This report summarizes an investigation to determine the impact of the proposed revisions to airport rules at Boston-Logan International Airport regarding ground movement of aircraft by towing in lieu of taxiing as it affects the fatigue life of the DC-9 aircraft. Tests were conducted using an instrumented tow bar to determine the range of loads which could be expected to occur in service. These loads were then incorporated into a loads model which represents the Boston-Logan towing regime. This loads model was then utilized to perform analysis on the DC-9 nose landing gear and its support structure to determine the fatigue effects. Cost estimates of additional testing, inspection and replacement of affected parts is provided. The results of this investigation indicate that several nose landing gear components could be seriously affected depending upon the degree of exposure to the additional towing at Boston and the number of flights already accumulated by the part at the time the additional towing is initiated at Boston. The immediate effect on these components could be minimized by a redistribution of aircraft within the airline fleet to reduce the exposure of high-time parts of the Boston towing regime. GRA

N80-30298# Systems Control, Inc., Palo Alto, Calif.
ANALYSIS OF T-2C HIGH ANGLE OF ATTACK FLIGHT TEST DATA WITH NONLINEAR SYSTEM IDENTIFICATION METHODOLOGY Final Report, 3 Apr. 1972 - 31 May 1978
James H. Vincent, W. Earl Hall, Jr., and Jeff G. Bohn Mar. 1980 90 p refs
(Contract N00014-72-C-0328)
(AD-A086327; ONR-CR-212-259-1F) Avail: NTIS
HC A05/MF A01 CSCL 01/3

This study represents one of the first thorough applications of advanced nonlinear system identification techniques to the problem of determining aircraft aerodynamic characteristics in the maximum-lift flight regime, and has produced results confirming the ability of these methods to develop realistic and useful dynamics models for flight test data and to provide a valuable guide for data acquisition system specification in future flight test programs. This study also demonstrated the value of employing wind tunnel data and theoretical (or empirical) aerodynamic analyses during the model structure determination stage in order to begin with a basic familiarity with the nature of nonlinearities to be encountered. GRA

N80-30299# Boeing Vertol Co., Philadelphia, Pa. Applied Technology Lab.
DESIGN, DEVELOPMENT, AND FLIGHT DEMONSTRATION OF THE LOADS AND STABILITY CHARACTERISTICS OF A BEARINGLESS MAIN ROTOR Final Report, Jun. 1976 - Oct. 1979
Peter G. C. Dixon Jun. 1980 162 p refs
(Contract DAAJ02-76-C-0026; DA Proj. 1F2-63211-D-157)
(AD-A086754; USAAVRADCOM-TR-80-D-3) Avail: NTIS
HC A08/MF A01 CSCL 01/3

The successful design, development, bench and whirl testing, and flight demonstration of the loads and stability characteristics of a bearingless main rotor (BMR) on the BO-105 helicopter were accomplished. The initial tests indicated that ground resonance damping was inadequate. For this program, a minimal modification, the stiffening of the aircraft skid landing gear, provided adequate damping for the continuation of the program. The BMR/BO-105 had similar air resonance to the baseline BO-105, except at low collective pitch settings where the BMR had lower but sufficient damping. Vibration levels were generally similar to the baseline, but in some regimes were higher. Maneuvering stability showed a significant improvement and other flight characteristics were similar to those of the standard BO-105. The level flight speed was limited only by power available and the 35-hr flight test program was not limited by structural characteristics. The feasibility of helicopter bearingless main rotors has thus been demonstrated. Understanding of the loads distribution in the two-beam lag/flap/torsion flexure at the blade root of this configuration needs improvement. Use of Froude scaled model wind tunnel testing accurately predicted the flight aeromechanical stability characteristics of the BMR; however, the analytical stability prediction methodology, although sufficiently accurate in hover, requires improvement and expansion into the forward flight modes. GRA

N80-30300# Aeronautical Research Labs., Melbourne (Australia).
CALIBRATION OF MIRAGE MAIN UNDERCARRIAGE TO DETERMINE WHEEL LOADS FROM MEASURED STRAINS
K. C. Watters and P. Atcliffe Jul. 1979 60 p refs
(AD-A086721; ARL/Struc-TM-300; AR-001-745) Copyright. Avail: NTIS HC A04/MF A01 CSCL 01/3

The port and starboard legs of a test main undercarriage of the Mirage IIIO have each been instrumented with six independent strain gauges and a potentiometer to measure oleo deflection. Calibration tests were performed in which components of the ground-to-wheel load were applied to each leg, both singly and in combination, and, from the measured strains, calibration parameters were derived. In order to determine wheel load components from measured strains, an iterative method of inverting the non-linear set of equations formed from the calibration parameters was developed. It was found that, due to the insensitive response of any gauge to the vertical load component, the equations were ill-conditioned, with calculated load components being very sensitive to changes in the measured strains. GRA

N80-30301# Aeronautical Research Labs., Melbourne (Australia).
FATIGUE DAMAGE ESTIMATION FOR THE BAeA AIRCRAFT FATIGUE DATA ANALYSIS SYSTEM
Robert C. Fraser Aug. 1979 58 p
(AD-A086470; ARL/Struc-TM-297) Copyright. Avail: NTIS
HC A04/MF A01 CSCL 01/3

The estimation of the fatigue damage from the strain range pair data generated by the airborne component of the BAeA Aircraft Fatigue Data Analysis System is described. GRA

N80-30302# Boeing Vertol Co., Philadelphia, Pa.
EVALUATION OF FORGED HELICOPTER COMPONENTS PROCESSED WITH CONTROLLED SOLIDIFICATION AND THERMAL MECHANICAL TREATMENTS Final Report, Dec. 1976 - Jun. 1980
William L. Weiss Jun. 1980 76 p refs
(Contract DAAG25-77-C-0015)
(AD-A086818; D210-11524-1; USAAVRADCOM-TR-80-F-6)
Avail: NTIS HC A05/MF A01 CSCL 11/6

A four task program was conducted to provide information for evaluating helicopter dynamic system components fabricated from aluminum alloy forgings produced with advanced processing techniques. Components produced with the advanced techniques, involving intermediate thermal-mechanical treatment of ingots, were tested side-by-side with conventionally produced components. Tests were conducted to determine fatigue strength and damage tolerance characteristics of the components. GRA

N80-30303# Lockheed-California Co., Burbank.
EVALUATION OF THE IMPACT OF TOWING THE L-1011 AIRPLANE AT BOSTON-LOGAN AIRPORT Final Report, Oct. 1978 - Aug. 1979
Max A. Gamon May 1980 113 p refs
(Contract DOT-FA78WA-4199)
(AD-A086977; LR-29190; FAA-NA-80-24) Avail: NTIS
HC A06/MF A01 CSCL 01/3

Results of a research program to determine the impact of towing transport airplanes at Boston-Logan Airport are presented. This study includes the measurement of actual towing loads during airline operations with the L-1011 at Los Angeles International Airport and Dorval, Quebec. The measured towing loads were obtained with an instrumented towbar and portable data recording package. Towing loads were also measured during controlled test conditions at Palmdale using the flight-test L-1011 airplane. A fatigue load spectrum representing ground maneuvering including the effects of extended towing was developed. Stress analysis of the nose landing gear and back-up structure was performed using the load spectrum representing extended towing at Boston-Logan. The results indicate that the proposed extended towing operations do not cause a reduction of fatigue life of the nose gear to below the design life for the L-1011. A discussion of alternate towing concepts is presented, and limiting condi-

tions are defined to ensure acceptable operational safety during extended towing. GRA

N80-30304# Analytic Sciences Corp., Reading, Mass.
A PLAN FOR DEVELOPING AND VALIDATING A GUN SYSTEM DESIGN TRADE-OFF METHODOLOGY Final Report, Jun. 1979 - Feb. 1980
Charles F. Price and Jang G. Lee 15 Feb. 1980 44 p refs
(Contract DAAK10-79-C-0213)
(AD-A087239; AD-E400432; TASC-TR-1640-1; ARSCD-CR-80008) Avail: NTIS HC A03/MF A01 CSCL 19/5

Procedures are described for validating a Helicopter Weapon Simulation Model (HWSSM) using data collected from Army's recent Air-to-Air Self Defense Test (AASDT), and for integrating the HWSSM with a gun system sizing model to compute system weight as a function of the basic performance parameters. These parameters include firing interval, probability-of-hit or probability-of-kill, the types of engagements, and the number of engagements of each type per mission. These procedures will provide the Army with an overall methodology for conducting airborne gun system design tradeoff studies. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-30305*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMULATION DEVELOPMENT AND EVALUATION OF AN IMPROVED LONGITUDINAL VELOCITY VECTOR CONTROL WHEEL STEERING MODE AND ELECTRONIC DISPLAY FORMAT
George G. Steinmetz Aug. 1980 97 p refs
(NASA-TP-1664; L-13435) Avail: NTIS HC A05/MF A01 CSCL 01D

Using simulation, an improved longitudinal velocity vector control wheel steering mode and an improved electronic display format for an advanced flight system were developed and tested. Guidelines for the development phase were provided by test pilot critique summaries of the previous system. The results include performances from computer generated step column inputs across the full airplane speed and configuration envelope, as well as piloted performance results taken from a reference line tracking task and an approach to landing task conducted under various environmental conditions. The analysis of the results for the reference line tracking and approach to landing tasks indicates clearly detectable improvement in pilot tracking accuracy with a reduction in physical workload. The original objectives of upgrading the longitudinal axis of the velocity vector control wheel steering mode were successfully met when measured against the test pilot critique summaries and the original purpose outlined for this type of augment control mode. R.K.G.

N80-30306# Smiths Industries, Inc., Clearwater, Fla. Aviation Div.
RELIABILITY AND MAINTAINABILITY IMPROVEMENT PROGRAM FOR THE AV-8 A/TAV-8A HARRIER HEAD-UP DISPLAY SET. VOLUME 1: MODIFICATIONS TO DIGITAL DISPLAY INDICATOR IP-1351/AVQ-30(V) Final Engineering Report, 1978 - 1980
Richard W. Lowrie 1 May 1980 18 p
(Contract N00019-77-A-0350)
(AD-A085309; SI-1003-Vol-1; NADC-78080-60-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 14/2

Modifications were made to the head-up display unit on the AV-8A aircraft, to improve reliability. The modifications consisted of substituting a quick release dual combiner for the servo driven single combiner, providing circuit protection against high voltage insulation breakdown, providing BIT-fail format indication in Test Mode 1, and U.S. sourcing of all components. GRA

N80-30307# Smiths Industries, Inc., Clearwater, Fla. Aviation Div.
RELIABILITY AND MAINTAINABILITY IMPROVEMENT PROGRAM FOR THE AV-8 A/TAV-8A HARRIER HEAD-UP DISPLAY SET. VOLUME 2: MODIFICATIONS TO DISPLAY SET CONTROL, C10626/AV9-30(V) Final Engineering Report, 1978 - 1980
Richard W. Lowrie 1 May 1980 15 p
(Contract N00019-77-A-0350)
(AD-A085310; SI-1002-Vol-2; NADC-78080-60-Vol-2) Avail: NTIS HC A02/MF A01 CSCL 14/2

Modifications were made to the pilots control unit for the head-up display on the AV-8A aircraft, to improve reliability. The modifications consisted of a new toggle switch designed to resist breakage or bending of the toggle arm, and new assembly instructions to prevent loosening or loss of push button covers or threaded components. GRA

N80-30308# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va. Manpower and Educational Systems Technical Area.
HELICOPTER ELECTRO-OPTICAL SYSTEM DISPLAY REQUIREMENTS. 2: PERFORMANCE OF HELICOPTER PILOTS WHEN USING A LOW-LIGHT-LEVEL TELEVISION SYSTEM DURING SIMULATED NAP-OF-THE-EARTH FLIGHT
Aaron Hyman, Richard M. Johnson, and Paul A. Gade Mar. 1980 21 p
(DA Proj. 2Q1-62722-A-765)
(AD-A086855; ARI-TR-442) Avail: NTIS HC A02/MF A01 CSCL 01/2

Previous ARI research has shown that pilots feel they can successfully use a low light level television system as an aid in night nap-of-the-earth (NOE) flight, even when the highlight luminance of its display is as little as 0.06 footlambert (fL). Videotaped presentations were used in this prior research, and estimations of the lowest usable display luminance were established on the basis of pilot judgment. The present experiment was designed to provide more objective evidence for determining the utility of such low luminance displays when they are used as aids in night NOE flight. Each of 24 Army helicopter pilots made 24 simulated flights over a highly realistic three dimensional terrain model as generated from an optical probe used in conjunction with an SIT television camera. The results showed that pilots had fewer crashes when using a larger display. All pilots flew as well with displays set so that highlight luminance was about 0.05 fL as they did with displays set so highlight luminance was about 0.2 fL. This report discusses the implications of these results for designing a usable low light level television system for night NOE flight. GRA

N80-30309# Hughes Aircraft Co., Culver City, Calif. Design Effectiveness Operations.
NONOPERATING FAILURE RATES FOR AVIONICS STUDY Final Technical Report, Sep. 1977 - Mar. 1979
George A. Kern, Steve S. Tung, Irving Quart, and Kam L. Wong Griffiss AFB, N.Y. RADC Apr. 1980 151 p refs
(Contract F30602-77-C-0187; AF Proj. 2338)
(AD-A087048; HAC-FR-79-70-1190R; RADC-TR-80-136) Avail: NTIS HC A08/MF A01 CSCL 14/4

This report presents the results of a study of the nonoperating failure rates of USAF avionic equipments. Quantitative assessment data on 26 different equipment/aircraft applications are included. The nonoperating failure rates as determined by three different methods utilizing Air Force maintenance data were measurably significant. On average, MTBF assessment results are improved by 22% when nonoperating failures are excluded from operational MTBF assessments. Average operating to nonoperating failure rate ratios for the equipments investigated ranged from 41 to 188. Comparisons between several reliability prediction methods and operational reliability levels achieved are included. Based on the six equipment types analyzed, it is concluded that field nonoperating failure rates cannot be predicted to a reasonable degree of accuracy by using any of the established prediction methods. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-30310*# General Electric Co., Cincinnati, Ohio. Aircraft Business Group.
ENGINE CYCLE STUDIES PROGRAM Final Report, Sep. 1978 - Oct. 1979
R. D. Allan, J. E. Johnson, W. Joy, R. H. Brown, and H. J. Barrial Aug. 1980 176 p refs
(Contract NAS3-21388)
(NASA-CR-159500; R80AEG428) Avail: NTIS HC A09/MF A01 CSCL 21E

The double bypass, variable cycle engine (VCE) used as the propulsion system for a Mach 2.4 cruise supersonic commercial transport was examined in the following areas: (1) the acoustic and performance payoffs of the high flow mode of the double bypass VCE; (2) possible cycle improvements for noise; (3) manufacturing cost, reliability and maintainability of the VCE compared to other engine concepts; (4) an assessment of the performance and economic payoffs of the features used in the double bypass VCE. The high flow capability of the double bypass VCE did show acoustic and performance payoffs both with unsuppressed and with mechanically suppressed coannular exhaust systems. At lower noise goals, changes to the baseline VCE cycle improved takeoff gross weight for a design version by up to 4%. The double bypass feature of the VCE provided performance and acoustic flexibility that resulted in lower takeoff gross weight for all noise levels, utilizing unsuppressed coannular nozzle, suppressed coannular nozzle, and single stream fully suppressed nozzle. The manufacturing cost, reliability, and maintainability of the double bypass VCE compares favorably with the simpler concepts studied (within 1 to 5.5%). L.F.M.

N80-30311# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
HIGH ENERGY X-RAY STUDY Final Report, Jan. 1978 - Feb. 1979
Malcolm K. Lewis Jun. 1980 204 p refs Prepared in cooperation with Lockheed Missiles and Space Corp., Palo Alto, Calif., and Varian Associates, Inc., Palo Alto, Calif.
(Contract F40600-78-C-0001)
(AD-A086279; AEDC-TR-79-53) Avail: NTIS HC A10/MF A01 CSCL 14/2

This study program investigated the feasibility, and developed a conceptual design, for an analytical/diagnostic X-ray system. This system would be used in existing AEDC test cells and would provide a capability to internally examine turbine engines and solid propellant rocket motors while operating under simulated altitude conditions. Diagnostic X-ray capabilities in each Test cell -- J-1/J-2, C-1/C-2, and J-5 -- were studied, and recommendations made. The participating contractors each developed conceptual plans for recommended equipment including the X-ray source, film detector, and positioning components. In addition, test cell environment, portability/survivability, cell modifications, personnel safety/radiation shielding and equipment standardization were studied, and recommendations were made. GRA

N80-30312# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Materials Behavior Branch.
VIBRATIONS OF A COMPRESSOR BLADE WITH SLIP AT THE ROOT Final Report, Nov. 1975 - Jun. 1979
David I. G. Jones Apr. 1980 144 p refs
(AF Proj. 2418)
(AD-A086852; AFWAL-TR-80-4003) Avail: NTIS HC A07/MF A01 CSCL 21/5

A simple discrete analytical model is developed to represent the vibration response behavior of a jet engine compressor or turbine blade, primarily in the fundamental mode, allowing for slip at the root. The analysis is compared with experiment, and agreement is found to be satisfactory, indicating that some of the phenomena involved can be modeled in a simple way. GRA

N80-30313# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
ADVANCED COMBUSTION SYSTEMS FOR STATIONARY GAS TURBINE ENGINES. VOLUME 4: COMBUSTOR VERIFICATION TESTING, ADDENDUM Final Report, Jul. - Oct. 1979
Robert M. Pierce, Clifford E. Smith, and B. S. Hinton Jan. 1980 119 p refs
(PB80-179849; FR-11405-Vol-4; EPA-600/7-80-017D-Vol-4)
Avail: NTIS HC A06/MF A01 CSCL 21E

Tests to evaluate the performance of the combustor on heavy fuels such as petroleum or shale residual oil and solvent refined coal (SRC) are described. Results from the tests show that all exhaust emission goals were met while burning three test fuels: a middle-cut distillate SRC, a residual shale oil, and an Indonesian/Malaysian residual oil. It was also demonstrated that the exhaust emission goals were met when operating a RB/QQ combustor at a high turbine inlet temperature (1426 C design) firing No. 2 fuel oil. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-30314# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
FEASIBILITY STUDY FOR INTEGRATED FLIGHT TRAJECTORY CONTROL FIGHTER Final Report, Jun. 1977 - Jun. 1979
Gregory L. Comegys, Leroy Addis, Jeffrey R. Ring, and Ronald VanWieren Wright-Patterson AFB, Ohio AFFDL Nov. 1979 311 p
(Contract F33615-77-C-3025; AF Proj. 2403)
(AD-A084784; ID-02R-0679; AFFDL-TR-79-3123) Avail: NTIS HC A14/MF A01 CSCL 09/2

The proliferation of increasingly sophisticated enemy military forces in the past decade, and the ability to quickly apply those forces anywhere in the world, has stressed the importance of a demonstrated deterrent capability. This capability should combine rapid reaction with the ability to apply the appropriate force at the appropriate place. Strategic and tactical power, global mobility and precise, well-ordered strike capability are necessary parts of the required capability. Communication and accurate time-space coordination will be required capabilities. The ability to strike at night and in adverse weather and to successfully redirect to a higher priority target, all in a well-coordinated manner, will help to offset the superiority of enemy aircraft numbers. The Integrated Flight Trajectory Control (IFTC) program has been concerned with solving these problems. The solution involves the development of a system which adds flight management capabilities through the use of digital computers to integrate guidance and control with control and display, navigation, weapon delivery, data-link systems and other on-board sensors. Following system development, the concept was demonstrated by realtime, man-in-the-loop simulation in the LSI Hybrid Computing Facility. GRA

N80-30315# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
THE USAF STABILITY AND CONTROL DIGITAL DATCOM. VOLUME 1: USER'S MANUAL Final Report, Aug. 1977 - Nov. 1978
John E. Williams and Steven R. Vukelich Wright-Patterson AFB, Ohio AFFDL Apr. 1979 313 p refs Supersedes AFFDL-TR-76-45-Vol-1 3 Vol.
(Contract F33615-77-C-3073; AF Proj. 8219)
(AD-A086557; AFFDL-TR-79-3032-Vol-1; AFFDL-TR-76-45-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 09/2

This report describes a digital computer program that

calculates static stability, high lift and control, and dynamic derivative characteristics using the methods contained in the USAF Stability and Control Datcom (revised April 1976). Configuration geometry, attitude, and Mach range capabilities are consistent with those accommodated by the Datcom. The program contains a trim option that computes control deflections and aerodynamic increments for vehicle trim at subsonic Mach numbers. Volume 1 is the user's manual and presents program capabilities, input and output characteristics, and example problems. The program is written in ANSI FORTRAN IV. The primary deviations from standard FORTRAN are Namelist input and certain statements required by the CDC compilers. Core requirements have been minimized by data packing and the use of overlays. User oriented features of the program include minimized input requirements, input error analysis, and various options for application flexibility. GRA

N80-30316# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
THE USAF STABILITY AND CONTROL DIGITAL DATCOM. VOLUME 2: IMPLEMENTATION OF DATCOM METHODS Final Report, Aug. 1977 - Nov. 1978
John E. Williams and Steven R. Vukelich Wright-Patterson AFB, Ohio AFFDL Apr. 1979 161 p refs Supersedes AFFDL-TR-76-45-Vol-2 3 Vol.
(Contract F33615-77-C-3073; AF Proj. 8219)
(AD-A086558; AFFDL-TR-79-3032-Vol-2; AFFDL-TR-76-45-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 09/2

This report describes a digital computer program that calculates static stability, high lift and control, and dynamic derivative characteristics using the methods contained in the USAF Stability and Control Datcom. Configuration geometry, attitude, and Mach range capabilities are consistent with those accommodated by the Datcom. The program contains a trim option that computes control deflections and aerodynamic increments for vehicle trim at subsonic Mach numbers. Volume 2 describes program implementation of Datcom methods. The program is written in ANSI FORTRAN IV. The primary deviations from standard Fortran are Namelist input and certain statements required by the CDC compilers. Core requirements have been minimized by data packing and the use of overlays. User oriented features of the program include minimized input requirements, input error analysis, and various options for application flexibility. GRA

N80-30317# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
THE USAF STABILITY AND CONTROL DIGITAL DATCOM. VOLUME 3: PLOT MODULE Final Report, Aug. 1977 - Nov. 1978
John E. Williams, Steven R. Vukelich, S. C. Murray, G. J. Mehlick, and T. B. Sellers Wright-Patterson AFB, Ohio AFFDL Apr. 1979 78 p refs 3 Vol.
(Contract F33615-77-C-3073; AF Proj. 8219)
(AD-A086559; AFFDL-TR-79-3032-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes a digital computer program that calculates static stability, high lift and control, and dynamic derivative characteristics using the methods contained in the USAF Stability and Control Datcom. Configuration geometry, attitude, and Mach range capabilities are consistent with those accommodated by the Datcom. The program contains a trim option that computes control deflections and aerodynamic increments for vehicle trim at subsonic Mach numbers. Volume 3 discusses a separate plot module for Digital Datcom. The program is written in ANSI FORTRAN IV. The primary deviations from standard FORTRAN are Namelist input and certain statements required by the CDC compilers. Core requirements have been minimized by data packing and the use of overlays. User oriented features of the program include minimized input requirements, input error analysis, and various options for application flexibility. GRA

N80-30318# Aeronautical Research Labs., Melbourne (Australia).
SEA KING MK. 50 HELICOPTER FLIGHT CONTROL SYSTEM: A MATHEMATICAL MODEL OF THE AFCS (ASW) MODE
Christopher R. Guy Jun. 1979 44 p refs
(AD-A086969; ARL/Aero-Note-393) Avail: NTIS HC A03/MF A01 CSCL 01/4

A mathematical model for the anti-submarine warfare (ASW) mode of the automatic flight control system (AFCS) for the Sea King Mk. 50 helicopter is presented. An outline of the ASW mode facilities is given first, followed by a description of the mathematical model, which includes a representation of each major element of the aircraft system. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

No abstracts in this category.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-30319*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TELECOMMUNICATIONS AND DATA ACQUISITION REPORT Progress Report, May - Jun. 1980
N. A. Renzetti 15 Aug. 1980 121 p refs
(Contract NAS7-100)
(NASA-CR-163431; TDA-PR-42-58) Avail: NTIS HC A06/MF A01 CSCL 17B

Deep Space Network progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implemention, and operations is documented. In addition, developments in Earth based radio technology as applied to geodynamics, astrophysics, and the radio search for extraterrestrial intelligence are reported. For individual titles, see N80-30320 through N80-30341.

N80-30320*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ACCURATE RADIO POSITIONS WITH THE TIDBINBILLA INTERFEROMETER c17
M. J. Batty (CSIRO, Sydney), D. J. Jauncey (CSIRO, Sydney), P. T. Rayner (CSIRO, Sydney), and S. Gulkis *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 1-5 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

The Tidbinbilla interferometer, designed specifically to provide accurate radio position measurements of compact radio sources in the Southern Hemisphere with high sensitivity using the 26 m and 64 m antennas of the Deep Space Network at Tidbinbilla, near Canberra, is discussed. The instrument also provides high accuracy flux density measurements for compact radio sources. E.D.K.

N80-30321*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TIDBINBILLA INTERFEROMETER c32
M. J. Batty (CSIRO, Sydney), D. L. Jauncey (CSIRO, Sydney), S. Gulkis, and M. J. Yerbury (Sydney Univ.) *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 6-8 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

A proposal to operate a two element interferometer using the 64 m and 26 m antennas of the Tidbinbilla Deep Space Station is discussed. The instrument is to be operated as a correlation interferometer, the sine and cosine products being

sampled once per second and recorded for later analysis. The receiver systems are currently under development. Preliminary measurements of the delay line and local oscillator systems and the site cables suggest that a phase stability to within about 1 deg should be achievable with temperature control of the receiver packages. E.D.K.

N80-30322*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DIGITAL RECORDING ACQUISITION SUBSYSTEM FOR RADIO INTERFEROMETRY APPLICATIONS IMPLEMENTATION PLAN c35
V. B. Kapoor *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 9-14 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14E

The digital recording acquisition subsystem (DRAS) is a wideband digital recording system that can accommodate data sample rates from 0.125 to 8 MHz in binary increments. The implementation of the DRAS for radio interferometry applications in support of the Crustal Dynamics Project is described. The functional and performance characteristics of the equipment and the key aspects of the implementation plan are discussed. E.D.K.

N80-30323*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI SYSTEM FOR WEEKLY MEASUREMENT OF UT1 AND POLAR MOTION: PRELIMINARY RESULTS c17
M. Roth and T. Yunck *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 15-20 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

The DSN implementation of a system for measuring UT1 and polar motion using very long baseline interferometry (VLBI) is currently being tested. The VLBI experiments are being conducted on a weekly basis on each of two intercontinental baselines. During a 17 day period in September 1979, data were obtained for seven consecutive experiments using an early version of that system. Those experiments were used to refine the estimation procedure to be used in the operational system and to provide a preliminary assessment of the performance of the system. E.D.K.

N80-30324*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROGRESS REPORT ON THE BLOCK 1 VLBI CORRELATOR IMPLEMENTATION c17
J. C. Peterson, J. W. Dillon, and D. H. Rogstad *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 21-23 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

The Block 1 VLBI Processor Subsystem (VPS) of the Very Long Baseline Interferometry (VLBI) System for the determination of station clock-sync parameters, UT1 and polar motion, and station platform parameters and for use in spacecraft tracking is discussed. The Block 1 VPS performs three basic functions: it receives the 500 kbit/sec video data over the GCF wideband data lines from each of the three DSN 64 m antennas; it cross correlates data; and it performs several postcorrelation data reduction operations on the correlated data including calibration, editing, and parameter estimation. E.D.K.

N80-30325*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BLOCK 1, PHASE 1 VERY LONG BASELINE INTERFEROMETRY IMPLEMENTATION c17
J. H. Wilcher *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 24-27 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

The Block 1, phase 1 VBLI System, implemented in the Deep Space Newtork and currently undergoing system testing, is discussed. The system can be characterized as the modification of existing equipment and the addition of new software in the 64 m subnet and the addition of new hardware and software in the Network Operations and Control Center. It is to be operational to support Voyager project navigation requirements and is to provide, on a weekly basis, the information related to station clock synchronization, UT1, and polar motion. E.D.K.

N80-30326*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 28-30 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized. Deep space station, ground communication, and network operations control capabilities are described. Author

N80-30327*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN MONITOR AND CONTROL SYSTEM, MARK III-80 c14
J. G. Leflang *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 31-33 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

The Deep Space Network monitor and control system, Mark III-80 is described. The major implementations required to evolve from the Mark III-78 to the Mark III-80 configuration are identified. The affected facilities are the deep space stations and the network operations control center (NOCC). At the deep space stations a stand-alone host processor is implemented. Included are software (host software) changes which provide downline loading to the stand-alone host processor from a disc unit of any idle data system computer. At deep space stations with a 34 m antenna, the microwave subsystem is provided with an interface which allows remote configuration selection at the central monitor and control operator's position. In the NOCC, software changes are implemented to provide precision power monitor and GCF monitor displays. M.G.

N80-30328*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEERS 10 THROUGH 12 SUPPORT c14
R. E. Nevarez *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 34-35 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

The activities of the Deep Space Network in support of the Pioneer 10 and 11 and Pioneer 12 (Pioneer-Venus) Missions from 16 December 1979 through 31 May 1980 are reported. The mission status for each of the spacecraft is also reported. M.G.

N80-30329*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEERS 6 THROUGH 9 SUPPORT c14
R. E. Nevarez *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 36-37 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

The cruise phases of Pioneer 6 through 9 missions and the operations of the Deep Space Network in supoort of the Pioneer missions are reported for the period of 16 December 1979 through 31 May 1980. Pioneer 6 through 9 are in cruise mode and spacecraft appear to be operating nominally. Pioneer 8 continues to require the 100 kW transmitter from 64 m stations due to the spacecraft's degraded receiver. Difficulties in acquiring a downlink from the Pioneer 6 are discussed. M.G.

N80-30330*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AUTOMATED FREQUENCY STANDARD STABILITY DATA REDUCTION c60
L. J. Knapp *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 38-40 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09B

A design using a medium sized computer, a fiber optic communication link, and a desk top computer to reduce data collected at a remote site for analysis of frequency standard

tests is described. Data generated at the Interim Frequency Standards Test Facility is collected on magnetic tape, which is then transported to a Sigma 5 computer. An Allan variance (two sample variance) is then calculated. The Allan variance (sigma vs tau) is then written to a data file in the Sigma 5. A fiber optic communication link between the Sigma 5 and a desk top computer was designed to transmit data in the Sigma 5 file to the desk top computer. A program was written for the desk top computer that will automatically access the data file in the Sigma 5, process the data and provide a data plot. M.G.

N80-30331*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SIGNAL TO NOISE RATIO CALCULATION FOR FIBER OPTICS LINKS **c74**

K. Y. Lau *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 41-48 refs (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 20F

The signal to noise ratio (SNR) effect upon the maximum transmission length of a fiberoptic system is discussed. The relationships of different system parameters are discussed. A general formula to obtain the SNR of a single mode fiberoptic system is derived. The SNR attainable with single mode and multimode fiber optics links was calculated from fundamental noise considerations. It was found that for single mode fibers, laser noise dominates the noise contributions for links less than 30 km long, while thermal noise dominates for longer links. Multimode fibers degrade SNR for long links because of intermode dispersion. For frequency standard transmission, as long as the baseband modulation signals are within the bandwidth of the fibers, respectable SNR can be attained with low loss fibers (approximately 1 dB/km) for links as long as 70 km. For wideband transmission SNR is decreased by a factor equal to the ratio of the bandwidth. M.G.

N80-30332*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

INPUT SIGNAL CONDITIONER FOR THE MULTIMEGASYMBOL TELEMETRY SYSTEM FEASIBILITY MODEL **c17**

G. L. Stevens *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 49-58 ref (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 17B

The input signal conditioner portion of the multimegasymbol telemetry demodulator and detector feasibility model is described. The input signal conditioner accepts the 55 MHz wideband IF signal of a Block 4 Deep Space Network receiver and provides selectable bandpass filtering, total power automatic gain control, and frequency translation providing inphase and quadrature outputs at baseband. M.G.

N80-30333*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

USE OF K SUB A-BAND FOR RADIO METRIC DETERMINATIONS **c32**

P. D. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 59-66 refs (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 20N

The use of K sub A-band to alleviate the radio metric degradation caused by charged particles is discussed. Those aspects of radio metrics which are relevant to the possible future use of K sub A-band deep space to Earth and Earth to deep space links are reviewed. In particular the effects of the Earth ionosphere, troposphere, and solar plasma are examined. It is concluded that, from the standpoint of reducing the harmful effects of charged particles, the use of K sub A-band appears highly desirable. While stability will be a more serious design constraint at K sub A-band than it is at X-band (for example in the ground power amplifier and the spacecraft multiplier stages) this problem is amenable to a state of the art engineering solution. M.G.

N80-30334*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

QUICKLIST: THE BASIS FOR A COMPUTER AIDED LOGIC DESIGN SYSTEM **c33**

W. A. Lushbaugh *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 67-71 (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 09C

Quicklist, a preprocessor for an existing wire list program that cuts the description of the wire list by about 67 percent over previous methods, is described. Quicklist uses two different methods to shorten the input data. The first of these is the use of parentheses to allow a compact way of describing signal names which increment (or decrement) by one, i.e., typical signal names in a bus. The other method used is the equal sign. Using this symbol in a signal list says that the rest of the signals on that chip are the same as those on the previous chip described. Quicklist is intended to be the basis of a computer aided logic design system. M.G.

N80-30335*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CONCERNING THE FEASIBILITY OF A REAL TIME SAR DIGITAL PROCESSOR FOR VOIR LOW RESOLUTION IMAGING MODES **c32**

T. K. Truong and R. G. Lipes *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 72-81 refs (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 17I

The feasibility of real time digital processing of synthetic aperture radar data for Venus orbiting imaging radar low resolution modes was investigated. First, it is shown that range migration is not a problem for these modes. Then, under the assumption of no range migration, fast Fourier transform implementations for accomplishing both range and azimuth correlation in real time are shown to be feasible with current technology. R.C.T.

N80-30336*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

FEASIBILITY AND COST STUDY ON VOIR SAR DATA TRANSFER VIA A BENT PIPE LINK **c32**

Y. H. Park and A. M. Goldman, Jr. *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 82-90 (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 17I

An INTELSAT/DOMSAT double hop bent pipe link for the Venus orbiting imaging radar synthetic aperture radar imaging data transfer from deep space stations 43 and 63 to the Jet Propulsion Laboratory was investigated. The cost for the bent pipe transfer was estimated and compared to that for the planned tape record/airfreight-the-tape transfer method. R.C.T.

N80-30337*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SPATIAL ACQUISITION OF OPTICAL SOURCES IN THE PRESENCE OF INTENSE INTERFERENCE **c74**

V. A. Vilnrotter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 91-96 refs (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 20F

The problem of spatially acquiring an optical beacon in the presence of intense optical interference is considered. It is demonstrated that conventional acquisition procedures cannot establish acceptable levels of acquisition probability when competing with strong optical interference without requiring unreasonable amounts of prime power. As a possible solution, it is shown that a more sophisticated acquisition scheme can virtually eliminate the effects of optical interference while requiring only a modest increase in system complexity. Author

N80-30338*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

NAVIGATION NETWORK OPERATIONAL CONSIDERATIONS **c17**

E. Hird *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 97-107 refs (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 17G

The development of the philosphy necessary for the initial operations costing of the three candidate navigation network designs is described. The effect of the need to minimize costs upon the operations and maintenance concepts, the simplification

of operations by adopting the very long base interferometry principle as a basis for the scenarios, and the estimation of the annual load factor based upon an assumed mission set are detailed. Author

N80-30339*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GROUND COMMUNICATION FACILITY AND NETWORK OPERATIONS CONTROL CENTER RECONFIGURATION c17
D. S. Bremner and C.-K. Hung *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 108-109 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

The reconfiguration of the computer facilities in the central communications terminal at the Jet Propulsion Laboratory is discussed. The status of both hardware and software changes are reported. R.C.T.

N80-30340*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
POWER LINE ANOMALIES AS THEY AFFECT THE OPERATION OF A DSN STATION: OVERVIEW c32
T. L. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 110-113 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20N

The problem of providing a sufficiently stable and reliable power source for the equipment in a DSN station is addressed. The potential for the occurrence of damaging commercial power variations is considered with respect to the need for a more precise power source. R.C.T.

N80-30341*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER-JUPITER RADIO SCIENCE DATA PAPERS c91
G. S. Levy and G. E. Wood *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 114-115 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 03B

The reduction and interpretation of the radio science data from the Voyager 1 and 2 encounters of the planet Jupiter and its satellites resulted in the preparation of several papers for publication in the special Voyager-Jupiter issue of the Journal of Geophysical Research. The radio science and tracking systems of the Deep Space Network provide the data which makes this research possible. This article lists submitted papers by title, with their authors and with abstracts of their contents. Author

N80-30342*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHUTTLE TIME AND FREQUENCY TRANSFER EXPERIMENT
D. W. Allan (NBS), C. O. Alley (Maryland Univ., College Park), R. Decher, R. F. C. Vessot (Smithsonian Astrophysical Observatory), and G. M. R. Winkler (Naval Observatory) Jun. 1980 32 p refs
(NASA-TM-78288) Avail: NTIS HC A03/MF A01 CSCL 22A

A proposed space shuttle experiment to demonstrate techniques for global high precision comparison of clocks and primary frequency standards is described. The experiment, using transmitted microwave and pulsed laser signals, compared a hydrogen maser clock onboard the space shuttle with a clock in a ground station in order to demonstrate time transfer with accuracies of 1 nsec or better and frequency comparison at the 10 to the -14th power accuracy level. T.M.

N80-30343*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HALLEY'S COMET 1985-86: A UNIQUE OPPORTUNITY FOR SPACE EXPLORATION
Robert W. Farquhar and William H. Wooden, II Jan. 1980 15 p refs
(NASA-TM-80633) Avail: NTIS HC A02/MF A01 CSCL 22A

A coordinated program to explore Halley's comet in 1985 to 86 is proposed. The program employs a variety of observational systems for remote observations and utilizes spacecraft encounters with the comet to obtain in-situ measurements. Included in the observational network are groundbased observatories, the Space Telescope, a Spacelab cometary observatory, small astronomical satellites, and experiments carried on airborne observatories and sounding rockets. It is assumed that a ballistic flythrough technique will be used to carry out the spacecraft encounters. The proposed strategy calls for the simultaneous launch of two spacecraft towards an intercept with Halley in March 1986. Following the Halley encounter one spacecraft is retargeted to intercept comet Borrelly in January 1988, while the other spacecraft proceeds to an encounter with comet Tempel 2 in September 1988. Author

N80-30344# Engins Matra, Velizy (France). Div. Etudes et Syntheses.
PROJECT MINOS: TECHNICAL STUDY Final Report [PROJET MINOS: ETUDE TECHNIQUE]
P. Bourg, J. Broquet, M. DoMauLam, and P. Rollier Jan. 1979 344 p In FRENCH; ENGLISH summary
(Contract CNES-78/0662)
(Rept-601/01) Avail: NTIS HC A15/MF A01

The MINOS project is an advanced study for large scale processing of materials in space, automatically and continously over a time span of 3 years. Concepts for automatic manipulation of materials, automatic supply of materials, and their retrieval from space were examined. A modular space station is proposed devoted mainly to material processing, but also to other missions such as observation and communication. Author (ESA)

N80-30345# European Space Agency, Paris (France).
[REPORT ON EUROPEAN SPACE ACTIVITIES, 1979] Annual Report
1979 175 p refs Original contains color illustrations
Avail: NTIS HC A08/MF A01

The year's activities are outlined including the scientific program, remote sensing, telecommunications, Spacelab, Ariane, satellite operations and data processing. Scientific and technical information services, ground facilities, administration, and budget are also discussed. Author (ESA)

N80-30346# European Space Agency, Paris (France).
GIOTTO: COMET HALLEY FLYBY. REPORT ON THE PHASE A STUDY
14 May 1980 87 p
(ESA-SCI(80)-4) Avail: NTIS HC A05/MF A01

The use of a GEOS type satellite, launched either by Ariane or by a Thor-Delta rocket, to intercept the nucleus of Halley's Comet close to the nucleus was studied. Present knowledge concerning comets was reviewed. The scientific objectives and a model payload including a lightweight camera, spectrometers, instruments for analyzing dust and plasma, and a magnetometer are described. A mission description including launch mass and launch windows is presented. Spacecraft structure, system configuration, thermal control, data handling, and power supply were analyzed. Scheduling, for the mission and development planning are proposed. Author (ESA)

N80-30347# European Space Agency, Paris (France). Space Science Dept.
[REPORT ON EUROPEAN SPACE ACTIVITIES]
W. R. Burke, ed. May 1980 315 p refs Presented at 23rd COSPAR Meeting, Budapest, Jun. 1980 Original contains color illustrations
(ESA-SP-1023) Avail: NTIS HC A14/MF A01

The 12 scientific satellites which were launched, and results obtained from analyses of data returned from them are reviewed. Findings are presented from satellites still active, Cos-B, GEOS-1, ISEE, IUE, and GEOS-2. Programs under development are reviewed; including Spacelab, Exosat, International Solar Polar Mission, Space Telescope, Firewheel, Hipparcos, and the Liquid Helium Cryostat. Author (ESA)

N80-30348# Societe Europeenne de Propulsion, Vernon (France). Dept. Espace.
STUDY ON THE UTILIZATION OF SOLAR ENERGY FOR THE OPERATION OF SPACELAB MATERIAL SCIENCE FURNACES Final Report

M. Robert, ed. and C. Fouche, ed. 1979 110 p refs
(Contract ESA-3787/78 F-FC(SC))
(ESA-CR(P)-1301) Avail: NTIS HC A06/MF A01

User requirements, Spacelab constraints, options for furnace type, sample storage and retrieval, and optics associated with the development of a solar energy system for a materials science furnace are studied. A design is proposed, including mass and dimensions, for an isothermal furnace for metallurgy experiments (temperatures up to 1800 deg). The mirror allows the concentration of 2 kW at the furnace aperture. The system is to be installed on a free flying pallet. Author (ESA)

N80-30349# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY ON THE UTILIZATION OF SOLAR ENERGY FOR THE OPERATION OF SPACELAB MATERIAL SCIENCE FURNACES Final Report
M. Bader, J. P. Baselt, W. Breitling, H. Lenski, and K. Suttner 24 Oct. 1979 113 p refs
(Contract ESA-3788/78-F-FC(SC))
(DS-ERT-21-79; ESA-CR(P)-1314) Avail: NTIS HC A06/MF A01

The user requirements, possibilities and constraints resulting from the Orbiter/Spacelab vehicle are summarized. The major elements of a solar heating facility are defined and technical solutions for the various components are outlined. Two different concepts are possible: a light concept and heat concept. The heat concept uses a heat storage element and heat pipe furnaces for isothermal, gradient or zone melting processing. It operates in day/night orbits up to temperature of 1250 - 1580 K, depending on the process. In the light concept light transfer in a light guide is discussed, but a more simple system with the furnace directly in the focus is described in detail. This furnace allows zone melting up to 3000 K and an isothermal coversion up to 200 K. For both concepts the technology is available and the usage of solar heating facilities appears very attractive.
Author (ESA)

N80-30350# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Electronics Div.
THE ROLE OF COMMAND AND DATA MANAGEMENT SUBSYSTEM (CDMS) IN A FUTURE PAYLOAD OPERATIONS SCENARIO Final Report
O. Neff, H.-J. Moster, and H. Reffel Feb. 1970 210 p refs
(Contract ESA-3906/79-F-HEW(SC))
(ESA-CR(P)-1325) Avail: NTIS HC A10/MF A01

Analysis of payload operation tasks resulted in an autonomous experiment concept. Features of the recommended concept include: experiment specific tasks are to be performed by microcomputers (Dedicated Experiment Processors - DEPs) and not by Command and Data Management Subsystem (CDMS); and development and complete checkout of autonomous experiments (hardware and software) is the principal investigator's responsibility. Based on this concept a payload operations scenario and requirements concerning crew activities, CDMS, and DEPs are defined. Modifications, necessary for the adaptation of CDMS to the concept, are described and include development of the DEP-Experiment Bus Adaptor, implementation of the subsystem computer/experiment computer link, and experiment computer system modifications. It is recommended that support be provided to the principal investigator to reduce experiment development and checkout costs by a DEP instrumentation pool and a CDMS simulation package for experiment checkout. ESA

N80-30351# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF TECHNICAL FEASIBILITY AND COSTING OF BIORACK. VOLUME 1: TECHNICAL REPORT Final Report
H. Braumann, W. Breitling, H. Francois, H. Lenski, P. Schiller, and P. Reusser (Reusser (Peter U.) A.G.) Nov. 1979 134 p
(Contract ESA-3988/79-F-DKR(SR))
(ESA-CR(P)-1332-Vol-1) Avail: NTIS HC A07/MF A01

Biorack is designed as a multi-user facility for carrying out biological experiments in Spacelab in the areas of cells, tissues, and micro-organisms. Fourteen proposed life science experiments have provided the basis for the Biorack design which consists of two different types of incubators, a freezer (-20 C minimum) and a glovebox for preservation and fixation techniques, all accommodated in one standard Spacelab single rack. Two each of two types of incubators are included in the Biorack, and operate in the temperature ranges of 27 C to 37 C (type 1) and 2 C to 27 C (type 2). A 35 mm camera, a high power microscope (1250 x), a low power stereo microscope (400 x), a centrifuge (200 g), and the necessary supporting subsystems for power conditioning and distribution, and data acquisition and recording, are included. For the development planning and cost estimation of the Biorack building phase, a low cost approach was adopted, which resulted in a development phase duration of 29 months and an estimated cost of about 5 million AU.
Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-30352*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
DESIGN OF A DYNAMIC TEST PLATFORM FOR AUTONOMOUS ROBOT VISION SYSTEMS
Gary C. Rich Aug. 1980 76 p
(Grant NsG-7369; Contract JPL-954880)
(RPI-TR-MP-69; NASA-CR-163500) Avail: NTIS HC A05/MF A01 CSCL 14B

The concept and design of a dynamic test platform for development and evluation of a robot vision system is discussed. The platform is to serve as a diagnostic and developmental tool for future work with the RPI Mars Rover's multi laser/multi detector vision system. The platform allows testing of the vision system while its attitude is varied, statically or periodically. The vision system is mounted on the test platform. It can then be subjected to a wide variety of simulated can thus be examined in a controlled, quantitative fashion. Defining and modeling Rover motions and designing the platform to emulate these motions are also discussed. Individual aspects of the design process are treated separately, as structural, driving linkages, and motors and transmissions. R.K.G.

N80-30326*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 28-30 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14B

N80-30327*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN MONITOR AND CONTROL SYSTEM, MARK III-80
J. G. Leflang *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 31-33 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

N80-30328*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PIONEERS 10 THROUGH 12 SUPPORT
R. E. Nevarez *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 34-35 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

N80-30329*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEERS 6 THROUGH 9 SUPPORT
R. E. Nevarez *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 36-37 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-30353 Institut d'Aeronomie Spatiale de Belgique, Brussels.
ARTIFICIAL SATELLITES, LIST FOR 1957 TO 1978 [TABLEAU DES SATELLITES ARTIFICIELS 1975 TO 1978]
J. Vercheval 1979 243 p refs In FRENCH; ENGLISH summary
(Aeronomica-Acta-F-28-1979) Avail: Issuing Activity

Successful launchings up to December 31, 1978 are summarized. A list of satellites is given with a brief description of the missions for the various types of satellites. A chronology of manned space flight is presented. Author (ESA)

N80-30354*# National Aeronautics and Space Administration, Washington, D. C.
MISSION OPERATION REPORT. GEOSTATIONARY OPERATIONAL SATELLITE GOES-D Mission Operation Report
4 Sep. 1980 44 p
(NASA-TM-81123; E-612-80-02) Avail: NTIS HC A03/MF A01 CSCL 22B

Descriptions of the Geostationary Operational Environmental Satellite (GOES-D) mission, spacecraft, launch vehicle, support, management responsibility, and projects costs are presented. The primary objectives are: (1) to launch the GOES-D into a synchronous orbit of sufficient accuracy to enable the spacecraft to provide continuous observations of the atmosphere on an operational basis; (2) to flight test the GOES-D in orbit, and when checked out, turn the spacecraft over to NOAA for operational use; and (3) to demonstrate, validate, and assess the temperature and moisture soundings from the Visible and Infrared Spin Scan Radiometer and Atmospheric Sounder. L.F.M.

N80-30355*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIATIONS IN THE NIMBUS-7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER COLD REFERENCE ANTENNA SIGNALS AND TEMPERATURES DURING TWO ORBITAL PERIODS
Per Gloersen, D. J. Cavalieri, and H. V. Soule (OAO Corp., Beltsville, Md.) Aug. 1980 73 p refs
(NASA-TM-81984) Avail: NTIS HC A04/MF A01 CSCL 22B

The observed effects of solar radiance on the Nimbus 7 scanning multichannel microwave radiometer (SMMR) cold reference signal are discussed. Unexpected diurnal responses in this signal sometimes larger than the typical cold reference signal resulted from acquisition of the solar disc. Solar heating of the SMMR components as a function of orbital locations was correlated with the cold reference radiances for two sets of sequential orbit six months apart. T.M.

N80-30356# Aerotherm Acurex Corp., Mountain View, Calif.
DEVELOPMENT AND TESTING OF TWO-STAGE HYBRID LAUNCHER Final Report
K. E. Suchsland and J. D. Watson 31 Oct. 1979 173 p refs
(AD-A086268; AD-E300807; ACUREX-FR-79-19/AS(7386))
Avail: NTIS HC A08/MF A01 CSCL 16/1

This report summarizes the development to date of a 1/4-scale launcher designed to launch a 7.2 kg model at a 6.1 km/sec in full scale. The hybrid launcher design principles are reviewed. Projected performance shows launch masses within soft-launch constraints that are 3 to 4 times larger than possible by using a conventional two-stage launcher. The results of component development tests leading to the subscale demonstration are presented. The importance of tungsten liners for obtaining the projected performance is emphasized, and the results of liner bond developments are described. GRA

N80-30357# Naval Ocean Systems Center, San Diego, Calif. Avionics Systems Branch.
HIGH TORQUE-TO-INERTIAL SERVO SYSTEM FOR STABILIZING SENSOR SYSTEMS. CANDIDATE SYSTEMS INCLUDE MISSILE GUIDANCE, SURVEILLANCE, AND TRACKING Final Report, Jul. 1979 - Jan. 1980
F. Dale Groutage Apr. 1980 275 p
(AD-A086705; NOSC/TR-527) Avail: NTIS HC A12/MF A01 CSCL 17/7

This is a technical report on the design and development of a high torque-to-inertia servo system for stabilizing a sensor system. The design philosophy leads to a low cost/high performance system. The stabilizing element developed is universal and has application for missile guidance, surveillance, and tracking sensor systems. The servo design is based on math models and is used to develop performance specifications and perform evaluations. GRA

N80-30358# Naval Research Lab., Washington, D. C.
RADIATION DOSE IN SATELLITES AT 1111 KILOMETERS WITH AN INCLINATION OF 63 DEG Interim Report
Mary D. Stemple 16 May 1980 35 p refs
(RR0120141)
(AD-A086779; AD-E000447; NRL-MR-4236) Avail: NTIS HC A03/MF A01 CSCL 22/2

A computer program was written to provide a convenient means of calculating the radiation dose received by a satellite in a specified orbit over a given time period. In this case, the orbit is circular at 1111 km altitude, 63 deg inclination. The input data required are tables of annualized orbit-integrated radiation dose vs. shielding thickness (or density) which were obtained from a separate calculation. These were prepared by the National Space Science Data Center, covering the time period from 1981 to 1989, from space environment models AP-8, AE-5, AE-6, AEI-7, and SOLPRO. The radiation dose was calculated using an infinite slab shielding geometry for trapped electrons, bremsstrahlung, trapped protons, and solar protons. A plotting routine for graphing 26 shield thicknesses up to 700 mils of aluminum is provided. Instructions for program execution and data deck setup, samples of the data tables and graphs, and a program listing are included. GRA

N80-30359# RAND Corp., Santa Monica, Calif.
SATELLITE CONSTELLATIONS FOR WORLDWIDE AND HEMISPHERE COVERAGE Final Report
L. N. Rowell Dec. 1979 58 p refs 3 Vol.
(Contract DCA100-78-C-0058)
(AD-A086920; RAND/N-1432-DCA) Avail: NTIS HC A04/MF A01 CSCL 17/2

Continuous Earth-to-space communications require that at least one satellite be in view of the ground station at all times. The satellite constellations discussed in this note are designed to maximize the probability that one or more of the satellites in the constellation will always be at an elevation angle of 20 degrees or more above the horizon of the ground station. (This maximum elevation angle is based on the assumption that millimeter waves will be used for communication.) Constellations of satellites in circular orbits at synchronous and five times synchronous altitude and also in elliptical orbits are presented. Some of the constellations are designed to maximize global coverage and station located anywhere on Earth) and others are designed to maximize coverage for the northern hemisphere. GRA

N80-30360# Aerospace Corp., El Segundo, Calif.
CHARACTERISTICS OF ELECTRICAL DISCHARGES ON THE T78-2 SATELLITE (SCATHA) Progress Report,

12 Feb. - 24 Apr. 1979
Harry C. Koons 15 Jul. 1980 28 p refs
(Contract F04701-79-C-0080)
(AD-A087249; TR-0880(5505-02)-2; SD-TR-80-49) Avail: NTIS HC A03/MF A01 CSCL 22/1

The P78-2 (SCATHA) satellite was launched on 30 January 1979 to measure the characteristics of the spacecraft charging process near synchronous orbit. A Charging Electrical Effects Analyzer onboard measures the characteristics of electrical discharges in both the frequency and time domain. Pulses are detected in response to commands, during electron and ion beam operations and during natural charging events. GRA

N80-30361# Centre National d'Etudes Spatiales, Toulouse (France).
RITZ 2 SOFTWARE: DYNAMIC LONGITUDINAL ANALYSIS USING A VARIATIONAL METHOD FOR SLENDER BODIES OF REVOLUTION CONTAINING LIQUIDS [LOGICIEL RITZ 2 - ANALYSE DYNAMIQUE LONGITUDINALE PAR METHODE VARIATIONNELLE DE STRUCTURES MINCES DE REVOLUTION CONTENANT DES LIQUIDES]
Henri Morand (Direc. de Lanceurs) and Bruno Belon (CAP SOGETI) Sep. 1979 355 p In FRENCH; ENGLISH summary
(CNES-NT-91) Avail: NTIS HC A16/MF A01

A variational method to study launch vehicle structures by longitudinal modal analysis is presented along with the corresponding software. The method is especially well adapted to liquid propellant rocket behavior. The added mass of the liquid is calculated on the basis of a hydroelastic hypothesis and according to theoretically defined variation principles. A matrix representation is generated numerically using a finite element routine. Machine memory loading is minimized by a simulataneous assemblyreduction subroutine. The RITZ 2 software computes eigenvalues, eigenvectors, generalized masses, and dynamic pressures for most axisymmetric configurations. The results are shown appropriate for pogo studies. A program user manual is also included. Author (ESA)

N80-30362# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY ON USE OF ISEE-B PLATFORM AS A PROBE FOR ESA/NASA COMETARY MISSION. VOLUME 1: TECHNICAL RESULTS Final Report
W. Trogus, R. D. Auer, R. Ockert, E. Bachor, L. Borucki, B. Caesar, R. Gieselmann, K. Goehler, M. Granzow, R. Hendricks et al Oct. 1979 291 p refs
(Contract ESTEC-3874/79-NL-MS)
(ESA-CR(P)-1316-Vol-1) Avail: NTIS HC A13/MF A01

The use of the existing international Sun Earth explorer B (ISEE-B) concept as probe for the planned cometary mission is assessed. A systems review covers mission and operations, selection and accommodation of a model payload as well as probe system configuration trade-offs. Starting from ISEE-B structure and subsystems, preferred solutions are selected and various options presented. Special points of effort were the definition of an micrometeorite hazard protection shield, the electromagnetic cleanliness, the confirmation of the thermal control design feasibility and the layout of spin-up ejection mechanism, which enclosed the antenna. It is concluded that the proposed probe baseline design and the subsystem concept are feasible and within state-of-the-art. Author (ESA)

N80-30363# European Space Agency, Paris (France).
SOUNDING ROCKET PROGRAM AERONOMY: COMPLEX PAYLOAD B2. REPORT OF SYSTEM DESIGN, INTEGRATION, TESTING AND FLIGHT
Hans Demharter, Guenter Hummeltenberg, Friedrich Kaczensky, and Hermann Waldmann Dec. 1979 128 p Transl. into ENGLISH of "Hoehenforschungsraketenprogramm aeronomie: Komplexe Nutzlast B2 Bereicht ueber Systementwicklung, Integration, Test und Flug" Rept. BMFT-FB-W-77-34 Messerschmidt-Boelkow-Blohm G.M.B.H., Ottobrunn, West Germany, Dec. 1977 128 p Original report in GERMAN previously announced as N79-30277
(ESA-TT-589; BMFT-FB-W-77-34) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 96

The technical design and development of three payloads for sounding rockets to be flown onboard SKYLARK 3 are described. Test results obtained during qualification and flight acceptance tests with these payloads are shown and the performance of the payload systems is evaluated using the operations data recorded during flight by the ground station. Author (ESA)

N80-30364# Engins Matra, Velizy (France). Automatisms Dept. Study and Synthesis Div.
STUDY OF OTS 2: INFLIGHT BEHAVIOR NUTATION INTERACTION WITH MOMENTUM WHEEL Final Report
Jean-Louis Lacombe, Delaunay, G. Pelta, and A. Legars Dec. 1979 89 p refs
(Contract ESA-3768/78-NL-JS)
(Rept-30/1357; ESA-CR(P)-1328) Avail: NTIS HC A05/MF A01

Synthesis of OTS 2 inflight data characterizing the nutation indicates a constant linear damping of the nutation conical angle with the Teldix wheel in service. With the signal wheel in service there is a nutation angle divergence the time constant of which has daily periodic variation (+ or - 30%). angle variation were investigated including: passive energy dissipation due to liquid sloshing and to structural damping; energy dissipation inside the wheel bearings; coupling between nutation motion and pitch control; coupling between nutation and solar array drive system; and interaction with the external geomagnetic and solar disturbances. Comparison between OTS 2 and Symphonie behavior supports the conclusion that Teldix wheel bearings do not contribute significantly to nutation angle decay. Analysis of the grease bearing characteristics indicates that the observed behavior is consistent with a worst case effect of the grease bearing. Simple and safe in-flight tests are proposed to validate the study assumption. Author (ESA)

N80-30365# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
BIRAMIS PAYLOAD STUDY. DETERMINATION OF THE RADIATION BALANCE OF THE EARTH WITH THE SPACE-BORNE MICROACCELEROMETER. VOLUME 2: CHARACTERIZATION AND SELECTION OF SPACECRAFT COATINGS Final Report [ETUDE DE LA DETERMINATION DU BILAN RADIATIF DE LA TERRE PAR MICROACCELEROMETRIE SPATIALE. ANNEXE 2: CARACTERISATION ET SELECTION DES REVETEMENTS]
Alain Paillous, Manola Romero, and Michel Riboulet May 1979 306 p refs In FRENCH; ENGLISH summary 3 Vol.
(Contract ESTEC-3454/77-NL-PP(SC))
(CERT-Vol-2; ESA-CR(P)-1334-Vol-2) Avail: NTIS HC A14/MF A01

Coatings for satellites were studied for a spacecraft which will measure the radiation budget of the Earth by detecting the radiation pressure through use of a microaccelerator (project BIRAMIS). Several types of coating were selected acting as radiation transducer and skin of the satlellite. Their optical properties were identified in the solar and infrared range, and the thrust coefficient of the satellite was estimated. Author (ESA)

N80-30366# Aerospace Engineering Office, Zurich (Switzerland).
STUDY OF A MATHEMATICAL MODEL OF A FLEXIBLE SOLAR ARRAY SUB-PANEL ASSEMBLY (VELSA 2) Final Report
K. J. Zimmermann 10 Dec. 1979 86 p refs
(Contract ESTEC-2990/76-NL-HP(SC))
(Rept-10.2-93/NT; ESA-CR(P)-1335) Avail: NTIS HC A05/MF A01

Methods and results of an analysis are presented for a flexible communication technology satellite (CTS) solar array sub-panel assembly and its correlation to test results. An approach is proposed for the design verification of large flexible solar arrays. The mathematical model used for the analysis of the blanket behavior is described and the methods applicable to the correlation of the mathematical model to the test results are discussed. The analytical results are given for the initial and the updated mathematical model for on-ground conditions. Dynamic results are provided for on-ground and on-orbit conditions differing from the later defined test conditions. Test enhancements are formulated based on the lack of data identified during the course of the model correlation. Aspects of the sensitivity of the mathematical

model to mesh size variations, boundary conditions, global and local stiffness changes, etc. were considered in the updated mathematical model. The latter predicts the test results with a sufficient accuracy (mean error 5%). Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-30367*# National Aeronautics and Space Administration, Washington, D. C.
THE SPACE SHUTTLE AT WORK
Howard Allaway 1979 83 p Original contains color illustrations
(NASA-SP-432; NASA-EP-156) Avail: NTIS HC $3.75/MF $3.75 CSCL 22B

The concept of the orbital flight of the space shuttle and the development of the space transportation system are addressed. How the system came to be, why it is designed the way it is, what is expected of it, and how it may grow are among the questions considered. Emphasis is placed on the effect of the space transportation system on U.S. space exploration in the next decade, including plans to make space an extension of life on the Earth's surface. J.M.S.

N80-30368*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
POGO SUMMARY REPORT MAIN PROPULSION TEST STATIC FIRINGS 1-7 FOR SHUTTLE DEVELOPMENT FLIGHT INSTRUMENTATION
C. M. Haddick, Jr. Jun. 1980 31 p refs
(Contract NAS9-15800)
(NASA-CR-160767; LEMSCO-15152; JSC-11613) Avail: NTIS HC A03/MF A01 CSCL 22B

Problems concerning the shuttle main propulsion system Polar Orbit Geophysical Observatory (POGO) instrumentation and the actions taken to correct them are summarized. Investigations and analyses appear to be providing solutions to correct the majority of questionable measurements. Corrective action in the handling of cables and connectors should increase the POGO measurement quality. Unacceptable levels of very low frequency noise and data level shifts may be related to test stand grounding configuration, but further investigation is required. L.F.M.

N80-30369*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Systems Engineering Dept.
STS-2 SAIL NON-AVIONICS SUBSYSTEMS MATH MODEL REQUIREMENTS
B. E. Carlton and R. W. Herold Jul. 1980 484 p
(Contract NAS9-15800)
(JSC-16748; LEMSCO-14524; NASA-CR-160772) Avail: NTIS HC A21/MF A01 CSCL 22B

Using a mathematical model, requirements for each of the nonavionic subsystems that interface with the shuttle avionics system are given. T.M.

N80-30370*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 LOW-SPEED GROUND NAVIGATION CONSOLE PROCEDURES
Jon Weaver Aug. 1980 308 p
(NASA-TM-81134; JSC-16701; Rept-80-FM-35) Avail: NTIS HC A14/MF A01 CSCL 22A

The space Transportation System 1 Flight onorbit mission phase is broken into three distinct subphases; those subphases being the rev 1 through rev 6 contigency reentry opportunities, the general onorbit time period, and the rev 34 to the postdeorbit Guam pass inclusive. The necessary information to ensure that sufficient data tables are accummulated in real time to support the postmission off line ancillary data analysis studies designed to support postmission ancillary data generation and investigation of mission related anomalies is given. T.M.

N80-30371*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
MISSION PLANNING AND ANALYSIS DIVISION DEVELOPMENT PLAN FOR STS-2 THROUGH STS-4
Mar. 1980 158 p
(NASA-TM-81133; JSC-16520; Rept-80-FM-27) Avail: NTIS HC A09/MF A01 CSCL 22A

The baseline products, schedules, and resource requirements for the Mission Planning and Analysis Division's support of Space Transportation System flights 2, 3, and 4 are presented. Major functions addressed are: orbiter software, Mission Control Center software, flight design, flight operations support, simulation tools, and postflight analysis. L.F.M.

N80-30372*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
FLIGHT FEASIBILITY ASSESSMENT OF SHUTTLE/LANDSAT-D/LANDSAT-D' MISSIONS
Richard E. Kincade and Michael B. Wortham Aug. 1980 44 p ref
(NASA-TM-81145; JSC-16760; Rept-80-FM-38) Avail: NTIS HC A03/MF A01 CSCL 22A

Because of performance limitations, the shuttle cannot rendezvous with the LANDSAT D satellite in its primary orbit; the actual rendezvous altitude is a function of the performance of the two LANDSAT vehicles and of the shuttle. The feasibility of retrieving LANDSAT D from a 210 n.mi. orbit, following delivery of LANDSAT D' to a 200 n. mi. orbit was assessed from an orbital analysis point of view. Parameters such as orbital altitude, phasing and length of rendezvous, which affect flight design for this flight are identified. The results of a study made for delivery to a 235 n. mi. orbit followed by retrieval from 245 n. mi. are included. A.R.H.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-30373*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
A HIGH SPEED TELEMETRY DATA LINK FOR AN AUTONOMOUS ROVING VEHICLE
David John Cipolle Aug. 1980 105 p refs Prepared for JPL
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163495; RPI-TR-MP-72) Avail: NTIS HC A06/MF A01 CSCL 09F

A data link system used on a prototype autonomous roving vehicle is described. This system provides a means of acquiring, formatting, and transmitting information on board the vehicle to a controlling computer. Included is a statement of requirements and the design philosophy. Additionally, interfacing with the rover systems is discussed, along with the overall performance of the telemetry link. Author

N80-30374# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SIMULANT REACTION TEMPERATURE MEASUREMENT VIA TELEMETRY FOR THE XM736 AT CHARGE 9 Final Report
William P. Damico, Jr. May 1980 61 p refs Supersedes ARBRL-IMP-639
(DA Proj. 1W4-64610-DF-94)
(AD-A086774; AD-E430472; ARBRL-MR-03021; ARBRL-IMP-639) Avail: NTIS HC A04/MF A01 CSCL 19/1

Six XM736 projectiles were fitted with a payload temperature measurement/telemetry system and fired at Charge 9 with flight times of approximately 100 seconds. Temperatures of the reaction produced by the liquid simulants were as high as 350 C during the terminal portions of the trajectory. These high temperatures

may be related to recent base failures that occurred during safety tests. GRA

N80-30375# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
TELEMETRY SYSTEM FOR EVALUATION OF BURN PROTECTION IN FULL-SCALE FUEL FIRE MANIKIN EXPOSURES Final Report
J. R. Piergallini and A. M. Stoll 1 May 1980 12 p refs (ZF61542001)
(AD-A086700; NADC-80092-60) Avail: NTIS HC A02/MF A01 CSCL 09/6

An eighteen channel PAM/FM (Pulse Amplitude Modulated/Frequency Modulated) telemetry system was developed for measuring temperature rise on the surface of a manikin beneath protective clothing for full-scale fuel fire exposures in completely enveloping flames. Thermistors are used as temperature sensors at various locations on a manikin surface and backed by material of known thermal properties in order to correlate temperature rise with skin burn damage. The transmitted signals are recorded on analog magnetic tape and converted to a digital format for computer analysis. The clothed manikin is passed through an aviation gasoline fire for three seconds with the telemetry system recording data during this period. Temperatures are analyzed at 0, 1, 2 and 3-second intervals with voltage outputs from the thermistors being converted to resistance readings and temperature readings by equations developed from curves of thermistor characteristics. Experimental results with respect to burn prediction are in agreement with data obtained by analysis of vesicant papers calibrated radiometrically to correlate with temperature-time effects productive of burns in living tissue. To date, 12 full-scale fuel fire tests have been conducted using the telemetry system and the performance of this system has exceeded original expectations in many respects such as sensitivity, accuracy and freedom from interference by ionizing gases within the flames. GRA

N80-30320*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ACCURATE RADIO POSITIONS WITH THE TIDBINBILLA INTERFEROMETER
M. J. Batty (CSIRO, Sydney), D. J. Jauncey (CSIRO, Sydney), P. T. Rayner (CSIRO, Sydney), and S. Gulkis *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 1-5 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

N80-30323*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI SYSTEM FOR WEEKLY MEASUREMENT OF UT1 AND POLAR MOTION: PRELIMINARY RESULTS
M. Roth and T. Yunck *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 15-20 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

N80-30324*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROGRESS REPORT ON THE BLOCK 1 VLBI CORRELATOR IMPLEMENTATION
J. C. Peterson, J. W. Dillon, and D. H. Rogstad *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 21-23 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

N80-30325*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BLOCK 1, PHASE 1 VERY LONG BASELINE INTERFEROMETRY IMPLEMENTATION
J. H. Wilcher *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 24-27 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

N80-30332*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INPUT SIGNAL CONDITIONER FOR THE MULTIMEGASYMBOL TELEMETRY SYSTEM FEASIBILITY MODEL
G. L. Stevens *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 49-58 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

N80-30338*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NAVIGATION NETWORK OPERATIONAL CONSIDERATIONS
E. Hird *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 97-107 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

N80-30339*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GROUND COMMUNICATION FACILITY AND NETWORK OPERATIONS CONTROL CENTER RECONFIGURATION
D. S. Bremner and C.-K. Hung *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 108-109 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-30376 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DYNAMICS AND CONTROL IN MODAL-SPACE OF FLEXIBLE SPACECRAFT Ph.D. Thesis
Hayrani Oz 1979 191 p
Avail: Univ. Microfilms Order No. 8020190

The independent modal space control proposed in this investigation shifts the problem of high dimensionality from the control problem to the structural dynamics problem, in recognition of the fact that the capabilities of available structural dynamics computational algorithms exceed those of modern control theory by at least one order of magnitude. The controller design is modular in form. Both nongyroscopic and gyroscopic systems are being considered. It is shown that for nongyroscopic systems no control spillover exists due to the uncontrolled modes included in the mathematical model. In the case of gyroscopic systems, the method calls for a 2nth order mathematical model to control n modes independently, which results in the elimination of the truncation effects relative to the 2nth order model in controlling the n modes. The derivation of a deterministic decoupled modal observer which estimates a linear combination of the modal state is given. Dissert. Abstr.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-30377*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
CALIBRATION VALIDATION FOR THE GEOS-3 ALTIMETER
C. F. Martin (Edgerton, Germeshausen and Grier, Inc., Riverdale, Md.) and R. Kolenkiewicz Jun. 1980 43 p refs Submitted for publication
(NASA-TM-80710) Avail: NTIS HC A03/MF A01 CSCL 14B

The absolute bias calibration for the GEOS-3 intensive mode altimeter was measured using two satellite passes whose

groundtracks were within 1 km of the Bermuda laser station. The Bermuda laser tracked on the two passes, and was supported by two other NASA lasers on one pass and by the NASA Spacecraft Tracking and Data Network on the other pass. For each pass, the altimeter data around Bermuda was smoothed and extrapolated to the point closest to overhead at the laser site. After correcting for tide heights and sea state effects, the two passes give calibration biases which are in agreement to within 26 cm and have a weighted mean of -5.69 + or - 0.16m for correcting altimeter measurements to the center-of-mass of the spacecraft (i.e., including the antenna tracking point correction). It was found impossible to reconcile the two calibration passes, as well as a set of altimeter crossovers in the middle of the GEOS-3 calibration area, without allowing for a data time tag error. On the bias of a selected set of four crossovers, and an assessment of probable sources of timing error, it was concluded that one interpulse period (10.24 msec) should be added to the data time tags. L.F.M.

N80-30378# Osservatorio Astronomico, Trieste (Italy). Gruppo Strumentazione ed Elaborazione Dati.
SUB ARC SECOND SENSOR CALIBRATION Final Report
G. Sedmark, S. Furlani, M. Pucillo, L. Rusconi, and P. Santin. 3 Nov. 1978. 155 p. refs.
(Contract ESTEC-3413/77-NL-AK(SC))
(OAT-586; ESA-CR(P)-1309) Avail: NTIS HC A08/MF A01

A feasibility study was performed for a subarcsecond sensor calibration system capable of performing geometrical calibrations on star and Sun sensors of accuracy of 1 milliarcsecond over + or - 1 arcsecond and 10 milliarcseconds over + or - 1 arcdegree, respectively. The realization of a calibration system consistent to the specified accuracy is meaningful only if the sensors to be calibrated are substantially insensitive to a rotationally symmetrical curvature of the wavefront output from the calibration system. The monitor subsystems required can be implemented by means of commercially available laser interferometers and autocollinators. The actuators required for positioning of the system components can be implemented by integrating commercially available piezoelectric actuators to custom-made electric motor endless screw actuators. The system should be isolated to external mechanical noise by a stack of two antivibration tables. Moreover, it is necessary to operate the system in a vacuum of 0.00001 atmosphere to avoid beam propagation errors induced by the atmosphere. The system should be computer controlled to optimize the calibration operations against internal mechanical noise, while the typical sensor scanning speed should not exceed 10 scans/second. Author (ESA)

N80-30379# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.
BIRAMIS PAYLOAD STUDY, VOLUME 1
A. M. Mainguy. 29 Jun. 1979. 137 p. refs. 3 Vol.
(Contract ESTEC-3454/77)
(ONERA-RT-4/3373-SYP-Vol-1; ESA-CR(P)-1334-Vol-1) Avail: NTIS HC A07/MF A01

The results obtained during the study of a spaceborne microaccelerometer are reported. The various coatings as well as the simulation are described in detail. Methods for calibrating this system on the ground and in orbit are discussed. R.C.T.

N80-30380# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de la Physique Generale.
BIRAMIS PAYLOAD STUDY. VOLUME 3: THE ACCELEROMETER SUPER-CACTUS [BIRAMIS - ETUDE DE LA CHARGE UTILE. 3: AVANT-PROJET DE L'ACCELEROMETRE SUPER-CACTUS]
A. Bernard, M. Gay, R. Juillerat, and M. LeFevre (Societe d'Applications Generales d'Electricite et de Mecanique). 25 Jun. 1979. 163 p. refs. In FRENCH; ENGLISH summary. 3 Vol.
(Contract ESA-3454/77)
(ONERA-RT-5/3373-SY-Vol-3; ESA-CR(P)-1334-Vol-3) Avail: NTIS HC A08/MF A01

A preliminary design study was performed for a three axis electrostatic microaccelerometer (Super CACTUS), having a measuring range of 10 to the minus 10th power m/sec. The instrument will be carried in the center of a spherical satellite measuring the Earth's radiation budget through detection of the radiation pressure (Project BIRAMIS). A capacitative mocrobalance was adapted to study the physical phenomena of the ball-cage contact. Experiments with this device are reported, along with theoretical studies supporting modifications to the original CACTUS device flown on the CASTOR experiment. Author (ESA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines, and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-30381 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Chemical Propulsion Information Agency.
THE 1980 JANNAF PROPULSION MEETING, VOLUME 5
Karen L. Strange, ed. Mar. 1980. 645 p. refs. Meeting held in Monterey, Calif., 11-13 Mar. 1980. 7 Vol.
(Contract N00024-78-C-5384)
(AD-A087063; CPIA-Publ-315-Vol-5) Avail: Issuing Activity CSCL 21/8

Liquid, solid, air breathing, and electric propulsion technology is presented in terms of tactical, strategic, and space applications. Specific emphasis is placed on propulsion technology for the space transportation system vehicles as well as communication satellites and missiles. For individual titles, see N80-30382 through N80-30421.

N80-30382* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL INVESTIGATION OF TWO HYDROGEN-OXYGEN ROCKET ENGINE SYSTEMS FOR LOW-THRUST APPLICATION
Dean D. Scheer. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p. 1-20. refs. (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21H

Two hydrogen-oxygen rocket engine system concepts were analyzed parametrically over a thrust range from 100 to 1000 pounds and a chamber pressure range from 175 to 1000 psia. Both concepts were regeneratively cooled with hydrogen and were pump fed by electric motor driven positive displacement pumps. Electric power was provided by either a turboalternator (turboalternator concept) or some means external to the engine system (auxiliary power concept). The computer program used to conduct the analyses along with the design characteristics of the major engine system components are briefly described. The feasible design range of the systems over the parametric range of thrust is discussed in terms of allowable chamber pressure considering the constraints of thrust chamber cooling and cycle power. Engine system estimated performance, mass, and dimensional envelope parametric data within the feasible design range are presented. Author

N80-30383* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LeRC REDUCED GRAVITY FLUID MANAGEMENT TECHNOLOGY PROGRAM
J. C. Aydelott and E. P. Symons. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p. 21-34. refs. (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21H

An overview of studies addressing reduced gravity fluid management problems using scale model propellant tanks in drop towers that provided up to five seconds of reduced gravity test time is given. The Cryogen Fluid Management Experiment designed to provide an orbital evaluation of a subcritical liquid hydrogen storage and supply as part of the shuttle/Spacelab program is described. An experiment to study orbital transfer of liquids and a Spacelab facility capable of housing multiple fluid dynamic and heat transfer experiments are also discussed.

Progress in the analytical evaluation of propellant management systems for both low and high thrust orbit transfer propulsion systems and the development of computer techniques for simulating reduced gravity fluid dynamic processes is reported.
J.M.S.

N80-30384* Rocketdyne, Canoga Park, Calif.
LEO-TO-GEO LOW THRUST CHEMICAL PROPULSION
J. M. Shop. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p. 35-51. refs (For primary document see N80-30381 21-20)
(Contract NAS3-21941)
Avail: Issuing Activity. CSCL 21H

One approach being considered for transporting large space structures from low Earth orbit (LEO) to geosynchronous equatorial orbit (GEO) is the use of low thrust chemical propulsion systems. A variety of chemical rocket engine cycles evaluated for this application for oxygen/hydrogen and oxygen/hydrocarbon propellants (oxygen/methane and oxygen/RP-1) are discussed. These cycles include conventional propellant turbine drives, turboalternator/electric motor pump drive, and fuel cell/electric motor pump drive as well as pressure fed engines. Thrust chamber cooling analysis results are presented for regenerative/radiation and film/radiation cooling.
J.M.S.

N80-30385 Aerojet Liquid Rocket Co., Sacramento, Calif. Orbit Transfer Vehicle Propulsion Systems.
ADVANCED EXPANDER CYCLE ENGINE FOR MANNED ORBIT TRANSFER VEHICLES
L. B. Bassham. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p. 53-67. refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity. CSCL 21/8

An approach to the design of a high energy orbit transfer vehicle (OTV) space engine using an advanced expander turbopump power drive cycle (AEC) is presented. The AEC engine concept selection resulted from an evaluation of potential performance, and risk reduction considerations. As such, the AEC engine meets all mission technical requirements of low weight, and high performance with a fixed envelope with maximum service life (totally reuseable) while maintaining benign operating environment for all critical components. Engine power cycle alternatives are evaluated against the design drivers and trades are made which isolate the most desirable features. Development risk is then factored into the evaluation to definitize the most desirable solution. The selected advanced expander engine (AEC) exemplifies the mergence of previous operational experience, manned system requirements and performance of high energy propellants with economic risk assessment for the manned orbit transfer vehicle engine.
J.M.S.

N80-30386* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UPPER STAGES UTILIZING ELECTRIC PROPULSION
David C. Byers. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p. 69-84. refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity. CSCL 21H

The payload capabilities of upper stages using electric propulsion for a LEO to GEO orbit transfer mission are presented. The impact on payloads of total mass in LEO, thrusting (trip) time, propellant type, specific impulse, and power source characteristics was evaluated. Dependent upon detailed assumptions, electric stages were found capable of delivering payloads in thrusting time less than 50 days with payloads always initially increasing rapidly with increasing thrusting times. For the shorter thrusting (trip) times the payloads increased with increasing propellant mass and decreasing specific impulse. At very long trip times, however, the payload increased with decreasing propellant mass and increasing specific impulse. Variation of the specific mass of the power source between 5 and 30 kg/kW caused the minimum trip times to vary about a factor of three and at short trip times strongly affected the electric stage payload capabilities.
J.M.S.

N80-30387 Rocketdyne, Canoga Park, Calif.
CRYOGENIC LOX/H2 ENGINE CANDIDATES FOR ORBITAL TRANSFER MISSIONS. PART 1: EXPANDER CYCLE OPTIMIZATION
R. Wahl, A. Martinez, A. Sobin, and J. Gloss. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p. 85-100 (For primary document see N80-30381 21-20)
Avail: Issuing Activity. CSCL 21H

Main propulsion LOX/hydrogen engines exhibiting high performance, high reliability, reusability, light weight, simplicity, and well advanced state of development were characterized for use in the orbital transfer vehicle (OTV). Two well known engine cycles (the staged combustion and the expander) demonstrated the best potential of meeting OTV requirements, with the staged combustion excelling in performance and the expander excelling in mechanical simplicity. Characterization included performance, weight, payload, cost, programmatics, engine off design operation, reliability, and risk assessment analyses. Results provided inputs for subsequent vehicle studies and indicated further optimization of both engines was in order. In the case of the expander cycle engine, further optimization has increased performance significantly, while in the case of the staged combustion cycle engine simplicity and performance are improved.
J.M.S.

N80-30388* Aerojet Liquid Rocket Co., Sacramento, Calif.
DUAL THROAT ENGINE DESIGN FOR A SSTO LAUNCH VEHICLE
C. J. OBrien and J. W. Salmon. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p. 101-118. refs (For primary document see N80-30381 21-20)
(Contract NAS8-32967)
Avail: Issuing Activity. CSCL 21H

A propulsion system analysis of a dual fuel, dual throat engine for launch vehicle application was conducted. Basic dual throat engine characterization data are presented to allow vehicle optimization studies to be conducted. A preliminary baseline engine system was defined. Dual throat engine performance, envelope, and weight parametric data were generated over the parametric range of thrust from 890 to 8895 KN (200K to 2M lb-force), chamber pressure from 6.89 million to 34.5 million N/sq. m (1000 to 5000 psia) thrust ratio from 1.2 to 5, and a range of mixture ratios for the two tripropellant combinations: LO2/RP-1 + LH2 and LO2/LCH4 + LH2. The results of the study indicate that the dual fuel dual throat engine is a viable single stage to orbit candidate.
Author

N80-30389* Thiokol Corp., Brigham City, Utah. Wasatch Div.
SPACE SHUTTLE SOLID ROCKET MOTOR (SRM) DEVELOPMENT AND QUALIFICATION
Robert K. Lund and Boyd C. Brinton. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p. 119-134 (For primary document see N80-30381 21-20)
(Contract NAS8-30490)
Avail: Issuing Activity. CSCL 21H

The configuration of reusable solid propellant motors for the space shuttle vehicle is delineated and traces their design evolution. Also presented are the summary results of the first two of the three qualification motor firings designated QM-1 and QM-2.
J.M.S.

N80-30390 Aerojet Liquid Rocket Co., Sacramento, Calif.
TITAN LIQUID BOOST MODULE FOR SHUTTLE PERFORMANCE AUGMENTATION
J. G. Muehlbauer and A. E. Inman (Martin Marietta Corp., Denver, Colo.). *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p. 135-145 (For primary document see N80-30381 21-20)
Avail: Issuing Activity. CSCL 21/8

The shuttle orbital vehicle 103/external tank 26 has a projected payload capability of 24,000 pounds on DOD Mission 4 with a 109% rated thrust level SSME, a 6,000 lb external tank weight reduction, and a 5,100 lb orbiter weight reduction. As this is significantly below the 32,000 lb Mission 4 requirement, performance enhancement, in the form of thrust augmentation is supplied by the Titan Liquid Boost Module (LBM). The Titan LBM, installed aft of the external tank, has ignition at five seconds after liftoff when the shuttle is clear of the facility. Following a 200 second burn, LBM is jettisoned using an ordnance separation device. This burn duration provides over 17,000 pounds

performance improvement at VAFB, well beyond Mission 4 requirements. J.M.S.

N80-30391* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FLUORINE-HYDRAZINE PROPULSION TECHNOLOGY UPDATE
D. L. Bond, M. A. Appel, and G. W. Kruger. *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 147-164 refs (For primary document see N80-30381 21-20)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H
The current status of the fluorine hydrazine propulsion system development is discussed. Progress on the components, rocket engine, and system design is presented. A detailed look at a fluorine hydrazine system as a potential propulsion option for the Galileo Project (Jupiter orbiter) is delineated and the results of safety and technical reviews which were accomplished to verify the feasibility of this option are summarized. J.M.S.

N80-30392* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A PUMP FED BIPROPELLANT PROPULSION SYSTEM FOR PLANETARY MISSIONS
P. N. Estey. *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 165-179 refs (For primary document see N80-30381 21-20)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H
A pump fed bipropellant liquid propulsion system is proposed for use on planetary missions. The primary use of this system is to provide the thrust for orbit insertion around the planet. The mass scaling equations for the pump fed and pressure fed N2O4/MMH propulsion systems are developed and presented graphically. It is shown that the pump fed propulsion system begins to be less massive than the equivalent pressure fed system at a propellant mass of approximately 450 kg (1000 lb sub m). Using the Venus Orbiting Imaging Radar (VOIR) mission as an example, it is shown that the pump fed propulsion system saves approximately 371 kg (818 lb sub m) of spacecraft mass at launch over the VOIR spacecraft using a pressurized propellant feed system. Some of the candidate pumps and drive systems are presented and briefly described. The applicability of the pump fed system to the JPL fluorine hydrazine propulsion system is also addressed. J.M.S.

N80-30393* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HEAT STERILIZABLE PROPELLANT DEVELOPMENT
F. A. Anderson, S. H. Kalfayan, and C. A. Wilkins. *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 181-201 refs (For primary document see N80-30381 21-20)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H
The development of solid propellants which are stable at temperatures up to 135 C for periods of time sufficiently long to allow the propellant to be thermally sterilized is considered. Ingredient modifications and processing methods developed enabling the processing of 32 kg (70 lbs) propellant grains that have successfully withstood seventeen cycles of fifty-four (54) hours each at 135 C are discussed. J.M.S.

N80-30394 TRW Defense and Space Systems Group, Redondo Beach, Calif. Subsystem Engineering Section.
UNDERSTANDING FLOW BLOCKAGE IN SMALL THRUSTERS
D. E. Fritz, R. L. Sackheim, and J. C. Lewis. *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 203-216 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8
The requirements of high performance, low thrust, and large total impulse of hydrazine engines used in geosynchronous communication satellites are discussed. The use of electrical augmentation energy to increase thruster specific impulse into the 300 second range is considered. The phenomenon of nonvolatile residue (NVR) deposition in the small diameter injector flow passageways of low thrust hydrazine engines is investigated. The deposition rate affects the life and performance of both conventional catalytic and electrical augmented thrusters. Data of nonvolatile residue induced flow blockage in hydrazine engines are presented. Mechanisms for NVR deposition and design considerations for minimizing or eliminating NVR buildup are discussed. J.M.S.

N80-30395 Communications Satellite Corp., Clarksburg, Md.
NORTH-SOUTH STATION KEEPING WITH ELECTRIC PROPULSION USING ONBOARD BATTERY POWER
B. A. Free. *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 217-229 refs Sponsored by the International Telecommunications Satellite Organization (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8
If electric propulsion is substituted for monopropellant hydrazine for north-south stationkeeping of geostationary satellites, a net propulsion system mass reduction equal to about one tenth of spacecraft mass is gained. Conventional solar cell powering of the electric propulsion system imposes a severe cyclic lifetime requirement. With onboard batteries, larger and more efficient thrusters can be used, and the required cyclic lifetime is reduced considerably. Battery powered electric propulsion becomes more feasible as the satellite end of life power-to-mass ratio increases, and as the thruster efficiency improves. Battery powered north-south stationkeeping (NSSK) is practicable for many satellites with state of the art electric propulsion hardware. Author

N80-30396 Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
US AIR FORCE PROGRAMS IN ELECTRIC PROPULSION
R. J. Vondra. *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 231-243 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21H
Development of the milliNewton solid Teflon pulsed plasma thruster (PPT) for auxiliary propulsion use is discussed. Exploratory efforts to evaluate the magnetoplasmadynamic (MPD) thruster, the pulsed inductive thruster and rail gun technology for primary propulsion application are described. J.M.S.

N80-30397 TRW Defense and Space Systems Group, Redondo Beach, Calif.
FRACTURE MECHANICS DESIGN OF SHUTTLE PAYLOAD PRESSURE VESSELS
J. C. Lewis. *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 245-268 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8
Shuttle payload safety policy permits fracture mechanics design of payload pressure vessels to save weight. The behavior of pre-existing cracks in thin walled metallic pressure vessels is described. A logical approach to fracture mechanics design of thin-walled pressure vessels is presented. Step-by-step procedures for determining initial crack sizes and crack propagation rates are given. Techniques for generating required fracture mechanics design data are described. Finally, an analytical example for determining the wall thickness from fracture mechanics properties is shown. J.M.S.

N80-30398 Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
PULSED PLASMA PROPULSION TECHNOLOGY
V. N. Benham and M. R. Brasher. *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 269-280 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8
A pulsed plasma propulsion system with an impulse bit approximately 50 times larger and total impulse approximately 25 times larger than previous is described. The helical feed thruster system consisting of electrodes, capacitors, electronics, and propellant is integrated into a high altitude facility and operated 24 hours a day. Direct impulse and mass discharge measurements are taken to determine the performance of the thruster. Analysis is made during testing of any deficiencies in thruster system design which affect the long life and high performance. The discharge life testing of low inductance, extended foil capacitors having a design life of 10 to the 7th power shots and an energy

density of 88J/kg when operated at rated voltage and peak currents of 35KA, reversal of 25%, and rep-rate below Hz is discussed. The earlier capacitors consist of aluminum foil and a dielectric sandwich of polyvinylidene fluoride film ('K-film'), paper, and castor oil impregnant. They have a nominal capacity of 65 mu fd and are rated 2.5KV. The newer capacitors are composed principally of aluminum foil, 'K-film' and silicon oil impregnant. These have a nominal capacity of 80 mu fd and are rated at 2.2KV. J.M.S.

N80-30399* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OXYGEN PRODUCTION FOR INTERPLANETARY RETURN MISSIONS
R. Richter, R. Ash (Old Dominion Univ., Norfolk, Va.), and W. Dowler *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 281-299 refs (For primary document see N80-30381 21-20)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

Interplanetary missions with extraterrestrial returns are limited by large propulsion mass requirements. The injected mass landed on an extraterrestrial body can be reduced substantially by utilizing indigenous materials for the production of propellant on the extraterrestrial body. Analyses reported show that for Mars return missions, in situ production of oxygen during the wait between landing and the next low-energy return opportunity reduces the Earth-launch mass requirements to the allowable limit for direct entry and direct return missions. A small chemical processor using radioisotope thermal energy can extract oxygen several times its own mass from carbon dioxide, during the several-hundred-days wait on Mars. The fundamental element of the concept is the electrolytic process. Solid electrolyte cells for extracting oxygen from gaseous feedstock are identified. The basic physical principles underlying the extraction process are analyzed, and the relations between the major parameters established. The laboratory equipment for experimental investigation of the process is presented. J.M.S.

N80-30400 Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
PROPULSION SUBSYSTEM FOR THE SATELLITE DATA SYSTEMS SATELLITE
J. K. Anthony (Air Force Space Div., El Segundo, Calif.) and W. W. Butcher *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 301-315 (For primary document see N80-30381 21-20)
(Contract F04701-79-C-0006)
Avail: Issuing Activity CSCL 21/8

An integral satellite propulsion subsystem designed to perform orbit transfer as well as on orbit attitude control is described. The considerations and decisions made in configuring and designing the propulsion subsystem for a spinning STS specialized spacecraft are outlined. The development of a new propulsion subsystem application is reported including the propellant tanks, solid motor, and bipropellant thrusters. The propulsion subsystem operation is discussed as it relates to the mission sequence following ejection from the shuttle cargo bay. The paper is concluded with a brief discussion of propulsion subsystem testing with emphasis on unique tests. J.M.S.

N80-30401 Ford Aerospace and Communications Corp., Palo Alto, Calif.
BIPROPELLANT PROPULSION SYSTEM FOR INSAT-1
V. A. Moseley and R. C. Stechman (Marquardt Corp., Van Nuys, Calif.) *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 317-324 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

The requirements, system design and component characteristics of the propulsion system for the INSAT-1 communications/meteorological satellite are presented. This three axis stablized satellite is the first to employ an integrated bipropellant N2O4 - MMH system to provide all propulsion maneuvers after transfer orbit injection for a geosynchronous satellite. A total impulse capability of 400,000 lb-sec with growth capability without hardware change up to 444,000 lb-sec is provided in this 132 lb dry weight system, which includes one 100 lb apogee thruster and twelve 5 lbf attitude and orbit control thrusters fed by two 33 in diameter titanium propellant tanks. Author

N80-30402 United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
IUS MOTOR CASE DEVELOPMENT
Hugh M. Reynolds *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 325-353 (For primary document see N80-30381 21-20)
(Contract F04701-78-C-0040)
Avail: Issuing Activity CSCL 21/8

The development of the 63- and 93- inch diameter Kelvar/epoxy filament wound rocket motor cases for the inertial upper stage (IUS) propulsion system is decribed. The (IUS) requirements for the motor case are discussed in terms of its performance beyond the state of the art for large composite motor cases. Particular emphasis is placed on the skirt structural load requirements for the SRM-1. R.C.T.

N80-30403 Thiokol Corp., Brigham City, Utah. Wasatch Div.
QUALIFICATION OF MINUTEMAN STAGE 3 MOTOR FOR SPIN STABILIZED PERIGEE STAGES
Evan E. Day *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 355-374 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

The third stage of the Minuteman III ICBM was modified for space transportation system launch as a tailored upper stage. In order to use the Minuteman unique combination of performance (2.1 million lbf-sec), reliability (100% on 140 tests), and maturity (900 built), the motor was static fired while spinning at 70 rpm and 100 F, and also at 40 rpm and 40 F after three full temperature cycles. The propellant was also tested for spin effects up to 27 g in small motors, and the ignition system, propellant and case materials subjected to long vacuum exposure. All of the conditions of carry and launch from the shuttle were extensions of previous qualification on expendable missile vehicles. R.C.T.

N80-30404 Norton AFB Ballistic Missile Office, Calif.
MISSILE-X OVERVIEW
James A. DiBiase *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 375-386 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

An overview of the Missile-X (MX) weapon system is presented. The missile as well as the main features of its operation are summarized. The technologies being used in the development of the MX missile are described, an assessment of their risk is presented, and a comparison is made with the Minuteman III missile. A brief description is given of the proposed basing concept as well as its planned mode of operation are also given. R.C.T.

N80-30405 Thiokol Corp., Brigham City, Utah. Wasatch Div.
MX STAGE 1
Jack G. Hilden and P. R. Dykstra *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 387-396 (For primary document see N80-30381 21-20)
(Contract F04704-78-C-0009)
Avail: Issuing Activity CSCL 21/8

The full scale development of the MX missile is described. The operation modes of the stage one program are addressed with emphasis on the following: the functional requirements of the stage; the first stage performance requirements; and the program structure. R.C.T.

N80-30406 Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
COMMAND CONTROL OF SOLID PROPELLANT GAS GENERATORS AND THRUSTERS BY HOT CUTTERS
Leonard H. Caveny *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 397-411 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

A propulsion concept which is based on a simple thermomechanical means of increasing the rate at which the propellant burning surface regresses. The rocket motor firings which demonstrate the feasibility of the concept are described. It is shown that thrust and mass generation rate modulation ratios

in excess of 20:1 are possible. Motor firings demonstrated the fail-safe properties of the concept. The concept is not limited by the burning rate pressure exponent or by difficulties in burning metallized/fuel-rich propellants. applications to thrusted and masking decoys are described. R.C.T.

N80-30407 Auburn Univ., Ala. Dept. of Chemistry.
SYNTHESIS OF CMP BEGINNING WITH SODIUM BOROHYDRIDE **c28**
F. A. Johnson and W. E. Hill. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p 413-422. (For primary document see N80-30381 21-20)
(Contract DASG60-78-C-1043)
Avail: Issuing Activity. CSCL 21/8

The chemical synthesis of carborane was accomplished via three major steps: (1) pyrolysis of BH4(-) to B10H10(-2); (2) cage opening of B10H10(-2) to B10H12L2 (Lewis base); and (3) conversion of B10H12L2 to carborane. A differential scanning calorimeter was used to study the pyrolysis of Et4NBH4. The results are consistent with preparation of BH10H10(-2) ion in high yield. Efforts to ameliorate the erratic nature of the B10H10(-2) synthesis were patialy successful. Yields of 50% were consistently obtained at one atmosphere in conventional glass apparatus. R.C.T.

N80-30408 Callery Chemical Co., Pa.
PYROLYSIS OF (C2H5)4NBH4 TO [(C2H5) 4N] 2B10H10: USE OF A LIQUID HEAT TRANSFER MEDIUM **c28**
J. L. Little and R. M. Hunt. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p 423-433. refs (For primary document see N80-30381 21-20)
(Contract DASG60-78-C-0146)
Avail: Issuing Activity. CSCL 21/8

Scaleup of the pyrolysis of tetraethylammonium borohydride (Et4NBH4) to (bis)-tetraethylammonium dodecahydrododecaborate ([Et4N]2B10H10) was accomplished using triethlamine borane (TEAB) or mineral oil to obtain a stirrable slurry as an aid to heat transfer. The optimum ratio of Et4NBH4 to TEAB was 1.5 to 1. Reactor modification which facilitates removal of triethylamine lead to higher overall product yields and a higher percentage yield of B10H10(-2). Substituting mineral oil for TEAB gave lowered yield to B10H10(-2) further verifying that TEAB participates in the pyrolysis reaction. R.C.T.

N80-30409 Thiokol Corp., Huntsville, Ala.
REDUCTION IN COST OF ROCKET MOTOR MANUFACTURE BY USE OF LINER WITH CONTROLLABLE CURE
R. T. Davis, J. D. Byrd, I. G. Shepard, and K. E. Bevel. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p 435-465. (For primary document see N80-30381 21-20)
Avail: Issuing Activity. CSCL 21/8

A method was developed that reduces the processing costs of solid propellant rocket motors. This method employed the blocked isocyanate principle to produce a liner with a controllable cure which provides for either a short or long pot life and hold time capability. Cost reduction was achieved by flexibility in scheduling and utilization of equipment and facilities. A liner pot life in excess of 400 hours at 25 C (77 F) was demonstrated; at lower temperatures, a pot life in excess of 12 weeks was obtained. R.C.T.

N80-30410 Aerojet Liquid Rocket Co., Sacramento, Calif.
SINGLE STAGE LIQUID PROPULSION SYSTEMS: SPECIFIC OPTIMA FOR NRBM VEHICLES
D. W. Culver. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p 467-480. (For primary document see N80-30381 21-20)
Avail: Issuing Activity. CSCL 21/8

Storable bipropellant liquid rocket propulsion systems were evaluated for Medium Range Ballistics Missiles Vehicle application. Propulsion subsystem scoping studies, system conceptual designs, system mathematical modeling, and computer aided parametric system evaluation were included. Subsystem concept selections included propellants, propellant feed system, tankage geometry, propellant control, tank pressurization, pump fed engine cycle, thrust chamber assembly geometry, and thrust chamber assembly cooling. Results indicate the single stage selected design to be lighter weight than a two stage solid or liquid pressure fed system for equal range and payload requirements and to provide lower missile system life cycle cost than a two stage solid. R.C.T.

N80-30411 Rocketdyne, Canoga Park, Calif.
ADVANCES IN PROPELLANT PROPULSION TECHNOLOGY FOR INTERMEDIATE RANGE BALLISTIC MISSILE
D. L. Leonard, W. R. Bissell, W. H. Geniec, and I. E. Rosman. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p 481-499. Sponsored by General Dynamics/Convair. (For primary document see N80-30381 21-20)
Avail: Issuing Activity. CSCL 21/8

Currently available liquid propulsion system technology was applied to intermediate range ballistic missiles and shows advantages over solid propellant systems in terms of range, performance, and weight. Design of specific systems was based upon parametric data optimization and new technology data developed for air launched and ground launched ballistic missile systems through in house and contractual studies. Both pressure fed and pump fed liquid propellant systems were studied for a variety of propellant combinations, payload reqirements, launch constraints, and missile ranges. Pump fed systems were found to be lighter weight and higher performing than equivalent solid motor systems for both ground launched and air launched missiles. Pump fed system were also found to be smaller and higher performing for the same range and payload requirements than the comparable pressure fed missiles. It was determined that a combined lighter weight tank structure and rocket engine could be used with the pump fed liquid system and propellant carry capability improvements realized through better packaging within the missile's gross weight limit for pump fed systems. R.C.T.

N80-30412 Aerojet Solid Propulsion Co., Sacramento, Calif. Aerojet Tactical Systems.
DEVELOPMENT OF A REDUCED SMOKE ROCKET MOTOR FOR THE AIM-9B, E, J, P SIDEWINDER MISSILE
R. S. Newman and P. L. Smith. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p 501-521. ref (For primary document see N80-30381 21-20)
(Contract F04611-76-C-0045)
Avail: Issuing Activity. CSCL 21/8

The results of the balance of development and the subsequent qualification program, in which all tests were successfully completed, except hot aging followed by cold firing are described. An extensive company sponsored failure analysis program was conducted in which the cause of the anomalous performance of the aged motors was determined to be hardening of the propellant in the forward section of the motor due to the migration of plasticizer from the propellant into the insulator/liner. Subsequently, sufficient plasticizer was added to the liner to establish a chemically balanced system. Motors made with the modified liner formulation were successfully hot aged and cold fired, qualifying the motor for production. R.C.T.

N80-30413 Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
MACH 3 HYDROGEN EXTERNAL/BASE BURNING
Warren C. Strahle, Douglas H. Neale, and James E. Hubbartt. *In* APL. The 1980 JANNAF Propulsion Meeting, Vol. 5. Mar. 1980. p 523-543. refs (For primary document see N80-30381 21-20)
(Grant AF-AFOSR-2794-75)
Avail: Issuing Activity. CSCL 21/8

Experimental studies of base pressure manipulation for an axisymmetric model at Mach 3 with simulated and actual external/base burning are described. Early work using contoured test section walls and cold gas base region injection is reviewed to demonstrate wake detail and length scale changes under the influence of simulated external/base burning. Tests with actual combustion of radially and axially injected hydrogen are then reported. Outstanding performance values with significant base drag reduction is shown for injection and burning directly in the near wake (base burning). Current attempts at radial injection and burning in the free stream (external burning) have not yet succeeded. These tests, however, have defined an envelope within which external burning, if feasible, is achieved. Author

N80-30414 Textron Bell Aerospace Co., Buffalo, N. Y.
MODULATION OF A GAS GENERATOR
Morton Shorr *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 545-556 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

A theoretical mathematical examination of gas generator modulation that can be achieved by injecting an oxidizer into the combustion zone of an underoxidized solid propellant grain is presented. The chamber pressure time history is assumed to have a comparable slope with and without injection so that pressure modulation limits define also the mass flow limits.
J.M.S.

N80-30415 Thiokol Corp., Brigham City, Utah. Wasatch Div.
HARM ROCKET MOTOR DEVELOPMENT
In APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 557-567 (For primary document see N80-30381 21-20)
(Contracts N00123-74-C-1772; N00123-76-C-0183)
Avail: Issuing Activity CSCL 21/8

The YSR113-TC-1 rocket motor developed for use in the AGM-88A high speed antiradiation missile (HARM) is described. The HARM Weapon System is designed to detect, acquire, display, and select a radiating surface-to-air threat and to launch a missile which will guide to and destroy the threat. The weapon system is employed on A-6, A-7, and F/A-18 aircraft and on the F-4G. Features of the rocket motor discussed are: an envelope 2.12 m (83.5 in) in length and 0.254 m (10.0 in) in diameter; the required impulse in accordance with a prescribed boost/sustain thrust profile; interface with the launcher, control section, and four aerodynamic fins; and a low visual signature during flight.
J.M.S.

N80-30416 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
POST-LAUNCH RESULTS OF THE TIP SPACECRAFT PULSED-PLASMA MICROTHRUSTERS
Stanley J. Kowal *In its* The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 569-582 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

Two satellites developed as a part of the Transit Improvement Program (TIP) incorporated microthrusters of the pulsed jet type. These thrusters, also referred to as Teflon solid propellant propulsion systems (TSPPS) are described. The two satellites, known as TIP-II and TIP-III, both had malfunctions which prevented them from achieving full operational capability, but the malfunctions did not prevent a complete and successful test of the operation of the TSPPS including firing of one thruster more than 1.2 million times (about 20% of its operational life).
J.M.S.

N80-30417 Nevada Univ., Reno. School of Mines.
MEASURED AND PREDICTED LASER SIGNAL ATTENUATION THROUGH A SOLID ROCKET PLUME
Eugene Miller, J. W. Connaughton (Army Missile Command), and L. B. Thorn (Army Missile Command) *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 583-593 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

In response to the need for smokeless solid rockets for a new generation of missiles, smoke was characterized. Laser attenuation through solid rocket plumes was measured in static and flight tests. Modeling of the formation of secondary smoke in the plume and the attenuation of a laser signal through it was conducted. Results are presented comparing predicted and experimental laser signal attenuations for a flight test using a rocket loaded with 87% ammonium perchlorate - 1% Al - HTPB binder.
J.M.S.

N80-30418 Thiokol Corp., Brigham City, Utah. Wasatch Div.
LLMM SRAM 3-D GRAIN STRUCTURAL ANALYSIS c28
A. W. Macbeth *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 595-612 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

During the SRAM Longer Life Motor Modification (LLMM) development program, soft and hard propellant areas were found near the propellant-liner-insulation bondline. Structurally, this grain condition was thought to be detrimental. A technique was developed to characterize the mechanical and failure properties of soft and hard propellants. Analyses indicated that an LLMM SRAM grain with soft and hard layer penetrometer readings between 0.7 and 6.2 mm met the SRAM 0.4 MS design criteria. Structural test vehicle (STV) mechanical behavior results showed that the laboratory uniaxial constant strain stress relaxation modulus data did not accurately represent propellant grain behavior during most loading conditions. Conversely, laboratory uniaxial constant strain rate initial tangent modulus or maximum stress secant modulus data did represent grain mechanical behavior. STV deformations were predicted accurately when these data were used. Another STV result showed that near bondline grain soft spots appeared to be averaged or masked out; therefore, the uniform soft layer assumption was found experimentally to be conservative. The LLMM SRAM grain structural adequacy was demonstrated by the absence of failure in three STVs.
J.M.S.

N80-30419 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Fuels Branch.
LIQUID AIRBREATHING MISSILE FUELS: AN OVERVIEW OF PROPERTIES AND APPLICATIONS c28
James R. McCoy *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 613-619 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

Critical design properties are listed and discussed for the liquid hydrocarbon fuels available for air breathing missile propulsion. Examples are given which demonstrate the steps taken in development of a fuel specification. Current systems using or considering use of these fuels are mentioned. Finally, the origin and significance of tabulated fuel properties are considered.
Author

N80-30420 Dynamics Research Corp., Wilmington, Mass.
OPTIMIZED PROPULSION/GUIDANCE ANALYSIS OF RAMJET POWERED VEHICLES
Fred Goldstein and Anthony Calise (Drexel Univ.) *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 621-633 refs (For primary document see N80-30381 21-20)
(Contract F33615-79-C-2088)
Avail: Issuing Activity CSCL 21/8

An evaluation of the use of singular perturbation methods for developing computer algorithms for on-line optimal control of ramjet powered vehicles is presented. Optimal control solutions using singular perturbation theory (SPT) are derived which incorporate optimal aerodynamic control of turn rate and optimal thrust magnitude control of velocity. Maximum lift coefficient, maximum load factor, minimum and maximum velocity and thrust, and instrumentation related constraints are enforced. Particular attention is given to identifying quantities that can be precomputed and stored (as a function of total energy), thus reducing the onboard computational load. Numerical results are given that illustrate the nature of the optimal intercept flight paths, and which demonstrate the impact on trajectory shaping through use of optimal control techniques.
J.M.S.

N80-30421 Boeing Aerospace Co., Seattle, Wash.
APPLICATION OF AN ADVANCED TRAJECTORY OPTIMIZATION METHOD TO RAMJET PROPELLED MISSILES
S. W. Paris, B. K. Joosten, and L. E. Fink *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 635-650 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

The mission performance characteristics of ramjet propelled missiles are highly dependent upon the trajectory flown. Integration of the trajectory profile with the ramjet propulsion system performance characteristics to achieve optimal missile performance is very complex. A general computer code (CTOP) is applied to ramjet powered missiles to compute open-loop optimal trajectories. The CTOP employs Chebychev polynomial representations of the states and controls, allowing a transformation of the continuous optimal control problem to one of parameter optimization. With this method, the trajectory boundary conditions are always satisfied. State dynamics and path constraints are enforced via penalty functions. The presented results include

solutions to minimum fuel to climb, and minimum time to target intercept problems. J.M.S.

N80-30422 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
JANNAF 11TH PLUME TECHNOLOGY MEETING, VOLUME 2
Theodore M. Gilliland, ed. Jul. 1979 233 p refs Conf. held at Redstone Arsenal, Ala., 8-10 May 1979
(Contract N00024-78-C-5384)
(AD-A079647; CPIA-PUBL-306) Avail: Issuing Activity CSCL 21/8

Common problems in plume technology are discussed. Exhaust plume flow field property measurements and predictions, and infrared radiation are emphasized. For individual titles, see N80-30423 through N80-30431.

N80-30423* Physical Dynamics, Inc., La Jolla, Calif.
PLUME INTERFERENCE WITH SPACE SHUTTLE RANGE SAFETY SIGNALS
F. P. Boynton and P. S. Rajaseknar *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 1-25 refs (For primary document see N80-30422 21-20)
(Contract NAS8-32528)
Avail: Issuing Activity CSCL 20H

The computational procedure for signal propagation in the presence of an exhaust plume is presented. Comparisons with well-known analytic diffraction solutions indicate that accuracy suffers when mesh spacing is inadequate to resolve the first unobstructed Fresnel zone at the plume edge. Revisions to the procedure to improve its accuracy without requiring very large arrays are discussed. Comparisons to field measurements during a shuttle solid rocket motor (SRM) test firing suggest that the plume is sharper edged than one would expect on the basis of time averaged electron density calculations. The effects, both of revisions to the computational procedure and of allowing for a sharper plume edge, are to raise the signal level near tail aspect. The attenuation levels then predicted are still high enough to be of concern near SRM burnout for northerly launches of the space shuttle. R.C.T.

N80-30424* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PLUME IMPINGEMENT PRESSURE MEASUREMENTS TAKEN DURING SEA LEVEL FIRINGS OF A TOMAHAWK MOTOR
David C. Seymour, Terry F. Greenwood, and Sheldon D. Smith *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 47-78 refs Prepared in cooperation with Lockheed Missiles and Space Co., Huntsville, Ala. (For primary document see N80-30422 21-20)
Avail: Issuing Activity CSCL 21H

Plume impingement pressure and force data taken during a special test program utilizing Tomahawk solid motors are presented. The test program consisted of five firings of a Tomahawk solid propellant rocket motor in which the exhaust plume impinged on a flat plate located 12.2 ft and 17 ft from the nozzle exit plane. A brief description of the plume math model used to generate the mobile launch platform design loads is included. R.C.T.

N80-30425 Aerodyne Research, Inc., Bedford, Mass. Center for Electro-Optical Signature Studies.
HIGH RESOLUTION BAND MODELS: APPLICATION TO THE 4.3 MICROMETER CO2 BAND
Lawrence S. Bernstein, David C. Robertson, and John A. Conant *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 79-93 refs (For primary document see N80-30422 21-20)
Avail: Issuing Activity CSCL 21/8

A general theory for predicting band model parameters for the parallel bands of linear triatomic molecules is used to determine high resolution band model parameters for the 4.3 micrometers CO2 band from 200 - 3000 K. Comparisons are made to experimental data covering this same temperature range. The band model predictions and data are shown to be in good agreement. Application of the high resolution band model parameters to plume emission-atmospheric absorption calculations in the CO2 fundamental band head region (2380 - 24 per cm) is discussed. Line by line and band model plume signature predictions are compared for an aircraft plume over 0, 0.5, and 5 km atmospheric paths. The line by line and band model predictions for the 0 and 0.5 km paths are in good agreement. For the 5 km path, the band model overestimates the atmospheric transmission by a factor of two. The reason for this overprediction is discussed and a correction formula is presented which should extend the accuracy of band model emission-atmospheric absorption predictions to long viewing paths (approximately 20 km at sea level). R.C.T.

N80-30426 Aerodyne Research, Inc., Bedford, Mass. Center for Chemical and Environmental Physics.
A MONTE CARLO SIMULATION OF SOLAR INDUCED FLUORESCENT SCATTERING IN OPTICALLY THICK HIGH ALTITUDE PLUMES
James B. Elgin and Lawrence S. Bernstein *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 95-115 refs (For primary document see N80-30422 21-20)
(Contract F19628-78-C-0145)
Avail: Issuing Activity CSCL 21/8

A high altitude plume is modeled as an infinite cylinder populated with solar absorbing species. Incident solar photons are considered across the Doppler line width of the absorber, and successive absorptions and reemissions are simulated using a Monte Carlo technique. Smooth convergent results are obtained by utilizing a direct determination of spherical harmonics coefficients. Spatial, angular and spectral distributions are presented and discussed for various optical depths and branching ratios. Author

N80-30427* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DIRECT SIMULATION MONTE CARLO METHOD APPLIED TO SHUTTLE FLOW FIELD ANALYSIS
R. A. Outlaw, L. T. Melfi, Jr., F. J. Brock (Old Dominion Univ.), and J. E. Hueser (Old Dominion Univ.) *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 117-146 refs (For primary document see N80-30422 21-20)
Avail: Issuing Activity CSCL 20D

A program for analyzing the flow field in the neighborhood of the orbiting shuttle was developed which uses a probabilistic Monte Carlo technique and is capable of analyzing three dimensional steady or unsteady flow with internal and external boundary conditions. A numerical solution for the flow field is produced which is the probabilistic equivalent of a complete solution for the time dependent, three dimensional Boltzmann equation. The program computes the inward molecular flux at the flow boundaries, both external and internal, and the motion of all molecules within the flow field under the influence of both surface interactions and molecular collisions. The internal boundary is a close approximation of the actual shuttle geometry. The shuttle surface is divided into 38 surface elements for which temperature and outgassing flux density may be independently specified. A typical flow field analysis (including 9 molecular species) for an aft thrust-up VCS engine firing is discussed. Results are compared to engine off results and both are compared to the Woods Hole criteria. A.R.H.

N80-30428* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A NOZZLE BOUNDARY LAYER MODEL INCLUDING THE SUBSONIC SUBLAYER USABLE FOR DETERMINING BOUNDARY LAYER EFFECTS ON PLUME FLOWFIELDS
Basil P. Cooper, Jr. *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 147-165 refs (For primary document see N80-30422 21-20)
(Contracts NAS8-21810; NAS8-31644)
Avail: Issuing Activity CSCL 21H

A model for the boundary layer at the exit plane of a rocket nozzle was developed which, unlike most previous models, includes the subsonic sublayer. The equations for the flow near the nozzle exit plane are presented and the method by which the subsonic sublayer transitions to supersonic flow in the plume is described. The resulting model describes the entire boundary layer and can be used to provide a startline for method-of-characteristics calculations of plume flowfields. The model was incorporated

into a method of characteristics computer program and comparisons of computed results to experimental data show good agreement. The data used in the comparisons were obtained in tests in which mass fluxes from a 22.2-N (5 lbf) thrust engine were measured at angles off the nozzle centerline of up to 150 deg. Additional comparisons were made with data obtained during tests of a 0.89-N (0.2 lbr) monopropellant thruster and from the OH-64 space shuttle heating tests. The agreement with the data indicates that the model can be used for calculating plume backflow properties. A.R.H.

N80-30429 Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
CRITICAL REQUIREMENTS FOR MID-ALTITUDE IR PREDICTIONS
S. Rudman, P. DelGuidice, and R. Ambruso *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 167-185 refs (For primary document see N80-30422 21-20)
(Contract F44620-76-C-0021)
Avail: Issuing Activity CSCL 21/8

It is shown that it is increasingly difficult to predict rocket plume radiation as altitude increases. This is a result of a compounding of the effects of increasing sensitivity of the Planck function to temperature increments and the increasing uncertainty in the temperature predictions as altitude increases. An analysis is used to derive an expression which shows the specific dependence. An analysis is used to derive an expression which shows the specific dependence of station radiation on plume temperature, radiator species mass fraction and temperature profile parameters. One expression successfully reduces all the far field station radiation for two model problems to a single constant. Another relationship is equally successful in the near field region. The analysis is best suited for an optically thin gas, but may not be limited to that case. Major sources of temperature increments or inaccuracies which plume modellers must account for or control include nonideal thermochemical properties, finite rate chemical relaxation, shock heating associated with multiple nozzle exhaust systems and tolerances of numerical calculation schemes. Author

N80-30430 Interstate Electronics Corp., Anaheim, Calif.
MEASURING AND MODELING ROCKET-PLUME DOPPLER SPECTRAL ASYMMETRY IN CW DOWNLINK TRANSMISSIONS
H. I. Sargeant, E. J. Walcek, and W. A. Janos *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 187-209 refs (For primary document see N80-30422 21-20)
(Contract N00030-75-C-0011)
Avail: Issuing Activity CSCL 21/8

Two surface receiving stations, 64 kilometers (40 nautical miles) apart, measured an unmodulated S-band (2,200-MHz), radio frequency (RF) test signal emitted by a Poseidon missile. On site, horizontally and vertically polarized received signals were measured. At the other site, the Range Instrumentation Ship USNS Range Sentinel (TAGM-22), measured left- and right-hand circularly polarized received signals. The nature of rocket plume interactions with the microwave test signal was studied as a function of aspect angle, particularly regarding plasma-induced RF angle modulations. For tailon aspect angles, where severe plume attenuations were evident, Doppler shifts of the plume-induced signal were quantified together with time histories. The results illustrate an apparent multipath effect possibly created by plume-caused shifts in the equivalent phase center of the transmitting array. Phase-shift jitter also was noted during the postboost phase. Predetection tape recordings of the signal were reduced and analyzed by fast Fourier transform and digital filtering techniques. A.R.H.

N80-30431 Concentration, Heat and Momentum Ltd., Surrey (England).
COMPUTER ANALYSIS OF THE BASE-FLOW REGION OF A ROCKET EXHAUST
D. G. Tatchell, N. C. Markatos, and D. B. Spalding *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 211-230 refs Sponsored by the Propellant, Explosives and Rocket Motor Establishment, Westcott, England (For primary document see N80-30422 21-20)
Avail: Issuing Activity CSCL 21/8

The BAFL2 computer code for analyzing the recirculating flow region near the base-wall of a rocket is described. The rocket is assumed to be flying straight ahead, so the flow is treated as axisymmetric. The analysis includes calculation of velocities (two components), pressure, temperature and concentrations of an arbitrary number of reacting chemical species. Effects of turbulence are included via a two equation turbulence model, involving solution of additional transport equations for turbulence kinetic energy and its rate of dissipation. The solution method is a finite difference one. A.R.H.

N80-30432# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
TECHNIQUE AND MEASUREMENT OF HEAT FLUX AND FLAME TEMPERATURE IN ROCKET PLUME EXPOSURES Final Report
J. R. Piergallini and A. M. Stoll 7 May 1980 12 p refs
(WF52852300)
(AD-A086533; NADC-80093-60) Avail: NTIS
HC A02/MF A01 CSCL 06/5

An investigation was performed using model rocket static test engines simulating full scale rocket engine firings with instrumented live animals, heat flux transducers and thermocouples for burn injury assessments. Available data on rocket engine flame temperatures was either extrapolated or computed from chemical compositions and because of the unique 'dirty' characteristics of the flame, it was necessary to devise special instrumentation for direct measurements. A heat flux transducer was fabricated to measure the energy impingent upon the skin surface at various distances from the rocket engine. The transducer was calibrated against a graphite imaging furnace capable of producing 15 cal/sq cm sec, in conjunction with a standard radiation source and radiometer. Radiometric observations were used also to describe precisely the pulse shape of the rocket engine plume. External and intradermal thermocouples measured the actual temperatures experienced in producing a white burn in the rat (equivalent to a second degree burn in the human) and for monitoring each test and correlating one exposure with another. This paper describes the techniques and measurements used, the generation of a time-temperature profile for producing the standard burn effect and provides a temperature history at the level of the burn site. GRA

N80-30433# California Univ., Livermore. Lawrence Livermore Lab.
MODELING PROPELLANT COMBUSTION INTERACTING WITH AN ERODING SOLID SURFACE
A. C. Buckingham (AIAA) 6 May 1980 12 p refs Presented at AIAA-SAE-ASME 16th Joint Propulsion Conf., Hartford, Conn., 30 Jun. - 2 Jul. 1980 Sponsored in part by AROD and U.S. Army ARRADCOM Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83727; CONF-800620-2) Avail: NTIS
HC A02/MF A01

Turbulent combustion flow acting on and influenced by an eroding wall surface was modeled. The combustion flow field is particle laden. Significant particulate mass loading occurs in the immediate neighborhood of the wall as a result of erosion products issuing from the deteriorating solid surface. Cases are also considered in which a substantial particle mass loading develops near the wall as a result of finely divided (sub micron diameter) particulates such as TiO2 and talcum powder which are added to suppress erosion. In addition to statistical turbulent field particle flow interaction, the model includes multi-component molecular diffusion processes, and gas phase, gas/surface and or solid surface chemical reactions. Results indicate that despite the unsteady flow conditions, a limiting erosion rate is approached. This occurs as a result of the effective blowing off of the issing vapor phase products. The blowing reduces the gradients driving the incident combustion heat and mass transfer. DOE

N80-30434# Fulmer Research Inst. Ltd., Stoke Poges (England).
DEVELOPMENT AND TESTING OF CLEANING PROCEDURES AND FEEDING SYSTEMS FOR A FIELD EMISSION THRUSTER MODEL Final Report
D. Stewart and P. Wilson May 1979 188 p refs
(Contract ESTEC-2502/75-AK)
(FRI-R664/3; ESA-CR(P)-1305) Avail: NTIS

HC A09/MF A01

Tests were made to determine a successful cleaning procedure for operating the feed system of a field emission thruster using cesium as the propellant. Emission tests using an emitter made from nickel arrays show that cleaning can be achieved without electron or argon ion bombardment. The emitter and accelerator electrode geometry were studied and a high beam transmission, greater than 99%, was obtained. No significant improvement in performance was gained by the use of quadruple arrays or razor blade emitters. Two tests made with gallium as the propellant were unsuccessful due to poor wetting of the emitter.

Author (ESA)

N80-30435# United Kingdom Atomic Energy Authority, Culham (England).

FIELD EMISSION ELECTRIC PROPULSION ION OPTICS OF DOUBLE EDGED MATERIALS Final Report

C. L. Thomas and P. F. Little Dec. 1978 43 p refs

(Contract ESTEC-3308/77-NL-AK(SC))

(CLM-RR/E1/25; ESA-CR(P)-1307) Avail: NTIS HC A03/MF A01

Calculations of some aspects of the ion optics of double edged emitters are reported. The correct source distributions for various beam currents were derived by adjusting the source distributions so as to reproduce current distributions measured experimentally, downstream of the accelerator. The experimental accelerator was modified so that a smooth electrode profile allows 100% transmission of ions. This electrode was further modified to reduce the effect of electron back-bombardment of the emitter. To obtain information about the disposition of the liquid surface within the double emitter, the electric field inside the emitter was computed. The two electrode system was augmented by a decelerator in an attempt to focus the beam. It was found that with the voltage specified, no focusing is possible. Neutralizing electrons are introduced into the beam downstream of the decelerator but only a 3 1/2% reduction in the emergent angle is obtained.

Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-30436*# Martin Marietta Corp., Denver, Colo.

EVALUATION AND PREDICTION OF LONG TERM SPACE ENVIRONMENTAL EFFECTS ON NON-METALLIC MATERIALS Quarterly Progress Report

John A. Shepie 8 Jul. 1980 13 p

(Contract NAS8-33578)

(NASA-CR-161545; MCR-80-509-Issue-3; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 07D

Ten materials were evaluated for mechanical and dielectric properties following long term vacuum exposure. Data obtained for these materials is presented in tabular form.

T.M.

N80-30437# Oak Ridge National Lab., Tenn. Solid State Div.

STRUCTURAL DEFECTS IN LASER- AND ELECTRON-BEAM ANNEALED SILICON

J. Narayan 1979 14 p refs Presented at the Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 26 Nov. 1979

(Contract W-7405-eng-26)

(CONF-791112-62) Avail: NTIS HC A02/MF A01

Laser and electron beam pulses were used to provide an almost ideal source of heat by which thin layers of semiconductors are rapidly melted and solidified with heating and cooling rates exceeding 10 to the 80th power C/sec. Microstructural modification obtained as a function of laser parameters were examined. It is shown that both laser and electron beam pulses can be used to remove displacement damage, dislocations, dislocation loops and precipitates. Annealing of defects underneath the oxide layers in silicon is possible within a narrow energy window. The formation of cellular structure provides a rather clear evidence of melting which leads to segregation and supercooling and subsequent cell formation.

DOE

N80-30438# Computer Corp. of America, Cambridge, Mass.

THE DESIGN OF A SYSTEM FOR PRE-PROTOTYPE USE OF THE CHEMICAL SUBSTANCE INFORMATION NETWORK

Donald A. Eastlake, III, Aren J. Horowitz, and David A. Low 31 Dec. 1979 54 p refs

(PB80-178320; CCA-79-26) Avail: NTIS HC A04/MF A01 CSCL 07D

The design of a system which assists users in the retrieval of related data from remote chemical information systems is presented. The design employs an intelligent terminal to generate commands to and 'capture' output from remote systems, transform data output by one system into input to another system, and 'substitute' data files for keyboard input. It is the first in a series of early Chemical Substances Information Network.

GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-30439 Drexel Univ., Philadelphia, Pa.

STATISTICAL ANALYSIS OF THE FATIGUE OF COMPOSITE MATERIALS Ph.D. Thesis

Harry Richard Miller 1980 138 p

Avail: Univ. Microfilms Order No. 8019353

Several aspects of the problem of defining the statistical distribution function for the fatigue life of composite materials are studied. The maximum likelihood method is employed to obtain the parameter estimating equations for the case where the underlying distribution is a two parameter Weibull and the sample on which the estimation is to be based is doubly progressively censored. An iterative solution scheme for these equations is presented and an example shown. An application to proof testing is also suggested. The maximum likelihood parameter estimating equations are derived for the case where the underlying distribution is composed of two segments, one in the low life region and one in the high life region, where each segment has the form of a two parameter Weibull distribution. A model is developed for the fatigue failure of structures composed of identical elements arranged in parallel. The exact equations for the probability of failure of two and three element parallel systems are derived. Solution of these equations is shown to require multiple numerical integration. An approximate recursion formula is also derived.

Dissert. Abstr.

N80-30440 Polytechnic Inst. of New York.

COMPRESSIVE DEFORMATION CHARACTERISTICS OF SOME CEMENTED TUNGSTEN CARBIDES AT ELEVATED TEMPERATURES Ph.D. Thesis

Moon Hyoun Chung 1980 158 p

Avail: Univ. Microfilms Order No. 8019393

High temperature compressive deformation characteristics of three commercial grade cemented tungsten carbides were studied in the temperature range from ambient 900 C. Stress-strain relationships for the three carbides at five different temperatures between room temperature and 850 C were established. Using replica electron microscopy and optical microscopy, the polished and fractured surfaces of the samples, deformed to various degrees at the five different temperatures were analyzed. Dissert. Abstr.

N80-30441*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OUTGASSING DATA FOR SPACECRAFT MATERIALS

William A. Campbell, Jr., Richard S. Marriott, and John J. Park Aug. 1980 259 p refs

(NASA-RP-1061; Rept-80-F-7000) Avail: NTIS HC A12/MF A01 CSCL 11D

A system for determining the mass loss in vacuum and for collecting the outgassed compounds was developed. Outgassing data, derived from tests at 398 K (125 degrees C) for 24 hours in vacuum as per ASTM E 59577, are compiled for numerous materials for spacecraft use. The data presented are the total mass loss (TML) and the collected volatile condensable materials (CVCM). The various materials are compiled by likely usage and alphabetically.

R.K.G.

N80-30442# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Metallurgy and Mining Engineering.
STRUCTURE AND DEFORMATION CHARACTERISTICS OF RHEOCAST METALS Final Report, 24 Jun. 1976 - 23 Jun. 1979
R. Mehrabian, F. M. Hosking, F. Folgar Portillo, and R. Wunderlin Mar. 1980 95 p refs
(Contract DAAG46-76-C-0046; DA Proj. 1T1-62105-AH-84) (AD-A086469; AMMRC-TR-80-5) Avail: NTIS HC A05/MF A01 CSCL 11/4

This report describes work aimed at developing wear resistant composites of aluminum base alloys, using rheocasting and associated processes. It is anticipated that the feasibility of use of such composites in track blocks of land vehicles would be subsequently determined. Composites of two wrought (2014 and 2024) and one cast (201) aluminum alloys containing 2 to 30 weight percent of Al2O3 and SiC particles in the size range of the 1 to 142 micrometers were prepared using a compositing apparatus developed in this investigation. The non-metals were successfully added and retained in the aluminum alloy matrices using the rheological properties of a partially solidified, vigorously agitated alloy to advantage. Subsequently, the composites were reheated to above their liquidus temperature, shaped and solidified under high pressure in a forging press. The microstructures, the wear behavior and the mechanical properties of the composites were studied. Composites with particulate additions larger than 5 micrometers in size possessed homogeneous structures. On the other hand, 1 micrometer particles tended to cluster. The wear behavior of the composites was studied on a pin-on-disk type machine built during this investigation. It was shown that composites containing large amounts of non-metals, about 20 wt%, of Al2O3 or SiC exhibit excellent wear resistance and low coefficients of friction. The wear mechanism in the matrices and the composites were also established. GRA

N80-30443# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Metallurgy and Mining Engineering.
A FUNDAMENTAL STUDY OF A NEW FABRICATION TECHNIQUE FOR FIBER REINFORCED ALUMINUM MATRIX COMPOSITES Final Report, 22 Mar. 1976 - 11 Aug. 1979
R. Mehrabian 20 Apr. 1980 21 p refs
(Grants DAAG29-76-G-0170; DAAG29-78-G-0067)
(AD-A086282; ARO-13847.3-MSX) Avail: NTIS HC A02/MF A01 CSCL 11/4

The feasibility of fabricating fiber-reinforced aluminum alloys by addition of discontinuous fibers to partially solid slurries and completely liquid matrices was investigated. In the first phase of the program, emphasis was placed on the study of interface interactions between polycrystalling Al2O3 fibers and Al-2 to 8%Mg, Al-4.5%Cu and Al-4.5%Cu-1 to 2%Mg alloys produced by the slurry process. In general, it was observed that the incorporation of fibers could be readily achieved by this technique, and that fibers appeared wetted after a few minutes of contact with the melt. The composites produced exhibited an intimate, void free bond between the constituents. In addition, a region of significantly altered microstructure resulted from accumulation of oxide and/or aluminate particles which either formed within the melt and were attached to the moving fibers, or used the fiber surface as a substrate to grow on. Microscopic examination of this interaction zone and thermodynamic considerations indicated that it consisted of fine alpha-Al2O3, aluminates, oxides of the alloying elements, and probably some intermetallic compounds. GRA

N80-30444# Connecticut Univ., Storrs.
FATIGUE BEHAVIOR OF GLASS FIBER REINFORCED POLYBUTYLENETEREPHTHALATE Final Report, May 1978 - Apr. 1979
A. T. DiBenetto Apr. 1980 77 p refs
(Contract DAAG46-78-C-0027; DA Proj. 1L1-62105-AH-8H) (AD-A087104; AMMRC-TR-80-17) Avail: NTIS HC A05/MF A01 CSCL 11/4

The fatigue behavior of short glass fiber reinforced PBT composites has been investigated under different environmental conditions. Exposure to water at high temperature causes embrittlement, while improved processing and exposure to high humidity cause an increase in ductility. The fatigue life is a function of the environmental conditioning, the stress level of the test and the ductility of the material. The quantity (Theta (max)/- Theta =)2 ln t(B) is independent of environmental conditioning and increases with increasing ductility. The total deformation-to-break during fatigue consists of a deformation attributable to cyclic softening and a longer term deformation that continues at nearly constant rate until failure occurs. The cyclic softening is associated with cyclic stress-strain characteristics, while longer term deformation is controlled by creep and microcavitational phenomena. Crack propagation rates in notched plates were measured. The crack propagation behavior was somewhat dependent on the stress history of the material. GRA

N80-30445# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT OF ALTERNATE SILICONE POTTING COMPOUNDS. VOLUME 6: DEVELOPMENT OF SECONDARY ALTERNATES FOR DOW CORNING'S AEROSPACE SEALANT, DC93-119
W. E. Cady and A. T. Buckner 2 Feb. 1980 29 p refs
(Contract W-7405-eng-48)
(UCRL-52434-Vol-6) Avail: NTIS HC A03/MF A01

A substitute for Dow Corning's DC-93-119 silicone compound can be formulated from Sylgard 184, dielectric gel Q3-6527, and either accelerator QCF3-6559 or DC1107 fluid. Also, a substitute can be formulated from Sylgard 186, dielectric gel Q3-6527, and accelerator QCF3-6559 because the system is not fast enough with QCF3-6559; although, it can be speeded up with the addition of DC1107, the level of extractables is unacceptably high. DOE

N80-30446# Sandia Labs., Albuquerque, N. Mex.
WIND-TUNNEL AND FLIGHT TESTS OF ABLATORS AND INSULATORS FOR ROCKET VEHICLES
Robert E. Sheldahl, Sam G. Beard, Jr., Irving Auerbach, and Thomas F. Covert Apr. 1980 30 p refs Presented at 26th Intern. Instrumentation Symp., Seattle, 5-8 May 1980
(Contract EY-76-C-04-0789)
(SAND-80-05230; CONF-800502-12) Avail: NTIS HC A03/MF A01

Some high performance rocket systems experience enough aerodynamic heating aft of the nose cone to require thermal protection to keep the temperature of the structure below allowable limits. Results of rocket tests and wind tunnel tests indicate that any of the 10 materials tested could provide the required thermal protection for the payload and motor of a rocket system for the environments studied. The temperatures of the cork phenolic showed two entirely different responses. In the wind tunnel, the material apparently burned and produced the highest structure temperatures. On the Terrier-Malemut rocket test, it proved the best insulator, probably as a result of the low oxygen content in the boundary layer. This indicates that cork phenolic works very well for this type of test, but for a rocket launched in a shallow trajectory, the cork phenolic may react more as it did in the wind tunnel. Cork phenolic may prove very effective where a char is of no consequence and the vehicle trajectory is not shallow. DOE

N80-30447# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
IMPURITY EFFECTS ON THE CREEP OF POLYCRYSTALLINE MAGNESIUM AND ALUMINUM OXIDES AT ELEVATED TEMPERATURES Technical Progress Report, 19 Dec. 1978 - 18 Dec. 1979
Ronald S. Gordon Dec. 1979 20 p refs
(Contract EY-76-S-02-1591)
(COO-1591-34) Avail: NTIS HC A02/MF A01

Research is described on: the effect of mixed transition metal impurities (Fe-Ti, Mn-Ti, and Mg-Ti) on the steady state creep of polycrystalline aluminum oxides; stress relaxation deformation studies on polycrystalline MgO and Al2O3, pure and doped with iron; and the theoretical analysis of ambipolar diffusion taking into account interfacial defect creation and/or annihilation processes at grain boundaries, and impurity effects, particularly those with mixed dopants. The diffusional creep of polycrystalline alumina can be completely explained provided Schottky defects are assumed to be the intrinsic defects in Al2O3. DOE

N80-30448# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
DEPENDENCE OF SILICON CARBIDE COATING PROPERTIES ON DEPOSITION PARAMETERS: PRELIMINARY REPORT
R. J. Lauf and D. N. Braski May 1980 35 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7209) Avail: NTIS HC A03/MF A01

The effects of deposition variables on the structure and properties of the SiC layer in fission fuel particles are investigated. The silicon carbide is deposited by the thermal decomposition of methyltrichlorosilane in an excess of hydrogen. The grain size and shape depend on coating rate and deposition temperature. The fine structure of the coating, observed at the submicrometer level by transmission electron microscopy, has been found to vary in the same way as does the general microstructure observed optically. X ray diffraction has shown the presence of one or more polytypes of alpha-SiC in coatings deposited at relatively low temperatures and/or relatively high coating rates. The coating density and surface morphology are strongly dependent on deposition temperature and coating rate. The best surface appearance is observed in those coatings that have the highest density. DOE

N80-30449# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
ADVANCED ELECTRON BEAM TECHNIQUES FOR METALLIC AND CERAMIC PROTECTIVE COATING SYSTEMS
Donald H. Boone and John W. Fairbanks Feb. 1980 27 p refs Presented at the ASM/SAMPE Conf. on Specialized Cleaning, Finishing and Coating Processes, Los Angeles, 5 Feb. 1980
(Contract W-7405-eng-48)
(LBL-10520; CONF-800235-1) Avail: NTIS HC A03/MF A01

The need for protective coatings in energy conversion equipment operating at high temperatures with nonpetroleum alternative fuels is discussed. The development of electron beam evaporation physical vapor deposition (EB-PVD) processes for applying such ceramic coatings is described, and current research is reviewed. It is concluded that the needs for the use of protective coatings will continue to increase as our quest for greater energy efficiency and more diversified fuel sources expands. Overlay coatings and composite system will be required to meet these requirements in a cost effective manner consistent with materials availability. These needs spurred interest and activity in the overlay coating processing area in general and in EB-PVD techniques in particular where even greater activity is predicted in the future. DOE

N80-30450# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
COMPARISON OF QUASI-ISOTROPIC FIBER REINFORCED COMPOSITE LAMINATES
John C. Duke, Jr. Nov. 1979 125 p refs
(Contract W-7405-eng-48)
(UCRL-15225) Avail: NTIS HC A06/MF A01

Because preliminary tests on composite laminate rotors for flywheels indicated that nominally quasi-isotropic laminates were reasonably isotropic with regard to stiffness, but that the strength values differed by 40% depending on direction, tensile, ultrasonic, and acoustic emissions tests were conduted on specimens of graphite-epoxy, S-2 glass epoxy, and Kevlar 49 epoxy composite systems. Results are presented. DOE

N80-30451# Ecole Nationale Superieure de Techniques Avancees, Paris (France).
[TECHNICAL RESEARCH ACTIVITIES FOR 1978] Annual Report [RAPPORT D'ACTIVITES SUR LES RECHERCHES A L'ECOLE NATIONALE SUPERIEURE DE TECHNIQUES AVANCEES EN 1978]
1979 101 p refs In FRENCH
Avail: NTIS HC A06/MF A01

Laboratory research and pedagogical applications are reported in chemistry and physics, thermochemical combustion, computer sciences, materials science, ellipsometry and composite materials structures, and fluid mechanics (naval and oceanographic applications). Applied optics, specifically, time resolution spectroscopy is also considered. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N80-30452 Delaware Univ., Newark.
A LOW TEMPERATURE SPECIFIC HEAT STUDY OF SOME DISORDERED ALLOY SYSTEMS Ph.D. Thesis
Patrick Francis Gleeson, Jr. 1980 131 p
Avail: Univ. Microfilms Order No. 801932

The specific heat of some crystalline and amorphous alloy systems was measured in the temperature range 0.5-30 K. Two ternary platinum-based crystalline alloy systems, Ptlr-Au and Pt-Rh-Au are studied and changes in the electronic contribution of the specific heat are discussed in the context of several models. The specific heat of the metallic glass Fe40Ni40P14B6 is compared to the specific heat of the same alloy measured after each of two successive annealing processes, where care was taken to avoid recrystallization temperatures. Changes in the electronic and lattice contributions are discussed in terms of short range ordering models. Dissert. Abstr.

N80-30453 California Inst. of Tech., Pasadena.
SHOCK TEMPERATURES OF MATERIALS: EXPERIMENTS AND APPLICATIONS TO THE HIGH PRESSURE EQUATION OF STATE Ph.D. Thesis
Gregory Allen Lyzenga 1980 214 p
Avail: Univ. Microfilms Order No. 8021025

Temperature measurements obtained during impact driven shock wave experiments with solid and liquid samples at pressures near 100 GPa are reported and discussed. Experimental results confirm that throughout moderate ranges of shock pressure amplitude, transparent dielectrics emit thermal radiation from the region of the shock front, with a spectrum which is characteristic of the Hugoniot state temperature. Shock temperatures in sodium chloride crystals have been measured in the pressure range 70 to 105 GPa. The observed temperatures, between 4000 and 8000 K, are in agreement with the results of earlier determinations and with calculations assuming the occurrence of shock induced melting. Results of experiments to measure shock temperatures in metallic silver include a successful measurement of 5950 K at a pressure of 185 GPa. Shock temperature measurements in silica (SiO2) produced anomalous results suggestive of melting occurring in the stishovite phase near 100 GPa pressure and 4700 K temperature. Experimental measurements with alpha quartz, fused silica samples single crystal forsterite, and water are also discussed. Dissert. Abstr.

N80-30454 California Inst. of Tech., Pasadena.
NON-STEADY BEHAVIOR OF A FLAME SPREADING FROM A POINT IN A TWO-DIMENSIONAL DUCT Ph.D. Thesis
Mallaoi Venkata Subbaiah 1980 134 p
Avail: Univ. Microfilms Order No. 8020431

Non-steady behavior of a flame stabilized in a two dimensional duct was studied. The problem was formulated by an integral technique in which the governing equations were integrated across the duct to obtain integral relations for the mean flow variables. The flow on either side of the flames sheet were matched by appropriate matching conditions. Fluid flow through the flame surface caused the integral relations to explicitly involve the fluid velocities at the flames. An independent description of the flame shape and the irrotational flow field upstream of the flame was provided by a source distribution on the duct axis. The integral relations were analyzed by perturbation technique, in which the dominant order solution represents the steady flame development. The steady flame configuration was perturbed by an acoustic wave incident on the compact flame region. The time dependent counterpart of the integral relations describes the ensuing non steady flow fields. The flame perturbation describes the ensuing non steady flow fields. The flame perturbation exibited a traveling wave pattern with considerable amplification along the flame zone. Dissert. Abstr.

N80-30455 Minnesota Univ., Minneapolis.
STRUCTURE AND PATHOLOGY OF THE STEADY STATE, STABILITY AND DYNAMICS OF THE COMBUSTION OF AN IMPERVIOUS CARBON PARTICLE Ph.D. Thesis
Eduardo Mon 1979 201 p
Avail: Univ. Microfilms Order No. 8019550

A model of diffusion and reaction based on the Stefan-Maxwell equations was constructed for the stagnant boundary that surrounds a carbon particle during combustion. The model included the heterogeneous combustion reactions in concert with radiation as nonlinear boundary conditions. Using the stoichiometric coupling of the molar fluxes, the problem was reduced to a single conservation equation that results from the homogeneous oxidation of carbon monoxide. The effects of various parameter values on the solution were examined. In particular, variation of the particle size provide conclusions as to whether or not a carbon monoxide flame develops in the boundary layer. A simplified transient model was used to develop local asymptotic stability criteria for analysis of the multiple steady states. A special case arose when carbon monoxide burned outside the boundary layer as the linearized conservation equations were then solvable by a finite Fourier transform. In the more general case, results were obtained by Galerkin's method. Regions of instability created by variation of the particle size and ambient oxygen concentration were investigated. Dissert. Abstr.

N80-30456 Princeton Univ., N. J.
PYROLYSIS AND OXIDATION KINETIC MECHANISMS FOR PROPANE Ph.D. Thesis
Donald Jerome Hautman 1980 266 p
Avail: Univ. Microfilms Order No. 8018658

The reaction kinetics of complex paraffins were investigated. The experiments were performed in a high temperature, adiabatic, turbulent flow reactor. Spatial chemical sampling and temperature measurements were made using an instrumented probe. The composition of the chemical samples was determined using a gas chromatograph. The kinetic analysis employed both overall and elementary reaction mechanisms. Pyrolysis and oxidation kinetics were investigated since both processes can be present in combustion phenomena. Overall and elementary kinetic descriptions of the pyrolysis of C3H8 were proposed. The overall rate of C3H8 disappearance was described by a first order rate expression. This rate expressions agrees with previously reported rate data. Dissert. Abstr.

N80-30457 Minnesota Univ., Minneapolis.
STUDIES OF CONTINUOUS CHROMATOGRAPHIC REACTORS Ph.D. Thesis
Byong Kwon Cho 1980 274 p
Avail: Univ. Microfilms Order No. 8019517

Theoretical numerical and experimental investigations of continuous chromatographic reactors were conducted. In the first part, the steady state behavior of a countercurrent chromatographic reactor was analyzed mathematically for a reversible reaction adsorption system occurring in an ideal chromatographic reactor in which negligible axial diffusion and instantaneous adsorption equilibrium are assumed. In the second part, a continuum model for the reaction in a rotating annular reactor under ideal chromatographic conditions was set up, assuming the reactor bed, packed with catalyst and/or adsorbent particles, can be treated as a homogeneous continuum. The resulting hyperbolic system of quasilinear first order particle differential equations was solved using Lax first order finite difference method. Comparisons of numerically simulated reactor performance with experimental results showed good agreement, although some differences occurred as experimentation proceeded, most probably due to deactivation of the adsorbent, activated charcoal. Dissert. Abstr.

N80-30458*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRESSURE DEPENDENCE OF THE ABSOLUTE RATE CONSTANT FOR THE REACTION OH + C2H2 FROM 228 TO 413K
J. V. Michael, D. F. Nava, R. P. Borokowski, W. A. Payne, and L. J. Stief Jul. 1980 25 p refs Submitted for publication
(NASA-TM-80743) Avail: NTIS HC A02/MF A01 CSCL 07D

The pressure dependence of absolute rate constants for the reaction of OH + C2H2 yields products has been examined at five temperatures ranging from 228 to 413 K. The experimental techniques which was used is flash photolysis-resonance fluoresence. OH was produced by water photolysis and hydroxyl resonance flurorescnet photons were measured by multiscaling techniques. The results indicate that the low pressure bimolecular rate constant is 4 x 10 the the minus 13th power cu cm molecule (-1) s(-1) over the temperature range studied. A substantial increase in the bimolecular rate constant with an increase in pressure was observed at all temperatures except 228 K. This indicates the importance of initial adduct formation and subsequent stablization. The high pressure results are well represented by the Arrhenius expression (k sub bi) sub infinity = (6.83 + or - 1.19) x 10 to the minus 12th power exp(-646 + or - 47/T)cu cm molecule (-1)s(-1). The results are compared to previous investigated and are theoretically discussed. The implications of these results on modeling of terrestrial and planetary atmospheres and also in combustion chemistry are discussed. Author

N80-30459# Texas Univ. at Austin. Dept. of Electrical Engineering.
NEW NONLINEAR OPTICAL PROCESSES IN MOLECULES AT INFRARED FREQUENCIES Annual Report, 30 Sep. 1978 - 29 Sep. 1979
Michael F. Becker 1 Nov. 1979 32 p refs
(Grant AF-AFOSR-3712-78)
(AD-A086206; AFOSR-80-0465TR; AR-1) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report details progress in the study of optical nonlinearities in molecules at infrared wavelengths. The objectives have been to investigate triply resonant third harmonic generation and singly, two photon resonant third harmonic generation. In the first area, the limiting process of multiphoton absorption has received emphasis. In the second area, work has concentrated on molecules which have very strong, narrow, two photon resonances. The successful application of third harmonic generation techniques to study collisionless multiphoton excitation in sulfur hexafluoride was accomplished. Depending on the excitation frequency, one or two photon processes have been identified which deplete the population of the discrete vibrational energy levels into the quasi-continuum. Similar third harmonic generation experiments have yielded lower conversion efficiency in ammonia than in sulfur hexafluoride. Only a single rotational level in ammonia is found to be resonant, so the susceptibility is only minimally enhanced. In the area of two photon resonant molecules, the susceptibility and projected conversion efficiency has been calculated for deuterated methane. Because of the very narrow and strong two photon resonance, the calculated third harmonic conversion is larger than has been observed in any gas phase molecule to date. GRA

N80-30460# Syracuse Univ., N. Y. Dept. of Chemical Engineering and Materials Science.
SURFACE PHYSICS AND CHEMISTRY OF ELECTRICAL CONTACT PHENOMENA Annual Report, 1 Oct. 1979 - 31 Aug. 1980
Richard W. Vook 1 Jun. 1980 30 p refs
(Contract N00014-79-C-0763)
(AD-A086733) Avail: NTIS HC A03/MF A01 CSCL 07/4

The vacuum surface segregation of impurities on copper slip ring materials was studied by Auger electron spectroscopy. In addition the surface chemical composition, electrical contact resistance, and friction were measured in situ for a copper slip ring rotating in vacuum against two copper wire brushes running in separate tracks. The results are embodied in reprints and preprints of 4 papers attached as appendices to the report. GRA

N80-30461# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricant Research Lab.
DETERMINATION OF AROMATICITY OF FUELS AND LUBRICANT BASESTOCKS BY ULTRAVIOLET SPECTROSCOPY Interim Report, Jan. 1977 - Feb. 1980
Frank M. Newman and Marvin K. Greenberg Feb. 1980 26 p refs Presented at the Conf. on Anal. Chem. and Appl. Spectry., Pittsburgh, Mar. 1978
(Contracts DAAK70-78-C-0001; DAAK70-80-C-0001)

(AD-A086654; AFLRL-103) Avail: NTIS HC A03/MF A01 CSCL 07/4

A rapid and inexpensive ultraviolet spectroscopic method for determining the aromaticity of turbine and diesel fuels and of lubricant basestocks has been developed. The method employs fixed cells of 0.010, 0.10, and 1.00 cm pathlength in which a sample spectrum is obtained in the 190 to 350 nm region. Absorbance values at several wavelengths and simple matrix calculations yield weight percent ring carbon in substituted benzenes, napthalenes, and phenanthrenes/anthracenes. The precision and accuracy of the method are good for both standards and fuel blends. The method is currently in use for correlation work in both turbine combustors and diesel engines. A large number of virgin and re-refined lubricant basestocks have been analyzed and the results compared to those from other methods. The UV data are more detailed and are believed to be more reliable and accurate. GRA

N80-30462# Locus, Inc., State College, Pa.

INSTRUMENTATION FOR DETECTING HAZARDOUS MATERIALS. Final Report, Jun. 1979 - Jun. 1980

Gerard J. Gross, David E. Harris, Gerard Lachs, and Robert M. Dillman. Jun. 1980. 261 p. refs

(Contract DCPA01-79-C-0305)

(AD-A086467; Rept-940-4) Avail: NTIS HC A12/MF A01 CSCL 17/5

The status of material sensing technology as it might be applied to the detection and identification of hazardous materials is reviewed. The scope of types of hazards includes toxic, fire, and explosion hazards but not nuclear radiation hazards. A list of 115 materials considered to pose significant hazards in emergency operations is derived. Then both remote and nonremote instrument types are evaluated, with emphasis on their potential application for development of a portable detection instrument. Though no instrument exists now in a form ready to use for the role studied here, several types show promise for future development: a remote passive IR absorption instrument, a nonremote dispersive IR analyzer, and a nonremote portable gas chromatograph/mass spectrometer. A number of instrument types for purposes other than primary identification are also reviewed and comments made on application and future development. An extensive list of references on material sensing technology is included. GRA

N80-30463# Virginia Univ., Charlottesville. Dept. of Chemistry.

TRANSITION METAL-PROMOTED OXIDATIVE FUSION WITH CARBORANE AND BORINE ANIONS. SYNTHESIS OF C4B SUB n (N = 8-11) CARBORANE SYSTEMS IN THE PRESENCE OF B5H8(-) OR B-3H8(-) IONS

Narayan S. Hosmane and Russell N. Grimes. Jul. 1980. 39 p. refs. Submitted for publication

(Contract N00014-75-C-0305; NR Proj. 053-569)

(AD-A087252; TR-33) Avail: NTIS HC A03/MF A01 CSCL 07/2

Simultaneous treatment of CoCl2 or FeCl2 with the (CH3)2C2B4H5)- and (B5H8)- ions in THF at room temperature gave mixed-ligand metallacarborane complexes. In the iron-borane-carborane reaction the order of addition of reagents is important; thus, treatment of FeCl2 initially with (B5H8)- followed later by ((CH3)2C2B4H5)- gave species identified mass spectroscopically as [(CH3)2C2B5H5]2FeH2 and (CH3)4C4B10H10, neither of which was observed in the previously described 'simultaneous' reaction. GRA

N80-30464# Air Force Academy, Colo. Directorate of Chemical Sciences.

CHEMILUMINESCENT REACTIONS OF SELENIUM AND TELLURIUM WITH FLUORINE

William G. Thorpe. Apr. 1980. 217 p. refs

(AF Proj. 2303)

(AD-A087202; FJSRL-TR-80-0010) Avail: NTIS HC A10/MF A01 CSCL 07/4

The Group VI elements, selenium and tellurium, are found to react with fluorine emitting a broad spectral chemiluminescence. The chemiluminescence is characteristic of that emitted by a diatomic molecule. The proposed emitting species are SeF and TeF. Selenium reacts with fluorine with a weak chemiluminescence in the visible between 3800 A and 8900 A. Identical spectra are obtained regardless of whether the source of selenium is the elemental vapor or hydrogen selenide. In the hydrogen selenide/fluoride reaction, vibrationally excited HF is produced with the identified bands: (4,0), (5,1), (6,2), and (3,0) superimposed on the SeF chemiluminescence. GRA

N80-30465# Naval Research Lab., Washington, D. C. Combustion and Fuels Branch.

CATALYTIC OXIDATION OF CARBON MONOXIDE AT HIGH HUMIDITY AND LOW TEMPERATURE. Interim Report

J. K. Musick and F. W. Williams. 10 Jun. 1980. 19 p.

(AD-A087206; AD-E000475; NRL-8397) Avail: NTIS HC A02/MF A01 CSCL 07/4

Two catalysts (hopcalite and palladium) were tested for efficiency in promoting oxidation of carbon monoxide (CO). The catalysts were tested using air at 21,000 per h to the minus 1 space velocity, 50% relative humidity, and various temperatures. The air was contaminated with approximately 100 ppm each of methane, dichlorofluoromethane (R-12), and dichlorotetrafluoroethane (R-114) in addition to approximately 5000 ppm of CO. Hopcalite was further tested under similar conditions except that the air was at 100% relative humidity. There is little difference in the efficiencies of hopcalite and palladium catalyst for oxidizing CO at 57 to 62 C, both are low. At 119 to 122 C, the palladium is more efficient than hopcalite. The simultaneous presence of three other contaminants decreased the efficiency of both hopcalite and palladium for oxidizing CO. With the hopcalite preheated to about 119 C, the heat of reaction is not sufficient to maintain the oxidation of CO under the conditions tested. The minimum temperature at which hopcalite and palladium catalysts will completely oxidize CO under the conditions tested is in the 70 to 100 C range. GRA

N80-30466# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

FORMATION AND CONTROL OF FUEL-NITROGEN POLLUTANTS IN CATALYTIC COMBUSTION OF COAL-DERIVED GASES. Quarterly Technical Progress Report, 15 Dec. 1978 - 15 Mar. 1979

F. V. Bracco, C. Bruno, B. Kim, D. A. Santavicca, J. H. Semler, and P. M. Walsh. 1 Apr. 1979. 55 p. refs

(Contract EF-77-S-01-2762)

(FE-2762-7) Avail: NTIS HC A04/MF A01

Computed axial and radial gas temperature and carbon monoxide concentration profiles inside a catalyst channel during carbon monoxide combustion are presented. The integrated carbon monoxide concentration profiles at the exit are compared with experimentally measured values. The resonance absorption and Raman scattering techniques for measuring gas temperature and species concentration are summarized. DOE

N80-30467# National Academy of Sciences - National Research Council, Washington, D. C.

SYMPOSIUM ON ATOMIC SPECTROSCOPY

1979. 221 p. refs. Presented at the SAS-79 Symp. on Atomic Spectry., Tucson, Ariz., 10 Sep. 1979

(Contract DE-AC02-79ER-10460)

(DOE/ER-10460/1; CONF-790997) Avail: NTIS HC A10/MF A01

Abstracts of several presentations addressing developments in atomic spectroscopy are given. Topics covered include: fast beam spectroscopy; astrophysical and other spectra; highly ionized spectroscopy; complex spectra; Rydberg levels; fine structure, hyperfine structure and isotope shift; lineshapes; lifetimes, oscillator strengths and Einstein coefficients; and spectroscopy with lasers. DOE

N80-30468# Thomson-CSF, Orsay (France). Lab. Central de Recherches.

PERFECTING OF NUCLEAR MICROANALYSIS OF DEUTERIUM BY MEANS OF ION IMPLANTATION. APPLICATION TO THE STUDY OF THE HYDROGENATION OF AMORPHOUS SILICON THROUGH IONIC IMPLANTATION. Final Report [MISE AU POINT DE LA MICROANALYSE NUCLEAIRE DU DETERIUM A L'AIDE D'UN IMPLANTEUR D'IONS ET SON APPLICATION A L'ETUDE DE L'HYDROGENATION DE SILICIUM AMORPHISE PAR IMPLANTATION IONIQUE]

D. Dieumegard and D. Dubreuil. 1979. 80 p. refs. In FRENCH. (Contract DGRST-77-7-1650)
Avail: NTIS. HC A05/MF A01

The technique of nuclear microanalysis of deuterium by means of the reaction D (3He, p)4He was perfected on an ion implantor of 400 kV. The sensitivity of the method was about 10 to the 13th power deuterium atoms /sq cm, for an analytical depth of 5000 A in silicon for a three minute experiment. This technique was applied to the study of the hydrogenation of amorphous silicon, by means of ionic implantation and in a deuterium plasma. Kinetics of the trapping of deuterium were measured between ambient temperature and 460 C. The measurements of the concentration outline allow the determination of the diffusion coefficient of the deuterium in amorphous silicon. The thermal stability of the deuterium in the layers was also studied.
Author (ESA)

N80-30469# National Bureau of Standards, Washington, D.C. National Engineering Lab.
FLAMMABILITY TESTING OF SOLIDS UNDER THE FEDERAL HAZARDOUS SUBSTANCES ACT. Final Report, 1974 - 1975
Richard D. Peacock and Marianne P. Vaishnav. Apr. 1980. 93 p. refs. Sponsored in part by Consumer Product Safety Commission.
(PB80-179047; NBSIR-78-1580) Avail: NTIS. HC A05/MF A01. CSCL 13L

Experimental work performed for the improvement of test methods for shredded or slit films, powders, pastes, and granular substances, and for extremly flammable solids is discussed. GRA

N80-30470# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
COMBUSTION OF DROPS AND SPRAYS OF NO. 2 DIESEL OIL AND ITS EMULSIONS WITH WATER AND METHANOL. VOLUME 1: EXPERIMENTAL. Final Report, Jul. 1978 - Aug. 1979
S. R. Gollahalli, M. L. Rasmussen, and S. J. Moussavi. Jan. 1980. 231 p. refs. 2 Vol.
(Contract DOT-RC-82011)
(PB80-178213; OU-AMNE-79-15-Vol-1; DOT/RSPA/DPB-50-80/1-Vol-1) Avail: NTIS. HC A11/MF A01. CSCL 21G

The combustion behavior of No. 2 diesel oil and its emulsions with water and methanol is examined experimetally. The experiments are carried out in three parts: a study of stability and microstructure of emulsions, single drop combustion studies, and spray combustion studies. The results show that unsupported drops of No. 2 diesel oil emulsions with water and methanol undergo disruption during combustion and the fragmentation activity depends on emulsion and ambient variables. The ignition and pollutant emission characteristics of No. 2 diesel oil sprays also are seen to be affected by emulsification. GRA

N80-30471# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
COMBUSTION OF DROPS AND SPRAYS OF NO. 2 DIESEL OIL AND ITS EMULSIONS WITH WATER AND METHANOL. VOLUME 2: THEORETICAL. Final Report, Jul. 1978 - Aug. 1979
M. L. Rasmussen and S. R. Gollahalli. Jan. 1980. 131 p. refs. 2 Vol.
(Contract DOT-RC-82011)
(PB80-178221; OU-AMNE-79-16-Vol-2; DOT/RSPA/DPB-50-80/2-Vol-2) Avail: NTIS. HC A07/MF A01. CSCL 21G

The combustion behavior of No. 2 diesel oil and its emulsions with water and methanol is analyzed theoretically. Two theoretical models to analyze the variation of drop temperature with emulsion parameters are developed. The differential model considers the diffusion and specific heat effects inside the composite emulsion drop. The integral model does not consider the temperature variation inside the drop. Analytic solutions for both models are developed assuming constant properties. The integral model is also solved numerically considering the variation of properties and using some empirical input data. Both models predict the variation of drop disruption time with the internal phase content in qualitative agreement with the experimentally measured values for the drops of No. 2 diesel oil-water emulsion with water volume fractions up to 0.20. GRA

N80-30472# Membrane Systems, Inc., San Diego, Calif.
DEVELOPMENT OF REVERSE OSMOSIS MEMBRANE FOR SEAWATER DESALINATION. Final Report
Richard G. Sudak, James B. Bott, Ronald L. Fox, Susan J. Gagner, and Max E. McKee. Sep. 1979. 118 p.
(Contract DI-14-34-0001-8523)
(PB80-182090; W80-04802) Avail: NTIS. HC A06/MF A01. CSCL 07D

Composite reverse osmosis membranes were formed with a polysulfone porous substrate. The membrane barrier layer was formed by the interfacial polycondensation of polyethylenimine and isophthaloyl chloride. The barrier layer was capable of single stage seawater desalination in that selected membrane samples had a flux of 17 GFD and a rejection of 99%. Asymmetric polyimide membrane was developed further by optimization of casting formulations and conditions. When tested, the best results were 5.8 GFD and 98.4% rejection. A composite membrane barrier layer was formed on polysulfone substrate interfacially with poly(epichlorohydrin-secondary diamines) and isophthaloyl chloride. The best results were 9.6 GFD and 95% rejection. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-30473 Rensselaer Polytechnic Inst., Troy, N. Y.
FATIGUE OF Ni-Al-Mo ALIGNED EUTECTICS. Ph.D. Thesis
John Michael Tartaglia. 1980. 242 p.
Avail: Univ. Microfilms. Order No. 8020416

The influence of test temperature, environment frequency and heat treatment on fatigue resistance of two nickel-aluminum-molybdenum (gamma/gamma prime-alpha) aligned eutectics, Ni-17.7 w%Al - 16.3% Mo, designated AGI5, and Ni-14.4% Al-20% Mo, designated AG34, were determined. Both alloys were tested in high cycle tension-tension fatigue at 25 C and 825 C. Testing at room temperature was performed in air and in vacuum. All tests were performed at 20 hz except that AGI5 was tested at 20.2 and 0.2 hz. Cracks at 725 C were surface initiated, while fractures at 825 C originated within the specimen cross section, suggesting the possbility of a creep fatigue interaction at 825 C. Both alloys reveal stage 2 cracking at elevated temperature; AGI5 has lower fatigue resistance at 725 C when the test frequency is decreased. Dissert. Abstr.

N80-30474 Rensselaer Polytechnic Inst., Troy, N. Y.
THE INFLUENCE OF COHERENCY STRAINS ON THE ELEVATED TEMPERATURE MECHANICAL BEHAVIOR OF Ni-15Cr-Al-Ti-Mo ALLOYS. Ph.D. Thesis
Douglas Arthur Grose. 1980. 281 p.
Avail: Univ. Microfilms. Order No. 8020405

The effect of changes in weight traction gamma prime on the minimum of steady-state creep rate was investigated. The temperature dependence of coherency strain as represented by the gamma-gamma prime mismatch was determined over the temperature range 25 C to 800 C by X-ray diffraction. Elevated temperature tensile tests were performed on single-phase, control alloys. Steady state creep data was obtained at 0.58 Tm for selected alloys following peak-aging and 500 hour aging heat treatments at 760 C. Transmission electron microscopy was employed to characterize the deformation substructures and to establish mechanical property-structure relationships. The flow stress increment due to precipitation of gamma prime when normalized by the weight fraction of gamma prime was found to be linearly correlated to the magnitude of gamma-gamma prime mismatch over the temperature inteval 25 C to 800 C. The linear correlation was strongest for high gamma-gamma prime misfit alloys regardless of the antiphase boundary energy (APBE). Dissert. Abstr.

N80-30475 Notre Dame Univ., Ind.
HYDROGEN-RELATED PHENOMENA IN A NICKEL-BASE ALLOY Ph.D. Thesis
Richard James Coyle 1980 163 p
Avail: Univ. Microfilms Order No. 8020958

A series of hydrogen related phenomena which influence embrittlement processes were examined. These phenomena included the influence of aging on hydrogen absorption during and outgassing after electrolytic charging, the effect of aging time on hardness, time to failure and fracture mode, accelerated hydrogen transport by mobile dislocations, hydrogen induced changes in fracture mode, and the effect of hydrogen on ductile fracture mechanisms. The results indicate the dependence of embrittlement on aging time in Hastelloy C-276 involves two processes. At short aging times embrittlement may be due to either P segregation or planar slip caused by short-range order. At longer times long range order is most likely responsible for embrittlement by promoting a planar slip mode. Dissert. Abstr.

N80-30476 Lehigh Univ., Bethlehem, Pa.
FRACTURE TOUGHNESS OF SOME CRYOGENIC ALLOYS Ph.D. Thesis
Bruce Robert Somers 1980 305 p
Avail: Univ. Microfilms Order No. 8019729

The elastic plastic fracture behavior of some alloys for cryogenic service was investigated using fractographic and J integral techniques. The stable crack growth initiation processes of four materials were studied: an iron 13 percent chromium 19 percent manganese austenitic alloy (Fe13Cr19Mn); an aluminum alloy with 6 percent magnesium (AMG 6); an aluminum alloy with 4.4 percent magnesium (5083); and a 99.8 percent aluminum (1180). The J integral versus crack extension, resistance curves were determined in both LT and TL orientations for Fe 13Cr19Mn, AMG 6 and 5083 at 111K and for Fe13Cr19 Mn at 76K. Compact specimens of 18 mm and 20 mm thickness were used. The J value required to initiate true crack growth, J sub IC at 111K for the 5083 LT and TL using a linear least squares R curve with 19 points averaged for each crack extension was 19.1; 16.8, 18.7, 11.3, 380, and 188 KJ square meters respectively. The J sub IC at 76K for the Fe13Cr19 LT and TL orientations using a 9 point average for each crack extension was 225 and 123 KJ/square meters respectively. At 111K the J sub IC of the 1180 aluminum was too high to be measured using a 20 mm thick specimen. Using the thickness, J levels up to 88 KJ/square meters produced only blunting.
Dissert. Abstr.

N80-30477 Delaware Univ., Newark.
HEATS OF TRANSFORMATION OF EUTECTIC ALLOYS Ph.D. Thesis
Diana Farkas 1980 256 p
Avail: Univ. Microfilms Order No. 8019916

A method to determine unknown eutectic compositions was developed, based on combined results of differential thermal analysis with metallography and microprobe analysis. A differential thermal analyzer, which gave satisfactory accuracy for qualitative measurements, was built to handle the relatively large samples that are required for this procedure. The method allowed determination of eutectic composition in no more than three steps. The heats of the resulting alloys were measured using commercial calorimeters, a differential thermal analyzer and a differential scanning calorimeter. The possibility of measuring heat capacities by differential thermal analysis was also analyzed.
Dissert. Abstr.

N80-30478 California Univ., Berkeley.
THE COMPUTER SIMULATION OF MARTENSITIC TRANSFORMATIONS IN IDEALIZED SYSTEMS Ph.D. Thesis
Sheree Hsiao-Ru Chen 1979 155 p
Avail: Univ. Microfilms Order No. 8014635

The theory of the martensite transformation was studied by constructing a computer model of martensitic transformation in an idealized system. The model had its source in the general observation that the characteristics of martensitic transformations in solids are largely determined by the problem of accommodating the strain associated with the martensitic distortion of the crystal lattice. The martensitic transformation was modeled as a transformation which occurs through the sequential formation of individual martensitic elements, each of which carries the elementary transformation strain. Statistical equations were developed which govern the selection of the transformation path, or specific sequence in which elementary martensite particles appear in the model, and which specify the kinetics of transformation along any known path. A useful representative path was defined, the minimum energy path. The resulting model was then used for the detailed simulation of a martensitic transformation in a pseudo two dimensional system. Despite the simplicity of the model virtually all interesting qualitative aspects of the developing martensitic transformation are shown to be inherently present within it.
Dissert. Abstr.

N80-30479*# General Electric Co., Huntsville, Ala.
ANALYSIS AND CALCULATION OF MACROSEGREGATION IN A CASTING INGOT. MPS SOLIDIFICATION MODEL. VOLUME 1: FORMULATION AND ANALYSIS Final Report
Anna L. Maples and David R. Poirier (Arizona Univ., Tucson) Jul. 1980 54 p refs
(Contract NAS8-33573)
(NASA-CR-161540; Rept-80HV007-Vol-1) Avail: NTIS
HC A04/MF A01 CSCL 11F

The physical and numerical formulation of a model for the horizontal solidification of a binary alloy is described. It can be applied in an ingot. The major purpose of the model is to calculate macrosegregation in a casting ingot which results from flow of interdendritic liquid during solidification. The flow, driven by solidification contractions and by gravity acting on density gradients in the interdendritic liquid, was modeled as flow through a porous medium. The symbols used are defined. The physical formulation of the problem leading to a set of equations which can be used to obtain: (1) the pressure field; (2) the velocity field; (3) mass flow and (4) solute flow in the solid plus liquid zone during solidification is presented. With these established, the model calculates macrosegregation after solidification is complete. The numerical techniques used to obtain solution on a computational grid are presented. Results, evaluation of the results, and recommendations for future development of the model are given. The macrosegregation and flow field predictions for tin-lead, aluminum-copper, and tin-bismuth alloys are included as well as comparisons of some of the predictions with published predictions or with empirical data.
T.M.

N80-30480*# General Electric Co., Huntsville, Ala.
ANALYSIS AND CALCULATION OF MACROSEGREGATION IN A CASTING INGOT. MPS SOLIDIFICATION MODEL. VOLUME 2: SOFTWARE DOCUMENTATION Final Report
Anna L. Maples Jul. 1980 84 p
(Contract NAS8-33573)
(NASA-CR-161541; Rept-80HV007-Vol-2) Avail: NTIS
HC A05/MF A01 CSCL 11F

The software developed for the solidification model is presented. A link between the calculations and the FORTRAN code is provided, primarily in the form of global flow diagrams and data structures. A complete listing of the solidification code is given.
T.M.

N80-30481*# General Electric Co., Huntsville, Ala.
ANALYSIS AND CALCULATION OF MACROSEGREGATION IN A CASTING INGOT. MPS SOLIDIFICATION MODEL. VOLUME 3: OPERATING MANUAL Final Report
Anna L. Maples Jul. 1980 48 p
(Contract NAS8-33573)
(NASA-CR-161542; Rept-80HV007-Vol-3) Avail: NTIS
HC A03/MF A01 CSCL 11F

The operation of solidification model 1 is described. Model 1 calculates the macrosegregation in a rectangular ingot of a binary alloy as a result of horizontal axisymmetric bidirectional solidification. The calculation is restricted to steady-state solidification; there is no variation in final local average composition in the direction of isotherm movement. The physics of the model are given.
T.M.

N80-30482*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
EVALUATION OF THE CYCLIC BEHAVIOR OF AIRCRAFT TURBINE DISK ALLOYS, PART 2 Contractor Report, Jul.

1978 - Mar. 1980
B. A. Cowles and J. R. Warren. Jul. 1980. 196 p. refs.
(Contract NAS3-21379)
(NASA-CR-165123; PWA-FR-13153-Pt-2) Avail: NTIS HC A09/MF A01 CSCL 11F

Several nickel-base aircraft turbine disk superalloys were evaluated at 650 C for resistance to fatigue crack initiation and propagation under cyclic and cyclic/dwell conditions. Controlled strain low cycle fatigue (LCF) and controlled load crack propagation tests were performed and results utilized to provide a direct comparison among the alloys. Tests were performed on selected alloys to evaluate the effects of hold times, mean stresses, stress-dwell cycle types, inert environment, and contractor test methods. At the lower total strain ranges of interest, the alloys exhibited generally increasing initiation life with increasing tensile strength for both cyclic (0.33 Hz) and cyclic/dwell (900-sec hold per cycle) conditions. Rank order of the alloys by LCF initiation life changed substantially at higher strain ranges, approaching the rank order expected from monotonic tensile ductilities. The effect of the 900 sec (15 min) hold time fatigue life varied significantly from alloy to alloy. Generally, the higher-strength, finer-grained alloys exhibited more significant reductions in fatigue life due to the dwell. The effects of mean strain were found to be negligible and the effects of mean stress were pronounced. At high strain ranges the mean stress was near zero and did not contribute to reduction in life. At low strain ranges, however, mean stresses were large and significant reductions in LCF lives occurred. L.F.M.

N80-30483# Massachusetts Inst. of Tech., Cambridge. Dept. of and Center for Materials Science and Engineering.
MONITORING METASTABLE PHASES AND GRAIN STRUCTURES DERIVED FROM GLASSY ALLOYS. Technical Report, Oct. 1978 - Jan. 1980
Ken-Sue Tan, Thomas Wahl, and Roy Kaplow. 24 Mar. 1980. 13 p. refs. Presented at Conf. on Rapidly Quenched Mater., Reston, Va., 24 Mar. 1980. Submitted for publication.
(Contract N00014-76-C-0171; Grant NSF DMR-78-24185; NR Proj. 031-795)
(AD-A085882; TR-4) Avail: NTIS HC A02/MF A01 CSCL 11/2

The glassy phase affords a potentially unique route to achieving new metastable structures with desirable properties. X-ray diffraction, Mossbauer spectroscopy and electron microscopy studies of iron base alloys show a number of potentially useful (and perhaps generally characteristic) behaviors in the transition from the as-quenched glass towards equilibrium, such as relaxed glassy states, supersaturated solid solutions, unique metastable compounds and phase morphologies, and ultra-fine grain sizes. GRA

N80-30484# Massachusetts Inst. of Tech., Cambridge.
AUSTENITIC GRAIN GROWTH CHARACTERISTICS IN RAPIDLY SOLIDIFIED MARTENSITIC STEELS. Technical Report, Oct. 1978 - Jan. 1980
M. Suga, J. L. Goss, G. B. Olson, and J. B. VanderSande. 25 Mar. 1980. 10 p. refs. Presented at 2d Intern. Conf. on Rapid Solidification Processing Principles and Technologies, Reston, Va., 23-26 Mar. 1980. Submitted for publication.
(Contract N00014-76-C-0171; NR Proj. 031-795)
(AD-A085883; TR-5) Avail: NTIS HC A02/MF A01 CSCL 11/6

Comparison of the austenitic grain growth characteristics of conventionally processed and rapidly solidified 9Ni-4Co and 2Mo steels has revealed an unusual resistance to grain coarsening of the rapidly solidified material. At 1200 C where the conventionally processed material coarsens to a grain size of several hundred microns, the rapidly solidified material retains a grain size of approximately 20 micrometers. The morphological characteristics of the inhibited grain growth indicate strong pinning at prior powder particle boundaries. Long-time austenitizing treatments at 1100-1200 C eventually lead to discontinuous coarsening. Evidence so far suggests that the unusual coarsening resistance may be due to finely distributed sulfides. It is anticipated that high austenitizing treatment of rapidly solidified steels will allow improvement of sharp-crack fracture toughness (K sub IC) without the loss of Charpy energy and tensile ductility associated with excessive grain coarsening; exploitation of this phenomenon, however, will require an extreme level of cleanliness in powder processing. GRA

N80-30485# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
A STEM ANALYSIS OF TWO RAPIDLY SOLIDIFIED STAINLESS STEELS. Technical Report, Oct. 1978 - Jan. 1980
T. F. Kelley and J. B. VanderSande. 25 Mar. 1980. 15 p. refs. Presented at 2d Conf. on Rapid Solidification Processing Principles and Technologies, Reston, Va., 23-26 Mar. 1980. Submitted for publication.
(Contract N00014-76-C-0171; NR Proj. 031-795)
(AD-A085887; TR-6) Avail: NTIS HC A02/MF A01 CSCL 11/6

Scanning transmission electron microscopy (STEM) has been used for microstructural and microchemical analysis of two rapidly solidified austenitic stainless steels. One steel is a high sulfur, 303 stainless type. In this rapidly solidified steel, sulfide particles (MnS) are found to be two or three orders of magnitude smaller in size, and more uniformly distributed, than in the conventionally processed material. Extremely small sulfide particles have been observed at the cell walls and in the intracellular region of the solidification structure of individual rapidly solidified powder particles. Moreover, composition profiles have been obtained by the STEM across regular and nonregular cell walls in these powders which indicate that a high degree of chemical homogeneity was obtained. A comparison is made of the microstructures and microchemistry of individual powders, consolidated powder product, and conventionally processed versions of this high sulfur austenitic stainless steel. The rapidly solidified powders of a high phosphorus stainless steel have also been observed in STEM. The results of these observations are presented in light of the data obtained on the high sulfur steel. GRA

N80-30486# Indiana Univ. at Bloomington. Dept. of Chemistry.
THE MOLYBDENUM-MOLYBDENUM TRIPLE BOND. 7.1 BIS (1,3-di-p-TOLYTRIAZENIDO) TETRAKIS (DIMETHYLAMIDO) DIMOLYBDENUM
M. H. Chisholm, D. A. Haitko, J. C. Huffman, and K. Folting. 9 May 1980. 14 p. refs.
(Contract N00024-76-C-0826)
(AD-A086239; TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 07/3

Mo2(NMe2)(6) reacts in hydrocarbon solvents with 1,3-di-p-tolyltriazine, C7H8NNNHC7H8, to give the title compound, Mo2(NMe2)4(C7H8N3C7H8)2, as a red, crystalline solid. An X-ray study shows that in the solid state each molybdenum atom is coordinated to four nitrogen atoms which lie in a plane; there is an unbridged molybdenum-to-molybdenum triple bond with a Mo-Mo distance of 2.212(1) angstroms, and the molecule has crystallographically imposed C2 symmetry. Variable temperature 1H nmr spectra recorded at 220 MHz support the view that this form of the molecule is present in solution. GRA

N80-30487# Naval Research Lab., Washington, D. C.
AN ION BEAM MILLIPROBE FOR MATERIALS ANALYSIS. Final Report
R. D. Willis and A. R. Knudson. 21 Mar. 1980. 26 p. refs.
(RR0220844)
(AD-A086109; AD-E000433; NRL-MR-4187) Avail: NTIS HC A03/MF A01 CSCL 20/7

An ion beam 'milliprobe' has recently been constructed and tested in the Materials Modification and Analysis Branch and is now being applied to the microanalysis of materials. Singly charged ion beams from the NRL 5 MV Van de Graaff accelerator with energies up to 4 MeV can be utilized. A miniature electrostatic lens in line with a pinhole aperture focuses these ion beams to spot sizes as small as approximately 20 micrometers in diameter (0.8 mil, hence the name 'milliprobe'). The sample is positioned in the millibeam by means of a motorized X-Y translation stage which allows one to conduct computer controlled two dimension scans of the sample with one micrometer steps. The milliprobe has been used in conjunction with conventional ion beam analysis techniques to characterize the near-surface regions of alloys and semiconductor materials when good lateral resolution

is a requirement. The use of the microprobe is briefly illustrated in two current studies: (1) wear reduction in stainless steels by the implantation of nitrogen and (2) surface composition changes induced by the laser annealing of silicon that has been implanted with nitrogen. GRA

N80-30488# University Coll. of Swansea (Wales). Dept. of Metallurgy and Materials Technology.
REVIEW OF EUROPEAN POWDER METALLURGY OF SUPERALLOYS Technology Assessment Report
R. W. Evans. Dec. 1979. 65 p. refs. Sponsored in part by AFOSR
(AD-A086682; EOARD-TR-80-10) Avail: NTIS
HC A04/MF A01 CSCL 11/6

This review is an attempt to summarise the state of research and development in Europe into powder metallurgy of superalloys, and to ascertain which areas of the technology still require attention before the promised advantages of the powder metallurgy route are achieved. Although 'superalloys' are normally taken to be those alloys whose bases are nickel or cobalt, the present review deals with materials which are currently in prospect of production by powder metallurgy and which find use in the hot parts of aeroturbines. Thus it includes an account of some ferritic materials and some titanium alloys. The review deals with disc and blade alloys and discusses powder production, consolidation and the relationships between processing, structure and the final properties of powder alloys. GRA

N80-30489# Sussex Univ., Brighton (England). School of Engineering and Applied Sciences.
SPLAT-QUENCHING OF ZIRCONIUM ALLOYS, WITH SPECIAL REFERENCE TO MARTENSITE AND PRECIPITATE REACTIONS Technical Report, May 1978 - Apr. 1979
Srikumar Banerjee. 15 Nov. 1979. 58 p. refs
(Contract N00014-78-G-0048)
(AD-A086847; TR-3) Avail: NTIS HC A04/MF A01 CSCL 11/6

A detailed TEM study is reported of the structure of splat-quenched zirconium alloys as follows: Zr-Nb, various compositions; Zr-27at% Al; Zr-14at% Ni; Zr-24at% Fe. The details of martensite and omega morphology in Zr-Nb, spinodal and precipitation reactions in Zr-Al, and the crystallisation of the amorphous phase in Zr-Ni and Zr-Fe are all fully described. In Zr-FE, a novel morphology is described: a circular core of beta surrounded by six twin-related 'petals' of alpha, forms a 'sunflower' pattern not hitherto reported. GRA

N80-30490# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
PLASTIC FLOW AND FRACTURE PROCESSES IN POWDER METALLURGICAL NICKEL-BASE SUPERALLOYS Final Report, 1 Mar. 1977 - 29 Feb. 1980
C. C. Law and M. J. Blackburn. Feb. 1980. 134 p. refs
(Contract F49620-77-C-0083; AF Proj. 2306)
(AD-A086697; PWA-FR-13317; AFOSR-80-0468TR) Avail: NTIS HC A07/MF A01 CSCL 11/6

The advent of powder metallurgical methods for nickel-base superalloys has made it possible to use high-strength alloys for large components such as turbine disks. Although much of the manufacturing and process technology for such products is reasonably well understood, many of the features of the structure-property relationships in these alloys remain unclear. This document describes the results of a three-year effort undertaken to provide insight into the factors that control specific properties in advanced powder metallurgical nickel-base superalloys. The first-year effort examined the stress-rupture characteristics of smooth sections of a number of alloys including AF115 and MERL 76. It was concluded that the ability of a material to store dislocations controls the creep rate but that the fracture processes were dictated by grain boundary structures. Models that satisfactorily accounted for the behavior pattern were developed. The second-year effort extended the study to notch-rupture properties which were found to depend upon a larger number of variables. An interesting parallel between short notch lives and the fracture times of smooth sections tested under stress relaxation was found. Based on this observation, certain mechanical criteria for poor notch characteristics could be identified. GRA

N80-30491# Naval Research Lab., Washington, D. C. Surface Chemistry Branch.
STUDIES ON CORROSION PREVENTION OF MARDAN CONNECTORS BY ORGANIC COATINGS Final Report, May 1977 - Sep. 1979
B. J. Kinzig and J. S. Murday. 9 Jun. 1980. 36 p. refs
(AD-A086730; AD-E000464; NRBL-MR-4230) Avail: NTIS
HC A03/MF A01 CSCL 11/3

Electrical disturbances caused by the formation of corrosion products on computer contacts is a serious problem, especially in older contacts containing a tarnish-prone silver layer under gold plating. The efficacy of a number of corrosion preventative organic fluids in preventing corrosion in sulfide-bearing atmospheres has been evaluated, in conjunction with a chromating process for the same purpose. Studies were made both with connectors and with silver. A statistical treatment applied to visual evaluation clearly identified two organic formulations as effective corrosion inhibitors, verifying other observations. These fluids were as effective as chromating alone, but an additional measure of protection was afforded by the combination of chromate/organic fluid. GRA

N80-30492# Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.
THE INFLUENCE OF PRIOR WARM ROLLING ON FRACTURE TOUGHNESS OF HEAT TREATED AISI 52100 STEEL M.S. Thesis
Jeffrey F. McCauley. Mar. 1980. 83 p. refs
(AD-A086821) Avail: NTIS HC A05/MF A01 CSCL 11/6

An investigation was conducted to determine the effects of prior warm rolling on AISI 52100 bearing steel in the hardened condition. Microstructural and mechanical properties of both standard and warm rolled 52100 were investigated. Heat treatments, consisting of both conventional hardening treatments and isothermal transformation treatments, were conducted prior to fracture toughness, hardness, and tensile testing. Conventional hardening treatments resulted in martensitic structures with low toughness; prior warm rolling resulted in the rolled materials exhibiting both higher hardness and toughness than the standard 52100 in the hardened condition. Isothermal transformation treatments resulted in substantially improved toughness, especially in the material processed at 300 C. GRA

N80-30493# National Bureau of Standards, Washington, D.C. National Measurement Lab.
STUDIES OF MICROSCOPIC ASPECTS OF WEAR PROCESSES IN METALS Annual Report, 1 Apr. - 31 Dec. 1979
A. W. Ruff and J. P. Blau. Jun. 1980. 79 p. refs
(Contract N00014-79-F-0034)
(AD-A086760; NBSIR-80-2058) Avail: NTIS
HC A05/MF A01 CSCL 11/6

Wear experiments have been conducted in copper alloys and steels under dry sliding conditions in order to study the microscopic aspects of wear and the mechanisms involved. Two experimental wear test systems have been developed, a linear sliding tester and a block-on-ring computer controlled tester. Preliminary findings have compared the wear rates of three different steels, one a high strength-low alloy 'dual phase' steel, and two copper-aluminum alloys. Worn surface and subsurface morphologies have been studied using optical and scanning electron microscopy. Wear debris particles have been recovered from the tests and compared in morphological characteristics between the materials. Mechanical properties measurements of two of the steels were carried out to determine strain hardening characteristics for comparison with wear behavior. Micro-hardness measurements have also been made. Initial wear rate and friction transients for tests in laboratory air and argon have been examined to study processes involved in the early stages of sliding. GRA

N80-30494# Imperial Coll. of Science and Technology, London (England).
THE ROLE OF HYDROGEN IN THE STRESS CORROSION FAILURE OF HIGH STRENGTH Al-Zn-Mg ALLOYS AND SENSITIZED AUSTENITIC STAINLESS STEELS Final Annual Technical Report
L. Christodoulou, M. G. Lackey, H. M. Flower, F. J. Humphreys, and P. R. Swann. Apr. 1980. 39 p. refs

(Grant DA-ERO-77-G-011; DA Proj. 1T1-61102-BH-57)
(AD-A086427) Avail: NTIS HC A03/MF A01 CSCL 11/6

An investigation into the effect of exposure of Al-Zn-Mg alloys to water vapor has shown that hydrogen, produced by the reaction is absorbed by both the alloy grain boundaries and matrix. The amount of absorbed hydrogen depends on the local chemistry and the metal/oxide interface and is influenced by alloying additions. Attainment of a critical concentration of dissolved hydrogen in the boundaries leads to brittle intergranular fracture on the subsequent application of stress. Attainment of a critical hydrogen concentration in the matrix leads to transgranular cleavage fracture. Depending upon the alloy composition and heat treatment bubbles of gaseous hydrogen can be formed at suitable sites within the alloys such as grain boundary particles. The formation of grain boundary bubbles reduces embrittlement by reducing the local concentration of dissolved hydrogen. It is proposed that the interaction of stress and environmental variables with the above criteria governs the environmental failure of Al-Zn-Mg alloys in aqueous and water vapor containing environments. It is suggested that such failures are hydrogen embrittlement dominated. GRA

N80-30495# Electronics Research Lab., Adelaide (Australia).
THE FLASH EVAPORATION OF POWDERED INDIUM ANTIMONIDE
R. H. Hartley Jan. 1980 20 p refs
(AD-A086531; ERL-0103-TR; AR-001-904) Avail: NTIS HC A02/MF A01 CSCL 11/6

It has been shown experimentally for deposition rates of practical interest, that the flash evaporation of powdered indium antimonide from a black body source yields a stoichiometric vapor over a wide angular range about the axis of the source. Films deposited by this means have an excellent surface finish and are free from the surface defects often associated with flash evaporation employing other source geometries. GRA

N80-30496# California Univ., Berkeley. Dept. of Materials Science and Mineral Engineering.
MODIFIED 43XX STEELS FOR HIGH TOUGHNESS Final Report, 27 Sep. 1977 - 31 Mar. 1980
Naresh J. Kar, V. F. Zackay, and E. R. Parker Apr. 1980 70 p refs
(Contract DAAG46-78-C-0036; DA Proj. 1L1-61102-AH-42)
(AD-A086453; AMMRC-TR-80-20) Avail: NTIS HC A04/MF A01 CSCL 11/6

Isothermal transformations were carried out in the vicinity of M sub s temperatures on Si, Al: Si modified AISI 4330, 4340 steels, which had been remelted by electroslag refining (ESR) techniques. The microstructures of the heat-treated variants were characterized by transmission electron microscopy. Mechanical property evaluations (Charpy impact energies, tensile strengths, plane-strain fracture toughness data) of the different microstructures were also carried out. Isothermal transformations in these steels resulted in bainite, bainite: martensite microstructures, containing moderate amounts of retained austenite. The austenite was found to be in the form of thin films around the bainite, martensite laths. The strength-toughness combinations obtained in this investigation for Si-modified AISI 4330 steel appear to be superior to those for unmodified AISI 4340 and 300- M steels, whilst the strength-toughness combinations obtained for Al: Si modified AISI 4340 steel appear to be comparable to those for 18 Ni Co Mo maraging steel. The merits of ESR-processing these steels are also reflected in the uniform Charpy impact properties obtained for the different orientations investigated. GRA

N80-30497# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
AN INVESTIGATION OF A COMPOSITE OXIDE FILM AS A CORROSION INHIBITOR FOR 2024 ALUMINUM Interim Report, Jan. - Dec. 1979
Neil T. McDevitt and Frank N. Weaver (Morris Brown Univ.) Jun. 1980 38 p refs
(AF Proj. 2419)
(AD-A086791; AFWAL-TR-80-4065) Avail: NTIS HC A03/MF A01 CSCL 11/4

This study shows the corrosion resistance of the oxide film on 2024 aluminum can be improved over the neat anodic oxide by forming a composite oxide film using as a sequential process a chromate conversion solution dip followed by phosphoric acid anodization. GRA

N80-30498# Aeronautical Research Labs., Melbourne (Australia).
SCATTER OF FATIGUE CRACK RATES IN 7XXX ALUMINUM ALLOYS
D. G. Ford Mar. 1980 17 p refs
(AD-A086543; ARL/Struc-TM-309) Avail: NTIS HC A02/MF A01 CSCL 11/6

Thirty-three crack growth curves were analysed in order to estimate the logarithmic variance of fatigue crack growth rate for several 7XXX Aluminum Alloys in various conditions. The estimated standard deviation common to all of these was s = 0.1241 with 18 degrees of freedom. It was concluded that this estimate holds for differing types of 7XXX aluminium alloys, constant amplitude and block programme loading. The errors it summarises include effects of microstructure, heat treatment and purity not described by the alloy specification. R.C.T.

N80-30499# Southern Univ., Baton Rouge, La. Dept. of Mechanical Engineering.
AN INVESTIGATION OF MECHANISMS EFFECTING ENVIRONMENTAL STRESS CRACKING IN TITANIUM ALLOY
Ira J. Graham 3 Apr. 1980 31 p refs
(Contract N00019-79-C-0137)
(AD-A086979) Avail: NTIS HC A03/MF A01 CSCL 11/6

The acoustic emission technique was applied to monitor visible crack growth and microcrack formations as energy release in real time in titanium alloy using a 12.8 mm (0.510 in) WOL compact specimen in a plane strain mode. The specimens were fatigued in the 30 - 60 Hz range at a determined stress intensity factor (K sub I) with an acoustic emission transducer at a gain of 85 dB and a bandpass frequency of 0.1 - 0.3 MHz. A stable crack advanced and microcracks formed at angles other than parallel to the advancing stable crack as intermittent energy bursts in or along the boundaries of the grains. The energy release, referred to as 'acoustic emission', is a kind of elastic stress impulse. Crack movement in the order of magnitude million in/cyl were detected. Determination was made of the subcritical stress intensity factor (K sub sc) where the amplitude of the fatigue cycles no longer provide the energy source large enough to cause the crack to advance. GRA

N80-30500# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
DEFORMATION OF AN ALLOY WITH A LAMELLAR MICROSTRUCTURE: EXPERIMENTAL
K. S. Chan, C. C. Wojcik, and D. A. Koss May 1980 34 p refs
(Contract N00014-76-C-0037; Grant AF-AFOSR-2596-74)
(AD-A087100; TR-12) Avail: NTIS HC A03/MF A01 CSCL 11/6

The deformation behavior of individual Widmanstatten colonies comprised of aligned lamellae of ductile phases has been investigated. Based on the alpha-beta Ti alloy, Ti-8Al-1Mo-1V, this study shows the existence of a large 2 X variation in the critical resolved shear stress for yielding of individual colonies. Schmid's Law is not obeyed except for prism slip parallel to the beta lamellae. In addition, colonies with a high yield stress exhibit a high work hardening rate and fine, uniform slip, while colonies with a low yield stress deform by planar, non-uniform slip. This behavior appears to be independent of slip system basal, prism, or pyramidal and of microstructure alpha-beta vs. alpha-alpha: martensite. The experimental behavior is correlated to several colony orientation parameters including the stress axis, slip plane, slip direction, and orientation of the alpha-beta interface. The yield stress of a colony is found to increase as the slip direction of the dominant macroscopic slip plane tends toward being normal to the alpha-beta interface. These results indicate that the macroscopic flow behavior of colonies comprised of ductile lamellae depends on the ability of a slip system, once activated in the softer phase, to shear through the harder phase. The data also indicates that the interaction stresses at the phase interfaces are not a principal factor controlling macroscopic yielding. Finally, the alignment of a slip system in the alpha-phase

with a potential slip system in the beta-phase lamellae does not appear to affect the yield stress strongly. GRA

N80-30501# Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.
EXPERIMENTAL DETERMINATION OF THE TEMPERATURE DEPENDENCE OF METALLIC WORK FUNCTIONS AT LOW TEMPERATURES Final Report
P. Bruce Pipes Mar. 1980 6 p refs
(Contracts EY-76-S-02-2314; DE-AS02-76ER-02314)
(DOE/ER-02314) Avail: NTIS HC A02/MF A01

Work involving the use of a modified Kelvin technique to study the temperature dependence of the work function of both bare metallic surfaces and metallic surfaces with He-4 gas adsorbed onto them is described. DOE

N80-30502# Bendix Corp., Kansas City, Mo.
PULSE PLATING OF NICKEL DEPOSITS
C. J. Stimetz and M. F. Stevenson Feb. 1980 17 p refs Presented at 67th Ann. AES Tech. Conf., Milwaukee, 22-26 Jun. 1980
(Contract EY-76-C-04-0613; DE-AC04-76DP-00613)
(BDX-613-2378; CONF-800621-1) Avail: NTIS HC A02/MF A01

Pulse plated and conventional nickel deposits were compared for differences in morphology, mechanical properties, and microstructure. The deposits were obtained from nickel sulfamate, nickel chloride, and Watts nickel plating solutions. No significant difference were found in the direct and pulse current deposits from the sulfamate and chloride solutions; however, significant differences in microstructures, yield strength, and microhardness were observed in deposits from the Watts nickel solution. DOE

N80-30503# Sandia Labs., Albuquerque, N. Mex.
METALLOGRAPHIC PREPARATION OF TITANIUM DIBORIDE COATINGS
Mark E. McAllaster Mar. 1980 12 p
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-80-0596) Avail: NTIS HC A02/MF A01

A method is described for preparing metallographic cross sections of thin, hard, chemically vapor deposited titanium diboride coatings on various softer substrates. Standard metallographic preparation techniques were found to result in fracturing and edge rounding of the coatings. It is shown that these problems can be avoided by unidirectional grinding on worn 600 grit silicon carbide abrasive paper. Typical photomicrographs of chemically vapor deposited titanium diboride coatings are shown along with photomicrographs of intermediate phases that form at the titanium diboride substrate interfaces. DOE

N80-30504# California Univ., Livermore. Lawrence Livermore Lab.
VISCOSITY OF METALS IN EXPLOSIVE WELDING
I. D. Zakharenko and V. I. Mali Nov. 1979 9 p refs Transl. into ENGLISH of the book "Gorenie i Vzryv, Materialy Tretego Vsesoyuznogo Simpoziuma go Goreniyu i Vzryvu" Moscow, Nauka Press, 1972 p 575-578 Conf. held in Moscow, 5-10 Jul. 1971
(UCRL-Trans-11542) Avail: NTIS HC A02/MF A01

A mathematical analysis of explosive welding is given of metal plates. DOE

N80-30505# Sandia Labs., Albuquerque, N. Mex.
HYDROSTATIC STRESS DEPENDENT YIELD OF 7075-T6 ALUMINUM
Steve E. Benzley, Tom G. Priddy, and Mark S. SooHoo Mar. 1980 21 p refs
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-2220) Avail: NTIS HC A02/MF A01

Tension and compression tests on notched cylindrical bars made of 7075-T6 aluminum, conducted as a part of an investigation of the mechanics of ductile fracture, are discussed. The compression tests showed significantly stiffer behavior in the nonlinear portion of the experiment than those found from the tension tests. This difference was accounted for by incorporating a hydrostatic stress dependent yield model in the analysis of the experiment. The model was verified by comparing finite element calculations with the actual experimental results. DOE

N80-30506# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
WELDABILITY OF THERMALLY GRAIN-REFINED Fe12Ni-0.25Ti FOR CRYOGENIC STRUCTURAL APPLICATIONS M.S. Thesis
Douglas Edwards Williams Feb. 1980 43 p refs
(LBL-10259) Avail: NTIS HC A03/MF A01

The weldability of a research alloy designed for structural use in liquid helium temperature, cryogenic environments is investigated. Plates of iron 12 weight percent nickel 0.25 weight percent titanium were grain refined by the four step, grain refining thermal treatment developed for this alloy and welded with Inconel Number 92 weld wire using the gas metal arc welding process with argon 15% helium gas shielding. Both a single pass and a double sided, two pass electron beam weld were also made without filler metal addition. Weldments were radiographed and sectioned and the charpy V notch specimens removed were tested at liquid nitrogen and helium temperatures. DOE

N80-30507# Pennsylvania State Univ., University Park. Metallurgy and Physics Depts.
HYDROGEN ABSORPTION IN METALS: A FIELD ION MICROSCOPY STUDY Progress Report, 1 Jun. 1979 - 31 May 1980
T. Sakwrai and H. W. Pickering Feb. 1980 9 p refs
(Contract DE-AC02-79ER-10430)
(DOE/ER-10430) Avail: NTIS HC A02/MF A01

Progress is summarized in sample preparation, computer interfacing for automated data acquisition, and computer simulation of ion optics of atom probes, in addition to the actual chemical compositional analysis of the Fe-Ti alloy samples and observations on hydrogen induced microcracking. It is found that Ti segregates at the surface and grain boundaries when heated to and above 800 C. Some of the Ti atoms form clusters with carbon, nitrogen, and oxygen as a nucleus. The formation and propagation of a microcrack involving hydrogen was documented on a truly atomic scale. DOE

N80-30508# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Materials Science and Engineering.
CONSEQUENCES OF THE RE-TRANSFORMATION OF PRECIPITATED AUSTENITE IN FERRITIC CRYOGENIC STEELS
J. W. Morris, Jr., C. K. Syn, J. I. Kim, and B. Fultz Jun. 1979 12 p refs Presented at the Intern. Conf. on Martensitic Transformation, Boston, 24 Jun. 1979
(Contract W-7405-eng-48; N00014-75-C-0154)
(LBL-10128; TN-8; CONF-7906103-4) Avail: NTIS HC A02/MF A01

The retransformation of precipitated austenite (gamma/sub R/) in Fe-(6-9)%Ni steels is investigated, with particular emphasis on the influence of transformation characteristics on alloy toughness at cryogenic temperature. In all cases studied the precipitated austenite retransforms, either during cooling to cryogenic temperature or during deformation prior to fracture of the alloy. When the retransformation is thermally induced the product martensite tends to form in a variant identical to that present before precipitation of the austenite, no significant refinement of the microstructure is achieved. On the other hand, mechanical transformation of the austenite produces a distribution of martensite variants determined by the local strain, hence preserving a refined microstructure conducive to low temperature toughness. DOE

N80-30509# Brown Univ., Providence, R. I. Div. of Engineering.
EFFECT OF ALLOY DEFORMATION ON THE AVERAGE SPACING PARAMETERS OF NON-DEFORMING PARTICLES
J. Fisher and J. Gurland Feb. 1980 16 p refs Submitted for publication
(Contract DE-AC02-80ER-10556)
(COO-3084-75; TR-75) Avail: NTIS HC A02/MF A01

It is shown on the basis of stereological definitions and a few simple experiments that the commonly used average dispersion parameters, are a fraction (alpha/sub alpha/)/sub beta/, areal particle density N/ sub alpha beta/ and mean free path lambda/sub alpha/, remain invariant during plastic deformation

in the case of non-deforming equiaxed particles. Directional effects on the spacing parameters N/sub alpha beta/ and lambda/sub alpha/arise during uniaxial deformation by rotation and preferred orientation of nonequiaxed particles. Particle arrangement in stringered or layered structures and the effect of deformation on nearest neighbor distances of particles and voids are discussed in relation to strength and fracture theories. DOE

N80-30510# Brown Univ., Providence, R. I. Engineering Div.
VOID NUCLEATION IN SPHEROIDIZED STEELS DURING TENSILE DEFORMATION
John Robb Fisher, Jr. Apr. 1980 193 p refs
(Contracts EY-76-S-02-3084; E(11-1)-3084)
(COO-3084-77) Avail: NTIS HC A09/MF A01

The effects of various mechanical and material parameters on void formation at cementite particles in axisymmetric tensile specimens of spheroidized plain carbon steels are investigated. Desired microstructures for each of three steel types were obtained. Observations of void morphology with respect to various microstructural features were made using optical and scanning electron microscopy. DOE

N80-30511# Mound Lab., Miamisburg, Ohio.
NICKEL-IRON ALLOY CORROSION IN A SEALED PYROTECHNIC SYSTEM
Elton E. Tibbitts and Robert F. Salerno 1980 23 p refs
Presented at the 7th Intern. Pyrotechs. Seminar, Vail, Colo., 14 Jul. 1980
(Contract DE-AC04-76DP-00053)
(MLM-2707(OP); CONF-800713-2) Avail: NTIS HC A02/MF A01

Actuators loaded with Ti/KClO4 and aged for several days had chlorine containing corrosion products on Alloy-52 electrode pins and Tophet-C bridgewire surfaces. An in depth analysis of these materials indicated that moisture, organic contamination, and chlorine were the major causes of the corrosion. Definite evidence was uncovered that indicated a partial decomposition of the KClO4 was the major source of the chlorine. In the presence of moisture, particles that settle on the metal surface cause the formation of galvanic or oxygen concentration cells that dissolve to produce electrolytes on the metal surface causing corrosion of the metal. It is shown that corrosion can be eliminated by reducing the humidity to below a critical level and vacuum drying the pyrotechnic so that no moisture is considered on the metal. Since water is consumed in the reaction forming hydrated oxides or hydroxides, the extent of the reaction is limited by the amount of water in the sealed unit. DOE

N80-30512# Standard Pressed Steel Labs., Naas (Ireland). Space Lab.
EVALUATION OF TITANIUM BOLTS COATED WITH IVADIZE ALUMINUM AND KALGARD 2240 C IN TORQUE TENSION TESTS
J. Newnham, B. Hassell, and P. Behan Nov. 1979 68 p refs
(Contract ESTEC-3698/78-NL-PP(SC))
(SPS-5254; ESA-CR(P)-1304) Avail: NTIS HC A04/MF A01

Proprietary aluminum coatings were evaluated in torque tension tests on titanium alloy nuts and bolts. The objective was to identify a coating/lubricant combination for titanium alloy fasteners, which would give consistent frictional conditions on repeated installations, provide corrosion resistance in marine environments, and be compatible with space conditions. The coatings evaluated were the McDonnell 'Ivadize' coating, and Kalgard 2240 C paint coating. Both were tested in the unlubricated condition, and lubricated either with an oil or a bonded molybdenum disulphide coating. Ivadize coated fasteners did not allow more than about five applications even with the best lubricant. Kalgard coatings allowed the full twenty five installations without excessive increase in friction, when molybdenum disulphide was used as lubricant. Author (ESA)

N80-30513# National Bureau of Standards, Washington, D.C. Corrosion and Electrodeposition Group.
MEASURING THE RATE OF CORROSION OF REINFORCING STEEL IN CONCRETE Annual Report
E. Escalante, S. Ito, and M. Cohen Mar. 1980 45 p refs
Sponsored in part by Federal Highway Administration Washington, D.C.
(PB80-170848; NBSIR-80-2012) Avail: NTIS HC A03/MF A01 CSCL 13C

Progress in developing a nondestructive method for measuring the corrosion of steel in concrete as related to bridge deck deterioration is reported. Several polarization techniques for measuring the corrosion rate of steel in concrete are correlated to actual weight loss measured gravimetrically. The design of a prototype automated minicomputer system for measuring the corrosion of steel in concrete is also described. Laboratory results on the effect of pH, Cl-, O sub 2, and moisture on initiating and maintaining corrosion in mortar are included. GRA

N80-30514# National Materials Advisory Board, Washington, D. C.
SUPPLY AND USE PATTERNS FOR THE PLATINUM-GROUP METALS Final Report
1980 220 p refs Sponsored in part by Dept. of Commerce and Bureau of Mines
(Contract GS-00-DS-(P)-94008)
(PB80-179088; NMAB-359) Avail: NTIS HC A10/MF A01 CSCL 11F

A survey of background information on the chemistry, geology, and supply sources and a detailed evaluation of current and future usage for all six platinum group metals are presented. The extensive use of platinum, palladium, and later, rhodium in automotive emission control systems is projected to continue for some time. Recycling of spent or discarded catalytic converters is advised as an important source of the platinum group metals they contain, but the current (1978) economic picture appears to make the activity marginal at best. The content of the National Stockpile is reviewed and the need to increase the amounts and to upgrade the forms to existing specifications is shown. In addition, it is recommended that rhodium be added to the stockpile list as a critical and strategic material. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-30515 Pennsylvania Univ., Philadelphia.
CHARACTERIZATION OF MACROMOLECULAR FILMS ADSORBED IN TRACK-ETCHED MEMBRANES Ph.D. Thesis
Gregory Lawrence Powers 1980 208 p
Avail: Univ. Microfilms Order No. 8018600

A method was developed for determining the thicknesses of adsorbed macromolecular layers in porous membranes. Bovine serum albumin (BSA) was chosen as the solute macromolecule owing to its uniformity, stability, and size. The porous membranes were of muscovite mica with pores formed by the track etch process. The thickness of the (tightly bound) layer was determined by measuring electrolyte conductance (KCl) through the pores in the presence and absence of BSA. Electrolyte conduction was also employed to provide an accurate assessment of molecular partitioning in the pores. The partitioning measurement gave information on the total amount of BSA in the pores, both that bound as a wall layer as well as additional protein in solution within the pore. Membranes were made from sheets of muscovite mica 7 micron thick. Damage tracks were formed by irradiation with a collimated beam of massive fission fragments emitted from a Cf252 source. The damage tracks produced were etched into discreet pores with hydroflouric acid. Dissert. Abstr.

N80-30516 Iowa State Univ. of Science and Technology, Ames.
FATIGUE EFFECTS IN THE WEAR OF POLYMERS Ph.D. Thesis
Vinod Kumar Jain 1980 184 p
Avail: Univ. Microfilms Order No. 8019638

A wear equation was developed using the concept of repetitive loading of asperities on the mating surfaces in a sliding situation. It postulates elastic deformation in the contact zone and asperities with spherical tips. The wear equation is epxressed in terms of the sliding parameters, surface topographical parameters, modulus of elasticity, and fatigue properties of the

weaker material. The equation is consistent with experimental data for the case of poly(methyl methacrylate), poly(vinyl chloride) and high density polyethylene pins sliding against a steel disk. Scanning electron microscopy revealed that the worn surfaces of poly(methyl methacrylate) and high density polyethylene pins were covered with arced ripples stretching across the transverse direction. In the case of poly(vinyl chloride) there were signs of considerable plastic deformation on the worn surface. The fracture surfaces of notched fatigue samples of poly(methyl methacrylate) exhibited well-defined striation markings which were obscure, ill-defined and discontinuous in the case of high density polyethylene and poly(vinylchloride). The final stage of fatigue fracture in the latter two materials was accompanied with plastic deformation. Dissert. Abstr.

N80-30517# Naples Univ. (Italy). Dept. of Chemical Engineering.
EFFECT OF APPLIED STRESS, THERMAL ENVIRONMENT AND WATER IN EPOXY RESINS Interim Scientific Report, 1 Jul. 1978 - 30 Nov. 1979
L. Nicolais, E. Drioli, and A. Apicella. Nov. 1979. 54 p. refs. Prepared for European Office of Aerospace Research and Development, London.
(Grant AF-AFOSR-3369-77; AF Proj. 2307)
(AD-A086200; AFOSR-80-0474TR) Avail: NTIS
HC A04/MF A01 CSCL 11/4

Because of their elevated physical properties, epoxy resins are widely used as matrices for high performance composites. However, due to moisture induced plasticization and formation of microcavities, high temperature and humidity tend to reduce their physical properties. A history dependent solubility model is generalized in accordance with the Dual Mode Sorption theory to account for effective water diffusion coefficients based on microcavitational damage brought about by temperature and moisture. Laboratory testing for weight changes in sorption-description experiments have been accomplished using a McBain quartz-spring microbalance placed in a temperature and humidity controlled cell. Equilibrium moisture absorption levels were represented both by linear and upward isotherms depending upon the humidity history. Analysis of sorption data, using a transport model in which part of the diffusing molecules are completely immobilized in the formed microcavities, revealed the damaging process to be in agreement with the diffusion coefficient depressions and solubility increases predicted by the model. A crazing criterion is qualitatively used to test the nature of the damaging process. GRA

N80-30518# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
EFFECT OF STRUCTURE ON PHYSICAL PROPERTIES OF POLYMERS Final Report, 1 Jan. 1976 - 31 Dec. 1979
Frank E. Karasz. 31 Dec. 1979. 22 p. refs.
(Grant AF-AFOSR-2983-76; AF Proj. 2303)
(AD-A086199; AFOSR-80-0475TR) Avail: NTIS
HC A02/MF A01 CSCL 11/9

The overall objective of this research program has been to investigate the physical nature of macromolecular systems as a function of the chemical and stereochemical structure of the macromolecule. A potential improvement in important facets of polymer properties was an underlying premise in the design and execution of the research. The work performed included investigations of the behavior of polymers in solution, as well as in the solid state and was accompanied by a program of theoretical studies to complement the experimental work. One focus of the research was the area of polymer-polymer interactions in binary blends, in which factors influencing compatibility, i.e., mutual solubility, were systematically investigated by a number of thermodynamic techniques. Heats of polymer mixing were obtained for selected systems and shown to be useful in predicting phase behavior otherwise obscured by non equilibrium effects. The latter were also investigated theoretically in studies of the effect of domain size and composition on glass transition temperatures and allied phenomena. Another area of research concerned the physical properties of model epoxy network systems, and in particular, the effect of water on these properties. A characteristic of cross linked polymers is their ready plasticization by relatively small amounts of low molecular weight materials and the basis of this observation has been explained on a thermodynamic basis. Solution properties of polymers were studied by means of quasi-elastic light scattering. GRA

N80-30519# Dow Corning Corp., Midland, Mich. Advanced Research Lab.
CYCLIC FLUOROSILICONE POLYMERS AND COPOLYMERS Final Report, 1 Jan. 1977 - 31 Jan. 1980
O. R. Pierce and K. M. Lee. 1980. 39 p.
(Contract F49620-77-C-0012; AF Proj. 2303)
(AD-A086748; AFOSR-80-0469TR) Avail: NTIS
HC A03/MF A01 CSCL 11/9

Several reactions were examined as potential routes to reactive cyclic tetrasiloxanes and their precursors. The reactions examined in some detail were cohydrolysis, siloxy-chloride exhange, hydrolysis of triple bond SiCl, triple bond SiOMe and triple bond SiH and acetoxy-silanol condensations. Using these reactions several intermediates were prepared and the new compounds were characterized. GRA

N80-30520# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
MODEL COMPOUND STUDIES OF RIGID ROD AROMATIC HETEROCYCLIC POLYMER SYSTEMS. PART 1: THE CRYSTAL AND MOLECULAR STRUCTURES OF 2,6-DIPHENYLBENZL (1,2-D:4,5-D') BISTHIAZOLE AND 2,6-DIPHENYLBENZO (1,2-D:5,4-D') BISOXAZOLE Final Report, Apr. 1977 - Apr. 1978
M. W. Wellman, W. W. Adams, D. R. Wiff, and A. V. Fratini. Feb. 1980. 28 p. refs.
(AF Proj. 2303)
(AD-A086804; AFML-TR-79-4184-Pt-1) Avail: NTIS
HC A03/MF A01 CSCL 11/9

The X-ray crystal structures of two monomeric model compounds for polybisbenzoxazole (PBO) and polybisbenzthiazole (PBT) are presented. The PBO model compound molecules stack along the b crystallographic axis in two vertical columns of differing orientation and are inclined to b by an angle of 36 deg. The repeat distance along b is 5.94A and the perpendicular distance between adjacent molecules in a particular stack is 3.4A. The PBT model compound molecules stack most efficiently along its b crystallographic axis with an inclination angle of 36.8 deg. Adjacent molecules along c exhibit a crossing pattern with a dihedral angle of 73.6 deg. The relationship between the model compound structures and the gross packing features of polymer chains in PBO and PBT are discussed. GRA

N80-30521# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
TRIAXIALLY WOVEN FABRICS OF KEVLAR, DACRON POLYESTER AND HYBRIDS OF KEVLAR AND DACRON POLYESTER Final Report
Eleanor Th. Vadala. 3 Apr. 1980. 20 p. refs.
(WF414110001)
(AD-A086866; NADC-80020-60) Avail: NTIS
HC A02/MF A01 CSCL 11/9

To provide data for possible LTA (Lighter Than Air) application, four triaxially woven fabrics were made using yarns of: (1) Kevlar aramid, (2) Dacron polyester and (3) hybrids of aramid and polyester. The woven triaxial fabrics were coated with urethane. The material samples were characterized by removal and test of specimens. The test matrix included creasing and environmental conditioning tests. GRA

N80-30522# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
ORGANIC METALS AND SEMICONDUCTORS: THE CHEMISTRY OF POLYACETYLENE, (CH) SUB X, AND ITS DERIVATIVES Interim Report
Alan G. MacDiarmid and Alan J. Heeger. 24 Nov. 1979. 13 p. refs. Presented at the 3d Intern. Congr. of Quantum Chem., Kyoto, Oct. 1979.
(Contract N00014-75-C-0962; NR Proj. 356-602)
(AD-A086870; TR-79-11) Avail: NTIS HC A02/MF A01 CSCL 20/12

Polyacetylene, (CH)x, is the simplest possible conjugated organic polymer and is therefore of special fundamental interest. In a series of studies, Shirakawa and Ikeda have shown that it can be prepared in the form of lustrous, silvery, flexible,

polycrystalline films having any desired cis/trans content by catalytic polymerization of gaseous acetylene, C2H2. The cis-rich films can be stretched easily at room temperature in excess of three times their original length with concomitant partial alignment of the (CH)x fibrils. Dark red gels of toluene in (CH)x may be prepared using a lower catalyst concentration. Highly porous, very low density, 'foam-like' (CH)x can be obtained from these gels. Both cis- and trans-(CH)x are p type semiconductors which can be treated with a variety of p or n type dopants with concomitant increase in conductivity to give a series of semiconductors and ultimately, 'organic metals'. This report will be directed primarily towards a description of the more chemically oriented aspects of (CH)x and its derivatives. GRA

N80-30523# Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.
CONDUCTING ORGANIC POLYMERS: DOPED POLYACETYLENE Interim Technical Report
Alan J. Heeger and Alan G. MacDiarmid. 24 Nov. 1979. 45 p. refs. Presented at the Advanced Study Inst. on the Phys. and Chem. of Low Dimensional Solids, Tomar, Portugal, Aug. 1979
(Contract N00014-75-C-0962; NR Proj. 356-602)
(AD-A086869; TR-79-10) Avail: NTIS HC A03/MF A01 CSCL 11/9

Linear polyacetylene, (CH)x is the simplest conjugated organic polymer and is therefore of special fundamental interest. Interest in this semiconducting polymer has been stimulated by the successful demonstration of doping with associated control of electrical properties over a wide range; the electrical conductivity of films of (CH)x can be varied over 12 orders of magnitude from that of an insulator (sigma approximately equal to ten to the minus 9th power/ohm/cm) through semiconductor to a metal (sigma approximately equal to ten to the minus 13th power/ohm/cm). Various electron donating or accepting molecules can be used to yield n-type or p-type material, and compensation and junction formation have been demonstrated. GRA

N80-30524# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
FRACTURE STUDIES OF HIGH TEMPERATURE CERAMICS Final Report, 1 Oct. 1975 - 30 Sep. 1979
D. Lynn Johnson. May 1980. 67 p. refs.
(Grants AF-AFOSR-2920-76; NSF DMR-76-80847; AF Proj. 2306)
(AD-A086653; AFOSR-80-0501TR) Avail: NTIS HC A04/MF A01 CSCL 11/2

A high-temperature isothermal instrumented impact testing apparatus was designed and built and utilized to test a variety of high performance ceramic materials at temperatures up to 1500 C. Test specimens were held on an anvil in the furnace and heated rapidly to the test temperature. An impacter broke the samples in 3 point bending, and high speed digital recorders stored the outputs of force and velocity transducers. The controlled flaw technique was utilized to obtain the critical stress intensity factor, K sub IC. Hot-pressed silicon nitride materials containing MgO, CeO2 or ZrO2 sintering aids showed a decrease in K sub IC as the temperature exceeded 1300 C. Hot-pressed silicon carbide containing alumina sintering aid showed a similar decrease. Sintered alpha-SiC, on the other hand, showed a gradual increase in K sub IC at temperatures up to 1500 C. Reaction bonded SiC failed to break at the controlled flaw, but exhibited a drop in impact fracture force at temperatures approaching the melting point of silicon. GRA

N80-30525# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
CHEM-BRAZE ABRADABLE SEAL ATTACHMENT Final Report, 6 Oct. 1978 - 15 Oct. 1979
Charles C. McComas, Steve T. Narsavage, and Hal W. Pettit, Jr. May 1980. 51 p.
(Contract DAAG46-78-C-0062)
(AD-A086872; PWA-FR-12248; USAAVRADCOM-TR-80-F-5) Avail: NTIS HC A04/MF A01 CSCL 11/2

An improved Chem-Braze bonding system for attaching sintered abradable seals to compressor blade tip-shrouds was developed. The improved Chem-Braze system incorporates glycerin as an inhibitor to prevent premature evaporation which prolongs working life and allows adequate time to attach seals to engine hardware. Manufacturing guidelines including glycerin concentration, working environment, slurry thickness, bonding pressure, drying and curing parameters, and refurbishing techniques were established. Tooling techniques for attaching abradable seals to engine hardware using this improved system were selected based on a feasibility demonstration which incorporated simulated engine hardware. Nondestructive inspection (NDI) techniques for verifying bond integrity were investigated, but a satisfactory technique was not identified. A preliminary economic analysis indicated significant cost savings for attaching abradable seals to compressor blade tip-shrouds using the improved Chem-Braze system compared to attachment with gold-nickel braze. GRA

N80-30526# Hughes Research Labs., Malibu, Calif. Exploratory Studies Dept.
MOISTURE PROTECTIVE COATINGS FOR ALKALI HALIDE IR OPTICS Semiannual Report, 1 Nov. 1979 - 30 Apr. 1980
Frederick G. Yamagishi and Leroy J. Miller. Jul. 1980. 23 p.
(Contract MDA903-80-C-0096; ARPA Order 3833)
(AD-A086747) Avail: NTIS HC A02/MF A01 CSCL 11/3

The objective of this program is to develop plasma-polymerized films that are transparent, moisture-protective coatings to increase the lifetime and durability of press-forged KBr IR optical elements. Reaction conditions have been established that yield uniform films of plasma-polymerized ethane (PPE) on polished and etched single crystal KBr flats. On polishing, polycrystalline KBr formed localized grains that could not be removed by chemical etching with HBr. Surface passivation could be achieved with a plasma of CF3Br or CF2C12. An air leak in the reactor caused extensive corrosion problems with CF3Br. Repairing the leak eliminated the corrosion problem. On a concurrent IR D program, we are developing a new surface passivation method for NaCl using a non-IR-absorbing surfactant. PPE deposited on this treated surface afforded protection from damage by 98% relative humidity for 11 days. It is important to eliminate trapped free radicals in the film to reduce the chance of forming a more polar material caused by the reaction of the radicals with atmospheric oxygen. Treating the film briefly with a hydrogen plasma quenched the radicals, but the method was no more effective than the present method of storing under an ethylene atmosphere. The use of DEHA, a two hydrogen atom donor, is being studied in an IR D program as a radical quencher and may be applied to this program if it proves successful. GRA

N80-30527# Pennsylvania Univ., Philadelphia. Dept. of Physics.
PHOTOCONDUCTIVITY IN POLYACETYLENE Interim Technical Report
S. Etemad, M. Ozaki, D. L. Peebles, A. J. Heeger, and A. G. MacDiarmid. 8 Jul. 1980. 19 p. Submitted for publication
(Contracts N00014-75-C-0962; DE-AC04-79ET-23002)
(AD-A086942; LRSM-TR-80-6) Avail: NTIS HC A02/MF A01 CSCL 11/9

An extensive study of the photoconductivity together with new measurements of the absorption coefficient of polyacetylene have been carried out. It is shown that the photoconductivity in trans-(CH) sub x is controlled by localized states (inside the gap) induced either by isomerization or by dilute doping. The presence of such states and their effect on the photoconductivity of trans-(CH) sub x is accounted for by the recently proposed soliton model. GRA

N80-30528# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
MAGNETIC SOLITON DEFECTS IN POLYACETYLENE Interim Technical Report
B. R. Weinberger, E. Ehrenfreund, J. Kaufer, A. Pron, and A. J. Heeger. 8 Jul. 1980. 19 p. refs.
(Contract N00014-75-C-0962)
(AD-A086978; TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 11/9

Magnetic resonance studies of undoped polyacetylene indicate a mobile defect induced upon isomerization to the trans-isomer. The unpaired spin in the pi-system is spread over approximately fourteen carbon atoms. The results are in all respects consistent with the soliton model. GRA

N80-30529# Coast Guard Research and Development Center, Groton, Conn.
THE DYNAMIC BEHAVIOR OF NYLON AND POLYESTER LINE Final Report
Kenneth R. Bitting Apr. 1980 115 p refs
(AD-A087106; CGR/DC-9/79; USCG-D-39-80) Avail: NTIS HC A06/MF A01 CSCL 11/9

Tests to determine the dynamic response of nylon and polyester, double braided and 8 strand plaited line were conducted. Line samples were excited mechanically in a tensile testing machine according to an experimental design in which frequency of excitation, mean load, and load amplitude were varied. The dynamic stiffness was measured. Samples of nylon and polyester line were placed in the ocean for 4 to 5 years and then tested with the same dynamic test procedure as was previously performed on the new line samples. The dynamic stiffness of nylon double braided line approximately doubled after five years of exposure to the marine environment, and polyester 8 strand plaited and double braided line increased about 10 to 25 percent. Snap load tests were conducted on nylon 8 strand plaited line (snap load is a cyclic loading in which zero is the minimum tension) and it was found that samples failed from fatigue when the maximum load exceeds 30 percent of the rated breaking strength. Samples do not fail by 200,000 cycles if the maximum load does not exceed 30 percent. Field and laboratory abrasion tests were also conducted on nylon, polyester, and polypropylene line of the 8 strand plaited, double braided, and 3 strand twisted constructions. R.K.G.

N80-30530# Midwest Research Inst., Golden, Colo.
PROPERTIES OF A SOLAR ALUMINA-BOROSILICATE SHEET GLASS
R. T. Coyle, M. A. Lind, J. E. Shelby, J. Vitko, and A. F. Shoemaker Jan. 1980 15 p refs Presented at the 12th Intern. Glass Congr., Albuquerque, N. Mex., 6 - 11 Jul. 1980
(Contract EG-77-C-01-4042)
(SERI/TP-334-565; CONF-800705-1) Avail: NTIS HC A02/MF A01

Solar energy applications place unique requirements on sheet glass including very low solar absorption, outstanding stability of absorption in the outdoor environment, low cost, and elastic formability for making concentrating mirrors. A solar sheet glass was developed. In evaluations reported the glass shows outstanding chemical durability and optical and mechanical properties. DOE

N80-30531# National Technical Information Service, Springfield, Va.
LUBRICATING OIL ANALYSIS FOR WEAR MONITORING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Diane M. Cavagnaro Apr. 1980 179 p Supersedes NTIS/PS-79/0382; NTIS/PS-78/0339
(PB80-807688; NTIS/PS-79/0382; NTIS/PS-78/0339) Avail: NTIS HC $30.00/MF $30.00 CSCL 11H

The topics pertain to the chemical analysis of lubricating oils to determine and monitor the wear of engines of transmissions. The purpose of this analysis is to predict failure before it occurs in order to allow time to undertake corrective maintenance. Many of these reports are part of the Army's Spectrometric Oil Analysis Program (SOAP). Various detectors and analytical methods are cited as well and their implementation. This updated bibliography contains 172 abstracts, 11 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-30532 Cornell Univ., Ithaca, N. Y.
DRY ANAEROBIC FERMENTATION TO METHANE OF ORGANIC RESIDUES Ph.D. Thesis
Walter John Wujcik 1980 253 p
Avail: Univ. Microfilms Order No. 8020903

Anaerobic fermentation was studied over a two year period with mixtures of dairy cow manure and residue material, including straw, sawdust, peat moss, and newsprint paper. Batch reactors were operated at total solid concentrations of 10 to 68.5 percent. The effect of water content, available water, and salts (sodium chloride and ammonia-nitrogen) on anaerobic fermentation to methane of dry substrates was measured. Performance was evaluated in terms of gas and methane production, substrate utilization, volatile acid production, and other parameters. The role of moisture content in the anaerobic fermentation to methane of organic residues was defined. A first order decay model was utilized to describe the kinetics of microbial decomposition for batch dry anaerobic fermentation. The relative importance of salt inhibition versus water content of the substrate was determined. Dissert. Abstr.

N80-30533 North Carolina State Univ. at Raleigh
DEVOLATILIZATION KINETICS AND ELEMENTAL RELEASE IN THE PYROLYSIS OF PULVERIZED COAL Ph.D. Thesis
Victor Hugo Agreda 1979 428 p
Avail: Univ. Microfilms Order No. 8020475

The evolution of volatile matter and trace elements from pulverized coal during pyrolysis in an inert atmosphere was studied in batch and laminar flow furnace reactors. Five coals were investigated, ranging in rank from ignitic to anthracitic. It was determined that at any pyrolysis temperature ash losses may have a significant effect on calculated extents of devolatilization, making the commonly used ash tracer technique a potential source of error in all experimental pyrolysis studies. A technique to correct estimated weight losses for this effect was developed. An empirical mathematical model was developed to correlate the equilibrium release of Hg, Pb, Cl, As, and Se, as a function of temperature for the five coals studied. The same model was found to correlate sulfur release data for coals with rank up to bituminous. Dissert. Abstr.

N80-30534 California Univ., Davis
DOWNDRAFT GASIFICATION CHARACTERISTICS OF MAJOR CALIFORNIA RESIDUE-DERIVED FUELS Ph.D. Thesis
Bryan Martin Jenkins 1980 385 p
Avail: Univ. Microfilms Order No. 8018978

The results of 30 fuel trials in a laboratory scale, fixed bed air blown downdraft gas producer operating at ambient pressure to produce a low-Btu fuel gas from solid agricultural, forest, and municipal residues are reported. The nature of the residue fuels, including chemical composition, energy content, and processing required to produce a suitable fuel for use in the gas producer, is also included. The nature of the products and by-products of the gasification process is discussed. Mass and energy balances on the producer are calculated for each fuel trial. The process occurring in the producer is described. The influences of fuel moisture content, air input rate, fuel ash content and the form of the fuel on producer operation are discussed. A mathematical model using the techniques of chemical equilibrium is developed to predict gas composition from the fuel composition, fuel moisture content, and air to fuel ratio. Dissert. Abstr.

N80-30535*# United Technologies Research Center, East Hartford, Conn.
AUTOIGNITION CHARACTERISTICS OF AIRCRAFT-TYPE FUELS
Louis J. Spadaccini and John A. TeVelde Jun. 1980 88 p refs
(Contract NAS3-20066)
(NASA-CR-159886; R80-914617-1) Avail: NTIS HC A05/MF A01 CSCL 21D

The ignition delay characteristics of Jet A, JP 4, no. 2 diesel, cetane and an experimental referee broad specification (ERBS) fuel in air at inlet temperatures up to 1000 K, pressures of 10, 15, 20, 25 and 30 atm, and fuel air equivalence ratios of 0.3, 0.5, 0.7 and 1.0 were mapped. Ignition delay times in the range of 1 to 50 msec at freestream flow velocities ranging from 20 to 100 m/sec were obtained using a continuous flow test apparatus which permitted independent variation and evaluation of the effect of temperature, pressure, flow rate, and

fuel/air ratio. The ignition delay times for all fuels tested appeared to correlate with the inverse of pressure and the inverse exponent of temperature. With the exception of pure cetane, which had the shortest ignition delay times, the differences between the fuels tested did not appear to be significant. The apparent global activation energies for the typical gas turbine fuels ranged from 38 to 40 kcal/mole, while the activation energy determined for cetane was 50 kcal/mole. In addition, the data indicate that for lean mixtures, ignition delay times decrease with increasing equivalence ratio. It was also noted that physical (apparatus dependent) phenomena, such as mixing (i.e., length and number of injection sites) and airstream cooling (due to fuel heating, vaporization and convective heat loss) can have an important effect on the ignition delay. R.K.G.

N80-30536# Battelle Columbus Labs., Ohio. Analytical and Environmental Chemistry Section.
ANALYTICAL TECHNIQUES FOR AROMATIC COMPONENTS IN AIRCRAFT. Final Report, 15 Jun. 1978 - 30 Jun. 1979
J. Scott Warner and Richard P. Kenan. Oct. 1979. 87 p. refs
(Contract F33615-78-C-2019; AF Proj. 3048)
(AD-A086343; AFAPL-TR-79-2093) Avail: NTIS HC A05/MF A01 CSCL 21/4

An ultraviolet detector was shown to be highly satisfactory for the selective determination of aromatic components in jet fuels. The detector was operated at 208 nm and used with a glass capillary column gas chromatographic system. The detector gave a linear response in the range of interest and could detect individual benzenes and naphthalenes in jet fuels at levels down to 0.1% and 0.02% respectively. A photoionization detector having a 9.5 eV source was found to be not sufficiently selective for aromatic hydrocarbons to be of value for fuel characterization. GRA

N80-30537# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
SIMULATIONS OF GAS PHASE DETONATION: INTRODUCTION OF AN INDUCTION PARAMETER MODEL
E. S. Oran, J. P. Boris, T. R. Young, Jr., M. Flanigan, M. Picone, and T. Burks (Science Applications, Inc., McLean, Va.). 25 Jun. 1980. 34 p. refs
(RR024241)
(AD-A087007; AD-E000488; NRL-MR-4255) Avail: NTIS HC A03/MF A01 CSCL 19/1

Detailed numerical simulations of supersonic reactive flow and gas phase detonation problems are very expensive due to their computer time and memory requirements. The bulk of this cost is in integrating the ordinary differential equations describing chemical reactions. A global induction parameter model has thus been developed which describes the chemical induction time of a mixture and allows for release of energy over a finite time period. The specific gases for which it has been calibrated are stoichometric mixtures of hydrogen and methane in air. The relatively inexpensive induction parameter model is then used in time-dependent one and two dimensional simulations of supersonic reactive flows. GRA

N80-30538# Institute of Gas Technology, Chicago, Ill.
PROCESS EVALUATION: STEAM REFORMING OF DIESEL FUEL OIL. Final Technical Report, 24 Apr. - 24 Dec. 1979
George A. Jarvi, Ronald M. Bowman, Elias H. Camara, and Anthony L. Lee. 15 Feb. 1980. 51 p. refs
(Contract DAAK70-79-C-0048)
(AD-A087053) Avail: NTIS HC A04/MF A01 CSCL 21/4

This project is an evaluation of a proprietary catalyst as a means of steam-reforming diesel fuel oil (Fed. Spec. VV-F-800B, symbol DF-2). A system for testing the catalyst has been designed, built and successfully used to screen operating conditions of temperature, space velocity, and H2O/C ratio. A duration test has been conducted showing the catalyst capable of steam reforming diesel fuel, but with the production of naphthalene after 30 hours. Hydrogen production remained stable through the 86 hours of the test. GRA

N80-30539# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
EXPLOSIBILITY OF EXPLOSIVE AND PROPELLANT DUST. Final Report
W. T. Moore, P. Lu, S. Roorda, B. Fishburn, N. Slagg, R. M. Rindner, and W. Seals. Jul. 1980. 43 p. refs
(AD-A087240; AD-E400449; ARLCD-TR-79045) Avail: NTIS HC A03/MF A01 CSCL 09/4

A specially designed flow system was constructed to obtain more detailed data on the effect of particle size and concentration on the spark ignition of propellant and explosive dusts. With this apparatus the concentration can be controlled over a 1.5 m (5 ft), and streak photography can be employed to determine the velocity of flames and/or explosion waves. Thus information on both ignition and propagation can be obtained. The ignition characteristics of M1 propellant, RDX, HMX, and ball powder were determined. The concentration was varied from 0.15 to 1.5 g/liter, and the particle size was from 75 to 225 micrometers. Ignition with subsequent flame propagation required a concentration of at least 0.15 to 0.3 g/liter for all dusts tested. Values from previous studies conducted in a Hartmann apparatus ranged from 0.1222 g/liter to 0.5 g/liter for some of the same materials with similar particle sizes. Thus the lower limits of ignition are in good agreement; however, due to the relatively small size of the Hartmann apparatus, direct comparisons of ignition at upper limits are difficult. GRA

N80-30540# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
PARTIAL LIQUEFACTION OF COAL BY DIRECT HYDROGENATION. Quarterly Progress Report, Oct. - Dec. 1979
A. Y. Falk. 1980. 38 p.
(Contract EX-76-C-01-2044)
(FE-2044-51) Avail: NTIS HC A03/MF A01

Fifteen additional reactor tests with an average duration of 1 hour each were made in the 1 TPH process development unit (PDU). The water cooled heat recovery quench unit was employed for all these tests. In general, operation of the PDU is progressing smoothly. No significant operational/hardware problems were encountered. The new product recovery system and heat recovery quench unit appear to be functioning well and as designed. Analysis of results from the tests conducted employing the heat recovery quench unit indicates carbon conversion results that are consistent with the results of the previous testing. Tables summarizing the test conditions and carbon conversion results, product gas compositions, and liquids (heavy and light oils) properties are presented. DOE

N80-30541# Brigham Young Univ., Provo, Utah.
ALLOY CATALYSTS WITH MONOLITH SUPPORTS FOR METHANATION OF COAL-DERIVED GASES. Quarterly Technical Progress Report, 21 Jun. - 20 Sep. 1979
Calvin H. Bartholomew. 5 Oct. 1979. 40 p. refs
(Contract EF-77-S-01-2729)
(FE-2729-8) Avail: NTIS HC A03/MF A01

Kinetic studies of monolithic Ni/Al2O3 revealed a shift in activation energy for methanation of CO above 573 K. In kinetic studies at high pressure rapid deactivation was observed for low loading monolithic catalysts. A one dimensional computer model for methanation over monolithic catalysts was developed to provide insight into experimental conversion vs. temperature data taken in this laboratory. A method for qualitatively determining sulfur on poisoned catalysts was developed and tested. Metal crystallite size distribution data obtained from transmission electron micrograph (TEM) studies on Ni/silica catalysts suggest that sintering may occur by both crystallite and atomic migration mechanisms. The TEM studies of 3% Ni/TiO2 reveal the presence of raft-like crystallites. These and other accomplishments are reported and discussed. DOE

N80-30542# Institute of Gas Technology, Chicago, Ill.
EXPERIMENTAL PROGRAM FOR THE DEVELOPMENT OF PEAT GASIFICATION. TASK 2: HYDROGASIFICATION. TASK 3: FLUIDIZED-BED TESTS. Interim Report, 1 Oct. 1978 - 31 Jul. 1979
Feb. 1980. 72 p. refs
(Contract EX-76-C-01-2469)
(FE-2469-48; IR-7) Avail: NTIS HC A04/MF A01

The effects of temperature, hydrogen partial pressure, residence time, and particle size on product distribution and yields were determined. A total of thirty tests were conducted in an

entrained flow hydrogasification process development unit with Minnesota, North Carolina, and Maine peats. These tests were conducted at temperatures of about 1000 to 1500 F, hydrogen partial pressures of 0 to 250 psia, residence times of 2 to 30 seconds, and particle sizes of -10+100, -10+20, and -60+120 mesh. The results show that overall carbon conversion and hydrocarbon gas yield for the Minnesota peat are about 20% and 50% higher than those for North Carolina and Maine peats, respectively. R.C.T.

N80-30543# Puerto Rico Univ., Rio Piedras. Center for Energy and Environment Research.
PRODUCTION OF SUGARCANE AND TROPICAL GRASSES AS A RENEWABLE ENERGY SOURCE Quarterly Reports, 1 Jun. - 30 Nov. 1979
A. G. Alexander. 1979. 73 p. refs.
(Contracts ET-78-S-05-5912; DE-AS05-78ET-20071)
(ORO-5912-T3; AES-UPR-C-481; QR-1/2) Avail: NTIS HC A04/MF A01

The principal yield trends for biomass included: (1) increased yields with delay of harvest frequency; (2) lack of response to narrow row spacing; and (3) lack of appreciable yield differences between varieties when allowed to reach maturity. First ratoon yields for both sugarcane and napier grass significantly exceeded the plant crop yields. For sugarcane, the average production of millable cane was 88.6 tons/acre year. Total dry matter (including trash) averaged 33.6 tons/acre year. Second year yield increases consisted largely of dry matter (32%) as opposed to green material (18%). The highest napier grass yields were about 91 green tons and 33 dry tons/acre year, approximately 29% and 35% higher than the year 1 output. Production costs for sugarcane amounted to $25.46/oven-dry ton, or about $1.70/million BTUs. Puerto Rico is presently paying around $4.00/million BTUs in the form of imported bunker C residual oil. Sucrose yields were quite low, averaging 6.6%, but total fermentable solids were comparable to the commercial sugarcane yields in Puerto Rico. L.F.M.

N80-30544# Chevron Research Co., Richmond, Calif.
REFINING AND UPGRADING OF SYNFUELS FROM COAL AND OIL SHALES BY ADVANCED CATALYTIC PROCESSES. LABORATORY AND PILOT PLANT STUDIES OF THE PROCESSING OF SRC-1 Interim Report
R. F. Sullivan, B. E. Stangeland, H. C. Chen, and C. E. Rudy. Nov. 1979. 80 p.
(Contract EX-76-C-01-2315)
(FE-2315-45; IR-2) Avail: NTIS HC A05/MF A01

Solvent refined coal (SRC) from the SRC-1 process is a high melting solid material that contains large amounts of nitrogen, oxygen, and metallic contaminants and is low in hydrogen content. It is a feed that is extremely difficult to convert to transportation fuels in high yields using commercial fixed bed, catalytic hydroprocessing technology. It was demonstrated that SRC 1 can be hydrotreated in the presence of a coal derived solvent at moderate cracking conversions (e.g., 50% conversion to material boiling below 850 F) for at least 1000 hours without serious plugging of the catalyst bed. However, even at these relatively low conversion levels, catalyst deactivation rates are unacceptably high. With higher severity hydroprocessing, high conversion can be obtained and most of the heteroatoms can be removed. However, severe plugging occurs in the catalyst beds in a short period of time. We do not regard conversion of SRC-1 to transportation fuels by the routines here as being commercially feasible. DOE

N80-30545# UOP, Inc., Des Plaines, Ill.
UPGRADING OF COAL LIQUIDS: HYDROCRACKING OF EDS PROCESS DERIVED GAS OILS Interim Report
Frederick J. Riedl and Armand J. DeRosset. Nov. 1979. 120 p.
(Contract EF-77-C-01-2566)
(FE-2566-33) Avail: NTIS HC A06/MF A01

The applicability of commercial UOP catalysts and processes for hydrocracking coal derived distillates, produced by the Exxon Donor Solvent (EDS) process was evaluated. Process conditions within commercial ranges were selected to produce either fuel oil or gasoline. Hydrocracking was done in two stages. When operating in the gasoline mode, the first stage produced a high nitrogen product to be used in a series flow, two reactor, second stage hydrocracking process. When operating in the fuel oil mode, first stage operation produced a low nitrogen product to be used in a single reactor second stage hydrocracking process. The volumeric yields of C5(+) gasoline and butanes from the gasoline mode operation ranged from 105 to 115.5% and 18 to 26%, respectively. The octane number of the C5(+) gasoline ranged from 75 to 83 RON clear. The overall hydrogen consumption ran from 3300 to 4200 SCF/bbl, all of which can be supplied by reforming the gasoline and steam reforming the C1 to C4 gases. In the fuel oil mode, yield of environmentally acceptable distillate was about 88%. DOE

N80-30546# Battelle Columbus Labs., Ohio.
THERMOPHYSICAL PROPERTIES OF COAL LIQUIDS Quarterly Technical Status Report, 1 Jan. - 31 Mar. 1980
J. W. Droege, G. H. Stickford, and S. P. Chauhan. 15 Apr. 1980. 31 p.
(Contract DE-AC01-79ET-14941)
(BMI-2053; QTSR-2) Avail: NTIS HC A03/MF A01

Certain physical properties of coal solvent slurries, namely, viscosity, thermal conductivity, density, heat of reaction, and specific heat, as these slurries undergo dissolution reactions were determined. Major modifications to the viscometer were made, providing a lifting force more nearly constant with position of the bob, and a sensing coil for velocity measurements which gives a signal linear with velocity. The viscometer was calibrated with a series of liquids with a variety of viscous properties. The calibration constant varies somewhat with viscosity. A transient line source technique was selected for thermal conductivity measurements. A thin vertical wire acts both as heater and thermometer. When a current is passed through the wire, its temperature changes in a manner that depends partly on the thermal conductivity of the surrounding medium. Density determinations may be possible as a byproduct of the viscosity work. DOE

N80-30547# Mobil Research and Development Corp., Paulsboro, N. J. Processes Research and Technical Service Div.
UPGRADING OF COAL LIQUIDS FOR USE AS POWER GENERATION FUELS Final Report
P. J. Angevine, M. Becker, R. B. Callen, M. J. Dabkowski, M. P. Granchi, L. A. Green, R. H. Heck, C. A. Simpson, S. S. Shih, and T. R. Stein. Dec. 1979. 247 p. refs. Sponsored by Electric Power Research Inst.
(EPRI Proj. 361-2)
(EPRI-AF-1225) Avail: NTIS HC A11/MF A01

Residual coal liquids were hydroprocessed in fixed bed unit to upgrade them to power generation fuels. A series of catalysts was evaluated for the desulfurization of short contact time (SCT) Solvent Refined Coal (SRC). Low sulfur (0.4 wt. %) boiler fuels were produced with hydrogen consumptions as low as 800 and 1200 scf/B from Indiana 5 regular SRC and W. Kentucky SCT SRC, respectively. Constant temperature aging runs were conducted with both regular and short contact time SRC. A kinetic aging model was developed to estimate process conditions and yields in either a fixed bed or ebullated bed reactor. Chemical characterization indicated that W. Kentucky SCT SRC molecules are significantly larger and more polar than those of Indiana 5 regular SRC. The high conversion of asphaltenes to less polar material does not appear necessary for SRC desulfurization. DOE

N80-30548# Westinghouse Electric Corp., Madison, Pa. Advanced Coal Conversion Dept.
ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION Quarterly Progress Report, 1 Oct. - 31 Dec. 1978
H. K. Altiner, M. J. Arthurs, E. J. Chelen, P. Cherish, Z. F. Hudson, S. Katta, D. L. Kearns, L. K. Rath, N. D. Rohatgi, L. A. Salvador et al. 30 Jun. 1979. 137 p. ref.
(Contract EF-77-C-01-1514)
(FE-1514-97) Avail: NTIS HC A07/MF A01

The operation of the PDU focused on testing of the single stage gasifier system using numerous coal feedstocks and oxygen and steam as the gasification media. Operating summaries with the significant results of these tests are described. Test TP-018-5 was the last shakedown test in an experimental test grid with highly caking Pittsburgh seam coal. This test grid was designed to show the effects of varying the oxygen and steam

flows on the higher heating value of the product gas on a dry basis. In addition, a slight modification to the oxidant tube geometry was examined during this test as well as in tests TP-019-1 and TP-019-2. The operability of the oxygen blown gasifier on more highly reactive feedstocks was explored in the TP-019 test series. Three coals successfully gasified ranged from Montana Rosebud sub bituminous coal to two highly volatile bituminous B rank coals: Indiana No. 7 and Western Kentucky No. 9. DOE

N80-30549# Utah Univ., Salt Lake City. Dept. of Mining and Fuels Engineering.
APPLIED RESEARCH AND EVALUATION OF PROCESS CONCEPTS FOR LIQUEFACTION AND GASIFICATION OF WESTERN COALS. Quarterly Progress Report, Jul. - Dec. 1979
Wendell H. Wiser. Mar. 1980. 12 p. refs.
(Contracts EX-76-C-01-2006; E(49-18)-2006)
(FE-2006-17). Avail: NTIS. HC A02/MF A01.

The experimental work on coal dissolution in hydrogen donor solvents was completed. The data are analyzed and interpreted to explain the major structural features of each high volatile bituminous coal examined. The findings are related to the heterogeneity, polymeric nature, aromaticity, aromatic cluster size and distribution of the clusters in the coal. The results are specific to the particular coal, but agree generally with the current understanding of coal structure. The effects of pressure, temperature, and contact time on sulfur removal were determined at a constant hydrogen/oil feed ratio of 5000:1 std cc H2/cc oil, one specific catalyst bed weight (equivalent stationary bed heights of about 5 in.) and one catalyst particle size (49 micron average diameter). Within the chosen operating range, the SRC allowed smooth and stable operation of the fluid bed without any agglomeration of the catalyst particles. Some typical results are shown. DOE

N80-30550# Oak Ridge National Lab., Tenn. Chemical Technology Div.
SIMULTANEOUS PHOTOPRODUCTION OF HYDROGEN AND OXYGEN BY PHOTOSYNTHESIS
Elias Greenbaum. 1979. 21 p. refs. Presented at 2d Symp. on Biotechnol. in Energy Production and Conserv., Gatlinburg, Tenn., 2-5 Oct. 1979.
(Contract W-7405-eng-26)
(CONF-791072-32). Avail: NTIS. HC A02/MF A01.

Results suggest that the photosynthetic production of hydrogen and oxygen represents an intriguing way to capture and convert solar energy into stored chemical free energy. It is particularly noteworthy that all three of the only known potential, direct photosynthetic watersplitting systems - blue-green algae, green algae, and the chloroplast-ferredoxin-hydrogenase system, have now been shown to photoproduce molecular hydrogen and oxygen simultaneously for prolonged periods of time. DOE

N80-30551# Argonne National Lab., Ill. Materials Science Div.
MATERIALS TECHNOLOGY FOR COAL-CONVERSION PROCESSES. Progress report, Jul. - Dec. 1979
1980. 95 p. refs.
(Contract W-31-109-eng-38)
(ANL-80-12; PR-19). Avail: NTIS. HC A05/MF A01.

Analysis of refractories exposed to slag attack during the last 500 h test run shows that complex spinels formed at the slag refractory interfaces of the chrome-spinel, alumina-chromia, and alumina refractories. Silicon carbide refractories reacted with iron oxides and produced a low melting ferrosilicon alloy and CO or CO2 gas. A high temperature ultrasonic erosion scanner was installed and field tested at the Solvent Refined Coal (SRC) coal liquefaction plant. Automatic data acquisition was accomplished through direct coupling to the SRC on site computer. The scanner has detected erosive wear in the SRC erosion corrosion test loop. Results suggest that as exposure time increases, a greater oxygen partial pressure is required for breakaway corrosion. Synergistic erosion corrosion studies conducted in a simulated coal gasification atmosphere at 815 C, with 150 Al2O3 at 22 m/s as erodant, show that Incoloy 800 was the most corrosion resistant alloy tested and 1015 carbon steel the least resistant. DOE

N80-30552# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS (MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL) Quarterly Technical Progress Report, 1 Nov. 1979 - 31 Jan. 1980
Yong K. Ahn, Yung C. Chen, Herbert T. Chen, Richard W. Helm, Eric T. Nelson, Kevin J. Shields, Richard P. Stringer, and Richard C. Bailie (West Virginia Univ., Morgantown). 1980. 106 p.
(Contracts ET-78-C-02-5022; DE-AC02-78ET-20611)
(DOE/ET-20611/11). Avail: NTIS. HC A06/MF A01.

The biomass allocation model was developed and is undergoing testing. Data bases for biomass feedstock and thermochemical products are complete. Simulated data on process efficiency and product costs are being used while more accurate data are being developed. Process models for entrained bed and fixed bed gasifiers based on coal were adapted to biomass. Conceptual economics were generated for seven of the fourteen process configurations via a biomass economic computer program. Pulse tests in a fluidized bed to determine the effect of particle size on reaction rates and product gas composition were completed. Two hour shakedown tests using peanut hulls and wood as the biomass feedstock and the fluidized bed reactor mode were carried out. A comparison was made of the gas composition using air and steam. To date approximately 70 biomass types were collected. Thermal gravimetric, pyrogaschromatographic and effluent gas analysis were began on pelletized samples of these biomass species. DOE

N80-30553# IIT Research Inst., Chicago, Ill.
DESIGN AND EVALUATION OF PROGRESSIVELY BURNING PYROTECHNIC FORMULATIONS
James L. Austing and Paul W. Cooper. 1980. 24 p. refs. Presented at the 7th Intern. Pyrotechnics Seminar, Vail, Colo., 14 Jul. 1980. Prepared in cooperation with Sandia Labs., Albuquerque, N. Mex.
(Contract EY-76-C-04-0789)
(SAND-80-0355C; CONF-800713-1). Avail: NTIS. HC A02/MF A01.

The design and evaluation of a pyrotechnic that burns for 2 ms and generates gas cubically with time is described. The charge is a mixture of two aluminum-plated pyrotechnics, viz., aluminum-potassium perchlorate (Al-KC104) and aluminum-vanadium pentoxide (Al-V2O5). The Al-KC104 is a gas generator, each gram of which produces 320 cc of gas (STP); the Al-V2O5, on the other hand, is a gasless pyrotechnic. Progressive generation of gas is achieved by utilizing mixtures of two pyrotechnics in increments that are progressively richer in gas generant, over a range of 14.6% to 100% Al-KC104 by weight. The deflagration rate of the system is a function of the Al-KC104 content, and ranges from 16.2 in./msec for a mixture with 14.6% Al-KC104 by weight to 30.0 in./msec for pure Al-KC104. An evaluation of the pyrotechnic charge fired in air showed that the design goals were adequately achieved. The growth of the gas cloud was monitored by high speed Fastax photography. DOE

N80-30554# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
MOLTEN SALT COAL GASIFICATION PROCESS DEVELOPMENT UNIT. Quarterly Technical Progress Report, Apr. - Jun. 1979
M. H. Slater. 30 Sep. 1979. 56 p.
(Contract EF-77-C-03-1429)
(SAN-1429-52; QTPR-13). Avail: NTIS. HC A04/MF A01.

The design, construction, and operation of a process development unit (PDU) which will convert 1 ton of coal per hour into low Btu gas is described. The third successful gasification run was performed. The solids feed system, the combustion air system, the gasifier/quench system, the ash removal system, the sulfur removal system, and the sodium carbonate regeneration system were all operated simultaneously as a single, integrated unit. The gasifier was operated at atmospheric pressure for a total of 272 continuous hours. Gas was produced with an average HHV of 88.6 Btu/scf while gasifying coal at a rate of 400 lb/hr. DOE

N80-30555# Argonne National Lab., Ill. Systems Engineering and Technology Group.
ENVIRONMENTAL IMPLICATIONS OF ACCELERATED GASOHOL PRODUCTION: PRELIMINARY ASSESSMENT
Jan. 1980 129 p refs
(Contract W-31-109-eng-38)
(ANL/ES-91) Avail: NTIS HC A07/MF A01

The environmental impacts of increasing US production of fuel ethanol by 330 million gallons per year in the 1980 to 1981 time frame in order to substitute gasohol for 10% of the unleaded gasoline consumed in the United States are assessed. Alternate biomass feedstocks are examined and corn is selected as the logical feedstock, based on its availability and cost. Three corn conversion processes that could be used to attain the desired 1980 to 1981 production are identified; fermentation plants that use a feedstock of starch and wastes from an adjacent corn refining plant are found to have environmental and economic advantages. If ethanol production is increased substantially after 1981, the environmentally acceptable use or disposal of stillage, a liquid by product of fermentation, could become a serious problem. DOE

N80-30556# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
SECOND PHASE OF A COALBED METHANE EXTRACTION AND UTILIZATION PROGRAM
Apr. 1980 140 p
(Contract DE-AC21-78MC-08332)
(AESD-TM-3026) Avail: NTIS HC A07/MF A01

The coalbed site was further explored to improve its definition as a methane fuel reservoir and to develop the design of a system capable of providing a large scale demonstration of the recovery of coalbed methane and utilization of it in an industrial application, i.e., process heat and electric power. Three new wells were cored and drill stem testing was conducted on two of them. The site was evaluated as containing 7960 mcf of coalbed methane per acre. The producing well, previously developed, continued in operation except for brief periods of shutdown for equipment maintenance. The well attained a peak flow rate of 85.3 mcf/day and an average daily flow rate in excess of 38 mcf. L.F.M.

N80-30557# Battelle Columbus Labs., Ohio.
THERMOPHYSICAL PROPERTIES OF COAL LIQUIDS Quarterly Technical Status Report, 1 Oct. - 31 Dec. 1979
J. W. Droege and S. P. Chauhan 21 Jan. 1980 9 p
(Contract DE-AC01-79ET-14941)
(BMI-2043; QTSR-1) Avail: NTIS HC A02/MF A01

Certain physical properties of coal solvent slurries are to be determined as these slurries undergo dissolution reactions. The properties are viscosity, thermal conductivity, density, heat of reaction, and specific heat. Development of an experimental plan was completed and some of the needed equipment was placed on order. Exploratory viscosity measurements were made, showing the need for several modifications and disclosing the nature of the stirring difficulties to be anticipated. DOE

N80-30558# Argonne National Lab., Ill.
US DEPARTMENT OF ENERGY'S METHANE FROM LANDFILLS PROGRAM
Michael L. Wilkey 1979 10 p Presented at the Biogas and Alc. Production Conf., Chicago, 25 Oct. 1979
(Contract W-31-109-eng-38)
(CONF-7910126-1) Avail: NTIS HC A02/MF A01

Energy savings and recovery from urban waste streams through participation in the development, evaluation, and implementation of the technologies necessary for recovery, processing, and utilization of combustible gases generated in landfills are considered. The feasibility of landfill gas recovery and use, as well as future optimization techniques and methods, are examined. DOE

N80-30559# Environmental Protection Agency, Ann Arbor, Mich. Test and Evaluation Branch.
EVALUATION OF XRG NO. 1: A FUEL ADDITIVE
Edward Anthony Barth Feb. 1980 16 p refs
(PB80-180672; EPA-AA-TEB-80-12) Avail: NTIS HC A02/MF A01 CSCL 21D

XRG No. 1, a fuel additive developed to increase fuel efficiency in automobiles, is evaluated. Contrary to the manufacturer's claims, the test results showed neither a general increase in fuel economy nor a decrease in emissions associated with the addition of XRG No. 1 to the fuel. GRA

N80-30560# National Technical Information Service, Springfield, Va.
HYDROGEN STORAGE: STORAGE AS A GAS OR LIQUID. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1974 - May 1980
Diane M. Cavagnaro Jun. 1980 151 p Supersedes NTIS/PS-79/0581; NTIS/PS-78/0546 Updates NTIS/PS-75/379
(PB80-811086; NTIS/PS-79/0581; NTIS/PS-78/0546; NTIS/PS-75/379) Copyright Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The bibliography relates to storing hydrogen as a liquid or a gas. Topics include fuel storage, energy storage, and the construction of tanks used to store the material. Any type of storage that is related to batteries, fuel cells, or solar cells are excluded, unless the abstract states that its purpose is to store hydrogen. This updated bibliography contains 144 abstracts, 18 of which are new entries to the previous edition. GRA

N80-30561# National Technical Information Service, Springfield, Va.
HYDROGEN STORAGE: HYDROGEN AS A HYDRIDE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1974 - May 1980
Diane M. Cavagnaro Jun. 1980 142 p Supersedes NTIS/PS-79/0582; NTIS/PS-78/0547 Updates NTIS/PS-75/379
(PB80-811094; NTIS/PS-79/0582; NTIS/PS-78/0547) Copyright Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The bibliography covers hydrogen storage as a hydride. Topics include the chemical and physical properties of the hydride, and how useful it may be for hydrogen storage. Also considered is the conversion of hydrogen to a hydride and the conversion back to hydrogen. This updated bibliography contains 135 abstracts, 14 of which are new entries to the previous edition. GRA

N80-30407 Auburn Univ., Ala. Dept. of Chemistry.
SYNTHESIS OF CMP BEGINNING WITH SODIUM BOROHYDRIDE
F. A. Johnson and W. E. Hill *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 413-422 (For primary document see N80-30381 21-20)
(Contract DASG60-78-C-1043)
Avail: Issuing Activity CSCL 21/8

N80-30408 Callery Chemical Co., Pa.
PYROLYSIS OF (C2H5)4NBH4 TO [(C2H5) 4N] 2B10H10: USE OF A LIQUID HEAT TRANSFER MEDIUM
J. L. Little and R. M. Hunt *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 423-433 refs (For primary document see N80-30381 21-20)
(Contract DASG60-78-C-0146)
Avail: Issuing Activity CSCL 21/8

N80-30418 Thiokol Corp., Brigham City, Utah. Wasatch Div.
LLMM SRAM 3-D GRAIN STRUCTURAL ANALYSIS
A. W. Macbeth *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 595-612 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

N80-30419 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Fuels Branch.
LIQUID AIRBREATHING MISSILE FUELS: AN OVERVIEW OF PROPERTIES AND APPLICATIONS
James R. McCoy *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 613-619 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

31 ENGINEERING (GENERAL)

Includes vacuum technology, control engineering, display engineering, and cryogenics.

N80-30562 California Univ., San Diego, La Jolla
PLANAR MECHANICS OF FULLY GROUTED CONCRETE MASONRY Ph.D. Thesis
Robert Oakford Nunn 1980 126 p
Avail: Univ. Microfilms Order No. 8018792

A continuum model for the behavior of fully grouted concrete masonry is developed. Both unreinforced and reinforced masonry are considered, but otherwise attention is restricted to a single material type. Data were taken from prisms of several configurations, and from 5 foot square panels cut at an angle relative to the joint system. The panels were tested under direct biaxial stresses with one edge in tension and the other in compression or stress free. The elastic behavior is found to be linear. The form of the elastic law describing this behavior is determined and the moduli are evaluated showing substantial anisotropy in stiffness. Hysteresis loops at several load rates are described, and the relation of these loops to the damping of structure is discussed. The significance of prism configuration and end conditions, and the relation of prism compressive strength to wall compressive strength are discussed. A law describing the dependence of unreinforced uniaxial tensile strength on direction shows moderate anisotropy in tensile strength and is incorporated into a law of unreinforced biaxial strength for the special case of principal stresses of opposite sign. Dissert. Abstr.

N80-30563 Cornell Univ., Ithaca, N. Y.
MICROCRACKING AND ENGINEERING PROPERTIES OF HIGH-STRENGTH CONCRETE Ph.D. Thesis
Ramon Luis Carrasquillo 1980 270 p
Avail: Univ. Microfilms Order No. 8020801

The differences in mechanical properties between high strength and normal strength concretes are established and those differences are explained in terms of differences in observed internal microcracking in concrete at different stages of loading. Concretes made using gravel and crushed limestone coarse aggregates at each of three different strength levels ranging from 4,000 psi to 11,000 psi were studied. The results of the microcracking study and the study of the mechanical properties are presented. A criterion for definition of failure in uniaxial compression for the concretes tested is presented. Failure is considered to occur at the discontinuity point defined as that point when a self propagating microcracking mechanism is developed eventually causing disruptive failure with time. The predicted stress and strain ratios at discontinuity based on the microcracking study are compared to those at which sudden changes occur in the Poisson's ratio and volume change curves. Dissert. Abstr.

N80-30564# Naval Research Lab., Washington, D. C.
SUBMICROSECOND COMPARISONS OF TIME STANDARDS WITH THE NAVIGATION TECHNOLOGY SATELLITES (NTS) Interim Report, May - Sep. 1978
J. Buisson, T. McCaskill, J. Oaks, D. Lynch, and C. Wardrip 30 Apr. 1980 14 p refs Submitted for publication
(AD-A086780; AD-E000459; NRL-8395) Avail: NTIS HC A02/MF A01 CSCL 14/2

During May through September 1978 a six nation cooperative experiment was performed to intercompare time standards of major laboratories at the submicrosecond level using NTS satellites. NTS time transfer receivers, which were developed for use with the NTS series of satellites, were installed at the Division of National Mapping (DNM), Australia; in Japan at the Radio Research Laboratories (RRL) and the National Research Laboratory of Metrology (NRLM); National Research Council (NRC), Canada; Royal Greenwich Observatory (RGO), England; Bureau International de l'Heure, France (BIH); Institute for Applied Geodesy (IFAG), West Germany; and in the U.S. at the Goddard Space Flight Center (GSFC), National Bureau of Standards (NBS), Naval Research Laboratory (NRL), and the Naval Observatory (USNO). The results obtained by satellite were compared to those obtained by portable clocks. At all stations the differences were less than 0.75 microseconds. The RMS of the data from nine stations is less than 0.4 microseconds. GRA

N80-30565# EG and G Washington Analytical Services Center, Inc., Rockville, Md.
MOORING DYNAMICS: COMPUTER MODELS AND EXPERIMENTS AT A SIXTY FOOT SCALE
David B. Dillon Jul. 1980 95 p refs
(Contract N00014-78-C-0273)
(AD-A086854; EG/G-TR-4999-0004) Avail: NTIS HC A05/MF A01 CSCL 20/4

The U.S. Navy Civil Engineering Laboratory is conducting a series of dynamic cable experiments in order to evaluate computer models of cable systems used in the ocean. The results of an experiment using 60 foot cables are compared to two computer simulations in this report. Other experiments at scales of six feet and 2,500 feet have been performed. Three cases from the experiment conducted in the hydroballistics tank of the Naval Surface Weapons Center in 1976 are compared to the SNAPLOAD and SEADYN computer models. Two of the runs simulate the anchor-last deployment of a mooring, the third shows the relaxation of a mooring displaced laterally, then released. The quality of the experimental data is evaluated by comparing each case to the static, elastic catenary equations at the start and finish of each run. The measured positions of points along the static catenaries are found typically to agree with the catenary calculations within 1 to 2 percent of the cable length. Tension measured at the fixed end typically agrees with the calculated value within about 12 percent. GRA

N80-30566# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
HYDRODYNAMICS OF TURBOMACHINES Final Report
A. J. Acosta May 1980 7 p refs
(Contracts N00014-67-A-0094; N00014-76-C-0156)
(AD-A086873) Avail: NTIS HC A02/MF A01 CSCL 13/10

The present concerns have been primarily with applications to flows of liquids in turbomachines rather than gases. Each medium has its own special problems in addition to the common basis in fluid mechanics. Liquid flows in particular are subject to cavitation when the pressure falls below the vapor pressure. Cavitation is a major element in many applications of naval hydrodynamics. Here the 'turbomachine' is the propulsion system and cavitation on the components of this system, primarily the rotor or propeller, may cause intense noise, if the extent of cavitation is small, significant material erosion if there is a somewhat larger amount of cavitation, or a major performance change (loss of thrust, efficiency, etc.) when there is a large extent of cavitation. The establishment of conditions for the onset of cavitation is then an important feature in almost all naval hydrodynamic applications. Just this particular problem has been the source of much recent effort in cavitation inception research and has been a feature of some of the present work herein. GRA

N80-30567# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
USE OF FABRICS AND OTHER MEASURES FOR RETARDING REFLECTIVE CRACKING OF ASPHALTIC CONCRETE OVERLAYS Final Report
Ralph D. Jackson Mar. 1980 22 p refs
(Contract DOT-FA78WAI-837)
(AD-A085851; WES/MP/GL-80-2; FAA-RD-80-8) Avail: NTIS HC A02/MF A01 CSCL 13/2

Prevention or control of reflection cracks in asphaltic concrete overlays has been a problem from the inception of this type of construction. The many different treatments that have been tried in an effort to solve this problem are: (1) reinforcement within and below the overlay, (2) bond breakers, (3) stress relieving layers, (4) asphalt-mix additives, and (5) placement of fabrics between the existing pavement and the overlay. At the present time, no treatment has been tried that will completely prevent the formation of reflection cracks. Some treatments do delay the formation of cracks, while others do not appear to help at all. Indications are that fabrics do have some beneficial effects, such as a moisture barrier, even though the overlays develop reflection cracks. The fabrics that have been tried for the control of reflection cracks included: (1) Petromat, (2) Bidim, (3) Typar,

(4) Cerex, (5) Mirafi, (6) Structofors, (7) Bituthene, (8) Protecto-Wrap, and (9) Fiberglass. Asphalt-rubber interlayers, as formulated by the Arizona Refining Company and the Sahuaro Petroleum Company, show promise in retarding reflection cracks. GRA

N80-30568# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
CENTER OF GRAVITY Final Report
18 Jul. 1980 11 p
(AD-A086961; TOP-2-2-800) Avail: NTIS HC A02/MF A01 CSCL 14/2

This report describes standard techniques for determining the center of gravity of heavy equipment including vehicles and large weapons. It covers suspension, reaction, and weighing methods and includes procedures for calculating the combined center of gravity of two or more masses when attached to each other and considered a single unit. It discusses error factors and factors to be considered in selecting the appropriate method. These techniques apply to wheeled and tracked vehicles, trailers, large weapons, construction equipment, and certain types of warehouse and shop equipment. GRA

N80-30569# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
SAFETY AND HEALTH HAZARD EVALUATION, GENERAL EQUIPMENT Final Report
6 May 1980 22 p
(AD-A086990; TOP-10-2-508) Avail: NTIS HC A02/MF A01 CSCL 09/3

This TOP describes development test procedures required to determine whether general equipment is free from design, operational or maintenance hazards which could prevent accomplishment of their intended mission. Checklists and a hazard analysis format are provided to assist test personnel in the assessment of hazards. GRA

N80-30570# Lehigh Univ., Bethlehem, Pa.
MANUFACTURE OF SUPERCONDUCTING WIRE Progress Report, 1 Feb. - 15 Oct. 1979
B. Avitzur, Y. T. Chou, S. Talbert, and R. Wu. Oct. 1979 79 p refs
(Contract DE-AC02-79ER-10367)
(DOE/ER-10367/2) Avail: NTIS HC A05/MF A01

Aspects of the manufacturing technology for superconducting wires are addressed. The typical present day procedure to assemble a billet, extrude and draw it, with intermediate and final anneals, is described. Then an hypothetical production line with potential alternative processes along the entire path from heavy billet to fine wire, is laid out. Several processes at different stages of development, are offered, with the message that their potential must be explored for the development of a more reliable product, at a more economical production cost. An analysis of core fracture and its prevention during the process of drawing is provided. Treatment of velocity fields for a bi-metallic rod leads to the determination of criteria for the prevention of fracture. The criteria are presented graphically. Finally, the micro properties of superconducting wires are examined. A modification of the bronze method for niobium-tin superconductors is proposed. DOE

N80-30571# Centre Scientifique et Technique du Batiment, Paris (France).
[RESEARCH IN BUILDING CONSTRUCTION AND MATERIALS FOR 1978] Annual Report
Sep. 1978 56 p In ENGLISH and FRENCH
(CSTB-192) Avail: NTIS HC A04/MF A01

Sociological questions, the economics of building construction, and problems relating to acoustics, lighting, colorimetry, and climatology are reviewed. Also studied are thermal requirements, structural materials, stability, and fire safety as well as building maintenance. Author (ESA)

N80-30572# Centre Scientifique et Technique du Batiment, Paris (France).
[ACTIVITIES IN THE BUILDING TRADE INDUSTRY IN 1978] Annual Report [L'ACTIVITE DU CENTRE SCIENTIFIQUE ET TECHNIQUE DU BATIMENT (CSTB) EN 1978]
Apr. 1979 361 p refs In FRENCH
(CSTB-198) Avail: NTIS HC A16/MF A01

Activities in architecture, construction techniques, economics, social sciences, meteorology, foundation technology, structural stability, fire resistance, and acoustics are outlined. Other topics include materials properties, lighting, climatology, and aerodynamics of structures. Author (ESA)

N80-30573# Polytechnic Inst. of New York.
PREDICTION OF EARTHQUAKE RESISTANCE OF STRUCTURES Final Report
Ping-Chun Wang. 20 Jan. 1980 200 p refs
(Grant NSF PFR-76-14893)
(PB80-170731; NSF/RA-800013) Avail: NTIS HC A09/MF A01 CSCL 13M

Methods of predicting structural resistance to earthquakes were studied. Particular emphasis was given to developing an upper bound or critical ground excitation for a structure of major importance, so that a high level of confidence in the prediction of structural resistance may be achieved. Both linear and nonlinear structures were considered. The method was applied to several nuclear reactors. Results indicate that the method is conservative but not overly so. The responses from the critical excitation are in the range of 1.1 to 2 times those produced by recorded earthquakes of the same intensity. GRA

N80-30574# TRW Systems and Energy, Redondo Beach, Calif.
DEVELOPMENT STUDY OF A NOVEL CONTINUOUS-FLOW IMPACTOR Final Report, Jul. 1976 - Nov. 1978
E. F. Brooks, N. Gat, M. E. Taylor, T. E. Chamberlain, R. J. Golik, and R. Watson. Jan. 1980 127 p refs
(Contract EPA-68-02-2165)
(PB80-179286; EPA-600/7-80-014) Avail: NTIS HC A07/MF A01 CSCL 13B

Results of a development study involving feasibility verification of a novel particle impactor in which the impaction surface is the interface between two opposing jets are given. Particles cross the interface between the aerosolladen gas and a previously particle-free gas, are entrained in the latter, and are conveyed out for analysis. Work consisted of an initial literature search and analysis, followed by design, fabrication, and testing of a laboratory unit. A good particle separation capability was demonstrated. A design effort showed the feasibility of a staged in situ particle monitoring subsystem to give semicontinuous output of particle size distribution. GRA

N80-30575# Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.
COMMONALITY OF EARTHQUAKE AND WIND ANALYSIS Ph.D. Thesis
Pedro J. Cevallos-Candau and W. J. Wall. Jan. 1980 210 p refs
(Grants NSF ENV-75-08456; NSF ENV-77-07190)
(PB80-178312; UILU-ENG-80-2002; SRS-472; NSF/RA-800022) Avail: NTIS HC A10/MF A01 CSCL 13M

The common features of general dynamic analysis procedures employed for evaluating the effects of wind and earthquake excitation were investigated. A major goal was to investigate and develop a basis for generating response spectra for wind loading, which in turn would permit the use of modal analysis techniques for wind analysis in a manner similar to that employed for earthquake engineering. Random vibration techniques were applied for developing response spectra for wind loading. In order to generate wind response spectra, the wind loading is divided into two parts, a mean load treated as a static component and a fluctuating load treated as a dynamic component. The spectral representation of the wind loading constitutes a simple procedure for estimating the forces associated with the dynamic component of the gusting wind. GRA

N80-30576# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Civil Engineering.
SIMPLE AND COMPLEX MODELS FOR NONLINEAR SEISMIC RESPONSE OF REINFORCED CONCRETE STRUCTURES
Mehdi Saiidi and Mete A. Sozen. Aug. 1979 194 p refs
(Grant NSF PFR-78-16318)
(PB80-182413; UILU-ENG-79-2013; SRS-465; NSF/RA-790388) Avail: NTIS HC A09/MF A01 CSCL 13M

The possibility of simplifying the nonlinear analysis of reinforced concrete structures subjected to severe earthquakes was investigated. One thrust was a microscopic study of the simple models leading to acceptable results. For this phase, a multi-degree nonlinear model was developed to analyze rectangular reinforced concrete frames for given base acceleration records, and which is capable of accepting a collection of hysteresis systems, some previously used and others developed in the course of this project. The second phase comprised a macroscopic study which included development of a simple model that resulted in a reasonably close estimate of nonlinear response. A given structure was viewed as a single degree of freedom system which recognized stiffness changes due to the nonlinearity of material. GRA

N80-30577# Portland Cement Association, Skokie, Ill.
DESIGN AND CONSTRUCTION OF LARGE-PANEL CONCRETE STRUCTURES. REPORT 6: DESIGN METHODOLOGY
Donald M. Schultz. Mar. 1979. 118 p. refs.
(Contract HUD-H-2131R)
(PB80-189137; HUD-0001431) Avail: NTIS
HC A06/MF A01 CSCL 13M

The structural integrity of large panel concrete buildings under abnormal conditions is considered with emphasis on the importance of the design strengths of large panel structures and their individual elements. Topics covered include the scope, limitations, and definitions involved in the design methodology, some general considerations of analysis and design, and minimum requirements for integrity. Foundations, floor and roof elements, walls, joints, and connections between precast members are discussed and details of handling, assembly, and erection, and special provisions for seismic and wind design are included. An appendix on site planning considerations is provided. GRA

N80-30578# National Bureau of Standards, Washington, D.C. National Engineering Lab.
THE CALIBRATION OF ANGLE BLOCKS BY INTERCOMPARISON. Final Report
Charles P. Reeve. Apr. 1980. 27 p. refs.
(PB80-182132; NBSIR-80-1967) Avail: NTIS
HC A03/MF A01 CSCL 14B

The calibration of angle blocks at the National Bureau of Standards is described. Test blocks normally come in sets of 16 nominal sizes from 1 second to 45 degrees. Their angular values are calibrated by intercomparison with NBS master angle blocks and other test blocks of the same nominal size. Each test block is also measured for its maximum out-of-flatness and out-of-squareness. Statistical tests are performed in order to maintain control over the short term and long term variability of the measurement process. A complete description of the measurement process is given with special attention paid to the mathematical model for the measurements and the least squares estimation of the angular values. The method for determining the standard deviations of the short term and long term errors is also given. GRA

32 COMMUNICATIONS

Includes land and global communications, communications theory, and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-30579 California Inst. of Tech., Pasadena.
THE INFLUENCE OF RANDOM MEDIA ON THE PROPAGATION AND DEPOLARIZATION OF ELECTROMAGNETIC WAVES. Ph.D. Thesis
Jerry Michael Harris. 1980. 111 p.
Avail: Univ. Microfilms. Order No. 8018891

A discrete model for the continuous random medium is developed by dividing the volume occupied by the inhomogeneities into independent elementary scattering volumes. Scattering by each of these elementary volumes is analyzed to obtained the complex amplitude and polarization of the single scattered field. Then multiple scattering among the many elementary volumes is used to estimate the composite values for scattering per unit length and depolarization per unit length of the medium. The manifestation of scattering in the medium is the generation of an incoherent or fluctuating electric wavefield and a coherent or average electric wavefield. It is shown that the total electrical wavefield propagating in the medium satisfies an integral equation which is directly reducible to the classical equation for radiation transfer. Two phenomenological parameters are needed to describe the penetration of the wave into a plane-parallel medium, when a polarized plane wave is normally incident. These parameters appear as diffusion constants in expression for the solution for the coherency and Stokes matrices. These solutions describe how wave energy is progressively converted from the initially coherent and polarized field to an incoherent and unpolarized field as the wave propagates. Dissert. Abstr.

N80-30580 California Univ., Irvine.
A SEARCH FOR ADVANCED FIELDS IN ELECTROMAGNETIC RADIATION. Ph.D. Thesis
Jeffrey David Schmidt. 1980. 209 p.
Avail: Univ. Microfilms. Order No. 8019697

An experiment to search for an advanced component of electromagnetic radiation, as suggested by the time symmetry of Maxwell's equations was conducted. A dipole transmitting antenna was driven periodically with 10.2 GHz microwave pulses of 12 ns duration and 4 watt instantaneous power. A receiving dipole antenna at a distance R = 10m away was instrumented to search for power above noise received in a time gate at a time r/c prior to transmission of each pulse. Data were integrated over 10 to the 7th power pulses. The experiment was performed at Lick Observatory, atop Mt. Hamilton, CA, to enable placement of the antennas so that a line connecting them, when extended to infinity in both directions, encounters no local complete absorber. Defining R to be the ratio of signal power in the advanced time gate to power received in a corresponding retarded gate at time r/c after pulse transmission, a limit is obtained: R < 10 to the -11.5th power. Runs were also made using dielectric microwave lenses placed to focus an advanced radiation component, yielding a more theory dependent result: R > 10 to the 14th power. Dissert. Abstr.

N80-30581 Dartmouth Coll., Hanover, N.H.
CERENKOV RADIATION IN DIELECTRIC-LOADED WAVEGUIDES. Ph.D. Thesis
Kevin Lee Felch. 1980. 224 p.
Avail: Univ. Microfilms. Order No. 8019066

The use of Cerenkov radiation as a source of high frequency, high power microwave radiation is dealt with in detail. Using the Cerenkov interaction, when a relativistic electron beam is passed down the center of a dielectric-lined waveguide, microwave radiation at frequencies in excess of 150 GHz and power levels of about 1 W were produced. In addition, microwave radiation with approximately 1 kW of peak power at frequencies between 20 GHz and 35 GHz were observed. These results and a theoretical model serve to explain many of the experimental observations and the basic scaling of such a Cerenkov microwave generator. By the proper manipulation of the various parameters of the experiment it is shown theoretically how a Cerenkov generator might be scaled in such a way as to be a viable source of high power, submillimeter radiation. Finally, specific methods which may be applied to the present experimental efforts in order to investigate the various ways in which higher output frequencies and powers may be obtained. Dissert. Abstr.

N80-30582 Pennsylvania Univ., Philadelphia.
EDGE EFFECTS IN LOW SIDELOBE ARRAY ANTENNAS. Ph.D. Thesis
Leonard Howard Yonnks. 1980. 159 p.
Avail: Univ. Microfilms. Order No. 8018630

The influence of the edge effects, which fall in the category of systematic errors, on the sidelobe performance of a very low sidelobe antenna was examined. This was accomplished by examining the problem of an infinite linear parallel plate array with strip blockage. The analysis was performed by deriving a Fredholm integral equation of the first kind for the electric field in the array aperture. The integral equation was subsequently solved using the moment method to obtain the aperture field.

the reflection coefficients, and the radiation patterns, or element factors, of each the elements. Solutions were obtained for waveguide arrays excited with both TE wave and TEM waves. An efficient method of computing the element factors of the elements in either the special array under study or in a uniform array was introduced. The contribution of edge effect to antenna sidelobes was quantified by introducing the element factor error function. By examining the upper bound on the sidelobe contribution due to edge effects, it was shown that the antenna size has a lower bound below which the edge effect sidelobe contribution may not be neglected. Dissert. Abstr.

N80-30583 Drexel Univ., Philadelphia, Pa.
PROPAGATION IN A DIELECTRIC WAVEGUIDE USING THE GREEN'S FUNCTION METHOD Ph.D. Thesis
Louis Anthony Pitale 1980 75 p
Avail: Univ. Microfilms Order No. 8019354

The Green's function response of a two dimensional linear, homogeneous, isotropic, lossless, planar dielectric waveguide to an elemental electric current source is described. The source is located within the waveguide transverse to the direction of propagation. Solutions are found by first considering the associated one dimensional transverse transmission line problem. A field point is chosen at different points within the waveguide showing the field distribution in terms of the various singularities of the asymptotic form of the Green's function. Extensions to the Hertz potential and to electric and magnetic fields are shown. Responses to longitudinal electric current sources and transverse and longitudinal magnetic current sources are also indicated. Applications to transverse deterministic and stochastic inhomogeneous waveguide media and the dyadic Green's function construction is noted. Dissert. Abstr.

N80-30584 Virginia Polytechnic Inst. and State Univ., Blacksburg.
CW AND PULSED BEAM PROPAGATION IN FOCUSING MEDIA WITH RANDOM-AXIS MISALIGNMENTS Ph.D. Thesis
Stelios John Patsiokas 1979 119 p
Avail: Univ. Microfilms Order No. 8020223

A statistical technique which allows the asymptotic evaluation of second- and higher-order statistical observables related to the stochastic complex parabolic equation, without having first to derive equations for second- or higher-order coherence functions was applied to the problem of CW and pulsed beam propagation in a focusing medium characterized by random-axis misalignments. Particular emphasis is placed on the computation of second- and fourth-order physical observables (e.g., the spreading of the mean CW intensity, the variance of on- and off-axis intensity fluctuations, etc., as well as the on-axis ensemble-averaged pulse intensity). Dissert. Abstr.

N80-30585 Polytechnic Inst. of New York.
ON THE EXTRAPOLATION OF BAND-LIMITED SIGNALS Ph.D. Thesis
Christodoulos C. Chamzas 1980 210 p
Avail: Univ. Microfilms Order No. 8019391

The determination of the Fourier Transform of a band-limited signal in terms of a finite segment is examined. The Papoulis' Extrapolation Algorithm is extended in a broader class of signals and its convergence is considerably improved by a multiplication with an adaptive constant, chosen to minimize the mean square error in the extrapolation interval. The discrete version of the iteration is examined and then modified in order to converge to the best linear mean square estimator of the unknown signal when noise is added to the given data. The problem of determining the frequencies, amplitudes and phases of a sinusoidal signal from incomplete noisy data, is considered and the extrapolation algorithm is properly modified to estimate these quantities. The obtained iteration is nonlinear and adaptively reduces the spectral components due to noise. The adaptive extrapolation technique is applied to the problem of image restoration for objects consisting of point or line sources, and to an ultrasonic problem. Dissert. Abstr.

N80-30586 Cincinnati Univ., Ohio.
THE PROPAGATION OF ELASTIC WAVES IN HETEROGENEOUS MEDIA Ph.D. Thesis
James S. Kelm 1980 152 p
Avail: Univ. Microfilms Order No. 8021073

Approximate solutions are presented for the case of general properties in the media. Solutions are developed for a transformed canonical form of the well known wave equation, referred to as the Klein-Gordon form. These approximate solutions use as a basis, the constant coefficient exact solution in their development. Solutions restricted to the wavefront (or arrival time) and far field time domains are developed. Also, a solution is developed for slowly varying coefficients of the Klein-Gordon equation. This solution provides an accurate representation of wave propagation throughout the time domain. The solution is particularly useful in predicting transient pulse propagation and the ensuing local tailing or reflection of the wave in media with rapidly varying properties. The solution techniques presented complement and extend the work available in the literature. These techniques provide greater insight to the problem of elastic wave propagation in heterogeneous media and can be applied in a reasonably simple manner. Dissert. Abstr.

N80-30587*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A STUDY OF A SPACE COMMUNICATION SYSTEM FOR THE CONTROL AND MONITORING OF THE ELECTRIC DISTRIBUTION SYSTEM. VOLUME 2: SUPPORTING DATA AND ANALYSES
A. Vaisnys May 1980 270 p refs
(Contracts NAS7-100; DE-AI01-79ET-29372)
(NASA-CR-163478; JPL-Pub-80-48-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 17B

It is technically feasible to design a satellite communication system to serve the United States electric utility industry's needs relative to load management, real-time operations management, remote meter reading and to determine the costs of various elements of the system. The functions associated with distribution automation and control and communication system requirements are defined. Factors related to formulating viable communication concepts, the relationship of various design factors to utility operating practices, and the results of the cost analysis are discussed. The system concept and several ways in which the concept could be integrated into the utility industry are described. R.K.G.

N80-30588*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
GENERATION AND INJECTION OF E.M. WAVES IN SPACE PLASMA BY MEANS OF A LONG ORBITING TETHER Semiannual Progress Report, 11 Dec. 1979 - 10 Jun. 1980
Jul. 1980 44 p refs
(Contract NAS8-33520)
(NASA-CR-161533; SAPR-1) Avail: NTIS HC A03/MF A01 CSCL 20N

The generation and injection of electromagnetic waves in space plasma by means of a long orbiting tether are considered. The objectives include an estimation of the portions of the primary electrodynamic power developed by the tether that goes to excite each of various wave generation and injection mechanisms expected to be present during a tether's orbital flight, an evaluation of the signal levels associated with each one of the mechanisms above, and verification of their detectability with state-of-the-art instrumentation on the Earth surface or elsewhere. The generation and injection of Alfven waves and electron whistler waves were identified as the most relevant mechanisms activited by the electrodynamic tether. The physical mechanisms that govern these two families of phenomena were investigated and the ratio between the power that goes in Alfven waves and in whistlers was derived. The analysis of the possible production of accelerated electrons by the electrodynamic tether was initiated. E.D.K.

N80-30589# Stanford Univ., Calif. Computer Systems Lab.
DISTRIBUTION OF PACKET DELAY AND INTERDEPARTURE TIME IN CARRIER SENSE MULTIPLE ACCESS
Fouad A. Tobagi 1 Apr. 1980 37 p refs
(Contract DAAG29-79-C-0138)
(AD-A086446; TR-187; ARO-16783.1-A-EL) Avail: NTIS HC A03/MF A01 CSCL 17/2

Existing analysis of the carrier sense multiple access mode (CSMA) has led to the determination of the average channel performance in terms of average throughput and average packet

delay. This was achieved by formulating a semi-Markovian model for CSMA channels with a finite population of users. In this paper, it is shown that, using the same model, it is possible to derive the actual packet delay distribution. The analysis is similar in nature to that provided for slotted ALOHA channels. These results are useful in the design of systems intended for real time applications such as digitized speech, and in the analysis of multihop packet radio systems. GRA

N80-30590# Ohio State Univ., Columbus. ElectroScience Lab.
PATTERN ANALYSIS OF A HORN ANTENNA IN THE PRESENCE OF OBSTACLES
W. D. Burnside and C. S. Kim. Feb. 1980. 44 p. refs.
(Contract N62269-78-C-0379; WO6380000)
(AD-A086426; ESL-711588-1; NADC-80095-30) Avail: NTIS
HC A03/MF A01 CSCL 20/14

It is suggested that the geometrical theory of diffraction (GTD) can be applied to problems in which the single antenna considered previously is replaced by a large array. It is demonstrated that GTD can successfully predict the low scattering associated with a pattern side lobe hitting a plate or set of plates. In that it is not pertinent what created the low side lobe which intersects the plate, a rectangular horn is used as the source in that it is much simpler to control experimentally. Based on many comparisons between calculated and measured results, it appears that GTD can accurately predict these low scattering levels, i.e., especially accurate for at least the first 20 dB below the maximum plate illumination level. E.D.K.

N80-30591# Ohio State Univ., Columbus. ElectroScience Lab.
AIRBORNE ANTENNA PATTERN CODE USER'S MANUAL
W. D. Burnside and T. Chu. Mar. 1980. 106 p. refs.
(Contracts N62269-78-C-0379; F30602-79-C-0068; WO6380000)
(AD-A086331; ESL-711588-2; NADC-80096-30) Avail: NTIS
HC A06/MF A01 CSCL 20/14

This report describes the use of a computer code to analyze antenna mounted on aircraft fuselage. Ramjet configurations can be handled as a special case by this code. The pattern can be taken in terms of an arbitrary conical cut. The organization of the code, definition of input and output data, multiple finite plate approach to simulate the structures on aircraft and various examples are presented. The analysis is based on the geometrical theory of diffraction, and various computed patterns are compared with experimental results. GRA

N80-30592# Naval Underwater Systems Center, Newport, R. I. Submarine Electromagnetic Systems Dept.
THE MAGNETIC CHARACTERISTICS OF TAPE WRAPPED CYLINDRICAL FERROMAGNETIC LAMINATIONS FOR FREQUENCIES BELOW 50 KHZ
Louis J. Dalsass. 22 Feb. 1980. 19 p. refs.
(AD-A086333; NUSC-TM-791227) Avail: NTIS
HC A02/MF A01 CSCL 09/3

The leakage magnetic fields from magnetic devices are known to create EMI problems for sensitive shipboard VLF receivers and sonar equipment. Devices which contain ferromagnetic cores can be particularly significant EMI offenders because of the high flux densities available in their magnetic circuits. This memorandum discusses the magnetic characteristics of various laminated cores found in shipboard equipment (with source frequencies extending into the VLF band). Test results are presented for an open tape cylindrical lamination containing an axial and radial air gap. Although this is a more complicated magnetic circuit, its behavior is shown to be identical to predictions derived for simple lamination shapes without air gaps for frequencies up to 50 kHz. GRA

N80-30593# Naval Research Lab., Washington, D. C.
SURVEY OF POTENTIAL RADIO FREQUENCY INTERFERENCE SOURCES. Final Report
C. David Crandall. 13 May 1980. 210 p.
(WO5270S00)
(AD-A086785; AD-E000465; NRL-MR-4200) Avail: NTIS
HC A10/MF A01 CSCL 17/9

This report is a survey of the potential Radio Frequency Interference (RFI) sources that are currently affecting the analysis of data from the Seasat Scanning Multichannel Microwave Radiometer (SMMR) and those sources that could affect the design of the Large Antenna Multichannel Microwave Radiometer (LAMMR) for the National Oceanic Satellite System (NOSS). The Seasat SMMR survey is limited to the 6.5 to 6.7 GHz channel and to emitters on the West Coast of the United States and Canada where RFI has been encountered. The NOSS LAMMR survey covers all of the potential frequencies of interest: 3.0 to 7.6 GHz, 10.5 to 11.0 GHz, 13.4 to 14.0 GHz, 14.5 to 14.7 GHz, 17.0 to 18.8 GHz, 20.8 to 22.4 GHz, 34.0 to 35.5 GHz, 36.0 to 37.0 GHz, 76.0 to 77.0 GHz, and 88.0 to 94.0 GHz. Also included are excerpts from the current international frequency allocation tables and excerpts from the U.S. position which was presented at the 1979 World Administration Radio Conference (WARC). GRA

N80-30594# Naval Research Lab., Washington, D. C. Systems Integration and Instrumentation Branch.
SYNTHESIS OF MCJ CODES. Interim Report
Hugo M. Beck. 4 Apr. 1980. 21 p. refs.
(AD-A086778; AD-E000444; NRL-8393) Avail: NTIS
HC A02/MF A01 CSCL 09/4

Constructive techniques are given for the encoding and decoding of Massey-Costello-Justesen (MCJ) error control block codes. These codes form a family of maximum distance separable (MDS) codes distinct from the Reed-Solomon (RS) codes. The MCJ codes offer ease of encoding and decoding for either hardware or software implementations, based on the more natural Galois ground field mathematical operations involved in the associated algorithms. Because of inherent burst error control capabilities, these codes can be considered for channel error protection as well as for end-to-end message error control. GRA

N80-30595# Naval Research Lab., Washington, D. C. Target Characteristics Branch.
A NEW CLASS OF PULSE COMPRESSION CODES AND TECHNIQUES. Interim Report
B. L. Lewis and F. F. Kretschmer. 26 Mar. 1980. 26 p. refs.
(SF12141491)
(AD-A086787; AD-E000442; NRL-8387) Avail: NTIS
HC A03/MF A01 CSCL 17/9

A new class of symmetrical polyphase codes is introduced that promises to be very useful in pulse expander-compressor circuits for radar systems. These codes are very compatible with digital signal processing techniques. The code symmetry permits digital pulse expander-compressors to be implemented with less hardware than required with any previously known code. Another significant advantage of the new codes is that precompression bandwidth limiting such as normally would be found in any well-designed radar actually improves the mainlobe to sidelobe ratios obtainable with the new codes while it degrades that obtainable with the previously known Frank code. GRA

N80-30596# Naval Research Lab., Washington, D. C.
PRELIMINARY RESULTS OF RADAR ENVIRONMENTAL MAPPING. Interim Report
B. H. Cantrell. 28 Apr. 1980. 21 p. refs.
(RR0210541)
(AD-A086788; AD-E000440; NRL-8400) Avail: NTIS
HC A02/MF A01 CSCL 17/9

The signals received by radars often contain much more information than the echoes from targets, but usually only the target echoes are extracted. Means of extracting the environmental conditions such as rain and land clutter, noise jamming, short-pulse interference, and thermal-noise regions are studied. The knowledge of the environmental conditions is thought to be useful in target tracking and radar control processes. GRA

N80-30597# Dikewood Industries, Inc., Albuquerque, N. Mex.
INTERACTION BETWEEN A PARALLEL-PLATE EMP SIMULATOR AND A CYLINDRICAL TEST OBJECT. Final Report
J. Lam. Kirtland AFB, N. Mex. AFW. May 1980. 41 p. refs.
(Contract F29601-78-C-0045; AF Proj. 3763)
(AD-A086815; AD-E200519; DC-FR-1299-3;
AFWL-TR-79-138) Avail: NTIS HC A03/MF A01 CSCL 20/14

The interaction between a bounded-wave EMP simulator and a test object is studied with a geometrical model. The model consists of a finite, open-ended cylinder inside a parallel-plate waveguide. The interaction problem is formulated exactly by means of an integrodifferential equation, which is subsequently reduced to a matrix equation. An approximate analytical solution of the matrix equation is obtained. The singularities of the solution in the complex-frequency plane are investigated. The effects of the simulator/test-object interaction on the pole singularities are numerically evaluated. GRA

N80-30598# Dikewood Industries, Inc., Albuquerque, N. Mex.
DISCRETE AND CONTINUOUS SPECTRA OF FINITE-WIDTH, PARALLEL-PLATE SIMULATOR FIELDS Final Report
F. C. Yang Kirtland AFB, N. Mex. AFWL May 1980 108 p refs
(Contract F29601-78-C-0045; AF Proj. 3763)
(AD-A086813; AD-E200518; DC-FR-1299-2; AFWL-TR-79-137) Avail: NTIS HC A06/MF A01 CSCL 20/14

The discrete (referred as modes) and continuous spectra of finite-width, parallel-plate simulator fields are investigated. Formulas suitable for numerical calculation are obtained for both the transverse-magnetic (TM) and transverse-electric (TE) fields. Numerical results for the propagation constants and the field distributions of the higher order TM modes are presented. It is found that in the working volume of the parallel-plate simulator some of the higher-order TM modes resemble those of a closed waveguide, and the field of the continuous spectrum decays at least as z-2 for waves propagating along the z-direction. GRA

N80-30599# Dikewood Industries, Inc., Albuquerque, N. Mex.
PARALLEL-PLATE TRANSMISSION LINE TYPE OF EMP SIMULATORS: SYSTEMATIC REVIEW AND RECOMMENDATIONS Final Report
D. V. Giri, T. K. Liu, F. M. Tesche (LuTech, Inc., Albuquerque, N. Mex.), and R. W. P. King (Harvard Univ.) Kirtland AFB, N.Mex. AFWL May 1980 169 p refs
(Contract F29601-78-C-0045; AF Proj. 3763)
(AD-A086814; AD-E200520; DC-FR-1299-4) Avail: NTIS HC A08/MF A01 CSCL 20/14

This report presents various aspects of the two-parallel-plate transmission line type of EMP simulator. Much of the work is the result of research efforts conducted during the last two decades at the Air Force Weapons Laboratory, and in industries/universities as well. The principal features of individual simulator components are discussed. The report also emphasizes that it is imperative to hybridize our understanding of individual components so that we can draw meaningful conclusions of simulator performance as a whole. GRA

N80-30600# Dikewood Industries, Inc., Albuquerque, N. Mex.
EXCITATION OF THE PARALLEL-PLATE SECTION OF A BOUNDED WAVE EMP SIMULATOR BY A CONICAL TRANSMISSION LINE Final Report
J. Lam Kirtland AFB, N. Mex. AFWL May 1980 55 p refs
(Contract F29601-78-C-0045)
(AD-A086812; AD-E200517; DC-FR-1299-1; AFWL-TR-79-136) Avail: NTIS HC A04/MF A01 CSCL 20/14

The excitation of a parallel-plate electromagnetic pulse (EMP) simulator by an electromagnetic pulse via a conical transmission line is analyzed. The analysis first establishes an exact formulation of the problem by use of the technique of electric-field integrodifferential equations. It then goes over to a simpler, approximate formulation in the form of an integrodifferential equation for the total longitudinal surface current flowing on the simulator. This equation is further transformed into an integral equation, and the model structure of its solution investigated. A self-consistent method for solving the integral equation is developed. An analytical formula for the current in the transverse-electromagnetic (TEM) mode is thereby obtained. The analysis concludes with a numerical study of the TEM current and its variation with the parameters of the simulator geometry. GRA

N80-30601# Syracuse Univ., N. Y.
EXPERIMENTAL VALIDATION OF THE ANTENNA PATTERN DISTORTION COMPUTER PROGRAM: DISTORT (UHF ANTENNAS) Technical Report, Apr. - Nov. 1978
Jose Perini and Hubert Moses Scott AFB, Ill. Air Force Communications Command 30 Apr 1980 93 p
(Contract F30602-75-C-0121)
(AD-A086330; RADC-TR-80-8; EEG-TR-80-5) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report describes the procedures and the experimental measurements carried out to validate the Antenna Pattern Distortion Computer Program (DISTORT) for the AT-197/GR and AS-1097/GR UHF antennas. The report also covers the validation of the reflection coefficient formulation for imperfect Earth. GRA

N80-30602# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
RADIO RECEIVER, SPURIOUS RESPONSE: TEST OPERATIONS PROCEDURE Final Report
12 May 1980 15 p
(AD-A086463; TOP-6-2-545) Avail: NTIS HC A02/MF A01 CSCL 17/2

This TOP determines and measures the spurious responses of AM/FM radio receivers by using commonly available test instrumentation. It has general applicability to all receivers, including image, intermediate frequency (IF) feed-through, local oscillator related, and extraneously produced spurious responses. Spurious responses are signals propagated at frequencies outside of the tuned principal response frequency to which the receiver responds with measurable output power. They reveal frequencies where the receiver is most susceptible to undesired signals (jamming). GRA

N80-30603# Parke Mathematical Labs., Inc., Carlisle, Mass.
SPECTRAL ANALYSIS OF SCINTILLATION DATA TAKEN FROM AN AIRCRAFT, PART 1 Final Report, Oct. 1976 - Oct. 1979
Theodore B. Barrett Hanscom AFB, Mass. AFGL Feb 1980 83 p refs
(Contract F19628-76-C-0296; AF Proj. 7663)
(AD-A086837; AFGL-TR-80-0055-Pt-1; Rept-0296-1) Avail: NTIS CSCL 20/14

This report provides theoretical background material for the development of a thin phase screen model for radio scintillation. This model is then used to derive an expression for the expected amplitude scintillation spectra (spectral density funciton) which might be observed in a geometry which includes a satellite based transmitter, an aircraft based receiver and a thin, intermediate scintillation-producing medium. A computer procedure was developed for testing the model under various geometries and for various parameters describing the bulk properties statistical properties of the medium. In addition to the development of a theoretical model, this report includes material on experimental spectral analysis and, in particular, details on a spectral analysis procedure which was used on amplitude scintillation and data gathered from an aircraft in geomagnetic equatorial regions. GRA

N80-30604# Polytechnic Inst. of New York, Brooklyn.
WAVE PROPAGATION IN HONEYCOMB AND FOAM-CORE PANELS FOR APPLICATION TO PANEL NDE Final Technical Report, 1 Jul. 1977 - 11 Oct. 1979
Henry L. Bertoni and S. K. Park Griffiss AFB, N.Y. RADC Apr. 1980 141 p refs
(Contract F19628-77-C-0130; AF Proj. 2305)
(AD-A086667; RADC-TR-80-112) Avail: NTIS HC A07/MF A01 CSCL 13/13

For rapid inspection, it is most useful to consider acoustic waves traveling along the larger dimensions of the panels. A study was made of the waves propagating in the honeycomb itself, particularly in the frequency range where the wavelength is on the order of the cell diameter. The characteristics of Bloch waves propagating in a honeycomb of infinite extent were calculated. At low frequencies, the honeycomb was found to act as an elastic continuum. At high frequencies, the periodicity and anisotropy of the honeycomb affect the propagation of the Bloch waves, and result in the presence of stop bands for propagation in certain directions. Computations of the frequency dependence, direction dependence, and polarization of the Bloch waves were made. In addition, the propagation characteristics

of the waves guided by an aluminum face plate bonded to a honeycomb of semi-finite extent were studied in the low frequency range where the honeycomb acts as an elastic absorber. It was found that the presence of the honeycomb strongly perturbs the waves guided by the face plate, so that one can expect to inspect for de-bonded regions by measuring propagation characteristics. Similar results were found for a foam core bonded to an aluminum face plate. In this case, a glue layer bonding face plate to the foam was also considered and found to have a significant effect on the guided waves. GRA

N80-30605# Georgia Inst. of Tech., Atlanta. Electronic Technology Lab.
ADAPTIVE TIME DELAY CIRCUITRY FOR INTERFERENCE CANCELLATION SYSTEMS. Final Technical Report, 30 Oct. 1978 - 31 Oct. 1979
Donald E. Clark and William A. Hardell. Griffiss AFB, N.Y. RADC Apr. 1980. 58 p. refs.
(Contract F30602-78-C-0120; AF Proj. 2338)
(AD-A086326; GIT-A-2287(F)) Avail: NTIS
HC A04/MF A01. CSCL 09/1

The objective of this research program was to study and investigate variable time delay techniques for use in interference cancellation systems so as to improve their performance. A comprehensive survey of past research pertaining to HF, VHF, and UHF variable time delay techniques was undertaken. The survey also included microwave variable time delay techniques that are adaptable to the lower bands. As part of this program, variable delay lines were constructed and experimental measurements performed. Specifically, two types of delay lines were investigated, one using a coaxial transmission section with a helix surrounding a ferrite rod and the other a powdered ferrite and dielectric loaded coaxial section. The report presents experimental results over the HF, VHF, and UHF bands. GRA

N80-30606# Naval Postgraduate School, Monterey, Calif.
MODELING OF PULSES HAVING ARBITRARY AMPLITUDE AND FREQUENCY MODULATION. Ph.D. Thesis
Francis Martin Lunney. Mar. 1980. 150 p. refs.
(AD-A086567) Avail: NTIS. HC A07/MF A01. CSCL 09/4

A model is developed which provides for the generation of the approximate spectra of pulsed signals with arbitrary amplitude and frequency modulation. Error bounds associated with the model are developed providing an insight into performance accuracy. The concept of using two approximate spectra to generate a more exact spectrum by means of computationally trivial calculations is addressed. The model is used to validate the feasibility of using frequency domain discriminants in the signal classification process. GRA

N80-30607# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
BOUNDS ON THE UTILIZATION OF ALOHA-LIKE MULTIPLE-ACCESS BROADCAST CHANNELS
Pierre A. Humblet. Jun. 1980. 16 p. refs.
(Contract N00014-75-C-1183; Grant NSF ENG-77-19971; ARPA Order 3045)
(AD-A086655; LIDS-P-1000) Avail: NTIS. HC A02/MF A01. CSCL 17/2

Pippenger's model for synchronous protocols that resolve conflicts among message transmissions on a multiple-access broadcast channel is extended to the case where the transmission times depend on the outcome of the transmissions. An information theoretic method is used to provide new bounds on the utilization of the channel. GRA

N80-30608# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
A CONFLICT RESOLUTION ALGORITHM FOR NOISY MULTIACCESS CHANNELS. B.S. Thesis
David Mark Ryter. Jun. 1980. 76 p. refs.
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A086767; LIDS-TH-1007) Avail: NTIS
HC A05/MF A01. CSCL 17/2

An efficient contention resolution scheme has been developed by Gallager to be used in allocating usage of common channel to a large number of independent transmitters. Time is divided into equal size intervals called slots. Message transmissions begin only at slot boundaries and do not overlap boundaries. Depending on the channel history, as monitored by the users, the algorithm defines a system-wide 'transmission interval' at the beginning of each slot. A user can only transmit when it possesses a message with a generation time falling at the current transmission interval. This algorithm is modelled as a Markov process. The Gallager algorithm is based on the assumption that the transmitters make no errors in the detection of channel activity. This thesis investigates the case where a limited class of detection errors is introduced into the system. A modified algorithm is proposed to effectively correct these errors. This Noisy Channel Algorithm includes a stack mechanism and two special processing states. The algorithm is again modelled as a Markov process and retains some key features of the Gallager algorithm. The algorithm is analyzed and the degree to which system performance is downgraded by errors is determined. GRA

N80-30609# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A PREDICTOR MODEL FOR SHF AND EHF MILSATCOM SYSTEM AVAILABILITIES IN THE PRESENCE OF RAIN
Leonard M. Schwab. 21 Feb. 1980. 104 p. refs.
(Contract F19628-80-C-0002)
(AD-A086714; TN-1980-15) Avail: NTIS. HC A06/MF A01. CSCL 20/14

A numerical method for computing MILSATCOM system availability based on predicted link availability is described. Link availability can be computed in the model for frequencies of 10-50 GHz, arbitrary geostationary satellite subpoint, and arbitrary value of link margin in dB. Computed availability contours are plotted on a Mercator grid of the world. GRA

N80-30610# Kansas Univ. Center for Research, Inc., Lawrence.
ANALYTICAL STUDY OF THE BISTATIC RADAR CROSS-SECTION OF A PROLATE SPHEROID. Final Report, 1 May 1979 - 1 Feb. 1980
Albert W. Biggs and Stanton B. McMillian. Mar. 1980. 37 p. refs.
(Grant AF-AFOSR-0105-79; AF Proj. 2305)
(AD-A086846; AFOSR-80-0532TR) Avail: NTIS
HC A03/MF A01. CSCL 17/9

Bistatic radar has important application in strategic and tactical space surveillance and in weapon tracking. At the present time, there is a lack of standard techniques for measuring radar cross sections. This effort was a feasibility study into obtaining an exact radar cross section for the Advanced Strategic Air Launched Missile (ASALM). The study was limited to the bistatic cross section of a typical target. A prolate spheroid was selected because it resembles an air cruise missile. Results were configured in the form of bistatic cross sections with a computer program to generate additional cross sections for prolate spheroids with different major to minor axis ratios. Any surface that is convex at each point, and which has no two distinct points where the outward normal vectors are in the same direction, can be handled similarly. Hence, the program written could very quickly be changed to handle a figure that is ellipsoidal in all the major planes, or even a parabola of revolution that extends to infinity in one direction. It is simple a matter of being able mathematically to describe the surface. GRA

N80-30611# Johns Hopkins Univ., Baltimore, Md. Dept. of Psychology.
THE HUMAN USE OF TELECOMMUNICATION SYSTEMS. Final Report, 1 Oct. 1974 - 30 Jun. 1980
Alphonse Chapanis. Jun. 1980. 25 p. refs.
(Contract N00014-75-C-0131; NR Proj. 196-135)
(AD-A086745) Avail: NTIS. HC A02/MF A01. CSCL 05/10

This report summarizes a series of studies in a research program dealing with interactive communication, conferencing and teleconferencing. The studies fall into three broad classes: (1) a naturalistic study of real conferences in academic, business, and government settings; (2) several laboratory experiments investigating human and system variables in telecommunications; and (3) studies relating to language and language usage in interactive communication and telecommunication. The principal findings of the studies are summarized and integrated and implications are drawn for the design of telecommunication systems. GRA

N80-30612# Johns Hopkins Univ., Baltimore, Md. Dept. of Psychology.
COMMUNICATION CONTROL AND LEADERSHIP IN TELECOMMUNICATIONS BY SMALL GROUPS
Peter D. Pagerey. Jun. 1980. 125 p. refs.
(Contract N00014-75-C-0131; NR Proj. 196-135)
(AD-A086746; TR-10) Avail: NTIS. HC A06/MF A01. CSCL 05/10

This experiment examined the effect of communication control on the telecommunications of four subject problem solving groups, and on the emergence of leaders within the groups. Sixteen four-subject teams solved four realistic problems, one on each of four days, by communicating over a closed-circuit television system with an added audio capacity. Teams were assigned to communication systems which either did or did not have centrally controlled switching so that only one person could talk at a time, and to systems in which either (1) one subject was appointed to perform some of the experimenter's tasks or (2) no group member was so designated. Four degrees of control over communication thus ranged from no control (communication was not centrally switched, no appointed helper) to absolute control (appointed helper who switched the communication). The subject who switched the communication and/or helped the experimenter was chosen at random by the experimenter prior to the start of the first experimental session and remained the same throughout the remaining sessions. Teams were paid a bonus of up to $2.60 for each problem solution. The size of a team's bonus depended on how well the team solved each problem as determined by comparing their solutions with criterion solutions. Dependent measures include the time to solution, a measure of the quality of solution based on the size of the bonus, measures of verbal communication, and questionnaire responses. GRA

N80-30613# California Univ., Los Angeles. School of Engineering and Applied Science.
COLLISION-RESOLUTION ALGORITHMS AND RANDOM-ACCESS COMMUNICATIONS Interim Report
James L. Massey. Apr. 1980. 80 p. refs. Submitted for publication
(Contract N00014-78-C-0778)
(AD-A086695; UCLA-ENG-8016) Avail: NTIS. HC A05/MF A01. CSCL 17/2

The problem considered is the random-accessing by very many transmitters of a common receiver over a time-slotted collision-type channel with feedback. A collision-resolution algorithm (CRA) is a protocol for the transmission and retransmission of packets such that, after a collision, all transmitters eventually and simultaneously learn that all the colliding packets have been successfully retransmitted. Focus is placed on a CRA due to Capetanakis (the CCRA) and a slight modification thereof (the MCCRA). The fundamental traffic-independent properties of the CCRA and MCCRA are derived by means of a recursive analysis, with emphasis on the mean and variance of the number of slots required to resolve a collision among N packets. These results are then used to analyze by a Markovian approach the performance of various random-access algorithms, built upon the CCRA and MCCRA, for the case of infinitely many identical sources generating Poisson traffic. The maximum stable throughput is determined for each random-access algorithm, and tight upper and lower bounds are developed for the delay-throughput characteristic of the 'obvious' random-access algorithm built upon the CCRA. GRA

N80-30614# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
THEORETICAL ANTENNA ANALYSIS Interim Report
H. E. King, Robert B. Dybdal, and Dorothy S. Chang. 1 Jul. 1980. 23 p. refs.
(Contract F04701-79-C-0080)
(AD-A086703; TR-0080(5930-06)-1; SD-TR-80-50) Avail: NTIS. HC A02/MF A01. CSCL 20/14

The results of the analytical work for the Antennas task of the FY 1979 Mission-Oriented Investigation and Experimentation (MOIE) program are summarized. The radiation pattern computation of a 46.8 lambda diameter paraboloidal reflector antenna is compared with experimental results. The pattern analysis accounts for the feed blockage and feed-strut scatter. Good agreement between the theoretical and experimental results exists for wide-angle sidelobes. The diffraction levels from a half-plane edge and a rounded edge were computed, and good correlation with experimental results is indicated. The radiation patterns of a monopole mounted on a circular and a rectangular ground plane were also computed. GRA

N80-30615# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE KING SURFACE CURRENT PROBING TECHNIQUE IN A TRANSIENT APPLICATION Electromagnetics Research Report, 1 Jan. 1978 - 1 Dec. 1979
L. Wilson Pearson and Youn M. Lee. Dec. 1979. 90 p. refs.
(Contract N00014-77-C-0362)
(AD-A087203; RR-79-4) Avail: NTIS. HC A05/MF A01. CSCL 20/3

An experimental technique to measure transient surface currents of a scatterer using a King-type semicircular miniature probe is reported. The principal extension of the King technique is the use of the loop probe in transient currents measurement. The transient characteristics of the probe are considered based on the Whiteside theory (29) for the loop. The probes fabricated were subjected to transient excitation in a coaxial calibration jig. Their frequency responses were determined by Fourier transforming their output and deconvolving the excitation spectrum. The agreement between the measured results and the Whiteside theory is observed and evaluated. The probe geometry was tested in an application context, namely, the probing of current on a cylindrical scatterer. The induced surface currents were measured using the probe along the scatterer, and deconvolution of the probe transfer function was carried out subsequently. The deconvolved waveforms are reported and the results of numerical predictions by way of a time domain integral equation technique are reported for comparison. The application goal for this work lies in the numerical extraction of the Singularity Expansion Method (SEM) description of scattering from a given object, using measured transient data. GRA

N80-30616# Pacific-Sierra Research Corp., Santa Monica, Calif.
MULTIPLE SCATTERING IN CLOUDS
A. P. Ciervo. Sep. 1979. 78 p. refs.
(Contract N00014-78-C-0751; DARPA Order 8650; RT21222801)
(AD-A087043; PSR-923) Avail: NTIS. HC A05/MF A01. CSCL 20/6

This report develops an analytic model for the propagation of an optical pulse through a multiple scattering medium. Such a model is needed to investigate the effect of clouds on optical communications from a satellite to a submarine. A key initial result is the derivation of simple expressions for the first two spatial and angular moments of the radiance distribution for a narrow delta-function source immersed in an infinite scattering medium. The moments support a diffusion approximation for the transport process in an infinite plane-parallel cloud. First the radiance is calculated at the cloud exit and on a plane an arbitrary distance below the cloud, then power collected by a finite receiver located on this plane is computed. The model is validated by comparing its results with computer simulation curve fits for optically thick clouds (i.e., tau = 15). The model is capable of duplicating nearly all the simulation results but at significantly lower cost. Furthermore, detailed calculations impractical to simulate are readily computed. GRA

N80-30617# Columbia Univ., New York. Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report, 1 Apr. 1979 - 31 Mar. 1980
George W. Flynn. 31 Mar. 1980. 186 p. refs.
(Contracts DAAG29-79-C-0079; DAAG29-80-C-0043; N00014-78-C-0517; ET-78-R-03-1876; DE-AS02-78ER-4940; Grants AF-AFOSR-0082-79; NSF ENG-76-16424; NSF MPS-75-0411; NSF CHE-77-11384; NSF CHE-77-24343)
(AD-A087034; PR-30) Avail: NTIS. HC A09/MF A01. CSCL 07/4

Preliminary studies of spin relaxation of optically pumped sodium in xenon gas have shown that Van der Waals NaXe cause a substantial part of the relaxation. The electron-nuclear spin exchange cross section between Na and Xe129 has been

measured to be less than ten to the -19th power/sq cm. Calculations and preliminary experiments have shown that radiofrequency spectroscopic studies of the anomalously long lived 5D state of cesium are possible. Further studies of dense alkali vapors have shown that all of the alkali vapors sodium, potassium, rubidium and cesium, have absorption bands in the spectral region between 1 micron and 2.5 micron. The possibility that some of these bands might be useful for the construction of infrared excimer lasers is being investigated. GRA

N80-30618# Kansas Univ., Lawrence. Remote Sensing Lab.
RADAR BACKSCATTER STUDY OF SEA ICE
R. G. Onstott, George J. Dome, Clifford V. Delker, Javed S. Patel, and R. K. Moore. Feb. 1980. 273 p. refs.
(Contract N00014-76-C-1105)
(AD-A087032; CRINC/RSL-TR-331-14) Avail: NTIS
HC A12/MF A01. CSCL 17/9

The ability to use radar to discriminate ice types has been investigated. Radar backscatter measurements were made of shorefast sea ice near Point Barrow, Alaska in May 1977 and April 1978, with a surface-based FM-CW scatterometer that swept from 1-2 GHz and from 8.5-17.5 GHz. The 1-2 GHz measurements showed that thick first-year and multiyear sea ice cannot be distinguished at 10 deg-70 deg incidence angles, but that undeformed sea ice can be discriminated from pressure-ridged thick first-year sea ice and lake ice. Results also indicate that frequencies between 8-18 GHz have the ability to discriminate between thick first-year sea ice, multiyear sea ice, and lake ice. The lowest frequency, 9 GHz, was found to provide the greatest separation between these ice categories with significant levels of separation existing between angles of incidence from 15 deg to 70 deg. The radar cross-sections for the like polarizations, VV and HH, were very similar in absolute level and angular response. The radar cross-sections for VV-polarization were usually the highest in absolute level. Cross-polarization provided a slightly greater separation between these categories of ice. GRA

N80-30619# Lockheed Missiles and Space Co., Palo Alto, Calif.
STUDY OF ELF PROPAGATION ANOMALIES AS RELATED TO IMPROVED KNOWLEDGE OF ELECTRON DENSITY PROFILES PRODUCED BY ENERGETIC PARTICLE PRECIPITATION. Annual Technical Report
Willam L. Imhof, Robert C. Gunton, Tryve R. Larsen, Joseph B. Reagan, Edward E. Gaines, and Roland E. Meyeroff. 30 Jan. 1980. 91 p. refs.
(Contract N00014-79-C-0175)
(AD-A087255; LMSC-D681778) Avail: NTIS
HC A05/MF A01. CSCL 20/14

A study has been made of extremely low frequency (ELF) wave propagation anomalies as related to energetic particle precipitation, principally during solar particle events (SPE). Based on calculation of the predicted signal strengths at Tromso for transmissions from the Wisconsin Test Facility (WTF) a criterion has been selected for possible use in a field test operation. If the ion pair production rates at 40 km are equal to or greater than 1 x 1000/cc/sec then it is probable that a 3 dB or larger reduction in signal strength would occur for such an event. Since this preliminary criterion is based on ELF signal strength computation assuming no local time variations along the propagation path, more detailed calculations of the local time ionospheric effects should be performed. A study was made of the expected effect of local time variations during solar particle events on the ELF propagation over the path from WTF to Tromso. Electron and ion density profiles for the various segments of the test path were calculated with the ion chemistry model, taking into account the local time for each segment. In a comparison of conditions measured and calculated for SPE72 on 4 August 1972 near the peak of the event and conditions measured and calculated for a similar case assuming a season of 21 December, very little difference in signal strength attenuation over the path was found. GRA

N80-30620# Electronics Research Lab., Adelaide (Australia).
RADAR EMITTER RECOGNITION USING PULSE REPETITION INTERVAL
R. M. Hawkes. Defence Research Centre, Salisbury, Australia. Mar. 1980. 59 p. refs.
(AD-A086968; ERL-0132-TR; AR-001-976; TR-3) Avail: NTIS
HC A04/MF A01. CSCL 15/4

A method for estimating radar emitter pulse repetition interval parameters for intercepted emissions is presented. Adaptive parameter estimates based on certain measurements are derived. The measurements are obtained by a readily implementable observation procedure. The approach can deal with emitters with variable pulse repetition interval in a dense environment. Computer simulation results for the techniques are included. GRA

N80-30621# Sterling-Winthrop Research Inst., Rensselaer, N. Y.
ASSESSMENT OF THE CAPACITY OF THE AUTOMATED RADAR TERMINAL SYSTEMS (ARTS IIIA) FOR THE YEARS 1980-1990. Final Report, Oct. 1978 - Apr. 1980
W. Pailen, Hugh C. Wintermoyer, and Robert Sittler. Jun. 1980. 450 p. refs. Prepared in cooperation With Argon Crop., Waltham, Mass.
(Contract DOT-FA78WAI-942)
(AD-A087243; FAA-RD-80-51) Avail: NTIS
HC A20/MF A01. CSCL 17/7

The capability of the ARTS 3A to support future air traffic growth and functional enhancements through 1990 is examined. The approach used is to investigate a few high traffic density sites which are representative of the three current terminal system configurations: single sensor sites (Detroit); dual sensor sites (Chicago, Los Angeles); and Metroplexes (New York). Loading factors are determined for each model site. These factors include the number and type of sensors and displays, the instantaneous traffic counts, and functional capability. The loading parameters are then used as inputs to a processing model, developed in this study, in order to determine if the ARTS 3A can provide adequate processing capacity. The loading parameters are also used to develop estimates of memory requirements. The results of the study indicate that processing capacity limitations, if not overcome, will likely constrain functional growth at Metroplex facilities but will present no problems for single and dual sensor sites. Current memory capacity limitations are shown to present significant problems for both Metroplexes and dual sensor sites. GRA

N80-30622# Naval Research Lab., Orlando, Fla.
STUDIES ON THE REDUCTION OF INTERMODULATION GENERATION IN COMMUNICATIONS SYSTEMS. Final Report
G. H. Stauss, G. C. Bailey, C. D. Bond, C. A. Carosella, and A. C. Ehrlich. 7 Jul. 1980. 94 p. refs.
(AD-A086995; AD-E000492; NRL-MR-42) Avail: NTIS
HC A05/MF A01. CSCL 17/2

Potential means of intermodulation generation in multiplex systems are reviewed and evaluated theoretically. The dominant mechanisms involve nonohmic junctions and ferromagnetic components. Junctions through aluminum oxide films have been studied experimentally and a possible means of improvement is described. Experimental tests of ferromagnetic components show the need to exclude them entirely from multiplex and high performance systems. With care in the choice and assembly of components, it is concluded that intermodulation signals can be kept to the level of thermal noise in most configurations. GRA

N80-30623# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
A 35 GHz RADAR TO MEASURE PARTICLES IN RAYLEIGH FIELDS [EIN 35-GHZ-RADAR ZUR TEILCHENMESSUNG IM RAYLEIGH-BEREICH]
Klaus Kaufmann. Aug. 1978. 13 p. In GERMAN.
(TUM-RT-KB-78/4) Avail: NTIS. HC A02/MF A01

The speed of free glass or metal particles with diameters of 0.1 to 1 mm in Rayleigh fields was measured using 35 GHz. The construction of the radar system, as well as the technical data, the measurements, the results and the future applications are outlined. Author (ESA)

N80-30624# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
A 35 GHz DOPPLER RADAR TO MEASURE THE SPEED OF SMALL PARTICLES [EIN 35-GHZ-DOPPLERRADAR ZUR GESCHWINDIGKEITSMESSUNG KLEINER TEILCHEN]
Klaus Kaufmann. May 1979. 15 p. In GERMAN.

(TUM-RT-KB-79/2) Avail: NTIS HC A02/MF A01

A radar system is presented which detects particles smaller than 1 mm (up to 0.5 mm diameter). The analysis of the Doppler signal gives the speed of the free particle and its dimensions. The construction of the radar is outlined and the measurements on the acceleration presented. Author (ESA)

N80-30625# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.

DOPPLER RADAR MEASUREMENT IN HIGH SPEED FIELDS [DOPPLERRADARMESSUNGEN IM HOCHGESWINDIGKEITSBEREICH]

Klaus Kaufmann Jul. 1979 17 p In GERMAN

(TUM-RT-KB-79/8) Avail: NTIS HC A02/MF A01

Measurements of particles accelerated up to 5 km/sec from a light gas gun are given. Particle diameters were 1.5 mm, accelerated in a 250 Torr vacuum. Author (ESA)

N80-30626# Thomson-CSF, Paris (France). Dept. Espace-Satellites.

STUDY AND DEVELOPMENT OF A SLOTTED WAVEGUIDE ELEMENT IN AN ANTENNA ARRAY Final Report [ETUDE ET DEVELOPPEMENT D'UN ELEMENT D'ANTENNE RESEAU A GUIDES A FENTES]

Nov. 1979 183 p refs In FRENCH

(Contract ESA-3692/78-NL-AK(SC))

(ESA-CR(P)-1286) Avail: NTIS HC A09/MF A01

A configuration for an antenna waveguide array to be incorporated into a satellite synthetic aperture radar is presented. Different types of slot antennas are evaluated for their radio and electrical characteristics. A vertical slot waveguide is chosen and the testing of a simplified scale model of the antenna is reported. A mathematical performance prediction method is shown to be both comprehensive and valid. A final radar panel design is proposed, while its performance is caclulated for the 50 MHz frequency band. Author (ESA)

N80-30627# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

FUNDAMENTALS OF A THEORY FOR CONFORMAL ANTENNAS

C. von Winterfeld Mar. 1979 22 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium der Verteidigung

(Rept-2-79) Avail: NTIS HC A02/MF A01

A fundamental matrix theory leading to the parameterization of conformal antenna radiation patterns of the horn radiator or thick dipole type is developed. It can be used as the basis for numerical investigations of conformal arrays or radar targets. The electromagnetic behavior of an antenna is represented by a scattering matrix. This matrix is derived from matrices, the elements of which are antilinear forms of mode functions corresponding to spherical waves of bounded regions or free space. The generalized nature of this approach is emphasized especially for implementation in a computer program. Author (ESA)

N80-30628# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

A MAXIMUM LIKELIHOOD ESTIMATOR FOR THE EXTENT OF RADAR OR SONAR TARGETS USING HIGH RESOLUTION SIGNALS

F. Dommermuth Jul. 1979 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium der Verteidigung

(Rept-3/79) Avail: NTIS HC A03/MF A01

A maximum likelihood estimator for the length of a highly resolved radar or sonar target is introduced. Simplified assumptions concerning the statistics of echo and background noise make it possible to analyze its efficiency analytically. The time discrete output of the receiver is described as an exponential integral of a distributed random amplitude signal, the noise variable of which has the same distribution, thus reducing the variable echo plus noise. After optimization, the accuracy and sensibility of the exponentially distributed estimators was evaluated using computer simulation. Results show a signal to noise ratio of 10 dB with 50% confidence. Author (ESA)

N80-30629# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

WIDEBAND BEAMFORMER TO CONTROL A 38 ELEMENT SONAR ANTENNA

L. P. Wengert Sep. 1979 37 p refs In GERMAN; ENGLISH summary

(Rept-5/79) Avail: NTIS HC A03/MF A01

A brief description of the functional characteristics of charge transfer devices is given and various beamformer designs using these components are studied. A sonar beamformer (for a line array of 32 beams) operating in real time in the frequency range from 30 Hz to 2.3 KHz was built based on the 'series parallel structure' concept. A simulator for the generation of signals for twin independent wave fronts was used to measure beamformer performance. Results indicate that this beamformer design is comparable with alternative digital signal processing systems, while the beamformer presented remains ten times less expensive to build. Author (ESA)

N80-30630# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

MEASURING APPARENT TARGET LENGTH USING TARGET RESOLVING SIGNALS

J. Ziegenbein and F. Dommeruth Sep. 1979 30 p refs In GERMAN; ENGLISH summary

(Rept-6/79) Avail: NTIS HC A03/MF A01

Four algorithms for determining the duration of target resolving sampled echo signals are examined. Two algorithms are derived from maximum likelihood considerations, while the two other procedures are based on maximizing the detection index. Assuming target fluctuation statistics to be Gaussian and double Gaussian, the deviation between estimated apparent target length and true apparent target length was determined by computer simulations in terms of mean value deviation and variance. Results show that the maximum likelihood algorithms perform better if the signal to noise ratio is smaller than 10 dB, otherwise all of the algorithms are comparable. Author (ESA)

N80-30631# Centre National d'Etudes Spatiales, Toulouse (France).

INTRODUCTION TO THE STUDY OF NOISE IN CHARGED COUPLED DEVICES [INTRODUCTION A L'ETUDE DU BRUIT DANS LES DISPOSITIFS A COUPLAGE DE CHARGES]

Guy Rolland Jul. 1979 78 p refs In FRENCH; ENGLISH summary

(CNES-NT-90) Avail: NTIS HC A05/MF A01

Noise phenomena in charge coupled devices (CCD's) and in their associated circuitry are reviewed. The physics of CCD's operation, covering the mechanism of charge transfer, input circuit, output circuits, and photosensor principles, are explained. The description, localization, and analysis of different sources of noise are detailed. Emphasis is on photosensor signals, transfer register noise, and noise in distributed floating gate amplifiers as well as in floating diffusion amplifier. A noise measurement system designed to separate sources of noise in CCD's is then presented. Author (ESA)

N80-30632# Little (Arthur D.), Inc., Paris (France).

TREND ANALYSIS. SPACE COMMUNICATIONS SYSTEM TECHNOLOGY. PHASE 1: DEFINITION OF USER NEEDS Final Report

Malcolm H. Ross and Arthur Solomon 3 Dec. 1979 122 p refs

(Contract ESA-3789/78-F-FC(SC))

(ADL-82871F; ESA-CR(P)-1308) Avail: NTIS HC A06/MF A01

In order to specify and rank the technical goals for ESA space communication missions in the 1985-1995 period, the future development of telecommunication needs of countries was identified and the suitability of implementation by space systems was assessed. For countries other than in Western Europe the demand for telecommunication services for the 1985-1995 period was estimated for each country by consideration both of the status and plans of the existing networks and of the expected economic parameters for the period. A model was constructed to compare the costs of the different terrestrial and space communication systems that would meet the projected needs. For no country was a single service space communication system cost competitive with terrestrial systems. To have a chance of

being cost competitive with terrestrial systems some additional services need to be included in the space segment, or the space segment should serve more than one country in a region. Also, for Western Europe, it was concluded that a space implementation is not cost effective for communication services on a stand alone basis. Author (ESA)

N80-30633# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
MULTI-USER TIME DIVISION MULTIPLE ACCESS (TDMA) AND SPREAD SPECTRUM (SS)-TDMA
G. B. Alaria, R. DeBassa, P. Destefanis, F. Pattini, and R. Pretti Feb. 1980 122 p refs
(Contract ESTEC-3657/78-NL-AK(SC))
(ESA-CR(P)-1324) Avail: NTIS HC A06/MF A01

An assessment was made of the feasibility and performance of equipment for a regenerative satellite which could accommodate users with nonuniform bit-rate requirements. Evaluation topics were dealt with in terms of band width, number of repeaters onboard, ground stations, and satellite fill factor as a function of the different user bit-rates. A semi empirical model was the basis for this analysis. An analysis was made of three possible solutions for the implementation of the bit-rate conversion process. A conceptual design of onboard hardware is presented, technologies to be used are identified, and circuit complexity and power requirements estimated. Author (ESA)

N80-30634# Politecnico di Torino (Italy). Ist. di Elettronica e Telecommunicazioni.
SIMULATION MODELS FOR MICROWAVE POWER TRANSISTORS UNDER LARGE SIGNAL OPERATING CONDITIONS. PART 1: THEORETICAL AND EXPERIMENTAL RESULTS Final Report
S. Benedetto, M. Biey, E. Biglieri, C. Naldi, U. Pisani, V. Pozzolo, G. P. Bava, F. Filicori (Bologna Univ.), and V. Monaco (Bologna Univ.) Dec. 1979 169 p refs
(ESA-CR(P)-1336-Pt-1) Avail: NTIS HC A08/MF A01

The problem of measuring, modeling, and analyzing class-C transistor amplifiers at high signal levels was studied. Transistor models were reviewed, and measurements of their parameters described. Computer simulation of microwave transistor amplifiers is then considered, and three solutions are proposed including: a harmonic-balance technique; a Volterra-series analysis technique; and a technique based on S-parameters. Results of the measurements performed on the amplifier are presented and compared with those obtained from simulation. Author (ESA)

N80-30635# British Aerospace Dynamics Group, Bristol (England). Communications and Countermeasures Group.
STUDY OF INTERFERENCES IN SATELLITE COMMUNICATION SYSTEMS. VOLUME 3: STUDY REPORT Final Study Report
K. Allsebrook, D. Pictor, and D. Salter Jul. 1979 134 p refs Document includes a microfiche supplement 2 Vol.
(Contract ESTEC-3647/78-NL-AK(SC))
(ESS/CCG-66-Vol-3; ESA-CR(P)-1338-Vol-3) Avail: NTIS HC A07/MF A01

Literature on the subject of interference was summarized. Phase shift keying and analog FM systems, code division multiple access systems, recommended methods of computing the effect of an energy dispersed FM TV interferer on a narrow band victim receiver are included along with effects of interference on a phase-locked-loop receiver, and applicability of the models used, for the case of multiples interference. Author (ESA)

N80-30636# British Aerospace Dynamics Group, Bristol (England). Communications and Countermeasures Group.
STUDY OF INTERFERENCES IN SATELLITE COMMUNICATION SYSTEMS. VOLUME 4: EXECUTIVE SUMMARY
K. Allsebrook Jul. 1979 22 p refs 2 Vol.
(Contract ESTEC-3647/78-NL-AL(SC))
(ESS/CCG-67-Vol-4; ESA-CR(P)-1338-Vol-4) Avail: NTIS HC A02/MF A01

A computer library of calculation techniques was established, forming the basis of a reference set of procedures for determining the effects of an interfering signal on a wanted link. The programs were designed in an expandible, modular form. The literature was searched for appropriate methods of computing the baseband degradation for the particular wanted and interfering modulation types. The merits and difficulties in implementing each calculation method were assessed and the accuracy of the results produced were considered. Author (ESA)

N80-30637# National Technical Information Service, Springfield, Va.
PHASED ARRAYS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Mar. 1980
William E. Reed Apr. 1980 253 p
(PB80-808041; NTIS/PS-79/0411; NTIS/PS-78/0331) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The design, performance, radiation patterns, and applications of phased arrays are presented in these Federally-sponsored research reports. Applications include communications, radar, optical, spacecraft, and navigational aids. This updated bibliography contains 244 abstracts, 44 of which are new entries to the previous edition. GRA

N80-30638# National Technical Information Service, Springfield, Va.
PHASED ARRAYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Mar. 1980
William E. Reed Apr. 1980 163 p Supersedes NTIS/PS-79/0413; NTIS/PS-78/0332
(PB80-808058; NTIS/PS-79/0413; NTIS/PS-78/0332) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography cites reports from worldwide research on the design, performance, radiation patterns, and applications of phased arrays. Applications include radar, communications, optical, electronic countermeasures, acoustic, aircraft, and spacecraft. This updated bibliography contains 157 abstracts, 73 of which are new entries to the previous edition. GRA

N80-30639# National Technical Information Service, Springfield, Va.
MICROWAVE COMMUNICATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1976 - May 1980
William E. Reed Jun. 1980 287 p Supersedes NTIS/PS-79/0525; NTIS/PS-78/0525
(PB80-810831; NTIS/PS-79/0525; NTIS/PS-78/0525) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Research reports pertinent to the techniques, equipment, reliability, and utilization of microwave communications are cited. Studies on microwaves relays, links, data transmission, telemetry, satellite communications, multiplexing, and propagation are included. This updated bibliography contains 280 abstracts, 46 of which are new entries to the previous edition. GRA

N80-30640# National Technical Information Service, Springfield, Va.
ELECTROMAGNETIC SHIELDING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1972 - May 1980
William E. Reed Jun. 1980 309 p Supersedes NTIS/PS-79/0526; NTIS/PS-78/0524
(PB80-810849; NTIS/PS-79/0526; NTIS/PS-78/0524) Avail: NTIS HC $30.00/MF $30.00 CSCL 09C

The bibliography presents research on electromagnetic shielding of electronic and electrical equipment personnel, and ordnance. The shielding effectiveness of materials and structures is covered. Nuclear electromagnetic pulse shielding is included. This updated bibliography contains 301 abstracts, 19 of which are new entries to the previous edition. GRA

N80-30641# Federal Communications Commission, Washington, D. C. Policy Development Div.
UHF TASK FORCE: EXECUTIVE OVERVIEW AND SUMMARY Final Report
Raymond M. Wilmotte Jan. 1980 14 p refs
(PB80-177280; FCC/PRB/PDD/6) Avail: NTIS HC A02/MF A01 CSCL 17B

Estimates were made of the spectrum required for the operation of viable television stations up to the year 1990. Estimates of the spectrum needs of the civil maritime and aeronautical services were a fraction of those estimated by these industries because the task force took into account the expected and possible improvements in spectrum efficiency. In connection with land mobile, a development contract was granted leading

to an amplitude compandored single sideband system requiring a bandwidth of 5 KHz compared with 20-30 KHz of the current frequency modulation system. Consideration was given to using the forces of the marketplace instead of regulation for introducing spectrum saving technologies. GRA

N80-30321*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TIDBINBILLA INTERFEROMETER
M. J. Batty (CSIRO, Sydney), D. L. Jauncey (CSIRO, Sydney), S. Gulkis, and M. J. Yerbury (Sydney Univ.) *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 6-8 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

N80-30333*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
USE OF K SUB A-BAND FOR RADIO METRIC DETERMINATIONS
P. D. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 59-66 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20N

N80-30335*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONCERNING THE FEASIBILITY OF A REAL TIME SAR DIGITAL PROCESSOR FOR VOIR LOW RESOLUTION IMAGING MODES
T. K. Truong and R. G. Lipes *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 72-81 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17I

N80-30336*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FEASIBILITY AND COST STUDY ON VOIR SAR DATA TRANSFER VIA A BENT PIPE LINK
Y. H. Park and A. M. Goldman, Jr. *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 82-90 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17I

N80-30340*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
POWER LINE ANOMALIES AS THEY AFFECT THE OPERATION OF A DSN STATION: OVERVIEW
T. L. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 110-113 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20N

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-30642 California Inst. of Tech., Pasadena.
MONOLITHIC INTEGRATION OF GALLIUM ARSENIDE OPTOELECTRONIC DEVICES Ph.D. Thesis
Israel Ury 1980 103 p
Avail: Univ. Microfilms Order No. 8021028

The examples of the monolithic integration of optical and electronic devices on seminsulating GaAs substrates are described. In the first example, an injection laser was integrated with a Gunn oscillator to yield a high frequency modulated optical source. In the second example, an injection laser was integrated with a metal semiconductor field effect transistor (MESFET) which was used to modulate the current through the laser. In the third example, an integrated optical repeater was demonstrated which consisted of a MESFET optical detector, a current source, a transistor driver, and an injection laser all fabricated on a single chip. The repeater displayed an optical gain of 10 dB. A method was sought to form a laser cavity which did not occupy the entire width of a chip. The result was the demonstration of whispering gallery lasers which take the shape of quarter and half rings. The performance of the curved laser was reduced from that of the straight lasers due to optical scattering at imperfections along the curve. A general theory is developed which describes mode conversion in perturbed dielectric resonaters and is applied to the case of the whispering gallery laser and its predictions are compared with experiment. Dissert. Abstr.

N80-30643 Iowa State Univ. of Science and Technology, Ames.
SUPERCONDUCTIVITY IN Th-Nb COMPOSITES Ph.D. Thesis
Loren Frederick Goodrich 1980 143 p
Avail: Univ. Microfilms Order No. 8019631

Heat capacities, critical temperatures, and critical currents were measured for directionally solidified eutectic Th-Nb wires in order to determine whether superconductor normal metal boundary is a strong pinning center for quantized vortices. The heat capacity data show that there is a large change in pair potential at the super normal boundaries as predicted by de Gennes boundary length b, and to show that Ginsburg-Landua predicts the changes in the superconductors rather well. The equilibrium thermodynamical properites are predicted from the filament size and spacing rather well. Critical currents seem to be independent of the density of super normal boundaires and some other factors must control J sub c. The magnetic field dependence of C sub p and J sub c tend to confirm this conclusion. A field as small as 20 mT will decrease the pair potential in the normal metal by factors of 100 with no apparent change in J sub c. The critical current data was insensitive to Nb filament diameter over the range of 8 to 116 nm indicating that the superconductor normal metal interfaces were not effective pinning centers. Dissert. Abstr.

N80-30644 Cornell Univ., Ithaca, N. Y.
SUPERCONDUCTING DIAMAGNETISM IN SAMPLES OF SN(X), TaSe(3) AND NbS Ne(3) Ph.D. Thesis
Clifford Marc Bastuscheck 1980 157 p
Avail: Univ. Microfilms Order No. 8020793

The highly anisotropic metals (SN)x, TaSe3 and NbSe3 have shown low temperature behavior which could be associated with unusual superconducting properties. The present susceptibility measurements, made using a very sensitive SQUID magnetometer, were undertaken to add to the understanding of these new materials and to investigate the nature of superconductivity in the unusual systems which these materials present. The primary results of the investigation of samples TaSe3, and NbSe3 is the observation of superconducting diamagnetism and flux trapping indicating long range, stable superconducting phase coherence in the samples. However, the unusual dependence of the susceptibilities at very low tempertures (below 0.5 K) suggests that the samples contain a large fraction of normal meta. It seems possible that NbSe3 and TaSe3 are in fact not superconducting above 20 mK. Dissert. Abstr.

N80-30645*# SRI International Corp., Menlo Park, Calif.
ANALYSIS OF ELECTRICAL TRANSIENTS CREATED BY LIGHTNING Final Report
J. E. Nanevicz and E. F. Vance Hampton, Va. NASA. Langley Research Center Jul. 1980 107 p refs
(Contract NAS1-13792; SRI Proj. 4026)
(NASA-CR-159308) Avail: NTIS HC A06/MF A01 CSCL 09C

A series of flight tests was conducted using a specially-instrumented NASA Learjet to study the electrical transients created on an aircraft by nearby lightning. The instrumentation included provisions for the time-domain and frequency-domain recording of the electrical signals induced in sensors located both on the exterior and on the interior of the aircraft. The design and calibration of the sensors and associated measuring systems is described together with the results of the flight test measurements. The results indicate that the concept of providing instrumentation to follow the lightning signal from propagation field, to aircraft skin current, to current on interior wiring is basically sound. The results of the measurement indicate

that the high frequency signals associated with lightning stroke precursor activity are important in generating electromagnetic noise on the interior of the aircraft. Indeed, the signals produced by the precursors are often of higher amplitude and of longer duration that the pulse produced by the main return stroke.
Author

N80-30646# California Univ., Berkeley. Dept. of Physics.
SUPERCONDUCTIVE DEVICES FOR MILLIMETER WAVE DETECTION MIXING AND AMPLIFICATION
P. L. Richards and T-M Shen. 1980. 48 p. refs
(Contract N00014-75-C-0496)
(AD-A086443) Avail: NTIS HC A03/MF A01 CSCL 20/3

Single particle (quasiparticle) tunneling through an insulating barrier between two superconductors or between a superconductor and a normal conductor is used to make very low noise detectors and mixers for millimeter wavelengths. The nonlinearity of the I vs. V curve obtained from tunneling between two superconductors can be so strong that classical theory breaks down and photon assisted tunneling theory must be used to understand device performance. Quantum theory predicts that a quasiparticle tunnel junction can be operated as a microwave photon detector with quantum efficiency close to unity or as a heterodyne mixer with conversion gain and with mixer noise temperature comparable with the quantum noise limit. Both of these predictions are experimentally realized using superconductor insulator superconductor junctions.
Author

N80-30647# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
HIGH VOLTAGE SWITCH USING EXTERNALLY IONIZED PLASMAS Final Technical Report, 26 Jun. 1978 - 21 Dec. 1979
John Dzimianski and Laurence E. Kline. Wright-Patterson AFB, Ohio. AFWAL. Apr. 1980. 80 p. refs
(Contract F33615-78-C-2010; AF Proj. 2301)
(AD-A086761; DYD-55585-AA; AFWAL-TR-80-2041) Avail: NTIS HC A05/MF A01 CSCL 09/1

A physical model was developed and the performance parameters were studied for high voltage high current on/off switches which use the low energy secondary electrons in an electron beam (e-beam) sustained discharge as the conducting medium. The model equations are presented and described along with the underlying physical assumptions. Electron transport data and static breakdown voltages were calculated for N2, Ar, a N2:Ar = 1:9 mixture and CH4 by numerically solving the Boltzmann equation to find the energy distribution. Study of steady state performance for N2, Ar, N2:Ar = 1:9 and CH4 indicated that the N2:Ar = 1:9 and CH4 were both good candidate gases; hence transient switch performance was studied for these two gases. The performance of the e-beam plasma switches was mapped in a regime where the power delivered to the load is much greater than the e-beam power. Study of e-beam sources pointed to the thin film field emission cathode as offering a means of controlling e-beam plasma switches with very high control power gain. A switch geometry was suggested using such an e-beam source. The comparison of different switch types with on/off capability indicated that the e-beam externally ionized plasma switches have the potential to be developed into devices that would be competitive or superior in size and capability with any other approach providing equivalent electrical performance.
GRA

N80-30648# Auburn Univ., Ala. Dept. of Physics.
SECOND BREAKDOWN SUSCEPTIBILITY OF SILICON-ON-SAPPHIRE DIODES HAVING SYSTEMATICALLY DIFFERENT GEOMETRIES Final Report, 1 Jun. 1977 - 31 Dec. 1979
Paul P. Budenstein, Aradhana Baruah, Edward R. Knight, and Fu-Tai Kiou. 30 May 1980. 524 p. refs
(Grants DAAG29-78-G-0111; DAAG29-77-G-0189)
(AD-A086345; ARO-15840.3-A-EL) Avail: NTIS HC A22/MF A01 CSCL 09/1

Experiments were performed on thin films silicon-on-sapphire (SOS) diodes (p(+) - n - n(+)) to determine the roles of geometry and doping level (ten to the 15th power to ten to the 17th power atoms/cubic centimeters) on current configurations, second breakdown susceptibility, and damage morphology. Geometric parameters varied including diode width, n-region length, n-region doping density, diffusion spikes of different sizes and configurations on the n(+)n or p(+)n interfaces, contact spikes at the n(+)-metal and p(+)-metal interfaces, and a variety of other current concentration geometries. Prior to the present study, the effectiveness of junction defects in reducing resistance to second breakdown was not known. However, it was suspected that such defects might result in 'maverick' devices, that is, devices which fail much below their rated electrical parameters. SOS diodes, specially fabricated by Rockwell International, were tested using Sunshine's stroboscopic technique. This method exploits the decrease of the optical transmittancy of silicon with increasing temperature.
GRA

N80-30649# TRW Defense and Space Systems Group, Redondo Beach, Calif. Electronics Technology and Devices Lab.
SURFACE ACOUSTIC WAVE MICROWAVE OSCILLATOR AND FREQUENCY SYNTHESIZER Interim Report, 1 Oct. 1979 - 1 Apr. 1980
D. J. Dodson and M. Y. Huang. Jun. 1980. 52 p.
(Contract DAAB07-78-C-2992)
(AD-A086336; DELET-TR-78-2992-3; IR-3) Avail: NTIS HC A04/MF A01 CSCL 09/5

The objective of the program is the development of Surface Acoustic Wave (SAW) oscillator and synthesizer technology. The two year effort is planned as follows: Task 1 - Development of SAW devices for oscillator applications at microwave (L-band) frequencies. Emphasis to be placed on achieving wideband tuning capabilities, improved oscillator stability performance and reduced power requirements. Task 2 - Investigate UHF surface acoustic wave devices which can best impact on synthesizer performance parameters such as: switching speed, minimum frequency step size, total achievable bandwidth, short, medium and long term stability as well as maximum suppression of spurious mode level. Concurrently promising new synthesizer designs will be studied on the basis of these designs to arrive at target specification in a package providing a significant reduction in size, weight and power consumption. Since Task 1 was completed prior to this reporting period, during the third six months of the program design of the synthesizer circuitry was largely completed. SAW delay line/filters to be used in both the injection locked SAW oscillators and in the SAW Filter Bank have been designed and are being fabricated. The design of the delay lines was based partially on an investigation of the injection locking properties of SAW oscillators. RF/LSI circuitry has been processed and is currently being tested.
GRA

N80-30650# Southern Methodist Univ., Dallas, Tex. Dept. of Electrical Engineering.
ESTIMATION OF CONFIDENCE LIMITS FOR TESTING LARGE LOGIC NETWORKS Final Report
John L. Fike, C. H. Kapadia, B. Peikari, and K. Kavipurapu. May 1980. 85 p. refs
(AD-A086281; AFOSR-80-0504TR) Avail: NTIS HC A05/MF A01 CSCL 09/3

This report describes a methodology and means for accurately determining confidence limits for the reliability of large digital networks, without exhaustively exercising all possible input sequences or simulating all logic faults in the network. The report is divided into two parts. In the first part, some mathematical models to estimate the reliability of digital circuits are presented. A heuristic method of assigning weights to faults depending on their 'importance' in a given circuit is described. The models presented can be used to: (1) predict the reliability of a circuit, (2) evaluate test sequences and (3) develop more accurate reliability models of (redundant) fault tolerant computers. The second part of the report deals with the statistical methods of estimating confidence limits.
GRA

N80-30651# Texas Instruments, Inc., Dallas.
RELIABILITY EVALUATION OF GaAs POWER FETs Interim Report, 7 Nov. 1978 - 6 Nov. 1979
H. M. Macksey and L. W. Joy. Griffiss AFB, Ohio. RADC. Apr. 1980. 91 p. refs
(Contract F30602-79-C-0037; AF Proj. 2338)
(AD-A086668; TI-08-80-06) Avail: NTIS HC A05/MF A01 CSCL 09/1

The devices chosen for this study were the TI MSX802

and laboratory devices, Dexcel 3615A-P100F, MSC 88002, and NEC 868196. All are hermetically packaged GaAs power FETs with approximately 0.5 W output power. The study includes device physical, electrical (CW and pulsed), and environmental characterization, electrical (CW and pulsed) and environmental stress tests, and failure analysis. The device physical characterization has been completed and the data are presented. The CW electrical characterization is almost complete, and detailed data are shown for a typical device. No device had significant changes in electrical parameters following operation for 1000 hours at room temperature. The environmental characterization has just begun, and no results are available yet. The results from the cw electrical stress tests, which have been completed, are presented. There are some correlations between the various device structures and the results from different manufacture's devices. The environmental stress tests have begun, and preliminary results are presented. Most of the effort for the remainder of the program will be spent on completing these tests. The pulse characterization and stress tests have not yet begun. The failure analyses are described along with the test causing the failure. GRA

N80-30652# Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Physics.
INTEGRATED THIN FILM dc SQUIDS Final Report, Nov. 1976 - 31 Oct. 1979
G. B. Donaldson Oct. 1979 27 p refs
(Grant DA-ERO-76-G-079; DA Proj. 1T1-61102-BH-57)
(AD-A086466) Avail: NTIS HC A03/MF A01 CSCL 20/3

A new thin film low temperature facility has been developed and used for work on three aspects of DC SQUIDS. First, ellipsometric studies have been made of the process of RF sputter etch oxidation of Pb-In alloys and of Nb. Second, structures based on Nb-NbOx-Pb/In Josephson junctions have been produced and successfully operated as planar SQUIDs with a flux noise of 0.000085 Phi sub o sq rt Hz. Finally, all Nb structures, based on Nb-NbOx/Au-Nb junctions, have been operated as SQUIDs though so far with inferior noise performance (0.05 Phi sub o sq rt Hz). Work is proceeding on the production of integrated magneometric structures using photolithographic techniques to etch planar flux transformers and the associated components. GRA

N80-30653# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
ARTWORK ANALYSIS TOOLS FOR VLSI CIRCUITS M.S. Thesis
Clark Marshall Baker Jun. 1980 78 p refs
(Contract N00014-75-C-0661)
(AD-A087040; MIT/LCS/TP-239) Avail: NTIS HC A05/MF A01 CSCL 09/5

Current methods of designing Very Large Scale Integrated (VLSI) chips do not insure that the chips will perform correctly when manufactured. Because the turnaround time on chip fabrication varies from a few weeks to a few months, a scheme other than try it and see if it works is needed. Checking of chips by hand simulation and visual inspection of checkplots will not catch all of the errors. In addition, the number of transistors per chip is likely to increase from ten thousand to over a million in the next few years. This increase in complexity precludes any manual verification methods; some better method is needed. A series of programs that use the actual mask descriptions for input are described. These programs perform various levels of checks on the masks, yielding files suitable for simulation. Some of the checks are the usual 'design rule' checks of looking for minimum line widths and adequate spacing between wires. However, there are many more constraints in VLSI circuits than are expressed by usual design rules. The programs check these constraints using the mask descriptions as input. All of the errors mentioned so far can be classified as syntactic errors; in addition, certain errors are detected. The detection of semantic errors requires various levels of simulation. The input to the simulators is derived from the artwork. GRA

N80-30654# Maine Master Electric Products Co., Winterport.
RESEARCH AND DEVELOPMENT OF CONCEPT LEADING TO AN AUTOMOTIVE ALTERNATOR WITH SIGNIFICANTLY IMPROVED EFFICIENCY AND WEIGHT Final Report, 1 Feb. 1979 - 31 Jan. 1980
Ray C. Noddin 5 Jan. 1980 26 p
(Contract DE-AC02-79CS-50042)
(COO-50042-1) Avail: NTIS HC A03/MF A01

A 20 to 25 percent improvement in both output/pound and efficiency relative to control performance of a present production Delco #1102848 alternator was achieved by substitution of a redesign stator of equal or smaller weight and size and in a configuration lending to low cost and manufacturability. Analysis of bench tests on the subject alternator incorporating the redesigned stator reveals an output/pound improvement of 30 percent thereby exceeding the design goal, and an average efficiency improvement of 25 percent easily equalling, and at most points of the performance curve, exceeding the design goal. This was achieved in a design employing proven, low-cost, high volume manufacturing techniques. The redesigned stator also lends itself to direct interchangeability with stators in production alternators. DOE

N80-30655# Oak Ridge National Lab., Tenn.
EDDY CURRENT HEATING OF IRREGULARLY SHAPED PLATES BY SLOW RAMPED FIELDS
Lawrence Dresner 1979 5 p refs Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791102-167) Avail: NTIS HC A02/MF A01

Theorems are presented for estimating eddy current heating of irregularly shaped plates by a perpendicular ramped field. The theorems, derived from two complementary variational principles, give upper and lower bounds to the eddy current heating. Illustrative results are given for rectangles, isosceles triangles, sectors of circular annuli, rhombuses, and L shaped plates. A comparison is made with earlier work. DOE

N80-30656# Los Alamos Scientific Lab., N. Mex.
THE dc SUPERCONDUCTING POWER TRANSMISSION LINE PROJECT AT LASL: US DOE DIVISION OF ELECTRIC ENERGY SYSTEMS Final Progress Report, 1 Nov. 1972 - 30 Sep. 1979
F. J. Edeskuty, comp. Apr. 1980 270 p refs
(Contract W-7405-eng-36)
(LA-8323-PR; FPR-24) Avail: NTIS HC A12/MF A01

Plans for the development of a high capacity, underground dc superconducting power transmission line (dc SPTL) that uses Nb3Sn superconducting wires cooled to 12 K by gaseous helium are discussed. The dc SPTL offers a number of potential advantages including: no system stability or load flow constraints, lower short circuit current levels than any other transmission system; reactive compensation is not needed; no dielectric losses are exhibited; conductor losses are negligible; and the dc SPTL cable has the highest efficiency and current density capability of all cables. The requirement for such high power transmission capability is still several decades in the future and the SPTL technology is considered a high risk undertaking. Activities in electrical engineering, cryogenic engineering, and superconductor design are summarized. E.D.K.

N80-30657# Sandia Labs., Albuquerque, N. Mex.
COMPRESSED MAGNETIC FLUX AMPLIFIER WITH CAPACITIVE LOAD
O. M. Stuetzer Mar. 1980 27 p refs
(Contract EY-76-C-04-0789)
(SAND-79-2339) Avail: NTIS HC A03/MF A01

The operation of a compressed magnetic flux (CMF) transducer into an inductive-resistive load is discussed. A second order theory for this combination is considered with repect to the variation of skin depth with time, and flux trapping by wire shape and by two contact delay phenomena. An attempt to extend this second-order theory directly to the capacitive load case proved anaytically unfeasible. DOE

N80-30658# Sandia Labs., Albuquerque, N. Mex.
OPTICALLY COUPLED MICROWAVE SWITCH
Richard A. Kiehl and David M. Drury 1979 14 p refs Symp. held in Washington, D.C., 28 May 1980 Submitted for publication
(Contract EY-76-C-04-0789)
(SAND-80-0029C; CONF-800521-1) Avail: NTIS HC A02/MF A01

A new microwave switch that uses lightwaves to couple microwave energy between its ports is shown to offer outstanding performance in terms of on/off ratio and reverse isolation while exhibiting a state independent input impedance. DOE

N80-30659# Brookhaven National Lab., Upton, N. Y.
X-RAY EXAMINATION OF LAPPED ELECTRICAL INSULATION
A. C. Muller. 1979. 8 p. Presented at the Conf. on Elec. Insulation and Dielectric Phenomena, Whitehaven, Pa., 21 Oct. 1979
(Contract EY-76-C-02-0016)
(BNL-27456; CONF-791028-4) Avail: NTIS HC A02/MF A01

The design and use of radiographic equipment for examining underground power transmission cable insulation for defects are described. The portable radiogrpahic equipment can be used to examine cables in factories, in test facilities, or at underground installations. Radiographs of plastic-wound and paper-wound cables are included. DOE

N80-30660# Danish Research Center for Applied Electronics, Hoersholm.
KEYBOARDS AND TOUCH CONTROLS: AN EVALUATION OF RELIABILITY AND CONSTRUCTIONAL PRINCIPLES FOR 11 DIFFERENT TYPES
E. Johansen, S. T. Olesen, and A. Willumsen. Oct. 1979. 45 p. refs. Sponsored by Sammenslutningen for Paalidelighedsog Miljoeteknik (SPM) and Danish Council of Technology
(ECR-90) Avail: NTIS HC A03/MF A01

A 'performance quality' evaluation of 11 different varieties of keyboards and touch controls was made. The devices tested include seven keyboards of the push button type, two plane design keyboards, a Hall-element switch, and a capacitive touch control. The same test procedures were used on all the devices, regardless of their quality or price class, as only real performance is of interest. The tests covered mechanical endurance, thermal exposure, humidity exposure, H2S and SO2 exposure, a solder examination, a vibration test, and the measurement of contact bounce. In the case of destructive testing, contact resistance serves as the control factor. All test results are related to an analysis of construction design. Author (ESA)

N80-30661# Instituto de Electronica de Communicaciones, Madrid (Spain). Dept. de Microondas.
STUDY AND DEVELOPMENT OF PRINTED CIRCUIT ELEMENTS FOR SYNTHETIC APERTURE RADAR ARRAY ANTENNAS. Final Report
J. Barbero Sanchez, F. Jimenez Asenjo, R. Villar Gomez, M. Peralta Bellido, J. Torres Riera, and F. Vila Castelar. Oct. 1979. 234 p. refs. Prepared in cooperation with Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejan de Ardoz (Spain)
(Contract ESTEC-3683/78-NL-AK(SC))
(ESA-CR(P)-1303) Avail: NTIS HC A11/MF A01

A general presentation of the state-of-the-art on planar array antennas is combined with a technical discussion and selection of the best suited elements for circular patch and slot-stripline radiators. The mutual coupling between radiators in several types of 1 X 8 arrays with circular patch elements was examined to optimize the distances between them in the complete SAR array antenna. A simple microstrip feeding network with low permittivity substrate, easy to realize by photoetching was designed and measured. The impedance and radiation pattern of a 2 x 8 subarray fed by the preceding network was measured. The performance of elementary radiators concerning resonant frequency, impedance, bandwidth, radiation pattern, polarization, and efficiency were studied. The advantages and disadvantages and the influence of mechanical tolerances on their electromagnetic behavior was investigated. Author (ESA)

N80-30662# Sira Inst. Ltd., Chislehurst (England).
EVALUATION OF RADIATION EFFECTS IN THE MA328 CCD IMAGE SENSOR. Final Report
D. J. Purll, B. T. Meggitt, R. A. A. Freeman (Fulmer Research Inst. Ltd.), and A. G. Holmes-Siedle (Fulmer Research Inst. Ltd.). Jan. 1980. 146 p. refs
(Contract ESTEC-3748/78)
(Sira-6/5309/00; ESA-CR(P)-1317) Avail: NTIS HC A07/MF A01

Information specifically useful to the ESA Polaris Sensor development was obtained by irradiating several CCD's with gamma radiation to a maximum dose of 20 krad, compared with the estimated 5 year geostationary dose of 5 krad. The clearest results were those concerning trapped charge and interface state build-up in the charge transfer areas of the devices. Operation of the shift registers in the space radiation environment would appear to present no problem. Changes in both response and dark current nonuniformities show the necessity for dynamic rather than prelaunch calibration in high accuracy applications. The output circuitry, comprising a number of MOS transistors, was more sensitive, and the complex nature of interdependences between bias voltages in this region is indicated. Optimum operation was restored in one device after a dose of 20 krad by a small adjustment of substrate voltage alone. Other problem areas are the incidence of catastrophic failures even in the absence of radiation damage, and of major defects which appeared in initially good devices after relatively small doses of radiation. Author (ESA)

N80-30663# British Aerospace Dynamics Group, Bristol (England).
STUDY AND EVALUATION OF MODULAR PACKAGING TECHNIQUES FOR ON BOARD DATA HANDLING: TECHNOLOGY ASSESSMENT. Final Report
J. Perry, comp. Nov. 1979. 64 p. refs
(Contract ESTEC-2840/76-NL-HP(SC))
(ESS/SS-918; ESA-CR(P)-1327) Avail: NTIS HC A04/MF A01

The detailed design and the manufacture of a test model for environmental testing of a Modular Packaging Scheme for use with the On Board Data Handling System was completed. During the development/testing phase, redesign and modifications were implemented to meet the severe vibration levels imposed. This phase was completed by successful vibration testing to the worst case envelope covering Ariane, Shuttle and Thor-Delta. The unit design was mass optimized and the manufacturing tolerances were finalized. A representative OBDH configuration unit was again manufactured and vibration tested. Author (ESA)

N80-30664# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
FURTHER FABRICATION STUDIES OF DRY LUBRICATED SLIP RING BRUSH MATERIALS FOR SATELLITE APPLICATIONS
K. T. Scott and K. R. J. Cottell. Nov. 1979. 47 p. refs
(Contract ESTEC-3284/77-NL-PP)
(AERE-G-1480; ESA-CR(P)-1331) Avail: NTIS HC A03/MF A01

A vacuum hot pressing technique was developed for the fabrication of slip ring brush material consisting of 10, 7.5 and 5W/o MOS2 dispersions in an Ag-3.0W/o CU matrix. The densities (96-97%) theoretically obtained with the new mixtures were slightly lower than those reached in previous work. Microstructural investigation revealed the MOS2 to be predominantly distributed at the grain boundaries by with incomplete coverage at the lowest sulphide loading. There was a definite pressing texture but also some evidence that the pressing parameters might be near a limit beyond which rapid grain growth in the metal matrix would take place. A processing procedure for the production of slip ring brush material was written. Author (ESA)

N80-30665# National Bureau of Standards, Boulder, Colo. National Engineering Lab.
DEVELOPMENT OF STANDARDS FOR SUPERCONDUCTORS. Annual Report, 1979
F. R. Frickett. Dec. 1979. 46 p. refs
(Contracts DE-PR01-79ET-52052; DE-PR02-79ET-26603; DE-PR01-79ER-10354)
(PB80-175417; NBSIR-80-1629) Avail: NTIS HC A03/MF A01 CSCL 20L

A set of useful voluntary standards for measurements on modern practical superconductors that will be acceptable to both manufacturers and users is investigated. Agreement on a set of standard definitions for the various parameters is also necessary.

The status of the program is described and a brief historical introduction is included. The need for standards in this area is described in detail with particular attention paid to the need for consensus among all interested parties and the techniques for achieving it. Results from experimental research and a review of the wire manufacturers programs are presented. GRA

N80-30666# National Technical Information Service, Springfield, Va.
INTEGRATED CIRCUIT RELIABILITY. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1978 - May 1980
William E. Reed Jun. 1980 201 p Supersedes NTIS/PS-79/0602; NTIS/PS-78/0579
(PB80-811128; NTIS/PS-79/0602; NTIS/PS-78/0579) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography presents research pertinent to design, reliability prediction, failure and malfunction, processing techniques, and radiation damage. This updated bibliography contains 193 abstracts, 17 of which are new entries to the previous edition. GRA

N80-30667# National Technical Information Service, Springfield, Va.
LIGHTNING, SURGE AND TRANSIENT PROTECTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Apr. 1980
William E. Reed Jun. 1980 114 p Supersedes NTIS/PS-79/0154; NTIS/PS-78/0187
(PB80-810781; NTIS/PS-79/0154; NTIS/PS-78/0187) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 09C

Techniques and devices for the protection of electronic and electrical equipment are presented in these Federally sponsored research reports. The citations include research on suppressors, limiters, lightning arresters, electromagnetic pulse protection devices, and overvoltage protection networks. Electromagnetic shielding is excluded. This updated bibliography contains 106 abstracts, 44 of which are new entries to the previous edition. GRA

N80-30334*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
QUICKLIST: THE BASIS FOR A COMPUTER AIDED LOGIC DESIGN SYSTEM
W. A. Lushbaugh *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 67-71 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-30668 Virginia Polytechnic Inst. and State Univ., Blacksburg.
STABILITY OF BOUNDARY-LAYER FLOWS OVER CURVED WALLS Ph.D. Thesis
Jerzy Maciej Floryan 1980 175 p
Avail: Univ. Microfilms Order No. 8020206

The formal analysis of the Gortler-type instability is presented. The boundary layer equations and the disturbance equations are formulated in a general, orthogonal, curvilinear system of coordinates constructed from the inviscid flow over a curved surface. Effects of the curvature of the wall on the boundary layer flow are analyzed and are shown to be insignificant for the intended stability analysis. The basic approximation for the disturbance equations is presented and solved numerically. Previous analyses are discussed and compared with the present one. Results show the importance of the boundary layer growth and are in a good agreement with the experimental data. Effects of suction are introduced and are shown to stabilize the boundary layer. Dissert. Abstr.

N80-30669 Oregon Univ., Eugene.
THE SHEAR VISCOSITY FOR THE SOFT SPHERE LIQUID VIA DISCRETE CELL HYDRODYNAMICS Ph.D. Thesis
Salma Begum 1980 154 p
Avail: Univ. Microfilms Order No. 8018847

The shear viscosity and the longitudinal momentum transfer for the soft sphere liquid was calculated numerically by computer simulation using a discrete cell hydrodynamics method. It is based on a formulation which is discrete in space and time. For the soft sphere viscosity, there is good agreement between the nonequilibrium molecular dynamics calculation and the discrete cell hydrodynamics results. The discrete cell hydrodynamics method is also over 50 times more efficient than previous methods because the discrete method is not sensitive to large scale fluctuations as other methods. Thus, the discrete cell hydrodynamics method is more useful for calculating fluid transport properties. Dissert. Abstr.

N80-30670 Idaho Univ., Moscow.
SIMILITUDE MODELING OF NATURAL CONVECTION HEAT TRANSFER THROUGH AN APERTURE IN PASSIVE SOLAR HEATED BUILDINGS Ph.D. Thesis
Dennis David Weber 1980 123 p
Avail: Univ. Microfilms Order No. 8019798

An experimental study of natural convection heat transfer through a doorway in a two room passive solar heated building is described. Similitude modeling was the method used to measure natural convection heat transfer coefficients in a model geometrically scaled down by a factor of five. Freon gas was used as the working fluid to obtain dynamic similarity within the model. A temperature difference was maintained between the two rooms by a heated vertical wall which simulated a thermal storage wall in the other room. Heat transfer through the doorway was measured as a function of a characteristics temperature differential and the geometry of the doorway. A comparison of the results of this work with previous full scale studies and with the theory shows good correlation. Deviation of the Grashof number dependence from the theoretical predictions were caused by errors in assumptions of the relationship between the characteristic temperature differential and the temperature differences in the doorway. Velocity and temperature profiles measured in the doorway allowed a critical examination of these assumptions. Dissert. Abstr.

N80-30671 Minnesota Univ., Minneapolis.
FLUX-SPLINE METHOD FOR HEAT, MASS AND MOMENTUM TRANSFER Ph.D. Thesis
Luciano Magno Costalonga Varejao 1980 257 p
Avail: Univ. Microfilms Order No. 8019584

A more accurate numerical method was developed for heat, mass, and momentum transfer. In the method, called Flux-Spline Method, the discretization equation for the dependent variable is obtained by assuming that its associated total (convection + diffusion) flux is linear within the control volume. The method was applied to several test problems where it is shown that its accuracy and order of accuracy are much higher than those of the conventional exponential methods. Dissert. Abstr.

N80-30672 Auburn Univ., Ala.
A THEORETICAL STUDY OF DEVELOPING GAS-LIQUID FLOWS IN VERTICAL PIPES Ph.D. Thesis
Hany Mahmoud Fahmy Aly 1980 139 p
Avail: Univ. Microfilms Order No. 8019883

The current theory of two phase flow was evaluated with emphasis on the mathematical modeling of two phase flow. The mathematical formulation of the two phase flow is generally associated with many constitutive relations as well as uncertainty in specifying the interaction terms between phases. The flow of two dispersed phases can best be described by the mixture theory. Some possible mixture models are described and discussed. The problem of developing, axisymmetric, laminar flow of gas liquid mixtures in circular pipes was formulated in terms of the single phase (or homogeneous flow) model and the diffusion model. The resulting set of non linear partial differential equations was solved numerically by using the step-by-step marching integration technique. The effect of the relevant parameters were investigated. The flow field was found to be affected by both

the void fraction and the void-fraction profile which is affected by the diffusion as the flow continues to develop. Dissert. Abstr.

N80-30673 California Inst. of Tech., Pasadena.
THE TRANSLATIONAL MOTION OF PARTICLES IN A VISCOELASTIC LIQUID. Ph.D. Thesis.
Grant Fred Tiefenbruck. 1980. 260 p.
Avail: Univ. Microfilms. Order No. 8020434.

The translation motion at low Reynolds number of a slender rod near a vertical wall was studied. When the rod is not too near the wall, its motion is found to be in qualitative agreement with theoretical solutions for the motion of a rod in an unbounded second-order fluid. When the rod is nearer to the wall its motion is shown to correspond qualitatively to a simple superposition of the motion in an unbounded second-order fluid and the motion in a Newtonian fluid near a vertical wall. The equations governing the motion of a solid sphere and a spherical bubble in a viscoelastic fluid of infinite extent were solved numerically. The computed solutions were compared with analytic solutions obtained by asymptotic theory considerably beyond the expected range of validity. Many features of the flow can be described by the model fluid behavior in shear and extensional flows. Dissert. Abstr.

N80-30674 Lehigh Univ., Bethlehem, Pa.
THE ANNULAR HEAT PIPE OPERATING LIMIT EQUATIONS AND CHEMICAL REACTOR APPLICATION. Ph.D. Thesis.
Yves Parent. 1980. 205 p.
Avail: Univ. Microfilms. Order No. 8019722.

Capillary limit predictions based on the bi-dimensional liquid pressure distribution were compared using a simplified unidimensional model which is suggested by a conventional axial heat pipe design procedure. The possibilities of integration of the AHP device to a chemical reactor system were investigated using a simplified one dimensional tube wall reactor model with the catalytic partial oxidation of Naphthalene kinetics. The behavior of this system with and without the AHP was compared for a range of operating reactor temperature and also feed temperature. Although operational parameters chosen were optimal in relation to the system without AHP, the system incorporating the AHP device suggests interesting advantages. The analysis also shows some inconsistencies in the reactor behavior beyond a given operating reactor temperature. It is believed that such a situation stems from a multiplicity of solutions inherent to the model chosen. The relative important of final heat sink coupling is demonstrated and various design options, suitable for application to the system at hand, are presented and discussed. Dissert. Abstr.

N80-30675 Polytechnic Inst. of New York.
LAMINAR NATURAL CONVECTION ALONG VERTICAL CORNERS AND RECTANGULAR DUCTS. Ph.D. Thesis.
K. Ramakrishna. 1980. 243 p.
Avail: Univ. Microfilms. Order No. 8019411.

The flow along a vertical right angle corner formed by the intersection of two vertical semi-infinite flat plates whose surface temperature varies according to the relation T(w) - T(infinity) = Nx sub n was analyzed by an asymptotic expansion procedure. The interaction of the boundary layers developing on the two plates or the corner results in a three dimensional flow in the corner region. A similarity solution is found to exist for the nonuniform surface temperature at the corner plates defined by T(w) - T(infinity) = Nx sub n. The resulting flow equations are numerically solved by a strongly implicit finite difference procedure using Stone's algorithm. The governing equations of flow in rectangular ducts were nondimensionalized by different dimensionless parameters for isothermal and constant heat dissipation conditions at the duct walls. The simultaneous development of velocity and temperature in the entrance length of isothermal and constant heat flux square ducts are calculated using a marching procedure and a strongly implicit finite difference procedure using Stone's algorithm in the cross plane. Dissert. Abstr.

N80-30676 Princeton Univ., N. J.
A COMPARISON AMONG VARIOUS THEORIES FOR TURBULENT, REACTING, PLANAR MIXING LAYERS. Ph.D. Thesis.
Stephen Flanders Parker. 1980. 216 p.
Avail: Univ. Microfilms. Order No. 8019825.

The planar, turbulent, mixing layer was analyzed for both nonreacting, variable density flows and reacting flows. A coordinate transform was employed to remove the singularity at the mixing layer edge, which appears when the laminar diffusivity is neglected where the turbulent diffusivity goes to zero. An iterative quazilinearized implicit finite difference scheme was used to solve the governing set of equations. For the nonreacting flows similarity solutions were obtained. Comparisons were made among the computational results and with existing experimental data. The major differences between the models and types of averaging were in the predicted spreading parameter. For reacting flow, two different approaches to the calculation of the ignition length were analyzed. In both approaches several different kinetic models were employed. Comparisons among the models indicated significant sensitivity to the form of averaging and the choice of kinetic remodeling with a lesser sensitivity to the choice of turbulence modeling. Dissert. Abstr.

N80-30677 Polytechnic Inst. of New York.
BUBBLE DYNAMICS IN STRUCTURAL FOAM PROCESSING. Ph.D. Thesis.
Hee Ju Yoo. 1980. 211 p.
Avail: Univ. Microfilms. Order No. 8019419.

The stress distribution of viscoelastic polymer melts in a converging channel were determined by measuring wall normal stress and stress birefringence. The Coleman-Noll second order fluid was used to derive theoretical expressions for the wall normal stress, and shear, and shear and normal stresses in the converging flow field. Bubble dynamics in foam extrusion through a converging die was studied by recording bubble dynamics in the flow channel on movie films as a gas charged molten polymer was extruded. A theoretical analysis was made of bubble dynamics in which a threadlike bubble was assumed to flow along the center line of the die and the Coleman-Noll second fluid model was assumed to described the rheological behavior of the gas charged molten polymer. Bubble growth during mold filling was recorded on a movie film as gas charged molten polymer was injected into a mold cavity. A theoretical study of bubble growth in foam injection molding was conducted in which a spherical bubble was assumed to grow after the injection nozzle was closed and the DeWitt models assumed to describe the rheological behavior of gas charged molten polymers. The cell size and distribution of molded specimens as affected by processing variables was investigated by employing short-shot molding process under isothermal conditions. Dissert. Abstr.

N80-30678 Carnegie-Mellon Univ., Pittsburgh, Pa.
NONSYMMETRIC SPLIT OF FLOW DURING COCURRENT UPFLOW AT AIR-WATER MIXTURES THROUGH SYMMETRIC BIFURCATIONS. Ph.D. Thesis.
Mark Daniel Frewer. 1980. 179 p.
Avail: Univ. Microfilms. Order No. 8020154.

In order to approximate the flow channels in a packed bed, the bifurcations were either U-tubes of small diameter, 4 - 8 mm, or a knife edge, which splits a 1/4 inch I.D. tube into two semicircular channels. The length of the parallel tubes or channels was varied between 10.0 and 100.0 cm. At low air and water flowrates the flow splits nonsymmetrically. Nonsymmetric flow occurs because the symmetric becomes unstable to perturbations in air split, at low air flow. The negative slope of the pressure drop versus air flowrate curves in this region indicates that an increase in air flow in one tube will lead to a pressure decrease, which will cause more flow to enter that tube. Opposing this transition is the pressure drop required to accelerate the flows in the one tube. The transition from symmetric flow is predicted based on the balance of these two pressure drops. The agreement between actual and predicted air flowrates at which the transition will occur is reasonable. A model was developed to estimate the response of the water in the slow flowing tube. It was found that most transitions occurred at calculated amplitudes of response of between 2.5 and 4.0 cm. Dissert. Abstr.

N80-30679 Virginia Polytechnic Inst. and State Univ., Blacksburg.
INTERACTING INVISCID AND LAMINAR VISCOUS FLOW, AND SOME ASPECTS OF THEIR STABILITY. Ph.D. Thesis.
Saad Aly M. Ragab. 1979. 207 p.

Avail: Univ. Microfilms Order No. 8020226

The method of matched asymptotic expansions is used to obtain a second order triple deck solution for the case of constant wall temperature. It includes the problem of an adiabatic wall as a special case. A second order accurate finite difference scheme is developed for solving the lower deck equations. The theory is applied to supersonic flows past compression ramps and incompressible flows over small humps with small bubble separation. Also a numerical method for integrating the interacting boundary layer equations for incompressible flows is developed. For incompressible flows over small humps the first order theory is in good agreement with the interacting boundary layer. By including the second order terms in the triple deck theory, better agreement is obtained. For supersonic flows past corners, the agreement between the triple deck theory and solutions of the full Navier-Stokes equations is improved only in the free interaction region for an adiabatic wall. The second order theory breaks down for cold walls. Dissert. Abstr.

N80-30680 California Inst. of Tech., Pasadena.
NON-NEWTONIAN MIGRATION OF A DEFORMABLE DROP IN SHEARING FLOWS Ph.D. Thesis
Paul Chun-Ho Chen 1979 126 p
Avail: Univ. Microfilms Order No. 8019697

The lateral migration of a deformable drop suspended in a unidirectional shearing flow of a slightly nonnewtonian fluid was considered both theoretically and experimentally. Analytical expressions for the migration velocity due to the separate effects of drop deformation and fluid viscoelasticity were obtained for a two dimensional flow and then extended to the case of a general quadratic flow. The direction and magnitude of the migration velocity was calculated for the particular cases of Poiseuille flow in a tube and linear shear flow, and compared with experimental data. The Couette flow problem was studied experimentally. The size of the inner rotor of the Couette device was varied systematically to assess the role of velocity profile curvature on drop migration. Both deformation and nonnewtonian effects were considered. Significant observations not reported in previous studies include the migration of a deformable Newtonian drop to an equilibrium position between the centerline and the inner rotor and the close competition between normal stress and shape deformation contributions for the case of a Newtonian drop in a nonnewtonian fluid. Dissert. Abstr.

N80-30681 North Carolina State Univ., Raleigh.
SYMMETRY MAPPINGS AND CONSERVATION LAWS IN RELATIVISTIC FLUIDS Ph.D. Thesis
Davis Regault Oliver 1979 165 p
Avail: Univ. Microfilms Order No. 8020503

Certain matter symmetries, which may not coincide with geometric symmetries are described in relation to investigations of conservation laws admitted by certain relativistic fluids. In particular, the role matter symmetries in investigations of this kind is elaborated and further developed in relation to the following: (1) hydrodynamic descriptions of relativistic fluid; (2) the Cauchy problem for general relativistic fluid; (3) thermodynamic and kinetic theory models for relativistic fluid and;(4) certain relativistic charged fluids. Only symmetries which can be described by point mappings on the space-time manifold or tangent bundle are considered. Symmetries of this type can be naturally defined in terms of Lie deformations of various physical and geometric objects. Dissert. Abstr.

N80-30682 Toledo Univ., Ohio.
MARANGONI BUBBLE MOTION IN ZERO GRAVITY Ph.D. Thesis
Robert Lloyd Thompson 1979 417 p
Avail: Univ. Microfilms Order No. 8019363

The Marangoni phenomenon is proposed as the primary mechanism for the movement of gas bubble in a nonisothermal liquid in a low gravity environment. In such a two-phase flow system, local variations in surface tension at the bubbles surface can be caused by a temperature gradient in the liquid. Shearing stresses thus generated at the bubble surface lead to convection in both media, as a result of which the bubble begins to move. A mathematical model consisting of the Navier-Strokes and thermal energy equation, together with the appropriate boundary conditions for both media is presented. Parameter perturbation theory is used to solve this boundary value problem, with the expansion parameter being the Marangoni number. The zeroth, first and second order approximation for the velocity, temperature and pressure distribution in the liquid and in the bubble, and the deformation and terminal velocity of the bubble are determined. Comparison of the zeroth-order analytical results for the bubble terminal velocity showed good agreement with the experimental measurements. Dissert. Abstr.

N80-30683 Minnesota Univ., Minneapolis.
TURBULENT HEAT TRANSFER AND FLUID FLOW CHARACTERISTICS FOR AIR FLOW IN AN UNSYMMETRICALLY HEATED TRIANGULAR DUCT Ph.D. Thesis
Carlos Alberto Carrasco Altemani 1980 191 p
Avail: Univ. Microfilms Order No. 8014507

Experiments were performed to obtain the heat transfer and friction factor characteristics for an asymmetrically heated triangular duct. Two of the walls were heated so as to obtain axially uniform heat flux and circumferentially uniform temperature. The third wall was made of an insulator plastic material and was not directly heated. Another triangular duct, with identical inner geometry, was positioned upstream of the heated duct and served as the hydrodynamic development duct. The experimentally determined thermally developed values of the Nusselt number were compared to correlations found in the literature for turbulent heat transfer in uniformly heated circular tubes. The predicted values were at least 15 per cent higher than the measured ones. A modification of the Petukhov-Popov equation, using the actual measured values of the friction factor for the heating runs, predicts values of the Nusselt number within 5 per cent of the measured values. The measured values of the Stanton numbers were within 4 per cent of those from a numerical finite-difference solution from the literature. Dissert. Abstr.

N80-30684 California Inst. of Tech., Pasadena.
NATURAL CONVECTION FILM BOILING ON A VERTICAL SURFACE Ph.D. Thesis
David C. Sherman 1980 213 p
Avail: Univ. Microfilms Order No. 8020429

Experimental results are presented for an investigation of free convection film boiling heat transfer to saturated ethanol, saturated Freon 113, and saturated distilled water from a vertical cylinder. High speed motion pictures of the vapor-liquid interface in film boiling were obtained. All tests were conducted at atmospheric pressure over a range of heat flux between 9000 and 37000 BTU hr sq ft. A study of the stability of the vapor-liquid interfaces is performed and the results are compared to the photographic data. Parameters influencing the heat transfer process are developed and the experimental data is used to determine their proper relationship. The heat transfer coefficient in natural convection film boiling of saturated liquids on moderately long vertical surfaces at constant heat flux is shown to be insensitive to vertical position, and to be dependent only on the temperature differential and the fluid properties. A strong possibility of liquid droplet entrainment in the vapor flow is indicated by the presence of a rough, wavy interface, and relatively high speed vapor-flow, and by the unexpectedly strong dependence of the heat transfer on the latent heat of vaporization. Dissert. Abstr.

N80-30685 Delaware Univ., Newark.
THE EFFECT OF SUSPENDED SOLIDS ON THE VISCOUS DRAG ON AN OSCILLATING DISK Ph.D. Thesis
Chun-Hsun Rin 1980 134 p
Avail: Univ. Microfilms Order No. 8019920

The problem of a rigid, neutrally buoyant sphere above an infinitely long flat plate oscillating in its own plane in an incompressible viscous fluid was studied. An approximate solution of the unsteady Stokes equation is obtained for the fluid velocity, the translational and the rotational velocities of the sphere by the method of reflections up to the first reflection. The formulae for the drag and the torque on the sphere, the shear stress on the plate, the energy dissipation of the plate motion were derived. The solution is valid in a region within the boundary layer but not too close to the wall, i.e., for small ratio of sphere radius to distance of its center from the wall. The results were compared with the classical solution of an infinite flat plate oscillating in a viscous fluid and were discussed in terms of the physical

parameters of the problem. Applying the single particle results to an assembly of particles in a dilute suspension, the formula for suspension viscosity was derived. The result is in close agreement with Einstein's formula for suspension viscosity. The theoretical result indicates that the viscous drag on the oscillating disk increases when solid particles are present in the fluid. Dissert. Abstr.

N80-30686*# Lockheed Missiles and Space Co., Huntsville, Ala.
NUMERICAL ANALYSIS OF NATURAL CONVECTION IN TWO-DIMENSIONAL SQUARE AND CIRCULAR CONTAINERS IN LOW GRAVITY Interim Report
S. J. Robertson, L. W. Spradley, and M. P. Goldstein Aug. 1980 39 p refs
(Contract NASw-3281)
(NASA-CR-163487; LMSC-HREC-TR-D697821) Avail: NTIS HC A03/MF A01 CSCL 20D

A numerical study of natural convection in circular cylinder and square enclosures shows that the analytic low Rayleigh number theory of previous investigators is valid for Rayleigh numbers up to 1000. For a Rayleigh number of 5000, steady state values of maximum fluid velocity differ by 20 percent. This deviation between analytic theory and numerical results increases for higher Rayleigh numbers. In addition, the low Rayleigh number theory is shown to be valid for higher Rayleigh numbers for a portion of the transient phase before significant deviation becomes apparent. It is also shown that square shaped experimental configurations may be analytically approximated with good accuracy by circular cylinders of equal cross sectional area for the prediction of convection velocities and flow patterns at low Rayleigh number. Author

N80-30687*# Sheffield Univ. (England). Combustion Aerodynamics Research Lab.
DETAILED INVESTIGATION OF A VAPORISING FUEL SPRAY. PART 1: EXPERIMENTAL INVESTIGATION OF TIME AVERAGED SPRAY Progress Report
A. J. Yule, C. Ah Seng, R. Boulderstone, A. Ungut, P. G. Felton, and N. A. Chigier Jul. 1980 36 p refs
(Grant NsG-7517)
(NASA-CR-163483; CARL-IM-80-3) Avail: NTIS HC A03/MF A01 CSCL 20D

A laser tomographic light scattering technique provides rapid and accurate, high resolution measurements of droplet sizes, concentrations, and vaporization. Measurements using a computer interfaced thermocouple are presented and it is found that the potential exists for separating gas and liquid temperature measurements and diagnosing local spray density by in situ analysis of the response characteristics of the thermocouple. The thermocouple technique provides a convenient means for measuring mean gas velocity in both hot and cold two phase flows. The experimental spray is axisymmetric and has carefully controlled initial and boundary conditions. The flow is designed to give relatively insignificant transfer of momentum and mass from spray to air flow. The effects of (1) size-dependent droplet dispersion by the turbulence, (2) the initial spatial segregation of droplet sizes during atomization, and (3) the interaction between droplets and coherent large eddies are diagnosed. L.F.M.

N80-30688# Tennessee Univ. Space Inst., Tullahoma.
FLOW VISUALIZATION STUDY OF SECONDARY FLOW IN A CORNER Final Report, 1 Jan. 1978 - 30 Jun. 1979
Frank G. Collins Dec. 1979 55 p refs
(Grant AF-AFOSR-3537-78; AF Proj. 2307)
(AD-A082634; AFOSR-80-0257TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

An experimental investigation has been made of secondary flow in a 90 degree corner. The tests were run in a water tunnel at low speed (approximately 0.3 ft. per sec.) with emphasis on an attempt to visualize the embedded vortices in the laminar flow. The Reynolds number range was 11,000 to 52,500 per foot; the corner model was 9.75 in. wide by 48 in. long. The model was aligned in the tunnel so that no streamwise pressure gradient was present. Flow visualization was by means of hydrogen bubbles and dye. None of the streak-line examined with either the bubbles or the dye showed any indication of the presence of secondary motion in the first 18 inches of the corner. This is not believed to be conclusive since the vortices may exist at other distances along the corner (the limit here was imposed by the flow visualization apparatus used) or may be poorly developed in the initial length examined. GRA

N80-30689# California Univ., Berkeley. Dept. of Mechanical Engineering.
APPLICATIONS OF RAYLEIGH SCATTERING TO TURBULENT FLOWS WITH HEAT TRANSFER AND COMBUSTION Final Report, 1 Mar. 1978 - 29 Feb. 1980
L. Talbot 6 May 1980 71 p refs
(Contract F44620-76-C-0083)
(AD-A086660; AFOSR-80-0535TR) Avail: NTIS HC A04/MF A01 CSCL 71/2

Rayleigh scattering has been developed as a diagnostic technique and used in conjunction with Laser Doppler Anemometry to study two reacting flows; the interaction of a Karman vortex street with a flame, and the interaction of grid-produced turbulence with a flame. It was found that one of the dominant effects of heat release and flow dilatation is to decrease turbulent kinetic energy, and to increase the integral scales of the turbulence. Flame holder drag is found to have a major effect on the flow-field behind the flame. The Markstein model for the effect of wrinkling on flame stability appears to be in qualitative agreement with the results of the vortex interaction experiments. GRA

N80-30690# Pittsburgh Univ., Pa. Dept. of Mathematics and Statistics.
ANALYSIS OF NUMERICAL METHODS FOR THE EQUATIONS OF FLUID DYNAMICS Final Report
C. A. Hall and T. A. Porsching Jun. 1980 6 p refs
(Contract F49620-79-C-0100)
(AD-A086659; AFOSR-80-0543TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

During the last twenty-five years, the published literature on computational fluid dynamics has grown enormously. However, there are few papers dealing with the analysis of computational methods for time dependent multidimensional flow. There also seems to be a polarization of investigators into two groups: advocates of finite difference methods and advocates of finite element methods. It is our contention that an 'ideal' computational model for fluid flow problems may in fact draw on the strengths of both schools of thought. For example, we have recently implemented a frontal solution technique, originally devised for finite element analyses, in a finite difference model of two-phase fluid flow. GRA

N80-30691# Dayton Univ., Ohio. Research Inst.
THE STABILITY OF A COMPRESSIBLE FREE SHEAR LAYER Final Technical Report, Jan. - Sep. 1978
David F. Roscoe and Wilbur L. Hankey Oct. 1979 50 p refs
(Contract F33615-76-C-3145; AF Proj. 2307)
(AD-A086664; AFWAL-TR-80-306) Avail: NTIS HC A03/MF A01 CSCL 20/4

Inviscid flows with an inflection point in the velocity profile have been identified by Lord Rayleigh (1880) to be unstable. Michalke (1964) computed the amplification factors of the instability for a shear layer in incompressible flow. This report extends this work to include compressible flows. The results indicate large amplification rates occur through the transonic range but reduce drastically for supersonic flows. GRA

N80-30692# Tel-Aviv Univ. (Israel). School of Engineering.
ON THE SPREADING RATE AND STRUCTURE OF A TURBULENT SPOT Final Report, 1 Mar. 1979 - 29 Feb. 1980
I. Wygnanski and J. Haritonidis (Univ. of Southern California, Los Angeles) 19 Mar. 1980 47 p refs Prepared for European Office of Aerospace Research and Development, London
(Grant AF-AFOSR-3275-77; AF Proj. 2307)
(AD-A086445; AFOSR-80-0472TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Velocity measurements in the plane of symmetry of a turbulent spot are reported. The number of data points taken at various streamwise locations was adequate to map the ensemble averaged flow field in a spot at a given instance. These results are compared to velocity taken in laboratory coordinates (i.e., at a given station with variable time), whereupon it is shown that the flow field in

the spot depends either on its distance from its origin or on the time elapsed from its initiation. The two variables are not independent, so the flow may be transformed into a time (space) independent problem. The dependence of the spot on the Reynolds number and on the surrounding laminar boundary layer is established. The effects of these parameters on the shape of the ensemble averaged spot, its size, characteristic celerities, and relative rate of entrainment, are discussed. GRA

N80-30693# Delaware Univ., Newark. Applied Mathematics Inst.
ON THE INITIATION OF DETONATIONS IN A ONE-DIMENSIONAL SYSTEM Interim Report
Robert P. Gilbert. 1980. 33 p. refs.
(Contract AF-AFOSR-2879-76; AF Proj. 2304)
(AD-A086713; TR-48A; AFOSR-80-0499TR) Avail: NTIS
HC A03/MF A01 CSCL 19/4

The report is intended to provide Institute members with a concise discussion on the computation of the flow behind a shock leading to detonation in a one dimensional system. The computation would be performed using the method of characteristics, and this reduction would also be used later for our investigation of the stochastic initiation of detonations. Stochastic effects might be introduced either as white noise or as variations in material properties such as so-called 'hot spots'. Mathematically these effects would appear as part of the 'driving terms' in the characteristic formulation. Consequently the purpose of the present report is to be viewed primarily as a supportive document for our research effort on the stochastic initiation of detonation. GRA

N80-30694# Dayton Univ., Ohio.
SIMULATION OF VISCOUS STEADY FLOW PAST AN ARBITRARY TWO-DIMENSIONAL BODY Final Report, Aug. 1979 - Jan. 1980
Michele Napolitano. Wright-Patterson AFB, Ohio. AFFDL. Feb. 1980. 46 p. refs.
(Contract F33615-76-C-3145; AF Proj. 2307)
(AD-A086799; AFWAL-TR-80-3038) Avail: NTIS
HC A03/MF A01 CSCL 20/4

A numerical technique is developed for solving laminar steady flow past an arbitrary two-dimensional body. A system of body oriented coordinates is first generated numerically by means of the transformation of Thompson et al. The vorticity-stream function Navier-Stokes equations are then solved by the Alternating Direction Implicit procedure of Douglas and Gunn. A relaxation-like time derivative is added to the stream function equation and the vorticity equation is linearized in time so that only the converged steady solution has physical meaning. Numerical results are presented for two model problems (a one dimensional Poiseuille flow and the driven cavity problem) and for flow past a NACA 0012 airfoil for moderate to high values of the Reynolds Number. Finally, advantages and limitations for the proposed algorithm are briefly addressed. GRA

N80-30695# General Applied Science Labs., Inc., Westbury, N. Y.
R2D2: A FORTRAN PROGRAM FOR TWO-DIMENSIONAL CHEMICALLY REACTING, HYPERTHERMAL, INTERNAL FLOWS. VOLUME 2: USER GUIDE Final Report, 15 May 1978 - 30 Sep. 1979
Gertrude Weilerstein, Robert Ray, Gabriel Miller, and John Erods. Wright-Patterson AFB, Ohio. AFFDL. Jan. 1980. 67 p. refs. 2 Vol.
(Contract F33615-78-C-3016; AF Proj. 2404)
(AD-A086762; GASL-TR-254-Vol-2; AFFDL-TR-79-3162-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 09/2

Program R2D2, a FORTRAN program for finite difference solution of the unsteady equations of motion of an inviscid, chemically reacting and/or vibrationally excited mixture of gases in a two dimensional (planar or axisymmetric) duct, is described. The formulation and method of analysis has been outlined in Volume 1 of this report. The present volume describes the input, output, and operational procedures of the program. A summary flow chart of the main program is also presented, and the functions of all subroutines are outlined. Instructions for changing the thermochemical Block Data and the program dimensions are also presented. GRA

N80-30696# United Technologies Corp., East Hartford, Conn. Energy Conversion Systems Analysis Group.
TWO-PHASE NOZZLE THEORY AND PARAMETRIC ANALYSIS Technical Annual Report, 15 May 1979 - 14 May 1980
Simion C. Kuo and Charles W. Deane. Jun. 1980. 94 p. refs.
(Contract N00014-79-C-0344; RR0240302)
(AD-A086795; UTRC/R80-954624-2) Avail: NTIS
HC A05/MF A01 CSCL 20/4

This study sought to formulate a working theory with which the performance of two phase nozzles can be analyzed parametrically over a wide range of flow conditions and fluid properties. As a basis for formulating the theory, the technical status of two phase nozzles was assessed, the governing flow parameters were identified, and the flow domains classified with the previously available theory. A working theory of two phase nozzles suitable for parametric analyzes and optimization was then formulated, incorporating the significant interphase effects of velocity slip, droplet breakup, and droplet heat transfer. Liquid/gas combinations for two phase nozzles, and suitable combinations for marine propulsion and other selected applications were discussed. Single phase (or homogeneous) theory was reviewed from the viewpoints of energy conversion in a nozzle and was compared with models applicable to separate phases in terms of their flow domains. Finally, a working theory of two phase nozzles was formulated based on the governing flow parameters and on six basic equations that described the two phase flow. From this theory, a computer model was developed which includes the significant interphase effects of velocity slip, droplet beakup, and heat transfer and which is suitable for parametric analysis and optimization. Preliminary parametric calculations based on use of this model were compared with results from previous two phase nozzle models and with available experimental data. GRA

N80-30697# Tennessee Univ., Tullahoma. Dept. of Aerospace and Mechanical Engineering.
UNSTEADY SWIRLING FLOWS IN GAS TURBINES Annual Technical Report, 1 Apr. 1979 - 31 Mar. 1980
M. Kurosaka. May 1980. 149 p. refs.
(Contract F49620-78-C-0045; AF Proj. 2307)
(AD-A086765; AFOSR-80-0509TR) Avail: NTIS
HC A07/MF A01 CSCL 20/4

The objective of the investigation is to acquire fundamental understanding of a phenomenon characterized by violent fluctuations occurring in swirling air flows in aircraft engines: this flow instability, dubbed here as 'vortex whistle', is known to be capable of causing severe fatigue failure in gas turbine components. In the present report period, the analysis started from the compressible unsteady Navier-Stokes equations; this was necessary in order to assess the importance of the so-called higher order effects in the boundary layer upon the streaming. Resorting to the apparatus of a matched asymptotic expansion, the analytical representation of the acoustic streaming was derived anew. The results are in essential agreement with our previous conclusions and we were able to confirm, on firmer ground, the existence of the threshold swirl beyond which the free vortex distribution changes into a forced vortex type; these are written up in a paper form appended to this report. Second, based upon the analytical results, a test rig with two different tangential injection manifolds was designed, constructed and installed; the acquisition of the data from them will form the central effort of the next, Phase 2 activity. GRA

N80-30698# Naval Research Lab., Washington, D. C.
FINITE ELEMENT MODELING FOR CONVECTION-DIFFUSION PROBLEMS Interim Report
George A. Keramidas. 15 May 1980. 81 p. refs.
(RR023141)
(AD-A086777; AD-E000466; NRL-MR-4225) Avail: NTIS
HC A05/MF A01 CSCL 20/13

The scope of this study is to develop the basic equations for deriving a finite element formulation which can be used to solve problems related to convection and diffusion dominated flows. The formulation is based on the introduction of a generalized quantity defined as heat displacement. The governing equation is expressed in terms of this quantity and a variational formulation is developed which leads to an equation similar in form to

Lagrange's equation of mechanics. This equation may be solved by any numerical method, though it is of particular interest for application of the finite element method. The developed formulation is used to derive two finite element models for solving convection-diffusion boundary value problems. The performance of the two element models is investigated and numerical results are given for different cases of conversion and diffusion with three types of boundary conditions. The numerical results obtained show not only the efficiency of the numerical models to handle pure convection, pure diffusion and mixed convection-diffusion problems but also good stability and accuracy. The applications of the developed numerical models is not limited to diffusion-convection problems but can also be applied to other types of problems such as mass transfer, hydrodynamics and wave propagation. GRA

N80-30699# Flow Research, Inc., Kent, Wash.
VISUALIZATION STUDY OF TURBULENT SPOTS Interim Technical Report, 1 May 1978 - 30 Apr. 1980
Mohamed Gad-El-Hak and James J. Riley 1 May 1980 60 p refs
(Contract F49620-78-C-0062; AF Proj. 2307)
(AD-A086831; FLOW-RR-162; AFOSR-80-0473TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

An investigation of turbulent spots evolving in a laminar boundary layer has been conducted during the period 1 May 1978 - 30 April 1980. A flat plate was towed through an 18 m water channel. The plate was mounted under a carriage that was towed at a constant velocity. The carriage rides on a continuously replenished oil film giving a vibrationless tow. Turbulent spots were initiated by a solenoid valve that ejected a small amount of water through a hole located downstream from the leading edge. A novel visualization technique has been employed that utilizes fluorescent dye excited by a sheet of laser. Some aspects of entrainment and structure of turbulent spots were inferred from the present experiments. In particular, the present results strongly suggest that another mechanism, in addition to entrainment, is needed to explain the lateral growth characteristics of the turbulent zone defining the spot. This mechanism, termed growth by destabilization, appears to be a result of the turbulence in the spot destabilizing the unstable laminar boundary layer in the neighborhood of the spot. Two additional tasks were carried out as part of this investigation. The first, a theoretical study of three-dimensional wave packets, and the second an investigation of the effects of drag reducing polymers and stratification on turbulent spots. GRA

N80-30700# Wisconsin Univ. - Madison. Mathematics Research Center.
THE CONVERGENCE OF PERIODIC WAVES TO SOLITARY WAVES IN THE LONG WAVE LIMIT Technical Summary Report
J. F. Toland Mar. 1980 53 p refs Sponsored in part by United Kingdom Science Research Council
(Contract DAAG29-75-C-0024)
(AD-A086370; MRC-TSR-2054) Avail: NTIS HC A04/MF A01 CSCL 20/4

It is shown that large amplitude solitary water waves arise as the limit of periodic waves whose wavelengths increase indefinitely. This result is obtained after a new version of the Nekrasov integral equation for periodic waves has been derived. Its resemblance to the equation for solitary waves (1) leads to this convergence result once the global existence proof for solitary waves given in (1) has been taken into account. GRA

N80-30701# Illinois Univ. at Chicago Circle, Chicago.
RATE MEASUREMENT IN SHOCK WAVES WITH THE LASER-SCHLIEREN TECHNIQUE
J. H. Kiefer and J. C. Hajduk 1979 14 p refs Presented at 12th Intern. Symp. on Shock Tubes and Waves, Jerusalem, Aug. 1979
(Contract ER-78-S-02-4759)
(COO-4759-2; CONF-7908112-1) Avail: NTIS HC A02/MF A01

The laser schlieren or narrow laser beam deflection technique is discussed with particular reference to its application to very fast processes. The optics of the beam shock wave interaction is then examined by use of the scalar formulation of Huygens' principle (Kirchoff integral), with the shock density profile introduced as a transmission coefficient. The accuracy with which the signal generated by a differential detector will reproduce the variation of the refractive index gradient in a reactive shock is discussed in terms of this formulation. The response of such a detector to passage of a curved shock in a rare gas is also determined with the aid of the shock curvature theory of de Boer. These calculations are in good agreement with experiment and locate the time origin, coincidence of shock leading edge and beam center, on the positive portion of the signal near zero-crossing, an assignment that is in disagreement with the earlier calculations of Dove and Teitelbaum. DOE

N80-30702# California Univ., Livermore. Lawrence Livermore Lab.
FINITE ELEMENT SIMULATIONS OF THERMALLY INDUCED CONVECTION IN AN ENCLOSED CAVITY
C. D. Upson, P. M. Gresho, and R. L. Lee Mar. 1980 37 p refs
(Contract W-7405-eng-48)
(UCID-18602) Avail: NTIS HC A03/MF A01

The simulations reported establish benchmark comparisons of different techniques of solving the Navier-Stokes and thermal energy equations for a particular thermally driven flow. Also included is a brief analysis of the results and some comparisons with previous solutions. The second section of this paper contains a result at a higher Rayleigh number and some tilted cavity results, performed, in part, as potential candidates for more difficult followup benchmark problems. DOE

N80-30703# Los Alamos Scientific Lab., N. Mex.
NOVEL APPROACH TO THE COMPUTATION OF AXISYMMETRIC COUNTERCURRENT PATTERNS IN GAS CENTRIFUGES
L. D. Cloutman Feb. 1980 34 p refs
(Contract W-7405-eng-36)
(LA-8258-MS) Avail: NTIS HC A03/MF A01

A numerical algorithm based on finite Fourier Chebyshev transforms for solving the total reflux, thermal drive centrifuge problem is presented. The method should be capable of providing steady state solutions with excellent resolution in a few minutes of computer time. The same technique may be easily applied to other problems, including the isotope diffusion equation. A simple diffusion equation is solved to show certain aspects of the numerical method, in particular, its excellent convergence properties. DOE

N80-30704# Nevada Univ., Las Vegas. Desert Research Inst.
THERMODYNAMIC RELATIONS BETWEEN SELECTED PARAMETERS DESCRIBING UNSATURATED FLOW
Clinton M. Case May 1980 47 p refs
(Contract DE-AC08-76DP-01253)
(DOE/DP-01253/18; DRIP-45018) Avail: NTIS HC A03/MF A01

The first law of thermodynamics is applied to unsaturated flow by replacing the usual PdV term (P is pressure and V is volume) for a chemical system which appears there by phi d theta sub s (phi is matric suction and theta sub s is the degree of saturation). If the assumption is made that hysterectic behavior of the moisture characteristic can be ignored, all the usual thermodynamic relations can be derived in which P is replaced by phi and V is replaced by theta sub s and the various thermodynamic potentials, internal energy, U, entropy, S, and so on, are understood to be normalized to unit void volume of the soil being considered. This leads to a thermodynamically derived theoretical expression for the slope of the teristic in terms of theta sub s temperature, T, and the thermal expansivity of water, beta sub 1. DOE

N80-30705# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
A COMPUTER PROGRAM FOR TRANSIENT AND AXISYMMETRIC ABLATION, CONDUCTION AND RADIATION
L. Fusade and A. Rives 1979 11 p Presented at Intern. Conf. on Numerical Methods in Thermal Probl., Swansea, England, 2-6 Jul. 1979
(SNIAS-792-422-120) Avail: NTIS HC A02/MF A01

Multidimensional characteristics of heat conduction and ablation, associated with high thermal fluxes encountered by heat shielding on space vehicles and ballistic missiles during atmospheric reentry, are modeled theoretically, then implemented in a computer program. This program allows analysis and design of axisymmetric bodies, taken into account two input parameters (for the heat shielding material), mass transfer coefficient and heat of ablation, as functions of pressure and temperature. Thermo-mechanical erosion is computed empirically, including surface roughness effects. Author (ESA)

N80-30706# Technische Hogeschool, Delft (Netherlands). Lab. for Thermal Power Engineering.
FUNDAMENTAL INVESTIGATION OF INTERACTION FORCES IN BUBBLE SWARMS AND APPLICATION TO THE DESIGN OF CENTRIFUGAL SEPARATORS Ph.D Thesis
R. Wisman May 1979 349 p refs
(WTHD-115) Avail: NTIS HC A15/MF A01

Rotating gas-liquid flows were investigated, both experimentally and during the development of a numerical description. The interaction forces in bubble swarms were observed, resulting in correlations for the drag force and virtual mass coefficients. The validity of these correlations was verified using first, atmospheric air-water mixtures, then high pressure steam water mixtures. Applicability to the numerical solution of the momentum balances is shown. A computer procedure (ANALEST) for computation of rotating gas liquid flows, based on differential mass and momentum balances, was developed. Eight flow variables were identified but only seven could be computed. The results were used in the design and testing of a venturi separator for nuclear boiling water reactors. Design rules were provided to translate the separating effect obtained with this reduced scale separator to an upscaled version. Author (ESA)

N80-30707# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
TRANSFORMATION OF A DROP FALLING ON THE SURFACE LAYER OF A LIQUID IN A VORTEX RING [UMBILDUNG EINES FALLENDEN TROPFENS AN DER OBERFLAECHE EINER FLUESSIGKEITSSCHICHT IN EINEN RINGWIRBEL]
Peter E. M. Schneider Aug. 1979 128 p refs In GERMAN
(MPIS-15/1979; ISSN-0436-1199) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 35.30

The vortex which is formed when a drop falls on the surface layer of a liquid was studied. The factors involved in the formation of this vortex were examined with particular emphasis on drop radius, height of the drop fall, depth of the liquid, and the physical qualities of the drop and of the liquid. R.C.T.

N80-30708# Hochschule der Bundeswehr, Munich. (West Germany). Fachbereich Luft- und Raumfahrttechnik.
OSCILLATIONS OF A LIQUID WITH A FREE SURFACE IN A WEDGE SHAPED CONTAINER [FLUESSIGKEITS-SCHWINGUNGEN MIT FREIER OBERFLAECHE IN KEIL-FOERMIGEN BEHAELTERN]
Helmut F. Bauer 1979 62 p refs In GERMAN
(HSBW-FB-LRT-WE-9-4-79) Avail: NTIS HC A04/MF A01

The natural frequencies of a frictionless and incompressible liquid with a free surface in a wedge shaped containers with a small opening angle are determined. Results indicate that it is possible to determine the pressure distribution, surface distortion, liquid forces and moments from the speed potential. The natural frequencies of several containers measured in the experiment confirm the theoretical values. Author (ESA)

N80-30709# Poitiers Univ. (France).
DEVELOPMENT OF A THERMAL MODEL LIBRARY: APPLICATION TO DYNAMIC SIMULATION OF THERMAL CONTROL FOR SPACELAB FLUID LOOPS Final Report [DEVELOPPEMENT D'UNE BIBLIOTHEQUE DE MODELES THERMIQUES: APPLICATION A LA SIMULATION DYNAMIQUE DU CONTROLE THERMIQUE DES BOUCLES DE FLUIDES DE SPACELAB]
J. B. Saulnier, A. Alexandre, and J. Martinet Oct. 1979 121 p refs In FRENCH; ENGLISH summary
(Contract ESTEC-3615/78-NL-AK)
(ESA-CR(P)-1302) Avail: NTIS HC A06/MF A01

The analogies between thermal and electrical parameters were extended, and electrical network analysis methods applied to thermal problems (including active thermal control). A library of thermal models was developed using ASTEC 3, and applied to some dynamic simulations of the environmental control fluid loops of SPACELAB. Author (ESA)

N80-30710# Societe Anonyme Belge de Constructions Aeronautiques, Brussels (Belgium).
DIODE BEHAVIOR Final Report
Dec. 1979 88 p refs
(Contract ESA-3737/78)
(ESA-CR(P)-1319) Avail: NTIS HC A05/MF A01

The diode behavior of a gas controlled variable conductance heat pipe (VCHP) was studied. A literature search was made covering the various heat pipe control functions and techniques, along with the state-of-the-art for diode operation. The diode operation limits and characteristics were predicted for the AH95 type VCHP and a technique evolved to extend the diode operation limit. One AH95 VCHP was tested and improved to obtain a better diode capability. A comparison was made between the liquid trap and gas blockage diode techniques. Author (ESA)

N80-30711# Societe Anonyme Belge de Constructions Aeronautiques, Brussels (Belgium).
CRYOGENIC HEAT PIPES, PHASE 1 REPORT
Dec. 1979 55 p refs
(Contract ESA-3737/78)
(ESA-CR(P)-1323) Avail: NTIS HC A04/MF A01

The use of small diameter heat pipes using ammonia as a heat carrier was investigated for space applications. An initial analysis and literature search determined the most promising power levels. Experimentation with 3 mm pipes working with ethane and methane confirmed their potentiality as to the power level, tilting capability, integration flexibility, and resistance to adverse environments. Author (ESA)

N80-30712# European Space Agency, Paris (France).
CALCULATIONS OF FREE TURBULENT SHEAR FLOW WITH A THREE EQUATION TURBULENCE MODEL BY J. C. ROTTA
Eberhard Meineke Apr. 1980 65 p refs Transl. into ENGLISH of "Berechnung Freier Turbulenter Scherstroemungen mit einem 3-Gleichungs-Turbulenzmodell von J. C. Rotta", Rept. DLR-FB-77-60 DFVLR, Goettingen, West Germany
(ESA-TT-525; DLR-FB-77-60) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 26.10

Calculations were made using a system of partial differential equations which describe plane and axisymmetric turbulent flows at high Reynolds numbers. This system includes three equations to describe turbulent field quantities in addition to the two equations for the longitudinal and cross flow component of the mean flow. These are the equation for the kinetic energy of fluctuations, the equation for a characteristic length scale, and the transport equation for the Reynolds shear stress. After the necessary closure assumptions, which contain only empirically determinable coefficients, the equations form Rotta's turbulent model. The equations were numerically solved for three cases of free shear flow and the influence of the coefficients of the shear stress transport equation on the solution was studied. A single set of coefficients is given, for which the calculated flow cases are found in satisfactory agreement with experimental results. Author (ESA)

N80-30713# European Space Agency, Paris (France).
FLOW PHENOMENA IN GRAVITATIONLESS MELTING ZONES IN THE PRESENCE OF ELECTROMAGNETIC FIELDS
Chung-Hwang Chun Jan. 1980 63 p refs Transl. into ENGLISH of "Stroemungsvorgaenge in Schwerelosen Schmelzzonen bei Anwesenheit Elektromagnetischer Felder", Rept. BMFT-FB-W-77-42 Technische Univ., Hanover, Dec. 1977 Original report in GERMAN previously announced as N79-30528
(ESA-TT-592; BMFT-FB-W-77-42) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 14.70

Under the condition of zero-gravity the convection in a melting zone, caused by the gradient of surface tension

(Marangoni-convection), influences substantially the process of crystal growth. It may be influenced by application of electromagnetic fields. An analysis of the significant forces leads to the characteristic number of similarity and to the classification of the melting flow with regard to the efficiency of the electromagnetic forces. The Marangoni-convection and its influence by means of magnetic fields in the cylindrical melting zone of silicon were studied numerically. From the results the temperature and velocity fields with and without the magnetic field can be predicted and compared. The basis is provided for systematic studies of the optimal flow and temperature conditions for crystal growth.
Author (ESA)

N80-30714# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
OPTIMIZATION OF A ROTATING THERMALLY CONDUCTING JOINT AND INCORPORATION IN A LABORATORY MODEL DEPLOYABLE RADIATOR Final Report
B. Hinderer Mar. 1980 113 p
(Contract ESTEC-3765/78-NL-PP)
(DS-190-0-78; ESA-CR(P)-1337) Avail: NTIS
HC A06/MF A01

A thermal and mechanical optimization of a thermally conducting joint and an attached heat pipe radiator was performed. A thermal node model was established to calculate different design configurations. The sealing-bearing concept was redesigned to minimize torque. Axially grooved heat pipe profiles were established for the design goal of this deployable radiator model. An engineering model deployable radiator was constructed and submitted to a thermal-vacuum test. Temperature drops from feeder to radiator closely met predictions, but measured torque exceeded expectations but was within an acceptable range for space applications. The heat pipe network comprising the heat pipes of the radiator and those integrated in the rotor profile was not entirely satisfactory. Evaluation of the results of thermal-vacuum test and previous heat pipe tests led to no definite explanation for the problems with some of the radiator heat pipes.
Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-30715 Cincinnati Univ., Ohio.
A HOLOGRAPHIC INTERFEROMETRIC STUDY OF THE TEMPERATURE DEPENDENCE OF DIFFUSION OF AQUEOUS SODIUM CHLORIDE IN WATER, FROM 32 C TO 50 C Ph.D. Thesis
Gray Gabelmann 1980 67 p
Avail: Univ. Microfilms Order No. 8021033

The detection of an apparent second order phase transition in bulk water structure in tetramethylammonium chloride solutions by proton nuclear magnetic resonance spectroscopy was reported. Measurements indicated that the entropic increase with temperature is continuous but a discontinuity appears in the first derivative at about 42 C. This discontinuous behavior of the chemical shift of bulk water protons suggests the existence of a second order phase change in the water structure (a biphasic change). Such a phase change must be characterized by changes in the structure of the liquid. The thermodynamic variables that show a discontinuity during such a phase change are monitored directly. A change in volume, for example, will cause a change in density which will alter the vaporization energy of a liquid. The diffusion constant is closely related to the vaporization energy, so as the diffusion constant is monitored, changes in the density are detected. Any biphasic behavior should be seen as a change in the temperature dependence of the diffusion constant for the system. The diffusion constant for the diffusion of aqueous NaCl into H2O over the temperature range 32 C to 50 C using holographic interferometry was measured. The interferograms were analyzed using a method recently developed.
Dissert. Abstr.

N80-30716*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARS 1414 RECORDER ENVIRONMENTAL TESTS
David Langjahr Aug. 1980 31 p
(NASA-TP-1709; Rept-80F5124) Avail: NTIS
HC A03/MF A01 CSCL 14E

Environmental testing is described and the data of the Modular Airborne Recording System (MARS) 1414 is presented. The preliminary data marks a starting point for more complete thermal testing in the future. The unit was operated at +/-55 C at one atmosphere, -10 C at 75,000 feet (28 mm Hg)at the other. Temperatures at 13 locations on the unit were monitored and plotted against elapsed time. From the test results, some estimation can be made of ambient temperatures in which the heaters will operate and shut off. This data is sufficient to complete a preliminary analysis of the MARS 1414 Recorder, and to design further tests.
R.K.G.

N80-30717*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DIAL WITH HETERODYNE DETECTION INCLUDING SPECKLE NOISE: AIRCRAFT/SHUTTLE MEASUREMENTS OF O3, H2O, AND NH3 WITH PULSED TUNABLE CO2 LASERS
Philip Brockman, Robert V. Hess, Leo D. Staton, and Clayton H. Bair Aug. 1980 14 p refs Presented at Intern. Conf. on Heterodyne Systems and Technol., Williamsburg, Va. 25-27 Mar. 1980 Submitted for publication
(NASA-TP-1725; L-13876) Avail: NTIS HC A02/MF A01
CSCL 20E

Atmospheric trace constituent measurements with higher vertical resolution than attainable with passive radiometers are discussed. Infrared differential absorption lidar (DIAL), which depends on Mie scattering from aerosols, has special advantages for tropospheric and lower stratospheric applications and has great potential importance for measurements from shuttle and aircraft. Differential absorption lidar data reduction involves comparing large amplitude signals which have small differences. The accuracy of the trace constituent concentration inferred from DIAL measurements depends strongly on the errors in determining the amplitude of the signals. Thus, the commonly used SNR expression (signal divided by noise in the absence of signal) is not adequate to describe DIAL measurement accuracy and must be replaced by an expression which includes the random coherent (speckle) noise within the signal. A comprehensive DIAL computer algorithm is modified to include heterodyne detection and speckle noise. Examples for monitoring vertical distributions of O3, H2O, and NH3 using a ground-, aircraft-, or shuttle-based pulsed tunable CO2 laser DIAL system are given.
R.K.G.

N80-30718# Aeronautical Research Labs., Melbourne (Australia).
CALIBRATION OF A STRAIN-GAUGED CT4-A UNDERCARRIAGE
V. Romes Jan. 1980 62 p refs
(AD-A086965; ARL/STRUC-TM-308) Copyright. Avail: NTIS
HC A04/MF A01 CSCL 01/3

This memo presents the basic equations required to relate strains to components of flight and landing loads acting on CT4-A undercarriage legs. Details of strain gauge locations are contained in ARL Drawing No. 53432 and photographs and details of the test rig are included. The results of the calibration in February 1977 are recorded with details of the subsequent analysis. The application to flight test data is also described.
GRA

N80-30719# Aeronautical Research Labs., Melbourne (Australia).
ANALYSIS OF GROUND CALIBRATION DATA FROM STRAIN GAUGES ATTACHED TO THE AIRFRAME OF CT4-A AIRTRAINER A19-031
M. G. J. Higgs Aug. 1979 39 p
(AD-A086970; ARL/STRUC-TM-296) Copyright. Avail: NTIS
HC A03/MF A01 CSCL 01/3

A CT4A Airtrainer airframe was subjected to wing bending, wing torque, fin loading and tailplane loading. The resulting strains are analyzed.
GRA

N80-30720# Eastman Kodak Co., Rochester, N. Y.
OPTICAL POWER SPECTRUM ANALYZER. SCANNING LASER BEAM SYSTEM PERMITS FULL FORMAT COVERAGE Final Report
S. C. Arnold and D. J. Josephson 17 Dec. 1979 24 p
(Contract DACA76-78-C-0003)
(AD-A087047; ETL-0214) Avail: NTIS HC A02/MF A01 CSCL 14/2

On 18 April 1978, Eastman Kodak Company was awarded a contract to design, fabricate, test, deliver and install an Optical Power Spectrum Analyzer (OPSA). The contract defines a design and fabrication effort intended to draw upon developed technology for its operating principles. This final report therefore deals with the results of final acceptance testing and how the final performance test data compares with initial design requirements. GRA

N80-30721# National Technical Information Service, Springfield, Va.
SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 186 p Supersedes NTIS/PS-79/0502; NTIS/PS-78/0411
(PB80-809775; NTIS/PS-79/0502; NTIS/PS-78/0411) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E

A bibliography of 179 abstracts covering the applications and techniques of Schlieren and shadowgraphy photography is presented. The majority of the reports are primarily concerned with flow visualization, although there are included studies on heat transfer and combustion processes. GRA

N80-30322*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DIGITAL RECORDING ACQUISITION SUBSYSTEM FOR RADIO INTERFEROMETRY APPLICATIONS IMPLEMENTATION PLAN
V. B. Kapoor *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 9-14 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14E

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-30722 California Inst. of Tech., Pasadena.
THE MODE LOCKED DYE LASER, 1. PICOSECOND PHOTOCONDUCTIVITY OF SEMI-INSULATING GALLIUM-ARSENIDE, 2 Ph.D. Thesis
Richard Harrison Moyer 1980 135 p
Avail: Univ. Microfilms Order No. 8020426

The principles and practice of the passive mode locking of a CW dye laser are discussed with emphasis on the dynamics of picosecond pulse production as well as the techniques of high resolution pulse width measurement. The characterization of the mode locked dye laser through real time temporal and spectral measurements is also described. The development and applications of the opto-electronic semiconductor switch are considered. Design considerations of the high speed photoconductive device and results of experiments in which picosecond pulses activate the devices are discussed. The experimental results are interpreted to yield numerical estimates of carrier recombination rates. An experimental technique for determining these parameters through ultrafast magnetophotoconductivity is introduced as well. Results show good agreement with the steady state measurements. Dissert. Abstr.

N80-30723 California Inst. of Tech., Pasadena.
THEORY OF THE LONGITUDINAL FREE ELECTRON LASER, 1. A THEORETICAL MODEL OF THE LINEAR ELECTROOPTIC EFFECT, 2 Ph.D. Thesis
Chun-Ching Shih 1980 202 p
Avail: Univ. Microfilms Order No. 8019907

A proposed longitudinal free electron laser is described in which simulated by a relativistic electron beam passing through a periodically corrugated waveguide. The wavelength of the radiation is widely tunable by changing the electron energy. Theoretical investigations are based on the single electron analysis. Both linear and nonlinear treatments of the laser mechanism in a free electron laser are carried out analytically. The phenomena of homogeneous and inhomogeneous interactions lossy gain, space charge effect, large signal behavior, large gain amplification, and electron dynamics are discussed. A one energy gap model, dielectric theory, and the concept of bond charge were used to investigate the linear Pockel's effect. A general expression is obtained for the electrooptic coefficient of a crystal and is applied to the calculation for diatomic and ternary compounds. The results are generally in good agreement with the measured values for nearly all the crystals in which the electrooptic coefficient had been determined. Dissert. Abstr.

N80-30724 Southern Methodist Univ., Dallas, Tex.
MODELING, SIMULATION, AND CONTROL OF A CLOSED CYCLE LASER GAS SUPPLY SYSTEM Ph.D. Thesis
Stephen Kent Vernon 1980 120 p
Avail: Univ. Microfilms Order No. 8019073

Patel's concept of passing laser gas through a cavity to prevent a heat build up is studied. The flow system used is the closed cycle or circulator type where the gas is contained in a ductwork system to be circulated by a turbine and cooled by heat exchangers. The first step in solving this problem is to model the system, which is done with component models and conservation equations. Once the model is complete, the system can be simulated on a digital computer. Two different models are presented with the first a fourteenth order model and the second a fifth order model. Simulation results for both models are given. The heat exchanger controller is designed using the heat exchanger model in stand alone fashion. The pressure controller is designed using an eighth order linearized circuit model. The control system designs are then tested using the fourteenth order simulation program. Dissert. Abstr.

N80-30725 Polytechnic Inst. of New York.
ANALYSIS OF THE COPPER VAPOR LASER AND DEVELOPMENT OF A GENERAL LASER PLASMA MODEL Ph.D. Thesis
George Michael Kull 1980 156 p
Avail: Univ. Microfilms Order No. 8019401

Excellent qualitative and quantitative agreement between modeled and experimental results clarified the important processes involved in the copper vapor laser. These processes are: radiation trapping, stepwise excitation, cavity loss factors, and electron collisional excitation of the lower and upper laser levels. To accomplish this comparison a general model for a pulsed gas discharge laser was developed and applied to the copper vapor laser. An iterative implicit method of solution is used. All nonlinear coefficients are represented as rational functions. The lowest five levels and three higher excited levels of neutral atomic copper plus the singly ionized copper ground level were included in the model as well as the neutral and singly ionized ground states of the buffer gas. When the three higher excited levels were removed, the output laser pulse widened indicating that stepwise excitation to these additional levels plays a role in the laser kinetics. Semiclassical excitation cross sections of the Gryzinski-type were compared with impact parameter cross sections. Dissert. Abstr.

N80-30726*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
REAL-TIME OPERATING SYSTEM FOR A MULTI-LASER/MULTI-DETECTOR SYSTEM
Gary Coles Jul. 1980 120 p refs
(Grant NsG-7369)
(NASA-CR-163486; RPI-TR-MP-65) Avail: NTIS HC A06/MF A01 CSCL 20E

The laser-one hazard detector system, used on the Rensselaer Mars rover, is reviewed briefly with respect to the hardware subsystems, the operation, and the results obtained. A multi-detector scanning system was designed to improve on the original system. Interactive support software was designed and programmed to implement real time control of the rover or platform with the elevation scanning mast. The formats of both the raw data and the post-run data files were selected. In addition, the

interface requirements were selected and some initial hardware-software testing was completed. E.D.K.

N80-30727*# Cincinnati Univ., Ohio.
NUCLEAR ISOMER SUITABLE FOR GAMMA RAY LASER Final Technical Report, 15 Jan. 1977 - 31 May 1979
Shacheenatha Jha 31 May 1979 16 p refs
(Grant NsG-3091)
(NASA-CR-163482) Avail: NTIS HC A02/MF A01 CSCL 20E

The operation of gamma ray lasers (gasers) are studied. It is assumed that the nuclear isomers mentioned in previously published papers have inherent limitations. It is further assumed that the judicious use of Bormann effect or the application of the total external reflection of low energy gamma radiation at grazing angle of incidence may permit the use of a gaser crystal sufficiently long to achieve observable stimulated emission. It is suggested that a long lived 0(+) isomer decaying by low energy gamma ray emission to a short lived 2(+) excited nuclear state would be an attractive gaser candidate. It is also suggested that the nuclear isomer be incorporated in a matrix of refractory material having an electrostatic field gradient whose principal axis lies along the length of the medium. This results in the preferential transmission of electric quadrupole radiation along the length of the medium. E.D.K.

N80-30728# Illinois Univ. at Urbana-Champaign. Electro-Physics Lab.
OPTICALLY PUMPED FAR INFRARED MOLECULAR LASERS Final Report, 1 Feb. 1976 - 31 Jan. 1980
Paul D. Coleman Apr. 1980 138 p refs
(Grant AF-AFOSR-2988-76; AF Proj. 2301)
(AD-A086495; UILU-ENG-80-2540; AFOSR-80-0441TR) Avail: NTIS HC A07/MF A01 CSCL 20/5

This report summarizes studies on optically pumped far infrared molecular gas lasers. The research has been concerned with the general subjects of far infrared integrated optics and technology, the discovery of new optically pumped molecular laser systems, and the study and analysis of nonlinear processes (Raman and hyper-Raman) that can occur in optically pumped systems. The theoretical density matrix analysis of the gain spectra of nonlinear systems and the first detailed experimental measurements of these systems are presented. It is demonstrated that third and fifth order nonlinear processes can exceed first order laser processes. An experimental study of the generation of a 22.653 GHz signal (the largest wavelength yet reported) in optically pumped NH3 is described. The frequency tunability and single shot spectral characteristics of the signal were measured with precision. A single laser pump in a four-level system can yield two laser signals, which in the linear case are not coupled together. However, with stronger pumping, nonlinear effects can couple the two laser signals with the result that the behavior of one laser signal is determined by the other and vice versa. The self-consistent analysis of this problem is described. GRA

N80-30729# Advanced Research and Applications Corp., Sunnyvale, Calif.
A STUDY OF LOW-TEMPERATURE PROCESSES IN NON-EQUILIBRIUM ELECTRONIC STATES Final Report, Feb. 1978 - Jan. 1980
T. C. Wang, T. J. Magee, J. Peng, and R. A. Armistead Apr. 1980 58 p refs
(Contract F49620-78-C-0010; AF Proj. 2301)
(AD-A086494; AFOSR-80-0467TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

Primary focus was directed to experimental studies of the electrical behavior of weakly-coupled superconductors. Two types of superconducting devices were used, Josephson tunnel junctions and superconducting thin-film microbridges. The experiments showed that non-equilibrium states created by microwave irradiation and quasiparticle injection will change the current voltage characteristics of Josephson devices. Experiments were also conducted to determine if the grain size of superconducting niobium (Nb) films could be controlled using scanning laser annealing. Initial (as deposited) grain sizes were dependent upon the deposition technique. Regardless, laser annealing resulted in substantial modifications to the structure of the Nb films. With proper laser annealing techniques, relatively fine-grained polycrystalline films were converted to large polycrystalline grains with an average size of 5 by 10 micrometers. GRA

N80-30730# Rochester Univ., N. Y. Lab. for Laser Energetics.
DEVELOPMENT OF X-RAY LASER MEDIA: MEASUREMENT OF GAIN AND DEVELOPMENT OF CAVITY RESONATORS FOR WAVELENGTHS NEAR 130 ANGSTROMS Annual Report, 1 Nov. 1978 - 31 Dec. 1979
James M. Forsyth Feb. 1980 36 p refs
(Grant AF-AFOSR-3189-77)
(AD-A086670; AFOSR-0503-80TR) Avail: NTIS HC A03/MF A01 CSCL 20/5

A new experimental facility was used to explore a range of conditions under which inverted populations on soft X-ray transitions could be produced in laser heated plasmas. Direct measurements with grating spectrographs were performed in the vicinity of 130 angstroms to develop the diagnostic techniques for gain determination. Designs for reflectors suitable for use in cavity resonators at soft X-ray wavelengths were developed. Construction of apparatus to produce such reflectors was begun. A patent on the reflector design was applied for. GRA

N80-30731# United Technologies Research Center, East Hartford, Conn.
CALCULATION OF THE ENERGETICS AND COLLISION DYNAMICS OF ELECTRONIC TRANSITION LASERS Final Report, 1 Apr. 1977 - 31 Mar. 1980
H. Harvey Michaels and R. H. Hobbs May 1980 55 p refs
(Contract F49620-77-C-0064; AF Proj. 2303)
(AD-A086657; UTRC/R80-922853; AFOSR-80-0537TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

This research develops techniques and computational schemes for a priori prediction of the kinetics and the product distribution of atomdiatom reactions. This involves (1) improved calculation techniques for potential energy surfaces for the reactants and products; (2) quantum and classical mechanical calculations of the dynamics of the reaction; and (3) detailed calculations for systems with high potential as electronic transition lasers. GRA

N80-30732# Georgia Inst. of Tech., Atlanta. School of Physics.
CROSS SECTIONS FOR IONIZATION OF RARE GAS EXCIMERS BY ELECTRON IMPACT AND ATOMIC AND MOLECULAR PROCESSES IN EXCIMER LASER Final Report, 1 Apr. 1978 - 30 Sep. 1979
M. Raymond Flannery and K. J. McCann Mar. 1980 121 p refs
(Contract F33615-78-C-2028; AF Proj. 2301)
(AD-A086698; AFWAL-TR-80-2015) Avail: NTIS HC A06/MF A01 CSCL 20/5

Theoretical cross sections for ionization of metastable excimers: helium, neon, argon, krypton and zenon, and of metastable mercury are presented. Systematic trends in inelastic form factors and Born cross sections for collisional transitions between excited neighboring levels of atoms are discovered and discussed. Key cycles of atomic and molecular collision processes in excimer lasers are delineated and discussed. GRA

N80-30733# Battelle Columbus Labs., Ohio.
QUANTUM MECHANICAL STUDIES OF MOLECULAR HYPERPOLARIZABILITIES Final Technical Report
30 Apr. 1980 68 p refs
(Contract F49620-78-C-0046)
(AD-A086662; AFOSR-0466-80TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

The objectives of this effort are threefold: develop state-of-the-art quantum mechanical methods to predict, from first principles, hyperpolarizabilities of atoms and molecules; determine why previous theoretical calculations have not been able to even provide order of magnitude estimates of experimental hyperpolarizabilities; and apply the quantum mechanical techniques developed in this work to predict hyperpolarizabilities and non-linear susceptibilities for a number of atoms and molecules of interest. This effort will provide complementary information to on-going experimental efforts directed toward obtaining hyperpolarizabilities. GRA

N80-30734# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
STUDIES OF LASER SELECTIVE EXCITATION OF ATOMS
Norbert Drewell Dec. 1979 152 p refs
(Grant AF-AFOSR-2902-76)
(AD-A086497; UTIAS-229; AFOSR-80-0507TR) Avail: NTIS HC A08/MF A01 CSCL 17/4

Sample preparation through laser ablation of a solid target under vacuum has been combined with short-pulsed laser selective excitation to create a new and convenient experimental technique for measuring atomic radiative lifetimes. The lifetimes of the three resonance states of chromium determined in this way compare very favourably with those found through other experimental means. In addition, the technique has been extended to demonstrate experimentally the potential for plasma diagnostics using two-wavelength selective excitation with short laser pulses. The ratio of population densities of two energy states of chromium atoms has been measured as a function of time during the expansion of the ablation plasma. Extended saturation pumping of the resonance transition in sodium vapour has been investigated theoretically. Rate equations for 20 energy levels in the sodium atom, and the rate equations for the free electrons, were integrated numerically. It has been found that multiphoton ionization, combined with superelastic heating of free electrons can account for the rapid and complete ionization of an un-ionized vapour, as reported in the literature. The detailed theoretical results have led to the development of a simple model which accurately predicts the temporal variation of electron density. GRA

N80-30735# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
INVERSION OF SPECTRAL LINESHAPES TO YIELD COLLISIONAL RATE CONSTANTS Status Report, 1 Sep. 1978 - 31 Aug. 1980
J. Gelfand, H. Rabitz, and R. B. Miles 1 Jun. 1980 13 p refs
(Contract N00014-78-C-0721)
(AD-A086347; SR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

State-to-state collisional energy transfer rates are being obtained by the inversion of pressure broadened linewidth data. Measurements of linewidths in overtone vibration-rotation transitions have yielded information rotationally elastic and inelastic collision rates for vibrationally excited HCl. Work is continuing in acquiring similar information for vibrationally excited HF and DF using tunable laser photoacoustic spectroscopy. GRA

N80-30736# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
INFLUENCE OF WALL IMPEDANCE ON THE ELECTRON CYCLOTRON MASER INSTABILITY Final Report
Han S. Uhm 1 Mar. 1980 50 p refs
(ZR01109)
(AD-A086401; NSWC/TR-80-131) Avail: NTIS HC A03/MF A01 CSCL 20/5

The influence of finite wall impedance effects on the cyclotron maser instability of a hollow electron beam is investigated. The stability analysis is carried out within the framework of the linearized Vlasov-Maxwell equations, assuming that the beam thickness is much less than the radius of the beam. The formal dispersion relation for azimuthally symmetric electromagnetic perturbations is obtained, including the influence of an arbitrary value of wall impedance. One of the most important features of this analysis is that, for a purely resistive wall, the growth rate of instability is substantially reduced by allowing even a very small amount of resistivity. Moreover, the range of axial wave-numbers corresponding to instability increases rapidly as the wall resistivity is increased. Cyclotron maser stability properties in a dielectric loaded waveguide is also investigated. It is shown that by an appropriate choice of the dielectric constant epsilon and thickness of dielectric material, the bandwidth of instability can be increased more than twice of that for a plain conducting waveguide. GRA

N80-30737# Columbia Univ., New York. Dept. of Electrical Engineering and Computer Science.
HIGH POWER SUBMILLIMETER AND INFRARED RADIATION FROM INTENSE RELATIVISTIC ELECTRON BEAMS Final Report, 1 Jan. 1975 - 31 Dec. 1979
S. P. Schlesinger, T. C. Marshall, and P. Diament Mar. 1980 11 p refs
(Contract F44620-75-C-0055; AF Proj. 2301)
(AD-A086688; AFOSR-0545-80TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

A series of experiments was performed to test the dependence of superadient power generated by stimulated Raman backscattering (at 2 mm wavelength) upon ripple-field amplitude and length. Experiments were also performed to understand the possibility of using distributed feedback in a collective mode free electron laser. A theoretical study was completed to understand the growth of circular waveguide modes by parametric coupling to cold beam waves, with field gradients included. This is similar to free electron laser configurations to be studied in upcoming experiments. GRA

N80-30738# United Technologies Research Center, East Hartford, Conn.
SHORT PULSE UV-VISIBLE WAVEGUIDE LASER Final Technical Report, 15 May 1979 - 14 May 1980
Leon A. Newman 1 Jul. 1980 72 p refs Submitted for publication
(Contract N00014-79-C-0309)
(AD-A086856; UTRC/R80-924636-1) Avail: NTIS HC A04/MF A01 CSCL 20/5

The operation of a N2(-) ion waveguide laser (4278 A) excited by charge transfer from He2(-) created in a capacitively coupled self-sustained discharge is described. In addition, the results of an experimental diagnostic program and a computer modeling program, conducted to explain the general operations of the discharge pumped He-N2 system, are presented. The results of this program indicate upper laser level electron quenching and lower level pumping may be seriously limiting the achievable laser efficiency of this system. GRA

N80-30739# Laser Analytics, Inc., Bedford, Mass.
MODEL LS-2X LASER SOURCE DETECTOR TEST SYSTEM Final Report
May 1980 27 p refs
(Contract DAAB07-78-C-2465)
(AD-A086540) Avail: NTIS HC A03/MF A01 CSCL 17/5

Proper, characterization of infrared photodiodes requires a series of optical tests that include blackbody response, spatial uniformity, pulse response, and wavelength sensitivity measurements. The results of these optical tests will depend upon many fundamental properties of the detector crystal, namely absorption depth of the radiation, bulk lifetimes of injected carriers, surface recombination effects, carrier drift and diffusion effects, trapping effects and other mechanisms. Some of these effects are not clearly understood but may play important roles in such application as high speed pulse detectors, laser heterodyne receivers, or large area high resolution detector arrays. Spears has shown that proper spatial and temporal characterization of HgCdTe CO2 laser heterodyne receivers must be done at the operating frequencies. A realistic characterization of the pulse response of an infrared detector must be made at the operating wavelength, generally that of peak detector response. Certain fixed frequency gas lasers such as CO2, CO, or HF can provide sufficient power and speed for detector characterization but they have limited wavelength coverage and are often cumbersome to use. On the other hand, Pb-salt tunable diode lasers can provide more than 100 micro w of power emitted from nearly a point source, subnanosecond risetime pulses and wavelength selectability between 2.8 and 30 micrometers. These characteristics make diode lasers an ideal source for pulse spatial response measurements of infrared detectors. GRA

N80-30740# Naval Research Lab., Washington, D. C.
SPATIAL AND TEMPORAL COHERENCE OF A 35 GHZ GYROMONOTRON USING THE TE01 CIRCULAR MODE
M. E. Read, R. M. Gilgenbach, R. Lucey, Jr., and K. R. Chu 20 Jun. 1980 22 p refs
(XF54581007)
(AD-A086997; AD-E000486; NRL-MR-4244) Avail: NTIS HC A02/MF A01 CSCL 20/5

The characteristics of a 35 GHz oscillator operating with the TE sub 01 circular waveguide mode are described. The device

produced 147 kW, with an efficiency of 31% at 100 kW. The total radiated energy was 2 KJ per pulse. The spectral coherence appears to be equal to those of other high quality microwave tubes. The mode purity is greater than 95%. GRA

N80-30741# Naval Research Lab., Washington, D. C. Optical Sciences Div.
UNSTEADY THERMAL BLOOMING OF INTENSE LASER BEAMS Final Report, 1975 - 1977
J. T. Ulrich and P. B. Ulrich 31 Jan. 1980 19 p refs
(AD-A087207; AD-E000476; NRL-8352) Avail: NTIS HC A02/MF A01 CSCL 20/5

A four dimensional (three space plus time) computer program has been written to compute the nonlinear heating of a gas by an intense laser beam. Unsteady, transient cases are capable of solution and no assumption of a steady state need be made. The transient results are shown to asymptotically approach the steady-state results calculated by the standard three dimensional thermal blooming computer codes. The report discusses the physics of the laser-absorber interaction, the numerical approximation used, and comparisons with experimental data. A flowchart is supplied in the appendix to the report. GRA

N80-30742# Stanford Univ., Calif.
LASER PHYSICS AND LASER TECHNIQUES Final Technical Report, 1 Jan. 1977 - 31 Dec. 1979
A. E. Siegman and R. L. Byer Feb. 1980 98 p refs
(Contract F49620-77-C-0092; AF Proj. 2301)
(AD-A087245; GL-3093; AFOSR-80-0551TR) Avail: NTIS HC A05/MF A01 CSCL 20/5

A three-year program research in laser physics and techniques has been carried out to help meet Air Force mid- and long-term requirements. Development of an optically pumped atomic mercury laser was completed. Picosecond spectroscopy experiment led to measurements of ultrafast relaxation and diffusion times in solids. Work on efficient numerical methods for optical resonator calculations resulted in a Fast Hankel Transform for calculations in cylindrical coordinates. Improvements to the FHT algorithm have been made and a two-stage algorithm developed. An efficient procedure for analyzing nonlinear beam interactions has been developed; also several fundamental questions on aspects of laser resonators have been resolved. A diffraction-biased ring resonator was invented, and an analysis of phase conjugate mirror resonators carried out. Studies of optically pumped lasers including mercury dimer as a potential laser mechanism were carried out. A number of two photon laser systems were investigated, and studies of four-wave mixing as a frequency conversion process completed. Improvements in the growth of lithium niobate crystals led to higher power tunable infrared and visible sources. Finally, stimulated rotational Raman scattering was demonstrated for efficient frequency conversion in the infrared. GRA

N80-30743# Maryland Univ., College Park. Dept. of Physics and Astronomy.
RESONANT INTERACTION BETWEEN AN ACTIVE MOLECULAR MEDIUM AND A FREE ELECTRON LASER
H. Wilhelmsson Dec. 1979 19 p refs
(Contract N00014-80-C-0050)
(AD-A087056; PUB-80-116; TR-80-068) Avail: NTIS HC A02/MF A01 CSCL 20/5

The system of a relativistic electron beam and an active molecular (maser) medium in the presence of a ripple magnetic field is studied theoretically. The tunability of the free electron laser could be used to reach different lines of such a molecular medium. We use a Lorentz model to describe the molecular transitions, a hydromagnetic model for the beam, and formulate the resonance condition for the two cases where (1) the coupling occurs at a common interface, e.g., cylindrical, between the beam and the molecular medium, and (2) the beam and the molecules fill the same volume in space. The coupling between the beam and the molecules offers possibilities of enhanced radiation and improved coherence. In the case where the free electron laser acts as a pump of the molecules stimulated radiation could in principle be obtained at a new wavelength, i.e., the coupled system acts as a frequency transformer. GRA

N80-30744# Army Missile Command, Redstone Arsenal, Ala. High Energy Laser Center.
MID-TERM PROGRESS REPORT ON THE DEVELOPMENT OF ARMY CLOSED CYCLE CIRCULATOR (CCC) SYSTEM
Myron W. Cole and Cornelius C. Shih 20 Sep. 1979 110 p refs
(AD-A087219; AD-E950001; DRCPM-HEL-79-5) Avail: NTIS HC A06/MF A01 CSCL 14/2

A closed cycle circulator system was developed for recirculating the laser gas through the cavity in order that problems of acoustic attenuation, thermal control, gas contamination, and power gain may be investigated for various pulsed energy inputs at the cavity. The circulator was assembled and tested for its performance evaluation. Its instrumentation subsystem was developed and calibrated to a reasonable accuracy. For safety, standard operating procedures have been established for review and approval. The instruments calibrated include hot wire anemometers for velocity and temperature, piezoelectric transducers for pressure, flowmeter for mass flow rate, and interferometer for medium homogeneity. A series of trial tests of the closed cycle circulator system resulted in an experimental analysis of performance data providing a better control of flow conditions in the cavity through the control mechanism. GRA

N80-30745# Oak Ridge National Lab., Tenn.
EVALUATION OF A HIGH POWER SUBMILLIMETER PULSED LASER SYSTEM
K. L. VanderSluis, D. P. Hutchinson, and P. A. Staats 1980 7 p Presented at the Japan/US Workshop on Far-Infrared Diagnostics, Boston, 28 Jan. 1980
(Contract W-7405-eng-26)
(CONF-800138-1) Avail: NTIS HC A02/MF A01

The selection, development, and testing of the system components are described. The power and frequency profiles achieved in tests made on the assembled system are included. These results, and knowledge gained through design and development work, have suggested improvements in design characteristics to be applied to future research on this diagnostic method. DOE

N80-30746# Thomson-CSF, Orsay (France). Lab. Central de Recherches.
SEMICONDUCTOR LASER TECHNOLOGY: STRIPE STRUCTURE Final Report [TECHNOLOGIE LASER SEMICONDUCTEUR, STRUCTURE RUBAN]
J. C. Carballes, E. Duda, and J. Apruzzese Jan. 1978 48 p refs In FRENCH; ENGLISH summary
(Contract DGRST-76-7-0686)
(LCR-34-078/R/G5) Avail: NTIS HC A03/MF A01

Different types of stripe geometry lasers were analyzed and fabricated by the following methods: shallow proton implantation (no proton penetration in the active layer); deep proton implantation (proton penetration in the active layer); mesa etching (stripe obtained by chemical etching); and oxide isolation (local oxidation on the P side layer). The P.I characteristic (light power versus current intensity), near and far field diagram, astigmatism and thermal resistance of lasers were studied. The properties of the different types of lasers was made were examined, and their potential applications were determined. It is shown that shallow proton implantation is feasible for optical communication applications. Oxide isolation is relevant to fabrication of high light power emitting lasers. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-30747 Toledo Univ., Ohio.
SENSOR FAILURE ANALYSIS AND MULTIVARIABLE CONTROL FOR AIRBREATHING PROPULSION SYSTEMS Ph.D. Thesis
Khosrow Behbehani 1979 244 p
Avail: Univ. Microfilm Order No. 8019360

A sensor/actuator failure analysis technique for turbofan jet engines is developed. The technique utilizes redundant information

embedded in the engine model residual and does not require multiple hardware redundancy. Three phases of failure analysis, namely detection, isolation, and accommodation are considered. Failure detection and isolation techniques are developed by utilizing the concept of generalized likelihood ratio (GLR) tests. These techniques are applicable to both time-varying and time-invariant systems. Three GLR detectors are developed for: (1) hard-over sensor failure; (2) hard-over actuator failure; (3) brief disturbances in the actuators. The probability distribution of the GLR detector and the detectability of sensor/actuator failures are established. Failure type is determined by the maximum of the GRL detectors. Failure accommodation is accomplished by extending the multivariable nyquest array control design techniques to nonsquare system design. Dissert. Abstr.

N80-30748 Lehigh Univ., Bethlehem, Pa.
THE EFFECTS OF TITANIUM ON SUBMERGED-ARC WELD METAL Ph.D. Thesis
James P. Snyder, III 1980 108 p
Avail: Univ. Microfilms Order No. 8019728

The effects of titanium on the mechanical properties and microstructure in the submerged arc weld deposit of high strength, low alloy, silicon aluminum killed, low sulfur steels containing various amounts of titanium were determined. The titanium was introduced into the weld via dilution from the base plate. The nominal carbon, manganese, silicon, and titanium ranges in the weld deposits were 0.05 to 0.15, 1.0 to 1.4, 0.35 to 0.60, and 0.0 to 0.15% respectively. Generally, yield and tensile strengths correlated well with carbon, manganese, silicon, and titanium. Yield strength ranged from 449 to 535 MPa and tensile strengths ranged from 570 to 648 MPa. As titanium increased, both the yield and tensile strengths increased. The toughness was strongly dependent on titanium and manganese content, while carbon and silicon had smaller effects. Toughness ranged from 5J at -46 C to 106J at +52 C. Titanium reduced toughness by increasing the maximum weld hardness through solid solution hardening and also by increasing the amount of ferrite veining at low manganese levels. Manganese improved toughness by reducing the amount of ferrite veining and by refining the microstructure. Although titanium is detrimental to the toughness of submerged arc welds, its deleterious effects can be offset by proper selection of welding consumables. Dissert. Abstr.

N80-30749*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
AN ADVANCED TERRAIN MODELER FOR AN AUTONOMOUS PLANETARY ROVER
Erwin L. Hunter Jul. 1980 91 p refs Prepared for JPL
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163485; RPI-TR-MP-67) Avail: NTIS
HC A05/MF A01 CSCL 13I

A roving vehicle capable of autonomously exploring the surface of an alien world is under development and an advanced terrain modeler to characterize the possible paths of the rover as hazardous or safe is presented. This advanced terrain modeler has several improvements over the Troiani modeler that include: a crosspath analysis, better determination of hazards on slopes, and methods for dealing with missing returns at the extremities of the sensor field. The results from a package of programs to simulate the roving vehicle are then examined and compared to results from the Troiani modeler. L.F.M.

N80-30750*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
A PROPULSION SYSTEM FOR THE MARS ROVER VEHICLE
David C. Bogdan Aug. 1980 60 p refs Prepared for JPL
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163494; RPI-TR-MP-70) Avail: NTIS
HC A04/MF A01 CSCL 13I

The vehicle control electronics for the Mars rover vehicle is described. A functional description of the electronics and its place in the entire system is given. The hardware involved is described from a user's point of view. Changes and additions to the software are included. T.M.

N80-30751*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
A PROPULSION AND STEERING CONTROL SYSTEM FOR THE MARS ROVER
Jeffrey M. Turner Aug. 1980 82 p refs
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163501; RPI-TR-MP-77) Avail: NTIS
HC A05/MF A01 CSCL 13I

The design of a propulsion and steering control system for the Rensselaer Polytechnic Institute prototype autonomous Mars roving vehicle is presented. The vehicle is propelled and steered by four independent electric motors. The control system must regulate the speeds of the motors so they work in unison during turns and on irregular terrain. An analysis of the motor coordination problem on irregular terrain, where each motor must supply a different torque at a different speed is presented. A procedure was developed to match the output of each motor to the varying load. A design for the control system is given. The controller uses a microprocessor which interprets speed and steering commands from an off-board computer, and produces the appropriate drive voltages for the motors. T.M.

N80-30752# Army Armament Research and Development Command, Dover, N. J. Scientific and Engineering Applications Div.
THE SHAFT BOOK: DESIGN CHARTS FOR TORSIONAL PROPERTIES OF NONCIRCULAR SHAFTS: USER'S MANUAL
Robert I. Isakower Mar. 1980 95 p refs
(AD-A086498; MISD-UM-80-5) Avail: NTIS
HC A05/MF A01 CSCL 20/11

Design charts and tables have been developed for the elastic torsional stress analyses of free prismatic shafts, splines and spring bars with virtually all commonly encountered cross sections. Circular shafts with rectangular and circular keyways, external splines, and milled flats along with rectangular and X-shaped torsion bars are presented. A computer program was developed at the U.S. Army ARRADCOM, Dover, N.J. site which provides a finite difference solution to the governing (POISSON's) partial differential equation which defines the stress functions for solid and hollow shafts with generalized contours. Using the stress function solution for the various shapes and Prandtl's membrane analogy, the author is able to produce dimensionless design charts (and tables) for transmitted torque and maximum shearing stress. The design data have been normalized for a unit dimension of the cross section (radius or length) and are provided in this report for solid shapes. The eleven solid shapes presented, along with the classical circular cross section solution, provides the means for analyzing 144 combinations of hollow shafts with various outer and inner contours. Hollow shafts may be analyzed by using the computer program directly or by using the solid shape charts in this report and the principles of superposition based on the concept of parallel shafts. GRA

N80-30753# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH-TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Quarterly Report, Jan. - Mar. 1980
M. W. Horner May 1980 77 p refs
(Contract EX-76-C-01-1806)
(FE-1806-86) Avail: NTIS HC A05/MF A01

Progress in the development of a coal derived low BTU gas fueled high temperature, 2600 to 3000 F firing temperature, gas turbine for use in a combined cycle power plant is reported. Information is included on component design and testing, materials testing, and evaluation of the commerical viability of the gas turbine system. DOE

N80-30754# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Progress Report, Dec. 1979
10 Jan. 1980 37 p
(Contract EX-76-C-01-1806)
(FE-1806-79) Avail: NTIS HC A03/MF A01

Fabrication of the hot gas path development test stand is completed and the mixing chamber and the three combustion

chambers were delivered. Successful casting for the second stage nozzle was made. Ultrasonic nondestructive evaluation of the composite water-cooled nozzle was completed. No unbonding of the composite materials was detected. A plan for sectioning the nozzle for further evaluation is being prepared. Heat transfer testing on the flat plate specimen in the shock tunnel is continuing. Testing of radial cooling passages in the motorized rig continues. The effects of channel tilt, rotational speed, and channel diameter on the heat transfer performance of the passage were evaluated. Results continue to validate the design adequacy of this bucket cooling approach. Fired stability testing of the combustor fuel nozzle on test fuel (propane/steam) in the atmospheric test stand was completed. All configurations tested demonstrated adequate flame stability. Detailed status of the combustor development is reported. DOE

N80-30755# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
DESIGN AND DEVELOPMENT OF STIRLING ENGINES FOR STATIONARY POWER APPLICATIONS IN THE 500 TO 3000 HP RANGE. SUBTASK 1A REPORT: STATE-OF-THE-ART CONCEPTUAL DESIGN
1 Mar. 1980 363 p.
(Contract DE-AC02-79ET-15209)
(DOE/ET-15209-T1) Avail: NTIS HC A16/MF A01

Reliable cost data for a stationary Stirling engine capable of meeting future needs for total energy/cogeneration systems were obtained and a pragmatic and conservative base design for a first generation hardware was established. Four engine types, V-type crank engine, radial engine, swashhplate engine, and rhombic drive engine, and three heat transport systems, heat pipe, pressurized gas heat transport loop, and direct gas fired system, were selected. After a preliminary layout cycle, the rhombic drive engine was eliminated due to intolerable maintenance difficulties on the push rod seals. The V, radial and swashplate engines were taken through a detailed design/layout cycle, to establish all important design features and reliable engine weights. After comparing engine layouts and analyzing qualitative and quantitative evaluation criteria, the V-crank engine was chosen as the candidate for a 1985 hardware demonstration. DOE

N80-30756# Miami Univ., Coral Gables, Fla.
HYDROGEN ENGINE PERFORMANCE ANALYSIS PROJECT Annual Report
Robert R. Adt, Jr., Michael R. Swain, and John M. Pappas. Jan. 1980 469 p. refs. Prepared in cooperation with Hawthorne Research and Testing, Inc., Coral Gables, Fla.
(Contract EC-77-C-03-1212)
(SAN-1212-T1; AR-2) Avail: NTIS HC A20/MF A01

Baseline data for throttled and unthrottled, carburetted and timed hydrogen induction, IVC hydrogen-fueled engine configurations, with and without exhaust gas recirculation and water injection, were obtained. These data, along with descriptions of the test engine and its components, the test apparatus, experimental techniques, experiments performed and the results obtained, are given. Analyses of other hydrogen-engine project data are also presented and compared with the results of the present effort. The unthrottled engine vis-a-vis the throttled engine is found, in general, to exhibit higher brake thermal efficiency. The unthrottled engine also yields lower No sub x emissions, which were found to be a strong function of fuel-air equivalence ratio. DOE

N80-30757# Biphase Energy Systems, Inc., Santa Monica, Calif.
DESIGN STUDY OF A TWO-PHASE TURBINE BOTTOMING CYCLE Final Report
Walter R. Studhalter. 15 Jun. 1979 123 p. refs.
(Contract EY-76-C-03-1207)
(DOE/ET-15350-T1) Avail: NTIS HC A06/MF A01

The use of a biphase turbine system to recover waste heat from diesel engines was examined and found to have many favorable attributes. Among these were low rpm, high torque, low heat exchanger cost, and simplicity. Several candidate working fluid combinations were tested at temperatures of interest. The contact heat exchanger concept was substantiated by large scale experiment. The program includes subscale tests of key hardware components of a biphase turbine bottoming system. These are the two-phase nozzle, two-phase turbine, and direct contact heat exchanger. A comprehensive cost analysis was completed. A three-year program leading to a full-size system field demonstration is planned. Progress in the first year of this program and the effort started on the second year program are reported. DOE

N80-30758# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
PERFORMANCE OF A DIESEL ENGINE OPERATING ON RAW COAL-DIESEL FUEL AND SOLVENT REFINED COAL-DIESEL FUEL SLURRIES Final Report
H. P. Marshall. Mar. 1980 129 p. refs.
(Contract ET-78-S-01-3288)
(CONS-3288-T6) Avail: NTIS HC A07/MF A01

Performance tests using an 11 kW single cylinder diesel engine were made to determine the effects of three different micronized coal fuel oil slurries being considered as alternative fuels. Slurries containing 20, 32, and 40% wt micronized raw coal in no. 2 fuel oil were used. Results are presented indicating the changes in the concentrations of SO sub X and NO sub X in the exhaust, exhaust opacity, power and efficiency, and in wear rates relative to operation on fuel oil no. 2. The engine was operated for 10 hours at full load and 1400 rpm on all fuels except the 40% wt slurry. This test was discontinued because of extremely poor performance. DOE

N80-30759# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
ASSEMBLY AND TESTING OF A CATALYTIC HYDRAZINE GAS GENERATOR Final Report
E. O. Breves. 22 Feb. 1980 194 p.
(Contract ESTEC-3450/77-NL-AK(SC))
(VB-0421-011-B; ESA-CR(P)-1322) Avail: NTIS HC A09/MF A01

A standard OTS 2N catalytic hydrazine thruster was modified for use as a gas generator and life tested in a gas generator plenum system for a period of 1 year. The plenum system comprised a 7 liter tank, feeding two 0.1 N thrusters via a 5 micron filter. The thrusters were operated in a pulsed mode at a duty cycle of 0.1 s ON/1 s OFF. The plenum tank pressure was maintained between 1.9 and 2.1 bar by automatic cycling of the gas generator. The operating frequency of the gas generator was typically every 45 minutes. The operating duration per cycle was a function of the hydrazine inlet pressure. The pre-heat holding temperature of the gas generator was 180/C. The gas generator performed flawlessly during the test. However, X-ray examination of the catalyst bed at the end of test revealed that about 25% of the catalyst had been lost and that the second catalyst retainer screen had incurred a weld failure, becoming detached and displaced on one side of the chamber wall. This mechanical degradation had no influence on the performance of the gas generator. During the tests problems were encountered involving metallic cyanide deposits which blocked the thruster values. Author (ESA)

N80-30760# European Space Agency, Paris (France).
INVESTIGATION OF THE SOLIDIFICATION BEHAVIOR OF ELECTRON BEAM WELDS UNDER MICROGRAVITATIONAL CONDITIONS
Hartmut Bogs, Peter R. Sahm, and Peter Hesse. Jan. 1980 90 p. refs. Transl. into ENGLISH of "Untersuchung der Erstarrungsbedingungen von Elektronenstrahlschweissen unter Abzug der Gravitationsbedingten Konvektion in der Schmelze". Rept. BMFT-FB-W-77-40. Brown, Boverie und Cie A.G., Heidelberg Dec. 1977. Original report in GERMAN previously announced as N79-30372.
(ESA-TT-591; BMFT-FB-W-77-40) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 21.40

A literature survey was conducted to find ways and formulate how to visualize convection currents in the EB-melt-channel and thereby localize the g-dependent components of this convection. Preliminary experiments were conducted with steels to find ways to show how convection influences microstructure and properties. The results of this work have been summarized in three proposals for further experimentation. These are: electron beam welding of a transparent medium to directly visualize convection phenomena; utilization of larger than lg-values in order to extrapolate back to Og-behavior; and controlled experiments with Cr-steels

to measure the effect of convection on mechanical properties and microstructure. Author (ESA)

N80-30761# National Centre of Tribology, Risley (England). European Space Tribology Lab.
VACUUM TESTS ON A ROTARY/LINEAR SLEEVE BEARING
J. Gillies and R. B. Watters. Sep. 1979. 18 p.
(Contract ESA-2584/79)
(ESA-ESTL-42; ESA-CR(P)-1326) Avail: NTIS
HC A02/MF A01

A proprietary 1 inch nominal I/D ROTCLIN linear sleeve bush bearing was tested and compared with angular contact bearings of similar size. The bearing was torque tested in air and in vacuum over small forward and reverse angular and axial movements of the bearing shaft, and under varying conditions of temperature. Thermal conductance of the bearing stiffness was calculated and compared with a similar diameter deep groove or angular contact bearing. Author (ESA)

N80-30762# University Coll. of Swansea (Wales). Swansea Tribology Centre.
MOLYBDENUM DISULPHIDE LUBRICATION. A CONTINUATION SURVEY: 1979 TO 1980
A. R. Lansdown. 1979. 82 p. refs
(Contract ESTEC-2261/74)
(STC-79/419; ESA-CR(P)-1330) Avail: NTIS
HC A05/MF A01

The history of MoS2 as a lubricant is addressed. Specification emphasis is placed on its chemical and physical properties, the mechanism of lubrication, bonded films, lubrication by MoS2 alone or in bulk solids, oils and greases. Other dichalcogenides are mentioned as are design guidance, performance prediction, corrosion, quality control and testing. Author (ESA)

N80-30763# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
ADVANCED COMBUSTION SYSTEMS FOR STATIONARY GAS TURBINE ENGINES. VOLUME 3: COMBUSTOR VERIFICATION TESTING Final Report, Jan. 1978 - Apr. 1979
R. M. Pierce, C. E. Smith, and B. S. Hinton. Jan. 1980. 153 p. refs
(Contract EPA-68-02-2136)
(PB80-177108; FR-11405; EPA-600/7-80-017C) Avail: NTIS
HC A08/MF A01 CSCL 13B

The scaleup of the rich-burn/quick-quench (RB/QQ) model to a full scale gas turbine combustor is described and test results from the full scale evaluations are documented. Test results were very positive, showing that the RB/QQ concept can reduce NOx to approximately 45 ppm for clean distillate oil and to approximately 75 ppm for a distillate oil doped to 0.5% nitrogen, as pyridine. Carbon monoxide emissions below the 100 ppm program goal were also demonstrated. These tests also indicate that this combustor concept may be capable of low emission performance on petroleum residual oil and synthetic liquid fuels such as SRC 11 or shale oil. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-30764 Iowa State Univ. of Science and Technology, Ames.
SOME TOPICS IN RELIABILITY THEORY Ph.D. Thesis
Nader Baradaran Ebrahimi. 1980. 122 p.
Avail: Univ. Microfilms Order No. 8019629

Various notions of multivariate negative dependence are introduced and their interrelationship is studied. Examples are given to illustrate these concepts. Applications of the results in statistics and probability are given. A partial ordering is developed among negative quadrant dependent distributions with fixed marginals. Basic properties and closure under certain statistical operations are derived. Applications of the results in statistics and probability are given. Various definitions of multivariate new better than used (NBU) and new better than used in expectation (NBUE) life distributions are introduced and their interrelationship is studied. Examples are given to illustrate these concepts. Various closure properties of multivariate NBU and NBUE distributions are proved. It is shown how shock models governed by a general counting process satisfying certain conditions can generate multivariate NBU and NBUE distributions. Dissert. Abstr.

N80-30765# Florida State Univ., Tallahassee. Dept. of Statistics.
IMPERFECT REPAIR Interim Report
Mark Brown and Frank Proschan. Apr. 1980. 16 p. refs
(Contract F49620-79-C-0157; Grant AF-AFOSR-3678-78; AF Proj. 2304)
(AD-A086845; FSU-Statistics-M546; AFOSR-78-108TR; AFOSR-80-0533TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A device is repaired at failure. With probability p, it is returned to the 'good as new' state (perfect repair); with probability 1 - p it is returned to the functioning state, not is only as good as a device of age equal to its age at failure (imperfect repair). Repair takes negligible time. We obtain the distribution F sub p of the interval between successive good as new states in terms of the underlying life distribution F. We show that if F is in any of the life distribution classes: IFR, DFR, IFRA, DFRA, NBU, NWU, DMRL, or IMRL, then F sub p is in the same class. Finally, a number of monotonicity properties for various parameters and random variables of the stochastic process is obtained. The results obtained are of interest in the context of stochastic processes in general, as well as being useful in the particular imperfect repair model studied. GRA

N80-30766# IBM Federal Systems Div., Gaithersburg, Md.
ANALYSIS OF DISCRETE SOFTWARE RELIABILITY MODELS Final Technical Report, Oct. 1978 - Sep. 1979
W. D. Brooks and R. W. Motley. Griffiss AFB, N.Y. RADC. Apr. 1980. 144 p. refs
(Contract F30602-78-C-0346; AF Proj. 5581)
(AD-A086334; RADC-TR-80-84) Avail: NTIS
HC A07/MF A01 CSCL 09/2

Discrete (binomial and Poisson) software reliability models, previously developed by IBM, are presented. They were examined for their validity using historical data provided by RADC from seven development projects. Simulated error data that closely agreed with the model assumptions were also used for validation. The results indicated that the models provide reasonable fits to the historical error data. GRA

N80-30767# Aerospace Corp., El Segundo, Calif. Guidance and Control Div.
ORIENTATION OF MEASUREMENT SENSORS FOR OPTIMUM END-OF-LIFE PERFORMANCE Final Report
P. K. Mazaika. 25 Jun. 1980. 28 p. refs
(Contract F04701-79-C-0080)
(AD-A086280; TR-0080-5901-03-1; SD-TR-80-41) Avail: NTIS HC A03/MF A01 CSCL 14/4

Relative orientations of on-board measurement sensors are found that ensure the best possible measurement accuracy in the end-of-life situation when all but three sensors have failed. For five and six sensors, the optimum orientations are, respectively, the single cone and dodecahedron configurations. For seven and eight sensors, new configurations are found that are, respectively, 25 and 20% more accurate than previously proposed configurations. In general, there is a tradeoff between performance at end-of-life and performance earlier in a configuration's lifetime. GRA

N80-30768# Martin Marietta Aerospace, Orlando, Fla. Microelectronics Lab.
COMPUTER AIDED AUTOMATED HYBRID SUBSTRATE PROBE TESTING DEVELOPMENT Final Report, Oct. 1978 - Mar. 1980
Connie D. Gill and Robert E. Sulouff (Microelectronics Engineering Corp., Auburn, Ala.). 31 Mar. 1980. 39 p. refs
(Contract DAAK40-78-C-0299)
(AD-A087124; OR-15908) Avail: NTIS HC A03/MF A01 CSCL 14/2

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The use of an electron beam for the contactless probing of hybrid substrates is discussed. The injection of an electrical charge using the electron beam results in a surface field which enhances the generation of secondary electrons which a second electron probe is directed at a substrate probe position. The discussion of the theoretical basis and experimental findings are correlated. The results of this study indicate that a new method of substrate probing exists. However, careful interpretation of the results must be performed. The applicability to multilayer thick film substrates suggest future adaptation as an in-line manufacturing or test technique. GRA

N80-30769# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
DESIGN GUIDELINES AND OPTIMIZATION PROCEDURES FOR TEST SUBSYSTEM DESIGN Final Report, May 1978 - May 1979
Donald N. Lord, George A. Walz, and Stan Green. Apr. 1980 267 p. refs
(Contract F30602-78-C-0167; AF Proj. 2338)
(AD-A087059; RADC-TR-80-111) Avail: NTIS HC A12/MF A01 CSCL 14/2

This study provides guidelines and procedures to optimize the design of built-in-test equipment. The procedures are applicable to the design of both avionic and ground electronic systems. Optimization of the test subsystem is achieved by properly specifying three key design parameters (test effectiveness, mean corrective maintenance time, and test subsystem production costs) during the Conceptual Phase. These parameters then form the 'design to' criteria for optimization during the System, Subsystem, and Detail Design Phases. The report provides straightforward mathematical tools, algorithms, and trade-off procedures to assist the designer during each design phase. GRA

N80-30770# Societe Anonyme Belge de Constructions Aeronautiques, Brussels (Belgium).
HIGH PERFORMANCE VCHP LIFE TEST Final Report
Dec. 1979 60 p. refs
(Contract ESA-3007/76)
(ESA-CR(P)-1321) Avail: NTIS HC A04/MF A01

A one year aging test was conducted on stainless steel, ammonia filled, 9.5 mm diameter variable conductance heat pipes (VCHP). The VCHP's are capable of transporting 100 watt meter and of achieving a temperature control range of 8 C when operated passively. One year aging was completed without degradation of the maximum heat transport or temperature control range. Several parameters influencing the temperature control range were further investigated. Aging will continue for two more years under the same conditions. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis, fatigue, and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-30771 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NO. 5
Judith Nagle-Eshleman, ed. May 1980 115 p. refs
(AD-A085328) Avail: Naval Research Lab., Attn: code 5804, Washington, D.C. 20375. Annual rate HC $100.00 CSCL 20/11

Dynamic problems related to shock and vibration are addressed. Specific emphasis is given to the technical developments applicable to problems on the following systems: sea systems; ground system; air system; and space systems. For individual titles, see N80-30772 through N80-30773.

N80-30772 Army Materials and Mechanics Research Center, Watertown, Mass.
SHOCK IN SOLIDS: ARMY MATERIALS RESEARCH AND APPLICATIONS
R. Shea and J. F. Mescall. *In* Shock and Vibration Information Center. The Shock and Vibration Digest, Vol. 12, No. 5, May 1980 p. 7-18 refs. Presented at the 50th Shock and Vibration Symp., Colorado Springs, Colo., Oct. 1979 (For primary document see N80-30771 21-39)
Avail: Naval Research Lab., Attn: code 5804, Washington, D.C. 20375. Annual rate HC $100.00 CSCL 20/11

Guidelines are presented for using existing materials and to develop materials for armor, penetrators, and fragment devices. The codes for predicting the shock response of solids are discussed as well as failure mechanisms and current research efforts. R.C.T.

N80-30773 Argonne National Lab., Ill.
CROSS-FLOW-INDUCED INSTABILITIES OF CIRCULAR CYLINDERS
S. S. Chen. *In* Shock and Vibration Information Center. The Shock and Vibration Digest, Vol. 12, No. 5, May 1980 p. 21-34 refs (For primary document see N80-30771 21-39)
Avail: Naval Research Lab., Attn: code 5804, Washington, D.C. 20375. Annual rate HC $100.00 CSCL 20/11

Dynamic instability of circular cylinder arrays subjected to cross flow is reviewed. Instability mechanisms, different types of instability, mathematical models, empirical correlations for the critical flow velocity, and effects of various system parameters are discussed. Author

N80-30774 California Inst. of Tech., Pasadena.
THE APPLICATION OF OPTICAL INTERFEROMETRY TO TIME DEPENDENT UNBONDING, PARTS 1, 2, AND 3 Ph.D. Thesis
Kenneth MacDougall Liechti. 1980 155 p.
Avail: Univ. Microfilms Order No. 8020424

The local crack front deformation is measured to examine the limits of the validity for the linear theory and to provide a basis for future modelling. Within this framework, particular attention is paid to the aspects of local failure mode interaction and the time dependence of the unbonding process. The small displacements in the crack front region require a resolution on the order of a wavelength of light. The experimental techniques used are therefore based on optical interferometry. The displacements applied to the adherends are controlled to the same order by a thermally actuated servoloading device. The development of the experimental techniques used to measure the unbound profiles as well as to measure and control the displacements applied to the adherends are discussed. For stationary cracks, experiments are described which examine the extent of the nonlinearity in the crack front deformation field while fracture criteria are developed and compared for unbonding rates in steadily propagating cracks. Proposals for improvement of the experimental techniques and further experiments are discussed. Dissert. Abstr.

N80-30775 Carnegie-Mellon Univ., Pittsburgh, Pa.
ON THE DYNAMIC ENERGY RELEASE RATE IN ELASTIC CRACK PROPAGATION Ph.D. Thesis
Chikayoshi Yatomi. 1980 52 p.
Avail: Univ. Microfilms Order No. 8020172

A unified treatment of the dynamic energy release rate, epsilon, for a sharp, straight crack in a hyperelastic body undergoing finite strain is presented. Epsilon is decomposed into the usual quasi static energy release rate plus a nonpositive dynamic contribution. Thus, for a dynamic solution the energy release rate computed using the classical quasi static formula is larger than the actual dynamic energy release rate. Dissert. Abstr.

N80-30776 Rensselaer Polytechnic Inst., Troy, N. Y.
ON THE THERMOMECHANICAL RESPONSE OF 3.5 Ni-Mo-V ALLOY STEEL AND TYPE 304 STAINLESS STEEL UNDERGOING CYCLIC UNIAXIAL INELASTIC DEFORMATION Ph.D. Thesis
Steven Lester Adams. 1980 208 p.
Avail: Univ. Microfilms Order No. 8020394

The rise in temperature technique was used to measure the thermomechanical responses of 3.5 Ni-Mo-V low alloy steel and type 304 stainless steel subjected to fully reversed strain controlled cyclic uniaxial deformation. The nominal total mechanical strain

range was equal to 0.01 and the test frequency was 1.0 hz. Both materials exhibited significant self-heating with maximum specimen temperatures increasing 55 C after one hundred seconds. A comparison of measured temperatures with predicted temperatures which had been calculated assuming the complete convertibility of the mechanical plastic work into heat shows that it is necessary to postulate a structural power response in order to completely match the measured temperature response. The structural power response exhibited a transient and a quasi steady-state component. Both the 3.5 Ni-Mo-V and the type 304 stainless possessed cumulative energy stored or released responses similar to torsionally deformed OFHC copper.
Dissert. Abstr.

N80-30777 Rensselaer Polytechnic Inst., Troy, N. Y.
LINEAR-NONLINEAR INTERFACE FOR FINITE ELEMENT TRANSIENT IMPACT DAMAGE ANALYSIS Ph.D. Thesis
Kenneth William Brown 1980 105 p
Avail: Univ. Microfilms Order No. 8020397

A nonlinear transient finite element structural model is interfaced with a linear finite element representation. This analysis technique, which allows local nonlinear modeling of a predominantly linear structural response, is shown to be particularly applicable to impact damage analysis of jet engine fan blades, due to the relatively local nature of blade nonlinear response to impact events, coupled with the large area where linear theory is sufficient for blade impact response definition. Analysis efficiency is enhanced through elimination of stiffness recomputation over the regions of the structure where linear theory is appropriate. Additional enhancement is obtained through the application of problem size reduction procedures to the linear analysis region. Using the present techniques run time reductions of greater than seventy per cent were attained. Comparisons are made between test and the present analysis technique for three test cases. Very good correlations are noted between test and analysis for deflections of an explosively loaded flat plate and a gelatin ball impacted flat panel. Dynamic strain comparisons are shown, with good agreement between test and analysis.
Dissert. Abstr.

N80-30778 Washington Univ., Seattle.
TECHNIQUES OF ANALYSIS OF LOAD-DISPLACEMENT RECORDS BY J-INTEGRAL METHODS Ph.D. Thesis
Hugo Alejandro Ernst 1979 215 p
Avail: Univ. Microfilms Order No. 8019161

Exact methods are used to obtain J from a single load displacement record for different configurations based on dimensional analysis and deformation theory of plasticity to imply the dependence of the load on crack length and displacement. The methods also permit the evaluation of the crack length increment delta a and hence complete J-R curves can be constructed. Formulae for T sub mat and T sub app are presented as well. Conditions for the existence of the so called eta factor are stated, and subsequent simplifications of the general method by its use are shown. Results of analysis of experimental work for different configuration material combinations are presented showing the adequacy of the general methodology.
Dissert. Abstr.

N80-30779 California Inst. of Tech., Pasadena.
ON THE PROPAGATING BUCKLE AND ITS ARREST Ph.D. Thesis
Stelios Kyriakides 1980 198 p
Avail: Univ. Microfilms Order No. 8019894

If an offshore pipeline locally buckles in the presence of sufficiently large external pressure, a propagating buckle is initiated. The buckle propagates along the pipeline until it encounters a region of adverse conditions-low pressure or an arresting device. The lowest pressure at which a buckle propagates is defined as the propagation pressure. An experimental study of this quantity is presented and a semi-empirical expression derived by examining various models of the phenomenon. The dynamics of the propagating buckle are also examined and a parametric study of the steady state velocity of propagation is carried out. A systematic way of empirically deriving the parametric dependence of arresting devices is included and experimental results of two such arrestors are discussed. A 'flip-flop' mode of propagation was discovered and studied. An explanation of the phenomenon is attempted.
Dissert. Abstr.

N80-30780 South Carolina Univ., Columbia.
GENERAL SHEARING SPECKLE INTERFEROMETRY AND NUMERICAL BOUNDARY-INTEGRAL TECHNIQUES IN EXPERIMENTAL MECHANICS Ph.D. Thesis
Faissal Abdel Haleem Moslehy 1980 102 p
Avail: Univ. Microfilms Order No. 8020306

Laser speckle interferometry is used as an experimental technique to measure in-plane surface displacement components of a deformed solid. A general theory of laser speckle interferometry which includes both the contributions of in-plane and out of plane deformation is developed and verified through several experimental examples. The basic information consists of a double exposure photographic record of a sheared wavefront of the image of the surface points of a body in a reference and deformed configurations. Several examples are presented to illustrate the application of the coupled laser speckle interferometry and boundary integral solution technique to two dimensional elasticity problems. This coupled technique between laser speckle interferometry and the numerical boundary integral equation method proved to be an accurate and efficient procedure for solving significant engineering problems.
Dissert. Abstr.

N80-30781 Michigan State Univ., East Lansing.
LARGE DEFLECTION RESPONSE OF AN ELLIPTICAL SECTION RING TO DISTURBED AXIAL LOAD Ph.D. Thesis
Lawrence Alan Nattrass 1980 155 p
Avail: Univ. Microfilms Order No. 8020725

The behavior of a circular ring with an elliptical cross-section was studied to determine its suitability as a spring. The design parameters for a spring system to support and axial load included an annular configuration of fixed diameter and minimum volume. The load and deflection range were specified. Since the spring supported a mass, the natural frequency of the system was also a consideration. Considering the need to store a fixed amount of energy in a minimum volume, the optimum spring appeared to be one which had a flat load-deflection curve. The load-deflection characteristics of the ring proved to meet most of the system parameters. The uniqueness and originality of the concept necessitated the development of an analytical model, prediction of performance and failure parameters and experimental verification of the design. An analytical model was developed to predict the force-deflection and stress-deflection characteristics of a given ring. The effects of friction were considered and the useful range of the ring was described in terms of critical angles for self-locking. The model agreed with the experimental results.
Dissert. Abstr.

N80-30782 Massachusetts Univ., Amherst.
NONLINEAR BEHAVIOR OF GUYED TOWERS Ph.D. Thesis
Chi-Yuan Ling 1980 160 p
Avail: Univ. Microfilms Order No. 8019476

The large deflection, elastic behavior of guyed towers subjected to both vertical and horizontal loads at the top is investigated. The exact governing nonlinear equations are derived using variational calculus and solved by means of the Newton-Raphson method. Postbuckling paths for systems with or without pretension in the cables are obtained. The collapse loads of systems with vertical loads as well as vertical and horizontal loads are determined. The effect of a distributed wind load on the tower is also studied. Both cables with and without the effect of sag due to wind and weight are considered. Numerical results are presented. Only relatively short towers, approximately 100 ft. tall, that are supported by a single set of guy wires are discussed. Both three and four cable guys as well as fixed and hinged mast bases are considered.
Dissert. Abstr.

N80-30783 Minnesota Univ., Minneapolis.
NUMERICAL OPERATIONAL METHODS IN STRUCTURAL DYNAMICS Ph.D. Thesis
Ganapathy Venkata Narayanan 1980 298 p
Avail: Univ. Microfilms Order No. 8019552

A general and systematic discussion on the use and importance of the operational method of Laplace transform for determining the response of large linear dynamic systems governed by partial or ordinary differential equations of the second order with respect to time is presented. The Laplace transform technique,

when applied on these equations with respect to time, reduces the dynamic problem to a state one, which can be solved in the transform plane by any covenient numerical method such as the finite element, finite difference or boundary integral method. The final solution or response of the dynamic system is obtained by a numerical inversion of the transformed solution. Various existing methods of numerical inversion of Laplace transform, selected on the basis of their generality, accuracy and computational efficiency, are reviewed and critically discussed in great detail. Two groups of numerical examples from the area of structural vibrations are presented in detail to illustrate the application of these numerical operational methods.
Dissert. Abstr.

N80-30784 Princeton Univ., N. J.
APPLICATION OF A ROOT LOCUS TECHNIQUE TO MULTILOOP VELOCITY OUTPUT FEEDBACK VIBRATION SUPPRESSION CONTROLLERS Ph.D. Thesis
Daniel Croel Herrick 1980 150 p
Avail: Univ. Microfilms Order No. 8018660

This technique is a generalization of the classical single input single output root locus. Formulas are developed for the root behavior of the structural equation when the damping matrix is either small or large. Low gain root behavior termed departure rates in the neighborhood of the natural frequencies of vibration, are given by a matrix perturbation equation. Formulas for high gain behavior describe the possible limiting migration patterns for damped structural poles called finite zero, infinite zero asymptotes and origin zero arrival directions. The predictability of root behavior for intermediate levels of gain based on the root locus formulas is examined. Some matrix prescription based on the root locus formulas are tested. The root locus approach is tested with several sample structures, the most complicated comprising twelve resonant modes. Some of the mathematical techniques that underlie the root locus technique are applied to the calculation of frequency response fixed points. Dissert. Abstr.

N80-30785# National Aerospace Lab., Amsterdam (Netherlands).
MINITWIST, A SHORTENED VERSION OF TWIST
H. Lowak, J. B. de Jonge, J. Franz, and D. Schuetz 1 May 1979 27 p refs Prepared in cooperation with Lab. fuer Betriebsfestigkeit, Darmstadt, West Germany
(NLR-MP-79018-U; ICAF-1147; LBF-TB-146) Avail: NTIS HC A03/MF A01

A description of the shortened version of the Transport Wing Standard Program (TWIST) is given. In all cases where testing time is a prohibitive factor to use TWIST, it is proposed to use this shortened program. The user of this shortened program should be aware that in most cases the load cycles with high frequency and low amplitude omitted in MINITWIST would contribute to damage; thus the results will overestimate the fatigue life. T.M.

N80-30786# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
NON-CONTACTING STRAIN CONTROL AND ACOUSTIC EMISSION IN HIGH-TEMPERATURE TESTING
H. Fuhring [1979] 10 p refs
(ICAF-1142) Avail: NTIS HC A02/MF A01

Methods and accuracy of longitudinal strain control tests of smooth cylindrical specimens, crack initiation detection, and high temperature testing using acoustic emissions are described. T.M.

N80-30787*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LATERAL DENSITY VARIATIONS IN ELASTIC EARTH MODELS FROM AN EXTENDED MINIMUM ENERGY APPROACH
Braulio V. Sanchez Jun. 1980 29 p refs Submitted for publication
(NASA-TM-80742) Avail: NTIS HC A03/MF A01 CSCL 08M

Kaula's minimum energy approach was extended to include the nonhydrostatic gravitational potential energy and the density perturbation field was obtained to degree and order eight. The depth profiles for the density perturbation show a stratification with density excesses and deficiencies alternating with depth. The addition of the gravitational potential energy in the minimization process does not change significantly the conclusions based on results for the minimum shear strain energy case, concerning the inability of the mantle to withstand the lateral loading elastically. T.M.

N80-30788# Metcut Research Associates, Inc., Cincinnati, Ohio.
CRITICALLY LOADED HOLE TECHNOLOGY ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT Final Report, 27 Dec. 1977 - 27 Oct. 1979
John B. Kohls, Stephen C. Ford, and George Roth Wright-Patterson AFB, Ohio AFML Mar. 1980 135 p Prepared in cooperation with Battelle Columbus Labs., Ohio and Dayton Univ. Research Inst., Ohio
(Contract F33615-78-C-5030)
(AD-A086021; AFWAL-TR-80-4027; Rept-970-26000-1) Avail: NTIS HC A07/MF A01 CSCL 11/6

A pilot test program was conducted which consisted of a coordinated test activity between interested AGARD SMP member countries. The program leads to a more uniform attitude toward fatigue testing and evaluation of critically loaded hole parameters among its participants. This report describes the U.S. portion of the test program. The report includes both open hole and low load transfer joint testing of specimens having both high and low quality test holes. The quality level of the holes was based primarily on cost. The report also includes a technique for verifying the loading accuracy of the spectrum fatigue equipment used by each of the participants. GRA

N80-30789# Dayton Univ., Ohio.
QUICK REACTION EVALUATION OF MATERIALS FOR SYSTEMS APPLICATIONS Final Temperature Report, 3 Jan. 1978 - 31 Mar. 1980
D. R. Askins, R. R. Cervay, D. L. Hart, and B. H. Wilt Wright-Patterson AFB, Ohio AFML Apr. 1980 372 p refs
(Contract F33615-78-C-5002; AF Proj. 2421)
(AD-A085859; UDR-TR-80-12; AFWAL-TR-80-4025) Avail: NTIS HC A15/MF A01 CSCL 11/4

This report is divided into four sections summarizing the engineering studies completed under contract to the Air Force Wright Aeronautical Laboratories, Materials Support Division. A variety of materials evaluations were completed under the categories of Alloys and Composites, Electronic Failure Analysis, Elastomers, and Plastics, Adhesives, and Composites. GRA

N80-30790# Ceramic Finishing Co., State College, Pa.
LOCALIZED IMPACT DAMAGE IN CERAMICS. LOCALIZED IMPACT DAMAGE IN ZINC SULFIDE CRACK GROWTH FROM SMALL FLAWS IN LARGER GRAINS IN ALUMINA Technical Report, 1 Feb. 1979 - 31 Jan. 1980
H. P. Kirchner, T. J. Larchuk, and J. M. Ragostra Feb. 1980 104 p
(Contract N00014-74-C-0241)
(AD-A085874; TR-8) Avail: NTIS HC A06/MF A01 CSCL 11/2

The following topics are covered in this report (1) localized impact damage in zinc sulfide, and (2) crack growth from small flaws in larger grains in alumina. Zinc sulfide specimens were damaged by static and impact loading using glass spheres. The various types of cracks were identified and their size were measured. The maximum impact loads were estimated by several methods including an experimental method based on the assumption that static and impact loads are equal at equal indentation radii, a semiempirical method previously developed on this program and a method suggested by Hutchings. Crack growth in alumina was simulated for the case of small flaws in larger surface crystals to determine the range of crystal sizes and loading rates in which single crystal fracture energies would be expected to control fracture. This should be expected only for large crystals and very high loading rates. GRA

N80-30791# Terra Tek, Inc., Salt Lake City, Utah.
EVALUATION OF A NEW FRACTURE TOUGHNESS MEASURING TECHNIQUE, AND ADAPTATION OF THE TECHNIQUE TO USE ULTRA-SMALL SPECIMENS Final Report
Lynn M. Barker Sep. 1979 54 p refs
(Contract DAAG46-78-C-0040; DA Proj. 1L1-62105-AH-84)
(AD-A085892; AMMRC-TR-79-53) Avail: NTIS

HC A04/MF A01 CSCL 11/6

Three separate investigations were undertaken to determine the applicability of the short rod fracture toughness measurement method to materials such as HF1 fragmentation steel, which is of particular interest to the Army. In the first study, short rod fracture toughness (K sub Ic SR) measurements were compared with ASTM E 399 measurements of toughness (K sub Ic) in a number of metallic materials. Very good agreement was found. In the second study, the methods of fabricating and testing ultrasmall short rod specimens (6.35 mm diameter) were developed and used in measurements of HF1 material taken from actual shell casings. The agreement of the ultrasmall short rod measurements with the toughness as measured by precracked charpy specimens of the same material was rather poor. The third study was made to determine the sensitivity of the short rod toughness measurement to the size of the specimen used in the test. Short rods of various sizes of 4340 steel and two heat treatments of HF1 steel were tested. The specimen size independence of the 4340 steel was marginal, but it was excellent for the HF1 steel. A trend toward an increasing scatter in K sub IC SR data with decreasing specimen size was noted. Recommendations for decreasing the data scatter and automating the test are made. GRA

N80-30792# Rockwell International Corp., Columbus, Ohio. Missiles Systems Div.

NUMERICAL ESTIMATION OF STRESS INTENSITY FACTORS BY A FINITE DIFFERENCE EULERIAN METHOD (THE HELP CODE) Final Report

M. S. Chawla and J. A. Zukas. Aberdeen Proving Ground, Md. Ballistics Research Labs. Apr. 1980. 38 p. refs.

(Contract DAAD05-77-C-0139)

(AD-A086111; AD-E430460; ARBRL-CR-00426) Avail: NTIS HC A03/MF A01 CSCL 19/4

A finite difference Eulerian code, HELP, is employed to study the stress enhancement effects in the vicinity of a crack tip in a rectangular plate which is subjected to a sudden uniaxial loading in the plane strain geometry. The results are in excellent agreement with those obtained from other methods. This demonstrates the usefulness and accuracy of the HELP code in simulating dynamic problems of fracture mechanics. GRA

N80-30793# State Univ. of New York at Buffalo. Dept. of Engineering Science, Aerospace Engineering and Nuclear Engineering.

TORSIONAL WAVES IN A BIMETALLIC CYLINDER. PART 1: AXIALLY HOMOGENEOUS CASE

R. K. Kaul, R. P. Shaw, and W. Muller. Oct. 1979. 43 p. refs.

(Contracts N00014-75-C-0302; N00014-71-C-0108)

(AD-A085822; Rept-107) Avail: NTIS HC A03/MF A01 CSCL 20/11

The dispersion spectrum is found for axially symmetric torsional waves in an elastic, bimetallic rod with cylindrical core and concentric outer casing. Plotting of the various branches of the spectrum is simplified by the presence of discrete invariant points which are independent of the material properties, and through which the spectral lines must pass. The slope and curvature of the spectral lines at cutoff frequencies, the asymptotic approximations at high frequency, the nonexistence of complex branches, the problem of coexistence and the concept of energy flow are also studied. GRA

N80-30794# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.

A COMPARATIVE STUDY ON THE ELASTIC-PLASTIC COLLAPSE STRENGTH OF INITIALLY IMPERFECT DEEP SPHERICAL SHELLS

Robert Kao. Feb. 1980. 42 p. refs.

(Contract N00014-75-C-0946)

(AD-A086006) Avail: NTIS HC A03/MF A01 CSCL 13/13

A finite-difference method for the large deformation elastic-plastic analysis of spherical caps is applied to predict the collapse strength of initially imperfect deep spherical shells. Twelve uniformly loaded hemispherical shell models with flat spots at their apex are analyzed. For each model, a number of shallow spherical regions containing the flat spot are selected from its domain. One of these selected shallow regions yields a minimum buckling pressure; this minimum value is taken as the theoretical buckling load for the shell model under consideration. Present solutions are in good agreement with existing experimental and empirical results. The good comparison suggests that initially imperfect deep spherical shells may be analyzed by using a much simpler mathematical model - the spherical cap, and thus the analytical cost may be greatly reduced. This also demonstrates that the collapse of imperfect spherical shells is primarily a local phenomenon and therefore dependent on local geometry. Consequently, the presence of initial imperfections must be fully taken into consideration in any large deformation inelastic buckling analysis before such analysis can be expected to quantitatively predict the collapse strength of practical shell structures. GRA

N80-30795# Dayton Univ., Ohio. Aerospace Mechanics Div.

A REVIEW OF NONLINEAR FRACTURE RELATIVE TO FATIGUE Final Report, Sep. 1978 - Sep. 1979

T. Weerasooriya, J. P. Gallagher, and H. C. Rhee. 30 Sep. 1979. 85 p. refs.

(Contract F33615-78-C-5184; AF Proj. 2418)

(AD-A086671; UDR-TR-79-99; AFML-TR-79-4196) Avail: NTIS HC A05/MF A01 CSCL 20/11

This report reviews currently available parameters, methodology, and data that support further developments in elastic-plastic fracture mechanics (EPFM) technology for modeling fatigue crack growth rate (FCGR) behavior. In general, it can be stated that linearly elastic fracture mechanics (LEFM) parameters can be used to model FCGR behavior except when the zone of cyclic plasticity accompanying the crack process is large with respect to crack length and other structural length parameters. The literature provides two types of EPFM parameters which are available for modeling FCGR behavior when the limitations of LEFM are exceeded: one type is based on the characterization of the intensity of the crack tip stress-strain field; the other is based on the determination of a specific mechanical parameter which is evaluated at a point close to the crack tip. GRA

N80-30796# Vought Astronautics, Dallas, Tex.

FATIGUE AND FRACTURE OF ULTRAHIGH STRENGTH STEEL AND TITANIUM ROLL BONDED AND DIFFUSION BONDED LAMINATES Final Report, 25 Sep. 1978 - 25 Mar. 1980

L. E. Sloter and D. H. Peterson. May 1980. 79 p. refs.

(Contract N00019-78-C-0491)

(AD-A086511; ATC-R-9200/OCR-31) Avail: NTIS HC A05/MF A01 CSCL 11/6

The results of the fabrication by roll bonding of metal-metal laminates and the fatigue and fracture toughness testing of these laminates are reported and discussed. Laminate panels have been prepared from layers of steel alloy 300M interleaved with thin layers of two carbon steels and an ultrahigh carbon steel and from Ti-10V-2Fe-3Al interleaved with Ti-15V-3Cr-3Al-3Sn by roll bonding and from Ti-6Al-4V interleaved with commercially pure titanium by diffusion bonding. Both the steel and titanium alloys were heat treated such that their maximum strengths were obtained. Through proper selection of interleaf alloys (thin layers of material bonded between primary layers of the principal alloy) and heat treatment, critical frcture toughness properties were improved by over 100% over the monolithic values at ultimate strength levels of 290 ksi (1999 MPa) for the 300M steel and 190 ksi (1310 MPa) for the Ti-10V-2Fe-3Al. This improvement brought the toughness at these strength levels to values acceptable for damage tolerant service in aerospace structures or other structures requiring high fracture toughness at high strength levels. Furthermore, the fatigue strength of simulated flawed structural items machined from laminated plate was demonstrated to be superior to the equivalent monolithic material for both the steel and titanium alloys. GRA

N80-30797# Princeton Univ., N. J. Dept. of Civil Engineering.

NONLOCAL STRESS FIELD AT GRIFFITH CRACK

N. Ari and A. Cemal Eringen. Jun. 1980. 28 p. refs.

(Contract N00014-76-C-0240; NR Proj. 064-410)

(AD-A086496; Rept-80-SM-7; TR-54) Avail: NTIS HC A03/MF A01 CSCL 20/11

By means of nonlocal elasticity theory, the Griffith crack problem is solved to determine the state of stress in a plate weakened by a line crack. The maximum stress is found to be

finite and occurs away from the crack tip. Cohesive stress is estimated and compared with the calculations based on atomic lattice theory. GRA

N80-30798# Wisconsin Univ. - Madison. Mathematics Research Center.
A DECOMPOSITION PROCEDURE FOR LARGE SCALE OPTIMAL PLASTIC DESIGN PROBLEMS Technical Summary Report
Ikuyo Kaneko and Cu Duong Ha. May 1980. 30 p. refs.
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A086560; MRC-TSR-2075) Avail: NTIS HC A03/MF A01 CSCL 12/1
A decomposition procedure is proposed in this paper for solving a class of large scale optimal design problems for perfectly plastic structures under several alternative loading conditions. The conventional finite element method is used to cast the problem into a finite dimensional constrained nonlinear programming problem. Structures of practically meaningful size and complexity tend to give rise to a large number of variables and constraints in the corresponding mathematical model. The difficulty is that the state-of-the-art Mathematical Programming theory does not provide reliable and efficient ways of solving large scale constrained nonlinear programming problems. The natural idea to deal with the large scale structural problem is to somehow decompose the problem into an assembly of small size problems each of which represents an analysis of the behavior of each finite element under a single loading condition. This paper proposes one such way of decomposition based on the duality theory and a recently developed iterative algorithm. GRA

N80-30799# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
THE SURFACE SINGULARITY OF CRACKS Interim Report
Zdenek P. Bazant and Luis F. Estenssoro. Oct. 1979. 162 p. refs. Submitted for publication.
(Grant AF-AFOSR-2859-75; AF Proj. 2307)
(AD-A086491; Struct-Eng-79-10/2515; AFOSR-80-0457TR) Avail: NTIS HC A08/MF A01 CSCL 20/11
The three dimensional singular stress field near the terminal point 0 of the crack front edge at the surface of an elastic body is investigated. The variational principle governing the displacement distribution on a unit sphere about point 0 is derived from the differential equations of equilibrium, and more directly, from the potential energy. By energy flux arguments it is found that the front edge of a propagating crack must terminate at the surface obliquely at a certain angle, whose dependence upon the inclination of a crack plane is also solved. The angle is the same for Modes 2 and 3, but different for Mode 1. For Mode 1, the surface point trails behind the interior of the propagating crack, while for Modes 2 and 3 it moves ahead. Consequently, a combination of Mode 1 with Modes 2 and 3 is impossible at the surface terminal point of a propagating crack whose plane is orthogonal. When the plane is inclined, the three intensify factors can combine only in certain fixed ratios. The crack edge angle is a function of the angle of the crack plane. Some results are also presented for notches and for cracks that intersect a two material interface. E.D.K.

N80-30800# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON THE CHARACTERIZATION OF STRAIN-HARDENING IN PLASTICITY
J. Casey and P. M. Naghdi. May 1980. 47 p. refs.
(Contract N00014-75-C-0148; NR Proj. 064-436)
(AD-A086551; UCB/AM-80-5) Avail: NTIS HC A03/MF A01 CSCL 20/11
In the context of a purely mechanical, rate-type theory of elastic-plastic materials and utilizing a strain space formulation, this paper is concerned mainly with developments pertaining to strain-hardening behavior consisting of three distinct types of material response, namely hardening, softening and perfectly plastic behavior. It is shown that such strain-hardening behavior may be characterized by a rate-independent quotient of quantities occurring in the loading criteria of strain space and the corresponding loading conditions of stress space. With the use of special constitutive equations, the predictive capability of the results obtained are illustrated for strain-hardening response and saturation hardening in a uniaxial tension test. GRA

N80-30801# Washington Univ., Seattle. Dept. of Mechanical Engineering.
INFLUENCE OF SMALL SCALE YIELDING ON DYNAMIC FRACTURE Interim Report
A. S. Kobayashi, M. Ramulu, and B. S-J. Kang. May 1980. 21 p. refs.
(Contract N00014-76-C-0060; NR Proj. 064-478)
(AD-A086335; TR-38) Avail: NTIS HC A02/MF A01 CSCL 20/11
Dynamic fracture and crack-arrest responses of the well-discussed wedge-loaded rectangular, double cantilever beam (WL-RDCB) specimens machined from a 3.2 mm thick annealed polycarbonate sheet were studied by dynamic photoelasticity and dynamic finite element analysis. A small, but finite plastic yield zone surrounded the propagating crack which resulted in crack velocities, dynamic fracture toughness and crack arrest toughness lower than those observed previously in 6.4 mm thick polycarbonate fracture specimens. GRA

N80-30802# Wisconsin Univ. - Madison. Mathematics Research Center.
AN INTEGRAL BOUND ON THE STRAIN ENERGY FOR THE TRACTION PROBLEM IN NONLINEAR ELASTICITY WITH SMALL STRAINS
Joseph J. Roseman (Tel-Aviv Univ.). Apr. 1980. 20 p. refs.
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041; Grant DAAG29-76-G-0102)
(AD-A086377; MRC-TSR-2060) Avail: NTIS HC A02/MF A01 CSCL 20/11
For the traction boundary value problem in nonlinear elastostatics for a body which is convex in its undeformed reference state and with the assumption of sufficiently small strains (but not necessarily small displacement gradients), an upper bound is obtained for the elastic strain energy in terms of the L sub 2-integral norms of the surface tractions and body forces with the constant depending only upon the ratio of the outer and inner diameters and the physical constants of the material. This result extends previous known results in linear elasticity (infinitesimal displacement gradients) and finite elasticity (small but finite displacement gradients) into the small strain theory of nonlinear elasticity. GRA

N80-30803# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
CURING STRESS FIELDS IN INVOLUTE EXIT CONES Final Report, 1 Nov. 1979 - 15 Feb. 1980
N. J. Pagano. Feb. 1980. 58 p. refs. Prepared in cooperation with Prototype Development Associates, Inc., Santa Ana, Calif.
(AF Proj. 2419)
(AD-A086404; AMFL-TR-79-4191) Avail: NTIS HC A04/MF A01 CSCL 20/11
A procedure is developed for determining the unusual distribution of ply material in an involute exit cone and then it is used in an analysis of the curing stresses in an IUS exit cone billet. The ply pattern analysis produces three Euler angles at each material point that are used to define properties for a finite element model of the billet. Attention is focused on the delamination failure mode observed during post cure and large regions of cross-ply tension are shown to occur during cool down. Comparisons with autopsy data show that the predicted ply fiber distribution is in good agreement with that observed in the IUS billet, while the finite element stress pattern seems to correlate with observed cracking patterns. Finally, a sensitivity study shows a striking dependence of the interlaminar normal stress on the orientation of the ply pattern on the cloth. GRA

N80-30804# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Mechanical and Industrial Engineering.
OPTIMALITY CRITERION TECHNIQUES APPLIED TO STRUCTURES COMPOSED OF DIFFERENT ELEMENT TYPES Technical Report, Sep. 1978 - May 1980
M. I. Syed, K. D. Willmert, and M. R. Khan. 1980. 10 p. refs. Presented at the 21st AIAA/ASME Struct., Structural Dyn. and Mater. Conf., Seattle, 12-14 May 1980.
(Contract N00014-76-C-0064)

(AD-A086644; MIE-059) Avail: NTIS HC A02/MF A01 CSCL 11/4

The optimality criterion design method, developed by Khan, Willmert and Thornton which exploits the concept of one most critical constraint, has been extended in this paper to handle more complex structures, specifically ones composed of several different types of elements. The elements considered were the truss, and two different plane stress elements: a constant strain triangular element and a rectangular symmetric shear panel. The optimality criterion method treats multiple load conditions and stress and displacement constraints. A wing-box structure is considered as an example to demonstrate the efficiency and simplicity of the method. GRA

N80-30805# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN ASTRONOMICAL GLOSSARY
Laurence G. Taff. 12 Feb. 1980. 105 p.
(Contract F19628-80-C-0002; AF Proj. 3221)
(AD-A084445; ETS-52; ESD-TR-79-328) Avail: NTIS
HC A06/MF A01 CSCL 03/1

At various times during the development of the GEODSS system it became clear that a common, technical vocabulary could be a useful thing. There are many precisely defined astronomical quantities one needs to intelligently discuss star catalogs, optical data reduction, orbital analysis, photometry, etc. Partially as an outgrowth of this need, but mostly through the impetus of a forthcoming reference work, this Glossary was assembled. Its orientation is heavily toward astrometry, rather than astronomy or astrophysics. Also, it is frequently difficult to give precise and concise definitions. In some cases, it is impossible to provide the precise meaning without complicated formulas and much discussion. Nevertheless, sometimes sacrificing clarity for brevity and with a minimum of mathematics, the following 800 items are presented. GRA

N80-30806# Forest Products Lab., Madison, Wis.
LAMINATED BEAMS OF ISOTROPIC OR ORTHOTROPIC MATERIALS SUBJECTED TO TEMPERATURE CHANGE
Shun Cheng and T. Gerhardt (Westvaco Corp., Covington, Va.)
Jun. 1980. 31 p. refs.
(AD-A087230; FSRP-FPL-375) Avail: NTIS
HC A03/MF A01 CSCL 13/13

This paper considers laminated beams with layers of different isotropic or orthotropic materials fastened together by thin adhesives. The stresses that result from subjecting each component layer of the beam to different temperature or moisture stimuli which may also vary along the length of the beam, are calculated. Two dimensional elasticity theory is used so that a wide range of problems, such as that of beams composed of layers of orthotropic materials like wood, can be studied, and accurate distributions of normal and shear stresses obtained. The stress intensity along the bearing surfaces of the layers of the beam is of particular importance because it is responsible for delamination failures of laminated structural elements. The distributions of interlaminar normal and shear stresses measured along the longitudinal axis of the beam indicate that high stress intensity occurs in the end zones of the beam. Thus, delamination failure, when it occurs, will start at the end of the beam. GRA

N80-30807# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Automatic Data Processing Center.
A THREE-DIMENSIONAL STABILITY ANALYSIS/DESIGN PROGRAM (3DSAD). REPORT 1. GENERAL GEOMETRY MODULE
Fred T. Tracy. Jun. 1980. 47 p.
(AD-A087074; WES-INSTRUCTION-K-80-4) Avail: NTIS
HC A03/MF A01 CSCL 13/13

This module of the three dimensional stability analysis/design program (3DSAD) enables the engineer to describe the geometry of a three dimensional structure, to interactively plot the desired structure, and then to obtain volume, weight, and centroid information for the structure. The general ways in which geometry is described are (a) two dimensional cross sections extended in the third dimension, (b) eight-node brick elements, and (c) clusters of planar polygonal patches. Curved segments can be either circular, elliptical, or quadratic. Hidden lines in a view can be either deleted or dashed. GRA

N80-30808# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
PAVEMENT EVALUATION AND OVERLAY DESIGN USING VIBRATORY NONDESTRUCTIVE TESTING AND LAYERED ELASTIC THEORY. VOLUME 1: DEVELOPMENT PROCEDURE Final Report, Oct. 1977 - Dec. 1978
Richard A. Weiss. Mar. 1980. 175 p. refs.
(Contract DOT-FA73WAI-377)
(AD-A087186; FAA-RD-77-186-Vol-1) Avail: NTIS
HC A08/MF A01 CSCL 01/5

A procedure is developed for determining the allowable load carrying capacities and the required overlay thicknesses of airport pavements. A layered elastic theory approach is used with vibratory nondestructive tests supplying the dynamic responses of pavements. For a given pavement, a computer program SUBE is used to determine the value of the subgrade Young's modulus from the measured dynamic responses, and a computer program PAVEVAL, which is based on the layered elastic theory, is used to calculate the allowable load carrying capacity and the required overlay thickness. Limiting subgrade strains and horizontal stresses in pavement layers are used as criteria for determining load carrying capacities and overlay thickness requirements. Single and multiple wheel loadings are considered. Volume 2 of this report presents a validation of these procedures for three airport sites. GRA

N80-30809# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
STRESS CONCENTRATIONS IN SCREW THREADS
G. P. OHara. Apr. 1980. 47 p. refs. Presented at the NASTRAM Users Colloq., Greenbelt, Md., Oct. 1979
(AD-A087218; AD-E440073; ARLCB-TR-80010) Avail: NTIS
HC A03/MF A01 CSCL 13/5

The concept of stress concentration in screw threads is defined as a ratio of maximum fillet stress normalized to shear transfer rate. The data is presented as a plot of fillet stress vs. radial stress for a particular thread form. The Heywood equation is used to generate the basic plots and NASTRAN is used to extend the analysis to the case both where flanks of an individual thread tooth are in contact and the case where a finite axial stress is superimposed. GRA

N80-30810# Naval Research Lab., Washington, D. C. Material Science and Technology Div.
PIPING INELASTIC FRACTURE MECHANICS ANALYSIS
C. I. Chang, M. Nakagaki, C. A. Griffis, and R. A. Masumura. 30 Jun. 1980. 92 p. refs.
(Contract NRC-03-79-116)
(AD-A087002; AD-E000493; NRL-MR-4259;
NUREG-CR-1119) Avail: NTIS HC A05/MF A01 CSCL 20/11

Available experimental data and the analytical methods for predicting rupture of LWR piping are assembled and assessed. The analytical techniques investigated can be catalogued into three major groups: structural response, semiempirical methods, and the J-controlled growth approach. A leak-before-break condition is also investigated. GRA

N80-30811# Naval Research Lab., Washington, D. C. Metals Performance Branch.
OBSERVATIONS ON THE GENERALITY OF THE GRAIN-SIZE EFFECT ON FATIGUE CRACK GROWTH IN ALPHA PLUS BETA TITANIUM ALLOYS Final Report
G. R. Yoder, L. A. Cooley, and T. W. Crooker. 19 May 1980. 13 p. refs.
(RR0220148)
(AD-A087215; AD-E000479; NRL-MR-4232) Avail: NTIS
HC A02/MF A01 CSCL 20/11

Results obtained through analysis of the literature agree with those of our own as regards the effect of grain size (l) on region-II fatigue crack growth rates (da/dN) of alpha - beta titanium alloys in ambient air, viz. that for a given value of stress intensity range (delta kappa), da/dN decreases as (l) is increased. The analysis indicates that when microstructural modification of a given alloy affects a reduction in da/dN, the reduction appears attributable to an increase in l. Conversely, when microstructural modification fails to affect a significant

change in da/dN, the result appears attributable to a negligible change in I. Comparison of fatigue crack growth behavior at stress intensity ranges of 15, 21 and 40 MPa square root m indicates a diminution of the grain size effect with increased delta kappa. As elucidated in terms of the reversed plastic zone size model, diminution of the grain size effect follows as a consequence of the reduced portion of the structure sensitive mode of crack growth present as delta kappa is increased. GRA

N80-30812# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
THE PREDICTION OF RESPONSE OF SOLIDS TO THERMAL LOADING USING THE FINITE ELEMENT CODE AGGIE 1 Interim Report
David H. Allen and Walter E. Haisler 30 May 1980 53 p refs
(Contract N00014-76-C-0150; NR Proj. 064-534)
(AD-A087042; TR-3275-80-1) Avail: NTIS HC A04/MF A01 CSCL 20/11

In previous work the authors have proposed a theory of predicting the response of elastic plastic solids subjected to thermal loads. The theory was cast in a finite element framework and has now been placed in the finite element code AGGIE I. In this paper several example problems will be compared to experimental and other theoretical results. It will be shown that the model in its current form is adequate for modelling the response of many solids composed of temperature dependent materials. GRA

N80-30813# Old Dominion Univ., Norfolk, Va. Dept. of Mathematics.
FRACTURE PROBLEMS IN POWER LAW VISCOELASTIC MATERIALS Final Report, 1 Jun. 1979 - 30 Jun. 1980
Arje Nachman Jun. 1980 25 p refs
(Contract F49620-79-C-0076; AF Proj. 2304)
(AD-A087244; AFOSR-80-0562TR) Avail: NTIS HC A02/MF A01 CSCL 20/11

Two papers were completed during the contract year. They are appended to this report. The first has been accepted for publication the International Journal of Solids and Structures. The second has recently been submitted to the same journal. Both papers concern themselves with the general issue of debonding. In each paper loading criteria were exhibited under which an interface edge crack between dissimilar elastic media would propagate. It was felt that these questions must be settled for the elastic case before an intelligent approach to the viscoelastic case could be possible. Moreover, several very interesting viscoelastic debonding problems have recently been formulated by the author, so the general program outlined in the contract will be carried forward. GRA

N80-30814# George Washington Univ., Washington, D.C. Dept. of Civil Mechanical and Environmental Engineering.
NONLINEAR CREEP BUCKLING ANALYSIS OF INITIALLY IMPERFECT SHALLOW SPHERICAL SHELLS
Robert Kao Jul. 1980 51 p refs
(Contract N00014-75-C-0946)
(AD-A087017) Avail: NTIS HC A04/MF A01 CSCL 20/11

Creep buckling times and creep deformations are obtained for axisymmetric shallow spherical shells with and without initial imperfections. For nonlinear creeps, both strain hardening and time hardening rules are employed in the analysis; results indicate that strain hardening yields better estimates of shell life than time hardening. Results also show that the initial imperfection plays an important role in shortening shell creep buckling times. GRA

N80-30815# Argonne National Lab., Ill. Reactor Analysis and Safety Div.
ACCURATE NUMERICAL SOLUTIONS FOR ELASTIC-PLASTIC MODELS
H. L. Schreyer, R. F. Kulak, and J. M. Kramer Mar. 1980 27 p refs
(Contract W-31-109-eng-38)
(ANL-80-31) Avail: NTIS HC A03/MF A01

The accuracy of two integration algorithms is studied for the common engineering condition of a von Mises, isotropic hardening model under plane stress. Errors in stress predictions for given total strain increments are expressed with contour plots of two parameters: an angle in the pi plane and the difference between the exact and computed yield surface radii. The two methods are the tangent predictor/radial return approach and the elastic predictor/radial corrector algorithm originally developed by Mendelson. The accuracy of a combined tangent predictor/radial corrector algorithm is also investigated. DOE

N80-30816# Oak Ridge National Lab., Tenn.
DETERMINATION OF K-FACTORS FOR ARBITRARILY SHAPED FLAWS AT PRESSURE VESSEL NOZZLE CORNERS
J. W. Bryson 1979 20 p refs Presented at the 7th Water Reactor Safety Res. Inform. Meeting, Gaithersburg, Md., 5 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791118-11) Avail: NTIS HC A02/MF A01

Photoelastic and finite elements studies are being conducted to determine Mode I stress intensity factor distributions along arbitrarily shaped flaw fronts at pressure vessel nozzle corners. Comparisons of results fron NOZ-FLAW, BIGIF, and the photoelastic studies showed that (1) good agreement was obtained between NOZ-FLAW and the photoelastically determined K sub 1s for the deep flaw in an ITV model, (2) good agreement was obtained between NOZ-FLAW BIGIF for shallow and moderately deep flaws in a BWR model, and (3) less satisfactory agreement was obtained between NOZ-FLAW and the photoelastic results for the BWR models, particularly for moderately deep to deep flaws. Attempts are presently being made at understanding and explaining the discrepancies between the two. DOE

N80-30817# Argonne National Lab., Ill. Components Technology Div.
USE OF ENDOCHRONIC PLASTICITY FOR MULTI-DIMENSIONAL SMALL AND LARGE STRAIN PROBLEMS
B. J. Hsieh Apr. 1980 103 p refs
(Contract W-31-109-eng-38)
(ANL-CT-79-19) Avail: NTIS HC A06/MF A01

The endochronic plasticity theory, proposed in its general form by K. C. Valanis, is investigated. The explicit forms of the constitutive equation resemble closely those of the classical theory of linear viscoelasticity. Excellent agreement between the predicted and experimental results is obtained for some metallic and nonmetallic materials for one dimensional cases. Explicit constitutive equations are derived that are consistent with the general theory for one dimensional (simple tension or compression), two dimensional plane strain or stress, and three dimensional axisymmetric problems. DOE

N80-30818# Illinois Inst. of Tech., Chicago. Dept. of Mechanics and Mechanical and Aerospace Engineering.
STUDY OF THE INTERACTIONS BETWEEN FRICTION, WEAR AND SYSTEM RIGIDITY Progress Report, 1 Jul. 1979 - 30 Jun. 1980
V. Aronov, A. F. DSouza, S. Kalpakjian, and I. Shareef Mar. 1980 52 p refs
(Contract DE-AC02-79ER-10471)
(DOE/ER-10471/1) Avail: NTIS HC A04/MF A01

Progress in friction and wear studies is reported. After an extensive study of various possible systems for friction, wear and vibration measurements, a pin and disk sliding system was designed to be used on a rigid lathe bed. This versatile design has the capability of controlling the applied load, rigidity and damping of the total frictional system. The design and construction of the pin holding assembly were completed with certain features to render it suitable for acquisition of appropriate data such as forces and displacements. Special instrumentation was obtained; the major components of which are a tri-axial quartz piezoelectric force transducer, a tri-axial ceramic piezoelectric accelerometer for measurements of vibrations of the slider, charge preamplifiers with dc power supply, and monitoring equipment such as a spectral analyzer and an oscillograph. Preliminary experiments indicate that the system is appropriate for the type of study undertaken. Some preliminary experimental results are included. DOE

N80-30819# Oxford Univ. (England). Dept. of Engineering Sciences.

DYNAMIC MEASUREMENTS OF MICROPOLAR ELASTIC CONSTANTS
W. E. Jahsman (Colorado Univ., Boulder) and R. D. Gauthier (Colorado School of Mines) 1979 47 p refs
(OUEL-1291/91) Avail: NTIS HC A03/MF A01

A series of dynamic tests utilizing a compression type Kolsky apparatus was conducted. Short cylindrical specimens machined from bulk composite material were subjected to short duration compressive pulses. Similar tests were conducted on specimens of the constituent materials of the composite. Differences are observed between the records for the constituent materials and for the composite specimen. The records for the constituents are smooth and compared well with predictions based on one dimensional wave propagation through homogeneous isotropic elastic solids. The record for the composite materials exhibit high frequency ripples which no reasonable adjustment in the averaged material properties can explain. Analysis shows that in addition to the classical Rayleigh-Lamb frequency equations, an independent set of micropolar frequency equations is generated. By associating the fundamental and first harmonic of the micropolar frequencies with the high frequency ripples appearing on the measured signal for the composite, it is possible to calculate two of the four micropolar elastic constants for the material. On the basis of these results, it is concluded that for certain composites dynamic measurements can provide the resolution needed to determine at least some of the micropolar elastic constants. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-30820 Cornell Univ., Ithaca, N. Y.
AN OPTIMAL STATE ESTIMATION ALGORITHM FOR TERRAIN-RANGING SYSTEMS Ph.D. Thesis
Won Teh Hwang 1980 95 p
Avail: Univ. Microfilms Order No. 8020831

A simple recursive algorithm for continuous dynamic positional state estimation referenced to a moving vehicle equipped with the above image mapping systems is developed by making use of optimal and suboptimal Kalman filters and minimization techniques of the least squares loss function subject to constraints of budget simplicity, and survivability in hostile environment. The applied theories are mainly the theories of system and optimal control with some broad understanding of navigation and electrooptics. The general objective of the algorithm are to make selected measurements of the outputs of the image mapping systems to minimize the trace of the resulting error covariance matrix of the state estimates and also to make selections such that the error covariances of the estimates of unmeasured quantities be small. A performance index for use in the algorithm is developed and evaluated. Dissert. Abstr.

N80-30821 California Inst. of Tech., Pasadena.
DEGRADATION OF PICTURE QUALITY BY SPECKLE IN COHERENT MAPPING SYSTEMS Ph.D. Thesis
Vuaya Narayan Korwar 1980 183 p
Avail: Univ. Microfilms Order No. 8019904

The problem of specifying the extent of the degradation caused by speckle in pictures meant to be examined by a human observer was investigated. A plausible theoretical model was developed for the decision process used by the observer in the detection or discrimination task. This model was used to relate the probability of making a correct decision to the relevant picture parameters such as contrast ratio between the reflectivities of various parts of the picture, number of looks per pixel, picture size, and dimension of the features of lines. Calculations for the reasonable SAR parameters of 1 dB contrast ratio and 12 looks per pixel show that, in order to achieve a probability of correct decision of 0.95, (1) a small square in a 100 by 100 pixel background needs to be about 7 pixels on a side; (2) a 100 by 100 pixel grating of line pairs needs to have lines about 2 pixels wide; and (3) a simple geometrical form (a specific one) needs to be at least 12 pixels on a side to be distinguished from another (specific) form of the same size, when these two forms are the only possible alternatives. Dissert. Abstr.

N80-30822 Old Dominion Univ., Norfolk, Va.
THE DEVELOPMENT OF A STEPPED FREQUENCY MICROWAVE RADIOMETER AND ITS APPLICATION TO REMOTE SENSING OF THE EARTH Ph.D. Thesis
Richard Harrington 1980 188 p
Avail: Univ. Microfilms Order No. 8020139

The design, development, application, and capabilities of a variable frequency microwave radiometer are described. This radiometer has demonstrated the versatility, accuracy, and stability required to provide contributions to the geophysical understanding of ocean and ice processes. The design technique utilized a closed loop feedback method, whereby noise pulses were added to the received electromagnetic radiation to achieve a null balance in a Dicke switched radiometer. Stability was achieved through the use of a constant temperature enclosure around the low loss microwave front end. Remote sensing experiments were conducted from an aircraft platform using this radiometer. Four significant scientific observations were accomplished during these experiments. These observations consisted of the first radiometric mapping of an ocean polar front, exploratory experiments to measure the thickness of lake ice, first discrimination between first year and multiyear ice below 10 GHz, and the first known measurements of frequency sensitive characteristics of sea ice. Dissert. Abstr.

N80-30823*# Purdue Univ., Lafayette, Ind. Lab for Applications of Remote Sensing.
[REMOTE SENSING RESEARCH STUDIES] Final Report, 1 Dec. 1978 - 30 Nov. 1979
D. A. Landgrebe Nov 1979 126 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10117; NASA-CR-160551; SR-P9-00414; LARS-120279) Avail: NTIS HC A07/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30824*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR BOUNDARY DETECTION AND REGISTRATION PROGRAM (BDARP1)
D. P. McKay and F. Collen, Principal Investigators Apr. 1978 124 p ERTS
(Contract NAS9-15200)
(E80-10216; NASA-CR-160651; LEC-12128; JSC-13966) Avail: NTIS HC A06/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-30825*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM, PHASE 3 Quarterly Report, 1 Jan. - 31 Mar. 1980
R. P. Mroczynski, Principal Investigator, S. Schwingendorf, D. Freeman, C. Kozlowski, C. Smith, and C. Peterson 18 Apr. 1980 121 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15325)
(E80-10242; NASA-CR-160725; LARS-CR-041880) Avail: NTIS HC A06/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-30826*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DETAILED DESIGN SPECIFICATION FOR THE AUTOMATIC STATUS AND TRACKING SYSTEM MODIFICATIONS FOR LACIE PROCEDURE 1
J. M. Everette, D. L. Smith, and C. C. deValcourt, Principal Investigator May 1977 49 p ERTS
(Contract NAS9-15200)
(E80-10243; NASA-CR-160674; LEC-10529; JSC-12885) Avail: NTIS HC A03/MF A01 CSCL 14B
There are no author-identified significant results in this report.

N80-30827*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PRELIMINARY USER GUIDE FOR THE PROGRAM GTDDM (GROUND TRUTH DOT DUMP)
C. W. Ahlers, Principal Investigator Jul. 1978 11 p refs ERTS
(Contract NAS9-15200)
(E80-10244; NASA-CR-160715; LEC-12636; JSC-14423) Avail: NTIS HC A02/MF A01 CSCL 09B
There are no author-identified significant results in this report.

N80-30828*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DESIGN SPECIFICATION FOR COLOR CODED SPECTRAL PLOTS
B. E. Wills, Principal Investigator Sep. 1976 28 p ERTS
(Contract NAS9-12200)
(E80-10245; NASA-CR-160706; LEC-9924; JSC-11851) Avail: NTIS HC A03/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-30829*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
FLORIDA WATER RESOURCES Final Report
Apr. 1980 325 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS10-9348)
(E80-10246; NASA-CR-154634; KSC-TR-51-3) Avail: NTIS HC A14/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N80-30830*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
FLORIDA WATER RESOURCES, EXECUTIVE SUMMARY
Apr. 1980 18 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS10-9348)
(E80-10247; NASA-CR-154634-Summ; KSC-TR-51-3-Summ) Avail: NTIS HC A02/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N80-30831*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
HIGH DENSITY TAPE REFORMATTING SYSTEM/LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (HDTRS/LIVES) THROUGHPUT ANALYSIS
A. J. Bowen, Jr., Principal Investigator Feb. 1980 29 p ERTS
(Contract NAS9-15800)
(E80-10248; NASA-CR-160664; LEMSCO-14548; JSC-16967) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30832*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
IMPLEMENTATION SPECIFICATION FOR LARGE AREA CROP INVENTORY EXPERIMENT (LACIE) PHASE 3 AUTOMATIC STATUS AND TRACKING SYSTEM
C. C. deValcourt Mar. 1977 46 p Revised ERTS
(Contract NAS9-15200)
(E80-10249; NASA-CR-160618; LEC-8675-Rev-A; JSC-11401-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-30833*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR SCATTER PLOTS FOR DIRECT WHEAT
O. A. Wehmanen, Principal Investigator Oct. 1978 66 p ERTS
(Contract NAS9-15200)
(E80-10250; NASA-CR-160686; LEC-12822; JSC-14546) Avail: NTIS HC A04/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-30834*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
CLASSIFICATION WITH SPECTRAL-SPATIAL-TEMPORAL ARCHETYPES
P. J. Aucoin, Jr. and L. E. Giddings, Principal Investigators Aug. 1978 21 p ERTS
(Contract NAS9-15200)
(E80-10251; NASA-CR-160716; LEC-12691; JSC-14456) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30835*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR FIELD STATISTICS (FIELDSTAT)
D. K. McCarley, Principal Investigator Sep. 1978 99 p ERTS
(Contract NAS9-15200)
(E80-10252; NASA-CR-160685; LEC-12804; JSC-14487) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30836*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR CLASY PROGRAM MODIFICATION
P. J. Aucoin, Jr. and C. Horton, Principal Investigators Apr. 1978 171 p ERTS
(Contract NAS9-15200)
(E80-10253; NASA-CR-160711; LEC-12185; JSC-13986) Avail: NTIS HC A08/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30837*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DETAIL DESIGN SPECIFICATION FOR ENHANCEMENT OF THE AUTOMATIC STATUS AND TRACKING SYSTEM SOFTWARE
D. K. McCarley, Principal Investigator, J. M. Everette, and K. P. Eckel Nov. 1977 102 p ERTS
(Contract NAS9-15200)
(E80-10254; NASA-CR-160634; LEC-11512; JSC-13789) Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30838*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR MERGE OF BTREAD, PHASE 1 AND PHASE 2 ACCURACY ASSESSMENT PROGRAMS
A. Rios, Principal Investigator Oct. 1978 11 p ERTS
(Contract NAS9-15200)
(E80-10255; NASA-CR-160718; LEC-12833; JSC-14556) Avail: NTIS HC A02/MF A01 CSCL 09B

There are no author-identified significant results in this report.

N80-30839*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
USER'S GUIDE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE) PHASE 3 PDP 11/45 AUTOMATIC STATUS AND TRACKING SYSTEM
C. C. deValcourt, Principal Investigator. Mar. 1977. 48 p. ERTS.
(Contract NAS9-15200)
(E80-10256; NASA-CR-160722; LEC-10148; JSC-12535) Avail: NTIS HC A03/MF A01 CSCL 14B
There are no author-identified significant results in this report.

N80-30840*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CLASSIFICATION OF MULTISPECTRAL IMAGES ACCORDING TO CROSSWISE TEXTURAL CHARACTERISTICS [CLASSIFICACAO DE IMAGENS MULTIESPECTRAIS, TRAVES DE CARACTERISTICAS DE TEXTURA]
Nelson deJesusParada, Principal Investigator, Enivaldo doOFilho, Nelson D. A. Mascarenhas, and Claudio R. Sonnemburg. May 1980. 87 p. refs In PORTUGUESE; ENGLISH summary Sponsored by NASA. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS.
(E80-10257; NASA-CR-163369; INPE-1734-RPE/134) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30841*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATING THE REFORESTED AREA FOR THE MUNICIPALITY OF BURI BY AUTOMATIC ANALYSIS OF LANDSAT IMAGERY [AVALIACAO DE AREAS REFLORESTADAS DO MUNICIPIO DE BURI, ATRAVES DE ANALISE AUTOMATICA DE IMAGENS DO LANDSAT]
Nelson deJesusParada, Principal Investigator, David Chung Liang Lee, Redro Hernandez Filho, and Yosio Edemir Shimabukuro. Dec. 1979. 24 p. refs In PORTUGUESE; ENGLISH summary Sponsored by NASA. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS.
(E80-10258; NASA-CR-163365; INPE-1635-RPE/094) Avail: NTIS HC A02/MF A01 CSCL 02F
The author has identified the following significant results. The class of reforestation (Pinus, Eucalyptus, Araucaria) was defined using iterative image analysis (1-100) and LANDSAT MSS data. Estimates of class area by 1-100 were compared with data supplied by the forestry institute in Sao Paulo. LANDSAT channels 4 and 5 served to differentiate the Pinus, Eucalyptus, and Araucaria from the other trees. Channels 6 and 7 gave best results for differentiating between the classes. A good representative spectral response was obtained for Auraucaria on these two channels. The small relative differences obtained were +4.24% for Araucaria, -7.51% for Pinus, and -32.07% for Eucalyptus.

N80-30842*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY OF THE ATMOSPHERIC EFFECTS ON THE RADIATION DETECTED BY THE SENSOR ABOARD ORBITING PLATFORMS (ERTS/LANDSAT) M.S. Thesis - October 1978 [ESTUDO DOS EFEITOS ATMOSFERICOS SOBRE AS RADIACOES PELOS SENSORES A BORDO DE PLATFORMAS ORBIT AIS (ERTS/LANDSAT)]
Nelson deJesusParada, Principal Investigator and Tsutomu Morimoto. Mar. 1980. 110 p. refs In PORTUGUESE; ENGLISH summary. Sponsored by NASA. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57918. ERTS.
(E80-10259; NASA-CR-163366; INPE-1689-TDL/021) Avail: NTIS HC A06/MF A01 CSCL 02C
The author has identified the following significant results. Multispectral scanner data for Brasilia were corrected for atmospheric interference using the LOWTRAN-3 computer program and the analytical solution of the radiative transfer equation. This improved the contrast between two natural targets and the corrected images of two different dates were more similar than the original ones. Corrected images of MSS data for Ribeirao Preto gave a classification accuracy for sugar cane about 10% higher as compared to the original images.

N80-30843*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF LANDSAT DATA FOR ESTIMATING THE AREA OF SUGAR CANE IN THE STATE OF SAO PAULO M.S. Thesis [USO DE DADOS DO LANDSAT PARA AVALIACAO DE AREAS OCUPADAS COM CANA-DE-ACUCAR NO ESTADO DE SAO PAWLO]
Nelson deJesusParada, Principal Investigator and Francisco Jose Mendonca. Apr. 1980. 83 p. refs In PORTUGUESE; ENGLISH summary. Sponsored by NASA. ERTS.
(E80-10260; NASA-CR-163367; INPE-1713-TDL/023) Avail: NTIS HC A05/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-30844*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UTILIZATION OF LANDSAT DATA TO INVENTORY THE SUGAR CANE IN THE STATE OF SAO PAULO [UTILIZACAO DE DADOS DO LANDSAT PARA INVENTARIO DA CANA-DE-ACUCAR DO ESTADO DE SAO PAULO]
Nelson DeJesusParada, Principal Investigator, Francisco Jose Mendonca, David Chung Liang Lee, Yosio Edemir Shimabukuro, Antonio Tebaldi Tardin, Rene Antonio Novaes, and Sherry Chou Che Jan. 1980. 18 p. refs In PORTUGUESE; ENGLISH summary. Sponsored by NASA. ERTS.
(E80-10261; NASA-CR-163368; INPE-1668-NTE/157) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-30845*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE PATTERSON-PITT-THADANI MINIMUM LOSS CLASSIFIER
C. W. Ahlers, Principal Investigator. May 1978. 56 p. ERTS.
(Contract NAS9-15200)
(E80-10262; NASA-CR-160712; LEC-12285; JSC-14246) Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30846*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR PHASE 3 MODEL AREAS ADDED TO THE MONTHLY DATA BASE OF THE US
K. Williams, Principal Investigator. Mar. 1977. 28 p. ERTS.
(Contract NAS9-15200)
(E80-10263; NASA-CR-160669; LEC-10354; JSC-12709) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30847*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
THE INTEGRATED ANALYSIS PROCEDURE FOR IDENTIFICATION OF SPRING SMALL GRAINS AND BARLEY
R. W. Payne, Principal Investigator. May 1980. 20 p. refs. Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development. ERTS.
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10274; NASA-CR-160727; FC-L0-451; LEMSCO-14385; JSC-16360) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-30848*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
STATISTICAL OUTLIER DETECTION (SOD): A COMPUTER PROGRAM FOR DETECTING OUTLIERS IN DATA

R. S. Chhikara, C. L. Horton, M. A. Mendlowitz, and A. H. Feiveson, Principal Investigators (NASA Johnson Space Center) Jun. 1980 25 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10275; NASA-CR-160728; FC-LO-00432; LEMSCO-14594; JSC-16346) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30849*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
USER'S GUIDE FOR THE YIELD ESTIMATION SUBSYSTEM DATA MANAGEMENT SYSTEM (YESDAMS)
Roy Davenport and Mike Sestak, Principal Investigators Apr. 1978 51 p ERTS
(Contract NAS9-15200)
(E80-10276; NASA-CR-160710; LEC-12184; JSC-13985) Avail: NTIS HC A04/MF A01 CSCL 05A

There are no author-identified significant results in this report.

N80-30850*# Royal Australian Navy Research Lab., Edgecliff.
HEAT CAPACITY MAPPING MISSION PROJECT HCM-051 Interim Report
C. S. Nilsson, J. C. Andrews, M. W. Lawrence, S. Ball (Weapons Systems Research Lab., Salisbury, Australia), and A. R. Latham, Principal Investigators May 1980 70 p refs Sponsored by NASA Original contains imagery Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; nondomestic users send orders to 'Attn: World Data Center A for Rockets and Satellites' HCMM
(E80-10278; NASA-CR-163344; Internal-TM-3/80) Avail: NTIS HC A04/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-30851*# Pan American Univ., Edinburg, Tex. Dept. of Physical Science
LIGHT REFLECTANCE, TRANSMITTANCE, AND UTILIZATION WITHIN A VEGETATIVE CANOPY Final Report, 1 Oct. 1978 - 30 Sep. 1979
E. W. LeMaster and J. E. Chance, Principal Investigators Apr. 1980 39 p refs ERTS
(Grant NsG-9015)
(E80-10282; NASA-CR-163347) Avail: NTIS HC A03/MF A01 CSCL 20F

There are no author-identified significant results in this report.

N80-30852*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
OPERATOR'S GUIDE FOR LACIE PHASE 3 AUTOMATIC STATUS AND TRACKING SYSTEM
D. L. Smith, Principal Investigator Mar. 1977 8 p ERTS
(Contract NAS9-15200)
(E80-10284; NASA-CR-160670; JSC-12729) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30853*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
IMPLEMENTATION SPECIFICATION DOCUMENT FOR MERGE OF BTREAD, PHASE 1, AND PHASE 2 ACCURACY ASSESSMENT PROGRAMS
F. Tragni, Principal Investigator May 1978 14 p ERTS
(Contract NAS9-15200)
(E80-10285; NASA-CR-160713; LEC-12348; JSC-14277) Avail: NTIS HC A02/MF A01 CSCL 09B

There are no author-identified significant results in this report.

N80-30854*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DESIGN SPECIFICATION FOR ERIPS FIELDS DATA BASE DECK CONVERSION
C. T. Gardner, Principal Investigator Jun. 1977 18 p ERTS
(Contract NAS9-12200)
(E80-10286; NASA-CR-160667; LEC-10775; JSC-12950) Avail: NTIS HC A02/MF A01 CSCL 09B

There are no author-identified significant results in this report.

N80-30855*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DRAFT USER PROCEDURES: SOFTWARE WHEAT YIELD PREDICTIONS/FOREIGN EQUIVALENT TEST
J. Stewart, Principal Investigator Nov. 1978 32 p ERTS
(Contract NAS9-15200)
(E80-10287; NASA-CR-160687; LEC-12975; JSC-14607) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30856*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
ESTIMATION OF PROBABILITIES OF LABEL IMPERFECTIONS AND CORRECTION OF MISLABELS
C. B. Chittineni, Principal Investigator Mar. 1980 44 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10288; NASA-CR-160704; SR-LO-00427; LEMSCO-14356) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30857*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE CMAS IMAGE-100 HYBRID SYSTEM. VOLUME 2: DETAILED FLOW CHARTS AND PROGRAM LISTINGS, PART 1
L. E. Giddings, Principal Investigator Aug. 1977 395 p ERTS
(Contract NAS9-15200)
(E80-10289; NASA-CR-160709; LEC-10822-Vol-2-Pt-1; JSC-13030-Vol-2-Pt-1) Avail: NTIS HC A17/MF A01 CSCL 09B

There are no author-identified significant results in this report.

N80-30858*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE CAMS IMAGE-100 HYBRID SYSTEM. VOLUME 3: UTILITIES AND SHARED SUBROUTINES
L. E. Giddings, Principal Investigator Aug. 1977 200 p ref ERTS
(Contract NAS9-15200)
(E80-10290; NASA-CR-160684; LEC-10822-Vol-3; JSC-13030-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-30859*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT-2 AND LANDSAT-3 FLIGHT EVALUATION REPORT Technical Report, 23 Jan. - 23 Apr. 1979
1 Jun. 1979 255 p ERTS
(Contract NAS5-21808)
(E80-10291; NASA-CR-159999; Doc-76SDS4227) Avail: NTIS HC A12/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-30860*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AGRISTARS CROPPING PRACTICES AND CROP CHARACTERISTICS BASED ON 1979 ESCS OBSERVATIONS
M. A. Wise and D. E. Pitts, Principal Investigators Apr. 1980 448 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development
(Proj. AgRISTARS)

(E80-10292; NASA-TM-81105; SR-JO-00438; JSC-16353) Avail: NTIS HC A19/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30861*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

A LABELING TECHNOLOGY FOR LANDSAT IMAGERY

T. B. Dennis and M. D. Pore, Principal Investigators. May 1980 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E80-10293; NASA-CR-160689; AR-LO-00425; LEMSCO-14357; JSC-16341) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30862*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

MAXIMAL ANALYSIS LABELING PROCEDURE (PRELIMINARY)

J. M. Disler, Principal Investigator. Feb. 1980 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E80-10294; NASA-CR-160665; FC-LO-00700; JSC-16399) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30863*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

AN EXPLORATORY STUDY TO DEVELOP A CLUSTER-BASED AREA ESTIMATION PROCEDURE

R. K. Lennington, Principal Investigator. May 1980 102 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E80-10295; NASA-CR-160729; SR-LO-00442; LEMSCO-14670; JSC-16358) Avail: NTIS HC A06/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30864*# Environmental Research and Technology, Inc., Concord, Mass.

INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Progress Report, Apr. - Jun. 1980

James C. Barnes, Principal Investigator. Jul. 1980 7 p Sponsored by NASA HCMM

(E80-10297; NASA-CR-163351) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Comparison of the thermal IR band temperatures over the rapidly melting snowcover in a number of locations in the Salt-Verde Arizona watershed by the U-2 high altitude multispectral scanner, with temperatures for these same locations measured by the corresponding HCMM pass, indicate that the U-2 temperatures are typically 5 C higher than the values analyzed from the HCMM infrared digital printout. Results tend to substantiate findings of other investigators that with the offset that has been applied to all HCMM data, the HCMM temperature values may, in fact, actually be 5 C too low. Analysis of differences between the HCMM day and night temperatures for selected snowcovered areas in the Sierra Nevada Mountains, derived from the daytime and nighttime printouts, show greater delta tau values for the sparsely vegetated higher elevations than for the lower elevation, more densely forested terrain. The differences for the 12 hour sequence are also greater in most instances than the 36 hour difference.

N80-30865*# Stanford Univ., Calif. Dept. of Geology.

SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA

Ernest I. Rich, Principal Investigator. 21 Jul. 1980 2 p HCMM

(Contract NAS5-24479)

(E80-10298; NASA-CR-163352) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Structural features in the Norther California Coast Ranges are clearly discernable on Nite-IR images and some of the structural linears may result in an extension of known faults within the region. The Late Mesozoic marine sedimentary rocks along the western margin of the Sacramento Valley are clearly defined on the Nite-IR images and in a gross way individual layers of sandstone can be differentiated from shale. Late Pleistocene alluvial fans are clearly differentiated from second generation Holocene fans on the basis of tonal characteristics. Although the tonal characteristics change with the seasons, the differentiation of the two sets of fans is still possible.

N80-30866*# Consiglio Nazionale delle Ricerche, Milan (Italy) Inst. per la Geofisica della Litosfera.

STUDY OF GEOLOGICAL STRUCTURE OF SICILY AND OTHER ITALIAN AREAS Progress Report

Roberto Cassinis, Principal Investigator, Giovanni Lechi, Eugenio Zilioli, and Alberto Marini. Jun. 1980 6 p Sponsored by NASA HCMM

(E80-10299; NASA-CR-163353; PR-3) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-30867*# Montana Univ., Missoula. Wildlife-Wildlands Inst.

GRIZZLY BEAR HABITAT ANALYSIS. SECTION 3: LANDSAT-1 MULTISPECTRAL IMAGERY AND COMPUTER ANALYSIS OF GRIZZLY BEAR HABITAT

John J. Craighead, Principal Investigator. 1980 300 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E80-10300; NASA-CR-163382) Avail: NTIS HC A13/MF A01 CSCL 06C

There are no author-identified significant results in this report.

N80-30868*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MAPPING URBANIZED AREA EXPANSION THROUGH DIGITAL IMAGE PROCESSING OF LANDSAT AND CONVENTIONAL DATA

Steven Z. Friedman, Principal Investigator. 1 Mar. 1980 88 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NAS7-100)

(E80-10301; NASA-CR-163355; JPL-Pub-79-113) Avail: NTIS HC A05/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-30869*# Kansas State Univ., Manhattan. Evapotranspiration Lab.

USE OF SOIL MOISTURE INFORMATION IN YIELD MODELS

Edward Kanemasu, Arlin Feyerherm, John Hanks, Mel Keener, Dan Lawlor, Phil Rasmussen, Harold Reetz, Keith Saxton, and Craig Wiegand, Principal Investigators. Jul. 1980 48 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-14899; Proj. AgRISTARS)

(E80-10302; NASA-CR-160749; SM-MO-00462) Avail: NTIS HC A03/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-30870*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EVALUATING THE USE OF ANALYST LABELS IN MAXIMUM LIKELIHOOD CLUSTER PROPORTION ESTIMATION

R. K. Lennington and G. R. Terrell, Principal Investigators. Apr. 1980. 14 p. refs. Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development. ERTS.
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10303; NASA-CR-160754; SR-LO-00456; LEMSCO-14672; JSC-16538) Avail: NTIS. HC A02/MF A01. CSCL 05B.

There are no author-identified significant results in this report.

N80-30871*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
EVALUATION OF BAYESIAN SEQUENTIAL PROPORTION ESTIMATION USING ANALYST LABELS
R. K. Lennington and K. M. Abotteen, Principal Investigators. May 1980. 17 p. refs. Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development. ERTS.
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10304; NASA-CR-160753; SR-LO-00453; LEMSCO-14355; JSC-16361) Avail: NTIS. HC A02/MF A01. CSCL 05B.

The author has identified the following significant results. A total of ten Large Area Crop Inventory Experiment Phase 3 blind sites and analyst-interpreter labels were used in a study to compare proportional estimates obtained by the Bayes sequential procedure with estimates obtained from simple random sampling and from Procedure 1. The analyst error rate using the Bayes technique was shown to be no greater than that for the simple random sampling. Also, the segment proportion estimates produced using this technique had smaller bias and mean squared errors than the estimates produced using either simple random sampling or Procedure 1.

N80-30872*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION OF THE CAMS/CAS INTERFACE TAPE REPORT GENERATION PROGRAM FOR LACIE B
K. P. Eckel, Principal Investigator. May 1978. 131 p. ERTS.
(Contract NAS9-15200)
(E80-10306; NASA-CR-160750; LEC-12267; JSC-14238) Avail: NTIS. HC A07/MF A01. CSCL 09B.

There are no author-identified significant results in this report.

N80-30873*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT SPECIFICATION FOR CLASSY CONVERSION
P. J. Aucoin, Jr. and C. Horton, Principal Investigators. Sep. 1978. 261 p. ERTS.
(Contract NAS9-15200)
(E80-10307; NASA-CR-160751; LEC-12743; JSC-14475) Avail: NTIS. HC A12/MF A01. CSCL 09B.

There are no author-identified significant results in this report.

N80-30874*# Environmental Research Inst. of Michigan, Ann Arbor.
ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 15 Nov. 1979 - 15 Feb. 1980
May 1980. 97 p. Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development. ERTS.
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10308; NASA-CR-160698; ERIM-132400-39-P) Avail: NTIS. HC A05/MF A01. CSCL 05B.

There are no author-identified significant results in this report.

N80-30875*# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
APPLICATION EXPLORER MISSION-A HEAT CAPACITY MAPPING MISSION Progress Report
[1980] 19 p. Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601) Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM.
(E80-10309; NASA-CR-163378) Avail: NTIS. HC A02/MF A01. CSCL 08B.

The author has identified the following significant results. Fine orogenic sediments, not detectable on the images recorded within the visible wavelength region, can be clearly recognized on all night IR-images. The area of glaciation in the northern foreland of the Alps can be partially identified on the basis of night-IR data. The terminal moraine of various glacierization phases can be mapped and the relative dry and unsorted moraine material consisting of crystalline components can be located through the vegetation cover. The eastern part of the glaciation area can be traced because of reverse temperature effect. In addition to the upper Bavarian lakes, the night-IR images clearly indicate the distribution of high soil moisture areas such as swamps and bogs. The geological border of the upper fresh water molasse in the northern part of the basin north of Munich is identifiable on night IR-imagery. Drift peat areas can be located on day-IR images of the dry season of the year.

N80-30876*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE CONTRIBUTION OF THE DIFFUSE LIGHT COMPONENT TO THE TOPOGRAPHIC EFFECT ON REMOTELY SENSED DATA
Chris Justice and Brent Holben. Jun. 1980. 45 p. refs. Submitted for publication.
(NASA-TM-80728) Avail: NTIS. HC A03/MF A01. CSCL 20F.

The topographic effect is measured by the difference between the global radiance from inclined surfaces as a function of their orientation relative to the sensor position and light source. The short wave radiant energy incident on a surface is composed of direct sunlight, scattered skylight, and light reflected from surrounding terrain. The latter two components are commonly known as the diffuse component. The contribution of the diffuse light component to the topographic effect was examined and the significance of this diffuse component with respect to two direct radiance models was assessed. Diffuse and global spectral radiances were measured for a series of slopes and aspects of a uniform and surface in the red and photographic infrared parts of the spectrum, using a nadir pointing two channel handheld radiometer. The diffuse light was found to produce a topographic effect which varied from the topographic effect for direct light. The topographic effect caused by diffuse light was found to increase slightly with solar elevation and wavelength for the channels examined. The correlations between data derived from two simple direct radiance simulation models and the field data were not significantly affected when the diffuse component was removed from the radiances. Radiances from a 60 percent reflective surface, assuming no atmospheric path radiance, the diffuse light topographic effect contributed a maximum range of 3 pixel values in simulated LANDSAT data from all aspects with slopes up to 30 degrees. R.K.G.

N80-30877# Wisconsin Univ. - Madison.
MONITORING THE USE OF RIVERWAYS WITH AERIAL PHOTOGRAPHY: THE DEVELOPMENT, TESTING, AND EVALUATION OF A COMPUTER ASSISTED METHODOLOGY Final Report
R. H. Becker, William A. Gates, and Bernard J. Niemann, Jr. 31 Mar. 1980. 363 p.
(Contract DACW25-79-C-0008)
(AD-A086471) Avail: NTIS. HC A16/MF A01. CSCL 14/5

The objectives of this investigation were to develop, test and evaluate a recreational monitoring methodology using aerial photography and computer assisted data capture with auxiliary equipment. To meet these objectives, photography was flown, interpretation techniques were developed and utilized, hardware was assembled, software was written and recreational monitoring results were obtained. Section 1, includes a statement of objectives, how the report is organized, a summary of available photography, a brief summary of methods employed, and some conclusions. Section 2, Pool 16 Users Results, includes the results obtained from applying the methodology for six flights over Pool 16. It also includes discussion of the results and provides graphic

examples of results. Section 3, Evaluation of the Methodology, includes equipment and personnel requirements, the time utilized developing and testing the methodology, and the costs incurred. The reliability of the methodology, error control and error discovery are discussed. Section 4, Aerial Photographic Methods, includes a detailed discussion of the methods and equipment employed to purchase, obtain and process the aerial photography for the riverway. Section 5, Interpretative methods, discusses the methods employed to interpret, locate and encode targets from the photography. Section 6, Handbook/Codebook, includes a detailed description of each variable encoded as part of the methodology. It also includes the rules used to interpret each of the target types. GRA

N80-30878# Earth Science Consulting and Technology Corp., Costa Mesa, Calif.
MULTI-SOURCE IMAGE ANALYSIS Final Report
David D. Steller, Michael R. Mel, Debra J. Shiroma, William Muir, and Julie A. Sowma. Dec. 1979. 157 p. refs.
(Contract DAAK70-78-C-0180)
(AD-A086332; ETL-0208) Avail: NTIS HC A08/MF A01 CSCL 08/6

For the purposes of this study, multi-source image analysis is defined as the utilization of imagery from panchromatic photography, radar and thermal infrared systems for providing military geographic information. The imagery was limited to sets available from a variety of governmental and commercial sources. Effort was made to obtain images from all three sensor systems, but at some test sites only one or two types were utilized. Sensor characteristics were evaluated in relationship to the targets of interest and sensor keys determined. Several useful enhancement techniques were utilized to emphasize feature parameters. Comparison interpretation using all three image types provided valuable complementary target information. GRA

N80-30879# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
RADIO-ECHO SOUNDING IN THE ALLAN HILLS, ANTARCTICA, IN SUPPORT OF THE METEORITE FIELD PROGRAM Special Report
Austin Kovacs. May 1980. 12 p. refs.
(Grant NSF DPP-77-19565)
(AD-A086858; CRREL-SR-80-23) Avail: NTIS HC A02/MF A01 CSCL 08/12

Radio-echo sounding measurements made on Ross Island and in the Allan Hills Antarctica indicate that radio-echo sounding may offer the unique possibility of detecting a buried meteorite in glacial ice. The results also revealed internal layering within the snow on Ross Island and in the snow filling an ice depression west of Allan Nunatak. Radio-echo sounding also gave the depth to bedrock near the west side of Allan Nunatak. The greatest ice depth measured was 310 m. GRA

N80-30880# LeSchack Associates Ltd., Silver Spring, Md.
CORRELATION OF UNDER-ICE ROUGHNESS WITH SATELLITE AND AIRBORNE THERMAL INFRARED DATA
Leonard A. LeSchack. May 1980. 46 p. refs.
(Contract N00014-76-C-0757)
(AD-A085512; TR-2) Avail: NTIS HC A03/MF A01 CSCL 08/12

This report, based on empirical data, concludes that a correlation has been found between easily obtainable sea ice surface temperature and under-ice roughness data which are obtainable only at great expense. Under-ice roughness is valuable in evaluating acoustic attenuation beneath the Arctic ice and is expressed in terms of either root-mean-square (RMS) ice depth or standard deviation about the mean ice depth, both of which are closely correlated. By showing a functional relationship between the skewness of the surface temperature distribution as derived from NOAA VHRR Satellite thermal infrared data and the under-ice roughness, the way appears clear to make a chart of Arctic under-ice roughness for Arctic acoustic programs and for nuclear submariners. In a second study, under ice data recorded in April 1976 by the SSN GURNARD was correlated with the skewness of temperature distributions derived from NOAA VHRR IR data recorded in March 1976 over nominally the same area of the Beaufort Sea. A third study was then conducted that shows, perhaps more graphically than the others, the correlation of under-ice data recorded by the British nuclear submarine HMS SOVEREIGN between 16-21 October 1976 with airborne IR data recorded during the same period over the submarine track by a Canadian Forces Argus aircraft. In all three examples, when the RMS ice depth range was between 4 and 8 m, corresponding to a standard deviation of ice depth ranging between 2 and 6 m, there is a strong, negative linear correlation between the skewness of the temperature distributions, whether measured from satellites or aircraft, and the under-ice roughness measured by submarine upward-looking sonar. GRA

N80-30881# Edgerton, Germeshausen and Grier, Inc., Sunnyvale, Calif.
AERIAL GAMMA RAY AND MAGNETIC SURVEY: RATON BASIN PROJECT. THE RATON AND SANTA FE QUADRANGLES OF NEW MEXICO Final Report
Dec. 1979. 324 p. refs.
(Contract EY-76-C-13-1664)
(GJBX-9(80)-Vol-2) Avail: NTIS HC A14/MF A01

The Santa Fe quadrangle in central New Mexico lies principally within the Southern Rocky Mountains and Great Plains Provinces. The west is dominated by the Sangre de Cristo Mountains. The eastern and southern regions contain portions of the Sierra Grande Arch and the Las Vegas and Tucumcari Basins. These structures primarily contain permian, triassic, cretaceous, and tertiary sediments. Many areas of the quadrangle are covered by cretaceous through quaternary igneous rocks of a variety of types. Magnetic data reflect both deep and shallow sources. The basins show as regions of low frequency/low amplitude wavelengths except where significant amounts of igneous rocks are exposed. The Santa Fe quadrangle has been unproductive in terms of uranium. All known uranium occurrences to date have proven uneconomic. Two goups of anomalies in the Sangre de Cristo Mountains appear to be most significant in terms of their peak count rates. DOE

N80-30882# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
REMOTE SENSING OF WILDLAND RESOURCES: A STATE-OF-THE-ART REVIEW Forest Service Final General Technical Report
Robert C. Aldrich. Dec. 1979. 62 p. refs.
(PB80-184609; FSGTR-RM-71) Avail: NTIS HC A04/MF A01 CSCL 14E

A review, with literature citations, of current remote sensing technology, applications, and costs for wildland resource management, including collection, interpretation, and processing of data gathered through photographic and nonphotographic techniques for classification and mapping, interpretative information for specific applications, measurement of resource parameters, and observations and counts of occurrences is presented. GRA

N80-30883# North Carolina State Univ. at Raleigh.
PROBABILITY SAMPLING TO MEASURE POLLUTION FROM RURAL LAND RUNOFF Final Report, Jul. 1974 - Dec. 1978
F. J. Humenik, D. W. Hayne, M. R. Overcash, J. W. Gilliam, and A. M. Witherspoon. Feb. 1980. 215 p. refs.
(Grant EPA-R-803328)
(PB80-175946; EPA-600/3-80-035) Avail: NTIS HC A10/MF A01 CSCL 08H

The feasibility of probability sampling in describing quality of rural water not affected by point sources is examined. The study site was a portion of the Chowan River Basin in Virginia and North Carolina. Flow was measured along with dissolved oxygen, temperature, conductivity, and pH. All samples were analyzed for nitrate plus nitrite nitrogen, total Kjeldahl nitrogen, total phosphate, and chloride. Flow was highly variable in time and space; concentration was less so. GRA

N80-30884# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN: PHYSICAL, CHEMICAL, AND GEOLOGIC PROPERTIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - May 1980
Robena J. Brown. Jun. 1980. 123 p. Supersedes NTIS/PS-79/0585; NTIS/PS-78/0563. Updates COM-73-11676

(PB80-811235; NTIS/PS-79/0585; NTIS/PS-78/0563; COM-73-11676) Avail: NTIS HC $30.00/MF $30.00 CSCL 08J

Remote sensing methods as they are applied to ocean temperature, sea ice, marine biology, and sound and light transmission are included. Techniques of measurement using radiometry, microwave spectroscopy, radar systems, infrared spectroscopy, and photography are described. These measurements are made from both aircraft and satellites. This updated bibliography contains 116 abstracts, 17 of which are new entries to the previous edition. GRA

N80-30885# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN: DYNAMICS. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1970 - May 1980
Robena J. Brown. 1980. 191 p. Supersedes NTIS/PS-79/0586; NTIS/PS-78/0564. Updates COM-73-11676.
(PB80-811243; NTIS/PS-79/0586; NTIS/PS-78/0564; COM-73-11676) Avail: NTIS HC $30.00/MF $30.00 CSCL 08J

Remote sensing methods as they are applied to ocean currents, wind sediment transport, ocean waves, sea states, and air water interactions are included. The various techniques of measurement using radiometers, lasers, radar, and microwave and infrared equipment are described. This updated bibliography contains 183 abstracts, 18 of which are new entries to the previous edition. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *85 Urban Technology and Transportation*.

N80-30886 Drexel Univ., Philadelphia, Pa.
INDUSTRIAL APPLICATION AND ASSESSMENT OF WASTE ENERGY RECOVERY TECHNOLOGIES. Ph.D. Thesis
Michael John Koluch. 1980. 319 p.
Avail: Univ. Microfilms Order No. 8019349

Nine generic waste energy recovery technologies were examined for potential applications in industry. These were heat exchangers, Rankine power cycles, Brayton power cycles, Stirling power cycles, heat pumps, absorption cooling systems, expanders, burner, and cogeneration systems. Several industries were examined. A methodology was developed to assess waste energy recovery technologies. It comprises an industry waste flow/technology compatibility prescreen computer model, prescreen evaluation, specific technology application computer model and technology application assessment. Technology limitations were incorporated into a computer model to prescreen potential applications in 87 industrial processes. Results of that prescreen indicated that heat exchangers, heat pumps, Rankine cycles and cogeneration systems ranked highest in the utilization of waste streams. Numerous specific waste stream, technology, end use applications were examined in detail. Performance technology models were used to simulate applications. M.G.

N80-30887 Vanderbilt Univ., Nashville, Tenn.
SOLAR THERMAL ENERGY STORAGE USING A PARAFFIN WAX PHASE CHANGE MATERIAL. Ph.D. Thesis
Arthur Bart Shapiro. 1980. 134 p.
Avail: Univ. Microfilms Order No. 8018904

A shell tube thermal energy storage (TES) unit is proposed with the shell side containing a paraffin wax. The physical system is mathematically modelled by the two dimensional transient heat conduction equation in cylindrical coordinates. This equation is solved by an explict finite difference algorithm. A numerical marching method is used in the z direction to preserve the three dimensional nature of the physical system. The numerical solution uses temperature dependent thermodynamic and transport properties. Values for the density thermal conductivity, and enthalpy for the solid and liquid phase were determined by experimental methods and extrapolation of published property data. Results from a parametric study are presented in graphs of percent storage capacity versus time and tube side fluid temperature drop versus time. The parameters varied were tube side fluid mass flow rate, tube length, tube diameter, and tube spacing. The results present valuables insight into operational trends and acceptable operating ranges of the TES unit. A design example using these results is presented. Dissert. Abstr.

N80-30888*# General Electric Co., Fairfield, Conn. Energy Technology Operation.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 6: COMPUTER DATA. PART 1: COAL-FIRED NOCOGENERATION PROCESS BOILER, SECTION A. Final Report
W. F. Knightly. May 1980. 469 p.
(Contract DEN3-31)
(NASA-CR-159770-Pt-1-A; DOE/NASA/0031-80/6-Vol-6-Pt-1A; GE80ET0105-Vol-6-Pt-1A) Avail: NTIS HC A20/MF A01 CSCL 10B

About fifty industrial processes from the largest energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidate which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum based residual and distillate liquid fuels, and low Btu gas obtained through the on site gasification of coal. Computer generated reports of the fuels consumption and savings, capital costs, economics and emissions of the cogeneration energy conversion systems (ECS's) heat and power matched to the individual industrial processes are presented. National fuel and emissions savings are also reported for each ECS assuming it alone is implemented. Two nocogeneration base cases are included: coal fired and residual fired process boilers. T.M.

N80-30889*# General Electric Co., Fairfield, Conn. Energy Technology Operation.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 6: COMPUTER DATA. PART 1: COAL-FIRED NOCOGENERATION PROCESS BOILER, SECTION B. Final Report
W. F. Knightly. May 1980. 480 p.
(Contract DEN3-31)
(NASA-CR-159770-Pt-1-B; DOE/NASA/0031-80/6-Vol-6-Pt-1B; GE80ET0105-Vol-6-Pt-1B) Avail: NTIS HC A21/MF A01 CSCL 10B

About fifty industrial processes from the largest energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidate which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum based residual and distillate liquid fuels, and low Btu gas obtained through the on site gasification of coal. Computer generated reports of the fuel consumption and savings, capital costs, economics and emissions of the cogeneration energy conversion systems (ECS's) heat and power matched to the individual industrial processes are presented. National fuel and emissions savings are also reported for each ECS assuming it alone is implemented. Two nocogeneration base cases are included: coal fired and residual fired process boilers. T.M.

N80-30890*# General Electric Co., Fairfield, Conn. Energy Technology Operation.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY

(CTAS). VOLUME 6: COMPUTER DATA. PART 2: RESIDUAL-FIRED NOCOGENERATION PROCESS BOILER **Final Report**
W. F. Knightly May 1980 296 p
(Contract DEN3-31)
(NASA-CR-159770-Pt-2; DOE/NASA/0031-80/6-Vol-6-Pt-2; GE80ET0105-Vol-6-Pt-2) Avail: NTIS HC A13/MF A01 CSCL 10B

About fifty industrial processes from the largest energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidate which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum based residual and distillate liquid fuels, and low Btu gas obtained through the on site gasification of coal. Computer generated reports of the fuel consumption and savings, capital costs, economics and emissions of the cogeneration energy conversion systems (ECS's) heat and power matched to the individual industrial processes are presented. National fuel and emissions savings are also reported for each ECS assuming it alone is implemented. Two nocogeneration base cases are included: coal fired and residual fired process boilers. T.M.

N80-30891*# Rice Univ., Houston, Tex.
SOLAR POWER SATELLITE OFFSHORE RECTENNA STUDY Final Report
May 1980 284 p refs Prepared in cooperation with Brown and Root Development, Inc., Houston, Tex. and Little (Arthur D.), Inc., Cambridge, Mass.
(Contract NAS8-33023)
(NASA-CR-161543) Avail: NTIS HC A13/MF A01 CSCL 10A

Offshore rectennas are feasible and cost competitive with land rectennas but the type of rectenna suitable for offshore use is quite different from that specified in the present reference system. A nonground plane design minimizes the weight and greatly reduces the number of costly support towers. This perferred design is an antenna array consisting of individually encapsulated dipoles with reflectors or traps supported on feed wires. Such a 5 GW rectenna could be built at a 50 m water depth site to withstand hurricane, winter storm, and icing conditions for a one time cost of $5.7 billion. Subsequent units would be about 1.3 less expensive. More benign and more shallow water sites would result in substantially lower costs. The major advantage of an offshore rectenna is the removal of microwave radiation from populated areas. L.F.M.

N80-30892*# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION REPORT FOR SOLARON-DUFFIELD, DUFFIELD, VIRGINIA Seasonal Report, Oct. 1979 - Mar. 1980
Jul. 1980 90 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161507) Avail: NTIS HC A05/MF A01 CSCL 10A

The Solaron Duffield Solar Energy System was designed to provide 51 percent of the space heating, and 49 percent of the domestic hot water (DHW) to a two story 1940 square foot area residence using air as the transport medium. The system consists of a 429 square foot collector array, a 265 cubic foot rock thermal storage bin, heat exchangers, an 80 gallon DHW preheat tank, pumps, blowers, controls, air ducting and associated plumbing. A air-to-liquid heat pump coupled with a 1,000 gallon water storage tank provides for auxiliary space heating and can also be used for space cooling. A 52 gallon electric DHW tank using the solar preheated water provides domestic hot water to the residence. The solar system, which became operational July 1979, has the following modes of operation: First Stage: (1) collector to storage and DHW; (2) collector to space heating; (3) storage to load. Second Stage: (4) heat pump auxiliary direct; (5) auxiliary heat from heat pump storage. Third Stage: (6) electrical resistance (strip) heat. Author

N80-30893*# IBM Federal Systems Div., Huntsville, Ala. Federal Systems Div.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION REPORT FOR IBM SYSTEM 4 AT CLINTON, MISSISSIPPI Seasonal Report, Oct. 1978 - Mar. 1980
Jul. 1980 91 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161509) Avail: NTIS HC A05/MF A01 CSCL 10A

The IBM System 4 Solar Energy System is described and evaluated. The system was designed to provide 35 percent of the space heating and 63 percent of the domestic hot water preheating for a single family residence located within the United States. The system consists of 259 square feet of flat plate air collectors, a rock thermal storage containing 5 1/2 ton of rock, heat exchangers, blowers, a 52 gallon preheat tank, controls, and associated plumbing. In general, the performance of the system did not meet design expectations, since the overall design solar fraction was 48 percent and the measured value was 32 percent. Although the measured space heating solar fraction at 32 percent did agree favorably with the design space heating solar fraction at 35 percent, the hot water measured solar fraction at 33 percent did not agree favorably with the design hot water solar fraction of 63 percent. In particular collector array air leakage, dust covered collectors, abnormal hot water demand, and the preheat tank by pass valve problem are main reasons for the lower performance. M.G.

N80-30894*# IBM Federal Systems Div., Huntsville, Ala. Federal Systems Div.
SOLAR ENERGY SYSTEM ECONOMIC EVALUATION FINAL REPORT FOR SEMCO-LOXAHATCHEE, LOXAHATCHEE NATIONAL WILDLIFE REFUGE, PALM BEACH COUNTY, FLORIDA Final Report
Jul. 1980 98 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161512) Avail: NTIS HC A05/MF A01 CSCL 10A

Economic analysis of the solar energy system installed at Loxahatchee, was developed for Loxahatchee and four other sites typical of a wide range of environmental and economic conditions in the continental United States. This analysis was accomplished based on the technical and economic models in the f Chart design procedure with inputs based on the characteristics of the installed system and local conditions. The results are expressed in terms of the economic parameters of present worth of system costs over a projected twenty year life, life cycle savings, year of positive savings and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables was also investigated. The results demonstrate that the solar energy system is economically viable at all of the five sites for which the analysis was conducted. T.M.

N80-30895*# City of Kansas City, Mo.
SOLAR HEATING AND DOMESTIC HOT WATER SYSTEM INSTALLED AT KANSAS CITY, FIRE STATIONS, KANSAS CITY, MISSOURI Final Report
Jul. 1980 170 p Sponsored by NASA
(Contract EX-76-C-01-2373)
(NASA-CR-161513) Avail: NTIS HC A12/MF A01 CSCL 10A

The solar system was designed to provide 47 percent of the space heating, 8,800 square feet area and 75 percent of the domestic hot water (DHW) load. The solar system consists of 2,808 square feet of Solaron, model 2001, air, flat plate collector subsystem, a concrete box storage subsystem which contains 1,428 cubic feet of 0.5 inch diameter pebbles weighing 71.5 tons, a DHW preheat tank, blowers, pumps, heat exchangers, air ducting, controls and associated plumbing. Two 120 gallon electric DHW heaters supply domestic hot water which is preheated by the solar system. Auxiliary space heating is provided by three electric heat pumps with electric resistance heaters and four 30 kilowatt electric unit heaters. There are six modes of system operation. R.K.G.

N80-30896*# IBM Federal Systems Div., Huntsville, Ala. Federal Systems Div.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION REPORT FOR IBM SYSTEM 3, GLENDO, WYOMING Seasonal Report, Jan. - Dec. 1979
Jun. 1980 85 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161520) Avail: NTIS HC A05/MF A01 CSCL 10A

The analysis used was based on instrumented system data monitored and collected for at least one full season of operation. The long-term field performance of the installed system is described. Technical contributions to the definition of techniques and requirements for solar energy system design are given. T.M.

N80-30897*# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
SATELLITE POWER SYSTEM (SPS) MAGNETRON TUBE ASSESSMENT STUDY Final Performance Review
12 Aug. 1980 99 p refs
(Contract NAS8-33157)
(NASA-CR-161547; MA03) Avail: NTIS HC A05/MF A01 CSCL 10A

Taks performed to extend the data base and to define a technology development program for the magnetron directional amplifier for the SPS are reviewed. These include: (1) demonstrating the tracking of phase and amplitude of the microwave output to phase and amplitude references; (2) expanding the range of power over which the directional amplifier will operate; (3) recognizing the importance of amplitude control in overall system design and in simplifying power conditioning; (4) developing a preliminary design for the overall architecture of the power module; (5) demonstrating magnetron starting using the amplitude control system; (6) mathematically modelling and performing a computerized study of the pyrolytic graphite radiating fin; (7) defining the mass of the magnetic circuit for the SPS tube; (8) noise measurement; (9) achieving harmonic suppression by notch reflection filters; (10) estimating the mass of the transmitting antenna; (11) developing a magnetron package with power generation, phase control, and power condition functions; and (12) projecting magnetron package characteristics. A.R.H.

N80-30898*# ECON, Inc., Princeton, N. J.
SPS SALVAGE AND DISPOSAL ALTERNATIVES Final Report
30 Jun. 1980 90 p refs
(Contract NAS8-33783)
(NASA-CR-161548; Rept-80-1489) Avail: NTIS HC A05/MF A01 CSCL 10A

A wide range of salvage options exist for the satellite power system (SPS) satellite, ranging from use in and beyond geosynchronous orbit to use in low Earth orbit to return and use on Earth. The satellite might be used intact to provide for various purposes, it might be cannibalized, or it might be melted down to supply materials for space- or ground-based products. The use of SPS beyond its nominal lifetime provides value that can be deducted from the SPS capital investment cost. It is shown that the present value of the salvage value of the SPS satellites, referenced to the system initial operation data, is likely to be on the order of five to ten percent of its on-orbit capital cost. (Given a 30 year satellite lifetime and a four percent discount rate, the theoretical maximum salvage value is 30.8 percent of the initial capital cost). The SPS demonstration satellite is available some 30 years earlier than the first full-scale SPS satellite and has a likely salvage value on the order of 80 percent of its on site capital cost. In the event that it becomes desirable to dispose of either the demomstration or full-scale SPS satellite, a number of disposal options appear to exist for which intact disposal costs are less than one percent of capital costs. L.F.M.

N80-30899*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Electronic and Control Lab.
SOLAR SITE TEST MODULE
Ralph R. Kissel and Donald R. Scott Jul. 1980 32 p Sponsored in part by DOE
(NASA-TM-78291) Avail: NTIS HC A03/MF A01 CSCL 10A

A solar site test module using the Rockwell AIM 65 microcomputer is described. The module is designed to work at any site where an IBM site data acquisition system (SDAS) is installed and is intended primarily as a troubleshooting tool. It collects sensor information (temperatures, flow rates, etc.) and displays or prints it immediately in calibrated engineering units. It will read one sensor on demand, periodically read up to 10 sensors or periodically read all sensors. Performance calculations can also be included with sensor data. Unattended operation is possible to, e.g., monitor a group of sensors once per hour. Work is underway to add a data acquisition system to the test module so that it can be used at sites which have no SDAS. Author

N80-30900*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 7: SYSTEM/SUBSYSTEM REQUIREMENTS DATA BOOK Final Report
G. M. Hanley Sep. 1980 120 p
(Contract NAS8-32475)
(NASA-CR-3324; SSD-79-0010-7-Vol-7) Avail: NTIS HC A06/MF A01 CSCL 10A

The identified subsystem/systems requirements are defined for the solar power satellites. Recommendations for alternate approaches which may represent improved design features are presented. T.M.

N80-30901*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
G. M. Hanley Washington NASA Sep. 1980 67 p refs 7 Vol.
(Contract NAS8-32475)
(NASA-CR-3317; SSD-79-0010-1-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 10A

System definition studies resulted in a further definition of the reference system using gallium arsenide solar arrays, analysis of alternative subsystem options for the reference concept, preliminary solid state microwave concept studies, and an environmental analysis of laser transmission systems. The special emphasis studies concentrated on satellite construction, satellite construction base definition, satellite construction base construction, and rectenna construction. Major emphasis in the transportation studies was put on definition of a two stage parallel burn, vertical takeoff/horizontal landing concept. The electric orbit transfer vehicle was defined in greater detail. Program definition included cost analyses and schedule definition. T.M.

N80-30902# Prototech, Inc., Newton Highlands, Mass.
ENERGY SAVINGS BY MEANS OF FUEL CELL ELECTRODES IN ELECTRO-CHEMICAL INDUSTRIES Annual Report, 1 Aug. 1978 - 31 Jul. 1979
Robert J. Allen, Walter Juda, Robert W. Lindstrom, and Henry G. Petrow 31 Oct. 1980 200 p refs
(Contract ET-78-C-02-4881)
(COO-4881-12) Avail: NTIS HC A10/MF A01

Energy and cost savings in electrowinning of zinc by substituting, for the conventional lead anode, a Prototech proprietary hydrogen anode operating on pure and impure feeds were evaluated experimentally along with voltage, and thus energy savings in chloralkali membrane cells by substituting, for the conventional steel cathode, a Prototech proprietary air cathode. Suitable air electrodes for metal/water/air batteries were considered. Cost estimates of all processes investigated based on laboratory results were prepared. DOE

N80-30903# Pacific Missile Test Center, Point Mugu, Calif.
PACIFIC MISSILE TEST CENTER ENERGY PROJECTS. SUMMARY OF PROJECTS, CONTRIBUTIONS, AND PLANS
Jay Rosenthal and Craig Savant Jan. 1980 53 p refs
(AD-A086196; PMTC-TP-80-14) Avail: NTIS HC A04/MF A01 CSCL 13/2

This report is a compilation of the projects undertaken at the Pacific Missile Test Center to conserve energy, develop and apply alternative energy sources, and develop, in the 1980s,

basic capability (BACADE) projects for applying energy-saving technology to the needs of the Pacific Missile Test Center. GRA

N80-30904# IIT Research Inst., Chicago, Ill.
NAVY-NEW HAMPSHIRE WIND ENERGY PROGRAM Final Report, 4 Jun. - 31 Oct. 1979
S. A. Bortz, R. A. Budenholzer, R. D. Carlson, I. Fieldhouse, and J. Kornfeld Nov. 1979 264 p refs Supersedes IITRI-D6169 (Contract N00014-79-C-6503)
(AD-A086506; IITRI-M6052; IITRI-D6169) Avail: NTIS HC A12/MF A01 CSCL 10/2

This program investigated the potential of the Mt. Washington, New Hampshire area for generating electric power from wind energy as an alternative to fossil fuels. The U.S. Naval Shipyard at Portsmouth, New Hampshire is among those facilities which could benefit initially from successful wind generated power. IIT Research Institute (IITRI) specialists performed the following tasks: (1) Evaluation of New Hampshire's wind energy resources for potential electric power generation using meteorological, topographical, biological and other available information, (2) Assessment of the environmental, social, technical, and other possible barriers to the development of wind energy resources, and (3) Economic evaluation of installing one or more wind turbine generators to supply power either directly to the Shipyard or to lines of the Public Service Company of New Hampshire which supplies the Shipyard. GRA

N80-30905# Energy Research Corp., Danbury, Conn.
AQUEOUS TRIFLUOROMETHANESULFONIC ACID FUEL CELLS Interim Technical Report, Jun. 1978 - Aug. 1979
Michael George Dec. 1979 47 p refs
(Contract DAAK70-78-C-0103)
(AD-A086579; ERC-6154-I) Avail: NTIS HC A03/MF A01 CSCL 10/2

Subscale hydrogen-air fuel cells were successfully operated with 6M TFMSA as the electrolyte at temperatures as high as 60 C. The fuel cell performance was enhanced over similarly loaded electrodes in H3PO4 due to the apparent improved kinetics for the oxygen reduction reaction. A variety of unsupported and supported Pt electrocatalysts could be effectively utilized. TFMSA fuel cells could be operated stably for periods as long as 3000 hours if water balance was maintained. Activity coefficients calculated by the van Laar equations were utilized to predict water partial pressures of dilute TFMSA solutions. GRA

N80-30906# Duracell International, Inc., Burlington, Mass. Lab. for Physical Science.
LITHIUM-THIONYL CHLORIDE BATTERY Quarterly Report, 1 Nov. 1979 - 31 Jan. 1980
A. N. Dey, N. Hamilton, W. Bowden, P. Witalis, and D. Cubbison Jun. 1980 61 p refs
(Contract DAAB07-78-C-0563; DA Proj. 1L1-62705-AH-94)
(AD-A085661; DELET-TR-78-0563-5; QR-5) Avail: NTIS HC A04/MF A01 CSCL 10/3

The Li/SOCl2 inorganic electrolyte system is the highest energy density system known to date. It consists of an Li anode, a carbon cathode and SOCl2, which acts both as a solvent and cathode active material. The electrolyte salt that has been used most extensively is LiAlCl4, but salts such as Li2B10Cl10 and Li2O(AlCl3)2 have also been used successfully in this system for improving the shelf life characteristics. The main objective of this program is to develop high rate Li/SOCl2 cells and batteries for portable applications of the U.S. Army. The cells and batteries must deliver higher energy densities than are presently available and must be safe to handle under field conditions. GRA

N80-30907# Rockwell International Corp., Golden, Colo. Energy Systems Group.
ROCKY FLATS SMALL WIND SYSTEMS TEST CENTER ACTIVITIES. VOLUME 1: ATMOSPHERIC TEST DATA COLLECTED FROM SMALL WIND ENERGY CONVERSION SYSTEMS Interim Report, 1 Jul. 1978 - 30 Jun. 1979
Jul. 1979 122 p 2 Vol.
(Contracts EY-76-C-04-3533; DE-AC04-76DP-03533)
(RFP-3004-Vol-1; IR-2-Vol-1) Avail: NTIS HC A06/MF A01

The wind system data of various tests of small wind energy conversion system (SWECS) are presented. Much of the data are not final, but are believed to present an accurate representation of the performance of each system. Because of operating problems and failures experienced by some of the machines (and at times by the data collection system) the amount of data available for analysis varies widely from system to system. Data are presented on a total of 16 machines, including updated data on nine machines which were presented in the first semiannual report. Vibration, controlled velocity testing and plans for a dynamometer test facility (which is under construction) are described. The description of each system under test includes information on design output, output type, rotor configuration, and other basic design features. The condition under which each SWECS was tested are described. Graphic plots of quantitative data and narrative accounts of qualitative data collected on each SWECS are provided. DOE

N80-30908# Rockwell International Corp., Golden, Colo. Energy Systems Group.
ROCKY FLATS SMALL WIND SYSTEMS TEST CENTER ACTIVITIES. VOLUME 2: CONTROLLED VELOCITY, VIBRATION AND DYNAMOMETER TESTING OF SMALL WIND ENERGY CONVERSION SYSTEMS Interim Report
Jul. 1979 44 p 2 Vol.
(Contracts EY-76-C-04-3533; DE-AC04-76DP-03533)
(RFP-3004-Vol-2; IR-2-Vol-2) Avail: NTIS HC A03/MF A01

Controlled velocity, vibration, and dynamometer testing performed on small wind energy conversion systems are discussed. Results of controlled velocity testing on wind machines and of vibration testing of five wind machines are included. DOE

N80-30909# Physical Sciences, Inc., Woburn, Mass.
COAL PROCESSING FOR FUEL CELL UTILIZATION. TASK 11: FLUIDIZED BED COAL GASIFICATION MODEL; DATA ANALYSIS AND PREDICTIONS
Michael L. Finson Jan. 1980 69 p refs
(Contract EW-78-A-21-8450)
(METC-8450-T1; TR-209) Avail: NTIS HC A04/MF A01

Development and application of a computational model for fluidized bed gasification of coal is described. A two phase bubbling bed reactor model accounts for the development of bubbles, clouds, and emulsion, with a new statistical treatment to predict bubble size. Coal char reactivity is described in detail, using models for carbon heterogeneous chemistry, pore structure, and mass transport previously developed. Volatile release is handled in a semiempirical manner, and potential gas phase reactions between fuel and oxygen in the bubbles are allowed. The data imply larger gas by passing and particle carry over than predicted, and the computed performance exceeds that observed. The computer program was exercised to map out gasifier performance over a range of conditions. It is shown that proper fluidization often requires more gas flow than can be accommodated chemically, due to limited kinetics and mass transport. DOE

N80-30910# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLAR PHOTOVOLTAIC MODULE DEGRADATION FROM ELECTRO-MIGRATION
C. F. Hornig, E. S. Wainwright, S. E. Forman, M. S. Hsu, and M. P. Themelis 15 Apr. 1980 27 p refs
(Contract EY-76-C-02-4094)
(COO-4094-64) Avail: NTIS HC A03/MF A01

The effects of outdoor weathering on both encapsulated and unencapsulated solar photovoltaic modules are discussed. Degradation modes that result from exposure in a terrestrial environment and which influence long term module performance are identified. Two modules, stripped of their protective RTV coating, and a third encapsulated module were placed in the open circuit mode and monitored for five months. The encapsulated module showed no evidence of degradation during the five months of this investigation. The unencapsulated modules showed signs of both physical and electrical degradation. Auger analysis of these unencapsulated cells disclosed the migration of Sn between positive and negative surfaces on the same cell and the migration of Sn from the cell's negative grid (when this negative grid is adjacent to a cell row at lower potential or the metal module edge). This migrating Sn, combined with the SiOx antireflective film, altered the coating structure and appearance. Both degradation modes depend on the presence of moisture, and will thus reduce module peak power by 8 to 11 percent. DOE

N80-30911# Sandia Labs., Albuquerque, N. Mex.
UTILITY VIEWS ON SOLAR THERMAL CENTRAL RECEIVERS
M. J. Fish Apr. 1980 67 p refs
(Contract EY-76-C-04-0789)
(SAND-80-8203) Avail: NTIS HC A04/MF A01

The concerns of a number of US utilities about the solar thermal central receiver concepts are reported. The discussions forced on identifying technical demonstrations and government incentives necessary for commercializing the technology. The implications for a commercialization plan are discussed. DOE

N80-30912# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
THIN FILMS OF InP FOR PHOTOVOLTAIC ENERGY CONVERSION: Quarterly Technical Progress Report, 29 Sep. - 28 Dec. 1979
Harold M. Manasevit, R. P. Ruth, L. A. Moudy, J. J. J. Yang, and R. E. Johnson Jan. 1980 45 p refs
(Contract DE-AC02-79ET-23004)
(COO-3004-2; QTPR-2) Avail: NTIS HC A03/MF A01

Growth parameters are established using triethylindium, diethylzinc (DEZn), and PH3 sources for the formation of Zn doped p type InP films. The properties of grains and grain boundaries in polycrystalline InP films are investigated using several polycrystalline film/substrate combinations, including tungsten (W) layers produced by roller coating and screen printing on polycrystalline alumina, and mechanically abraded surfaces of single crystal bulk InP:Fe wafers. The use of GaP as an alternative intermediate layer material to GaAs on low cost substrates for subsequent growth of InP films is also examined. Auger electron spectroscopy analysis done on a group of specially prepared Zn treated films of polycrystalline InP indicates the presence of Zn at surfaces of InP:Zn films grown on Al and/or heat treated in high concentrations of DEZn at 600 C. However, no Zn is detected in polycrystalline films grown under deposition conditions that would be expected to produce highly doped p type epitaxial films if single crystal substrates were used. DOE

N80-30913# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE ESTIMATES FOR ATTACHED SUNSPACE PASSIVE SOLAR HEATED BUILDINGS
Robert D. McFarland and Robert W. Jones (South Dakota Univ., Vermillion) 1980 6 p refs Presented at 1980 Ann. Meeting of Am. Sect. of Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2-6 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-853; CONF-800604-4) Avail: NTIS HC A02/MF A01

Performance predictions are made for attached Sun space types of passively solar heated buildings. The predictions are based on hour by hour computer models developed in the framework of PASOLE, the passive solar energy simulation program. The models have been validated by detailed comparison with actual hourly temperature measurements taken in attached sunspace test rooms. DOE

N80-30914# Argonne National Lab., Ill. Integrated Assessments and Policy Evaluations Group.
CLIMATE AND ENERGY: A COMPARATIVE ASSESSMENT OF THE SATELLITE POWER SYSTEM (SPS) AND ALTERNATIVE ENERGY TECHNOLOGIES
David A. Kellermeyer Jan. 1980 69 p refs
(Contract W-31-109-eng-38)
(DOE/ER-0050) Avail: NTIS HC A04/MF A01

The potential effects of five energy technologies on global, regional, and local climate are assessed. The energy technologies examined are coal combustion, light water nuclear reactors, satellite power systems, terrestrial photovoltaics, and fusion. The assessment focuses on waste heat rejection, production of particulate aerosols, and emission of carbon dioxide. The current state of climate modeling and long range climate prediction introduces considerable uncertainty into the assessment, but it may be concluded that waste heat will not produce detectable changes in global climate until world energy use increases 100 fold, although minor effects on local weather may occur now; that carbon dioxide from coal combustion in the US alone accounts for about 30% of the current increase in global atmospheric CO2 which may, by about 2050 increase world temperature 2 to 3 C, with pronounced effects on world climate; and that rocket exhaust from numerous launches during construction of a satellite power system may affect the upper atmosphere, with uncertain consequences. DOE

N80-30915# Argonne National Lab., Ill. Integrated Assessments and Policy Evaluations Group.
COMPARATIVE ASSESSMENT OF ENVIRONMENTAL WELFARE ISSUES ASSOCIATED WITH THE SATELLITE POWER SYSTEM (SPS) AND ALTERNATIVE TECHNOLOGIES
E. P. Levine, M. J. Senew, and R. R. Cirillo Apr. 1980 99 p refs
(Contract W-31-109-eng-38)
(DOE/ER-0055) Avail: NTIS HC A05/MF A01

Environmental deterioration and associated welfare effects from two mature electric power generation systems (combustion of coal and light water nuclear reactors) are compared with those expected from a conceptual satellite power system. Each activity within the energy pathway for each power system is examined to determine the potential welfare effects it imposes on a community. The severities of these effects are compared. On the basis of this comparison and the state of knowledge concerning specific environmental impacts and welfare effects, key environmental issues are identified for subsequent, in-depth analyses. DOE

N80-30916# Argonne National Lab., Ill. Energy and Environmental Systems Div.
COMPARATIVE ANALYSIS OF NET ENERGY BALANCE FOR SATELLITE POWER SYSTEMS (SPS) AND OTHER ENERGY SYSTEMS
R. R. Cirillo, B. S. Cho, M. R. Monarch, and E. P. Levine Apr. 1980 143 p refs
(Contract W-31-109-eng-38)
(DOE/ER-0056) Avail: NTIS HC A07/MF A01

The net energy balance of seven electric energy systems is assessed: two coal-based, one nuclear, two terrestrial solar, and two solar power satellites, with principal emphasis on the latter two systems. Solar energy systems require much less operating energy per unit of electrical output. However, on the basis of the analysis used here, coal and nuclear systems are two to five times more efficient at extracting useful energy from the primary resource base than are the solar energy systems. The payback period for all systems is less than 1.5 years, except for the terrestrial photovoltaic (19.8 yr) and the solar power satellite system (6.4 yr), both of which rely on energy-intensive silicon cells. DOE

N80-30917# Hittman Associates, Inc., Columbia, Md.
USE OF ORGANIC WORKING FLUIDS IN RANKINE ENGINES
H. M. Curran Sep. 1979 23 p refs
(Contract DE-AC03-79CS-00202)
(DOE/CS-30202/T1) Avail: NTIS HC A02/MF A01

A compilation is presented of state-of-the-art data on the use of organic working fluids in operational Rankine cycle engines. Particular attention is given to the determination of the maximum temperatures used for various working fluids in operational Rankine cycle engines and identification of thermal instability and chemical reaction problems related to these temperatures. Information is included on the characteristics and selection of working fluids; the behavior of lubricating oils in contact with working fluids; operational experience; and recommended organic fluids R and D. DOE

N80-30918# Ueland and Junker, Architects and Planners, Philadelphia, Pa.
SOLAR ATRIUM: A HYBRID SOLAR HEATING AND COOLING SYSTEM Technical Progress Report, 19 Mar. - 19 Jun. 1979
Mark Ueland 28 Jun. 1979 10 p
(Grant EG-77-G-04-4135)
(DOE/CS-34135/T1; TPR-7) Avail: NTIS HC A02/MF A01

Construction progress of the test model residence in which 'solar atrium' is to be installed is listed. Photographs of the 'solar atrium' are included. R.K.G.

N80-30919# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
HYBRID PHOTOVOLTAIC/THERMAL SYSTEMS WITH A SOLAR-ASSISTED HEAT PUMP
Edward A. Kush 1980 7 p refs Presented at the Am. Sect./Intern. Solar Energy Soc. 1980 Ann. Meeting Phoenix, Ariz., 2-6 Jun. 1980
(Contracts EY-76-C-02-0016; DE-AC02-76CH-00016)
(BNL-27667) Avail: NTIS HC A02/MF A01

An outline of possibilities for effective use of photovoltaic/thermal (PV/T) collectors with a Solar Assisted Heat Pump is given. A quantitative analysis of the performance and cost of the various configurations as a function of regional climates, using up-to-date results from solar heat pump and PV/T collector studies, will be required for more definitive assessment; and it is recommended that these be undertaken in the PV/T Program. Particular attention should be paid to development of high performance PV/T collectors, matching of heat pump electrical system to PV array and power conditioning characteristics, and optimization of storage options for cost effectiveness and utility impact. DOE

N80-30920# Battelle Pacific Northwest Labs., Richland, Wash.
SUPPLEMENTARY MATERIAL ON PASSIVE SOLAR HEATING CONCEPTS: A COMPILATION OF PUBLISHED ARTICLES. PRESENTED IN CONJUNCTION WITH A SERIES OF PASSIVE SOLAR HEATING SEMINARS SPONSORED BY THE SOLAR ENERGY TECHNOLOGY TRANSFER PROGRAM
May 1979 99 p
(Contract EY-76-C-06-1830)
(PNL-SA-7820) Avail: NTIS HC A05/MF A01

A compilation of published articles and reports dealing with passive solar energy concepts for heating and cooling buildings is presented. The following are included: fundamentals of passive systems, applications and technical analysis, graphic tools, and information sources. DOE

N80-30921# Pennsylvania State Univ., University Park. Materials Research Lab.
CONTROLLED CADMIUM TELLURIDE THIN FILMS FOR SOLAR CELL APPLICATIONS (EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS) Quarterly Progress Report, 9 Oct. 1979 - 8 Jan. 1980
K. Vedam, M. B. Das, and S. V. Krishnaswamy Feb. 1980 28 p refs
(Contract DE-AC04-79ET-23013)
(DOE/ET-23023/T3; QPR-3) Avail: NTIS HC A03/MF A01

Emphasis during the third quarter of the program was on the improvement of the quality of sputtered films, their characterization and use in the fabrication of Schottky barrier type diodes and solar cell structures. Films prepared under different conditions and on different substrates were examined showing modular growths under certain conditions. I-V, C-V, and photovoltaic characteristics were measured on numerous samples based on n- and p-type films on Ni substrates having top metallization of either evaporated Au and Al. The n-type samples showed up to 200 mV V/sub oc/and small short-circuit currents. The characteristics observed are indicative of the presence of interfacial layer and surface states. Surface state's capacitance were measured on p-type samples metalized with Au. DOE

N80-30922# Department of Energy, Washington, D. C. Div. of Central Solar Technology.
REPORT OF THE 6TH OCEAN THERMAL ENERGY CONVERSION CONFERENCE. OCEAN THERMAL ENERGY FOR THE 1980'S
Gordon L. Dugger, ed. 1979 543 p refs Conf. held in Washington, D.C., 19 Jun. 1979 Prepared in cooperation with the Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
(CONF-790631-1) Avail: NTIS HC A23/MF A01

For the United States, four ocean energy technologies offer significant promises: Ocean Thermal Energy Conversion (OTEC) (using heated surface waters), wave power, ocean currents, and salinity gradients. An overview of the DOE program for these four technologies is presented in terms of plans, concept descriptions, projected market penetration, and potential institutional barriers to implementation. The OTEC program presently receives about 95% of the total ocean energy systems funds. Up to 2 Quads (2 x 1,000,000,000,000,000 Btu/yr fuel equivalent or approximately 22 GW(e) of average OTEC power output) is practically achievable by the year 2000, dependent only on the commercialization strategy employed after the demonstration plant. DOE

N80-30923# Sandia Labs., Albuquerque, N. Mex. Photovoltaic Projects Div.
PHOTOVOLTAIC SYSTEMS AND APPLICATIONS PERSPECTIVE
Gary J. Jones 1980 8 p refs Presented at the Am. Sect. of the Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2 Jun. 1980
(Contract EY-76-C-04-0789)
(SAND-80-0926C; CONF-800604-14) Avail: NTIS HC A02/MF A01

The National Photovoltaic Program is currently in the proccess of increasing emphasis on full scale system experiments in the potential user environment. At this point large amounts of design information are available and need to be brought together in usable form to support this effort. The state of understanding in the system definition area for the major applications is reviewed, and the remaining issues, especially as they impact the field test activities, are indicated. DOE

N80-30924# Rocket Research Corp., Redmond, Wash.
SULFURIC ACID AND WATER CHEMICAL HEAT PUMP/CHEMICAL ENERGY STORAGE PROGRAM, PHASE 2-A Final Report
E. C. Clark 1979 132 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8176; RRC-79-R-727) Avail: NTIS HC A07/MF A01

A solar charged chemical heat pump/chemical energy storage (solar/CHP/CES) device is described with the ability to utilize solar energy for heat pumping, space cooling, and extended duration thermal energy storage. A study of solar/CHP/CES system economics, system optimization and component testing, and assessment of the ability to commercialize the system is presented. DOE

N80-30925# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
DEVELOPMENT OF SOLAR DRIVEN ABSORPTION AIR CONDITIONERS AND HEAT PUMPS
K. Dao, M. Wahlig, E. Wali, J. Rasson, and E. Molishever Mar. 1980 3 p refs Presented at the DOE Active Solar Heating and Cooling Contractors Rev. Meeting, Lake Tahoe, Nev., 26 Mar. 1980
(Contract W-7405-eng-48)
(LBL-10771; CONF-800340-6) Avail: NTIS HC A02/MF A01

The development of absorption refrigeration systems for solar active heating and cooling applications is discussed. The approaches investigated are those using air-cooled condenser-absorber and those leading to coefficient of performances (COP) that increase continuously with heat source temperature. This is primarily an experimental project, with the emphasis on designing, fabricating and testing absorption chillers in operating regimes that are particularly suited for solar energy applications. It is demonstrated that the conventional single-effect ammonia-water absorption cycle can be used (with minor modifications) for solar cooling. DOE

N80-30926# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
SOLAR ASSISTED HEAT PUMP PROGRAM OVERVIEW AND SUMMARY OF WORK AT BROOKHAVEN NATIONAL LABORATORY
John W. Andrews 1980 6 p refs Presented at the Ann. DOE Active Solar Heating and Cooling Contractors Rev. Meeting, Incline, Nev., 26-28 Mar. 1980
(Contract EY-76-C-02-0016)
(BNL-27662) Avail: NTIS HC A02/MF A01

Four generic paths for avoiding the high utility power demand for solar assisted heat pump systems when the Sun is not shining and storage is depleted are described. These include the bimodal solar assisted heat pump system, direct expansion solar

collector/heat pump systems, volume dominated ground coupled systems, and area dominated ground coupled systems. Work on heat pump development, ground coupling, and low cost collectors for use with these systems is reviewed. DOE

N80-30927# Argonne National Lab., Ill. Chemical Engineering Div.
DEVELOPMENT OF ADVANCED BATTERIES AT ARGONNE NATIONAL LABORATORY Summary Report, 1979
Apr. 1980 46 p
(Contract W-31-109-eng-38)
(ANL-80-32) Avail: NTIS HC A03/MF A01

The batteries being developed are for electric vehicle propulsion and stationary energy storage applications. The principal cells under investigation at present are of a vertically oriented, prismatic design with one or more inner positive electrodes of FeS or FeS2 facing negative electrodes of Li-Al alloy, and molten LiCl-KCl electrolyte; the cell operating temperature is 400 to 500 C. A small effort on the development of a calcium/metal sulfide cell is also being conducted. A 40 kWh electric vehicle battery was fabricated and delivered for testing. During heat-up, one of the modules failed due to a short circuit. A failure analysis was conducted and the Mark IA program completed. Development work on the next electric vehicle battery (Mark 11) was initiated. Work on stationary energy storage batteries consisted primarily of conceptual design studies. DOE

N80-30928# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SYSTEM DESIGN, TESTS RESULTS, AND ECONOMIC ANALYSIS OF A FLYWHEEL ENERGY STORAGE AND CONVERSION SYSTEM FOR PHOTOVOLTAIC APPLICATIONS
A. R. Millner and T. Dinwoodie 1980 7 p Presented at the 14th Photovoltaics Specialists Conf., San Diego, Calif., 7 Jan. 1980 Prepared in cooperation with MIT, Cambridge, Mass.
(Contract EY-76-C-02-4094)
(COO-4094-70; CONF-800106-18) Avail: NTIS HC A02/MF A01

The development of a flywheel interface and storage system for use with photovoltaic power sources is discussed. Test data on the performance of components built to investigate the feasibility of such a system, and the results of economic studies of the system showing user-worth analysis and manufacturing-cost estimates, are presented. The system has magnetic bearings, a maximum-power-point tracker, dc input, and cycloconverter output from an ironless-armature motor-generator. DOE

N80-30929# Ames Lab., Iowa. Dept. of Chemical Engineering.
PROCESSES TO INCREASE UTILIZATION OF POWER SOLID WASTES
M. J. Murtha and G. Burnet 1979 18 p refs Presented at the ASCE Power Res. Council/Elect. Power Res. Inst. Workshop, San Diego, Calif., 23 Apr. 1979
(Contract W-7405-eng-82)
(ISM-245; CONF-790499-3) Avail: NTIS HC A02/MF A01

Two processes are being developed for extracting metals from fly ash, limestone, and soda ash is sintered and the alumina extracted from the clinker using a dilute sodium carbonate solution. Recoveries of over 90% are obtained from both bituminous and subbituminous coal ashes, and the calcium silicate residue can be used as a raw material for cement. The second metals recovery method involves high temperature chlorination of the ash in the presence of a reductant in an equilibrium fixed bed or fludized bed reactor. Several metals are recovered as chlorides. Ash feed preparation for both processes includes magnetic separation of an iron-rich fraction which shows promise as a heavy media material or an iron ore. It is expected that at least one of the processes will work on other coal wastes such as fluidized bed combustion residue, coal gasification and liquefaction wastes, and limestone scrubber sludge. DOE

N80-30930# Westinghouse Electric Corp., East Pittsburgh, Pa. Advanced Systems Technology Dept.
DESIGN STUDY AND ECONOMIC ASSESSMENT OF MULTI-UNIT OFFSHORE WIND ENERGY CONVERSION SYSTEMS APPLICATION. VOLUME 1: EXECUTIVE SUMMARY Final Report
L. A. Kilar 14 Jun. 1979 59 p
(Contract EX-76-C-01-2330)
(WASH-2330-78/4-Vol-1) Avail: NTIS HC A04/MF A01

Offshore wind energy conversion system design, both deep and shallow water, are evaluated. The costs of building offshore platforms and underwater cables for power transmission are discussed. Maps show the U.S. ocean areas most suitable for optimum results. L.F.M.

N80-30931# Rockwell International Corp., Golden, Colo. Rocky Flats Plant.
SENCENBAUGH: MODEL 1000-14 WIND TURBINE GENERATOR Performance Report
K. K. Higashi Jul. 1979 13 p
(Contract DE-AC04-76DP-03533)
(RFP-3034/3533/79-5) Avail: NTIS HC A02/MF A01

Data are provided which give an accurate picture of the performance of the Sencenbaugh Model 1000-14 under conditions approximating normal use. Every effort was made to ensure that the data provided are accurate and the calibration of all instruments was continuously maintained. The tests were designed to develop a power curve for a known load (application) and determine the ability of the machine to survive high winds (85 mph or greater). The Sencenbaugh was tested under a variety of tail assembly adjustment modes. In none of the tests did the test data match the manufacturer's performance curve; however, changing the tail orientation resulted in proved performance. The model tested is no longer in production, and was replaced by a model with a redesigned tail assembly. L.F.M.

N80-30932# General Electric Co., St. Petersburg, Fla.
NEW PROCESSING FOR DEB POWDER FOR THERMAL BATTERIES
R. Szwarc and R. D. Walton Jun. 1980 9 p refs Presented at the 29th Power Sources Conf., Atlantic City, 9 Jun. 1980
(Contract EY-76-C-04-0656)
(GEPP-OP-486; CONF-800612-4) Avail: NTIS HC A02/MF A01

The electrochemical batteries employed are primary reserve batteries which employ a pelletized cell design. Each cell consists of an electrolyte-depolarizer pellet sandwiched between an anode and a heat pellet. The depolarizer-electrolyte, commonly referred to as DEB, is composed of CaCrO4, LiClKC1 eutectic and SiO2 binder powder, which has been blended and pressed into pellets. The DEB pellet serves as electrolyte and as active cathode when the salt becomes molten upon battery activation. The heat pellet serves the dual purpose of providing the heat necessary to activate the battery and as the cathode current collector. The heat pellet is composed of iron powder and KC104. Since activated life requirements for batteries vary from seconds up to one hour, the battery must be well insulated to conserve the heat produced by the ignition of the heat pellets to maintain the electrolyte in a molten state and to protect sensitive electronic components in contact with the battery case. Because the electrolyte, particularly LiCl, is hygroscopic, the baterries are hermetically sealed in stainless steel cans, and are manufactured in dryrooms maintaned at 3% relative humidity or better. DOE

N80-30933# Sandia Labs., Albuquerque, N. Mex.
PERFORMANCE DATA FOR A LITHIUM-SILICON/IRON DISULFIDE, LONG-LIFE, PRIMARY THERMAL BATTERY
Rod K. Quinn, Arlen R. Baldwin, and James R. Armito 1980 18 p refs Presented at the 24th Power Sources Conf., Atlantic City, 9 Jun. 1980
(Contract EY-76-C-04-0789)
(SAND-79-2148C; CONF-800612-3) Avail: NTIS HC A03/MF A01

The effects of various environmental tests on battery performance are reported. In order to simulate possible nuclear ordnance environments, batteries were subjected to shock, rhythmic and random vibration, and longitudinal and lateral acceleration in the unactivated and activated state. The level and duration of these tests varied, but the performance remained good. The effects of variation in current density from open circuit to 1 A/sq cm as well as various pulse loads were examined. Also presented are results of stabilizing the batteries at temperatures in the range of -54 C to +70 C as reflected in

various performance parameters. The Li(Si)/LiCl.KCl/FeS2 electrochemical system was also applied to two new Sandia designed batteries requiring rugged, medium life performance, i.e., activated lives of 2.5 and 4 minutes. Encouraging initial results of this application are included here. DOE

N80-30934# TRW Energy Systems, Redondo Beach, Calif.
FEASIBILITY STUDY FOR INDUSTRIAL COGENERATION FUEL CELL APPLICATION
15 Nov. 1979 67 p refs
(Contract ET-78-C-03-1889)
(SAN-1889-T1) Avail: NTIS HC A04/MF A01

A study of the feasibility of using a first generation, phosphoric acid fuel cell as a cogenerating, total energy system for aluminum processing is presented. The objectives of the study were to: (1) determine the technical, institutional, and economic factors which would make the first generation fuel cell attractive; (2) identify modifications of fuel cell technology which would enhance fuel cell attractiveness in an industrial climate; and (3) define institutional and economic changes which might enhance fuel cell attractiveness. The study incorporated a number of tasks, involving site selection, thermal and electrical load characterization, definition of fuel cell fuel supply options, evaluation of environmental impacts, and consideration of ownership options. DOE

N80-30935# Mound Lab., Miamisburg, Ohio.
POWER INDEPENDENT IGNITION ENERGY MEASUREMENTS
J. Mohler 1980 11 p ref Presented at the 7th Intern. Pyrotechnics Seminar, Vail, Colo., 14 Jul. 1980
(Contract DE-AC04-76DP-00005)
(MLM-2709(OP); CONF-800713-7) Avail: NTIS HC A02/MF A01

A procedure for establishing the minimum, power independent ignition energy is described. Integration of the power pulse from start until ignition yields the ignition energy. Repetition of this procedure at different power levels permits one to plot energy versus firing time. Since conduction losses are time dependent, extrapolation of the resulting curve to zero time yields an ignition energy value that is independent of losses due to thermal conduction. A key to the success of the procedure is accurate observation of ignition time. It was found that the reaction energy released at ignition causes a discernible deflection in the firing current record. By comparison of light emission and current traces, it was found that the onset of deflagration occurs at the inflection point of the current trace deflection. This procedure has been successfully applied to hot pressed thermite samples, yielding ignition energies that are in qualitative agreement with the expected sensitivities of the samples. DOE

N80-30936# Brookhaven National Lab., Upton, N. Y.
COMPARATIVE ASSESSMENT OF FIVE LONG-RUN ENERGY PROJECTIONS
Andy S. Kydes and John D. Pearson Dec. 1979 134 p refs
(Contract DE-AC02-76CH-00016)
(DOE/EIA/CR-0016/02) Avail: NTIS HC A07/MF A01

Five long term forecasts of energy projection are compared under similar assumptions. These include: (1) PILOT Process integrated Model/Welfare Equilibrium Model system (PILOT or PPIM/WEM); (2) ETA-MACRO energy economy model system; (3) the combined Brookhaven National Laboratory (DNL/DJA) energy model system; (4) the FOSSIL2 (1978) energy model; and (5) the Long range Energy Analysis Package energy model ARC-78. The method of preparation of each forecast is summarized and the differences are explained both in terms of data assumption and methodological approach. R.K.G.

N80-30937# Brookhaven National Lab., Upton, N. Y. Electrochemical Technology Group.
FUEL CELLS FOR ELECTRIC UTILITY AND TRANSPORTATION APPLICATIONS
S. Srinivasan 1980 30 p refs Presented at the Seminar on Electrochem. Systems: Batteries and Fuel Cells, Fortaleza-Ceara, Brazil, 2 Mar. 1980
(Contract EY-76-C-02-0016)
(BNL-27452; CONF-800324-2) Avail: NTIS HC A03/MF A01

The status of fuel cell development is reviewed. For terrestrial electric utility applications, the most promising are phosphoric acid, molten carbonate and solid electrolyte fuel cells. The first will be coupled with a reformer (to convert natural gas, petroleum derived and biomass fuels to hydrogen) while the second and third with a coal gasifier. As ground transportation power sources, the promising systems are phosphoric (or alternate acid) and alkaline electrolyte fuel cells. In the first case, methanol is most attractive while in the second, it will be hydrogen stored as a compressed gas or as a hydride. A technoeconomic assessment of a 'Regenerative Hydrogen-Halogen Energy Storage System' demonstrates the prospects of its use for load leveling when coupled with nuclear, solar or wind power plants. DOE

N80-30938# Oak Ridge National Lab., Tenn. Energy Div.
THERMALLY DRIVEN OPEN-CYCLE HEAT PUMP SYSTEM
F. C. Chen 1980 9 p refs Presented at the 11th Ann. Modeling and Simulation Conf., Pittsburgh, 1 May 1980
(Contract W-7405-eng-26)
(CONF-800549-1) Avail: NTIS HC A02/MF A01

The technical feasibility of a thermally driven open cycle heat pump is analyzed through the design simulation. It is intended to utilize waste heat from Federal nuclear facilities via temperature augmentation for process steam production. Based on the simulation analysis, the design of the open cycle heat pump to supply 4535 kg/hour 10,000 lb/hour, 121 C process steam is within the state-of-the-art. Its energy savings and cost estimate as compared to a baseline case and the alternatives are also presented. DOE

N80-30939# Brobeck (William M.) and Associates, Berkeley, Calif.
CONTROL SYSTEM CONSIDERATIONS FOR AN ALUMINUM-AIR BATTERY POWERED ELECTRIC VEHICLE Final Report
Laurence E. Cox, Gregory V. Hassman, and Stephen F. Post 15 May 1980 35 p
(Contract W-7405-eng-48)
(UCRL-15241; Rept-4500-95-23-R1A) Avail: NTIS HC A03/MF A01

Basic motor controller requirements and tradeoffs between 30 cell and 60 cell aluminum air battery systems were established. A sample controller design was evolved and basic characteristics were evaluated. Advantages of a 60 cell battery system over a 30 cell were found in the areas of control system costs, weights, and efficiency. DOE

N80-30940# United Technologies Corp., South Windsor, Conn. Power Systems Div.
CONCEPTUAL DESIGN OF ELECTRICAL BALANCE OF PLANT FOR ADVANCED BATTERY ENERGY STORAGE FACILITY Annual Report, Mar. 1979
Joseph R. Vivirito and Frederick J. Kornbrust Jan. 1980 137 p Prepared for Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(ANL-80-16; FCR-1367) Avail: NTIS HC A07/MF A01

The development of advanced batteries for utility energy storage systems is discussed. Realization of the full benefits available from those systems requires development, not only of the batteries themselves but also the ac/dc power converter, the bulk power interconnecting equipment, and the peripheral electric balance of plant equipment that integrate the battery/converter into a properly controlled and protected energy system. These overall system aspects are addressed for a 20 MW, 100 MWh lithium/sulfide battery system. DOE

N80-30941# Battelle Pacific Northwest Labs., Richland, Wash.
SITING HANDBOOK FOR SMALL WIND ENERGY CONVERSION SYSTEMS
Harry L. Wegley, James V. Ramsdell, Montie M. Orgill, and Ron L. Drake Mar. 1980 90 p refs
(Contracts EY-76-C-06-1830; DE-AC06-76RL-01830)
(PNL-2521-Rev-1) Avail: NTIS HC A05/MF A01

A siting guide for small wind energy conversion systems having a rated capacity of less than 100 kilowatts is presented. Meteorological, geographical, and wind data collection considerations are discussed. By properly using the siting techniques, an owner can select a site that will yield the most power at the

least installation cost, the least maintenance cost, and the least risk of damage or accidental injury. DOE

N80-30942# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
ENERGY ANALYSIS PROGRAM, FY 1979
Apr. 1980 78 p refs
(Contract W-7405-eng-48)
(LBL-10320) Avail: NTIS HC A05/MF A01

Energy analysis attempts to understand the volitional choices of energy use and supply available to human society, and the multi-faceted consequences of choosing any one of them. Topics deal with economic impacts; assessments of regional issues and impacts; air quality evaluation; institutional and political issues in California power plant siting; assessment of environmental standards; water issues; characterization of aquatic systems dissolved oxygen profiles; modeling; computer-generated interactive graphics; energy assessment in Hawaii; solar energy in communities; utilities solar financial data; population impacts of geothermal development; energy conservation in colleges and residential sectors; energy policy; decision making; building energy performance standards; standards for residential appliances; and impact of energy performance standards on demand for peak electrical energy. DOE

N80-30943# Rockwell International Corp., Golden, Colo. Energy Systems Group.
SMALL WIND TURBINE SYSTEMS 1979: A WORKSHOP ON R AND D REQUIREMENTS AND UTILITY INTERFACE/ INSTITUTIONAL ISSUES. VOLUME 1: R AND D REQUIREMENTS
Darrell M. Doge, ed. and Joel V. Stafford, ed. 1979 299 p refs Conf. held at Boulder, Colo., 27 Feb. - 1 Mar. 1979
(Contract EY-76-C-04-3533)
(RFP-3014-Vol-1) Avail: NTIS HC A13/MF A01

Current wind turbine design efforts to reduce the cost of energy to a minimum, and still provide a safe and reliable turbine system are discussed. The major thrust of any supporting research and technology development program should be directed toward this same goal. The factors which contribute to the cost of energy, and which can possibly be improved by research and development are analyzed. DOE

N80-30944# Auburn Univ., Ala. Water Resources Research Inst.
EXPERIMENTAL STUDY OF THE STORAGE OF THERMAL ENERGY IN CONFINED AQUIFERS Final Report, 1 Jul. 1977 - 31 Dec. 1979
F. J. Molz, A. David Parr, and Peter F. Andersen May 1980 51 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-7338/1) Avail: NTIS HC A04/MF A01

A two cycle experiment was performed in which heated water was stored in a confined aquifer and then recovered. During the first cycle, 54,784 cubic meters of water were pumped from a shallow supply aquifer, heated to an average temperature of 55 C, and injected into a deeper confined aquifer where the ambient temperature was 20 C. After a storage period of 51 days, 55, 345 cubic meters of water were produced from the confined aquifer. Throughout the first cycle, which lasted approximately six months, ground water temperatures were recorded at six depths in each of ten observation wells, and hydraulic heads were recorded in five observation wells. During the 41 day production period, the temperature of the produced water varied from 55 C to 33 C, and 66 percent of the injected thermal energy was recovered. The second cycle injection began on 9/23/78 and continued until 11/25/78 when 58,010 cubic meters of water had been recovered. The major problem experienced during the first cycle, a clogging injection well, was reduced by regular backwashing. DOE

N80-30945# Automation Industries, Inc., Richland, Wash. Vitro Engineering Div.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Apr. 1980 233 p
(Contracts W-31-109-eng-38; DE-AC01-79CS-30027)
(SOLAR/0010-80/04) Avail: NTIS HC A11/MF A01

The environmental data are presented in the form of tables for each solar site. The solar sites are grouped into 12 zones, each of which consists of several adjacent states. The insolation table presents the total, diffuse, direct, maximum, and extraterrestrial radiation for the solar site. It also shows the ratio of total extraterrestrial radiation, as a percent. The temperature table gives the average, daytime, nighttime, maximum, minimum, and inlet water temperatures for the solar site. Additional tables are presented for some of these solar sites, supplying either wind or relative humidity data, or both. A technical discussion of the instruments and measurements used to obtain these data tables is given, and a map illustrating the climate zones is provided. DOE

N80-30946# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
ADVANCED PHOTOVOLTAIC CONCENTRATOR CELLS Quarterly Technical Progress Report, 28 Aug. - 30 Nov. 1979
S. W. Zehr, H. T. Yang, and J. S. Harris, Jr. Dec. 1979 43 p refs Prepared for Midwest Research Inst., Golden, Colo.
(Contract EG-77-C-01-4042)
(DSE-4042-T30) Avail: NTIS HC A03/MF A01

Activities demonstrating the technical feasibility of advanced high efficiency concentrator solar converters are described. The approach is to fabricate two cell, non-lattice matched, monolithic stacked converters using optimum pairs of cells having bandgaps in the range of 1.6 to 1.7 eV and 0.95 to 1.1 eV. The low bandgap cells are to be fabricated from AlGaSb(As) compositions by LPE. These subcells are then to be joined into a monolithic structure by an appropriate thermal bonding technique which will also form the needed transparent intercell ohmic contact between the two subcells. The activities this quarter were focused on the development and study of low bandgap cell structures and attempts to develop suitable techniques for the thermal bonding operation. DOE

N80-30947# Tata Inst. of Fundamental Research, Bombay (India). Documentation Center.
SOLAR PASSIVE SYSTEMS FOR BUILDINGS
Mar. 1980 52 p refs
(NP-24377) Avail: NTIS (US Sales Only) HC A04/MF A01; DOE Depository Libraries

A survey is presented of design knowledge and systematic presentation of proven concepts is provided with suitable illustrations. Current design literature was studied to provide an overview of building practices. DOE

N80-30948# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
STATIC INVESTIGATION OF ROTOR BLADES AT REST AND UNDER QUASI-STATIONARY LOADING [STATISCHE UNTERSUCHUNG VON ROTORBLAETTERN UNTER EIGENGEWICHT UND IM STATIONAEREN BETRIEB]
J. H. Argyris, K. A. Braun, and B. Kirchgaessner 1979 57 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Bundesministerium fuer Forschung und Technologie, Bonn (West Germany)
(ISD-243; ISSN-0170-6071) Avail: NTIS HC A04/MF A01

The rotor blades of a horizontal axis wind energy converter which have flap and lead-lag freedom as well as a flap-pitch coupling, were dimensioned and studied under both nonoperating deadweight and quasi-stationary loading at constant forces rated operation. With a suitable mass distribution it is possible to drastically reduce the blade bending moments in the flap direction. Materials well known in aircraft construction were considered, among which carbon fiber reinforced plastic is shown to be the most suitable. Most of the blade models were investigated without a lead-lag hinge. Conical oscillation at rated operation was assumed for the layout of these rotor blades. It is reduced considerable for the same blade models when lead-lag freedom is incorporated while maintaining sufficient centrifugal stiffness in the lag direction. Author (ESA)

N80-30949# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
STABILITY AND DYNAMIC RESPONSE TO GRAVITATIONAL FORCES OF THE FLAPPING AND LEAD-LAG

HINGES ON A RIGID ROTOR BLADE WITH THE LEADING-EDGE ANGLE OF ATTACK AND FLAPPING BEING COUPLED [STABILITAET UND SCHWERKRAFTRESPONSE DER SCHLAG-SCHWENKBEWEGUNG EINES STARREN ROTORBLATTES MIT BLATTWINKELRUECKSTEUERUNG]
J. H. Argyris and B. Kirchgaessner 1979 53 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Bundesministerium fuer Forschung und Technologie, Bonn (West Germany)
(ISD-244; ISSN-0170-6071) Avail: NTIS HC A04/MF A01
The coupled flapping and lead-lag motion of a single, rigid rotor blade of a wind energy converter with flapping and lead-lag hinges as well as a coupling of the angle of attack with the flapping motion is investigated. The equations of motion are developed under the assumption of linearized quasi-stationary aerodynamic forces. Static and dynamic stability of the coupled flapping and lead-lag motion are investigated. The equations are integrated for different cases under cyclic gravitational forces to get an estimate of the influence of force terms and of the error from the linearization of the conservation expressions.
Author (ESA)

N80-30950# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
DYNAMIC ANALYSIS OF A ROTOR BLADE WITH LEAD-LAG FREEDOM, FLAPPING FREEDOM, AND VARIABLE-CONTROLLED BLADE PITCH ANGLE [DYNAMISCHE ANALYSE EINES ROTORBLATTES MIT SCHLAGFREIHEIT, SCHWENKREIHEIT UND BLATTWINKERLUECKSTEUERUNG]
J. H. Argyris, K. A. Braun, and B. Kirchgaessner 1979 95 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Bundesministerium fuer Forschung und Technologie, Bonn (West Germany)
(ISD-258; ISSN-0170-6071) Avail: NTIS HC A05/MF A01
The dynamic behavior of the rotor blades of a wind energy converter with flapping and lead-lag hinges as well as coupling of flapping and blade pitch is investigated. Under the assumption of rigid support of the hub and of constant rotational speed, a linearized system of differential equations of motion is developed using finite element idealization given linearized quasi-stationary aerodynamic forces. For two rotor blade models, which differ only in their stiffness in the lead-lag direction, the complex eigenfrequencies are calculated. Further, the dynamic response of the rotor blades in computed for cyclic gravity loads at rated operation, for a gust, and for the case of tower wake. From the deformation of the structure the stresses at selected points along the blade are derived, while for one version of the rotor blade, torque and rotor thrust are also determined. Author (ESA)

N80-30951# Austrian Solar and Space Agency, Vienna. Abteilung Sonnenenergie.
REGENERATIVE ENERGY SOURCES FOR THE PRODUCTION OF LOW TEMPERATURE HEAT: ENERGY SOURCES, ENERGY TYPES, AND ENERGY CONVERSION; RESULTS AND APPLICATIONS; MEASURES TO PROMOTE USE [REGENERATIVE ENERGIEQUELLEN ZUR ERZEUGUNG VON NIEDERTEMPERATURWAERME. ENERGIEQUELLEN, ENERGIEFORMEN UND ENERGIEUMWANDLUNG; ANWENDUNGEN UND ERFAHRUNGEN; FOERDERUNGSMASSNAHMEN]
Gerhard Faninger and Manfred Bruck 1979 123 p refs In GERMAN; ENGLISH summary
(ISBN-3-7041-0038-2) Avail: NTIS HC A06/MF A01; Austrian Solar and Space Agency, Vienna Sch 25
The experience gained so far concerning the utilization of regenerative energy sources is summarized. Advantages and disadvantages of various systems for the production of low temperature heat are analyzed and recommendations are made for applications regarding hot water production, heating of swimming pools, and space heating. The mechodology of the planning of solar facilities is presented, in addition to a description of the basics of solar technologies. The importance of the utilization of regenerative energy sources is underlined through the presentation of the development of energy management in Austria. The necessity of pursuing measures to accelerate market introduction of solar technology is stressed. A survey of the present measures undertaken for the promotion of solar techniques is given. Author (ESA)

N80-30952# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
PILOT SCALE COMBUSTION EVALUATION OF WASTE AND ALTERNATE FUELS, PHASE 3 Final Report, Feb. - Aug. 1978
R. A. Brown and C. F. Busch Mar. 1980 227 p refs (Contract EPA-68-02-1885)
(PB80-177413; EPA-600/7-80-043) Avail: NTIS HC A11/MF A01 CSCL 13B
The results of three studies which evaluated the combustion of waste products and alternate fuels are presented. The first evaluated a distributed air staging concept for NOx control in pulverized coal fired systems. The second evaluated combustion control techniques and NO emissions when firing coal/oil mixtures. The third evaluated emissions and combustion characteristics of refuse derived fuel (RDF) cofired with either natural gas or pulverized coal. GRA

N80-30953# National Technical Information Service, Springfield, Va.
THERMIONIC ENERGY CONVERSION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - May 1980
William E. Reed Jun. 1980 135 p Supersedes NTIS/PS-79/0596; NTIS/PS-78/0591
(PB80-810906; NTIS/PS-79/0596; NTIS/PS-78/0591) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 10B
Research on thermionic power generation, power plant design, converter design, and basic research on thermionic materials are cited. Spacecraft applications are included. This updated bibliography contains 129 abstracts, 23 of which are new entries to the previous edition. GRA

N80-30954# National Technical Information Service, Springfield, Va.
MAGNETOHYDRODYNAMIC GENERATORS IN POWER GENERATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980
William E. Reed Jun. 1980 278 p Supersedes NTIS/PS-79/0608; NTIS/PS-78/0528
(PB80-810856; NTIS/PS-79/0608; NTIS/PS-78/0578) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 10B
The citations include research on performance, costs, efficiency, and design of MHD generators and their use in fusion and fission reactors, and fossil fueled plants. This updated bibliography contains 272 abstracts, 40 of which are new entries to the previous edition. GRA

N80-30955# National Bureau of Standards, Washington, D.C. National Measurement Lab.
MATERIALS FOR FUEL CELLS Annual Report, Jan. - Dec. 1978
L. H. Bennett, C. K. Chiang, M. I. Cohen, A. L. Dragoo, A. D. Franklin, and A. J. McAlister Mar. 1980 89 p refs
(PB80-182355; NBSIR-80-1991) Avail: NTIS HC A05/MF A01 CSCL 10B
The Materials for Fuel Cells Program at NBS during this year consisted of three major elements which taken together reinforce each other in techniques and concepts; these elements embrace; (1) electrocatalysis, especially hydrogen oxidation, on non noble metals and alloys; (2) degradation mechanisms involving solid oxygen-transporting electrolytes; and (3) development of instruments. GRA

N80-30956# National Technical Information Service, Springfield, Va.
WIND POWER. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - 1978
Audrey S. Hundemann Jun. 1980 263 p
(PB80-811433) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 10B
The feasibility, use, and engineering aspects of wind power and windmills are discussed in these citations of Federally funded research reports. Abstracts primarily cover the use of wind power for electric power generation and wind turbine design and performance. General studies dealing with comparative analyses

of wind power and alternative energy sources are included, as are energy storage devices which can be used in these systems. This updated bibliography contains 253 abstracts, none of which are new entries to the previous edition. GRA

N80-30957# National Technical Information Service, Springfield, Va.
WIND POWER. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - May 1980
Audrey S. Hundemann Jun. 1980 305 p Supersedes NTIS/PS-79/0536, NTIS/PS-78/0417
(PB80-811441; NTIS/PS-79/0536; NTIS/PS-78/0417)
Copyright Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Windmill and wind power feasibility, use, and engineering are discussed in these citations of worldwide research. Abstracts primarily cover the use of wind power for electric power generator and wind turbine design and performance. General studies dealing with the use of wind power in developing countries and comparative analyses of wind power and alternative energy sources are included, as are studies on energy storage systems. This updated bibliography contains 299 abstracts, 174 of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-30958# California Univ., Irvine.
PROCEEDINGS OF THE CONFERENCE ON ENVIRONMENTAL TOXICOLOGY
Apr. 1980 292 p refs Conf. held at Dayton, Ohio, 13-15 Nov. 1979
(Contract F33615-76-C-5005; AF Proj. 6302)
(AD-A086341; AFAMRL-TR-79-121) Avail: NTIS HC A13/MF A01 CSCL 06/2

Major technical areas discussed included environmental hazards of fibrous dusts, toxicokinetics of inhaled gases and vapors, and the environmental hazards of toxicants in surface water systems. The oncogenic effects of hydrazine in animal models and immunotoxic reactions as manifested by skin and lung hypersensitivity was presented. GRA

N80-30959# Institute of Ecology, Indianapolis, Ind.
CARBON DIOXIDE EFFECTS RESEARCH AND ASSESSMENT PROGRAM. THE ROLE OF TEMPERATE ZONE FORESTS IN THE WORLD CARBON CYCLE: PROBLEM DEFINITION AND RESEARCH NEEDS
T. V. Amentano, ed. and J. Hett, ed. Feb. 1980 76 p refs Workshop held at Indianapolis, 23-24 Mar. 1980
(DE-AC02-79EV-10040)
(CONF-7903105) Avail: NTIS HC A05/MF A01

Existing data on growth and utilization of the temperate zone forest carbon pool are examined and further research needs in relation to the role of temperate forests in the global carbon cycles are identified. Topics covered include: (1) current trends in temperate zone forests in North America, Europe, and Asia; (2) regional analysis of forest carbon exchange in New England and the Southeastern United States; (3) policy aspects of a temperate zone forest research program; (4) limitations to the analysis of temperate zone forest carbon exchange; and (5) growth trends in commercial forests of North America; and (6) the influence of civilization upon European and Asian forests. DOE

N80-30960# Oak Ridge National Lab., Tenn.
EVALUATION OF UNCERTAINTIES IN SELECTED ENVIRONMENTAL DISPERSION NEEDS
Craig A. Little and Charles W. Miller 1979 4 p refs Presented at Am. Nucl. Soc. Meeting, San Francisco, 12 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791103-108) Avail: NTIS HC A02/MF A01

Compliance with standards of radiation dose to the general public has necessitated the use of dispersion models to predict radionuclide concentrations in the environment due to releases from nuclear facilities. Because these models are only approximations of reality and because of inherent variations in the input parameters used in these models, their predictions are subject to uncertainty. Quantification of this uncertainty is necessary to assess the adequacy of these models for use in determining compliance with protection standards. The capabilities of several dispersion models to predict accurately pollutant concentrations in environmental media are characterized. Three types of models are discussed: aquatic or surface water transport models, atmospheric transport models, and terrestrial and aquatic food chain models. Using data published primarily by model users, model predictions are compared to observations. DOE

N80-30961# Aspen Inst. for Humanistic Studies, Boulder, Colo.
MODELING THE PROSPECTS FOR CLIMATIC CHANGE: CURRENT STATE-OF-THE-ART AND IMPLICATIONS
William W. Kellogg 4 Apr. 1980 44 p refs Presented at the Econ. Methodologies for Climate Change, Ft. Lauderdale, Fla., 24 Apr. 1980 Prepared in cooperation with the National Center for Atmospheric Research, Boulder, Colo.
(Contract DE-AC02-79EV-10281)
(CONF-800474-1) Avail: NTIS HC A03/MF A01

Expected changes in the world's climate, primarily as a result of anthropogenic perturbations to the global carbon cycle brought about by fossil fuel burning and large scale deforestation are discussed. The status of our ability to model the planetary system that determines the climate is summarized. DOE

N80-30962# Oak Ridge National Lab., Tenn. Health and Safety Research Div.
USERS MANUAL FOR DWNWND: AN INTERACTIVE GAUSSIAN PLUME ATMOSPHERIC TRANSPORT MODEL WITH EIGHT DISPERSION PARAMETER OPTIONS
David E. Fields and Charles W. Miller May 1980 39 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6874) Avail: NTIS HC A03/MF A01

The computer code DWNWND is an interactive implementation of the Gaussian plume model. It allows the user to specify any one of eight different sets of the empirically determined dispersion parameters. Using the selected dispersion parameters, ground-level normalized exposure estimates are made at any specified downwind distance. Computed values may be corrected for plume depletion due to deposition and for plume settling due to gravitational fall. With this interactive code, the user chooses values for ten parameters which define the source, the dispersion and deposition process, and the sampling point. DWNWND is written FORTRAN for execution on a PDP 10 computer, requiring less than one second of central processor unit time for each simulation. DOE

N80-30963# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
DELIQUESCENCE PROPERTIES AND PARTICLE SIZE CHANGE OF HYDROSCOPIC AEROSOLS
Ignatius N. Tang 1979 23 p refs Presented at the Symp. on Biol. Studies of Environ. Pollutants: Aerosol Generation and Exposure Facilities, Honolulu, Hawaii, 1 Apr. 1979
(Contract EY-76-C-02-0016)
(BNL-27094; CONF-7904123-1) Avail: NTIS HC A02/MF A01

The deliquescent properties of pure and mixed salt aerosols and the particle size change as a function of relative humidity are discussed. Experimental results are presented for the growth of mixed chlorides (NaCl-KCl), mixed sulfates (H_2SO_4-$(NH_4)_2SO_4$), and mixed $(NH_4)_2SO_4$-NH_4NO_3 aerosol systems. It is shown that the behavior of the mixed salt aerosols in a moist atmosphere can be predicted from phase diagrams and pertinent thermodynamic properties of the bulk solutions. The evaporation of a saline droplet in an atmosphere of decreasing humidities is also investigated experimentally. For each deliquescent salt aerosol, there is a threshold humidity below which the solution droplets will quickly evaporate to become crystalline particles. The information is useful in the selection of a suitable humidification procedure to generate test aerosols for exposure studies. DOE

N80-30964# Environmental Protection Agency, Ann Arbor, Mich. Test and Evaluation Branch.
EVALUATION OF THE RAM-JET DEVICE, A PCV AIR BLEED

Edward Anthony Barth. Jan. 1980. 14 p.
(PB80-170657; EPA-AA-TAEB-80-10) Avail: NTIS
HC A02/MF A01 CSCL 13F

The potential for emission reduction or fuel economy improvement compared to conventional engines and vehicles was determined for retrofit device designed to bleed in extra air to the engine by allowing ambient air to bypass the carburetor under high engine load conditions. GRA

N80-30965# TRW Systems and Energy, Redondo Beach, Calif.
TOTAL PARTICULATE MASS EMISSION SAMPLING ERRORS. Final Report, Nov. 1976 - Apr. 1977
E. F. Brooks. Jul. 1979. 52 p. refs.
(Contract EPA-68-02-2165)
(PB80-181910; EPA-600/7-79-155) Avail: NTIS
HC A04/MF A01 CSCL 13B

A first cut estimate of sampling errors in the measurement of total particulate mass emissions from stationary sources is given. Measurement errors are divided into two general categories: sampling errors and analysis errors. Total particulate mass sampling errors are evaluated within the framework of a system error analysis. The evaluation leads to a ranking of individual error sources and estimates of total system error. Analysis results show that a Level 1 should have a sampling accuracy of better than a factor of + or - 2, with a confidence of 95%, except at a control device outlet where the accuracy is more likely to be a factor of + or - 3, especially if the control device is an electrostatic precipitator. GRA

N80-30966# North Carolina Univ. at Chapel Hill. School of Public Health.
PHOTOCHEMICAL STUDY OF NOx REMOVAL FROM STACK GASES. Final Report, Jan. 1977 - Mar. 1979
John R. Richards and Donald L. Fox. Mar. 1980. 202 p. refs.
(Grant EPA-R-804740)
(PB80-181274; EPA-600/7-80-038) Avail: NTIS
HC A10/MF A01 CSCL 07E

The technical feasibility of a photochemical pretreatment system for NOx control at coal fired boilers is evaluated. The approach utilizes reaction mechanisms similar to those responsible for photochemical oxidant incidents. The reactions are initiated under controlled conditions while the pollutants are at high concentration and while the reaction products can be removed. Results indicate that, under time and light limited conditions, it is possible to quench the photochemical reactions at the NO2 peak and prior to the formation of ozone, aerosols, and other secondary products. Photochemical oxidation of NO was insensitive to SO2 concentration and CO2 concentration. The photochemical system appears compatible with conditions resulting from combustion modifications to suppress NOx generation. GRA

N80-30967# Bowdoin Coll., Brunswick, Maine.
THE BENEFITS OF AIR AND WATER POLLUTION CONTROL: A REVIEW AND SYNTHESIS OF RECENT ESTIMATES. Final Report
Myrick A. Freeman, III. Dec. 1979. 191 p. refs. Sponsored by Council on Environmental Quality.
(PB80-178759) Avail: NTIS HC A09/MF A01 CSCL 13B

A critical reveiw of previous studies which estimate air and water pollution control benefits in monetary terms or which might provide an empirical basis for such an estimate is given. The reasons for the estimates to be so different are discussed and benefit estimates are recalculated whenever possible on the basis of common assumptions concerning price level, base period, degree of cleanup, and imputed values in order to compare the different estimates. GRA

N80-30968# City Coll. of the City Univ. of New York. Dept. of Electrical Engineering.
REMOTE MONITORING OF GASEOUS POLLUTANTS BY DIFFERENTIAL ABSORPTION LASER TECHNIQUES. Final Report, Jun. 1974 - Jun. 1978
S. A. Ahmed, J. S. Gergely, and F. Barone. Feb. 1980. 217 p. refs.
(Grant EPA-R-803109)
(PB80-179351; EPA-600/2-80-049) Avail: NTIS
HC A10/MF A01 CSCL 13B

A single ended laser radar (LIDAR) system was designed, built, and successfully operated to measure range resolved concentrations of NO2, SO2, and O3 in the atmosphere using a Differential Absorption of Scattered Energy LIDAR technique. For the NO2 measurements, the dye laser output was used directly in a novel simultaneous two wavelength output mode in which two wavelengths, one on and one off the resonance absorption of NO2 molecules are transmitted simultaneously and the relative attenuation determined for the two backscattered signals detected. For the SO2 and O3 measurements, it was necessary to frequency double the output of the dye laser to match the absorption spectra of the SO2 and O3 molecules. GRA

N80-30969# Environmental Research Lab., Athens, Ga.
SURVEY ANALYSIS OF PHENOLIC COMPOUNDS IN INDUSTRIAL EFFLUENTS BY GAS CHROMATOGRAPHY MASS SPECTROMETRY
W. M. Shackelford and R. G. Webb. 1979. 15 p. refs. Submitted for publication.
(PB80-177793; EPA-600/J-79-056) Avail: NTIS
HC A02/MF A01 CSCL 07D

Use of continuous liquid-liquid extractor improved the recovery of phenolic compounds from those effluents that formed intractable emulsions during liquid-liquid extraction by shake-out. Tenax GC and SP1240 DA proved to be the best general purpose gas chromatographic column packings for a broad range of phenolic compounds. Derivatization procedures using diazomethane and pentafluorobenzyl bromide were found to be successful only under rigorously controlled conditions. For survey work, it appears that derivatization is of questionable value for initial qualitative analysis because, in many cases, the character of the matrix is not known. GRA

N80-30970# Systems Applications, Inc., San Rafael, Calif.
MODELLING OF SIMULATED PHOTOCHEMICAL SMOG WITH KINETIC MECHANISMS. VOLUME 2 CHEMK: A COMPUTER MODELING SCHEME FOR CHEMICAL KINETICS. Final Report
G. Z. Whitten and H. Hogo. Feb. 1980. 115 p. refs.
(Contract EPA-68-02-2428)
(PB80-181084; EPA-600/3-80-028B) Avail: NTIS
HC A06/MF A01 CSCL 07E

Mechanisms that describe the formation of photochemical smog are developed using a computer modeling technique directed toward the simulation of data collected in two smog chambers, an indoor chamber and a dual outdoor chamber. Individual compounds for which specific experiments were simulated and mechanisms developed include the following: formaldehyde, acetaldehyde, ethylene, propylene, butane, and toluene. The user's manual and coding for a chemical kinetics computer program, CHEMK, is contained. GRA

N80-30971# Office of Science and Technology, Washington, D. C.
SCIENTIFIC AND TECHNICAL NEEDS FOR HAZARDOUS WASTE MANAGEMENT
Louis H. Blair, Carl R. Gerber, and Leonard C. Slosky. Oct. 1979. 58 p.
(PB80-177173) Avail: NTIS HC A04/MF A01 CSCL 13B

Recommendations for research and technology development and for the application of existing knowledge are given. Recommendations with longer term implications call for improved procedures and data to define wastes and waste sites in terms of the degree of hazard they pose to human health and the environment; new and improved technologies for destroying or detoxifying future waste streams as well as mixtures of wastes already in 'problem' sites; criteria for siting new facilities; and an environment research center dedicated to hazardous waste. GRA

N80-30972# Environmental Protection Agency, Research Triangle Park, N.C. Quality Assurance Div.
AN EVALUATION STUDY OF EPA METHOD 8. Final Report
Joseph E. Knoll and M. Rodney Midgett. Mar. 1980. 44 p. refs.
(PB80-181936; EPA-600/4-80-018) Avail: NTIS

HC A03/MF A01 CSCL 07D

Techniques used in the source test method for acid mist and sulfur dioxide emissions from sulfuric acid plants are evaluated. Evidence is shown that trace amounts of peroxides in isopropyl alcohol (IPA) result in the conversion of sulfur dioxide to sulfate and cause positive errors in acid mist values. Methods for measuring and purifying IPA are described. Collection efficiencies of train components are described and two alternate indicators are evaluated. Solid ammonium sulfates's use as audit samples is discussed. Field testing is also described in which paired probe techniques were employed. Both ammonia and dimethyl analine, which are employed as gas scrubbers, cause sulfur dioxide to be retained in the isopropyl alcohol and result in large positive interferences in acid mist values. Ferric oxide, present in the effluents of steel pickling operations, causes a large negative interference in acid mist values. GRA

N80-30973# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. of Toxicology and Aerosol Research.

DESIGN AND PERFORMANCE OF AN AEROSOL MASS DISTRIBUTION MONITOR Final Report, 1977 - 1979

W. Stoeber, F. J. Moenig, H. Flachsbart, and N. Schwarzer Mar. 1980 53 p refs

(Grant EPA-R-803592)

(PB80-179310; EPA-600/2-80-053) Avail: NTIS HC A04/MF A01 CSCL 14B

The instrument consists of a newly designed spiral duct aerosol centrifuge equipped with highly sensitive quartz sensors for in situ weighing of the deposited aerosol masses. The instrument further includes a clean air device for maintaining constant aerosol flow conditions, and electronic parts for the operation of the quartz sensors. The mass of aerosol deposited on the quartz crystals is automatically measured by an electronic counter while the rotor of the centrifuge continues spinning. The data are handled by a microprocessor. GRA

N80-30974# Lincoln Lab., Mass. Inst. of Tech., Lexington. Div. of Applied Research/ASRA.

TUNABLE LASER SURVEY OF MOLECULAR AIR POLLUTANTS: DOPPLER-LIMITED SPECTRA OF THE C-H STRETCHING BANDS OF FORMALDEHYDE, ETHYLENE, ETHANE AND ALLENE Final Report

A. S. Pine Jan. 1980 145 p refs

(Grant NSF DAR-78-24562)

(PB80-180003; NSF/RA-800011) Avail: NTIS HC A07/MF A01 CSCL 07D

High resolution (Doppler limited) near infrared spectra of several hydrocarbons and other light molecules of atmospheric significance were surveyed and catalogued using a unique difference frequency laser spectrometer. Such spectra can be applied to the detection, identification, and quantitative monitoring of molecular air contaminants using lasers or other high resolution spectroscopic instruments. The complete Doppler limited spectra of the complex and rich C-H stretching bands of formaldehyde (H2CO), ethylene (C2H4), ethane (C2H6), and allene (C3H4) are presented. Precise frequencies and intensities of the spectral lines also are listed in an atlas for each molecule along with assignments, made by several collaborators, for most of the observed transitions. GRA

N80-30975# Dames and Moore, Bethesda, Md.

REPORT OF THE NCAQ ATMOSPHERIC DISPERSION MODELING PANEL. VOLUME 1: RECOMMENDATIONS Final Report

M. W. Chandler, J. Lewis, B. Zalcman, J. I. Kelly, A. F. Nugent, G. S. Hoopes, J. Mikula, and J. J. Herrman Mar. 1980 87 p refs Conf. held at Reston, Va., 13-16 Nov. 1979

(Contract NCAQ-5-AQ-7379)

(PB80-174964; AQ-7379-1) Avail: NTIS HC A05/MF A01 CSCL 04A

Uses and limitations of currently available models for air quality management, and appropriate dispersion models and/or technical approaches to be considered in the evaluation of the Clean Air Act are given. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-30976 Washington Univ., St. Louis, Mo.

MICROCHARACTERIZATION OF INTERPLANETARY DUST COLLECTED IN THE EARTH'S STRATOSPHERE Ph.D. Thesis

Philip Bernard Fraundorf 1980 352 p

Avail: Univ. Microfilms Order No. 8018727

The internal structure of thirteen 10 micrometer aggregates were examined using selected techniques from the field now known as analytical electron microscopy. The aggregates were collected in the Earth's stratosphere at 20 km altitude by impactors mounted on NASA U-2 aircraft. Eleven of them exhibited relative major element abundances similar to those found in chondritic meteorities. For this and other reasons, these eleven particles are believed to represent relatively unaltered interplanetary dust. Interplanetary dust is thought to be of cometary origin, and comets in turn provide the most promising reservoir for unaltered samples of materials present during the collapse of the solar nebula. It is shown that the chondritic aggregates probably contain important information on a wide range of processes in the early solar system. The observations are consistent with the hypotheses that: (1) the particles represent fragments of interplanetary dust; (2) some of them have not been significantly altered by thermal or radiation processes since their assembly; (3) interplanetary dust is of cometary origin; and (4) the dust parent materials consist of a wide range of relatively unaltered leftovers from the collapse of the solar nebula. Dissert. Abstr.

N80-30977 California Univ., San Diego.

STUDY OF SEISMIC WAVE EXCITATION FOR TWO EARTHQUAKES IN NORTHERN BAHA, CALIFORNIA Ph.D. Thesis

Nava Pichardo 1980 293 p

Avail: Univ. Microfilms Order No. 8018794

Two earthquakes of comparable local magnitude from different regions of northern Baja California are studied to explore possible causes for the observed stronger excitation of surface waves by earthquake from the Delta region (relative to earthquake of comparable local magnitude in the Peninsular Ranges region). Consideration of how the magnitude and moment determinations are related to the spectra of the two earthquakes exemplifies how departure from the implicit spectral and time similarity makes the corrections (or implied corrections) for period in the magnitude definitions inconsistent in relation to other scaling parameters. Also illustrated is how short period measurements, like Ml and mb will sample longer periods for an earthquake with a longer source time function, and how the time window implicit in the determination of magnitudes (and in some methods of moment determination in the time domain) may represent only part of the seismic energy contributing to the seismogram. Dissert. Abstr.

N80-30978*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

A REPORT ON THE GRAVITATIONAL REDSHIFT TEST FOR NON-METRIC THEORIES OF GRAVITATION Final Report, 1 Feb. - 31 Aug. 1980

Aug. 1980 55 p refs

(Grant NsG-8059)

(NASA-CR-163496) Avail: NTIS HC A04/MF A01 CSCL 08E

The frequencies of two atomic hydrogen masers and of three superconducting cavity stabilized oscillators were compared as the ensemble of oscillators was moved in the Sun's gravitational field by the rotation and orbital motion of the Earth. Metric gravitation theories predict that the gravitational redshifts of the two types of oscillators are identical, and that there should be no relative frequency shift between the oscillators; nonmetric theories, in contrast, predict a frequency shift between masers and SCSOs that is proportional to the change in solar gravitational potential experienced by the oscillators. The results are

consistent with metric theories of gravitation at a level of 2%. T.M.

N80-30979*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
STUDY AND EVALUATION OF IMPULSE MASS SPECTROMETERS FOR ION ANALYSIS IN THE D AND E REGIONS OF THE IONOSPHERE Final Report, 1 Jun. 1965 - 31 Dec. 1979
Bruce R. Kendall 31 Dec. 1979 176 p refs
(Grant NGL-39-009-032)
(NASA-CR-163490) Avail: NTIS HC A09/MF A01 CSCL 04A

Theoretical and numerical analyses were made of planar, cylindrical and spherical electrode time-of-flight mass spectrometers in order to optimize their operating conditions. A numerical analysis of potential barrier gating in time-of-flight spectrometers was also made. The results were used in the design of several small mass spectrometers. These were constructed and tested in a laboratory space simulator. Detailed experimental studies of a miniature cylindrical electrode time of flight mass spectrometer and of a miniature hemispherical electrode time of flight mass spectrometer were made. The extremely high sensitivity of these instruments and their ability to operate at D region pressures with an open source make them ideal instruments for D region ion composition measurements. T.M.

N80-30980*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPHERICAL EARTH ANALYSIS AND MODELING OF LITHOSPHERIC GRAVITY AND MAGNETIC ANOMALIES Ph.D. Thesis - Purdue Univ.
R. R. B. vonFrese (Purdue Univ.), W. J. Hinze (Purdue Univ.), and L. W. Braile (Purdue Univ.) May 1980 180 p refs
(Contract NAS5-25030)
(NASA-TM-80709) Avail: NTIS HC A09/MF A01 CSCL 08E

A comprehensive approach to the lithospheric analysis of potential field anomalies in the spherical domain is provided. It has widespread application in the analysis and design of satellite gravity and magnetic surveys for geological investigation. T.M.

N80-30981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULTANEOUS MEASUREMENTS OF MAGNETOTAIL DYNAMICS BY IMP SPACECRAFT
Donald H. Fairfield, Ronald P. Lepping, E. W. Hones, Jr. (LASL), S. J. Bame (LASL), and J. R. Asbridge (LASL) Aug. 1980 49 p refs Submitted for publication
(NASA-TM-81986) Avail: NTIS HC A03/MF A01 CSCL 03B

Changes in tail energy density during substorms in the magnetotail are given. In addition to plasma sheet thinnings seen prior to substorm onsets, a gradual decrease in plasma beta was detected in the deep tail which precedes onset and the more prominent plasma disappearance that typically accompanies it. The frequency of thinnings and the regions over which they occurred indicate that drastic changes in plasma sheet thickness are common features of substorms which occur at all locations across the tail. T.M.

N80-30982# Naval Research Lab., Washington, D. C.
EXPERIMENTS ON THE JUNCTION OF RELATIVISTIC ELECTRON BEAMS INTO PREFORMED CHANNELS IN THE ATMOSPHERE: A FEASIBILITY STUDY Interim Report
M. Raleigh, J. D. Sethian, R. B. Fiorito, L. Allen, R. F. Fernsler, and J. R. Greig 13 May 1980 49 p refs
(RR0110901)
(AD-A086732; AD-E000452; NRL-MR-4220) Avail: NTIS HC A03/MF A01 CSCL 04/1

A study was made of the interaction of an intense relativistic electron beam (REB) with a preformed reduced density channel in the atmosphere. The channel was designated by laser induced, aerosol initiated air breakdown and was heated by passage of an electric current. However, at the time the REB was injected into the channel no externally applied heating current remained. By varying the time between creation of the hot channel and injection of the REB, we were able to observe interactions of the beam with both high conductivity and low conductivity channels. In the former case the beam did not propagate in the channel, whereas in the latter case the beam did propagate in the channel. These results are discussed in terms of the residual conductivity in the channel, and in terms of the radius of the return current distribution compared to that of the beam. GRA

N80-30983# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
COMPARISON OF RESULTS FROM THE S3-2 SATELLITE AND THE CHATANIKA RADAR IN AN EARLY MORNING AURORA Interim Report
Roger P. Vancour and Bertram M. Shuman 22 Oct. 1979 18 p refs
(AF Proj. 2311)
(AD-A086861; AFGL-TR-79-0254; AFGL-ERP-680) Avail: NTIS HC A02/MF A01 CSCL 04/1

During orbit 6352, the Air Force satellite S3-2 passed by the Chatanika radar in a trajectory that was only 12 deg off from the geomagnetic meridian along which the radar scanned. This report presents the analysis of the data for this orbit from the triaxial fluxgate magnetometer, the electrostatic analyzer aboard the satellite, and the radar data. These data were obtained simultaneously during a morning active aurora. Comparisons of current densities determined by these experiments are made, and the agreement between the electrostatic analyzer precipitating electron fluxes and the electron densities determined from the radar data is shown. GRA

N80-30984# Naval Research Lab., Washington, D. C.
INFLUENCE OF MAGNETIC SHEAR ON THE CURRENT CONVECTIVE INSTABILITY IN THE DIFFUSE AURORA
J. D. Huba and S. L. Ossakow 16 Apr. 1980 21 p refs
(RR0330244)
(AD-A086789; AD-E000443; NRL-MR-4219) Avail: NTIS HC A02/MF A01 CSCL 04/1

The influence of magnetic shear on the current convective instability is investigated for conditions typical of the high latitude F region during the diffuse aurora. It is found that magnetic shear (1) reduces the growth rate of the instability (although it does not stabilize the mode); and (2) substantially localizes the mode structure parallel to the density gradient. GRA

N80-30985# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
PLASMA FIELD STUDIES DURING MAGNETIC DISTURBANCES Final Report, Aug. 1979 - Jun. 1980
W. P. Olson, K. A. Pfitzer, and S. J. Scotti 30 Jun. 1980 39 p refs
(Contract N00014-79-C-0791)
(AD-A086420) Avail: NTIS HC A03/MF A01 CSCL 04/1

This work summarizes the work performed during the contract period. The goal was the development of quantitative disturbed-time magnetic and electric field in the magnetosphere. The July 29, 1980 event was the model disturbance used to develop a realistic magnetic and electric field model for a disturbed period. GRA

N80-30986# Logicon, Inc., Lexington, Mass.
CONDENSED STORAGE OF DIFFUSION EQUATION SOLUTIONS FOR ATMOSPHERIC DENSITY MODEL COMPUTATIONS
James N. Bass 25 Jan. 1980 13 p refs
(Contract F19628-78-C-0209; AF Proj. 9993)
(AD-A086868; AFGL-TR-80-0038; SR-1) Avail: NTIS HC A02/MF A01 CSCL 04/1

It is shown that all neutral thermospheric component densities in diffusive equilibrium can be derived from a single function of height. This is used to permit considerable savings in storage of Jacchia 1977 model densities compared to storing the solution for each component, which requires use of external random access files. The single solution can be built into the computer code, making it more transportable to different computers. A subroutine has been developed implementing this method, including the latest results for atomic nitrogen and the non-diffusive equilibrium solution for atomic hydrogen. GRA

N80-30987# Epsilon Labs., Bedford, Mass.
SATELLITE DENSITY GAUGE INSTRUMENTATION PROGRAM Final Report, 11 Jan. 1977 - 30 Dec. 1978
Carl A. Accardo and John Dulchinos Jan. 1980 72 p refs
(Contracts F19628-77-C-0062; F19828-74-C-0156; AF Proj. 5690)
(AD-A086809; AFGL-TR-80-0036) Avail: NTIS HC A04/MF A01 CSCL 09/1

The report contains a description of a U.S. Air Force Geophysics Laboratory Atmosphere Density experiment. Two instruments developed under an earlier program were qualified for space flight and were flown in the spring of 1978. Discussion of instrument performance and flight results are presented. GRA

N80-30988# Analytic Sciences Corp., Reading, Mass.
A FAST ESTIMATION ALGORITHM FOR TWO-DIMENSIONAL GRAVITY DATA, GEOFAST
Kevin S. Tait 15 Nov. 1979 83 p refs
(Contract F19628-77-C-0152; AF Proj. 3204)
(AD-A086835; TASC-TR-868-1-1; AFGL-TR-80-0016; SR-2) Avail: NTIS HC A05/MF A01 CSCL 08/5

This report describes an algorithm for the efficient computation of minimum variance estimates from large amounts of two dimensional gravity data. The method (called GEOFAST for 'geodetic fast estimation') is based on the fast Fourier transform and takes advantage of the underlying structure of the statistical models in the frequency domain. An approximate solution is obtained in a number of computer operations proportional to N log sub 2, where N is the number of data points and the proportionality constant is controlled by the desired level of accuracy. Results are presented from two test cases, using GEOS-3 radar altimeter data to estimate mean gravity anomalies, which verify the efficiency and accuracy of the algorithm. GRA

N80-30989# Naval Research Lab., Washington, D. C.
AURORAL ELECTRODYNAMICS I. 1: PRELIMINARY ELECTRON DENSITY PROFILE. 2: VEHICLE POTENTIAL CHANGES DURING AN ACTIVE BEAM EXPERIMENT Memorandum Report
D. N. Walker, J. C. Holmes, and E. P. Szuszczewicz 19 May 1980 16 p refs
(RR0330244)
(AD-A086728; AD-E000455; NRL-MR-4229) Avail: NTIS HC A02/MF A01 CSCL 04/1

The report presents preliminary findings obtained by a pulsed plasma probe aboard a payload launched by a Terrier-Malemute sounding rocket from the Poker Flat Research Range. Results are outlined both during passive and active (i.e., an Argon plasma gun) experiments. Modifications to the design of the pulsed probe circuitry which allow tracking of the vehicle potential are described. The vehicle potential deduced from the analog records is plotted during times of interest (gun pulsing periods). An electron density profile with gun pulsing times indicated is also provided. GRA

N80-30990# Reims Univ., France. Lab. de Physique Moleculaire.
ATLAS OF THE INFRARED FREQUENCIES OF OZONE, PART 1 [ATLAS DES FREQUENCES INFRAROUGES DE L'OZONE. 1 PARTIE]
1979 131 p In FRENCH 2 Vol.
Avail: NTIS HC A07/MF A01

The frequency, energy, and relative intensity of ozone resonances in the infrared are given in tabular form. For part 2 see N80-30991. Author (ESA)

N80-30991# Reims Univ., France. Lab. de Physique Moleculaire.
ATLAS OF THE INFRARED FREQUENCIES OF OZONE, PART 2 [ALTAS DES FREQUENCES INFRAROUGES DE L'OZONE. 2 PARTIE]
1979 161 p In FRENCH 2 Vol.
Avail: NTIS HC A08/MF A01

The frequency, energy, and relative intensity of ozone resonances in the infrared are given in tabular form. For part 1 see N80-30990. Author (ESA)

N80-30992# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
SOUNDING ROCKET PROGRAM AERONOMY. PROJECT UPPER POLAR ATMOSPHERE. SUPRA-THERMAL AURORAL PARTICLE OBSERVATIONS Final Report
Klaus Wilhelm Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 42 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-03) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8.40

The scientific objectives of a supra-thermal particle experiment launched on four sounding rocket payloads in the framework of the project 'upper polar atmosphere' are described, as well as the design, development and calibration activities. The data obtained are presented in various stages of the data reduction process to facilitate co-operative scientific interpretations incorporating all measurements taken by the payloads. Author (ESA)

N80-30993# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
ROCKET MEASUREMENT OF TOROIDAL MAGNETIC FIELDS IN AN EQUATORIAL ELECTROJET: METHOD OF EVALUATION [RAKETENMESSUNGEN TOROIDALER MAGNETFELDER IM AEQUATORIALEN ELEKTROJET: AUSWERTUNGS METHODE]
Guenter Musmann 1979 75 p refs In GEORGIAN
(GAMMA-34) Avail: NTIS HC A04/MF A01

A rocket experiment was conducted in 1970 in Brazil to demonstrate the existence of the toroidal magnetic fields of the equatorial electrojet by means of Sun sensors, azimuth sensors and magnetometers. The calculation of the Earth's magnetic field with the D component (declination), I (inclination), and the position of the Sun (zenith distance and azimuth) are useful for the exploitation of the results. An evaluation method is proposed which allows the determination of the rotation of the declination due to the toroidal magnetic field. Author (ESA)

N80-30994# Midwest Research Inst., Kansas City, Mo.
EARTHQUAKE RISK AND DAMAGE FUNCTIONS: AN INTEGRATED PREPAREDNESS AND PLANNING MODEL APPLIED TO NEW MADRID Final Report
Ben-Chieh Liu, Chang-Tseh Hsieh, Robert Gustafson, Otto Nuttli, Richard Gentile, and William Park 7 Dec. 1979 335 p refs
(Grant NSF ENV-77-15669)
(PB80-170368; NSF/RA-790428) Avail: NTIS HC A15/MF A01 CSCL 08K

The methodology and the data needed to guide public and private planning and future decision making for earthquake hazard preparedness and risk mitigation are presented. The focus is on the New Madrid Fault region, especially the effect on the St. Louis and Memphis Standard Metropolitan Statistical Areas. An interdependent planning simulator model was developed to tie together statistically the seismic risk or physical damage functions to economic damage functions for potential earthquake risk assessment and impact evaluation for the next 50 years. GRA

N80-30995# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A MULTIDIRECTIONAL PHOTODIODE ARRAY FOR THE MEASUREMENT OF SOLAR RADIANCES
J. M. Davis, C. Vogel, and S. K. Cox Feb. 1980 51 p refs Sponsored in part by Eppley Lab., Inc.
(Grant NSF ATM-78-12631)
(PB80-181753; AS-PAPER-322; ISSN-0067-0340) Avail: NTIS HC A04/MF A01 CSCL 04A

An instrument designed to measure the angular variation of radiance field in the .3 to 1.1 micrometers spectral bandpass is described. The instrument consists of thirteen photodiode detectors mounted in fixed positions. Data analysis procedures designed to produce a continuous depiction of the radiance field over a 2 pi steradian solid angle from the thirteen discrete observations are described. These analysis procedures utilize spherical harmonics basis functions as a means of interpolation between the thirteen discrete radiance observations. An analysis procedure used to infer the direct component of the solar configuration selected upon the the basis of satisfying the analytical procedures.

sampling a 2 pi steradian field of view and minimizing sensor overlap, is given. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-30996 Oklahoma Univ., Norman.
AN INVESTIGATION OF SATELLITE-RADAR CORRELATION FUNCTIONS Ph.D. Thesis
Louis Arthur Hembree, Jr. 1980 210 p
Avail: Univ. Microfilms Order No. 8018924

A multivariate optimal interpolation objective analysis which combines satellite, radar, and gage data to give improved results in estimating surface rainfall is developed. The problems of combining the radar and satellite data sets through the use of space time correlation fields are discussed. These correlation fields represent the storm structure as implied by the observed data. The correlation fields are modeled using a four dimensional Gaussian damped cosine function whose parameters reflect the storm characteristics. The function fitting also gives an estimate of the noise present in the data. The parameters of the model correlation function can also be used to classify storms with respect to their structural characteristics. The correlations between the satellite data and radar derived rain rates were found to range from an order of 0.2 to 0.53 at the space time lags appropriate to maximizing the correspondence between patterns; consequently, the potential value of using the multivariate objective analysis methodology is established. Dissert. Abstr.

N80-30997# Meteorological Research Inst., Tokyo (Japan).
THE GMS USERS' GUIDE, ISSUE 1
Mar. 1980 111 p
Avail: NTIS HC A06/MF A01

User instructions for the Geophysical Monitoring Satellite (GMS) system are provided. The GMS system consists of GMS spacecraft, Command and Data Acquisition Station, Data Processing Center, Turn Around Ranging Stations, and Tracking and Control Center. T.M.

N80-30998# Meteorology International, Inc., Monterey, Calif.
THE APPLICATION OF MEASURES OF SYNOPTIC SIMILARITY TO THE EVALUATION AND DEVELOPMENT OF ATMOSPHERIC PREDICTION MODELS, TASK 2 Final Report
Manfred M. Holl, Michael J. Cuming, and Barbara A. Hawkins
Apr. 1980 51 p refs
(Contract N00228-79-C-0035)
(AD-A086034; MII-M-247; NEPRF-CR-30-02) Avail: NTIS HC A04/MF A01 CSCL 04/2

A method is described for bitcoding meteorological analyses and forecasts in terms of specifying parameters which measure pattern characteristics. By matching the associated bit strings, an absolute measure of the similarity between forecast and analyzed synoptic fields can be obtained. Applications to numerical model verification, evaluation and development are discussed. This report is a supplement to NAVENVPREDRSCHFAC CR 79-01 dated March 1979, Task 1 of same title. GRA

N80-30999# Weather Wing (7th), Scott AFB, Ill.
FORECAST WORKSHEET: A NEW APPROACH Final Report
Thomas L. Rich and Ronald G. Shaw 1 May 1980 22 p refs
(AD-A086151; Rept-WW/TN-80/001) Avail: NTIS HC A02/MF A01 CSCL 04/2

Forecasters are given mixtures of centralized forecasting guidance for various models, techniques, and data bases; valid for varying times or time intervals; and presented in many different ways. But to produce an operationally sound forecast, they must logically assemble the various bits and pieces, resolve all inconsistencies, and visualize the interactive changes that will be taking place in the atmosphere. This report describes the results of a study of worksheets normally used by Air Weather Service units to prepare forecasts. It identifies weaknesses that exist in many worksheets and describes a new worksheet format which provides a more logical step-by-step process for preparing forecasts. GRA

N80-31000# New Mexico State Univ., Las Cruces. Dept. of Electrical and Computer Engineering.
THE DESCRIPTION OF THE ROBIN PROGRAM AND ITS CONVERSION TO THE INTERDATA 7-32 COMPUTER SYSTEM
M. Don Merrill and Donald Elwell May 1980 140 p refs
(Contract DAAD07-76-C-0115; DA Proj. 1P6-65702-D-127)
(AD-A086810; ERADCOM/ASL-CR-80-0115-1) Avail: NTIS HC A07/MF A01 CSCL 09/2

ROBIN (the operational program for computation of upper atmosphere density and other parameters from a passive inflatable falling sphere) was developed for the Air Force Cambridge Research Laboratory by the University of Dayton Research Institute in the 1960's. Its utilization was limited to the Meteorological Rocket Network ranges that had high precision radars and large capacity computers. The development of minicomputers and the deployment of Nike Hercules tracking radars at several Army meteorological rocket sites made it possible to expand the use of the ROBIN sphere to remote locations. The only remaining barrier was the adaptation of the ROBIN program to a minicomputer. This report describes the conversion of the ROBIN-UNIVAC 1108 program used by the Atmospheric Sciences Laboratory at White Sands Missile Range, New Mexico, to the Interdata 7-32 minicomputer. GRA

N80-31001# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
OBJECTIVE QUALITY CONTROL OF ARTILLERY COMPUTER METEOROLOGICAL MESSAGES
Ernest B. Stenmark Apr. 1980 44 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A086554; ERADCOM/ASL-TR-0055) Avail: NTIS HC A03/MF A01 CSCL 09/2

Artillery computer meteorological (CM) messages are susceptible to having errors introduced into them during preparation at the Meteorological Section, during transmission to the user unit, and during entry into the Fire Direction Center computer. Quality control during preparation of the CM message is largely a manual function and thus subject to human error. At the Fire Direction Center, in the case of the most advanced computerized tactical fire direction control system, TACFIRE, quality control of the CM message is limited to superficial automated checks that relate primarily to message format, not content, and to reliance upon visual screening by the TACFIRE operator before acceptance, storage, and usage of the message. No quality control checks of the contents of the message are made during movement of the CM message from the preparer to the user. This report documents the development of procedures for objectively performing meteorologically consistent quality control checks on the contents of single CM messages that would require only very limited automatic data processing resources to implement at either the preparer or user end, or both, and that would improve upon the validity checks currently implemented in the TACFIRE system. GRA

N80-31002# Naval Postgraduate School, Monterey, Calif.
A CLIMATOLOGICAL STUDY OF THE FORCING OF THE NORTH PACIFIC OCEAN BY SYNOPTIC STORM ACTIVITY M.S. Thesis
Michael Scott Risch Mar. 1980 67 p refs
(AD-A086841) Avail: NTIS HC A04/MF A01 CSCL 04/2

Synoptic storm activity over the North Pacific Ocean is investigated by using a special series of six-hourly surface wind analyses prepared by Fleet Numerical Oceanographic Center (FNOC) covering the period 1969-1978. Temporal variance of the surface wind components at each grid point is 'high pass' filtered, thereby removing all temporal variability except that having time scales less than ten days. Both the total and the filtered wind components were used to calculate the cube of the friction velocity and the wind stress curl. Monthly 'climatologies' are calculated by computing ten-year averages of monthly mean cube of the friction velocity and wind stress curl from total and filtered

wind components for each month of the year. It was found that while climatological maps of cube of the friction velocity calculated from filtered data show spatially coherent patterns that are clearly associated wtih monthly storm tracks, similar maps of wind stress curl do not show such coherent patterns. Maps of anomalous storm activity, as given by the difference between the monthly value and the climatological value for that month, are also prepared and qualitatively compared to observations of large scale sea surface temperature (SST) anomalies. GRA

N80-31003# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
SHORTRANGE FORECASTING THROUGH EXTRAPOLATION OF SATELLITE IMAGERY PATTERNS. PART 2:. TESTING MOTION VECTOR TECHNIQUES Final Report
H. Stuart Muench 10 Dec. 1979 30 p refs
(AF Proj. 6670)
(AD-A086862; AFGL-TR-79-0294; AFGL-ERP-685) Avail: NTIS HC A03/MF A01 CSCL 04/2

An effort is underway at Air Force Geophysics Laboratory to develop automated procedures to make short-range (0-6 hr) terminal weather forecasts using GOES imagery data. A simple approach is to extrapolate the cloud patterns using motion vectors derived from a comparison of successive images. This report describes a test of candidate motion vector techniques using twelve cases of six successive images in a variety of weather conditions. Included in the techniques were two that track brightness centers, three that use cross-covariance, and two using winds aloft. All were compared against persistence (no motion, no change). For all time periods and all thresholds, a binary covariance technique had the highest scores but the techniques using winds aloft were very close. Also, no technique was much better than persistence. There is evidence that most (perhaps 75 percent) of the total changes occurring are not due to simple motion of the cloud patterns but due to more complex processes. GRA

N80-31004# Naval Research Lab., Washington, D. C.
PLANETARY BOUNDARY LAYER PARAMETERIZATION FOR TROPICAL CYCLONES BASED ON GENERALIZED SIMILARITY THEORY
Simon Wei-Jen Chang and Rangarao V. Madala 20 May 1980 35 p refs
(ZF52551001)
(AD-A086781; AD-E000460; NRL-MR-4235) Avail: NTIS HC A03/MF A01 CSCL 04/2

A planetary boundary layer (PBL) parameterization based on the generalized similarity theory (GST) was developed for tropical cyclone models. This parameterization, with only one layer, is necessary in modeling tropical cyclones for computational speed. The momentum, sensible heat and moisture fluxes are mutually dependent in this parameterization through nondimensional gradient equations. The internal structure of the PBL is determined implicitly through universal functions. In comparison with a complex, one dimensional, multiyear PBL model, the GST parameterization yields accurate moisture fluxes, but slightly overestimates the momentum flux and underestimates the sensible heat flux. The GST parameterization produces very realistic dynamics, energetics and thermal structure in an axisymmetric tropical cyclone model. This GST parameterization is judged superior to drag coefficient parameterization and is a good alternative to the more expensive, multilayer parameterization. GRA

N80-31005# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.
OPTICAL TURBULENCE FORECASTING: A TUTORIAL Environment Research Paper
Edmond M. Dewan 22 Jan. 1980 69 p refs
(AF Proj. 6687)
(AD-A086863; AFGL-TR-80-0030; AFGL-ERP-694) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report is a tutorial on the effects of atmospheric turbulence upon systems which rely upon the propagation of laser beams. In addition to providing a simplified presentation of turbulence theory and optical effects, it describes the state of the art of the new technique of radiosonde estimation of index of refraction fluctuations. Suggestions are given for future research which will help to answer current Air Force needs. The feasibility of some laser systems will depend upon the value of r sub o, the coherence length (which is related to C sub n sq which in turn is related to the degree of turbulence). At present, the statistics of r sub o are inadequate. GRA

N80-31006# National Center for Atmospheric Research, Boulder, Colo.
AEROSOLS AND CLIMATE
William W. Kellogg 1980 18 p refs Presented at the Intern. Workshop on the Energy/Climate Interactions, Munster, West Germany, 3 Mar. 1980 Prepared in cooperation with the Aspen Inst. for Humanistic Studies, Boulder, Colo.
(Contract DE-AC02-79EV-10281)
(CONF-800309-5) Avail: NTIS HC A02/MF A01

The atmospheric burden of particles, or aerosols, produced by human activities, especially in industrialized regions and those where slash-burn agricultural practices are followed, are discussed. Sources of aerosols discussed include burning of fossil fuels or other materials, photochemical reactions involving organic molecules, oxides of nitrogen, and sunlight, and the oxidation of sulfur dioxide, produced when sulfur-bearing fuel is burned, to sulfuric acid thereby forming sulfate particles or droplets. Emphasis is placed on the way in which the aerosols influence the atmospheric heat balance. DOE

N80-31007# Aspen Inst. for Humanistic Studies, Boulder, Colo.
CONSEQUENCES OF A HYPOTHETICAL WORLD CLIMATE CHANGE PRODUCED BY INCREASED ATMOSPHERIC CARBON DIOXIDE Progress Report, 1 Sep. 1979 - 31 Apr. 1980
Walter Orr Roberts May 1980 8 p
(Contract DE-AC02-79EV-10281)
(DOE/EV-10281/1) Avail: NTIS HC A02/MF A01

Progress is reported on a research program seeking to understand the effects of increased global levels of atmospheric CO2 as a result of human activities. An outline of the major social, economic, geopolitical and ethical issues to be faced as a result of global warming is being attempted. Groundwork is being laid for a longer term effort to delineate possible strategies to meet the predicted challenges. Author (DOE)

N80-31008# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
PRECIPITATION ESTIMATIONS FROM SATELLITE MEASUREMENTS OF HEAT RADIATION AT 19.35 AND 37 GHz [NIEDERSCHLAGSRATEN AUS SATELLITENMESSUNGEN DER WAERMESTRAHLUNG BEI 19.35 UND 37 GHZ]
H. J. Jung Jun. 1979 125 p refs In GERMAN
(Contract DFG-195/17)
(Mitt-26) Avail: NTIS HC A06/MF A01

A method to measure rain rates (0.1 to 50 mm/hr) from satellites (Nimbus 5/6) at 19.35 GHz and at 37 GHz was developed. The calculation of radiation transfer for polarized and unpolarized radiation is utilized. In the spectrum field the radiation transfer is observed for different values of the absorption in gas (H2O and O2), of the extinction in hydrometers (clouds, raindrops, hail and ice particles) and of the emission and reflection possibilities on the ground and water surface. A study of 2 hurricanes shows that it is possible to give a rain rate independent from cloud type and precipitation type. The accuracy of the determination is of 30-40% for rain rates between 0.1 and 7 mm/hr and of 30-100% for rain rates superior to 7 mm/hr. Author (ESA)

N80-31009# World Meteorological Organization, Geneva (Switzerland).
PARAMETERIZATION OF EXTENDED CLOUDINESS AND RADIATION FOR CLIMATE MODELS Global Atmospheric Research Programme
1979 158 p refs Prepared in cooperation with International Council of Scientific Unions, Rome (Italy)
Avail: NTIS HC A08/MF A01

The following topics were deliberated: sensitivity of climate to cloud, cloud prediction and parameterization, mechanisms of cloud formation, observational programs, effect of aerosols, and cloud climatology. The panel recommended that a global cloud climatological data set be developed from existing observations,

that sensitivity and diagnostic studies be carried out to test the dependence of climate on cloudiness, that a set of field observational programs for the improvement of cloud parameterization in climate models be developed to investigate the microphysics of extended cloud formation and the bulk radiative properties of clouds as a function of cloud type. Author (ESA)

N80-31010# World Meteorological Organization, Geneva (Switzerland).
PLAN AND BASIS OF THE WORLD CLIMATOLOGY PROGRAM, 1980 TO 1983 [PLAN ET BASE DU PROGRAMME CLIMATOLOGIQUE MONDIALE, 1980 A 1983]
1979 76 p In FRENCH
(WMO-540; ISBN-9-263-20540-X) Avail: NTIS HC A05/MF A01

The following elements of the program are described: Climatological data and climatological applications are described. Other topics include climatic influences and world climate research. Author (ESA)

N80-31011# World Meteorological Organization, Geneva (Switzerland).
THE 6TH GARP PLANNING MEETING FOR THE MONSOON EXPERIMENT (MONEX) Global Atmospheric Research Programme
1979 93 p refs Meeting held in Singapore, 5-9 Nov. 1979 Prepared in cooperation with International Council of Scientific Unions, Rome (Italy)
(GARP-Spec-34) Avail: NTIS HC A05/MF A01

An assessment of the operations and the review and planning for data management activities is presented, following completion of the field phases of the winter and summer components of the Monsoon Experiment (MONEX). The availability and formats of the quick look data are given. Abstracts of papers representing preliminary scientific results are appended. Author (ESA)

N80-31012# World Meteorological Organization, Geneva (Switzerland).
THE 7TH WMO EXECUTIVE COMMITTE INTER-GOVERNMENT PANEL SESSION ON THE FIRST GARP GLOBAL EXPERIMENT Global Atmospheric Research Programme
1979 134 p refs Conf. held at Geneva, Nov. 1979 Prepared in cooperation with International Council of Scientific Unions, Rome (Italy)
(GARP-Spec-35) Avail: NTIS HC A07/MF A01

The performance of the First Garp Global Experiment (FGGE) Composite Observing System, the status of FGGE data management, and implementation of the regional experiments were reviewed. An assessment of data sets collected during the Global Weather Experiment by surface stations ships and buoys, balloons, satellites, and aircraft is presented. Author (ESA)

N80-31013# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
STUDY OF A PULSED COHERENT LIDAR FOR CROSSWIND SENSING
S. F. Clifford, T. R. Lawrence, G. R. Ochs, and T-I. Wang Mar. 1980 53 p refs Sponsored in part by Army Electronics Research and Development Command, White Sands Missile Range
(PB80-181027; NOAA-TM-ERL-WPL-48) Avail: NTIS HC A04/MF A01 CSCL 04B

A work undertaken to assess the validity and impact of particular assumptions made in deriving the system signal to noise ratio (SNR) expression utilized in an investigation of the expected performance of a system for remote wind measurements in the troposphere is documented. The analysis indicates that the independent turbulence assumption strongly overestimated the effects of turbulence, that the quadratic power wave structure function assumption was wholly inadequate, and that neglecting the apodization effects amounted to an SNR overestimation at the range where the lidar is focused. GRA

N80-31014# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
THE SOUTH POLE AUTOMATIC CONDENSATION NUCLEI COUNTER: INSTRUMENT DETAILS AND FIVE YEARS OF OBSERVATIONS
Mark E. Murphy and Barry A. Bodhaine Feb. 1980 94 p refs
(PB80-181712; NOAA-TM-ERL-ARL-82; NOAA-80032804)
Avail: NTIS HC A05/MF A01 CSCL 04B

An automatic condensation nuclei counter has been operating continuously at the Amundson-Scott South Pole station since 1974 as part of the Geophysical Monitoring for Climatic Change (GMCC) program. This instrument (calibrated by a Pollak nuclei counter standard), with its high sensitivity and fast response, can provide continuous aerosol climatology and identify periods of contamination from local sources. The annual variation of nuclei concentration is apparent and is repeatably consistent over the five year period. Nuclei concentrations occasionally reach values as low as 7/cu cm during the austral winter (April through September), begin to increase near the time of astronomical sunrise, and reach values as high as about 240/cu cm during summer months. GRA

N80-31015# National Environmental Satellite Center, Washington, D. C.
ENVIRONMENTAL SATELLITE IMAGERY JUNE 1979 Key to Meteorological Records Documentation, no. 5.4
Mar. 1980 97 p
(PB80-181852; NOAA-80042201) Avail: NTIS HC A05/MF A01 CSCL 04B

The Key to Meteorological Records Documentation (KMRD) No. 5.4 series is issued monthly to describe current cloud data obtained by NOAA's operational environmental satellites. It contains daily global satellite imagery in condensed form as a guide to data stored in the NOAA archive, and is designed to assist users in selecting data for research and climatological use. GRA

N80-31016# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Research Labs.
COMPARISON OF ESTIMATED AND OBSERVED VALUES FOR SOLAR RADIATION AT THE SURFACE OF THE AFRICAN CONTINENT
J. K. Nimira Jan. 1980 51 p refs
(Grant NSF ATM-78-15529)
(PB80-180417; NOAA-TM-ERL-ARL-83; NOAA-80041601)
Avail: NTIS HC A04/MF A01 CSCL 04B

Solar radiation fluxes at the surface of the African continent were estimated by three methods. The methods used cloud data derived from satellite measurements, observed sunshine hour data, and data on several other parameters measured at 57 ground stations throughout Africa. The estimated values were then compared with actual observed global solar radiation values from 10 selected stations. The percentage deviation between estimated and observed values was generally less than plus or minus 15%. GRA

N80-31017# National Technical Information Service, Springfield, Va.
CLOUD SEEDING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - May 1980
Robena J. Brown Jun. 1980 141 p Supersedes NTIS/PS-79/0575; NTIS/PS-78/0523
(PB80-811037; NTIS/PS-79/0575; NTIS/PS-78/0523)
Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

The bibliography is divided into two sections. The first covers generalized studies on cloud seeding techniques and theory, including environmental and water resources planning studies. The second section presents the results of specific cloud seeding experiments. This updated bibliography contains 132 abstracts, 22 of which are new entries to the previous edition. GRA

N80-31018# National Climatic Center, Asheville, N. C.
SELECTIVE GUIDE TO CLIMATIC DATA SOURCES Key to Meteorological Records Documentation.
Keith D. Butson and Warren L. Hatch Dec. 1979 157 p Sponsored by NOAA
(PB80-187354; KMRD-4.11; NOAA-80050101) Avail: NTIS HC A08/MF A01 CSCL 04B

This guide is arranged to indicate the publication(s) in which these data in their various climatological categories (temperature, precipitation, wind, atmospheric pressure, humidity, etc.), both surface and upper air, may be found. A brief review of the pertinent historical facts associated with each publication is given

where appropriate. The various climatological tables, charts, and graphs included in each publication are listed, and in many cases abbreviated examples are shown. GRA

N80-31019# Delaware Univ., Newark. Water Resources Center.
THE USE OF THE CLIMATIC WATER BUDGET TO EVALUATE THE VALIDITY OF A PRECIPITATION RECORD
John R. Mather and Clinton M. Rowe, Jr. Aug. 1979 43 p refs Submitted for publication
(Contract DI-14-34-0001-9008)
(PB80-182157; CONTRIB-28; W80-04877; OWRT-A-040-DEL(5); TR-6) Avail: NTIS HC A03/MF A01 CSCL 04B

From 1927 to 1963 the precipitation recorded at La Porte, Indiana, about 30 miles southeast of the Chicago-Gary industrial complex was significantly higher than the precipitation found at any nearby station. Two reasons were suggested for this anomaly. The first assumes that the record is correct and suggests that industrial pollution has resulted in increased downwind precipitation amounts. The second assumes that the record is incorrect and is merely the result of instrumental or observer error. The use of the climatic water budget to determine the more likely conclusion is described. Values of runoff were computed from climatic data from La Porte as well as from South Bend, and Plymouth, Indiana, the stations nearest to LaPorte. GRA

N80-31020# Colorado State Univ., Fort Collins. Dept. of Atmosphere Science.
GATE PHASE 3 MEAN SYNOPTIC-SCALE RADIATIVE CONVERGENCE PROFILES
Steven A. Ackerman and Stephen K. Cox Apr. 1980 135 p refs Sponsored in part by NOAA
(Grants NSF ATM-78-05743; NSF ATM-78-12631)
(PB80-180797; AS-PAPER-324; ISSN-0067-0340) Avail: NTIS HC A07/MF A01 CSCL 04B

Tropospheric radiative convergence profiles are derived for an easterly wave composite during Phase 3 of the GATE. The easterly waves observed were generally well developed. The profiles also represent the magnitude and the spatial distribution of the Intertropical Convergence Zone (ITCZ) in the GATE area. The 12 hour mean daytime and nighttime profiles are presented. Cloud top pressure distributions, as a function of wave position, are also presented. Day-night differences in the cloud top pressure distributions and radiative convergence profiles are discussed. GRA

N80-31021# National Oceanic and Atmospheric Administration, Washington, D. C. Federal Coordinator for Meteorological Services.
NATIONAL SEVERE LOCAL STORMS OPERATIONS PLAN
Mar. 1980 48 p
(PB80-187362; FCM-80-1; NOAA-80040403) Avail: NTIS HC A03/MF A01 CSCL 04B

The thirteenth of an annual series of National Severe Local Storms Operations Plans that was developed after a 1967 request by the Federal Coordinator for Meteorological Service and Supporting Research is presented. This plan outlines the responsibilities of the various United States agencies which provide meteorological services in observing and forecasting severe local storms. GRA

N80-31022# National Center for Atmospheric Research, Boulder, Colo.
PROJECT PHOENIX. THE SEPTEMBER 1978 FIELD OPERATION
W. H. Hooke, ed. Dec. 1979 294 p refs Sponsored by NSF
(PB80-180433; BOA-1; NOAA-80041603) Avail: NTIS HC A13/MF A01 CSCL 04B

The instruments tested and compared and equipment used during Project PHOENIX, a major field study of the planetary boundary layer are described. The data gathering systems evaluated include multiple Doppler radar, microwave radiometer, FM-CW radar, TPQ-11 radar, lidar, optical wind sensors, the Portable Automated Mesonet, rawinsonde, microbarograph, acoustic sounders, balloons, aircraft, and the 300 m BAO tower. Also provided are a discussion of the project's background and planning, a description of the synoptic weather situation during the experiment, instructions for access to the data, and a daily summary log of PHOENIX operations. GRA

N80-31023# Water and Power Resources Service, Denver, Colo. Office of Atmospheric Resources Management.
THE SIERRA COOPERATIVE PILOT PROJECT. PRECIPITATION MANAGEMENT RESEARCH IN THE SIERRA NEVADA Status Report
Dec. 1979 66 p
(PB80-182389) Avail: NTIS HC A04/MF A01 CSCL 04B

The research, design, environmental, and public involvement activities of the Sierra Cooperative Pilot Project are reported. The technical feasibility and social acceptability of cloud seeding in the Sierra Nevada to supplement the region's water supply is addressed. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-31024 California Univ., San Diego, La Jolla.
MODELS OF THE EQUATORIAL OCEAN CIRCULATION Ph.D. Thesis
Michael James McPhaden 1980 121 p
Avail: Univ. Microfilms Order No. 8018789

The steady circulation is examined using a linear equatorial beta plane formulation in which continuous density stratification is a key element. The basin is horizontally unbounded and forced by either winds or a surface temperature boundary conditions. Two vertically diffusive models are proposed to examine the effects of different turbulence parameterizations. One is characterized by temperature dissipation proportional to temperature itself, the other has biharmonic friction proportional to a fourth derivative of velocity. Both lead to equations for the steady state that are in many ways analogous to the well known equations governing equatorial wave motion. The analogies are exploited both in obtaining analytical solution and in describing the flow dynamics. Dissert. Abstr.

N80-31025# Washington Univ., Seattle. Applied Physics Lab.
LONG-TERM MEASUREMENT OF ABYSSAL CURRENTS IN THE NORTH PACIFIC Final Report, 1 Jul. 1973 - 30 Sep. 1979
Bruce A. Taft 10 Jan. 1980 33 p refs
(Contract EY-76-S-06-2225)
(DOE/EV-71030/1; RLO-2225-TA-30) Avail: NTIS HC A03/MF A01

Current measurements were made over a 19 month period in the deep Pacific in a region centered at 30 deg 30 min N, 158 deg W. Current meters were moored at 100 and 1100 m off the bottom in two arrays of six moorings. Each mooring had a meter at 100 m above the bottom, and two moorings included an additional meter at the 1100 m level. Most records showed higher eddy kinetic energies than the mean kinetic energy. The time space average eddy kinetic energy is compatible to the lowest values yet measured in the western North Atlantic. The mean vector speed varied from 0.4 to 3.6 cm/s; the directions were variable and showed little consistency. Spectral peaks occurred at the two semidiurnal tidal frequencies M2 and S2 and at the diurnal/inertial frequency. In the low frequency band, there were energetic periods near 70 and 150 days as well as periods that were longer than the period of measurement. The M2 semidiurnal tidal currents were coherent and appear to be consistent with a position of M2 amphidrome at 25 N, 135 W. DOE

N80-31026# Science Applications, Inc., Raleigh, N.C.
SOUTH ATLANTIC OCS PHYSICAL OCEANOGRAPHY, VOLUME 2 Final Report
Mar. 1980 348 p refs
(Contract DI-AA550-CT7-29)
(PB80-181555; BLM/YM/ES-80/2) Avail: NTIS HC A15/MF A01 CSCL 08C

The results of the first year of a four year physical oceano-

graphic and meteorological data collection effort on the Outer Continental Shelf (OCS) from Cape Hatteras, North Carolina to Cape Canaveral, Florida, during the period of September 1977 through November 1978 are presented. Currents, circulation and mixing processes in the Georgia Embayment/South Atlantic Bight (SAB) are studied to assess the effects of CCS oil and gas activities on the biological environment, as well as on recreational and commercial fishing. GRA

N80-31027# Science Applications, Inc., Raleigh, N.C.
SOUTH ATLANTIC OCS PHYSICAL OCEANOGRAPHY, VOLUME 3 Final Report
Mar. 1980 638 p Original contains color illustrations
(Contract DI-AA550-CT7-29)
(PB80-181563; BLM/YM/ES-80/3-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 08J

The complete sets of Data Products resulting from the short-term and long-term current meter mooring data, hydrographic sampling, and meteorology/sea state observations are presented. Ship tracks and sampling plans followed on each cruise are included along with cross-shelf sections and spatial distribution of hydrographic variables. J.M.S.

N80-31028# Instituto del Mar del Peru, Callao.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. DATA REPORT: CRUISE B/1, SNP-1, 7604 Data Report, 24-25 Apr. 1976
O. Guillen, R. Calienes, and N. Ochoa Jul. 1979 114 p refs
In ENGLISH and SPANISH Sponsored by NSF
(PB80-132921; NSF/IDOE/CUEA/DR-62; NSF/IDOE-79-130)
Avail NTIS HC A06/MF A01 CSCL 08J

Physical chemical and biological bottle data are presented in tabular form and in horizontal and vertical displays. The data represent Cruise B/1, SNP-1, 7604 April 24-28, 1976. The area covered was between Pisco and Callao in the equatorial region of the Pacific Ocean. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-31029 Iowa State Univ. of Science and Technology, Ames.
A PARABOLOIDAL FLOW CYTOMETER FOR IMPROVED FLUORESCENCE ANALYSIS OF SINGLE CELLS Ph.D. Thesis
Mary Jane Skogen Hagenson 1980 161 p
Avail: Univ. Microfilms Order No. 8019634

A flow cytometer featuring a paraboloidal flow chamber for optical collection was designed to improve fluorescence analysis of single cells. The improvement is achieved by increasing the fluorescence collection efficiency permitting measurement of weakly fluorescent particles and by improving fluorescent intensity resolution, thereby making it possible to differentiate cells with smaller differences in fluorescence intensity. The paraboloidal flow system was evaluated with standard spheres, mouse testicular cells and nuclei, and weakly fluorescent cells. It was demonstrated that the paraboloid; (1) improves fluorescence intensity resolution relative to orthogonal systems by nearly 20% for standard particles and round spermatid nuclei; (2) increases the fluorescence signal to noise ratio, allowing measurement of fluorescence which was not resolved from background noise in orthogonal systems; and (3) is relatively insensitive to particle orientation with respect to illumination and collection optics. Dissert. Abstr.

N80-31030*# California Univ., Davis. Dept. of Animal Physiology.
THERMOREGULATION IN RATS: EFFECTS OF VARYING DURATION OF HYPERGRAVIC FIELDS Annual Report, 1 Jul. 1979 - 31 Aug. 1980
J. M. Horowitz and B. A. Horwitz Aug. 1980 28 p refs
(Grant NsG-2234)
(NASA-CR-163481) Avail: NTIS HC A03/MF A01 CSCL 06C

The effects of hypergravitational fields on the thermoregulatory system of the rat are examined. The question underlying the investigation was whether the response of the rat to the one hour cold exposure depends only upon the amplitude of the hypergravic field during the period of cold exposure or whether the response is also dependent on the amplitude and duration of the hypergravic field prior to cold exposure. One hour of cold exposure applied over the last hour of either a 1, 4, 7, 13, 19, 25, or 37 hr period of 3G evoked a decrease in core temperature (T sub c) of about 3 C. However, when rats were subjected concurrently to cold and acceleration following 8 days at 3G, they exhibited a smaller fall in T sub c, suggesting partial recovery of the acceleration induced impairment of temperature regulation. In another series of experiments, the gravitational field profile was changed in amplitude in 3 different ways. Despite the different gravitational field profiles used prior to cold, the magnitude of the fall in T sub c over the 1 hr period of cold exposure was the same in all cases. These results suggest that the thermoregulatory impairment has a rapid onset, is a manifestation of an ongoing effect of hypergravity, and is not dependent upon the prior G profile. M.G.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-31031 California Univ., Davis.
THE EFFECT OF PHYSICAL CONDITIONING ON +Gz TOLERANCE Ph.D. Thesis
William Lewis Epperson 1980 86 p
Avail: Univ. Microfilms Order No. 8018968

The influence of physical conditioning on tolerance to a centrifugation profile of alternating 15 second plateaus at 4.5 and 7.0 +Gz--called Simulated Aerial Combat Maneuvering (SACM)--was determined using 24 young men as subjects. These subjects were assigned to groups as controls (C) (no physical training), runners (R), and weight trainers (W); and followed a 12 week protocol of specified physical training. Tolerance to centrifugation, maximum oxygen consumption, muscle strength, and body composition were periodically determined. The +Gz tolerance of the runners and controls increased at an average rate of 4 seconds per week during the course of the experiment. The weight trainers increased their G tolerance at an average rate of 15 seconds per week. Fatigue scores indicate that group W subjects take longer to reach a given level of fatigue than did the subjects of the other groups. It appears therefore that a physical conditioning program of weight training will improve human tolerance to repeated and prolonged exposure to high +Gz loads. Dissert. Abstr.

N80-31032 Drexel Univ., Philadelphia, Pa
AN INVESTIGATION OF CARDIAC THRESHOLD VARIABILITY RELATIVE TO STIMULUS SHAPE AND RESPIRATORY CYCLE Ph.D. Thesis
Leonid Hrebien 1980 168 p
Avail: Univ. Microfilms Order No. 8019351

To study threshold relative to stimulus shape, energy strength duration relationships were determined for three different stimulating waveforms: the standard rectangular, the sawtooth (ramp), and the exponential. Stimulus threshold energies were determined at pulse durations ranging from 0.4 to 3.0 milliseconds for each waveform and the results were plotted as energy strength duration curves. It was found that threshold energy requirements for sawtooth stimuli were 3-27% lower than for standard rectangular stimuli at the same pulse widths. Also, exponential stimuli showed energy reductions of 2-30% from the rectangular stimuli. Threshold determinations were made once a minute for 20 to 30 minutes using rectangular pulses, 1 millisecond in duration. It was found that threshold energies varied as much as 37% above the mean to 19% below the mean value for the 20-30 minute run of the experiment. It was found that during certain portions of the respiration cycle pacemaker pulses of a given amplitude would elicit cardiac response whereas these same pulses failed to pace during other phases of the breathing cycle. Dissert. Abstr.

N80-31033 California Univ., San Diego, La Jolla.
TOPOGRAPHICAL SIMULATION OF THE BLOOD VESSELS OF THE HUMAN BULBAR CONJUNCTIVA AND APPLICATION TO PRESSURE-FLOW RELATIONSHIPS Ph.D. Thesis
Bruce Miles Fenton 1980 175 p
Avail: Univ. Microfilms Order No. 8018778

A preliminary study was performed in which length of conjunctival vessels per unit area tissue (vascular density) was measured for two categories of patients: diabetics and nondiabetics. It was assumed that the conjunctiva represents a nonspecialized tissue whose microcirculatory network, in the presence of chronic disease, in some way reflects a generalized trend manifest to a varying degree in other vascular beds. Specifically, it was demonstrated that there were significant differences in length per unit area values between diabetic and nondiabetic cohorts. In addition, age was seen to exert a dramatic influence on overall vascularity. In order to more fully explore the influence of these quantitative variations on blood-tissue exchange properties of the system, a much more detailed type of analysis was required, namely a complete topographical mapping of the conjunctival vasculature. By applying an approach developed by the geomorphological sciences, it was shown that changes in vessel lengths, numbers, and diameters could be related to order number by applying three basic mathematical relationships.
Dissert. Abstr.

N80-31034 Carnegie-Mellon Univ., Pittsburgh, Pa.
ANALYSIS OF HUMAN AUDITORY BRAINSTEM RESPONSES FOR COMPLEX STIMULI Ph.D. Thesis
Paul Joseph Ainslie 1980 207 p
Avail: Univ. Microfilms Order No. 8020148

The results of the application of an analysis technique to separate responses of the auditory brainstem responses (ABRS) are reported for three types of complex click stimuli: monaural clicks with contralateral masking noise, monaural click trains of 1 to 4 clicks with interclick times of 2 to 61.5 msec, and binaural clicks with interaural time delays of 0 to 7 msec of interaural intensity differences of 0 to 30 dB. Responses recorded for monaural clicks without and with contralateral broadband masking noise were combined to estimate a masking effect waveform. The derived waveform resembled an ABR for direct monaural stimulation at 35 dB lower stimulus magnitude. Control experiments showed this derived masking effect waveform to be due to acoustic crosstalk evoking an ABR in the ear contralateral to the monaurally stimulated ear. Responses for monaural click train stimuli were analyzed by deriving a waveform estimating the response to each click of the click train. These derived responses showed little change after the response to the third click. Responses to binaural stimuli were obtained and compared to the sum of the responses for the constituent monaural stimuli.
Dissert. Abstr.

N80-31035# National Technical Information Service, Springfield, Va.
COLD WEATHER STRESS ON HUMANS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980
Elizabeth A. Harrison Jun. 1980 152 p Supersedes NTIS/PS-79/0589; NTIS/PS-78/0540
(PB80-810989; NTIS/PS-79/0589; NTIS/PS-78/0540) Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

The selected abstracts cover cold stress, cold tolerance, cold injuries, acclimatization, protective clothing, and cold water exposure as related to cold weather stress on humans. This updated bibliography contains 145 abstracts, 5 of which are new entries to the previous edition.
GRA

N80-31036# National Institutes of Health, Bethesda, Md. Lab. of Neurobiology.
INTRODUCTION TO ELECTROCHEMISTRY OF NERVE MEMBRANES
Ichiji Tasaki Mar. 1980 695 p refs
(PB80-178908; NIMH-80/03) Avail: NTIS HC A99/MF A01 CSCL 06P

The evolution of physiology of nerve fibers is linked closely with that of electrochemistry. Experimental facts known at the present time are described and interpreted on the basis of present level of understanding of morphology, biochemistry and physical chemistry. Old theories are also discussed in detail for the experimental basis of those theories are still meaningful. The volume is written primarily for students of biology and medicine who are interested in the properties of nerve fibers.
GRA

N80-31037# National Technical Information Service, Springfield, Va.
ULTRASONICS IN MEDICINE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980
Elizabeth A. Harrison Jun. 1980 157 p Supersedes NTIS/PS-79/0563; NTIS/PS-78/0494
(PB80-810922; NTIS/PS-79/0563; NTIS/PS-78/0494) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 06E

The bibliography presents citations from Federally funded research on the use of ultrasound in diagnosis and therapy. Information is presented on ultrasonic imaging techniques, echoencephalography, echocardiography, use of ultrasound in bone surgery, and ultrasonic instrumentation. This updated bibliography contains 150 abstracts, 25 of which are new entries to the previous edition.
GRA

N80-31038# National Technical Information Service, Springfield, Va.
ULTRASONICS IN MEDICINE. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1978 - May 1980
Elizabeth A. Harrison Jun. 1980 257 p Supersedes NTIS/PS-79/0565; NTIS/PS-78/0495
(PB80-810930; NTIS/PS-79/0565; NTIS/PS-78/0495) Avail: NTIS HC $30.00/MF $30.00 CSCL 06E

Research reports on the applications of ultrasound to diagnosis and therapy are cited from worldwide literature. Information is presented on ultrasonic imaging techniques, ultrasonic echoencephalography, echocardiography, use of ultrasound in surgery, and ultrasonic instrumentation in biomedical measurement. This updated bibliography contains 250 abstracts, 137 of which are new entries to the previous edition.
GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-31039*# Behavioral Research Applications Group, Inc., Rochester, N. Y.
INSTRUMENT SCANNING AND CONTROLLING: USING EYE MOVEMENT DATA TO UNDERSTAND PILOT BEHAVIOR AND STRATEGIES Final Report
A. O. Dick Washington, D.C. NASA Sep. 1980 89 p refs (Contract NAS1-14793)
(NASA-CR-3306; BRAG-TR-79-2) Avail: NTIS HC A05/MF A01 CSCL 05I

Eye movement data and other parameters including instrument readings, aircraft state and position variables, and control maneuvers were recorded while pilots flew ILS simulations in a B 737. The experiment itself employed seven airline pilots, each of whom flew approximately 40 approach/landing sequences. The simulator was equipped with a night visual scene but the scene was fogged out down to approximately 60 meters (200 ft). The instrument scanning appeared to follow aircraft parameters not physical position of instruments. One important implication of the results is: pilots look for categories or packets of information. Control inputs were tabulated according to throttle, wheel position, column, and pitch trim changes. Three seconds of eye movements before and after the control input were then obtained. Analysis of the eye movement data for the controlling periods showed clear patterns. The results suggest a set of miniscan patterns which are used according to the specific details of the situation. A model is developed which integrates scanning and controlling. Differentiations are made between monitoring and controlling scans.
R.K.G.

N80-31040# Army Natick Research and Development Command, Mass. Clothing Equipment and Materials Engineering Lab.
THE PSYCHOMOTOR PERFORMANCE OF MEN AND

WOMEN WEARING TWO TYPES OF BODY ARMOR
Carolyn K. Bensel, Darrell S. Fink, and Sirvart A. Mellian Mar. 1980 115 p refs
(DA Proj. 1L1-62723-AH-98; DA Proj. 1G4-64713-DL-42)
(AD-A086742; NATICK/CEMEL-195; NATICK/TR-80/014) Avail: NTIS HC A06/MF A01 CSCL 19/4

This study was conducted to determine the effects of load carrying equipment (LCE) and two types of fragmentation protective armor vests, Standard B Fragmentation Protective Body Armor (STD B) and the Personnel Armor System for Ground Troops (PASGT), on body flexibility, rate of movement, psychomotor coordination, manual dexterity, and effort exerted for task performance. Twelve men and twelve women, outfitted in utilities, performed the battery of 16 tasks under each of the following clothing conditions: utilities alone, STD B armor, PASGT armor, LCE, STD B armor - LCE, and PASGT armor - LCE. In general, performance levels were highest when the utilities were worn without any additional items and lowest when the STD B vest was worn in conjunction with the LCE. The STD B armor impaired certain aspects of psychomotor performance, particularly body flexibility, to a greater extent than the PASGT vest did. The collar and shoulder designs seemed to be the critical features responsible for the superior performance achieved with the PASGT vest. After the data had been transformed to remove effects accounted for by difference in the basic capabilities of men and women, two tasks which required arm movements were found to be significantly affected by the sex variable. The women's performance of these movements was impaired relative to the men's because of the excessive length of the armor across the women's shoulders. GRA

N80-31041# Honeywell Systems and Research Center, Minneapolis, Minn.
HUMAN OPERATOR INTERFACE WITH FLIR DISPLAYS
Final Report, Jun. 1977 - Sep. 1979
Larry G. Goble, L. G. Williams, P. D. Pratt, J. Wald, G. Rubin, and T. Hanson Wright-Patterson AFB, Ohio AMRL Mar. 1980 251 p refs
(AD-A086284; Doc-79SRC54; AMRL-TR-79-114) Avail: NTIS HC A12/MF A01 CSCL 17/5

This report presents an extensive review of factors which limit performance of forward-looking infrared (FLIR) systems. Two critical variables of system performance, modulation transfer function (MTF) and noise equivalent delta temperature (NE delta T), were chosen for further experimental analysis. The experiment used a digital simulation of minimum resolvable temperature (MRT) paradigm to test two modeled FLIR systems. Detection and recognition data were collected for two targets (four-bar and square) in trials with varying levels of size, contrast, noise, and MTF. The test results were compared with the NVL predictive model(Ratches, et al., 1975) used to evaluate FLIR system performance. GRA

N80-31042# Illinois Univ. at Urbana-Champaign, Champaign. Engineering-Psychology Research Lab.
AN INVESTIGATION OF THE DUAL TASK PERFORMANCE RELATIONSHIP TO HEMISPHERIC SPECIALIZATION
Interim Report
Christopher D. Wickens and Diane Lynn Sandry Jun. 1980 41 p refs
(Contract N00014-79-C-0658; NR Proj. 196-158)
(AD-A086808; EPL-80-1/ONR-80-1) Avail: NTIS HC A03/MF A01 CSCL 05/10

The efficiency of dual task performance may be influenced by a number of variables such as the level of practice of the individual, the difficulty of the task, and the particular processing resources or capacities for which the two tasks compete. The current research investigates the relation between the capacities employed in two tasks--a verbal processing resource inferred to reside in the left cerebral hemisphere, and a spatial resource in the right--and the controlling hand. Specifically a condition of task-hemispheric integrity is defined when the processing and responding of each task is carried out in a single cerebral hemisphere. In the experiment, this condition occurs when a tracking task, inferred to be spatial right-hemispheric in its processing is controlled with the left hand, while a Sternberg memory search Reaction Time task with the letter stimuli, inferred to be verbal left-hemispheric, is responded to with the right hand. A 'mixture' condition is created with the opposite hand assignment, so that each hemisphere processes the information associated with one task, while responding to the other (i.e., Sternberg Task-left hand, Tracking-right). GRA

N80-31043# Illinois Univ. at Urbana-Champaign, Champaign. Dept. of Psychology.
DIFFERENTIALLY WEIGHTING LINEAR MODELS OF BEHAVIOR: AN EMPIRICAL COMPARISON OF SIX METHODS
Charles K. Parsons (Georgia Inst. of Technology, Atlanta) and Charles L. Hulin Jun. 1980 35 p refs Sponsored in part by Illinois National Guard
(Contract N00014-75-C-0904; NR Proj. 170-802)
(AD-A086876; TR-80-4) Avail: NTIS HC A03/MF A01 CSCL 12/1

Six methods of estimating regression weights for a linear model of behavior were compared in 51 samples of National Guardsmen. Ordinary least squares, Bayesian m-group regression, ridge regression, equal weighting, and two related methods were used. Weights were estimated in one-half of each sample and then applied to data in the other half. Ratios of observations to predictors ranged from 4:1 to 19:1. Cross validation R sq was used as the index of model or equation stability. Results support earlier findings that least squares weights are relatively unstable in small samples, but do not indicate the superiority of any one other method. Future research and implications for using these regression techniques in testing behavioral models are discussed. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-31044*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Engineering and Analysis Dept.
ADVANCED FLIGHT DESIGN SYSTEMS SUBSYSTEM PERFORMANCE MODELS. EXECUTIVE SUMMARY
K. C. Parker and J. G. Torian Jun. 1980 17 p
(Contract NAS9-15793)
(NASA-CR-160768; TRW-34902-H001-R0-00) Avail: NTIS HC A02/MF A01 CSCL 06K

Subsystem performance analysis required in flight design to assess the capability of the environmental control and life support system (ECLSS) to support the flight requirements and define operational procedures under contingency flight conditions is described. Current ECLSS modeling techniques are limited in the variety of configurations and they employ batch mode computer programs execution methods. Improvements in the variety of configurations that are modeled and a reduction in effort required for modeling and analysis is accomplished by developing a modular computer program which operates interactively. T.M.

N80-31045*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Engineering and Analysis Dept.
ADVANCED FLIGHT DESIGN SYSTEMS SUBSYSTEM PERFORMANCE MODELS. USER GUIDE: ENVIRONMENTAL ANALYSIS ROUTINE LIBRARY
K. C. Parker and J. G. Torian Jun. 1980 138 p refs
(Contract NAS9-15793)
(NASA-CR-160769; TRW-34902-H002-R0-00) Avail: NTIS HC A07/MF A01 CSCL 06K

A user guide for a library of interactive computer routines used to develop performance analysis models of specific environmental control and life support subsystems is presented. T.M.

N80-31046*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Engineering and Analysis Dept.
ADVANCED FLIGHT DESIGN SYSTEMS SUBSYSTEM PERFORMANCE MODELS. SAMPLE MODEL: ENVIRONMENTAL ANALYSIS ROUTINE LIBRARY

K. C. Parker and J. G. Torian Jun. 1980 40 p
(Contract NAS9-15793)
(NASA-CR-160770; TRW-34902-H003-R0-00) Avail: NTIS
HC A03/MF A01 CSCL 06K

A sample environmental control and life support model performance analysis using the environmental analysis routines library is presented. An example of a complete model set up and execution is provided. The particular model was synthesized to utilize all of the component performance routines and most of the program options. T.M.

N80-31047# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
FLAME TESTING OF TWO SAMPLES OF EXPOSURE SUIT MATERIAL Final Report
Frank H. Jacobson 9 May 1980 16 p refs
(W0606SL00)
(AD-A086739; NADC-80097-60) Avail: NTIS
HC A02/MF A01 CSCL 11/5

Reported deficiencies in authorized quick-donning ship-abandon type exposure suits has prompted use of other suits made of materials with unknown flame and heat retardant properties. Therefore, tests were requested to be addressed first to the question of flammability of the material, and second to the question of heat retardation by the material. The materials tested may provide better protection against standard 3 second exposures to fuel fires than any fabrics previously tested in this laboratory. However, the protection falls off sharply as the exposure is continued. GRA

N80-31048# Navy Clothing and Textile Research Facility, Natick, Mass.
THERMAL INSULATION MATERIALS FOR DIVER'S UNDERWEAR GARMENT Final Technical Report, 1977 - 1978
Norman F. Audet, George M. Orner, and Zelig Kupferman Feb. 1980 31 p refs Presented at Ann. Winter Meeting of ASME, Ocean Eng. Div., San Francisco, 12-15 Dec. 1978
(TF51523003)
(AD-A086743; NCTRF-139; Rept-2-78) Avail: NTIS
HC A03/MF A01 CSCL 06/17

The Navy Clothing and Textile Research Facility (NCTRF) conducted studies on commercially available foam and fibrous thermal insulating materials to determine those which would be effective in a diver's dry-suit underwear garment. An effective insulation had to allow the pressurized gaseous environment existing within the diver's dry suit to permeate the insulation, have good compressional resistance at hydrostatic pressures up to 2 psi (13.8 kPa), and provide an intrinsic thermal insulation value of 1.0 to 1.5 clo. Evaluations of candidate materials and comparisons with existing materials used in diver's dry-suit underwear indicated that a fine pore open cell foam and the polypropylene microfiber batt material having densities of approximately 0.12 gr/c cm and 0.05 gr/c cm and thermal insulation resistance of 1.8 and 2.11 clo/cm at 2 psi (13.8 kPa), respectively, would meet the thermal requirements for the underwear garment and would be superior to those presently being used. The foam compressed less than 30% at 2 psi (13.8 kPa). The fibrous material compressed 60% at 2 psi (13.8 kPa) but had such a high specific clo value incompressed (2.27 clo/cm) that thermal resistance at 2 psi (13.8 kPa) was still estimated to be 2.11 clo/cm. GRA

N80-31049# Los Alamos Scientific Lab., N. Mex.
LASER PROTECTIVE EYEWEAR PROGRAM AT THE LOS ALAMOS SCIENTIFIC LABORATORY
D. C. Winburn 1980 24 p refs Presented at Ind. Hyg. Conf., Houston, Tex., 18-23 May 1980
(Contract W-7405-eng-36)
(LA-UR-80-1038; CONF-800531-1) Avail: NTIS
HC A02/MF A01

The proliferation of lasers focused considerable attention on providing adequate eye protection for experimenters involved in the use of a wide variety of nonionizing radiation. Experiments with fast/pulsed lasers (Nd:YAG, HF, and CO2) were performed to gain biological threshold data on ocular damage. In parallel, eye protection devices were evaluated, which resulted in the development of lightweight, comfortable spectacles of colored glass filters that can be ground to prescription specifications. Goggle styles are employed in specific applications. DOE

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-31050 State Univ. of New York at Stony Brook.
THE DESIGN AND IMPLEMENTATION OF A HIERARCHICAL MULTICOMPUTER Ph.D. Thesis
Devesh Bhatt 1980 187 p
Avail: Univ. Microfilms Order No. 8019737

System organization, communication, control, and fault tolerance are in the context of a hierarchical multicomputer. The hardware design of the hierarchical multicomputer is presented. The system is uniformly extensible to a very large number of processors without a significant increase in the complexity of the hardware and software subsystems. Particular attention is paid to the design of the interprocessor links, and the implications of the support required. The issues of task distribution, scheduling, and interprocess communication are addressed. It is noted that considerable simplification can be achieved by dedicating a processor to one user task at a time without much penalty in typical utilization figures. The emphasis is on designing a facility which does not impose any unwanted non-causal synchronization on the client processes. The design of a level structured kernel to implement these functions is presented. Finally, the issues of error detection, localization and confinement, dynamic reconfiguration, recovery, diagnostics, and interactive debugging are addressed. Dissert. Abstr.

N80-31051 Southern Methodist Univ., Dallas, Tex.
A STATEMENT ORIENTED DATA FLOW PROCESSOR Ph.D. Thesis
Robert Wayne Heller 1980 107 p
Avail: Univ. Microfilms Order No. 8019072

A computer architecture is investigated which is based on the separation of programs into three distinct classes of items: data, operations, and control structures incorporating facets from both the classical von Neumann and data flow organizations. The resulting hybrid architecture solves some of the problems inherent in data flow designs, while retaining the parallelism in executions of expressions present in such designs. Furthermore, since the design is based upon the structure of programs, the design has many of the desirable properties of the language directed architectures. Dissert. Abstr.

N80-31052# Maryland Univ. -College Park. Dept. of Chemistry.

A DIGITAL TEMPERATURE CONTROL AND MEASUREMENT SYSTEM
R. B. Strem, B. K. Das, W. T. Angel, J. T. Siewick, S. C. Greer (NBS, Gaithersburg, Md.), and C. T. VanDegrift 4 Jul. 1980 24 p refs Submitted for publication
(Contract N00014-79-C-0008; NR Proj. 051-701)
(AD-A086805; TR-1) Avail: NTIS HC A02/MF A01 CSCL 09/2

An automated digital temperature control and measurement system with a temperature resolution of 0.3 to 3.0 mK and operating in the temperature range -40 C to -79 C is described in this report. GRA

N80-31053# Naval Research Lab., Washington, D. C. Communications Sciences Div.
FUNCTIONAL DESIGN FOR AN AUTOMATED DATA BASE ERROR DETECTION SYSTEM Final Report
Gerald A. Wilson, Sandra B. Salazar, and Kathryn L. Heninger 15 May 1980 87 p refs
(XF21244103)
(AD-A086811; AD-E000448; NRL-MR-4223) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report documents the design proposed for an automated system for data base error detection. The system, called COPE, will be a front end to the data base management system to catch errors before they enter the data base. It will check for errors in each user's updates and prevent errors due to undesirable interactions between users. It should be invisible to the users during normal processing when an error is detected, it will operate interactively to inform the user and to request correction. GRA

N80-31054# Southern Methodist Univ., Dallas, Tex. School of Industrial Engineering.
RANDOM PROCESS GENERATION Final Report, 1 Jun. 1977 - 30 Sep. 1979
Bruce W. Schmeiser Jun. 1980 13 p refs
(Contract N00014-77-C-0425; NR Proj. 277-236)
(AD-A086758) Avail: NTIS HC A02/MF A01 CSCL 09/2

'Random process generation' includes all aspects of modeling and generating (pseudo) random variates for driving probabilistic simulations on digital computers. Topics include the selection of appropriate statistical distributions, parameter determination, diagnostic checking, and generation of random variables. The research performed under the auspices of this contract emphasized the use of general four parameter families of distribution during the first year. The second year concentrated on generation of random vectors from multivariate distributions. Several other topics were considered as well. A brief summary of the principal investigator's thoughts on the future of random process generation concludes the report. GRA

N80-31055# Yale Univ., New Haven, Conn. Dept. of Computer Science.
A SURVEY OF SYNCHRONIZATION PROBLEMS
George Holober Sep. 1980 55 p refs
(Contract N00014-75-C-0752)
(AD-A086509; TR-181/80) Avail: NTIS HC A04/MF A01 CSCL 09/2

Decreased hardware costs will facilitate the use of parallel computation in the near future. Synchronization primitives will be needed to implement concurrent algorithms. Many such primitives have been proposed to date. Unfortunately, their power can only be accurately measured in terms of their ability to solve a particular set of synchronization problems. A correspondingly large number of such problems have been proposed along with the primitives. We present some of these synchronization problems and outline their parameters, variations, and histories. GRA

N80-31056# Wisconsin Univ. - Madison. Mathematics Research Center.
DESIGN CONSIDERATIONS FOR DATA-FLOW DATABASE MACHINES
Haran Boral and David J. DeWitt Mar. 1980 36 p refs
(Contracts DAAG29-79-C-0165; DAAG29-75-C-0024; Grant NSF MCS-78-01721)
(AD-A086374; MRC-TSR-2058) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper presents a discussion of the application of data-flow machine concepts to the design and implementation of database machines which execute relational algebra queries. We analyze the performance of multiprocessor nested-loops and sort-merge join algorithms and show that the nested-loops algorithm is generally superior. Three levels of operand granularity for data-flow database machines are introduced and compared using the nested-loops join algorithm. We demonstrate that relation-level granularity is too coarse and that tuple-level granularity is too fine. The third level of granularity, a page of a relation, is shown to be the best choice from both hardware and software viewpoints. Finally a preliminary design for a data-flow database machine which utilizes page-level granularity and supports distributed control of instruction execution is presented. GRA

N80-31057# Stanford Univ., Calif. Dept. of Computer Science.
THE COMPUTER MODERN FAMILY OF TYPEFACES
Donald E. Knuth Jan. 1980 210 p Sponsored in part by the NSF, IBM and Xerox Corp.
(Contract N00014-76-C-0330)
(AD-A086359; SU-STAN-CS-80-780) Avail: NTIS HC A10/MF A01 CSCL 09/2

This report gives machine-independent definitions of all the styles of type planned for use in future editions of The Art of Computer Programming. Its main purpose is to provide a detailed example of a complete family of font definitions using METAFONT, so that people who want new symbols for their own books and papers will understand how to incorporate them easily. The fonts are intended to have the same spirit as those used in earlier editions of The Art of Computer Programming, but each character has been redesigned and defined in the METAFONT idiom. It is hoped that some readers will be inspired to make similar definitions of other important families of fonts. The bulk of this report consists of about 400 short METAFONT programs for the various symbols needed, and as such it is pretty boring, but there are some nice illustrations. GRA

N80-31058# Maryland Univ., College Park. Dept. of Computer Science.
REAL-WORLD PROPERTIES IN THE REQUIREMENTS FOR EMBEDDED SYSTEMS
Pamela Zave 1979 17 p refs
(Contract N00014-77-C-0623)
(AD-A086867) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper addresses a central issue in the specification of requirements for embedded systems: How can the ragged and open-ended properties of the 'real world' be usefully included in a coherent, closed requirements specification. Certainly the term 'embedded system' is closely associated with the physical properties of computing environments, such as time and hardware reliability. Section 2 argues that emphasis on real-world, or physical, properties defines embedded systems, so that the role of these properties in requirements specification for embedded systems is indeed central. Section 3 sketches an approach to the requirements problem which should be well suited to the inclusion of physical attributes, but explains that a nagging problem remains. Section 4 presents a trial solution to this problem GRA

N80-31059# Doty Associates, Rockville, Md.
HANDBOOK OF PROCEDURES FOR ESTIMATING COMPUTER SYSTEM SIZING AND TIMING PARAMETERS. VOLUME 1: PROCEDURES AND TECHNIQUES Final Technical Report, 16 May 1979 - 15 Feb. 1980
William B. Humphrey and John N. Postak 15 Feb. 1980 157 p refs
(Contract F19628-79-C-0106)
(AD-A086444; DAI-TR-235-Vol-1; ESD-TR-80-115-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 09/2

This first volume of the handbook presents procedures that provide a structured approach for estimating computer system sizing and timing parameters during the acquisition life-cycle of Embedded Computer Systems (ECS). The procedures were designed for use by the Electronic Systems Division's Computer Systems Engineering Directorate (ESD/TOI). Based on engineering discipline, the procedures provide a step-by-step program to assist ESD/TOI engineers and computer scientists in evaluating

or conducting initial sizing and timing estimates, updates, or developmental monitoring. Procedural steps are discussed with emphasis on actions that should be taken, risks that should be considered, constraints that may be encountered, and factors that may affect the quality of the estimate at various stages of the acquisition. Techniques that can be used in estimating sizing and timing parameters are also discussed, including data requirements, assumptions, and levels of confidence. In addition, this volume also contains a reference listing, bibliography, glossary, and an index. GRA

N80-31060# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.
NUMERICAL STUDIES IN COMPUTER AIDED DESIGN. PART 2: STUDIES IN HIGH SPEED Final Report
D. A. Calahan. 12 May 1980. 15 p. refs.
(Grant AF-AFOSR-2812-75; AF Proj. 2304)
(AD-A087060; AFOSR-80-0546TR) Avail: NTIS
HC A02/MF A01 CSCL 09/2

This report summarizes research investigating (1) algorithms for the vectorized direct solution of sparse simultaneous equations, and (2) the application of vector processors to aerodynamic fluid flow. The research was performed between April 1, 1975 and March 31, 1980. GRA

N80-31061# Radian Corp., Houston, Tex.
RADIAN DART MICROCOMPUTER SYSTEM HARDWARE DOCUMENTATION OPERATION SYSTEM DESCRIPTION. DART 2 DOCUMENTATION, VOLUME 3
23 May 1979. 131 p.
(Contract EY-77-C-02-4596)
(COO-4596-1-Vol-3) Avail: NTIS HC A07/MF A01

An operator's manual for the DART 2 Acquisition, Reduction, and Transmission system is presented. Topics include system capabilities and configurations; ways in which the microprocessor-based central processing unit communicates with the memory and peripheral devices; theory of operation for the system components; and a section of reference data including schematic diagrams, cable lists, device specification sheets, and other detailed information. DOE

N80-31062# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
RANDOM ACCESS MEMOMY, VOLUME 1 Final Report
A. J. Legg. Aug. 1979. 75 p. 2 Vol.
(Contract ESTEC-3005/76-NL-HP(SC))
(ESS/SS-935-Vol-1; ESA-CR(P)-1329-Vol-1) Avail: NTIS
HC A04/MF A01

The design production, and testing of an engineering model of the highly reliable semiconductor random access memory are discussed. A set of equipment is described including a Texas 990/4 computer, silent 700 terminal, interface unit, console and loom. R.C.T.

N80-31063# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
RANDOM ACCESS MEMORY, VOLUME 2 Final Report
A. J. Legg. Aug. 1979. 81 p. refs. 2 Vol.
(Contract ESTEC-3005/76-NL-HP(SC))
(ESS/SS-935-Vol-2; ESA-CR(P)-1329-Vol-2) Avail: NTIS
HC A05/MF A01

An engineering model of highly reliable semiconductor memory was developed, which has a storage capacity of 16K words of 16 bits/word. The method of error correction used to improve reliability is the Single Error and Erasure Correction (SEEC) scheme. Modular packaging was used. The memory component used in the design was the CMOS 6508 type of 1K X 1 static random access memory. A set of test equipment was surveyed comprising a Texas 990/4 computer, silent 700 terminal, interface unit, console and looms. Functional tests on the memory used specially developed test software, and included write-read checks on the memory in fault free conditions and under several conditions of simulated faults. Thermal testing was also performed. Author (ESA)

N80-31064# Computer Sciences Corp., Las Vegas, Nev.
COMMAND PROCEDURES FOR MANIPULATING TAPE DATA FILES: A SET OF PROCEDURES DEVELOPED FOR USE WITH THE COMNET ALPHA TIME SHARING SYSTEM Final Report, Jun. 1978 - Mar. 1979
R. A. McCrory and L. R. Williams. Mar. 1980. 32 p. refs.
Prepared in cooperation with EPA, Las Vegas, Nev.
(PB80-177546; EPA-600/8-80-013) Avail: NTIS
HC A03/MF A01 CSCL 09B

The lack of simple terminal commands to manipulate tape data files is discussed. It enabled relatively inexperienced programmers or scientists to maintain large infrequently used data sets on magnetic tape. A set of terminal command language procedures which greatly simplify the maintenance of data files on magnetic tape is documented. The command procedures are invoked by entering a single work at the computer terminal. The computer queries the user for specific information and then submits a job to accomplish the actual data transfer. Ancillary procedures are included to facilitate the housekeeping requirements of tape management. The storage of large infrequently used data sets on magnetic tape saves ADP funds and frees system resources for other applications. Such savings lessen capital investment requirements as the agency's ADP needs expand. Disk storage charges are cut by 50 percent by the use of these procedures. GRA

N80-30330*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AUTOMATED FREQUENCY STANDARD STABILITY DATA REDUCTION
L. J. Knapp. *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980. p 38-40 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-31065 Pennsylvania Univ., Philadelphia.
REVERSIBLE IMAGE COMPRESSION Ph.D. Thesis
Larry Bernard Grim. 1980. 180 p.
Avail: Univ. Microfilms Order No. 8018551

Algorithms which are reversible and can be used to encode images for storage are examined. These algorithms make use of spatial redundancy found in the original in both the X and Y direction and also temporal redundancy between images in a sequence. It deviates from the standard approach to encoding in that it uses only computer length words and half words for the basic unit of storage and not the bit as was done by previous techniques. The images are first mapped into bit planes. The compression is then done on the individual bit planes. The use of bit planes provides significant advantage over compressing the original pixels. Dissert. Abstr.

N80-31066 Vanderbilt Univ., Nashville, Tenn.
AUGMENTED PREDICTIVE PARSING Ph.D. Thesis
Joseph Lovell Linn. 1980. 99 p.
Avail: Univ. Microfilms Order No. 8018887

An Augmented Predictive parser which extends the Recursive Descent technique by making available more state information than is available in Recursive Descent parsers is described. The extra state information gives the Augmented Predictive parsers considerably more power. After providing a suitable formalism to describe the parsers it is shown that these Augmented Predictive parsers are just as powerful as the LR(k) parsers. A method by which an Augmented Predictive parser may be obtained from a deterministic context free grammar is given. Last, it is demonstrated that there are many cases where the parsers have considerable size advantages over parsers produced by other current techniques. Dissert. Abstr.

N80-31067 Idaho Univ., Moscow.
KL: A WELL-STRUCTURED BEGINNING COMPUTER LANGUAGE Ph.D. Thesis
Van Houten. 1980. 90 p.
Avail: Univ. Microfilms Order No. 8019797

A programming language, KL, designed and developed specifically for use in introductory computer science courses is described. The structure of KL requires that each statement begin with a keyword and end with a semicolon. This decreases the implementation effort and adds to the simplicity of the language. This form also eliminates the necessity for reserved words which often cause difficulty for the user. The keywords have been chosen to be meaningful and, when possible, short. The tools needed for abstraction are included in KL. User defined data types are available in KL. Procedures and functions are also available for dividing a computer problem into subtasks. KL requires structured programming techniques because no other constructs are available. This should start good programming habits. The concepts of structured programming can be learned using KL and later applied to other less structured languages. Dissert. Abstr.

N80-31068 Massachusetts Univ., Amherst.
PATH SELECTION FOR SYMBOLIC EXECUTION SYSTEMS Ph.D. Thesis
John Lowe Woods. 1980. 192 p.
Avail: Univ. Microfilms. Order No. 8019505

A path generation method that may be used in conjunction with a symbolic execution system to analyze programs is described. This path generation method attempts to generate sets of paths that satisfy user selected program coverage goals. This method differs from previous attempts at path generation in that it uses a dynamic goal oriented approach in which paths are generated one statement at a time during the symbolic execution process. As each path is generated information is stored about the path and the area of the program it covers. Information from the current path and from previous paths is used at each step of the path generation process. Three different path situations are identified--branch selection, loop processing, and path generation in invoked procedure--and a different technique is developed to handle each of these situations. The method was implemented and tested. The test results indicate that the techniques developed are successful in producing paths that achieve a high degree of program coverage. Dissert. Abstr.

N80-31069 Rensselaer Polytechnic Inst., Troy, N. Y.
QUISP: A COMPUTER PROCESSOR FOR THE DESIGN AND DISPLAY OF QUADRIC-SURFACE BODIES Ph.D. Thesis
Joshua Zev Levin. 1980. 126 p.
Avail: Univ. Microfilms. Order No. 8020408

Quadric-surface bodies are useful for modelling manmade objects, and it is important that any computer aided design system be able to work with such bodies. The QUISP processor was designed to accept descriptions of quadric-surface bodies in either character string form (via the QUADRIL language), or through interactive input. The QUADRIL has a mixture of English-like and algebraic syntax. It may be used to specify quadric-surface bodies and then to display them on a variety of media. The interactive input allows commands to be entered by push buttons to accomplish anything that QUADRIL can do. The QUISP outputs line drawings of the quadric-surface bodies, with optional removal of hidden curves. All the lines in the drawings are projections of quadric-surface intersection curves, which are calculated using parametric methods. Dissert. Abstr.

N80-31070*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SCHEDULER SOFTWARE FOR TRACKING AND DATA RELAY SATELLITE SYSTEM LOADING ANALYSIS: USER MANUAL AND PROGRAMMER GUIDE
Ray Craft, Christel Dunn, Janet McCord, and Louis Simeone. 13 Jun. 1980. 101 p.
(NASA-TM-78290) Avail: NTIS HC A06/MF A01 CSCL 09B

A user guide and programmer documentation is provided for a system of PRIME 400 minicomputer programs. The system was designed to support loading analyses on the Tracking Data Relay Satellite System (TDRSS). The system is a scheduler for various types of data relays (including tape recorder dumps and real time relays) from orbiting payloads to the TDRSS. Several model options are available to statistically generate data relay requirements. TDRSS time lines (representing resources available for scheduling) and payload/TDRSS acquisition and loss of sight time lines are input to the scheduler from disk. Tabulated output from the interactive system includes a summary of the scheduler activities over time intervals specified by the user and overall summary of scheduler input and output information. A history file, which records every event generated by the scheduler, is written to disk to allow further scheduling on remaining resources and to provide data for graphic displays or additional statistical analysis. Author

N80-31071*# Kentron International, Inc., Hampton, Va. Technical Center.
SEGMENTATION, DYNAMIC STORAGE, AND VARIABLE LOADING ON CDC EQUIPMENT
Sherwood H. Tiffany. Sep. 1980. 72 p. refs.
(Contract NAS1-16000)
(NASA-CR-3315) Avail: NTIS HC A04/MF A01 CSCL 09B

Techniques for varying the segmented load structure of a program and for varying the dynamic storage allocation, depending upon whether a batch type or interactive type run is desired, are explained and demonstrated. All changes are based on a single data input to the program. The techniques involve: code within the program to suppress scratch pad input/output (I/O) for a batch run or translate the in-core data storage area from blank common to the end-of-code - 1 address of a particular segment for an interactive run, automatic editing of the segload directives prior to loading, based upon data input to the program, to vary the structure of the load for interactive and batch runs, and automatic editing of the load map to determine the initial addresses for in core data storage for an interactive run. Author

N80-31072*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
A HILL SLIDING STRATEGY FOR INITIALIZATION OF GAUSSIAN CLUSTERS IN THE MULTIDIMENSIONAL SPACE
John K. Park, Yung H. Chen, Daryl B. Simons, and Lee D. Miller. Jul. 1980. 29 p. refs. Presented at the Joint Soil and Machine Process. of Remotely Sensed Data Symp., West Lafayette, Ind., 3-6 Jun. 1980.
(NASA-TM-80721; Rept-80F4508) Avail: NTIS HC A03/MF A01 CSCL 09B

A hill sliding technique was devised to extract Gaussian clusters from the multivariate probability density estimate of sample data for the first step of iterative unsupervised classification. Each cluster was assumed to posses a unimodal normal distribution. A clustering function proposed distinguished elements of a cluster under formation from the rest in the feature space. Initial clusters were extracted one by one according to the hill sliding tactics. A dimensionless cluster compactness parameter was proposed as a universal measure of cluster goodness and used satisfactorily in test runs with LANDSAT multispectral scanner data. The normalized divergence, defined by the cluster divergence divided by the entropy of the entire sample data, was utilized as a general separability measure between clusters. An overall clustering objective function was set forth in terms of cluster covariance matrices, from which the cluster compactness measure could be deduced. Minimal improvement of initial data partitioning was evaluated by this objective function in eliminating scattered sparse data points. The hill sliding clustering technique developed herein has the potential applicability to decomposition any multivariate mixture distribution into a number of unimodal distributions when an appropriate distribution function to the data set is employed. R.K.G.

N80-31073# Naval Surface Weapons Center, Dahlgren, Va.
COMPUTER PROGRAMMING AND CODING STANDARDS FOR THE FORTRAN AND SIMSCRIPT II.5 PROGRAMMING LANGUAGES Final Report
Robert T. Bevan and John H. Reynolds. Apr. 1980. 78 p. refs.
(AD-A086499; NSWC/TR-3878) Avail: NTIS HC A05/MF A01 CSCL 09/2

Contemporary studies of the software development process have shown definitively that an 'ad hoc' attempt at developing large and complex programming systems yields software that is too expensive, too difficult to maintain, inefficient, and, often, incorrect. Worse, it is very difficult to assure oneself that it is correct. This report deals with standards that make the

development of programs a more precise process. This does not mean to imply that use of a rigorous set of programming standards is a panacea for computer programming. On the contrary, use of standards merely reduces the number of errors introduced. Using standards such as those documented in this report will be seen to require more effort on the part of the programming staff than heretofore. This effort is not in vain, however, since the additional effort consists of tasks that were simply not done in the approaches of the past. Additionally, standards greatly improve the reliability, maintainability, and transportability of the resultant programs. GRA

N80-31074# Weapons Systems Research Lab., Adelaide (Australia).
DISCRETE/CONTINUOUS SIMULATION LANGUAGE
T. J. Packer, J. R. Coleby, and T. J. Galvin Jun. 1979 92 p
(AD-A086487; WSRL-0104-TR) Avail: NTIS
HC A05/MF A01 CSCL 09/2

This report takes the form of a user guide for the Discrete/Continuous Simulation Language (DCSL). This language has been developed to allow the convenient setting-up of simulations based directly upon models formulated in a graphical modelling language referred to here as GML. The DCSL System Program is written in FORTRAN and hence DCSL is easily implemented on most modern machines. GRA

N80-31075# Wisconsin Univ. - Madison. Mathematics Research Center.
GENERALIZED EQUATIONS AND THEIR SOLUTIONS. PART 2: APPLICATIONS TO NONLINEAR PROGRAMMING Summary Report
Stephen M. Robinson Mar. 1980 31 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-79-01066)
(AD-A086365; MRC-TSR-2048) Avail: NTIS
HC A03/MF A01 CSCL 12/1

We prove that if the second-order sufficient condition and constraint regularity hold at a local minimizer of a nonlinear programming problem, then for sufficiently smooth perturbations of the constraints and objective function the set of local stationary points is nonempty and continuous; further, if certain polyhedrality assumptions hold (as is usually the case in applications) then the local minimizers, the stationary points and the multipliers all obey a type of Lipschitz condition. Through the use of generalized equations, these results are obtained with a minimum of notational complexity. GRA

N80-31076# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
GRAPH: AN INTERACTIVE COMPUTER PROGRAM USED FOR TECHNICAL PLOTTING Final Report, 1 Jul. 1977 - 1 Aug. 1978
Sandra K. Drake Apr. 1980 100 p Revised
(AF Proj. 3066)
(AD-A086354; AFAPL-TR-78-90) Avail: NTIS
HC A05/MF A01 CSCL 09/2

This technical report describes a computer program 'graph' which supplies a capability to do efficient plotting of all types of analytical data in a manner suitable for direct substitution into technical papers and articles. DISPLA, a prepackaged set of subroutines from Integrated Software Systems Corporation was used in creation of 'graph'. Input is designed for the TEK4010 on-line computer terminal. Style and format of the created plot is specified by the user through interactive questions and answers. Options include special alphabets, curve fitting procedures, axis labeling and scaling, and the use of multi-curves. GRA

N80-31077# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering and Computer Science.
SELF-METRIC SOFTWARE. VOLUME 1: SUMMARY OF TECHNICAL PROGRESS Final Technical Report, 1 Aug. 1976 - 15 Jan. 1980
Stephen S. Yau Griffiss AFB, N.Y. RADC Apr. 1980 110 p refs
(Contract F30602-76-C-0397; AF Proj. 5581)
(AD-A086290; RADC-TR-80-138-Vol-1) Avail: NTIS
HC A06/MF A01 CSCL 09/2

This report documents the research performed under RADC Contract by Northwestern University in the area of developing effective techniques for large scale software maintenance, including those for the design, implementation, validation, and evaluation of reliable and maintainable software systems with a high degree of automation. During this contract period, research in the areas of ripple effect analysis, testing during software maintenance, specification for program modifications, quality factors for software maintainability, and dynamic monitoring of program behavior was conducted. In this report, the software maintenance process is first described. The research results which have been presented in previous papers and interim technical reports are summarized, and unfinished work is presented. GRA

N80-31078# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering and Computer Science.
SELF-METRIC SOFTWARE. VOLUME 2: A HANDBOOK. PART 1: LOGICAL RIPPLE EFFECT ANALYSIS Final Technical Report, Aug. 1976 - Jan. 1980
Steven S. Yau, James S. Collofello, and Ching-Chu Hsieh Griffiss AFB, N.Y. RADC Apr. 1980 41 p refs 3 Vol.
(Contract F30602-76-C-0397; AF Proj. 5581)
(AD-A086291; RADC-TR-80-138-Vol-2-Pt-1) Avail: NTIS
HC A03/MF A01 CSCL 09/2

This handbook consists of two parts on ripple effect analysis for large-scale software maintenance. In part 1, a ripple effect analysis technique for software maintenance from the logical or functional perspective is presented. In a separate volume, part 2 of the handbook, a ripple effect analysis technique for software maintenance from the performance perspective is presented. The purpose of this handbook is to present ripple effect analysis techniques to assist software maintenance personnel to do a better job in large-scale software maintenance. The material presented in this handbook is organized in three levels. At the first level, the software maintenance process is described and the need for effective ripple effect and techniques for large-scale software maintenance is given. The capabilities and restrictions of the logical ripple effect analysis technique, as well as how this technique is interfaced with the user, are presented. At the second level, the logical ripple effect analysis technique is outlined in two phases: the lexical analysis phase and the tracing phase. At the third level, the steps of the logical ripple effect analysis technique are given in detail. However, the detailed theory behind this technique is not presented in ths handbook, but contained in other reports. GRA

N80-31079# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering and Computer Science.
SELF-METRIC SOFTWARE. VOLUME 3: A HANDBOOK. PART 2: PERFORMANCE RIPPLE EFFECT ANALYSIS Final Technical Report, Aug. 1976 - Jan. 1980
Steven S. Yau and James S. Collofello Griffiss AFB, N.Y. RADC Apr. 1980 46 p refs 3 Vol.
(Contract F30602-76-C-0397; AF Proj. 5581)
(AD-A086292; RADC-TR-80-138-Vol-3-Pt-2) Avail: NTIS
HC A03/MF A01 CSCL 09/2

In this volume part 2 of the handbook, a ripple effect analysis technique for software maintenance from the performance perspective is presented. The purpose of this handbook is to present ripple effect analysis techniques to assist software maintenance personnel to do a better job in large-scale software maintenance. The material presented in this handbook is organized in three levels. At the first level, the software maintenance process is described and the need for effective ripple effect analysis techniques for large-scale software maintenance is given. The capabilities and restrictions of the performance ripple effect analysis technique, as well as how this technique is interfaced with the user, are presented. At the second level, the performance ripple effect analysis technique is outlined in two phases: the lexical analysis phase and the tracing phase. At the third level, the steps of the performance ripple effect analysis technique is not presented in this handbook, but contained in other reports. Finally, the integration of the processing steps of the performance ripple effect analysis and the logical ripple effect analysis is discussed. GRA

N80-31080# Texas Univ., Austin. Center for Cybernetics Studies.
A DUAL ALGORITHM TO SOLVE LINEAR LEAST ABSOLUTE

VALUE APPROXIMATIONS
Ronald Armstrong and Mabel Kung (McMaster Univ.) Jun. 1980 19 p refs
(Contracts N00014-75-C-0569; N00014-80-C-0242)
(AD-A087078; CCS-RR-370) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents a special purpose dual linear programming algorithm to solve linear least absolute value problems. In addition, strategies involving start procedures are examined. Implementations of computer based techniques are discussed. Computational results with three computer code versions of the algorithm are given. GRA

N80-31081# Texas Univ. at Austin. Applied Research Labs.
USER'S MANUAL FOR NEMESIS AND PLMODE
Ruth Gonzalez and Susan G. Payne 1 May 1980 132 p
(Contract N00014-79-C-0263)
(AD-A087254; ARL-TM-80-6) Avail: NTIS HC A07/MF A01 CSCL 09/2

The normal mode model, NEMESIS, was designed and implemented at the Applied Research Laboratories, The University of Texas at Austin ARL'S (UT), to aid in the investigation of low frequency, range invariant, acoustic propagation effects. The mathematical basis and numerical scheme of this model are described by Gonzalez and Hawker (1980). NEMESIS computes the eigenvalues and normal modes of the depth separated acoustic wave equation. Group velocities and modal attenuation terms are also computed. Propagation loss and velocity potential for a source and receiver at a given range can be calculated from these quantities (Gonzalez and Hawker, 1980). A computer model, PLMODE, was designed to perform these computations, and the computer code for both NEMESIS and PLMODE was prepared for export to other research laboratories. This report is designed to accompany this software and to assist persons who wish to use it. The contents include descriptions of the modeled environment, the input data and their format, and the output produced by the models. An explanation of the diagnostic messages that may arise during execution of the models is also included. Estimates of memory requirements and execution times are given along with sample data sets and their resulting output. GRA

N80-31082# Illinois Univ. at Chicago Circle, Chicago. Dept. of Mathematics.
A COMPUTER ALGORITHM FOR GENERATING A BASIS OF THE TRADES ON T-DESIGNS Interim Report
A. Hedayat and Huey-Luen Hwang Jun. 1980 22 p refs
(Grant AF-AFOSR-3050-76; AF Proj. 2304)
(AD-A087251; AFOSR-80-0561TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

To study the existence and nonexistence of t-designs it is enough to investigate a combinatorial structure called trades on t-designs. This report presents a computer algorithm for generating the basis of trade on t-designs. The technique is elucidated via several examples. GRA

N80-31083# Oak Ridge National Lab., Tenn. Fusion Energy Div.
HLYWD: A PROGRAM FOR POST-PROCESSING DATA FILES TO GENERATE SELECTED PLOTS OR TIME LAPSE GRAPHICS
J. K. Munro, Jr. May 1980 65 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-109) Avail: NTIS HC A04/MF A01

The program HLYWD is a post processor of output files generated by large plasma simulation computations or of data files containing a time sequence of plasma diagnostics. It is intended to be used in a production mode for either type of application; i.e., it allows one to generate along with the graphics sequence, segments containing title, credits to those who performed the work, test to describe the graphics, and acknowledgement of funding agency. The current version is designed to generate 3D plots and allows one to select type of display (linear or semilog scales), choice of normalization of function values for display purposes, viewing perspective, and an option to allow continuous rotations of surfaces. This program was developed with the intention of being relatively easy to use, reasonably flexible, and requiring a minimum investment of the user's time. DOE

N80-31084# Software und Engineering fuer Daten- verarbeitungs- und Automationssysteme, Frankfurt am Main (West Germany).
RELIABILITY OF SOFTWARE GENERATED BY LANGUAGE PROCESSORS
Konrad F. Kreuter Jul. 1979 192 p refs
(Contract ESA-3490/78-D-JS(SC))
(SESA-P35532; ESA-CR(P)-1333) Avail: NTIS HC A09/MF A01

The elements which a programming language must provide to allow a homologous mapping of different levels of problem formulation are identified. An example problem is formulated at six different levels of refinement to demonstrate aspects to be considered between the first draft of an algorithm down to a complete machine dependent implementation with minimum storage requirements for data. For all these levels, ALGOL 68 is used as a notational tool. This was done to show that it is not necessary to use different languages when describing a problem and its solution on different levels of abstraction, provided the language has enough expressive power. There are other programming languages with equal behavior. A comparison of the languages ALGOL 68, PL/1, CPL1, HAL/S, PEARL, and the requirements for the language ADA are given. Author (ESA)

N80-31085# European Space Agency, Paris (France).
USER'S GUIDE FOR A COMPUTER SIMULATION PROGRAM FOR MULTI-RIGID-BODY SYSTEMS
P. Boland (ESTEC, Noordwijk, Netherlands) Feb. 1980 74 p refs
(ESA-STM-216) Avail: NTIS HC A04/MF A01

The FORTRAN 4 program provides the solution to large rotations of arbitrary, joint connected, rigid body systems. Relative rotations are described by Tait-Bryan angles in a 1-2-3 sequence. The interface between the main core of the program and the user consists of subroutines that make it possible to accommodate external perturbations, connection torques or prescribed motions. System modelling and input and output procedures are explained in detail. Several explicit examples are given, to illustrate the versatility of the program. The complete list of instructions is provided. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N80-31086 Polytechnic Inst. of New York.
THROUGHPUT CALCULATIONS FOR MULTIPROCESSOR COMPUTER SYSTEMS Ph.D. Thesis
Mehmet Ulema 1980 225 p
Avail: Univ. Microfilms Order No. 8019418

Approximate analytic methods for evaluating the performance of multiprocessor systems are described. A processor oriented approach is developed to calculate the throughput of a multiprocessor system by building a Markov chain model taking the state as the number of processors working (active) at a unit time interval. The assumption is made that a processor may be active using a memory module or active without using a memory module, or may not be active waiting for a memory module to become free. To simplify the computations for systems with large numbers of processors, queued processors will be permitted to make (possibly) new requests at the end of a cycle. Asymptotic expressions are also derived for the systems with large numbers of processors. In describing the importance of bus communication techniques, it is demonstrated how the analysis can be used for the synchronous and asynchronous type bus communication techniques in a time shared/common bus interconnection structure which is an example of the partially connected topology. Dissert. Abstr.

N80-31087# California Univ., Berkeley. Electronics Reserach Lab.
THE DESIGN METHODOLOGY OF DISTRIBUTED COMPUTER SYSTEMS Final Technical Report, 1 Jul. 1978 - 30 Jun. 1979

C. V. Ramamoorthy. May 1980. 201 p. refs.
(Grant AF-AFOSR-3630-78; AF Proj. 2304)
(AD-A086690; AFOSR-80-0542TR) Avail: NTIS
HC A10/MF A01 CSCL 09/2

Performance evaluation techniques for asynchronous concurrent systems is developed using the Petri net approach. Analysis techniques for deadlocks in asynchronous concurrent systems is also explored. Moreover, a need for adaptive reconfiguration techniques is established along with necessary and sufficient conditions for reconfigurability. Then a method is described for evaluating the available reconfiguration strategies based on a figure of merit. GRA

N80-31088# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
SIZING DISTRIBUTED SYSTEMS: OVERVIEW AND RECOMMENDATIONS. Final Report.
Sandra A. Mamrak. May 1980. 25 p. refs.
(PB80-184377; NBS-SP-500-60; LC-80-600061) Avail: NTIS
HC A02/MF A01 CSCL 09B

An overview of sizing techniques, a brief discussion of the factors that affect choosing one or a combination of techniques, and a set of recommendations for choosing tools for sizing distributed systems is given. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-31089# Yale Univ., New Haven, Conn. Dept. of Computer Science.
AFFECT UNITS AND NARRATIVE SUMMARIZATION. Research Report.
Wendy S. Lehnert. May 1980. 58 p. refs.
(Contract N00014-75-C-1111; Grant NSF IST-79-18463)
(AD-A086735; RR-179) Avail: NTIS HC A04/MF A01 CSCL 05/7

The analysis of narrative text involves various levels of description. On the lowest level are word meanings and syntactic structure within single sentences. On a higher level there are problems of generating inferences and integrating information into memory. At the highest level is the notion of a macro-structure or narrative plot. The identification of high-level narrative structures is central to the problem of narrative summarization. But the intuitive notion of a plot is useless for a process model of summarization unless we can specify the hierarchical representations that allow us to analyze input and produce plots as output. A representational strategy has been developed for high-level structural analysis in conjunction with the BORIS system (a narrative text understanding system). The structures produced effectively encode plot lines in terms of connected graph structures where graph nodes correspond to specific affect units. An affect unit is an abstraction of affective causality which is recognized in a bottom-up manner at the time of understanding. Simple manipulations of these graph structures yield the conceptual basis for narrative summaries, but the actual process of summarization depends on certain connectivity properties in the graph structure. GRA

N80-31090# University of Southern California, Los Angeles. Dept. of Electrical Engineering.
TIGHT ROUNDS ON THE RESPONSE OF MULTIVARIABLE SYSTEMS WITH COMPONENT UNCERTAINTY.
Michael G. Safonov. 31 Aug. 1979. 10 p. refs.
(Contract F44620-76-C-0061; Grant NSF ENG-78-05628)
(AD-A086580) Avail: NTIS HC A02/MF A01 CSCL 12/2

For Multi-Input-Multi-Output (MIMO) feedback systems having internal components that are subject to parameter variations, nonlinearity, or unmodeled dynamics within given 'conic sector' bounds, tight bounds (which also turn out to take the form of 'conic sector' bounds) are derived for the input-output relation of the closed-loop system. In the case of linear-time invariant systems, the 'conic sector' bounds are interpretable in terms of the maximal singular values of certain frequency-response matrices. GRA

N80-31091# California Univ., Berkeley. Electronics Research Lab.
FOUNDATIONS OF FEEDBACK THEORY FOR NONLINEAR DYNAMICAL SYSTEMS.
C. A. Desoer and Y. T. Wang. 31 Aug. 1979. 83 p. refs.
Submitted for publication.
(Contract F44620-76-C-0100; Grant NSF ENG-78-84522)
(AD-A086578) Avail: NTIS HC A05/MF A01 CSCL 09/3

We study the fundamental properties of feedback for nonlinear, time-varying, multi-input, multi-output, distributed systems. The classical Black formula is generalized to the nonlinear case. Achievable advantages and limitations of feedback in nonlinear dynamical systems are classified and studied in five categories: desensitization, disturbance attenuation, linearizing effect, asymptotic tracking and disturbance attenuation, linearizing effect, asymptotic tracking and disturbance rejection, stabilization. Conditions under which feedback is beneficial for nonlinear dynamical systems are derived. Our results show that if the appropriate linearized inverse return difference operator is small, then the nonlinear feedback system has advantages over the open-loop system. Several examples are provided to illustrate the results. GRA

N80-31092# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
ROBUSTNESS WITH OBSERVERS.
J. C. Doyle (Honeywell Systems and Research Center) and G. Stein. 31 Aug. 1979. 20 p. refs.
(AD-A086610) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper describes an adjustment procedure for observer-based linear control systems which asymptotically achieve the same loop transfer functions (and hence the same relative stability, robustness, and disturbance rejection properties) as full state feedback control implementations. GRA

N80-31093# Honeywell Systems and Research Center, Minneapolis, Minn.
ON FEEDBACK SYSTEMS POSSESSING INTEGRITY WITH RESPECT TO ACTUATOR OUTAGES.
C. A. Harvey. 31 Aug. 1979. 11 p. refs.
(Contract ET-78-C-01-3391)
(AD-A086609) Avail: NTIS HC A02/MF A01 CSCL 12/1

For systems that are open-loop stable, there is a class of feedback controllers that have the property that the closed loop system is stable and remains stable in case actuator outages occur. Properties of a special subclass of these controllers are discussed. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-31094 Iowa State Univ. of Science and Technology, Ames.
STABILITY OF POWER SYSTEMS AND OTHER SYSTEMS OF SECOND ORDER DIFFERENTIAL EQUATIONS. Ph.D. Thesis.
Sherwin James Skar. 1980. 147 p.
Avail: Univ. Microfilms Order No. 8019664

Analytic criteria are developed to predict the stability or instability of equilibrium points of systems of second order differential equations. The results are applied to the swing equations for electric power systems. It is shown that the trivial solution is exponentially stable if and only if the linearization matrix is stable. This rapid rate of convergence ensures that the asymptotic stability of a certain subsystem will imply the stability of the whole system. In the case of uniform damping, stability results proved by linearization allow one to classify equilibrium points as either stable or unstable, except for a certain critical case. To help implement these and related results, an algorithm is developed to determine whether all eigenvalues of a matrix are real and nonpositive. Other stability criteria are proved using invariance theory and an extension of the concept of Hamilton-

can systems. A sufficient condition for a nonlinear map being one to one in a convex region is proved. A simple analytic criterion for the existence of stable equilibrium states is proved for the swing equations with negligible transfer conductances.
Dissert. Abstr.

N80-31095 Rensselaer Polytechnic Inst., Troy, N. Y.
AN ADAPTIVE GRID FINITE ELEMENT METHOD FOR INITIAL-BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Stephen Francis Davis 1980 225 p
Avail: Univ. Microfilms Order No. 8020401

A finite element method is developed to solve initial boundary value problems for vector systems of parabolic partial differential equations in one space dimension and time. The methods adapt the computational mesh as the solution progresses in time and are thus able to follow and resolve such sharp transitions as boundary layers, shock layers, or wave fronts. This permits an accurate solution to be calculated with fewer mesh points than would be necessary with a uniform mesh. The overall method contains two parts, a solution algorithm and a mesh selection algorithm. The solution algorithm is a finite element-Galerkin method on trapezoidal space time elements, using either piecewise linear or cubic polynomial approximations. The mesh selection algorithm builds upon variable knot spline interpolation. Error estimates are obtained for the solution algorithm. The mesh selection algorithm is shown to produce a mesh which minimizes the L sq error of the solution for a given number of mesh points. A computer code implementing these algorithms has been written and applied to a number of problems.
Dissert. Abstr.

N80-31096 California Inst. of Tech., Pasadena.
ALGEBRAIC CODING THEORY Ph.D. Thesis
Robert Calderbank 1980 75 p
Avail: Univ. Microfilms Order No. 8019886

Quadratic residue codes, quasicyclic binary codes, and symmetry codes are investigated. It is shown how to regard such a code as an ideal in an algebra generated by a group of automorphisms of the code. The algebra is then used to establish a square root bound on the minimum weight of the code. The extended quadratic residue codes of length (q + 1), where q is an odd prime power, are constructed from representations of the special linear group, SL sub 2 (q). A square root bound is established on the minimum weight in quasi-cyclic binary codes. The construction of symmetry codes is extended to fields other than GF(3). Given an odd prime power q, and a finite field F of odd characteristic containing the square root of -q, a (2q + 2, q + 1) symmetry code over F is constructed. A square root bound is established on the minimum weight in this enlarged family of symmetry codes. When q is identical to -1 (mod 4) this bound is tight and is achieved by an (8,4,4) code over GF(7). Additional results are presented.
Dissert. Abstr.

N80-31097*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RELATIONSHIPS AMONG THE SLOPES OF LINES DERIVED FROM VARIOUS DATA ANALYSIS TECHNIQUES AND THE ASSOCIATED CORRELATION COEFFICIENT
Steven C. Cohen Jul. 1980 7 p ref Submitted for publication
(NASA-TM-80733) Avail: NTIS HC A02/MF A01 CSCL 12A

A technique for fitting a straight line to a collection of data points is given. The relationships between the slopes and correlation coefficients, and between the corresponding standard deviations and correlation coefficient are given.
T.M.

N80-31098# Stanford Univ., Calif. Div. of Applied Mechanics.
ON MATCHED ASYMPTOTIC EXPANSIONS AND THE CALCULUS OF VARIATIONS Interim Report
H. Pasic and G. Herrmann Jun. 1980 19 p refs
(Contract N00014-76-C-0054)
(AD-A086807; SUDAM-80-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown, with the aid of two examples, that the calculus of variations may be used to an advantage over the method of matched asymptotic expansions in solving singular boundary layer problems of applied mechanics. It is shown, with the aid of two examples, that the calculus of variations may be used to an advantage over the method of matched asymptotic expansions in solving singular boundary-layer problems of applied mechanics.
GRA

N80-31099# Wisconsin Univ. - Madison. Mathematics Research Center.
CONVERGENCE ESTIMATES FOR SEMIDISCRETE PARABOLIC EQUATION APPROXIMATIONS Technical Summary Report
Peter H. Sammon Mar. 1980 49 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A086369; MRC-TSR-2053) Avail: NTIS
HC A03/MF A01 CSCL 12/1

In this paper, we study certain semidiscrete methods for approximating the solutions of initial boundary value problems, with homogeneous boundary conditions, for certain kinds of parabolic equations. These semidiscrete methods are based upon the availability of several different Galerkin-type approximation methods for the associated elliptic steady-state problem. The properties required of the spacial discretization methods are listed and estimates of the error made by the resulting semidiscrete approximations and of its time derivatives are given. In particular, estimates are given that require only weak smoothness assumptions on the initial data. Verifications of the required properties for various Galerkin-type methods are also given.
GRA

N80-31100# Wisconsin Univ. - Madison. Mathematics Research Center.
ON THE MAXIMUM PRINCIPLE FOR PSEUDOPARABOLIC EQUATIONS Technical Summary Report
Emmanuele DiBenedetto and Michel Pierre Apr. 1980 56 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A086380; MRC-TSR-2063) Avail: NTIS
HC A04/MF A01 CSCL 12/1

This report considers the equation d/dt (mu lambda delta mu)-delta mu--0 in a cylindrical domain. Unlike the heat equation, the positivity of the boundary data is not sufficient to insure that the solution is nonnegative. It is desirable to identify those boundary data for which the above property is true. One reason is that, since the above equation is a model for heat conduction and for fluid flow in fractured porous media, it is of interest to locate those boundary data that make the correspondent physical process meaningful. In this paper several boundary value problems associated with the above equation are studied and necessary and sufficient conditions on the data are given to insure the nonnegativity of the solution.
GRA

N80-31101# Wisconsin Univ. - Madison. Mathematics Research Center.
CONVERGENT APPROXIMATIONS IN PARABOLIC VARIATIONAL INEQUALITIES. 2: HAMILTON-JACOBI INEQUALITIES Summary Report
Joseph W. Jerome Mar. 1980 18 p refs
(AD-A086364; MRC-TSR-2047) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This paper studies the two-sided differential inequality which characterizes the optimal payoff in a two person differential game, when the strategies available to the players are stopping times. By converting the inequality to an equation via a so-called penalization method, we are able to apply a standard numerical method for approximating solutions of nonlinear equations. We obtain new rates of convergence for the procedure.
GRA

N80-31102# Wisconsin Univ. - Madison. Mathematics Research Center.
ON THE NUMBER OF PERIODIC TRAJECTORIES FOR A HAMILTONIAN FLOW AND A CONVEX ENERGY SURFACE
Ivar Ekeland and Jean-Michel Lasry Mar. 1980 49 p refs
(Contract DAAG29-75-C-0024)
(AD-A086367; MRC-TSR-2050) Avail: NTIS
HC A03/MF A01 CSCL 12/1

In this paper, it is assumed that the Hamiltonian H is convex of IR(n) x IR(n), and that the origin (0,0) is an isolated equilibrium.

It is also assumed that some ball B around the origin can be found such that the energy surface H to the minus 1(h) lies outside B but inside square root of 2 B. Under these assumptions, we prove that there are at least n distinct periodic orbits of the Hamiltonian flow (H) with energy level h. GRA

N80-31103# Wisconsin Univ. - Madison. Mathematics Research Center.
STATIONARY POINTS AND FINITE-DIFFERENCE SCHEMES FOR DIFFERENTIAL INCLUSIONS Summary Report
Jean-Pierre Aubin Apr. 1980 29 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A086381; MRC-TSR-2063) Avail: NTIS
HC A03/MF A01 CSCL 12/1

So called 'differential inclusions', in which the rate of change x(dot) of the state variable x is restricted to lie in a specified set F(x) (and not given exactly) arise naturally in economics, control theory and other fields. As with differential equations, one is interested in the existence of stationary points. Here it is shown that if F is tangent to a compact convex set (in a sense made precise), then the differential inclusion has a stationary point within this set. Moreover, a discrete implicit difference scheme which approximates the inclusion will also be solvable when the tangency condition holds and the initial data is chosen from the set. GRA

N80-31104# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
STABILITY OF DICED SYSTEMS Interim Report
T. L. Johnson Mar. 1980 21 p refs
(Contracts F49620-80-C-0002; ET-76-C-01-2295; AF Proj. 2304)
(AD-A086685; LIDS-P-980; AFOSR-80-0547TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Diced systems are defined as autonomous systems governed by ordinary differential equations having discontinuities (in R to the nth power) on submainfolds where one or more of the state variables takes an integer value. Such systems may be regarded as approximations of continuous systems or as representative models of a class of discontinuous systems. Trajectories of such systems (for a given initial state) are readily calculated and may exhibit complex sliding-mode segments. Asymptotic properties of such trajectories are discussed and classified. Motivation is given in terms of observed properties of interconnected power systems. GRA

N80-31105# Delaware Univ., Newark. Applied Mathematics Inst.
ANALYTIC CONTINUATION OF SOLUTIONS TO LINEAR PARTIAL DIFFERENTIAL EQUATIONS Interim Report
David Colton 1980 20 p refs
(Grants AF-AFOSR-2879-76; NSF MCS-78-02542)
(AD-A086712; TR-76A; AFOSR-80-0498TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In this paper we shall indicate some of the current directions in the study of the analytic continuation of solutions to partial differential equations. Our intended audience is not only those mathematicians working in the area of partial differential equations, but also complex analysts interested in seeing how a major topic in the theory of analytic functions can be extended to include certain classes of linear partial differential equations. Our specific aim is to provide a survey of the general area of the analytic continuation of solutions to partial differential equations and their application. GRA

N80-31106# Delaware Univ., Newark. Applied Mathematics Inst.
ALGORITHMS ANALYSIS OF A MARKOVIAN MODEL FOR A SYSTEM WITH BATCH AND INTERACTIVE JOBS Interim Report
Jean Paul Colard and Guy Latouche Mar. 1980 35 p refs
(Grants AF-AFOSR-3236-77; NSF ENG-79-08351; AF Proj. 2304)
(AD-A086711; TR-52B; AFOSR-80-0500TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

A computer system serving both batch and interactive jobs is modeled as a single server queue, with an infinite source of ordinary customers and a finite source of priority customers. The stability condition and the stationary probability distribution are determined. For a stable system, it is shown how the distribution and moments, of the waiting time, the sojourn time, the completion time, and the busy period, may be efficiently computed. GRA

N80-31107# Clarkson Coll. of Technology, Potsdam, N.Y.
LUMPED NONLINEAR SYSTEM ANALYSIS WITH VOLTERRA SERIES Final Phase Report, Nov. 1978 - Nov. 1979
H. K. Thapar and B. J. Leon Apr. 1980 175 p refs
(Contract F30602-78-C-0102; AF Proj. 2338)
(AD-A086428; RADC-TR-80-140) Avail: NTIS
HC A08/MF A01 CSCL 09/3

This study investigates the application aspect of the Volterra series method to nonlinear system analysis, with special emphasis on nonlinear circuits. The contents are organized into five parts: (1) important aspects of Volterra series method; (2) characterization of multiple nonlinearity circuits (systems) using Volterra series; (3) response on nonlinear systems from Volterra series system characterization; (4) Computer-aided analysis of mildly nonlinear circuits using Volterra series; and (5) concrete examples from the application of Volterra series method to nonlinear circuit problems. Algorithms for adapting the Volterra series method for the computer-aided distortion and zero-state transient analysis of mildly nonlinear circuits are developed next. A symbolic approach is used which not only improves the computational efficiency but also provides a link to the earlier ideas on convergence, etc. An overview of the digital computer program PRANC, which uses the Volterra series method, is also given. GRA

N80-31108# Wisconsin Univ. - Madison. Mathematics Research Center.
REGULARIZING EFFECTS OF HOMOGENEOUS EVOLUTION EQUATIONS
Michael G. Crandall and Philippe Benilan May 1980 23 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A086561; MRC-TSR-2076) Avail: NTIS
HC A02/MF A01 CSCL 12/1

It is well known that solving the initial-value problem for the heat equation forward in time takes a 'rough' initial temperature into a temperature which is smooth at later times t = greater than 0. One aspect of this is the validity of certain estimates on tut when u is a solution of the heat equation. In this paper we prove related estimates on nonlinear evolution equations which are governed by homogeneous nonlinearities. The results apply to classes of nonlinear diffusion equations and to conservation laws. The results are interesting from the point of view of identifying a new 'regularization' mechanism and the estimates themselves cast new light on the nature of the solutions of some initial-value problems with rough initial data. GRA

N80-31109# Wisconsin Univ. - Madison. Mathematics Research Center.
VIABLE AND MONOTONE TRAJECTORIES OF DIFFERENTIAL INCLUSIONS
Jean-Pierre Aubin Apr. 1980 32 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A086382; MRC-TSR-2064) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This paper begins with an exposition of results of Haddad on the solvability of differential inclusion (in which the rate of change x(dot) of the state variable x is restricted to lie in a specified at F(x) and is not given exactly) for a solution x with x(t) epsilon K for t greater than or = 0 and K a specified set of 'viable states'. Problems of this sort arise naturally in control theory and economics. A main point is the generality of the assumptions under which the theory is successful. Results on monotone trajectories and the convergence of a generalized Newton method to a rest state are also presented. GRA

N80-31110# Wisconsin Univ. - Madison. Mathematics Research Center.
HOW TO HOMOGENIZE A NONLINEAR DIFFUSION EQUATION E.G. STEFANS PROBLEM

Alain Damlamian (Paris-Sud Univ.) Apr. 1980 17 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A086379; MRC-TSR-2061) Avail: NTIS
HC A02/MF A01 CSCL 20/13

This report discusses the homogenization of a Stefan problem (i.e., heat conduction with change of phase) when the structure is epsilon-periodic and proves that the constitutive laws of the limit medium do not depend upon the boundary conditions and are those of an anisotropically heat conducting medium which undergoes a change of phase at each temperature of change of phase of the original substance. GRA

N80-31111# Wisconsin Univ. - Madison. Mathematics Research Center.
FULLY NONLINEAR SECOND ORDER ELLIPTIC EQUATIONS WITH LARGE ZEROTH ORDER COEFFICIENT
Lawrence C. Evans (Kentucky Univ.) and Pierre-Louis Lions (Paris Univ.) Apr. 1980 22 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grant NSF MCS-77-01952)
(AD-A086383; MRC-TSR-2065) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This report proves the existence of classical solutions to certain fully non-linear second order elliptic equations with large zeroth order coefficient. The principal tool is an a priori estimate asserting that the C superscript 2, alpha-norm of the solution cannot lie in a certain interval of the positive real axis. GRA

N80-31112# Wisconsin Univ. - Madison. Mathematics Research Center.
ASYMPTOTIC BEHAVIOR OF POSITIVE SOLUTIONS OF NONLINEAR VOLTERRA EQUATIONS FOR HEAT FLOW
Ph. Clement (Technische Hogeschool, Delft, Netherlands) and J. A. Nohel May 1980 37 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041; Grant DAAG29-77-G-0004)
(AD-A086385; MRC-TSR-2069) Avail: NTIS
HC A03/MF A01 CSCL 20/11

This report considers nonlinear heat flow in a homogeneous bar of unit length of a material with memory with the ends of the rod maintained at zero temperature and with the history of temperature prescribed for time t less than or be known for the physical problem. The operator (A) in (V) is a nonlinear differential operator together with boundary conditions, and the forcing term f in (V) depends on the given initial temperature distribution, the given external heat supply, and the given history of temperature. GRA

N80-31113# Wisconsin Univ. - Madison. Mathematics Research Center.
ASYMPTOTIC PROPERTIES OF SOLUTIONS OF NONLINEAR ABSTRACT VOLTERRA EQUATIONS
Ph. Clement (Technische Hogeschool, Delft, Netherlands), R. C. MacCamy (Carnegie-Mellon Univ.), and J. A. Nohel May 1980 44 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grants DAAG29-77-G-0004; NSF MCS-77-01149)
(AD-A086387; MRC-TSR-2070) Avail: NTIS
HC A03/MF A01 CSCL 20/11

A general theory is developed which gives sufficient conditions in terms of the kernel b, the operator A, and the forcing term f for the solution u of (V) to be bounded on o < t < infinity and which further assures that the solution u tends to a limit u sub infinity as t approaches infinity under certain conditions u sub infinity = o, under others u sub infinity is the unique solution of an appropriate limit equation associated with (V). A complete analysis is given as one special case of the boundedness and asymptotic properties of the solution of the above heat flow problem, under physically reasonable assumption concerning the relaxation functions, the nonlinear operator, the initial temperature distribution, and the external heat supply. R.C.T.

N80-31114# Naval Postgraduate School, Monterey, Calif.
CLASSIFICATION TECHNIQUES FOR MULTIVARIATE DATA ANALYSIS M.S. Thesis
Jin Ki Lee 28 Mar. 1980 121 p refs
(AD-A086521) Avail: NTIS HC A06/MF A01 CSCL 12/1

The multivariate analysis techniques of cluster analysis, principal components analysis, and discriminant analysis are examined in this thesis. The theory and applications of each of the techniques are discussed. Computer software available at the Naval Postgraduate School is discussed and sample jobs are included. A hierarchical cluster analysis algorithm, available in the IMSL software package, is applied to a set of data extracted from a group of subjects for the purpose of partitioning a collection of 26 attributes of a weapon system into six clusters of superattributes. A nonhierarchical clustering procedure, principal components analysis, and discriminant analysis were all applied to a collection of data on tanks consisting of twenty-four observations of ten attributes of tanks. The cluster analysis shows that the tanks cluster somewhat naturally by nationality. The principal components analysis and the discriminant analysis show that tank weight is the single most important discriminator among nationality. GRA

N80-31115# Naval Ocean Systems Center, San Diego, Calif.
TWO'S-COMPLEMENT FIXED-POINT MULTIPLICATION ERRORS, THEORY Final Report, May 1975 - Sep. 1979
L. P. Mulcahy 1 Apr. 1980 60 p refs
(AD-A086826; NOSC/TR-538) Avail: NTIS
HC A04/MF A01 CSCL 12/1

Analytic forms of a variety of two's-complement multiplication error statistics are derived. An FIR filter structure is used to define the individual error statistics which are used in the calculation of the filter output variance and spectrum. The approach used in deriving the statistics is to show that a regularity exists in the structure of the errors as the multiplier input is stepped through a series of consecutive values. The error structure is a function of coefficient value, number representation, and word lengths. This regular structure allows the use of the Poisson Summation Formula in deriving error statistics based on multiplier inputs obtained from quantized random variables. The error statistics are categorized according to families of coefficient values denoted by the parameter v. This parameter is the effective word length of the error. Specific forms of the statistics are given for Gaussian quantizer inputs. GRA

N80-31116# Michigan Univ., Ann Arbor. Dept. of Mathematics.
APPROXIMATION OF THE SPECTRUM OF CLOSED OPERATORS, THE DETERMINATION OF NORMAL MODES OF A ROTATING BASIN Interim Report
Mitchell Luskin, Jean Descloux (Ecole Polytechnique Federale de Lavsanne), and Jacques Rappaz (Ecole Polytechnique, Palaiseav, France) Mar. 1980 45 p refs Submitted for publication
(Contract F49620-79-C-0149; AF Proj. 2304)
(AD-A086661; AFOSR-TR-80-0548) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This paper gives a theory of spectral approximation for closed operators in Banach spaces. The perturbation theory developed in this paper is applied to the study of a finite element procedure for approximating the spectral properties of a differential system modeling a fluid in a rotating basin. GRA

N80-31117# Naval Research Lab., Washington, D. C. Plasma Physics Div.
A NON-RECURSIVE INCOMPLETE CHOLESKY DECOMPOSITION METHOD FOR THE SOLUTION OF LINEAR EQUATIONS WITH A SPARSE MATRIX
A. Hain 16 Jun. 1980 26 p refs
(AD-A087005; AD-E000482; NRL-MR-4264) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The incomplete Cholesky decomposition and the subsequent iterative solution by the conjugate gradient method has been described recently by D. Kershaw. The drawback of a triangular decomposition on a vector machine is the need for recursive computations. This paper proposes a method which eliminates the need for recursive computations. They are replaced by a number of non-recursive operations. This method can be utilized in the solution of potential equations in late time electrostatic codes. GRA

N80-31118# Arizona Univ., Tucson. Program in Applied Mathematics.
A SINGULAR PERTURBATIONS APPROACH TO REDUCED-

ORDER MODELING AND DECOUPLING FOR LARGE SCALE LINEAR SYSTEMS
Robert E. OMalley, Jr. Jul. 1980 11 p refs
(Contract N00014-76-C-0326; NR Proj. 041-466)
(AD-A087050; Rept-28) Avail: NTIS HC A02/MF A01 CSCL 12/1

This tutorial presentation introduces the two-time-scale concept and applies it to provide approximate solutions to initial value problems for large scale linear systems. GRA

N80-31119# Arizona Univ., Tucson. Program in Applied Mathematics.
ON MULTIPLE SOLUTIONS OF SINGULARLY PERTURBED SYSTEMS IN THE CONDITIONALLY STABLE CASE
Robert E. OMalley, Jr. Jul. 1980 23 p refs Presented at the Adv. Seminar on Singular Perturbations and Asymptotics, Madison, Wis., 28-30 May 1980 Sponsored in part by AFOSR, Army Research Office and NSF
(Contract N00014-76-C-0326; NR Proj. 041-466)
(AD-A087049; Rept-29) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper seeks the asymptotic behavior of solutions to nonlinear singularly perturbed boundary value problems for ordinary differential equations. Presuming a Jacobian matrix has a fixed number of (strictly) stable and unstable eigenvalues, the limiting solution can often be obtained from a reduced problem. Boundary layer behavior will satisfy a conditionally stable system, and multiple solutions will often result. The asymptotic structure of solutions is helpful in developing numerical solution schemes, and is vital in various applications (including some optimal control problems). GRA

N80-31120# Colorado State Univ., Fort Collins. Dept. of Statistics.
EXACT TWO-SIDED CONFIDENCE INTERVALS ON NONNEGATIVE LINEAR COMBINATION OF VARIANCE
Franklin A. Graybill and Chih-Ming Wang (SPSS, Inc.) 1 Jul. 1980 20 p refs
(Contract N00014-78-C-0463; NR Proj. 042-402)
(AD-A087052; TR-4) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method is presented for obtaining two sided confidence intervals on a nonnegative linear combination of two variances and the confidence coefficient is 'exact' (equal to a specified value 1-alpha). GRA

N80-31121# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
MATRIX METHODS FOR DETERMINING SYSTEM POLES FROM TRANSIENT RESPONSE. Electromagnetics Research Report, 1 Sep. 1978 - 30 Apr. 1979
T. L. Henderson May 1980 55 p refs
(Contract N00014-77-C-0362)
(AD-A087204; RR-80-1) Avail: NTIS HC A04/MF A01 CSCL 12/1

The problem treated is that of identifying the poles of a finite order system by observing its transient decay after cessation of input, for a limited time, using (possibly) multiple observation points and experimental repetition. Various approaches are studied, having the common characteristic that a homogeneous matrix equation must be solved. Several techniques that have been given scant attention in the literature are consolidated into the treatment, together with new results including an analytical treatment of the consequences of assuming an excessively high system order, derivation of a statistically unbiased estimate for an intermediate parameter in the solution, new theorems on error effects, a recipe for effective use of the singular value decomposition, a new method for suppression of extraneous poles, an elucidating derivation and extension of the method of Jain, a new form of the problem wherein the system poles are eigenvalues, and a study of the relationship between various pole identification methods. GRA

N80-31122# Pennsylvania State Univ., University Park. Applied Research Lab.
WAVES, CAUSTICS AND THOM'S THEOREM. Ph.D. Thesis
Arthur Daniel Gorman 5 Mar. 1980 90 p refs
(Contract N00024-79-C-6043)
(AD-A086974; ARL-PSU-TM-80-26) Avail: NTIS HC A05/MF A01 CSCL 12/1

The technique of Maslov for determining the first term in the asymptotic series solution of linear partial differential equation is extended to determine the full asymptotic series solution of the reduced Helmholtz equation for scalar waves propagated in an inhomogeneous medium. The algorithm requires the characterization of the medium by a canonical phase function determined from a criterion derived from Thom's classification of singularities. GRA

N80-31123# Brookhaven National Lab., Upton, N. Y. Applied Mathematics Dept.
HIGH ORDER TIME SETTING METHODS FOR NONLINEAR EVALUATION EQUATIONS
Joseph E. Pasciak 1980 9 p refs Presented at 2nd Intern. Symp. on Innovative Numerical Analysis in Appl. Eng. Sci., Montreal, 16 Jun. 1980
(Contract EY-76-C-02-0016)
(BNL-27011; CONF-800625-1) Avail: NTIS HC A02/MF A01

How to derive high order time approximation procedures for certain nonlinear evolution equations based on a given high order approximation procedure for the homogeneous linear problem is demonstrated. For L a fixed differential operator, nonlinear evolution equations of the form u/sub t + Lu = J(u) are considered where J(u) is a nonlinear function of u. A stable and high order algorithm for approximating the linear problem v/sub t + Lv = 0 is assumed to be given. It is shown how to use the approximation algorithm to get high order approximation for the evaluation equation. The results of computational experiments are given which illustrate the benefits of the time stepping methods. The Korteweg-deVries equation and a nonlinear Schroedinger equation are considered. The spatial discretization is given by the spectral method with trigonometric polynomials (Fourier method). DOE

N80-31124# IBM Watson Research Center, Yorktown Heights, N.Y.
CONVENTIONS AND FORMULAS FOR USING THE MUELLER-STOKES CALCULUS IN ELLIPSOMETRY
P. S. Hauge, R. H. Muller, and C. G. Smith Dec. 1979 40 p refs Presented at the 4th Intern. Conf. on Ellipsometry, Berkeley, Calif., 20 Aug. 1979 Prepared in cooperation with Lawrence Berkeley Lab., Calif. and Bell Telephone Lab., Murray Hill, N.J.
(Contract W-7405-eng-48)
(LBL-10172; CONF-790857-3) Avail: NTIS HC A03/MF A01

A sign convention is proposed which specifies the ellipticity angle and the fourth Stokes parameter to be positive when the tip of the instantaneous electric field vector describes a right handed helix in space. Polarization of this type is designed as right handed and represented by a point on the northern half of the Poincare sphere. The consequences of using this convention, along with the previously adopted e/sup i(wt + delta)/ convention for the electric field, are seen in the relation among several representations of polarization state. These include the magnitudes and phases of the electric field components, the Jones vector, coherency matrix, Stokes parameters, Poincare sphere, polarization ratio, ellipsometric parameters psi and delta, and the azimuth and ellipticity of the polarization ellipse. The formalism for converting the Jones matrix into the matrix that transforms the coherency vector or the Stokes vector (Mueller matrix) is described. Mueller matrices for a linear retarder and an isotropic reflecting surface and the description of a compensator analyzer polarimeter are given. DOE

N80-31125# Knolls Atomic Power Lab., Schenectady, N. Y.
HIGH-ORDER CURVED FINITE ELEMENTS
E. L. Wachspress Mar. 1980 24 p refs Presented at the Symp. on Finite Elements, Storrs, Conn., 2 May 1980
(Contract DE-AC12-76SN-00052)
(KAPL-4134; CONF-800537-1) Avail: NTIS HC A02/MF A01

Recent finite element analysis of adaptive refinement focused attention on high order approximation within elements. High order approximation may be attained over curved elements with either

rational basis functions expressed directly in the global coordinates or with a particular class of isoparametric basis functions. Theory for construction of high order rational bases yields modification to the blending method for a spectral class of elements in order to achieve higher order approximation within these elements.
DOE

N80-31126# Montpellier Univ. (France). Dept. de Physique Mathematique.
ON SOME SPECTRAL PROBLEMS AND ISOSPECTRAL EVOLUTIONS CONNECTED WITH THE CLASSICAL STRING PROBLEM. PART 1: CONSTANTS OF MOTION
Pierre C. Sabatier Jul. 1979 9 p refs 2 Vol.
(PM/79/19-Pt-1) Avail: NTIS HC A02/MF A01
For some spectral problems that are associated with the classical string problem, it is shown that one spectrum completely determines the values of certain functionals. If the N first eigenvalues are known, these functionals are minimal for degenerate densities made of a finite number of heavy points.
Author (ESA)

N80-31127# Universite des Sciences et Techniques du Languedoc, Montpellier (France). Dept. de Physique Mathematique.
ON SOME SPECTRAL PROBLEMS AND ISOSPECTRAL EVOLUTIONS CONNECTED WITH THE CLASSICAL STRING PROBLEM. PART 2: EVOLUTION EQUATION
Pierre C. Sabatier Jul. 1979 6 p refs 2 Vol.
(PM/79/20-Pt-2) Avail: NTIS HC A02/MF A01
The evolution equations associated with the singular string problem that can be derived from the operator are studied. Results show that given certain assumptions, the spectral problem is equivalent to the one dimensional Schroedinger problem, the discrete spectrum corresponding to bound states, the continuous one to scattering.
Author (ESA)

N80-31128# Universite des Sciences et Techniques du Languedoc, Montpellier (France). Dept. de Physique Mathematique.
SOME COMMENTS ON THE RATIONAL SOLUTIONS OF THE ZAKHAROV-SCHABAT EQUATIONS
V. B. Matveev 1979 13 p refs
Avail: NTIS HC A02/MF A01
A family of the rational solutions of the Zakharov-Schabat equations is described. This family is characterized by an extremely simple superposition principle which follows directly from the Darboux-invariance of the Zakharov-Schabat equations. An infinite sequence of polynomials P sub n (x, y, t, t sub 4,..., t sub m), m < or = n, is presented so that the developed formula will represent some class of solutions of the Kadomtcev-Petviashvily (K-P) equation. The parameters t sub 4,..., t sub K represent the explicit action of the commuting flows, related with the Zakharov-Schabat operators of the higher order, on the solutions of the K-P equation and can be fixed independently in each P sub i. The polynomials P sub n are closely related with the second Waring formula. This relation imposes some specific constraints on the motion of the n particle Moser-Calodgero system generated by P sub n.
Author (ESA)

N80-31129# Goeteborg Univ. (Sweden). Dept. of Mathematics.
OCCURRENCES IN A BRANCHING PROCESS
Martin Haernqvist 1979 83 p refs
Avail: NTIS HC A05/MF A01
With general convergence theory for branching processes as a basis, two special problems are investigated. In one situation, an extra point process of events during life is assigned to each realized individual and the behavior of the superposition of such point processes in action is studied as the population grows. With the proper scaling and under some regularity conditions the superposition is shown to converge in distribution to a Poisson process. One implication of this result is that the collection of death moments of individuals has an asymptotic Poisson description. In the second situation, rare events among the individuals in the special Bellman-Harris branching process are studied. It is shown that the point process of occurrences of a certain event that may concern life or reproduction of the individual in the population has a mixed Poisson limit as the probability of the event tends to zero. Established weak convergence techniques for point processes are applied. Some recent strong convergence theorems for branching processes are also used. Finally, a result on the asymptotics of the maximal age among existing individuals is derived.
Author (ESA)

N80-31130# Goeteborg Univ. (Sweden). Dept. of Mathematics.
STUDIES OF STABILITY IN APPLIED MATHEMATICS Thesis
Ingvar Mellander 1979 13 p refs
(ISBN-91-7222-268-9) Avail: NTIS HC A02/MF A01
The asumptotic behavior of the solutions to two nonlinear systems of ordinary differential equations were studied. One of them is a deterministic model for infectious diseases which extends the model by Lajmanovich and Yorke since seasonal variations are allowed. The other system is a model for certain deposition processes. The periodic case of both systems was investigated.
Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-31131# North Carolina Univ. at Chapel Hill.
ANTITHETIC VARIATES REVISITED
George S. Fishman and BaoSheng D. Huang Jun. 1980 40 p refs
(Contract N00014-76-C-0302)
(AD-A086114; TR-80-4) Avail: NTIS HC A03/MF A01 CSCL 12/1
This paper extends earlier results in the area of variance reduction techniques applied to simulation on a computer. In particular, it views the antithetic sampling technique as a combination of rotation and reflection sampling on a circle. The covariance structures induced by the techniques separately and together are derived and conditions under which they are optimal sampling plans are described. Rates of convergence for the variance of the sample mean are given for bounded, continuous and discrete random variables and for unbounded continuous random variables with special, although commonly encountered, structure.
GRA

N80-31132# Maryland Univ., College Park. Computer Science Center.
COMPUTER ERROR BOUNDS FOR AGGREGATED MARKOV CHAIN
G. W. Stewart May 1980 33 p refs
(Contract N00014-76-C-0391)
(AD-A086193; TR-901) Avail: NTIS HC A03/MF A01 CSCL 12/1
This paper describes a method for computing the steady state probability vector of a nearly completely decomposable Markov chain. The method is closely related to one proposed by Simon and Ando and developed by Courtois. However, the method described here does not require the determination of a completely decomposable stochastic approximation to the transition matrix and hence it is applicable to matrices other than stochastic. An error analysis of the procedure is given which results in effectively computable error bounds.
GRA

N80-31133# Temple Univ., Philadelphia, Pa. Dept. of Mathematics.
FAILURE TIME DISTRIBUTIONS: ESTIMATES AND ASYMPTOTOC RESULTS Interim Report
Janos Galambos 1980 24 p refs
(Grant AF-AFOSR-3504-78; AF Proj. 2304)
(AD-A086828; AFOSR-80-0515TR) Avail: NTIS HC A02/MF A01 CSCL 12/1
The paper deals with life distributions for coherent systems of components. Two major questions are discussed: (1) estimation of system life from data, or knowledge, on component lives, and (2) asymptotic models. Both questions are related to extremes of a sequence of random variables through the path set and cut set decomposition of coherent systems, which reduce a

coherent system to either a parallel or series system. Since for these decompositions, the classical theory of extremes of independent and identically distributed random variables does not provide an acceptable approximation, the emphasis is on dependent random variables, or when the random variables are not identically distributed. The inequalities presented when discussing question (i) above are applicable not only to extreme value problems but to an arbitrary multivariate distribution using lower dimensional marginals. The asymptotic models are discussed in the light of hazard rate properties of the limiting distributions of the models. A parametric family of distributions is proposed for approximating life distributions whose hazard rate is bath-tub shaped, this representing a burn-in period, an accidental failure period and a wear-out period. GRA

N80-31134# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE PROPERTIES OF A NEW GOODNESS-OF-FIT TEST Technical Report, Jan. - Mar. 1980
Richard Franke and Toke Jayachandran 1 May 1980 95 p refs
(RR0000110)
(AD-A086563; NPS53-80-003) Avail: NTIS HC A05/MF A01 CSCL 12/1

We investigate the power properties of a new goodness-of-fit test proposed by Foutz (1980). This new test is compared with the Chi squared test and the Kolmogorov-Smirnov (K-S) test for normality when the samples come from (1) the family of asymmetric stable distributions, (2) mixture of normal distributions, and (3) the Pearson family. The general conclusion is that the new test performs better than the Chi squared and the K-S test when the parent distribution is heavy tailed. If the hypothesized distribution differs from the true distribution in location only, the new test does not do as well as the other two. GRA

N80-31135# California Univ., Berkeley. Operations Research Center.
PREPOSTERIOR ANALYSIS OF BAYES ESTIMATORS OF MEAN LIFE, 1
Richard E. Barlow and Alexander S. Wu Feb. 1980 26 p refs
(AD-A086771; CORC-80-4) Avail: NTIS HC A03/MF A01 CSCL 12/1

In considering life test experiments from a behavioristic Bayes point of view, we may speculate on the effect of model misspecification on the posterior mean under alternative stopping rules. Of course, under the life distribution model, we expect the mean of the posterior to equal the mean of the prior. However, if we think the model may have been misspecified, we would no longer expect this equality. We show that for Bayes estimators of mean life under the exponential model and general priors on mean life, we expect, based on a preposterior analysis, that the mean of the posterior will increase with sample size when the true model has an increasing failure rate and certain fixed stopping rules are used. Also, we show that for Bayes estimators of mean life based on the natural conjugate prior for the exponential model and complete samples, the Bayes risk is less when the coefficient of variations is less than for the exponential model. Recommendations relative to use of life test sampling plans based on an exponential model are made. GRA

N80-31136# Wisconsin Univ. - Madison. Mathematics Research Center.
CUMULATIVE PROCESSES: LINEAR COMBINATIONS OF ORDER STATISTICS AND PERCENTILES
Sue Leurgans Mar. 1980 33 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-78-09525; NSF MCS-77-16974)
(AD-A086372; MRC-TSR-2056) Avail: NTIS HC A03/MF A01 CSCL 12/1

Percentiles and linear combinations of order statistics are statistics which are sometimes preferred to averages because they can be less sensitive to the presence of a few wild observations. It is well known that for large samples, both percentiles and linear combinations of order statistics resemble averages in that the appropriately normalized statistic is approximately normally distributed, with parameters which depend on the underlying distributions. This paper shows that percentiles and linear combinations of order statistics resemble averages in a stronger sense. It is well known that if a sequence of averages is plotted against the number of observations contributing to the average, and the resulting plot is rescaled appropriately, then for long sequences the picture will act like a realization of a Brownian motion path. This paper establishes that this is still true if the averages are replaced by percentiles or by linear combinations of order statistics. GRA

N80-31137# Wisconsin Univ. - Madison. Mathematics Research Center.
MEASURES OF LACK OF FIT, AND TRANSPORTATION OF PREDICTORS IN COMPOSITE DESIGNS
G. E. P. Box and N. R. Draper May 1980 24 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A086562; MRC-TSR-2077; UWIS-DS-80-603) Avail: NTIS HC A02/MF A01 CSCL 12/1

The central composite designs are investigated in terms of their ability to detect lack of fit and it is shown that measures of nonquadraticity can be obtained in all the k major directions. The geometrical interpretation of this is explained. The relationship of these lack of fit measures to the estimation of power transformations in the predictor variables is also explored. GRA

N80-31138# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.
CONVERGENCE OF PROGRESSIVELY CENSORED LIKELIHOOD RATIO PROCESSES IN LIFE-TESTING
Joseph C. Gardiner Jun. 1980 19 p refs
(Contract N00014-79-C-0522; Grant BRSG-S07-RR07049-14)
(AD-A087057; RM-391) Avail: NTIS HC A02/MF A01 CSCL 12/1

The weak convergence of certain (randomly stopped) likelihood ratio processes based on the ordered observations corresponding to a random sample is considered in the situation where the hazard rate function of the underlying distribution is separable in its variables. It is shown that under mild conditions on the stopping variables the log likelihood function is locally asymptotically normal. Some remarks pertaining to the general ease and applications of the theorems proved are also discussed. GRA

N80-31139# Iowa Univ., Iowa City. Dept. of Statistics.
BOUNDS ON MIXTURES OF DISTRIBUTIONS ARISING IN ORDER RESTRICTED INFERENCE
Tim Robertson and F. T. Wright 10 Jul. 1980 22 p refs
Prepared in cooperation with Missouri Univ., Rolla
(Contracts N00014-80-C-0322; N00014-80-C-0321)
(AD-A087117) Avail: NTIS HC A02/MF A01 CSCL 12/1

In testing hypotheses involving order restrictions on a collection of parameters, distributions arise which are mixtures of standard distributions. Since tractable expressions for the mixing proportions do not, in general, exist even for parameter collections of moderate size, the implementation of these tests may be difficult. It is not necessary to bound the individual mixing proportions in order to obtain a bound for the tail probabilities of the 'mixed' distributions. Bounds for such tail probabilities are derived and their application to several order restricted hypothesis testing situations is discussed. These results are also applied to obtain the least favorable configuration in a two sample likelihood ratio test of the equality of two multinomial populations versus a stochastic ordering alternative. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-31140 Johns Hopkins Univ., Baltimore, Md.
MINIMIZING THE COST OF OPERATING AIRCRAFT ON MULTISTOP TOURS Ph.D. Thesis
Norman Babcock Waite 1980 130 p
Avail: Univ. Microfilms Order No. 8020260

An operationally practical means of informing the pilot on operational decisions during a multistop tour in order to complete the tour feasibly and at minimum expected cost is presented.

The minimum is in the following sense: no means of flying the tour where decisions are made using information available up to the time each decision is made can do better. Optimality is proved. Computational experience and results are included.
Dissert. Abstr.

N80-31141# Illinois Univ., Chicago. Dept. of Mathematics.
STUDY OF OPTIMALITY CRITERIA IN DESIGN OF EXPERIMENTS Interim Report
A. Hedayat 3 Jun. 1980 33 p refs Presented at the Intern. Symp. on Statistics and Related Topics, Ottawa, 5-8 May 1980
(Grant AF-AFOSR-3050-79; AF Proj. 2304)
(AD-A086830; AFOSR-80-0514TR) Avail: NTIS
HC A03/MF A01 CSCL 12/2
This paper rigorously studied various optimality criteria currently adopted by design specialists in choosing a best design for performing an experiment. These optimality criteria includes: G-optimality, D-optimality, L-optimality, E-optimality, S-optimality, (M,S)-optimality, PHI sub p-criteria, Universal optimality, type 1 and 2 criteria and Schur optimality. GRA

N80-31142# Army Military Personnel Center, Alexandria, Va.
MULTIPLE OBJECTIVES AND THE PATH DETERMINATION PROBLEM M.S. Thesis. Final Report
J. E. Thomas, Jr. 3 Jul. 1980 91 p refs
(AD-A086744) Avail: NTIS HC A05/MF A01 CSCL 12/2
The shortests path problem exists as a major component of many network problems. For problems with a single objective, algorithms developed over the past twenty-five years have made the solution of this problem a relatively simple exercise. For multiobjective problems, adaptation of shortest path methodologies to generate noninferior solutions is a complex and difficult task. This thesis introduces an algorithm, based on label-correcting algorithmic techniques, which identifies all noninferior paths from one node in a network to all other nodes in the network in a single computer run. The algorithm, titled the Noninferior Path Labeling Algorithm (NPLA), is shown to be at least four to ten times faster than shortest path labeling algorithms applied multiobjectively for a problem with two objectives. NPLA is judged to be unique in its capability to identify all solutions which lie in duality gaps of the noninferior solution set. NPLA has been found to be easily programmed, efficient, and capable of being used with all network designs. It is readily adaptable to problems of more than two objectives. GRA

N80-31143# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
DECENTRALIZED ALGORITHMS FOR OPTIMIZATION OF SINGLE COMMODITY FLOWS M.S. Thesis
Isidro Marcos Castineyra Figueredo Jun. 1980 64 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A086736; LIDS-TH-999) Copyright. Avail: NTIS
HC A04/MF A01 CSCL 12/2
Message routing was studied in a data communication network in which all messages are addressed to the same node of the network. We approach this problem by the minimization of a linear, increasing function of the message flow in the links of the network. In this minimization we consider explicitly the capacities of the links. We present two algorithms which can be executed in a distributed manner, i.e. the data processing facilities at the nodes of the network cooperate in this minimization by interchanging messages and processing them. One of the algorithms is an adaptation of the primal simplex method of linear programming. The other is an adaptation of D. R. Fulkerson's 'out-of-kilter' algorithm. We give simulation results of the performance of the first algorithm, and a bound on the total number of messages required by the second algorithm. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-31144 Cornell Univ., Ithaca, N. Y.
EULER MANIFOLDS AND STIEFEL-WHITNEY HOMOLOGY CLASSES Ph.D. Thesis
Darko Veljan 1979 98 p
Avail: Univ. Microfilms Order No. 8020898
The geometry of Euler manifolds is investigated systematically. Basic properties of Stiefel-Whitney homology classes (combinatorially defined) on Euler manifolds mod 2 are established, and a system of axioms for these classes is given. As a byproduct of this axiomatic description it is shown that the Stiefel-Whitney classes on compact Euler manifolds mod 2 which satisfy mod 2 Poincare duality are homotopy invariants. This is shown by proving that Stiefel conjecture is valid on this class of spaces. The main tools in proving the uniqueness of the axioms are block bundle transversalities and an interpretation of cohomology classes as certain morphisms on bordism groups into the group of coefficients. Dissert. Abstr.

N80-31145 Memphis State Univ., Tenn.
BANACH SPACE SHIFT OPERATORS Ph.D. Thesis
James Earl Robinson 1980 111 p
Avail: Univ. Microfilms Order No. 8020390
Various kinds of shift operators which have been defined on Banach space are investigated along with the interrelationships that exist among these classes of operators. Of particular interest is the connection between Crownover shifts and Gellar Schauder basis shifts. Different kinds of Schauder bases on Banach space are studied. The orthogonality of bases as given through several distinct interpretations are considered. Normal bases, monotone bases, and orthogonal bases are compared. A kind of reverse monotone condition is imposed on a basis to determine its relationship to the other definitions. A necessary and sufficient condition for a Crownover shift on a reflexive space to be a Gellar Schauder basis shift and a technique for approximating Gellar Schauder basis shifts with Crownover shifts on certain spaces are developed. Dissert. Abstr.

N80-31146*# Massachusetts Inst. of Tech., Cambridge. Lab for Information and Decision Systems.
LINEAR STATE FEEDBACK, QUADRATIC WEIGHTS, AND CLOSED LOOP EIGENSTRUCTURES M.S. Thesis. Final Report
Peter Murray Thompson Sep. 1980 101 p refs
(Grant NsG-1553)
(NASA-CR-163484; LIDS-FR-1029) Avail: NTIS
HC A06/MF A01 CSCL 12A
Equations are derived for the angles of general multivariable root loci and linear quadratic optimal root loci, including angles of departure and approach. The generalized eigenvalue problem is used to compute angles of approach. Equations are also derived to find the sensitivity of closed loop eigenvalue and the directional derivatives of closed loop eigenvectors. An equivalence class of quadratic weights that produce the same asymptotic eigenstructure is defined, a canonical element is defined, and an algorithm to find it is given. The behavior of the optimal root locus in the nonasymptotic region is shown to be different for quadratic weights with the same asymptotic properties. An algorithm is presented that can be used to select a feedback gain matrix for the linear state feedback problem which produces a specified asymptotic eigenstructure. Another algorithm is given to compute the asymptotic eigenstructure properties inherent in a given set of quadratic weights. Finally, it is shown that optimal root loci for nongeneric problems can be approximated by generic ones in the nonasymptotic region.
L.F.M.

N80-31147# Columbia Univ., New York. Dept. of Computer Science.
ON THE OPTIMAL SOLUTION OF LARGE LINEAR SYSTEMS
J. F. Traub and H. Nozniakowski Jan. 1980 74 p refs
(Contract N00014-76-C-0037; Grant NSF MCS-78-23676)
(AD-A086349) Avail: NTIS HC A04/MF A01 CSCL 12/1
We investigate the minimal number of matrix-vector multiplications to approximately solve a linear system. The minimal number of multiplications depends on the properties of a class of problems such as symmetry, positive definiteness, and bound on condition number. For different classes of problems we obtain the minimum exactly or almost exactly and establish with algorithms are optimal, that is, attain the minimum. Furthermore, we obtain quantitative results on how the lack of certain properties increases the minimum. GRA

N80-31148# Wisconsin Univ. - Madison. Mathematics Research Center.
DICHOTOMIES FOR BAND MATRICES
Carl deBoor Mar. 1980 27 p refs
(Contract DAAG29-75-C-0024)
(AD-A086373; MCR-TSR-2057) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Spline approximation is often most effective when the breakpoint (knot) sequence can be chosen suitably nonuniform. At the same time, standard spline approximation schemes (such as least-squares approximation by splines) are so far only known to be bounded as long as the breakpoint sequence is almost uniform. Any such bound is obtained (explicitly or implicitly) in terms of a bound on the inverse of certain matrices which are banded. Any attempt at establishing bounds for more general breakpoint sequences must therefore come to grips with the inverses of these band matrices. The hope is that Demko's discovery of the exponential decay of band matrix inverses will lead eventually to those desired bounds. GRA

N80-31149# Wisconsin Univ. - Madison. Mathematics Research Center.
NOTES ON GENERALIZED BOUNDARY VALUE PROBLEMS BANACH SPACES
R. C. Brown (Alabama Univ., University) Mar. 1980 40 p refs
(Contract DAAG29-75-C-0024)
(AD-A086371; MRC-TSR-2055) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Multipoint boundary conditions arise in the theory of beams or plates with interior point loads, and also the mathematical theory of splines. Interface conditions arise in problems of diffusion through parallel 'slabs' with different properties (e.g., nuclear reactors or the study of shock waves). Adjoints of such differential operators also are encountered when one attempts to derive Euler-Lagrange equations for constrained minimization problems. Our method is very general and is designed to work for partial differential, integral and functional differential operators as well as differential operators. Part 1 presents some of the abstract machinery to solve the problem. Part 2 will apply this machinery to concrete and applied problems of the type mentioned above. GRA

N80-31150# Wisconsin Univ. - Madison. Mathematics Research Center.
WHAT IS THE MAIN DIAGONAL OF A BIINFINITE BAND MATRIX?
Carl deBoor Mar. 1980 17 p refs
(Contract DAAG29-75-C-0024)
(AD-A086366; MRC-TSR-2049) Avail: NTIS
HC A02/MF A01 CSCL 12/1

How to single out a particular diagonal of a biinfinite band matrix A as its main diagonal, using the decomposition of the solution set of Ax = 0 into those which are bounded at infinity and those which are bounded at - infinity is shown. As an application, it is proved that the inverse of the coefficient matrix for the system satisfied by the B-splines coefficients of the cubic spline interpolant at knots is checkerboard and that, under certain assumptions, the local mesh ratio must be bounded. M.G.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-31151# Oak Ridge National Lab., Tenn. Fusion Energy Div.
STATUS OF THE STRUCTURAL DESIGN OF SUPERCONDUCTING MAGNETS FOR THE LARGE COIL PROGRAM
W. H. Gray and C. J. Long 1979 6 p refs Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791102-160) Avail: NTIS HC A02/MF A01

The status of the structural designs, analysis methods, and verification tests being performed by the participating Large Coil Program design teams is reviewed. The significant structural mechanics concerns being investigated are presented. DOE

N80-31152# Los Alamos Scientific Lab., N. Mex.
MEASUREMENTS OF ELECTRON HEAT FLOW ALONG A dc MAGNETIC FIELD IN STRONG TEMPERATURE GRADIENTS
R. S. Massey, J. C. Ingraham, B. L. Wright, and H. Dreicer 1980 11 p refs Presented at the Inter. Symp. on Phys. and Open-Ended Fusion Systems, Tsukuba, Japan, 15 Apr. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1109; CONF-800441) Avail: NTIS
HC A02/MF A01

Measurements of electron heat flow parallel to B are performed on fully-ionized quiescent plasma column under conditions for which the electron-electron collisional mean free path, 1/sub ee/, is not small relative to the electron temperature-gradient scale-length. Pulsed microwave heating at one location on the column and nonperturbing microwave resonator measurements of temperature at two locations on the column are used to create and to measure the heat flow. Results are compared with the predictions of a 1-D heat diffusion code that has a parameter, alpha, multiplying the Spitzer heat conductivity coefficient, and that also has provision for limiting the heat flux to q/sub L = beta nkT square root of kt/m (where beta is an adjustable parameter) in order to model the transition to larger values of (1/sub ee/T)dT/dx/. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-31153 Washington Univ., Seattle.
COCHLEAR MICROPHONIC EVIDENCE FOR MECHANICAL PROPAGATION OF DISTORTION PRODUCTS (f2-f1) AND (2f1-f2) Ph.D. Thesis
Gary Lee Gibian 1980 150 p
Avail: Univ. Microfilms Order No. 8018729

Cochlear microphonic (CM) data were obtained from the second and third turns of the chinchilla cochlea. Fluid-filled glass micropipettes were used to record from scala media, and nichrome wire electrodes were used to record differentially between scala vestibuli and scala tympani. Validity of our results is supported in part by the sensitivity and sharp tuning of the CM and, in the case of the scala media recordings, by the presence of a normal DC endolymphatic potential. It was observed, with sound pressure levels (SPL) as low as 25 dB, that these distortion products in CM display tuning similar to the single-tone response. The tuning similarities observed in the present CM study are consistent with previous neural studies. From these tuning similarities, it is concluded that our CM data reflect the presence of mechanically propagated distortion products at low SPLs. Dissert. Abstr.

N80-31154 Catholic Univ. of America, Washington, D.C.
ARRAY GAIN IMPROVEMENT BY SELECTIVE SENSOR EXCLUSION Ph.D. Thesis
Louis Allen Mole 1980 181 p
Avail: Univ. Microfilms Order No. 8018808

The application of the sensor exclusion criteria to real experimental data provides array gain improvement probabilities which compare favorably with the model's calculated values and, in addition, indicate the levels of expected improvement. Specifically, three selected sensor exclusion criteria values are used to process two data sets to indicate their effect on the array gain results. For one data set, the processing results demonstrate average and peak improvement values as great as 2 and 9.5 dB, respectively, whereas, for the second set, these values were as great as 7 and 11.5 dB, respectively. Correspondingly the probability that the application of the criteria will provide array gain improvement varied between 17 and 64 percent for the first data set and between 34 and 92 percent for the second. The results of the study conclusively indicate that selective sensor exclusion criteria may be formulated and

implemented so as to improve array performance and increase array gain. Dissert. Abstr.

N80-31155# Army Construction Engineering Research Lab., Champaign, Ill.
THE BLAST NOISE PREDICTION PROGRAM: USER REFERENCE MANUAL Interim Report
V. Pawlowska and L. Little. Aug. 1979. 78 p. refs.
(CERL-IR-N-75) Avail: NTIS HC A05/MF A01

User instructions for the Blast Noise Prediction computer program, BNOISE 1.0, which is designed to predict the noise impacts of Army blast noise operations are provided. A sample run and a list of module error messages are provided, along with a description of the manipulation of the modules used by the Blast Noise program. T.M.

N80-31156# Army Construction Engineering Research Lab., Champaign, Ill.
MITIGATION OF NOISE IMPACT VIA OPERATIONAL CHANGES Final Report
Richard Raspet. Sep. 1979. 23 p. refs.
(CERL-TR-N-76) Avail: NTIS HC A02/MF A01

Three case studies which can serve as a guide for using operational changes of artillery and demolition to reduce noise impacts at Army installations are presented. In each case study, the initial and final noise impact is documented by computer generated equal noise contours. Operational changes may be used to reduce the total area impacted, to reduce the noise level in a particular location, or to shift the impacted area away from the noise sensitive areas. R.K.G.

N80-31157# Naval Underwater Systems Center, New London, Conn. Office of Engineering Mechanics.
ANALYSIS OF SCATTERING AND RADIATION OF ACOUSTIC WAVES FROM AN AXISYMMETRIC STRUCTURE IN A INFINITE FLUID MEDIUM
Jayant S. Patel. 27 Mar. 1980. 52 p. refs.
(AD-A086587; NUSC-TR-5821) Avail: NTIS HC A04/MF A01 CSCL 20/1

Analysis of scattering and radiation of acoustic waves from an axisymmetric structure in an infinite fluid medium is presented. It is shown that the use of a basis function, consistent with the one used for axisymmetric pressure on the finite surface, yields accurate results and uses fewer finite surface elements than does piston-type analysis. GRA

N80-31158# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
EVALUATION OF ULTRASONIC CLEANING SYSTEMS
T. J. Gillespie. 1980. 11 p. Presented at the ACS Meeting-in-Miniature, Tampa, Fla., 8 May 1980.
(Contract DE-AC04-76DP-00656)
(GEPP-OP-501; CONF-800538-3) Avail: NTIS HC A02/MF A01

Several methods, for evaluating ultrasonic cleaners were tested, including pencil marked ceramic, Al foil erosion, Branson cavin meter, etc. A method was devised which involves applying a thin metallize coating to a ceramic plate. This method was used to evaluate new ultrasonic cleaners. DOE

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-31159 Indiana Univ., Bloomington.
ANALYTIC APPROACHES TO ATOMIC RESPONSE PROPERTIES Ph.D. Thesis
Edward Eugene Lamm. 1980. 347 p.
Avail: Univ. Microfilms Order No. 8016432

Analytic asymptotic theories of atomic response properties are constructed that yield results as accurate as those obtained by more elaborate numerical methods. A novel and simple method is used to determine the multipole sum rules S sub L (-k), for positive and negative values of k, of the hydrogen atom and the hydrogen negative ion in the asymptotic approximation. An analytically-tractable extended asymptotic model for the response properties of weakly-bound anions is proposed and the multipole polarizability, multipole sum rules, and photodetachment cross section determined by the model are computed analytically. Dipole polarizabilities and photodetachment cross sections determined from the model for Li-, Na-, and K- are compared with numerical results. Agreement is typically within 15 percent if the pseudopotential is included. A comprehensive and unified treatment of atomic multipole oscillator strengths, dynamic multipole polarizabilities, and dispersion force constants in a variety of Coulomb-like approximations is presented. Dissert. Abstr.

N80-31160 Delaware Univ., Newark.
A ZERO CORE-CONTRIBUTION MODEL FOR PHOTODETACHMENT OF ATOMIC AND MOLECULAR NEGATIVE IONS Ph.D. Thesis
Robert Merrell Stehman. 1980. 213 p.
Avail: Univ. Microfilms Order No. 8019952

A simple model for computing photodetachment cross sections was developed. The model which represents a negative ion by an equivalent one electron system is simple to apply since only the asymptotic behavior of the electron's wave function is required. For atomic negative ions, only the orbital angular momentum, (lambda), of an electron in the outermost shell, the electron affinity and the atomic radius of the parent neutral atom need be known. Comparable information is required for molecular ions. This information is available for many ions from sources independent of photodetachment experiments. The model shows that atomic ions divide into groups according to their value of lambda. Within each group, ions have cross sections sharing common features, with the maximum cross sections being nearly proportional to the square of the atomic radii of the parent atoms. The model is applied to the homonuclear diatomic ions O2(-) and S2(-). In addition to computing the total photodetment cross section, the model gives information about detachment associated with single vibrational transitions. Dissert. Abstr.

N80-31161 Idaho Univ., Moscow.
ISOBAR PRODUCTION IN HEAVY ION COLLISIONS Ph.D. Thesis
Lawrence Willard Townsend. 1980. 113 p.
Avail: Univ. Microfilms Order No. 8019796

The production of isobars with concomitant giant resonance excitations due to peripheral collisions of relativistic heavy ions is investigated. The interaction is described by a modified form of the one-pion exchange potential where the projectile ordinary spin operator is replaced by a transition spin operator which described the creation of an isobar from a nucleon. The scattering is analyzed using time-dependent harmonic perturbation theory to determine the reaction total cross sections. The results obtained are applied to the specific collision of 2.1 GeV/nucleon O-16 projectiles with C-12 targets at rest. Cross sections are investigated using two different models for the nuclear spin states. In the first, a single isobar is formed in the projectile while the target is excited to one of its isovector excited states near 15 MeV via the collective spin giant resonance mechanism. In the second, the target is excited to this same state again, and the projectile, by analogy, is assumed excited to a collective isobar giant resonance state. The calculations for the two reactions are repeated, with comparable results, for a nuclear spin model where the many-body spin states are described by unsymmetrized products of individual particle spins. Dissert. Abstr.

N80-31162 Michigan State Univ., East Lansing.
A HYDRODYNAMIC THEORY OF HEAVY ION COLLISIONS Ph.D. Thesis
David Carl Mundinger. 1980. 104 p.
Avail: Univ. Microfilms Order No. 8020723

The dynamics of an interacting Fermi liquid formed the basis for a macroscopic description of heavy ion collisions. A computation was done, first of all, for the one dimensional case using a Lagrangian technique. The breakup threshold was calculated for the collision between two semi-infinite slabs of nuclear matter. This one dimensional model contains many of the features of heavy ion collisions. Based on these results a model was made for the collision between spherical nuclei. The degrees of freedom

that we emphasize are the centers of the two nuclei, and the location of two boundaries which separate the nuclear matter into a compressed region and two uncompressed regions. Using the equation of state, along with the conservation laws for mass and momentum, we can generate equations of motion for each of the dynamical variables. The momentum transport between the two nuclei is taken from the theory of a collisionless Fermi gas. Angular distributions, energy loss, and fusion cross sections have been studied. Dissert. Abstr.

N80-31163 California Univ., Riverside
THEORETICAL STUDIES OF MOLECULAR COLLISION PROCESSES. 1: TWO-POTENTIAL APPROACH FOR ELECTRON-MOLECULAR SCATTERING. 2: THREE-DIMENSIONAL QUANTUM MECHANICAL STUDY ON ATOM-MOLECULE REACTIVE COLLISION WITH ROTATIONALLY PRE-EXCITED TARGET MOLECULE Ph.D. Thesis
James Cheng Sun 1980 293 p
Avail: Univ. Microfilms Order No. 8020622

Theoretical studies were carried out on two categories of molecular collision processes: (1) molecule scattering with a light incident particle-electron, and (2) molecule scattering with a heavy incident - particle atom. For the electron-molecule scattering, a two-potential approach was formulated for elastic and vibrational transitions with intermediate- and high-energy impact electrons. In this approach, contributions to the scattering process come from the incoherent sum of two dominant potentials: a short-range shielded nuclear Coulomb potential from individual atomic center, and a permanent/induced long-ranged potential. Applications to e-N2, e-CO2 scatterings from 50-800 eV incident electron energy yielded good agreement with absolutely calibrated experiments. The three dimensional atom-molecule reactive collision was studied quantum-mechanically within the T-matrix formalism with the adiabetic approximation. Application to the D + H2 reaction on the ab initio Liu-Siegbahn-Truhlar--Horowitz surface was made. Scattering cross sections of the rotationally pre-excited target molecule are in general 2 to 3 times smaller than those of the ground state molecule. Dissert. Abstr.

N80-31164# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy
ATOMIC AND MOLECULAR PROCESSES. Final Report, 1 Jul. 1977 - 15 May 1980
M. A. Biondi 25 Jun. 1980 6 p. refs
(Contract N00014-76-C-0098; ARPA Order 2686)
(AD-A086764) Avail: NTIS HC A02/MF A01 CSCL 20/5

The topics investigated experimentally and theoretically by the Pittsburgh Atomic Sciences Institute with applications to high power laser development and atmospheric IR backgrounds are enumerated. Reports containing the detailed scientific progress in these studies are cited. Finally, a list of the journal articles describing the results of the programs, with full references, is given. GRA

N80-31165# California Univ., Santa Barbara. Dept. of Physics.
ENERGY TRANSFER AND OPTICAL SPECTROSCOPY OF DIATOMIC MOLECULES IN CHEMICALLY REACTING SYSTEMS. Final Report, 1 Aug. 1976 - 31 Dec. 1979
H. P. Broida and David O. Harris Dec. 1979 8 p. refs
(Grant AF-AFOSR-3138-77)
(AD-A086829; AFOSR-80-0540TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

Increased capabilities in remote sensing, communication and several other areas depend on developments in laser technology. Chemical lasers indicate a high probability of fulfilling these needs through their properties of different wavelengths, high power, high operating efficiency and lower weight. Additionally, optically pumped metal dimers are attractive systems for visible tunable gas lasers. The development of new improved chemical laser systems and optically pumped laser systems requires an increased understanding and knowledge of the properties and characteristics of candidate reactions and molecules. Detailed spectroscopic studies on both CuF and Ca2 have been carried out. Use of laser photoluminescence has produced spectroscopic information previously unobtainable. We have obtained improved molecular constants and dissociation energies, radiative lifetimes, and quenching cross-sections for electronically excited products. In addition previously unknown electronic states have been identified. GRA

N80-31166# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
ELECTRONIC STOPPING POWER CALCULATIONS FOR ALL HEAVY IONS AT LOW VELOCITY IN ALL ELEMENTS. Final Report
J. G. Brennan and D. J. Land 17 Mar. 1980 65 p. refs
(AD-A087107; NSWC/TR-80-89) Avail: NTIS HC A04/MF A01 CSCL 20/8

Values of the electronic stopping power for projectiles from carbon to uranium in elemental targets from hydrogen through the transuranic elements at the Bohr velocity, are presented in sets of tables. The stopping powers were calculated within a modified Firsov model. An algorithm for determining the stopping power from v0 to v3 to 4 v sub o is discussed. GRA

N80-31167# Naval Research Lab., Washington, D. C. Plasma Radiation Group
ELECTRON IONIZATION CROSS SECTIONS IN THE DISTORTED-WAVE APPROXIMATION. Interim Report
M. Blaha and J. Davis 18 Jun. 1980 51 p. refs
(RR0130143)
(AD-A087210; AD-E000478; NRL-MR-4245) Avail: NTIS HC A04/MF A01 CSCL 20/8

Eight different modifications (A1-A8) of the distorted wave approximation for the calculation of electron ionization cross sections are introduced and results are compared with other theoretical methods and experiment. Non-exchange approximations (A1-A4) are characterized by different orthogonal properties of wave functions and by different choices of asymptotic charges for the ejected electron. Results of these approximations are compared for H, He, He(+), Li(+), and Mg(+). The best approximation (A4) is then used for more complex atomic systems such as Li, C(+3), C(+), N(+), O(+), O, Ne(+), Na(+), and K(+). A4 generally agrees better with experiment than the Born or Coulomb-born approximation. Exchange approximations (A5-A8) are characterized by different choices of asymptotic charges in the exchange amplitude. These approximations have been tested on hydrogen and although a slight improvement over the non-exchange approximations has been obtained in the case of A5, the difference does not appear to be too significant. GRA

N80-31168# California Univ., Los Angeles. Dept. of Chemistry.
REACTIONS AND RELAXATION OF VIBRATIONALLY EXCITED HYDROGEN. Final Report
Jerome V. V. Kasper 20 Jun. 1980 6 p.
(Grant AF-AFOSR-3612-78; AF Proj. 2303)
(AD-A086976; AFOSR-80-0541TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

One of the goals of this research was the measurement of H2(v equal 1) and H2(v equal 2) formed by the reaction of H with HI. The technique used is quantitative absorption spectroscopy on various absorption bands of H2 near 1100 angstroms in the vacuum ultraviolet. Preliminary calculations indicated that features due to HI in this region would be sufficiently weak under the desired operating conditions that quantitative spectroscopy of the transitions from the vibrationally excited H2 could be performed. This proved not to be the case. Pressures on the order of 10 to 100 millitorr of HI obscured the bands in this region. The signal/noise ratio of the original apparatus which employed sodium salicylate to down convert the vacuum ultraviolet photons to near uv-visible ones was inadequate to the task of unraveling the spectrum. Subsequent equipment improvements have reduced the source noise. The spectrometer and pressure gauge have been modified and interfaced to a digital computer. The analysis software determines the equivalent widths of the spectral features and converts these to pressures of H2 in specific (v, J) states. The flow system and reaction cell for the photolytic experiments proposed was constructed and awaits mating with the now operational laser. GRA

N80-31169# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.
HIGH-TEMPERATURE, HIGH-RESOLUTION MEASUREMENTS OF CO2 IN THE REGION OF 2200 TO 2400 CM-1

Hajime Sakai (Massachusetts Univ., Amherst), Mark Esplin (Massachusetts Univ., Amherst), William Dalton (Massachusetts Univ., Amherst), and George A. Vanasse. 27 Feb. 1980. 21 p. refs.
(AF Proj. 2310)
(AD-A087234; AFGL-TR-80-0068; AFGL-ERP-698) Avail: NTIS. HC A02/MF A01. CSCL 07/4

The CO2 vibrational rotational transition in the 4.3 micrometers region (2200 to 2400/cm) was observed at an elevated temperature of 600 K. The technique of Fourier spectroscopy was used to observe the spectrum with a resolution of 0.006/cm. The identified lines are expressed in terms of the molecular constants determined through the least-square-error fitting method. GRA

N80-31170# Syracuse Univ., N. Y. High Energy Theory Group.
RESEARCH PROGRAM IN ELEMENTARY PARTICLE THEORY. Progress Report, period ending 30 Jun. 1980.
1980. 42 p. refs.
(Contracts EY-76-S-02-3533; DE-AS02-65ER-03533)
(COO-3533-161) Avail: NTIS. HC A03/MF A01

Progress was made in the understanding of systems with unusual topological properties. A variational formulation of the equations that govern spinning particles in general relativity was accomplished. Perturbative as well as nonperturbative properties of quantum chromodynamics aspects were investigated. The question concerning gauge fixing in non-Abelian gauge theories was studied. Several new phenomenological aspects of unified electroweak interactions were explored with the object of finding experimental tests for models other than the currently accepted Salam-Weinberg theory. A unified electroweak model was investigated to account for the repeated fermionic generations and to incorporate CP violations and explain the CP violation as well as the Cabibbo-like angles in terms of the quark masses. A unified theory for all interactions was proposed. Finally, axially symmetric multi-instanton solutions were shown to be generated from a set of conformal mappings. DOE

N80-31171# Sandia Labs., Albuquerque, N. Mex.
LOW ENERGY ION BEAM SYSTEMS FOR SURFACE ANALYTICAL AND STRUCTURAL STUDIES
G. C. Nelson. 1980. 30 p. refs. Presented at Intern. Conf. on Low Energy Ion Beams, Bath, England, 14 Apr. 1980.
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-2392C; CONF-800466-2) Avail: NTIS. HC A03/MF A01

The use of low energy ion beam systems for surface analytical and structural studies is addressed. Areas where analytical methods which utilize ion beams can provide a unique insight into materials problems are discussed. The design criteria of ion beam systems for performing materials studies are described and the systems now being used by a number of laboratories are reviewed. Finally, several specific problems are described where the solution was provided at least in part by information provided by low energy ion analysis techniques. DOE

N80-31172# Tennessee Univ., Knoxville. Dept. of Physics and Astronomy.
DIFFERENTIAL CHARGE TRANSFER TO THE CONTINUUM BY IONS IN ATOMIC HYDROGEN. Progress Report and Renewal Proposal.
Ivan Sellin and Robert S. Thoe. 1980. 26 p.
(Contract DE-AS05-79ER-10512)
(DOE/ER-10512/T1) Avail: NTIS. HC A03/MF A01

The projectile Z, velocity, angular, and charge state dependence of charge exchange to continuum states for H(+) C(6+), and O(8+) ions on atomic hydrogen are studied. Some technical details concerning work done in connection with the proposed experiment are given. An exploratory spectrum of continuum capture electrons from 234-MeV Ar(18+) on H2 is shown. DOE

N80-31173# Ohio State Univ., Columbus. Dept. of Physics.
ZERO-POINT ENERGY OF CONFINED FERMIONS
Kimball A. Milton. 1980. 23 p. refs.
(Contract DE-AC02-76ER-01545)
(DOE/ER-01545/274) Avail: NTIS. HC A02/MF A01

A closed form for the reduced Green's function of massless fermions in the interior of a spherical bag is obtained. In terms of this Green's function, the corresponding zero point or Casimir energy is computed. It is proposed that a resulting quadratic divergence can be absorbed by renormalizing a suitable parameter in the bag model (that is, absorbed by a contact term). The residual Casimir stress is attractive, but smaller than the repulsive Casimir stress of gluons in the model. The result for the total zero point energy is in substantial disagreement with bag model phenomenological values. DOE

N80-31174# Montpellier Univ. (France). Dept. de Physique Mathematique.
THEORETICAL ASPECTS OF POSITRON ELECTRON ANNIHILATION AND HYPERON HYPERON COLLISIONS
F. M. Renard. 1979. 57 p. refs. Presented at Intern. School of Elementary Particle Phys., Kupari-Dubrovnik, Yugoslavia, Sep. 1979.
(PM/79/15) Avail: NTIS. HC A04/MF A01

Questions arising in quantum physics, specifically annihilation and particle collision processes, are discussed. General properties of the total cross section of the positron electron reaction which yields hadrons are given. The phenomenological parton model, quantum chromodynamic corrections, and nonperturbative effects are covered. Inclusive and exclusive final states of this annihilation reaction are brought up, leading to the parton jet model, variables for jet analysis, quantum chromodynamic jets, and gluon jets. Hyperon collisions are considered in terms of kinematical factors, leptonic processes, and hadronic production, resonances, and total cross section. These collisions are studied for hadronic production with high particle energies and involving quantum chromodynamic jets. Photon structure functions, deep inelastic processes, and exotic processes are also mentioned. Author (ESA)

N80-31175# Montpellier Univ. (France). Dept. de Physique Mathematique.
ON THE OPTIMALITY OF AXIOMATIC CONSTRAINTS FOR PION PION SCATTERING: THE CASE OF THE LOWER BOUNDS
G. Auberson and G. Mennessier. 1979. 13 p. refs.
(PM/79/16) Avail: NTIS. HC A02/MF A01

A nine parameter family of pion-pion yields pion-pion amplitudes F(s,t) is constructed such that (1) all the analytic and unitary conditions used in the derivation of rigorous absolute bounds are satisfied and (2) F(s,t) can assume negative values in the unphysical region. Within this set the values of F(4/3,4/3) and of the scattering length a (00) = F(4,0) are minimized. Best results realized are F(4/3,4/3) = -1.69 and a (00) = -0.88, whereas the best present lower bounds are F(4/3,4/3) = -8.2 and a(00) = -1.65. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-31176 California Univ., Los Angeles.
INTERACTION BETWEEN PARTICLE BEAMS AND NONLINEAR STATES. Ph.D. Thesis.
Philip Lok-Wah Leung. 1980. 115 p.
Avail: Univ. Microfilms. Order No. 8016006

The effect of transit time damping on localized high frequency electric field was investigated. Computer simulation of the particle orbits inside a caviton is presented showing the energy exchange between the caviton and particles. Experiments illustrating various ways of enhancement and suppression of transit time damping are discussed. Results indicate that the rate of transit time damping depends critically on the ambient plasma particle distributions and the particle orbits. The formation of potential double layers in a current carrying plasma was studied. Measurements of particle distributions and the noise spectrum associating with a stationary double layer are presented. Moving double layers were observed when the drift velocity of electrons was approximately twice the thermal velocity. A model developed for double layer formation

can explain the physical mechanism for double layer formation and the existence of moving double layers. Dissert. Abstr.

N80-31177# Spire Corp., Bedford, Mass.
COLLECTIVE ION ACCELERATION AND ELECTRON BEAM PROPAGATION IN DIELECTRIC GUIDES Annual Report, 1 Feb. 1979 - 31 Jan. 1980
Ward Halverson and Anton C. Greenwald 1 Apr. 1980 35 p refs
(Contract F49620-79-C-0046; AF Proj. 2301)
(AD-A086493; AR-10067-01; AFOSR-80-0465TR) Avail: NTIS HC A03/MF A01 CSCL 20/7

Measurements of front velocity and transported electron beam current are reported for several configurations of dielectric guide. It appears that the ions which determine the speed of beam-front propagation come only from a short section of dielectric near the inlet of the guide. They are accelerated in the potential well of the virtual cathode formed when the space-charge-limited electron beam is injected. Plasma formed by electron bombardment of the downstream guide walls apparently does not influence the beam-front speed, although it is important in determining the efficiency of current transport. Measurements of collective ion acceleration have been deferred until the second year of the program. GRA

N80-31178# Naval Research Lab., Washington, D. C. Plasma Physics Div.
ABSOLUTE CALIBRATION OF A PROMPT GAMMA RAY DETECTOR FOR INTENSE BURSTS OF PROTONS
F. C. Young, F. Oliphant, S. J. Stephanakis, and A. R. Knudson 31 Mar. 1980 33 p refs Sponsored by DNA
(AD-A086726; AD-E000457; NRL-MR-4171) Avail: NTIS HC A03/MF A01 CSCL 18/4

A detector for determining the intensity and duration of kiloampere pulsed proton beams is described. Two different size detectors were calibrated absolutely using the continuous proton beam from a Van de Graaff accelerator. An absolute measurement of a kiloampere pulsed proton beam is described, and the measured current is in agreement with an independent determination of the total proton intensity by nuclear activation. GRA

N80-31179# Effects Technology, Inc., Santa Barbara, Calif.
TWCP ELECTRON BEAM TESTING PROGRAM: VOLUME 2: PRELIMINARY CHARACTERIZATION OF THE BLACKJACK 3 PULSED ELECTRON BEAM FOR MATERIAL RESPONSE STUDIES Final Report, Jul. 1977 - Dec. 1978
F. A. Bick, comp. 5 Apr. 1979 39 p refs 4 Vol.
(Contracts DNA001-76-C-0357; DNA001-78-C-0063)
(AD-A086306; AD-E300843; ETI-CR-79-610-Vol-2; DNA-5036F-2-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 11/4

This volume describes the preliminary characterization of the Maxwell Laboratory Blackjack III pulsed electron beam facility as to energy spectrum, depth-dose profiles and fluence levels and uniformity. These tests were conducted preparatory to obtaining impulse and stress generation data on FM5822A carbon phenolic, and 91-LD phenolic resin. These tests demonstrated the capabilities of the Blackjack III facility for material response studies for peak electron energies of 0.7 to 1.0-MeV with fluence levels less than 200 cal/sq cm. GRA

N80-31180# Effects Technology, Inc., Santa Barbara, Calif.
TWCP ELECTRON BEAM TESTING PROGRAM: VOLUME 3: MATERIAL RESPONSE INSTRUMENTATION FOR THE BLACKJACK 3 ELECTRON BEAM FACILITY Final Report, Jul. 1977 - Dec. 1978
F. A. Bick, comp. 5 Apr. 1979 47 p refs 4 Vol.
(Contracts DNA001-76-C-0357; DNA001-78-C-0063)
(AD-A086307; AD-E300844; ETI-CR-79-610-Vol-3; DNA-5036F-3-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 11/4

This volume describes the instrumentation developed to characterize the Blackjack III pulsed electron beam facility environment, and to obtain impulse and stress generation data on FM5822A carbon phenolic, and 91-LD phenolic resin. The primary diagnostical contribution was the development of an in situ fluence measurement technique that significantly reduced experimental uncertainties. Impulse data were obtained using a translating Ronchi ruling and fiber optic light guide. Stress data were obtained simultaneously with the impulse measurements using a laser interferometer. This technique increased the amount of data obtained, and also provides a direct correlation between the impulse and stress data. These gages were all designed to operate in the intense radiation environment associated with a pulsed electron beam machine, and also in the magnetic field (25 kG) used to guide the electron beam. GRA

N80-31181# Oak Ridge National Lab., Tenn.
SEARCH FOR MAGNETIC DIPOLE STRENGTH AND GIANT SPIN-FLIP RESONANCES IN HEAVY NUCLEI
D. J. Horen 1980 27 p refs Presented at Intern. Symp. on Highly Excited States in Nucl. Reactions, Osaka, 12 May 1980
(Contract W-7405-eng-26)
(CONF-800540-1) Avail: NTIS HC A03/MF A01

A description is given of the use of high-resolution (n,n) scattering and the (p,n) reaction as tools to investigate highly excited states, with emphasis on information pertaining to magnetic dipole strength and giant spin-flip resonances in heavy nuclei. It is shown how the ability to determine uniquely the spins and parities of resonances observed in neutron scattering was instrumental to an understanding of the distribution of M1 strength in Pb(207) and Pb(208). Some recent results of (p,n) studies with intermediate energy protons are discussed. Energy systematics of the giant Gamow-Teller (GT) resonance are presented. It is shown how the (p,n) reaction might be useful in locating M1 strength in heavy nuclei. DOE

N80-31182# California Univ., Berkeley. Lawrence Berkeley Lab.
WASTE ISOLATION SAFETY ASSESSMENT PROGRAM: TASK 4: COLLECTION AND GENERATION OF TRANSPORT DATA THEORETICAL AND EXPERIMENTAL EVALUATION OF WASTE TRANSPORT IN SELECTED ROCKS Annual Progress Report, 1 Oct. 1978 - 30 Sep. 1979
R. J. Silva, L. V. Benson, A. W. Yee, and G. A. Parks (Stanford Univ., Calif.) 30 Sep. 1979 109 p refs
(Contract W-7405-eng-48)
(LBL-9945) Avail: NTIS HC A06/MF A01

The sorption of cesium on the solid substrates Min-u-sil (quartz) and Belle Fourche clay (montmorillonite) was investigated. Cesium sorption isotherms were obtained for the two substrates at 26 C. Preliminary analysis of the sorption data indicate that while the clay data could be explained by simple mass action expressions, the quartz data could not. Theoretical efforts were aimed at developing and testing an electrolyte binding electrical double layer model to predict sorption isotherms. A computerized version of the model, MINEQL, which simultaneously considers surface and solution chemical equilibria, was brought to operational status. Input parameters required by MINEQL were determined and sorption isotherms for Cs on the Belle Fourche clay were calculated over the same range of parameters as the experimental measurements. Comparisons showed that the model was able to simulate the isotherms quite well except at the lowest pH values for the 0.002M and 0.01M NaCl solutions. DOE

N80-31183# Rockwell International Corp., Richland, Wash. Rockwell Hanford Operations.
STUDIES TO ASSESS THE FEASIBILITY OF STORING NUCLEAR WASTE IN COLUMBIA PLATEAU BASALTS
Raul A. Deju Jul. 1979 17 p refs Presented at the Intern. Symp. on Underground Disposal of Radioact. Wastes, Otaniemi, Finland, 2 Jul. 1979
(Contract EY-77-C-06-1030)
(RHO-BWI-SA-19; IAEA-SM-243/36; CONF-790711-5) Avail: NTIS HC A02/MF A01

The feasibility of utilizing Columbia Plateau Basalts as a site for terminal storage of commerical nuclear waste is addressed. Columbia Plateau basalts system integration, geology, hydrology, engineered barries studies, engineering testing, and the construction of a near surfaces test facility are briefly described. DOE

N80-31184# California Univ., Berkeley. Lawrence Berkeley Lab. Nuclear Science Div.
PHENOMENA AT VERY HIGH SPINS

F. S. Stephens Mar. 1980 14 p refs Presented at Conf. on Band Struct. and Nucl. Dyn., New Orleans, 27 Feb. - 1 Mar. 1980
(Contract W-7405-eng-48)
(LBL-10645; CONF-800213-11) Avail: NTIS HC A02/MF A01

A discussion of current ideas about the physics of very high spin states, some comments about noncollective behavior up to the highest spins where it is known, and a presentation of a method for studying collective behavior up to spins of 60 to 70 h are presented. The intention is that the overview presented in the first part will be sufficiently broad to indicate the relationship of the noncollective and collective behavior discussed in the other parts, and to provide some understanding of the compromise in behavior that seems to occur at the very highest spins. DOE

N80-31185# Sandia Labs., Albuquerque, N. Mex.
INTENSE PULSED ION BEAMS FOR FUSION APPLICATIONS
S. Humphries, Jr. Apr. 1980 220 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0402) Avail: NTIS HC A10/MF A01

Ion injectors which utilize the introduction of electrons into vacuum acceleration gaps in conjunction with high voltage pulsed power technology to achieve high output current are discussed. Power levels from injectors exceeding 1000 MW/sq cm were obtained for pulse lengths on the order of 10 to the -7 sec. The physics and technology of intense ion beams and their applications in fusion research are considered. A number of potential uses in magnetic confinement systems are proposed. DOE

N80-31186# Texas A&M Univ., College Station. Dept. of Chemistry.
X-RAY EMISSION IN HEAVY-ION COLLISONS Progress Report, 1 Apr. - 31 Mar. 1980
R. L. Watson Apr. 1980 51 p refs
(Contract DE-AS05-78ER-06036)
(DOE/ER-06036/3) Avail: NTIS HC A04/MF A01

Results from several investigations of the X-ray emission in heavy-ion collisions are presented. Areas covered include; spectra of K alpha X-rays from 64 MeV sulfur ions traveling in solids; foil-excited K alpha X-ray transitions in few-electron sulfur ions; high resolution study of the target thickness dependence of X-ray emmision from 65 MeV sulfur ions; dynamic screening of highly stripped sulfur ions in solids; Mg K alpha X-ray satellites excited by ion bombardment, multiplet structure and dependence on projectile and chemical environment; angular distributions of beam and target K alpha X-ray; chemical effects on K X-ray satellites of fluorine compounds; and non linear least-squares peak-fitting program employing Voight functions. DOE

N80-31187# Rockwell International Corp., Golden, Colo. Energy Systems Group.
NATIONAL WASTE TERMINAL STORAGE PROGRAM: CONTAINMENT SYSTEM CONCEPTS FOR TRANSPORTING TYPE B QUANTITIES OF TRANSURANIC WASTE
Robert J. Rushton and Richard J. Merlini 14 Sep. 1979 94 p refs
(Contract EY-76-C-04-3533)
(RFP-2862) Avail: NTIS HC A05/MF A01

A series of shipping containment system preliminary concepts for Type B quantities of transuranic waste was formulated. The concepts were based on hypothetical accident protection requirements, potential waste forms, and selected hardware design/ considerations. The concepts consist of suggested waste system containment configurations and construction material suggestions. Analysis of the concepts, based on such features as fabrication ease and cost, utility, and payload efficiency, revealed that concepts utilizing processed waste forms and/or disposable waste packages to provide a major portion of the required accident protection are most favorable. DOE

N80-31188# California Univ., Livermore. Lawrence Livermore Lab.
ADVANCED THREE-DIMENSIONAL THERMAL MODELING OF A BASELINE SPENT FUEL REPOSITORY
Thomas J. Altenbach and William E. Lowry 29 Apr. 1980 55 p refs
(Contract W-7405-eng-48)
(UCID-18660) Avail: NTIS HC A04/MF A01

A three dimensional thermal analysis using finite difference techniques was performed to determine the near field response of a baseline spent fuel repository in a deep geologic salt medium. The base case in this thermal analysis considers one 10 year old pressurized water reactor (PWR) spent fuel assembly emplaced to yield a 36 kW/acre (8.9 W/sp m) loading. A unit cell model in an infinite array is used to simplify the problem and provide upper bound temperatures. Boundary conditions are imposed which allow simulations to 1000 years. Variations studied include a comparison of ventilated and unventilated storage room conditions, emplacement packages with and without air gaps surrounding the canister, and room cool down scenarios with ventilation following an unventilated state for retrieval purposes. It was found that at this low power level, ventilating the emplacement room has an immediate cooling influence on the canister and effectively maintains the emplacement room floor near the temperature of the ventilating air. DOE

N80-31189# Montpellier Univ. (France). Dept. de Physique Mathematique.
THE REACTION POSITRON ELECTRON YIELDS HYPERON + HADRONS AT HIGH ENERGY
M. Gourdin (Paris VI Univ.) and F. M. Renard Jul. 1979 18 p refs
(PM/79/18) Avail: NTIS HC A02/MF A01

Contributions to this reaction due to lepton radiation and central emission (expressed in terms of photon structure functions) are described in their most general form including weak neutral currents and polarization effects. The photon structure functions are calculated with the quark parton model. Applications to cross sections, photon spectra, asymmetries, and polarizations are given for the LEP energy range. Author (ESA)

74 OPTICS

Includes light phenomena.

N80-31190 Arizona Univ., Tucson.
SCATTERPLATE INTERFEROMETRY Ph.D. Thesis
Lawrence Francis Rubin 1980 142 p
Avail: Univ. Microfilms Order No. 8020324

A description of scatterplate interferometry from both a theoretical and experimental viewpoint is presented. Through the use of Fourier optics and stochastic processes techniques, a formalized theory of scatterplate interferometry is shown particularly in how the flip or inversion symmetry of the scatterplates itself affects the flip symmetry. Also described are the effects on the fringe quality produced by non-laser sources as well as aberrations in the interferometer optics. Experimental verification of these aspects is shown to be in good agreement with the theory. In addition, material is presented on scatterplate fabrication. Additional refinements including null testing with the scatterplate and an infrared scatterplate interferometer are also described. Dissert. Abstr.

N80-31191 Virginia Polytechnic Inst. and State Univ., Blacksburg.
MEASUREMENT OF SURFACE ROUGHNESS AND CORRELATION LENGTH USING DICHROMATIC SPECKLE Ph.D. Thesis
Mitrajyoti Deka 1980 74 p
Avail: Univ. Microfilms Order No. 8020178

A computer simulation study of the dichromatic speckle was conducted and the surface roughness and correlation length of sample surfaces were measured using a stylus instrument and similar measurements with dichromatic speckle. The rms difference of the two speckle intensities was analyzed for spot sizes smaller than, comparable and larger than the correlation length of the surface. The rms roughness of the sample ground glasses was calculated from the data obtained from the stylus instrument. The correlation length was obtained from an online multichannel FFT processor connected to the stylus instrument. The correlation length was estimated from the correlation function. The rms

difference between the speckle intensities of two different wavelengths were measured for various spot sizes. For each intensity 64 K data samples was collected and processed in a PDP 11/40 computer. These data were used to calculate the second moment of the monochromatic speckle, the cross correlation of these and the rms difference. The roughness and the correlation length of the surface were estimated from these results. The results obtained from the dichromatic speckle are in good agreement with the values obtained from the stylus instrument. Dissert. Abstr.

N80-31192 Drexel Univ., Philadelphia, Pa.
A THEORETICAL STUDY OF TRANSIENT EFFECTS IN ABSORPTIVE OPTICAL BISTABILITY Ph.D. Thesis
James David Fanna 1980 133 p
Avail: Univ. Microfilms Order No. 8019347

A bistable absorber in the good cavity limit and the Fokker-Planck equation that describes the time evolution of the quasi-probability distribution are considered. The existence of two distinct mechanisms of relaxation into steady state is established. The first consists of a local relaxation around the minimum (or minima) of a suitably defined potential. The second stage, which occurs over a much longer time scale, results from tunneling from one minimum to the other across the local maximum. Both mechanisms are considered. A linearization technique generalized for multistable systems is described and tested with numerical solutions of the Fokker-Planck equation. Tunneling is described, using a first passage technique, which is capable of modeling multistable systems. First passage times for optical bistability are calculated numerically and compared to previous tunneling estimates. Dissert. Abstr.

N80-31193*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
LASER OPTICAL APPRAISAL AND DESIGN OF A PRIME/ROVER INTERFACE
James A. Donaldson Jul. 1980 93 p refs
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163508; RPI-TR-MP-68) Avail: NTIS HC A05/MF A01 CSCL 20F

An appraisal of whether to improve the existing multi-laser/multi detector system was undertaken. Two features of the elevation scanning mast which prevent the system from meeting desired specifications were studied. Then elevation scanning mast has 20 detectors, as opposed to the desired 40. This influences the system's overall resolution. The mirror shaft encoder's finite resolution prevents the laser from being aimed exactly as desired. This influences the system's overall accuracy. It was concluded that the existing system needs no modification at present. The design and construction of a data emulator which allowed testing data transactions with a PRIME computer is described, and theory of operation briefly discussed. A full blown PRIME/Rover Interface was designed and built. The capabilities of this Interface and its operating principles are discussed. R.K.G.

N80-31194# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ALIGNMENT OF LIQUID CRYSTALS BY SURFACE GRATINGS
David C. Shaver 31 Oct. 1979 71 p refs
(Contract F19628-80-C-0002; ARPA Order 3336)
(AD-A086816; ESD-TR-79-267; TR-538) Avail: NTIS HC A04/MF A01 CSCL 20/6

Square-wave grating structures with periodicities ranging from 3200 A to 12 micrometers were etched into fused quartz substrates, and the effect of such gratings on liquid crystal alignment was studied. Gratings with periodicities below 4 micrometers appear to be required to align typical room temperature nematic liquid crystals. At larger periodicities a pronounced defect texture forms. The defect texture is created during nucleation and growth of the nematic phase as it cools from the isotropic phase. The defect texture is stabilized by adsorption of an oriented molecular layer on the substrate surfaces. This adsorbed layer exerts an orienting torque on the bulk liquid crystal. Experiments were performed to demonstrate the existence of such an adsorbed layer. The tilt angle of the nematic director from the plane of quartz substrates was measured for liquid crystals used in the alignment experiments. M24 and the 'heptyl/butyl mixture' align with the director in the substrate plane. M8BA aligns with a tilt angle of about 23 deg on fused quartz, whether or not a grating structure is present. Surface gratings were also formed by patterning a 'monolayer' of DMOAP. Such patterned organic monolayers, which have no appreciable surface relief, are effective at aligning liquid crystals. This represents a new approach to liquid crystal alignment. High-quality alignment of the smectic A phase of M24 was induced by a 3200-A-period square-wave surface-relief grating. A novel twisted-nematic liquid crystal display which uses metal gratings for polarization of light as well as for liquid crystal alignment was fabricated. GRA

N80-31195# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
OPTICAL INTERARRAY PROCESSING Final Report, 1 Oct. 1979 - 31 Mar. 1980
Mar. 1980 41 p refs
(Contract N00014-80-C-0216)
(AD-A086665) Avail: NTIS HC A03/MF A01 CSCL 20/6

This project had two major objectives. The first objective was to demonstrate nonreal time generation of ambiguity functions from one dimensional input transducers. The second objective was to design front end and rear end electronics capable of supporting real time operation of the optical processor. Both of these objectives were successfully achieved, and in addition, a new optical architecture was invented (LIPS), and its feasibility and superiority was experimentally demonstrated. The optical system demonstrating the proposed Passive Optical Tau-Shift concept (POTS) was designed with a large f number (~20) for aberration-free performance, and the system length became 12 meters. One dimensional Bragg cell-sized photographic transparencies were used to generate ambiguity functions. The results of processing both analytic V-FM signals and synthetic data from NOSC showed excellent agreement with theoretical predictions in terms of the correlation peak height and resolution. Another optical architecture based on an entirely new concept of a space variant Linear Phase Shifter (LIPS) was independently developed. It generates a tau-shift by a shear operation instead of the rotation used in pots. GRA

N80-31196# Electronics Research Lab., Adelaide (Australia).
THE SPECTRAL CHARACTERISTICS OF METAL FILM BEAM SPLITTERS
J. R. Venning Jan. 1980 56 p refs
(AD-A086419; ERL-0123-TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

The spectral and polarisation characteristics of metallic beam splitters and mirrors made of single films of aluminum, silver, rhodium or nichrome on glass are described. Normal incidence transmission data of each thickness of metal film used in the beam splitter calculations is included for use when measuring or monitoring the deposition of the thin films. The presentation is mostly graphical and intended for the user and maker of simple metal beam splitters. GRA

N80-31197# ITT Electro-Optical Products Div., Roanoke, Va.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR RUGGEDIZED TACTICAL FIBER OPTIC CABLE Quarterly Progress Report, 1 Jan. - 31 Mar. 1980
R. J. Hoss and R. Kopstein 28 Apr. 1980 71 p
(Contract DAAK80-79-C-0789)
(AD-A086874; ITT-80-17-048; CORADCOM-79-0789-3; QPR-3) Avail: NTIS HC A04/MF A01 CSCL 20/6

The scope of this quarter's effort, as reported herein, includes the following tasks and achievements: (1) Cable Process Optimization: (a) Complete polyurethane jacket evaluation samples (four types, four manufacturers), (b) Complete fungus testing, (c) Select optimized polyurethane type, (d) Begin optimized cable fabrication for third engineering sample, (e) Deliver second engineering sample and test report (lay length and polyurethane evaluation samples); (2) Use of Facilities: (a) Achieve 75% of production rate on the high speed strander, (b) Install new Kevlar serving line, start setting up, and make operational, (c) complete extruder set up and work toward 0.8 h/km rate, (d) Set up and make spooler operational, achieve 50% production rate, (e) Assemble test stations and characterize; and (3) Secondary Performance Milestones: (a) Achieve 0.5 dB/km induced attenuation from cabling operation. GRA

N80-31198# ITT Electro-Optical Products Div., Roanoke, Va.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR RUGGEDIZED TACTICAL FIBER OPTICS CABLE Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
R. J. Hoss and R. Kopstein 28 Jan. 1980 67 p
(Contract DAAK80-79-C-0789)
(AD-A086706; ITT-80-03-078; CORADCOM-79-0789-2; QPR-2) Avail: NTIS HC A04/MF A01 CSCL 20/6

The scope of this quarter's effort, as reported herein, includes the following tasks and achievements: (1) Cable Process Optimization-(a) Complete first engineering samples; test, select optimized fiber buffering, (b) Complete lay length evaluation samples, test, select optimized lay length, (c) Receive polyurethane materials (four types, four manufacturers); (2) Use of Facilities-(a) High speed strander, set up and operational; achieve 50% of production rate, (b) Extruder set up and operational, (c) Fiber optic measurement station design complete and partial fabrication. GRA

N80-31199# Purdue Univ., Lafayette, Ind.
CRITICALLY EVALUATED DATA ON OPTICAL AND TRANSPORT PROPERTIES OF SOLIDS REFRACTIVE INDEX AND ABSORPTION COEFFICIENT OF SELECTED OPTICAL MATERIALS Annual Report, 1 May 1979 - 30 Apr. 1980
H. H. Li 3 Jun. 1980 13 p refs
(Contract F44620-76-C-0105; AF Proj. 2308)
(AD-A089658; AFOSR-80-0539TR) Avail: NTIS HC A02/MF A01 CSCL 20/6

In this report, experimental material on the absorption coefficients of alkaline Earth halides was searched, compiled, and analyzed. It was found that the bulk of available data was concentrated to the absorption edges of the main transparent region for the four materials calcium fluoride, strontium fluoride, barium fluoride, and magnesium fluoride. An equation was formulated to best describe the absorption data in the infrared multiphonon region as a function of both frequency and temperature. It was noted that the same type of equation is equally valid for both alkaline Earth halides and alkali halides. Although the intrinsic absorption was predicted by the proposed equation, discrepancies might occur in the region where absorption is extremely low and where extrinsic absorptions due to impurities and surface contamination dominate the intrinsic absorption by factors ranging from fractions to multiples of ten. Experience has shown that extrinsic contributions can be reduced through improved crystal growing and surface polishing techniques. The work on the absorption coefficient of silicon and germanium was in progress. It was found that the absorption coefficient is sensitive to the amount and kind of impurities usually being introduced as desirable dopants. Numerous experimental material was made available. Currently the work remained in the stage of data extraction and compilation. GRA

N80-31200# California Univ., Livermore. Lawrence Livermore Lab.
COMPREHENSIVE DESCRIPTION OF FIELDS IN OPTICAL FIBERS BY MEANS OF THE PROPAGATING BEAM METHOD
M. D. Feit and J. A. Fleck, Jr. Apr. 1980 27 p refs Presented at Conf. on Phys. of Fiber Optics, Chicago, 28 Apr. 1980; sponsored by Am. Ceramic Soc.
(Contract W-7405-eng-48)
(UCRL-84219; CONF-800430-1) Avail: NTIS HC A03/MF A01

The propagating beam method is shown to provide a configuration space description of the field in an optical fiber and generate all of the information necessary for a complete description of the field in terms of modes. Illustrations are given of the method's capabilities for generating mode eigenfunctions, eigenvalues, and group delays for several index profiles of practical interest. DOE

N80-31201# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
COMPUTER CONTROLLED MEASUREMENT OF SHAPES AND THEIR VARIATIONS BY MEANS OF ACTIVE TARGETS AND AN OPTOELECTRONIC CONVERTER [RECHNERGESTEUERTE FORM- UND VERFORMUNGSMESSUNG MITTELS AKTIVER ZIELPUNKTE UND OPTOELECTRONISCHER WANDLER]
J. H. Argyris, W. Aicher, K. Eberle, and M. Kirschstein Sep. 1979 24 p refs In GERMAN
(Contract DFG-AR-44/27/41)
(ISD-245) Avail: NTIS HC A02/MF A01

The suitability of a system for the measurement of displacements and deformations by means of a computer controlled optoelectronic system was studied. Efforts to increase precision and resolution by means of analytical corrections are described. Author (ESA)

N80-31202# Thomson-CSF, Orsay (France). Lab. Central de Recherches.
NONLINEAR OPTICS IN GUIDED STRUCTURES. APPLICATION TO FREQUENCY DOUBLING Final Report [OPTIQUE NON LINEARE EN STRUCTURES GUIDEES. APPLICATION AU DOUBLAGE DE FREQUENCE]
M. Papuchon and M. Digonnet 12 Jan. 1978 33 p refs in FRENCH
(Contract DGRST-77-7-0086)
(LCR-78-05/R/G5) Avail: NTIS HC A03/MF A01

The possibility of the formation of a second harmonic in optical waveguides was studied particularly in those made through metallic diffusion in crystals such as $LiNbO_3$ or $LiTaO_3$. Waveguides made by the diffusion of titanium in $LiNbO_3$ were designed and tested. The results obtained from the testing of waveguides in $LiTaO_3$ through local metallic diffusion are presented. Author (ESA)

N80-31203# Thomson-CSF, Meudon-la-Foret (France). Lab. Central de Recherches.
USE OF INTEGRATED OPTICS FOR ANALOG DATA SIGNAL CONDITIONING ABOARD SPACECRAFT Final Report
C. Puech, M. Papuchon, and J. C. Anne Sep. 1979 121 p refs
(Contract ESTEC-3746/78-NL-PP(SC))
(LCR-79-108/R/G5; ESA-CR(P)-1300) Avail: NTIS HC A06/MF A01

A predesign elaboration is presented of an optical conditioning unit for the data delivered by a multispectral scanner using integrated optics and fiber optics technology. A laboratory model of an integrated optical amplitude modulator was built. The system was selected as a model for a representative optical waveguide system for use on board spacecraft. It consists of an optical data conditioning unit that would be used in conjunction with a multispectral camera to perform sensor signal pre-processing operations, such as: remotely controlled amplitude and dc level adjustments, data multiplexing and analog-to-digital conversion. The implementation described uses hybrid optical waveguide technology. It permits the definition of key optical elements, such as the digitally driven amplitude modulator. Author (ESA)

N80-31204# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
MEASUREMENT OF OPTICAL FIBER BANDWIDTH IN THE TIME DOMAIN
Douglas L. Franzen and G. W. Day Feb. 1980 72 p refs Sponsored in part by DOD
(PB80-177421; NBS-TN-1019) Avail: NTIS HC A04/MF A01 CSCL 20F

A system for determining optical fiber bandwidth from time domain information is described. A measurement gives the optical fiber transfer function (or frequency response) relating the output waveform to the input. An analysis is given of the variables affecting the measurement. This includes a discussion of such input related topics as launching conditions, mode scramblers, and laser diode sources; output related topics include a discussion of optical detectors. Laser diodes are evaluated with respect to short pulse performance, near field emission, material dispersion limits, and other spectral behavior like chirping; detectors are evaluated with respect to time response, linearity, and uniformity. A number of bandwidth related topics are briefly presented and typical experimental results given. GRA

N80-30331*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SIGNAL TO NOISE RATIO CALCULATION FOR FIBER OPTICS LINKS

K. Y. Lau *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 41-48 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20F

N80-30337*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPATIAL ACQUISITION OF OPTICAL SOURCES IN THE PRESENCE OF INTENSE INTERFERENCE
V. A. Vilnrotter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 91-96 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-31205 Lehigh Univ., Bethlehem, Pa.
A SEARCH FOR THE PERSISTENT VELOCITY AUTOCORRELATION IN HYDROGEN BY DENSE PLASMA DECAY Ph.D. Thesis
Hyo Sang Lee 1980 169 p
Avail: Univ. Microfilms Order No. 8019719

A pulsed plasma was produced in very high density neutral hydrogen gas by a 20 ns, 60 KV Blumlein discharge and six simultaneous time resolved diagnostic measurements were carried out during a 3 micron period in order to describe the full plasma evolution. The whole experiment is repeated for various densities between one twelfth and one sixth of the close packing density. A numerical simulation code was developed to independently reproduce all measurable details of the full evolution of the laboratory plasma. The simulation was successful in predicting correctly all measured features of the plasma in the afterglow regime, thus establishing the simulation as a reliable basis for testing the reality of the Alder-Wainwright effect. In regard to the persistent velocity autocorrelation, the question remains unresolved because the experimental uncertainty is slightly greater than the difference between the two results of the simulation one with and the other without the Alder-Wainwright effect in the diffusion coefficient, over the entire range of the gas density covered in the experiment. Dissert. Abstr.

N80-31206 California Inst. of Tech., Pasadena.
PARTICLE CONFINEMENT AND MAGNETIC FLUCTUATIONS IN TOKAMAK DISCHARGES WITH GAS PUFFING Ph.D. Thesis
Bruce Stephen Levine 1980 193 p
Avail: Univ. Microfilms Order No. 8019905

Particle confinement and magnetic fluctuations associated with short (< 1 msec) gas pulses into a Tokamak discharge are investigated experimentally. The fluctuations are measured with movable pairs of magnetic probes, each containing a poloidal and radial coil and inserted into the outer regions of the plasma. When neutral gas is added and the current channel contracts, the fluctuation spectra are dominated by an m = 2 mode that grows with the classical tearing-mode rate. When the gas feed is terminated, much broader spectra of modes with m up to 15 are observed. The m = 2 mode dominates the poloidal spectra, while the radial spectra have numerous modes of appreciable amplitude. Time-delay measurements suggest that many of the higher order (m > 3) modes originate in deformation of the m = 2 and m = 3 magnetic islands. A strong m = 7 is found to be localized near the limiter in q(a) = 3.8 discharges, hence this mode is identified as an m = 7, n = 2. It is found that the m = 2 mode becomes destabilized for discharges for which the peak puff density approaches the upper limit given by the Murakami scaling relation. Dissert. Abstr.

N80-31207# Naval Research Lab., Washington, D. C.
THE NONLINEAR DYNAMICS OF MHD UNSTABLE PLASMAS Interim Report
Wallace M. Manheimer 12 May 1980 69 p
(AD-A086729; AD-E000453; NRL-MR-4175) Avail: NTIS HC A04/MF A01 CSCL 20/9

Topics covered include: (1) quasilinear theory and Rutherford's nonlinear theory of tearing modes; (2) island overlap and the onset of stochasticity; (3) the Taylor-Woltjer theory of spontaneous field reversal and current limitation; and (4) Kadomtsev's theory of internal disruptions and an introduction to numerical simulations. A.R.H.

N80-31208# Naval Research Lab., Washington, D. C.
HIGH ORDER ZIP DIFFERENCING OF CONVECTIVE TERMS Interim Report
Steven T. Zalesak 8 May 1980 39 p refs Sponsored by DNA
(AD-A086725; AD-E000458; NRL-MR-4218) Avail: NTIS HC A03/MF A01 CSCL 20/9

The ZIP flux form for differencing the term (wv) sub x, where w is a convected quantity and v is a convective velocity, is observed to be equivalent to differencing the alternative expression wv sub x - w sub x v using centered second order finite differences. Based on this observation, the extension of the ZIP flux concept to arbitrarily high order accuracy is given. Computational examples show the advantage both of the ZIP flux concept itself and of its higher order forms within the context of flux-corrected transport (FCT) algorithms. GRA

N80-31209# Naval Research Lab., Washington, D. C.
PROPERTIES OF ABLATIVELY ACCELERATED TARGETS
B. H. Ripin, S. E. Bodner, S. H. Gold, H. R. Griem, J. Grun, M. J. Herbst, R. H. Lehmberg, E. A. McLean, J. M. McMahon, and S. P. Obsenschain 16 May 1980 34 p refs Presented at CLEOS/ICF '80 Topical Meeting on Inertial Confinement Fusion, San Diego, Calif., 27 Feb. 1980 Sponsored by DOE (RR0110941)
(AD-A086727; AD-E000456; NRL-MR-4212) Avail: NTIS HC A03/MF A01 CSCL 20/9

Targets are ablatively accelerated to high velocity (10 to the 7th power cm/s) with good hydrodynamic efficiency (about 20%) using low-irradiance (10 to the 13th power - 10 to the 14th power) long (3 - 4 ns) Nd-laser pulses. Detailed properties of the interaction and acceleration as well as comments upon the suitability of this approach to the laser fusion application are presented. Results of unique 'double-target' experiments are also included. GRA

N80-31210# California Univ., Los Angeles. School of Engineering and Applied Science.
STUDIES OF NONLINEAR PHENOMENA IN PLASMAS Final Report, 1 Jan. 1979 - 31 Mar. 1980
P. K. C. Wang Mar. 1980 150 p refs
(AF Proj. 2301)
(AD-A086456; UCLA-ENG-8012; AFOSR-80-0502TR) Avail: NTIS HC A07/MF A01 CSCL 20/9

This report summarizes the result of a study on nonlinear phenomena in plasmas with main emphasis on developing deterministic theories for plasma turbulence based on the Ruelle-Takens theory of strange attractors, and on the interaction of solitons. The main results include the demonstration of the occurrence of turbulence-like solutions in a simplified Zakharov model for Langmuir turbulence and a number of nonlinear three wave interactions. he stability of mode converted lower hybrid solitons is also studied. GRA

N80-31211# Naval Research Lab., Washington, D. C. Plasma Physics Div.
MHD PLASMA CHANNEL RESPONSE TO PROPAGATING ION BEAMS Interim Report
D. G. Colombant, D. Mosher, and Shyke A. Goldstein 24 Jun. 1980 14 p refs
(AD-A087214; AD-E000473; NRL-MR-4252) Avail: NTIS HC A02/MF A01 CSCL 20/9

Hydrodynamic response of plasma channels induced by intense propagating ion beams is examined using both analytical estimates and a one dimensional radial numerical model. It is found that mega-ampere, 3-5 MeV proton beams can be propagated in deuterium background over several meters. GRA

N80-31212# Naval Research Lab., Washington, D. C.
GAS CHANNEL FORMATION STUDIES INCLUDING REAL-AIR THERMODYNAMIC PROPERTIES
Selig Kainer and Martin Lampe 26 Jun. 1980 31 p refs
(ARPA Order 3718)
(AD-A086999; AD-E000490; NRL-MR-4247) Avail: NTIS HC A03/MF A01 CSCL 20/13

Real-air thermodynamic properties are included in studies of reduced density channel formation by expansion of a heated cylinder of air. A model for density profile at late times, previously given for a polytropic ideal gas, is extended to the present case. It is shown that a relation between pressure P, density rho, and specific energy epsilon, of the form properties. The variation of f with epsilon, i.e., of specific heat with temperature, can strongly modify the initial pressure profile associated with a given energy density profile. The effects of real-gas thermodynamics during the hydrodynamic expansion, on the other hand, are rather weak. GRA

N80-31213# Oak Ridge National Lab., Tenn.
LARGE ASPECT RATIO TOKAMAK STUDY
R. L. Reid, J. A. Holmes, W. A. Houlberg, Y. K. M. Peng, D. J. Strickler, T. G. Brown, C. Sardella, and G. W. Wiseman 1979 6 p refs Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979 Prepared in cooperation with Grumman Aerospace Corp., Bethpage, N.Y.
(Contract W-7405-eng-26)
(CONF-791102-156) Avail: NTIS HC A02/MF A01

The potential for producing a viable long burn Tokamak reactor through enhanced volt-second capability of the ohmic heating transformer by employing high aspect ratio designs was investigated. The plasma physics, engineering, and economic implications of high aspect ratio Tokamaks were accessed in the context of extended burn operation. Plasma startup and burn parameters were addressed using a one dimensional transport code. The pulsed electrical power requirements for the poloidal field system, which have a major impact on reactor economics, were minimized by optimizing the field in the ohmic heating coil and the wave shape of the ohmic heating discharge. A high aspect ratio reference reactor was chosen and configured. DOE

N80-31214# Department of Energy, Washington, D. C.
ASSESSMENT OF THE US MIRROR FUSION PROGRAM. REPORT OF THE 1980 MIRROR SENIOR REVIEW PANEL
Apr. 1980 36 p
(DOE/ER-0057) Avail: NTIS HC A03/MF A01

Progress in the magnetic confinement of high temperature plasmas for the release of fusion energy is reported. Emphasis is placed on the development of the tandem mirror concept, and its incorporation into the single cell mirror reactor. L.F.M.

N80-31215# California Univ., Livermore. Lawrence Livermore Lab.
NONLINEAR EVOLUTION OF RESISTIVE INTERCHANGE MODES IN REVERSED FIELD PINCHES
D. D. Schnack and J. Killeen Apr. 1980 6 p refs Presented at RFP Workshop, Los Alamos, New Mex., 28 Apr. - 2 May 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84301) Avail: NTIS HC A02/MF A01

The results are presented of the application of a two dimensional resistive MHD computer code to the nonlinear evolution of resistive interchange modes in tearing-mode-stable reversed field pinch equilibria. One finds the m = 1 mode is insignificant when the singular surface is outside the field reversal point, and is more active nonlinearly but still fairly localized when the singular surface lies in the inner regions of the plasma. The m = 0 mode, which is not present in Tokamaks, is found to lead to highly distorted flux surfaces and interchange vortices of large radial extent when beta is near the Suydam marginal point. However, if the initial beta is sufficiently small, this mode remains localized allowing significant Ohmic heating of the pinch to occur. DOE

N80-31216# California Univ., Livermore. Lawrence Livermore Lab.
TECHNIQUES OF PLASMA PRODUCTION AND HEAT. 32: PLAN FOR THE PLASMA MICROWAVE-HEATING SYSTEM AT THE T-10M FACILITY
V. A. Flyagin, V. V. Alikaev, S. N. Vlasov, A. G. Luchinin, G. S. Nusinovich, V. G. Usov, and V. I. Khizhnyak Jan. 1980 10 p refs Transl. into ENGLISH from Conf. on Eng. Probl. of Thermonucl. Reactors (USSR) p 3-9 Conf. held in Leningrad, 28 Jun. 1977
(UCRL-Trans-11563; CONF-7706118) Avail: NTIS HC A02/MF A01

A plasma heating technique is proposed which uses an ordinary wave whose electric field during transverse propagation is parallel to the longitudinal magnetostatic field of the chamber. Such a wave can be introduced into the Tokamak from the outside of the torus, where there are large ports in the vacuum chamber of the apparatus. The width of the plasma layer in which microwave energy is absorbed decreases as the angle between the wave vector K vector and the direction of the chamber longitudinal magnetic field H vector approaches 90 deg. To test this assertion experimentally in the T-10M facility, it is proposed to provide adjustment of the angle of injection of microwave radiation into the Tokamak. DOE

N80-31217# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
PLASMA ROTATION IN REVERSED-FIELD THETA PINCHES
L. C. Steinhauer Feb. 1980 54 p refs
(Contract DE-AC06-76ET-53027)
(MSNW-80-1144-1) Avail: NTIS HC A04/MF A01

Field reversed plasmas were observed to spin up and develop a destructive rotating m = 2 instability. While the instability threshold has been reasonably well characterized, the cause of the rotation remains obscure. Of the several mechanisms proposed, one of the most likely is the following: end shorting on open field lines spins up that portion of the plasma; viscous drag then spins up the plasma on closed field lines. Theoretical models are developed to describe these processes. The predicted behavior falls into three regimes. For low aspect ratio (equal to or less than 2.5) the plasma is highly viscous, rotates as a rigid body and spins up to instability in a few Alfven transit times. At intermediate aspect ratio (2.5 to 4) the plasma is weakly viscous; it reaches instability in the viscous transfer time which lengthens very rapidly for higher aspect ratio. At high aspect ratio (equal to or greater than 4) spin up is slower than the resistive decay of the plasma, and instability should not arise. DOE

N80-31218# Naval Research Lab., Washington, D. C. Plasma Physics Div.
HARD X-RAY SPECTRUM FROM A ONE-FLUID LASER PLASMA MODE Interim Report
D. G. Colombant and W. M. Manheimer 27 May 1980 15 p refs
(Contract ES-77-A-01-6021)
(NRL-MR-4241) Avail: NTIS HC A02/MF A01

Comparisons between hard X-ray experimental spectra and those obtained from a one dimensional, one temperature fluid laser-produced plasma model show good agreement over several orders of magnitude in X-ray intensity and for Nd-laser irradiances varying between 1 and 8 x 10 to the 15th power w/sq cm. The key to this agreement is the careful modeling of electron energy flux limitation by return current driven ion acoustic turbulence. DOE

N80-31219# Princeton Univ., N. J. Plasma Physics Lab.
VORTEX FORMATION DURING rf HEATING OF PLASMA
R. W. Motley May 1980 50 p refs
(Contract DE-AC02-76CH-03073)
(PPPL-1658) Avail: NTIS HC A03/MF A01

Experiments on a test plasma show that the linear theory of waveguide coupling to slow plasma waves begins to break down if the RF power flux exceeds 30 W/ sq cm. Probe measurements reveal that within 30 microseconds an undulation appears in the surface plasma near the mouth of the twin waveguide. This surface readjustment is part of a vortex, or off-center convective cell, driven by asymmetric RF heating of the plasma column. DOE

N80-31220# California Univ., Livermore. Lawrence Livermore Lab.
ADIABATIC COMPRESSION OF FIELD-REVERSED PLASMA
J. W. Shearer. 28 Apr. 1980. 20 p. refs.
(Contract W-7405-eng-48)
(UCID-18614) Avail: NTIS. HC A02/MF A01

Field-reversed plasma compression occurs in a number of different contexts. Theta pinches are compressed by a time-increasing magnetic field, produced either by a large mirror field supply or by a moving conductor (liner). A moving field-reversed plasma that encounters an increasing magnetic mirror field also experiences compression due to the increase in the local field as seen by the plasma. This interaction occurs at the entrance to the moving ring reactor and in the BETA-II plasma ring injection experiment. The adiabatic compression of the moving ring is considered by means of some dimensional scaling rules. DOE

N80-31221# Princeton Univ., N. J. Plasma Physics Lab.
REVIEW OF THE WALL PROBLEM AND CONDITIONING TECHNIQUES FOR TOKAMAKS
H. F. Dylla. May 1980. 39 p. refs.
(Contract DE-AC02-76CH-03073)
(PPPL-1666) Avail: NTIS. HC A03/MF A01

A review is given of the present understanding of the physical mechanisms, the resulting surface effects, and benefits to plasma performance of the various conditioning procedures. Particular attention is given to the application of hydrogen glow discharge cleaning and the use of titanium gettering as conditioning procedures. DOE

N80-31222# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
MHD ELECTRODE DEVELOPMENT. Quarterly Report, Oct. - 30 Dec. 1979
John W. Sadler, Laurence H. Cadoff, Jeff Bein, W. Dean Coe, Jr., James A. Dilmore (Westinghouse Research and Development Center), Edsel W. Fratti, Dave Jacobs, Edgar L. Kochka, Jack A. Kuszyk, S. K. Lau et al. Feb. 1980. 119 p. refs.
(Contract DE-AC01-79ET-15529)
(FE-15529-5) Avail: NTIS. HC A06/MF A01

Results of bonding studies in support of an evaluation of platinum capped anodes and iron cathodes are presented. In addition, an attachment technique has been developed for bonding the indium-doped hafnia current leadout material to a compliant nickel mesh and results are reported. Laboratory electrochemical corrosion tests indicate that major reductions in polarization, electrical resistivity and ionic transference number of the slag can be achieved with moderate additions of cobalt which will produce a significant reduction in the electrochemical stress. Status of design, procurement and modification activities in support of the installation of a conventional three tesla magnet is presented. DOE

N80-31223# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
COLLISIONAL PLASMA TRANSPORT: TWO DIMENSIONAL SCALAR FORMULATION OF THE INITIAL BOUNDARY VALUE PROBLEM AND QUASI ONE DIMENSIONAL MODELS. Thesis - Utrecht Univ.
J. W. Mugge. Oct. 1979. 242 p. refs. Sponsored by EURATOM and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek.
(Rept-79-120) Avail: NTIS. HC A11/MF A01

The collisional plasma transport problem was formulated as an initial boundary value problem for general characteristic boundary conditions. Starting from the full set of hydrodynamic and electrodynamic equations, an expansion in the electron-ion mass ratio together with a multiple timescale method yield simplified equations on each timescale. Through the introduction of potentials a two dimensional scalar formulation in terms of quasilinear integrodifferential equations of second order for a domain consisting of plasma and vacuum subdomains was obtained. For both one dimensional and quasi-one dimensional geometries the initial boundary value problem was reduced to a free boundary problem consisting of a system of four strongly coupled quasilinear second order integrodifferential equations of the parabolic type with plasma boundary conditions of a generalized third type. The local plasma velocity as well as the spatial second order differential structure (diffusion matrix) were explicity derived for both the plane and circular slab (belt) geometry. Author (ESA)

N80-31224# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
IDEAL MAGNETOHYDRODYNAMIC EQUILIBRIUM OF A WEAKLY TOROIDAL PLASMA WITH ELONGATED CROSS SECTION. PART 1: ELLIPTIC CROSS SECTION
W. Schuurman and E. J. M. VanHeesch. Oct. 1979. 21 p. refs. Sponsored by EURATOM and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek.
(Rept-79-121-Pt-1) Avail: NTIS. HC A02/MF A01

Analytic solutions are constructed of the ideal magnetohydrodynamic equations describing the equilibrium of a toroidal plasma with an elliptic cross section and surrounded by vacuum. The method used is a series expansion in the inverse aspect ratio. The toroidal effects considered include the appearance of a toroidal surface current and a shift of the stagnation points in the vacuum towards the major axis of the torus. The demand of negligible second order effects excludes the appearance of a second magnetic axis or any other equilibrium limit on beta. With a metal wall placed arbitrarily on one of the flux surfaces in the vacuum, a formula is derived for the toroidal shift of the plasma column as a function of the compression ratio, the poloidal beta and the ellipticity. Numerical examples show that for high compression ratios the toroidal shift decreases considerably if the ellipticity is increased. At low values of the compression ratio, however, there exists a critical ellipticity where the toroidal displacement has a minimum. Author (ESA)

N80-31225# Messerschmidt-Boelkow G.m.b.H., Ottobrunn (West Germany).
EFFECTIVE COLLISION FREQUENCY AND ELECTRON TEMPERATURE IN A WEAKLY IONIZED ARGON PLASMA
C.-P. Schneider. 18 Oct. 1979. 23 p. refs.
(MBB-UA-498-79OE) Avail: NTIS. HC A02/MF A01

The effective collison frequency, nu, of a low density, shock heated argon plasma under the influence of a weak electric field which oscillates harmonically with angular frequency sigma was calculated. It is shown that for the high frequency case sigma > nu bar where nu bar is the collision frequency in a Maxwellian gas plasma, one has nu asymptotic to 2 nu bar provided that the imaginary part of the argon plasma conductivity is negligibly small in comparison to the real part. The influence of the theoretical model used to calculate nu on the values of the electron temperature derived from measurements is next compared to results obtained by data reduction in which the hard sphere model for particle encounters was utilized. It is found that a single power law assumption for argon electron cross sections over the temperature range 3000 to 10,000 K leads to appreciable errors. Therefore, a numerically integrated average momentum corss section is considered to yield most accurate results when applied in connection with the hard sphere model. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-31226 California Inst. of Tech., Pasadena.
INFLUENCE OF JOSEPHSON EFFECT ON PROXIMITY COUPLED SUPERCONDUCTORS. Ph.D. Thesis
Warren Yiu-Cho Lai. 1980. 264 p.
Avail: Univ. Microfilms Order No. 8020423

Experimental investigations to examine the influence of Josephson effect on proximity coupled superconductors are reported. The results are interpreted with a proposed physical model that incorporates spatial gradients in both the phase and the amplitude of the proximity induced energy gap. Calculations based on this model successfully describe and explain most of the experimental observations. This model also indicates the

evolution of weak coupling (Josephson effects with two superconductors) to strong coupling (phase slip in one dimensional superconductor) in superconductivity. A major influence of Josephson effect on proximity coupled superconductors is the distinction between the phase in the current-phase relationship and phase in the voltage-phase relationship in both the stationary and nonstationary situations. This distinction leads to the possibility of multiple states of proximity induced superconductivity. The transition between these states is identified as a phase slip process involving phase change of less than 2 pi. This phase slip in the nonstationary regime results in a supercurrent with an a.c. component and a d.c. component. Dissert. Abstr.

N80-31227 Oregon Univ., Eugene.
QUANTUM LIMIT MAGNETOCONDUCTIVITY IN THE DILUTE IMPURITY REGIME Ph.D. Thesis
Shamsi-Deen Babatunde Elegba 1980 115 p
Avail: Univ. Microfilms Order No. 8018850

A system containing a low concentration of impurities with short-ranged potentials in the presence of a very strong magnetic field is investigated. Here, fairly realistic potential models such as the Thomas-Fermi potential are considered. These potential models are approximated in a systematic fashion to obtain a potential model for which there is an exact expression for the single site t-matrix. The single site t-matrix is then inserted into a general expression for the static magnetoconductivity tensor. The potential models used are all non-local and their non-locality alters the velocity operator which in turn changes the transport properties of the system. A generalization of the Nozieres result is obtained for the Hall conductivity sigma xy plus a correction term which is very important in the case of strong potential scattering. Thus the Hall conductivity obtained in this work can differ greatly from the usual semiclassical expression for strong scattering. The result obtained for sigma xx in the present work is, however, similar to Noziers' except that the inconsistency in the potential model leads to a different numerical result. Dissert. Abstr.

N80-31228 Pennsylvania Univ., Philadelphia.
INELASTIC ELECTRON TUNNELING SPECTROSCOPY INTENSITIES AS A FUNCTION OF SURFACE COVERAGE: EXPERIMENTAL DETERMINATION, PHYSICAL MODEL, AND APPLICATION Ph.D. Thesis
Andrew Arnold Cederberg 1980 152 p
Avail: Univ. Microfilms Order No. 8018531

Inelastic Electron Tunneling (IET) spectra were taken using standard experimental techniques and a liquid doping procedure. The surface coverage determined independently by selecting the dopant solution concentration. The connection between dopant solution concentration and surface coverage is explained by using a statistical mechanical model to derive adsorption isotherms relevant to IETS doping. Using the adsorption isothermal analysis, the binding energy of the benzoate ion on alumina is extracted from published experimental data. Intensities for nine modes of benzoic acid are examined at coverages of 9 percent to 83 percent of full monolayer coverage and one mode of acetic acid is studied at coverages from 25 percent to 95 percent of monolayer coverage. It is found that IETS intensity, defined in the usual way as the normalized change in conductance, is a nonlinear function of surface coverage. A physical model is presented which attributes this behavior to a difference in elastic tunneling conductances for electrons traversing empty or filled regions of the dopant layer in a partially doped IET junction. The intensity results are applied to the study of the reaction which binds the acid to the oxide surface during IETS doping. Dissert. Abstr.

N80-31229 Pennsylvania Univ., Philadelphia.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF BONDING OF SIMPLE LIGANDS TO METAL COMPLEXES AS REFLECTED IN THEIR PHOTOELECTRON SPECTRA Ph.D. Thesis
Guillermo Manuel Loubriel 1980 212 p
Avail: Univ. Microfilms Order No. 8018575

The interaction between small molecules and transition metal atoms is investigated. Nitric oxide adsorbed on clean metal surfaces and transition metal complexes like Cr(NO)4, Cr(CO)6 and Ni(CO)4 were studied. The approach used was to learn as much as possible about the electronic structure and bonding in carbonyls and nitrosyls where the atomic positions were known and use this knowledge to help determine the bonding geometry of NO adsorbed on Ni(100). In addition to the analysis of photoemission, theoretical calculations of electronic structure via the self-consistent field X alpha multiple scattering technique were performed. The bonding of NO to transition metal atoms occurs mainly through the interaction of the levels of the metal atom and the 2 pi level of NO. In Cr(NO)4 this bonding is reflected in a charge transfer of about half an electron into the 2 pi level of each one of the NO molecules. The results of first principles calculations of shakeup energies and shakeup intensities for the photo-electron spectra of carbonyls and nitrosyls are reported. The mechanisms by which core holes produced by the photo-excitation are screened are discussed. The results for Ni(CO)4 and Cr(NO)4 are in excellent agreement with experiment. Dissert. Abstr.

N80-31230 Pennsylvania Univ., Philadelphia.
RESONANCES AND COLLECTIVE EFFECTS IN PHOTOEMISSION Ph.D. Thesis
Harry Jay Levinson 1980 175 p
Avail: Univ. Microfilms Order No. 8018572

Factors which determine the intensity of photoionization other than a system's initial state, in atoms, molecules, and solids were investigated. The effect of dielectric response on surface photoemission has been studied on Al(001). In a spectral region where the metal was far from transparent (near or below the bulk plasma frequency) a spatially varying photon field at the metal surface was found to contribute significantly to the photoionization cross section. The actual cross section was more than an order of magnitude larger than the inappropriate result obtained within the dipole approximation. This was ascertained by making an absolute determination of the photoionization cross section for the surface state and Fermi level on Al(001). A gas phase spectrometer capable of measuring angle-resolved cross sections was used to study asymmetry parameters in N2 and branching ratios of the spin orbit split 5p level in xenon using synchrotron radiation. The affect of final state resonances on the photoionization cross section from SF6 were studied by a theoretical self consistent field X alpha calculation. A breakdown of the single particle picture was observed. Dissert. Abstr.

N80-31231 California Univ., Santa Barbara.
STUDY AND CHARACTERIZATION OF SEMICONDUCTOR SURFACES AND INTERFACES Ph.D. Thesis
John David Langan 1979 279 p
Avail: Univ. Microfilms Order No. 8019842

Indium antimonide surfaces were prepared with surface state densities less than 10 to the 10th power 2V/sq cm and without capacitance voltage hysteresis by preservation of the thin, natural oxide on the substrate surface. Quasi-static capacitance-voltage and conductance measurements were made on MOS structures. It is shown that apparent measurements on InSb structures of high surface state densities in capacitance and conductance techniques could be due to misinterpretation because of the presence of surface potential lateral inhomogeneity. The presence, chemical identification, and thickness of the natural oxide, both before and after the LTCVD process were independently confirmed by Auger electron spectroscopy and X-ray photoelectron spectroscopy. The oxidation state and resultant electrical properties are identified with changes in LTCVD reactor conditions. In general, the natural oxide composition is shown to be In2O3 and Sb2O3, although Sb oxide is removed during the LTCVD reaction, due to the volatility of Sb. The relative Sb/In ratio varies within the oxide, but generally is 0.25. Dissert. Abstr.

N80-31232 Michigan State Univ., East Lansing.
MICROSTRUCTURAL ASPECTS OF IMPACT OF EROSION IN LiF, NaCl, KCl AND CaF2 SINGLE CRYSTALS Ph.D. Thesis
Susan Roberta Schuon 1980 119 p
Avail: Univ. Microfilms Order No. 8020737

To clarify the fundamental mechanisms of material removal in erosion by solid particles entrained in a fluid stream impinging on a solid surface, single crystals were selected for targets in view of their precisely defined structure. The damage to the target by impact of a single particle ('single-impact mode') and by impact of a stream of particles ('multiple-impact mode') was

studied by scanning electron microscopy. In addition, the damage by multiple impact was assessed by measuring the erosion rate. In the single impact mode, the damage is highly dependent on the mechanical properties of the target as chips spalled off or micromachined out in individual impacts. At normal impact, the predominant mechanism is intersecting fractures, but at impact angles away from the normal, micromachining appears. NaCl and KCl, and in fact becomes the major mechanism of material removal. In LiF, only a little micromachining occurs and in CaF2, none at all; hence in these materials, spalling is the controlling mechanism for loss in individual impacts. Dissert. Abstr.

N80-31233 North Carolina State Univ. at Raleigh.
COMPARISON OF ATOMIC CONCENTRATION PROFILES, DEFECT DENSITY PROFILES, AND TYPES OF MICROSTRUCTURAL DEFECTS IN GaAs ANNEALED AFTER IMPLANTATION WITH Be Ph.D. Thesis
Kae-Shyong Lee 1979 69 p
Avail: Univ. Microfilms Order No. 8020494

Semi-insulating chromium-doped GaAs was implanted with 100 keV Be ions to fluences of 5 x 10 to the 13th power and 1 x 10 to the 15th power ions/sq cm. Specimens were annealed at 800 C for thirty minutes. Beryllium atomic concentration profiles, as determined by secondary ion mass spectrometry, were compared to the defect profiles obtained from transmission electron stereomicroscopy techniques for the annealed samples. A major redistribution of Be was observed compared to the as-implanted distribution after annealing at the higher fluence, whereas only a slight redistribution of Be occurred for the lower fluence. A major difference in the defect density profiles was observed with the fluences used for this study in the region where the annealed specimens were compared. The distribution of defects throughout the implanted-annealed layer was examined using sectioned specimens. The distribution and size of defects appear to be directly influenced by the Be concentration and its associated implantation induced damage. In addition, chromium doped semi-insulation /001/ GaAs was annealed at elevated temperatures after implantation with a Be fluence of 1 x 10 to the 15th power ions/sq cm at 60 keV. Dissert. Abstr.

N80-31234 Stanford Univ., Calif.
ADLAYER EFFECTS ON THE SURFACE REACTIVITY OF W(100) AND Mo(100) SINGLE CRYSTALS Ph.D. Thesis
Edmond Inq-Ming Ko 1980 282 p
Avail: Univ. Microfilms Order No. 8016841

The surface reactivity of W(100) and Mo(100) single crystals with adsorbed carbon and oxygen was studied using flash desorption spectroscopy and temperature programmed reaction spectroscopy. Carbon and oxygen adatoms were deposited by the thermal cracking of ethylene and the chemisorption of molecular oxygen, respectively. For either adatom several ordered overlayers were observed as a function of coverage and temperature. The presence of either carbon or oxygen severely hindered the ability of W(100) and Mo(100) to dissociatively chemisorb hydrogen or carbon monoxide. In the case of carbon, a correlation was found between the available fourfold sites on the surface and the amount of carbon monoxide dissociated. The ability of the carbide surface to adsorb molecular carbon monoxide was not significantly affected. On the other hand, oxygen was found to suppress the chemisorption of molecular carbon monoxide at room temperature as it reduced the carbon monoxide binding energy considerably more than carbon. Dissert. Abstr.

N80-31235 Iowa State Univ. of Science and Technology, Ames.
RAMAN SCATTERING BY A MOLECULE ADSORBED AT THE SURFACE OF A THIN METALLIC FILM Ph.D. Thesis
Mark Francis Wright 1980 81 p
Avail: Univ. Microfilms Order No. 8019677

The Raman scattering cross section is calculated using standard third order perturbation theory. The scattering is viewed as a three-stage process: an electron-hole pair is created in the metal by the incident photon; the excited electron scatters off the molecule inelastically, exciting a molecular vibration; the electron finally recombines with the hole emitting the Raman scattered photon. The electrons in the film are confined by infinite potential barriers at the surfaces, but are otherwise free. The resulting sinusoidal one-electron eigenfunctions are used to calculate the nonlocal conductivity tensor in the random phase approximation. Maxwell's equations are then used to determine the vector potential inside the film, which allows the electron-photon matrix elements to be calculated. The electron-molecule interaction is deduced from experimental data on low energy inelastic electron scattering from polar molecules. Calculations are performed for the frequency dependence of the Raman cross section with two different film thicknesses. Dissert. Abstr.

N80-31236 Iowa State Univ. of Science and Technology, Ames.
ELECTRONIC BAND STRUCTURE AND OPTICAL PROPERTIES OF THE CUBIC Sc, Y AND La HYDRIDE SYSTEMS Ph.D. Thesis
Douglas Jay Peterman 1980 122 p
Avail: Univ. Microfilms Order No. 8019657

Self-consistent band calculations of ScH2 and YH2 were carried out using the Korringa-Kohn-Rostoker method. The respective joint densities of states were computed and compared to the dielectric functions determined from the optical measurements of Weaver, Rosei and Peterson. Additional calculations were performed in which the Fermi level or band gap energies were rigidly shifted by a small energy increment. These calculations were used to simulate the derivative structure in thermomodulation spectra and relate the origin of experimental interband features to the calculated energy bands. While good systematic agreement was obtained for several spectral features, the origin of low-energy interband transitions in YH2 cannot be explained by these calculated bands. Measurements of the optical absorptivity of LaH(x) with $1.6 < x < 2.9$ are presented which, as expected, indicate a more premature occupation of the octahedral sites in the larger LaH2 lattice. These experimental results also suggest that, in contrast to recent calculations, LaH3 is a small-band-gap semiconductor. Dissert. Abstr.

N80-31237 California Univ., Santa Barbara.
SURFACE PLASMONS CONFINED BY MICROSTRUCTURES Ph.D. Thesis
Ronald Wallace Rendell 1979 174 p
Avail: Univ. Microfilms Order No. 8019845

Surface plasmons confined by microstructures on tunnel junctions are theoretically examined. A theory of surface plasmons excited by inelastic electron tunneling is formulated in a way which can be conveniently modified to take into account the effects of a random distribution of impurities in the counterelectrode. Two qualitatively different dispersion regimes found in the smooth junction surface plasmons suggest a convenient and natural division of possible microstructure excitations into two types: gap modes which are confined to a region beneath the microstructure, and rod modes which are confined to the bulk of the microstructure. The frequency, angular, polarization, and surface distribution dependence of optical emission by the rod and gap modes excited by inelastic tunneling are examined in detail. In addition, the cases of microstructures raised above a junction, superconducting microstructures, and microstructures in an external field are discussed. Dissert. Abstr.

N80-31238 California Inst. of Tech., Pasadena.
PHONON REFLECTION FROM CRYSTAL INTERFACES AND THE KAPITZA PROBLEM Ph.D. Thesis
Peter Taborek 1979 123 p
Avail: Univ. Microfilms Order No. 8020432

The heat pulse technique is used to study phonon reflection from sapphire-vacuum and sapphire-liquid helium interfaces. In order to interpret the complex time-of-flight spectra, the problem of the reflection of elastic waves in an anisotropic medium is analyzed in detail. The analysis shows that there are, in general, nine phonon reflection processes, each with a different time of flight, which transfer energy from heater to detector via a single reflection. Although the sharp features in the reflection signal due to specular (k micron conserved) processes can be explained using anisotropic elastic theory, approximately half the energy which reaches the detector arrives via nonspecular channels. The non-specular scattering, which may be due to surface roughness, gives rise to broad features in the signal. The main difference between crystal-vacuum and crystal-helium reflection signals is that the non-specular signal is much smaller for the helium covered surface. The specular signal is not affected by helium. Apparently, the non-specular processes are involved in the anomalous Kapitza conductance. A method of analyzing

phonon focusing based on an asymptotic analysis of the phonon Green's function is developed. Dissert. Abstr.

N80-31239 Pennsylvania Univ., Philadelphia.
STRUCTURAL AND ELECTRONIC PROPERTIES OF A LINEAR CHAIN MERCURY COMPOUND Ph.D. Thesis
Richard David Spal 1980 171 p
Avail: Univ. Microfilms Order No. 8018614

The quasi one dimensional metal consists of one dimensional lattices, or chains, of Hg atoms, periodically arrayed in channels along the a and b axes of a three dimensional, tetragonal host lattice of AsF6(-) octahedra. The primary properties investigated were X-ray scattering, dc conductivity and Hall effect, and the Meissner effect. The compound exhibits usual type 1 superconductivity, and unusual, anisotropic superconductivity at low temperatures. Meissner effect observations demonstrate type 1 superconductivity with a critical temperature of 43 K and a critical field of about 20 G. Between .43 and 4.1 K, conductivity and magnetization measurements reveal anisotropic superconductivity, with a critical field curve similar to that of Hg. Detailed analysis of the data shows that the origin of the anisotropic superconductivity is not surface Hg, as proposed in the literature, nor Hg inclusions with minimum dimensions of at least 1 micron but may be smaller inclusions which are strongly influenced by the proximity effect. Dissert. Abstr.

N80-31240 Cornell Univ., Ithaca, N. Y.
DIFFUSION INDUCED GRAIN BOUNDARY MIGRATION IN Au-Cu AND Au-Ag THIN FILMS Ph.D. Thesis
Ju-Don Pan 1980 142 p
Avail: Univ. Microfilms Order No. 8020865

Diffusion induced grain boundary migration was studied by employing Au-Cu and Au-Ag thin film specimens. The results support the conclusion that this phenomenon is widespread and that it can lead to boundary migration and bulk composition change under conditions where neither is expected. Two approaches were employed to study this phenomenon. In the first approach polycrystalline gold thin films were coated with either copper or silver layers annealed and etched in an appropriate acid bath to strip off the copper or silver layers. The microstructure and the chemical composition of these alloy zones, were studied by means of both transmission electron microscopy and scanning transmission electron microscopy. In the second approach coated gold thin films were depth profiled by combined Auger Electron Spectroscopy and Xe Ion Sputtering. In both approaches, it was observed that the boundary migration rate decreased as the migration proceeded. Dissert. Abstr.

N80-31241# Royal Aircraft Establishment, Farnborough (England).
LIQUID CRYSTALS (NEMATIC LIQUIDS)
K.-H. Walter, W. Geffecken, and W. Geubel 30 Oct. 1979 94 p refs Transl. into ENGLISH of "Flussige Kristalle (Nematische Flussigkeiten)", Rept. BMFT-FB-T-76-71 Siemens A.G., Munich, 1976
(RAE-Lib-Trans-2020; BR72936; BMFT-FB-T-76-71) Avail: NTIS HC A06/MF A01

The development of a screen matrix with liquid crystals is described. The starting point was primarily a matrix concept that envisaged auxiliary elements for the decoupling. However, the concept of using liquid crystals capable of storage proved to be more advantageous in regard to actual realization and the attainment of higher resolution. The end result of the work is a matrix consisting of 16,000 image-pints (each 0.5 x 0.5 sq mm) that utilizes the bistability effect, is suited to the representation of graphical data or alphanumeric symbols, and operates in an erase-write action. Circuit concepts for the integration of the driver elements are worked out. The technological problems associated with the Matrix as well as with general liquid crystal displays (such as surface purification, surface orientation, sealing techniques, and aging processes) are treated. L.F.M.

N80-31242*# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
EPITAXIAL GROWTH OF SINGLE CRYSTAL FILMS Final Report, 4 Oct. 1975 - 31 May 1980
M. D. Lind May 1980 36 p refs
(Contract NAS8-31733)
(NASA-CR-161544; ERC41001.30FR) Avail: NTIS HC A03/MF A01 CSCL 20L

An experiment in gallium arsenide liquid phase epitaxy was performed successfully on the SPAR 6 flight October 17, 1979. The design, fabrication, and testing of the experimental apparatus, and the performance and results of the experiment are discussed. Author

N80-31243# Marquette Univ., Milwaukee, Wis. Dept. of Physics.
ELECTRICAL CHARACTERIZATION OF GERMANIUM IMPLANTED GALLIUM ARSENIDE Final Report, 1 Jun. 1979 - 31 May 1980
Frank L. Pedrotti 2 Jun. 1980 8 p refs
(Grant AF-AFOSR-0113-79; AF Proj. 2306)
(AD-A086652; AFOSR-80-0462TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

The amphoteric electrical properties of germanium single implants into gallium arsenide, and of dual implants of germanium with either gallium or arsenic into gallium arsenide, have been studied. Room temperature implantation was performed for all implanted ions at 120 keV, with doses ranging from 5E12 to 3E15 ions per square centimeter. Implanted samples were annealed with pyrolytic silicon nitride encapsulants at temperatures ranging from 700 to 1000 degrees Celsius. Both p- and n-type layers were observed. Type of conductivity, electrical activation, and carrier mobility were found to depend critically upon ion dose and anneal temperature. The general electrical behavior suggests that in samples of lower dose and anneal temperature, the implanted Ge ions go into As sites preferentially, producing p-type activity, whereas in samples of higher dose and anneal temperature, more Ge ions go into Ga sites, producing n-type activity. Conductivity was found to change from p- to n-type at an intermediate dose of 3E14 ions per square centimeter and at an anneal temperature between 900 and 950 degrees Celsius. It has been determined that additional implantation of As into GaAs Ge favors Ge occupancy of Ga sites and an enhancement of n-type activity, whereas the additional implantation of Ga encourages Ge occupancy of As sites and an enhancement of p-type activity. Enhancement factors of as much as 8 for p-type activations, and as much as 50 for n-type activations have been measured. GRA

N80-31244# Varian Associates, Palo Alto, Calif. Solid State Lab.
SUBMICRON FETS USING MOLECULAR BEAM EPITAXY Annual Report, Aug. 1978 - Aug. 1979
S. Bandy, D. Collins, and C. Nishimoto Aug. 1979 44 p refs
(Contract N00014-77-C-0655; RF62581001)
(AD-A086422; AR-2) Avail: NTIS HC A03/MF A01 CSCL 20/12

Electron-beam exposure and MBE material have been used to achieve quarter-micron gate length GaAs FETs. A noise figure of 1.5 dB with an associated gain of 15 dB has been measured at 8 GHz. GRA

N80-31245# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
DOUBLY ROTATED CUT SAW DEVICES Interim Report, 15 Aug. 1979 - 1 Mar. 1980
D. F. Williams and F. Y. Cho Jun. 1980 113 p refs
(Contract DAAK20-79-C-0275)
(AD-A086734; DELET-TR-79-0275-1; IR-1) Avail: NTIS HC A06/MF A01 CSCL 20/2

The objective of this program is the exploratory development of doubly rotated cuts of quartz possessing superior Surface Acoustic Wave (SAW) properties for applications involving environmentally hardened devices. The key properties examined and optimized both theoretically and experimentally are: first, second and third order Temperature Coefficients of Delay (TCD), piezoelectric coupling factor, power flow angle, Bulk Acoustic Wave (BAW) inverse velocity surfaces, degeneracies and leaky waves, and sensitivities of the above quantities to misorientations and manufacturing tolerances. The program consists of two major task areas comprising an interactive numerical/experimental approach. Task 1 involves the numerical computation of the key SAW properties for doubly rotated quartz substrates for the purpose of locating promising angular ranges with properties

superior to the singly rotated cuts now in existence. More detailed calculations follow to refine the angular coordinates in order to specify cuts for experimental verification in Task 2. In Task 2, sets of substrates with promising orientations identified in Task 1 will be prepared and SAW device patterns will be fabricated for evaluation of the key SAW properties. The experimental results of this task will be correlated with the theoretical predictions and an iterative process develops for refinement of both theoretical and experimental parameters. As the program proceeds, working SAW device models will be delivered as a demonstration of progress and an indication of the future potential of the doubly rotated cuts. GRA

N80-31246# Litton Systems, Inc., Morris Plains, N. J. Airtron Div.
THE GROWTH OF BERLINITE (AlPO4) SINGLE CRYSTALS Final Report, 1 Jul. 1977 - 30 Sep. 1979
Larry E. Drafall and Roger F. Belt Mar. 1980 75 p refs
(Contract F19628-77-C-0213)
(AD-A086751; RADC-TR-80-73) Avail: NTIS HC A04/MF A01 CSCL 20/2

Single crystals of the berlinite mineral phase of anhydrous aluminum orthophosphate have been grown for possible surface acoustic wave applications. The desired piezoelectric form of AlPO4 is the alpha-phase which is stable from 130 to 580 C. A seeded hydrothermal growth technique was used. Nutrient was prepared by heating hydrated alumina and phosphoric acid in a sealed silver liner from 140 to 200 C at a rate of 5 deg/day and a 15 deg temperature gradient. Because AlPO4 has retrograde solubility, the nutrient was placed in a silver mesh basket in the upper, cooler portion of the liner with the seeds situated in the lower, hotter portion. A 20% free area baffle separated the two regions. Two basic techniques were used for the growth runs. The constant temperature method with a 10 C gradient produced rates of 23-25 mils/day. The rates could be varied significantly depending on such parameters as growth temperature, gradient, nutrient basket mesh size, seed orientation and baffle design. The second technique used increasing temperature at a rate of 5 C/day over the range of 140-200 C to obtain average growth rates of 22-32 mils/day. Seed orientation for most runs was (0001) plates. New growth of AlPO4 for the most part was clear and of fair quality. GRA

N80-31247# Cornell Univ., Ithaca, N. Y.
GROWTH OF GRAIN BOUNDARY CAVITIES UNDER APPLIED STRESS AND INTERNAL PRESSURE
James F. Mancuso (Combustion Engineering, Windsor, Conn.) and Che-Yu Li 1980 21 p refs
(Contract EY-76-S-02-2172)
(COO-2172-26) Avail: NTIS HC A02/MF A01

The growth of grain boundary cavities in nickel under internal pressure and applied stress is investigated. Under the experimental conditions, the growth kinetics was found to be controlled by stress induced mass transfer. The growth rate was found not to be a linear function of the applied stress. The growth rate was found to depend on grain boundary orientation and grain boundary sliding. DOE

N80-31248# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Solid State Physics Research Lab.
IMPURITY STUDIES IN THE SINGLE CRYSTAL CADMIUM SULFIDE Final Report, 1966 - 1974
Lawrence C. Greene Dec. 1979 125 p refs
(AF Proj. 7885)
(AD-A086741; AFML-TR-79-4104) Avail: NTIS HC A06/MF A01 CSCL 20/2

In cadmium sulfide crystals, an easily observed and measured phenomenon is the low temperature bound exciton emission spectrum. The spectral lines are sharp, and their wavelength can be measured with considerable precision. The spectral position of the lines in a magnetic field can tell us much about the symmetry and structure of the center. The purpose of this work was to establish a relationship between the bound exciton spectra and defect or impurity structure of the crystal. A line associated with a neutral donor and a pair of lines associated with an ionized donor were found for the very purest material. A neutral donor was found for crystals equilibrated in hydrogen, and a pair of ionized donors for material equilibrated in hydrogen sulfide. Lithium doped crystals showed several pairs of ionized donor lines as well as a large number of characteristic neutral donor lines. Silver doping produced a large number of characteristic lines, but the nature of the associated centers has not been established. Sodium showed many characteristic lines, some associated with neutral donors, some with ionized donors, as well as lines clearly associated with complex structures. Potassium and rubidium both showed characteristic ionized donor lines. GRA

N80-31249# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
GaAs SURFACE EFFECTS Interim Technical Report, 1 Jul. 1978 - 1 Jul. 1979
G. Kinoshita and Gordon G. Kuhlmann Wright-Patterson AFB, Ohio AFWAL Mar. 1980 61 p refs
(Contract F33615-78-C-1591; AF Proj. 2305)
(AD-A087033; C79-1032/501; AFWAL-TR-80-1018) Avail: NTIS HC A04/MF A01 CSCL 07/4

This report presents the results of the first six months of a program to investigate the passivation of GaAs surfaces using a native insulator. Ion implantation of phosphorus and subsequent oxidation of the surface was used to form the insulator. Post-implant annealing indicates that CVD SiO2 has somewhat better encapsulating properties than sputtered Si3N4. It was found that high dose phosphorus implantation significantly reduces decomposition of the semiconductor surface under the SiO2 encapsulant during high temperature annealing. Ion microprobe analysis of the implant profiles indicate that phosphorus diffusion is not significant during either high temperature annealing or oxidation. Elemental depth profiles of oxide layers indicate phosphorus incorporation into the film in the region from the peak of the implant to the interface with the semiconductor. A lack of arsenic and phosphorus at the oxide surfaces indicates that this region may be composed primarily of Ga2O3. GRA

N80-31250# New Univ. of Ulster, Coleraine (Northern Ireland). School of Physical Sciences.
GROWTH AND APPLICATION OF CADMIUM TELLURIDE Final Technical Report, Feb. 1977 - Jan. 1980
R. H. Williams and M. H. Patterson Jan. 1980 171 p refs
(Grant DA-ERO-77-G-026; DA Proj. 1T1-61102-BH-57)
(AD-A086991) Avail: NTIS HC A08/MF A01 CSCL 20/2

Large Single Crystals of CdTe were grown by the methods of Liquid Encapsulated Czochralski, Fast Vertical Bridgman, Travelling Heater Method, Stockbarger method. Electrical characterization was done by Seebeck, Hall Effect and Conductivity measurements. Surfaces were investigated using XPS, UPS, AES and LEED. Metal-CdTe contacts were fabricated. Formation of these was monitored using XPS, UPS, LEED, AES. Barrier Heights were established by I-V, C-V and UPS measurements. Results show that the effect of the CdTe surface on the type of contact formed is very marked. GRA

N80-31251# Naval Research Lab., Washington, D. C. Solid State Devices Branch.
GaAs FET DEVICE FABRICATION AND ION IMPLANTATION TECHNOLOGY Summary Report, 1 Oct. 1978 - 30 Sep. 1979
Kenneth J. Sleger and Harry B. Dietrich 25 Jun. 1980 26 p refs
(ZF54581001)
(AD-A087004; AD-E000481; NRL-MR-4263) Avail: NTIS HC A03/MF A01 CSCL 09/1

Microwave device fabrication and evaluation in conjunction with ion implantation has been selected to provide a benchmark technology for evaluation of semi-insulating GaAs and InP grown at NRL and elsewhere. Devices have been processed by a combination of conventional contact photolithography and liftoff techniques to achieve geometries with linewidths as small as 0.8 microns. A plasma deposited layer of Si3N4 has been employed as an annealing encapsulant at temperatures between 800 C and 850 C for 15-30 minutes (GaAs) or 700 C - 750 C for 15 minutes (InP). Si and Se were used as the principal implant species. During this period, the Si3N4 encapsulation process and the fabrication of GaAs FETs with one micron gate lengths and noise figures below 2.4 dB at 6 GHz have become routine. Difference in microwave performance between ion

implanted channel and epitaxial channel (industrially supplied) GaAs FETs was systematically correlated with various materials parameters such as mobility and light sensitivity and with static FET characteristics such as looping, backside gating, pinch-off voltage and transconductance. Experimental results indicate that good microwave performance can be obtained even though a few of the static or material characteristics are independently judged to be substandard. GRA

N80-31252# Los Alamos Scientific Lab., N. Mex.
ELECTRON RESPONSE THEORY OF LATTICE VIBRATIONS: EMERGENCE OF CONCEPTS AND A GLANCE AT THE FUTURE
D. C. Wallace. 1980. 21 p. refs. Presented at Condensed Matter Div. of European Phys. Soc. Conf., Antwerp, 9-11 Apr. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1000; CONF-800468) Avail: NTIS HC A02/MF A01
Lattice dynamics, the theory of phonons, is historically reviewed. Electronic structure solids and superconductivity are discussed. Speculations on the future of solid state physics are presented. E.D.K.

N80-31253# Oak Ridge National Lab., Tenn.
ADVANCED DESIGNS FOR HIGHLY STABLE SUPERCONDUCTOR SYSTEMS
J. W. Lue and J. R. Miller. 1979. 11 p. refs. Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791102-148) Avail: NTIS HC A02/MF A01
A basic conductor design is given to take advantage of the enhanced stability of cable-in-conduct conductors brought about by transient pressure waves in helium. The design is discussed in terms of manufacturability, performance, and applicability in large fusion magnets. A few small scale test conductors have been constructed. Preliminary test results on the performance of one of them is included. Possible variations offered by the flexibility of the basic design is also discussed. DOE

N80-31254# Oak Ridge National Lab., Tenn. Solid State Div.
CRYSTAL DEFECT STUDIES USING X-RAY DIFFUSE SCATTERING
1980. 19 p. refs. Presented at Am. Inst. of Metal. Engr. Meeting, Las Vegas, Nev., Feb. 1980
(Contract W-7405-eng-26)
(CONF-800205-7) Avail: NTIS HC A02/MF A01
The effect of interruptions of the crystal lattice on the scattering of X-rays is considered, and examples are presented of the use of the diffuse scattering to study the defects. X-ray studies of self-interstitials in electron irradiated aluminum and copper are discussed in terms of the identifications of the interstitial configuration. Methods for detecting the onset of point defect aggregation into dislocation loops are considered and techniques for determination of separate size distributions for vacancy loops and interstitial loops are presented. Direct comparisons of dislocation loop measurements by X-rays with existing electron microscopy studies of dislocation loops indicate agreements of large size loops, but X-ray measurements report higher concentration in the smaller loop range. Methods for distinguishing between loops and three dimensinal precipitates are discussed and possibilities for detailed studies considered. DOE

N80-31255# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.
SEQUENTIAL PURIFICATION AND CRYSTAL GROWTH FOR THE PRODUCTION OF LOW COST SILICON SUBSTRATES Quarterly Technical Progress Report, 15 Sep. - 31 Dec. 1979
Ming Liaw, Frank Secco, Bill Ingle, and Don Down. Feb. 1980. 42 p. refs.
(Contract EG-77-C-01-4042)
(DOE/SERI-8119-3/1; QTPR-1) Avail: NTIS HC A03/MF A01
The direct purification of MG-Si is being investigated. A unique characteristic of the approach used by this project is the use of a crystal puller to perform both purification and crystal growth. Sequential steps of purification were taken. By the completion of this series of purification, the purified MG-Si melt will be further purified by impurity redistribution using ingot pulling. The final purified silicon will be in an ingot form of desired dimensions for slicing into silicon sheets. The sequential steps of purification include: (1) leaching of MG-Si charge, (2) phase separation, (3) reactive gas treatment, (4) liquid-liquid extraction (called Slagging), and (5) purification by redistribution of impurities using ingot pulling. Progress on items (1) and (2) is reported. DOE

N80-31256# Ames Lab., Iowa. Dept. of Materials Science, Engineering and Physics.
ELECTRONIC STRUCTURE STUDIES OF METAL HYDRIDES
J. H. Weaver, D. T. Peterson, and D. J. Peterman. 1980. 23 p. refs. Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, 7 Apr. 1980. Prepared in cooperation with Wisconsin Univ., Stoughton
(Contract W-7405-eng-82)
(ISM-265; CONF-800402-1) Avail: NTIS HC A02/MF A01
Representative metal hydrides were examined through photoelectron and optical spectroscopies. The results are compared with predictions of the one-electron band model for the various metal-hydrogen systems. Generally excellent agreement is found. The discussion emphasizes Nb4H3 and the dihydrides of Sc, Y, Nd, Gd, Tb, Er, Lu, Hf, and Th. DOE

N80-31257# Ames Lab., Iowa. Dept. of Materials Science, Engineering and Physics.
OPTICAL AND PHOTOEMISSION STUDIES OF LANTHANUM HYDRIDES
D. J. Peterson and J. H. Weaver. 1980. 14 p. refs. Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, 7 Apr. 1980. Prepared in cooperation with Wisconsin Univ., Stoughton. Sponsored in part by NSF
(Contract W-7405-eng-82)
(ISM-264; CONF-800402-5) Avail: NTIS HC A02/MF A01
The results of optical absorptivity and photoemission measurements on lanthanum hydrides. LaH/sub x/(1.98 < or = x < or = 2.89) are reported. The low energy (< or = 0.5 eV) optical features in LaH/sub x/ are attributed to the filling of octahedral sites. Higher energy interband absorption involves states within the d band complex, analogous to other dihydrides. As x increases above 2.0, the optical features change rapidly due to the increase in the number of occupied octahedral sites. Various band structure studies suggest that LaH3 might be a semiconductor. Photoemission results show that as x increases, the d derived states at E/sub F/ are drawn down and that for LaH2 only very weak valence band emission is observed. The hydrogen derived bonding bands are shown centered approximately 5 eV below E/sub F/. Observed chemical shifts in the La 5p/sub 1/23/2/ cores are discussed for 1.98 < or = x < or = 2.89. DOE

N80-31258# Ames Lab., Iowa. Dept. of Physics.
METAL-ELECTROLYTE BOUNDARY STUDIES WITH IN SITU PHOTOEMISSION
D. E. Grider and T. E. Furtak. 1980. 18 p. refs. Presented at the Conf. on Non-traditional Approaches to the Study of the SolidElectrolyte Interface, Snowmass, Colo., 23 Sep. 1979
(Contract W-7405-eng-82)
(ISM-257; CONF-790956-5) Avail: NTIS HC A02/MF A01
The boundary between copper (111) and 0.5 M H2SO4 is investigated using interfacial photoemission spectroscopy. Exploiting knowledge of electron momentum restrictions a feature in the ratio of p-polarized to s-polarized photoelectron yield was correlated with the onset of transitions to Bloch-like final states within the metal at 4.1 eV. This provide some energy specification in the electron energy integrated yield data. The quality of the interface was monitored using both clean and adsorbate (thiourea) covered Cu surfaces. The major effect of adsorption is attributed to a loss of conversation of electron momentum parallel to the surface during the emission process. DOE

N80-31259# Istituto Superiore di Sanita, Rome (Italy)
MOLECULAR REORIENTATIONS IN LIQUID CRYSTALS. THE 13 C -/1H/ NUCLEAR OVERHAUSER EFFECTS IN LIQUID MBBA
L. Radics (Central Research Inst. of Chemistry, Budapest, Hungary) and P. L. Indovina. 4 Jun. 1979. 30 p. refs. Sponsored by Italian National Research Council
(ISS-P-79/4) Avail: NTIS HC A03/MF A01

High resolution 13 C, 1H spin-lattice relaxation times (T(1)C, T(1)H) and 13 C-/1H/ nuclear Overhauser enhancement factors (NOEF) were measured at 25 MHz (T(1)C) as well as at 100 MHz (T(1)H) for the nematic liquid crystal N-(p-methoxybenzilidene)-p-n buthylaniline (MBBA) over the nematic-isotropic transition between 43 and 75 C. Most of the carbon atoms in the molecule exhibit highly reduced NOEEs indicating the presence of slow motions affecting the T(1) processes. On the basis of dilution experiments, the low frequency motions can be attributed to the overall reorientation of the molecule. Estimates of the respective correlation time give 2 nanosec which is an order of magnitude larger than the value currently accepted for this motion. It is shown that a model of slow overall reorientation and fast multiple internal rotation of groups can adequately explain the temperature dependence of the relaxation parameters and predict a substantial contribution to the frequency dependence of proton spin lattice relaxation time down to the MHz range. Author (ESA)

N80-31260# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany)
MEASUREMENT OF THE ENERGY DEPENDENCE OF THE INTEGRAL SCATTERING CROSS SECTION FOR ELECTRONIC STIMULATION IN SHOCKS OF ALKALI WITH MERCURY, WITH SPECTRAL ANALYSIS OF LIGHT. Thesis [MESSUNG DER ENERGIEABHAENGIGKEIT DES INTEGRALEN STREUQUERSCHNITTS FUER ELEKTRONISCHE ANREGUNG IN STOESSEN VON ALKALIEN MIT QUECKSILBER MIT SPEKTRALER ANALYSE DES LICHTES]
Udo Krause. Sep. 1979. 125 p. refs. In GERMAN
(MPIS-17/1979, ISSN-0436-1199) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21.60

An integral scattering experiment was performed with the measurement of the electronic stimulation of alkalies (Na, K, Rb) in the case of collisions with mercury. The energy field from 20 to 1400 eV was studied. Other measurements were made of integral cross section for the light emission in case of collisions of the three alkalies with CO2. The measurement were interpreted using adiabatic potential curves and with a comparison with quantum mechanics calculations. Author (ESA)

N80-31261# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany)
STUDY OF THE ANISOTROPIC POTENTIAL OF KCl AND CsCl IN A ROTATION INELASTIC COLLISION WITH RARE GASES. PART A: STUDY OF THE QUADRUPOLE MOMENT OF MOLECULES FROM ROTATION INELASTIC SCATTERING CROSS SECTIONS OF CsF. Thesis - Bonn Univ. [A. UNTERSUCHUNG DES LANGREICHWEITIGEN, ANISOTROPEN POTENTIALS VON KCL UND CSCL BEI ROTATIONSINELASTISCHEN STOESSEN MIT EDELGASEN. B. ERMITTLUNG DER QUADRUPOLMOMENTE VON MOLEKUELEN AUS ROTATIONSINELASTISCHEN STREUQUERSCHNITTEN DES CSF]
Gerhard Meyer. Oct. 1979. 150 p. refs. In GERMAN
(MPIS-19/1979-Pt-A) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25.80

The reversible potential for rotation inelastic shocks between molecules and atoms is studied. Some physical qualities such as the quadrupole moment of molecules with well known electrostatic potential are presented. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics, and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-31262 Johns Hopkins Univ., Baltimore, Md.
THERMODYNAMICS BASED ON A WORK INEQUALITY. Ph.D. Thesis
Chi-Sing Man. 1980. 147 p.
Avail: Univ. Microfilms Order No. 8020268

An attempt is made to extend Truesdell's work estimate (W sub 0) by seeking appropriate quantities, namely, the cumulative heat received C - , and the temperatures theta(-) sub s, theta(-) sub i to replace the heat absorbed C, and the temperatures theta(max), theta(min) respectively, in (W sub 0) so that the resulting estimate (W) is appropriate to inhomogeneous process and when restricted to homogeneous processes is equivalent to (W sub 0). For a body B which undergoes a thermodynamic process in a time interval T, the work estimate (W) is postulated to hold for every part P of B and for every subinterval of T. This postulate is called the fundamental work inequality (W), and the continuum thermodynamics is studied for when the Clausius-Duhem inequality is replaced by the postulate (W). Since most of the objections against basing thermodynamics on the Clausius-Duhem inequality remain if by (W), it is not claimed that (W) is the final form of the Second Law in continuum thermodynamics. Rather, (W), as a replacement for the Clausius-Duhem inequality, is taken as an intermediate step in the program of making the second generic principle of continuum thermodynamics a statement regarding heat and work. Dissert. Abstr.

N80-31263# Los Alamos Scientific Lab., N. Mex.
NON-ADIABATIC MASS PARAMETERS
G. Schuette. 1980. 4 p. refs. Presented at Workshop on Nucl. Dyn., Granlibakken, Calif., 17-21 Mar. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1020; CONF-800363-1) Avail: NTIS HC A02/MF A01

A fissioning nucleus is described by a Hamiltonian consisting of the kinetic energy, a single particle potential and a pairing force. The solution of the time dependent Schroedinger equation is obtained for a nucleus starting in the BCS ground state. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-31264# General Accounting Office, Washington, D. C. Financial and General Management Studies Div.
WIDER USE OF BETTER COMPUTER SOFTWARE TECHNOLOGY CAN IMPROVE MANAGEMENT CONTROL AND REDUCE COSTS. Report to the Congress
29 Apr. 1980. 67 p. refs.
(PB80-178254; FGMSD-80-38) Avail: NTIS HC A04/MF A01; CSCL 05A

Because the Federal Government spends billions of dollars annually on computer progams, GAO made this review to determine if the latest tools and techniques were being used to

develop and maintain those programs. Computer specialists at many agencies were unaware of the newer, better methods; others were reluctnat to change to them. The Government can improve management control and save significant amounts through appropriate use of better software tools and techniques. GAO recommends various ways to promote such use. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology, micrography, and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-31265# Sandia Labs., Albuquerque, N. Mex. Computer Aids Systems Development.
INVESTIGATION INTO INTERACTIVE GRAPHICS DATA BASE EXCHANGE VIA GERBER DATA
Robert E. Parks. Mar. 1980. 18 p.
(Contract EY-76-C-04-0789)
(SAND-80-0588) Avail: NTIS. HC A02/MF A01.

The use of the Gerber language as a common data form through which design data could be exchanged between unlike systems is examined. Applicon Graphic System was used cyclically to check retention or degeneration of the data integrity when the original design was extracted/defined in the Gerber language and reentered into the AGS utilizing various Gerber interface Programs. Even though plots of the files appear very similar, the individual data bases are very dissimilar. Programs, both present and future, that might supply needed information or design aids and characteristics would find it virtually impossible to do so from a data base lacking the sophistication and completeness of the original AGS data base. Man machine hours required to bring the data base back to original quality would be extensive. The loss of data base integrity shown by this study was restricted to an AGS to AGS transfer. The loss could very easily be magnified if the transfer were between unlike systems. DOE

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law, international law, international cooperation, and patent policy.

N80-31266# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1981, PART 4: INDEX
Washington. GPO. 1980. 115 p. Hearing on S. 2238 and S. 2240 before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation, 96th Congr., 2d Sess., 1980.
(GPO-65-791) Avail: Subcommittee on Science, Technology, and Space.

An index is presented for the U. S. Senate hearing to authorize a supplemental appropriation to the National Aeronautics and Space Administration for fiscal year 1981. L.F.M.

N80-31267# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT INDEPENDENT AGENCIES APPROPRIATION BILL, 1981
Washington. GPO. 4 Sep. 1980. 139 p. Report to accompany H. R. 7631 presented by the Comm. on Appropriations at the 96th Congr., 2d Session., 23 Jan. 1979.
(S-96-926) Avail: US Capitol, Senate Document Room.

A Senate committee report on a bill authorizing appropriations for the Department of Housing and Urban Development and various independent agencies for the fiscal year ending September 30, 1981 is presented. Amendments and an explanation of the contents of the bill are included. L.F.M.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-31268*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A STUDY OF A SPACE COMMUNICATION SYSTEM FOR THE CONTROL AND MONITORING OF THE ELECTRIC DISTRIBUTION SYSTEM. VOLUME 1: SUMMARY. Final Report
A. Vaisnys. May 1980. 54 p. refs.
(Contracts NAS7-100; DE-AI01-79ET-29372)
(NASA-CR-163477; JPL-Pub-80-48-Vol-1) Avail: NTIS. HC A04/MF A01. CSCL 13F.

It is technically feasible to design a satellite communication system to serve the United States electric utility industry's needs relative to load management, real-time operations management, remote meter reading, and to determine the costs of various elements of the system. A definition of distribution control and monitoring functions is given. Associated communications traffic is quantified. A baseline conceptual design in terms of operating capability and equipment is described, important factors to be considered in designing a system are examined, and preliminary cost data are provided. Factors associated with implementation are discussed and conclusions and recommendations are listed. R.K.G.

N80-31269*# National Aeronautics and Space Administration, Washington, D. C.
NASA PROGRAM PLAN. Fiscal Years, 1981 - 1985
Jan. 1980. 233 p.
Avail: NTIS. HC A11/MF A01. CSCL 05A.

Major facts are given for NASA'S planned FY-1981 through FY-1985 programs in aeronautics, space science, space and terrestrial applications, energy technology, space technology, space transportation systems, space tracking and data systems, and construction of facilities. Competition and cooperation, reimbursable launchings, schedules and milestones, supporting research and technology, mission coverage, and required funding are considered. Tables and graphs summarize new initiatives, significant events, estimates of space shuttle flights, and major missions in astrophysics, planetary exploration, life sciences, environmental and resources observation, and solar terrestrial investigations. The growth in tracking and data systems capabilities is also depicted. A.R.H.

N80-31270# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 3: PARALLEL SYSTEMS
S. P. DeGrey. 30 Sep. 1979. 60 p.
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-3) Avail: NTIS. HC A04/MF A01.

The hybrid vehicle type is characterized by arrangement of the heat engine and electric motor in the power train such that a direct mechanical or fluid mechanical power path from both the motor and engine to the wheels is available. Out of the several possible component arrangements that could satisfy these

requirements, a configuration in which the engine and motor are mounted in tandem, driving a 4 speed manual transmission, was selected for extensive computer analysis. Simulation of all the identified missions were run for this parallel hybrid configuration. For each mission, the battery mass fraction which is defined as the ratio of the battery mass to the gross vehicle weight (expressed in percent) was varied from 5 to 30%. These vehicles were designed such that the total energy usage of the battery before cut off would be about 80% of the C/3 discharge rate.
DOE

N80-31271# Aerospace Corp., El Segundo, Calif. Energy Conservation Directorate.
STUDY OF HYDROGEN-POWERED VERSUS BATTERY-POWERED AUTOMOBILES
J. J. Donnelly, Jr. (Escher Technology Associates), W. J. D. Escher, W. C. Greayer, and R. J. Nichols May 1979 79 p refs
(Contract EM-78-C-03-2184)
(ATR-79(7759)-1-Vol-1) Avail: NTIS HC A05/MF A01

Potential vehicle characteristics were identified for two candidate automobile propulsion systems. The first vehicle system employs a gaseous, hydrogen-fueled, internal combustion engine and either a liquid or metal hydride energy storage system. The second vehicle system employs an electronically controlled, electric motor power-train and a battery energy storage system. Tasks performed included in the technical and economic assessment of the state of the art and future alternatives in hydrogen production and delivery, the hydrogen vehicle assment, the battery-electric vehicle assessment, and the comparison of the principal vehicle alternative in 1985, 1990, and 2000. The comparison included weight, size, cost, energy, and design range relationships and the implications on expenditure of all major energy sources. Results are presented, and conclusions are drawn. Comments are made on the future roles of hydrogen and electricity in automobile propulsion. DOE

N80-31272# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRIC AND HYBRID VEHICLE SYSTEM RESEARCH AND DEVELOPMENT PROJECT: HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 1: SUMMARY
Frank T. Surber 30 Sep. 1979 70 p refs 10 Vol.
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-1) Avail: NTIS HC A04/MF A01

The potential of hybrid vehicles as a replacement of the conventional gasoline or diesel fueled internal combustion engine vehicle within the next 20 to 30 yr are considered. Hybrid vehicle designs and applications which are technically and economically viable are discussed. Critical technical areas where research and development can be most usefully concentrated are identified. R.C.T.

N80-31273# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRIC AND HYBRID VEHICLE SYSTEM RESEARCH AND DEVELOPMENT PROJECT, HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 4: SERIES SYSTEMS
Z. Popinski 30 Sep. 1979 76 p 10 Vol.
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-4) Avail: NTIS HC A05/MF A01

An evaluation of the series configuration is presented. The series configuration has the advantage that the engine is mechanically uncoupled from the wheels and can be operated at its best economy point much of the time. The mechanical energy produced by the engine is converted through a generator into electrical energy which is used to drive the motor or charge the batteries. This configuration offers a good degree of flexibility. It has the disadvantage that substantial losses of energy occur since the mechanical energy from the engine passes through several components before being used to drive the wheels. The energy produced by the engine is reduced by the product of efficiencies of components connected in series. Trade-offs involved in the study of the series configurations were directed toward establishing the size of the engine, motor and generator to meet vehicle acceleration performance; determining what level to operate the engine, and determining when to use the battery. These results were then used in the electric range simulation.
DOE

N80-31274# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRIC AND HYBRID VEHICLE SYSTEM RESEARCH AND DEVELOPMENT PROJECT, HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 6: COST ANALYSIS
K. S. Hardy 30 Sep. 1979 106 p
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-6) Avail: NTIS HC A06/MF A01

The economic feasibility of a variety of hybrid vehicles with respect to conventional vehicles specifically designed for the same duty cycle defined by the mission analysis was determined. Several different hybrid configurations including parallel, parallel-flywheel, and series vehicles were evaluated. The ramifications of incorporating examples of advanced batteries, these being the advanced lead acid, nickel zinc, and sodium sulfur were also investigated. Vehicles were specifically designed with these batteries and for the driving cycles specified by the mission. It was concluded that: in the event that gasoline prices reach $2.50 to $3.00/gal, hybrid vehicles in many applications will become economically competitive with conventional vehicles without subsidization; in some commercial applications hybrid vehicles could be economically competitive, when the gasoline price ranges from $1.20 to $1.50/gal. DOE

N80-31275# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRIC AND HYBRID VEHICLE SYSTEM RESEARCH AND DEVELOPMENT PROJECT, HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 8: SCENARIO GENERATION
K. O. Leschly 30 Sep. 1979 43 p refs
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-8) Avail: NTIS HC A03/MF A01

Scenarios are described which have been generated to develop of consistent and credible forecasts required to estimate the potential impact of hybrid vehicles on future petroleum consumption in the USA, given a set of specific electric, hybrid and conventional vehicle designs. The four major areas of concern are population and vehicle fleet size, travel patterns and vehicle fleet mix, conventional vehicle technology (Otto baseline), battery technology, and prices. The forecasts were generated to reflect two baseline scenarios, a Petroleum Conservation Scenario and an Energy Conservation Scenario. The primary assumption in scenario A is higher gasoline prices than in scenario B. This should result in less travel per car and an increased demand for smaller and more fuel efficient cars. In scenario B the primary assumption is higher prices on cars (new as well as used) than in scenario A. This should lead to less cars and a shift to other modes of transportation. DOE

N80-31276# Societe Nationale Industrielle Aerospatiale, Paris (France).
RECENT DEVELOPMENTS IN AEROSPACE TECHNOLOGY
J. Balazard 12 Nov. 1979 29 p
(SNIAS-792-502-101) Avail: NTIS HC A03/MF A01

A rundown of aerospace research and development activities is presented. Advances in supercritical wing technology and flow field modeling around helicopters are highlighted. Materials studies cover a titanium forming process, nonmetallic helicopter blade performance, and composite materials used in aircraft (A300 B) structures. Work on missile propulsion systems is mentioned. Recent contributions to aerospace equipment and systems design are cited. Optimization of aerospace-related manufacturing techniques is also discussed. Author (ESA)

N80-31277# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
NONCONTACTING SUSPENSION AND PROPULSION FOR GROUND TRANSPORTATION Final Report
D. N. Wormley, H. H. Richardson, J. K. Hedrick, D. A. Limbert, and D. Mercaldi Dec. 1979 461 p refs
(Contract DOT-OS-60135)
(PB80-176274; DOT/RSPA/DPB-50-79/34) Avail: NTIS HC A20/MF A01 CSCL 13F

The technological base available for evaluation of noncontacting vehicle suspension and propulsion systems in urban and intercity transport system was assessed. Analytical and experimental performance data for two specific systems - attractive,

ferromagnetic suspension systems and air cushion suspension systems were developed. GRA

N80-31278# Wisconsin Univ. - Madison. Engineering Experiment Station.
FLYWHEEL ENERGY MANAGEMENT SYSTEMS FOR IMPROVING THE FUEL ECONOMY OF MOTOR VEHICLES
N. H. Beachley and A. A. Frank. Aug. 1979. 195 p. refs.
(Contract DOT-OS-60177)
(PB80-175300; DOT/RSPA/DPB-50-79/1) Avail: NTIS HC A09/MF A01 CSCL 13F

The experimental flywheel vehicle has demonstrated 32 mpg over the EPA-CVS Federal Urban Driving Cycle at an inertia weight of 2750 lb. Calculations based on experimental engine data indicate that federally mandated emissions levels could be achieved with little degradation in fuel economy. The computer simulation programs developed have been verified by experiment. GRA

N80-31279# General Accounting Office, Washington, D. C. Energy and Minerals Div.
INDUSTRIAL WASTES: AN UNEXPLORED SOURCE OF VALUABLE MINERALS
15 May 1980. 83 p.
(PB80-180250; EMD-80-45) Avail: NTIS HC A05/MF A01 CSCL 11F

The need for minerals recovery from industrial wastes is addressed. It is reported that industrial wastes often contain valuable metals, and often dispose of in ways that preclude the future recovery of mineral values. Although Congress passed the Resources Conservation and Recovery Act of 1976 to, among other objectives, improve the recovery of usable meterials from wastes, the Executive Branch has done little to enhance mineral recovery, especially from industrial wastes. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-31280 New Mexico Univ., Albuquerque.
A PHOTOMETRIC INVESTIGATION OF POSSIBLE BINARY OCCURRENCE IN THE CENTRAL STARS OF SEVENTEEN PLANETARY NEBULAE Ph.D. Thesis
Jack Donald Drummond. 1980. 127 p.
Avail: Univ. Microfilms. Order No. 8019219

All known and suspected visual, spectroscopic, and spectrum binaries, as well as all reported variable central stars, are presented in a series of tables. A photoelectric study was conducted in order to determine the status of short period variability of the central regions of seventeen planetary nebulae. Only the stellar appearing planetary nebula M1-2 was found to be variable. Its short period suggests that it may be only the second eclipsing binary found among central stars to date. A method of concentric apertures was developed to determine the amount of light contributed by the central star vis-a-vis the nebula through a given aperture and filter. The procedure enabled UBV magnitudes and colors of central stars to be measured including some in the sample of seventeen for which no previous values were published. Mean nebular UBV magnitudes, surface brightnesses, and color indices were also found with the technique. Various UBV two parameter were constructed, revealing possible nebular/stellar sequences; a star-plus-nebula two color diagram identifies three spectral classes of central stars, and two suspected binaries in the seventeen studied. Dissert. Abstr.

N80-31281 California Univ., San Diego, La Jolla.
OBSERVATIONS AND INTERPRETATION OF THE PERMITTED EMISSION LINE SPECTRA OF QUASI-STELLAR OBJECTS Ph.D. Thesis
Richard Charles Puetter. 1980. 188 p.
Avail: Univ. Microfilms. Order No. 8018796

Combined optical and infrared spectrophotometry of the emission line spectra of 14 QSOs are presented. A formalism is described for the solution of the frequency-integrated radiative transfer equation and the atomic steady state equation appropriate to an externally irradiated, semi-infinite medium. Asymptotic forms for scaling forms for scaling law solutions to the radiative transfer equation are developed. Escape probabilities appropriate to the above scaling law solutions are discussed for subordinate lines, strongly interlocked resonance lines, weakly interlocked resonance lines, and the bound free continua. The formation of the hydrogen Lyman alpha Balmer, and Paschen lines and the Balmer continuum in highly idealized QSO broad emission line clouds (ELCs) of constant temperature and density, irradiated by an external source of power law spectral form was calculated. The permitted emission line region that emerges is of many dense, hot, photoionized condensations that are optically thick in the resonance lines of all abundant atomic species and the Balmer lines of hydrogen, and which cover a large fraction of the sky as seen from the central object. Dissert. Abstr.

N80-31282 Massachusetts Univ., Amherst.
VERY LONG BASELINE INTERFEROMETRY OBSERVATIONS OF THE MASERS TOWARD ORION A Ph.D. Thesis
Stanley Severin Hansen. 1980. 217 p.
Avail: Univ. Microfilms. Order No. 8019464

Based on velocity, and position, the water vapor masers in Orion may be divided into five classes, four of which are associated with stages of star formulation. The fifth class may be associated with an evolved star. The masers of the fifth class have velocities from -7 to -3 km and from + 15 to 18 gm. These masers are large (10 to 60 a.u.) and less variable than the other H20 masers and occur in a single cluster 1000 a.u. in diameter. The OH masers with velocities similar to the fifth class of H20 masers are less variable, less polarized, and larger than the other OH masers. All the SiO masers have the same velocities as the H20 masers of the fifth class and at the same position. This evidence strongly suggests that all these masers exist in expanding shells of gas about a single object. VLBI observations at 1665 MHz detected three OH masers with apparent diameters of 10 30 a.u. The two strongest of these were spatially coincident, circularly polarized in opposite senses, and of equal amplitude, suggesting that they may be a Zeeman pair. The velocity separation requires a 3 milligauss magnetic field. Dissert. Abstr.

N80-31283*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIABLE X-RAY SPECTRA OF BL LAC OBJECTS: HEAO-1 OBSERVATIONS OF PKS 0548-322 AND 2A 1219+306
D. M. Worrall (California Univ., San Diego), E. A. Boldt, S. S. Holt, R. F. Mushotzky, and P. J. Serlemitsos. May 1980. 21 p. refs. Submitted for publication.
(NASA-TM-80700) Avail: NTIS HC A02/MF A01 CSCL 03A

X-ray spectra for the BL Lac objects PKS 0548-322 and 2A 1219+305 measured with the HEAO-1 A2 detectors during pointing maneuvers on September 30, 1978 and May 31, 1978 respectively are presented. Both fit single power law components with low energy absorption. For 2A 1219+305, a thermal bremsstrahlung form gives an unacceptable fit. From a comparison with other statistically poorer observations taken at 6 month intervals while the satellite was in its normal scanning mode, it is found that the sources exhibit spectral variability. A summary of measurements of the 5 BL Lac objects detected with the A2 experiment is presented and it is concluded that X-ray spectral changes in this class of source are common. Their general X-ray spectral characteristics distinguish BL Lac objects from other classes of X-ray emitting active galactic nuclei. Analysis of their total spectra indicates that most of the energy is emitted in the 5 to 100 eV band. M.G.

N80-31284*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY ASTRONOMICAL SPECTROSCOPY
S. S. Holt. Jun. 1980. 19 p. refs. Submitted for publication. (NASA-TM-80737). Avail: NTIS. HC A02/MF A01. CSCL 03A.

The current status of the X-ray spectroscopy of celestial X-ray sources, ranging from nearby stars to distant quasars, is reviewed. Particular emphasis is placed on the role of such spectroscopy as a useful and unique tool in the elucidation of the physical parameters of the sources. The spectroscopic analysis of degenerate and nondegenerate stellar systems, galactic clusters and active galactic nuclei, and supernova remnants is discussed. M.G.

N80-31285*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
QUASI-SIMULTANEOUS OBSERVATIONS OF THE BL LaC OBJECT MK 501 IN X-RAY, UV, VISIBLE, IR AND RADIO FREQUENCIES
D. M. Kondo, D. M. Worrall, R. F. Mushotzky, R. L. Hackney (Univ. of Western Kentucky), K. H. Hackney (Univ. of Western Kentucky), J. B. Oke (Palomar Observatory), H. Yee (Palomar Observatory), G. Neugebauer (Palomar Observatory), K. Matthews (Palomar Observatory), and P. A. Feldman (NRC of Canada, Ottawa). Jul. 1980. 32 p. refs. Submitted for publication. (NASA-TM-81985). Avail: NTIS. HC A03/MF A01. CSCL 03A.

Quasi-simultaneous observations of the BL Lacertae (Lac) objects MK 501 were performed for the first time at X-ray, ultraviolet, visible, infrared, and radio frequencies. The observed spectral slope from the X-ray to UV regions is positive and continuous, but that from the mid UV to visible light region becomes gradually flat and possibly turns down toward lower frequencies; the optical radio emission can not be accounted for by a single power law. Several theoretical models were considered for the emission mechanism. A quantitative comparison was performed with the synchrotron-self-Compton model; the total spectrum is found consistent with this model. The spectrum from visible light to X-ray is consistent with synchrotron radiation or with inverse-Compton scattering by a hot thermal cloud of electrons. The continuity of the spectral slope from X-ray to UV implied by the current data suggests that the previous estimates of the total luminosity of this BL Lac object is underestimated by a factor of about three or four. T.M.

N80-31286# Engins Matra, Velizy (France). Instrumentation Dept.
HIPPARCOS PAYLOAD STUDY, VOLUMES 1 AND 2. Final Report
14 Jan. 1980. 279 p.
(Contract ESTEC-3967/79-NL-MS)
(Rept-60/890; ESA-CR(P)-1318). Avail: NTIS. HC A13/MF A01.

A feasibility study was made which includes the mirror manufacturing process, relay optics, and star mapper grid for the three mirror telescope. The stiffness and strength requirements, and materials selection were studied, and a dynamic structural analysis performed. Payload thermal control was reviewed in terms of mirror distortion. Detection and electronics subsystems were reviewed and a data flow assessment made for data handling. Reliability predictions were made for the payload electronics. A technological development program is presented to answer uncertainties about mirror fabrication and assembly, radiation effects, and wavefront error verification. Author (ESA)

N80-31287# European Space Research and Technology Center, Noordwijk (Netherlands).
HIPPARCOS. SPACECRAFT DESIGN AND DEVELOPMENT
5 Dec. 1979. 322 p.
(ESA-PF-616). Avail: NTIS. HC A14/MF A01.

A mission study was performed including the scientific objectives, principles of observation, and a theoretical analysis of system accuracy. The payload was not included in the study. Orbital parameters, environmental conditions, thermal control, power supplies, and reliability were examined. Data handling, ground operations including computer software were analyzed, and a development plan was proposed. Author (ESA)

90 ASTROPHYSICS

Includes cosmology, and interstellar and interplanetary gases and dust.

N80-31288 Pennsylvania Univ., Philadelphia.
ORBITAL DECAY AND ACCRETION FOR PLANETARY OR BINARY SYSTEMS WITHIN A PLANETARY NEBULA. Ph.D. Thesis
Kyu Hong Choi. 1980. 120 p.
Avail: Univ. Microfilms. Order No. 8018533.

The problem of the survival of a planet and low mass secondary orbiting a primary star that becomes a planetary nebula is studied. The values of the mass of the primary used are 1.0, 1.5, and 2.0 solar mass. The values for the planet's mass are 0.001 and 0.01 solar mass. The mass of the secondary is 0.1 solar mass. The evolution of the orbital elements and mass of the secondary due to accretion and drag forces in the common envelope are presented. The possible application of the results to V471 Tau, UU Sgr, WZ Sge, and Sun-Jupiter system are discussed. Dissert. Abstr.

N80-31289*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TORQUES ON A NEARLY RIGID BODY IN A RELATIVISTIC GRAVITATIONAL FIELD
Alessandro Caporali. Aug. 1980. 25 p. refs.
(NASA-TM-78295). Avail: NTIS. HC A02/MF A01. CSCL 03B.

The effect of post-Newtonian potentials on the rotation of a nearly rigid body is shown to consist of a precession and a torque. The frequency of the precession can be exactly represented by means of suitable differential operators. The relativistic torques in the quadrupole approximation depend on the instantaneous orientation of the principal axes of one body with respect to the position like the classical torque and velocity of the other. For a relatively low mass body, such as a gyroscope, these velocity-dependent torques have no observable consequences. Author

N80-31290*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for High Energy Astrophysics.
SOFT CP VIOLATION AND THE GLOBAL MATTER-ANTIMATTER SYMMETRY OF THE UNIVERSE
Goran Senjanovic (Maryland Univ., College Park) and F. W. Stecker. Jun. 1980. 17 p. refs. Submitted for publication. (NASA-TM-80730). Avail: NTIS. HC A02/MF A01. CSCL 03B.

Scenarios for baryon production are considered within the context of SU(5) and SO(10) grand unified theories where CP violation arises spontaneously. The spontaneous CP symmetry breaking then results in a matter-antimatter domain structure in the universe. Two possible, distinct types of theories of soft CP violation are defined. In the first type the CP nonconservation originates only from the breaking of SU(2) sub L X U(1) symmetry, and in the second type, even at the unification temperature scale, CP violation can emerge as a result of symmetry breaking by the vacuum expectation values of the superheavy Higgs sector scalers. M.G.

N80-31291*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UTILIZATION OF MULTI-BODY TRAJECTORIES IN THE SUN-EARTH-MOON SYSTEM
Robert W. Farquhar. Aug. 1980. 24 p. refs. Submitted for publication. (NASA-TM-80740). Avail: NTIS. HC A02/MF A01. CSCL 03B.

An overview of three uncommon trajectory concepts for space missions in the Sun-Earth-Moon System is presented. One concept uses a special class of libration-point orbits called 'halo orbits.' It is shown that members of this orbit family are advantageous

for monitoring the solar wind input to the Earth's magnetosphere, and could also be used to establish a continuous communications link between the Earth and the far side of the Moon. The second concept employs pretzel-like trajectories to explore the Earth's geomagnetic tail. These trajectories are formed by using the Moon to carry out a prescribed sequence of gravity-assist maneuvers. Finally, there is the 'boomerang' trajectory technique for multiple-encounter missions to comets and asteroids. In this plan, Earth-swingby maneuvers are used to retarget the original spacecraft trajectory. The boomerang method could be used to produce a triple-encounter sequence which includes flybys of comets Halley and Tempel-2 as well as the asteroid Geographos. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology, and manned and unmanned flights.

For spacecraft design see *19 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-31292 Washington Univ., Seattle.
THERMOLUMINESCENCE STUDIES OF THE THERMAL AND RADIATION HISTORIES OF CHRONDRITIC METEORITES Ph.D. Thesis
Charles Lee Melcher 1980 175 p
Avail: Univ. Microfilms Order No. 8018748

The thermoluminescence properties of chondritic meteorites are investigated to understand the ways in which the stored TL reflects the thermal and radiation histories of these objects. Differences in TL levels measured in recent falls are attributed to small differences in orbital temperatures. In addition, a correlation between TL level and terrestrial age is observed in meteorites of known terrestrial age. A modification of the apparatus for measurement of thermoluminescence is described in which a microcomputer is interfaced to the existing light detection and heating control units. The computer allows photons to be counted directly and the numbers stored automatically for later manipulation. This results in more precise as well as more efficient data acquisition and reduction. Dissert. Abstr.

N80-31293 Arizona Univ., Tucson.
POLARIMETRY OF JUPITER AT LARGE PHASE ANGLES Ph.D. Thesis
Clifford Paul Stoll 1980 95 p
Avail: Univ. Microfilms Order No. 8020326

Pioneer 10 and 11 polarimetry maps of Jupiter, taken at a wide variety of phase angles, were analyzed. Data were reduced in two colors for Jupiter's South Equatorial Belt (latitude -5 to -8 degrees) and scattering models were constructed. Variations in polarization from center to limb set constraints on the vertical structure of the atmosphere. The absolute polarization near the center of the disc constrained the single scattering polarization phase matrix of the scattering particles. It was found that a two cloud model with a haze in the upper atmosphere fits the data best. The haze particles are closely approximated by conservatively scattering spheres of index of refraction 1.5 and uniformly distributed sizes between 0.16 and 0.18 microns radius. A relationship exists between the required index of refraction for the haze particles and the mean size of the particles. The upper cloud, which is thought to be made of ammonia crystals, must be at least optical depth 2, and could be semi-infinite. The polarization scattering properties of the clouds are distinctly different from the haze, indicating a compositional or size difference. The lowest cloud is more weakly constrained. Dissert. Abstr.

N80-31294*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
INTERPRETATION OF LASER/MULTI-SENSOR DATA FOR SHORT RANGE TERRAIN MODELING AND HAZARD DETECTION
Brian S. Messing Aug. 1980 102 p refs Prepared for JPL (Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163492; RPI-TR-MP-75) Avail: NTIS HC A06/MF A01 CSCL 08B

A terrain modeling algorithm that would reconstruct the sensed ground images formed by the triangulation scheme, and classify as unsafe any terrain feature that would pose a hazard to a roving vehicle is described. This modeler greatly reduces quantization errors inherent in a laser/sensing system through the use of a thinning algorithm. Dual filters are employed to separate terrain steps from the general landscape, simplifying the analysis of terrain features. A crosspath analysis is utilized to detect and avoid obstacles that would adversely affect the roll of the vehicle. Computer simulations of the rover on various terrains examine the performance of the modeler. T.M.

N80-31295# Scientific Translation Service, Ann Arbor, Mich.
STUDY OF A CHEMICAL ANALYZER OF THE CONDENSABLES IN THE ATMOSPHERE OF VENUS BY ATTENUATED TOTAL IR-REFLECTION Final Scientific Report
J. E. Blamont, G. Israel, F. Goutail, F. Letki, and G. Souchon Apr. 1980 48 p refs Sponsored by DOE Prepared for Argonne National Lab., Ill.
(ANL-Trans-1184) Avail: NTIS HC A03/MF A01

Results of the development of a Venusian aerosol analyzer and laboratory measurements made with it are presented. The scientific method developed for the detection and analysis of aerosols in the atmosphere of Venus is described. DOE

N80-31296# Los Alamos Scientific Lab., N. Mex. Nuclear Chemistry Group.
SILVER ISOTOPIC ANOMALIES IN IRON METEORITES: COSMIC-RAY PRODUCTION AND OTHER POSSIBLE SOURCES
Robert C. Reedy 18 Apr. 1980 18 p refs Presented at the 11th Lunar and Planetary Sci. Conf., Houston, Tex., Mar. 1980 (Contract W-7405-eng-36)
(LA-UR-80-1199; CONF-800361-1) Avail: NTIS HC A02/MF A01

The sources of excess Ag107 observed in iron meteorites are examined with emphasis on the reactions of cosmic ray particles with palladium. The cross sections for the production of the silver isotopes from palladium by energetic cosmic ray particles are evaluated and used to calculate spallogenic production rates relative to that of Mn53 from iron. The upper limit for the production rate of excess Ag107 by galactic cosmic ray particles is 400 atoms/min/kg(Pd) which over an exposure age of 10 to the 9th years, would make only 1% of the observed excesses of Ag107. Neutron capture reactions with Pd isotopes produce mainly Ag109. Binary fission of a siderophilic superheavy element would be expected to yield more Ag109 than Ag107. An intense proton irradiation in the early solar system probably would produce a lower ratio (Pd107/Pd108) to (A126/A127) than observed in meteorites. Therefore the presence of excess Ag107 in iron meteorites with large Pd/Ag ratios very likely is due to the incorporation of 6.6 x 10 to the 6th per year Pd107 of nucleosynthetic origin in these meteorites. DOE

N80-30341*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER-JUPITER RADIO SCIENCE DATA PAPERS
G. S. Levy and G. E. Wood *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 114-115 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-31297*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SOLAR ACTIVITY PREDICTION OF SUNSPOT NUMBERS (VERIFICATION). PREDICTED SOLAR RADIO FLUX; PREDICTED GEOMAGNETIC INDICES Ap AND Kp
Samuel R. Newman Aug. 1980 45 p refs

(NASA-TM-81139; JSC-16762; IN-80-FM-041) Avail: NTIS HC A03/MF A01 CSCL 03B

Efforts to further verify a previously reported technique for predicting monthly sunspot numbers over a period of years (1979 to 1989) involved the application of the technique over the period for the maximum epoch of solar cycle 19. Results obtained are presented. Methods and results for predicting solar flux (F10.7 cm) based on flux/sunspot number models, ascent and descent, and geomagnetic activity indices as a function of sunspot number and solar cycle phase classes are included.

A.R.H.

N80-31298*# Denver Univ., Colo. Dept. of Physics.
NEW ATLAS OF IR SOLAR SPECTRA
A. Goldman, R. D. Blatherwick, , F. H. Murcray, J. W. VanAllen, C. M. Bradford, G. R. Cook, and D. G. Murcray. Jun. 1980 142 p refs
(Grants NsG-1432; NSF ATM-76-83908)
(NASA-CR-163499) Avail: NTIS HC A07/MF A01 CSCL 03B

Over 4500 absorption lines have been marked on the spectra and the corresponding line positions tabulated. The associated absorbing telluric or solar species for more than 90% of these lines have been identified and only a fraction of the unidentified lines have peak absorptions greater than a few percent. The high resolution and the low Sun spectra greatly enhance the sensitivity limits for identification of trace constituents. T.M.

N80-31299# Los Alamos Scientific Lab., N. Mex.
SOLAR WIND FLOWS ASSOCIATED WITH HOT HEAVY IONS
Edward Eugene Fenimore. May 1980 58 p refs
(Contract W-7405-eng-36)
(LA-8344-T) Avail: NTIS HC A04/MF A01

Heavy ion spectra from three different periods throughout the solar cycle were analyzed. The spectra indicating hot coronal conditions occur in roughly 1/7th of all measurements and almost exclusively in postshock flows (PSFs), nonshock related helium abundance enhancements (HAEs), or noncompressive density enhancements (NCDEs). The PSFs and HAEs are both probably interplanetary manifestations of solar flares. The observation of several flare related HAEs which were not preceded by an interplanetary shock suggests that the flare heated plasma can evolve into the solar wind without producing a noticeable shock at 1 AU. The NCDEs with hot heavy ions differ from the PSFs and HAEs in several ways implying that they evolve from events or places with lower temperatures and less energy than those associated with the flares, but with higher temperatures and densities than the quiet corona. Active regions, coronal mass ejections, and equatorial streamers are possible sources for the NCDEs with spectra indicating hot coronal conditions. DOE

N80-31300# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 426, FEBRUARY 1980. SUPPLEMENT: EXPLANATION OF DATA REPORTS
Feb. 1980 92 p refs
(PB80-186133; SGD-426-Suppl; NOAA-80040905-Suppl) Avail: NTIS HC A05/MF A01 CSCL 03B

The supplement contains the description and explanation of the data in the monthly publication, Solar-Geophysical Data, compiled by the National Geophysical and Solar-Terrestrial Data Center in Boulder, Colorado. Solar-Geophysical Data is intended to keep research workers informed on a timely schedule of the major events of solar activity and the associated interplanetary, ionospheric, radio propagation, and other grophysical effects.

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N80-31301# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 426, FEBRUARY 1980. PART 1: PROMPT REPORTS Data Report, Dec. 1979 - Jan. 1980
Helen E. Coffey, ed. Feb. 1980 180 p 2 Vol.
(PB80-186141; SGD-426-Pt-1; NOAA-80040903-Pt-1) Avail: NTIS HC A09/MF A01 CSCL 03B

In addition to an index for 1979-1980, this prompt report provides data for January 1980 on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, solar wind measurements, inferred interplanetary mangetic field polarities, mean solar magnetic field, coronal holes, and the Boulder Geomagnetic Substorm Log. It also provides data for December 1979 on: daily solar activity center, sudden ionospheric disturbances, spacecraft observations, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. This issue also has a section on late data: solar wind measurements December 1979, solar radio emission November and December 1979, solar X-ray radiation October 1979, and cosmic rays October, November 1979. GRA

N80-31302# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 426, FEBRUARY 1980. PART 2: COMPREHENSIVE REPORTS Data Report, Aug. 1979
Helen E. Coffey, ed. Feb. 1980 50 p 2 Vol.
(PB80-186158; SGD-426-Pt-2; NOAA-80040904-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 03B

In addition to an index for 1979-1980, this issue of comprehensive reports provides data for August 1979 on: solar radio emission, energetic solar particles and plasma, and solar X-ray radiation. Solar Flare data are now eleven months delayed from date of observation, rather than the usual six months. A delay in the final listing of solar flare data also delays the Daily Flare Index, the Regional Flare Index and the Abbreviated Calendar Record. The miscellaneous data includes the energetic solar particles July 1979, active regions March 30-July 17, 1979, and synoptic solar maps March 30-July 17, 1979. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-31303 Pennsylvania Univ., Philadelphia.
THE RELATION BETWEEN THE GALACTIC COMPACT RADIO SOURCES AND THE EXTRAGALACTIC COMPACT RADIO SOURCES Ph.D. Thesis
Bernard Jay Geldzahler. 1980 133 p
Avail: Univ. Microfilms Order No. 8018546

Maps resulting from high resolution, high sensitivity observations are presented for the quasars 3C138 and 3C286. For the first time, the structure of 3C138 over angular scales between 0.010 and 0.45 is reported. Strong evidence in favor of oppositely directed dual beam models of energy transport in extragalactic radio sources is provided by a newly discovered low surface brightness feature in 3C286 which is interpreted as the first detection of the counterjet proposed in such models. Six Galactic or suspected Galactic compact radio sources were also observed. Cygnus X-3,1909 + 048(=SS433), CL4, G127.11 + 0.54, G74.87 + 1.22, and the compact radio source at the Galactic center. It is demonstrated that the structures and physical properties of the Galactic and extragalactic compact radio sources are similar and that the Galactic objects lie on the extreme low luminosity end of an apparent continuum of luminosities. The nature of the radiation mechanism at the site of the energy generation is discussed. Dissert. Abstr.

99 GENERAL

N80-31304# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES. VOLUME 34, NO. 6
Richard S. Hughes, ed. and Don J. Peters, ed. 30 Jun. 1980 54 p
(AD-A086806; ESN-34-6) Avail: NTIS HC A04/MF A01 CSCL 05/2

This monthly publication presents brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by calling attention to current developments and to institutions and individuals engaged in these scientific efforts. The articles are written primarily by members of the staff of ONRL and occasionally articles are prepared by, or in cooperation with, members of the scientific staffs of the United States Air Force's European Office of Aerospace Research and Development and the United States Army Research and Standardization Group. Articles are also contributed by visiting Stateside scientists. GRA

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Typical Subject Index Listing

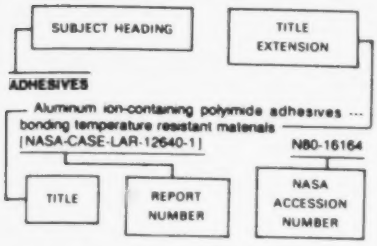

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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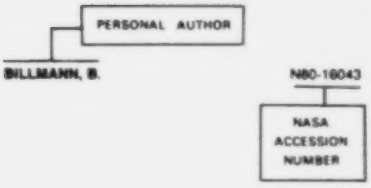

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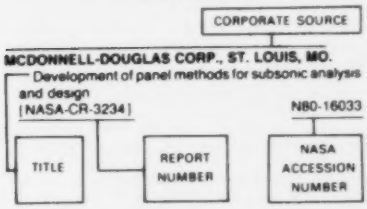

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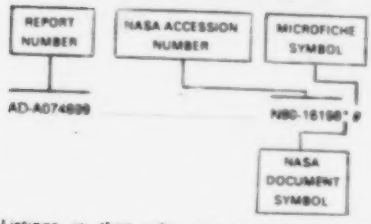

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AD-E000475 N80-30465 #
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AD-E200520 N80-30599 #
AD-E300807 N80-30356 #
AD-E300843 N80-31179 #
AD-E300844 N80-31180 #
AD-E400432 N80-30304 #
AD-E400449 N80-30539 #
AD-E430460 N80-30792 #
AD-E430472 N80-30374 #
AD-E430473 N80-30278 #
AD-E440073 N80-30809 #
AD-E950001 N80-30744 #

ADL-82871F N80-30632 #

AEDC-TR-79-9 N80-30281 #
AEDC-TR-79-53 N80-30311 #

AERE-G-1480 N80-30664 #

AERONOMICA-ACTA-F-28-1979 N80-30353

AES-UPR-C-481 N80-30543 #

AESD-TM-3026 N80-30556 #

AFAMRL-TR-79-121 N80-30958 #

AFAPL-TR-78-90 N80-31076 #
AFAPL-TR-79-2093 N80-30536 #

AFFDL-TR-76-45-VOL-1 N80-30315 #
AFFDL-TR-76-45-VOL-2 N80-30316 #
AFFDL-TR-79-3032-VOL-1 N80-30315 #
AFFDL-TR-79-3032-VOL-2 N80-30316 #
AFFDL-TR-79-3032-VOL-3 N80-30317 #
AFFDL-TR-79-3123 N80-30314 #
AFFDL-TR-79-3162-VOL-2 N80-30695 #

AFGL-ERP-680 N80-30983 #
AFGL-ERP-685 N80-31003 #
AFGL-ERP-694 N80-31005 #
AFGL-ERP-698 N80-31169 #

AFGL-TR-79-0254 N80-30983 #
AFGL-TR-79-0294 N80-31003 #
AFGL-TR-80-0016 N80-30988 #
AFGL-TR-80-0030 N80-31005 #
AFGL-TR-80-0036 N80-30987 #
AFGL-TR-80-0038 N80-30986 #
AFGL-TR-80-0055-PT-1 N80-30603 #
AFGL-TR-80-0068 N80-31169 #
AFGL-TR-80-0108 N80-30280 #
AFGL-TR-80-0109 N80-30275 #

AFLRL-103 N80-30461 #

AFML-TR-79-4104 N80-31248 #
AFML-TR-79-4184-PT-1 N80-30520 #
AFML-TR-79-4196 N80-30795 #

AFOSR-TR-80-0548 N80-31116 #

AFOSR-78-108TR N80-30765 #
AFOSR-80-0257TR N80-30688 #
AFOSR-80-0441TR N80-30728 #
AFOSR-80-0457TR N80-30799 #
AFOSR-80-0462TR N80-31243 #
AFOSR-80-0465TR N80-30459 #
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AFOSR-80-0467TR N80-30729 #
AFOSR-80-0468TR N80-30490 #
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AFOSR-80-0475TR N80-30518 #
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AFOSR-80-0499TR N80-30693 #
AFOSR-80-0500TR N80-31106 #
AFOSR-80-0501TR N80-30524 #
AFOSR-80-0502TR N80-31210 #
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AFOSR-80-0507TR N80-30734 #
AFOSR-80-0509TR N80-30697 #
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AFOSR-80-0546TR N80-31060 #
AFOSR-80-0547TR N80-31104 #
AFOSR-80-0551TR N80-30742 #
AFOSR-80-0561TR N80-31082 #
AFOSR-80-0562TR N80-30813 #
AFOSR-0466-80TR N80-30733 #
AFOSR-0503-80TR N80-30730 #
AFOSR-0545-80TR N80-30737 #

AFWAL-TR-80-306 N80-30691 #
AFWAL-TR-80-1018 N80-31249 #
AFWAL-TR-80-2015 N80-30732 #
AFWAL-TR-80-2041 N80-30647 #
AFWAL-TR-80-3038 N80-30694 #

AFWAL-TR-80-4083 ..... N80-30312 #
AFWAL-TR-80-4025 ..... N80-30789 #
AFWAL-TR-80-4027 ..... N80-30788 #
AFWAL-TR-80-4080 ..... N80-30497 #

AFWL-TR-79-138 ..... N80-30600 #
AFWL-TR-79-137 ..... N80-30598 #
AFWL-TR-79-139 ..... N80-30597 #

AMRL-TR-79-4191 ..... N80-30803 #

AMMRC-TR-79-53 ..... N80-30791 #
AMMRC-TR-80-5 ..... N80-30442 #
AMMRC-TR-80-17 ..... N80-30444 #
AMMRC-TR-80-20 ..... N80-30496 #

ARRL-TR-79-114 ..... N80-31041 #

ARL-CT-79-19 ..... N80-30817 #

ANL-TRANS-1194 ..... N80-31295 #

ANL-80-12 ..... N80-30551 #
ANL-80-19 ..... N80-30940 #
ANL-80-31 ..... N80-30815 #
ANL-80-32 ..... N80-30927 #

ANL/ES-81 ..... N80-30555 #

AQ-7379-1 ..... N80-30975 #

AR-LO-00425 ..... N80-30861* #

AR-1 ..... N80-30459 #
AR-2 ..... N80-30756 #
AR-2 ..... N80-31244 #
AR-001-746 ..... N80-30300 #
AR-001-904 ..... N80-30495 #
AR-001-978 ..... N80-30620 #
AR-10987-01 ..... N80-31177 #

ARBRL-CR-00426 ..... N80-30792 #

ARBRL-MP-439 ..... N80-30374 #

ARBRL-MR-03021 ..... N80-30374 #
ARBRL-MR-03023 ..... N80-30278 #

ARI-RR-1228 ..... N80-30288 #

ARI-TR-442 ..... N80-30308 #

ARL-PSU-TM-80-36 ..... N80-31122 #

ARL-TM-80-6 ..... N80-31081 #

ARL/AERO-NOTE-393 ..... N80-30318 #

ARL/STRUC-TM-296 ..... N80-30719 #
ARL/STRUC-TM-297 ..... N80-30301 #
ARL/STRUC-TM-300 ..... N80-30300 #
ARL/STRUC-TM-308 ..... N80-30718 #
ARL/STRUC-TM-309 ..... N80-30498 #

ARLCB-TR-80010 ..... N80-30809 #

ARLCD-TR-79045 ..... N80-30539 #

ARO-13847.3-MEX ..... N80-30443 #
ARO-15840.3-A-EL ..... N80-30648 #
ARO-16783.1-A-EL ..... N80-30589 #

ARSCD-CR-60039 ..... N80-30304 #

AS-PAPER-322 ..... N80-30995 #
AS-PAPER-324 ..... N80-31020 #

ATC-R-6200/CCR-31 ..... N80-30796 #

ATR-79(7759)-1-VOL-1 ..... N80-31271 #

BCR-613-2576 ..... N80-30502 #

BLM/YM/ES-80/2 ..... N80-31026 #
BLM/YM/ES-80/3-VOL-3 ..... N80-31027 #

BMFT-FB-T-78-71 ..... N80-31241 #

BMFT-FB-W-77-34 ..... N80-30363 #
BMFT-FB-W-77-40 ..... N80-30760 #

BMFT-FB-W-77-42 ..... N80-30713 #
BMFT-FB-W-79-03 ..... N80-30992 #

BMI-2043 ..... N80-30557 #
BMI-2053 ..... N80-30546 #

BNL-27011 ..... N80-31123 #
BNL-27094 ..... N80-30963 #
BNL-27452 ..... N80-30937 #
BNL-27456 ..... N80-30659 #
BNL-27662 ..... N80-30926 #
BNL-27667 ..... N80-30919 #

BOA-1 ..... N80-31022 #

BRAG-TR-79-2 ..... N80-31039* #

BR72936 ..... N80-31241 #

CARL-IM-80-3 ..... N80-30687* #

CCA-79-26 ..... N80-30438 #

CCS-RR-370 ..... N80-31080 #

CERL-IR-N-75 ..... N80-31155 #

CERL-TR-N-76 ..... N80-31156 #

CERT-VOL-2 ..... N80-30365 #

CGR/DC-9/79 ..... N80-30529 #

CLM-RR/E1/25 ..... N80-30435 #

CNES-NT-90 ..... N80-30631 #
CNES-NT-91 ..... N80-30361 #

COM-73-11676 ..... N80-30884 #
COM-73-11676 ..... N80-30885 #

CONF-790499-3 ..... N80-30929 #
CONF-790631-1 ..... N80-30922 #
CONF-790711-5 ..... N80-31183 #
CONF-790857-3 ..... N80-31124 #
CONF-790956-5 ..... N80-31258 #
CONF-790997 ..... N80-30467 #
CONF-791028-4 ..... N80-30659 #
CONF-791072-32 ..... N80-30550 #
CONF-791102-148 ..... N80-31253 #
CONF-791102-156 ..... N80-31213 #
CONF-791102-160 ..... N80-31151 #
CONF-791102-167 ..... N80-30655 #
CONF-791103-108 ..... N80-30960 #
CONF-791112-62 ..... N80-30437 #
CONF-791118-11 ..... N80-30816 #
CONF-800106-18 ..... N80-30928 #
CONF-800138-1 ..... N80-30745 #
CONF-800205-7 ..... N80-31254 #
CONF-800213-11 ..... N80-31184 #
CONF-800235-1 ..... N80-30449 #
CONF-800309-5 ..... N80-31006 #
CONF-800324-2 ..... N80-30937 #
CONF-800340-6 ..... N80-30925 #
CONF-800361-1 ..... N80-31296 #
CONF-800363-1 ..... N80-31263 #
CONF-800402-1 ..... N80-31256 #
CONF-800402-5 ..... N80-31257 #
CONF-800430-1 ..... N80-31200 #
CONF-800441 ..... N80-31152 #
CONF-800466-2 ..... N80-31171 #
CONF-800468 ..... N80-31252 #
CONF-800474-1 ..... N80-30961 #
CONF-800502-12 ..... N80-30446 #
CONF-800521-1 ..... N80-30658 #
CONF-800531-1 ..... N80-31049 #
CONF-800537-1 ..... N80-31125 #
CONF-800538-3 ..... N80-31158 #
CONF-800540-1 ..... N80-31181 #
CONF-800549-1 ..... N80-30938 #
CONF-800604-4 ..... N80-30913 #
CONF-800604-14 ..... N80-30923 #
CONF-800612-3 ..... N80-30933 #
CONF-800612-4 ..... N80-30932 #
CONF-800620-2 ..... N80-30433 #
CONF-800621-1 ..... N80-30502 #
CONF-800625-1 ..... N80-31123 #
CONF-800705-1 ..... N80-30530 #
CONF-800713-1 ..... N80-30553 #
CONF-800713-2 ..... N80-30511 #
CONF-800713-7 ..... N80-30935 #
CONF-7706118 ..... N80-31216 #
CONF-7903105 ..... N80-30959 #
CONF-7904123-1 ..... N80-30963 #
CONF-7906103-4 ..... N80-30508 #
CONF-7908112-1 ..... N80-30701 #
CONF-7910126-1 ..... N80-30558 #

CONS-3288-T6 ..... N80-30758 #
CONS-4209-T1-VOL-1 ..... N80-31272 #
CONS-4209-T1-VOL-3 ..... N80-31270 #
CONS-4209-T1-VOL-4 ..... N80-31273 #
CONS-4209-T1-VOL-6 ..... N80-31274 #
CONS-4209-T1-VOL-8 ..... N80-31275 #

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COO-2172-26 ..... N80-31247 #
COO-3004-2 ..... N80-30912 #
COO-3084-75 ..... N80-30509 #
COO-3084-77 ..... N80-30510 #
COO-3533-161 ..... N80-31170 #
COO-4094-64 ..... N80-30910 #
COO-4094-70 ..... N80-30928 #
COO-4596-1-VOL-3 ..... N80-31061 #
COO-4759-2 ..... N80-30701 #
COO-4881-12 ..... N80-30902 #
COO-50042-1 ..... N80-30654 #

CORADCOM-79-0789-2 ..... N80-31198 #
CORADCOM-79-0789-3 ..... N80-31197 #

CORC-80-4 ..... N80-31135 #

CPIA-PUBL-305 ..... N80-30422
CPIA-PUBL-315-VOL-5 ..... N80-30381

CRINC/RSL-TR-331-14 ..... N80-30618 #

CRREL-SR-80-23 ..... N80-30679 #

CSTB-192 ..... N80-30571 #
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C79-1032/501 ..... N80-31249 #

DAI-TR-235-VOL-1 ..... N80-31059 #

DC-FR-1299-1 ..... N80-30600 #
DC-FR-1299-2 ..... N80-30598 #
DC-FR-1299-3 ..... N80-30597 #
DC-FR-1299-4 ..... N80-30599 #

DELET-TR-78-0563-5 ..... N80-30906 #
DELET-TR-78-2992-3 ..... N80-30649 #
DELET-TR-79-0275-1 ..... N80-31245 #

DLR-FB-77-60 ..... N80-30712 #

DNA-5036F-2-VOL-2 ..... N80-31179 #
DNA-5036F-3-VOL-3 ..... N80-31180 #

DOC-76SDS4227 ..... N80-30859* #
DOC-79SRC54 ..... N80-31041 #

DOE/CS-30202/T1 ..... N80-30917 #
DOE/CS-34135/T1 ..... N80-30918 #

DOE/DP-01253/18 ..... N80-30704 #

DOE/EIA/CR-0016/02 ..... N80-30936 #

DOE/ER-0050 ..... N80-30914 #
DOE/ER-0055 ..... N80-30915 #
DOE/ER-0056 ..... N80-30916 #
DOE/ER-0057 ..... N80-31214 #
DOE/ER-01545/274 ..... N80-31173 #
DOE/ER-02314 ..... N80-30501 #
DOE/ER-06036/3 ..... N80-31186 #
DOE/ER-10367/2 ..... N80-30570 #
DOE/ER-10430 ..... N80-30507 #
DOE/ER-10460/1 ..... N80-30467 #
DOE/ER-10471/1 ..... N80-30818 #
DOE/ER-10512/T1 ..... N80-31172 #

DOE/ET-15209-T1 ..... N80-30755 #
DOE/ET-15350-T1 ..... N80-30757 #
DOE/ET-20611/11 ..... N80-30552 #
DOE/ET-23023/T3 ..... N80-30921 #

DOE/EV-10281/1 ..... N80-31007 #
DOE/EV-71030/1 ..... N80-31025 #

DOE/NASA/0031-80/6-VOL-6-PT-1B ..... N80-30889* #
DOE/NASA/0031-80/6-VOL-6-PT-2 ..... N80-30890* #
DOE/NASA/0031-80/6-VOL-6-1A ..... N80-30888* #

DOE/SERI-8119-3/1 ..... N80-31255 #

DOT/RSPA/DPB-50-79/1 ..... N80-31278 #
DOT/RSPA/DPB-50-79/34 ..... N80-31277 #
DOT/RSPA/DPB-50-80/1-VOL-1 ..... N80-30470 #
DOT/RSPA/DPB-50-80/2-VOL-2 ..... N80-30471 #

DRCPM-HEL-79-5 ..... N80-30744 #

DRIP-45018 ..... N80-30704 #

DS-ERT-21-79 ..... N80-30349 #

DS-190-0-78 ..... N80-30714 #

DSE-4042-T30 ..... N80-30946 #

DYD-55585-AA ..... N80-30647 #

D210-11524-1 ..... N80-30302 #

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EG/G-TR-4999-0004 ..... N80-30565 #

EMD-80-45 ..... N80-31279 #

EOARD-TR-80-10 ..... N80-30488 #

EPA-AA-TAEB-80-10 ..... N80-30964 #

EPA-AA-TEB-80-12 ..... N80-30559 #

EPA-600/J-79-056 ..... N80-30969 #
EPA-600/2-80-049 ..... N80-30968 #
EPA-600/2-80-053 ..... N80-30973 #
EPA-600/3-80-028B ..... N80-30970 #
EPA-600/3-80-035 ..... N80-30883 #
EPA-600/4-80-018 ..... N80-30972 #
EPA-600/7-79-155 ..... N80-30965 #
EPA-600/7-80-014 ..... N80-30574 #
EPA-600/7-80-017C ..... N80-30763 #
EPA-600/7-80-017D-VOL-4 ..... N80-30313 #
EPA-600/7-80-038 ..... N80-30966 #
EPA-600/7-80-043 ..... N80-30952 #
EPA-600/8-80-013 ..... N80-31064 #

EPL-80-1/ONR-80-1 ..... N80-31042 #

EPRI-AF-1225 ..... N80-30547 #

ERADCOM/ASL-CR-80-0115-1 ..... N80-31000 #

ERADCOM/ASL-TR-0055 ..... N80-31001 #

ERC-6154-I ..... N80-30905 #

ERC41001.30FR ..... N80-31242* #

ERIM-132400-39-P ..... N80-30874* #

ERL-0103-TR ..... N80-30495 #
ERL-0123-TR ..... N80-31196 #
ERL-0132-TR ..... N80-30620 #

ESA-CR(P)-1286 ..... N80-30626 #
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NASA-CR-163487 ..... N80-30686* #
NASA-CR-163490 ..... N80-30979* #
NASA-CR-163492 ..... N80-31294* #
NASA-CR-163494 ..... N80-30750* #
NASA-CR-163495 ..... N80-30373* #
NASA-CR-163496 ..... N80-30978* #
NASA-CR-163499 ..... N80-31298* #
NASA-CR-163500 ..... N80-30352* #
NASA-CR-163501 ..... N80-30751* #
NASA-CR-163508 ..... N80-31193* #
NASA-CR-165123 ..... N80-30482* #

NASA-EP-196 ..... N80-30367* #

NASA-RP-1061 ..... N80-30441* #

NASA-SP-432 ..... N80-30367* #

NASA-TM-78289 ..... N80-30342* #
NASA-TM-78290 ..... N80-31070* #
NASA-TM-78291 ..... N80-30899* #
NASA-TM-78295 ..... N80-31289* #
NASA-TM-80633 ..... N80-30343* #
NASA-TM-80700 ..... N80-31283* #
NASA-TM-80709 ..... N80-30190* #
NASA-TM-80710 ..... N80-30377* #
NASA-TM-80721 ..... N80-31072* #
NASA-TM-80728 ..... N80-30876* #
NASA-TM-80730 ..... N80-31290* #
NASA-TM-80733 ..... N80-31097* #
NASA-TM-80737 ..... N80-31284* #
NASA-TM-80740 ..... N80-31291* #
NASA-TM-80742 ..... N80-30787* #
NASA-TM-80743 ..... N80-30458* #
NASA-TM-81105 ..... N80-30880* #
NASA-TM-81123 ..... N80-30354* #
NASA-TM-81133 ..... N80-30371* #
NASA-TM-81134 ..... N80-30370* #
NASA-TM-81139 ..... N80-31297* #
NASA-TM-81145 ..... N80-30372* #
NASA-TM-81984 ..... N80-30355* #
NASA-TM-81985 ..... N80-31285* #
NASA-TM-81986 ..... N80-30881* #

NASA-TP-1064 ..... N80-30305* #
NASA-TP-1069 ..... N80-30296* #
NASA-TP-1709 ..... N80-30716* #
NASA-TP-1725 ..... N80-30717* #

NATICK/CEMEL-195 ..... N80-31040 #

NATICK/TR-80/014 ..... N80-31040 #

NBS-SP-500-60 ..... N80-31088 #

NBS-TN-1019 ..... N80-31204 #

NBSIR-79-1580 ..... N80-30469 #
NBSIR-80-1629 ..... N80-30665 #
NBSIR-80-1967 ..... N80-30578 #
NBSIR-80-1991 ..... N80-30655 #
NBSIR-80-2012 ..... N80-30513 #
NBSIR-80-2058 ..... N80-30493 #

NCTRF-139 ..... N80-31048 #

NEPRF-CR-30-02 ..... N80-30996 #

NIMH-80/03 ..... N80-31036 #

NLR-MP-79018-U ..... N80-30785 #

NMAB-359 ..... N80-30514 #

NOAA-TM-ERL-ARL-82 ..... N80-31014 #
NOAA-TM-ERL-ARL-83 ..... N80-31016 #

NOAA-TM-ERL-WPL-48 ..... N80-31013 #

NOAA-TR-NOS-91 ..... N80-30295 #
NOAA-80032804 ..... N80-31014 #
NOAA-80040101 ..... N80-30295 #
NOAA-80040403 ..... N80-31021 #
NOAA-80040903-PT-1 ..... N80-31301 #
NOAA-80040904-PT-2 ..... N80-31302 #
NOAA-80040905-SUPPL ..... N80-31300 #
NOAA-80041601 ..... N80-31016 #
NOAA-80041603 ..... N80-31022 #
NOAA-80042201 ..... N80-31015 #
NOAA-80050101 ..... N80-31018 #

NOSC/TR-527 ..... N80-30357 #
NOSC/TR-538 ..... N80-31115 #

NP-24377 ..... N80-30947 #

NPS53-80-003 ..... N80-31134 #
NPS55-80-009 ..... N80-30291 #
NPS55-80-010 ..... N80-30290 #

NRBL-MR-4230 ..... N80-30491 #

NRL-MR-42 ..... N80-30622 #
NRL-MR-4171 ..... N80-31178 #
NRL-MR-4175 ..... N80-31207 #
NRL-MR-4187 ..... N80-30487 #
NRL-MR-4200 ..... N80-30593 #
NRL-MR-4212 ..... N80-31209 #
NRL-MR-4218 ..... N80-31208 #
NRL-MR-4219 ..... N80-30984 #
NRL-MR-4220 ..... N80-30982 #
NRL-MR-4223 ..... N80-31053 #
NRL-MR-4225 ..... N80-30698 #
NRL-MR-4229 ..... N80-30989 #
NRL-MR-4232 ..... N80-30811 #
NRL-MR-4235 ..... N80-31004 #
NRL-MR-4236 ..... N80-30358 #
NRL-MR-4241 ..... N80-31218 #
NRL-MR-4244 ..... N80-30740 #
NRL-MR-4245 ..... N80-31167 #
NRL-MR-4247 ..... N80-31212 #
NRL-MR-4252 ..... N80-31211 #
NRL-MR-4255 ..... N80-30537 #
NRL-MR-4259 ..... N80-30810 #
NRL-MR-4263 ..... N80-31251 #
NRL-MR-4264 ..... N80-31117 #

NRL-8352 ..... N80-30741 #
NRL-8387 ..... N80-30595 #
NRL-8393 ..... N80-30594 #
NRL-8395 ..... N80-30564 #
NRL-8397 ..... N80-30465 #
NRL-8400 ..... N80-30596 #

NSF/IDOE-79-130 ..... N80-31028 #

NSF/IDOE/CUEA/DR-62 ..... N80-31028 #

NSF/RA-790388 ..... N80-30576 #
NSF/RA-790428 ..... N80-30994 #
NSF/RA-800011 ..... N80-30974 #
NSF/RA-800013 ..... N80-30573 #
NSF/RA-800022 ..... N80-30575 #

NSWC/TR-80-89 ..... N80-31166 #
NSWC/TR-80-131 ..... N80-30736 #
NSWC/TR-3878 ..... N80-31073 #

NTIS/PS-75/379 ..... N80-30560 #
NTIS/PS-78/0187 ..... N80-30667 #
NTIS/PS-78/0331 ..... N80-30637 #
NTIS/PS-78/0332 ..... N80-30638 #
NTIS/PS-78/0339 ..... N80-30531 #
NTIS/PS-78/0411 ..... N80-30721 #
NTIS/PS-78/0417 ..... N80-30957 #
NTIS/PS-78/0494 ..... N80-31037 #
NTIS/PS-78/0495 ..... N80-31038 #
NTIS/PS-78/0523 ..... N80-31017 #
NTIS/PS-78/0524 ..... N80-30640 #
NTIS/PS-78/0525 ..... N80-30639 #
NTIS/PS-78/0540 ..... N80-31035 #
NTIS/PS-78/0546 ..... N80-30560 #
NTIS/PS-78/0547 ..... N80-30561 #
NTIS/PS-78/0563 ..... N80-30884 #
NTIS/PS-78/0564 ..... N80-30885 #
NTIS/PS-78/0578 ..... N80-30954 #
NTIS/PS-78/0579 ..... N80-30666 #
NTIS/PS-78/0591 ..... N80-30953 #
NTIS/PS-78/0598 ..... N80-30294 #
NTIS/PS-79/0154 ..... N80-30667 #

NTIS/PS-79/0382 ..... N80-30531 #
NTIS/PS-79/0411 ..... N80-30637 #
NTIS/PS-79/0413 ..... N80-30638 #
NTIS/PS-79/0502 ..... N80-30721 #
NTIS/PS-79/0525 ..... N80-30639 #
NTIS/PS-79/0526 ..... N80-30640 #
NTIS/PS-79/0536 ..... N80-30957 #
NTIS/PS-79/0563 ..... N80-31037 #
NTIS/PS-79/0565 ..... N80-31038 #
NTIS/PS-79/0575 ..... N80-31017 #
NTIS/PS-79/0581 ..... N80-30560 #
NTIS/PS-79/0582 ..... N80-30561 #
NTIS/PS-79/0585 ..... N80-30884 #
NTIS/PS-79/0586 ..... N80-30885 #
NTIS/PS-79/0589 ..... N80-31035 #
NTIS/PS-79/0594 ..... N80-30294 #
NTIS/PS-79/0596 ..... N80-30953 #
NTIS/PS-79/0602 ..... N80-30666 #
NTIS/PS-79/0608 ..... N80-30954 #

NTSB-AAS-79-2 ..... N80-30287 #

NUREG-CR-1119 ..... N80-30810 #

NUSC-TM-791227 ..... N80-30592 #

NUSC-TR-5821 ..... N80-31157 #

NWC-TP-6067 ..... N80-30284 #

OAT-586 ..... N80-30378 #

ONERA-RT-4/3373-SYP-VOL-1 ..... N80-30379 #
ONERA-RT-5/3373-SY-VOL-3 ..... N80-30380 #

ONR-CR-212-259-1F ..... N80-30298 #

OR-15908 ..... N80-30768 #

ORNL/CSD/TM-109 ..... N80-31083 #

ORNL/SUB-7338/1 ..... N80-30944 #

ORNL/TM-6874 ..... N80-30962 #
ORNL/TM-7209 ..... N80-30448 #

ORO-5912-T3 ..... N80-30543 #

OU-AMNE-79-15-VOL-1 ..... N80-30470 #
OU-AMNE-79-1∂-VOL-2 ..... N80-30471 #

OUEL-1291/91 ..... N80-30819 #

OWRT-A-040-DEL(5) ..... N80-31019 #

PB80-132921 ..... N80-31028 #
PB80-170368 ..... N80-30994 #
PB80-170657 ..... N80-30964 #
PB80-170731 ..... N80-30573 #
PB80-170848 ..... N80-30513 #
PB80-174964 ..... N80-30975 #
PB80-175300 ..... N80-31278 #
PB80-175417 ..... N80-30665 #
PB80-175946 ..... N80-30883 #
PB80-176274 ..... N80-31277 #
PB80-177108 ..... N80-30763 #
PB80-177173 ..... N80-30971 #
PB80-177280 ..... N80-30641 #
PB80-177306 ..... N80-30287 #
PB80-177413 ..... N80-30952 #
PB80-177421 ..... N80-31204 #
PB80-177546 ..... N80-31064 #
PB80-177793 ..... N80-30969 #
PB80-178213 ..... N80-30470 #
PB80-178221 ..... N80-30471 #
PB80-178254 ..... N80-31264 #
PB80-178312 ..... N80-30575 #
PB80-178320 ..... N80-30438 #
PB80-178759 ..... N80-30967 #
PB80-178908 ..... N80-31036 #
PB80-179047 ..... N80-30469 #
PB80-179088 ..... N80-30514 #
PB80-179286 ..... N80-30574 #
PB80-179310 ..... N80-30973 #
PB80-179351 ..... N80-30968 #
PB80-179849 ..... N80-30313 #
PB80-180003 ..... N80-30974 #
PB80-180250 ..... N80-31279 #
PB80-180417 ..... N80-31016 #
PB80-180433 ..... N80-31022 #
PB80-180672 ..... N80-30559 #
PB80-180797 ..... N80-31020 #
PB80-181027 ..... N80-31013 #
PB80-181084 ..... N80-30970 #
PB80-181274 ..... N80-30966 #
PB80-181555 ..... N80-31026 #
PB80-181563 ..... N80-31027 #
PB80-181712 ..... N80-31014 #
PB80-181753 ..... N80-30995 #
PB80-181852 ..... N80-31015 #
PB80-181910 ..... N80-30965 #
PB80-181936 ..... N80-30972 #
PB80-182090 ..... N80-30472 #
PB80-182132 ..... N80-30578 #
PB80-182157 ..... N80-31019 #
PB80-182355 ..... N80-30955 #
PB80-182389 ..... N80-31023 #
PB80-182413 ..... N80-30576 #
PB80-184377 ..... N80-31088 #
PB80-184609 ..... N80-30882 #
PB80-184757 ..... N80-30295 #
PB80-186133 ..... N80-31300 #
PB80-186141 ..... N80-31301 #
PB80-186158 ..... N80-31302 #
PB80-187354 ..... N80-31018 #
PB80-187362 ..... N80-31021 #
PB80-189137 ..... N80-30577 #
PB80-807688 ..... N80-30531 #
PB80-808041 ..... N80-30637 #
PB80-808058 ..... N80-30638 #
PB80-809775 ..... N80-30721 #
PB80-810781 ..... N80-30667 #
PB80-810831 ..... N80-30639 #
PB80-810849 ..... N80-30640 #
PB80-810856 ..... N80-30954 #
PB80-810906 ..... N80-30953 #
PB80-810922 ..... N80-31037 #
PB80-810930 ..... N80-31038 #
PB80-810989 ..... N80-31035 #
PB80-811037 ..... N80-31017 #
PB80-811052 ..... N80-30294 #
PB80-811086 ..... N80-30560 #
PB80-811094 ..... N80-30561 #
PB80-811128 ..... N80-30666 #
PB80-811235 ..... N80-30884 #
PB80-811243 ..... N80-30885 #
PB80-811433 ..... N80-30956 #
PB80-811441 ..... N80-30957 #

PM/79/15 ..... N80-31174 #
PM/79/16 ..... N80-31175 #
PM/79/18 ..... N80-31189 #
PM/79/19-PT-1 ..... N80-31126 #
PM/79/20-PT-2 ..... N80-31127 #

PMTC-TP-80-14 ..... N80-30903 #

PNL-SA-7820 ..... N80-30920 #

PNL-2521-REV-1 ..... N80-30941 #

PPPL-1658 ..... N80-31219 #
PPPL-1666 ..... N80-31221 #

PR-3 ..... N80-30866* #
PR-19 ..... N80-30551 #
PR-30 ..... N80-30617 #

PSR-923 ..... N80-30616 #

PUB-80-116 ..... N80-30743 #

PWA-FR-12248 ..... N80-30525 #
PWA-FR-13153-PT-2 ..... N80-30482* #
PWA-FR-13317 ..... N80-30490 #

QPR-2 ..... N80-31198 #
QPR-3 ..... N80-30436* #
QPR-3 ..... N80-30921 #
QPR-3 ..... N80-31197 #

QR-1/2 ..... N80-30543 #
QR-5 ..... N80-30906 #

QTPR-1 ..... N80-31255 #
QTPR-2 ..... N80-30912 #
QTPR-13 ..... N80-30554 #

QTSR-1 ..... N80-30557 #
QTSR-2 ..... N80-30546 #

RADC-TR-80-8 ..... N80-30601 #
RADC-TR-80-73 ..... N80-31246 #
RADC-TR-80-84 ..... N80-30766 #
RADC-TR-80-111 ..... N80-30769 #
RADC-TR-80-112 ..... N80-30604 #
RADC-TR-80-136 ..... N80-30309 #
RADC-TR-80-138-VOL-1 ..... N80-31077 #
RADC-TR-80-138-VOL-2-PT-1 ..... N80-31078 #
RADC-TR-80-138-VOL-3-PT-2 ..... N80-31079 #
RADC-TR-80-140 ..... N80-31107 #

RAE-LIB-TRANS-2020 ..... N80-31241 #

RAND/N-1432-DCA ..... N80-30359 #

REPT-WW/TN-80/001 ..... N80-30999 #

REPT-2-78 ..... N80-31048 #
REPT-2-79 ..... N80-30627 #
REPT-3/79 ..... N80-30628 #
REPT-5/79 ..... N80-30629 #
REPT-6/79 ..... N80-30630 #
REPT-10.2-93/NT ..... N80-30366 #
REPT-28 ..... N80-31118 #
REPT-29 ..... N80-31119 #
REPT-30/1357 ..... N80-30364 #
REPT-60/890 ..... N80-31286 #
REPT-79-120 ..... N80-31223 #
REPT-79-121-PT-1 ..... N80-31224 #
REPT-80-F-7000 ..... N80-30441* #
REPT-80-FM-27 ..... N80-30371* #
REPT-80-FM-35 ..... N80-30370* #
REPT-80-FM-38 ..... N80-30372* #
REPT-80-SM-7 ..... N80-30797 #
REPT-80-1489 ..... N80-30896* #
REPT-80F4508 ..... N80-31072* #
REPT-80F5124 ..... N80-30716* #
REPT-80HV007-VOL-1 ..... N80-30479* #
REPT-80HV007-VOL-2 ..... N80-30480* #
REPT-80HV007-VOL-3 ..... N80-30481* #
REPT-107 ..... N80-30793 #
REPT-601/01 ..... N80-30344 #
REPT-940-4 ..... N80-30462 #
REPT-970-26000-1 ..... N80-30788 #
REPT-0296-1 ..... N80-30603 #
REPT-4500-95-23-R1A ..... N80-30939 #

RFP-2862 ..... N80-31187 #
RFP-3004-VOL-1 ..... N80-30907 #
RFP-3004-VOL-2 ..... N80-30908 #
RFP-3014-VOL-1 ..... N80-30943 #
RFP-3034/3533/79-5 ..... N80-30931 #

RHO-BWI-SA-19 ..... N80-31183 #

RLO-2225-TA-30 ..... N80-31025 #

RM-391 ..... N80-31138 #

RPI-TR-MP-65 ..... N80-30726* #
RPI-TR-MP-67 ..... N80-30749* #
RPI-TR-MP-68 ..... N80-31193* #
RPI-TR-MP-69 ..... N80-30352* #
RPI-TR-MP-70 ..... N80-30750* #
RPI-TR-MP-72 ..... N80-30373* #
RPI-TR-MP-75 ..... N80-31294* #
RPI-TR-MP-77 ..... N80-30751* #

RR-79-4 ..... N80-30615 #
RR-80-1 ..... N80-31121 #
RR-179 ..... N80-31089 #

RRC-79-R-727 ..... N80-30924 #

R80-914617-1 ..... N80-30535* #
R80AEG428 ..... N80-30310* #

S-96-926 ..... N80-31267 #

SAN-1212-T1 ..... N80-30756 #
SAN-1429-52 ..... N80-30554 #
SAN-1889-T1 ..... N80-30934 #

SAND-78-8176 ..... N80-30924 #
SAND-79-2148C ..... N80-30933 #
SAND-79-2220 ..... N80-30505 #
SAND-79-2339 ..... N80-30657 #
SAND-79-2392C ..... N80-31171 #
SAND-80-0029C ..... N80-30658 #
SAND-80-0355C ..... N80-30553 #

SAND-80-0402 ..... N80-31185 #
SAND-80-0588 ..... N80-31265 #
SAND-80-0596 ..... N80-30503 #
SAND-80-0926C ..... N80-30923 #
SAND-80-8203 ..... N80-30911 #
SAND-80-05230 ..... N80-30446 #

SAPR-1 ..... N80-30588* #

SD-TR-80-41 ..... N80-30767 #
SD-TR-80-49 ..... N80-30360 #
SD-TR-80-50 ..... N80-30614 #

SERI/TP-334-565 ..... N80-30530 #

SESA-P35532 ..... N80-31084 #

SGD-426-PT-1 ..... N80-31301 #
SGD-426-PT-2 ..... N80-31302 #
SGD-426-SUPPL ..... N80-31300 #

SI-1002-VOL-2 ..... N80-30307 #
SI-1003-VOL-1 ..... N80-30306 #

SIRA-6/5309/00 ..... N80-30662 #

SM-MO-00462 ..... N80-30869* #

SNIAS-792-422-120 ..... N80-30705 #
SNIAS-792-502-101 ..... N80-31276 #

SOLAR/0010-80/04 ..... N80-30945 #

SPS-5254 ..... N80-30512 #

SR-JO-00438 ..... N80-30860* #

SR-LO-00427 ..... N80-30856* #
SR-LO-00442 ..... N80-30863* #
SR-LO-00453 ..... N80-30871* #
SR-LO-00456 ..... N80-30870* #

SR-P9-00414 ..... N80-30823* #

SR-1 ..... N80-30735 #
SR-1 ..... N80-30986 #
SR-2 ..... N80-30280 #
SR-2 ..... N80-30988 #
SR-3 ..... N80-30275 #

SRS-465 ..... N80-30576 #
SRS-472 ..... N80-30575 #

SSD-79-0010-1-VOL-1 ..... N80-30901* #
SSD-79-0010-7-VOL-7 ..... N80-30900* #

STC-79/419 ..... N80-30762 #

STRUCT-ENG-79-10/2515 ..... N80-30799 #

SU-STAN-CS-80-780 ..... N80-31057 #

SUDAM-80-3 ..... N80-31098 #

TASC-TR-868-1-1 ..... N80-30988 #
TASC-TR-1021-1 ..... N80-30289 #
TASC-TR-1640-1 ..... N80-30304 #

TDA-PR-42-58 ..... N80-30319* #

TI-08-80-06 ..... N80-30651 #

TN-8 ..... N80-30508 #
TN-1980-15 ..... N80-30609 #

TOP-2-2-800 ..... N80-30568 #
TOP-6-2-545 ..... N80-30602 #
TOP-10-2-508 ..... N80-30569 #

TPR-7 ..... N80-30918 #

TR-1 ..... N80-31052 #
TR-2 ..... N80-30880 #
TR-3 ..... N80-30489 #
TR-3 ..... N80-30620 #
TR-4 ..... N80-30483 #
TR-4 ..... N80-31120 #
TR-5 ..... N80-30484 #
TR-6 ..... N80-30485 #
TR-6 ..... N80-31019 #
TR-8 ..... N80-30790 #
TR-10 ..... N80-30612 #
TR-12 ..... N80-30500 #
TR-33 ..... N80-30463 #
TR-38 ..... N80-30801 #
TR-48A ..... N80-30693 #
TR-52B ..... N80-31106 #
TR-54 ..... N80-30797 #
TR-75 ..... N80-30509 #
TR-76A ..... N80-31105 #
TR-79-10 ..... N80-30523 #
TR-79-11 ..... N80-30522 #
TR-80-1 ..... N80-30486 #
TR-80-1 ..... N80-30528 #
TR-80-4 ..... N80-31043 #
TR-80-4 ..... N80-31131 #
TR-80-068 ..... N80-30743 #
TR-181/80 ..... N80-31055 #
TR-187 ..... N80-30589 #
TR-209 ..... N80-30909 #
TR-538 ..... N80-31194 #
TR-901 ..... N80-31132 #
TR-0080(5930-06)-1 ..... N80-30614 #
TR-0080-5901-03-1 ..... N80-30767 #
TR-0880(5505-02)-2 ..... N80-30360 #
TR-3275-80-1 ..... N80-30812 #

TRW-34902-H001-R0-00 ..... N80-31044* #
TRW-34902-H002-R0-00 ..... N80-31045* #
TRW-34902-H003-R0-00 ..... N80-31046* #

TSC-FAA-80-11-1-VOL-1 ..... N80-30266 #

TUM-RT-KB-78/4 ..... N80-30623 #
TUM-RT-KB-79/2 ..... N80-30624 #
TUM-RT-KB-79/8 ..... N80-30625 #

UCB/AM-80-5 ..... N80-30800 #

UCID-18602 ..... N80-30702 #
UCID-18614 ..... N80-31220 #
UCID-18660 ..... N80-31188 #

UCLA-ENG-8012 ..... N80-31210 #
UCLA-ENG-8016 ..... N80-30613 #

UCRL-TRANS-11542 ..... N80-30504 #
UCRL-TRANS-11563 ..... N80-31216 #

UCRL-15225 ..... N80-30450 #
UCRL-15241 ..... N80-30939 #
UCRL-52434-VOL-6 ..... N80-30445 #
UCRL-83727 ..... N80-30433 #
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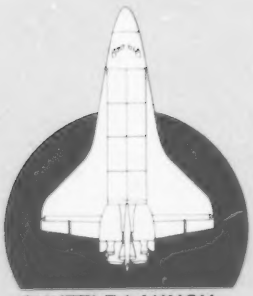

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03 AIR TRANSPORTATION AND SAFETY 2947

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04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 2948

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06 AIRCRAFT INSTRUMENTATION 2952

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07 AIRCRAFT PROPULSION AND POWER 2953

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13 ASTRODYNAMICS 2958

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Includes laminates.

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Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

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For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 3003

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 3006

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 3007

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 3008

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 3010

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 3011

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) 3017

43 EARTH RESOURCES 3017

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 3019

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 3032

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 3036

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 3040

Includes weather forecasting and modification.

48 OCEANOGRAPHY 3043

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 3044

Includes genetics.

52 AEROSPACE MEDICINE 3045

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 3049

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 3051

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 3052

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 3054

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 3057

Includes computer networks.

63 CYBERNETICS 3058

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 3058

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 3060

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 3062

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 3062

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

70 PHYSICS (GENERAL) 3063

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*

71 ACOUSTICS 3063
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 3064
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 3065
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 3066
Includes light phenomena.

75 PLASMA PHYSICS 3068
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 3071
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS N.A.
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 3075
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 3075
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 3078
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *15 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 3079
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 3080
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 3080
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 3081
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 3082
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 3082

Note: N.A. means that no abstracts were assigned to this category for this issue.

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REPORT NUMBER

N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey 3 Sep 1979 409 p refs
(Contract NAS1-15624)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01
CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, STANFORD/AMES JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS - STUDIES OF TURBULENT SEPARATION OF AIRFOILS AND WINGS
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-62)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0002, STUDY FOR THE EVALUATION OF IN-FLIGHT INSTRUMENT FLIGHT RULES PROCEDURES TRAINER
J.H. Gandelman, Embry Riddle Aeronautical University, Graduate School, *Regional Airport, Daytona Beach, Florida* 32014 (NAS 6-3040)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

1.0003, DATA ANALYSIS FOR PLASMA WAVE INSTRUMENT DYNAMICS EXPLORER PHASE III
S.D. Shawhan, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (NAS 5-25690)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0004, GRADUATE STUDENT RESEARCHERS PROGRAM
A.F. Davidsen, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (NGT 21-001-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0005, BASIC RESEARCH IN DIGITAL STOCHASTIC MODEL ALGORITHMIC CONTROL
R.K. Mehra, Scientific Systems Inc., *1640 Massachusetts Ave., Cambridge, Massachusetts* 02138 (DF143940; F33615-79-C-3613)

This effort supports AFFDL TP03, flight control technology, and specific goal FG02, flight control system design techniques. Most current digital design methodology used in practice is in reality a conversion of a predesigned analog system, using various approximate transformations. These procedures do not take into account the inherent flexibility and uniqueness of the digital computer to solve control of flight problems. The specific objective of this research is to create the mathematical basis that may be utilized by practicing control system engineer to directly design a robust and hierarchical digital control system for a flight vehicle characterized as multiple input/output and whose dynamics are characterized by equations of motion that are piecewise-continuous and nonstationary. In addition, the mathematics must account for state and control constraints and allow for a mixed analog/digital controller design. The payoff of such research is dramatic in that robustness permits some uncertainty in the dynamics of the unaugmented flight vehicle, hierarchy transitions analog frequency design procedures to direct digital control design and, finally, the capability to mix analog and digital controllers helps to minimize the risk of transition of the control system designs from totally analog to direct digital. This latter payoff will be particularly beneficial for advanced control configured vehicle control system designs currently envisioned, as they have been flight test proven primarily by analog mechanization. A satisfactory conclusion of the research will lead to a cost and performance optimized digital control system for future military aircraft.

The first task in the research effort is to critically evaluate current implementations of the MAC concept to identify those algorithm parameters that are sensitive to process and measurement noise, and those parameters that determine stability, sample rate selection, and robustness of the digital controller. This first task will be largely analytical. The second task of the research effort is to demonstrate the analytical conclusions and design guidelines using a digital simulation of a generic tactical missile-autopilot combination. The final product for this research shall be an explicit description of the criteria necessary to achieve the stated digital control design objective using the model algorithmic control (MAC) concept. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, NACS EXPERIMENT FOR DYNAMICS EXPLORER PROJECT PHASE III
G.R. Carignan, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical Engineering, *Ann Arbor, Michigan* 48104 (NAS 5-26069)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0007, DATA ANALYSIS FOR FABRY-PEROT-INTERFEROMETER FOR DYNAMICS EXPLORER PROJECT PHASE III
P.B. Hays, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (NAS 5-25691)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0008, DEVELOPMENT OF AN AERODYNAMIC HEATING COMPUTER PROGRAM FOR COMPUTER-AIDED DESIGN SYSTEMS
F.R. Dejarnette, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Raleigh, North Carolina* 27607 (NCC 1-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0009, A DIGITAL CONTROL VALVE INVESTIGATION
G.D. Jenney, Dynamic Controls Inc., *Dayton, Ohio* (DF143560; F33615-79-C-3605)

This effort addresses flight control actuation technology for military aircraft. Conventional analog electrohydraulic control valves contain a spool valve which moves in proportion to the amplitude of the input signal. The spool valve is sensitive to hydraulic fluid particle contamination and has a leakage path between the spool and its sleeve. reducing this leakage path by reducing the clearance between the spool and sleeve increases contamination sensitivity and the possibility of galling due to spool and sleeve thermal and structural distortions. The objective of this effort is to establish the feasibility of using a digital (solenoid) control valve in place of the conventional analog electrohydraulic control valve for aircraft control systems. This will significantly simplify the mechanical control actuator design and improve reliability.

A digital control valve will be mechanized with solenoid operated two position poppet valves which exhibit both positive seal off and contamination insensitivity. The control valve will be assembled in an actuator assembly with driving electronics and the assembly tested. The investigation will also concentrate on developing a suitable solenoid valve specifically for the digital valve application.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0010, COMPUTATIONAL METHODS FOR LARGE AEROSPACE STRUCTURES
V. Venkayya, U S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143120)

The Air Force function that this work effort supports is basic research in structural mechanics for aerospace vehicles. The deficiency is in computational models for large aerospace structures which incorporate static, dynamic and thermal loading. The objective is to assess our computational capability to work such problems, develop more efficient methods, and improve our understanding of the exo-atmospheric loading environment. This work will contribute to improving the design of low-cost, lightweight, large aerospace vehicles.

Initial activities will concentrate on an assessment of current local computational methods for problems involving discrete structures under static, dynamic, and thermal loading. Methods will be improved as necessary using numerical algorithms and modelling techniques currently being developed. Large lattice type structures will be examined to improve methods for systems with many degrees of freedom.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, SYSTEM DESIGN OF A 20 KW PHOTOVOLTAIC CONCENTRATOR APPLICATION EXPERIMENT AT THE DALLAS-FORT WORTH, TEXAS AIRPORT
Unknown, E Systems Inc., *1200 S. Jupiter Rd., P.O. Box 226118, Dallas, Texas* 75266 (ET-78-C-04-5311)

SUPPORTED BY U.S. Dept. of Energy

1.0012, DEVELOPMENT OF A UNIFIED THERMAL AND TRAJECTORY MODEL FOR THE PREDICTION OF HIGH-ALTITUDE BALLOON PERFORMANCE
L.A. Carlson, Texas A & M University, College Station Campus, School of Engineering, Dept. of Aerospace Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAS 6-3072)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

1.0013, ION DRIFT METER INSTRUMENT DATA ANALYSIS FOR DYNAMICS EXPLORER
R.A. Heelis, University of Texas, Dallas Campus, Graduate School, *Richardson, Texas* 75080 (NAS 5-26068)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0014, LOW ATTITUDE PLASMA INVESTIGATION DATA ANALYSIS FOR DYNAMICS EXPLORER PHASE III
J.D. Winningham, University of Texas, Dallas Campus, Graduate School, *Richardson, Texas* 75080 (NAS 5-26070)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0015, RETARDING POTENTIAL ANALYZER INSTRUMENT FOR DYNAMICS EXPLORER PHASE III
W.B. Hanson, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (NAS 5-26071)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, COMPUTING LOW-THRUST TRANSFERS TO SYNCHRONOUS ORBIT
J.V. Breakwell, Stanford University, School of Engineering, Dept. of Aeronautics, *Stanford, California* 94305 (NAG 3-63)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

2.0002, NUCLEAR POWERED SATELLITE STUDIES
Unknown, Pennsylvania State University, University Park Campus, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (EY-76-S-02-4045)

SUPPORTED BY U.S. Dept. of Energy

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CONVERSION OF CELLULOSIC AND WASTE POLYMER MATERIAL TO GASOLINE
J.L. Kuester, Arizona State University, School of Engineering & Applied Sciences, Dept. of Chemical Engineering, *Tempe, Arizona* 85281 (EY-76-S-02-2982)

The project is aimed at the conversion of cellulosic or waste polymer materials to liquid, transportable fuels. The cellulose source may be from urban refuse, agricultural or forest residues or from crops deliberately grown for energy conversion purposes (land or marine). Since cellulose (biomass) is obtained by photosynthesis (carbon dioxide plus water plus sunlight), the project is solar in nature and the feedstock (plant material) is considered a renewable resource. The process involves decomposing the feed material to basic compounds under the influence of heat (pyrolysis). The basic compounds are then introduced into a chemical reactor where a diesel or jet fuel type material is produced. If a high octane gasoline is desired, a final reaction step is used (reforming).

SUPPORTED BY U.S. Dept. of Energy

3.0002, A STUDY OF PROCESSING PARAMETERS FOR NON-METALLIC COMPOSITES

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0003, PHOTOCHEMISTRY OF MATERIALS IN THE STRATOSPHERE, LAWRENCE BERKELEY LABORATORY

H.S. Johnston, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720 (ERDA EC 04-01-01)

(1) A small telescope, spectrometer, optical multichannel analyzer, and minicomputer are used to follow light directly from the sun and from Rayleigh-scattered zenith sky light during sunrise or sunset. (2) Laboratory studies are made of elementary chemical and photochemical reactions for which rate constants are needed for model calculations in the atmosphere, and such model calculations are made. (1) By the end of calendar 1976, we hope to have established the feasibility (or not) of the method being used. (2) The results expected are new rate constants for reactions involving HO, HOO, Cl, ClO, and NO/sub 3/ free radicals and for molecular N/sub 2/O/sub 5/. (1) If the method is feasible, the apparatus will be simplified to a maximum possible extent, and another simpler system will be built. (2) Each new or better rate constant is a goal in itself, and it can be entered in tables of such values used by modelers of atmospheric reactions or of other processes involving the same reactions.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

3.0004, CROSSED MOLECULAR BEAMS

Y.T. Lee, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720

Investigation of the dynamics of elementary atomic and molecular processes and the energetics of exotic radicals and ion clusters using crossed molecular beams. Information on mechanism and dynamics of chemical reactions obtained from the direct identification and measurements of velocity and angular distributions of product molecules from single collisions. Reactions of oxygen atoms and free radicals with carbon-containing molecules and radicals under single collision conditions; primary products of many important reactions of oxygen atoms; hyperthermal chemical reactions of hydrogen, deuterium and halogen atoms; reaction of electronically excited atoms and molecules; interaction potentials between atomic and molecular species; inter- and intramolecular energy transfers and the energetics of radical molecules and the spectroscopy of molecule ions. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0005, RESEARCH IN CHEMICAL KINETICS

F.S. Rowland, University of California, Irvine Campus, School of Physical Sciences, Dept. of Chemistry, *Irvine, California* 92664

(1) Laboratory measurement of the cross-sections for absorption of solar ultraviolet and visible radiation by molecules of stratospheric interest, including CCl/sub 2/F/sub 2/, CCl/sub 3/F, CClFO, ClONO/sub 2/, etc. (2) Laboratory measurement of chemical reaction rates pertinent to stratospheric chlorine chemistry. (3) Computer calculations of atmospheric profiles for various chemical compounds, including CCl/sub 2/F/sub 2/, CCl/sub 3/F, CClFO, etc. (4) Consideration of the physicochemical processes for removal of halogen-containing molecules from all parts of the atmosphere. (1) Completion of above tasks. (2) Formulation of new problems in response to results and/or interpretations of experiments described above. The results should aid in control decisions on the possible ban of certain chlorofluorocarbon compounds (and exclusion of others) because of the hazard of stratospheric ozone depletion. (1) No scheduled decision dates. (2) No dates scheduled for completion of particular instruments, or for particular research tasks among those listed above. (3) Next scheduled project report: September, 1977. (4) Reports on completed phases of the scientific work as each phase reaches a suitable stage of completion.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

3.0006, AN INVESTIGATION OF THE EFFECT OF SURFACE IMPURITIES ON THE ABSORPTION KINETICS OF HYDROGEN CHEMISORBED IRON

M.R. Shanabarger, University of California, Santa Barbara Campus, School of Engineering, Dept. of Chemical & Nuclear Engineering, *Santa Barbara, California* 93106 (NCC 2-63)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0007, ELECTRODE POLARIZATION STUDIES IN HOT CORROSION SYSTEMS

O.F. Devereux, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Metallurgy, *Box U-37, Storrs, Connecticut* 06268 (EY-76-J-02-2960)

Hot corrosion of structural metals, iron, chromium, nickel, steel, and stainless steel, will be studied via electrode polarization in electrolytes which may arise in coal gasification reactors, specifically, molten sodium carbonate equilibrated with various sulfur-bearing reducing gas mixtures. Gas chemistry will be controlled by control of P/sub H2/, P/sub CO/, and P/sub H2S/, with a total pressure of one atmosphere and a temperature of 1000 degrees C. The nature and activity of other gas and liquid-phase species will be determined by thermodynamic modelling. Parallel manometric studies will be conducted on the nature of the gas/metal reaction in the absence of an electrolyte. These studies are intended to yield both empirical design data and detailed information concerning the nature of the hot corrosion reactions in these systems, and thermodynamic and kinetic parameters pertaining thereto.

SUPPORTED BY U.S. Dept. of Energy

3.0008, RESEARCH PROGRAM IN MATERIALS SCIENCE

H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NCC 1-36)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0009, INVESTIGATIONS OF INTERMETALLIC ALLOY HYDRIDING MECHANISMS

B.R. Livesay, Georgia Inst. of Technology, Georgia Tech Research Inst., *225 North Ave. N.W., Atlanta, Georgia* 30332 (EY-76-S-05-5246)

The objective of this program is to characterize the microstructure and physical properties of selected intermetallic compounds as related to the hydrogen sorption and desorption processes The investigations primarily concern films (both thin and thick) of FeTi and certain RT5 alloy systems where R repesents a rare earth and T a transition metal element. Through hydrogen absorption, these alloys present significant energy storage possibilities. Changes in the microstructure, magnetic properties, electronic structure, and pressure-composition relationships caused by modifications to the alloy system are studied. Surface coatings, ternary element substitutions and thermal-mechanical treatments are among the modifications made to provide information which will lead to fir Jing an optmal alloy system for hydrogen storage. The hydrogen-alloy system properties are characterized using such analytical techniques as TEM, AES and SEM as well as resistivity and magnetic measurements. The high critical hydrogen-alloy compositional curves are determined using microbalance techniques. Film thicknesses are also adjusted to provide a separation between bulk and surface properties. Attention is directed towards establishing factors that determine such chracteristics as hydride nucleation sites, growth

mechanisms, hydride decomposition, hysteresis and stability, which govern the hydriding behavior of these systems.

RESULTS: Developed methods for preparation and study of hydriding intermetallic compounds in form of thin films which remain intact during hydride cycling. Measured behavior of magnetization and magnetic anisotropy energies as function of equilibrium hydrogen pressure. Developed high hydrogen pressure equipment systems for in situ physical property measurements: 1a. Torque magnetometer; 2a. Tricrobalance; and 3a. Four-point-probe resistivity cell.

SUPPORTED BY U.S. Dept. of Energy

3.0010, HYDROGEN BEHAVIOR IN BCC METALS

H.K. Birnbaum, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Metallurgy & Mining Engineering/Materials Research, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

The mobility of hydrogen and its isotopes in solids is being studied using a variety of techniques. Emphasis is being placed on understanding the quantum diffusion mechanism of these light interstitials. Long range diffusion measurements using the Gorsky effect and local reorientation studies of H and its clusters with other solutes using acoustic techniques are being carried out. In addition to measurements of the H jump frequencies over a wide temperature range, these techniques allow a determination of the non-classical isotope effects and of the structure and behavior of small solute clusters containing H. A new technique, anelastic piezo-resistance is being applied to these studies.

In addition to its behavior inside the metal, the mobility of hydrogen at the metal-gas surface is being studied using the combined techniques of Raman spectroscopy, Auger analysis and permeation methods. This study determines the vibrational modes of H, its interactions with absorbed surface species such as SO2, H2S and H2O, and the effect of these factors on entry of hydrogen into the solid.

In cooperation with Argonne National Laboratory we are using electron diffraction, T.E.M. and neutron scattering methods to study the behavior of hydrogen in high concentration alloys. Phonon dispersion curves, diffuse scattering and crystal structure determinations are all being applied in an attempt to understand the dramatic changes in physical properties on forming the high H concentration alloys.

SUPPORTED BY U.S. Dept. of Energy

3.0011, APPLICATIONS OF ELECTRON MICROSCOPY IN MATERIALS SCIENCE

H.L. Fraser, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Metallurgy & Mining Engineering/Materials Research, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

This project is divided into three subgroups; one involves the development of techniques and interpretative methods of analytical electron microscopy. In this area, much work has been done on the use of x-ray energy dispersive analysis for microchemical determination in thin foils on the scale of approximately 200 Angstrom units. The sources of spurious x-ray signals have been determined and methods to reduce their contribution to the measured x-ray spectrum have been accomplished. Electron energy loss spectroscopy for light element determination has also been developed. The other two parts of this project involve a study of plasmon losses evident in the electron energy spectrum in specimens of various hydrogen metal alloys, and the effect of surface oxidation on defect production in B2 compounds (specifically Beta-NiAl). In the study of plasmon losses, the aim is to develop a technique of identifying and possibly quantifying hydrogen hydrides in thin metal foils. In the case of surface oxidation, it is important to understand the source of defects that are generated during annealing.

SUPPORTED BY U.S. Dept. of Energy

3.0012, MECHANISM OF STRESS-CORROSION CRACKING PROPAGATION STUDIES

E.N. Pugh, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Metallurgy & Mining Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

The propagation of stress-corrosion cracks is being investigated in a range of engineering materials, primarily using fractographic and acoustic-emission techniques. In 1978, the studies were focussed on two alloys, namely Ti-8Al-1Mo-1V and Admiralty Metal. In the former, a comparison was completed of the characteristics of stress-corrosion cracking (SCC) in aqueous chloride solutions, internal hydrogen embrittlement (IHE) and gaseous hydrogen embrittlement (GHE). The comparison provided strong evidence that SCC in Ti-8Al-1Mo-1V is a form of hydrogen embrittlement. A layer of titanium hydride was observed on fracture surfaces produced by GHE, supporting the view that cracking proceeds discontinuously by the repeated formation and rupture of this brittle layer. Crack propagation was also discontinuous in SCC and IHE, but there was no evidence for hydride formation, leaving the specific role of hydrogen in doubt in these cases. In the case of Admiralty Metal, SCC in ammoniacal solutions was found to occur by discontinuous cleavage on (110) planes. The cause of embrittlement has not been established in this case but both hydrogen and selective dissolution of zinc are currently being investigated.

SUPPORTED BY U.S. Dept. of Energy

3.0013, THE APPLICATION OF X-RAY PHOTOELECTRON AND AUGER SPECTROSCOPY TO SOME SELECTED GEOCHEMICAL PROBLEMS

I. Adler, University of Maryland, College Park Campus, School of Agriculture, Dept. of Chemistry, *College Park, Maryland* 20742 (EAR78-16421)

This project is concerned with the use of X-ray photoelectron and Auger Spectroscopy for research in several diverse areas including electronic structures of minerals, interaction processes between small organic molecules with clay and mineral surfaces, radiation damage in mineral systems such as those associated with solar wind bombardment of lunar surfaces and finally the Auger Spectra of the transition metals. Some of the proposed studies include the study of ion induced chemical alterations by XPS, the electronic structure and spectra of sulfide minerals, the electronic structure of silicates and studies on the interactions of small organic molecules with clay mineral surfaces.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

3.0014, SOURCES AND DISTRIBUTION OF TRACE ELEMENTS IN THE ANTARCTIC ATMOSPHERE

W.H. Zoller, University of Maryland, College Park Campus, School of Agriculture, Dept. of Chemistry, *College Park, Maryland* 20742 (DPP79-08964)

Gaseous and particulate samples from the Antarctic atmosphere that were collected over the past austral winter and summer at South Pole and aboard an instrumented LC-130 aircraft during the past austral summer will be analyzed. The chemical composition of these aerosols will be determined. Their variation as a function of particle size and time will be investigated, and these parameters will be related to the history of the air masses that were sampled. The size distribution of the particulate material will also be determined, and the effect of ice crystals scavenging for the removal of the particulate material from the atmosphere will be investigated. The samples taken of the Mt. Erebus plume will be evaluated to determine if Erebus emissions are a source of the aerosols observed at South Pole.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

3.0015, THE STUDY OF ATPASES IN EXTREME HALOPHILES AS POSSIBLE EVOLUTIONARY MARKERS
C.A. Ponnamperuma, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Chemistry, *College Park, Maryland* 20742 (NCA 2-420001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0016, METAL VAPOR EXCIMERS
J. Jacob, Avco Corp., Everett Research Laboratory, *2385 Revere Beach Pkwy., Everett, Massachusetts* 02149 (ES-77-C-02-4275)

The objective of this research is to investigate metal vapor excimers and CdHg in particular. To achieve this objective, a 600 degrees C discharge cell will be designed and fabricated. This cell will be interfaced with a high energy electron gun. Initially the discharge physics will be studied; we will obtain V-I characteristics. The fluorescence efficiency of CdHg will be measured. Also, by probing the active medium with a dye laser we will measure the gain and absorption as a function of wavelength. Finally, an optical cavity will be constructed and laser experiments on the CdHg will be attempted.

SUPPORTED BY U.S. Dept. of Energy

3.0017, MATERIALS PROCESSING RESEARCH BASE FOR THE MATERIALS PROCESSING
M.C. Flemings, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 7645)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

3.0018, ELECTRONIC CONDUCTION IN SOLID OXIDE ELECTROLYTES
H.L. Tuller, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EG-77-S-02-4436)

The following investigations are being performed: electronic conduction in solid oxide electrolytes, a subgroup of fast ionic conductors in which oxygen diffuses rapidly at elevated temperatures. Parameters controlling nonstoichiometry, impurities, and electronic mobility; pure and doped ThO2 examined for electronic conductivity, thermoelectric power, and ionic transference number; and microstructural studies of second phases, grain boundary effects, and segregation. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0019, SPECTROSCOPIC INVESTIGATIONS OF SMALL MOLECULE INTERACTIONS ON METAL OXIDE SURFACES
E.I. Solomon, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ER-78-S-02-4988)

A research program for the investigation of the surface chemistry of catalytically important metal oxide systems is proposed. Primary emphasis will be placed on the interaction of a number of chemically relevant small molecules with zinc oxide, aluminum oxide and chromium oxide single crystal surfaces and catalytic powders. These experiments will employ two separate vacuum systems, in order to perform both survey type and detailed spectroscopic investigations. The surveys of the adsorption chemistry of these crystals will be performed using angle integrated ultraviolet photoemission spectroscopy in combination with Low Energy Electron Diffraction, Auger, and X-ray photoemission spectroscopy. More detailed spectroscopic investigations of the adsorbed molecules will be performed using angle-resolved ultraviolet photoemission and high resolution electron energy loss spectroscopy. By these techniques we hope to elucidate the nature of the surface geometric and electronic structural requirements for chemisorption on these materials, and thus gain insight into the fundamental processes of oxide catalysis.

RESULTS TO DATE: Studies have been performed on single crystal surfaces of zinc oxide for four orientations: (1010), (1120), (0001), and (0001). Adsorption of CO is strongly enhanced on the two non-polar (1010) and (1120) faces over the adsorption on the polar (0001) and (0001) faces, indicating that the adsorption requires both coordinatively unsaturated zinc and oxygen ions. (Adsorption on the polar faces would then be associated with the high density of non-polar steps occurring on these faces.) Further chemisorption studies have been performed with NH3, H2O, CO2, H2 and 02. Poisoning and ligand competition studies on the four ZnO faces have been used to investigate the adsorption behavior and to further characterize the nature of the interaction of CO with ZnO.

SUPPORTED BY U.S. Dept. of Energy

3.0020, ALTERNATIVE FUELS/ENERGY SOURCE STUDY FOR NONHIGHWAY TRANSPORT SYSTEMS
R. Alpaugh, Exxon Research & Engineering Co., *1600 Linden Ave., Linden, New Jersey* 07036 (EC-77-C-05-5438)

In this project combinations of power systems, fuels, and time frames will be evaluated for the purpose of identifying the most attractive of these combinations for further development and commercialization. To accomplish this a literature search will be conducted. The data will be screened by considering issues such as resource availability, interaction with military and international sectors, institutional problems, and cross-mode impacts. A ranking of fuel choices by mode and time frame will then be developed. From this, R and D requirements will be identified and the contractor will recommend an R and D program designed to promote the orderly transition of nonhighway modes to non-petroleum based fuels.

SUPPORTED BY U.S. Dept. of Energy

3.0021, DEUTERIUM PLASMA-MATERIAL WALL INTERACTIONS
J.K. Tien, Columbia University, School of Engineering & Applied Science, Dept. of Mining Metallurgical & Mineral Engineering, *Broadway & W. 116th St., New York, New York* 10027 (EG-77-S-02-4393)

The achievement of fusion as a safe, viable energy source depends on the integrity of the materials used to contain the thermonuclear reaction. Of all the fluxes which these materials will have to withstand, one of the most insidious involves the interaction of the fuel for the fusion reaction, that is, the hydrogen isotope plasma with material surfaces. Hydrogen isotopes are capable of reducing the ductility of structural materials to unacceptable levels. In addition, their bombardment of material surfaces results in significant loss of material leading to poisoning of the plasma and thus to preventing the achievement of fusion conditions. At Columbia University, we employ an electromagnetic plasma shock tube to study the accelerated exposure of materials to deuterium plasma. A single shock tube run, lasting only 20 hours, is the equivalent of an entire year of Tokamak fusion power reactor, deuterium plasma exposure. A range of materials is being subjected to plasma exposure. They include candidate fusion materials, such as stainless steels, and nickel base alloys; advanced concept materials such as refractory metal alloys; and nonmetallics such as graphite and boron nitride. We have documented the occurrence of unipolar arcing, a most insidious mechanism which is capable of producing copious amounts of plasma impurities. We have also determined by direct observation the penetration of deuterium into these materials. The occurrence of bulk embrittlement effects has also been detected. Our next objective is to extend our work to include the plasma exposure of specimens at elevated temperatures, typical of actual reactor operation (i.e., approximately 500 degrees C).

SUPPORTED BY U.S. Dept. of Energy

3.0022, NITRIC OXIDE PRODUCTION FROM CHEMICALLY BOUND NITROGEN IN COAL
Unknown, Research Foundation of State University of New York, *P.O. Box 9, Albany, New York* 12201 (EF-77-G-01-2742)

The factors which influence the conversion of chemically bound nitrogen in coal to the oxides of nitrogen will be exam-

best copy available

ined in a laboratory combustor. The work will focus on the role of flame temperature, coal and char composition and aerodynamic mixing on fuel nitrogen conversion in coal combustion. The problem will be approached experimentally in two steps. First the relative levels of fuel NO and thermal NO will be determined for a pulverized coal diffusion flame. Fuel NO will be isolated by using various mixtures of argon, oxygen and carbon dioxide in place of atmospheric air in our combustor and comparing to the NO levels obtained when the coal sample is burned in air under that same flame temperature condition. Different types and ranks of coal will be examined to determine the influence of the actual fuel composition upon our results. The composition will be determined from ultimate and proximate analysis. The composition of the products of combustion will be sampled and analyzed using a variety of techniques. The NO, NO2, CO2,O2, SO2 and total hydrocarbon gas concentrations will be monitored in the exit plane of the combustor. This will provide an overall evaluation of factor influencing NO production from fuel bound nitrogen compounds. The second phase of the work will examine the influence of coal particle density and velocity (hence mixing effects) upon NO generation. Sampling will also be done at these locations to provide a concentration map of constituents within the combustor. Results should provide insight of the local effects influencing fuel NO production.

SUPPORTED BY U.S. Dept. of Energy

3.0023, THEORETICAL STUDIES OF CHEMISORPTION ON TRANSITION METAL SURFACES - INTERACTION OF HYDROGEN WITH TITANIUM

J.L. Whitten, Research Foundation of State University of New York, *Stony Brook, New York* 11794 (EG-77-S-02-4387)

This research is concerned with the theory of chemisorption of molecules on solid surfaces and is directed toward the development of a theoretical model for treating electronic interactions ab initio. Calculations on the hydrogen - titanium system are proposed in which the objective is to obtain a detailed account of molecule - surface interactions including an adequate response of the lattice to the adsorbate. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy

3.0024, LOCAL ELECTRONIC PROPERTIES OF SEMICONDUCTOR SURFACES AND INTERFACES

M.G. Lagally, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Mineral & Metallurgical Engineering, *Madison, Wisconsin* 53706 (EG-77-S-02-4435)

The local electronic properties of surfaces and interfaces of some elemental and compound semiconductors will be studied using Auger Electron Spectroscopy (AES). In addition, chemisorption of Cl and O on Si will be studied. AES will be augmented with XPS and UPS to investigate a series of orthorhombic IV–VI semiconductor compounds. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, MODELING OF THE EVOLUTION OF MAGNETIC FIELD STRUCTURE IN AN ACTIVE REGION

S.T. Wu, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (NGT 01-002-081)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0002, CONCEPTUAL DESIGN STUDY OF LIGHTNING OPTICAL/SENSOR SYSTEMS

W.L. Wolfe, University of Arizona, Graduate School, Dept. of Optical Sciences, *Tucson, Arizona* 85721 (NAS 8-33720)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0003, LIGHTNING DETECTION FROM SPACE

P. Krider, University of Arizona, School of Liberal Arts, Dept. of Atmospheric Sciences, *Tucson, Arizona* 85721 (NAS 8-33718)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0004, FAILURE MECHANISM STUDY OF GAAS TECHNOLOGY

G. Ladd, Hughes Aircraft Co., *3100 W. Lomita Blvd., Torrance, California* 90509 (DF912000; F30602-78-C-0326)

The objective of this effort will be to determine the reliability limitations of GaAs field effect transistor devices.

The approach will consist of in-depth physical studies of possible life limiting mechanisms such as electromigration, ohmic contact degradation, charge trapping at interface, crystal defects, deplating of metals, and defects in passivation. Arrhenius activation energies for the above mechanisms will be determined and their effect on the reliable life of various FET devices will be developed. Devices representing the limits of frequency, power output, and low noise will be analyzed to establish worst case operating conditions with trade-offs depending on the system life required for various applications. Test structures will be used to isolate various failure mechanisms for detailed determination of the activation energy and the affect of material, processing and stress factors on the activation energy. The end item will be a report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0005, DESIGN AND CONSTRUCT PROTOTYPE ENGINE FOR ENERGY CONSERVATION - 1HP NITINOL HEAT ENGINE

Unknown, McDonnell Douglas Corp., *5301 Bolsa Ave., Huntington Beach, California* 92647 (ET-78-C-05-6028)

SUPPORTED BY U.S. Dept. of Energy

4.0006, LABORATORY TEST OF THE THEORY OF IONOSPHERIC STABILITY UNDER POWER SATELLITES

Unknown, Power Conversion Tech. Inc., *San Diego, California* 92121

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

4.0007, THE FOURTH INTERNATIONAL CONFERENCE ON PHOTON CORRELATION TECHNIQUES IN FLUID MECHANICS

K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-66)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0008, CONTROL AND MODELING OF A CELSS (CONTROLLED ECOLOGY LIFE SUPPORT SYSTEM)

D.M. Auslander, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (NCC 2-67)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0009, VAPOR-LIQUID PHASE SEPARATOR
T.H. Frederking, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (NCC 2-64)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0010, HIGH DEFORMATION-RATE EXTENSIONAL RHEOLOGY OF POLYMERIC ANTI-MISTING ADDITIVES
S. Middleman, University of California, San Diego Campus, School of Engineering, Dept. of Aerospace & Mechanical Engineering Sciences, *P.O. Box 109, La Jolla, California* 92037 (NCA 2-658001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0011, ASSESS USE AND DEVELOPMENT OF A COMPUTER CODE ROTATING FLOWS
K.J. Kopecky, Drake University, School of Liberal Arts, Dept. of Mathematics, *25th & University Ave., Des Moines, Iowa* 50311 (NAS 8-33728)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0012, RECRUIT INTO ENGINEERING HIGH ABILITY MINORITY AND FEMALE STUDENTS (REHAMFS)
J.W. Bonds, Bowie State College, Graduate School, *Bowie, Maryland* 20715 (NCA 5-96)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0013, REDUCTION OF RTG DATA FROM VIKING LANDERS AND PIONEER SPACECRAFT
C. Goebel, Teledyne Energy Systems, *110 W. Timonium Rd., Timonium, Maryland* 21093

SUPPORTED BY U.S. Dept. of Energy

4.0014, NONLINEAR OPTICAL INTERACTIONS IN SEMICONDUCTORS
M.M. Salour, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF055150; F49620-79-C-0071)

AF function - secure space communications and covert optical electronics require devices which exploit special properties and interactions of materials with infrared radiation. Opportunity -infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - this effort investigates a variety of nonlinear optical processes in semiconductors utilizing ultrafast spectroscopic techniques to probe the basic physics of the interaction of intense subpicosecond pulses with semiconductors. How work contributes - the ultimate goal of this work is to use these interactions as the basis for obtaining tunable coherent infrared sources as required for communications, optical radars, and plasma diagnostics for plumes and exhausts.

To achieve the goal of generating tunable coherent infrared sources and controlling this radiation by means of novel mode-locking and modulation techniques, the following nonlinear processes will be studied: 1) ultrafast radiative recombination processes in CDS and CDSE - the characteristic delay, rise and decay times of recombination radiation at high exciton densities will be measured, 2) enhancement of electron-hole recombinations by adjusting the band gap of narrow-gap semiconductors to the energy of elementary excitation in solids such as phonons or plasmons. Testing this approach via pumping of different samples of n-type semimetallic Hg1-x Cd x Te and making time resolved photoconductivity and lifetime measurements with an ultrafast streak camera, 3) pulsed, optical pumping experiments in semiconductors, 4) time resolved induced absorption due to exciton-biexciton transitions, 5) laser-induced dielectric breakdown in transparent solids, 6) optical frequency mixing spectroscopy in semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, DYNAMIC ANALYSIS OF THE SOLAR ELECTRIC PROPULSION (SEP) SOLAR ARRAY AND SPACE SHUTTLE
E.G. Abu Saba, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Civil Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NCC 1-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0016, MICROPROCESSOR CONTROL OF A WIND TURBINE
A. Dybbs, Case Western Reserve University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *University Cir., Cleveland, Ohio* 44106 (NCC 3-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0017, POWER TRAIN DEVELOPMENT/ANALYSIS LARGE SCALE WIND TURBINE SUPPORTING RESEARCH AND TECHNOLOGY PROGRAM
R. Kasuba, Cleveland State University, School of Engineering, Dept. of Mechanical Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NCC 3-6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0018, APPLIED AERODYNAMICS OF WIND TURBINES
R.E. Wilson, Oregon State Higher Education System, Oregon State University, School of Engineering, Dept. of Mechanical Engineering, *200 Covell Hall, Corvallis, Oregon* 97331 (EY-76-S-06-2227-023)

SUPPORTED BY U.S. Dept. of Energy

4.0019, RAY-TRACING FOR EFFECTS OF DISTURBANCES & SPACETENNA STRUCTURAL DISTORTIONS ON THE SOLAR POWER SATELLITE PILOT BEAM SIGNAL (ABBREV)
A. Marouf, Texas A & M University, College Station Campus, School of Engineering, Dept. of Electrical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAS 9-16088)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0020, TIRE NONLINEAR MODEL
C.M. Anderson, College of William & Mary, Williamsburg College, Graduate School, *Ewell Hall, Williamsburg, Virginia* 23185 (NCC 1-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0021, ELECTRON BEAM CHARGING AND ARC DISCHARGING OF SPACECRAFT INSULATING MATERIALS
K.G. Balmain, University of Toronto, *92 College St., Toronto, Ontario, Canada* M5S 1B2 (NSG 7647)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, LNB SYSTEMS DEVELOPMENT

R.H. Canada, Sperry Support Services, *1112 Church St., Huntsville, Alabama* 35801 (NAS13-60)

OBJECTIVE: To develop a meteorological and oceanographic data acquisition system for installation on the U.S. Coast Guard's Large Navigation Buoys (LNB). The data will be transmitted via the GOES satellite and distributed via the National Weather Service's network.

APPROACH: A prototype system was installed in October 1979 on the Columbia River Bar LNB for a six-month test and evaluation. Results of the prototype testing will be used to finalize the design for refitting most of the LNB's.

CURRENT PLANS AND PROGRESS: The procurement and installation of operational systems will begin in FY81 as part of the National Weather Service's Coastal and Offshore Observation Programs (COOPS).

SUPPORTED BY U.S. Dept. of Commerce, Office of Ocean Engineering, National Data Buoy Office

5.0002, FIELD SUPPORT FOR STATE PLUME STUDIES

J.F. Meagher, U.S. Tennessee Valley Authority, Air Quality Research Section, *c/o OSWHA, Muscle Shoals, Alabama* 35660 (D8-E721-DL; G603A-AA-053)

This task is part of a large program to determine transport, transformation, and removal processes and rates affecting atmospheric concentrations of sulfur compounds. Initial emphasis is on studies of definable plumes out to times and distances of 24 hrs. and 500 km, respectively. Field support consists of providing personnel to make observations, collect data, perform limited source sampling, and support other investigators, as well as providing physical facilities, including power and communications for the many components of the study. Support aircraft are also provided.

The output of this task is principally support for all investigators in the program; limited analyses of data on source emissions rates and boundary layer structure will also be furnished.

Work underway in preparation for the study will be continued through the actual field work in August 1978.

Copies of data for deriving emission rates from the TVA's Cumberland power plant for all days of the August field study were furnished, together with data for the Johnsonville and Paradise plants when plumes from these sources might have been affecting sampling results. Copies of five unpublished data volumes listing meteorological and air quality monitoring data were prepared and distributed to participants for use in analyzing data from surface and airborne measurement platforms. Copies of the data on magnetic tape were provided to the STATE data bank. A two-volume analysis of the meteorological conditions for each sampling day was prepared and distributed to participants.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0003, STUDY EFFECTS OF INTERNAL WAVE ON THE NEUTRAL ATMOSPHERE

R.J. Hung, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (NAS 8-33726)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0004, ANALYSIS AND APPLICATION OF VECTOR MAGNETIC FIELD DATA IN PREDICTING FLARES

K.R. Krall, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (NAS 8-33525)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0005, DATA ANALYSIS & MODELING OF ULTRAVIOLET SPECTROMETER & POLARIMETER EXPERIMENT & OTHER RELATED EXPERIMENTS FOR SOLAR MAXIMUM MISSION

S.T. Wu, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (NAS 8-33526)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0006, MAGNETIC FIELD ANNIHILATION IN THE MAGNETOSPHERE AND SOME APPLICATIONS

S.I. Akasofu, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (EY-76-S-06-2229 005)

The magnetic field annihilation process has been believed to be one of the basic processes in cosmic electrodynamics, releasing a considerable amount of energy in a relatively short time, and has also been believed to take place in the tail region of the magnetosphere (manifested by magnetospheric substorms), in the planets (such as Mercury and Jupiter), in some comets, and in certain regions of the Galaxy. The one common feature in these regions is that the oppositely directed magnetic field regions are separated by a thin sheet-like region (often called the neutral sheet). We have been interested in energy-related geophysical problems in the arctic region. During the last 12 months, we helped corrosion engineers of the Alyeska Pipeline Co. in monitoring an induction current in the Trans-Alaska pipeline. We have found that electric currents of order 200 amperes are induced in the pipe during medium auroral activity. We are at present monitoring the amount of electric currents which leaks from short segments of an underground section of the pipe. We have also been interested in applying the audio-frequency (10 Hz to 10KHz) magnetotelluric method in sounding permafrost regions in Fairbanks. (ERDA 77-55)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

5.0007, INTERPRETATION OF LARGE GEOLOGIC FEATURES AND TRENDS ASSOCIATED WITH ALASKAN MINERAL OCCURRENCES BY MEANS OF ENHANCED SATELLITE IMAGERY

P.A. Metz, University of Alaska, Fairbanks Campus, School of Mineral Industry, *Fairbanks, Alaska* 99735 (G5195004; ASK-79-XPL (7))

OBJECTIVE: To interpret and correlate large geologic features and trends with known Alaskan mineral occurrences by means of enhanced satellite imagery.

APPROACH: Major mineral occurrences (approximately 250) will be plotted on a 1:1,000,000 base map. Computer enhanced ERTS imagery of Alaska will be examined to determine optimal spectral combinations for depicting linear and geometric features, lithologies, and alteration suites. Orientation, length, spacing, and density of linear intersections will be determined. Density of linear intersections and mineral occurrences will be contoured by trend surface techniques. Rose diagrams will be constructed. Data obtained from this research will complement existing projects on mineral resource evaluation and will be incorporated in a publication on the Geology and Mineral Resources of Alaska.

SUPPORTED BY U.S. Dept. of the Interior, Office of Surface Mining Reclamation & Enforcement

5.0008, COMPUTER STUDIES OF BAROCLINIC STABILITY IN SPHERICAL GEOMETRY

R.L. Gall, University of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (NAS 8-33815)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0009, INVENTORY AND HAZARDS MONITORING OF MINED LANDS USING AUTOMATED PROCESSING OF SATELLITE IMAGERY AND COLLATERAL DATA

C.E. Glass, University of Arizona, School of Engineering, Dept. of Mining & Geological Engineering, *Tucson, Arizona* 85721 (G5195005; ARZ-79-RES (1))

OBJECTIVES: Develop an operational program using satellite remote sensing data, collateral data, and automated image analysis to provide coal, uranium, and copper mine inventory, monitoring and reclamation of mined lands. Develop videotape seminars and short courses concerning the previously stated objectives.

PROCEDURES: Utilize computer mapping and analysis methods applied to remote sensor imagery and collateral data. Arizona will be the study area.

SUPPORTED BY U.S. Dept. of the Interior, Office of Surface Mining Reclamation & Enforcement

5.0010, VEGETATION MAPPING AND INVENTORY OF FOREST RESOURCES FOR SANTA CRUZ COUNT USING LANDSAT IMAGERY

N.H. Pillsbury, California State University & Colleges, California Polytechnic State University, School of Agriculture & Natural Resources, Dept. of Natural Resources Management, *San Luis Obispo, California* 93407 (NCA 2-678001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0011, ONE- AND TWO-DIMENSIONAL ATMOSPHERIC COMPUTER MODEL AND STUDIES

C.A. Riegel, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2-68)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0012, MECHANISMS FOR THE EFFECT OF SOLAR VARIABILITY ON WEATHER

W.O. Roberts, Aspen Inst. for Humanistic Studies, *1919 14th St., Suite 811, Boulder, Colorado* 80302 (ER-78-S-02-4634)

To establish statistical relationships between parameters of variable solar activity and meteorological effects. To fit physical mechanisms to these statistical results, attempting to find plausible physical explanations for the various features of the relationships discovered through statistical analysis. To attempt to verify these proposed mechanisms using independent data.

RESULTS: In the 2 1/2 months of the current project, we have examined the effects of the passage of large solar plages across the solar disc on the circulation of the earth's atmosphere. As the plage approaches the center of the sun, the intensity of cyclonic circulation in the earth's atmosphere increases.

SUPPORTED BY U.S. Dept. of Energy

5.0013, REMOTE SENSING OF WATER QUALITY VIA LASER-RAMAN SPECTROSCOPY

M.C. Goldberg, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Denver, Colorado* (CR 71-176)

Water quality determinations in large lakes, estuaries or rivers are difficult at best by single point measurements. A remote sensing device capable of rapid scan over large areas would efficiently, and rapidly convey continuous water quality data to the water user and the hydrologist. This data would immediately give a quality map of basins, and estuaries. Such information cannot be obtained with present methods due to logistic and cost barriers. Remote methods cut cost, give continuous rather than point data, and reduce time of analysis from months to hours.

A study would utilize an array of lasers each operating at a particular frequency chosen to permit a 'fingerprinting' identification which utilizes the strongest absorptions of the particular compounds being sought, and detect laser-induced fluorescence of water contaminants. The energy source can be modulated and the 'fingerprinting' frequencies selected for maximum sensitivity. Laser light attenuation should be measured as a function of water composition, angle of incidence, water surface roughness and atmospheric interference. The laser frequencies and the details of light source modulation and detector design must be selected for maximum sensitivity. Sunlight interference can be simulated by superposing a sunlamp or actual sunlight onto the laboratory water sample.

A continuous wave laser, operating in the green red region will be used in conjunction with a detector package to evaluate the possibility of sensing surface films. Experience gained will be incorporated into a second phase which would be sensing and recording the sediment profile of surface waters. Use of a pulsed laser combined with a ranging detection system and a sweep field mounting would be incorporated into laboratory simulations to evaluate sensitivity and feasibility of this approach to remote sensing.

The project was inactive during FY 74.

Move to adequate space, set up a dual laser spectrometer system capable of examining dissolved solutes, suspended materials and solid surfaces. The limits of resolution and sensitivity for single component systems will be established.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0014, RADIONUCLIDE MIGRATION NEAR NUCLEAR EXPLOSION SITES, NEVADA TEST SITE

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Approximately 90 nuclear devices have been exploded beneath the water table at Nevada Test Site. Although dissolved radionuclides have been identified in water collected from explosion cavities, the lack of documented migration of explosion-derived nuclides other than tritium has led to some complacency that the most hazardous contaminants are retained indefinitely at explosion sites. The mobility or immobility of specific radioisotopes must be documented by controlled field experiments at and near explosion sites.

The objective of the study is to determine as quantitatively as possible the degree of mobility of specific radionuclides in the natural media of Nevada Test Site. USGS/WRD objectives in the first of at least two experiments are: (1) determine the hydraulic properties of alluvium in the vicinity of the Cambric explosion sites in Frenchman Flat; (2) characterize the chemical quality of water and the changes resulting from the explosion; and (3) select a location and supervise construction and pumping of a well near the Cambric site. An additional objective is to identify sites for similar experiments in other media.

At the site currently being investigated and at future sites, the approach will be: (1) review of hydraulic and hydrochemical data to determine the probable natural characteristics; (2) drill through the collapsed rubble above and in the explosion cavity and pump water at several depths to determine chemical, radiochemical, and hydraulic properties; (3) pump water from a well located 3 to 5 cavity radii from the explosion point and sample for chemical and radiochemical analysis; (4) model the flow field and interpret data in terms of the model; and (5) prepare reports on experimental methods and results.

A total of 2.347 x 10**6 m**3 of water have been pumped from RNM-2S, a satellite well to Cambric Reentry site. A tritium breakthrough occurred about December 1977 and concentrations have steadily increased from below detection levels of 480 to 4.12 x 10**5 pCi/L without any indication of reaching a plateau. Quality of water samples from RNM-2S are very steady. A continuous record of water levels in three observation wells, including the pumped well, indicate near steady-state conditions.

Pumping at RNM-2S will continue, samples will be taken for tritium analysis 2 to 3 times per week. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0015, INVESTIGATIONS OF POINT AND NON-POINT SOURCE EMISSIONS THROUGH CONTROLLED AIRBORNE SAMPLING

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Lightweight remote controlled samplers which are carried aloft by tethered balloons have been developed to investigate particulate and gaseous emissions from point and non-point sources. The sampling systems have both vertical and horizontal mobility and are capable of sampling at selected altitudes for relatively long periods of time. meterological packages are also attached to the balloons so that the ambient temperature, wet bulb temperature, and pressure are monitored at the same time as the sampling operations.

To date, the systems have been used to sample fly ash emissions from the plumes of coal fired power plants. Field programs to investigate the effects of flue gas conditioning on the emissions from a power plant burning low sulfur western coal and to investigate the particulate and gaseous constituents of the plume from a portland cement plant are planned for the near future.

During the second program year efforts will continue to quantify the impact of conditioning treatments on power plant emissions. The balloon-borne samplers will also be used to monitor other point and non-point source emitters where sampling from the ground, from towers, or by aircraft is impractical.

SUPPORTED BY U.S. Environmental Protection Agency

5.0016, CHARACTERIZATION OF GLASSY SILICATE SPHERULES IN DEEP-SEA SEDIMENTS

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This research project is investigating the geographical distribution patterns, age of deposition, and the physical and chemical properties of small, glassy particles (microtektites) which have been observed in deep-sea sediment cores. The origin and significance of these glassy objects has been the subject of considerable discussion since their discovery about fifteen years ago. One interpretation is that they represent the direct input of extra terrestrial material after falling through the atmosphere and settling through the water column. Alternatively, they may reflect the impact of large extraterrestrial objects with the earth's crust and the re-melting of the earth's crust into glassy droplets which 'splashed' outward over a large portion of the earth's surface. The basic objective of the research is to determine the origin of these glassy objects, and use the results to interpret the history of extraterrestrial source materials to the earth's surface. The results also provide a means for precise stratigraphic control in particular age intervals of deep sea sediments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0017, SEA SURFACE SATELLITE THERMAL RESOURCE DATA

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The objective of this project is to provide an analytical tool for synoptic assessment of thermal resource and biota variations at sites of probable OTEC locations via satellite imagery. The project also provides a synoptic assessment of principal variant (sea surface temperatures) in OTEC thermal resources. The final scope of effort of this project is contingent upon related resource assessment projects.

The suggested scope of effort is to: a. Determine OTEC thermal resource data requirements by review of existing system and subsystems specifications. b. Assess the state of practice in thermal IR imagery via satellite and compare to OTEC requirements. c. Develop a methodology for acquiring relevant data and apply to OTEC resource assessment. d. Prepare a scheme for OTEC operational usage of satellite data. e. Analyze existing IR data and include this information in OTEC data summaries/atlas(es). f. Acquire and analyze oceanic optical properties for plant impact assessment.

BIBLIOGRAPHIC REFERENCES: Maul, G., de Witt, T.P., Yanaway, A., and Baig, S. Geostationary Satellite Observations of Gulf Stream Meanders: Infrared Measurements and Time-series Analysis, Journal of Geophysical Research. No. 83, C-12, pp. 6123-6135 (1978).

SUPPORTED BY U.S. Dept. of Energy, Office of Solar Geothermal Electric & Storage Systems

5.0018, GEOHYDROLOGY OF SINKHOLES, WEST-CENTRAL FLORIDA

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Sinkholes are an important avenue of recharge to the Floridan aquifer as well as a potential source of pollution. Aquifer stress caused by ground-water withdrawals accelerates sinkhole development, particularly during dry periods when pumpage is at a maximum and head difference between the surficial and artesian aquifer is greatest. Cases of sinkhole collapse and land subsidence due to the effects of pumpage have been documented. Occurrence of sinkholes in highways and in land adjacent to well fields is common. Because of the increasing demands for water in the near future, it is anticipated that the frequency and magnitude of sinkholes near well fields may increase.

Develop an understanding of sinkholes and their relation to the hydrologic system by relating sinkhole occurrence, density, and type to ground-water withdrawals, and to geohydrologic factors such as topography, drainage patterns and densities, confining-bed thickness, solution features in the limestone, head differences between surficial and artesian aquifers, and drought or flood conditions. Develop a classification of sinkhole types and potential of occurrence in selected well-field areas. A map of sinkhole-prone areas of Southwest Florida Water Management District will be compiled.

A terrain analysis of the study area will be made using parameters such as areas of internal drainage, size, shape, density and interrelations of sinkholes, thickness of overburden, confining-layer thickness, and head difference between Floridan and surficial aquifers. In addition, well-field records will be researched for quality-of-water data, pumpage records, and reported sinkhole occurrences.

Study sinkhole density, size, shape, interrelationships, on existing aerial photos and photomaps in selected areas. Research well-field records for quality of water data, pumpage records, and reported sinkhole occurrences. Field check selected sinks. Attempt spatial analysis of sink density and relationships. Attempt correlation of sink size, shape, interrelationship with head difference, confining bed thickness, occurrence on terraces of known geologic age. Compile final map of areas of internal drainage, evaluate data and write report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0019, NORTH PACIFIC EXPERIMENT (NORPAX) - EXCHANGE OF EQUATORIAL PACIFIC WATERS FROM TRITIUM STUDIES

R.A. Fine, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., *4600 Rickenbacker Cswy., Coral Gables, Florida* 33149 (OCE78-22120)

This project is part of the North Pacific Experiment (NORPAX). The long-range goal of NORPAX is to understand fluctuations in the upper layers of the Pacific Ocean with scales of months to years and space scales in excess of 1,000 kilometers, and the relationship of these oceanographic fluctuations to overlying and adjoining atmosphere. Achievement of this goal should eventually lead to improved weather/climate prediction for both the Pacific Ocean and North America.

One major component of NORPAX is a coordinated field program to determine the space and time variability of the density and velocity fields in the upper layers of the Equatorial Pacific current system. This field program will occur between February 1979 and July 1980 and will involve the efforts of a number of scientists. Measurements will be made from ships, airplanes and moored and drifting instruments.

This grant will fund Drs. Fine and Ostland to do the logistics and analysis of tritium on the Equatorial shuttle. Initially, several hundred samples will be taken on two legs of the shuttle. Tritium and hydrographic data will be used to estimate the exchange rates between equatorial current systems and the quantitative importance of meridional transport to the data will

be used to estimate the exchange rates between equatorial current system and the quantitative importance of meridional transport to the upwelling process.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0020, MODIFICATION OF A COMPUTER GENERAL CIRCULATION MODEL OF THE EARTH'S ATMOSPHERE FOR THE ATMOSPHERIC GENERAL CIRCULATION EXPERIMENT

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SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

5.0021, PROGRAM FOR SOLAR ENERGY METEROLOGICAL RESEARCH AND TRAINING SITES

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We plan to modify, and where necessary, expand or contract the solar radiation and anemometer networks now operating in Hawaii so that in time we shall be able to estimate with some confidence the solar energy potential and its annual and diurnal variations at any point in the islands. Careful routine comparisons of radiometers with a sub-standard and calibration of anemometers in our wind tunnel would ensure high-quality measurements. Our already extensive list of courses relevant to solar energy would be supplemented by more focused courses in meteorology and engineering, incorporating laboratory work at solar radiation and wind field sites and emphasizing relationships between input and energy output. Seminars and workshops would reach and inform a wider, non-academic audience. Research, involving both graduates and undergraduates, would explore the underlying physical causes of diffuse radiation and of terrain-effects on radiation, of fluctuations in the trade wind inversion and their influence on surface wind speeds. We would also determine whether cloudiness monitored from satellites, and rainfall measured by recording gauges, could be correlated with direct measurements of radiation. Throughout we would seek to improve the quality of radiation and wind forecasts out to about 36 hours. Developments in numerical modelling would be tested and any that performed well, applied.

SUPPORTED BY U.S. Dept. of Energy

5.0022, FRACTURE CONTROL OF COEUR D'ALENE ORE DEPOSITS

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OBJECTIVE: Delineate new exploration targets for base metals in Northern Idaho's Coeur d'Alene mining district through study of regional distribution of fractures by remote-sensing methods combined with surface mapping and analysis of fracture control of underground ore bodies in operating mines.

APPROACH: Examine ore control of existing bodies and search for new in-mine exploration targets using remote-sensing imagery data and digital data combined with surface mapping techniques. The linear study will gather (1) known surface traces and trends of ore bodies, faults, and fractures, (2) available information on foliation attitudes of host rocks, and formation contacts, and (3) data on ore body orientation and orientation of ore body related fractures. Starting from the thesis that the bulk of the Coeur d'Alene ore bodies is fracture controlled, this project will attempt to develop a fuller knowledge of fracture patterns to recognize favorable new ideas for exploration on district-wide and individual mine bases. Efforts will address ground truth for various various fracture systems disclosed by linear analysis primarily at operating mines and other favorable-appearing target areas. Stratigraphic and chemical work will investigate the possibility of strata-bound sulfides in the Silver Belt.

SUPPORTED BY U.S. Dept. of the Interior, Office of Surface Mining Reclamation & Enforcement

5.0023, MODELS FOR ABUNDANCES OF VOLATILE MATERIALS IN ATMOSPHERES OF TERRESTRIAL PLANETS & FOR THE INTERIORS OF URANUS & NEPTUNE (ABBREV)

A.S. Grossman, Iowa State University of Science & Technology, College of Humanities & Sciences, Dept. of Physics, *Beardshear Hall, Ames, Iowa* 50010 (NCA 2-340002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0024, PLANNING STUDY FOR URBAN STORM-WATER-QUALITY INVESTIGATIONS IN THE SUB-HUMID PLAINS AREA

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The U.S. Geological Survey under interagency agreement with the Environmental Protection Agency, will implement a program of studies to evaluate water-quality and water-quantity problems as associated with urban-stormwater runoff in several major cities nationwide. The studies will provide a data base for a wide geographic distribution. Because distribution densities and physiographic and climatic conditions will vary widely and will be unique to each area, prototype work plans must be developed regionally in order to arrive at a nationally consistent data base for urban hydrology.

To conceive a regional work plan for an urban-stormwater quality study to be made in the sub-humid plains area. The plan will detail procedures for (a) selection of basin(s) to be studied, (b) selection of data collection sites, (c) designation of the principal parameters and frequency for hydrologic data collection, and (d) definition of approach for evaluation and interpretation of the data.

The general approach for the preparation of the 'prototype' work plan will be to (1) select a typical urban watershed in the sub-humid plains area where an urban stormwater-quality study is considered feasible; (2) compile information on basin boundaries, basin characteristics, and storm-sewer network; (3) compile land use maps and aerial photos to determine various land uses and percentage of each within the basin; and (4) define hydraulic characteristics of the basin in relation to sampling site selections and suitability of sites for instrumentation.

Select a typical urban watershed and compile basin characteristics.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0025, DEVELOPMENT & DEMONSTRATION OF A LONG RANGE TRACER SYSTEM

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OBJECTIVE: This project will provide meteorological assistance in describing and interpreting air quality in the Western U.S. from existing or proposed energy resource activities.

APPROACH: Energy development sites will be surveyed, existing or proposed air quality and meteorological monitoring networks will be surveyed and assessed, and environmental impact from future sources will be predicted. Selected air quality measurements will be analyzed, using meteorological trajectory and removal data.

PROGRESS: Recommendations for augmenting or modifying existing networks will be made, and meteorological support will be provided for ambient air monitoring performed in EPA Energy Accomplishment Plan 81 ABF.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Office of Environmental Processes & Effects Research

5.0026, EVALUATION OF THE PROPOSED MICROWAVE SOUNDING UNIT

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0027, JOINT US-USSR MID-OCEAN DYNAMICS EXPERIMENT (POLYMODE) - THEORETICAL STUDIES OF LAGRANGIAN KINEMATICS AND DYNAMICS AND GULF STREAM RINGS

G.R. Flierl, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (OCE77-28350)

This project is part of POLYMODE. The long range goal of POLYMODE is to understand the role of the mesoscale eddies in the general circulation of the ocean.

This project includes theoretical work on two separate but overlapping problems in mesoscale oceanic theory: Lagrangian Kinematics and dynamics, and Gulf Stream Ring modelling. The Lagrangian problems study the movements of submerged floating particles such as Sofar floats, water with special chemical or temperature-salinity characteristics, or biological matter. The kinematic studies deal with the trajectories of particles in a given flow field (e.g. the velocity field of a moving Gulf Stream Ring) or in a turbulent flow field with given statistics. The dynamical studies will consider the simplification of the Lagrangian equations of motion under the standard constraints characterizing mesoscale motions--long time and length scales and dominantly geostrophic, hydrostatic force balances. Applications to oceanic experiments will be considered.

The Gulf Stream Ring studies will include calculations of the ability of one of these mesoscale vortices to carry particles along with it as it moves through the ocean. Dynamical models of the rings will be studied to determine which physical effects cause or inhibit translation, distortions of the circular shape, dispersion (formation of neighboring highs and lows by wave radiation), and decay. The existence and properties of 'Solitary waves' with a circular shape will be investigated. In these waves, the nonlinear terms in the equations of motion counteract the terms which tend to cause dispersion, leading to an eddy of a long-lived nature.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0028, DISPERSAL OF COAL DUST FROM TRANSSHIPMENT AND POWER PLANT STORAGE FACILITIES

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Rapid methods for sampling and identification of particulates will be used to study the dispersal of wind-borne particulates from power plants and validation of numerical models for dust dispersal. A numerical model based on statistical solution to the gradient transfer problem has been developed for this project. The model will be validated at a test site in Minnesota.

Rapid detection of dustfall has been made possible by optically scanning for spherical fly ash on particle by particle basis. The method has been developed here for examination of particle shapes in suspended solids.

Samples will be collected at the Cohasset Power Plant for various wind episodes and scanned optically to determine dustfall rates as a function of winds for model calibration purposes. Subsequently, the model will be used to determine yearly deposition rate and distribution of fly ash fallout around the plant. Prediction of the long term accumulations will be checked by examination of dustfall accumulated in snow. Snow surface reflectivity monitored at ground and from satellite offers a possible check on the determination of the distribution of dustfall.

SUPPORTED BY U.S. Environmental Protection Agency

5.0029, POLLUTANT MONITORING BUOY DEVELOPMENT

R.H. Canada, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Data Buoy Office, Engineering Div., *NSTL Sta., Biloxi, Mississippi* 39529

OBJECTIVE: To develop buoy systems for measuring limited parameters in areas of hazardous material spills. The buoys will be stored and maintained in an operational readiness state, be easily transportable to a deployment site in the coastal waters of the United States, and be deployed from 82-foot or larger vessel of opportunity without specal handling equipment. The program goals are for a production cost of approximately $15,000 per buoy.

APPROACH: To use a modified, off-the-shelf microprocessor-based data system for acquiring the data and transmitting it via the GOES satellite.

CURRENT PLANS AND PROGRESS: A new hull design being completed by April 1980 will then be developed for use in the prototype testing.

SUPPORTED BY U.S. Dept. of Commerce, Office of Ocean Engineering, National Data Buoy Office

5.0030, TECHNIQUES OF FLOOD-PLAIN MAPPING FOR LAND-USE MANAGEMENT OF FLOOD PLAINS

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Identification of lands subject to flooding is necessary for land-use management on flood plains. Accurate delineation on maps, of areas subject to inundation by floods of a given frequency is required--information on frequency of flood discharges, profiles of water-surface elevations along the channel, and large-scale topographic maps. Information obtained during field surveys is needed for computing water-surface profiles by step-backwater procedures. New techniques of photogrammetry, electronic measurement from aircraft, computation of backwater profiles, and the plotting of maps and cross sections by computer may offer more efficient means of flood-plain delineation.

To evaluate potential flood-mapping techniques, appraise their accuracy in relation to cost for various uses and time frame in which flood-plain maps are of maximum use, and to investigate means to carry out flood-mapping techniques at an accelerated rate.

Investigate and compare available methods of obtaining data required for preparing maps, charts, and interpretive reports associated with identification of flood-prone areas. Determine the range in costs involved in the conventional aerial photography-stereo model approach of obtaining measurements of valley cross sections. Investigate the potential of the laser altimeter in its application to aerial surveying, and the possibility of direct survey from the air without going through the stereomodel plotting process.

The fabrication phase of the contract work begins at Draper Lab Oct. 1, 1978 and because of budgetary constraints will likely span a 3-year period. The department has authorized USGS to include a $3.6 million item for this work in its FY'80 budget request. This would leave $770k to be requested for FY'81, assuming no added costs were incurred due to the time stretchout. About $1 million of unused inertial guidance hardware is being drawn from other Draper Lab contract work for adaptation to the USGS' APT system at substantial savings. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0031, PREDICTION OF SUBSIDENCE ASSOCIATED WITH UNDERGROUND COAL MINING

D.J. Barr, University of Missouri, Rolla Campus, School of Engineering, Dept. of Mining Petroleum & Geological Engineering, *Rolla, Missouri* 65401 (G5195025; MSR-79-XTR (2))

OBJECTIVES: To develop a predictive model for subsidence and ground stability in the Interior Coal Province.

APPROACH: Using an existing remote sensor image processing system and interactive data base software programs, a set of geographically referenced files of digitized topographic, stra-

tigraphic and structural geologic data will be created along with corresponding underground mine layout, extraction characteristics and underground operation conditions. The files of digitized surface and subsurface geologic features will be constructed for an area of known subsidence over existing underground coal mines in the Illinois coal basin. The relationships of spatial geologic data (including subsurface geology, surface lineaments, topography and drainage features) to depth and shape of mine workings; mine roof, pillar and floor stability; and surface subsidence effects will be determined. That combination of features which constitutes the predictive relationship for known conditions will then be tested in other areas of similar geology and mine practice in order to establish measures of accuracy and reliability.

SUPPORTED BY U.S. Dept. of the Interior, Office of Surface Mining Reclamation & Enforcement

5.0032, AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCES PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA
R.E. Stoiber, Dartmouth College, School of Arts & Sciences, Dept. of Earth Science, *P.O. Box 833, Hanover, New Hampshire* 03755 (NCC 5-22)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0033, NIGHT-TIME/DAY-TIME ORBITAL SURVEY OF LIGHTNING EXPERIMENT SUPPORT
M. Brooks, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (NAS 8-33817)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0034, PRECIPITATION-RUNOFF MODELING OF WATERSHED SYSTEMS IN NORTHWESTERN NEW MEXICO
H.R. Hejl, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Albuquerque, New Mexico* (NM 79-333)

The effects of surface mining for coal on the quantities and quality of surface flow systems in the strippable coal-lease area in the San Juan Basin during a period of change in land use are unknown. The Bureau of Land Management needs to predict the effects of surface mining on the water resources in the coal-lease areas in order to manage the coal-bearing areas of the public domain.

Develop, test, and verify precipitation-runoff models for predicting surface runoff characteristics and sediment yield under various land-use conditions in the coal-lease areas in northwestern New Mexico. The emphasis will be on relating parameters used by the model to measurable physical features of a selected watershed basin to facilitate transferability of the model from an instrumented basin to uninstrumented basins.

A selected watershed basin with a drainage area of less than 10 square miles in the strippable coal-lease area in the San Juan Basin will be instrumented for collecting streamflow data for quantity and quality of water, precipitation data, soil-moisture data in the root zone, and meteorological data. Data will be tested in the basic precipitation-runoff model development by the modeling group in the Central Region office, as it is collected, to aid in refinement of data collection and model development. The basic model is a modular package using a distributed-parameter approach. The long-term rainfall required as the driving variable for the model will be generated with a stochastic model from short-term rainfall records collected throughout the coal-lease region of San Juan Basin.

Operation of streamflow gaging station, recording raingage, PS-69 automatic pump sampler, and single-stage sampler at the selected watershed basin for precipitation-runoff modeling. Additional instrumentation to be installed and operated will include four recording raingages over the basin and meteorological station which will collect data on relative humidity, air temperature, wind speed, wind direction, and solar radiation. Soil-moisture observation wells will be installed in the watershed and monitored periodically. The operation of these recording raingages throughout the coal lease region will be a part of the project.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0035, ANALYSIS OF INTERMEDIATE WAVELENGTH ANOMALIES OVER THE OCEANS IN MAGNETIC FIELDS MONITOR SATELLITE AND SEA SURFACE DATA
J. LaBreque, Columbia University, Graduate School, *109 Low Memorial Library, New York, New York* 10027 (NAS 5-25891)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0036, AIRBORNE SPECTRORADIOMETER TECHNIQUES FOR MINERAL EXPLORATION IN FORESTED TERRAIN
J.T. Kuo, Columbia University, School of Mines, *Broadway & W. 116th St., New York, New York* 10027 (DAR78-16320)

The purpose of the project is to investigate and verify the phenomenon of detecting plant stress, due to toxic metals in the soil, by spectral radiation. If the phenomenon is verifiable, as it appears to be, a method of prospecting for buried ore bodies in forested areas can be developed. The prospecting method would utilize a spectroradiometer and aircraft for rapid transects over an area of interest.

The project consists of: (1) a comprehensive analysis of existing spectral data obtained over known ore bodies, (2) geochemical and biochemical analyses of plant and soil samples obtained at the same sites as the spectral data and (3) controlled botanical experiments in the laboratory.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Applied Research

5.0037, THE MOTION OF CIRCUMPLANETARY PARTICLES - THE ORIGIN AND EVOLUTION OF PLANETARY RINGS, AND POSSIBLE DUST COATINGS OF REGULAR SATELLITES
J.A. Burns, Cornell University, Ithaca Campus, School of Engineering, Dept. of Theoretical & Applied Mechanics, *242 Carpenter Hall, Ithaca, New York* 14853 (NCA 2-175001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0038, DATA ANALYSIS AND MODELING OF ULTRAVIOLET SPECTROMETER AND POLARIMETER EXPERIMENT AND OTHER RELATED EXPERIMENTS FOR SOLAR MAXIMUM MISSION
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SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0039, DEMONSTRATION PROJECT TO EVALUATE THE UTILITY OF OPERATIONAL APPLICATIONS OF LANDSAT TO COUNTY AND LOCAL GOVERNMENT AGENCIES
P.R. Baumann, State University of New York, College at Oneonta, School of Arts & Sciences, Dept. of Geography, *Oneonta, New York* 13820 (NAS 5-25967)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0040, PLANETARY ATMOSPHERES RESEARCH
T. Owen, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Science, *Stony Brook, New York* 11790 (NCC 5-23)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0041, AUTOMATED TECHNIQUES FOR MAPPING URBAN LAND COVER WITH REMOTE SENSING DATA
R. Craig, Kent State University, School of Arts & Sciences, Dept. of Geology, *Hilltop Dr., Kent, Ohio* 44240 (NAS 5-26111)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0042, SERVICE, MATERIALS AND PERSONNEL NECESSARY TO PROVIDE CORRELATIVE DATA EFFORTS FOR WFC FIELD MEASUREMENTS OFFICE
J.K. Luers, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (NAS 6-3086)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0043, HYDROLOGIC MODELING COAL CREEK BASIN NEAR LEHIGH, OKLAHOMA (EMRIA)
S.J. Playton, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Oklahoma City, Oklahoma* (OK 78-049)

Coal underlying about 375,000 acres in the eastern Oklahoma coal field is Federally owned. The Bureau of Land Management is charged with the responsibility of assessing probable water-resource impacts and reclamation capabilities of any area under Federal jurisdiction in which surface mining for coal might occur. None of the studies so far underway in Oklahoma's coal fields specifically addresses the problem of predicting effects on water resources of extracting coal by surface mining techniques. A study by the U.S. Geological Survey, in cooperation with the Bureau of Land Management, is under way.

The study's primary objective is to collect and interpret sufficient hydrologic data to predict and assess the effects of surface mining for coal and subsequent reclamation efforts on hydrologic characteristics. A secondary objective is collection of sufficient hydrologic data so that baseline hydrologic conditions can be defined and possible changes occurring after mining takes place can be documented.

Development, calibration, and verification of a watershed model is the approach to be used to aid prediction of future effects of surface mining for coal. The data required for such a modeling effort are sufficiently complex and expensive as to render modeling large areas unfeasible in terms of available money and manpower. Oklahoma District's study will be concentrated in one basin, the Coal Creek basin near the town of Lehigh in Coal County, Oklahoma.

All instrumentation for necessary data collection was purchased and installed in FY78. Included are a stream-gaging station, a climatological data-gathering station, continuous water-quality monitor, automatic water sampler, 4 precipitation gages, neutron-probe access tubes, 3 crest-stage gages, and 2 batteries of single-stage sediment samplers. After installation, operation commenced on a part-year basis.

All installed instrumentation will be operated and maintained, and hydrologic data necessary for model calibration and establishment of base line conditions will be collected. A detailed geologic map of the area will be prepared.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0044, SOLAR ENERGY METEROLOGICAL RESEARCH AND TRAINING SITE
E.W. Hewson, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Atmospheric Sciences, *126 Agricultural Hall, Corvallis, Oregon* 97331 (EY-77-G-06-1059)

The project objectives include: (1) to establish a primary solar radiation and related meteorological measurements and research facility at Oregon State University, Corvallis; (2) to develop an academic year training program at Oregon State University with new courses on the theory and measurement of solar radiation; (3) to conduct summer workshops on solar energy measurement and instrumentation techniques and to organize a seminar series on solar energy related topics; and (4) to expand the statewide network of solar radiation monitoring stations, presently maintained by the University of Oregon, Eugene, to include the remaining four states of the region. Planned activities include: (1) radiation climatology of the Pacific Northwest; (2) passage of solar radiation in clouds and fogs; (3) radiative transfer in cloudy, turbid atmospheres; (4) multispectral radiometric and polarimetric investigations of atmospheric turbidity; (5) radiative properties of surfaces; (6) photometry of the daytime sky; and (7) interpolation among solar radiation measurement stations in mountainous terrain.

SUPPORTED BY U.S. Dept. of Energy

5.0045, INFRARED HETERODYNE OBSERVATION OF THE STRATOSPHERE FROM BALLOON BASED PLATFORM
M.M. Abbas, Drexel University, School of Science, Dept. of Physics & Atmospheric Science, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NCC 1-33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0046, CHEMICAL ANALYSIS OF VEGETATION SAMPLES
C.B. Smith, Pennsylvania State University, University Park Campus, School of Agriculture, Dept. of Horticulture, *201 Ag. Admin. Bldg., University Park, Pennsylvania* 16802 (NAS 5-25996)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0047, WATERBORNE ORGANIC MATTER ANALYSIS
J. Yungel, West Chester State College, Undergraduate School, Dept. of Earth Sciences, *West Chester, Pennsylvania* 19380 (NAS 6-3096)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0048, IMPROVING ESTIMATES OF STREAMFLOW CHARACTERISTICS IN COAL MINING AREAS WITH DIGITAL LAND-COVER DATA FROM SATELLITES
E.F. Hollyday, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *A 413 Federal Bldg., U.S. Courthouse, Nashville, Tennessee* 37203 (TN 79-039)

The government needs to judge the adequacy of proposed reclamation plans submitted by coal strip-mine operators. This judgment in part must be based upon the best available estimate of natural streamflow. These estimates may be made by transferring streamflow records from gaged to ungaged sites by techniques of regionalization that involve multiple regression of basin characteristics with streamflow characteristics. Studies have shown that basin characteristics measured from satellite data can improve the accuracy of these estimates in other regions.

The primary objective is to improve upon the regression equations used to estimate streamflow in areas affected by coal mining in the Cumberland Plateau by using land-cover information derived from digitally processed LANDSAT data as well as maps. The digital data will update the land-cover data base for the New River basin project 'Hydrologic Effects of Coal Mining'.

The usefulness of the digital land-cover data base, developed from LANDSAT tapes and available map data, will be tested by an experiment designed to compare two sets of regression equations, one containing the most up-to-date, but routinely-derived, basin characteristics, and the other containing the gee-whiz basin characteristics derived from LANDSAT tapes and available maps.

Acquire base map; transfer drainage divides to base; measure value of map-derived basin characteristics; acquire LANDSAT tapes; let data-processing contract; classify terrain based upon field reconnaissance and available imagery; transfer classification to base map and measure land-cover data by drainage basins; run regressions of streamflow characteristics vs. basin characteristics; interpret; draft report; publish report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0049, PROJECT DA VINCI MANNED SCIENTIFIC BALLOON EXPEDITION

Unknown, Inst. for Storm Research Inc., *Houston, Texas* 77006 (EY-76-C-05-4763)

SUPPORTED BY U.S. Dept. of Energy

5.0050, DIAGNOSTIC ANALYSIS OF THE ENVIRONMENT OF SEVERE STORMS USING ATMOSPHERIC VARIABILITY

J.R. Scoggins, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Meteorology, *College Station, Texas* 77843 (NAS 8-33776)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0051, SOLAR POWER SATELLITE MICROWAVE/IONOSPHERE INTERACTION STUDY

J. Clynch, University of Texas, Austin Campus, Applied Research Lab., *200 W. 21st, Austin, Texas* 78712 (NAS 9-16086)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0052, LIGHT SCATTERING BY NONSPHERICAL PARTICLES

K. Liou, Utah Higher Education System, University of Utah, School of Science, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NCA 2-821001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0053, DEVELOPMENT OF DATA PROCESSING

E.C. Kinole, Old Dominion University, School of Engineering, Dept. of Mathematical & Computing Sciences, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NCC 1-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0054, COORDINATION OF WRD INSTRUMENTATION

R.W. Paulson, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (WD 72-070)

Increasing requirements by WRD Districts for the supply of instrumentation, and by the WRD data collection program for new and better data define a need for coordination of instrumentation development and supply. Moreover, there needs to be a focal point through which WRD's instrumentation program is represented to other government agencies, foreign hydrologic activities, and instrument development companies in the private sector.

To establish an instrumentation coordination function within the WRD.

During the period FY77-79 WRD has established a hydrologic instrumentation facility at NSTL Station, Miss., to provide a central facility to supply, repair, and develop WRD instrumentation. The resources of this facility and the WRD's satellite telemetry research program are the principal activities being coordinated to insure that WRD priorities are met. With time the scope of coordination will expand.

Significant progress was made in defining the role of the Hydrologic Instrumentation Facility (HIF). A HIF Building was begun. A proposal from COMSAT General was received for a real time hydrologic data collection pilot program.

Staff the HIF and complete removal of all significant instrumentation activities from Reston. Finish negotiating a contract with COMSAT General. Finish program planning for an instrumentation development effort by the HIF.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0055, EVALUATION OF A COMSAT GENERAL PILOT PROJECT TO PROVIDE THE USGS WITH A REAL-TIME HYDROLOGIC INFORMATION SERVICE

W.G. Shope, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (WD 79-142)

The Water Resources Division has identified numerous needs and benefits for real-time hydrologic data telemetered from remote data collection sites. Acquisition of real-time data will allow better operation of the data collection network and permit timely delivery of critical data to the water user community. Because of limited manpower and ever-expanding technology, it would be very difficult, if not impossible, for WRD to provide extensive support to real-time data activities.

To evaluate the hydrologic information services proposed by COMSAT General and to develop specifications for a 5-year, 2,000-site, real-time network that will be contracted in 1981.

The pilot project calls for a 101-site network that includes Virginia (1), Pennsylvania (20), Massachusetts (20), Florida (15), Colorado (20), Arizona (15), and Washington (10). The contractor will be responsible for acquisition (sensors), collection (satellite telemetry), screening (error checks, alerts), and dissemination (teleprocessing). Data will be delivered to the Reston Honeywell computer in real-time where it will be available for interactive processing by WRD users. Once each day the data will be transferred to WATSTORE from the Honeywell computer. The project will be managed and evaluated by the Chief, WRD Data Relay Project, and participating Districts.

Select 101 sites, begin operations under the contract, and evaluate results of preliminary reports from the contractor on instrumentation and system performance. These data will be used to formulate specifications for an operational real-time data collection service involving more than 2,000 sites.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0056, MICROWAVE REMOTE SENSING

W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 73-088)

The project office is involved in a wide variety of remote sensing and ground truth work in the Arctic Ocean through the AIDJEX (Arctic Ice Dynamics Joint Experiment) and POLEX (Polar Experiment) organizations, and in the Gulf of St. Lawrence and Lake Ontario through NASA's SKYLAB program and the International Field Year for the Great Lakes (IFYGL). The imagery from ERTS-1 and NOAA-2 satellites have provided us with the first large-scale high resolution imagery of the sea ice canopy. Also the first all-weather, all-time synoptic imagery of the Arctic ice canopy is provided by the ESMR imagery from NIMBUS 5. It is necessary to compare the various data with surface data to get some idea of the gross dynamics and morphology of the Arctic canopy. Comparison of this satellite data with surface data from the Gulf and Lake Ontario areas will give us a picture of the gross dynamics and morphology of these regions.

The AIDJEX-NASA aircraft data and surface ground truth data have given us the means of distinguishing multiyear ice, first year ice, and water by means of microwave imagery of the ice canopy. Canadian and Creel scientists and NASA and Canadian aircraft will provide us with important aircraft data and ground truth measurements of fresh water and sea ice on the Gulf of St. Lawrence and Lake Ontario. However, in order to properly estimate the amount of each form and its metamorphosis it is necessary to cross-correlate the high resolution ERTS-1 and NOAA-2 imagery with the low resolution microwave imagery. Once this is done, select areas of the Arctic ice canopy where AIDJEX ground truth data is available will be studied and selected areas in the Gulf and Lake Ontario where SKYLAB data and ground truth measurement are available will be studied. These data will be very useful to help in the planning of the main AIDJEX experiment to take place in 1975-1976 and for future POLEX experiments.

The project office receives ERTS-1 data from several sources and NOAA-2 data from the National Environmental Satellite Service. The ESMR data comes slowly from Goddard Space Flight Center to the project office, and NASA SKYLAB

data will be available also covering the Gulf of St. Lawrence and Lake Ontario. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0057, ELECTROMAGNETIC METHODS FOR MEASURING SNOWPACKS

M.F. Meier, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 73-101)

Snow is an important water resource in many areas, but it changes rapidly and is difficult to measure. No method currently exists for measuring water equivalent (mass) or free-water content (wetness) of snow remotely. The latter characteristic cannot even be measured at a station with sufficient accuracy for many hydrologic or remote-sensing purposes.

Develop better understanding of electromagnetic properties of snow, especially absorption, volume-scattering, and back-scattering. Devise instruments to be used in the field to make these measurements and to obtain hydrologically useful data. Adapt these instruments to remote (airborne) systems.

Study theory, do numerical modelling, develop instruments, test these in the field, and design prototype systems. Investigate swept-frequency radar, electrical resonance-width, and microwave-absorption methods, and other innovative techniques.

No funding was provided this year, but cooperation did continue with Dr. Linlor. A profiling snow-wetness (liquid water content) meter using active microwave absorption was completed and testing begun in snow. This instrument and others were used to determine radar parameters of snow.

Continue modest cooperative effort.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0058, 1980 LAND COVER CLASSIFICATION FOR THE PUGET SOUND REGION

R.D. Shinn, University of Washington, School of Architecture & Urban Planning, Dept. of Urban Planning, *Seattle, Washington* 98105 (NCA 2-850001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0059, BOMB RADIOCARBON SECTIONS ALONG THE HAWAII-TAHITI SHUTTLE TRACK

Unknown, University of Washington, School of Arts & Sciences, Dept. of Geological Sciences, *Seattle, Washington* 98105

SUPPORTED BY U.S. Dept. of Energy

5.0060, NONPOINT-SOURCE POLLUTION FOR URBAN AND RURAL AREAS IN LOWER FOX RIVER BASIN

P.E. Hughes, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Madison, Wisconsin* (WI 79-096)

Methods for estimating nonpoint-source pollutant loading from different land-use types and intensities in urban and rural areas are required to develop effective water-quality-management plans. Before such pollution can be controlled adequately, better methods are required to identify source areas, determine quantity and quality of runoff, and correlate change in loads with change in land-use practices or management.

Determine nonpoint-source pollutant loads in urban and rural streams. Estimate effects of change in land-use practice or management on loads. Test the application of several water-quality models for estimating loads. Evaluate remote sensing techniques for land-use characteristics for water-quality modeling.

Streamflow and water-quality data will be collected at 2 urban sites and one rural site which are representative of different types of land use. Land-use data will be determined by the University of Wisconsin from high altitude and LANDSAT imagery. Four water-quality models will be calibrated and verified, and their results compared for accuracy. Nonpoint-source pollutant load will be computed for the basin using best model.

Establish 2 urban and 1 rural watershed-monitoring stations. Rate stations and collect water-quality samples for 9 or 10 storms. Monitor streamflow and precipitation in basin. Select water-quality models for evaluation, and perform initial calibration of models.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0061, MEASUREMENT OF AIRBORNE AND PRECIPITATION RADIOACTIVITY AND ITS METEOROLOGICAL APPLICATION

R. Reiter, Institut fur Atmospharische Umweltforschung der Fraun. Gesel, *Kreuzeckbahnstrasse 19 Frg, Garmisch Partenkirchen, Federal Republic of Germany* (EY-76-C-02-3425)

The influx of stratospheric air into the biosphere is studied with the objective to obtain information about the frequency distribution of stratospheric intrusions as a function of seasonal and inter-annual variations. Stratospheric intrusions are indicated by high concentrations of the cosmogenic radionuclides Be7, P32, P33, and the ozone, measured at the mountain observatory Zugspitze (300 m a.s.l.). The transport of stratospheric air into the troposphere is determined on the basis of the isentropic trajectory analysis. The forecasting of stratospheric intrusions is performed based on observations of the variation of the relative humidity in the upper troposphere.

The quality of the forecasting technique is subjected to a statistical examination.

Aerosol layers in the stratosphere are measured by means of a lidar system.

RESULTS: It has been possible to prognosticate the fallout of the Chinese nuclear test of 25 September 1976. The forecasts of the influx intensity of stratospheric air into the biosphere came exactly true in 70% of the cases. The height of the stratospheric aerosol layer found changed during the period of observation.

SUPPORTED BY U.S. Dept. of Energy

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, TERRESTRIAL ECOLOGY PROGRAM

R.G. Clements, University of Puerto Rico, Rio Piedras Campus, U.S. Dept. of Energy Center For Energy & Environmental Res., *Caparra Heights Station, San Juan, Puerto Rico* 00935 (000616)

The study will describe the interrelationships among climate, vegetation, soils, animals and man and their combined influence upon the hydrologic cycle of the drainage basin both at the local and regional level. Programmed research to be ordered by a five year comprehensive research plan to produce a data base and models where applicable, for environmental assessment and management. (1) Completion of Five Year Master Research Plan September 1976. (2) Interim reports on Soil, Plant, Animal and Limnological Surveys, January 1977. (3) Publication of 'Succession and Regrowth following Irradiation in a Tropical Forest'. (4) A ten year summary January 1977. (5) Initiation of the hydrology project of the Upper Espirito Santo Basin, 1978. (6) Establishment of drainage network throughout the drainage basin, 1977. (7) First approximation model of drainage basin, 1978.

SUPPORTED BY U.S. Dept. of Energy, Div. of Biomedical & Environmental Research

6.0002, ACCELERATION VERSUS ORTHOSTATIC TOLERANCE AFTER EXERCISE TRAINING IN MEN AND WOMEN

P.J. Brock, California State University & Colleges, California State University, Hayward Campus, School of Education, Dept. of Physical Education, *25800 Carlos Bee Blvd., Hayward, California* 94542 (NCA 2-290001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, THE EFFECT OF SPACE FLIGHT AS SIMULATED BY BED REST ON DRUG DISPOSITION
D.C. Harrison, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NCC 2-70)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, CARDIOVASCULAR EFFECT OF WEIGHTLESSNESS STUDIED BY TWO-DIMENSIONAL REAL-TIME ULTRASOUND
R.L. Popp, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NAS 9-16050)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0005, EVALUATION OF OSTEOCALCIN AS THE HOMEOSTATIC CONTROL MECHANISM FOR MINERALIZATION IN BONE
C.W. Asling, University of California, San Francisco Campus, School of Medicine, Dept. of Anatomy, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665004)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0006, INTERACTIONS BETWEEN OSMOLALITY AND BLOOD VOLUME IN THE CONTROL OF VASOPRESSIN SECRETION
D.J. Ramsay, University of California, San Francisco Campus, School of Medicine, Dept. of Physiology, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665006)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, EFFECTS OF ADRENERGIC AGENTS ON VASOPRESSIN SECRETION
I.A. Reid, University of California, San Francisco Campus, School of Medicine, Dept. of Physiology, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665005)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, GRADUATE STUDENT RESEARCHERS PROGRAM
I. Kuntz, University of California, San Francisco Campus, School of Pharmacy, Dept. of Pharmaceutical Chemistry, *551 Parnassus Ave., San Francisco, California* 94122 (NGT 05-029-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0009, PROLIFERATION AND DIFFERENTIATION OF PERIODONTAL LIGAMENT CELLS AND BONE CELLS DURING SIMULATED WEIGHTLESSNESS
W.E. Roberts, University of the Pacific, School of Dentistry, Dept. of Anatomy, *San Francisco, California* 94103 (NCA 2-588002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, LIFE SCIENCE FLIGHT EXPERIMENT
D.E. Parker, Miami University, School of Arts & Sciences, Dept. of Psychology, *Oxford, Ohio* 45056 (NAS 9-16049)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0011, LIFE SCIENCE FLIGHT EXPERIMENT - MOTION PERCEPTIONS IN ZERO GRAVITY
D.E. Parker, Miami University, School of Arts & Sciences, Dept. of Psychology, *Oxford, Ohio* 45056 (NAS 9-16051)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0012, HUMAN CAPABILITIES IN ACOUSTIC ENVIRONMENTS
C.S. Harris, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325120)

Air Force noise environments may affect motor performance, physiological function, thought processes and contribute to fatigue in personnel as well as affecting hearing. Special problems may arise with infrasonic, impulsive, and noncontinuous acoustic energy exposures. This effort is to define noise exposure conditions which degrade and threaten task accomplishment in order to specify safe operating parameters and eventually exposure guidelines. This effort will provide support for the whole body exposure effects standards sections in AFR 161-35.

The approach is to quantify cognitive and psychomotor performance on specific tasks in acoustic environs to such a degree that allowable exposure conditions can be adequately defined. The nature and difficulty of the performance tasks will be varied together with the frequency, duration and intensity of the acoustic stimulus in an effort to identify variables in the stimulus, task or subject that might result in reduced human capabilities. Post-exposure task performance will be examined for continuous and varying acoustic signals. A substantial technology base describing human performance in acoustic environs will be realized when these results are integrated with those from earlier efforts. This work unit is a continuation of work unit 72310903, Human Capabilities in Infrasound, and work unit 72310904, Acoustic Degradation of Human Capabilities. Semiannual review was accomplished 30 Sep 78 in conjunction with the preparation of the technical management review.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, EFFECT OF EXPOSURE TO MICROWAVES ON THE NEUROENDOCRINE STATUS OF THE RAT
R.D. Stith, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Physiology & Biophysics, *Box 26901, Oklahoma City, Oklahoma* 73190 (DF054360; AFOSR-79-0041)

AF function - Air Force operating environments expose personnel to a wide variety of potential hazards which may limit or degrade man's ability to perform effectively. Current technology does not permit an adequate assessment of responses and tolerance to single, sequential or long-term exposure to these radiations. Fundamental data on the bioeffects of microwaves are necessary for the establishment and maintenance of adequate electromagnetic radiation safety criteria. Deficiency - very little is known about possible electromagnetic effects on biological systems exposed to athermal densities. In certain brain regions, microwave absorption and temperature effects may be 4 to 6 times higher than the mean temperature increase. No systematic, controlled investigations on a well-known chain of biochemical events in microwave-irradiated animals have been reported. Objective - the objective of the proposed research is to determine if whole body exposure to continuous wave or pulsed wave microwave radiation will result in quantifiable alterations in the neuroendocrine status of the brain. How research contributes - data obtained from these experiments will enable more accurate reappraisal of Air Force and occupational personnel exposure standards for microwave radiation. This research will support and contribute to research outlined in RO 1.9.1.2, electromagnetic radiation.

The objectives of this proposal will be achieved by exposing rats to various power densities of microwaves and then assaying hypothalamic and brain stem slices for norepinephrine, dopamine, serotonin, cyclic adenosine monophosphate (cAMP), cyclic guanosine monophosphate (cGMP), tryosine hydroxylase,

and tryptophan hydroxylase. In addition, blood samples will be assayed for the pituitary hormones ACTH, GH, and TSH.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0014, MITRAL VALVE MODEL
H.E. Whitmore, Texas A & M Research Foundation, *Faculty Exchange Box H, College Station, Texas* 77843 (DF324490; F33615-78-D-0629)

To develop mathematical algorithms which allow investigators to explore the correlations between mitral valve disorders and the development of heart disease in the USAF flying population.

The first phase of the task involves examining the literature and deriving possible mathematical models. At the end of the first phase, several possible models will be presented for consideration. The second and final phase involves implementing the selected model and verifying its feasibility with USAFSAM data related to mitral valves.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0015, STUDY TO DEVELOP A FACTOR ANALYSIS STATISTICAL CAPABILITY FOR THE DESIGN PERFORMANCE LABORATORY
J.H. Stramler, Texas A & M University, College Station Campus, School of Science, Dept. of Biology, *College Station, Texas* 77843 (NAS 9-16073)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0016, AEROSPACE MEDICINE RESIDENCY PROGRAM
M.M. Key, University of Texas, Health Science Center at Dallas, Graduate School of Biomedical Sciences, *5323 Harry Hines Blvd., Dallas, Texas* 75235 (NGT 44-089-980)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0017, LIFE SCIENCE FLIGHT EXPERIMENT - INFLUENCE OF GRAVITY
M.P. Mlastala, University of Washington, Graduate School, *Seattle, Washington* 98105 (NAS 9-16052)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, WORKSHOPS ON AUTOMATED DECISION MAKING AND PROBLEM SOLVING
E. Heer, University of Southern California, School of Engineering, Dept. of Industrial & Systems Engineering, *3551 University Ave., Los Angeles, California* 90007 (NCC 1-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0002, DATA FITTING
G.D. Taylor, Colorado State University, School of Natural Sciences, Dept. of Mathematics, *Fort Collins, Colorado* 80523 (DF055710; F49620-79-C-0124)

AF function - design of structural components for aerospace vehicles. Opportunity - to improve upon and expand the applicability of recent adaptive curve fitting schemes. Objective - to study and develop methods of fitting arbitrary data sets with computationally effective representations. How work contributes - results may hasten the development of data fitting computer software packages which would be useful for effective data reduction of massive data sets for computational manipulation or useful for data synthesis of sparse data sets for interpolation.

This effort will examine both one-dimensional and multi-dimensional data sets. (A) In the one-dimensional case, the study of recently developed adaptive curve fitting techniques and associated computer routines will continue. The main focus will be on the numerical testing and comparing of these routines. Also, the possibility of implementing these routines in a interactive mode will be examined. Finally, properties of a given data set that make one routine more effective than another will be identified and classified. (B) In the multi-dimensional case, adaptive piecewise polynomial surface fitting (2-D and higher-dimension) will be developed. The differential correction algorithm will be studied. Also, effective ways of selecting subsets of the original data set that exhibit the overall behavior of the data will be pursued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, STUDIES OF THE NUMERICAL SOLUTION OF ELLIPTIC PARABOLIC BOUNDARY VALUE PROBLEMS
Unknown, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (EY-76-S-05-3443)

The goal of the project is to understand the theoretical behavior of the numerical treatment of partial differential equations which could be organically placed in the general finite-element solver. The main emphasis will be given to problems which are important in applications but are not the standard ones, and to the question of how to effectively handle problems with nonsmooth coefficients and singular solutions. The problem of reliability and accuracy in the prescribed range of computational cost with self-adaptive approach will be focussed on also. The theoretical notion of a closure of the entire numerical process will be applied to design and asymptotically optimal approach. The theoretical investigations will be in close conjunction with practical computations.

RESULTS: Results in the proposed field have been obtained by the investigators and published in the form of various reports and publications.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

7.0004, OPERATION OF A COMPUTER CENTER AND RESEARCH IN PLASMA PHYSICS
Unknown, New York University, Graduate School, *100 Washington Sq. E., New York, New York* 10003 (EY-76-C-02-3077)

The main thrust of the Laboratory is in numerical analysis and partial differential equations with emphasis on computational fluid dynamics. Topical areas of endeavor are as follows: Development of shockless airfoil codes for industry. The Laboratory has underway a joint project with Pratt-Whitney Aircraft to test compressor airfoils designed at N.Y.U. Computational magnetohydrodynamics in three dimensions, such as the modeling of equilibrium and stability of a plasma in toroidal geometry. One objective is to bring the high beta stellarator into a range of operation competitive with current Tokamak research. Flow problems relevant to the upgrading of compressors used in gaseous diffusion process for the enrichment of uranium. Elastodynamic and fracture problems related to nuclear shots to stimulate the flow of natural gas from relatively impermeable strata by fracturing the rock. Computer modeling of reacting chemical systems for new and more efficient ways of utilizing chemical fuels. Application of simulation methods to the study of time evolution of quenched binary alloys, to gain understanding of the formation of alloys to predict their strengths and behavior with respect to radiation damage. The environmental impact of a power station in raising the temperature of an adjacent flowing river, particularly when the river flow is controlled by the operation of a dam. Laser fusion studies with the goal of obtaining energy from controlled thermonuclear reactions driven by high power lasers. Theoretical and numerical methods used to

study the reflooding problem in a loss of coolant accident in reactors. Through participation in the ARPANET, the Laboratory has access to very fast and powerful computers that permit effective handling of the multidimensional problems that arise in energy research. In computer science, the Laboratory develops compilers and high level programming languages.

SUPPORTED BY U.S. Dept of Energy, Office of Energy Research.

7.0005, OPTIMAL MULTICROP SAMPLING AND AGGREGATION PROCEDURES DEVELOPMENT
H.O. Hartley, Duke University, Trinity College of Arts & Sciences, Dept. of Mathematics, *Durham, North Carolina* 27706 (NAS 9-16020)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

7.0006, ANALYSIS OF COMPUTATIONAL METHODS FOR NONLINEAR PARABOLIC DIFFERENTIAL SYSTEMS
R.L. Brown, University of Virginia, School of Engineering & Applied Science, Dept. of Applied Mathematics & Computer Science, *Garrett Hall, Charlottesville, Virginia* 22903 (DF054980; AFOSR-79-0024)

AF function - the design of reentry vehicles. Deficiency - efficient and accurate numerical schemes are needed to solve associated nonlinear parabolic differential equations. Objective - to reduce the computing time for solving parabolic equations in general with the flow on a cone problem being used to motivate and verify such computational improvements. How work contributes - algorithms developed may be used for the design of reentry and aerospace vehicles.

1. The effect on maximum and minimum stable stepsize in the x direction of using finite element representation of the boundary value problem will be investigated. 2. The generation of large algebraic amplification matrices involved in stability analysis of multistep methods will be studied. 3. The feasibility of using general purpose initial value problem integration packages will be studied. 4. The nonlinear stability region of the flow on a cone problem will be found using software currently being developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, STUDY OF HIGH-SPEED COMPLEX NUMBER ALGORITHMS
R. Heisler, Walla Walla College, Graduate School, Dept. of Mathematics, *College Place, Washington* 99324 (NAS 5-25994)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, CHARACTERIZATION OF ADVANCED ELECTRIC PROPULSION SYSTEMS
P.K. Ray, Tuskegee Inst., Graduate School, *Tuskegee Institute, Alabama* 36088 (NAG 3-76)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0002, ELDOR INVESTIGATIONS OF RADIATION PROCESSES
Unknown, University of Alabama, Graduate School, *P.O. Box 2846, University, Alabama* 35486 (EY-76-S-05-4062)

The objective of the present research is to examine the role of the host matrix as a function of temperature in determining the type and yield of radicals produced by X-irradiation of a crystalline or glass material using electron-electron double resonance (ELDOR), electron-nuclear double resonance (ENDOR), electron spin resonance (ESR) and heavy atom substitution techniques. After many years of research on the effects of radiation on crystalline materials, it is still difficult to predict from the thermal history, nature of radiation, crystal structure or form of the parent molecule what radical species will be stable at any given temperature. However, an examination of the ELDOR spectra of an irradiated substance results in a partial or complete measure of the relaxation mechanisms which, in turn, are related to the host matrix itself. The host matrix can be changed slightly by using the heavy atom substitution technique, by using different methods of crystallization, and by including radical precursors in clathrates, permitting a study of the relation among host matrix variation, radical yield and relaxation parameters.

RESULTS: ESR investigations carried out on single crystals of irradiated fluoro, chloro and bromo derivatives of acetamide and acetic acid have shown that a large matrix effect is present which is dependent upon the leaving group size, crystal structure and degree of crystallization. ELDOR measurements between 5 degrees K and 370 degrees K have shown a large variation in ELDOR intensity dependent on intramolecular motion, quadrupole coupling, p-orbital anisotropy, spin diffusion and tunnelling rotation. Forbidden ESR lines overlapped by intense ESR lines, ESR lines too broad to detect, ENDOR transitions and radical cluster have been studied by ELDOR.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0003, CORRELATIONS BETWEEN AURORAL FEATURES AND LOW-ENERGY ION CHARACTERISTICS IN THE MAGNETOSPHERE
J.L. Horwitz, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Physics, *Huntsville, Alabama* 35807 (NGT 01-002-082)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0004, STUDIES ON LASERS AND LASER DEVICES
S.E. Harris, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (NAG 2-44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0005, A THREE-DIMENSIONAL MODEL OF BOW SHOCK LOCATION AND MOTION
R.E. Holzer, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (NAGW 74)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0006, THE MEASUREMENT OF TOTAL CROSS SECTIONS AND EQUILIBRIUM FRACTIONS OF 10 TO 200 KEV D AND D2 POSITIVE IONS IN COLLISION WITH METAL VAPORS
T.J. Morgan, Wesleyan University, Graduate School, Dept. of Physics, *Middletown, Connecticut* 06457 (EY-76-S-02-4022)

PURPOSE: Measure cross-section for formation of negative deuterium ions (D-minus) by charge exchange of positive deuterium ions (D-plus) and dissociation of positive molecular deuterium ions (D-plus). Also measure equilibrium negative ion fractions. These data are required for understanding and design of negative ion type neutral beam injection systems. APPROACH: We are measuring the yields of D-plus, D-minus, and D as functions of target thickness. From the slope of the curve of yield versus thickness we obtain the cross-sections. As the target thickness is increased, the yields will eventually become constant. These values are the equilibrium yields. The initial D-plus ions are produced in an RF source, accelerated and momentum analyzed. They pass through a metal vapor target cell designed to reach temperatures near 1000 degrees C. The analysis section contains electrostatic separation plates,

three Faraday cups, and a secondary electron emission detector. (ERDA 77-66)

SUPPORTED BY U.S. Dept. of Energy

8.0007, GRADUATE STUDENT RESEARCHERS PROGRAM
C.W. Wernitz, Catholic University of America, School of Arts & Sciences, Dept. of Physics, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (NGT 09-005-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0008, QUANTITATIVE ANALYSIS OF SOLUTE SEGREGATION IN ALLOYS BY TRANSMISSION ELECTRON MICROSCOPY
Unknown, State University System of Florida, University of Florida, Graduate School, *Gainesville, Florida* 32601 (EY-76-S-05-4311)

OBJECTIVES: 1. To measure experimentally second phase nuclei or embryonic second phase particles at crystal defects. 2. To characterize very small crystal defects (less than or equal to 100 A) such as dislocation loops or voids.

Segregation of solute atoms, impurities, or point defects into clusters or onto existing crystal defects is a vital first step in the development of second phase precipitates or in the development of complex microstructures resulting from radiation damage. Such objects are beyond the direct analytical capabilities of even the best electron microscope. However, computer simulation of electron microscope images can be used to interpret highly complex strain contrast images provided: 1) the experimental conditions are well regulated and 2) the computer modeling conditions are sufficiently realistic. Both of these conditions have been shown to be met for a wide variety of complex linear and planar defects and for some point defect images. In addition, simulation experiments can be used to test complex imaging criteria and to suggest the optimum experimental conditions for the electron microscope.

Our test specimens have included θ' precipitates in Al-Cu alloys, oxide platelets in silicon, and quenched-in vacancies in pure Al. We propose next to use HVEM in situ irradiation of several BCC and FCC foils to fully test our catalog of computed dislocation loop images. If successful, these methods may be used to study the mechanisms of loop formation, the size distribution of defects, and the superposition of precipitates on loops and voids.

RESULTS: Development of rapid, general computer simulation program to match TEM images of dislocations, planar faults, dislocation loops and other small three dimensional defects, and combinations thereof. Calculated catalog of possible images for loops in FCC and BCC structures (isotropic, infinitesimal approximation). Applications to alloys (Al-Cu and Ni-base), oxidation defects in silicon, quenched-in defects in Al, irradiated defects in W.

SUPPORTED BY U.S. Dept. of Energy

8.0009, PHOTOELECTRIC EMISSION FROM THIN FILMS IN THE VACUUM ULTRAVIOLET REGION
W. Pong, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Physics, *2444 Dole St., Honolulu, Hawaii* 96822 (EY-76-S-03-0235-009)

This project is concerned with the fundamental and applied research on materials of interest to the energy research and development program. The experimental technique involves the application of vacuum ultraviolet radiation to investigate the optical and electronic properties of solid films and surfaces. Materials of interest in our current studies are those which are suitable for: solar photovoltaic energy conversion; windows and reflectors for high-power laser beams; solar energy collectors.

SUPPORTED BY U.S. Dept. of Energy

8.0010, BASIC STUDIES OF ATOMIC DYNAMICS
Unknown, University of Chicago, Graduate School, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (EY-76-S-02-1674)

This continuing project tries to unravel the correlations between the motions of different particles and the energy exchanges between different types of motion in electron collision and photoabsorption processes. The next major task which is contemplated is to concentrate effort toward achieving two distinct substantial advances on the theory of joint excitation and correlations of an electron pair. Other sustained efforts will be directed to the application of atomic points of view to solid-state problems and to the unraveling of the mechanism of atomic orientation by collision.

RESULTS: Since October 1, 1976 seven papers published or in the process of publication are identified as COO-1674-123, 124, 125, 130, 131, 132, and 136. Numbers 126, 127, 128, 129, are abstracts of papers presented at various conferences. Numbers 133, 134, and 135, are talks presented at various conferences and are to appear in print.

SUPPORTED BY U.S. Dept. of Energy

8.0011, THE STUDY OF PHONONS IN AMORPHOUS AND CRYSTALLINE SOLIDS UTILIZING THE APPLICATION OF LASER RAMAN SPECTROSCOPY
Unknown, University of Chicago, Graduate School, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (EY-76-S-02-2126)

Amorphous diamond films, which are superhard and exhibit the physical characteristics of crystalline diamond, will be studied with optical techniques to ascertain their structural characteristics and the influence of those characteristics on physical properties.

We will attempt to intercalate the graphitic form of amorphous carbon films and vitreous carbon with the donor alkali metals, K, Rb, and Cs. Successful intercalation should yield information on the structure of disordered carbon as well as drastically alter the electronic properties of the material. Sufficient intercalation may result in a new type of metallic glass. We will also endeavor to intercalate the acceptor compounds, sulfuric and nitric acid. Successful intercalation will be detected from physical, electrical, and optical changes in the film.

The low-frequency Raman spectrum and Brillouin spectrum of amorphous arsenic will be studied to detect excess scattering from non-Debye-like excitations. Such excitations have been associated with the anomalous linear term in the specific heat exhibited by all glasses studied to date except amorphous arsenic.

An effort will be made to observe irreversible and reversible photostructural and thermostructural changes in evaporated bulk As2O3 glass. The optical effects associated with such changes provide the capacity for high-density rapid information storage. The atomic configurations associated with the changes will be studied using Raman, infrared, Brillouin, and X-ray techniques.

The two-dimensional order disorder transformation in graphite intercalated to stage 2 and higher with alkali metal atoms will be studied with X-ray and optical techniques. The temperature dependence of the Raman continuum in stage 1, C8K, C8Rb, and C8K, will be carefully studied as will the spectra of C6M, M equals Li, Sr, Ca, Ba to distinguish between the nearest layer model and zone folding model for vibrational excitations of intercalated graphite. An X-ray and Raman study of graphite intercalated with alkali metal ammonia solutions will be undertaken. The inversion splitting of the nu 2(A1) band of NH3 will be used to probe the graphite interlayer interaction.

Crystals of NaxWO3 0 less than or equal to x less than or equal to 0.5 will be prepared, characterized, and studied with polarized temperature-dependent Raman spectroscopy. (Text abridged)

SUPPORTED BY U.S. Dept. of Energy

8.0012, FIN STABILIZATION OF MAGNETICALLY CONFINED PLASMAS
V.H. Weston, Purdue Research Foundation, *West Lafayette, Indiana* 47907 (EY-76-S-02-4125)

It is proposed to continue the study of different outer conducting configurations on the stability of magnetically confined plasmas, with emphasis on fins or conducting surface lying on radial planes of field lines exterior to a cylindrical circular plasma. Multiple interaction terms between fins will be taken

into account and the extension from the small pitch case to the large pitch case will be considered. The effects of different outer conductor configurations on the stability of the various modes will be ascertained by comparing the corresponding minimum form of the perturbed vacuum field portion of the energy integrals.

RESULTS: A comparison of the effect of different configurations of the outer conducting surface on the stability of a cylindrical circular plasma of radius A and length L was made. The usual surface perturbation of the form eikz plus or minus in theta, k equals approximately 0 are treated. 'Fins' of zero thickness have no effect on the n equals 0 mode. However they do tend to stabilize the important n equals 1 mode. Neglecting multiple interaction terms, preliminary results indicated that four fins in the planes theta equals 0, plus or minus pi over 2 and pi with a/c equals .9 where c is distance of edge of fin to center of plasma have the same stabilization effect on the n equals 1 mode as the concentric outer cylinder of radius b where a/b equals .45.

SUPPORTED BY U.S. Dept. of Energy

8.0013, OPTICAL PROPERTIES OF SEMICONDUCTORS, MAGNETIC SEMICONDUCTORS AND FAR-INFRARED EMISSION FROM SEMICONDUCTORS

H.Y. Fan, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR77-24306)

Experimental studies of magnetic semiconductors and far-infrared emission from semiconductors doped with impurities will be carried out as an extension of research supported by DMR-7511178. The one-magnon and two-magnon Raman scattering processes have been observed and investigated in manganese oxide, cobalt oxide and cubic manganese sulfide. The change in the Raman scattering of phonons associated with the structural phase transition in di-vanadium trioxide has also been observed. Careful spectroscopic studies of the Raman scattering in di-vanadium trioxide will be carried out to determine the effects of various external conditions, such as strong magnetic fields, on the metal-insulator, structural and antiferromagnetic phase transitions in this material. Also, the studies of far-infrared emission from semiconductors containing shallow impurity levels will be continued. This effort will be directed toward obtaining stimulated emission. Experiments to determine the level of stimulation as a function of wavelength and to observe spatial coherence of the emission will be carried out.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0014, ATOMIC PHYSICS WITH HIGHLY IONIZED IONS

P. Richard, Kansas State University, School of Arts & Sciences, Dept. of Physics, *Anderson Hall, Manhattan, Kansas* 66502 (EY-76-S-02-2753)

Atomic physics with energetic highly ionized ions will be performed under five programs to study (1) the production of X-rays in solid media, (2) the processes of electron loss and gain in gas media, (3) X-ray spectroscopy in ion-atom collisions, (4) atomic collisions theory and (5) applications and developments with heavy ion beams. The process of electron capture will be studied experimentally and theoretically under topics 1, 2, 3, and 4. Alignment of atomic states will be investigated through the observation of target and projectile radiation. The target thickness dependence of X-ray yields will be studied to obtain target and projectile vacancy production and vacancy quenching cross sections in solids. X-ray spectroscopy of heavy ions will be initiated for X-rays with energy approximately greater than 4 keV using a new Cauchois spectrometer. Impact parameter dependences of cross sections will be extended to heavier ion partners.

RESULTS: During the 12-month period from 1 August 1976 to 31 July 1977, 19 scientific papers were published, 10 scientific papers are in the process of publication and 23 contributed and invited papers were presented on a wide range of experimental and theoretical analysis of ion-atom interactions at high energies.

SUPPORTED BY U.S. Dept. of Energy

8.0015, ELECTRON EXCITATION CROSS-SECTIONS FOR MULTIPLY CHARGED IONS

J. Callaway, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (EY-76-S-05-4881)

The work proposed is the continuation of theoretical calculations of the cross-sections for excitation of positive ions of the lithium and helium isoelectronic sequences by electron impact. The energy range considered is from the threshold for excitation to approximately 4 times the ionization energy. The calculations will be based on a close coupling expansion with exchange. Different methods of solution of the coupled integro-differential equations including the R-matrix method, the matrix variational method, and the non-iterative integral equation method will be investigated for speed and accuracy. The energy range studied is one in which simple approximations of the Coulomb Born type are not valid. The contribution of Rydberg series of resonances below some excitation thresholds will be determined. Extrapolation of excitation cross-sections along helium-isoelectronic sequence will be made. Consideration of relativistic effects in both the structure of the ion and in the description of scattering as the nuclear charge increases will be made so that we can determine excitation cross-sections for highly stripped impurity ions in high temperature plasmas of interest in thermonuclear reactors.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0016, A STUDY OF THE TWO-BODY DISSOCIATION OF LIGHT NUCLEI IN NUCLEAR FIELDS

R.W. Huggett, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (EY-76-S-05-4699)

The objective of the experiment is to measure the cross sections for the dissociation of light nuclei into two-body nuclear final states during peripheral nuclear collisions. The cross section for dissociation into a specific two-body nuclear final state is proportional to the square of the probability that the projectile nucleus existed as a configuration of the two final-state nuclei at the time of collision. The results will be significant because there has been increasing speculation recently concerning the existence of short-lived conglomerates of nucleons called 'clusters' within a parent nucleus.

The experiment will employ beams of 20/10 Ne, 16/8 O, 14/7 N, 12/6 C, 10/5 B, 6/3 Li, 4/2 He, and 2/1 H ions.

The kinetic energy of the heavy ions will be 2.1 GeV per nucleon. Those interactions in which the projectile nucleus dissociates into two fragments within the target will be selected electronically and recorded on magnetic tape for analysis.

The measured quantities will include the trajectories and charges of the incident nucleus and both final-state nuclei. The momenta of both final-state nuclei will be deduced from their bending angles in a magnetic field of 38 kG-m. Wire spark chambers with magnetostrictive readout will be used to encode the positions of projectile and final-state nuclei. Charges will be measured in scintillation counter hodoscopes.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0017, THEORETICAL STUDIES OF HIGHLY IONIZED SPECIES

Unknown, Harvard University, Cambridge Campus, Graduate School, *Cambridge Station, Cambridge, Massachusetts* 02138 (Y-76-S-02-2887)

Applications of the relativistic random phase approximation will be carried out for the neon isoelectronic sequence, to inner shell ionization processes, and to electron scattering by elements of high nuclear charge. Non-radiative charge transfer processes will be studied. Dissociative recombination in low temperature

plasmas and dielectronic recombination in high temperature plasmas will be considered.

Model potential methods will be used to study the copper and zinc isoelectronic sequences, as well as multiphoton processes with weak and strong electromagnetic fields.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0018, ELECTRONIC RELAXATION PROCESSES IN POLYATOMIC MOLECULES

Unknown, Wayne State University, Graduate School, *Cass & Antoinette Aves., Detroit, Michigan* 48202 (EY-76-S-02-2192)

The main thrust of this proposal is to investigate isotope effect on electronic relaxation as a probe of detailed mechanisms of radiationless processes. Three programs are presented in the proposal.

The first program explores the isotope effects on both the overall and the spin sublevel decay rates of the lowest triplet state (T1), and their dependence on the T1-T2 vibronic coupling. Much of the experiments are designed to test the specific theoretical predictions based on the important working hypothesis that the vibronic coupling between n pi* and pi pi* states leads to a very efficient radiationless transition from the lower of the two vibronically coupled states (proximity effect). The study represents the most stringent test of the proximity effect that has been carried out to date.

The second program involves studies of isotope, viscosity, and temperature effects on the formation and decay dynamics of excimers and exciplexes. The specific question we address is the role of the inter-ring stretching vibration in radiationless transitions of these systems. The results should provide the first step toward understanding the little known radiationless process in composite molecular systems. Supersonic molecular beam laser spectroscopy of excimers is also proposed to complement these photophysical studies.

Finally, in the third program, we propose to examine the lifetimes of triplet yields triplet fluorescence and their deuterium isotope effects in anthracene and its derivatives. These studies will be combined with the spectroscopic investigations of lower-lying triplet states to gain a detailed understanding of the mechanism of singlet yields triplet intersystem crossing in aromatic hydrocarbons.

RESULTS: Experimental and theoretical studies of isotopes and substituent effects on T1 radiationless decay rates have been carried out as a test of the working hypothesis that vibronic coupling between n pi* and pi pi* states leads to very efficient radiationless decay from the lower of the two vibronically coupled pair (proximity effect). In addition to providing general support to this hypothesis, the results indicate that isotope effects on spin sublevel decay rates are needed for a stringent test of the proximity effect.

The radiationless decay rates of the 3B1g state of anthracene and its derivatives have been deduced. (Text Abridged)

SUPPORTED BY U.S. Dept. of Energy

8.0019, EXPERIMENTAL AND THEORETICAL STUDIES IN SOLID STATE AND LOW TEMPERATURE PHYSICS EMPHASIZING RESEARCH LIQUID HELIUM AND OTHER MATERIALS

Unknown, University of Minnesota, Minneapolis Campus, Graduate School, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (EY-76-S-02-1569)

The proposed research consists of studies of superconductivity, magnetism at low temperature, and of superfluidity in liquid helium.

The research on superconductivity is aimed at understanding the dynamics of the superconducting order parameter and the fluctuations associated with the superconducting-to-normal transition. The work proposed includes measurements of the pair-field susceptibility in films with magnetic impurities and in current-carrying films, with particular attention being paid to the behavior of the 'longitudinal' and 'transverse' modes of the order parameter. Also included are measurements of the specific heats of high-Tc Nb3Ge films. In addition, the competition between superconductivity and the metal-nonmetal transition in films of HgxXex-1 will be investigated.

The research on magnetism will employ nuclear orientation and SQUID magnetometry to study magnetization of very dilute alloys of manganese in copper, silver, and gold at temperatures in the range from 1 to 100 mK in applied fields from 10 G to 80 kG. Studies of the properties of hyperfine-enhanced nuclear collants and a search for collants capable of achieving temperatures below 1mK will be continued. A collaborative study of the properties of paramagnetic materials for magnetic refrigerators will be undertaken in the temperature range from 1 to 100 K in fields from 0 to 80 kG.

The research on superfluidity involves both pure 4He and 3He/4He mixtures and concerns the dynamics of superfluid flow. It is proposed to carry out measurements of the superfluid density of 3He/4He mixtures in fine regular pores using a Helmholtz resonator technique, extending previous measurements on pure 4He. A search for an AC Josephson effect in pure 4He will be undertaken using an apparatus conceived in analogy to an RF SQUID. In addition, measurements of the superfluid circulation around a fine wire in pure 4He will be continued with wires less than or equal to 25 microns in diameter to probe the quantization of circulation hypothesis.

RESULTS: Measurements of the superconducting pair-field susceptibility have been started in Er-doped Al films and on current-carrying films of pure Al. A technique to measure the heat capacities of thin superconducting films has been developed. (Text Abridged)

SUPPORTED BY U.S. Dept. of Energy

8.0020, OBSERVATION OF LUMINESCENT SPECTRA IN LOW ENERGY ION-NEUTRAL COLLISIONS

Unknown, University of Missouri, St. Louis Campus, Graduate School, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (EY-76-S-02-2718)

The research is directed toward determination of the energy partitioning among internal energy states of the product of low-energy (1 to 500 eV) positive ion-neutral molecule collisions by observation of luminescence from decay of these excited products. Previous studies of kinematics and dynamics of reactive potential energy of exothermic systems showed that the energy can be efficiently converted to internal energy of the collision products. The present research is designed to yield precise internal state distributions in the collision products. The apparatus provides a mass-selected ion beam which is directed into a collision cell containing neutral gas at low pressure. Photons emerging from the collision cell are analyzed and counted to yield the collision-produced spectrum. Since the experiments are performed under single-collision conditions, details of the energy partitioning on a molecular level are obtained.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0021, A STUDY OF THE PHOTOIONIZATION PROCESSES OF ATOMS

J.A. Samson, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (EY-76-S-02-2892)

The experimental and theoretical study of atomic photoionization processes has advanced rapidly in the past decade so that both experimental and theoretical total photoionization cross sections in the vacuum ultraviolet region, at least for the rare gases, are possible with accuracies of plus or minus 10%. This accuracy makes possible the major objective of the proposed experimental and theoretical research program, which is to unravel the effects of electron correlation and of spin-orbit interaction on atomic photoionization processes. While the proposed research nevertheless requires the refinement and advancement of current techniques, the possibility of combined theoretical and experimental attack on these new research problems is a distinct benefit to both theory and experiment and increases the probability of obtaining significant results. Specifically it is proposed to measure and/or calculate total and partial photoionization cross sections, photoelectron branching ratios and angular distributions, and multiple ionization cross sections either over an energy region of a few Rydbergs above threshold or over the narrow energy region of an autoionizing resonance. These studies will be carried out both for the rare gases as well as for

less studied atoms, in particular open-shell atoms. Among the atoms for which experimental work is proposed are the rare gases, metal vapors, and O. Among the atoms for which theoretical work is proposed are Al, Cl, and Xe. In addition, photoionization of hydrogen-like atoms in high magnetic fields will be studied theoretically.

RESULTS: Random phase approximation calculations for photoionization of an open-shell atom have been carried out for atomic chlorine. Virtual double excitations in the ground state, which influence rare gas photoabsorption cross sections significantly, do not play as important a role in atomic chlorine due to an averaging out of these effects among many final state channels. Photoelectron angular distributions have been calculated for the outer (open) shells of the halogens and the chalcogens and it is found that anisotropic electron-ion interactions are strongest in the second row of the periodic table. Experimentally, a rotatable vacuum UV polarizer and a fixed electron energy analyzer have been designed and built to measure the photoelectron angular distribution of atomic oxygen at 584 A; work is continuing. (Text Abridged)

SUPPORTED BY U.S. Dept. of Energy

8.0022, THEORY OF ELECTRON-PHONON SCATTERING EFFECTS IN METALS
W.E. Lawrence, Dartmouth College, School of Arts & Sciences, Dept. of Physics & Astronomy, *P.O. Box 833, Hanover, New Hampshire* 03755 (EY-76-S-02-2315)

Studies of quasiparticle lifetimes and transport relaxation times will be continued for the noble and polyvalent metals. A method for accurate calculation of the transport times at low temperatures will be developed, and applied in specific instances. The variational method will be applied to a number of non-equilibrium phenomena in superconductors. An attempt to clarify the relationships between superconducting and normal-phase lifetimes will be made. Electron-electron scattering will be studied further, with attempt to account for relaxation time anisotropy and the resulting interference with other scattering mechanisms.

RESULTS: Diffusion model derived and formalized; electrical and thermal DMR calculated in detail for potassium and copper, variational convergence tested; quasiparticle properties calculated for aluminium, method developed for low temperature lifetime calculations; superconducting order parameter relaxation times related to anisotropic quasiparticle lifetime of normal phase, detailed calculation done for aluminium; electron-electron effects calculated for noble metals, reviewed for simple metals.

SUPPORTED BY U.S. Dept. of Energy

8.0023, THEORETICAL PLASMA PHYSICS RESEARCH
M.N. Rosenbluth, Inst. for Advanced Study, *Princeton, New Jersey* 08540 (EY-76-S-02-3237)

Work is proposed on the following topics: 1. Nonlinear Tearing Modes in Tokamaks; 2. Ballooning modes; 3. Effects of Alpha Particles; 4. Drift Tearing Modes and Stochastic Magnetic Fields; 5. Electron Cooling of Ion Beams; 6. Ion Ring Stability; 7. Shear Alfven Modes in High Beta Mirrors; 8. Tormac Research; 9. Ruelle-Takens Attractor Theory; 10. Drift Convective Cells.

SUPPORTED BY U.S. Dept. of Energy

8.0024, EXPERIMENTAL AND THEORETICAL STUDIES ON THE PHYSICS OF BIOLOGICAL MOLECULES
J.J. Hopfield, Princeton University, Graduate School, Dept. of Physics, *205 Nassau Hall, Princeton, New Jersey* 08540 (DMR78-05916)

This research is aimed at an understanding of how biological molecules, assemblies, and systems operate from a physical and quantitative viewpoint. Currently under study are electron transfer proteins and assemblies (where an understanding of the mechanism of electron transfer and its relation to molecular structure and environment are sought), hemoglobin (where the mechanism by which the global structure affects local chemical properties is investigated), and accuracy problems and mechanisms in biosynthesis. The work is a closely integrated combination of experiment and theory, as in the electron transfer studies. The theoretical description of vibronically coupled electron tunneling transfer is now being tested by studying a charge transfer band described by the theory. The band is three orders of magnitude weaker than any previously studied. This experimental study is capable of providing a complete test of the concepts, constructs, and parameters of the theory. With an understanding of the mechanism of reaction, an approach to understanding some of the physical problems of photosynthesis and oxidative phosphorylation can begin. The chief experimental tool is very sensitive. modulation spectroscopy.

This is a continuation of research supported under DMR 75-14264.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, THEORETICAL HIGH-ENERGY PHYSICS
T.D. Lee, Columbia University, Graduate School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (EY-76-C-02-2271)

The investigations of the Columbia Theoretical Group have been and will continue to be concerned with all theoretical aspects of high-energy physics. Our main efforts will lie in the areas of particle physics, field theory and symmetry principles, including their extensions to related problems in atomic and nuclear physics, astrophysics and statistical mechanics. We shall continue our close relationships with groups carrying out experiments at Nevis, Brookhaven, SLAC, Argonne, Berkeley, NAL and CERN. We shall attempt to maintain a broad view of the prospects of high-energy physics which may be useful in the future determination of national scientific policy.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0026, HIGH BETA PLASMA RESEARCH
C. Chu, Columbia University, School of Engineering & Applied Science, Dept. of Applied Physics & Nuclear Engineering, *Broadway & W. 116th St., New York, New York* 10027 (EY-76-S-02-2456)

We are performing experiments studying the equilibrium stability of plasma in a modest size rectangular cross section high-beta Tokamak. Theoretical and computational high beta plasma studies closely related to our experiments are also being done by us. We are studying plasma-wall interactions and the metallurgical effects of deuterium-plasma bombardment of first wall materials.

SUPPORTED BY U.S. Dept. of Energy

8.0027, INFLUENCE OF GRAIN BOUNDARIES ON ELECTRICAL TRANSPORT PROPERTIES OF POLYCRYSTALLINE SI FILMS
D.G. Ast, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (EY-76-S-02-2899)

To continue work on preparation of controlled grain boundary structures in Si. To characterize the structure of these boundaries by high resolution transmission electron microscopy. To investigate the electrical properties of these boundaries by conventional electrical measurements.

RESULTS: A variety of twist and tilt boundaries have been fabricated and their structure has been analyzed. The electrical activity of microtwins (frequently mistaken for stacking faults) has been investigated.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0028, SPIN RESONANCE AND THE STUDY OF SOLIDS AND LIQUIDS
R.M. Cotts, Cornell University, Ithaca Campus, School of Physical Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR77-24561)

This is a continuation of research previously supported under DMR 73-07521.

A series of experiments which will utilize nuclear magnetic resonance to investigate the details of diffusive motion of hydrogen atoms in transition metal-hydrogen systems will be carried out. The results of two separate experiments (temperature dependence of relaxation times and pulsed gradient spin echo techniques) will be combined to determine the diffusion step length of hydrogen atoms in titanium hydride. A new multiple pulse technique for measuring the hydrogen diffusion coefficient will be applied to vanadium and tantalum hydrides. The motion of hydrogen in the low temperature phases of Group VB metals will also be studied using measurements of the relaxation times. The purpose of the low temperature experiment is to determine changes in mobility with change in phase and to search for low temperature deviation which would indicate tunneling modes for hydrogen.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0029, INVESTIGATE TRAVELING IONOSPHERIC DISTURBANCES IN EARTH'S IONOSPHERE BY ANALYSIS OF SATELLITE TO SATELLITE DIFFERENTIAL DOPPLER DATA AVAILABLE

S.H. Gross, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Electrical Engineering, *333 Jay St., Brooklyn, New York* 11201 (NAGW 51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0030, NUCLEAR STRUCTURE THEORY

Unknown, University of Rochester, Graduate School, *Administration Bldg., Rochester, New York* 14627 (EY-76-S-02-2171)

Our research program is, broadly, the development and application of nuclear theory, including nuclear structure and nuclear reactions. This involves the development of new general theoretical methods, as well as the detailed examination of particular nuclei or nuclear reactions. We are working in the following areas: 1) Shell-model spectroscopy. Theory of the effective interaction and other aspects of the shell-model from the many-body point of view. 2) Spectral distribution methods in complex nuclei, including level densities and strength distribution, as well as general studies of nuclear symmetries and statistical behavior. 3) Interactions of high-energy particles with nuclei, including the theory of nuclear reactions of elementary particles, as well as nuclear-structure aspects of particle-removal reactions.

SUPPORTED BY U.S. Dept. of Energy

8.0031, DIFFUSIONAL CREEP OF MULTICOMPONENT SYSTEMS

Unknown, University of Rochester, Graduate School, *Administration Bldg., Rochester, New York* 14627 (EY-76-S-02-2296)

The successful completion of impression creep studies on Cu-Ni single crystals of all compositions and on beta-Tin single crystals of 3 orientations proved to us once more that impression creep can be a convenient substitute for conventional creep testing. The data obtained on these crystals are actually better than literature values because of the elimination of sample-to-sample variations. In the next period we propose to finish the Bi-Sb system using the apparatus already built for beta-Tin studies.

In addition we propose to study micro-impression elasticity to measure local elastic modulus using the same indentation technique and, at the same time, to extend impression creep studies to low temperatures. However, most important of all, we propose to study creep mechanisms by selective laser excitation. A tunable laser will be used to sort out different deformation of diffusive mechanisms in both crystalline and amorphous solids.

RESULTS: Two manuscripts are in preparation: 1. Impression Creep of Cu-Ni Single Crystals; 2. Impression Creep of beta-Tin Single Crystals.

SUPPORTED BY U.S. Dept. of Energy

8.0032, PLANAR MULTIJUNCTION HIGH VOLTAGE SOLAR CELLS

V.J. Kapoor, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (NAG 3-80)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0033, NEUTRON STUDIES OF LIGHT NUCLEI

Unknown, Ohio University, Athens Campus, Graduate School, *Athens, Ohio* 45701 (EY-76-S-02-2490)

The structure of light nuclei will be studied by means of their interaction with neutrons. The experimental program will include the elastic and inelastic scattering for neutrons interacting with 6Li, 7Li, 10B, 11B, 12C and 13C measured at the Ohio University Tandem Accelerator Laboratory by use of sub-nanosecond pulsed beams and time-of-flight methods. These results will be analyzed via the R-matrix formalism for comparison to theoretical model predictions. This research will enable us to improve our knowledge of the structure of light nuclei and develop further the various theoretical models for nuclear structure and nuclear reactions. These nuclei have particularly important applications in fusion reactor programs as well as in the standards used for measurement of cross sections and neutron fluxes.

RESULTS: A large set of data has been measured for the elastic and some inelastic scattering cross sections for neutrons scattered from 6Li, 7Li, 10B, 11B and 12C between 4 MeV and 8 MeV for angles from 20 degrees to 160 degrees using the Ohio University Tandem Accelerator. An R-matrix calculation has extracted several properties for the compound nuclei.

SUPPORTED BY U.S. Dept. of Energy

8.0034, ELECTRONIC STRUCTURE OF DEFECTS IN OXIDES

G.P. Summers, Oklahoma State University, Agricultural Experiment Station, Dept. of Physics, *107 Whitehurst Hall, Stillwater, Oklahoma* 74075

Optical absorption bands have been found in 'as grown' Al2O3 which are similar to bands found in particle irradiated material. In particular, a band at 6 eV which has been assigned to an O2-vacancy is found to anneal at 1250 degrees C in 'as grown' material compared to 600 degrees C in particle irradiated material.

SUPPORTED BY Oklahoma State Government

8.0035, ELECTRONIC STRUCTURES OF DEFECTS IN OXIDES

Unknown, Oklahoma State University, Graduate School, *211-215 Whitehurst Hall, Stillwater, Oklahoma* 74075 (EY-76-S-05-4837)

The object of the proposed research is to determine the production and trapping of electric charge within the oxides alpha-Al2O3, CaO, SrO, ZnO and spinel, which can be excited by light (photoconductivity) both before and after irradiation of the materials by gamma-rays, high-energy electrons, protons, or neutrons. The purpose is to detemine as well as possible the electronic structure of defects produced in the materials as a result of the irradiation. In particular we are concerned with radiation-induced anion vacancies in these materials. Additional information will be obtained by measuring photoluminescence and fluorescence lifetimes associated with the radiation-induced defects. The measurements are composed closely with recent calculations of the electronic structure of the defects. We are also concerned with determining the role played by ion group impurities in controlling charge transfer in alpha-Al2O3. Also, we compare results of radiation-induced defects with those produced in non-stoichiometric oxides, in particular CaO.

RESULTS: Photoconductivity has been detected from radiation-induced anion vacancies in SrO of CaO. The thermal ac-

tivation energy for the one electron center is 0.12 eV and 0.24 eV in SrO and CaO, respectively. In SrO the charge is released into the conduction band or fluorescence occurs from a long-lived electronic state (approximately 0.42 microseconds). Photoconductivity measurements indicate that a radiation-induced optical band at 204 nm in alpha-Al2O3 is a composite band.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0036, A STUDY OF FLOW AND LOSS PROCESSES AT THE ENDS OF A LINEAR THETA PINCH

T.M. York, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Aerospace Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (EY-76-S-02-4020)

Purpose: investigate the physics of end loss from a theta pinch including mechanisms governing the loss and methods of inhibiting loss to improve confinement. Approach: Construct a 50 cm pinch apparatus with a 10 cm discharge coil. Measure the loss rate of plasma within the pinch coil, and correlate measurements with properties (pressure, density and temperature) near and at ends; test the theoretical models of end loss with experiments for collisional and collisionless plasmas, with and without magnetic mirrors. (ERDA 77-66)

SUPPORTED BY U.S. Dept. of Energy

8.0037, EXCITATION AND IONIZATION OF HIGHLY CHARGED IONS BY ELECTRON IMPACT

D.H. Sampson, Pennsylvania State University, University Park Campus, School of Science, Dept. of Astronomy, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (EY-76-S-02-2897)

The project involves calculation of the cross sections or rates for excitation and ionization of highly charged impurity ions by electron impact. This data is needed in determining the energy balance in the high temperature plasmas occurring in fusion energy research. The impurity ions are excited principally by electron impact and decay by emission of x-rays, which escape the plasma. This results in one of the principal energy loss mechanisms in the plasma. These atomic processes mostly occur at severe enough conditions that the cross sections or rates can't be directly measured and so theoretical quantum mechanical calculations are required.

SUPPORTED BY U.S. Dept. of Energy

8.0038, MICROWAVE-OPTICAL DOUBLE RESONANCE SPECTROSCOPY

Unknown, University of Pittsburgh, Graduate School, *1028H Cathedral of Learning, Pittsburgh, Pennsylvania* 15213 (EY-76-S-02-3435)

The principal objective of this research project is to develop basic knowledge about the structure of matter and its interaction with radiation through the exploration of new physical and chemical phenomena. Of particular interest are short-lived chemical species which are produced by irradiation of solids with x-rays, gamma-rays, and ultraviolet light, and include electronically excited molecules, free radicals, and collective excitations in solids. Because of their short lifetimes, the development of new experimental techniques such as optical detection of magnetic resonance spectroscopy forms an integral part of this project. The results of this research will find application in environmental chemistry, laser-induced isotope separation, natural product synthesis, and energy generation, storage, and conversion devices.

SUPPORTED BY U.S. Dept. of Energy

8.0039, ELECTRON BEAM-PLASMA INTERACTIONS IN THE LABORATORY AND IN THE IONOSPHERE

W. Bernstein, Rice University, School of Natural Sciences, Dept. of Physics, *6100 Main, Houston, Texas* 77001 (NAGW 69)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0040, ENERGETICS OF ATOMIC AND MOLECULAR INTERACTIONS

G.K. Walters, Rice University, School of Natural Sciences, Dept. of Physics, *6100 Main, Houston, Texas* 77001 (EY-76-S-05-4676)

This program emphasizes studies of structure and interactions of excited atoms, molecules, electrons and ions in both gases and liquids, as well as properties of and atomic interactions with solid surfaces. The program is oriented toward basic problems of relevance to the nation's energy program. Specific areas of current activity include studies of reactions and radiative lifetimes in atomic and molecular systems of high-efficiency laser promise (of interest for laser fusion, laser isotope separation), new approaches (both experimental and theoretical) to the study of solid surfaces, and ultimately heterogeneous catalysis, and understanding of spectra and collisional effects of general interest in plasma physics and controlled thermonuclear reaction technology.

The program involves 1) the use of electron (e-beam) bombardment and time-resolved spectroscopy in the study of transient excited species in dense gases of laser importance; 2) new approaches to the study of atomically clean crystalline surfaces, and their interaction with ambient gases; 3) development of tunable ultraviolet lasers; 4) theoretical studies of collision processes involving electrons, ions, atoms and molecules.

RESULTS: 1) Radiative lifetimes and reaction rates in dense rare gases and their mixtures (important to modeling and optimizing rare gas lasers); 2) demonstration of sizeable spin-polarization in low-energy electron diffraction from clean surfaces (important as new diagnostic for surface analysis, perhaps ultimately to heterogeneous catalysis); 3) advances in tunable dye laser technology; 4) new theoretical description of selected atomic and molecular collision processes and ion- and atom-surface interactions relevant to advanced energy research.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0041, STUDY OF NEUTRON-PROTON INTERACTION IN THE 300-700 MEV ENERGY REGION

Unknown, Texas A & M Research Foundation, *Faculty Exchange Box H, College Station, Texas* 77843 (EY-76-S-05-4449)

The objectives of this work are: to determine the spectrum of neutrons produced in 500-800 MeV proton bombardment of deuterium and other light elements; to use the most suitable reaction for the development of monoenergetic neutron beams needed to study the neutron-proton interaction in the 500-800 MeV energy region; to measure the differential cross sections for elastic neutron-proton scattering and for pion production in neutron-proton collisions at 500-800 MeV; to measure the neutron-proton total cross section at 500-800 MeV; to measure the neutron-proton polarization and spin-correlation parameters at 500-800 MeV. These measurements will constitute a complete determination of the neutron-proton interaction in that energy region, realizing one of the fundamental goals of intermediate-energy physics. The 500-800 MeV neutron beams will also be used to study the spectra of charged particles produced in neutron bombardment of various nuclei. The experiments will be carried out at the Los Alamos Meson Physics Facility using a magnetic spectrometer, multiwire proportional counters, scintillation counters, a polarized hydrogen target, and other appropriate instrumentation.

RESULTS: Differential cross section for np elastic scattering and angular distribution for np d P at 463,647 and 800 MeV; cross sections for np charge-exchange and nD back-angle elastic scattering at 200-800 MeV; cross sections for np positive pion and negative pion at 800 MeV; neutron spectra from 647 and 800 MeV proton bombardment of 1H, 2H and various solid targets; p and d spectra from 800 neutron bombardment of various targets.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0042, NUCLEAR SPECTROSCOPY WITH HEAVY IONS

Unknown, Texas A & M University, College Station Campus, Cyclotron Inst., *College Station, Texas* 77843 (EY-76-S-05-4322)

Heavy-ion reactions are used to populate a narrow range of spin states in residual nuclei in the rare-earth region. The mechanism of reactions such as (14N, alpha) or (19F, alpha) in which direct transfer of 10B or 15N occurs to the target nucleus is under study. Possible applications of such reactions to spectroscopic studies of high-spin states will be investigated. The use of neutron-rich incident heavy-ion beams and neutron-rich targets as a means of reducing interference from charged-particle evaporation in compound-nucleus reactions will be extended to higher bombarding energy. In-beam studies by conversion-electron spectroscopy will be continued.

RESULTS: The transitional nucleus 150Gd is well characterized below the pairing gap as a slightly anharmonic vibrator. Higher lying yrast states have negative parity and odd spin. Quasiparticle configurations appear to contribute strongly to states above spin 11. The transitional nucleus 128Ba has been found to be nearly unstable with respect to gamma deformation. An electron-gamma ray coincidence measurement has shown that the EO component in the 12 beta yields 12g transition in 154Gd is small. High-spin states in 168Hf and 172Hf have been investigated.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0043, RESEARCH PROGRAM IN ELEMENTARY PARTICLE THEORY

Unknown, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (EY-76-S-05-3992)

The Center for Particle Theory's primary research mission is investigating the fundamental structure of matter. It proposes to carry out this research through a broad program of techniques currently utilized in elementary particle physics. Investigations of the fundamental quantum field theoretic method of the elementary particle interactions involves full understanding of the quantum measurement problem. In addition, whatever quantum field theoretical methods develop they must be applied to ongoing high energy experimental phenomenology. Therefore, a program using quantum field theories for the phenomenology of weak and electromagnetic interactions is proposed. Elementary particle physics developments have recently been shown to have important implications in current astrophysical problems. A program in extending the application of particle physics methods to Astrophysics will be continued. Recently the discovery of gauge fields has indicated the possibility of a unified theory of strong, weak, electromagnetic and gravitational force systems. A significant program in developing these supersymmetric theories of matter is currently underway at Texas. The methods of group theory analysis applied to particle phenomena has long been identified with the group at Texas. This program and its algebraic counterpart will continue.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0044, STUDIES OF IMPULSIVE PENETRATION AND VISCOUS INTERACTIONS

W.J. Heikkila, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (NAGW 53)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0045, GALLIUM ARSENIDE (GAAS) SOLAR CELL MODELING STUDIES

J.H. Heinbockel, Old Dominion University, School of Sciences & Health Professions, Dept. of Mathematical & Computing Sciences, *P.O. Box 6173, Norfolk, Virginia* 23508 (NAG 1-64)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0046, OPTICAL FIBER INTERFEROMETER FOR THE STUDY OF ULTRASONIC WAVES IN COMPOSITE MATERIALS

R.O. Claus, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Electrical Engineering, *Blacksburg, Virginia* 24061 (NAG 1-68)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0047, PION-NUCLEON INTERACTION AND MESONIC ATOMS

Unknown, University of Wyoming, Graduate School, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (EY-76-S-02-2197)

A series of experiments has been initiated to study several charge states of the reaction pi N yields pi pi N near their thresholds and to compare the average moduli of the matrix elements extrapolated to the thresholds with the predictions of soft pion theory. These experiments will test the applicability of the theory to the reactions, and will also provide more information about the processes just above the thresholds than has previously been available. The theory contains two parameters, the pion decay constants f pi which is determined consistently to 15 percent by other processes and the measure of deviation from the sigma model xi; hence at least two charge states must be studied to confirm or deny the theory. The first experiment measured d2 sigma/d lambda dT for the positive pion mesons in the center of momentum for negative pion p yields negative pion positive pion n at six energies between 229 and 356 MeV with a doubly focusing magnetic spectrometer, and these doubly differential cross sections have been integrated to find the reaction cross section. From these measurements, xi has been determined to about 10 percent for a given pion decay constant. An additional experiment now in progress will measure the cross sections for this reaction at 200 and 229 MeV to reduce the uncertainty in the process of extrapolation and hence to establish xi to about 5 percent or better. Techniques for observing other charge states will be studied and a suitable experiment proposed which will critically test the applicability of soft pion theory. If the applicability is tentatively accepted, the experiment completed would yield the most accurate measurements available for the S wave, isoscalar and isotensor pi pi scattering lengths.

In another series of experiments with the same apparatus, the cross sections for positive pion and negative pion double charge exchange in the disintegration of 16O, 40Ca and 208Pb will be measured. Comparison with theory should indicate the importance of double scattering, 3.3 resonance exchange, and nucleon-nucleon correlation in this process. (Text abridged)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, ENERGY ENVIRONMENT STUDY

R.S. Strangways, Old Dominion University, Graduate School, Dept. of Economics, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NAG 1-66)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, ABSORPTION OF SUNLIGHT IN THE ATMOSPHERE OF VENUS

M.G. Tomasko, University of Arizona, Lunar & Planetary Lab., *Tucson, Arizona* 85721 (NAGW 55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0002, MAINTENANCE AND OPERATION OF THE 60 INCH NASA TELESCOPE
H.P. Larson, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (NAS 8-33732)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0003, OBSERVATIONS OF EMISSION IN BRIGHT, LOW REDSHIFT QUASARS
B.T. Soifer, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 5-47)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0004, DEFINITION STUDY OF THE TOTAL ABSORPTION SHOWER COUNTER
R. Hofstadler, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (NAS 5-26020)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0005, X-RAY EMISSION FROM T TAURI STARS
L.V. Kuhi, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-336)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0006, MICROWAVE AND THEORETICAL STUDIES RELATED TO THE COBE SATELLITE MISSION
G.F. Smoot, University of California, Berkeley Campus, Space Sciences Lab., *3 Leuschner Observatory, Berkeley, California* 94704 (NAGW 66)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0007, X-RAY OBSERVATIONS OF OPTICAL ABSORPTION-LINE QUASI-STELLAR OBJECTS ON THE HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATOR PROGRAM
E.M. Burbidge, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (NAG 8-340)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0008, IMPROVEMENT OF DATA HANDLING AT THE LICK OBSERVATORY
L.B. Robinson, University of California, Santa Cruz Campus, Lick Observatory, *Mount Hamilton, California* 95140 (AST78-23104)

This grant supports a modest improvement in the data handling facilities for the telescopes of the Lick Observatory of the University of California. Industry compatible tape drives will be supplied so that data taken with the Image Tube Scanner, a modern, efficient detector system, can be carried to various computers for data reduction. The Image Tube Scanner is one of the most effective and productive detector systems in use in astronomy today. The excellent linearity and accurate subtraction of interfering skylight increases manyfold the observational capabilities and has extended the useful life of the Lick Observatory in the face of encroaching cities and man-made light pollution.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0009, STUDY OF CIRCUMSTELLAR SHELLS AND STELLAR WIND VARIABILITY IN SUPERGIANT STARS
T.P. Snow, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-15)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0010, HOLD A COLLOQUIUM ON THE SATELLITES OF JUPITER AND PUBLISH THE RESULTS IN A BOOK WITH THE SAME TITLE
Unknown, University of Hawaii System, Manoa Campus, Graduate School, *Spalding Hall, Room 359, Honolulu, Hawaii* 96822 (NAGW 65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0011, INTERNATIONAL CONFERENCE ON INFRARED ASTRONOMY
D.P. Cruikshank, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Astronomy, *2444 Dole St., Honolulu, Hawaii* 96822 (NAGW 61)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0012, OBSERVATIONS OF HIGHLY OBSCURED INTERSTELLAR CLOUDS
P.C. Frisch, University of Chicago, School of Physical Sciences, Dept. of Astronomy & Astrophysics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (NAG 5-53)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0013, PLAN AND ESTABLISH PRELIMINARY INTERFACES FOR THE COSMIC RAY NUCLEI EXPERIMENT
P. Meyer, University of Chicago, School of Physical Sciences, Dept. of Physics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (NAS 5-26099)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0014, RADIO SOURCES NEAR COS-B GAMMA-RAY SOURCES
R.C. Lamb, Iowa State University of Science & Technology, College of Humanities & Sciences, Dept. of Physics, *Beardshear Hall, Ames, Iowa* 50010 (NAG 8-338)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0015, INTERPLANETARY MONITORING PLATFORM-J DATA REDUCTION AND ANALYSIS
D.A. Gurnett, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (NAS 5-26125)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0016, INTERFACES BETWEEN THE ORBITER & INSTRUMENT FOR THE FAR ULTRAVIOLET TELESCOPE/SPECTROMETER (ABBREV)
A.F. Davidson, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAS 5-26057)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0017, STUDIES OF SEYFERT AND X-RAY GALAXIES
A.S. Wilson, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAG 5-54)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0018, DEFINITION PHASE FOR TRANSITION RADIATION AND IONIZATION CALORIMETER (TRIC) TELESCOPE
G.B. Yodh, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (NAS 5-26098)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0019, SPECIAL OBSERVATIONS OF WU MA STARS
A.K. Dupree, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAG 8-344)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0020, OBSERVATIONS OF THE ULTRAVIOLET SPECTRA OF ASTRONOMICAL SOURCES
J.E. McClintock, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0021, SEARCH FOR X-RAYS FROM THE SHAKBAZYAN I GROUP OF GALAXIES AND SEARCH FOR X-RAYS FROM THE SUPERNOVA REMNANTS IN NCG 4449
R.P. Kirshner, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Astronomy, *Ann Arbor, Michigan* 48104 (NAG 8-341)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0022, INTERFACES BETWEEN SPACE TRANSPORTATION SYSTEM/SPACELAB & INSTRUMENT PER HIGH ENERGY INTERACTIONS OF COSMIC RAYS (ABBREV)
C.J. Waddington, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Physics & Astronomy, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (NAS 5-26056)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0023, ABSORPTION MEASURES OF GALACTIC HALO GAS
L.L. Cowie, Princeton University, School of Natural Sciences, Dept. of Astronomy, *Box 430, Princeton, New Jersey* 08540 (NAG 5-48)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0024, ANTARES SOFT X-RAY OBSERVATIONS FROM HIGH ENERGY ASTRONOMICAL OBSERVATORY-2 & SIZE AND STRUCTURE OF AR LACERTAE CORONA (ABBREV)
D.M. Gibson, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (NAG 8-347)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0025, INTERFACES BETWEEN THE SPACE TRANSPORTATION SYSTEM/SPACELAB & INSTRUMENT FOR WIDE-BAND GERMANIUM X-RAY SPECTROMETER (ABBREV)
R. Novick, Columbia University, Graduate School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (NAS 5-26041)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0026, GASEOUS CORONAE OF GALAXIES AND RED QUASI-STELLAR OBJECTS
A.E. Glassgold, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (NAG 8-337)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0027, SUPERNOVA-LIKE QUASARS
P.J. Huggins, New York University, Washington Square & University College of Arts & Sciences, Dept. of Astronomy, *421 1st Ave., New York, New York* 10012 (NAG 8-343)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0028, ULTRAVIOLET OBSERVATIONS OF THE CONTINUA OF NEBULAE AND THEIR EXCITING STARS
H.L. Helfer, University of Rochester, School of Arts & Sciences, Dept. of Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (NAG 5-46)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0029, SPECTROSCOPIC INVESTIGATIONS OF BRIGHT GASEOUS NEBULAE
S.J. Czyzak, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Astronomy, *164 W. 17th Ave., Columbus, Ohio* 43210 (NAG 5-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0030, ULTRAVIOLET STUDIES OF LATER TYPE BERYLLIUM STARS
A. Sletteback, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Astronomy, *164 W. 17th Ave., Columbus, Ohio* 43210 (NAG 5-52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0031, STELLAR ENVELOPES OF ACTIVE CLOSE BINARIES TO BE OBSERVED UNDER HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATOR PROGRAM
R.H. Koch, University of Pennsylvania, School of Arts & Sciences, Dept. of Astronomy, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (NAG 8-346)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0032, STATISTICS OF SPECTROSCOPICALLY IDENTIFIED WHITE DWARF STARS
E.M. Sion, Villanova University, School of Liberal Arts & Sciences, Dept. of Astronomy, *Villanova, Pennsylvania* 19085 (AST78-13396)

This grant will provide funds for updating a catalogue of spectroscopically identified white dwarf stars. The number of such stars has doubled since the first catalogue was published. In addition to including much new material in the catalogue, there will be new user additions and corrections. The updated

catalogue will contain data needed for many statistical studies of these objects. It will be valuable for studies of the kinetics, space densities, and origins of various types of white dwarf stars. The catalogue will enable astronomers to separate and classify various types of compact stars. Other applications of this catalogue include studies of the internal structure of white dwarf stars.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0033, A SCIENTIFIC PROGRAM IN PLANETARY ATMOSPHERIC STUDIES
A.L. Broadfoot, University of South Carolina, School of Science & Mathematics, Dept. of Physics & Astronomy, *Admin. Bldg., Room 115, Columbia, South Carolina* 29208 (NAGW 62)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0034, THE CONTRACTOR SHALL DESIGN, DEVELOP, CONSTRUCT AND TEST A FULLY OPERATIONAL LUNAR LASER RANGING STATION
E. Silverberg, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NASW 3296)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

10.0035, OBSERVATIONS OF SELECTED ASTRONOMICAL OBJECTS
K.H. Bohm, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (NAG 5-45)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0036, X-RAY AND OPTICAL STUDY OF SYMBIOTIC STARS
G. Wallerstein, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (NAG 8-342)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0037, X-RAY EMISSION AE/BE STARS - X-RAYS & UV OBSERVATIONS OF QB SUPERGIANTS - X-RAY EMISSION FROM LUMINOUS EARLY TYPE STARS (ABBREV)
J.P. Cassinelli, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Astronomy, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAG 8-345)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0038, INTERFACE FOR WISCONSIN ULTRAVIOLET PHOTOELECTRIC POLARIMETER EXPERIMENT (ABBREV)
A.D. Code, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Astronomy, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAS 5-26055)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0039, GENERATE AN INVESTIGATION DEVELOPMENT PLAN AND ESTABLISH PRELIMINARY INTERFACES FOR THE DIFFUSE SOFT X-RAY BRAGG SPECTROMETER
W.L. Kraushaer, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAS 5-26078)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0040, BACK-UP DATA ACQUISITION
L. Broglio, Universita degli Studi di Roma, *Rome, Italy* (NASW 2135)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Tracking & Data Systems

GENERAL

11.0001, OPERATION OF A STATE TECHNOLOGY APPLICATIONS CENTER (STAC) IN THE STATE OF FLORIDA
Unknown, State University System of Florida, Florida Agricultural & Mechanical University, Graduate School, *Tallahassee, Florida* 32307 (NASW 3351)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

11.0002, PHASE ONE - STUDY OF MICROWAVE RADIATION FOR SOIL STERILIZATION - PHASE TWO - ANALYSIS OF LANDSAT DATA FOR SEDIMENT IN THE CHESAPEAKE BAY
J.G. Wutoh, University of Maryland, Eastern Shore, Undergraduate School, Dept. of Natural Sciences, *Princess Anne, Maryland* 21853 (NAG 6-3)

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VOLUME 18 NUMBER 22/NOVEMBER 23, 1980

Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-31305# Society of Experimental Test Pilots, Lancaster, Calif.
SOCIETY OF EXPERIMENTAL TEST PILOTS TECHNICAL REVIEW, VOLUME 14, NO. 4: 23RD SYMPOSIUM PROCEEDINGS
1980 252 p refs Symp held at Beverly Hills, Calif., 26-29 Sep 1979
Copyright. Avail: Issuing Activity
The design and performance of various military and civil aircraft are discussed. Other topics include runway repair, flight into icing conditions, research aircraft, the history of flight tests, as well as the history of flight. For individual titles, see N80-31306 through N80-31322.

N80-31306# McDonnell-Douglas Corp., St. Louis, Mo.
F/A-18 STATUS REPORT **c05**
John E. Krings. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4, 1980, p 1-9 (For primary document see N80-31305 22-01)
Avail: Issuing Activity
The design and configuration details of the F/A-18 aircraft are summarized. The test programs discussed include envelope expansion, propulsion, controllability, radar, and missile compatibility tests. Problems encountered and subsequent changes and improvements made are cited. E.D.K.

N80-31307# Fairchild Republic Co., Farmingdale, N. Y.
NIGHT/ADVERSE WEATHER A-10 EVALUATOR PROGRAM (A-10B) **c05**
Wendell H. Shawler. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4, 1980, p 10-21 (For primary document see N80-31305 22-01)
Avail: Issuing Activity
The development and flight testing of a cost effective system applicable to a ground attack system such as the A-10 and which would extend its mission capability to the night and adverse weather regime is discussed. Aircraft operability and survivability with low altitude attack is demonstrated as well as the ability to integrate tactics, sensors, and munitions to destroy a threat. The aircraft modifications required and the first flight test results of the modified aircraft are presented. E.D.K.

N80-31308# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
THE TORNADO ALL-WEATHER HIGH-SPEED LOW-LEVEL SYSTEM **c04**
Ludwig Obermeier. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4, 1980, p 22-36 (For primary document see N80-31305 22-01)
Avail: Issuing Activity
The military requirement for the Tornado Interdictor/Strike version (IDS) calls for an advanced air to ground weapon system capable of striking enemy targets in areas of heavy defensive armament and electronic countermeasures under all weather and light conditions. The Tornado as an airborne weapon system was developed to meet the requirement of flexible response in all weather conditions. The role of high speed, all weather, low level flying necessitates a high precision navigation and aiming system, defensive electronics, and advanced automatic terrain following capability coupled with good ride qualities. E.D.K.

N80-31309# Air Force Flight Test Center, Edwards AFB, Calif.
F-16 EUROPEAN TEST AND EVALUATION **c05**
Thomas P. McAtee and Loren Timm. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4, 1980, p 37-51 (For primary document see N80-31305 22-01)
Avail: Issuing Activity
European flight tests on the F-16 were performed to qualify the aircraft for operations in adverse weather and to complete operational tests and evaluations. The results are presented from the following areas: routine operations, air to air effectiveness, and air to surface effectiveness. E.D.K.

N80-31310# McDonnell-Douglas Corp., St. Louis, Mo.
YAV-8B STATUS REPORT **c05**
Charles A. Plummer, Jr. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4, 1980, p 52-59 (For primary document see N80-31305 22-01)
Avail: Issuing Activity
The AV-8A was modified into the YAV-8B configuration. The fuselage, cockpit, tail section, and main gear were only slightly changed. The major changes include: a supercritical airfoil to reduce transonic drag, improve maneuvering, and provide 75% more fuel storage; a second row of auxiliary inlet air doors was installed, the inlet lip shape changed, and the inlet radius increased about 1.5 inches; positive circulation is generated by large flaps interconnected with the nozzles such that full flap is obtained with approximately 50 deg of nozzle angle; and lift improvement devices which include strakes fitted to the 30 mm gun pods under the aircraft and a retractable door, or dam, which connects them at the forward end. E.D.K.

N80-31311# Air Force Flight Test Center, Edwards AFB, Calif.
HAVE BOUNCE **c05**
Richard A. Borowski. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4, 1980, p 60-67 (For primary document see N80-31305 22-01)
Avail: Issuing Activity
A variety of runway repair methods were tested. The most successful repair method is the AM-2 mat. An AM-2 mat is made up of extruded aluminum sections 2 feet wide which interlock to form a mat 54 feet wide and of any desired length. The mat is 1.5 inches thick and has a 4 foot ramp at each end. The mats are anchored in place over bomb craters that were filled and leveled. The basic method used was to validate computer simulations of F-4 aircraft dynamic response to multiple runway repairs in which structural failures were indicated. E.D.K.

N80-31312# Piper Aircraft Corp., Lockhaven, Pa.
GENERAL AVIATION ICING FLIGHT TEST **c03**
William H. Lawton. *In* Society of Experimental Test Pilots. Soc.

of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 60-67 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

Flight tests into known icing were conducted using an experimental Navajo series aircraft fitted with instrumentation to document test conditions and parameters. The development of an icing tanker and flight tests are described. E.D.K.

N80-31313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE QUIET SHORT-HAUL RESEARCH AIRCRAFT (QSRA) **c05**
James L. Martin. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 77-93 refs (For primary document see N80-31305 22-01)
Avail: Issuing Activity CSCL 01C

The Quiet Short-Haul Research Aircraft (QSRA) is to be used as a flight facility for advanced flight experiments in terminal area operations. The overall objective of the QSRA program is to expand the technology base of the upper surface blowing propulsive lift concept in order to establish design criteria for the aircraft industry and to establish criteria for advanced STOL aircraft. E.D.K.

N80-31314*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE STATUS **c16**
Donald K. Slayton. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 94-116 (For primary document see N80-31305 22-01)
Avail: Issuing Activity CSCL 22B

Technology problems relating to the shuttle thermal protection system and the auxiliary power units for flight control of engine gimbaling and aero surfaces are examined as well as yet unresolved difficulties associated with the main engine, external tank doors, and the payload bay doors. Concepts for launch crew escape and for flight inspection are discussed, and the orbital flight test drivers are identified. The majority of OFT objectives can be accomplished in a success oriented four flight program. Carry over will be accommodated in the operational phase with a mini-DFI package. Primary shuttle systems requiring additional testings are (1) aerodynamics (forward CG); (2) thermal control system (high beta); (3) payload deployment and retrieval system (retrieval, a maximum weight, and proximity operations); (4) SSME throttling to 109%; and (5) SSME nozzle entry aerodynamic heating (up elevon/body flap position at hypersonic velocities). A.R.H.

N80-31315# Rockwell International Corp., Pittsburgh, Pa.
SABRELINER 65 **c05**
William R. Yoakley. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 119-122 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

Sabreliner 65 business jet features the latest technology in fan-jet engines, supercritical wing theory, and solid state avionics. Its structural features, systems features, descriptions, and general performance are compared with those of the Sabreliner 60. A.R.H.

N80-31316# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THE DEVELOPMENT OF THE WORLD'S FIRST TRIENGINE BUSINESS JET, THE MYSTERE FALCON 50 **c05**
Jerome A. Resal. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 23-137 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

To meet the demand for a business jet with a range of 2700 nautical miles, the fuselage of the F-20 was modified to accommodate three TRE731-2 engines identical to those of the F-10 aircraft. A three dimensional wing with a definite relationship to that of the F-10 and the Mercure was optimized to provide increased fuel capacity. Other changes to develop the prototype Falcon 50 are described as well as the telemetry used in its first flight test. Compared to the Falcon 20, the Falcon 50 weighs one third more, but for the same trip, burns less fuel and flies faster. It is twice as heavy as the Falcon 10 and with one more engine climbs higher. With five passengers, and full fuel (some 130 pounds under maximum gross weight), it can climb directly to 41,000 feet and fly 3500 nautical miles in still air, finishing the cruise at 45,000 feet. At maximum gross weight, the distance covered is 3300 nautical miles. Large range cruisings are set for Mach 0.72 to 0.75. A.R.H.

N80-31317# Canadair Ltd., Montreal (Quebec).
CL-600 CHALLENGER **c05**
E. D. Adkins. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 138-144 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

The CL-600 aircraft has a span of 61 feet 10 inches, a length of 67 feet 9 inches, and a height of 20 feet 3 inches. The maximum takeoff weight is 36,000 pounds, and the maximum landing weight is 33,000 pounds. It is powered by two Avco Lycoming ALF-502 engines, each developing 7500 pounds of thrust at sea level. The flight flutter program and stall program are described. A.R.H.

N80-31318# Society of Experimental Test Pilots, Lancaster, Calif.
P-59 **c05**
Laurence C. Craigie. *In its* Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 147-165 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

The history of the development of propellerless aircraft is reviewed with particular emphasis on security measures taken during the design, production, and testing of the XP-59A, America's first jet aircraft. Special features of the Heinkel 178 and 280, the CC-1 and CC-2, the Gloster E-28/39, and the Messerschmitt 262 are also examined. A.R.H.

N80-31319# McDonnell-Douglas Corp., St. Louis, Mo.
AIRCRAFT WINGTIP COUPLING EXPERIMENTS **c05**
C. E. Anderson. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 166-184 refs (For primary document see N80-31305 22-01)
Avail: Issuing Activity

A method of increasing the range of an aircraft was investigated. The method involved attaching two free floating panels which carry fuel as extensions to the wings. The concept of this method was also extended to other uses; two escort fighters were carried along on a large bomber aircraft, without sacrifice of any bomber range. It is shown that the feasibility of this method is reliant on the proper alignment of the wingtip extensions (whatever they are), by a simple automatic flight control system. R.C.T.

N80-31320# Society of Experimental Test Pilots, Lancaster, Calif.
DEVELOPMENT OF THE GERMAN RESEARCH ESTABLISHMENT FOR GLIDING
Karl Schieferstein. *In its* Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 185-208 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

Various methods of aircraft towing were investigated. Specific flight tests are discussed and the results of those tests are presented. R.C.T.

N80-31321# Air Force Flight Test Center, Edwards AFB, Calif.
REVIEW OF FIVE YEARS OF FLIGHT TESTING THE B-1 **c05**
John S. Smith, III and Frederick A. Fiedler. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 209-231 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

Several flight tests involving the B-1 bomber are described. Emphasis was placed on the following: terrain following; weapons systems delivery; hinge moment; electrical system malfunctions; and wing oscillations. R.C.T.

N80-31322# Aerotron, Inc., Bennington, Vt.
CROSSING THE CHANNEL IN THE GOSSAMER

ALBATROSS c05
Paul Macready. *In* Society of Experimental Test Pilots. Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4, 1980, p. 232-243. (For primary document see N80-31305 22-01)
Avail: Issuing Activity

The controlled, human powered flight of the Gossamer Albatross aircraft over the English channel is discussed. All significant events leading to and including the flight are described. R.C.T.

N80-31323# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
PRODUCTION ORIENTED MAINTENANCE ORGANIZATION: A CRITICAL ANALYSIS OF SORTIE-GENERATION CAPABILITY AND MAINTENANCE QUALITY. M.S. Thesis
David A. Diener and Barry L. Hood. Jun. 1980. 179 p. refs. (AD-A087095; AFIT-LSSR-52-80) Avail: NTIS. HC A09/MF A01. CSCL 01/3

The Production Oriented Maintenance Organization (POMO) represents an Air Force initiative directed at improving sortie-generation capability. Although POMO is currently in use within TAC, PACAF, USAFE, and AAC, its impact has not been fully evaluated. This research was directed at determining what effect, if any, POMO has had on sortie-generation capability and aircraft quality. Six research hypothesis variables relating to sortie-generation capability and three relating to aircraft quality were evaluated to make this determination. Data were obtained from HQ ADCOM and six active duty ADCOM FISs. Performance data covered each FIS before and after POMO implementation. Research findings reflected both positive and negative results. Improvement was found in four sortie-generation variables of which three were strongly related to POMO. Degradation occurred in all three of the aircraft quality variables in the post-POMO period. Within the scope of this research, the authors conclude that, within ADCOM, POMO has had some positive effects on sortie-generation capability and some negative effects on aircraft quality. GRA

N80-31324# Vought Corp., Dallas, Tex. Maintainability Engineering Group.
MAINTAINABILITY INDEX MODEL DATA BASE STUDY Final Report, Jul. 1970 - Sep. 1979
Dennis H. Kovatch. 16 Jun. 1980. 83 p. refs. (Contract N00140-79-C-0445) (AD-A087844; Rept-2-57404/OR-52451) Avail: NTIS. HC A05/MF A01. CSCL 01/3

This report presents a review of ten years of aircraft maintenance data and its effects on mathematical modeling. A Maintainability Index Model (MIM) was previously developed using 3-M data from the 1975-1976 time period. Since then, maintenance data for the aircraft used to develop the MIM has increased resulting in the model under predicting current year data by 40% and life cycle data by 18%. Because of the variability and instability of 3-M data, a recommendation is made to update the model annually on an interim basis through the use of Maintenance Inflation Factors and to provide a complete update of the MIM data base every five years. GRA

N80-31325# XYZYX Information Corp., Canoga Park, Calif.
AIRCRAFT MAINTENANCE EFFECTIVENESS SIMULATION (AMES) MODEL. Final Report, Oct. 1977 - Sep. 1979
David Gold, Bruce Kleine, Frank Fuchs, Sal Ravo, and Kay Inaba. Feb. 1980. 116 p. (Contract N61339-77-D-0028) (AD-A087516; NAVTRAEQUIPC-77-D-0028-1) Avail: NTIS. HC A06/MF A01. CSCL 01/3

This report covers a project to develop and test a functional simulation model of aircraft maintenance. The model is called AMES, which means Aircraft Maintenance Effectiveness Simulation. AMES is a computer model that simulates the operation and maintenance of an aircraft squadron. It is different from other aircraft models in that it measures the effects of human errors in maintenance (maintenance accuracy). AMES is a potential tool for managers to help identify those aspects of maintenance with large payoffs for improving operational readiness and/or mission completion rate. Additionally, AMES can be used to evaluate quantitatively the effects of human factors improvements on aircraft readiness. AMES is important to the maintenance community because of its treatment of maintenance error rates. Maintenance errors are known to have a large impact on many other factors in the maintenance performance equation, e.g., elapsed time, consumption of spares, aborted missions, etc. However, this knowledge has seldom been put to good use. One reason is that errors are difficult to measure. Another reason is that the effects of errors are highly interactive, and not easily traced by conventional analysis techniques. GRA

N80-31326# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
MATHEMATICAL MODELING OF LINEAR AND NON-LINEAR AIRCRAFT STRUCTURES
Jul. 1980. 38 p. refs. Presented at the Spring 1980 Meeting of the Struct. and Mater. Panel, Athens. (AGARD-R-687; ISBN-92-835-1365-7) Avail: NTIS. HC A03/MF A01

Mathematical modeling of aircraft structures were used to determine the flutter boundaries and the dynamics of the aircraft. Specific emphasis is placed on improving the theoretically obtained flexibility and mass distributions of a structure and analyzing the nonlinear behavior of wing stores configurations. For individual titles, see N80-31327 through N80-31328.

N80-31327# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
OPTIMIZATION OF THE MATHEMATICAL MODEL OF A STRUCTURE c05
Helmut Zimmerman. *In* AGARD. Math. Modeling of Linear and Non-Linear Aircraft Struct. Jul. 1980. p. 1-14. refs. (For primary document see N80-31326 22-01)
Avail: NTIS. HC A03/MF A01

Adjustment algorithms are presented for improving the theoretically obtained flexibility or stiffness and mass distribution of such a structure by dynamic test or ground resonance test results. The necessary assumptions for the adjustment and the mathematical formalism for the adjustment procedure are given. Experiences gained and adjustment results obtained with these algorithms are reported on concentrating especially on one which uses only the measured and calculated eigenfrequencies. Proposals for improvements on the procedures and in the algorithms are also given. R.C.T.

N80-31328# Aeritalia S.p.A., Torino (Italy).
EFFECTS OF NONLINEARITIES ON WING-STORE FLUTTER c08
G. DeFerrari, L. Chesta, O. Sensburg (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich), and A. Lotze (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich). *In* AGARD. Math. Modeling of Linear and Non-Linear Aircraft Struct. Jul. 1980. p. 15-32. refs. (For primary document see N80-31326 22-01)
Avail: NTIS. HC A03/MF A01

Findings from ground resonance tests and flight flutter tests are presented and an explanation for these test results is given. Calculations with linear assumptions (parameter variations) were made and the method of harmonic balance for finding these parameters was applied. It is shown that certain levels of excitation must be reached in order to make flight flutter tests reliable for establishing flutter clearance speeds. R.C.T.

N80-31329# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AIRCRAFT ASSESSMENT AND ACCEPTANCE TESTING
May 1980. 195 p. refs. Lecture held in Gol, Norway, 5-6 Jun. 1980, in Athens, 9-10 Jun. 1980, and in Ankara, 12-13 Jun. 1980. (AGARD-LS-108; ISBN-92-835-0266-3) Avail: NTIS. HC A09/MF A01

The present state of the art of aircraft assessment and acceptance testing of production aircraft is reviewed. Emphasis is placed on the practical aspects of this technique in order to help the flight crews and organizations dealing with this activity. Flight test instrumentation methods are set forth that do not require the use of sophisticated ground and airborne instrumentation for data acquisition or large computers for data processing. Flight test techniques described illustrate ways to acquire acceptable results utilizing a minimum of instrumentation or no

instrumentation. For individual titles, see N80-31330 through N80-31341.

N80-31330# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
SOME COMMENTS ON THE PROBLEMS INVOLVED IN AIRCRAFT ASSESSMENT AND ACCEPTANCE TESTING c05
J. F. Renaudie. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 26 p. ref. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

The objectives of assessment and acceptance tests and criteria for assessment are presented. The means, organization, and programs of flying, the technical programs of assessment and acceptance tests, and the technique of flight testing are also discussed. E.D.K.

N80-31331# Air Force Flight Test Center, Edwards AFB, Calif.
USAF DEVELOPMENT TEST AND EVALUATION c05
Laurence P. Colburn. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 13 p. refs. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

The test and evaluation of new weapon systems is an integral part of the total acquisition process. The major emphasis in the early development stages is placed on quantitative test and analysis to determine functional adequacy and specification compliance. Highly instrumented aircraft are used to provide data on aircraft performance, flying qualities, structural integrity, and subsystem operation. The management and test procedures used at the Air Force Flight Test Center to plan, conduct, and report on the development test and evaluation phase are presented. E.D.K.

N80-31332# British Aerospace Aircraft Group, Dunsfold (England).
SOME EXAMPLES OF PROCEDURES USED IN UK FOR ACCEPTANCE TESTING OF AIRCRAFT PRODUCED BY THE AIRCRAFT INDUSTRY UNDER GOVERNMENT CONTRACT c05
R. J. Poole. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 6 p. refs. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

The scope of the testing carried out on instrumented aircraft is illustrated in order to indicate the range of data that can be made available to bodies evaluating a production aircraft. Aircraft are flight tested to a production flight test schedule to ensure consistent handling and performance throughout the fleet and an example of the content of a schedule is presented. Tests include measurement of aerodynamic loading and inertia loading of the airframe structure, measurement of the aircraft stability and control characteristics, measurement of thrust and lift boundaries, takeoff, landing, climb, cruise, and descent performance, and determination of engine handling characteristics. E.D.K.

N80-31333# Societe de Fabrication d'Instruments de Mesure SFIM, Massy (France). Measurement and Recording Div.
A REVIEW OF FLIGHT TEST INSTRUMENTATION SYSTEMS FOR ACCEPTANCE TESTING OF THE PRODUCTION AIRCRAFT c06
Claude Robert. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 3 p. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

A definition is given of flight test instrumentation. Two cases considered are that the aircraft is fitted with a crash recording system and that no special recording means are available on the aircraft. A general description of present accident recording systems is presented. E.D.K.

N80-31334# Air Force Flight Test Center, Edwards AFB, Calif.
PERFORMANCE TESTING PRODUCTION AIRLINES c05
Roger C. Crane. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 27 p. refs. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

A discussion of basic performance testing and data analysis concepts along with pretest information requirements are presented. Ground tests such as instrumentation calibrations, installed static thrust calibrations, and airplane gross weight and center of gravity checks are outlined. Flight tests which enable static source position error determination, as well as an assessment of takeoff, cruise, acceleration, and turning performance are discussed. Also described are tests that enable assessments of the engine handling characteristics of the airplane. The presentation and analysis of the data acquired during each type of tests are also outlined with emphasis on using test day data as opposed to test day data corrected to standard day conditions. E.D.K.

N80-31335# British Aerospace Aircraft Group, Dunsfold (England).
EVALUATION OF LONGITUDINAL CHARACTERISTICS INCLUDING STABILITY HANDLING AND CG RANGE c08
R. J. Poole. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 16 p. refs. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

Tests used by contractors to assess the longitudinal stability and control characteristics of an aircraft are enumerated to give an indication of the measured flight test data that can be made available to an evaluating body. Simple flight tests to obtain qualitative and quantitative data on static, maneuver and dynamic stability, low speed handling, turning performance and high Mach number effects during an evalaution are also described. E.D.K.

N80-31336# British Aerospace Aircraft Group, Dunsfold (England).
EVALUATION OF LATERAL AND DIRECTIONAL CHARACTERISTICS AND SPINNING BEHAVIOUR c08
R. J. Poole. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 12 p. refs. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

The lateral and directional handling characteristics that should be investigated during an evaluation of an aircraft already tested by a contractor and test techniques utilizing limited flight test instrumentation to gather quantitative data are described. An approach to the assessment of spin entry and recovery behavior is also presented. E.D.K.

N80-31337*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT RESEARCH TECHNIQUES UTILIZING REMOTELY PILOTED RESEARCH VEHICLES c05
R. Dale Reed. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 15 p. refs. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

The use of the remotely piloted research vehicle (RPRV) in aeronautical research is surveyed. The flight test experience that has been acquired with several types of RPRV's including those with a pilot in the loop is emphasized. The approaches utilized range from the simplest and least expensive of vehicles, such as the Minisnuffler, to the sophisticated highly maneuverable aircraft technology (HiMAT) RPRV. The advantages and disadvantages of RPRV's are discussed, as well as safety considerations. The ground rules set early in a program can profoundly affect program cost effectiveness and timeliness. M.G.

N80-31338# Air Force Flight Test Center, Edwards AFB, Calif.
QUALITATIVE ARMAMENT SUBSYSTEM ASSESSMENT c05
Lawrence P. Colburn. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 16 p. refs. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

A qualitative approach to armament subsystem tests, the objectives which can be achieved, and analysis methods for the major aircraft weapon systems are addressed. It is concluded that a qualitative evaluation of the armament subsystem can provide the basis for determining the operational effectiveness and suitability of the system for procurement. A substantial amount of information may be gathered to evaluate a weapon system

without extensive or sophisticated instrumentation. Minimal aircraft and weapon range instrumentation requirements are detailed. M.G.

N80-31339# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
ELECTRO-MAGNETIC COMPATIBILITY **c32**
Henry Maidment *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 6 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

The historical background to the growth in problems of electromagnetic compatibility (EMC) in UK Military aircraft is reviewed and the present approach for minimizing these problems during development is discussed. The importance of using representative aircraft for final EMC assessments is stressed, and the methods of approach in planning and executing such tests are also outlined. The present equipment qualification procedures are based on assumptions regarding the electromagnetic fields present within the airframe, and the nature of the coupling mechanisms. These cannot be measured with any certainty in representative aircraft. Thus EMC assessments rely on practical tests. Avionics systems critical to flight safety, and systems vital to mission effectiveness require test methods that provide a measure of the safety and performance margins available to account for variations that occur in production and service use. Some proven methods are available, notably for detonator circuits, but in most other areas further work is required. Encouraging process has been made in the use of current probes for the measurement of interfering signals on critical signal lines, in conjunction with complementary test house procedures, as a means for obtaining the safety margins required in flight and engine control systems. Performance margins for mission systems using digital techniques are difficult to determine, and there is a need for improved test techniques. The present EMC qualification tests for equipment in the laboratory do not guarantee freedom from interference when installed, and the results are limited in value for correlating with aircraft tests. M.G.

N80-31340# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
CHECKING OF COMMUNICATIONS AND RADIO NAVIGATION SYSTEMS **c32**
Henry Maidment *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 24 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

The testing of aircraft communications and radio navigation systems is addressed. Limited assessments need to take account of variations in ground station performance, and uncertainty regarding radio wave propagation conditions. Antenna performance can vary markedly in different aircraft to affect the radial coverage of all systems, or the accuracy achieved by direction finding equipment. Aircraft transmitting antenna characteristics can be quantified for a relatively modest outlay on ground station equipment, and subjective communications quality assessments can be enhanced by using suitable yet inexpensive voice recorders that are also useful for noting observed navigation data for subsequent analysis. An accompanying aircraft of known performance can provide a comparative basis for the assessment of range performance and provide the means for checking air to air modes. Test objectives should be related to the intended operational use of the aircraft, but need to be interpreted into schedules for use over standard test routes, that have the widest application for all classes of aircraft. An example is given of a possible schedule of tests and the form of analysis that might apply. M.G.

N80-31341# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugführung.
PERFORMANCE OF NAVIGATION SYSTEMS **c04**
Karlheinz Hurrass *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 18 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

The radio navigation systems of VHF omnidirectional range/distance measuring equipment (VOR/DME) and the tactical air navigation system, as well as Doppler navigation and inertial navigation are described to show in which way and how far they can be used. Their error behavior is described especially and in detail. It is suggested that by combining various navigation systems, navigation accuracy can be greatly increased. One integrated system is dealt with and explained with the aid of flight tests. The system consists of a simple dead-reckoning system aided by DME distance measurements. Both systems are integrated by emans of a Kalman filter. The dead-reckoning system uses heading, true air speed, and an estimated velocity of the wind. The DME-interrogator is constantly switched over to frequencies of different ground stations (multiple DME). M.G.

N80-31342# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE APPLICATION OF DESIGN TO COST AND LIFE CYCLE COST TO AIRCRAFT ENGINES
May 1980 168 p refs Conf. held at Saint Louis, France, 12-13 May 1980 and London, 15-16 May 1980
(AGARD-LS-107; ISBN-92-835-0265-5) Avail: NTIS HC A08/MF A01

The cost of design and development of weapon systems must include not only the cost of production but also deployment training, operational use, and support. The latest methodologies of cost/performance comparison and tradeoffs for aircraft engines are examined with emphasis on data collection, analysis, modelling and estimating all development and operations costs. Contractual provisions and the costs related to incentives for performance and reliability are included. For individual titles, see N80-31343 through N80-31349.

N80-31343# RAND Corp., Washington, D. C.
AN APPROACH TO THE LIFE CYCLE ANALYSIS OF AIRCRAFT TURBINE ENGINES **c07**
J. R. Nelson *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 27 p refs (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

A methodology derived from historical data for life cycle analysis of aircraft turbine engines is described and applied at the engine subsystem and aircraft systems levels. The methodology enables the weapon system planner to acquire early visibility of cost magnitudes, proportions, and trends associated with a new engine's life cycle, and to identify drivers that increase cost and can lower capability. The procedure followed was to develop a theoretical framework for each phase of the life cycle; collect and analyze data for each phase; develop parametric cost estimating relationships (CERs) for each phase; use the CERs in examples to ascertain behavior and obtain insights into cost magnitudes, proportions, and trends, and to identify cost drivers and their effects; and examine commercial experience for cost data and operational and maintenance practices. A.R.H.

N80-31344# Ministry of Defence, London (England).
DESIGN TO LIFE CYCLE COSTS INTERACTION OF ENGINE AND AIRCRAFT **c07**
E. J. Jones *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 15 p (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

The distribution of life cycle costs for a typical combat aircraft between airframe, avionics and engine is discussed. Distribution of costs for the aircraft between development, production, initial support and operation and support is compared with the distribution for the engine. The effect of fleet size and service life upon the life cycle costs are indicated. The large commitment of life cycle costs early in the conceptual and feasibility phase of the program is indicated. The choice of engine is an example of this early commitment. The relative effect of the choice of single or twin engine installation of a derated engine or the use of an existing engine upon the engine life cycle costs, and the interaction with aircraft costs is discussed. The severe operating conditions for the engine of a combat aircraft are reviewed. Reduced support costs are not expected to give a large fold return on extra engine development investment. A.R.H.

N80-31345# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aeronautical Systems Div.

PROGRESS ON THE US AIR FORCE APPROACH FOR THE PRACTICAL MANAGEMENT OF ENGINE LIFE CYCLE COSTS **c07**

Richard E. Steere, Edward G. Koepnick, and Robert A. Dean *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 10 p refs (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

Efforts to more effectively influence the life cycle costs of newly acquired gas turbine power plants are reviewed. A combination of technical and business practice initiatives was undertaken or planned across the entire life cycle spectrum, i.e., from first entry with the exploratory development program through the decision to phase the product out of the active inventory. The status of technical and management activities is addressed and various business concepts and strategies being studied by the U.S. Air Force which complement the earlier initiatives as they impact engine life cycle costs are presented. The role of the USAF Propulsion System Program Office as the continuing focal point for these life cycle efforts is discussed. The ideas presented are not new as they have been employed successfully at one time or another on an individual basis in the development and support of military and commercial gas turbine power plants. What is new, is the systems management view of the life cycle process and what can be done practically today vs tomorrow to enhance engine life cycle costs in an integrated fashion. A.R.H.

N80-31346# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).

MILITARY ENGINE PROGRAMS WITH COST OBJECTIVES [PROGRAMMES DE MOTEURS MILITAIRE A OBJECTIES DE COUT] **c07**

Claude Foure *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 28 p In FRENCH (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

Approaches discussed include the analysis of value; reliability and maintainability studies; the direct operating cost of motor parts as considered by aircraft companies; and the management of efforts in technological progress. Topics covered include means for forecasting costs which are desirable to set at each phase of the program; the types of organization adapted to such programs; and possible action to be taken when the objectives are fixed or revised after initial definition, with or without modification of the definition. Economy measures related to the high cost of fuels and return from the value concept and tradeoffs are also examined. Transl. by A.R.H.

N80-31347# General Electric Co., Lynn, Mass. Aircraft Engine Group.

LOGISTICS FORECASTING FOR ACHIEVING LOW LIFE CYCLE COST **c81**

G. Walker *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 25 p refs (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

The on condition maintenance concept (OCM) provides the potential for reduced life cycle costs (LCC) by fully utilizing potential parts life and reducing maintenance frequency. With the advent of OCM logistics requirements are heavily influenced by wearout characteristics and usage severity. In such cases more sophisticated forecasting methods are required which realistically represent the dynamics of the logistics system inherent in such a maintenance philosophy. If efficient logistics management is to be attained, such forecasting tools should also provide the capability to perform tradeoff studies on the cost effectiveness of alternative maintenance or logistics systems. The use of modelling methods which are proving practical in forecasting and tradeoff analyses and therefore in establishing an optimum logistics and support environment is explored. Methods discussed include the consideration of wearout characteristics where components exhibit an age related replacement rate, and also replacement of components which may have a specified maximum life in terms of operating cycles or mission severity. The use of engine history recorders and parts tracking systems and their impact on achieving optimum LCC is also discussed. A.R.H.

N80-31348# Rolls-Royce Ltd., Bristol (England). Aero Div.

THE APPLICATION OF DESIGN TO COST AT ROLLS-ROYCE **c07**

R. J. Symon and K. J. Dangerfield *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 17 p (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

Experience in evolving and applying a formal design to cost discipline is described in chronological order of the main events which occurred during the last five years with brief reference to the previous period. A new type of department was created to face the principal problem, that control of costs requires interactive links between the management disciplines at all levels. The way in which this group fits into the existing organization to ensure that effective cost control becomes part of the established routines is discussed. Comments are made on the nature of cost and its fundamental difference from the other parameters which the designer has traditionally managed. Conclusions likely to apply to any commercial manufacturing company are suggested and comments made regarding the future responsibility of engineers in determining the financial success of the companies for which they work. Complementary roles for management and financial accountants to support the new responsibilities of the engineers are also indicated. A.R.H.

N80-31349# Boeing Aerospace Co., Seattle, Wash. Systems Cost Analysis Div.

EVALUATING AND SELECTING THE PREFERRED AIR BREATHING WEAPON SYSTEM **c07**

Frank A. Watts *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 16 p (For primary document see N80-31342 22-01)

Avail: NTIS HC A08/MF A01

The life cycle costs of three equally effective strategic forces are discussed with the objective of isolating the preferred air breathing component. Terms are defined, cost elements are reviewed, and an example is described in which various strategic forces containing advanced aircraft are compared and the preferred choice is dependent on whether least cost is measured by short term, long term, or intermediate budgetary considerations. A.R.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-31350*# De Havilland Aircraft Co. of Canada Ltd., Ottawa (Ontario).

PHASE 2 AND 3 WIND TUNNEL TESTS OF THE J-97 POWERED, EXTERNAL AUGMENTOR V/STOL MODEL

D. B. Garland and J. L. Harris Mar. 1980 174 p refs (Contract NASw-2797)

(NASA-CR-163578; DHC-DND-80-1) Avail: NTIS HC A08/MF A01 CSCL 01A

Static and forward speed tests were made in a 40 multiplied by 80 foot wind tunnel of a large-scale, ejector-powered V/STOL aircraft model. Modifications were made to the model following earlier tests primarily to improve longitudinal acceleration capability during transition from hovering to wingborne flight. A rearward deflection of the fuselage augmentor thrust vector was shown to be beneficial in this regard. Other augmentor modifications were tested, notably the removal of both endplates, which improved acceleration performance at the higher transition speeds. The model tests again demonstrated minimal interference of the fuselage augmentor on aerodynamic lift. A flapped canard surface also showed negligible influence on the performance of the wing and of the fuselage augmentor. T.M.

N80-31351*# United Technologies Research Center, East Hartford, Conn.

INFLUENCE OF MISTUNING ON BLADE TORSIONAL FLUTTER

A. V. Srinivasan Aug. 1980 55 p refs
(Contract NAS3-21603)
(NASA-CR-165137; R80-914545-16) Avail: NTIS HC A04/MF A01 CSCL 01A

An analytical technique for the prediction of fan blade flutter was evaluated by utilizing first stage fan flutter data from tests on an advanced high performance engine. The formulation includes both aerodynamic and mechanical coupling among all the blades of the assembly. Mistuning is accounted for in the analysis so that individual blade inertias, frequencies, or damping can be considered. Airfoil stability was predicted by calculating a flutter determinant, the eigenvalues of which indicate the extent of susceptibility to flutter. When blade to blade differences in frequencies are considered, a stable system is predicted for the test points examined. For a tuned system, it was found that torsional flutter can be predicted at a limited number of interblade phase angles. Examination of these phase angles indicated that they were 'close' to the condition of acoustic resonance. For the range of Mach numbers and reduced frequencies considered, the so called subcritical flutter cannot be predicted. The essential influence of mechanical coupling among the blades is to change the frequencies of the system with little or no change in damping; however, aerodynamic coupling together with mechanical coupling could change not only frequencies, but also damping in the system, with a trend toward instability. A.R.H.

N80-31352*# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.

AN ASYMPTOTIC UNSTEADY LIFTING-LINE THEORY WITH ENERGETICS AND OPTIMUM MOTION OF THRUST-PRODUCING LIFTING SURFACES Final Report

Ali Reza Ahmadi Sep. 1980 345 p refs
(Grant NGR-22-009-818)
(NASA-CR-163526; MIT-80-2) Avail: NTIS HC A15/MF A01 CSCL 01A

A low frequency usteady lifting line theory was developed for a harmonically oscillating wing of large aspect ratio. This wing was assumed to be chordwise rigid but completely flexible in the span direction. The theory was developed by use of the method of matched asymptotic expansions which reduces the problem from a singular integral equation to quadrature. The wing displacements were prescribed and the pressure field, airolads and unsteady induced downwash were obtained in closed form. The influence of reduced frequency aspect ratio, planform shape and mode of oscillation on wing aerodynamics was demonstrated through numerical examples. Compared with lifting surface theory computation time was reduced significantly. R.C.T.

N80-31353*# Razak (Kenneth), Wichita, Kans.

COMPUTATION OF SPANWISE DISTRIBUTION OF CIRCULATION AND LIFT COEFFICIENT FOR FLAPPED WINGS OF ARBITRARY PLANFORM Final Report

Kenneth Razak Aug. 1980 61 p refs
(Contract NAS1-15249)
(NASA-CR-159329) Avail: NTIS HC A04/MF A01 CSCL 01A

The question of the effect of distribution and magnitude of spanwise circulation and shed vorticity from an airplane wing on the distribution pattern of agricultural products distributed from an airplane was studied. The first step in an analysis of this question is the determination of the actual distribution of lift along an airplane wing, from which the pattern of shed vorticity can be determined. A procedure is developed to calculate the span loading for flapped and unflapped wings of arbitrary aspect ratio and taper ratio. The procedure was programmed on a small programmable calculator, the Hewlett Packard HP-97, and also was programmed in BASIC language. They could be used to explore the variations in span loading that can be secured by variable flap deflections or the effect of flying at varying air speeds at different airplane gross weights. Either an absolute evaluation of span loading can be secured or comparative span loading can be evaluated to determine their effect on swath width and swath distribution pattern. The programs are intended to assist the user in evaluating the effect of a given spanload distribution. J.M.S.

N80-31354# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

A CRITICAL COMMENTARY ON MEAN FLOW DATA FOR TWO-DIMENSIONAL COMPRESSIBLE TURBULENT BOUNDARY LAYERS

H. H. Fernholz May 1980 229 p refs
(AGARD-AG-253; AGARDograph-253; ISBN-92-835-1362-2)
Avail: NTIS HC A11/MF A01

A discussion of mean flow profile data for compressible boundary layers is presented. The commentary includes discussion of the theoretical basis for interpretation of measurements, concepts from low speed studies, and interpretation of mean flow data with and without pressure gradient. The causes of normal pressure gradients are described, so as to allow an estimation of their magnitude and their influence on boundary layer scale lengths. E.D.K.

N80-31355# Nielsen Engineering and Research, Inc., Mountain View, Calif.

BASIC STUDIES OF WING-BODY INTERFERENCE AT HIGH ANGLES OF ATTACK AND SUPERSONIC SPEEDS Final Report, 1 Jun. 1978 - 31 May 1979

Goetz H. Klopfer and Jack N. Nielsen Oct. 1979 82 p refs
(Contract N00014-78-C-0490; RR0141184)
(AD-A087134; NEAR-TR-206; ONR-CR-215-263-1) Avail: NTIS HC A05/MF A01 CSCL 20/4

The problem of computing the steady inviscid supersonic flows about thin wings having sharp subsonic leading edges and leading edge separation is solved in this paper. Both wings alone or wings in the presence of the body are considered. To obtain an efficient procedure the steady Euler equations are used as the basic governing equations as opposed to the more complicated Navier-Stokes equation. The viscous effects, important near the sharp leading edges, are simulated by a Kutta condition applied at the leading edges of the wings. The rest of the flow field is essentially controlled by the inviscid equations. The equations, written in conservation form in generalized curvilinear coordinates, are approximated by MacCormack's second-order accurate predictor-corrector algorithm. The flow tangency conditions at the body surface are satisfied by Abbett's scheme and the outer bow-shock position by the Rankine-Hugoniot jump relations. Internal shock waves or tangentially discontinuities are captured. The slip surface emanating from the leading edge of the sharp wing excited nonlinear instabilities in the MacCormack's scheme, which were stabilized by special flow dependent fourth order damping terms. GRA

N80-31356# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).

MODEL SCALE EFFECTS ON A 16-309 FLAPPED HYDROFOIL SECTION

Eric A. Jones Apr. 1980 46 p refs
(AD-A087343; DREA-TM-80/B) Avail: NTIS HC A03/MF A01 CSCL 20/4

Wind and water tunnel testing of a NACA 16-309 hydrofoil section with the standard a = 1.0 camber line and equipped with a 25% flap-chord ratio, simple, sealed flap is reported. Differences between test results from the two facilities are discussed, as well as the effect of placing roughness strips near the leading edge. Results are given showing the dependency of force, moment, and, in particular, cavitation inception on Reynolds number over the range from 1.25 to 4.0 million. M.G.

N80-31357# ARO, Inc., Arnold Air Force Station, Tenn.

STORE SEPARATION TESTING TECHNIQUES AT THE ARNOLD ENGINEERING DEVELOPMENT CENTER. VOLUME 2: DESCRIPTION OF CAPTIVE TRAJECTORY STORE SEPARATION TESTING IN THE AERODYNAMIC WIND TUNNEL 4T Final Report, 1 Oct. 1978 - 30 Sep. 1979

J. B. Carman, Jr., D. W. Hill, Jr., and J. P. Christopher AEDC Jun. 1980 134 p refs 4 Vol.
(AD-A087561; AEDC-TR-79-1-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 20/4

This report describes the current captive trajectory support (CTS) hardware, system operation, and the captive trajectory applications program for the Aerodynamic Wind Tunnel (4T). Also included are brief descriptions of additional CTS applications and some guidelines for potential users of the system. GRA

N80-31358# ARO, Inc., Arnold Air Force Station, Tenn.
STORE SEPARATION TESTING TECHNIQUES AT THE ARNOLD ENGINEERING DEVELOPMENT CENTER. VOLUME 4: DESCRIPTION OF DYNAMIC DROP STORE SEPARATION TESTING Final Report, 1 Oct. 1978 - 30 Sep. 1979
E. G. Allee, Jr. Jun. 1980 40 p refs 4 Vol.
(AD-A087490; AEDC-TR-79-1-Vol-4) Avail: NTIS HC A03/MF A01 CSCL 20/4

Dynamic drop testing is a method of trajectory simulation whereby store models which are both geometrically and dynamically scaled are released in the wind tunnel air stream and the resulting trajectories are mapped photographically. Drop testing is often used when captive trajectory testing is not feasible or for final trajectory verification prior to flight tests. GRA

N80-31359# Dayton Univ., Ohio. Applied Mathematics Group.
THE TREATMENT OF THE SONIC LINE AND OF SHOCKS IN A FINITE ELEMENT APPROACH TO TRANSONIC FLOW COMPUTATIONS Interim Report, Oct. - Dec. 1979
Karl G. Guderley Wright-Patterson AFB, Ohio AFWAL Feb. 1980 41 p refs
(Grant AF-AFOSR-3524-78; AF Proj. 2304)
(AD-A087740; UDR-TR-80-32; AFWAL-TR-80-3046) Avail: NTIS HC A03/MF A01 CSCL 20/4

Even if one uses the same shape functions throughout in a finite element computation of transonic flow fields, one must, for reasons of stability, apply the weights differently in the subsonic and supersonic regions. In the present report this aspect is accepted without further discussion. It is necessary, in addition, to impose special conditions at the sonic line and at the line where one returns from supersonic to subsonic speeds. These conditions are first explored by means of a semidiscretization. (The differential operators are discretized with respect to the direction normal to the streamlines, but not with respect to the streamline direction.) The resulting system of ordinary differential equations has singular points, whose position is related to the transition from one regime to the other. These singularities are compatible with weak solutions of the problems. (Finite difference and finite element solutions are realizations of the concept of weak equality.) But from the physical point of view these singularities are not admissible, at least not in the transition from a subsonic to a supersonic speed. One thus obtains the requirements that at the sonic line the partial differential equation be satisfied in the strong sense. GRA

N80-31360# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
RANGES AND CRITICAL VALUES OF ADVANCE RATIO FOR BLADE/VORTEX INTERSECTION PATTERNS OF A HELICOPTER ROTOR
L. R. Lucassen Jul. 1979 31 p refs Presented at 5th European Rotorcraft and Powered Lift Aircraft Forum, Amsterdam, 5-7 Sep. 1979
(NPL-MP-79030-U) Avail: NTIS HC A03/MF A01

The free vortices trailing from the tip of helicopter rotor blades lead to large changes in induced velocity and local angle of attack, resulting in peaks in aerodynamic loading. For a single rotor in forward flight an analysis was performed on the geometry of blade/vortex intersection, while an undistorted, in-plane wake is assumed. This showed the existence of seven ranges of advance ratio, each range being characterized by a different blade/vortex intersection pattern. These ranges are separated by six critical advance ratios, which are functions only of the ratio between the number of rotor blades and the serial number index of the preceding blade or tip vortex. The lowest critical advance ratio is in agreement with data published on the position of a ripple in the power required curves for level flight, as measured for several helicopter types. Author (ESA)

N80-31361# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
DESIGN OF A CALCULATION METHOD FOR THREE DIMENSIONAL TURBULENT BOUNDARY LAYERS
J. P. F. Lindhout and B. vandenBerg 29 Nov. 1979 14 p refs Presented at the 3d GAMM Conf. on Numerical Methods in Fluid Mech., Cologne, 10-12 Oct. 1979
(Contract NIVR-1820)
(NLR-MP-79036-U) Avail: NTIS HC A02/MF A01

An engineering method is presented to compute the three dimensional laminar and turbulent boundary layer flow over nondevelopable surfaces. Turbulence phenomena are described by a simple eddy viscosity model. The method was organized to enhance its user oriented properties. The organization and the numerics are discussed in the framework of relational diagrams which elucidate the relations between information sets and processes. Results are shown for the laminar flow over a flat plate with an attached cylinder and for the turbulent flow over the root section of an aircraft wing. Author (ESA)

N80-31362# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
CALCULATIONS BY A FIRST ORDER THEORY OF SUPERSONIC FLOW AROUND DELTA WINGS
S. G. Hedman 1980 22 p refs
(Contract FMV-F-INK-11-12-93490)
(FFA-TN-AU-810) Avail: NTIS HC A02/MF A01

Preliminary calculations of delta wings in supersonic flow were made with a method based on theoretical work of Oswatitsch and Sun. The flow field is computed with acoustic theory for an image wing in the characteristic space. Following that, the real wing's coordinates in physical space are calculated. The planform of the image wing must be modified until the corresponding real wing has obtained the wanted shape. The theory is of first order accuracy expressed in the characteristic variables. Traces of the characteristics in physical space and bow shock waves were found for cases with wings with and without incidence. As the wing disturbances increase it becomes more difficult to give to the real wing the wanted shape. The possible practical use of the method is probably limited to slender wings at small incidences. Author (ESA)

N80-31363# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CONTRIBUTION TO THE STUDY OF SUPERSONIC LAMINAR SEPARATION: UTILIZATION AND IMPROVEMENTS IN INTEGRAL METHODS OF CALCULATION Ph.D. Thesis - Lille Univ.
Gilles About 1980 90 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-662)
(ONERA-NT-1980-1; ISSN-0078-3781) Avail: NTIS HC A05/MF A01

Calculations were performed on supersonic layer separation phenomena by solving coupled perfect fluid equations and integral form boundary layer equations. Three types of improvements are suggested: definition of similitude profiles approximated by a simple analytical representation and the use of a second order boundary layer formulation proposed by Crocco, adaptation of Le Balleur's numerical method and its application to separated and reattaching flow on a compression ramp or under shock wave reflection conditions; and determination of three parameter velocity profiles able to take sublaminar layers into account and their utilization in a three moment integral method as suggested by Crocco. Author (ESA)

N80-31364# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
AN INVESTIGATION OF SCALE EFFECTS ON THE TRANSONIC FLOW OVER SWEPT WINGS. PART 1: MEASUREMENTS ON A MODEL OF A TRANSPORT-AIRCRAFT CONFIGURATION
D. J. Weeks London Aeronautical Research Council Nov. 1976 126 p refs Supersedes RAE-TR-76158; ARC-37486 (ARC-R/M-3842-Pt-1; BR74033; RAE-TR-76158; ARC-37486) Avail: NTIS HC A07/MF A01; HMSO £14 PHI

Measurements of forces and wing pressures at Mach numbers 0.70, 0.79 and 0.85, and at Reynolds numbers in the range 1.7 million to 13.6 million, on a half model of a transport-aircraft-type wing-body combination, were analyzed to show the effects of changes of Reynolds number and transition position on the transonic flows over the upper surface of the wing at high incidence. Each of the three Mach numbers provides a different example of flow development and form of scale effect. Author (ESA)

N80-31365# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
JET INTERFERENCE ON SUPERCRITICAL WINGS. PART 1: EXPERIMENTS ON A TWO-DIMENSIONAL WING. PART 2: EXPERIMENTS ON A SWEPT WING
J. A. Bagley and A. G. Kurn London Aeronautical Research Council Jan. 1977 105 p refs Supersedes RAE-TM-77007; RAE-TM-77008; ARC-37279; ARC-37281
(ARC-R/M-3845; BR74032; RAE-TR-77007; RAE-TR-77008; ARC-37279; ARC-37281) Avail: NTIS HC A06/MF A01; HMSO £15 PHI

Wind tunnel tests were made to investigate the influence of the jet from several different nozzles on the pressure distribution on adjacent wing panels with supercritical profiles. An existing unswept wing panel was used for one test; a 25 deg swept wing panel was used for the other and additional measurements were made with pylons fitted to two of the nozzles. The nozzle shapes and their location relative to the wing were chosen to represent a modern airbus configuration with fan engines. The results indicate that, in the cruise configuration, the influence of the jet is fairly small, and in most cases it simply reinforces certain features of the pressure distribution measured without jet blowing. Author (ESA)

N80-31366# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
WIND TUNNEL MEASUREMENT OF LATERAL AERODYNAMIC DERIVATIVES USING A NEW OSCILLATORY RIG, WITH RESULTS AND COMPARISONS FOR THE GNAT AIRCRAFT
C. O. OLeary London Aeronautical Research Council Oct. 1977 45 p refs Supersedes RAE-TR-77159; ARC-37724
(ARC-R/M-3847; BR74569; RAE-TR-77159; ARC-37724) Avail: NTIS HC A03/MF A01; HMSO £10 PHI

The investigation of aircraft handling characteristics at high angle of attack and high subsonic speeds is hampered by the lack of accurate data on aerodynamic derivatives. The development of a rig and method of test for the measurement of oscillatory lateral aerodynamic derivatives under these conditions is described. Tests were made on a 0.16 scale model of a Gnat T Mk 1 aircraft and the results compared with those from wind tunnel static tests, flight tests and estimates. Agreement with the other data is reasonably close except in the case of some cross damping derivatives. The accuracy of measurement of derivatives due to rate of roll should be improved by a proposed design of the excitation system. Author (ESA)

N80-31367# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
MEASUREMENTS OF PRESSURE DISTRIBUTIONS AND PRESSURE DRAGS AT ZERO INCIDENCE ON BOTH BLUNT AND SHARP AXISYMMETRIC FOREBODIES AT A MACH NUMBER OF 3
L. C. Ward London Aeronautical Research Council Nov. 1976 33 p refs Supersedes RAE-TR-76160; ARC-37355
(ARC-R/M-3849; BR74568; RAE-TR-76160; ARC-37355) Avail: NTIS HC A03/MF A01; HMSO £8 PHI

Surface pressure distrubutions measured on a number of axisymmetric forebodies at zero incidence and a Mach number of 3 are presented. Integrated pressure drags are compared with the theoretical drags of sharp cones having the same forebody fineness ratios, showing that significant drag reductions can be achieved at this Mach number by the suitable use of nose blunting, leading also to an increase of usable volume in the forebody. Results are compared with published data for determining the pressure drag of spherically blunted cones. Author (ESA)

N80-31368# Royal Aircraft Establishment, Farnborough (England).
A BRIEF INVESTIGATION OF THE TWO-DIMENSIONALITY OF THE FLOW OVER AN AIRFOIL IN THE 8 FOOT BY 6 FOOT TRANSONIC WIND TUNNEL
P. H. Cook and M. A. McDonald London HMSO Dec. 1979 20 p refs
(RAE-TM-Aero-1828; BR72384) Avail: NTIS HC A02/MF A01

Oil flow on the surface and pitot pressure measurements in the wake of a 0.762 m chord airfoil in a 8 ft x 6 ft tunnel indicate that there is no significant spanwise convergence or divergence of the flow within the boundary layer and wake of the model. The measurements were made at subsonic conditions where no regions of separated flow existed on the model, but where significant subsonic drag creep had previously been measured. Author (ESA)

N80-31369# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
A NUMERICAL METHOD FOR THE CALCULATION OF LAMINAR INCOMPRESSIBLE BOUNDARY LAYERS WITH STRONG VISCOUS-INVISCID INTERACTION
A. E. P. Veldman 7 Mar. 1979 49 p refs
(NLR-TR-79023-U) Avail: NTIS HC A03/MF A01

A method for the calculation of boundary layers with strong viscous inviscid interaction is presented. The method differs from the classical methods for solving boundary layer equation, through the use of an interactive boundary condition which replaces the usually prescribed pressure. This boundary condition describes how the outer potential flow reacts on the presence of the boundary layer. The method is demonstrated on two problems: a boundary layer with a separation bubble and the flow near the trailing edge of a flat plate. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-31370# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN ANALYSIS OF THE FUTURE REQUIREMENTS FOR MATERIALS HANDLING EQUIPMENT IN THE MILITARY AIRLIFT COMMAND
Christopher Carson and Charles D. Munson Jun. 1980 107 p refs
(AD-A087094; AFIT-LSSR-35-80) Avail: NTIS HC A06/MF A01 CSCL 15/5

Civilian wide-bodied aircraft are presently used to augment the Military Airlift Command's airlift capability. Many analysts believe that this wide-body usage will increase in the future. However, even today, the basic 463L materials handling equipment system (e.g., K-loaders) cannot accommodate civilian wide-bodies. Cargo loader adapters and modifications have proven infeasible, necessitating the use of elevators for loading/unloading operations. Therefore, the purpose of this study was to examine whether the United States Air Force should continue to write specifications around the present K-loaders, or initiate acquisition of a cargo loader capable of interfacing with both military aircraft and civilian wide-bodied aircraft. The examination of these two decision alternatives involved three main phases: (1) a forecast of the future U.S. wide-body and narrow-body market, (2) a determination of Military Airlift Command's future loader requirements based on predicted changes in cargo activity, and (3) a net present value analysis of system costs built on various policies for loader replacement. After the results of these phases were obtained, the authors concluded that the Air Force should continue to acquire, operate, and maintain its present K-loader system. GRA

N80-31371# School of Aerospace Medicine, Brooks AFB, Tex.
CRITICAL INTERFACES BETWEEN ENVIRONMENT AND ORGANISM IN CLASS A MISHAPS: A RETROSPECTIVE ANALYSIS Final Report, 30 Aug. - 27 Dec. 1978
Stan R. Santilli Jun. 1980 44 p refs
(AF Proj. 7930)
(AD-A087341; SAM-TR-80-5) Avail: NTIS HC A03/MF A01 CSCL 01/2

Aircraft mishap prevention efforts in the past have been extremely successful. Since 1970 the mishap rate decrease has leveled off. Most experts agree, however, that it can be further reduced. This study focuses on the human factors aspects that

have consistently played a prominent role in mishap causation but only recently have received significant scrutiny. The approach taken in this study has as its premise that both the environment and the organism bring with them a certain degree of mishap potential and that a mishap occurs as a result of the additive effects, or critical interfaces, of the two. Determining these critical interfaces by retrospective analysis of past mishaps is the method used here, the immediate goal being to identify more clearly the root cause of human factors mishaps. Recommendations are offered for future efforts to avoid these critical interfaces or to decrease the mishap potential inherent in the environment and the organism. GRA

N80-31372# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Vertical Equipment Div.
COMPUTER SIMULATION OF EJECTION SEAT PERFORMANCE AND PRELIMINARY CORRELATION WITH EMPIRICAL DATA Final Technical Report, 1 Oct. 1977 - 1 Feb. 1979
Lanny A. Jines Apr. 1980 78 p refs
(AF Proj. 2402)
(AD-A087275; AFFDL-TR-79-3150) Avail: NTIS HC A05/MF A01 CSCL 01/3

The comparison of six-degree-of-freedom computer program modeling ejection seat performance to empirical data from ejection seat track tests is discussed. The computer subroutines model the ejection seat components which generate forces on the seat and crewperson combination during ejection. The resulting motion described in terms of trajectory parameters, as well as acceleration time histories on the ejectee is correlated with measured data from recent Air Force track test programs in which ejection seat performance was determined. GRA

N80-31373# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
MEDICAL AND TOXICOLOGICAL FACTORS IN AIRCRAFT ACCIDENTS
William R. Kirkham Apr. 1980 12 p refs Presented at the 14th Ann. Southern Methodist Univ. Air Law Symp., Dallas, 6-8 Mar. 1980
(AD-A087690; FAA-AM-80-6) Avail: NTIS HC A02/MF A01 CSCL 01/2

A number of factors operating within pilots may impair their ability to operate aircraft in a safe manner, thus accounting for some of the 83 to 87 percent of pilot 'causes' of general aviation accidents. Aircraft accident investigators should be attuned to characteristics of the accident, witness statements, and autopsy and laboratory findings that may suggest partial or complete incapacitation in the pilot. Incapacitation may be brought on by a medical condition which may be revealed at autopsy or be inferred only from medical history. Spatial disorientation is a subjective evaluation only and a form of incapacitation rated as the third most frequent 'cause' of fatal general aviation accidents. Lack of oxygen--hypoxia--is a constant threat to incapacitate in aircraft operating at high altitudes. Toxicological factors such as alcohol, drugs, and gases (e.g., carbon monoxide) should always be sought in fatal aircraft accidents by obtaining blood, urine and other specimens for laboratory analyses. Aerial application pilots may be incapacitated by the poisonous materials they apply, especially the cholinesterase-inhibiting insecticides. The finding of therapeutic drugs in the blood or other specimens from accident victims, or of tablets, pills, etc., at the scene, may point to underlying medical conditions that may impair pilot performance. The author discusses these principles and illustrates them briefly with cases to make accident investigators and others aware of the importance of medical and toxicological factors in aircraft accidents. GRA

N80-31374# Desmatics, Inc., State College, Pa.
A GENERAL STATISTICAL APPROACH FOR USING AUXILIARY INFORMATION IN THE DEVELOPMENT OF AN IMPACT ACCELERATION INJURY PREDICTION MODEL
John J. Peterson and Dennis E. Smith Aug. 1980 24 p refs
(Contract N00014-79-C-0128)
(AD-A087810; TR-112-6) Avail: NTIS HC A02/MF A01 CSCL 01/2

This report discusses general procedures for simultaneously incorporating various sources of auxiliary information into an impact acceleration injury prediction model. The sources of auxiliary information considered are supplemental continuous empirical data and a priori knowledge in the form of model parameter estimates and constraints. GRA

N80-31312# Piper Aircraft Corp., Lockhaven, Pa.
GENERAL AVIATION ICING FLIGHT TEST
William H. Lawton *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 60-67
(For primary document see N80-31305 22-01)
Avail: Issuing Activity

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-31375*# Lockheed Aircraft Corp., Burbank, Calif.
DEVELOPMENT OF ADVANCED AVIONICS SYSTEMS APPLICABLE TO TERMINAL-CONFIGURED VEHICLES Final Report, Oct. 1978 - Jan. 1980
R. L. Heimbold, H. P. Lee, and M. F. Leffler Sep. 1980 105 p refs
(Contract NAS1-15546)
(NASA-CR-3280; LR-29326) Avail: NTIS HC A06/MF A01 CSCL 01D

A technique to add the time constraint to the automatic descent feature of the existing L-1011 aircraft Flight Management System (FMS) was developed. Software modifications were incorporated in the FMS computer program and the results checked by lab simulation and on a series of eleven test flights. An arrival time dispersion (2 sigma) of 19 seconds was achieved. The 4 D descent technique can be integrated with the time-based metering method of air traffic control. Substantial reductions in delays at today's busy airports should result. S.F.

N80-31376# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
IN-FLIGHT EVALUATION OF A SEVERE WEATHER AVOIDANCE SYSTEM FOR AIRCRAFT Final Report
Robert K. Baum and Timothy J. Seymour May 1980 128 p refs
(Contract FAA/ARD-740)
(AD-A087426; AFWAL-TR-80-3022) Avail: NTIS HC A07/MF A01 CSCL 01/2

Since there is increased interest in severe weather avoidance systems to augment conventional radar, a joint flight program was undertaken to evaluate the Ryan Stormscope as a thunderstorm avoidance tool. Comparisons were made between Stormscope electrical activity areas and precipitation contours from both on-board and ground weather radar displays. Strongest correlation between radar and Stormscope was found in regions of high precipitation gradients. Comparisons were also made between Stormscope and a ground-based Lightning Detection and Ranging System (LDAR) to determine range and azimuth accuracy of the electrical activity displayed on Stormscope. Because of inherent differences among these systems (i.e., type and rate of data acquisition), corresponding groups of electrical activity areas were compared. Items compared were group area ratios, group overlap areas and group centroid locations. In general, Stormscope groups were larger than corresponding LDAR groups (150% on the average). Additionally, Stormscope group centroid locations differed an average of 15 NM in range and 11 deg in azimuth from those on the LDAR system. This margin of error is acceptable for in-flight thunderstorm avoidance. GRA

N80-31377# Tufts Univ., Medford, Mass. Dept. of Electrical Engineering.
BALLOON-SUPPORTED LORAN ANTENNA, NEW HARD-

WARE FOR TETHERED BALLOONS, AND PAYLOADS USED IN BAMM FLIGHTS Final Report, 1 Nov. 1976 - 31 Dec. 1979
Alvin H. Howell Hanscom AFB, Mass. AFGL 28 Feb. 1980 14 p
(Contract F19628-77-C-0047; AF Proj. 6665)
(AD-A087487; AFGL-TR-80-0043) Avail: NTIS
HC A02/MF A01 CSCL 17/9

Analysis of corona losses on a proposed balloon-supported loran antenna pointed the way to a workable design that was fully implemented and given an operational test. By-products of the antenna work included the production of a smart valve and useful new hardware for tethered balloons. Payloads were prepared for and used in three successful data-gathering balloon flights for the Balloon Altitude Mosaic Measurements program. GRA

N80-31378# Tufts Univ., Medford, Mass. Dept. of Electrical Engineering.
BALLOON-SUPPORTED ANTENNA FOR LORAN C/D NAVIGATION SYSTEM
Alvin H. Howell Jan. 1980 22 p
(Contract F19628-77-C-0047; AF Proj. 6665)
(AD-A087488; AFGL-TR-80-0107; SR-1) Avail: NTIS
HC A02/MF A01 CSCL 17/9

Analysis of corona losses on a proposed balloon-supported Loran antenna indicated the planned design could not be operated at full voltage because losses would far exceed the available power. This study, and a comparison study of expected corona loss on the operational antenna, pointed the way to a successful design. Special top-loader-tethers were procured, and essential hardware was built to implement the design. Electrical constants were measured in a launch test, after which interface hardware was produced for an operational test that was carried out at Anniston, Alabama. GRA

N80-31379# Dayton Univ., Ohio. Management Science.
LANDING SYSTEM RELIABILITY AND SAFETY MODEL Final Report, Sep. 1974 - Jun. 1979
L. Fudge, L. Gephart, and G. Yingling Wright-Patterson AFB, Ohio AFFDL Aug. 1979 179 p refs
(Contract F33615-74-C-3075; AF Proj. 2403; AF Proj. 2187)
(AD-A087524; AFFDL-TR-79-3107) Avail: NTIS
HC A09/MF A01 CSCL 01/2

A total systems analysis procedure for identifying the safety hazards and risks associated with the use of a defined flight control system for low visibility approach and landing (Category 3) was developed. The analysis includes the ground transmitting system, airborne automatic flight control system, pilot and copilot operating in the system, and crew procedures. Actual data from Category 3 experience in a specially equipped C-141 aircraft, along with equipment failure data from C-141 fleet experience was used to test and confirm the modeling techniques. GRA

N80-31380# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
A SIMULATION INVESTIGATION ON THE FEASIBILITY OF CURVED APPROACHES UNDER MICROWAVE LANDING SYSTEM (MLS) GUIDANCE
L. J. J. Erkelens 20 Sep. 1978 101 p refs Revised
(Contract RB-RLD-1978-2.4)
(NLR-TR-78035-U) Avail: NTIS HC A06/MF A01

A flight simulator was used to investigate the utility of seven laterally curved approaches with various turn angles and final intercept altitudes, executed with a B-747 aircraft. Three weather situations were included, with winds of 15 m/sec and wind shears of 0.17 m sec/m. A minimum cloud base of 30.5 m was used. A flight director operating in the instrument landing system tracking mode and supplied with minor modifications in the roll bar drive was used as primary guidance instrument. Additional provisions were made to enable the pilot to monitor the approach. It was found that curved approaches with turn angles up to 180 deg can be carried out safely provided that the turn completion altitude is not much less than 305 m. Special provisions are needed with respect to the autopilot/flight director drive to achieve accurate tracking on the curved segment in strong wind conditions. Author (ESA)

N80-31308# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
THE TORNADO ALL-WEATHER HIGH-SPEED LOW-LEVEL SYSTEM
Ludwig Obermeier *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 22-36
(For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31341# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
PERFORMANCE OF NAVIGATION SYSTEMS
Karlheinz Hurrass *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 16 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-31381*# Northrop Corp., Hawthorne, Calif. Aircraft Div.
FLOW VISUALIZATION STUDY OF THE HiMAT RPRV
Dale J. Lorincz Feb. 1980 73 p refs Original contains color illustrations
(Contract NAS4-2616)
(NASA-CR-163094; NOR-80-128) Avail: NTIS
HC A04/MF A01 CSCL 01C

Water tunnel studies were performed to qualitatively define the flow field of the highly maneuverable aircraft technology remotely piloted research vehicle (HiMAT RPRV). Particular emphasis was placed on defining the vortex flows generated at high angles of attack. The flow visualization tests were conducted in the Northrop water tunnel using a 1/15 scale model of the HiMAT RPRV. Flow visualization photographs were obtained for angles of attack up to 40 deg and sideslip angles up to 5 deg. The HiMAT model was investigated in detail to determine the canard and wing vortex flow field development, vortex paths, and vortex breakdown characteristics as a function of angle of attack and sideslip. The presence of the canard caused the wing vortex to form further outboard and delayed the breakdown of the wing vortex to higher angles of attack. An increase in leading edge camber of the maneuver configuration delayed both the formation and the breakdown of the wing and canard vortices. Additional tests showed that the canard vortex was sensitive to variations in inlet mass flow ratio and canard flap deflection angle. T.M.

N80-31382*# Sikorsky Aircraft, Stratford, Conn.
BIFILAR ANALYSIS STUDY, VOLUME 1
W. Miao and T. Mouzakis Aug. 1980 89 p refs
(Contract NAS1-15612)
(NASA-CR-159227; SER-510035-Vol-1) Avail: NTIS
HC A05/MF A01 CSCL 01C

A coupled rotor/bifilar/airframe analysis was developed and utilized to study the dynamic characteristics of the centrifugally tuned, rotor-hub-mounted, bifilar vibration absorber. The analysis contains the major components that impact the bifilar absorber performance, namely, an elastic rotor with hover aerodynamics, a flexible fuselage, and nonlinear individual degrees of freedom for each bifilar mass. Airspeed, rotor speed, bifilar mass and tuning variations are considered. The performance of the bifilar absorber is shown to be a function of its basic parameters: dynamic mass, damping and tuning, as well as the impedance of the rotor hub. The effect of the dissimilar responses of the individual bifilar masses which are caused by tolerance induced mass, damping and tuning variations is also examined. T.M.

N80-31383*# Sikorsky Aircraft, Stratford, Conn.
BIFILAR ANALYSIS USERS MANUAL, VOLUME 2
Sebastian J. Cassarino Aug. 1980 366 p refs

(Contract NAS1-15612)
(NASA-CR-159228-Vol-2; SER-510036) Avail: NTIS HC A16/MF A01 CSCL 01C

The digital computer program developed to study the vibration response of a coupled rotor/bifilar/airframe coupled system is described. The theoretical development of the rotor/airframe system equations of motion is provided. The fuselage and bifilar absorber equations of motion are discussed. The modular block approach used in the make-up of this computer program is described. The input data needed to run the rotor and bifilar absorber analyses is described. Sample output formats are presented and discussed. The results for four test cases, which use the major logic paths of the computer program, are presented. The overall program structure is discussed in detail. The FORTRAN subroutines are described in detail. T.M.

N80-31384*# Lockheed-Georgia Co., Marietta.
EVALUATION OF LAMINAR FLOW CONTROL SYSTEM CONCEPTS FOR SUBSONIC COMMERCIAL TRANSPORT AIRCRAFT Summary Report
Sep. 1980 100 p refs
(Contract NAS1-14631)
(NASA-CR-159254; LG80ER0149) Avail: NTIS HC A05/MF A01 CSCL 01C

A study was conducted to evaluate alternatives in the design of laminar flow control (LFC) subsonic commercial transport aircraft for operation in the 1980's period. Analyses were conducted to select mission parameters and define optimum aircraft configurational parameters for the selected mission, defined by a passenger payload of 400 and a design range of 12,038 km (6500 n mi). The baseline aircraft developed for this mission was used as a vehicle for the evaluation and development of alternative LFC system concepts. Alternatives were evaluated in the areas of aerodynamics structures, materials, LFC systems, leading-edge region cleaning and integration of auxiliary systems. Based on these evaluations, concept in each area were selected for further development and testing and ultimate incorporation in the final study aircraft. Relative to a similarly-optimized advanced technology turbulent transport, the final LFC configuration is approximately equal in direct operating cost but provides decreases of 8.2% in gross weight and 21.7% in fuel consumption. Author

N80-31385*# National Aeronautics and Space Administration, Washington, D. C.
WING PROFILE DESIGN OF THE WORLD CHAMPIONSHIP SAIL PLANE SB 11
K. H. Horstmann and A. Quast May 1980 9 p Transl. into ENGLISH from DFVLR-Nachr. (West Germany), Nov. 1979 p 19-20 Original language document announced as A80-13181 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75829) Avail: NTIS HC A02/MF A01 CSCL 01C

A glider capable of climbing while circling in an updraft at low speed with a great mount of lift while gliding to the next updraft at high speed and with minimal altitude loss was designed. The wing profile design alleviates several problems and leaves no gap between wind and flap. A constant thickness flap eliminates the need for a flexible contour section which in turn reduces control effort. The conventional method of banking with ailerons is retained. Improved performance is demonstrated. S.J.

N80-31386*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
COMPARISON OF CALCULATED AND MEASURED BLADE LOADS ON A FULL-SCALE TILTING PROPROTOR IN A WIND TUNNEL
Wayne Johnson Sep. 1980 22 p Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
(NASA-TM-81228; USAAVRADCOM-TR-80-A-8) Avail: NTIS HC A02/MF A01 CSCL 01C

The loads measured in a wind tunnel on a full-scale tilting proprotor are compared with calculated results. The data consists primarily of oscillatory beamwise bending moments at 35% radial station, oscillatory spindle chord bending moments, and oscillatory pitch link loads. The measured and calculated results as a function of thrust are compared over a range of nacelle angles from 0 to 75 deg, and a range of speeds from 80 to 185 knots.T.M.

N80-31387*# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
PROGRESS REPORT 3 OF COOPERATIVE PROGRAM FOR DESIGN, FABRICATION, AND TESTING OF HIGH MODULUS COMPOSITE HELICOPTER SHAFTING Final Report, 1 Jan. 1975 - 30 Jun. 1979
Charles C. Wright (AARADCOM, Dover, N.J.) and Donald J. Baker Jun. 1980 139 p refs
(DA Proj. 1T1-62105-A-331)
(NASA-TM-82272; AD-A086849; AD-E400434; ARLCD-TR-79028) Avail: NTIS HC A07/MF A01 CSCL 11/4

This report describes the third phase of work, the objective of which was to overcome the excessive brittleness of the previously developed UH-1 helicopter tail rotor drive shaft design which demonstrated a shaft train weight savings of 53.1% over the current 2024-T3 aluminum shaft train. A materials impact program demonstrated exceptionally noteworthy performance of two woven constructions containing E-glass and PRD 49-III (designation later changed to KEVLAR 49) fibers in an epoxy resin matrix. Thermoplastic matrices and PRD 49-III fiber provided impact resistance at low weight which was superior to composites having the same fiber in a thermoset resin matrix. A design, fabrication, and test program showed that shaft impact resistance could be improved over the previously developed graphite composite design at a cost in shaft train rate savings. The shaft train weight savings of the most impact tolerant construction was 4.0% over the current aluminum shaft train. Alternating plies of graphite and glass appear to provide substantially greater tube impact durability than that provided by hybridization of the two fibers into one tape wound to a ply design equivalent in strength and stiffness to that of the alternating ply design. Recommendations were made to continue research work to exploit the potential for more impact-durable structures through the use of KEVLAR 49 fiber, woven structures, thermoplastic matrices and THORNEL 50-S/KEVLAR 49 blends with thermoset matrices. GRA

N80-31388# Naval Ship Research and Development Center, Bethesda, Md.
REMOTELY PILOTED SEAPLANE FOR ANTISUBMARINE WARFARE Final Report
C. Joseph Martin and Basil Papadales, Jr. Jul. 1980 27 p refs Presented at the Advan. Concepts Workshop in ASW Weapon Systems, San Diego, Calif., 7-9 Aug. 1979
(NF41421091)
(AD-A086932; DTNSRDC-80/078; DTNSRDC-Aero-1267) Avail: NTIS HC A03/MF A01 CSCL 01/3

The remotely piloted seaplane (RPS) for antisubmarine warfare (ASW) is a small, relatively inexpensive, unmanned water-based aircraft that provides excellent time-on-station performance, tactical flexibility, and energy efficiency. In the 1980's, command, control, and communications (C3) technology will be available which will permit a seaplane to be designed with no crew on board. Such a vehicle would be capable of performing military ASW operations in open ocean areas while taking full advantage of its waterborne capability. The removal of a crew from the seaplane has a substantial impact on the aircraft design. A RPS having a 1200 n mi radius of action and 72 hr time-on-station would weigh only 34,800 lb (15,764 kgm) and would incorporate a 5300 lb (2400 kg) ASW payload. GRA

N80-31389# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
DETERMINATION OF THE CHARACTER OF THE LATERAL-DIRECTIONAL MOTION OF AN AIRBORNE TOWED VEHICLE
H. George Baroff 30 Apr. 1980 30 p refs
(WF11124704)
(AD-A087445; NADC-80037-60) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report presents the derivation of the lateral directional equations of motion of an airborne towed vehicle. Herein it is assumed that the tow cable is stable and is attached to the vehicle at other than its center of gravity. In addition to

customary airborne vehicle equations of motion, the lateral rotation rate of the cable attachment point on the vehicle is described as a function of cable length. Components of cable tension are included in the equations. Determinations of the character of the lateral directional motion of a HTM-11 and a modified HTM-11 towed vehicles employing the developed equations of motion are discussed. GRA

N80-31390# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEMS DYNAMIC ANALYSIS COMPONENT DATA HANDBOOK Final Technical Report, 1 Jun. 1978 - Nov. 1979
Roy Deshazer, Ray Levek, Mike Stevens, and Bob Young Wright-Patterson AFB, Ohio Apr. 1980 100 p refs
(Contract F33615-78-C-2026; AF Proj. 3145)
(AD-A087366; AFWAL-TR-80-2040) Avail: NTIS HC A05/MF A01 CSCL 01/3

The component data handbook has been developed to aid users of the aircraft hydraulic system dynamic analysis computer programs HSFR, SSFAN, and HYTRAN in selecting input data. The handbook provides brief descriptions of the general usage components modeled by these computer programs, tabulates the necessary input data for each program and catalogs typical data trends or actual input data of components that have been simulated. GRA

N80-31391# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
HELICOPTER-SHIP QUALIFICATION TESTING
L. T. Renirie and T. Hoekstra 3 Jul. 1979 16 p refs Presented at 5th European Rotorcraft and Powered Lift Aircraft Forum, Amsterdam, 4-7 Sep., 1979
(NLR-MP-79027-U) Avail: NTIS HC A02/MF A01

A test method was developed for establishing limits for helicopter takeoff and landing imposed by turbulence and flight deck motion. An onboard recorder monitors the helicopter engine parameters, collective pitch lever position, pedal position, radar altitude, vertical and lateral acceleration, and instant of takeoff and landing. Onboard ship, relative wind speed and direction, pitching and rolling angles, and vertical and lateral acceleration are recorded. To quantify the human factors in controlling the helicopter a pilot rating technique is applied. It was found that operational limits for the helicopter in terms of relative wind speed and direction can be established straightforwardly. With respect to ship motion, it was found satisfactory to use the 2 sigma value of motion parameters as a representative measure to define limits. Wind tunnel tests of ship models are described. Author (ESA)

N80-31392# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
SIGNIFICANCE OF A ROTOR BLADE FAILURE FOR FLEET OPERATION, INSPECTION, MAINTENANCE, DESIGN AND CERTIFICATION
R. J. H. Wanhill, E. A. B. deGraaf, and A. A. M. Delil Sep. 1979 16 p refs Presented at 5th European Rotorcraft and Powered Lift Aircraft Forum, Amsterdam, 4-7 Sep. 1979
(NLR-MP-79021-U) Avail: NTIS HC A02/MF A01

The catastrophic fracture of a rotor blade from a large helicopter was analyzed, with essentially immediate consequences for continued fleet operation, inspection and maintenance of the same type of rotor blade. Fractography indicated that the hollow blade spar had failed by fatigue originating from one or two corrosion pits under the spar/pocket joint. The service failure investigation was reviewed to serve as an essential illustration for subsequent discussion of remedial action for similar types of rotor blades, and design aspects, philosophy and procedure. This includes the adhesive bonding system, the pressurizing gas crack detection system, rotor blade working stresses, and estimation of fatigue initiative and crack growth lives. Author (ESA)

N80-31393# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
MANEUVER SPECTRUM FATIGUE CRACK PROPAGATION IN ALUMINUM ALLOY SHEET MATERIALS
R. J. H. Wanhill 14 May 1980 34 p refs
(Contract RNLAF-Klu-RE-1977.c14)
(NLR-TR-78091-U) Avail: NTIS HC A03/MF A01

Aluminum alloy sheets of 2024-T3, 2048-T851, 7075-T6 and 7475-T761, were compared for fatigue crack propagation resistance under maneuver spectrum and constant amplitude loading. For maneuver spectrum loading 7475-T761 was superior overall, probably due to toughness of this alloy. Alloy 2024-T3 was superior for lower stress levels and lower crack growth rates with maneuver spectrum loading and for lower delta K values with constant amplitude loading, while 7475-T761 was superior for higher crack growth rates and higher stress levels with maneuver spectrum loading and for higher delta K values with constant amplitude loading. Author (ESA)

N80-31394# Aircraft Research Association Ltd., Bedford (England).
THE DESIGN OF AXISYMMETRIC COWLS FOR PODDED NACELLES FOR HIGH BY-PASS RATIO TURBOFAN ENGINES
M. J. Langley London Aeronautical Research Council May 1979 81 p refs Supersedes ARA-54; ARC-38204
(ARC-R/M-3846; BR74570; ARA-54; ARC-38204) Avail: NTIS HC A05/MF A01; HMSO £14 PHI

The design and test of forecowl profiles for a podded engine nacelle of modern proportions, with the specific aim of obtaining favorable supercritical flow development over the cowl exterior is described. Six cowl shapes were tested, exploiting the pressure distribution principle previously evolved for high speed airfoils. Features of the measured surface pressure distributions over the cowls were related to the occurrence of drag rise, from either increase of Mach number or decrease of flow ratio (spillage). The level of high speed drag performance reached by the best cowl designs tested was equivalent to or slightly better than the corresponding optimum NACA 1-series cowl, superiority at low speed being retained throughout. Author (ESA)

N80-31395# Royal Aircraft Establishment, Farnborough (England).
A STUDY OF THE USE OF BLOCKING MASSES IN REDUCING HELICOPTER CABIN NOISE
C. H. Ellen (Imperial Coll.) London HMSO Mar. 1980 23 p refs
(RAE-TM-Aero-1838; BR73588) Avail: NTIS HC A02/MF A01

A brief theoretical examination of the use of blocking masses for application to helicopter structure is presented. The effects of a periodic array of blocking masses are compared with the effect of a single blocking mass for a bending wave on a plate. The significance of the modal structure is demonstrated, and the analysis of the excitation of a membrane strip at a point between two blocking masses is used to illustrate how the energy flow varies with frequency of excitation. Author (ESA)

N80-31306# McDonnell-Douglas Corp., St. Louis, Mo.
F/A-18 STATUS REPORT
John E. Krings *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31307# Fairchild Republic Co., Farmingdale, N. Y.
NIGHT/ADVERSE WEATHER A-10 EVALUATOR PROGRAM (A-10B)
Wendell H. Shawler *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p10-21 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31309# Air Force Flight Test Center, Edwards AFB, Calif.
F-16 EUROPEAN TEST AND EVALUATION
Thomas P. McAtee and Loren Timm *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 37-51 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31310# McDonnell-Douglas Corp., St. Louis, Mo.
YAV-8B STATUS REPORT
Charles A. Plummer, Jr. *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980

p 52-59 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31311# Air Force Flight Test Center, Edwards AFB, Calif.
HAVE BOUNCE
Richard A. Borowski *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 60-67 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE QUIET SHORT-HAUL RESEARCH AIRCRAFT (QSRA)
James L. Martin *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 77-93 refs (For primary document see N80-31305 22-01)
Avail: Issuing Activity CSCL 01C

N80-31315# Rockwell International Corp., Pittsburgh, Pa.
SABRELINER 65
William R. Yoakley *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 119-122 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31316# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THE DEVELOPMENT OF THE WORLD'S FIRST TRIENGINE BUSINESS JET, THE MYSTERE FALCON 50
Jerome A. Resal *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 23-137 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31317# Canadair Ltd., Montreal (Quebec).
CL-600 CHALLENGER
E. D. Adkins *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 138-144 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31318# Society of Experimental Test Pilots, Lancaster, Calif.
P-59
Laurence C. Craigie *In its* Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 147-165 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31319# McDonnell-Douglas Corp., St. Louis, Mo.
AIRCRAFT WINGTIP COUPLING EXPERIMENTS
C. E. Anderson *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 166-184 refs (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31321# Air Force Flight Test Center, Edwards AFB, Calif.
REVIEW OF FIVE YEARS OF FLIGHT TESTING THE B-1
John S. Smith, III and Frederick A. Fiedler *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 209-231 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31322# Aerotron, Inc., Bennington, Vt.
CROSSING THE CHANNEL IN THE GOSSAMER ALBATROSS
Paul Macready *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 232-243 (For primary document see N80-31305 22-01)
Avail: Issuing Activity

N80-31327# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
OPTIMIZATION OF THE MATHEMATICAL MODEL OF A STRUCTURE
Helmut Zimmerman *In* AGARD Math. Modeling of Linear and Non-Linear Aircraft Struct. Jul. 1980 p 1-14 refs (For primary document see N80-31326 22-01)
Avail: NTIS HC A03/MF A01

N80-31330# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
SOME COMMENTS ON THE PROBLEMS INVOLVED IN AIRCRAFT ASSESSMENT AND ACCEPTANCE TESTING
J. F. Renaudie *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 26 p ref (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31331# Air Force Flight Test Center, Edwards AFB, Calif.
USAF DEVELOPMENT TEST AND EVALUATION
Laurence P. Colburn *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 13 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31332# British Aerospace Aircraft Group, Dunsfold (England).
SOME EXAMPLES OF PROCEDURES USED IN UK FOR ACCEPTANCE TESTING OF AIRCRAFT PRODUCED BY THE AIRCRAFT INDUSTRY UNDER GOVERNMENT CONTRACT
R. J. Poole *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 6 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31334# Air Force Flight Test Center, Edwards AFB, Calif.
PERFORMANCE TESTING PRODUCTION AIRLINES
Roger C. Crane *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 27 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31337*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT RESEARCH TECHNIQUES UTILIZING REMOTELY PILOTED RESEARCH VEHICLES
R. Dale Reed *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 15 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31338# Air Force Flight Test Center, Edwards AFB, Calif.
QUALITATIVE ARMAMENT SUBSYSTEM ASSESSMENT
Lawrence P. Colburn *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 16 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-31396 Old Dominion Univ., Norfolk, Va.
ANALYTIC AND EXPERIMENTAL STUDIES OF A TRUE AIRSPEED SENSOR Ph.D. Thesis
Joseph Yao-Cheng Shen 1980 203 p
Avail: Univ. Microfilms Order No. 8019959

The analysis and design of a true airspeed sensor is described. In an attempt to model the complicated fluid mechanics of the vortex precession, three dimensional, inviscid, unsteady, incompressible fluid flow was studied by using the hydrodynamical linearized stability theory. The results show that the frequency response is linearly proportional to the airspeed. The designed sensor basically consists of a vortex tube, a swirler, and a pick up system. When air passed through the swirler, a precessional flow was generated at the region before and after the sudden enlargement area. Also an audiable vortex whistle is generated. The signal is picked by the microphone and the frequency response is shown in a frequency counter. The measurement for both

closed conduit tests and wind tunnel tests were recorded. A computer program was developed for obtaining the numerical solution to the theoretical model. Computational results for various combinations of vortex tubes and swirlers have been obtained. Dissert. Abstr.

N80-31397*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PERCEPTION OF AIRCRAFT SEPARATION WITH PILOT-PREFERRED SYMBOLOGY ON A COCKPIT DISPLAY OF TRAFFIC INFORMATION
Sharon OConnor (San Jose State Univ.), Sharon Jago (San Jose State Univ.), Daniel Baty, and Everett Palmer. Sep. 1980. 16 p. refs.
(Grant NsG-2269)
(NASA-TM-81172; A-8107) Avail: NTIS HC A02/MF A01 CSCL 01D

The concept of a cockpit display of traffic information (CDTI) was developed for use in later full mission simulator evaluations of the CDTI concept. Pilots chose their preferred method of displaying air traffic information for several variables. Variables included: type of background, update rate, update type, predictor type, and history type. Each pilot designed a display he felt would be most useful in flight operations. After a series of test trials, each pilot was given the opportunity to modify the display for the experimental task. For a second day of testing, they repeated the experimental task using their display as well as displays chosen by other pilots. Results indicated a variety of individual preferences in symbology and differences in the accuracy of judgments. Pilots indicated concern for clutter of the display, relationship of the displayed symbology to physical reality, and a need to perceive the relative motion of the intruder aircraft. Analysis of data indicated that pilots were able to improve their performance with practice. R.K.G.

N80-31333# Societe de Fabrication d'Instruments de Mesure SFIM, Massy (France). Measurement and Recording Div.
A REVIEW OF FLIGHT TEST INSTRUMENTATION SYSTEMS FOR ACCEPTANCE TESTING OF THE PRODUCTION AIRCRAFT
Claude Robert. *In* AGARD Aircraft Assessment and Acceptance Testing. May 1980. 3 p. (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-31398*# TRW, Inc., Cleveland, Ohio. Materials Technology
COST ANALYSIS OF COMPOSITE FAN BLADE MANUFACTURING PROCESSES. Final Report
T. S. Stelson and C. F. Barth. Jun. 1980. 87 p. refs.
(Contract NAS3-21352)
(NASA-CR-159876; TRW-ER-8064) Avail: NTIS HC A05/MF A01 CSCL 21E

The relative manufacturing costs were estimated for large high technology fan blades prepared by advanced composite fabrication methods using seven candidate materials/process systems. These systems were identified as laminated resin matrix composite, filament wound resin matrix composite, superhybrid solid laminate, superhybrid spar/shell, metal matrix composite, metal matrix composite with a spar and shell, and hollow titanium. The costs were calculated utilizing analytical process models and all cost data are presented as normalized relative values where 100 was the cost of a conventionally forged solid titanium fan blade whose geometry corresponded to a size typical of 42 blades per disc. Four costs were calculated for each of the seven candidate systems to relate the variation of cost on blade size. Geometries typical of blade designs at 24, 30, 36 and 42 blades per disc were used. The impact of individual process yield factors on costs was also assessed as well as effects of process parameters, raw materials, labor rates and consumable items. A.R.H.

N80-31399*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REVERSE THRUST PERFORMANCE OF THE QCSEE VARIABLE PITCH TURBOFAN ENGINE
N. E. Samanich, D. C. Reemsnyder, and H. E. Blodmer. 1980. 57 p. refs. Presented at the Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by Am. Soc. of Automotive Engr.
(NASA-TM-81558; E-519) Avail: NTIS HC A04/MF A01 CSCL 21E

Results of steady state reverse and forward to reverse thrust transient performance tests are presented. The original quiet, clean, short haul, experimental engine four segment variable fan nozzle was retested in reverse and compared with a continuous, 30 deg half angle conical exlet. Data indicated that the significantly more stable, higher pressure recovery flow with the fixed 30 deg exlet resulted in lower engine vibrations, lower fan blade stress, and approximately a 20 percent improvement in reverse thrust. Objective reverse thrust of 35 percent of takeoff thrust was reached. Thrust response of less than 1.5 sec was achieved for the approach and the trakeoff to reverse thrust transients. Author

N80-31400*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPERIMENTAL EVALUATION OF THE PERFORMANCE DEFICIT OF AN AIRCRAFT ENGINE STARTER TURBINE
Jeffrey E. Hass, Richard J. Roelke, and Paul Hermann (Sunstrand Corp., Rockford, Ill.). 1980. 21 p. ref. Presented at the Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by Am. Soc. of Automotive Engr.
(NASA-TM-81571; E-539) Avail: NTIS HC A02/MF A01 CSCL 21E

An experimental investigation was made to determine the reasons for the low aerodynamic performance of a 13.5 centimeter tip diameter aircraft engine starter turbine. The investigation consisted of an evaluation of both the stator and the stage. An approximate ten percent improvement in turbine efficiency was obtained when the honeycomb shroud over the rotor blade tips was filled to obtain a solid shroud surface. Author

N80-31401*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA HIGH-SPEED TURBOPROP PROGRAM
James F. Dugan, Brent A. Miller, Edwin J. Graber, and David A. Sagerser. 1980. 48 p. refs. Presented at the Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by the Am. Soc. of Automotive Engr.
(NASA-TM-81561; E-452) Avail: NTIS HC A03/MF A01 CSCL 01C

Technology readiness for Mach 0.7 to 0.8 turboprop powered aircraft with the potential for fuel savings and DOC reductions of up to 30 and 15 percent respectively relative to current in-service aircraft is addressed. The areas of propeller aeroacoustics, propeller structures, turboprop installed performance, aircraft cabin environment, and turboprop engine and aircraft studies are emphasized. Large scale propeller characteristics and high speed propeller flight research tests using a modified testbed aircraft are also considered. J.M.S.

N80-31402*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED COMPONENTS FOR ENGINE FUEL SAVINGS
Robert J. Antl and John E. McAulay. 1980. 33 p. refs. Presented at the Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by Am. Soc. of Automotive Engr.
(NASA-TM-81577; E-506) Avail: NTIS HC A03/MF A01 CSCL 21E

The Engine Component Improvement (ECI) Project formulated to address near term improvements for current engines is described with emphasis on the development of component technologies to reduce the fuel consumption of CF6, JT9D, and JT8D engines. The technical and economical acceptability and the fuel saving

potential of nine concepts are demonstrated. Descriptions of these concepts, results of testing, and the status as to entering airline service are presented. Also presented is the status of the remaining concepts still under development. J.M.S.

N80-31403# AiResearch Mfg. Co., Phoenix, Ariz.
ADVANCED TECHNOLOGY COMPONENTS FOR MODEL GTP305-2 AIRCRAFT AUXILIARY POWER SYSTEM. Final Report, 6 May 1975 - 15 Jul. 1979
James R. Kidwell and Gerold D. Large. Wright-Patterson AFB, Ohio. AFWAL. Feb. 1980. 538 p.
(Contract F33615-75-C-2016; AF Proj. 3145)
(AD-A087838; AFAPL-TR-79-2106) Avail: NTIS HC A23/MF A01. CSCL 10/2
The GTP305-2 Advanced APU is a single shaft, all shaft power engine incorporating an axial-centrifugal compressor, a reverse flow annular combustor and a radial-axial turbine. Cycle analyses indicated a 10 percent high pressure compressor flow increase improved matching characteristics with the low pressure compressor. The combustion system is a reverse flow annular combustor with an air-assist/airblast fuel injection system. The radial-axial turbine stage is characterized by an integrally cast turbine rotor and a cast exhaust duct assembly. The Integrated Components Assembly (ICA) rig consists of the combustor and turbines with a dummy mass on the shaft to simulate the compressor. ICA testing was conducted to establish component performance at design operating conditions. ICA and cold air aerodynamic testing of the turbine stage and cooling flow effects, indicates design efficiency goals were exceeded. ICA test results, cold-air testing and combustion system parameters were input to the cycle model. Room temperature strain-control LCF tests were performed and results analyzed on a Weibull distribution. Data analysis indicated LCF life improvement was obtained through HIP and heat treatment. GRA

N80-31404# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
ENVIRONMENTAL TESTING OF COATINGS FOR GAS TURBINES
A. J. A. Mom. 10 Jul. 1979. 14 p. refs. Presented at 9th Intern. Thermal Spraying Conf., Gravenhage, Netherlands, 19-23 May 1980
(NLR-MP-79028-U) Avail: NTIS HC A02/MF A01
An environmental test chamber was built to analyze the effects of air pollutants on gas turbine materials and components. Engine conditions including temperature, stress, thermal-cycling and gas velocity are reproduced. Actual components or test pieces are tested according to realistic mission profiles using a flight by flight test procedure. Good agreement was obtained between corrosion behavior in service and that in the test rig. Author (ESA)

N80-31343# RAND Corp., Washington, D. C.
AN APPROACH TO THE LIFE CYCLE ANALYSIS OF AIRCRAFT TURBINE ENGINES
J. R. Nelson. *In* AGARD. The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980. 27 p. refs (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

N80-31344# Ministry of Defence, London (England).
DESIGN TO LIFE CYCLE COSTS INTERACTION OF ENGINE AND AIRCRAFT
E. J. Jones. *In* AGARD. The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980. 15 p. (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

N80-31345# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aeronautical Systems Div.
PROGRESS ON THE US AIR FORCE APPROACH FOR THE PRACTICAL MANAGEMENT OF ENGINE LIFE CYCLE COSTS
Richard E. Steere, Edward G. Koepnick, and Robert A. Dean. *In* AGARD. The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980. 10 p. refs (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

N80-31346# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).
MILITARY ENGINE PROGRAMS WITH COST OBJECTIVES [PROGRAMMES DE MOTEURS MILITAIRE A OBJECTIES DE COUT]
Claude Foure. *In* AGARD. The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980. 28 p. In FRENCH (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

N80-31348# Rolls-Royce Ltd., Bristol (England). Aero Div.
THE APPLICATION OF DESIGN TO COST AT ROLLS-ROYCE
R. J. Symon and K. J. Dangerfield. *In* AGARD. The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980. 17 p. (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

N80-31349# Boeing Aerospace Co., Seattle, Wash. Systems Cost Analysis Div.
EVALUATING AND SELECTING THE PREFERRED AIR BREATHING WEAPON SYSTEM
Frank A. Watts. *In* AGARD. The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980. 16 p. (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls, and autopilots.

N80-31405 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DESIGN OF AN ADAPTIVE CONTROL SYSTEM FOR THE EBF/STOL AIRCRAFT WITH PROVISIONS FOR EIGENVALUE AND EIGENVECTOR SELECTION. Ph.D. Thesis
Jan W. Crane. 1980. 103 p.
Avail: Univ. Microfilms Order No. 8020202
The design of an adaptive controller that is characterized by the ability to provide the designer with a means of selecting the closed-loop eigenvalues and shape each eigenvector is presented. The method generates the necessary constraints between the attainable eigenvalues and their eigenvectors. A least squares solution for the feedback gains is obtained from the remaining equations. The application of the procedure to the design of model following, state decoupling, and trajectory following controllers is accomplished by specifying the eigenvalues and eigenvectors of the final system. Also included in the controller is an on-line identifier for providing up to date information about the system and a control effector failure detector. The procedure has been applied to the design of controllers for the EBF/STOL aircraft. State decoupling and trajectory following controllers are designed and simulated. The simulation is performed without identification and with full knowledge of the system. A final simulation of the state decoupling controller is performed with the system identifier and the failure detector. Dissert. Abstr.

N80-31406 Georgia Inst. of Tech., Atlanta.
GUST RESPONSE ANALYSIS BY MODAL DECOMPOSITION OF THE GUST IMPINGEMENT DISTRIBUTION. Ph.D. Thesis
Frederick David Eichenbaum. 1980. 187 p.
Avail: Univ. Microfilms Order No. 8018148
The mode impingement method which achieves a radical improvement in computational efficiency over the current panel method of multi-dimensional (2-D and 3-D) gust response analysis, is described. The mode impingement method employs an orthogonal decomposition of the gust impingement distribution to reduce a large number of statistically interdependent panel inputs to a small number of statistically independent impingement patterns or gust modes. Since the normalized gust modes are slowly varying functions of frequency, orthogonal decomposition need be performed only at the chosen interpolation frequencies

for which aerodynamic input data are furnished. Modal accuracy is then maintained throughout the interpolation interval by simple interpolation procedures. The small deficit in local gust amplitude resulting from exclusion of the higher modes is eliminated by a compensating adjustment in the local amplitude of the included gust modes. Results are compared with corresponding dynamic response flight test measurements and with alternative analysis techniques. Dissert. Abstr.

N80-31407*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF ROTOR PARAMETER VARIATIONS ON HANDLING QUALITIES OF UNAUGMENTED HELICOPTERS IN SIMULATED TERRAIN FLIGHT
Peter D. Talbot, Daniel D. Dugan, Robert T. N. Chen, and Ronald M. Gerdes. Aug. 1980. 88 p. refs.
(NASA-TM-81190; A-8158) Avail: NTIS. HC A05/MF A01. CSCL 01C

A coordinated analysis and ground simulator experiment was performed to investigate the effects on single rotor helicopter handling qualities of systematic variations in the main rotor hinge restraint, hub hinge offset, pitch-flap coupling, and blade lock number. Teetering rotor, articulated rotor, and hingeless rotor helicopters were evaluated by research pilots in special low level flying tasks involving obstacle avoidance at 60 to 100 knots airspeed. The results of the experiment are in the form of pilot ratings, pilot commentary, and some objective performance measures. Criteria for damping and sensitivity are reexamined when combined with the additional factors of cross coupling due to pitch and roll rates, pitch coupling with collective pitch, and longitudinal static stability. Ratings obtained with and without motion are compared. Acceptable flying qualities were obtained within each rotor type by suitable adjustment of the hub parameters, however, pure teetering rotors were found to lack control power for the tasks. A limit for the coupling parameter L sub q/L sub p of 0.35 is suggested. Author

N80-31408*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
A SIMULATOR STUDY OF CONTROL AND DISPLAY AUGMENTATIONS FOR HELICOPTERS. Final Report.
J. C. Adamson, Gerardus J. Born, and Theodore A. Dukes. Jan. 1980. 104 p. refs.
(Contract NAS2-9437)
(NASA-CR-163451; AD-A087201; MAE-1428) Avail: NTIS. HC A06/MF A01. CSCL 01/4

A fixed-based simulator study of a decelerating approach to hover on instruments was performed with five different control augmentation systems ranging from damping feedbacks to attitude command with heading-hold. On a CRT display the environment was simulated by the view of landing pad and the horizon. Superimposed on this image was all flight information needed, together with special symbology for self-contained landing aid based on airborne measurements only; there were a total of four display augmentation levels. Among other findings, the statistically significant differences in data obtained with six test pilots suggest that a relatively inexpensive addition to the display (i.e., quickening of an error rate vector with short term attitude information) makes up for the difference between rate command and attitude command control systems. A quantitative objective measure of improvements was found to suggest the major findings of the report. GRA

N80-31409# AiResearch Mfg. Co., Torrance, Calif.
ELECTROMECHANICAL ACTUATION DEVELOPMENT. Final Report, 20 Sep. 1978 - 15 Dec. 1979
Robert A. Lewis, John Gray, and Neal E. Wood. Feb. 1980. 118 p. refs.
(Contract F33615-76-C-3043)
(AD-A085847; Rept-80-16763; AFWAL-TR-80-3024) Avail: NTIS. HC A06/MF A01. CSCL 01/4

Electromechanical actuation of primary flight control surfaces has been demonstrated by the development of an integrated rotary hinge-line dual-redundant actuation unit. The controller power level of 30 amp at 270 vdc was demonstrated. Thermal characteristics of the motor and actuator were evaluated at ambient temperatures ranging from -65 F to 250 F. GRA

N80-31410# Aeronautical Research Labs., Melbourne (Australia).
WESSEX MODERNIZATION: A PRELIMINARY SIMULATION STUDY
Christopher R. Guy. Apr. 1979. 42 p. refs.
(AD-A087799; ARL/Aero-Note-391) Avail: NTIS. HC A03/MF A01. CSCL 01/3

A preliminary simulation study for a modernized Wessex helicopter, proposed for use by the RAN, is presented. The study uses mathematical models of the Wessex Mk31B aerodynamics/kinematics and modified Sea King Mk50 flight control system to simulate the flight dynamic behavior of the modernized Wessex. Results indicate that good flight performance can be obtained provided system parameters are chosen correctly. GRA

N80-31411# Analytic Sciences Corp., Reading, Mass.
VALIDATION OF HIGH ANGLE-OF-ATTACK ANALYSIS METHODS. Annual Technical Report, 1 Feb. 1977 - 31 Dec. 1978
Paul W. Berry, John R. Broussard, and Sol W. Gully. 20 Sep. 1979. 194 p. refs.
(Contract N00014-75-C-0432; NR Proj. 215-237)
(AD-A087621; TASC-TR-612-3; ONR-CR-215-237-3F) Avail: NTIS. HC A09/MF A01. CSCL 01/3

This report extends, applies, and validates the aircraft stability and control methodologies developed by TASC and reported in ONR-CR-215-237-2. These methodologies enable the prediction of airframe stability boundaries, control and power difficulties, and stability boundaries of the combined pilot, control system, and aircraft. In the realm of control system design, these methods enable the construction of digital command augmentation systems which provide precise command response over the entire flight regime while augmenting the airframe stability characteristics. The design of an air combat digital flight control system for the F-14A is described in this report, and its performance is verified by the use of a nonlinear six degree-of-freedom aircraft simulation and an air combat pilot model. Comparison of the tracking accuracy of the DFCS aircraft to that of a conventionally controlled aircraft indicates that the DFCS provides better tracking and reduces the likelihood of control-induced departure. In the realm of pilot model validation, a method of choosing the best model among those hypothesized is described and its operation demonstrated. Piloted simulation data are processed which indicate that the pilot does not change his control strategy to correspond to changes in the aircraft flight condition. GRA

N80-31328# Aeritalia S.p.A., Torino (Italy).
EFFECTS OF NONLINEARITIES ON WING-STORE FLUTTER
G. DeFerrari, L. Chesta, O. Sensburg (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich), and A. Lotze (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich). *In* AGARD. Math. Modeling of Linear and Non-Linear Aircraft Struct. Jul. 1980. p. 15-32. refs. (For primary document see N80-31326 22-01)
Avail: NTIS. HC A03/MF A01.

N80-31335# British Aerospace Aircraft Group, Dunsfold (England).
EVALUATION OF LONGITUDINAL CHARACTERISTICS INCLUDING STABILITY HANDLING AND CG RANGE
R. J. Poole. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 16 p. refs. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

N80-31336# British Aerospace Aircraft Group, Dunsfold (England).
EVALUATION OF LATERAL AND DIRECTIONAL CHARACTERISTICS AND SPINNING BEHAVIOUR
R. J. Poole. *In* AGARD. Aircraft Assessment and Acceptance Testing. May 1980. 12 p. refs. (For primary document see N80-31329 22-01)
Avail: NTIS. HC A09/MF A01.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-31412# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
THE USE OF SIMULATORS FOR TRAINING IN-FLIGHT AND EMERGENCY PROCEDURES
Edward E. Eddowes (Air Force Human Resources Lab., Williams AFB, Arizona) and Wayne L. Waag (Air Force Human Resources Lab., Williams AFB, Arizona) Jun. 1980 39 p refs
(AGARD-AG-248; ISBN-92-835-1363-0) Avail: NTIS HC A03/MF A01

The nature of pilot skills is examined and a strategy for using flight simulators to acquire and maintain such skills is suggested. Salient characteristics of state-of-the-art simulators and the visual display system capabilities they provide for training contact flying tasks are described. Research on transfer of learning from simulator to aircraft in a variety of training tasks is reviewed. The use of simulators as aircraft substitutes and their integration within an array of ground training media are compared and contrasted to illustrate the cost effectiveness potential of these two approaches. The rationale for and the characteristics of a simulator oriented emergency procedures training program which emphasizes pilot decision making skills are presented. The development of aircrew performance measurement systems for use in evaluating, refining, and documenting simulator training effectiveness is reported. An interpretation of the impact of current developments on the future use of simulators is offered and a list of conclusions provided. E.D.K.

N80-31413*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
DEVELOPMENT AND VALIDATION OF A HYBRID-COMPUTER SIMULATOR FOR A TRANSONIC CRYOGENIC WIND TUNNEL
Jerry J. Thibodeaux and S. Balakrishna (Old Dominion Univ.) Sep. 1980 84 p refs
(NASA-TP-1695; L-13691) Avail: NTIS HC A05/MF A01 CSCL 14B

A study was undertaken to model the cryogenic wind tunnel process, to validate the model by the use of experimental data from the Langley 0.3 Meter Transonic Cryogenic Tunnel, and to construct an interactive simulator of the cryogenic tunnel using the validated model. Additionally, this model was used for designing closed loop feedback control laws for regulation of temperature and pressure in the 0.3 meter cryogenic tunnel. The global mathematical model of the cryogenic tunnel that were developed consists of coupled, nonlinear differential governing equations based on an energy state concept of the physical cryogenic phenomena. Process equations and comparisons between actual tunnel responses and computer simulation predictions were examined. Also included are the control laws and simulator responses obtained using the feedback schemes for closed loop control of temperature and pressure were also included. R.C.T.

N80-31414# McDonnell Aircraft Co., St. Louis, Mo.
V/STOL EQUIVALENT SYSTEMS ANALYSIS Final Report, 27 Aug. 1979 - 27 May 1980
Carl G. Carpenter and John Hodgkinson Mar. 1980 225 p refs
(Contract N62269-79-C-0700)
(AD-A087283; NADC-79141-60) Avail: NTIS HC A10/MF A01 CSCL 01/3

A fixed base manned V/STOL handling qualities simulation was performed to answer questions concerning: (1) the pilot's frequency range of interest, (2) the maximum allowable mismatch between high order systems and their low order equivalents, (3) acceptability of high order appearing responses and (4) the piloting effects of phase lag at the natural frequency versus time delay. Various high or low frequency terms were added to low order attitude systems. Pilot ratings and comments showed that the pilot's frequency range of interest was 5-4.0 rad/sec; the amount of mismatch allowed was dependent on the type of high order dynamics added on the match frequency range; pilots did not accept high order appearing dynamics and; time delay is a better correlating parameter than phase lag at the configuration natural frequency. Equivalent systems analysis established criteria for the different flying qualities levels in terms of equivalent parameters. GRA

N80-31415# Johns-Manville Sales Corp., Denver, Colo. Research and Development Center.
HEAT RECLAMATION FROM FLIGHT SIMULATORS: SUMMARY Final Report, 1 Sep. 1978 - Mar. 1980
P. B. Shepherd 13 Jun. 1980 17 p
(AD-A087295; USAFESA-TS-2083) Avail: NTIS HC A02/MF A01 CSCL 13/1

A survey of selected Army flight simulator facilities was performed to determine the applicability of heat recovery devices to the associated air conditioning equipment. It was concluded that there is little potential for heat recovery at nearly all of the facilities because the refrigerant used (R-22) and the operating characteristics of the chillers produce compressor discharge temperatures too low to be suitable for any purposes other than chilled air reheat for humidity control. GRA

N80-31416# Royal Aircraft Establishment, Farnborough (England).
POSSIBLE METHODS FOR REMOVING SMALL AIRBORNE PARTICLES FROM THE FLOW IN THE 5 METER PRESSURIZED LOW-SPEED WIND TUNNEL
P. J. Butterworth London HMSO Dec. 1979 26 p refs
(RAE-TM-Aero-1828; BR73902) Avail: NTIS HC A03/MF A01

Because of the size and complexity of the 5 meter wind tunnel, its use raises problems of erosion of wind-tunnel models which were not encountered with other low-speed facilities. Two methods for removal of small particles were investigated. They are the use of fine mesh fabric screens as filters, and aerodynamic separation at the corners of the tunnel circuit. The results show that particles smaller than 0.3 mm cannot be filtered out within the practicable pressure drop limitations of the tunnel circuit. However, small particles have a sufficiently high probability of striking the concave surfaces of the corner vanes that if grease or some other retentive material were applied, the particles could be quickly removed from the circuit. This latter method is being kept in reserve for the 5 meter tunnel, since physical means such as sweeping and vacuum cleaning seem to give adequate results. After lengthy shutdown for maintenance of an 8 ft x 8 ft tunnel, the lower parts of the corner vanes of that tunnel are coated with a suitable grease to remove small airborne particles. Author (ESA)

N80-31417# Royal Aircraft Establishment, Farnborough (England).
EXPLORATORY STUDIES ON THE DESIGN OF ACOUSTIC SPLITTERS FOR WIND TUNNELS
W. J. G. Trebble London HMSO Jan. 1980 31 p refs
(RAE-TM-Aero-1829; BR72353) Avail: NTIS HC A03/MF A01

The choice of geometry and materials for acoustic splitters in wind tunnels is discussed with particular reference to the requirements for modifying a 5 ft and a 24 ft wind tunnel. The optimum theoretical design of acoustic splitters is considered and practical materials to match the requirements are chosen. Experimental investigations at small scale in an aero-acoustic research rig with ducted flow are described. Attention is drawn to the need for the splitters to have a good aerodynamic profile and to the problems associated with the self-noise of the splitters when they are installed in high speed section of the tunnel circuit. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-31418*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

MATERIALS PROCESSING IN SPACE PROGRAM TASKS Fiscal Year, 1980
R. J. Naumann, ed. Aug. 1980 193 p
(NASA-TM-78294) Avail: NTIS HC A09/MF A01 CSCL 22A

The history, strategy, and overall goal of NASA's Office of Space and Terrestrial Applications program for materials processing in space are described as well as the organizational structures and personnel involved. An overview of each research task is presented and recent publications are listed. A.R.H.

N80-31419*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
MATERIALS PROCESSING IN SPACE, 1980 SCIENCE PLANNING DOCUMENT
Robert J. Naumann Aug. 1980 167 p
(NASA-TM-78297) Avail: NTIS HC A08/MF A01 CSCL 22A

The scientific aspects of the Materials Processing in Space program are described with emphasis on the major categories of interest: (1) crystal growth; (2) solidification of metals, alloys, and composites; (3) fluids and chemical processes; (4) containerless processing, glasses, and refractories; (5) ultrahigh vacuum processes; and (6) bioprocessing. An index is provided for each of these areas. The possible contributions that materials science experiments in space can make to the various disciplines are summarized, and the necessity for performing experiments in space is justified. What has been learned from previous experiments relating to space processing, current investigations, and remaining issues that require resolution are discussed. Recommendations for the future direction of the program are included. A.R.H.

N80-31420*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
REPORT ON ACTIVE AND PLANNED SPACECRAFT AND EXPERIMENTS
Richard Horowitz, ed. and Robert W. Nostreys, ed. Aug. 1980 319 p
(NASA-TM-80905; NSSDC/WDC-A-R/S-80-06) Avail: NTIS HC A14/MF A01 CSCL 22A

Information on current and planned spacecraft activity for a broad range of scientific disciplines is presented. The information covers a wide range of disciplines: astronomy, Earth sciences, meteorology, planetary sciences, aeronomy, particles and fields, solar physics, life sciences, and material sciences. These spacecraft projects represent the efforts and funding of individual countries as well as cooperative arrangements among different countries. R.C.T.

N80-31421*# National Aeronautics and Space Administration, Washington, D. C.
CERTAIN PROBLEMS OF SPACE BIOTECHNOLOGY
V. N. Gilyarov Jun. 1980 12 p Transl. into ENGLISH of "Nekotoryye Zadachi Kosmicheskoy Bioteknologii", Rept. Pr-345 Acad. of Sci. USSR, Moscow, 1977 p 1-13 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76235; Pr-345) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments in the field of biotechnology conducted by the USA Apollo and Skylab space probes are described, as well as the joint Soviet-American Apollo-Soyuz Test Project (ASTP). Experiments in electrophoretic separation in space of biological compounds in a liquid medium are detailed. Space processing of vaccines and separation of human and animal cells are described. Methyl-cellulose, a coating for use in electrophoresis was developed. Erythropoietin, which stimulates the formation of red blood corpuscles in bone marrow, was obtained in pure form. S.J.

N80-31422*# KMS Fusion, Inc., Ann Arbor, Mich. Div. of Material Sciences
GLASS SHELL MANUFACTURING IN SPACE Semiannual Report, Dec. 1979 - May 1980
Robert L. Nolen, Jr., Matthias A. Ebner, and Raymond L. Downs 25 Jun. 1980 27 p
(Contract NAS8-33103)
(NASA-CR-161556) Avail: NTIS HC A03/MF A01 CSCL 22A

A heat transfer model was developed that mathematically describes the heating and calculates the thermal history of a gel particle in free-fall through the furnace. The model parameters that greatly affect the calculations were found to be gel particle mass, geometry, specific heat, and furnace gas. Empirical testing of the model has commenced. The code calculations and the initial empirical testing results both indicate that the gel-to-shell transformation occurs early and rapidly in the thermal history of the gel particle, and that for current work the heat transfer rate is not a limitation in shell production. Author

N80-31423*# General Dynamics/Convair, San Diego, Calif.
CONCEPTUAL DESIGN OF AN ORBITAL PROPELLANT TRANSFER EXPERIMENT. VOLUME 2: STUDY RESULTS
G. L. Drake, C. E. Bassett, F. Merino, L. E. Siden, R. E. Bradley, E. J. Carr, and R. E. Parker Aug. 1980 196 p refs
(Contract NAS3-21935)
(NASA-CR-165150; GDC-ASP-80-013-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 22A

The OTV configurations, operations and requirements planned for the period from the 1980's to the 1990's were reviewed and a propellant transfer experiment was designed that would support the needs of these advanced OTV operational concepts. An overall integrated propellant management technology plan for all NASA centers was developed. The preliminary cost estimate (for planning purposes only) is $56.7 M, of which approximately $31.8 M is for shuttle user costs. R.K.G.

N80-31424# Analytical and Computational Mathematics, Zurich (Switzerland).
INTERPLANETARY TWO POINT BOUNDARY VALUE PROBLEMS: EXTENSION OF THE UNIFIED SYSTEM FOR ORBIT COMPUTATION (USOC), VOLUME 4
Dec. 1979 241 p refs
(Contract ESOC-3488/78-D-IM(SC))
(ESA-CR(P)-1347) Avail: NTIS HC A11/MF A01

The unified system for orbit computation was extended to allow the resolution of two point boundary value problems for interplanetary flight computation. The implementation is done in three different stages corresponding to three levels of accuracy: unperturbed patched conics method, method of matched asymptotic expansions, and numerical quasilinearization method. Author (ESA)

N80-31425# European Space Agency, Paris (France).
INVESTIGATIONS INTO THE ELECTRODEPOSITION OF DISPERSION LAYERS UNDER ZERO GRAVITY CONDITIONS
Josef Ehrhardt Nov. 1979 82 p refs Transl. into ENGLISH of "Studie ueber die Galvanische Abscheidung von Dispersionsschichten unter Weltraumbedingungen", Rept. BMFT-FB-W-771 Bundesmin. fuer Forschung und Technol., Dec. 1977 Original report in GERMAN previously announced as N79-30347
(ESA-TT-574; BMFT-FB-W-77-11) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany, DM 21

Spacelab experiments are proposed to investigate the behavior of particles suspended in an electrolyte during migration to the cathode and during their incorporation in the deposition layer. The precise deposition mechanism is unknown and the transport of the dispersoid to the cathode cannot be investigated under terrestrial conditions because of sedimentation and convection. A survey of the literature was made regarding deposition mechanisms, increase of strength, hardness and resistance to oxidation, improvement of the wear resistance, dry lubrication, and improvement of corrosion behavior. Design considerations for an electrolytic cell were defined to the extent that a laboratory version can be constructed. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-31426*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE SECULAR DECREASE IN THE SEMIMAJOR AXIS OF LAGEOS ORBIT
David Parry Rubincam Jul. 1980 43 p refs Submitted for publication
(NASA-TM-80734) Avail: NTIS HC A03/MF A01 CSCL 22A

The semimajor axis of the Lageos orbit is decreasing secularly at the rate of -1.1 mm/day due to an unknown force. Nine possible mechanisms are investigated. Five of the mechanisms, resonance with the Earth's gravitational field, gravitational radiation, the Poynting-Robertson effect, transfer of spin angular momentum to the orbital angular momentum, and drag from near Earth dust are ruled out because they are too small to require unacceptable assumptions to account for the observed rate. Three other mechanisms, the Yarkovsky effect, the Schach effect, and terrestrial radiation pressure could possibly give the proper order of magnitude for the decay rate, but the characteristic signatures of these perturbations do not agree with the observed secular decrease. Atmospheric drag from a combination of charged and neutral particles is the most likely cause for the orbital decay. This mechanism explains at least 71 percent of the observed rate of decrease of the semimajor axis. Author

N80-31427# Royal Aircraft Establishment, Farnborough (England).
SAMOS 2 (1961 ALPHA 1): ORBIT DETERMINATION AND ANALYSIS AT 31:2 RESPONSE
Doreen M. C. Walker London HMSO Feb. 1980 31 p refs (RAE-TR-80022; RAE-Space-575; BR73770) Avail: NTIS HC A03/MF A01

Samos 2, 1961 alpha 1, launched on 31 January 1961, was the first satellite to enter a Sun-synchronous orbit at an inclination of 97.4 deg. The initial perigee and apogee heights were 474 km and 557 km respectively, the initial period was 94.97 min and the satellite decayed 21 October 1973 after more than 12 years in orbit. Samos 2 passed through the condition of 31:2 resonance in June 1971 and orbital parameters were determined at 22 epochs from 1974 observations using the RAE orbit refinement program, PROP, between mid April and mid September 1971. The variations of inclination and eccentricity during this time were analyzed and values for six lumped 31st order harmonic coefficients in the geopotential were obtained. These lumped harmonic coefficients were compared with those derived from the individual coefficients of order 31 and appropriate degrees, from the most recent Goddard Earth Model, GEM 10C. The decrease in inclination between launch and 1971 was examined. It is found to be caused mainly by a near resonant solar gravitational perturbation. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-31428*# Michigan Univ., Ann Arbor. Space Physics Research Lab.
DESIGN STUDY FOR ELECTRONIC SYSTEM FOR JUPITER ORBIT PROBE (JOP) Final Report, 14 Feb. - 30 Sep. 1978
B. P. Elero, Jr. and G. R. Carignan 30 Sep. 1978 115 p (Contract NAS5-24454)
(NASA-CR-160021; Rept-016117-1-F) Avail: NTIS HC A06/MF A01 CSCL 22B

The conceptial design of the Jupiter probe spectrometer is presented. Block and circuit diagrams are presented along with tabulated aprts lists. Problem areas are considered to be (1) the schedule, (2) weight limitations for the electronic systems, and (3) radiation hardness of the electronic devices. F.O.S.

N80-31429# National Environmental Satellite Service, Washington, D. C.
SATELLITE ACTIVITIES OF NOAA, 1979
Jul. 1980 25 p
Avail: NTIS HC A02/MF A01

Programs using satellite data from the National Oceanic and Atmospheric Administration's polar orbiting and geostationary systems are described. These include: determining winds and temperature; monitoring global radiation; environmental warning systems; monitoring agriculture conditions; determining Earth's shape and gravity field; fisheries monitoring; and determining oceans, lakes, and hydrological conditions. L.F.M.

N80-31430# Defense Communications Agency, Arlington, Va. MILSATCOM Systems Office.
LEASE VERSUS BUY CONSIDERATIONS FOR MILSATCOM SYSTEMS AND AN ACQUISITION STRATEGY FOR STRATSAT SSS LEASE/BUY STUDY Final Report
Leonard G. Larson and Ralph L. Spaulding Apr. 1980 99 p (AD-A087411; AD-E100349; DCA/MSO-TR-80-1) Avail: NTIS HC A05/MF A01 CSCL 15/5

This report examines the lease/buy question as it applies to MILSATCOM systems to illuminate the issues involved and identify the factors that tend to drive a decision toward one or the other acquisition method. The report is organized into five sections: (1) lease vs. buy considerations for MILSATCOM systems - a tutorial on the various aspects pertaining to lease vs. buy consideration; (2) acquisition strategy for STRATSAT - discussion of four possible acquisition strategies to acquire STRATSAT; (3) comparative cost analysis of STRATSAT lease vs. buy options - discussion of methodology and results of the lease vs. buy cost comparisons; (4) contractor responses to leasing STRATSAT - review of contractor positions and views related to the practicality and feasibility of leasing STRATSAT; and (5) appendixes - description of leasing arrangements for GAPFILLER, LEASAT, and TDRSS. GRA

N80-31431# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
TEST OF AN ELECTROHYDRAULIC DIGITAL ACTUATOR FOR ADVANCED MISSILE SYSTEMS Final Report, Sep. 1978 - Sep. 1979
Mark C. Twyman Feb. 1980 75 p refs
(AD-A087274; AFWAL-TR-80-2001) Avail: NTIS HC A04/MF A01 CSCL 16/4

This report describes the testing of a digital electrohydraulic stepper actuator developed by Bendix Systems Division under a previous Air Force R & D contract. The testing included calibration and 50 hours of durability cycling type tests. The actuator was designed for a stall torque of 2000 in. pounds at a 3000 psi differential pressure. A discussion of the problems encountered during this program and an inspection analysis of the actuator after testing are included in this report. GRA

N80-31432# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DSCS 2, BATTERY ANOMALY INVESTIGATION SATELLITES

9437 AND 9438 Final Report
Paul Bauer and Charles Lurie 25 Apr. 1980 324 p refs
(Contract F04701-77-C-0118)
(AD-A087390; TRW-32824-AR-019-01; SD-TR-80-33) Avail: NTIS HC A14/MF A01 CSCL 10/3

This report presents a description of the anomalous behavior of the electric power subsystems of DSCS 2 satellites 9437 and 9438, and of the investigations conducted to determine the cause of the anomalies. These investigations include ground test simulations using flight-configuration batteries, component level testing, and analyses of components and systems. The investigations are described and the results discussed. The study concludes that the anomalous behavior was the result of battery cell short circuiting. The cause of the short circuiting is identified as excessive overcharge, its cause and the corrective actions taken are discussed. GRA

N80-31433# Aerojet Services Co., Sacramento, Calif.
ENGINEERING SERVICES IN SUPPORT OF SOUNDING ROCKETS Final Report, 1 Jul. 1977 - 30 Nov. 1979
James F. Olsen Hanscom AFB, Mass. AFGL Nov. 1979 17 p
(Contract F19628-77-C-0182)
(AD-A087801; ASC-2895FR-01) Avail: NTIS HC A02/MF A01 CSCL 22/2

Engineering field personnel provide support for launch of sixteen sounding rockets from two launch sites. Sixteen engineering tasks were performed. GRA

N80-31434# Honeywell, Inc., Hopkins, Minn.
THE MINI-REFRACTIONSONDE SYSTEM (MRS) FOR MEASURING REFRACTIVE INDEX
Curtis D. Motchenbacheh Jun. 1979 5 p Sponsored by NADC
(AD-A087845; GIDEP-E164-0689) Avail: NTIS HC A02/MF A01 CSCL 20/6

This paper discusses the mini-refractionsonde program plan and status. The development of the sonde, ground station, balloon filling and handling equipment are described. Discussions on utilization of the sonde are included. GRA

N80-31435# Battelle Pacific Northwest Labs., Richland, Wash.
WORKSHOP ON SATELLITE POWER SYSTEMS (SPS) EFFECTS ON OPTICAL AND RADIO ASTRONOMY
G. M. Stokes and P. A. Ekstrom Apr. 1980 273 p refs Conf. held at Seattle, May 1979
(Contract EY-76-C-06-1830)
(CONF-7905143) Avail: NTIS HC A12/MF A01

The impacts of the satellite solar power system on astronomy are concluded to be: increased sky brightness, reducing the effective aperture of terrestrial telescopes; microwave leakage radiation causing erroneous radioastronomical signals; direct overload of radioastronomical receivers at centimeter wavelengths; and unintentional radio emissions associated with massive amounts of microwave power or with the presence of large, warm structures in orbit causing the satellites to appear as individual stationary radio sources; finally, the fixed location of the geostationary satellite orbits would result in fixed regions of the sky being unusable for observations. DOE

N80-31436# Royal Aircraft Establishment, Farnborough (England).
THE MAGNETIC TESTING OF THE X4 SPACECRAFT
D. W. S. Lodge London HMSO Dec. 1979 28 p refs
(RAE-TR-79144; RAE-Space-572; BR72759) Avail: NTIS HC A03/MF A01

The X4 spacecraft (named Miranda after launch) was tested in a magnetic test facility to confirm that the design aim of a spacecraft permanent and stray magnetic moment of less than 0.63 micro Wb.m was achieved and to establish worst case conditions. These objectives were satisfactorily met for both the integration and flight models. The flight model left the facility with a permanent moment of 0.04 micro Wb.m, negligible stray moment and symmetrical induced moments of approximately 0.2 micro Wb.m in each axis. The integration model was returned after the launch and exhibited no significant change in its magnetic properties. Tests were also carried out on satellite subsystems, in particular the experiment B, C and D package. Author (ESA)

N80-31437# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
PROCESSING OF METEOSAT ATTITUDE MEASUREMENT FLIGHT DATA AND EVALUATION OF THE PERFORMANCE OF AN ADAPTIVE FILTERING TECHNIQUE
C. R. Traas and G. Moek 18 Aug. 1978 69 p refs
(Contract ESTEC-3319/77)
(NLR-TR-78146-U) Avail: NTIS HC A04/MF A01

The attitude measurement data of the geosynchronous spacecraft Meteosat were analyzed using an adaptive recursive filtering technique. The mathematical models of spacecraft dynamics and sensors were kept very simple. Modeling errors are such that without adaptive feedback, strong divergence of the filtering process occurs. It is shown that the adaptive process stabilizes the filtering considerably. Complete error consistently, however, could not be attained in the present case. The background of this latter fact is analyzed. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-31438*# Northrop Corp., Hawthorne, Calif. Aircraft Group.
SPACE SHUTTLE ORBITER FLOW VISUALIZATION STUDY
Dale J. Lorincz Feb. 1980 68 p refs Original contains color illustrations
(Contract NAS4-2616)
(NASA-CR-163092; NOR-80-82) Avail: NTIS HC A04/MF A01 CSCL 22B

The vortex flows generated at subsonic speed during the final portion of atmospheric reentry were defined using a 0.01 scale model of the orbiter in a diagnostic water tunnel. Flow visualization photographs were obtained over an angle-of-attack range to 40 deg and sideslip angles up to 10 deg. The vortex flow field development, vortex path, and vortex breakdown characteristics were determined as a function of angle-of-attack at zero sideslip. Vortex flows were found to develop on the highly swept glove, on the wing, and on the upper surface of the fuselage. No significant asymmetries were observed at zero sideslip in the water tunnel tests. The sensitivity of the upper surface vortex flow fields to variations in sideslip angle was also studied. The vortex formed on the glove remained very stable in position above the wing up through the 10 deg of sideslip tested. There was a change in the vortex lifts under sideslip due to effective change in leading-edge sweep angles. Asymmetric flow separation occurred on the upper surface of the fuselage at small sideslip angles. The influence of vortex flow fields in sideslip on the lateral/ directional characteristics of the orbiter is discussed. A.R.H.

N80-31439*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TACAN OPERATIONAL DESCRIPTION FOR THE SPACE SHUTTLE ORBITAL FLIGHT TEST PROGRAM
C. L. Hughes and Paul J. Hudock Nov. 1979 90 p refs
(Contract NAS9-15800)
(NASA-CR-160775; LEC-13790; JSC-16276) Avail: NTIS HC A05/MF A01 CSCL 17G

The TACAN subsystems (three TACAN transponders, six antennas, a subsystem operating program, and redundancy management software in a tutorial form) are discussed and the interaction between these subsystems and the shuttle navigation system are identified. The use of TACAN during the first space transportation system (STS-1), is followed by a brief functional description of the TACAN hardware, then proceeds to cover the software units with a view to the STS-1, and ends with a discussion on the shuttle usage of the TACAN data and anticipated performance. R.K.G.

N80-31440*# Analytic Sciences Corp., Reading, Mass.
SPACE SHUTTLE NAVIGATION ANALYSIS. VOLUME 1:

GPS AIDED NAVIGATION Final Report
G. A. Matchett, M. A. Vogel, and T. J. MacDonald 31 May 1980 245 p refs
(Contract NAS9-15151)
(NASA-CR-160765; TR-1001-1-1-Vol-1) Avail: NTIS
HC A11/MF A01 CSCL 22A

Analytical studies related to space shuttle navigation are presented. Studies related to the addition of NAVSTAR Global Positioning System user equipment to the shuttle avionics suite are presented. The GPS studies center about navigation accuracy covariance analyses for both developmental and operational phases of GPS, as well as for various orbiter mission phases. T.M.

N80-31441*# Analytic Sciences Corp., Reading, Mass.
SPACE SHUTTLE NAVIGATION ANALYSIS. VOLUME 2: BASELINE SYSTEM NAVIGATION Final Report
Harold L. Jones, Gerd Luders, Gary A. Matchett, and Robert G. Rains 30 May 1980 99 p refs
(Contract NAS9-15151)
(NASA-CR-160766; TR-1001-1-1-Vol-2) Avail: NTIS
HC A05/MF A01 CSCL 22A

Studies related to the baseline navigation system for the orbiter are presented. The baseline navigation system studies include a covariance analysis of the Inertial Measurement Unit calibration and alignment procedures, postflight IMU error recovery for the approach and landing phases, on-orbit calibration of IMU instrument biases, and a covariance analysis of entry and prelaunch navigation system performance. T.M.

N80-31442*# Fairchild Stratos Corp., Manhattan Beach, Calif.
SPACE TRANSPORTATION SYSTEM DISCONNECT Final Report
5 Mar. 1980 145 p
(Contract NAS8-32806)
(NASA-CR-161565; ER-76300-5) Avail: NTIS
HC A07/MF A01 CSCL 22B

The use of medium duty 300 psi fluid disconnects for orbital servicing was demonstrated to be both practical and technically feasible. A prototype disconnect was designed and tested, based on criteria formulated from a survey of expected usage requirements for orbital servicing concepts. Testing involved the comparison of three seal materials (EPR, Neoprene and Teflon), and two test media (helium and Freon 21), and was conducted over a temperature range of -150 F to - 225 F. Results indicate low helium leakage (10 to the -4 power sccs) and extremely low engagement forces (56 lb sub f). Testing was also performed on a new seal design. Design concepts for a cryogenic disconnect and a high pressure disconnect were investigated. Results of an industry survey for usable orbital servicing disconnects and areas needing attention in future studies are discussed. A.R.H.

N80-31443*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE PREVENTION OF ELECTRICAL BREAKDOWN AND ELECTROSTATIC VOLTAGE PROBLEMS IN THE SPACE SHUTTLE AND ITS PAYLOADS. PART 1: THEORY AND PHENOMENA Final Report
Dennis W. Whitson 3 Feb. 1975 110 p refs
(NASA-TM-81137; JSC-09331-1-Pt-1) Avail: NTIS
HC A06/MF A01 CSCL 22B

An introduction to the theory of corona discharge and electrostatic phenomena is presented. The theory is mainly qualitative so that workers in the field should not have to go outside this manual for an understanding of the relevant phenomena. Some of the problems that may occur with the space shuttle in regard to electrical discharge are discussed. E.D.K.

N80-31444*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE PREVENTION OF ELECTRONICAL BREAKDOWN AND ELECTROSTATIC VOLTAGE PROBLEMS IN THE SPACE SHUTTLE AND ITS PAYLOADS. PART 2: DESIGN GUIDES AND OPERATIONS CONSIDERATIONS
Dennis W. Whitson 3 Feb. 1975 48 p refs
(NASA-TM-81138; JSC-09331-2-Pt-2) Avail: NTIS
HC A03/MF A01 CSCL 22B

The specific electrical discharge problems that can directly affect the shuttle vehicle and its payloads are addressed. General design guidelines are provided to assist flight hardware managers in minimizing these kinds of problems. Specific data are included on workmanship practices and system testing while in low pressure environments. Certain electrical discharge problems that may be unique to the design of the shuttle vehicle itself and to its various mission operational models are discussed. E.D.K.

N80-31445*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. Mission Planning and Analysis Div.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 4: ONORBIT PROFILE-CYCLE 3.1.1
Jul. 1980 41 p refs Supersedes JSC-14483; Rept-78-FM-51-Rev-1
(NASA-TM-82183; JSC-16683-Vol-4; Rept-80-FM-40-Vol-4; JSC-14483; Rept-78-FM-51-Rev-1) Avail: NTIS
HC A03/MF A01 CSCL 22A

The orbital flight test (OFT) phase of the shuttle program consists of four orbital flights beginning in November 1980 and continuing through 1981. The major purpose of the OFT program is to demonstrate and verify shuttle systems and flight capabilities by satisfying the OFT requirements, is presented. The onorbit portion of the operational flight profile (OFP) for the first Space Transportation System-1 (STS-1) flight is presented. This onorbit document (volume 4) is one in a series that, taken together, will define the STS-1 OFP. This OFP onorbit document represents a combination of the STS-1 ground rules and constraints and the initialization data. The STS-1 flight activities described reflect the trajectory, consumable, crew activity, and flight requirement baseline as of May 1, 1980. Flight plans for the ascent, onorbit, and descent phases of the test flight are presented. F.O.S.

N80-31446*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. Mission Planning and Analysis Div.
LEVEL B/C SOFTWARE GROUND NAVIGATION PROGRAM. DELTA-T PROCESSOR
Aug. 1980 45 p refs Supersedes Rept-79-FM-1
(NASA-TM-82184; JSC-16728; Rept-80-FM-34; Rept-79-FM-1) Avail: NTIS HC A03/MF A01 CSCL 22A

The Delta-T Processor (DTP) computes the instantaneous downtrack error in a specified orbiter onboard navigation state vector recovered via downlink telemetry. The downtrack error, expressed in units of time, is computed based on current incoming Earth based range and Doppler navigation tracking data and the ground selected onboard navigation state vector. The computed time difference when used to modify the timetag of the vector used for onboard navigation reduces the instantaneous downtrack error in this vector to within the threshold of the DTP, the input data, and the onboard software. This threshold is currently estimated to be approximately 2 to 4 nautical miles. The DTP is not restricted to using only onboard vectors. Any vector, either input via the manual entry device or accessible via the vector administration table, may be used. The DTP does not require that both data types be available. E.D.K.

N80-31314*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE STATUS
Donald K. Slayton *In* Society of Experimental Test Pilots Soc. of Exptl. Test Pilots Tech. Rev., Vol. 14, No. 4 1980 p 94-116
(For primary document see N80-31305 22-01)
Avail: Issuing Activity CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-31447*# Boeing Aerospace Co., Seattle, Wash. Engineering Technology.
DESIGN, FABRICATION AND TEST OF GRAPHITE/POLYIMIDE COMPOSITE JOINTS AND ATTACHMENTS FOR ADVANCED AEROSPACE VEHICLES Quarterly Technical Progress Report, 1 Oct. 1979 - 31 Jan. 1980
D. E. Skoumal 15 Feb. 1980 62 p refs
(Contract NAS1-15644)
(NASA-CR-159111; QTPR-4) Avail: NTIS HC A04/MF A01 CSCL 22B

Bonded and bolted designs are presented for each of four major attachment types. Prepreg processing problems are discussed and quality control data are given for lots 2W4604, 2W4632 and 2W4643. Preliminary design allowables test results for tension tests and compression tests of laminates are included. The final small specimen test matrix is defined and the configuration of symmetric step-lap joint specimens are shown. Finite element modeling studies of a double lap joint were performed to evaluate the number of elements required through the adhesive thickness to assess effects of various joint parameters on stress distributions. Results of finite element analyses assessing the effect of an adhesive fillet on the stress distribution in a double lap joint are examined. A.R.H.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-31448# Northeastern Univ., Boston, Mass. Electronics Research Lab.
COMMUNICATION AND INSTRUMENTATION SYSTEMS FOR SPACE VEHICLES Final Report, 12 Jan. 1976 - 30 Nov. 1979
J. Spencer Rochefort, Lawrence J. OConnor, and Norman C. Poirier 1 Jan. 1980 63 p refs
(Contract F19628-76-C-0111; AF Proj. 7659)
(AD-A087944; AFGL-TR-80-0189) Avail: NTIS HC A04/MF A01 CSCL 22/2

Contract effort can be grouped under airborne and ground support instrumentation systems, rocket and balloon field programs, and evaluation testing of commercial telemetry components. Instrumentation systems developed have included pre-flight calibrators, ground-based radiometers, airborne photometers, airborne television, a PCM encoder and a commutated-umbilical ground check-out system. Rocket field programs have been involved with HIRIS, multi-E-fields, LN2 interferometers, composition technology, payload dynamics, field widened interferometers, the ECLIPSE '79 program, a post burn-out thrust experiment and an eschelle spectrometer. Balloon field programs have been concerned with an airborne photometer, the BAMM program and an extreme ultraviolet experiment. Brief mention is given to the components tested under an evaluation program concerned with such airborne components as, voltage controlled oscillators, VHF and UHF transmitters and lithium batteries.GRA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-31449*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE SPACE SYSTEMS/LOW-THRUST PROPULSION TECHNOLOGY
Jul. 1980 347 p refs Meeting held at Cleveland, 20-21 May 1980
(NASA-CP-2144; E-510) Avail: NTIS HC A15/MF A01 CSCL 21H

The potentially critical interactions that occur between propulsion, structures and materials, and controls for large spacecraft are considered, the technology impacts within these fields are defined and the net effect on large systems and the resulting missions is determined. Topical areas are systems/mission analysis, LSS static and dynamic characterization, and propulsion systems characterization. For individual titles, see N80-31450 through N80-31471.

N80-31450*# National Aeronautics and Space Administration, Washington, D. C.
INTRODUCTION: THE CHALLENGE OF OPTIMUM INTEGRATION OF PROPULSION SYSTEMS AND LARGE SPACE STRUCTURES
Richard F. Carlisle *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 1-8 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

A functional matrix of possible propulsion system characteristics for a spacecraft for deployable and assembled spacecraft structures shows that either electric propulsion or low thrust chemical propulsion systems could provide the propulsion required. The trade-off considerations of a single propulsion engine or multiengines are outlined and it is shown that a single point engine is bounded by some upper limit of thrust for assembled spacecraft. The matrix also shows several additional functions that can be provided to the spacecraft if a propulsion system is an integral part of the spacecraft. A review of all of the functions that can be provided for a spacecraft by an integral propulsion system may result in the inclusion of the propulsion for several functions even if no single function were mandatory. Propulsion interface issues for each combination of engines are identified. A.R.H.

N80-31451*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LARGE SPACE SYSTEMS TECHNOLOGY PROGRAM
Robert L. James, Jr. *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 9-22 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

Technical challenges of shuttle-era large space systems include the development of space-configured spacecraft concepts, compatibility with the space transportation system, and cost effectiveness. The objectives and organization of NASA's large space structures program are outlined and program elements are discussed. The technology for the offset wrap-rip and the maypole (hoop/column) antenna concepts are discussed as well

as analysis techniques for predicting the electromagnetic performance of a broad class of large reflectors. Deployable systems, assembly methods, and modular control systems for space platforms are described. Assembly equipment and devices, surface sensors and shape control, control and stabilization, and integrated analysis and design are also considered. A.R.H.

N80-31452*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRIC PROPULSION TECHNOLOGY
Robert C. Finke *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 23-30 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

The advanced electric propulsion program is directed towards lowering the specific impulse and increasing the thrust per unit of ion thruster systems. In addition, electrothermal and electromagnetic propulsion technologies are being developed to attempt to fill the gap between the conventional ion thruster and chemical rocket systems. Most of these new concepts are exagenous and are represented by rail accelerators, ablative Teflon thrusters, MPD arcs, Free Radicals, etc. Endogenous systems such as metallic hydrogen offer great promise and are also being pursued. A.R.H.

N80-31453*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL PROPULSION TECHNOLOGY
Richard J. Priem *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 31-36 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

An overview of NASA's low thrust liquid chemical propulsion program is presented with particular emphasis on thrust system technology in the ten to one thousand pound thrust range. Key technology issues include high performance of cooled low thrust engines; small cryogenic pumps; multiple starts-shutdowns (10) with slow ramps (approximately 10 seconds); thrust variation - 4/1 in flight and 20/1 between flights; long life (100 hours); improved system weight and size; and propellant selection. A.R.H.

N80-31454*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LSS/PROPULSION INTERACTIONS STUDIES
Omer F. Spurlock *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 37-52 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

Interactions between the LSS and the propulsion system are large, significant, interrelated, and complex. Issues and problems in interfacing include the effects on the structure from static, dynamic, and launch loads, control, thrust distribution, throttling, and the environment. Control interaction, the disposal of debris/obsolete spacecraft, and the constraints of launch to low Earth orbit must also be considered. A.R.H.

N80-31455*# Martin Marietta Corp., Bethesda, Md.
DOD LOW-THRUST MISSION STUDIES
William E. Pipes *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 53-71 (For primary document see N80-31449 22-20)
(Contract F04611-79-C-0032)
Avail: NTIS HC A15/MF A01 CSCL 21H

The space transportation system (STS) will be the principal means of launching USAF spacecraft beginning in the 1980's. Since it is manned and reusable it provides new opportunities for unique approaches for cost effective utilization of its capabilities. The STS also places additional requirements and constraints on advanced spacecraft deployment systems that did not previously exist for expandable launch vehicles. To fully utilize these new capabilities designers must be prepared by having cost effective technologies available. Advanced propulsion technology that would provide flexibility, performance, and economic benefits to future Air Force missions was identified. Both electric and chemical propulsion systems are discussed. An LO2/LH2 stage with a torus LO2 tank and 500 lbf pump fed engine is high on the list of propulsion technology. A.R.H.

N80-31456*# General Dynamics Corp., San Diego, Calif.
LOW-THRUST VEHICLES CONCEPT STUDIES
William J. Ketchum *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 73-96 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

Low thrust chemical (hydrogen-oxygen) propulsion systems configured specifically for low acceleration orbit transfer of large space systems were studied in order to provide the required additional data to better compare new, low thrust chemical propulsion systems with other propulsion approaches such as advanced electric systems. Study results indicate that it is cost-effective and least risk to combine the low thrust OTV and stowed spacecraft in a single 65 K shuttle. Mission analysis indicates that there are 25 such missions, starting in 1987. Multiple shuttles (LSS in one, OTV in another) result in a 20% increase in LSS (SBR) diameter over single shuttle launches. Synthesis and optimization of the LSS characteristics and OTV capability resulted in determination of the optimum thrust-to-weight and thrust level. For the space based radar with radial truss arms (center thrust application), the optimum thrust-to-weight (maximum) is 0.1, giving a thrust of 2000 lb. For the annular truss (edge-on thrust application) the structure is not as sensitive, and thrust of 1000 lb appears optimum. For the geoplatform, optimum T/W is .15 (3000 lb thrust). The effects of LSS structure material, weight distribution, and unit area density were evaluated, as were the OTV engine thrust transient and number of burns. A.R.H.

N80-31457*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-THRUST VEHICLE CONCEPT STUDIES
George R. Smolak *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 97-106 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

Part of NASA's orbit transfer vehicle propulsion program is devoted to the development of analytical tools to define propulsion system performance, weight, size, and other parameters, and to develop packing concepts for LSS mission propulsion and payload systems. Packing studies discussed relate to shuttle cargo bay constraints; low thrust engine profile and performance; large space frame concept and weight; low thrust vehicles stowed in shuttle, LSS payload capability, and weight distribution. Further study is needed to determine interactions among propulsion system, payload structures, and shuttle. Low thrust-to-weight ratios are desirable to maximize payload weights and deployed areas. A.R.H.

N80-31458*# Martin Marietta Corp., Bethesda, Md.
PRIMARY PROPULSION/LARGE SPACE SYSTEM INTERACTIONS Progress Report, 20 Sep. 1979 - 20 Sep. 1980
Ralph H. Dergance *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 107-128 (For primary document see N80-31449 22-20)
(Contract NAS3-21955)
Avail: NTIS HC A15/MF A01 CSCL 21H

Three generic types of structural concepts and nonstructural surface densities were selected and combined to represent potential LSS applications. The design characteristics of various classes of large space systems that are impacted by primary propulsion thrust required to effect orbit transfer were identified. The effects of propulsion system thrust-to-mass ratio, thrust transients, and performance on the mass, area, and orbit transfer characteristics of large space systems were determined. A.R.H.

N80-31459*# Boeing Aerospace Co., Seattle, Wash.
AUXILIARY CONTROL OF LSS Progress Report, 28 Aug. 1979 - 27 Nov. 1980
William Smith *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 129-141 (For primary document see N80-31449 22-20)
(Contract NAS3-21952)
Avail: NTIS HC A15/MF A01 CSCL 21H

Seven classes of large space structures were identified and idealized into simple geometric shapes which could be easily modelled. Scaling laws were generated which allowed the seven

ideal structures to be continuously scaled as to size and mass properties over their respective size ranges. Relevant sources of disturbances were determined and their effects on LSS were compared. These disturbances were applied over the range of scaling parameters to generate control force and torque requirements. Important auxiliary propulsion system (APS) characteristics were identified and an APS characteristic sensitivity matrix was established. A.R.H.

N80-31460*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECT OF ORBITAL TRANSFER LOADS ON LARGE PLATFORMS
Joseph E. Walz, Harold G. Bush, Walter L. Heard, Jr., and John J. Rehder *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 143-155 refs (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

A preliminary automated structural sizing procedure suitable for conceptual design and early tradeoff studies of large truss platforms configured for shuttle transportation to LEO is discussed as well as some orbital transfer design considerations. Platforms that are sized to withstand orbital transfer loads for the LEO to GEO maneuver are compared to platforms sized only for LEO application. It is concluded that for platforms supporting low mass distributed payloads, platform and strut frequency requirements are strong design drivers for LEO applications. The struts are found to be extremely slender, thinswalled, and of small diameter. If full advantage is to be taken of these minimum mass designs, a manufacturing capability must be developed for long straight struts. For platforms that are to be transferred from LEO to GEO in a deployed state, the orbital transfer loads become design drivers. However, even for an initial thrust-to-weight ratio equal to 0.1, a platform on the order of 100 m diameter appears packageable with its OTV in one shuttle flight, and larger platforms appear possible at lower thrust-to-weight ratios. A.R.H.

N80-31461*# Astro Research Corp., Santa Barbara, Calif.
INFLUENCE OF INTERORBIT ACCELERATION ON THE DESIGN OF LARGE SPACE ANTENNAS
John M. Hedgepeth *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 157-178 refs (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

The characteristics of the acceleration-induced loading in structures consisting of triangular lattices are investigated and some initial quantitative results on the effect on the design mass and stowage volume are presented. The approach used defines the structural design that would be used if no interorbit acceleration were required and then determines what strengthening would be required to accommodate the loads due to acceleration. The basic zero acceleration design can be based on the stringent accuracy requirements placed on the antennas. A.R.H.

N80-31462*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTEGRATED ANALYSIS OF LARGE SPACE SYSTEMS c66
Joseph P. Young *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 179-192 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 12B

Based on the belief that actual flight hardware development of large space systems will necessitate a formalized method of integrating the various engineering discipline analyses, an efficient highly user oriented software system capable of performing interdisciplinary design analyses with tolerable solution turnaround time is planned. Specific analysis capability goals were set forth with initial emphasis given to sequential and quasi-static thermal/structural analysis and fully coupled structural/control system analysis. Subsequently, the IAC would be expanded to include a fully coupled thermal/structural/control system, electromagnetic radiation, and optical performance analyses. A.R.H.

N80-31463*# Boeing Aerospace Co., Seattle, Wash.
INTEGRATED ANALYSIS CAPABILITY FOR LARGE SPACE SYSTEMS c66
Robert G. Vos *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 193-202 (For primary document see N80-31449 22-20)
(Contract NAS5-25767)
Avail: NTIS HC A15/MF A01 CSCL 12B

The development of an integrated analysis computer program capable of performing the conceptual/preliminary structural system design analysis of large space systems is addressed. The integrated analysis capability (IAC) specifications include thermal/structural/controls integration, an emphasis on existing software and interactive graphics and I/O, a project size capability of 1 to 50 users (1 to 5 users concurrent), and the use of the FORTRAN '77 language. The advantages of the DISCOS and NASTRAN computer programs to the IAC are outlined and recommendations for other programs are made. Barriers to the development of the system arising from the interdisciplinary data flow are defined. M.G.

N80-31464*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONTROLS FOR LSS c66
Fernando Tolivar *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 203-217 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

An overiew of control development for large space structures (LSS) is presented addressing the activities of LSS modeling for control synthesis, technology identification and development, and performance evaluation. Specifically discussed are a 100 meter wrap rib antenna, a multiple payload science application platform, and a solar power satellite. In addition, the static shape control of flexible space structures by utilizing the Green's function is described. M.G.

N80-31465*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRIC PROPULSION AND POWER
David C. Byers *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 219-228 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

The development of electric propulsion systems is discussed and the benefits of these systems to various space mission requirements are outlined. The characteristics and development status of 8 and 30 cm mercury ion thrusters and solar electric propulsion systems are reported. In addition the advantages of an inert gas thruster for Earth orbital missions are examined and include its capability for operation at higher values of specific impulse, the ease at which it can be integrated with space systems, and it's low pollution potential. M.G.

N80-31466*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ELECTRIC PROPULSION FOR SPS
Earle M. Crum *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 229-236 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21C

The design and characteristics of the solar power satellite electric propulsion system are described. Both the payload powered orbital transfer vehicle and the independent powered transfer vehicle configuations are discussed. Mass estimates for the system, the average cost per system unit, and the cost per flight estimates are also given. M.G.

N80-31467*# Aerojet Liquid Rocket Co., Sacramento, Calif.
LOW-THRUST CHEMICAL ROCKET ENGINE STUDY
Joseph A. Mellish *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 237-261 (For primary document see N80-31449 22-20)
(Contract NAS3-21940)
Avail: NTIS HC A15/MF A01 CSCL 21H

Parametric data and preliminary designs on liquid rocket engines for low thrust cargo orbit-transfer-vehicles are described and those items where technology is required to enhance the

designs are identified. The results of film cooling studies to establish the upper chamber pressure limit are given. The study showed that regen cooling with RP-1 was not feasible over the entire thrust and chamber pressure ranges. The thermal data showed that the RP-1 bulk temperature exceeded the study coking temperature limit of 1010 R. Based upon the results presented, O2/H2 and O2/CH4 regen engine systems and O2/H2 film cooled engines were selected for further study in the system analysis. Six engine design concepts are examined. M.G.

N80-31468*# Rockwell International Corp., Pittsburgh, Pa.
LOW-THRUST CHEMICAL PROPULSION
James M. Shoji *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 263-286 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

Results from investigations leading to the definition of low thrust chemical engine concepts are described. From the thrust chamber cooling analyses, regenerative/radiation-cooled LO2/H2 thrust chambers offered the largest thrust and chamber pressure operational envelope primarily due to the superior cooling capability of hydrogen and its low critical pressure. Regenerative/radiation-cooled LO2/CH4 offered the next largest operational envelope. The maximum chamber pressure for film/radiation-cooling was significantly lower than for regenerative/radiation-cooling. As in regeneration-cooling, LO2/H2 thrust chambers achieved the highest maximum chamber pressure, LO2/CH4 film/radiation-cooling was found not feasible and LO2/RP-1 film/radiation-cooling was extremely limited. In the engine cycle/configuration evaluation, the engine cycle matrix was defined through the incorporation of the heat transfer results. Engine cycle limits were established with the fuel-cell power cycle achieving the highest chamber pressure; however, the fuel cell system weights were excessive. The staged combustion cycle achieved the next highest chamber pressure but the preburner operational feasibility was in question. M.G.

N80-31469*# Martin Marietta Corp., Bethesda, Md.
LOW-THRUST CHEMICAL ORBIT TO ORBIT PROPULSION SYSTEM PROPELLANT MANAGEMENT STUDY Progress Report, 14 Sep. 1979 - 14 Nov. 1980
Ralph H. Dergance *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 287-310 refs (For primary document see N80-31449 22-20)
(Contract NAS3-21954)
Avail: NTIS HC A15/MF A01 CSCL 21H

Propellant requirements, tankage configurations, preferred propellant management techniques, propulsion systems weights, and technology deficiencies for low thrust expendable propulsion systems are examined. A computer program was utilized which provided a complete propellant inventory (including boil-off for cryogenic cases), pressurant and propellant tank dimensions for a given ullage, pressurant requirements, insulation requirements, and miscellaneous masses. The output also includes the masses of all tanks; the mass of the insulation, engines and other components; total wet system and burnout mass; system mass fraction; total impulse and burn time. M.G.

N80-31470*# Rockwell International Corp., Pittsburgh, Pa.
SOLAR ROCKET SYSTEM CONCEPT ANALYSIS Final Report
Jack A. Boddy *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 311-336 (For primary document see N80-31449 22-20)
(Contract F04611-79-C-0007)
Avail: NTIS HC A15/MF A01 CSCL 21H

The use of solar energy to heat propellant for application to Earth orbital/planetary propulsion systems is of interest because of its performance capabilities. The achievable specific impulse values are approximately double those delivered by a chemical rocket system, and the thrust is at least an order of magnitude greater than that produced by a mercury bombardment ion propulsion thruster. The primary advantage the solar heater thruster has over a mercury ion bombardment system is that its significantly higher thrust permits a marked reduction in mission trip time. The development of the space transportation system, offers the opportunity to utilize the full performance potential of the solar rocket. The requirements for transfer from low Earth orbit (LEO) to geosynchronous equatorial orbit (GEO) was examined as the return trip, GEO to LEO, both with and without payload. Payload weights considered ranged from 2000 to 100,000 pounds. The performance of the solar rocket was compared with that provided by LO2-LH2, N2O4-MMH, and mercury ion bombardment systems. A.R.H.

N80-31471*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED CONCEPTS
Bruce A. Banks *In its* Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 337-342 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

The relative strengths of those interactions which enable propulsive forces are listed as well as the specific impulse of various propellants. Graphics show the linear synchronous motor of the mass driver, the principle of the direct current electromagnetic launcher, and the characteristics of the rail gun. A.R.H.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-31472*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN IMPROVED SYNTHESIS OF 2,4,8,10-TETROXASPIRO (5.5) UNDECANE Patent Application
Algirdas C. Poshkus, inventor (to NASA) (National Academy of Sciences - National Research Council, Washington, D.C.) Filed 3 Sep. 1980 10 p Sponsored by NASA
(NASA-Case-ARC-11243-2; US-Patent-Appl-SN-183707) Avail: NTIS HC A02/MF A01 CSCL 07C

Pentaerythritol can be converted to its diformal, 2,4,8,10 -tetroxaspiro (5.5) lundecane, by heating it ot a temperature within of about 110 to 150 C for a period of up to 10 minutes, in the presence of a slight excess of paraformaldehyde and of a catalytic quantity of an acid catalyst such as sulfuric acid. The reaction may be carried out in two steps, by forming first the monoformal, then the diformal. In any case, total reaction time is about 10 minutes and yield of diformal are greater than 90 percent. Several advantages of the improved process in terms of shortened reaction times, yields labor and energy requirements, adaptability to continuous operation, and overall simplicity and convenience are discussed. NASA

N80-31473*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CHEMICAL RESEARCH PROJECTS OFFICE: AN OVERVIEW AND BIBLIOGRAPHY, 1975-1980
D. A. Kourtides, A. H. Heimbuch, and J. A. Parker Aug. 1980 36 p
(NASA-TM-81227; A-8317) Avail: NTIS HC A03/MF A01 CSCL 07D

The activities of the Chemical Research Projects Office at Ames Research Center, Moffett Field, California are reported. The office conducts basic and applied research in the fields of polymer chemistry, computational chemistry, polymer physics, and physical and organic chemistry. It works to identify the chemical research and technology required for solutions to problems of national urgency, synchronous with the aeronautic and space effort. It conducts interdisciplinary research on chemical problems, mainly in areas of macromolecular science and fire research. The office also acts as liaison with the engineering community and assures that relevant technology is made available to other NASA centers, agencies, and industry. Recent accomplishments are listed in this report. Activities of the three research groups, Polymer Research, Aircraft Operating and Safety, and Engineering Testing, are summarized. A complete bibliography which lists all Chemical Research Projects Office publications, contracts, grants, patents, and presentations from 1975 to 1980 is included. L.F.M.

N80-31474# Rocketdyne, Canoga Park, Calif.
RESEARCH STUDIES IN/NF4(+)/SALTS Final Technical Report, 1 Apr. 1977 - 31 Mar. 1980
K. O. Christe 23 May 1980 124 p refs
(Contract DAAG29-77-C-0007)
(AD-A086981; RI/RD80-157; ARO-14394.10-C) Avail: NTIS HC A06/MF A01 CSCL 07/2

This report describes the results of a 3 year program in basic research studies in NF4(-) chemistry. The mechanism of NF4(-) salt formation and decomposition was determined and the decomposition kinetics of NF4AsF6 and NF4BF4 were measured. The formation of NF3(-) salt intermediates, both in the formation and decomposition of NF4(-) salts, was established, and the NF3(-) radical cation was thoroughly characterized by ESR spectroscopy. Improved synthetic methods were developed for NF4SbF6 and its metathesis to other NF4(-) salts. A new method was developed for the synthesis of NF4(-) salts derived from polymeric Lewis acids which do not form HF soluble cesium salts. The following new NF4(-) salts were synthesized and thoroughly characterized: (NF4) 2MnF6, NF4HF2, NF4UF5O, NF4CLO4 and NF4SO3F. In addition, the novel N2F3SnF5 and N2F3SbF6 salts, which are useful burning rate modifiers in solid propellant NF3-F2 gas generator formulations, were prepared and characterized. Unsuccessful attempts were made to prepare NF4NO3, NF4ClF4O, NF4BrF4O, NF4BrO4 and NF4(-) salts of several transition metal fluoride anions. Crystal structure determinations of NF4BF4 and NF4SbF6, and the measurement of thermodynamic data on NF4BF4, NF4PF6, NF4AsF6, and NF4SbF6 are in progress. GRA

N80-31475# National Technical Information Service, Springfield, Va.
BIOCOMPATIBLE MATERIALS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1978 - Jun. 1980
Elizabeth A. Harrison Jun. 1980 70 p Supersedes NTIS/PS-79/0697; NTIS/PS-78/0675
(PB80-811904; NTIS/PS-79/0697; NTIS/PS-78/0675) Avail: NTIS HC $30.00/MF $30.00 CSCL 06L

The cited reports cover studies on the fabrication and preparation of biomaterials and the in vivo and in vitro evaluation of the compatility of the materials to tissues and blood components. Utilization in mechanical organs, prosthetic devices, implants, and surgical materials is discussed. This updated bibliography contains 60 abstracts, 24 of which are new entries to the previous edition. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-31476 Virginia Polytechnic Inst. and State Univ., Blacksburg.
EFFECTS OF MOISTURE, RESIDUAL THERMAL CURING STRESSES AND MECHANICAL LOAD ON THE DAMAGE DEVELOPMENT IN QUASI-ISOTROPIC LAMINATES Ph.D. Thesis
Ronald Dean Kriz 1979 128 p
Avail: Univ. Microfilms Order No. 8020212

The maximum moisture absorbed in [01 + or - 45/90] sub s and [0/90/ + or - 45] sub s laminates fabricated from T300/5208 was demonstrated. Emphasis was placed on using reasonable approximations for wet, dry, and out of plane (v sub 23, G sub 23) elastic properties since these properties are required to predict the damage free stress state at the laminate edge. Classical laminate theory and a finite element model were used to predict stress states prior to the first formation of damage. Crack patterns characteristic of the laminate in a wet or dry condition were also predicted using a shear lag model. Development of edge damage was recorded and observed during the test by transferring an image of the damage from the edge surface on to a thin acetate sheet (replica technique), such that the damage imprinted on the acetate sheet could be immediately viewed on a microfiche card reader. Moisture was shown to significantly alter the interior and edge dry stress states due to swelling and a reduction of elastic properties. Dissert. Abstr.

N80-31477 Delaware Univ., Newark.
MICROMECHANICS OF SHORT-FIBER COMPOSITE Ph.D. Thesis
Seuchi Nomura 1980 178 p
Avail: Univ. Microfilms Order No. 8019944

Various mechanical properties of multiphase short fiber composite materials were studied. Each fiber was modeled as an ellipsoidal inclusion embedded in a homogeneous matrix and was distributed unidirectionally and randomly in a transverse plane. Strain field expressions at each point of the composite were obtained by using the Green's function perturbation method and the self consistent approximation, and by making use of these expressions effective constants of the composite such as elastic moduli, thermal conductivities and thermal expansion coefficients were derived. Viscoelastic behavior and work hardening effects were also studied. Dissert. Abstr.

N80-31478 Virginia Polytechnic Inst. and State Univ., Blacksburg.
INVESTIGATION OF CONSTRAINT EFFECTS ON FLAW GROWTH IN COMPOSITE LAMINATES Ph.D. Thesis
Peter Chun-Ngok Yeung 1979 107 p
Avail: Univ. Microfilms Order No. 8020238

Results are presented for the case of a transverse flaw in an interior ply perpendicular to the loading axis. Two orientations of the flawed ply were examined (0 and 90 degrees), and two distinctly different constraint situations were studied (cross-ply constraint and biaxial constraint). Various nondestructive testing methods were employed to evaluate the material response and to determine the damage and damage growth in the specimens. These techniques include replication, ultrasonic c-scan, ultrasonic attenuation, acoustic emission, x-radiography, thermography and stiffness measurement. In-plane constraint is the principal contributor to notched strength and changes in notched strength under quasi-static loading. Through-the-thickness constraint controls the pattern and spacing of transverse cracks in the off-axis plies to form a characteristic damage state in the laminates. Out-of-plane stresses produced by contraints are influential on the growth of damage along ply interfaces, especially during cyclic loading. Dissert. Abstr.

N80-31479*# Boeing Aerospace Co., Seattle, Wash.
LARC-13 ADHESIVE DEVELOPMENT Final Report, Oct. 1978 - Jun. 1980
S. G. Hill, C. H. Sheppard, and J. C. Johnson Jun. 1980 50 p refs
(Contract NAS1-15562)
(NASA-CR-159317; Rept-2-3621) Avail: NTIS HC A03/MF A01 CSCL 11A

A LARC-13 type adhesive system was developed and property data obtained that demonstrated improved thermomechanical properties superior to base LARC-13 adhesive. An improved adhesive for 589 K (600 F) use was developed by physical or chemical modification of LARC-13. The adhesive was optimized for titanium and composite bonding, and a compatible surface preparation for titanium and composite substrates was identified. The data obtained with the improved adhesive system indicated it would meet the 589 K (600 F) properties desired for application on space shuttle components. Average titanium lap shear data were: (1) 21.1 MPa (3355 psi) at RT, (2) 13.0 MPa (1881 psi) at 600 F, and (3) 16.4 MPa (2335) after aging 125 hours at 600 F and tested at 600 F. S.F.

N80-31480*# Celanese Research Co., Summit, N.J.
STUDY OF CATALYST CURED LaRC-160/CELION 6000 COMPOSITES Final Report, Jun. 1979 - Aug. 1980
Robert Edelman Sep. 1980 44 p refs
(Contract NAS1-15749)
(NASA-CR-159335) Avail: NTIS HC A03/MF A01 CSCL 11D

LaRC 160 polyimide was modified with a high temperature peroxide catalyst, USP-138, in an attempt to reduce the final cure temperature to below 316 C. This effort was directed at obtaining a material for 177 C use that would cure at similar temperatures to a high performance epoxy while still maintaining the good moisture resistance of a polymide material. Attempts to prepare a laminate made from Celion 6000 fiber and 5% catalyzed LaRC 160 resin gave a material with minimal properties after curing at 193 C. Acceptable properties were

not obtained until a final cure temperature of 260 C was used. A control laminate containing no catalyst and cured under the same conditions had only half the level of shear strength. The catalyzed LaRC 160 prepreg was also used to examine the possibility of shortening the conventional LaRC 160 cure at 316 C. Maximum properties were obtained using a 2.5% catalyzed product with a final cure temperature of 316 C held for fifteen minutes. Differences in properties between catalyzed and uncatalyzed product disappeared, however, when the cure time at 316 C was extended to 45 minutes. Author

N80-31481*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE VULNERABILITY OF ELECTRIC EQUIPMENT TO CARBON FIBERS OF MIXED LENGTHS: AN ANALYSIS
Wolf Elber Aug. 1980 23 p refs
(NASA-TM-80215) Avail: NTIS HC A02/MF A01 CSCL 11D

The susceptibility of a stereo amplifier to damage from a spectrum of lengths of graphite fibers was calculated. A simple analysis was developed by which such calculations can be based on test results with fibers of uniform lengths. A statistical analysis was applied for the conversation of data for various logical failure criteria. A.R.H.

N80-31482*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A CARBON FIBER EXPOSURE TEST FACILITY AND INSTRUMENTATION
A. L. Newcomb, Jr. Aug. 1980 47 p
(NASA-TM-80220) Avail: NTIS HC A03/MF A01 CSCL 11D

A facility to evaluate the risk associated with the exposure of electrical and electronic equipment to airborne carbon/graphite fibers was constructed. A wide variety of instrumentation is described and illustrated. S.F.

N80-31483# Wyoming Univ., Laramie. Dept. of Mechanical Engineering.
NONLINEAR VISCOELASTIC BEHAVIOR OF A COMPOSITE MATERIAL USING A FINITE ELEMENT MICROMECHANICAL ANALYSIS Interim Report
Brent G. Schaffer and Donald F. Adams Jun. 1980 158 p refs
(Contract DAAG29-79-C-0189)
(AD-A087367; UWME-DR-001-101-1; ARO-16370.1-MS)
Avail: NTIS HC A08/MF A01 CSCL 11/4

The analysis uses an elastoplastic finite element micromechanics computer program to model a unidirectional composite subjected to any combination of longitudinal, transverse, and hygrothermal loadings. Time-dependent effects are included by means of nonlinear viscoelastic constitutive equations. The method of solution is based upon the conditions for generalized plane strain which permits a pseudo-three dimensional analysis. It also contains two failure criteria, viz., an octahedral shear stress criterion and a hydrostatic criterion. Application of load or changes in temperature or moisture are input through time-independent increments. A plotting package is also included which allows the user to obtain a total of eight different plots; octahedral shear stress and strain, maximum and minimum principal stress, in-plane shear stress, out-of-plane longitudinal stress, and normal and tangential shear stress on the fiber-matrix interface. The study demonstrates that the associated program is able to model essentially any type of stress input or hygrothermal history. GRA

N80-31484# Dyna East Corp., Wynnewood, Pa.
STATISTICAL ANALYSIS OF STRENGTH AND LIFE OF COMPOSITE MATERIALS Final Report, 1 Apr. 1977 - 31 Oct. 1979
Pei Chi Chou, A. S. D. Wang, Robert Croman, Harry Miller, and James Alper May 1980 72 p refs
(Contract F33615-77-C-5039; AF Proj. 2307; AF Proj. 2419)
(AD-A087741; AFWAL-TR-80-4049) Avail: NTIS HC A04/MF A01 CSCL 11/4

Static strength and fatigue life of unidirectional graphite/epoxy composites are studied in terms of statistical models of fatigue degradation and residual strength. A two segment Weibull distribution for fatigue life, and a cumulative damage rule for fatigue are introduced. Experimental tests performed support the assumption that a specimen's rank in strength is equal to its rank in fatigue life. Fatigue weakens the matrix, and thus degrades the residual compression strength, and not the residual tension strength in early life. In some cases, residual tension strength initially increases. Proof tests can guarantee a minimum strength, and to a lesser extent, a minimum fatigue life. GRA

N80-31485# Army Materials and Mechanics Research Center, Watertown, Mass.
THE EFFECT OF MECHANICAL WORKING ON SiC WHISKER-REINFORCED ALUMINUM ALLOYS Final Report
Dennis M. Riggs and Peter Gillis Apr. 1980 18 p
(AD-A087565; AMMRC-TR-80-11) Avail: NTIS HC A02/MF A01 CSCL 11/4

The effects of mechanical working on SiC whisker-reinforced aluminum alloys were investigated. The effects of pressing, extruding, and rolling on whisker dispersion, L/D ratio, and orientation were determined by examination of polished cross sections using conventional optical microscopy and by examination of replicas with a transmission electron microscope. These results were correlated with the mechanical properties of the composite. It was found that mechanical working of the composites significantly degrades the whiskers, particularly the L/D ratio. Extrusion and rolling, however, do impart an orientation to the whiskers in the direction of working. It was also found that clumping observed in the unworked billets is carried through both the extrusion process and rolling. These SiC-rich areas apparently lead to the formation of porosity in the composites during working. The high level of mechanical properties found in the worked composites suggests that optimization of the secondary working parameters (in such a manner as to minimize whisker damage) may result in the realization of a truly unique structural material. GRA

N80-31486# Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.
SUPERCONDUCTIVITY IN FILAMENTARY EUTECTIC COMPOSITES Progress Report, 1 Jun. 1979 - 31 May 1980
Mark P. Zaitlin 1980 21 p refs
(Contract DE-AC02-78ER-04938)
(COO-4938-3) Avail: NTIS HC A02/MF A01

Electrical resistivity and magnetic susceptibility were measured as a function of temperature on samples of Nb-Th eutectic composite. Samples with Nb filament radii as small as 38A were used which is considerably less than the coherence length in Nb of approximately 380A. Surprisingly, measurements of all samples show a drop in electrical resistance near the transition temperature of bulk Nb and an unmeasurably small resistance by approximately 8K. The magnetic susceptibility showed essentially perfect diamagnetism below approximately 7K to 9K even for samples with the smallest of filament radii. This is in contradiction to theories of the proximity effect which predict a sharp decrease in the transition temperature for samples with a radius smaller than the coherence length. Some measurements in a static magnetic field were also made. DOE

N80-31487# Cornell Univ., Ithaca, N. Y. School of Mechanical and Aerospace Engineering.
PROBABILISTIC MODELS OF THE STRESS-RUPTURE OF COMPOSITE MATERIAL, PHASE 3 Progress Report, 15 Jun. 1978 - 14 Jun. 1980
S. L. Phoenix Mar. 1980 34 p refs
(Contract EY-76-S-02-4027)
(COO-4027-3) Avail: NTIS HC A03/MF A01

The development of static and time dependent models for the failure of composite materials was pursued. These models are based on the chain of bundles probability model for composite failure wherein local load sharing among nonfailed fiber elements in a bundle plays a key role. At the outset, it was believed that the static model was well developed in the literature by others, and that work on the time dependent versions could proceed. In these versions, the viscoelasticity of the matrix was to be the cause of the time effects. Unfortunately, initial studies showed the published analysis on the static case to be superficial, and a rigorous extension to the time dependent case was not possible.

The static model was thoroughly investigated. Sophisticated analytical and numerical techniques were developed to treat the static model, and these show promise of being extendable to the time dependent case. Exact analysis was performed on composites with few fibers to gain insight, and a recursive technique was developed to treat composites of larger sizes.
DOE

N80-31488# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.
INELASTIC DEFORMATION IN CRYSTALLINE NONMETALLIC MATERIALS Progress Report
D. L. Kohlstedt. Apr. 1980. 46 p. refs
(Contracts DE-AS02-77ER-04441; EG-77-S-02-4441; Grant NSF DMR-76-24180)
(COO-4441-3) Avail: NTIS HC A03/MF A01

Densification of polycrystalline TiC was studied during hot-pressing and sintering of powders. Starting powders of Ti plus C, TiC, and TiC plus Ti were reacted at 1700 C to 1835 C above the melting point of Ti metal (T/sub m/ = 1675 C for Ti). The bulk C:Ti ratio was maintained in the range 0.97 to 0.6 in order to allow the possibility of producing a single phase material. All of the resulting microstructures, examined in the scanning electron microscope, contain press both along the grain boundaries and within the grains. The samples fabricated from Ti metal plus TiC contain substantially fewer pores than those produced from TiC powder alone. Debye-Scherrer X-ray diffraction analyses demonstrate that in the TiC plus Ti runs, all of the Ti is transformed to substoichiometric TiC after a few minutes at 1800 C. While sintering time and temperature have a small influence on the final density, increasing the weight percent of Ti metal added to TiC dramatically increases the final density and the hardness.
DOE

N80-31489# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF FIBER-MATRIX INTERFACE STRUCTURE AND INTERFACIAL DIFFUSION PHENOMENA IN COTAC-TYPE SOLIDIFICATION COMPOSITES. EFFECT ON THE THERMAL STABILITY OF THE FIBERS Ph.D. Thesis - Paris-Sud Univ.
Elvire Maroni. 1979. 102 p. refs. In FRENCH; ENGLISH summary
Report will also be announced as translation (ESA-TT-661)
(ONERA-NT-1979-11; ISSN-0078-3781) Avail: NTIS HC A06/MF A01

The fiber matrix interfacial structure of Cotac type composites was determined by electron microscopy. Interfaces were characterized using the diffusion technique. High resolution autoradiographs showed that diffusion was predominant along the fiber matrix interface. The diffusion coefficients of nickel and niobium were measured for Cotac 74 and Ni, Cr-TaC composites in order to obtain the diffusion data required to predict the high temperature stability of Cotac type composites. The high values of the activation energies for the interfacial diffusion of both nickel and niobium result from the interaction of the diffusing species with carbon. The structural stability of Cotac type composites was investigated at elevated temperatures. It is estimated from the experimental data that no degradation due either to isothermal Ostwald ripening or to thermal gradient coarsening should occur in service at high temperatures.
Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-31490*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SYNTHESIS OF DAWSONITES Patent Application
Robert L. Altman, inventor (to NASA). Filed 14 Aug. 1980. 10 p.
(NASA-Case-ARC-113261-1; US-Patent-Appl-SN-178192)
Avail: NTIS HC A02/MF A01 CSCL 07A

Alkali metal and ammonium dawsonites are prepared by a nonaqueous process where equimolar quantities of the corresponding hydrogen carbonate and aluminum hydroxide in finely divided state are heated together to a temperature within the range of 150 to 250 C for a period of 1 to 6 hours under a carbon dioxide pressure within the range of 120 to 360 psig. Carbonates may be used instead of hydrogencarbonates. A type of dawsonite is provied that can be used in extinguishing fires caused by hot surface ignition of hydrocarbon fuels.
NASA

N80-31491 This accession not used.

N80-31492# Texas Univ. at Austin. Dept. of Chemistry.
PHOTOASSISTED WATER-GAS SHIFT REACTION OVER PLATINIZED Ti O(2) CATALYSTS Technical Report, 1 Jan. - 31 Dec. 1980
Shinri Sato and John M. White. 15 Jul. 1980. 31 p. refs
Submitted for publication
(Contract N00014-75-C-0922; NR Proj. 056-578)
(AD-A087363; TR-15) Avail: NTIS HC A03/MF A01 CSCL 07/4

The reaction of gas phase water with CO (water-gas shift reaction) over platinized, powdered TiO2 is found to be catalytic under UV illumination. The reaction kinetics have been studied at temperatures from 0 to 60 C. At 25 C, the reaction is zero order both in CO and water when p sub CO = or > 0.3 torr and p sub H2O = or > 5 torr and the activation energy is 7.5 kcal/mole. The wavelength dependence of the reaction rate shows a cut-off near, but slightly below, the band gap of titanium oxide. The quantum efficiency of the reaction is about 0.5% at 25 C.
GRA

N80-31493# Texas Univ. at Austin. Dept. of Chemistry.
AN ELECTRON SPECTROSCOPIC INVESTIGATION OF THE INTERACTION OF METHANOL WITH POLYCRYSTALLINE ALUMINUM Technical Report, 1 Jan. - 21 Dec. 1980
J. W. Rogers, Jr., R. L. Hance, and J. M. White. 15 Jun. 1980. 21 p. refs. Submitted for publication
(Contract N00014-75-C-0922; NR Proj. 056-578)
(AD-A087309; TR-14) Avail: NTIS HC A02/MF A01 CSCL 07/4

X-ray and ultraviolet photoelectron spectroscopic results are reported for the interaction of CH3OH with clean polycrystalline Al in the temperature range 110-500 K. Methanol is molecularly chemisorbed at low exposure and low temperature (110 K) followed by condensation at higher exposure. The multilayers desorb beginning near 170 K and the chemisorbed layer is converted into a surface methoxide. Room temperature adsorption also leads to formation of the methoxide species which is stable to approximately 500 K, at which point it decomposes evolving CH4 and leaves the surface oxidized.
GRA

N80-31494# Texas Univ. at Austin. Dept. of Chemistry.
PHOTOCATALYTIC PRODUCTION OF HYDROGEN FROM WATER AND TEXAS LIGNITE USING A PLATINIZED TITANIA CATALYST Technical Report, 1 Jan. - 31 Dec. 1980

Shinri Sato and John M. White 15 Jul. 1980 11 p refs Submitted for publication
(Contract N00014-75-C-0922; NR Proj. 056-578)
(AD-A087364; TR-16) Avail: NTIS HC A02/MF A01 CSCL 07/4

Using a physical mixture of powdered Texas lignite and platinized titania in the presence of water vapor and ultraviolet light, we show that a catalytic reaction occurs at 23 C to form hydrogen and carbon dioxide. These results are contrasted with a recent electrochemical conversion process. GRA

N80-31495# Oakland Univ., Rochester, Mich. Dept. of Chemistry.
ELECTROCHEMICAL GENERATION OF THE NAKED METAL ANIONIC CLUSTERS
B. Stanley Pons, David J. Sarture, R. Craig Taylor, and Ralph W. Rudolph (Michigan Univ.) 15 Jun. 1980 8 p refs
(Contract N00014-79-C-0664)
(AD-A087344; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Tin and lead electrodes reduce in the presence of electrodeposited sodium in ethylenediamine to give highly charged naked metal anionic clusters. GRA

N80-31496# Washington Univ., Seattle. Dept. of Chemistry.
COLLISIONAL RELAXATION OF VIBRATIONAL ENERGY TRANSIENT IN THE METHYLCYCLOPROPANE SYSTEM. A VARIABLE ENCOUNTER METHOD STUDY
D. F. Kelley, T. Kasai, and B. S. Rabinovitch 1 Aug. 1980 27 p refs Submitted for publication
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A087802; TR-16) Avail: NTIS HC A03/MF A01 CSCL 07/3

The Variable Encounter Method has been used to study vibrational energy transients in the isomerization of methylcyclopropane to various butenes. This system was studied with reactor surface temperatures of 800 K to 1130 K and average numbers of collisions per encounter with the reactor of 5.6 and 20.0. The reaction rate was treated on the basis of total, rather than individual butene rates, because of butene product interconversion. An exponential model of energy transfer was found to give the best fit to the data with the average down step energy -delta E prime = decreasing from 1860/cm to 1415/cm with increase of temperature over the range studied. Incubation times increased from 14 to 19 collisons with increase in temperture, and these times together with valves of the conventional relative collision efficiency Beta and values of -delta E prime =, are compared with those of other molecules studied by VEM. The calculated transient population distributions and the associated sequential reaction probabilities are also displayed. GRA

N80-31497# United Technologies Research Center, East Hartford, Conn.
CARS CONCENTRATION SENSITIVITY WITH AND WITHOUT NONRESONANT BACKGROUND SUPPRESSION Final Technical Report, 9 May 1979 - 22 Apr. 1980
Alan C. Eckbreth and Robert J. Hall Jun. 1980 71 p refs
(Contract N00014-79-C-0351)
(AD-A087557; UTRC-R80-954628-1) Avail: NTIS HC A04/MF A01 CSCL 07/4

Species detectivity is limited in conventional CARS with aligned laser polarizations by the presence of a background, nonresonant electronic contribution to the CARS signal. At low species densities, a modulated CARS spectrum results which can be used to perform concentration measurements from the spectral shape, a unique feature of CARS. When the species concentration becomes very low, the 'signal' from the specie of interest, i.e., the modulation, essentially disappears into the nonresonant background and the specie is no longer detectable. By proper orientation of the polarizations of the pump and Stokes laser fields and the CARS signal polarization analyzer, the nonresonant background can be suppressed leaving the pure CARS spectrum of the specie being probed. Unfortunately, a factor of sixteen reduction in resonant mode signal accompanies the elimination of the background. In this report, investigations of background suppression from CO in flames are described using polarization sensitive CARS with spectrally broadband Stokes waves. The studies were conducted in flat CO-air diffusion flames employing nonplanar, crossed-beam phase matching, i.e., folded BOXCARS. The relative concentration sensitivity of CARS with and without background suppression was compared at both high and low temperatures. GRA

N80-31498# Duke Univ., Durham, N. C. Dept. of Physics.
MICROWAVE INVESTIGATIONS OF MATTER Final Report, 15 Oct. 1976 - 30 Nov. 1979
Frank C. DeLucia Jun. 1980 91 p refs
(Grant DAAG29-77-G-0007)
(AD-A087480; ARO-14150.7-P) Avail: NTIS HC A05/MF A01 CSCL 07/4

The project 'Microwave Investigations of Matter' represented a broad attack on a wide variety of scientific topics and technological developments in the millimeter and submillimeter spectral region. Attached are the journal publications and a brief summary of our work. In addition to the cited journal publications, approximately an equal number of invited and contributed papers have been presented at scientific meetings. Because the material in these talks is highly correlated with journal articles, they will not be listed separately. GRA

N80-31499# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering.
COMBUSTION STUDIES OF COAL-IN-OIL DROPLETS Final Report, 1 Aug. 1977 - 31 Jul. 1979
C. K. Law Dec. 1979 60 p refs
(Contract DE-FG01-77ET-10660)
(DOE/ET-10660/1) Avail: NTIS HC A04/MF A01

The combustion characteristics of droplets of coal-oil mixtures (COM) were investigated both theoretically and experimentally. The agglomeration of the coal powder occurs upon complete implications regarding radiation transfer, total burning time, and particulate collection efficiency. Agglomeration is somewhat irrelevant for COM with no. 6 oil because of the small volatility differentials between coal and no. 6 oil. As a result of agglomeration, fine-crushing the coal is unnecessary unless they can be reduced to micron-sizes such that agglomerate ignition is facilitated. DOE

N80-31500# Wisconsin Univ. - Madison.
MECHANISTIC STUDIES RELATED TO THE METAL CATALYZED REDUCTION OF CARBON MONOXIDE TO HYDROCARBONS Progress Report, 1 Apr. 1979 - 31 Mar. 1980
Charles P. Casey Apr. 1980 11 p refs
(Contract DE-AC02-77ER-04222)
(DOE/ER-04222/3) Avail: NTIS HC A02/MF A01

The stoichiometric reactions of metal complexes which parallel probable steps in the metal catalyzed reduction of CO are being investigated. The information obtained should be useful in the design and discovery of homogeneous catalysts for the reduction of CO to hydrocarbons. It was found that the structure and kinetic stability of metal formyl compounds are very similar to metal acetyl compounds. However, metal formyl compounds are thermodynamically much less stable than metal acetyl compounds towards decarbonylation. Hydride donation reactions of metal formyl compounds were discovered. A neutral metal formyl compound discovered and its reactions were investigated. Preparation of (C5H5) Re (CO)(NO)(CH2OH), the first authentic example of a hydroxymethyl metal compound, was accomplished and studies of its reactions with acid, with base, with CO, and with H2 were begun. DOE

N80-31501# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
INTERPRETATION OF RAYLEIGH SCATTERING IN A FLAME
I. Namer, R. W. Schefer, and M. Chan Apr. 1980 26 p refs Presented at the Conf. of the Western States Sect. of the Combust. Inst., Irvine, Calif., 21 Apr. 1980
(Contract W-7405-eng-48)
(LBL-10655; CONF-800408-3) Avail: NTIS HC A03/MF A01

Typical values of correction factors as a function of degree of reaction, fuel, and equivalence ratio are calculated for an idealized one dimensional flame front. The fuels considered are

H2, CH4, C2H3, C2H6 and C2H5. Errors of up to 30% can occur in the interpretation of the Rayleigh scattering as gas density for the heavier hydrocarbon fuels due, primarily, to the presence of CO as an intermediate combustion product. Conversely, using H2 as a fuel will result in a maximum error of 3% which is within the expected experimental accuracy of a typical Rayleigh scattering system. The interpretation of Rayleigh scattering as temperature was found to have larger error than the interpretation as density. Nevertheless, when corrections are applied for charges in gas composition, Rayleigh scattering provides an excellent measure of total gas density and temperature in flames. DOE

N80-31502# Brigham Young Univ., Provo, Utah.
INVESTIGATION OF SULFUR-TOLERANT CATALYSTS FOR SELECTIVE SYNTHESIS OF HYDROCARBON LIQUIDS FROM COAL-DERIVED GASES Quarterly Technical Progress Report, 18 Sep. - 18 Dec. 1979
Calvin H. Bartholomew 10 Jan. 1980 24 p refs
(Contract DE-AC01-79ET-14809)
(FE-14809-1) Avail: NTIS HC A02/MF A01

Silica-supported cobalt and iron catalysts were prepared by simple impregnation to incipient wetness with aqueous metal salt solutions. Several impregnations were necessary to ensure a uniform deposition of the metal salt, each followed by intermediate drying. After the final impregnation, the catalysts were dried. These dried samples were then bulk reduced in flowing hydrogen. The reduced catalysts were next passivated with 1% air in nitrogen and crushed to a fine powder for use. The cobalt boride on alumina catalyst was prepared under an N2 blanket in a sealed reaction vessel to avoid the formation of boron oxide. Enough alumina was used so that if all the cobalt adhered to the support 18 wt% metal loading would result. DOE

N80-31503# Wayne State Univ., Detroit, Mich. Coll. of Engineering Energy Center.
ULTRASONIC CHARACTERIZATION OF COAL LIQUEFACTION PRODUCTS Final Report, 11 Apr. 1979 - 11 Feb. 1980
Charles B. Leffert, Leo Weisman, and Diane Moore 29 Feb. 1980 75 p refs
(Contract DE-AC22-79PC-10346)
(DOE/PC-10346/1; CEEC-80-1203-1) Avail: NTIS HC A04/MF A01

The Wayne State University ultrasonic device and technique was used successfully to calibrate coal derived 0 to 45% wt% asphaltene in oil mixtures (2 wt% increments) for transmitted signal strength versus temperature (25 to 100 C). Computer aided cross plots of the transmitted signal strength versus concentration of asphaltene showed that a wide range of concentration and temperature exists where the viscosity dominated (lower temperature) sound absorption is such that a single valued number for the concentration of the asphaltene can be obtained from measurement of the sample temperature and transmitted signal strength and thus obtain a measure of the quality of the coal-derived product. It is concluded that there is an excellent expectation that the Wayne State ultrasonic device and technique could be used to simultaneously measure (on line) the suspended particle concentration as well as the quality of the coal-derived product. DOE

N80-31504# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
CROSSED MOLECULAR BEAM STUDIES OF CHEMILUMINESCENT REACTIONS Ph.D. Thesis
Carol Cuzens Kahler Apr. 1980 175 p refs
(Contract W-7405-eng-48)
(LBL-10545) Avail: NTIS HC A08/MF A01

The chemiluminescent bimolecular halogen-halogen reactions of F2 with I2, Br2, and IC1, were studied by the crossed molecular beam technique. The observed reaction thresholds of 4.2 and 5.9 kcal/mole for I2 + F2, respectively, are the same as the threshold energies for production of the stable trihalogens I2F and C1IF. A threshold of 11.3 kcal/mole was found for Br2 + F2; no threshold for Br2F was previously reported. Also described is a crossed molecular beam study of the chemiluminescent reaction of + O3 yields NO2 + O2. The cross section was found to increase with increasing collision energy. The reaction threshold was 2.1 kcal/mole. The chemiluminescence was found to increase with increasing NO temperature. This is explained by assuming the cross section varies as E sub rot sup 1.4 where E sub rot is the average rotational energy of the NO beam. DOE

N80-31505# Brandeis Univ., Waltham, Mass.
HYDROGEN-TRANSFER AND CHARGE TRANSFER IN PHOTOCHEMICAL AND HIGH ENERGY RADIATION INDUCED REACTIONS: EFFECTS OF THIOLS Final Report, 1 Feb. 1960 - 31 Jan. 1979
Saul G. Cohen Mar. 1980 19 p refs
(Contract EY-76-S-02-3118)
(DOE/ER-03118/13) Avail: NTIS HC A02/MF A01

Absorption of ultraviolet or visible light, or high energy radiation, may lead to highly reactive free radicals. Thiols affect the reactions of these radicals in the following ways: (1) transfer of hydrogen from sulfur of the thiol to a substrate radical, converting the radical to a stable molecule, and the thiol to a reactive thiyl radical; and (2) transfer of hydrogen from a substrate radical or molecule to thiyl, regenerating thiol. The thiol is thus used repeatedly and a single molecule may affect the consequences of many quanta. Three effects may ensue, depending upon the system irradiated: (1) the substrate radicals may be converted by thiol-thiyl to the original molecules, and protection against radiation damage is afforded; (2) the radicals may be converted to molecules not identical with the starting materials, and in both cases damage caused by radical combination processes is prevented; and (3) product yields may be increased where the initial radicals might otherwise regenerate starting materials. DOE

N80-31506# Mound Lab., Miamisburg, Ohio.
AUTOMATED MULTI-SAMPLE GAS CHROMATOGRAPHIC ANALYSIS OF FOSSIL FUEL GASES
Daniel R. Rohler, Gary L. Young, and Victoria M. Franchetti 11 Jun. 1980 21 p ref
(Contract DE-AC04-76DP-00053)
(MLM-2721) Avail: NTIS HC A02/MF A01

Fully automated gas chromatographic analysis of multiple Fischer Assay retort gas samples was achieved. The system used included a commercially available microprocessor controlled gas chromatograph fitted with an inhouse designed and constructed automated gas sampling rack. This system unattended duplicate analysis of four samples and one standard; the total output of analyses per day was twice that using manual operation. Automation of the rack was achieved through microprocessor control of four time programmable contact closures which operate a set of valves and a printer for sampling, regulating, and recording manifold pressure. Accuracies and precisions using the gas chromatograph sampling rack automatically were comparable to those achieved during manual operation. DOE

N80-31507# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF LINEAR ACCELERATOR TECHNOLOGY TO THE DETECTION OF TRACE AMOUNTS OF TRANSURANICS IN WASTE BARRELS
M. R. Cates, B. W. Noel, J. T. Caldwell, W. E. Kunz, D. A. Close, L. A. Franks, and J. L. Pigg 1980 24 p refs Presented at Intern. Symp. on the Management of Alpha-Contaminated Wastes, Vienna, 2-6 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1274; CONF-800611-3) Avail: NTIS HC A02/MF A01

Electron linear accelerators (linacs), as sources of photons and neutrons, can produce a significant number of fissions in transuranic isotopes contained in large barrels of waste material. Both photons and thermal neutrons were used to detect about 1 mg of plutonium in 105 kg matrices. A sequential interrogation with neutrons and photons, easily possible with linacs, can show both fertile and fissile constituents among the heavy mass isotopes. The advantages of linacs in solving existing assay problems include: (1) high available beam current; (2) variable beam current, beam energy, pulse width, and pulse repetition frequency; and (3) beam-scanning ability. They also are compatible with passive assay instruments. Their versatility makes it likely that they will remain useful as assay technology advances. DOE

N80-31508# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
STUDY OF SOLID METAL/CERAMIC REACTIONS Progress Report, 18 Jun. 1979 - 17 Mar. 1980
R. L. Mehan and M. R. Jackson. 26 Feb. 1980. 40 p. refs.
(Contract DE-AC02-79ER-10413)
(DOE/ER-10413/1) Avail: NTIS HC A03/MF A01

Ceramic-metal reactions are investigated for SiC, Si/SiC, and Si4N4 with a Ni-Cr-Al superalloy. Results from metallographic and microhardness measurements, reaction kinetics, and investigations of phase relations are presented. Considering the reaction rates of SiC and Si/SiC, the activation energy at lower temperatures (700 C and 800 C) seem similar, with the Si/SiC forming larger reaction zones than SiC. This is consistent with metallographic observations and the fact that more Si is available from Si/SiC than from the decomposition of SiC. However, as the eutectic is approached, the rate increases significantly for the Si/SiC and more so for pure Si. Because of the presence of Cr and Al in the Ni, a liquid phase may form below 900 C. DOE

N80-31509# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
LATTICE EXPANSION AS A MEASURE OF SURFACE SEGREGATION AND SOLUBILITY OF HYDROGEN IN ALPHA-FeTiH/SUB x
J. J. Reilly, J. R. Johnson, F. Reidinger, J. F. Lynch, J. Tanaka, and R. H. Wiswall. 1980. 19 p. refs. Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, Colo. 7 Apr. 1980
(Contract EY-76-C-02-0016)
(BNL-27523; CONF-800402-12) Avail: NTIS HC A02/MF A01

The lattice expansion of alpha-FeTiH sub x was found to be anomalously small as a function of hydrogen content. The apparent partial molar volume of hydrogen, anti V sub H, was 0.1 - (-0.1) cc/g atom (FeTiH sub - 0.03), a value much lower than the accepted range of 2.2 to 1.4 cc/g atom previously reported the hydrogen metal solutions. The behavior is attributed to preferential occupation by hydrogen of Ti rich sites produced by surface segregation effects which are known to occur in activated FeTi. The alpha/alpha - beta phase boundary is estimated to occur at an overall composition equivalent to FeTi sub approximately 0.04. At this composition approximately 85% of the total hydrogen content is estimated to be associated with surface layers approximately 100 A in depth. Unactivated FeTi (low surface area) behaved quite differently and it is clear that in the low dilution region surface segregation effects play a dominant role with respect to system behavior. DOE

N80-31510# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
THERMOCHEMICAL STABILITY DIAGRAMS FOR CONDENSED PHASES AND VOLATILITY DIAGRAMS FOR VOLATILE SPECIES OVER CONDENSED PHASES IN TWENTY METAL-SULFUR-OXYGEN SYSTEMS BETWEEN 1150 AND 1450 K
E. A. Gulbransen and G. H. Meier. May 1980. 222 p. refs.
(Contract DE-AC01-79ET-13547)
(DOE/FE-13547/01) Avail: NTIS HC A10/MF A01

Stability diagrams and diagrams for the volatile metal oxide and sulfide species in the Al-O-S, Ca-O-S, Ce-O-S, Co-O-S, Cr-O-S, Fe-O-S, Hf-O-S, K-O-S, Mg-O-S, Mn-O-S, Mo-O-S, Na-O-S, Ni-O-S, Nb-O-S, Si-O-S, Ta-O-S, Ti-O-S, V-O-S, W-O-S, and Zr-O-S systems are presented. The importance of the volatile species, melting points of the condensed phases and constitution of the condensed phases as a function of the oxygen and sulfur potential of the reaction environment is discussed with regard to high temperature oxidation and hot corrosion of metals and alloys. DOE

N80-31511# Mound Lab., Miamisburg, Ohio.
HYDROGEN MOBILITY AT HIGH CONCENTRATIONS
R. C. Bowman, Jr. 1980. 112 p. refs.
(Contract DE-AC04-76DP-00053)
(MLM-2729(OP)) Avail: NTIS HC A06/MF A01

The roles of crystal structure, hydrogen site occupancy, phase transition, and isotope substitution on the hydrogen diffusion behavior were considered. General diffusion concepts and experimental methods that have been most often used to determine the hydrogen mobility in the high concentration metal hydride phases are presented. Nuclear magnetic resonance techniques that were extensively applied in hydride diffusion studies were reviewed. Plausible models of the microscopic diffusion mechanisms are presented and compared with observed diffusion behavior. DOE

N80-31512# California Univ., Berkeley. Lawrence Berkeley Lab. Physics, Computer Science and Mathematics Div.
NUMERICAL SIMULATION OF THE INTERACTION OF A FLAME WITH A KARMAN VORTEX STREET
I. Karasalo, A. J. Chorin, I. Namer, F. Robben, and L. Talbot. Apr. 1980. 24 p. refs. Presented at the Conf. of the Western States Sect. of the Comb. Inst., Irvine, Calif., 21 Apr. 1980
(Contract W-7405-eng-48)
(LBL-10679; CONF-800408-4) Avail: NTIS HC A02/MF A01

A numerical study of a simplified flow configuration modeling the interaction of a laminar flame with a Karman vortex street is presented. The flow is assumed to be inviscid and the flame is modeled as a line source of specific volume with a burning speed which depends on the local curvature. Complete flow fields are calculated as a function of time for various values of the Markstein parameter, vortex shedding frequency, separation and strength. rho sub u/rho sub b was 4.0 and the velocity far upstream was set at 60 cm/s for all cases. The essential features of the interaction of a flame with a vortex street are demonstrated, including a deflection of the vortex street ahead of the flame, a development of a flame brush, the deflection of the mean flame position, and the increase in the mean rate of consumption when the vortices are introduced. DOE

N80-31513# California Univ., Berkeley. Lawrence Berkeley Lab.
CATALYZED COMBUSTION OF LEAN FUEL/AIR MIXTURES
R. W. Schefer and F. Robben. Apr. 1980. 20 p. refs. Presented at 4th Workshop on Catalytic Combust., Cincinnati, 14-15 May 1980
(Contract W-7405-eng-48)
(LBL-10842; CONF-800553-1) Avail: NTIS HC A02/MF A01

The effect of catalytic surface activity on gas phase and surface reaction ignition temperatures was studied for H2, C3H8, and C2H6 air mixtures flowing over a platinum and a quartz surface. The gas phase ignition temperature is a function of catalyst surface reactivity. That is at lower temperatures the quartz surface was essentially noncatalytic and resulted in gas phase ignition temperatures up to 100 K lower than with the platinum surface. At increased surface temperatures the catalytic activity of the quartz surface approached that of the platinum and gas phase ignition temperatures were identical for both surfaces. DOE

N80-31514# Polytechnic Inst. of New York, Farmingdale. Aerodynamics Labs.
COMPLETE BURNING AND EXTINCTION OF A CARBON PARTICLE IN AN OXIDIZING ATMOSPHERE
Moshe Matalon. May 1980. 46 p. refs.
(Contract ET-78-C-01-3084)
(FE-3084) Avail: NTIS HC A03/MF A01

The departure from an equilibrium gas phase behavior is described in order to obtain the rate of mass loss M of a pure carbon particle immersed in an oxidizing atmosphere over a wide range of Damkoehler numbers D/sub g/ (representing either the particle size or the ambient pressure). The analysis allowed a small leakage of oxygen through the flame so that M depended on the direct oxidation C - O2 as well. The structure of a thin but finite flame where the CO oxidation takes place was analyzed and its influence on M was determined. When the flame exists, it stands at a well defined distance from the particle and in particular it can be adjacent to it, this depends on the particle size and on its surface temperature. DOE

N80-31515# Oak Ridge National Lab., Tenn. Chemical Technology Div.

COMPUTER SIMULATION OF DISPLACEMENT CATION EXCHANGE CHROMATOGRAPHY: SEPARATION OF TRIVALENT ACTINIDES AND LANTHANIDES

C. W. Forsberg. May 1980. 84 p. refs.
(Contract W-7405-eng-26)
(ORNL/TM-6738) Avail: NTIS. HC A05/MF A01

A first generation mathematical model of displacement cation exchange chromatography (CES) was constructed. The model incorporated the following phenomena: diffusion of cations up and down the column, diffusion of cations from the bulk liquid to the resin surface, and equilibrium of cations between liquid and solid resin beads. A limited number of experiments with rare earths using DTPA as the separation agent were undertaken to increase the current understanding of the processes involved in cation exchange chromatography. The numerical computer program based on the mathematical model was written in FORTRAN IV for use on the IBM 360 series of computers. DOE

N80-31516# Illinois Inst. of Tech., Chicago. Dept. of Chemistry.
STUDIES OF COMBUSTION KINETICS AND MECHANISMS Progress Report, 1 Jun. 1978 - 31 May 1980

David Gutman. 30 Jan. 1980. 7 p.
(Contracts DE-AS02-78ER-14953; ET-78-S-02-4953)
(DOE/ER-14953/T1) Avail: NTIS. HC A02/MF A01

A pulsed CO2 TEA laser was used to dissociate free radical precursors, and a photoionization mass spectrometer is used to monitor the reactions of the radicals. Laser-induced decompositions of ethyl acetate, trifluoroiodomethane, ethyl nitrate, and dimethylsulfoxide were carried out. DOE

N80-31517# Oak Ridge National Lab., Tenn. Computer Sciences Div.
RESIN BEAD U AND PU ANALYSIS OF WAK INPUT SOLUTIONS: A STATISTICAL SUMMARY OF EXPERIMENT NO. 1

C. K. Bayne, J. A. Carter, D. H. Smith, and R. L. Walker. Jun. 1980. 45 p. refs.
(Contract W-7405-eng-26)
(ORNL/TM-7362; (SPO-99)) Avail: NTIS. HC A03/MF A01

A statistical analysis of the resin bead experimental data was made to identify sources of variations among the measurements of isotopic atom ratios and elemental concentrations of plutonium and uranium. Comparisons among treatment means of the analytical laboratory and the resin bead preparation methods are tabulated using Duncan's multiple range test. DOE

N80-31518# Los Alamos Scientific Lab., N. Mex.
INFRARED ANALYSIS OF COAL GASIFIER PRODUCT GASES

R. F. Holland, G. P. Quigley, and M. C. Vasquez. 1980. 11 p. refs. Presented at the Symp. on Instrumentation and Control for Fossil Energy Processes, Virginia Beach, Va., 9 Jun. 1980.
(Contract W-7405-eng-36)
(LA-UR-80-1625; CONF-800602-6) Avail: NTIS. HC A02/MF A01

Infrared absorption measurements using a Fourier transform infrared spectrometer were found to be a convenient way to measure the concentration of certain infrared absorbing gases always present in a coal gasifier product steam. Preliminary measurements using this technique with gas mixtures representative of gasifier products in high pressure, statically filled cells are described. DOE

N80-31519# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A PREDICTION MODEL FOR TURBULENT DIFFUSION FLAMES, INCLUDING NO-FORMATION

J. Janicka (Technische Hochschule, Aachen) and W. Kollmann. Sep. 1979. 17 p. refs. Presented at AGARD-PEP 54th Specialists' Meeting on Combustor Modeling, Cologne, 3-5 Oct. 1979. Submitted for publication.
(VKI-Preprint-1979-14) Avail: NTIS. HC A02/MF A01

A prediction model for turbulent diffusion flames burning gaseous fuels was developed and applied to H2-air flames. In the simplified system of chemical reactions the fast reactions are assumed to be in equilibrium whereas three-body recombinations are treated in nonequilibrium. For the H2-air flames this assumption leads to a description of the reacting system with only two variables: reaction fraction and reaction variable. Two methods of treating such a system in a turbulent flow are discussed. Two sets of equations are complemented with a modified version of the kinetic energy/dissipation rate turbulence model. The NO-formation in such flames can be calculated using the nonequilibrium values (mean values and covariances) of the O and H radicals. The results obtained with both models are compared with experiments and show good agreement. Author (ESA)

N80-31520# Propellants, Explosives and Rocket Motor Establishment, Westcott (England).
THE AUTOXIDATION OF HYDRAZINE AND ALKYL SUBSTITUTED HYDRAZINE VAPORS

J. M. Bellerby. London: HMSO. May 1980. 30 p. refs.
(PERME-Memo-92; BR74110) Avail: NTIS. HC A03/MF A01

The existing body of experimental work on the kinetics of the low temperature autoxidation of hydrazine and the alkyl substituted hydrazines, monomethylhydrazine (MMH) and unsymmetrical dimethylhydrazine (UDMH), is reviewed. In the particular case of the UDMH/O2 reaction (for which the most reliable data are available) a mechanism is put forward which involves the initial formation, by a chain process, of a hydroperoxide. This intermediate is then assumed to undergo wall reactions to give the observed major products. It is further proposed that the hydroperoxide acts as a chain branching agent in the gas phase, thereby giving rise to autocatalysis. The consequences of autocatalysis are examined and seen to account for several previously unexplained features of the kinetic data on the UDMH autoxidation. A full scheme is then proposed for this reaction which successfully accounts for the major and minor products and for the overall stoichiometry. Author (ESA)

N80-31521# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
APPLICATION OF PHYSIOCHEMICAL ANALYSIS METHODS TO FORMING STRATIFIED MATERIALS WITH HIGH TEMPERATURE ENERGY MATRICES [METHODES D'ANALYSES PHYSICO-CHIMIQUES APPLIQUEES AU MOULAGE DES STRATIFIES A MATRICE APOXY HAUTE TEMPERATURE]

Paul Hebrard. Paris, 1980. 28 p. In FRENCH. Presented at Conf. on Journees d'Etudes Intern. du Verre Textile et des Plastiques Renforces, Paris, 16-17 Apr. 1980.
(SNIAS-801-422-105) Avail: NTIS. HC A03/MF A01

The techniques permit a nonporous, completely or sufficiently polymerized homogeneous material with an optimum fiber/matrix ratio to be obtained which is free from volatile matter. Methods employed include: thermogrammetry, differential microcalorimetry, and dynamic viscoelastic analysis. Tables of results relating to specific materials are given together with a series of graphs representing the various corresponding thermal and mechanical characteristics. The use of such methods leads to a high degree of reliability in the fabriction process and to the production of materials of guaranteed quality. Author (ESA)

N80-31522# Environmental Research Lab., Athens, Ga. Analytical Chemistry Branch.
ION CHROMATOGRAPHY OF ANIONS. Interim Report, Jul. 1978 - Jul. 1979

Thomas B. Hoover and George D. Yager. Mar. 1980. 44 p. refs.
(PB80-184450; EPA-600/4-80-020) Avail: NTIS. HC A03/MF A01. CSCL 07D

A Dionex model 10 ion chromatograph was evaluated for the measurement of anionic species in water. The theoretical effect of hydrogen ion activity (pH) on the elution time of phosphate and arsenate was tested and emprical selectivity coefficients was determined for the major protolytic species of these acids. Calibration curves were obtained several anions by direct injection of 0.1 mL of standards. Detection limits for ions other than chloride were approximatley 0.2 micrograms independent of the method of sample introduction. For chloride the detection limit was 2 ng, by direct injection. The concentrator column permitted determination of any of the above ions at concentrations greater than to micrograms/L. GRA

N80-31523# Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
PHYSICAL PROPERTIES AND STABILITY OF WATER IN FUEL OIL EMULSIONS Final Report, Aug. 1978 - Aug. 1979
H. S. Fogler, S. R. Reddy, S. C. Siegmund, and M. A. Palazzolo. Jan. 1980. 146 p. refs.
(Contract DOT-OS-70056)
(PB80-184203; UMICH-015657; DOT-SPA-DPB-50-79-16) Avail: NTIS HC A07/MF A01 CSCL 07D

Ultrasonically induced interfacial instability and cavitation were used to produce emulsions of water-in-gasoline, no. 2 diesel oil, no. 4 heating oil and no. 6 fuel oil without the addition of surfactants. Compressibility measurements are presented for each of the four fuel oils as a function of water volume fraction. Measurements are also presented for no. 4 heating oil as a function of temperature. Corrosion rates for mild steel were measured in emulsions of rates for mile steel were measured in emulsions of no. 6 fuel oil at 10% volume fraction of water at 70 C and 90 C. The viscosity of oil-in-water emulsions was studied as a function of volume fraction of oil and of particle size distribution of oil in the emulsions. The stability of the oil-in-water emulsion was studied for the case of simultaneous creaming and flocculation. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-31524 Iowa State Univ. of Science and Technology, Ames.
FAST DIFFUSION AND ELECTROMIGRATION OF METALLIC SOLUTES IN THORIUM Ph.D. Thesis
William Nile Weins. 1980. 90 p.
Avail: Univ. Microfilms Order No. 8019675

The electrotransport and chemical diffusion of iron, cobalt, and nickel in thorium are described. The transport parameters D and Z were measured in both alpha and beta-thorium. The experimental results indicate that these solutes are fast-diffusing species in alpha-thorium. The internal friction behavior associated with these solutes in thorium was investigated. Results indicate that there are two relaxation peaks associated with each of these solutes in thorium. Experimental values of the activation energy associated with one of the relaxation peaks are coincident with the values of activation energy for diffusion and suggest that both processes are controlled by the same mechanism. Considerations of other data indicate that this mechanism involves an interstitial defect. Dissert. Abstr.

N80-31525 Polytechnic Inst. of New York.
A THEORETICAL AND EXPERIMENTAL STUDY OF THE MECHANICAL BEHAVIOR OF ALPHA-BETA TiMn ALLOYS Ph.D. Thesis
Sreeramamurthy Ankem. 1980. 248 p.
Avail: Univ. Microfilms Order No. 8019386

Elastic interactions at the Widmanstatten alpha-beta titanium alloy interfaces that rise due to compatibility requirements have been calculated for various orientations if the interface with respect to the stress axis. The stress and strain distributions in alpha-beta Ti-Mn alloys have been calculated as a function of strain, volume fraction of phases, and particle size. Near the interface, strains in beta are higher than they are away from the interface. In alpha the strains are lower near the interface. Stresses have the same behavior as the strains. The average strain in alpha is higher than the average strain in beta. The ratio of the strain in alpha, epsilon sub alpha, to the strain in beta, epsilon sub beta is minimum for a given strain near 50 volume percent of beta. This ratio increases with strain up to 25% the limit of total strain examined. The ratio decreases with decreasing particle size and uniformity of strain increases with decreasing particle size. Interface sliding was more prominent in Wid structures than equiaxed structures. Various room temperature tensile properties have been determined for both Wid. alpha and equiaxed alpha microstructures for six Ti-Mn alloys. Dissert. Abstr.

N80-31526 Utah Univ., Salt Lake City.
THE EFFECT OF MIXED TRANSITION-METAL DOPANTS ON THE HIGH TEMPERATURE CREEP OF POLYCRYSTALLINE ALUMINA Ph.D. Thesis
Yasuro Ikuma. 1980. 165 p.
Avail: Univ. Microfilms Order No. 8019063

High density (-99%) polycrystalline alumina doped with transition metal impurities (Fe and/or Ti, Mn + Ti, and Mg and/or Ti) was fabricated by hot pressing. Creep tests were performed on this material using a four point bend dead load technique. A range of grain sizes (5 to 300 micrometers), temperatures (1100 to 1500 C), stresses (2-17 MN/square meters and oxygen partial pressures (10 to the minus 11th power - 0.86 atm) was studied. The Mn + Ti dopant couple is by far the most effective in enhancing the creep rate of polycrystalline alumina. A creep deformation map was constructed in which constant strain rate lines were computed for variable grain sizes and impurity content. In this type of creep mapping, the range of variable over which interfacial (grain boundary) defect annihilation processes become important in diffusional creep is clearly illustrated. Dissert. Abstr.

N80-31527*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHERENCE OF ION BEAM SPUTTER DEPOSITED METAL FILMS ON H-13 STEEL
Michael J. Mirtich. 1980. 17 p. refs. Presented at the 27th Natl. Am. Vacuum Soc. Symp., Detroit, 14-17 Oct. 1980.
(NASA-TM-81585; E-562) Avail: NTIS HC A02/MF A01 CSCL 11F

An electron bombardment argon ion source was used to sputter deposit 17 different metal and metal oxide films ranging in thickness from 1 to 8 micrometers on H-13 steel substrates. The film adherence to the substrate surface was measured using a tensile test apparatus. Comparisons in bond strength were made between ion beam, ion plating, and RF deposited films. A protective coating to prevent heat checking in H-13 steel dies used for aluminum die casting was studied. The results of exposing the coated substrates to temperatures up to 700 degrees are presented. R.K.G.

N80-31528*# National Materials Advisory Board, Washington, D. C.
AMORPHOUS AND METASTABLE MICROCRYSTALLINE RAPIDLY SOLIDIFIED ALLOYS: STATUS AND POTENTIAL Final Report
Nicholas J. Grant, Carl F. Cline, Lance A. Davis, Bernard H. Kear, and Fred E. Luborsky. May 1980. 170 p. refs. Sponsored in part by NASA.
(Contract MDA903-78-C-0038)
(NASA-CR-163449; AD-A086000; NMAB-358) Avail: NTIS HC A08/MF A01 CSCL 11/6

The nature, properties, processing, and possible applications of two classes of materials are described: amorphous solids, particularly glassy metals, and metastable microcrystalline alloys. The thermodynamics and structural considerations of both amorphous and metastable metals and nonmetals are discussed in detail. The chemistry and properties of systems for which data are available also are described as are the processing limitations and methods. Application possibilities are discussed, and the report concludes with recommendations for research and development. GRA

N80-31529# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
ORGANIC METALS AND SEMICONDUCTORS: THE CHEMISTRY OF POLYACETYLENE (CH)X, AND ITS DERIVATIVES Interim Technical Report
Alan G. Macdiarmid and Alan J. Heeger. 24 Nov. 1979. 13 p. refs. Presented at the 3d Intern. Congr. of Quantum Chem., Kyoto, Japan, Oct. 1979.
(Contract N00014-75-C-0962)
(AD-A087054; TR-79-11) Avail: NTIS HC A02/MF A01 CSCL 11/9

Polyacetylene is quite remarkable in that its conductivity can be readily modified to span an extraordinarily large range. Considering possible polyacetylene derivatives, replacement of some or all of the hydrogen atoms in polyacetylene with organic

or inorganic groups, copolymerization of acetylene with other acetylenes or olefins, and the use of different dopants should lead to the development of a large new class of conducting organic polymers with electrical properties that can be controlled over the full range from insulator to semiconductor to metal. Furthermore, there is considerable potential for the possible application of a parent or doped polyacetylene to the fabrication of various types of electronic devices, solar cells, etc. GRA

N80-31530# Boeing Military Airplane Development, Seattle, Wash. Advanced Aircraft Branch.
CAST ALUMINUM STRUCTURES TECHNOLOGY (CAST) STRUCTURAL TEST AND EVALUATION, PHASE 5. PART 2: FATIGUE AND FRACTURE PROPERTIES OF CAST ALUMINUM BULKHEADS Final Report, Feb. 1977 - Jan. 1980
Christian K. Gunther Apr. 1980 72 p refs
(Contract F33615-76-C-3111; AF Proj. 486U; AF Proj. 485U)
(AD-A087336; D180-25724-2; AFWAL-TR-80-3021-PT-2)
Avail: NTIS HC A04/MF A01 CSCL 11/6

The fatigue and fracture properties of four cast A357-T6 aluminum alloy bulkheads were investigated. Constant amplitude fatigue, crack growth, and fracture toughness specimens were excised from the bulkheads for this purpose. The data obtained from these specimens confirmed the assumed properties used in the durability and damage tolerance analyses of the bulkhead. GRA

N80-31531# Boeing Military Airplane Development, Seattle, Wash. Advanced Airplane Branch.
CAST ALUMINUM STRUCTURES TECHNOLOGY (CAST) STRUCTURAL TEST AND EVALUATION, PHASE 5. PART 3: STATIC PROPERTY ALLOWABLES Final Report, Jun. 1976 - Aug. 1979
Dale L. McLellan Apr. 1980 144 p refs
(Contract F33615-76-C-3111; AF Proj. 486U; AF Proj. 485U)
(AD-A087337; D180-25724-3; AFWAL-TR-80-3021-Pt-3)
Avail: NTIS HC A07/MF A01 CSCL 11/6

This document contains static mechanical properties of A257-T6 aluminum alloy castings. Properties of castings are relatable to non-destructively measured soundness and aluminum dendrite size. A criterion is developed for design properties in terms of these physical parameters applicable to all castings of the same alloy and temper regardless of size, shape, method of production, mold materials or other process variables. GRA

N80-31532# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
[TRAPPING BY TiC PARTICLES AND TWIN FORMATION IN Fe-Ti] Status Report, 1 Nov. 1970 - 30 Apr. 1980
30 Apr. 1980 10 p refs
(Contract N00014-75-C-0265)
(AD-A085998) Avail: NTIS HC A02/MF A01 CSCL 11/6

The resistance of an HSLA steel to hydrogen embrittlement was studied and were correlated to hydrogen diffusivity data and microstructural analysis with the observed mechanical behavior of the alloy containing internal hydrogen. The effect of microstructure on subsequent hydrogen transport in the alloy with a composition of 1.37% Mn, 0.22% Ti, 0.64% C and 0.26% Si was investigated. All specimens were solution annealed followed by quenching and aging at temperatures from 600 C to 900 C. Since the only considerable change in the microstructure for heat treatments, compared to the the as-quenched condition, is the nucleation and growth of TiC particles, it is reasonable to believe that they are responsible for the irreversible trapping. After ambient cathodic charging of hydrogen into three different titanium and carbon content iron alloys, only one showed twinning formation. For all charging times of this alloys, twins were found at or near TiC particles with the size of twins increasing as the amount of hydrogen increased. A.R.H.

N80-31533# Massachusetts Inst. of Tech., Cambridge. Corrosion Lab.
HYDROGEN INDUCED INTERGRANULAR CRACKING OF NICKEL-BASE ALLOYS
M. Kurkela, T. S. F. Lee, and R. M. Latanision Jul. 1980 107 p refs
(Contract N00014-78-C-0002; NR Proj. 036-127)
(AD-A087305; TR-4) Avail: NTIS HC A06/MF A01 CSCL 11/6

This report is intended to summarize the activities pursued during the second year of a program directed toward an evaluation of the susceptibility of nickel and nickel base alloys to embrittlement by cathodically produced hydrogen. GRA

N80-31534# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWDERS
R. E. Lewis Jun. 1980 15 p refs
(Contract F33615-78-C-5203; DARPA Order 3417)
(AD-A087401; LMSC-D770654) Avail: NTIS
HC A02/MF A01 CSCL 11/6

Advanced aluminum alloys are to be developed that will provide major payoffs for important new aircraft, spacecraft, and missile systems in the next decade. Payoffs will result from weight savings of structural components which, in turn, lead to increased range, payload, service life, and decreased life-cycle cost. The objective of this program is to develop advanced aluminum alloys from rapidly solidified particulate that meet specific property goals. In addition, the program is to establish a metallurgical basis suitable for manufacturing scale-up and application to new weapon systems. GRA

N80-31535# Boeing Military Airplane Development, Seattle, Wash. Advanced Aircraft Branch.
CAST ALUMINUM STRUCTURES TECHNOLOGY (CAST). PHASE 5: STRUCTURAL TEST AND EVALUATION. PART 1: FULL SCALE TEST Final Report, Feb. 1977 - Jan. 1980
Christian K. Gunther Apr. 1980 114 p refs
(Contract F33615-76-C-3111; AF Proj. 486U; AF Proj. 485U)
(AD-A087807; D180-25724-1; AFWAL-TR-80-3021-Pt-1)
Avail: NTIS HC A06/MF A01 CSCL 11/6

Full scale tests were conducted on the cast A357-T6 aluminum alloy bulkheads developed and manufactured for the Cast Aluminum Structures Technology (CAST) program. One test article was subjected to four lifetimes of durability and damage tolerance testing and a second was subjected to additional two lives of damage tolerance testing including residual strength tests to and exceeding ultimate loads. The full scale test program successfully demonstrated that the static strength, durability, and damage tolerance requirements for the bulkhead were met. GRA

N80-31536# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
TRANSPIRATION-COOLED NOSETIP DEVELOPMENT Final Report, Jul. 1978 - Jan. 1980
N. C. Campbell, G. F. Pittinato, and M. T. Martin Jun. 1980 111 p
(Contract DAAG46-78-C-0034; DA Proj. 1W1-62113-A-661)
(AD-A087837; AMMRC-TR-80-30) Avail: NTIS
HC A06/MF A01 CSCL 11/6

A 316L stainless steel transpiration cooled nosetip for a high performance missile system was designed and fabricated using powder metallurgy techniques. The geometry of the nosetip was established, and permeability requirements were analytically defined. A parametric study of subscale billets determined permeability as a function of powder size and sintering temperature. Near-net-shape billets were fabricated, and machining procedures for the porous material were established. A comparison was made between the actual and calculated gas flow through the nosetip over its entire surface. Two nosetips were successfully tested in a thermal environment approximating the flight environment at the Edwards Air Force Base Rocket Propulsion Laboratory (RPL). Tests were conducted at 0 degree and 10 degree angles of attack. GRA

N80-31537# International Nickel Co., Inc., Suffern, N. Y. Research and Development Center.
METALLURGICAL STUDIES OF HYDROGEN STORAGE ALLOYS Final Report
Apr. 1980 218 p refs
(Contract DE-AC02-76CH-00016)
(DOE/CS-0016/T2) Avail: NTIS HC A10/MF A01

The surface poisoning of metal hydrides by impurities in the

hydrogen used. Alloys investigated were LAN15, FeTi, and Fe Mn Ti. Gaseous impurities studied were O2, H2O, and Co. The nature of the surface structures formed, and consequently the degree of poisoning varies markedly from alloy to alloy and from impurity to impurity. A number of rate limiting reaction steps are apparent and examples of complex compound film formation, chemisorption, and possibly physisorption can be seen. Results show the hope of developing surface structures with significant resistance to impurity gases and especially the possibility of designing practical regeneration cycles. DOE

N80-31538# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
METALLURGICAL ANALYSIS AND HIGH TEMPERATURE DEGRADATION OF THE BLACK CHROME SELECTIVE ABSORBER
Carl M. Lampert. Mar. 1980. 19 p. refs. Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 21-25 Apr., 1980. Submitted for publication.
(Contract W-7405-eng-48)
(LBL-10293; CONF-800439-6) Avail: NTIS HC A02/MF A01

A well known coating, Harshaw Chemical Company's Chromonyx was selected for detailed scrutiny of its properties and degradation modes when exposed to high temperatures. Both asplated and annealed microstructural models were presented. Technical means used in this microstructural characterization were: scanning and transmission electron microscopy, Auger depth profiling, hemispherical reflectance and energy dispersive X-ray analysis. From these results a physical metallurgical model for wavelength selective properties of the coating was developed. Thus, it was observed that black chrome degraded as Cr2O3 oxide particles grew and chromium depleted. This effect was pronounced in air and to a lesser degree in medium vacuum. Oxidation by preferential diffusion and outgassing which causes structural changes, may take place. DOE

N80-31539# General Atomic Co., San Diego, Calif.
EFFECTS OF SURFACE CONDITION ON THE CORROSION OF CANDIDATE STRUCTURAL MATERIALS IN A SIMULATED HTGR-GT ENVIRONMENT
L. D. Thompson. Feb. 1980. 107 p. refs.
(Contract EY-76-C-03-0167; GA Proj. 6400)
(GA-A-15673) Avail: NTIS HC A06/MF A01

A simulated high temperature gas cooled reactor helium environment was used to study the effects of surface finish conditions on the subsequent elevated temperature corrosion behavior of key candidate structural materials. The environment contained helium with 500 micro-atmospheres H2/50 micro-atmospheres CO/50 micro-atmospheres CH4/ 0.5 micro-atmospheres H2O at 900 C with total test exposure durations of 3000 hours. Specimens with lapped, grit-blasted, pickled, and preoxidized surface conditions were studied. Materials tested included two cast superalloys, IN 100 and IN 713LC, one centrifugally cast high temperature alloy, HK 40 one oxide dispersion strengthened alloy, Inconel MA 754, and three wrought high temperature alloys, Hastelloy Alloy X, Inconel Alloy 617, and Alloy 800H. DOE

N80-31540# General Atomic Co., San Diego, Calif.
CARBURIZATION OF AUSTENITIC ALLOYS BY GASEOUS IMPURITIES IN HELIUM
G. Y. Lai and W. R. Johnson. Mar. 1980. 48 p. refs. Submitted for publication.
(Contract DE-AT03-76ET-35300; GA Proj. 6400)
(GA-A-15790) Avail: NTIS HC A03/MF A01

Corrosion tests of Alloy 800H, Inconel Alloy 617 and Hastelloy Alloy X in helium containing various amounts of H2, CO, CH4, H2O and CO2 were conducted in a temperature range from 649 C to 1000 C for exposure time up to 10,000 hr. Four different helium environments were investigated. The results show that the carburization kinetics in low oxygen potential environments are significantly higher, approximately an order of magnitude higher at high temperatures, than those in high oxygen potential environments for all three alloys. Thermodynamic analyses indicated no significant differences in the thermodynamic carburization potential between low and high oxygen potential environments. It is believed that the enhanced carburization kinetics observed in the low oxygen potential environments were related to kinetic effects. A qualitatively mechanistic model was proposed to explain the enhanced kinetics. The present results further suggest that controlling the oxygen potential of the service environment can be an effective means of reducing carburization of alloys. DOE

N80-31541# Aluminum Co. of America, Alcoa Center, Pa.
PRODUCTION OF ALUMINUM-SILICON ALLOY AND AND FERROSILICON AND COMMERCIAL PURITY ALUMINUM BY THE DIRECT REDUCTION PROCESS. Interim Technical Report, 1 Jun. - 31 Aug. 1979
M. J. Bruno. Sep. 1979. 22 p.
(Contract EC-77-C-01-5089)
(CONS-5089-8; ITR-4) Avail: NTIS HC A02/MF A01

Burden materials ground to -65 mesh prior to agglomeration compared favorably to -200 mesh grinds. Ball forming agglomeration was developed for bauxite-clay-coke mixes. The balls produced had higher strength and abrasion resistance than extrusions made from the same formulations. Neutron activation analysis for Al, Si, Fe and oxygen combined with the analysis of Ti by atomic absorption and carbon by combustion provided the best analytical procedure for reactor metal samples. Continuous, steady-state operation produced significant quantities of coalesced metal alloy; individual metal yields for Al, Si, Fe and Ti ranged from 64 to 93%. The mechanical Auger minimized burden bridging during the induction heated runs. Extensive phase analyses were completed on metal product samples by optical microscope techniques, resulting in identification of phases and understanding of relationships between phases formed. DOE

N80-31542# Northwestern Univ., Evanston, Ill.
INVESTIGATION OF DISPERSED IRON ALLOY CATALYST IN THE CARBON MONOXIDE-HYDROGEN SYNTHESIS REACTION. Progress Report, 1 Aug. 1979 - 31 Jul. 1980
John B. Butt and Lyle H. Schwartz. Apr. 1980. 12 p. refs.
(Contract DE-AC02-78ER-04993)
(COO-4993-2) Avail: NTIS HC A02/MF A01

A series of Fe-Ni, Fe-Co, Fe-Cu and Fe-K catalysts supported on SiO2 were prepared, characterized, and investigated with respect to activity and selectivity in CO-H2 synthesis. Several silica supported iron nitrides were also prepared and characterized. Efforts directed toward the identification of the particle sizes and phases formed upon preparation, calcination, reduction and carburization are described. It was found that the conditions of preparation strongly affect the nature of the resulting catalyst, both with respect to alloy homogeneity, metal particle size, and catalytic activity. For the Fe system in particular, standard methods of preparation via impregnation and calcination result in very large particle (ca. 80 nm) composites of smaller individual grains (ca. 10 nm). Characterization via X-ray or Moessbauer, however, reveals only the characteristic dimension of the granules and not of the composite particles. DOE

N80-31543# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
STRAIN HARDENING AND DUCTILITY OF IRON: AXISYMMETRIC vs PLANE STRAIN ELONGATION
George Langford. May 1980. 72 p. refs.
(Contract DE-AC02-76ER-04072)
(DOE/ER-04072/3) Avail: NTIS HC A04/MF A01

The strain hardening of iron at high strains in plane strain elongation (strip drawing) is shown to fall increasingly below that of drawn iron wires at true strains above 2, going through zero strain hardening at epsilon = 3.0, and becoming strongly negative thereafter, at least up to epsilon = 4.1. High resolution selected area electron diffraction was used to map the size, shape and crystallographic orientations of a group of about 50 contiguous cells centered around an incipient shear band in an edge section of a strip drawn to epsilon = 1.8. This map shows no textural instability or change in orientation associated with the shear band, although it does show substantial misorientations throughout the group of cells, the axis of these misorientations lying in the same directions as the trace of the shear band. The only instability seen in this shear band is microstructural: the slip distances in the two primary slip directions are quite anisotropic, being much longer along the trace of the shear band. DOE

N80-31544# Teel (R. B.) and Associates, Chatham, N.J.
STRESS-CORROSION CRACKING OF STEELS IN AMMONIA: A SURVEY WITH CONSIDERATION ON GIVEN OTEC DESIGN
R. B. Teel (Teel R. B. and Associates) ANL Mar. 1980 44 p refs
(Contract W-31-109-eng-38)
(ANL/OTEC-BCM-008) Avail: NTIS HC A03/MF A01

Carbon steel, alloy steel, and high-strength, quenched and tempered steel, when under applied or residual stress and especially when cold formed and/or welded without subsequent thermal stress relief, are subject to failure by stress-corrosion cracking (SCC) in air contaminated dry ammonia. Water as well as hydrazine when present in small amounts are effective inhibitors in an all steel system. Where water has proven effective as an inhibitor of SCC in an all steel system, it may not be adequate in a mixed metal system. With aluminum tubes, the tube sheet will either have to be solid aluminum, aluminum clad steel, or some nonconductive coating will be necessary to effectively remove the cathodic alloy from the galvanic circuit. Research is required to determine the severity of the coupling effect between dissimilar alloys in ammonia especially the possibility of accelerated SCC failures of stressed steel where the presence of an inhibitor in the ammonia may not be sufficient to override the galvanic coupling effect. DOE

N80-31545# Defence Research Information Centre, Orpington (England).
A STUDY ON MECHANICAL PROPERTIES OF HEAVY ALLOYS
Eun Chung and Dong Nyung Lee London Feb. 1980 19 p refs Transl. into ENGLISH from Taehan Kunsok Hakhoe Chi (Korea), v. 17, no. 1, 1978 p 38-45 Sponsored by UK Minister of Education
(DRIC-T-5966; BR73104) Avail: NTIS HC A02/MF A01

Liquid phase sintering of four tungsten alloys was studied. Mechanical properties and hardness were examined. The compositions of the alloys were respectively: (1) 94% W-3% Ni-3% Fe, (2) 94% W-2.5% Ni-2.5% Fe-1% Co, (3) 94% W-2.5% Ni-2.5% Fe-1% Mo, (4) 94% W-2.5% Ni-2.5% Fe-1% Mn. It was found that coarsening of tungsten particles in the specimens during sintering followed the diffusion controlled growth mechanism, and that hardness decreased with increased sintering time. Author (ESA)

N80-31546# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
THE ROLE OF ELECTRON MICROSCOPY BY TRANSMISSION IN THE STUDY OF RADIATION DAMAGE IN METALS [IL RUOLO DELLA MICROSCOPIA ELETTRONICA PER TRASMISSIONE NELLO STUDIO DEI DANNI DA RADIAZIONE NEI METALLI]
G. Chevallard and D. Wenger Dec. 1979 87 p refs
(CISE-1541) Avail: NTIS HC A05/MF A01

The applications of transmission electron microscopy to the study of radiation damage in metals are discussed. The principles of this technique are reviewed and the method compared with other methods. The interpretation of the micrography contrast effects due to metal defects and the interpretation rules used to identify these defects are examined. The defect population analysis, necessary for the characterization of the microstructure before and after the irradiation, is discussed. Author (ESA)

N80-31547# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
ELECTRONIC PROPERTIES OF MATERIALS AND CORROSION PHENOMENA. A NONCONVENTIONAL APPROACH TO THE MECHANISM OF STRESS CORROSION CRACKING [PROPRIETA ELETTRONICHE DEI MATERIALI E FENOMENI DI CORROSIONE. UN APPROCCIO NON CONVENZIONALE AI MECCANISMI DI STRESS CORROSION CRACKING]
M. Martinelli and C. Ronchetti Nov. 1978 59 p refs In ITALIAN; ENGLISH summary
(CISE-N-188) Avail: NTIS HC A04/MF A01

The perturbations induced on metal free electrons by the mechanical stress state are analyzed, as well as the consequences of such perturbations on the metal-solution interface and then on the electrochemical parameters. It is found that the metal strain state, both from an elastic and a plastic standpoint, has remarkable effects on the metal fermi energy and work function and that such effects influence the redox potential of an electrode made up with the same material. A working hypothesis is formulated, where the modification of the metal electronic state is the main cause for the onset of material areas with a different electrochemical behavior. Author (ESA)

N80-31548# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
COMPARISON OF FRACTURE TOUGHNESS IN TITANIUM ALLOYS IMI 550 AND IMI 551
R. J. H. Wanhill 14 May 1980 21 p refs
(Contract NIVR-1696)
(NLR-TR-78143-U) Avail: NTIS HC A02/MF A01

Fracture toughness tests on two high strength titanium alloys, IMI 550 and 551, showed that the higher strength alloy, IMI 551, had a much lower toughness. The alloys were very similar in microstructure and fracture mechanisms. A number of model formulations for predicting fracture toughness were compared with the experimental results. This comparison indicated a number of parameters to be important, namely yield stress, elastic modulus, plane strain fracture strain, strain hardening exponent, and microvoid (dimple) diameter. The observed increase in fracture strain, dimple diameter, and fracture toughness with decreasing strength can be rationalized by voids occuring earlier during deformation and by voids initiating at many sites inactive in the lower strength material. Author (ESA)

N80-31549# Texas Engineering Experiment Station, College Station. Industrial Economics Research Div.
GULF COAST MANGANESE NODULE PROCESSING PLANT LOCATION CRITERIA
Daniel Bragg Aug. 1979 167 p
(Grant NOAA-04-7-158-44105)
(PB80-182082; NOAA-80041102) Avail: NTIS HC A08/MF A01 CSCL 11F

A number of physical, economic, regulatory and attitudinal characteristics of the coastal area of five states making up the Gulf Coast region of the U.S. are examined. This effort was directed at identifying those areas suitable for further study as potential locations for onshore manganese nodule processing plants. It was concluded that: the impact of the proposed plants will be no different than that of most large process-type plants already in operation in the region; the benefits of the proposed plants should more than offset the demand for local, tax supported services. Early interaction between government and private enterprise should help assure the development of a commercially viable, environmentally compatible nodule processing industry. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-31550 Lehigh Univ., Bethlehem, Pa.
THE FATIGUE CRACK PROPAGATION BEHAVIOR OF SEMI-CRYSTALLINE POLYMERS Ph.D. Thesis
Philip Eric Bretz 1980 206 p
Avail: Univ. Microfilms Order No. 8019707

The effect of molecular weight (MW) and plasticizer content on the fatigue crack propagation (FCP) response of semi-crystalline polymers is evaluated. In addition, a comprehensive comparison of crack growth rates in amorphous and semi-crystalline polymers is made. Fatigue tests were performed on specimens of nylon 66 (N66) and polyacetal (PA) ranging in MW from 17,000-34,000 and 30,000-70,000, respectively. While toughness increased by 30% with MW in this range, crack growth rates decreased by a factor of 3.5 in N66 and a factor of 5 in PA. As for the effect of plasticization, crack tip blunting dominated at low water contents (< or ~ 2.5%) and reduced FCP rates, while the modulus decrement at higher moisture levels accelerated crack velocity. A comparison of crack growth rates for semi-crystalline and amorphous polymers confirmed the

superior fatigue resistance of the multi-phase materials. A positive correlation between reduced FCP rates and increased toughness was observed for semi-crystalline polymers. Fracture surface morphology was examined to ascertain the mechanisms of cyclic damage and fatigue crack propagation. Dissert. Abstr.

N80-31551*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHOSPHORUS-CONTAINING BISIMIDE RESINS Patent Application
Indra K. Varma (National Academy of Science - National Research Council, Washington, D.C.), George M. Fohlen, and John A. Parker, inventors (to NASA) Filed 5 Aug. 1980 12 p
(NASA-Case-ARC-11321-1; US-Patent-Appl-SN-175452) Avail: NTIS HC A02/MF A01 CSCL 07C

Fire resistant resins particularly useful for making laminates with inorganic fibers such as graphite fibers are made by condensation of an ethylenically unsaturated cyclic anhydride with bis (diaminophenyl) phosphine oxide, and by addition polymerization of the bisimide so obtained. Up to about 50%, on a molar basis, of benzophenonetetracarboxylic acid anhydride can be substituted for some of the cyclic anhydride to alter the properties of the products. Graphite cloth laminates made with these resins have shown 800 C char yields greater than 70% by weight in nitrogen. Limiting oxygen indexes of more than 10% were determined for these resins. NASA

N80-31552*# AiResearch Mfg. Co., Phoenix, Ariz.
THE 3500 HOUR DURABILITY TESTING OF COMMERCIAL CERAMIC MATERIALS Interim Report
W. D. Carruthers, D. W. Richerson, and K. W. Benn Jul. 1980 237 p refs
(Contracts DEN3-27; EC-77-A-31-1040)
(NASA-CR-159785; DOE/NASA/0027-80/1; AiResearch-31-3575A) Avail: NTIS HC A11/MF A01 CSCL 11B

A two year durability testing program to evaluate four commercially available ceramic materials under simulated automotive gas turbine combustor discharge conditions was conducted. Conditions included extended cyclic thermal exposures up to 2500 F and 3500 hours. Selected for evaluation were Norton NCX-34 hot pressed silicon nitride, AiResearch RBN 101 reaction bonded silicon nitride, Carborundum pressureless sintered d-siC and British Nuclear Fuels, Ltd. Retel reaction sintered silicon carbide marketed by Pure Carbon Co. These materials initially were exposed to 350 hours/1750 cycles at 1200 and 1270 C (2200 and 2500 F). Subsequent exposure to 1050, 2100, and 3500 hours were performed on the materials maintaining 50 percent of baseline strength after the initial exposure. Additional evaluations of exposed bars included dimension changes, weight changes, dye penetrant, specific damping capacity changes, scanning electron microscope fractography and X-ray diffraction. S.F.

N80-31553# Union Carbide Corp., Parma, Ohio. Carbon Products Div.
ACTIVATED CARBON FABRIC FROM PITCH Final Report, 15 Jun. 1978 - 14 Sep. 1979
S. M. Boszor Jun. 1980 39 p refs
(Contract DAAK60-78-C-0053; DA Proj. 1L1-62723-AH-98)
(AD-A087030; PR-79-562; NATICK/TR-80/015; CE-MEL-214) Avail: NTIS HC A03/MF A01 CSCL 11/5

A project was undertaken to determine whether pitch-based carbon cloth could be made into an active cloth suitable for clothing protective against hazardous chemical environments. The experiments involved activating pitch-based cloth by standard methods in steam and CO2 in a laboratory reactor. Cloth with sorptivities exceeding 50% CCl4 by weight, surface areas exceeding 800 sq m/gm, and breaking strengths exceeding 5 kg per 25 mm wide strip were produced. Conditions were optimized to produce cloth of the highest area sorptivities for NARADCOM evaluation. GRA

N80-31554# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
EFFECT OF OXIDIZING FUELS ON AIRCRAFT FUEL SYSTEM ELASTOMERS AND SEALANTS Final Report
C. Nadler 20 May 1980 19 p ref
(AD-A087267; NADC-80076-60) Avail: NTIS HC A02/MF A01 CSCL 21/4

Jet fuels containing peroxides resulting from hydrogenation during refining have potential for damaging fuel system elastomeric components. Immersion tests were conducted for 1000 hours between 130 - 165 F in JP-5 containing 1, 5, and 10 meq. peroxide/1000 gm fuel with various fuel system sealants and elastomers. Damage thresholds were indicated and maximum allowable peroxide contents were recommended. GRA

N80-31555# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
SEMICONDUCTING AND METALLIC COVALENT POLYMERS: (CH)x AND ITS DERIVATIVES Interim Technical Report
Alan G. MacDiarmid and Alan J. Heeger 8 Jul. 1980 13 p refs Presented at ACS Meeting, San Francisco, Sep. 1980
(Contract N00014-75-C-0962; NR Proj. 356-602)
(AD-A086941; TR-80-5) Avail: NTIS HC A02/MF A01 CSCL 11/9

Polyacetylene, (CH)x, is the simplest possible conjugated organic polymer and is therefore of special fundamental interest. It can be prepared in the form of lustrous, silvery, flexible, polycrystalline films having any desired cis/trans content by catalytic polymerization of gaseous acetylene, C2H2. The cis-rich films can be stretched easily at room temperature in excess of three times their original length with concomitant partial alignment of the (CH)x fibrils. Dark red gels of toluene in (CH)x may be prepared using a lower catalyst concentration. Highly porous, very low density, 'foam-like' (CH)x can be obtained from these gels. Both cis- and trans-(CH)x are p-type semiconductors which can be treated with a variety of p- or n-type dopants with concomitant increase in conductivity to give a series of semiconductors and ultimately, 'organic metals'. This report will be directed primarily towards a description of the more chemically oriented aspects of (CH)x and its derivatives. GRA

N80-31556# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Materials Engineering.
FORMATION AND FAILURE OF ELASTOMER NETWORKS VIA THERMAL, MECHANICAL AND SURFACE CHARACTERIZATION Final Technical Report, 24 Aug. 1978 - 30 Jun. 1980
David W. Dwight and James E. McGrath Dec. 1979 61 p refs
(Contract DAAK30-78-C-0098)
(AD-A087284; TARADCOM-12498) Avail: NTIS HC A04/MF A01 CSCL 11/10

This work focussed upon development of ESCA, SEM/EDAX, TGA, DSC and TMA methodologies for synthetic elastomer compounds typically used in tank track pad service by the U.S. Army. The initial goal was to develop a molecular model of the failure mechanisms that lead to costly pad replacement. Exploratory measurements were conducted on fully compounded, uncured rubber, and pre- and post-service track pads. Studied also were laboratory-prepared samples involving variable matrix (SBR, EPDM and 50/50 SBR/BR) as well as zinc oxide particle shape and size. An initial data base has been accumulated with surface and thermo-mechanical analysis that could provide useful structure-property information for further research and development of engineering elastomers. GRA

N80-31557# Pennsylvania Univ., Philadelphia. Lab. for Research on Structure of Matter.
ELECTRICAL TRANSPORTATION DOPED POLYACETYLENE Interim Report
Y. W. Park, A. J. Heeger, M. A. Ruy, and A. G. Macdiarmid 8 Jul. 1980 60 p refs Submitted for publication
(Contract N00014-75-C-0962; Grant NSF DMR-76-80994; NR Proj. 356-602)
(AD-A087289; TR-80-4) Avail: NTIS HC A04/MF A01 CSCL 11/9

The results of an experimental study of electrical conductivity and thermopower in doped polyacetylene are reported. Included are measurements on both as-grown and partially oriented films doped with iodine and AsF6; (CH(AsF5)sub y)sub x and (CH(I3)sub y)sub x where y covers the full doping range. The data indicate three important concentration regimes; the dilute limit (y-0.001),

the transitional region (0.001-y-0.01), and the metallic state (y > 0.01. GRA

N80-31558# McDonnell Aircraft Co., St. Louis, Mo. Material and Process Development Dept.
CHEMICAL CHARACTERIZATION AND QUALITY CONTROL FOR AN ADHESIVE Final Report, 13 Nov. 1978 - 13 Feb. 1980
T. A. Sewell Feb. 1980 48 p refs
(Contract N00019-79-C-0064)
(AD-A087739) Avail: NTIS HC A03/MF A01 CSCL 11/1
The objective of this program has been to develop analytical test methods applicable to an adhesive system and demonstrate the viability of these techniques for in-plant quality control and to establish acceptance criteria with statistically valid accept/reject limits. GRA

N80-31559# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
MEASUREMENT OF THERMOPHYSICAL PROPERTIES OF EPOXY/DIAMINE POLYMERS AND ASSOCIATED ADDITIVE PROPERTIES
Gilbert F. Lee 11 Oct. 1979 37 p refs
(AD-A087833; NSWC/WOL/TR-78-195) Avail: NTIS HC A03/MF A01 CSCL 11/9
This report describes work done on several epoxy/diamine polymers. The goal of this work was to determine the coefficient of thermal expansion, specific heat capacity, and the structure to property relationship. Also the density, coefficient of thermal expansion, and heat capacity were predicted using the method of additive parameters. A comparison between the experimental and predicted properties was made to determine the accuracy of this method. GRA

N80-31560# Army Materials and Mechanics Research Center, Watertown, Mass. Ceramics Research Div.
CERAMICS FOR VEHICULAR ENGINES: STATE-OF-THE-ART Final Report
R. Nathan Katz Jun. 1980 25 p refs Presented at the 4th Conf. on Mod. Ceram. Technol., St. Vincent, Italy, 28-31 May 1979
(DARPA Order 1849)
(AD-A087589; AMMRC-MS-80-2) Avail: NTIS HC A02/MF A01 CSCL 11/2
The use of silicon-based, high performance ceramics offers significant potential for energy conservation in heat engine technology. In particular, three families of silicon-based engineering ceramics, the alumino silicates, the silicon nitrides, and the silicon carbides, possess unique combinations of properties which make these materials very attractive candidates for components in gas turbine, diesel, and Stirling engines. After a brief discussion of the design process with brittle materials, this paper will review some of the relevant properties of various members of each of these three families of engineering materials, as processed by a variety of routes. Some advantages and disadvantages of the major materials/process combinations will be discussed. Selected examples of applications of a variety of materials/process combinations as applied to vehicular engine technology will be presented. GRA

N80-31561# Rensselaer Polytechnic Inst., Troy, N. Y.
MELT RHEOLOGY OF BLOCK COPOLYMERS IN RELATION TO MELT STRUCTURE Final Report, 24 Sep. 1976 - 23 Mar. 1980
C. I. Chung 23 Jun. 1980 33 p refs
(Grants DAAG29-76-G-0334; DAAG29-78-G-0178)
(AD-A087484; CIC-ARO-80-1; ARO-14149.3-MS) Avail: NTIS HC A03/MF A01 CSCL 11/9
It is well known that block copolymers composed of incompatible polymers have multiphase structure, each component polymer being separated into its own phase, and their multiphase structure leads to unusual physical properties. In particular, block copolymers composed of a soft polymer as the major component and a hard polymer as the minor component can have elastomeric properties since the hard polymer blocks from different molecules segregate into hard domains dispersed in the soft matrix of the soft polymer blocks and the hard domains serve as crosslinking and reinforcement. Some block copolymers of this nature are now successfully used as thermoplastic elastomers. Block copolymers also exhibit unusual melt rheological properties notably very high viscosity and elasticity in comparison to the component homopolymers of equal molecular weight. The unusual melt rheological properties have been attributed to the remnants of the multiphase structure which persist far above the glass transition or melting points of the component polymers. GRA

N80-31562# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
ANALYSIS OF FLUORIDE IN POLYMER MATERIALS
Benny R. Richardson May 1980 12 p refs
(Contract DE-AC04-76DP-00487)
(MHSMP-80-23) Avail: NTIS HC A02/MF A01
In order to determine whether bis (2,2-dinitro-2-fluorethyl) formal is present in polymers, a fluoride-specific ion electrode was tested. Interference was eliminated by means of matrix matching. The method was calibrated. DOE

N80-31563# California Univ., Livermore. Lawrence Livermore Lab.
ANALYTICAL TESTING AND CHARACTERIZATION OF THREE POLYSILOXANE GUMS
J. R. Kolb, W. E. Cady, E. S. Jessop, and D. M. Hoffman 28 Apr. 1980 19 p refs Presented at the JOWOG Meeting, Kansas City, Mo., 16-18 Jun. 1980
(Contract W-7405-eng-48)
(UCRL-84351; CONF-800628-1) Avail: NTIS HC A02/MF A01
The development of characterization methodology for silicone gums as well as the concomitant chemical and physical analyses of the polysiloxanes RG97, SE54 and Y3976 are discussed. Procedures for the determination of anti M/sub w/, anti M/sub n/, and MWD vinyl and phenyl contents of the gums by magnetic resonance or chromatographic techniques, and volatile content of the gums by thermogravimetric analysis are briefly addressed. A comparison of the siloxane gums indicates that the random SE54 is a high phenyl content, high molecular weight, low volatile resin of high quality. RG97 is in contrast a relatively low molecular weight, high volatile content gum that is inferior to SE54. The developmental material Y3976, which is synthesized by a different procedure, is close in properties to the SE54 gum but is somewhat lower in phenyl content. DOE

N80-31564# California Univ., Livermore. Lawrence Livermore Lab.
SYNTHESIS OF BLOCK COPOLYMERS OF METHYL SILOXANE, PHENYL SILOXANE, VINYL SILOXANE, ETCETERA Summary Report, 1 Aug. 1978 - 30 Jun. 1979
J. A. Ibemsei 30 Jun. 1979 7 p refs
(Contract W-7405-eng-48)
(UCRL-15159) Avail: NTIS HC A02/MF A01
Synthesis of homo poly(dimethylsiloxane) PDMS, homo poly(diphenylsiloxane PDPS, and di and tri block copolymers of PDMS and PDPS were carried out by anionic living polymerization, using the following reagents: hexamethylcyclotrisiloxane, HMTS and hexaphenylcyclotrisiloxane, HPTS (monomers), n-BuLi and dilithium diphenyldisilanolate, DLS (initiators), DMSO and THF (promotors) and Toluene (solvent). Lithium based catalysts were used in order to minimize siloxane rearrangement (equilibration) reactions. DOE

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling, and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N80-31565 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE 16TH JANNAF COMBUSTION MEETING, VOLUME 1
Thomas W. Christian, ed. Dec. 1979 744 p refs Meeting held in Monterey, Calif., 10-14 Sep. 1979 4 Vol.
(Contract N00024-78-C-5384)

(AD-A084680; AD-E500148; CPIA-Publ-308-Vol-1) Avail: Issuing Activity CSCL 21/9

Topics on deflagration-to-detonation transition (DDT) and on combustion within guns are presented. Subjects discussed include: impact DDT and sympathetic detonation; DDT of granulated propellants; stress, fracture, and ignition processes involved in DDT; screening tests for DDT; liquid propellant gun technology; charge design and gun propellant combustion; gun ignition processes and mechanisms; and gun modeling and performance. For individual titles, see N80-31566 through N80-31587.

N80-31566 Los Alamos Scientific Lab., N. Mex.
PRIMER ON SDT, XDT, PICKUP, AND SYMPATHETIC DETONATION
Louis C. Smith and Bobby G. Craig. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1. Dec. 1979. p 1-13. refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

The chain of events underlying accidental detonation is discussed, beginning with charge breakup and/or ignition. Deflagration, shock formation, and then shock detonation transition (SDT) all constitute the deflagration detonation transition (DDT) phase. Detonation waves, defined as intense, reactive shock waves, are analyzed as well as other less reactive types of shock waves. The chain of events for sympathetic detonation, XDT, and pickup are also presented. E.D.K.

N80-31567 Los Alamos Scientific Lab., N. Mex.
USE OF FLASH X-RAY AS A DIAGNOSTIC TOOL IN THE DYNAMIC TESTING OF PROPELLANTS AND ROCKET MOTORS
L. E. Bryant and J. A. Bertola (Hercules, Inc., Magna, Utah). *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1. Dec. 1979. p 15-26 (For primary document see N80-31565 22-28)
(Contract N00030-78-MO-78007)
Avail: Issuing Activity CSCL 21/9

A brief introduction to the technique of flash X-ray is given. Flash X-ray applications at 150 kV, 480 kV, and 2 MeV are explained as to purpose of tests and flash X-ray diagnostics. The parameters of these tests are given as are pictures of the X-ray results with explanations of the images and the conclusions drawn from them. Author

N80-31568 Hercules, Inc., Magna, Utah.
PROPELLANT EXPLOSIVE REACTIONS IN THE INSTRUMENTED SHOTGUN TEST
R. C. Jensen. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1. Dec. 1979. p 27-41. ref (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

Instrumented shotgun tests were conducted on crosslinked double base propellant over an impact velocity range from 0.152 to 0.914 mm microsecond. Four different types of reactions were observed. Reactions were classified based on flash X-ray photographs, blast overpressure, light intensity, and target plate damage. No sharp velocity threshold exists between the various reaction regimes. Reactions at impingement velocities less than those required to produce high order detonation are of great interest. Author

N80-31569 Hercules, Inc., Magna, Utah.
A SCALING RELATIONSHIP FOR IMPACT INITIATED DETONATIONS
B. Brown, L. Green (California Univ., Lawrence Livermore Lab.), R. Hunt (Hercules, Inc., Cumberland, Md.), and R. W. Courtney (Hercules, Inc., Cumberland, Md.). *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1. Dec. 1979. p 43-50. refs (For primary document see N80-31565 22-28)
(Contract N00030-74-C-0100)
Avail: Issuing Activity CSCL 21/9

The results of experiments on one solid propellant are combined with other similar data to yield a scaling correlation for impact initiation of detonation. A modification of the critical energy concept is used to correlate the data. The solid propellant thus considered is less impact sensitive than either TNT or PBX-9404 in impact tests. Author

N80-31570 Naval Surface Weapons Center, White Oak, Md.
BURNING TO DETONATION TRANSITION IN POROUS BEDS OF A HIGH ENERGY PROPELLANT
R. R. Dernecker, D. Price, and H. W. Sandusky. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1. Dec. 1979. p 51-78. refs (For primary document see N80-31565 22-28)
(Contract N00030-78-WR-82428)
Avail: Issuing Activity CSCL 21/9

In the high confinement apparatus it was demonstrated that pressurization along most of the predetonation column was mild. The region of accelerating pressure buildup, necessary for DDT, occurred shortly before a transition to detonation. This pressure buildup was associated with the propagation of compressive waves both forward and rearward in the predetonation period. The origin of the event producing these compressive waves appears to be a rapid heat release mechanism rather than a pressure buildup produced by confined burning. The predetonation column lengths observed in the high and low confinement systems are comparable at high porosities. Thus, the effect of confinement on the DDT susceptibility of this material at high porosities is small although confinement would be expected to be more important at lower porosities. E.D.K.

N80-31571 Naval Surface Weapons Center, White Oak, Md.
DEFLAGRATION TO DETONATION TRANSITION BEHAVIOR OF ALUMINIZED HMX
Donna Price and A. R. Clairmont, Jr. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1. Dec. 1979. p 79-89. refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

The effect of fine and coarse aluminum on the transitional behavior of HMX in charges pressed to 90% theoretical minimum density was investigated. A thick walled tube with heavy end closures is instrumented with ionization probes (IP) and strain gages (SG). These serve to measure front velocities, convective ignition and detonation fronts from the IP data, and compressive fronts from the SG data. Other parameters measured were predetonation column length and two relative times to detonation, the time of discharge of the first ionization probe to time of onset of detonation and the time between the appearances of the first compressive front and onset of detonation. It was found that the aluminized charges which exhibited transition appeared to follow the same DDT mechanism as that initially proposed for 91/9 RDX/wax and that shown by pure RDX and pure HMX. Although the presence of aluminum did not change the DDT mechanism, it did slow down the transitional process increasingly as the Al content rose. All three DDT parameters show a smooth increase with increasing aluminum content. E.D.K.

N80-31572 Naval Surface Weapons Center, White Oak, Md.
COMPACTION AND THE BURNING TO DETONATION TRANSITION AT LOW CONFINEMENT
R. R. Bernecker, H. W. Sandusky, and A. R. Clairmont, Jr. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1. Dec. 1979. p 91-116. refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

A study was made of the deflagration to detonation transition (DDT) in porous charges of propellants at low confinement using a streak camera and flash radiography. To measure density gradients quantitatively along the porous column, X-ray tracers were added to the porous columns during pressing. The propellants evaluated in this work included two friable, crosslinked double base (XLDB) propellants, VLU and VLZ, a modified double base propellant, FKM, and a nitrocellulose (NC) ball powder. The FKM and NC were in a powdered form, the VLZ was shredded and the VLU particles were cuboid. At about 56% theoretical maximum density shredded VLZ and granular FKM transited to detonation while the NC did not. The NC material showed extensive axial compaction although the density profiles along the column were the lowest of all the materials. The VLZ exhibited both axial and radial compaction which was distinctly unsymmetrical, the radiographs illustrated severe nonplanar displacement of the tracers. E.D.K.

N80-31573 Naval Surface Weapons Center, White Oak, Md.
EFFECT OF PROPELLANT CRACK BURNING ON HIGH ENERGY PROPELLANT SAFETY

K. Kim. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 121-141 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

Selective calculations were made for burning in cracks as it pertains to solid rocket motor propellants. The possibility of obtaining pressures high enough to cause a shock to detonation transition (SDT) in propellant grains is examined. Variables effecting the crack combustion process selected for study are: crack shape, location, surface roughness, propellant deformation, ignition criterion, and burning rate. Results suggest that SDT should not occur in propellants unless the granulation of the grain is severe enough to provide large burning surface area.
Author

N80-31574 Ballistic Research Labs., Aberdeen Proving Ground, Md.
A MODEL FOR CONFINED COMBUSTION OF COMPRESSIBLE, LINEAR VISCOELASTIC SOLID PROPELLANT
Douglas E. Kooker. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 143-165 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

A mathematical model is developed for transient combustion of an end burning, compressible, linear viscoelastic solid propellant grain confined in a one dimensional closed chamber. The time dependent analysis is capable of studying nonlinear wave propagation in both the solid and gas phases. Theoretical predictions for a family of fast burning propellants indicate (1) pulsating burning rates as well as stress waves in the propellant, (2) traveling waves in the gas phase which grow to shock strength, and (3) a burning rate excursion in which the gas velocity leaving the surface approaches the sonic condition.
Author

N80-31575 Utah Univ., Salt Lake City. Dept. of Mechanical and Industrial Engineering.
A CALCULATIONAL MODEL FOR FRAGMENTATION IN VISCOELASTIC MATERIALS
S. R. Swanson. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 167-176 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

Experimental evidence has shown that under certain combinations of stress loading and material properties, fracture in solids can occur in which a large number of particles are formed. A model of fracture for viscoelastic materials is presented that attempts to calculate the distribution of fragment size and the associated surface to volume ratio of these fragments. Calculations are made on an element basis in conjunction with a dynamic finite element code. The model assumes a statistical distribution of inherent microflaws that grow under stress according to quasistatic and dynamic crack propagation laws measured in laboratory tests. Crack interaction to form fragments is computed on a statistical basis. Calculations for a shear test geometry show formation of few fragments at low test speeds, but a significant increase in surface to volume ratios at higher velocities. These results are in good agreement with laboratory test results.
E.D.K.

N80-31576 Los Alamos Scientific Lab., N. Mex.
SHEAR IGNITION OF EXPLOSIVES
A. W. Campbell. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 177-198 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

The role of shear in the initiation of burning in explosives was explored. The PBX-9404, a rigid explosive containing 96 wt% HMX, and a compliant propellant containing 50 wt% solids were subjected to pressure pulses of a few kilobars amplitude. Pressure pulses were generated by burning HMX at loading densities from 0.04 to 1.22 g/cu cm and were transmitted to the test explosive usually by a metal piston. It was shown that violet burning can be induced in the PBX-9404 by rapid compression, and by the use of steel shear rings the rate of reaction can be intensified so that a transition from burning to detonation results.
R.C.T.

N80-31577 Naval Weapons Center, China Lake, Calif.
COOK-OFF IN FUEL FIRE
Ronald F. Vetter. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 199-204 (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

Solid rocket motors reaction to immersion in fuel fire is considered. The complexity of the thermal and structural occurrences leading to eventual pressure vessel failure are discussed. An attempt is made to understand and predict the mode of failure (level of violence of the reaction) with computer modeling as well as actual fire tests of various configurations.
R.C.T.

N80-31578 Naval Surface Weapons Center, White Oak, Md.
DETECTION OF LOCAL HEATING AND REACTION INDUCED BY IMPACT
C. S. Coffey, W. L. Elban, and S. J. Jacobs. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 205-219 refs (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

A heat sensitive film was used to detect the heat generated in a sample by impact. Localized hot spots were recorded in inert, explosive and propellant materials. In the explosives and propellants these hot spots were potential ignition sites. It was demonstrated that the physical properties of the sample have a profound influence on the amount of local heating generated by impact.
R.C.T.

N80-31579 Sandia Labs., Albuquerque, N. Mex.
INITIATION OF GRANULAR EXPLOSIVES BY RAMP WAVES
R. E. Setchell. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 221-231 refs (For primary document see N80-31565 22-28)
(Contract DE-AC04-76DP-00789)
Avail: Issuing Activity CSCL 21/9

Initiation processes in granular explosives experiencing finite risetime loading, in contrast to shock loading were investigated. Ramp waves having a risetime of either 0.3 micro seconds or 0.8 micro seconds were transmitted into the explosive PBX-9404, resulting in initial waves having a peak axial stress of 5.1 GPa. The incident waves were generated in discs of a glass-ceramic, pyroceram, by planar impact of copper faced projectiles using a gas fired gun facility. Velocity interferometry was used to measure particle velocity histories after the initial wave had propagated through explosive samples having different thicknesses. For comparison, similar measurements were made for the case of shock loading to the same initial peak stress.
R.C.T.

N80-31580 Hercules, Inc., Magna, Utah.
TRANSITION TO DETONATION OF CROSSLINKED DOUBLE-BASE PROPELLANT IN LARGE SCALE NOL CARD GAP TESTS
Robert L. Keefe. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 233-245 (For primary document see N80-31565 22-28)
Avail: Issuing Activity CSCL 21/9

The susceptibility of explosives and propellants to the shock initiation of detonation was determined. The effects of variables on rocket motor hazards were analyzed. Operational techniques and materials, sample preparation, sample formulation variation, and sample processing variations were tested.
R.C.T.

N80-31581 Princeton Combustion Research Labs., Inc., N.J.
COMPRESSION-IGNITION SENSITIVITY STUDIES OF LIQUID MONOPROPELLANT IN A DYNAMIC-LOADING ENVIRONMENT
N. A. Messina, L. S. Ingram, P. E. Camp, and M. Summerfield. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 247-284 refs (For primary document see N80-31565 22-28)
(Contract DAAK10-78-C-0315)
Avail: Issuing Activity CSCL 21/9

Monopropellant liquid propellant gun systems were developed generally along two lines, the preloaded type (so-called bulk loaded liquid propellant gun and the direct injection type (so-called regenerative type). In each of these types, the liquid

charge was brought rather rapidly up to gun operating pressure, ca. 30 to 60 kpsi, in a rise time on the order of 0.1 to 1 msec. Although hundreds of successful firings were made with both types of gun, with several different types of liquid monopropellant, in sizes up to 4 inch barrels, a few destructive explosions have taken place, all of them on startup during the rapid pressure rise associated with ignition of the gun. This almost successful test record suggests that the particular monopropellants selected are not themselves at fault, or explosions would have occurred with far greater frequency. R.C.T.

N80-31582 Ballistic Research Labs., Aberdeen Proving Ground, Md.

TRANSIENT COMBUSTION CALCULATIONS WITH VARIABLE THERMAL PROPERTIES

Carl W. Nelson *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 327-337 refs (For primary document see N80-31565 22-28)

Avail: Issuing Activity CSCL 21/9

The response of solid propellant combustion to steep pressurization pulses was calculated with consideration of temperature dependent thermal properties of the solid and quasisteady gas phase. Response was calculated for a uniformly distributed gas phase reaction and for the Zeldovich heat feedback theory with variations in surface heat release, pressurization rate, and thermal properties of the solid. Regression rate excursions of two to three times the quasi-steady rate ($r = aPn$) were calculated for nominal values of propellant properties. Higher excursions were calculated for the distributed flame with assumed constant thermal properties. For pressurization rates approximating calculated DDT rates, the excursions survived at high pressures. R.C.T.

N80-31583 Ballistic Research Labs., Aberdeen Proving Ground, Md.

COMBUSTION CHARACTERISTICS OF CONSOLIDATED PROPELLANTS

A. A. Juhasz, I. W. May, W. P. Aungst, J. O. Doali, and R. E. Bowman *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 433-452 refs (For primary document see N80-31565 22-28)

Avail: Issuing Activity CSCL 21/9

Consolidated single and double base extruded propellants and a double base ball propellant were burned in a closed bomb. The parameters studied included mode of ignition and effects of compaction density on sample combustion. Overall mass burning behavior, especially round to round reproducibility, was found to be strongly ignition dependent. Consolidation was found to reduce the average mass generation rate for the propellant samples. Surface area ratio vs. mass fraction burned plots were generated for these runs using an inverse closed bomb data reduction program. Progressive surface area development was observed for fifty percent or more of propellant mass fraction burned. Best progressivity was found for the most dense, physically strongest propellant samples. Author

N80-31584 Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

IGNITION OF SOLID PROPELLANTS UNDER TRANSIENT FLOW CONDITIONS

Avi Birk and Leonard H. Caveny *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 515-540 refs (For primary document see N80-31565 22-28)

Avail: Issuing Activity CSCL 21/9

The site and mode of convective ignition of propellant cylinders in crossflow was determined. A shock tunnel was used to provide up to 20 ms of flowing heated gas at: 1 to 2 MPa; 1600 to 2100 K; 10 to 300 m/s. Test gases were 100% N2, 10% O2/90% N2, and 50% O2/50% N2. Instrumentation included six radiation detectors, high speed shadowgraph sequences, pressure probes, and heat flux gauges. Ignition is a gas phase process. Compared to triple base propellant, single base and double base propellants ignited more rapidly in oxidizer containing flows. Flame blowoff occured for high Reynolds number (e.g., 16,000), low free stream oxidizer flows. The high heating rates accompanying boundary layer development can produce submillisecond ignition. Depending on the flow conditions first ignition occurs either at the leading edge or in the wake. R.C.T.

N80-31585 Ballistic Research Labs., Aberdeen Proving Ground, Md.

SHOCK TUBE IGNITION OF NITROCELLULOSE AND NITRAMINES

Arthur Cotten and Leon J. Decker *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 541-546 refs (For primary document see N80-31565 22-28)

Avail: Issuing Activity CSCL 21/9

A reflected shock technqiue was used to study ignition of small (approximately 1 micrometer particles of NC (12.2% N), RDX and HMX by shock heated N2 at reflected shock gas temperatures (T bar) between 600-1200 K and pressures between .1-1.5 MPa. For T bar > 750 K, ignition delays were independent of pressure and were almost independent of T bar. For T < 750 K, the temperature dependence increased markedly and the nitramine delays showed an inverse pressure dependence although the NC delays remain pressure independent. The activation energy for the delays was approximately 37 Kcal/mole for HMX and 17 Kcal/mole for NC. R.C.T.

N80-31586 Army Armament Research and Development Command, Dover, N. J.

HOLOGRAPHIC OBSERVATIONS OF BLACK POWDER COMBUSTION

R. Field, P. Wartman, and J. D. Trolinger (Spectron Development Labs., Inc., Costa Mesa, Calif.) *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 547-558 refs (For primary document see N80-31565 22-28)

(Contract DAAK10-79-M-4364)

Avail: Issuing Activity CSCL 21/9

The basic combustion behavior of black powder and other igniter materials using pulsed laser holography was investigated. The combustion of single grains of black powder was examined at ambient pressure and pressures up to 0.72 MPa (105 psi). The short pulse duration and monochromaticity of the laser radiation provided high spatial resolution in the recording of the particle field generated during the grain combustion. Particle velocities obtained from double pulsed holograms were examined. The formation of the observed particle field appears to be due in part to stripping-off of a molten reactant material from the surface of the grain by gases forming within a molten surface layer. Differences in the particle field with change in pressure were also studied. R.C.T.

N80-31587 Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.

MEASUREMENT AND CORRELATION OF INTRAGRANULAR STRESS AND PARTICLE-WALL FRICTION IN GRANULAR PROPELLANT BEDS

K. K. Kuo, B. B. Moore, and V. Yang *In* APL The 16th JANNAF Combust. Meeting, Vol. 1 Dec. 1979 p 559-581 refs (For primary document see N80-31565 22-28)

(Contract DAAG29-77-G-0163)

Avail: Issuing Activity CSCL 21/9

A test rig was designed for obtaining instantaneous porosity, intragranular stress, and particle wall friction in the mechanical compaction of granular material. A dimensionless compaction similarity parameter was found to correlate the experimental data well, regardless of particle size and shape. Empirical correlations for WC-870 and WC-846 granular propellants were obtained. Mathematical expressions for the speed of sound transmitted through these two types of propellants were also obtained. A scanning electron microscope was used to examine some of the deformed granular propellants after compaction. Numerous surface fissures were observed; these increased surface areas may contribute significantly to the DDT process. R.C.T.

N80-31588 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Chemical Propulsion Information Agency.

THE 16TH JANNAF COMBUSTION MEETING, VOLUME 2

Thomas W. Christian, ed. Dec. 1979 666 p refs Conf. held at Naval Postgraduate School, Monterey, Calif., 10-14 Sep. 1979

(Contract N00024-78-C-5384)

(AD-A084681; CPIA-Publ-308-Vol-2) Avail. Issuing Activity CSCL 21/9

Various aspects of propellant combustion are discused. Among the topics considered are: nitramine decomposition and combustion; steady state combustion; aluminum combustion; and

combustion instrumentation and diagnostics. For individual titles, see N80-31589 through N80-31623.

N80-31589 Ballistic Research Labs., Aberdeen Proving Ground, Md.
A PRIORI THERMOCHEMISTRY AND RATE CONSTANT ESTIMATES FOR FLAME ZONE REACTIONS
G. F. Adams and G. D. Bent *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 113-125 refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

The use of theoretical chemical methods to predict the properties and chemical rate coefficients for several evanescent chemical species that occur in propellant flames is described. Molecular electronic structure theory calculations were used to predict heats of reaction and activation barriers with estimated error of plus or minus 2 kcal per mol. R.C.T.

N80-31590 Georgia Inst. of Tech., Atlanta.
COMBUSTION OF NON-ALUMINIZED BINDERS IN TAPERED SANDWICHES
J. C. Handley, E. W. Price, and A. Ghosh *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 127-147 refs (For primary document see N80-31588 22-28)
(Contract N00014-75-C-0332)
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Four different binders in a tapered two dimensional ammonium perchlorate (AP)-binder sandwich were investigated. Both quenched combustion techniques and cinephotomacrography of the burning samples were used to observe the deflagration process and the interaction of the diffusion flamelets with it. The four binders were tested over the 1.38 MPa (200 psi) to 13.8 MPa (2000 psi) pressure range. The scanning electron microscope was used to investigate the partially burned samples. Particular emphasis was placed on the binder layer and its residue along with the melt flow out over the oxidizer surface. It was found that a minimum binder thickness existed at 1.38 MPa beyond which deflagration could not be sustained. The binder melt flow was very important in determining the AP deflagration rate in the vicinity of the binder. R.C.T.

N80-31591 Dayton Univ., Ohio.
STATISTICAL ANALYSIS OF COMPOSITE SOLID PROPELLANT COMBUSTION
Robert L. Glick *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 149-152 refs (For primary document see N80-31588 22-28)
(Grant AF-AFOSR-0022-79)
Avail: Issuing Activity CSCL 21/9

Functional forms for correlating steady state ballistic data were tested. Results indicate that these forms markedly improve correlation in certain cases but failed in precisely those cases where previous correlations were successful. R.C.T.

N80-31592 Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
EFFECT OF EROSIVE BURNING ON PRESSURE AND TEMPERATURE SENSITIVITY
J. P. Renie, M. E. Barger, and J. R. Osborn *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 153-169 refs (For primary document see N80-31588 22-28)
(Grant AF-AFOSR-3381-77)
Avail: Issuing Activity CSCL 21/9

The results of calculations of burning rate, pressure exponent and temperature sensitivity are presented for a series of monomodal ammonium perchlorate propellants. Both the oxidizer particle size and the crossflow velocity are considered as parameters. The results are obtained with the erosive burning petite ensemble model. This erosive burning model is based on the hypothesis that the erosive burning effect is due to the enhancement of the transport properties in the gas phase reaction zones caused by the presence of a turbulent boundary layer. Results indicate that burning rate, pressure exponent and temperature sensitivity may be materially changed as the cross flow velocity is increased for those propellants having an oxidizer particle size greater than a certain size. Below an oxidizer particle size of 10 microns, the results show that these combustion parameters remain unchanged as the crossflow velocity is increased. Above this oxidizer particle size, an increase in the crossflow velocity causes substantial increases in both the propellant burning rate and pressure exponent. At the same time, decreased temperature sensitivity results for increased crossflow velocities with propellants having the larger oxidizer particles. R.C.T.

N80-31593 Atlantic Research Corp., Alexandria, Va.
AN INVESTIGATION OF THE EFFECTS OF FORMULATION PARAMETERS ON EROSIVE BURNING OF COMPOSITE PROPELLANTS
Merrill K. King *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 171-191 refs (For primary document see N80-31588 22-28)
(Contract F49620-78-C-0016)
Avail: Issuing Activity CSCL 21/9

A series of ten composite solid propellants with systematically varied formation parameters were characterized with respect to the dependence of burning rate on pressure and product crossflow velocity over a wide range of these variables. Predictions of the erosive burning characteristics of these formulations made with a simple model based on columnar diffusion flame bending were found to agree fairly well with data except at low pressure conditions where propellant heterogeneity is relatively unimportant. A second generation, considerably more fundamental model of composite propellant combustion (with and without crossflow) which includes both the flame bending mechanism and a turbulent transport property augmentation erosive burning mechanism also yielded predictions in good agreement with data, even in the low pressure region where the first generation model failed for five of the six formulations against which it has been tested to date. The most important factor effecting the sensitivity of composite propellant burning rate to crossflow was found to be the base (no crossflow) burning rate versus pressure characteristics of the propellant, low burning rate propellants being more sensitive to crossflow. R.C.T.

N80-31594 Aeronautical Research Associates of Princeton, Inc., N. J.
ANALYSIS OF AMMONIUM PERCHLORATE COMBUSTION IN A TURBULENT FLOW
R. A. Beddini and A. K. Varma *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 193-210 refs (For primary document see N80-31588 22-28)
(Contract F49620-78-C-0016)
Avail: Issuing Activity CSCL 21/9

The effects of turbulence on the mean reaction rate and on reaction rate correlations (combustion-turbulence interaction) was investigated with application to the erosive burning of ammonium perchlorate (AP). The analysis indicates that regions of both decreased and increased reaction rate and turbulent diffusivity can exist in the flame zone, and that the decreased reaction rate may account for the decreased burning rate (negative erosion) observed for some propellants. Fully interacting calculations were performed using a previously developed erosive burning theory and both the Beckstead-Derr-Price (BDP) and Guirao-Williams AP combustion models. The results show that: (1) although significant changes in reaction rate and turbulent diffusivity profiles are obtained, no appreciably decreased burning rate is predicted for AP using either combustion model; (2) for both normal and erosive burning, the flame height produced by the BDP model is substantially greater than that produced by the Guirao-Williams model; and (3) as a consequence of the disparate flame heights, a much greater susceptibility of AP to erosive burning is predicted with the BDP model. R.C.T.

N80-31595 Air Force Systems Command, Wright-Patterson AFB, Ohio.
EROSIVE BURNING, A SURVEY OF THE RUSSIAN LITERATURE
Wayne A. Zwart and Robert L. Glick *In* APL The 16th JANNAF Combust. Meeting, Vol. 2 Dec. 1979 p 211-224 refs Prepared in cooperation with Dayton Univ., Ohio (For primary document see N80-31588 22-28)
Avail: Issuing Activity CSCL 21/9

A survey of Russian literature in the area of erosive burning is presented with specific emphasis on erosive burning. It is shown that the Soviets have established that negative erosion

exists as a result of eddy currents. It is demonstrated that when the propellant is released form the surface in the condensed phase, positive erosion can be eliminated when specific conditions exist. Dynamic erosion has also been investigated and the effects of velocity and frequency were established. R.C.T.

N80-31596 Naval Weapons Center, China Lake, Calif. Aerothermochemistry Div.
EFFECT OF BINDER TYPE ON ALUMINUM COMBUSTION AND ALUMINUM OXIDE FORMATION
K. J. Kraeutle, R. Reed, Jr., A. I. Atwood, and H. B. Mathes. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 225-236. refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

The combustion of three aluminized propellants which contained different binders was studied in a window bomb, a pipe burner, and a T-burner. The binders were chosen for their particular decomposition behavior and for their interaction with ammonium perchlorate (AP) as observed by hot-stage microscopy. The results show the influence of binder type on the burn rate, on the size distribution of residue collected after pipe burner and T-burner firings, and on the acoustic damping as measured in the T-burner at a frequency of 800 Hz. Damping rates of the propellants were calculated based on the size data of T-burner as well as pipe burner residues for comparison with measured values. Finally, the combustion of the propellants and the decomposition of their binders were observed by cinephotography. Author

N80-31597 Naval Research Lab., Washington, D. C.
APPLICATION OF ADVANCED OPTICAL SPECTROSCOPIC METHODS TO ENERGETIC MATERIALS
L. S. Goldberg, J. M. Schnur, P. E. Schoen, W. L. Faust, T. R. Royt, S. Wunder, and M. Abebe. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 237-243. refs. Sponsored in part by ONR and Naval Sea Systems Command. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

Progress on the application of advanced optical spectroscopic methods to the study of energetic materials is described. Principal areas of research are high pressure Brillouin and Raman light scattering spectroscopy and picosecond laser spectroscopy. E.D.K.

N80-31598 Los Alamos Scientific Lab., N. Mex.
TEMPORAL AND SPATIAL LOCATION OF THE TRANSITION-TO-DETONATION POINT IN PROPELLANT GRAINS
A. S. Lundy, J. B. Ramsay, A. L. Criscuolo, A. D. Martin, J. A. Montoya, and J. R. Parker. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 245-255. Sponsored in part by SAMSO, AFRPL and US Navy Strategic Systems Project Office. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

Techniques used for the study of the high speed phenomena associated with condensed phase explosives and which are modified and applied to the diagnosis of detonation transition in several test motors are reviewed. The general design criteria for such instrumentation with regard to the frequency response of the transducer, signal channels, and recording equipment are reviewed as well. E.D.K.

N80-31599 Aerojet Solid Propulsion Co., Sacramento, Calif.
TESTING OF A UNIQUE IGNITION SYSTEM FOR LARGE SOLID-PROPELLANT ROCKET MOTORS
D. L. Nachbar and M. B. McDole. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 257-271. refs (For primary document see N80-31588 22-28)
(Contract F04701-73-C-0423)
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The design, analyses, and test results of an integral caseless, nozzleless ignition concept for large solid propellant rocket motors is presented. An approximate 60 percent rocket motor igniter inert weight reduction for payload trade-off gain was the primary ignition concept advantage. The ignition system main charge is formed by configured motor propellant at the forward section of the motor around the igniter boss. This configured forward section, which is an integral portion of the motor propellant grain, is designed to operate as a small, low pressure nozzleless rocket motor, providing sufficient pressure and heat-flux output into the main motor propellant section to achieve reproducible motor ignition. Forward section propellant ignition is achieved by output from a relatively small, radial exhausting pyrotechnic igniter containing BKNO3 pellets. The integral caseless, nozzleless igniter concept was successfully demonstrated, and ignition concept performance and motor propellant ignition performance met design requirements. Also target weight requirements for the MX Upper Stage motor were achieved. However, potential problems in motor grain stress were encountered. M.G.

N80-31600* Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
THEORETICAL DETERMINATION OF NOZZLE ADMITTANCES USING A FINITE ELEMENT METHOD
R. K. Sigman and B. T. Zinn. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 273-286. refs (For primary document see N80-31588 22-28)
(Grant NsG-3036)
Avail: Issuing Activity. CSCL 21/9

A finite element method (FEM) is used to predict the admittances of axisymmetric nozzles. The flow in the nozzle is assumed to be isentropic and the disturbances are assumed to be small so that linear analyses apply. An approximate two dimensional compressible flow model is used to describe the steady flow in the nozzle. The propagation of acoustic disturbances is governed by the complete linear acoustic wave equation. This partial differential wave equation is transformed to an integral equation using Galerkin's method and Green's theorem is applied so that the acoustic boundary conditions can be introduced through the boundary residuals. A two dimensional finite element method using linear triangular elements is used to solve the integral acoustic equation. A one dimensional FEM is used to solve the reduced nozzle acoustic equation developed by Crocco and the solution is used to verify the sufficiency of the boundary residual formation. It is shown that agreement between predicted values of the admittance and experimental data is quite good. M.G.

N80-31601 Naval Weapons Center, China Lake, Calif. Aerothermochemistry Div.
ASSESSMENT OF CHAMBER PRESSURE OSCILLATIONS IN THE SHUTTLE SRB
H. B. Mathes. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 287-304. refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

A combustion stability analysis performed for three burn times of the shuttle solid propellant booster motor (SRB) is discussed. The results of the analysis indicated that SRB was exceptionally stable. Analysis of motor firing data shows that a low level pressure oscillation is present throughout burn. The observed oscillations, while somewhat erratic in regard to both amplitude and frequency, show a general pattern through burn that is similar for all motors investigated to date. Variations in maximum pressure amplitude and frequency occur between different motors at the same burn time. The variations between motors have been statistically treated to provide predictions of maximum pressure amplitude and maximum and minimum frequency of the first axial acoustic mode under several sets of specified conditions. The origin of the pressure oscillations, which have not exceeded 0.25 percent of the mean chamber pressure, is thought to be connected with coupling between turbulence or vortex shedding and acoustic wave motions in the motor. M.G.

N80-31602 United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
PRELIMINARY EXPERIMENTS ON ACOUSTIC OSCILLATIONS DRIVEN BY PERIODIC SHEDDING
R. Dunlap and R. S. Brown. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 305-319. refs (For primary document see N80-31588 22-28)
(Contract F04701-77-C-0060)
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The flow and geometry combinations which maximize acoustic oscillations under rocket motor type flow conditions are investigated. Nitrogen was injected into a chamber through a sonic choke and exhausted through a second choke at the other end.

Two restrictors were located at various axial positions along the chamber. At each location, the spacing of the two restrictors was varied and the effect on the acoustic pressure level was measured. Amplitude frequency spectra of the pressure were obtained to determine which modes were excited. In addition, hot wire anemometer measurements were made in the region between the restrictors for some flow conditions. Comparisons between the pressure and velocity spectra show increased acoustic pressure levels occur simultaneously with increased velocity oscillations. The data also show that increased acoustic pressure levels can be correlated with Strouhal Number and position of the restrictors relative to the acoustic mode shape. The results support the thesis that periodic shedding may be an important source of acoustic driving in solid rocket motors. M.G.

N80-31603 Dayton Univ., Ohio.
ON RESPONSE FUNCTIONS FOR COMPOSITE SOLID PROPELLANT
Robert L. Glick. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 321-324. refs (For primary document see N80-31588 22-28)
(Grant AF-AFOSR-0022-79)
Avail: Issuing Activity. CSCL 21/9

The use of results from combustion modeling to provide a physically reasonable framework for manipulating (correlation, interpolation, extrapolation) experimental data thereby permitting one to operate from a sparse data base is discussed. Several modeling frameworks are examined and suggestions are made concerning the case of composite propellants. M.G.

N80-31604 Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
EXPERIMENTAL DETERMINATION OF SOLID PROPELLANT ADMITTANCES BY THE IMPEDANCE TUBE METHOD
J. D. Baum, B. R. Daniel, and B. T. Zinn. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 325-341. refs (For primary document see N80-31588 22-28)
(Grant AF-AFOSR-2571-73)
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The application of the modified impedance tube technique in the measurement of the admittances and response functions of burning solid propellants is addressed. The relationship between the admittance of the burning solid propellant surface and the impedance tube wave structure is utilized to determine the admittance at the propellant surface. This is accomplished by measuring the resulting acoustic wave structure and relating it to the unknown admittance by utilizing the solutions of the impedance tube wave equations. Improvements in the data acquisition and data reduction procedures are discussed. It is shown that the real part of the admittance Y sub R remains constant during the steady state burn period while gas phase losses may vary significantly during the same time period. Reproducibility of the measured quantities is established as well as the capability of this experimental technique to measure gas phase losses in the impedance tube simultaneously with the measurement of the burning solid propellant surface admittance. M.G.

N80-31605 Princeton Univ., N. J. Mechanical and Aerospace Engineering Dept.
DIRECT MEASUREMENTS OF ACOUSTIC ADMITTANCE USING LASER DOPPLER VELOCIMETRY
L. H. Caveny, K. L. Collins, and S. W. Cheng. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 343-361. refs. Sponsored by ONR and Army Ballistic Research Lab. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

Research was directed at making measurements of velocities in propane/air and solid propellant flames using laser Doppler velocimetry (LDV) instrumentation. Combustors were developed to impose a controlled periodic pressure disturbance on burning solid propellants and to excite a propane/air flame. A tracking system was developed to maintain the LDV control volume at a fixed position above the regressing propellant surface. The research demonstrated double base and composite propellants and for alumina seeded propane/air flames. The simultaneous velocity and pressure measurements were used to obtain acoustic admittances. Author

N80-31606 United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
ROTATING VALVE FOR VELOCITY COMBUSTION RESPONSE MEASUREMENTS
R. S. Brown, R. C. Waugh, and V. L. Kelly. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 363-384. refs (For primary document see N80-31588 22-28)
(Contract F49620-77-C-0048)
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The dual valve approach for measuring velocity coupled characteristics in greater detail is investigated. A mathematical analysis of the transient ballistics was developed. The solution of the transient mass, momentum, and energy equations incorporates both linear and nonlinear velocity coupling, as well as pressure coupling, particle damping, flow turning, and nozzle losses in the analysis. Parametric studies were made by using the nonlinear velocity coupling model. The results show the interaction of mean velocity magnitude, threshold velocity, and amplitude of the velocity oscillation on the predicted pressure oscillations. An experimental apparatus was constructed and its performance under controlled cold flow conditions was compared with predictions. Agreement between predicted and experimental behavior was demonstrated under pressure coupled conditions. In the velocity coupled mode, the cold flow tests showed that control of the phase angle between the two valves is important to ensure proper performance of the apparatus. E.D.K.

N80-31607 Thiokol Corp., Brigham City, Utah. Wasatch Div.
INVESTIGATION OF THREE VELOCITY COUPLED T-BURNER DESIGN
Steven L. Folkman and Kenneth J. Wanlass. *In* APL. The 16th Jannaf Combust. Meeting, Vol. 2. Dec. 1979. p. 385-398. refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

An experimental investigation was conducted to compare various techniques of measuring the linear velocity coupled response of a solid propellant. Three velocity coupled T-burner designs were investigated: (1) a center vented T-burner, (2) a second mode T-burner, and (3) a flared end T-burner. Two basic propellants were utilized in testing, an aluminized PBAN propellant and an aluminized HTPB propellant. The primary intent of the investigation was to compare the nominal values of velocity coupled response and their dispersions in the three configurations. The flared end T-burner design exhibited considerably less data scatter than the center vented design. The nominal values of velocity coupled response calculated from the center vent and the flared end design are very comparable. Harmonic content in the flared end T-burner was lower compared to the center vent design. The second model T-burner gave a large amount of data scatter and does not appear to be a promising design. E.D.K.

N80-31608 Thiokol Corp., Huntsville, Ala.
STUDIES OF MOTOR INSTABILITY PROBLEMS
R. O. Hessler. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 399-428. refs (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

Each of the three motors discussed was predicted to be stable by comfortable margins in the lower longitudinal modes. Two of the motors exhibited spontaneous oscillations in the axial modes. Data analysis of these motors indicated that the longitudinal modes were indeed stable and that the oscillations were driven by vortexes caused by flow over discontinuities in the propellant geometry. In each motor when the grain discontinuity was removed the oscillations were eliminated. These studies led to statement of a steady state solution to the cavity wave equation. This solution predicts finite amplitude oscillations in stable motors in response to combustion, flow, or external oscillatory inputs. A method of predicting the frequency and strength of flow periodicities is also presented. A single motor from a third project responded to what was considered a small charge pulse with a rapid growth to large amplitudes and a mean pressure increase. Analysis of the data indicates that the response was appreciably different from the basis of linear theory. E.D.K.

N80-31609 Naval Postgraduate School, Monterey, Calif.
A PRIMITIVE VARIABLE COMPUTER MODEL FOR COMBUSTION WITHIN SOLID FUEL RAMJETS
C. A. Stevenson and D. W. Netzer. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 429-450. refs. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

An adaptation of a primitive variable, finite difference computer program was accomplished in order to predict the reacting flow field in a solid fuel ramjet. The predictions of the primitive variable computer model are compared with an earlier computer model and empirical data. It was found that the newer model reasonably predicted the flow field and permitted calculations within the aft mixing chamber. E.D.K.

N80-31610 Atlantic Research Corp., Alexandria, Va.
L*-INSTABILITY IN DUCTED ROCKET FUEL GENERATORS
B. D. Goracke and M. K. King. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 451-460. refs. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

Studies have shown that a fuel throttling capability enhances the performance of a ducted rocket, while necessitating fuel rich gas generator operation at low pressure. Two fuel rich formulations were tested at low pressure and observed to exhibit oscillations much lower in frequency than those commonly observed with conventional propellants. A model was postulated and the theory confirmed that the oscillations were L* in nature and satisfactorily predicted L* pressure boundaries and frequency. E.D.K.

N80-31611 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF A PHOTON CORRELATION LASER VELOCIMETER FOR USE IN TURBULENT MIXING REGION MEASUREMENTS
G. D. Catalano, H. E. Wright, and A. Cornuto. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 461-469. refs. Prepared in cooperation with Air Force Inst. of Technology. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

A laser velocimeter using a photon correlation processing scheme was developed for use in obtaining reliable information in turbulent mixing regions. Quantities measured in this investigation include mean velocities and turbulent intensities. Measurements were made in a rectangular nozzle free jet flow both with the laser velocimeter and with a hot-wire anemometer. The Mach number at the exit plane of the nozzle was varied from 0.2 to 0.8. The laser velocimeter obtained mean velocity data was found to correspond quite closely to the information obtained by using the hot-wire. The turbulent intensities were found to be much more difficult to measure using the laser velocimeter. Author

N80-31612 Systems Research Labs., Inc., Dayton, Ohio.
EVALUATION OF CARS IN A PRACTICAL COMBUSTION ENVIRONMENT
G. L. Switzer, W. M. Roquemore, R. P. Bradley, P. W. Schreiber, and W. B. Roh. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 471-485. refs. Prepared in cooperation with AFAPL and Air Force Inst. of Technology. (For primary document see N80-31588 22-28)
(Contract F33615-77-C-2019; AF Proj. 2308)
Avail: Issuing Activity. CSCL 21/9

Results of coherent anti-Stokes Raman scattering (CARS) measurements made in a bluff-body-stabilized flame with turbulent and recirculating flow characteristics similar to those in many practical combustion systems are presented. The CARS system design is based upon a single-mode, ruby laser, oscillator amplifier combination operating at a repetition rate of 1 Hz and a ruby pumped, near infrared, broad band, dye, laser. Three types of CARS measurements are presents: (1) single pulse Q-branch spectra of N2 captured with an optical multichannel analyzer (OMA); (2) single pulse N2 and O2 number densities obtained by wide band integration of all Q branch lines; and (3) N2 spectra obtained by stepping a monochromator while exciting the medium with a broad band Stokes beam. Temperatures are estimated by comparing scanned N2 spectra with computer generated spectra. Axial and radial profile measurements of temperature, O2 concentration, and N2 concentration are presented. The results of CARS radial temperature measurements at a single axial location are compared with corresponding thermocouple data. The OMA spectra suggest that it is feasible to obtain single pulse measurements of temperture, N2 concentration, and O2 concentration at any location in the bluff-body-stabilized flame. E.D.K.

N80-31613* United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF THE FEASIBILITY OF CARS MEASUREMENTS IN SCRAMJET COMBUSTION
J. A. Shirley, D. C. Eckbreth, and R. J. Hall. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 487-509. refs. (For primary document see N80-31588 22-28)
(Contract NAS1-15491)
Avail: Issuing Activity. CSCL 21/9

Results are presented of analytical and experimental investigations to determine the feasibility of using coherent anti-Stokes Raman spectroscopy (CARS) to measure temperature and species concentrations in supersonic combustion experiments. Experimental CARS spectra of O2 and H2 in a laboratory flat H2 - air diffusion flame are presented. Temperatures deduced from both species generally agree with radiation corrected thermocouple measurements. Oxygen concentrations were determined from the shape of the experimental spectra. Measured H2 CARS signal magnitudes are in good agreement with analytical predictions based on H2 concentration profiles determined from spontaneous Raman scattering. Based on these results, CARS diagnostics appear to be feasible if problems associated with the supersonic flow are not too severe. Author

N80-31614 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
COMPARISON OF THERMOCOUPLE, GAS SAMPLING, AND RAMAN MEASURED TEMPERATURES IN AN AFTERBURNING TURBOJET ENGINE PLUME
W. M. Roquemore and P. P. Yancy. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 511-527. refs. Prepared in cooperation with Dayton Univ. Research Inst. (For primary document see N80-31588 22-28)
(Contract F33615-77-C-2019; AF Proj. 3048)
Avail: Issuing Activity. CSCL 21/9

The results of plume temperature measurements made with three different probes, a Pt 13% Rh-Pt thermocouple probe, a gas sampling probe, and a spontaneous Raman scattering optical probe are desribed. Thermocouple measurements were corrected for radiation and recovery. A combination gas sampling and pressure probe was used to measure carbon dioxide, carbon monoxide, and total hydrocarbon concentrations and total gas stream pressures. Temperatures were calculated from the concentration measurements. Raman scattering measurements were made in a near-backscattering geometry using a pulsed nitrogen gas laser, a computer controlled SPEX double spectrometer, and an 8850 RCA photomultiplier tube with EGG/ORTEC time gated current integration detection apparatus. Raman temperatures were determined by fitting calculated spectra to the experimental spectra of the nitrogen gas in the plume. The temperatures measured by the Raman, gas-sampling, and thermocouple techniques were in agreement within the experimental error of about 5 percent except at maximum engine power where the thermocouple deviated by about 10 percent. E.D.K.

N80-31615 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
FLOWFIELD STUDIES OF DUMP COMBUSTERS
R. S. Borsy. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p. 529-540. refs. (For primary document see N80-31588 22-28)
(Contract F33615-78-C-2066)
Avail: Issuing Activity. CSCL 21/9

A comprehensive series of cold flow experiments was performed as part of a parametric study of the flow characterization of an axisymmetric dump combustor. Two inlets, one smaller than the other, were used. Gas concentrations of simulated fuel-air were measured in the dump combustor using an on-line mass

spectrometer. Gas sampling results with the smaller inlet showed better mixing compared to the larger inlets. In addition to gas sampling, measurements of total pressure profiles and wall static pressure were also obtained. The results of this effort are summarized. E.D.K.

N80-31616 Virginia Polytechnic Inst. and State Univ., Blacksburg. Aerospace and Ocean Engineering Dept.
MEAN DROPLET DIAMETER RESULTING FROM ATOMIZATION OF A TRANSVERSE LIQUID JET IN A SUPERSONIC AIR STREAM
J. A. Schetz, A. S. Nejad, and A. K. Jakubowski. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 541-555. refs. Sponsored by AFOSR. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

The feasibility of routine measurements of the mean droplet diameter in the spray resulting from normal injection of liquid jets into a supersonic airstream under density conditions in a blow-down wind tunnel employing the diffractively scattered light technique was investigated. Studies of the effects of injector diameter, jet/free stream dynamic pressure ratios, and location in the jet plume on the mean droplet diameter were conducted. The diffractively scattered light technique is capable of measuring the mean droplet diameter in the spray with good experimental accuracy if great care is exercised in the selection and use of all optical components. The mean droplet size is on the order of 10 microns for injectors of the order of 1.3 mm. The mean droplet diameter has an inverse relation with respect to jet/free stream dynamic pressure ratio, a direct relation with the orifice diameter and decreases as the measurement station moves farther downstream from injector orifice and the smallest droplets are always found near the windward edge of the spray plume. E.D.K.

N80-31617 University of Southern California, Los Angeles. Combustion Lab.
REDUCTION OF COMBUSTION EFFICIENCY ASSOCIATED WITH LIQUID PHASE DROP DECOMPOSITION
M. Gerstein and P. Roy Choudhury. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 557-568. ref. (For primary document see N80-31588 22-28)
(Grant AF-AFOSR-3354-77)
Avail: Issuing Activity. CSCL 21/9

The inefficiency of droplet evaporation due to liquid phase pyrolysis at higher pressures results in a nonlinear form of diameter squared relationship. Under such a condition, a coupling between evaporation and liquid phase pyrolysis can cause a large reduction in the combustion efficiency of an advanced airbreathing propulsion system using either a commercial fuel blend or a synthetic fuel. The degradation in combustion efficiency can be minimized by accelerating the initial evaporation process before significant pyrolysis can take place and the concentration of the residue can increase. E.D.K.

N80-31618 General Electric Co., Lynn, Mass. Aircraft Engine Group.
HIGH DENSITY FUELS DESIGN CONSIDERATIONS FOR COMBUSTORS AND COMBUSTION ASSESSORIES IN SUBSONIC CRUISE MISSILE PROPULSION SYSTEMS
J. D. Cohen and J. S. Hoffman. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 569-578. refs. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

High density fuels show significant promise for increasing the range of volume limited aircraft. For weapons systems such as the current generation of subsonic cruise missiles, small aircraft are employed, propelled by air breathing turbine engines. It can be forecasted that the range of these craft will be nearly proportional to volumetric energy content of the proposed fuels, provided the fuels can be delivered and burned efficiently, and provided the impact on size and weight of the missile can be minimized. The impact of dense fuel use on combustion system design considerations is explored. E.D.K.

N80-31619* Hersh Acoustical Engineering, Chatsworth, Calif.
EFFECT OF GRAZING FLOW ON THE NONLINEAR ACOUSTIC BEHAVIOR OF HELMHOLTZ RESONATORS
A. S. Hersh. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 579-603. refs. (For primary document see N80-31588 22-28)
(Contract NAS3-19745)
Avail: Issuing Activity. CSCL 21/9

A semi empirical fluid mechanical model is derived of the acoustic behavior of thin walled single orifice Helmholtz resonators in a grazing flow environment. The model assumes that the flow field incident to a resonator orifice consists of a spherical sound particle velocity field superimposed upon a mean grazing flow. The incident and cavity sound fields are connected in terms of an orifice discharge coefficient whose values are determined experimentally using the two microphone method. With regard to its application to rocket motor interiors, the most important finding of this study is that the acoustic impedance of Helmholtz resonators is affected by grazing flow when the product of the amplitude of the sound pressure incident to the resonator orifice and the rocket motor interior mean grazing flow speed are less than 0.5. For values greater than 0.5, the acoustic impedance is independent of the grazing flow. E.D.K.

N80-31620 Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ADMITTANCES AND CHARACTERISTIC COMBUSTION TIMES OF REACTIVE GASEOUS PROPELLANT INJECTORS
B. A. Janardan, B. R. Daniel, and B. T. Zinn. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 605-615. refs. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

The results of an experimental investigation undertaken to determine the effect of the number of elements in a coaxial injector upon the injector admittance and the characteristic combustion time are presented. The data indicate that for a fixed oxidizer and fuel flow rates and a given open area ratio of the injector, the frequency range during which the injector can sustain instabilities depends upon the number of injector elements. Also, data are presented that correlate the measured characteristic combustion times of the injector with the self driving periods of the experimental combustor. E.D.K.

N80-31621* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND EVALUATION OF HIGH PERFORMANCE ROCKET ENGINE INJECTORS FOR USE WITH HYDROCARBON FUELS
A. J. Pavli. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 617-643. refs. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

An experimental program to determine the feasibility of using a heavy hydrocarbon fuel as a rocket propellant is reported. A method of predicting performance of a heavy hydrocarbon in terms of to experimental test results. Combustion length effects were explored over a range of 21.6 cm. to 55.9 cm. Four injector types were tested, each over a range of mixture ratios. Further configuration modifications were obtained by reaming each injector several times to provide test data over a range of injector pressure drop. E.D.K.

N80-31622 AiResearch Mfg. Co., Torrance, Calif.
INVESTIGATION OF A PUTTY PROPELLANT TURBINE POWER SYSTEM
James C. Riple, Robert L. Schultz, and John C. Trowbridge. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 645-655. ref. Prepared in cooperation with United Technologies Corp., Sunnyvale, Calif. (For primary document see N80-31588 22-28)
Avail: Issuing Activity. CSCL 21/9

Uncured solid propellant is a viscous putty which can be pumped, extruded, and throttled. In turbine applications it provides control flexibility previously only available with liquid propellants, while retaining the safety, handling, storage, and cost advantages of solid propellants. Design concepts of a compact, lightweight turbine power system using uncured propellant were investigated for a short duration, intermittent duty application. Various propellant formulations were prepared and tested for ballistic,

rheological, and safety characteristics. A subscale gas generator and propellant high pressure pump were built and tested. Author

N80-31623 Physical Sciences, Inc., Woburn, Mass.
A MECHANISM FOR THE PHOTOCHEMICAL INDUCED COMBUSTION OF H2/F2 MIXTURES INHIBITED BY O2
P. Lewis, R. L. Taylor, and J. Cronin. *In* APL. The 16th JANNAF Combust. Meeting, Vol. 2. Dec. 1979. p 657-668. refs. (For primary document see N80-31588 22-28)
(Contract N00173-76-C-0190)
Avail: Issuing Activity. CSCL 21/9

Using the most recent mechanisms and rate constants for the chemistry of the H2/F2/O2 molecular system, detailed modeling studies of stability data have shown that these data are explainable with reasonable accuracy. This same chemistry model was also used to explain the variation in performance of a H2/F2 pulsed chemical laser with added O2. The results show that although there is some gain in laser performance by operating at low O2 concentrations, the inverse linear dependence on O2 concentration rules out any dramatic increase in performance. E.D.K.

N80-31624°# Air Products and Chemicals, Inc., Allentown, Pa.
A STUDY OF INDUSTRIAL HYDROGEN AND SYNGAS SUPPLY SYSTEMS. Final Report
W. J. Amos, J. Solomon, and K. F. Eliezer. Oct. 1979. 159 p. Prepared for JPL.
(Contracts NAS7-100, JPL-955421)
(NASA-CR-163523) Avail: NTIS. HC A08/MF A01. CSCL 21D

The potential and incentives required for supplying hydrogen and syngas feedstocks to the U.S. chemical industry from coal gasification systems were evaluated. Future hydrogen and syngas demand for chemical manufacture was estimated by geographic area and projected economics for hydrogen and syngas manufacture was estimated with geographic area of manufacture and plant size as parameters. Natural gas, oil and coal feedstocks were considered. Problem areas presently affecting the commercial feasibility of coal gasification discussed include the impact of potential process improvements, factors involved in financing coal gasification plants, regulatory barriers affecting coal gasification, coal mining/transportation, air quality regulations, and competitive feedstock pricing barriers. The potential for making coal gasification the least costly H2 and syngas supply option. Options to stimulate coal gasification system development are discussed. A.R.H.

N80-31625°# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
A STUDY ON THE ELECTROLYSIS OF SULFUR DIOXIDE AND WATER FOR THE SULFUR CYCLE HYDROGEN PRODUCTION PROCESS. Final Report
Jul. 1980. 121 p. refs. Prepared for JPL.
(Contracts NAS7-100, JPL-955380)
(NASA-CR-163517; AESD-TME-3043) Avail: NTIS. HC A06/MF A01. CSCL 21D

Experimental electrolysis cells using various platinum catalyzed carbon electrodes were tested. When operated at 200 mA/sq cm current density using 50 w/o acid at 50 C and 1 atm, a reference cell required 1.22 volts and degraded rapidly. After several improvements were incorporated into electrodes and the test cell configuration, a later cell required only 0.77 volts under identical operating conditions. At a lower current density, 100 mA/sq cm, the cell required only 0.63 volts. Kinetic studies on metal electrodes, measurements of temperature effects on electrode kinetics, investigations of electrocatalytic activities of metal electrodes over a wide range of acid concentrations, cyclic voltametric studies and evaluation of alternate catalysts were also conducted. From diffusivity experiments, a cation exchange membrane material, P-4010, exhibited an excellent diffusion coefficient, more than two orders of magnitude lower than that of rubber. Ionic resistivity measurements of eight materials showed that microporous rubber had the lowest resistivity. A.R.H.

N80-31626# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
SOME CIVIL ENGINEERING AND MANAGEMENT ASPECTS OF CONVERSION FROM JP-4 TO JP-8 FUEL BY THE UNITED STATES AIR FORCE IN THE CONTINENTAL UNITED STATES. M.S. Thesis
Steven M. Pittman and J. Parke K. Smith. Jun. 1980. 96 p. refs.
(AD-A087221; AFIT-LSSR-5-80) Avail: NTIS. HC A05/MF A01. CSCL 15/5

The purpose of this thesis is to examine the possible conversion in the CONUS from JP-4 turbine fuel to JP-8. While many studies have been conducted to analyze the effects of the conversion on aircraft and support systems there has been little work done to analyze the effects on the facilities in which the fuel is stored and transported. This thesis examines the effects of conversion on the fuel bulk storage tanks and on the piping and pumping system used to transport the fuel. Where appropriate, recommendations have been made concerning the modifications necessary to these facilities to counter any detrimental effects associated with the conversion. GRA

N80-31627# Department of Energy, Bartlesville, Okla. Energy Technology Center.
AVIATION TURBINE FUELS, 1979
Ella Mae Shelton. May 1980. 15 p. refs.
(DOE/BETC-PPS-80/2) Avail: NTIS. HC A02/MF A01

Properties of some aviation turbine fuels marketed in the United States during 1979 are presented. The samples represented were typical 1979 production and were analyzed in the laboratories of 17 manufactuers of aviation turbine (jet) fuels. The data were submitted for study, calculation, and compilation. DOE

N80-31628# California Univ., Berkeley. Lawrence Berkeley Lab.
MULTIPHASE REACTOR MODELING FOR ZINC CHLORIDE CATALYZED COAL LIQUEFACTION. M.S. Thesis
Peter James Joyce. Apr. 1980. 107 p. refs.
(Contract W-7405-eng-48)
(LBL-9870) Avail: NTIS. HC A06/MF A01

A generalized reactor design was presented for a low temperature, coal conversion method, where coal was slurried in an 83 wt % zinc chloride methanol melt and allowed to react at moderate conditions of 275 deg C and 600 psi hydrogen. In the reactor, the slurried melt flowed downward in plug flow on the order of 1 foot per minute through a distance of 15 feet. Liquid mass-transfer studies with the model were undertaken to examine specific effects of zinc chloride in a viscous medium, in order to determine the rate-limiting step in the overall hydrogen absorption rate. The absorption rate can be expressed in terms of a resistance-in-series model. The use of zinc chloride introduces no new effects and the chemical reaction rate of the coal particle is controlling. DOE

N80-31629# Chevron Research Co., Richmond, Calif.
REFINING AND UPGRADING OF SYNFUELS FROM COAL AND OIL SHALES BY ADVANCED CATALYTIC PROCESSES. Quarterly Report, Oct. - Dec. 1979
R. F. Sullivan and D. J. Orear. Jan. 1980. 43 p. refs.
(Contract EX-76-C-01-2315)
(FE-2315-48) Avail: NTIS. HC A03/MF A01

Current pilot plant results are presented for processing of H-Coal whole process product derived from Illinois No. 6 coal first, hydrotreating of the whole oil and, second, extinction recycle hydrocracking of the hydrotreated product. The 250F+ portion of severely hydrotreated Illinois H-Coal whole process product meets the jet fuel specifications for aromatics content, smoke, freeze, and flash points and almost meets the current specification for gravity and end point. The yield of 250F+ product is 90.4LV% based on feed. The diesel fuel oxidation stability of 300F+ hydrotreated products is excellent, even without additives. A large batch of low aromatic, denitrified Illinois H-Coal whole process product was prepared for downstream hydrocracking. In this preparation roughly 2100 SCF/bbl of hydrogen was consumed by the oil. The whole product from this hydrotreater was then cracked in an extinction recycle hydrocracker to make a 350F product. In this hydrocracking step, an additional 800 SCF/bbl of hydrogen was consumed by the oil. DOE

N80-31630# Institute of Gas Technology, Chicago, Ill.
PIPELINE GAS FROM COAL: HYDROGENATION (IGT HYDROGASIFICATION PROCESS). Interim Report, 1 Jul.

1977 - 30 Jun. 1978
May 1980 384 p refs
(Contracts EX-76-C-01-2434; EF-77-C-01-2434; E(49-18)-2434; Proj 9000)
(FE-2434-33a; IR-2) Avail: NTIS HC A17/MF A01

Tests were conducted to acquire data with bituminous coal at high carbon conversions and to obtain data at high char conversions with high char throughputs. Tests were conducted to determine whether the major modifications recently incorporated would facilitate optimum operating conditions and clinker-free operation. Tests were conducted to optimize reactor operation by improving char conversion, increasing the temperature in the steam-oxygen gasifier to 1800 F, and continuing to reduce the steam-to-char ratios. Test were initiated to achieve a lower steam-to-char ratio and a significantly lower superficial gas velocity in the steam-oxygen gasifier. DOE

N80-31631# Rockwell International Corp., Canoga Park, Calif. Environmental and Energy Systems Div.
MOLTEN SALT COAL GASIFICATION PROCESS DEVELOPMENT UNIT. Quarterly Technical Progress Report, Jul - Sep. 1979
M. H. Slater 19 Oct. 1979 31 p
(Contract EF-77-C-03-1429)
(SAN-1429-56; QTPR-14) Avail: NTIS HC A03/MF A01

The design construction, and operation of a process development unit (PDU) which will convert 1 ton of coal per hour into low-Btu gas is presented. Details were complete and all parts were fabricated for the melt withdrawal system modifications designed to increase the reliability of the system. The fabrication of pressure-rated gas burners for the melt withdrawal system was initiated. These heaters operate over the entire pressure range of PDU testing; i.e., from one atmosphere through 20 atmospheres. DOE

N80-31632# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.
FOSSIL FUELS RESEARCH MATRIX PROGRAM. US ENVIRONMENTAL PROTECTION AGENCY/DEPARTMENT OF ENERGY FOSSIL FUELS RESEARCH MATERIALS FACILITY
W. H. Griest and M. R. Guerin Jun. 1980 52 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7346) Avail: NTIS HC A04/MF A01

Health and environmental-effects studies of alternate fossil fuels technologies were conducted. Sets of sample differing in some systematic manner (e.g., coal-, shale-, and petroleum-derived counterparts; processing history; etc.) were brought to the attention of investigators expert in various biological and chemical tests systems. The result is a series of matrix experiments whereby various groups apply a variety of tests to given sets of samples. The matrix program provides a convenient source of useful samples and guidance on sample characteristics and data gaps in exchange for results of the individual investigations. DOE

N80-31633# Dravo Corp., Pittsburgh, Pa. Chemical Plant Div.
PITTSBURGH ENERGY TECHNOLOGY CENTER HYDROGASIFICATION PROCESS: CONCEPTUAL COMMERCIAL SCALE PLANT DESIGN
28 Dec. 1979 115 p refs
(Contract DE-AC21-78MC-08484)
(DOE/MC-08484/T1) Avail: NTIS HC A06/MF A01

Hydrogasification pilot plant tests at various H2 coal ratios and coal throughputs or North Dakota lignite, Illinois No. 6 and a Western sub-bituminous coal were reviewed. Additional testing at higher H2 coal ratios confirmed that greater coal throughputs were possible. Conceptual commercial scale plant designs based on the North Dakota lignite and the Illinois No. 6 coal showed total plant investment figures of $1668 MM and $1998 MM for the two coals, respectively. Gas costs based on the Unitity Finance Method of calculation yielded costs ranging from $4.91/MM Btu and $5.26/MM Btu for lignite at $5.00 and $8.00 per ton. Corresponding figures for the Illinois No. 6 coal were gas costs of $6.08 to $6.73 for coal costs of $20 and $30 per ton, respectively. Gas cost sensitivity analyses are performed. Further study of the process is warranted. DOE

N80-31634# Westinghouse Electric Corp., Madison, Pa. Advanced Coal Conversion Dept.
ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION. Quarterly Progress Report, 1 Jan. - 31 Mar. 1979
31 Aug. 1979 68 p
(Contract EF-77-C-01-1514)
(FE-1514-101) Avail: NTIS HC A04/MF A01

Additional testing of the gasifier-agglomerator reactor included direct coal feed as well as oxygen-blown gasification of a char or coal bed. Support work on fuel processing was conducted to investigate operating conditions for the process development unit test program; provide troubleshooting capability for PDU operation, obtain data for PDU modifications, analyze and interpret results from PDU operation, develop process models for scale-up, and understand process phenomena to achieve reliable operation. Work was conducted in the areas of cold flow and analytical modeling, coal behavior, coal and ash chemical phenomena, environmental impact, and process and systems engineering consultation. DOE

N80-31635# Air Products and Chemicals, Inc., Allentown, Pa.
CRYOGENIC METHANE SEPARATION/CATALYTIC HYDROGASIFICATION PROCESS ANALYSIS. Quarterly Report, 15 Oct. 1978 - 15 Jan. 1979
16 Jan. 1979 19 p
(Contract ET-78-C-01-3044)
(FE-3044-T7) Avail: NTIS HC A02/MF A01

Efforts were directed towards identifying the most attractive acid gas removal systems, per case, based on preliminary screenings. Using proprietary information obtained from the respective vendors of the Benfield and Rectisol acid gas removal processes, preliminary cost estimates were complete for the Exxon CCG process. Several sets of computer simulations, for different acid gas removal configurations, for the Selexol process were developed to optimize methane recovery and utility savings. DOE

N80-31636# Institute of Gas Technology, Chicago, Ill.
PIPELINE GAS FROM COAL: HYDROGENATION (IGT HYDROGASIFICATION PROCESS). Quarterly Report, 1 Oct. - 31 Dec. 1979
May 1980 75 p
(Contract EX-76-C-01-2434)
(FE-2434-58; QR-14) Avail: NTIS HC A04/MF A01

A data base to optimize the design of the HYGAS process. Test 83 operations was established and post run inspection was conducted to determine the operating behavior of washed Kentucky coal under process conditions. After smooth, continuous solids transfer could not be established through the 339 line from the high temperature reactor to the steam/oxygen gasifier, the test was terminated. Several holes and a crack found in solids transfer line 339 during the post run inspection were the source of these difficulties. Test 84 was the second test of a new series with Western Kentucky coal, and the objectives were the same as those of Test 83. The reactor operated in a self sustained mode for 215 hours, during which 317 tons of pretreated char were fed to the gasifier. Three steady state periods totaling 83.5 hours, were selected for detailed analysis. Routine maintenance and major turnaround work in preparation for test 85 was started. DOE

N80-31637# Institute of Gas Technology, Chicago, Ill.
COAL GASIFICATION PILOT PLANT SUPPORT STUDIES. Quarterly Report, 1 Apr. - 30 Jun. 1979
Jan. 1980 162 p refs
(Contract ET-78-C-01-2806)
(FE-2806-5) Avail: NTIS HC A08/MF A01

Improving pilot plant operation, achieving expected conversion, and effecting cost savings are discussed. Projects are classified into four tasks as follows: (1) studies of gasification reactions for improving the performance of coal gasification reactors; (2) studies of fluidized bed reactors in coal gasification processes; (3) studies to improve the processing techniques of product and waste gases from coal gasification; and (4) studies to improve methods of feed preparation for coal gasification. Each task is further divided into a number of subtasks dealing with specific aspects of the task. The objectives of the subtasks

and their technical progress during the last quarter (April 1 through June 30, 1979) are presented. DOE

N80-31638# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
ADVANCED DEVELOPMENT OF A SHORT-RESIDENCE-TIME HYDROGASIFIER. Annual Technical Progress Report
21 Jan. 1980. 153 p. refs.
(Contract ET-78-C-01-3125)
(FE-3125-12) Avail: NTIS. HC A08/MF A01

Relocation and modification of the subscale hydrogasifier test facility to accommodate longer duration testing was accomplished. A joint decision was made to scale the previously planned 1/4-TPH system to a nominal 3/4-TPH system. The required adjustments were primarily in the form of line size changes which were implemented during the installation of the process piping. Additional modifications to the reactor train support structure and handling capability were made to accommodate the larger reactor pressure vessel, having an 11.75 in. inside diameter. Facility modifications are planned to provide capability for simulated recycle gas feed, and provide for more representative sampling for improved material balances. DOE

N80-31639# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
ADVANCED DEVELOPMENT OF A SHORT-RESIDENCE-TIME HYDROGASIFIER. Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1980
Apr. 1980. 152 p. refs.
(Contract ET-78-C-01-3125)
(FE-3125-18) Avail: NTIS. HC A08/MF A01

Progress in the development of test facilities for the hydrogasification of coal and peat is described. The surveillance of materials for components and carbon conversion efficiency are discussed. DOE

N80-31640# IIT Research Inst., Chicago, Ill.
DESIGN, ENGINEERING AND EVALUATION OF REFRACTORY LINERS FOR SLAGGING GASIFIERS. Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1979
R. F. Firestone, C. Hales, and M. J. Greaves. Jan. 1980. 27 p. Prepared in cooperation with McKee (Davy) Corp., Cleveland.
(Contract ET-78-C-01-2785)
(IITRI-M-6043-5, QTPR-5) Avail: NTIS. HC A03/MF A01

Temperatures in slagging gasifiers are in the 2500 F to 3300 F range which limits the materials which can be used. In addition the combination of high pressure (up to 1500 psi) with water vapor and the presence of carbon monoxide and hydrogen can present corrosion problems for refractories. Low iron, high alumina refractories are the presently preferred materials for coal gasification plants. The atmospheres and other conditions found in vessels used in coal gasification require the use of dense and insulating high Al_2O_3 refractory shapes and castables. Low SiO_2 and low Fe_2O_3 refractories are necessary to resist steam and CO. In processes that involves molten carbonates or where slag may run down walls, fused cast Al_2O_3 is used to avoid corrosion and erosion. Considerable research is required to establish optimum refractory systems and design methods for slagging coal gasifiers. DOE

N80-31641# Gulf Research and Development Co., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS. Final Report
D. C. Succop and F. E. Wynne. Mar. 1980. 98 p.
(Contract EX-76-C-01-1800)
(FE-1800-45) Avail: NTIS. HC A05/MF A01

The conversion of coal to synthetic gasoline and other distillate motor fuels, by delayed coking of a coal/petroleum resid slurry with an associated displacement of petroleum residual to the fluid catalytic cracking unit was studied. The cooking process met or exceeded technical and economic predictions. Ambient pressure coking experiments with two different coal slurries demonstrated synergistic increases in C3(+) distillate yield and product quality. Slurry viscosity measurements and heater fouling tests indicated only slightly pseudo-plastic slurry behavior and no unusual pumping resistance of pressure drop in slurry heaters. However, above 814 F rapid coking and heater fouling was experienced. Laboratory hydrogen transfer mechanism studies led to the conclusion that no C-C transfer occurred during coking. The process appears to be that of general H-H scrambling, perhaps promoted by the presence of a metal reactor and/or coal mineral matter functioning as a catalyst. DOE

N80-31642# North Dakota Univ., Grand Forks. Dept. of Chemistry.
CHEMISTRY OF LIGNITE LIQUEFACTION. Quarterly Report, Jul. - Sep. 1978
Virgil I. Stenberg, Richard Baltisberger, Kenneth J. Kalbunde, Neil F. Woolsey, Donald Severson, and Max Souby. Oct. 1978. 82 p. refs.
(Contract EX-76-C-01-2211)
(FE-2211-11) Avail: NTIS. HC A05/MF A01

Various results related to the liquefaction of lignite are reported. The structural chemical analysis of oxygen and nitrogen compounds in coal liquids is facilitated by acetylation. Solvent refined lignite and solvent refined coal were hydrogenated using a variety of catalysts. The resulting liquids were fractionated by distillation and examined by mass spectroscopy and nuclear magnetic resonance. Model compounds were reduced using carbon monoxide-water or hydrogen using various catalysts (among others fly ash) in an effort aimed at reducing the severity of coal liquefaction conditions. Electron transfer from thermally activated magnesium oxide powder to nitrobenzene and adsorbed carbon monoxide was also studied. DOE

N80-31643# Los Alamos Scientific Lab., N. Mex.
HYDROGEN PRODUCTION FROM THE SOLAR BASED LASL CADMIUM CYCLE
C. F. V. Mason, M. G. Bowman, and R. G. Behrens. 1980. 6 p. refs. Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980.
(Contract W-7405-eng-36)
(LA-UR-80-1400; CONF-800806-2) Avail: NTIS. HC A02/MF A01

A thermochemical H_2 cycle is presented where the high temperature step can be powered by a solar heat source. The cycle consists of three reactions: the thermal decomposition of CdO and $CdCO_3$ and the oxidation of Cd using water and CO_2 to form $CdCO_3$ and H_2. Experimental data is presented which indicates that CdO(g) is less stable than previously thought. Kinetic studies of the H_2 producing reaction show both Pd and NH_4Cl to be good catalysts. NH_4Cl, although introducing more possibilities for side reactions, appears to be the better catalyst. Drying studies on $CdCO_3$ show that water retention problems are minimal. DOE

N80-31644# Engineering Societies Commission on Energy, Inc., Washington, D. C.
MATERIALS FOR COAL CONVERSION AND USE. VOLUME 2: MATERIALS OF CONSTRUCTION FOR COAL CONVERSION SYSTEMS. PART 1: COAL GASIFICATION. PART 2: COAL LIQUEFACTION. Final Report
Vinod K. Nangia. Oct. 1979. 409 p. refs.
(Contract EF-77-C-01-2468)
(FE-2468-59-Vol-2-Pt-1/2) Avail: NTIS. HC A18/MF A01

The principles of coal gasification and liquefaction are reviewed and the various technologies and equipment used are examined. Present and past work on the behavior of materials in coal conversion and use environments is reported. Available data are evaluated and problems areas related to materials are identified. Operating conditions are defined for these technologies in terms of temperature, pressure, erosive and corrosive environments, and their effects on the construction materials. Candidate materials are proposed based on extrapolation of the available data and related experience from other technologies. Areas needing further research and development are recommeneded. DOE

N80-31645# TRW Energy Systems Planning Div., McLean, Va.
METHANE RECOVERY FROM COALBEDS PROJECT, PHASE 2. Annual Report, 1979
1979. 101 p.
(Contract DE-AC21-78MC-08089)
(DOE/MC-08089/T4) Avail: NTIS. HC A06/MF A01

Field activities relating the estimation of the methane resources contained in the nation's coalbeds and the determination of exploration and production technologies that allow extrapolation from test sites to larger resource areas are reported. Projects goals and management are also addressed. DOE

N80-31646# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
LIQUID FUELS FROM BIOMASS: CATALYSTS AND REACTION CONDITIONS
Manu Seth, Sabri Ergun, Ted Vermeulen, and Roger Djafar. Apr. 1980. 72 p. refs
(Contract W-7405-eng-48)
(LBL-9789) Avail: NTIS. HC A04/MF A01

The use of alpha-phellandrene as a hydrogen transfer agent in wood liquefaction was studied at 200 C. No significant thermally promoted hydrogen transfer occurred under these conditions. Dilute sulfuric acid was added to test the possibility of hydride transfer from alpha-phellandrene to wood. Extensive solvent alkylation of the wood occurred in the presence of up to 2 wt % of sulfuric acid. Addition of palladium as a hydrogenation catalyst resulted in lower overall conversion based on the toluene-insoluble residue obtained, and in lowered levels of solvent alkylation. Several inorganic salts were tested as catalytic additives for wood liquefaction at 250 C in the presence of tetralin as a possible hydrogen donor. No hydrogen transfer from the solvent was observed. Of the additives tested, nickel chloride, sodium carbonate, and ferric chloride resulted in wood conversions greater than or equal to those obtained in the absence of an additive. DOE

N80-31647# Battelle Columbus Labs., Ohio.
ECONOMIC EVALUATION OF THE MIT PROCESS FOR MANUFACTURE OF ETHANOL
D. M. Jenkins and T. S. Reddy. 28 Jun. 1979. 32 p. refs
(Contract ET-78-X-01-3992)
(DSE-3992-T1) Avail: NTIS. HC A03/MF A01

Conceptual process designs were developed for two cases, Case A which was based on the experimental data obtained to date, and Case B which hypothesized the suppression of acid byproducts. Economic estimates may be slightly on the low side since they did not consider feedstock storage nor working capital requirements. The manufacturing costs for Case A appeared to be comparable to those of the manufacture of ethanol from corn. The plant size used for this analysis was 1500 ton/day corn stover. This is considered to be a realistic size. The conceptual plants make about 27 million gal/yr ethanol in Case A and 41 million gal/yr in Case B. DOE

N80-31648# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SURVEY OF BIOMASS GASIFICATION. VOLUME 3: CURRENT TECHNOLOGY AND RESEARCH
Apr. 1980. 302 p. refs. 3 Vol.
(Contract EG-77-C-01-4042)
(SERI/TR-33-239-Vol-3) Avail: NTIS. HC A14/MF A01

This survey of biomass gasification was written to areas of gasification that are ready for commercialization now and those areas in which further research and development will be most productive. Consideration is given to: a survey of gasifier types; a directory of current manufacturers of gasifiers and gasifier development programs; and a sampling of gasification research and development programs and their unique features. Air gasification for the conversion of existing gas/oil boiler systems to biomass feedstocks is compared with the price of installing new biomass combustion equipment. Chapter 12 treats gas conditioning as a necessary adjunct to all but close-coupled gasifiers, in which the product is promptly burned. Synthesis gas processes for conversion to methanol, ammonia, gasoline, or methane are evaluated technically and economically. DOE

N80-31649# Dynatech R/D Co., Cambridge, Mass.
PEAT BIOGASIFICATION DEVELOPMENT PROGRAM
Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
1979. 28 p. refs
(Contract DE-AC01-79ET-14696)
(DOE/ET/14696-T1) Avail: NTIS. HC A03/MF A01

The effects of different alkalis, temperatures, and oxygen partial pressures on the solubility of peat organic material were determined. Multi-stage pretreatment was investigated by pretreating the effluent from previous NaOH pretreatment cooks. Bacteria from three inoculation sources are being grown anaerobically on a growth medium containing a standard nutrient medium and one of twelve aromatic compounds. The concentration of aromatic compound is increased gradually to acclimate the bacteria to compounds which may result from peat pretreatment. A preliminary design for a full scale peat biogasification plant developed. The plant is designed to produce 75 millions SCFD of pipeline quality methane. Major segments of the plant are concerned with the transport, handling, pretreatment, and fermenting of the aqueous peat slurry, and the purification of the resulting methane gas. R.K.G.

N80-31650# Solar Turbines International, San Diego, Calif. Applied Sciences Div.
AUTOMOTIVE STORAGE OF HYDROGEN USING MODIFIED MAGNESIUM HYDRIDES. Final Report, Mar. 1976 - Mar. 1978
D. A. Rohy, J. F. Nachman, A. N. Hammer, and T. E. Duffy. 1979. 82 p. refs
(Contract EY-76-C-03-1167)
(SAN-1167-1) Avail: NTIS. HC A05/MF A01

Due to the relative stability of MgH2, modifications of the MgMH/sub x/ (M = metal ion) were made to decrease the dissociation temperature while retaining high hydrogen capacity. This parameter is crucial since vehicle exhaust will supply the thermal energy to dissociate the hydride in an automobile. Hydride dissociation temperature (T/sub D/) should be 200 C to ensure uninterrupted fuel flow at all driving and idle conditions. Alloys comprised of Mg, Cu and Ni came closest to meeting the dissociation temperature goal. Dissociation temperature, hydrogen capacity and material cost are reported for each alloy tested in this program. DOE

N80-31651# General Atomic Co., San Diego, Calif.
HYDROGEN PRODUCTION BY THE GA SULFUR-IODINE PROCESS
G. E. Besenbruch, K. H. McCorkle, J. H. Norman, D. R. OKeefe, J. R. Schuster, P. W. Trester, and M. Yoshimoto (Idemitsu Kosan Co., Ltd., Tokyo). May 1980. 17 p. Presented at the 3d World Hydrogen Energy Conf., Tokyo, 23 Jun. 1980
(Contract DE-AC02-80ET-26225; Proj. 3260)
(GA-A-15777-Rev; CONF-800616-6-Rev) Avail: NTIS. HC A02/MF A01

The progress of the overall total development effort of the General Atomic (GA) sulfur-iodine thermochemical water splitting cycle over the last two years is summarized. The major accomplishments were significant improvements in the chemistry of the process; development, review, and revision of an engineering flow sheet, resulting in a thermal process efficiency of 47%; screening, identification, and testing of potential materials-of-construction for the corrosive process fluids; small-scale demonstration of the cycle in a closed loop under recycle conditions; installation of bench-scale equipment and demonstration of parts of the processing in this system; and development of a conceptual, preliminary flowsheet for the GA sulfur-iodine cycle driven by solar energy. Thermochemical water splitting by the sulfur-iodine cycle is a feasible process. Thermal efficiencies in the range of 50% are achievable. DOE

N80-31652# California Univ., Livermore. Lawrence Livermore Lab.
GASIFICATION OF COAL WITH SOLAR ENERGY
William R. Aiman and David W. Gregg. Jun. 1980. 28 p. refs. Presented at 88th Natl. Meeting of the AIChE Conf., Philadelphia, 8-12 Jun. 1980
(Contract W-7405-eng-48)
(UCRL-84458; CONF-800610-8) Avail: NTIS. HC A03/MF A01

Coal reactors are adaptable to solar-energy facilities. Two advantages make solar coal gasification attractive economically: synthesis gas (a nitrogen-free product) can be produced without pure oxygen and only half as much coal is required. Solar energy is available 8 hours per day; therefore, post-gasification processing units must be oversized and equipped for rapid startup and shutdown. This disadvantage is balanced by the 50 percent

reduction cost for coal and coal pretreatment equipment and in the sulfur content of the product gas. A moving bed reactor, a fluidized bed reactor, a closed-loop, heat-transfer-fluid reactor, and an open-loop, heat-transfer-fluid reactor are discussed. The expected performance of a moving-bed gasifier yields products with an energy content 25 percent higher than the initial coal compared to 17 percent higher for a fixed-bed gasifier. DOE

N80-31653# Gulf Research and Development Co., Pittsburgh, Pa. Chemical and Minerals Div.
UNDERGROUND GASIFICATION FOR STEEPLY DIPPING COAL BEDS. RAWLINS TEST NO. 1
1980 29 p Prepared in cooperation with TRW Energy Systems Planning Div., McLean, Va.
(SAN-13108-35; Rept-624RL106) Avail: NTIS HC A03/MF A01

The first US field test of gasification for a steeply dipping coal seam was recently completed. A 23 ft thick coal bed dipping at 63 was used to test the feasibility of using underground coal gasification techniques to extract energy from steeply dipping coal beds. The coal was ignited at a vertical depth of 400 ft utilizing a directionally drilled process well pair. The test was designed to investigate the effects of water/air injection, steam/air injection, and steam/oxygen injection. According to plan approximately 1200 tons of coal were utilized during the test. The heating value of the product gas initially climbed to approximately 180 Btu/SCF and as expected, gradually declined to the 120 to 130 Btu/SCF range. A five day steam/oxygen blown experiment was conducted subsequent to the steam/air phase. As expected steam/oxygen injection easily doubled the product gas heating value to the 240 to 260 Btu/SCF range. DOE

N80-31654# California Univ., Livermore. Lawrence Livermore Lab.
LLL IN SITU COAL GASIFICATION PROJECT Quarterly Progress Report, Oct. - Dec. 1979
Robert J. Cena, ed. and Barbara S. Strack, ed. 23 Apr. 1980 40 p refs Sponsored in part by Gas Research Inst.
(Contract W-7405-eng-48)
(UCRL-50026-79-4) Avail: NTIS HC A03/MF A01

Thermal data were analyzed to determine the performance of the drilled horizontal channel during forward gasification. Thermal and material balance data were combined to determine late time burn boundaries for the experiment. Process wells were inspected to determine failure characteristics and pinpoint late-time injection location. Ground water quality before and after Hoe Creek No. 3 and the effects of aquifer interconnection on hydraulic measurements at the Hoe Creek No. 2 and No. 3 sites are discussed. DOE

N80-31655# Sandia Labs., Albuquerque, N. Mex. Thermal Processes Div.
INSTRUMENTATION AND PROCESS CONTROL DEVELOPMENT FOR IN SITU COAL GASIFICATION Quarterly Report, 1 Dec. 1979 - 31 Mar. 1980
Robert E. Glass, ed. Jun. 1980 26 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1025) Avail: NTIS HC A03/MF A01

The Hanna 4B thermal data was analyzed with respect to the fundamental controlling mechanisms in in situ coal gasification. Two of the concerns center on: (1) the behavior of the reservoir with respect to varying permeability zones and (2) mechanisms of initial cavity growth during forward gasification. In an attempt to deal with these concerns, two specific areas of interest are being pursued: (1) a reservoir model with variable permeability; and (2) a structural model of the coal seam using the finite element program ADINA. While these models remain in the development stage, initial results indicate that the approaches being used will yield useful results when completed. DOE

N80-31656# Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.
MIXING AND GASIFICATION OF COAL IN ENTRAINED FLOW SYSTEMS. VOLUME 2: USER'S MANUAL FOR A COMPUTER PROGRAM FOR 1-DIMENSIONAL COAL COMBUSTION OR GASIFICATION (1-DICOG) Final Report
L. Douglas Smoot and Philip J. Smith 31 Aug. 1979 215 p refs Sponsored in part by Electric Power Research Inst.
(Contract EF-77-S-01-2666)
(FE-2666-F-Vol-2) Avail: NTIS HC A10/MF A01

A one dimensional, steady state model describing pulverized coal combustion and gasification is presented. Emphasis was placed on the description of the coal reaction processes and gas particle interactions, one dimensional fluid mechanics and particle-particle, particle-wall radiation. Moisture vaporization from the coal particles, multistep coal pyrolysis, and heterogeneous char oxidation by multiple oxidizers were modeled for polydispersed coal particle size or types. Although the formation was one dimensional, mixing rates of primary and secondary streams and recirculation within the reactor were accounted for as specified input. The resulting model predicted thermal, chemical and physical histories for both the gaseous and particle phases. Gas-particle interactions accounted for appropriate diffusion and kinetic rates. Gas phase reactions were assumed to be in local chemical equilibrium. The solution technique used predictor-corrector methods for integration of the ordinary nonlinear differential equations which were coupled with a number of auxiliary algebraic equations. DOE

N80-31657# Department of Energy, Washington, D. C. Office of Advanced Conservation Technologies.
HYDRIDES VERSUS COMPETING OPTIONS FOR STORING HYDROGEN IN ENERGY SYSTEMS
James H. Swisher and Edward D. Johnson (OAO Corp., Washington, D.C.) 7 Apr. 1980 43 p refs Presented at Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, Colo., 7 Apr. 1980
(Contract DE-AC01-79CS-60478)
(CONF-800402-13) Avail: NTIS HC A03/MF A01

Hydrogen storage in metal hydrides was compared to other forms of hydrogen storage. Comparisons were made using technical performance, cost, and safety as the criteria. Hydrides applications and alternatives for vehicular applications, chemical heat pumps, engines, peak shaving, and others were examined. DOE

N80-31658# Department of Energy, Pittsburgh, Pa. Energy Technology Center.
RECENT COAL-OIL MIXTURE COMBUSTION TESTS AT PETC
Y. S. Pan, G. T. Bellas, M. P. Mathur, J. I. Joubert, and D. Bienstock Jun. 1980 38 p refs
(DOE/PETC-TR-80/5) Avail: NTIS HC A03/MF A01

Coal-oil mixture combustion tests with coal concentration of up to 50 percent were successfully conducted in a 700 horsepower watertube boiler designed originally for oil firing. A 500 h duration test with coal-oil mixture containing 40 percent coal was completed. No derating of the boiler occurred, carbon-conversion efficiencies were above 98 percent, and boiler efficiencies were the same as when firing No. 6 fuel oil. All combustion tests were conducted with No. 6 fuel oil mixed with Pittsburgh Seam coal pulverized to a coal particle size of 90 percent minus 200 mesh. Test results relating to boiler performance, pollutant emissions, ash deposition, and corrosion, erosion, and fouling behavior are presented. DOE

N80-31659# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF COMBUSTION DATA TO UTILIZE LOW-Btu GASES AS INDUSTRIAL PROCESS FUELS: MODIFICATION OF FLAME CHARACTERISTICS Quarterly Report, 1 Jan. - 31 Mar. 1980
Richard T. Waibel Apr. 1980 7 p
(Contract DE-AC01-79ET-14851)
(DOE/ET-14851/2) Avail: NTIS HC A02/MF A01

The burner modifications that yield suitable flame characteristics and shapes with oxygen blown gases manufactured from coal were determined. Methods of enchancing the flame characteristics of manufactured gases from air-blown gasifiers were evaluated. DOE

N80-31660# National Technical Information Service, Springfield, Va.
SYNTHETIC FUELS FROM MUNICIPAL, INDUSTRIAL, AND AGRICULTURAL WASTES. CITATIONS FROM THE NTIS

DATA BASE Progress Report, 1964 - Jun. 1980
Audrey S. Hundemann Jun. 1980 230 p Supersedes NTIS/PS-79/0545; NTIS/PS-78/0499
(PB80-81137 NTIS/PS-79/0545; NTIS/PS-78/0499) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

Research efforts directed toward production of gaseous and liquid synthetic fuels from solid wastes are discussed. Waste products used in the syntheses include manure, sewage, paper, and wood. In most citations, methane is the primary fuel produced; however, the production of oils, methanol, and ethanol is also discussed. This updated bibliography contains 218 abstracts, 54 of which are new entries to the previous edition. GRA

N80-31661# Office of Technology Assessment, Washington, D.C.
TAGGANTS IN EXPLOSIVES
Apr. 1980 270 p refs
(PB80-192719; OTA-ISC-116; LC-80-600070) Avail: NTIS HC A12/MF A01 CSCL 19A

Issues surrounding a proposal to require that commercial explosives and gunpowders carry 'identification taggants' and/or 'detection taggants' as an aid to law enforcement are examined. Four major questions are addressed: (1) it reviews the program to develop such taggants and addresses the question of whether taggants would work; (2) it assesses whether taggants might create a safety hazard; (3) the cost of a taggant program is calculated, and (4) the likely value of such a program to law enforcement is assessed. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-31662 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NO. 7
Judith Nagle-Eshleman, ed. Jul. 1980 96 p refs
(AD-A087855) Avail: Naval Research Lab., Attn: code 5804, Washington, D.C. 20375 Annual rate HC $100.00

The causes of rotor instability are addressed with emphasis on internal damping, dry friction, and bearing forces. The factors involved in the mathematical modeling of fluid transients in machines are also considered. For individual titles, see N80-31663 through N80-31664.

N80-31663 Kobe Univ. (Japan).
STABILITY PROBLEMS OF ROTOR SYSTEMS c37
T. Iwatsubo *In* Shock and Vibration Information Center The Shock and Vibration Inform. Digest, Vol. 12, No. 7 Jul. 1980 p 3-8 refs (For primary document see N80-31662 22-31)
Avail: Naval Research Lab., Attn: code 5804, Washington, D.C. 20375 Annual rate HC $100.00

A review of the literature published in 1978 and 1979 on instability in rotor systems is presented. Instability due to internal damping, dry friction, bearing forces, fluid forces, parametric excitation, torsional and torsional lateral vibration, and asymmetric elements are included. J.M.S.

N80-31664 Ohio State Univ., Columbus. Dept. of Mechanical Engineering.
MODELING OF FLUID TRANSIENTS IN MACHINES, PART 2: ADVANCED CONSIDERATIONS c34
R. Singh *In* Shock and Vibration Information Center The Shock and Vibration Inform. Digest, Vol. 12, No. 7 Jul. 1980 p 11-17 refs (For primary document see N80-31662 22-31)
Avail: Naval Research Lab., Attn: code 5804, Washington, D.C. 20375 Annual rate HC $100.00

A state-of-the-art literature review is presented with emphasis on advanced mathematical modeling considerations. The following topics are discussed: modeling of turbomachinery and positive displacement machinery; dynamic coupling of machines; transient behavior of machinery systems and installations; multidimensional transients; two phase flow; interaction between wave propagation and fluid flow modes; and experimental modeling methods. R.C.T.

N80-31665 California Univ., San Diego, La Jolla.
SEISMIC STABILITY OF BLOCK STRUCTURES Ph.D. Thesis
Richard Luttrell Furgerson 1980 120 p
Avail: Univ. Microfilms Order No. 8018779

When studying earthquake damage reinforced concrete or concrete masonry structures, it was observed that the mechanisms of failure are often simple ones; the vulnerable connections between structural components degrade under stress allowing the major substructures to separate, lose support, and topple. This type of failure is said to result from kinetic instability. For the purpose of analysis, structures with degraded connections are modeled as assemblages of rigid substructures with only friction acting between them. A statistical analysis of data from experiments on concrete masonry members gives an asymptotic Coulomb law describing this friction which is included in the model equations of motion. The equations of motion for a simple shear wall floor slab assemblage subjected to simulated earthquake loading are solved numerically. The result shows a surprisingly well defined relation between the maximum amplitude of excitation, the natural frequency of the structure, and a numerically valued hazard from kinetic instability. When presented graphically, the result allows a designer to assess hazard from kinetic structural instability by inspection. Dissert. Abstr.

N80-31666 Mississippi State Univ., State College.
DEVELOPMENT AND EVALUATION OF THE EPOXY REPAIR METHOD FOR REINFORCED CONCRETE FLEXURAL MEMBERS Ph.D. Thesis
Sak Kongsuwan 1980 232 p
Avail: Univ. Microfilms Order No. 8021117

Repair procedures were developed based on both the evaluation of the past epoxy repair methods and the pilot study in this research. Fifteen reinforced concrete beams were failed in flexure to produce failures ranging from light to heavily damaged. The damaged beams were repaired using the methods developed and tested. It was concluded that it is possible to repair failed reinforced concrete beams (particularly in flexure) by using the developed repair method. The loading capacity of a repaired beam was verified both experimentally and theoretically as being restorable to approximately the same level as of the original beam regardless of the type and degree of failure. The durability of repaired beams, subjected to cycle loading, is somewhat less than the durability of the original beams. The decrease of durability of the repaired beams is attributed by the softening of steel, the amount of epoxy present in the concrete, and the presence of microcracks. Repaired beams which were failed by one cycle loading were found to behave identically to the original undamaged beams. Dissert. Abstr.

N80-31667*# Northern Research and Engineering Corp., Woburn, Mass.
US COAST GUARD LIGHTWEIGHT FIRE-FIGHTING MODULE Final Report
15 May 1980 117 p
(Contract NAS8-31977)
(NASA-CR-161552; NREC-1296-1) Avail: NTIS HC A06/MF A01 CSCL 13B

The U.S. Coast Guard Fire-fighting Module developed for the purpose of fighting fires in harbors and on ships is described. The module can be lifted by a dockside crane or helicopter and placed on the deck of a patrol boat or cutter for transportation to the scene of the fire. At the fire the module can be set up and put in operation by a crew of two in approximately fifteen minutes. Once in operation the module will deliver water to two fire nozzles at a pressure of 150 psi and a flow rate of 2000 gpm. Sufficient fuel is carried in the module for three hours of continuous operation. A record of the development of the fire fighting module is also presented. L.F.M.

N80-31668# Aeronautical Research Labs., Melbourne (Australia).
REDUCTION IN SWING OF A SONAR BODY WINCHED FROM THE SEA BY A HELICOPTER
N. E. Gilbert Aug. 1979 23 p refs
(ARL/AERO-NOTE-395; AR-001-766) Avail: NTIS

HC A02/MF A01

To avoid the possibility of collision with the helicopter, an automatic procedure is proposed in which the sonar body is alternately raised and lowered during defined periods of each oscillation. When the prescribed degree of damping is achieved, the body is raised continuously to the trail position. Performance of the method is judged by the amount of additional raise time required. L.F.M.

N80-31669# Earthquake Engineering Research Inst., Berkeley, Calif.

UNDISTURBED SAMPLING AND CYCLIC LOAD TESTING OF SANDS

Sukhmander Singh, H. Bolton Seed, and Clarence K. Chan. Dec. 1979. 147 p. refs.

(Contracts DACW39-77-M-0859; DACW39-78-M-2016)

(AD-A087298; UCB/EERC-79/33) Avail: NTIS HC A07/MF A01 CSCL 08/13

The influence of sampling disturbance on the cyclic strength characteristics of sands was evaluated. Sampling types studied include block sampling by advance trimming and sampling, push-tube sampling and a freezing technique. It is shown that block sampling caused minimal density changes and provides a very high quality sample. The push-tube sampling method caused density changes and the less resistant structure of virgin soil deposits underwent pronounced density changes. It is further indicated that if the confining pressure is maintained and drainage is not impeded the volume changes during freezing are insignificant and the cyclic strength characteristics are not altered. It is concluded that the influence of disturbance due to sampling handling requires careful interpretation in evaluating the significance of cyclic load test data. R.K.G.

N80-31670# Bendix Corp., Kansas City, Mo.

FABRICATION FOR PRECISION MECHANISMS Final Report

L. K. Gillespie. Mar. 1980. 103 p. refs.

(Contract DE-AC04-76DP-00613)

(BDX-613-2388) Avail: NTIS HC A06/MF A01

Twenty-five manufacturing operations were studied to improve the precision of existing machining and assembly techniques. The study included the machining of metals and plastics using techniques new to the manufacture of miniature switches, timers, and actuators. Drilling, tapping, and press-fitting miniature features were evaluated. Fixturing and handling techniques, friction reduction, and the forming of ceramic parts were also studied. Many of the new approaches from this study were incorporated into existing processes and further refined. DOE

N80-31671# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.

GRAVITATIONAL CONVECTION OF SUBCOOLED He 1 AND THE TRANSITION INTO SUPERFLUID He 2 AT ATMOSPHERIC PRESSURE

S. Caspi. Jun. 1980. 7 p. refs. Presented at the 8th Intern. Cryogenic Eng. Conf., Genoa, 3-6 Jun. 1980

(Contract W-7405-eng-48)

(LBL-10928; CONF-800631-2) Avail: NTIS HC A02/MF A01

The propagation velocity of the He 2-He 1 interface at 1 atm was measured in a large experimental cryostat. During cooldown, He 2 at the lambda temperature propagates up and down in a gravitational field with an interface velocity V/sub b/ which depends on the He 1 temperature T/sub infinity/. For T/sub infinity/ = 4K, V/sub b/ = 0.1 mm/sec and for T/sub infinity/ = 2.2 K, V/sub B/ = 2 mm/sec. During warm up, He-1 propagated with an interface velocity V/sub b/ > 30 mm/sec that was measured as low bound only. A mathematical model gives a temperature dependent interface thickness in the range 0.0002 approximately equals delta < 0.4 mm. DOE

N80-31672# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.

INVESTIGATION OF THE VIBRATIONAL BEHAVIOR OF A CABLE-STAYED BRIDGE UNDER WIND LOADS

J. W. G. vanNunen and A. J. Persoon. 12 Feb. 1979. 15 p. ref. Presented at Intern. Conf. on Environ. Forces on Eng. Struct., London, 3-6 Jul. 1977

(NLR-MP-79004-U) Avail: NTIS HC A02/MF A01

Wind tunnel tests were carried out on a two dimensional model to establish the flutter stability of the bridge and to determine resonance vibrations due to vortex shedding. During construction of the actual bridge, vibration measurements were performed and the wind-induced vibrational behavior of the structure was observed. Measured resonance vibration agreed very well with the values for the model tests in the tunnel. Author (ESA)

N80-31673# National Bureau of Standards, Washington, D.C. Center for Building Technology.

ENERGY BUDGET PROCEDURES AND PERFORMANCE CRITERIA FOR ENERGY CONSERVING BUILDING ILLUMINATION SYSTEMS

Albert T. Hattenburg, Jim L. Heldenbrand, D. K. Ross, R. G. Stein, and W. Taq. May 1980. 122 p. refs.

(Contract EA-77-A-01-6010)

(PB80-184229; NBSIR-80-2052) Avail: NTIS HC A06/MF A01 CSCL 13A

Subsystem energy budget development procedures and performance criteria for building illumination were developed by a consultant team of practitioners experienced in building illumination systems. A general procedure is described wherein the energy required for efficient illumination of a building is examined and corresponding power and annual energy budget guidelines are developed. This methodology is applied to three classes of building offices, schools, and residences to illustrate the method. Representative power and energy budgets are developed. GRA

N80-31674# Battelle Columbus Labs., Ohio.

MEASUREMENT AND CORRELATION ANALYSIS PLAN FOR CONCRETE TIE AND FASTENER PERFORMANCE ANALYSIS Interim Report, Oct. - Dec. 1979

F. E. Dean, H. D. Harrison, R. H. Prause, E. T. Selig, and D. McMahon. Nov. 1979. 206 p. refs. Prepared in cooperation with Massachusetts Univ., Amherst

(Contract DOT-FR-8164)

(PB80-183882; FRA/ORD-79/51) Avail: NTIS HC A10/MF A01 CSCL 13F

An experiment plan and a correlation methodology through which the long term performance of concrete tie track will be evaluated are presented. The experiment plan defines test segments, instrumentation, and measurement procedures for a comprehensive evaluation, over a two year period, of three concrete tie test sections and one wood tie control section, all of which are installed on revenue service track. This evaluation is to be correlated with similar track performance data from the Faculty for Accelerated Service Testing (FAST). Formats for FAST data to be requested from the Transportation Test Center are summarized. Finally, the methods of direct comparison, regression and analytical simulation, by which track performance at FAST and on the revenue service will be compared, are defined. GRA

N80-31675# National Bureau of Standards, Washington, D.C. Office of International Relations.

NATIONAL BUREAU OF STANDARDS AND AGENCY FOR INTERNATIONAL DEVELOPMENT (NBS/AID) COURSE ON WEIGHTS AND MEASURES SERVICES Final Report

H. Steffen Peiser, ed., Charles C. Raley, ed., Albert D. Tholen, ed., and Penelope M. Odar, ed. Apr. 1980. 86 p. Course held in Los Angeles, Seattle, and Portland, Oreg., 15-27 Jul. 1979

(Grant PASA-TA(CE)-6-71)

(PB80-187206; NBSIR-80-2022) Avail: NTIS HC A05/MF A01 CSCL 14B

The weights and measures systems of the United States and the role of the National Bureau of Standards was considered so that officials of industrializing nations might consider what parts of the U.S. system might usefully be adapted to conditions in their home countries. An exchange of experience in each of the participant's countries was presented. Countries represented included Egypt, Honduras, India, Liberia, Mexico, Nigeria, Sri Lanka, Sudan, Thailand, and Tunisia. GRA

N80-31676# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Civil Engineering.

SEISMIC RESPONSE OF LIGHT ATTACHMENTS TO

BUILDINGS
Roberto Villaverde and Nathan M. Newmark Feb. 1980 442 p refs Sponsored in part by Consejo Nacional de Ciencia y Tecnologia
(Grants NSF ENV-75-08456; NSF ENV-77-07190)
(PB80-1185028; UILU-ENG-80-7006;
Structural-Research-Ser-469; NSF/RA-800035) Avail: NTIS HC A19/MF A01 CSCL 13M

An approximate simple method for predicting the response of secondary systems attached to buildings subjected to earthquakes is presented. Secondary systems comprise a variety of attachments to the floors and walls of large and complex buildings which because of their different characteristic and functions, are not considered part of the structures which support them. The method is based on the premise that interaction between a primary and secondary system can be accounted for by analyzing the interconnected system constructed by such primary and secondary system. The response spectrum method is used to determine the maximum response of the assembled system, and analytical expressions are derived for each step. Comparative studies indicate that this approximate procedure provides a convenient alternative method for the rational seismic design of secondary systems. GRA

N80-31677# Sydney Univ. (Australia). Civil Engineering Labs.
FINITE LAYER ANALYSIS OF CONSOLIDATION, PART 2
J. R. Booker and J. C. Small Nov. 1979 44 p refs
(PB80-182587; R-358-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 13M

The theory developed is extended to apply to the consolidation of horizontally layered soils under both axially symmetric and general surface loading. The method again leads to a considerable reduction in the amount of core storage necessary for computer solution and can be implemented on a minicomputer. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-31678 Pennsylvania Univ., Philadelphia.
AN ANALYSIS OF BURST COMMUNICATION IN TIME DIVISION MULTIPLE ACCESS SYSTEMS Ph.D. Thesis
Christopher Hughes Morton 1980 516 p
Avail: Univ. Microfilms Order No. 8018588

Burst communication performance is quantified through analysis of three fundamental, interrelated aspects of the problem: proper carrier synchronization structures for the burst mode and their statistical performance, the associated structure and error probability performance of the detection circuitry, and the definition of useful measures of burst communication quality. MAP interval estimation theory is used to obtain generalized carrier estimation structures for digitally modulated signals corrupted by passage through a channel exhibiting both linear filtering and nonlinear distortion as well as the presence of Gaussian noise. For M-ary PSK signal sets, special attention is paid to low and high SNR approximations of the optimum structure, their use in the burst mode, and their relationship to supressed carrier tracking loops currently in practical use. Using the method of weighted residuals (Generalized Galerkin Method), an approximate theory of generating both acquisition and steady-state statistics of candidate synchronizers containing N-pole loop filters, is set forth. Dissert. Abstr.

N80-31679 Drexel Univ., Philadelphia, Pa.
DETECTION OF WEAK SIGNALS IN NON-GAUSSIAN NOISE Ph.D. Thesis
Ning Hsing Lu 1980 222 p
Avail: Univ. Microfilms Order No. 8019355

A class of detectors to test for the presence or absence of weak signals in additive non-Gaussian noise is considered. A locally optimum detector (LOD), is derived in the Neyman-Pearson sense as a model of generalized likelihood ratio under a condition such that the signal is weak compared to the additive noise perturbation. The LOD is comprised of a zero-memory nonlinearity (ZMNL) followed by a matched filter, matched to the signal, or its correlator equivalent. The asymptotic detection performance of the LOD under non-Gaussian, Gaussian, and Cauchy conditions are derived and compared. An adaptive threshold detector (ATD) for the detection of weak signals in additive noise of unknown power level is next discussed. The ATD consists of a LOD, a noise level estimator, and a decision device. The detection threshold is made adaptive according to the information provided by the noise-level estimator in order to keep a fixed false alarm probability. Finally, a suboptimum detector (SOD) and an adaptive detector are proposed for the detection of weak signals in non-Gaussian noise. In contrast to the LOD, the SOD is relatively easy to implement and is shown to perform well for a wide range of underlying noise distributions. Dissert. Abstr.

N80-31680 Missouri Univ. -Rolla.
APPLICATION OF THE CHIRPED Z-TRANSFORM TO PROCESSING FREQUENCY HOPPING SPREAD SPECTRUM SIGNALS Ph.D. Thesis
Sultan Mahmood 1980 175 p
Avail: Univ. Microfilms Order No. 8019014

Charge coupled device/chirped Z transform (CCD/CZT) oriented detection schemes for a frequency-hopped spread spectrum (FHSS) signal in the presence of white Gaussian noise and radio frequency interference are derived. For the case when an FHSS signal is corrupted by white Gaussian noise, the frequency-hopped complex exponents representing a binary symbol are assumed to have partial coherence. The optimum receiver structures are derived from the likelihood ratio for the received waveform samples in the frequency domain. The FH signal itself is divided into time and frequency chips. Signal processing proceeds on a time chip basis. The signal from a time chip is sampled, transformed via the CZT to yield the spectrum in various frequency chips and then correlation is performed. Expressions are derived for the probability of correct detection (P sub D) for both single and double threshold detectors when the FHSS signal is degraded by white Gaussian noise alone and by noise together with jamming. Performance of the detectors is shown in terms of plots of P sub D against various parameters. Dissert. Abstr.

N80-31681 Auburn Univ., Ala.
AN ANALYSIS OF RADOME-INDUCED RADAR POINTING ERROR Ph.D. Thesis
David Gilbert Burks 1980 205 p
Avail: Univ. Microfilms Order No. 8015412

The effect of a tangent ogive radome on the pointing accuracy of a monopulse radar that employs an aperture antenna is analyzed. The radar is assumed to be operating in the receive mode and the incident fields at the antenna are found by a ray tracing procedure. Rays that enter the antenna aperture by direct transmission through the radome and by single reflection from the radome interior are considered. The theory of monopulse radar and the transmission and reflection properties of planar dielectric slabs are presented first to form a background for the radome analysis. Two orthogonal polarization states which can be combined to produce an arbitrarily polarized incident field are considered. The antenna can be scanned in two angular directions and radar pointing error is presented for both these angles as a function of antenna scan angle and polarization of the incident field. A comparison of two different radome wall designs is made in order to both illustrate the analytical techniques and to show the engineering tradeoffs in radome design. Dissert. Abstr.

N80-31682 British Broadcasting Corp., Kingswood (England). Engineering Div.
CRYSTAL PALACE BAND 2 TESTS: COMPARISON OF TRANSMITTED POLARIZATIONS
J. H. Causebrook Jul. 1980 11 p refs
(BBC-RD-1980/7) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, Engl.

A transmitter was tested, to examine the relative merits of different polarizations for Band 2 fm radio broadcasts. The tests allowed for reception at roof top level, in cars, and on portables.

The relative amounts of multi-path were assessed. It is concluded that in heavily built up areas, as well as in other types of area, there is a significant advantage for car radios and portables in transmitting a vertical component. If this is added to a present horizontally polarized transmission with equal power (3 dB more transmitter power) the effective increase in signal for these receivers is 5 to 7 dB, while stereo reception on fixed horizontal aerials is not significantly affected. R.C.T.

N80-31683 British Broadcasting Corp., Kingswood (England). Engineering Div.
A STUDY OF PEAK MULTIPLEXED SIGNAL LEVEL IN THE CONTEXT OF 2 1/2 OR 3-CHANNEL SURROUND-SOUND TRANSMISSIONS
E. W. Taylor. Jul. 1980. 17 p. refs
(BBC-RD-1980/6) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, England

The effect on peak multiplexed signal level of quadrature modulating the 38 kHz subcarrier of a pilot tone stereophonic system with the third or T signal of a 2 1/2 or 3 channel system UHJ surround-sound transmission is discussed. Theoretically derived values are compared with measurements made using test material received during independent local radio experimental 2 1/2 channel system UHJ transmissions. The conditions under which measurements of peak baseband signal level give a realistic indication of peak multiplexed signal level are described. Author

N80-31684*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SIMPLE STRIPLINE DESIGN FOR UNEVEN POWER SPLIT
M. C. Bailey. Aug. 1980. 10 p.
(NASA-TM-81870) Avail: NTIS HC A02/MF A01 CSCL 09C

A technique for the design of stripline or microstrip power dividers for unequal, but in-phase, power split is described. The output power ratio is determined by selecting the location of the input port in a manner analogous to the tap point for an electric power transformer. The technique yields a usable bandwidth of 7 to 8 percent and is attractive for tapered amplitude distribution networks for narrow band phased arrays. S.F.

N80-31685*# Arinc Research Corp., Annapolis, Md.
VIDEO DISTRIBUTION SYSTEM COST MODEL Final Report
I. Gershkoff, J. Kent Haspert, and B. Morgenstern. Jul. 1980. 225 p.
(Contract NAS5-25401)
(NASA-CR-160020; Publ-1358-01-3-2238) Avail: NTIS HC A10/MF A01 CSCL 17B

A cost model that can be used to systematically identify the costs of procuring and operating satellite linked communications systems is described. The user defines a network configuration by specifying the location of each participating site, the interconnection requirements, and the transmission paths available for the uplink (studio to satellite), downlink (satellite to audience), and voice talkback (between audience and studio) segments of the network. The model uses this information to calculate the least expensive signal distribution path for each participating site. Cost estimates are broken downy by capital, installation, lease, operations and maintenance. The design of the model permits flexibility in specifying network and cost structure. T.M.

N80-31686# Institute for Telecommunication Sciences, Boulder, Colo.
VOICE PERFORMANCE MEASUREMENTS Final Report
W. J. Hartman and L. E. Pratt. Jun. 1980. 26 p. ref
(Contract DOT-FA79WAI-013)
(AD-A087108; FAA-RD-80-71) Avail: NTIS HC A03/MF A01 CSCL 09/4

Subjective intelligibility scores are determined for various combinations of signal-to-noise ratios, clipping, filtering, and pre-emphasis/de-emphasis. These are compared with scores derived using linear predictive coding (LPC). An overall correlation of 0.88 is obtained between the two sets of scores. GRA

N80-31687# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Fleet Systems Dept.
MOVING TARGET DETECTOR DATA UTILIZATION INVESTIGATION Data Analysis Report, 1975 - 1976
F. R. Castella, M. J. Feil, J. T. Miller, and C. L. Roe. Mar. 1980. 141 p. refs
(Contract DOT-FA74WA-3423)
(AD-A086962; JHU/APL/FP8-T-041; FAA-RD80-29) Avail: NTIS HC A07/MF A01 CSCL 17/9

The Moving Target Detector (MTD), developed by MIT's Lincoln Lab., under contract to the Federal Aviation Administration (FAA), was designed as an improved video processor for use with the Airport Surveillance Radars within the Automated Radar Terminal System (ARTS) 3 automated Air Traffic Control (ATC) system. This device interfaces between the analog radar system and the digital automatic tracking system to provide automatic target detection and false alarm regulation. In addition to range, bearing, and amplitude data, the MTD provides Doppler information on detected targets. This data is in the form of unconsolidated reports that are to be centroided and tracked to provide a primary radar data base for ATC functions. In order to evaluate the potential benefits of this MTD data on the ATC tracking operation, the present study was conducted using experimental data gathered by the FAA and Lincoln Laboratory with an FPS-18 radar at the National Aviation Facilities Engineering Center during the summer of 1975. The principal investigations focus on: development of a centroid algorithm for extracting significant target features; and using these features within the subsequent tracking function. GRA

N80-31688# McDonnell-Douglas Research Labs., St. Louis, Mo.
RADIATION AND SCATTERING FROM BODIES OF TRANSLATION, VOLUME 1 Final Technical Report, 26 Sep. 1977 - 26 Jul. 1979
L. N. Medgyesi-Mitschang. Griffiss AFB, N.Y. RADC. Apr. 1980. 67 p. refs. 3 Vol.
(Contract F30602-77-C-0233; AF Proj. 2338)
(AD-A087402; RADC-TR-80-142-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 20/14

An analytical formulation, based on the method of moments (MM) is described for solving electromagnetic problems associated with finite-length cylinders of arbitrary cross section, denoted in this report as bodies of translation (BOT). This class of bodies can be used to model structures with noncircular cross sections such as wings, fins, and aircraft fuselages. The theoretical development parallels in part the MM formulation developed earlier by Mautz and Harrington for bodies of revolution (BOR). Like the latter approach, a modal expansion is used to describe the unknown surface currents on the BOT. The present analysis has been developed to treat the far-field radiation and scattering from a BOT excited by active antennas or illuminated by a plane wave of arbitrary polarization and angle of incidence. In addition, the electric and magnetic near-field components are determined in the vicinity of active and passive apertures (slots). Using the Schelkunoff equivalence theorem, the aperture-coupled fields within a BOT are also obtained. The formulation has been implemented by a computer algorithm and validated using accepted data in the literature. GRA

N80-31689# McDonnell-Douglas Research Labs., St. Louis, Mo.
RADIATION AND SCATTERING FROM BODIES OF TRANSLATION. VOLUME 2: USER'S MANUAL, COMPUTER PROGRAM DOCUMENTATION Final Technical Report, 26 Sep. 1977 - 26 Jul. 1979
L. N. Medgyesi-Mitschang and J. M. Putnam. Griffiss AFB, N.Y. RADC. Apr. 1980. 126 p. 3 Vol.
(Contract F30602-77-C-0233; AF Proj. 2338)
(AD-A087403; RADC-TR-80-142-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 20/14

A hierarchy of computer programs implementing the method of moments for bodies of translation (MM/BOT) is described. The algorithm treats the far-field radiation and scattering from finite-length open cylinders of arbitrary cross section as well as the near fields and aperture-coupled fields for rectangular apertures on such bodies. The theoretical development underlying the algorithm is described in Volume 1. The structure of the computer algorithm is such that no a priori knowledge of the method of moments technique or detailed FORTRAN experience are

presupposed for the user. A set of carefully drawn example problems illustrates all the options of the algorithm. For more detailed understanding of the workings of the codes, special cross referencing to the equations in Volume 1 is provided. For additional clarity, comment statements are liberally interspersed in the code listings, summarized in the present volume. GRA

N80-31690# Naval Ocean Systems Center, San Diego, Calif. EM Propagation Div.
EQUATORIAL SCINTILLATION OF SATELLITE SIGNALS AT UHF AND L-BAND FOR TWO DIFFERENT ELEVATION ANGLES Technical Report, 1 Jan. 1979 - May 1980
M. R. Paulson 1 May 1980 185 p refs
(RR0320801)
(AD-A087404; NOSC/TR-543) Avail: NTIS
HC A09/MF A01 CSCL 20/14

An investigation of the equatorial scintillation of satellite signals at uhf and L-band for 10 and 50 degree elevation angles is reported. Diurnal and seasonal variations of scintillation, as well as solar cycle dependence, are given. The occurrence and intensity of scintillations are compared for the two frequencies and for the two elevation angles. A number of fade duration distributions for fades greater than 6 and greater than 12 dB below the undisturbed signal are shown for each frequency and each satellite. A periodicity in the occurrence of scintillation is reported and is attributed to the gravitation field of the Moon. It is proposed that the Moon's gravity affects the occurrence and intensity of equatorial scintillation by modulating the velocity of the zonal winds at ionospheric heights. GRA

N80-31691# Parke Mathematical Labs., Inc., Carlisle, Mass.
GROUND RANGE AND BEARING ERROR DETERMINATION AND DISPLAY FOR AN OTH RADAR SYSTEM WITH AN ARCTIC TROUGH IONOSPHERE Final Report, Oct. 1976 - Oct. 1979
Dean Bandes and Theodore B. Barrett Hanscom AFB, Mass. AFGL Feb 1980 52 p refs
(Contract F19628-76-C-0296; AF Proj. 7663)
(AD-A087010; Rept-0296-FR-2-Pt-2; AFGL-TR-80-0055-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report describes the algorithms used to determine range and bearing errors which might be incurred in an OTH radar system where the propagating medium includes an arctic trough. Several types of plots for displaying this error information are described along with an example. GRA

N80-31692# Naval Research Lab., Washington, D. C. Advanced Systems Branch.
RADAR EMI AT SEA Interim Report
Louis J. Lavedan 28 Jan. 1980 21 p refs
(AD-A087213; AD-E000449; NRL-MR-4082) Avail: NTIS
HC A02/MF A01 CSCL 17/9

As quantity and complexity of electronic systems on Navy ships increase, so does the probability of rf interference between systems, even those located on separate ships. This report briefly describes the coupling mechanisms possible between 200 MHz and 4000 MHz and supplies data in the form of graphs and describes a method whereby the magnitude of the interference can be quickly calculated for the various sea environments. GRA

N80-31693# Network Analysis Corp., Great Neck, N. Y.
PACKET RADIO DEPLOYMENT STUDY
10 Apr. 1980 193 p refs
(Contract DAAK80-79-C-0763)
(AD-A087417; FR-207-01-R1) Avail: NTIS
HC A09/MF A01 CSCL 17/2

This report documents the results of the Packet Radio Deployment Study whose objective is to assess the potential of the Packet Radio technology for satisfying communications requirements in the military environment. The focus of this study has been on the following three tasks: enhancement of the packet radio simulation program (PRSIM); implementation of a military scenario model; and design, routing and performance analysis of packet radio networks for the military scenarios. GRA

N80-31694# Army Electronics Research and Development Command, Fort Belvoir, Va. Night Vision and Electro-Optics Labs.
MEASUREMENTS OF MILLIMETER WAVE RADAR TRANSMISSION AND BACKSCATTER DURING DUSTY INFRARED TEST 2, DIRT 2 Final Report
F. C. Petito and E. W. Wentworth May 1980 40 p
(DA Proj. 1E2-63710-DK-70)
(AD-A086189; DELNV-TR-0011) Avail: NTIS
HC A03/MF A01 CSCL 17/9

Recently there has been much interest expressed to determine the ability of millimeter wave radar to perform target acquisition during degraded visibility conditions. In this regard, one of the primary issues of concern has been the potential of high-explosive artillery barrages to obscure the battlefield from millimeter wave radar systems. To address this issue 95 GHz millimeter wave radar measurements were conducted during the Dusty Infrared Test 2 (DIRT 2). This test was held at White Sands Missile Range, NM, 18-28 July 1979. Millimeter wave transmission and backscatter measurements were performed during singular live firings and static detonations of 155 mm and 105 mm high-explosive artillery rounds in addition to static detonations of C-4 explosives. A brief description of the millimeter wave portion of the test and instrumentation is given. The data along with some preliminary conclusions are presented. GRA

N80-31695# Defense Communications Engineering Office, Reston, Va. Transmission Engineering Div.
ASSESSMENT OF FREQUENCY SELECTIVE FADING ON DCS TRANSMISSION SYSTEM PERFORMANCE.
David R. Smith and John L. Osterholz Aug. 1979 56 p refs
(AD-A087794; AD-E100356; DCEC-EP-5-79; Rept-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

Recent reassessments of digital LOS transmission systems indicate that transmission is affected by more than power fading alone. Tests showed that extensive inband amplitude and phase distortion occur during even relatively shallow fades. To facilitate the study of these phenomena, a hybrid computer simulation of the AN/FRC-DCS Digital Radio was developed, and is described in this EP. GRA

N80-31696# Defense Communications Engineering Office, Reston, Va. Transmission Engineering Div.
PROCEEDINGS OF SEMINAR ON FREQUENCY SELECTIVE FADING AND ITS EFFECT ON DIGITAL LOS RADIO
David R. Smith, ed. Jan. 1980 246 p refs Conf. held at Reston, Va., 26 Nov. 1979
(AD-A087793; AD-E100375; DCEC-TN-2-80; Rept-2) Avail: NTIS HC A11/MF A01 CSCL 17/2

Recent analysis and testing of digital LOS radio links reported in the literature indicate that frequency selective fading may be responsible for performance degradation in the form of inband amplitude and phase distortion. To facilitate an exchange of information among interested groups from government and industry, a seminar was organized by and held at DCEC on the subject of frequency selective fading and its effects on digital LOS radio. This TN presents the proceedings of that seminar. GRA

N80-31697# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
DYNAMIC BEHAVIOR OF SHORTEST PATH ROUTING ALGORITHMS FOR COMMUNICATION NETWORKS
Dimitri P. Bertsekas Jun. 1980 56 p refs
(Contracts N00014-75-C-1183; MDA903-78-C-0129; Grant NSF ENG-77-15949)
(AD-A087706; LIDS-TH-1005) Avail: NTIS
HC A04/MF A01 CSCL 17/2

Several proposed routing algorithms for store and forward communication networks, including one currently in operation in the ARPANET, route messages along shortest paths computed by using some set of link lengths. When these lengths depend on current traffic conditions as they must in an adaptive algorithm, dynamic behavior questions such as stability convergence, and speed of convergence are of interest. This paper is the first attempt to analyze systematically these issues. It is shown that minimum queuing delay path algorithms tend to exhibit violent oscillatory behavior in the absence of a damping mechanism. The oscillations can be damped by means of several types of schemes, two of which are analyzed in this paper. In the first scheme a constant bias is added to the queuing delay

thereby providing a preference towards paths with a small number of links. In the second scheme the effects of several past routings are averaged as, for example, when the link lengths are computed and communicated asynchronously throughout the network. GRA

N80-31698# Sperry Gyroscope Co., Great Neck, N. Y.
COLUMN NETWORK STUDY FOR A PLANAR ARRAY USED WITH AN UNATTENDED RADAR Final Technical Report
Gerald L. Hanley and Harry R. Perini Jun. 1980 65 p
(Contract F19628-78-C-0166; AF Proj. 2448)
(AD-A087809; SG-4253-1182; RADC-TR-80-191) Avail: NTIS HC A04/MF A01 CSCL 17/9

Objectives of this program are to investigate design and fabrication techniques for an azimuthally phase-steerable planar array with dual beams for elevation coverage. Network costs, network insertion loss, antenna pattern performance, and reliability are significant considerations. A stripline dual beam column network is being designed, fabricated and tested to demonstrate achievable performance and competitive techniques for production and installation costs are being studied. This report summarizes the work completed during the program: completion of the antenna conceptual design, development of all the required components, design of the dual beam column network, and results of competitive techniques for production. GRA

N80-31699# Airborne Instruments Lab., Melville, N. Y.
MICROWAVE TRANSVERSAL EQUALIZER Final Technical Report, 1 Nov. 1978 - 30 Nov. 1979
J. Wolczok and G. Kanischak Griffiss AFB, N.Y. RADC May 1980 48 p refs
(Contract F30602-78-C-0352; AF Proj. 4506)
(AD-A087603; RADC-TR-80-121) Avail: NTIS HC A03/MF A01 CSCL 09/5

A Microwave Transversal Equalizer has been designed, fabricated, and installed at RADC and is capable of reducing side-lobe distortion levels of -18 dBm to less than -35 dBm. The MTE operates in the 3.0 to 3.5 GHz frequency range. GRA

N80-31700# Army Materiel Development and Readiness Command, Adelphi, Md. Countermeasures/Counter-Countermeasures Office.
PSEUDONOISE SPREAD-SPRETRUM SYSTEMS FOR MILITARY COMMUNICATIONS
Don J. Torrieri Dec. 1979 27 p refs
(DA Proj. 1S2-63749-D-462)
(AD-A087701; CM/CCM-79-9) Avail: NTIS HC A03/MF A01 CSCL 17/2

The basic characteristics of various pseudonoise spread-spectrum systems are discussed with emphasis on direct-sequence modulation. A necessary condition is derived for the concealment of a pseudonoise waveform from detection. The condition establishes a lower bound for the pseudonoise code length. The bit error probability in the presence of various types of interference is determined. It is shown that if the total bandwidth and the word duration are fixed, the potential improvement in performance due to error-correction coding is partially counterbalanced by the resulting decrease in processing gain. Methods of reducing the mutual interference in a network of pseudonoise systems are examined. Jamming strategies, acquisition techniques, and hybrid frequency-hopping pseudonoise systems are discussed. Differences in the error rate performance between frequency-hopping systems and pseudonoise systems are illustrated. GRA

N80-31701# Illinois Univ. at Urbana-Champaign, Urbana. Electromagnetics Lab.
EVALUATION OF LOSSES IN MICROSTRIP ANTENNA MATERIALS Interim Report
Y. T. Lo, W. F. Richards, and J. E. Brewer Griffiss AFB, N.Y. RADC Apr. 1980 60 p refs
(Contract F19628-78-C-0025; AF Proj. 2305)
(AD-A087476; RADC-TR-80-85; IR-3) Avail: NTIS HC A04/MF A01 CSCL 09/5

A microstrip antenna consists of a conducting patch etched on a dielectric substrate over a ground plane. To evaluate the antenna efficiency, one must know the losses in the material. The dielectric loss is specified by its loss tangent and the copper by its conductivity (or equivalently by its skin-depth at a given frequency). Usually, they can be determined separately with well-known experimental procedures. However, for the copper-cladded material used in microstrip antennas, the surfaces of both the dielectric slab and copper (20) plates are deliberately roughened and filled with bonding agent in-between for mechanical strength. In this case, the separate measurements for the two materials become meaningless. Many measurements were conducted in this manner, and in most cases good consistent results were obtained. The loss parameters so determined resulted in theoretically computed antenna impedance characteristics in nearly perfect agreement with the measured results. However, the inconsistency in a few other cases suggests that there may be a significant amount of inhomogeneity in the manufacturing process in the material from one part to the other, or from batch to batch. GRA

N80-31702# Michigan Univ., Ann Arbor. Radiation Lab.
A THEORETICAL STUDY OF DIELECTRIC-FILLED EDGE-SLOT ANTENNAS Final Report, 1 Jun. 1979 - 31 May 1980
Dipak L. Sengupta Jul. 1980 7 p refs
(Contract DAAG29-79-C-0096)
(AD-A087482; ARO-14808.4-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

A theory has been developed for the dielectric filled edge slot (DFES) antennas. It clearly brings out the effects of various parameters on the performance of the antenna, and can be used for the design of such antennas under a variety of conditions. In addition to the theory of DFES antennas, the following accomplishments were realized: (a) the equivalent circuit of DFES antennas and (b) the equivalent parameters for the tuning posts in a radial waveguide. The techniques used and the results obtained may be applied to other antennas, e.g., to probe-fed patch antennas tuned by metallic posts. GRA

N80-31703# Queens Univ., Kingston (Ontario).
PERFORMANCE CHARACTERISTICS OF LEAKY COAXIAL CABLES Final Technical Report, Nov. 1977 - Jun. 1979
James L. Mason Griffiss AFB, N.Y. RADC Apr. 1980 171 p refs
(Contract F19628-77-C-0249; AF Proj. 4600)
(AD-A087475; RADC-TR-79-340) Avail: NTIS HC A08/MF A01 CSCL 17/9

This work deals with guided radar and reports on the experiments and analysis that were performed to obtain information on the function of leaky coaxial cables used as radio frequency intrusion sensors. Four subjects were investigated: (1) environmental effects on the leaky coaxial cable and the guided radar system, (2) use of Doppler shift caused by an intruder to determine the velocity and direction of the intruder, (3) target identification, classification and signature, and (4) a single leaky coaxial cable intrusion detection system. The most important environmental factor was moisture, either rain or snow. Results have demonstrated that the velocity of a target moving longitudinally between the leaky cable sensors can be measured, based on the Doppler shift in the return signal. Rudimentary target classification has been demonstrated based on a defined target signature--the log-magnitude of the Fourier transform of the target vector. A single cable intrusion detection system was investigated which incorporated a modulation technique which allowed the intruder to be located. GRA

N80-31704# University of Southern California, Los Angeles. Image Processing Inst.
HIGH RESOLUTION DIGITAL RADAR IMAGING OF ROTATING OBJECTS Ph.D. Thesis
Yeh-Hua Peter Chuan Jun. 1980 269 p refs
(Contract F33615-76-C-1203; DARPA Order 3119)
(AD-A087510; USCIPI-970) Avail: NTIS HC A12/MF A01 CSCL 17/9

This dissertation is devoted to the imaging aspect of the problem of obtaining high resolution images of practical radar targets with digital processing techniques. The motion compensation aspect of the problem is also briefly described. A multi-frequency stepped (MFS) radar is assumed and the Fourier transform relationship between the data (dimensioned in aspect angle and signal frequency) and the target reflectivity function is derived in both 2-D and 3-D forms. Assuming that the data

is available for 360 deg aspect angle and using wideband radar, a coherent digital processing method is developed which will give the best possible resolution. Such a situation occurs when the target makes a complete turn. It is found that for such an imaging system the resolution is inversely proportional to the mean carrier frequency if such frequency is large compared to the signal bandwidth. In the case when the data is undersampled in range or aspect angle or both, a modified coherent digital signal processing technique is described that will get around such difficulty. It is found that the modified processing method gives poorer resolution but is better than either the mixed processing method or the incoherent processing method. The latter two processing techniques are also described in this dissertation. Experimental results are also presented and problems with real targets such as shadowing, glint, and scintillation are discussed. GRA

N80-31705# Los Alamos Scientific Lab., N. Mex. Computer Div.
WAVE PROPAGATION IN A dc SUPERCONDUCTING CABLE. PART 1: ANALYSIS
Pritindra Chowdhuri and Mary-Anne Mahaffy 1980 9 p refs Presented at the IEEE PES Summer Meeting, Minneapolis, Jul. 1980
(Contract W-7405-eng-36)
(LA-UR-80-125; CONF-800722-1) Avail: NTIS HC A02/MF A01

A dc superconducting cable design consisting of four concentric metallic cylinders, of which two carry the load current and two comprise the cryogenic enclosure, is considered. When a transient voltage is impressed across such a cable, the major dielectric may not be fully stressed to its design value, and unwanted voltage stresses may develop across other parts of the cable. The surge voltage propagation characteristics of a four conductor dc superconducting cable for a step function input voltage is analyzed. This analysis, although mainly directed to superconducting cables, is also applicable to other multiconductor transmission lines. DOE

N80-31706# Los Alamos Scientific Lab., N. Mex.
WAVE PROPAGATION IN A dc SUPERCONDUCTING CABLE. PART 2: PARAMETRIC EFFECTS
P. Chowdhuri and M. Mahaffy 1980 9 p refs Presented at IEEE PES Summer Meeting, Minneapolis, Jul. 1980
(Contract W-7405-eng-36)
(LA-UR-80-126; CONF-800722-2) Avail: NTIS HC A02/MF A01

Wave propagation in several designs, of dc superconducting cables are studied. The dc conventional cables are also included for the purpose of comparison. For a multiconductor cable system, undesirable transient voltages may develop across parts that are not designed to withstand high voltages. The effects of several parameters such as voltage rating, number of conductors, conductor resistances, Earth resistivity, terminal grounding resistances of the grounded conductors at the origin and dielectric constants were studied. Voltage rating, conductor resistances, and terminal grounding resistances seem to influence the transient performance of a multiconductor cable significantly. The effect of finite Earth resistivity is insignificant. DOE

N80-31707# Los Alamos Scientific Lab., N. Mex.
DYMAC COMMUNICATIONS SYSTEM
Kathleen A. Lindsay Jan. 1980 130 p
(Contract W-7405-eng-36)
(LA-8182-M) Avail: NTIS HC A01/MF A01

The DYMAC Communications System is part of a nuclear safeguard system called DYMAC - short for DYnamic Materials ACcountability -that gathers accountability information at the Los Alamos Scientific Laboratory (LASL) Plutonium Processing Facility. The communications system handles transmissions between data entry terminals and nondestructive assay instruments located in the facility, and a computer located in a adjacent building. The components that make up the communication network are described including how they operate, and detailed information about all of the connections. Circuit diagrams for all the LASL modifications and LASL fabricated equipment are provided. In addition, a series of procedures are described for tracing cables, reconfiguring various parts of the system, testing data transmissions, and troubleshooting malfunctions. DOE

N80-31708# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY ASSESSMENT OF THE ELECTROMAGNETIC ENVIRONMENT IN THE IMMEDIATE VICINITY OF THE ETA ACCELERATOR
H. S. Cabayan, E. Bogdan, J. Zicker, D. Wythe, and G. J. Burke Apr. 1980 116 p refs
(Contract W-7405-eng-48)
(UCID-18631) Avail: NTIS HC A06/MF A01

The electromagnetic fields in the immediate vicinity of the Experimental Test Accelerator (ETA) at the Lawrence Livermore Laboratory were characterized. Various EM sensors that cover the frequency band from the very low frequencies up into the GHz region were used. The probes, the test set up and the data processing techniques are described. DOE

N80-31709# Centre National d'Etudes Spatiales, Toulouse (France).
RESIDUAL ERROR OF DUAL-FREQUENCY SPATIAL RADIO TRACKING SYSTEMS DUE TO THE IONOSPHERE [ERREUR IONOSPHERIQUE RESIDUELLE DANS LES SYSTEMES DE RADIOLOCALISATION SPATIALE BIFREQUENCES]
Jean Saint-Etienne Jan. 1980 48 p refs In FRENCH; ENGLISH summary Presented at CNEXO Colloq., Brest, France 1-5 Oct. 1979
(CNES-NT-93) Avail: NTIS HC A03/MF A01

Errors due to ionospheric interference in navigation and geodetic satellite systems are discussed. The raw error without correction is indicated. The possibility of correction by the use of ionospheric models is briefly considered. More details concerning a method of correction which uses an additional link operating at a frequency well separated from that of the main link, taking into account the dispersive property of the ionosphere, are given. Correction by dual frequency measurement is then formalized. Results are applied to the case of range measurements involving group propagation velocity and to the case of range rate measurements (Doppler effect) involving phase propagation velocity. Author (ESA)

N80-31710# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France). Dept. PCE.
ANALYSIS OF ELECTROMAGNETIC WAVE FIELD FROM MODELS WITH ONE OR TWO PRIVILEGED DIRECTIONS [ANALYSE DE CHAMPS D'ONDES ELECTROMAGNETIQUES A PARTIR DE MODELES A UNE OU DEUX DIRECTIONS PRIVILEGES]
L. J. Buchalet Sep. 1979 52 p refs In FRENCH Sponsored in part by Delegation Gen. a la Rech. Sci. et Tech. (DGRST)
(CRPE-NT-76) Avail: NTIS HC A04/MF A01

A method was developed to analyze the measurements of an electromagnetic wave field in a spatial magnetoplasma. The definition of the wave distribution function is first recalled. The technique is explained for obtaining the spectral matrix (measured without noise). The methods for calculating the parameters are presented. The study was then repeated in the presence of noise and the differences noted. The models with one or two privileged directions are studied. The analysis of real data, from the Omega emitter and collected through a GEOS satellite, is then presented. Author (ESA)

N80-31711# Fondazione Ugo Bordoni, Rome (Italy).
[ACTIVITIES IN THE FIELD OF COMMUNICATIONS IN ITALY, 1978] Annual Report [RELAZIONE SULL'ATTIVITA DI COLLABORAZIONE CON L'ISTITUTO SUPERIORE POSTE E TELECOMUNCAZIONE SVOLTA DALLA FONDAZIONE UGO BORDONI NEL 1978]
Renato Koch Feb. 1979 50 p refs In ITALIAN
Avail: NTIS HC A03/MF A01

The 1978 research activities are summarized covering radio communication systems, cable communication systems and digital sytems, automatic systems in communications, management and control, and laser systems and optoelectronics. Author (ESA)

N80-31712# Fondazione Ugo Bordoni, Rome (Italy).
THE POSSIBILITY OF UTILIZING CODING TECHNIQUES

TO IMPROVE THE AVAILABILITY OF DIGITAL RADIO LINK NETWORKS AT FREQUENCIES OVER 10 GHz [POSSIBILITA' DI IMPIEGO DI TECHNICHE DI CODIFICA PER MIGLIORARE LA DISPONIBILITA' DI RETE IN PONTI RADIO NUMERICI A FREQUENZE SUPERIORI A 10 GHz]
Angelo Bernardini (Rome Univ.), Paolo Mandarini (Rome Univ.), and Gianfranco Meucci (Rome Univ.) Dec. 1978 20 p refs In ITALIAN
(FUB-54-1978) Avail: NTIS HC A02/MF A01

An optimal solution of the number of available circuits as a function of the out-of-service probability by using couples of channel co-decoders at the extremities of the radio link is developed. The conclusions are extended to suboptimal solutions with different degrees of redundancy. The evaluation of hop length in the absence of the co-decoding method is presented. Author (ESA)

N80-31713# Fondazione Ugo Bordoni, Rome (Italy)
APPLICATIONS OF THE FINITE ELEMENT METHOD TO THE CALCULATION OF ELECTROMAGNETIC FIELDS IN CYLINDRICAL STRUCTURES [APPLICAZIONE DEL METODO DEGLI ELEMENTI FINITI AL CALCOLO DEL CAMPO ELETTROMAGNETICO IN STRUCTTURE CILINDRICHE]
E. Carli (Trieste Univ.), T. Corzani (Trieste Univ.), L. Mansi (Trieste Univ.), and E. Valentinuzzi (Trieste Univ.) Mar. 1979 49 p refs In ITALIAN
(FUB-2-1979) Avail: NTIS HC A03/MF A01

The finite element method is adapted to open structures where surface waves can propagate. Applications are considered in conventional areas such as microwave circuits and antenna or less conventional subjects such as traffic control. The proposed computer program is described and numerical results are given. The computer memory requirements and the limitations regarding surface wave applications are discussed. Author (ESA)

N80-31714# Fondazione Ugo Bordoni, Rome (Italy)
QUANTIZATION NOISE SPECTRA CALCULATION [CALCOLO DELLO SPETTRO DEL RUMORE DI QUANTIZZAZIONE]
Alberto Fiocco (Ancona Univ., Italy), Luigi Giacomelli (Ancona Univ., Italy), Renato Lucarelli, and Aldo Roveri (Rome Univ.) Jun. 1979 20 p refs In ITALIAN
(FUB-5-1979) Avail: NTIS HC A02/MF A01

The quantization noise power density spectrum calculation is studied and a discussion of the quantization noise definition presented. The application of the developed formulas allows the computation of the bilateral noise spectra as a function of the normalized frequency both for uniform and non-uniform quantization. Numerical examples are given in chart form. Author (ESA)

N80-31715# Fondazione Ugo Bordoni, Rome (Italy)
PROPAGATION IN DIELECTRIC GUIDES [PROPAGAZIONE IN GUIDE DIELECTTRICHE]
Paolo DiPorto Jun. 1979 21 p refs In ITALIAN
(FUB-6-1979) Avail: NTIS HC A02/MF A01

The theory of electromagnetic wave propagation in optical fibers is reviewed. Equations for step-index and graded-index fibers are developed. The numerical aperture, mode delay, impulse response, chromatic and modal dispersion, and other concepts related to fiber optics are examined. Author (ESA)

N80-31716# Fondazione Ugo Bordoni, Rome (Italy)
CUSTOMER ACCESS PROTOCOLS TO INTEGRATED SERVICES DIGITAL NETWORKS
Nicola Accarino, Maurizio Decina (Istituto di Comunicazioni Elettriche, Rome), Claudio Rossi, and Aldo Roveri (Istituto di Communicazioni Elettriche, Rome) Jun. 1979 11 p refs Presented at 27th Intern. Conv. on Commun., Genoa, Oct. 1979
(FUB-7-1979) Avail: NTIS HC A02/MF A01

Trends in the conception of local digital networks offering a variety of services including data and telephony are presented, and the interaction between customer access protocols and network architectures discussed. The basic features of a customer-to-network signalling scheme are presented which allow the full treatment of circuit-switched data calls at 64 kbit/s by the Pulse Code Modulation (PCM) local and trunk exchanges and the processing of packet switched data calls by specialized network nodes accessed on demand via the PCM facilities. Author (ESA)

N80-31717# Fondazione Ugo Bordoni, Rome (Italy)
SOME PROPERTIES OF THE PARTIAL RESPONSE CODES OF AN ORDER GREATER THAN TWO [SU ALCUNE PROPRIETA' DEI CODICI PARTIAL RESPONSE DI ORDINE SUPERIORE AL BINARIO]
Giuseppe Maria Poscetti (Rome Univ.) Jun. 1979 36 p refs In ITALIAN
(FUB-9-1979) Avail: NTIS HC A03/MF A01

An analysis of the cases for which precoding of a generalized order is possible is presented, and the properties of the digital sum, used in limited digital sum codes, are studied for orders greater than two. It is concluded that a high number of levels in the codified message are usually found when using codes of a higher order, for which the studied cases are not expected to have immediate application. Author (ESA)

N80-31718# Fondazione Ugo Bordoni, Rome (Italy)
PROCEDURES FOR OUT-OF-SERVICE VERIFICATION AND HOP LENGTH DIMENSIONING IN NUMERICAL RADIO LINKS [PROCEDIMENTI DI VERIFICA DI FUORI SERVIZIO E DI DIMENSIONAMENTO DI TRATTRA IN PONTI RADIO NUMERICI]
Angelo Bernardini (Rome Univ.), Paolo Mandarini (Rome Univ.), and Gianfranco Meucci (Rome Univ.) Jun. 1979 77 p refs In ITALIAN
(FUB-10-1979) Avail: NTIS HC A05/MF A01

General procedures for out of service verification in a 2500 km radio link in the presence of propagation anomalies due to rain of multipath are studied. It is shown that the out of service situation may be verified if the out of service probability function is known, and this function is examined for the cases of cross polarization attenuation and of uniform attenuation and depolarization. A FORTRAN program was written to perform the estimation. The out of service verification in the presence of selective attenuation due to multiple path and depolarization is discussed, including the evaluation of the space diversity effects on the out of service probability. Author (ESA)

N80-31719# Fondazione Ugo Bordoni, Rome (Italy)
DEVELOPMENT OF COST 202 PROJECT: NUMERICAL LOCAL NETWORKS FOR TELECOMMUNICATIONS [STATO DI SVILUPPO DEL PROGETTO COST 202: RETI LOCALI NUMERICHE PER TELECOMUNICAZIONI]
Nicola Accarino, Maurizio Decina (Istituto di Comunicazioni Elettriche, Rome), Roberto Montemuro, Claudio Rossi, and Francesco Villani Jun. 1979 9 p refs In ITALIAN
(FUB-14-1979) Avail: NTIS HC A02/MF A01

The COST 202 project is defined as a three-year research project studying digital techniques employable within the next 30 years in local networks. The participation of several European nations is mentioned. The main areas of the project which were agreed upon, are the evolution of local networks, signalization in local networks, and transmission on existing lines. The preliminary research activities undertaken by the Italian group are detailed, including 64 kbits numerical telephony, new services in circuit or packet switching up to 64 kbit/s telemetry, access to local networks, transmission interfaces, and terminal architecture. Author (ESA)

N80-31720# Fondazione Ugo Bordoni, Rome (Italy)
CAPACITY OPTIMIZATION OF A RESERVE NETWORK USED FOR REROUTING DAMAGED SERVICE BLOCKS [OTTIMIZZAZIONE DELLE CAPACITA' DI UNA RETE DI RISERVA IMPIEGATA PER IL REISTRADAMENTO DEI BLOCCHI DI ESERCIZIO IN AVARIA]
Gaetone Bonaventura (Stato dei Servizi Telefonici), Ugo Mocci, and Giacomo Ravaioli May 1979 10 p refs In ITALIAN Presented at 27th Intern. Conv. on Commun., Genoa, 9-12 Oct. 1979
(FUB-18-1979) Avail: NTIS HC A02/MF A01

The use of a standby network is an effective method for the rerouting of groups of circuits when a fault occurs on a transmission medium in a long distance network. Two problems are considered: to find a minimum cost standby network able

to reroute all the interrupted groups, at least when only one block at a time is defective, and to find the largest part of the in-service network that can still be protected meeting a prescribed bound on the cost of the standby network. The influences of different choices of rerouting criteria and of network structure are examined using a computer program. Author (ESA)

N80-31721# Fondazione Ugo Bordoni, Rome (Italy).
A PROCEDURE FOR SATISFYING IN AN OPTIMAL WAY TIME VARYING CIRCUIT REQUIREMENTS [UNA PROCEDURA PER IL SODDISFACIMENTO OTTIMO DI RICHIESTE DI CIRCUITI VARIABILI NEL TEMPO]
Francesco Mazzarella, Ugo Mocci, Giacomo Ravaioli, and Sandra Spedaletti. May 1979. 9 p. refs. In ITALIAN. Presented at 27th Intern. Conv. on Commun., Genoa, 9-12 Oct. 1979
(FUB-19-1979) Avail: NTIS. HC A02/MF A01

The problem of satisfying at minimum cost, time-varying circuit requirements between centers of a telecommunication network is considered. The overall procedure works in two phases. In the first, one of the requirements are routed through the network, and the circuit number of each link is computed. In the second phase, an optimal plan of installation is determined. The procedure was implemented with a computer program. Author (ESA)

N80-31722# Fondazione Ugo Bordoni, Rome (Italy).
INFLUENCE OF THE SPACE STRUCTURE AND PHYSICAL PROPERTIES OF RAIN ON THE EVALUATION OF THE ANISOTROPY AND DEPOLARIZING PROPERTIES [INFLUENZA DELLA STRUTTURA SPAZIALE E DELLE PROPRIETA' FISICHE DELLE PRECIPITATIONI SUFLA VALUTAZIONE DELLA ANISOPTROPIA E DELLA PROPRIETA'S DEPOLARIZZANTI]
Dario Maggiori (Politecnico di Milan) and Aldo Paraboni. Dec. 1979. 37 p. refs. In ITALIAN
(FUB-22-1979) Avail: NTIS. HC A03/MF A01

The anisotropy and polarization of centimeter waves propagating through rain was studied as a function of meteorological parameters such as the drop diameter distribution, the drop temperature, the rain intensity profile through the wave path, and the distribution of the axial ellipsoidal drop symmetry orientation. A block diagram of the computer program for the determination of the joint probability density function of the attenuation and anisotropy is presented with numerical example. The effects of the parameters under discussion are discussed. Author (ESA)

N80-31723# Fondazione Ugo Bordoni, Rome (Italy).
INFLUENCE OF PROPAGATION CHARACTERISTICS AND REPEATERS ON THE PERFORMANCE OF A MULTIPLE LINK TELETEXT SYSTEM [INFLUENZA DELLE CARATTERISTICHE DI PROPAGAZIONE E DEI RIPETITORI SULLE PRESTAZIONI DI UN SISTEMA TELETEXT A PIU' RIMBALZI]
Paolo Mandarini (Rome Univ.). Dec. 1979. 37 p. refs. In ITALIAN
(FUB-24-1979) Avail: NTIS. HC A03/MF A01

A general method of system analysis is presented, and used for the determination of the error probability function for any given situation, including propagation or equipment anomalies. The method is also employed to determine the relationship between the mentioned anomalies and the variations in the signal to noise ratios. Two examples of teletext transmission simulation are given, one assuming ideal propagation conditions and the other assuming a 250 KHz detuning, in both from 14 dB down to an error probability of 10 to the minus 8th power. Author (ESA)

N80-31724# Fondazione Ugo Bordoni, Rome (Italy).
EVALUATION OF SERVICE AVAILABILITY IN A PACKET SWITCHING NETWORK [SULLA VALUTAZIONE DEL GRADO DI SERVIZIO DI UNA RETE A COMMUTAZIONE DI PACCHETTO]
Nicola Accomo, Giovanni Barbanera, and Claudio Rossi. Sep. 1979. 47 p. refs. In ITALIAN
(FUB-26-1979) Avail: NTIS. HC A03/MF A01

After reviewing the problem parameters and defining the service availability as a function of the average delay time, the flow deviation method is used for optimizing the routing strategy of the network. The routing is of a proportional type based upon minimizing the average delay time. A computer program is presented and its applications are discussed. Author (ESA)

N80-31725# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
TRISTATIC SODAR [SODAR TRISTATICO]
A. Ricotta and M. Berico. Mar. 1980. 34 p. refs. In ITALIAN
(LPS-80-6) Avail: NTIS. HC A03/MF A01

The operating principles of sodar (acoustic radar working at 1 to 3 kHz) are reviewed and a system using three modules placed at the vertices of a triangle is described. The tristatic system was developed to measure the wind total velocity vector and to explore boundary layer dynamics. Author (ESA)

N80-31726# Thomson-CSF, Meudon-la-Foret (France). Dept. Espace-Satellites.
A FEASIBILITY STUDY OF A SATELLITE FREQUENCY MODULATION BROADCASTING SYSTEM. VOLUME 3: COMPLEMENTARY STUDY ON THE ATTENUATION IN THE SHADOW ZONES, MULTIPLE PATHS, AND CIRCULAR POLARIZATION RECEPTION ANTENNAS. Final Report [ETUDE DE FAISABILITE D'UN SYSTEME DE RADIODIFFUSION SONORE A MODULATION DE FREQUENCE PAR SATELLITE. VOLUME 3: COMPLEMENT D' ETUDE SUR ATTENUATION DANS LES ZONES D'OMBRE-TRAJETS MULTIPLES-ANTENNE DE RECEPTION EN POLARISATION CIRCULAIRE]
V. Biggi and F. Horgan (Telecommunications Ltd.). Dec. 1979. 60 p. Partly in ENGLISH and FRENCH
(Contract ESA-3208/77-F-HGE(SC))
(ESA-CR(P)-1313-Vol-3) Avail: NTIS. HC A04/MF A01

The attenuation in shadow zones caused by several obstacles was measured. The statistical reception improvement obtained using space diversity by means of two antennas and two receptors on the same automobile was evaluated. It was found that in all cases a distinct improvement may be expected from a system of diversity reception. Measurements were made using a circularly polarized receiving antenna, resulting in a 3 dB improvement for the received signal. Author (ESA)

N80-31727# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE NOISE IN ELECTRIC NETWORKS [IL RUMORE NELLE RETI ELECTTRICHE]
G. V. Pallottino. May 1980. 52 p. refs. In ITALIAN
(LPS-80-10) Avail: NTIS. HC A04/MF A01

Models representing noise in electrical networks with one or two ports are discussed. A general expression was derived for the noise factor and for noise temperature for the case of arbitrary correlation among equivalent noise generators. The problems related to networks implemented by several cascaded blocks are briefly discussed. Author (ESA)

N80-31728# National Technical Information Service, Springfield, Va.
TELECOMMUNICATION: ECONOMIC STUDIES. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1964 - 1978
William E. Reed. Jun. 1980. 287 p.
(PB80-811136) Avail: NTIS. HC $30.00/MF $30.00. CSCL 17B

Research on economic evaluations of the telecommunications industry is cited. Communication satellites, common carriers, cable television, telephones systems, and television systems are all covered in the bibliography. Economic studies of the foreign telecommunications industry are included. This updated bibliography contains 280 abstracts, none of which are new entries to the previous edition. GRA

N80-31729# National Technical Information Service, Springfield, Va.
TELECOMMUNICATION: ECONOMIC STUDIES. CITATIONS FROM THE NTIS DATA BASE. Progress Report, 1979 - May 1980
William E. Reed. Jun. 1980. 67 p. Supersedes NTIS/PS-79/0603, NTIS/PS-78/0581

(PB80-811144; NTIS/PS-79/0603; NTIS/PS-78/0581) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Research on economic evaluations of the telecommunications industry is cited. Communication satellites, common carriers, cable television, telephone systems, and television systems are all covered in the bibliography. Economic studies of the foreign telecommunications industry are included. This updated bibliography contains 60 abstracts, 36 of which are new entries to the previous edition. GRA

N80-31339# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
ELECTRO-MAGNETIC COMPATIBILITY
Henry Maidment *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 6 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

N80-31340# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
CHECKING OF COMMUNICATIONS AND RADIO NAVIGATION SYSTEMS
Henry Maidment *In* AGARD Aircraft Assessment and Acceptance Testing May 1980 24 p refs (For primary document see N80-31329 22-01)
Avail: NTIS HC A09/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-31730 Johns Hopkins Univ., Baltimore, Md.
HYBRID FAULT DIAGNOSIS IN DIGITAL SYSTEMS Ph.D. Thesis
Sivanarayana Malleia 1980 139 p
Avail: Univ. Microfilms Order No. 8020265

A systematic approach to fault diagnosis which considers the presence in a system of not only permanent faults, but also intermittent faults was developed. An analysis model of systems for relating tests and faults is presented which encompasses most of the existing models in the literature. To consider combinations of permanent and intermittent faults, the concept of a hybrid fault situation is introduced. A strategy is developed for the diagnosis of hybrid fault situations, and then, the resulting necessary and sufficient conditions on the test-fault interrelationships are derived. Lower bounds are determined on the hybrid fault diagnosability of a system in terms of its permanent fault diagnosability. These bounds establish that test sets with the same permanent fault diagnosing capability may have significantly different hybrid fault diagnosing capabilities. Hence, for efficient testing of a system, the choice of the tests to be applied to the system must, in general, be influenced by hybrid fault diagnosis considerations. Dissert. Abstr.

N80-31731*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DIGITAL DEMODULATOR Patent Application
Thomas A. Shull, inventor (to NASA) Filed 18 Jul. 1980 9 p (NASA-Case-LAR-12659-1; US-Patent-Appl-SN-171928) Avail: NTIS HC A02/MF A01 CSCL 09C

A digital demodulator for converting pulse code modulated (PCM) data from phase-shift key (PSK) to non-return-to-zero (NRZ-L) and to bio phase (BiO-L) is described. The demodulator is composed of standard integrated logic circuits. The key to the demodulation function is a pair of cross coupled one shot multivibrators which, with a flip-flop produce the NRZ-L. In order to generate BiO-L, the PSK carrier is constrained to be 2 to the n times the data bit rate. If NRZ-L is all that is required, the circuitry is greatly simplified and the 2 to the n times bit rate constraint can be removed from the carrier. A flip-flop, an OR gate, an AND gate, and a binary counter generate the bit rate clock BTCK for the NRZ-L. The remainder of the circuitry is for converting the NRZ-L and BTCK into BiO-L. NASA

N80-31732*# RCA Labs., Princeton, N. J. Microwave Technology Center.
Ku-BAND FIELD-EFFECT POWER TRANSISTORS Final Report, 9 Nov. 1977 - 8 Aug. 1979
Gordon C. Taylor and Ho-Chung Huang Sep. 1979 152 p refs
(Contract NAS5-24355)
(NASA-CR-160010; PRRL-79-CR-39) Avail: NTIS HC A08/MF A01 CSCL 09C

A single stage amplifier was developed using an 8 gate, 1200 micrometer width device to give a gain of 3.3 + or - 0.1 dB over the 14.4 to 15.4 GHz band with an output power of 0.48 W and 15% minimum efficiency with 0.255 W of input power. With two 8 gate devices combined and matched on the device carrier, using a lumped element format, a gain of 3 dB was attained over the 14.5 to 15.5 GHz band with a maximum efficiency of 9.9% for an output power of 0.8 W. E.D.K.

N80-31733# Army Missile Command, Redstone Arsenal, Ala. Engineering Lab.
GOLD PLATED LEAD-CLINCHED LEAD SOLDER JOINT STUDY
Roger L. Yocom Sep. 1979 26 p refs
(AD-A087352; AD-E950003; DRSMI-E-79-29) Avail: NTIS HC A03/MF A01 CSCL 09/1

In this study the effects of soldering to gold-plated lead wires as opposed to soldering to pretinned or double-tin dipped lead wires are investigated. Also investigated were the differences between Types 1, 2, and 3 lead termination methods as described in MIL-P-46843, Paragraphs 3.6.4.3.7, 3.6.4.3.8, and 3.6.4.3.9 respectively. Data generated may be utilized in the design of printed circuit boards, the revision of soldering and component specifications, and for decision criteria upon which engineering changes may be evaluated. GRA

N80-31734# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.
CAPACITORS FOR AIRCRAFT HIGH POWER Final Report, May 1975 - Oct. 1979
Robert D. Parker Apr. 1980 260 p
(Contract F33615-75-C-2021; AF Proj. 3145)
(AD-A087427; AFWAL-TR-80-2037) Avail: NTIS HC A12/MF A01 CSCL 09/1

This report describes an exploratory program conducted to develop reliable lightweight pulse discharge capacitors for airborne application. The specific duty was a 1 minute burst every 2 hours, and both low (50pps) and high (300pps) repetition rate service was to be considered. The energy density goals were 400 to 1100 J/kg with a 20 microsec capacitor current pulse width. A five layer polysulfone/kraft paper dielectric was selected for high rate service, while polyvinylidene fluoride/kraft paper was chosen for the low rate service. Both mineral oil and dioctylphthalate fluids were used. Tension controlled winding was used to eliminate failure producing folds. Reduced temperature drying further reduced wrinkles. Special filtration, purification, and cleaning produced very high resistivity fluids free from particles. A highly instrumented test bay accurately simulated a pulse forming network environment and allowed detailed and accurate testing. The best single section high rate results were 550 J/kg at 100,000 - 1,000,000 shot life at double the specified duty, while the best low rate results were slightly higher. Case weight minimization was stuided, and three prototype lightweight cases were built. Several techniques for smoothing rough capacitor foils were examined, and a flame technique was selected as being most easily implemented. Problems of terminating extended foils were examined, and a flame-spray method selected as most practical. GRA

N80-31735# Litton Systems, Inc., San Carlos, Calif. Electron Tube Div.
NON-PERIODIC HELIX TWT STUDY Final Report
May 1980 53 p refs
(Contract N00173-76-C-0194)
(AD-A087413) Avail: NTIS HC A04/MF A01 CSCL 09/1

The purpose of this contract was to determine the feasibility of using various techniques to increase the operating voltages and peak power levels of helix type traveling-wave tubes. An oscillation suppression technique has been proposed which has application at high voltages and high frequencies. Based on a theoretical analysis of loading in transmission lines, calculations have been made which predict the presence of stopbands. Cold tests were performed which verified the accuracy of these calculations. A tube was built and tested. The test results indicate that the modes exist as predicted in cold test. Further testing is required to determine whether or not the stopband exists for hot test operation. GRA

N80-31736# Lockheed Missiles and Space Co., Palo Alto, Calif. Palo Alto Research Lab.
POROUS ELECTRODE STUDIES Final Summary Report, 1973 - 1980
T. Katan. Jul. 1980. 27 p. refs.
(Contract N00014-73-C-0397)
(AD-A087528; LMSC-D766555) Avail: NTIS HC A03/MF A01 CSCL 07/4

Morphological and chemical changes are determined within the pores of analog porous electrodes to deduce the sequence of reactions and current distribution. The Silver/Silver Chloride System was shown to undergo a dissolution-diffusion-deposition during anodizing, and the applicability of the Newman-Bennion theory was demonstrated. GRA

N80-31737# New Mexico State Univ., Las Cruces.
THE USE OF MINIATURE ELECTRET MICROPHONES IN SMALL OPTOACOUSTIC CELLS Final Report
Stuart A. Schleusener. 30 Jun. 1980. 28 p. refs.
(Grant DAAG29-78-G-0080)
(AD-A087520; ARO-15969.1-GS) Avail: NTIS HC A03/MF A01 CSCL 09/5

Subminiature electret microphones were used in miniature spectrophone tests. Data has been obtained from gas mixtures with pressures as high as 660 Torr down as low as 2 Torr of CO2. Line broadening effects are very noticeable throughout the lower pressure region. Results show that subminiature electret microphones are competitive with other transducers in spectrophone work. GRA

N80-31738# Bendix Corp., Kansas City, Mo.
COST EFFECTIVE SYSTEM FOR CONNECTING MULTIWIRE CABLES TO PRINTED WIRING BOARDS Final Report
F. H. Lewis. Mar. 1980. 10 p.
(Contract DE-AC04-76DP-00613)
(BDX-613-2302) Avail: NTIS HC A02/MF A01

A system flexible enough to meet present and future work requirements was developed. The Component Locator System usually is referred to as a Work Director. The Work Director shows the exact location for installing the wire on the pointed wiring board (PWB) and codes the Cable Scanner for the correct wire. The Cable Scanner then provides an audible signal when the operator touches the correct wire. This combination of Component Locator System and Cable Scanner eliminates the following operations: marking wires for identification; sorting marked wires when attaching to connectors; electrically checking wire number versus pin number; identifying wires by markings when installing them in the PWB; and determining the proper PWB hole location from a visual aid. DOE

N80-31739# Boston Univ., Mass.
INFRARED ABSORPTION SPECTRUM OF FREE CARRIER IN POLAR SEMICONDUCTORS Progress Report, 1 Jul. 1979 -30 Jun. 1980
B. Jensen. Feb. 1980. 11 p. refs.
(Contract DE-AC02-79ER-10444)
(DOE/ER-10444/1) Avail: NTIS HC A02/MF A01

The Drude Zener Theory of the absorption of high frequency radiation by free carriers was extended into the quantum region in terms of a frequency dependent relaxation time which predicts the dc mobility in the quasiclassical limit. Numerical calculations of the frequency and concentration dependent electron scattering rate were completed for InP, InAs, Ga(0.47)In(0.53)As, and previous results for GaAs extended to high carrier concentrations. Calculated results for GaAs are in good agreement with experimental measurements of the mobility which are found to be independent of a wide variety of conditions of material preparation. This indicates that disagreement with previous theoretical calculations was not due to compensation. Calculations for ZnSe and further investigation of the modification of the optical constants by the presence of an intense laser field and by a static magnetic field are currently planned. DOE

N80-31740# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France). Dept. ETE.
VOLTAGE CONVERTER (DC/DC) USED ON A SATELLITE. APPLICATIONS TO THE ARCAD 3 AND PICPAB PROJECTS [CONVERTISSEUR D'ALIMENTATION DC/DC EMBARQUE SUR SATELLITE. APPLICATIONS AUX PROJETS ARCAD 3 ET PICPAB]
M. Auger. 2 Nov. 1979. 54 p. refs. In FRENCH.
(CRPE-NT-77) Avail: NTIS HC A04/MF A01

The specifications of a converter of the type used for the ISOPROBE experiment are given. A model was built and tested, the ARCAD3. The circuit diagrams are presented and problems discussed in terms of off-the-shelf components presently available. Author (ESA)

N80-31741# Royal Signals and Radar Establishment, Malvern (England).
MICROWAVE FREQUENCY MEMORY
C. M. Boyne. London HMSO. Mar. 1980. 16 p. refs.
(RSRE-Memo-3257; BR74217) Avail: NTIS HC A02/MF A01

A circuit is described which is capable of remembering the frequency of a single pulse of RF in the band 9.2 - 9.8 GHz. The minimum pulse duration is 100 nsec and the set on accuracy is to within + or - 5 MHz. The memory is an oscillator which is set to one of a number of discrete frequencies by the injection of an RF pulse. It is shown that the oscillator can be switched to a new frequency at any time by injecting a new signal. Author (ESA)

N80-31742# Defence Research Information Centre, Orpington (England).
INTEGRATION OF FILTERS BY MEANS OF LINEAR MOS CIRCUITS
P. Christiansen, P. J. Gebhardt, and G. Kohlbacher. London. May 1980. 37 p. refs. Transl. into ENGLISH from Wiss. Ber. AEG-Telefunken, v. 52, no. 1/2, 1979. p. 131-138. Sponsored by Bundesministerium fuer Forschung und Technologie.
(DRIC-T-6106; BR74161) Avail: NTIS HC A03/MF A01

The implementation and characteristics of charge coupled device filters and switched capacitor filters produced using linear MOS technology are described. The analysis includes a discussion of circuit sections such as input stages, differential current integrator, clock pulse generator, inverters, source followers, differential amplifiers, and operational amplifiers, all using linear MOS circuit techniques. Author (ESA)

N80-31743# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
ATMOSPHERIC ELECTRICITY-AIRCRAFT INTERACTION
May 1980. 227 p. refs. Lectures held in London, 9-10 Jun. 1980, in Munich, 12-13 Jun. 1980, and in Menlo Park, Calif., 24-25 Jun. 1980.
(AGARD-LS-110; ISBN-92-835-1361-4) Avail: NTIS HC A11/MF A01

The fundamentals of atmospheric electricity phenomena are reviewed with emphasis on the hazards, criteria, testing, and protection of aircraft. Insights are provided from both pilot and design perspectives. For individual titles, see N80-31744 through N80-31757.

N80-31744# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
ATMOSPHERIC ELECTRICITY INTERACTIONS WITH AIRCRAFT: AN OVERVIEW
Gary A. DuBro. *In* AGARD Atmospheric Elec.-Aircraft Interaction. May 1980. 11p. refs. (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

Concern for the vulnerability of aircraft flight-critical and

mission-critical avionics to atmospheric electricity hazards has increased over the last fifteen years. The major hazards of concern are lightning and static electrification. Two primary factors have contributed to a potentially increased threat to new generation aircraft: (1) increasingly widespread use of sensitive microelectronics in flight-critical and mission-critical electronic and electrical systems; and (2) the reduced electromagnetic shielding afforded by many advanced structural materials. A description of the atmospheric electricity interaction with aircraft and the manner in which it impacts the aircraft avionics is summarized. Key areas of pertinent research and development are identified and the present state of the art in each of these key areas is presented. E.D.K.

N80-31745# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT MISHAP EXPERIENCE FROM ATMOSPHERIC ELECTRICITY HAZARDS
Don W. Clifford *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 17 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

Aircraft mishaps resulting from inflight lightning strikes can range from inconsequential to catastrophic. A basic understanding of how lightning affects aircraft, based upon both military and commercial experience is established. Pilot reports of some representative incidents are described in detail, illustrating how the various atmospheric conditions and interaction mechanisms have affected aircraft operations. A summary of inflight mishap conditions is presented describing the range of flight circumstances under which aircraft are usually struck. The interaction of high current arcs with structural and external electrical hardware, the effects of electromagnetic coupling to interior avionics, and the effects of corona and high voltage sparking are also discussed. E.D.K.

N80-31746# Tuebingen Univ. (West Germany).
PHENOMENOLOGY OF LIGHTNING/AIRCRAFT INTERACTION
R. P. Muehleisen *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 6 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

Two types of lightning discharges having different characteristics are intracloud and cloud to cloud discharges and cloud to ground discharges. The many hypotheses of thundercloud electrification are introduced. Calculation results and graphs are given due to the electric field strength around thunderclouds. The distortion of these fields by aircraft bodies and the initiation of triggered lightnings are described. E.D.K.

N80-31747# Lightning Technologies, Inc., Pittsfield, Mass.
SUSCEPTIBILITY OF AVIONICS TO LIGHTNING INDIRECT EFFECTS
J. Anderson Plumer *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 27 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The ways that lightning currents may flow in an airframe and basic mechanisms whereby these currents may induce transient voltages and currents in typical aircraft electrical circuits are described. Examples of induced voltages and currents measured during simulated lightning tests are presented and significant aspects are discussed, together with estimates of the ranges of induced voltages to be expected in typical circuits. Examples of the magnetic fields that are responsible for some of these induced effects are also presented. A discussion of the basic damage effects that lightning induced voltages may have on typical solid state electronic components is included. E.D.K.

N80-31748# United Kingdom Atomic Energy Authority, Abingdon (England)
MODELS FOR ASSESSING HAZARDS DUE TO LIGHTNING
P. F. Little *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 14 p refs Sponsored by the UK Ministry of Defence (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The characteristics of lightning current pulses and the radiated fields produced by lightning are summarized. The transmission line model of the ground flash is considered and the derivation of the parameters of the line from the physical processes taking place is treated in various degrees of approximation. Changes in the shape of the current pulse occur as the return stroke is propagating and the implications of these changes in waveform are discussed. The transition from leader channel to return stroke channel may be regarded as a shock front and this aspect is explored also in respect of the leader advance. The coupling of fields and currents due to lightning into the aircraft when it forms part of the return stroke channel and when it is close to an independent stroke is considered in the light of these physical models. Author

N80-31749# McDonnell Aircraft Co., St. Louis, Mo.
LIGHTNING TEST CRITERIA FOR AIRCRAFT AVIONICS SYSTEMS
Don W. Clifford *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 12 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The evolutionary history of the test criteria for lightning testing of aerospace systems and avionics equipment is presented along with a summary of the salient features and the rationale for selection of the parameters specified in the documents. Test criteria are set forth in terms of the various current and voltage waveforms to be used in lightning tests. The simulation waveforms are based upon statistical summaries of the natural lightning environment. Modern tests criteria documents account for the dynamic nature of the lightning interaction with aircraft by using the zonal concept to more accurately identify the threat to specific systems and equipment. Test techniques can affect simulated lightning test results and the modern criteria documents include recommended practices for achieving accurate and consistent results. Some predictions of future changes in the criteria documents are made on the basis of information about the lightning threat based upon recent measurements of natural lightning. E.D.K.

N80-31750# McDonnell Aircraft Co., St. Louis, Mo.
LIGHTNING TESTING FOR AIRCRAFT AVIONICS SYSTEMS
Don W. Clifford *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 23 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The test techniques used to evaluate lightning effects on avionics equipment are discussed. The facilities necessary to produce the current and voltage waveforms specified in the criteria documents are briefly described as are the sensors and instrumentation used to measure and record the test data. Where test setup details can affect test results, the preferred techniques are described. Techniques for full vehicle tests are discussed briefly as they may impact the next generation of criteria documents. E.D.K.

N80-31751# United Kingdom Atomic Energy Authority, Abingdon (England)
THE COUPLING OF LIGHTNING FIELDS INTO AIRCRAFT AND CABLES
P. F. Little *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 14 p refs Sponsored by the UK Ministry of Defence (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The current distribution in the skin of an aircraft struck by lightning is described and the effects of airframe resonance are noted. Nearby strikes produce initially an electromagnetic pulse which is scattered by the aircraft, creating circulating currents in the skin: this process is considered. The magnetic fields at the surface diffuse into the skin, and significant currents flow on the interior after a time lag dependent on the skin resistivity. In addition, the surface fields couple directly into the interior through breaks in the conducting skin or through insulating panels. Methods of calculating the magnetic and electric fields in the interior of the aircraft are discussed, and the effects on electrical and electronic systems described. The screening of internal cabling is reviewed. Author

N80-31752# Lightning Technologies, Inc., Pittsfield, Mass.
PROTECTION OF AIRCRAFT AVIONICS FROM LIGHTNING INDIRECT EFFECTS
J. Anderson Plumer *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 26 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The estimation of magnitudes of voltages and currents induced on shielded and unshielded wiring, and the utilization of shields to reduce the level of these effects in sensitive circuits is discussed. Circuit design practices that also can be utilized to minimize induced effects are reviewed along with the various types of surge suppression devices that are available and the advantages and disadvantages of each. Transient coordination and methods of verification are discussed. M.G.

N80-31753# Lightning Technologies, Inc., Pittsfield, Mass.
LIGHTNING EFFECTS ON AIRCRAFT: A COCKPIT PERSPECTIVE
J. Anderson Plumer *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 12 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

Typical conditions in which strikes have been experienced by large and small aircraft are described, together with effects as experienced by flight crews. Most strikes have occurred when the aircraft is flying at between 3000 and 5000 meters altitude, where the outside air temperature is within 5 deg of 0 C and there exists a light to moderate amount of precipitation. Strikes to aircraft have, however, occurred at altitudes as high as 12,000 m and also when the aircraft are parked on the ground. If an aircraft approaches a highly electrified region it may actually trigger a strike, especially if the aircraft is large and causes a significant perturbation in the nearby electric field. Aircraft lightning strike mechanisms, effects to avionics and electric power systems, engine effects, and effects to personnel are addressed. M.G.

N80-31754# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
BASIC PHENOMENOLOGY OF ELECTRICAL DISCHARGES AT ATMOSPHERIC PRESSURE
Joseph Taillet *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 19 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The mechanism of three types of discharge induced by static charging (spark, corona, and surface streamers) is described in detail. From this mechanism, the radioelectric noise emitted by these discharges is predicted. It is concluded that sparks and surface streamers are generators of powerful radioelectric disturbances. Proper bonding eliminates sparks and specific treatments suppress surface discharges. Coronas are necessary for getting rid of the accumulated static charge. On the one hand, attention should be given to reducing as much as possible the coupling between coronas discharges and antennas of the avionic system. On the other hand, use of corona microdischarges can bring a further improvement in static noise reduction. M.G.

N80-31755# SRI International Corp., Menlo Park, Calif. Electromagnetic Sciences Lab.
STATIC CHARGING EFFECTS ON AVIONIC SYSTEMS
J. E. Nanevicz *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 15 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The electromagnetic character of various noise sources--corona discharge, surface streamers, and spark discharges are discussed. The results of flight tests and laboratory discharge simulations are given. In general, the source data exist both as time domain waveforms and as frequency domain spectra. The differences between the noise signals generated by the different sources are discussed, and the dependence of noise levels on aircraft charging current are indicated. Results of laboratory determinations of coupling between source locations and antennas are also presented together with the results of flight test experiments conducted to verify the coupling information. Finally, the source data is combined with the coupling information to predict the equivalent noise fields to be expected at typical antenna locations on aircraft. These noise fields are compared to atmospheric noise levels to determine the degree of system performance degradation that can result from precipitation static noise. M.G.

N80-31756# SRI International Corp., Menlo Park, Calif. Electromagnetic Sciences Lab.
ALLEVIATION TECHNIQUES FOR EFFECTS OF STATIC CHARGING ON AVIONICS
J. E. Nanevicz *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 14 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

The various mechanisms by which static charging of aircraft affects avionic systems are identified, and techniques to mitigate the effects are described. Noise reduction schemes intended to eliminate aircraft charging itself are confined to the elimination of surface streamer discharges on electrically insulating frontal surfaces by coating the surface with electrically conductive material. This procedure allows the charging current to flow off the surface as rapidly as it arrives without generating noise. Another technique for eliminating surface streamer noise at the source is simply to relocate insulating materials (i.e., antenna insulating materials) to regions at the aft of the aircraft where they will not be charged by impinging precipitation particles or to install particle deflectors upstream of the dielectric surface. Successful techniques for the control of corona discharge noise involve forcing the discharge to occur from special discharging devices installed at high field regions on the aircraft where corona discharges are likely to occur naturally. The dischargers are designed to reduce the corona source intensity and to decouple the discharge source from the airframe. Practical dischargers are capable of reducing corona discharge noise by as much as 60 dB. Noise generated by sparking between sections of the metal structure can be eliminated by electrical bonding of all portions of the structure. Descriptions of techniques demonstrated by laboratory and flight tests to be successful in controlling precipitation charging interference are given. M.G.

N80-31757# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
AIRCRAFT STATIC CHARGING TESTING
Joseph Taillet *In* AGARD Atmospheric Elec.-Aircraft Interaction May 1980 7 p refs (For primary document see N80-31743 22-33)
Avail: NTIS HC A11/MF A01

A procedure is proposed for: (1) characterizing in the laboratory the effects of aircraft charging on the operation of unprotected navigation and communication systems; (2) assessing in the laboratory the validity of the protective methods; (3) checking in the factory the correct application of these methods; (4) routine testing between flights, in the field, of the good condition of the protecting devices and treated surfaces. A test method is developed which would include checking the bonding between metallic surfaces, measuring the value of surface resistance of semi-conductive coatings or resistive paints deposited over insulating substrate, simulating tribo-electric charging or charge collection separately on any surface element of the aircraft, and verifying that the coupling between dischargers and antennas is minimal. M.G.

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-31758 Lehigh Univ., Bethlehem, Pa.
MULTISYSTEM MODELING OF UNSTEADY LIQUID FLOW
Ph.D. Thesis
Joel Leonard Caves 1980 230 p
Avail: Univ. Microfilms Order No. 8019708

A single set of governing equations called system-independent

equations, is derived describing the conservation of mass and momentum for flow through a generalized porous conduit. Generic coefficients in the system-independent equations relate the changes in liquid and conduit properties to the variations in pressure and velocity. Supplemental system-dependent equations or laboratory experimentation can be used to quantify the coefficients for each particular flow system. The validity of the system-independent equations is shown by comparison with traditional solutions to single-system problems of transient flow in a closed conduit, an open channel, an unconfined aquifer, and a confined aquifer. Computer simulations of the classical problem involving free surface and pressurized flow in the Wettingen Tunnel and of a stream-aquifer interaction problem demonstrate the value of the system-independent equations for transient analysis of multisystem problems where the completeness, practicality, and versatility of the equations can be exploited. Dissert. Abstr.

N80-31759*# Sheffield Univ. (England). Dept. of Chemical Engineering.
INVESTIGATIONS OF EDDY COHERENCE IN JET FLOWS
A. J. Yule. 1980. 27 p. refs. Presented at Intern. Conf. on the Role of Coherent Structures in Modelling Turbulence and Mixing, Madrid, 25-27 Jun. 1980
(Grant NSG-7517)
(NASA-CR-163525) Avail: NTIS HC A03/MF A01 CSCL 20D

In turbulent shear flow the term coherent structures refers to eddies which are both spatially coherent, i.e., large eddies, aand also temporally coherent, i.e., they retain their identities for times which are long compared with their time scales in fixed point measurements. In transitional flows, the existence of such structures is evident from flow visualizations. In many other flows, such structures are not so evident. The reasons for the existence of these two classes of flows are discussed and attention is focused upon the more difficult flows, where coherent structures are not so evident. Techniques by which the existence (or nonexistence) of such structures in these flows can be established from point measurements, are also discussed. A major problem is shown to be the need to discriminate between real losses in eddy coherence and apparent losses in coherence introduced by phase scrambling effects which 'smear' multipoint correlations. The analysis of multiprobe time dependent data in cold and reacting round turbulent jets is described and it is shown how evidence of strong eddy coherence can be extracted from data. R.K.G.

N80-31760*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
AN EXPERIMENTAL STUDY OF MULTIPLE JET MIXING
D. Krothapalli, D. Baganoff, and K. Karamcheti. Jun. 1979. 162 p. refs.
(Grants NsG-2007; NsG-2233)
(NASA-CR-163537; SU-JIAA-TR-23) Avail: NTIS HC A08/MF A01 CSCL 20D

Measurements of an incompressible jet issuing from an array of rectangular lobes, equally spaced with their small dimensions in a line, both as a free jet, and as a confined jet, are carried out in three parts: (1) on a single rectangular free jet, (2) on the same jet in a multiple free jet configuration, and (3) on the same jet in a multiple jet configuration with confining surfaces (two parallel plates are symmetrically placed perpendicular to the long dimension of each lobe covering the entire flow field under consideration). In the case of a single rectangular free jet, the flow field of the jet is characterized by the presence of three distinct regions in the axial mean velocity decay and are referred to as potential core region, two dimensional type region, and axisymmetric type region. In the case of a multiple free jet, the flow field for downstream distance X greater than 60D (D = width of a lobe) resembles that of a jet exiting from a two dimensional nozzle with its short dimension being the long dimension of the lobe. S.F.

N80-31761# Applied Research Lab., State College, Pa.
WATER TUNNEL SIMULATION STUDY OF THE LATER STAGES OF WATER ENTRY OF CONICAL HEAD BODIES. PHASE 2: EFFECT OF THE AFTERBODY ON STEADY STATE VENTILATED CAVITIES
D. R. Stinebring and J. W. Holl. 3 Dec. 1979. 74 p. refs.
(Contract N00024-79-C-6043)
(AD-A086980; ARL/PSU-TM-79-206) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report documents the second phase of the water tunnel studies that are intended to simulate the cavity running phase of water entry. The primary purpose of the investigation was to study the effect of afterbody arrangement on steady state ventilated cavities. The models utilized were 1.0 inch diameter conical nosed bodies with a 45 deg. apex angle. Three models were tested: one having a 1.0 inch diameter afterbody, one having a 0.5 inch diameter afterbody and the third having no afterbody. The cavitation number as a function of cavity length and ventilation air flow coefficient as a function of cavitation number were measured for all models. The pressure distribution was found for a wide range of cavity lengths for the model with the 1.0 inch diameter afterbody. Data for the ventilation air flow coefficient and pressure distribution are in good agreement with previous studies of similar models. An interesting result is that the model requiring the lowest ventilation air flowrate for a given cavitation number was the model with no afterbody. For most of the flow states investigated, the model with the 0.5 inch diameter afterbody required the highest flowrate. The transition between the reentrant jet and twin vortex regimes was studied briefly. At transition, the cavity would grow four or five times its original length for a slight increase in ventilation air flowrate. A cavity attrition test was conducted to simulate the decay of a cavity behind a missile. GRA

N80-31762# Applied Research Lab., State College, Pa.
A SPLINE RELAXATION PROCEDURE FOR CALCULATING AXISYMMETRIC FLOW FIELDS ABOUT BODY/PROPELLER COMBINATIONS. 1: FROZEN VORTICITY AND POTENTIAL FLOWS
G. H. Hoffman. 14 May 1980. 49 p. refs.
(Contract N00024-79-C-6043)
(AD-A087027; ARL/PSU-TM-80-108) Avail: NTIS HC A03/MF A01 CSCL 20/4

A general numerical solution method is presented for calculating incompressible axisymmetric viscous/turbulent flow in the tail-near wake region of a body-propeller combination. The method makes use of the parabolic vorticity transport approximation in conjunction with polynomial splines to achieve sufficient accuracy in high flow gradient regions with as few grid points as possible. A sheared body fitted coordinate system is used and the numerical solution of the finite difference equations is obtained by standard line overrelaxation. This report presents the details of the method for the first phase of the work where the vorticity transport equation is omitted (frozen vorticity flow). Sample potential flow and frozen vorticity solutions are presented with no propeller present. GRA

N80-31763# Naval Academy, Annapolis, Md. Div. of Engineering and Weapons.
HYDRODYNAMIC COEFFICIENTS FOR VERTICAL CIRCULAR CYLINDERS AT FINITE DEPTH
Tarik Sabuncy (Teknik Univ., Istanbul) and Sander Calisal. 1980. 74 p. refs.
(AD-A087334; USNA-EW-11-80) Avail: NTIS HC A04/MF A01 CSCL 20/4

Hydrodynamic coefficients for vertical circular cylinders at finite water depth are obtained and presented for different depth to radius and draft to radius ratios. A summary of equations for computer application is also presented. Limiting values for heave added mass for zero frequency is also discussed. GRA

N80-31764# Lumley (John L.), Ithaca, N.Y.
THE PRESSURE FOOTPRINT OF A TURBULENT LAYER ON A COMPLIANT BOUNDARY. Technical Report, 1 Aug. 1979 - 31 Jul. 1980
John L. Lumley. 31 Jul. 1980. 53 p. refs.
(Contract N00014-79-C-0727)
(AD-A087296) Avail: NTIS HC A04/MF A01 CSCL 20/4

An examination was made of one way in which a compliant boundary may affect the low wavenumber pressure field measured at the surface under a turbulent boundary layer. Specifically, we assume that the low wavenumber pressure field measured at the wall results from the large scale motions in the outer part of the flow, and that these are triggered by the bursting in the

buffer layer, which is caused in its turn by secondary instabilities growing on inflectionary profiles caused by longitudinal vortices in the sub and buffer layers. The direct effect of the compliant boundary on the growth of these longitudinal vortices, using the energy method, was examined. We represent the compliant boundary by a half space filled with a linear visco-elastic medium with a single time constant. We find that the effect of the boundary is to introduce an effective slip in the boundary condition on the disturbance (the longitudinal vortices), producing a boundary condition intermediate between the inviscid boundary condition and the no-slip boundary condition. Since this boundary condition is less dissipative, the vortices are less stable, and have a higher growth rate. They might consequently be expected to grow faster and occur more frequently, if this were the only mechanism involved, resulting in a shift of the low wavenumber pressure spectrum to higher frequencies. This appears to be the opposite of observations, suggesting that other mechanisms are involved. GRA

N80-31765# Rockwell International Corp., Columbus, Ohio. North American Aircraft Div.
DEVELOPMENT OF A NOZZLE TO IMPROVE THE TURNING OF SUPERSONIC COANDA JETS Final Report, 15 Jun. 1979 - 15 Mar. 1980
Paul M. Bevilaqua and John D. Lee Apr. 1980 58 p refs
Prepared in cooperation with Ohio State Univ., Columbus
(Contract F33615-79-C-3026; AF Proj. 2404)
(AD-A087709; NR80H-18; AFWAL-TR-80-3027) Avail: NTIS HC A04/MF A01 CSCL 20/4

The hypothesis that shaping the jet velocity profile improved the thrust vectoring of supersonic Coanda jets was experimentally tested. A new nozzle design procedure, based on the method of characteristics, was developed to design a nozzle which delivers an arbitrary exit velocity profile. Such a nozzle was designed for a pressure ratio of 2.5, to provide a jet matched to a circular Coanda surface with radius equal to five jet thicknesses. The thrust vectoring of this nozzle was then compared to that of a convergent divergent nozzle over a range of pressure ratios from 1.5 to 3.5. It is concluded that supersonic nozzles provide greatly improved turning of Coanda jets, and that shaping the velocity profile further improves the thrust vectoring. GRA

N80-31766# AeroChem Research Labs., Inc., Princeton, N. J.
EXPERIMENTAL STUDY OF CHEMICALLY REACTING TURBULENT FREE SHEAR LAYERS Final Report, 23 Sep. 1976 - 30 Nov. 1978
Robert K. Gould Feb. 1980 55 p refs
(Contracts EX-76-C-01-2446; E(49-18)-2446)
(FE-2446-8) Avail: NTIS HC A04/MF A01

The model chemical reaction used to study turbulent mixing/reacting flows was the NO/O3 reaction. A novel photolysis/chemiluminescence technique was employed to measure reactant concentrations, c/sub NO/ and c/sub O3/, and a product concentration, c/sub NO2/, simultaneously at points in the flow field. From such measurements, the required statistical quantities, i.e., probability density functions and correlations of reactants and product concentrations, are obtained. These data were supplemented by measurements of the turbulence power spectra and intensity throughout the flow. The flow studied was an axisymmetric turbulent jet exhausting into a nearly stationary, uniform channel flow. Cases examined were a reacting case in which the jet contains dilute O2 in N2 and the channel flow is dilute NO in N2; and a nonreacting (but otherwise identical flow) in which a jet of N2 containing small quantities of NO and NO2 exhausts into pure N2. DOE

N80-31767# Sandia Labs., Albuquerque, N. Mex. Fluid and Thermal Sciences Dept.
EXPERIMENTAL STUDY OF THE STEADY NATURAL CONVECTION IN A HORIZONTAL ANNULUS WITH IRREGULAR BOUNDARIES
R. D. Boyd 1980 66 p refs Presented at the 19th Natl. Heat Transfer Conf., Orlando, Fla., 27 Jul. 1980
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-2354C; CONF-800723-1) Avail: NTIS HC A04/MF A01

The natural convective heat transfer across an annulus with irregular boundaries was studied using a Mach-Zehnder interferometer. The annulus was formed by an inner hexagonal cylinder and an outer concentric circular cylinder. This configuration models, in two dimensions, a liquid metal fast breeder reactor spent fuel subassembly inside a shipping container. During the test, the annulus was filled with a single gas, either neon, air, argon, krypton, or xenon, at a pressure of about 0.5 MPa. From temperature measurements, both local and mean Nusselt numbers (Nu/sub delta/) at the surface of the inner cylinder were evaluated, with mean Rayleigh number (anti Ra/sub delta/) varying from 4.54 X 10 to the 4th power to 0.915 x 10 to the 6th power (delta is the local gas width). DOE

N80-31768# E-Systems, Inc., Greenville, Tex.
DEMONSTRATION OF FIBER OPTIC LINK APPLICATIONS IN UTILITY PLANT MULTIPLEXED INSTRUMENT AND CONTROL SYSTEMS Final Report
W. D. Redus, G. R. Craig, and W. J. B. Oldham Jan. 1980 111 p Sponsored by EPRI
(EPRI Proj. 1173-1)
(EPRI-NP-1322) Avail: NTIS HC A06/MF A01

The application of data transmission via fiber optic cables was demonstrated for a utility plant instrumentation system. The project demonstrated that fiber optics is a viable method of transmitting I&C instrumentation. There is a cost penalty for light transmitters, receivers, and higher cable cost, which must be weighed against the advantages. The light beam and cable are essentially immune to crosstalk, electromagnetic interference, switching and transient interference, humidity, pressure, and reasonable temperature environments. There are potential handling difficulties with glass cable since a crimp or sharp bend radius will break the cable. A reasonable field-installable connector is essential. Plastic cable is very readily installed, spliced, and handled. Its major limitation is the higher transmission loss that restricts plastic cable to shorter runs of a few hundred feet. A time domain reflectometer (light beam radar) can locate cable breaks and is necessary for plant installations. Cables must be marked for distance locations. DOE

N80-31769# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL CALCULATION OF THERMAL CONVECTION IN POROUS MEDIA IN TWO DIMENSIONS WITH APPLICATIONS TO NUCLEAR REPOSITORY DESIGN
D. E. Maiden May 1980 15 p refs
(Contract W-7405-eng-48)
(UCID-18700) Avail: NTIS HC A02/MF A01

A computer code HP2D was developed to calculate the effect. Transient and steady state heat and fluid flow in porous media are calculated. The code allows for anisotropy of hydraulic conductivities, temperature dependent fluid density and viscosity. A heat source and a variety of temperature and flow boundary conditions can be easily employed. The code solves two coupled governing equations. The time dependent heat transport is solved by an alternating direction implicit technique; and the steady state flow of water is solved by a Gauss-Seidel Poisson solver. A sample calculation of thermal convection about a repository is given. DOE

N80-31770# General Electric Co., Schenectady, N. Y. Mechanical Systems and Technology Lab.
LAMINAR FLOW CYCLONE DEVELOPMENT PROGRAM Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1980
W. B. Giles and K. L. Bekofske Apr. 1980 22 p
(Contracts DE-AC21-78ET-11031; ET-78-C-01-3242)
(FE-3242-40) Avail: NTIS HC A02/MF A01

A modified water flow model to study the influence of inlet wall heating is discussed. This wall heated model of the radial inflow region has been adapted with additional thermocouples, plus insulation of the rim. The data continue to indicate highly stable flow conditions up to the maximum test Reynolds numbers. DOE

N80-31771# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium)
A STUDY INTO THE USE OF A PHOTON CORRELATION TECHNIQUE IN BOTH LOW AND HIGH SPEED FLOWS
R. S. Figliola and G. Vorropoulus Feb. 1980 34 p refs
(VKI-TM-27) Avail: NTIS HC A03/MF A01

A laser anemometer system using a photon correlation technique in conjunction with a dual beam-Doppler difference optical system was tested. An introduction to the technique is presented. Correlograms were obtained in both low and high speed flows having various degrees of turbulence. Comparisons are made with measurements from a pitot-static tube, a hot-wire anemometer, and a period counter processor. The technique obtained good results even at extremely low light levels with signals of poor signal to noise ratio at velocities up to M = 1.2. Author (ESA)

N80-31772# Maryland Univ., College Park. Dept. of Mechanical Engineering.
TWO-PHASE FLOW MODEL TEST FACILITY Interim Report, 15 Aug. 1975 - 31 Jan. 1977
Dirse W. Sallet, Manfred Guehler, and Chung Y. Tsui. Apr. 1980 26 p.
(Contract DOT-FR-64181)
(PB80-181647; FRA/ORD-76/298) Avail: NTIS HC A03/MF A01 CSCL 20D
Test facilities for the investigation of two phase flows are described. The test facility completed to this date consists of the blow down test apparatus and the bubble and slug flow tunnel. It is the purpose of the test facilities to support, test and aid in the development of safety valve sizing equations when different two phase regimes occur. GRA

N80-31773# National Bureau of Standards, Washington, D.C. Building Thermal and Service Systems Div.
METHOD OF TESTING, RATING AND ESTIMATING THE HEATING SEASONAL PERFORMANCE OF HEAT PUMPS
Walter H. Parken, Jr., George E. Kelly, and David A. Didion. Apr. 1980 66 p. Sponsored in part by DOE
(PB80-185622; NBSIR-80-2002) Avail: NTIS HC A04/MF A01 CSCL 13A
Test and rating procedures are presented for electrically driven residential air to air heat pumps operating in the heating mode. The procedures are designed to include the effects of part load (cyclic) operation, variations in outdoor temperature, and frost formation on the heating performance. Using the test procedure results, a calculation procedure is presented for estimating the heating seasonal performance and cost of operation of residential heat pump units. GRA

N80-31664 Ohio State Univ., Columbus. Dept. of Mechanical Engineering.
MODELING OF FLUID TRANSIENTS IN MACHINES. PART 2: ADVANCED CONSIDERATIONS
R. Singh. *In* Shock and Vibration Information Center. The Shock and Vibration Inform. Digest, Vol. 12, No. 7, Jul. 1980 p. 11-17 refs. (For primary document see N80-31662 22-31)
Avail: Naval Research Lab., Attn. code 5804, Washington, D.C. 20375. Annual rate HC $100.00

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-31774*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FILM ADVANCE INDICATOR Patent Application
E. Thomas Freeman, Charles W. Stump, and Francis R. Dreisbach, inventors (to NASA). Filed 18 Jul. 1980 9 p.
(NASA-Case-LAR-12474-1; US-Patent-Appl-SN-171934) Avail: NTIS HC A02/MF A01 CSCL 14E
A film advancement indicator which includes an optical sensor that detects the rotational movement of a disc that rotates only when the film advances is described. When the film does not advance an indicator light is activated. A counter is included in the electronic circuit to determine the number of film frames advanced. NASA

N80-31775*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DATA ACQUISITION TECHNIQUES FOR EXPLOITING THE UNIQUENESS OF THE TIME-OF-FLIGHT MASS SPECTROMETER: APPLICATION TO SAMPLING PULSED GAS SYSTEMS
Kenneth A. Lincoln. Aug. 1980 15 p. refs. Presented at the Dyn. Mass Spectrometry Symp., Canterbury, England, 7-10 July 1980
(NASA-TM-81224; A-8308) Avail: NTIS HC A02/MF A01 CSCL 14B
Mass spectra are produced in most mass spectrometers by sweeping some parameter within the instrument as the sampled gases flow into the ion source. It is evident that any fluctuation in the gas during the sweep (mass scan) of the instrument causes the output spectrum to be skewed in its mass peak intensities. The time of flight mass spectrometer (TOFMS) with its fast, repetitive mode of operation produces spectra without skewing or varying instrument parameters and because all ion species are ejected from the ion source simultaneously, the spectra are inherently not skewed despite rapidly changing gas pressure or composition in the source. Methods of exploiting this feature by utilizing fast digital data acquisition systems, such as transient recorders and signal averagers which are commercially available are described. Applications of this technique are presented including TOFMS sampling of vapors produced by both pulsed and continuous laser heating of materials. E.D.K.

N80-31776*# Barnes Engineering Co., Stamford, Conn.
SELENIUM IMMERSED THERMISTOR BOLOMETER STUDY Final Technical Report, Sep. 1978 - Mar. 1979
W. H. Rolls. Jun. 1979 42 p.
(Contract NAS5-25319)
(NASA-CR-160013; BEC-2774) HC A03/MF A01 CSCL 14B
The noise characteristics of thermistor bolometers immersed in layers of arsenic/selenium glass uniform in composition were examined. Using a controlled deposition technique, layers of glass were deposited, thermistor bolometers immersed, and their electrical characteristics measured after various thermal treatments. Markedly improved stability of the detector noise was observed using this new technique. L.F.M.

N80-31777*# United Technologies Research Center, East Hartford, Conn.
DESIGN, FABRICATION AND TESTING OF AN OPTICAL TEMPERATURE SENSOR
W. W. Morey, W. H. Glenn, R. O. Decker, and W. C. McClurg. Jul. 1980 54 p. refs.
(Contract NAS3-21841)
(NASA-CR-165125; R80-924624-11) Avail: NTIS HC A04/MF A01 CSCL 14B
The laboratory breadboard optical temperature sensor based on the temperature dependent absorptive characteristics of a rare earth (europium) doped optical fiber. The principles of operation, materials characterization, fiber and optical component design, design and fabrication of an electrooptic interface unit, signal processing, and initial test results are discussed. Initial tests indicated that, after a brief warmup period, the output of the sensor was stable to approximately 1 C at room temperature or approximately + or - 0.3 percent of point (K). This exceeds the goal of 1 percent of point. Recommendations are presented for further performance improvement. L.F.M.

N80-31778*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INVESTIGATION OF ELECTRICAL NOISE IN SELENIUM-IMMERSED THERMISTOR BOLOMETERS
John L. Tarpley and Pedro D. Sarmiento. Aug. 1980 30 p. refs.
(NASA-TM-82001) Avail: NTIS HC A03/MF A01 CSCL 14B
The selenium immersed, thermistor bolometer, IR detector failed due to spurious and escalating electrical noise outburst as a function of time at elevated temperatures during routine ground

based testing in a space simulated environment. Spectrographic analysis of failed bolometers revealed selenium pure zones in the insulating selenium arsenic (Se-As) glass film which surrounds the active sintered Mn, Ni, Co oxide flake. The selenium pure film was identified as a potentially serious failure mechanism. Significant changes were instituted in the manufacturing techniques along with more stringent process controls which eliminated the selenium pure film and successfully produced 22 study bolometers. S.F.

N80-31779# Texas Technological Univ., Lubbock. Optical Systems Lab.
SPACE-VARIANT PROCESSING USING PHASE CODES AND FOURIER-PLANE SAMPLING TECHNIQUES Interim Report
Rangachar Kasturi 1 Jun. 1980 158 p refs
(Grant AF-AFOSR-0076-79)
(AD-A087285; AFOSR-80-0557TR; SR-1) Avail: NTIS HC A08/MF A01 CSCL 14/5

This report discusses alternative approaches to using multiplex holography representing space-variant optical systems. The first part of the report presents the results of extensive computer simulations used in evaluating the effectiveness of Gold codes in encoding the multiple reference beams required in a sampled input/multiple reference beam realization of a space-variant system. The second part considers a totally different approach which samples the input plane and the transfer function plane. This latter approach eliminates crosstalk entirely, but requires multiple copies of the sampled input function during the playback step. The results of preliminary experiments conducted to evaluate this alternative approach for representing space-variant systems holographically are presented, including experiments verifying the coherent addition of the multiplexed holograms on playback using computer-multiplexed holograms. GRA

N80-31780# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
ADAPTATION OF A KRATKY CAMERA TO USE WITH A ONE DIMENSIONAL POSITION SENSITIVE DETECTOR
Ryong-Joon Roe, J. C. Chang, M. Fishkis, and J. J. Curro 1 Aug. 1980 34 p refs Submitted for publication
(Contract N00014-77-C-0376; NR Proj. 356-655)
(AD-A087523; TR-4) Avail: NTIS HC A03/MF A01 CSCL 14/5

A Kratky small-angle X-ray camera was modified so as to allow the use of a one dimensional position sensitive detector with it. The modification was designed in such a way that most of the calibrations, necessary for subsequent correction of the collected intensity data, can be performed with little alteration in the collimation geometry or the electronics settings. In particular, the calibration of the uniformity of detector efficiency can be performed by repeated vertical travel of the detector at a constant speed across a beam scattered from a sample. A much higher speed of data collection, with no increase in the background noise nor any loss in the angular resolution, has been achieved in comparison to a regular Kratky camera operating in step-scanning mode. The practical utility of combining the PSD with a Kratky camera for studies of isotropic samples has been demonstrated. GRA

N80-31781# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
THE EFFECTS OF RADIATION ON MATERIALS. INSTRUMENT DESIGN AND CALIBRATION [GLI EFFETTI DELLA RADIAZIONE NEI MATERIALI. PROGETTO E MESSA A PUNTO DI ALCUNE APPARECCHIATURE]
E. Caruso, F. Cristofori, L. Filoni, A. Gray, A. Decesare, and G. Vanoli Oct. 1979 70 p refs In ITALIAN; ENGLISH summary
(CISE-1524) Avail: NTIS HC A04/MF A01

The design of an irradiation creep apparatus, the equipment for the automation of thermal treatments and of electrical resistivity measurements, and a magnetic susceptibility balance are described. These instruments are used to study the behavior of radiation damaged materials. An introduction concerning magnetic properties of materials is given. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-31782# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
OPTICAL AND DISCHARGE STUDIES OF NOVEL ELECTRONIC TRANSITION LASER SPECIES
Stephen R. Leone 4 Jan. 1980 19 p refs
(Contract N00014-77-C-0115; ARPA Order 2840)
(AD-A087123) Avail: NTIS HC A02/MF A01 CSCL 20/5

A new class of diatomic lasers has been developed by optical pumping. These lase on lines in the near ultraviolet and visible regions of the spectrum. Optical excitation studies show that these molecular systems have high efficiency, may be scalable to high average powers, are nondegradable, and offer promise for pumping by other excitation schemes, such as electric discharge. It is possible that one or more candidate systems in this category of lasers might be useful in generating blue-green radiation for underwater applications. Preliminary investigations with electric discharge excitation show good formation of glow dischargers in sulfur dimer vapor. Materials problems and the difficulties of high temperature discharge technology appear to be the major drawbacks in pursuing such studies further for laser action. GRA

N80-31783# Illinois Univ. at Urbana-Champaign. Electro-Physics Lab.
SHORT INTENSE SUBMILLIMETER PULSE GENERATION Final Report, 1 Jul. 1979 - 30 Jun. 1980
Thomas A. DeTemple Jul. 1980 27 p refs
(Contract DAAG29-79-C-0075)
(AD-A087421; UILU-ENG-80-2546; ARO-16751.2-P) Avail: NTIS HC A03/MF A01 CSCL 20/5

The use of a mode-locked CO2 laser for an optically pumped near millimeter wave source has been refined and extended to the generation of pulses from C(13)H3F at 1.22mm. More refined theoretical estimates illustrate the transient nature of the conversion process in both space and time and set approximate limits on the ultimate pulse duration to be about one-half that of the pump. The implications are that one is not limited by the intrinsic linewidth in producting short pulse and that significant conversion may occur in modest distances, of order meters, suggesting quasi-compact sources for further experiments. GRA

N80-31784# Cober Electronics, Inc., Stamford, Conn.
HIGH VOLTAGE NANOSECOND PULSE GENERATOR Interim Technical Report, 1 May - 31 Oct. 1979
C. Zavales Jul. 1980 19 p
(Contract DAAB07-77-C-2641; DA Proj. 1L7-62705-AH-94)
(AD-A087291; DELET-TR-77-2641-5; IR-5) Avail: NTIS HC A02/MF A01 CSCL 14/2

A parallel Blumlein circuit, combined with a spark gap switch, was designed for operation at 24 kV, 5,000 A peak. Tests were conducted with a single Blumlein with a 10 ohm load. Because of problems with breakdown in the triggered spark gap, a slightly larger spark gap was substituted. An acceptable pulse is delivered from the pulse forming network after adjustment of the inductive elements in the network. GRA

N80-31785# Stanford Univ., Calif. Edward L. Ginzton Lab.
RESEARCH STUDIES ON RADIATIVE COLLISION LASERS Final Technical Report, 10 Mar. 1977 - 9 Jan. 1980
S. E. Harris and J. F. Young Jun. 1980 37 p refs
(Contract F19628-77-C-0072; AF Proj. 2306)
(AD-A087714; SU-GL-3090; RADC-TR-80-172) Avail: NTIS HC A03/MF A01 CSCL 20/5

This final report reviews the results of a program of theoretical and experimental studies of the physics and applications of radiative collisional processes involving two atoms and a photon simultaneously. GRA

N80-31786# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
QUASICONTINUUM PHYSICS Final Technical Report, 1 Jul. 1978 - 30 Jun. 1980
Eli Yablonovitch and N. Bloembergen Jul. 1980 74 p refs
(Contract N00014-78-C-0531)

(AD-A087622) Avail: NTIS HC A04/MF A01 CSCL 20/8

Polyatomic molecules are prepared in highly excited vibrational states by short high intensity CO2 laser pulses. The excited state is probed by a second infrared pulse, or by visible fluorescence. An apparatus involving two independently tunable infrared pulses permits time resolved infrared spectroscopy intramolecular interactions. Visible infrared double pulse experiments permit the study of quasi-continuum vibrational absorption in an electronically excited state of the molecule. GRA

N80-31787# RCA Labs., Princeton, N. J.
INJECTION LASER MODE STUDIES Final Report, 18 Apr. 1977 - 17 Apr. 1980
H. S. Sommers, Jr. Jun 1980 30 p refs
(Contract DAAG29-77-C-0021)
(AD-A087522; PRRL-80-CR-23; ARO-14755.11-EL) Avail: NTIS HC A03/MF A01 CSCL 20/5

This document is the sixth semiannual report and the final report of a basic study of the modes of injection lasers. The concern is the fundamental relationship between the modal properties of diode lasers, their structure, and the nature of the electrical drive. The semiannual report features three pioneering studies: The development of an equation of state relating the laser power, spectrum, and beam profile to the input current and laser structure; the behavior of the laser on transition of threshold as the current is increased through the immediate vicinity of threshold; and the comparison of the laser spectrum under pulsed drive to excitation with a dc current. It also touches on the behavior of quarternary lasers operating at 1.2 micrometers. The report concludes with a consideration of the outstanding fundamental problem at the present time, the dynamic interaction of the laser which reduces the number of spectral lines in the coherent output of a laser as the current drive is increased. GRA

N80-31788# California Univ., Livermore. Lawrence Livermore Lab.
PROPERTIES OF LOW-INDEX LASER MATERIALS
Marvin J. Weber 9 May 1980 7 p refs Presented at the Topical Conf. on Basic Opt. Properties of Mater., Gaithersburg, Md., 5-7 May 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84399; CONF-800552-1) Avail: NTIS HC A02/MF A01

Measurements of n sub 2 for a large class of oxide and fluoride crystals and glasses were made using 100 ps, 1.06 micrometer laser pulses and time resolved interferometry. Values of n sub 2 for various glasses are summarized. DOE

N80-31789# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
MEASURING FEATURES OF THE FLUENCE AT THE FAR FIELD OF CO2 PULSED LASER: AN ISSUE STUDY WITH SUGGESTIONS ON HOW TO DO IT
Eric G. Johnson, Jr., Robert J. Phelan, Jr., and Don R. Boyle Apr. 1980 56 p refs
(PB80-191141; NBSIR-80-1628) Avail: NTIS HC A04/MF A01 CSCL 20F

Measuring the energy density incident on targets where the energy is from a pulse of high energy at CO2 wavelengths and where the targets are located at the far field is discussed. The analysis considers a ground based target for testing and calibration of the measurement systems and a drone towed behind an airplane from which the energy distribution information is telemetered to the ground station. Each stage of the measurement system from the reception of the incident laser pulse on the drone to the pulse coded transmission of the sampled data to a ground based computer is described. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-31790* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FREE-PISTON REGENERATIVE HOT GAS HYDRAULIC ENGINE Patent
Donald G. Beremand, inventor (to NASA) Issued 5 Aug. 1980 7 p Filed 12 Oct. 1978 Supersedes N79-10426 (17 - 12, p 0057)
(NASA-Case-LEW-12274-1; US-Patent-4,215,548; US-Patent-Appl-SN-950876; US-Patent-Class-60-520; US-Patent-Class-417-383) Avail: US Patent and Trademark Office CSCL 13I

A displacer piston which is driven pneumatically by a high-pressure or low-pressure gas is included in a free-piston regenerative hydraulic engine. Actuation of the displacer piston circulates the working fluid through a heater, a regenerator and a cooler. The present invention includes an inertial mass such as a piston or a hydraulic fluid column to effectively store and supply energy during portions of the cycle. Power is transmitted from the working fluid to a hydraulic fluid across a diaphragm or lightweight piston to achieve a hydraulic power out-put. The displacer piston of the present invention may be driven pneumatically, hydraulically or electromagnetically. In addition, the displacer piston and the inertial mass of the present invention may be positioned on the same side of the diaphragm member or may be separated by the diaphragm member.
Official Gazette of the U.S. Patent and Trademark Office

N80-31791 Princeton Univ., N. J.
AXISYMMETRIC FLOW FIELDS IN MOTORED AND FIRING SPARK-IGNITION ENGINES Ph.D. Thesis
Juan Ignacio Ramos 1980 206 p
Avail: Univ. Microfilms Order No. 8019829

The axisymmetric, turbulent flow field in both motored and firing engines was modeled by using a modified version of the k/e model which introduces the compressibility effects in the Reynolds stresses. The conservation equations were integrated along computational control-volumes and were solved by an inversion of tridiagonal matrices. A global perturbation technique was incorporated in the continuity and energy equations to accelerate the convergence of the flow field. The valve was simulated as an infinitely thin plate, which remains either fixed or for a two-stroke cycle, or moves in a specified manner for a four-stroke cycle. For the motored engine, only a single gas, namely air, was considered. Results show that characteristics of the fluid dynamical held for a firing engine are similar to those of motored engine; however, in the former case, there is a higher rate of heat transfer from the mixture to the cylinder walls. Dissert. Abstr.

N80-31792 California Univ., Irvine.
LYAPUNOV STABILITY OF MULTI-MACHINE POWER SYSTEMS Ph.D. Thesis
Yuan Kuan Chen 1980 193 p
Avail: Univ. Microfilms Order No. 8019686

The stability of multi-machine power systems is investigated by means of the Decomposition-Aggregation method. The power system is decomposed into low order subsystems, each of which consist of an isolated subsystem and an interconnection. The stability of each isolated subsystem is studied using Barbasin's method in terms of its stability region and stability measures. Using these stability measures and constraints on the interconnection of the subsystems, an aggregated model of the overall system is formed. The stability criterion of the overall system can be established by examining the negative definiteness of an aggregated matrix. If this matrix is of the Metzler type and if negative diagonal quasidominance is satisfied, then the matrix is a negative definite matrix, and in turn, the stability of the overall system is guaranteed. Linear programming is utilized to determine the optimum weighting given to each subsystem in the overall Lyapunov function so that the least restrictive stability region for the overall system is obtained. Dissert. Abstr.

N80-31793 Polytechnic Inst. of New York.
AN INVESTIGATION TO MEASURE INTERPARTICLE FRICTION AND TO DETERMINE IMPORTANT MATERIAL AND ENVIRONMENTAL VARIABLES WHICH INFLUENCE THIS FRICTION Ph.D. Thesis
Jones Samuel Adeniyi 1980 171 p
Avail: Univ. Microfilms Order No. 8019382

The effects of humidity, temperature and lubricants on the frictional properties of iron, copper and graphite powders, plaster,

and Portland cement were investigated using a newly designed dynamic friction measuring apparatus. The results show that in both metal powders, friction decreased as the humidity increased. This decrease in friction reached a minimum at some optimum amount of humidity, then as the humidity increased beyond optimum value, friction increased. This optimum value of humidity is not the same for all the powders. There is very little of temperature on the friction of both iron and copper powders. The addition of mineral oil as a lubricant shows that the friction is reduced at low temperature but increased gradually to some maximum as the temperature increased above the room temperature and then dropped to a new value. In the case of plaster and Portland cement, the friction increased, with increasing humidity up to a certain maximum and then dropped again. Dissert. Abstr.

N80-31794*# Battelle Columbus Labs., Ohio.
SSME TURBOPUMP BEARING ANALYTICAL STUDY Final Report
J. W. Kannel and T. Merriman 20 Aug. 1980 33 p refs
(Contract NAS8-33576)
(NASA-CR-161554) Avail: NTIS HC A03/MF A01 CSCL 13I

Three shuttle pump bearings operating under severe overspeed and shut-down conditions are evaluated. The specific parameters investigated include outer race stresses, cage stresses, cage-race drag, bearing heating, and crush loading. A quasi-dynamic version of the BASDAP computer code was utilized which involved the calculation of ball-race forces (inner and outer), contact pressures, contact dimensions, and contact angles as a function of (1) axial load, (2) radial load, and (3) centrifugal load on the bearing. Generally, radial loads on the order of 13,300 N (3000 pounds) per bearing or 26,700 N (6000 pounds) per bearing pair, could be expected to cause severe problems to any of the bearings with a 17,800 N (4000 pounds) axial load. Further, when possible temperature excursions are considered, even a load of 8900 N (2000 pounds) may be excessive. However, high momentary radial loads with a 3800 N (850 pounds) axial load would not be anticipated to cause catastrophic failure of the fuel pump bearing. M.G.

N80-31795*# Eaton Corp., Southfield, Mich. Engineering and Research Center.
SMALL PASSENGER CAR TRANSMISSION TEST; FORD C4 TRANSMISSION Final Report
M. P. Bujold Jun. 1980 383 p
(Contracts DEN3-124; EC-77-A-31-1044)
(NASA-CR-159881; ERC-LIB-8060; DOE/NASA/0124-2) Avail: NTIS HC A17/MF A01 CSCL 13I

A 1979 Ford C4 automatic transmission was tested per a passenger car automatic transmission test code (SAE J651b) which required drive performance, coast performance, and no load test conditions. Under these test conditions, the transmission attained maximum efficiencies in the mid-eighty percent range for both drive performance tests and coast performance tests. The major results of this test (torque, speed, and efficiency curves) are presented. Graphs map the complete performance characteristics for the Ford C4 transmission. A.R.H.

N80-31796*# Eaton Corp., Southfield, Mich. Engineering and Research Center.
SMALL PASSENGER CAR TRANSMISSION TEST; CHEVROLET LUV TRANSMISSION Final Report
M. P. Bujold Jun. 1980 420 p
(Contract DEN3-124; EC-77-A-31-1044)
(NASA-CR-159882; ERC-LIB-80121; DOE/NASA/0124-3) Avail: NTIS HC A19/MF A01 CSCL 13I

A 1978 Chevrolet LUV manual transmission tested per the applicable portions of a passenger car automatic transmission test code (SAE J651b) which required drive performance, coast performance, and no load test conditions. Under these test conditions, the transmission attained maximum efficiencies in the upper ninety percent range for both drive performance tests and coast performance tests. The major results of this test (torque, speed, and efficiency curves) are presented. Graphs map the complete performance characteristics for the Chevrolet LUV transmission. A.R.H.

N80-31797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULATION AND VISUALIZATION OF FACE SEAL MOTION STABILITY BY MEANS OF COMPUTER GENERATED MOVIES
I. Etsion and B. M. Auer 1980 19 p refs Proposed for presentation at the Fluid Sealing Conf., Leeuwenhorst, Holland, 1-3 Apr. 1980; sponsored by the British Hydrodynamic Research Assoc.
(NASA-TM-81581; E-554) Avail: NTIS HC A02/MF A01 CSCL 13I

A computer aided design method for mechanical face seals is described. Based on computer simulation, the actual motion of the flexibly mounted element of the seal can be visualized. This is achieved by solving the equations of motion of this element, calculating the displacements in its various degrees of freedom vs. time, and displaying the transient behavior in the form of a motion picture. Incorporating such a method in the design phase allows one to detect instabilities and to correct undesirable behavior of the seal. A theoretical background is presented. Details of the motion display technique are described, and the usefulness of the method is demonstrated by an example of a noncontacting conical face seal. M.G.

N80-31798*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OBSERVATION OF PRESSURE VARIATION IN THE CAVITATION REGION OF SUBMERGED JOURNAL BEARINGS
I. Etsion and L. P. Ludwig 1980 27 p refs Proposed for presentation at the Lubrication Conf., New Orienas, 11-14 Oct. 1981; sponsored by the ASME
(NASA-TM-81582; E-555) Avail: NTIS HC A03/MF A01 CSCL 13I

Visual observations and pressure measurements in the cavitation zone of a submerged journal bearing are described. Tests were performed at various shaft speeds and ambient pressure levels. Some photographs of the cavitation region are presented showing strong reverse flow at the downstream end of the region. Pressure profiles are presented showing significant pressure variations inside the cavitation zone, contrary to common assumptions of constant cavitation pressure. Author

N80-31799# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.
A METHODOLOGY FOR MODELING CONFINED, TEMPERATURE SENSITIVE CUSHIONING SYSTEMS
Virginia P. Kobler Jun. 1980 162 p refs
(AD-A087351; AD-E950004; DRSMI-RL-80-10) Avail: NTIS HC A08/MF A01 CSCL 13/4

A methodology for modeling the impact response of a confined cushioning system has been demonstrated. Data for modeling were acquired from test drops made with a test specimen comprised of a plywood cube (protected item) within a cleated plywood shipping container, under controlled environmental conditions, utilizing 2 inch Minicel as the cushioning system. Individual curves were developed for each temperature and drop height for both the interior box and total container system. Utilizing a stepwise regression procedure, a general model was developed for the interior box and also for the total container system. The general model permits the cushion designer to predict the impact response of a container system within drop heights of 12 to 30 inches, a temperature range of -65 F to 160 F, and a static stress range of 0.088 to 1.255 psi. GRA

N80-31800# Pennsylvania State Univ., University Park. Applied Research Lab.
THRUSTING CHARACTERISTICS OF PROPULSORS
W. S. Gearhart and E. P. Bruce 30 May 1980 33 p refs
(Contract N00024-79-C-6043)
(AD-A087281; ARL/PSU-TM-80-118) Avail: NTIS HC A03/MF A01 CSCL 13/10

The function of any propulsive system, is to provide a forward thrust along its axis. The design objective is to obtain a maximum in propulsor thrust with a minimum of shaft power while satisfying practical limits of propulsor size, shaft speed, and cavitation resistance. The generation of thrust requires that some kinetic energy be lost in the propulsive slipstream. These losses

are associated with both axial and rotational velocity components in the slipstream. In addition, the presence of rotational velocity in the slipstream results in a low pressure region in the far wake which reduces the net effective thrust generated by the propulsor. It has been the tradition of the propulsor designer to neglect the rotational effects, other than considering the kinetic energy losses, since it is assumed that the rotational component of velocity in the far wake is small. This assumption is valid for propulsors that ingest large mass flows and place a small amount of energy per unit mass in the flow. However, the trend now is toward more heavily loaded propulsors, both of the open or ducted type. Thus, a reevaluation of the relative magnitudes of the losses associated with the velocity components in the propulsive slipstream is necessary. It is the intent of this paper to evaluate, for a given shaft power, the relative losses in propulsor thrust associated with the axial and rotational velocity components in the slipstream. GRA

N80-31801# Columbia Univ., New York. Tribology and Lubrication Research Lab.
EXPERIMENTAL INVESTIGATION OF HYDRODYNAMIC SELF-ACTING GAS BEARINGS AT HIGH KNUDSEN NUMBERS Final Report, 1977 - 1980
Yiao-Tee Hsia and Gerald A. Domoto 1 Jul. 1980 157 p refs
(Contract N00014-75-C-0552; NR Proj. 062-491)
(AD-A087400; FR-28) Avail: NTIS HC A08/MF A01 CSCL 13/9

This investigation gives experimental confirmation of the 'slip flow' theory, developed by Burgdorfer, for modelling hydrodynamic gas bearing with clearances below 0.25 micrometers. An interferometric technique using two CW lasers is used to measure the small clearances with an 0.025 micrometer accuracy. The pitch and roll angles of the slider bearing and the surface contour of the slider are also measured interferometrically. The effects of molecular rarefaction are studied by operating the bearing in different gas media with different mean free paths. Air is used to study Knudsen numbers below 0.5 while helium is used to study Knudsen numbers above 0.5. Experimentally measured trailing edge clearances and pitch angles are compared with theoretical predictions using the 'modified' Reynolds equation with velocity slip boundary conditions. The modified Reynolds equation is solved numerically using two different numerical algorithms. Excellent agreement between experiment and theory is found for clearances as high as 1.60 micrometers to as low as 0.075 micrometers with corresponding ambient Knudsen number of 0.04 and 2.51, respectively. GRA

N80-31802# Shaker Research Corp., Ballston Lake, N. Y.
ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GUIDE. PART 1: FLEXIBLE ROTOR DYNAMICS Interim Report, Apr. 1976 - Nov. 1979
C. H. T. Pan, E. R. Wu, and A. I. Krauter AFAPL Wright-Patterson AFB, Ohio Jun. 1980 370 p refs
(Contract F33615-76-C-2038; AF Proj. 3048)
(AD-A087806; SRC-78-TR-27-Pt-1; AFAPL-TR-78-6-Pt-1) Avail: NTIS HC A16/MF A01 CSCL 01/3

This report describes an update of the Air Force computer programs concerned with the dynamics of high speed rotors. The new program, which replaces AFAPL/SFL Programs No. 100, 101, and 117, has the capability to perform a variety of rotordynamics analyses. These analyses include torsional vibration and bending vibration. The bending analyses consist of those for critical speeds, unbalance response, asynchronous response, and rotor stability. In addition, the program incorporates the following: a formulation based on whirl coordinates with an exact bending solution between rotor modelling stations, the capability to utilize a small subset of these stations in much of the calculations, a set of bearing characteristics that depend on rotor speed and vibration frequency and that include anisotropy and damping, and an economical combination of a separate rotor analysis and the characteristics of the bearings. The report includes: an introduction to use of the program as well as a detailed user's manual, an overview of the mathematical basis of the program and a complete presentation of those mathematics. GRA

N80-31803# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. des Systemes Balistiques et Spatiaux.
BISTABLE SOLENOID VALVE, VOLUME 1 Final Report [ELECTROVANNE BISTABLE A VERROUILLAGE]
B. Gosse 24 Jul. 1979 108 p In FRENCH
(Contract ESTEC-2946/76-NL-AK)
(MU/LR-97.091/79-Vol-1; ESA-CR(P)-1306-Vol-1) Avail: NTIS HC A06/MF A01

The specification, design, test procedures and results for a solenoid valve are presented. The bistable valve is to be used in pneumatic circuits up to 300 bars and in hydrazine circuits in aerospace applications. Total weight is less than 0.25 kg. Pressure drop is less than 0.1 bar for 10 g/s hydrazine flow or 1 g/s nitrogen flow. A position detection device based on hall effect cells is included. The test results show that the design is appropiate for space use. Comments are made on the admissible pressure drop at satellite life end, on the maximum opening pressure when working with liquids, and the replacement of the hall effect position detector by a shock detector device. Author (ESA)

N80-31804# National Centre of Tribology, Risley (England). European Space Tribology Lab.
[ACTIVITIES OF THE EUROPEAN SPACE TRIBOLOGY LABORATORY FOR 1979] Progress Report
E. J. Robbins Feb. 1980 14 p refs Original contains color illustrations
(Contract ESA-2584/75-MD)
(ESA-ESTL-44; ESA-CR(P)-1342) Avail: NTIS HC A02/MF A01

Solar array drive mechanism tests, tilt mechanism tests, development of test techniques, development of solid lubricants for ball bearings, calculations of ball bearing torque and stiffness, slip-ring developments, and studies on relative lubricities of oils in vacuum are discussed. Four out of thirty requests for consulting involved small experimental programs which are summarized. Author (ESA)

N80-31663 Kobe Univ. (Japan).
STABILITY PROBLEMS OF ROTOR SYSTEMS
T. Iwatsubo *In* Shock and Vibration Information Center The Shock and Vibration Inform. Digest, Vol. 12, No. 7 Jul. 1980 p 3-8 refs (For primary document see N80-31662 22-31)
Avail: Naval Research Lab., Attn: code 5804, Washington, D.C. 20375. Annual rate HC $100.00

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques, and quality control.

N80-31805# General Dynamics Corp. Fort Worth, Tex. Structural and Design Dept.
DURABILITY METHODS DEVELOPMENT, VOLUME 1. PHASE 1: SUMMARY Final Technical Report, Apr. 1978 - Jun. 1979
S. D. Manning, W. R. Garver, S. P. Henslee, J. W. Norris, B. J. Pendley, S. M. Speaker, V. D. Smith, B. G. W. Yee, M. Shinozuka (Modern Analysis, Inc., Ridgewood, N. J.), and J. N. Yang (George Washington Univ., Washington, D.C.) Wright-Patterson AFB, Ohio AFFDL Sep. 1979 113 p refs
(Contract F33615-77-C-3123; AF Proj. 2401)
(AD-A087301; FZM-657-Vol-1; AFFDL-TR-79-3118-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 13/5

A summary is presented of an analytical methodology developed to meet USAF durability requirements. Details are given in four companion volumes. Analytical approaches that are currently used or have potential to be used to determine economic life are surveyed. Results of a structural survey of durability problems experienced at USAF ALC's are summarized. Durability critical parts criteria and economic life criteria are discussed. An analytical method to determine the crack population in a structure as a function of service-time is presented. Fastener-hole cracking is the basic form of damage analyzed.

Representations of initial quality and growth of small cracks are discussed. The effect of inspection and repair on the distribution of cracks is included. GRA

N80-31806# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF NONDESTRUCTIVE GAMMA-RAY AND NEUTRON TECHNIQUES FOR THE SAFEGUARDING OF IRRADIATED FUEL MATERIALS
J. R. Phillips, J. K. Halbig, D. M. Lee, S. E. Beach, T. R. Bement, E. Dermendjiev, C. R. Hatcher, K. Kaieda, and E. C. Medina. May 1980. 89 p. refs.
(Contract W-7405-eng-36)
(LA-8212) Avail: NTIS. HC A05/MF A01

Nondestructive gamma ray and neutron techniques were used to characterize the irradiation exposures of irradiated fuel assemblies. Techniques for the rapid measurement of the axial activity profiles of fuel assemblies were developed using ion chambers and Be(gamma, n) detectors. Detailed measurements using high resolution gamma ray spectrometry and passive neutron techniques were correlated with operator declared values of cooling times and burnup. DOE

N80-31807# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
REASSESSMENT OF SERVICE LIFE BY COMPARATIVE SPECIMEN TESTS
J. B. deJonge. 23 Feb. 1979. 20 p. refs. Presented at 10th ICAF Symp., Brussels, 16-18 May, 1979. Sponsored by Netherlands Research Branch of the Directorate of Materials Air.
(NLR-MP-79008-U) Avail: NTIS. HC A02/MF A01

Various aspects of aircraft service life reassessment are discussed in light of the fact that the actual load experience of aircraft may deviate appreciably from design assumptions. Life assessment procedures using comparative fatigue tests on speciments are described for the F-5 aircraft used by the Royal Netherlands Air Force specimens were developed representing critical areas using the same material and heat treatment, same grain direction, surface treatment, and same bolt type. Author (ESA)

N80-31808# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE ULTRASONIC TESTING AND INSPECTION. CITATIONS FROM THE NTIS DATA BASE. Progress Report, May 1977 - May 1979
Guy E. Habercom, Jr. Jun. 1980. 288 p.
(PB80-811821) Avail: NTIS. HC $30.00/MF $30.00. CSCL 14B

A bibliography containing 220 abstracts is presented. Ultrasonic equipment and techniques for nondestructive inspection/testing of materials and fabrication processes are investigated. GRA

N80-31809# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE ULTRASONIC TESTING AND INSPECTION. CITATIONS FROM THE NTIS DATA BASE. Progress Report, Jun. 1979 - May 1980
Guy E. Habercom, Jr. Jun. 1980. 102 p. Supersedes NTIS/PS-79/0635; NTIS/PS-78/0566.
(PB80-811839; NTIS/PS-79/0635; NTIS/PS-78/0566) Avail: NTIS. HC $30.00/MF $30.00. CSCL 14B

A bibliography containing 94 abstracts is presented. Ultrasonic equipment and techniques for nondestructive inspection/testing of materials and fabrication processes are investigated. GRA

N80-31810# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE ULTRASONIC TESTING AND INSPECTION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE. Progress Report, Apr. 1978 - May 1979
Guy E. Habercom, Jr. Jun. 1980. 267 p. Supersedes NTIS/PS-78/0568; NTIS/PS-77/0404.
(PB80-811847; NTIS/PS-78/0568; NTIS/PS-77/0404) Avail: NTIS. HC $30.00/MF $30.00. CSCL 14B

A bibliography containing 259 abstracts is presented addressing ultrasonic equipment and techniques for nondestruction inspection/testing of materials and fabrication processes. GRA

N80-31811# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE ULTRASONIC TESTING AND INSPECTION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE. Progress Report, Jun. 1979 - May 1980
Guy E. Habercom, Jr. Jun. 1980. 221 p. Supersedes NTIS/PS-79/0637; NTIS/PS-78/0568.
(PB80-811854; NTIS/PS-79/0637; NTIS/PS-78/0568) Avail: NTIS. HC $30.00/MF $30.00. CSCL 14B

Ultrasonic equipment and techniques for nondestruction inspection/testing of materials and fabrication processes are investigated in these reports obtained from worldwide literature. This updated bibliography contains 213 abstracts, all of which are new entries to the previous edition. GRA

N80-31812# Transportation Systems Center, Cambridge, Mass.
DETERMINATION OF TIRE QUALITY FROM NONDESTRUCTIVE INSPECTION. Final Report, Sep. 1975 - Mar. 1979
S. N. Bobo. Nov. 1979. 65 p.
(PB80-185358; DOT-TSC-NHTSA-79-30; DOT-HS-804-828) Avail: NTIS. HC A04/MF A01. CSCL 13F

Capability of an ultrasonic nondestructive inspection system to identify the groups with a high propensity to failure is described. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis, fatigue, and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-31813 Michigan Univ., Ann Arbor.
A NEW METHOD FOR THE SOLUTION OF ANISOTROPIC THIN PLATE BENDING PROBLEMS. Ph.D. Thesis
Benjamin Chin-wen Wu. 1980. 137 p.
Avail: Univ. Microfilms. Order No. 8020753

The indirect boundary integral method which uses the Green's function of a clamped circular plate of isotropic material was modified to solve an isotropic thin plate problem. Three major modifications introduced are (1) the set of fictitious moments are replaced by an additional set of fictitious forces, and the entire set of fictitious forces is located outside of the embedded contour; (2) the numerical integration is replaced by a simple summing process; and (3) the Green's function for a clamped circular plate is replaced by the Green's function of an infinite plate. With these modifications, significant improvements in solution accuracy and computing efficiency have been achieved. The second order singularity difficulties associated with free edges are avoided, and due to the simplicity of the new method, the computing costs are reduced by about sixty percent. Since the Green's functions for orthotropic and anisotropic infinite plates are also available, the new method is readily extended to orthotropic and anisotropic thin plate bending problems. Dissert. Abstr.

N80-31814 Idaho Univ., Moscow.
ELASTIC-PLASTIC FRACTURE ANALYSIS OF TYPE 304 STAINLESS STEEL FLAT-PLATE AND PIPE SECTIONS CONTAINING SURFACE FLAWS. Ph.D. Thesis
Walter Graham Reuter. 1980. 376 p.
Avail: Univ. Microfilms. Order No. 8019794

Thirty-six (36) flat-plate specimens, each containing a surface flaw of either rectangular, triangular, or ellipsoidal configuration, were tested to instability. Data collected consisted of load, cross head displacement, crack-opening displacement, strain gage, acoustic emission, reflective photoelasticity, stop-action photography, and motion pictures. Analytical techniques were developed to predict conditions for initiation of subcritical crack growth, for the defect to penetrate the 6.4 mm(0.25 in.) wall thickness, and for instability. The capabilities of the analytical techniques are compared with test results obtained from nine (9) pipe

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specimens. The pipe specimens contained triangular-shaped surface flaws that were oriented with the defect length in the axial direction. The pipe specimens were hydrostatically loaded until the defect penetrated the wall thickness. Based on test results of this program it is possible to accurately predict from flat-plate specimen tests the conditions required for a defect to penetrate the wall thickness of a pipe. Dissert. Abstr.

N80-31815 Notre Dame Univ., Ind.
DYNAMIC BUCKLING OF INELASTIC SPHERICAL SHELLS Ph.D. Thesis
Glen Eugene Funk 1980 359 p
Avail: Univ. Microfilms Order No. 8020960

The dynamic inelastic buckling of the complete spherical shell having mechanical properties characterized by a strain rate potential is investigated. Both bilinear elastic-plastic and Ramberg-Osgood uniaxial stress-strain relationships are considered. A minimum principle is employed to develop the equations of perturbed motion in functional form. In addition to the quadratic terms, cubic and quartic terms are retained in the functional to observe the magnitude of motion at which these terms become significant. An unloading criterion is developed and a generalized deflection measure is introduced. A first order difference formulation is employed to solve the system of equations. Numerical results obtained for initial velocity or impulse loading indicate that motions can become unstable prior to the critical time indicated by the quasibifurcation criterion. The results are attributed to the variation of the perturbed motion stress-strain relations with time arising from the equal biaxial stress state associated with the unperturbed motion. Dissert. Abstr.

N80-31816 Polytechnic Inst. of New York.
CRITICAL EXCITATIONS FOR LINEAR AND NONLINEAR STRUCTURAL SYSTEMS Ph.D. Thesis
Aristodimos J. Philippacopoulos 1980 74 p
Avail: Univ. Microfilms Order No. 8019409

Seismic assessment of structures is discussed. The basis for this assessment lies in the concept of the critical excitation which is generated by combining a properly selected set of recorded ground motions together with a maximization procedure. It is a site as well as system dependent excitation. Both 'linear' and 'nonlinear' were considered. For the nonlinear case a linearization technique based on the concept of equivalent linearization was employed. 'Critical response spectra' were constructed by generating critical excitations for a range of spectral frequencies. Finally a 'simulated critical excitation' was generated in order to extend the concept of critical excitation. This means that a single input may be employed for all the design variables of a particular structure. From the applications it is concluded that the seismic assessment of structures based on critical excitations leads to results which are conservative to a certain degree. However this conservatism is fully justifiable for 'socially or economically important structures', which generally require high confidence level of reliability for their seismic assessment. Dissert. Abstr.

N80-31817 Michigan State Univ., East Lansing.
ELASTIC BUCKLING OF ARCHES BY FINITE ELEMENT METHOD Ph.D. Thesis
Jose Gregorio Lange 1980 186 p
Avail: Univ. Microfilms Order No. 8020717

The elastic buckling load of arches were computed by representing an arch by beam finite elements curved in one plane but deformable in three dimensional space. The equilibrium equation was obtained from the first variation of the potential energy. To avoid dealing with nonlinear equations, an estimate of the buckling load was obtained by assuming that the displacement increased linearly with the applied load until buckling occurs. A computer program was prepared for the implementation of the linear equilibrium solution and the buckling load solutions. Numerical results were obtained involving arc ribs with in-plane and out-of-plane behavior. The types of buckling problems considered are: in-plane, out-of-plane, tilted loads, and the effect of out-of-plane horizontal loads on the inplane buckling load. Results indicate that while a small out-of-plane horizontal load may have little effect on the inplane buckling load, the latter decreases rapidly with increases in the horizontal load. Dissert. Abstr.

N80-31818# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
FURTHER EXPERIMENTAL STUDIES ON VIBRATIONS AND BUCKLING OF ECCENTRICALLY LOADED STIFFENED CYLINDRICAL SHELLS
J. Singer and Y. Segal Dec. 1978 46 p refs
(TAE-331) Avail: NTIS HC A03/MF A01

A method for detection of load eccentricity of stringer-cylindrical shells from vibration tests developed earlier was applied to shells with prescribed load eccentricity. Seven shells with outward or zero load eccentricity were tested and analyzed. In the tests, the shells were vibrated at different load levels and finally buckled. The experimental and theoretical results verify the methods of load eccentricity identification and buckling load prediction and extend their applicability. Author

N80-31819# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE UTILITY OF PLANE STRAIN APPROXIMATIONS FOR OBLIQUE IMPACT COMPUTATIONS
J. A. Zukas, G. H. Jonas, and J. J. Misey Oct. 1979 39 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A081120; ARBRL-MR-02969) Avail: NTIS HC A03/MF A01 CSCL 20/11

The feasibility of using the plane strain mode of a 2D code in lieu of a 3D code for this oblique kinetic energy penetration problem was determined. First, a comparison in a normal impact problems was made between the axisymmetric and the plane strain modes of the two dimensional HELP code. A volumetric relationship was given for the kinetic energy and the axial momentum of the projectile, but data scaling for other variables of the projectile and those of the target were not determined. Next, HELP in the plane strain mode was utilized to solve a long rod impact at 60 deg. obliquity and the results were compared with experimental data. The oblique impact problem was also modeled with a three dimensional version of the EPIC code. A comparison of rod loss penetration depth, and penetrator and target profiles revealed very good agreement, at early times when the penetrator density was greater than that of the target. A.R.H.

N80-31820*# Lockheed-Georgia Co., Marietta.
DESIGN AND ANALYSIS OF A STIFFENED COMPOSITE FUSELAGE PANEL
J. N. Dickson and S. B. Biggers Aug. 1980 51 p refs
(Contract NAS1-15949)
(NASA-CR-159302; LG80ER0137) Avail: NTIS HC A04/MF A01 CSCL 20L

The design and analysis of stiffened composite panel that is representative of the fuselage structure of existing wide bodied aircraft is discussed. The panel is a minimum weight design, based on the current level of technology and realistic loads and criteria. Several different stiffener configurations were investigated in the optimization process. The final configuration is an all graphite/epoxy J-stiffened design in which the skin between adjacent stiffeners is permitted to buckle under design loads. Fail safe concepts typically employed in metallic fuselage structure have been incorporated in the design. A conservative approach has been used with regard to structural details such as skin/frame and stringer/frame attachments and other areas where sufficient design data was not available. M.G.

N80-31821# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
LOCAL APPROACH TO PROBLEMS OF FATIGUE CRACK GROWTH
H. Fuhring 1979 11 p refs Transl. into ENGLISH from Sitzung des Arbeitskreises Betriebsfestigkeit (Stuttgart), 1979 p 509-518
(ICAF-1143) Avail: NTIS HC A02/MF A01

Fatigue fracture mechanics attempts to express crack growth as a function of local quantity, either the cyclic strain variation or the range of the stress intensity factor above the crack opening level, so that the damage is reduced to a few pure fatigue mechanisms. This approach to crack growth problems permits the introduction of data resulting from any confirmed knowledge of material behavior (environmental effects, hardening, softening,

three dimensional plasticity effects, etc.). Fundamental studies interpreting the role of crack closure on crack growth are reviewed. These consider constant amplitude crack tip stress and strain states as well as crack surface displacements under variable amplitude loading. A computer program was developed for calculating the load sequences and for deriving the N curve. Predictions using only basic structural and material data vary by a factor of plus or minus 2 compared with experiments. A.R.H.

N80-31822# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
EFFICIENT COMPUTATIONAL TECHNIQUES FOR THE ANALYSIS OF SOME PROBLEMS OF FRACTURE IN PRESSURE VESSELS AND PIPING. Interim Report
T. Nishioka and Satya N. Atluri. Jun. 1980. 30 p. refs.
(Contract N00014-78-C-0636; NR Proj. 064-610)
(AD-A087225; GIT-CACM-SNA-20; TR-4) Avail: NTIS HC A03/MF A01 CSCL 20/11

Results of (1) a numerical investigation, based on an energy consistent moving-singularity dynamic finite element procedure, of fast crack propagation in a finite plate; (2) numerical simulation of experimental data on fast crack propagation and arrest in a double-cantilever-beam specimen; and (3) stress-intensity factor solutions in a thermally shocked cylindrical vessel containing an inner surface (meridional) elliptical flaw, are presented. Comparison of these results with other available solutions, and pertinent discussions, are included. GRA

N80-31823# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
DYNAMIC FRACTURE ANALYSIS: A TRANSLATING-SINGULARITY FINITE ELEMENT PROCEDURE. Interim Report
Satya N. Atluri and T. Nishioka. Jun. 1980. 10 p. refs. Submitted for publication.
(Contract N00014-78-C-0636; NR Proj. 064-610)
(AD-A087226; GIT-CACM-SNA-2; TR-6) Avail: NTIS HC A02/MF A01 CSCL 20/11

In this paper an efficient finite element method, which accounts for the translating singularities near the tip of a dynamically propagating crack, is presented. Two aspects of analyses of dynamic fracture, namely, (1) determination of dynamic stress intensity factors from given crack velocity history; and (2) determination of crack velocity history (and arrest) from given dynamic fracture toughness versus crack velocity data are considered. Results are presented and discussed for wedge loaded rectangular, as well as tapered, double cantilever beam specimens. GRA

N80-31824# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
NEW GENERAL AND COMPLEMENTARY ENERGY THEOREMS, FINITE STRAIN, RATE-SENSITIVE INELASTICITY, AND FINITE ELEMENTS: SOME COMPUTATIONAL STUDIES. Interim Report
Satya N. Atluri and H. Murakawa. 1980. 20 p. Submitted for publication.
(Contract N00014-78-C-0636; NR Proj. 064-610)
(AD-A087227; GIT-CACM-SNA-23; TR-7) Avail: NTIS HC A02/MF A01 CSCL 20/11

General variational theorems for the rate problems of rate-dependent finite strain inelasticity, in terms of the appropriate rates of the first and second Piola-Kirchhoff stress tensors, the symmetrized Biot-Lure stress tensor, and their conjugate measures of strain-rate are discussed. Certain new rate-complementary-energy principles, involving the rate of spin and the rate of the symmetrized Biot-Lure stress tensor as variables, are stated for finite strain analysis of rate-sensitive materials, such as those exhibiting elasto-visco-plastic and creep behavior. Uniqueness and stability criteria for those inelastic solids, using the finite element counterparts of the new complementary energy rate principles, are discussed. Computational studies, using the complementary energy methods, discussed herein include: (1) bifurcation necking and post-buckling analyses of initially perfect elasto-plastic bars and (2) post-buckling and large-deformation analyses of thin elastic plates under inplane compression and transverse bending loads. GRA

N80-31825# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
NUMERICAL MODELING OF DYNAMIC CRACK PROPAGATION IN FINITE BODIES, BY MOVING SINGULAR ELEMENTS. PART 2: RESULTS. Interim Report
T. Nishioka and Satya N. Atluri. Jun. 1980. 29 p. refs.
(Contract N00014-78-C-0636; NR Proj. 064-610)
(AD-A087228; GIT-CACM-SNA-25; TR-9) Avail: NTIS HC A03/MF 01 CSCL 20/11

Using the moving-singularity finite element method described in Part 1 of this paper, several problems of dynamic crack propagation in finite bodies have been analysed. Discussions of the effects of wave interactions on the dynamic stress-intensity factors are presented. The obtained numerical results are compared with the corresponding infinite domain solutions and other available numerical solutions for finite domains. GRA

N80-31826# General Dynamics Corp. Fort Worth, Tex.
FATIGUE BEHAVIOR OF ADHESIVELY BONDED JOINTS, VOLUME 1. Final Technical Report, Jul. 1976 - Apr. 1980
John Romanko and W. G. Knauss. Wright-Patterson AFB, Ohio AFML. Apr. 1980. 193 p. refs. 2 Vol.
(Contract F33615-76-C-5220; AF Proj. 7340)
(AD-A087280; AFWAL-TR-80-4037-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 11/1

The fatigue behavior of adhesively bonded aluminum joints was investigated analytically and experimentally. Stress distributions in the adhesive interlayer were calculated to guide planning of the joint tests and the interpretation of the test results. Finite element stress analyses were conducted using a linear elastic, and a three element linear viscoelastic model for the adhesive behavior. Thick adherend lap shear specimens of the model joint configuration were fabricated and tested. These specimens were instrumented and subjected to sinusoidal fatigue tests at several frequencies, humidities and temperatures. Certain tests were interrupted at various stages and the specimens examined for fatigue damage. Damage was found to initiate in the calculated high stress regions, and to propagate with further load cycling. Observations and recommendations resulting from the investigation are included in this final report. GRA

N80-31827# General Dynamics Corp. Fort Worth, Tex.
FATIGUE BEHAVIOR OF ADHESIVELY BONDED JOINTS. VOLUME 2: APPENDICES. Final Technical Report, Jul. 1976 - Apr. 1980
John Romanico and W. G. Knauss. Wright-Patterson AFB, Ohio AFML. Apr. 1980. 78 p. refs. 2 Vol.
(Contract F33615-76-C-5220; AF Proj. 7340)
(AD-A087360; AFWAL-TR-80-4037-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 11/1

The fatigue behavior of adhesively bonded aluminum joints was investigated analytically and experimentally. Stress distributions in the adhesive interlayer were calculated to guide planning of the joint tests and the interpretation of the test results. Finite element stress analyses were conducted using a linear elastic, and a three element linear viscoelastic model for the adhesive behavior. Thick adherend lap-shear specimens of the model joint configuration were fabricated and tested. These specimens were instrumented and subjected to sinusoidal fatigue tests at several frequencies, humidities and temperatures. Certain tests were interrupted at various stages and the specimens examined for fatigue damage. Damage was found to initiate in the (calculated) high stress regions, and to propagate with further load cycling. Observations and recommendations resulting from the investigation are included in this final report. GRA

N80-31828# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
ON CRACK PROPAGATION ALONG CRYSTALLOGRAPHIC SLIP BANDS
K. S. Chan and D. A. Koss. Jun. 1980. 8 p. refs. Presented at the Acta/Scripta Metallurgica Conf. on Dislocation Modeling, Gainesville, Fla., 22-27 Jun. 1980.
(Contract N00014-76-C-0037)
(AD-A087128; TR-13) Avail: NTIS HC A02/MF A01 CSCL 20/11

The influence of the crystallography of slip (fcc, hcp, and bcc) on crack propagation along planar slip bands is examined

for two different inclined-crack configurations. If a crack propagates along a slip band and the Burger:s vector of slip within that band is contained in the plane of the crack, (i.e., coplanar slip), then non-coplanar slip is hindered and large normal stresses develop near the crack-tip even for inclined cracks. The magnitude of these normal stresses is largest for basal plane cracking in a hcp material. However, the calculations show that the magnitude of the plastic constraint factor even for an inclined crack in fcc and bcc alloys fracturing along crystallographic slip bands is also large and comparable to a mode I crack in a polycrystalline material. The combination of the intense shear caused by the planar slip and the large normal stresses should result in easy crack propagation across individual grains and could result in a susceptibility to hydrogen embrittlement. GRA

N80-31829# Naval Ship Research and Development Center, Bethesda, Md.
DETERMINATION OF FATIGUE DAMAGE Research and Development Report
R. N. Pangborn (Pennsylvania State Univ.), T. Tsakalakos (Rutgers Univ.), W. F. Mayo (Rutgers Univ.), S. Weissman (Rutgers Univ.), and I. R. Kramer Aug. 1980 37 p refs
(AD-A087442; DTNSRDC-80/093) Avail: NTIS
HC A03/MF A01 CSCL 11/6

The deformation response of polycrystalline AA2024-T4 to cyclic loading has been determined by conventional and double crystal diffractometry. These studies show a preferential work hardening near the surface compared to the bulk. The defect distribution as a function of depth was also investigated as a function of the fraction of fatigue life. From these studies, it was determined that the remaining fatigue life could be predicted by determining the average ratio beta/beta* where beta is the linewidth at any number of fatigue cycles and beta* is the critical linewidth at fracture. Current studies have shown these predictions to be valid for tests where the stress amplitude is held constant for the entire test. A few tests have also been performed where the loading sequence is more complicated. In these tests, the X-ray predictive method was found to be far more accurate than conventional methods. GRA

N80-31830# Systems Research Labs., Inc., Dayton, Ohio.
TWO DIMENSIONAL LINEAR ELASTIC ANALYSIS OF FRACTURE SPECIMENS: USER'S MANUAL OF A FINITE ELEMENT COMPUTER PROGRAM Final Report
Jalees Ahmad Wright-Patterson AFB, Ohio AFML Feb. 1980 117 p refs
(Contract F33615-79-C-5025)
(AD-A087440; AFWAL-TR-80-4008) Avail: NTIS
HC A06/MF A01 CSCL 09/2

A Finite Element code for plane stress and plane strain linear elastic analysis of fatigue crack growth test specimen configurations was developed. A user's manual for the above code, along with user's manuals for a mesh plotting program, and mesh generating programs for compact, three point bend, and ring specimen geometries, is provided. Numerical examples for several specimen geometries are also included. GRA

N80-31831# Lockheed Missiles and Space Co., Palo Alto, Calif. Applied Mechanics Lab.
STINT/CD: A STAND-ALONE EXPLICIT TIME INTEGRATION PACKAGE FOR STRUCTURAL DYNAMICS ANALYSIS
Phillip G. Underwood and K. C. Park Jun. 1980 46 p refs
(Contract N00014-74-C-0355)
(AD-A087423; LMSC-D770637) Avail: NTIS
HC A03/MF A01 CSCL 13/13

This paper is a user's guide for the stand-alone explicit direct time integration package STINT/CD for structural dynamics analysis. STINT/CD uses an automatic variable time increment central difference method. The purpose, function, limitations, and usage of the package are described. A FORTRAN listing of STINT/CD is given along with a sample problem which illustrates its usage and performance. GRA

N80-31832# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
VIBRATION OF THICK RECTANGULAR PLATES OF BIMODULUS COMPOSITE MATERIAL
C. W. Bert, J. N. Reddy, W. C. Chao, and V. S. Reddy May 1980 30 p refs
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A087424; OU-AMNE-80-8) Avail: NTIS
HC A03/MF A01 CSCL 11/4

A finite-element analysis is carried out for small-amplitude free vibration of laminated, anisotropic, rectangular plates having arbitrary boundary conditions, finite thickness-shear moduli, rotatory inertia, and bimodulus action (different elastic properties depending upon whether the fiber-direction strain is tensile or compressive). The element has five degrees of freedom, three displacements and two slope functions, per node. An exact closed-form solution is also presented for the special case of freely supported single layer orthotropic and two layer, cross-ply plates. This provides benchmarks to evaluate the validity of the finite-element analysis. Both solutions are compared with numerical results existing in the literature for special cases (all for ordinary, not bimodulus, materials) and good agreement is obtained. GRA

N80-31833# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
THERMAL BENDING OF THICK RECTANGULAR PLATES OF BIMODULUS COMPOSITE MATERIAL
J. N. Reddy, C. W. Bert, Y. S. Hsu, and V. S. Reddy Jun. 1980 32 p refs
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A087425; OU-AMNE-80-9) Avail: NTIS
HC A03/MF A01 CSCL 11/4

Closed-form and finite-element solutions are presented for thermal bending and stretching of laminated composite plates. The material of each layer is assumed to be elastically and thermoelastically orthotropic and bimodular, i.e., having different properties depending upon whether the fiber-direction normal strain is tensile or compressive. The formulations are based on the thermoelastic version of the Whitney-Pagano laminated plate theory, which includes thickness shear deformations. Numerical results are obtained for deflections and neutral-surface positions associated with normal strains in both of the in-plane coordinates. The closed-form and finite-element results are found to be in good agreement. GRA

N80-31834# Akron Univ., Ohio. Inst. of Polymer Science.
DETACHMENT OF AN ELASTIC MATRIX FROM A RIGID SPHERICAL INCLUSION
A. N. Gent 1 Jul. 1980 23 p refs
(Contract N00014-76-C-0408; NR Proj. 092-555)
(AD-A087414; TR-8) Avail: NTIS HC A02/MF A01 CSCL 11/1

An approximate theoretical treatment is given for detachment of an elastomer from a rigid spherical inclusion by a tensile stress applied to the elastomeric matrix. The inclusion is assumed to have an initially debonded patch on its surface and the conditions for growth of the patch are derived from fracture energy considerations. Catastrophic debonding is predicted to occur at a critical applied stress when the initial debond is small. The strain energy dissipated as result of this detachment, and hence the mechanical hysteresis, are also evaluated. When a reasonable value is adopted for Young's modulus (E) of the elastomeric matrix, it is found that detachment from small inclusions, of less than abut 0.1 mm in diameter, will not occur, even when the level of adhesion is relatively low. Instead, rupture of the matrix near the inclusion becomes the preferred mode of failure at an applied stress given approximately by E/2. For still smaller inclusions, of less than about 1 micrometer in diameter, rupture of the matrix becomes increasingly difficult, due to the increasing importance of a surface energy term. These considerations account for the general features of reinforcement of elastomers. GRA

N80-31835# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
NUMERICAL MODELING OF DYNAMIC PROPAGATION IN FINITE BODIES, BY MOVING SINGULAR ELEMENTS. PART 1: FORMULATION Interim Report
T. Nishioka and S. N. Atluri Jun. 1980 28 p refs
(Contract N00014-78-C-0636; NR Proj. 064-610)
(AD-A087395; GIT-CACM-SNA-24-Pt-1; TR-8) Avail: NTIS

HC A03/MF A01 CSCL 20/11

An efficient numerical (finite element) method is presented for the dynamic analysis of rapidly propagating cracks in finite bodies, of arbitrary shape, wherein linear-elastic material behavior and two dimensional conditions prevail. Procedures to embed analytical asymptotic solutions for singularities in stresses/strains near the propagating crack-tip, to account for the spatial movement of these singularities along with the crack-tip, and to directly compute the dynamic stress-intensity factor, are presented. GRA

N80-31836# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

THERMOELASTICITY OF CIRCULAR CYLINDRICAL SHELLS LAMINATED OF BIMODULUS COMPOSITE MATERIALS

Y. S. Hsu, J. N. Reddy, and C. W. Bert. Jul. 1980. 38 p. refs.
(Contract N00014-78-C-0647)
(AD-A087429; OU-AMNE-80-14) Avail: NTIS
HC A03/MF A01 CSCL 11/4

Closed-form and finite-element solutions are presented for the thermoelastic behavior of laminated composite shells. The material of each layer is assumed to be thermoelastically orthotropic and bimodular, i.e., having different properties depending upon whether the fiber-direction normal strain is tensile or compressive. The formulations are based on the thermoelastic generalization of Dong and Tso's laminated shell theory, which includes thickness shear deformations. The finite element used here has five degrees of freedom per node (three displacements and two bending slopes). Numerical results are presented for deflections and the positions of the neutral surfaces associated with bending along both coordinate directions. The closed-form and finite-element results are found to be in good agreement. GRA

N80-31837# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Metals Behavior Branch.

AN EXPERIMENTAL WEIGHT FUNCTION METHOD FOR STRESS INTENSITY FACTOR CALIBRATION. M.S. Thesis. Interim Report, Jan. - Oct. 1979

Dan Bar-Tikva. Apr. 1980. 93 p. refs.
(AF Proj. 2307)
(AD-A087846; AFWAL-TR-80-4001) Avail: NTIS
HC A05/MF A01 CSCL 20/11

The weight function procedure allows one to convert stress intensity factors K and crack displacement information obtained for one crack configuration and loading into the stress intensity factor solution for the same geometry and another loading. The feasibility of using the weight function idea for a two dimensional case with experimental results is demonstrated in this work. Mode 1 stress intensity factor K1 measurements obtained by a laser interferometric technique and crack mouth opening displacement measurements were taken for an edge cracked strip subjected to four point bending. These results were used to construct (numerically) a weight function with the aid of a computer program written for this purpose. Results of K1 for the same geometry with two different loading configurations, uniform tension and three point bending (with two different length to width ratios) were computed. These results agree favorably with the known solution and demonstrate that a set of experiments for a single loading can accurately predict the stress intensity factor for any other loading configuration of the same geometry. The advantage of the weight function method would be particularly important if these loading configurations are difficult or impossible to reproduce in the laboratory. GRA

N80-31838# Hanford Engineering Development Lab., Richland, Wash.

THERMOELASTIC BUCKLING OF PLATES IN A CYLINDRICAL GEOMETRY AGAINST AN ELASTIC BACK SUPPORT

L. D. Simmons (Portland Univ.) and R. W. Wierman. 1980. 17 p. refs. Presented at the Intern. Conf. on Thermal Stresses in Mater. and Struct. in Severe Thermal Environments, Blacksburg, Va., 19 Mar. 1980.
(Contract EY-76-C-14-2170)
(HEDL-SA-2066-FP; CONF-800360-1) Avail: NTIS
HC A02/MF A01

A plate which is fixed at its edges to a strong edge support structure will develop large compressive stresses when heated from ambient temperature more rapidly than the support structure. Determining the response of the plate to this situation requires stability analysis to ascertain whether the plate might buckle, or whether the constrained thermal expansion will lead to compressive stresses exceeding the yield point because it did not buckle. A special case, in which the plate is curved slightly into a cylindrical shape and the convex face of the plate is against a supporting surface, is considered. DOE

N80-31839# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

CRACK PROPAGATION IN HASTELLOY X

T. Weerasooriya and J. P. Strizak. May 1980. 39 p. refs.
(Contract W-7405-eng-26)
(ORNL/TM-7255) Avail: NTIS HC A03/MF A01

The fatigue and creep crack growth rates of Hastelloy X were examined both in air and impure helium. Creep crack growth rate is higher in air and impure helium at 650 C. Initial creep crack growth from the original sharp fatigue crack is by an intergranular mode of fracture. As the cracking accelerates at higher stress intensities, growth is by a mixed mode of both intergranular and transgranular fracture. Fatigue crack growth rate increases with increasing temperature and decreasing frequency for the image of stress intensities reported in the literature and is lower in impure helium than in air. DOE

N80-31840# California Univ., Livermore. Lawrence Livermore Lab.

PLASTICITY UNDER COMBINED STRESS LOADING

Mark L. Wilkins and John E. Reaugh (Science Applications, Inc., San Leandro, Calif.). 8 Feb. 1980. 8 p. refs. Presented at the ASME Pressure Vessels and Piping Technol. Conf., San Francisco, 12-15 Aug. 1980. Submitted for publication.
(Contract W-7405-eng-48)
(UCRL-83322; CONF-800804-1) Avail: NTIS
HC A02/MF A01

The stress-strain fields occurring in pressure vessels and pipes are, in general, combinations of tension and shear. Material specimens tested separately in simple tension and simple shear provide experimental data on the flow stress and failure conditions for these two limiting cases. Computer simulations of tension and torsion tests corresponding to experiments on aluminum 6061-T651 are presented. Aluminum is used as a first step for developing a method to study the plasticity and ductile fracture of reactor grade steel under combined stresses. It is noted that the flow stress differs for plastic flow in tension compared to torsion. A general flow-stress model is derived from the experiments. DOE

N80-31841# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

REMOTE MEASUREMENT OF CRACK GROWTH IN DOUBLE CANTILEVER BEAM (DCB) SPECIMENS

H. P. vanLeeuwen, L. Schra, and A. M. Otter. 1979. 62 p. refs.
(NLR-TR-79006-U) Avail: NTIS HC A04/MF A01

A method is suggested to determine crack length and load or load line crack opening displacement by measuring beam separation and free end rotation on extensions to the free ends of a double cantilever beam specimen. Application of the method to specimens with real stress crack corrosion cracks gave large discrepancies between crack lengths derived from calibration data for slits and crack lengths measured by direct observation of the specimen surface. Also, on the basis of a few calibration runs made on a specimen with a real crack, it is concluded that the calibration curves for specimens with slits may differ appreciably from those for specimens with real cracks. A discrepancy was noted between the relations of free end rotation to cract length observed between a specimen which was left to cract freely and a specimen which was recalibrated repeatedly during the test. Author (ESA)

N80-31842# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

MATHEMATICAL FORMULATION OF DAMPING FOR STRUCTURAL RESPONSE ANALYSIS

H. H. Ottens. 27 Feb. 1979. 12 p. refs. Presented at AGARD Specialist Meeting on Damping Effects in Aerospace Struct., Williamsburg, Va., 1-6 Apr. 1979.

(NLR-MP-79010-U) Avail: NTIS HC A02/MF A01

A survey is presented of damping models that are commonly used in structural response analysis of aerospace structures. The models are evaluated with respect to the required knowledge of structural damping, the mathematical complexity, and the accuracy of the calculated response. The survey is limited to linear damping models and special attention was given to models which represent lightly damped structures. Author (ESA)

N80-31843# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

ANALYSIS OF AXIALLY LOADED STRINGER STIFFENED CIRCULAR CYLINDERS

Aake Samuelson and Peter Vestergren 1979 64 p refs

(Contract FMV-F-FL-82223-78-002-21-001)

(FFA-TN-HU-2134) Avail: NTIS HC A04/MF A01

The available methods of analysis for the different possible modes of buckling of circular cylinders are summarized. It is concluded that densely stiffened cylinders behave in a way similar to that of an unstiffened shell and the methods of analysis available yield resonably good agreement with test results. In sparsely stiffened cylinders the lower buckling load is governed by the behavior of the shell plate between the stiffeners. Recommendations for design calculations of different types of stiffened cylinders are given. Author (ESA)

N80-31844# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

BUCKLING OF CYLINDERS WITH LONGITUDINAL STIFFENERS SUBJECTED TO AXIAL COMPRESSION Final Report. M.S. Thesis - Royal Inst. of Technology, Stockholm

Hans Groth 1979 90 p refs

(Contract FMV-F-FL-82223-78-174-21-001)

(FFA-TN-HU-2184) Avail: NTIS HC A05/MF A01

The cylinders were designed to buckle in the local buckling region in accordance with the theory for curved panels. This theory was supposed to give the best agreement with test results, but theories for plane plates were also compared to the test results. Eight, twelve, and twenty stringers were used and the end fixtures simulated nearly clamped elastic boundary conditions. The stringers could be considered as heavy. The specimens were not geometrically perfect. The purpose of the tests was to examine the buckling behavior of sparsely stringer stiffened cylinders manufactured with regular workshop tolerances. It was found that most of the available theories are suitable only for the unstiffened cylinder or the general instability cylinders. The only theory that is found for sparsely stiffened cylinders seems to be column theory, which gives an overly conservative design since the influence from the shell is not taken into account. Author (ESA)

N80-31845# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

EVALUATION AND COMPARISON OF NONDESTRUCTIVE SERVICE INSPECTION METHODS

E. A. B. deGraaf and P. DeRijk 17 Apr. 1979 10 p refs Presented at 9th World Conf. on Nondestructive Testing, Melbourne, Nov. 1979

(NLR-MP-79005-U) Avail: NTIS HC A02/MF A01

Fatigue cracks in 102 aluminum alloy specimens were inspected with eddy currents, ultrasonics, X-rays, and penetrants. The specimens were then corroded and the inspections repeated. Inspection results were verified by fractographic examination of the opened up fatigue cracks. It was found that: (1) excepting the use of penetrant before corrosion, long cracks were missed upon the application of five nondestructive testing (NDT) techniques both before and after corrosion under laboratory conditions; (2) inspection efficiency is governed by crack depth rather than crack length; (3) four out of five NDT techniques applied indicated a theshold length for crack detection; 4) for all the NDT methods the scatter with regard to accuracy increased with decreasing crack length; (5) although these techniques underestimated crack length, eddy current and ultrasonic inspections achieved the same accuracy both before and after corrosion; (6) the accuracy of penetrant inspection decreased significantly after corrosion;(7) sensitivity and probability of detection of all five NDT techniques decreased significantly after corrosion; and (8) before corrosion penetrant is the most reliable, sensitive, and accurate inspection method. After corrosion penetrant remains the most sensitive, but eddy current is more reliable. Author (ESA)

N80-31846# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

METHODS FOR THE INTERPOLATION AND THE EXTRAPOLATION OF THE RESULTS OF CREEP RUPTURE TESTS

H. P. vanLeeuwen 27 Feb. 1979 71 p In DUTCH; ENGLISH summary Presented at Meeting of the Creep Comm. of the Netherlands Soc. of Mater. Sci., Cleveland, 30 Mar. 1979

(NLR-MP-79007-U) Avail: NTIS HC A04/MF A01

A survey of extrapolation methods, graphic analysis, statistics and mathematical models relevant to creep rupture are presented. Minimal commitment and discrete function values, and creep diagrams are also discussed. Author (ESA)

N80-31847# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

FLIGHT SIMULATION FATIGUE CRACK PROPAGATION IN 7010 AND 7075 ALUMINUM ALLOY PLATE

R. J. H. Wanhill, W. G. J. tHart, and L. Schra May 1979 20 p refs

(NLR-MP-79019-U) Avail: NTIS HC A02/MF A01

The fatigue crack propagation resistances of 7010-T7651, 7010-T73651 and 7075-T7351 thick plate were compared for flight simulation (gust spectrum) loading conditions. The 7075-T7351 was slightly superior, and it was shown that this superiority was not essentially due to the higher fracture thoughness of this alloy. The influence of specimen thickness on the crack propagation resistance was significant. Thinner specimens gave longer crack propagation lives, generally lower crack propagation rates, and generally longer delays in crack growth following severe flights. Author (ESA)

N80-31848# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

ENVIRONMENTAL FATIGUE

R. J. H. Wanhill Jun. 1979 25 p refs Presented at Soc. of Met. Engr. Sem. on Metal Fatigue, Leuven, Belgique, Oct. 1979

(NLR-MP-79025-U) Avail: NTIS HC A02/MF A01

An overview of the environmental influences on fatigue crack initiation and propagation is given followed by a discussion of practical measures to alleviate and control the environmental contribution. These include design changes facilitating inspection and reducing fatigue and corrosion, surface protection, cathodic protection materials changes, the use of inhibitors, water displacing compounds, sealants, and barrier layers. Author (ESA)

N80-31849# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

THEORY AND CALCULATION OF VIBRATING STRUCTURES

Roger Valid 1980 58 p refs In FRENCH; ENGLISH summary Presented at CEA/EDF Conf. on Vibrations des Struct. dans le Domaine Ind., Jouy-en-Josas, France, 15-19 Oct. 1979 Report will also be announced as translation (ESA-TT-663)

(ONERA-P-1980-1) Avail: NTIS HC A04/MF A01

Finite element methods, linear vibration theory and the calculation of geometrically nonlinear structures are covered. Finite element methods are developed in a simple manner from the displacement method. Details are given about the most commonly used elements. The theory of linear vibrations is treated for the discrete case. Its variational properties are, however, recalled for both discrete and continuous cases. Formulas describing the response to various excitations (transient, harmonic, periodic, and random) are given. Variational form methods for calculating structures with geometrical nonlinearities are presented together with the algorithms most commonly used for arbitrary excitations. The stability of dynamic systems is introduced. Author (ESA)

N80-31850# National Technical Information Service, Springfield, Va.

FINITE ELEMENTS IN STRUCTURAL ANALYSIS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1977 - May 1980

Brian Carrigan Jun. 1980 233 p Supersedes NTIS/PS-79/0706; NTIS/PS-78/0639
(PB80-811516; NTIS/PS-79/0706; NTIS/PS-78/0639) Avail: NTIS HC $30.00/MF $30.00 CSCL 20K

The bibliography cites Government sponsored research reports concerning finite element analysis as applied to structural mechanics problems. Some computer programs are mentioned, but for a more complete listing of software developed for structural problems, see the Published Searches titled structural mechanics software. This updated bibliography contains 222 abstracts, 68 of which are new entries to the previous edition. GRA

N80-31851# National Bureau of Standards, Washington, D.C. Measurement Lab.
FRACTURE CONTROL PRACTICES FOR METAL STRUCTURES
H. I. McHenry and S. T. Rolfe (Kansas Univ., Lawrence) Jan. 1980 115 p refs Sponsored in part by Naval Ship Research and Development Center
(PB80-185648; NBSIR-79-1623) Avail: NTIS HC A06/MF A01 CSCL 13M

Fracture control practices are the engineering procedures and requirements that contribute to the prevention of fracture in metal structures. These practices are identified as the elements of fracture control and each element is defined and described. The systematic application of these practices to the prevention of fracture in a particular structure is accomplished by either the code approach or the performance specification approach to fracture control. In these two approaches, the consideration given to each of the elements of fracture control is discussed and illustrated with examples for specific types of structures. Selected practices that may be of use in Naval systems are discussed. GRA

42 GEOSCIENCES (GENERAL)

N80-31852# Army Engineer Topographic Labs., Fort Belvoir, Va. Center for Remote Sensing.
EVALUATING SOIL MOISTURE AND TEXTURAL RELATIONSHIPS USING REGRESSION ANALYSIS Progress Report, Jan. - Jun. 1979
Melvin B. Satterwhite May 1980 35 p refs
(DA Proj. 4A1-61102-B-52C)
(AD-A087371; ETL-0226) Avail: NTIS HC A03/MF A01 CSCL 08/13

Soil moisture and textural conditions are described for 179 soil samples from an arid to semiarid climate. Stepwise multiple regression analysis of these data produced four regression equations that related (1) the percent sand and clay and (2) the percent fines, with the percent soil water held at 0.33 bar (FC) and the 15 bar (WP) potentials. Evaluation of these equations showed no differences between the estimates at the 0.33 bar potential using either the percent sand and clay or the percent fines. Better estimates for the WP were obtained when the percent sand and clay were used instead of the percent fines. The differences between the estimated soil moisture at FC or WP varied less than 30 percent from the measured soil moisture values for 161 (90 percent) of the 179 soil samples. The differences between the estimated and the measured soil moisture values were not significant at the 95 percent level of confidence. The regression equations provide a method by which the potential percent soil water held at the FC or WP can be estimated from soil textural data. The accuracy and precision of the results of applying these equations to soils of other areas has not been determined. It would seem, however, that they would be applicable in those instances where only general working estimates are needed. GRA

N80-31853# Ohio State Univ., Columbus. Dept. of Geodetic Science.
A WORLD VERTICAL NETWORK
Oscar L. Colombo Feb. 1980 70 p refs
(Contract F19628-79-C-0027; AF Proj. 2309)
(AD-A086011; DGS-296; SR-4; AFGL-TR-80-0077) Avail: NTIS HC A04/MF A01 CSCL 08/5

Gravimetric data, levelling, and precise position fixes using artificial satellites or the Moon could be combined to estimate the potential difference between benchmarks situated far apart to an accuracy of a few tenths of kgal m. This is substantially better than what can be obtained with tide gauges, which are affected by the stationary sea surface topography. A set of these benchmarks can link national and continental levelling nets into a unified World Vertical Network. GRA

N80-31854# Geological and Economic Survey, Morgantown, West Va.
INORGANIC GEOCHEMISTRY OF DEVONIAN SHALES IN SOUTHERN WEST VIRGINIA: GEOGRAPHIC AND STRATIGRAPHIC TRENDS
Michael Ed Hohn, Ronald W. Neal, and J. J. Renton Apr. 1980 41 p refs
(Contract EY-76-C-05-5199)
(DOE-METC/5199/7) Avail: NTIS HC A03/MF A01

Samples of cuttings from twenty-one wells and a core from a single well in southern West Virginia were analyzed for major and minor elements: silicon, aluminum, iron, magnesium, calcium, sodium, titanium, phosphorus, manganese, sulfur, zinc, and strontium. Stratigraphic and geographic controls on elemental abundances were studied through canonical correlations, factor analyses, and trend surface analysis. The most abundant elements, silicon and aluminum, show gradual trends through the stratigraphic column of most wells, with silicon increasing and aluminum decreasing upsection. Other elements such as calcium, sulfur, and titanium change abruptly in abundance at certain stratigraphic boundaries. Important geographic trends run east-west: for instance, one can see an increase in sulfur and a decrease in titanium to the west; and a decrease in silicon from the east to the central part of the study area, then an increase further west. DOE

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-31855* National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY (ISSUE 26)
Jul. 1980 118 p
(NASA-SP-7041(26)) Avail: NTIS HC $10.50 CSCL 05B

This bibliography lists 480 reports, articles, and other documents introduced into the NASA scientific and technical information system between April 1, 1980 and June 30, 1980. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. A.R.H.

N80-31856*# National Aeronautics and Space Administration, Washington, D. C.
A DESCRIPTION OF A SYSTEM OF PROGRAMS FOR MATHEMATICALLY PROCESSING ON UNIFIED SERIES (YeS) COMPUTERS PHOTOGRAPHIC IMAGES OF THE EARTH TAKEN FROM SPACECRAFT
V. G. Zolotukhin, B. I. Kolosov, D. A. Usikov, V. I. Borisenko, S. T. Mosin, and V. N. Gorokhov Jun. 1980 29 p refs Transl. into ENGLISH of "Opisaniye systemy Programm Mathematicheskoy Obrabutki na EVM Yedinoy Serii (ES) Fotograficheskikh Apparatov (Kompleks SOFI)", Rept. Pr-336 Acad. of Sci. USSR, Inst. of Space Research, Moscow, 1977 p 1-30 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences (USSR), Moscow

(Contract NASw-3198)
(NASA-TM-76208; Pr-336) Avail: NTIS HC A03/MF A01 CSCL 14E

A description of a batch of programs for the YeS-1040 computer combined into an automated system for processing photo (and video) images of the Earth's surface, taken from spacecraft, is presented. Individual programs with the detailed discussion of the algorithmic and programmatic facilities needed by the user are presented. The basic principles for assembling the system, and the control programs are included. The exchange format within whose framework the cataloging of any programs recommended for the system of processing will be activated in the future is displayed. T.M.

N80-31857*# National Aeronautics and Space Administration, Washington, D. C.

RADUGA EXPERIMENT: MULTIZONAL PHOTOGRAPHING THE EARTH FROM THE SOYUZ-22 SPACECRAFT

Ya. Ziman, Yu. Chesnokov, B. Dunayev, V. Aksenov, V. Bykovskiy, R. Ioaskhim, K. Myuller, V. Choppe, and V. Volter Jul. 1980 27 p refs Transl. into ENGLISH of "Eksperiment Raduga--Mnogozonal Noye Fotografirovan ye Zemli s Kosmicheskogo Korablya Soyuza-22" Rept D-254 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-35 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76234; D-254) Avail: NTIS HC A03/MF A01 CSCL 14E

The main results of the scientific research and 'Raduga' experiment are reported. Technical parameters are presented for the MKF-6 camera and the MSP-4 projector. Characteristics of the obtained materials and certain results of their processing are reported. L.F.M.

N80-31858*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

STATE ESTIMATION AND ABSOLUTE IMAGE REGISTRATION FOR GEOSYNCHRONOUS SATELLITES

Richard S. Nankervis, David W. Koch, and Henry M. Sielski (Computer Sciences Corp.) May 1980 16 p refs Presented at the Conf. of the Am. Congr. on Surv. and Mapping and Am. Soc. of Phot., St. Louis, 9-14 Mar. 1980
(Contract NAS5-24350)
(NASA-TM-80712) Avail: NTIS HC A02/MF A01 CSCL 14E

Spacecraft state estimation and the absolute registration of Earth images acquired by cameras onboard geosynchronous satellites are described. The basic data type of the procedure consists of line and element numbers of image points called landmarks whose geodetic coordinates, relative to United States Geodetic Survey topographic maps, are known. A conventional least squares process is used to estimate navigational parameters and camera pointing biases from observed minus computed landmark line and element numbers. These estimated parameters along with orbit and attitude dynamic models are used to register images, using an automated grey level correlation technique, inside the span represented by the landmark data. In addition, the dynamic models can be employed to register images outside of the data span in a near real time mode. An important application of this mode is in support of meteorological studies where rapid data reduction is required for the rapid tracking and predicting of dynamic phenomena. Author

N80-31859# Army Engineer Topographic Labs., Fort Belvoir, Va.

ERRORS IN AUTOMATIC PASS POINT MENSURATION USING DIGITAL TECHNIQUES

Michael A. Crombie Jun. 1980 22 p refs
(DA Proj. 4A7-62707-A-855)
(AD-A087443; ETL-0232) Avail: NTIS HC A02/MF A01 CSCL 08/2

A technique for automatically measuring pass points from digital stereo images is evaluated. Numerical estimates of x-parallax and y-parallax for a specific stereo pair of images is presented as a function of terrain relief. GRA

N80-31860# Army Engineer Topographic Labs., Fort Belvoir, Va.

TERRAIN ANALYST SYNTHESIZER STATION

Gunther Schwarz Jun. 1980 28 p
(DA Proj. 4A7-62707-A-855)
(AD-A087370; ETL-0231) Avail: NTIS HC A03/MF A01 CSCL 08/2

This report describes the Terrain Analyst Synthesizer Station built under contract for USAETL. Tests were performed to determine the characteristics and adherence to the specifications set forth in the Purchase Description. GRA

N80-31861# California Univ., Livermore. Lawrence Livermore Lab.

SIMPLIFIED GROUNDWATER FLOW MODELING: AN APPLICATION OF KALMAN FILTER BASED IDENTIFICATION

K. D. Pimentel, J. V. Candy, S. G. Azevedo, and T. A. Doerr May 1980 13 p refs Presented at the Intern. Federation of Inform. Process. Working Conf. on Simulation and Environ., Bangor, Wales, 18-20 Sep. 1979
(Contract W-7405-eng-48)
(UCRL-82649; CONF-7909138-1) Avail: NTIS HC A02/MF A01

Groundwater contaminant transport models are needed in risk assessments for licensing and regulating long-term nuclear waste repositories. Groundwater flow rather than contaminant transport was considered because the flow problem is more simple. A pump-drawdown test is modeled with a reduced-order set of ordinary differential equations obtained by differencing the partial differential equation. The accuracy of the reduced model was determined by comparing it with the analytic solution for the drawdown test. An accuracy requirement of 2 percent error which was established at the single observation well and a model with only 21 states which was established satisfied that criterion. That model was used in an extended Kalman filter with synthesized measurement data from one observation well to identify transmissivity within 1 percent error and storage coefficient within 10 percent error. Several statistical tests used to assess the performance of the estimator/identifier found it to be satisfactory for this application. DOE

N80-31862# Rockwell International Corp., Richland, Wash. Energy Systems Group.

LANDSAT DATA AS A BASIS FOR REGIONAL ENVIRONMENTAL ASSESSMENT WITHIN THE COLUMBIA PLATEAU

L. S. Leonhart and J. G. Stephan (Battelle Pacific Northwest Labs., Richland, Wash.) May 1980 19 p Presented at the 6th Can. Symp. on Remote Sensing, Halifax, Canada, 21-23 May 1980
(Contract DE-AC06-77RL-01030)
(RHO-BWI-SA-43; CONF-800577-1) Avail: NTIS HC A02/MF A01

An environmental assessment is being performed in conjunction with siting a radioactive waste terminal-storage facility within the federally operated Hanford Site in south-central Washington. Initial assessments involved classification of four contiguous LANDSAT scenes recorded over the region and about 300 high-altitude (U-2) photographs. The resulting mosaic was segregated into ten land-cover classes. The classified land-cover data were then machine-integrated with digital irrigation well-location data. The resulting groundwater multi-source data product was required by hydrologists to segregate potential artificial recharge areas from artificial groundwater discharge areas. Related studies employed LANDSAT data and aerial imagery to identify linear structures and other geologic features which may have a significant bearing on the tectonic and/or hydrological setting of the Columbia Plateau. DOE

N80-31863# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.

SENSORS FOR REMOTE SENSING [SENSORI PER TELERILEVAMENTO]

E. M. Bastida, F. Gardossi, A. Sona, F. Svelto, and V. Svelto Jan. 1979 53 p refs In ITALIAN; ENGLISH summary
(CISE-N-190) Avail: NTIS HC A04/MF A01

The most important remote sensing methods are discussed. Particular attention is devoted to the sensors, defined as the components transforming the electromagnetic information into

usable data. Photographic methods, radar and microwave methods, and applications of infrared and laser radiation are included.
Author (ESA)

N80-31864# Royal Aircraft Establishment, Farnborough (England).
A STUDY OF LANDSAT MULTISPECTRAL SCANNER DATA TAPES
A. H. Benny London HMSO Feb. 1980 37 p refs
(RAE-TR-80018; RAE-Space-574; BR/3767) Avail: NTIS HC A03/MF A01

A detailed study is described of a number of computer compatible magnetic tapes containing LANDSAT multi-spectral scanner (MSS) data. The differences between raw and corrected data tapes are shown along with the conversion process. It also shows the differences between the existing and a new form of corrected data tape. A computer program was written to enable raw data desirable for certain computer analyses to be obtained from the existing stocks of corrected data tapes. Author (ESA)

N80-31865# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Digitale Bildverarbeitung.
COMPARATIVE EXPERIMENTAL STUDY ON THE USE OF ORIGINAL AND COMPRESSED MULTISPECTRAL LANDSAT DATA FOR APPLIED RESEARCH
Klaus A. Ulbricht Feb. 1980 81 p refs Original contains color illustrations
(Contract ESTEC-3569/78-NL-HP(SC))
(DFVLR-FB-80-03; ESA-CR(P)-1343) Avail: NTIS HC A05/MF A01

Parts of two multispectral LANDSAT scenes, compressed by ratio 6.4 to 1, were investigated to determine the effect of the compression on the image contents. The LANDSAT image of the Bayuda desert in Sudan was submitted to supervised maximum likelihood classification before and after compression of data as a function of the rejection class parameter sigma. Different approaches as to the use of circular or rectangular training areas for classification on original and compressed scene served to investigate the influence of compression on image contents. Partitioning of classified image is given on a percentage basis as a function of sigma. Three dimensional clusters of spectral channels and histograms show the influence of compression. The heavy population of blue green algae on LANDSAT scene of the baltic of August 7, 1975, was another example used to test the influence of data compression. Three dimensional clusters of grey values of spectral channels of the investigated area and histograms show influence of compression. The effects of compression on partitioning of classified scences, are displayed in several tables and figures. Author (ESA)

N80-31866# Environmental Research Lab., Duluth, Minn. Large Lakes Research Station.
RESULTS OF A JOINT USA/USSR HYDRODYNAMIC AND TRANSPORT MODELING PROJECT, APPENDICES B, C, AND D Final Report, May - Dec. 1977
John F. Paul, William L. Richardson (Hydrochemical Inst., USSR), Alexander B. Grostko (Rostov State Univ., USSR), and Anton A. Matveyev Sep. 1979 252 p refs
(PB80-187529; EPA-600/3-79-101) Avail: NTIS HC A12/MF A01 CSCL 08H

Three geographical areas were modeled. The modeling approaches ranged from those employing material and mass conservation to describe water movement to those involving solution of the complete three dimensional hydrodynamic equations. The modeling calculations were compared to available data and, in all cases, reasonable agreement was obtained. GRA

N80-31867# Kansas Water Resources Research Inst., Manhattan.
SIMULATION OF RESERVOIR AND LAKE SEDIMENTATION Project Completion Report, Jul. 1973 - Jun. 1975
William M. Merrill Apr. 1980 158 p refs
(Contract DI-14-31-0001-4085)
(PB80-182801; CONTRIB-215; W80-05010; OWRT-B-036-KAN(1)) Avail: NTIS HC A08/MF A01 CSCL 08H

Two lakes were used to develop a model of reservoir sedimentation and two computer programs to simulate it. Basis for the model is a statement of general relationships formulated to describe sedimentation in shallow marine basins, modified to apply to relatively small freshwater bodies. In its modified form, the statement serves as foundation for quantitative and semiquantitative expressions that are translated into algorithms to simulate reservoir processes. The model and programs are appropriate only for reservoirs established on alluvial streams in which an essentially unlimited supply of sediment, 90 percent or more of which is silt and clay and at least 30 percent of which is clay of two microns or less, can be assured. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-31868 California Univ., Davis.
SOLAR DOMESTIC HOT WATER SYSTEM, A COMPARATIVE STUDY AND STORAGE TANK INVESTIGATION Ph.D. Thesis
Marvin Francis Young 1980 291 p
Avail: Univ. Microfilms Order No. 8019006

A computer program was developed to simulate five typical solar domestic hot water systems which included both thermosyphon and pumped designs that were assembled and tested. Numerical simulations of these systems were verified by comparison to experimental results. Predicted thermal performance, i.e., collector inlet and outlet temperatures, and auxiliary energy requirements were found to be in excellent agreement with experiments. The computer program was then used to predict the long term annual performance of the various systems at 14 different locations throughout California. Load size and load distribution were also varied. Economic analyses were performed on each system with the goal of identifying the most economical system at each location under a prescribed load (gallons/day) size and distribution pattern (time of day for hot water use). It was found that in almost all cases the two tank thermosyphon system was the most cost effective system for all locations, load sizes and distributions and shows promise of being the most widely used solar domestic hot water system.
Dissert. Abstr.

N80-31869*# United Technologies Corp., South Windsor, Conn. Power Systems Div.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 3: ENERGY CONVERSION SYSTEM CHARACTERISTICS Final Report
Jan. 1980 283 p refs
(Contracts DEN3-30; EC-77-A-31-1062)
(NASA-CR-159761; DOE/NASA/0030-80/3-Vol-3; UTC-FCR-1333-Vol-3) Avail: NTIS HC A13/MF A01 CSCL 10B

Six current and thirty-six advanced energy conversion systems were defined and combined with appropriate balance of plant equipment. Twenty-six industrial processes were selected from among the high energy consuming industries to serve as a frame work for the study. Each conversion system was analyzed as a cogenerator with each industrial plant. Fuel consumption, costs, and environmental intrusion were evaluated and compared to corresponding traditional values. The advanced energy conversion technologies indicated reduced fuel consumption, costs, and emissions. Fuel energy savings of 10 to 25 percent were predicted compared to traditional on site furnaces and utility electricity. With the variety of industrial requirements, each advanced technology had attractive applications. Fuel cells indicated the greatest fuel energy savings and emission reductions. Gas turbines and combined cycles indicated high overall annual savings. Steam turbines and gas turbines produced high estimated returns.

In some applications, diesels were most efficient. The advanced technologies used coal derived fuels, or coal with advanced fluid bed combustion or on site gasifications. Data and information for both current and advanced energy conversion technology are presented. Schematic and physical descriptions, performance data, equipment cost estimates, and predicted emissions are included. Technical developments which are needed to achieve commercialization in the 1985-2000 period are identified. R.K.G.

N80-31870*# General Electric Co., Philadelphia, Pa. Thermal Power Systems Engineering.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 3: INDUSTRIAL PROCESSES Final Report
W. B. Palmer, H. E. Gerlaugh, and R. R. Priestley. Apr. 1980. 478 p. Sponsored by DOE.
(Contract DEN3-31)
(NASA-CR-159767; DOE/NASA/0031-80/3-Vol-3; GE80ET0104-Vol-3) Avail: NTIS HC A21/MF A01 CSCL 10B

Cogenerating electric power and process heat in single energy conversion systems rather than separately in utility plants and in process boilers is examined in terms of cost savings. The use of various advanced energy conversion systems are examined and compared with each other and with current technology systems for their savings in fuel energy, costs, and emissions in individual plants and on a national level. About fifty industrial processes from the target energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidate which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum based residual and distillate liquid fuels, and low Btu gas obtained through the on site gasification of coal. An attempt was made to use consistent assumptions and a consistent set of ground rules specified by NASA for determining performance and cost. Data and narrative descriptions of the industrial processes are given. R.K.G.

N80-31871*# California Univ., Los Angeles.
SILICON SOLAR CELL FABRICATION TECHNOLOGY Final Report
O. M. Stafsudd. 15 May 1980. 37 p. refs. Sponsored by NASA and DOE. Prepared for JPL.
(Contract JPL-954902)
(NASA-CR-163394; JPL-9950-386; DOE/JPL-954902) Avail: NTIS HC A03/MF A01 CSCL 10A

Device fabrication and photoconductive lifetime decay measurements were used to characterize single and polycrystalline silicon substracts. The device characterization of the processed materials was done by spectral response measurements and absolute quantum efficiency at a single wavelength. The results were then reduced to yield the diffusion length of the various samples. The photoconductive lifetime decay method was implemented in order to determine the minority carrier lifetime in unprocessed wafers. T.M.

N80-31872*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM ECONOMIC EVALUATION FOR ELCAM-TEMPE, TEMPE, ARIZONA AND ELCAM-SAN DIEGO, SAN DIEGO, CALIFORNIA Final Report
Jun. 1980. 102 p. refs. Prepared for DOE.
(Contract NAS8-32036)
(NASA-CR-161492) Avail: NTIS HC A06/MF A01 CSCL 10A

The long term economic performance of the solar energy system at its installation site is analyzed and four additional locations selected to demonstrate the viability of the design over a broad range of environmental and economic conditions. The economic analysis of the solar energy systems that were installed at Tempe, Arizona and San Diego, California, is developed for these and four other sites typical of a wide range of environmental and economic conditions in the continental United States. This analysis is accomplished based on the technical and economic models in the f Chart design procedure with inputs based on the characteristics of the installed system and local conditions. The results are expressed in terms of the economic parameters of present worth of system cost over a projected twenty year life: life cycle savings; year of positive savings; and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables is also investigated. The results demonstrate that the solar energy system is economically viable at all of the sites for which the analysis was conducted. R.K.G.

N80-31873*# AeroChem Research Labs., Inc., Princeton, N. J.
DEVELOPMENT OF A MODEL AND COMPUTER CODE TO DESCRIBE SOLAR GRADE SILICON PRODUCTION PROCESSES Final Report, 21 Sep. 1977 - 30 Sep. 1979
R. K. Gould and R. Srivastava. Dec. 1979. 126 p. refs. Sponsored in part by DOE.
(Contract JPL-954862)
(NASA-CR-163515; AeroChem-TP-392; JPL-954862-79/8) Avail: NTIS HC A07/MF A01 CSCL 10A

Two computer codes were developed for describing flow reactors in which high purity, solar grade silicon is produced via reduction of gaseous silicon halides. The first is the CHEMPART code, an axisymmetric, marching code which treats two phase flows with models describing detailed gas-phase chemical kinetics, particle formation, and particle growth. It can be used to described flow reactors in which reactants, mix, react, and form a particulate phase. Detailed radial gas-phase composition, temperature, velocity, and particle size distribution profiles are computed. Also, deposition of heat, momentum, and mass (either particulate or vapor) on reactor walls is described. The second code is a modified version of the GENMIX boundary layer code which is used to compute rates of heat, momentum, and mass transfer to the reactor walls. This code lacks the detailed chemical kinetics and particle handling features of the CHEMPART code but has the virtue of running much more rapidly than CHEMPART, while treating the phenomena occurring in the boundary layer in more detail. L.F.M.

N80-31874*# AeroChem Research Labs., Inc., Princeton, N. J.
SILICON HALIDE-ALKALI METAL FLAMES AS A SOURCE OF SOLAR GRADE SILICON Final Report
D. B. Olson, W. J. Miller, and R. K. Gould. Jan. 1980. 75 p. refs. Sponsored in part by DOE.
(Contract JPL-954777)
(NASA-CR-163514; Aerochem-TP-395; JPL-954777-80/8) Avail: NTIS HC A04/MF A01 CSCL 10A

The feasibility of using continuous high-temperature reactions of alkali metals and silicon halides to produce silicon in large quantities and of suitable purity for use in the production of photovoltaic solar cells was demonstrated. Low pressure experiments were performed demonstrating the production of free silicon and providing experience with the construction of reactant vapor generators. Further experiments at higher reagent flow rates were performed in a low temperature flow tube configuration with co-axial injection of reagents and relatively pure silicon was produced. A high temperature graphite flow tube was built and continuous separation of Si from NaCl was demonstrated. A larger scaled well stirred reactor was built. Experiments were performed to investigate the compatability of graphite based reactor materials of construction with sodium. At 1100 to 1200 K none of these materials were found to be suitable. At 1700 K the graphites performed well with little damage except to coatings of pyrolytic graphite and silicon carbide which were damaged. L.F.M.

N80-31875*# Sanders Associates, Inc., Nashua, N. H. Energy Systems Center.
SMALL SOLAR ELECTRIC SYSTEM COMPONENTS DEMONSTRATION Final Report
Aug. 1980. 123 p. Original contains color illustrations.
(Contract JPL-955279)
(NASA-CR-163513) Avail: NTIS HC A06/MF A01 CSCL 10A

The design and testing of high temperature thermal storage modules (TSM) are reported. The test goals were to demonstrate the thermocline propagation in the TSM, to measure the steepness of the thermocline, and to measure the effectiveness of the

TSM when used in a Brayton system. In addition, a high temperature valve suitable for switching the TSM at temperatures to 1700 F is described and tested. Test results confirm the existence of a sharp thermocline under design conditions. The thermal profile was steeper than expected and was insensitive to air density over the range of the test conditions. Experiments were performed which simulated the airflow of a small Brayton engine, 20 KWe, having a pair of thermal storage modules acting as efficient recuperators. Low pressure losses, averaging 12 inches of water, and high effectiveness, 93% for a 15 minute switching cycle, were measured. The insulation surrounding the ceramic core limited thermal losses to approximately 1 KWt. The hot valve was operated over 100 cycles and performed well at temperatures up to 1700 F. M.G.

N80-31876*# Solarex Corp., Rockville, Md.
PILOT LINE REPORT: DEVELOPMENT OF A HIGH EFFICIENCY THIN SILICON SOLAR CELL
G. Storti, J. Culik, and C. Wrigley Jul. 1980 55 p refs Prepared for JPL
(Contract JPL-954883)
(NASA-CR-163522; SX/115/PL-2) Avail: NTIS HC A04/MF A01 CSCL 10A

Alternate processing technologies were developed and introduced into the pilot line with a resulting increase in the efficiency of the thin cells. The introduction of an aluminum paste alloy technique for the formation of a back surface field represents a significant advance over previous techniques. The fabrication and results for quantities in excess of 2000 2 cm x 2 cm thin cells and 1000 5 cm x 5 cm thin cells are described. Substantial improvement in performance and yield of the thin cells were obtained. The overall yield of the 2 cm x 2 cm pilot line was better than 38%, while the best lot yield was greater than 51%. The average power density of the 2 cm x 2 cm cells was approximately 16.8 mW/sq cm with an average AMO (at 25 C) efficiency of 12.4%. The lot yield of the 5 cm x 5 cm pilot line improved from only 7% at the beginning of the operation to better than 17% as experience was gained. The average 5 cm x 5 cm thin cell had an AMO efficiency (at 25 C) of 11.5%. A.R.H.

N80-31877*# Motorola, Inc., Chicago, Ill.
PHOTOVOLTAIC MODULE ELECTRICAL TERMINATION DESIGN REQUIREMENT STUDY Final Report
F. J. Mosna, Jr. and J. Donlinger Jul. 1980 150 p refs Prepared for JPL
(Contract JPL-955367; JPL Proj. 2369)
(JPL-955367-80/1; NASA-CR-163518) Avail: NTIS HC A07/MF A01 CSCL 10A

Pertinent electrical termination attributes were identified and used in the development of selection criteria which included function, environmental durability, utility, manufacturing, code, and cost. Significant aspects of each criteria are discussed, and eight different types of terminations are ranked according to their performance in remote, residential, intermediate, and industrial applications. A.R.H.

N80-31878*# Cooperson Brack Associates, Montchanin, Del.
SOLAR ENERGY SYSTEM DEMONSTRATION PROJECT AT WILMINGTON SWIM SCHOOL, NEW CASTLE, DELAWARE Final Report
Jul. 1980 94 p Sponsored by NASA
(Contract EM-78-F-01-5190)
(NASA-CR-161538) Avail: NTIS HC A05/MF A01 CSCL 10A

A solar energy system located at the Wilmington Swim School, New Castle, Delaware is described. The system was designed for a 40 percent heating and a 30 percent hot water solar contribution serving the heat loads in the following order: space heat - new addition, domestic water - entire facility, and pool heating - entire facility. On a cost basis for 2920 hours of operation, the heat reclaimed would cost $969.66 annually if provided by gas at 3.79 per million Btu's. At 5.5 centers per kwh, heat recovery costs of $481.80 percent a net savings of $487.86 annually. L.F.M.

N80-31879*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
THREE COMPUTER CODES TO READ, PLOT AND TABULATE OPERATIONAL TEST-SITE RECORDED SOLAR DATA
Stephen D. Stewart, Robert S. Sampson, Jr., Richard E. Stonemetz, and Sandra L. Rouse Jul. 1980 89 p Sponsored in part by DOE
(NASA-TM-78293) Avail: NTIS HC A05/MF A01 CSCL 10A

Computer programs used to process data that will be used in the evaluation of collector efficiency and solar system performance are described. The program, TAPFIL, reads data from an IBM 360 tape containing information (insolation, flowrates, temperatures, etc.) from 48 operational solar heating and cooling test sites. Two other programs, CHPLOT and WRTCNL, plot and tabulate the data from the direct access, unformatted TAPFIL file. The methodology of the programs, their inputs, and their outputs are described. M.G.

N80-31880*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION. SEASONAL REPORT FOR WORMSER, COLUMBIA, SOUTH CAROLINA Contractor Report, Jun. 1979 - May 1980
Aug. 1980 110 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161546) Avail: NTIS HC A06/MF A01 CSCL 10A

The Wormser Solar Energy System's operational performance from April 1979 through March 1980 was evaluated. The space heating subsystem met 42 percent of the measured space heating load and the hot water subsystem met 23 percent of the measured hot water demand. Net electrical energy savings were 4.36 million Btu's or 1277 kwh. Fossil energy savings will increase considerably if the uncontrolled solar energy input to the building is considered. L.F.M.

N80-31881*# National Aeronautics and Space Administration, Washington, D. C.
COMPOSITE ROTOR BLADES FOR LARGE WIND ENERGY INSTALLATIONS
A. Kussmann, J.P. Molly, and D. Muser Apr. 1980 14 p refs Transl. into ENGLISH from DFVLR-Nachr. (West Germany), Jun. 1979 p 40-44 Original language document was announced as A79-41235 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75822) Avail: NTIS HC A02/MF A01 CSCL 10B

The design of large wind power systems in Germany is reviewed with attention given to elaboration of the total wind energy system, aerodynamic design of the rotor blade, and wind loading effects. Particular consideration is given to the development of composite glass fiber/plastic or carbon fiber/plastic rotor blades for such installations. Author

N80-31882*# Westinghouse Research and Development Center, Pittsburgh, Pa.
CELL MODULE AND FUEL CONDITIONER Quarterly Report, Apr. - Jun. 1980
D. Q. Hoover, Jr. Jul. 1980 75 p
(Contracts DEN3-161; DE-AI 03-79ET-11272)
(NASA-CR-159888; DOE/NASA/0161-4; Rept-80-9E6-MARED-R3; QR-3) Avail: NTIS HC A04/MF A01 CSCL 10A

The computer code for the detailed analytical model of the MK-2 stacks is described. An ERC proprietary matrix is incorporated in the stacks. The mechanical behavior of the stack during thermal cycles under compression was determined. A 5 cell stack of the MK-2 design was fabricated and tested. Designs for the next three stacks were selected and component fabrication initiated. A 3 cell stack which verified the use of wet assembly and a new acid fill procedure were fabricated and tested. Components for the 2 kW test facility were received or fabricated and construction of the facility is underway. The definition of fuel and water is used in a study of the fuel conditioning subsystem. Kinetic data on several catalysts, both crushed and pellets, was obtained in the differential reactor. A preliminary definition of the equipment requirements for treating tap and recovered water was developed. S.J.

N80-31883*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR COLT YOSEMITE, YOSEMITE NATIONAL PARK, CALIFORNIA Progress Report, May 1979 - Apr. 1980
Aug. 1980 88 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161539) Avail: NTIS HC A05/MF A01 CSCL 10A

The system's operational performance from May 1979 through April 1980 is described. Solar energy satisfied 23 percent of the total performance load, which was significantly below the design value of 56 percent. A fossil savings of 80.89 million Btu's or 578 gallons of fuel oil is estimated. If uncontrolled losses could have been reduced to an inconsequential level, the system's efficiency would have been improved considerably. L.F.M.

N80-31884*# Old Dominion Univ., Norfolk, Va. Dept. of Mathematical Sciences.
GALLIUM ARSENIDE (GaAs) SOLAR CELL MODELING STUDIES Final Report, 16 May - 16 Aug. 1980
John H. Heinbockel Sep. 1980 55 p refs
(Grant NAG1-64)
(NASA-CR-163538) Avail: NTIS HC A04/MF A01 CSCL 10A

Various models were constructed which will allow for the variation of system components. Computer studies were then performed using the models constructed in order to study the effects of various system changes. In particular, GaAs and Si flat plate solar power arrays were studied and compared. Series and shunt resistance models were constructed. Models for the chemical kinetics of the annealing process were prepared. For all models constructed, various parametric studies were performed. T.M.

N80-31885# RAND Corp., Santa Monica, Calif.
A QUANTITATIVE EVALUATION OF CLOSED-CYCLE OCEAN THERMAL ENERGY CONVERSION (OTEC) TECHNOLOGY IN CENTRAL STATION APPLICATIONS
E. C. Gritton, R. Y. Pei, J. Aroesty, M. M. Balaban, C. Gazley, R. W. Hess, and W. H. Krase May 1980 137 p refs
(Contract DE-AC01-79PE-70078)
(R-2595-DOE) Avail: NTIS HC A07/MF A01

An evaluation of a closed cycle Ocean Thermal Energy Conversion (OTEC) system for delivery of electric power to the United States is presented. Performance and costs of complete commercial OTEC systems are analyzed at the system level using inputs from component analyses and thermal resource data in the Gulf of Mexico. Such sites could feed the Gulf Coast from the west coast of Florida to the New Orleans area. By exploiting the temperature difference between warm surface waters and cold water from the depths to operate a thermodynamic cycle to generate electricity, OTEC acts as a heat engine that taps the surface waters of tropical and subtropical oceans as a heat source and the cold water originating in the polar regions as a heat sink. Results of the engineering analysis indicate that the system and platform appear to be within the state-of-the-art. L.F.M.

N80-31886*# Naval Weapons Support Center, Crane, Ind.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY 6.0 AMPERE HOUR NICKLE CADMIUM SPACECRAFT CELLS FOR THE DYNAMIC EXPLORER SATELLITE PROGRAM
J. D. Harkness 9 Apr. 1980 18 p
(NASA Order S-57075-AG)
(NASA-CR-160014; WQEC/C-80-128) Avail: NTIS HC A02/MF A01 CSCL 10C

Evaluation tests of 10 nickel cadmium cells are described. Although pressures were greater than what normally was exhibited by General Electric cells in the past, it is recommended that these cells be placed on life test simulating the predicted Dynamic Explorer flight profiles. L.F.M.

N80-31887*# Naval Weapons Support Center, Crane, Ind.
INITIAL EVALUATION TESTS OF 20.0 AMPHERE-HOUR SEALED NICKEL-CADMIUM CELLS MANUFACTURED FOR NASA'S STANDARD CELL PROGRAM
J. D. Harkness 9 May 1979 61 p
(NASA Order S-57075-AG)
(NASA-CR-160015; WQEC/C-79-144) Avail: NTIS HC A04/MF A01 CSCL 10C

Evaluation tests of 116 nickel cadmium cells provided by four manufacturers are described. Each manufacturer's group of cells, on the average, indicated an increase in plate stack thickness following the test. No limits or requirements were exceeded by any of the cells manufactured by General Electric. Limits/requirements exceeded during the charge portion of the testing are given. L.F.M.

N80-31888*# Naval Weapons Support Center, Crane, Ind.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY 40.0 AMPERE-HOUR NICKEL-CADMIUM SPACECRAFT CELLS FOR THE TRACKING DATA RELAY SATELLITE SYSTEM
J. D. Harkness 21 Dec. 1978 17 p
(NASA Order S-53742-AG)
(NASA-CR-160016; WQEC/C-78-416) Avail: NTIS HC A02/MF A01 CSCL 10C

Five cells provided by NASA's Goddard Space Flight Center were evaluated at room temperature and pressure (25 C plus or minus 2 C) with discharges at the 2 hour rate. Measurements of the cell containers following test, indicated an average increase of .006 inches at the plate thickness. Average end of charge voltages and pressures, and capacity output in ampere hours were determined. Three cells exceeded the voltage requirements of 1.52 volts during both c/10 charges at 20 C. All cells exceeded the voltage requirement of 1.52 volts during the 0 C overcharge test, although their end charges were below 1.50 volts. The pressure requirement of 65 psia was exceeded by both pressure transducer cells during c/10 charges at 25 C and 20 C and also during the 0 C overcharge test. The cells with pressure transducers reached a pressure of 20 psia before reaching the voltage limit of 1.550 volts during the pressure versus capacity test, and exhibited a pressure decay of 2 psia during the last 30 minutes of the 1 hour open circuit stand. Average capacity was 51.3 ampere hours. A.R.H.

N80-31889*# Naval Weapons Support Center, Crane, Ind.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY 50.0 AMPERE HOUR NICKEL CADMIUM SPACECRAFT CELLS FOR THE LANDSAT-D SATELLITE PROGRAM
J. D. Harkness 9 Apr. 1980 20 p
(NASA Order S-5707-AG)
(NASA-CR-160017; WQEC/C-80-104) Avail: NTIS HC A02/MF A01 CSCL 10C

Evaluation tests of eight nickel cadmium cells are described. Although high cell pressures were observed, it is recommended that these cells be placed on a near orbit life test. L.F.M.

N80-31890*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 2, PART 1: SYSTEM ENGINEERING Final Report
G. M. Hanley Washington Sep. 1980 258 p 7 Vol.
(Contract NAS8-32475)
(NASA-CR-3318; SSD-79-0010-2-1) Avail: NTIS HC A12/MF A01 CSCL 10A

Top level trade studies are presented, including comparison of solid state and klystron concepts, higher concentration on the solar cells, composite and aluminum structure, and several variations to the reference concept. Detailed trade studies are presented in each of the subsystem areas (solar array, power distribution, structures, thermal control, attitude control and stationkeeping, microwave transmission, and ground receiving station). A description of the selected point design is also presented. Author

N80-31891*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 4: TRANSPORTATION ANALYSIS Final

Report
G. M. Hanley. Washington NASA Sep. 1980 270 p refs
(Contract NAS8-32475)
(NASA-CR-3321; SSD-79-0010-4-Vol-4) Avail: NTIS
HC A12/MF A01 CSCL 10A

Transportation system elements were synthesized and evaluated on the basis of their potential to satisfy overall satellite (SPS) transportation requirements and of their sensitivities, interfaces, and impact on the SPS. Additional analyses and investigations were conducted to further define transportation system concepts that will be needed for the developmental and operational phases of an SPS program. To accomplish these objectives, transportation systems such as shuttle and its derivatives have been identified; new heavy lift launch vehicle concepts, cargo and personnel orbital transfer vehicles and intra-orbit transfer vehicle concepts have been evaluated. To a limited degree, the program implications of their operations and costs were assessed. The results of these analyses have been integrated into other elements of the overall SPS concept definition studies. T.M.

N80-31892# Avco Systems Div., Wilmington, Mass.
HIGH ENERGY DENSITY COMPOSITE FLYWHEEL PROGRAM Final Report, Jun. 1976 - May 1980
A. D. Sapowith, A. L. Gurson, and J. A. McElman 30 May 1980 155 p refs
(Contract DAAG53-75-C-0269)
(AD-A087076; AVSD-0170-80-RR) Avail: NTIS
HC A08/MF A01 CSCL 11/4

A bi-directional composite flywheel was instrumented with strain gages and tested to destruction. The flywheel was designed to exhibit constant stress in both radial and circumferential directions for all radial positions. Strain gage data verified this design. The burst speed was 38,741 rpm representing a specific energy level of 32.3 Wh/lb. The flywheel was constructed of Kevlar composite, had an outside diameter of 19.5 in., an axial thickness of 1.5 in. and weighed 18.6 lbs. Premature failure was initiated at the inside diameter by excessive pressure exerted by a metal hub. A polyacrylate hub design, with test data, is presented to solve this problem. GRA

N80-31893# GTE Labs., Inc., Waltham, Mass.
INVESTIGATION OF METHODS TO ELIMINATE VOLTAGE DELAY IN Li/SOCl2 CELLS Final Report, 19 Sep. 1978 - 19 Sep. 1979
Carl Schlaikjer, Clifton A. Young, and Marc Dobrusin May 1980 61 p refs
(Contract DAAB07-78-C-0558; DA Proj. 1L1-61102-AH-47)
(AD-A086992; DELET-TR-78-0558-1F) Avail: NTIS
HC A04/MF A01 CSCL 10/3

A comparative study of thionyl chloride electrolytes containing LiAlCl4, Li2B10Cl10, or Li2B12Cl12 has been carried out by monitoring LiCl film growth on lithium samples stored in these electrolytes and by evaluating the startup and measuring the capacity of anode limited lithium/thionyl chloride cells. The film growth on lithium samples was monitored by galvanostatic pulse polarization, by weight gain analysis, and by examination under the scanning electron microscope. The film growth rate on lithium in Li2B10Cl10/SOCl2 was found to be comparable to that in pure SOCl2, about one tenth of that found in LiAlCl4/SOCl2. Storage for longer periods of time or higher temperatures caused thicker films to form. The polyhedral borate electrolyte produced smooth films on lithium with widely scattered crystals, instead of closely packed crystals as in LiAlCl4/SOCl2. Lithium/thionyl chloride cells containing Li2B10 Cl10/SOCl2 started without delay at -20 C, even after prolonged storage at elevated temperature. The polyhedral borate electrolyte also reduced self discharge by local cell reduction of the solvent against cell hardware connected to the anode. GRA

N80-31894# Technical Univ. of Denmark, Lyngby.
SOLAR ENERGY APPLICATIONS FOR DWELLING; MODELLING AND SIMULATION PART Final Report
Ove Joergensen 1980 109 p
(EUR-6681/I-EN) Avail: NTIS (US Sales Only)
HC A06/MF A01; DOE Depository Libraries

Methods developed within the EC countries are presented and compared. The methods were used to predict the performance of three different solar heating systems: a domestic hot water system, a pure house heating system, and a combined system. Three different sets of weather data were used: Carpentras, Hamburg, and Ireland. The comparisons were undertaken on three different timebases: yearly, monthly, and hourly. A sensitivity analysis was formed on different parameters by different programs. DOE

N80-31895# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A REVIEW OF THE METHODS FOR PASSIVE SOLAR SYSTEMS ANALYSIS M.S. Thesis
Albert P. Allan and Gary D. Transmeir Jun. 1980 140 p refs
(AD-A087509; AFIT-LSSR-66-80) Avail: NTIS
HC A07/MF A01 CSCL 10/1

Due to recent needs expressed by the Air Force, a review and evaluation of the methods of analysis for passive solar energy systems was conducted. The methods of analysis evaluated were those that could be worked without the use of computers or programmable calculators. A selection model was designed to systematically and objectively evaluate the methods. The selection model was a variation of a scoring model and based on six criteria. The criteria were: performance, economics, flexibility, implementation, usability, and computing devices. Of the methods evaluated, the Passive Solar Design Handbook was the recommended method of analysis to be used in the Air Force. The method was written by the Los Alamos Scientific Laboratory for the Department of Energy. This method was comprehensive yet simple to use and understand. GRA

N80-31896# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEMS SODIUM-COOLED RECEIVER CONCEPT. VOLUME 2, BOOK 1: CONCEPTUAL DESIGN, SECTIONS 1 THROUGH 4 Final Report
Jan. 1980 277 p
(Contract DE-AC03-78ET-20567)
(DOE/ET-20567/1-2-Bk-1; ESG-79-30-Vol-2-Bk-1) Avail: NTIS HC A13/MF A01

Solar/fossil steam Rankine cycle, commercial scale, power plant systems that are economically viable and technically feasible are described. The market analysis, parametric analysis, and the selection process for the preferred system are given. Author (DOE)

N80-31897# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEMS SODIUM-COOLED RECEIVER CONCEPT. VOLUME 2, BOOK 2: CONCEPTUAL DESIGN, SECTIONS 5 AND 6 Final Report
Jan. 1980 317 p refs
(Contract DE-AC03-78ET-20567)
(DOE/ET-20567/1-2-Bk-2; ESG-79-30-Vol-2-Bk-2) Avail: NTIS HC A14/MF A01

Solar/fossil steam Rankine cycle, commercial scale, power plant systems that are economically viable and technically feasible are described. The detailed conceptual design and cost/performance estimates and an assessment of the commercial scale solar central receiver hybrid power system are given. Author (DOE)

N80-31898# Midwest Research Inst., Golden, Colo.
BASIC RESEARCH NEEDS AND PRIORITIES IN SOLAR ENERGY. VOLUME 1: EXECUTIVE SUMMARY. TECHNOLOGY CROSSCUTS FOR DOE
T. S. Jayadev, ed. and David Roessner, ed. Jan. 1980 49 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-351-358-Vol-1) Avail: NTIS HC A03/MF A01

Priorities for basic research important to the future development of solar energy are presented. More than 120 leading scientists who were engaged in or knowledgeable of solar related research were surveyed. The scientific disciplines included in the report were chemistry, biology, materials sciences, engineering and mathematics, and the social and behavioral sciences. Each discipline was subdivided into two to five topical areas and,

within each topical area, research needs were described and ranked according to the priorities suggested in the survey. Three categories of priority were established: Crucial, important, and needed. A narrative accompanying the description of research needs in each topical area discusses the importance of research in the area for solar energy development and presents the bases for the priority rankings recommended. DOE

N80-31899# Midwest Research Inst., Golden, Colo.
BASIC RESEARCH NEEDS AND PRIORITIES IN SOLAR ENERGY. VOLUME 2: TECHNOLOGY CROSSCUTS FOR DOE
J. S. Jayadev and D. Roessner Jan. 1980 93 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-351-358-Vol-2) Avail: NTIS HC A05/MF A01

Priorities for basic research important to the future developments of solar energy are identified, described, and recommended. The scientific disciplines included in the report are: chemistry; biology; materials sciences; engineering and mathematics; and the social and behavioral sciences. Each discipline is subdivided into two to five topical areas and within each topical area research needs are described and ranked according to the priorties suggested in the survey. Three categories of priority were established: crucial, important, and needed. The importance of research in the area for solar energy development is discussed and the bases for the priority rankings recommended are presented. DOE

N80-31900# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
SITES FOR WIND-POWER INSTALLATIONS: PHYSICAL MODELING OF THE INFLUENCE OF HILLS, RIDGES AND COMPLEX TERRAIN ON WIND SPEED AND TURBULENCE. PART 1: EXECUTIVE SUMMARY
R. N. Meroney, V. A. Sandborn, R. J. B. Bouwmeester, H. C. Chien, and M. Rider Jun. 1978 102 p refs
(Contract EY-77-S-06-2438)
(RLO-2438-78/1) Avail: NTIS HC A06/MF A01

Wind tunnel model measurements were performed to study the influence of topography profile, surface roughness and stratification on the suitability of various combinations of these variables for wind power sites. For the range of examined cases (large turbulence integral scales with respect to surface feature scales) the flow is dominated by inviscid dynamics. Detailed tables of velocity, turbulence intensity, pressure, spectra, etc., were prepared to guide numerical model design and experimental rule of thumb constrictions. Cases include hill slopes, neutral and stratified flows, two and three dimensional symmetric ridges, six alternate hill and escarpment shapes, and a variety of windward versus leeward slope combinations to evaluate ridge separation characteristics. DOE

N80-31901# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
SITES FOR WIND-POWER INSTALLATIONS: WIND CHARACTERISTICS OVER RIDGES, PART 2 Final Report
R. J. B. Bouwmeester, R. N. Meroney, and V. A. Sandborn Jun. 1978 122 p refs
(Contract EY-77-S-06-2438)
(RLO-2438-78/2) Avail: NTIS HC A06/MF A01

A wind tunnel study of the flow field over triangular shaped and sinusoidal shaped ridge models with varying upwind and downwind slopes under various thermal stratification conditions was conducted. A simple technique was developed to predict the velocity amplification profile above a ridge crest for an arbitrary ridge slope. Largest speedups were measured for the steepest symmetrical ridge which did not cause flow separation. Criteria for flow separation over ridges are provided in this report. Applicability of the results for ridges with finite width is discussed. DOE

N80-31902# Oak Ridge National Lab., Tenn.
FOSSIL ENERGY PROGRAM Quarterly Progress Report, period ending 31 Dec. 1979
Apr. 1980 336 p
(Contract W-7405-eng-26)
(ORNL-5630) Avail: NTIS HC A15/MF A01

Research and development projects that were carried out in support of the increased utilization of coal are described. Other fossil fuel alternatives to oil and gas as sources of clean energy are described. DOE

N80-31903# Acurex Corp., Mountain View, Calif. Alternate Energy Div.
DESIGN, CONSTRUCTION, AND OPERATION OF A 150 KW SOLAR-POWERED IRRIGATION FACILITY, PHASE 2 Final Report, 30 Sep. 1977 - 30 Sep. 1979
D. Duffy, M. Matteo, and D. Rafinejad May 1980 147 p refs
(Contract EG-77-C-04-4159)
(ALO-4159-1) Avail: NTIS HC A07/MF A01

A solar powered experimental facility providing 150 kW of electric power for the operation of deep well irrigation pumps was designed and constructed. The solar collectors tracked on full automatic, and the power conversion system was started and operated on automatic control. DOE

N80-31904# Rockwell International Corp., Thousand Oaks, Calif.
ADVANCED PHOTOVOLTAIC CONCENTRATOR CELLS Quarterly Technical Progress Report, 1 Dec. 1979 - 29 Feb. 1980
S. W. Zehr, H. T. Yang, J. J. Yang, and J. S. Harris, Jr. 1980 31 p refs Prepared for Midwest Research Inst., Golden, Colo.
(Contract DE-AC02-77CH-00178)
(DSE-4042-T40; QTPR-2) Avail: NTIS HC A03/MF A01

Activities aimed at demonstrating the technical feasibility of advanced high efficiency concentrator solar converters are described. They were largely focused on the development and study of low bandgap cell structures and attempts to develop suitable techniques for the thermal bonding operation. DOE

N80-31905# University of Southern California, Los Angeles. Dept. of Materials Science.
LOW COST SOLAR CELLS BASED ON AMORPHOUS SILICON ELECTRODEPOSITED FROM ORGANIC SOLVENTS Final Technical Report, 1 Sep. 1978 - 31 Aug. 1979
F. A. Kroeger 1979 34 p
(Contract EY-76-S-03-0113-040)
(SAN-0113/40-3) Avail: NTIS HC A03/MF A01

A variety of silicon compounds were chosen for electrolysis experiments. These compounds are dissolved in non aqueous solvents. Where the conductivity of the solutions is low, supporting electrolytes were added. The electrolysis was carried out using silicon nickel, conducting glass, stainless-steel or copper cathodes, graphite, platinum or silicon anodes and saturated calomel or Ag/AgCl as reference electrodes. The silicon coatings obtained by electrolysis vary in color. Energy dispersive X-ray analysis in the scanning electron microscope indicated the coatings to contain large concentrations of silicon; infrared absorption and reflection studied showed bands characteristics of SiO, SiCl or SiF vibrations, and thus indicates the presence of these elements in the films. No SiH bands were observed. Doping reagents were added to the electrolyte and a-Si coatings doped with phosphorous or boron were obtained. These were tested by hot point probe for the thermoelectric carrier type. The electrical resistance of the coatings was determined by measuring the potential drop when the electrolysis was interrupted as a function of films thickness. DOE

N80-31906# Midwest Research Inst., Golden, Colo.
DEVELOPMENT OF HIGH EFFICIENCY CASCADE SOLAR CELLS Quarterly Technical Progress Report
31 Mar. 1980 16 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T38; QTPR-3) Avail: NTIS HC A02/MF A01

Development of AlGaAsSb/GaAsSb materials, GaInP materials via VPE, GaAlAs/GaAs cell, and OM/CVD studies is reported. Spectral response, V-I characteristics, and electron microprobe analysis results are presented. DOE

N80-31907# Pennsylvania State Univ., University Park. Materials Research Lab.
CONTROLLED CADMIUM TELLURIDE THIN FILMS FOR SOLAR CELL APPLICATIONS: EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS Quarterly Progress Report, 9 Jul. - 8 Oct. 1979

K. Vedam Nov. 1979 31 p
(Contract DE-AC04-79ET-23013)
(DOE/ET-23013/T4; QPR-2) Avail: NTIS HC A03/MF A01

Numerous cadmium telluride films with excess Cd or Te were prepared by controlled RF sputtering technique and characterized. It was found that slight excess of Cd or Te affects the structure, as well as the electrical resistivity of the film, markedly. Ohmic contacts with fairly low contact resistance were achieved on Cd-rich specimens. DOE

N80-31908# Florida Univ., Gainesville. Coll. of Engineering.
PHYSICAL MODELS OF THIN FILM POLYCRYSTALLINE SOLAR CELLS BASED ON MEASURED GRAIN-BOUNDARY AND ELECTRONIC PARAMETER PROPERTIES Quarterly Report
Fredrik A. Lindholm, J. G. Fossum, P. A. Holloway, and A. Neugroschel Dec. 1979 40 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T37) Avail: NTIS HC A03/MF A01

Models were developed for recombination currents in polysilicon pn-junction solar cells. Several analytic approximations, were used and checked ultimately for self-consistency with the results of the analysis. The models were defined such that their parameters can be related directly to measurements, and the models were hence useful in interpreting experimental results. They also can be used to study, in a systematic way, cell-design modifications to improve the efficiency, e.g., grain-boundary passivation techniques. DOE

N80-31909# Mobil Tyco Solar Energy Corp., Waltham, Mass.
AMORPHOUS SILICON THIN FILM HETEROJUNCTION SOLAR CELLS Annual Report, 24 Sep. 1978 - 30 Nov. 1979
M. C. Cretella, J. A. Gregory, D. B. Sandstrom, and W. P. Paul Mar. 1980 71 p refs
(Contract DE-AC03-78ET-20460)
(DOE/ET-20460/4) Avail: NTIS HC A04/MF A01

A flexible slow discharge apparatus capable of yielding reproducible uniform films of a-Si(H) to provide a reference material for comparison with subsequent alloyed materials was developed. C substituted and Ge substituted a-Si/sub x/M/sub 1-x(H) alloys were prepared over a range of compositions and on a variety of substrate materials. Tin substitution was also attempted. Two types of measurements were made: (1) those to evaluate the material properties and (2) those to determine device characteristics. The techniques included examining the features of the infrared vibrational spectra, the determination of the absorption edge and the optical energy gap, measurements of the dark conductivity and the photo conductivity performance as solar cells and the spectral response of junction devices. Author (DOE)

N80-31910# Boeing Aerospace Co., Seattle, Wash.
EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS, CU/SUB 2-x/Se Final Report, 1 May 1979 - 30 Apr. 1980
R. A. Mickelsen, J. M. Stewart, and W. S. Chen Apr. 1980 37 p refs
(Contract DE-AC04-79ET-23005)
(DOE/ET-23005/T4) Avail: NTIS HC A03/MF A01

Copper selenide (Cu/sub 2-x/Se) films were investigated as a promising potential semiconductor material for low cost, mass produced thin film photovoltaic solar cells. Major activities were the development of the semiconductor film formation process, characterization of the deposited films, calculation of the projected cell performance from theoretical analysis, and the fabrication and testing of simple cell structures. DOE

N80-31911# Midwest Research Inst., Golden, Colo. Industrial Applications and Policy Branch.
INVESTIGATION OF LEARNING AND EXPERIENCE CURVES
Frank Krawiec, John Thornton, and Michael Edesess Apr. 1980 193 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-353-459) Avail: NTIS HC A09/MF A01

The applicability of learning and experience curves for predicting future costs of solar technologies is assessed, and the major test case is the production economics of heliostats. Alternative methods for estimating cost reductions in systems manufacture are discussed, and procedures for using learning and experience curves to predict costs are outlined. Because adequate production data often do not exist, production histories of analogous products/processes are analyzed and learning and aggregated cost curves for these surrogates estimated. If the surrogate learning curves apply, they can be used to estimate solar technology costs. However, an approach that combines a neoclassical production function with a learning by doing hypothesis is needed to yield a cost relation compatible with the historical learning curve and the traditional cost function of economic theory. DOE

N80-31912# Physical Sciences, Inc., Woburn, Mass.
COAL PROCESSING FOR FUEL CELL UTILIZATION: TASK 9: ONE-DIMENSIONAL (STREAMTUBE) MODEL FOR ENTRAINED-FLOW GASIFIER ANALYSIS
P. F. Lewis and M. L. Finson Oct. 1979 72 p refs
(Contract EW-78-A-21-8450)
(METC-8450-T2-Vol-1; TR-198A) Avail: NTIS HC A04/MF A01

A model was developed to describe the phenomena which occur in entrained flow gasifiers similar to the METC G3 approximation, and includes finite rate pyrolysis and homogeneous and heterogeneous chemistry. The model also includes radiative and conductive heat transfer, and has the capability of including a distribution of particle sizes. The results indicate that finite rate gas phase chemistry and the presence of smaller particles play a significant role in determining the location of the flame within the gasifier. DOE

N80-31913# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANALYTICAL PREDICTION OF LIQUID PHOTOVOLTAIC/THERMAL FLAT-PLATE COLLECTOR PERFORMANCE
Pattabiraman Raghuraman 29 Nov. 1979 19 p refs
(Contract EY-76-C-02-4094)
(COO-4094-66) Avail: NTIS HC A02/MF A01

A one dimensional analysis that predicts the electrical and thermal efficiencies of a liquid photovoltaic/thermal flat plate collector was developed. The analysis, reduces the 15 percent difference between analysis and measured thermal efficiency obtained by the classical analysis of Hottel and Whillier. DOE

N80-31914# Technische Hogeschool, Delft (Netherlands).
ABSORPTION REFRIGERATION MACHINE DRIVEN BY SOLAR HEAT Final Report
C. Keizer and S. H. Liem 1980 101 p refs
(EUR-6748-EN) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

A mathematical model of a single and a two stage solar absorption regrigeration system is developed in which data of collectors and weather data can be implicated. The influence of the generator, the absorber efficiencies, and the cooling temperature on the coefficient of performance (COP) of a singe and two stage absorption refrigeration process are investigated. For low generator temperatures the absorber efficiency has more influence on COP than the generator efficiency. Only spectral selective double window and high performance collectors can be used for air cooled solar absorption refrigeration systems at an evaporator temperature of -5 C. It is concluded that a water cooled solar absorption refrigeration system in combination with a solar tapwater installation for household use can be achieved with 6 to 8 square meters high performance collector area. DOE

N80-31915# Illinois Univ. at Urbana-Champaign, Urbana. Office of Vice Chancellor for Research.
ENERGY ANALYSIS OF GEOTHERMAL-ELECTRIC SYSTEMS
Robert A. Herendeen and Randall Plant Dec. 1979 215 p refs
(Contract ET-78-S-02-5085)
(COO-5085-4) Avail: NTIS HC A10/MF A01

Standard energy analysis was applied to 4 types of geothermal-electric technologies: liquid dominated, hot dry rock, geopressure, and vapor dominated. It was found that all are net energy producers. Expected uncertainties are not large enough to threaten this conclusion. Vapor dominated, the only technol-

ogy in current commercial use to produce electricity in the US, has the highest energy ratio (13 - - 4). These results for energy ratio are equal to or less than some from other workers. In the case of liquid dominated, environmental control technology has a considerable energy requirement. DOE

N80-31916# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
EFFECT OF CIRCUMSOLAR RADIATION ON PERFORMANCE OF FOCUSING COLLECTORS
Paul Bendt and Ari Rabl. Apr. 1980. 58 p. refs.
(Contract EG-77-C-01-4042)
(SERI/TR-34-093) Avail: NTIS. HC A04/MF A01

Circumsolar data are used to develop fast computational procedures for calculating the effect of circumsolar radiation on both the instantaneous and the long term average performance of focusing collectors. For predictions of long term average performance, a standard synthetic circumsolar scan has been developed that describes the brightness distribution of the solar disk (limb darkening) and of the circumsolar region. The radiation intercepted by a receiver is calculated separately for the solar portion and for the circumsolar portion of this standard Sun shape, and these two contributions are then weighted according to the long term average circumsolar ratio for the location and period under study. DOE

N80-31917# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
OPTICAL ANALYSIS OF POINT FOCUS PARABOLIC RADIATION CONCENTRATORS
Paul Bendt and Ari Rabl. Apr. 1980. 39 p. refs.
(Contract EG-77-C-01-4042)
(SERI/TR-631-336) Avail: NTIS. HC A03/MF A01

A simple formalism is developed for analyzing the optical performance of point focus parabolic radiation concentrators. To account for off axis aberrations of the parabola, an angular acceptance function is defined as that fraction of a beam of parallel radiation incident on the aperture which would reach the receiver if the optics were perfect. The radiation intercepted by the receiver of a real concentrator is obtained as a convolution of angular acceptance function, of optical error distribution, and of angular brightness distribution of the radiation source. Losses resulting from absorption in the reflector or reflection at the receiver are treated by a multiplicative factor rho alpha where rho equals reflectance of the reflector and alpha equals absorptance of the receiver. For numerical calculations, this method is more accurate and less time consuming than the ray tracing method. In many cases, there are acceptable approximations whereby the results can be obtained by reading a graph or evaluating a simple curve fit. DOE

N80-31918# Sandia Labs., Albuquerque, N. Mex. Thermal Subsystems Div.
THERMAL ENERGY STORAGE FOR SOLAR THERMAL APPLICATIONS PROGRAM. Progress Report, Oct. 1979 - Mar. 1980
Lee G. Radosevich. May 1980. 100 p. ref.
(Contract DE-AC04-76DP-00789)
(SAND-80-8218) Avail: NTIS. HC A05/MF A01

Developments in thermal energy storage technology are reported including: (1) storage for water/steam cooled collector receiver; (2) storage for molten salt cooled sensible heat collector/receiver; (3) storage for liquid metal cooled sensible heat collector/receiver; (4) storage for gas cooled sensible heat collector receiver; (5) storage for organic or silicone fluid cooled sensible heat collector/receiver; and (6) dish mounted latent heat buffer storage. DOE

N80-31919# Rockwell International Corp., Golden, Colo.
ALUMINUM-SILVER ALLOY FILMS FOR SOLAR REFLECTORS
R. D. Adams, C. W. Nordin, and K. D. Masterson. 1980. 14 p. refs. Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 21 Apr. 1980. Prepared in cooperation with Midwest Research Inst., Golden, Colo.
(Contract DE-AC04-76DP-03533)
(REP-3021; CONF-800439-5) Avail: NTIS. HC A02/MF A01

Films of aluminum silver alloys were formed using triode sputtering. Films with a wide variety of composition were produced and evaluated. Films deposited at low substrate temperatures had a high specular reflectance. At higher temperatures two phase alloys formed which had rough low reflecting surfaces. DOE

N80-31920# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR SIR GALAHAD COMPANY, SINGLE FAMILY RESIDENCE, VIRGINIA BEACH, VIRGINIA
20 Jul. 1979. 51 p.
(Contracts EX-76-A-29-1020; HUD-H-2372)
(SOLAR/1028-79/50) Avail: NTIS. HC A04/MF A01

A solar energy system designed to provide solar energy for space heating and domestic hot water heating is described. Solar energy is collected by an array of double glazed flat plate collectors with a gross area of 640 square feet. Solar energy is transferred from the collector array to a 1500 gallon above ground storage tank. Water is used as the heat collection, transfer and storage medium. Freeze protection is provided by means of circulation of hot water from storage through the collectors. Space heating demands are met by circulating hot water from storage through air heating coils in an air distribution system located in the house. Auxiliary space heating is provided by a heat pump and electric heater strips. Solar energy for preheating domestic hot water is provided by circulating water from the solar storage tank through a water to water heat exchanger located solar storage tank. The dwelling has been fully instrumented for performance evaluation since October 1978. Original cost estimates for provisioning and installation of the solar system are given. DOE

N80-31921# Honeywell, Inc., Minneapolis, Minn. Technology Strategy Center.
DUAL CURVATURE ACOUSTICALLY DAMPED CONCENTRATING COLLECTOR. Final Technical Report
G. A. Smith and R. A. Rausch. May 1980. 348 p. refs.
(Contracts EM-78-C-04-4196; DE-AC04-78CS-34196)
(DOE/CS-34196/T1) Avail: NTIS. HC A15/MF A01

The design and performance parameters of a dual curvature, concentrating solar collector are investigated. The reflector of the solar collector is achieved with a stretched film reflective surface that approximates a hyperbolic paraboloid and is capable of line focusing at concentration ratios ranging from 10 to 20X. A prototype collector was designed based on analytical and experimental component trade off activities as well as economic analyses of solar thermal heating and cooling systems incororating this type of collector. A prototype collector incorporating six 0.66 x 1.22 m (2 x 4 ft) was fabricated and subjected to a limited thermal efficiency test program. A peak efficiency of 36% at 121 C (250 F) was achieved based upon the gross aperture area. Commercialization activities were conducted, including estimated production costs of $134.44/sq m for the collector assembly (including a local suntracker and controls) and $24.33/sq m for the reflector subassembly. DOE

N80-31922# Gilbert/Commonwealth, Reading, Pa.
FEASIBILITY STUDY: FUEL CELL COGENERATION IN A WATER POLLUTION CONTROL FACILITY, VOLUME 1. Final Report
J. H. Hirschenhofer, D. B. Bailleul, L. M. Barton, R. J. Brumberg, C. E. Hannan, H. H. Fiedler, M. G. Kile, M. G. Klett, G. A. Malone, H. P. Milliron et al. Feb. 1980. 151 p. refs. Prepared in cooperation with the Bergen County Utilities Authority, Little Ferry, N.J.; Public Service Electric and Gas Co., Newark, N.J.; and United Technologies Corp., East Hartford, Conn.
(Contract DE-AC03-79ET-12431)
(DOE/ET-12431/T1-Vol-1) Avail: NTIS. HC A08/MF A01

A conceptual design study was conducted to investigate the technical and economic feasibility of a cogeneration fuel cell power plant operating in a large water pollution control facility. In this particular application, the fuel cell power plant would use methane rich digester gas from the water pollution control facility as a fuel feedstock to provide electrical and thermal energy. Several design configurations were evaluated. These configurations were comprised of combinations of options for locating the fuel cell power plant at the site, electrically connecting it with the water pollution control facility, using the rejected

power plant heat, supplying fuel to the power plant, and for ownership and operation. A configuration was selected which met institutional/regulatory constraints and provided a net cost savings to the industry and the electric utility. DOE

N80-31923# California Univ., Berkeley. Lawrence Berkeley Lab. Information Methodology Research Project.
MATERIAL-FLOW DATA STRUCTURES AS A BASIS FOR ENERGY INFORMATION SYSTEM DESIGN
V. V. Krishnan and D. F. Cahn. Apr. 1980. 20 p. refs. Presented at 9th Mid-Yr. Meeting of the Am. Soc. for Inform. Sci., Pittsburgh, 15-17 May 1980
(Contract W-7405-eng-48)
(LBL-10248; CONF-800529-3) Avail: NTIS HC A02/MF A01

The US petroleum supply and distribution system is analyzed. Data structures conducive to information system design are developed. Quantized petroleum flows among restricted channels in the distribution net form the basis of the data structure. The resultant vectorial representations provide a direct link between conceptual models of system function and information system implementations. Simultaneously, they ease otherwise difficult problems such as data validation and error isolation. DOE

N80-31924# Sandia Labs., Albuquerque, N. Mex. Midtemperature Solar Subsystems Test Facility.
FIELD EXPERIENCE WITH SOLAR CONCENTRATING COLLECTOR CONTROL SYSTEMS
H. J. Gerwin. 1980. 4 p. ref. Presented at Joint Autom. Control Conf., San Francisco, 13 Aug. 1980
(Contract DE-AC04-76DP-00789)
(SAND-79-2044C; CONF-800805-6) Avail: NTIS HC A02/MF A01

Various types of solar concentrating collectors were tested and evaluated. Each collector type has a different control system that includes a Sun tracker sensor, fluid flow control, and safety circuits for equipment protection. The Sun tracker system sensors that were tested include shadow band, linear concentrated flux, computer driven (ephemeris), optical balance, and linear flux integration. Most of the systems evaluated were early development models and comparisons are made on the basis of field test conditions. Several fluid flow control approaches were included with the collectors. Generally, the fluid controls were designed to maintain a constant temperature by either varying the pump speed or a control valve. The safety circuits were designed to operate on signals such as overtemperature, insufficient fluid flow, and overtravel. Component failures and corrective actions are also discussed. DOE

N80-31925# Sandia Labs., Albuquerque, N. Mex. Systems Analysis.
SCRAM: A FAST COMPUTATIONAL MODEL FOR THE OPTICAL PERFORMANCE OF POINT FOCUS SOLAR CENTRAL RECEIVER SYSTEMS
Kenneth D. Bergeron and Clement J. Chiang. Apr. 1980. 41 p. refs.
(Contract DE-AC04-76DP-00789)
(SAND-80-0433; TID-4500-R67-UC62) Avail: NTIS HC A03/MF A01

A mathematical approximation procedure, designated Sandia Central Receiver Approximation Model is described. A computational procedure which allows the user to define the heliostat field boundaries and tower height arbitrarily, generating a model for optical field performance, including shadowing, blocking, cosine, losses, and atmospheric attenuation, and which requires only a polynomial evaluation for each set of Sun angles was developed. One reason that the accuracy in field performance predictions is higher than that of the generating function for the model is that much of the error in the generating function is due to an oscillatory behavior associated with a moire pattern in the optical response of the heliostat field. DOE

N80-31926# Midwest Research Inst., Golden, Colo.
ANALYTICAL MODELING OF LINE FOCUS SOLAR COLLECTORS
John D. Wright. Apr. 1980. 8 p. refs. Presented at the Joint Autom. Control Conf., San Francisco, 13 Aug. 1980
(Contract EG-77-C-01-4042)
(SERI/TP-333-591; CONF-800805-1) Avail: NTIS HC A02/MF A01

Simplified models relating deviations in outlet temperature to changes in inlet temperature, insolation, and fluid flow rate are illustrated. The basic responses and the distributed parameter nature of line focus collectors are described. Detailed models were used to develop transfer functions and frequency response curves useful for design. DOE

N80-31927# California Univ., Berkeley. Sanitary Engineering Research Lab.
SOLAR ENERGY CONVERSION THROUGH BIOPHOTOLYSIS. Annual Report, 1 Apr. 1978 - 31 Mar. 1979
J. R. Benemann, M. A. Murray, P. C. Hallenbeck, K. Miyamoto, A. G. Olafsen, D. J. Esteva, and L. V. Kochian. 1 May 1979. 236 p. refs.
(Contract EY-76-S-03-0034)
(SAN-0034-239-1-T2; AR-3) Avail: NTIS HC A11/MF A01

The state-of-the-art of biophotolysis was reviewed and a bioengineering analysis carried out. The conclusions were that practical biophotolysis systems are feasible; however, they will require, in most cases, relatively long-term research and development. The biophotolysis system developed, utilizing heterocystous blue-green algae, was demonstrated both indoors and outdoors with a model converter system using the heterocystous blue-green alga Anabaena cylindrica. Maximal light energy conversion efficiencies were 2.5 percent indoors and about 0.2 percent outdoors, averaged for periods of about two weeks. Achievement of such rates required optimization of N2 supply and culture density. A small amount of N2 in the argon gas phase used to sparge the cultures was beneficial to the stability of a long-term hydrogen-production activity. A relatively small amount of the hydrogen produced by these cultures can be ascribed to the activity of the reversible hydrogenase which was studied by nitrogenase inactivation through poisoning with tungstate. DOE

N80-31928# Brookhaven National Lab., Upton, N. Y.
ELECTROLYSIS-BASED HYDROGEN STORAGE TECHNOLOGY
Gerald Strickland. Nov. 1979. 6 p. Presented at the ANS Meeting, San Francisco, 12 Nov. 1979
(Contract DE-AC02-76CH-00016)
(BNL-26923; CONF-791103-112) Avail: NTIS HC A02/MF A01

The major development areas deal with advanced water electrolysis systems, hydrogen storage materials and systems, and end-use applications. Work on hydrogen production deals with improving the system for KOH electrolysis, and on developing the acidic solid-polymer-electrolyte system for the electrolysis of water. The advantages of the techniques for storing hydrogen via metal hydrides and hollow glass microspheres are described. TiFe-based hydride was tested as an energy storage medium for electric energy storage, for automotive fuel, and for bulk hydrogen storage. Pairs of selected hydrides were used in tests simulating a solar-driven heat pump. The pressure-temperature characteristics of hydrides are being utilized in development of a hydrogen chemical compressor. Glass microspheres are being studied for the automotive fuel application. DOE

N80-31929# General Accounting Office, Washington, D. C.
FEDERAL DEMONSTRATIONS OF SOLAR HEATING AND COOLING ON COMMERCIAL BUILDINGS HAVE NOT BEEN VERY EFFECTIVE
15 Apr. 1980. 46 p.
(EMD-80-41) Avail: NTIS HC A03/MF A01

An analysis is provided of the commercial buildings solar heating and cooling demonstration program implemented by DOE. A discussion of the objectives of the law authorizing the program and an evaluation of the success of the program in meeting those objectives are included. Practicality, data dissemination, and development of a viable solar industry are discussed. DOE

N80-31930# FWG Associates, Inc., Tullahoma, Tenn.
SUMMARY OF GUIDELINES FOR SITING WIND TURBINE GENERATORS RELATIVE TO SMALL-SCALE, TWO-DIMENSIONAL TERRAIN FEATURES. Final Report
Walter Frost and Dieter K. Nowal. Mar. 1979. 395 p. refs.

(Contracts DE-AC06-77ET-20242; EY-76-C-06-2443)
(RLO-2443-77/1) Avail: NTIS HC A17/MF A01

The terrain features considered are one or more surface roughness changes on otherwise flat terrain, shelterbelts or windbreaks, and bluff and smooth contoured hills. Estimates are given of the preferred wind turbine generators (WTG) location relative to these terrain features and of the resulting degradation in available wind power due to locating the WTG other than at the preferred site. The siting criteria are based on fluid mechanics analyses of somewhat idealized terrain geometries and prevailing atmospheric conditions. Therefore, the results presented show trends and order of magnitude effects rather than absolute values. The theoretical approach to analyzing the flow field and the reliability of the analytical assumptions for each terrain feature considered are discussed in their respective sections. DOE

N80-31931# Environmental Research Inst. of Michigan, Ann Arbor.
DEMONSTRATION OF AN ADVANCED SOLAR GARDEN WITH A WATER CEILING Technical Progress Report, Jul. - 31 Dec. 1979
Reed Maes, Catherine Riseng, and G. Thomas Feb. 1980 27 p
(Contract DE-FG02-79R5-10122)
(DOE/R5-10122/1) Avail: NTIS HC A03/MF A01

The rationale of the transparent water ceiling is developed and its implementation in the solar garden is described. The experimental procedures for evaluating the water ceiling as an integral part of an ongoing garden agricultural experiment are discussed. DOE

N80-31932# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
EVALUATION OF CONTROL STRATEGIES FOR SOLAR COLLECTOR LOOPS
Mashuri L. Warren, Steven R. Schiller, and Michael Wahlig Jun. 1980 15 p refs Presented at the Am. Sec. of the ISES Conf., Phoenix, Ariz., 2-6 Jun. 1980
(Contract W-7405-eng-48)
(LBL-10716; CONF-800604-22) Avail: NTIS HC A02/MF A01

Proportional and on/off controllers were evaluated and compared using a theoretical dynamic collector model. Control strategies using various flow rates, controller set points, insolation patterns, ambient temperature conditions, and collector types are evaluated. Energy collection efficiency, parasitic power consumption, pump cycling, and auxiliary heat usage are compared. DOE

N80-31933# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
SOLAR ASSISTED HEAT PUMP STUDIES: HEAT PUMP HARDWARE AND EXPERIMENTS, SIMULATIONS, EARTH COUPLING CONTRACTS AND SUPPORTING CONTRACTS
Edward A. Kush 1980 6 p refs Presented at the Ann. DOE Active Solar Heating and Cooling Contractors Rev. Meeting, Incline, Nev., 26-28 Mar. 1980 Sponsored in Part by DOE
(Contracts EY-76-C-02-0016; DE-AC02-76CH-00016)
(BNL-27668) Avail: NTIS HC A02/MF A01

The status of the heat pump hardware development contracts, the results to date of the in house heat pumps experiments, the progress of the contractural effort in Earth coupling, and the activities of various supporting contracts are summarized. DOE

N80-31934# Minnesota Mining and Mfg. Co., St. Paul. Industrial Electrical Products Div.
THERMOELECTRIC MATERIALS EVALUATION PROGRAM Technical Summary Report
J. D. Hinderman Apr. 1979 288 p refs
(Contract EY-76-C-02-2331)
(MMM-2331-0602) Avail: NTIS HC A13/MF A01

Topical reports are presented on: (1) hot and cold end delta T's, (2) hardware mobility, (3) p-leg sublimation suppression, (4) thermodynamic stability of p-legs, (5) n-leg material process improvements to reduce extraneous resistance, (6) n-leg cracking, (7) dynamic evaluation of converter, and (8) data base and degradation modes. Twenty attachments are included which present supporting drawings, specifications, procedures, and data. DOE

N80-31935# Institute of Gas Technology, Chicago, Ill.
FUEL CELL RESEARCH ON SECOND-GENERATION MOLTEN-CARBONATE SYSTEMS Technical Report, 1 Jul. - 30 Sep. 1979
Dec. 1979 116 p refs
(Contract DE-AC03-78ET-11276; Proj. 61021)
(SAN-11276-2) Avail: NTIS HC A06/MF A01

The development and testing of fuel cell components is discussed. Structural analysis of the cell package showed that electrolyte tile cracking caused by thermal cycling can be greatly reduced by reducing the thermal expansion difference between the cell separator plate and the electrolyte tile and by reducing the ratio of the separator plate thickness to the electrolyte tile thickness. Mechanical property measuremens were made on a variety of electrolyte tile compositions. The tile microstructure (agglomerate size and LiAlO2 distribution) strongly affected the tile strength. Carbonate compositions were identified that matched more closely the thermal expansion of the metallic cell components. Cell testing of these compositions showed good performance. A potentially cost effective method of fabricating electrolyte tiles and electrodes using the tape-casting method was demonstrated. In addition, good powder quality was achieved using the spray-drying technique for electrolyte powder preparation. DOE

N80-31936# Aerodyne Research, Inc., Bedford, Mass.
CHARACTERIZATION OF OPEN-CYCLE, COAL-FIRED MHD GENERATORS Quarterly Technical Progress Report, 1 Jul. 1978 - 30 Apr. 1979
C. E. Kolb, J. Wormhoudt, V. Yousefian, W. Cheng, F. Bien, M. Martinez-Sanchez, and J. Silver May 1979 100 p refs
(Contract EX-76-C-01-2478)
(ARI-RP-43; QTPR-9; QTPR-10) Avail: NTIS HC A05/MF A01

The successful design of full scale open cycle, coal fired MHD generators for baseload electrical production requires a detailed understanding of the plasma chemical and plasma dynamic characteristics of anticipated combustor and channel fluids. Progress in efforts to model negative ion formation and slag condensation effects on core flow conductivity, to improve the ability to sample and characterize laboratory produced coal combustion plasmas, and to measure mechanisms and rates of slag oxide condensation are discussed. A set of parametric calculations showing the influence of various input parameters on a nominal full scale, supersonic generator system is also presented. DOE

N80-31937# United Technologies Corp., South Windsor, Conn. Power Systems Div.
AC/DC POWER CONVERTER FOR BATTERIES AND FUEL CELLS Annual Report
R. W. Rosati, J. L. Peterson, and J. R. Vivirito Dec. 1979 211 p refs
(EPRI Proj. 841-1)
(EPRI-EM-1286) Avail: NTIS HC A10/MF A01

The leading commutating circuit options for an advanced self-commutated-type power converter were tested and analyzed by computer simulation. An analytical and experimental evaluation of advanced commutation circuits, and evaluation of alternative advanced bridge design, selection of the most desirable conceptual design, and the development of a mathematical models converter response are described. Experimental data and preliminary converter specifications are contained in the appendixes. DOE

N80-31938# United Technologies Corp., South Windsor, Conn. Power Systems Div.
DEVELOPMENT OF MOLTEN CARBONATE FUEL CELL POWER PLANT TECHNOLOGY Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1979
H. C. Healy, R. A. Sanderson, R. J. Wertheim, P. F. Farris, A. P. Mientek, R. C. Nickols, M. Katz, R. P. Iczkowski, R. R. Fredley, R. C. Stewart et al Mar. 1980 80 p
(Contract DE-AC01-79ET-15440)
(DOE/ET-15440/1; QTPR-1) Avail: NTIS HC A05/MF A01

A study baseline fuel cell system and module configuration

were established. Studies to determine user requirements and to characterize the fuel cell power block and coal gasifier subsystems were initiated. Cell stack design was initiated with completion of preliminary design requirements for the cell cathodes. Laboratory tests were also initiated to identify alternative materials for separator plates, reactant manifold seals, and electrolyte tile fillers. A mechanical tape casting technique for producing 18 x 24 inch sheets of electrolyte matrix tape was successfully demonstrated. Theoretical and experimental studies were initiated to define the effects of known sulfur contaminants on cell performance. A literature survey was initiated to identify other possible contaminants. Planning and design efforts for construction of a mobile cell test unit were initiated. The mobile unit will be used to verify the molten carbonate cell's ability to operate on gasified coal by tests at a gasifier site. DOE

N80-31939# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.

ASSESSMENT OF INDUSTRIAL ENERGY CONSERVATION BY UNIT PROCESSES

Doan L. Phung, Willem vanGool, David A. Boyd, Dominique Casavant, Warren D. Devine, Jr., Heriberto Plasa, and William G. Pollard Mar. 1980 191 p

(Contract DE-AC05-76OR-00033)

(ORAU/IEA-80-4-M) Avail: NTIS HC A09/MF A01

The investment required to produce a given amount of conservation, the amount of conservation to be accomplished before costs equal those of new supply, and how a given investment should be allocated to yield the largest energy savings are questions addressed from the perspective of energy use in industrial unit operations. It was found that: a real energy minimum exists which is distinct from the process thermodynamic limit and this minimum represents the limit to conservation; cost/energy relationships for an industrial process can be described to first approximation by a single technology parameter which is characteristic of that particular technology; the technology parameter permits competing technologies to be ranked by energy saving potential for a given investment; and government investment in conservation can be allocated for greatest return using the technology parameters of, and the fractions of energy use by, each of the unit operations. Energy embodied in conservation equipment may, under certain circumstances, decrease the rate at which the benefits of conservation appear in national energy accounts. DOE

N80-31940# Battelle Columbus Labs., Ohio.

PILOT STUDY TO SELECT CANDIDATES FOR ENERGY CONSERVATION RESEARCH FOR THE CHEMICAL INDUSTRY Final Report

J. E. Burch, J. L. Otis, and R. W. Hale 15 Nov. 1979 116 p refs

(Contract W-7405-eng-92)

(DOE/TIC-11114) Avail: NTIS HC A06/MF A01

The functions and energy consumption of the various unit operations involved in several chemical processes are studied and areas where research could lead to energy-conservation options of broad utility to the chemical industry are identified. Four energy-intensive chemical processes which produce ammonia and carbon dioxide, chlorine and caustic soda, carbon black, and ethylbenzene and styrene were selected. Information was obtained from the literature on the structure of the industry sectors and the production technologies, and was used to determine material balances, process streams, temperatures, pressures, and energy requirements for the various unit operations. An energy matrix was prepared for each process, showing the function provided by and the energy involved in each unit operation or process. A variety of chemical engineers and chemists analyzed the energy matrices, flow charts, and other information for each process and made suggestions as to areas wherein research might be expected to produce energy saving results. DOE

N80-31941# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

RESIDENTIAL SOLAR HEATING AND COOLING USING EVACUATED TUBE SOLAR COLLECTORS: CSU SOLAR HOUSE 3, EXECUTIVE SUMMARY Final Report, 1 Feb. 1976 - 30 Sep. 1978

Dan S. Ward, John C. Ward, and H. S. Oberoi Mar. 1979 50 p refs

(Contract EY-76-C-02-2858)

(COO-2858-24) Avail: NTIS HC A03/MF A01

A residential solar heating and cooling system installed in Colorado State University (CSU) Solar House 3 is described. From 1 February 1976 through 31 May 1978 the CSU Solar House 3 system utilized the Owens-Illinois liquid heating evacuated tube solar collector. During the period 1 June 1978 through 30 September 1978, the Chamberlain liquid heating, state-of-the-art plate solar collector was evaluated for a complete cooling season. DOE

N80-31942# Arizona State Univ., Tempe. School of Engineering.

TERRESTRIAL PHOTOVOLTAIC POWER SYSTEMS WITH SUNLIGHT CONCENTRATION

C. E. Backus and B. D. Wood Mar. 1980 191 p refs

(Contract EY-76-C-04-0789)

(SAND-80-7008) Avail: NTIS HC A09/MF A01

Experiments were conducted on the flux uniformity and spectral distribution in the concentrated sunlight under a 1.08 meter. The preliminary data from these experiments show that the short circuit currents from a cell are directly proportional to the total illumination falling on the surface of the cell and not on the uniformity of the light profile. An available gallium aluminum arsenide cell was used with a hot mirror and a silicon cell to demonstrate that the efficiency of the combined system is greater than that achievable with the use of a single cell. An algorithm for calculating the electrical and thermal performance of a linear concentrated cell array developed. This computer program, based on quasi-steady state analysis, will calculate the array temperature and electrical outputs based on the day, time, transfer fluid inlet temperature and flow rate, ambient temperature, wind speed and direction, optical characteristics of the linear concentrator and solar irradiation. DOE

N80-31943# Aerospace Corp., El Segundo, Calif. Energy and Resources Div.

EVALUATION OF LINE FOCUS SOLAR CENTRAL POWER SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY

15 Mar. 1980 28 p refs

(Contract EY-76-C-03-1101)

(ATR-80(7773-03)-1-Vol-1) Avail: NTIS HC A03/MF A01

An evaluation was completed to ascertain the applicability of line focus technologies to electrical power applications and to compare their performance and cost potential with point focus central receiver power systems. Although the high temperature line focus and fixed mirror line focus concepts duplicate the heat source characteristics and power conversion technology of the central receiver concepts, these configurations do not offer a sufficient improvement in cost to warrant full scale development. The systems are less complex than their point focus counterpart and should the central receiver system development falter they provide reasonable technology alternatives. DOE

N80-31944# Aerospace Corp., El Segundo, Calif. Energy Resources Div.

EVALUATION OF LINE FOCUS SOLAR CENTRAL POWER SYSTEMS. VOLUME 2: SYSTEMS EVALUATION

15 Mar. 1980 213 p refs

(Contract EY-76-C-03-1101)

(ATR-80(7773-03)-1-Vol-2) Avail: NTIS HC A10/MF A01

An evaluation was completed to ascertain the applicability of line focus technologies to electrical power applications and to compare their performance and cost potential with point focus central receiver power systems. It was concluded that although the high temperature line focus and fixed mirror line focus concepts duplicate the heat source characteristics and power conversion technology of the central receiver concepts, these configurations do not offer a sufficient improvement in cost to warrent full scale development. The systems are, however, less complex than their point focus counterpart and should the central receiver system development falter they provide reasonable technology alternatives. The parabolic trough concept was found to provide a low temperature technology alternative to the central receiver concept with promising performance and cost potential. DOE

N80-31945# Massachusetts Univ., Amherst.
CONTINUED EVALUATION OF COMPACT HEAT EXCHANGERS FOR OTEC EVALUATION Final Report
J. G. McGowan DOE Oct. 1979 141 p refs
(Contract EG-77-S-02-4238)
(COO-4238-14) Avail: NTIS HC A07/MF A01

Investigations were carried out to establish the applicability of compact plate type heat exchangers to OTEC power systems and to (1) provide experimental verification of predicted performance (heat transfer and fluid flow) under OTEC operating conditions (using NH2); (2) provide initial performance data for several desirable plate type OTEC heat exchanger panels; (3) provide test apparatus for continued experimental testing of OTEC compact heat exchanger panels; and (4) provide design information on applicable manufacturing processes maintenance requirements and arrangement concepts for plate type heat exchangers. DOE

N80-31946# Department of Energy, Washington, D. C. Assistant Secretary for Conservation and Solar Energy.
OCEAN ENERGY SYSTEMS: MULTIYEAR PROGRAM PLAN
May 1980 130 p
(DOE/CS-0161) Avail: NTIS HC A07/MF A01

Specific planned activities to be conducted by the Department of Energy in connection with the Ocean Energy System Program for FY 1979 through FY 1984 are described. Program funding is presently 95 percent OTEC, with 5 percent directed toward alternate energy sources such as salinity gradients waves and currents, technical status, ocean energy systems resource requirements, issues, and a management plan are discussed. DOE

N80-31947# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
EFFICIENCY OF ENERGY CONVERSION IN NITINOL
Richard D. Kopa Sep. 1979 77 p refs Presented at the Nitinol Heat Engine Conf., Silver Spring, Md., 26 Sep. 1978
(Contract W-7405-eng-48)
(LBL-9750; CONF-7809211-1) Avail: NTIS HC A05/MF A01

The efficiency of the energy conversion in Nitinol was investigated experimentally. An electronically controlled Cycle Simulator subjected a single Nitinol wire element to the stress strain temperature cycles corresponding to a specific thermodynamic cycle. The test parameters, which were varied singly or in combination, included various stress levels, stress rates, percent of elongation of the wire, temperature levels, heating and cooling rates, cycling speeds, etc. Efficiency values as a function of these variables were plotted in graphs and the factors affecting efficiency are discussed. The fundamental limitation of the energy conversion efficiency is set by the inefficient type of thermodynamic cycle - namely, the isothermal cycle - to which the solid state heat engine operation is restricted. DOE

N80-31948# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEMS SODIUM-COOLED RECEIVER CONCEPT. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jan. 1980 48 p refs
(Contract DE-AC03-78ET-20567)
(DOE/ET/20567-1/1; ESG-79-30-Vol-1) Avail: NTIS HC A03/MF A01

Solar/fossil steam Rankine cycle, commercial scale, power plant systems are presented. Economical viability and technical feasibility of the systems is considered. DOE

N80-31949# Aerospace Corp., El Segundo, Calif. Energy and Resources Div.
RESIDENTIAL PHOTOVOLTAIC SYSTEMS: A REVIEW AND COMPARATIVE EVALUATION OF FOUR INDEPENDENT STUDIES OF POTENTIAL CONCEPTS
Fred C. Finlayson Apr. 1980 75 p ref
(Contract DE-AC04-76DP-00789)
(SAND-80-7010) Avail: NTIS HC A04/MF A01

Four independent studies of residential applications of photovoltaic generating systems were recently conducted by major industrial contractors: General Electric, Westinghouse, MIT-Lincoln Labs, and The Aerospace Corporation. The conclusions of the contractors had a number of important similarities and differences. An analysis of the several contractor's results, together with an identification of the sources of their similarities and differences is presented. DOE

N80-31950# Battelle Columbus Labs., Ohio.
PHOTOVOLTAIC INSTITUTIONAL ISSUES STUDY
George A. Watkins, Gerry Noel, John Hagely, John Broehl, Mary Duchi, Harry Smail, Tom Martineau, and Ben Maiden Apr. 1980 223 p refs
(Contracts DE-AC04-76DP-00789; W-7405-eng-92)
(SAND-79-7054) Avail: NTIS HC A10/MF A01

Institutional issues are presented in the context of nine prototypical systems, designed to reflect institutional issue variation. Key institutional issues associated with each of the aforementioned issue areas were explored to demonstrate their relevance to application of photovoltaics. Programmatic recommendations are made which could serve to address institutional issues identified. Opportunities for those persons, agencies and governmental entities involved in the commercialization and widespread use of photovoltaics to address the institutional issues identified are included. DOE

N80-31951*# Argonne National Lab., Ill. Integrated Assessments and Policy Evaluations Group.
METHODOLOGY FOR THE COMPARATIVE ASSESSMENT OF THE SATELLITE POWER SYSTEM (SPS) AND ALTERNATIVE TECHNOLOGIES
T. Wolsko, W. Buehring, R. Cirillo, J. Gasper, L. Habegger, K. Hub, D. Newsom, M. Samsa, E. Stenehjem, and R. Whitfield Jan. 1980 79 p refs Sponsored by NASA
(Contract W-31-109-eng-38)
(NASA-CR-163049; DOE/ER-0051) Avail: NTIS HC A05/MF A01

The energy systems concerned are the satellite power system, several coal technologies, geothermal energy, fission, fusion, terrestrial solar systems, and ocean thermal energy conversion. Guidelines are suggested for the characterization of these systems, side-by-side analysis, alternative futures analysis, and integration and aggregation of data. A description of the methods for assessing the technical, economic, environmental, societal, and institutional issues surrounding the development of the selected energy technologies is presented. DOE

N80-31952# Ames Lab., Iowa.
PHOTOELECTROCHEMICAL SOLAR CELLS BASED ON D-BAND ELECTROCHEMISTRY AT TRANSITION METAL DISELENIDES Technical Progress Report, 14 Aug. - 30 Nov. 1979
Thomas E. Furtak and Bruce A. Parkinson Feb. 1980 20 p refs
(Contracts W-7405-eng-82; EG-77-C-01-4042)
(IS-4724) Avail: NTIS HC A02/MF A01

Successful growth of WSe2 crystals led to the production of photocells which operate with greater than 5 percent monochromatic power conversion efficiency in I(-)/I2 solution. Scanning light spot maps were used to identify and evaluate inhomogeneities across the surface and to serve as a reference for the edge passivation program which helped improve performance significantly. Results are discussed. DOE

N80-31953# University of Southern California, Los Angeles. Dept. of Materials Science.
LOW COST SOLAR CELLS BASED ON AMORPHOUS SILICON ELECTRODEPOSITED FROM ORGANIC SOLVENTS Final Technical Report, 1 Sep. 1978 - 31 Aug. 1979
F. A. Kroeger 1979 34 p
(Contract EY-76-S-03-0113)
(SAN-0113-040-T6) Avail: NTIS HC A03/MF A01

A variety of silicon compounds were chosen for electrolysis experiments viz, silicon tetrachloride, silicon tetrabromide, tetraethylorthosilicate, potassium hexafluoro silicate and ammonium hexafluoro silicate. These compounds are dissolved in non aqueous solvents, acetone, acetic acid, ethylene glycol, propylene glycol, propylene carbonate, pyridine, ethylene diamine,

1-chloropropane, formamide, N-Ndi methyl formamide, etc. Where the conductivity of the solutions is low, supporting electrolytes like tetrabutyl ammonium chloride, bromide or perchlorate are added. The electrolysis was carried out using, silicon nickel, conducting, glass, stainless-steel or copper cathodes, graphite, platinum or silicon anodes and saturated calomel or Ag/AgCl as reference electrodes. DOE

N80-31954# Sandia Labs., Albuquerque, N. Mex. Solar Energy Systems Analysis
ANALYTICAL EVALUATION OF A SOLAR THERMOPHOTOVOLTAIC CONVERTER
Michael W. Edenburn May 1980 30 p refs
(Contract DE-AC04-76DP-00789)
(SAND-78-1962) Avail: NTIS HC A03/MF A01

A solar thermophotovoltaic (TPV) converter uses concentrated sunlight to heat a cavity-enclosed emitter to a few thousand degrees kelvin. The emitter illuminates photovoltaic cells with thermal radiation, and the cells convert the radiation into electricity. Emitter temperature, cell reflectance to radiation with energy below the cell's bandgap energy, and concentration ratio requirements are parametrically considered. Concentration ratio is treated in a rigorous manner to determine what concentration values can be practically achieved and what influence they have on converter performance. Important conclusions reached are that an emitter temperature of 2000 K is close to optimum and a cell reflectance value of 0.98 is required for below bandgap radiation. A secondary concentrator must be used and a primary mirror quality resulting in a 4 milliradian reflected-beam dispersion must be obtained to achieve a 24% conversion efficiency. DOE

N80-31955# South Dakota Univ., Vermillion.
PASSIVE SOLAR HEATING OF BUILDINGS WITH ATTACHED GREENHOUSE Progress Report, 29 Feb. - 29 Apr. 1980
Robert W. Jones Apr. 1980 28 p
(Contract DE-AC02-79CS-30242)
(DOE/CS-30242/2) Avail: NTIS HC A03/MF A01

The thermal performance of attached greenhouse buildings analyzed in order to determine the component sizes and configurations which optimize performance. The analytical method is dynamic computer simulation using a thermal network model and actual hourly meteorological and solar radiation data from the northcental region. Conclusions on design guidelines are discussed. DOE

N80-31956# Sandia Labs., Albuquerque, N. Mex. Exploratory Batteries Div.
LONG-TERM LITHIUM BATTERY TESTS, 2 Semiannual Report
Samuel C. Levy Mar. 1980 16 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-1383; SAR-2) Avail: NTIS HC A02/MF A01

Data from the second 6 month period of a 6 year test of ambient temperature lithium batteries are reported. Lithium-sulfur dioxide cells from three manufacturers and lithium-polycarbon monofluoride cells from a fourth are included. One year's storage at room temperature or below had a minor effect on capacity. Storage at 49 C resulted in a significant capacity loss. Two mechanisms were identified that may result in premature failure of cells stored at elevated temperatures: corrosion of an aluminum-to-tantalum weld in the positive terminal, and an attack on the glass-to-metal seal in the header. Continuous discharge under a pulsed load resulted in a considerable loss of capacity. A white deposit containing oxide, sulfate, and some carbonate was found in these cells at the anode-to-case contact. DOE

N80-31957# Sandia Labs., Albuquerque, N. Mex. Aerodynamics Dept.
AERODYNAMIC PERFORMANCE OF A 5-METRE-DIAMETER DARRIEUS TURBINE WITH EXTRUDED ALUMINUM NACA-0015 BLADES
Robert E. Sheldahl, Paul C. Klimas, and Louis V. Feltz Mar. 1980 41 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0179) Avail: NTIS HC A03/MF A01

A 5 metric-diameter vertical-axis wind turbine with extruded aluminum blades of NACA-0015 airfoil cross section was tested. Several turbine rotational speeds are presented and compared with earlier test results. Performance comparison is made with a vortex/lifting line computational code. DOE

N80-31958# New Mexico Univ., Albuquerque. Civil Engineering Research Facility.
AUTOMATIC-CONTROL SYSTEM FOR THE 17-METRE VERTICAL AXIS WIND TURBINE (VAWT)
Gerald M. McNerney Mar. 1980 49 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0984) Avail: NTIS HC A03/MF A01

An automatic control system was designed and implemented to study automatic control of a vertical axis wind turbine (VAWT) and to better judge the fatigue life and reliability of the VAWT under what will be normal operating conditions for power production. This system, including the necessary hardware, is discussed in detail along with a simplified cost analysis. DOE

N80-31959# Los Alamos Scientific Lab., N. Mex.
PASSIVE SOLAR SPACE HEATING
J. Douglas Balcomb 1980 11 p refs Presented at the Am. Sect. of the ISES Conf., Phoenix, Ariz., 2 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1076; CONF-800604-11) Avail: NTIS HC A02/MF A01

An overview of passive solar space heating is presented. Trends in design, new developments, performance measures, analytical design aids, and monitored building results are given. DOE

N80-31960# Little (Arthur D.), Inc., Cambridge, Mass.
LARGE WIND TURBINE GENERATOR PERFORMANCE ASSESSMENT Technology Status Report
W. A. Vachon Jan. 1980 90 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 1348-1)
(EPRI-AP-1317; TSR-1) Avail: NTIS HC A05/MF A01

Large wind turbine generator development and field test activities are presented. An approach for gathering, distilling, and assessing WT test data is presented, with emphasis on the usefulness of the data to the industry. DOE

N80-31961# General Electric Co., Schenectady, N. Y. Energy Systems Programs Dept.
DEVELOPMENT OF ADVANCED BATTERIES FOR UTILITY APPLICATION Interim Report, 1 Sep. 1977 - 30 May 1979
S. P. Mitoff Feb. 1980 345 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 128-4; EPRI Proj. 128-5)
(EPRI-EM-1341) Avail: NTIS HC A15/MF A01

Sodium-sulfur batteries for utility load-leveling applications are considered. Safety tests demonstrated the need for a safety insert for the sodium to limit the rate sodium and sulfur could react in the event of a beta tube failure. Performance testing demonstrated a cell capacity greater than the 168 Ah design value, but the electrical resistance was approximately 30% greater than the design value. Two concepts for a 100 kWh battery module were investigated. The first uses forced-convection nitrogen cooling. The second uses liquid organic coolant and is more compact and less costly, and provides better temperature control. However, the organic coolant design introduces potential fire hazards and corrosion concerns. A model was developed and experiments were performed to characterize the performance of the resistive mat between the polysulfides and the ceramic electrolyte. Also, a new measurement of the entropy change associated with the sodium-sulfur reaction was completed. DOE

N80-31962# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
GALLIUM ARSENIDE SOLAR CELLS FOR VERY HIGH CONCENTRATION SYSTEMS: RECENT RESULTS, PROBLEMS AND EXPECTATIONS [CELLE SOLARI ALL'ARSENIURO DI GALLIO PER SISTEMI AD ALTISSIMA CONCENTRAZIONE: RISULTATI RECENTI, PROBLEMI E PROSPETTIVE]
G. Guarini Oct. 1979 12 p refs In ITALIAN Presented at Conf. on Conversione Foltovoltaica dell'Energia Solar, Milan,

18-19 Oct. 1979
(CISE-1518) Avail: NTIS HC A02/MF A01

The state-of-the-art of solar cell research for use under highly concentrated solar radiation is reviewed. The application of GaAlAs-GaAs cells, systems using thermal recovery, and research on multi-energy levels are discussed. It is concluded that high concentration systems based on GaAlAs multicolor cells with efficiency over 30% appear to be attractive and economically feasable solutions. The three junction monolithic cell (efficiency 40-45%) is an important research goal.
Author (ESA)

N80-31963*# New Mexico Univ., Albuquerque. Technology Application Center.
SOLAR THERMAL HEATING AND COOLING. A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Progress Report, Apr. - Jun. 1979
Mike Arenson Aug. 1979 207 p
(Contract NASw-2936)
(NASA-CR-163535; PB80-174030; TAC-STHC-79-002) Avail: NTIS HC $27.50/MF $27.50 CSCL 13A

This bibliographic series cites and abstracts the literature and technical papers on the heating and cooling of buildings with solar thermal energy. Over 650 citations are arranged in the following categories: space heating and cooling systems; space heating and cooling models; building energy conservation; architectural considerations, thermal load computations; thermal load measurements, domestic hot water, solar and atmospheric radiation, swimming pools; and economics. GRA

N80-31964*# New Mexico Univ., Albuquerque. Technology Application Center.
SOLAR THERMAL COMPONENTS. A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, Jan. - Mar. 1979
William R. Bozman, ed. Jun. 1979 86 p
(Contract NASw-2936)
(NASA-CR-163448; PB80-115249; TAC-STHC-79-001) Avail: NTIS HC $27.50/MF $27.50 CSCL 10A

This bibliographic series cites and abstracts literature and technical papers on components applied to solar thermal energy utilization. The quarterly volumes are divided into ten categories: material properties; flat plat collectors; concentrating collectors; thermal storage; heat pumps; coolers and heat exchangers; solar ponds and distillation; greenhouses; process pleat; and irrigation pumps. Each quarterly volume is compiled from a wide variety of data bases, report literature, technical briefs, journal articles and other traditional and non traditional sources. The Technology Application Center maintains a library containing many of the articles and publications referenced in the series. GRA

N80-31965# National Technical Information Service, Springfield, Va.
WIND POWER. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - May 1980
Audrey S. Hundemann Jun. 1980 145 p Supersedes NTIS/PS-79/0534; NTIS/PS-78/0416
(PB80-811458; NTIS/PS-79/0534; NTIS/PS-78/0416) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

The feasibility, use and engineering aspects of wind power and windmills are discussed in these citations of Federally funded research reports. Abstracts primarily cover the use of wind power for electric power generation and wind turbine design and performance. General studies dealing with comparative analyses of wind power and alternative energy sources are included, as are energy storage devices which can be used in these systems. This updated bibliography contains 135 abstracts, 112 of which are new entries to the previous edition. GRA

N80-31966# Patent and Trademark Office, Washington, D. C. Office of Technology Assessment and Forecast.
PATENT PROFILES: SOLAR ENERGY
Jan. 1980 195 p
(PB80-190010) Avail: NTIS HC A09/MF A01 CSCL 10A

Profiles of United States patenting in five major areas of solar energy technology, and in the related areas of wind, geothermal and tide and wave energy are presented. A list of assignees ranked by the number of patents in the technology to which they held title at the time of the patent grant is provided. Assignees are listed alphabetically followed by a numerical listing of patents to which they held title at the time of patent grant.
GRA

N80-31967# Utah Water Research Lab., Logan. Coll. of Engineering.
DESIGN OF A COST EFFECTIVE SOLAR POWERED WATER PUMP
Duane G. Chadwick Apr. 1980 44 p refs
(Contract DI-14-34-0001-8047)
(PB80-182819; UWRL/H-80-02; W80-05011; OWRT-A-036-UTAH-1) Avail: NTIS HC A03/MF A01 CSCL 13K

The basic design consists of an expanding gaseous piston confined inside a chamber which is located in series with, and between, an inlet and an outlet check valve. The gas is generated by volatilizing cyclopentane or hexane. Four variations of this basic design concept were built and evaluated. Considerations in the choice of a cost effective solar collector are also reviewed. A 70 C heat source temperature is required to operate the pump if cyclopentane is used as the volatile fluid, 90 C is required if hexane is used. The pumps have a capacity of approximately 6 liters/minute when pumped to a height of 2 meters. Two square meters of sunshine are sufficient to operate the pump.
GRA

N80-31968# Dartmouth Coll., Hanover, N.H. Resource Policy Center.
INTERACTIONS BETWEEN ENERGY SUPPLY AND TRANSPORTATION-RELATED ENERGY USE, VOLUME 1 Final Report
Thomas J. Adler, John W. Ison, and Jay C. Geinzer Jan. 1980 177 p refs
(Contract DOT-RC-82003)
(PB80-185002; DOT/RSPA/DPB-50-80-7) Avail: NTIS HC A09/MF A01 CSCL 10A

The structure of ENTRANS and some of its policy analysis applications are described. ENTRANS is a computer simulator model of the interactions between energy supply and transportation related energy use. It includes a complete representation of the characteristics of transportation supply (public transit, carpooling, highways, and autos) and of households' travel related decisions (car type, travel mode, trip length, and frequency choices). The model is capable of analyzing a wide range of policies designed to change automobile fuel use. The results of several detailed policy analyses are described. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-31969*# University of Central Florida, Orlando. Dept. of Biological Sciences.
A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEMS (STS) AT JOHN F. KENNEDY SPACE CENTER. VOLUME 4: THREATENED AND ENDANGERED SPECIES OF THE KENNEDY SPACE CENTER. PART 1: MARINE TURTLE STUDIES Final Report, 1976 - 1979
L. M. Ehrhart Sep. 1980 417 p refs
(Contract NAS10-8986)
(NASA-CR-163122-Vol-4-Pt-1; TR-51-2-Vol-4Pt-1) Avail: NTIS HC A18/MF A01 CSCL 13B

The status of marine turtle populations in the KSC area was studied using data from previous results from ground and aerial surveillance conducted from 1976 to April 1979. During ground surveillance, various data were recorded on emergent turtles such as: species, weight, tag number (if previously tagged), time discovered, activity at discovery and the location of discovery. Observations were also made on nesting and reproductive characteristics, population estimates, immigration and emigration and growth rate of the turtles. Mortality studies were additionally made and autopsies performed on dead turtles found in the area. It is concluded that further mortality documentation should be done just prior to and just after a future space launch operation

in order to accurately assess the cause and effect relationship of such a launch on the turtle population. A.R.H.

N80-31970*# University of Central Florida, Orlando. Dept. of Biological Sciences.
A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEMS (STS) AT JOHN F. KENNEDY SPACE CENTER. VOLUME 4: THREATENED AND ENDANGERED SPECIES OF THE KENNEDY SPACE CENTER. PART 2: THREATENED AND ENDANGERED BIRDS AND OTHER THREATENED AND ENDANGERED FORMS Final Report, Sep. 1976 - Apr. 1979
L. M. Ehrhart Sep. 1980 148 p refs
(Contract NAS10-8986)
(NASA-CR-163122-Vol-4-Pt-2; TR-51-2-Vol-4-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 06C

Data are presented which were collected by ground and aerial surveillance of 37 species of birds observed within the environs of KSC which are on lists of rare and endangered biota in Florida. Additional information was obtained on other threatened species such as the West Indian manatee, the salt marsh snake, the Indigo snake, the Gopher tortoise, the American alligator, and the Florida mouse. Results of the literature search were used to obtain a historical perspective and aid in the analysis of the field data collected. A.R.H.

N80-31971*# Alabama Univ. in Huntsville. School of Science and Engineering.
NUMERICAL SIMULATION OF ADVECTION FOG FORMATION ON MULTI-DISPERSE AEROSOLS DUE TO COMBUSTION-RELATED POLLUTANTS Final Report
R. J. Hung and G. S. Liaw Jul. 1980 118 p refs
(Contract NAS8-31729)
(NASA-CR-161566; UAH-RR-248) Avail: NTIS HC A06/MF A01 CSCL 13B

The effects of multi-disperse distribution of the aerosol population are presented. Single component and multi-component aerosol species on the condensation/nucleation processes which affect the reduction in visibility are described. The aerosol population with a high particle concentration provided more favorable conditions for the formation of a denser fog than the aerosol population with a greater particle size distribution when the value of the mass concentration of the aerosols was kept constant. The results were used as numerical predictions of fog formation. Two dimensional observations in horizontal and vertical coordinates, together with time-dependent measurements were needed as initial values for the following physical parameters: (1)wind profiles; (2) temperature profiles; (3) humidity profiles; (4) mass concentration of aerosol particles; (5) particle size distribution of aerosols; and (6) chemical composition of aerosols. Formation and dissipation of advection fog, thus, can be forecasted numerically by introducing initial values obtained from the observations. T.M.

N80-31972# Mission Research Corp., Santa Barbara, Calif.
THE INCREASED ATTACHMENT DUE TO IONIZATION INDUCED SMOG IN EMP ENVIRONMENTS Final Report, 1 Apr. 1977 - 31 Oct. 1979
Murray Scheibe 31 Oct. 1979 37 p refs
(Contract DNA001-77-C-0224)
(AD-A087850; AD-E300859; MRC-R-532; DNA-5077F) Avail: NTIS HC A03/MF A01 CSCL 07/1

The increased electron attachment due to HNO3 production in the EMP source region is investigated. The HNO3 produced is found to be roughly linear with the total ionization up to an ionization value of about 2 x 10 to the 16th power ion pairs. Above this, the HNO3 production is less than linear. Although the attachment to HNO3 was not enough to explain the lightning strokes in the Mike shot, it can affect the field in the EMP source region. The attachment to other species via endothermic reactions which involve electrons which have been heated by the electric field was also investigated. It was concluded that only those reactions in which the energy change is small, such as the reactions with O3 and HNO2 and H2O2, hold much hope of contributing significantly to the overall attachment. The necessary experimental data for these reactions, however, is not available. GRA

N80-31973# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Lab.
REMOTE SENSING PROCEDURES FOR DETECTING AND MONITORING VARIOUS ACTIVITIES REGULATED BY THE MOBILE DISTRICT Final Report, Oct. 1976 - Sep. 1978
Horton Struve and William L. Kirk Apr. 1980 397 p refs
(AD-A087584; WES/TR/EL-80-1) Avail: NTIS HC A17/MF A01 CSCL 14/5

The objective of this study was to develop procedures for use by the U.S. Army Engineer District, Mobile, to detect and monitor activities requiring a Corps of Engineers permit pursuant to Section 404 of the Federal Water Pollution Control Act Amendments of 1972, Section 10 of the River and Harbor Act of 1899, and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972. The detection and monitoring procedures developed in this study included three methods of acquiring remotely sensed data: satellite and aircraft borne digital scanner methods and airborne photographic methods. The two digital scanner systems investigated for the study were the LANDSAT Multispectral Scanner System and the National Aeronautics and Space Administration Modular Multispectral Scanner. The equipment and procedures used in these systems, which obtain the type of information required by the Regulatory Functions Branch, Mobile District, are described. Aerial photographic systems are described, and examples of several applications of detection and monitoring procedures involving wetlands, waterbodies, and structures are given. A summary of available remote sensing imagery from Federal and State agencies is given. GRA

N80-31974# Los Alamos Scientific Lab., N. Mex. Enviornmental Surveillance Group.
LASL EXPERIENCE IN DECONTAMINATION OF THE ENVIRONMENT
A. John Ahlquist 1979 19 p refs Presented at the Environ. Decontamination Workshop, Oak Ridge, Tenn., 4 Dec. 1979
(Contract W-7405-eng-36)
(LA-UR-80-926; CONF-791234-2) Avail: NTIS HC A02/MF A01

Land area surveys for radioactive contamination are reviewed. Cleanup of lands considered to have unacceptable levels of radioactive contamination is described. DOE

N80-31975# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK Progress Report, Feb. 1980
Feb. 1980 221 p
(Contract DE-AC01-79CS-30027)
(SOLAR/0010-80/02) Avail: NTIS HC A10/MF A01

The network consits of (1) sensors which measure key performance parameters at a selected site; (2) a Site Data Acquisition System (SDAS); (3) telephone transmission circuits; and (4) a Central Data Processing System (CDPS). Sensor data are collected and stored on a cassette tape in the SDAS. The CDPS collects and processes the information and performs the required computations. For the majority of parameters, raw data is collected approximately every five minutes. Solar insolation and certain other parameters, which are subject to rapid variance, are sampled every 32 seconds. The CDPS interrogates each SDAS on a daily basis and retrieves all accumulated data. At the conclusion of data retrieval, the SDAS Cassette is reset by command from the CDPS for continuing data collection. Environmental information collected at the sites for the reporting month are presented. Only those sites for which the data are found to be valid are reported. DOE

N80-31976# Aspen Inst. for Humanistic Studies, Boulder, Colo.
PROSPECT OF A GLOBAL WARMING AND STUDIES OF ITS SOCIETAL IMPACTS
William W. Kellogg 1979 16 p refs Presented at the 7th Global Modeling Conf., Laxenburg, Austria, 2-5 Oct. 1979 Prepared in cooperation with National Center for Atmospheric Research, Boulder, Colo.
(Contract DE-AC02-79EV-10281)
(CONF-7910158-1) Avail: NTIS HC A02/MF A01

Discussion of a significant climate change in the near future as a result of the continued burning of fossil fuel is presented.

The major components of the program that will need to be undertaken to assess the economic and societal adjustments resulting from climatic change are outlined. DOE

N80-31977# Oak Ridge National Lab., Tenn. Health and Safety Research Div.

ANALYSIS OF COAL-DERIVED PRODUCTS AND ENVIRONMENTAL SYSTEMS BY SYNCHRONOUS FLUORESCENCE AND ROOM TEMPERATURE PHOSPHORESCENCE

T. Vo-Dinh and R. B. Gammage 1980 7 p refs Presented at the Symp. on Instrumentation and Control for Fossil Energy Processes, Virginia Beach, Va., 9 Jun. 1980

(Contract W-7405-eng-26)

(CONF-800602-4) Avail: NTIS HC A02/MF A01

Two simple room temperature techniques, synchronous fluorescence and phosphorescence, were utilized to determine the polynuclear aromatic (PNA) compounds in various complex systems including synthetic multicomponent mixtures and real life samples such as workplace air particulate extracts and coal derived samples. The results demonstrate that as many as a dozen PNA compounds can be identified and quantified by these two analytical methods. DOE

N80-31978# Los Alamos Scientific Lab., N. Mex.

EFFECTIVE TRANSPORT VELOCITY AND PLUME ELONGATION IN NOCTURNAL VALLEY WIND FIELDS

W. E. Clements, S. Barr, and M. M. Fowler 1980 7 p refs Presented at 2nd Joint Conf. on Appl. of Air Pollution Meteorol., Am. Meteorol. Soc., New Orleans, 24-27 Mar. 1980

(Contract W-7405-eng-36)

(LA-UR-80-791; CONF-800327-8) Avail: NTIS HC A02/MF A01

Using three atmospheric tracers, the effective transport velocity and plume elongation produced by nocturnal drainage wind in three different valleys were investigated. Tracer was released in each valley in a well defined drainage wind field and sequentially sampled at downvalley locations. The effective transport velocity was determined from the elapsed time from the start of the release to the time when the plume concentration reached 10% of its peak value and the distance from the release site. The plume elongation factor was determined from the ratio of the width (time) of the plume at 10% of its peak value to the duration of the release. Mean measured winds were computed from surface wind instruments along the drainage flow path with values weighted by the estimated time the plume was in the wind field best represented by a measurement. DOE

N80-31979# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

A COMPUTER PROGRAM FOR THE SCATTERING OF A POLLUTANT [UN PROGRAMME DE CALCUL DE LA DISPERSION D'UN POLLUTANT]

A. Foussat 1979 21 p refs In FRENCH Presented at Intern. Assoc. for Hydraulic Res. Seminar on Les Refrigerants Atmospheriques, Chatou, France, 13-14 Nov. 1978

(VKI-Preprint-1979-4) Avail: NTIS HC A02/MF A01

A computer program for atmospheric diffusion in the presence of a pollutant with a density different from that of air is presented. This program is chiefly aimed at the prediction of gas concentrations near large buildings. After computation of the velocity field, the scattering of a pollutant is determined in the field. However, in the case of a nonstationary velocity field, both computations may be made together. A few examples are given. Author (ESA)

N80-31980# National Technical Information Service, Springfield, Va.

ATMOSPHERIC MODELING OF AIR POLLUTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - 1978

Brian Carrigan Jun. 1980 225 p

(PB80-811623) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

Lower atmospheric modeling of air pollution from both mobile and stationary sources are covered in the bibliography. Local diffusion, urban heat islands, precipitation washout worldwide diffussion, climatology, and smog are covered. Stratospheric modeling concerning supersonic aircraft is excluded. This updated bibliography contains 216 abstracts, none of which are new entries to the previous edition. GRA

N80-31981# National Technical Information Service, Springfield, Va.

ATMOSPHERIC MODELING OF AIR POLLUTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1979 - May 1980

Brian Carrigan Jun. 1980 139 p Supersedes NTIS/PS-79/0690; NTIS/PS-78/0631

(PB80-811631; NTIS/PS-79/0690; NTIS/PS-78/0631) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

Lower atmospheric modeling of air pollution from both mobile and stationary sources are covered in the bibliography. Local diffusion, urban heat islands, precipitation washout, worldwide diffusion, climatology, and smog are covered. Stratospheric modeling concerning supersonic aircraft are excluded. This updated bibliography contains 130 abstracts, 88 of which are new entries to the previous edition. GRA

N80-31982# KVB Inc., Irvine, Calif. Research and Analyses Div.

DETERMINATION OF AIR POLLUTANT EMISSION FACTORS FOR THERMAL TERTIARY OIL RECOVERY OPERATIONS IN CALIFORNIA, VOLUME 1 Final Report

Harold J. Taback May 1980 92 p refs

(Contract ARB-A7-075-30)

(PB80-187594; KVB-5807-842-Vol-1; ARB-R-80/116) Avail: NTIS HC A05/MF A01 CSCL 13B

Results of a study to determine the nature and extent of air pollutants resulting from thermally enhanced oil recovery operations in California are presented. Emission factors for some of the sources of these pollutants were determined. The pollutants of concern were particulate matter, sulfur oxides, nitrogen oxides, carbon monoxide, hydrocarbons, and hydrogen sulfide. Emission factors were developed by source testing steam generators and two types of well vents, those associated with steam injection fields and those associated with in-situ combustion (or fireflood) oil recovery methods. GRA

N80-31983# KVB Inc., Irvine, Calif. Research and Analyses Div.

DETERMINATION OF AIR POLLUTANT EMISSION FACTORS FOR THERMAL TERTIARY OIL RECOVERY OPERATIONS IN CALIFORNIA. VOLUME 2: APPENDIX Final Report

Harold J. Taback Nov. 1979 190 p

(Contract ARB-A7-075-30)

(PB80-187602; KVB-5807-842-Vol-2; ARB-R-79/117) Avail: NTIS HC A09/MF A01 CSCL 13B

Detailed data from tests conducted during the program is given. GRA

N80-31984# Army Cold Regions Research and Engineering Lab., Fort Wainright, Alaska. Alaskan Projects Office.

THE FATE AND EFFECTS OF CRUDE OIL SPILLED ON SUBARCTIC PERMAFROST TERRAIN IN INTERIOR ALASKA Final Report, 1975 - 1979

L. A. Johnson, E. B. Sparrow, T. F. Jenkins, C. M. Collins, C. V. Davenport, and T. T. McFadden Mar. 1980 143 p refs

(Grant EPA-IAF-D7-0794)

(PB80-187305; EPA-600/3-80-040) Avail: NTIS HC A07/MF A01 CSCL 08L

The short and long term effects of spills of hot Prudhoe Bay crude oil on permafrost terrain in subarctic interior Alaska were studied after two experimental oil spills of 7570 liters (2000 gallons) each one in winter and one in summer, on 500 sqm test plots were made at a forest site underlain by permafrost. Oil movement, thermal regime, botanical effects, microbiological responses, permafrost impact, and composition of the oil in the soil were monitored for two years. Oil movement during the winter spill occurred within the surface moss layer beneath the snow. In the summer spill, movement of the oil was primarily below the moss in the organic soil and was more rapid, moving 30 m downslope in the first 24 hours and 41 m total through the summer. The oil in the winter spill moved only 18 m downslope in the first day and stopped. Remobilization occurred in the spring allowing the oil in the winter spill to

move an additional 17 m. The total area affected by the summer spill was nearly one and one-half times as large as the winter spill. GRA

N80-31985# Washington Univ., Seattle. Dept. of Civil Engineering.
UNIVERSITY OF WASHINGTON ELECTROSTATIC SCRUBBER TESTS: COMBINED PARTICULATE AND SO2 CONTROL Final Report, Jun. 1978 - Aug. 1979
Michael J. Pilat Nov. 1979 62 p refs
(Grant EPA-R-806035)
(PB80-182603; EPA-600/7-79-245) Avail: NTIS HC A04/MF A01 CSCL 13B

A liquor recycle system was constructed permitting the pilot plant to operate in an open or closed loop mode. All SO2 tests were run in an open loop mode using either water or Na2CO3 solution as the scrubbing liquor. Simultaneous inlet and outlet source tests using cascade impactors provided size dependent and overall mass basis particle collection efficiency data. Measured over all particle collection efficiencies were 98.99% to 99.80%, depending on scrubbing operating conditions. SO2 collection efficiencies were 8.02% to 97.41%, depending on the scrubber operating conditions, inlet SO2 concentration, and the type of scrubbing liquor used. GRA

N80-31986# Research Triangle Inst., Research Triangle Park, N. C.
POLLUTANTS FROM SYNTHETIC FUELS PRODUCTION: COAL GASIFICATION SCREENING TEST RESULTS
J. G. Cleland, S. K. Gangwal, C. M. Sparacino, R. M. Zweidinger, D. G. Nichols, and F. O. Mixon Aug. 1979 101 p refs
(Grant EPA-R-804979)
(PB80-182769; EPA-600/7-79-200) Avail: NTIS HC A06/MF A01 CSCL 13B

Coal gasification test runs were conducted in a semibatch, fixed bed laboratory gasifier in order to evaluate various coals and operating conditions for pollutant generation. Extensive analyses were performed for organic and inorganic compounds and trace elements in the tars and hydrocarbon oils, aqueous condensates, and reactor residues resulting from the gasification tests. Results are reported for sulfur species in the product gas stream, for consent decree pollutants contained as volatile organic compounds in the product gas, for phenol and related compounds in the aqueous condensate and tar/oil sample, and for polynuclear aromatic hydrocarbons species in the tar/oil. GRA

N80-31987# North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
PHOTOCHEMICAL AEROSOL FORMATION: REACTIVE HYDROCARBON-NOx-SO2 SYSTEMS Final Report
Donald L. Fox, Harvey E. Jeffries, and Charles F. Feigley Dec. 1979 156 p refs Sponsored by Coordinating Research Council, Inc.
(PB80-187990; CRC-APRAC-CAPA-8-71) Avail: NTIS HC A08/MF A01 CSCL 07D

The results of an investigation of photochemical aerosol formation by 1-hexene, 1,7-octadiene, cyclohexene, cyclopentene, and toluene are reported. The experiments were conducted in the University of North Carolina outdoor aerosol chamber utilizing natural sunlight to activate the photochemical reactions in systems containing a single hydrocarbon, nitric oxide (NO), and nitrogen oxide (NO2). The effect of sulfur dioxide (SO2) on these systems was also determined. The chamber was operated as a batch chemical reactor with injections of the reactants made before sunrise, and the chemical and physical transformations were measured until approximately 1500 EDT. GRA

N80-31988# Northrop Services, Inc., Research Triangle Park, N. C.
APTI (AIR POLLUTION TRAINING INSTITUTE) COURSE 450 SOURCE SAMPLING FOR PARTICULATE POLLUTANTS. STUDENT WORKBOOK
Dec. 1979 166 p
(Contract EPA-68-02-2374)
(PB80-182439; EPA-450/2-79-007) Avail: NTIS HC A08/MF A01 CSCL 07D

Tables of nomenclature, source sampling forms, and representations of selected course visual materials are given to aid the student in his understanding of Environmental Protection Agency, Federal reference method 5 for sampling particulate matter from stationary sources. GRA

N80-31989# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
FEDERAL PLAN FOR OCEAN POLLUTION RESEARCH DEVELOPMENT AND MONITORING Working Paper, FY 1981 - 1985
Edward D. Goldberg, ed. Dec. 1979 291 p refs Presented at Workshop on Assimilative Capacity of US Coastal Waters for Pollutants, Crystal Mountain, Wash., 29 Jul. - 4 Aug. 1979
(PB80-193295; NOAA-80050709; Working-Paper-1) Avail: NTIS HC A13/MF A01 CSCL 13B

Coastal waters can assimilate certain amounts of various pollutants without being undersirably degraded. The workshop determined amounts and kinds of pollutants that could be assimilated by these nearby waters without unacceptable effects. GRA

N80-31990# North Carolina State Univ., Raleigh. Dept. of Chemical Engineering.
COAL GASIFICATION/GAS CLEANUP TEST FACILITY: VOLUME 1. DESCRIPTION AND OPERATION Final Report, Sep. 1977 - Dec. 1978
J. K. Ferrell, R. M. Felder, R. W. Rousseau, J. C. McCue, R. M. Kelly, and W. E. Willis Mar. 1980 108 p refs
(Grant EPA-R-804811)
(PB80-188378; EPA-600/7-80-046A-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 13B

An integrated fluidized-bed coal gasification reactor and acid gas removal system are described. The gasifier operates at 100 psig at up to 2000 F, and has a coal feed capacity of 50 lb/hr. The gas cleaning system contains a cyclone, a venturi scrubber, and an absorber/flash/tank/stripper system for acid gas removal. A detailed description of the plant and associated facilities, a summary of operating procedures, and results of a run for the steam oxygen gasification of a Western Kentucky No. 11 coal char are given. By following the outlined operating procedures, the plant can be brought to steady state in less than 4 hours. GRA

N80-31991# Transportation Research Board, Washington, D.C.
HIGHWAY NOISE ABATEMENT
Grant S. Anderson, Christopher W. Menge, Fred L. Hall, Harvey S. Knauer, Robert E. Armstrong, Louis F. Cohn, and Mary McLaughin, ed. 1980 38 p refs
(PB80-190622; TRB/TRR-740; ISBN-0-309-02998-8; LC-80-17422) Avail: NTIS HC A03/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

Various aspects of highway noise abatement are discussed. A barrier cost reduction program and the attitudes toward noise barriers before and after construction are considered along with sound absorption treatments for highway noise barriers. The effectiveness of noise barriers is addressed, specifically those adjacent to I-95 in Philadelphia and along the Capital Beltway (I-495) in northern Virginia. A systematic method for prioritizing barrier retrofit projects for highways is described. GRA

N80-31992# Environmental Research and Technology, Inc., Westlake Village, Calif.
DEVELOPMENT OF THE ELSTAR (ENVIRONMENTAL LAGRANGIAN SIMULATOR OF TRANSPORT AND ATMOSPHERIC REACTIONS) PHOTOCHEMICAL AIR QUALITY SIMULATION MODEL AND ITS EVALUATION RELATIVE TO THE LARPP (LOS ANGELES REACTIVE POLLUTANT PROGRAM) DATA BASE
A. C. Lloyd, F. W. Lurmann, D. G. Godden, J. P. Hutchins, A. Q. Eschenroeder, and R. A. Nordsieck Sep. 1979 570 p refs
(PB80-188139; ERT/P-5287-500; CRC-APRAC-CAPA-12-72-DB) Avail: NTIS HC A24/MF A01 CSCL 13B

The data analysis and model development work performed to create and validate ELSTAR (Environmental Lagrangian Simulator of Transport and Atmospheric Reactions), a photochemical trajectory model for the prediction of ozone and nitrogen dioxide concentrations are discussed. A description of the stepwise

development and testing of the model, a discussion of the test results, recommendations for future field programs, a discussion of the model's limitations, and a recommended procedure to be followed in subsequent ELSTAR applications are included. GRA

N80-31993# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemical and Environmental Engineering.
RELATIONSHIP BETWEEN SPECIFIC NON-METHANE HYDROCARBONS AND OZONE IN AMBIENT AIR AND THEIR ROLE IN TRANSPORTATION CONTROL STRATEGIES Final Report, Jul. 1977 - Oct. 1978
E. R. Altwicker and F. DiCesare Sep. 1979 139 p refs
(Contract DOT-OS-70070)
(PB80-184922; JBA32-F; DOT-RSPA-DPB-50-79-25) Avail: NTIS HC A07/MF A01 CSCL 13B

Specific nonmethane hydrocarbon concentrations in ambient air were measured in two urban regions: New York City and the Albany/Troy/Schenectady area. A total of forty three hydrocarbons were identified via gas chromatography. Ambient sampling results were coupled with emission inventory information to generate a hydrocarbon source reconciliation to relate automotive and stationary source emissions to ambient air quality. Models that relate hydrocarbons and nitric oxide to ozone formation were reviewed. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-31994*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF UPPER ATMOSPHERE DYNAMICS Final Report
R. G. Roper and H. D. Edwards Jul. 1980 90 p refs
(Grant NGL-11-002-004; Proj. E-16-605)
(NASA-CR-163519) Avail: NTIS HC A05/MF A01 CSCL 04A

A brief overview of the significant contributions made to the understanding of the dynamics of the Earth's upper atmosphere is presented, including the addition of winds and diffusion to the semi-empirical Global Reference Atmospheric Model developed for the design phase of the Space Shuttle, reviews of turbulence in the lower thermosphere, the dynamics of the equatorial mesopause, stratospheric warming effects on mesopause level dynamics, and the relevance of these studies to the proposed Middle Atmosphere Program (1982-85). A chronological bibliography, with abstracts of all papers published, is also included. L.F.M.

N80-31995*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATMOSPHERIC PARTICULATE ANALYSIS USING ANGULAR LIGHT SCATTERING
Mark Z. Hansen [1980] 40 p refs Submitted for publication
(NASA-TM-81112) Avail: NTIS HC A03/MF A01 CSCL 04A

Using the light scattering matrix elements measured by a polar nephelometer, a procedure for estimating the characteristics of atmospheric particulates was developed. A theoretical library data set of scattering matrices derived from Mie theory was tabulated for a range of values of the size parameter and refractive index typical of atmospheric particles. Integration over the size parameter yielded the scattering matrix elements for a variety of hypothesized particulate size distributions. A least squares curve fitting technique was used to find a best fit from the library data for the experimental measurements. This was used as a first guess for a nonlinear iterative inversion of the size distributions. A real index of 1.50 and an imaginary index of -0.005 are representative of the smoothed inversion results for the near ground level atmospheric aerosol in Tucson. Author

N80-31996*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR NEPHELOMETER FOR ATMOSPHERIC PARTICULATE STUDIES
Mark Z. Hansen and W. H. Evans [1980] 31 p refs Submitted for publication
(NASA-TM-81113) Avail: NTIS HC A03/MF A01 CSCL 04A

A polar nephelometer for use in studying atmospheric aerosols was developed. The nephelometer detects molecular scatter from air and measures scattering from very clean air using pure molecular scattering for calibration. A compact system using a folded light path with an air cooled argon laser for the light source was designed. A small, sensitive detector unit permits easy angular rotation for changing the scattering angle. A narrow detector field of view of + or - 1/4 degree of scattering along with a single wavelength of incident light is used to minimize uncertainties in the scattering theory. The system is automated for data acquisition of the scattering matrix elements over an angular range from 2 degrees to 178 degrees of scattering. Both laser output and detector sensitivity are monitored to normalize the measured light scattering. S.F.

N80-31997# Naval Postgraduate School, Monterey, Calif.
VERIFICATION OF THE BULK MODEL FOR CALCULATIONS OF THE OVERWATER INDEX OF REFRACTION STRUCTURE FUNCTION, (C SUB N)2
K. L. Davidson, G. E. Schacher, C. W. Fairall, D. E. Spiel, and E. C. Rittenden Jul. 1980 45 p refs
(AD-A087097; NPS61-80-016) Avail: NTIS HC A03/MF A01 CSCL 04/1

Overwater measurements of mean and fluctuating meteorological parameters have been made coincident with optical scintillation measurements. These data have been used to verify the NPS bulk aerodynamics model for calculating the index of retraction structure function, (C sub N)-squared. The average disagreement between calculated and measured values was 33% verifying the validity of the model. IR measured sea surface temperatures cannot be used in the model and this is discussed. GRA

N80-31998# Arcon Corp., Waltham, Mass.
IONOSPHERIC MODELING AND PROPAGATION ANALYSIS Final Technical Report, Nov. 1976 - Sep. 1979
David C. Miller and Joseph Gibbs Apr. 1980 75 p
(Contract F19628-77-C-0051; AF Proj. 2305)
(AD-A087259; RADC-TR-80-29) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes several studies and the development of computer techniques toward improving the capability of predicting and assessing HF propagation through the ionosphere. These studies included the development of vertical electron density models which can accurately represent observed oblique and vertical ionograms. These models have been represented by a series of functions which describe the individual ionospheric layers and which are analytically integratable to yield expected ray path trajectories. A computer program has been written which incorporates these features and yields results which are two orders of magnitude faster than those available using conventional numerical ray tracing techniques. The technique has been applied to several studies including the simulation of the backscatter leading edge of oblique ionograms and the determination of HF circuit parameters for a specified ground coverage. The results are presented as a function of the change in individual ionospheric layer parameters. GRA

N80-31999# HSS, Inc., Bedford, Mass.
TIME DELAY OF TERRESTRIAL LIGHT PULSES PROPAGATING THROUGH CLOUDS TO SATELLITE SYSTEMS Final Report, 1 Apr. 1977 - 30 Sep. 1979
H. S. Stewart and L. B. Woolaver Patrick AFB, Fla. AFTAC 7 Jul. 1980 203 p refs
(Contract F08606-77-C-0024)
(AD-A087242; HSS-B-058; AFTAC-TR-80-23) Avail: NTIS HC A10/MF A01 CSCL 08/5

A method is described and applied for interpreting optically filtered all sky photographs so as to generate curves of the time dependent probability that a photon emitted by an isotropic source near the Earth's surface will reach a satellite at any elevation and azimuth in the sky. Two basic concepts are involved:

first that the probability at lambda = 0.76 microns for absorption of light by atmospheric oxygen is proportional to the square root of the dwell time of the light in the atmosphere, and second, that a time dependent reciprocity theorem exists allowing observations of the skylight incident on a ground based detector to be interpreted in terms of the probability that a photon starting at the detector can reach a satellite in the direction of the Sun. Detailed theory and operating equations were developed and appropriate equipment was built and operated. Computerized reduction of microdensitometer scans of the all sky photographs led to values of mean time delay and transmission for 125000 equal elements of solid angle in the sky. These were summed to generate the time dependent probability. Photographs made at Kennedy Space Center were used to generate delay curves for seven satellite directions on nine separate occasions. M.G.

N80-32000# Emmanuel Coll., Boston, Mass.
MODELLING OF EQUATORIAL PHASE AND AMPLITUDE SCINTILLATIONS FROM OGO-6 AND AE IRREGULARITY DATA Scientific Report, 1 Mar. 1978 - 28 Feb. 1979
Sunanda Basu and Santimay Basu Hanscom AFB, Mass. AFGL Nov. 1979 29 p refs
(Contract F19628-78-C-0005; AF Proj. 4643)
(AD-A087011; AFGL-TR-80-0141; SR-1) Avail: NTIS HC A03/MF A01 CSCL 04/1

The technique of modelling equatorial phase and amplitude scintillations from in situ measurements of irregularity amplitude, ambient ionization density and irregularity power spectrum is outlined. The in situ measurements do not directly provide information on irregularity layer thickness for which radar backscatter observations are utilized. The equatorial scintillation models developed from OGO-6 and AE-C in situ measurements during the two solstices are presented. Considerable differences in the longitude variation of scintillations are predicted during the two solstices. The model estimates are in good agreement with the available ground based phase and amplitude measurements. Problems associated with the use of bottomside spread-F data for transionospheric propagation modelling at VHF/UHF are also discussed. GRA

N80-32001# Physical Dynamics, Inc., La Jolla, Calif.
STABILITY OF BOUNDARY LAYER FLOW Final Report, 11 Sep. 1979 - 31 Jan. 1980
B. E. Freeman and L. E. Hauser Mar. 1980 89 p refs
(Contract N00173-79-C-0302)
(AD-A087028; PD-JL-80-220) Avail: NTIS HC A05/MF A01 CSCL 04/1

A technique is developed and applied for the evaluation of conditions under which marine boundary layers are unstable, and for computing the rate of growth of unstable motions. Linear perturbation equations are formulated which account for influence of wind shear, static stability, Coriolis force, turbulent diffusion, large scale convergence, and geostrophic wind on linear stability. The mean quantities can be prescribed by analytic functions or supplied as numerical tables derived either from observed/specified data or a boundary layer model. The linearized model is solved as a generalized eigenvalue problem. Related calculations with the SIGMET code are discussed, including radar properties of the marine boundary layer. GRA

N80-32002# Naval Research Lab., Washington, D. C. Plasma Physics Div.
QUASILINEAR SCATTERING FROM WAVES DRIVEN BY BEAM-PLASMA INSTABILITIES Interim Report
S. H. Brecht (Science Applications, Inc., McLean, Va.) and P. J. Palmadesso 21 Apr. 1980 35 p refs Sponsored by DNA
(AD-A087208; AD-E000474; NRL-MR-4203) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Starfish southern conjugate rebrightening is explained by velocity diffusion perpendicular to the Earth's magnetic field line. The diffusion is caused by particle scattering off of the harmonics of ion cyclotron waves commonly called Bernstein modes. Quasilinear estimates of the wave fluctuation levels indicate that the debris streaming down the field lines will excite these waves and then be scattered by them. GRA

N80-32003# Naval Research Lab., Washington, D. C.
NONLINEAR EVOLUTION OF DIFFUSE AURORAL F REGION IONOSPHERIC IRREGULARITIES Interim Report
M. J. Keskinen (Berkeley Research Associates, Arlington, Va.), S. L. Ossakow, and B. E. McDonald 2 Jul. 1980 28 p refs Sponsored by DNA and ONR
(RR0330244)
(AD-A086998; AD-E000491; NRC-MR-4246) Avail: NTIS HC A03/MF A01 CSCL 04/1

Numerical simulations of the nonlinear evolution of the current convective instability in the diffuse aurora have been performed for conditions typical of the nighttime high latitude F region. Our results show nearly field aligned plasma irregularities developing in regions of well defined northward gradients of total electron content (TEC) and field-aligned diffuse auroral particle precipitation. In addition, we find equatorward movement of plasma enhancements and northward (poleward) movement of plasma depletions (holes). Furthermore, one dimensional spatial power spectra of the irregularities in both the north-south and east-west directions are well described by inverse laws. GRA

N80-32004# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
MAGNETOSPHERIC AND INTERPLANETARY ELECTROSTATICS: A SIMPLE BUT EXPLICIT MODEL Final Interim Report
Michael Schulz 1 Jul. 1980 10 p refs
(Contract F04701-79-C-0080)
(AD-A087110; TR-0080-5505-02-1; SD-TR-80-44) Avail: NTIS HC A02/MF A01 CSCL 04/1

This is a generalization of Dungey's 1961 model for the prototype of an 'open' magnetosphere. The magnetic-field lines are traced by superimposing a uniform B field parallel to the geomagnetic dipole axis. There results a quasi-cylindrical separatrix (the 'magnetopause') between field lines that intersect the Earth and those that do not. However, the magnetic field outside the magnetosphere can be multiplied by an arbitrary factor (positive or negative) without altering the field-line geometry. Any discontinuity in B at the 'magnetopause' is supported by azimuthal currents there. The electrostatic problem is asymptotically analogous to that of a dielectric cylinder in an asymptotically uniform electric field (which owes its origin to the solar wind in this case). It is easy to map from the asymptotic solution inward and equatorward, since the magnetic field lines are treated as electric equipotentials. The tangential component of the electric field is continuous at the magnetopause but varies between limits that correspond to the 'open' and 'closed' models of the magnetosphere, as defined by the access of interplanetary plasma. GRA

N80-32005# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CAD: A CODE FOR THE CALCULATION OF ATMOSPHERIC DENSITY
William L. Oliver 2 Apr. 1980 26 p refs
(Contract F19628-80-C-0002; AF Proj. 2129)
(AD-A087447; TN-1980-20; ESD-TR-80-28) Avail: NTIS HC A03/MF A01 CSCL 04/1

An efficient machine implementation of the 1972 COSPAR International Reference Atmosphere (CIRA) is developed for use in evaluating atmospheric drag effects upon earth orbiting satellites. Restriction of this procedure to the satellite orbit region of significant drag and the use of an alternate temperature profile representation have enabled a factor of 30 improvement in machine execution time compared with that required by the code supplied by CIRA publication while incurring only a few percent difference in the density results. GRA

N80-32006# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE INVESTIGATION OF THE MAGNETOSPHERIC DYNAMICS IN CONJUNCTION WITH THE SCATHA SATELLITE OBSERVATIONS Final Report, 1 Oct. 1978 - 30 Sep. 1979
Ching-I. Meng Dec. 1979 140 p refs
(Contract N00014-72-C-4401)
(AD-A087433; AFGL-TR-80-0070) Avail: NTIS HC A07/MF A01 CSCL 08/14

This task consists of two parts. The first part concerns (a) the collection and analysis of ground based and satellite data for

the purpose of monitoring the magnetospheric conditions in support of the SCATHA satellite activity at Air Force Geophysics Laboratory, and (b) the technical support in the study of the particle and field data returned by SCATHA satellite. The second part is to analyze observations of auroral phenomena made by satellites of the USAF Defense Meteorological Satellite Program. The effort at APL/JHU for the first part of this task was majorly in the role of providing supports to the SCATHA activity and for the second part of DMSP observations was in the understanding of polar region auroral phenomena. Therefore, this final report is divided into a summary of efforts supporting SCATHA and scientific results from analyzing DMSP data. The former consists of (1) a short description of why and how the ground based magnetic data can be used in monitoring the magnetospheric conditions and (2) a list of data collected together with a guide for using these data. The latter contains (1) a list and abstracts of all scientific reports and journal articles published or submitted for publication, during this reporting period, with at least partial sponsorship attributed to AFGL, and (2) an article concerning a possible diurnal variation of the auroral oval size. GRA

N80-32007*# Rice Univ., Houston, Tex.
QUANTITATIVE SIMULATION OF A MAGNETOSPHERIC SUBSTORM. 1: MODEL LOGIC AND OVERVIEW
M. Harel, R. A. Wolf, R. W. Spiro, P. H. Reiff, C.-K. Chen, W. J. Burke, F. J. Rich, and M. Smiddy Jan. 1980 92 p refs
(Grant NGR-44-006-137; Contract F19628-77-C-0005; Grant NSF ATM-74-21185; AF Proj. 2311)
(NASA-CR-163547; AD-A087699; AFGL-TR-80-0128; SR-2)
Avail: NTIS HC A05/MF A01 CSCL 04/1

This and the following two papers report results of the first comprehensive computer simulation of the behavior of the Earth's inner magnetosphere during a substorm type event. We have developed a self consistent quantitative model to compute electric fields, currents and the resulting plasma flow in the inner-magnetosphere/ionosphere system. Dawn-dusk electric fields show a general correlation with the east-west magnetic field perturbations. Unexpectedly, two of the passed display substantial regions of sunward plasma flow poleward of the main part of the region-1 Birkeland currents. The cross-polar-cap potential drops computed from the data represent the first effort at satellite monitoring of this important parameter during various phases of a substorm, and shown an important enhancement during the substorm. Numerical results from these first-try simulations were consistent with most of the established features of convection in the inner magnetosphere. GRA

N80-32008*# Rice Univ., Houston, Tex.
QUANTITATIVE SIMULATION OF A MAGNETOSPHERIC SUBSTORM. 2: COMPARISON WITH OBSERVATIONS
M. Harel, R. A. Wolf, R. W. Spiro, P. H. Reiff, C.-K. Chen, W. J. Burke, F. J. Rich, and M. Smiddy Jan. 1980 81 p refs
(Grant NGR-44-006-137; Contract F19628-77-C-0005; Grants NSF ATM-74-21185; NSF ATM-79-20157; AF Proj. 2311)
(NASA-CR-163548; AD-A087700; AFGL-TR-80-0129; SR-3)
Avail: NTIS HC A05/MF A01 CSCL 04/1

Several results of computer simulation of the behavior of the inner magnetosphere during the substorm-type event of 19 September 1976 are discussed. The model predicts a modest ring-current injection, in to about L=6. The model Birkeland currents agree satisfactorily with the averaged observations of Iijima and Potemra, in terms of direction, strength and overall pattern. The model provides a useful picture of the overall magnetosphere-ionosphere current system. The model indicates that the total Joule heating during the event is about 2-3 times the increase in ring-current energy, a result that is in apparent contradiction to some previous estimates. GRA

N80-32009# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE INFLUENCE OF ATMOSPHERIC DYNAMICS ON OZONE AND TEMPERATURE STRUCTURE
Robert O. Olsen and Jagir S. Randhawa May 1980 43 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-A087702; ERADCOM/ASL-TR-0057) Avail: NTIS HC A03/MF A01 CSCL 04/1

A two phase sounding program was undertaken at White Sands Missile Range, New Mexico, during the first week of February and June 1973 to measure upper atmosphere temperature, winds, and ozone. In situ and ground based instrumentation were used. The program was designed to investigate atmospheric transport processes occurring in the lower stratosphere and troposphere. Observations taken in January on the day following the passage of a jet stream over the station showed a large increase (30 percent) in the total ozone. Also ozone concentration increased as temperature increased at the double tropopause region. During the second phase of the study, the first week of June, the height of the tropopause moved downward approximately 3 km, from an altitude of 16 km on 1 June to 13 km on 8 June. The variations of ozone in the troposphere and temperature at tropopause altitudes corresponded with associated atmospheric circulation changes, indicating circulation influence at these altitudes. GRA

N80-32010# Tel-Aviv Univ. (Israel). Dept. of Geophysics and Planetary Sciences.
SIZE DISTRIBUTION, CHEMICAL COMPOSITION AND OPTICAL PROPERTIES OF ATMOSPHERIC DUST IN ISRAEL: A COMPARISON OF URBAN AND DESERT AEROSOLS UNDER CLEAR AND DUSTY CONDITIONS Final Report, 1 Jul. 1978 - 1 Mar. 1980
Zev Levin Feb. 1980 73 p refs
(Grant DA-ERO-78-G-087)
(AD-A087608) Avail: NTIS HC A04/MF A01 CSCL 04/1

Measurements of aerosol size distributions, chemical composition and optical properties were carried out at two locations in Israel. Tel Aviv was chosen as an urban region and Mitzpe Ramon as a desert region. The measurements indicate that the size spectra between 0.15 - 12 micrometers can be approximated by a power law type distribution. The spectra in Tel Aviv show higher concentrations and greater slopes than those from the desert. Diurnal variations between day and night are observed in the size distribution of the summertime measurements in Tel Aviv. These are believed to be related to the increase in aerosol size due to absorption of water vapor during high relative humidity periods. The chemical composition in Tel Aviv was found to strongly depend on the meteorological conditions. The optical measurements also suggest strong differences between Tel Aviv and the desert. Filter samples of atmospheric particulate matter from Tel Aviv always appeared darker than those from the desert site. Measurements of imaginary refractive index in the 0.3 to 1.7 micrometer spectral region are presented. These measurements are consistently higher by a factor of 2 to 4 in Tel Aviv as compared to simultaneous samples from the desert site. Seasonal variations have also been observed and are believed to be primarily related to temperature inversions near or at the ground during the winter months and to the effect of pollution from Southern Europe which is carried eastward by synoptic scale motion. GRA

N80-32011# Air Force Global Weather Central, Offutt AFB, Nebraska.
SPECIAL SENSOR H (SSH) MOISTURE SOUNDING Interim Report
Richard C. Savage Mar. 1980 23 p refs
(AD-A087576; AFGWC/TN-80/001) Avail: NTIS HC A02/MF A01 CSCL 04/2

Analysis of variance in the 18-30 micrometers water vapor sensing channels of the DMSP SSH infrared sounder indicates the channels are too opaque in moist atmospheres. Their statistical influence must be carefully controlled in forming statistical inversion matrices for temperature profiles. GRA

N80-32012# Weston Observatory, Mass. Dept. of Geology and Geophysics.
INVESTIGATION OF MAGNETIC FIELD PHENOMENA IN THE IONOSPHERE Final Report, 1 Jul. 1976 - 30 Sep. 1979
John F. Devane and Edward A. Johnson Jan. 1980 58 p refs
(Contract F19628-76-C-0291; AF Proj. 7601)
(AD-A087526; AFGL-TR-80-0099) Avail: NTIS HC A04/MF A01 CSCL 08/14

Weston Observatory (Boston College) has maintained a geomagnetic observatory to continuously monitor changes in the geomagnetic field and to provide standards for magnetic instrumentation and to maintain a coil system in which a wide variety of magnetic instrumentation can be tested and calibrated to support AFGL RESEARCH. The observatories in Project MAGAF have been installed and maintained. The secular change in the geomagnetic field at Weston is detailed for the past six years. Modifications have been made in the network instrumentation to insure reliability and accuracy of the data digitally transmitted to Hanscom AFB. A three component magnetic observatory has been designed around the total field sensor. The reliability of the principal components of the network has been investigated and changes proposed for the remote observatories. GRA

N80-32013# Bureau of Mines and Geology, Moscow, Idaho. Dept. of Lands.
ADDITIONS AND CORRECTIONS TO THE BIBLIOGRAPHY OF GEOLOGIC STUDIES, COLUMBIA PLATEAU (COLUMBIA RIVER BASALT) AND ADJACENT AREAS, IN IDAHO, 1980
William Strowd and Gail S. Hustedde 1980 124 p refs
(Contract DE-AC02-77RL-01030)
(RHO-BWI-C-68) Avail: NTIS HC A06/MF A01

Materials that have become available since the original publication and pertinent literature that had originally been overlooked are included. Index maps that show locations of geologic studies and geochemical petrographic, remanent paleomagnetic, and radiometric age-dated sites within the Columbia River Basalt Group field within Idaho are presented. Archeological sites, test wells, mines, quarries, and other types of excavations are also identified. DOE

N80-32014# Sandia Labs., Albuquerque, N. Mex.
PRELIMINARY ONE-DIMENSIONAL THERMAL ANALYSIS OF WASTE EMPLACEMENT IN TUFFS
Bruce M. Bulmer and Allen R. Lappin Apr. 1980 31 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-1265) Avail: NTIS HC A03/MF A01

One dimensional calculations of near field temperatures resulting from waste emplacement in a multiple layered tuff stratigraphy are presented. Results indicate a marked sensitivity of peak temperatures to assignment of in situ fluid pressure, geothermal heat flux, waste type, and location of waste relative to a specific stratigraphic discontinuity. Under the criterion that allowable initial power densities are limited by the occurrence of boiling at a distance of 10 m from emplaced waste, allowable power densities are calculated to range up to 150 kW/acre or more, depending upon geothermal heat flux and waste type. DOE

N80-32015# Royal Aircraft Establishment, Farnborough (England).
ODD ZONAL HARMONICS IN THE GEOPOTENTIAL FROM ANALYSIS OF 28 SATELLITE ORBITS
D. G. King-Hele, C. J. Brookes, and G. E. Cook London HMSO Feb. 1980 49 p refs
(RAE-TR-80023; RAE-Space-576; BR73771) Avail: NTIS HC A03/MF A01

The geopotential is usually expressed as an infinite series of spherical harmonics, and the odd zonal harmonics are the terms independent of longitude and antisymmetric about the equator they define the 'pear-shape' effect. The coefficient J3, J5, J7, ... of these harmonics were evaluated by analyzing the variations in eccentricity of 28 satellite orbits from near-equatorial to polar. Most of the orbits from previous determinations in 1973 are used again, but three new orbits are added, including two at inclinations between 62 and 63 deg, which have been specially observed for more than five years by the Hewitt cameras. With the help of the new orbits and revised theory, sets of J-coefficients with standard deviations about 40% lower than before were obtained. The accuracy of the longitude-averaged geoid profile is estimated as 50 cm, except at latitudes above 86 deg. The geoid profile and predicted amplitude of the oscillation in eccentricity are compared with those from other sources. Author (ESA)

N80-32016# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SOLAR-TERRESTRIAL PREDICTIONS PROCEEDINGS. VOLUME 3: SOLAR ACTIVITY PREDICTIONS
Richard F. Donnelly Mar. 1980 520 p refs Presented at the Intern. Solar-Terrest. Predictions Proc. and Workshop, Boulder, Colo., 23-27 Apr. 1979
(PB80-195001; NOAA-80050712) Avail: NTIS HC A22/MF A01 CSCL 04A

Chapter A includes the contributions on long term solar activity predictions. Most of these papers involve statistical techniques. Chapter B presents predictions of the interplanetary magnetic field. Chapter C discusses solar flare and active region predictions. Chapter D contains papers about using the optical, microwave or X-ray data to make short term predictions of the particle radiation at Earth. GRA

N80-32017# SRI International Corp., Menlo Park, Calif.
AIRBORNE MEASUREMENTS OF STRATOSPHERIC OZONE INTRUSIONS INTO THE TROPOSPHERE OVER THE UNITED STATES. VOLUME 2: DATA CATALOG Final Report
William Viezee, Warren B. Johnson, and Hanwant B. Singh Sep. 1979 242 p
(SRI Proj. 6690)
(PB80-190705; CRC-APRAC-CAPA-15-76B-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 04A

A rural atmospheric data collection and analysis program for the period 8 August 1977 to 7 September 1979 was conducted. Two field programs using an instrumented aircraft were carried out to investigate the downward vertical transport of ozone rich air from the stratosphere as a potential cause of natural tropospheric ozone. A catalog of observational data is presented. GRA

N80-32018# Nebraska Univ., Lincoln. Ross Ice Shelf Project Management Office.
INITIAL REPORT ON GEOLOGICAL MATERIALS COLLECTED AT RISP SITE J9
Peter-Noel Webb Oct. 1979 136 p refs Prepared in cooperation with Univ. of Northern Illinois, De Kalb
(Contracts NSF C-1059; NSF C-726)
(PB80-188253; RISP/TR-79-1; CHC-APRAC-CAPA-8-71-7) Avail: NTIS HC A07/MF A01 CSCL 08G

Sampling of 58 cores at Ross Ice Shelf Project Site J9 was undertaken in December of both 1977 and 1978. Analysis of sea floor wave forms suggests that the northward movement of the Ross Ice Shelf in this region might be between 1 and 4 m a day. The lithological, paleontological, and stratigraphical core analyses are described. A data of 174 m.y. was obtained from Rb/Sr dating of fine grained detrital feldspars in a dredge sample of the core upper unit. GRA

N80-32019# Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
MEASUREMENT, PREDICTION, AND HAZARD EVALUATION OF EARTH FISSURES AND SUBSIDENCE, SOUTH-CENTRAL ARIZONA
James K. Boling, Jr., Michael C. Carpenter, N. M. Johnson, and S. N. Davis 1980 113 p refs
(Contract DI-14-34-0001-9003; OWRT Proj. A-092-ARIZ(1))
(PB80-183908; W80-05006) Avail: NTIS HC A06/MF A01 CSCL 08G

Earth fissuring and subsidence research in south central Arizona consisted of measurement of horizontal movements of earth fissures and mapping of erosional features and hazard evaluation of earth fissures. Records will form the data base for predictive models of subsidence and earth fissuring. Bimonthly horizontal strain measurements of fissures were made over a three year period at locations near Signal Peak, Picacho Mountains,

and in Avra Valley. Fissures opened and closed repeatedly. They exhibited relatively smooth movement with occasional sudden jumps. Fissures closed during long dry periods and opened after high rainfall. GRA

N80-32020# National Geodetic Survey, Rockville, Md.
TIDAL CORRECTIONS TO GEODETIC QUANTITIES
P. Vanicek. Feb. 1980. 38 p. refs.
(PB80-189376; NOAA-TR-NOS-83; NOAA-80043001) Avail: NTIS. HC A03/MF A01. CSCL 08E

The origin of tidal force is explained and mathematically treated. Then the phenomena caused by tidal force are shown, first by viewing the Earth as rigid, and then elastic. Particular emphasis is given to the formation of corrections arising from these tidal phenomena, and the complete range of geodetic observations and corrections is included. Finally, corrections for sea tide are discussed. All tidal aspects that would be of interest to a geodesist are treated from a geodetic point of view. GRA

N80-32021# State Univ. of New York at Potsdam. Dept. of Geological Sciences.
A DETAILED MAGNETIC SURVEY OF THE SAINT LAWRENCE RIVER: OAK POINT TO LAKE ONTARIO, NEW YORK
Frank Revetta and John Cardinal. 1979. 43 p. refs. Sponsored by NOAA.
(PB80-191471; NOAA-80050202) Avail: NTIS. HC A03/MF A01. CSCL 08N

Measurements of the total intensity of the Earth's magnetic field in the St. Lawrence River between Oak Point and Lake Ontario indicated magnetic anomalies of high magnitude and steep gradients due to rocks of varying magnetic susceptibility in the Precambrian basement complex. The anomalies and magnetic contours that trend continuously across the river indicated no large lateral offset in this area. Also, magnetic anomalies associated with diabase dikes in the Gananoque, Ontario, and Grandstone Island areas indicated no lateral offset in that area. GRA

N80-32022# National Oceanic and Atmospheric Administration, Washington, D. C. Aeronomy Lab.
PROGRAM OF RESEARCH AND MONITORING FOR EARLY DETECTION OF STRATOSPHERIC OZONE CHANGE. REPORT TO CONGRESS OF FINDINGS FOR 1978 - 1979
Jan. 1980. 47 p. refs.
(PB80-184021; NOAA-80041106) Avail: NTIS. HC A03/MF A01. CSCL 04A

Research and monitoring of the stratosphere for the purpose of early detection of changes in the stratosphere and climatic effects of such changes is described. The findings from stratospheric research and monitoring program are applicable to issues of national concern in three broad areas: measurements from the worldwide ozone monitoring network, other measurements of significant stratospheric parameters and model calculations of stratospheric ozone behavior under continued chlorofluorocarbon release. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-32023*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
INITIAL DIRECT STRIKE LIGHTNING DATA
Felix L. Pitts and Mitchel E. Thomas. Aug. 1980. 25 p. refs.
(NASA-TM-81867) Avail: NTIS. HC A02/MF A01. CSCL 04B

Data waveforms of the rate of change of electric flux density obtained during two lightning strikes to an aircraft specially instrumented for lightning electromagnetic measurements are presented. The aircraft was operating in a thunderstorm environment to elicit strikes. The instrumentation system configuration, flight conditions, and strike scenario showing probable lightning path on the aircraft are described. The waveforms, which were obtained at a 10 nanosecond sample interval, indicate significant excursions of the rate of change of electric flux density occurred over few hundred nanoseconds time interval. T.N.

N80-32024# RAND Corp., Santa Monica, Calif.
ANOMALOUS SNOWFALL CAUSED BY NATURAL-DRAFT COOLING TOWERS
Randall L. Koenig. May 1980. 48 p. refs.
(Grant DE-AC03-76EV-01191)
(RAND/N-1479-DOE) Avail: NTIS. HC A03/MF A01

Tabulation of a number of aerial observations of plumes at subfreezing temperatures indicates that a cooling tower plume is likely to produce measurable snow if its temperature is colder than -13 C and the saturation deficit of the ambient air is less than 0.5 g m to the -3 power. These empirically derived criteria were tested using a numerical model of cloud microphysics that simulates the most important processes of transfer of water substance between vapor, liquid, and ice, including nucleation and development of particle-size spectra. Among the many quantities computed is the flux density of snow at the base of the plume. From this, together with average fallspeed and horizontal wind speed, the amount and pattern of snowfall at the ground was computed. Comparison of the computational results with observations of actual plumes shows that the model has skill in predicting plume behavior and strongly supports the criterion of -13 C for plume snowfall, however, the maximum snowfall depth is predicted to occur nearer the source than is observed. A.R.H.

N80-32025*# Tennessee Univ. Space Inst., Tullahoma. Scientific and Technical Information Branch.
ATMOSPHERIC TURBULENCE SIMULATION TECHNIQUES WITH APPLICATION TO FLIGHT ANALYSIS. Final Report
Show-Tien Wang and Walter Frost. Sep. 1980. 171 p. refs.
(Contract NAS8-32692)
(NASA-CR-3309; M-302) Avail: NTIS. HC A08/MF A01. CSCL 04B

Statistical modeling of atmospheric turbulence is discussed. The statistical properties of atmospheric turbulence, in particular the probability distribution, the spectra, and the coherence are reviewed. Different atmospheric turbulence simulation models are investigated, and appropriate statistical analyses are carried out to verify their validity. The models for simulation are incorporated into a computer model of aircraft flight dynamics. Statistical results of computer simulated landings for an aircraft having characteristics of a DC-8 are reported for the different turbulence simulation techniques. The significance of various degrees of sophistication in the turbulence simulation techniques on the landing performance of the aircraft is discussed. Author

N80-32026# Weather Wing (7th), Scott AFB, Ill.
SATELLITE DERIVED WINDS
Brian E. Heckman. 1 Jul. 1980. 15 p. refs.
(AD-A087023; REPT-7WW/TN-80/002) Avail: NTIS. HC A02/MF A01. CSCL 04/2

This report explains how satellite derived winds are produced, discusses reliability and accuracy of satellite winds, possible uses, and provides instructions for decoding TWXX-series bulletins. It identifies differences in decoding procedures for U.S., Japanese, and European GOES wind bulletins, and it also provides examples of bulletins and how data may be plotted. GRA

N80-32027# TRW Defense and Space Systems Group, Redondo Beach, Calif. Engineering Sciences Lab.
ANALYTIC MODELING OF SEVERE VORTICAL STORMS. Final Report, 9 Jul. 1979 - 8 Jul. 1980
Francis Fendell, Phillip Feldman, and George Carrier. 8 Jul. 1980. 45 p. refs.
(Contract N00014-79-C-0508)
(AD-A086919; TRW-35524-6001-UT-00) Avail: NTIS. HC A03/MF A01. CSCL 04/2

Analytic modeling of well organized convective storms was undertaken to elucidate the evolution from a moderately intense one cell vortex--characterized by low level pressure deficits on the order of one percent of atmospheric pressure--to a very intense two cell vortex--characterized by low level pressure deficits on the order of ten percent of atmospheric pressure. The physical distinction between the two stages is the insertion of a dry,

compressionally heated, nonrotating, central downdraft of originally tropopause level air in the more severe case. The quasisteady mature description of the thermohydrodynamic structure of each vortex is being developed, and then the conditions for transition from the moderately intense to the very intense vortex are to be sought. The practical motivation is to make progress toward the highly desirable, but very formidable, task of being able to anticipate which tropical storms or minimal hurricanes will evolve to supertyphoons. Description of the two cell vortex is the current challenge. In particular, the properties and location of the eye wall are sought, since the potential vortex and surface inflow subdivisions of the structure of a very intense vortex are in hand. The modeling proceeds from basic thermohydrodynamic principles. Nonessential geometric detail, as well as association of conclusions with the details of particular parameterizations, is being avoided as much as possible. GRA

N80-32028# Texas A&M Univ., College Station. Dept. of Physics.

OCEAN-ATMOSPHERE INTERFACE: ITS INFLUENCE ON RADIATION

Gilbert N. Plass, Terry J. Humphreys, and George W. Kattawar 22 May 1980 61 p refs Submitted for publication

(Contract N00014-80-C-0113)

(AD-A087046; TR-14) Avail: NTIS HC A04/MF A01 CSCL 20/6

The influence of the ocean atmosphere interface on the radiance distribution in both the ocean and atmosphere is investigated. At visible wavelengths in the real ocean just below the surface, the downwelling radiance is a maximum within the critical angle and drops off by one or two orders of magnitude toward the horizon. The usual explanation that this is due to the sky radiation concentrated within the critical angle and the total internal reflection of the weak upward radiance at the ocean surface at angles outside the critical angle is too simplistic. There are two other important factors: (1) the atmosphere must have sufficient optical thickness so that appreciable sky (multiple scattered) radiation develops at all angles in the downward direction; and (2) the water must have appreciable absorption so that the upwelling radiance just below the ocean surface is only a small fraction of the downwelling radiance entering the ocean. The radience distribution in a homogeneous medium is compared with that in the same medium with an atmosphere ocean interface at various depths within the medium. Most of the calculations are done for Rayleigh scattering centers, but some results are given for Mie type scattering. GRA

N80-32029# Washington Univ., Seattle. Polar Science Center.

FRAM 1 METEOROLOGY REPORT

Eric Leavitt and Roger Andersen May 1980 61 p refs

(Contract N00014-79-C-0032)

(AD-A086983) Avail: NTIS HC A04/MF A01 CSCL 04/2

The Fram experiment was conceived as a series of studies to study the geophysics and oceanographic characteristics of the eastern Arctic. The meteorological experiment was designed to provide basic data on wind velocities for the oceanographic experiments, to measure the drag coefficient of the pack ice in the area of the camp, and to collect standard weather data and transmit it to Thule for inclusion in the synoptic network and for planning flight support operations. This report describes the experiment, the data analysis procedures and the data products which are available. The time series of half hour averages of wind speed, direction, and air temperature plus the air pressure every three hours are included as an appendix. Results of the drag coefficient calculations are also included. GRA

N80-32030# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.

A DEMONSTRATION TEST OF THE MODULAR AUTOMATED WEATHER SYSTEM (MAWS) Final Report, Jan. 1977 - Jan. 1979

Donald A. Chisholm, Richard H. Lynch, James C. Weyman, and Edward B. Geisler AFSC 24 Mar. 1980 85 p refs

(AF Proj. 6670)

(AD-A087070; AFGL-TR-80-0087; AFGL-IP-285) Avail: NTIS HC A05/MF A01 CSCL 04/2

A microprocessor-based automated airfield weather observing and forecasting system called MAWS (Modular Automated Weather System) was developed to demonstrate the feasibility of modernizing many of the observing and forecasting functions performed in operational base weather stations. Scott Air Force Base, Illinois, was chosen as the demonstration site and operations were conducted from January 1977 through January 1979. Weather sensors at five observation sites around the airfields were polled several times each minute, the data transmitted over commercial, voice-grade telephone lines to a central supervisory microprocessor where the data were suitably collated, averaged and formatted for display on alpha-numeric display devices at key locations and for magnetic tape archiving for post analysis. The demonstration confirmed that modernized weather support can be largely achieved with state-of-the-art, commercially available hardware/software. Such a system would be compatible with other automation efforts in civilian weather services and other C-cubed efforts in the DOD. The advantage of spatially and temporally detailed weather information in marginal and adverse situations was documented. Sensor siting considerations were addressed in relation to specific weather elements and observational requirements. The contributions of automated met watch procedures and short-range guidance forecasts of RVR landing minima were demonstrated. Feedback on system performance and acceptability was obtained from cognizant AWS offices. GRA

N80-32031# Naval Research Lab., Washington, D. C.

ICING CHARACTERISTICS OF LOW ALTITUDE, SUPERCOOLED LAYER CLOUDS Interim Report, Feb. - Oct. 1980

Richard K. Jeck May 1980 74 p refs

(Contract DOT-FA79WAI-020)

(AD-A087137; FAA-RD80-2423) Avail: NTIS HC A04/MF A01 CSCL 04/2

A limited amount of new data has been obtained on the icing environment during initial airborne measurements aimed at developing environmental icing criteria for use in certifying helicopters for flight into icing conditions. Supercooled cloud characteristics are reported for 12 icing events encountered at temperatures from -10 C to 0 C at altitudes from 3500 to 6500 ft above the surface of Lake Erie and Lake Michigan. Recorded droplet size spectra from a Particle Measuring Systems: Axially Scattering Probe (ASSP) were used to compute droplet mass (volume) median diameter (MMD) and, in addition to a Johnson-Williams LWC Indicator, the liquid water content (LWC). A review of available historical data from 1944-1950, upon which the atmospheric icing standards of Appendix C, FAR 25 were based, reveals that data obtained from measurements of ice accretion on multidiameter cylinders are subject to a number of significant errors of both signs. These probable errors, which will continue to be evaluated, may be responsible for the conclusions that (1) the historical LWC values are generally larger than those observed in the flights described in this report, (2) the historical MMDs appear to be generally too small for all values of LWC and (3) the historical droplet size distributions are unreliable, as is acknowledged in the later historical literature. GRA

N80-32032# University of Southern California, Los Angeles. Systems Management Center.

DEVELOPMENT OF THE MICROWAVE RADIATIVE TRANSFER PROGRAM FOR CLOUDY ATMOSPHERES APPLICATIONS TO DMSP SSM/T CHANNELS Final Report, 1 Jun. 1978 - 30 Sep. 1979

Kuo-Nan Liou, Paul T. Nipko, Grant C. Aufder-Haar, and Hwa-Young Yeh 30 Dec. 1979 128 p refs

(Contract F19628-78-C-0144; AF Proj. 7670)

(AD-A087434; AFGL-TR-80-0051) Avail: NTIS HC A07/MF A01 CSCL 20/13

A microwave radiative transfer program for cloudy and precipitating atmospheres applicable to the DMSP SSM/T channels has been developed. The microwave transfer program takes into account the simultaneous contributions of multiple scattering and absorption by hydrometeors and absorption due to molecular oxygen and water vapor in the atmosphere. Sensitivity analyses have been carried out to investigate the effects of the rainfall rate, cloud thickness, and cloud location on the upwelling brightness temperature over land and ocean surfaces for two

different atmospheric profiles. Over the land surface, it is shown that increasing the cloud liquid water content and cloud thickness significantly reduces the brightness temperatures for SSM/T channels 1 - 3. Over the ocean surface, however, the brightness temperatures for channels 1 - 3 are increased as the cloud liquid water content increases and reach to maximum values depending on the cloud thickness involved. Moreover, we show the importance of the cloud position and the atmospheric temperature profile on the brightness temperature values. In addition, investigation of the effects of precipitation on the temperature retrieval using both the theoretically simulated values and real SSM/T data has also been carried out on the basis of a statistical method. The hypothetical retrieval experiments reveal that the temperatures close to the surface suffer increased degradation as the rainfall rate increases. This finding is further supported by the analysis employing the real SSM/T data for a number of case studies in which temperature profiles from radiosondes are available for comparisons. GRA

N80-32033# Naval Postgraduate School, Monterey, Calif. Environmental Physics Group.
ATMOSPHERIC MARINE BOUNDARY LAYER MIXING RATES IN THE CALIFORNIA COASTAL REGION
G. E. Schacher, K. L. Davidson, and C. W. Fairall May 1980 125 p refs Prepared in cooperation with BDM Corp., Monterey, Calif.
(AD-A087264; NPS61-80-003) Avail: NTIS HC A06/MF A01 CSCL 04/2

The Naval Postgraduate School has conducted five research cruises in California coastal waters for which sufficient data was obtained to allow boundary layer mixing rates to be determined. These data have been processed to determine the mixing rates. The rates have been correlated with meteorological conditions and geographical location and average values for use in air pollution models have been determined. A simplified method for calculating the mixing rate from mean meteorological parameters is presented. GRA

N80-32034*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
ON THE DYNAMIC FORCING OF SHORT-TERM CLIMATE FLUCTUATIONS BY FEEDBACK MECHANISMS
E. R. Reiter Sep. 1979 68 p refs
(Grant NsG-5340; Contract EY-76-S-02-1340; Grant NSF ATM-78-17835)
(NASA-CR-162865; COO-1340-66) Avail: NTIS HC A04/MF A01 CSCL 04B

Various internal feedback mechanisms in the ocean atmosphere system were studied. A variability pattern of sea surface temperature with a quasibiennial oscillation (QBO) was detected off the coast of Senegal, in the Gulf of Guinea and even in the Gulf Stream as it leaves the North American continental shelf. Possible physical connections between some of these QBO's were pointed out by a hypothetical feedback model. Interaction of a QBO with the annual cycle may lead to beating frequencies resembling climatic trends of a duration of several years. DOE

N80-32035# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
INFLUENCE OF VOLCANIC AEROSOLS AND OCEANIC SURFACE TEMPERATURES ON TROPOSPHERIC TEMPERATURES
Alfredo R. Navato 1979 13 p refs Presented at the NOAA Climate Diagn. Workshop, Madison, Wisc., Oct. 1979
(Contract DE-AS02-76EV-12195)
(COO-2195-36) Avail: NTIS HC A02/MF A01

Results of a study to estimate the sensitivity of the tropical (20 deg N to 20 deg s) tropospheric temperatures to oceanic surface temperatures of the Pacific Ocean, Atlantic Ocean, and Indian Ocean, and to atmospheric dust and aerosol concentrations over the northern tropics and over the Southern Hemisphere are summarized. DOE

N80-32036# Fondazione Ugo Bordoni, Rome (Italy).
A STUDY ON ALGORITHMS AND PROCESSING PROGRAMS FOR DATA FROM INTERFERENCE DUE TO HYDROMETEORS AT 17.8 GHz [STUDI DEGLI ALGORITMI E DEI PROGRAMMI DI ELABORAZIONE DEI DATA DI INTERFERENZA DOVUTA A IDROMETEORE A 17.8 GHz]
Aldo Paraboni (Politecnico di Milan) Sep. 1979 47 p refs In ITALIAN
(FUB-12-1979) Avail: NTIS HC A03/MF A01

Rain interference studies related to a future Sirio satellite experiment are presented. The physical characteristics of the parameters to be measured are examined. The measuring system characteristics are related to the experiment objectives. The data processing techniques to assure optimal use of existing infrastructure are discussed. Author (ESA)

N80-32037# Fondazione Ugo Bordoni, Rome (Italy).
CHARACTERIZATION AND INFLUENCE OF THE PARAMETERS OF A MODEL TO DESCRIBE HYDROMETEOR DIFFUSION [INDIVIDUAZIONE ED INFLUENZA DEI PARAMETRI DI UN MODELLO ATTO A CARATTERIZZARE I FENOMI DI DIFFUSIONE DA IDROMETEORE]
Aldo Paraboni (Politec. di Milan) Sep. 1979 32 p refs In ITALIAN
(FUB-23-1979) Avail: NTIS HC A03/MF A01

A structural model of hydrometeor electromagnetic radiation diffusion is presented referred to centimeter and millimeter wavelengths and to satellite-ground transmissions. Two approaches to the probalistic prevision of scattering coupling, one taking into consideration the Misme-Fimbel storm cell model, and the other considering a stratified structure only, are discussed. Author (ESA)

N80-32038# Royal Netherlands Meteorological Inst., De Bilt. Statistisch Bureau.
RESULTS OF COMPARATIVE MEASUREMENTS WITH VARIOUS TYPES OF PLUVIOMETERS DURING THE PERIOD OF DECEMBER 1971 TO JANUARY 1975 AT DE BILT, NETHERLANDS [RESULTATEN VAN VERGELIJKENDE METINGEN MET DIVERSE TYPEN REGENMETERS IN HET TIJDVAK DECEMBER 1971 - JANUARI 1975 TE DE BILT]
A. Denkema 1980 6 p refs In DUTCH
(KNMI-V-342) Avail: NTIS HC A02/MF A01

Precipitation amounts and averages are given for ten different types of raingage installed at the same site. A national raingage for the Netherlands with a 200 cm sq opening was among the instruments used. The placement of the instruments relative to each other is shown. Author (ESA)

N80-32039# Royal Netherlands Meteorological Inst., De Bilt. Wetenschappelijk Onderzoek.
CLIMATOLOGY IN THE NETHERLANDS. ABSTRACTS OF SEVEN LECTURES GIVEN ON CLIMATE DAY [KLIMAATONDERZOEK IN NEDERLAND. SAMENVATTINGEN VAN EEN 7-TAL LEZINGEN GEHOUDEN OP DE 'KLIMAATDAG' 30 JANUARI 1980 TE DE BILT]
1980 46 p refs In DUTCH Lectures presented at De Bilt, Netherlands, 30 Jan. 1980
(KNMI-V-345) Avail: NTIS HC A03/MF A01

Climatology is studied with emphasis on climate change and modeling. Topics include use of fossil pollens in climate study, pollen research in Greece, modeling of ice caps, climate research using archival material, dendroclimatology and isotopes. Author (ESA)

N80-32040# Royal Netherlands Meteorological Inst., De Bilt. Fysisch Meteorologisch Onderzoek.
THE OCCURENCE OF A NOCTURNAL WIND MAXIMUM AT LOW ALTITUDE [HET OPTREDEN VAN EEN NACHTELIJK WINDMAXIMUM OP LAGE HOOGTE]
A. G. M. Driedonks 1980 28 p refs In DUTCH Presented at Colloq., De Bilt, Netherlands, Nov. 1979
(KNMI-V-346) Avail: NTIS HC A03/MF A01

A model is used to explain wind variation above the nocturnal boundary layer. Observations from Cabauw, the Netherlands are presented. It is shown that the maximum wind phenomenon may have a large horizontal spread. The circumstances favorable for the occurence of nocturnal wind maxima are shown. Author (ESA)

N80-32041# Royal Netherlands Meteorological Inst., De Bilt. Wetenschappelijk Onderzoek.

ANTHROPOGENIC CLIMATE CHANGES. STATE-OF-THE-ART SURVEY [ANTROPOGENE KLIMAATSVERANDERINGEN. OVERZICHT VAN DE STAND VAN ZAKEN]
J. Reiff, ed. and C. J. E. Schuurmans, ed. 1980 58 p refs Partly in DUTCH and ENGLISH
(KNMI-V-347) Avail: NTIS HC A04/MF A01

Climate change on both a global regional scale is discussed. The consequences of increased levels of freon, aerosols, CO2, and heating are examined as well as the effects of deforestation of tropical regions, increased desertification, and creation of artificial lakes. Urban climate and precipitation downwind from industrial zones are included. Author (ESA)

N80-32042# World Meteorological Organization, Geneva (Switzerland).
CONVERSION OF GRID-POINT DATA INTO METEOROLOGICAL MAPS WITH A MINI-COMPUTER SYSTEM
D. Soederman and L. Winberg 1980 47 p refs
(WMO-553; WWW-PLR-37; ISBN-92-63-10553-7) Avail: NTIS HC A03/MF A01; WMO, Geneva SWFR 5

The hardware and software required for installing and operating a grid-to-map conversion system at a regional or national meteorological center are described. General information is given on system configurations to be used for the conversion, including a mini-computer and plotter, or a direct computer-to-facsimile system. The software systems required to decode and generate maps from data encoded in the World Meteorological Organization GRID/GRAF codes are discussed and the graphical conversion system in operation at the Finnish Meteorological Institute is described. Author (ESA)

N80-32043# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ENVIRONMENTAL WIND IN BUILT-UP AREAS
D. Olivari Feb. 1980 46 p refs Presented at Symp. on Recente Evolutie in de Hoogbouw, Leuven, Belgium, 28-29 Mar. 1979
(VKI-TM-26) Avail: NTIS HC A03/MF A01

The interaction between man-made structures and surface wind was studied. The structure of atmospheric winds and the effects of wind on human comfort are reviewed and the wind flow through built up areas is examined. The experimental techniques used and results obtained are discussed. It is shown that many observed effects are not clearly understood and that the only tool available for the prediction of the wind condition at the pedestrian level for new building developments is the wind tunnel. Author (ESA)

N80-32044# National Bureau of Standards, Washington, D.C. National Engineering Lab.
HURRICANE WIND SPEEDS IN THE UNITED STATES Final Report
Martin E. Batts, Martin R. Cordes, Larry R. Russell, James R. Shaver, and Emil Simin May 1980 54 p refs Sponsored in part by DOE Prepared in cooperation with Russell (Larry R.) and Associates, Inc.
(Grant NSF ENV-77-16113)
(PB80-181126; NBS-BSS-124; LC-80-600039) Avail: NTIS HC A04/MF A01 CSCL 04B

A Monte Carlo simulation technique is used to obtain estimates of hurricane wind speeds in the Gulf of East Coasts of the United States. The sources of data, the probabilistic models for the climatological characteristics of hurricanes, and the physical models to the hurricane wind speed field used in the estimation are described. GRA

N80-32045# Water and Power Resources Service, Denver, Colo. Office of Atmospheric Resources Management.
USERS GUIDE FOR THE ANALYSIS AND INTERPRETATION OF SATELLITE IMAGERY ON THE HIGH PLAINS SUMMER CLOUD AND MESOSCALE SYSTEMS
David A. Matthews Jan. 1980 47 p refs
(PB80-175987) Avail: NTIS HC A03/MF A01 CSCL 04B

A guide to the analysis and interpretation of clouds and mesosynoptic systems observed in geosynchronous satellite imagery over the High Plains and Rocky Mountain region of the United States is presented. This guide provides examples of typical cloud types and mesoscale and synoptic scale systems. Methods used in the identification of these different phenomena are described to show the user how to interpret the information available on visible satellite imagery. Summertime convective and stratiform cases are analyzed with numerous examples of different cloud and cloud system structures. GRA

N80-32046# National Weather Service, Silver Spring, Md. Office of Hydrology.
COMPARISON OF GENERALIZED ESTIMATES OF PROBABLE MAXIMUM PRECIPITATION WITH GREATEST OBSERVED RAINFALLS
John T. Riedel and Louis C. Schreiner Mar. 1980 75 p refs
(PB80-191463; NOAA-TR-NWS-25; NOAA-80050601) Avail: NTIS HC A04/MF A01 CSCL 04B

Known storms of record over the United States east of the 105th meridian and west of the Continental Divide that have point or areal rainfall depths that are ≥ 50 percent of PMP are summarized. More than 240 storms met this criteria. The storms are identified and percentages of PMP are shown on maps. Some judgement on the relative magnitude of PMP in the two large regions is given by comparison of the ratios of PMP to 100 year return period rainfall. Such ratios for 24 hours range from 4 to 6 east of the 105th meridian. For the western mountainous states, these ratios are as low as 2 in the more mountainous locations and as high as 6 in the desert and sheltered spots. GRA

N80-32047# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
DOPPLER RADAR STUDIES DURING THE SIERRA COOPERATIVE PILOT PROJECT
W. R. Moninger Jan. 1980 110 p refs
(PB80-191455; NOAA-TM-ERL-WPL-50; NOAA-80050711) Avail: NTIS HC A06/MF A01 CSCL 04B

Two case studies of frontal winter storms revealed a low level high speed jet moving toward the NNW, parallel to the foothills, was present ahead of both fronts; and both storms were highly complex, having a substructure of up and downdrafts oriented nearly perpendicular to the frontal surface. These storms differed in significant ways from typical high plains storms: (1) the strongest updrafts and greatest condensation rates occur in the lowest 1 to 2 km above cloud base, and (2) updrafts correspond generally to regions of high radar reflectivity factor, downdrafts to low reflectivity. GRA

N80-32048# Environmental Data and Information Service, Washington, D. C.
MARINERS WEATHER LOG, VOLUME 24, NO. 2
Elwyn E. Wilson, ed. Mar. 1980 86 p refs
(PB80-188444; NOAA-80050102; ISSN-0025-3367) Avail: NTIS HC A05/MF A01 CSCL 04B

Estimation of surface pressures from satellite cloud patterns; North Atlantic tropical cyclones, 1979; and Great Lakes Weather Map Service plus Special Great Lakes Marine Storm Report for lakes mariners. GRA

N80-32049# National Hurricane and Experimental Meteorology Lab., Coral Gables, Fla.
NATIONAL HURRICANE AND EXPERIMENTAL METEOROLOGY LABORATORY COLLECTED REPRINTS, 1979
Mar. 1980 127 p refs
(PB80-192917; NOAA-80050702) Avail: NTIS HC A07/MF A01 CSCL 04B

Hurricanes, tropical cumulus convection and the atmospheric environments in which they occur and with which they interact are described. Mathematical models through high speed, large capacity computers are developed. These models simulate the development, structure, and behavior of hurricanes and other mesoscale events in their natural state and when experimentally modified. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-32050*# Texas A&M Univ., College Station.
ALTIMETRY DATA OVER TRENCHES AND ISLAND-ARCS

AND CONVECTION IN THE MANTLE Final Report, 1 Nov. 1979 - 31 Aug. 1980
18 Sep. 1980 26 p refs
(Contracts NCC5-11; NAGS-94)
(NASA-CR-163516) Avail: NTIS HC A03/MF A01 CSCL 08C

Transfer function techniques were developed to calculate the isostatic component of the geoid signal over trench/island arc/back arc systems. Removal of this isostatic component from geoid profiles determined by GEOS 3 radar altimetry leaves a residual geoid that can be attributed to the effect of mass inhomogeneities below the depth of compensation. Efforts are underway to extend the analysis to all the major trench/island arc systems of the world in order to provide more detailed understanding of the dynamic processes occurring beneath island arcs. A.R.H.

N80-32051*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE SEASAT SAR WIND AND OCEAN WAVE MONITORING CAPABILITIES: A CASE STUDY FOR PASS 1339M
Robert C. Beal Jan. 1980 66 p refs Revised Sponsored in part by NASA
(Contract MO-A01-78-00-4330)
(NASA-CR-163454; NOAA-80050104; PB80-194996; JHU/APL/SIR-79U-019) Avail: NTIS HC A04/MF A01 CSCL 08C

A well organized low energy 11 sec. swell system off the East Coast of the U.S. was detected with the Seasat Synthetic Aperture Radar and successfully tracked from deep water, across the continental shelf, and into shallow water. In addition, a less organized 7 sec. system was tentatively identified in the imagery. Both systems were independently confirmed with simultaneous wave spectral measurements from a research pier, aircraft laser profilometer data, and Fleet Numerical Spectral Ocean Wave Models. GRA

N80-32052# Environmental Research Inst. of Michigan, Ann Arbor.
SEASAT SAR COASTAL OCEAN WAVE ANALYSIS. A WAVE REFRACTION AND DIFFRACTION STUDY Final Report, Aug. 1978 - Nov. 1979
R. A. Shuchman, E. S. Kasischke, A. Klooster, and P. L. Jackson Nov. 1979 117 p refs
(Contract MO-A01-78-00-4339)
(PB80-189384; ERIM-138600-2F; NOAA-80050103) Avail: NTIS HC A06/MF A01 CSCL 08C

Analysis techniques used to exploit Seasat synthetic aperture radar (SAR) data are discussed and the Seasat SAR's capability to image gravity waves in coastal waters is evaluated. Synthetic aperture radar analysis techniques investigated were the effects of gravity wave motion on Seasat SAR focusing, geometric rectification of SAR data, use of optical Fourier transforms to obtain dominant wavelength and direction information from SAR data, and the use of digital techniques to exploit SAR data. Refraction of gravity waves in coastal waters was clearly evident, and a wave refraction model was used to predict water depths using inputs from the Seasat SAR data. GRA

N80-32053# Brookhaven National Lab., Upton, N. Y.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. DATA REPORT 65: SEDIMENT DATA FROM SHORT CORES DURING JOINT 2 OFF PERU Data Report
Gilbert T. Rowe Oct. 1979 57 p refs
(PB80-183155; NSF/IDOE-CUEA-DR-65; NSF/IDOE-80-11) Avail: NTIS HC A04/MF A01 CSCL 08G

Data obtained from cored sediments collected during the JOINT 2 CUEA experiment off Peru are presented. The cores were obtained with gravity cores or by subsampling a vanVeen grab. The 6 centimeter diameter cores range in length from 9 to 63 centimeters. Analyses conducted on sediment material include organic carbon, organic nitrogen, percent calcium carbonate and pore water concentrations of ammonia, nitrite, nitrate, silicate and phosphate. These data were collected in an attempt to gain knowledge of the interrelationships between early diagenesis and remineralization of organic matter, bioturbation, and dissolved ion exchange between the sediments and the overlying water. GRA

N80-32054# New Hampshire Univ., Durham. Dept. of Earth Sciences.
A STUDY OF ESTUARINE TIDAL DISSIPATION AND BOTTOM STRESS
Richard P. Trask and Wendell S. Brown Feb. 1980 74 p refs Sponsored by NOAA
(PB80-194988; UNH-SG-166; NOAA-80050713) Avail: NTIS HC A04/MF A01 CSCL 08C

Estimates of bottom stress in a tidal estuary are made by two independent means. Net energy budget calculations provided estimates of rates of tidal energy dissipation which can be interpreted in terms of an area averaged bottom stress (energy dissipation method). A second independent estimate of an area averaged bottom stress was made using the long wave momentum and continuity equations and estimates of sea surface slope and current acceleration (dynamic inference method). Preliminary energy budget calculations made for the Great Bay Estuary, New Hampshire, showed that a two km section of the estuary exhibits anomalously large tidal energy dissipation which was assumed to be due to bottom friction. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-32055*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES IN GAS EXCHANGE, TISSUE RESPIRATION AND GLYCOLYSIS IN RATS DURING HYPOKINESIA
L. V. Zorya May 1980 11 p refs Transl. into ENGLISH from Fiziol. Zh. (USSR), v. 22, no. 3, 1976 p 414-417 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76149) Avail: NTIS HC A02/MF A01 CSCL 06C

The results of an experiment which studied changes in oxygen balance under conditions of hypokinesia in rats is presented. The effect of the stress during hypokinesia is expressed most clearly in the changes of general gas exchange, and in the intensity of liver and myocardial tissue respiration. L.F.M.

N80-32056*# National Aeronautics and Space Administration, Washington, D. C.
THE INFLUENCE OF MODULATED SINUSOIDAL CURRENT ON THE STATE OF CHROMATIN FROM NEURONS OF THE CEREBRAL CORTEX OF RATS IN HYPOKINESIA
Z. A. Sokolova May 1980 10 p refs Transl. into ENGLISH from Vop. Kurortol., Fizioter. Lech. Fiz. Kul't (USSR), no. 1, Jan. - Feb. 1978 p 56-59 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76160) Avail: NTIS HC A02/MF A01 CSCL 06C

The biochemical changes under the influence of modulated sinusoidal current in the central nervous system were investigated. The methodology used is discussed, the results are reported in a table, and conclusions are presented. R.K.G.

N80-32057*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF SINUSOIDAL MODULATED CURRENTS AND ACUTE HYPOXIA ON CORTICOSTERONE CONTENT AND ACTIVITY OF CERTAIN DEHYDROGENASES IN TISSUES OF DIFFERENT RAT ORGANS DURING HYPOKINESIA
L. L. Melik-Aslanova and I. D. Frenkel May 1980 12 p refs Transl. into ENGLISH from Vod. Kurortol., Fizioter. Lech. Fiz. Kulit. (USSR), no. 1, Jan. - Feb. 1978 p 59-65 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Central Inst. of Health Resort Treatment and Physical Therapy, Moscow
(Contract NASw-3198)
(NASA-TM-76161) Avail: NTIS HC A02/MF A01 CSCL 06C

The state of hypokinesia in rats was reproduced by keeping them for 30 days in special box cages that restricted their mobility in all directions. Results show the resistance to acute hypoxic hypoxia is increased. This is linked to the considerable rise in the reduced level of corticosterone in different organs and the succinate dehydrogenase activity in the liver and brain. The letter indicated the primary oxidation of succinate, which has great importance in the adaptation of the oxidative metabolism to acute oxygen insufficiency. The use of sinusoidal modulated currents in the period of hypokinesia promotes normalization of the indices for resistance of the rats to acute hypoxia. L.F.M.

N80-32058*# National Aeronautics and Space Administration, Washington, D. C.
THE DYNAMICS OF CERTAIN INDICATORS OF NUCLEIN METABOLISM DURING HYPOKINESIA IN RATS OF DIFFERENT AGES UNDER THE INFLUENCE OF SINUSOIDAL MODULATED CURRENTS AND MEASURED PHYSICAL LOAD
Z. A. Sokolova May 1980 9 p refs Transl. into ENGLISH from Vop. Kurortol., Fizioter. Lech. Fiz. Kulit. (USSR), no. 5, Sep.-Oct. 1977 p 67-70 Transl. by Scientific Translation Service, prepared by Central Inst. of Health Resort Treatment and Physiology, Moscow
(Contract NASw-3198)
(NASA-TM-76162) Avail: NTIS HC A02/MF A01 CSCL 06C

The influence of sinusoidal modulated currents was studied and physical loads on the nucleic acid content and the nucleotide composition of the total RNA in muscles of rats of various ages under conditions of hypodynamia were measured. Methodology utilized is described and conclusions are presented. R.K.G.

N80-32059*# National Aeronautics and Space Administration, Washington, D. C.
ABSORPTION OF THIAMINE AND NICOTINIC ACID IN THE RAT INTESTINE DURING FASTING AND IMMOBILIZATION STRESS
O. G. Kirilyuk and Yu. V. Khmelevskiy Jun. 1980 11 p refs Transl. into ENGLISH from Fiziol. Zh. (USSR), v. 23, no. 1, 1977 p 98-102 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Medical Inst., Kiev
(Contract NASw-3199)
(NASA-TM-76193) Avail: NTIS HC A02/MF A01 CSCL 06C

By perfusion of isolated sections of intestine with a solution containing thiamine at a concentration of 3.1 micromole, it was established that thiamine absorption in animals fasted for 72 hours decreased by 28 percent, whereas absorption increased by 12 percent in rats after 24 hour immobilization. After immobilization, absorption of label in the intestinal mucosa increased. Na K ATPase activity in the intestinal mucosa decreased by 10 percent during fasting, and it increased with immobilization of the animals. Activity of Na K ATPase in the intestinal mucosa cells determined the absorption rate of thiamine and nicotinic acid at the level of vitamin transport through the plasma membranes of the enterocytes. R.K.G.

N80-32060*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF FACTORS OF PROLONGED SPACE FLIGHT ON CONDITIONS OF TORTOISE SKELETON
G. P. Stupakon, A. I. Volozhin, V. A. Korzhenyants, V. S. Yagodovskiy, A. N. Polyakov, V. V. Korolev, and V. A. Elivanov Aug. 1980 13 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 6, Nov. - Dec. 1979 p 9-14 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76352) Avail: NTIS HC A02/MF A01 CSCL 06C

After a 60-90 day space flight mild osteoporosis developed in the epiphyses and metaphyses of long tubular bones of tortoises, which was not attributed to reduced mineral saturation of the preserved bone tissue microstructures. The diminished strength of the cancellous bone of the epiphyses in tortoises after space flight was due to the reduced properties of its structure. The strength of the compact substance did not change under the effect of weightlessness. R.C.T.

N80-32061# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
[HEALTH AND ENVIRONMENTAL RESEARCH RELATED TO ENERGY DEVELOPMENT AND USE] Annual Progress Report, 1 Jul. 1978 - 30 Jun. 1979
Jun. 1979 160 p
(Contract EY-76-C-03-0012)
(UCLA-12-1217) Avail: NTIS HC A08/MF A01

Highlights of research for FY-1979 is reported in the areas of biomolecular and cellular science, environmental biology of desert ecosystems and nuclear medicine. Abstracts of 156 published reports are included. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-32062* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 209)
Aug. 1980 57 p
(NASA-SP-7011(209)) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240; HC $7.00 CSCL 06E

This bibliography lists 169 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1980. Author

N80-32063# Illinois Univ. at Urbana-Champaign. Dept. of Psychology.
GROUND-REFERENCED VISUAL ORIENTATION WITH IMAGING DISPLAYS Final Scientific Report, Oct. 1977 - Sep. 1979
Stanley N. Roscoe Nov. 1979 47 p
(Contract F49620-77-C-0117)
(AD-A081882; ENG-PSY-79-4/AFOSR-79-4) Avail: NTIS HC A03/MF A01

Problems related to the accurate judgment of size and distance as required of pilots in flight were investigated over a two year period. The experiments covered a broad spectrum of psychophysiological issues involving the measurement of visual accommodation and its correlation with various other dependent variables. The latter included a short term memory task, physiological measures of autonomic balance, scores on a personality test of introversion extraversion, and responses to a personal inventory questionnaire. Psychophysiological issues investigated included the size distance invariance hypothesis, the moon illusion, night and empty field myopia, the dark focus and its so called Mandelbaum effect, the nature of the locus of the accommodative stimulus, and possible relationships among accommodative responses, autonomic balance, and personality. A.R.H.

N80-32064*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES IN BONE TISSUE UNDER CONDITIONS OF HYPOKINESIA AND IN CONNECTION WITH AGE
E. P. Podrushnyak and E. I. Suslov Jun. 1980 7 p refs Transl. into ENGLISH from Fiziol. Zh. (USSR), v. 19, no. 6, Nov. - Dec. 1973 p 841-943 Transl. was announced as N80-21971 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76154) Avail: NTIS HC A02/MF A01 CSCL 06P

X-ray micrography was used to study the optical density of the blackening of X-ray photographs made of five bones in 9 young people (ages 24 to 29) before and after strict bed rest for 16 to 37 days. Photometric studies of the X-ray film determined the relative concentration of bone structure before and after hypokinesia. In addition, the bone tissues of 25 cadavers of practically healthy individuals (aged 18 to 70) who died from injuries were investigated using X-ray structural analysis. Results show that the reaction to the state of hypokinesia is not uniform in different individuals and is quite often directly reversed. It

was established that pronounced osteoporosis can be found in a relatively short time after conditions of hypokinesia in healthy young individuals. Results show that the stabilization of the crystalline structure of hydroxyapatite, especially its crystal formation, is finished by the age of 20 to 25. From 25 to 60, the crystal lattice remains in stable condition but X-ray analysis shows a reduction in the hydroxyapatite density. A.R.H.

N80-32065*# National Aeronautics and Space Administration, Washington, D. C.

EFFECTS OF HIRUDIN-INDUCED ACTIVATION OF NON-ENZYMATIC FIBRINOLYSIS DURING IMMOBILIZATION STRESS

F. B. Shapiro, I. P. Baskova, L. U. Cherkesova, L. A. Lyapina, and M. D. Goldovskaya Jul. 1980 14 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 64, no. 11, Nov. 1978 p 1567-1574 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Moscow State Univ.
(Contract NASw-3199)
(NASA-TM-76189) Avail: NTIS HC A02/MF A01 CSCL 06S

The specific inhibitor of thrombin, hirudin, was used for studying the mechanism of the activating effect of ACTH and adrenalin on nonenzymatic fibrinolytic activity (NEFA), the latter characterizing the function of the anticoagulation system (ACS). Simultaneous administration of ACTH and hirudin to animals subjected to immobilization stress did not reduce the effect of ACTH on NEFA, while simultaneous administration of adrenalin and hirudin revealed a diminished effect of the former. This suggests different mechanisms of ACTH and adrenalin effects upon NEFA: the stimulating effect of norepinephrine is realized through throminogenesis followed by activation of the ACS function and by increased NEFA and therefore inhibitable by hirudin which forms an inactive complex with thrombin. In fact the stimulating effect of ACTH upon NEFA is brought about specifically by another route than thrombinogenesis and thus occurs in the presence of hirudin. Hirudin itself has no effect upon NEFA. Author

N80-32066*# National Aeronautics and Space Administration, Washington, D. C.

RESTORATION OF PHYSICAL PERFORMANCE CAPACITY OF ATHLETES AFTER PROLONGED RESTRICTION OF THEIR MOTOR ACTIVITY

A. D. Soldatov and V. I. Finogeyev Aug. 1980 12 p Transl. into ENGLISH from Teor. Prakt. Fiziol. Kult. (USSR), no. 5, May 1979 p 19-22 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by All-Union Scientific Research Inst. of Physical Culture
(Contract NASw-3198)
(NASA-TM-76305) Avail: NTIS HC A02/MF A01 CSCL 06P

The effects of different regimens of treatment following prolonged hypokinesia were studied in order to determine the most effective program. The types of programs considered were passive means, consisting of physical therapy; active means, consisting of athletic training; and a combined program. In the first stage of the experiment, the effects of a 10 day period of hypokinesia were studied. It was determined that the restoration programs must address the problems of: (1) increasing defense function and general tone of the body; (2) restore orthostatic stability; and (3) increase general endurance. In later stages, groups of athletes and nonathletes underwent 30 day periods of hypokinesia. Restoration was carefully monitored for groups treated with the various regimens. It was determined that the most effective treatment was a comprehensive program of passive and active therapy. Author

N80-32067*# National Aeronautics and Space Administration, Washington, D. C.

PHYSICAL EXERCISES ON A BICYCLE-ERGOMETER AND RUNNING TRACK TO PREVENT HYPODYNAMIA IN WORKERS OF INTELLECTUAL LABOR

V. V. Vasilyeva, Ye. N. Korableva, and V. V. Trunin Aug. 1980 7 p refs Transl. into ENGLISH from Teor. Prakt. Fiziol. Kult. (USSR), no. 10, Oct. 1979 p 34-36 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by P. F. Lesgaft State Order of Lenin and Order of the Red Banner Inst. of Physical Culture
(Contract NASw-3198)
(NASA-TM-76306) Avail: NTIS HC A02/MF A01 CSCL 06P

A program of exercises was developed and tested, consisting of a 12 minute session on a variable load bicycle ergometer and a 10-11 min. run with brief stretching and resting sessions between. Physical performance capacity was measured before, during, and after the period of the experiment and physical exams conducted. After a 4 month test period involving 30 men, aged 25-35, the program was found to be successful in increasing physical performance capacity. The PWC170 increased an average of 22 percent and maximum oxygen consumption 14 percent. Arterial pressure dropped (120/75 to 114/68), vital capacity of lungs increased by 6 percent, strength of respiratory muscles by 8.8 percent, duration of respiratory delay by 18 percent. Duration of cardiac cycles increased, stress index decreased. Cardiac contraction rate 2 minutes after work on the ergometer decreased from 118 to 102 bt/min. R.C.T.

N80-32068*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF HYPOKINESIA ON BLOOD MICROCIRCULATION

A. M. Chernukh, O. G. Gazenko, B. M. Fedorov, T. N. Krupina, P. N. Aleksandrov, D. I. Shagal, N. Ye. Ranferova, and T. N. Proskurina Aug. 1980 9 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 3, May - Jun. 1979 p 10-13 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76308) Avail: NTIS HC A02/MF A01 CSCL 06S

Blood microcirculation in the region of the scleral bulbar conjunctiva and the nail folds on the fingers and toes was studied in 18 practically healthy men during 182 day antiorthostatic hypokinesia and 30 day rehabilitation period. Marked changes in microcirculation in the sclera and feet and less evident changes on the hands was revealed. A complex of special prophylactic physical exercises had a distinctly favorable effect on circulation in the hands. Author

N80-32069*# National Aeronautics and Space Administration, Washington, D. C.

THERAPEUTIC GYMNASTICS IN COMPREHENSIVE TREATMENT OF PATIENTS WITH GENERALIZED MYASTHENIA

R. L. Kapelovich Aug. 1980 9 p refs Transl. into ENGLISH from Vop. Kurortol., Fizioter. Lech Fiz. Kul' T. (USSR), no. 5, Sep. - Oct. 1979 p 41-45 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by I. M. Sechenov First Moscow Medical Inst.
(Contract NASW-3198)
(NASA-TM-76312) Avail: NTIS HC A02/MF A01 CSCL 06E

The technique of therapeutic gymnastics was used for patients with mayasthenia gravis to control the consequences of hypodynamia induced by the myasthenic process. It is concluded that during myasthenia, the severity of the disease is due to the affection of the cross striated musculature. The most life threatening are the disorders in respiration and swallowing, that can be intensified by forced stay in bed and immobility. It is also concluded that the use of therapeutic gymnastics in patients which myasthenia promotes efficient presurgical preparation, and in the post surgical period; prevention of pulmonary complications and normalization of respiration. Therapeutic gymnastics with regard to the severity and localization of the myasthenic disorders must be a component part of the presurgical preparation and postsurgical management of patients with generalized myasthenia. R.C.T.

N80-32070*# National Aeronautics and Space Administration, Washington, D. C.

ORTHOCLINOSTATIC TEST AS ONE OF THE METHODS FOR EVALUATING THE HUMAN FUNCTIONAL STATE

V. A. Doskin, L. D. Gissen, O. Z. Bomshteyn, E. N. Merkin, and S. B. Sarychev Aug. 1980 8 p refs Transl. into ENGLISH from Gig. Sanit. (USSR), no. 4, Apr. 1979 p 41-44 Transl. by

Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by All-Union Scientific Research Inst. of Physical Culture, Moscow
(Contract NASw-3198)
(NASA-TM-76321) Avail: NTIS HC A02/MF A01 CSCL 06P

The possible use of different methods to evaluate the autonomic regulation in hygienic studies were examined. The simplest and most objective tests were selected. It is shown that the use of the optimized standards not only makes it possible to detect earlier unfavorables shifts, but also permits a quantitative characterization of the degree of impairment in the state of the organism. Precise interpretation of the observed shifts is possible. Results indicate that the standards can serve as one of the criteria for evaluating the state and can be widely used in hygienic practice. R.C.T.

N80-32071*# National Aeronautics and Space Administration, Washington, D. C.
BLOOD FILLING AND FLOW IN LUNGS DURING CHANGE IN BODY POSITION IN SPACE
A. S. Pogodin and B. I. Mazhbich Aug. 1980 12 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 66, no. 4, Apr. 1980 p 555-561 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Academy of Medical Sciences, Siberia
(Contract NASw-3198)
(NASA-TM-76333) Avail: NTIS HC A02/MF A01 CSCL 06P

In the horizontal position (supine and lateral), in the upright position (head up and head down) and during change of the cat body position in space, quantitative responses of regional blood volume and blood flow in the lungs (ml/100 cu cm) revealed presence of the gradient in the gravitation direction. Blood volume and blood flow of different lung portions changed qualitatively and quantitatively in different ways. These changes occurred only in the direction producing the equality of regional hydrostatical and hemodynamic loads in the lungs at either horizontal level. Author

N80-32072*# National Aeronautics and Space Administration, Washington, D. C.
OCCUPATIONAL CHANGES IN THE ORGAN OF HEARING AND EQUILIBRIUM IN SAILORS AND FISHERMAN
R. P. Menyakin and V. I. Poperetskaya Aug. 1980 9 p refs Transl. into ENGLISH from Vestn. Otorino-laringol. (USSR), no. 1, Jan - Feb. 1980 p 39-42 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Vladivostok Medical Inst.
(Contract NASW-3198)
(NASA-TM-76335) Avail: NTIS HC A02/MF A01 CSCL 06P

Prophylactic examination in persons engaged in fishing industry and in sailors of ocean-going ships demonstrated occupational cochlear neuritis, resulting from the action of noise and vibration. Five hundred and fifty three sailors and fishermen working under conditions of noise were studied. A total of 233 persons 43.7% were found to be suffering from changes of the auditory analyzer typically resulting from the action of noise and vibration. The most pronounced changes of hearing were revealed in fishermen, in 44.8% of the persons examined, the percentage also being the highest among the engine room workers (63%). The incidence of cochlear neuritis in sailors of the ocean-going steamship line and in personnel of research ocean-going ships was almost equal (39.9-40%). These indices differed in the engine room workers (42-46%). Vestibular function was investigated by caloric and rotation tests with the use of electronystagmography. The data obtained point to diminution of the vestibular analyzer excitability with increase of the length of navigation service. R.C.T.

N80-32073*# National Aeronautics and Space Administration, Washington, D. C.
CERTAIN FEATURES OF THE COCHLEOVESTIBULAR SYNDROME IN THE RESIDUAL STAGE OF TRAUMATIC BRAIN DISEASE
M. I. Garshin and V. Ye. Volyanskiy Aug. 1980 12 p refs Transl. into ENGLISH from Vestn. Otorino-Laringol. (USSR), no. 2, Mar.-Apr. 1980 p 37-41 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Psychoneurological Clinic, Odessa
(Contract NASw-3198)
(NASA-TM-76337) Avail: NTIS HC A02/MF A01 CSCL 06E

Caloric and rotation tests were applied to the study of the vestibular analyser in 84 patients in the residual state of traumatic disease of the brain. Vestibular disturbances of different degree revealed in 79 patients were as a rule accomplished by cochlear derangement. In the majority of patients the vestibular syndrome was supratentorial with the involvement of the diencephal-hypothalmic, subcortical, and cortical levels of the brain. Vestibular dysfunction correlated with such factors as severity of the sustained craniocerebral traum, duration of the posttraumatic period, and, particularly, with the character of the residual neurological syndrome. In accordance with the latter, it is recommended that vestibular disturbances be treated in the residual period of closed craniocerebral injuries with due regard for the principal pathophysiological mechanisms of the underlying neurological syndrome. Author

N80-32074*# National Aeronautics and Space Administration, Washington, D. C.
DIAGNOSIS OF LATENT FORMS OF LABYRINTHINE AFFECTIONS
V. P. Vaslilyeva Aug. 1980 10 p refs Transl. into ENGLISH from Vestn. Otorino-Laringol. (USSR), no. 3, May-Jun. 1980 p 22-27 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by I.M. Sechenov First Moscow Medical Inst.
(Contract NASw-3198)
(NASA-TM-76338) Avail: NTIS HC A02/MF A01 CSCL 06E

Features and significance of individual vestibular symptoms for the diagnosis of latent labyrinthitis and limited forms of labyrinthine affections offering considerable difficulties are discussed. Vestibular symptoms are indistinct. In case of the negative fistular symptom the greatest significance is acquired by the study of posture nystagmus according to the results of electronystagmograms, changes of tonic reactions and statics, as well as data of experimental vestibular tests. The necessity of evaluation of all the vestibular symptoms from the point of view of their vector characteristics and in a complex of evidence obtained by otoneurological examination of the patient is emphasized. Delicate topic and differential diagnosis of vestibular disturbances is of great importance and significance in the choice of the conservative or surgical method of treatment. Author

N80-32075*# National Aeronautics and Space Administration, Washington, D. C.
TECHNIQUE OF ELECTRICAL STIMULATION OF THE VESTIBULAR ANALYZER UNDER CLINICAL CONDITIONS
S. N. Khechinashvili, B. M. Zargaryan, and K. G. Karakozov Aug. 1980 8 p refs Transl. into ENGLISH from Vestn. Otorino-laringol. (USSR), no. 5, Sep. - Oct. 1978 p 74-77 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Tbilisi Inst. of Physician Advancement
(Contract NASw-3198)
(NASA-TM-76347) Avail: NTIS HC A02/MF A01 CSCL 06P

Vestibular reactions appear under the action of direct current (dc) on the labyrinth of man and animals. A decrease of the stimulation effect of dc on the extralabyrinthine nervous formations in the suggested method is achieved by the use of electric pulses with steep front and back parts, as well as by previous anesthetization of the skin in the electrode application area by means of novocain solution electrophoresis. For this purpose a pulse producer giving trapezoid pulses with smoothly changing fronts and duration was constructed. With the help of an interrupter it is possible to stop the current increase instantly, and stimulation is performed at the level of the pulse 'plateau'. To induce vestibular reactions under monopolar stimulation, it is necessary to apply the current twice as high as that with bipolar electrode position. The use of short pulses with steep front and back parts for electrode stimulation of the vestibular analyzer is considered to be inexpedient. Author

N80-32076*# National Aeronautics and Space Administration, Washington, D. C.
REVIEW OF BOOK-ULTRASOUND IN OTORHINOLARYNGOLOGY
I. V. Soldatov Aug. 1980 8 p Transl. into ENGLISH from Zh. Ushnykh Nosovykh Gorlovykh Bolez. (USSR), no. 3, May - Jun. 1979 p 86-87 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Academy of Medical Sciences
(Contract NASw-3198)
(NASA-TM-76349) Avail: NTIS HC A02/MF A01 CSCL 06E

Ultrasonic therapy for certain diseases is discussed. Success is reported in the treatment of chronic tonsilitis, sinusitis, and Meniere's disease. L.F.M.

N80-32077*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
PHYSIOLOGICAL REACTIONS OF A PASSENGER TO TRANSPORTATION CONDITIONS
A. M. Lakshin and V. P. Novoselov Aug. 1980 8 p refs Transl. into ENGLISH from Gig. Sanit. (USSR), no. 9, Sep. 1979 p 84-85 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Ministry of Communication, Moscow
(Contract NASw-3198)
(NASA-TM-76350) Avail: NTIS HC A02/MF A01 CSCL 06S

The effect of transportation conditions on the performance capacity of a passenger were studied, in order to establish the time for his most rapid inclusion in production activity after the trip. It was concluded that the transportation conditions impair the functional condition of the passenger's organism. The restoration of the functional state to the initial level occurs mainly in the space of one day. It is shown that it is necessary to take into consideration the adaptation of the organism during transfer to another climate zone. R.C.T.

N80-32078*# National Aeronautics and Space Administration, Washington, D. C.
REVIEW OF BOOK VESTIBULAR CRISES
N. S. Blagoveshchenskaya Aug. 1980 5 p Transl. into ENGLISH from Vestn. Otorino-Laringol. (USSR), no. 1, Jan. - Feb. 1980 p 36-77 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76354) Avail: NTIS HC A02/MF A01 CSCL 06E

The etiology, pathogenesis, clinical practice, treatment and rehabilitation of patients with vestibular crises is discussed. Classifications for vestibular disorders are given. Information on the frequency of vestibular crises is given. T.M.

N80-32079*# National Aeronautics and Space Administration, Washington, D. C.
USE OF PHYSICAL CULTURE TO INCREASE RESISTANCE OF SAILORS TO MOTION SICKNESS
I. V. Salanin Aug. 1980 8 p refs Transl. into ENGLISH from Teor. Prakt. Fiz. Kult. (USSR), no. 11, Nov. 1979 p 35-37 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Moscow State Inst. of Physical Culture
(Contract NASw-3198)
(NASA-TM-76355) Avail: NTIS HC A02/MF A01 CSCL 06S

From 50% to 70% of sailors are exposed to motion sickness in storms. A program of physical exercises is described and tested for effectiveness in preventing this problem. In comparing the results of tests of susceptibility to motion sickness given to groups before and after a program of exercises and to a control group, it is found that physical education can strengthen the vestibulary apparatus and help prevent motion sickness. A.R.H.

N80-32080*# National Aeronautics and Space Administration, Washington, D. C.
VESTIBULAR REACTIONS IN PATIENTS DURING OCCLUSION FORM OF CHORIOEPENDYMITIS
E. A. Ladyzhenskaya and B. K. Arifdzhanov Aug. 1980 10 p Transl. into ENGLISH from Med. Zh. Uzb. (USSR), no. 11, Nov. 1979 p 16-19 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Order of the Red Banner of Labor Medical Inst., Tashkent
(Contract NASw-3198)
(NASA-TM-76356) Avail: NTIS HC A02/MF A01 CSCL 06P

A change in intracranial pressure during chorioependymitis is discussed. The inflammatory process in the choroid plexi and walls of the cerebral ventricles is described. The otoneurological method, not having any significant contraindications, can be employed repeatedly, quaranteeing control in dynamics over the course of the disease and effectiveness of treatment. T.M.

N80-32081# School of Aerospace Medicine, Brooks AFB, Tex.
USAFSAM MICROPROCESSOR AUDIOMETER: SYSTEM REFERENCE MANUAL Final Report, Aug. 1977 - Aug. 1979
Michael L. Tworek, Jay H. Schlag, Donald C. Gasaway, and Harrell C. Sutherland Apr. 1980 29 p refs
(AD-A087342; SAM-TR-80-8) Avail: NTIS HC A03/MF A01 CSCL 06/5

A microprocessor audiometer was designed and built by USAFSAM personnel to investigate new techniques in audiometry and hearing conservation. The system's primary function is to provide a flexible test bed for developing new audiogram algorithms and implementing hearing conservation decision criteria. Pertinent information regarding hardware and software implementation is provided. GRA

N80-32082# Dayton Univ., Ohio. School of Engineering.
ANALYSIS AND MEASUREMENT OF HELMETED AIRCREWMAN RESPONSE RESULTING FROM BIRDSTRIKE Final Report, 1 Mar. 1977 - 31 Mar. 1979
Norman S. Phillips Wright-Patterson AFB, Ohio AMRL Jan. 1980 234 p refs
(Contract F33615-77-C-0534; AF Proj. 7231)
(AD-A087737; UDR-TR-79-56; AMRL-TR-79-75) Avail: NTIS HC A11/MF A01 CSCL 06/5

The purpose of the research was to investigate and evaluate the birdstrike phenomena in terms of injury potential. Data collected during canopy testing indicated that significant deflection could occur and cause deformation into the space occupied by the helmeted aircrewman. The traveling wave and its interaction with the helmeted head created an unusual impact environment for which evaluation criteria did not exist. In order to generate new criteria it was necessary to utilize the Articulated Total Body Model (ATBM) and incorporate within the model characteristics of the canopy, the helmet and human head and neck system. With a configuration representative of the impact phenomena, the kinetic response of the system to selected impacts could be compared with biomechanical data to infer injury. The deformation characteristics of the canopy were established by analysis of F-16 film data collected during birdstrike tests. The data indicate that the canopy deformation depth is proportional to bird kinetic energy but that canopy deformation wave speed does not increase with bird speed. The helmet stiffness characteristics were established from available drop test data. Force displacement curves were idealized for incorporation into the ATBM. These, along with canopy compliance data, were used to construct the stiffness at the canopy helmet interference. GRA

N80-32083# Wright State Univ., Dayton, Ohio. Dept. of Psychology.
DETECTION OF MOVING TARGETS IN PERIPHERAL VISION Final Scientific Report, Jun. 1978 - Jul. 1979
Frank E. Ward Dec. 1979 26 p refs
(Grant AF-AFOSR-3647-78; AF Proj. 2313)
(AD-A082541; AFOSR-80-0211TR) Avail: NTIS HC A03/MF A01 CSCL 06/16

Human detection of a moving target is a function of target size and contrast and target velocity. Recent work in human psychophysics and animal electrophysiology has shown that visual information is processed in many channels, each specialized to detect a particular aspect of the visual stimulus. For example, the human visual system appears to contain channels sensitive to spatial frequency, or target size. It was also shown that different spatial frequencies are processed at different temporal rates.

suggesting that detection may depend upon an interaction of target size and velocity. E.D.K.

N80-32084# Missouri Univ., Columbia. John M. Dalton Research Center.
MECHANISMS OF OXYGEN TOXICITY AT THE CELLULAR LEVEL Annual Report, 1 Apr. 1979 - 31 Mar. 1980
Olen R. Brown 30 Jul. 1980 35 p refs
(Contract N00014-76-C-0328)
(AD-A087831; TR-4) Avail: NTIS HC A03/MF A01 CSCL 06/1

Significant progress occurred in four areas: (1) Effect of hyperoxia on reverse glycolysis: We concluded that glucose protects Escherichia coli against hyperoxia better than other intermediates later in glycolysis and in the Krebs cycle but not because of a specific inhibition of reverse glycolysis. There was no significant impairment of the three enzymes of reverse glycolysis: fructose-1,6-diphosphatase, phosphoenolpyruvate synthase, or phosphoenolpyruvate carboxykinase. (2) Effect of hyperoxia on synthesis of RNA, DNA and pyridine nucleotide coenzymes: Evidence was obtained for direct inhibition of RNA synthesis in cells poisoned by hyperoxia, while protein synthesis was not directly affected. DNA synthesis is impaired but it is not proven whether this is direct or indirect. NAD and NADH were severly decreased in cells during poisoning by hyperoxia. This decrease was prevented by niacin, but not quinolinate which is consistent with poisoning of quinolinate phosphoribosyltransferase (QPT), as previously reported. PRPP does not protect against oxygen poisoning, PRPP synthetase is not affected by hyperoxia, but PRPP accumulates in oxygen poisoned cells which is in agreement with inhibiton of QPT. (3) Relationship of thiamine to oxygen toxicity. GRA

N80-32085# Cornell Univ., Ithaca, N. Y.
MOLECULAR MECHANISMS OF THE EPITHELIAL TRANSPORT OF TOXIC METAL IONS, PARTICULARLY MERCURY, CADMIUM, LEAD, ARSENIC, ZINC, AND COPPER Progress Report, 1 Jan. - 31 Dec. 1979
R. H. Wasserman 1979 54 p refs
(Contract EY-76-S-02-2792)
(COO-2792-3) Avail: NTIS HC A04/MF A01

The mechanism of lead transport, and especially the particular similarities or dissimilarities between lead and calcium in this process were studied. The absorption of these metals was determined in 3 week old White Leghorn cockerels, raised on a commercial diet or on a specified diet, using in vivo ligated loop procedure. The dose administered into the loop contained 0.5 micron Ci Pb203 (and/or 0.1 micron Ci Ca47), and 0.01 mM lead acetate (and/or 1 mM CaCl2) in 0.5 ml 0.15 M NaCl, pH 6.5. It was shown that lead is rapidly taken up by the mucosal tissue, and slowly transferred into the body, whereas less calcium is retained by the tissue and the transfer of calcium is many times as effective as that for lead. They appear to respond in a similar manner to a low calcium intake and vitamin D treatment. Certain differences were, however, observed in the absorption process. Increasing luminal stable lead concentration from 0.01 to 1.00 mM Pb, significantly reduced the percentage of radiolead absorbed, but did not affect the absorption of calcium. Also, vitamin D enhanced the transfer of plasma Ca47 into the lumen but did not affect the transfer of plasma Pb203. R.C.T.

N80-32086# Royal Aircraft Establishment, Farnborough (England).
TOWARDS A BETTER UNDERSTANDING OF TEMPORARY THRESHOLD SHIFT OF HEARING
K. R. Maslen London HMSO Mar. 1980 50 p refs
(RAE-TM-FS-319; BR73973) Avail: NTIS HC A03/MF A01

It was thought that temporary threshold shift (TTS) of hearing due to exposure to noise might be more easily understood if the shifts were considered in terms of the rms pressure rather than in dB. The form is to be expected if the rate of shift of the pressure threshold were proportional to the difference between itself and the ultimate threshold were calculated and compared with a limited selection of published data. Good agreement with data for the growth of TTS in individuals was found, and moderately good agreement with recovery. Agreement with data on intermittent exposures was poor, but this may be due in part to the fact that only averaged data were found and averaging the widely disparate figures obtained for individuals may mask the true effects. It is also shown that the maximum ultimate TTS due to exposure to noise may be simply related to the mean square pressure of that noise. It is suggested that at least some facets of TTS can be simply described in terms of exponential pressure shifts. Author (ESA)

N80-32087# Bureau of Radiological Health, Rockville, Md.
PROCEEDINGS OF A WORKSHOP ON THERMAL PHYSIOLOGY
T. Whit Athey, ed. Mar. 1980 84 p refs Workshop held at Rockville, Md., 29 Mar. 1979 Sponsored by Interagency Regulatory Liaison Group
(PB80-187867; FDA/BRH-80/60; DHEW/PUB/FDA-80-8109) Avail: NTIS HC A05/MF A01 CSCL 06R

A consistent radiation protection philosophy for radio frequency and microwaves is developed. Radio frequency and microwave emitters and the populations exposed to significant sources are identified and classified. A biological and physical research program is developed. GRA

N80-32088# Professional Staff Association of the Rancho Los Amigos Hospital, Inc., Downey, Calif.
EFFECTS OF AEROSOLS, OXIDES OF NITROGEN, AND OXIDANTS ON HUMAN HEALTH Final Report
Michael T. Kleinman, William S. Linn, and Jack D. Hackney Dec. 1979 112 p refs Sponsored by Coordinating Research Council, Inc.
(PB80-184583; CRC-APRAC-CAPM-31-79) Avail: NTIS HC A06/MF A01 CSCL 06T

Volunteers in normal health and volunteers with asthma were exposed to polydisperse ammonium nitrate aerosol under conditions simulating 'worst-case' ambient exposures. Normal volunteers exposed to 0.37 ppm ozone plus 0.37 ppm sulfur oxide plus 100 micrograms/cu m polydisperse sulfuric acid aerosol under simulated ambient conditions showed small statistically significant decrements in forced expiratory function. Hemoglobin saturation was sampled repeatedly with a Hewlett-Packard ear oximeter during exposures of volunteers to ozone under simulated ambient conditions. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-32089# RAND Corp., Santa Monica, Calif.
THE INFLUENCE OF VISUAL-SPATIAL ABILITY AND STUDY PROCEDURES ON MAP LEARNING SKILL Progress Report, Jun. 1978 - Jan. 1979
Cathleen Stasz and Perry W. Thorndyke Jun. 1980 40 p refs
(Contract N00014-78-C-0042; NR Proj. 157-410)
(AD-A087247; RAND/N-1501-ONR) Avail: NTIS HC A03/MF A01 CSCL 05/10

This study investigated the influence of two sources of individual differences in knowledge acquisition from maps: abilities and learning procedures. Twenty-five subjects provided verbal protocols while attempting to learn two maps. Visual spatial ability was highly correlated with recall of spatial attributes of the map and with overall learning performance, while associative memory ability was most correlated with verbal attribute recall. Subject selected procedures for encoding spatial information and assessing learning progress also distinguished the behavior of successful and less successful learners. However, subjects of high and low ability differed little in the study procedures they chose. Although both ability differences and procedure use were important contributors to performance, a direct comparison of these sources of variation suggested that abilities are most predictive of map learning. These observations led us to the following conclusions: (1) the use of effective study procedures can influence map learning performance, and (2) high ability subjects benefit more from the use of these procedures than low ability subjects. GRA

N80-32090# Air Force Human Resources Lab., Brooks AFB, Tex. Operations Training Div.
AIRBORNE PERFORMANCE MEASUREMENT ASSESSMENT: LOW ALTITUDE TACTICAL FORMATION IN TWO OPERATING ENVIRONMENTS Interim Report, Jun. - Oct. 1978
Joseph C. Demaio and Edward E. Eddowes Jul. 1980 17 p refs
(AF Proj. 1123)
(AD-A087068; AFHRL-TR-79-44) Avail: NTIS HC A02/MF A01 CSCL 05/9

A method was developed to assess pilot performance in low altitude tactical formation (LATF) and to relate overall performance to performance on subtasks necessary to mission success. The method was used to evaluate the performance of 28 pilots assigned to an operational A-7 squadron. The method was found to provide a consistent measure of pilot performance and to reveal the importance of certain pilot skills to the LATF task. Performance ratings were obtained under routine operating conditions and under conditions of simulated combat. Differences were obtained in performance ratings under the two conditions. Implications for currency training were discussed. GRA

N80-32091# School of Aerospace Medicine, Brooks AFB, Tex.
A REVIEW OF USAFSAM STUDIES EMPLOYING MULTIPLE-TASKS PERFORMANCE DEVICES Final Report, Oct. - Dec. 1979
Bryce O. Hartman, Russell A. Benel, and William F. Storm Jun. 1980 21 p refs
(AD-A087272; SAM-TR-80-16) Avail: NTIS HC A02/MF A01 CSCL 05/10

Apparatus development at the USAF School of Aerospace Medicine to measure the performance and proficiency of systems operators is reviewed. The devices reviewed are all classified as multiple-task performance batteries that were designed to measure efficiency in the general sense. Simulators of specific systems were not included. The bulk of this paper consists of summaries of studies. GRA

N80-32092# Litton Mellonics Systems Development Div., Springfield, Va.
TEAM TRAINING APPLICATIONS OF VOICE PROCESSING TECHNOLOGY Final Technical Report, 1 Aug. 1979 - 31 Mar. 1980
Beverly A. Popelka and C. Mazie Knerr 31 Mar. 1980 36 p refs
(Contract MDA903-79-C-0209; ARPA Order 3690)
(AD-A085999) Avail: NTIS HC A03/MF A01 CSCL 05/9

Automated speech technology and intelligent computer assisted instruction offer unique solutions to problems of training teams in communication and coordination skills. At this point in the emergence of automated speech technology, scientists have only begun to explore its training uses. The application of automated speech technology entails adaptive training, or intelligent computer assisted instruction techniques in which the computer acts like a human tutor. This report reviews the goals and accomplishments of automated speech processing and its application to training, especially military team training. GRA

N80-32093# North Carolina Univ. at Chapel Hill. Psychometric Lab.
INDIVIDUAL DIFFERENCE RELATIONS IN PSYCHOMETRIC AND EXPERIMENTAL COGNITIVE TASKS Final Report
John B. Carroll Apr. 1980 335 p refs
(Contract N00014-77-C-0722; RR0420401; NR Proj. 150-406)
(AD-A086057; Rept-163) Avail: NTIS HC A15/MF A01 CSCL 05/10

A critical survey is made of recent literature pertaining to the possibility of measuring important dimensions of human cognitive ability through various types of simple cognitive tasks. The survey focuses on individual differences (IDs) found in cognitive tasks that have received extensive study in experimental cognitive psychology-for example, simple and choice reaction time, lexical decision, stimulus matching, probed search of short term memory, memory span, free and serial recall, simple sentence comprehension, and analogical reasoning. Questions of paramount interest were: What kinds of individual differences are observed in these tasks? Do they exhibit sufficient variance and reliability to measure stable individual characteristics that may be of relevance in personnel selection and other operational context? What are the dimensions of these IDs from a factor analytic standpoint? How are they related to those observed through more conventional psychometric tests? To what extent are they subject to the effects of practice and specific training, or related to demographic variables in such a way as to reduce their utility for operational use? Can the study of individual difference in simple cognitive tasks be valuable in the development of psychological theory: A considerable portion of the monograph is devoted to the definition and specification of 'elementary cognitive tasks' (ECTs) and to how ETCs can be administered, in experimental settings, so as optimally to reveal IDs in cognitive processes. A scheme for classifying ECTs according to basic paradigms is presented, and suggestions are made concerning procedures, including computer simulation, for conceptualizing and analyzing underlying processes. GRA

N80-32094# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
METHODS FOR COLLECTING AND ANALYZING TASK ANALYSIS DATA Final Report
A. John Eschenbrenner, Jr., Philip B. DeVries, Jr., James T. Miller, and Hendrick W. Ruck Jul. 1980 176 p refs
(Contract F33615-77-C-0076)
(AD-A087710; AFHRL-TR-79-45-1) Avail: NTIS HC A09/MF A01 CSCL 05/9

Task analysis, a critical front end activity in the Instructional System Development methodology, is the process of partitioning job tasks into their component subtasks and identifying the skills and knowledges required to support task performance. This study was initiated in response to a Request for Personnel Research generated by the Air Training Command, which noted that 'a wide range of nonstandardized task analysis procedures are in use throughout the training community.' Implementation of a standardized procedure for identifying essential subtasks and supporting skills and knowledges was expected to hold considerable potential for increasing training efficiency and reducing training costs. A simplified task analysis procedure and documentation system was specified, and a task analysis handbook was prepared. Handbook procedures were field tested at six Air Force installations. Results indicated that the handbook procedures met the design criteria of simplicity, validity, reliability, and time efficiency/cost effectiveness. The feasibility and utility of implementing a computer based task analysis data bank was assessed, and a preliminary data bank design was then developed. Additionally, two technology transfer seminars were conducted to assist Air Force personnel in applying handbook task analysis procedures. GRA

N80-32095# Virginia Polytechnic Inst. and State Univ., Blacksburg.
AIR-TO-AIR TARGET ACQUISITION FACTORS AND MEANS OF IMPROVEMENT Final Report, Nov. 1978 - Jul. 1979
Edward B. Costanza, Scott R. Stacey, and Harry L. Snyder Mar. 1980 241 p refs
(Contract F33615-78-D-0629; AF Proj. 2787)
(AD-A087848; VPI-HFL-79-10; SAM-TR-80-9) Avail: NTIS HC A11/MF A01 CSCL 06/16

This report summarizes the literature on target acquisition with emphasis on target detection and collision avoidance in the air-to-air environment. A comprehensive, annotated bibliography is included. Major factors in air-to-air acquisition are discussed, pertinent data are presented, and potential improvements through training are listed. The report is concluded with a description of a research program designed to improve air-to-air detection performance. GRA

N80-32096# Massachusetts Inst. of Tech., Cambridge. Man-Machine Systems Lab.
THE USE OF INFORMATION TRANSMISSION AS NONPARAMETRIC CORRELATION IN THE ANALYSIS OF COMPLEX BEHAVIOR: A PRELIMINARY REPORT Technical Report, 1 Jul. 1979 - 30 Jun. 1980
Neville Moray May 1980 120 p refs
(Contract N00014-77-C-0256)

(AD-A087832) Avail: NTIS HC A06/MF A01 CSCL 05/8

Recent developments of classical information theory by Conant and Ashby have given rise to a number of techniques by which the behavior of a complex system can be analyzed. Even in the absence of any information about the intensity of the variables measured it is possible to detect which parts of the system are closely coupled and which independent. The metrics of the variables can be mixed, nominal, ordinal, etc. and the method is particularly suited to dynamic systems. This paper discusses how the structure of the 'molecules' of behavior can be deduced from the entropies of the 'atoms', and outlines the solutions to certain methodological problems involved. Examples of the method are given from the fields of attention and skills, including the representation of the effects of practice on a 7-degree-of-freedom perceptual motor skill involving a complex man-machine interface. Further analysis and development of the technique is being carried out and will be reported subsequently. GRA

N80-32097# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

VISUAL SCENE PERCEPTION. FREQUENCY DOMAIN DATA AND MODEL PARAMETER ESTIMATION PROCEDURE

P. H. Wewerinke 15 Mar. 1979 24 p refs Presented at 15th Ann. Conf. on Manual Control, Dayton, Ohio, 20-22 Mar. 1979 Sponsored by Netherlands Agency for Aerospace Programs (NIVR)

(NLR-MP-79009-U) Avail: NTIS HC A02/MF A01

Results of a theoretical study and an accompanying experiment are presented concerning the visual scene perception process and its impact on aircraft approach performance. Visual scene characteristics were represented by the configurations involved. Their effect on approach performance and human information processing (primarily in terms of observation noise spectra and perceptual thresholds) was investigated utilizing a model of the visual scene perception process. The model is based on linear perspective geometrical cues and on relative (visual) motion cues and is combined with the optimal control model. Results are presented of an automated model matching procedure. Via a first order gradient method, a matching criterion (involving variances and frequency domain data) was minimized yielding a set of observation noise model parameter values. These values led to the perceptual thresholds associated with the visual cues involved. Author (ESA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-32098*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.

PROJECT FIRES. VOLUME 1: PROGRAM OVERVIEW AND SUMMARY, PHASE 1B Final Report

Fred J. Abeles May 1980 49 p refs

(Contract NAS8-32329)

(NASA-CR-161529) Avail: NTIS HC A03/MF A01 CSCL 06Q

Overall performance requirements and evaluation methods for firefighters protective equipment were established and published as the Protective Ensemble Performance Standards (PEPS). Current firefighters protective equipment was tested and evaluated against the PEPS requirements, and the preliminary design of a prototype protective ensemble was performed. In phase 1B, the design of the prototype ensemble was finalized. Prototype ensembles were fabricated and then subjected to a series of qualification tests which were based upon the PEPS requirements. Engineering drawings and purchase specifications were prepared for the new protective ensemble. Author

N80-32099*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.

PROJECT FIRES. VOLUME 4: PROTOTYPE PROTECTIVE ENSEMBLE QUALIFICATION TEST REPORT, PHASE 1B Final Report

Fred J. Abeles May 1980 127 p refs

(Contract NAS8-32329)

(NASA-CR-161532) Avail: NTIS HC A07/MF A01 CSCL 06Q

The qualification testing of a prototype firefighter's protective ensemble is documented. Included are descriptions of the design requirements, the testing methods, and the test apparatus. The tests include measurements of individual subsystem characteristics in areas relating to both physical testing, such as heat, flame, impact penetration and human factors testing, such as dexterity, grip, and mobility. Also, measurements related to both physical and human factors testing of the complete ensemble, such as water protection, metabolic expenditures, and compatibility are considered. M.G.

N80-32100*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.

PROJECT FIRES. VOLUME 3: PROTECTIVE ENSEMBLE DESIGN AND PROCUREMENT SPECIFICATION, PHASE 1B Final Report

Fred J. Abeles May 1980 133 p

(Contract NAS8-32329)

(NASA-CR-161531) Avail: NTIS HC A07/MF A01 CSCL 06Q

Each of the subsystems comprising the protective ensemble for firefighters is described. These include: (1) the garment system which includes turnout gear, helmets, faceshields, coats, pants, gloves, and boots; (2) the self-contained breathing system; (3) the lighting system; and (4) the communication system. The design selection rationale is discussed and the drawings used to fabricate the prototype ensemble are provided. The specifications presented were developed using the requirements and test method of the protective ensemble standard. Approximate retail prices are listed. A.R.H.

N80-32101*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Biotechnology, Research and Development Div.

DEVELOPMENT OF A PREPROTOTYPE VAPOR COMPRESSION DISTILLATION WATER RECOVERY SUBSYSTEM Final Report

K. L. Johnson Nov. 1978 289 p ref

(Contract NAS9-15136)

(NASA-CR-160779; LMSC-D626041) Avail: NTIS HC A13/MF A01 CSCL 06K

The activities involved in the design, development, and test of a preprototype vapor compression distillation water recovery subsystem are described. This subsystem, part of a larger regenerative life support evaluation system, is designed to recover usable water from urine, urinal rinse water, and concentrated shower and laundry brine collected from three space vehicle crewmen for a period of 180 days without resupply. Details of preliminary design and testing as well as component developments are included. Trade studies, considerations leading to concept selections, problems encountered, and test data are also presented. The rework of existing hardware, subsystem development including computer programs, assembly verification, and comprehensive baseline test results are discussed. Author

N80-32102# Mitre Corp., Bedford, Mass.

REQUIREMENTS DEFINITION AND DESIGN GUIDELINES FOR MAN-MACHINE INTERFACE IN C3 SYSTEM ACQUISITION

Sidney L. Smith Jun. 1980 120 p refs

(Contract F19628-80-C-0001; AF Proj. 572R)

(AD-A087258; M80-10; ESD-TR-80-122) Avail: NTIS HC A06/MF A01 CSCL 17/2

The man-machine interface (MMI) represents a significant proportion of the hardware and software investment in Air Force C3 system acquisition. Early definition of MMI requirements and provision of design guidance in functional specification may be critical to successful system development. Tentative design guidelines are proposed in this report for further elaboration, trial application and subsequent evaluation in collaboration with selected ESD/MITRE program engineering efforts. GRA

N80-32103# School of Aerospace Medicine, Brooks AFB, Tex.
MAN-RATING OF THE NAVY/AIR FORCE OXYGEN GENERATING SYSTEM (NAOGS) Interim Report, 1 Jan. 1978 - 30 Sep. 1979
Ronald D. Holden, Arnott A. Moore, Kenneth G. Ikels, and Richard L. Miller May 1980 15 p refs
(AF Proj. 1930)
(AD-A087270; SAM-TR-80-12) Avail: NTIS HC A02/MF A01 CSCL 01/3

The Navy/Air Force Oxygen Generating System (NAOGS) program is a joint effort between the Air Force and the Naval Air Development Center to develop a two man onboard oxygen generator for tactical aircraft. One of the proposed systems is based upon reversible sorption of oxygen from aircraft engine bleed air using fluomine, a cobalt chelate. The NAOGS fluomine system was manufactured by Garrett/AiResearch Division, Torrance, California. The USAF School of Aerospace Medicine performed man-rating of the NAOGS-fluomine unit prior to flight test by the U.S. Navy. The experimental protocol at USAFSAM consisted of both unmanned and manned testing, during which the product oxygen was monitored for quantity, purity, and trace contaminant content. Man-rating consisted of actual flight simulations with 2 test subjects at four different altitudes for periods up to 2 hours while breathing the product oxygen. The NAOGS, for the most part, performed adequately during both manned and unmanned testing. The exceptions were a lower than specification oxygen production rate and a short-term drop in oxygen purity during each bed switching cycle. These shortcomings are discussed in the context of the forthcoming flight test program. GRA

N80-32104# School of Aerospace Medicine, Brooks AFB, Tex.
THERMAL CONDITIONS IN THE COCKPIT OF USAF AIRCRAFT: INFLIGHT MEASUREMENTS FROM THE A-7, A-10, F-4, F-15, AND YC-14 Interim Report, Jun. 1977 - Dec. 1978
Richard F. Stribley Apr. 1980 71 p refs
(AD-A087273; SAM-TR-80-6) Avail: NTIS HC A04/MF A01 CSCL 01/3

Cockpit environmental data are presented for A-7, A-10, F-4, F-15, and YC-14 aircraft. Representative values for dry-bulb, dew-point, and black-globe temperatures; air velocity; and four additional air temperatures are presented for each flight. The data are summarized and the physiological implications of the recorded temperatures are discussed. A detailed description of the USAF School of Aerospace Medicine Miniature Environmental Monitor 2 (MEM 2) is provided. GRA

N80-32105# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
ADHESIVE COATINGS FOR DH-411 HELMETS
J. C. Lazowski Jan. 1980 18 p refs
(AD-A087319; DCIEM-TC-80-C-02) Avail: NTIS HC A02/MF A01 CSCL 06/17

Helicopter helmets in the Canadian Forces are required in two interchangeable roles, white and camouflaged. At present, helmets used by members of tactical helicopter squadrons are painted green to achieve the camouflage effect. Painting and stripping of helmets are time-consuming tasks which may deteriorate the impact protection of the helmet. Two adhesive coatings, olive drab gun tape and an adhesive vinyl coating in a disruptive pattern, were evaluated to determine the effect of extremes of temperature upon the coatings and the coated helmet shell. It was found that a marked discoloration of the helmet shell occurred during seven hour exposures to 200 F when coated with olive drab gun tape. It is concluded that the adhesive vinyl coating is superior to the gun tape on the basis of appearance and discoloration of the helmet shells. GRA

N80-32106# National Technical Information Service, Springfield, Va.
HELMETS: CONSTRUCTION, EFFECTIVENESS, AND HUMAN FACTORS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980
Edith Kenton Jun. 1980 195 p
(PB80-810963) Avail: NTIS HC $30.00/MF $30.00 CSCL 06Ω

A bibliography containing 188 abstracts is presented covering a variety of helmets including motorcyclist and bicyclist's helmets, industrial firefighters, mining, infantry and flightcrew's helmets, police and riot helmets, and swimmer's and diver's protective helmets. Topics cover areas such as the materials used in helmet construction, the development of design criteria, configuration, and components of helmets such as suspension systems, cooling, and goggles. A number of citations deal with performance tests and requirements, test methods, structural and dynamic testing, human factors evaluation, operational efficiency, speech intelligibility, and sound localization. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-32107 Polytechnic Inst. of New York.
DATA STRUCTURE INDEPENDENCE IN DATA BASE MANAGEMENT SYSTEMS Ph.D. Thesis
E. James Emerson 1980 224 p
Avail: Univ. Microfilms Order No. 8019396

The system that is proposed to achieve data structure independence includes three schemas: conceptual, physical and logical. The role of the conceptual schema is to represent the enterprise's data in such a way that the integrity of the data base is assured and data structure independenece is achieved. To accomplish this a relational model of data with extensions to provide for integrity assertions was selected for the conceptual schema. The conceptual schema serves as the base from which both the logical and physical schemes are derived, thereby completely isolating one from the other. The physical schema has many similarities to a CODASYL data base. It contains owner to member sets and permits them to be combined to form networks. Additionally, it contains extensions such as secondary indexes, and could be augmented with additional facitilies in the future. The logical schema has a single syntax used to define logical views for a CODASYL, Relational or IMS data model. The logical schemas are dervied from the conceptual schema using four primitive mappings. It is demonstrated that these mappings are sufficient to generate the data structures required for the three models, and the structural mappings that are required to achieve data structure independence. Dissert. Abstr.

N80-32108 Polytechnic Inst. of New York.
MULTI-MICROPROCESSOR/MULTI-MICROCOMPUTER ARCHITECTURES: THEIR MODELING AND ANALYSIS Ph.D. Thesis
Dimitris A. Protopapas 1980 199 p
Avail: Univ. Microfilms Order No. 8019410

Conditions under which a finite source queue can be

approximated by an infinite source one are presented, and a mean-wait approximation technique is developed for the computationally involved M/G/I/N queueing system. An approximation method is also developed for the generalized finite source queue, GI/G/I/N. Expressions are derived for the LST, and the variance of M/G/I/N, when service distributions are nonanalytic. Application of the Mi/Mi/I/N queueing model, is introduced. Generic micro-models are developed for the common bus multi-microprocessor/multi-microcomputer architecture. Both symmetric and asymmetric models are analyzed using the results derived for finite queues. Models are developed for traffic sharing, symmetrical or load balancing, and functionally distributed organizations, which are then analyzed using the generalized queueing approximation techniques. Performance, cost, and other merits of these organizations are compared, and conclusions are drawn. Dissert. Abstr.

N80-32109 California Univ., Santa Barbara.
MICROCOMPUTERS AND TIMESHARING Ph.D. Thesis
William Langdon Proctor 1979 277 p
Avail: Univ. Microfilms Order No. 8019853

The ability of microprocessors to support the data manipulations required by timesharing with reentrant program execution is demonstrated by evaluation of an operational prototype. Response latency due to processor loading is analyzed theoretically and empirically for an application involving dispersal of textual data to a number of concurrent users. The application is a text dialog language known as Pilot. The question of economic viability is considered by comparing cost-effectiveness of microprocessor timesharing, dedicated microprocessing and mainframe timesharing. Several recent microprocessor architectures are comparatively evaluated in relation to programming requirements of timesharing with reentrant program execution. This results in a number of observations regarding the physical structures of a central processor which significantly affect compatibility with timesharing. A computer assisted design and optimization methodology is introduced providing a means for evaluation of hardware cost functions and programming efficiency for existing and tentative architectures in the context of specific applications. Dissert. Abstr.

N80-32110# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
USAFSAM WAIVER FILE INTELLIGENT TERMINAL: HARDWARE REFERENCE MANUAL Final Report, Oct. 1976 - Jun. 1979
Michael L. Tworek, M. Edward Womble, and Shelburne D. Wilson Apr. 1980 24 p refs
(AF Proj. 7755)
(AD-A087340; SAM-TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 09/2

The hardware design and configuration of an intelligent microcomputer terminal is described. This terminal is used to access a data base on a larger main frame computer. The system was designed to provide maximum flexibility at the users fingertips by making the complex data base management system (DBMS) of the main frame computer transparent to the user. All aspects of the system configuration are outlined to provide sufficient knowledge for maintenance and repair. GRA

N80-32111# Massachusetts Inst. of Tech., Cambridge. Computer Science Lab.
PROGRAMS FOR DISTRIBUTED COMPUTING: THE CALENDAR APPLICATION
Irene Greif Jul. 1980 11 p refs
(Contract N00014-75-C-0661)
(AD-A087357; MIT/LCS/TM-168) Avail: NTIS HC A02/MF A01 CSCL 09/2

The calendar application involves a wide range of issues in distributed computing, from implementation of distributed data bases to design of a user interface that will enable the user to comprehend the complex distributed environment in which he is working. This memo summarizes current status of design and implementation of calendars. Sections 2 and 3 are taken from a progress report of March 1980 and section 4 is an update to that report including current status plans. We began our design of calendar systems with the intention of focussing on implementation issues, particularly those of communication, sharing of data, and the use of forms as the standard interface among modules. To assure variety in our implementation experience, we generated alternative designs of calendars. Implementations of several of them are now underway. During later design phases we became more interested in the functionality of the calendar and its user interface. To some extent the use of forms as the communication medium shapes the human interface as well as the process to process interface. Also, some aspects of the functionality, most notably the notion of (tentative meeting) have arisen from analysis of the distributed implementation. Section 2 is a report on the functionality of the calendars we are building. Section 3 is about the distributed implementation. GRA

N80-32112# Doty Associates, Rockville, Md.
HANDBOOK OF PROCEDURES FOR ESTIMATING COMPUTER SYSTEM SIZING AND TIMING PARAMETERS, VOLUME 2: ADDENDUM Final Technical Report, 16 May 1979 - 15 Feb. 1980
William B. Humphrey and John N. Postak 15 Feb. 1980 175 p refs
(Contract F19628-79-C-0106)
(AD-A086140; DAI-TR-235-Vol-2; ESD-TR-80-115-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 09/2

In this volume, information about selected ESD C3 Embedded Computer Systems (ECS) is presented to illustrate the types of data that could be considered in the development of computer system analogies for sizing and timing studies. Also included are a number of graphic representations of computer system sizing and timing relationships that are based on algorithms developed by various computer scientists during the past several years. Although the relationships are presented in absolute values, users are cautioned not to consider any relationship by itself. Rather, they should be considered additional possible data points in the overall evaluation of a computer system's sizing and timing parameters. Also included are two examples of the application of the procedures discussed in volume 1: a proposed revision of the Data Item Description (DID) entitled, Computer Program Timing and Sizing Data (DI-S-30568); and a list of suggestions for future work to update and improve the estimating procedures. In addition, a reference listing, an annotated bibliography, and an index are provided. GRA

N80-32113# Los Alamos Scientific Lab., N. Mex.
IMPLEMENTING ADVANCED DATA ANALYSIS TECHNIQUES IN NEAR-REAL-TIME MATERIALS ACCOUNTING
Jack T. Markin, Alice L. Baker, and James P. Shipley 1980 10 p refs Presented at the 21st Ann. Meeting of the Inst. of Nucl. Mater. Management, Palm Beach, Fla., 30 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1816; CONF-800655-10) Avail: NTIS HC A02/MF A01

Materials accounting for special nuclear material in fuel cycle facilities is implemented more efficiently by applying decision analysis methods, based on estimation and detection theory, to analyze process data for missing material. These methods are incorporated in the computer program DECANAL, which calculates sufficient statistics containing all accounting information, sets decisions thresholds, and compares these statistics to the thresholds in testing the hypothesis H sub 0 of no missing material against the alternative H sub 1 that material is missing. DECANAL output provides alarm charts indicating the likelihood of missing material and plots of statistics that estimate materials loss. This program is a useful tool for aggregating and testing materials accounting data for timely detection of missing material. DOE

N80-32114# Royal Signals and Radar Establishment, Malvern (England).
THE TOUCH PAD: A VERSATILE COMPUTER INPUT DEVICE
R. S. Newton, A. V. Matthews, and T. C. Butler London HMSO Sep. 1979 14 p refs Sponsored by United Kingdom Civil Aviation Authority
(RSRE-Memo-3229; BR74691) Avail: NTIS HC A02/MF A01

A touch sensitive high resolution input device designed for interaction with displays is described. The active surface of the pad reacts to light finger pressure and transmits the finger

coordinates to the computer. By associating a marker on the screen with the coordinates, the marker may be tracked to coincide with a displayed object. Acceptance of the so identified object is made by simply lifting the finger. The active surface is formed from a rigid base carrying 128 parallel conductors overlaid by a flexible sheet carrying 128 orthogonal conductors. Separation is maintained by a slight air pressure. The electronics are controlled by an Intel 8080 microprocessor. Author (ESA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-32115 Pennsylvania Univ., Philadelphia.
AUTOMATIC TRANSACTION DECOMPOSITION IN A DISTRIBUTED CODASYL PROTOTYPE SYSTEM Ph.D. Thesis
Frank Germano, Jr. 1980 243 p
Avail: Univ. Microfilms Order No. 8018547

Alternative distributed database management systems (DDBMS) architectures for the distribution of CODASYL-like structures were investigated and a prototype distributed CODASYL architecture, DSEED was defined. To provide acceptable performance, the use of a high level data language beyond the DML level and beyond the set level is indicated. Towards this end, the syntax and semantics of a (FOR EACH) data language, SEEDFe, is defined. The automatic decomposition using a preprocessor of SEEDFE programs into a front end control task and subordinate back end tasks is described. A global view mechanism, coupled with this decomposition process, provides geographic transparency for the application programmer. This mechanism, whose operation is controlled by a global schema defined by data definition facilities, guides the mapping of multiple, underlying local views to a global database view. Since some sets in this global view can have owner and member records which are not collocated, the notion of a distributed set is defined and a possible implementation proposed.
Dissert. Abstr.

N80-32116 California Univ., Santa Barbara.
MODELING A SOFTWARE ENGINEERING PROJECT MANAGEMENT SYSTEM Ph.D. Thesis
Richard Hall Thayer 1979 751 p
Avail: Univ. Microfilms Order No. 8019850

A model of a Software Engineering Project Management System was developed and then verified (or corrected) through the use of structured case studies. The major issues opinion survey identified 20 major problems in project management; 13 of the 20 were overwhelming major problems; 7 were problems of a lesser magnitude. The project management survey data (structured case studies), were also used to verify the results of the major issues opinion survey. Nine of the 20 major issues were verified as problems, two were inconclusive, and nine were not problems. As a result, six major issues concerning planning and one concerning controlling were judged conclusively as problems by both surveys. It is shown that software engineering project management has all the basic functions of any management task; that the major issues of software engineering project management can be identified and will act as road signs for research in project management; and, that various functions and activities of a development project can be identified that will improve the project manager's capability to deliver his project on time, within cost, and in response to the user's needs.
Dissert. Abstr.

N80-32117# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
TESTING COBOL PROGRAMS BY MUTATION. VOLUME 1: INTRODUCTION TO THE CMS.1 SYSTEM M.S. Thesis
Jeanne Marie Hanks Feb. 1980 76 p refs
(Contract N00014-79-C-0231; Grant DAAG29-78-G-0121)
(AD-A087310) Avail: NTIS HC A05/MF A01 CSCL 09/2

Program mutation is a testing technique which has been applied to FORTRAN programs (ABDLS). This thesis will describe the application of mutation to the COBOL language in an automated program mutation system. The thesis will describe the development of a COBOL Mutation System (CMS.1), its testing using FORTRAN mutation analysis, and the subset of COBOL that is supported by CMS.1. The internal representation selected to represent the COBOL source statements and a description of the mutant operators that are implemented in CMS.1 will also be supplied. GRA

N80-32118# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTERLISP MAINTENANCE Final Report
Alice K. Hartley 1979 11 p
(Contract N00039-78-C-0300; ARPA Order 3554)
(AD-A087338; BBN-4304) Avail: NTIS HC A02/MF A01 CSCL 09/2

INTERLISP is an exceedingly powerful programming environment that makes it possible to implement large, complex systems in a very short time. The INTERLISP maintenance contract covers the following tasks: maintenance of the system level portion of INTERLISP, including tracking down and fixing bugs, modifying and improving existing features in response to the needs of the ARPA community, and keeping up with hardware and operating system changes; documentation of the system level portions of INTERLISP for inclusion in the INTERLISP manual; release of new systems to the ARPA community; and installation of INTERLISP in the National Software Works. GRA

N80-32119# SRI International Corp., Menlo Park, Calif. Computer Science Lab.
CANONICAL FORMS AND UNIFICATION Interim Report
Jean-Marie Hullot Apr. 1980 25 p refs
(Contract F49620-79-C-0099; AF Proj. 2304)
(AD-A087640; SRI/CSL-70; AFOSR-80-0506TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Fay has described a complete T-unification for equational theories T that possess a complete set of reductions as defined by Knuth and Bendix. This algorithm relies essentially on using the narrowing process defined by Lankford. This paper first studies the relations between narrowing and unification and gives a new version of Fay's algorithm. It then shows how to eliminate many redundancies in this algorithm and gives a sufficient condition for its termination. Finally, it is shown how to extend the previous results to various kinds of canonical term rewriting systems. GRA

N80-32120# SRI International Corp., Menlo Park, Calif. Computer Science Lab.
A CATALOGUE OF CANONICAL TERM REWRITING SYSTEMS Interim Report
Jean-Marie Hullot Apr. 1980 38 p refs
(Contract F49620-79-C-0099; AF Proj. 2304)
(AD-A087641; SRI/CSL-113; AFOSR-80-0460TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

It is attempted in this paper to put together some experimental results obtained by Knuth and Bendix, Lankford and Ballantyne, Peterson and Stickel, as well as to present some new results. It does not give a theoretical study of the methods used. Thus the reader is assumed to be familiar with the original Knuth and Bendix algorithm and its extensions. GRA

N80-32121# California Univ., Livermore. Lawrence Livermore Lab.
GRAPHICS LIBRARY FOR REAL TIME DISPLAY AND DATA ANALYSIS
Hal R. Brand and Richard K. Yamauchi 15 Jan. 1980 169 p
(Contract W-7405-eng-48)
(UCID-18543) Avail: NTIS HC A08/MF A01

A graphics library was written to plot chemical experimental data in real time and to plot data analysis results interactively. The library was designed for use on Digital Equipment Corporation's RSX-11M operating system. The graphics devices were a 17 inch cathode ray tube with light pen, a Tektronix 4025 terminal, and a four pen plotter. DOE

N80-32122# Royal Aircraft Establishment, Farnborough (England).
A METHOD OF INTERPOLATION USING CUBIC POLYNOMIALS WHICH AVOIDS UNNATURAL OVERSHOOTS

G. F. Butler London HMSO Jun. 1979 38 p refs (RAE-TM-Aero-1812; BR69581) Avail: NTIS HC A03/MF A01

Problems which can occur with the application of cubic polynomials in computer curve plotting are discussed and a coordinate rotation is proposed which avoids unnatural overshoots in the curve. A procedure is given for estimating the gradient at the given data points from local conditions and a criterion for choosing a suitable step length for plotting is introduced. A FORTRAN subroutine for calculating points on the curve is included. Author (ESA)

N80-32123# National Technical Information Service, Springfield, Va.
COMPUTER SOFTWARE RELIABILITY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1977 - May 1980
Brian Carrigan Jun. 1980 269 p Supersedes NTIS/PS-79/067; NTIS/PS-78/0643
(PB80-811797; NTIS/PS-79/0671; NTIS/PS-78/0643) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography containing 261 abstracts addressing computer software reliability modeling, software verification, and the evaluation of test tools for the measurement of software correctness is presented. General discussions are included. GRA

N80-32124# Illinois State Dept. of Transportation, Springfield.
EVALUATION OF INCIDENT DETECTION ALGORITHMS Final Report
Moshe Levin and Gerianne M. Krause Dec. 1979 123 p refs Sponsored by FHWA
(PB80-187255; Physical-Research-85; FHWA/IL/PR-085; IHR-005) Avail: NTIS HC A06/MF A01 CSCL 13B

Offline and online evaluations were conducted. Six algorithms were evaluated using incident and incident-free data collected on Chicago's expressways under various traffic and environmental conditions. Algorithm efficiency was evaluated in terms of detection rate, false alarm rate, and mean-time-to- Detect. The evaluation included a comparative analysis of algorithm efficiency; effect of lateral detectorization on algorithm performance; hierarchical analysis of threshold effectiveness and the effect of incident severity on algorithm performance. GRA

N80-32125# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
GUIDANCE AND CONTROL SOFTWARE
Louis J. Urban, ed. (Aeronautical Systems Div.) May 1980 221 p refs In ENGLISH and FRENCH
(AGARD-AG-258; ISBN-92-835-0287-1) Avail: NTIS HC A10/MF A01

Software design and management are discussed with respect to avionics applications. Particular attention is given to guidance and control systems, communication systems, and weapon systems. For individual titles, see N80-32126 through N80-32142.

N80-32126# British Aerospace Aircraft Group, Preston (England).
AN APPROACH TO THE DERIVATION AND VALIDATION OF REQUIREMENTS
A. O. Ward *In* AGARD Guidance and Control Software May 1980 24 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The problems associated with the development of requirements for guidance and control software are discussed. Ideas are suggested that will overcome these problems and a specific application of those ideas are described in terms of a methodology and associated tools. The position and contribution of requirements definition in the perspective of the overall product life cycle are examined. Two relevant viewpoints are considered: the resources needed to produce requirements; and the quality of requirements and its impact on budget. R.C.T.

N80-32127# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
TRENDS IN THE DEVELOPMENT OF SOFTWARE FOR GUIDANCE AND CONTROL
Peter F. Elzer *In* AGARD Guidance and Control Software May 1980 10 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

An attempt is made to classify the steps of the development process for computer programs in guidance and control systems. Possible methologies are identified as well as support tools for development on each level. Several existing methods are described. R.C.T.

N80-32128# Naval Air Development Center, Warminster, Pa. Advanced Software Technology Div.
A MODERN FACILITY FOR SOFTWARE PRODUCTION AND MAINTENANCE
H. G. Stuebing *In* AGARD Guidance and Control Software May 1980 14 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

A facility was designed, developed, and used for the life cycle support of weapon system software. This facility consists of a software system which runs on a commercial multicomputer configuration. The approach features increased management visibility of the software development process, increased programmer productivity through automation, reducing the cost of change during maintenance, and the use of automated regression testing to improve software quality. R.C.T.

N80-32129# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
LOGIC STRUCTURE FOR TESTABILITY AND FAILURE DETECTION
U. Schulz and A. Roelker *In* AGARD Guidance and Control Software May 1980 8 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

A concept of the logic structure for testability and failure detection of digital, modular, onboard data acquisition and control units within avionics systems were investigated. The concept was developed according to the maintenance levels within the German Air Force. The tests and failure detection were performed during operation as well as during pre- and post-flight tests without additional external special to type test equipments. The tests were totally integrated into the avionic system. R.C.T.

N80-32130# Office of the Under Secretary of Defense for Research and Engineering, Washington, D. C.
THE UNITED STATES DEPARTMENT OF DEFENSE COMMON HIGH ORDER LANGUAGE
David A. Fisher *In* AGARD Guidance and Control Software May 1980 9 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The design, development, aquisition, management, and operational support and maintenance of computer software are discussed with respect to avionics applications. Specific emphasis is given to major weapon systems, communications systems, and command control systems. R.C.T.

N80-32131# Softech, Inc., Waltham, Mass.
COMPILER WRITING TECHNIQUES FOR AVIONICS APPLICATIONS
Raymond J. Rubey and Barry L. Wolman *In* AGARD Guidance and Control Software May 1980 8 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

Some of the options in compiler construction for avionics applications are reveiwed and the structure of a typical compiler is described. Major emphasis is placed on the significant differences which exist between compilers for avionics applications and compilers used in general purpose applications. R.C.T.

N80-32132# Software Management Consultants, Torrance, Calif.
SOFTWARE VERIFICATION AND VALIDATION
Donald J. Reifer *In* AGARD Guidance and Control Software May 1980 13 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The terms verification and validation are described and detailed guidance for their conduct is given. For each activity, the responsibilities of the participating organizations are identified

and applicable concepts, methods, products and problems are discussed. R.C.T.

N80-32133# Naval Air Development Center, Warminster, Pa.
SOFTWARE MAINTENANCE MANAGEMENT PROCESS
William R. Bogdan *In* AGARD Guidance and Control Software May 1980 9 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The management concepts utilized in developing a maintenance capability to support fleet tactical software are addressed. The tactical software being maintained is described and the kind of management planning that is essential to fleet software maintenance is presented. Software design factors are discussed that will reduce maintenance costs by making the initial software development more amenable to subsequent modification. The methodology the Navy uses to control changes to a software configuration baseline is addressed and how the Navy insures reliability of the software prior to fleet release is included. Also provided is an overview for the work breakdown structure and the organization of resources for work accomplishment. Estimating procedures are described for determining software maintenance cost. R.C.T.

N80-32134# National Aerospace Lab., Amsterdam (Netherlands). IRAS Mission Operations.
DATA SYSTEM FOR THE INFRA-RED ASTRONOMICAL SATELLITE (IRAS)
R. C. VanHoltz *In* AGARD Guidance and Control Software May 1980 21 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The data system that is being developed for the Infra-Red Astronomical Satellite (IRAS) is discussed. After introducing the satellite and its objectives, the setup of the on board and the ground data system is described. The subsystem responsible for the control of the satellite, called IRAS Ground Operations, is then exposed in more detail. The tasks of this subsystem include orbit determination and prediction, real time operations, spacecraft performance evaluation and maintenance, and data preprocessing, distribution, and filing. Finally, the data system configuration control mechanism which was devised to meet the complexity and multinational setup of the system is portrayed. M.G.

N80-32135# General Dynamics Corp. Fort Worth, Tex.
ADVANCED DESIGN CONCEPTS AND PRACTICES IN THE F-16 MISSION COMPUTER SOFTWARE
Judith A. Edwards *In* AGARD Guidance and Control Software May 1980 15 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

Developments in the design of the F-16 mission computer software are discussed. Improved system performance resulted from several broad-scope software design decisions that were applied to the mission computer for the F-16 avionics system. These design decisions were made in the areas of the control and scheduling functions. The selected control concepts relied upon a table-driven system that employed only positive logic and a simplified executive. The Multicomputer configuration was a loosely coupled in an asynchronous network. Communications in the network were implemented via a standard 16-bit protocol. Data consistency was addressed in the basic interface specification as well as the detailed implementation. In general, the timing and hardware design features were hidden from the algorithms through system control approaches. In all, the flexibility and optimizations that resulted from the implementation concept have been well established through two block updates and several demonstration and research programs. M.G.

N80-32136# Ministry of Defence, London (England).
MAIN COMPUTER SOFTWARE FOR THE MRCA TORNADO
K. Sanderson *In* AGARD Guidance and Control Software May 1980 16 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The main computer software for the tri-national requirement Tornado (Panavia 200 MRCA Tornado) is discussed. Particular reference is made to the role of the national avionic system companies in the participating nations and the organization provided by them for the design and development of the avionic system, including the software. The specification of the top level avionic design requirements and a description of the computing hardware and data transmission arrangements provide an introduction to the specific software development topics. These cover the specification of the software requirements, the development of the Operational Flight Program, the software structure and documentation, hardware-software integration and testing facilities, documentation for the control and reporting of the testing, configuration control aspects, and production software modification control. M.G.

N80-32137# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
THE LOGIC OF THE ELECTRIC FLIGHT CONTROL SYSTEM EXPERIMENT ON THE CONCORDE [LOGICIEL DU SYSTEME DE COMMANDE DE VOL ELECTRIQUE EXPERIMENTE SUR CONCORDE]
Y. Negre and J. Raullet *In* AGARD Guidance and Control Software May 1980 11 p In FRENCH (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

An experiment using a numerical electric flight control system to control low speed longitudinal instability on the Concorde is described. The security and performance objectives which influenced the system definition are outlined with particular emphasis on problems related to the definition, installation and experimentation with the logic used. Conclusions are drawn principally regarding the level of security which can be expected for onboard logical elements. Transl. by A.R.H.

N80-32138# Smiths Industries Ltd., Bishops Cleeve (England). Electronic Displays Branch.
DESIGN AND DEVELOPMENT OF SOFTWARE FOR SEA HARRIER HUDWAC
E. P. Jones and S. Howison *In* AGARD Guidance and Control Software May 1980 12 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The development of the airborne software for the Sea Harrier Head-Up Display and Weapon Aiming Computer System is described. The system requirements are outlined and include the symbology generation for both head-up and head-down display systems; weapon aiming computations; flight path guidance for both target interception and aircraft to ship recovery; pointing and control commands for radar and guided weapons; first line avionic system test and fault identification; and extensive operational self test and failure tolerance. The hardware configuration, software design, and software writing utilizing the CORAL programming language are discussed. M.G.

N80-32139# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SOFTWARE FOR AN INTEGRATED FLIGHT CONTROL AND NIGHT VISION SYSTEM FOR MILITARY HELICOPTERS
P. Elzer, F. Figel, and W. Hoffman *In* AGARD Guidance and Control Software May 1980 8 p refs Sponsored by the German Federal Ministry of Defense (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The functions and structure of an integrated digital flight control and night vision system for military helicopters is described. Its partially redundant components are connected via a serial bus. This resulted in a system with distributed processors. The software had to be structured according to the distributed character of the system and had to take into account the master-terminal principle of the bus architecture. It comprises the algorithms for flight control and handling of the night vision equipment as well as management functions for the bus, the displays, input commands, and error handling. Development of the software and integration of the system were supported by appropriate hardware aids. A special device was developed to facilitate integration of the distributed system. For this the same modular electronic components were used as for the control system. M.G.

N80-32140# IBM Federal Systems Div., Owego, N. Y.
SPACE SHUTTLE APPLICATIONS. PART 1: REDUNDANT

COMPUTER OPERATION. PART 2: REDUNDANT COMPUTER SOFTWARE DESIGN AND TEST
Robert E. Poupard and Caroline T. Sheridan *In* AGARD Guidance and Control Software May 1980 9 p (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The operational characteristics of the space shuttle redundant data processing system are defined. The system was designed to meet the fail operational/fail safe requirements of the space shuttle mission and is comprised of a redundant set of four IBM AP-101 general purpose computers programmed to produce identical, simultaneous output commands. Particular emphasis is given to the design testing of the system software. Additional design characteristics, namely the incorporation of asynchronous interrupts and multiple asynchronous priority levels, are examined and techniques utilized for ensuring data integrity are reviewed. M.G.

N80-32141# Naval Air Development Center, Warminster, Pa. Combat Systems Software Div.
SOFTWARE APPLICATIONS AS DEMONSTRATED IN THE P-3C AVIONICS SYSTEM
John W. Heap *In* AGARD Guidance and Control Software May 1980 15 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The software management methodology developed for generation of the P-3C system software for the three UPDATE versions of the avionics system is covered. Emphasis is placed on the software development flow process depicting control points and deliverables, standards and objectives set for the software functions and design, the contracting strategy, and tool and facilities employed. M.G.

N80-32142# Boeing Military Airplane Development, Seattle, Wash.
EXECUTIVE SOFTWARE REUSABILITY FOR DISTRIBUTED AVIONICS ARCHITECTURES
R. F. Bousley *In* AGARD Guidance and Control Software May 1980 12 p refs (For primary document see N80-32125 22-61)
Avail: NTIS HC A10/MF A01

The impact of distributed microprocessor-based systems integrated (mission-oriented) avionics software is addressed. An overview is given of hardware networks and bus control mechanization issues in distributed architectures. Executive software considerations are emphasized. It appears that a functional decomposition of the executive software will help to maximize the reusability of this software since only those functional modules changed. A modularized executive, along with a firm executive/applications software interface, will allow maximum reusability of the applications software. This will minimze the impact on the integration task during mission software development. M.G.

62 COMPUTER SYSTEMS

Includes computer networks.

N80-32143 Cincinnati Univ., Ohio.
A FAST ANALYSIS AND MODIFICATION ALGORITHM FOR COMPUTER AIDED DESIGN OF LARGE SCALE NETWORKS Ph.D. Thesis
Chin-Fu Chen 1980 240 p
Avail: Univ. Microfilms Order No. 8021067

A fast algorithm for network analysis is developed; it merges the conventional two phase approach into one process. The LU-factors (and their inverses) of a network matrix are built up through a branch by branch reconstruction of the given network. This fast algorithm, called Successive LU Decomposition or SLUD, is derived through the concept of tearing and generalized network formulation. There is no need to find the LU-factors of the whole Jacobian matrix. The computation speed for circuit analysis including the dc, ac, transient and eigenvalue problems substantially improved. For large scale networks with repetitive subnetworks the saving in computation time and memory requirement is even more significant. Based on the SLUD concept an algorithm for constitutive modifications is developed. A circuit simulation program was implemented in PL/I and several examples are presented. As compared with the conventional approach, the SLUD algorithm has demonstrated a saving of 40% in computation time for the dc analysis of a 60 branch network. Dissert. Abstr.

N80-32144 Carnegie-Mellon Univ., Pittsburgh, Pa.
PARTITIONING AND COOPERATION IN A DISTRIBUTED MULTIPROCESSOR OPERATING SYSTEM: MEDUSA Ph.D. Thesis
John Kenneth Ousterhout 1980 161 p
Avail: Univ. Microfilms Order No. 8020166

The design of Medusa, an operating system with a highly distributed control structure that runs on the Cm multimicroprocessor is analyzed. The Cm hardware is distributed, yet extremely flexible in the kinds of interprocessor communication it permits. Thus Medusa's structure arose from a consideration of two issues: partitioning and cooperation. Medusa consists of five relatively independent utilities that execute on different processors. Each utility provides one abstraction for the rest of the system and communicates with user programs and other utilities via messages. Functions are distributed between utilities at a very low abstract level. Since processors in cm are plentiful but small, all programs, including the utilities, are organized as task forces that contain several concurrent, cooperating activities. Medusa attempts to make cooperation between activities of a task force both powerful and efficient. One mechanism for this is executing all runnable activities of the task force and also executing each on a different processor. Dissert. Abstr.

N80-32145*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OVERVIEW OF INTEGRATED PROGRAMS FOR AEROSPACE-VEHICLE DESIGN (IPAD)
Robert E. Fulton Washington Sep. 1980 23 p refs Presented at IPAD Natl. Symp., Denver, 17-19 Sep. 1980
(NASA-TM-81874; L-14022) Avail: NTIS HC A02/MF A01 CSCL 09B

An overview of a joint industry/government project, denoted Integrated Programs for Aerospace-Vehicle Design (IPAD), which focuses on development of technology and associated software for integrated company-wide management of engineering information is presented. Results to date are summarized and include an in-depth documentation of a representative design process for a large engineering project, the definition and design of computer-aided design software needed to support that process, and the release of prototype software to integrated selected design functions. M.G.

N80-32146# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
APPLICATIONS OF INFORMATION THEORY TO DATA COMMUNICATION NETWORKS
Robert G. Gallager Jul. 1980 24 p refs Presented at NATO Advan. Study Inst., Norwick, England, 4-14 Aug. 1980
(Contract N00014-75-C-1183; Grant NSF ECS-79-19880; ARPA Order 3045; NR Proj. 049-383)
(AD-A087624; LIDS-P-1017) Avail: NTIS HC A02/MF A01 CSCL 09/2

The use of information theory in the study of Data Communication Networks can be roughly divided into two parts. The first deals with usual information theoretic problem of reliable and efficient transmission of information, generalized to treat multiple sources and destination. The second deals with the special problems caused by the bursty sources typical of data networks. These sources typically produce short messages interspersed with long and unpredictable intervals of silence. This makes the sources highly nonstationary over time intervals comparable to tolerable communication delays. This lecture will deal primarily with this second class of issues. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-32147 Notre Dame Univ., Ind.
ON THE TOTAL SYNTHESIS PROBLEM OF LINEAR MULTIVARIABLE CONTROL Ph.D. Thesis
Raghvendra Ramchandra Gejji 1980 204 p
Avail: Univ. Microfilms Order No. 8020961

The algebraic structure behind the basic total synthesis problem (TSP) is established. The fundamental mapping of TSP is introduced and a characterization of the solution set of TSP is given as a rational vector space. It is shown that solutions that provide for internal stability must be in a partucular subset which is a free module over a ring of fractions formed from polynomials. Coefficients are considered as the field of reals. The utility of a minimal polynomial basis in characterizing the above subset is described. The problem of subjective criteria in calculation of minimal bases is discussed, and a case study which leads to an empirical balancing rule for countering this problem is presented. Design is approached as an approximation technique using least squares methods to select, among the feasible solutions, the nearest neighbor to a specified target performance. A question arising as a result is whether control goals may be incorporated in the specified target performance. An example result on how tracking goals lead to constraints on the closed loop transfer function matrix is therefore included. A comprehensive example is included. Dissert. Abstr.

N80-32148*# Honeywell Systems and Research Center, Minneapolis, Minn.
ROBUSTNESS OF MULTILOOP LINEAR FEEDBACK SYSTEMS
J. C. Doyle 31 Aug. 1979 27 p refs 2 Vol.
(Grant NG-1323; Contracts N00014-75-C-0144; E(11-1)-3070)
(NASA-CR-163450; AD-A086581) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This paper presents a new approach to the analysis of robustness or sensitivity of multiloop linear feedback systems. The properties of the return difference equation are examined using the concepts of singular values, singular vectors and the spectral norm of a matrix. A number of new tools for multiloop systems are developed which are analogous to those for scalar Nyquist and Bode analysis, providing a generalization of the scalar frequency-domain notions such as stability margins and M circles. GRA

N80-32149# Colorado Univ., Boulder.
QUANTITATIVE SYNTHESIS OF UNCERTAIN MULTIPLE INPUT-OUTPUT FEEDBACK SYSTEM
Isaac M. Horowitz (Weizmann Inst. of Science, Rehovot, Israel) 31 Aug. 1979 51 p refs
(Grant AF-AFOSR-2946-76)
(AD-A087014) Avail: NTIS HC A04/MF A01 CSCL 09/2

An n input, n output plant is given with a specified range of parameter uncertainty and specified tolerances on the n to the 2nd power system response to command functions and the n to the 2nd power response to disturbance functions. It is shown how Schauder's fixed point theorem may be used to generate a variety of synthesis techniques, for a large class of such plants. The design guarantees the specifications are satisfied over the range of parameter uncertainty. An attractive property is that design execution is that of successive single loop designs, with no interaction between them and no iteration necessary. Stability over the range of parameter uncertainty is automatically included. By additional use of Schauder's theorem, these same synthesis techniques can be rigorously used for quantitative design in the same sense as above, for n x n uncertain nonlinear plants, even nonlinear time varying plants, in response to a finite number of inputs. The latter approach is sufficient. However, a scientific theory of feedback should certainly include quantitative design techniques. In this paper, it is shown how Schauder's fixed point theorem can be used to generate a variety of precise quantitative mio synthesis techniques suitable for various problem classes. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-32150# Magnetic Observatory, Hermanus (South Africa).
WORKSHOP ON DIGITAL TIME SERIES ANALYSIS WITH GEOPHYSICAL APPLICATIONS
5 Jun. 1980 293 p refs Workshop help at Hermanus, South Africa, 22-24 Apr. 1980
(CSIR-S-238; ISBN-0-7988-1889-1) Avail: NTIS
HC A13/MF A01

Fourier transforms, digital filtering, and maximum entropy spectral analysis are among the principal topics discussed in twenty-two unedited papers. The use of these techniques in astronomical photometry and in seismology is discussed. Other applications of time series analysis such as predicting rainfall in South Africa, determining the resonance of Table Bay harbor, analyzing geomagnetic pulsations, measuring ocean surface waves, differentiating noisy data, and measuring vector currents, the autocorrelation analysis of atmospheric pressure, and a digital autocorrelation spectrometer and radio astronomical spectral analysis are also considered. A.R.H.

N80-32151# Stanford Univ., Calif. Systems Optimization Lab.
COMPUTING FINITE-DIFFERENCE APPROXIMATIONS TO DERIVATIVES FOR NUMERICAL OPTIMIZATION
Philip E. Gill, Walter Murray, Michael A. Saunders, and Margaret H. Wright May 1980 27 p refs
(Contracts N00014-75-C-0267; DAAG29-79-C-0110; DE-AC03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MCS-79-26009; NSF ENG-77-06761)
(AD-A087428; SU-SOL-80-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

Finite-difference approximations to derivatives are useful not only in optimization algorithms, but also in other circumstances such as sensitivity analysis. In this paper we discuss methods for estimating the relative cancellation error and relative truncation error in a finite-difference approximation and propose a technique for computing the finite-difference interval so that the bounds upon the errors are balanced. We also propose a method for choosing the finite-difference interval in a quasi-Newton algorithm for unconstrained minimization that uses function values only. GRA

N80-32152# Naval Ship Research and Development Center, Bethesda, Md. Computation, Mathematics and Logistics Dept.
FINITE ELEMENT ANALYSIS OF PIPING TEES Final Report, Oct. 1979 - Jun. 1980
Antonio J. Quazon, Gordon C. Everstine, and Michael E. Golden Jun. 1980 49 p refs
(AD-A087353; DTNSRDC/CMLD-80/11) Avail: NTIS
HC A03/MF A01 CSCL 13/11

Finite element analyses were performed for a 24 in. x 24 in. x 10 in. schedule 40 carbon steel piping tee subjected to five orthogonal forces, six orthogonal moments, and internal pressure. The NASTRAN and CORTES/SA computer programs were used to compute displacements and normalized principal stresses for four finite element models. (CORTES/SA is a special purpose finite element analysis program for tee joints developed at the University of California at Berkeley.) The first three models generated were analyzed by NASTRAN, and the third and fourth models were analyzed by CORTES/SA, resulting in a total of five finite element analyses. Flexibility factors and normalized principal stresses were then compared to experimentally obtained results. One of the four models investigated was generated from actual measured geometry using GPRIME, a geometric and finite element modeling system developed at DTNSRDC. The other three models were generated from an idealized tee using the data generator contained in CORTES/SA. The generation by GPRIME of the finite element model from actual geometry was more difficult and expensive than the generation of CORTES/SA of an idealized model of the tee. In addition, the idealized model proved to be adequate when analyzed by NASTRAN. GRA

N80-32153# Naval Postgraduate School, Monterey, Calif.
SIMULATION OF SOME AUTOREGRESSIVE MARKOVIAN SEQUENCES OF POSITIVE RANDOM VARIABLES
Peter A. W. Lewis and A. J. Lawrance Oct. 1979 29 p refs
Presented at Winter Simulation Conf., Dec. 1979
(NR Proj. 042-284; RR0000110)
(AD-A087368; NPS55-79-024) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Methods for simulating dependent sequences of continuous positive valued random variables with exponential, Gamma, mixed exponential and uniform marginal distributions are given. In most cases the sequences are first order, linear autoregressive, Markovian processes. A two parameter family of this type with exponential marginals is defined and its transformation to a similar multiplicative process with uniform marginals is given. It is shown that for a subclass of this two parameter family extension to mixed exponential marginals is possible, giving a model of broad applicability for analyzing data and modelling stochastic systems. Efficient simulation of some of these schemes is discussed. GRA

N80-32154# Naval Postgraduate School, Monterey, Calif. Dept. of Operations Research.
REGRESSION-ADJUSTED ESTIMATES FOR REGENERATIVE SIMULATIONS, WITH GRAPHICS
Peter A. W. Lewis and P. Heidelberger (IBM, Yorktown Heights, N.Y.) Apr. 1980 55 p refs
(NR Proj. 042-084)
(AD-A087369; NPS55-80-019) Avail: NTIS
HC A04/MF A01 CSCL 12/1

The independent block structure of regenerative processes and the known convergence rates of the means of ratio estimators are exploited to produce bias free regression adjusted estimates (rare's) for regenerative simulations. Direct assessments of the variances of the estimates are obtained, as well as indications, both formal and graphical, of their normality or nonnormality. GRA

N80-32155# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
ON THE NUMERICAL INTEGRATION OF TWO-POINT BOUNDARY VALUE PROBLEMS FOR STIFF SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS
Joseph E. Flaherty and Robert E. OMalley, Jr. (Arizona Univ., Tucson) Jun. 1980 11 p refs Presented at Intern. Conf. on Boundary and Interior Layers, Dublin, 3-6 Jun. 1980
(Contract N00014-76-C-0326; Grant AF-AFOSR-0192-80; NR Proj. 041-466)
(AD-A087396; Rept-30) Avail: NTIS HC A02/MF A01 CSCL 12/1

A class of two point boundary value problems are considered for systems for the form dx = f(x, y, t, epsilon), edy = g sub 1 (x, t, epsilon) + g sub 2 (x, t, epsilon)y where the matrix g sub 2 (x, t, 0) has a hyperbolic splitting with a fixed number of stable and unstable eigenvalues. Solutions to such boundary value problems can then be expected to have boundary layer behavior near both endpoints in the limit epsilon approaches 0(+). Our analysis shows, in particular, how to determine the reduced order boundary value problem satisfied by the limiting interior solution. Orthogonal matrix methods are used to determine this reduced problem and appropriate boundary layer corrections in a computationally effective manner. Numerical experiments with model problems illustrate the possibility of multiple solutions and show how our asymptotic results can be used in combination with the COLSYS code for solving two point problems via collocation. GRA

N80-32156# Pennsylvania Univ., Philadelphia. Dept. of Systems Engineering.
ROBUST AND QUANTIZED WIENER FILTERS FOR p-POINT SPECTRAL CLASSES Interim Report
Leonard J. Cimini and Saleem A. Kassam 1980 7 p refs
Presented at Conf. on Inform. Sci. and Systems, Princeton, N.J., Mar. 1980 Submitted for publication
(Grant AF-AFOSR-3154-77)
(AD-A086409; AFOSR-80-0425TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The classical solution for linear estimation of a signal in additive noise is given by the well known Wiener filter. In certain circumstances, however, it is advantageous to have a filter which is piecewise constant and which provides good performance over an entire class of signal and noise power spectral densities. First, a procedure is presented for determining the optimal piecewise constant filter. Then, for a particular class of power spectral densities, termed the p-point spectral class, the robust filter is determined. GRA

N80-32157# Pennsylvania Univ., Philadelphia. Dept of Systems Engineering.
ROBUST WIENER FILTERS FOR CORRELATED SIGNALS AND NOISE Interim Report
George Moustakides and Saleem A. Kassam 1980 7 p refs
Presented at Conf. on Inform. Sci. and Systems, Princeton, N.J., Mar. 1980 Submitted for publication
(Grant AF-AFOSR-3154-77; AF Proj. 2304)
(AD-A086410; AFOSR-80-0426TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In this report, the Wiener filtering problem, when the cross spectral density matrix of the signal and noise is not exactly known is considered the filters which are saddle point solutions for the criterion of performance (mean square error, MSE) over the classes of allowable density matrices are obtained. Solutions for various classes are also given. GRA

N80-32158# Stanford Univ., Calif.
METHODS FOR LARGE-SCALE NONLINEAR OPTIMIZATION
Philip E. Gill, Walter Murray, Michael A. Saunders, and Margaret H. Wright May 1980 25 p refs Presented at the SIAM Conf. on Elec. Power Probl: The Mathematical Challenge, Seattle, Mar. 1980
(Contracts DAAG29-79-C-0110; N00014-75-C-0267; DE-AC03-76SF-00326; DE-AT03-76ER-72018)
(AD-A087555; SU-SOL-80-8; ARO-16470.13-M)
HC A02/MF A01 CSCL 12/1

The application of optimization to electrical power technology often requires the numerical solution of systems that are very large and possibly nondifferentiable. A brief survey of the state-of-the-art of numerical optimization is presented in which those methods that are directly applicable to power system problems will be highlighted. The areas of current research that are most likely to yield direct benefit to practical computation are identified. The paper concludes with a survey of available software. GRA

N80-32159# Stanford Univ., Calif. Systems Optimization Lab.
ASPECTS OF MATHEMATICAL MODELING RELATED TO OPTIMIZATION
Philip E. Gill, Walter Murray, Michael A. Saunders, and Margaret H. Wright May 1980 35 p refs Presented at the Conf. on Software for Numerical Optimization, London, Mar. 1978
(Contracts DAAG29-79-C-0110; DE-AC03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MCS-79-26009; NSF ENG-77-06761)
(AD-A087556; SU-SOL-80-7; ARO-16470.12-M) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Many practical optimization problems involve mathematical models of complex real-world phenomena. This paper discusses some aspects of modeling that influence the performance of optimization methods. Information and advice are given concerning the construction of smooth models, the transformation of an optimization problem from one category to another, scaling, formulation of constraints, and techniques for special types of models. GRA

N80-32160# Naval Ocean Systems Center, San Diego, Calif.
RECURSIVE LEAST SQUARES LATTICE ALGORITHMS: A GEOMETRICAL APPROACH Final Report, Jul. - Aug. 1979
M. J. Shensa 15 Dec. 1979 20 p refs
(AD-A087566; NOSC/TR-552) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Several time-recursive least squares algorithms have been developed in recent years. In this report a geometrical formalism is defined which utilizes a nested family of metric spaces indexed by the data time interval. This approach leads to a simplified derivation of the so-called recursive least squares lattices

algorithms (recursive in time and order). In particular, it is found that the resulting structure provides a single framework which encompasses an entire family of fairly complex algorithms as well as providing geometrical insight into their behavior. GRA

N80-32161# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
AN EFFICIENT METHOD FOR PERFORMING PARTIAL FRACTION EXPANSION
John F. Mahoney Feb. 1980 16 p refs
(Contract DAAG29-79-C-0119)
(AD-A087486; RR-80-11; ARO-16356.5-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

An escalation method for performing partial fraction expansions is presented for the case that the complete list of zeros of the denominator of the proper rational function is known. Expressions for the number of divisions and multiplications required are developed. The new method requires fewer such arithmetic operations than does the method of Henrici. A numerical example is provided. GRA

N80-32162# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
THE METHOD OF CONTRACTING ELLIPSOIDS
James E. Falk 18 Apr. 1980 38 p refs
(Contract DAAG29-79-C-0062)
(AD-A087485; Serial-T-418; ARO-16229.3-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

The details of 'Khachian's Algorithm,' or the 'Russian Algorithm', are derived. Previously reported results based on 'deep cuts' are verified, and a proof of the polynomial convergence properties is sketched. GRA

N80-32163# Sandia Labs., Livermore, Calif. Applied Mechanics Div.
REVIEW OF STIFFNESS AND IMPLICIT FINITE DIFFERENCE METHODS IN COMBUSTION MODELING
R. J. Kee and H. A. Dwyer (California Univ., Davis) Apr. 1980 82 p refs Presented at the 7th Colloq. on Gasdyn. of Explosions and Reactive systems, Goettingen, West Germany, 19 Aug. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-8623) Avail: NTIS HC A05/MF A01

A physical interpretation of stiffness in chemical kinetics modeling is presented. A general overview of the mathematical concepts important to the implementation of implicit methods is presented. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-32164 Vermont Univ. and State Agricultural Coll., Burlington.
NONPARAMETRIC ESTIMATION OF A LIFETIME DISTRIBUTION VIA THE RENEWAL FUNCTION Ph.D. Thesis
David Charles Trindade 1980 207 p
Avail: Univ. Microfilms Order No. 8018168

A group of N systems, each system consisting of c similar components is considered. The components fail independently with a cumulative lifetime distribution function (CDF) denoted by F(t) and a nonparametric estimate of F(t) from system lifetime data is developed. Cases are considered in which only system fail times, and not the fail times of the individual components are recorded. The practical implication of this process is that after the first replacement on a system has been made, it is not possible to ascertain from the recorded system fail times whether the failure occurred on an original or replaced item. However, is is shown that there is a function called the renewal function, which can be estimated directly for this pooled process and then used to estimate the component CDF. The pooling of systems with different entry times into operation result in different current operating times, and hence progressive or multiple censoring of groups of component lifetimes. The renewal function M(t) is defined as the expected number of component renewals or replacements by time t at a single component position. The CDF F(t) can be determined from M(t) via a well known equation called the fundamental renewal function. Dissert. Abstr.

N80-32165 Cornell Univ., Ithaca, N. Y.
ON THE THEORY OF CROSSOVER DESIGNS WITH RESIDUAL EFFECTS Ph.D. Thesis
Ronald Paul Kershner 1980 189 p
Avail: Univ. Microfilms Order No. 8020842

Five key areas in the theory of crossover designs with residual effects are addressed. These areas are: (1) a general discussion of the nature of repeated measures designs and the various types of treatment effects that might arise in such application; (2) a restructuring of the intraclass correlation covariance structure as it pertains to repeated measurements applications; (3) a detailed discussion of certain inherent estimability problems that arise in linear models containing residual treatment effects; (4) resolution of the current controversy surrounding the two treatment crossover designs; and (5) a fresh look at some published designs for three and four treatments with a view toward assessing variance optimality and estimability of certain interaction effects for a varying number of treatment periods. Dissert. Abstr.

N80-32166 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE CAUSAL ANALYSIS OF MULTIPLE TIME SERIES: A FREQUENCY DOMAIN APPROACH USING GROUP DELAY Ph.D. Thesis
Michael Lee Deaton 1980 118 p
Avail: Univ. Microfilms Order No. 8020203

An alternative notion of causality between two processes called local causality is given and is shown to overcome the difficulties in the Wiener/Granger approach. A test for local causal relations is proposed. The main features of the new definition are that it describes causal relations between frequency components of two stochastic processes and that it uses the previously seldom used group delay function. The definition rests heavily upon the interpretation of the group delay function as a measure of the lead lag relationships between the frequency components of two stochastic processes. This interpretation has been hinted at in the literature without strict justification. A rigorous development of this interpretation is given. For describing the lead lag relationships between multivariate processes, the partial group delay function is defined and shown to have an interpretation as a lead lag indicator for frequency components of multivariate stochastic processes. Using the partial group delay function, a definition of local causality among multivariate processes is given. An estimator for the partial group delay function is proposed. Dissert. Abstr.

N80-32167 California Univ., Riverside.
A BAYESIAN PROCEDURE TO COMPARE AND CHOOSE AMONG LOGISTIC REGRESSION MODELS Ph.D. Thesis
Francisco Garcia-Hernandez 1980 88 p
Avail: Univ. Microfilms Order No. 8020607

A Bayesian procedure based on the posterior odds ratio is developed. This procedure is applied to two cases of model specifications: (1) to select from a given set the best subset of explanatory variables; and (2) to select the best of two alternative sets of explanatory variables. The posterior odds ratio procedure was applied to select the best subset of a given set of explanatory variables when the dependent variable is the married woman's participation in the labor force and to compare two alternative theories that explain the participation of married women in the labor force. The results obtained in the empirical analysis are very encouraging. The procedure discriminates very well between a good model and a bad model. Dissert. Abstr.

N80-32168 State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
THE APPLICATION OF CLUSTER ANALYSIS TO THE MASS APPRAISAL OF FOREST AND VACANT LAND Ph.D. Thesis
Susan Gail Stafford 1979 204 p
Avail: Univ. Microfilms Order No. 8019083

Cluster analysis, in conjunction with multiple regression techniques and discriminant analysis is used to improve the market value estimates for vacant and forest land. Sales data from three upstate New York counties were merged into one master file.

Inter-county data filters were devised to reduce any problems with inter-county variable definition incompatibility. Half of the data was clustered into several (8) small clusters. The inter-property resemblance measures were based on ten variables. Regression equations were determined of each cluster. Analysis of regression techniques were used to evaluate similarities among the regression coefficients. Clusters were combined where appropriate discriminant analysis was used to locate the clusters. The other half of the data was assigned to the appropriate cluster on the basis of the classification functions from discriminant analysis. Those properties which were initially clustered and those which were classified into the same cluster were combined. Final regression equations were computed for the three overall clusters. Dissert. Abstr.

N80-32169# Colorado State Univ., Fort Collins. Dept. of Statistics.

TESTING FOR A CHANGE POINT Ph.D. Thesis

Nancy Jean Farden and L. L. Scharf Apr. 1980 181 p refs
(Contract N00014-75-C-0518)
(AD-A087111; ONR-TR-19) Avail: NTIS HC A09/MF A01 CSCL 12/2

A nonparametric procedure based on differences of averages was proposed to test for a change in the location parameter of the distribution for a sequence of independent random variables. It is assumed that at most one change may have occurred and that the point of change is an unknown parameter; the initial value of the location parameter is assumed known. A method of testing for a change point for small sample sizes which is easy to use and which will detect a change quickly was obtained. Exact critical regions were tabulated for a less than or equal to 20; the power of the tests and properties of the estimator for the change point was studied. Appropriate design of experiments for detecting change points are suggested. T.M.

N80-32170# Purdue Univ., Lafayette, Ind. School of Industrial Engineering.

BATCH SIZE EFFECTS IN THE ANALYSIS OF SIMULATION OUTPUT

Bruce Schmeise Jun. 1980 28 p refs
(Contract N00014-79-C-0832)
(AD-A087045) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers the effects of using fewer batches than are necessary to satisfy normality and independence assumptions. Using too few batches results in (1) correct probability of covering the mean, (2) an increase in expected half length, (3) an increase in the standard deviation of the half length, and (4) an increase in the probability of covering incorrect values of the mean (analogous to Type II error in hypothesis testing). These effects, quantified here, are shown to be small when at least eight to ten batches are used, with least effect on confidence intervals having low confidence values. With the effects of using too few batches quantified, a simulation practitioner can make the trade off between the ease of using very few batches with known independence and normality versus using a batching algorithm to squeeze some remaining information from the data. For researchers developing batching algorithms, the results are useful in selecting initial batch sizes. The results may also be useful in the context of using independent replications to establish confidence intervals on the mean. Finally, some criteria and a procedure are suggested for Monte Carlo comparison of confidence interval procedures. These suggestions are not restricted to batch mean algorithms. GRA

N80-32171# Claremont Mens Coll., Calif. Inst. of Decision Science.

A COMPARISON BETWEEN MLE AND BLUE FOR A DECREASING FAILURE RATE DISTRIBUTION WHEN USING CENSORED-DATA

James Lucke, Janet Myhre, Sam Saunders (Washington State Univ.), and Patrick Williams Mar. 1980 25 p refs
(Contract N00014-78-C-0213)
(AD-A087359; Rept-80-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

Estimation procedures for the shape and scale parameters of a mixed exponential, decreasing failure rate distribution are compared and the more advantageous methods are determined for various situations. The maximum likelihood estimate, MLE, is slightly more accurate than Best Linear Unbiased Estimator of the scale parameter based on the first K order statistics. In the joint case the MLE's are much superior to other possible estimates of the distribution. GRA

N80-32172# Illinois Univ. at Chicago Circle, Chicago. Dept. of Mathematics.

STOCHASTIC ORDERING AND A CLASS OF MULTIVARIATE NEW BETTER THAN USED DISTRIBUTIONS Interim Report

Emad El-Neweihi Jun. 1980 29 p refs
(Grant AF-AFOSR-3050-76; AF Proj. 2304)
(AD-A087288; AFOSR-80-0560TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A new characterization for the univariate class of new better than used (NBU) distributions in terms of stochastic ordering is introduced. A multivariage version of this characterization is then used to define a multivariate class of NBU distributions. Basic properties of this class are derived. Comparison and relationships of this new class with earlier classes are developed. Two multivariate new worse than used (NMW) classes of life distributions are defined and compared and their basic properties are studied. GRA

N80-32173# California Univ., Berkeley. Operations Research Center.

THE BAYESIAN APPROACH TO STATISTICS

Dennis V. Lindley May 1980 42 p refs Presented at Symp. on Recent Advances in Statistics, Lisbon, Apr. 1980
(Grant AF-AFOSR-3179-77; AF Proj. 2304)
(AD-A087836; ORC-80-9) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper discusses several topics that arise in applying Bayesian ideas to inference problems. The Bayesian paradigm is first described as an appreciation of the world through probability: probability being expressed in terms of gambles. Various justifications for this view are outlined. The role of models in the specification of probabilities is considered; together with related problems of the size and complexity of the model, robustness and goodness of fit. Some attempt is made to clarify the concept of conditioning in probability statements. The role of the second argument in a probability function is emphasized again in discussion of the likelihood principle. The relationship between the probability specification and real-world experiences is explored and a suggestion is made that zero probabilities are, in a sense, unreasonable. It is pointed out that it is unrealistic to think of probability as necessarily being defined over a sigma-field. The paper concludes with some remarks on two common objections to the Bayesian view. GRA

N80-32174# Tennessee Univ., Knoxville. Dept. of Psychology.

IS BAYESIAN ESTIMATION PROPER FOR ESTIMATING THE INDIVIDUAL'S ABILITY

Fumiko Samejima 15 Jul. 1980 153 p refs
(Contract N00014-77-C-0360; RR0420401; NR Proj. 150-402)
(AD-A087829) Avail: NTIS HC A08/MF A01 CSCL 12/1

There is a widespread belief among psychologists in the area of applied measurement that Bayesian estimation is better than the maximum likelihood estimation because of the additional information, i.e., prior. For example, many researchers in the computerized adaptive testing use Bayesian methods in the estimation of the examinee's ability. In this paper, this myth is debated theoretically, and in relation with the behavioral reality. Simulation studies are also used to show how biases caused by priors will affect the resultant estimation of the examinee's ability. GRA

N80-32175# Centre National d'Etudes Spatiales, Toulouse (France).

ANALYSIS OF PRINCIPAL COMPONENTS IN THE SEBESTYEN DISCRIMINATION METHOD [ROLE D'ANALYSE EN COMPOSANTES PRINCIPALES DANS LA METHODE DE DISCRIMINATION DE SEBESTYEN]

Jean Pierre Thouvenin Jan. 1980 41 p refs In FRENCH; ENGLISH summary
(CNES-NT-92) Avail: NTIS HC A03/MF A01

Sebestyen's decision - discrimination method based on

principal component analysis is explained. This method is the basis of the data discrimination system for the resonance measurement experiment flown on board the ISEE 1 satellite launched by NASA in October 1977. This pattern recognition problem is fully developed. The optimal number of characteristics needed to describe a data point is determined. The point is represented in N-dimensional space where the different axes correspond to the desired characteristics. The unity of the distance between each point along each axis is then analyzed to determine if it is equal or not to the variance of the characteristic corresponding to that axis. A minimum variance defines the discrimination. Author (ESA)

N80-32176# Fondazione Ugo Bordoni, Rome (Italy).
STATISTICAL PROPERTIES OF THE DIGITAL SUM IN PARTIAL RESPONSE CODES [PROPRIETA' STATISCHE DELLA SOMMA DIGITALE NEI CODICI PARTIAL-RESPONSE]
Giuseppe Maria Poscetti (Rome Univ.) Mar. 1979 36 p refs In ITALIAN
(FUB-21-1979) Avail: NTIS HC A03/MF A01

A study of the statistical properties of the digital sum in partial response codes is presented with particular reference to the estimation of the variance as a significant parameter for the evaluation of the effect of distortion at low channel frequencies. The problems examined are the computation of the probability distribution and the autocorrelation of the message as a function of the incoming message statistical properties, and the analysis of the transit of a discrete time random process of known statistical characteristics through a linear system with known transfer functions. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-32177 California Univ., Davis.
A STUDY OF NONLINEAR WAVES DESCRIBED BY THE CUBIC SCHRODINGER EQUATION Ph.D. Thesis
Arthur Eugene Walstead 1980 244 p
Avail: Univ. Microfilms Order No. 8019004

A system of quasilinear evolution equations (the modulational equations) were derived for the values of the four parameters of cnoidal waves when they are slowly varying in space and time. The system is subsequently determined to be hyperbolic or elliptic, stable or unstable according to the sign of a certain coefficient pq. Riemann invariants are obtained for several limits for the stable case (pq < 0) and growth rates are obtained for several limits, including the solitary wave chain, for the unstable case (pq > 0). The dynamics of the cubic Schroedinger equation (CSE) generalized to two spatial dimensions are studied for the case pq > 0. A large class of similarity solutions with cylindrical symmetry are obtained systematically using infinitesimal transformation group techniques. The methods are adapted to obtain the symmetries of the action functional of the CSE and to deduce nine integral invariants. A numerical study of the self similar solutions reveals that they are modulationally unstable and that singularities dominate the dynamics of the CSE in two dimensions. The CSE is derived using perturbation theory for a specific problem in plasma physics - the evolution of the envelope of a near monochromatic electromagnetic wave in a cold magnetized plasma. Dissert. Abstr.

N80-32178# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
AN APPROXIMATE SOLUTION OF SINGULARLY PERTURBED NON-LINEAR PURSUIT-EVASION GAMES
N. Farber and J. Shinar Feb. 1979 86 p refs
(TAE-359) Avail: NTIS HC A05/MF A01

A methodology to obtain an approximate solution of a singularly perturbed nonlinear differential game is presented. The outcome of the game with approximate strategies, defined as extended value, is related to the saddle point value of the game. In an example of a simple pursuit-evasion game, it is shown that the proposed methodology leads to an easily implementable feedback form solution with faily accurate results. This approach seems to be attractive to analyze realistic air combat models without solving a two point boundary value problem. Author

N80-31462*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTEGRATED ANALYSIS OF LARGE SPACE SYSTEMS
Joseph P. Young *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 179-192 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 12B

N80-31463*# Boeing Aerospace Co., Seattle, Wash.
INTEGRATED ANALYSIS CAPABILITY FOR LARGE SPACE SYSTEMS
Robert G. Vos *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 193-202 (For primary document see N80-31449 22-20)
(Contract NAS5-25767)
Avail: NTIS HC A15/MF A01 CSCL 12B

N80-31464*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONTROLS FOR LSS
Fernando Tolivar *In* NASA. Lewis Research Center Large Space Systems/Low-Thrust Propulsion Technol. Jul. 1980 p 203-217 (For primary document see N80-31449 22-20)
Avail: NTIS HC A15/MF A01 CSCL 21H

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-32179 North Carolina State Univ., Raleigh.
REPEATABILITY OF SPATIAL CONFIGURATIONS DEFINED BY INTERACTION MATRICES Ph.D. Thesis
Ada Ray Corral 1980 94 p
Avail: Univ. Microfilms Order No. 8020523

The repeatability of the spatial configuration of the location points represented by a vector of estimated interaction effects was studied as a way of determining the impact of random error in the classification of locations according to the genotype by environment interaction. Also the problem of the relative gain or loss of precision in the classification when the dimension of the space of estimated location points is reduced to include only the more important dimensions as reflected in the eigenvalues of the interaction covariance matrix, together with some distributional properties of these eigenvalues are discussed. To do this, a Monte Carlo experiment was carried out using 2000 independent sets of random errors which were used to generate the estimated interaction effects. Different true configurations and different choices of lambda the number of locations, and v, the number of cultivars were used. To measure the degree to which the estimated points reproduced the true points the statistic m to the 2nd power was used; m to the 2nd power is the standardized sum of squared distances between the true location points and the corresponding estimated points after rotation and dilation. Dissert. Abstr.

N80-32180# Center for Naval Analyses, Alexandria, Va. Operations Evaluation Group.
LIMIT CYCLE SOLUTIONS OF REACTION-DIFFUSION EQUATIONS Ph.D. Thesis - Vanderbilt Univ., Aug. 1980
Davis Cope Jun. 1980 330 p refs
(AD-A087114; OEG-PP-287) Avail: NTIS HC A15/MF A01 CSCL 07/4

Contents: Introduction to Reaction-Diffusion Equations; Stability of Limit Cycle Solutions of Reaction-Diffusion Equations; An Analytic Construction for Winfree's Isochrons; Perturbation of the Limit Cycle Solution to Reaction-Diffusion Equations; Numerical Solutions of Reaction-Diffusion Equations; Traveling Waves in Reaction-Diffusion Systems. GRA

N80-32181# Wisconsin Univ. - Madison.
SUBHARMONIC SOLUTIONS OF A FORCED WAVE EQUATION

Paul H. Rabinowitz Nov. 1979 14 p refs
(Contract N00014-76-C-0300)
(AD-A087031) Avail: NTIS HC A02/MF A01 CSCL 12/1

In a recent paper, the existence of subharmonic solutions of forced Hamiltonian systems of ordinary differential equations was established. The goal of this note is to show that subharmonics also occur for a class of semilinear wave equations. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-32182# Technical Training Group (3395th), Keesler AFB, Miss.
THE NATURE OF SCIENCE: A CASE STUDY OF ELECTROMAGNETIC THEORY FROM OERSTED TO HERTZ Final Report
Donald Ralph Baucom 9 Jul. 1979 42 p refs
(AD-A087200) Avail: NTIS HC A03/MF A01 CSCL 20/3

This paper is a case study of the development of a scientific theory, specifically, the development of electromagnetics in the 19th century. After a brief introduction that discusses the nature of science and technology and their interaction in modern research and development, an overview of the science of electricity and magnetism prior to 1800 is presented. Following this introduction, the study focuses on the contributions to the development of electromagnetic theory of four major scientists: Hans Christian Oersted, Michael Faraday, James Clerk Maxwell, and Heinrich Hertz. GRA

N80-32183# Northeastern Univ., Boston, Mass.
HIGH PRESSURE STUDIES TO DETERMINE THE EFFECTS OF VOLUME AND TEMPERATURE ON THE LATTICE DYNAMICS OF MOLECULAR SOLIDS: N2, CO2, CH4 Progress Report, 1 Jul. 1979 - 30 Jun. 1980
F. D. Medina May 1980 7 p refs
(Contract DE-AC02-79ER-10443)
(DOE/ER-10443/1) Avail: NTIS HC A02/MF A01

The temperature dependence of the far infrared spectrum of alpha-N2 was studied for a sample at constant volume. The two modes observed near 50 and 72/cm have frequencies which increase slightly with temperature. The integrated intensity of the mode near 50/cm remains constant with temperature, within experimental uncertainty. The Grueneisen parameter of this mode was estimated to be approximately 3. Two samples of solid CH4 of different densities were grown. Grueneisen parameters of 2.6 and 3.1 were obtained for the librational mode and one translational mode in phase 2. The former indicates an anisotropic intermolecular potential with a strong volume dependence. Changes in the spectrum indicate that the 2 to 3 phase transition involves a sudden, simultaneous tetragonal distortion of the lattice and ordering of the orientationally disordered molecules of phase 2, with a slow reorientation of the ordered molecules. DOE

N80-32184# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
STRUCTURAL ANALYSIS OF SUPERCONDUCTING BENDING MAGNETS
R. B. Meuser May 1980 6 p ref Presented at the 8th Intern. Cryogenic Eng. Conf., Genoa, 3-6 Jun. 1980
(Contract W-7405-eng-48)
(LBL-10950; CONF-800631-3) Avail: NTIS HC A02/MF A01

Mechanical stresses, displacements, and the effects of displacements upon aberrations of the magnetic field in the aperture were calculated for a class of superconducting bending magnet configurations. The analytical model employed for the coil was one in which elements are free to slide without restraint upon each other, and upon the surrounding structure. Coil configurations considered range from an idealized one in which the current density varies as cosine theta to more realistic ones consisting of regions of uniform current density. The results for the more realistic coils closely match those of the cosine theta coil. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-32185 Johns Hopkins Univ., Baltimore, Md.
OPTICAL PROBING OF ACOUSTIC EMISSION DURING DEFORMATION OF MICROTENSILE SPECIMENS Ph.D. Thesis
William James Bruchey 1980 98 p
Avail: Univ. Microfilms Order No. 8020122

Optical interferometric techniques were adapted to detect and analyze acoustic emission signals from 304L stainless steel in order to determine the correlation between fracture surface topography and acoustic emission signals emitted by the material during plastic deformation and failure. A pneumatic load system was developed to accept an optical interferometer as the device for detecting acoustic emission signals. Microtensile specimens were fabricated which limited the zone of deformation to approximately three cubic millimeters in volume. Use of the optical probe permitted the monitoring of transient surface displacements to within fractures of a millimeter of the deforming volume. Results demonstrate that acoustic emission is a volume phenomena. For the small plastic zone size investigated, the acoustic emission counts have been minimized to the extent that signals are spatially separated in time and waveform analysis can be conducted on each of the signals. Test results show that existing models describing dislocations as the source of acoustic emission are not sufficient to describe the observed behavior. Dissert. Abstr.

N80-32186*# Lockheed-Georgia Co., Marietta.
A STUDY OF THE TRANSMISSION CHARACTERISTICS OF SUPPRESSOR NOZZLES
K. K. Ahuja, M. Salikuddin, R. H. Burrin, and H. E. Plumbee, Jr. Jun. 1980 263 p refs
(Contract NAS3-20797)
(NASA-CR-165133) Avail: NTIS HC A12/MF A01 CSCL 20A

The internal noise radiation characteristics for a single stream 12 lobe 24 tube suppressor nozzle, and for a dual stream 36 chute suppressor nozzle were investigated. An equivalent single round conical nozzle and an equivalent coannular nozzle system were also tested to provide a reference for the two suppressors. The technique utilized a high voltage spark discharge as a noise source within the test duct which permitted separation of the incident, reflected and transmitted signals in the time domain. These signals were then Fourier transformed to obtain the nozzle transmission coefficient and the power transfer function. These transmission parameters for the 12 lobe, 24 tube suppressor nozzle and the reference conical nozzle are presented as a function of jet Mach number, duct Mach number polar angle and temperature. Effects of simulated forward flight are also considered for this nozzle. For the dual stream, 36 chute suppressor, the transmission parameters are presented as a function of velocity ratios and temperature ratios. Possible data for the equivalent coaxial nozzle is also presented. Jet noise suppression by these nozzles is also discussed. A.R.H.

N80-32187*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE INFLUENCE OF WALL RESONANCES ON THE LEVITATION OF OBJECTS IN A SINGLE-AXIS ACOUSTIC PROCESSING CHAMBER
Bruce B. Ross Sep. 1980 11 p refs
(NASA-TM-78299) Avail: NTIS HC A02/MF A01 CSCL 20A

Instabilities were observed in high temperature, single axis acoustic processing chambers. At certain temperatures, strong wall resonances were generated within the processing chamber itself and these transverse resonances were thought sufficient to disrupt the levitation well. These wall resonances are apparently not strong enough to cause instabilities in the levitation well. T.M.

N80-32188*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTAL INVESTIGATION OF THE RADIATION OF SOUND FROM AN UNFLANGED DUCT AND A BELLMOUTH, INCLUDING THE FLOW EFFECT
Jean-Michel Ville (George Washington Univ.) and Richard J. Silcox Aug. 1980 65 p refs
(NASA-TP-1697; L-13252) Avail: NTIS HC A04/MF A01 CSCL 20A

The radiation of sound from an inlet as a function of flow velocity, frequency, duct mode structure, and inlet geometry was examined by using a spinning mode synthesizer to insure a given space-time structure inside the duct. Measurements of the radiation pattern (amplitude and phase) and of the pressure reflection coefficient were obtained over an azimuthal wave number range of 0 to 6 and a frequency range up to 5000 Hz for an unflanged duct and a bellmouth. The measured radiated field and pressure reflection coefficient without flow for the unflanged duct agree reasonably well with theory. The influence of the inlet contour appears to be very drastic near the cut-on frequency of a mode and reasonable agreement is found between the bellmouth pressure reflection coefficient and a infinite hyperboloidal inlet theory. It is also shown that the flow has a weak effect on the amplitude of the directivity factor but significantly shifts the directivity factor phase. The influence of the flow on the modulus of the pressure reflection coefficient is found to be well described by a theoretical prediction. M.G.

N80-32189# Utah Univ., Salt Lake City. Dept. of Mathematics.
SPECTRAL ANALYSIS OF SOUND PROPAGATION IN STRATIFIED FLUIDS Technical Summary Report
Calvin H. Wilcox Apr. 1980 154 p refs
(Contract N00014-76-C-0276; NR Proj. 041-370)
(AD-A087735; TSR-38) Avail: NTIS HC A08/MF A01 CSCL 20/1

This paper presents a spectral analysis of the acoustic fields in stationary plane stratified fluids whose densities and sound speeds are functions of the depth. The analysis is based on families of normal mode fields that have simple physical interpretations. The acoustic field in such a fluid may be described by an acoustic potential or by the excess pressure. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-32190*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATOMIC EMISSION LINES IN THE NEAR ULTRAVIOLET; HYDROGEN THROUGH KRYPTON, SECTION 1
Raymond L. Kelly Apr. 1979 403 p
(NASA-TM-80268-Sect-1) Avail: NTIS HC A08/MF A01 CSCL 20H

A compilation of spectra from the first 36 elements was prepared from published literature available through October 1977. In most cases, only those lines which were actually observed in emission or absorption are listed. The wavelengths included range from 2000 Angstroms to 3200 Angstroms with some additional lines up to 3500 Angstroms. Only lines of stripped atoms are reported; no molecular bands are included. L.F.M.

N80-32191*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATOMIC EMISSION LINES IN THE NEAR ULTRAVIOLET; HYDROGEN THROUGH KRYPTON, SECTION 2
Raymond L. Kelly Apr. 1979 384 p
(NASA-TM-80268-Sect-2) Avail: NTIS HC A17/MF A01 CSCL 20H

A compilation of spectra from the first 36 elements was prepared from published literature available through October 1977. In most cases, only those lines which were actually observed in emission or absorption are listed. The wavelengths included range from 2000 Angstroms to 3200 Angstroms with some additional lines up to 3500 Angstroms. Only lines of stripped atoms are reported; no molecular bands are included. L.F.M.

N80-32192# IRT Corp., San Diego, Calif.
INVESTIGATION OF ELECTRON ATTACHMENT IN POLYATOMIC MOLECULES Final Report, 1 Apr. 1977 - 31 Mar. 1980
Jerry T. Dowell 30 May 1980 62 p refs
(Contract F49620-77-C-0071; AF Proj. 2303)
(AD-A087278; IRT-8164-004; AFOSR-80-0549TR) Avail: NTIS HC A04/MF A01 CSCL 20/7

Electron attachment to polyatomic molecules was studied using molecular beams of variable temperature crossed with an electron of high energy resolution. Species investigated include sulfur hexafluoride, molybdenum hexafluoride, and tungsten oxide polymers. New results were obtained in sulfur hexafluoride demonstrating importance of internal energy for the dissociative attachment in molybdenum hexafluoride. Tungsten oxide vapor exhibits both monomer and dimer negative ion formation near zero energy, apparently from dissociative attachment to the trimer. GRA

N80-32193# Stanford Univ., Calif. Edward L. Ginzton Lab.
RESEARCH STUDIES ON RADIATIVE COLLISIONAL PROCESSES Interim Technical Report
S. E. Harris and J. F. Young Jun. 1980 36 p
(Contract F49620-80-C-0023)
(AD-A087527; SU-GL-3147; ARO-16996.1-P) Avail: NTIS HC A03/MF A01 CSCL 20/8

A radiative collisional process is one wherein two atoms and a photon simultaneously participate. In the prototype reaction, energy is first stored in a state of some atom and an incident laser is tuned so as to satisfy the energy defect between this storage state and a selected state of a second atom. In the presence of this incident laser beam, the collision cross section may be as large as 10 to the minus 12th sq cm (i.e., corresponding to billiard ball sizes of the atoms of almost 100 A), thereby allowing rapid transfer of energy to the target species. Of particular interest, the storage species may not only be an excited state of an atom, but instead may also be the ground state of an ion. An intense laser field may then be used to rapidly transfer this energy to an excited ionic state of a second species. Such a process is termed as laser induced charge transfer. Since ground state ions are easily created and represent a means of longlived energy storage, laser induced charge transfer processes are particularly exciting for applications. GRA

N80-32194# New York Univ., N. Y. Dept. of Physics.
ENERGY-RELATED ATOMIC AND MOLECULAR STRUCTURE AND SCATTERING STUDIES Annual Progress Report, 1 Jul. 1979 - 30 Jun. 1980
Benjamin Bederson Mar. 1980 39 p refs
(Contract ER-78-S-02-4971)
(DOE/ER-04971/2) Avail: NTIS HC A03/MF A01

Measurements of polarizabilities of highly polar molecules and dimers, and of a number of atoms distributed through the periodic table, and, of the scattering of low energy electrons by highly polar molecules were made. For this latter series of measurements, an entirely new apparatus was designed and its external components were completed. A new electron optics assembly was also designed. Details of these projects are presented; analysis and data of the polarizability measurements are also given. DOE

N80-32195# Oregon Univ., Eugene. Inst. of Theoretical Science.
ATOMIC SCALE RESOLUTION WITH CORRELATION HOLOGRAPHY
Paul L. Csonka 1979 8 p
(Contract EY-76-S-06-2230)
(DOE/ER-70004/260) Avail: NTIS HC A02/MF A01

Observation of small objects was made. Observations were compatible with the principles of quantum mechanics, even when the probability of disturbing the object as a result of observation was arbitrarily small. DOE

N80-32196# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

MEASUREMENTS OF ELECTRONIC STIMULATION OF ATOMS IN COLLISIONS WITH ATOMS AND MOLECULES NEAR THE THRESHOLD [MESSUNG DER ELEKTRONISCHEN ANREGUNG VON ATOMEN IN STOSS MIT ATOMEN UND MOLEKUELEN IN SCHWELLENNAEHE]
Detlev Pust Jun. 1979 82 p refs In GERMAN
(MPIS-14/1979) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Karlsruhe, West Germany DM 15,30

The seeded beam experiment is described. The stimulation of Xe in collisions with Xe is measured. The experimental results confirm the theoretical calculation. Author (ESA)

N80-32197# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
CRITERIA FOR DATA ELABORATION OF GAMMA SPECTRA OF AMBIENT SAMPLES [CRITERI DI ELABORAZIONE DI SPETTRI GAMMA DI CAMPIONI AMBIENTALI]
A. L. Traversi Nov. 1979 10 p refs In ITALIAN Presented at 21st AIPR Congr., Palermo, Italy, 16-19 Oct. 1979
(CISE-1536) Avail: NTIS HC A02/MF A01

An analysis of low frequency count gamma spectra data processing, from ambient samples measured with Ge(Li) detectors is presented. Some concepts are examined, such as peak significance and minimum detectable count for a given background. Solutions are suggested for the determination of the peak area, for the computation of the confidence interval and for transformation of counts in concentration (pCi/kg). A model is proposed for the evaluation of the efficiency curve as a function of the energy based on polynomial regression techniques. Author (ESA)

N80-32198# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
FIELD GAMMA SPECTROMETRY SYSTEM WITH Ge(Li) DETECTORS [SISTEMA PER SPETTROMETRIA GAMMA IN CAMPO CON RIVELATORE A Ge(Li)]
N. DePasquale and R. Dugnani Lonati Nov. 1979 10 p refs In ITALIAN Presented at 21st AIPR Congr., Palermo, Italy, 16-19 Oct. 1979
(CISE-1537) Avail: NTIS HC A02/MF A01

The design and means of adjustment of a field gamma spectrometry system is described. The system uses position adjustable Ge(Li) detectors and a portable ionization camera. The detector resolution is high enough to discriminate the relative contribution to the total dose measured by the camera of several sources such as artificial radioactive nuclei, the gamma emmiters produced by natural series decay, and potassium 40. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-32199# Naval Research Lab., Washington, D. C.
COLLECTIVE ACCELERATION OF ELECTRONS USING AUTOACCELERATION PROCESSES
Thomas R. Lockner and Mashe Friedman Jul. 1980 32 p refs
(ARPA Order 3718)
(AD-A087001; AD-E000494; NRL-MR-4258) Avail: NTIS HC A03/MF A01 CSCL 20/7

A means of collectively accelerating an intense electron beam is demonstrated. A long pulse (800 ns) electron beam is propagated through cavity structures which redistributed the energy in the beam such that most of the beam energy is transferred to a short segment (6 nsec) in the tail of the bram; electrons are accelerated in a two cavity system from 200 KeV to energies of 2.4 - 3.0 MeV at a beam current of approximately 8 kA. The extension of this principle to larger number of cavities appears feasible. GRA

N80-32200# Battelle Pacific Northwest Labs., Richland, Wash.
CRITICALITY SAFETY CONSIDERATIONS IN THE GEOLOGIC DISPOSAL OF SPENT NUCLEAR FUEL ASSEMBLIES
B. F. Gore, G. W. McNair, and S. W. Heaberlin May 1980 53 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3268) Avail: NTIS HC A04/MF A01

Features of geologic disposal which hamper the demonstration that criticality cannot occur therein include possible changes of shape and form, intrusion of water as a neutron moderator, and selective leaching of spent fuel constituents. If the criticality safety of spent fuels disposal depends on burnup, independent measurements verifying the burnup should be performed prior to disposal. The status of nondestructive analysis method which might provide such verification is discussed. Calculations were performed to assess the potential for increasing the allowed size of a spent fuel disposal canister if potential water intrusion were limited by close packing the enclosed rods. Several factors were identified which severely limited the potential of this application. The theoretical limit of hexagonal close packing cannot be achieved due to fuel rod bowing. It is concluded the disposal canisters should be sized on the basis of assumed optimum moderation. DOE

N80-32201# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
SMALL-SCALE DEMONSTRATION OF HIGH-LEVEL RADIOACTIVE WASTE PROCESSING AND SOLIDIFICATION USING ACTUAL SRP WASTE
J. K. Okeson, R. M. Galloway, E. L. Wilhite, G. B. Woolsey, and R. B. Ferguson 1980 33 p refs Presented at the AIChE 89th Natl. Meeting, Portland, Oreg., 17-20 Aug. 1980
(Contract DE-AC09-76SR-00001)
(DP-MS-80-2; CONF-800802-2) Avail: NTIS HC A03/MF A01

A small scale demonstration of the high-level radioactive waste solidification process by vitrification in borosilicate glass was conducted using 5-6 liter batches of actual waste. Equipment performance and processing characteristics of the various unit operations in the process are reported and, where appropriate, are compared to large-scale results obtained with synthetic waste. DOE

N80-32202# Atomics International Div., Richland, Wash. Engineered Barriers Group.
FUNCTIONS OF AN ENGINEERED BARRIER SYSTEM FOR A NUCLEAR WASTE REPOSITORY IN BASALT
W. E. Coons, E. L. Moore, M. J. Smith, and J. D. Kaser Jan. 1980 35 p refs
(Contract DE-AC06-77RL-01030)
(RHO-BWI-LD-23) Avail: NTIS HC A03/MF A01

The functions of components selected for an engineered barrier system for a nuclear waste repository in basalt are defined providing a focal point for barrier material research and development by delineating the purpose and operative lifetime of each component of the engineered system. A five component system (comprised of waste form, canister, buffer, overpack, and tailored backfill) is discussed. Redundancy is provided by subsystems of physical and chemical barriers which act in concert with the geology to provide a formidable barrier to transport of hazardous materials to the biosphere. The barrier system is clarified by examples pertinent to storage in basalt, and a technical approach to barrier design and material selection is proposed. DOE

N80-32203# Union Carbide Corp., Oak Ridge, Tenn.
ASSUMPTIONS AND GROUND RULES USED IN NUCLEAR WASTE PROJECTIONS AND SOURCE TERM DATA
S. N. Storch and B. E. Prince Sep. 1979 137 p
(Contracts W-7405-eng-26; DE-AC06-76PL-01830)
(ONWI-24) Avail: NTIS HC A07/MF A01

Assumptions and ground rules of long term domestic commercial nuclear waste projections published by two sources are compared. Target capacity growths associated with these projections range from 183 to 570 GW(e) for the year 2000. Each study regards the once through (no recycle) fuel cycle as a reference case. Fuel cycles employing reprocessing and various recycle strategies were also considered. The studies are compared with respect to characteristics and packaging/shipment features of spent fuel and wastes generated from reprocessing and other fuel cycle activities. Issues associated with the interim storage

of spent fuel are discussed along with the characteristics and issues relating to ore mill tailings and non-fuel cycle wastes. Assumptions and limitations associated with certain computer codes (viz., ORIGEN, KWIKPLAN, WASPR, and DISFUL) employed in the four waste projection studies are also outlined. DOE

N80-32204# Geological Survey, Denver, Colo.
RESISTIVITY SOUNDING INVESTIGATION BY THE SCHUMBERGER METHOD IN THE SYNCLINE RIDGE AREA, NEVADA TEST SITE, NEVADA
L. A. Anderson, R. J. Bisdorf, and D. R. Schoenthaler 1980 67 p refs
(Contract EW-78-A-08-1543)
(USGS-OFR-80-466) Avail: NTIS HC A04/MF A01

A resistivity survey was made in the north central sector of the Nevada Test Site as part of an extensive search for suitable geologic environments to be used as repositories for radioactive waste products. The surficial geology, mapped and inferred faults, resistivity sounding sites, borehole emplacements, and alinements of resistivity cross sections compiled from the interpreted sounding data are included. DOE

N80-32205# Rockwell International Corp., Richland, Wash. Hanford Operations.
TECHNICAL PROGRAM PLAN, BASALT WASTE ISOLATION PROJECT
Dec. 1979 128 p
(Contract DE-AC06-77RL-01030)
(RHO-CD-132-Rev-5) Avail: NTIS HC A07/MF A01

The Basalt Waste Isolation Project program objectives, scope and scientific technologies are discussed. The work breakdown structure of the project includes: project management and support, systems integration, geosciences, hydrology, engineered barriers, test facility design and construction, engineering testing, repository studies, and schedules. Author (DOE)

N80-32206# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
SYSTEMATIC APPROACH FOR ASSESSMENT OF ALTERNATIVE NUCLEAR WASTE MANAGEMENT STRATEGIES
Gour-Tsyh Yeh 1979 8 p refs Presented at the Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 26 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791112-66) Avail: NTIS HC A02/MF A01

The fate and transport of radwaste in the environment and to man was evaluated using system of flow dynamic and waste transport models for the physical environment, transfer models to biota, and dose models to man. Flow dynamic and waste transport models are included for computing spatial temporal variations of the flow field and radwaste concentration in subsurface aquifers, surface water regimes, estuaries/oceans, and the atmosphere. Transfer models are linked to flow dynamic and waste transport models to study the uptake from and to the physical environment of the waste by aquatic and terrestrial biota. Dose models are used to compute both the radwaste input to man and its effect on man. With these series of computations, the radiation dose from alternative nuclear waste management strategies can be computed. Coupled with the exposure and effect analysis, the approach should facilitate the selection of the best management methodologies among many alternatives. DOE

N80-32207# Oak Ridge National Lab., Tenn.
STATISTICAL SENSITIVITY ANALYSIS OF A SIMPLE NUCLEAR WASTE REPOSITORY MODEL
Y. Ronen, J. L. Lucius, and E. M. Blow Jun. 1980 75 p
(Contract W-7405-eng-26)
(ORNL/TM-7310) Avail: NTIS HC A04/MF A01

A preliminary step in a comprehensive sensitivity analysis of the modeling of a nuclear waste repository. The purpose of the complete analysis is to determine which modeling parameters and physical data are most important in determining key design performance criteria and then to obtain the uncertainty in the design for safety considerations. The theory for a statistical screening design methodology is developed for later use in the overall program. The theory was applied to the test case of determining the relative importance of the sensitivity of near field temperature distribution in a single level salt repository to modeling parameters. The exact values of the sensitivities to these physical and modeling parameters were then obtained using direct methods of recalculation. The sensitivity coefficients found to be important for the sample problem were thermal loading, distance between the spent fuel canisters and their radius. Other important parameters were those related to salt properties at a point of interest in the repository. DOE

74 OPTICS

Includes light phenomena.

N80-32208*# Visidyne, Inc., Burlington, Mass.
PINHOLE X-RAY/CORONAGRAPH OPTICAL SYSTEMS CONCEPT DEFINITION STUDY Final Report
T. F. Zehnpfenning, S. A. Rappaport, and R. B. Wattson 12 Sep. 1980 81 p
(Contract NAS8-33697)
(NASA-CR-161567; VI-556) Avail: NTIS HC A05/MF A01 CSCL 20F

The Pinhole X-ray/Coronagraph Concept utilizes the long baselines possible in Earth orbit with the space transportation system (shuttle) to produce observations of solar X-ray emission features at extremely high spatial resolution (up to 0.1 arc second) and high energy (up to 100 keV), and also white light and UV observations of the inner and outer corona at high spatial and/or spectral resolution. An examination of various aspects of a preliminary version of the X-ray Pinhole/Coronagraph Concept is presented. For this preliminary version, the instrument package will be carried in the shuttle bay on a mounting platform and will be connected to the occulter with a deployable boom such as an Astromast. Generally, the spatial resolution, stray light levels, and minimum limb observing angles improve as the boom length increases. However, the associated engineering problems also become more serious with greater boom lengths. T.M

N80-32209# Electronics Research Lab., Adelaide (Australia).
APPLICATION OF INTERFRAME FILTERING TO LINE SCANNED INFRARED IMAGING SYSTEMS
G. V. Poropat Nov. 1979 22 p refs
(AD-A086971; ERL-0112-TM; AR-001-827) Avail: NTIS HC A02/MF A01 CSCL 17/5

The use of frame storage in an imaging system to implement interframe filtering is analyzed and its effects on image signal to noise ratio determined. Simulation of interframe processing on imagery obtained using an AGA Thermovision is described. The application of interframe filtering to real time imaging systems is examined. GRA

N80-32210# Harry Diamond Labs., Adelphi, Md.
A VERSATILE FIBER-OPTICS SIGNAL LINK FOR EMP TESTING AND GENERAL LABORATORY APPLICATIONS Technical Memorandum, Jul. 1977 - Jul. 1978
James C. Blackburn and Robert Martin Jun. 1980 26 p refs
(AD-A087253; HDL-TM-80-5) Avail: NTIS HC A03/MF A01 CSCL 20/6

A fiber-optic analog signal link is described that was designed specifically to be used for EMP measurements. The link accepts electrical inputs in the range from millivolts to volts and converts them to optical signals which are then transmitted by optical fibers to a remote receiver. The unit is unaffected by electric fields up to hundreds of kilovolts/meter, and a bandwidth of about 130 MHz is provided; the unit has a dynamic range of approximately 30 dB. This dynamic range is extended an additional 45 dB by an internal attenuator which is commanded (by an optical fiber link) to insert a fixed attenuation in the range of 0 to 45 dB between the input connecter and transmitter. A self-calibrator is also commanded by the same link. An unusual circuit feature is the use of a single electro-optic device to perform both light-emitting diode and detector functions. GRA

N80-32211# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
SENSITIVE MEASUREMENT OF PHOTON LIFETIME AND TRUE REFLECTANCES IN AN OPTICAL CAVITY BY A

PHASE SHIFT METHOD
J. M. Herbelin, J. A. McKay, M. A. Kwok, R. H. Ueunten, and D. S. Urevig 10 Jul. 1980 23 p refs
(Contract F04701-79-C-0080)
(AD-A087248; TR-0080-5610-2; SDTR-80-48) Avail: NTIS HC A02/MF A01 CSCL 20/6

A simplified method for measuring the effective photon lifetime in an optical resonator was developed. The technique requires the passage of a modulated continuous wave laser beam through the resonator and the measurement of the resultant shift in the phase of the transmitted intensity. The method not only permits a quick and precise measurement of the mirror reflectances, but also permits these measurements to be in situ. Such an 'on the spot' evaluation capability should be extremely useful in applications ranging from the investigation of new laser systems to the development of improved optical coatings. The method is also sensitive to the effects of absorption, scattering, and transmission from elements in the cavity. Cavity losses smaller than 100 ppm were detected. GRA

N80-32212# Naval Research Lab., Washington, D. C. Optical Sciences Div.
TRANSMITTANCE MEASUREMENTS AT DIRT-II Final Report
Joseph A. Curcio, Kenneth M. Haught, and Michael A. Woytko 10 Jul. 1980 53 p ref
(AD-A087003; AD-E000484; NRL-MR-4260) Avail: NTIS HC A04/MF A01 CSCL 20/6

This is a report on the NRL experiments at the DIRT-II tests sponsored by the Atmospheric Sciences Laboratory at the White Sands Missile Range in July 1970. The NRL experiment was designed to measure spectral transmittance through smoke and dust clouds generated by detonations of various explosive charges and also by impact of artillery rounds. Spectral transmission data as a function of time for 0.55 micrometers, 1.06 micrometers, and 10.37 micrometers were obtained for 63 events comprised of static detonations and artillery rounds. Transmission data for 1.06 micrometers, in most cases were similar and equal to 0.55 micrometers. In dry soil conditions the 10.37 micrometers channel showed higher transmittance values than the visible channel. There are indications that 10.37 micrometers transmittance in wet soil events is lower than visible presumably because of strong liquid water absorption at the IR wavelength. GRA

N80-32213# University of Southern California, Los Angeles.
RAMAN-INDUCED KERR EFFECT STUDIES Final Report, 15 Jul. 1976 - 14 Jul. 1979
Robert W. Hellwarth 10 Jun. 1980 14 p refs
(Grant DAAG29-76-G-0295; DA Proj. 1T1-61102-BH-57)
(AD-A087410; ARO-14188.1-P) Avail: NTIS HC A02/MF A01 CSCL 20/6

The Raman-Induced Kerr Effect, developed at U.S.C. is a new form of laser spectroscopy which is beginning to find wide application as a remote diagnostic sensor of fast (picosecond to nanosecond) transient shocks, explosions, and plasma arcs. GRA

N80-32214# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
ON THE FEASIBILITY OF USING FLIR (FORWARD LOOKING INFRARED) DATA FOR CROSSWIND MEASUREMENTS
G. R. Ochs, S. F. Clifford, and Ting-i Wang White Sands Missile Range, N. Mex. Atmospheric Sciences Lab. Jun. 1980 46 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A087738; ERADCOM/ASL-CR-80-8003-1) Avail: NTIS HC A03/MF A01 CSCL 17/5

The feasibility was theoretically examined and experimentally tested for extracting crosswind information from a forward looking infrared thermal sight system (FLIR). A general solution to the problem of obtaining crosswind information from the observation of focal plane image fluctuations is obtained. Wind weighting functions are obtained for receiving apertures and detector sizes of interest for the particular case of viewing the horizon. Experimental results are presented from measurements at visible wavelengths using stationary detectors placed in the focal plane, and also from the recorded video signals obtained directly from the FLIR. These results show that under controlled conditions with a suitable scene and C sub n to the 2nd power level it is possible to obtain crosswind information from the FLIR system. GRA

N80-32215# Harry Diamond Labs., Adelphi, Md.
THE LSR/2 OPTICALLY COUPLED SIGNAL TRANSMISSION LINK Technical Memorandum, Jul. 1978 - Mar. 1979
James C. Blackburn Dec. 1979 25 p refs
(AD-A087552; HDL-TM-79-24) Avail: NTIS HC A02/MF A01 CSCL 17/2

The design is presented for a fiber optic transmission system intended for carrying analog instrumentation signals over a 1 km length of single fiber. The bandwidth (+ or - 3 dB) is 5 kHz to 220 MHz with a dynamic range of approx. 35 dB. Special attention is given to minimizing the modal noise produced by the single mode laser source. GRA

N80-32216# General Electric Co., Utica, N. Y. Aerospace Electronic Systems Dept.
COMMON APERTURE TECHNIQUES FOR IMAGING ELECTRO-OPTICAL SENSORS Final Report, Jul. 1978 - Nov. 1979
Wright-Patterson AFB, Ohio Air Force Wright Aeronautical Labs. Feb. 1980 305 p
(Contract F33615-76-C-1135; AF Proj. 2004)
(AD-A087558; Rept-79-556-C0-10; AFWAL-TR-80-1012) Avail: NTIS HC A14/MF A01 CSCL 20/6

A multispectral optical imaging system was designed and fabricated to demonstrate the feasibility of utilizing a pointable common optical aperture in conjunction with interchangeable day or night TV sensors and a thermal imaging sensor. Limited processing capability was incorporated to permit mixing of both visible and infrared video of common scenes for more effective all weather electrooptical capability. An optical configuration was established which will accommodate image sensors as well as illuminating and designating/ranging lasers. In the early phases of the program various techniques were evaluated for optimizing spectral separation, gating image intensifiers and minimizing degradation of sensor performance due to insertion of .723 and 1.06 micron laser radiation through the common aperture. Preliminary testing indicates that combining sensors achieves synergistic performance in targeting and identification. Edited monthly R D Status Reports detail the design, fabrication and integration aspects of the program. GRA

N80-32217# ITT Electro-Optical Products Div., Roanoke, Va.
ULTRA LOW OPTICAL FIBER CABLE ASSEMBLIES Semiannual Report, 1 Dec. 1978 - 31 Jul. 1979
J. C. Smith, R. Kopstein, and X. G. Glavas Fort Monmouth, N.J. Army Communication Research and Development Command May 1980 97 p
(Contract DAAB07-78-C-2922)
(AD-A087517; CORADCOM-78-2922-2) Avail: NTIS HC A05/MF A01 CSCL 20/6

Progress toward development of ruggedized ultra low loss 8.0 D B/KM optical fiber cable assemblies consisting of six optical fibers is reported. Effort involves investigations of fiber, cabling, and connector development on an individual as well as combined basis for meeting requirements of tactical TDM communication systems. During this reporting period, extensive testing and evaluation of three six fiber cables was performed in accordance with technical guidelines. Pertinent test results are summarized herein. Complete test data is reported elsewhere. Program areas requiring additional investigation are described. Development status of two types of connectors is discussed and preliminary test data presented. Difficulties incurred with fiber connector interface are identified. GRA

N80-32218# RCA Labs., Princeton, N. J. Energy Systems Research Lab.
LAMINATED FRESNEL LENSES
Robert W. Jebens Apr. 1980 27 p
(Contract DE-AC04-76DP-00789)
(SAND-80-7007) Avail: NTIS HC A03/MF A01

A fabrication method for making plastic on glass laminated Fresnel lenses is discussed. These Fresnel lenses are for application in a solar photovoltaic concentrator array. This laminated Fresnel lens fabrication method consists of making a silastic rubber mold

of a master lens array. Cast acrylic Fresnel lens arrays commercially available have potential cleaning and abrasion problems, have very large thermal expansion, and have dimensional uncertainties in their manufacture. The laminated lens is dimensionally stable with low thermal expansion, has good cleaning characteristics, and is very inexpensive in materials cost. The measured transmission of such a lens on low iron glass is 80.4 percent compared with 85.1 percent for a cast acrylic lens, and the optical quality is good enough for application in the 100X to 200X concentration range. An approach to making large lens arrays (3 by 6 ft) on a commercial scale is explored. DOE

N80-32219# Fondazione Ugo Bordoni, Rome (Italy).
MEASUREMENT OF THE INDEX PROFILE OF OPTICAL FIBERS BY THE REFRACTION METHOD [LA MISURA DEL PROFILO D'INDICE DI FIBRE OTTICHE CON IL METODO DI RIFRAZIONE]
Ludovico Muzii Jul. 1979 24 p refs In ITALIAN
(FUB-13-1979) Avail: NTIS HC A02/MF A01

A device to measure the functional characteristics of optical fibers by the refracted near field method is described. The basic theory is reviewed and experimental results presented. The optical system using a 6300 A laser source and the measuring procedure are detailed. Errors are + or - 1 micron for the diameter, + or - 0.005 for the aperture, and + or - 0.1 for the alpha exponent. The effect of anomalous profiles on the measured results are discussed. Author (ESA)

N80-32220# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
LASER DOPPLER VELOCIMETRY: PRINCIPLES, POTENTIAL AND EXAMPLES OF POSSIBLE APPLICATIONS
M. L. Riethmuller Feb. 1979 9 p refs Presented at Neth. Soc. for Photonics Conf. on Properties and Appl. of Laser Radiation II, Delft, 18-20 Apr. 1979 Submitted for publication
(VKI-PREPRINT-1979-6) Avail: NTIS HC A02/MF A01

The working principles and applications examples of the laser Doppler velocimeter are presented. Advanced systems permitting multidimensional simultaneous measurement are mentioned. The examples presented include supersonic flow measurements, free surface velocity measurement in rheological flows, and velocity profile measurements inside the gelatin layer of a photosensitive film. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-32221 Cornell Univ., Ithaca, N. Y.
AN EXPERIMENTAL INVESTIGATION OF THE TRAPPING AND ENERGY LOSS MECHANISMS OF INTENSE RELATIVISTIC ELECTRON RINGS IN HYDROGEN GAS AND PLASMA Ph.D. Thesis
Adrain Charles Smith, Jr. 1977 677 p
Avail: Univ. Microfilms Order No. 8020918

Gas trapping, average ring electron energetic, plasma trapping, and hollow beam cusp injection into gas and plasma were investigated using the Cornell RECE-Berta facility. Data from an axial array of magnetic probes were compared with findings from a high energy electron current monitor to show that the trapping proceeds as a relaxation process in which an initially uniform, circulating sheath of current collapses axially in 300-500 ns to form a steady state ring. Multifoil X-ray absorption spectroscopy was used to analyze the Bremsstrahlung generated by the electrons as they impinge upon a thin tungsten wire target suspended in the circulating current. Results show that the particle energy loss rates were constant functions of time and that, typically, net energy losses of about 10 percent of the initial ring energy (500 keV) were sustained by the electrons during their residence in the mirror trap. The results of electron ring trapping and confinement in neutral gas were extended to studying these processes in a presonized plasma. A set of preliminary experimental results are presented in which an annular electron beam was passed through a coaxial, non adiabatic magnetic cusp located at one end of the magnetic mirror well. Dissert. Abstr.

N80-32222 Lehigh Univ., Bethlehem, Pa.
STARK PROFILE MEASUREMENT OF Cu REVERSAL LINES IN A DENSE PLASMA Ph.D. Thesis
Peter Scott Sincerny 1980 135 p
Avail: Univ. Microfilms Order No. 8019727

A dense plasma was produced between two copper electrodes by ionizing high pressure (850 atm) hydrogen gas with a short electrical discharge pulse. A full set of diagnostic experiment was performed to quantitatively measure the plasma evolution. The profiles of two self reversal copper resonance lines were measured as a function of the ambient hydrogen gas pressure. These lines appear at 3247 A and 3274 A. The full half width of the two lines is found to range from 52 A to 67 A. Two computer simulation codes were developed to provide quantitative details of the plasma source. The electron density responsible for the broadening of the spectral lines was determined by analyzing the results of the numerical simulations. The region of the plasma controlling the observed line profile was identified by successfully reproducing the observed line profiles on the basis of the simulation results and with an assumed line shape. The usefulness of the observed reversal line profiles for comparison with Stark theory is limited due to the superposition of the copper lines at the high electron density, thus making individual analysis difficult. Dissert. Abstr.

N80-32223*# Colorado State Univ., Fort Collins. Dept. of Physics.
INTERACTION OF HIGH VOLTAGE SURFACES WITH THE SPACE PLASMA Annual Report
Harold R. Kaufman and Raymond S. Robinson May 1980 50 p refs
(Grant NsG-3196)
(NASA-CR-165131) Avail: NTIS HC A03/MF A01 CSCL 20I

High voltage solar arrays provide spacecraft power while optimizing mass and power efficiency. Operating such arrays in the space plasma environment can result in anomalously large currents being collected through insulation defects. Two thicknesses of the insulating material were tested, with no effect found due to insulator thickness. In these tests the polyimide thickness was always much less than the pinhole diameter. The pinhole area was varied over an area range of more than 30:1. It was found that the current collected was independent of the pinhole area for hole diameters from 0.35 to 2.0 mm. Two types of adhesives were tried in two different configurations. The adhesives were chosen for their extreme difference in vacuum qualifications. Neither adhesive types nor configuration made a significant difference in current collection. The temperature of the insulating material was also varied. It was found that current collection decreased with increasing temperature. Tests were conducted to see if pinhole current collection decreased with time, as was indicated by the effects of several short tests. Current was collected for over four hours while the conductor potential was held constant at 1000 volts. A smooth decrease with time was not observed, but rather a roughly constant current collection with brief surges to high values. Tests were also conducted with the simulated solar cell biased negative. The current was found to be proportional to pinhole area. R.K.G.

N80-32224# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A MEASUREMENT OF DEUTERIUM NEUTRAL BY THE BALMER-SERIES IN THE STP-2 HIGH BETA SCREW PINCH TOKAMAK
S. Yamaguchi and K. Hirano Jun. 1980 23 p refs
(IPPJ-471) Avail: NTIS HC A02/MF A01

The Balmer-alpha and beta are measured with a calibrated spectrograph in STP-2 screw pinch Tokamak operated under the maximum toroidal field being 9.2 kg, peak plasma current 30 kA and filling pressure 5 mtorr. The electron temperature and density profiles are obtained by ruby laser Thomson scattering. It is shown that electron temperature is about 10 eV and density is of the order 10 to the 14th power cu cm. A non-cylindrical symmetric Abel-inversion technique was used to deduce the emission coefficient profiles from that of the line intensity of the Balmer's. The collisional radiative model is applied to the

rate equations to estimate the ground state population density. It is found that at 4 micron sec from the start of the discharge the deuterium neutral density may be approximately 2 x10 to the 12th power cu cm at the center of plasma and 2 x 10 to the 14th power cu cm at the periphery. These values may contain an error of about factor two. Time history of neutral deuterium density is consistent with the increase of plasma density. A.R.H.

N80-32225# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PRELIMINARY EXPERIMENT OF NEUTRAL BEAM INJECTION HEATING IN JIPP T-2 STELLARATOR
O. Kaneko, Y. Oka, H. Okamura, T. Kunibe, and T. Kuroda Jun. 1980 25 p refs
(IPPJ-470) Avail: NTIS HC A02/MF A01

Neutral beam injection experiments are carried out in JIPP T-2, which is a hybrid device of stellarator and Tokamak. Two neutral beam injectors are equipped tangentially in the direction of co- and counter-injections. Hydrogen neutral beams of 22 Kev, 60 KW (co-injection) and 30 KW (counter-injection) are applied to the ohmically heated stellarator plasma and also to the Tokamak plasma. The bulk ion heating efficiency for co-injection is around 1.6 eV/KW in the case of stellarator and 1.9 eV/kW in the case of Tokamak, while the heating efficiencies for counter-injection are about 1.6eV/kW in both cases. The difference between the Tokamak and stellarator is considered to be caused by the enhanced orbit loss due to the helical ripples in the stellarator. Author

N80-32226# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
TESTS OF A LIGHTWEIGHT 200 kW MHD CHANNEL AND DIFFUSER Final Report, Mar. 1977 - Dec. 1978
James F. Holt and Jerome Pearson Mar. 1980 175 p refs
(AF Proj. 3145)
(AD-A087022; AFWAL-TR-80-2021) Avail: NTIS HC A08/MF A01 CSCL 10/2

A 200 kW lightweight MHD generator channel and diffuser were tested over a regime of 235 individual firings of the open cycle combustor systems. The diagonal conducting wall channel delivered full rated power with no interelectrode breakdown. Vibration measurements indicated no fatigue of the channel structure. GRA

N80-32227# Maryland Univ., College Park. Dept. of Physics and Astronomy.
ELECTROMAGNETIC OSCILLATING TWO STREAM INSTABILITY OF PLASMA WAVES
C. S. Liu and V. K. Tripathi May 1980 18 p refs
(Contracts N00014-77-C-0590; DE-A505-77DP-40032)
(AD-A087732; PUB-80-178; TR-80-101) Avail: NTIS HC A02/MF A01 CSCL 20/9

Oscillating two stream instability, in which a plasma wave decays into a zero frequency electrostatic mode and two Langmuir wave sidebands has been known for some time and shown to be an important nonlinear process leading to soliton formation, plasma collapse, etc. In this paper we have investigated the electromagnetic oscillating two stream instability of electrostatic and electromagnetic plasma waves of finite wave number by which a pump wave decays into a purely growing electromagnetic mode and two sidebands, viz., Langmuir waves of shorter wavelengths. In the case of an electromagnetic pump, i.e., a laser radiation, we have studied this instability including the effect of plasma inhomogeneity and shown its importance as a source of self-generated magnetic fields in laser fusion experiments. GRA

N80-32228# Naval Surface Weapons Center, White Oak, Md.
PLASMA INSTABILITY IN ELECTRON AND POSITRON COLLIDING BEAMS IN STORAGE RING
Han S. Uhm and Chuan S. Liu (Maryland Univ., College Park) Apr. 1980 31 p refs Submitted for publication
(Contract N00014-77-C-0590)
(AD-A087733; PUB-80-180; TR-80-103; PL-80-040) Avail: NTIS HC A03/MF A01 CSCL 20/7

The filamentation instability of the electron and positron colliding beams in a storage ring are investigated within the framework of the rigid beam model and the Vlasov-Maxwell equations, and closed algebraic dispersion relations for the complex eigenfrequency omega are obtained. It is shown that the typical growth rate of instability is a substantial fraction of the electron plasma frequency omega(pe), thereby severely limiting the electron density in storage ring. Moreover, the influence of collective self-field effects on the electron and positron colliding beams in the storage ring is investigated. The analysis is carried out, distinguishing the cases, where (a) the particle motions are in a very coherent orbit, and (b) the randomness dominates the operational condition of a storage ring (e.g., the incoherent collision location by small fluctuation, etc.). In either case, it is shown that the self-fields effects play a dominant role in the stability behavior of transverse orbit or the expansion of the beam cross sections. GRA

N80-32229# Maryland Univ., College Park. Dept. of Physics and Astronomy.
IRREVERSIBILITY AND TRANSPORT IN THE LOWER HYBRID DRIFT INSTABILITY
J. F. Drake Mar. 1980 36 p refs
(Contracts N00014-79-C-0665; DE-AC05-79ET-53044)
(AD-A087728; PUB-80-155; TR-80-088) Avail: NTIS HC A03/MF A01 CSCL 20/9

The dynamics of electrons in a low frequency wave propagating perpendicular to a uniform magnetic field are studied and the implications of these results for transport and heating by the lower hybrid drift instability are explored. Below a threshold e phi/T(i) approximately .25-.5, all electron energy and momentum exchange with the wave are reversible and no plasma transport is possible. Above this threshold, trapping of electrons by the wave potentials takes place and causes irreversible electron heating and momentum exchange. These results imply that anomolous transport in inhomogeneous plasma with weak drifts (diamagnetic velocity less than the ion thermal velocity) may be substantially less than previously predicted. GRA

N80-32230# Westinghouse Electric Corp., Philadelphia, Pa. Advanced Energy Systems Div.
MHD ELECTRODE DEVELOPMENT Quarterly Report, Jan. - 31 Mar. 1979
John W. Sadler, Jeff Bein, David L. Black, Laurence H. Cadoff, James A. Dilmore, Alfred G. Eggers, Edsel W. Frantti, Edgar L. Kochka, Jack A. Kuszyk, and S. K. Lau May 1979 186 p refs
(Contract DE-AC01-79ET-15529)
(FE-15529-2) Avail: NTIS HC A09/MF A01

Zirconia based electrode compositions are selected for inclusion in the up coming nonslagging super hot WESTF test 42. Fabrication and processing details for these materials are presented. Test results were used to rank these materials as candidates for use under the slagging hot or nonslagging super hot operating modes. Laboratory screening tests, including electrochemical and anode arc erosion tests, have continued. A comprehensive analytical model was derived which permits detailed analysis of the role of slag properties as well as electrode slag polarization on the nature of electrochemical reactions under hot slagging conditions. Anode arc erosion tests were extended to provide preliminary data on the effect of potassium carbonate/slag versus potassium sulfate/slag mixtures on the arc erosion of copper and platinum clad copper anode samples. The results indicate increased arc damage for the sulfate/slag mixture. DOE

N80-32231# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
MHD HIGH PERFORMANCE DEMONSTRATION EXPERIMENT Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
Jan. 1980 44 p
(Contract ET-78-I-01-2895)
(FE-2895-7) Avail: NTIS HC A03/MF A01

The attainment of MHD performance on a sufficiently large scale to verify that the projected efficiency of the commercial MHD concept is considered. Shakedown testing of the magnet and flow train was completed and operation of the HPDE system in the Faraday power producing mode has continued. A peak power of about 18 MW was produced with a magnetic field of 2.8 T. Significant results which were obtained involved a definition of the transverse voltage characteristics, including the voltage drop near the electrode walls, and a definition of the fluid flow through the channel and diffuser. Several operational problems

were encountered including erosion of heat sink components of the burner and channel entrance and Hall potential shorting at the aft end of the channel and diffuser. Required hardware procurement and modification were initiated by the end of the quarter to solve these problems. DOE

N80-32232# Battelle Pacific Northwest Labs., Richland, Wash.
DEVELOPMENT, CHARACTERIZATION AND EVALUATION OF MATERIALS FOR OPEN CYCLE MHD Quarterly Report, period ending Sep. 1979
J. Lambert Bates and D. D. Marchant Nov. 1979 59 p refs
(Contracts EY-76-C-06-1830; DE-AC06-76RL-01830)
(PNL-2004-12) Avail: NTIS HC A04/MF A01

The development of hafnium rare earth oxides, with demonstrated potential for MHD hot electrode, continues at a high level. Procedures for fabricating high density ceramic compacts with uniform microstructures at temperatures below 1875 K for three compositions were developed. Bars of these materials are being fabricated for testing in the Westinghouse WESTF facility. Yttrium chromites, which have also shown potential for hot electrodes, are being fabricated into test bars by a commercial supplier. These materials are being prepared for testing in ESTF. The required electrical conductivity and thermal conductivity are being measured for these electrode materials. The RFG air preheater refractory, tested in Montana State University's heat exchangers was characterized and evaluated. The potential mechanism for corrosive attack by the molten slag was identified. DOE

N80-32233# General Atomic Co., San Diego, Calif.
CONCEPTUAL DESIGN OF RST: AN rf-DRIVEN, STEADY-STATE TOKAMAK Final Report
R. Prater, D. Bhadra, L. Bikadi, R. Bourque, W. Chen, C. Chu, J. Dalessandro, R. Harvey, M. Henderson, T. Ohino et al Mar. 1980 251 p refs
(EPRI Proj. 323-3)
(EPRI-AP-1351) Avail: NTIS HC A12/MF A01

The preliminary conceptual design of a radio frequency driven, steady state Tokamak (RST), is described. The function of RST was to develop the physics and engineering bases for the development of the Tokamak as a true steady state reactor. The physics of radio frequency current drive, using a variety of electromagnetic waves, is discussed. The device made use of a novel superconducting toroidal magnetic field coil concept, in which the axial current was carried in only three return legs, and superconducting pullback coils were used to reduce the magnetic field ripple. This technique greatly increases access to the plasma. Impurity control by means of edge cooling, bundle divertor, and radio frequency wave momentum sources is discussed, as well as fueling. DOE

N80-32234# Aerodyne Research, Inc., Bedford, Mass.
CHARACTERIZATION OF OPEN-CYCLE, COAL-FIRED MHD GENERATORS Quarterly Technical Progress Report, 1 May - 31 Jul. 1979
C. E. Kolb, J. Wormhoudt, V. Yousefian, W. Cheng, F. Bien, D. Dvore, and M. Martinez-Sanchez Aug. 1979 88 p refs
(Contract EX-76-C-01-2478)
(ARI-RP-46; QTPR-11) Avail: NTIS HC A05/MF A01

A diffusion controlled heterogeneous condensation model and channel heat loss model for incorporation into the PACKAGE code used to calculate core flow plasma properties and generator efficiency were developed. PACKAGE calculations comparing realistic baseload subsonic and supersonic generator models are also presented. The refinement of a laboratory scale coal combustion plasma source and its associated molecular beam mass spectrometer diagnostic and diode laser absorption plasma temperature measurement systems was documented. A numerical model describing arc behavior in magnetohydrodynamic electrode boundary layers is presented. DOE

N80-32235# California Univ., Livermore. Lawrence Livermore Lab.
SUPERCONDUCTIVITY AND CRYOGENICS FOR MIRROR FUSION
D. N. Cornish 19 May 1980 22 p refs Presented at the 8th Intern. Cryog. Eng. Conf., Genoa, 3 Jun. 1980
(Contract W-7405-eng-48)
(UCRL-83916; CONF-800631-5) Avail: NTIS HC A02/MF A01

A brief introduction to the mainline experiments being presently pursued in mirror fusion research is followed by a more detailed description of the cryogenic and superconductive aspects of the Mirror Fusion Test Facility and its extension to a tandem machine. The large volume of magnetic field required for confinement has maximum intensity of close to 8 T and is produced by a variety of superconducting magnets. A large and complex cryogenic system is necessary to provide the 4 K environment for these coils and to meet the large cryopumping needs of the machine. DOE

N80-32236# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
EVALUATION OF TWO-BEAM SPECTROSCOPY AS A PLASMA DIAGNOSTIC Ph.D. Thesis
Barton Dawes Billard Apr. 1980 212 p refs
(Contract W-7405-eng-48)
(LBL-10913) Avail: NTIS HC A10/MF A01

A two beam spectroscopy system was evaluated theoretically and experimentally. This new spectroscopic technique uses correlations between components of emitted light separated by a small difference in angle of propagation. It is thus a non-perturbing plasma diagnostic which was shown to provide local (as opposed to line of sight averaged) information about fluctuations in the density of light sources within a plasma. This information was not obtainable by the usual spectroscopic methods. DOE

N80-32237# Texas Univ., Austin. Fusion Research Center.
DIRECT OHMIC HEATING OF POSITIVE IONS IN TOKAMAK PLASMAS
A. A. Ware Mar. 1980 26 p refs
(Contract DE-AC05-76ET-53036)
(DOE/ET/53036-16) Avail: NTIS HC A03/MF A01

Two mechanisms which will transfer part of the ohmic heat from the electrons to the ions are described. The direct ohmic heating of the ions was considered. The magnetic pumping cooling of the electrons and associated magnetic pumping heating of the ions caused by the poloidal rotation of the plasma were considered. Both mechanisms caused rates of energy transfer which were of the same order of magnitude as the collisional transfer and are therefore important corrections to be considered in both electron and ion energy containment calculations. DOE

N80-32238# Argonne National Lab., Ill.
MATERIALS PROGRAM PLAN FOR INERTIAL CONFINEMENT FUSION
A. Garde, B. O. Hall, S. D. Harkness, P. S. Maiya, M. D. Rechtin, and C. Y. Li (Cornell Univ., Ithaca, N.Y.) Aug. 1979 87 p refs
(Contract W-31-109-eng-38)
(ANL/FPP-TM-126) Avail: NTIS HC A05/MF A01

The effect of the irradiation environment on the microstructure of materials was studied. The importance of pulse effects on microstructural development was evaluated. The development effort that is necessary to cope with the high cycle loading of the first wall structure was studied. The interrelationship between specimen and component testing is presented. Static mechanical property requirements are also considered. Lithium compatibility was treated. DOE

N80-32239# California Univ., Livermore. Lawrence Livermore Lab.
HEAT TRANSFER IN INERTIAL CONFINEMENT FUSION REACTOR SYSTEMS
Jack Hovingh 23 Apr. 1980 23 p refs Presented at the 19th Natl. Heat Transfer Conf., Orlando, Fla., 27-30 Jul. 1980
(Contract W-7405-eng-48)
(CONF-800723-8) Avail: NTIS HC A02/MF A01

The short time and deposition distance for the energy from inertial fusion products resulted in local peak power densities. An overview of the various inertial fusion reactor designs which attempt to reduce these peak power intensities and the heat transfer considerations for each design are presented. DOE

N80-32240# Sandia Labs., Albuquerque, N. Mex.
PULSED POWER TECHNOLOGY FOR PARTICLE BEAM FUSION
J. P. VanDevender, T. H. Martin, E. L. Neau, J. T. Crow, and G. Yonas 1980 8 p Presented at the Intern. Conf. on Lasers, Shanghai, 3 May 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0696C; CONF-800555-1) Avail: NTIS HC A02/MF A01

A brief review of the Particle Beam Fusion Accelerator I is given. Its advantages for inertial confinement fusion are described. Author (DOE)

N80-32241# Brookhaven National Lab., Upton, N. Y.
HYPERFUSE: A NOVEL INERTIAL CONFINEMENT SYSTEM UTILIZING HYPERVELOCITY PROJECTILES FOR FUSION ENERGY PRODUCTION AND FISSION WASTE TRANSMUTATION
Henry Makowitz, James R. Powell, and Richard Wiswall 1980 14 p refs Presented at the 2nd Intern. Conf. on Emerging Nucl. Energy Systems, Lausanne, Switzerland, 8 Apr. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27784; CONF-800446-4) Avail: NTIS HC A02/MF A01

Parametric system studies of an inertial confinement fusion (ICF) reactor system to transmute fission products from an LWR economy were carried out. The ICF reactors would produce net power in addition to transmuting fission products. The particular ICF concept examined is an impact fusion approach termed HYPERFUSE, in which hypervelocity pellets, traveling on the order of 100 to 300 km/sec, collide with each other or a target block in a reactor chamber and initiate a thermonuclear reaction. The DT fusion fuel is contained in a shell of the material to be transmuted. The 14 MeV fusion neutrons released during the pellet burn cause transmutation reactions that convert the long lived fission products either to stable products or to species that decay with a short half life to a stable product. DOE

N80-32242# Research Inst. of National Defence, Stockholm (Sweden).
RELAXATION OF CHARGED PARTICLES INJECTED INTO A HOT PLASMA
Nils Hoernquist Mar. 1980 19 p refs
(FOA-C-20342-A2) Avail: NTIS HC A02/MF A01

Relaxation ranges and times of charged particles injected into a hot plasma are derived and compared with classical theory. Distant collisions as well as a more vigorous expression for close collisions are taken into account, revealing a significant difference for ion-ion relaxation. By using Bethe's formula for the stopping power of an energetic particle injected into a solid and redefining the ionization potential into a 'plasma potential' by dimensional arguments, an expression for the plasma case is derived and shown to be in qualitative accord with the rigorous expression for relaxation. Author (ESA)

N80-32243# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France).
CURRENT OPERATION AND FUTURE USES OF HIGH POWER PLASMA GENERATORS [EXPLOITATION ACTUELLE ET PERSPECTIVES D'UTILISATION DES GENERATEURS DE PLASMA DE GRANDE PUISSANCE]
M. Labrot Paris 1980 16 p In FRENCH Presented at Journees d'Etudes sur l'Electrothermie Facteur de Mutation et de Develop. Ind., Versailles, France, 6-7 Mar. 1980
(SNIAS-801-430-104) Avail: NTIS HC A02/MF A01

A plasma generator was built to simulate the conditions associated with the reentry of space vehicles into the atmosphere. Its configuration is given together with the attainable performance. The different types of captor used to measure the various related parameters are exposed together with a brief analysis of the basic laws governing the phenomena taking place. The results of one year of operation are given. Certain industrial applications such as thermal drilling are envisaged. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-32244* National Aeronautics and Space Administration. Pasadena Office, Calif.
MEANS FOR GROWING RIBBON CRYSTALS WITHOUT SUBJECTING THE CRYSTALS TO THERMAL SHOCK-INDUCED STRAINS Patent
Samuel Berkman (RCA, Princeton, N.J.), Kyong-Min Kim (RCA, Princeton, N.J.), and Harold E. Temple, inventors (to NASA) (RCA, Princeton, N.J.) Issued 5 Aug. 1980 5 p Filed 31 Aug. 1978 Supersedes N79-10917 (17 - 01, p 0121) Sponsored by NASA
(NASA-Case-NPO-14298-1; US-Patent-4,216,186; US-Patent-Appl-SN-938579; US-Patent-Class-422-246; US-Patent-Class-156-DIG.96) Avail: US Patent and Trademark Office CSCL 20B

A susceptor particularly suited for use in growing a ribbon crystal employing edge defined film fed growth techniques is described. The susceptor includes a die through which a melt is drawn for forming a crystal ribbon. This is combined with a coolant delivery system characterized by a pair of jets for directing a stream of fluid coolant along a path extended to impinge on the susceptor in close proximity with the die in nonincident relation with the crystal being grown.

Official Gazette of the U.S. Patent and Trademark Office

N80-32245* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF GROWING A RIBBON CRYSTAL PARTICULARLY SUITED FOR FACILITATING AUTOMATED CONTROL OF RIBBON WIDTH Patent
Theodore F. Ciszek, inventor (to NASA) (IBM, Poughkeepsie, N.Y.) Issued 12 Aug. 1980 8 p Filed 28 Apr. 1978 Supersedes N78-24952 (17 - 15, p 2056) Sponsored by NASA
(NASA-Case-NPO-14295-1; US-Patent-4,217,165; US-Patent-Appl-SN-901055; US-Patent-Class-156-601; US-Patent-Class-156-617SP; US-Patent-Class-156-DIG.64; US-Patent-Class-156-DIG.88) Avail: US Patent and Trademark Office CSCL 20B

A method of growing a ribbon crystal is described wherein a meniscus of molten semiconductor material attached to vertical movable seed is lifted at a rate substantially equal to the rate at which the meniscus freezes. The method is characterized by the steps of continuously sensing the brightness of the growth region of the ribbon in selected areas across the ribbon width for detecting changes in the intensity of the brightness of the selected areas, and modifying the temperature of the meniscus and pulling speed in response to changes detected in the intensity for controlling the geometry of the ribbon.

Official Gazette of the U.S. Patent and Trademark Office

N80-32246*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRYSTAL CLEAVING MACHINE Patent Application
John S. J. Benedicto and Frederick C. Hallberg, inventors (to NASA) Filed 29 Aug. 1980 19 p
(NASA-Case-GSC-12584-1; US-Patent-Appl-SN-182879) Avail: NTIS HC A02/MF A01 CSCL 20B

A machine is disclosed for cleaving hard crystals with precision and uniformity. It includes a vertical axis positioning control means for an adjustable spring tension guided hammer mechanism employed to strike an anvil and thereby generate a crystal cleaving shock wave transmitted to a cleaving blade. An underlying crystal holding fixture with horizontal position control means includes a zero reference stop face for the crystal and opposing spring loaded clamping and vertical positioning elements which are precisely guided. The crystal is restrained only to the extent that it remains in an ideal position for cleaving until the shock wave begins to propagate along a cleavage plane. Thus the shock wave forces that separate the crystal are balanced and the light restraining force used to hold the crystal allows it to splay apart with minimal shock wave damping. NASA

N80-32247*# National Aeronautics and Space Administration, Washington, D. C.

EXPERIMENTAL TECHNIQUES FOR DETERMINATION OF THE ROLE OF DIFFUSION AND CONVECTION IN CRYSTAL GROWTH FROM SOLUTION

L. Zefiro Mar. 1980 16 p refs Transl. into ENGLISH from Rend. Soc. Ital. Mineral. Petrologia (Italy), v. 34, no. 2, 1978 p 663-673 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Genoa Univ., Italy

(Contract NASw-3199)

(NASA-TM-76131) Avail: NTIS HC A02/MF A01 CSCL 20L

Various studies of the concentration of the solution around a growing crystal using interferometric techniques are reviewed. A holographic interferometric technique used in laboratory experiments shows that a simple description of the solution based on the assumption of a purely diffusive mechanism appears inadequate since the convection, effective even in reduced columns, always affects the growth. A.R.H.

N80-32248# Honeywell Corporate Technology Center, Bloomington, Minn.

FEASIBILITY OF OPEN TUBE SLIDER GROWTH OF HgCdTe FROM Te-RICH SOLUTION Interim Technical Report, Jan. 1979 - Jan. 1980

Joseph L. Schmit and John E. Boners Feb. 1980 62 p refs

(Contract F33615-77-C-5142; AF Proj. 2423)

(AD-A086342; AFWAL-TR-80-4068) Avail: NTIS HC A04/MF A01 CSCL 20/2

This report covers the feasibility demonstration of the growth of Hg1-x-CdxTe by liquid phase epitaxy from Te-rich solution at atmospheric pressure. Growth parameters are calculated from the phase diagram, measurement methods are described for determining layer thickness, uniformity, composition, and electrical properties. Substrate preparation and the growth process are described. Comparisons are made with growth from Hg-rich and HgTe-rich solutions. Layers as thin as 2 micrometers and as thick as 54 micrometers have been grown; most layers are 1 cm sq but some are 2x3 cm sq. We conclude that LPE growth is feasible from Te-rich solution at atmospheric pressure and are continuing our efforts to optimize the growth parameters and to increase the layer area. GRA

N80-32249# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.

FABRICATION OF JOSEPHSON TUNNEL JUNCTIONS BY REACTIVE ION MILLING

Alan W. Kleinsasser and Robert A. Buhrman 21 Jul. 1980 12 p refs

(Contract N00014-76-C-0526)

(AD-A087448; Rept-80-3) Avail: NTIS HC A02/MF A01 CSCL 20/10

A new technique has been developed for growing high quality, ultrathin oxide layers on metal films, suitable for use as tunneling barriers in Josephson junction devices. The oxides are produced with an argon oxygen ion beam, and the rate of growth is determined by the competition between oxidation and sputtering by the ions. The oxidation technique has been applied to the fabrication of high current density submicron niobium lead alloy Josephson junctions. High quality junctions have been produced with critical current densities exceeding 100,000 amp/sq cm and having low leakage currents at voltages below the energy gap. An edge geometry has been developed, allowing in line junctions to be formed on the ion mill patterned edge of Nb film. In this way, junction width is controlled by the Nb film thickness. GRA

N80-32250# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.

HIGH QUALITY SUBMICRON NIOBIUM TUNNEL JUNCTIONS WITH REACTIVE ION BEAM OXIDATION

Alan W. Kleinsasser and R. A. Buhrman 22 Jul. 1980 15 p refs

(Contract N00014-76-C-0526; NR Proj. 319-096)

(AD-A087449; Rept-80-4) Avail: NTIS HC A02/MF A01 CSCL 20/10

A new reactive ion beam oxidation technique has been applied to the fabrication of rugged, high quality niobium-lead alloy Josephson tunnel junctions. Control of critical current density over a wide range is possible, and critical current densities exceeding 1 million amp/sq cm have been obtained. In addition, a process-compatible edge geometry has been developed which allows a junction to be formed on the faceted edge of a niobium base electrode, yielding devices with areas of 10 to the minus 9th power sq cm using 1 micrometer photolithography. GRA

N80-32251# Wisconsin Univ. - Madison. Dept. of Metallurgical and Mineral Engineering and Materials Science Center.

SURFACE DEFECTS AND THERMODYNAMICS OF CHEMISORBED LAYERS

M. G. Lagally, T.-M. Lu, and D. G. Welkie 14 Sep. 1979 35 p refs

(Contract N00014-76-C-0727; NR Proj. 392-014)

(AD-A086918) Avail: NTIS HC A03/MF A01 CSCL 07/4

Chemisorbed overlayers on single crystal surfaces can in many cases be considered as lattice gases. The general features of temperature-coverage phase diagrams resulting from attractive or repulsive adatom interactions in such systems are discussed in analogy with binary solid solutions. The effect of surface and overlayer defects on the determination of phase boundaries is considered. The use of low energy electron diffraction (LEED) to study surface defects and overlayer phase diagrams is briefly summarized. GRA

N80-32252# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.

ORGANIC METALS AND SEMICONDUCTORS: THE CHEMISTRY OF POLYACETYLENE, CH(X), AND ITS DERIVATIVES Interim Technical Report

Alan G. MacDiarmid and Alan J. Heeger 21 Oct. 1979 14 p refs Presented at the Advan. Study Inst. on the Phys. and Chem. of Low Dimensional Solids, Tomar, Portugal, Aug. 1979

(Contract N00014-75-C-0962; NR Proj. 356-602)

(AD-A087102; TR-79-8) Avail: NTIS HC A02/MF A01 CSCL 07/3

Both cis- and trans-forms of polyacetylene, (CH)(x), may prepared as silvery, flexible polycrystalline, semiconducting films. The cis-films can be stretched to over three times their original length with partial alignment of the (CH)(x) fibrils. Through chemical or electrochemical doping, the electrical conductivity of the films can be increased over twelve orders of magnitude with properties ranging from insulator to semiconductor to metal. By the use of donors or acceptors, n-type or p-type polymer, respectively, is produced. Photoelectrochemical photovoltaic cells have been fabricated using (CH)(x) as the active photoelectrode. GRA

N80-32253# Stanford Univ., Calif. Edward L. Ginzton Lab.

SUPERCONDUCTING TUNNELING AND TUNNELING APPLICATIONS IN HIGH Tc A15 SUPERCONDUCTORS Final Report

M. R. Beasley May 1980 39 p refs

(Contract N00014-77-C-0439)

(AD-A087125; GL-3133) Avail: NTIS HC A03/MF A01 CSCL 20/3

This program was an outgrowth of our early empirical successes in forming superconducting tunnel junctions on thin films of the high transition temperature superconductors, specifically those in the so-called A15 class such as Nb3Sn (Tlc) approximately 18 K) and V3Si (Tlc) approximately 16 K). Prior to this all attempts at tunneling in the A15 superconductors had been on bulk material and were not widely successful. Moreover such non-thin film junctions are of limited device interest. As a result of this program we now have general junction formation techniques, apparently suitable for the A15 superconductors as a class, which are being routinely used for material diagnostics and for studies of the superconducting properties of these materials. More importantly, perhaps, they appear to have important device potential. We summarized only the main results and conclusions, referring the reader to the appendix for a more comprehensive discussion. GRA

N80-32254# Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.

ORGANIC METALS AND SEMICONDUCTORS: POLYACETYLENE (CH)x AND ITS DERIVATIVES

Alan G. MacDiarmid and Alan J. Heeger 21 Oct. 1979 12 p refs Submitted for publication
(Contract N00014-75-C-0962; NR Proj. 356-602)
(AD-A087024; LRSM-TR-79-9) Avail: NTIS HC A02/MF A01 CSCL 07/3

Polyacetylene (CH sub x) is the simplest organic polymer. Both the cis- and trans-forms may be prepared as silvery, flexible, polycrystalline, semiconducting films. The cis-films can be stretched over three times their original length with partial alignment of the (CH) fibrils. Through chemical or electrochemical doping, the electrical conductivity of the films can be increased over twelve orders of magnitude with properties ranging from insulator to semiconductor to metal. By the use of donors or acceptors n-type or p-type polymer, respectively, is produced. When doped, the partly aligned (CH) films show marked anisotropic electrical and optical properties. Studies have shown that rectifying p-n junctions as well as Schottky barrier junctions can readily be fabricated from polyacetylene. GRA

N80-32255# Hughes Research Labs., Malibu, Calif.
ADVANCED SILICON MATERIAL DEVELOPMENT FOR LADIR Interim Report, 15 Aug. 1978 - 15 Aug. 1979
H. Kimura and O. J. Marsh Jun. 1980 48 p
(Contract F33615-78-C-5062)
(AD-A087286) Avail: NTIS HC A03/MF A01 CSCL 17/5

This interim report gives dopant distribution results from several float zoned 100 silicon crystals. Uniformity of Ga improves as the growth rate is decreased and the rotation rate during growth is increased. These results agree qualitatively with diffusion theory and show promise of substantial uniformity improvement over state of the art SiGa material for IR detector applications. GRA

N80-32256# University of Southern California, Los Angeles. Dept. of Electrical Engineering.
CHARGE STORAGE, RETENTION AND ENDURANCE IN MNOS DEVICES Final Report, 10 Apr. 1977 - 13 Apr. 1980
Kurt Lehovec 13 Jun. 1980 47 p refs
(Contract DAAG29-79-C-0095; Grants DAAG29-78-G-0100; DAAG29-77-G-0123)
(AD-A087432; ARO-14744.6-EL) Avail: NTIS HC A03/MF A01 CSCL 20/12

The steady state current through the double dielectric of MNOS capacitors on p-silicon substrate was measured as function of temperature for several fixed fields in the silicon oxide of a polarity promoting hole flow from the silicon. It is shown that the availability of empty recipient trap states for holes tunneling from the silicon into the nitride controls the current. The occupancy of these trap states is governed by Frenkel-Poole detrapping at elevated temperatures and by Fowler-Nordheim tunnel emission from the traps at low temperature. Transient charging measurements support this interpretation. GRA

N80-32257# Advanced Research and Applications Corp., Sunnyvale, Calif.
IMPROVEMENT IN GaAs DEVICE YIELD AND PERFORMANCE THROUGH SUBSTRATE DEFECT GETTERING Final Report, 1 Feb. 1978 - 19 Jun. 1980
T. J. Magee, J. Peng, R. Ormond, R. A. Armistead, M. Malbon (Avantek, Inc., Santa Clara, Calif.), and C. A. Evans, Jr. (C. Evans and Associates) Jun. 1980 119 p refs
(Contract N00014-78-C-0065; ARPA Order 0010; NR Proj. 243-022)
(AD-A087712; ARACOR-TR-19-3) Avail: NTIS HC A06/MF A01 CSCL 20/12

The use of mechanically produced, back surface damage as a means of gettering impurities and defects in GaAs wafers has been investigated. Comparative analyses have been done on both ion implantation and mechanical back surface damage gettering techniques. The increased thermal stability of mechanically produced damage has shown ion implantation techniques to be less effective for gettering over long anneal periods at elevated temperatures. Stress gradients produced by graded dislocation distributions produce reductions in front surface defect concentrations and effective gettering of Au and Cr at the back surfaces. Thermal stability times of back surface damage at anneal temperatures of 700-800 C is typically on the order of 2 - 3 hours, corresponding to the point at which major back surface microstructural damage is largely annealed. Increases in the thermal stability period were attained by encapsulating the back surface with an As-doped SiO2 layer. Gettering of Cr by back surface damage was also investigated at low temperatures (300 C - 400 C) for anneal periods of 10 - 300 hrs. Measurable concentrations of Cr were detected with the process characterized by an activation energy of approximately 0.88 eV and a time dependent term, exp (theta square root of t). Using the developed gettering procedures, FET structures were fabricated on VPE layers on pregettered GaAs wafers. Dramatic improvements in yield per wafer, noise figures at higher frequencies and input capacitance values were obtained on 'inscreened' wafers processed through a normal fabrication line. GRA

N80-32258# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
PROPERTIES OF SUPERCONDUCTOR-NORMAL METAL-SUPERCONDUCTOR MICROBRIDGES Ph.D. Thesis
John Michael Warlaumont 21 Jul. 1980 179 p refs
(Contract N00014-76-C-0526; NR Proj. 319-096)
(AD-A087512; Rept-80-2) Avail: NTIS HC A09/MF A01 CSCL 09/5

This thesis describes the fabrication and electrical measurement of short, high resistance (R approx. 1 ohm) superconductor-normal metal-superconductor microbridges. These small (length and width as small as 200 nm), planar structures were produced using electron beam lithography and ion beam etching. Lead-copper-lead structures were primarily studied; other materials were also briefly investigated. The small cross section of the bridges resulted in a uniform current distribution in the bridges at all temperatures, thus enabling the experimental determination of the critical current versus temperature relation for all temperatures between T sub c and 0.05 T sub c, where T sub C is the transition temperature of the electrodes. The low voltage current voltage (I-V) characteristics were studied in detail. Constant voltage steps were observed in the I-V curves for all frequencies of microwave radiation used. The high resistance of these samples permitted measurement of the I-V curves for voltages much greater than the energy gap of the electrodes. A high voltage peak in the dV/dI curves was observed, and it was speculated that this peak was due to an extra dissipation in the electrodes. In addition, the low voltage resistance was found to have a temperature dependence which agreed with the phenomenological theory of Pippard et al., a theory which attributes the extra resistance to energy dissipation in the electrodes. GRA

N80-32259# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
THEORY OF JOSEPHSON JUNCTION MIXERS
Gosta J. Ehnholm 22 Jul. 1980 5 p
(Contract N00014-76-C-0526)
(AD-A087511; Rept-80-5) Avail: NTIS HC A02/MF A01 CSCL 09/5

A mathematical analysis of the rf irradiated Josephson junction has shown that an external load at the rf frequency is transformed into a parametric small signal Josephson junction seen at dc as a subharmonic step in the U-I characteristic. This model is used to investigate the properties of Josephson junction mixers. GRA

N80-32260# Sandia Labs., Albuquerque, N. Mex.
ELECTRONIC PROPERTIES OF SILICON GRAIN BOUNDARIES
G. E. Pike and C. H. Seager 1980 24 p refs Presented at the Conf. on Phys. of Fiber Optics, Chicago, 28 Apr. 1980
(Contract EY-76-C-04-0789)
(SAND-79-2350C; CONF-800430-2) Avail: NTIS HC A02/MF A01

The theory of the electrostatic barriers which form at silicon grain boundaries are discussed with specific reference to polycrystalline silicon. The use of experimental conductance and capacitance measurements to obtain the barrier height and energy density of grain boundary states are illustrated. DOE

N80-32261# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
GRAIN BOUNDARY DISLOCATIONS IN PLANE MATCHING GRAIN BOUNDARIES
R. Schindler, J. E. Clemans, and R. W. Balluffi Aug. 1979

34 p refs
(Contract DE-AS02-78ER-05002)
(DOE/ER-05002/7) Avail: NTIS HC A03/MF A01

Secondary grain boundary dislocation structures were observed in plane matching boundaries over a relatively wide range of crystal misorientations and grain boundary orientations. Results indicate that many boundaries occurring in polycrystalline materials which have been assumed to be general boundaries in previous studies may actually have been special boundaries of the plane matching type. Also, it appears that such boundaries should be found in general polycrystalline material with a relatively high probability. R.C.T.

N80-32262# Sandia Labs., Albuquerque, N. Mex.
FUNDAMENTAL STUDIES OF GRAIN BOUNDARY PASSIVATION IN POLYCRYSTALLINE SILICON WITH APPLICATION TO IMPROVED PHOTOVOLTAIC DEVICES Final Research Report, Feb. - Dec. 1979
C. H. Seager and D. S. Ginley Feb. 1980 118 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0879) Avail: NTIS HC A06/MF A01

Several aspects of the electrical properties of silicon grain boundaries were studied. The temperature dependence of the zero bias conductance and capacitance of single boundaries was measured and shown to be in good agreement with a simple double depletion layer/thermal emission model developed to predict the transport properties of such structures. In addition, it was shown that deconvolution of the I-V properties of some boundaries yields effective one electron densities of trapping states which are in good agreement with estimates obtained by low temperature electron emission measurements. Experiments were also performed which indicate that diffusion of atomic hydrogen into silicon grain boundaries greatly reduces this density of trapping states. In properly prepared, large grained polycrystalline samples, all measurable traces of grain boundary potential barriers can be removed to substantial penetration depths after several hours exposure to a hydrogen plasma at elevated temperatures. Initial experiments on prototype polysilicon solar cells have shown that this passivation process can improve AM1 efficiencies. DOE

N80-32263# National Technical Information Service, Springfield, Va.
GUNN EFFECT DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1979 - May 1980
William E. Reed Jun. 1980 72 p Supersedes NTIS/PS-79/0599; NTIS/PS-78/0362
(PB80-812050; NTIS/PS-79/0599; NTIS/PS-78/0362) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

The application of Gunn effect devices to microwave generation, amplification, and control is included in these reports from worldwide literature. The Gunn effect in semiconductors is discussed. Design, fabrication, and properties of Gunn diodes are included. This updated bibliography contains 64 abstracts, all of which are new entries to the previous edition. GRA

N80-32264# National Technical Information Service, Springfield, Va.
GUNN EFFECT DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Mar. 1976 - Mar. 1979
William R. Reed Jun. 1980 299 p Supersedes NTIS/PS-78/0362; NTIS/PS-77/0257
(PB80-812068; NTIS/PS-78/0362; NTIS/PS-77/0257) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

The application of Gunn effect devices to microwave generation, amplification, and control is included in these reports from worldwide literature. The Gunn in semiconductors is discussed. Design, fabrication, and properties of Gunn diodes are included. This update bibliography contains 290 abstracts, none of which are new entries to the previous edition. GRA

N80-32265# National Technical Information Service, Springfield, Va.
GUNN EFFECT AND TRANSFERRED ELECTRON DEVICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1977 - May 1980
William E. Reed Jun. 1980 92 p Supersedes NTIS/PS-79/0598; NTIS/PS-78/0361
(PB80-812035; NTIS/PS-79/0598) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

A bibliography containing 99 abstracts addressing the Gunn effect and transferred electron devices is presented. The application of Gunn effect and transferred electron devices to microwave generation, amplification, and control is included. The Gunn effect in semiconductors is dicussed along with the design, fabrication, and properties of Gunn diodes and transferred electron devices. GRA

N80-32266# National Technical Information Service, Springfield, Va.
AMORPHOUS SEMICONDUCTORS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Jun. 1980
Brian Carrigan Jun. 1980 191 p Supersedes NTIS/PS-79/0623; NTIS/PS-78/0671
(PB80-811342; NTIS/PS-79/0623; NTIS/PS-78/0617) Avail: NTIS HC $30.00/MF $30.00 CSCL 20L

A bibliography containing 181 abstracts is presented on amorphous semiconducting thin films, chalcogenides, materials fabrication, properties, and testing. Amorphous semiconductor usage in electronic devices, laser materials, ovonic switches, and memory devices are included. GRA

N80-32267# National Technical Information Service, Springfield, Va.
TRANSFERRED ELECTRON DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - May 1980
William E. Reed Jun. 1980 250 p Supersedes NTIS/PS-79/0600; NTIS/PS-78/0363
(PB80-812043; NTIS/PS-79/0600; NTIS/PS-78/0363) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

A bibliography containing 242 abstracts addressing the application of transferred electron devices to microwave oscillation, amplification, and switching is presented. GRA

N80-32268# National Bureau of Standards, Washington, D.C. Electron Devices Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: TECHNICAL IMPEDIMENTS TO A MORE EFFECTIVE UTILIZATION OF NEUTRON TRANSMUTATION DOPED SILICON FOR HIGH-POWER DEVICE FABRICATION Final Report
D. R. Myers May 1980 38 p refs Sponsored in part by DOE
(PB80-183874; NBS-SP-400-60; LC-80-600047) Avail: NTIS HC A03/MF A01 CSCL 20L

The problems involved in the neutron transmutation doping process are summarized. The concerns related to damage in transmutation doped silicon resulting from the neutron irradiation are presented. Suggestions for future research are presented. GRA

N80-32269# National Bureau of Standards, Washington, D.C. Electron Devices Div.
THE NBS SEMICONDUCTOR TECHNOLOGY PROGRAM AND VLSI (VERY LARGE SCALE INTEGRATION)
W. Murray Bullis and R. I. Scace Jun. 1980 11 p refs
(PB80-185531; NBSIR-80-2057) Avail: NTIS HC A02/MF A01 CSCL 20L

Several examples of past successful programs and their significance are given. An outline of the present plans for expansion to cover the problems of very large scale integration (VLSI) is presented. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-32270*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PAYLOAD CREW TRAINING SCHEDULER (PACTS) USER'S MANUAL
David L. Shipman Jul. 1980 308 p
(NASA-TM-78284) Avail: NTIS HC A14/MF A01 CSCL 05A

The operation of the payload specialist training scheduler (PACTS) is discussed in this user's manual which is used to schedule payload specialists for mission training on the Spacelab experiments. The PACTS program is a fully automated interactive, computerized scheduling program equipped with tutorial displays. The tutorial displays are sufficiently detailed for use by a program analyst having no computer experience. The PACTS program is designed to operate on the UNIVAC 1108 computer system, and has the capability to load output into a PDP 11/45 Interactive Graphics Display System for printing schedules. The program has the capacity to handle up to three overlapping Spacelab missions. R.K.G.

N80-32271# Air Force Academy, Colo.
A RESEARCH ACTIVITIES MANAGEMENT SYSTEM Final Report, 1 Nov. 1979 - 27 Feb. 1980
John S. Wilkes Feb. 1980 43 p
(AF Proj. 2303)
(AD-A086576; FJSRL-TR-80-0007) Avail: NTIS HC A03/MF A01 CSCL 05/2

A Research Activities Management System is described. It is a computerized storage and retrieval system that allows the manager of a scientific or engineering research organization to receive an organized accounting of the research activities of the organization. The scope of the data base and the nature of the items comprising the data base are defined. Examples of the use of the system are presented, using the research activities of a chemistry basic research laboratory as the data base. GRA

N80-32272# Skelly and Loy, Harrisburg, Pa.
GENERAL APPLICATION OF THE CRITICAL PATH METHOD TO RESOURCE CHARACTERIZATION AND PLANNING FOR UNDERGROUND COAL MINING Final Technical Report
May 1980 287 p refs
(Contract DE-AC01-79ET-11268)
(DOE/ET-11268/3) Avail: NTIS HC A13/MF A01

Application of the critical path method (CPM) to the total mine planning process is described. A commercially available CPM software package called SPRED (Solution of the Precedence Diagram) was chosen. A key prerequisite to the application of CPM was the identification of all of the activities involved in the mine planning process and the determination of all of the interrelationships that exist between them. A network format depicted all of the activities as labeled boxes in their proper logical sequence of events. Interdependencies were shown by lines connecting the related activities. Information necessary for the application of critical path scheduling techniques was produced and the data prepared in the format suitable for input to the SPRED system. DOE

N80-31347# General Electric Co., Lynn, Mass. Aircraft Engine Group.
LOGISTICS FORECASTING FOR ACHIEVING LOW LIFE CYCLE COST
G. Walker *In* AGARD The Appl. of Design to Cost and Life Cycle Cost to Aircraft Eng. May 1980 25 p refs (For primary document see N80-31342 22-01)
Avail: NTIS HC A08/MF A01

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-32273*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NSSDC AND WDC-A-R/S DOCUMENT AVAILABILITY AND DISTRIBUTION SERVICES
Jun. 1980 13 p
(NASA-TM-81120; NSSDC/WDC-A-R/S-80-02) Avail: NTIS HC A02/MF A01 CSCL 05B

Documents available from the National Space Science Data Center (NSSDC) and the World Data Center A for Rockets Satellites are described. The availability, costs, ordering procedures for documents presently available, and the procedures for obtaining future documents are given. NSSDC, established by NASA to further the widest practicable use of reduced data obtained from space science investigations and to provide investigators with an active repository for such data, is responsible for the active collection, organization, storage, announcement, retrieval, dissemination, and exchange of data received from satellite experiments. Information on sounding rocket investigations is also collected. A.R.H.

N80-32274# Range Commanders Council, White Sands Missile Range, N. Mex. Documentation Group.
UNIVERSAL DOCUMENTATION SYSTEM HANDBOOK. VOLUME 1: SYSTEM DESCRIPTION, PROGRAM INTRODUCTION AND STATEMENT OF CAPABILITY Final Report
Nov. 1979 91 p Supersedes DG-501-70-Vol-1 3 Vol.
(AD-A087072; DG-501-79-Vol-1; DG-501-70-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 14/2

This handbook describes the Universal Documentation System (UDS). The UDS is used to formally document user agency test program support requirements and support agency capabilities and commitments to support those requirements. The UDS handbook is published in three volumes. Volume 1 describes the total UDS structure, the individual documents within the system, and the use and control of the system. Volume 1 also includes sample forms and specific instructions for the Program Introduction (PI) and Statement of Capability (SC) documents which are the first level of UDS documents. GRA

N80-32275# Range Commanders Council, White Sands Missile Range, N. Mex.
UNIVERSAL DOCUMENTATION SYSTEM HANDBOOK. VOLUME 2: PROGRAM REQUIREMENTS AND OPERATIONS REQUIREMENTS DOCUMENTS
Nov. 1979 281 p 3 Vol.
(AD-A087073) Avail: NTIS HC A13/MF A01 CSCL 14/2

This handbook describes the Universal Documentation System (UDS). The UDS is used to formally document user agency test program support requirements and support agency capabilities and commitments to support those requirements. The UDS handbook is published in three volumes. This volume, Volume 2, describes the system and the procedure for preparation of the Program Requirements Document (PRD) and the Operations Requirements (OR) document. Each requirements document will be prepared by the user agency according to the format and policies prescribed in this volume. GRA

N80-32276# Defense Technical Information Center, Alexandria, Va. Directorate of Base Services.

SOURCE HEADER LIST, SUPPLEMENT 3 Progress Report, period ending 9 Jun. 1980

James P. Burrell Jun. 1980 301 p Supersedes DDC/TR-79/1-Suppl-2

(AD-A087000; DTIC/TR-80/5-Suppl-3; DDC/TR-79/1-Suppl-2) Avail: NTIS HC A14/MF A01 CSCL 05/9

Source names used by the Defense Technical Information Center in the Research and Technology Work Unit Information System, and the Technical Report, Program Planning, and Independent Research and Development Data Banks are compiled alphabetically. Each of the source names is assigned a 6 digit numeric code for computer input and retrieval, a 4 digit alphanumeric geopolitical code and a 1 digit alphanumeric type code. This supplement is a companion to the Source Header List, AD-A041700. GRA

N80-32277# Defense Technical Information Center, Alexandria, Va.

DATA ELEMENT DICTIONARY: DTIC UNIFORM DATA SYSTEM

Allan Kuhn, comp. and Melissa L. Young, comp. Apr. 1980 553 p

(AD-A083800; DTICH-4185.8) Avail: NTIS HC A24/MF A01 CSCL 05/2

The dictionary standardizes the data elements and identifies the data uses that constitute the Defense Technical Information Center uniform system. These standardized data elements enable DTIC to incorporate its data banks, currently operating independently, into a uniform system. They provide the capability of standardized access to all component data bases, or any combination of them. The dictionary serves as a communication link between system designers, programmers and subject specialists. It provides a foundation for effective management of data. Detailed descriptions of the current data banks and their relationships to the planned uniform system are included. Author (GRA)

N80-32278# Oak Ridge Gaseous Diffusion Plant, Tenn. Computer Sciences Div.

REVIEW OF DEPARTMENT OF ENERGY SPONSORED CODES AND DOCUMENTATION AVAILABLE FROM PURDUE AND LEHIGH UNIVERSITIES PROCESSES MODELING CONTRACTS

David M. Lister Apr. 1980 43 p refs

(Contract W-7405-eng-26)

(K/CSD/TM-35) Avail: NTIS HC A03/MF A01

The Purdue project had two principal objectives. The first was to construct a modular computer simulation package for the design of coal conversion systems. The second was to use this package to study general coal conversion flowsheet alternatives. Seven general codes and seven models of major components of the modified Illinois Coal Gasification Group (ICGG) process were developed. The object of the Lehigh work was to select, assemble and develop numerical algorithms implemented as computer codes for the dynamic analysis and continuous simulation of the modified ICGG coal conversion plant. Two general-purpose programs and nine models of major components of the ICGG plant were developed. A brief description of these programs and their availability and performance on the Oak Ridge IBM computer systems are presented. DOE

N80-32279# Ohio State Univ., Columbus. Computer and Information Science Research Center.

INFORMATION FLOW AND ANALYSIS: THEORY, SIMULATION, AND EXPERIMENTS. PART 1: BASIC THEORETICAL AND CONCEPTUAL DEVELOPMENT. PART 2: SIMULATION EXAMPLES, AND RESULTS. PART 3: PRELIMINARY EXPERIMENTS AND ANALYSIS Final Report

M. C. Yovits, C. R. Foulk, and L. L. Rose Dec. 1979 84 p refs

(Grants NSF GN-41628; NSF IST-76-21949; NSF IST-79-08327)

(PB80-180995; OSU-CISRC-TR-80-4-Pt-1; OSU-CISRC-TR-80-4-Pt-2; OSU-CISRC-TR-80-4-Pt-3) Avail: NTIS HC A05/MF A01 CSCL 05A

Research which has been underway to develop a fundamental and general theory of information flow and analysis is described. More specifically, the research attempts to: (1) identify and quantify important variables and parameters in the information flow process; (2) establish relationships among these variables; (3) apply the theory to practical situations and to examine the resulting implications; and (4) develop models, both simulation and experimental, to utilize and validate the theory. GRA

N80-32280# National Technical Information Service, Springfield, Va.

DISTRIBUTED DATA PROCESSING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980

Brian Carrigan Jun. 1980 171 p Supersedes NTIS/PS-79/0710; NTIS/PS-78/0671

(PB80-812217; NTIS/PS-79/0710; NTIS/PS-78/0671) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of Federally-funded research cites studies on the concepts, design, development, implementation, and application of distributed data processing. Also included are studies on distributed data bases. General communication studies related to major computer networks are cited in another bibliography. This update bibliography contains 164 abstracts, 37 of which are new entries to the previous edition. GRA

N80-32281# National Technical Information Service, Springfield, Va.

DISTRIBUTED DATA PROCESSING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Jul. 1979 - May 1980

Brian Carrigan Jun. 1980 242 p Supersedes NTIS/PS-79/0711; NTIS/PS-78/0672

(PB80-812225; NTIS/PS-79/0711; NTIS/PS-78/0672) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide journal literature cites studies on the concepts, design, development, implementation, and application of distributed data processing. Also included are studies on distributed data bases. General communication studies related to major computer networks are cited in another bibliography. This updated bibliography contains 231 abstracts, all of which are new entries to the previous edition. GRA

N80-32282# National Technical Information Service, Springfield, Va.

DISTRIBUTED DATA PROCESSING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1979

Brian Carrigan Jun. 1980 254 p Supersedes NTIS/PS-79/0711; NTIS/PS-78/0672

(PB80-812233; NTIS/PS-79/0711; NTIS/PS-78/0672) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide journal literature cites studies on the concepts, design, development, implementation, and application of distribution data processing. Also included are studies on distributed data bases. General communication studies related to major computer networks are cited in another bibliography. This updated bibliography contains 243 abstracts, none of which are new entries to the previous edition. GRA

N80-32283# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

INTERNATIONAL ACCESS TO AEROSPACE INFORMATION

Apr. 1980 105 p refs In ENGLISH and FRENCH Meeting held in Athens, 17-18 Oct. 1979

(AGARD-CP-279; ISBN-92-835-0264-7) Avail: NTIS HC A06/MF A01 CSCL 05B

A review of the status of Greek organization and facilities with respect to access to aerospace information is presented. The state of European cooperation in the field and the nature of NASA's contribution is considered. Requirements and tools for international cooperation and data exchange are discussed, as well as problems in the utilization of aerospace literature and nonliterature data in aerospace research and development. For individual titles, see N80-32284 through N80-32294.

N80-32284# Scientific Research and Technical Agency, (Greece).
ACCESS TO AEROSPACE INFORMATION: THE GREEK SITUATION
K. N. Kourogenis *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 4 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

The establishment of the Greek National Information Program in the form of the National Documentation Center (NDC) is described. The role of the NDC is to create and coordinate a national network of scientific and technical data and information in accordance with international standards and to disseminate processed information to those interested with a view to the economic development of the country. Bibliographies, reprographic services and translation and terminology services are to be provided by the NDC. E.D.K.

N80-32285# European Space Agency, Frascati (Italy). Information Retrieval Service.
EUROPEAN COOPERATION IN FIELD OF AEROSPACE INFORMATION
W. A. Martin *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 10 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

Agreements reached in the early 1960's leading to the establishment of the ESRO/ELDO Space Documentation Service are reviewed. European cooperation in both the input of aerospace information and its utilization is described. Details of ESA-IRS activities in support of the NASA information system are given. The development of the use of aerospace information in Europe as evidenced by the growth of IRS networking is examined. Research into aerospace information handling is outlined. The relationship between ESA and the CEC is explained in the context of EURONET. E.D.K.

N80-32286*# National Aeronautics and Space Administration, Washington, D. C.
THE ROLE OF NASA FOR AEROSPACE INFORMATION
George P. Chandler, Jr. *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 4 p (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01 CSCL 05B

The NASA Scientific and Technical Information Program operations are performed by two contractor operated facilities. The NASA STI Facility, located near Baltimore, Maryland, employs about 210 people who process report literature, operate the computer complex, and provide support for software maintenance and developments. A second contractor, the Technical Information Services of the American Institute of Aeronautics and Astronautics, employs approximately 80 people in New York City and processes the open literature such as journals, magazines, and books. Features of these programs include online access via RECON, announcement services, and international document exchange. E.D.K.

N80-32287# British Library, London (England). International Centre for Bibliographic Descriptions.
STATE-OF-THE-ART OF STANDARDIZATION OF BIBLIOGRAPHIC DATA ELEMENTS
Harold Diericky *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 7 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

The current situation with regard to standardization of data elements in bibliographic records is summarized. The following areas are considered: headings, bibliographic description proper, other areas or particular attributes of the bibliographic record. International and national rules and standards of international significance are dealt with. Although the difficulty for standardization efforts to suit the different requirements of various user groups is recognized, the conclusion reached is that standardization of form and presentation of bibliographic data elements is an essential prerequisite to achieve international compatibility of bibliographic records, particularly in an automated environment. Author

N80-32288# Netherlands School of Business, Breukelen.
STATE-OF-THE-ART OF DATA EXCHANGE: PROBLEMS OF FORMATS AND STANDARDS
J. S. MackenzieOwen *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 5 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

The vast growth of bibliographic data services over recent years has produced many problems in the field of compatibility for data exchange. It is beginning to be understood that there exists a major gap between the library community on the one side, and the abstracting and indexing services on the other side. It is also becoming clear that any standardized format for bibliographic data exchange should be flexible enough to incorporate the diverse needs of many different users. An effort is being undertaken by UNESCO to solve these problems. The present situation, problems, and future developments in this field are described. E.D.K.

N80-32289# Institut fuer Flugmechanik, Brunswick (West Germany).
THE USE OF MULTILINGUAL REFERENCE TOOLS IN THE PRODUCTION AND TRANSFER OF TECHNICAL INFORMATION
Gerhard Rosenau *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 18 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

A survey of the problems of expressing technical information in one language is given. The discussion of the additional problems encountered in producing the information in more than one or in a foreign language leads to the description of the different types of multilingual reference tools, of their advantages, and of their deficiencies. Based on the experience gained during the revision of the AGARD Multilingual Aeronautical Dictionary criteria developed for a future multilingual reference system are presented. E.D.K.

N80-32290# Lucas Group Services Ltd., Solihull (England).
KINDS OF ACCESS TO UNCLASSIFIED LITERATURE
C. P. Auger *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 4 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

The nature of unclassified literature is reviewed and the categories available and their organization are examined. The preponderance of reports literature is noted and current awareness and on line services receive particular attention. Consideration is given to the great variety of users seeking access for one reason or another and the different routes open to them. Finally attention is turned to some of the problems which need to be overcome if access is to be improved. E.D.K.

N80-32291# Centre de Documentation de l'Armement, Paris (France). Div. Information.
THE MANAGEMENT OF DOCUMENTS HAVING A RESTRICTED CHARACTER [LA QUESTION DES DOCUMENTS AYANT UN CARACTERE DE RESTRICTION]
J. H. Klopp *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 5 p ref In FRENCH (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

Documents containing military or industrial secrets or information reserved to the needs of the State are best managed in a manner analogous to that used for open documents, but with important security regulations imposed by a documentation center. It is preferable for a defense documentation center to create a chain of use parallel to the classic chain of use for open documents, rather than to intermingle documents. The most important advantage of the decision to create a special center

for processing classified documents is an uncontested control of the stamping, stocking, and dissemination of these documents. The importance of declassification is discussed and a table is provided showing the markings used by NATO and 14 of its member nations for the various classifications of restricted documents. Transl. by A.R.H.

N80-32292# Atomic Energy Research Establishment, Harwell (England). Computer Science Div.
FULL TEXT HANDLING: A CRITICAL REVIEW
R. P. L. Jones *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 10 p (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

The wide capabilities of full text information retrieval systems are demonstrated. The basic capabilities of such systems are described including the strengths and weaknesses that seem to be inherent in the techniques that are in use. The wider application of such systems is also described. Emphasis is placed on their capability to form a nucleus for integrated information management systems which are flexible in use and do not require programming skills to exploit them. E.D.K.

N80-32293# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
THE NUMERIC AEROSPACE DATA: PROBLEMS OF EVALUATION, HANDLING AND DISSEMINATION
G. K. Hartmann *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 10 p refs (For primary document see N80-32283 22-82)
Avail: NTIS HC A06/MF A01

In context with dissemination and handling procedures the problems being faced are to distinguish between small, medium, and large information systems. Due to the fact that most of the numeric aerospace data are nonreproducible time series data (often also space dependent) with tremendous growth rates it is becoming extremely difficult and time consuming for any scientist and information system not actively working in the specific field to evaluate, disseminate, and handle those data with a high degree of efficiency and reliability. Thus it is very likely that also in the future, numeric aerospace data exchange activities will by far dominate the pure handling activities despite any technical progress. E.D.K.

N80-32294*# Lunar and Planetary Inst., Houston, Tex.
THE ROLE OF WORLD DATA CENTERS AND THE LUNAR AND PLANETARY INSTITUTE IN THE INTERNATIONAL EXCHANGE OF LUNAR AND PLANETARY DATA
Frances B. Waranius *In* AGARD Intern. Access to Aerospace Inform. Apr. 1980 8 p refs (For primary document see N80-32283 22-82)
(Grant NSR-09-051-001)
(LPI-Contrib-382) Avail: NTIS HC A06/MF A01

The success of many lunar and planetary investigations has resulted in the accumulation of a mass of data in a myriad of formats and medias. The application of these data to comparative planetology, origin of the solar system, and potential industrial applications of space has made it necessary for scientists from many disciplines to have access to the data. The collections of these data are so diverse that it is often difficult to select what is needed based on catalog information alone. The Lunar and Planetary Institute (LPI) proposes to bring the user and the data together. As a research support organization operated by the Universities Space Research Association, the LPI through its active Visiting Scientist Program, a balanced program of study workshops and topical conferences, and organized and supervised data collections has assisted scientists, educators, and students to review, study, and obtain the data necessary to the pursuit of their research. E.D.K.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-32295# Council on Environmental Quality, Washington, D.C.
THE GLOBAL 2000 REPORT TO THE PRESIDENT. ENTERING THE TWENTY-FIRST CENTURY, VOLUME 1
1980 55 p refs 2 Vol.
Avail: SOD HC

Probable trends in population, resources, and environment were estimated between the year 1975 and 2000. Trend projections were developed using the long term global models employed by federal agencies. It is indicated that if present trends continue, the world in 2000 will be more crowded, more polluted, less stable ecologically, and more vulnerable to disruption than the world today. Major findings and conclusions are reported. R.C.T.

N80-32296# Council on Environmental Quality, Washington, D.C.
THE GLOBAL 2000 REPORT TO THE PRESIDENT. ENTERING THE TWENTY-FIRST CENTURY. VOLUME 2: THE TECHNICAL REPORT
1980 775 p refs 2 Vol.
Avail: SOD HC

Changes in pollution, climate, technology, Earth resources, energy, and the environment until the end of the century as projected by U.S. Government agencies using their most frequently employed long term planning models and analytical tools are discussed. A sequential approach was used to obtain a measure of self consistency, coherence, and interrelationship so as to provide an integrated global model which reflects the implications if current U.S. policies remain unchanged. Each of the models used is described and other global models are examined and compared with the global model developed. A.R.H.

N80-32297 Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
EXAMPLE OF A POLICY AIMED AT INCREASING THE VALUE OF SPIN-OFFS FROM SPACE TECHNOLOGY IN OTHER FIELDS [EXEMPLE D'UNE POLITIQUE DE VALORISATION DE RETOMBES TECHNOLOGIQUES SPATIALES DANS D'AUTRES DOMAINES]
Didier G. Compard Paris 1980 36 p In FRENCH Presented at Intern. Colloq. on the Econ. Effects of Space and Other Adv. Technol., Strasbourg, 28-30 Apr. 1980
(SNIAS-801-422-101) Avail: NTIS HC A03

Emphasis is given to applications derived from space systems, launching devices and ballistic motors. The underlying philosophy is presented together with the objectives sought. These applications concern energy (storage facilities, off-shore oil installations, nuclear and solar power), medicine, vehicle breaking systems, new materials, some specific technologies (extraction of metals, chemical synthesis, drilling), and safety (particularly in aeronautics. Special studies including the design and demonstration of systems for the chemical and petroleum industries, as well as software systems for ships and other proposes are also described. Some concrete examples are treated. Economics aspects are discussed together with expected developments.
Author (ESA)

N80-32298*# Budd Co., Fort Washington, Pa. Technical Center.
A MASS REDUCTION EFFORT OF THE ELECTRIC AND HYBRID VEHICLE Final Report
Richard B. Freeman and Herbert A. Jahnle Mar. 1980 193 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955283)
(NASA-CR-163520; TCR-0513; JPL-955283-1; JPL-9950-374) Avail: NTIS HC A09/MF A01 CSCL 13F

Weight reduction, cost competitiveness, and elimination of the intrusion beam resulted from the redesign and fabrication using composite materials of the door outer panel and intrusion beam from a Chevrolet Impala. The basis of the redesign involved replacing these two steel parts with a single compression molding using the unique approach of simultaneously curing a sheet molding compound outside panel with a continuous glass fiber intrusion strap. A weight reduction of nearly 11 pounds per door was achieved. Additional weight savings are possible by taking advantage of the elimination of the intrusion beam to design thinner door structures. The parts consolidation approach allows the composite structure to be cost competitive with the original steel design for both the lower production car models and for the near to midterm production vehicles using current state of the art composite production techniques. The design, prototype fabrication, costing, material, properties and compression molding production requirements are discussed. A.R.H.

N80-32299*# Battelle Columbus Labs., Ohio.
DESIGN STUDY OF STEEL V-BELT CVT FOR ELECTRIC VEHICLES Final Report
J. C. Swain, T. A. Klausing, and J. P. Wilcox Jun. 1980 131 p refs
(Contracts DEN3-116; EC-77-A-31-1044)
(NASA-CR-159845; DOE/NASA/0116-80/1) Avail: NTIS HC A07/MF A01 CSCL 13F

A continuously variable transmission (CVT) design layout was completed. The intended application was for coupling the flywheel to the driveline of a flywheel battery hybrid electric vehicle. The requirements were that the CVT accommodate flywheel speeds from 14,000 to 28,000 rpm and driveline speeds of 850 to 5000 rpm without slipping. Below 850 rpm a slipping clutch was used between the CVT and the driveline. The CVT was required to accommodate 330 ft-lb maximum torque and 100 hp maximum transient. The weighted average power was 22 hp, the maximum allowable full range shift time was 2 seconds and the required lift was 2600 hours. The resulting design utilized two steel V-belts in series to accommodate the required wide speed ratio. The size of the CVT, including the slipping clutch, was 20.6 inches long, 9.8 inches high and 13.8 inches wide. The estimated weight was 155 lb. An overall potential efficiency of 95 percent was projected for the average power condition.
Author

N80-32300# SRI International Corp., Menlo Park, Calif. Center for Resource and Environmental System Studies.
RAILROAD ELECTRIFICATION IN AMERICA'S FUTURE: AN ASSESSMENT OF PROSPECTS AND IMPACTS Final Report
Ronald K. White, Irving W. Yabroff, Edward M. Dickson, R. Allen Zink, Mary E. Gray, and Albert E. Moon Jan. 1980 175 p refs
(Contracts EY-76-C-03-1176; DE-AT03-76CS-50115)
(SAN-1176-T4) Avail: NTIS HC A08/MF A01

Such considerations as the level of traffic, the relative financial health of individual railroads, the capacity of the associated supply and engineering/construction industries, and the logical connecting points at classifying yards, as well as the national interest value of creating a continuous system, are used to construct a scenario for railroad electrification that closely approximates how an electrification program might be implemented. This scenario provides for an electrified network involving 14 mainlines operated by 10 companies that could transport much of the nation's rail borne freight. Five years of planning and engineering work would be required for each link before construction could begin. With 1000 miles or less of electrified route per year, 14 years would be needed to construct the 9000 mile network. Railroad energy costs, railroad freight levels, maintenance costs, purchases and leases of rolling stock, electrification facility investments, future inflation, rate setting practices, annual depreciation, taxes, and profits are calculated.
DOE

N80-32301# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
AN ATTEMPT TO ESTIMATE THE ECONOMIC EFFECTS IN THE CHOICE OF SPACE TECHNOLOGY SPIN-OFFS [TENTATAIVE D'ESTIMATION DES EFFETS ECONOMIQUES DANS LES CHOIX DE RETOMBES TECHNOLOGIQUES SPATIALES]
Jean-Michel Contant Paris 1980 9 p refs In FRENCH Presented at Intern. Colloq. on the Econ. Effects of Space and Other Adv. Technol., Strasbourg, 28-30 Apr. 1980
(SNIAS-801-422-107) Avail: NTIS HC A02/MF A01

The use of multicriteria methods to rationalize the choice of the particular technologies to be developed is presented. A methodical approach emphasizing the importance of economic, financial, commercial, and technological considerations is developed. It is concluded that some feedback is necessary, if subjective influences on the appreciation of the economic effects ensuing are to be overcome. The accounting services existing today in companies and organisations are not well adapted to conduct the type of analysis necessary. Author (ESA)

N80-32302# Transportation Systems Center, Cambridge, Mass.
ASSESSMENT OF OPERATIONAL AUTOMATED GUIDEWAY SYSTEMS-AIRTRANS, PHASE 2 Final Report, Jun. 1977 - Jul. 1979
C. W. Watt, D. Elliott, D. Dunoye, T. Dooley, and W. S. Kwok Jan. 1980 338 p refs Prepared in cooperation with Institut de Recherche des Transports, Arouell (France)
(PB80-182538; DOT-TSC-UMTA-79-19; UMTA-MA-06-0067-79-1) Avail: NTIS HC A15/MF A01 CSCL 13F

The automated guideway system at the Dallas-Fort Worth Airport, AIRTRANS, is assessed. Main areas covered include: (1) changes in system configuration including the addition of employee service and the modifications of the failure management and control systems; (2) the availability, reliability, and maintainability history of the system and its components; (3) the operational safety history of the system; and (4) a life cycle cost study of the system. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-32303*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE

VERSION OF THE CATALOG OF SUPPLEMENTAL STARS TO THE BONNER DURCHMUSTERUNG
Wayne H. Warren, Jr. May 1980 12 p refs
(NASA-TM-81119; NSSDC/WDC-A-R/S-80-01) Avail: NTIS HC A02/MF A01 CSCL 03A

The magnetic tape version of the Bonn catalog is described. The catalog contains a listing of supplemental stars having lower case letter designations following the BD numbers after which they have been inserted. A sample catalog is also presented. R.C.T.

N80-32304*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF THE PERTH 70: A CATALOGUE OF POSITIONS OF 24900 STARS TAPE B, MEAN VALUES OF THE OBSERVATION
Wayne H. Warren, Jr. Jul. 1980 11 p
(NASA-TM-80849; NSSDC/WDC-A-R/S-80-04) Avail: NTIS HC A02/MF A01 CSCL 03A

The Perth 70 catalog contains accurate positions of 24978 stars, plus other useful data such as approximate proper motions, radial velocities, and parallaxes. The Perth 70 is a result of meridian circle observations made by the Hamburg observatory expedition to Perth as part of the international effort of Southern References Stars (SRS). Tape B, which contains mean values of the observations and corresponds to the printed catalog is described. A.R.H.

N80-32305*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASTRONOMICAL DATA CENTER BULLETIN, VOLUME 1, NO. 1
Wayne H. Warren, Jr., ed., Theresa A. Nagy, ed., and Jaylee M. Mead, ed. Jul. 1980 54 p refs
(NASA-TM-80764; NSSDC/WDC-A-R/S-80-07-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 03A

Information about work in progress on astronomical catalogs is presented. In addition to progress reports, an upadated status list for astronomical catalogs available at the Astronomical Data Center is included. Papers from observatories and individuals involved with astronomical data are also presented. L.F.M.

N80-32306*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BLACKBODY CURVES FOR THE IUE SPECTRAL RANGE LAMBDA 1150 TO LAMDA 3200 FROM 6,000 TO 200,000 K
W. A. Feibelman Aug. 1980 44 p
(NASA-TM-81997) Avail: NTIS HC A03/MF A01 CSCL 03A

Two sets of blackbody curves are presented for the wavelength region covering the international ultraviolet explorer spectrographs. One set is normalized to unity at 3200 A, the other is normalized at 1900 A for those astronomers primarily interested in data for the SWP range. The blackbody curves extend from 1150 to 3200 A and cover the temperature range from 6,000 to 200,000 K. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-32307# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTATIONAL ASTROPHYSICS RELATING TO THE INTERSTELLAR MEDIUM: PROBLEMS AND PROSPECTS FOR THE 1980'S
Paul R. Woodward May 1980 8 p Presented at the Conf. on Computational Astrophys., Langley AFB, Va. Feb. 1980; sponsored by NASA. Ames Research Center Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84410; CONF-800236-1) Avail: NTIS HC A02/MF A01

The general goal of research on the interstellar medium is to understand the structure and dynamics of the interstellar gas. This subject is important for three reasons. First, the classic tracers of the spiral structure of galaxies are related directly to the gaseous component of galactic disks, therefore, an understanding of the dynamics of the gas is essential in interpreting observations of spiral galaxies. Second, radio continuum observations relate to the magnetic field, which is frozen into the gas under most circumstances. Hence these observations must be interpreted using magnetohydrodynamic models. Third, the initial conditions for star formation are determined by the structure and dynamics of the interstellar gas. In this way gas dynamics plays an essential role in understanding the relative numbers of binary and single stars, the formation of planetary systems, and even the evolution of the stellar content of galaxies. DOE

N80-32308# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL STUDY OF ROTATING INTERSTELLAR CLOUDS: EQUILIBRIUM AND COLLAPSE Ph.D. Thesis
Michael Lester Norman Jun. 1980 231 p refs Submitted for publication
(Contract W-7405-eng-48)
(UCRL-52946) Avail: NTIS HC A11/MF A01

The equilibrium and collapse of rotating, axisymmetric, idealized interstellar gas clouds is calculated with a 2D hydrodynamics code. The hydrodynamics features an improved angular momentum advection algorithm. Angular momentum is advected consistently with mass by deriving angular momentum fluxes from mass fluxes and the local distribution of specific angular momentum. Local conservation is checked by a graph of mass versus specific angular momentum for the cloud as a whole. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-32309*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MINERALOGIC AND PETROLOGIC STUDIES OF LUNAR SAMPLES AND METEORITES Final Report, 1 Feb. 1979 - 31 Aug. 1980
John A. Wood 31 Aug. 1980 17 p refs
(Grant NsG-7596)
(NASA-CR-163498) Avail: NTIS HC A02/MF A01 CSCL 03B

Experimental and thermodynamic research on the pressure temperature limits of the stability of the mineral assemblages found in pristine, spinel bearing lunar highland lithologies demonstrated the likelihood that the minerals originated in the lower stratigraphic levels of the primordial crust. The phase equilibrium in silicate solid/liquid systems of planetary importance were thermochemically interpreted in order to model the early formation of the crusts and maneles of Earth and Moon sized planets. The petrography and chemical composition of coarse grained gabbro, the chemical analysis and age dating of clasts from Apollo 16 breccia, the analysis of glass particles from Apollo 16 soil samples, the study of Allende and Mokoia meteorites as a source of information about events in the solar nebula, and the hydrothermal alteration of amorphous materials were also investigated. The capabilities of a model for addressing the problem of the origin of the Earth's moon by the disruptive capture mechanism are examined as well as models of the thermal evolution of hypothetical meteorite bodies. Progress in determining the composition of stony meteorite specimens collected at the Allan Hills site during the Antarctic field exploration is reported. A.R.H.

N80-32310*# National Aeronautics and Space Administration, Washington, D. C.

THE INTERNATIONAL HALLEY WATCH
Jul. 1980 80 p refs
(NASA-TM-82181) Avail: NTIS HC A05/MF A01 CSCL 03B

In preparation for the 1985 to 1986 apparition of Halley's Comet, the International Halley Watch (IHW) has initiated a comprehensive program to stimulate, encourage, and coordinate scientific observation of the apparition. The observing groups with which the IHW plans to interact are discussed and the ground based observing nets are described in detail. An outline of the history of observations of Halley's Comet and a synopsis of comet properties and physics are included. E.D.K.

N80-32311*# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE MOSAICS OF MARS: AS SEEN BY THE VIKING LANDER CAMERAS Final Report
Elliott C. Levinthal (Stanford Univ.) and Kenneth L. Jones Washington NASA Sep. 1980 79 p
(Grant NsG-7538)
(NASA-CR-3326) Avail: NTIS HC A05/MF A01 CSCL 03B

The mosaics and derivative products produced from many individual high resolution images acquired by the Viking Lander Camera Systems are described. A morning and afternoon mosaic for both cameras at the Lander 1 Chryse Planitia site, and a morning, noon, and afternoon camera pair at Utopia Planitia, the Lander 11 site. The derived products include special geometric projections of the mosaic data sets, polar stereographic (donut), stereoscopic, and orthographic. Contour maps and vertical profiles of the topography were overlaid on the mosaics from which they were derived. Sets of stereo pairs were extracted and enlarged from stereoscopic projections of the mosaics. S.F.

N80-32312# Lincoln Lab., Mass. Inst. of Tech., Lexington.
WHERE ARE THE ASTEROIDS? THE DESIGN OF ASTPT AND ASTID
Laurence G. Taff 15 Apr. 1980 81 p refs
(Contract F19628-80-C-0002; AF Proj. 3221)
(AD-A087422; TN-1980-24; ESD-TR-80-25) Avail: NTIS HC A05/MF A01 CSCL 03/1

The design of software to be used for the planning of minor plant planet observations and the identification of a particular asteroid when it is observed at a given time is discussed. In each case the large number of cataloged asteroids (approximately 2200) has required that the software be optimal with respect to execution speed. This is accomplished by using an approximate geocentric ecliptic position to eliminate, as quickly (in terms of CPU time) as possible, the minor planet from further consideration. In particular, using the type of analysis applicable to near-stationary artificial satellites, and carefully quantifying the nature of the approximations, an approximate geocentric ecliptic latitude and longitude are obtained in such a fashion that the computations needed for these are not only minimal but, should the actual location of the minor planet be needed, maximally used there too. The user's interaction with the software documentation of the calculations, sample outputs, and the rationale of observing asteroids are also discussed. M.G.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-32313# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOLAR MAGNETIC FIELD STUDIES (PHOTON COUNTER) Final Report, Aug. - Sep. 1979
L. Mertz Hanscom AFB, Mass. AFGL Oct. 1979 26 p refs
(Contract F19628-79-C-0183)
(AD-A082242; AFGL-TR-79-0240) Avail: NTIS HC A03/MF A01 CSCL 03/2

Two dimensional photon counters that preserve the temporal ordering of the photons in a form suitable for a new algorithm for speckle imaging are described. Specifications are given for such a device that is under development and attention is given to a commercially available device that is being procured. The calibration and sensitivity of the speckle imaging algorithm are also discussed. A.R.H.

N80-32314*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LONGITUDINAL AND TRANSVERSE MAGNETIC FIELD PROGRAM PROCEDURE AND DETAILED SPECIFICATION FOR SIGMA 5
Caroline K. Wang Aug. 1980 91 p
(NASA-TM-78292) Avail: NTIS HC A05/MF A01 CSCL 03B

A computer program and procedure for plotting the contour of the data transferred from the Marshall Space Flight Center solar magnetography is presented. The plotted data then can be easily compared with solar data from other sources, such as the Solar Maximum Mission. From the data file for circular polarization the longitudinal program plots the contours for filtered longitudinal plot and intensity plot by choosing the positive and negative contour levels, intensity levels, and also X,Y plotting ranges which need to be used. In a similar manner the transverse program generates the transverse contour plot, azimuth plot, and intensity plot from the linear polarization data files. M.G.

N80-32315*# Weber State Coll., Ogden, Utah. Dept. of Physics.
SPECTRUM SYNTHESIS OF EUV SOLAR FLARE LINE PROFILES Final Report
David A. Tripp Jul. 1980 18 p refs
(Contract NAS8-33113)
(NASA-CR-161551) Avail: NTIS HC A02/MF A01 CSCL 03B

A classic double ribbon flare of importance 1B occurred at approximately 1405 UT on June 15, 1973, reached an H alpha maximum at 1413 UT, and ended at 1455 UT. The flare occurred in an old and simplifying bipolar region at N18 W32. This flare was studied due to the extensive temporal data available. A total of 136 spectra of wavelength ranges from 1100 to 3000 A were taken during the flare's duration by the Naval Research Laboratory normal incidence slit spectrograph. Using this data the nature of the solar chromosphere of a flare event as a function of time was determined. E.D.K.

N80-32316*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HELIOS SOLAR PROBES SCIENCE SUMMARIES Progress Report, 1974 - 1979
James H. Trainor, ed. Aug. 1980 106 p refs
(NASA-TM-82005) Avail: NTIS HC A06/MF A01 CSCL 03B

The principal results of the Helios investigations through the first five years of the missions are presented. R.C.T.

N80-32317# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
SOLAR ECLIPSE (1979). PART 1: ATMOSPHERIC SCIENCES LABORATORY FIELD PROGRAM SUMMARY
Melvin G. Heaps (New Mexico State Univ., Las Cruces), Robert O. Olsen (New Mexico State Univ., Las Cruces), Warren Berning (New Mexico State Univ., Las Cruces), John Cross, and Authur Gilcrease May 1980 43 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A087318; ERADCOM/ASL-TR-0059) Avail: NTIS HC A03/MF A01 CSCL 04/1

The 26 February 1979 solar eclipse provided a unique opportunity to investigate the properties of the middle atmosphere, including the lower ionospheric D region, during a succinct day-'night'-day transition. The Atmospheric Sciences Laboratory (ASL) assisted in coordinating a multiagency field experiment program which encompassed a wide range of effort. Experiments carried out during the several day period centering on the eclipse were characterized by an unusually high degree of success. Nineteen small sounding rockets and 14 large rockets were launched without a major experimental failure. Ground based measurements provided additional information. Of particular interest to the Army is the investigation of electron attachment/detachment processes in the D region which in turn have a bearing on ELF, VLF, and HF communications, BMD radar systems,

and atmospheric deionization in the post nuclear burst atmosphere. This report is Part 1 of a series and is primarily concerned with providing a summary of the 1979 Solar Eclipse Field Program and sponsored experiments. Part 2 will provide an account of the experimental data acquired by the ASL experiments, and a subsequent Part 3 will detail the atmospheric modeling efforts using the data from the 1979 solar eclipse. GRA

N80-32318# Rochester Univ., N. Y. Dept. of Mechanical and Aerospace Sciences.
DYNAMICAL PHENOMENA IN SUNSPOTS Final Report, 1 Oct. 1978 - 30 Sep. 1979
John H. Thomas, Alfred Clark, Jr., and Mark A. Schauer. 15 Feb. 1980. 83 p. refs.
(Contract F19628-77-C-0079; AF Proj. 2311)
(AD-A086010; AFGL-TR-80-0064) Avail: NTIS HC A05/MF A01 CSCL 03/2

The reflection of upward and downward propagating Alfven waves in sunspots is studied, in order to assess the possibility of cooling by Alfven waves. Wave reflection is studied by means of a three layer model of the umbral atmosphere. The results show very strong downward reflection of Alfven waves in the photosphere and low temperature, but only weak upward reflection in the convection zone. Further study of more realistic magneto-atmospheric waves (including the effects of compression and buoyancy) shows strong upward reflection in the convection zone as well as strong downward reflection in the photosphere and low chromosphere. These results tend to rule out significant sunspot cooling by waves. A study of a simple thermal model of a sunspot, based on the concept of partial inhibition of convection, shows that the inhibition mechanism can yield acceptable distributions of surface temperature. The results of this model also show that: (1) the edge of the umbra is sharp, even for deep spots; (2) deep spots produce weak bright rings, but shallow spots produce intense bright rings in conflict with observations; and (3) only a shallow surface layer of the sunspot is cool, the rest being warmer than the surroundings. Umbral oscillations in sunspots are studied and identified as a resonant response of the umbral atmosphere to forcing by oscillatory convection in the subphotosphere. The full linearized equations for magneto-atmospheric waves are solved numerically for a detailed model of the umbral atmosphere. It is suggested that the Sun's radius and surface temperature vary with the solar cycle due to the variation of total magnetic buoyancy in the convection zone over the cycle of the solar dynamo. GRA

N80-32319# Watt Engineering Ltd., Cedaredge, Colo.
CIRCUMSOLAR RADIATION
A. D. Watt. Apr. 1980. 283 p. refs.
(Contract DE-AC04-76DP-00789)
(SAND-80-7009) Avail: NTIS HC A13/MF A01

The development of a model which will permit estimation of circumsolar radiation based on solar and meteorological input data is discussed. The results of observations are presented including radiance characteristics and time variations of the circumsolar component at a number of locations. The characteristics of the atmosphere are presented with primary emphasis on large particles. Physical models of circumsolar radiation are developed. The model results are based on: long term average turbidity values, derived average pollen loadings, and actual monthly average sky cover values for the years shown. Regression analysis employed to determine the circumsolar values based on observed solar radiation and atmospheric parameters. The regression derived models show that fairly good agreement can be obtained between observed and calculated monthly average circumsolar ratios by simple expressions employing only the active cavity radiometer values. DOE

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-32320*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Space Sciences Dept.
DATA REDUCTION AND ANALYSIS FOR THE TRW IMP-7 PLASMA WAVE EXPERIMENT Final Report
Frederick L. Scarf. 31 Oct. 1979. 5 p. refs.
(Contract NAS5-23150)
(NASA-CR-160011; Rept-22751-6011-RU-00) Avail: NTIS HC A02/MF A01 CSCL 03B

Highlights from the IMP 7 plasma wave experiment are briefly outlined. The measurements in the tail revealed great complexities involving substorms and fireballs and provided insight into the overall dynamics of the magnetosphere. The low levels of magnetic turbulence may be of significance with respect to the development of tearing mode dissipation for reconnection events. The IMP wave observations in the distant magnetosphere boundary region showed that the boundaries were quite diffuse and frequently purely defined. Finally, nearly simultaneous IMP 7 and 8 comparisons were used to achieve an understanding of shock structure and propagation. M.G.

N80-32321# Laboratorio di Ricerca e Technologie per lo Studio del Plasma nello Spazio, Frascati (Italy).
ISOTROPIC MODULATION OF GALACTIC COSMIC RAYS
Nunzio Iucci (Rome Univ.). Oct. 1979. 16 p. refs. Presented at 16th. Intern. Cosmic Ray Conf., Kyoto, Aug. 1979.
(LPS-79-12) Avail: NTIS HC A02/MF A01

Phenomena associated with cosmic ray isotropic modulation are reviewed. Both short-term and long-term variations are considered. For the most part, neutrino monitor data is cited. Results are used to explain solar activity cycle-related modulation fluctuations. The effects of Forbush decreases as well as cosmic ray modulation produced by coronal holes are touched on. Possible modulation as a result of 27 day recurrences is postulated. Finally, the power spectra of cosmic ray intensity fluctuations are analyzed using a maximum entropy method. Author (ESA)

99 GENERAL

N80-32322# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
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The report is organized in two parts. The first part summarizes the IR D work of the Research Center, which is the Division of the Laboratory devoted primarily to long term scientific research. The second part summarizes the IR D activities carried out in other, generally more applications oriented, groups of the Laboratory. GRA

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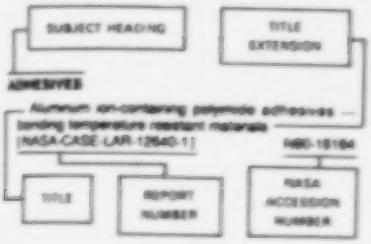

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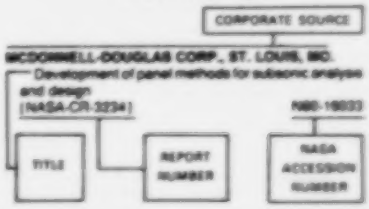

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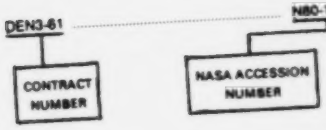

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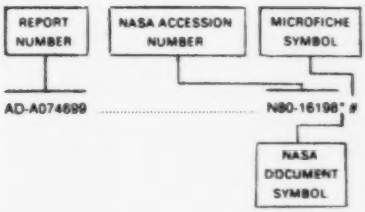

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 3083

02 AERODYNAMICS 3084

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 3087

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 3088

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 3091

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 3093

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 3093

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 3095

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 3095

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 3096

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS N.A.

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 3097

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

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Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 3098

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 3099

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 3099

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 3099

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 3100

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 3100

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 3102

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 3107

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 3111

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 3114

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) 3121

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 3124

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 3130

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 3135

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 3137

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For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

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Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 3140

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 3143

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 3144

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

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43 EARTH RESOURCES 3151

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 3156

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *85 Urban Technology and Transportation*.

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Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 3183

Includes weather forecasting and modification.

48 OCEANOGRAPHY 3187

Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 3188

Includes genetics.

52 AEROSPACE MEDICINE 3188

Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 3189

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 3190

Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.

Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 3192

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61 COMPUTER PROGRAMMING AND SOFTWARE 3192

Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 3194

Includes computer networks.

63 CYBERNETICS 3194

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 3194

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 3198

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 3200

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 3200

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

70 PHYSICS (GENERAL) 3200

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

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72 ATOMIC AND MOLECULAR PHYSICS 3203
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 3204
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

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Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 3217
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Includes information storage and retrieval technology, micrography, and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 3219
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 3220
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 3220
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 3221
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 3221
Includes planetology; and manned and unmanned flights.
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Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 3222
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GENERAL

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Note: N.A. means that no abstracts were assigned to this category for this issue.

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NASA ACCESSION NUMBER → N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif ← CORPORATE SOURCE

TITLE → STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE

PUBLICATION DATE

AUTHOR → D. J. Mourey 3 Sep 1979 409 p refs

(Contract NAS1-15624)

AVAILABILITY SOURCE

CONTRACT OR GRANT → (NASA-CR-159149) Avail: NTIS HC A18/MF A01

CSCL 01C ← COSATI CODE

REPORT NUMBER → The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, MINIMIZATION OF DIFFERENCES BETWEEN SIMULATED AND ACTUAL FLIGHT DATA FOR AREA NAVIGATION ON HIGH SPEED AIRCRAFT
A. Hargrove, Tuskegee Inst., Graduate School, *Tuskegee Institute, Alabama* 36088 (NAG 1-72)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0002, NON-STEADY COMBUSTION IN BURNERS FOR AIRCRAFT GAS TURBINES
F.E. Marble, California Inst. of Technology, School of Engineering, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 3-70)

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1.0003, JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS ANALYSIS OF COMPRESSIBLE FLOW IN SUBSONIC DIFFUSERS
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NAG 2-43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0004, THE JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS EXPERIMENTAL INVESTIGATION OF FLOW OVER A SINGLE BACKWARD FACING STEP
S.J. Kline, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (NAG 2-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0005, DROPLET IMPACT DYNAMICS AND HEAT TRANSFER
W.W. Bowley, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Mechanical Engineering, *Box U-37, Storrs, Connecticut* 06268 (NAG 3-64)

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1.0006, TRANSONIC AIRFOIL DESIGN BY OPTIMIZATION METHODS IN THE JOINT INSTITUTE FOR ADVANCEMENT OF FLIGHT SCIENCES AT NASA-LANGLEY RESEARCH CENTER
M.M. Hafez, George Washington University, Graduate School, *901 23rd St. N.W., Washington, District of Columbia* 20037 (NAG 2-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0007, SYSTEM 2000 AIRCRAFT/STORE INTERFACE DATA SYSTEM
J. Terranova, U.S. Dept. of Defense, Air Force, Armament Lab., *Eglin Air Force Base, Florida* 32542 (DF645320)

Air Force function - compatibility analyses and configuration control of aircraft and weapon interfaces. Deficiency - the aircraft/store interface data system (ASIDS), which was developed as a tool to assist in the above function, requires conversion to the System 2000 procedural language interface to simplify user access and system output. Objective - produce System 2000 PLI analysis software for the ASIDS to make the ASIDS capabilities available as a System 2000 resource. How work contributes - this effort will provide the DOD aircraft and store communities with a multi-user, accessible and centrally controlled aircraft/store electrical interface analysis capability.

The ADTC Math Laboratory will be tasked to convert the existing ASIDS electrical interface analysis software into System 2000's PLI software. Complete documentation in accordance with established military standards will be a product of this effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0008, PREDICTION OF SOUND RADIATION FROM DIFFERENT PRACTICAL JET ENGINE INLETS
B.T. Zinn, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (NAG 3-67)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0009, THE MECHANISMS OF FLAME HOLDING IN THE WAKE OF A BLUFF BODY
R.A. Strehlow, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (NAG 3-60)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0010, WATER DROPLET DYNAMICS IN ANNULAR CASCADE
S.N. Murthy, Purdue University, School of Mechanical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (NAG 3-62)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0011, AN ASSESSMENT OF GENERAL AVIATION DEICING SYSTEMS ON CONTEMPORARY AIRFOILS
D.L. Kohlman, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 3-71)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0012, DEVELOPMENT OF UNSTEADY SUCTION ANALOGY
C.E. Lan, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 1-75)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0013, RESEARCH ON UNSTEADY, THREE-DIMENSIONAL TRANSONIC FLOW
W.L. Harris, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 1-60)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0014, A STUDY OF SUPERSONIC THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS
A. Demetriades, Montana State University, School of Engineering, Dept. of Mechanical Engineering, *Bozeman, Montana* 59715 (NAG 2-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0015, MODEL DEVELOPMENT FOR SHOCK WAVE BOUNDARY LAYER INTERACTION EXPERIMENT
I. Greber, Case Western Reserve University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *University Cir., Cleveland, Ohio* 44106 (NAG 3-61)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0016, LAMARS MOTION MODIFICATION STUDY
L.R. Maki, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144190)

This effort supports engineering simulation research and development conducted in the Flight Control Development Laboratory. The AFFDL large amplitude multimode aerospace research simulator (LAMARS) has recently been found to have motion deficiencies which appear to be primarily software-oriented. The objective is to substantially reduce, if not eliminate, these deficiencies by analyzing and modifying the present motion system software. The quality of the motion cues has a direct bearing on the effectiveness of LAMARS simulations.

A thorough review and analysis of the LAMARS motion system software will be conducted. Available data on washout effects and adjustments will be compiled and assessed. Washout analysis will be performed on the CDC computer system. An analysis of the LAMARS system hardware will also be conducted as a performance check. Following demonstration and evaluation of the modified system, a manned simulation evaluation will be performed. Availability of the LAMARS system will affect the completion dates of certain portions of the project requiring its use.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, VISUAL SYSTEM MICROPROCESSOR DRIVE IMPLEMENTATION
J. Pollard, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143790)

This effort is in support of the engineering R&D simulation mission of the engineering flight simulation facility (AFFDL/FGD). It addresses the method of controlling and driving the terrain model visual system resident at the facility. The objective is to design and implement a microprocessor-based system for controlling and driving this system, with both hardware and software development anticipated. Fruition will result in the 'freeing' of a valuable general purpose computer for other applications, and help to establish in-house expertise in this area.

The approach involves a cooperative effort between AFFDL/FGD and USAFA/DFEE over approximately a one-year period. Most hardware and system software aspects will be handled by DFEE, while visual-related software will be handled primarily by FGD. Cross-involvement is of course expected and is to be encouraged for training reasons. A project schedule is currently under mutual formulation and review. The scheduling indicates parallel development of hardware and software portions with mutual feedback influencing later portions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, FLAP-LAG-TORSIONAL DYNAMICS OF EXTENSIONAL AND INEXTENSIONAL ROTOR BLADES IN HOVER AND IN FORWARD FLIGHT
M.R. Crespo Da Silva, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NAG 2-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0019, DEVELOPMENT OF AN AIRFOIL ICE ACCRETION MODEL
J.K. Luers, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (NAG 3-65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0020, THE SPINNING OF LIGHT AIRCRAFT
B.W. McCormick, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Aerospace Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NAG 1-73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0021, GENERATION OF COST- AND FUEL-OPTIMAL VERTICAL FLIGHT PROFILES
J.F. Wiggs, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (NAG 1-69)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, EFFECTS OF PAYLOAD HANDLING CONSIDERATIONS ON SPACE SHUTTLE TRAJECTORIES DURING PROXIMITY OPERATIONS
W.T. Fowler, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

Research is being conducted into the proximity operations, or rendez-vous, phase of space shuttle missions involving payload recovery. One- and two-impulse trajectories from station-keeping locations within 1000 feet of the target body payload are being considered. A one-impulse trajectory is defined to have a final relative velocity less than or equal to 0.2 ft./sec. This value is the maximum allowable rate (at maximum payload mass of 3200 lbs.) for RMS capture. All successful rendez-vous

trajectories must meet rigid constraints on plume impingement, crew visibility, total fuel consumption, total coast time (time from first impulse to final approach), and safety. This continuing project is in its second year.

SUPPORTED BY University of Texas

2.0002, NONLINEAR ESTIMATION THEORY
B.D. Tapley, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: By the application of the Martingale Theory and smoothing properties to the study of nonlinear stochastic dynamic systems, an approximate nonlinear estimation algorithm has been developed. In order to determine its effectiveness, the nonlinear estimation algorithm as well as the extended Kalman filter are applied to the problem of estimating the trajectory of a planetary spacecraft using range, range-rate, sun-planet and star-planet angle measurements. The result of the computer-simulated study shows that the nonlinear algorithm is superior to the extended Kalman filter when the measurements are highly nonlinear. A comparison of the algorithm with other nonlinear estimation algorithms is being made also. This line of research is expected to extend for several years.

SUPPORTED BY University of Texas

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, INVESTIGATION OF MITOCHONDRIA AS A MEANS TO DETERMINE THE EFFECTS OF SPACE WEIGHTLESSNESS ON THE AGING PROCESS OF DROSOPHILA
L.S. Yengoyan, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCA 2-675004)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0002, SELECTION AND TESTING OF DIAPHRAGM MATERIALS FOR HIGH TEMPERATURE PRESSURE TRANSDUCERS
J.D. MacKenzie, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Materials Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (NAG 3-69)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0003, LIQUID LITHIUM CORROSION AND CORROSION FATIGUE RESEARCH
Unknown, Colorado School of Mines, Graduate School, *Golden, Colorado* 80401 (EY-76-S-02-2313)

Liquid lithium corrosion kinetics (weight loss and intergranular penetration) of ferrous alloys are being established as a function of impurity content, temperature and stress. Materials being investigated are iron, iron-chromium and iron-chromium-nickel alloys, such as 2 1/4 Cr - 1 Mo steel and type 304 stainless steel. Deformation-enhanced corrosion is being studied by various modes of loading, including torsional fatigue techniques which allow large amounts of strain without specimen instability. Spindle techniques are also being applied to determine the influence of the fluid velocity of the liquid lithium. Mossbauer spectroscopy, Auger secondary electron spectroscopy and electron microscopy are being applied to better understand the nature of the lithium-penetrated grain boundaries.

RESULTS: Mathematical expressions for grain boundary penetration and weight loss rate coefficients, as functions of the nitrogen content and temperature, were established for 304L stainless steel in liquid lithium. The environmental conditions where each mode of attack is dominant are being determined. Deformation-enhanced corrosion behavior has been reported. An MTS mechanical testing system has been installed in a protective atmosphere box to determine the role of deformation of the corrosion processes.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0004, RESEARCH ON DEFORMATION PROCESSES IN REFRACTORY METALS
Unknown, State University System of Florida, University of Florida, Graduate School, *Gainesville, Florida* 32601 (EY-76-S-05-3262)

The mechanical properties of metals and alloys can be strongly influenced by phenomena other than simple slip. Among these perturbing phenomena are dynamic strain-aging, mechanical twinning, and dynamic recovery. The nature of these, and the magnitude of their effects on the stress-strain behavior of the metals titanium, niobium, vanadium and tantalum containing interstitial impurities, are being determined. Emphasis is now being placed on an attempt to find interrelations between dynamic strain-aging and slow strain-rate embrittlement. In transition metals, both types of phenomena can be caused by interstitial elements such as hydrogen, oxygen, nitrogen and carbon when the latter is in solid solution. Specific attention is being paid to the niobium-oxygen-hydrogen, niobium-oxygen and vanadium-hydrogen systems. Tensile tests will be carried out to fracture on specimens of high purity niobium and vanadium alloyed with the appropriate interstitials between 4 and 1100 K at several strain rates. Internal friction, fractographic ductility and stress-strain data from these tests will be correlated and analyzed. These tests will be complimented by static strain-aging tests in which the specimens are aged under stress.

RESULTS: During the past year, as part of this project, the diffusion coefficients of oxygen and nitrogen were remeasured in the three type Va metals. Improved torsion pendulum and elastic after-effect techniques were employed. In these procedures the data were analyzed with the aid of a non-linear least squares computer optimization program. These new data, when combined with existing high temperature data in the literature, favor the assumption that O and N occupy octahedral sites in the type Va bcc lattice.

SUPPORTED BY U.S. Dept. of Energy

3.0005, STUDIES OF POINT DEFECTS ON MECHANICAL PROPERTIES OF METALS INCLUDING ELECTRON IRRADIATION STRENGTHENING OF ALL SINGLE CRYSTALS
M. Meshii, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science & Engineering, *633 Clark St., Evanston, Illinois* 60201 (EY-76-S-02-1367)

The effect of point defects on the mechanical behavior of b.c.c. metallic single crystals is being investigated. The point defects under investigation are interstitial atoms produced by electron irradiation (1 to approximately 2 MeV) and interstitial solutes introduced by diffusion annealing. This study will characterize the electron irradiation effects on the mechanical properties of metals and alloys and, at the same time, will enhance the understanding of strength and its dependence on experimental parameters such as temperature, strain rate, and structure of specimen materials in terms of the atomic mechanisms involved. The current emphasis is on the comparison of iron and niobium single crystals in the irradiation effect and the surface film effect.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0006, USE OF VERY HIGH PRESSURE TO INVESTIGATE THE STRUCTURE OF MATTER
H.G. Drickamer, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Chemical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

The basic thesis of our research is that high pressure is an essential tool for understanding electronic phenomena in condensed systems. With increasing compression there is increased overlap among electronic orbitals. Different types of orbitals are

perturbed to different degrees. A study of these perturbations permits one to characterize electronic states and excitations, to test theories, and, under some circumstances, to induce electronic transitions to new ground states.

Our current research centers around luminescence measurements. We can measure energies and peak shapes over a range from 240 to 1200 nm, lifetimes to as fast as one nanosecond, and efficiencies as low as 10 to the minus 5th power to 10 to the minus 6th power. With these techniques we study the behavior of a variety of organic and inorganic solutes in crystalline, liquid and amorphous (polymers and glasses) media.

The types of phenomena with which we are concerned include energy transfer, Jahn-Teller splitting of excited states, phonon-assisted transitions, radiationless transition rates, intersystem crossing, the mixing of n-pi and pi-pi excitations, and the structure of the excited state in complexes.

SUPPORTED BY U.S. Dept. of Energy

3.0007, SEMICONDUCTOR CRYSTAL GROWTH BY ION BEAM SPUTTERING

J.E. Greene, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Metallurgy & Mining Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-1198)

Energetic particle-surface interactions play a determining role in the growth of compound semiconductor thin films by sputtering. An ultra-high vacuum ion beam sputtering system containing in situ analytic techniques such as low-energy electron diffraction, Auger electron spectroscopy, modulated mass spectrometry, and secondary ion mass spectrometry has been developed in order to investigate the effects of energetic particle bombardments during film growth on elemental sticking probabilities, nucleation kinetics, enhanced interfacial diffusion, and film growth morphology. The growth of metastable alloys is also being studied.

SUPPORTED BY U.S. Dept. of Energy

3.0008, MICROCHEMISTRY OF SOLIDS

C.A. Wert, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Metallurgy & Mining Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

Many second-phase compounds in solids are extremely fine particles and are widely dispersed through the solids. Alloying elements which strengthen materials--commonly carbides, oxides, or nitrides--oftentimes are dispersed in particles of size 50 to a few hundred Angstroms. Determination of crystal structure and chemical compound of these dispersions is being made using quantitative analytical electron microscopy. Using these techniques, we have determined the crystal structure and stoichiometry of carbides in a mixed vanadium-titanium-carbon alloy. Three carbides exist in three aging regions, one just above room temperature, one at about 600 degrees C and one at temperatures over 1000 degrees C. These carbides can be completely characterized down to particle sizes around 300 to 500 A. This work is being transferred to another project and some new work related to microchemistry of inclusions in coal is being investigated. The structure and composition of iron sulfides in a coal char derived from a liquefaction process are being examined. Using transmission electron microscopy, we are beginning to examine the mineral constituents in coal itself.

SUPPORTED BY U.S. Dept. of Energy

3.0009, HIGH-TEMPERATURE EFFECTS OF INTERNAL GAS PRESSURE IN CERAMICS

A.A. Solomon, Purdue Research Foundation, *West Lafayette, Indiana* 47907 (EY-76-S-02-2713)

Experimental study of the role of entrapped gases and microstructure on the rate-controlling mechanisms of pressure-induced densification and swelling of ceramics is to be made, with emphasis on grain size and stoichiometry effects in single-crystal and polycrystalline CoO. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0010, COBALT IN NICKEL-BASE SUPERALLOYS

J.F. Radavich, Purdue University, School of Materials Engineering, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NAG 3-59)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0011, PHOTOIONIZATION AND FIELD IONIZATION OF HIGHLY EXCITED ONE- AND TWO-ELECTRON ATOMS

D. Kleppner, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EG-77-S-02-4370)

Experimental studies of the structure of highly excited (Rydberg) states of one- and two-electron atoms in high electric fields; photoionization processes in atomic species close to their ionization limits. Such species exhibit relatively long lifetimes (compared to those atoms excited in lower levels of excitation) and offer unique opportunities to probe atomic structure and electron correlation phenomena. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy

3.0012, NUCLEAR MAGNETIC RESONANCE STUDIES OF POLYPHOSPHAZENE POLYMERS AND METALLIC ALLOYS

P. Sagalyn, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G4726)

(1) To determine the microstructure(s) and thermal properties of polymers having phosphorous-nitrogen backbones, and to correlate them with bulk properties to help produce improved polyphosphazenes. (2) By using the electric field gradient to determine the changes which occur in the immediate vicinity of point defects in metals, to improve the characterization of radiation damage, damage due to ion implantation, and solvent-solute interactions. To characterize beryllium metal and alloys via NMR for quality assurance and for gaining understanding that will lead to improved materials for missiles, aircraft and composites.

(1) NMR spin-lattice relaxation times and line parameters will be measured as functions of temperature to characterize the motions of l-side chains and backbone in poly(bis(trifluoroethoxy)phosphazene). If time permits, other poly(alkoxy-phosphazenes) will be examined. (2) Extensions of our theory of EFGS due to point defects in metals will be applied, as time permits, to dilute alloys of and vacancies in aluminum. Manuscripts on Be and BeNi, currently in first draft form, will be completed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0013, THE RADIATION CHEMISTRY OF LIQUID AND PLASTIC CRYSTALS

Unknown, University of Mississippi, University Campus, Graduate School, *126 Biology Bldg., University, Mississippi* 38677 (EY-76-S-05-3781)

The purpose of this investigation is the understanding of the radiation chemistry of compounds in the nematic liquid crystal state and of compounds in the plastic crystal state. From the understanding of the radiation chemistry in these mesomorphic states, it is the intention of this study to develop a model or models to explain the effects of radiation. Due to the liquid-like nature of these mesomorphic states, the initial effort is directed to a modified diffusional model.

In addition to the standard radiation chemical approach to this problem, several other approaches are being made. One of these involves determination of the rotational energy barriers from polarized optical transmission spectra. The second involves determination of the diffusional barriers from nmr T1 (rho) measurments. The third approach involves determination of the initial G-values and nature of the species initiating the reactions from positron probe lifetime studies.

SUPPORTED BY U.S. Dept. of Energy

3.0014, HYDROGEN CYANIDE REACTIONS IN COMBUSTION SYSTEMS
W.J. McLean, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (EG-77-S-02-4457)

Studies of the chemical processes associated with hydrogen cyanide in combustion environments by the use of a single pulse shock tube with product analysis by gas chromatography. A high temperature fast flow reactor is also used with product analysis by quadrupole mass spectrometry. The two techniques make possible observations spanning a wide range of reaction times and temperatures; comparison of measured compositions with predictions based on plausible models for the reactions. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy

3.0015, DEFECTS OF METAL CRYSTALS
R.W. Balluffi, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (EY-76-S-02-3158)

The objective of the present research effort is a broad investigation of the properties of crystal defects in metal crystals. Attention during the past year was focused on point-defects (vacancies, self-interstitial atoms (both substitutional and interstitial) and aggregates of point-defects. A strong emphasis was placed on the use of different irradiating species (300-700 eV Xe positive ions, 100 to 1500 eV He positive ions, 250 to 2000 eV Ne positive ions, 30 keV W positive Mo positive or Cr positive ions, and fast neutrons) to introduce both vacancies interstitials (self and impurity) in a number of different pure metals (Mo, Au, W) and alloys (W(Re)), Mo (Ti), Mo (Ti plus Zr), Ni4Mo, Pt3CO, Ni3Fe and Ni3Mn). Progress was made in the following areas: (A) The Direct Observation of the Point-Defect Structure of Depleted Zones in Ion-Irradiated Metals; (B) The Spatial Distribution of Self-Interstitial Atoms Within and Around Depleted Zones; (C) An FIM Study of Stage I Recovery of Ion-Irradiated Molybdenum; (D) The Transmission Sputtering of Gold Thin Films by Low Energy (less than 1 keV) Xenon Ions; (E) Atom-Probe Field-Ion Microscope Studies; (F) The Range of Focused Collision Replacement Sequences in Ordered Alloys and the Random Disordering of Ordered Alloys; (G) The Recovery Behavior in Stages I, II and III of Proton-Irradiated Tungsten; and (H) the Fast-Neutron Irradiation of Wire Specimens in EBR-II.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0016, ATOMIC AND MOLECULAR PROPERTIES AND THEIR RELATIONSHIP TO SEPARATION PROCESSES
W.L. Taylor, Monsanto Research Corp., Mound Laboratory, *P.O. Box 32, Miamisburg, Ohio* 45342

Investigation of fundamental isotope properties for the improvement of isotope separation processes; experimental and theoretical work on gas transport and thermodynamic properties in solid, liquid, and gas phases; thermal diffusion factors by the Trennschaukel and two-bulb methods; isotopic vapor pressures; mutual diffusion coefficients; total and differential atomic scattering cross-sections; fundamental atomic interactions by evaluation of the intermolecular potential. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0017, CHEMICALLY MODIFIED ELECTRODES
W.J. Wallace, Muskingum College, Undergraduate School, Dept. of Chemistry, *New Concord, Ohio* 43762 (NAG 3-79)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0018, STUDY OF THE IONIZING RADIATION-INDUCED REACTIONS IN ORGANIC COMPOUNDS
Unknown, Ohio State University Research Foundation, *1314 Kinnear Rd., Columbus, Ohio* 43212 (EY-76-S-02-1116)

Determination of enhancement of Ar excimer and Ar (ls) atom yields by admixture of Ne and Ar, measurement of rate constants for growth and decay of Ar excimers and Ar/Ne mixed excimers, measurement of rate constants for quenching of Ar (ls) atoms and transient and metastable Ar excimers by N2 and elucidation of mechanisms for decay of Ne (ls) atoms in pure Ne gas - by fast spectrophotometric monitoring of absorbing species following passage of brief, high current, high kinetic energy electron beam pulses through samples of rare gases and mixtures containing rare gases.

RESULTS: Ar (ls) atoms in pure Ar decay entirely via formation of Ar excimers at 100 to 700 torr, 153K to 300K. Resonance state Ar (ls) atoms as well as metastable state Ar (ls) atoms decay through first excited singlet excimer state - the latter by means of inverse predissociation from the first metastable state of the excimer. Temperature coefficients of Ar (ls) decay constants are small, positive and attributable to effects of temperature on collision frequencies of elementary steps.

SUPPORTED BY U.S. Dept. of Energy

3.0019, STRUCTURE OF GLASSES CONTAINING TRANSITION METAL IONS
W.B. White, Pennsylvania State University, University Park Campus, Materials Research Lab., *Research Center, Room 212, University Park, Pennsylvania* 16802 (EY-76-S-02-2754)

This research concerns the structure and behavior of insulator glasses with respect to the transition metals as additives. The research strategy is to prepare silicate, borate, and other host glasses, and to study the local structure, interaction with glass structure influence on nucleation and crystallization and phase separation of a selected set of transition metal ions. Experimental approaches include structure of glass by Raman spectroscopy, local structure around transition metal ions by optical absorption and luminescence spectroscopy, experiments on the controlled reduction of the transition metals to investigate the effect of oxygen activity in the glass and the way in which the transition ions are bound to the glass structure. Completed investigations include structure of nitrate glasses, structure of lead silicate glasses, identification of molecular chromate and dichromate groups in silicate and borate glasses, optical and luminescence spectroscopy of Cr3 ions in silicate glass, construction of several theoretical models for molecular relaxation and electron-phonon interactions, and the role of iron and titanium in silicate glasses.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0020, CERAMIC MATERIALS FOR HIGH-TEMPERATURE PRESSURE TRANSDUCERS
R.C. Bradt, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Materials Engineering, *116 Deike Bldg., University Park, Pennsylvania* 16802 (NAG 3-68)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0021, ANGULAR MOMENTUM EFFECTS IN NUCLEAR REACTIONS
Unknown, Texas A & M University, College Station Campus, Cyclotron Inst., Dept. of Chemistry, *College Station, Texas* 77843 (EY-76-S-05-3924)

Research supported by ERDA contract E(40-1)-3924 will be continued. Counter telescopes will be used to measure the yields, energy distributions and angular distributions of elements produced in the reactions induced by heavy ions of energies less than or equal to 100 MeV/amu. Mechanisms of interaction will be deduced. Theoretical models of reaction mechanisms, potential energy surfaces and nuclear properties under conditions of high angular momentum will be tested. Projectiles of 12C, 14N, 16O, 20Ne and 40Ar will be employed. In a collaboration involving LASL, LBL, BNL, ORNL and TAMU, attempts will be made to make direct on-line mass measurements of neutron-rich nuclei produced in the reactions of 800 MeV protons with uranium.

RESULTS: Cross-sections, energy distributions and angular distributions for the deep-inelastic and fusion reactions of 197 MeV 12C with Ni, Y, Ag, Tb and Au targets have been meas-

ured. The gamma-ray multiplicities of products of the reactions of 120 MeV 20Ne with 27Al have been measured. Five new neutron-rich isotopes, 27Ne, 31Mg, 32Mg, 34Al and 39P have been discovered.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0022, IMPURITY EFFECTS ON THE CREEP OF POLYCRYSTALLINE MAGNESIUM AND ALUMINUM OXIDES AT ELEVATED TEMPERATURES

R.S. Gordon, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Materials Science & Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (EY-76-S-02-1591)

Steady-state creep studies (constant load and stress relaxation) under four-point bending and tensile conditions will be conducted at temperatures between 1100 and 1600 degrees C on dense polycrystalline MgO and Al2O3 specimens which have been doped with transition metal impurities (e.g., Fe, Cr, Mg, Mn, Ti). Tests will be conducted over a range of stresses (up to 20,000 psi) and oxygen partial pressures (1-10 atm). Test specimens are fabricated by vacuum hot pressing at 1500-1700 degrees C. After fabrication and before creep, testing specimens are annealed at 1450-1900 degrees C. to stabilize the grain size and/or to insure a uniform impurity distribution.

The overall objective of these studies is to understand the role of impurities in governing the relative roles of the diffusional, unaccomodated grain boundary sliding, and dislocation mechanisms to the high temperature creep of polycrystalline MgO and Al2O3. Secondly, the role of lattice defects which are created by solid solution impurities in diffusional creep processes will be evaluated. Impurities and experimental variables such as temperature, oxygen partial pressure, and grain size which contribute to increased high-temperature creep resistance are of major interest.

RESULTS: The creep of hot-pressed, high purity polycrystalline magnesium oxide takes place both by non-viscous (dislocation) and diffusional modes depending on the stress and grain size. Diffusional creep has been identified in high purity, fine-grained MgO by evaluating transient creep data in terms of simultaneous grain growth. Doping with iron in amounts up to about 5 cation percent has several effects on the high-temperature creep behavior. 1. Diffusional contributions to the creep rate are enhanced and are dominant for small grain sizes and stresses. 2. Increasing amounts of trivalent iron in solid solution lead to increased rates of viscous creep due to cation vacancy information but they have little or no effect on non-viscous or dislocation mechanisms of creep, which are dominant at high stresses in coarse-grained material. Iron in solid solution makes the diffusional creep rate sensitive to the oxygen partial pressure. Creep rates in oxidizing atmospheres are faster than those in reducing environments. (Text Abridged)

SUPPORTED BY U.S. Dept. of Energy

3.0023, X-RAY STUDIES OF THE BEHAVIOR OF TITANIUM AND MOLYBDENUM FILMS ON SILICON SUBSTRATES

C.R. Houska, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Materials Engineering, *Blacksburg, Virginia* 24061 (DMR77-26824)

This research will be a study of high-temperature reaction kinetics between thin films of titanium or molybdenum and silicon single crystal substrates. Reaction of such films with silicon to form metal silicides is used to form ohmic contacts and barriers on silicon semiconductor devices.

The major experimental tool to be used in these studies will be X-ray diffraction with supporting scanning electron microscopy. X-ray data will be collected at elevated temperatures to determine the identity, thickness, and orientation factors for each phase formed during the reaction. Computer simulations will be used to fit diffusion profiles. The X-ray line shape data will be analyzed to obtain uniform and non-uniform strain in the film and reaction layers, as well as to obtain subgrain size.

This is a renewal of NSF Grant DMR75-17201.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0024, ENVIRONMENTAL DEGRADATION OF ENGINEERING MATERIALS II

M.R. Louthan, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Materials Engineering, *Blacksburg, Virginia* 24061 (NAG 3-78)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, RADIATION AND SCATTERING OF IONIZED LIGHTNING CHANNELS

T.H. Shumpert, Auburn University, School of Engineering, Dept. of Electrical Engineering, *Auburn, Alabama* 36830 (NAS 8-33880)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0002, ELECTROSTATIC FUEL CONDITIONING OF INTERNAL COMBUSTION ENGINES

P.I. Gold, California State University & Colleges, California State University, Los Angeles Campus, School of Engineering, Dept. of Mechanical Engineering, *Los Angeles, California* 90032 (NAG 3-73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0003, STUDY TO DETERMINE POSSIBILITY OF SATELLITE USE IN BPA

Unknown, Edutel Communications Inc., *Palo Alto, California* 94304

SUPPORTED BY U.S. Dept. of Energy

4.0004, MIST-FLOW OCEAN THERMAL ENERGY PROCESS

S.L. Ridgway, R & D Associates, *4640 Admiralty Way, P.O. Box 9695, Marina Del Rey, California* 90291 (W-7405-ENG-26-SUB 7613)

The objective of this project is to determine the feasibility of the mist lift ocean thermal energy process. Essential components of the system are to be developed and tested. The fluid dynamics of the two-phase flow that takes place in the lift tube should be understood in sufficient depth and detail to enable reasonable projections of the operating characteristics and boundaries of the possible capital costs of a mist flow ocean thermal energy plant. The influence of mist parameters (droplet size, droplet size distribution) and transport parameters (pressure gradient, duct profile, and velocity schedule) on the lift effectiveness of the two-phase flow is to be determined.

A thermodynamic analysis of the mist flow process is complete. The two-phase flow analyses were based on the assumption of constant lift effectiveness and preliminary choices of possible duct area profiles, injection velocity, and flow velocity schedule. The results of this analysis were used for the technical and cost assessments. Analyses of experimental results will be followed so that a baseline mist lift efficiency can be established. Previous systems analysis showed that a low lift efficiency would not raise capital costs excessively.

SUPPORTED BY U.S. Dept. of Energy, Office of Solar Geothermal Electric & Storage Systems

4.0005, THERMOELECTRIC GENERATOR TESTING AND RTG DEGRADATION EVALUATION
G. Stapfer, U.S. National Aeronautics & Space Admin., Jet Propulsion Lab., *4800 Oak Grove Dr., Pasadena, California* 91103

The objectives of this work are: (1) life testing of thermoelectric generators representing technologies proposed for and used in space flight RTGs to accumulate a performance base not available elsewhere; and (2) to understand the degradation mechanisms in a high-temperature selenide thermopile through materials and power module testing with the aim of formulating a model to predict its long-term behavior.

SUPPORTED BY U.S. Dept. of Energy

4.0006, CAPACITANCE AND CONDUCTANCE DEEP LEVEL TRANSIENT SPECTROSCOPY
L. Forbes, University of California, Davis Campus, School of Engineering, Dept. of Electrical Engineering, *Davis, California* 95616 (ENG79-11373)

An electronic measurement system is being acquired that is used to detect deep level electronic energy states in semiconductor materials. The system uses capacitance and conductance data as functions of temperature to deduce properties of the states. Surface oxide and bulk traps in gallium arsenide and silicon-on-sapphire films are being investigated with the aid of the system.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0007, SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEMS PHASE I
Unknown, Martin Marietta Corp., Denver Division, *P.O. Box 179, Denver, Colorado* 80201 (ET-78-C-03-2234)

SUPPORTED BY U.S. Dept. of Energy

4.0008, BASIC MECHANISMS INFLUENCING SOLAR CELL EFFICIENCY FOR TERRESTRIAL APPLICATIONS
F.A. Lindholm, State University System of Florida, University of Florida, School of Engineering, Dept. of Electrical Engineering, *220 Black Hall, Gainesville, Florida* 32611 (EY-76-S-05-5134)

The objectives of this research are: (1) to determine and describe the basic mechanisms that control and limit solar-cell conversion efficiency; (2) to develop mathematical models that enable the inclusion of these mechanisms in the engineering design of solar cells; and (3) to explore design improvements based on the understanding gained of the basic mechanisms. By basic mechanisms are meant the mechanisms that determine the transport, recombination, and generation of electrons and holes in semiconductor material and, thereby, in large measure, determine the solar conversion efficiency. Thus the research focusses on the mechanisms that control the electronic parameters, such as lifetime and effective band gap, that characterize the transport, recombination and generation processes. It focusses also on the basic mechanisms by which such design variables as injection level, doping profile, and device structure influence these processes.

SUPPORTED BY U.S. Dept. of Energy

4.0009, ICE/FROST DETECTION USING MILLIMETER WAVE RADIOMETRY
J.A. Gagliano, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAS 8-33800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0010, SURFACE TEMPERATURES AND GLASSY STATE INVESTIGATIONS IN TRIBIOLOGY
W.O. Winer, Georgia Inst. of Technology, School of Mechanical Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAG 3-77)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0011, SYNTHESIS AND OPTIMIZATION OF SPIRAL BEVEL GEAR TOOTH SURFACES
F.L. Litvin, University of Illinois, Chicago Circle Campus, School of Engineering, Dept. of Mechanical Engineering, *Box 4348, Chicago, Illinois* 60680 (NAG 3-48)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0012, MECHANICAL FEASIBILITY OF THE WLVEC ENGINE
G. Steelman, WLVEC Technology Co., *310 S. 11th St., Odel, Iowa* 50003 (DE-AC05-77ET20163)

The objective is to demonstrate the technical feasibility of a drogue-chute type model ocean energy conversion system.

The contractor will build a demonstration drogue-chute type ocean energy conversion test model to assess the efficiency of mechanical power conversion and perform scaling analysis of model to prototype.

A demonstration model has been fabricated. Most of the equipment has been purchased and assembled. The Power Loop (parachutes and drive cable) is completed. The Power Extraction wheels are partially completed. Testing will follow completion.

SUPPORTED BY U.S. Dept. of Energy, Office of Solar Geothermal Electric & Storage Systems

4.0013, PHOTOVOLTAIC GAS AS CELL THERMAL STUDY
I.D. Bankston, University of Southwestern Louisiana, College of Engineering, Dept. of Mechanical Engineering, *P.O. Box 3131, Lafayette, Louisiana* 70501 (NAS 8-33765)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0014, IMAGE COLLAPSING CONCENTRATORS
S.L. Sargent, Solar Energy Technology Inc., *Bedford, Massachusetts* 01730 (EG-77-G-04-4163)

Research and development project is directed toward discovery and development of optical collectors for solar energy using novel designs of stepped (Fresnel) lens and subreflectors. The following objectives are expected to be reached: (1) lenses for concentration ratios of 3 times or more which do not require movements or tracking of sun all year around; (2) lenses constructed of flat prisms of thin cross-section and low mechanical tolerance; (3) subreflectors which will improve the aperture efficiency of lenses to 80% or better and will allow for segmented operation of concentrators at operating temperature of approximately 100 degrees C; (4) development of low-cost, thinner lens concentrators using new Image Collapsing Concentrator Concepts proprietary with Solar Energy Technology, Inc.; and (5) prototypes and testing using Laser and Solar thermal procedures will be carried out.

SUPPORTED BY U.S. Dept. of Energy

4.0015, ENGINEERING APPRAISAL OF AERODYNAMIC AND ATMOSPHERIC EFFECTS ON DRY COOLING
Unknown, Cornell University, Ithaca Campus, Graduate School, *101 Sage Graduate Ctr., Ithaca, New York* 14850 (EY-76-S-02-2924)

SUPPORTED BY U.S. Dept. of Energy

4.0016, ELECTROCHEMICAL FLUORINATION OF POLYMERIC MATERIALS FOR HIGH ENERGY DENSITY AQUEOUS AND NON-AQUEOUS BATTERY AND FUEL CELL
C.C. Liu, Case Western Reserve University, School of Engineering, Dept. of Chemical Engineering, *University Cir., Cleveland, Ohio* 44106 (NAG 3-66)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0017, DEVELOPMENT OF OPTIMIZATION TECHNIQUES FOR CONTROL OF VEHICLE STORED ENERGY AND OPTIMIZATION OF HYBRID VEHICLE PROPULSION SECTION
J.F. Donoghue, Cleveland State University, School of Engineering, Dept. of Electrical Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NAG 3-84)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0018, TEST ANALYSIS TECHNIQUES
F. Ostdiek, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF463680)

Develop standardized in-house analysis techniques, algorithms, computational programs, and problem-solving methods in the areas of internal aerodynamics, flow measurement, aeroelasticity, and data reduction for use on all CRF test programs.

Review present-day industry and government testing techniques and build analytical, visual, computer, and small-scale tools tailored to the specialized needs of the CRF.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0019, MINI-TRACKER RANGING SYSTEM
R.M. Fike, Oklahoma State University, Graduate School, *211-215 Whitehurst Hall, Stillwater, Oklahoma* 74075 (NAS 6-3103)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0020, AUTOMATED DATA ANALYSIS SYSTEM IN LASER SPECKLE INTERFEROMETRY AND BOUNDARY INTEGRAL EQUATION METHODS
W.F. Ranson, University of South Carolina, School of Engineering, Dept. of Mechanical Engineering, *Admin. Bldg., Room 115, Columbia, South Carolina* 29208 (NAG 3-75)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0021, EVALUATION OF A WIND-WHEEL ELECTRIC-POWER GENERATOR
W.B. Swim, State University & Community College System of Tennessee, Tennessee Technological Unviversity, School of Engineering, Dept. of Mechanical Engineering, *P.O. Box 128A, Cookeville, Tennessee* 38501 (NAG 8-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0022, DEVELOPMENT OF THE MECHANICAL COMPONENT OF A HIGH PRECISION STRAIN GAGE ACCELEROMETER
F.H. Speckhart, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS10-9834)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

4.0023, DEVELOPMENT OF SYNTHETIC APERTURE RADAR DESIGN APPROACH FOR WIDE-SWATH IMPLEMENTATION
B.R. Jean, Texas A & I University, Graduate School, *W. Santa Gertrudis, Kingsville, Texas* 78363 (NAS 9-16102)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0024, DEVELOPMENT OF COMPUTER MODELS FOR THE PREDICTION OF LARGE DISTORTED REFLECTOR ANTENNA CHARACTERISTICS
S.M. Moskowitz, Old Dominion University, School of Engineering, Dept. of Electrical Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NAG 1-63)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0025, RESIDENT RESEARCH ASSOCIATESHIP PROGRAM
Unknown, Sweet Briar College, Undergraduate School, *Sweet Briar, Virginia* 24595 (NCA 1-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, PRODUCT END USER ANALYSIS INCLUDING ENVIRONMENTAL, SAFETY AND RETROFIT PROBLEMS FOR MEDIUM BTU SYNTHESIS GAS
S. Proffitt, University of Alabama in Huntsville, Graduate School, *Huntsville, Alabama* 35807 (NAS 8-33889)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0002, APPLICATIONS OF RADAR AND INFRARED AIRBORNE REMOTE SENSING TO GEOTHERMAL RESEARCH ON PILGRAM SPRINGS, ALASKA
R.B. Forbes, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (NAG 9-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0003, IMPACT CRATERING EXPERIMENTS
R. Greeley, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NAGW 56)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0004, INVENTORY AND CLASSIFICATION OF WINDFORMS
C.S. Breed, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02366)

Work planned for FY 79 includes: 1) Completion of the inventory and classification of martian windforms, and selection of appropriate frames to illustrate the Atlas of Martian Eolian Landforms. 2) Photographic and statistical analysis of select typical martian windforms for comparison with their terrestrial counterparts as seen on LANDSAT and high-altitude aerial pictures. 3) Compilation of an Atlas of Martian Eolian Landforms for submission as a NASA Special Publication in FY 80.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, RESEARCH IN RADAR APPLICATIONS
H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02347)

Side-looking radar images will be acquired from orbital and aircraft altitudes, using radar systems similar to those planned for future planetary missions. SEASAT images will be obtained at L-band frequency; look angle will be approximately 50 degrees. Same-side and opposite-side stereo radar images will be obtained by commercial simultaneous L-band and X-band radar systems. Interpretive geologic maps will be compiled from these

images of three areas. Geologic maps will also be compiled of the three areas from visible and IR wavelength images. Specific areas where the radar-generated map differs from the visible/IR map will be checked in the field. Conventional geologic mapping has already been completed in the areas chosen for this study; geologists responsible for the completed geologic mapping will be consulted when the field check is conducted.

Three test areas were chosen where diverse geologic units are thought to be analogous to those that will be imaged by future planetary missions, and where the most time and cost-effective studies can be conducted. Silt and sand dune patterns will be imaged and compared in the Cortez and Algadones areas. Basaltic and rhyolitic extrusive volcanic rocks, intrusive igneous rocks, and sedimentary formations will also be contrasted in the Cortez area. Lava flows, sedimentary rocks, dune fields and river channel deposits will be compared in the San Francisco volcanic field.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, SPACE SHUTTLE RADAR

G.G. Schaber, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02188)

STATE TO WHICH PROJECT PERTAINS: Arizona.

During FY 79 the project goals will be to further identify and refine techniques to obtain radar backscatter information on diverse terrain types that can be used to interpret radar images to be obtained by the Space Shuttle Radar (SIR-A experiment) during 1979. The project will also continue to provide other types of geologic support with regard to selection of terrain targets for the mission and mission operations.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0007, RADAR IMAGE PROCESSING RESEARCH

L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02350)

STATE TO WHICH PROJECT PERTAINS: Arizona.

Several types of radar images of a collection of geologic targets have been or will be acquired for input to digital image processing. The radar data that have been collected include two frequencies and two different polarizations; different resolutions, azimuths and depression angles for the same frequencies and polarization. From both aircraft and SEASAT data the objectives are to investigate the following areas: 1. geometric corrections to include point perspective projections; 2. clean-up of the digital data (i.e., noise removal techniques which include bit errors, drop-lines, speckle and coherent patterns); 3. digital registration for the radar images of differing frequencies, polarizations and look directions; 4. topography enhancement; 5. radar albedo enhancement; 6. digital mosaicking of several image strips; 7. elimination of the radar shadow by using two different look directions; and 8. development of digital filters which will minimize the 'ringing' effects from high contrast images.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0008, GALILEO NIMS

L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02238)

Provides scientific guidance and leadership in the design and fabrication of the NIMS instrument, in the design of the mission orbital sequences, and in planning ground-based data reduction and science analysis. This activity will be ongoing through 1985.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0009, FRAUNHOFER LUMINESCENCE

R.D. Watson, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Data Center, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001

STATES TO WHICH PROJECT PERTAINS: Western United States, Oklahoma, Maine, and Florida.

Laboratory measurements of the luminescence of selected gases present in natural seeps are planned to both quantify their luminescence properties and to determine their detectivity with the imaging FLD. Tank tests, using the imaging FLD suspended over the tank, will be conducted to correlate physical properties of oil (specific gravity, film thickness, weathering, etc.) and gas seeps with their luminescence properties. Luminescence images of selected sites of oil and gas seeps, as well as vegetated areas under hydrocarbon stress, will be acquired in cooperation with other federal agencies and the GEOSAT Committee.

Analysis of imagery acquired over areas of geochemically stressed vegetation, luminescent playas and uranium sandstones will proceed and will incorporate further refinements in image analysis techniques.

Additional sampling of materials in areas where FLD imagery was acquired is planned for atomic absorption and chemical analysis. Results of this analysis will permit a more accurate determination of the cause of luminescence anomalies.

A proposal to incorporate an imaging FLD in a shuttle experiment for acquiring luminescence images of selected areas on the Earth's surface from orbit altitudes will be submitted to the National Aeronautical and Space Administration (NASA).

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0010, GROUND-WATER HYDROLOGY OF THE COCONINO AQUIFER IN SOUTHERN APACHE COUNTY, ARIZONA - A MATHEMATICAL ANALYSIS

P.P. Ross, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Flagstaff, Arizona* (AZ 78-046)

Coconino aquifer will be the source of water for large ground-water withdrawals in the near future. Coronado generating plant and possible construction of a second generating plant will require additional water. Also, more water will be needed to support construction and maintenance personnel and satellite industries. Pumpage may increase by 50,000 AF within the next few years. Effects of the project pumpage are unknown because the ground-water flow system is poorly defined in part of the area.

The principal objectives are (1) to provide a preliminary estimate of the average recharge and discharge values and to difine the aquifer characteristics of that part of the Coconino aqifer that is within southern Apache County, and (2) to determine the potential effects of the projected ground-water withdrawals.

Potentiometric surface, aquifer thickness, water-level decline and aquifer characteristic data at selected points are available. Additional data required include estimates of recharge and discharge. Recharge will be estimated by a flow net analysis and discharge will be estimated on the basis of available spring-flow, stream-flow and pumpage measurements. The model will be calibrated using steady-state and transient-state techniques. When the model is calibrated the project pumpage values will be used to simulate water-level declines for the years 1985 and 2000.

The steady-state model was calibrated. The model seems to be sensitive to changes in transmissivity, which reflect the geologic structure of the area. Part of the report was written.

The transient-state model will be run to verify the steady-state calibration.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0011, STUDY OF AN OPTICAL SPECTROMETER TO MEASURE ATMOSPHERIC COMPOSITION FROM ENTRY PROBES
M.G. Tomasko, University of Arizona, Lunar & Planetary Lab., *Tucson, Arizona* 85721 (NAG 5-76)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0012, INVESTIGATION OF THE CHEMICAL DYNAMICS OF THE VENUS ATMOSPHERE
G.T. Sill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (NAGW 67)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0013, SOLAR DIAMETER MEASUREMENTS FOR STUDY OF SUN CLIMATE COUPLING
H.A. Sill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (NAS 5-26176)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0014, DYNAMICS OF PLANETARY ATMOSPHERES
A.P. Ingersoll, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sciences, *1201 E. California Blvd., Pasadena, California* 91109 (NAGW 58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0015, DEVELOPMENT OF MATHEMATICAL TECHNIQUES FOR ASSIMILATION OF REMOTE SENSING DATA INTO ATMOSPHERIC MODELS
J.H. Seinfeld, California Inst. of Technology, School of Engineering, Dept. of Chemical Engineering, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 1-71)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0016, INVENTORY AND CLASSIFICATION OF VOLCANIC FEATURES
C.A. Hodges, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02359)

In FY 79, we expect to complete a preliminary survey of mosaics made from Viking orbiter photographs, with the intent of obtaining a representative sample of candidate volcanic landforms. We can then formulate a scheme for classification and cataloging such landforms so that analyses and interpretations can be conducted systematically.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0017, A PLAN TO DEFINE A PROGRAM OF BASIC RESEARCH IN UTILIZATION AND EVALUATION OF INFORMATION DERIVED FROM REMOTELY SENSED DATA
J.E. Estes, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NAS 9-16077)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0018, CREEP OF ORTHOENSTATITE AT HIGH TEMPERATURE AND LOW STRAIN RATES
C.G. Sammis, University of Southern California, School of Letters Arts & Sciences, Dept. of Geological Sciences, *3551 University Ave., Los Angeles, California* 90007 (NAGW 43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0019, A LABORATORY INVESTIGATION OF THE REFLECTIVE PROPERTIES OF SIMULATED, OPTICALLY THICK CLOUDS
T.B. McKee, Colorado State University, School of Engineering, Dept. of Atomospheric Science, *Fort Collins, Colorado* 80523 (NAG 5-58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0020, REMOTE LASER MEASUREMENTS
L.V. Batlin, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA74278)

PROJECT OBJECTIVE: To investigate the possibilities for practical remote temperature measurements in the atmosphere on the basis of the Doppler broadening of the molecular spectrum. The basic principle is to measure the broadening of laser light scattered by molecules.

CURRENT YEAR PLAN: Operate a system which should be able to provide data which can be compared with theoretical predictions of the spectra from the lower part of the atmosphere for the effect of collective phenomena. The system is based on scanning both in height and in frequency.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0021, SOLAR X-RAY IMAGER INSTRUMENT
R. Grubb, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8B240458)

OBJECTIVE: To study the feasibility of a next-generation Solar X-Ray Imager Instrument.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0022, SUPPLEMENT TO PRE-PROFS
D. Haugen, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AC44423)

OBJECTIVE: To design, develop and install an automatic data-acquisition system for observing, analyzing and displaying surface wind, temperature, moisture, and precipitation within a one-hundred-mile radius of the Boulder/Denver area.

CURRENT YEAR PLAN: To complete the installation of an automated system based on weather stations currently in existence and to display time averages of the available data at the National Weather Service Office, Denver, Colorado. Emphasis will be to exploit existing meteorological sensors within the current year.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0023, PRE-PROFS
D. Haugen, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA75722)

OBJECTIVE: To design, develop, and install an automatic data-acquisition system for observing, analyzing, and displaying surface wind, temperature, moisture, and precipitation within a one-hundred-mile radius of the Boulder/Denver area.

CURRENT YEAR PLAN: To complete the installation of an automated system based on weather stations currently in existence and to display time averages of the available data at the National Weather Service Office, Denver, Colorado. Emphasis will be to exploit existing meteorological sensors within the current year.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0024, NEAR-SHORE METEOROLOGY
R.M. Reynolds, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (R7120848)

OBJECTIVE: As part of the OCSEAP effort, obtain a descriptive picture of the extent, magnitude, frequency and distribution of near-shore meteorological processes which contribute to the circulation and mixing of coastal waters.

CURRENT YEAR PLAN: An existing mesoscale model will be applied to each of three study areas with the resulting wind field to be analyzed in terms of forcing functions being modelled. Operational data will be collected from both synoptic scale and mesoscale instruments to obtain data in near-shore regions for verification of model output and for providing understanding of off-shore and along-shore wind variations.

PROGRESS REPORT: Wind data from several sources in the Yakutat area were collected. Several aircraft flights were made to provide large-scale near-synoptic coverage of the study area. Data indicate winds near the coast are more directional than those off-shore. The effect of the coastal range on turning coastal flow is evident.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Land Management

5.0025, GRAVITY WAVE STUDIES
J.W. Wright, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (RDJ44833)

Conduct a program of theoretical and experimental studies concerned with the effects of atmosperic gravity waves on the ionosphere and, in turn, with their effects on methods of observing the ionosphere.

SUPPORTED BY University of California

5.0026, LANDSAT AND AIRCRAFT IMAGERY FOR MINE-GROUND STABILITY EVALUATION
R.K. Rinkenberger, U.S. Dept. of Labor, Mine Safety & Health Admin., *P.O. Box 25367, Denver, Colorado* 80225

STATES TO WHICH PROJECT PERTAINS: Colorado, Utah, Wyoming, New Mexico, Kentucky, New York.

A suite of computer enhancement routines will be performed on five LANDSAT CCT's using the EROS Data Center GE-100 System. The tapes represent underground coal, limestone and salt mine sites and surface coal pits in New York, Kentucky, New Mexico, Wyoming, Utah, and Colorado. The sites have been extensively evaluated by the Mine Safety and Health Administration (MSHA) using conventional methods of imagery analysis. Initial observations using computer-aided imagery analysis, i.e., enhancement routines such as linear stretch, non-linear stretch (PFD) principle components, overview, and rationing, show promise for extending the interpretation capabilities related to mine-ground stability evaluations. The major output products from the exercise will be 35 mm slides of 90 separate images including annotated overviews, subscenes, ratios, lineaments, principal components, and composites.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0027, TREE-RING ANALYSIS OF RECENT SLIDE MOVEMENT, MANTI LANDSLIDE, UTAH
S.S. Agard, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Engineering Geology, *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9550-02400)

STATE TO WHICH PROJECT PERTAINS: Utah.

The major objective of this project is to test and further develop the techniques of tree-ring analysis as applied to recent mass movements through a detailed study of the Manti landslide. This includes evaluating the effects of the most recent movement (1974 to present) of the Manti landslide on tree growth, investigating the history and nature of movement prior to 1974 using tree rings, climate records, and air-photos, and examining the relationship between climate and slide movements. Efforts in the current year will include: 1. collection of additional cores and sections from within and adjacent to the Manti landslide; 2. preliminary analysis of tree cores collected during FY 78; 3. investigation of alternative numerical, graphical, and statistical analysis techniques; 4. compilation of climate records and other supportive data; and 5. preparation of preliminary reports.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0028, REMOTE MONITORING OF SOURCE PARAMETERS FOR SEISMIC PRECURSORS
G.L. Choy, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Global Seismology, *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9920-02383)

To search for and to accumulate statistics about spatial and temporal changes of waveforms and source parameters that can be associated with an imminent major earthquake.

To evaluate the effectiveness of a standardized and digitally recorded global network of seismographs as a remote monitor for these spatial and temporal changes.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0029, MOLE LAKE
B.D. Smith, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9780-02186)

STATE TO WHICH PROJECT PERTAINS: Wisconsin.

Ground geophysical surveys will be conducted to follow up the completed airborne geophysical survey to characterize potential areas of massive sulfide mineralization on Indian lands. New EM methods will be evaluated to determine their applicability to massive sulfide mineralization exploration. Computer contour maps of the airborne data will be constructed for use in both metallic and non-metallic mineral evaluations. IP complex resistivity surveys will be used where needed to help differentiate metallic from non-metallic conductors (e.g., sulfides versus graphites). Bore hole geophysical surveys will be used to help establish the nature of the electrical properties of the felsic volcanic units that are the host rocks for massive sulfide mineralization.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0030, RESEARCH ON THE CAUSES OF THE TEMPORAL CHANGES IN THE EARTH'S ALBEDO
H. Dhuria, University of the District of Columbia, Undergraduate School, *4100 Connecticut Ave. N.W., Van Ness Campus, Washington, District of Columbia* 20008 (NAG 5-75)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0031, KENNEDY SPACE CENTER PRECIPITATION MONITORING PROGRAM
B.C. Madsen, State University System of Florida, University of Central Florida, School of Arts & Sciences, Dept. of Chemistry, *P.O. Box 25000, Orlando, Florida* 32816 (NAS10-9841)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

5.0032, INVESTIGATIONS OF MEDIUM WAVELENGTH MAGNETIC ANOMALIES IN THE EASTERN PACIFIC USING MAGNETIC FIELDS MONITOR SATELLITE DATA
C.G. Harrison, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., *4600 Rickenbacker Cswy., Coral Gables, Florida* 33149 (NAS 5-26201)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

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5.0033, RESOURCE EVALUATION OF THORIUM AND ASSOCIATED HEAVY MINERAL-BEARING SAND OF THE COASTAL AREA OF GEORGIA

K. McConnell, State Geological Survey, *19 Martin Luther King Dr. S.W., Room 400, Atlanta, Georgia* 30334 (14-08-0001-G-491)

STATE TO WHICH PROJECT PERTAINS: Georgia.

Recently the Coastal Plains Commission has made an aeroradiometric map that includes the coastal area of Georgia. This project is to explore radiometric highs over beach sands for possible heavy mineral deposits. Work will be carried out by drilling holes in six areas. Heavy minerals will be separated and those samples containing more than two percent heavy minerals will be further processed for their thorium and titanium content.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0034, HAWAIIAN VOLCANISM AND ITS PLANETARY IMPLICATIONS

D.W. Peterson, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Hawaiian Volcano Observatory, *Hawaii National Park, Hawaii* 96718 (9720-02162)

STATE TO WHICH PROJECT PERTAINS: Hawaii.

The planetary geology program at the Hawaiian Volcano Observatory strives to promote scientific interaction between observatory staff and researchers interested in planetary volcanism. This is accomplished through topical studies by Observatory staff and visiting planetary geologists. Plans for FY1979 include compilation of two or more comprehensive photo-atlases of Hawaiian landforms and surface features.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0035, RADAR

K.H. Shreeve, U.S. Dept. of Commerce, Equipment Development Lab., *Silver Spring, Maryland* 20910 (8AA830)

TECHNICAL OBJECTIVE: Cooperative effort to study new techniques and equipment to improve the NWS weather radar facility and its usefulness. EDL, in cooperation with the National Severe Storms Laboratory (NSSL), Norman, Oklahoma, SDO's Technique Development Laboratory (TDL), OTS, OM&O, and others, will work to improve hydrologic and meteorologic output products, communications, and to establish new equipment and technique requirements and specifications.

APPROACH: 1. Continue the joint experimental program with NSSL, OTS, and OM&O to establish an operational Doppler radar configuration and field techniques. 2. Experiment with the Signal Variability Processor (SVP) to establish the best use of pulse-to-pulse difference techniques. 3. Study state-of-the-art techniques in radar, display and communications in preparation for the procurement and operation of a next generation radar prototype facility.

PROGRESS: Signal processing, data processing, and display techniques for both conventional and Doppler radar are under investigation for possible application to new radar systems. An experimental color display system was developed for use on the National Severe Storms Laboratory's (NSSL) Doppler radar. Doppler radar's use for velocity measurements is key to providing advanced severe weather warnings, in particular for tornadoes and damaging wind situations. The Radar Data Processor (RADAP) equipment's functional design and specification was completed, and it is now in the procurement cycle. This equipment will provide the first operational automated data processing, communications and display equipment. As next generation radars become available, RADAP will be expanded and become an integral part of the system. Analysis of the operational use of SVP data has proven complicated. Additional statistical analysis hardware has been constructed and recording equipment procured to allow computer analysis, hopefully leading to a better understanding and improved use of SVP data. The success of several RADAP output products, such as rainfall accumulation, depends on the non-weather echo rejection ability of the SVP equipment.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service

5.0036, AGRICULTURAL WEATHER PREDICTION - GENERAL AGRICULTURAL WEATHER GUIDANCE

G.M. Carter, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8D43102)

OBJECTIVES: To develop automated techniques for prediction of weather variables of general importance to agriculture throughout the United States. These forecasts will be used primarily as guidance for NWS forecasters.

APPROACH: Techniques will be developed to combine MOS forecasts of several differing weather elements to obtain automated forecasts of agricultural parameters such as percent of possible sunshine, relative humidity, drying rates, and dew.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0037, AGRICULTURAL WEATHER PREDICTION - SPECIALIZED AGRICULTURAL WEATHER GUIDANCE

G.M. Carter, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8D43101)

OBJECTIVE: To develop automated techniques for prediction of weather variables of particular importance to agriculture for several areas in the United States where agriculture is a major industry. These forecasts may be used as guidance for NWS forecasters or may be issued directly to the public.

APPROACH: We use the MOS concept to derive equations to predict elements such as air and soil temperature, precipitation, relative humidity, dew, and frost, and appropriately disseminate the resulting forecasts. The selection of weather elements and forecast areas is closely coordinated with the agricultural program leader in OM&O. Forecasts from the various operational agricultural guidance packages are carefully monitored.

PROGRESS: Five-day forecasts of maximum and minimum air temperatures and bare-ground and grassy-ground soil temperature, plus 3-day forecasts of minimum relative humidity and the probability of various amounts of precipitation are routinely transmitted to NWS forecasters in Indiana. In addition, 3-day forecasts of the probability of several intensities of ground condensation are now being developed.

Five-day forecasts of maximum and minimum air temperatures, plus 3-day forecasts of probability of precipitation amounts, are routinely transmitted to NWS forecasters in Michigan. In addition, 3-day forecasts of the probability of frost are now being developed.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0038, TERMINAL WEATHER PREDICTION - SHORT-RANGE AVIATION FORECASTING

R.G. Miller, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8D590501)

OBJECTIVE: To develop and implement at AFOS field sites improved techniques to rapidly update forecasts for the weather elements required in the terminal forecast for projections in the range 0-to-12-h.

APPROACH: Locally available observations will be used in an equivalent Markov model to forecast the elements of the surface observation. The results will be compared to the results of the single station technique now used in the AFOS monitoring and updating system. Ways to incorporate the forecasts from other TDL techniques (e.g., model output on 2- to 6-h thunderstorms) into the AFOS field site short-range data base will be sought.

PROGRESS: Design of software for preparing observational data for input to Markov model on this new subtask began in July 1978.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0039, AFOS FORECAST APPLICATION - LOCAL MONITORING AND UPDATING

D.J. Vercelli, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8C27021)

OBJECTIVE: To develop an automated procedure for AFOS systems at WSFO's which will monitor all surface aviation observation (SAO's) and terminal forecasts (FT's) within each WSFO's area of responsibility and (1) alert the forecaster when a problem or potential problem arises with the FT, and (2) provide objective guidance for preparing FT's.

APPROACH: AFOS system minicomputers at WSFO's will be programmed to compare each observation with the FT for that terminal and determine if a discrepancy exists with respect to: (1) official FT amendment criteria (problem), or (2) other criteria to be established (potential problem). When either condition occurs, the system will generate a message to the forecaster which will indicate the situation and provide an objective forecast of the surface weather elements. Forecasts will be produced by single station equations or, as necessary, generalized operator equations; both will use the latest observation to produce forecasts. The system will also produce guidance forecasts at any time upon request of the forecaster.

PROGRESS: All software has been converted and debugged for use on the Eclipse system. Internal acceptance testing by TDL has been completed. Forecast equations have been developed for the first 4 WSFO's implemented under AFOS and the aviation terminals under their area of responsibility.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0040, STUDIES OF PLANETARY ATMOSPHERES THROUGH OCCULTATIONS

Unknown, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAGW 68)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

5.0041, OPTICAL TECHNIQUES FOR EARTH ROTATION MEASUREMENTS

S. Ezekiel, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF582270; F19628-79-C-0082)

AF function - weapon systems navigation and delivery. Deficiency -launch site, target position, and geoid uncertainties degrade accuracy of weapon delivery. Objective - precise, automatic rotation sensor applicable to the measurement of azimuth, latitude, rotation rate and geophysical parameters. How research contributes - contractor proposes to study optical techniques for accurately sensing the earth's rotation axis which relates to astronomic latitude, azimuth and magnetic declination.

Study optical techniques for detecting earth's rotations; primarily work will be done with a large passive ring cavity with the aim of developing techniques for both long-term geophysical research and for smaller sensors which could be used in geodetic instruments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0042, IMPROVED MICROWAVE RETRIEVAL TECHNIQUES FOR ATMOSPHERIC TEMPERATURES, WINDS AND HUMIDITY

D.H. Staelin, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-10)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0043, APPLICATION OF LASER RANGING AND VERY LONG BASELINE INTERFEROMETER DATA TO A STUDY OF PLATE TECTONIC DRIVING FORCES

S.C. Solomon, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0044, GEOPHYSICAL STUDY OF THE STRUCTURES AND PROCESSES OF THE CONTINENTAL CONVERGENCE ZONES

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0045, MINOR USE PESTICIDES RESEARCH, TO SUPPLEMENT THE IR-4 PROJECT (NORTH CENTRAL REGION)

R.J. Sauer, Michigan State University, Agricultural Experiment Station, Dept. of Entomology, *New Administration Bldg., East Lansing, Michigan* 48823 (0070856; MICL01235)

OBJECTIVE: To supplement the IR-4 Project effort through increasing the rate of data development (primarily efficacy, phytotoxicity and residue data) within the North Central Region's state agricultural experiment stations in order to expedite the clearance of pesticides for minor uses, principally on agricultural crops.

APPROACH: Solicit, classify and screen NC state requests for minor use pesticide clearances; secure commitments from requesting states to put out field plots necessary to collect adequate efficacy and phytotoxicity data and, where needed, generate sufficient sampling for residue analyses; provide for shipment of samples to the leader laboratory (MI AES) or the satellite laboratory (ND AES) or other laboratories as necessary; and transmit data to IR-4 Project Office for petition preparation and subsequent registration.

PROGRESS: During the period, under the direction of IR-4 Leader Laboratory program, 61 food use projects were initiated by cooperators in 9 of the North Central States (IL, IN, MI, MN, NB, OH, ND, SD, and WE). In addition, cooperators from CO and NC also submitted residue samples for projects simultaneously being conducted in the N.C. Region. Most of these field projects have been successfully completed (some were lost due to floods and other unforeseen circumstances) and the resultant residue samples submitted to the Analytical Laboratory of the Leader Laboratory and the satellite laboratory at North Dakota State University required more than 4,500 residue analyses. The field and residue results have been forwarded to IR-4 headquarters at Rutgers University and are in various stages of petition submission and review by EPA. Typical of the registrations received in the N.C. region was a Minnesota project for the use of malathion to control rice worms and maggots in wild rice.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Michigan

5.0046, TIME VARIABLE EARTH RADIATION BALANCE MODELS AND INTERPRETATION OF SATELLITE RADIATION BUDGET MEASUREMENTS

F.L. Bartman, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (NAG 1-67)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0047, PRELIMINARY INTERFACES BETWEEN THE ORBITER AND INSTRUMENT FOR THE HIGH RESOLUTION DOPPLER IMAGER (ABBREV)
P.B. Hayes, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Oceanic Sciences, *Ann Arbor, Michigan* 48104 (NAS 5-26189)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0048, DEVELOPMENT OF ABSORPTION TECHNIQUE FOR OH MEASUREMENTS IN AMBIENT AIR
C.C. Wang, Wayne State University, School of Engineering, Dept. of Electrical & Computer Engineering, *5950 Cass Ave., Detroit, Michigan* 48202 (NAG 2-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0049, CONDUCT SHORT COURSES IN REMOTE SENSING, AS AN AID IN MINE ENGINEERING, RECLAMATION AND QUALITY CONTROL
D.J. Barr, University of Missouri, Rolla Campus, School of Engineering, Dept. of Mining Engineering, *Rolla, Missouri* 65401 (NAS13-150)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0050, CLOUD CONDENSATION NUCLEI MEASUREMENT WORKSHOP
W. Kocmond, University of Nevada, System Office, Desert Research Inst., *Reno, Nevada* 89507 (NAS 8-33820)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0051, ANALYSIS OF UNIVERSITY OF NEW HAMPSHIRE ATS-6 DATA MULTIPLE SPACECRAFT STUDIES
T.E. Moore, University System of New Hampshire, University of New Hampshire, School of Life Sciences & Agriculture, Dept. of Earth Sciences, *Durham, New Hampshire* 03824 (NAGW 52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0052, RESEARCH OF PRECISE LEVELING SPACE GEODESY AND GEODYNAMICS
J.E. Oliver, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Geological Sciences, *Ithaca, New York* 14850 (NAG 5-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0053, THE STRUCTURAL AND TECTONIC EVOLUTION OF THE NORTH ANOTOLEON FAULT
J.F. Dewey, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Geology, *1400 Washington Ave., Albany, New York* 12222 (NAG 5-24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0054, CRATER MODIFICATION BY GRAVITY
H.J. Melosh, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (NAGW 50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0055, POPULATION STATUS OF BOBCAT AND RIVER OTTER IN NORTH CAROLINA
J.D. Hair, University of North Carolina, North Carolina State University, Agricultural Experiment Station, Dept. of Zoology, *Raleigh, North Carolina* 27600 (0078711; NC05429)

OBJECTIVE: Determine population dynamics and habits of bobcat and otter in North Carolina. Determine and evaluate state-wide bobcat and otter habitat.

APPROACH: Bobcat and otter carcasses will be collected throughout the State in association with legal trapping seasons. Animals will be aged - examination of cementum annuli. Sex ratios will be determined. Reproductive tracts of females will be examined to determine reproductive rates, estrus periods and parturition dates. Based on above data, time-specific life tables will be developed. Food habits will be determined for radio-marked individuals and parameters describing habitat preferences will be quantified and plotted on computerized habitat maps. LANDSAT imagery will be used to document state-wide habitat potentials. Population and demographic data will be used to objectively assess harvest levels compatible with annual sustained yield management strategies.

SUPPORTED BY North Carolina State Government

5.0056, MAGNETIC FIELDS MONITOR SATELLITE SCIENCE INVESTIGATION DATA AND AEROMAGNETIC DATA IN THE EASTERN PIEDMONT OF THE UNITED STATES
I.J. Won, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Geosciences, *Raleigh, North Carolina* 27607 (NAS 5-26157)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0057, INVESTIGATION OF SMALL-SCALE TERRAIN EFFECTS WITHIN CLIMATE MODELS
J.W. Deardorff, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Atmospheric Science, *126 Agricultural Hall, Corvallis, Oregon* 97331 (NAG 5-51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0058, COMBINED USE OF REMOTE SENSING AND SEISMIC OBSERVATIONS TO INFER RECENT CRUST DEFORMATION, ACTIVE FAULTING AND STRESS FIELDS
S.S. Alexander, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Geosciences, *116 Deike Bldg., University Park, Pennsylvania* 16802 (NAG 5-49)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0059, ELECTROMAGNETIC DEEP-PROBING OF THE EARTH'S INTERIOR FROM ARTIFICIAL SATELLITES - CONSTRAINTS ON REGIONAL EMPLACEMENT OF CRUSTAL RESOURCES
J.F. Hermance, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NAS 5-26138)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0060, STUDY OF THE EFFECTS OF CONTINENTAL WAKES
E.M. Parmentier, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NAG 5-50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0061, WASHINGTON DNR FOREST CLASSIFICATION

G.R. Johnson, Technicolor Graphic Services Inc., *Sioux Falls, South Dakota* 57198

STATE TO WHICH PROJECT PERTAINS: Washington.

The utility of digital analysis techniques for classifying western Washington forest lands with LANDSAT multispectral scanner (MSS) data is being investigated. The methodology for merging site-specific forest inventory data and terrain data with LANDSAT MSS data has been demonstrated.

Results of digital image processing techniques applied to LAMDSAT data will be compared to forest resource information to identify what forest resource groups can be identified with LANDSAT data. LANDSAT data will be classified into these resource groups and the classification accuracy estimated by using a simple random sampling scheme. Statistics to estimate percent correct classification as well as contingency tables which identify the nature and frequency of classification errors will be generated.

SUPPORTED BY U.S. Dept. of the Interior, Land Information & Analysis Office, EROS Data Center

5.0062, TARGETING, INVENTORYING AND MONITORING GROUND-WATER RESOURCES

J.R. Lucas, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Data Center, *Sioux Falls, South Dakota* 57198

STATES TO WHICH PROJECT PERTAINS: South Dakota, Iowa, Wisconsin, Kansas and other locations in the Gulf Coast and High Claims.

The application of LANDSAT multispectral scanner data for targeting sources of shallow ground water in glaciated terrains is being demonstrated and documented. Conventional photo interpretation procedures are being used to delineate surficial material patterns on LANDSAT imagery of eastern South Dakota, southeastern Wisconsin, and north central Iowa. Linear and curvilinear patterns, drainage patterns, and cover type patterns have been found to relate to occurrences of pre-glacial buried valleys and landforms associated with continental glaciation. Glacial phenomena characterized by stratified sand and gravel deposits are often significant shallow aquifers. Published hydrologic and geomorphic data are being used to assess the significance of patterns distinguished on LANDSAT imagery as they relate to potential sources of ground water in glaciated terrains.

SUPPORTED BY U.S. Dept. of the Interior, Land Information & Analysis Office, EROS Data Center

5.0063, WEED CONTROL IN VEGETABLES AND ORNAMENTALS AND THE EFFICIENCY OF HERBICIDES IN HORTICULTURAL SOILS

R.M. Menges, U.S. Dept. of Agriculture, Federal Research Office, Weed Control Research, *509 W. 4th St., Weslaco, Texas* 78596 (0017326; 7202-20280-001)

OBJECTIVE: Determine the effect of microclimate on the growth of weed species in vegetables and ornamentals and on herbicidal selectivity and movement and persistence in soils. Determine the feasibility of using infrared and ultra-high frequency (UHF) electromagnetic energy for weed control.

APPROACH: The herbicides glyphosate, bensulide, bromoxynil, butralin, methazole, and newly screened compounds will be applied by various soil incorporation and formulation techniques under different soil and plant microclimate conditions in cucurbit and root, bulb and cole crop vegetables and rosaceous ornamentals. Bioassays and chromatographic assays will be used to evaluate herbicidal activities. Herbicidal effectiveness, movement and persistence in soils and effect on plant growth and quality will be measured. UHF electromagnetic energy will be applied to the soil; the influence of soil texture and moisture, weed seed species, mass and moisture and depth of seed in soil will be evaluated. Weed species included will be London rocket (Simbrium irio L.), wild common sunflower (Helianthus annuus L.), and ragweed parthenium (Parthenium hysterophorus L.). The feasibility of infrared photography will be studied to remotely sense specific weed populations in crop production areas.

PROGRESS: Texas panicum, Palmer amaranth, and common purslane competed for yield of cucumber but were selectively controlled by soil-incorporated bensulide or butralin applied at planting and followed by post-emergence soil-incorporated butralin or trifluralin. Butralin persisted 11 weeks in soil to control Palmer amaranth but did not injure sorghum field-grown in rotation. Wild common sunflower populations of one plant per 7.6 cm of onion row competed for yield more than in populations of one plant per 76.2 cm of row in the first 9 weeks after emergence. The R haze (infinite reflectance) of Johnsongrass, lambsquarters and sowthistle leaves at 0.85 mm was significantly higher than sunflower, ragweed, or London rocket. Earth Resources Technology Satellite (LANDSAT-2) multispectral scanner (MSS) data were used to detect silverleaf sunflower from other plant species and to estimate its hectarage accurately.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Subtropical Texas Area

5.0064, ANALYSIS OF DATA FROM THE PIONEER VENUS SOUNDER PROBE MASS SPECTROMETER

J.H. Hoffman, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (NAGW 64)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0065, INTEGRATED TERRAIN MAPPING

C.J. Robinove, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092

STATE AND FOREIGN COUNTRY TO WHICH PROJECT PERTAINS: Queensland, Australia, California.

Digital images will be used to map land capability in Queensland, Australia and California, U.S.A. Terrain will be grouped into categories of land capability by the use of a statistical analysis of LANDSAT data.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0066, LANDSAT IMAGE MAPS OF CAPE COD

R.S. Williams, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092 (E-0043)

STATE TO WHICH PROJECT PERTAINS: Massachusetts.

A variety of experimental LANDSAT image maps of Cape Cod and Cape Cod National Seashore (National Park Service) are in preparation by the U.S. Geological Survey's EROS Program. Project plans for FY 79 include: (1) the publication of a 1:250,000-scale LANDSAT image of Cape Cod in a poster format; (2) preparation of a 1:250,000-scale LANDSAT image map of Cape Cod, annotated with locations of geological and historical significance and with an extensive text; (3) preparation of an abstract on the use of LANDSAT 3 RBV images of Cape Cod to document and to delineate coast-line changes caused by the severe winter storm of 6-7 February 1978; and (4) to determine the feasibility of using LANDSAT 3 RBV images as 1:125,000-scale images bases for a geological map of Cape Cod.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0067, REMOTE SENSING AND ECOLOGICAL RESEARCH IN WETLANDS

V.P. Carter, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (NR 73-090)

Wetlands are poorly understood, hydrologically controlled environments. They are essential elements in estuarine, marine,

lacustrine, and riverine productivity. Information on (1) wetland hydrologic variables and their relation to wetland vegetation, (2) wetland dynamics and boundary fluctuations, (3) short and long term temporal changes, and (4) other ecological aspects as needed to improve our understanding of these ecosystems and to aid in classification and mapping. Wetland plants may serve as sensitive hydrologic indicators giving information on water (oxygen) stress or water quality parameters such as salinity, turbidity, pH, nutrients, or the presence of various pollutants.

To determine the spectral characteristics of wetland vegetation and relate these to interpretation of remotely sensed data. To develop improved methodology for mapping and classifying coastal and inland wetlands in cooperation with other interested government agencies and non-government groups or individuals. To examine seasonal and long-term changes in wetland ecology as related to changes in environmental parameters including hydrology, water quality, and land use. To assist with interdisciplinary studies requiring biological research and remote sensing such as the Potomac Estuary Study. To aid in the development of models that utilize remote sensing data as part of the prime data base.

Develop cooperative research projects. Cooperators include WRD Districts, TVA, Topo. Division (USGS), USFWS, NASA, JPL, interested state agencies and local groups, and others. Work with all types of remotely sensed data and available types of analysis equipment in order to achieve the best possible results in a variety of wetland studies. Assist in interdisciplinary studies by providing biological and remote sensing information that can be related to study objectives.

(1) Cooperative Project with TVA completed and final report prepared. (2) Wetland classification system for Tennessee Valley Region published. (3) Dismal Swamp Project - Map of Roads and Ditches Published, transition zone project started, additional observation wells have been installed and project revised to consider vegetative indicators. (4) Fish and Wildlife Classification System has been completed. (5) LANDSAT analysis in Alaska completed and report published. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0068, DUAL-POLARIZATION SPACE DIVERSITY MEASUREMENTS WITH THE SIRIO SATELLITE
A.H. Krebs, Virginia Polytechnic Inst. & State University, Graduate School, *Blacksburg, Virginia* 24061 (NASW 3357)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0069, APPLICATION OF THE AVE-SESAME DATA SET TO MESOSCALE STUDIES
D. Suchman, University of Wisconsin, Madison Campus, Space Science & Engineering Center, *Agriculture Hall, Madison, Wisconsin* 53706 (NAS 8-33799)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0070, SUBSIDENCE OF RECLAIMED COAL MINE SPOILS, COLSTRIP, MONTANA
J.M. White, Carter Mining Co., *P.O. 209, Gillette, Wyoming* 82716 (I-0002)

STATE TO WHICH PROJECT PERTAINS: Montana.

Precise leveling surveys and ground and aerial inspections were conducted to determine the nature and practical effects of subsidence due to consolidation of reclaimed spoils at the Rosebud Mine, Colstrip, Montana. In spoils 30- to 40-years old, subsidence of spoils occurring since 1968 averages 0.1 m, and is of no practical effect. In spoils rehandled to form fill in 1968, subsidence approaches 0.25 m and is due to excessively steep side slopes, and to consolidation in response to saturation. Subsidence in areas strip mined since 1971 is as great as 0.6 m in restricted areas subject to saturation due to runoff and is apparently confined to the redistributed top-soil.

Research completed, report in preparation.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, EFFECTS OF CIRCADIAN RHYTHM PHASE ALTERATIONS ON PHYSIOLOGICAL AND PSYCHOLOGICAL VARIABLES - IMPLICATIONS TO PILOT PERFORMANCE
D.C. Holley, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCA 2-675005)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0002, EARLY EVOLUTION OF THE CYANOPHYTA
E.C. Weaver, California State University & Colleges, San Jose State University, School of Science, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCA 2-675003)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, PLANETARY BIOLOGY AND MICROBIAL ECOLOGY
K.H. Nealson, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (NAGW 73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0004, EXPLORATORY STUDIES OF THE RELATIONSHIP OF GASTRIC ACTIVITY AND OTHER PHYSIOLOGICAL MEASURES TO MOTION SICKNESS
J. Kamiya, University of California, San Francisco Campus, Langley Porter Neuropsychiatric Inst., Dept. of Psychiatry, *401 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, CONFERENCE ON FUNDAMENTAL ISSUES IN GLOBAL ECOLOGY
D.B. Botkin, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Biological Science, *Santa Barbara, California* 93106 (NASW 3392)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0006, MAINTENANCE OF NASA PRIMATE RESOURCES AND PRIMATE BASELINE DATA
H.M. McClure, Emory University, School of Medicine, Dept. of Pathology, *1364 Clifton Rd. N.E., Atlanta, Georgia* 30322 (NAS 2-10627)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, THE ROLE OF THE SYMPATHOADRENAL SYSTEM DURING EXPOSURE TO HEAT AND COLD
R.S. Elizondo, Indiana University, Bloomington Campus, School of Medicine, Dept. of Anatomy & Physiology, *Memorial Hall, Bloomington, Indiana* 47401 (NCA 2-335001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, LIFE SCIENCE FLIGHT EXPERIMENT
A. Bhattacharya, University of Kentucky, Graduate School, *Limestone & Euclid, Lexington, Kentucky* 40506 (NAS 9-16045)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0009, SPACE BIOLOGY RESEARCH PROJECT
X.J. Musacchia, University of Louisville, School of Arts & Sciences, Dept. of Biology, *129 E. Broadway, Louisville, Kentucky* 40202 (NAGW 70)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0010, LIFE SCIENCE FLIGHT EXPERIMENT - FACTORS AFFECTING RESPIRATORY TRACT PARTICLE DEPOSITION AND CLEARANCE IN THE SPACE ENVIRONMENT
D.L. Swift, Johns Hopkins University, School of Hygiene & Public Health, Dept. of Environmental Health Science, *615 N. Wolfe St., Baltimore, Maryland* 21205 (NAS 9-16036)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0011, A RESEARCH PROGRAM WITH SPECIAL EMPHASIS ON ALGAL MAT STUDIES AND MICROBIAL LIFE IN EXTREME ENVIRONMENTS
H.O. Halvorson, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (NAGW 72)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0012, THE EFFECT OF SPACE FLIGHT ON THE GROWTH, MINERALIZATION AND REMODELING OF THE RHESUS MONKEY SKELETON
D.J. Simmons, Washington University, School of Medicine, Dept. of Surgery, *660 S. Euclid Ave., St. Louis, Missouri* 63110 (NAS 2-10636)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0013, SIMULATION OF WATER INFLUENCE ON MOLECULAR STRUCTURE USING AN IMPROVED MOLECULAR DYNAMICS APPROACH
J.T. Egan, State University of New York, Buffalo Campus, Graduate School, *1300 Elmwood Ave., Buffalo, New York* 14222 (NCA 2-750001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0014, ISOLATION AND CHARACTERIZATION OF POST-HYPOXIC HEMOLYTIC FACTORS IN BLOOD
S.A. Landaw, State University of New York, Upstate Medical Center, School of Medicine, Dept. of Medicine/Radiology, *766 Irving Ave., Syracuse, New York* 13210 (NCA 2-765001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0015, INERTIAL AND GEOMETRIC PROPERTY BIODYNAMIC DATA REDUCTION SYSTEM B
R.R. Rasmussen, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325190)

The use of biodynamics models for the prediction of body response during impacts and other abrupt accelerations encountered in Air Force operations is a feasible complementary research approach to actual experimentation with men and animals. However, the successful and meaningful application of biodynamic mathematical models requires not only a sound formulation of model structure, but also a detailed compilation and reduction of input data describing body properties, initial positions and interactive forces. The proper formatting and specification of the input data generally is accomplished by extensive analysis and reduction of information obtained from independent experiments. The present effort is for the development of an analysis system specifically suited to the reduction of body inertial, geometric and joint-segment property data. The data output of this system will have direct application to the articulated total body (ATB) model and models of similar structure, and will provide a convenient and efficient framework for the compilation of anthropometric and body inertial data readily applicable to analysis of body dynamics and specification of body surface geometry in any given configuration.

The implementation of this system will require the addition of a color graphics terminal to an existing PDP-8A computer and the development of software for body segment data manipulation and display. The system will be interfaced with the main CDC computer at Wright-Patterson AFB to allow data transfer between the two systems. The visual system will be used to display body segment surface-defining contours, various landmarks on the surface or interiorly defined points, axes systems associated with overall segment orientation, landmarks, principal inertial moments, preferred axes of rotation of the joint and for internal force application and adjacent segment-relative orientations. This data reduction system will be specifically applied to the generation of appropriate data sets for human subjects used in impact tests at AMRL/BB, which will in turn be used with the ATB model for model validation and investigation of various test parameter variations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, BIODYNAMIC DATA BANK
Unknown, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325140)

Man's capability to function safely and effectively under the severe dynamic stresses produced by high-performance aircraft must be continually reassessed, using actual dynamic tests with human and animal subjects, measurements of body tissue properties, predictive mathematical models, and evaluations of aircraft accident causes and results. These research methods produce voluminous data which must be stored and retrieved to be used as input data for future research and to prevent duplication of effort. The objective of this work unit is to organize the diverse data from biodynamic environmental research into a unified data bank with a single computerized index, so that researchers may gain access to past and current research data stored at AMRL.

A feasibility study will be performed to identify equipment costs, environmental and power supply needs of equipment, and factors which have contributed to the success or failure of similar data bank projects. The results of the feasibility study will be used in the engineering design study for the physical plant that will house the data and data-manipulation equipment. Equipment will be installed as funds permit and data storage will begin. Concurrently, the computerized index will be developed and procedures for operating the data bank and transmitting data to the using research engineers will be devised. When operational procedures and equipment are working satisfactorily, the approach will be confined to collecting, reformatting (if necessary), indexing, and disseminating data on a continuing basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, LIFE SCIENCE FLIGHT EXPERIMENTS - DETERMINATION OF SEGMENTED FLUID SHIFTS IN HUMANS WHICH ACCOMPANY THE ONSET OF WEIGHTLESSNESS
R.J. Gowen, South Dakota School of Mines & Technology, School of Engineering, *Rapid City, South Dakota* 57701 (NAS 9-16028)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0018, PSYCHOSOCIAL CORRELATES OF MITRAL VALUE PROLAPSE
R. Ursano, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF325650)

To assess psychosocial variables related to onset, worsening of symptoms, and sudden death in mitral valve prolapse (MVP).

Three patient groups will be compared for psychosocial variables related to stress - MVP group, cardiac non-MVP group, and a non-cardiac group. The MVP group will be reexamined yearly in conjunction with their USAFSAM follow-up to correlate the progression of MVP in relation to psychosocial variables.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0019, INFLUENCE OF WEIGHTLESSNESS - CARDIOVASCULAR EFFECT
D.L. Eckberg, Virginia Commonwealth University, Medical College of Virginia, Dept. of Medicine/Biophysics, *1200 E. Broad St., Richmond, Virginia* 23298 (NAS 9-16046)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, GRADUATE STUDENT RESEARCHERS PROGRAM SIMULATION
W.J. Karplus, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Computer Science, *405 Hilgard Ave., Los Angeles, California* 90024 (NAG 2-41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0002, URBAN AREA CHANGE DETECTION PROCEDURES WITH REMOTE SENSING DATA
E. Maxwell, Colorado State University, School of Forestry & Natural Resources, Dept. of Earth Resources, *Fort Collins, Colorado* 80523 (NAS 5-26127)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0003, MATHEMATICAL ASPECTS OF AUTOMATIC MESH GENERATION
P.R. Eiseman, Scientific Research Associates Inc., *P.O. Box 498, Glastonbury, Connecticut* 06033 (DF055720; F49620-79-C-0132)

AF function - design of aerospace and reentry vehicles. Deficiency - there is a need for an efficient technique for the automatic generation of coordinates which can be used as a framework to numerically solve modeling equations in physics and engineering. Objective - to develop and analyze a mathematical theory for automatic coordinate generation. How work contributes - the technique to be developed can be applied to aerodynamic problems with complex geometries.

The following tasks are proposed: (1) To derive and analyze the multi-surface coordinate transformation with local continuous functions applied to the associated vector field interpolation. Included in the analysis will be an examination of the distribution of coordinate curves and of the constraints on curve shapes. Also, a simple computer code to demonstrate some of the mathematical results will be written. (2) To repeat task (1) after replacing the local continuous functions with continuous functions that have continuous first derivatives.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, DESIGN OF FAULT-TOLERANT COMPUTERS USING READ-ONLY MEMORIES AS BASIC BUILDING BLOCKS
D.K. Pradhan, Oakland University, Graduate School, *Rochester, Michigan* 48063 (DF055750; F49620-79-C-0119)

AF function - digital avionics systems. Important functions in growing numbers are being performed by digital computers on USAF aircraft. Deficiency - the correct functioning of the computer system is crucial since malfunctions could have catastrophic consequences for an aircraft. Such ultra-reliable computers are not yet available at affordable costs. Objective - to perfect methods for the design of fault-tolerant digital systems that use read-only memories as basic building blocks. How work contributes - the results of this research, if successful, would permit the construction of ultra-reliable computers which are essential for advanced technology aerospace vehicles.

The basic units of the planned computer architecture will be read-only memory chips. The capabilities of error-correcting codes will be exploited with the goal of achieving the required fault tolerance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
L.R. Scott, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Mathematics, *Ann Arbor, Michigan* 48104 (DF055940; F49620-79-C-0149)

AF function - the design of aerospace and reentry vehicles. The design of chemical laser devices. The study of nuclear weapons effects. Opportunity - to obtain better error bounds on the approximate solutions of the partial differential equations which model many of these design problems. Objective - to investigate maximum-norm estimates for finite element methods for certain types of partial differential equations. How work contributes - techniques may be developed which are useful in solving problems in laser and aircraft design.

The two investigators will study the following topics: (1) maximum-norm estimates for finite element methods for linear elliptic dirichlet problems and for nonlinear time-dependent problems, (2) numerical methods for the solution of some model equations for nonlinear dispersive waves, (3) spectral approximation of unbounded operators, (4) collocation-Galerkin method for nonlinear first-order hyperbolic systems, and (5) error estimates in negative order Sobolev norms for a class of finite element methods for linear first-order hyperbolic systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, DATA ACQUISITION AND ANALYSIS OF A RANGE-FINDING SYSTEM FOR SPACE CONSTRUCTION
C.N. Shen, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Electrical Engineering, *110 8th St., Troy, New York* 12181 (NAG 1-61)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0007, EVALUATION OF COMPUTER-AIDED RELIABILITY ESTIMATION (CARE) III
K.S. Trivedi, Duke University, Trinity College of Arts & Sciences, Dept. of Computer Science, *Durham, North Carolina* 27706 (NAG 1-70)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0008, IMPROVED ITERATIVE METHODS FOR SOLVING SPARSE SYSTEMS OF LINEAR EQUATIONS
R.S. Varga, Kent State University, School of Arts & Sciences, Dept. of Mathematics, *Hilltop Dr., Kent, Ohio* 44240 (DF056120; F49620-79-C-0175)

AF function - the design of chemical laser devices, the study of nuclear weapons effects on structures and aerospace vehicles. Deficiency - many problems in laser and nuclear phenomenology studies involve the solution of large, sparse linear

systems. Present techniques for solving such systems are not very efficient and often ineffective. Objective - to study, both theoretically and computationally, algorithms to solve iteratively large, sparse linear systems. How work contributes - algorithms to be developed may lead to useful computer codes needed at several AFSC laboratories.

One goal is to determine the exact class of all real, symmetric, positive definite, square matrices A for which A is stable for any choice of a graph G. Precise necessary and sufficient conditions for A to be stable will be pursued. Then the implicit conjugate gradient method coupled with stable factorizations will be used to solve the linear system. Also, acceleration of this technique by the block successive over-relaxation method and by the Chebyshev semi-iterative method will be investigated both theoretically and numerically. Another goal is to study symbolic methods to evaluate function-space integrals. Specifically, MACSYMA will be used to evaluate Wiener integrals. The method involves a functional Monte Carlo algorithm which will be extended to handle a variety of differential equations, including elliptic systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, INFORMATION ASSESSMENT FOR AIRBORNE C2

S. Stark, U.S. Dept. of Defense, Navy, Naval Air Development Center, Software & Computer Directorate, *Warminster, Pennsylvania* 18974 (DN081125)

Systematically develop, test and evaluate automation decision-aiding techniques, algorithms, and related man-machine interfaces to develop technology products applicable to airborne command and control systems and operations.

Establish a systematic standardized analysis methodology to identify and parameterize airborne command and control decision requirements to allow experimental demonstration/evaluation of significant automation decision-aiding algorithms and processing system configuration requirements. Perform investigation analysis to apply state-of-the-art artificial intelligence approaches to improve mission performance via automation and decision aid to human operator-decision functions. Those situations where application development of automation decision aiding would have the greatest positive impact will be identified and appropriate algorithms, man-machine interfaces, lab tests, test procedures, simulation, and validation criteria will be implemented, demonstrated and evaluated. Work will also be performed on contract under work unit ZH302 for program element 62757N, and work units AJ601B and AJ601B1.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Command Control & Guidance Admin.

7.0010, DEFINITION OF THE OPERATIONAL SEMANTICS OF ADA

S. Feyock, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Mathematics & Computer Science, *Ewell Hall, Williamsburg, Virginia* 23185 (NAG 1-62)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0011, A NEW OBSERVER SYSTEM FOR DETERMINING ORIENTATION OF BALLOON-BORNE OBSERVATIONAL PLATFORMS

N.J. Nigro, Marquette University, School of Engineering, Dept. of Mechanical Engineering, *1515 W. Wisconsin Ave., Milwaukee, Wisconsin* 53233 (NAG 1-65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, HIGH ENERGY COSMIC RAY BALLOON FLIGHT INVESTIGATIONS

J.C. Gregory, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Chemistry, *Huntsville, Alabama* 35807 (NAS 8-33975)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0002, CONTAINERLESS PROCESSING TECHNOLOGY ANALYSIS

J.E. Rush, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Physics, *Huntsville, Alabama* 35807 (NAS 8-33731)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0003, LABORATORY MEASUREMENTS AND STUDIES OF ELECTRON- MOLECULE/ATOM-COLLISION CROSS-SECTIONS

Unknown, California Inst. of Technology, Graduate School, *1201 E. California Blvd., Pasadena, California* 91109 (EN-77-S-04-4131)

SUPPORTED BY U.S. Dept. of Energy

8.0004, INTERACTION OF HIGH-POWERED LASERS WITH PLASMAS

K.A. Brueckner, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (EY-76-S-03-0034-268)

The research will be directed at the interaction of lasers with plasmas, with emphasis on the wavelength dependence on the processes of absorption and hydrodynamic energy transfer. Particular emphasis will be given to the effect of ponderomotive forces, the production of fast electrons and ions, and the coupling to the hydrodynamic implosion process. Additional studies are proposed of the effect on implosion hydrodynamics of composite shell structure.

The studies will be based on experimental data obtained by close liaison with laser programs in the U.S.A. and, as far as possible, on the programs in Europe and the U.S.S.R.

SUPPORTED BY U.S. Dept. of Energy

8.0005, RESEARCH ON LATTICE-MISMATCHED SEMICONDUCTOR LAYERS

R.L. Bell, Varian Associates Inc., Solid State Laboratory, *611 Hansen Way, Palo Alto, California* 94303

The scope of work under the contract involves growth and evaluation of alloy films on GaAs. Of immediate interest are InGaAsP layers on GaAs and studies of defects and lattice mismatch. Conduct fundamental materials research aimed at developing improved understanding of growth and properties of III-V-layered materials for solar energy applications.

SUPPORTED BY U.S. Dept. of Energy

8.0006, ELECTRON DISLOCATION INTERACTIONS AT LOW TEMPERATURES

J.M. Galligan, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Metallurgy, *Box U-37, Storrs, Connecticut* 06268 (EY-76-S-02-2305)

The following topics are being studied: electron drag on dislocations; use of superconductor-normal transition to alter electronic state; dislocation-fluxoid interactions; flow stress-field interactions in normal metals; dislocation-interstitial interactions; and Pb, Pb-Sn, Pb-Ag, Cu and Nb. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0007, THEORETICAL STUDY OF RADIATIVE INTERACTION AND ENERGY TRANSFER PROCESSES OF MOLECULAR AND ATOMIC SYSTEMS

Unknown, Howard University, Graduate School, *2400 6th St. N.W., Washington, District of Columbia* 20001 (EY-76-S-05-4048)

SUPPORTED BY U.S. Dept. of Energy

8.0008, RESEARCH RELATIVE TO OPTICAL CONSTANTS AND PROPERTIES OF MATERIAL IN THE EXTREME ULTRAVIOLET

R.M. Catchings, Howard University, School of Liberal Arts, Dept. of Physics & Astronomy, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAG 5-79)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0009, PERFORM CERTAIN LASER FUSION RESEARCH WORK

Unknown, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228

SUPPORTED BY U.S. Dept. of Energy

8.0010, LASER FUSION RESEARCH

Unknown, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375

SUPPORTED BY U.S. Dept. of Energy

8.0011, A FUSION STUDIES PROGRAM

W.M. Stacey, Georgia Inst. of Technology, School of Nuclear Engineering, *Atlanta, Georgia* 30332 (ET-78-S-05-5683)

This project is concerned with the development of an understanding of impurity control, burn cycle dynamics and control, and reactor technological/economic trade-offs for future fusion reactors. This year, about 2/3 of the effort is devoted to work aimed at understanding the performance of a plasma in a tokamak-type fusion reactor. The remaining 1/3 of the effort is devoted to studies of the technological trade-offs in tokamak reactors. The research consists of theoretical and computer analyses.

SUPPORTED BY U.S. Dept. of Energy

8.0012, LOW-TEMPERATURE STUDIES OF DEFECTS AND SOLIDS

A.C. Anderson, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics/Materials Research Laboratory, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

This purpose of this project is to obtain experimental data on a variety of defect structures, both to provide a basic understanding of the defect and to permit prediction of the behavior of bulk properties when defects are present. Reduced temperatures (0.02-300 K) are used in the investigation since such data are often more amenable to theoretical interpretation and thus provide a foundation for a general theoretical development, and because some important phenomena, such as superconductivity, occur only at low temperatures. Several measurement techniques are used: thermal and electrical conductivity, specific heat, thermal expansion, ultrasonics, and dielectric polarization. Low-temperature thermal conductivity measurements, for example, provide both technical data (appropriate to cryogenic engineering application) and a source of very-high-frequency phonons to probe the dynamic response of defect structures. Three generalized classes of defects are being investigated, namely dislocations, interface and surfaces, and disordered and composite materials, including polymers and superionic conductors.

SUPPORTED BY U.S. Dept. of Energy

8.0013, EVAPORATION OF A SOLID DEUTERIUM PELLET IN A CONTROLLED THERMONUCLEAR PLASMA

J. Dorning, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Nuclear Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

The evaporation rate and total penetration distance of a solid deuterium pellet after injection into a thermonuclear plasma have been studied. Detailed computer calculations in which hydrodynamics and phase transition thermodynamics are treated in a fully self-consistent manner have been done. Self-consistent shielding effects produced by the expanding evaporated material have been included. Both long-range-force energy exchanges among charged particles and short-range-force interactions between charged and neutral species have been investigated since the evaporation times of these fuel pellets are very sensitive to energy exchange mechanisms.

SUPPORTED BY U.S. Dept. of Energy, Brookhaven National Lab.

8.0014, RADIATION DAMAGE IN SOLIDS

J.S. Koehler, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics/Materials Research Laboratory, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

We are irradiating pure metals and semiconductors with MeV electrons at low temperatures (down to 0.5 K). The damage production and the subsequent thermal annealing are studied by measuring changes in anomalous x-ray transmission and changes in electrical resistance. We are attempting to determine the geometrical structure and the properties of interstitials, lattice vacancies, and of various clusters of defects in these materials.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0015, NUCLEAR MAGNETIC RESONANCE IN SOLIDS

C.P. Slichter, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics/Materials Research Laboratory, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

The interests of this group are in the fundamentals of solid-state physics, including many-body problems, phase transitions, and exotic properties. At low temperatures, iron atoms in copper exhibit a phenomenon called the Kondo effect as a result of the exchange coupling of the iron atom to the conduction electrons. The explanation has challenged theorists since this is a true many-body problem. We are studying it by using ultrasensitive nuclear magnetic resonance to measure the conduction electron spin polarization which the exchange coupling produces at copper nuclei which are near neighbors to the iron atoms. In most metals, the electron charge distribution is uniform, apart from the periodic density changes arising from the presence of the nuclei. Several years ago, Overhauser proposed that in some cases the stable state would be non-uniform, i.e., there would be a charge density wave, the wavelength of which bore no relation to the lattice periodicity. Such waves have recently been found in compounds such as NbSe2 and TaS2. These materials also exhibit superconductivity, and there is speculation that the two phenomena are related. The properties of such crystals, especially emphasizing the charge density waves, are under study. A new technique has been invented for measuring electrical conductivity. The application of it to the organic conductor TTF-TCNQ has been the subject of intense study since Heeger first proposed it might be a high-temperature superconductor.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0016, SUMMER INSTITUTE IN SCIENCE AND TECHNOLOGY FOR JUNIOR HIGH SCHOOL GIRLS

O.B. Butler, Bowie State College, Graduate School, Dept. of Mathematics, *Bowie, Maryland* 20715 (NCA 5-97)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0017, NUCLEAR MOMENTS AND NUCLEAR STRUCTURE
Unknown, Johns Hopkins University, Graduate School, *34th & Charles Sts., Baltimore, Maryland* 21218 (EY-76-S-02-3274)

We propose to complete the system designed to study energetic central collision of heavy ions to study the properties of nuclear matter via the emission of gamma rays. An initial study proved very successful and the group is approved for further study beginning in 1978. Follow-up studies of high-spin nuclear states resulting from pion capture are in progress and will continue in the future. High-precision data using a curved crystal spectrometer in collaboration with groups from Yale and Columbia will be carried out at Nevis as an additional program to study the excitation of nuclei via pion capture.

The experiment on the nuclear moments of beta emission is being completed and will take new directions in the future. The programs on electrons and positrons from high-energy collisions will continue. Some future experiments are also being planned for the measurement of linear polarization of gamma rays resulting from high-spin excitation of nuclei.

RESULTS: A new program studying the behavior of nuclear matter under very high excitation was begun at the Bevatron with experiments designed to study the gamma radiation emitted from central collision of heavy ions. A preliminary experiment showed the feasibility of the system and gave the first results of correlations of gamma rays with such collisions. Studies of electrons resulting from heavy-ion collisions using a special high acceptance beta spectrometer were made indicating the beginnings of effects that are complements of the so-called combined atom X-ray phenomena.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0018, THEORETICAL STUDIES OF ELECTRONIC TRANSITION LASERS
Unknown, U.S. Dept. of Commerce, National Bureau of Standards, *Gaithersburg, Maryland* 20760 (EA-77-A-01-6010-037)

SUPPORTED BY U.S. Dept. of Energy

8.0019, PLASMA PHYSICS OF PELLET FUSION
Unknown, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (EY-76-S-05-5000)

Pellet fusion involves both the design of appropriate pellets and the development of a pulsed power technology (electron, ion, or laser beams) capable of igniting the pellets. We are investigating several plasma problems that arise in this field. (1) Various mechanisms are expected to generate magnetic fields in target pellets. The generation and evolution of these fields during deposition and compression are being analyzed. (2) Heavy ion beams in the 10-100 GeV range have been proposed for pellet ignition. We are developing a model for the propagation of one such focussed ion beam through the relatively dense gas that may exist in the target chamber of a reactor. Our model contains the effects of beam ion stripping, background plasma generation by the beam ions, and electron avalanching in the electric fields produced by the ion pulse. Charge and partial current neutralization, together with stability conditions and the effects of pre-ionization will be calculated. (3) The production of hard X-rays by heavy multi-GeV ions slowing down in a high atomic weight target (e.g., the outer layer of a pellet) is being calculated.

SUPPORTED BY U.S. Dept. of Energy

8.0020, NONLINEAR THEORY OF LASER PLASMA INTERACTIONS
Unknown, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (ES-77-S-05-5558)

SUPPORTED BY U.S. Dept. of Energy

8.0021, PRODUCTION ANALYSIS OF THERMONUCLEAR PLASMAS IN HIGH BETA DEVICES
H.R. Griem, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (EG-77-C-05-5307)

PURPOSE: Investigate the feasibility of fast theta pinch heating and its compatibility with confinement in a toroidal configuration with a circular cross-section for the 10/sup 13/-10/sup 15/cubic cm density regime. APPROACH: A circular cross-section torus (THOR), 40 cm minor and 1 m major diameter have been constructed. The input energy sources are six 100 kJ swinging LC generators with an initial dI/dt of 10/sup 12/A/sec. each. A variable bias field of 0 to 1 kg can be provided. A linear fast theta pinch (FTP - 46 cm diameter, 1 m length, 30 kJ input energy, initial dI/dt equals 10/sup 12/A/sec.) is used to continue heating and diagnostic experiments in the 10/sup 12/ by 10/sup 13/ cm/sup 3/ density regime. A smaller theta pinch (STP15 cm diameter, 30 cm length, B approximately 17 kG) enables extension of investigations to densities greater than 10/sup 15/ with t/sub i/ approximately 1 keV. (ERDA 77-66)

SUPPORTED BY U.S. Dept. of Energy

8.0022, RARE GAS HALIDE LASERS FOR FUSION
Unknown, Avco Corp., Everett Research Laboratory, *2385 Revere Beach Pkwy., Everett, Massachusetts* 02149

SUPPORTED BY U.S. Dept. of Energy

8.0023, LASER PLASMA THEORY FOR MICROWAVE MODELING EXPERIMENTS
Unknown, Avco Corp., *2385 Revere Beach Pkwy., Everett, Massachusetts* 02149

SUPPORTED BY U.S. Dept. of Energy

8.0024, DETERMINATION OF PSEUDOGAP-STATE DENSITY AND CARRIER MOBILITY IN RF-SPUTTERED AMORPHOUS SILICON
Unknown, Harvard University, Cambridge Campus, Office for Research Contracts, *10 Divinity Ave., Cambridge, Massachusetts* 02138

SUPPORTED BY U.S. Dept. of Energy

8.0025, ACTIVITIES DIRECTED TOWARD IMPROVING THE UNDERSTANDING OF THE PHYSICS OF HIGH CURRENT PULSED ELECTRON BEAMS
Unknown, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EY-76-S-02-2766)

The purpose of this program is the study of the dynamics of charged particle motions in relativistic diodes subjected to a transverse magnetic field. To date we have concentrated our investigation on cylindrical diodes acted upon by externally generated magnetic fields. The parapotential flow was unstable, as evidenced by copious microwave emission. During the coming year we propose to investigate the particle dynamics in pinched diodes in which the magnetic field is self-generated by the electron flow. Pinching will be initiated by laser generation of anode blow-off plasma. Microwave emission will be used as a diagnostic indicator of instabilities.

SUPPORTED BY U.S. Dept. of Energy

8.0026, DEVELOP AND TEST A DIGNOSTIC SYSTEM FOR SPATIAL MEASUREMENT OF ION TEMPERATURE IN HIGH TEMPERATURE PLASMAS
Unknown, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EY-76-S-02-2710)

SUPPORTED BY U.S. Dept. of Energy

8.0027, CADMIUM TELLURIDE TECHNOLOGY DEVELOPMENT
G. Entine, Radiation Monitoring Devices Inc., *444 Hunt St., Watertown, Massachusetts* 02172 (EY-76-C-02-2541)

Government-owned crystal growth and detector evaluation equipment is used to produce semiconductor materials and radiation detection devices. Funding support is primarily used for technology dissemination and reporting costs, analysis of results,

and consulting relative to CdTe detector applications. Reports, applications information and annual reports will be prepared and delivered.

SUPPORTED BY U.S. Dept. of Energy

8.0028, CHARGE TRANSFER CROSS-SECTION DETERMINATIONS IN HEAVY ION-HEAVY ION COLLISIONS
J.H. Macek, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (EG-77-S-02-4379)

Direct charge exchange between individual ions is expected to be the principal loss mechanism and limiting design factor in any heavy ion-driven inertial fusion energy production scheme. Estimates are required of the direct charge exchange cross-sections between singly ionized heavy elements in the KeV energy range. This project will use the molecular perturbed stationary state approximation method to calculate charge exchange cross-sections. The study will assess the need to take into account metastable, intermediate charge states. Results of this technique will be compared with those obtained by other procedures. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy

8.0029, FORMULATIONS ON ELEMENTARY PARTICLES INCLUDING WORK RELATED TO OBSERVATIONS ASSOCIATED WITH COSMIC RAY PHYSICS AND ASTROPHYSICS
R. Dashen, Inst. for Advanced Study, *Princeton, New Jersey* 08540 (EY-76-S-02-2220)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0030, INELASTIC MOLECULAR COLLISIONS - APPLICATION OF THEORETICAL METHODS TO PROBLEMS RELEVANT TO LASER OPERATIONS
Unknown, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (EY-76-S-02-2542)

SUPPORTED BY U.S. Dept. of Energy

8.0031, INVESTIGATIONS IN PLASMA DYNAMICS
Unknown, Stevens Inst. of Technology, Graduate School, *Castle Point Station, Hoboken, New Jersey* 07030 (EY-76-S-02-3004)

Analytical study of RF plasma heating in toroidal devices, nonlinear drift waves and drift waves in magnetic shear geometry. Computer-generated analytical results on parametric instabilities arising in RF heating of plasmas.

RESULTS: The modification of the drift wave spectrum by lower hybrid heating waves was studied. It was shown that zero frequency drift modes are not unstable in Tokamaks. A dispersion relation for nonlinear scattering of drift waves has been derived. Progress has been made in automating the calculation of parametric processes analytically by computer.

SUPPORTED BY U.S. Dept. of Energy

8.0032, DEVELOPMENT OF ANTENNA SPECIFICATIONS FOR THE ADVANCED SYNTHETIC APERTURE RADAR (ASAR) PROJECT
K.R. Carver, New Mexico State University, Las Cruces Campus, School of Engineering, Dept. of Electrical Engineering, *University Park, Las Cruces, New Mexico* 88003 (NAS 9-16092)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

8.0033, PERFORM WORK TO CARRY OUT BRANMA CODE CALCULATIONS TO SIMULATE PLASMA LOADS FOR PROTO II ACCELERATOR
Unknown, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (EY-77-X-04-1067)

SUPPORTED BY U.S. Dept. of Energy

8.0034, NON-ADIABATIC APPROACH TO VIBRONICALLY ASSISTED RADIATIVE AND RADIATIONLESS TRANSITIONS
M. Lax, City University of New York, City College, School of Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (EG-77-S-02-4335)

A relation will be developed between the vibronically assisted radiative cross-section and that for radiationless transitions. Calculations will be made of the cross-section associated with a true multiphonon process. The method proposed will treat the nuclei classically but avoid the adiabatic approximation and will be patterned after a method due to Landau and Zener. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy

8.0035, FLUORESCENT SCATTERING BY MOLECULES EMBEDDED IN SMALL PARTICLES
P.J. McNulty, Clarkson College of Technology, School of Arts & Sciences, Dept. of Physics, *51 Main St., Potsdam, New York* 13676 (EE-77-S-02-4361)

SUPPORTED BY U.S. Dept. of Energy

8.0036, GENERATION AND FOCUSSING OF PULSED INTENSE ION BEAMS
R.N. Sudan, Cornell University, Ithaca Campus, School of Engineering, Dept. of Applied Engineering & Physics, *242 Carpenter Hall, Ithaca, New York* 14853 (ES-77-S-02-4209)

The proposed work involves the focussing of intense ion beams in a spherical magnetically insulated diode to obtain a point focus. The ability to focus such beams by quadrupole magnetic lenses will also be examined. Improvements in the divergence of the emitted beam from the diode will be sought. Propagation and stability of the beams will be studied in low pressure gas.

RESULTS: Intense ion beams have been focussed in cylindrical, magnetically insulated diodes to a line focus at the current density of approximately 0.5 kA and a total current close to 100 kA. Intense ion beams to the order of 10 kA at a few hundred kV have been magnetically focussed by a dipole lens. It has been found that the propagation of the ion beams can be explained in terms of charged and current neutralized beams where the individual particles follow ballistic trajectories.

SUPPORTED BY U.S. Dept. of Energy

8.0037, CHARGE EXCHANGE COLLISIONS OF HIGHLY STRIPPED IONS WITH ATOMIC HYDROGEN
Unknown, University of Pittsburgh, Graduate School, *1028H Cathedral of Learning, Pittsburgh, Pennsylvania* 15213 (EG-77-S-02-4257)

New double tandem accelerator techniques will be used to study charge exchange of totally stripped C, N, and O ions as well as highly stripped Ni and Fe ions. The excited state content of ion beams produced by charge exchange will be investigated using kinetic energy analysis.

RESULTS: Cross-sections have been measured for partially stripped B, C, N, O, Si and Fe ion collisions with H, H2, He and Ar. Kinetic energy analysis of B3 ion produced in B4 ion-Ar collisions has been accomplished. Highly stripped ions have been decelerated to lower energies using a double tandem accelerator.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0038, STUDIES FOR THE PRODUCTION OF SUPERPURE SILICON NITRIDE
Unknown, University of Pittsburgh, Graduate School, *1028H Cathedral of Learning, Pittsburgh, Pennsylvania* 15213 (EG-77-S-02-4357)

SUPPORTED BY U.S. Dept. of Energy

8.0039, (GP-B) GRAVITY PROBE-B POINTING CONTROL AND ERROR ANALYSIS
J.C. Hung, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Electrical Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS 8-33849)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0040, MICROSTRUCTURAL STUDIES OF HYDROGEN AND DEUTERIUM IN BCC REFRACTORY METALS
S.C. Moss, University of Houston, School of Arts & Sciences, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (EY-76-S-05-5111)

Hydrogen- (or deuterium-) related phenomena (lattice strain, hydride precipitation, electronic effects, Fermi surface determination, phonon dispersion) in refractory metals (V, Nb, Ta) are to be studied by using neutron scattering, X-ray diffraction, gamma-ray Compton scattering, and positron annihilation. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0041, THE INITIAL PHASES OF A TOKAMAK DISCHARGE
R.D. Bengtson, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (EG-77-S-05-5615)

This experimental study will be conducted in a research Tokamak with design parameters R equals 53 cm, A equals 16 cm, B equals 10 to 20 KG, I/sub p/ equals 80 to 160 KA, T/sub e/ equals 400 eV, usable pulse length 50 msi. Emphasis will be placed on impurity transport and atomic physics studies of discharge initiation by a variety of techniques. Diagnostics to be installed on the device include 2 and 4 mm microwave Thompson scattering, and a wide variety of spectrometers.

SUPPORTED BY U.S. Dept. of Energy

8.0042, NONLINEAR MAGNETOHYDRODYNAMICS
G.M. Vahala, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (EY-76-S-05-5260)

It now seems quite natural to attain a high Beta Tokamak state by means of intense neutral beam injection. Clarke has shown that such a sequence of equilibria can be flux conserving (FCT concept). Very extensive (and non-trivial) numerical codes have been developed to study such FCT equilibria. We propose to obtain analytic solutions with nonlinear q (psi), p (psi) profiles by means of perturbation techniques. This analytic work is crucial, not only to better understand the results from the numerical codes, but because it will open the door to further analytic work on transport and stability.

The above approach and philosophy is the standard one performed in magnetic confinement studies. We believe it is of utmost importance to study non-perturbative non-linear MHD--in particular, a statistical approach to magnetic confinement. Recently, we (with Leaf Turner of LASL) have been successful in applying a statistical approach (used in fluid turbulence with periodic boundary conditions) to 3-D MHD turbulence in cylindrical geometry. We propose to apply this technique to considering the disruptive instability, magnetic island formation, transport, field reversal in toroidal z-pinches.

SUPPORTED BY U.S. Dept. of Energy

8.0043, THE PHYSICS AND CHEMISTRY OF SUPPORTED METAL CLUSTERS
J.T. Dickinson, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (NCA 2-840002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0044, STUDIES OF THERMONUCLEAR PLASMA EMPHASIZING PLASMA STUDIES WITH TOROIDAL MULTIPOLES
Unknown, University of Wisconsin, Madison Campus, Graduate School, *500 Lincoln Dr., Madison, Wisconsin* 53706 (EY-76-S-02-2387)

SUPPORTED BY U.S. Dept. of Energy

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, GUIDE FOR THE TEACHING AND STUDENT RESEARCH OF THE APPLICATIONS OF SHUTTLE-DERIVED SPACE UTILIZATION TECHNOLOGIES
T.S. Cheston, Georgetown University, Graduate School, *3800 Reservoir Rd. N.W., Washington, District of Columbia* 20007 (NASW 3397)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

9.0002, SAMPLING ERRORS FOR REGRESSION STATISTICS FROM COMPLEX SAMPLE DESIGNS
G. Kalton, University of Michigan, Ann Arbor Campus, Graduate School, *Rackham Bldg., Ann Arbor, Michigan* 48104 (NAS 1-16107)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, EVOLUTION OF THE CHROMOSPHERES TRANSITION REGIONS IN DWARF STARS
M.S. Giampapa, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAG 5-57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0002, ULTRAVIOLET SPECTROSCOPY OF HEAVY ELEMENT ABUNDANCES IN THE NOVACE
R.E. Williams, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAG 5-56)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0003, RESEARCH OF THE STELLAR POPULATION OF NORMAL GALAXIES
J.G. Cohen, California Inst. of Technology. Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 5-68)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0004, DATA REDUCTION AND ANALYSIS OF INTERPLANETARY MONITORING PLATFORM (IMP) ELECTRON ISOTOPE SPECTROMETER EXPERIMENT
E.C. Stone, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAS 5-25789)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0005, OBSERVATIONS OF SELECTED JOVIAN ATMOSPHERIC FEATURES
J.T. Trauger, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sciences, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 5-66)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0006, ECLIPSE COVERAGE OF SELECTED VARIABLE AND BINARY STARS
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 5-69)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0007, STUDY OF CHROMOSPHERIC ACTIVITY IN SPECTROSCOPIC BINARY SYSTEMS
L.V. Kuhi, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 5-55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0008, SPECTROSCOPIC OBSERVATIONS OF SELECTED STELLAR SYSTEMS
P.S. Conti, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astrogeophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-78)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0009, DISTRIBUTION AND KINEMATICS OF INTERSTELLAR GAS
W. Herbst, Wesleyan University, School of Liberal Arts & Sciences, Dept. of Astronomy, *Middletown, Connecticut* 06457 (NAG 5-59)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0010, COMETARY OBSERVATIONS WITH THE INTERNATIONAL ULTRAVIOLET EXPLORER
W.M. Jackson, Howard University, Graduate School of Arts & Sciences, Dept. of Astronomy, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAG 5-65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0011, DEFINITION PHASE FOR TRANSITION RADIATION AND IONIZATION CALORIMETER (TRIC) TELESCOPE
D. Muller, University of Chicago, School of Physical Sciences, Dept. of Physics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (NAS 5-26076)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0012, ULTRAVIOLET COMETARY SPECTROPHOTOMETRY
M.F. Ahearn, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAG 5-74)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0013, OBSERVATION OF GLOBULAR CLUSTERS AND X-RAY BUSTERS
J.E. Grindlay, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAG 5-72)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0014, MULTIFREQUENCY OBSERVATIONS OF SELECTED EXTRAGALACTIC SOURCES
A.E. Glassgold, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (NAG 5-73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0015, INVESTIGATION OF EMISSION LINE PROFILES IN TYPE 1 SEYFERT GALAXIES
S. Gregory, Bowling Green State University, School of Arts & Sciences, Dept. of Astronomy, *Bowling Green, Ohio* 43402 (NAG 5-64)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0016, DEVELOPMENT OF A HIGH RESOLUTION GAMMA RAY TELESCOPE
G.M. Frye, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (NASW 3404)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0017, STUDIES OF NEW BRIGHT CHROMOSPHERICAL ACTION STARS
B.W. Bopp, University of Toledo, School of Arts & Sciences, Dept. of Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (NAG 5-67)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0018, ULTRAVIOLET STUDY OF PECULIAR WHITE DWARFS
G.A. Wegner, Pennsylvania State University, University Park Campus, School of Science, Dept. of Astronomy, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (NAG 5-60)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0019, ULTRAVIOLET STUDIES OF THE COMPONENTS OF CEPHEID VARIABLES
D.H. McNamara, Brigham Young University, School of Engineering Science & Technology, Dept. of Physics, *B-166 A S B, Provo, Utah* 84601 (NAG 5-62)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0020, SPACELAB/ULTRAVIOLET IMAGING TELESCOPE - ASTRONOMICAL INVESTIGATIONS
R.W. O'Connell, University of Virginia, School of Arts & Sciences, Dept. of Astronomy, *Garrett Hall, Charlottesville, Virginia* 22903 (NAS 5-26110)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

GENERAL

11.0001, VERY LONG BASELINE INTERFEROMETER UPGRADING IMPLEMENTATION, OPERATION AND MAINTENANCE OF THE HARVARD RADIO ASTRONOMY STATION

A.E. Lilley, Harvard University, Cambridge Campus, Harvard College Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (NAS 5-25677)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

11.0002, ORGANIZATION OF THE PAPERS OF HENRY NORRIS RUSSELL

S. Weart, American Inst. of Physics Inc., *335 E. 45th St., New York, New York* 10017 (SOC78-17435)

Henry Norris Russell, possibly the most influential person in the development of modern stellar astronomy, made significant contributions to all aspects of the science during the period 1900-1950. He enjoyed a position of influence and authority in the astronomical community not equalled today. His papers will be organized, catalogued and partially microfilmed for the use of historians, philosophers and sociologists of science. An archive assistant will be employed at Princeton University Library, where the papers are located, to engage in the physical organization.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-32323*# Michigan Univ., Ann Arbor.
INTERACTION BETWEEN A NORMAL SHOCK WAVE AND A TURBULENT BOUNDARY LAYER AT HIGH TRANSONIC SPEEDS. PART 1: PRESSURE DISTRIBUTION. PART 2: WALL SHEAR STRESS. PART 3: SIMPLIFIED FORMULAS FOR THE PREDICTION OF SURFACE PRESSURES AND SKIN FRICTION Final Report
T. C. Adamson, Jr., M. S. Liou, and A. F. Messiter. Sep. 1980 136 p refs
(Grant NsG-1326)
(NASA-CR-3194) Avail: NTIS HC A07/MF A01 CSCL 02A

An asymptotic description is derived for the interaction between a shock wave and a turbulent boundary layer in transonic flow, for a particular limiting case. The dimensionless difference between the external flow velocity and critical sound speed is taken to be much smaller than one, but large in comparison with the dimensionless friction velocity. The basic results are derived for a flat plate, and corrections for longitudinal wall curvature and for flow in a circular pipe are also shown. Solutions are given for the wall pressure distribution and the shape of the shock wave. Solutions for the wall shear stress are obtained, and a criterion for incipient separation is derived. Simplified solutions for both the wall pressure and skin friction distributions in the interaction region are given. These results are presented in a form suitable for use in computer programs.
Author

N80-32324# Sikorsky Aircraft, Stratford, Conn.
ADVANCED STRUCTURES MAINTENANCE CONCEPTS Final Report, Aug. 1979 - Mar. 1980
Thomas N. Cook, Michael G. Adams, Rocco R. Digenova, and David P. Maass. Jun. 1980 120 p
(Contract DAAK51-79-C-0027; DA Proj. 1L1-62209-AH-76)
(AD-A087609; SER-510029; USAAVRADCOM-TR-80-D-16)
Avail: NTIS HC A06/MF A01 CSCL 11/4

A detailed R M analysis was conducted for an advanced composite rear fuselage for the UH-60A Black Hawk helicopter. Methods of improving the damage tolerance of the structure in areas of high impact exposure were evaluated. Cost effective R M options were recommended for incorporation in the design. Materials and techniques for performing rapid, low skill level repair of composite airframe structures in the Army field environment were investigated. Epoxide impregnated preform patches were evaluated for repair of primary structural components. Polyurethane foam kits were studied as a potential method of creating forms and mandrels for laminating repairs on the aircraft. A modular design concept was developed for the UH-60A composite rear fuselage. Module replacement methods were defined. Studies were conducted to assess the economics of modular maintenance versus conventional types of repair. Potential improvements in combat repairability were evaluated. GRA

N80-32325# Transportation Systems Center, Cambridge, Mass. Statistical Design and Analysis Branch.
GENERAL AVIATION ACTIVITY AND AVIONICS SURVEY, 1978 Annual Summary Report, CY 1978
Judith C. Schwenk. Mar. 1980 161 p refs Sponsored by DOT
(AD-A087653; TSC-FAA-80-6; FAA-MS-80-5) Avail: NTIS HC A08/MF A01 CSCL 01/2

This report presents the results and a description of the 1978 General Aviation Activity and Avionics Survey. The survey was conducted during early 1979 by the FAA to obtain information on the activity and avionics of the United States registered general aviation aircraft fleet, the dominant component of civil aviation in the U.S. The survey was based on a statistically selected sample of about 13.3 percent of the general aviation fleet and obtained a response rate of 74 percent. Survey results are based upon responses but are expanded upward to represent the total population. Survey results revealed that during 1978 an estimated 39.4 million hours of flying time were logged by the 198,778 active general aviation aircraft in the U.S. fleet, yielding a mean annual flight time per aircraft of 197.7 hours. The active aircraft represented 85 percent of the registered general aviation fleet. The report contains breakdowns of these and other statistics by manufacturer/model group, aircraft type, state and region of based aircraft, and primary use. Also included are fuel consumption, lifetime airframe hours, avionics, and engine hours estimates. GRA

N80-32326# Arizona State Univ., Tempe. Dept. of Industrial and Management Systems Engineering.
DEVELOPMENT OF AN EFFECTIVENESS PLANNING AND EVALUATION MODEL FOR AIR FORCE MAINTENANCE ORGANIZATIONS Final Scientific Report, 1 May 1979 - 15 Feb. 1980
Hewitt H. Young. 1 Apr. 1980 216 p refs
(Grant AF-AFOSR-0111-79; AF Proj. 2313)
(AD-A088061; ASU-ERC-R-80016; AFOSR-80-0598TR) Avail: NTIS HC A10/MF A01 CSCL 15/5

A preliminary effort was made to generate a survey-supported model which would (1) permit periodic evaluation of the performance effectiveness of an Air Force maintenance squadron and (2) highlight equipment and human resource factors which are contributing either positively or negatively to maintenance squadron performance. The model is generated from survey data, collected from a stratified sample of maintenance technicians and their shift supervisors, and processed by means of a stepwise, linear multiple regression statistical package to provide a performance prediction equation. Factors which surface as significant in the equation indicate positive and negative contributions to squadron performance effectiveness. The modeling effort is based on studies with the 82nd Air Training Command Wing at Williams AFB and the 405th Tactical Air Command Wing at Luke AFB, both in Arizona. The model was validated using immediate supervisor ratings of maintenance technician performance in speed and quality of work, averaged across a squadron. Based on the analyses and results of studies covering two maintenance squadrons at Williams AFB and three maintenance squadrons at Luke AFB, the model provides

excellent predictions of squadron performance effectiveness and highlights significant contributing factors. GRA

N80-32327# Office of Air Force History, Washington, D. C.
THE US AIR SERVICE IN WORLD WAR I. VOLUME 3: THE BATTLE OF SAINT MIHIEL
Maurer Maurer, comp. 1979 827 p refs Prepared in cooperation with Albert F. Simpson Historical Research Center, Maxwell AFB, Ala. 3 Vol.
(AD-A088294) Avail: NTIS HC A99/MF A01 CSCL 15/7

The Battle of Saint Mihiel is of singular significance in the history of United States participation in World War I. It was the first battle in France in which an American army fought under the American flag. The U.S. offensive gained all objectives quickly and with relatively few casualties. It eliminated a menacing salient that had threatened the Allied battleline for four years, and it cleared the way for new offensive that would end the war in less than two months. Aerial operations at Saint Mihiel made the battle an important event in the history of U.S. Military aviation. It was, primarily, Col. William (Billy) Mitchell's show. He put together the largest air force ever committed to battle and drew up the plan for its employment. This volume presents documents relating to the role of U.S. aviation in the Battle of Saint Mihiel. It is the third in a series of four volumes that the Office of Air Force History is publishing on the U.S. Air Service in World War 1. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-32328*# Illinois Inst. of Tech., Chicago.
EFFECTS OF AXISYMMETRIC CONTRACTIONS ON TURBULENCE OF VARIOUS SCALES Final Report
Jimmy Tan-atichat, Hassan M. Nagib, and Robert E. Drubka Sep. 1980 376 p refs
(Grant NsG-3220)
(NASA-CR-165136; R80-1) Avail: NTIS HC A17/MF A01 CSCL 01A

Digitally acquired and processed results from an experimental investigation of grid generated turbulence of various scales through and downstream of nine matched cubic contour contractions ranging in area ratio from 2 to 36, and in length to inlet diameter ratio from 0.25 to 1.50 are reported. An additional contraction with a fifth order contour was also utilized for studying the shape effect. Thirteen homogeneous and nearly isotropic test flow conditions with a range of turbulence intensities, length scales and Reynolds numbers were generated and used to examine the sensitivity of the contractions to upstream turbulence. The extent to which the turbulence is altered by the contraction depends on the incoming turbulence scales, the total strain experienced by the fluid, as well as the contraction ratio and the strain rate. Varying the turbulence integral scale influences the transverse turbulence components more than the streamwise component. In general, the larger the turbulence scale, the lesser the reduction in the turbulence intensity of the transverse components. Best agreement with rapid distortion theory was obtained for large scale turbulence, where viscous decay over the contraction length was negligible, or when a first order correction for viscous decay was applied to the results. T.M.

N80-32329*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
CALCULATION OF THE TRANSIENT MOTION OF ELASTIC AIRFOILS FORCED BY CONTROL SURFACE MOTION AND GUSTS
A. V. Balakrishnan and John W. Edwards Aug. 1980 167 p refs
(Contract NAS4-2472)
(NASA-TM-81351; H-1125; Rept-505-36-24) Avail: NTIS HC A08/MF A01 CSCL 01A

The time-domain equations of motion of elastic airfoil sections forced by control surface motions and gusts were developed for the case of incompressible flow. Extensive use was made of special functions related to the inverse transform of Theodorsen's function. Approximations for the special cases of zero stream velocity, small time, large and time are given. A numerical solution technique for the solution of the general case is given. Examples of the exact transient response of an airfoil are presented. T.M.

N80-32330*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A CONTINUED FRACTION REPRESENTATION FOR THEODORSEN'S CIRCULATION FUNCTION
Robert N. Desmarais Sep. 1980 33 p refs
(NASA-TM-81838) Avail: NTIS HC A03/MF A01 CSCL 01A

Theodorsen's circulation function relates lift to downwash in unsteady two dimensional incompressible flow. A continued fraction representation for the circulation function is described. The continued fraction converges and has a particularly simple coefficient pattern. R.K.G.

N80-32331# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
A STUDY OF TRANSIENT ABLATION OF BLUNT BODIES Ph.D. Thesis
Kazuhiro Nakahashi (National Aerospace Lab., Kakuda, Japan) Jul. 1980 29 p refs
(ISAS-581-Vol-45-No-6; ISSN-0372-1418) Avail: NTIS HC A03/MF A01

The results of a numerical approach to transient thermal response of ablating blunt bodies made of Teflon are given. A simplified thermal model was proposed to solve thermal field in the ablator having phase transition. The viscous shock-layer flow and heat conduction in the ablator were calculated using an alternately iterative scheme, and the transient thermal response of the ablating bodies is discussed in detail with emphasis on the effects of chemical reactions of the ablation products. The chemical reactions such as combustion of the ablation products in the shock layer modify characteristics of the wall heating rate significantly. The existing simple formula, which is proposed for estimating surface heating rate with reactive coolant injection, cannot predict the real heating characteristics over the ablating surface. T.M.

N80-32332*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRESSURE DATA FOR FOUR ANALYTICALLY DEFINED ARROW WINGS IN SUPERSONIC FLOW
James C. Townsend Sep. 1980 128 p refs
(NASA-TM-81835; L-13703) Avail: NTIS HC A07/MF A01 CSCL 01A

In order to provide experimental data for comparison with newly developed finite difference methods for computing supersonic flows over aircraft configurations, wind tunnel tests were conducted on four arrow wing models. The models were machined under numeric control to precisely duplicate analytically defined shapes. They were heavily instrumented with pressure orifices at several cross sections ahead of and in the region where there is a gap between the body and the wing trailing edge. The test Mach numbers were 2.36, 2.96, and 4.63. Tabulated pressure data for the complete test series are presented along with selected oil flow photographs. Comparisons of some preliminary numerical results at zero angle of attack show good to excellent agreement with the experimental pressure distributions. Author

N80-32333*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AERODYNAMIC CHARACTERISTICS OF THREE HELICOPTER ROTOR AIRFOIL SECTIONS AT REYNOLDS NUMBER FROM MODEL SCALE TO FULL SCALE AT MACH NUMBERS FROM 0.35 TO 0.90
Kevin W. Noonan and Gene J. Bingham Sep. 1980 85 p refs Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
(DA Proj. 1L1-61102-AH-45)
(NASA-TP-1701; L-13139; AVRADCOM-TR-80-B-5) Avail: NTIS HC A05/MF A01 CSCL 01A

An investigation was conducted in the Langley 6 by 28 inch transonic tunnel to determine the two dimensional aerodynamic characteristics of three helicopter rotor airfoils at Reynolds numbers from typical model scale to full scale at Mach numbers from about 0.35 to 0.90. The model scale Reynolds numbers ranged from about 700,00 to 1,500,000 and the full scale Reynolds numbers ranged from about 3,000,000 to 6,600,000. The airfoils tested were the NACA 0012 (0 deg Tab), the SC 1095 R8, and the SC 1095. Both the SC 1095 and the SC 1095 R8 airfoils had trailing edge tabs. The results of this investigation indicate that Reynolds number effects can be significant on the maximum normal force coefficient and all drag related parameters; namely, drag at zero normal force, maximum normal force drag ratio, and drag divergence Mach number. The increments in these parameters at a given Mach number owing to the model scale to full scale Reynolds number change are different for each of the airfoils. R.K.G.

N80-32334*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A NEW THEORY FOR RAPID CALCULATION OF THE GROUND PATTERN OF THE INCIDENT SOUND INTENSITY PRODUCED BY A MANEUVERING JET AIRPLANE

Raymond L. Barger. Washington, Sep. 1980. 24 p. refs.
(NASA-TP-1733; L-13629) Avail: NTIS. HC A02/MF A01. CSCL 01A.

An approximate method for computing the jet noise pattern of a maneuvering airplane is described. The method permits one to relate the noise pattern individually to the influences of airplane speed and acceleration, jet velocity and acceleration, and the flight path curvature. The analytic formulation determines the ground pattern directly without interpolation and runs rapidly on a minicomputer. Calculated examples including a climbing turn and a simple climb pattern with a gradual throttling back are presented. T.M.

N80-32335*# Bihrle Applied Research, Inc., Jericho, N. Y.

ROTARY BALANCE DATA FOR A TYPICAL SINGLE-ENGINE GENERAL AVIATION DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEG TO 90 DEG. 2: HIGH-WING MODEL C

Randy S. Hultberg and Julio Chu. Oct. 1980. 335 p. refs.
(Contract NAS1-14849)
(NASA-CR-3201) Avail: NTIS. HC A15/MF A01. CSCL 01A.

Aerodynamic characteristics obtained in a helical flow environment utilizing a rotary balance located in the Langley spin g tunnel are presented in plotted form for a 1/6 scale, single engine, high wing, general aviation model. The configurations tested included the basic airplane and control deflections, wing leading edge devices, tail designs, and airplane components. Data are presented without analysis for an angle of attack range of 8 deg to 90 deg and clockwise and counter clockwise rotations covering a spin coefficient range from 0 to 0.9. Author

N80-32336# Royal Aircraft Establishment, Farnborough (England).

CONCERNING THE SEPARATED FLOW ABOUT AN INFLATING PARACHUTE

N. V. Akrushkin, A. K. Kuchugura, and N. K. Tsyganov. Jun. 1980. 12 p. refs. Transl. into ENGLISH of the book "Volnyv Sploshnykh Sredakh" Kiev, 1978 p 60-67.
(RAE-Trans-2031; BR75806) Avail: NTIS. HC A02/MF A01.

The separated flow about an inflating canopy was modelled. The canopy geometry was approximated by a conical frustum with a hemispherical cap. The canopy envelope was replaced by a distribution of discrete vortex rings and the separated flow region was modelled by free ring vortices. The canopy pressure distribution and the mean flow velocity through the canopy vent were determined for one instant during the inflation for various vent sizes and canopy porosity values. T.M.

N80-32337*# Boeing Commercial Airplane Co., Seattle, Wash.

LARGE SCALE WIND TUNNEL INVESTIGATION FOR FUTURE MODIFICATIONS TO THE QUIET SHORT-HAUL RESEARCH AIRCRAFT

Donald N. Hultman. Sep. 1980. 35 p. refs.
(Contract NAS2-9196)
(NASA-CR-152349) Avail: NTIS. HC A03/MF A01. CSCL 01A.

Results of wind tunnel investigation performed to eliminate the leading edge blowing system on the baseline quiet short haul research aircraft are presented. This was accomplished by repositioning the leading edge flaps to a slotted position. Gap, overlap, and deflection angle variations were investigated. A configuration was established that satisfies QSRA performance and safety requirements. A.R.H.

N80-32338*# Lear Siegler, Inc., Santa Monica, Calif. Astronics Div.

A COMPARISON OF FLIGHT AND SIMULATION DATA FOR THREE AUTOMATIC LANDING SYSTEM CONTROL LAWS FOR THE AUGMENTOR WING JET STOL RESEARCH AIRPLANE

B. Feinreich and G. Gevaert. [1980] 18 p. refs.
(Contract NAS2-10324)
(NASA-CR-152365) Avail: NTIS. HC A02/MF A01. CSCL 01A.

Automatic flare and decrab control laws for conventional takeoff and landing aircraft were adapted to the unique requirements of the powered lift short takeoff and landing airplane. Three longitudinal autoland control laws were developed. Direct lift and direct drag control were used in the longitudinal axis. A fast time simulation was used for the control law synthesis, with emphasis on stochastic performance prediction and evaluation. Good correlation with flight test results was obtained. S.F.

N80-32339*# Nielsen Engineering and Research, Inc., Mountain View, Calif.

A CORRELATION METHOD TO PREDICT THE SURFACE PRESSURE DISTRIBUTION OF AN INFINITE PLATE OR A BODY OF REVOLUTION FROM WHICH A JET IS ISSUING

Final Report, 1 Dec. 1978 - 1 May 1980

Stanley C. Perkins, Jr. and Michael R. Mendenhall. Jan. 1980. 200 p. refs.
(Contract NAS2-10125)
(NASA-CR-152345; NEAR-TR-211) Avail: NTIS. HC A09/MF A01. CSCL 01A.

A correlation method to predict pressures induced on an infinite plate by a jet exhausting normal to the plate into a subsonic free stream was extended to jets exhausting at angles to the plate and to jets exhausting normal to the surface of a body revolution. The complete method consisted of an analytical method which models the blockage and entrainment properties of the jet and an empirical correlation which accounts for viscous effects. For the flat plate case, the method was applicable to jet velocity ratios up to ten, jet inclination angles up to 45 deg from the normal, and radial distances up to five diameters from the jet. For the body of revolution case, the method was applicable to a body at zero degrees angle of attack, jet velocity ratios 1.96 and 3.43, circumferential angles around the body up to 25 deg from the jet, axial distances up to seven diameters from the jet, and jet-to-body diameter ratios less than 0.1. R.C.T.

N80-32340# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

DYNAMIC TECHNIQUE FOR LAUNCHING STRATOSPHERIC BALLOONS WITH EXPERIMENTS WEIGHING MORE THAN 500 Kg ABOARD [TECNICA DINAMICA PARA LANCHAMENTO DE BALOES ESTRATOSFERICOS COM EXPERIMENTOS A BORDO DEMAIS DE 500 KG]

Inacio Malmonge Martin. Jul. 1980. 11 p. refs. In PORTUGUESE; ENGLISH summary. Presented at the 32d Reuniao Anual da SBPC, 6-12 Jul. 1980. Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico.
(INPE-1821-RPE/187) Avail: NTIS. HC A02/MF A01.

A simple launching system, spool type, fixed to the front of a truck having a special winch was developed. This was possible through the estimation of the balloon launching thrust from data tables on the gas temperature, the tube equivalent volume of water and the initial inflating pressure. A description of this technique and the results obtained in two 100,000 cu m balloon launchings are presented. T.M.

N80-32341# Payne, Inc., Annapolis, Md.
AFTERBODY DRAG. VOLUME 1: DRAG OF CONICAL AND CIRCULAR ARC AFTERBODIES WITHOUT JET FLOW Final Report
Peter R. Payne, Richard M. Hartley, and Robert M. Taylor May 1980 60 p refs
(Contract N00014-77-C-0039; WF32322203)
(AD-A087514; A125-1-Vol-1; DTNSRDC/ASED-80/10-Vol-1)
Avail: NTIS HC A04/MF A01 CSCL 20/4

A series of charts is presented which permits the determination of the base and boattail drag of conical and circular arc afterbodies. The effect of Reynolds number is considered. GRA

N80-32342# Payne, Inc., Annapolis, Md.
AFTERBODY DRAG. VOLUME 2: JET INTERFERENCE EFFECTS ON SUBSONIC BOATTAIL DRAG Final Report
Peter R. Payne Jun. 1980 74 p refs
(Contract N00014-77-C-0039; WF3232203)
(AD-A087515; A125-1-Vol-2; DTNSRDC/ASED-80/12-Vol-2)
Avail: NTIS HC A04/MF A01 CSCL 20/4

The effect of a propulsive jet on the static pressure distribution over the boattail from which it issues is discussed as well as the effect on the boattail drag. A basis is given for developing a more comprehensive analysis, provided the flow is not separated. A zero base area is assumed. GRA

N80-32343# Stevens Inst. of Tech., Hoboken, N. J.
A PROCEDURE FOR CALCULATION OF THE PRESSURE ALONG THE AXIS OF A TIP VORTEX Final Report, 10 Oct. 1977 - 30 Sep. 1978
T. V. Davies and T. P. Breslin May 1980 36 p refs
(Contract N00014-78-C-0114; SR0230101)
(AD-A087667; SIT-DL-80-9-2124) Avail: NTIS
HC A03/MF A01 CSCL 20/4

The generation of vortical flow abreast the lateral edge and downstream of a lifting surface is examined from the basic equations of fluid mechanics using the Oseen approximation. Coupled equations which arise from matching inner and outer expansions about a conical region are derived. Their numerical solution (not attempted here) is expected to provide a more accurate prediction of the pressure distribution along the vortex axis and, hence, to a reliable prediction of inception of tip cavitation as a function of Reynolds number, and the loading on the lifting surface in the vicinity of the tip. GRA

N80-32344# Weapons Research Establishment, Adelaide (Australia).
IMPROVEMENTS TO THE NSWC AERODYNAMICS PREDICTION PROGRAM OF PARTICULAR SIGNIFICANCE FOR BOMBS
L. M. Sheppard Mar. 1980 22 p refs
(AD-A087769; WSRL-0146-TR) Avail: NTIS
HC A02/MF A01 CSCL 19/2

During use of the NSWC missile aerodynamics prediction program, a number of deficiencies have been found. Because these deficiencies are important on bombs, simple but effective corrections have been devised. Details are given of a revised expression for boattail normal force at subsonic and transonic speeds. This is necessary because the program gives normal force results that are much too large in magnitude when the base diameter is small. Also included is a correction for boattail center of pressure. In order to cope with fuses and lugs on bombs, allowances have been devised for truncated nose viscous separation pressure drag at subsonic and transonic speeds, and for excrescence drag at all speeds. The program includes an allowance for viscous separation drag at the nose shoulder, at transonic speeds. Finally, a correction has been included to account for the wave drag due to large amounts of nose blunting, including the region near the drag rise Mach number. Comparisons are made with experimental data from a number of sources, in order to show that the modified program is effective and useful. GRA

N80-32345# Engineering Analysis, Inc., Ames, Iowa.
COMPUTATION OF THREE-DIMENSIONAL SUPERSONIC VISCOUS FLOWS IN INTERNAL CORNERS Final Report, 15 Jan. 1979 - 15 Jan. 1980
John C. Tannehill and Dale A. Anderson Mar. 1980 53 p refs
(Contract F33615-79-C-3000; AF Proj. 2307)
(AD-A085857; AFWAL-TR-80-3017) Avail: NTIS
HC A04/MF A01 CSCL 20/4

Three dimensional, supersonic viscous flows in internal corners are computed by solving the unsteady Navier-Stokes equations subject to a local conical assumption. These governing equations are solved using MacCormack's explicit finite difference scheme. A generalized coordinate system is employed which permits the grid to be refined near walls as well as in interaction regions so that viscous details can be properly resolved. Both shock fitting and shock capturing techniques are used. Two different corner flowfields are computed and the results are compared with experimental data and previous numerical solutions of the complete Navier-Stokes equations. GRA

N80-32346# Naval Research Lab., Washington, D. C. Marine Technology Div.
VORTEX SHEDDING FROM STATIONARY AND VIBRATING BLUFF BODIES IN A SHEAR FLOW Interim Report, FY 1980
Owen M. Griffin 11 Aug. 1980 43 p refs
(AD-A088083; NRL-MR-4287) Avail: NTIS
HC A03/MF A01 CSCL 20/4

If a fluid is in relative motion past a stationary bluff, or unstreamlined, structure and the vortex shedding frequency approaches one of the natural frequencies of the structure, then resonant flow-induced oscillations of the structure can occur when the damping of the system is sufficiently low. These resonant oscillations are accompanied by a 'lock-on' or capture of the vortex shedding frequency by the vibration frequency over a range of flow speeds, and this lock-on effect causes the wake and the structure to oscillate in unison. The periodic lift and the mean drag forces are amplified as a result of the vibrations, and changes in these fluid forces are closely related to the changes that occur in the flow field in the near wake of the body. Many practical ocean and wind engineering situations involve lightly damped structures that are located in flows of air or water that are nonuniform along the length of the structure. The primary difference between a uniform flow and a shear flow is the presence and added complexity, in a shear flow, of vorticity whose vector is normal to the plane of the flow. When the incident flow approaches the body this vorticity is turned into the flow direction and interacts with the vortices which are shed from the body into the wake. GRA

N80-32347# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
LOW SPEED AERODYNAMIC CHARACTERISTICS OF WINGS OF ASPECT RATIOS 3 AND 4 EQUIPPED WITH HIGH LIFT SYSTEMS
Lynn A. Trobaugh, David G. Lee, and Michael J. Harris May 1980 94 p refs
(WF41421091)
(AD-A087768; DTNSRDC/ASED-80/09) Avail: NTIS
HC A05/MF A01 CSCL 20/4

Low speed wind tunnel data show that wings of aspect ratios 3 and 4 can produce maximum lift coefficients twice that of conventional double slotted flap configurations by using powered high lift systems. These high lift systems, which utilize either the circulation control or upper surface blowing concepts, were applied to a semispan wing fuselage model having a supercritical airfoil section. GRA

N80-32348# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
THEORETICAL CALCULATION OF VISCOUS-INVISCID TRANSONIC FLOWS Research and Development Report
Tsze C. Tai Aug. 1980 66 p refs Presented at the 1979 - 1980 Lecture Ser. on Shock-Boundary Layer Interaction in Turbomachines at the Von Karman Inst. for Fluid Dyn., Belgium, 2-6 Jun. 1980
(AD-A087745; DTNSRDC-80/104; DTNSRDC/AERO-1268)
Avail: NTIS HC A04/MF A01 CSCL 20/4

The current status of computational capabilities for calculating viscous inviscid transonic flows other than the solution of Navier-Stokes equations is presented. Techniques for solving transonic inviscid flows and compressible integral boundary layer methods are reviewed, and systems for strong viscous inviscid

interactions are described. Generally, the transonic viscous inviscid interaction is characterized by a subcritical boundary layer with a supersonic outer stream. The thickening boundary layer produces a pressure rise which causes further thickening of the boundary layer. The physical flow is best modeled by direct coupling of the viscous and inviscid systems to allow immediate interaction between the shock wave and the boundary layer. It appears that the method of integral relations for the outer inviscid flow, combined with an integral boundary layer scheme, possesses such a capability. To facilitate the computation, a hybrid approach to the transonic inviscid solution, which consists of the finite difference method for solving the overall transonic inviscid potential flow field and the method of integral relations for solving Euler's equation in the shock region, is suggested. Finally, the application of the steady two dimensional methods to the quasi two dimensional problem on axisymmetric stream surface of a cascade flow at transonic speeds is discussed. GRA

N80-32349# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Dept. of Aerospace.
HYPERSONIC WIND TUNNEL STUDY OF A 15 DEG - 30 DEG HALF ANGLE CONCAVE BICONIC MODEL UP TO HIGH ANGLES OF ATTACK Final Scientific Report, 1 Dec. 1978 - 30 Nov. 1979
Bryan E. Richards. Dec. 1979. 40 p. refs.
(Grant AF-AFOSR-3474-78; AF Proj. 2307)
(AD-A088129; VKI-I-62) Avail: NTIS HC A03/MF A01 CSCL 16/3

Heat transfer and pressure measurements have been measured on a 15 - 30 deg half angle biconic model with a blunt nosetip in the Von Karman Institute Longshot free piston tunnel at Mach 15 and 20 Reynolds numbers between one and five million based on model base diameter. The test flow parameter closely simulated reentry aerodynamic conditions. The angle of attack of the model was varied from 0 to 20 deg. Information derived from the measurements and also schlieren pictures enabled understanding of the effects of Mach number, Reynolds number and flow incidence on the flow over the model and the location and size of heat transfer peaks. GRA

N80-32350# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
INVESTIGATION OF TRANSIENT INDUCED AERODYNAMICS IN A MOVING DECK ENVIRONMENT Final Report, Oct. 1978 - Sep. 1979
Robert E. Palmer. 7 Feb. 1980. 81 p. refs.
(WF41400000)
(AD-A088164; NADC-79260-60) Avail: NTIS HC A05/MF A01 CSCL 01/2

Operating a V/STOL aircraft in ground effect can greatly alter the aerodynamic forces and moments acting on the aircraft. By introducing a moving ground plane, such as the deck of a DD963 class destroyer, the complexity of the resulting flow field is significantly increased. This added complexity makes it even more difficult to perform successful shipboard takeoff and recovery operations. In order to fully utilize the potential shipboard operational capabilities of V/STOL aircraft a better understanding of these phenomena is required. To accomplish this, the effects of basic single axis deck motions must be examined. Analysis of these independent deck motions (heave, pitch, roll) enable the development of prediction techniques applicable to a preliminary design environment. These methods provide the designer a tool for estimating the transient induced aerodynamics acting on a V/STOL aircraft in a moving deck environment. Data for the three fan subsonic V/STOL configuration was selected for study. GRA

N80-32351# Dynamics Technology, Inc., Torrance, Calif.
FEASIBILITY STUDY OF APPLYING LAMINAR FLOW CONTROL TO AN LTA VEHICLE Final Report
Dwight J. Warner, Suphi Ozgur, and Wayne W. Haigh. Apr. 1980. 49 p. refs.
(Contract N00140-79-C-6565)
(AD-A088148; DT-7909-14; NADC-80144-60) Avail: NTIS HC A03/MF A01 CSCL 20/4

The feasibility of applying laminar boundary-layer control with body shaping to a high altitude, Lighter-Than-Air vehicle was investigated. Solar-radiation-induced surface heating was shown to have a destablizing effect on laminar flow and caused the laminar flow to break down on regions of the vehicle surface exposed to high levels of solar radiation. Aerodynamic drag estimates were made for the vehicle. Surface waviness and roughness criteria for achieving laminar flow were determined. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-32352*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Oct. - 31 Dec. 1978
Apr. 1980. 39 p. refs. Prepared in cooperation with Battelle Columbus Labs., Mountain View, Calif.
(NASA-TM-81197; A-8176; QR-10) Avail: NTIS HC A03/MF A01 CSCL 01C

Knowledge of limitations of the Air Traffic Control system in conflict avoidance capabilities is discussed. Assumptions and expectations held by by airmen regarding the capabilities of the system are presented. Limitations related to communication are described and problems associated with visual approaches, airspace configurations, and airport layouts are discussed. A number of pilot and controller reports illustrative of three typical problem types: occurrences involving pilots who have limited experience; reports describing inflight calls for assistance; and flights in which pilots have declined to use available radar services are presented. Examples of Alert Bulletins and the FAA responses to them are included. T.M.

N80-32353*# Lockheed-California Co., Burbank.
APPLICATION OF ADVANCED TECHNOLOGIES TO SMALL, SHORT-HAUL TRANSPORT AIRCRAFT Final Report, Jun. 1979 - Jun. 1980
T. G. Coussens and R. H. Tullis. Jun. 1980. 203 p. refs.
(Contract NAS2-10264)
(NASA-CR-152363; LR-29450) Avail: NTIS HC A10/MF A01 CSCL 01C

The performance and economic benefits available by incorporation of advanced technologies into the small, short haul air transport were assessed. Low cost structure and advanced composite material, advanced turboprop engines and new propellers, advanced high lift systems and active controls; and alternate aircraft configurations with aft mounted engines were investigated. Improvements in fuel consumed and aircraft economics (acquisition cost and direct operating cost) are available by incorporating selected advanced technologies into the small, short haul aircraft. T.M.

N80-32354# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
GENERAL AVIATION ACCIDENTS: POSTCRASH FIRES AND HOW TO PREVENT OR CONTROL THEM Special Study
28 Aug. 1980. 22 p. refs.
(NTSB-AAS-80-2) Avail: NTIS HC A02/MF A01

It was shown that postcrash fires occurred in approximately 8.0 percent of the 22,002 general aviation accidents during 1974-1978. About 59 percent of the accidents involving postcrash fire resulted in fatalities, while fatalities were involved in only 13.3 percent of those accidents without fire. It was demonstrated that feasible techniques for the containment of fuel exist. It was shown that fuel containment dramatically reduces fire injuries and deaths. It was shown that there are few regulations dealing with the postcrach fire problem in general aviation aircraft. Six recommendations to the Federal Aviation Administration for corrective action are given. T.M.

N80-32355# Battelle Columbus Labs., Ohio.
EVALUATION OF SAFETY PROGRAMS WITH RESPECT TO THE CAUSES OF GENERAL AVIATION ACCIDENTS: VOLUME 1: TECHNICAL REPORT
T. M. Connor and C. W. Hamilton May 1980 221 p refs
(Contract DOT-FA78WA-4159)
(AD-A087685; FAA-ASP-80-2-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 01/2

The objective of this study was to determine the extent to which the FAA safety programs were aligned with the causes of general aviation accidents. The data base used in this study consisted of a total of 30,592 general aviation accident records compiled by the National Transportation Safety Board (NTSB) from 1971 through 1977. Analysis of these records was made with respect to NTSB-cited cause/factors. FAA programs implemented during the study time period and pertaining to safety were also included in this study. GRA

N80-32356# Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Inst.
AIRCRAFT CRASHWORTHINESS STUDIES: FINDINGS IN ACCIDENTS INVOLVING AN AERIAL APPLICATION AIRCRAFT
William R. Kirkham, James M. Simpson, Terry F. Wallace, and Paula M. Grape Apr. 1980 44 p refs
(AD-A084619; FAA-AM-80-3) Avail: NTIS HC A03/MF A01 CSCL 01/2

Aircraft crashworthiness features are presented. Modern aerial application aircraft are recognized as being the most crashworthy in the civil aviation fleet. Eighteen accidents involving an aerial application aircraft are presented. Crashworthiness is the protection by the aircraft against injury to the pilots from impact forces. The cockpit afforded good protection but in many of the accidents pilot restraint systems failed. There were no failures in lap belts or lap belt attachments. The structural attachment of the shoulder harness failed in a rare accident and the manufacturer strengthened the attachment. In three aircraft the inertia reel, to which the shoudler harness was attached, failed, diminishing the effectiveness of the shoudler harness in attenuating impact forces on the pilots. In 14 of the 18 accidents the seat completely or partially separated from the seat track, and in 14 accidents one or more of the cast alloy seat legs or pedestals broke. T.M.

N80-32357# Calspan Advanced Technology Center, Buffalo, N.Y.
ADVANCED RESTRAINT SYSTEM MODELING Final Report, Apr. 1978 - Nov. 1979
Frank E. Butler and John T. Fleck May 1980 176 p refs
(Contract F33615-78-C-0516; AF Proj. 7231)
(AD-A088029; CALSPAN-6306-V-1; AFAMRL-TR-80-14) Avail: NTIS HC A09/MF A01 CSCL 01/2

The Articulated Total Body (ATB) model is currently being used by the AFAMRL to study the biomechanics of the pilot seat ejection from an aircraft. The new ATB-II model presented in this report incorporates features developed since the original ATB model completion and new mathematical algorithms designed to improve the usefulness and correct some of the deficiencies of the model. The new features developed for this research program are a new harness belt system, rate dependent force producing functions, arbitrary specification of the motion of multiple segments and the computation of the initial orientation from orthogonal projections of the segment axes. GRA

N80-32358# Simula, Inc., Tempe, Ariz.
AIRCRAFT CRASH SURVIVAL DESIGN GUIDE. VOLUME 4: AIRCRAFT SEATS, RESTRAINTS, LITTERS, AND PADDING Final Report, Sep. 1977 - Feb. 1980
S. P. Desjardins and D. H. Laananen Jun. 1980 275 p refs Revised 5 Vol.
(Contract DAAJ02-77-C-0021; DA Proj. 1L1-62209-AH-76)
(AD-A088441; TR-7822-Vol-4; USARTL-TR-79-72D) Avail: NTIS HC A12/MF A01 CSCL 01/2

This five volume document has been assembled to assist design engineers with the development of crashworthy U.S. Army aircraft. The five volumes of the Aircraft Crash Survival Design Guide cover the following topics: Volume 1 - Design Criteria and Checklists; Volume 2 - Aircraft Crash Environment and Human Tolerance; Volume 3 - Aircraft Structural Crashworthiness; Volume 4 - Aircraft Seats, Restraints, Litters, and Padding; Volume 5 - Aircraft Postcrash Survival. This volume (Volume 4) contains information on aircraft seats, litters, personnel restraint systems, and hazards in the occupant's immediate environment. Requirements for design of seats, litters, and restraint systems are discussed, as well as design principles for meeting these requirements and testing for verification that the systems perform as desired. Energy absorbing devices for use in seat are described, as are various types of cushions. Delethalization of cockpit and cabin interiors is discussed, including the use of protective padding and the design of controls for prevention of injury. Finally, computerized methods of analysis for evaluation of seats, restraints, and the occupant's immediate environment are presented. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-32359* National Aeronautics and Space Administration. Pasadena Office, Calif.
INTERFEROMETRIC LOCATING SYSTEM Patent
Peter F. MacDoran, inventor (to NASA) (JPL) Issued 29 Jul. 1980 10 p Filed 31 Aug. 1978 Supersedes N79-10039 (17 - 01, p 0006) Sponsored by NASA
(NASA-Case-NPO-14173-1; US-Patent-4,215,345; US-Patent-Appl-SN-938581; US-Patent-Class-343-112R) Avail: US Patent and Trademark Office CSCL 17G

A system is described for determining the position of a vehicle or other target that emits radio waves and which is of the type that senses the difference in time of arrival at spaced ground stations of signals from the vehicle to locate the vehicle on a set of intersecting hyperbolas. A network of four ground stations detects the radio emissions from the vehicle and by means of cross correlation derives the relative signal delay at the ground stations from which the vehicle position is deduced. Because the signal detection is by cross correlation, no knowledge of the emission is needed, which makes even unintentional radio noise emissions usable as a locator beacon. By positioning one of the four ground stations at an elevation significantly above the plane of the other three stations, a three dimensional fix on the vehicle is possible.

Official Gazette of the U.S. Patent and Trademark Office

N80-32360# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
AZIMUTH OBSERVABILITY ENHANCEMENT DURING INS IN-FLIGHT ALIGNMENT
Itzhack Y. Bar-Itzhack and Boaz Porat Apr. 1979 32 p refs
(TAE-362) Avail: NTIS HC A03/MF A01

The questions whether an axial acceleration maneuver is superior to a lateral one during the in flight alignment (IFA) of an inertial navigation system (INS) and whether there exists a simple test or an expression which clearly indicates it are addressed. An axial maneuver is not superior to a lateral one in general. There are, however, three classes of alignment problems in which axial maneuver is superior. These cases are modeled by simple models which yield analytic expressions clearly indicating the superiority of the axial maneuver during IFA of an INS. These three classes of alignment problems encompass a large number of existing systems. T.M.

N80-32361*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT PERFORMANCE OF THE TCV B-737 AIRPLANE AT MONTREAL/DORVAL INTERNATIONAL AIRPORT, MONTREAL, CANADA, USING TRSB/MLS GUIDANCE
William F. White and Leonard V. Clark Sep. 1980 36 p refs

(NASA-TM-81885) Avail: NTIS HC A03/MF A01 CSCL 17G

The NASA terminal configured vehicle B-737 was flown in support of the world wide FAA demonstration of the time reference scanning beam microwave landing system. A summary of the flight performance of the TCV airplane during demonstration automatic approaches and landings while utilizing TRSB/MLS guidance is presented. The TRSB/MLS provided the terminal area guidance necessary for automatically flying curved, noise abatement type approaches and landings with short finals.

A.R.H.

N80-32362*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PRELIMINARY EVALUATION OF TIME AND DISTANCE SPACING CUES USING A COCKPIT DISPLAYED TARGET

James R. Kelly. Aug. 1980. 24 p. refs.

(NASA-TM-81794) Avail: NTIS HC A03/MF A01 CSCL 17G

A simulator evaluation was conducted to compare time and distance selfspacing cues wherein a pilot establishes and maintains separation from a cockpit displayed target. Langley's terminal configured vehicle simulator which represents an advanced aircraft employing cathode ray tubes for primary flight displays and highly augmented flight control modes was used. Three tasks, two in trail rendezvous tasks (target straight and level and target turning) and one merge task were utilized. Three pilots flew each task twice, once with a time predictor cue and once with a distance predictor. Both time and distance spacing methods are operationally acceptable to the pilots. A slight preference was indicated by the pilots for the distance based predictor in performing rendezvous and merging tasks. Analysis of the recorded data showed the spacing performance with both predictors was essentially the same.

R.K.G.

N80-32363*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SHUTTLE OFT LEVEL C NAVIGATION REQUIREMENTS: ON-ORBIT

Sep. 1980. 241 p. Revised.

(NASA-TM-82205; JSC-14713; Rept-79-FM-10-Rev-2) Avail: NTIS HC A11/MF A01 CSCL 17G

Level C detailed requirements for the orbital operations computer loads, OPS 2 and OPS 8 are provided. These requirements represent the total on-orbit rendezvous navigation baseline requirements for the on-orbit rendezvous navigation sequencer, the on-orbit rendezvous UPP sequencer, the on-orbit rendezvous navigation, the on-orbit prediction, and the on-orbit user parameter processing function. The landing site update function requirements are also given.

T.M.

N80-32364*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

COMBINATIONS OF 148 NAVIGATION STARS AND THE STAR TRACKER

R. Duncan. Sep. 1980. 76 p. ref.

(NASA-TM-82203; JSC-16790; Rept-80-FM-43) Avail: NTIS HC A05/MF A01 CSCL 17G

The angular separation of all star combinations for 148 nav star on the onboard software for space transportation system-3 flight and following missions is presented as well as the separation of each pair that satisfies the viewing constraints of using both star trackers simultaneously. Tables show (1) shuttle star catalog 1980 star position in M 1950 coordinates; (2) two star combination of 148 nav stars; and (3) summary of two star-combinations of the star tracker 5 deg filter. These 148 stars present 10,875 combinations. For the star tracker filters of plus or minus 5 deg, there are 875 combinations. Formalhaut (nav star 26) has the best number of combinations, which is 33.

A.R.H.

N80-32365# Committee on Government Operations (U. S. House).

FAA'S COLLISION-AVOIDANCE PROGRAM

Washington GPO 1979. 495 p. Hearings before the Subcomm. of the Comm. on Govt. Operations, 95th Congr., 2nd Sess., 7-8 Dec. 1978.

(GPO-40-611) Avail: Committee on Government Operations

The hearings of the House Subcommittee on Government Operations investigating the actions of the Federal Aviation Administration to correct deficiencies in the air traffic control system are presented. Testimony is given regarding the development and capabilities of electronic anticollision devices and systems including the discrete address beacon system and proximity warning indicators. In addition existing air traffic control procedures are examined, and specific reference is made to the air tragedy at San Diego on Sept. 25, 1978.

M.G.

N80-32366# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

COOPERATIVE ESTIMATION OF TARGETS BY MULTIPLE AIRCRAFT. M.S. Thesis

Ralph S. Bryan. Jun. 1980. 331 p. refs.

(AD-A085799; AFIT/GE/EE/80-5) Avail: NTIS HC A15/MF A01 CSCL 17/7

A cooperative estimator of aerial target motion was designed to combine tracking information from two cooperating fighter aircraft that are tracking a single aerial target in either range and angle, or in angle only. The cooperation occurs when information, in the form of raw measurements or state estimates, is transferred between aircraft via a telemetry link. Necessary information about attackers' relative position and orientation was assumed error free, transmission delays and other details of a data link were not included, tracker errors were modeled as white noise, and timing and word length constraints of actual real time filter software were not addressed.

S.F.

N80-32367# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.

DISCRETE ADDRESS BEACON SYSTEM (DABS) FRONT END PROCESSOR EN ROUTE CENTRAL COMPUTER COMPLEX PROTOCOL. Final Report

11 Apr. 1980. 17 p. refs.

(AD-A085482; FAA-RD-80-37) Avail: NTIS HC A02/MF A01 CSCL 17/7

The Discrete Address Beacon System (DABS) was devloped as an evolutionary replacement for the current Air Traffic Control Radar Beacon System (ATCRBS). The DABS sensor, singly and in cooperation with other DABS sensors, provides surveillance of, and two way digital communications with aircraft equipped with DABS transponders, and provide surveillance of ATCRBS equipped aircraft. Surveillance data and data link services is provided via suitable land lines to Air Traffic Control (ATC) facilities (terminal and en route). The DABS/ATC interface consists of two digital links to each facility: a two way communications link and a one way surveillance link from sensor to ATC. The Common ICAO Data Interchange Network (CIDIN) protocol is used on the two way communications data link. When DABS is interfaced to an en route ATC facility, a special device, called the front end processor (FEP) is used to perform translation between the CIDIN protocol and the protocol used by the en route Central Computer Complex (CCC). The protocol to be used between the FEP and en Route CCC is defined.

J.M.S.

N80-32368# Systems Control, Inc., Palo Alto, Calif.

AIRBORNE RADAR APPROACH FLIGHT TEST EVALUATING VARIOUS TRACK ORIENTATION TECHNIQUES. Final Report

Larry D. King. Jun. 1980. 195 p. refs.

(Contract DOT-FA79WA-4293)

(AD-A088426; FAA-RD-80-60) Avail: NTIS HC A09/MF A01 CSCL 17/7

This comprehensive report presents the results of a flight test experiment of an Airborne Radar Approach (ARA) System utilizing various track orientation techniques and operational modes. The tests were performed in the immediate area of NAFEC in Atlantic City, N.J. The test environment involved the airport terminal area and offshore sites. The test aircraft was a NASA CH53A helicopter manufactured by Sikorsky Aircraft and currently based at NAFEC. The test period was from January 1979 to February 1979 and from June 1979 to August 1979. Flight tests for ARA accuracy and procedures development were performed in six distinct operational modes. These were as follows: beacon w/cursor, multiple beacon, skin paint, skin paint w/cursor, combined and beacon-only modes. The specific program objectives can be summarized as follows: (1) to evaluate the ability of the

radar operator to guide an aircraft along a predetermined path using various track orientation techniques, namely: the cursor and multiple beacon techniques; (2) to assist the FAA in developing and certifying standard ARA procedures and weather minimums; (3) to define and quantify specific ARA system functions and characteristics for use in a Minimum Operational Performance Standards (MOPS) document. GRA

N80-32369# Transportation Systems Center, Cambridge, Mass.
LORAN-BASED BUOY POSITION AUDITING SYSTEMS: ANALYTICAL EVALUATION Final Report, Feb. - Dec. 1979
Joseph A. Wolfson, Peter D. Engels, Martin C. Poppe, Jr. (Cambridge Engineering, Vt.), James M. Foltz (Analytical Sciences Corp., Reading, Mass.), and Leon M. DePalma Feb. 1980 256 p refs
(AD-A088266; TSC-USCG-80-2; USCG-D-09-80) Avail: NTIS HC A12/MF A01 CSCL 17/7

An analytic evaluation and comparison of the following candidate Buoy Position Auditing System (BPAS) configurations is presented in this report: transmission of digital Time Difference (TD) data from a Loran-C receiver on the buoy, retransmission of Loran-C pulses from the buoy, and combination of helicopter Loran-C data and helicopter to buoy microwave ranging data in a variable geometry solution. The candidate BPAS configurations utilize Loran-C in the differential mode. A model is developed to characterize differential Loran-C errors, accounting for the expected effect of the land/sea water conductivity interface. The error model is utilized alone, or with a microwave ranging system error model, to estimate buoy position fix accuracy afforded by each BPAS configuration. Accuracy estimates and data on cost, complexity, and technical risk are employed to recommend a BPAS configuration for testing. It is concluded that Loran-C pulse retransmission is not a viable BPAS configuration. The variable geometry BPAS configuration is highly accurate, due to calibration of Loran-C errors by processing of redundant data, but is not presently cost effective. The digital TD transmission BPAS configuration is recommended for testing, due to its simplicity and low cost. GRA

N80-32370# Naval Research Lab., Washington, D. C. Space Systems Div.
GPS NAVSTAR-4 AND NTS-2 LONG TERM FREQUENCY STABILITY AND TIME TRANSFER ANALYSIS Interim Report
J. A. Buisson, T. B. McCaskill, O. J. Oaks, M. M. Largay, and S. B. Stebbins 30 Jun. 1980 32 p refs
(AD-A088092; NRL-8419) Avail: NTIS HC A03/MF A01 CSCL 17/7

Since the launch of the first Navigation Technology Satellite (NTS) in 1974, international time transfer experiments have been performed as part of the concept validation phase of the Global Positioning System (GPS). Time transfer results from both NTS-1 and NTS-2 are presented, including recent measurements from receivers located in South America, Germany, Japan, and the United States. A time link to the DOD Master clock allows submicrosecond intercomparison of UTS (USNO, MC1) with clocks in the respective countries via the NTS link. Work is progressing toward a retrofit conversion of existing NTS receivers (located at NASA and foreign observatories) into GPS time transfer receivers. Initial results are presented on the long term rubidium frequency stability as measured from the GPS NAVSTAR-4 space vehicle (SV). Analysis has been performed for sample times varying from 1 to 10 days. Using a 154 day data span starting on day 36, 1979, data was collected from the four GPS monitor stations located at Vandenberg, Guam, Alaska, and Hawaii. A time domain estimate for the NAVSTAR-4 SV clock offset is obtained for each SV pass over the GPS monitor sites, using a smoothed reference ephemeris, with corrections for ionospheric delay, tropospheric delay, earth rotation, and relativistic effects. Conversion from the time domain to the frequency domain is made using the two sample Allan Variance, sigma tau plots are used to identify the noise processes. Estimates of flicker and white frequency noise for the NAVSTAR-4 rubidium frequency standard are obtained. GRA

N80-32371# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ALTERNATE WAVEFORMS FOR A LOW-COST CIVIL GLOBAL POSITIONING SYSTEM RECEIVER Final Report, Aug. 1979 - Apr. 1980
Herman F. Vandevenne and Edward J. Kelly Jun. 1980 128 p refs
(Contract DOT-TSC-RA-78-06)
(AD-A088345; ATC-86; FAA-EM-79-16; TSC-FAA-79-24) Avail: NTIS HC A07/MF A01 CSCL 17/7

This report examines the technical feasibility of alternate waveforms to perform the GPS functions and to result in less complex receivers than is possible with the GPS C/A waveform. The approach taken to accomplish this objective is (a) to identify, after a quick broad overview, a few promising waveforms, (b) to complete the architectural synthesis of a GPS system based on the new waveforms, (c) to analyze the performance of these systems in providing ranging and communication capability and (d) to assess the impact on receiver hardware and software. One conclusion is that the class of pulsed waveform, when combined with emerging matched filter technology, permits the use of a greatly simplified receiver design. A major part of the report consists of description of a pulse based GPS design. Although very specific, the design was intended as a vehicle for performance analysis only and many refinements and alternatives within the same class are possible. Other classes of waveforms such as tone ranging and chirped FM waveforms, although adequate, do not seem superior to the present PN encoded CW waveform for GPS. Finally, if the 'alternate' waveform is simply the present C/A waveform but with a substantially increased power level, it is shown that with the present designs the performance will be greatly increased or, alternatively, performance margin can be traded for a simplified receiver implementation. GRA

N80-32372# Federal Aviation Administration, Atlantic City, N.J. Technical Center.
INITIAL DATA BANK REPORT: FALL 1978; WINTER, SPRING, SUMMER, FALL 1979, WINTER 1980 Data Report, 1978 - 1980
Lorraine I. Rzonca Jul. 1980 22 p
(AD-A088204; FAA-CT-80-189; FAA-RD-80-83) Avail: NTIS HC A02/MF A01 CSCL 17/7

The International Bank for airborne Omega data has begun operation at the Federal Aviation Administration (FAA) Technical Center. This first report issued by the Data Bank is based upon preliminary data for Pacific flights in fall 1978 and winter/spring 1979 and upon data from North Atlantic flights in summer/fall 1979 and winter 1980. At least three Omega stations were received during all phases of these flights. No significant seasonal variations or effects due to solar activity were noted in the signal to noise values. These values were highly repeatable (under the same conditions) with major drops due to ice cap attenuation and operation in areas of normally high very low frequency (VLF) noise. Differences in signal to noise between signals traversing daylight/night ice cap (for both Greenland and Antarctica) were noted. GRA

N80-32373# Federal Aviation Administration, Atlantic City, N.J.
SYSTEM DESCRIPTION FOR THE AIRBORNE-OMEGA DATA BANK
Lorraine I. Rzonca Jul. 1980 34 p refs
(AD-A087606; FAA-CT-80-191; FAA-RD-80-84) Avail: NTIS HC A03/MF A01 CSCL 17/7

The Airborne-Omega Data Bank has been established at the Federal Aviation Administration (FAA) Technical Center. Its main objective is to provide a centralized repository for operational airborne-Omega data so that performance which is representative of the majority of production airborne-Omega navigation equipments under various ionospheric conditions (including high solar activity) may be evaluated. Details of the methods developed for data collection, processing, and reporting are documented in this report. Current status and plans for the near future are discussed. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-32374# Sikorsky Aircraft, Stratford, Conn.
ADVANCED STRUCTURES CONCEPTS R AND M/COST ASSESSMENTS Final Report, Oct. 1977 - Feb. 1979
Thomas N. Cook Sep. 1979 237 p refs
(Contract DAAJ02-77-C-0061; DA Proj. 1L2-62209-AH-76)
(AD-A077373; SER-510016; USARTL-TR-79-18) Avail: NTIS HC A11/MF A01 CSCL 01/3

In service experience with helicopter airframe structures, particularly bonded structures and composite materials was surveyed. Laboratory testing was conducted to assess the damage tolerance of several composites in both monolithic and sandwich construction, and to test the effectiveness of simple field type repairs. A method was developed to assess and rank the R&M characteristics of advanced composite structures designs. The method involves a systematic evaluation of the many variables affecting the reliability and maintainability of helicopter airframe structures. Damage potential, damage tolerance, repairability and replaceability are among the key factors evaluated. The product of this analysis is a qualitative rating of structural reliability, hardware reliability and maintainability. Sensitivity studies indicate that advanced composites can be cost effective and that the life cycle costs are dominated by the initial cost of manufacture and by the structural reliability of the design. The R&M and cost characteristics of four advanced composites concepts, representing a cross section of helicopter airframe structures, were analyzed. A.R.H.

N80-32375*# Lockheed-California Co., Burbank.
APPLICATIONS OF ADVANCED ELECTRIC/ELECTRONIC TECHNOLOGY TO CONVENTIONAL AIRCRAFT Final Report, Jul. 1979 - Aug. 1980
R. L. Heimbold Jul. 1980 277 p refs
(Contract NAS9-15863)
(NASA-CR-163576; LR-29520) Avail: NTIS HC A13/MF A01 CSCL 01C

The desirability of seven advanced technologies as applied to three commercial aircraft of 1985 to 1995 was investigated. Digital fly by wire, multiplexing, ring laser gyro, integrated avionics, all electric airplane, electric load management, and fiber optics were considered for 500 passenger, 50 passenger, and 30 passenger aircraft. The major figure of merit used was Net Value of Technology based on procurement and operating cost over the life of the aircraft. An existing computer program, ASSET, was used to resize the aircraft and evalute fuel usage and maintenance costs for each candidate configuration. Conclusions were that, for the 500 passenger aircraft, all candidates had a worthwhile payoff with the all electric airplane having a large payoff. L.F.M.

N80-32376*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME AERODYNAMIC CONSIDERATIONS RELATED TO WIND TUNNEL MODEL SURFACE DEFINITION
Blair B. Gloss Sep. 1980 13 p refs
(NASA-TM-81820) Avail: NTIS HC A02/MF A01 CSCL 01C

The aerodynamic considerations related to model surface definition are examined with particular emphasis in areas of fabrication tolerances, model surface finish, and orifice induced pressure errors. The effect of model surface roughness texture on skin friction is also discussed. It is shown that at a given Reynolds number, any roughness will produce no skin friction penalty. R.C.T.

N80-32377*# Lockheed-Georgia Co., Marietta.
STUDY OF AN ADVANCED TRANSPORT AIRPLANE DESIGN CONCEPT KNOWN AS FLATBED Final Report
R. G. Smethers, E. W. Caldwell, W. E. Warnock, and J. M. Wilson, Jr. Oct. 1980 180 p refs
(Contract NAS1-15867)
(NASA-CR-159337; LG80ER0085) Avail: NTIS HC A09/MF A01 CSCL 01C

The design concept and configuration of the Flatbed transport aircraft are presented. The Flatbed configuration combines into one frame, the ability to haul cargo, virtually unrestrained by cross sectional dimensions of the fuselage. The feasibility and capability of the Flatbed is discussed in depth. R.C.T.

N80-32378*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ENGINE BLEED AIR REDUCTION IN DC-10
W. H. Newman and M. R. Viele Sep. 1980 75 p refs
(Contract NAS3-21763)
(NASA-CR-159846) Avail: NTIS HC A04/MF A01 CSCL 01C

An 0.8 percent fuel savings was achieved by a reduction in engine bleed air through the use of cabin air recirculation. The recirculation system was evaluated in revenue service on a DC-10. The cabin remained comfortable with reductions in cabin fresh air (engine bleed air) as much as 50 percent. Flight test verified the predicted fuel saving of 0.8 percent. R.C.T.

N80-32379*# Lightning Technologies, Inc., Pittsfield, Mass.
IMPROVED TEST METHODS FOR DETERMINING LIGHTNING-INDUCED VOLTAGES IN AIRCRAFT Final Report
K. E. Crouch and J. A. Plumer Sep. 1980 106 p refs
(Contract NAS4-2613)
(NASA-CR-3329; LT-80-59) Avail: NTIS HC A06/MF A01 CSCL 01C

A lumped parameter transmission line with a surge impedance matching that of the aircraft and its return lines was evaluated as a replacement for earlier current generators. Various test circuit parameters were evaluated using a 1/10 scale relative geometric model. Induced voltage response was evaluated by taking measurements on the NASA-Dryden Digital Fly by Wire F-8 aircraft. Return conductor arrangements as well as other circuit changes were also evaluated, with all induced voltage measurements being made on the same circuit for comparison purposes. The lumped parameter transmission line generates a concave front current wave with the peak di/dt near the peak of the current wave which is more representative of lightning. However, the induced voltage measurements when scaled by appropriate scale factors (peak current or di/dt) resulting from both techniques yield comparable results. L.F.M.

N80-32380# Kuhn (Richard E.), Newport News, Va.
CONCEPTUAL STUDY OF MODIFYING AN EXISTING FIGHTER FOR V/STOL CAPABILITY AND COMBAT MANEUVERING ENHANCEMENT Final Report
Richard E. Kuhn Jul. 1980 59 p refs
(Contract N00167-80-M-0844)
(AD-A087657; DTNSRDC-80/088;
DTNSRDC/ASED-AERO-1269) Avail: NTIS HC A04/MF A01 CSCL 01/3

The possibility of modifying an existing fighter aircraft to give it V/STOL capability and of incorporating a V/STOL control system that could also be used in conventional flight to improve the aircraft's combat maneuverability is examined. The study indicates that the F-18 could be given a V/STOL capability using either the lift plus lift-cruise or the vertical attitude take off and landing (VATOL) concept. The lift-cruise plus remote burner concept does not appear to be compatible with the F-18 airframe. The ADEN nozzle concept currently under development, with some modification, could be used on either the lift plus lift-cruise or the VATOL concepts to vector the cruise engine thrust and thereby augment the conventional controls for improved high angle of attack combat maneuverability. GRA

N80-32381# Aeronautical Research Labs., Melbourne (Australia).
TRANSONIC PITCH DAMPING OF A DELTA WING AIRCRAFT DETERMINED FROM FLIGHT MEASUREMENTS
R. A. Feik Jul. 1979 30 p refs
(AD-A087771; ARL/AERO-TM-153) Avail: NTIS HC A03/MF A01 CSCL 20/4

A flight investigation aimed mainly at determining the pitch damping of a 60 degree Delta wing aircraft between M 0.7 and M - 1.2 has been undertaken. Flight tests were conducted by ARDU and the measurements obtained have been successfully

analysed at ARL using a modified Newton-Raphson parameter estimation procedure. The results for pitch damping as well as other longitudinal aerodynamic derivatives have been compared with wind tunnel and/or theoretical estimates. Further information has also been gained relating to the necessary conditions for successful extraction of parameters from flight data. The parameter estimation procedure has proved to be an effective analysis method even when only a modest amount of flight data, obtained using a relatively simple instrumentation package, has been available. GRA

N80-32382# Naval Ship Research and Development Center, Bethesda, Md.
DEVELOPMENT OF HIGH LIFT DEVICES FOR APPLICATION TO ADVANCED NAVY AIRCRAFT Final Report
James H. Nichols, Jr. Apr. 1980 47 p ref Presented at the Workshop on V/STOL Aerodyn., Monterey, Calif., 16-18 May 1979
(WF41421091)
(AD-A084226; DTNSRDC-80/058; DTNSRDC/AERO-1266) Avail: NTIS HC A03/MF A01 CSCL 01/3

A number of methods for generating high lift to provide a short takeoff and landing (STOL) capability for advanced Navy aircraft are evaluated with emphasis on low aspect ratio wings. Upper surface blowing, circulation control wing, and wing tip sails are given the most attention. Experimental data were obtained in the wind tunnels on these concepts as specifically applied to wings of aspect ratios 3 to 5. Flight demonstrations of a circulation control wing application to the A-6 aircraft showed the ability to more than double the lifting capability which resulted in landing speed reductions of more than 30 percent, landing ground roll reductions of more than 50 percent, and takeoff distance reductions of at least 25 percent. The experimental high lift system data was applied to a conceptual STOL baseline aircraft in order to estimate the impact on mission performance and identify their various merits as applicable to the particular restrictions of small ship operations. T.M.

N80-32383# Rockwell International Corp., Thousand Oaks, Calif.
COMPUTATIONAL AND SIMPLIFIED ANALYTICAL TREATMENT OF TRANSONIC WING-FUSELAGE-PYLON-STORE INTERACTIONS Final Technical Report, 1 Jul. 1978 - 31 Dec. 1979
Vijaya Shankar and Norman D. Malmuth 25 Apr. 1980 17 p refs Presented at the AIAA 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980
(Contract N00014-78-C-0477; NR Proj. 212-257)
(AD-A085619; ONR-CR-212-257-IF; SC5172.10TR) Avail: NTIS HC A02/MF A01 CSCL 01/3

Transonic modified small disturbance theory was employed to numerically model the flow field around wing-fuselage-pylon-store configurations. A fine grid region enclosing the wing-pylon-store was embedded within a global crude grid and a successive crude-fine relaxation was performed. With a simple image point concept, the store and the pylon were introduced into an existing wing fuselage program thus avoiding excessive additional computer memory requirements. Comparison on results with experiments for the F-5 wing with a pylon-store arrangement is presented. A study of the roles of pylon height, store diameter, pylon span mount location, angle of attack and Mach number relative to the achievement of optimum L/D from beneficial nonlinear interference is presented. A simplified analytical approach to compute the loading on the store using an immersion theory is indicated and validated against experiments. T.M.

N80-32384# Boeing Vertol Co., Philadelphia, Pa.
DESIGN AND ANALYSIS OF CH-47 EXTERNAL CARGO HANDLING SYSTEM (SNUBBED LOAD) Final Report, Sep. 1977 - Oct. 1979
Theodore S. Garnett, Jr., Richard F. Campbell, and David J. Hodder Oct. 1979 445 p refs
(Contract DAAJ02-77-C 0069)
(AD-A088057; D210-11555-1) Avail: NTIS HC A19/MF A01 CSCL 01/3

Development of a preliminary design concept to snub containerized external cargo loads to the CH-47 aircraft, for improved terrain and Night/IMC flight capability, has been completed. Results are suitable for detail design implementations leading to prototype demonstration of the system in the future. The External Cargo Handling System (ECHS) snubs loads (of up to 25,000 lbs. weight) against the helicopter landing gear, using a self hoisting adapter framework powered by 6 horsepower tandem electric hoists installed of nonlinear vibration isolation mounts to interface the load with the aircraft. The ECHS snubbing adapter uses guide arms for load acquisition assistance, and twistlocks to lock the load to the adapter. No structural modification to the CH-47 is required. Compared to carrying cargo on conventional external sling suspension with a CLAH adapter, load snubbing provides a substantial performance benefit for terrain flight missions; and at the same time improves both masking and maneuverability along with capability for flight at night, or in IMC condition. GRA

N80-32385# Solar Turbines International, San Diego, Calif.
MANUFACTURING PROCESS DEVELOPMENT FOR DUST AND RAIN EROSION RESISTANT COATED METALLIC CLADS FOR HELICOPTER ROTORS Final Report, 5 Apr. 1976 - 30 Jul. 1980
David P. Huey and Alvin R. Stetson Jun. 1980 184 p refs
(Contract DAAG46-76-C-0033)
(AD-A088440; SR80-R-4511-37) Avail: NTIS HC A09/MF A01 CSCL 13/8

Manufacturing processes for creating erosion resistant coatings on metallic rotor blade leading edges were optimized as a follow on to a coating development program sponsored by AMMRC (Contract DAAG74-C-0054). Solide coated, titanium rotor nose caps were produced in sections up to 30 inches long. Commercially pure (A75) and alloyed (Ti-6Al-4V) titanium was used. Newly developed graphite coating mandrels made possible simultaneous coating and creep forming of titanium sheet material to accurate airfoil contours. Sand and rain erosion tests were performed along with tensile, impact, salt spray and adhesive bonding tests. Costs per part for production quantities were estimated. Solide coated test specimens of titanium and SAE 430 stainless steel were provided to three major helicopter manufacturers for test and evaluation: Hughes, Sikorsky and Bell. Their conclusions were that Solide coatings are excellent in rain erosion resistance and low angle sand erosion resistance but do not meet minimum survival requirements when subjected to sand erosion by large particles (greater than 100 micrometer) impinging at high angles (greater than 45 degrees). GRA

N80-32386# Sikorsky Aircraft, Stratford, Conn. Aircraft Div.
HELICOPTER DYNAMIC PERFORMANCE PROGRAM. VOLUME 1: ENGINEER'S MANUAL Final Report, Nov. 1976 - Nov. 1978
Robert E. Studwell Jul. 1980 136 p refs
(Contract DAAJ02-76-C-0066; DA Proj. 1F2-62209-AH-76)
(AD-A088474; SER-510011-Vol-1; USARTL-TR-79-27A-Vol-1)
Avail: NTIS HC A07/MF A01 CSCL 01/3

A computer program for evaluating helicopter performance in accelerated flight has been developed. The program was designed to permit analysis of any definable single rotor helicopter. Provisions for partial or total power loss at any point along the flight path are included. To accommodate emergency conditions provisions are made for evaluation of auxiliary power devices, tip rockets, JATO, RATO, fly wheels, drag brakes, and dropping of external loads. Optimization routines for establishing height velocity envelopes are also included. The program is linked with a plot package which provides 40 prime output variables to be plotted. A perspective view of the flight path and plots of height velocity diagrams are also available. This volume covers the engineering aspects of the program. Volume 2 presents the User's Manual. GRA

N80-32387# Sikorsky Aircraft, Stratford, Conn.
HELICOPTER DYNAMIC PERFORMANCE PROGRAM. VOLUME 2: USER'S MANUAL Final Report
R. E. Studwell Jul. 1980 101 p
(Contract DAAJ02-76-C-0066; DA Proj. 1F2-62209-AH-76)
(AD-A088318; USARTL-TR-79-27-B-Vol-2; SER-510011-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 01/3

The program provides a means of rapidly estimating rotorcraft takeoff and landing capabilities from or to any given heliport size or location. Proper application of the instructions outlined

herein for computing opertional capabilities and flight procedures can minimize the risk and cost of testing rotorcraft capabilities in the takeoff, landing and emergency of flight. The program has been written in FORTRAN IV and designed primarily for interactive operation on the IBM 360/65 computer system, in conjunction with a PDP-11 and DEC-GT-40 scope and a Houston bed type plotter. Interfacing with a Tektronix storage tube Model 4010, 4012, or 4014, the Houston plot bed and the IBM 360/65 is also available. Options for batch processing with and without Houston plots has been provided. With minor modifications the program can also be interfaced with a CDC or UNIVAC 1110 in lieu of the IBM 360/65. Program modifications required for CDC 6600 compatibility are covered in Section 9 of this report. GRA

N80-32388# Monsanto Research Corp., Dayton, Ohio.
INTEGRAL AIRCRAFT FUEL TANK LEAK CLASSIFICATION
Interim Technical Report, 1 Sep. 1978 - 15 Apr. 1979
Leo Parts, Thomas J. Bucher, Benito P. Botteri (AFAPL, Wright-Patterson AFB, Ohio), and Robert E. Cretcher (AFAPL, Wright-Patterson AFB, Ohio) Jan. 1980 193 p refs
(Contract F33615-78-C-2023; AF Proj. 3048)
(AD-A088168; MRC-DA-894; AFAPL-TR-79-2992) Avail: NTIS HC A09/MF A01 CSCL 01/2

A parametric study has been conducted to investigate external leakage from aircraft integral fuel tanks. The effects of the following parameters on the rate of surface dispersion of fuels were examined: fuel type, leakage rate, surface material, fuel and surface temperature, air flow rate over the test surface, and surface angle of inclination. The dispersing fuel films were found to be very thin (0.05 mm/0.002 in.); i.e., limited liquid volume flow results in extensive surface coverage. Fuels of low volatility such as JP-5 and JP-8 dispersed at a faster rate over the surface and exhibited a greater propensity for dripping than those of high volatility (AvGas and JP-4). Low temperatures, inclined surfaces, and polyurethane latex surface coating enhanced fuel dripping from the test surface. Fuel flow rates required to support sustained burning at the leakage site were investigated with JP-4, JP-5, JP-8, JP-4/JP-8 mixtures, and AvGas. The measurements were conducted at temperatures ranging from 3.3 C to 98 C (38 F to 209 F). The vapor pressure of the fuel at the test temperature has a very pronounced effect on the propensity of the leaking fuel to sustain burning. The minimum volume flow rates required for sustained burning ranged from 0.2 ml/min (AvGas at 23 C (73 F)) to 9 ml/min. (JP-5 at 98 C (208 F)). GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices, and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-32389*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
USE OF NOSE CAP AND FUSELAGE PRESSURE ORIFICES FOR DETERMINATION OF AIR DATA FOR SPACE SHUTTLE ORBITER BELOW SUPERSONIC SPEEDS
Terry J. Larson and Paul M. Siemers, III (NASA, Langley Research Center) Sep. 1980 128 p refs
(NASA-TP-1643; H-1096) Avail: NTIS HC A07/MF A01 CSCL 01D

Wind tunnel pressure measurements were acquired from orifices on a 0.1 scale forebody model of the space shuttle orbiter that were arranged in a preliminary configuration of the shuttle entry air data system (SEADS). Pressures from those and auxiliary orifices were evaluated for their ability to provide air data at subsonic and transonic speeds. The orifices were on the vehicle's nose cap and on the sides of the forebody forward of the cabin. The investigation covered a Mach number range of 0.25 to 1.40 and an angle of attack range from 4 deg. to 18 deg. An air data system consisting of nose cap and forebody fuselage orifices constitutes a complete and accurate air data system at subsonic and transonic speeds. For Mach numbers less than 0.80 orifices confined to the nose cap can be used as a complete and accurate air data system. Air data systems that use only flush pressure orifices can be used to determine basic air data on other aircraft at subsonic and transonic speeds. T.M.

N80-32390# Rockwell International Corp., Columbus, Ohio. Autonetics Missile Systems Div.
OH-58C HELICOPTER MAST MOUNTED SIGHT/ DESIGNATOR SAFETY STATEMENT
21 Feb. 1980 51 p refs
(Contract DAAK10-77-C-0212)
(AD-A087673; C80-1337/034C) Avail: NTIS HC A04/MF A01 CSCL 19/5

The Safety Statement was prepared by the Autonetics Columbia, OH Missile Systems Division of Rockwell International under Contract DAAK10-77-C-0212 for the design and fabrication of a mast mounted sight, with integrated laser designator, that is mounted above the rotor mast of an OH-58C helicopter. It was found, based upon design data, operating and maintenance procedures, and experience gained in the laboratory, that the GFP laser within the mast mounted sight can be used and maintained with hazards controlled within acceptable limits. GRA

N80-32391# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va. Manpower and Educational Systems Technical Area.
HELICOPTER ELECTRO-OPTICAL SYSTEM DISPLAY REQUIREMENTS. 3: THE EFFECTS OF CRT DISPLAY SIZE AND LUMINANCE ON DARK ADAPTATION OF HELICOPTER PILOTS
Richard M. Johnson, Aaron Hyman, and Paul A. Gade Mar. 1980 18 p refs
(DA Proj. 2Q1-62722-A-765)
(AD-A088527; ARI-TR-443) Avail: NTIS HC A02/MF A01 CSCL 05/8

Previous research has indicated that pilots may be able to successfully use a television display of low luminance level as an aid to nighttime nap-of-the-Earth helicopter flight. This experiment was conducted to assess the effects of display luminance level and display size on pilots' visual dark adaptation. Brightness matches made by 12 Army helicopter pilots were used to determine the magnitude of the dark-adaptation loss that resulted from viewing a 13 cm and a 26 cm CRT display at relatively bright and dim luminance levels. In the procedure used, one eye was light adapted to the CRT panel display while the other eye remained dark adapted. Then, while the pilots viewed a simulated windscreen display, the luminance setting for the dark-adapted eye was adjusted independently until the display appeared equally bright to both eyes. Windscreen display luminance for the previously light-adapted eye remained fixed at a highlight brightness of 0.01 footlambert (equivalent to full Moon illumination). The larger display was judged to produce the greater dark-adaptation loss, even though the larger display could be successfully used at a lower luminance level. This result might have been due the the greater involvement of the peripheral rod retinal receptor cells when pilots made judgments following exposure to the larger light-adapting display. In such a case, selective attenuation of the blue end of the spectral energy output from the CRT phosphor could reduce the magnitude within 1 second after light adaptation to a dim 26 cm television display showed a 67% loss in the apparent brightness of the windscreen display. This is equivalent to flying under one-third full moon conditions. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-32392* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AIRCRAFT ENGINE NOZZLE Patent
Norman E. Sorensen and Eldon A. Latham, inventors (to NASA) Issued 29 Jul. 1980 7 p Filed 23 Mar. 1979 Supersedes N79-23971 (17 - 15, p 1934)
(NASA-Case-ARC-10977-1; US-Patent-4,214,703; US-Patent-Appl-SN-023436; US-Patent-Class-239-127.3; US-Patent-Class-60-264; US-Patent-Class-239-265.33) Avail: US Patent and Trademark Office CSCL 21E

A variable area exit nozzle arrangement for an aircraft engine was a substantially reduced length and weight which comprises a number of longitudinally movable radial vanes and a number of fixed radial vanes. The movable radial vanes are alternately disposed with respect to the fixed radial vanes. A means is provided for displacing the movable vanes along the longitudinal axis of the engine relative to the fixed radial vanes which extend across the main exhaust flow of the engine.
Official Gazette of the U.S. Patent and Trademark Office

N80-32393*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
MULTIPLE PURE TONE ELIMINATION STRUT ASSEMBLY Patent Application
Frank W. Burcham, Jr., inventor (to NASA) Filed 11 Sep. 1980 9 p
(NASA-Case-FRC-11062-1; US-Patent-Appl-SN-185869) Avail: NTIS HC A02/MF A01 CSCL 21E

An acoustic noise elimination assembly is described which has a capability for disrupting the continuity of fields of sound pressures forwardly projected from fans or rotors of a type commonly found in the fan or compressor first stage for airbreathing engines when operating at top speeds in the supersonic range. The assembly includes a tubular cowl defining a duct for delivering an airstream axially into the intake for a jet engine and a sound barrier defined by a plurality of intersecting flat plates or struts, having a line of intersection coincident with a longitudinal axis of the tubular cowl which serves to disrupt the continuity of rotating fields of multiple pure tonal components of noise. NASA

N80-32394*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE DETERIORATION OF COMMERCIAL HIGH-BYPASS RATIO TURBOFAN ENGINES
Charles M. Mehalic and Joseph A. Ziemianski 1980 30 p refs Presented at SAE Aerospace Congr., Los Angeles, 13-16 Oct. 1980 and at the 56th AGARD Propulsion and Energetics Symp. on Turbine Engine Testing, Turin, 29 Sep. - 3 Oct. 1980 Revised
(NASA-TM-81552-Rev; E-511-Rev) Avail: NTIS HC A03/MF A01 CSCL 21E

The results of engine performance deterioration investigations based on historical data, special engine tests, and specific tests to define the influence of flight loads and component clearances on performance are presented. The results of analyses of several damage mechanisms that contribute to performance deterioration such as blade tip rubs, airfoil surface roughness and erosion, and thermal distortion are also included. The significance of these damage mechanisms on component and overall engine performance is discussed. E.D.K.

N80-32395*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE ENERGY EFFICIENT ENGINE PROJECT Status Report
Lawrence E. Macioce, John W. Schaefer, and Neal T. Saunders 1980 42 p refs Presented at the Aerospace Congr., Los Angeles, 13-16 Oct. 1980
(NASA-TM-81566; E-531) Avail: NTIS HC A03/MF A01 CSCL 21E

The Energy Efficient Engine Project is directed at providing, by 1984, the advanced technologies which could be used for a generation of fuel conservative turbofan engines. The project is conducted through contracts with the General Electric Company and Pratt and Whitney Aircraft. The scope of the entire project and the current status of these efforts are summarized. A description of the preliminary designs of the fully developed engines is included and the potential benefits of these advanced engines, as well as highlights of some of the component technology efforts conducted to date, are discussed. E.D.K.

N80-32396*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-PRESSURE PERFORMANCE OF ANNULAR, HIGH-PRESSURE (40 ATM) HIGH-TEMPERATURE (2480 K) COMBUSTION SYSTEM
Jerrold D. Wear Washington Sep. 1980 20 p refs
(NASA-TP-1713; E-372) Avail: NTIS HC A02/MF A01 CSCL 21E

Experimental tests were conducted to develop a combustion system for a 40 atmosphere pressure, 2480 K exhaust gas temperature, turbine cooling facility. The tests were conducted in an existing facility with a maximum pressure capability of 10 atmospheres and where inlet air temperatures as high as 894 K could be attained. Exhaust gas temperatures were as high as 2365 K. Combustion efficiences were about 100 percent over a fuel air ratio range of 0.016 to 0.056. Combustion efficiency decreased at leaner and richer ratios when the inlet air temperature was 589 K. Data are presented that show the effect of fuel air ratio and inlet air temperature on liner metal temperature. Isothermal system pressure loss as a function of diffuser inlet Mach number is also presented. Data included exhaust gas pattern factors; unburned hydrocarbon, carbon monoxide, and oxides of nitrogen emission index values; and smoke numbers. Author

N80-32397*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PRELIMINARY ASSESSMENT OF THE IMPACT OF 2-D EXHAUST-NOZZLE GEOMETRY ON THE CRUISE RANGE OF A HYPERSONIC AIRCRAFT WITH TOP-MOUNTED RAMJET PROPULSION
Walter A. Vahl and John P. Weidner Washington Sep. 1980 60 p refs
(NASA-TM-81841; L-13518) Avail: NTIS HC A04/MF A01 CSCL 21E

A theoretical study of full length and shortened, two dimensional, isentropic, exhaust nozzles integrated with top mounted ramjet propulsion nacelles were conducted. Both symmetric and asymmetric contoured nozzles with a range of angular orientations were considered. Performance comparisons to determine optimum installations for a representative hypersonic vehicle at Mach 5 cruise conditions are presented on the basis of cruise range, propulsive specific impulse, inlet area requirements, and overall lift drag ratio. The effect of approximating the nozzle internal contours with planar surfaces and the determination of viscous and frozen flow effects are also presented. T.M.

N80-32398# Systems Research Labs., Inc., Newport News, Va. RASA Div.
INVESTIGATION OF PERFORMANCE, NOISE, AND DETECTABILITY CHARACTERISTICS OF REMOTELY PILOTED VEHICLE (RPV) PROPELLERS Final Report
D. S. Janaki Ram Jun. 1980 168 p refs
(Contract DAAJ02-77-C-0029)
(AD-A088325; RASA/SRL-14-79-05; USAAVRADCOM-TR-80-D-7) Avail: NTIS HC A08/MF A01 CSCL 01/3

Several small scale propeller configurations applicable to a conceptual Remotely Piloted Vehicle (RPV) aircraft were designed, fabricated, and tested to determine their performance, acoustic, and detectability characteristics. The tests were conducted in static and simulated forward flight conditions in a wind tunnel. Propellers tested included tractor, pusher, and ducted configurations. The acoustic data obtained were used to determine the slant range and altitude of no detection of each propeller configuration. The data were analyzed to determine the effects of blade number, blade design (activity factor and twist), diameter, tip speed, thrust, and forward velocity on the acoustic and detectability characteristics of the propeller configurations tested. The performance data did not show any conclusive trends except that the ducted and pusher propeller configurations tested were less efficient than their open and tractor counterparts respectively. GRA

N80-32399# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

LOW COST PROCESS FOR MANUFACTURING OF OXIDE DISPERSION STRENGTHENED (ODS) TURBINE NOZZLE COMPONENTS Final Report, 30 Jun. 1976 - 31 Dec. 1979
J. A. Stahl, R. J. Perkins, and P. G. Bailey Dec. 1979 143 p refs
(Contract F33615-76-C-5235; AF Proj. 8556)
(AD-A088019; AFML-TR-79-4163) Avail: NTIS HC A07/MF A01 CSCL 21/5

This final technical report describes a program for producing low cost processes for the manufacture of Oxide Dispersion Strengthened (ODS) turbine nozzle components. The processes established in this program will demonstrate that high pressure turbine vanes, low pressure turbine vanes and high pressure turbine bands can be manufactured from near net shape components via directional forging and forge bending. GRA

N80-32400# McDonnell-Douglas Research Labs., St. Louis, Mo.
UNSTEADY TRANSONIC FLOWS IN A TWO-DIMENSIONAL DIFFUSER Annual Report, 1 Apr. 1979 - 31 Mar. 1980
Miklos Sajben, Thomas J. Bogar, and Joseph C. Kroutil May 1980 30 p refs
(Contract F49620-77-C-0082; AF Proj. 2307)
(AD-A088231; AFOSR-80-0628TR) Avail: NTIS HC A03/MF A01 CSCL 21/5

Extensive measurements of shock position and pressure distributions (wall static, core flow static, and core flow total) were made, complemented by spark schlieren and high speed schlieren photographic information. Measurements were made at shock Mach numbers up to 1.35, with and without excitation. The excitation amplitudes were low, with frequencies from 0 to 330 Hz. Unexcited flows displayed two dominant natural frequencies for attached flows (shock Mach numbers below 1.27) and one dominant peak for separated flows (shock Mach numbers above 1.28). The dominant frequencies depend strongly on shock strength. Diffuser response to excitation appears to follow patterns expected on the basis of low amplitude (acoustic) wave propagation concepts, provided that the stream wise variation of the flow speed is considered and realistic boundary conditions are applied at the ends of the channel. The study strongly suggests that the effective acoustic impedance associated with the shock/boundary layer interaction zone is an important determinant of diffuser response to small amplitude external perturbations. GRA

N80-32401# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
PROJECT SQUID Final Technical Report, Oct. 1967 - Dec. 1979
R. F. Hoglund, R. Goulard, and S. N. B. Murthy Feb. 1980 242 p
(Contracts N00014-75-C-1143; N00014-67-A-0226; NR Proj. 098-038; Proj. SQUID)
(AD-A088006; SQUID-PU-R2-80) Avail: NTIS HC A11/MF A01 CSCL 21/5

The Final Technical Report provides a summary report of the activities under Project SQUID carried out under Contracts N00014-67-0226, N00014-67-A-0226 and N00014-75-C-1143 during the period Oct. 1967-Dec. 1979 with the Office of Naval Research. Projects carried out under subcontract to Purdue University as well as Workshops and Colloquia organized under the auspices of Project SQUID are discussed. Project SQUID is a continuing program devoted to fundamental research of long range relevance to the technology of jet propulsion. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-32402*# Oklahoma State Univ., Stillwater.
HANDLING QUALITIES OF LARGE FLEXIBLE AIRCRAFT Ph.D. Thesis
Supat Poopaka Dec. 1980 72 p
(Grant NsG-4018)
(NASA-CR-163593) Avail: NTIS HC A04/MF A01 CSCL 01C

The effects on handling qualities of elastic modes interaction with the rigid body dynamics of a large flexible aircraft are studied by a mathematical computer simulation. An analytical method to predict the pilot ratings when there is a severe modes interactions is developed. This is done by extending the optimal control model of the human pilot response to include the mode decomposition mechanism into the model. The handling qualities are determined for a longitudinal tracking task using a large flexible aircraft with parametric variations in the undamped natural frequencies of the two lowest frequency, symmetric elastic modes made to induce varying amounts of mode interaction. R.C.T.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-32403*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
MODELING AND CONTROL OF TRANSONIC CRYOGENIC WIND TUNNELS Final Summary Report, period ending Oct. 1980
S. Balakrishna and A. Tennille, ed. Oct. 1980 53 p refs
(Grant NsG-1503)
(NASA-CR-163588) Avail: NTIS HC A04/MF A01 CSCL 14B

The problem of automatic control of fan driven closed circuit, transonic, cryogenic tunnels, which use gaseous nitrogen as the test medium and sprayed liquid nitrogen as the coolant was investigated. Operation of the tunnel gas of a wind tunnel at cryogenic temperatures yielded considerable enhancement of flow Reynolds number. This property was successfully exploited in realizing free flight equivalent flow Reynolds numbers on relatively small models. This quantum improvement in Reynolds number capability was demonstrated by the successful operation of the 0.3 meter Transonic Cryogenic Tunnel (0.3 m TCT). The initial operation of the 0.3 m TCT was by manual manipulation of the tunnel control inputs: liquid nitrogen flow into the tunnel by a valve, gaseous nitrogen flow out of the tunnel by a valve, and the fan speed. The operating experience indicated a highly coupled process which tended to creep away from equilibrium. This pointed to a need for automatic control of the cryogenic tunnel. T.M.

N80-32404*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
SELECTED DATA FROM A TRANSONIC FLEXIBLE WALLED TEST SECTION Semiannual Progress Report
S. W. D. Wolf Sep. 1980 108 p refs
(Grant NsG-7172)
(NASA-CR-159360) Avail: NTIS HC A06/MF A01 CSCL 14B

Twenty four test runs of the Transonic Self-Streamlining Wind Tunnel were performed with the flexible walls 'streamlined' around a two dimensional section of four inch chord, over the Mach number range 0.3 to 0.89. Relevant wall and model data for the streamlined cases are presented. L.F.M.

N80-32405*# Boeing Aerospace Co., Seattle, Wash.
LASER ANGLE MEASUREMENT SYSTEM Final Report
C. R. Pond, P. D. Teixeira, and R. E. Wilbert Oct. 1980 51 p
(Contract NAS1-15410)
(NASA-CR-159306; D180-25234-1) Avail: NTIS HC A04/MF A01 CSCL 14B

The design and fabrication of a laser angle measurement system is described. The instrument is a fringe counting interferometer that monitors the pitch attitude of a model in a wind tunnel. A laser source and detector are mounted above the mode. Interference fringes are generated by a small passive element on the model. The fringe count is accumulated and

displayed by a processor in the wind tunnel control room. Optical and electrical schematics, system maintenance and operation procedures are included, and the results of a demonstration test are given. R.C.T.

N80-32406# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
DESIGN CONCEPT FOR FUEL FIRE FACILITY SCALE-DOWN Final Report
John R. Piergallini. Aug. 1979. 58 p. refs.
(WF51523000)
(AD-A084624; NADC-79227-60) Avail: NTIS HC A04/MF A01 CSCL 14/2

An all-weather, self-sustaining, indoor fuel-fire facility for the generation of data for the evaluation of burn-protective capacity of personal gear for naval aircrewmen and flight deck personnel in full-scale fuel fire exposures was developed. A scaled-down indoor version of the existing fuel-fire facility provided realistic data for protective-capacity analysis. An automated enclosed facility allows experiments to be conducted efficiently indoors in a closely controlled environment with minimal risk to personnel and surrounding and with more timely and consistent results in the analysis of data for burn protection of naval aircrewmen. T.M.

N80-32407# Southwest Research Inst., San Antonio, Tex. Engineering Sciences Div.
NEW CONCEPT STUDY FOR REPAIR OF BOMB-DAMAGED RUNWAYS. VOLUME 1: CONCEPT IDENTIFICATION Final Report, 1 May 1977 - 24 Jul. 1978
E. Jack Baker, Jr. and Ernest P. Bergmann. Sep. 1979. 186 p. refs.
(Contract F08635-77-C-0154; AF Proj. 2104)
(AD-A088188; Rept-02-4891-Vol-1;
AFESC/ESL-TR-79-27-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 01/5

An in-depth review of bomb crater repair processes and material resulted in the identification of twelve concepts. Each concept is a general solution to the problem of crater repair which is amenable to implementation using numerous combinations of fill and cap materials. In addition to the study and description of repair processes, an in depth review of alternate runway strategies is presented. GRA

N80-32408# Sperry Rand Corp., Huntsville, Ala. Support Services.
AUTOMATIC TEST EQUIPMENT Final Technical Report
28 Feb. 1980. 150 p. refs.
(Contract DAAK40-79-D-0020; DA Proj. 1L1-62303-A-214)
(AD-A088177; AD-E950018; SP-212-1055;
DRSMI-RL-CR-80-3) Avail: NTIS HC A07/MF A01 CSCL 14/2

This report presents an overview of recent activities within Industry and the Department of Defense on Automatic Test Equipment (ATE). A review of ad hoc projects both within the services and jointly with industry is presented beginning with the Electronic Test Equipment Task Force established in 1974. A brief description of the major ATE systems in use by the Navy and Air Force together with a more detailed description of existing and planned Army ATE is presented. The report concludes with the need to emphasize Built-In Test Equipment in future Army missile systems. GRA

N80-32409# Federal Lab. Consortium, Washington, D. C.
FEDERAL LABORATORY CONSORTIUM RESOURCE DIRECTORY
Nov. 1979. 159 p. Prepared in cooperation with Naval Weapons Center, China Lake, Calif.
(Grant NSF ISP-78-22221)
(PB80-199078; NSF/RA-790268) Avail: NTIS HC A08/MF A01 CSCL 14B

This directory of the resource capability within Federal laboratories, contains information to bridge the communications gap between the Federal Laboratory Consortium and potential users in the public and private sectors. A map pinpointing the locations of the Consortium's member laboratories and an alphabetical list of the Consortium's laboratories, detailing their areas of application and activity is contained. More specific sub-areas are given under each general listing, and each sub-area includes a list of laboratories in that particular area of expertise. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-32410* National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGY FOR LARGE SPACE SYSTEMS. A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 3
Jul. 1980. 85 p.
(NASA-SP-7046(03)) Avail: NTIS HC $8.00 CSCL 22A

A bibliography containing 217 abstracts addressing the technology for large space systems is presented. State of the art and advanced concepts concerning interactive analysis and design, structural concepts, control systems, electronics, advanced materials, assembly concepts, propulsion, solar power satellite systems, and flight experiments are represented. M.G.

N80-32411*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
POTENTIAL PROBLEMS RELATIVE TO TDRS/IUS TILT TABLE ELEVATION WITH FAILED VRCS
Jerome Bell. Sep. 1980. 29 p.
(NASA-TM-82201; JSC-16870; IN-80-FM-50) Avail: NTIS HC A03/MF A01 CSCL 22A

Operational concerns and preliminary solution alternatives related to elevating the inertial upper stage/tracking and data relay satellite (IUS/TDRS) with a failed orbiter vernier reaction control system (VRCS) are presented. Problems arise from the combination of TDRS thermal constraints and tilt table constraints (the primary reaction control system (PRCS) cannot be used to hold attitude while the tilt table is being elevated), and the problems are compounded by the minimum PRCS attitude deadband. The potential solution options are affected by the launch window, flight profile, crew procedures, vehicle capability and constraints, and flight rules. T.M.

N80-32412*# General Dynamics/Convair, San Diego, Calif.
COMPARATIVE THERMAL ANALYSIS OF ALTERNATE CRYOGENIC FLUID MANAGEMENT EXPERIMENT (CFME) CONFIGURATIONS
F. Merino and R. F. O'Neill. Jul. 1980. 66 p. refs.
(Contract NAS3-21935)
(NASA-CR-165151; GDC-CRAD-80-014) Avail: NTIS HC A04/MF A01 CSCL 22A

The Cryogenic Fluid Management Experiment (CFME) was analyzed to assess the feasibility and advisability of deleting the vapor cooled shield (VCS) from the baseline CFME insulation and pressure control system. Two alternate concepts of CFME insulation and pressure control, neither of which incorporated the VCS, were investigated. The first concept employed a thermodynamic vent system (TVS) to throttle the flow through an internal wall mounted heat exchanger (HX) within the pressure vessel to decrease boiloff and pressure rise rate, while the second concept utilized a TVS without an internal heat exchanger. Only the first concept was viable. Its performance was assessed for a seven day mission and found to be satisfactory. It was also concluded that VCS development costs would be greater than for an internal HX installation. Based upon the above comparisons, the HX was recommended as a replacement for the VCS. A.R.H.

N80-32413*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
A STUDY ON VARIOUS METHODS OF SUPPLYING PROPELLANT TO AN ORBIT INSERTION ROCKET ENGINE Final Technical Report
John E. Boretz, Sam Hunu, Matt Thompson, Mike Pagani, Bob Paulsen, Joe Lewis, and Don Paul. 9 May 1980. 170 p. refs.
(Contracts NAS7-100; JPL-955656)
(TRW/DSSG-36358.001; NASA-CR-163587; JPL-9950-415)
Avail: NTIS HC A08/MF A01 CSCL 22A

Various types of pumps and pump drives were evaluated to

determine the lightest weight system for suppplying propellants to a planetary orbit insertion rocket engine. From these analyses four candidate propellant feed systems were identified. Systems Nos. 1 and 2 were both battery powered (lithium-thionyl-chloride or silver-zinc) motor driven pumps. System 3 was a monopropellant gas generator powered turbopump. System 4 was a bipropellant gas generator powered turbopump. Parameters considered were pump breake horsepower, weight, reliability, transient response and system stability. Figures of merit were established and the ranking of the candidate systems was determined. Conceptual designs were prepared for typical motor driven pumps and turbopump configurations for a 1000 lbf thrust rocket engine.
T.M.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-32414*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
UAH/NASA WORKSHOP ON SPACE SCIENCE PLATFORM
S. T. Wu, ed. (Alabama Univ., Huntsville) and Samuel Morgan, ed. Dec. 1978 205 p refs Workshop held at Joe Wheeler State Park Resort, Ala., 21-25 Aug. 1978
(NASA-TM-82204) Avail: NTIS HC A10/MF A01 CSCL 22B
The scientific user requirements for a space science platform were defined. The potential user benefits, technological implications and cost of space platforms were examined. Cost effectiveness of the platforms' capabilities were also examined.
T.M.

N80-32415# Range Commanders Council, White Sands Missile Range, N. Mex. Documentation Group.
UNIVERSAL DOCUMENTATION SYSTEM HANDBOOK. VOLUME 3: PROGRAM SUPPORT PLAN AND OPERATIONS DIRECTIVE Final Report
Nov. 1979 218 p
(AD-A089222; DG-501-79-Vol-3) Avail: NTIS HC A10/MF A01 CSCL 14/2
This volume of the Universal Documentation System handbook presents procedures to be followed in preparing the program support plan and operations directive documents to be used by support agencies. Responsibilities and security aspects are considered in the support requirements.
GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters, manned orbital laboratories; reusable vehicles, and space stations.

N80-32416*# Vought Corp., Dallas, Tex.
ENVIRONMENTAL PROTECTION REQUIREMENTS FOR SCOUT/SHUTTLE AUXILIARY STAGES Final Report
G. L. Qualls, S. S. Kress, W. W. Storey, and P. N. Ransdell Sep. 1980 66 p refs
(Contract NAS1-12500)
(NASA-CR-3328) Avail: NTIS HC A04/MF A01 CSCL 13B
The requirements for enabling the Scout upper stages to endure the expected temperature, mechanical shock, acoustical and mechanical vibration environments during a specified shuttle mission were determined. The study consisted of: determining a shuttle mission trajectory for a 545 kilogram (1200 pound) Scout payload; compilation of shuttle environmental conditions; determining of Scout upper stages environments in shuttle missions; compilation of Scout upper stages environmental qualification criteria and comparison to shuttle mission expected environments; and recommendations for enabling Scout upper stages to endure the exptected shuttle mission environments.
R.K.G.

N80-32417*# Martin Marietta Corp., Denver, Colo.
TITAN PROBE TECHNOLOGY ASSESSMENT AND TECHNOLOGY DEVELOPMENT PLAN STUDY Final Report
Angelo J. Castro Jul. 1980 191 p refs
(Contract NAS2-10380)
(NASA-CR-152381; TPT-MA-02-3) Avail: NTIS HC A09/MF A01 CSCL 22B
The need for technology advances to accomplish the Titan probe mission was determined by defining mission conditions and requirements and evaluating the technology impact on the baseline probe configuration. Mission characteristics found to be technology drivers include (1) ten years dormant life in space vacuum; (2) unknown surface conditions, various sample materials, and a surface temperature; and (3) mission constraints of the Saturn Orbiter Dual Probe mission regarding weight allocation. The following areas were identified for further development: surface sample acquisition system; battery powered system; nonmetallic materials; magnetic bubble memory devices, and the landing system. Preentry science, reliability, and weight reduction and redundancy must also be considered.
A.R.H.

N80-32418*# California Univ., Berkeley. Space Sciences Lab.
FILTER DEVELOPMENT FOR THE EXTREME ULTRAVIOLET EXPLORER Final Report, 10 Jul. 1977 - 30 Jun. 1980
Randy Kimble and Patrick Jelinsky 30 Jun. 1980 22 p
(Contract NAS5-24189)
(NASA-CR-160039) Avail: NTIS HC A02/MF A01 CSCL 22B
Thin film filters with extreme ultraviolet bandpasses unattainable with previously available filter materials were developed. Titanium and antimomy were identified as the most promising materials for providing the scientifically important 350-500 A bandpass heretofore unattainable with thin film filters. Titanium foils and titanium-antimony sandwich foils of the required uniformity and durability were fabricated. Transmission measurements and optimization studies indicate that the titanium-antimony combination provides an ideal bandpass for scientifically valuable, high-sensitivity observations with EUVE. Environmental testing of the mechanical strength, moisture sensitivity and aging characteristics of the newly developed filter materials demonstrate flightworthy performance.
S.F.

N80-32419# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council of Scientific and Technical Research.
APT 80-1 TECHNICAL NOTES [NOTA TECNICA APT 80-1]
Marlene Elias Aug. 1980 9 p In POLISH
(INPE-1845-NTE/162) Avail: NTIS HC A02/MF A01
Technical data concerning TIROS-N and NOAA-6 are presented.
Transl. By F.O.S.

N80-32420# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. of Studies and Research in Space Technology.
SATELLITE SPACECRAFT CHARGING CONTROL MATERIALS Interim Scientific Report, 1 Sep. 1978 - 30 Apr. 1980
B. Benaissa, L. Levy, A. Paillous, and D. Sarrail Wright-Patterson AFB, Ohio AFML Apr. 1980 141 p refs
(Grant AF-AFOSR-3704-78; AF Proj. 2422)

(AD-A087675; NERA/CERT/DERTS-CR-AF-05; AFWAL-TR-80-4029) Avail: NTIS HC A07/MF A01 CSCL 22/2

The feasibility of conductive adhesive techniques for the electrical interconnection of ITO-coated second surface mirrors has been studied. The good electrostatic performance and the durability of components combining ITO coated aluminized Kapton and aluminum straps by means of a silver loaded silicone have been confirmed by a prequalification program. The charge dissipation mechanisms for silica fabrics in a geosynchronous magnetic substorm environment have been studied by means of various sample configurations that have been tested under electron beam. Some recommendations have been given for a better use of silica fabrics as thermal control coatings in space. GRA

N80-32421# Naval Research Lab., Washington, D. C.
A DEMONSTRATION OF SATELLITE SHIELDING
J. B. Langworthy 22 Jul. 1980 26 p
(RR0120141)
(AD-A087752; AD-E000500; NRL-MR-4275) Avail: NTIS HC A03/MF A01 CSCL 22/2

A capability of performing electron shielding design for a real satellite is demonstrated by first posing a typical shielding problem and then solving it using the recently developed codes, SECTOR and BRANDE. In the process a modeling technique is introduced which allows conceptualizing the geometrical complexities of satellites in such a way that the shielding problem is made more methodical than the previous approach, a series of trials and corrections. GRA

N80-32422# Naval Postgraduate School, Monterey, Calif.
GUIDANCE AND CONTROL OF TACTICAL MISSILES M.S. Thesis
Thomas Alan Grote Dec. 1979 174 p refs
(AD-A085147) Avail: NTIS HC A08/MF A01 CSCL 16/2

The functioning program used to investigate the impact miss distance for the Supersonic Tactical Missile was modified. When the initial y-displacement error exceeded 1800 feet, the missile did not acquire the target. All errors smaller than this resulted in miss distances within 0.5 feet of the target. The midcourse guidance reference altitude was changed to reflect a sea-skimming missile. This simulation ran and impact was recorded. An attempt at adding random noise to the homing seeker was tried, but revealed that more information is required on this topic. The computer program was successfully converted and altered to run using the simplified ramjet model. T.M.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-32423* National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGICAL INNOVATION IN THE DESIGN AND DEVELOPMENT OF THE SPACE TRANSPORTATION SYSTEM
10 Sep. 1980 28 p
(NASA-TM-82190; P80-10155) Avail: NASA Scientific and Technical Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 22B

A general overview of the space transportation system is presented including a description of its intended operations and launch schedules. The advantages of using graphite epoxy and titanium/boron composite structures are examined as well as the capabilities of the thermal protection tiles. Technological advances used in the construction of the orbiter, the external tank, the solid rocket booster, and the main engine are assessed. Particular emphasis is given to computer controlled engine operations and the fly by wire system. A.R.H.

N80-32424* National Aeronautics and Space Administration, Washington, D. C.
SPACE SHUTTLE PRESS CONFERENCE
1 Aug. 1980 24 p
(NASA-TM-82191; P80-10156) Avail: NASA Scientific and Technical Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 22B

Details of the launch schedule for the first space transportation system flight are examined as well as solutions to problems related to the thermal protection system of the space shuttle main engine. Plans for rollout, to movement to the vehicle assembly building pad and flight readiness firing are considered, and the rationale for not flying the manned maneuvering unit is given. Manpower used in tile densification, the influence of DOD needs on the scheduling, prime contractor responsibilities, the role of Mission Control, and the differences between the orbiter and the space suit oxygen supply systems are also discussed. A.R.H.

N80-32425*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
MATED VERTICAL GROUND VIBRATION TEST
Edward W. Ivey Jul. 1980 96 p refs
(NASA-TM-78298) Avail: NTIS HC A05/MF A01 CSCL 22B

The Mated Vertical Ground Vibration Test (MVGVT) was considered to provide an experimental base in the form of structural dynamic characteristics for the shuttle vehicle. This data base was used in developing high confidence analytical models for the prediction and design of loads, pogo controls, and flutter criteria under various payloads and operational missions. The MVGVT boost and launch program evolution, test configurations, and their suspensions are described. Test results are compared with predicted analytical results. L.F.M.

N80-32426*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
USER'S GUIDE FOR THE FLIGHT DESIGN SYSTEM (FDS)
H. Rudy Ramsey, Michael E. Atwood, William G. Frisius, Althea A. Turner, and John K. Willoughby Aug. 1980 120 p Prepared in cooperation with Science Applications, Inc., Englewood, Colo. (Contract NAS9-15535)
(NASA-TM-82202; JSC-16794; IN-80-FM-47) Avail: NTIS HC A06/MF A01 CSCL 22A

Information about the Flight Design System (FDS) in the context of flight design is presented. The guide introduces the FDS user to the structure of FDS and to constructs within FDS (such as files of information or the part of FDS which interacts directly with the user). A guide to the commands available to FDS users is presented. A glossary of important terms, an index to terms, and a quick reference to the commands of FDS are included. T.M.

N80-32427*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 1: GROUND RULES AND CONSTRAINTS CYCLE 3.1.1
Jul. 1980 42 p refs Supersedes JSC-14483
(NASA-TM-82200; JSC-14483; JSC-16683-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

The ground rules and constraint to be used in generating the Space Transportation System 1 Flight operational flight profile are established. A brief summary of the flight is also presented. L.F.M.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-32428*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODELLING OF ENVIRONMENTALLY INDUCED DISCHARGES IN GEOSYNCHRONOUS SATELLITES
N. John Stevens 1980 9 p refs Presented at the Ann. Conf. on Nucl. and Space Radiation Effects, Ithaca, N.Y., 15-18 Jul. 1980; sponsored by IEEE
(NASA-TM-81598; E-581) Avail: NTIS HC A02/MF A01 CSCL 22B

The NASCAP computer code was used to compute the charging and discharging characteristics of a typical communications satellite in geosynchronous orbit. For the case of a severe substorm satellite surface differential charging in sunlight was found to be substantially less than that required to produce discharges in ground simulation studies. A discharge process was postulated involving discharges triggered at edges (or imperfection) followed by discharges to space. The characteristics of such discharges was parametrically varied to evaluate the possible effects on the satellite. Results indicated that discharge characteristics inferred from satellite monitors could be caused by predicted space discharges, that single cell discharges to space can reduce surface potentially over entire satellite, and that low density electron trajectory computations indicate that discharge generated electrons do not return to the satellite by long trajectories. Current transients predicted do not agree with available ground simulation results indicating that additional work must be done both analytically and experimentally to understand and fully explain these discrepancies. R.C.T.

N80-32429*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF THE REENTRY FLIGHT DYNAMICS SIMULATOR FOR EVALUATION OF SPACE SHUTTLE ORBITER ENTRY SYSTEMS
Lawrence F. Rowell, Richard W. Powell, and Howard W. Stone, Jr. Washington Oct. 1980 97 p refs
(NASA-TP-1700; L-13662) Avail: NTIS HC A05/MF A01 CSCL 14B

A nonlinear, six degree of freedom, digital computer simulation of a vehicle which has constant mass properties and whose attitudes are controlled by both aerodynamic surfaces and reaction control system thrusters was developed. A rotating, oblate Earth model was used to describe the gravitational forces which affect long duration Earth entry trajectories. The program is executed in a nonreal time mode or connected to a simulation cockpit to conduct piloted and autopilot studies. The program guidance and control software used by the space shuttle orbiter for its descent from approximately 121.9 km to touchdown on the runway. T.M.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-32430*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
FEASIBILITY OF MODIFYING THE HIGH RESOLUTION INFRARED RADIATION SOUNDER (HIRS/2) FOR MEASURING SPECTRAL COMPONENTS OF EARTH RADIATION BUDGET Final Report
Edward W. Koenig and Kent A. Holman Aug. 1980 80 p
(Contract NAS1-16180)
(NASA-CR-159353) Avail: NTIS HC A05/MF A01 CSCL 14B

The concept of adding four spectral channels to the 20 channel HIRS/2 instrument for the purpose of determining the origin and profile of radiant existence from the Earth's atmosphere is considered. Methods of addition of three channels at 0.5, 1.0 and 1.6 micron m to the present 0.7 micron m visible channel and an 18-25 micron m channel to the present 19 channels spaced from 3.7 micron m to 15 micron m are addressed. Optical components and physical positions were found that permit inclusion of these added channels with negligible effect on the performance of the present 20 channels. Data format changes permit inclusion of the ERB data in the 288 bits allocated to HIRS for each scan element. A lamp and collimating optic assembly may replace one of the on board radiometric black bodies to provide a reference source for the albedo channels. Some increase in instrument dimensions, weight and power will be required to accommodate the modifications. A.R.H.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-32431*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
ORBIT TRANSFER VEHICLE ENGINE STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
31 Jul. 1980 45 p
(Contract NAS8-33444)
(NASA-CR-161563; FR-13168-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 21H

The orbit transfer vehicle (OTV) engine study provided parametric performance, engine programmatic, and cost data on the complete propulative spectrum that is available for a variety of high energy, space maneuvering missions. Candidate OTV engines from the near term RL 10 engine to advanced high performance expander engines were examined. T.M.

N80-32432*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
ORBIT TRANSFER VEHICLE ENGINE STUDY. VOLUME 2: TECHNICAL REPORT Final Report
31 Jul. 1980 206 p
(Contract NAS8-33444)
(NASA-CR-161564; FR-13168-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 21M

The orbit transfer vehicle (OTV) engine study provided parametric performance, engine programmatic, and cost data on the complete propulsive spectrum that is available for a variety of high energy, space maneuvering missions. Candidate OTV engines from the near term RL 10 (and its derivatives) to advanced high performance expander and staged combustion cycle engines were examined. The RL 10/RL 10 derivative performance, cost and schedule data were updated and provisions defined which would be necessary to accommodate extended low thrust operation. Parametric performance, weight, envelope, and cost data were generated for advanced expander and staged combustion OTV engine concepts. A prepoint design study was conducted to optimize thrust chamber geometry and cooling, engine cycle variations, and controls for an advanced expander engine. Operation at low thrust was defined for the advanced expander engine and the feasibility and design impact of kitting was investigated. An analysis of crew safety and mission reliability was conducted for both the staged combustion and advanced expander OTV engine candidates. T.M.

N80-32433*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
ORBIT TRANSFER VEHICLE ENGINE STUDY. VOLUME 3: PROGRAM COSTS Final Report

31 Jul. 1980 45 p
(Contract NAS8-33444)
(NASA-CR-161574; PWA-FR-13168-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 21H

Budgetary and planning cost estimates are presented that were prepared for the development, production and operation and flight support phases for each of the engines proposed for OTV propulsion. The major features of each category engine are described. The development program estimates were structured to the preliminary program Work Breakdown Structures (WBS). Program costs are provided within the applicable WBS elements to Level 4 for each category engine. The production program cost estimates assume a first production lot of 50 units produced at a rate of two units per month. Cumulative average unit costs assume a 90% learning capability. The operations and flight support cost estimates are based on 15, 30 and 45 missions per year for the period 1988 through 1999. Estimated funding requirements were developed for each category and program phase. All cost estimates and funding data are presented in 1979 dollars. The assumptions and ground rules for these estimates are summarized. A.R.H.

N80-32434# Tennessee Univ. Space Inst., Tullahoma. Gasdynamics Div.
PHOTOGRAPHIC SPECTROSCOPIC MEASUREMENT OF ULTRAVIOLET SOLID ROCKET MOTOR PLUMES Final Report
Dennis R. Keefer, William J. Phillips, and Kenneth E. Hanwell 7 Feb. 1980 17 p refs
(Contract N60530-78-C-0020; ZF32392002)
(AD-A088438; UTSI-GD-TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 17/5

Photographic spectra having a nominal bandpass of 0.4 nm were obtained from the radiation from several solid rocket motor exhausts in the spectral region 250 nm to 430 nm. The spectra consisted primarily of a continuum with some molecular band structure which was found to originate from the molecules OH, PbO, NO CHO. These molecular bands were more pronounced in the region 290 nm to 320 nm, but the radiating systems involved extend to shorter wavelengths. The source of the continuum radiation was not determined explicitly, but is not inconsistent with a CO and O recombinations mechanism. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-32435* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RADIANT PANEL TESTS ON AN EPOXY/CARBON FIBER COMPOSITE
R. Ballard, D. E. Cagliostro, M. Gross, Ming Ta Hsu, and W. Winslow Mar. 1980 41 p refs Prepared in cooperation with San Jose State Univ., California
(NASA-TM-81185; A-8110) Avail: Issuing Activity CSCL 07B

The toxicity of epoxy/carbon fiber composites in fire environments is addressed. A radiant panel test chamber was developed to study the effects of pyrolysis of polymeric materials. The thermal response of the sample and the composition of gas and aerosol produced are determined. Toxicological effects of the gas and aerosol in the chamber are determined by studying changes in cardiac action, respiration, blood enzymes, and delayed escape responses in test animals. Data are presented for pyrolysis of an epoxy/carbon fiber composite at 2.5 W/sq cm. Nonflame and flame modes produced different gas and aerosol compositions and had different toxic effects. Nonflame modes produced large quantities of organic aerosols and carbon monoxide. These were not lethal but could hinder escape and may pose a long term toxic effect. The flame condition produced hydrogen cyanide in addition to other toxic products. M.G.

N80-32436# New York Univ., N. Y. Dept. of Physics.
INTERACTION OF RADIATION WITH MATTER. Proposed Technical Program, 1 Nov. 1979 - 31 Oct. 1980
Werner Brandt and M. Pope Oct. 1979 15 p refs
(Contract DE-AS02-79EV-02386)
(DOE/EV-02386/1) Avail: NTIS HC A02/MF A01

Summaries of research activities are presented. Areas of study include: environmental; photophysics; spectroscopic studies of polycyclic aromatic hydrocarbon carcinogen DNA complexes; reactions of polycyclic aromatic hydrocarbons adsorbed on metal oxide particles in the presence of oxygen and other pollutant gases; energy loss effect in inner shell excitations; very low velocity Coulomb deflection effects in K and L shell excitations; development of high vacuum target chamber for acceleration studies of low energy ion solid interactions; dynamic response of solids to slow ions; wakes in solids; statistical mechanics of particles in constrained area; and stopping power of nearly degenerate media. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N80-32437# Massachusetts Inst. of Tech., Cambridge. School of Engineering.
A MICRODEBONDING TEST FOR IN-SITU FIBER-MATRIX BOND STRENGTH AND MOISTURE EFFECTS
J. F. Mandell, J-H. Chen, and F. J. McGarry Feb. 1980 26 p refs
(Contract DAAG46-77-C-0770)
(R80-1) Avail: NTIS HC A03/MF A01

A test technique which gives a quantitative measure of the in situ fiber/matrix bond strength in composites is described. The test involves the compressive loading of a fiber or region of fibers on a polished specimen surface to produce debonding. Results are given for the debonding load for glass, aramid and graphite/epoxy composites. The change in debonding load is followed as the interface degrades during moisture conditioning at different points through the thickness. Refinements are needed to simplify interpretation of the debonding force in terms of interface shear strength, and to make the test more reproducible. S.F.

N80-32438# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
FRACTURE TESTING OF INJECTION MOLDED GLASS AND CARBON FIBER REINFORCED THERMOPLASTICS
J. F. Mandell, A. Y. Darwish, and F. J. McGarry Nov. 1979 36 p refs Sponsored by the Lord Corp.
(MIT-CE-R79-4) Avail: NTIS HC A03/MF A01

Polycarbonate, polysulfone, Nylon 6/6, polyphenylene sulfide and poly(amide-imide) samples containing either 40 percent graphite or 30-40 percent glass fibers were tested for fracture toughness, using linear elastic fracture mechanics methods. SEN specimens consistently positioned in centergated injection molded plaques gave KQ values insensitive to C/W ratio. These ranged from 2.8 to 10.5 (MNm)-3/2 reflecting the strong effects of fiber orientation. The toughness values of ductile and brittle matrices, greatly different when unreinforced, converged to similar levels (7-9(MNm)-3/2), with the addition of either fiber. A correlation between crack tip plastic zone size and longest fiber length appeared consistent with the dominant crack propagation mode which emphasized fiber avoidance: matrix and interface rather than fiber fracture. Author

N80-32439*# United Technologies Research Center, East Hartford, Conn.
COATINGS FOR GRAPHITE FIBERS Final Report
F. S. Galasso, D. A. Scola, and R. D. Veltri Aug. 1980 104 p refs
(Contract NAS1-14346)
(NASA-CR-159304; R80-914212-22) Avail: NTIS HC A06/MF A01 CSCL 11D

Graphite fibers released from composites during burning or an explosion caused shorting of electrical and electronic equipment. Silicon carbide, silica, silicon nitride and boron nitride were coated on graphite fibers to increase their electrical resistances. Resistances as high as three orders of magnitude

higher than uncoated fiber were attained without any significant degradation of the substrate fiber. An organo-silicone approach to produce coated fibers with high electrical resistance was also used. Celion 6000 graphite fibers were coated with an organo-silicone compound, followed by hydrolysis and pyrolysis of the coating to a silica-like material. The shear and flexural strengths of composites made from high electrically resistant fibers were considerably lower than the shear and flexural strengths of composites made from the lower electrically resistant fibers. The lower shear strengths of the composites indicated that the coatings on these fibers were weaker than the coating on the fibers which were pyrolyzed at higher temperature. T.M.

N80-32440*# United Technologies Research Center, East Hartford, Conn.
RESEARCH ON GRAPHITE REINFORCED GLASS MATRIX COMPOSITES Interim Report, Jun. 1978 - Feb. 1980
K. M. Prewo and E. R. Thompson Feb. 1980 95 p refs
(Contract NAS1-14346)
(NASA-CR-159312; R80-912545-49) Avail: NTIS HC A05/MF A01 CSCL 11D

High levels of mechanical performance in tension, flexure, fatigue, and creep loading situations of graphite fiber reinforced glass matrix composites are discussed. At test temperatures of up to 813 K it was found that the major limiting factor was the oxidative instability of the reinforcing graphite fibers. Particular points to note include the following: (1) a wide variety of graphite fibers were found to be comparable with the glass matrix composite fabrication process; (2) choice of fiber, to a large extent, controlled resultant composite performance; (3) composite fatigue performance was found to be excellent at both 300 K and 703 K; (4) composite creep and stress rupture at temperatures of up to 813 K was limited by the oxidative stability of the fiber; (5) exceptionally low values of composite thermal expansion coefficient were attributable to the dimensional stability of both matrix and fiber; and (6) component fabricability was demonstrated through the hot pressing of hot sections and brazing using glass and metal joining phases. R.K.G.

N80-32441*# Brown Univ., Providence, R. I. Div. of Engineering.
EFFECT OF PROCESSING PARAMETERS ON REACTION BONDING OF SILICON NITRIDE
Marc H. Richman, Otto J. Gregory, and Matthew B. Magida Oct. 1980 127 p refs
(Grant NsG-3118)
(NASA-CR-163579) Avail: NTIS HC A07/MF A01 CSCL 11D

Reaction bonded silicon nitride was developed. The relationship between the various processing parameters and the resulting microstructures was to design and synthesize reaction bonded materials with improved room temperature mechanical properties. T.M.

N80-32442*# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
STABILITY OPTIMIZATION OF LAMINATED COMPOSITE PLATES
Yoichi Hirano Jul. 1980 19 p refs
(Grant NGL-33-018-003)
(ISAS-579-Vol-45-No-4; NASA-CR-163456) Avail: NTIS HC A02/MF A01 CSCL 11D

The optimum design of plates with orthotropic layers under axial compression and shear is discussed. The plates considered are the laminates of N orthotropic layers whose principal material axes coincide with the plate axes. Each layer is assumed to have the same thickness and an equal number of fibers in the direction of + alpha sub i and - alpha sub i with respect to the plate axis. The fiber directions which give the highest axial buckling stress and the highest shear buckling stress are found by utilizing a mathematical optimization technique for various aspect ratios of the plates. Inhomogeneity in the direction of the plate thickness (stacking sequence) is taken into account in this analysis. Author

N80-32443# Naval Surface Weapons Center, Dahlgren, Va.
DETERMINATION OF KINETIC PARAMETERS FOR THERMAL DECOMPOSITION OF PHENOLIC ABLATIVE MATERIALS BY MULTIPLE HEATING RATE METHOD Final Report
J. B. Henderson, J. A. Wiebelt, M. R. Tant, and G. R. Moore Jul. 1980 33 p refs
(ZR0000101)
(AD-A087929; NSWC/TR-80-204) Avail: NTIS HC A03/MF A01 CSCL 07/3

The rate of decomposition for two widely used glass- and asbestos-phenolic ablative materials were measured using standard thermogravimetric techniques. Thermograms were obtained at six heating rates ranging from 10 degrees C/min to 160 degrees C/min. From these data, the kinetic parameters were determined by a slightly modified version of Friedman's method. Fractional weight loss calculated using the derived kinetic parameters over the temperature range of decomposition agreed with measured values with a mean error of 0.33 and 0.28 percent, with a standard deviation of errors 0.58 and 0.84 percent for glass and asbestos-phenolic, respectively. The 95 percent confidence for the mean error was 0.22 and 0.44 percent for the glass-phenolic and 0.14 and 0.42 percent for the asbestos-phenolic. Also, the activation energy was calculated by the Flynn and Wall method. The average activation energy values determined by the two methods agreed within 4.6 percent for both materials. GRA

N80-32444# Electronics Research Lab., Adelaide (Australia).
STRESS IN POROUS THIN FILMS THROUGH ADSORPTION OF POLAR MOLECULES
E. H. Hirsch Mar. 1980 27 p refs
(AD-A087770; ERL-0124-TR; AR-001-952) Copyright. Avail: NTIS HC A03/MF A01 CSCL 11/6

Films of magnesium fluoride are found to be under large tensile stress following exposure to water vapor. It is shown that this stress, which varies reversibly in magnitude with the adsorption equilibrium, can be attributed to electrostatic dipole interaction between the adsorbed water molecules. The effect is not confined to magnesium fluoride, but can occur in other materials of an appropriate porous structure. Its relevance to the stability of optical coatings is discussed, together with some other applications. GRA

N80-32445# Lockheed-California Co., Burbank.
EFFECT OF LOAD HISTORY ON FATIGUE LIFE Final Technical Report, 30 Aug. 1978 - 31 Dec. 1979
J. T. Ryder Wright-Patterson AFB, Ohio AFML Jun. 1980 261 p refs
(Contract F33615-78-C-5090; AF Proj. 2419)
(AD-A088439; LR-29586; AFWAL-TR-80-4044) Avail: NTIS HC A12/MF A01 CSCL 11/4

The primary objectives of this program are to: 1) study in detail how mechanical loading parameters affect the fatigue life of graphite/epoxy laminates; 2) determine the effects of environmental and geometrical perturbations on the effects studied in objective 1; 3) analyze the results in a manner such that an expanded foundation is laid for formulating fatigue life models based on knowledge of failure mechanisms. The research investigation is divided into four tasks: Task 1, Diagnostic Experimentation; Task 2, Effects of Loading Parameters; Task 3, Effects of Environment and Geometry; Task 4, Data Analysis and Reporting. Tasks 1, 2 and 3 are conducted sequentially while Task 4 is conducted simultaneously with all three tasks. This report describes the analytical and experimental work undertaken in Task 1. GRA

N80-32446# Prototype Development Associates, Inc., Santa Ana, Calif.
AN ANALYSIS OF INTERLAMINAR STRESS GRADIENTS AND IMPACT DAMAGE IN GRAPHITE-EPOXY LAMINATES Final Report, Jan. 1977 - Jan. 1978
E. L. Stanton and L. M. Crain Mar. 1980 86 p refs
(Contract N62269-77-C-0144)
(AD-A088317; NADC-80135-60; PDA-TR-5268-00-01) Avail: NTIS HC A05/MF A01 CSCL 11/4

Interlaminar stress gradients caused by an internal disbond and by low velocity impact are analyzed using 3D finite elements. The disbonded [0/+ or - 45/0211-45/45/0] laminate warps out of plane under or biaxial compression without large stress gradients. A much thicker 48 ply laminate [+ or - 45/02/+ or - 45/02/+ or - 45/0/90]2S is analyzed for impact by a

steel sphere that strikes the laminate off center. Large subsurface shear stresses occur around the perimeter of the contact area with a sinusoidal distribution. These results were obtained using the PATCHES-III program with new constraint elements for modeling laminates. GRA

N80-32447# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.
FLAW DETECTION AND EVALUATION OF COMPOSITE CYLINDERS USING LASER SPECKLE INTERFEROMETRY AND HOLOGRAPHY
Terry L. Vandiver 23 Nov. 1979 88 p refs
(AD-A088206; AD-E950017; DRSMI-RL-80-7-TR) Avail: NTIS HC A05/MF A01 CSCL 14/2

The objective of this work was to determine what constitutes a flaw in a composite tube. Speckle interferometry and holography were used to measure surface displacements of 108 fiber reinforced thin wall cylinders. E-glass, S-glass and Kevlar fibers were used. Cut fiber and impact flaws were investigated. A new automated laser speckle interferometry displacement contour analyzer was used in conjunction with a computer for data analysis. The system analyzes 5000 data points in less than four minutes. Full field reconstruction of laser speckle interferograms and holograms is presented. The techniques described give the investigator a full field displacement picture of the flawed structures as well as displacement data that can be used to determine stresses and strains. GRA

N80-32448# Little (Arthur D.), Inc., Cambridge, Mass.
A REVIEW AND ANALYSIS OF FIBER COUNTING METHODS Final Report
Jun. 1980 55 p
(Contract N60921-78-C-0221; W06520000)
(AD-A088240; NSWC/TR-80-210) Avail: NTIS HC A04/MF A01 CSCL 11/5

Fiber counting methods for use with carbon fibers are reviewed and analyzed. Recommendations are made for their use and comparison. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-32449# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
CHEMICAL, SPECTRAL, STRUCTURAL, AND CHARGE TRANSPORT PROPERTIES OF THE MOLECULAR METALS PRODUCED BY IONIZATION OF NICKEL PHTHALOCYANINE Interim Report
Raymond P. Scaringe, Charles J. Schramm, Djordje R. Stojakovic, Brian M. Hoffman, James A. Ibers, and Tobin J. Marks 17 Jul. 1980 72 p refs Submitted for publication
(Contract N00014-77-C-0231; Grants NSF DMR-76-80847-A01; NSF DMR-77-26409; NR Proj. 053-640)
(AD-A087553; TR-11) Avail: NTIS HC A04/MF A01 CSCL 07/3

Partial oxidation of metallophthalocyanines with iodine has provided an extensive new class of molecular conductors. As illustrated in the present case with nickel phthalocyanine, the properties of the resulting solid state array of pi-cation radicals include electrical conductivity which is comparable with that of the best-known stacked molecular conductors. A particularly intriguing feature of NiPcI1.0 charge transport is a transition from metallic to semi-conducting behavior which apparently is not reflected in the magnetic properties of the carriers. It is tempting to speculate that this behavior reflects a change in carrier mobility brought about by some subtle structural rearrangement such as a change in the ordering of the triiodide chains. In a broader perspective, the iodinated metallophthalocyanines, such as those reported here, represent the first entry into a widening area of conductive materials based upon the ligand pi systems of mixed-valent metallo-macrocyclic arrays. Clearly the insights gleaned and the methodology developed will lead to an ever-deepening understanding of those molecular characteristics which facilitate charge conduction and which optimize materials performance. GRA

N80-32450# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
THE QUANTUM DYNAMICS OF CHEMICAL REACTIONS Final Scientific Report, 1 Jun. 1977 - 30 Jun. 1979
Aron Kuppermann 14 Mar. 1980 22 p refs
(Contract AF-AFOSR-3394-77; AF Proj. 2303)
(AD-A084243; AFOSR-80-0292TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

Accurate and approximate quantum dynamical calculations were made on elementary chemical reactions of importance for the fundamental aspects of chemical dynamics and for advanced technologies of interest to the United States Air Force, such as high energy chemical lasers, plume technology, and the chemical effects of high energy radiation. These included calculations of three atom exchange reactions breakup collisions, three body recombinations vibrational quenching by reaction, tunneling, and eletronic branching ratios. The aim of these calculations was to develop an understanding of these processes and to develop benchmark data against which approximate methods may be tested. R.C.T.

N80-32451# Wisconsin Univ. - Madison. Dept. of Chemistry.
LUMINESCENT TELLURIUM-DOPED CADMIUM SULFIDE ELECTRODES AS PROBES OF SEMICONDUCTOR EXCITED-STATE DEACTIVATION PROCESSES IN PHOTOELECTROCHEMICAL CELLS
Arthur B. Ellis, Bradley R. Karas, and Holger H. Streckert 12 Aug. 1980 30 p refs Submitted for publication
(Contract N00014-78-C-0633; NR Proj. 051-690)
(AD-A088532; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

Correlations between quantum efficiencies for photocurrent (phi (x)), emission (phi r), and nonradiative recombination (phi (nr)) are discussed with reference to data from single-crystal, n-type, 100 and 1000 ppm CdS:Te-based photoelectrochemical cells (PECs) employing aqueous sulfide electrolyte. These materials emit while they serve as PEC electrodes. The assumption that the proportionality of phi (r) to phi (nr) is unaffected by potential leads to a simple expression relating phi (x) to phi (r) for monochromatic excitation. Calculated and observed emission data are in reasonable agreement; sources of deviation are discussed. Polychromatic excitation is shown to yield photocurrent and emission intensity which is approximately a weighted average of the values obtained with the constituent monochromatic frequencies. Practical implications of the phi (x) correlation with phi (r) are described, as are related results from other PECs. GRA

N80-32452# California Univ., Santa Barbara. Dept. of Physics and Chemistry.
SULFUR MODIFIES THE CHEMISORPTION OF CARBON MONOXIDE ON RHODIUM/ALUMINA MODEL CATALYSTS
R. M. Kroeker, W. C. Kaska, and P. K. Hansma 29 Jul. 1980 15 p refs Submitted for publication Sponsored in part by NSF
(Contract N00014-78-C-0011; NR Proj. 056-673)
(AD-A088043; TR-3) Avail: NTIS HC A02/MF A01 CSCL 07/4

The effect of D2 S on the chemisorption of CO on supported rhodium is examined with tunneling spectroscopy. It is seen that for low concentrations, D2 S decreases the density of species with two CO molecules per Rh atom and increases the density of species with one CO molecule per Rh atom. At higher concetrations D2 S decreases the density of all types of adsorbed CO. GRA

N80-32453# IBM Research Lab., San Jose, Calif.
VIBRATIONAL SPECTRA OF CARBON MONOXIDE CHEMISORBED ON ALUMINA-SUPPORTED NICKEL

PARTICLES: A TUNNELING SPECTROSCOPY STUDY
R. M. Kroeker, W. C. Kaska, and P. K. Hansma 29 Jul. 1980 24 p refs Submitted for publication Prepared in part by California Univ., Santa Barbara
(Contract N00014-78-C-0011)
(AD-A088044; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/4

Tunneling spectroscopy is used to study the chemisorption of CO on small nickel particles. The particles are grown from vapor on a thermally oxidized aluminum substrate. Carbon monoxide is observed to chemisorb in at least four distinct ways, giving CO stretching frequencies of 256.5, 246, 222 and 207 meV. The 256.5 meV species has low frequency modes at 45.5 and 59.5 meV. The low frequency modes of the remaining three species are not resolved sufficiently for identification. The frequencies of all modes were found to have some coverage dependence. The largest shift is seen in a CO stretching vibration that moves from 200 to 207 meV with increasing coverage. The effect of H2 co-adsorption is examined and evidence for the presence of oxygen on the particles is presented. The reaction of the chemisorbed CO with H2 on these nickel particles is found to produce very little surface hydrocarbon in contrast to results found previously for rhodium particles under similar conditions. GRA

N80-32454# Army Construction Engineering Research Lab., Champaign, Ill. Environmental Div.
IDENTIFICATION AND QUANTIFICATION OF HYDROCARBON PRODUCTS IN EFFLUENTS Interim Report
R. S. Vogel, W. J. Mikucki, R. J. Fileccia, and R. G. Lampo May 1980 62 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A088268; CERL-IR-N-91) Avail: NTIS HC A04/MF A01 CSCL 07/3

This report documents interim results of a study to (1) investigate the capability of infrared (IR) spectroscopy for the identification of specific hydrocarbon products in effluents from washracks and other vehicle service operations at Army installations, and (2) make a comparative evaluation of the Environmental Protection Agency's (EPA) gravimetric (STORET 00556) and IR (STORET 00560) methods of quantifying 'total hydrocarbons' in wastewater. Results have shown that IR spectroscopy can provide a basis for the identification of hydrocarbon products for which reference samples are available. In the initial phase of the work, a scheme of sequential discriminant analysis and pattern recognition was used with reference to a file of military specification (MIL SPEC) hydrocarbon products used in servicing wheel and track type Army vehicles. The complexity of IR data reduction was shown to increase rapidly with the number of hydrocarbon products present in a given sample, a result of a similarity in the hydrocarbon components' molecular structure. The use of gas liquid chromatography (GLC) in conjunction with IR spectroscopy provided additional discrimination and simplified data reduction. A comparative investigation of the gravimetric vs IR methods for the quantification of 'total hydrocarbons' in wastewater showed that the IR method was capable of higher precision than the gravimetric method at hydrocarbon concentrations less than 10 mg/l, and could provide information on chemical composition and consequently the origin of the hydrocarbon product. GRA

N80-32455# Naval Research Lab., Washington, D. C.
OPTO-ACOUSTIC STUDIES OF METHANE IMPURITIES IN ARGON Memorandum Report, Oct. 1978 - Oct. 1979
D. H. Leslie and G. L. Trusty 30 Jul. 1980 26 p refs
(AD-A088053; NRL-MR-4283) Avail: NTIS HC A03/MF A01 CSCL 07/4

An optoacoustic detection system has been constructed for detecting absorption of DF laser radiation. Absorption by methane in argon has been observed at 13 DF lines. The system was calibrated using independently measured absorption line parameters for CH4 broadened by argon at the DF line P sub 8. GRA

N80-32456# Rhode Island Univ., Kingston Dept. of Mathematics.
A COLLINEAR N-BODY PROBLEM OF CLASSICAL ELECTRODYNAMICS Interim Report
R. D. Driver and M. J. Norris May 1980 10 p refs Prepared in cooperation with Sandia Labs., Albuquerque, N. Mex.
(Contract F49620-79-C-0129; DE-AC04-76DP-00789; AF Proj. 2304)
(AD-A088114; AFOSR-80-0586TR) Avail: NTIS HC A02/MF A01 CSCL 20/3

A model for the motion of n charged particles on the x-axis is described which leads to a system of delay differential equations with delays dependent on the unknown trajectories. If appropriate past histories of the trajectories are given, say on a,0, then for sufficiently small t > or = 0 there is a system of n(2) ordinary differential equations of the form y' = f(t,y) with y(0) = y sub 0 given. A generalized Lipschitz type condition is developed which is satisfied in the electrodynamics case. It is demonstrated that solutions of the equations of motion exist and are unique as long as no two particles collide. M.G.

N80-32457# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
THE APPLICATION OF HIGH RESOLUTION ELECTRON ENERGY LOSS SPECTROSCOPY TO THE STUDY OF MODEL SUPPORTED METAL CATALYSTS
L. H. Dubois, P. K. Hansma, and G. A. Somorjai 29 Jul. 1980 27 p refs Submitted for publication Supported in part by NSF
(Contract N00014-78-C-0011; NR Proj. 056-673)
(AD-A088118; LBL-10733; TR-6) Avail: NTIS HC A03/MF A01 CSCL 07/4

Model supported metal catalysts were fabricated by evaporating a small quantity of rhodium onto an oxidized aluminum substrate. High resolution electron energy loss spectroscopy (ELS) was successfully used to obtain the vibrational spectra of carbon monoxide chemisorbed on these model catalysts. The ELS spectra are compared with vibrational spectra obtained by infrared spectroscopy and inelastic electron tunneling spectroscopy for CO chemisorbed on similar model catalysts. GRA

N80-32458# Oxford Univ. (England). Inorganic Chemistry Lab.
ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY OF VANADIUM (IV) COMPLEXES AND RELATED SPECIES Final Scientific Report, 1 Oct. 1977 - 31 Jul. 1980
Kenneth R. Seddon and P. Roger Dixon 27 Jul. 1980 109 p refs
(Grant AF-AFOSR-3368-77; AF Proj. 2301)
(AD-A088311; EOARD-TR-80-13) Avail: NTIS HC A06/MF A01 CSCL 07/4

The application of electron paramagnetic resonance (EPR) spectroscopy to the study of vanadium (IV) oxohalide complexes is discussed. The method is proved to be an invaluable structural tool for relating the structure of a complex in an amorphous or polycrystalline sample to that of the same complex in solution. Moreover, solution studies by (EPR) reveal previously unsuspected dissociation and displacement phenomena for complexes of the type /VOX sub 2 L sub n/(X = Cl or Br, L = mono- or bi-dentate ligand). M.G.

N80-32459# Catholic Univ. of America, Washington, D.C. Vitreous State Lab.
COMPOSITION AND TEMPERATURE DEPENDENCE OF SHEAR VISCOSITY OF HYDROCARBON MIXTURES Final Technical Report, 1 Jun. 1979 - 31 May 1980
M. Adel-Hadadi, A. V. Lesikar, and C. Moynihan Jul. 1980 108 p refs
(Contract N00019-79-C-0329)
(AD-A088236) Avail: NTIS HC A06/MF A01 CSCL 07/3

Shear viscosities and densities have been measured from 50 C to as low as -56 C for five C10 hydrocarbons: n-decane, n-butyl cyclohexane, cis-decalin, n-butyl benzine and 2,7-dimethyl octane and their mixtures. A literature review of theories of hydrocarbon mixture viscosities has been carried out. It is shown that previous theories, in general, cannot give a good account of the mixture viscosities over the wide temperature range covered in this study. Two simple semiempirical equations have been developed and applied to the description of the combined composition temperature dependence of the viscosity of both the hydrocarbons studied under the present contract and two polycyclic hydrocarbons studied under a parallel Air Force Contract.

The equations assume additivity of component free volumes in the mixtures and contain no more adjustable parameters than are required to account for the viscosities of the pure hydrocarbon components. GRA

N80-32460# Washington Univ., Seattle. Dept. of Chemistry.
ERROR PROPAGATION AND OPTIMAL PERFORMANCE IN MULTICOMPONENT ANALYSIS Interim Technical Report
Clemens Jochum, Peter Jochum, (Ludwig-Maximilians-Univ., Munich), and Bruce R. Kowalski Aug. 1980 36 p refs Submitted for publication
(Contract N00014-75-C-0536; NR Proj. 051-565)
(AD-A088207; TR-17) Avail: NTIS HC A03/MF A01 CSCL 07/4

A study of error propagation for multicomponent analysis in the presence of sample related interferences by the generalized standard addition method has been made. The results of the examination have led to an alternate experimental design and optimal computation algorithms which are tested using a four component spectrophotometric analysis. Additionally, the theory describes fundamental constraints to multicomponent analysis in the presence of chemical, physical and spectral interferences. GRA

N80-32461# Indiana Univ. at Bloomington. Dept. of Chemistry.
A LINEAR RESPONSE THEORY APPROACH TO TIME-RESOLVED FLUORIMETRY Interim Technical Report
G. M. Hieftje and E. E. Vogelstein 18 Jul. 1980 54 p refs Submitted for publication
(Contract N00014-76-C-0838; NR Proj. 051-622)
(AD-A088211; TR-26; TR-33) Avail: NTIS HC A04/MF A01 CSCL 07/4

A new conceptual and instrumental approach to time-resolved chemical measurements is presented. Based on the concepts of information and linear response theory, the new approach is applicable to a number of different areas, including nuclear magnetic resonance spectrometry, high-speed kinetic measurements, gas chromatographic analysis, and time-resolved luminescence spectrometry. In the particular examples given, the new approach is applied to the determination of luminescence lifetime. Accuracy and simplicity of the method are emphasized and its application to chemical analysis discussed. GRA

N80-32462# American Wind Energy Association, Washington, D.C.
CAPITAL FORMATION FOR SMALL WIND ENERGY CONVERSION SYSTEM MANUFACTURERS: A GUIDE TO METHODS AND SOURCES Final Report
Peter H. Smeallie and Benjamin Wolff May 1980 55 p refs Prepared in cooperation with Vonier (Thomas) Associates, Inc., Washington, D.C.
(Contract EG-77-C-01-4042)
(SERI/TR-98298-1) Avail: NTIS HC A04/MF A01

Sources of capital are described and the development of a business plan explained. Case histories of four wind companies' experiences in raising capital are included. DOE

N80-32463# Oak Ridge National Lab., Tenn. Chemistry Div.
HYDROGEN EXCHANGE IN SOME COAL-RELATED REACTIONS AT 400 C
Ben M. Benjamin, M. J. Michalczyk (Knox Coll., Galesburg, Ill.), and M. C. Woody 1980 12 p refs Presented at the AICE Conf., Philadelphia, 8 Jun. 1980
(Contract W-7405-eng-26)
(CONF-800610-7) Avail: NTIS HC A02/MF A01

The kinetics of the transfer of hydrogen from tetralin and other hydrogen rich solvents, or groups in coal were studied using the pure compounds, 1,2-diphenylethane (bibenzyl), and diphenylmethane as models. Because the thermolysis of the compound gives some different products when heated alone or when heated in the presence of a good hydrogen donor, such as tetralin, it was of interest to know where the cleavage fragments derive their hydrogen to give the final product. In order to resolve this aspect of the reaction, bibenzyl was prepared completely deuterated (99.8%) in the dimethylene linkage, and pyrolyzed in the presence of ordinary tetralin. From the data it is concluded that the benzyl radical, formed by cleavage of bibenzyl, gives toluene by abstracting hydrogen from tetralin. The product after 1 percent conversion was PhCD2H. In fact, in this mixture, tetralin-bibenzyl-d4 at 400 C, deuterium is lost from bibenzyl by exchange 3 to 4 times faster than it undergoes carbon-carbon bond scission. Thus, the chemistry of bibenzyl at 400 C is dominated by hydrogen exchange reactions. DOE

N80-32464# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT OF A TEMPORALLY AND SPATIALLY RESOLVED GRAZING INCIDENCE SPECTROMETER
D. D. Dietrich, R. J. Fortner, D. F. Price, R. E. Stewart, C. Gilman (Physics International, Berkeley, Calif.), and H. Helava (Physics International, Berkeley, Calif.) 1980 13 p refs Presented at the 3d Topical Conf. on High Temp. Plasma Diagnostics, Los Angeles, 17 Mar. 1980
(Contract W-7405-eng-48)
(UCRL-83808; CONF-800320-5) Avail: NTIS HC A02/MF A01

Design considerations are presented for a grazing incidence spectrometer which will resolve both temporally and spatially the emission from a wide variety of plasmas. The basis of the design involves use of microchannel plates which are curved to conform to the Rowland circle to the spectrometer. The spectra are obtained when the anode is property biased. The use of multiple anodes allows gating and with appropriate delays results in sequential time resolution of a few nanoseconds. Simultaneous gating of the anodes with spatial resolution of less than 100 microns for any given time frame can also be obtained. The efficiency of this spectrometer is also compared with conventional grazing incidence spectrometers. DOE

N80-32465# Sandia Labs., Albuquerque, N. Mex.
APPLICATIONS OF HIGH RESOLUTION INVERSE RAMAN SPECTROSCOPY
Adelbert Owyoung and Peter Esherick 1980 19 p refs Presented at the 7th Intern. Conf. on Raman Spectry., Ottawa, 4 Aug. 1980
(Contract EY-76-C-04-0789)
(SAND-80-0639C; CONF-800808-3) Avail: NTIS HC A02/MF A01

The use of high power, narrow band lasers significantly improved the resolving power and sensitivity of inverse Raman spectroscopy of gases. This technique, by showing some Q-branch spectra of heavy spherical tops is described. Some possible future applications are discussed. DOE

N80-32466# Los Alamos Scientific Lab., N. Mex.
ULTRA HIGH RESOLUTION INVERSE RAMAN SPECTROSCOPY OF METHANE IN A CW FREE EXPANSION JET
James J. Valentini, Peter Esherick, and Adelbert Owyoung 1980 4 p refs Presented at 11th Intern. Quantum Electron. Conf., Boston, 23 Jun. 1980 Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-80-1370C; CONF-800614-2) Avail: NTIS HC A02/MF A01

The feasibility of applying coherent Raman techniques to precise spectroscopic studies in molecular beams is addressed. An ultrahigh resolution inverse Raman spectrum of (12) CH4 was obtained in a cw free expansion jet in which the gas was cooled into a nonBoltzmann distribution of three rotational levels corresponding to the meta, para, and ortho nuclear spin states. DOE

N80-32467# Argonne National Lab., Ill. Energy and Environmental Systems Div.
PULSE COMBUSTION TECHNOLOGY FOR HEATING APPLICATIONS Quarterly Progress Report, 1 Jan. - 31 Mar. 1980
C. A. Blomquist, J. M. Clinch, and F. W. Ahrens Apr. 1980 28 p refs
(Contract W-31-109-eng-38)
(ANL/EES/TM-85) Avail: NTIS HC A03/MF A01

The technology base for fossil fuel fired pulse combustion heating systems was developed. Design data and design procedures for pulse combustion burners were developed. This design capability contributes to the accelerated industrial

development of cost effective, high efficiency systems for a variety of heating applications. DOE

N80-32468# Ad-Ex International, Portola Valley, Calif.
QUANTITATIVE GAS ANALYSIS OF SULFUR DIOXIDE IN NITROGEN BY FOURIER TRANSFORM INFRARED SPECTROPHOTOMETER
Y. Koga, M. Sugie, S. Kondo, and S. Saeri Dec. 1979 21 p refs Transl. into ENGLISH from Bunseki Kagaku (Japan), v. 28, 1979 p 298-303 Sponsored by DOE
(UCRL-Trans-11554) Avail: NTIS HC A02/MF A01

A method for quantitative gas analysis of sulfur dioxide contained in nitrogen using the Fourier transform infrared spectrophotometer was established. On account of the strong adsorption properties of sulfur dioxide, the measuring method adopted was one in which the sample was made to flow inside the cell and in the sampling system. Measurements were conducted with a total pressure of 3 atm of the sample gas and with a spectrophotometer resolving power of 0.5/cm. This method has a range of application to sulfur dioxide concentrations ranging from 15% to 300 ppM, and the precision of analysis was 1.9%. DOE

N80-32469# General Atomic Co., San Diego, Calif.
THERMOCHEMICAL WATER-SPLITTING CYCLE, BENCH-SCALE INVESTIGATIONS AND PROCESS ENGINEERING Annual Report, 1 Oct. 1978 - 30 Sep. 1979
G. Caprioglio, K. H. McCorkle, G. E. Besenbruch, and J. S. Rode Mar. 1980 142 p ref
(Contract DE-AT03-76SF-90351; GA Proj. 3260)
(GA-A-15788) Avail: NTIS HC A07/MF A01

Process development work on the sulfur iodine thermochemical water splitting cycle is summarized. The work consisted of laboratory bench scale investigations, demonstration of the process in a closed loop cycle demonstrator, and process engineering design studies. A bench scale system, consisting of three subunits, was designed to study the cycle under continuous flow conditions. Progress on the installation and operation of subunits 1 and 2 is described. A closed loop cycle demonstrator was installed and operated. Operation of the sulfur iodine cycle was demonstrated in this system under recycle conditions. The process engineering addresses the flowsheet design of a large scale production process consisting of four chemical sections and one helium heat supply section. The completed designs for these sections are presented. The thermal efficiency of the process calculated from the present flowsheet is 47%. DOE

N80-32470# University of Western Michigan, Kalamazoo. Dept. of Chemistry.
FUNDAMENTALS OF NITRIC OXIDE FORMATION IN FOSSIL FUEL COMBUSTION Progress Report, 29 Dec. 1978 - 28 Mar. 1980
Thomas Houser and Michael E. McCarville Jun. 1980 10 p refs
(Contracts DE-AC01-76ET-10593; EX-76-C-01-2018)
(FE-2018-16) Avail: NTIS HC A02/MF A01

It was assumed that a fraction (alpha) of decomposed pyridine formed an intermediate, a fraction of which (beta) was capable of reacting further to form HCN, and that formation was first order in intermediate. The following rate equation describes the data: rho/t = k/sub b/ alpa beta-k/sub b/rho. Rho is moles HCN formed/mole pyridine decomposed, t is contact time and k/sub b/ is the first order rate constant for the formation step. Since rho was independent of initial pyridine concentration, the formation step was necessarily first order. The fraction of decomposed pyridine which can form HCN at a given time ranged from 0.16 to 0.77, indicating a significant concentration of intermediate builds up at all conditions. No volatile product found in the pyrolysis is close to that range of yields, thus the precursor to the HCN must react further on leaving the reactor. DOE

N80-32471# University of Western Michigan, Kalamazoo. Dept. of Chemistry.
FUNDAMENTALS OF NITRIC OXIDE FORMATION IN FOSSIL FUEL COMBUSTION Progress Report, 29 Sep. - 28 Dec. 1979
Thomas Houser Jun. 1980 12 p refs
(Contracts DE-AC01-76ET-10593)
(FE-2018-15) Avail: NTIS HC A02/MF A01

A rate equation for the oxidation of pyridine in the temperature range of 948 to 1048 K and for both fuel lean and rich mixtures was developed. The rate is first order in oxygen and half order each in pyridine and oxygen consumed, indicating catalysis by product(s). Measurements of the products indicated, at all temperatures from 948 to 1273 K, that HCN was the major volatile product containing nitrogen for fuel rich mixtures. Only at 1273 K were there large amounts of NO produced from fuel lean mixtures. At 1173 K and below only very small yields of NO, about 1% or less, were found. The papers on pyridine pyrolysis kinetics were revised and resubmitted. DOE

N80-32472# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.
METHANOL AND METHYL FUEL CATALYST Progress Report, Sep. 1978 - Nov. 1979
Kamil Klier and Richard G. Herman Dec. 1979 9 p refs
(Contracts DE-AS01-78ET-10741; ET-78-S-01-3177)
(FE-3177-5) Avail: NTIS HC A02/MF A01

Results of diffuse reflectance studies and quantitative X-ray powder diffraction measurements supported the proposal that Cu(+)/ZnO solid solution is the catalytically important moiety in low pressure methanol synthesis catalysts. A decrease in CO2 concentration led to a decrease in carbon conversion to methanol over Ak based Cu/ZnO catalysts. This difference in kinetic behavior showed a remarkable influence of the support on the course of the synthesis. The dependence of reaction rates on CO2 concentration was actively investigated for these catalysts and for La based ternary catalysts, as well as for binary and ternary catalysts doped with alkali metal ions such as Rb(+). Although the effects on the methanol synthesis kinetics in the presence of CO2 were very marked, oxides did not appear to change the composition of the product and all catalysts investigated here are still highly selective to methanol. DOE

N80-32473# Johns Hopkins Univ., Baltimore, Md. Chemical Engineering Dept.
CONDENSATION PROCESSES IN COAL COMBUSTION PRODUCTS Progress Report, 1 Jul. 1979 - 30 Jun. 1980
Joseph L. Katz and Marc D. Donohue Apr. 1980 12 p ref
(Contract DE-AS02-79ER-10456; ER-78-S-02-4947)
(DOE/ER-10456/1) Avail: NTIS HC A02/MF A01

Slag vaporization is a serious problem in high temperature coal combustion and gasification processes. Cooling of process gas streams causes the slag vapors to condense, but they do not necessarily do so at equilibrium. Predicting the compositions and properties of the condensing species requires modeling the nucleation processes occurring in these systems. Progress toward modeling this nucleation process and toward implementing the model with a computer code suitable for design calculations is reported. DOE

N80-32474# Michigan Technological Univ., Houghton.
COAL COMBUSTION BY WET OXIDATION. WET OXIDATION OF COAL FOR ENERGY PRODUCTION: TEST PLAN AND PARTIAL RESULTS Interim Report
Jeffrie A. Bettinger 10 Jul. 1980 58 p refs
(Contract DE-FG01-78ET-12328)
(DOE/ET-12328/T1) Avail: NTIS HC A04/MF A01

A steam generating facility, employing the wet oxidation of coal as a heat source was studied. The higher the reaction temperature, the more complete is the combustion of coal. Operation at elevated temperatures and pressures present difficult design problems, and the necessary equipment is costly. With a reduction in temperature from 228 C to 232 C, the operating pressure is reduced by more than half, thus holding down the overall cost of the system. Both the enhancement of low temperature wet oxidation of coal, and the higher operating regions were studied. The coal selected for the first portion of this test is an Eastern Appalachian high-volatile-A Bituminous type, from the Upper Clarion seam in Pennsylvania. This coal was selected as being a typical high sulfur, eastern coal. The wet oxidation of coal to produce low pressure steam is a process suited for a high sulfur, low grade, coal. DOE

N80-32475# University of Western Michigan, Kalamazoo. Dept. of Chemistry.

FUNDAMENTALS OF NITRIC OXIDE FORMATION IN FOSSIL FUEL COMBUSTION Progress Report, 29 Jun. - 28 Sep. 1979
Thomas Houser DOE May 1980 12 p
(Contracts EX-76-C-01-2018; DE-AC01-76ET-10593)
(FE-2018-14) Avail: NTIS HC A02/MF A01

The rate of oxidation of pyridine was determined over a wide range of conditions: temperature range of 675 to 775 C; concentration 0.25 to 2.0 mole percent pyridine; and 1 to 7 mole percent oxygen. In addition, the oxidation of HCN was examined to determine the extent of NO formation. DOE

N80-32476# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF HIGH TEMPERATURE VISCOSITY MEASUREMENT TECHNIQUE
R. P. Wemple, W. F. Hammetter, and C. J. Greenhold Apr. 1980 27 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0641) Avail: NTIS HC A03/MF A01

The conception, development, and testing of: (1) an electro-agnetic viscometer and (2) an X-ray technique are reported. Both methods employ a falling metallic sphere in the melt and provide real-time data. Initial testing of the electromagnetic viscometer was performed at one bar and from 700 to 1300 C. Follow-on experiments with this viscometer were carried out at 1 bar and 0.466 Kbar (6.8 Kpsi) argon up to 1250 C at the Sandia Magma Energy Research Test Facility. The X-ray method was tested entirely at one bar and up to 1325 C. A simultaneous test series with both methods was performed at one bar. Various calibration glasses and basalts were used to evaluate the methods. Correlation of the two methods with each other and with reference data was within acceptable limits. DOE

N80-32477# Sandia Labs., Albuquerque, N. Mex.
COMPARISON OF COHERENT AND SPONTANEOUS RAMAN COMBUSTION DIAGNOSTICS
L. A. Rahn, P. L. Mattern, and R. L. Farrow Jun. 1980 29 p refs Presented at 18th Intern. Symp. on Combust.
(Contract DE-AC04-76DP-00789)
(SAND-80-8616) Avail: NTIS HC A03/MF A01

Detectivities are calculated for background substraction coherent anti-Stokes Raman scattering (CARS), inverse Raman scattering (IRS) and spontaneous Raman scattering (RS) for a wide range of pressures and temperatures applicable to combustion environments. The capability of each of these techniques to reject the background luminosity typical of real combustion environments is established quantitatively. Examples of spectra from CARS and IRS flame experiments are shown, and the complementary features of these techniques are discussed. DOE

N80-32478# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
CHARACTERISTIC PARAMETERS IN COMBUSTION PROCESSES AND THEIR ACCESSIBILITY TO CURRENT AND FUTURE DIAGNOSTICS Annual Report, 1 Jun. 1979 - 31 May 1980
R. Goulard 1 May 1980 21 p refs
(Contracts ER-78-S-05-5773; DE-AS05-78ER-05773)
(DOE/ER-05773/2) Avail: NTIS HC A02/MF A01

The advances in the fluid dynamics of jet mixing are discussed, with an emphasis on the 10 kHz range (especially vortex shedding). Also the very fast subnanosecond range of radical kinetics is investigated, as well as the comparably fast scattering and fluorescence processes. High speed diagnostics are discussed in these two ranges of time resolution, with an emphasis on optical tomography for the fluid dynamic time range 10 to the minus 4th power and on picosecond techniques for the physical chemistry range 10 to the minus 9th power. DOE

N80-32479# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF CARS AND LASER-INDUCED SATURATED FLUORESCENCE FOR PRACTICAL COMBUSTION DIAGNOSIS Final Report, Aug. 1978 - Aug. 1979
A. C. Eckbreth, P. A. Bonczyk, and J. F. Verdieck May 1980 105 p refs
(Contract EPA-68-02-3105)
(PB80-190515; EPA-600/7-80-091) Avail: NTIS HC A06/MF A01 CSCL 07D

Results of experimental investigations aimed at developing nonperturbing, spatially precise, in situ diagnostic techniques to measure species composition and temperature in flame are given. The practical feasibility of coherent antistokes roman spectroscopy (CARS) was demonstrated in a program of researchscale combustor testing (results agreed to within 5% for combustion zone temperature measurements made with CARS and with shielded thermocouples). Laser induced saturated fluorescence was examined in regard to its capability for measuring CH, CN, and NO concentrations in flames. Saturation of the fluorescence in CH and CN was achieved and considerable insight into the physics of saturated fluorescence was examined in regard to its capability for measuring CH, CN, and NO concentrations in flames. Saturation of the fluorescence in CH and CN was achieved and considerable insight into the physics of saturated fluorescence was obtained. Promising initial results of NO fluorescence in flames are described. GRA

N80-32480# National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Measurements Research Branch.
DIETHYLCARBAMOYL CHLORIDE - MEASUREMENTS RESEARCH BRANCH, ANALYTICAL METHOD
Jan. 1980 11 p ref
(PB80-193378) Avail: NTIS HC A02/MF A01 CSCL 07D

A known amount of air was drawn through a sorbent tube containing Porapak P to trap the analyte present. The Porapak P was transferred to a small stoppered sample container and the analyte was desorbed with ethyl acetate. An aliquot of the resulting solution was injected into a gas chromatograph equipped with a flame ionization detector. The area of the resulting peak was determined and compared with areas obtained from the injection of standards. GRA

N80-32481# National Bureau of Standards, Boulder, Colo. National Engineering Lab.
ANALYSIS OF LIQUID VOLUME AND LIQUID MASS FRACTIONS AT COEXISTENCE FOR PURE FLUIDS
Lambert John VanPoolen May 1980 64 p refs
(PB80-191133; NBSIR-80-1631) Avail: NTIS HC A04/MF A01 CSCL 07D

An analysis of the behavior of liquid volume and liquid mass fractions at coexistence for pure fluids is made. Scaled equations for the saturation liquid and vapor densities are analyzed and relationships between various exponents and among constant coefficients are presented. Inequalities which exist among the saturation densities and their derivatives are developed. A procedure to correlate saturation data with the critical point is applied to ethylene. An experimental procedure to determine, simultaneously, saturated liquid and vapor densities at a given temeprature are presented. GRA

N80-32482# California Univ., Davis. Water Resources Center.
MULTIELEMENT ANALYSIS OF WATER THROUGH OSMOTIC REDUCTION AND X-RAYS Technical Completion Report
Thomas A. Cahill, Danny J. Shadoan, and Chris. C. Couper May 1980 15 p refs
(PB80-216690; W80-05403; OWRT-A-069-CAL-1) Avail: NTIS HC A02/MF A01 CSCL 07D

A reverse osmosis or vapor filtration system was designed, built, and tested for reduction of water samples into particulate and solute fractions. The samples were reduced to 14cm2 circles of deposit on Nuclepore and cellophane substrates with little loss of material, suitable for direct introduction into X-ray analysis systems (X-ray fluorescence and/or particle induced X-ray emission). Sensitivities achieved depend on total mass loading in each phase, but ppb levels of transition metals in drinking water can be accomplished. Light element sensitivities are poorer due to chlorine interference in the cellophane. GRA

N80-32483# JRB Associates, McLean, Va.
MATERIALS BALANCE FOR BENZENE. LEVEL 1: PRELIMINARY Final Report
Robert L. Hall, Carlos Buitrago, Frank Monteoalvo, Tom Yatsko, and Karen Slimak 9 May 1980 161 p refs

(Contract EPA-68-01-5793)
(PB80-185663; Rept-2-800-03-379-51; EPA-560/13-80-014)
Avail: NTIS HC A08/MF A01 CSCL 07A

A level I materials balance was performed on benzene. Data for benzene production from petroleum by four processes (catalytic reformation, toluene dealkylation, toluene disproportionation, and isolation from pyrolysis gasoline) and for production from coal during coking are presented. Amounts of benzene consumed for the synthesis of nine direct derivatives and exports are presented. These uses constitute approximately 93 percent of total benzene usage. Nonconsumptive uses (solvents and inventory changes) were also tabulated. Emissions due to each of the above processes are reported or estimated where possible. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-32484* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH TOUGHNESS-HIGH STRENGTH IRON ALLOY Patent

Joseph R. Stephens and Walter R. Witzke, inventors (to NASA) Issued 29 Jul. 1980 4 p Filed 25 Jan. 1979 Supersedes N79-19145 (17 - 10, p 1255) Continuation-in-part of abandoned US Patent Appl. SN-803822, filed 6 Jun. 1977
(NASA-Case-LEW-12542-3; US-Patent-4,214,902; US-Patent-Appl-SN-007083; US-Patent-Class-75-124; US-Patent-Appl-SN-803822) Avail: US Patent and Trademark Office CSCL 11F

An iron alloy is provided which exhibits strength and toughness characteristics at cryogenic temperatures. The alloy consists essentially of about 10 to 16 percent by weight nickel, about 0.1 to 1.0 percent by weight aluminum, and 0 to about 3 percent by weight copper, with the balance being essentially iron. The iron alloy is produced by a process which includes cold rolling at room temperature and subsequent heat treatment. Official Gazette of the U.S. Patent and Trademark Office

N80-32485# National Academy of Sciences - National Research Council, Washington, D. C.

MATERIALS RESPONSE TO ULTRA-HIGH LOADING RATES Final Report

1980 152 p refs
(Contract MDA903-78-C-0038)
(NMAB-356) Avail: NTIS HC A08/MF A01

The equations of state, plastic yielding, empirical failure models, brittle crack propagation, ductile void growth, and adiabatic shear banding are individually examined. Current descriptions are examined in the light of the present understanding of deformation and failure mechanisms, in order to identify shortcomings and make recommendations for alleviating them. Existing deformation descriptions are found adequate for most present applications, but more effort is needed to obtain relevant dynamic material properties on the other hand, the description of dynamic material failure is in its infancy, and effort is required to advance both theory and experiment. M.G.

N80-32486*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FRACTURE TOUGHNESS OF BRITTLE MATERIALS DETERMINED WITH CHEVRON NOTCH SPECIMENS

J. L. Shannon, Jr., R. T. Bursey, D. Munz (Karlsruhe Univ.), and W. S. Pierce [1980] 17 p refs Proposed for presentation at the 5th Intern. Conf. on Fracture, Cannes, France, 29 Mar. - 3 Apr. 1981; sponsored by the International Congress on Fracture
(NASA-TM-81607; E-600) Avail: NTIS HC A02/MF A01 CSCL 11F

The use of chevron-notch specimens for determining the plane strain fracture toughness (K sub Ic) of brittle materials is discussed. Three chevron-notch specimens were investigated: short bar, short rod, and four-point-bend. The dimensionless stress intensity coefficient used in computing K sub Ic is derived for the short bar specimen from the superposition of ligament-dependent and ligament-independent solutions for the straight through crack, and also from experimental compliance calibrations. Coefficients for the four-point-bend specimen were developed by the same superposition procedure, and with additional refinement using the slice model of Bluhm. Short rod specimen stress intensity coefficients were determined only by experimental compliance calibration. Performance of the three chevron-notch specimens and their stress intensity factor relations were evaluated by tests on hot-pressed silicon nitride and sintered aluminum oxide. Results obtained with the short bar and the four-point-bend specimens on silicon nitride are in good agreement and relatively free of specimen geometry and size effects within the range investigated. Results on aluminum oxide were affected by specimen size and chevron-notch geometry, believed due to a rising crack growth resistance curve for the material. Only the results for the short bar specimen are presented in detail. M.G.

N80-32487*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF TWO-LAYER THERMAL BARRIER SYSTEMS ON DIRECTIONALLY SOLIDIFIED Ni-Al-Mo AND COMPARATIVE EFFECTS OF ALLOY THERMAL EXPANSION ON SYSTEM LIFE

Stephan Stecura Washington Oct. 1980 35 p refs
(NASA-TM-81604; E-453) Avail: NTIS HC A03/MF A01 CSCL 11F

A promising two-layer thermal barrier coating system (TBS), Ni-16.4Cr-5.1Al-0.15Y/ZrO2-6.1Y2O3 (all in weight percent), was identified for directionally solidified Ni-Al-Mo (gamma/gamma' alpha). In cyclic furnace tests at 1095 C this system on gamma/gamma' alpha was better than Ni-16. 4Cr-5.1Al-0. 15Y/ZrO2-7.8Y2O3 by about 50 percent. In natural gas - oxygen torch rig tests at 1250 C the ZrO2-6.1Y2O3 coating was better than the ZrO2-7.8Y2O3 coating by 95 percent, on MAR-M509 substrates and by 60 percent on gamma/gamma' alpha substrates. Decreasing the coefficient of thermal expansion of the substrate material from 17-18x10 to the -6 power/C (MAR-M200 + Hf and MAR-M509) to 11x10 to the -6 power/C (gamma/gamma' alpha) also resulted in improved TBS life. For example, in natural gas - oxygen torch rig tests at 1250 C, the life of Ni-16.4Cr-5.1Al-0.15Y/ZrO26.1Y2O3 was about 30 percent better on gamma/gamma' alpha than on MAR-M509 substrates. Thus compositional changes in the bond and thermal barrier coatings were shown to have a greater effect on TBS life than does the coefficient of thermal expansion. Author

N80-32488*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CREEP-RUPTURE BEHAVIOR OF SEVEN IRON-BASE ALLOYS AFTER LONG TERM AGING AT 760 DEG IN LOW PRESSURE HYDROGEN Final Report

Walter R. Witzke and Joseph R. Stephens Aug. 1980 40 p refs
(Contract EC-77-A-31-1040)
(NASA-TM-81534; DOE/NASA/1040-15; E-486) Avail: NTIS HC A03/MF A01 CSCL 11F

Seven candidate iron-base alloys for heater tube application in the Stirling automotive engine were aged for 3500 hours at 760 C in argon and hydrogen. Aging degraded the tensile and creep-rupture properties. The presence of hydrogen during aging caused additional degradiation of the rupture strength in fine grain alloys. Based on current design criteria for the Mod 1 Stirling engine, N-155 and 19-9DL are considered the only alloys in this study with stregnths adequate for heater tube service at 760 C. Author

N80-32489*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LONG-TIME CREEP BEHAVIOR OF THE TANTALUM ALLOY ASTAR 811C

William D. Klopp, Robert H. Titran, and Keith D. Sheffler (Pratt and Whitney Aircraft, East Hartford, Conn.) Sep. 1980 21 p refs
(NASA-TP-1691; E-041) Avail: NTIS CSCL 11F

The high vacuum creep behavior of Astar 811C (Ta-8W-1Re-0.7Hf-0.025C) was studied over the temperature range 800 C to 1700 C as a function of stress, temperature, and grain size in order to develop a relation for predicting long term creep. Primary

creep strain was related to time by the Garofalo exponential function, and a second exponential term was developed to describe the tertiary creep portion of the creep curve. No significant periods of secondary (linear) creep were observed. The creep curves were well expressed by a relation that includes terms for primary and tertiary creep. The initial and tertiary creep rates were obtained by differentiating the respective terms from the strain time relation and can be related to temperature by using a dual activation energy to account for lattice and dislocation core diffusion. The strain parameters were determined as power functions of the applied stress. A.R.H.

N80-32490*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
LOW-TEMPERATURE SOLDER FOR JOINING LARGE CRYOGENIC STRUCTURES
John D. Buckley and Paul G. Sandefur, Jr. Washington Sep. 1980 15 p refs
(NASA-TM-81836; L-13712) Avail: NTIS HC A02/MF A01 CSCL 11F

Three joining methods were considered for use in fabricating cooling coils for the National Transonic Facility. After analysis and preliminary testing, soldering was chosen as the cooling coil joining technique over mechanical force fit and brazing techniques. Charpy V-Notch tests, cyclic thermal tests (ambient to 77.8 K) and tensile tests at cryogenic temperatures were performed on solder joints to evaluate their structural integrity. It was determined that low temperature solder can be used to ensure good fin-to-tube contact for cooling-coil applications. Author

N80-32491# Minnesota Univ., Minneapolis. Dept. of Chemistry.
VIBRATIONAL FREQUENCIES OF HALOGEN ATOMS ADSORBED ON SILVER METAL SURFACES
Henry Nichols and Robert M. Hexter 17 Jul. 1980 24 p refs Submitted for publication
(Contract N00014-77-C-0209; NR Proj. 051-642)
(AD-A087664; TR-5) Avail: NTIS HC A02/MF A01 CSCL 11/6

The vibrational frequencies of halogens adsorbed on Ag 100 are calculated. The frequency of a single adsorbed atom vibration perpendicular to the surface is obtained from AgX (X = F, Cl, Br, I) crystal frequencies. Interaction between dipoles consisting of the effective charge on the absorbed atom and its induced image charge produces a coverage dependent frequency. The effective charge on the adsorbed atom is assumed to be 1.0 e, while the electronic polarizability of the real-plus-image atom system is assumed to be twice the electronic polarizability of x(-). At full coverage, the calculated frequencies for the k = 0 modes are 437, 241, 150, and 113/cm respectively for X = F, Cl, Br, and I, which compare well with experimental values, and these frequencies are assigned to external vibrational modes of halogen atoms adsorbed on silver. M.G.

N80-32492# Oxford Univ. (England). Dept. of Theoretical Chemistry.
INTERATOMIC FORCES IN SOLID AND LIQUID TRANSITION METALS Final Technical Report, Apr. 1978 - Mar. 1980
N. H. March and C. C. Matthai Jan. 1980 93 p refs
(Grant DA-ERO-78-G-052; DA Proj. 1T1-61102-BH-57)
(AD-A087672) Avail: NTIS HC A05/MF A01 CSCL 07/2

The objective was to obtain a practical description of the force fields in transition metals. Central pair potentials for Ni and Pt have been constructed in agreement with calculations and experiments. The obtained representation of the force field is very useful for f.c.c. solid transition metals. X-ray scattering factors showed that charge distribution in b.c.c. transition metals is highly angular. Bond charge model has been used to represent this angularity. GRA

N80-32493# Naval Research Lab., Washington, D. C.
NEUTRON IRRADIATION EFFECTS ON FATIGUE CRACK PROPAGATION IN TYPE 316 STAINLESS STEELS AT 649 DEG C
D. J. Michel and H. H. Smith 1 Aug. 1980 20 p refs
(Contract DE-AI05-80OR-20352)
(AD-A088052; NRL-MR-4282) Avail: NTIS HC A02/MF A01 CSCL 11/6

The fatigue and creep fatigue crack propagation performance of Type 316 stainless steel was investigated following fast neutron irradiation to a fluence level of about 5 x 10 to the 22nd power n/sq. cm (> 0.1 MeV), about 26 displacements per atom (dpa), at 649 C. The results from fatigue tests of both annealed and 20 percent cold worked steel show that irradiation produced no significant effect on crack propagation rate when compared with unirradiated steel tested at 649 C. For tests conducted using creep fatigue cycling, the inclusion of a two minute hold time at the maximum cyclic load resulted in a marked increase in the crack propagation rate of the annealed steel. The effect of a one minute hold time in the 20 percent cold worked, irradiated steel was to significantly increase the crack propagation rate at 649 C. Scanning electron microscope examination of the tested specimens revealed that the crack propagation mode of the specimens which exhibited increased crack propagation rates was primarily intergranular while a transgranular mode was observed for specimens with lower crack propagation rates. The results point toward a synergistic relationship between thermochemical history, precipitate formation, and hold time effects as the responsible mechanism for the crack propagation performance. GRA

N80-32494# SRI International Corp., Menlo Park, Calif.
DIP PROCESS THERMAL BARRIER COATINGS FOR SUPERALLOYS Final Report, 1 Jul. 1979 - 30 Jun. 1980
I. M. Allam, R. W. Bartlett, and G. N. Krishnan Jun. 1980 38 p refs
(Contract F49620-79-C-0225; AF Proj. 2306; SRI Proj. PYU-8658)
(AD-A088064; AFOSR-80-0572TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

A new technique of developing thermal barrier coatings for superalloys has been investigated. It involves hot dipping of superalloys samples into a molten bath of low melting Ce-Co or Ce-Ni alloy. By internally oxidizing these coatings, it is possible to obtain a duplex with a CeO2 rich oxide scale as the outer layer (thermal barrier) and an inner layer composite of fine cerium oxide particles dispersed in a matrix of Ni(Co)CrAl. This inner layer, or subscale, grades into the superalloy. Appropriate heat treatment can produce recrystallized CeO2 particles in the subscale that should improve adherence of the oxide scale to the subscale and substrate superalloy. The coating process does involve limited reaction between the coating alloy and superalloy. The thickness of this interaction zone can be controlled and compensated for in the design (cross section) of the superalloy component. GRA

N80-32495# Solar Turbines International, San Diego, Calif.
ISOTHERMAL ROLL FORGING OF T55 COMPRESSOR BLADES, PHASE 2 Final Report, Feb. 1978 - Jan. 1980
Fred K. Rose and Arthur G. Metcalfe Jun. 1980 118 p
(Contract DAAG46-76-C-0043)
(AD-A088076; SR80-R-4392-43;
USAAVRADCOM-TR-80-F12; AMMRC-TR-80-32) Avail: NTIS HC A06/MF A01 CSCL 13/8

The objective of Phase 2 of this manufacturing technology program was to produce the 2nd stage blade of the Avco T-55 engine for static evaluation using the isothermal roll forge process. Blades were produced in AM-350 alloy using two roll forge passes of the energy efficient, microprocessor controlled process. The blades met the fatigue, tensile and metallurgical requirements of Avco specifications. GRA

N80-32496# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
FUNDAMENTALS OF CORROSION FATIGUE BEHAVIOR OF METALS AND ALLOYS
David J. Duquette Aug. 1980 33 p refs
(Contract N00014-75-C-0466)
(AD-A088358) Avail: NTIS HC A03/MF A01 CSCL 11/6

It is well known that environment plays a very important role in fatigue failures. In some cases only crack propagation rates are affected, however, for many others all of the steps leading to failure, pre initiation deformation, crack initiation and crack propagation are affected. For still other cases, only the crack initiation and early propagation processes are affected. This

paper attempts to evaluate the mechanisms which have been proposed for environmental effects on the early stages of fatigue damage, including crack initiation and early propagation in gaseous and in aqueous environments. Evidence is presented which indicates that there is no unifying theory of environmental fatigue, but that each alloy/environment couple may exhibit significantly different behavior, depending on factors such as thermodynamics and kinetics as well as microstructure, slip character, etc. GRA

N80-32497# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
THE AUSTENITIZING BEHAVIOR OF A LOW ALLOY STEEL
Peter A. Thornton May 1980 34 p refs
(AD-A088540; AD-E440079; ARLCB-TR-80013) Avail: NTIS HC A03/MF A01 CSCL 11/6

The austenitizing behavior of a low alloy steel was examined from both the microstructural and the mechanical property standpoint. The temperature range over which austenitizing took place was accurately determined by metallographic and analytical techniques. Metallographic evidence showed that the dissolution of carbide continues after the crystallographic transition is completed. Also, the dissolution of the preponderance of carbide coincides with a 'leveling-off' trend in mechanical property response, viz., yield strength and Charpy impact toughness. The data demonstrated that a minimum temperature of 774 C (1425 F) can sufficiently austenitize this steel under the appropriate conditions. However, because of chemical segregation invariably found in large forgings, it is a sound practice to allow some contingency in the heat treatment parameters that will consistently provide an adequate austenitizing condition in the thickest sections of a component. GRA

N80-32498# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon System Lab.
ELECTRODEPOSITION OF TANTALUM AND TANTALUM-CHROMIUM ALLOYS
I. Ahmad, W. A. Spiak, and G. J. Janz May 1980 37 p refs
Presented at Ann. Meeting of AIME, Las Vegas, Nev., 24-28 Feb. 1980
(AD-A088542; AD-E440082; ARLCB-TR-80014) Avail: NTIS HC A03/MF A01 CSCL 13/8

A part of a program to develop erosion resistant coatings for advanced gun barrels, electrodeposition of tantalum and tantalum chromium alloys from fused FLINAK (eutectic mixture of LiF-KF-NaF) has been investigated. Tantalum chromium alloys containing 2-6% chromium were obtained by codepositing tantalum and chromium from an electrolyte containing 10 wt% TaF5(added as K2TaF7) and 0.5-1.5% Cr (added as CrF3), at 800 C and 15-40 ma/sq cm current density. The alloy coatings were smooth and columnar in structure. The microhardness of these coatings increased with the increase of chromium content. GRA

N80-32499# Naval Surface Weapons Center, Dahlgren, Va. Gun Systems and Munitions Div.
SHOCK COMPRESSION OF TANTALUM Final Report
Willis Mock, Jr. and William H. Holt Jun. 1980 26 p refs
(NSWC MIPR A35200-9-0004)
(AD-A088152; NSWC/TR-80-92) Avail: NTIS HC A03/MF A01 CSCL 11/6

The free-surface velocity of a shock-loaded 3.73 mm thick tantalum disk has been measured with a capacitor gauge. Stress reverberations were produced in the tantalum disk by impacting it with a 2.65 mm thick alpha titanium disk at a velocity of 0.111 km/s in a gas gun. An initial shock compressive stress slightly larger than the measured 2.1 GPa Hugoniot elastic limit was produced in the tantalum. The shape of the free-surface-velocity profile suggested that spall fracture did not occur in the specimen disk at this stress level. This result was verified by examining the recovered and sectioned disk. GRA

N80-32500# Cornell Univ., Ithaca, N. Y.
INITIAL STAGES OF OXIDATION OF METALS AND ALLOYS Progress Report, 1 Aug. 1979 - 30 Apr. 1980
J. M. Blakely Apr. 1980 18 p
(Contract DE-AC02-79ER-10501)
(DOE/ER-10501/1) Avail: NTIS HC A02/MF A01

Investigations of metal surface oxidation are reported. Be and Fe-Ni single crystal surfaces were studied using the techniques of Auger and electron loss spectroscopy and low energy electron diffraction. A detailed study of the Auger line shape from clean cleaved Be (0001) planes has provided a standard against which all previous work may be composed. Progress has been made in preparing clean Be surfaces by ion sputtering techniques, computer processing of Auger data and some preliminary LEED studies have been made both of clean and oxygen covered surfaces. A liquid nitrogen cold stage for ribbon type single crystal samples has been constructed. The composition of the (100) surface of a Ni-60, Fe-40 single crystal has been investigated over the temperature range from 25 to 900 C. Under uhv conditions, only very slight enrichment in Fe occurs. Preliminary studies have also been made of surface structure and of C and S segregation to this Fe-Ni(100) surface. DOE

N80-32501# Sandia Labs., Livermore, Calif.
DESIGN AND OPERATION OF THERMAL CONVECTION LOOPS FOR CORROSION TESTING IN MOLTEN NaNO3-KNO3
W. S. Winters, R. W. Bradshaw, and F. W. Hart Jun. 1980 28 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-8212) Avail: NTIS HC A03/MF A01

The design, construction, operation, and preliminary results of three molten draw salt corrosion loop experiments are discussed. The loops were constructed from 304 SS, 316 SS, and Incoloy 800. Results indicate that convective loop experiments are a valuable and relatively inexpensive method of assessing the effects of mass transport and a fully operational temperature gradient on molten salt materials compatibility. DOE

N80-32502# Los Alamos Scientific Lab., N. Mex.
COMPARISON OF FLOW CURVES OF 6061 ALUMINUM ALLOY AT HIGH AND LOW STRAIN RATES
A. E. Carden, P. E. Williams, and R. R. Karpp 1980 15 p refs Presented at the Intern. Conf. on the Met. Effects of High Strain Rate Deformation and Fabric., Albuquerque, N. Mex., 22 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1649; CONF-80061-5) Avail: NTIS HC A02/MF A01

Low strain rate tensile test data (10 to the -5 power to 10 to the -2 power/s) were obtained for 6061 aluminum alloy in the -T6- and -0- condition. Little, if any, strain rate effect was observed over this range of strain rates. Thirteen expanding ring tests were performed on 1 in. and 2 in. diam 6061-T6 and -0- temper rings with maximum strain rates of 3000 to 23,000/s. The flow stress at 2% circumferential exexpansion was determined from all of the tests and is shown to be dependent upon maximum strain rate. Furthermore, a size effect is observed, since flow stress at 2% strain and equal strain rates is greater in 2 in. rings than in 1 in. rings. This size effect may be due to shock hardening, but a definite conclusion has not yet been reached. The -T6- temper rings also show a size effect, but the difference between the 1 and 2 in. rings was not the same for all values of flow stress. DOE

N80-32503# Mound Lab., Miamisburg, Ohio.
THERMAL CONDUCTIVITY OF CONSOLIDATED Al/Cu2O THERMITES
Gary D. Miller and Lowell D. Haws 17 Jun. 1980 17 p refs
(Contract DE-AC04-76DP-00053)
(MLM-2698) Avail: NTIS HC A02/MF A01

Techniques for the measurement of the thermal conductivity, lambda, of Al/Cu2O consolidated thermites are addressed. Two methods, laser flash and comparative, were evaluated. The comparative method was found to be the method of choice. Results of the lambda measurements are reported as functions of temperature, part density, and aluminum particle shape. DOE

N80-32504# United Technologies Corp., South Windsor, Conn. Power Systems Div.
PARAMETER MONITORING FOR CORROSION CONTROL OF UTILITY GAS TURBINES Annual Report

Mar. 1980 104 p refs
(EPRI Proj. 643-1)
(EPRI-AP-1369) Avail: NTIS HC A06/MF A01

The conditions that cause deposition of corrodents and an engine control system that will minimize their effect are discussed. Field data on 600 engines were statistically analyzed to determine the influence on hot corrosion of: fuel type; engine washing; air filtration; and proximity of the engine sites to oceans. Laboratory tests were conducted to determine the effect of: sodium sulfate with and without impurities; temperature cycling; and sodium in the fuel. Sodium ion concentrations in the air stream inside engines were monitored for evidence of impulsive shedding of accumulated salt. Results show that intermittent water washing reduces the incidence of corrosion. An engine control system which monitors the atmospheric and fuel-borne salt concentrations and signals the need for an engine water wash cycle to remove accumulated salt before corrosion commences was designed, built, installed, and checked out. This unit can also reduce power, therefore temperature, to slow the corrosion rate if the wash is not performed. DOE

N80-32505# California Univ., Livermore. Lawrence Livermore Lab.
RF MAGNETRON SPUTTERING OF THICK PLATINUM COATINGS ON GLASS MICROSPHERES
S. F. Meyer, E. J. Hsieh, and R. J. Burt. 28 May 1980 14 p refs. Presented at the Intern. Conf. on Met. Coatings, San Francisco, 21 Apr. 1980
(Contract W-7405-eng-48)
(UCRL-83532; CONF-800439-9) Avail: NTIS HC A02/MF A01

Coating problems encountered included a rough surface and porous microstructure from the oblique incidence and lack of temperature and bias control, clumping of the microspheres causing nonuniformities, and particle accumulation causing cone defects. Sputtering parameters significantly affecting the coatings included total pressure, DC substrate bias, and the addition of doping gases. Using an ultrasonic vibrating screened cage and RF magnetron Sputtergun, microspheres were batch coated. DOE

N80-32506# Brookhaven National Lab., Upton, N. Y. Metallurgy and Materials Science Div.
APPLICATION OF ANALYTICAL ELECTRON MICROSCOPY TO THE STUDY OF INTERGRANULAR CORROSION IN 304 STAINLESS STEEL
C. S. Pande and R. L. Sabatini. 1980 9 p refs. Presented at the Ann. Meeting of the EMSA and 15th MAS Conf., San Francisco, 4 Aug. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27344; CONF-800801-5) Avail: NTIS HC A02/MF A01

The technique of analytical electron microscopy in a scanning transmission electron microscope fitted with an energy dispersive X-ray spectrometer is used to measure the chromium depletion in sensitized 304 stainless steel along the grain boundaries. It is shown that such measurements could be misleading unless care is taken to properly choose the regions on the grain boundaries for such analysis. DOE

N80-32507# Brookhaven National Lab., Upton, N. Y. Metallurgy and Materials Science Div.
FLUX PINNING IN BRONZE-PROCESSED Nb3Sn WIRES
M. Suenaga and D. O. Welch. 1980 13 p refs. Presented at the Intern. Cryog. Mater. Conf., Upton, N.Y., 28 May 1980
(Contract DE-AC02-76CH-00016)
(BNL-27964; CONF-800587-4) Avail: NTIS HC A02/MF A01

The scaling law derived by Kramer for magnetic flux pinning in high magnetic fields was examined for its applicability to the magnetic field dependence of critical-current densities in the bronze processed monofilamentary Nb3Sn wires. From this it was concluded that: (1) its prediction for the form of the dependence of critical current on magnetic field and grain size was found to be very good in most cases including wires with very small Nb3Sn grains. It was found very useful in comparison of J sub c for different wires and in extrapolating to obtain H sub c2 for these wires. (2) However, it could not account consistently for the anisotropy in critical current of a tape which was measured with H applied perpendicular and parallel to the tape face. (3) The values of Kappa sub 1 which were determined with the scaling law were too small by a factor of 2 to 3, and the trend in the variation with heat-treating time was opposite to that which is reasonably to be expected. DOE

N80-32508# Argonne National Lab., Ill. Materials Science Div.
CORROSION BEHAVIOR OF SEVERAL METALS IN ETHYLENE GLYCOL-BASE HEAT-TRANSFER FLUIDS UNDER CONDITIONS ENCOUNTERED IN SOLAR ENERGY SYSTEMS
G. J. Zeman. Jan. 1980 53 p refs
(Contract W-31-109-eng-38)
(ANL-79-96) Avail: NTIS HC A04/MF A01

The corrosion behavior of aluminum, copper, and iron in inhibited ethylene glycol-ASTM corrosive water solutions was evaluated in a laboratory loop under isothermal and heat flux conditions for 1000 h at temperatures between 378 and 413 K, in static autoclave tests at 450 K for 500 h, and by potentiodynamic polarization measurements at temperatures between 298 and 348 K. The effect of time, temperature, and ethylene glycol concentration of the heat transfer fluid on the extent of inhibitor depletion was determined from analyses of the reserve alkalinity, pH, and inhibitor content of the solutions. The performance of an electrochemical sensor as a monitor of fluid quality was also evaluated. A heat flux of 0.4 to 1.0 kW/sq m did not have a significant effect on the corrosion behavior of the various materials at temperatures between 378 and 413 K. The corrosion rates of aluminum, copper, and iron in the 50 volume percent inhibited ethylene glycol-corrosive water solution decreased as a function of time during the 1000 h test. At 413 K, the corrosion rate of copper was considerably higher than that of iron or aluminum at low flow velocity. DOE

N80-32509# General Electric Co., Schenectady, N. Y. Metallurgy Lab.
DEVELOPMENT OF A LOW LOSS MAGNETIC COMPOSITE UTILIZING AMORPHOUS METAL FLAKE. Semiannual Progress Report, 19 Sep. 1978 - 18 Mar. 1979
Lyman A. Johnson. Apr. 1979 68 p refs
(Contract ET-78-C-01-3205)
(CONS-3205-T1; SAPR-1) Avail: NTIS HC A04/MF A01

Progress is reported concerning processing amorphous metal flake by splat cooling and melt extracion, magnetic and physical properties assessment, and forming a composite of the metal flake and epoxy binders. DOE

N80-32510# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
STRUCTURE OF HIGH ANGLE GRAIN BOUNDARIES IN METALS AND CERAMIC OXIDES
R. W. Balluffi, P. D. Bristowe, and C. P. Sun. Dec. 1979 70 p refs. Presented at the Basic Sci. and Nuclear Div., Fall meeting of the ACS, New Orleans, 14-17 Oct. 1979
(Contract DE-AS02-78ER-05002; ER-78-S-02-5002)
(DOE/ER-05002/9; CONF-791045-8) Avail: NTIS HC A04/MF A01

The state of current knowledge of the structure of high angle grain boundaries in metals and in ceramic oxides is reviewed. Particular attention is given to effects due to differences in the bonding and crystal structure in these solid types. The results of recent experimental work and efforts to model grain boundary structure using computer simulation methods are described. Important characteristic features of boundaries in these materials are discussed. Difficulties which are presently being encountered in efforts to determine their structure are pointed out. DOE

N80-32511# Oak Ridge National Lab., Tenn.
MICROSTRUCTURE AND TENSILE PROPERTIES OF HEAVILY IRRADIATED 5052-0 ALUMINUM ALLOY
K. Farrell. 1980 23 p refs
(Contract W-7405-eng-26)
(CONF-800609-3) Avail: NTIS HC A02/MF A01

During neutron irradiation of an aluminum 2.2% magnesium solid solution alloy in the High Flux Isotope Reactor about seven percent insoluble, transmutant silicon was produced. Some of

this silicon reacted with the dissolved magnesium to form a fine precipitate of Mg2Si. A tight dislocation structure was also created. The alloy showed good resistance to cavity formation. Tension tests at 323, 373, and 423 K (0.35, 0.40, and 0.45 T sub m) showed pronounced irradiation-induced strengthening and an associated marked loss in ductility. These changes were greater than in magnesium free aluminum and in alloys containing preexisting, thermally aged Mg2Si precipitate. Increasing the thermal to fast flux ratio from 1.7 to 2.1 caused further strengthening beyond that expected from a simple increase in silicon level. DOE

N80-32512# Hanford Engineering Development Lab., Richland, Wash.
WEAR AND CORROSION PERFORMANCE OF METALLURGICAL COATINGS IN SODIUM
R. N. Johnson and D. G. Farwick. 24 Apr. 1980. 18 p. refs. Presented at Intern. Conf. on Metallurgical Coatings, San Diego, Calif., 24 Apr. 1980.
(Contract DE-AC14-76FF-02170)
(HEDL-SA-1979; CONF-800439-10) Avail: NTIS HC A02/MF A01

The friction, wear, and corrosion performance of several metallurgical coatings in 200 to 650 C sodium were reviewed. Emphasis was placed on those coatings which have successfully passed the qualification tests necessary for acceptance in breeder reactor environments. Tests included friction, wear, corrosion, thermal cycling, self welding, and irradiation exposure under as prototypic as possible service conditions. Coatings of various refractory metal carbides in metallic binders, nickel-base and cobalt-base alloys and intermetallic compounds such as the aluminides and borides were tested. Coating processes evaluated included plasma spray, detonation gun, sputtering, spark-deposition, and solid-state diffusion. DOE

N80-32513# National Technical Information Service, Springfield, Va.
METAL MATRIX COMPOSITES. A BIBLIOGRAPHY WITH ABSTRACTS. Progress Report, 1978 - Jun. 1980
William E. Reed. Jun. 1980. 110 p. Supersedes NTIS/PS-79/0681, NTIS/PS-78/0684.
(PB80-811912; NTIS/PS-79/0681; NTIS/PS-78/0684) Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

Fabrication, casting, mechanical properties and testing of metal matrix composites including eutectic, particulate, and whisker composites are included in this report of Federally-funded research. Studies on reinforcing materials, fatigue, failure, and structure are also reported. Most of this research is applied to aircraft and spacecraft components and superconducting machinery. This updated bibliography contains 99 abstracts, 42 of which are new entries to the previous edition. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-32514* National Aeronautics and Space Administration. Pasadena Office, Calif.
CURABLE LIQUID HYDROCARBON PREPOLYMERS CONTAINING HYDROXYL GROUPS AND PROCESS FOR PRODUCING SAME. Patent
Robert A. Rhein (JPL) and John D. Ingham, inventors (to NASA) (JPL). Issued 3 Oct. 1980. 6 p. Filed 28 Jun. 1973. Continuation-in-part of abandoned US Patent Appl. SN-332123, filed 13 Feb. 1973. Sponsored by NASA.
(NASA-Case-NPO-13137-1; US-Patent-4,118,427;
US-Patent-Appl-SN-374810; US-Patent-Appl-SN-332123;
US-Patent-Class-568-852; US-Patent-Class-568-861) Avail: US Patent and Trademark Office. CSCL 07A

Production of hydroxyl containing curable liquid hydrocarbon prepolymers by ozonizing a high molecular weight saturated hydrocarbon polymer such as polyisobutylene or ethylene propylene rubber is discussed. The ozonized material is reduced using reducing agents, preferably diisobutyl aluminum hydride, to form the hydroxyl containing liquid prepolymers having a substantially lower molecular weight than the parent polymer. The resulting curable liquid hydroxyl containing prepolymers can be poured into a mold and readily cured, with reactants such as toluene diisocyanate, to produce highly stable elastomers having a variety of uses such as binders for solid propellants.
Official Gazette of the U.S. Patent and Trademark Office

N80-32515* National Aeronautics and Space Administration. Pasadena Office, Calif.
PREPOLYMER DIANHYDRIDES. Patent
Robert A. Rhein (JPL) and John D. Ingham, inventors (to NASA) (JPL). Issued 1 Apr. 1980. 6 p. Filed 14 Aug. 1978. Continuation of abandoned US Patent Appl. SN-761252, filed 21 Jan. 1977. Sponsored by NASA.
(NASA-Case-NPO-13899-1; US-Patent-4,196,129;
US-Patent-Appl-SN-933186; US-Patent-Class-260-346.3;
US-Patent-Appl-SN-761252) Avail: US Patent and Trademark Office. CSCL 07A

A process for preparing dianhydrides that are miscible with hydroxyl prepolymers at moderate temperatures and can cure hydroxyl prepolymers to elastomers at moderate temperatures is disclosed. The dianhydrides are prepared by solution reaction of a prepolymer diol with excess hydride followed by removal of unreacted dianhydride. The prepolymer dianhydrides are miscible with hydroxyl substituted hydrocarbon prepolymers and cure the prepolymers to polyester-linked elastomers.
Official Gazette of the U.S. Patent and Trademark Office

N80-32516* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF CROSS-LINKING POLYVINYL ALCOHOL AND OTHER WATER SOLUBLE RESINS. Patent
Warren H. Phillipp, Charles E. May, Li-Chen Hsu, and Dean W. Sheibley, inventors (to NASA). Issued 19 Aug. 1980. 4 p. Filed 20 Dec. 1978. Supersedes N79-14172 (17 - 05, p. 0571).
(NASA-Case-LEW-13103-1; US-Patent-4,218,280;
US-Patent-Appl-SN-971596; US-Patent-Class-156-272;
US-Patent-Class-156-292; US-Patent-Class-264-22;
US-Patent-Class-264-212; US-Patent-Class-204-159.11;
US-Patent-Class-204-159.14; US-Patent-Class-427-44;
US-Patent-Class-428-500; US-Patent-Class-429-139) Avail: US Patent and Trademark Office. CSCL 07C

A self supporting sheet structure comprising a water soluble, noncrosslinked polymer such as polyvinyl alcohol which is capable of being crosslinked by reaction with hydrogen atom radicals and hydroxyl molecule radicals is contacted with an aqueous solution having a pH of less than 8 and containing a dissolved salt in an amount sufficient to prevent substantial dissolution of the noncrosslinked polymer in the aqueous solution. The aqueous solution is then irradiated with ionizing radiation to form hydrogen atom radicals and hydroxyl molecule radicals and the irradiation is continued for a time sufficient to effect crosslinking of the water soluble polymer to produce a water insoluble polymer sheet structure. The method has particular application in the production of battery separators and electrode envelopes for alkaline batteries.
Official Gazette of the U.S. Patent and Trademark Office

N80-32517*# Massachusetts Inst. of Tech., Cambridge. School of Engineering.
TOUGHENING OF THERMOSETTING POLYIMIDES
David S. Gollob, John F. Mandell, and Frederick J. McGarry. Aug. 1979. 47 p. refs. Sponsored by NASA.
(NASA-CR-163594; MIT-CE-R79-1) Avail: NTIS HC A03/MF A01 CSCL 07C

Work directed toward increasing the resistance to crack propagation of thermoset polyimides is described. Rubber modification and Teflon microfiber impregnation techniques for increasing fracture toughness are investigated. Unmodified Kerimid 601 has a fracture surface work value of 0.20 in-lbs/sq in. Dispersed particles of amine terminated butadiene acrylonitrile liquid rubber or of silicone rubber do not raise this value much. By contrast, 5 percent of well fibrillated Teflon produces an eight-fold increase in fracture toughness. Further process improvements should increase this factor to 20-30. M.G.

N80-32518# Pennsylvania Univ., Philadelphia.
MICROWAVE PROPERTIES OF LOW DENSITY (CH) SUB X Interim Technical Report
A. Feldblum, Y. W. Park, A. J. Heeger, A. G. MacDiarmid, G. Wnek, F. Karasz, and J. C. W. Chien 8 Jul. 1980 22 p refs Submitted for publication Prepared in cooperation with Massachusetts Univ., Amherst
(Contract N00014-75-C-0962; NR Proj. 356-602)
(AD-A086943; LRSM-TR-80-7) Avail: NTIS HC A02/MF A01 CSCL 11/9

The results of an initial study of the microwave properties of low density foam-like (CH) sub x are reported for intermediate dopant levels. The electrical conductivity and dielectric constant are obtained at microwave frequencies, and the results are analyzed in terms of effective medium theory. The possibility of utilizing the doped foam-like (CH) sub x as an efficient microwave absorber is discussed. GRA

N80-32519# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
ELECTRICALLY CONDUCTIVE MACROMOLECULES VIA COFACIAL ASSEMBLY TECHNIQUES Interim Report
Carl W. Dirk, Joseph W. Lyding, Karl F. Schoch, Jr., Carl R. Kannewurf, and Tobin J. Marks 17 Jul. 1980 12 p refs Submitted for publication
(Contract N00014-77-C-0231; Grant NSF DMR-76-80847; NR Proj. 053-640)
(AD-A087554; TR-12) Avail: NTIS HC A02/MF A01 CSCL 07/4

The properties of low-dimensional mixed valence material consisting of molecular stacks are critically dependent on the rather capricious and unpredictable intermolecular forces that dictate whether stacks form, whether the stacks are segregated, the orientation of donor with respect to acceptor, the relative orientation of units within a stack, and the stacking repeat distance. Discussed in this lecture are rational approaches to overcome such problems by combining polymer chemistry with recently developed methodology for synthesizing stacked, partially oxidized metallomacrocycles and for measuring the degree of incomplete charge transfer. New results on the chemical, structural, and electronic properties of highly conductive macro-molecules prepared by covalently linking metallomacrocycles in a rigid, face-to-face configuration as shown below, followed by doping, are presented. GRA

N80-32520# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
MECHANICAL PROPERTIES VERSUS MORPHOLOGY OF ORDERED POLYMERS Progress Report, 1 Sep. 1978 - 30 Aug. 1979
Edwin L. Thomas, R. J. Farris, and S. L. Hsu Wright-Patterson AFB, Ohio AFWAL May 1980 95 p refs
(Contract F33615-78-C-5175)
(AD-A087927; AFWAL-TR-80-4045) Avail: NTIS HC A05/MF A01 CSCL 11/9

Morphological techniques in conjunction with mechanical testing have been employed to determine the relationships between mechanical properties and morphology of a new class of high strength, high modulus, thermally stable aromatic heterocyclic polymers. The polymers studied were poly-p-phenylene benzobis-oxazole (PBO) and predominantly ploy-p-phenylene benzobisthiazole (PBT). The microstructural studies involved laser Raman and Fourier transform infrared spectroscopy, electron diffraction and electron microscopy, wide and small angle X-ray scattering and birefringence measurements. Mechanical measurements have employed ambient and high temperature mechanical testing as a function of strain rate and state of stress (uniaxial tension, double loop bending). The effect of processing conditions on fiber morphology and subsequently on mechanical properties has been studied for optimization of processing conditions for high strength and modulus rigid rod polymer fibers and films. GRA

N80-32521# Solar Turbines International, San Diego, Calif.
STUDY OF EROSION MECHANISMS OF ENGINEERING CERAMICS, STATIC FATIGUE OF CERAMICS Final Report, 1 Apr. 1973 - 1 Jan. 1980
Mary Ellen Gulden 31 Jul. 1980 58 p refs
(Contract N00014-73-C-0401; NR Proj. 032-542)
(AD-A087959; MD80-37-BK) Avail: NTIS HC A04/MF A01 CSCL 11/2

Two areas were investigated in this program: solid particle erosion of engineering ceramics and static fatigue of ceramics. In the erosion phase, the target materials investigated were several types of Si3N4, glass bonded Al2O3 and magnesium fluoride. The particle types were SiC and natural quartz sand. Particle sizes ranged between 10 and 1000 microns and particle velocities were in the subsonic regime. The particle size and velocity dependence on erosion, effect of erosion on strength and effect of number of impacts on erosion were determined. It was found that the type of erosion damage produced was more a function of relative target particle properties than of particle size and velocity for the erosion regime investigated. 'Elastic-plastic' impact, which is characterized by plastic deformation in the particle contact area, and radial and lateral cracks propagating outward from the contact area was observed on all targets impacted with SiC particles. Damage from quartz particle impact ranged from elastic-plastic on the relatively soft targets like MgF2 to shallow intergranular chipping with no secondary crack formation for the hard targets such as hot-pressed Si3N4. Static fatigue behavior of four ceramics was determined in various aqueous solutions at temperatures to 900 C. GRA

N80-32522# McDonnell Aircraft Co., St. Louis, Mo. Design Engineering Power and Fluid Systems Dept.
ADVANCED FLUID SYSTEM SIMULATION Final Report, 1 Jun. 1978 - 31 Jan. 1980
H. DeGarcia, R. F. Deshazer, R. J. Levek, Neil J. Pierce, and M. J. Stevens Wright-Patterson AFB, Ohio AFWAL Apr. 1980 770 p refs
(Contract F33615-78-C-2026; AF Proj. 3027)
(AD-A088060; AFWAL-TR-80-2039) Avail: NTIS HC A99/MF A01 CSCL 09/2

The report describes the continued development and test verification of digital computer models used to simulate hydraulic systems under dynamic conditions. A hydraulic acoustic generator was built and tested for frequency response work. Pulsation attenuation techniques are presented and several modifications were made to the Hydraulic Frequency Response Computer Program (HSFR) including a standing wave plot option. An empirical time domain pump model was developed and additional verification and development of the piston pump transient model was accomplished. Several enhancements were made to the Hydraulic Transient Analysis Computer Program (HYTRAN). A quasi-transient capability was added to the Steady State Flow Analysis Computer Program (SSFAN). The SSFAN Program was updated to extend the calculation capability, add new component models, program features, and reduce the program size. Several programming features were added to the Hydraulic Transient Thermal Analysis Computer Program (HYTTHA) including a temperature default section and environment section. Further verification work was accomplished on the HYTTHA program. GRA

N80-32523# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
OXIDATIVE STABILIZATION OF ACRYLIC FIBERS. PART 5: THE DECOLORATION REACTION
S. S. Chen, J. Herms, L. H. Peebles, Jr., and D. R. Uhlmann Aug. 1980 73 p refs
(Contract N00014-75-C-0542; NR Proj. 356-534)
(AD-A088299; TR-13) Avail: NTIS HC A04/MF A01 CSCL 11/9

When acrylic fibers are heat treated for various times at 220-250 C, they form dark, insoluble structures of uncertain chemical character which are inert to many strong oxidizing and reducing agents. The heat treated fibers are, however, rapidly decolored by warm alkaline hypochlorite solutions. When fibers which have undergone short time heat treatment are subjected to the hypochlorite, incubation periods are observed before decoloration is noted; and a swollen acrylic network remains after decoloration is complete. The acrylic network is primarily unreacted precursor units save for a small amount of hydrolyzed material. The decoloration reaction is zero order, indicating a reaction at the surface. Prior to the decoloration reaction, there is a penetration or plasticization of the subsurface material by

elements of the solution, as indicated by the presence of chlorine atoms in the interiors of exposed fibers. The rate of the decoloration reaction increases with increasing duration of the stabilization heat treatment. The precise structure of the final material depends therefore on the original fiber composition and the processing variables. GRA

N80-32524# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
ENGINEERING PROPERTIES OF MULTIPHASE BLOCK COPOLYMERS Final Report, 15 Jul. 1976 - 30 Apr. 1980
Andrew J. Wnuk, Thomas C. Ward, and James E. McGrath. 20 Jul. 1980. 103 p. refs.
(Grant DAAG29-76-G-0312)
(AD-A088327; ARO-14072.7-C) Avail: NTIS HC A06/MF A01 CSCL 11/9

Multiblock (A-B)n copolymers of bisphenol-A polycarbonate and several poly(arylether sulfones) have been investigated. The copolymers were prepared from hydroxyl terminated oligomers by an interfacial technique which utilized phosgene as the coupling agent. Characterization of the oligomers and copolymers included end group analysis, UV-Visible Spectroscopy, membrane osmometry, and gel permeation chromatography. GRA

N80-32525# De Soto, Inc., Des Plaines, Ill.
HIGH SOLIDS COATING SYSTEM Final Report, 5 Feb. 1979 - Feb. 1980
Gretchen L. McKay and Ashok K. Chattopadhyay. Jun. 1980. 62 p. refs.
(Contract F33615-79-C-5007; AF Proj. 2422)
(AD-A088225; AFWAL-TR-80-4073) Avail: NTIS HC A04/MF A01 CSCL 11/9

This contract research effort, a continuation of a previous Air Force supported contract (F33615-77-C-5101), was directed toward the development of a 65% volume solids, sprayable (airless electrostatic method), polyurethane exterior aircraft coating meeting MIL-C-83286B performance specifications. A high solids coating can significantly reduce solvent emissions and help the Air Force meet EPA/OSHA requirements for reduced environmental pollution and increased worker safety. One formulation, consisting of a combination of Acryloid AU-568 (oxazolidine), NIAX PCP-0300 (polyol), and Desmodur N-100 (polyisocyanate) was developed under the initial contract and found to exhibit performance properties closely approximating the program goals. During the present contract, this formulation was further evaluated. Attempts to upgrade the properties not meeting the performance specifications were made. Also, new commercially available resins were evaluated for incorporation into the high solids systems. GRA

N80-32526# Northwestern Univ., Evanston, Ill. Materials Research Center.
THERMALLY STIMULATED DISCHARGE CURRENT ANALYSIS OF EPOXY RESINS Annual Report, Feb. 1978 - Jan. 1980
T. D. Chang, H. Ueda, S. H. Carr, and J. O. Brittain. 30 Jul. 1980. 36 p.
(Contract N00014-78-C-0276; NR Proj. 356-677)
(AD-A088213; TR-2) Avail: NTIS HC A03/MF A01 CSCL 11/9

Network polymers resins have been prepared from selected binary combinations of diglycidl ether of butanediol or diglycidl ether of bisphenol A with ethylene diamine, diethylene triamine, diaminodiphynyl methane, or diaminodiphenyl sulfone. Thermally stimulated discharge current analyses were performed on these materials in an effort to elucidate significant molecular motions through the temperature range, approximately 80 K to 460 K. Assignments of dielectrically and mechanically active loss processes to motions involving penyl groups, pendant hydroxyl groups, or aliphatic backbone segments could be made in cases where there were clear indications based on the temperature-dependence of activation energy. GRA

N80-32527# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
COLLECTOR SEALANTS AND BREATHING Final Report, 25 Sep. 1978 - 31 Dec. 1979
M. A. Mendelsohn, R. M. Luck, F. A. Yeoman, and F. M. Navish, Jr. 20 Feb. 1980. 278 p. refs.
(Contract DE-AC04-78CS-15362)
(DOE/CS-15362/1) Avail: NTIS HC A13/MF A01

The pertinent properties of a variety of possible sealants for solar collectors were investigated, the most promising candidates were identified, and the effect of breathing in flat plate, thermal solar collector units was studied. Two types of sealants, Class PS which includes preformed seals or gaskets and Class SC which includes sealing compounds or caulks were considered. Environmental stresses evaluated include elevated temperatures, moisture, ultraviolet light, ozone and oxygen, and fungus. Factors such as design, fabrication, materials of construction, seals and sealing techniques and absorber plate coatings were observed on actual field units removed from service. Such phenomena as leakage, corrosion and formation of deposits on glazing and absorber plate were noted. The properties of several desiccants were evaluated in order to provide means to mitigate the deleterious effects of water on collector life. Adsorbents for organic degradation products of sealants were also investigated in order to protect the glazing and absorber plate from deposited coatings. DOE

N80-32528# Sandia Labs., Albuquerque, N. Mex.
GLASSES AND GLASS CERAMICS FOR SEALING TO ALUMINUM ALLOYS
James A. Wilder, Jr. 1979. 6 p. refs. Presented at the 12th Intern. Glass Congr., Albuquerque, N. Mex., Jul. 1980.
(Contract EY-76-C-04-0789)
(SAND-79-1405C; CONF-800705-2) Avail: NTIS HC A02/MF A01

Alkali alkaline Earth phosphate glasses which hermetically seal to aluminum alloys were developed. They have coefficients of thermal expanson greater than 200 x 10 to the minus 7th power/C and glass transition temperatures below 400 C. The relatively low fracture toughness values of the glasses increase by approximately 25% when the glasses are converted into glass ceramics. DOE

N80-32529# California Univ., Livermore. Lawrence Livermore Lab.
STRUCTURE-PROPERTY RELATIONSHIPS OF LINEAR METHYL-PHENYL-VINYL SILOXANE TERPOLYMERS
H. G. Hammon, E. S. Jessop, J. R. Kolb, and M. O. Riley. 8 May 1980. 10 p. refs. Presented at the Meeting of JOWOG, Kansas City, Mo., 25 Jun. 1980 and at the Am. Chem. Soc. Natl. Meeting, San Francisco, Aug. 1980. Submitted for publication.
(Contract W-7405-eng-48)
(UCRL-84303; CONF-800814-2; CONF-800628-2) Avail: NTIS HC A02/MF A01

The synthesis and characterization of siloxane polymers with properties tailored to meet specific design requirements is addressed. A series of 15 random terpolymers of dimethyl-diphenyl-methylvinyl siloxane were synthesized. In seven terpolymers the concentration of the methylvinyl repeat unit was varied from 0 to 5 weight percent maintaining phenyl content constant at 12 percent. The other eight terpolymers contained 0 to 18 weight percent phenyl repeat unit maintaining vinyl at one percent. The moduli increased directly with vinyl concentration, but the longation to break decreased until, at about two percent vinyl, the rubber becomes extremely friable. Increasing the phenyl content in the silicone decreased the degree of crystallinity and increases the polymer class transition in accord with theoretical predictions. The major effect of incorporation of phenyl groups is the elimination of the polymer's ability to crystallize at about three percent phenyl. This extends the rubbery plateau to the glass transition (-117 C) instead of the melting point (-44 C). DOE

N80-32530# California Univ., Livermore. Lawrence Livermore Lab.
SYNTHESIS AND CHARACTERIZATION OF NEW SILICONE CONDENSATION POLYMERS
N. L. Butler, H. G. Hammon, E. S. Jessop, J. R. Kolb, and M. O. Riley. 8 May 1980. 7 p. refs. Presented at the Meeting of JOWOG, Kansas City, Mo., 28 Jun. 1980 and at the Am. Chem. Soc. Natl. Meeting, San Francisco, Aug. 1980. Submitted for publication.

(Contract W-7405-eng-48)
(UCRL-84304; CONF-800814-1; CONF-800628-3) Avail: NTIS HC A02/MF A01

The synthesis of polysiloxanes as base polymers for cellular silicone materials is discussed. The polymers which are prepared via random equilibration of various cyclic tetrasiloxanes have adequate properties for certain applications but there is evidence to suggest that alternating block polysiloxanes prepared via condensation polymerization techniques have properties more desirable for use as flexible foam materials. The synthetic sequence involves reactions of functionally terminated (amino and hydroxy) polysiloxane oligomers to produce alternating block materials of high molecular weight dialkylamines as condensation by-products. Functional endcapping of these poly(dimethyl-diphenyl-methyl vinyl) siloxane copolymers with dimethylvinylsilyl groups is discussed. DOE

N80-32531# Hanford Engineering Development Lab., Richland, Wash.
CR-39 POLYMER, A PROMISING NEW SOLID STATE TRACK RECORDER FOR HIGH ENERGY NEUTRON APPLICATIONS
F. H. Ruddy, C. C. Preston (San Francisco Univ.), R. Gold, E. V. Benton, and J. H. Roberts (Macalester Coll.) 14 Apr. 1980 22 p. refs
(Contract DE-AC14-76FF-02170)
(HEDL-SA-2149; CONF-800551-20) Avail: NTIS HC A02/MF A01

The CR-39 polymer, a solid state track recorder with unprecedented sensitivity to lightly ionizing particles (such as protons) is developed for eventual neutron dosimetry applications. The diameters of proton tracks are found to vary smoothly and reproducibly as a function of energy from 0.20 to 18.0 MeV. Preliminary results on the response of CR-39 polymer to proton tracks as a function of angle show a rapid decrease of the registration efficiency from 100% to 0 for incidence less than 7 degrees. Proton recoil track size distribution in CR-39 polymer irradiated with monoenergetic neutrons of varying energy are presented. Some proposed high energy netron dosimetry and radiography systems using CR-39 polymer are discussed. DOE

N80-32532# Kansas State Univ., Manhattan. Dept. of Chemistry.
THE SYNTHESES OF NITRATE AND NITRITE SELECTIVE POLYMERS Ph.D. Thesis
Shang-Jaw Chiou 1979 175 p. refs
(PB80-195076; W80-05462; OWRT-A-979-Kan(2)) Avail: NTIS HC A08/MF A01 CSCL 07C

A high capacity nitrate and nitrite selective polymer was synthesized by attaching nitron to commercial polyvinylbenzyl chloride (60/40 ortho/para isomers). The capacity of this polymer to remove nitrate and nitrite from 0.001 M solution was 67% and 42% respectively. The compound 1 phenyl 2 diethylaminoethyl 4 amino benzoate was also synthesized and attached to commercial polyvinylbenzyl chloride. The nitrate and nitrite selectivity of this polymer was realized and the capacity of this polymer to remove nitrate and nitrite from aqueous solution was 76% and 65.6%, respectively. Another polymer was synthesized by attachment of 1 (4 nitrophenyl) 2 diethylaminoethyl 4 hydroxybenzoate to polyvinylbenzyl chloride (60/40 o/p isomers). The capacity of this polymer to remove nitrate and nitrite from aqueous solution was 80% and 68%, respectively. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-32533*# Lockheed-California Co., Burbank.
STUDY OF METHANE FUEL FOR SUBSONIC TRANSPORT AIRCRAFT Final Report, Jan. 1978 - Aug. 1979
L. K. Carson, G. W. Davis, E. F. Versaw, George R. Cunnington, Jr., and E. J. Daniels Sep. 1980 371 p. refs
(Contract NAS1-15239)
(NASA-CR-159320; LR-29157) Avail: NTIS HC A16/MF A01 CSCL 21D

The cost and performance were defined for commercial transport using liquid methane including its fuel system and the ground facility complex required for the processing and storage of methane. A cost and performance comparison was made with Jet A and hydrogen powered aircraft of the same payload and range capability. Extensive design work was done on cryogenic fuel tanks, insulation systems as well as the fuel system itself. Three candidate fuel tank locations were evaluated, i.e., fuselage tanks, wing tanks or external pylon tanks. R.C.T.

N80-32534# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
SENSITIVITY OF SOME EXPLOSIVE/BRINE MIXTURES Final Report
M. S. Kirshenbaum, J. R. Leccacoryi, and S. Portnoy Aug. 1980 20 p. refs
(AD-A087939; AD-E400455; ARLCD-TR-80021; DRXTH-IS-TR-80057) Avail: NTIS HC A02/MF A01 CSCL 19/1

Threshold levels were determined for the dried explosive and propellant contaminated salts derived from the decontamination brine solution used for the demilitarization of chemical munitions at the Chemical Agent Munition Disposal System Directorate demilitarization facility. Impact, friction and thermal sensitivity tests revealed that the thermal hazard was the controlling factor in determining the safe explosive concentrations. The test method used shows there is no thermal hazard if the total concentrations of the energetic materials are not greater than 10% by weight. GRA

N80-32535# Hazards Research Corp., Denville, N. J.
SENSITIVITY OF MOLTEN AND SOLID TNT CHARGES TO IMPACT BY PRIMARY STEEL FRAGMENTS Final Report
George Petino, Jr., Michael F. Leondi, and Paul D. Price Aug. 1980 66 p. refs
(Contract DAAK10-77-C-0155)
(AD-A087750; AD-E400394; ARLCD-CR-79025) Avail: NTIS HC A04/MF A01 CSCL 19/1

An experimental program was conducted to establish the sensitivity of molten and solid TNT to impact by nonspinning, primary steel fragments weighing 14 to 42 grams (0.5 to 1.5 oz) and traveling at velocities of 1,057 to 2,180 m/s (3,466 to 7,152 fps). Parameters that were varied included the absence or presence of steel acceptor plates, fragment weight per unit impact area and the molten vs. solid physical state of the TNT. GRA

N80-32536# Air Force Engineering and Services Center, Tyndall AFB, Fla. Environics Div.
BIOLOGICAL DEGRADATION OF HYDRAZINE Final Report, Jun. 1977 - Aug. 1978
Michael G. MacNaughton, Jay A. Farmwald, Larry McDaniels, and Gregory Urda Oct. 1979 46 p. refs
(AF Proj. 2103)
(AD-A084426; AFESC/ESL-TR-79-38; CEEDO-TR-78-13) Avail: NTIS HC A03/MF A01 CSCL 13/2

Due to the increased procurement, storage, and transportation of hydrazine (HZ) in support of the Titan and Minuteman operational missiles, the space shuttle, and F-16 combat fighter programs, the Air Force Engineering and Services Laboratory has been tasked with documenting the effects of fuel spills and low level continuous flow discharges on publicly owned treatment works (POTW). Using 12 bench scale continuous flow recycle reactors, it was shown that treatment efficiency (as measured by COD removal) is not seriously impaired for slug doses which increase aeration basin HZ concentrations up to 44 mg/l. Chemical oxygen demand (COD) recovery times for slug doses of 243 mg/l were approximately 4 to 5 days. Nitrification ceased at HZ concentrations above 23 mg/l. The 'no effect' concentration with respect to ammonia oxidation was determined to be between 1 to 23 mg/l while nitrate recovery times for doses up to 243 mg/l wave were on the order of 10 days. Continuous influent HZ concentrations above 10 mg/l seriously degrade COD

removal capabilities. Nitrification under continuous feed conditions was inhibited above 1 mg/l. Author

N80-32537# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy.

NATIONAL AVIATION FUEL SCENARIO ANALYSIS PROGRAM (NAFSAP). VOLUME 1: MODEL DESCRIPTION. VOLUME 2: USER MANUAL Final Report

Stephen G. Vahovich Mar. 1980 117 p

(AD-A084235; FAA-EE-80-12) Avail: NTIS HC A06/MF A01 CSCL 01/3

Forecasts of air carrier jet fuel usage by body type for three user defined markets are given. The model contains options which allow the user to easily change the composition of the future fleet so that fuel usage scenarios can be 'run'. The structure of the model is described. A computer users mannual is provided. T.M.

N80-32538# Ballistic Research Labs., Aberdeen Proving Ground, Md.

IGNITION OF NOS 365 LIQUID PROPELLANT CONTAINING AN AIR BUBBLE UNDER SIMULATED VREECH PRESSURIZATION CONDITIONS Final Report

Vincent M. Boyle and Edwin A. OLeary Apr. 1980 42 p

(DA Proj. 1L1-61102-AH-80)

(AD-A085723; AD-E430452; ARBRL-TR-02236) Avail: NTIS HC A03/MF A01 CSCL 21/9

A setback simulator was used to generate pressure within a liquid propellant containing a suspended air bubble. The bubble volume was varied from 1 to 200 micro liters. Several tests were made using a 1000 micro liter air space above the liquid propellant. Conclusions reached were: (1) a suspended air bubble makes liquid propellant more sensitive to pressure ignition; (2) the intensity of the reaction appears to increase with bubble size; (3) higher pressurization rates cause ignition of neat liquid propellant. However, this may be due to extrusion of the propellant around the pistons; and (4) the impact mode of activator operation, although permitting higher pressures and pressurization rates than the contact mode, also gives more variability in the results. S.F.

N80-32539# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.

TRANSIENT IGNITION MECHANISMS OF CONFINED SOLID PROPELLANTS UNDER RAPID PRESSURIZATION Summary Report, 1 Aug. 1979 - 31 Jul. 1980

Kenneth K. Kuo, Mridul Kumar, and Anil K. Kulkarni 6 Aug. 1980 58 p refs

(Contract N00014-79-C-0762)

(AD-A088080) Avail: NTIS HC A04/MF A01 CSCL 21/9

A comprehensive theoretical model was formulated to study the transient ignition mechanisms of solid propellants under rapidly varying pressure conditions. The model considers a two dimensional geometry to describe the ignition of a heterogeneous propellant. The rate of pressurization has been included in the energy equation to simulate rocket motor ignition conditions. The model does not make any a priori assumption of solid phase, heterogeneous, or gas phase ignition mechanism. Chemical reactions are considered in the gas phase, at the interface as well as in the subsurface. The most up to date chemical kinetics information is included in the model. A generalized ignition criterion has been proposed which allows ignition to occur at any site. GRA

N80-32540# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

SERVICE TEST OF TWO FUEL CONDUCTIVITY ADDITIVES Final Report, 1 Apr. 1977 - 1 Jan. 1980

Charles R. Martel and Frank P. Morse May 1980 86 p refs

(AD-A088046; AFWAL-TR-80-2051) Avail: NTIS HC A05/MF A01 CSCL 21/4

A service test of two fuel conductivity (anti-static) additives was conducted from April 1977 to May 1979 at eight Air Force bases. Since bases have continued to use the additive, a portion of the data reported herein extends to January 1980. The two candidate fuel additives were Shell Chemical Company's ASA-3 and E.I. duPont de Nemours and Company's Stadis 450. The additives were injected into the JP-4 aviation turbine fuel at either the refinery or terminal supporting the base. The conductivity of the JP-4 delivered to the service test base was to be maintained between 200 and 600 pS/m. The minimum and maximum fuel conductivity limits for servicing to aircraft was 100 to 700 pS/m. The effects of the additives on the air base fuel systems, filter separator elements, and on aircraft were monitored. GRA

N80-32541# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.

DETONATIONS AND MOLECULAR ELECTRONIC STRUCTURE OF EXPLOSIVES: THEORY AND ITS APPLICATION TO (NO +) SUB n Technical Report, Oct. 1977 - Dec. 1978

Richard D. Bardo 30 May 1980 58 p refs

(ZR01301; ZR01305)

(AD-A088223; NSWC/TR-79-175) Avail: NTIS HC A04/MF A01 CSCL 19/1

The theory of the electronic structure of molecular systems is discussed. It is suggested that certain electronic excited states are diminished in energy during compression, and that intersections of ground and excited state potential energy surfaces occur, thereby creating much lower activation energy barriers and greatly enhancing reaction rates. The molecular system (NO+)n is treated as a prototype explosive system. Ab initio and semiempirical calculations on the ground and excited electronic states of (NO+)n are presented. Intersections of the surfaces are seen to occur, suggesting that at high compressions the activation energy for bond scission may be substantially reduced. It is also shown that the changes in excitation energies depend primarily on the interactions of two or three NO(+) molecules, which suggests an enormous simplification in the study of excited states. GRA

N80-32542# Air Force Academy, Colo. Frank J. Seiler Research Lab.

PREDICTED PERFORMANCE OF ENERGETIC PLASTICIZER FORMULATIONS

Larry P. Davis, Robert A. Hildreth, and Melvin L. Druelinger Jun. 1980 20 p refs

(AF Proj. 2303)

(AD-A087658; FJSRL-TR-80-0015) Avail: NTIS HC A02/MF A01 CSCL 21/9

Calculations of heats of formation (MNDO) and specific impulse for a series of bis-fluorodinitroethyl alkyl ethers have been made. This series also included oxygen and sulfur hetero atoms, N-H, N-NO2 and CFNO2 substituents. These calculations reveal a trend toward decreasing Isp values as the hydrocarbon chain increases. The results suggest that ideal target molecules for synthetic efforts are the smaller members of this family of compounds, and that such compounds could be of value in applications as energetic plasticizers in propellant/munition formulations. The results also indicate that these compounds are promising in view of their increased performance compared to formulations using non-energetic plasticizers. GRA

N80-32543# Germantown Labs., Inc., Philadelphia, Pa.

INVESTIGATION OF FUELS CONTAINING COAL-OIL-WATER EMULSIONS FIRE TUBE TEST APPARATUS DESIGN AND CONSTRUCTION Quarterly Report, 1 Oct. - 31 Dec. 1979

Norman H. Cherry and Charles S. Stokes Jan. 1980 15 p

(Contract EF-77-C-01-2689)

(FE-2689-T4; QR-9) Avail: NTIS HC A02/MF A01

The fire tube test apparatus was operated at design capacity, 1,000,000 Btu's per hour, using No. 6 Gulf oil. Burner refinements were made for flowmeter accommodations. A test plan for the combustion studies is presented. DOE

N80-32544# Argonne National Lab., Ill. Energy and Environmental Systems Div.

ALCOHOL PRODUCTION FROM AGRICULTURAL AND FORESTRY RESIDUES

R. Opilla, L. Dale, and T. Surles May 1980 30 p refs

(Contract W-31-109-eng-38)

(ANL/EES/TM-88) Avail: NTIS HC A03/MF A01

Technologies available for the production of ethanol from whole corn are reviewed with emphasis on the environmental aspects of the process, including land utilization and possible air and water pollutants. Changes intended to improve the

economics of the process as well as to reduce some of the pollution from by-product disposal are suggested. Ethanol may be derived from renewable cellulosic substances by either enzymatic or acid hydrolysis of cellulose to sugar, followed by conventional fermentation and distillation. The use of two corn stover (field stalks remaining after harvest) and straw from wheat crops as a cellulosic feedstock is discussed. The environmental impact of a two stage acid process and an enzymatic process for feedstock production is evaluated and residuals expected from the manufacture of methyl and ethyl alcohols from woody biomass are considered. The methanol is produced in a gasification process, whereas ethanol is produced by hydrolysis and fermentation processes similar to those used to derive ethanol from cellulosic materials. DOE

N80-32545# Dynatech Corp., Cambridge, Mass.
LIQUID FUELS PRODUCTION FROM BIOMASS Progress Report, 1 Oct. - 31 Dec. 1979
J. E. Sanderson, P. F. Levy, D. L. Wise, M. R. Nabor, M. S. Molyneaux, and C. A. Hughes 1 Feb. 1980 67 p refs
(Contract DE-AC02-77ET-20050)
(COO-4388-10; Rept-1987; PR-10) Avail: NTIS HC A04/MF A01

It was found that marine algae could be converted to higher aliphatic organic acids and that these acids could be readily removed from the fermentation broth by membrane or liquid-liquid extraction. It was then proposed to convert these higher organic acids via Kolbe Electrolysis to aliphatic hydrocarbons, which may be used as a diesel fuel. A coenzyme M analogue, 2-bromoethanesulfonic acid was shown to be an effective suppressor of methane in nonsterile anaerobic fermentation of cellulosic substrates. Preliminary experiments were completed utilizing corn meal in which 2-bromoethanesulfonic acid and carbon monoxide were both found to be effective methane suppressors. The energy outputs and requirements for the production of liquid hydrocarbon fuel from corn are analyzed. As a means of expanding the number of potential substrates, pretreatment schemes are being investigated. DOE

N80-32546# Puerto Rico Univ., Rio Piedras. Agricultural Experiment Station.
PRODUCTION OF SUGARCANE AND TROPICAL GRASSES AS A RENEWABLE ENERGY SOURCE Quarterly Report, 1 Dec. 1979 - 29 Feb. 1980
Alex G. Alexander, W. Allison, M. Garcia, G. Ramirez, T. L. Chu, J. Velez-Santiago, and L. Smith 1980 39 p refs
(Contract ET-78-S-05-5912)
(DOE-ET-20071/T1; QR-3) Avail: NTIS HC A03/MF A01

Research continued on tropical grasses from Saccharum and related genera as sources of intensively propagated fiber and fermentable solids. Candidate screening (for short rotation grasses) was expanded to include six sorghum x Sudan grass hybrids developed by the Dekalb Company. Incomplete data indicate that two of the new grasses might be comparable to the NK hybrids in total biomass production and drought tolerance. Sugar-cane and napier grass yield trends in year 3 includes: (1) increased yields with delay of harvest frequency; (2) lack of response to close spacing; (3) a superiority of napier grass over sugarcane when harvested at intervals of six months or less; and (4) a general superiority of the sugarcane variety NCo 310 over varieties PR 980 and PR 64-1791. Delayed tasseling of a wild, early flowering S spontaneous hybrid enabled three crosses to be made in December using commercial hybrids as female parents. Approximately 1000 seedlings were produced. DOE

N80-32547# Argonne National Lab., Ill. Energy and Environmental Systems Div.
ASSESSMENT OF PERUVIAN BIOFUEL RESOURCES AND ALTERNATIVES
Jerome P. Harper, Wayne Smith (Florida Univ., Gainesville), and Eliseo Mariani (Marelco, Inc.) Aug. 1979 57 p refs
(Contract W-31-109-eng-38)
(ANL/EES/TM-86) Avail: NTIS HC A04/MF A01

Appraisal of the biofuel potential of Peru was based on: determination of current biofuel productivity; identification of Peruvian agricultural and forestry resources; assessment of resource development and management concerns; identification of market considerations; description of biofuel technological options; and identification of regional biofuel technology applications. Nine biofuel technology options for Peru are identified: (1) small to medium scale gasification; (2) a wood waste inventory; (3) stationary and mobile charcoal production systems; (4) wood distillation; (5) forest resource development and management; (6) electrical cogeneration; (7) anaerobic digestion technology; (8) development of ethanol production capabilities; and (9) agricultural strategies for fuel production. Applications of these biofuel options are identified for each of the three major regions of the country. DOE

N80-32548# Department of Energy, Washington, D. C. Assistant Secretary for Conservation and Solar Energy.
FIRST REPORT TO CONGRESS ON THE USE OF ALCOHOL IN MOTOR FUELS Annual Report
1 Apr. 1980 62 p
(DOE/CS-0165; AR-1) Avail: NTIS HC A04/MF A01

The following information is presented: (1) a description of the firms engaged in the alcohol fuel industry; (2) the amount of alcohol fuels sold in each state and the amount of gasoline saved in each state by reason of the use of alcohol fuels; (3) the revenue loss resulting from the exemptions from tax for alcohol fuels; and (4) the cost of production and the retail cost of alcohol fuels as compared to gasoline and special fuels before the imposition of any Federal excise tax. During 1979, a rapid increase in marketing of alcohol fuel, specifically the 10% blend known as gasohol, has caused a significant gap between the motor fuel marketplace and the information system(s) that compile a consistent data base for domestic energy production and consumption. DOE

N80-32549# Mound Lab., Miamisburg, Ohio.
ROLE OF Al SUBSTITUTION ON HYDROGEN DIFFUSION IN BETA-LaNi5Al/SUB y/H/SUB x
R. C. Bowman, Jr., B. D. Craft, A. Attalla, M. H. Mendelsohn, and D. M. Gruen 1980 13 p refs Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, Colo., 7 Apr. 1980 Prepared in cooperation with Argonne National Lab., Ill.
(Contract DE-AC04-76DP-00053)
(MLM-2733(OP); CONF-800402-14) Avail: NTIS HC A02/MF A01

Proton relaxation times measured by NMR pulse techniques were used to investigate hydrogen diffusion behavior in beta LaNi/sub 5-y/Al/sub y/H/sub x/ for 0 < y < 1.5. Al substitution increases E/sub a/ with a subsequent reduction in the apparent diffusion constants by more than two orders of magnitude relative to beta-LaNi sub 5 H sub 6 when y > or = 1. T sub 1 and T sub 1 sub rho/ values from high purity samples suggest that two types of jump processes with different activation energies are probably involved. DOE

N80-32550# Los Alamos Scientific Lab., N. Mex.
STUDIES OF FAST REACTIONS IN DETONATIONS
Charles L. Mader 1980 13 p refs Presented at NATO Adv. Study Inst. on Fast Reactions in Energetic Systems, Ioannion, Greece, 6-19 Jul. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1282; CONF-800714-1) Avail: NTIS HC A02/MF A01

The time dependent behavior of the flow in reaction zones of the detonating homogeneous explosives nitromethane, liquid TNT, and ideal gases was investigated using one and two dimensional Lagrangian and Eulerian numerical hydrodynamics with Arrhenius chemical reaction. A general model for bulk decomposition of heterogeneous explosives, called Forest Fire, was developed, which gives the rate of explosive decomposition as a function of local pressure. The model permits description of the process of heterogeneous explosive initiation, propagation, and failure. DOE

N80-32551# Los Alamos Scientific Lab., N. Mex.
DEVELOPMENTAL STUDIES OF CONSTITUTIVE MODELS FOR PLASTIC-BONDED EXPLOSIVES
Robert M. Hackett (Army Missile Command, Redstone Arsenal, Ala.), Randall L. Peeters, and William R. Oakes, Jr. Jun. 1980 12 p refs
(Contract W-7405-eng-36)

(LA-8204-MS) Avail: NTIS HC A02/MF A01

Typically, elastic and elastic-plastic theory are used in structural analysis computer programs to model the mechanical behavior of high explosives; these models, however, do not fit the observed behavior of plastic bonded explosives. The development of an equation of state creep model and a linear viscoelastic model for the analysis of these material systems is discussed and comparisons between experimental results and analytical model predictions are shown. DOE

N80-32552# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.

MODIFICATIONS FOR USE OF METHANOL OR METHANOL-GASOLINE BLENDS IN AUTOMOTIVE VEHICLES Technical Report, Sep. 1970 - Jan. 1980

D. J. Patterson, J. A. Bolt, and D. E. Cole Jan. 1980 194 p refs

(Contract DE-AC04-76CS-53682)

(ALO-3682-T1) Avail: NTIS HC A09/MF A01

Potential problems in the use of methanol or blends of methanol and gasoline as automotive fuels are examined. Retrofitting of existing vehicles as well as future vehicle design is considered. Several potentially serious problems are identified with methanol use. The most attractive solutions depend upon an integrated combination of vehicle modifications and fuel design. No vehicle problems are found which could not be solved with relatively minor developments of existing technology providing the methanol or blend fuel was itself engineered to ameliorate the solution. Research needs are identified in the areas of lubrication and materials. Because of the substantial costs and complexities of a retrofitting program, use of methanol must be evaluated in relation to other petroleum saving alternatives. Future vehicles can be designed initially to operate satisfactorily on these alternate fuels. However a specific fuel composition must be specified around which the future engines and vehicles can be designed. DOE

N80-32553# Brookhaven National Lab., Upton, N. Y.

HYDROGEN PRODUCTION FROM REMOTE POWER SITES

A. Mezzina, G. Grimes (DOE), R. Reeves (DOE), and R. Wiley (New York State Energy Research and Development Authority) Feb. 1980 10 p refs Presented at the Energy Sources Technol. Conf. and Exhibition, New Orleans, 3-7 Feb. 1980

(Contract EY-76-C-02-0016)

(BNL-27457; CONF-800204-9) Avail: NTIS HC A02/MF A01

The basic concept for adopting small existing dams to hydrogen production entails the energy conversion steps: hydropower to shaft power via a hydraulic turbine; shaft power to electrical power via a generator; and electrical power to hydrogen (and oxygen) via a water electrolyzer. The resource availability is discussed. The concept implementation in Potsdam, New York is mentioned. DOE

N80-32554# Oak Ridge National Lab., Tenn. Chemical Technology Div.

MODELING AND EVALUATION OF DESIGNS FOR SOLID HYDROGEN STORAGE BEDS

P. W. Fisher and J. S. Watson 1980 11 p refs Presented at the 3d World Hydrogen Energy Conf., Tokyo, 23-26 Jun. 1980

(Contract W-7405-eng-26)

(CONF-800616-8) Avail: NTIS HC A02/MF A01

Mathematical models were developed to predict the performance of metal hydride beds used for hydrogen storage. The relative importance of heat transfer, mass transfer, chemical kinetics, and equilibrium were evaluated through comparison of the models with experimental data supplied by Brookhaven National Laboratory for a cylindrical bed containing FeTi alloy. An equilibrium model containing no empirical parameters produced bed pressure and temperature which showed good agreement with experimental data. This model was used to evaluate two proposed designs for solid hydrogen storage beds in which (1) FeTi alloy was contained in tubes that were externally cooled, and (2) FeTi alloy was contained in a bed that were penetrated by cooling tubes. The model predicts that heat transfer surface area is utilized most effectively with the second cooling configuration. DOE

N80-32555# Department of Energy, Washington, D. C. Div. of Coal Conversion.

COAL DEMONSTRATION PLANTS Quarterly Report, Apr. - Jun. 1979

Apr. 1980 75 p

(DOE/FE-0004/79-2) Avail: NTIS HC A04/MF A01

Second generation technologies were demonstrated. The economic, environmental and productive capacity of a near commercial-size plant were validated by integrating and operating a modular unit using commercial size equipment. These facilities were aimed at accelerating and reducing the risks of industrial process implementation. Contracts for the design, construction, and operation of the demonstration plants were awarded through competitive procedures and were cost shared with the industrial partner. The government share of the cost involved for a demonstration plant depends on the plant size, location, and the desirability and risk of the process to be demonstrated. The various plants and programs are discussed: description and status, funding, history, flowsheet and progress during the current quarter. DOE

N80-32556# Worcester Polytechnic Inst., Mass.

KINETICS AND MECHANISMS OF CATALYTIC HYDROLIQUEFACTION AND HYDROGASIFICATION OF LIGNITE Quarterly Report, Jan. - Mar. 1980

Alvin H. Weiss, Wilmer L. Kranich, and Kemal Gueruez 20 Apr. 1980 29 p

(Contracts DE-AS01-77ET-10618)

(FE-2702-10) Avail: NTIS HC A03/MF A01

Delay in the delivery of a new pump prevented expansion of the range of flow rates already studied on lignite liquefaction in the continuous stirred tank reactor. Data previously reported have been refined and for the most part confirmed. Agitator speed does not affect reaction rate over the range of speeds used in experimental runs, but hydrogen pressure appears to exert an influence particularly at higher temperatures. A new batch reactor was put into operation which is expected to yield valuable catalyst screening and kinetic data. Successful design, fabrication, and operation of a fast-feed mechanism should greatly reduce the long preheating times which obscure the kinetic results of most batch studies. DOE

N80-32557# Westinghouse Electric Corp., Madison, Pa. Advanced Coal Conversion Dept.

ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION Quarterly Progress Report, 1 Oct. - 31 Dec. 1979

L. A. Salvador 25 Jan. 1980 74 p

(Contracts DE-AC01-76ET-10161; EF-77-C-01-1514)

(FE-1514-113; QPR-1) Avail: NTIS HC A04/MF A01

The results of gasification process development tests are reported. A review of the data and the effect of various modifications on cyclone deposits was conducted. It is tentatively concluded that the mechanism of deposit formation is the result of sticky particles or liquid droplets out of the combustion and/or gasification zone impacting on the hot refractory cyclone walls as a result of change in direction of flow. A water spray nozzle was installed in the freeboard area of the gasifier to quench particles with a liquid film and render them nonsticky. Water spray was also used to cool the gas and particles from 1800 F to 1300 F. At this temperature, the deposit was practically eliminated. However, long-duration tests with Pittsburgh seam and Ohio No. 9 coals are necessary before any firm conclusions can be drawn about the effect of water spray. Significant progress was made in the construction of the cold-flow, scale-up facility. In addition, studies were made on the reactivity of various chars in the laboratory fluidized bed. DOE

N80-32558# Montana State Univ., Bozeman. Dept. of Chemical Engineering.

CATALYTIC HYDROGENATION OF COAL-DERIVED LIQUIDS Progress Report, Dec. 1979 - Feb. 1980

Lloyd Berg and F. P. McCandless 28 Mar. 1980 30 p

(Contract DE-AC01-76ET-10495; EX-76-C-01-2034)

(FE-2034-18) Avail: NTIS HC A03/MF A01

The development of catalysts capable of converting solvent refined coal, SRC-2, into a feedstock suitable for a conventional petroleum refinery is assessed. A process which reduces the nitrogen content from the 1.17% in SRC-2 to at least as low as 0.3% is required. Four catalysts were fabricated and evaluated. A cobalt, molybdenum, nickel, tungsten metal loading was made on a molecular sieve base possessing 88.9A average pore diameter. It produced specification product before and after burnoff with air. Three cobalt molybdate catalysts of different metal loadings were fabricated on three different pore diameter bases, 88.9A, 156.5A, and 186.2A. DOE

N80-32559# Brookhaven National Lab., Upton, N. Y.
FUSION REACTORS FOR HYDROGEN PRODUCTION VIA ELECTROLYSIS
J. A. Fillo, J. R. Powell, and M. Steinberg 1979 7 p refs Presented at the 2d Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10-13 Dec. 1979
(Contract DE-AC02-76CH-00016)
(BNL-27782; CONF-791204-37) Avail: NTIS HC A02/MF A01

The decreasing availability of fossil fuels emphasizes the need to develop systems which will produce synthetic fuel to substitute for and supplement the natural supply. An important first step in the synthesis of liquid and gaseous fuels is the production of hydrogen. Thermonuclear fusion offers an inexhaustible source of energy for the production of hydrogen from water. Depending on design, electric generation efficiencies of approximately 40 to 60% and hydrogen production efficienceis by high temperature electrolysis of approximately 50 to 70% and projected for fusion reactors using high temperature blankets. Doe

N80-32560# Sandia Labs., Albuquerque, N. Mex.
CATALYST CHARACTERIZATION IN COAL LIQUEFACTION Annual Report, 1 Oct. 1978 - 30 Sep. 1979
M. G. Thomas and D. G. Sample Jun. 1980 57 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0123) Avail: NTIS HC A04/MF A01

Neutron activation of American Cyanamid 1442A CoMo catalyst was employed to tag a one day's charge of catalyst in H-Coal PDU run no. 9. The activity of Co-60 in the withdrawals has shown that 8 days are required to uniformly distribute a daily addition of catalyst in the bed during PDU run no. 9. Catalysts used in the LC-Fining of SRC-1 show aging characteristics similar to H-Coal catalyst: 20 to 30 w/o organic contamination, 2 to 5 w/o inorganic contamination, 50 percent loss of surface area, and changes in pore volume distributions. Elemental distribution of contaminants indicate that the catalysts are extremely efficient metals scavengers, with titanium and iron major contaminants penetrating 200 micrometers into the catalysts. A mechanistic pathway for coal liquefaction were experimentally verified by the combination of low temperature (25 to 300 C) batch reaction data in inert atmospheres, high temperature-moderate pressure reaction data (500 psi H2) from tubing reactors at 400 and 426 C, and high pressure (2000 psi H2) data collected in a continuous reactor at 400, 425, and 450 C. DOE

N80-32561# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
BIOTECHNOLOGY FOR A RENEWABLE RESOURCES CHEMICALS AND FUELS INDUSTRY, BIOCHEMICAL ENGINEERING R AND D
Ruxton H. Villet Apr. 1980 8 p refs Presented at 89th Ann. Meeting of AICE Portland, Oreg., 10-13 Aug. 1980
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-621-659; CONF-800802-4) Avail: NTIS HC A02/MF A01

An integration of research in biochemical engineering, microbial genetics, and biochemistry is required to establish an effective biotechnology of biomass processing for the production of fuels and chemicals. Reduction of the costs of producing chemicals and fuels from renewable resources will hinge on extensive research in biochemical engineering. DOE

N80-32562# Los Alamos Scientific Lab., N. Mex.
MICRO-LEVEL LAND USE IMPACTS OF BIOCONVERSION
Virginia Parsons 1980 6 p refs Presented at IASTED Energy Symp., Montreal, 28 May 1980
(Contract W-7405-eng-26)
(LA-UR-80-1426; CONF-800567-2) Avail: NTIS HC A02/MF A01

Local biomass potential, existing and use and potential land use impacts from bio-energy implementation for three of the fifteen counties selected for the TASE study are presented. The methodology created for the evaluation is useful in determining the biomass potential for any community or county, and in identifying regional differences inherent in the tradeoffs between existing land use and energy production. DOE

N80-32563# Dynatech R/D Co., Cambridge, Mass.
LIQUID FUELS PRODUCTION FROM BIOMASS Progress Report, 1 Jan. - 31 Mar. 1980
P. F. Levy, J. E. Sanderson, and D. L. Wise 31 Mar. 1980 48 p refs
(Contract EG-77-C-02-4388)
(COO-4388-11; Dynatech-2013; PR-11) Avail: NTIS HC A03/MF A01

It was found that marine algae could be converted to higher aliphatic organic acids and these acids can be converted to aliphatic hydrocarbons, which may be used as a diesel fuel. A coenzyme M analogue, 2-bromoethanesulfonic acid, was shown to be an effective suppressor of methane in nonsterile anaerobic fermentation of cellulosic substrates. An analysis of the energy outputs and requirements for the production of liquid hydrocarbon fuel from corn was performed. An analytical scheme for determining composition of biomass materials was devised. A tapered auger device was designed and built which was demonstrated on the bench to be effective for adding substrate and removing residue in a continuous manner from a fixed packed bed fermenter. A solvent extractor system using kerosene as the nonaqueous phase was constructed and is currently in operation in series with the 300 liter fixed packed bed fermenter. The electrolytic oxidation of organic acids produced in the 300 liter fixed packed bed fermenter is operating with a favorable energy balance of 6/1 based on the applied potential. DOE

N80-32564# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
CALIFORNIA'S BIOMASS AND ITS ENERGY POTENTIAL Ph.D. Thesis
Frank Bart Lucarelli, Jr. Apr. 1980 317 p refs
(Contract W-7405-eng-48)
(LBL-10058) Avail: NTIS HC A14/MF A01

Estimates of the costs of transforming biomass into different fuels as well as a survey of government's role in a biomass energy program are presented. The major findings are summarized below. (1) California's existing biomass resources are sufficient to provide only 20 percent of its future liquid fuel requirements. (2) Meeting the full transportation demand with biomass derived fuels will require the development of exotic biomass sources such as kelp farms and significant reduction in automobile travel in the State. (3) Under assumptions of moderate increases in gasoline prices and without major new government incentives, the cost of transforming biomass into transport fuels will be competitive with the price of gasoline on a Btu basis by the year 1990. (4) The environmental impacts of collecting most forms of biomass are beneficial and should reduce air pollution from agricultural burning and water pollution from feedlot and dairy farm runoff. DOE

N80-32565# California Univ., Livermore. Lawrence Livermore Lab.
USE OF AN AUTOMATED MASS SPECTROMETER FOR AN UNDERGROUND COAL GASIFICATION FIELD TEST
R. W. Crawford, R. G. Bedford, C. M. Wong, H. R. Brand, and K. I. Kishiyama Jul. 1980 29 p refs Presented at the Intern. Dyn. Mass Spectometry Symp., Canterbury, England, 7-10 Jul. 1980
(Contract W-7405-eng-48)
(UCRL-84366; CONF-800732-1) Avail: NTIS HC A03/MF A01

A time-of-flight mass spectrometer was used to analyze the product gas from an underground coal gasification field experiment. It proved to be precise and moderately accurate. It was extremely stable and reliable. Its speed was more than adequate for most

requirements. The analysis of product gas was fully automated, but any other operation took manual intervention. DOE

N80-32566# California Univ., Livermore. Lawrence Livermore Lab.
ECONOMICS OF SHALE OIL PRODUCTION BY RADIO FREQUENCY HEATING
Richard G. Mallon 7 May 1980 11 p refs
(Contract W-7405-eng-48)
(UCRL-52942) Avail: NTIS HC A02/MF A01

A conceptual facility for the production of shale oil by radio frequency (rf) heating was designed to evaluate the economic feasibility of this technique. The shale was processed in situ without being rubbed or explosively fractured. Metal electrodes inserted in a set of vertical drill holes were energized by a group of rf oscillators. The electric field was developed in such a way that heating within the block was almost uniform, and heating outside the block was very low. The facility schedule is planned so that off-peak electric power from existing generating stations is used to operate the oscillators. The two principal costs are purchase of electric power and mining operations. The largest capital requirement is oscillators and associated electrical equipment. DOE

N80-32567# Institute of Gas Technology, Chicago, Ill.
SYNTHETIC FUELS FROM US OIL SHALES: A TECHNICAL AND ECONOMIC VERIFICATION OF THE HYTORT PROCESS Quarterly Report, 1 Jan. - 31 Mar. 1980
Jun. 1980 71 p ref
(Contract DE-AC01-79ET-14102)
(DOE/ET-14102-2) Avail: NTIS HC A04/MF A01

The technical and economic feasibility of the HYTORT process for both Eocene and Devonian shales was demonstrated. The program is divided into five major task areas: laboratory program; vench scale program; process development unit tests; process environmental assessment; and process design and economics. DOE

N80-32568# Gulf Research and Development Co., Pittsburgh, Pa.
INVESTIGATION OF MECHANISMS OF HYDROGEN TRANSFER IN COAL HYDROGENATION, PHASE 2 Annual Report, Jan. - Dec. 1978
D. C. Cronauer, R. O. Ruberto, and D. C. Young May 1979 110 p refs
(Contract EX-76-C-01-2305)
(FE-2305-30) Avail: NTIS HC A06/MF A01

An understanding of the mechanism of hydrogen transfer to coal and its intermediates during liquefaction was developed. Results of experiments with coal and asphaltenes are consistent with those of the model compounds, and the knowledge of both phases were combined. Coal primarily cracks in linkages between aromatic type units such that transferred hydrogen exists on carbons alpha to an aromatic ring. The coal free-radicals abstract hydrogen from any available source such as hydroaromatics, naphthenes, alkyl aromatics and dissolved hydrogen, in roughly that order. Solvent losses through adduction and isomerization were significant, and lead to decreased activity or effectiveness of recycled solvents. The use of nmr gives an improved understanding of the mechanism of reactions involved in the liquefaction of coal. DOE

N80-32569# Filtrol Corp., Los Angeles, Calif.
DEVELOPMENT OF NEW CATALYSTS FOR COAL LIQUID REFINING Quarterly Report, 1 Jan. - 31 Mar. 1980
Apr. 1980 28 p refs
(Contracts DE-AC01-78ET-12103; FT-78-C-01-2595)
(FE-2595-5; QR-5) Avail: NTIS HC A03/MF A01

The first series of cracking catalysts formulated with 20% exchanged Na-Y zeolite, and 80% matrix binder was activity tested with a hydrotreating SRC-2 Fuel Oil Blend. The best results were obtained with a rare earth exchanged zeolite. An improved catalyst for hydrotreating SRC-2 Fuel Oil Blend was prepared from a nickel molybdate impregnated Kaiser alumina. Synthesis and characterization of various catalytic components and cation exchange of these materials is complete. DOE

N80-32570# Brookhaven National Lab., Upton, N. Y.
ADVANCED SYNFUELS PRODUCTION/POWER SYSTEMS UTILIZING LASER PARTICULATE CONTROL
T. Botts, Jr., J. R. Powell, and J. A. Fillo 1979 4 p refs
Presented at the 2d Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10-13 Dec. 1979
(Contract DE-AC02-76CH-00016)
(BNL-27783; CONF-791204-38) Avail: NTIS HC A02/MF A01

Coal fired turbines offer an attractive means of generating electrical power using an available resource and near term technologies. However, in order to maintain adequate turbine blade lifetimes, and thus make such plants economically attractive, better means of hot gas clean up than those presently available are needed. One possible solution to this problem is the use of intense laser beams to augment the conventional body forces in cyclones to increase collector efficiencies for smaller sized particulates. Finally, plant factors can be increased by means of alternate energy utilization during offpeak periods. One such scheme is to raise steam and perform high temperature electrolysis. It appears as if the hydrogen produced is more useful as a transportable fuel or chemical than as a means of energy storage. DOE

N80-32571# New Zealand Energy Research and Development Committee, Auckland.
AUTOMOTIVE FUELS FROM CELLULOSE MATERIALS Final Report
B. Higginson and R. H. Thornton Jan. 1980 28 p refs
(NZERDC-49; ISSN-0110-1692) Avail: NTIS HC A03/MF A01

The results of this investigation showed that it was feasible to link the alcohol fermentation and anaerobic digestion processes into a system for the production of both alcohol and methane from organic substrates. Although optimization of fermentation was attempted with due regard to energy conservation, for industrial application the cost of sugar will be the overriding factor. A hydraulic retention time of 10 days or longer was needed for effective digestion in which a reduction of chemical oxygen demand of up to 85% was achieved. Results indicated that further reduction in retention time may be possible if the microbial biomass could be either retained on support media, or recycled more effectively. A gas production rate of 4270 liters gas/cubic meter culture/day at 11.6 day retention time was obtained with the anaerobic contact digester using fodder beet spent wash. Using the same substrate, results over short periods with the anaerobic filter system could produce up to 4.8 liters gas/litre culture/day. The high methane composition of this gas (75 to 80%) make this an attractive proposition. DOE

N80-32572# Mechanical Technology, Inc., Latham, N. Y.
ASSESSMENT OF SYNTHANE MECHANICAL EQUIPMENT
J. T. McCabe, F. E. Kramberger, B. R. Hao, D. Dubis, and S. E. Carson May 1980 164 p refs
(Contract DE-AC01-77ET-10622)
(MTI-79TR5) Avail: NTIS HC A08/MF A01

Mechanical equipment in the Synthane pilot plant was subjected to operating conditions outside manufacturers' specifications. In some cases, these encounters were intentional and in other cases they resulted from insufficient data. All 106 of the test runs were terminated involuntarily. For the most part, the repetitive failures of plant materials and equipment originated from a combination of excessive solids overloading and corrosion/erosion caused by abnormal conditions of operation on fluid process streams. The extremes of these conditions were not anticipated nor were they taken into consideration in the design of the plant and in the selection of equipment and materials. Because of this situation, approximately half of the test run terminations were directly attributed to mechanical failures. Generally, for reasons given the maintenance, repair or replacement of failed equipment was not successful in eliminating or alleviating many failures until early 1978. Appropriate early planning can eliminate all these causes of failure in the future. DOE

N80-32573# Los Alamos Scientific Lab., N. Mex.
FLASH PYROLYSIS AND GASIFICATION OF COAL THROUGH LASER HEATING

W. H. Beattie and J. A. Sullivan 1980 6 p refs Presented at 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1094; CONF-800806-28) Avail: NTIS HC A02/MF A01

Experimental results obtained from the rapid pyrolysis of finely powdered coal are presented. The experiments are designed to provide basic information on gas yield, gas composition, optimum fluxes, and temperature history of coal samples under high intensity laser radiation. The information obtained from these experiments is used to test concepts for the use of concentrated sunlight to produce fuel gases from coal. Heating the coal at rates of 1000 to 10,000 C/s in an inert atmosphere of argon results in pyrolysis at temperatures between 400 and 800 deg C. The gases evolved are primarily CO, H2, and CH4 with lesser amounts of CO2 and other light hydrocarbons. Mass spectrometry is used to determine the composition of the evolved gases. The optimum flux for laser pyrolysis of coal was found to be 250w /sq cm. Results from experiments wherein the char created by pyrolysis is gasified to CO in an atmosphere of CO2 are also presented. DOE

N80-32574# Pace Co. Consultants and Engineers, Inc., Denver, Colo. Div. of Coal Conversion.
COAL LIQUEFACTION Quarterly Report, Apr. - Jun. 1979
Apr. 1980 65 p
(DOE/FE-0003/79-2) Avail: NTIS HC A04/MF A01

Current work is aimed at improved process configurations for both catalytic and non catalytic processes to provide more attractive processing economics and lower capital investment. The advantage of coal liquefaction is that the entire range of liquid products, especially boiler fuel, distillate fuel oil, and gasoline, can be produced from coal by varying the type of process and operating conditions used in the process. Furthermore coal derived liquids have the potential for use as chemical feedstocks. To provide efficient and practical means of utilizing coal resources, DOE is supporting the development of several conversion processes that are currently in the pilot plant stage. DOE

N80-32575# Maryland Univ., College Park. Dept. of Mechanical Engineering.
THERMODYNAMIC PROPERTIES OF LIQUEFIED PETROLEUM GASES (LPG) Interim Report, 15 Aug. 1975 - 31 Jan. 1977
Dirse W. Sallet and K. F. Wu Apr. 1980 111 p refs
(Contract DOT-FR-64181)
(PB80-189053; FRA/ORD-76/299) Avail: NTIS HC A06/MF A01 CSCL 21D

The thermodynamic properties of several liquefied petroleum gases (with particular emphasis on propane) are discussed in detail. Thermodynamic data for four liquefied petroleum gases were calculated and are presented in tabular form. Predictors of pure propane mass flow rates (based upon isentropic) homogeneous equilibrium flow are given. The influence of the thermodynamic data upon the predicted mass flow rates was demonstrated. GRA

N80-32576# Maryland Univ., College Park. Dept. of Mechanical Engineering.
THE CALCULATION OF THE THERMODYNAMIC PROPERTIES OF PROPANE, PROPYLENE, N-BUTANE, AND ETHYLENE Final Report, 31 Jan. 1977 - 31 May 1978
Dirse W. Sallet and Milton E. Palmer Apr. 1980 167 p refs
(Contract DOT-FR-64181)
(PB80-189061; FRA/ORD-76/300) Avail: NTIS HC A08/MF A01

The thermodynamic properties of propane, propylene, n-butane and ethylene were calculated and are presented in tables. The tables list the values of the specific volume, the enthalpy, the entropy, the specific heat at constant pressure, the specific heat at constant volume and the sonic velocity of the four hydrocarbons in a temperature and pressure range which can be encountered when these commodities are shipped by rail tank cars. This includes subcooled states, saturation equilibirum states and superheated states. The computer program with which the tables were generated is discussed in detail and a complete listing of the program is given. GRA

N80-32577# Radian Corp., Austin, Tex.
QUANTITATIVE ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS IN LIQUID FUELS Final Report, Oct. 1976 - Oct. 1978
Jerry L. Parr Apr. 1980 44 p refs
(Contract EPA-68-02-2466)
(PB80-187388; EPA-600/2-80-069) Avail: NTIS HC A03/MF A01 CSCL 21D

A quantitative analysis of 12 individual polynuclear aromatic hydrocarbons (PNAs) present in various aircraft turbine, diesel, and gasoline test fuels was determined. The fuel samples were analyzed by combined gas chromatography/mass spectrometry (GC-MS) after a preliminary isolation/concentration scheme. Liquid crystal chromatographic columns were employed to resolve isometric PNAs. GRA

N80-32578*# New Mexico Univ., Albuquerque. Technology Application Center.
BIOMASS ENERGY PRODUCTION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1975 - Apr. 1980
Peter W. Moore Jun. 1980 58 p Sponsored in cooperation with NASA and NTIS
(PB80-810807; NASA-CR-163595) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

These 210 citations from the international literature describe the production and/or utilization of most forms of biomass as a source of energy, fuel, food, and chemical intermediates or feedstocks. Biomass conversion by incineration, gasification, pyrolysis, hydrolysis, anaerobic digestion, or fermentation, as well as by catalytic, photosynthetic, chemosynthetic, and bioelectrochemical means are among the conversion processes considered. Discussions include biomass plantation and material productivity, transportation and equipment requirements, effects, comparisons of means and efficiencies of utilization and conversion, assessments of limitations, and evaluations of economic potential. GRA

N80-32579# National Technical Information Service, Springfield, Va.
SYNTHETIC FUELS FROM MUNICIPAL, INDUSTRIAL AND AGRICULTURAL WASTES. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1978 - Apr. 1980
Audrey S. Hundemann Jul. 1980 165 p Supersedes NTIS/PS-79/0547; NTIS/PS-78/0500
(PB80-812365; NTIS/PS-79/0547; NTIS/PS-78/0500) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The bibliography cites worldwide literature on the production of fuels from waste materials, such as animal manure, wood chips,sewage sludge, urban garbage, agricultural wastes, and old automobiles. This updated bibliography contains 159 citations, 57 of which are new entries to the previous edition. GRA

N80-32580# National Technical Information Service, Springfield, Va.
ALCOHOL FUELS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 256 p Supersedes NTIS/PS-79/0713; NTIS/PS-78/0673
(PB80-812431; NTIS/PS-79/0713; NTIS/PS-78/0673) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The bibliography covers Federally funded research on alcohol based fuels that may be used in the future as a fuel source. The citations cover synthesis, chemical analysis, performance testing, processing, pollution economics, environmental effects, and feasibilty. This updated bibliography contains 245 citations, 110 of which are new entries to the previous edition. GRA

N80-32581# National Technical Information Service, Springfield, Va.
ALCOHOL FUELS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1978
Diane M. Cavagnaro Jun. 1980 227 p
(PB80-812449) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The cited reports from a worldwide literature survey,

includes such topics as blends, synthesis, processes used, properties, engine performance evaluations, economics, safety measures, pollution effects, and combustion studies. Also covered are the sources from which alcohol fuels can be obtained, such as coal, solid wastes industry byproducts, and agricultural waste. This updated bibliography contains 220 citations, none of which are new entries to the previous edition. GRA

N80-32582# National Technical Information Service, Springfield, Va.
ALCOHOL FUELS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 163 p Supersedes NTIS/PS-79/0714; NTIS/PS-78/0674
(PB80-812456; NTIS/PS-79/0714; NTIS/PS-78/0674) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The cited reports from a worldwide literature survey discuss new technology in the field of alcohol fuels. The bibliography covers the different blends, synthesis, processes used, properties, engine performance evaluations, economics, safety measures, pollution effects, and combustion studies. The research also covers sources from which alcohol fuels can be obtained, such as coal, solid wastes, industrial by-products and agricultural wastes. This updated bibliography contains 156 citations, 21 of which are new entries to the previous edition. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-32583* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPARATUS FOR SUPPLYING CONDITIONED AIR AT A SUBSTANTIALLY CONSTANT TEMPERATURE AND HUMIDITY Patent
Henry D. Obler, inventor (to NASA) Issued 1 Jul. 1980 9 p Filed 6 Feb. 1979 Supersedes N79-19688 (17 - 10, p 1331
(NASA-Case-GSC-12191-1; US-Patent-4,210,278;
US-Patent-Appl-SN-009886; US-Patent-Class-236-49;
US-Patent-Class-236-13; US-Patent-Class-236-44C;
US-Patent-Class-165-16) Avail: US Patent and Trademark Office CSCL 13B

The apparatus includes a supply duct coupled to a source of supply air for carrying the supply air therethrough. A return duct is coupled to the supply duct for carrying return conditioned air therethrough. A temperature reducing device is coupled to the supply duct for decreasing the temperature of the supply and return conditioned air. A by-pass duct is coupled to the supply duct for selectively directing portions of the supply and return conditioned air around the temperature reducing device. Another by-pass duct is coupled to the return duct for selectively directing portions of the return conditioned air around the supply duct and the temperature reduction device. Controller devices selectively control the flow and amount of mixing of the supply and return conditioned air.

Official Gazette of the U.S. Patent and Trademark Office

N80-32584* National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR PLOTTING SUBSOIL STRUCTURE AND METHOD THEREFOR Patent
Keshavaiyengar Y. Narasimhan (JPL), Robert Nathan (JPL), and Shakkottai P. Parthasarathy, inventors (to NASA) (JPL) Issued 22 Jul. 1980 8 p Filed 6 Sep. 1977 Supersedes N79-20555 (17 - 11, p 1455) Sponsored by NASA
(NASA-Case-NPO-14191-1; US-Patent-4,214,226;
US-Patent-Appl-SN-830846; US-Patent-Class-367-27;
US-Patent-Class-181-102; US-Patent-Class-367-36;
US-Patent-Class-367-57) Avail: US Patent and Trademark Office CSCL 08M

Data for use in producing a tomograph of subsoil structure between boreholes is derived by pacing spaced geophones in one borehole, on the Earth surface if desired, and by producing a sequence of shots at spaced apart locations in the other borehole. The signals, detected by each of the geophones from the various shots, are processed either on a time of arrival basis, or on the basis of signal amplitude, to provide information of the characteristics of a large number of incremental areas between the boreholes. Such information is useable to produce a tomograph of the subsoil structure between the boreholes. By processing signals of relatively high frequencies, e.g., up to 100 Hz, and by closely spacing the geophones, a high resolution tomograph can be produced.

Official Gazette of the U.S. Patent and Trademark Office

N80-32585*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LIQUID IMMERSION APPARATUS FOR MINUTE ARTICLES Patent Application
Jewell G. Belcher and Ben R. Hollis, inventors (to NASA) Filed 18 Jul. 1980 9 p
(NASA-Case-MFS-25363-1; US-Patent-Appl-SN-171933) Avail: NTIS HC A02/MF A01 CSCL 13H

An apparatus for immersing minute articles such as integrated circuit chip in an etching solution during manufacture of the chips is described. The apparatus includes a basket having minute fluid passages in its sides and bottom, the passages being dimensioned to overcome buoyancy while allowing complete circulation. The basket has a removable lid member also having fluid passages to prevent air pockets and facilitate circulation. Both the basket and lid member are constructed of corrosion resistant material such as Teflon and are dimensional to provide a friction bit. A holder member including handle portion and support mean is disposed to support and retain the basket while in the solution. The overall combination of the basket, lid, and handle having the features referred to above enable treatment of the chips and avoidance of losses and unnecessary handling. E.D.K.

N80-32586*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.
PROJECT FIRES. VOLUME 2: PROTECTIVE ENSEMBLE PERFORMANCE STANDARDS, PHASE 1B Final Contractor Report
Fred J. Abeles May 1980 140 p refs
(Contract NAS8-32329)
(NASA-CR-161530) Avail: NTIS HC A07/MF A01 CSCL 13B

The design of the prototype protective ensemble was finalized. Prototype ensembles were fabricated and then subjected to a series of qualification tests which were based upon the protective ensemble performance standards PEPS requirements. Engineering drawings and purchase specifications were prepared for the new protective ensemble. A.R.H.

N80-32587*# Notre Dame Univ., Ind.
COUPLED WAVE MODEL FOR LARGE MAGNET COILS Final Report
G. J. Gabriel Sep. 1980 53 p refs
(Grant NsG-3182)
(NASA-CR-3332; E-535) Avail: NTIS HC A04/MF A01 CSCL 09C

A wave coupled model based on field theory is evolved for analysis of fast electromagnetic transients on superconducting coils. It is expected to play a useful role in the design of protection methods against damage due to high voltages or any adverse effects that might arise from unintentional transients. The significant parameters of the coil are identified to be the turn to turn wave coupling coefficients and the travel time of an electromagnetic disturbance around a single turn. Unlike circuit theoretic inductor, the coil response evolves in discrete steps having durations equal to this travel time. It is during such intervals that high voltages are likely to occur. The model also bridges the gap between the low and high ends of the frequency spectrum. Author

N80-32588# Nottingham Univ. (England). Dept. of Civil Engineering.
PERMANENT DEFORMATION OF FLEXIBLE PAVEMENTS Final Technical Report, Sep. 1978 - Jun. 1980
S. F. Brown, B. V. Broderick, and J. W. Pappin Jun. 1980 165 p refs
(Grants DA-ERO-78-G-114; DA-ERO-77-G-061;

DA Proj. 1T1-61102-BH-57)
(AD-A087859) Avail: NTIS HC A08/MF A01 CSCL 13/2

Seven pairs of pavements with granular bases were tested under controlled conditions. One pavement in each pair contained fabric inclusions. An improved testing facility was developed, including: (1) servo-hydraulic system for the loading carriage; (2) amplification and read-out system for pressure cells; (3) linearizing unit for strain coils; (4) transducers for measuring vertical and resilient deflection; (5) techniques for measuring in situ strain on fabric inclusions; (6) extensive use of nuclear density meter to monitor pavement and foundation materials. The following conclusions are drawn: (1) No improvement in performance resulted from fabric inclusions. (2) No consistent reduction in in-situ stresses, resilient strains, or permanent strains was observed as a result of fabric inclusion. (3) No consistent improvement in densities resulted from fabric inclusions. (4) Some slip apparently occurred between fabric and soil on those pavements which involved large deformations. The slip occurred between fabric and crushed limestone base rather than between fabric and silty-clay subgrade. GRA

N80-32589# Stanford Univ., Calif. Physics Labs.
ACOUSTIC MICROSCOPY AT CRYOGENIC TEMPERATURES Annual Summary Report, 1 Jul. 1979 - 30 Jun. 1980
C. F. Quate and J. Heiserman Jul. 1980 28 p refs
(Contract N00014-77-C-0412; NR Proj. 384-924)
(AD-A087677; SU-GL-3149) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report summarizes our progress in development of high resolution acoustic microscopes for use at cryogenic temperatures. During the past year we have concentrated on development of efficient acoustic matching layers for use in liquid helium and extension of our techniques to temperatures below 0.5 K in liquid helium. As a first step at these low temperatures, we have begun probing the acoustic properties of the liquid at frequencies at least 5 times higher than previously published results. GRA

N80-32590# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
MATHEMATICAL MODEL TO CORRELATE FROST HEAVE OF PAVEMENTS WITH LABORATORY
R. L. Berg, G. L. Guymon (California Univ., Irvine), and T. C. Johnson Feb. 1980 56 p refs Sponsored in part by FAA and Federal Highway Administration
(DA Proj. 4A7-62730-AT-42)
(AD-A084737; CRREL-80-10) Avail: NTIS HC A04/MF A01 CSCL 08/12

A mathematical model of coupled heat and moisture flow in soils was developed. The model includes algorithms for phase change of soil moisture and frost heave and permits several types of boundary and initial conditions. The finite element method for weighted residuals (Galerkin procedure) was chosen to simulate the spatial regime and the Crank-Nicholson method was used for the domain portion of the model. To facilitate evaluation of the model, the heat and moisture fluxes were essentially decoupled; moisture flux was simulated accurately, as were heat flux and frost heave in a laboratory test. Comparison of the simulated and experimental data illustrate the importance of unsaturated hydraulic conductivity. It is one parameter which is difficult to measure and for which only a few laboratory test results are available. Therefore, unsaturated hydraulic conductivities calculated in the computer model may be a significant source of error in calculations of frost heave. The algorithm incorporating effects of surcharge and overburn was inconclusively evaluated. Time-dependent frost penetration and frost heave in laboratory specimens were closely simulated with the model. L.F.M.

N80-32591# Hughes Helicopters, Culver City, Calif.
CONVENTIONAL MACHINING OF ESR 4340 STEEL Final Report, 1 Sep. 1978 - 1 Apr. 1980
K. K. Niji Jul. 1980 118 p
(Contract DAAG46-78-C-0046)
(AD-A088451; HH-80-125; USAAVRADCOM-TR-80-F-14; AMMRC-TR-80-34) Avail: NTIS HC A06/MF A01 CSCL 13/8

This program involved the study of conventional machining of heat treated ESR 4340 steel (Rc 54-57). Initial effort involved a survey of available data regarding the machining of high strength steels with hardnesses of Rc 50 and above. A machining program was conducted, determining optimum tools and conditions for turning, drilling, face milling, end milling, and grinding operations. Effects of various parameters includng cutting speeds, feeds, depths of cut, and cutting fluids on tool life was determined. All the operations were found to be extremely difficult and applicaton of conventional procedures is not feasible. Tool lives remained short despite reductions in speeds and feeds. Conventional grinding methods induced detrimental residual tensile stresses along the surface, resulting in cracking, lapping, and untempered martensitic structures. Low stress grinding techniques were found to be applicable to this material when proper dressing procedures and reduced rates were used. GRA

N80-32592# Mantle Engineering Co., Inc., Alexandria, Va.
AIR CUSHION CRAFT DEVELOPMENT, FIRST REVISION Final Report
Peter J. Mantle Jan. 1980 525 p refs
(AD-A084740; DTNSRDC-80/012-Rev-1) Avail: NTIS HC A22/MF A01 CSCL 13/10

The development of air cushion craft from their inception to the present day is described. Both aerostatic craft known as air cushion vehicles and surface effect ships as well as aerodynamic craft such as wing-in-ground effect vehicles are covered. The various available theories, empirical laws, and experimental data were brought together and expressed in unified form. Emphasis is given to reducing the data and analysis to their simplest forms for easy understanding and isolation of fundamental parameters. Currently operational craft, those still in their construction jigs, or in some cases those still on the drawing board are assessed and compared to the basic theories to give a measure of the state-of-the-art. Such topics as performance, propulsion, ride quality, and high speed aerodynamic craft are included. R.K.G.

N80-32593# United Technologies Corp., East Hartford, Conn.
ANALYTICAL MODELING OF THE HOT ISOSTATIC PRESSING PROCESS Final Report, 15 Jul. 1978 - 14 Jul. 1980
Brice N. Cassenti and K. J. Cheverton Jul. 1980 134 p refs
(Contract F49620-78-C-0090; AF Proj. 2307)
(AD-A088208; R80-944374-13; AFOSR-80-0592TR) Avail: NTIS HC A07/MF A01 CSCL 13/8

This report describes the results of a two-year investigation to develop a modeling strategy to predict the final shape of components manufactured by the Hot Isostatic Pressing (HIP) process. When a powder metal is subjected to the high pressures at high temperatures there is a permanent reduction in the macroscopic volume by approximately 30 percent. The volume reduction, which is not included in classical creep and plasticity theories, necessitates the modification of the classical theories. The major part of this report concerns development of a constitutive model for powder metals. A model for powder metals subjected to an external hydrostatic pressure has been developed and compares well with experimental results. The exact form of the theory for a multi-axial stress state was determined by a series of mechanical tests. The constitutive model has been incorporated into the MACR nonlinear finite element computer program and analysis of an independent experiment using the modified code has been performed and verified the accuracy of the theory. Once the theory had been verified it was applied to the HIP of a disk and a sensitivity study was performed to determine an efficient modeling strategy. The results of the program are discussed in detail. GRA

N80-32594# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
MATHEMATICAL MODEL TO CORRELATE FROST HEAVE OF PAVEMENTS WITH LABORATORY PREDICTIONS Final Report
Richard L. Berg, Gary L. Guymon, and Thaddeus C. Johnson Mar. 1980 54 p refs Sponsored by FAA
(AD-A084093; FAA-RD-79-109) Avail: NTIS HC A04/MF A01 CSCL 08/12

A mathematical model of coupled heat and moisture in soils was developed. The model includes algorithms for phase change of soil moisture and frost heave, and several types of boundary

and initial conditions are permitted. The finite element method of weighted residuals (Galerkin procedure) was chosen to simulate the spatial regime and the Crank-Nicholson method was used for the time domain portion of the model. To facilitate evaluation of the model, the heat and moisture fluxes were essentially 'decoupled'; moisture flux was then simulated accurately, as were heat flux and frost penetration. The coupled model was used to simulate frost penetration and frost heave in a laboratory test. Comparison of the simulated and experimental data illustrates the importance of unsaturated hydraulic conductivity. It is one parameter which is difficult to measure and for which only a few laboratory test results are available. Therefore, unsaturated hydraulic conductivities calculated in the computer model may be a significant source of error in calculations of frost heave.
Author

N80-32595# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
EFFECTS OF ENERGY-EFFICIENT VENTILATION RATES ON INDOOR AIR QUALITY AT AN OHIO ELEMENTARY SCHOOL
J. V. Berk, R. Young, C. D. Hollowell, I. Turiel, and J. Pepper. Apr. 1980. 68 p. refs.
(Contract W-7405-eng-48)
(LBL-10223; EEB-Vent-80-9) Avail: NTIS HC A04/MF A01

A mobile laboratory was used to monitor air outdoors and at three indoor sites (two classrooms and a large multipurpose room); tests were made at three different ventilation rates. The parameters measured were outside air flow rates, odor perception, microbial burden, particulate mass, total aldehydes, carbon dioxide, ozone, and nitrogen oxides. The results of these measurements are given and compared with the existing outdoor air quality standards. Carbon dioxide concentrations increased as the ventilation rate decreased, but still did not exceed current standards. Odor perceptability increased slightly at the lowest ventilation rate. Other pollutants showed very low concentrations, which did not change with reductions in ventilation rate. DOE

N80-32596# Los Alamos Scientific Lab., N. Mex.
MAGNETIC REFRIGERATION FOR SPACE APPLICATIONS
J. A. Barclay and W. A. Steyert. 1980. 6 p. refs. Presented at the 8th Intern. Cryog. Eng. Conf. Genoa, 3 Jun. 1980.
(Contract W-7405-eng-36)
(LA-UR-80-1566; CONF-800631-7) Avail: NTIS HC A02/MF A01

Magnetic refrigeration is briefly analyzed and thermodynamically compared to gas refrigeration. The characteristics of magnetic refrigerators with respect to spacecraft applications are discussed. High reliability coupled with high efficiency is possible. Results on several wheel and reciprocating magnetic refrigerators are summarized. DOE

N80-32597# Idaho National Engineering Lab., Idaho Falls.
EXPLOSIVE DEMOLITION OF ACTIVATED CONCRETE
D. L. Smith. 1980. 16 p. Presented at the Concrete Decontamination Workshop, Seattle, 28 May 1980.
(Contract DE-AC07-76ID-01570)
(CONF-800542-4) Avail: NTIS HC A02/MF A01

This paper describes the removal of a radiologically contaminated concrete pad. This pad was removed during 1979 by operating personnel under the direction of the Waste Management Program of EG and G Idaho, Inc. The concrete pad was the foundation for the Organic Moderated Reactor Experiment (OMRE) reactor vessel. The pad consisted of a cylindrical concrete slab 15 ft in diameter, 2 ft thick, and reinforced with steel bar. It was poured directly onto basalt rocks approximately 20 ft below grade. The entire pad contained induced radioactivity and was therefore demolished, boxed, and buried rather than being decontaminated. The pad was demolished by explosive blasting.
DOE

N80-32598# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Physics.
THERMODYNAMIC PROPERTIES OF SOLID HELIUM USING AN ANHARMONIC ANISOTROPIC CONTINUUM MODEL. Ph.D. Thesis
Terrell Dunlap Berker. 1980. 106 p. refs.
(Contract DE-AC02-76ER-01198)
(DOE/ER-01198/1314) Avail: NTIS HC A06/MF A01

An anharmonic anisotropic continuum model is used to describe the thermodynamic properties of solid helium for all three structures (hcp, fcc, and bcc) and both isotopes. Using a 6-n potential with the de Boer value for the attractive parameter, the two repulsive parameters b sub n and n are varied to obtain a best fit to experimental hcp HE4 data. The n = 11 potential gives good volume dependence over the entire experimentally accessible volume range, but too large an isotope effect. The n = 10 potential gives a better mass dependence, but a less satisfactory volume dependence. A detailed comparison of the calculations with experimental data shows that while it is possible to fit the volume dependence of the pressure, bulk modulus, and Debye temperature over a very wide range, the model overestimates the zero point contribution to the free energy. The conclusion is reached that the major discrepancies obtained result from the failure of the continuum model to take account of dispersion. This failure can be remedied by artifically endowing the continuum with dispersion. A program for the further development of the model is outlined. DOE

N80-32599# Bendix Corp., Kansas City, Mo.
METROLOGY DATA REDUCTION SYSTEM: PDP-11/34 COMPUTER SYSTEM
J. W. Cable. Apr. 1980. 48 p. refs.
(Contract DE-AC04-76DP-00613)
(BDX-613-2402) Avail: NTIS HC A03/MF A01

A PDP 11/34 computer system was installed to acquire, correct, scale, display, store, and process data obtained by microwave and dc area coupler controllers. The system is used to calibrate power sensors and impedance and dc measurement standards on a real time basis. The microwave data input is from a digital voltmeter and scanner arrangement, which also may be controlled from a P-ROM control board. The dc data input is from a passive device interface or from a terminal keyboard. DOE

N80-32600# Virginia Highway and Transportation Research Council, Charlottesville.
INVESTIGATION OF FATIGUE FAILURE IN BITUMINOUS BASE MIXES. Final Report
G. W. Maupin, Jr. Feb. 1980. 27 p. refs.
(PB80-188006; VHTRC-80-R36; FHWA/VA-80/36) Avail: NTIS HC A03/MF A01 CSCL 13D

A correlation between the results obtained with the fatigue test and those from the indirect tensile test on two base mixes was attempted in anticipation of the possible use of the latter test to design base mixes for maximum fatigue life. Two base mixes at several asphalt contents were tested at two test temperatures. Flexural fatigue tests and indirect tensile tests were performed for each mix and temperature condition. The asphalt content corresponding to the maximum fatigue life agreed generally with the asphalt content corresponding to maximum work in the indirect tensile test. The work computed from the indirect tensile test is useful in selecting the asphalt content for the maximum fatigue life of base mixes. GRA

N80-32601# Bjorksten Research Labs., Inc., Madison, Wis.
ALTERNATIVE HIGHWAY DEICING CHEMICALS. EXECUTIVE SUMMARY. Final Report, Jul. 1976 - Oct. 1979
Stanley A. Dunn and Roy U. Schenk. Mar. 1980. 20 p. refs.
(Contract DOT-FH-11-9100)
(PB80-193634; FHWA/RD-79/109) Avail: NTIS HC A02/MF A01 CSCL 13B

A search was made for road deicing chemicals to replace sodium chloride (NaCl). Two candidate deicers were found to be as effective as sodium chloride. One, methanol, reacts almost immediately upon contact with snow and ice but is less persistent than NaCl. The other calcium magnesium acetate (CMA), acts at about the same rate as NaCl in the temperature range of common activity and shows about the same persistence. It gives rise to about the same decreases in coefficients of braking traction and skidding friction as NaCl. CMA is a corrosion inhibitor, is beneficial to most soils and has no potential for harming drinking supplies. The unpurified CMA derived from solid wastes, primarily cellulose, gives improved traction and reduces production costs.
GRA

N80-32602# Purdue Univ., Lafayette, Ind. Joint Highway Research Project.
THE EFFECT OF COMPACTED PRESTRESS ON COMPACTED SHALE COMPRESSIBILITY Interim Report
G. R. Witsman and C. W. Lovell. 5 Sep. 1979. 199 p. refs. Sponsored by Indiana State Highway Commission.
(PB80-191158; JHRP-79-16; FHWA/IN/JHRP-79/16; IR-6) Avail: NTIS. HC A09/MF A01. CSCL 08M.

The compressibility of the compacted New Providence Shale was studied as a function of the compaction variables, viz., water content, compactive foot pressure, compaction effort, and compacted density. All samples were compacted in the kneading device to simulate low, standard and modified impact energy levels. All compression and/or heave was one dimensional. Compactive prestress was found to increase with compaction pressure and to decrease with compaction water content. To simulate the effects of the service environment, compacted samples were confined and saturated with measurements, of volume change. Such changes were either increases (heave) or decreases (settlement or collapse). The prediction equations developed are of the type needed to predict settlement of heaves within compacted shale embankments in service. GRA

N80-32603# Texas Transportation Inst., College Station.
PAVEMENT AND GEOMETRIC DESIGN CRITERIA FOR MINIMIZING HYDROPLANING. A TECHNICAL SUMMARY Final Report
D. M. Gallaway, G. G. Hayes, D. L. Ivey, W. B. Ledbetter, R. M. Olson, H. E. Ross, Jr., R. E. Schiller, Jr., and D. L. Woods. Dec. 1979. 111 p. refs.
(Contract DOT-FH-11-8269)
(PB80-190457; FHWA/RD-79/30) Avail: NTIS. HC A06/MF A01. CSCL 13B.

The empirical indications of hydroplaning as determined from hard data were covered. Precise measurements of surface drainage were examined, and equations relating pavement texture and cross slope and rainfall intensity were developed. Vehicle control as related to variation in cross slope was simulated with the HVOSM simulation model. A determination of the deficiencies in existing surface drainage design methodology for sag vertical curves was conducted, and innovative solutions to these problems are presented. From a detailed study of state rainfall records a method is presented for determining a design rainfall intensity. Field studies of open graded friction courses included water depths in simulated and natural rainfall, the effects of tire type, tread depth, inflation pressure, vehicle speed, and accumulated traffic. GRA

32 COMMUNICATIONS

Includes land and global communications, communications theory, and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-32604* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MULTIPLE BAND CIRCULARLY POLARIZED MICROSTRIP ANTENNA Patent
I-Ping Yu, inventor (to NASA) (Lockheed Electronics Co., Houston, Tex.) Issued 19 Aug. 1980. 7 p. Filed 22 Jun. 1979. Supersedes N79-27348 (17 - 18, p. 2393). Sponsored by NASA.
(NASA-Case-MSC-18334-1; US-Patent-4,218,682; US-Patent-Appl-SN-051270; US-Patent-Class-343-700MS; US-Patent-Class-343-830) Avail: US Patent and Trademark Office. CSCL 09C.

A multiple antenna assembly for communicating electromagnetic radiation is disclosed. An antenna element stack is constructed of a plurality of elliptical lamina antenna elements mutally separated by layers of dielectric material, and separated from a ground plane by dielectric material. The antenna assembly is coupled through a feed line in contact with the top antenna element. A conductor joins the remaining antenna elements to the ground plane. Each individual antenna element is operable for communication reception and transmission within a frequency band determined by the size of the particular antenna element. The sizes of the antenna elements may be selected to provide electromagnetic radiation communication over several distinct frequency bands, or to connect the individual bands into a broad band.

Official Gazette of the U.S. Patent and Tradmark Office.

N80-32605* National Aeronautics and Space Administration. Pasadena Office, Calif.
SUPPORT ASSEMBLY FOR CRYOGENICALLY COOLABLE LOW-NOISE CHOKE WAVEGUIDE Patent
Frank E. McCrea, inventor (to NASA) (JPL). Issued 29 Jul. 1980. 5 p. Filed 31 Aug. 1978. Supersedes N79-10246 (17 - 01, p. 0033). Sponsored by NASA.
(NASA-Case-NPO-14253-1; NASA-Case-NPO-14640-1; US-Patent-4,215,327; US-Patent-Appl-SN-938293; US-Patent-Class-333-252; US-Patent-Class-333-12; US-Patent-Class-333-99S) Avail: US Patent and Trademark Office. CSCL 09C.

A compact cryogenically coolable choked waveguide for low-noise input coupling into a cryogenically cooled device, such as a maser or parametric amplifier, utilizes coaxial stainless steel support tubes surrounding the waveguide and connected in cascade to provide a folded low thermal conduction path. The edges of the tubes connected are welded.

Official Gazette of the U.S. Patent and Trademark Office.

N80-32606 British Library Lending Div., Boston Spa (England).
TRANSMISSION OF 565 Mbit/s SIGNALS VIA COAXIAL CABLES
Helmut Bauch, Hans G. Jungmeister, and Karl Heinz Moehrmann. Jan. 1980. 14 p. refs. Transl. into ENGLISH from NTZ-Nachrtech. Z. (West Germany), v. 32, no. 9, 1979. p. 608-612.
(BLL-RDL-Trans-3793-(7737.470)) Avail: British Library Lending Div., Boston Spa, Engl.

A high bit rate transmission system which utilizes coaxial cables is described. In this installation the intermediate regenerations are operated parallel to the previously introduced repeaters of a 60 MHz CF system. The 60 MHz system on the coaxial pair 2.6/9.5 mm has a nominal repeater spacing of 1.55 km. The 60 MHz repeaters and the 565 Mbit/s intermediate regenerators can be accommodated together in the same underground container because they have the same maximum and minimum repeater spacing, temperature range and method of connection and also comparable external dimensions. The power loss of the regenerators constructed is only about 3 W per direction; this is the same as the power loss of the repeaters of the 60 MHz system, thereby allowing the same remote power feeding distance to be obtained. The underground regenerators, line terminal devices, and fault locating equipment required for the experimental system are described. M.G.

N80-32607*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MULTIBEAM SINGLE FREQUENCY SYNTHETIC APERTURE RADAR PROCESSOR FOR IMAGING SEPARATE RANGE SWATHS Patent Application
Atul Jain, inventor (to NASA) (JPL). Filed 3 Jul. 1980. 21 p. (Contract NAS7-100)
(NASA-Case-NPO-14525-2; US-Patent-Appl-SN-165910) Avail: NTIS. HC A02/MF A01. CSCL 20E.

A single-frequency multibeam synthetic aperture radar for large swath imaging is disclosed. Each beam illuminates a separate 'footprint' (i.e., range and azimuth interval). The distinct azimuth intervals for the separate beams produce a distinct Doppler frequency spectrum for each beam. After range correlation of raw data, an optical processor develops image data for the different beams by spatially separating the beams to place each beam of different Doppler frequency spectrum in a different location in the frequency plane as well as the imaging plane of the optical processor. Selection of a beam for imaging is made in the frequency plane by adjusting the position of an aperture, or in the image plane by adjusting the position of a slit. The raw data is processed in digital form in an analogous manner. NASA

N80-32608*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED COMMUNICATIONS SATELLITES

Joseph N. Sivo Washington 1980 19 p refs Presented at the Ann. Meeting of AAS and AIAA, Boston, 20-23 Oct. 1980
(NASA-TM-81599; E-585) Avail: NTIS HC A02/MF A01 CSCL 17B

The increase in demand for satellite communications services brought about shortages in available transponder capacity, especially at C-band. Interest shifted to the Ku-band frequency and currently carriers are rapidly moving to secure orbital slots for future satellite development. Projections of communications service demands over the next decade indiate growth in voice, data, and video services such that saturation of both C-band and Ku-band will occur by 1990. Emphasis must and will shift to Ka-band (20/30 GHz) frequency for fixed-satellite service. Advanced technologies such as multibeam antennas coupled with on-board satellite switching to allow implementation in this band of very high capacity satellite systems will be applied to meet the demand. Satellite system concepts that are likely in the 1990's and are likely to bring a new dimension to satellite delivered communication service are presented. The NASA 30/20 GHz communications satellite system demonstration program is discussed with emphasis on the related technology development. L.F.M.

N80-32609*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
A BOUNDS ON THE RESONANT FREQUENCY OF RECTANGULAR MICROSTRIP ANTENNAS
M. C. Bailey Sep. 1980 18 p refs
(NASA-TM-81882) Avail: NTIS HC A02/MF A01 CSCL 20M

The calculation of currents induced by a transverse electric plane wave normally incident upon an infinite strip embedded in a grounded dielectric slab is used to infer a lower bound on the resonant frequency (or resonant-E-plane dimension) for rectangular microstrip antennas. An upper bound is provided by the frequency for which the E-plane dimension is a half-wavelength. Author

N80-32610*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
A QUANTITATIVE ANALYSIS OF INTER-ISLAND TELEPHONY TRAFFIC IN THE PACIFIC BASIN REGION (PBR)
David D. Evans and Clifford H. Arth Washington Sep. 1980 20 p refs
(NASA-TM-81587; E-566) Avail: NTIS HC A02/MF A01 CSCL 17B

As part of NASA's continuing assessment of future communication satellite requirements, a study was conducted to quantitatively scope current and future telecommunication traffic demand in the South Pacific Archipelagos. This demand was then converted to equivalent satellite transponder capacities. Only inter-island telephony traffic for the Pacific Basin Region was included. The results show that if all this traffic were carried by a satellite system, one-third of a satellite transponder would be needed to satisfy the base-year (1976-1977) requirement and about two-thirds of a satellite transponder would be needed to satisfy the forecasted 1985 requirement. Author

N80-32611# Indian Space Research Organization, Bangalore.
SATELLITE INSTRUCTIONAL TELEVISION EXPERIMENT. TELEVISION COMES TO VILLAGE: AN EVALUATION OF SITE
Binod C. Agrawal Oct. 1978 107 p refs
(ISRO-SAC-TR-09-78) Avail: NTIS HC A06/MF A01

The process of existing rural communication was studied. The role of TV as a new medium of communication in SITE instructional areas and the process of change brought about by TV in the rural structure at microlevel are discussed. Methods and techniques followed for this study are described. Cultural profiles of the villages under the study are presented in a comparative perspective. The reception of TV in the villages and the characteristics of the viewers and their program preference are described. The impact of TV on school children and teachers is also analyzed. R.K.G.

N80-32612*# Texas Univ. at Austin. Electrical Engineering Research Lab.
CTS ATTENUATION AND CROSS POLARIZATION MEASUREMENTS AT 11.7 GHz Final Report, 16 Jun. 1976 - 30 Jun. 1979
W. J. Vogel Jun. 1980 32 p refs
(Contract NAS5-22576)
(NASA-CR-160025) Avail: NTIS HC A03/MF A01 CSCL 20N

The long-term attenuation, cross-polarization, and rain-rate data monitored in Austin, Texas from the circularly polarized 11.7 GHz satellite beacon transmitter aboard the Communications Technology Satellite are analyzed. Data events are significantly more likely during April-September, than during October-March, except for ice deplorization which predominates during the winter months. A time of day dependence of the events is also noted. The 10 dB fade level is exceeded for .03% during the thunderstorm months. Isolation with the same probability is 23 dB. M.G.

N80-32613# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council for Scientific and Technical Research.
DIFFRACTION OF A CASSEGRAIN ANTENNA SUBREFLECTOR [DIFRACAO DO SUB-REFLETOR DE UMA ANTENA TIPO CASSEGRAIN]
Carlos Alberto I. Miranda, Lucio Baptista T. Cividanes, and Carlos Eduardo Santana Jul. 1980 28 p refs In PORTUGUESE; ENGLISH summary
(INPE-1827-RPE/193) Avail: NTIS HC A03/MF A01

A solution for the field scattered by an axially symmetric subreflector, in the far field and near field regions, derived utilizing the induced current method. The formulation was applied to two subreflectors to investigate the effects of different peripheral illumination levels in the radiation pattern. For one of the subreflectors, the results of the near field and far field were compared. The conclusions presented are important in the design of Cassegrain antennas with gain optimization. T.M.

N80-32614# Harry Diamond Labs., Adelphi, Md.
APPROXIMATE CALCULATIONS OF RADIATION-INDUCED CURRENTS
Raine M. Gilbert May 1980 15 p refs Sponsored by the Defense Nuclear Agency
(AD-A087893; HDL-TM-80-2) Avail: NTIS HC A02/MF A01 CSCL 20/8

A simple procedure for calculating approximate values of radiation-induced currents is discussed. The procedure is intended for those who require only first-order estimates of such currents or who have neither time nor access to computer facilities for a more precise treatment. An example is given to illustrate the method. GRA

N80-32615# California Univ., San Diego, La Jolla Dept. of Electrical Engineering and Computer Sciences.
THE RECONSTRUCTION OF ANALOG SIGNALS FROM THE SIGN OF THEIR NOISY SAMPLES
Elias Masry 1 Aug. 1980 38 p refs
(Contract N00014-75-C-0652)
(AD-A087650) Avail: NTIS HC A03/MF A01 CSCL 09/3

The reconstruction of continuous-time signals s(t) from the sign of their (deliberately) contaminated samples is considered. Sequential, generally nonlinear estimates of s(t) are established and their performance is studied; error bounds and convergence rates are derived. The signal s(t) need not be bandlimited. The convergence rates obtained here are faster than those obtained for nonsequential estimates. The degradation in the reconstruction of the signal, due to transmission over an arbitrary noisy channel, is also investigated and bounds on the additional error are obtained. GRA

N80-32616# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
LOW SIDELOBE S-BAND LINE SOURCE ARRAY Interim Report
Gary E. Evans and William F. Hoover, Jr. Griffiss AFB, N.Y. RADC Mar. 1980 138 p
(Contract F19628-78-C-0151; AF Proj. 4600)
(AD-A087651; RADC-TR-79-338) Avail: NTIS HC A07/MF A01 CSCL 17/9

This report deals with the study and fabrication of a low

sidelobe, S-band linear dipole array. The specific design of this line source makes it directly applicable to a full size planar array for use in a high power, high efficiency, low sidelobe, tactical radar. Electrical and mechanical design details are discussed, including development of wideband, high isolation couplers, development of a crossed dipole radiator, the use of air dielectric stripline as a transmission medium, considerations regarding the corporate fed power divider, grating lobe considerations, size and weight budgets, and tactical constraints. Sources of both correlated and uncorrelated errors have been identified. A computer program is discussed which uses this error information to calculate statistically the azimuth patterns for the line source and for an array of N line sources. An error and tolerance budget has been determined that assures the array sidelobes to be below the -35, -38, -41, and -50dB level (first, second, third, and wide angle lobes, respectively. GRA

N80-32617# Army Missile Research and Development Command, Redstone Arsenal, Ala. Research Directorate.
PROCEEDINGS OF THE WORKSHOP ON MILLIMETER AND SUBMILLIMETER ATMOSPHERIC PROPAGATION APPLICABLE TO RADAR AND MISSILE SYSTEMS
Oskar M. Essenwanger, ed. and Dorothy A. Stewart, ed. Feb. 1980 187 p refs Workshop held 20-22 Mar. 1979, Redstone Arsenal, Ala.
(AD-A087754; AD-E950010; DRSMI-RR-80-3-TR) Avail: NTIS HC A09/MF A01 CSCL 20/14

A workshop on millimeter and submillimeter wave propagation through the atmosphere was held on 20-22 March 1979 at Redstone Arsenal, Alabama. This workshop served as a forum where scientists in diversified fields exchanged information on the latest results and discussed controversial issues and unresolved problems. The first few papers were concerned with MICOM needs. They specified the operating regions of interest for tactical applications and explained the rationale for the selection of these regions. The Terminal Homing Measurements program was described. Several papers discussed absorption by water vapor. Classical theories do not adequately describe the measured absorption in window regions between strong absorption lines. Alternate methods of explaining the discrepancies are to introduce reasonable modifications to existing models of line shapes or to consider the effect of water vapor dimers. Other effects on atmospheric propagation and instrumentation for measuring these effects were also discussed. Absorption and scattering by hydrometeors, dust and smoke were considered. Additional papers were concerned with terrain effects, turbulence, natural atmospheric emissions, refractivity gradients, and the relatively new method of pulse generation by swept-gain superradiance. GRA

N80-32618# Rome Air Development Center, Griffiss AFB, N.Y.
MULTIPATH PROPAGATION OVER SNOW AT MILLIMETER WAVELENGTHS
Uve H. W. Lammers and Dallas T. Hayes Feb. 1980 45 p refs
(AF Proj. 4600)
(AD-A087747; RADC-TR-80-54) Avail: NTIS HC A03/MF A01 CSCL 20/14

A series of multipath measurements over snow were conducted at Hanscom AFB during the winter 1978/1979. Data were obtained over a path-length of 179.5 m at frequencies of 35, 98, and 140 GHz. The gently rolling grass-covered terrain showed maximum height differences of 0.8 m. Snow covers included freshly fallen snow, old metamorphic snow, and sleet. The equipment consisted of CW transmitters at 2 m height and receivers mounted on a vertical positioner to measure the height-gain pattern of the received signal between 0.2 and 4 m height. Grazing angles for this geometry range between 0.5 and 2 degrees. Measured interference patterns between direct and terrain-reflected rays were generally coherent in appearance and exhibited cancellation depths of 20 dB and lower, depending on the type of snow cover. A computer program was developed in order to model the reflection as a specular process, with the underlying terrain represented by a series of linear sloping segments, derived from actual terrain height measurements. With appropriate transitions between the linear segments and reflection coefficients calculated from relevant snow parameters, calculated and measured height-gain patterns display quite similar qualities. GRA

N80-32619# Rome Air Development Center, Griffiss AFB, N.Y.
STATISTICAL CHARACTERIZATION OF ROUGH TERRAIN
John F. Lennon and Robert J. Papa Feb. 1980 43 p refs
(AF Proj. 2305)
(AD-A087746; RADC-TR-80-9) Avail: NTIS HC A03/MF A01 CSCL 20/14

A technique is presented to statistically characterize rough terrain surfaces. The approach is described in terms of a specific example but in principle is quite general and can be adapted to fit any number of situations. The starting point is the use of observed surface height data to generate statistical parameters for probability density functions (PDF) that potentially characterize the data. This involves the use of parameter estimation techniques. The estimated parameters are then used in an hypothesis test to determine the best PDF for the given data. The accuracy of the analysis depends on the available data, the estimators employed, and the determination of appropriate PDF's. The example consists of a large number of terrain regions in an area of eastern Massachusetts. Experimental data in the form of electromagnetic scattering from the surface are available for this site. Because of the number of cases involved, the complexity of the multivariate height distributions, and the type of measurements available, only a single observation of the multivariate data is used in the present analysis. Techniques to improve the parameter estimation are being pursued. The results of the statistical analysis in terms of mean height, variance, correlation, PDF, and a geologic feature characterizing each subregion are presented. These will be used in an electromagnetic scattering formulation to allow comparison with the experimental data. Once agreement is reached, other areas of interest can then be analyzed in a similar fashion. GRA

N80-32620# Semcor, Inc., Moorestown, N. J.
MILLIMETER WAVE RADAR SYSTEM CONCEPT STUDY, PHASE 1 Final Report, 1977 - 1978
Greg. Mansfield, Dan Lillie, and C. Shor Dover, N.J. ARRADCOM Aug. 1980 71 p
(Contract DAAK10-77-M-5014)
(AD-A087767; AD-E400454; ARSCD-CR-80012) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report represents the first phase of a three-phase concept study that is intended to produce a 'paper' design of a radar system capable of tracking low-flying subsonic aircraft at millimeter wave frequencies. GRA

N80-32621# Decision-Science Applications, Inc., Arlington, Va.
DEVELOPMENT AND EVALUATION OF AN EMISSIONS CONTROL DECISION AID Interim Report, Jul. 1978 - Jul. 1979
David F. Noble, George F. Pugh, James E. Densmore, Jr., and Max T. Nunenkamp Jul. 1980 156 p refs
(Contract N00014-77-C-0322)
(AD-A087358; DSA-246) Avail: NTIS HC A08/MF A01 CSCL 17/9

The DSA emissions control decision aid assists with the design and evaluation of mission control plans. As part of the Office of Naval Research operational decision aiding program, the aid was formally evaluated in tests conducted by an independent ONR consultant. This report describes modifications to the aid, preparation of user's manuals for test subjects, and development of scenarios for the test program. Aid improvements occurred primarily in response to suggestions during briefings, and suggest general principles of display design. The process for scenario development described here insured a set of test scenarios appropriate for an evaluation program. The user's manuals, included in the appendices describe how to use the aid to prepare EMCON plans. GRA

N80-32622# Republic Electronic Industries Corp., Melville, N.Y.
MULTIPLE THREAT GENERATOR (MTG-100) Final Technical Report, 1 Sep. 1978 - 11 Dec. 1979
J. Michaels May 1980 89 p refs
(Contract F30602-78-C-0229; AF Proj. 4506)
(AD-A087477; RADC-TR-80-151) Avail: NTIS HC A05/MF A01 CSCL 17/9

This technical report describes the Multiple Threat Generator (MTG-100) designed, developed, fabricated, installed and tested at Rome Air Development Center, by Republic Electronic

Industries Corp. The report describes the purpose of the equipment, and gives a functional description with a technical overview of both the hardware and software. Included in the report is an operational and maintenance procedure for the Multiple Threat Generator. GRA

N80-32623# ITT Defense Communications Div., Nutley, N.J.
SOLID STATE AUDIO/SPEECH PROCESSOR ANALYSIS Final Technical Report, 28 Sep. 1978 - 7 Dec. 1979
A. Richard Smith, B. Patrick Landell, and George Vensko Mar. 1980 99 p refs
(Contract F30602-78-C-0359; AF Proj. 4594)
(AD-A084743; RADC-TR-80-75) Avail: NTIS
HC A05/MF A01 CSCL 09/2

The progress made in evaluating the feasibility of applying charge coupled devices (CCD's) as well as microprocessors to reduce the cost and complexity of automatic speech recognition (ASR) systems are discussed. Experiments were conducted to measure the speed versus accuracy tradeoffs of four speed up techniques. The techniques were demonstrated to be worthwhile in an efficient realtime automatic word recognition (AWR) system. Microprocessor architectures were designed to implement the realtime AWR system and then evaluated in terms of cost and complexity using three different microprocessors: the 8 bit Intel 8085A; the 16 bit Motorola MC68000; and a 16 bit configuration of the AMD 2901A. Of the three, the AMD 2901A proved preferable from both a cost and a performance standpoint. Hardware cost projections for an AWR system featuring an AMD 2901A architecture and a bandpass filter CCD analyzer indicate that the hardware components for such a system should range between $1,500 for a 52 word vocabulary, to about $12,700 for a 780 word vocabulary. R.C.T.

N80-32624# Army Materiel Development and Readiness Command, Alexandria, Va. Countermeasures/Counter-Countermeasures Office.
A COMPUTER PROGRAM TO ANALYZE SPREAD-SPECTRUM SYSTEM PERFORMANCE
Hal R. Harrelson Dec. 1979 75 p refs
(DA Proj. 1S4-63749-D-462)
(AD-A084179; CM/CCM-79-5) Avail: NTIS
HC A04/MF A01 CSCL 17/4

A computer program was developed which analyzes and compares the performance of certain types of frequency hopping and psuedonoise (sometimes called direct sequence) spreadspectrum communication systems in the presence of hostile jamming. The program computes the probability of bit or word error as a function of the communication signal parameters (spectrum spreading methods, error-correcting coding, data modulation, bandwidth, etc) and the jamming parameters (jamming modulation, power, bandwidth). The output consists mainly of plots of error probability as a function of one or more of these parameters selected by the user. The plots are produced on an interactive computer graphics terminals, providing rapidly produced results and high user-computer interaction. GRA

N80-32625# SRI International Corp., Menlo Park, Calif.
DICE THROW UHF/SHF TRANSMISSION EXPERIMENT. VOLUME 3: FINAL DATA REDUCTION AND INTERPRETATION Progress Report, 16 Nov. 1976 - 19 Mar. 1979
Alan A. Burns and Patricia L. Crawley 1 Aug. 1979 142 p refs
(Contract DNA001-75-C-0206; SRI Proj. 3972)
(AD-A085760; DNA-4216T-3) Avail: NTIS HC A07/MF A01 CSCL 20/14

The final results from a radio frequency (rf) propagation experiment are presented. The experiment was designed to measure the effects of high-density, explosively produced dust clouds on a series of coherent signals ranging in frequency from 400 MHz to 10 GHz. Both amplitude and phase data were obtained. The observed rf results were found to be consistent with the behavior expected from theoretical considerations and dust densities obtained from a simple model based on material missing from the water and measured cloud volume. Because of the relatively small volume of space affected, rf effects were generally mild, unless a threshold combination of the dust density and the particle size distribution parameter were exceeded. Once the threshold was crossed, extinction coefficients rose to as much as several tens of decibels per kilometer. This was accompanied by the complete loss of a coherent signal component, strong fading, and the apparent onset of multiple scattering. T.M.

N80-32626# IIT Research Inst., Annapolis, Md.
TERRAIN SCATTER PARAMETER MODEL Phase Report, Oct. 1978 - Aug. 1979
J. T. Cochrane, Jr. Griffiss AFB, N.Y. RADC Feb. 1980 23 p ref
(Contract F19628-78-C-0006)
(AD-A084248; RADC-TR-80-11) Avail: NTIS
HC A02/MF A01 CSCL 09/2

The development of computer programs to analyze multipath signals associated with the terrain over which a target aircraft is flying is addressed. The statistical characterization of terrain used as input to the calculation of the diffuse and specular reflections appropriate to the surface features in the vicinity of the radar is discussed. Author

N80-32627# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
ELECTROMAGNETIC FIELDS INDUCED BY OCEAN CURRENTS Final Report, Jan. 1977 - Dec. 1978
Wasyl Wasylkiwsky Jul. 1979 297 p refs
(Contract MDA903-79-C-0202)
(AD-A085727; IDA-P-1399; IDA/HQ-79-21012) Avail: NTIS
HC A13/MF A01 CSCL 17/6

A comprehensive account of analytical results for computing electromagnetic fields that are induced by ocean sea water as a result of its motion relative to the geomagnetic field is provided. Emphasis is on the characterization of magnetic field and magnetic field gradient environment. The theoretical results are formulated so as to be directly applicable to the computation of sea water generated magnetic noise and to the assessment of its deletrious effects on the sensitivity of magnetic sensors employed for magnetic anomaly detection over an open ocean. Magnetic field component and gradient spectra are computed both for stationary and moving observation platforms. Author

N80-32628# Naval Postgraduate School, Monterey, Calif.
TWO DIMENSIONAL MATCHED FILTERING FOR ATTITUDE MEASUREMENT WITH APPLICATIONS TO TARGET TRACKING M.S. Thesis
Robert Howard Williams Mar. 1980 104 p refs
(AD-A084413) Avail: NTIS HC A06/MF A01 CSCL 17/9

An application of two dimensional Fourier Transform correlation for the attitude measurement of three dimensional objects is considered. Geometric optical equations and geometric translation and rotation equations necessary for the image error calculations are included. Minimum attitude resolution equations are developed to estimate image quantization necessary for given measurement error. These techniques are then applied as an additional measurement to the radar tracking problem. Author

N80-32629# Utah Univ., Salt Lake City. Dept. of Computer Science.
NOISE SUPPRESSION METHODS FOR ROBUST SPEECH PROCESSING Semiannual Technical Report, 1 Oct. 1979 - 31 Mar. 1980
Steven F. Boll, H. Ravindra, G. Randall, R. Armantrout, and R. Power May 1980 38 p refs
(Contract N00173-79-C-0045; ARPA Order 3301)
(AD-A085667; UTEC-CSC-80-058) Avail: NTIS
HC A03/MF A01 CSCL 17/2

Robust speech processing in practical operating environments requires effective environmental and processor noise suppression. This report describes the technical findings and accomplishments during this reporting period for the research program funded to develop real time, compressed speech analysis synthesis algorithms whose performance in invariant under signal contamination. Fulfillment of this requirement is necessary to insure reliable secure compressed speech transmission within realistic military command and control environments. Overall contributions resulting from this research program include the understanding of how environmental noise degrades narrow band, coded speech, development of appropriate real time noise suppression algorithms, and development of speech parameter identification methods that consider signal contamination as a fundamental element in the

estimation process. This report describes the current research and results in the areas of noise suppression using the dual input adaptive noise cancellation using the short time Fourier transform algorithms, articulation rate change techniques, and a description of an experiment which demonstrated that the spectral subtraction noise suppression algorithm can improve the intelligibility of 2400 bps, LPC 10 coded, helicopter speech by 10.6 point. GRA

N80-32630# Hughes Aircraft Co., El Segundo, Calif. Radar Systems Group.
TARGET IDENTIFICATION USING RADAR IMAGERY AND MOMENT METHODS Final Report, Sep. 1979 - Jun. 1980
George A. Ioannidis and Charles B. Dolan. Jun. 1980. 156 p. refs.
(Contract N00014-79-C-0643)
(AD-A088514; HAC-FR-80-23-919R; HAC-REF-E5599) Avail: NTIS. HC A08/MF A01. CSCL 17/9

In the past, most radar target recognition techniques have concentrated on the use of one dimensionsal target signatures. However, the development of the Synthetic Aperture Radar (SAR) and the recent development of the Inverse Synthetic Aperture (ISAR) technologies have made it possible to obtain radar images of targets and thus allow the use of two dimensional pattern classification schemes for automatic radar target recognition. One such two dimensional shape recognition scheme is a technique known as the method of moments, which has been successfully applied to the recognition of objects imaged in the visible and infrared spectrum. The images used in this investigation were generated by the application of the ISAR technique to turntable radar data and also data obtained from flying aircraft targets. GRA

N80-32631# Calspan Advanced Technology Center, Buffalo, N.Y.
DERIVATION OF NARROWBAND FREQUENCY-AGILE RADAR SIGNATURES FROM WIDEBAND DATA ANALYSIS OF X-BAND DATA Final Report, 7 Sep. 1978 - 7 Mar. 1979
B. H. Mohlke, R. A. Padgug, C. M. Szczesny, and P. M. McMahon. Nov. 1979. 49 p.
(Contract F33615-78-C-1617; AF Proj. 2136)
(AD-A088376; AFAL-TR-79-118723; CALSPAN-6384-S-2) Avail: NTIS. HC A03/MF A01. CSCL 17/9

This investigation demonstrated theoretically and experimentally that frequency-agile narrowband radar signatures can be derived from wideband data. The experimental work used X-band satellite data from Lincoln Laboratory's Long Range Imaging Radar (Haystack). The computer programs required for deriving narrowband signatures from two dimensional radar images were delivered to AFAL with this report. GRA

N80-32632# Weapons Systems Research Lab., Adelaide (Australia).
AN ITERATIVE APPROACH TO THE DECONVOLUTION OF THE NARROWBAND OUTPUTS OF A CONVENTIONAL BEAMFORMER
D. A. Gray. Feb. 1980. 31 p. refs.
(AD-A088276; WSRL-0141-TR) Avail: NTIS. HC A03/MF A01. CSCL 20/14

In conventional beamforming the estimated noise power wave number spectrum is the convolution of the incident distribution with the array response. By removing the effect of the array response an improved estimate of the incident wave-number spectrum may be obtained. In particular the method of progressive substitutions has been widely used to deconvolve array window. By assuming all the incident signals to be a linear super-position of a finite number of plane waves this method is extended to deconvolve the narrowband beam outputs of a conventional beamformer. Two methods are used, the first to deconvolve the complex beam amplitudes and the second to deconvolve the beam powers. The convergence of these proposed interactive solutions is proved and the relationship of the limits to some recently proposed quadratic estimators is shown. GRA

N80-32633# Naval Research Lab., Washington, D. C.
COMPUTATIONS OF THE RADIATION PATTERN OF A REFLECTOR ANTENNA Interim Report
J. K. Hsiao. 26 Aug. 1980. 19 p. refs.
(WF34372000)
(AD-A088273; NRL-MR-4325) Avail: NTIS. HC A02/MF A01. CSCL 20/14

This report describes a mathematical approach to compute the radiation pattern of a reflector antenna. The radiation integral is expanded into an orthogonal series in terms of a field point coordinate. Since this series is orthogonal, coefficients of this series can be easily determined. Once these coefficients are known, radiation patterns at any field point can be readily computed. Since this approach avoids performing the integration of the radiation integral at each field point, it greatly reduces the required computation. A brief description of the computer program is also included in this report. GRA

N80-32634# Naval Research Lab., Washington, D. C. Radar Div.
PRESENT AND FUTURE TRENDS IN SIGNAL PROCESSING TECHNOLOGIES Interim Report
Peter N. Marinos. 11 Aug. 1980. 32 p. refs.
(AD-A088085; NRL-MR-4299) Avail: NTIS. HC A03/MF A01. CSCL 17/9

This report provides a quick overview of various signal processing technologies and evaluates their impact on modern radar design in the 1980's. Although primary emphasis is placed on conventional solid-state technologies, a serious effort has been made to review more exotic physical phenomena and related technologies which have attracted, recently, a great deal of interest and are no longer viewed as scientific curiosities. The latter group includes surface acoustic waves (SAW), charge-coupled devices (CCD), magnetic bubble memories (MBM), Josephson junction (JJ) devices, and acousto-optics. GRA

N80-32635# Air Force Medical Center, Wright-Patterson AFB, Ohio.
VOICE COMMUNICATION RESEARCH EVALUATION SYSTEM
Richard L. McKinley. May 1980. 17 p. refs.
(AF Proj. 7231)
(AD-A088100; AFAMRL-TR-80-25) Avail: NTIS. HC A02/MF A01. CSCL 17/2

Aircraft voice communications may be degraded by a variety of sources such as electrical and/or acoustical noise, radio interference, jamming and various other forms of distraction. The Voice Communication Research and Evaluation System, located in the Biodynamics and Bioengineering Division of the Aerospace Medical Research Laboratory, has been developed for the comprehensive analysis and enhancement of operational voice communication. The basic system is comprised of a multi-station voice communication network consisting of the USAF standard aircraft intercommunication system, a standard A-19 diluter-demand oxygen regulation system and an on line computer data collection and data analysis system that displays results in real time. The system is housed in a large reverberation chamber containing a programmable sound source capable of reproducing the spectrum and level of any AF operational noise environment. Standardized voice communication effectiveness test materials are used to assess the performance of any aspect of the total voice communication link, however, emphasis is usually placed upon the performance of the aircrew members. This paper will descibe the salient features of this unique system and provide examples of its application to voice communication problems. GRA

N80-32636# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Metals and Ceramics Div.
ELASTIC WAVE PROPAGATION THROUGH MULTILAYERED MEDIA Final Report, 1 May - 1 Oct. 1979
Dale E. Chimenti and Robert L. Crane. Mar. 1980. 69 p. refs.
(AF Proj. 2418)
(AD-A088030; AFML-TR-79-4214) Avail: NTIS. HC A04/MF A01. CSCL 20/11

This report presents a review of the theory of elastic wave propagation in any number of fluid or solid layered media. Suitable wave equations are derived, and boundary conditions determined by the nature of the media and the character of the interfaces are applied, yielding a formal solution for the transmitted and reflected, longitudinal and transverse wave potentials. Computer-

generated graphs are presented which illustrate properties of the solutions in materials of interest in nondestructive evaluation. A tabulation of acoustic-velocity data for media commonly encountered in ultrasonic work is also included. GRA

N80-32637# Naval Research Lab., Washington, D. C.
A STUDY OF POWER AND ENERGY IN THE AURORA MODIFICATION PROJECT Final Report
John D. Shipman, Jr. 23 Jul. 1980 28 p
(AD-A088051; NRL-MR-4281) Avail: NTIS
HC A03/MF A01 CSCL 20/3

This report summarizes the results of a series of computer runs at NRL which were designed to determine if the measured loss of power and energy in the Aurora Modification Project tests in the Fall of 1978 was due to increasing capacitance in the water switches during the transit times of the streamers or was due to resistive losses in the water switches. From the results of these analyses, it is concluded that the losses were mainly due to resistance in the intermediate store and pulse forming liner output switches and that the changing switch capacitance mainly rounded the pulse shapes near the peak values without contributing to a major loss of energy. It is suggested that oil switches be considered as a replacement for the water switches since they have less loss, although there are risks and problems involved in their use. GRA

N80-32638# Naval Research Lab., Washington, D. C. Communications Sciences Div.
EXPERIMENTAL MEASUREMENTS OF AMBIENT ELECTROMAGNETIC NOISE FROM 1.0 TO 4.0 kHz Final Report
Robert J. Dirger, William D. Meyers, and John R. Davis 31 Jul. 1980 64 p refs
(RR0210141)
(AD-A088090; NRL-8413) Avail: NTIS HC A04/MF A01 CSCL 04/1

The spectral noise density, amplitude probability distribution (APD), and spectral content of ambient noise from 1.0 to 4.0 kHz were measured. Analysis of the recorded data included detailed investigation of the diurnal variation of the noise, comparison of the APDs with two atmospheric noise models, time domain excision of noise impulses to assess the reduction in noise achievable by nonlinear processing, investigation of broadband ionospheric emissions identified as polar chorus, and determination of the statistical variation (in frequency) of the spectral minimum near 3 kHz. The analysis of the diurnal variation suggested the existence of a large propagation anisotropy in the nighttime Earth ionosphere waveguide at 3 kHz, with east to west attenuation significantly lower than north-south attentuation. The observed seasonal and geographical averaged diurnal variations can be interpreted qualitatively in terms of worldwide thunderstorm distributions and day-night changes in the reflecting height of the ionospheric D-layer. The measured spectral noise density values are significantly lower than values measured under similar conditions by earlier investigations; the lower values are attributed to the use of a receiver with a lower intrinsic noise and careful site selection to avoid man made interference. The recorded APDs varied from a Rayleigh form during low noise periods in Norway to a distribtution with a tail at low exceedence values during higher noise periods in both Norway and Italy. Comparison of the APDs with the Field-Lewenstein model and the Middleton model generally showed satisfactory agreement. GRA

N80-32639# Rome Air Development Center, Griffiss AFB, N.Y.
A PARABOLIC CYLINDER REFLECTOR SYSTEM WITH LOW SIDELOBES: EXPERIMENTAL RESULTS Final Report
Peter R. Franchi, Nicholas P. Kerweis, and Lance F. Dennett Nov. 1979 22 p ref
(AF Proj. 4600)
(AD-A088202; RADC-TR-79-312) Avail: NTIS
HC A02/MF A01 CSCL 17/9

An off-set parabolic cylinder reflector system with low sidelobes is described, and experimental results are presented to substantiate the theoretical design. A reduced height waveguide primary feed system superimposing the TE(10) and TE(30) waveguide modes was designed, fabricated, and tested so that the required bandwidth and far field radiation patterns could be realized. GRA

N80-32640# Naval Ocean Systems Center, San Diego, Calif.
SATELLITE SENSING OF THE SOLAR-TERRESTRIAL ENVIRONMENT AND REAL-TIME RADIO PROPAGATION FORECASTING. LESSONS LEARNED FROM PROPHET. VOLUME 1: EXECUTIVE SUMMARY Final Report, 1972 - 1979
R. B. Rose (NOSC, San Diego, Calif.) and P. H. Levine 30 Sep. 1979 50 p refs
(Contract N00123-78-C-0043)
(AD-A088170; NOSC/TR-487-Vol-1) Avail: NTIS
HC A03/MF A01 CSCL 20/14

PROPHET denotes a class of radio propagation forecast terminals which represent the culmination of an 11 year development effort at the Naval Ocean Systems Center (NOSC) under the SOLRAD satellite program. The system is unique in that it provides a real-time link between Navy operations personnel and a worldwide network of ground-based and satellite-borne solar-terrestrial environment monitors. This link is used to generate - via distributed data processing - electromagnetic system performance predictions in formats specially tailored to meet the operational requirements of the user. An initial implementation of PROPHET has provided - over a 3 year period - highly successful hf frequency/antenna management support to the Technical Control Facility of the Naval Communication Station at Stockton, CA. This executive summary provides a concise overview of the evolution, structure, function, and accomplishments of PROPHET, together with recommendations for ways in which the PROPHET technology can be applied to recognized operational requirements fo the Navy. Technical details are elaborated in volume 2. GRA

N80-32641# M&S Computing, Inc., Huntsville, Ala.
INFORMATION ANALYSIS OF DYNAMICAL RADAR PARAMETERS
H. Vincent Poor 1 Apr. 1980 23 p refs
(Contract DAAK40-79-D-0018)
(AD-A088195; Rept-80-036; DRSMI-RE-CR-80-12) Avail: NTIS HC A02/MF A01 CSCL 17/9

This report examines the extension of the classical information analysis of radar systems to more general situations arising in modern radar practice. In particular, the introduction of dynamics into parameter modeling is considered in an information theoretical context. Such a treatment is motivated by the need to consider parameter dynamics in discrimination-mode radar signal processor design. Expected applications of the proposed techniques include development of theoretical performance limitations which can be used as benchmarks to which the performance of practical systems can be compared. GRA

N80-32642# Illinois Univ. at Urbana-Champaign, Urbana. Electromagnetics Lab.
RADIATION FROM AN OPEN-ENDED WAVEGUIDE WITH BEAM EQUALIZER. A SPECTRAL DOMAIN ANALYSIS
W. L. Ko, R. Mittra, and S. W. Lee Jul. 1980 38 p refs
(Contract N00014-75-C-0293)
(AD-A088179; UIEM-80-6; UILU-ENG-80-2547) Avail: NTIS
HC A03/MF A01 CSCL 20/14

A septum and an impedance matching post are used as a beam equalizer in an open-ended waveguide-feed for reflectors used in satellite communications systems. The performance of this design over a frequency band is evaluated using a spectral domain approach. The computed radiation patterns in the E- and H-planes, as well as the results for the impedance match, are presented. GRA

N80-32643# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN ANALYSIS OF FOLIAGE EFFECTS ON LONG-RANGE SURVEILLANCE
Donna L. Hogan 23 Apr. 1980 55 p refs
(Contract F19628-80-C-0002; AF Proj. 2217)
(AD-A088163; TN-1980-9; ESD-TR-80-29) Avail: NTIS
HC A04/MF A01 CSCL 17/9

Visibility is one of the key factors in determining the outcome of battles. With the advent of long range, moving target, air to ground surveillance radars, the motion of both the observing platform and the target have added to the visibility problem, which heretofore was analyzed in terms of shielding. The interaction of such factors as the minimum detectable velocity

of the target, the trajectories of the target and the airborne radar platform, and the terrain and foliage masking combine to control the amount of time which a target is observed in a given scenario. This report continues the work done on dynamic masking, compares the masking calculation with and without foliage on a typical super highway in New England, and finally examines the correlation between predicted and observed foliage and terrain masking. The work was done in connection with the test and evaluation of the Multiple Antenna Surveillance Radar (MASR), a scaled model of a long range moving target surveillance system. MASR operated at L-band with a beamwidth of approximately 4.5 deg. In typical flight operation it observed the target complex from a range of 25 to 40 km. The altitude was selected to give lookdown angles ranging from 3 deg to 6 deg. GRA

N80-32644# SRI International Corp., Menlo Park, Calif.
OPERATION OF THE PAVE PAWS RADAR SYSTEM AT BEALE AIR FORCE BASE, CALIFORNIA. PART 1: BASIC EIS APPENDICES Final Environmental Impact Statement
Jul. 1980 496 p refs
(Contract F08635-76-D-0132)
(AD-A088320; AFSC-TR-80-09) Avail: NTIS
HC A21/MF A01 CSCL 17/9

The document is the Final Environmental Impact Statement on the operation of the Pave Paws Radar System at Beale Air Force Base California. GRA

N80-32645# SRI International Corp., Menlo Park, Calif.
OPERATION OF THE PAVE PAWS RADAR SYSTEM AT BEALE AIR FORCE BASE, CALIFORNIA. PART 2. PUBLIC COMMENT AND AIR FORCE RESPONSE Final Environmental Impact Statement
Jul. 1980 192 p
(Contract F08635-76-D-0132)
(AD-A088321; AFSC-TR-80-10) Avail: NTIS
HC A09/MF A01 CSCL 17/9

This document presents the public comment and Air Force response to the Final Environmental Impact Statement on the Operation of the Pave Paws Radar System at Beale Air Force Base California. GRA

N80-32646# National Academy of Sciences - National Research Council, Washington, D. C. Engineering Panel on the PAVE PAWS Radar System.
RADIATION INTENSITY OF THE PAVE PAWS RADAR SYSTEM
1979 50 p refs
(Contract F49620-78-C-0118)
(AD-A088323; AFSC-TR-80-12) Avail: NTIS
HC A03/MF A01 CSCL 17/9

In May 1978, when the U.S. Air Force requested the National Research Council to assess certain aspects of its newest missile defense warning system then under construction at the Otis Air Force Base on Cape Cod, Massachusetts, the facility was the subject of intense public concern that exposure to its radiation emissions might be harmful to humans. The purpose of the radar facility, known as PAVE PAWS (PAVE being a code word for the Air Force unit in charge of the project PAWS, an acronym for Phased Array Warning System) is to detect and track ballistic missiles launched at sea as far as 3,000 nautical miles from U.S. shores. In order to discern ballistic missiles early in their trajectory, it operates at an angle as low as 3 degrees above the horizon. Its long range capacity is achieved by a fairly high average power level of 145kW. The Research Council's initial response was to establish two separate panels to examine the facility--one, the Engineering Panel on the PAVE PAWS Radar System, under the Assembly of Engineering, and the other the Panel on the Extent of Radiation from the PAVE PAWS Radar System Assembly of Life Sciences. This is the report of the Engineering Panel. The report of the second panel, consisting of an analysis of the exposure levels and potential biological effects of PAVE PAWS, will be published separately. GRA

N80-32647# Sandia Labs., Albuquerque, N. Mex. Applied Biology and Isotope Utilization Div.
ANALYSIS OF A FINITE LENGTH TUBULAR MONOPOLE ANTENNA DRIVEN BY A COAXIAL LINE
Marvin E. Morris May 1980 44 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-1557) Avail: NTIS HC A03/MF A01

The problem of a coaxially-driven, finite length tubular monopole antenna over an infinite ground plane is formulated as a rigorous boundary value problem. The resulting coupled pair of singular integral equations is numerically solved for the electric field in the end of the coaxial line and for total current on the antenna. The electric field is used to compute the admittance of the antenna. The admittance, electric field, and current are presented for a wide range of experimentally useful parameters. DOE

N80-32648# Sandia Labs., Albuquerque, N. Mex.
ADMITTANCE OF AN INFINITELY LONG MONOPOLE ANTENNA IMMERSED IN A DISSIPATIVE MEDIUM AND DRIVEN BY AN AIRFILLED COAXIAL LINE
Marvin E. Morris May 1980 23 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-1401) Avail: NTIS HC A02/MF A01

The effect of the dielectric interface between the medium being probed and the end of the coaxial line used to drive the antenna on admittance is discussed. The infinite monopole antenna driven with a coaxial line is used as a model to determine this effect. The integral equation appropriate to this geometry is numerically solved for a wide range of parameters and it is determined that the interface affects the admittance only slightly compared to the more significant effect of changing the drive geometry. The capacitive admittance correction due to the dielectric interface can be ignored for most experimental purposes for antennas immersed in nondissipative media. In dissipative media the situation is more complex. DOE

N80-32649# California Univ., Livermore. Lawrence Livermore Lab.
MATRIX THEORY OF ELASTIC WAVE SCATTERING: APPLICATION TO SCATTERING OF TRANSVERSE WAVES
Jon L. Opsal 25 Mar. 1980 6 p refs Presented at ARPA/AF Review of Progress in Quantitative NDE, La Jolla, Calif., 8 Jul. 1979
(Contract W-7405-eng-48)
(UCRL-84116; CONF-790757-4) Avail: NTIS
HC A02/MF A01

Calculations of elastic wave scattering using the method of optimal truncation are made for transverse waves incident on axially symmetric defects. Longitudinal incident waves are also considered with the results in agreement with those obtained previously. A number of features for incident transverse waves are presented as well as some of the practical aspects of the calculation (e.g., convergence, accuracy, and computer time). DOE

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-32650* National Aeronautics and Space Administration. Pasadena Office, Calif.
APPARATUS FOR MEASURING SEMICONDUCTOR DEVICE RESISTANCE Patent
Walter J. Matzen, inventor (to NASA) (Texas Instruments, Inc., Dallas) Issued 19 Aug. 1980 8 p Filed 23 Jun. 1978 Supersedes N78-28340 (16 - 19, p 2520) Sponsored by NASA
(NASA-Case-NPO-14424-1; NASA-Case-NPO-14430-1; US-Patent-4,218,650; US-Patent-Appl-SN-918534; US-Patent-Class-324-62; US-Patent-Class-324-64) Avail: US Patent and Trademark Office CSCL 09A

A test structure is described for enabling the accurate

measurement of the resistance characteristics of a semiconductor material and includes one or more pairs of electrical terminals disposed on the surface of the material to enable measurements of the resistance encountered by currents passed between the terminals. A pair of terminals includes a first terminal extending in a closed path, such as a circle, around a second terminal, so that all currents flowing between the terminals flow along a region of known width and length. Two or more pairs of concentric terminals can be utilized, wherein the ratio of radii of each pair of terminals is the same as the ratio for all other pairs of terminals, to facilitate the calculation of the contact resistance between each terminal and the semiconductor surface, as well as the calculation of the resistance of the semiconductor material apart from the effect of the terminal to semiconductor contact resistances.

Official Gazette of the U.S. Patent and Trademark Office

N80-32651*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRICAL SELF-ALIGNING CONNECTOR Patent Application
Keith H. Clark and Donald R. Scott, inventors (to NASA) Filed 15 Jul. 1980 13 p
(NASA-Case-MFS-25211-1; US-Patent-Appl-SN-168995) Avail: NTIS HC A02/MF A01 CSCL 09A

A self aligning electrical connector device including a receptacle component having a conically contoured interior and a plug component having a correspondingly contoured conical body receivable in the receptacle component is disclosed. The plug component includes a plurality of spaced conductive ring elements having a mating face and the receptacle component includes a plurality of corresponding spaced conductive ring elements providing mating interface with the mating face of the ring elements of the plug component when connected therewith. Each ring element of the receptacle component includes a plurality of segmented portions which defect downwardly when the plug component is inserted therein to assert a biasing force against the face of the ring elements of the plug component providing positive electrical contact and connection between the ring elements of the components. NASA

N80-32652*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
CONTROL ELECTRONICS FOR A MULTI-LASER/MULTI-DETECTOR SCANNING SYSTEM
William Kennedy Aug. 1980 113 p refs
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163565; RPI-TR-MP-73) Avail: NTIS HC A06/MF A01 CSCL 09C

The Mars Rover Laser Scanning system uses a precision laser pointing mechanism, a photodetector array, and the concept of triangulation to perform three dimensional scene analysis. The system is used for real time terrain sensing and vision. The Multi-Laser/Multi-Detector laser scanning system is controlled by a digital device called the ML/MD controller. A next generation laser scanning system, based on the Level 2 controller, is microprocessor based. The new controller capabilities far exceed those of the ML/MD device. The first draft circuit details and general software structure are presented. S.F.

N80-32653*# RCA Solid State Div., Somerville, N.J. Solid State Div.
ACCELERATED LIFE TESTING EFFECTS ON CMOS MICROCIRCUIT CHARACTERISTICS Final Report, May 1976 - Dec. 1979
1980 89 p
(Contract NAS8-31905)
(NASA-CR-161575) Avail: NTIS HC A05/MF A01 CSCL 09C

This report covers the time period from May 1976 to December 1979 and encompasses the three phases of accelerated testing: Phase 1, the 250 C testing; Phase 2, the 200 C testing; and Phase 3, the 125 C testing. The duration of the test in Phase 1 and Phase 2 was sufficient to take the devices into the wear out region. The wear out distributions were used to estimate the activation energy between the 250 C and the 200 C test temperatures. The duration of the 125 C test, 20,000 hours, was not sufficient to bring the test devices into the wear out region; consequently the third data point at 125 C for determining the consistency of activation energy could not be obtained. It was estimated that, for the most complex of the three device types, the activation energy between 200 C and 125 C should be at least as high as that between 250 C and 200 C. The practicality of the use of high temperature for the accelerated life tests from the point of view of durability of equipment was assessed. Guidelines for the development of accelerated life test conditions were proposed. The use of the silicon nitride overcoat to improve the high temperature accelerated life test characteristics of CMOS microcircuits was explored in Phase 4 of this study and is attached as an appendix to this report. E.D.K.

N80-32654*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
S AND Ku BAND FREQUENCY SOURCE DEVELOPMENT Final Report
Aug. 1980 104 p refs
(Contracts NAS5-25095; NAS5-23822)
(NASA-CR-160033) Avail: NTIS HC A06/MF A01 CSCL 09C

The results of the two part S- and Ku-band source development program are described. The S- and Ku-band sources were designed, fabricated, and evaluated. A high performance S- and Ku-band microwave signal source using state-of-the-art oscillator and microwave source technology was developed. T.M.

N80-32655*# Old Dominion Univ., Norfolk, Va.
PRELIMINARY DEVELOPMENT OF DIGITAL SIGNAL PROCESSING IN MICROWAVE RADIOMETERS Final Report, 1 Jan. - 31 Dec. 1979
William D. Stanley Sep. 1980 145 p refs
(Contract NAS1-15676)
(NASA-CR-3327) Avail: NTIS HC A07/MF A01 CSCL 09C

Topics covered involve a number of closely related tasks including: the development of several control loop and dynamic noise model computer programs for simulating microwave radiometer measurements; computer modeling of an existing stepped frequency radiometer in an effort to determine its optimum operational characteristics; investigation of the classical second order analog control loop to determine its ability to reduce the estimation error in a microwave radiometer; investigation of several digital signal processing unit designs; initiation of efforts to develop required hardware and software for implementation of the digital signal processing unit; and investigation of the general characteristics and peculiarities of digital processing noiselike microwave radiometer signals. A.R.H.

N80-32656*# Watkins-Johnson Co., Palo Alto, Calif.
DESIGN, FABRICATE AND TEST AN ELECTRON BOMBARDED SEMICONDUCTOR (EBS) AMPLIFIER Final Report
S. F. Blazo and J. B. Rettig [1980] 42 p
(Contract NAS5-20881)
(NASA-CR-160002) Avail: NTIS HC A03/MF A01 CSCL 09A

The deflected beam EBS amplifier consisting of an electron gun which forms a high energy, low current electron beam, a meander line deflection structure which deflects the electron beam in accordance with the RF input; and a target consisting of an array of EBS diodes, along with the impedance matching circuitry was developed. An efficient and linear 50 W CW EBS amplifier operating at 1.6 GHz suitable for space communication applications is discussed. At this level, the target efficiency was about 45 percent, showing that high efficiency operation could be obtained. Linear operation, so important for multisignal operation and efficient utilization of the limited frequency spectrum, was demonstrated with a gain variation of + or - 1 dB over a 30 dB dynamic range. Microstrip matching techniques were developed and are used in high frequency applications. R.K.G.

N80-32657# National Bureau of Standards, Washington, D.C. Electromagnetic Technology Div.
JOSEPHSON A/D CONVERTER DEVELOPMENT Annual Technical Report, 1 May 1978 - 30 Apr. 1979
C. A. Hamilton, R. E. Harris, R. L. Kautz, F. L. Lloyd, and R. L. Peterson 1 Sep. 1979 67 p refs

(Contract N00014-79-F-0005; NR Proj. 383-040)
(AD-A087671; SR-724-15-80) Avail: NTIS
HC A04/MF A01 CSCL 09/5

This report describes the second year of an effort to demonstrate an ultra-high-speed analog-to-digital converter using superconducting electronics. A converter was fabricated and tested, producing 200 to 700 megasamples per second. Experimental and theoretical support work is also presented. GRA

N80-32658# Aeronautical Research Labs., Melbourne (Australia).
A SIMPLIFIED DIGITAL FILTER DESIGN
A. J. Farrell Feb. 1980 37 p refs
(AD-A087772; ARL/AERO-TM-320) Avail: NTIS
HC A03/MF A01 CSCL 09/1

An eight-step procedure for the design of digital Butterworth low-pass filters is outlined which summarizes the methods of several standard textbooks on digital filter design. Examples of filters designed using the procedure are included. GRA

N80-32659# Harris SAI, Inc., Ann Arbor, Mich.
VARIATIONAL ANALYSIS OF HELICAL SLOW WAVE STRUCTURES Final Technical Report, 25 Oct. 1978 - 24 Jan. 1980
T. P. Fontana and D. M. MacGregor May 1980 91 p refs
(Contract F30602-79-C-0013; AF Proj. 4506)
(AD-A087478; RADC-TR-80-174) Avail: NTIS
HC A05/MF A01 CSCL 20/14

A variational technique has been used in predicting impedance and dispersion characteristics for the cold test measurements of helical traveling wave tubes. The variational formula of Bevensee is used in this method. An optimal combination of slow wave trial fields is found using Rumsey's reaction integral as a measure of equivalence to the true fields. In contrast to other approximate analyses, the variational formulation has the advantage of including the exact geometry and dielectric of the helical support. In order to verify the technique, two trial field regions have been used in successfully analyzing the sheath helix and the case of a homogeneous dielectric support. A composite metal-ceramic helix has also been analyzed. Simulation for the composite helix shows a reasonable dispersion for some combinations of harmonics over a wide frequency range when results are compared to experiment. However, the impedance computation is not yet satisfactory. In future developments, major modifications will be made to the trial fields in order to satisfy all boundary conditions simultaneously and improve the predicted impedance. In addition, the technique will be applied to other devices including wedge and rod supports. GRA

N80-32660# Air Force Weapons Lab., Kirtland AFB, N. Mex.
RADIATION EVALUATION STUDY OF LSI RAM TECHNOLOGIES Final Report
Gregory L. Dinger and Michael G. Knoll Jan. 1980 63 p refs
(AD-A084168; AD-E200471; AFWL-TR-79-118) Avail: NTIS
HC A04/MF A01 CSCL 09/3

Five commercial LSI static random access memory technologies having a 1 kilobit capacity were radiation characterized. Arrays from the transistor-transistor-logic (TTL), Schottky TTL, n-channel metal oxide semiconductor, complementary metal oxide semiconductor (CMOS), and CMOS/silicon on sapphire families were evaluated. Radiation failure thresholds for gamma doserate logic upset, total gamma dose survivability, and neutron fluence survivability were determined. A brief analysis of the radiation failure mechanism for each of the logic families tested is included. Author

N80-32661# Naval Postgraduate School, Monterey, Calif.
INTEGRATED CIRCUIT DESIGN OF A VIDEO RECONSTRUCTOR FOR A RANGE-GATED MOVING TARGET INDICATOR M.S. Thesis
George Achilleus Papadopoulos Dec. 1979 101 p refs
(AD-A084376) Avail: NTIS HC A06/MF A01 CSCL 09/5

The video reconstructors circuit of the channelized or range gated moving target indicator (MTI) is designed for integration or a single dual-in-line integrated circuit package. The developed chip model is tested and its performance evaluated for a wide range of operating conditions. The tests indicate that the model offers superior performance using discrete components. An extension of the technique offers opportunities in reducing the majority of the remaining channel elements to chip size. For many MTI applications this will yield still additional benefits. Full transistor-transistor-logic compatibility of the design makes the devices easily controllable with digital logic. The threshold voltage setting, the output gate control, and the integration time constant can be set by software or firmware. Author

N80-32662# Army Electronics Research and Development Command, Fort Monmouth, N. J.
ACCELERATION SENSITIVITY COMPENSATION OF CRYSTAL RESONATORS
Arthur Ballato Mar. 1980 78 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A085683; DELET-TR-80-7) Avail: NTIS
HC A05/MF A01 CSCL 14/2

Resonator configurations compensated for arbitary directions of the acceleration field, and requiring no additional electronics other than the oscillator circuitry normally used are described. This approach produces compensation with no changes in size, weight, and power, and applies to any crystal reference oscillator in any shock/vibration environment. Author

N80-32663# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology and Devices Lab.
ELECTROLUMINESCENT DISPLAY TECHNOLOGY
M. Robert Miller and Elliot Schlam Apr. 1980 13 p
(DA Proj. 1L1-62705-AH-9403)
(AD-A085641; DELET-TR-80-9) Avail: NTIS
HC A02/MF A01 CSCL 09/5

The development of the current high contrast, sunlight legible, thin film electroluminescent display technology is reviewed and device structures and operating characteristics are described. Drive and addressing considerations are presented in relation to device types, power dissipation, multiplexing, and viewability. An overview of the industry status is given including device availability and problems remaining to be solved. Applications of the technology are reviewed covering both user requirements and device capabilities. A survey of future prospects covers improvements in efficiency, multicolor displays, and various device configurations. E.D.K.

N80-32664# Science Applications, Inc., La Jolla, Calif.
ANALYTIC APPROACHES TO UNSTABLE RESONATORS Final Report
J. Nagel and D. Rogovin Jun. 1980 18 p refs
(Contract F49620-79-C-0027; AF Proj. 2301)
(AD-A088378; AFOSR-80-0623TR) Avail: NTIS
HC A02/MF A01 CSCL 09/1

The marginally stable regime has been distinguished from the unstable regime both qualitatively and quantitatively. New asymptotic techniques for solving the Fresnel-Kirchoff equation for marginally stable resonators were obtained. The method is analytical in nature and yields excellent predictions for the modes and losses of such cavities. Numerical results for both marginally stable and marginally unstable cavities are presented. In addition, conditions for the suitability of using empty resonator modes to describe gain filled cavities have been derived. This deviation is based on manipulations of the differential equation describing gain filled cavities in Hankel transform space. The result is an ordinary, linear Fresnel-Kirchoff integral equation with gain renormalized Fresnel number and eigenvalue. GRA

N80-32665# Thomas Electronics Inc., Wayne N. J.
PHOSPHOR-PENETRATION COLOR CATHODE-RAY TUBE Final Report, 1 Jul. 1974 - 30 Jun. 1979
Emil Sanford Jun. 1979 49 p refs
(Contract DAAB07-74-C-0605; DA Proj. 1S7-62705-AH-94)
(AD-A088518; WO-373; DELET-TR-74-C-0605-F) Avail: NTIS
HC A03/MF A01 CSCL 09/1

In a 16 in. diameter voltage penetration type color CRT a metallic mesh is mounted in proximity to the phosphor layer in order to isolate the switched high voltage fields applied to the phosphor screen from the magnetic deflection zone. Electron optical analysis predicts the degree of geometric distortion over the switching range of 10-20 kV. Some correction means are suggested. Objective goals for resolution and brightness are

quantitatively examined. The mechanical design is also described. GRA

N80-32666# Purdue Univ., Lafayette, Ind.
PRANC: PROGRAM FOR ANALYZING NONLINEAR CIRCUITS Final Phase Report, Nov. 1978 - Nov. 1979
H. K. Thapar and B. J. Leon Griffiss AFB, N.Y. RADC May 1980 241 p refs
(Contract F30602-78-C-0102; AF Proj. 2338)
(AD A088422; RADC-TR-80-139) Avail: NTIS HC A11/MF A01 CSCL 09/3

The application of the Volterra series method for the analysis of circuits with multiple nonlinear elements and multiple multifrequency input sources is described. Using multidimensional transform theory, an approach for deriving the Volterra transfer functions is given. The computation of the sinusoidal steady state response from these transfer functions is presented. Finally, algorithms for adapting the Volterra series method for computer aided steady state analysis of nonlinear circuits are described. A complete documentation of the program PRANC, which uses the Volterra series approach, is also contained in this report. GRA

N80-32667# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
DESIGN, FABRICATION AND EVALUATION OF LOW COST DIODE OSCILLATOR FOR MILLIMETER WAVES
Edmund E. Malecki and Harold Jacobs Apr. 1980 19 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A087954; DELET-TR-80-8) Avail: NTIS HC A02/MF A01 CSCL 09/1

There are urgent requirements for millimeter-wave oscillators in the range of 60 GHz, particularly for local oscillators, receivers, and low power transmit/receive applications such as the self-oscillating mixer. This report describes the design, fabrication and evaluation of a low cost Gunn diode oscillator structure where the diode is placed adjacent to a dielectric waveguide, which in turn, provides output coupling for radiation. Ten milliwatt output power was obtained from a diode at a frequency of 60 GHz. GRA

N80-32668# National Bureau of Standards, Washington, D.C. Center for Electronics and Electrical Engineering
SEMICONDUCTOR MEASUREMENT TECHNOLOGY Progress Report, 1 Apr. - 30 Sep. 1977
W. Murray Bullis, ed. Aug. 1980 46 p refs Sponsored in part by Navy Strategic Systems Project Office, Defense Nuclear Agency, DOE and Naval Ocean Systems Center
(ARPA Order 2397)
(AD-A088262; NBS-SP-400-45) Avail: NTIS HC A03/MF A01 CSCL 20/12

This progress report describes NBS activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices. Both in-house and contract efforts are included. The emphasis is on silicon device technologies. Principal accomplishments during this reporting period included (1) development of theoretical expressions for computing resistivity and hole mobility for boron-doped silicon; (2) completion of a study of problems associated with use of a scanning electron microscope for total dose testing of semiconductor devices; (3) completion of a pilot study to evaluate procedures for measuring 1 to 10 micrometer wide clear and opaque lines viewed with transmitted illumination; (4) completion of a preliminary study of test structures for estimating densities of process-induced random faults in device wafers; and (5) completion of an interlaboratory evaluation of the destructive wire-bond pull test. Also reported is other ongoing work on materials characterization by electrical and physical analysis methods, materials and procedures for wafer processing, photolithography, test patterns, and device inspection and test procedures. GRA

N80-32669# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
INVESTIGATION OF QUASI-OPTICAL INTEGRATED CIRCUITS AND ELECTROMAGNETIC SCATTERING AND RADIATION PROBLEMS Final Report, 1 Mar. 1977 - 31 May 1980
Raj Mittra Jul. 1980 8 p refs
(Grant DAAG29-77-G-0111)
(AD-A088075; ARO-14686.9-EL) Avail: NTIS HC A02/MF A01 CSCL 09/1

A brief summary of a three-year investigation of waveguides, passive components, active circuits and antennas for millimeter waves is presented. Research concentrated entirely on low loss, low cost and lightweight dielectrics that provide an alternative choice to metallic media which become lossy and expensive at millimeter wavelengths. The summary is supplemented by a complete listing of reports and journal publications resulting from the research. GRA

N80-32670# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
A MONOLITHIC GaAs IF AMPLIFIER FOR INTEGRATED RECEIVER APPLICATIONS
D. R. Decker, A. K. Gupta, W. Petersen, and D. R. Chen 1980 18 p refs
(Contract N00014-78-C-0624)
(AD-A088298) Avail: NTIS HC A02/MF A01 CSCL 17/2

A monolithic GaAs integrated amplifier was constructed for the 500 to 1000 MHz intermediate frequency band. The amplifier provides 8.0 + or - 1.5 dB gain across the band. The output of the amplifier utilizes a source follower configuration to obtain a favorably low output VSWR of less than 1.5:1 (return loss = 15 dB). All bias lines with integral bypass capacitors are contained on the chip and this amplifier is suitable for further integration as a building block of a monolithically integrated receiver front end. GRA

N80-32671# Naval Research Lab., Washington, D. C. Antenna Systems Staff.
BUILDING BLOCK FOR AN ORTHONORMAL-LATTICE-FILTER ADAPTIVE NETWORK Interim Report
W. F. Gabriel 10 Jul. 1980 42 p refs
(RR0210101; RR0210541)
(AD-A088088; NRL-8409) Avail: NTIS HC A03/MF A01 CSCL 09/5

The recent algorithm for a multistage multichannel orthonormal lattice filter proposed by M. Aftab Alam is a welcome addition to the library of adaptive-processing algorithms and provides a flexible alternative to the conventional approach of an optimum Weiner filter. This algorithm is based on a Gram-Schmidt orthonormalization procedure which is similar to cascade adaptive processing techniques described in earlier works. One of the most desirable features of this type of processing network is that it can be implemented with simple one-stage orthogonal-filter building blocks which directly filter the input data samples. These building blocks are the major subject of this report, and a particular configuration is developed based on a modified version of the familiar Howells-Applebaum algorithm. It can be implemented in either analog or digital form, data storage is not required, it is unconditionally stable, speed of convergence is no longer a problem, and the design is simple. The performance characteristics of a complete orthogonal-lattice-filter network operating in the spacial domain were simulated for example cases of one, two, and three strong incoherent signal sources spaced within a beamwidth for a eight-element linear-array antenna. The adaptive spacial filter patterns and the transient responses demonstrate that the building block has sufficient transient-response speed and control to permit full use of the processing capabilities inherent in a Gram-Schmidt cascade network. GRA

N80-32672# Polytechnic Inst. of New York, Brooklyn. Microwave Research Inst.
BASIC RESEARCH IN ELECTRONICS, JSEP Final Report, 1 Apr. 1978 - 31 Mar. 1980
Arthur A. Oliner Jun. 1980 87 p refs
(Contract F49620-78-C-0074; AF Proj. 2305)
(AD-A088121; POLY-MRI-1404-80; AFOSR-0620-80TR) Avail: NTIS HC A05/MF A01 CSCL 09/3

Contents: electromagnetics: millimeter wave waveguides and antenna arrays; hybrid ray mode formulation of ducted propagation; wave matter interactions, optical waveguiding structures; solid state electronics: X-ray guided wave electronics; interaction of millimeter waves and semiconductors; acoustoelectric and acoustooptic devices, electric and magnetic interactions in thin

films and surface regions of solids; new solid state materials, electronic properties of hydrogen in solids; information electronics; reduced order models of large scale systems; enhancement, extraction and reconstruction techniques; robust procedures in estimation and detection problems. GRA

N80-32673# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
HIGH CONTRAST ELECTROLUMINESCENT READOUT DEVICE Interim Report, 2 Oct. 1978 - 31 Jan. 1979
M. K. Kilcoyne Aug. 1980 35 p refs
(Contract DAAB07-78-C-2996; DA Proj. 1L1-62705-AH-94)
(AD-A088237; ERC41016.91RF; DELET-TR-78-8996-1) Avail: NTIS HC A03/MF A01 CSCL 14/2

The Rockwell Science Center has completed the first phase of the development program encompassing the design, fabrication, and characterization of experimental models of a high-contrast numeric electroluminescent readout device. This device consists of two digits of seven-segment numeric displays using a transparent electroluminescent thin film with a high-contrast background layer. The device also contains within its hermetically-sealed package, logic and drive circuitry to operate the numeric displays from a typical computer output data processing information, with typical 5 volt T sq L logic level and BCD input. GRA

N80-32674# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
HIGH CONTRAST ELECTROLUMINESCENT NUMERIC READOUT DEVICE Interim Technical Report, 1 Feb. - 31 May 1979
M. K. Kilcoyne Aug. 1980 35 p
(Contract DAAB07-78-C-2996; DA Proj. 1L1-62705-AH-94)
(AD-A088238; ERC41016.15IRF; DELET-TR-78-2996-2) Avail: NTIS HC A03/MF A01 CSCL 14/2

The Rockwell International Electronics Research Center has completed the second phase of the development program encompassing the design, fabrication, and characterization of experimental models of a high-contrast numeric electroluminescent readout device. This device consists of two digits of seven-segment numeric displays using a transparent electroluminescent thin film with high-contrast background layer. The device also contains within its hermetically sealed package, logic and drive circuitry to operate the numeric displays from a typical computer output data processing information, with five volt T sq L logic level and BCD input. GRA

N80-32675# Varian Associates, Palo Alto, Calif.
ADVANCED AN/TPQ-37 TRANSMITTER TUBE Interim Report, Oct. 1978 - Jun. 1979
R. H. Giebeler Aug. 1980 18 p
(Contract DAAB07-78-C-3007; DA Proj. 1L2-63742-DF-32)
(AD-A088235; DELET-TR-78-3007-1) Avail: NTIS HC A02/MF A01 CSCL 17/9

The purpose of this program is to improve the performance and reliability of the AN/TPQ-37 transmitter tube. The task is to build and test two high power, PPM focused, grid pulsed Traveling Wave Tubes (TWT) that meet the requirements of Technical Guidelines MW-119B. The TWT will employ a M-type cathode for reduced temperature operation and extended life. Gain variations will be minimized by use of in band loss techniques and weight will be reduced by using samarium cobalt magnets. GRA

N80-32676# Army Military Personnel Center, Alexandria, Va.
APPLICATION OF IMAGE INTENSIFIER TECHNOLOGY TO THE MILITARY, SCIENTIFIC, INDUSTRIAL, EDUCATIONAL, AND MEDICAL COMMUNITIES M.S. Thesis Final Report
Patrick H. Orell 30 May 1980 99 p refs
(AD-A088165) Avail: NTIS HC A05/MF A01 CSCL 09/1

This research paper addresses the applications of image intensifier technology to the military, scientific, industrial, educational and medical communities. Image intensifiers are components, that when incorporated into scopes, photographic cameras, television cameras and weapons delivery systems, allow the operator visibility into dark or low illumination areas. The technology has surfaced within the last twenty years and has been, until recently, confined to the military for applications. Image intensified devices are rapidily becoming more popular for various applications, yet many persons are not aware of their existence or potential. The paper is written in non-technical terms to describe the physical make-up of first and second generation Image Intensifiers and addresses the newly developed charged coupled devices and third generation intensifiers under development. It covers a representative sample of applications that have been documented to date by the various manufacturers of Image Intensifiers and the laboratories and agencies that evaluate them. The paper incorporates 37 photographs and illustrations of devices and their applications in support of the communities listed. A list of documented applications and an Image Intensifier tube sensitivity chart is provided for information and reference. GRA

N80-32677# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
THE EFFECT OF VIBRATION ON QUARTZ CRYSTAL RESONATORS
Raymond L. Filler May 1980 40 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A085642; DELET-TR-80-10) Avail: NTIS HC A03/MF A01 CSCL 14/2

The effect of acceleration, particularly vibration, on the frequency of quartz crystal controlled oscillators is described. Simple harmonic motion, complex and random vibrations, and frequency multiplication are covered. Several examples and experiment demonstrations are given. L.F.M.

N80-32678# General Electric Co., Schenectady, N. Y. Electrical Systems and Technology Div.
EVALUATION OF ADVANCED TECHNOLOGIES FOR POWER TRANSFORMERS, PART 1 Final Report, Nov. 1976 - Mar. 1979
S. F. Philip, J. R. Morris, D. K. Bartosh, J. R. Mcloughlin, C. W. Reed, W. F. Westendorp, H. M. Schneider, and E. C. Schrom Jun. 1980 185 p refs 2 Vol.
(Contracts DE-AC01-77ET-29069; EC-77-C-01-2134)
(DOE/RA-2134/01) Avail: NTIS HC A09/MF A01

The feasibility of using the following principal design concept for power transformers was explored: sheet conductors for the windings; a system of sealed, self-contained, annular cooling ducts containing circulating cooling fluid to cool the windings; polymer film for turn-to-turn insulation; and compressed gas insulation. Experimental and analytical studies indicate that the sheet wound, compressed-gas-insulated design should result in power transformers of significantly smaller size and weight when compared with oil-filled units of equivalent rating. These advanced technologies offer the opportunity for the design of more efficient power transformers. DOE

N80-32679# Ames Lab., Iowa.
AC LOSSES IN TYPE-2 SUPERCONDUCTORS
John R. Clem 1979 66 p refs
(Contract W-7405-eng-82)
(IS-M-280) Avail: NTIS HC A04/MF A01

The physics of ac losses in type 2 superconductors and in multifilamentary superconduction normal composite conductors is described. As an introduction, the ac eddy current losses in a homogeneous normal conducting cylindrical specimen subjected to an alternating applied magnetic field are briefly reviewed. The ac losses in a superconducting cylindrical specimen next are discussed in detail, with emphasis on the losses in a specimen subjected to an alternating applied longitudinal magnetic field. In general dissipation occurs via both flux flow losses, which are analogous to eddy current losses in the normal state, and hysteretic losses, which arise from bulk and surface pinning as well as annihilation of vortices of the opposite sense. Tests are suggested by which the dominant loss mechanisms can be identified. Finally, the losses in multifilamentary superconducting normal composite conductors are reviewed. DOE

N80-32680# General Electric Co., Pittsfield, Mass. Power Delivery Technical Resources Operation.
EVALUATION OF ALTERNATIVE INSULATING OILS FOR USE IN TRANSFORMERS AND OTHER ELECTRICAL APPARATUS: CHARACTERISTICS OF INSULATING OILS FOR ELECTRICAL APPLICATION Summary Report

T. O. Rouse Feb. 1980 100 p refs
(EPRI Proj. 562-1)
(EPRI-EL-809-SY) Avail: NTIS HC A05/MF A01

There is a realistic possibility that demand for traditional naphthenic transformer oils will exceed the available supply in the mid 1980's. The results of a program directed toward evaluating alternate fluids are summarized. Oils derived from paraffinic crude sources are predicted to be more plentiful. The results of studies suggest that these paraffinic coils will be satisfactory supplements replacement fluids. Because of the differences in low temperature behavior of the two types of oils, careful consideration must be given to matching a given oil to a given application. DOE

N80-32681# Westinghouse Electric Corp., Sharon, Pa. Materials and Manufacturing Technology Dept.
CHARACTERISTICS OF INSULATING OIL FOR ELECTRICAL APPLICATION Final Report
T. K. Sloat Dec. 1979 303 p refs
(EPRI Proj. 577-1)
(EPRI-EL-1300) Avail: NTIS HC A14/MF A01

Paraffinic crude oils are known to contain significant amounts of wax that, if not removed, could provide an insulating oil having a high pour point which could interfere with the low temperature functioning of most electrical equipment. Because of the wax problem, it was necessary to study the behavior of the paraffinic base insulating oil in representative production size equipment, such as tap changers and power circuit breakers, to be sure that the equipment would operate if exposed to temperatures as low as 40 C. Other studies, such as material compatibility, lubricity of the new oil, arc formed gas, response to dielectric breakdown levels represented in large power transformers, and accelerated aging in distribution transformers, were important to ensure full acceptance of a replacement oil. The work in this project was separated into different phases in order to provide a broad study of the new type of insulating oil. This evaluation of experimental oils indicated that paraffinic transformer oils as a class can provide useful supplements or replacements for naphthenic oils. DOE

N80-32682# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL PROPERTIES OF HIGH-CURRENT MULTIFILAMENTARY Nb3Sn CONDUCTORS
R. M. Scanlan, R. W. Hoard, D. N. Cornish, and J. P. Zbasnik 23 May 1980 13 p refs Presented at the Intern. Cryogenic Mater. Conf., Upton, N.Y., 28-29 May 1980
(Contract W-7405-eng-48)
(UCRL-84040; CONF-800587-1) Avail: NTIS HC A02/MF A01

Nb3Sn is a strain sensitive superconductor which exhibits large changes in properties for strains of less than 1 percent. The critical current density at 12 T undergoes a reversible degradation of a factor of two for compressive strains of about 1 percent and undergoes an irreversible degradation for tensile strains on the Nb3Sn greater than 0.2 percent. One conductor consists of filaments of Nb3Sn in a bronze matrix, and much progress has been made in understanding the mechanical behavior of this composite. The Nb3Sn filaments are placed in compression due to the differential thermal contraction between Nb3Sn and bronze which occurs when the composite is cooled from the Nb3Sn formation temperature (typically 700 C) to the 4.2 K operating temperature. The general behavior of the critical current when this conductor is subjected to a tensile stress is an increase to a maximum when the compressive strain on the Nb3Sn is relieved, followed by a decrease as the Nb3Sn filaments are placed in tension. DOE

N80-32683# Bendix Corp., Kansas City, Mo.
POWER RATINGS OF rf THIN FILM RESISTIVE ATTENUATORS
F. R. Smith Jun. 1980 15 p ref
(Contract DE-AC04-76DP-00613)
(BDX-613-2404) Avail: NTIS HC A02/MF A01

Most radio frequency (rf) assemblies built using hybrid microcircuit technology employ thin film attenuators. These attenuators are subject to moderate rf peak power and to moderate average power. Because of intracircuit mismatch, extra considerations of power requirements must be given. To meet these requirements, selected thin film resistive attenuators operated under large rf power conditions were investigated, and the power margin in which these attenuators can be used was defined. DOE

N80-32684# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A 50 Hz, 250 kV, 500 NS, 500 KW AVERAGE POWER PULSE
Malcolm T. Buttram 1980 6 p refs Presented at the 14th Pulse Power Modulator Symp. Orlando, Fla., 3 Jun. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0491C; CONF-800640-8) Avail: NTIS HC A02/MF A01

The development of a 50 Hz research pulser with per shot specifications of 250 kV, 500 ns FWHM, 10 kJ is described. It is designed for burst mode service. The pulser is a two element Guillemin Type C pulse forming network with two parallel Marx generators serving as the first element and a single Marx generator serving as the second element. The two Marx generators of the first element are considered and the important ongoing developmental areas are outlined. DOE

N80-32685# South Carolina Univ., Columbia. High Voltage Lab.
ELECTRO-OPTICAL MEASUREMENTS OF SOLID INSULATOR SURFACE FIELDS AND SURFACE CHARGING IN VACUUM
D. M. Hyslop, J. E. Thompson, and T. S. Sudarshan 21 Apr. 1980 113 p refs
(Grant NBS7-89009)
(PB80-192875) Avail: NTIS HC A06/MF A01 CSCL 09A

Electro optical measurements of the electric field along insulator surfaces and in the bulk of insulator materials was made to determine the mechanisms associated with insulator surface flashover. The Pockels effect in KDP was used in conjunction with a polarization interferometer and a pulsed laser to measure interfacial and bulk fields for KDP/vacuum interfaces. The results show that the solid insulator surface and bulk electric field distributions are spatially nonuniform. The electric field at the cathode is considerably enhanced while the field at the anode is reduced. The time evolution and steady state behavior of the insulator electric field distributions for DC, 60 Hz AC, and pulsed excitations are presented. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-32686# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
NUMERICAL SOLUTION OF A NONSTEADY BLAST WAVE PROPAGATION IN TWO-PHASE (SEPARATED FLOW) REACTIVE MEDIUM
Shmuel Eidelman and Alexander Burcat Jan. 1980 32 p refs
(TAE-388) Avail: NTIS HC A03/MF A01

The problem of a detonation in a two phase reactive medium is fully solved using the flux corrected transport algorithm (FCT) for an artificial viscosity method. This method is used to solve nonlinear hyperbolic equations of two phase flow and was chosen for its ability to suppress numerical oscillations and to describe complex shock waves. The solution of the problem is described. The details of a test case based on the analytical solution of a strong adiabatic point explosion are given. E.D.K.

N80-32687# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE MECHANISM OF A DETONATION WAVE ENHANCEMENT IN A TWO-PHASE COMBUSTIBLE MEDIUM
Shmuel Eidelman and Alexander Burcat Jan. 1980 25 p refs Presented at the 18th Intern. Combust. Symp.

(TAE-393) Avail: NTIS HC A02/MF A01

The mechanism of the enhancement of a detonation wave in a two phase reactive media was numerically explored. A special algorithm was used in order to differentiate between the numerical and the phenomenological oscillations. The oscillation of the main detonation wave was caused by a set of secondary waves, produced in the reaction zone behind the wave front. The wave length of the secondary waves was found by numerical methods. The graphical presentation of the process provides an overall picture of the mechanism of wave enhancement. E.D.K.

N80-32688*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

DEPRIMING OF ARTERIAL HEAT PIPES: AN INVESTIGATION OF CTS THERMAL EXCURSIONS Final Report, Sept. 1978 - Aug. 1980

D. Antoniuk and D. K. Edwards 20 Aug. 1980 214 p refs (Contract NAS3-21740)

(NASA-CR-165153; TRW-34129-6001-UT-00) Avail: NTIS HC A10/MF A01 CSCL 20D

Four thermal excursions of the Transmitter Experiment Package (TEP) were the result of the depriming of the arteries in all three heat pipes in the Variable Conductance Heat Pipe System which cooled the TEP. The determined cause of the depriming of the heat pipes was the formation of bubbles of the nitrogen/helium control gas mixture in the arteries during the thaw portion of a freeze/thaw cycle of the inactive region of the condenser section of the heat pipe. Conditions such as suction freezeout or heat pipe turn-on, which moved these bubbles into the active region of the heat pipe, contributed to the depriming mechanism. Methods for precluding, or reducing the probability of, this type of failure mechanism in future applications of arterial heat pipes are included. Author

N80-32689*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

WIND TUNNEL INVESTIGATION OF THE TITAN FORWARD SKIRT COMPARTMENT VENT FROM A FREE-STREAM MACH NUMBER OF 0.80 TO 1.96

Albert L. Johns Washington Sep. 1980 42 p refs

(NASA-TM-81572; E-541) Avail: NTIS HC A03/MF A01 CSCL 20D

A test was conducted to determine the flow characteristics of the Titan forward skirt compartment vent over a free stream Mach number range of 0.80 to 1.96. The vent was mounted in a flat plate and the plate was flush mounted to the tunnel side wall with coinciding center lines. Air was discharged from a duct, located on the tunnel side wall behind the plate, through a canted aft 30 deg honeycomb vent into the free stream. Data for the analysis of the Titan forward skirt compartment venting during ascent through the atmosphere are provided. Full scale simulated flight hardware, such as the honeycomb vent, duct corrugations and field joint ring were used. Boundary layer thicknesses were used to vary boundary height. The highest vent discharge coefficient for any given Mach number and vent pressure ratio generally occurred at the maximum displacement thickness. With no vent flow the static pressure in the vent region was generally less than the free stream static pressure. With vent flow, the static pressures upstream of the vent increased, and those downstream of the vent decreased. R.K.G.

N80-32690*# Martin Marietta Corp., Denver, Colo.

THERMAL RADIATION ANALYSIS SYSTEM TRASYS 2: USER'S MANUAL

Richard G. Goble and Carl L. Jensen Jun. 1980 294 p Revised 2 Vol.

(Contracts NAS1-15683; NAS9-15304)

(NASA-CR-159273-1; MCR-73-105-1-Rev-2) Avail: NTIS HC A13/MF A01 CSCL 20M

The Thermal Radiation Analyzer System (TRASYS) program put thermal radiation analysis on the same basis as thermal analysis using program systems such as MITAS and SINDA. The user is provided the powerful options of writing his own executive, or driver logic and choosing, among several available options, the most desirable solution technique(s) for the problem at hand. This User's Manual serves the twofold purpose of instructing the user in all applications and providing a convenient reference book that presents the features and capabilities in a concise, easy-to-find manner. T.M.

N80-32691*# Martin Marietta Corp., Denver, Colo.

THERMAL RADIATION ANALYSIS SYSTEM TRASYS 2. APPENDIX H: USER'S MANUAL

Richard G. Goble and Carl L. Jensen Jun. 1980 385 p 2 Vol.

(Contracts NAS1-15683; NAS9-15304)

(NASA-CR-159273-2) Avail: NTIS HC A17/MF A01 CSCL 20M

The user is provided the powerful options of writing his own executive, or driver logic and choosing, among several available options, the most desirable solution techniques for the problem at hand. Sample problems are presented. T.M.

N80-32692*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

AEROTHERMAL ANALYSIS OF A WING-ELEVON COVE WITH VARIABLE LEAKAGE

Roane L. Hunt Washington Sep. 1980 44 p refs

(NASA-TP-1703; L-13751) Avail: NTIS HC A03/MF A01 CSCL 20D

A mathematical model of the heating associated with leakage within the space shuttle orbiter wing elevon cove was used to analyze the aerothermal response of the structure. The analysis was applied to wind tunnel results and to shuttle entry conditions. A parametric study described the mechanism by which the energy of the ingested mass is distributed as a function of the Reynolds number, wall conductivity, surface emissivity, and cove height and length. The rate at which energy was transferred into the cove interior was primarily determined by the combined effects of the convection, wall capacitance, and internal radiation terms. Correlation with wind tunnel results indicated that the cold wall convective heating rates, wall temperature, and gas temperature of the cove were predicted by the analytical model for short exposure times. Predicted transient thermal response of the elevon cove subjected to shuttle entry conditions indicated that the allowable leak area at the cove seal was 20 percent less than that previously indicated by experiment. S.F.

N80-32693# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.

ON THE THEORY OF FLOW OF REGULAR WATER WAVE ABOUT A BODY

Francis Noblesse Mar. 1980 70 p refs

(Contract N00014-78-C-0169; NR Proj. 062-525)

(AD-A084359; Rept-80-2) Avail: NTIS HC A04/MF A01 CSCL 20/4

Results concerning the integral-equation-Green-function method of solution of the basic linerized problem of potential flow of regular water waves about a body are presented. The main results of the study are: (1) an integral equation for determining the velocity potential, (2) a relatively simple explict approximate solution of this integral equation, and (3) asymptotic expansions, ascending series, and one dimensional Taylor series expansions for efficient numerical evaluation of the Green function. L.F.M.

N80-32694# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.

CHEMICAL REACTIONS IN TURBULENT MIXING Annual Interim Scientific Report, 15 Apr. 1979 - 14 Apr. 1980

H. W. Liepmann, G. L. Brown, P. E. Dimotakis, and A. Roshko 25 Jun. 1980 29 p refs

(Contract F49620-79-C-0159; AF Proj. 2307)

(AD-A088529; GALCIT-151-A; AFOSR-80-0625TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The combustion facility (H2-F2) is now nearing completion. As of this writing, a high speed mixing layer has been realized in the test section, using high pressure air. This certifies the flow facility down to and including the test section. Preliminary results on the effect of high heat release in a turbulent mixing zone were obtained in the NO-O3 experiment. These results are consistent with predictions based on previously measured p.d.f.'s in non-reacting mixing layers, but in conspicuous disagreements with a variety of accepted model calculations. These results demonstrate again the important influence of the large scale

coherent structures on chemical reactions in turbulent flows. The Laser Induced Fluorescence technique has now been extended to allow direct space and time resolved measurements of the reaction products. The first four channels of the multi-channel laser Doppler velocimetry system are essentially completed. The first experiments using this new development are expected in the course of this summer. Digital image analysis of particle streak photography has also been explored as a direct means of two dimensional measurements of the velocity field in a plane. Finally, a prototype system using a 100 element acoustic detector array has been completed. Initial measurements with four of these channels using 300 kHz sound have been successfully made. GRA

N80-32695# Naval Ship Research and Development Center, Bethesda, Md.
BOUNDARY-LAYER FLOW ON AN AXISYMMETRIC BODY WITH AN INFLECTED STERN. Final Report
Thomas T. Huang, Nancy C. Groves, and Garnell Belt. Aug. 1980. 67 p. refs.
(AD-A088526; DTNSRDC-80/064) Avail: NTIS HC A04/MF A01 CSCL 20/4

Static pressure distributions, mean velocity profiles, distributions of turbulence intensities, and Reynolds stresses, spatial correlation coefficients, and the Taylor microscale of turbulence were measured across the stern boundary layer of an axisymmetric body with an inflected stern. A theoretical and numerical iteration scheme, which uses the boundary layer and open wake displacement body, is found to model satisfactorily the viscid-inviscid interaction between the thick stern boundary layer and the external potential flow. The measured values of turbulence intensity, eddy viscosity, and mixing-length parameters in the stern region are found to be much smaller than those of a thin boundary layer. An approximate similarity characteristic for the thick axisymmetric stern boundary layer is obtained when the measured mixing-length parameters, the measured correlation length scales, and the measured Taylor microscales are normalized by the square root of the boundary-layer cross-sectional area instead of the local boundary layer thickness. When this simple similarity hypothesis for the mixing length and the displacement body is incorporated into the McDonnell Douglas Corp., Cebeci-Smith differential boundary-layer method, modified to consider the displacement body and wake, the theory predicts very well the measured distributions of the mean velocity throughout the entire stern boundary layer. GRA

N80-32696# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF COHERENT STRUCTURE IN THE TURBULENT BOUNDARY LAYER. Annual Report, 1 May 1979 - 30 May 1980
D. E. Abbott, C. R. Smith, and J. D. A. Walker. May 1980. 17 p. refs.
(Contract F49620-78-C-0071; AF Proj. 2307)
(AD-A088248; AFOSR-80-0567TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

This project combines both experimental video flow visualization studies and theoretical investigations of a series of phenomenological and theoretical models based upon the three dimensional details of convected, coherent structural elements of a turbulent flow as it interacts with a solid surface. The progress over the past year has led to the experimental consideration of range of sub-problems including high Reynolds Number (4,000,000) turbulent flows, the effect of surface modification on low-speed streak formation, and the effect of vortex loop interaction with a solid boundary. To augment the visualization pictures, a computerized video-digitizing system has been developed. Preliminary results show tremendous promise for obtaining quantitative data from flow visualization pictures. The specific thrust of the theoretical studies has been focussed on three areas: (1) how two and three dimensional vortex structures interact with wall boundary layers, (2) the development of a new type of prediction method for two dimensional turbulent boundary-layer flows, and (3) improvement in numerical techniques for solving parabolic, boundary-layer equations. GRA

N80-32697# Oak Ridge National Lab., Tenn. Energy Div.
FLUOMEG: A PLANAR FINITE DIFFERENCE MESH GENERATOR FOR FLUID FLOW PROBLEMS WITH PARALLEL BOUNDARIES
C. Kleinstreuer (Rensselaer Polytechnic Inst., Troy, N.Y.) and M. R. Patterson. May 1980. 63 p. refs.
(Contract W-7405-eng-26)
(ORNL/TM-7115) Avail: NTIS HC A04/MF A01

A two or three dimensional finite difference mesh generator capable of discretizing subrectangular flow regions (planar coordinates) with arbitrarily shaped bottom contours (vertical dimension) was developed. This economical, interactive computer code, written in FORTRAN IV and employing DISSPLA software together with graphics terminal, generates first a planar rectangular grid of variable element density according to the geometry and local kinematic flow patterns of a given fluid flow problem. Then subrectangular areas are deleted to produce canals, tributaries, bays, and the like. For three dimensional problems, arbitrary bathymetric profiles (river beds, channel cross section, ocean shoreline profiles, etc.) are approximated with grid lines forming steps of variable spacing. Furthermore, the code works as a preprocessor numbering the discrete elements and the nodal points. Prescribed values for the principal variables can be automatically assigned to solid as well as kinematic boundaries. DOE

N80-32698# Sandia Labs., Albuquerque, N. Mex.
NUMERICAL SOLUTIONS FOR STEADY THERMAL CONVECTION FROM A CONCENTRATED SOURCE IN A POROUS MEDIUM
C. E. Hickox and H. A. Watts. Apr. 1980. 53 p. refs.
(Contract DE-AC04-76DP-00789)
(SAND-79-2214) Avail: NTIS HC A04/MF A01

Solutions for the steady, axisymmetric velocity and temperature fields associated with a point source of thermal energy in a fluid saturated porous medium are obtained numerically through use of similarity transformations. A point source located on the lower, insulated boundary of a semi-infinite region and a point source embedded in an infinite region are considered. Numerical results are presented from which complete descriptions of the velocity and temperature fields can be constructed for Rayleigh numbers ranging from 0.001 to 100. DOE

N80-32699# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
HEAT PUMPS IN LOW TEMPERATURE APPLICATIONS
J. G. Keller. 18 Aug. 1980. 5 p. refs. Presented at 15th Intersoc. Energy Conversion Engr. Conf., Seattle, 18 Aug. 1980
(Contract DE-AC07-76ID-01570)
(CONF-800806-7) Avail: NTIS HC A02/MF A01

Methods of efficiency using the lower temperature geothermal resources for space conditioning are presented. Water to air and water to water heat pumps for use with domestic or thermally marginal geothermal water in the 50 to 90 F (10 to 32 C) range are examined. Developments in geothermal resource utilization are presented. A diaphragm type heat pump for use with source temperatures as low as 40 C is discussed. DOE

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-32700*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
TWO-PHOTON EXCITATION OF NITRIC OXIDE FLUORESCENCE AS A TEMPERATURE INDICATOR IN UNSTEADY GAS-DYNAMIC PROCESSES
R. L. McKenzie and K. P. Gross (Polyatomics Research, Inc., Mountain View, Calif.). Sep. 1980. 56 p. refs. Submitted for publication
(NASA-TM-81220; A-8284) Avail: NTIS HC A04/MF A01 CSCL 14B

A laser induced fluorescence technique, suitable for measuring fluctuating temperatures in cold turbulent flows containing very low concentrations of nitric oxide is described. Temperatures below 300 K may be resolved with signal to noise ratios greater than 50 to 1 using high peak power, tunable dye lasers. The method relies on the two photon excitation of selected ro-vibronic transitions. The analysis includes the effects of fluorescence quenching and shows the technique to be effective at all densities below ambient. Signal to noise ratio estimates are based on a preliminary measurement of the two photon absorptivity for a selected rotational transition in the NO gamma (0,0) band. S.F.

N80-32701*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
ADVANCED VERY HIGH RESOLUTION RADIOMETER, MOD 2 ENGINEERING REPORT Final Report
[1980] 104 p.
(Contract NAS5-23400)
(NASA-CR-160034) Avail: NTIS HC A06/MF A01 CSCL 14B

The Advanced High Resolution Radiometer, Mod 2 (AVHRR/2) is a modification of the original AVHRR (AVHRR/1) to expand the number of channels from four to five and provide additional sensing in the infrared region. A comparison of the spectral regions employed in the two instruments is given. Three of the channels are the same on both instruments. The difference in instruments is in the long wave IR region where a single channel was replaced by two channels. The modification from AVHRR/1 to AVHRR/2 was done with a minimum of changes. The areas of change are highlighted and the modifications by module are summarized. It is seen that the primary changes are in the relay optics and in the cooler. In this development program only two models are involved. The first model, the Optical Test Model was constructed and tested to prove the performance and structural integrity of the optical system and the modified cooler. The second model constructed is the Protoflight. Only the areas of the AVHRR/2 which were modified from the AVHRR/1 design are discussed. E.D.K.

N80-32702# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio
INVESTIGATION OF PHOTOGRAPHIC IMAGE QUALITY ESTIMATORS
Gilbert G. Kuperman. Apr. 1980 112 p. refs
(AF Proj. 7184)
(AD-A087805; AFAMRL-TR-80-27) Avail: NTIS
HC A05/MF A01 CSCL 14/5

Three predictors of photographic image quality, Inverse Square Law (ISL), Modulation Transfer Function (MTF), and Sun's Equation, were compared against two subjective techniques: Resolving Power (RP) and Visual Image Evaluation (VIE), and five objective techniques: Acutance, Edge Width, Reciprocal Edge Spread (RES), and two MTF/Aerial Image Modulations (MTF/AIM). Tribar targets at four nominal contrast levels were photographed while the film plane was driven through 7 1/2 cycles of sinusoidal image motion at seven peak-to-peak displacement amplitudes, 0.00000 (i.e., static), 0.00025, 0.00050, 0.00075, 0.00100, 0.00125, and 0.00150 inches. An analysis of variance (ANOVA) was performed for the RP data. Targets, Amplitudes, and their interaction were found to be highly significant ($p < 0.01$). The independent variables and their interactions accounted for over 96 percent of the total experimental variance. The three predictive models (ISL, MTF, and Sun's Equation) all were highly correlated ($r > 0.96$) linear functions of RP. The VIE technique also proved to be highly linear correlate of RP ($r = 0.95915$). GRA

N80-32703# Naval Research Lab., Washington, D.C. Structural Mechanics Branch
LIQUID SURFACE LEVITATION HOLOGRAPHY. PART 1: THEORETICAL Interim Report
Alfred V. Clarke, Jr. 11 Aug. 1980 109 p. refs
(RR0230345)
(AD-A088418; NRL-8205) Avail: NTIS HC A06/MF A01
CSCL 20/1

The liquid surface levitation holography system has been analyzed, paralleling analyses by previous investigators but treating several new areas. Depth of focus and depth of field of the acoustic lens system are considered, accounting for differences in the acoustic properties of the imaging and object-tank fluids. The mechanical properties of the minitank membrane are shown to have three significant effects: multiple internal reflections of acoustic waves are enhanced in the minitank, which causes the minitank transfer function to become oscillatory for large imaging-fluid depths; deformation of the membrane can degrade the focused acoustic image; and coupling between motions of the membrane and of the liquid surface occurs at low spatial frequencies. Possible coupling between the acoustic field quantities (pressure, density, and velocity) and the surface levitation field is shown to be negligible for a typical system. The low-spatial-frequency deformation (bulge) of the liquid surface is calculated for typical system parameters. The natural frequencies of oscillation of the surface are much less than the rate at which the surface is excited. Consequently the bulge builds up to a steady-state value. GRA

N80-32704# Ampex Corp., Redwood City, Calif. Advanced Technology Div.
RECORDING MEDIA ARCHIVAL ATTRIBUTES (MAGNETIC) Final Technical Report, 30 May 1978 - 30 Nov. 1979
Neal Bertram and A. Eshel. Apr. 1980 123 p. refs
(Contract F30602-78-C-0181; AF Proj. 3205)
(AD-A088187; RR-80-01; RADC-TR-80-123) Avail: NTIS
HC A06/MF A01 CSCL 14/3

This study focuses on the long-term (10-15 year) storage effects on magnetic recording media with emphasis on digital magnetic tape. Both the theoretical and experimental aspects are presented covering the primary magnetic, chemical, and mechanical considerations. Definite storage and handling procedures along with an optimum long term magnetic recording system are discussed. Conclusions are that long term storage is possible with magnetic tapes provided tight environmental controls are maintained and low acceleration rewinds are performed at a minimum interval of 3 1/2 years. GRA

N80-32705# American Liquid Xtal Chemical Corp., Kent, Ohio
NEW INSTRUMENTATION FOR TEMPERATURE MEASUREMENT. PHASE 1: PROGRAM SOLICITATION, SMALL BUSINESS INNOVATION RESEARCH Final Report
James L. Fergason. 1980 28 p. refs
(Grant NSF DAR-79-17642)
(PB80-184682; NSF/RA-800037) Avail: NTIS
HC A03/MF A01 CSCL 14B

Temperature sensitive liquid crystals designed to meet the need for a measuring device to accurately measure temperature and temperature distribution in the presence of electric, magnetic, and sonic fields, especially with high space and thermal resolution are discussed. A technique was developed to make highly reproducible, stable configurations of liquid crystal encapsulates. Temperature stable sensors have been produced which can be calibrated to the National Bureau of Standards. The thermal properties of the liquid crystal can be matched to the properties of the surrounding medium. Since a two dimensional representation of the temperature distribution is possible, the use of this instrumentation has significant implications for bioengineering. GRA

N80-32706# California Univ., Berkeley. Lawrence Berkeley Lab.
BETA GAUGE INSTRUMENTATION FOR THE MEASUREMENT OF AEROSOL MASS Final Report
J. M. Jaklevic, R. C. Gatti, F. S. Goulding, and B. W. Loo. May 1980 39 p. refs
(PB80-195175; EPA-600/7-80-081) Avail: NTIS
HC A03/MF A01 CSCL 14B

An instrument developed for the routine measurement of aerosol mass using the beta gauge particle attenuation method is described and evaluated. Factors affecting the precision and accuracy of the measurement are discussed. Results of intercomparison studies between the beta gauge method and conventional gravimetric are presented. The design of the present instrument is particularly well suited for the automatic analysis of membrane filters obtained from modern dichotomous samplers. GRA

N80-32707# National Technical Information Service, Springfield, Va.

ACOUSTIC HOLOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980
William E. Reed Jul. 1980 172 p Supersedes NTIS/PS-70/0735, NTIS/PS-78/0700
(PB80-812530, NTIS/PS-79/0735, NTIS/PS-78/0700) Avail: NTIS HC $30.00/MF $30.00 CSCL 20A

Aspects of acoustic holography are covered in this bibliography of Federally funded research. Theory, equipment design, uses, and imaging techniques are presented. The applications include underwater and underground object locating, structural geology and tectonics, sonar imaging, non destructive testing, antenna radiation patterns, nuclear reactor inspection, remote sensing, and use in medical examination. This updated bibliography contains 168 citations, 15 of which are new entries to the previous edition. GRA

N80-32708# National Technical Information Service, Springfield, Va.
ACOUSTIC HOLOGRAPHY. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1980
William E. Reed Jul. 1980 334 p Supersedes NTIS/PS-79/0736, NTIS/PS-78/0701
(PB80-812548, NTIS/PS-79/0736, NTIS/PS-78/0701) Avail: NTIS HC $30.00/MF $30.00 CSCL 20A

Worldwide research on acoustic holography is covered. Theory, uses, equipment design, and imaging techniques are presented. Most of the studies are general and not applied to a specific use of acoustic holography. However, there are citations which do discuss its use in medicine, nuclear reactors, and nondestructive testing. This updated bibliography contains 328 citations, 34 of which are new entries to the previous edition. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-32709# Aerospace Corp., El Segundo, Calif. Threat Analysis Office.
AUTOMATING THE E-BEAM LASER Interim Report
Raymond G. DeBiase 30 Nov. 1979 28 p
(Contract F04701-79-C-0080)
(AD-A079529, SD-TR-79-10, TR-0080(5940-02)-3) Avail: NTIS HC A03/MF A01 CSCL 20/5

Experiments conducted in the E beam Laser Laboratory require the setting of gas flows, pressures, and voltages in a timed sequence, with a variety of sensors monitoring the system. The report describes the use of a CROMEMCO microcomputer and other hardware, and details a BASIC program that senses and displays process variables digitally, reads in process parameters interactively, acquires data during an experiment, and computes and prints out test conditions and results. Author

N80-32710# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF DISCHARGE PROCESSES IN ELECTRICALLY EXCITED BLUE/GREEN LASERS Final Report, 1 Jun. 1979 - 31 May 1980
Walter J. Wiegand 31 Jul. 1980 48 p refs
(Contract N00014-79-C-0593)
(AD-A087682, UTRC-R80-924780-1) Avail: NTIS HC A03/MF A01 CSCL 20/5

Total and partial cross sections for mercuric bromide (HgBr2) electron attachment and ionization reactions of importance in laser discharges have been measured in electron beam experiments. Corresponding rate coefficients have been determined independently in a pulsed, electron swarm apparatus. These studies have determined that the electron impact ionization cross section of HgBr2 is very large, increasing from a threshold at 10.6 eV to a value of 2 x 10 to the minus 15th power sq cm at 70 eV, with HgBr2 ion being the principal ion formed at low energies. Beam measurements also have revealed only one electron loss process, dissociative attachment. This attachment reaction which produces Br ion has a threshold energy of 3.1 eV and a peak cross section of 1 x 10 to the minus 17th power sq cm at 3.7 eV. From swarm measurements, an attachment rate coefficient of 1.5 x 10 to the minus 10th power cu cm/sec at a few electron volts average electron energy has been determined. This value is consistent with cross section values determined from beam measurements and with values inferred from kinetic modeling studies of electron beam controlled HgBr2 laser discharges. GRA

N80-32711# Naval Research Lab., Washington, D. C.
BEAM NONUNIFORMITY EFFECTS ON LASER ABLATIVELY ACCELERATED TARGETS
S. P. Obenschain, R. H. Lemberg, and B. H. Ripin 20 Aug. 1980 13 p refs
(AD-A088056, NRL-MR-4309) Avail: NTIS HC A02/MF A01 CSCL 18/1

A laser Doppler shift technique gives the velocity profiles of ablatively accelerated targets. Measurements of the effects of laser beam nonuniformity on the target acceleration are presented and interpreted in the context of laser pellet fusion. GRA

N80-32712# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
ADVANCED CONCEPTS IN CLOSED-CYCLE LASERS Final Technical Report, 6 Dec. 1976 - 30 Sep. 1979
Robert A. Olson and Dennis F. Grosjean Wright-Patterson AFB, Ohio Air Force Aero Propulsion Lab. Mar. 1980 187 p refs
(Contract F33615-76-C-2177; AF Proj. 2301)
(AD-A088226, AFWAL-TR-80-2026) Avail: NTIS HC A09/MF A01 CSCL 20/5

The status of closed-cycle-laser technology is reviewed. The technology and performance of closed-cycle lasers in a recirculating loop and in a novel annular-flow-return configuration are discussed. High-repetition-rate laser operation has been achieved in high-pressure mixtures of Ar:Xe, Ne:Xe, He:Xe, He:Kr, He:Ar, and CO2:CO:Xe:He. New laser lines at 5.13 and 5.44 microns have been observed for the He-Xe laser which generated a maximum average laser output power of 5.1 W at 9.5 kHz. Closed-cycle XeCl laser operation employing a recirculating-loop configuration is discussed. Previously measured laser-seeding-agent photoabsorption cross sections and photoionization yields have been verified. Absolute measurements of UV emission from a CO spark source and measurements of UV emission from a CO2:N2:He capillary discharge have been made. A sliding spark and a dielectric-coupled discharge have been investigated as laser-preionizaton sources. Mercury-halide photolytic excitation studies have been made, and HgBr2 photoabsorption cross sections have been measured. GRA

N80-32713# Avco-Everett Research Lab., Mass.
RARE GAS HALIDE LASERS FOR FUSION Final Technical Report, 1 Mar. 1979 - 29 Feb. 1980
C. Duzy, J. Hsia, H. Hyman, J. Jacob, D. Klimek, J. Parks, and D. Trainor Apr. 1980 106 p refs
(Contract DE-AC08-79DP-40103)
Avail: NTIS HC A06/MF A01

In an effort to reliably extend the understanding of KrF lasers, specific, detailed experimental data were collected and theoretical calculations were carried out to explore and document those issues identified as likely to be important in the short pulse operating regime. These included the effects of: (1) fuel burnup, (2) electron quenching, (3) gain/absorption at high current densities, (4) photoionization, (5) accessibility of the lying levels of KrF by laser flux, (6) temperature on fluorescence efficiency. DOE

N80-32714# California Univ., Livermore. Lawrence Livermore Lab.
THERMAL CHARACTERISTICS OF DISCHARGE-HEATED COOPER VAPOR LASER (DHCVL) HEAT SHIELDS FORMED OF MULTIPLE COAXIAL CYLINDERS
T. W. Alger 10 Jan. 1980 8 p refs Presented at the 1974 Natl. Heat Transfer Conf., Orlando, Fla., 27-30 Jul. 1980
(Contract W-7405-eng-48)
(UCRL-83649, CONF-800723-6) Avail: NTIS HC A02/MF A01

A calculational method for predicting the axial temperature variation of each cylinder of a finite length heat shield formed of multiple coaxial cylinders was developed for longitudinal

discharge, discharge heated copper vapor laser (DHCVL) application. This model includes diffuse gray thermal radiation and axial conduction effects, but it neglects radial conduction and convection. Example calculations for three different possible DHCVL geometries (diameters) are presented to demonstrate the importance of emmissivity, number of included cylinders and the applied heat flux on the plasma tube maximum temperature and the axial temperature profile. Comparison is made between a predicted and a measured DHCVL maximum plasma tube temperature. DOE

N80-32715# Los Alamos Scientific Lab., N. Mex.
EXCIMER LASER TECHNOLOGY
Phillip N. Mace. 1980. 9 p. refs. Presented at 24th SPIE Intern. Symp., San Diego, Calif., 1 Aug. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1427; CONF-800810-1) Avail: NTIS HC A02/MF A01

Scaling presently available excimer laser systems to lasers designed to operate at high average power and high pulse repetition rates for long periods of time is addressed. Key technology issues examined include preionization techniques, energy delivery systems, and system chemistry. The development of pulse power components, optical elements, and flow system components is also covered. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-32716* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REDUNDANT MOTOR DRIVE SYSTEM. Patent
John A. Calvert, inventor (to NASA). Issued 5 Aug. 1980. 6 p. Filed 4 Aug. 1978. Supersedes N78-28460 (16 - 19, p. 2534)
(NASA-Case-MFS-23777-1; US-Patent-4,215,592; US-Patent-Appl-SN-931217; US-Patent-Class-74-661; US-Patent-Class-74-425; US-Patent-Class-74-665C; US-Patent-Class-318-15) Avail: US Patent and Trademark Office. CSCL 13I

A drive system characterized by a base supporting a pair of pillars arranged in spaced parallelism, a shaft extended between and supported by the pillars for rotation about the longitudinal axis thereof, a worm gear affixed to the shaft and supported in coaxial relation therewith is described. A bearing housing of a sleeve like configuration is concentrically related to the shaft and is supported thereby for free rotation. A first and a second quiescent drive train, alternatively activatable, is provided for imparting rotation into said bearing housing. Each of the drive trains is characterized by a selectively energizable motor connected to a spur gear. Official Gazette of the U.S. Patent and Trademark Office

N80-32717* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BELT FOR TRANSMITTING POWER FROM A COGGED DRIVING MEMBER TO A COGGED DRIVEN MEMBER. Patent
Hossein Bahiman, inventor (to NASA). Issued 5 Aug. 1980. 4 p. Filed 18 Sep. 1978. Supersedes N78-32435 (16 - 23, p. 3086)
(NASA-Case-GSC-12289-1; US-Patent-4,215,590; US-Patent-Appl-SN-943086; US-Patent-Class-474-205; US-Patent-Class-198-847; US-Patent-Class-198-848) Avail: US Patent and Trademark Office. CSCL 13I

A belt for transmitting power from a cogged driving member to a cogged driven member such as a pair of wheel sprockets is described. The belt has inflexible teeth spaced along the direction of its travel. Each of the teeth has a longitudinal axis transverse to the direction of belt travel. The belt also includes substantially inextensible fasts spaced transversely to the direction of belt travel. The fasts extend in the direction of belt travel adjacent to the teeth and are looped around preselected numbers of the teeth. Official Gazette of the U.S. Patent and Trademark Office

N80-32718*# Mechanical Technology, Inc., Latham, N. Y.
DEVELOPMENT OF PROCEDURES FOR CALCULATING STIFFNESS AND DAMPING OF ELASTOMERS IN ENGINEERING APPLICATIONS, PART 7
A. Rieger and E. Zorzi. Sep. 1980. 85 p. refs.
(Contract NAS3-21623)
(NASA-CR-165138; Rept-80TR63) Avail: NTIS HC A05/MF A01. CSCL 13I

An elastomer shear damper was designed, tested, and compared with the performance of the T 55 power turbine supported on the production engine roller bearing support. The Viton 70 shear damper was designed so that the elastomer damper could be interchanged with the production T 55 power turbine roller bearing support. The results show that the elastomer sheer dampener permitted stable operation of the power turbine to the maximum operating speed of 16,000 rpm. Author

N80-32719*# Chrysler Corp., Detroit, Mich.
UPGRADED AUTOMOTIVE GAS TURBINE ENGINE DESIGN AND DEVELOPMENT PROGRAM, VOLUME 2. Final Report
C. E. Wagner, ed. and R. C. Pampreen, ed. Jun. 1979. 348 p. refs. Sponsored by NASA
(Contracts EY-76-C-02-2749; EC-77-A-31-1040)
(NASA-CR-159671; DOE/NASA/2749-79/2-Vol-2; COO-2749-43-Vol-2) Avail: NTIS HC A15/MF A01. CSCL 13I

Results are presented for the design and development of an upgraded engine. The design incorporated technology advancements which resulted from development testing on the Baseline Engine. The final engine performance with all retro-fitted components from the development program showed a value of 91 HP at design speed in contrast to the design value of 104 HP. The design speed SFC was 0.53 versus the goal value of 0.44. The miss in power was primarily due to missing the efficiency targets of small size turbomachinery. Most of the SFC deficit was attributed to missed goals in the heat recovery system relative to regenerator effectiveness and expected values of heat loss. Vehicular fuel consumption, as measured on a chassis dynamometer, for a vehicle inertia weight of 3500 lbs., was 15 MPG for combined urban and highway driving cycles. The baseline engine achieved 8 MPG with a 4500 lb. vehicle. Even though the goal of 18.3 MPG was not achieved with the upgraded engine, there was an improvement in fuel economy of 46% over the baseline engine, for comparable vehicle inertia weight. Author

N80-32720*# Rochester Inst. of Tech., N. Y.
DEVELOPMENT OF FLEXIBLE ROTOR BALANCING CRITERIA. Final Report
Wayne W. Walter and Neville F. Rieger. Mar. 1979. 115 p. refs.
(Grant NsG-3072)
(NASA-CR-159506) Avail: NTIS HC A06/MF A01. CSCL 13I

Several studies in which analytical procedures were used to obtain balancing criteria for flexible rotors are described. General response data for a uniform rotor in damped flexible supports were first obtained for plain cylindrical bearings, tilting pad bearings, axial groove bearings, and partial arc bearings. These data formed the basis for the flexible rotor balance criteria presented. A procedure by which a practical rotor in bearings could be reduced to an equivalent uniform rotor was developed and tested. It was found that the equivalent rotor response always exceeded to practical rotor response by more than sixty percent for the cases tested. The equivalent rotor procedure was then tested against six practical rotor configurations for which data was available. It was found that the equivalent rotor method offered a procedure by which balance criteria could be selected for practical flexible rotors, using the charts given for the uniform rotor. A.R.H.

N80-32721# Curtiss-Wright Corp., Wood-Ridge, N.J. Power System Div.
HIGH TEMPERATURE TURBINE TECHNOLOGY PROGRAM. PHASE 2: TECHNOLOGY TEST AND SUPPORT STUDIES. Technical Progress Report, 1 Jan. - 31 Mar. 1979
Apr. 1979. 140 p.
(Contracts EX-76-C-01-2291)

(FE-2291-44A; CW-WR-76-02-0-44A) Avail: NTIS HC A07/MF A01

Objectives of the program elements as well as technical progress and problems associated with coal derived clean fuels are presented. Progress on design, fabrication and checkout of test facilities and test rigs is described. The LP engine test program through 3000 F turbine inlet temperature is discussed. Design and analysis of the TSTR engine and synthesized low Btu gas components are discussed. Supporting materials and process investigations are reviewed. DOE

N80-32722# United Technologies Corp., East Hartford, Conn.
UTRC 8 KW WIND TURBINE TESTS
M. C. Cheney 1980 9 p refs Presented at the Wind Energy Conf., Boulder, Colo., 9 Apr. 1980
(Contract DE-AC04-76DP-03533)
(RFP-3085; CONF-800406-5) Avail: NTIS HC A02/MF A01

The prototype testing demonstrated the basic operation of the unique control concept of the Composite Bearingless Wind Turbine which utilizes a hub mounted pendulum employed to twist the graphite composite inboard region of the blade producing blade pitch variations. The tests also demonstrated the predicted performance of kW at 20 mph, and the high speed stall control feature. DOE

N80-32723# Advanced Mechanical Technology, Inc., Newton, Mass.
DESIGN AND DEVELOPMENT OF STIRLING ENGINES FOR STATIONARY POWER GENERATION APPLICATIONS IN THE 500 TO 3000 HORSEPOWER RANGE Quarterly Report
7 Jan. 1980 98 p
(Contract DE-AC02-79ET-15207)
(DOE/ET-15207/T1; QR-1) Avail: NTIS HC A05/MF A01

Factors considered in the generation of state of the art conceptual designs for a Stirling engine capable of being fueled by a variety of heat sources are discussed with emphasis on coal firing. Designs having the the greatest potential for fabrication, testing and demonstration in 1985 are considered as well as advanced technologies which require significant R and D before commercialization. Concepts examined include a heat transport system for integrating the engine heater head with such energy sources as conventional oil gas combustors, fluidized bed and other coal combustors, and combustors using coal derived liquid fuels and low/medium Btu gases. DOE

N80-32724# Massachusetts Inst. of Tech., Cambridge. School of Engineering.
IMPROVEMENT OF RELIABILITY OF WELDING BY IN-PROCESS SENSING AND CONTROL: DEVELOPMENT OF SMART WELDING MACHINES FOR GIRTH WELDING OF PIPES Progress Report
Jose Converti, Yehuda Dror, David E. Hardt, Koichi Masubuchi, Henry M. Paynter, and William C. Unkel 30 Nov. 1979 42 p refs
(Contract DE-AC02-79ER-10474)
(DOE/ER-10474/1; PR-1) Avail: NTIS HC A03/MF A01

Progress in a research program to improve the reliability of welding by developing a smart welding machine is reported. The machine is equipped with sensors, artificial intelligence, and actuators for reducing welding errors by one or two orders of magnitude. DOE

N80-32725# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
ACTIVE FEEDBACK CONTROL FOR STABILIZATION OF VIBRATION IN ROTATING MACHINERY (24.034) Quarterly Technical Report, 1 Apr. - 30 Jun. 1980
Bruce Bakaysa 1980 15 p
(Contract DE-AC01-79ET-13151)
(DOE/ET-13151/T5) Avail: NTIS HC A02/MF A01

Some of the considerations involved in the use of feedback control as a means of reducing the unbalanced response of a rotor or of eliminating or alleviating rotor dynamic instability are discussed. A simple model of a mass on a flexible shaft was used to illustrate the application of feedback control concepts. A description is given of a system which uses feedback control individually adjustable in the vertical and horizontal directions to support the shaft bearings. DOE

N80-32726# International Nickel Co., Inc., Suffern, N. Y. Research and Development Center.
WELD OVERLAYING FOR CORROSION RESISTANCE IN COAL GASIFICATION ATMOSPHERES Quarterly Report, 1 Mar. - 31 May 1979
Edward P. Sadowski 1979 65 p
(Contract ET-77-C-01-2621)
(FE-2621-13) Avail: NTIS HC A04/MF A01

Hardness and tensile testing of weldments exposed to a 1% H2S coal gasification atmosphere for 1000 hours at 982 C was completed. Corrosion evaulation of unwelded specimens of 304L, 310 SS and INCOLOY alloy 800H was also completed. The INCONEL Filler Metal 72 and R139 overlays increased and the AWS-ER309 overlays decreased in hardness after exposure. The welding process used had very little effect on the response of the FM-72 overlays, while R139 deposited by the SAW process had the least increase in hardness. The latter may be associated with the lower Al recovery obtained with the SAW process. Generally, the heat affected zone and base metals of all weldments decreased in hardness after exposure. All weldness decreased in room temperature yield and tensile strength after exposure. Most weldments suffered a decrease in tensile ductility. The 310 weldments had the largest percentage decrease and the 304L weldments the last percentage decrease in the original tensile ductility after exposure. DOE

N80-32727# Idaho National Engineering Lab., Idaho Falls.
CENTRIFUGAL PUMP PERFORMANCE UNDER SIMULATED TWO-PHASE FLOW CONDITIONS
Tien-Hu Chen and William J. Quarp 1980 28 p refs Presented at ASME Century 2 Emerging Technol. Conf., San Francisco, 10 Aug. 1980
(Contract DE-AC07-76ID-01570)
(CONF-800804-7) Avail: NTIS HC A03/MF A01

Test results from centrifugal (mixed-flow) pump performance testing using nitrogen-water flow to simulate steamwater two phase conditions are presented. Capability of the pump model used to analyze the thermal-hydraulic response when applied to a postulated loss-of-coolant accident in a light water reactor is examined. DOE

N80-32728# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
HIGH-TEMPERATURE TURBINE TECHNOLOGY PROGRAM. OVERALL PLANT DESIGN DESCRIPTION (OPDD) COAL-DERIVED LIQUID
M. W. Horner Mar. 1980 192 p refs
(Contract EX-76-C-01-1806)
(FE-1806-84) Avail: NTIS HC A09/MF A01

A highly reliable, commercially viable system based on coal-derived liquid fuel is described. A coal-derived liquid fueled, high firing temperature, water-cooled gas turbine system with a steam bottoming plant that has one reheat steam turbine is discussed. A detailed exposition of the organization, operation, and control of the integrated system is presented. The combined-cycle system specified provides improved flexibility of operation as well as reliability and efficiency. The PRD-6 gas turbine utilized in the system design has a 12:1 pressure ratio, compressor inlet air flow of 300 lb/second, and a 2600 F deg. firing temperature. The performance characteristics of the overall plant are given. DOE

N80-32729# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
HIGH-TEMPERATURE TURBINE TECHNOLOGY PROGRAM. OVERALL PLANT DESIGN DESCRIPTION (OPDD) LOW-Btu COAL GAS ELECTRIC POWER PLANT
M. W. Horner Mar. 1980 241 p
(Contract EX-76-C-01-1806)
(FE-1806-83) Avail: NTIS HC A11/MF A01

A highly reliable, commercially viable system based on coal derived fuel is described. The system consists mainly of high temperature, water cooled gas turbines that burn coal derived gas fuel, and a steam bottoming cycle with one reheat steam

turbine. The combined cycle system provides improved flexibility of operation as well as reliability and efficiency. DOE

N80-32730# Los Alamos Scientific Lab., N. Mex.
NUMERICAL SIMULATION OF REACTIVE FLOW IN INTERNAL COMBUSTION ENGINES
L. D. Cloutman, J. K. Dukowicz, and J. D. Ramshaw. 1980. 7 p. refs. Presented at 7th Intern. Conf. on Numerical Methods in Fluid Dyn., Palo Alto, Calif. 23-27 Jun. 1980; sponsored by NASA and Stanford Univ. Submitted for publication.
(Contract W-7405-eng-36)
(LA-UR-80-1633; CONF-800661-1) Avail: NTIS HC A02/MF A01

Multidimensional numerical simulations of the reactive fluid flow in an internal combustion engine cylinder are useful in helping engine designers obtain insight into the physical mechanism governing efficiency and pollutant formation. A comprehensive numerical model for internal combustion engine cylinder simulations is described. The model is currently embodied in a two dimensional (axisymmetric) computer code called CONCHAS-SPRAY. Work is in progress on a three dimensional code with the same features. DOE

N80-32731# Brookhaven National Lab., Upton, N. Y.
SOOT REDUCTION IN DIESEL ENGINES BY CATALYTIC EFFECTS
R. Sapienza, T. Butcher, C. Krishna, and J. Gaffney. 1980. 20 p. refs. Presented at 4th Workshop on Catalytic Combust., Cincinnati, 14-15 May 1980; sponsored by EPA.
(Contract DE-AC02-76CH-00016)
(BNL-27792; CONF-800553-2) Avail: NTIS HC A02/MF A01

Small additions of alcohols to the fuel and the presence of platinum surfaces in the combustion chamber can reduce soot emissions in a diesel engine. Tests were conducted over a limited range of operation in a single cylinder CFR engine. Most of the testing was done using pure cetane as a fuel at constant speed and load. Possible major features of the reaction mechanisms for both fuel additives and surface catalyst effectiveness are presented. DOE

N80-32732# Central Inst. for Industrial Research, Oslo (Norway).
CERAMIC COATINGS ON DIESEL ENGINE COMPONENTS Progress Report, Jan. - Aug. 1979
Ingard Kvernes and Karl Peter Lillend. Oct. 1979. 19 p. refs.
(Contract DE-AC03-79ET-15320)
(DOE/ET-15320/T1) Avail: NTIS HC A02/MF A01

The development and testing of ceramic coatings for diesel engine components are discussed. These coatings include oxides of Al, Cr, Zr, Mg, Si, Ti, and Ca, and Mo and Cr carbides. Data on their application and thermodynamic and wear characteristics are presented. Preliminary results show that, relative to valves and piston crowns: stabilized ZrO_2 coating under certain conditions increases the working life of various components; higher combustion temperature may improve the thermal efficiency by increased turbocharger air delivery; reduction in the component temperatures decreases the thermal stresses; the ZrO_2-MgO shows improved corrosion resistance in combustion gases compared to (ZrO_2)(Y_2O_3) and (ZrO_2)(CaO); the limitations of the coatings must be defined in more detail; and the adherence of thicker coatings must be improved. Optimization of the spraying process with respect to particle fusion is necessary. Also, Mo and Cr carbide coatings were found to increase the service life of piston rings. DOE

N80-32733# Porsche (Ferdinand) AG, Stuttgart (West Germany).
REDUCTION OF FUEL CONSUMPTION BY THERMODYNAMIC OPTIMIZATION OF THE OTTO MOTOR: COMPARATIVE INVESTIGATION OF OTTO DIESEL ENGINES
D. Gruden, R. Hahn, and H. Loercher. 1980. 171 p. refs. In GEORGIAN.
(EUR-6711-DE) Avail: NTIS (US Sales Only)HC A08/MF A01; DOE Depository Libraries.

Test on a 2.1 Otto engine for the Porshe 924 demonstrate that by optimizing the compression ratio, combustion chamber shape, fuel air ratio and ignition timing, it is possible to reduce the fuel consumption over the entire load and speed range from 4 to 30% in comparison with the conventional variant, without losing maximum power output. The compression ratio of the new engine is 13.0, and is operated with lean fuel/air mixture in the part load range. The acceleration time from 0 to 100 km/h is 9.7 s for the Otto variant, and 24.7 s for the diesel engine. The fuel consumption of both variants is about identical in mixed traffic conditions (city, road, highway). Exclusively in city driving (ECE-test) the diesel engine has a 9% better fuel consumption than the Otto engine due to its lower idle fuel consumption. At higher speeds (90 and 120 km/h), the fuel consumption of the thermodynamically optimized Otto engine is 2 to 8% lower. DOE

N80-32734# Transportation Systems Center, Cambridge, Mass.
POTENTIAL OF DIESEL ENGINE, 1979 SUMMARY SOURCE DOCUMENT Final Report
Thomas Trella. Mar. 1980. 166 p. refs. Sponsored by National Highway Traffic Safety Administration. 5 Vol.
(PB80-193659; DOT-TSC-NHTSA-79-38; DOT-HS-805130) Avail: NTIS HC A08/MF A01 CSCL 21E

The fuel economy potential of diesel engines in future passenger cars and light trucks was assessed. The primary technologies evaluated included: engine control strategy and implementation, the engine design variables, emissions and noise, fuels, lubricants, vehicle-engine matching, and the effects of vehicle characteristics. The major findings are summarized. GRA

N80-32735# Transportation Systems Center, Cambridge, Mass.
POTENTIAL OF DIESEL ENGINE, EMISSION TECHNOLOGY Final Report
Joseph Sturm and Thomas Trella. Mar. 1980. 47 p. refs. Sponsored by National Highway Traffic Safety Administration. 5 Vol.
(PB80-192685; DOT-TSC-NHTSA-79-40; DOT-HS-805239) Avail: NTIS HC A03/MF A01 CSCL 21E

Diesel engine emission technologies applicable to passenger cars and light trucks were surveyed. The general design and operating features are presented and discussed. Current and state-of-the-art concepts were reviewed with the focus on control of diesel emissions through modification of the combustion process, aftertreatment systems and fuel modifications. GRA

N80-32736# Transportation Systems Center, Cambridge, Mass.
POTENTIAL OF SPARK IGNITION ENGINE, EFFECT OF VEHICLE DESIGN VARIABLES ON TOP SPEED, PERFORMANCE, AND FUEL ECONOMY Final Report
Ralph W. Zub, Carol M. Neckyfarow, William M. Lew, and Ralph G. Colello. Mar. 1980. 86 p. refs. Sponsored by National Highway Traffic Safety Admistration. 4 Vol.
(PB80-191836; DOT-TSC-NHTSA-79-53; DOT-HS-805133) Avail: NTIS HC A05/MF A01 CSCL 21E

The effect of vehicle characteristics on vehicle performance and fuel economy was evaluated. Computer simulation offers repeatability and can predict minute changes in fuel economy based on relatively small vehicle alterations. The degree to which each vehicle parameter is modified is based upon projections presented in current literature. The results are assessed and an explanation of the interaction of the vehicle design characteristics on performance is presented. GRA

N80-32737# Transportation Systems Center, Cambridge, Mass.
POTENTIAL OF SPARK IGNITION ENGINE, 1979 SUMMARY SOURCE DOCUMENT Final Report, FY 1979
T. Trella, Ralph W. Zub, and Ralph G. Colello. Mar. 1980. 208 p. refs. Sponsored by National Highway Traffic Safety Administration. 4 Vol.
(PB80-191034; DOT-TSC-NHTSA-79-52; DOT-HS-805132) Avail: NTIS HC A10/MF A01 CSCL 21E

An assessment of the potential for spark ignition engines passenger cars and light trucks is provided. The assessment includes tradeoffs between fuel economy and emissions; improvements in spark ignition engine efficiency; improvements in engine parasitics; improvements due to transmissions; effect of aerodynamic drag and the rolling resistance on fuel economy; effect on performance and fuel economy of weight and axle ratio; lubricant improvements; impact of fuels; and noise considerations. GRA

N80-32738# Scientific Process and Research, Inc., Highland Park, N. J.

ON-LINE DIRECT DIGITAL CONTROL EXTRUSION PROCESS
Imrich Klein and Reuben Klein 4 Apr. 1980 102 p refs
(Grant NSF DAR-79-17508)
(PB80-186489; NSF/RA-800052) Avail: NTIS
HC A06/MF A01 CSCL 13H

Evaluation of existing extrusive control systems in the plastics industry and analysis of a new method of control are discussed. The term extrusion control system in relation to plastics processing operations includes set point controls for various types of heating and cooling equipment as well as motor speed controls for dc and hydraulic screw drives for digital and microprocessor based electronic systems, machine sequencers for injection and blow molding lines, and feed back loops for sheet thickness and insulation uniformity. The extrusion process is examined: the extrusion operation, analysis of existing control systems, directions for development of a new control system, program modules and linkages, and the alarm handler operation. GRA

N80-32739# Amex Systems, Inc., Hawthorne, Calif.
MINI ARC WELDING/BRAZING TECHNIQUE Final Report
G. L. Cann 31 Mar. 1980 68 p refs
(Grant NSF DAR-79-17748)
(PB80-186497; AMEX-0407; NSF/RA-800048) Avail: NTIS
HC A04/MF A01 CSCL 13H

Feasible applications of the mini-arc technique to competitive electron beam welding, or spot welding are described. This involved establishing the physical principles and processes which occur in all methods of making metal-to-metal or metal-to-ceramic joints. The mini-arc welder precludes the need for flux or other chemical cleaning processes. It operates on several selected materials and configurations. Results were compared to those using electron beam and spot welding. The mini-arc proved superior, sometimes creating welds which other techniques could not match. The mini-arc technique can reduce fabrication costs for selected materials and it is ideally suited for automation in manufacturing processes, especially those involving small dimensions. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-32740# Aeronautical Research Labs., Melbourne (Australia).
WEATHERING TESTS ON PROTECTIVE HELMETS APPROVED TO AUSTRALIAN STANDARD AS 1698, FOR VEHICLE USERS Interim Report
S. R. Sarrailhe and G. A. Thomas Nov. 1979 23 p refs
Sponsored by DOT
(AD-A084232; ARL/STRUC-TM-306; AR-001-773; IR-1) Avail: NTIS HC A02/MF A01 CSCL 06/17

The methodology to be used to investigate the effect of weathering on the performance of protective (crash) helmets approved to Australian Standard AS 1698 is described. The results of the preexposure inspections and tests are also provided. R.K.G.

N80-32741# California Univ., Berkeley. Operations Research Center.
ACCELERATED LIFE TESTS AND INFORMATION Research Report
Richard E. Barlow Jun. 1980 20 p refs
(Grant AF-AFOSR-3179-77; AF Proj. 2304)
(AD-A088014; ORC-80-14) Avail: NTIS HC A02/MF A01
CSCL 14/2

This is a partly philosophical discussion of the problems of conducting accelerated life test experiments and analyzing data from such experiments. Our objective is to predict life at a specified stress level. The concept of information is presented and its quantification via entropy discussed. GRA

N80-32742# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.

NONPARAMETRIC EMPIRICAL BAYES ESTIMATION OF RELIABILITY Interim Report
K. Y. Liang and W. J. Dadgett May 1980 14 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A088182; TR-58; AFOSR-80-0587TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Several sequences of nonparametric empirical Bayes estimators of a distribution (or reliability) function are considered. Their asymptotic optimality relative to a Dirichlet process prior is investigated, and the estimators are compared for a small number of stages with respect to Weibull distributions by computer simulation. GRA

N80-32743# Lockheed-California Co., Burbank.
AVAILABILITY/OPERATIONAL READINESS TEST SUBSYSTEM COST TRADEOFFS Final Technical Report
Richard M. Loveless May 1980 106 p refs
(Contract F30602-78-C-0179; AF Proj. 2338)
(AD-A088201; RADC-TR-80-182) Avail: NTIS
HC A06/MF A01 CSCL 15/5

This report describes the general test subsystem practices and tradeoff criteria that will make it possible for an equipment's or system's availability (or operational readiness) requirements to be met through the most cost effective usage of fault diagnosis/isolation/test subsystems that are used in conjunction with the maintenance of the equipment. The trade-off criteria are intended for use in planning the acquisition of new equipments and systems and to provide more accurate assessment of total life-cycle cost. GRA

N80-32744# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.
RELIABILITY CONSIDERATIONS OF ELECTRONICS COMPONENTS FOR THE DEEP UNDERWATER MUON AND NEUTRINO DETECTION SYSTEM
Branko Leskovar Feb. 1980 20 p refs Presented at the Process Workshop, Honolulu, 11-16 Feb. 1980
(Contract W-7405-eng-48)
(LBL-10548; CONF-800240-1) Avail: NTIS
HC A02/MF A01

The reliability of some electronics components for the Deep Underwater Muon and Neutrino Detection (DUMAND) System is discussed. An introductory overview of engineering concepts and technique for reliability assessment is given. Component reliability is discussed in the context of major factors causing failures, particularly with respect to physical and chemical causes, process technology and testing, and screening procedures. Failure rates for discrete devices and for integrated circuits as well as for basic electronics components are presented. The military reliability specifications and standards for semiconductor devices are reviewed. DOE

N80-32745# California Univ., Livermore. Lawrence Livermore Lab. Materials Engineering Div.
WELD EVALUATION ON SPHERICAL PRESSURE VESSELS USING HOLOGRAPHIC INTERFEROMETRY
Donald M. Boyd and William W. Wilcox 14 May 1980 16 p refs Presented at the Fourth Intern. Congr. on Exptl. Mechs., Boston, 26-30 May, 1980
(Contract W-7405-eng-48)
(UCRL-84079; CONF-800575-2) Avail: NTIS
HC A02/MF A01

Waist welds on spherical experimental pressure vessels were evaluated under pressure using holographic interferometry. A coincident viewing and illumination optical configuration coupled with a parabolic mirror was used so that the entire weld region could be examined with a single hologram. Positioning the pressure vessel at the focal point of the parabolic mirror provides a relatively undistorted 360 degrees of view of the waist weld. Double exposure and real time holography were used to obtain displacement information on the weld region. Results are compared with radiographic and ultrasonic inspections. DOE

N80-32746# California Univ., Livermore. Lawrence Livermore Lab. Materials Engineering Div.
HOLOGRAPHIC AND ACOUSTIC EMISSION OF EVALUATION OF PRESSURE VESSELS
Donald M. Boyd 5 Mar. 1980 7 p refs Presented at the

ASME Centennial PUP Conf., San Francisco, 12-15 Aug. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84046; CONF-800804-5) Avail: NTIS HC A02/MF A01

Optical holographic interferometry and acoustic emission monitoring were simultaneously used to evaluate two small, high pressure vessels during pressurization. The techniques provide pressure vessel designers with both quantitative information such as displacement/strain measurements and qualitative information such as flaw detection. The data from the holographic interferograms were analyzed for strain profiles. The acoustic emission signals were monitored for crack growth and vessel quality. DOE

N80-32747# Bendix Corp., Kansas City, Mo. Technical Communications Div.
AUTOMATIC VISUAL INSPECTION OF HYBRID MICROCIRCUITS Final Report
R. E. Hines May 1980 98 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2359) Avail: NTIS HC A05/MF A01

An automatic visual inspection system using a minicomputer and a video digitzer was developed for inspecting hybrid microcircuits (HMC) and thin film networks. The system performed well in detecting missing components on HMCs and reduced the testing time for each HMS by 7 percent. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis, fatigue, and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-32748# Army Materials and Mechanics Research Center, Watertown, Mass. Engineering Mechanics Div.
SCATTERED LIGHT PHOTOELASTIC ANALYSIS OF A PROJECTILE BULKHEAD TO STRUCTURAL CASE JOINT Final Report
Miloslav Benicek and Jiro Adachi Oct. 1979 16 p
(DA Proj. 1X4-64603-D-663)
(AD-A079563; AMMRC-TR-79-54) Avail: NTIS HC A02/MF A01 CSCL 20/11

Photoelastic stress analysis of the bulkhead to structural case pin joint of a projectile was carried out using the scattered light technique. Analysis provided three dimensional stress distributions in critical areas of the joint including the pinhole, pin bearing surfaces, and joint bearing surfaces. Stress gradients through the wall were found to be large; however, stress concentrations were found to be moderate with a maximum value of 3.7.
Author

N80-32749# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THEORETICAL STUDIES OF COLUMNS UNDER AXIAL IMPACT AND EXPERIMENTAL VERIFICATION
J. Ari-Gur, T. Weller, and J. Singer Aug. 1979 47 p refs
(TAE-377) Avail: NTIS HC A03/MF A01

The response of clamped columns, axially impacted by a mass, is studied. Rayleigh type beam equations and nonlinear strain displacement relations are assumed for linear-elastic anisotropic materials. The equations are solved by a finite difference approximation; the choice of mesh sizes is discussed, and recommendations for best discretization are given. Comparisons of the results with experiments and with some available analytic results show good correlation. Dynamic buckling criteria are discussed and buckling strains are determined for various columns. The overall response of a column is represented by a relation which yields a dynamic Southwell type relation. A dynamic amplification load factor (DLF) is defined, and parametric studies show that this factor is primarily dependent upon initial geometrical imperfection of the column, its effective slenderness, and the duration of the impulsive loading. E.D.K.

N80-32750# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ON THE CONSTITUTIVE LAWS FOR THE LARGE STRAIN CYLINDRICAL DEFORMATIONS OF SHELLS
Avinoam Libai and J. G. Simmonds (Virginia Univ.) May 1979 30 p refs
(TAE-370) Avail: NTIS HC A03/MF A01

Expressions are developed for the strain energy and stress resultants in the case of large strain-large bending cylindrical deformations of shells of nonlinear materials. The deformation variables are the extension and curvature of the material reference surface. The Mooney material is used as an example where appropriate. The influence of the large deformations on the constitutive laws is evaluated. Of special interest is the effect of cross terms and of the ability to express the stress resultants as partial derivatives of the strain energy with respect to appropriate deformation variables. Author

N80-32751# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
FRACTURE TOUGHNESS TESTING OF HDPE PLASTIC PIPE
Peter Flueeler (Swiss Federal Labs. for Testing Materials and Research, Duebendorf), Daniel R. Roberts, John F. Mandell, and Frederick J. McGarry Nov. 1979 30 p refs Sponsored by Agency for International Development
(MIT-CE-R79-5) Avail: NTIS HC A03/MF A01

A program to investigate the applicability of fracture toughness test methods to high density polyethylene pipe is described. Fracture toughness test specimens cut from pipe material were tested in a precracked three point bending test at different rates. The load vs crack opening displacement record was used in an attempt to judge the validity of the test and to determine the fracture load. This method appears to need further development for this class of materials as the results were difficult to interpret. Use of the maximum force for tests which appeared to fail in a quasi-brittle manner resulted in calculation of a fracture toughness value. This value was used to predict the burst pressure of pipes containing surface cracks in the longitudinal direction. The prediction of burst pressure was slightly conservative, but in agreement with the trend of the experimental results. Fractographic analysis indicates three modes of crack propagation: ductile, quasi-brittle, and brittle. Author

N80-32752*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
STATISTICAL ENERGY ANALYSIS OF COMPLEX STRUCTURES, PHASE 2 Final Report
R. W. Trudell and L. I. Yano Sep. 1980 78 p refs
(Contract NAS8-33191)
(NASA-CR-161576; MDC-G9203) Avail: NTIS HC A05/MF A01 CSCL 20K

A method for estimating the structural vibration properties of complex systems in high frequency environments was investigated. The structure analyzed was the Materials Experiment Assembly, (MEA), which is a portion of the OST-2A payload for the space transportation system. Statistical energy analysis (SEA) techniques were used to model the structure and predict the structural element response to acoustic excitation. A comparison of the intial response predictions and measured acoustic test data is presented. The conclusions indicate that: the SEA predicted the response of primary structure to acoustic excitation over a wide range of frequencies; and the contribution of mechanically induced random vibration to the total MEA is not significant.
F.O.S.

N80-32753*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE METHOD OF LINES IN THREE DIMENSIONAL FRACTURE MECHANICS
John Gyekenyesi and Laszlo Berke Washington 1980 19 p refs Presented at the Intern. Symp. on Absorbed Specific Energy and/or Strain Energy Density Criterion, Budapest, 17-19 Sep. 1980; sponsored by Lehigh Univ. and the Hungarian Acad. of Sci.
(NASA-TM-81593; E-576) Avail: NTIS HC A02/MF A01 CSCL 20K

A review of recent developments in the calculation of

design parameters for fracture mechanics by the method of lines (MOL) is presented. Three dimensional elastic and elasto-plastic formulations are examined and results from previous and current research activities are reported. The application of MOL to the appropriate partial differential equations of equilibrium leads to coupled sets of simultaneous ordinary differential equations. Solutions of these equations are obtained by the Peano-Baker and by the recurrance relations methods. The advantages and limitations of both solution methods from the computational standpoint are summarized. R.K.G.

N80-32754*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INTERLAMINAR STRESS SINGULARITIES AT A STRAIGHT FREE EDGE IN COMPOSITE LAMINATES
I. S. Raju (George Washington Univ.) and John J. Crews, Jr. Aug. 1980 31 p refs
(Grant NsG-1449)
(NASA-TM-81876) Avail: NTIS HC A03/MF A01 CSCL 20K

A quasi three dimensional finite element analysis was used to analyze the edge stress problem in four-ply, composite laminates. Convergence studies were made to explore the existence of stress singularities near the free edge. The existence of stress singularities at the intersection of the interface and the free edge is confirmed. S.F.

N80-32755# Materials Research Labs., Ascot Vale (Australia).
DATA CONTROLLER SYSTEM FOR FATIGUE CRACK MONITORING USING A POTENTIAL DROP TECHNIQUE
Barry J. Baxter 1979 22 p ref
(MRL-TN-429; AR-001-839) Avail: NTIS HC A02/MF A01

A control unit is described which was designed to interface with (1) a digital voltmeter calibrated to respond to fatigue crack growth, (2) load and cycle data from a servo hydraulic system, and (3) a desk calculator. The calculator is programmed to determine crack length, crack growth rate and stress intensity factors. Preset limits on the load and number of cycles permits termination of the test when the levels have been exceeded. Appropriate power supplies for the units are also discussed. A.R.H.

N80-32756*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RESEARCH IN NONLINEAR STRUCTURAL AND SOLID MECHANICS
Harvey G. McComb, Jr., comp. and Ahmed K. Noor, comp. (Joint Inst. for Advancement of Flight Sciences, Hampton, Va.) 1980 287 p refs Symp. on Computational Methods in Nonlinear Struct. and Solid Mech. held in Washington, D.C., 6-8 Oct. 1980; sponsored by NASA, George Washington Univ., NSF, ASCE and ASME
(NASA-CP-2147; L-13950) Avail: NTIS HC A13/MF A01 CSCL 20K

Nonlinear analysis of building structures and numerical solution of nonlinear algebraic equations and Newton's method are discussed. Other topics include: nonlinear interaction problems; solution procedures for nonlinear problems; crash dynamics and advanced nonlinear applications; material characterization, contact problems, and inelastic response; and formulation aspects and special software for nonlinear analysis. For individual titles, see N80-32757 through N80-32776.

N80-32757*# Rijkswaterstaat, The Hague (Netherlands).
ANALYSIS OF REINFORCED CONCRETE STRUCTURES WITH OCCURRENCE OF DISCRETE CRACKS AT ARBITRARY POSITIONS
J. Blaauwendraad, H. J. Grootenboer, A. L. Bouma (Technische Hogeschool, Delft, Netherlands), and H. W. Reinhardt (Technische Hogeschool, Delft, Netherlands) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 1-12 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

A nonlinear analysis of in-plane loaded plates is presented, which eliminates the disadvantages of the smeared crack approach. The elements used and the computational method are discussed. An example is shown in which one or more discrete cracks are dominant. E.D.K.

N80-32758*# University Coll. of Swansea (Wales).
COMPUTATIONAL MODELS FOR THE NONLINEAR ANALYSIS OF REINFORCED CONCRETE PLATES
E. Hinton, H. H. Abdel Rahman, and M. M. Huq *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 13-26 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

A finite element computational model for the nonlinear analysis of reinforced concrete solid, stiffened and cellular plates is briefly outlined. Typically, Mindlin elements are used to model the plates whereas eccentric Timoshenko elements are adopted to represent the beams. The layering technique, common in the analysis of reinforced concrete flexural systems, is incorporated in the model. The proposed model provides an inexpensive and reasonably accurate approach which can be extended for use with voided plates. E.D.K.

N80-32759*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NEWTON'S METHOD: A LINK BETWEEN CONTINUOUS AND DISCRETE SOLUTIONS OF NONLINEAR PROBLEMS
Gaylen A. Thurston *In its* Res. in Nonlinear Struct. and Solid Mech. 1980 p 27-46 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

Newton's method for nonlinear mechanics problems replaces the governing nonlinear equations by an iterative sequence of linear equations. When the linear equations are linear differential equations, the equations are usually solved by numerical methods. The iterative sequence in Newton's method can exhibit poor convergence properties when the nonlinear problem has multiple solutions for a fixed set of parameters, unless the iterative sequences are aimed at solving for each solution separately. The theory of the linear differential operators is often a better guide for solution strategies in applying Newton's method than the theory of linear algebra associated with the numerical analogs of the differential operators. In fact, the theory for the differential operators can suggest the choice of numerical linear operators. In this paper the method of variation of parameters from the theory of linear ordinary differential equations is examined in detail in the context of Newton's method to demonstrate how it might be used as a guide for numerical solutions. Author

N80-32760*# Electric Power Research Inst., Palo Alto, Calif.
NONLINEAR SOIL-STRUCTURE INTERACTION CALCULATIONS SIMULATING THE SIMQUAKE EXPERIMENT USING STEALTH 2D
H. T. Tang, R. Hofmann (Science Applications, Inc., San Leandro, Calif.), G. Yee (Science Applications, Inc., San Leandro, Calif.), and D. K. Vaughan (Weidlinger Associates, Menlo Park, Calif.) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 47-66 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

Transient, nonlinear soil-structure interaction simulations of an Electric Power Research Institute, SIMQUAKE experiment were performed using the large strain, time domain STEALTH 2D code and a cyclic, kinematically hardening cap soil model. Results from the STEALTH simulations were compared to identical simulations performed with the TRANAL code and indicate relatively good agreement between all the STEALTH and TRANAL calculations. The differences that are seen can probably be attributed to: (1) large (STEALTH) vs. small (TRANAL) strain formulation and/or (2) grid discretization differences. E.D.K.

N80-32761*# Akron Univ., Ohio. Dept. of Civil Engineering.
COMBUSTION: STRUCTURAL INTERACTION IN A VISCOELASTIC MATERIAL
T. Y. Chang, J. P. Chang, M. Kumar (Pennsylvania State Univ., University Park), and K. K. Kuo (Pennsylvania State Univ., University Park) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 67-90 refs (For primary document see N80-32756 23-39)
(Contract N00014-79-C-0762)
Avail: NTIS HC A13/MF A01 CSCL 20K

The effect of interaction between combustion processes and structural deformation of solid propellant was considered. The

combustion analysis was performed on the basis of deformed crack geometry, which was determined from the structural analysis. On the other hand, input data for the structural analysis, such as pressure distribution along the crack boundary and ablation velocity of the crack, were determined from the combustion analysis. The interaction analysis was conducted by combining two computer codes, a combustion analysis code and a general purpose finite element structural analysis code. E.D.K.

N80-32762*# North Texas State Univ., Denton. Dept. of Mathematics.
ITERATIVE METHODS BASED UPON RESIDUAL AVERAGING
J. W. Neuberger. *In* NASA. Langley Research Center. Res. in Nonlinear Struct. and Solid Mech. 1980 p 91-96 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

Iterative methods for solving boundary value problems for systems of nonlinear partial differential equations are discussed. The methods involve subtracting an average of residuals from one approximation in order to arrive at a subsequent approximation. Two abstract methods in Hilbert space are given and application of these methods to quasilinear systems to give numerical schemes for such problems is demonstrated. Potential theoretic matters related to the iteration schemes are discussed. E.D.K.

N80-32763*# Science Applications, Inc., San Leandro, Calif.
COMPUTATIONAL STRATEGY FOR THE SOLUTION OF LARGE STRAIN NONLINEAR PROBLEMS USING THE WILKINS EXPLICIT FINITE-DIFFERENCE APPROACH
R. Hofmann. *In* NASA. Langley Research Center. Res. in Nonlinear Struct. and Solid Mech. 1980 p 97-114 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

The STEALTH code system, which solves large strain, nonlinear continuum mechanics problems, was rigorously structured in both overall design and programming standards. The design is based on the theoretical elements of analysis while the programming standards attempt to establish a parallelism between physical theory, programming structure, and documentation. These features have made it easy to maintain, modify, and transport the codes. It has also guaranteed users a high level of quality control and quality assurance. Author

N80-32764*# Akron Univ., Ohio.
SELF-ADAPTIVE INCREMENTAL NEWTON-RAPHSON ALGORITHMS
Joseph Padovan. *In* NASA. Langley Research Center. Res. in Nonlinear Struct. and Solid Mech. 1980 p 115-127 refs (For primary document see N80-32756 23-39)
(Grant NAG3-54; Contract N00014-78-C-0691)
Avail: NTIS HC A13/MF A01 CSCL 20K

Multilevel self-adaptive Newton-Raphson type strategies are developed to improve the solution efficiency of nonlinear finite element simulations of statically loaded structures. The overall strategy involves three basic levels. The first level involves preliminary solution tunneling via primative operators. Secondly, the solution is constantly monitored via quality/convergence/nonlinearity tests. Lastly, the third level involves self-adaptive -algorithmic update procedures aimed at improving the convergence characteristics of the Newton-Raphson strategy. Numerical experiments are included to illustrate the results of the procedure. E.D.K.

N80-32765*# Oklahoma State Univ., Stillwater.
STUDY OF SOLUTION PROCEDURES FOR NONLINEAR STRUCTURAL EQUATIONS
Cline T. Young, II and Rembert F. Jones, Jr. (Naval Ship Research and Development Center, Washington, D.C.) *In* NASA. Langley Research Center. Res. in Nonlinear Struct. and Solid Mech. 1980 p 129-139 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

A method for the redution of the cost of solution of large nonlinear structural equations was developed. Verification was made using the MARC-STRUC structure finite element program with test cases involving single and multiple degrees of freedom for static geometric nonlinearities. The method developed was designed to exist within the envelope of accuracy and convergence characteristic of the particular finite element methodology used. E.D.K.

N80-32766*# Old Dominion Univ., Norfolk, Va.
RESPONSE OF NONLINEAR PANELS TO RANDOM LOADS
Chuh Mei. *In* NASA. Langley Research Center. Res. in Nonlinear Struct. and Solid Mech. 1980 p 141-163 refs (For primary document see N80-32756 23-39)
(Contract F49620-79-C-00169)
Avail: NTIS HC A13/MF A01 CSCL 20K

Lightweight aircraft structures exposed to a high intensity noise environment can fatigue prematurely if adequate consideration is not given to the problem. Design methods and design criteria for sonic fatigue prevention were developed based on analytical and experimental techniques. Most of the analytical work was based upon small deflection or linear structural theory which did not agree with the experimental results. A large deflection geometrical nonlinearity was incorporated into the analysis methods for determining the structural response to high intensity noise. The Karman-Herrmann large deflection equations with a single mode Galerkin approximation, and the method of equivalent linearization were used to predict mean square amplitude, mean square stresses, and nonlinear frequency at various acoustic loadings for rectangular panels. Both simply supported and clamped support conditions with immovable or movable inplane edges are considered. Comparisons with experimental results are presented. E.D.K.

N80-32767*# Battelle Columbus Labs., Ohio.
POST-BUCKLING BEHAVIOR OF A BEAM-COLUMN ON A NONLINEAR ELASTIC FOUNDATION WITH A GAP
Edward N. Kuznetsov and Thomas G. Johns (Battelle Houston Operations, Tex.) *In* NASA. Langley Research Center. Res. in Nonlinear Struct. and Solid Mech. 1980 p 165-173 refs Sponsored by American Gas Association Pipeline Research Committee (For primary document see N80-32756 23-39)
Avail: NTIS CSCL 20K

The structural behavior of an elastic beam-column placed with a gap between two nonlinearity elastic layers each resting on a rigid foundation was examined. The beam-column was laterally supported at both ends and subjected to a uniform transverse load and axial compression. Its slenderness was such that the axial compressive force exceeds the amount that would be necessary to buckle it as a simple supported column. The elastic layers were represented by an elastic foundation with a strongly nonlinear specific reaction taken as a rapidly increasing function of the layer compression. The analytical model developed simulated the entire pattern of the deflection and stress state including layer and end support reactions, under gradually increasing axial force. R.C.T.

N80-32768*# Linz (Austria).
STRAIGHTENING OF A WAVY STRIP: AN ELASTIC-PLASTIC CONTACT PROBLEM INCLUDING SNAP-THROUGH
Dieter F. Fischer and Franz G. Rammerstorfer. *In* NASA. Langley Research Center. Res. in Nonlinear Struct. and Solid Mech. 1980 p 175-185 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

The nonlinear behavior of a wave like deformed metal strip during the levelling process were calculated. Elastic-plastic material behavior as well as nonlinearities due to large deformations were considered. The considered problem lead to a combined stability and contact problem. It is shown that, despite the initially concentrated loading, neglecting the change of loading conditions due to altered contact domains may lead to a significant error in the evaluation of the nonlinear behavior and particularly to an underestimation of the stability limit load. The stability was examined by considering the load deflection path and the behavior of a load-dependent current stiffness parameter in combination with the determinant of the current stiffness matrix. R.C.T.

N80-32769*# Kansas State Univ., Manhattan. Dept. of Civil Engineering.

A PROPOSED GENERALIZED CONSTITUTIVE EQUATION FOR NONLINEAR PARA-ISOTROPIC MATERIALS
K. K. Hu, S. E. Swartz, and C. J. Huang *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 187-196 refs (For primary document see N80-32756 23-39)
(Grant NSF ENG-78-07829)
Avail: NTIS HC A13/MF A01 CSCL 20K

Finite element models of varying complexities were used to solve problems in solid mechanics. Particular emphasis was given to concrete which is nonisotropic at any level of deformation and is also nonlinear in terms of stress-strain relationships. R.C.T.

N80-32770*# Goodrich (B. F.) Co., Akron, Ohio.
FINITE ELEMENT ANALYSIS OF HYPERELASTIC STRUCTURES
Farhad Tabaddor *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 197-209 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

The use of the penalty function, to account for near incompressibility is discussed and compared to that of Lagrange multiplier. A scheme to use Lagrange multiplier, without having to treat it as unknown, is also presented. R.C.T.

N80-32771*# System Development Corp., Santa Monica, Calif.
SOLUTIONS OF CONTACT PROBLEMS BY THE ASSUMED STRESS HYBRID MODEL
Kenji Kubomura and Theodore H. H. Pian (MIT, Cambridge) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 211-224 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

A method was developed for contact problems which may be either frictional or frictionless and may involve extensive sliding between deformable bodies. It was based on an assumed stress hybrid approach and on an incremental variational principle for which the Euler's equations of the functional include the equilibrium and compatibility conditions at the contact surface. The tractions at an assumed contact surface were introduced as Lagrangian multipliers in the formulation. It was concluded from the results of several example solutions that the extensive sliding contact between deformable bodies can be solved by the present method. R.C.T.

N80-32772*# Ecole Polytechnique Federale de Lausanne (Switzerland).
FINITE ELEMENTS FOR CONTACT PROBLEMS IN TWO-DIMENSIONAL ELASTODYNAMICS
Thomas K. Zimmermann and Wing Kam Liu (California Inst. of Tech., Pasadena) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 225-235 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

A finite element approach for contact problems in two dimensional elastodynamics was proposed. Sticking, sliding, and frictional contact were taken into account. The method consisted of a modification of the shape functions, in the contact region, in order to involve the nodes of the contacting body. The formulation was symmetric (both bodies were contactors and targets), in order to avoid interpenetration. Compatibility over the interfaces was satisfied. The method was applied to the impact of a block on a rigid target. It is shown that the formulation can be applied to fluid structure interaction, and to problems involving material nonlinearity. R.C.T.

N80-32773*# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
INELASTIC BEHAVIOR OF STRUCTURAL COMPONENTS
Noor Hussain, K. Khozeimeh, and T. G. Toridis *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 237-250 refs (For primary document see N80-32756 23-39)
(Grant NSF PFR-79-16263)
Avail: NTIS HC A13/MF A01 CSCL 20K

A more accurate procedure was developed for the determination of the inelastic behavior of structural components. The actual stress-strain curve for the mathematical of the structure was utilized to generate the force-deformation relationships for the structural elements, rather than using simplified models such as elastic-plastic, bilinear and trilinear approximations. relationships were generated for beam elements with various types of cross sections. In the generational of these curves, stress or load reversals, kinematic hardening and hysteretic behavior were taken into account. Intersections between loading and unloading branches were determined through an iterative process. Using the inelastic properties obtained, the plastic static response of some simple structural systems composed of beam elements was computed. Results were compared with known solutions, indicating a considerable improvement over response predictions obtained by means of simplified approximations used in previous investigations. R.C.T.

N80-32774*# Ecole Polytechnique Federale de Lausanne (Switzerland).
NONLINEAR FINITE ELEMENT ANALYSIS: AN ALTERNATIVE FORMULATION
Silvio Merazzi and Peter Stehlin (Aeronautical Research Inst. of Sweden, Stockholm) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 251-261 refs Sponsored in part by Swiss National Science Foundation and National Swedish Board for Energy Source Development (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

A geometrical nonlinear analysis based on an alternative definition of strain is presented. Expressions for strain are obtained by computing the change in length of the base vectors in the curvilinear element coordinate system. The isoparametric element formulation is assumed in the global Cartesian coordinate system. The approach is based on the minimization of the strain energy, and the resulting nonlinear equations are solved by the modified Newton method. Integration of the first and second variation of the strain energy is performed numerically in the case of two and three dimensional elements. Application is made to a simple long cantilever beam. Author

N80-32775*# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
COROTATIONAL VELOCITY STRAIN FORMULATIONS FOR NONLINEAR ANALYSIS OF BEAMS AND AXISYMMETRIC SHELLS
Ted Belytschko, H. Stolarski (Polish Academy of Sciences, Warsaw), and C. S. Tsay *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 263-276 refs Sponsored by Electric Power Research Inst. (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

Finite element formulations for large strain, large displacement problems are formulated using a kinematic description based on the corotational components of the velocity strain. The corotational components are defined in terms of a system that rotates with each element and approximates the rotation of the material. To account for rotations of the material relative to this element system, extra terms are introduced in the velocity strain equations. Although this formulation is incremental, in explicitly integrated transient problems it compares very well with formulations that are not. R.C.T.

N80-32776*# Tokyo Univ. (Japan).
MICROCOMPUTER SYSTEM FOR MEDIUM-SIZED AND EXPERIMENTAL FINITE ELEMENT ANALYSIS
Yoshiaki Yamada, Hideto Okumura, and Tatsumi Sakurai (Japan Advanced Numerical Analysis, Inc.) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 277-289 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

The development of a microcomputer system is described. A series of finite element analysis programs are evaluated in terms of their cost effective application within the microcomputer system. It is shown that the system is practically maintenance free and can be sustained by individual laboratories of standard scale in the educational or academic environment. R.C.T.

N80-32777*# Systems Control, Inc., Palo Alto, Calif. Aeronautical and Marine Systems Div.

DYNAMIC MODAL ESTIMATION USING INSTRUMENTAL VARIABLES
H. Salzwedel. Jul. 1980. 66 p. refs
(Contract NAS2-10339)
(NASA-CR-152396; TR-6419-01) Avail: NTIS
HC A04/MF A01 CSCL 20K

A method to determine the modes of dynamical systems is described. The inputs and outputs of a system are Fourier transformed and averaged to reduce the error level. An instrumental variable method that estimates modal parameters from multiple correlations between responses of single input, multiple output systems is applied to estimate aircraft, spacecraft, and off-shore platform modal parameters. E.D.K.

N80-32778# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SHEAR STRAINS, STRAIN RATES AND TEMPERATURE CHANGES IN ADIABATIC SHEAR BANDS
Gerald L. Moss. May 1980. 31 p. refs
(DA Proj. 1L1-61102-AH-43)
(AD-A087765; AD-E430477; ARBRL-TR-02242) Avail: NTIS
HC A03/MF A01 CSCL 20/11

Experiments were conducted to determine the shear strains and strain rates in adiabatic shear bands in a Ni-Cr steel (rolled armor). An explosively driven mass was used to punch plugs from plate of the steel and, thereby, create adiabatic shear bands. There were originally planes of chemical inhomogeneity (reference bands) in the plane of the steel samples. The slopes of the reference bands were altered by the plastic shear, and they were, therefore, a measure of the plastic shear strain. From measurements of the slopes of the reference bands, it was found that the plastic shear was approximately an exponential function of distance through an adiabatic shear band. Shear strains of at least 572 developed after the onset of adiabatic shear. The results suggest how heating occurs within the shear bands, the maximum temperatures attained and the related strength degradation associated with the development of an adiabatic shear band. GRA

N80-32779# Army Armament Research and Development Command, Dover, N. J. Fire Control and Small Caliber Weapon Systems Lab.
A COMPARISON OF RESIDUAL STRESS MEASURING TECHNIQUES: THEIR STRENGTHS AND WEAKNESSES
Fred M. Witt, Fee M. Lee, and Walter M. Rider. Aug. 1980. 30 p. refs
(DA Proj. 1L1-61101-A-91A)
(AD-A088409; AD-E400457; ARSCD-SP-80001) Avail: NTIS
HC A03/MF A01 CSCL 20/12

Ongoing inhouse work on the measurement of residual stress in Army Materiel by both X-ray and strain gage mechanical relaxation methods is presented and compared. The X-ray portion includes problems associated with the calculation of stresses in highly textured samples while the strain gage portion describes effects produced by various mechanical methods to partially relieve the strain fields sensed by the active gage elements. Comparisons are also made of the errors introduced by considering the active element in the strain gage rosette as a point gage instead of one with finite length. GRA

N80-32780# Texas Engineering Experiment Station, College Station. Aerospace Engineering Dept.
A SURVEY OF CURRENT TEMPERATURE DEPENDENT ELASTIC-PLASTIC-CREEP CONSTITUTIVE LAWS FOR APPLICABILITY TO FINITE ELEMENT COMPUTER CODES Interim Report
David H. Allen. 31 May 1980. 41 p. refs
(Contract N00014-78-C-0150)
(AD-A088375; TEES-3275-80-2) Avail: NTIS
HC A03/MF A01 CSCL 20/11

The volume of the research effort currently under way to characterize the constitution of thermoelastic plastic creep materials is ample evidence of its importance. Although significant work has been done to obtain working constitutive models, in many cases the theory has not been cast with the remaining field equations into a working continuum model. In this paper, the author will consider models from classical plasticity and nonlinear viscoelasticity theory for applicability to the conservation of momentum. Based on physical accuracy as well as computational efficiency the author will assess the feasibilty of further development of each model. GRA

N80-32781# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
A VOID GROWTH FAILURE CRITERION APPLIED TO DYNAMICALLY AND STATICALLY LOADED THIN RINGS
A. M. Rajendran and I. M. Fyfe. Jun. 1980. 55 p. refs
(Grant DAAG29-77-G-0211)
(AD-A088515; Rept-80-10; ARO-15078.1-E) Avail: NTIS
HC A04/MF A01 CSCL 13/5

The introduction of inertia terms in the theoretical model of thin ring expansion shows that classical plastic instability concepts, defined in terms of the local strain in the necking region, no longer apply. However, in this report it is shown that, when the plastically incompressible constitutive model is replaced with a model applicable to porous plastic materials, a criterion based on critical void volume fraction provides an alternative means to predict failure. The theory also provides a method in which both geometric and metallurgical imperfections in a given sample might be considered. The application of this theory to thin ring specimens was used to confirm that the critical void growth concept predicts the uniform strain at failure as observed in aluminum and copper rings, under both quasi-static and high strain-rate loading conditions. GRA

N80-32782# Materials Research Labs., Ascot Vale (Australia).
A HIGH-SENSITIVITY POTENTIAL-DROP TECHNIQUE FOR FATIGUE CRACK GROWTH MEASUREMENTS
Graham Clark. Aug. 1979. 40 p. refs
(AD-A088278; MRL-R-755; AR-001-837) Copyright. Avail: NTIS HC A03/MF A01 CSCL 20/11

This report describes the design features of a highly sensitive and accurate system for monitoring the growth of fatigue cracks in laboratory specimens of various geometries. The system is based on the potential drop method which utilizes the electrical resistance changes associated with fatigue crack growth through the specimen cross section to detect crack length increments of a few micrometers. The technique is suitable for automation, and tests may be completed with a minimum amount of operator interference. A computer based data processing method is described, and the performance of the system in measuring both absolute crack length and crack growth rate is evaluated. GRA

N80-32783# Southwest Research Inst., San Antonio, Tex.
CRACK TIP PLASTICITY ASSOCIATED WITH CORROSION ASSISTED FATIGUE Interim Report, Jun. 1979 - Jun. 1980
D. L. Davidson and J. Lankford. 31 Jul. 1980. 51 p. refs
(Contract N00014-75-C-0138)
(AD-A087961; SWRI-02-4268) Avail: NTIS
HC A04/MF A01 CSCL 11/6

The effects of a water vapor environment on crack tip plasticity in low-carbon steel have been further examined. Strains in the plastic zone, as determined by stereoimaging, have been used to compute stresses at the same locations, and an estimate of the energy expended for creation of new crack area may also be computed using the same strains. These values are compared with similar information derived previously using plastic zone subgrain size distributions as determined by electron channeling. There is general agreement between the data determined by the two techniques. A model is offered for including the effects of water vapor upon crack tip plasticity into the damage accumulation analysis of fatigue crack propagation. A critical discussion is also given of the findings to date on the effects of environment on crack tip plasticity, and it is concluded that those findings may be explained by changes in the material properties very close to the crack tip, rather than in the bulk of the plastic zone. GRA

N80-32784# Washington Univ., Seattle. Dept. of Mechanical Engineering.
DYNAMIC MIXED MODE FRACTURE Interim Report
A. S. Kobayashi and M. Ramulu. Aug. 1980. 14 p. refs
(Contract N00014-76-C-0060; NR Proj. 064-478)
(AD-A088287; TR-39) Avail: NTIS HC A02/MF A01 CSCL 20/11

A newly developed data reduction process was used to re-evaluate dynamic photoelastic results and to extract dynamic stress intensity factors, K(I)dyn and K(II)dyn, associated with curved and branched cracks in fracturing Homalite-100 plates. A branching stress intensity factor approximately 5 times the fracture toughness was identified for this material. Moderate to severe crack curvings were associated with a K(I)dyn and K(II)dyn ratio as low as 0.05, but with positive remote stress component, sigma (ox). GRA

N80-32785# Queens Coll., Flushing, N. Y.
MOLECULAR DYNAMIC SHOCK WAVE STUDIES IN SOLIDS, FRACTURE AND CRACK PROPAGATION Final Report, 27 Sep. 1976 - 31 Jun. 1980
Arthur Paskin 31 Jun. 1980 4 p
(Grants DAAG29-76-G-0337; DAAG29-77-G-0223)
(AD-A088335; ARO-14444.2-E) Avail: NTIS HC A02/MF A01 CSCL 20/11

The earlier computer simulations of shock waves in solids was completed. An equation of state for shock waves in solids was developed and found to be an accurate description of shock wave properties. Computer simulation techniques were also used to study fracture and crack propagation in solids. The basic assumptions made in the usual continuum mechanics calculations were examined and found to be at best approximate. Some interesting results were found for rapidly applied stresses. GRA

N80-32786# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Dept. of Mechanics.
THE ANALYSIS AND DESIGN OF CONSTRAINED LAYER DAMPING TREATMENTS Technical Report, Apr. - Jun. 1980
Peter J. Torvik Jul. 1980 64 p refs
(AD-A088200; AFIT-TR-80-4) Avail: NTIS HC A04/MF A01 CSCL 20/11

A tutorial work in which the mechanisms by which large shear strain may be induced in a damping layer are explored. The parameters of the system which determine the effectiveness of constrained layer treatments are identified from analyses of several geometric configurations. Advances of the past two decades in the design and analysis of damping layers as a means of controlling the amplitude of resonant vibrations are reviewed. GRA

N80-32787# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
A PHOTOELASTOPLASTIC STUDY OF STRESS CONCENTRATION FACTORS AND RESIDUAL STRESSES IN TWO NOTCHED SPECIMENS OF POLYCARBONATE MATERIAL
Y. F. Cheng May 1980 30 p refs
(AD-A088538; AD-E440084; ARLCB-TR-80025) Avail: NTIS HC A03/MF A01 CSCL 20/11

A photoelastoplastic study on stress concentrations, in elastic as well as in elastoplastic states, in a C-shaped specimen and a compact tensile specimen of polycarbonate material has been made. The principles of the experimental method are outlined, equations for nominal stresses are given, and stress concentration factors are determined. Residual stresses after unloading are calculated by making the usual assumption that unloading is an elastic process. In the elastic state, stress concentration factors are readily applicable to specimens of any material with similar geometry and loading. In the elastoplastic state, it requires the similarity of stress strain relation between model and prototype materials. GRA

N80-32788# Sandia Labs., Albuquerque, N. Mex. Experimental Planning Div.
PUFF TOO: A RESIDUAL STRESS EXPERIMENT
Carl W. Smith Apr. 1980 85 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1674) Avail: NTIS HC A05/MF A01

Following the passage of the dynamic effects in a contained explosive detonation, there remains a strong compressive stress field in the material about the cavity. In this experiment, a 454 kg (1000 lb) sphere of high explosive was detonated in saturated ashfall tuff. Instrumentation measured peak stresses over the range of 0.1 to 6.0 GPa (1 to 6 Kbar) and the complete stress-time waveform, including the so-called residual stress, at the 0.1 GPa (1 kbar) peak stress range. Mineback revealed detonation-induced fractures and fractures induced by postevent work. DOE

N80-32789# Brookhaven National Lab., Upton, N. Y.
BENDING BEHAVIOR OF LAPPED PLASTIC EHV CABLES
G. H. Morgan and A. C. Muller 1980 6 p refs Presented at 1980 Intern. Symp. on Elec. Insulation, Boston, 9-11 Jun. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27331) Avail: NTIS HC A02/MF A01

One of the factors delaying the development of lapped polymeric cables was their reputed poor bending characteristics. Complementary programs were begun several years ago to mathematically model the bending of synthetic tape cables and to develop novel plastic tapes designed to have moduli more favorable to bending. A series of bend tests was recently completed to evaluate the bending performance of several tapes developed for use in experimental superconducting cables. The program is discussed and the results of the bend tests are summarized. DOE

N80-32790# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
MEAN WIND FORCES ON PARABOLIC-TROUGH SOLAR COLLECTORS
J. A. Peterka (Colorado State Univ.), J. M. Sinau (Colorado State Univ.), and J. E. Cermak (Colorado State Univ.) May 1980 121 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7023) Avail: NTIS HC A06/MF A01

Characteristics of mean wind loads produced by airflow in and around several configurations of parabolic trough solar collectors with and without a wind fence are discussed. Four basic parabolic shapes were investigated as single units and one shape was studied as part of several array fields. One scale model of each parabolic shape was constructed for mounting on a force balance to measure two forces and three moments. The effects of several dominant variables were investigated in this study: wind-azimuth (or yaw), trough elevation (or pitch) angle, array field configuration, and protective wind fence characteristics. All measurements were made in a boundary layer flow. DOE

N80-32791# Oak Ridge National Lab., Tenn. Computer Sciences Div.
APPROXIMATION OF FINITE ELEMENT NODAL POINT STRESSES FOR NONLINEAR MATERIAL MODELS
B. R. Bass, W. G. Johnson, and S. V. McGrath 28 Feb. 1980 44 p refs
(Contract W-7405-eng-26)
(K/TS-3798) Avail: NTIS HC A03/MF A01

A computational scheme is described for approximating elastic-plastic stress components at the nodal points of finite element grids. The method is based on a local least squares smoothing technique and a well known incremental plasticity model. During each load step of the materially nonlinear analysis, strain values at the Gauss integration points are extrapolated to the nodes; the incremental change in strains at the nodes is then determined from previously stored nodal strain values. The increment in nodal stresses is calculated from the incremental elastic-plastic stress-strain relations for the nodes and added to the nodal stresses computed in the previous update. An application of the scheme to the analysis of a thin bellows under compressive loading is discussed; the results are compared with those obtained from using a different nodal stress technique. DOE

N80-32792# Sandia Labs., Albuquerque, N. Mex.
FINITE ELEMENT ANALYSIS FOR THE INITIATION OF LAMELLAR TEARING IN WELDED JOINTS
Raymond D. Krieg and Robert K. Thomas 1980 23 p refs Presented at the ASME Century 2 Emerging Technol. Conf., San Francisco, 10 Aug. 1980
(Contract DE-AC04-76DP-00789; AT(29-1)-789)
(SAND-79-1891C; CONF-800804-10) Avail: NTIS HC A02/MF A01

A numerical procedure using the finite element method is presented for predicting the initiation of lamellar tearing in fillet welded T-joints commonly employed in large structures. Starting with a prescribed geometry, the welding process is approximated by a known time dependent volumetric heat source which simulates the arc heating and deposition of liquid metal. The transient nonlinear thermal and stress problems are then solved using finite element computer codes. Results of the elastic-plastic stress analysis are presented showing a predicted region of incipient lamellar tearing based on a ductile fracture theory which qualitatively agrees with the size and location of tears typically observed in photomicrographs. Additional insight into post failure crack lengtrh and stability is presented based on a simplified linear elastic fracture mechanics approach. Although the analysis procedure shows signs of promise, several weak points in the model are pointed out which must be improved before lamellar tearing can be quantified in an approach of this general type. DOE

N80-32793# Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.
CONSISTENT STRESS-STRAIN DUCTILE FRACTURE MODEL AS APPLIED TO TWO GRADES OF BERYLLIUM
T. G. Priddy, S. E. Benzley, and L. M. Ford. 1980. 46 p. refs.
(Contracts DE-AC04-76DP-00789; AT(29-1)-789)
(SAND-79-2126) Avail: NTIS. HC A03/MF A01

Published yield and ultimate biaxial stress and strain data for two grades of beryllium are correlated with a more complete method to characterizing macroscopic strain at fracture initiation in ductile materials. Results are compared with those obtained from an exponential, mean stress dependent model. Simple statistical methods are employed to illustrate the degree of correlation for each method with the experimental data. DOE

N80-32794# Los Alamos Scientific Lab., N. Mex.
PLASTIC DEFORMATION OF COLLIDING HEMISHELLS
David C. Moir and Timothy R. Neal. 1980. 13 p. ref. Presented at the Intern. Conf. on the Met. Effects of High Strain-Rate Deformation and Fabric., Albuquerque, N. Mex., 22-26 Jun. 1980.
(Contract W-7405-eng-36)
(LA-UR-80-1659; CONF-800641-4) Avail: NTIS. HC A02/MF A01

The collision of two hemishells is analyzed where one hemishell is clamped and the other impinges on the inner surface of the clamped hemishell. A model of rigid perfectly plastic behavior is proposed for the flow of material in the region of contact. An expression relating velocity and deformation is obainted and compared with the results of experiments. DOE

N80-32795# Sandia Labs., Albuquerque, N. Mex.
TECHNIQUE FOR THE GENERATION OF PRESSURE-SHEAR LOADING USING ANISOTROPIC CRYSTALS
J. W. Swegle and L. D. Chhabildas. 1980. 15 p. refs. Presented at the Intern. Conf. on the Met. Effects of High Strain Rate Deformation and Fabrication, Albuquerque, N. Mex., 22 Jun. 1980.
(Contract DE-AC04-76DP-00789)
(SAND-80-1301C; CONF-800641-2) Avail: NTIS. HC A02/MF A01

In the investigation, Y-cut quartz crystals are used as pressure-shear generators, and X-cut quartz and 6061-T6 aluminum are used as test speciments. The coupled longitudinal and shear motion generated within the Y-cut crystal can be transmitted into a test specimen bonded to the rear surface of the crystal, and monitored using velocity interferometer techniques. Experiments on X-cut quartz and 6061-T6 aluminum demonstrate applicability of the technique. Results obtained in this investigation are compared with numerical solutions using the finite difference wave propagation code TOODY. DOE

N80-32796# Wyoming Univ., Laramie. Energy Technology Center.
NEW METHOD TO DETERMINE THE INDEPENDENT SHEAR MODULI OF TRANSVERSELY ISOTROPIC MATERIALS
K. P. Chong, J. L. Chen, K. Uenishi, and J. W. Smith. 1980. 15 p. refs. Presented at the 4th SESA Intern. Congr. on Exptl. Mech., Boston, 25-30 May 1980.
(Contract DE-AT20-80LC-10224)
(CONF-800575-1) Avail: NTIS. HC A02/MF A01

A simple method is presented to determine the independent shear moduli of transversely isotropic materials. The method is tested on Green River Formation oil shale, one of such materials. The method is applicable for linear and nonlinear elastic materials. Mathematical formulation, derivation and solution are given, and test apparatus and results are presented. Comparison with other approximate results and acoustical methods are made. Confirmation of the test method with materials having known shear moduli is also presented. DOE

N80-32797# California Univ., Livermore. Lawrence Livermore Lab.
TECHNIQUE FOR STUDYING MULTIPLE FRACTURES PRODUCED AT INTERMEDIATE LOADING RATES
R. P. Swift and A. S. Kusubov. 4 Apr. 1980. 18 p. refs. Presented at the Rock Mech. Symp., Rolla, Mo., 28-30 May 1980.
(Contract W-7405-eng-48)
(UCRL-83653; CONF-800507-6) Avail: NTIS. HC A02/MF A01

A laboratory experimental technique was developed to study the effects of pressurizing the borehole of rock samples with tailored pulses at intermediate loading rates. The experimental apparatus provides sample confinement to 50 Mpa pressure, borehole pressures up to 200 MPa with loading rates from 0.01 to 100 MPa/ms, and pulse durations on the order of 1 to 50 ms. Observations from tests on a dense quartz sandstone under ambient confinement of 0.1 MPa are as follows: for static loading with oil, the breakdown pressure is about 21 MPa and two fractures oriented at 180 deg. are produced; for loadings with water at rates of about 10 MPa/ms, the breakdown pressure increases to about 30 MPa and multiple fractures are created; and for loading rates between 50 to 90 MPa/ms, the breakdown pressure increases to 35 MPa and there is an increase in the number of initiated fractures. DOE

N80-32798# Battelle Pacific Northwest Labs., Richland, Wash.
DEVELOPMENT OF ULTRASONIC TOMOGRAPHY FOR RESIDUAL STRESS MAPPING. Final Report
A. J. Boland, T. J. Davis, S. R. Doctor, T. P. Harrington, B. P. Hildebrand, D. K. Lemon, G. J. Posakony, and J. R. Skorpik. May 1980. 82 p. refs.
(Contract DE-AC06-76RL-01830; EPRI Proj. 504-2)
(EPRI-NP-1407) Avail: NTIS. HC A05/MF A01

The volumetric stress distribution in nuclear reactor piping and pressure vessels is becoming an increasingly important parameter in nondestructive evaluation. Research and development of instrumentation leading toward a means of measuring subsurface stress distributions in metals is described. Based on the principles of computerized tomography, an ultrasonic tomographic instrument uses an ultrasonic linear array to acquire time of flight data to an accuracy of 0.5 to 1.0 ns. The data are processed using a modified algebraic reconstruction technique program. A two dimensional map of the velocity distribution is displayed on a monitor. The velocity distribution is interpreted or calibrated in terms of stress through the acousto elastic coefficients. DOE

N80-32799# California Univ., Livermore. Lawrence Livermore Lab.
USING THE ACOUSTOELASTIC EFFECT TO MEASURE STRESS IN PLATES
Davis M. Egle. 5 Mar. 1980. 27 p. refs.
(Contract W-7405-eng-48)
(UCRL-52914) Avail: NTIS. HC A03/MF A01

Use of longitudinal ultrasonic waves for measuring the sum of the principal stresses in welded plates was investigated. A cross-correlation technique for measuring the time delay between two successive echoes was developed and shown to be capable of a precision of 10 ps. Stress measurements in a double cantilever beam and a disk and annulus specimen show good agreement with calculated values. DOE

N80-32800# Bendix Corp., Kansas City, Mo. Communication Services.
PLATED-THROUGH HOLE TESTING. Final Report

W. B. Abel. May 1980. 55 p.
(Contract DE-AC04-76DP-00613)
(BDX-613-2424) Avail: NTIS HC A04/MF A01

An improved microresistance testing method to measure the thickness of copper plating in plated-through holes of double sided printed wiring boards is presented. A new probe design, combined with a microprocessor controller, makes it possible for a direct reading tester to provide variables data. Tester design and software programs for the system are included. Results of correlation studies, comparing the improved resistance method to cross sectional measurements are presented. Limitations on the microresistance test method are discussed. DOE

N80-32801# Bendix Corp., Kansas City, Mo. Technical Communication Div.
FINITE ELEMENT STRESS ANALYSIS OF A COMPRESSION MOLD. Final Report
C. E. Watterson. Mar. 1980. 34 p. refs.
(Contract DE-AC04-76DP-00613)
(BDX-613-2387) Avail: NTIS HC A03/MF A01

Thermally molding stresses occurring in a compression mold during production molding were evaluated using finite element analysis. A complementary experimental stress analysis, including strain gages and thermocouple arrays, verified the finite element model under typical loading conditions. DOE

N80-32802# Argonne National Lab., Ill. Materials Science Div.
BIAXIAL CREEP-FATIGUE BEHAVIOR OF MATERIALS FOR SOLAR THERMAL SYSTEMS
S. Majumdar. May 1980. 36 p. refs.
(Contract W-31-109-eng-38)
(ANL-80-34) Avail: NTIS HC A03/MF A01

Biaxial creep fatigue data for Incoloy 800 and Type 316H stainless steel at elevated temperatures are presented. Tubular specimens were subjected to constant internal pressure and strain controlled axial cycling with and without hold times in tension as well as in compression. The results show that the internal pressure affects diametral ratchetting and axial stress range significantly. However, the effect of a relatively small and steady hoop stress on the cyclicfife of the materials is minimal. A 1 min compressive hold per cycle does not seriously reduce the fatigue life of either material; a tensile hole of equal duration causes a significant reduction in life for Type 316H stainless steel, but none for Incoloy 800. Fracture surfaces of specimens made of both materials were studied by scanning electron microscopy to determine the reason for the difference in behavior. DOE

N80-32803# Hanford Engineering Development Lab., Richland, Wash.
IN-REACTOR FATIGUE CRACK PROPAGATION
A. M. Ermi, D. A. Mervyn, and J. L. Straalsund. Aug. 1979. 15 p. Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13-16 Nov. 1979.
(Contract EY-76-C-14-2170)
(HEDL-SA-1927; CONF-791102-158) Avail: NTIS HC A02/MF A01

An in-reactor fatigue experiment designed to determine the effect of dynamic irradiation on the fatigue crack propagation (FCP) behavior of candidate fusion first wall materials is described. The experiment utilizes miniature center-cracked tension specimens developed specifically for in-reactor studies. In the test, a chain of eight specimens, precracked to various initial crack lengths, is stressed during irradiation to determine crack growth rate as a function of stress intensity. Load levels were chosen which result in small crack growth rates encompassing a regime of the crack growth curve not previously investigated during irradiation studies of FCP. Detailed design of the experiment is presented along with crack growth data obtained from prototypic testing of the experimental apparatus. These results are compared to data obtained under similar conditions generated by conventional test methods. DOE

42 GEOSCIENCES (GENERAL)

N80-32804# Naval Surface Weapons Center, Dahlgren, Va. Strategic Systems Dept.
EARTH'S ROTATION IN 1975-1979 BASED ON DOPPLER SATELLITE OBSERVATIONS. Final Report
Richard J. Anderle. May 1980. 59 p. refs.
(AD-A088095; NSWC/TR-80-232) Avail: NTIS HC A04/MF A01 CSCL 03/3

Doppler observations of Navy Navigation Satellites have been used to determine changes in Earth's rotation during the years 1975-1979. Annual and semiannual variations determined from the Doppler observations are not valid due to the neglect of the gravitational effects of atmospheric and ocean tides on the orbit of a satellite. However, variations with periods of 50 to 120 days are correlated well with astronomic results. These variations integrate to amplitudes of two or more milliseconds in UT-1. Shorter period variations only occasionally correlate with astronomic results. There are also occasional conflicts in phases, and, generally, there is only about a 50 percent agreement in amplitude of the shorter period variations obtained from observations of different satellites. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft, photogrammetry, and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-32805*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
EVALUATION OF REMOTE SENSING TECHNIQUES ON SELECTED FOREST SITES IN FLORIDA. Final Report
L. G. Arvanitis, R. Reich, and R. Newburne, Principal Investigators. Feb. 1980. 127 p. refs. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198. ERTS
(Contract NAS10-9466)
(E80-10296; NASA-CR-154635) Avail: NTIS HC A07/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-32806*# Remote Sensing Inst., Brookings, S. Dak.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUND-WATER POLLUTION. Interim Report, Apr. - Jun. 1980
Donald G. Moore, Principal Investigator and J. L. Heilman. Jun. 1980. 25 p. refs. HCMM.
(Contract NAS5-24206)
(E80-10310; NASA-CR-163350; SDSU-RSI-80-07) Avail: NTIS HC A02/MF A01 CSCL 13B

The author has identified the following significant results. Significant relationships were found between surface soil temperatures estimated from HCMM radiometric temperatures and depth to ground water and near surface soil moisture.

N80-32807*# Dartmouth Coll., Hanover, N.H.
AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCE/FEATURE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. 1: LANDSAT. 2: REMOTE SENSING OF VOLCANIC EMISSIONS. Semiannual Status Report, 1 Feb. - 31 Jul. 1980
Richard W. Birnie and Richard E. Stoiber, Principal Investigators. 31 Jul. 1980. 45 p. refs. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198. ERTS
(Contract NCC5-22)
(E80-10312; NASA-CR-163401; SASR-1) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-32808*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing
A MULTIPROCESSOR IMPLEMENTATION OF A CONTEXTUAL IMAGE PROCESSING ALGORITHM
B. W. Smith, H. J. Siegel, and P. H. Swain, Principal Investigators. Jul. 1980. 234 p. refs. Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development. ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10313; NASA-CR-163402; LARS-070180; SR-PO-00474) Avail: NTIS. HC A11/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-32809*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
AN ALGORITHM FOR ESTIMATING CROP CALENDAR SHIFTS OF SPRING SMALL GRAINS USING LANDSAT SPECTRAL DATA
Eric P. Crist and William A. Malila, Principal Investigators. Jun. 1980. 40 p. refs. Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development. ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10314; NASA-CR-160762; ERIM-132400-41-T; SR-EO-00459) Avail: NTIS. HC A03/MF A01. CSCL 02C
There are no author-identified significant results in this report.

N80-32810*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
SEASAT-A LAND APPLICATIONS DATA PROCESSING PLAN
S. B. Chism, Jr., Principal Investigator. Jan. 1977. 50 p. refs. ERTS
(Contract NAS9-15200)
(E80-10317; NASA-CR-160640; JSC-12574; LEC-9978) Avail: NTIS. HC A03/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-32811*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
HIGH DENSITY TAPE REFORMATTING SYSTEM/LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (HDTRS/LIVES) PRODUCTION TEST THROUGHPUT ANALYSIS
A. J. Bowen, Jr., Principal Investigator. Jun. 1980. 39 p. refs. ERTS
(Contract NAS9-15800)
(E80-10319; NASA-CR-160735; JSC-16718; LEMSCO-15039) Avail: NTIS. HC A03/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-32812*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION FOR EQUIPROBABILITY ELLIPSES REPRESENTATION OF CLASSY CLUSTERS
C. L. Horton and R. K. Lennington, Principal Investigators. Mar. 1980. 52 p. ref. ERTS
(Contract NAS9-15800)
(E80-10320; NASA-CR-160740; JSC-16703; LEMSCO-15019) Avail: NTIS. HC A04/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-32813*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
OPERATION PLAN FOR THE HIGH DENSITY TAPE/LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (HDT/LIVES) DATA PROCESSING SUPPORT
A. J. Bowen, Jr., Principal Investigator. Jun. 1980. 28 p. refs.
(Contract NAS9-15800)
(E80-10322; NASA-CR-160736) Avail: NTIS. HC A03/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-32814*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR CCITS PROCESSOR PROGRAM
R. F. Hansen, Principal Investigator. Feb. 1979. 65 p. ERTS
(Contract NAS9-15800)
(E80-10323; NASA-CR-160738; LEC-13077; JSC-14704) Avail: NTIS. HC A04/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-32815*# California Univ., Berkeley. Space Sciences Lab.
IRRIGATED LANDS ASSESSMENT FOR WATER MANAGEMENT APPLICATIONS PILOT TEST (APT). Final Report
Robert N. Colwell, John E. Estes, and Larry Tinney, Principal Investigators. 31 Jan. 1980. 156 p. refs. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(Grant NsG-2207)
(E80-10324; NASA-CR-163404; SSL-Ser-21-Issue-5) Avail: NTIS. HC A08/MF A01. CSCL 08H
There are no author-identified significant results in this report.

N80-32816*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR A LIST PROCESSING SYSTEM
C. W. Ahlers, F. J. Aucoin, Jr., and C. L. Horton, Principal Investigators. Jan. 1979. 281 p. refs. ERTS
(Contract NAS9-15800)
(E80-10325; NASA-CR-160739; JSC-14663; LEC-13076) Avail: NTIS. HC A13/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-32817*# California Univ., Berkeley. Space Sciences Lab.
APPLICATION OF REMOTE SENSING TO SELECTED PROBLEMS WITHIN THE STATE OF CALIFORNIA. Annual Report
Robert N. Colwell, Andrew S. Benson, John E. Estes, and Claude Johnson, Principal Investigators. 1 May 1980. 438 p. refs. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(Grant NsG-7220)
(E80-10326; NASA-CR-163405; SSL-Ser-21-Issue-14) Avail: NTIS. HC A19/MF A01. CSCL 05B
There are no author-identified significant results in this report.

N80-32818*# California Univ., Berkeley. Space Sciences Lab.
DEVELOPMENT OF AI PROCEDURES FOR DEALING WITH THE EFFECTS OF EPISODAL EVENTS ON CROP TEMPORAL SPECTRAL RESPONSE AND DEVELOPMENT OF AI GUIDELINES FOR CORN AND SOYBEAN LABELING. Annual Progress Report, 15 Nov. 1978 - 14 Nov. 1979
Robert N. Colwell, Principal Investigator. Nov. 1979. 193 p. refs. Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(Contract NAS9-14565; Proj. AgRISTARS)
(E80-10327; NASA-CR-160733; SSL-Ser-20-Issue-44; SR-89-00434) Avail: NTIS. HC A09/MF A01. CSCL 02C
There are no author-identified significant results in this report.

N80-32819*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
USING LANDSAT DIGITAL DATA FOR ESTIMATING GREEN BIOMASS
D. W. Deering and Robert H. Haas, Principal Investigators (Texas A and M Univ., College Station). Jun. 1980. 26 p. refs. Presented at the 30th Ann. Meeting of the Soc. for Range Management

Symp. on Rangeland Remote Sensing, Portland, Oreg., 17 Feb. 1977. Submitted for publication. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10328; NASA-TM-80727) Avail: NTIS
HC A03/MF A01 CSCL 06C

The author has identified the following significant results. Relationships between the quantity of mixed prairie rangelenad vegetation and LANDSAT MSS response were studied during four growing seasons at test sites throughout the United States Great Plains region. A LANDSAT derived parameter, the normalized difference was developed from theoretical considerations fro statistical estimation of the amount and seasonal condition of rangeland vegetation. This parameter was tested for application to local assessment of green forage biomass and regional monitoring of range feed conditions and drought. Results show that for grasslands in the Great Plains with near continuous vegetative cover and free of heavy brush and forbs, the LANDSAT digital data can provide a useful estimate of the quantity of green forage biomass (within 250 kg/ha), and at least five levels of pasture and range feed conditions can be adequately mapped for extended regions.

N80-32820*# Lancaster Univ. (England). Lunar and Planetary Unit.
SATELLITE MONITORING OF SEA SURFACE POLLUTION Final Report, Jan. 1977 - Jul. 1980
Gilbert Fielder, Timothy Stuart Hall, Principal Investigators, Duncan John Telfer, Lionel Wilson, and Richard John Fryer. Jul. 1980 20 p. HCMM
(NASA Order RD-1182)
(E80-10329; NASA-CR-163415; Rept-2-15/DF1) Avail: NTIS
HC A02/MF A01 CSCL 13B

There are no author-identified significant results in this report.

N80-32821*# Arizona Univ., Tucson. Office of Arid Lands Studies.
APPLIED REMOTE SENSING PROGRAM (ARSP) Annual Report, 1979 - 1980
Jack D. Johnson, Charles F. Hutchinson, David A. Mouat, Principal Investigators, Robert A. Schowengerdt, Linda S. Leigh, Michael C. Parton, Karen L. Reichardt, Charles H. Sauerwein, and Peter L. Warren. Jul. 1980 87 p. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NGL-03-002-313)
(E80-10330; NASA-CR-163416) Avail: NTIS
HC A05/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-32822*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED-TEMPERATURE VARIABILITY IN A LARGE AGRICULTURAL FIELD
John P. Millard, Robert C. Goettelman (LFE Corp., Richmond, Calif.), and Mary L. LeRoy, Principal Investigators. Aug. 1980 26 p. refs. Submitted for publication. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10331; NASA-TM-81222; A-8283) Avail: NTIS
HC A03/MF A01 CSCL 02C

The combined effect of water carved gullies, varying soil color, moisture state of the soil and crop, nonuniform phenology, and bare spots was measured for commercially grown barley planted on varying terrain. For all but the most rugged terrain, over 80% of the area within 4, 16, 65, and 259 ha cells was at temperatures within 3 C of the mean cell temperature. The result of using relatively small, 4 ha instantaneous field of views for remote sensing applications is that either the worst or the best of conditions is often observed. There appears to be no great advantage in utilizing a small instantaneous field of view instead of a large one for remote sensing of crop canopy temperatures. The two alternatives for design purposes are then either a very high spatial resolution, of the order of a meter or so, where the field is very accurately temperature mapped, or a low resolution, where the actual size seems to make little difference.

N80-32823*# Joint Research Centre of the European Communities, Ispra (Italy).
HCMM SATELLITE FOLLOW-ON INVESTIGATION NO. 025: SOIL MOISTURE AND HEAT BUDGET EVALUATION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST (TELLUS PROJECT) Progress Report, 1 Sep. 1979 - 31 Mar. 1980
S. Galli deParatesi, Principal Investigator. 31 Mar. 1980 63 p. refs. Sponsored by NASA. HCMM
(Proj. TELLUS)
(E80-10332; NASA-CR-163539; PR-2) Avail: NTIS
HC A04/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-32824*# Joint Research Centre of the European Communities, Ispra (Italy).
FURTHER DEVELOPMENTS OF THE TELL-US MODEL. 1: AN IMPLICIT FINITE DIFFERENCE SCHEME FOR THE NUMERICAL APPROXIMATION OF THE GROUND HEAT FLUX. 2: A SIMPLE ALGORITHM FOR ESTIMATING THE ACTUAL AND POTENTIAL EVAPOTRANSPIRATION OF VEGETATED SURFACES FROM ONE REMOTELY SENSED SURFACE TEMPERATURE NEAR THE DAILY MAXIMUM
J. Huygen, Principal Investigator. Nov. 1979 19 p. refs. Sponsored by NASA. HCMM
(Proj. TELLUS)
(E80-10333; NASA-CR-163540) Avail: NTIS
HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-32825*# Kansas Univ. Center for Research, Inc., Lawrence. Space Technology Center.
THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1979 - 31 Mar. 1980
B. G. Barr and E. A. Martinko, Principal Investigators. Jul. 1980 108 p. Original contains color imagery. Orginal photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NGL-17-004-024)
(E80-10337; NASA-CR-163417) Avail: NTIS
HC A06/MF A01 CSCL 13B

There are no author identified significant results in this report.

N80-32826*# Mississippi State Univ., Mississippi State.
APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 May - 31 Oct. 1979
W. Frank Miller, Dale A. Quattrochi, Bradley D. Carter, Gary K. Higgs, and Jimmy L. Solomon, Principal Investigators. 1 Nov. 1979 55 p. Original contains color illustrations. ERTS
(Grant NGL-25-001-054)
(E80-10338; NASA-CR-163418; SAPR-12) Avail: NTIS
HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-32827*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A METHODOLOGY FOR THE ENVIRONMENTAL ASSESSMENT OF ADVANCED COAL EXTRACTION SYSTEMS
Patrick J. Sullivan, Charles F. Hutchinson, Jeanne Makihara, and Jill Evensizer. 15 Jun. 1980 204 p. refs.
(Contracts NAS7-100; ET-75-I-01-9036)
(NASA-CR-163570; JPL-Pub-79-82) Avail: NTIS
HC A10/MF A01 CSCL 08I

Procedures developed to identify and assess potential environment impacts of advanced mining technology as it moves from a generic concept to a more systems definition are described. Two levels of assessment are defined in terms of the design stage of the technology being evaluated. The first level of analysis

is appropriate to a conceptual design. At this level it is assumed that each mining process has known and potential environmental impacts that are generic to each mining activity. By using this assumption, potential environmental impacts can be identified for new mining systems. When two or more systems have been assessed, they can be evaluated comparing potential environmental impacts. At the preliminary stage of design, a systems performance can be assessed again with more precision. At this level of systems definition, potential environmental impacts can be analyzed and their significane determined in a manner to facilitate comparisons between systems. At each level of analysis, suggestions calculated to help the designer mitigate potentially harmful impacts are provided. A.R.H.

N80-32828*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STEREOSAT: A PROPOSED PRIVATE SECTOR/GOVERNMENT JOINT VENTURE IN REMOTE SENSING FROM SPACE
Richard L. Anglin. 1 Aug. 1980. 130 p. refs.
(Contract NAS7-100)
(NASA-CR-163569; JPL-Pub-80-70) Avail: NTIS HC A07/MF A01 CSCL 22A
Stereosat, a free flying Sun synchronous satellite whose purpose is to obtain worldwide cloud-free stereoscopic images of the Earth's land masses, is proposed as a joint private sector/government venture. A number of potential organization models are identified. The legal, economic, and institutional issues which could impact the continuum of potential joint private sector/government institutional structures are examined. S.F.

N80-32829*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SEASAT. VOLUME 2: FLIGHT SYSTEMS Final Report
E. Pounder, ed. 1 Sep. 1980. 369 p. refs.
(Contract NAS7-100)
(NASA-CR-163571; JPL-Pub-80-38-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 05B
Flight systems used in the Seasat Project are described. Included are (1) launch operation; (2) satellite performance after launch; (3) sensors that collected data; and (4) the launch vehicle that placed the satellite into Earth orbit. Techniques for sensor management are explained. S.F.

N80-32830*# Martin Marietta Aerospace, Denver, Colo.
THE APPLICABILITY OF REMOTE SENSING TO EARTH BIOLOGICAL PROBLEMS. PART 2: THE POTENTIAL OF REMOTE SENSING IN PEST MANAGEMENT Final Report
J. T. Polhemus. Aug. 1980. 41 p. refs. 2 Vol.
(Contract NAS9-15918)
(NASA-CR-163589; MCR-80-610-pt-2; FR-2-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 06C
Five troublesome insect pest groups were chosen for study. These represent a broad spectrum of life cycles, ecological indicators, pest management strategies, and remote sensing requirements. Background data, and field study results for each of these subjects is discussed for each insect group. Specific groups studied include tsetse flies, locusts, western rangeland grasshoppers, range caterpillars, and mosquitoes. It is concluded that remote sensing methods are aplicable to the pest management of the insect groups studied. J.M.S.

N80-32831# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOCHEMISTRY OF SOME BRAZILIAN RIVERS
L. M. Moreira-Nordemann. Jun. 1980. 17 p. refs. Submitted for publication.
(INPE-1797-RPE/167) Avail: NTIS HC A02/MF A01
Concentrations of the totality of the dissolved salts and of sodium, calcium, potassium, magnesium and uranium were measured in ten rivers belonging to three hydrographic basins located in northeastern Brazil. Activity ratios U234/U238 were also measured. A correlation between the results obtained and the geological and climatic context of these regions was computed. Sodium is the most abundant element in the waters, except for rivers flowing in calcareous regions for which calcium is predominant. The concentrations of the major cations seem to be a function of the regional lithology whereas water salinity depends on climatic factors. R.K.G.

N80-32832# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COLLECTION, PROCESSING, AND DISTRIBUTION OF REMOTE SENSING DATA FROM BRAZILIAN RECEIVING STATION
Nelson deJesusParada. Jun. 1980. 18 p.
(INPE-1784-RPE/156) Avail: NTIS HC A02/MF A01
Basic information about the Brazilian LANDSAT tracking, receiving, processing and distribution system operated by INPE the Cachoeira Paulista Electronic and Photographic Processing Laboratory and Distribution Center. The increase of the users community - with more than 1,200 participant organizations - and the increase of the volume of images produced - near 20,000 in 1979 - are effective demonstration of the importance of remote sensing in Brazil. Types and prices of products available, product request and related items are discussed. Also, the already planned future achievements of the Brazilian Remote Sensing Satellite Program are briefly described. R.K.G.

N80-32833# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PLANNING AND EXECUTION OF A PHOTOGRAPHIC MISSION OVER A WHEAT PRODUCING REGION IN RIO GRANDE DO SUL, BRAZIL
Paulo Cesar Gurgel deAlbuquerque and Dal Arthur Cottrell. Jun. 1980. 11 p.
(INPE-1793-RPE/165) Avail: NTIS HC A02/MF A01
A wheat survey program was completed with the execution of a photographic mission during the booting growth stage of wheat. Three 20 km. by 40 km. target areas in Rio Grande do Sul were flown after cost/time saving changes in aircraft, oxygen requirements, geometric parameters and base of operations. A WILD RC-10 metric camera with WRATTEN filter was used to expose color IR film to produce 1:20,000 scale transparencies and semicontrolled mosaics for hectareage estimations and data integration with hardware for CCT analyses. R.K.G.

N80-32834# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
GEOCHEMICAL BALANCE OF THE SALGADO RIVER BASIN
L. M. Moreira-Nordemann and D. Nordemann. Aug. 1980. 43 p. refs. Submitted for publication.
(INPE-1849-RPE/206) Avail: NTIS HC A03/MF A01
The Salgado River basin (Bahia State, Brazil) was studied from the point of view of present climatic and geochemical conditions: inappropriate exploitation, irregular rainfall and high evaporation rate resulting in a state of unbalanced geochemical conditions. The water of the Salgado River showed high concentration of the total dissolved salts. The mean chemical composition and weathering rate of the rocks of the river basin were measured. S.F.

N80-32835# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CHARACTERIZATION OF CERRADO VEGETATION USING AUTOMATICALLY CLASSIFIED LANDSAT MSS DATA
Joao Roberto Dos Santos, Vitor Celso DeCarvalho, and Hideyo Aoki (Sao Paulo Univ.). Jun. 1980. 13 p. refs. Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980.
(INPE-1790-RPE/162) Avail: NTIS HC A02/MF A01
The characterization of physiognomic unities of cerrado vegetation through automatic IMAGE 100 analysis of LANDSAT MSS data was studied. The separability of the unities analyzed was verified (cerrado, campo cerrado, campo sujo) from respective spectral signatures obtained using a MAXVER and a JM distances algorithm. A correlation analysis of correctly classified values was performed. The results obtained include the following: (1) the use of four channels together presented the best class separation, independent of season; (2) in considering the use of isolated channels, channel 5 provided the largest percent correct classification; and (3) the highest separability was observed between cerrado and campo sujo forms. It is concluded that the separability of physiognomic unities can contribute to studies for the rational use of cerrado areas. R.K.G.

N80-32836# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE USE OF LANDSAT DATA FOR EVALUATION AND CHARACTERIZATION OF DEFORESTED PASTURELAND AND REFORESTED AREAS IN BRAZIL
Pedro Hernandez Filho, Armando Pacheco Dossantos, Evlyn Marcia Leao DeMoraesNovo, Yosio Edemir Shimabukuro, Valdete Duarte, Jose Simeao deMedeiros, Eduardo Carlos Mignone Alves, and Carlito Chefer deSantana Jun 1980 9 p refs Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr 1980 Prepared in cooperation with Brazilian Inst. for Forest Development, Sao Jose dos Campos
(INPE-1794-RPE/166) Avail: NTIS HC A02/MF A01
The compatibility of using LANDSAT data for pastureland and reforestation studies was studied. The degradation of pastureland after deforestation was identified automatically using four indicators: the percentages of exposed soil, lateritic soil, types of juquira and Gramineae species. Pine and eucalypt plantations were identified manually and automatically. The classification accuracy is 94.31 percent for pine and ranges from 67 23 to 92.30 percent for eucalypt. S.F.

N80-32837# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REMOTE SENSING APPLIED TO THE PROSPECTING OF GEOTHERMAL ANOMALY IN CALDAS NOVAS COUNTY, STATE OF GOIAS, BRAZIL
Paulo Veneziani and Celio Eustaquio DosAnjos Jun 1980 6 p refs Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980
(INPE-1792-RPE/164) Avail: NTIS HC A02/MF A01
Thermally anomalous areas associated with hot waters in the County of Caldas Novas, State of Goias, Brazil were studied. Data collection using a 50 cm soil thermometer and a Precision Radiation Thermometer indicated the presence of four principal anomalies. These areas were verified in the field. In the area of the town of Caldas Novas, of 14 deep wells drilled, none revealed water temperatures from 33 to 41 C, two contained hot mud, and one contained sulfurous water measured at 29 C. Two day wells were also encountered. L.F.M.

N80-32838*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
ON EXTRACTING BRIGHTNESS TEMPERATURE MAPS FROM SCANNING RADIOMETER DATA
P. Argentiero and Raul Garza-Robles Aug 1980 27 p refs Submitted for publication
(NASA-TM-81989) Avail: NTIS HC A03/MF A01 CSCL 08B
The extraction of brightness temperature maps from scanning radiometer data is described as a typical linear inverse problem. Spatial quantization and parameter estimation is described and is suggested as an advantageous approach to a solution. Since this approach takes into explicit account the multivariate nature of the problem, it permits an accurate determination of the most detailed resolution extractable from the data as well as explicitly defining the possible compromises between accuracy and resolution. To illustrate the usefulness of the method described for algorithm design and accuracy prediction, it was applied to the problem of providing brightness temperature maps during the NOSS flight segment. The most detained possible resolution was determined and a curve which displays the possible compromises between accuracy and resolution was provided. Author

N80-32839# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
HORIZONTAL DATUMS FOR NAUTICAL CHARTS
Thomas J. Vogel Jul 1980 23 p
(AD-A088340) Avail: NTIS HC A02/MF A01 CSCL 08/5
Marine navigation charts are based on many and varied geodetic datums in use throughout the world. These datums range from local datums to the DoD World Geodetic System (WGS) 1972. In many cases, the datums for adjoining charts will differ, although this difference will usually introduce only minor errors into the solution of navigational problems. There are times, however, when even small errors can be very disconcerting, if not dangerous, and it is under these conditions that it is advantageous for the navigator to possess some knowledge of the factors in datum selection and chart construction which lead to apparent discrepancies in position plotting. It is equally important for the chart compiler or cartographer to understand the basic principles of navigation and, therefore, the need for establishing clearly definable horizontal datums on charts. For this reason, the author has aimed at tracing the evolution of datums on Defense Mapping Agency (DMA) nautical charts, mainly for the benefit of cartographers who must realize how the product they produce impacts on the safety of navigation in ways other than the portrayal of up to date information such as navigation aids, depths, etc. This paper discusses the differences between chart datums and coordinates determined by using various navigation systems, accuracy requirements for nautical charts, navigation system accuracy requirements as related to datums, and datum transformation methods. GRA

N80-32840# Earth Satellite Corp., Washington, D. C.
GEOMETRIC PATTERN RECOGNITION TECHNIQUES APPLIED TO LAND LANDSAT DIGITAL DATA FOR URANIUM EXPLORATION
1979 291 p refs
(Contract DE-AC13-76GJ-01664)
(GJBX-26(80)) Avail: NTIS HC A13/MF A01
Six training sites were selected, consisting of Copper Mountain (Wyoming), Pumkin Buttes/Kaycee (Wyoming), Grants (New Mexico), Rossing (Namibia), Marysvale (Utah), and Beaverlodge (Saskatchewan). For each of these sites, displays and/or texture measures were generated, and where possible discrimination functions were developed to separate known uraniferous areas from areas of unknown uranium content. Of all data sources and all texture measures, the most successful was the measure pair, inverse difference moment plotted against angular second moment, applied to the third eigenband of the LANDSAT data. This measures pair permitted separation of uranium from non-uranium in certain geologies (particularly Pumpkin Buttes/Kaycee) but was unsuccessful in others. Although the results obtained cannot be described as providing a new tool for uranium exploration, there is clear evidence that computed texture measures are describing some element of the LANDSAT data source that cannot be readily observed or analyzed by human interpreters. DOE

N80-32841# Arctec, Inc., Columbia, Md.
SAINT LAWRENCE RIVER ALL-YEAR NAVIGATION ICE CONTROL SYSTEM Final Report
Jack W. Lewis and Robert P. Johnson Apr 1980 145 p refs Sponsored in part by Winter Navigation Season Extension Demonstration Program
(Contract DOT-SL-76-469)
(PB80-183478, SLSDC-281C-3) Avail: NTIS HC A07/MF A01 CSCL 08L
Designs and specifications for an ice control system which would allow all year navigation in the Brockville to Cardinal section of the international portion of the are proposed. A distorted scale (horizontal scale, 1:150; vertical scale, 1:60) hydraulic model of the section of the river extending from Stillwells Point, New York to Red Mills, New York was utilized. Three alternative ice control systems were tested under varying river flow rates and stage and under varying ice conditions which included ice cover formation, consolidated ice covers, and spring breakup. GRA

N80-32842# Ohio State Univ., Columbus Water Resources Center.
PRELIMINARY ESTIMATE OF REGIONAL EFFECTIVE GROUND-WATER RECHARGE RATES, RELATED STREAM FLOW AND WATER QUALITY IN OHIO Completion Report
Wayne A. Pettyjohn and Roger J. Henning 1979 333 p refs
(PB80-193535; W80-05466; OWRT A-051-OHIO-1) Avail: NTIS HC A15/MF A01 CSCL 08H
Regional effective ground water recharge rates during years of low, normal and high precipitation were calculated for Ohio by means of stream hydrograph separations using a computer. The included programs also produce tables of monthly and annual recharge rates, separated stream hydrographs, flow duration curves and tables, quality duration curves and tables, as well as quality

ratio graphs. Computer output is compared with manual separation techniques. GRA

N80-32843# Nebraska Univ., Lincoln. Dept. of Industrial and Management Systems Engineering.
MAPPING MODEL FOR DETERMINING LAND SUITABLE FOR IRRIGATION. Final Report.
Richard O. Hoffman. 28 Apr. 1980. 25 p. refs.
(Contract DI-14-31-0001-5027)
(PB80-188683; W80-05246; OWRT-A-039-NEB-1) Avail: NTIS. HC A02/MF A01. CSCL 08B.

CMS-11, a computer composite mapping system, was adapted for use on the IBM 360, Model 198 computer system at the University of Nebraska for use in developing a Nebraska map showing land that is suitable for the development of irrigation systems. A land use mapping process was used based on viewing each piece of land on two separate color IR aerial photos, one taken in early summer and the other in late summer. Separate computer plots were produced for each of 27 types of land use. The program was also used to develop a mathematical model that predicts the number of acres that will be developed in future years for each soil series. GRA

N80-32844# Bureau of Mines, Denver, Colo. Denver Research Center.
DEVELOPMENT OF A METHOD TO DETECT GEOLOGIC FAULTS AND OTHER LINEAR FEATURES FROM LANDSAT IMAGES. Report of Investigations, 1980.
Richard G. Burdick and Robert A. Speirer. 1980. 81 p. refs.
(PB80-189665; BM-RI-8413) Avail: NTIS. HC A05/MF A01. CSCL 08G.

A detection method for use with a minicomputer was developed. The method comprises a suite of programs that scans an image for all 'potential' lineaments. From this partially analyzed data, the final lineaments are picked by another routine. The method was field tested and results indicated good agreement between computer picked lineaments and ground features. GRA

N80-32845# Columbia Univ., New York. Aldridge Lab. of Applied Geophysics.
DETECTION OF HIDDEN MINERAL DEPOSITS BY AIRBORNE SPECTRAL ANALYSIS OF FOREST CANOPIES.
William Collins, Sheng-Huei Chang, and John T. Kuo. 1979. 66 p. refs.
(Grant NSF DAR-78-16320)
(PB80-193881; NSF/RA-800041) Avail: NTIS. HC A04/MF A01. CSCL 08G.

Field surveys and data analysis of four biogeochemical test sites confirmed the ability of an airborne system with high spectral resolution to detect an anomalous spectral waveform that appeared to be associated with sulfide mineralization. Known or suspected sulfide zones were detected on each site. GRA

N80-32846# Robertson Research (US), Inc., Houston, Tex.
PALEONTOLOGICAL RESOURCES EVALUATION: WEST DIVIDE PROJECT. Final Report.
Robert E. Sloan, Joseph H. Hartman, Laurie J. Dempsey, Martha E. Jordan, and Eddie B. Robertson. Mar. 1980. 61 p. refs.
(Contract DI-9-07-40-S0811)
(PB80-189889) Avail: NTIS. HC A04/MF A01. CSCL 08G.

A survey of the literature on the paleontological resources of the rock formation in the West Divided Project area is presented. The presence of several fossil rich sites in or near the proposed construction zone were revealed. The field investigation concentrated on these sites with the object of assessing the impact of the project on them. GRA

N80-32847# Robertson Research (US), Inc., Houston, Tex.
PALEONTOLOGICAL RESOURCES EVALUATION: RED FLEET RESERVOIR. Final Report.
Robert E. Sloan, Joseph H. Hartman, Laurie J. Dempsey, Martha E. Jordan, and Eddie B. Robertson. Mar. 1980. 54 p. refs.
(Contract DI-9-07-40-S0811)
(PB80-204258) Avail: NTIS. HC A04/MF A01. CSCL 08G.

The literature on the paleontological resources of the rock formations in the Red Fleet Reservoir area revealed that no previous collections were made within the reservoir take line. Significant collections of Jurassic vertebrates were documented from nearby areas such as Dinosaur National Monument. Field investigations uncovered fossil material from several rock formations and localities near and within the reservoir. The fossil material identified, which includes invertebrates from several horizons and disarticulated dinosaur bone material from the Morrison Formation, does not appear to be of significant scientific value. No mitigation measures are recommended. GRA

N80-32848# Geological Survey, Madison, Wis.
COMPARISON OF TRACER METHODS AND PREDICTIVE EQUATIONS FOR DETERMINATION OF STREAM-REAERATION COEFFICIENTS ON THREE SMALL STREAMS IN WISCONSIN. Final Report.
R. S. Grant and Steven Skavroneck (Wisconsin Dept. of Natural Resources, Madison). Apr. 1980. 43 p. refs.
(PB80-193642; USGS/WRD/WRI-80/024; USGS/WRI-80-19) Avail: NTIS. HC A03/MF A01. CSCL 08H.

Four modified nonradioactive tracer methods and 20 predictive equations for determination of stream reaeration coefficients (K2) in three small Wisconsin streams were compared with the radioactive tracer method developed by Tsivoglou. Of the four modified tracer techniques, the propane area technique, which measures the total weight of propane gas passing stream sampling stations, yielded the least mean absolute difference of 11.0 percent compared with the radioactive tracer method. The propane peak concentration, ethylene peak concentration, and ethylene total weight methods gave mean absolute differences of 18, 21, and 26 percent, respectively. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-32849* National Aeronautics and Space Administration, Washington, D. C.
ENERGY. A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 26, 1 APRIL - 30 JUNE 1980.
Jul. 1980. 321 p.
(NASA-SP-7043(26)) Avail: NTIS. HC $15.00. CSCL 10B.

This bibliography lists 1134 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System from April 1, 1980 through June 30, 1980. Author

N80-32850*# National Aeronautics and Space Administration, Pasadena Office, Calif.
IMPROVING THE EFFICIENCY OF SILICON SOLAR CELLS CONTAINING CHROMIUM. Patent Application.
Amal M. Salama, inventor (to NASA) (JPL). Filed 11 Sep. 1980. 16 p.
(Contract NAS7-100)
(NASA-Case-NPO-15179-1; US-Patent-Appl-SN-185867) Avail: NTIS. HC A02/MF A01. CSCL 10A.

Efficiency of silicon solar cells containing about 10 to the 15th power atoms/cu cm of chromium is improved about 26% by thermal annealing of the silicon wafer at a temperature of 200 C to form chromium precipitates having a diameter of less than 1 Angstrom. Further improvement in efficiency is achieved by scribing laser lines onto the back surface of the wafer at a spacing of at least 0.5 mm and at a depth of less than 13 micrometers to preferentially precipitate chromium near the back surface and away from the junction region of the device. This provides an economical way to improve the deleterious effects of chromium, one of the impurities present in metallurgical grade silicon material. NASA

N80-32851*# ARATEX Services, Inc., Encino, Calif.
SOLAR HOT WATER DEMONSTRATION PROJECT AT RED STAR INDUSTRIAL LAUNDRY, FRESNO, CALIFORNIA Final Report
Jul. 1980 82 p Sponsored in part by NASA. Marshall Space Flight Center
(Contract EX-76-C-01-2384)
(NASA-CR-161537) Avail: NTIS HC A05/MF A01 CSCL 10A

The performance of a Solar Hot Water System at a laundry in Fresno, Califironia is described. The system features an integrated wastewater heat recovery subsystem and a solar preheating system designed to supply a part of the hot water requirements. Performance data for a six month period are projected to an annual savings of $18,703. L.F.M.

N80-32852*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LOW-COST SOLAR ARRAY PROJECT AND PROCEEDINGS OF THE 15TH PROJECT INTEGRATION MEETING Progress Report, Dec. 1979 - Apr. 1980
Apr. 1980 385 p Meeting held on 2-3 Apr. 1980
(Contracts NAS7-100; EX-76-A-29-1012)
(NASA-CR-163568; DOE/JPL-1012-44; JPL-Pub-80-27; PR-15) Avail: NTIS HC A17/MF A01 CSCL 10A

Progress made by the Low-Cost Solar Array Project during the period December 1979 to April 1980 is described. Project analysis and integration, technology development in silicon material, large area silicon sheet and encapsulation, production process and equipment development, engineering, and operation are included. R.K.G.

N80-32853*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
A COMPUTER MODEL OF SOLAR PANEL-PLASMA INTERACTIONS Final Report
David L. Cooke and John W. Freeman [1980] 59 p refs
(Contract NAS9-15796)
(NASA-CR-160796) Avail: NTIS HC A04/MF A01 CSCL 10A

High power solar arrays for satellite power systems are presently being planned with dimensions of kilometers, and with tens of kilovolts distributed over their surface. Such systems face many plasma interaction problems, such as power leakage to the plasma, particle focusing, and anomalous arcing. These effects cannot be adequately modeled without detailed knowledge of the plasma sheath structure and space charge effects. Laboratory studies of 1 by 10 meter solar array in a simulated low Earth orbit plasma are discussed. The plasma screening process is discussed, program theory is outlined, and a series of calibration models is presented. These models are designed to demonstrate that PANEL is capable of accurate self consistant space charge calculations. Such models include PANEL predictions for the Child-Langmuir diode problem. S.F.

N80-32854*# EIC, Inc., Newton, Mass.
HYDROGEN PRODUCTION BY PHOTOELECTROLYTIC DECOMPOSITION OF H2O USING SOLAR ENERGY Final Report, 1 Dec. 1975 - 30 Nov. 1979
R. D. Rauh, S. A. Alkaitis, J. M. Buzby, and R. Schiff Aug. 1980 66 p refs
(Contracts NAS7-100; JPL-955271)
(NASA-CR-163586; JPL-9950-406) Avail: NTIS HC A04/MF A01 CSCL 10A

Photoelectrochemical systems for the efficient decomposition of water are discussed. Semiconducting d band oxides which would yield the combination of stability, low electron affinity, and moderate band gap essential for an efficient photoanode are sought. The materials PdO and Fe-xRhxO3 appear most likely. Oxygen evolution yields may also be improved by mediation of high energy oxidizing agents, such as CO3(-). Examination of several p type semiconductors as photocathodes revealed remarkable stability for p-GaAs, and also indicated p-CdTe as a stable H2 photoelectrode. Several potentially economical schemes for photoelectrochemical decomposition of water were examined, including photoelectrochemical diodes and two stage, four photon processes. S.F.

N80-32855*# Burt, Hill, Kosar, Rittleman, and Associates, Butler, Pa. Research and Solar Applications Div.
OPERATION AND MAINTENANCE COST DATA FOR RESIDENTIAL PHOTOVOLTAIC MODULES/PANELS Final Report
J. R. Oster, Jr., D. R. Zaremski, Jr., E. M. Albert, and S. L. Hawkins Jul. 1980 106 p refs
(Contract JPL-955614)
(NASA-CR-163585; DOE/JPL-955614-80/1; JPL-9950-408) Avail: NTIS HC A06/MF A01 CSCL 10A

Costs associated with the operation and maintenance of residential photovoltaic modules and arrays are studied. Six basic topics related to operation and maintenance to photovoltaic arrays are investigated: maintenance; cleaning; panel replacement; gasket repair/replacement; wiring repair/replacement; and termination repair/replacement. The effects of the mounting types (rack mount, stand off mount, direct mount and integral mount) and the installation/replacement type (sequential, partial interruption and independent) are identified and described. Methods of reducing maintenance costs are suggested. S.F.

N80-32856*# Texas Univ., Austin. Center for Electromechanics.
A STUDY OF THE APPLICABILITY/COMPATIBILITY OF INERTIAL ENERGY STORAGE SYSTEMS TO FUTURE SPACE MISSIONS Final Report
William F. Weldon Aug. 1980 139 p refs Sponsored in part by Texas Atomic Energy Research Foundation
(Contracts NAS7-100; JPL-955679)
(NASA-CR-163584; JPL-9950-413) Avail: NTIS HC A07/MF A01 CSCL 10C

The applicability/compatibility of inertial energy storage systems like the homopolar generator (HPG) and the compensated pulsed alternator (CPA) to future space missions is explored. Areas of CPA and HPG design requiring development for space applications are identified. The manner in which acceptance parameters of the CPA and HPG scale with operating parameters of the machines are explored and the types of electrical loads which are compatible with the CPA and HPG are examined. Potential applications including the magnetoplasmadynamic (MPD) thruster, pulsed data transmission, laser ranging, welding and electromagnetic space launch are discussed. S.F.

N80-32857*# Rockwell International Science Center, Thousand Oaks, Calif.
STUDY PROGRAM FOR ENCAPSULATION MATERIALS INTERFACE FOR LOW COST SILICON SOLAR ARRAY Annual Report, 1 Jan. - 31 Dec. 1979
D. H. Kaelble, F. B. Mansfeld, J. B. Lunsden, III, and C. Leung Mar. 1980 88 p refs
(Contracts JPL-954739; N00014-75-C-0788; NR Proj. 036-108)
(NASA-CR-163583; DOE/JPL-954739-3; SC5106.86AR; JPL-9950-416; AR-1) Avail: NTIS HC A05/MF A01 CSCL 10A

An atmospheric corrosion model was developed and verified by five months of corrosion rate and climatology data acquired at the Mead, Nebraska LSA test site. Atmospheric corrosion rate monitors (ACM) show that moisture condensation probability and ionic conduction at the corroding surface or interface are controlling factors in corrosion rate. Protection of the corroding surface by encapsulant was shown by the ACM recordings to be maintained, independent of climatology, over the five months outdoor exposure period. The macroscopic corrosion processes which occur at Mead are shown to be reproduced in the climatology simulator. Controlled experiments with identical moisture and temperature aging cycles show that UV radiation causes corrosion while UV shielding inhibits LSA corrosion. R.K.G.

N80-32858*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE WIND TURBINES: A UTILITY OPTION FOR THE GENERATION OF ELECTRICITY
W. H. Robbins, R. L. Thomas, and D. H. Baldwin 1980 18 p refs Presented at the Am. Power Conf., Chicago, 21-23 Apr. 1980; sponsored by Illinois Inst. of Tech.; presented at the Ann. Solar Energy Program Rev., Rockport, Maine, 26-28 Aug. 1980.

sponsored by Electric Power Research Inst.
(Contract DE-AI01-79ET-23139)
(NASA-TM-81502; DOE/NASA/23139-1; E-440) Avail: NTIS HC A02/MF A01 CSCL 10B

The wind resource is such that wind energy generation has the potential to save 6-7 quads of energy nationally. Thus, the Federal Government is sponsoring and encouraging the development of cost effective and reliable wind turbines. One element of the Federal Wind Energy Programs, Large Horizontal Axis Wind Turbine Development, is managed by the NASA Lewis Research Center for the Department of Energy. There are several ongoing wind system development projects oriented primarily toward utility application within this program element. In addition, a comprehensive technology program supporting the wind turbine development projects is being conducted. An overview is presented of the NASA activities with emphasis on application of large wind turbines for generation of electricity by utility systems. Author

N80-32859*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 6: IN-DEPTH ELEMENT INVESTIGATION Final Contractor Report
G. M. Hanley. Sep. 1980. 97 p. refs.
(Contract NAS8-32475)
(NASA-CR-3323; SSD-79-0010-6) Avail: NTIS HC A05/MF A01 CSCL 10A

The fabrication parameters of GaAs MESFET solid-state amplifiers considering a power added conversion efficiency of at least 80% and power gains of at least 10dB were determined. Operating frequency was 2.45 GHz although 914 MHz was also considered. Basic circuit to be considered was either Class C or Class E amplification. Two modeling programs were utilized. The results of several computer calculations considering differing loads, temperatures, and efficiencies are presented. Parametric data in both tabular and plotted form are presented. T.M.

N80-32860*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEM (SPS) CONCEPT DEFINITION STUDY. VOLUME 3: EXPERIMENTAL VERIFICATION DEFINITION Final Contractor Report
G. M. Hanley. Sep. 1980. 145 p.
(Contract NAS8-32475)
(NASA-CR-3320; SSD-79-0010-3) Avail: NTIS HC A07/MF A01 CSCL 10A

An evolutionary Satellite Power Systems development plan was prepared. Planning analysis was directed toward the evolution of a scenario that met the stated objectives, was technically possible and economically attractive, and took into account constraining considerations, such as requirements for very large scale end-to-end demonstration in a compressed time frame, the relative cost/technical merits of ground testing versus space testing, and the need for large mass flow capability to low Earth orbit and geosynchronous orbit at reasonable cost per pound. T.M.

N80-32861*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 5: SPECIAL EMPHASIS STUDIES Final Report
G. M. Hanley. Sep. 1980. 265 p. refs.
(Contract NAS8-32475)
(NASA-CR-3322; SSD-79-0010-5) Avail: NTIS HC A12/MF A01 CSCL 10A

Satellite configurations based on the Satellite Power System baseline requirements were analyzed and a preferred concept selected. A satellite construction base was defined, precursor operations incident to establishment of orbital support facilities identified, and the satellite construction sequence and procedures developed. Rectenna construction requirement were also addressed. Mass flow to orbit requirements were revised and traffic models established based on consutrcution of 60 instead of 120 satellites. Analyses were conducted to determine satellite control, resources, manufacturing, and propellant requirements. The impact of the laser beam used for space-to-Earth power transmission upon the intervening atmosphere was examined as well as the inverse effect. The significant space environments and their effects on spacecraft components were investigated to define the design and operational limits imposed by the environments on an orbit transfer vehicle. The results show that LEO altitude < 300 nmi and transfer orbit duration < 6 months are preferrable. J.M.S.

N80-32862# Naval Research Lab., Washington, D. C.
ENERGY STORAGE AS HEAT-OF-FUSION IN CONTAINERIZED SALTS. REPORT ON ENERGY STORAGE BOILER TANK Interim Report
T. A. Chubb, J. J. Nemecek, and D. E. Simmons. 27 Jun. 1980. 110 p. refs.
(Contract EC-77-A-31-1024; RR0240145)
(AD-A087753; AD-E000495; NRL-MR-4267) Avail: NTIS HC A06/MF A01 CSCL 10/3

This report is concerned with energy storage based on heat-of-fusion in containerized salt. The 'energy storage boiler tank' uses evaporation and condensation of a heat transfer fluid to provide heat transfer into and out of stacked cans of salt. The 'energy storage superheater tank' uses a network of alkali metal heat pipes to distribute heat throughout a building filled with salt cans. It uses a radiation to transfer energy to and from stacked cans of salt. The paper summarizes the rationale for energy storage in containerized salt, it discusses salt availability, salt processing, container requirements, can technology and heat transfer fluid degradation problems. These discussions lead to estimates of energy storage system costs. The Naval Research Laboratory is building a 2 MWht proof-of-concept energy storage boiler tank. Laboratory investigations studying the compatibility of the heat transfer fluid with the molten storage salt are described, along with measurements of temperature drops associated with the energy input process. An assessment of the current status of the energy storage boiler tank is presented. GRA

N80-32863# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
USE OF SOLAR ENERGY TO PRODUCE PROCESS HEAT FOR INDUSTRY
Ken Brown. Apr. 1980. 28 p. refs. Presented at the 30th Ann. Plant Eng. and Maintenance Conf., Chicago, 24 Mar. 1980.
(Contract EG-77-C-01-4042)
(SERI/TP-731-626; CONF-800373-1) Avail: NTIS HC A03/MF A01

The role of solar energy in supplying heat and hot water to residential and commerical buildings is familiar. On the other hand, the role that solar energy may play in displacing imported energy supplies in the industrial and utility sectors often goes unrecognized. The versatility of solar technology lends itself well to applications in industry; particulary to the supplemental supply for process heat. The status of solar thermal technology for industrial process heat applications, including a description of current costs and operating histories is surveyed. The most important objectives to be met in improving system performance, reducing cost, and identifying markets for solar industrial process heat are outlined. DOE

N80-32864# Avco-Everett Research Lab., Mass.
OPEN-CYCLE MHD POWER CONDITIONING AND CONTROL REQUIREMENTS DEFINITION Final Report
S. Petty and K. Williams. Mar. 1980. 70 p. refs.
(EPRI-AP-1345) Avail: NTIS HC A04/MF A01

A generic inverter configuration is defined, and the relevant characteristics of line and forced commutated inverters are compared and evaluated for their suitability for magnetohydrodynamic (MHD) power application. The interface requirements of an MHD channel inverter utility interactive system are defined, and a forced commutated inverter meeting these requirements is described. The results of a set of tests using this inverter are described along with recommendations for future work in this field. DOE

N80-32865# SRI International Corp., Menlo Park, Calif.
DIRECT ELECTROCHEMICAL GENERATION OF ELECTRICITY FROM COAL Progress Report, 16 May 1977 - 15 Feb. 1979
Robert D. Weaver, Steven C. Leach, Arthur E. Bayce, and Leonard Nanis. 1979. 151 p. refs.

(Contract EY-76-C-03-0115)
(SAN-0115/105-1) Avail: NTIS HC A08/MF A01

The feasibility of the coal air fuel cell was investigated. Results of fabrication of anodes from coal, the factors influencing cell design and voltage current behavior of the carbon anode, and results of materials selection for the air cathode are among the topics discussed. The overall thermal efficiency of a nonoptimized plant is calculated and presented. The results indicate a nonpolluting process equivalent to or exceeding present day thermal efficiencies. Conservative analysis for a plant with carbon pellet anode feed and bottoming thermal recovery indicates an overall efficiency of 53.3% and a cost of $758 per kilowatt (638 MW plant, 1978 dollars). This cost is below competing molten carbonate systems using gaseous anode feed. DOE

N80-32866# Braun (C. F.) and Co., Alhambra, Calif.
ASSESSMENT OF SULFUR REMOVAL PROCESSES FOR ADVANCED FUEL CELL SYSTEMS Final Report
G. A. Lorton. Jan. 1980. 156 p. refs. Sponsored by Electric Power Research Inst.
(EPRI-EM-1333) Avail: NTIS HC A08/MF A01

The performance characteristics of potential sulfur removal processes were evaluated and four of these processes, the Selexol process, the Benfield process, the Sulfinol process, and the Rectisol process, were selected for detailed technical and economic comparison. The process designs were based on a consistent set of technical criteria for a grass roots facility with a capacity of 10,000 tons per day of Illinois No. 6 coal. Two raw gas compositions, based on oxygen blown and air blown Texaco gasification, were used. The bulk of the sulfur was removed in the sulfur removal unit, leaving a small amount of sulfur compounds in the gas. The remaining sulfur compounds were removed by reaction with zinc oxide in the sulfur polishing unit. The impact of COS hydrolysis pretreatment on sulfur removal was evaluated. Comprehensive capital and O and M cost estimates for each of the process schemes were developed. DOE

N80-32867# Bechtel National, Inc., San Francisco, Calif.
COMBINED CYCLE SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEM STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Technical Report
Nov. 1979. 111 p. refs.
(Contracts ET-78-C-03-2051; DE-AC03-78ET-21050)
(DOE-ET-21050/1-1) Avail: NTIS HC A06/MF A01

The major effort of the project was development and assessment of a commercial scale power plant concept where both solar energy and fossil fuel are used to generate electricity. This so called hybrid concept was developed around a combined cycle gas turbine/steam turbine power plant. A market analysis, and parametric and system studies were included leading to a comparative evaluation of the Modified Strawman and Advanced Strawman systems. DOE

N80-32868# Bechtel National, Inc., San Francisco, Calif.
COMBINED CYCLE SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEM STUDY. VOLUME 2 Final Technical Report
Nov. 1979. 491 p. refs.
(Contracts ET-78-C-03-2051; DE-AC03-78ET-21050)
(DOE-ET-21050-1-2) Avail: NTIS HC A21/MF A01

The conceptual design for a commercial scale (nominal 100-MWe) central receiver solar/fossil fuel hybrid power system with combined cycle energy conversion was developed. A near term, metallic heat pipe receiver and an advanced ceramic tube receiver hybrid system are defined through parametric and market potential analyses. Energy storage is not required and analyses show no economic advantages with energy storage provisions. It is concluded that the near term solar hybrid system is a cost effective alternative to conventional gas turbines and combined cycle generating plants, and has potential for intermediate load market penetration at 15% annual fuel escalation rate. Due to their flexibility, simple solar/nonsolar interfacing, and short startup cycles, these hybrid plants have significant operating advantages. Utility company comments suggest that hybrid power systems will precede stand-alone solar plants. DOE

N80-32869# Kilkeary, Scott and Associates, Inc., Arlington, Va.
DOCUMENTATION OF VOLUME 3 OF THE 1978 ENERGY INFORMATION ADMINISTRATION ANNUAL REPORT TO CONGRESS Annual Report
29 Feb. 1980. 325 p. refs.
(Contract DE-AC01-79EI-10456)
(DOE/EIA-CR-0456) Avail: NTIS HC A14/MF A01

In a preliminary overview of the projection process, the relationship between energy prices, supply, and demand is addressed. Topics treated in detail include a description of energy economic interactions, assumptions regarding world oil prices, and energy modeling in the long term beyond 1995. Subsequent sections present the general approach and methodology underlying the forecasts, and define and describe the alternative projection series and their associated assumptions. Short term forecasting, midterm forecasting, long term forecasting of petroleum, coal, and gas supplies are included. The role of nuclear power as an energy source is also discussed. DOE

N80-32870# BDM Corp., McLean, Va.
PHOTOVOLTAIC APPLICATIONS DEFINITION AND PHOTOVOLTAIC SYSTEM DEFINITION STUDY IN THE AGRICULTURAL SECTOR. VOLUME 2: TECHNICAL RESULTS
R. W. Mengel, T. P. Nadolski, D. C. Sparks, S. K. Young, and A. Yingst. May 1980. 230 p. Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-79-7018/2-Vol-2) Avail: NTIS HC A11/MF A01

This volume describes the technical results of the study of potential photovoltaic (P/V) applications in US agriculture. The results presented address all technical aspects of the program and include a summary of agricultural energy consumption. The objectives of the technical effort reported were to: (1) identify and characterize agricultural energy demands that can effectively use P/V power systems; (2) develop effective P/V system designs for the four most promising applications; (3) determine performance and cost estimates for the designs; and (4) recommend systems for early test and demonstration and critical issues requiring further systems studies. The farms chosen for conceptual design include: (1) poultry layer farm, (2) hog production farm, (3) beef feedlot, and (4) year round vegetable farm. DOE

N80-32871# Oak Ridge National Lab., Tenn. Energy Div.
COMPARISON OF SOLAR-THERMAL AND FOSSIL TOTAL-ENERGY SYSTEMS FOR SELECTED INDUSTRIAL APPLICATIONS
Gerald D. Pine. Jun. 1980. 75 p. refs.
(Contract W-7405-eng-26)
(ORNL/TM-7022) Avail: NTIS HC A04/MF A01

Economic analyses of a conventional system and total energy systems based on phosphoric acid fuel cells, diesel piston engines, and central receiver solar thermal systems were performed for each of four industrial applications: a concrete block plant in Arizona, a fluid milk processing plant in California, a sugar beet processing plant in Colorado, and a meat packing plant in Texas. A series of sensitivity analyses was performed to show the effects of variations in fuel price, system size, cost of capital, and system initial cost. Solar total energy systems (STES) are more capital intensive than the other systems, and significant economies of scale are associated with the STES. If DOE solar system cost goals are met, STES can compete with the other systems for facilities with electrical demands greater than two or three megawatts, but STES are not competitive for smaller facilities. Significant energy resource savings, especially of oil and gas, resulted from STES implementation in the four industries. DOE

N80-32872# Sandia Labs., Albuquerque, N. Mex.
USER'S MANUAL FOR THE VERTICAL AXIS WIND TURBINE PERFORMANCE COMPUTER CODE DARTER
Paul C. Klimas and Ralph E. French. May 1980. 48 p. refs.
(Contract DE-AC04-76DP-00789)
(SAND-80-1155) Avail: NTIS HC A03/MF A01

The computer code DARTER (DARrieus, Turbine, Elemental Reynolds number) is an aerodynamic performance/loads prediction scheme based upon the conservation of momentum principle. It is the latest evolution in a sequence which began with a model developed by Templin of NRC, Canada and progressed through the Sandia National Laboratories developed SIMOSS (SImple

MOmentum, Single Streamtube) and DART (Darrieus Turbine) to DARTER. DOE

N80-32873# Battelle Pacific Northwest Labs., Richland, Wash.
POROUS MEDIA EXPERIENCE APPLICABLE TO FIELD EVALUATION FOR COMPRESSED AIR ENERGY STORAGE
R. D. Allen and P. J. Gutknecht. Jun. 1980. 98 p. refs.
(Contract DE-AC06-76RL-01830)
(PNL-3294) Avail: NTIS. HC A05/MF A01

A survey is presented of porous media field experience that may aid in the development of a compressed air energy storage field demonstration. Related experience embraces technologies of natural gas, thermal energy, and geothermal and hydrogen storage. Natural gas storage technology lends the most toward compressed air storage development, keeping in mind the respective differences between stored fluids, physical conditions, and cycling frequencies. Both fluids are injected under pressure into an aquifer to form a storage bubble confined between a suitable caprock structure and partially displaced ground water. State-of-the-art information is summarized as the necessary foundation material for field planning. Suggested ranges are given for injection air temperature and reservoir pressure. DOE

N80-32874# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESIDENTIAL PHOTOVOLTAIC FLYWHEEL STORAGE SYSTEM PERFORMANCE AND COST
R. D. Hay, A. R. Millner, and P. O. Jarvinen. 1980. 6 p. refs.
Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contract DE-AC02-76ET-20279)
(DOE/ET-20279/92; CONF-800806-22) Avail: NTIS. HC A02/MF A01

A subscale prototype of a flywheel energy storage and conversion system for use with photovoltaic power systems of residential and intermediate load-center size was designed, built and tested. System design, including details of such key components as magnetic bearings, motor generator, and power-conditioning electronics, are described. Performance results of prototype testing are given and indicate that this system is the equal of or superior to battery and inverter systems for the same application. Results of cost and user-worth analysis show that residential systems are economically feasible in stand-alone and in utility-interactive applications. DOE

N80-32875# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
PHOTOELECTRONIC PROPERTIES OF ZINC PHOSPHIDE CRYSTALS, FILMS AND HETEROJUNCTIONS. Quarterly Progress Report, 1 Jul. - 30 Sep. 1979
Richard H. Bube. Oct. 1979. 25 p. refs. Prepared in cooperation With Midwest Research Inst., Golden, Colo.
(Contract EG-77-C-01-4042)
(SU-DSE-4042-T12; QPR-2) Avail: NTIS. HC A02/MF A01

The closed tube horizontal growth method was pursued for the growth of single crystals of Zn3P2. The rate of material transport was increased by increasing the temperature difference between source and growth regions and by decreasing the distance involved. A boule with only 2 grains in a 12 mm diameter was obtained. Only small photoresponse was obtained with these totally experimental cells. The Zn3P2 films deposited on glass by CSVT were shown to be amorphous whereas those deposited on single crystal CdS were polycrystalline. Laser anealing was shown to have dramatic effects in crystallizing Zn3P2 films deposited on Si3N4 film substrates on single crystal Si. Thin films of Zn3P2 were deposited on glass substrates by vacuum evaporation. Optical transmission and reflection spectra, as well as photoconductivity spectral response were measured on a number of these films. DOE

N80-32876# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
PHOTOELECTRONIC PROPERTIES OF ZINC PHOSPHIDE CRYSTALS, FILMS AND HETEROJUNCTIONS. Quarterly Progress Report, 26 Feb. - 30 Jun. 1979
Richard H. Bube. Jul. 1979. 10 p. refs. Prepared in cooperation with Midwest Research Inst., Golden, Colo.
(Contract EG-77-C-01-4042)
(SU-DSE-4042-T10; QPR-1) Avail: NTIS. HC A02/MF A01

A closed tube method was developed for the synthesis of Zn3P2 from the elements which eliminates the potential dangers associated with high P pressures. Subsequent materials synthesis will be done routinely by this method. Initial efforts at single crystal growth of Zn3P2 from this material yielded polycrystalline material because of nucleation along the walls of the tube. Techniques for improving the situation are being tested. Progress is reported on the development of a CVD apparatus for the deposition of wide bandgap oxides and sulfides on a variety of substrates including Zn3P2. Layer deposition by the close spaced vapor transport method to be applied to Zn3P2 was successfully tested using CdTe on both quartz and CdS substrates. DOE

N80-32877# United Technologies Corp., South Windsor, Conn. Power Systems Div.
ADVANCED TECHNOLOGY FUEL CELL PROGRAM. Annual Report
J. A. S. Bett, C. L. Bushnell, R. F. Buswell, G. A. Gruver, J. M. King, and H. R. Kuna. 1980. 116 p. refs.
(EPRI-EM-1328) Avail: NTIS. HC A06/MF A01

Efforts were undertaken to establish a basis for the engineering development of an improved fuel cell power plant. These focused on molten carbonate fuel cells, advanced reformers, and use of coal products. Molten carbonate cell configurations were developed that are capable of enduring thermal cycles and were demonstrated in square foot stacks of 8 and 20 cells. Subscale cells were tested at pressures of up to 5 atmospheres with little, if any, carbon or methane formation in the fuel cell. In addition, an adiabatic, a hybrid, and a cyclic reformer were evaluated. DOE

N80-32878# Diamond Shamrock Chemical Co., Cleveland, Ohio. Electrolytic Systems Div.
OXYGEN ELECTRODES FOR ENERGY CONVERSION AND STORAGE. Annual Report, 1 Oct. 1977 - 30 Sep. 1978
1980. 362 p. refs.
(Contract EC-77-C-02-4146)
(DOE/ET-25502/1) Avail: NTIS. HC A16/MF A01

Very active oxygen electrocatalysts and their incorporations into high performance electrode structures were developed. These long life oxygen electrodes were designed for a spectrum of applications including industrial electrolysis, fuel cells, and metal air batteries. The operating life and initial cost of oxygen cathodes was developed. T.M.

N80-32879# Oak Ridge National Lab., Tenn.
THERMAL ENERGY STORAGE FOR BUILDING HEATING AND COOLING APPLICATIONS. Technical Progress Report, Apr. 1979 - Mar. 1980
J. F. Martin and H. W. Hoffman. Jun. 1980. 65 p. refs.
(Contract W-7405-eng-26)
(ORNL-TM-7319) Avail: NTIS. HC A04/MF A01

The ORNL program in thermal energy storage (TES) over the past year is reported. The program consists of developing sensible and latent heat technologies to meet the single goal of reduction in oil and gas consumption for residential and space conditioning. Three specific application elements were addressed: utility load management, solar energy applications; and conservation. Programs (both completed and ongoing) are summarized, and their relationship to the specific implementation plan are given. The program completed a transition from low temperature storage development including seasonal storage in natural aquifers to TES development for building heating and cooling applications. DOE

N80-32880# Oak Ridge National Lab., Tenn. Energy Div.
ANNUAL CYCLE ENERGY SYSTEM (ACES). Performance Report, Nov. 1977 - Sep. 1978
A. S. Holman and L. A. Abbatiello. May 1980. 77 p. refs.
(Contract W-7405-eng-26)
(ORNL/CON-42) Avail: NTIS. HC A05/MF A01

A single family residence near Knoxville, Tennessee, is being used to demonstrate the energy conserving features of the annual cycle energy system (ACES), an integrated heating and cooling system that utilizes a unidirectional heat pump and low temperature thermal storage. A second house, the control house, is being used to compare the performance of the ACES with that

of an electric resistance heating and hot water system combined with a central air conditioning system. The ACES reduced peak utility system demands significantly, a reduction from 11.7 to 3.1 kW was achieved in the winter and from 4.1 to 0.7 kW in the summer. The only problems encountered were a heat leak into the storage bin that was twice the calculated value and control logic errors that produced excessive hot water in the winter, requiring extensive use of the night heat rejection mode in the summer. These problems are currently being corrected.
DOE

N80-32881# Westinghouse Electric Corp., Pittsburgh, Pa.
OPEN-CYCLE MHD SYSTEMS ANALYSIS Final Report
T. E. Lippert and K. D. Weeks. Feb. 1980. 511 p. refs.
(EPRI Proj. 640-1)
(EPRI-AP-1316) Avail: NTIS. HC A22/MF A01

Five variant configurations of a coal burning open cycle magnetohydrodynamic electric power generating facility were studied for evaluation as candidate first generation power plants. A material and energy balance and cycle analysis was performed for each case to provide information for the conceptual designs and costing of all major MHD related components and subsystems as well as specification of other state of the art components. A economic comparison was made of each design by developing the cost of electricity based on component costs, estimates of operation and maintenance requirements, and the performance of each plant from the system analyses. An overall description of each plant is provided along with discussions of critical component and process development. An oxygen enriched OCMHD plant design was identified as an attractive candidate for first generation utility service. This plant design appears to offer competitive costs of electricity and minimizes development risk.
DOE

N80-32882# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
DEVELOPMENT OF CELLULOSE FLYWHEEL ROTORS Final Report
Arthur G. Erdman, David L. Hagen, and Darrell A. Frohrib. Mar. 1980. 105 p. refs. Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-79-7099) Avail: NTIS. HC A06/MF A01

The primary tasks addressed were the design and development of durable hub-to-rotor attachments and the balancing and vibrational analysis of the resulting hub rotor systems, and measuring and analyzing the strength distributions and durabilities of different types of plywood and of hub rotor systems. In accomplishing these tasks, a metallic hub to cellulose rotor bonding attachment was designed which utilizes a flexible scalloped metal band in lieu of the traditional elastomeric layers to accommodate the differential strain between rotor and hub. A self centering dynamic balancer was designed to automatically locate the inertial axis of a rotor. In analyzing rotor vibrations, a nondimensional design parameter was derived which correlates the support flexibility required to the usable strength and length of the rotor for a useful operating range above the transverse critical frequency.
DOE

N80-32883# Brookhaven National Lab., Upton, N. Y. Technology Assessment Group.
REFERENCE ENERGY SYSTEMS AS APPLIED TO REGIONAL ENERGY POLICY
A. Hermelee. Dec. 1979. 26 p. refs.
(Contract EY-76-C-02-0016)
(BNL-26987) Avail: NTIS. HC A03/MF A01

Reference Energy Systems (RES) was developed for the region serviced by the Tennessee Valley Authority for a base time period and projections developed for the years 1985 and 2000. The RES is a network representation of the technical activities required to supply various forms of energy to end-use activities. Technologies are defined for all operations involving specific fuels including resource extraction, refinement, conversion, transportation, distribution, and utilization. The impact of a new technology in terms of resource consumption may be evaluated by modifying the energy flow paths in a region to incorporate the new technology. Alternate paths through the network reflect the substitutability of resources and technologies for one another.
DOE

N80-32884# Solarex Corp., Rockville, Md.
INVESTIGATION OF THE IMPURITY TOLERANCE OF SEMICRYSTALLINE SILICON SOLAR CELLS: SILICON IMPACT PROGRAM Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1979
G. Storti, W. Regnault, and S. Johnson. 1980. 23 p. refs.
(Contract DE-AC02-77CH-00178)
(DSE-4042-T41; QTPR-1) Avail: NTIS. HC A02/MF A01

A Veeco resistance heated Czochralski crystal growing furnace was redesigned to allow for the in situ casting of semicrystalline silicon ingots. The casting technique employed is based upon the Bridgeman technique of crystal growth. Samples of metallurgical grade silicon were obtained and preparation of this material began for incorporation into the experimental castings. Initial casting experiments commenced using pure semiconductor grade silicon to establish a base line process for later experiments which will employ metallurgical grade silicon.
DOE

N80-32885# New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
ANALYSIS OF A PASSIVE HEAT PIPE COOLED SOLAR PHOTOVOLTAIC RECEIVER
K. T. Feldman, Jr. and D. D. Kenney. May 1980. 97 p. refs. Prepared in cooperation with Energy Engineering, Inc., Albuquerque, N. Mex. Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-80-7011) Avail: NTIS. HC A05/MF A01

A design study to analyze the performance of an aluminum heat pipe for passive cooling of photovoltaic cells is presented. The heat pipe vessel is an aluminum extrusion with a wedge shaped cross section. The solar cells are mounted on the lower surface where they are irradiated by a parabolic trough solar concentrator. The maximum solar cell temperature is 140 C. Heat is removed from the condenser surface by convection to the ambient air at 40 C. Working fluid selection, heat pipe analysis, and method of performance calculations are described.
DOE

N80-32886# Motorola, Inc., Phoenix, Ariz. Solar Operations.
SILICON CONCENTRATOR SOLAR CELL MANUFACTURING DEVELOPMENT
L. Grenon. May 1980. 174 p. Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-80-7018) Avail: NTIS. HC A08/MF A01

A manufacturing development program was conducted in which silicon concentrator solar cells designed to operate at 50 suns were produced. The purpose of this program was to determine the various design requirements for the cell at concentration, develop the manufacturing processes necessary to fabricate the solar cell, and fabricate a total of 2000 solar cells of two separate geometries. A technical analysis was performed to determine those parameters that affect the performance of a silicon concentrator solar cell. For the purposes of this contract, this analysis was limited to solar concentrations up to 50 suns. Included in the analysis are examinations of the base and emitter regions, surface effects, spectral response, and specific design criteria for both type 1 and type 2 concentrator solar cells. Based on the design requirements, a manufacturable process was developed and cells were fabricated.
DOE

N80-32887# Sandia Labs., Albuquerque, N. Mex. Solar Energy Projects Dept.
LINE-FOCUS SOLAR THERMAL ENERGY TECHNOLOGY DEVELOPMENT. REPORT FOR DEPARTMENT 4720 Annual Report
Kenneth D. Bergeron, ed., Roscoe L. Champion, ed., and Robert W. Hunke, ed. Apr. 1980. 144 p. refs.
(Contract DE-AC04-76DP-00789)
(SAND-80-0865-Rev) Avail: NTIS. HC A07/MF A01

The primary role of the Solar Energy Projects Department 2 is the development, evaluation, and testing of line focus solar thermal technology. This report is divided into two parts: (1) component and subsystem development including the design and analysis of collector modules, their components, and associated materials and processes, and (2) systems and applications

development, involving larger configurations of solar thermal line focus systems. The emphasis is on parabolic troughs, but significant efforts on hemispherical bowls, compound parabolic collectors, and dishes for the Solar Total Energy Project are also described. DOE

N80-32888# Midwest Research Inst., Golden, Colo.
PLANNING FOR ELECTRIC UTILITY SOLAR APPLICATIONS: THE EFFECTS ON RELIABILITY AND PRODUCTION COST ESTIMATES OF THE VARIABILITY IN DEMAND
George R. Fegan and C. David Percival. Jan. 1980. 14 p. refs
Presented at the ASME Century 2 Emerging Technol. Conf., San Francisco, 10 Aug. 1980
(Contract DE-AC02-76CH-00178)
(SERI/TP-351-545; CONF-800804-18) Avail: NTIS HC A02/MF A01

Previous studies showed the necessity for the consideration of hourly variability in the output from the intermittent generation source. However, the studies did not take into account the variability in the demand. A result is presented which shows that under general conditions the variability due to randomness can be ignored except in the neighborhood of the peak and minimum demands. DOE

N80-32889# Rocket Research Corp., Redmond, Wash.
CHEMICAL ENERGY STORAGE FOR SOLAR THERMAL CONVERSION Final Report
Richard D. Smith, D. R. Poole, C. H. Li, D. K. Carlson, and D. R. Peterson. 27 Apr. 1979. 99 p. refs
(Contract DE-AC04-76DP-00789)
(SAND-79-8198; RRC-80-R-678) Avail: NTIS HC A05/MF A01

The technical and economic aspects of using reversible chemical reactions to store energy in Solar Thermal Electric Conversion (STEC) facilities were studied. The study included identification of nine promising chemical reactions from a list of over 550 candidates, preliminary process designs of energy storage subsystems based on these nine reactions, and extensive systems studies of autonomous and hybrid STEC plants with energy storage subsystems based on the reversible oxidation of SO_2. The systems studies used a detailed simulation, based on a year long, hour by hour energy balance, of a central receiver STEC facility. Over a range of alternate energy cost and geographic location, the optimum busbar energy costs from autonomous STEC plants were 15 to 90% higher than those from hybrid plants. Optimum storage requirements of autonomous STEC plants were in the range of 200 to 400 hours, while those for hybrid plants were in the range of 15 to 30 hours. DOE

N80-32890# ARCO Solar, Inc., Chatsworth, Calif.
DESIGN AND FABRICATION OF COMBINED PHOTOVOLTAIC-THERMAL COLLECTORS
May 1980. 54 p.
(Contract DE-AC04-76DP-00789)
(SAND-79-7008) Avail: NTIS HC A04/MF A01

Two water-cooled and two air-cooled modules were designed, fabricated, and tested. Module designs were developed which effectively combined photovoltaic cell and module technology with solar thermal module technology, with minimum modification. The combined modules were designed to be mechanically interchangeable with production solar thermal modules. This design approach was selected to minimize installation and reliability problems, and to reduce costs of combined modules by minimizing new tooling requirements. Both the electrical and thermal performance of the experimental modules was lower than calculated during the design phase of the program, and lower than required by the Sandia specification. DOE

N80-32891# BDM Corp., McLean, Va.
PHOTOVOLTAIC APPLICATIONS DEFINITION AND PHOTOVOLTAIC SYSTEM DEFINITION STUDY IN THE AGRICULTURAL SECTOR. VOLUME 3. APPENDIXES Final Report
R. W. Mengel, T. P. Nadolski, D. C. Sparks, S. K. Young, and A. Yingst. May 1980. 221 p. refs
(Contract DE-AC04-76DP-00789)
(SAND-79-7018/3) Avail: NTIS HC A10/MF A01

A description of energy consumption for representative farm operations, design and simulation of ventilation for livestock shelters, irrigation systems and calculations; and detailed methodology for selecting multifunction PV system applications are presented. Hourly load data for the chosen farm operations; sample linear programming solution output format; life cycle cost calculation; and illustrative monthly load data for applications analysis and equipment data for applications analysis are also discussed. DOE

N80-32892# Barber-Nichols Engineering Co., Arvada, Colo.
SOLAR POWERED RANKINE CYCLE IRRIGATION PUMP Final Report
William D. Batton and Robert E. Barber. Sep. 1979. 87 p. refs
(Contract DE-AC03-78ET-20419)
(DOE/ET-20419/1; SAN-0419-1) Avail: NTIS HC A05/MF A01

Results of a test program where a small (288 square feet) collector field was installed and used for boiling-in-the-collector tests with R-113 as a working fluid are presented. Two different types of parabolic trough tracking collectors were purchased and tested. There were two rows (128 sq ft) of Del Manufacturing collectors and one row (160 sq ft) of Solar Kinetics collectors. All three rows were installed at a 5 degree angle (inclined to the South) oriented North-South and tracking East-West on the roof at Barber-Nichols in Arvada, Colorado. These two types of collectors have distinct differences that made it worthwhile to test each type. A Rankine engine, less turbine expander, was installed and used to complete a solar power system. The major experimental results are that the collectors did heat the R-113, did provide a vapor suitable for turbine feed, and stable flow did occur under all conditions, thus proving the feasibility of the boiling-in-collector concept. DOE

N80-32893# Bechtel National, Inc., San Francisco, Calif.
COMBINED CYCLE SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEM STUDY. VOLUME 3: APPENDICES Final Technical Report
Nov. 1979. 177 p. refs
(Contract ET-78-C-03-2051)
(DOE/ET-21050/1-3-Vol-3) Avail: NTIS HC A09/MF A01

A design study for a 100 MW gas turbine/steam turbine combined cycle solar/fossil fuel hybrid power plant is presented. The appendices contain: (1) preconceptual design data; (2) market potential analysis methodology; (3) parametric analysis methodology; (4) EPGS system description; (5) commercial-scale solar hybrid power system assessment; and (6) conceptual design data lists. DOE

N80-32894# Sandia Labs., Albuquerque, N. Mex. Solar Energy Projects Dept.
FLUID TEMPERATURE CONTROL FOR PARABOLIC TROUGH SOLAR COLLECTORS
Rudolph Schindwoff. 1980. 27 p. refs. Presented at the Joint Autom. Control Conf., San Francisco, 13 Aug. 1980
(Contract DE-AC04-76DP-00789)
(SAND-79-2006C; CONF-800805-2) Avail: NTIS HC A03/MF A01

Techniques for controlling the temperature of the heat transfer fluid in parabolic trough solar collectors fields were studied by computer simulation. In particular, the rather stringent temperature control requirements associated with thermal electric power generation or cogeneration systems are addressed. Computer models representing the fluid temperature dynamics of the collectors and interconnecting piping were developed and integrated with dynamic models of control elements to obtain a closed loop control system simulation. A specific control configuration was chosen consisting of a flow control valve and one or more temperature sensors to control the flow in each row of collectors. Various control algorithms were evaluated for stability and static errors, and time responses to startup transients and to partial and full collector cloud shadowing transients were obtained. The results indicated that the temperature control requirements can be satisfied using readily available components. DOE

N80-32895# Sandia Labs., Albuquerque, N. Mex. Experimental Aerodynamics Div.

PARABOLIC TROUGH SOLAR COLLECTOR WIND LOADING

Duane E. Randall, Donald D. McBride, and Roger E. Tate. 1980. 54 p. refs. Presented at the ASME Century 2 Emerging Technol. Conf., San Francisco, 18-20 Aug. 1980.
(Contract DE-AC04-76DP-00789)
(SAND-79-2134C; CONF-800804-16) Avail: NTIS HC A04/MF A01

Two wind tunnel force and moment tests conducted on parabolic trough solar collector configurations are discussed. The two tests were conducted in different flow field environments, one a uniform flow infinite airstream, the second a simulated atmospheric boundary layer flow with the models simulating a ground mounted installation. The force and moment characteristics of both isolated single module troughs and of trough modules within array configurations were defined over both operational and stow attitudes. The influence of various geometric design parameters for collector modules and arrays was established. Data indicate that forces and moments increase with mounting height and with trough aspect ratio. Collector modules interior to large arrays experience wind force reductions as high as 50 to 65%, while appropriate fences or berms surrounding the arrays can provide exterior modules with protection of this order. DOE

N80-32896# Chicago Univ., Ill.

FUNDAMENTALS AND TECHNIQUES OF NONIMAGING OPTICS FOR SOLAR ENERGY CONCENTRATION. Final Report

Roland Winston and Joseph J. Gallagher. 20 May 1980. 51 p. refs.
(Contract DE-AS02-78ER-04657)
(DOE/ER-04657/2) Avail: NTIS HC A04/MF A01

The properties of a variety of new and previously known nonimaging optical configurations were investigated. A thermodynamic model which explains quantitatively the enhancement of effective absorptance of gray body receivers through cavity effects was developed. The classic method of Liu and Jordan, which allows one to predict the diffuse sunlight levels through correlation with the total and direct fraction was revised and updated and applied to predict the performance of nonimaging solar collectors. The conceptual design for an optimized solar coolector which integrates the techniques of nonimaging concentration with evacuated tube collector technology was carried out and is presently the basis for a separately funded hardware development project. DOE

N80-32897# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

LOW-COST FLYWHEEL DEMONSTRATION PROGRAM. Final Report, 1 Oct. 1977 - 31 Dec. 1979

D. W. Rabenhorst, T. R. Small, and W. O. Wilkinson. Apr. 1980. 109 p. refs.
(Contract DE-AC01-77ET-26931)
(DOE/ET-26931/T1; SDO-5540) Avail: NTIS HC A06/MF A01

The Applied Physics Laboratory/Department of Energy Low Cost Flywheel Demonstration Program was initiated and all primary objectives were successfully achieved as follows: demonstration of a full-size, 1 kWh flywhel having an estimated cost in large volume production of approximately $50/kWh; development of a ball bearing system having losses comparable to the losses in a totally magnetic suspension system; and successful and repeated demonstration of the low cost flywheel in a complete flywheel energy storage system based on the use of ordinary house voltage and frequency. Application of the experience gained in the hardware program to project the system design into a complete, full scale, 30 kWh home type flywheel energy storage system was also completed. DOE

N80-32898# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.

RESEARCH AND DEVELOPMENT FOR INERTIAL ENERGY STORAGE BASED ON A FLEXIBLE FLYWHEEL. Final Report

John M. Vance. Jun. 1980. 50 p. refs. Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-79-7097) Avail: NTIS HC A03/MF A01

A design concept for a nonrigid energy storage flywheel suitable for home or farm use was investigated. The distinguishing feature of this flexible flywheel is its construction from high strength fibers (such as synthetic rope) with no bonding agent. The flexible flywheel is self balancing safe, has a high energy density capability (60 Wh/lb), and should be simple and economical to manufacture. A gimbal support system which stabilizes the flywheel without the need for a squeeze film damper was designed, analyzed, and tested. The conceptual design was developed for a flexible flywheel energy storage system suitable for interfacing with a small scale solar energy source. Cost estimates were prepared for the system in the 10 KWh and 50 KWh sizes. DOE

N80-32899# Battelle Nortwest Labs., Richland, Wash.

SEASONAL THERMAL ENERGY STORAGE. Program Progress Report, Apr. - Dec. 1979

J. E. Minor. Mar. 1980. 59 p. Prepared in cooperation with Tennessee Valley Authority, Chattanooga; Texas A and M Univ., College Station; Washington State Univ., Pullman; Auburn Univ., Ala.; California Univ., Lawrence Berkeley Lab.; ORNL, Tenn.; Terra Tek, Inc., Salt Lake City.
(Contract DE-AC06-70RL-01830)
(PNL-3322) Avail: NTIS HC A04/MF A01

The Seasonal Thermal Energy Storage (STES) Program demonstrates the economic storage and retrieval of thermal energy on a seasonal basis, using heat or cold available from waste or other sources during a surplus period to reduce peak period demand, reduce electric utilities peaking problems, and contribute to the establishment of favorable economics for district heating and cooling systems for commercialization of the technology. The STES Program utilizes ground water systems (aquifers) for thermal energy storage. The STES Program is divided into an Aquifer Thermal Energy Storage (ATES) Demonstration Task for demonstrating the commercialization potential of aquifer thermal energy storage technology using an integrated system approach to multiple demonstration projects and a parallel Technical Support Task designed to provide support to the overall STES Program, and to reduce technological and institutional barriers to the development of energy storage systems prior to significant investment in demonstration or commercial facilities. DOE

N80-32900# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.

COSTING METHODOLOGIES FOR ENERGY SYSTEMS

Jack Allentuck, Vinod Mubayi, and Ann W. Reisman. Nov. 1979. 23 p. refs. Presented at Conf. on Long-Term Energy Resources, Montreal, 3 Dec. 1979.
(Contract DE-AC02-76CH-00016)
(BNL-27603; CONF-791216-3) Avail: NTIS HC A02/MF A01

The problem of devising a methodology for arriving at costs of systems which may be used to compare alternative sources was addressed. The basic elements of such a methodology were examined. Diverse subjects such as resource supply curves, experience and learning, and the cost of environmental pollution were investigated. DOE

N80-32901# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.

SIMULATION MODEL FOR ASSESSING BUILDING ENERGY-CONSERVATION POLICIES

Peter T. Kleeman. May 1980. 13 p. refs. Presented at 11th Ann. Conf. on Modeling and Simulation, Pittsburgh, 1-2 May, 1980.
(Contract DE-AC02-76CH-00016)
(BNL-27802; CONF-800549-2) Avail: NTIS HC A02/MF A01

A multiple-region simulation model for estimating economic, environmental, and energy-related impacts of building energy-conservation policies is presented. The model is formulated as a time-stepped sequence of optimization subproblems, each reflecting building energy-conservation options and energy costs, and identifying optimal investments and energy consumption for the time step. DOE

N80-32902# Auburn Univ., Ala. Dept. of Mechanical Engineering.

OPERATOR MANUAL: HIGH TEMPERATURE HEAT PUMP
David F. Dyer, Glennon Maples, Thomas E. Burch, and Paul D. Chancellor. 4 Mar. 1980. 66 p.
(Contract DE-AC01-79CS-40163)
(DOE/CS-40163/T1) Avail: NTIS HC A04/MF A01

Experimental data were obtained from operating a high temperature heat pump system. The use of methanol as a working fluid necessitated careful monitoring of refrigerant temperatures and pressures with chemical analysis performed on the working fluid during scheduled down time. Materials sent to vendors and quotes received concerning equipment (compressor, evaporator, condensor, air heater, dryer, two accumulator tanks, and three expansion valves) are discussed. The detailed design and pricing estimates are included. Additional information on layout and construction; start-up; testing; shut down; scheduled maintenance and inspection; safety precautions; control system; and trouble shooting is presented. DOE

N80-32903# Lockheed Missiles and Space Co., Palo Alto, Calif.
ROLE OF MICROCOMPUTERS IN SECONDARY BATTERY DEVELOPMENT AND TESTING
Roger P. Hollandsworth and George B. Adams. 11 Dec. 1979. 138 p. refs.
(Contract W-7405-eng-48)
(UCRL-15171; LMSC-D681058) Avail: NTIS HC A07/MF A01

A low cost dedicated microcomputer system to secondary battery development and testing was developed. An overview of computers, hardware, and software is given. The particular application discussed is the zinc/ferricyanide hybrid redox battery. The system is capable of controlling the charge and discharge cycles of six or more secondary batteries based upon five or more operator determined cell parameters, and computing at the end of each cycle the voltaic, coulombic, and energy conversion efficiencies for each cell. The system described fulfills the objective of enabling one person to control, collect, and interpret cyclic data from many cells with a minimum of effort. DOE

N80-32904# Oak Ridge National Lab., Tenn. Energy Div.
THEORY AND DESIGN OF AN ANNUAL CYCLE ENERGY SYSTEM (ACES) FOR RESIDENCES
E. A. Nephew, L. A. Abbatiello, and M. L. Ballou. May 1980. 357 p. refs.
(Contract W-7405-eng-26)
(ORNL/CON-43) Avail: NTIS HC A16/MF A01

The basic concept of the Annual Cycle Energy System (ACES), and integrated system for supplying space heating, hot water, and air conditioning to a building, and the theory underlying its design and operation are described. Practical procedures for designing an ACES for a single family residence, together with recommended guidelines for the construction and installation of system components, are presented. Methods are discussed for estimating the life cycle cost, component sizes, and annual energy consumption of the system for residential applications in different climatic regions of the US. DOE

N80-32905# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
ECONOMIC EVALUATION OF THE ANNUAL CYCLE ENERGY SYSTEM (ACES). VOLUME 1: EXECUTIVE SUMMARY Final Report
May 1980. 70 p.
(Contract W-7405-eng-48)
(ORNL/Sub-7470/1-V1) Avail: NTIS HC A04/MF A01

Three different classes of building are investigated, namely: single family residence; multifamily residence; and commercial office building. For each building type in each geographic location, the economic evaluation of the annual cycle energy system (ACES) is based on a comparison of the present worth of the ACES to the present worth of a number of conventional systems. The results of this analysis indicate that the economic viability of the ACES is very sensitive to the assumed value of the property tax, maintenance cost, and fuel escalation rates, while it is relatively insensitive to the assumed values of other parameters. Fortunately, any conceivable change in the fuel escalation rates would tend to increase the viability of the ACES concept. An increase in the assumed value of the maintenance cost or property tax would tend to make the ACES concept less viable; a decrease in either would tend to make the ACES concept more viable. DOE

N80-32906# Pennsylvania State Univ., University Park.
ENERGY CONSERVATION VIA HEAT TRANSFER ENHANCEMENT Quarterly Progress Report, 1 Jul. - 30 Sep. 1979
G. H. Junkhan, A. E. Bergles, and R. L. Webb. Nov. 1979. 29 p. refs. Prepared in cooperation with Iowa State Univ., Ames.
(Contract ET-78-S-02-4649)
(COO-4649-10) Avail: NTIS HC A03/MF A01

The theory and practice of heat transfer enhancement are discussed. Technology studies on porous boiling surfaces and enhancement of flow boiling in helically coiled tubes are discussed. DOE

N80-32907# California Univ., Livermore. Lawrence Livermore Lab.
COMPARATIVE ANALYSIS OF ALUMINUM-AIR BATTERY PROPULSION SYSTEMS FOR PASSENGER VEHICLES
J. D. Salisbury, E. Behrin, M. K. Kong, and D. J. Whisler. 29 Feb. 1980. 103 p. refs.
(Contract W-7405-eng-48)
(UCRL-52933) Avail: NTIS HC A06/MF A01

Three electric propulsion systems using an aluminum air battery were analyzed and compared to the internal combustion engine (ICE) vehicle. The engine and fuel systems of a representative five passenger highway vehicle were replaced conceptually by each of the three electric propulsion systems. The electrical vehicles were constrained by the computer simulation to be equivalent to the ICE vehicle in range and acceleration performance. The vehicle masses and aluminum consumption rates were then calculated for the electric vehicles and these data were used as figures of merit. The Al-air vehicles analyzed were (1) an Al-air battery only electric vehicle; (2) an Al-air battery combined with a nickel zinc secondary battery for power leveling and regenerative braking; and (3) an Al-air battery combined with a flywheel for power leveling and regenerative braking. All three electric systems compared favorably with the ICE vehicle. DOE

N80-32908# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
LAMINATED, COMPOSITE FLYWHEEL FAILURE ANALYSIS
R. P. Nimmer. 6 Jun. 1980. 37 p. refs.
(Contract W-7405-eng-48)
(UCRL-15164) Avail: NTIS HC A03/MF A01

A hybrid, composite flywheel, composed of a laminated, flat S2 glass central disc, with a filament wound, graphite outer ring has been proposed for vehicle application. The failure mechanism of the laminated central disco of this hybrid design is discussed with reference to spin test data, nondestructive ultrasound test data, and supporting failure analysis. DOE

N80-32909# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY AND TECHNOLOGY REVIEW
Jun. 1980. 19 p.
(Contract W-7405-eng-48)
(UCRL-52000-80-6) Avail: NTIS HC A02/MF A01

A promising technique for detecting and quantifying the effects of cancer-causing agents in human somatic cells was developed. Using argon X-ray line imaging to measure the ion density of deuterium tritium fuel in an inertial confinement fusion target at the instant of ignition is described. The potential effects on the economy of a complete cutoff of Middle Eastern oil and how we might cope with them are discussed. L.F.M.

N80-32910# Brobeck (William M.) and Associates, Berkeley, Calif.
FABRICATION OF TWO ONE-FIFTH SCALE FIBER COMPOSITE FLYWHEELS Final Report
Apr. 1980. 43 p. ref.
(Contract W-7405-eng-48)
(UCRL-15231; WMB/A-4500-95-25-R1) Avail: NTIS

HC A03/MF A01

Two fiber composite flywheel rotors were fabricated. These flywheels are scaled down versions of two automotive flywheels built for Sandia Laboratories. The flywheels store a maximum of 0.97 kWh of kinetic energy. Energy density is 87 Wh/kg at the maximum operating speed of 56,000 rpm. The nominal flywheel dimensions are 35 cm diameter by 13 cm axial height. The weight of the flywheel rotor assembly is 11.16 kg. DOE

N80-32911# Midwest Research Inst., Golden, Colo.
POTENTIAL FOR SUPPLYING SOLAR THERMAL ENERGY TO INDUSTRIAL UNIT OPERATIONS
E. Kenneth May. Apr. 1980. 13 p. refs. Presented at the 89th Ann. Meeting of AICE, Portland, Oreg., 17-20 Aug. 1980
(Contract DE-AC02-77CH-00178)
(SERI/TP-632-584; CONF-800802-3) Avail: NTIS HC A02/MF A01

Adoption of solar thermal technology, considered in terms of the end use of energy delivered to industrial unit operations was studied. The use of low temperature processes, which are more easily integrated with solar thermal technology were studied. The adoption of solar technology is favored by the relative rates of increase of the costs of electricity and natural gas, and by energy conservation measures. High temperature hot water systems are more compatible with solar technology. DOE

N80-32912# Tennessee Univ., Knoxville.
REPAIR AND CELL CYCLE RESPONSE IN CELLS EXPOSED TO ENVIRONMENTAL BIOHAZARDS. Progress Report, 1 Jun. 1979 - 31 May 1980
Daniel Billen and Charles T. Hadden. 1980. 10 p. refs. Prepared in cooperation with ORNL, Tenn.
(Contract DE-AS05-76EV-04568)
(ORO-4568-26) Avail: NTIS HC A02/MF A01

Topics discussed include: (1) DNA repair in bacillus subtilis; (2) postreplication repair in rec mutants of B. subtilis; (3) photobiology of halogenated DNA; (4) effects of caffeine on pyrimidine dimer excision and postreplication repair in B. subtilis; and (5) DNA repair in toluene treated escherichia coli. DOE

N80-32913# Texas Univ. at Austin. Center for Energy Studies.
MONITORING OF THE PERFORMANCE OF A SOLAR HEATED AND COOLED APARTMENT BUILDING. Final Report
Gary C. Vliet and Robert L. Srubar. Mar. 1980. 95 p. refs.
(Contract EM-78-S-01-5235)
(DSE-5235-T1) Avail: NTIS HC A05/MF A01

An all electric apartment building in Texas was retrofitted for solar heating and cooling and hot water. The system consisted of an array of 1280 square feet of Northrup concentrating tracking collectors, a 5000 gallon hot water storage vessel, a 500 gallon chilled water storage vessel, a 25 ton Arkla Industries absorption chiller, and a two pipe hydronic air conditioning system. The solar air conditioning equipment was installed in parallel with the existing conventional electric heating and cooling system, and the solar domestic water heating served as preheat to the existing electric water heaters. The system was fully instrumented for monitoring. Detailed descriptions of the solar system, the performance monitoring system, and the data reduction processes are given. DOE

N80-32914# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANALYTICAL PREDICTION OF THE PERFORMANCE OF AN AIR PHOTOVOLTAIC/THERMAL FLAT PLATE COLLECTOR
P. Raghuraman. 30 Apr. 1980. 20 p. refs.
(Contract DE-AC02-76ET-20279)
(DOE/ET-20279/93) Avail: NTIS HC A02/MF A01

A one dimensional analysis predicted the electrical and thermal performance of an air photovoltaic/thermal flat plate collector. The analysis compared well with test measurements, predicting the thermal efficiency to within 2 percent. From the analysis, the poor thermal performance of the collector was attributable, in part, to the large undulations of the cell/silicon pottant surface in contact with the flowing air that resulted in less effective convective heat transfer areas between the cell and the air. DOE

N80-32915# Joint Center for Graduate Study, Richland, Wash.
[INVESTIGATION OF LOW-COST SOLAR CELLS BASED ON Cu2O] Quarterly Progress Report, 1 Nov. 1979 - 31 Jan. 1980
Larry C. Olsen. 12 Mar. 1980. 33 p. refs.
(Contract DE-AC04-79ET-23006)
(DOE/ET-23006/3; QPR-3) Avail: NTIS HC A03/MF A01

In-doped ZnS films with very good optical quality and finite conductivity were obtained by codepositing In and ZnS. Analysis of the internal photoresponse indicated that minority carrier diffusion lengths on the order of 10 micrometers are being achieved with the present Cu2O growth procedure. These devices appear to have an MIS structure or fixed charge at the interface. Another very significant achievement was the development of a surface preparation procedure which results in a nearly perfect stochiometry at the surface. DOE

N80-32916# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
SPECTRAL CHARACTER OF SOLAR AND CIRCUMSOLAR RADIATION
D. B. Evans, D. F. Grether, A. J. Hunt, and M. Wahlig. Mar. 1980. 6 p. refs. Presented at the ISES Conf., Phoenix, Ariz., 2 Jun. 1980
(Contract W-7405-eng-48)
(LBL-10802; CONF-800604-25) Avail: NTIS HC A02/MF A01

Information on the solar and circumsolar radiation (the solar aureole) for application to concentrating solar energy systems is discussed. Four instrument systems obtain detailed measurements of the solar and circumsolar intensity, both as a function of angular distance from the center of the Sun, and as a function of wavelength. A method of inverting filtered measurements to obtain the energy contained within a given wavelength interval is presented. Comparisons are made between the atmospheric transmission code LOWTRAN and normal incidence data. The amount of circumsolar radiation and the dependence of circumsolar radiation on angular distance from the Sun are discussed as a function of wavelength for selected atmospheric conditions. DOE

N80-32917# Energy Development Associates, Madison Heights, Mich.
DEVELOPMENT OF THE ZINC-CHLORIDE BATTERY FOR UTILITY APPLICATIONS. Progress Report, 1 Apr. 1978 - 31 Mar. 1980
May 1980. 407 p. refs.
(EPRI-EM-1417) Avail: NTIS HC A18/MF A01

Significant accomplishments were: development of a data base on the density, conductivity, viscosity, chlorine solubility, and the zinc transference number for ZnCl2-KCl-NaCl electrolytes; development of a model describing the hydrodynamic phenomena occurring between individual zinc and chlorine electrodes during charge; demonstration of cell electrochemical energy efficiencies of 74% for delivered capacity densities of 500 Wh/cm 2; completion of reliability studies for 100 MWh battery plants that discuss quantitatively plant availability and electricity cost in terms of module failure rate; invention of a module bypass switch concept that isolates a failed module in a series connected string and thereby avoids string outage. A computer model for module operation was also developed that allows prediction of the effects of component changes on module performance. DOE

N80-32918# Department of Energy, Washington, D. C. Office of Current Reporting.
INTERNATIONAL ENERGY INDICATORS
Jun. 1980. 40 p.
(DOE/IA-0010) Avail: NTIS HC A03/MF A01

Data on the crude oil capacity, production, and shut in of several countries are presented. Petroleum consumption by industrial countries is reported. Natural gas development throughout the world is reported. World reserves of crude oil and natural gas were estimated. T.M.

N80-32919# Virginia Polytechnic Inst. and State Univ., Blacksburg.
CdSiAs2 THIN FILMS FOR SOLAR CELL APPLICATIONS Quarterly Report, 9 Apr. - 30 Jun. 1979
L. C. Burton and L. H. Slack. 25 Jul. 1979. 51 p. refs.

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(Contract DE-AC04-79ET-23007)
(DOE/ET-23007/1) Avail: NTIS HC A04/MF A01

Near stoichiometric bulk polycrystalline CdSiAs2 was synthesized by two techniques: (1) direct fusion of the elements and (2) direct fusion of the binaries SiAs, Cd3As2 and CdAs2. The latter technique resulted in denser ternary material with good homogeneity. The above binaries melt congruently and were also formed by direct fusion. Sputtered ternary films were formed using a bulk CdSiAs2 target, and a composite target of CdAs2 discs in a Si plate. Composition of the CdSiAS2 target changed with sputtering time. Amorphous films deposited from that target were heat treated, and became crystalline and near stoichiometric but with poor mechanical properties. It appears that films deposited from the composite target (Si + CdAs2) can be adjusted to stoichiometry by means of sputtering power and target geometry. As deposited, these films also were amorphous. DOE

N80-32920# State Univ. of New York, Buffalo. Dept. of Electrical Engineering.
DEPOSITION, FABRICATION AND ANALYSIS OF POLY-CRYSTALLINE SILICON MIS SOLAR CELLS. Final Report, 1 Jan. - 31 Dec. 1979
Wayne A. Anderson. Mar. 1980. 112 p. refs.
(Contract DE-AC03-79ET-23044)
(DOE/ET-23044/4) Avail: NTIS HC A06/MF A01

MIS cell fabrication techniques, protovoltaic response data, I-V-T analysis to reveal conduction mechanisms, a detailed computer model, optimum MIS solar cell design, surface state effects, Auger studies, reliability studies and e-beam deposition of thin silicon films are discussed. The most important features include the one pump down fabrication process, establishing a consistent fabrication sequence, achieving 13% efficiency of 2 sq cm area, an evaluation of conduction mechanisms, establishing a detailed computer model, and setting up an improved e-beam system to deposit thin silicon films. DOE

N80-32921# RCA Labs., Princeton, N. J. Display and Energy Systems Research Lab.
AMORPHOUS THIN FILMS FOR SOLAR-CELL APPLICATIONS. Final Report
D. E. Carlson, R. W. Smith, I. Balberg, R. S. Crandall, B. E. Thompkins, J. Dresner, B. C. Goldstein, D. J. Szostak, J. J. Hanak, J. P. Pellicane et al. Feb. 1980. 176 p. refs.
(Contract DE-AC03-78ET-21074)
(DOE/ET-21074/4, PRRL-79-CR-47) Avail: NTIS HC A09/MF A01

Theories for the capture of electrons by deep centers in hydrogenated amorphous silicon (a-Si:H) and for field dependent quantum efficiency in a-Si:H are presented. The optimization of phosphorus-doped a-Si:H carried out in four different discharge systems is described. Some details of the dc proximity and rf magnetron discharge systems are also provided. Preliminary mass spectroscopy studies of the rf magnetron discharge in both SiH4 and SiF4 are presented. Measurements of the surface photovoltage were used to estimate the distribution of surface states of phosphorus-doped and undoped a-Si:H. A detailed description of carrier generation, recombination, and transport in a-Si:H solar cells is given. Finally, some characteristics of Pd-Schottky barrier cells are described for different processing histories. DOE

N80-32922# Miami Univ., Coral Gables, Fla. Clean Energy Research Inst.
ASSESSMENT OF HYDROGEN COMPRESSOR TECHNOLOGY FOR ENERGY STORAGE AND TRANSMISSION SYSTEMS. Final Report
Laxman G. Phadke, T. Nejat Vezirogiu, Richard W. Foster, and William J. D. Escher. Jan. 1979. 192 p. refs. Prepared in cooperation with Escher Technology Associates, St. Johns, Mich.
(Contract EC-77-S-05-5598)
(ORO-5598-T1) Avail: NTIS HC A09/MF A01

An initial assessment of hydrogen compressor technology for prospective energy systems applications is documented. Hydrogen, and hydrogen/natural gas blends, are generally related to the existing state of the art in natural compressors. Visits to natural gas transmission and storage facilities are reported on from the compressor applications standpoint. Present applications of hydrogen compressors, as reported by both manufacturers and users are summarized. Theoretical fluid dynamic and thermodynamic analysis of these fuel gases in compressors is provided. The implications of materials problems considered relevant to compressors are briefly discussed. Some general observations and recommendations are presented. DOE

N80-32923# RCA Labs., Princeton, N. J.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN-FILM SILICON SOLAR CELLS. Quarterly Report, 1 Sep. - 30 Nov. 1979
David Redfield. Dec. 1979. 23 p. refs.
(Contract DE-AC01-79ET-23108)
(DOE/ET-23108/2; QR-2) Avail: NTIS HC A02/MF A01

The effects of Auger recombination on the saturation current density of heavily doped semiconductors are shown to be more far reaching than was recognized. The equation generally used to predict and evaluate the saturation current in Si junctions always becomes invalid in the heavily doped cases of interest. The new procedure for determining J sub o was improved in two ways that now permit the identification of qualitative trends in J sub o in a significant manner. Experiments relating doping gradient effects to surface properties of Si solar cells provided new data on this relationship and led to the development of a simple new method for evaluating antireflection coatings. DOE

N80-32924# RCA Labs., Princeton, N. J.
LOW-COST EPITAXIAL TECHNIQUES FOR SOLAR-CELL FABRICATION. Quarterly Technical Progress Report, 28 Sep. 1979 - 24 Dec. 1979
R. V. Davello and P. H. Robinson. Jan. 1980. 27 p. refs. Prepared for Midwest Research Inst., Golden, Colo.
(Contract EG-77-C-01-4042)
(SERI/PR-82741-1; QTPR-1) Avail: NTIS HC A03/MF A01

A candidate low cost silicon substrate, designated upgraded metallurgical grade (UMG) silicon, was obtained. The electrical, physical, and structural properties of three grades of this material were measured. An initial epitaxial growth technique was standardized and qualified for application to the growth of diagnostic and solar cell structures. Such structures were grown on the three UMG grades of substrates and the properties of these layers were compared to those of the substrates. The defect density in the epitaxial films was lower than in the substrates, but greater aerial variation was observed for the less pure, multicrystalline grades of substrates. Solar cells were fabricated in epitaxial structures grown on all three UMG grades of substrates. DOE

N80-32925# Grumman Aerospace Corp., Bethpage, N.Y.
ELECTROCHEMICAL PHOTOVOLTAIC CELLS CdSe THIN FILM ELECTRODES. Quarterly Progress Report, Jun. - Aug. 1979
M. A. Russak and C. Creter. Sep. 1979. 34 p. refs.
(Contract EG-77-C-01-4042)
(DSE-4042-T16; QPR-1) Avail: NTIS HC A03/MF A01

Conversion efficiencies in the range of 10% with electrochemical cells utilizing thin film electrodes were obtained. A CdSe/aqueous sulfide polysulfide system was studied. Results of the initial CdSe deposition parameter study are given. The ratio of Se and Dc in the ns deposited film has marked effect on the film's chemical, microstructural, optical, and electrical properties. DOE

N80-32926# California Univ., Livermore. Lawrence Livermore Lab. Chemical Engineering Div.
SOLAR GASIFICATION OF CHARCOAL, WOOD AND PAPER
R. W. Taylor, Rene Berjoan (CNRS, Font Romeu, France), and J. P. Coutures (CNRS, Font Romeu, France). 20 May 1980. 15 p. Presented at User's Assoc. Annual Meeting, Las Cruces, N. Mex., 15-17 Apr. 1980. Submitted for publication.
(Contract W-7405-eng-48)
(UCRL-84411; CONF-800481-1) Avail: NTIS HC A02/MF A01

Charcoal, wood and paper were gasified in a 2 kW solar furnace by injecting water directly on the hot fuel. In the case of charcoal, approximately 30% of the incident solar energy was

stored as chemical energy and 55% of the injected water was consumed. Wood and paper gasification are explained by conventional pyrolysis followed by the gasification of the charcoal formed. DOE

N80-32927# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
RESEARCH ON Cu SUB x S/(Cd, Zn)S PHOTOVOLTAIC SOLAR ENERGY CONVERTERS. Final Report, Mar. 1977 - Sep. 1979
B. L. Chin, T. M. Peterson, U. Dahmen, K. Seshan, L. E. Sindelar, and J. Washburn. Mar. 1980. 119 p. refs.
(Contract W-7405-eng-48)
(LBL-10791) Avail: NTIS. HC A06/MF A01

The factors affecting the operation of CdS/Cu/sub x/S and (Cd,Zn)S/Cu/sub x/S photovoltaic cells were studied. The approach was to systematically study the single crystal heterojunction so as to eliminate the complicating effects of grain boundaries. Single crystal CdS and (Cd,Zn)S thin films were deposited onto both GaAs and Ge substrates by a hot wall vacuum deposition technique. These grown films were studied using X-ray diffraction, SEM-EDAX, TEM and Hall Effect experiments. Information concerning the effects of varying processing parameters on the chemical and structural nature of the deposited films was obtained. Detailed TEM studies revealed the presence of different dislocation structures which affect the cell performance. The relationship between structural information and cell operation was studied. DOE

N80-32928# Argonne National Lab., Ill.
SATELLITE POWER SYSTEMS (SPS) COST REVIEW
J. H. Crowley and E. J. Ziegler. May 1980. 89 p. refs.
(Contract W-31-109-eng-38)
(DOE/TIC-11190) Avail: NTIS. HC A05/MF A01

Estimated costs for three selected SPS designs were determined. One SPS concept uses silicon solar cells with a concentration ratio of one, the second uses gallium arsenide solar cells with a concentration ratio of two, and the third (reference) design incorporates features of the first two. The systems within the SPS designs chosen include: rectenna construction; graphite fiber reinforced thermoplastic structures; solar cells; satellite electrical slip rings; satellite electrical systems; and ground rectenna electrical systems. DOE

N80-32929# Solar Environmental Engineering Co., Inc., Fort Collins, Colo. SOLOCOST Service Center.
SOLAR INDEX GENERATION AND DELIVERY
Loren J. Lantz. 1980. 97 p. refs.
(Contract DE-AC02-78ET-20090)
(DOE/ET-20090/3) Avail: NTIS. HC A05/MF A01

Basically, the Solar Index represents the percentage of energy that solar would provide in order to heat an 80 gallon service hot water load for a given location and day. The Index is computed by utilizing SOLOCOST, a computer program, which also has applications to space heating, cooling, and heat pump systems and which supplies economic analyses for such solar energy systems. The Index is generated for approximately 68 geographic locations in the country on a daily basis. The definition of the Index, how the project came to be, what it is at the present time and a plan for the future are described. DOE

N80-32930# Fairchild Space and Electronics Co., Germantown, Md.
DESIGN EVOLUTION AND VERIFICATION OF THE GENERAL-PURPOSE HEAT SOURCE
A. Schock. [1980]. 11 p.
(Contract DE-AC02-77ET-33021)
(DOE/ET-33021/T1) Avail: NTIS. HC A02/MF A01

The general purpose heat source employs a modular design. Each 250 W module is completely autonomous, with its own passive safety provisions to prevent fuel release under all abort modes, including atmospheric reentry and Earth impact. This requires high impact temperatures, typically above 900 C and reasonably fine grain size, which in turn requires avoidance of excessive operating temperatures and reentry temperatures. These three requirements - on operating, reentry, and impact temperatures are in mutual conflict, since thermal design changes to improve any one of these temperatures tend to worsen one or both of the others. This design problem was overcome by successive design revisions, supplemented by thermal analyses and confirmatory vibration and impact tests. R.K.G.

N80-32931# Westinghouse Research and Development Center, Pittsburgh, Pa.
DEVELOPMENT OF COPPER SULFIDE/CADMIUM SULFIDE THIN FILM SOLAR CELLS. Technical Progress Report, 13 Jul. - 12 Oct. 1979
J. R. Szedon, F. A. Shirland, J. A. Stoll, and H. C. Dickey. 14 Feb. 1980. 36 p. refs.
(Contract EG-77-C-01-4042)
(DSE-4042-T42; TPR-1) Avail: NTIS. HC A03/MF A01

Preparation of CdS films by evaporation from a single graphite source, as generally used by the Institute of Energy Conversion (IEC) group at the University of Delaware, was implemented. Previously, four evaporation sources were used to permit uniform coverage of large area substrates. The graphite source used in this period is somewhat smaller than the IEC design to permit accommodation to the heater geometry currently available. Initial efforts with the single source evaporation were on characterizing the thickness profiles of the deposited films. This is needed to permit selection of conditions for obtaining films of about 30 microns thickness over the central 4 cm x 4 cm area of the substrates. Barrier processing according to the details of IEC method was used on four source CdS films. To date the best cells have only been about 1% efficient. Low short circuit current density values (approximately 5 mA/sq cm) have been the biggest problem. Annealing in 6% H2/Ar mixtures at 170 C after electrode grid evaporation generally has resulted in reduced values of J/sub sc/. DOE

N80-32932# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
CUPROUS OXIDE PHOTOVOLTAIC CELLS. Quarterly Technical Progress Report, 9 Jan. - 8 Apr. 1980
Dan Trivich. 8 Apr. 1980. 37 p. refs.
(Contract DE-AC04-79ET-23010)
(DOE/ET-23010/17; QTPR-4) Avail: NTIS. HC A03/MF A01

Metal insulator semiconductor cells and heterojunction cells with Cu2Owere studied. In particular the junctions were studied by Auger techniques to detect possible chemical changes at the interface. It was found that some preparation conditions could produce heterojunctions without chemical degradation. The effect of impurities in the starting Cu on the properties of the Cu2O and Cu2O solar cell was examined. Methods of measuring diffusion length were explored. DOE

N80-32933# Southern Methodist Univ., Dallas, Tex.
THIN FILMS OF SILICON ON METALLURGICAL SILICON SUBSTRATES. Final Report, 1 Sep. 1976 - 30 Sep. 1979
Ting L. Chu. Sep. 1979. 98 p. refs.
(Contracts EY-76-C-03-1285; DE-AC03-76ET-20405)
(SAN-1285-T2) Avail: NTIS. HC A05/MF A01

Metallurgical silicon was purified by a low cost technique, acid-extraction and phosphorus pentoxide treatment, to yield materials suitable for substrate purposes. Recrystallization techniques were developed to produce large grain silicon sheet supported on graphite. Silicon films of controlled thickness and dopant distribution were deposited on metallurgical silicon substrates, and the properties of silicon films and epitaxial p-n junctions were investigated in detail. Polycrystalline silicon solar cells were fabricated, and their properties including current-voltage characteristics, spectral response, minority carrier diffusion length, dopant profile, and stability, were characterized in detail. The properties of grain boundaries in polycrystalline silicon solar cells were investigated by photoresponse scan and EBIC techniques. DOE

N80-32934# Solarex Corp., Rockville, Md.
INVESTIGATION OF THE IMPURITY TOLERANCE OF SEMICRYSTALLINE SILICON SOLAR CELLS SILICON IMPACT PROGRAM
G. Storti, W. Regnault, S. Johnson, H. C. Lin (Maryland Univ.), and R. W. Armstrong (Maryland Univ.). 31 Mar. 1980. 96 p.
Sponsored by Solar Energy Research Inst.
(Contract DE-AC02-77CH-00178)
(DOE/CH-00178-T2; QTPR-2) Avail: NTIS. HC A05/MF A01

Design modifications were made to incorporate thermocouples into the polysilicon casting furnace to allow for the constant monitoring of the temperature profile during the casting process. A source of metallurgical grade (MG) silicon was chosen and the material was prepared by grinding the large pieces into powder. The uniformity of the feedstock was ascertained by optical emission spectrograph analysis of three random samples of the feedstock. A total of sixteen casting runs were made this quarter; Union Carbide CMG graphite was found to be the most suitable crucible material. Solar cells were fabricated from the successful castings (five 100% SG, and two containing 1% and 5% MG silicon, respectively). The average efficiency from the first SG ingot was 10.4% AM0 (in excess of 12% AM1). In general, solar cells fabricated from the top and bottom of the ingots exhibited better overall characteristics. The addition of MG silicon to the casting caused a large degradation in both light and dark I-V characteristics. DOE

N80-32935# Sandia Labs., Albuquerque, N. Mex.
US NATIONAL PHOTOVOLTAICS PROGRAM AND APPLICATIONS EXPERIMENTS IN THE INTERMEDIATE SECTOR
Miguel Rios, Jr. 1980 35 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0587C) Avail: NTIS HC A03/MF A01

The Department of Energy (DOE) commercial readiness goals for photovoltaics technology are summarized and the role of the national labs, research centers, and institutes in the strategy for achievement of these goals is outlined. Some examples of the flatplate and concentrator photovoltaics experiments that are under construction through the DOE Program Research and Development Announcements (PRDAs) are discussed. These experiments establish system feasibility and demonstrate the applicability of photovoltaics as an alternative energy source in the intermediate sector (industrial, commercial, and agricultural). Installed system costs for the proposed PRDAs are given and concentrator technology requirements for achievement of DOE commercial readiness goals are presented. DOE

N80-32936# Sandia Labs., Albuquerque, N. Mex.
GALLIUM ARSENIDE PHOTOVOLTAIC DENSE ARRAY FOR CONCENTRATOR APPLICATIONS
J. J. Wiczer, J. A. Cape, and J. S. Harris, Jr. 1980 16 p refs Presented at the Intern. Symp. of the SPIE, San Diego, Calif., 28 Jul. 1980 Prepared in cooperation with Rockwell International Corp., Thousand Oaks, Calif.
(Contract DE-AC04-76DP-00789)
(SAND-80-1569C; CONF-800719-6) Avail: NTIS HC A02/MF A01

An array of 256 densely packed gallium arsenide (GaAs) solar cells was designed, fabricated and tested to explore the feasibility of operating photovoltaic subsystems at solar central receiver facilities. The design goals, fabrication processes, and observed test results for such a photovoltaic array are reported. DOE

N80-32937# Sandia Labs., Albuquerque, N. Mex.
SIMPLE ECONOMIC EVALUATION AND APPLICATIONS EXPERIMENTS FOR PHOTOVOLTAIC SYSTEMS FOR REMOTE SITES
Miguel Rios, Jr. 1980 47 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0749C) Avail: NTIS HC A03/MF A01

A simple evaluation of the cost effectiveness of photovoltaic systems is presented. The evaluation was based on a calculation of breakeven costs of photovoltaics (PV) arrays with the levelized costs of two alternative energy sources (1) extension of the utility grid and (2) diesel generators. A selected number of PV applications experiments that are in progress in remote areas of the US are summarized. These applications experiments range from a 23 watt insect survey trap to a 100 kW PV system for a national park complex. The PV systems for remote areas are not cost effective in remote small applications with commercially available technology. DOE

N80-32938# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
GALLIUM ARSENIDE PHOTOVOLTAIC DENSE ARRAY FOR CONCENTRATOR APPLICATIONS
J. A. Cape, J. S. Harris, Jr., and J. J. Wiczer (Sandia Labs., Albuquerque, N. Mex.) 1980 14 p Presented at the Am. Sect. of the ISES Conf., Phoenix, Ariz., 2 Jun. 1980
(Contract DE-AC04-76DP-00789)
(SAND-79-2270C; CONF-800604-32) Avail: NTIS HC A02/MF A01

The design, fabrication, and testing are discussed for a dense array consisting of 16 overlapped linear modules each containing 16 contiguous 1 cm by 1.25 cm GaAs concentrator cells in a row. The overlapping is done so that only active cell area is presented to the concentrated sunlight. The array presents a frontal area of 320 cu cm and is designed to yield a system output of approximately 230 volts at 25 to 25 amps at 1000 SUNs. DOE

N80-32939# A/S International Solar Power Co. Ltd., Gentofte (Denmark).
FEASIBILITY STUDY ON A SOLAR HOUSE HEATING SYSTEM WITH A LOW QUALITY THERMAL FLOW Final Report
A. Eggers-Lura 1980 237 p refs
(EUR-6696-EN) Avail: NTIS (US Sales Only) HC A11/MF A01; DOE Depository Libraries

A solar energy/heatpump house heating system with a low quality thermal flow, and of integration into prefabricated concrete element buildings were studied. Denmark's energy problem, its energy policy, and its housing and building industry are briefly described. A survey is made of existing buildings in Europe which use high density walls/roofs as solar collectors, and of research and development work being undertaken in EEC on concrete solar collectors. The component that comprise a solar heating system integrated into a prefabricated concrete building structure are described. Feasibility of a solar/heatpump heating system integrated into a prefabricated one family dwelling of the dense, low level type was studied. Descriptions of the building and its heating system are given. Heat balance calculations private economy and energy economy calculations of the house and its alternative heating system are presented, and finally recommendations are made as to future work. DOE

N80-32940# California Univ., Livermore. Lawrence Livermore Lab.
ANALYSIS OF ALUMINUM-AIR BATTERY PROPULSION SYSTEMS FOR PASSENGER VEHICLES
J. D. Salisbury and E. Behrin 1 May 1980 10 p refs Presented at 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 17-22 Aug. 1980
(Contract W-7405-eng-48)
(UCRL-83824; CONF-800806-15) Avail: NTIS HC A02/MF A01

The performance characteristics of three electric propulsion systems based on the aluminum air(AL-air) battery were analyzed and compared to the internal combustion engine (ICE). In this comparison, the engine and fuel systems of a current five passenger vehicle were conceptually replaced by three Al-air systems; (1) an Al-air battery only system; (2) an Al-air battery combined with a nickel-zinc secondary battery for power leveling; and (3) an Al-air battery combined with a flywheel power leveler. Performance characteristics such as the average consumption rate of Al metal for the selected drive cycle, vehicle mass, and power system mass were determined for each Al-air propulsion system. Estimates of initial vehicle and life cycle costs of Al-air battery only vehicles indicate that all three systems can achieve performance and operation costs comparable to an ICE vehicle, and that the initial cost of Al-air battery only vehicles can approach the cost of ICE vehicles but at reduced power levels. DOE

N80-32941# California Univ., Livermore. Lawrence Livermore Lab.
ALUMINUM AIR BATTERY FOR ELECTRIC VEHICLE PROPULSION
John F. Cooper, Robert V. Homsy, and Jerry H. Landrum 1980 10 p refs Presented at 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22, Aug. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84443; CONF-800806-19) Avail: NTIS

HC A02/MF A01

Aluminum air battery development and the use of aluminum as a recyclable electrochemical fuel are discussed. The battery combines high specific energy (above 300 Wh/kg) and specific power (150 to 200 W/kg) with the capability of rapid refueling by addition of reactants. The objective is a commercially feasible, general purpose electric vehicle. Progress is reported in the scale up of aluminum air single cells to the automotive scale (0.1 m2 anodes) and in the development of a hydrargillite crystallizer, which is required to control electrolyte composition. The total cost and energy required to produce aluminum, and projected consumption by electric vehicles indicates that the aluminum air powered electric vehicle is potentially competitive with advanced automobiles using synthetic liquid fuels. DOE

N80-32942# Public Service Electric and Gas Co., Newark, N. J.
DISTRICT HEATING AND COOLING SYSTEMS FOR COMMUNITIES THROUGH POWER PLANT RETROFIT DISTRIBUTION NETWORK, VOLUME 4 Final Report, 1 Sep. 1978 - 31 May 1979
Oct. 1979 154 p
(Contract EM-78-C-02-4977)
(COO-4977/1-Vol-4) Avail: NTIS HC A08/MF A01

Institutional factors, legal and regulatory aspects, a preliminary economic analysis, and a proposal for future studies on retrofitting existing thermal power plants are presented. The data is utilized so that the thermal plants can supply heat for district heating and cooling systems for communities. DOE

N80-32943# Avco-Everett Research Lab., Mass.
ENGINEERING TEST FACILITY CONCEPTUAL DESIGN Final Technical Report
Feb. 1980 159 p
(Contract EF-77-C-01-2614)
(DOE/FE-2614/3) Avail: NTIS HC A08/MF A01

The power system configuration originally specified for the ETF considered the use of a high temperature air preheater, separately fired initially with oil and subsequently with a LBtu gas produced in a coal gasifier integrated with the power plant. This eliminates the need for a high temperature air preheater and its associated gasifier. The results from initial parametric design analysis in the separate study of early commercial MHD power plants reinforced the potential attractiveness of the use of oxygen enrichment of the combustion air. Preliminary analysis of the use of oxygen enrichment for ETF is also included. DOE

N80-32944# Chamberlain Mfg. Co., Waterloo, Iowa. Research and Development Div.
THE 3X COMPOUND PARABOLIC CONCENTRATING (CPC) SOLAR ENERGY COLLECTOR Final Technical Report
Robert W. Ballheim 25 Apr. 1980 207 p refs
(Contract DE-AC04-78CS-04239)
(DOE/CS-04239/T1; CMC-CB178-PR-017) Avail: NTIS HC A10/MF A01

A 3X compounds parabolic concentrating (CPC) collector was designed. The collector is a completely housed, 105.75 x 44.75 x 10.23 inch, 240 pound unit with six each evacuated receiver assemblies, a center manifold and a one piece glass cover. A truncated version of a CPC trough reflector system and the General Electric Company tubular evacuated receiver were integrated with a mass producible collector design suitable for operation at 250 to 450 F. The key criterion for optimization of the design was minimization of the cost per Btu collected annually at an operating temperature of 400 F. The reflector is a 4.1X design truncated to a total height of 8.0 inches with a resulting actual concentration ratio of 2.6 to 1. The manifold is an insulated area housing the fluid lines which connect the six receivers in series with inlet and outlet tubes extending from one side of the collector at the center. DOE

N80-32945# SRI International Corp., Menlo Park, Calif.
LINE-FOCUS SOLAR CENTRAL POWER SYSTEM, PHASE 1. SUBSYSTEM EXPERIMENT: RECEIVER HEAT TRANSFER
Arthur J. Slemmons Apr. 1980 125 p refs
(Contract EY-76-C-03-0115)
(DOE/ET-20550/1) Avail: NTIS HC A06/MF A01

Wind tunnel tests confirmed that heat losses due to natural convection are negligible in the line focus, solar powered receiver. Anomalies in the forced convection tests prevented definitive conclusions regarding the more important forced convection. Flow-visualization tests using a water table show much lower velocities inside the receiver cavity than outside, supporting the supposition that the forced heat transfer should be less than that from a standard exposed cylinder. Furthermore, the water table tests showed ways to decrease the low velocities in the cavity should this be desired. Further wind tunnel testing should be done to confirm estimates and to support advanced design. This testing can be done in standard wind tunnels since only the forced convection is of concern. DOE

N80-32946# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
THERMOGRAPHIC TECHNIQUES APPLIED TO SOLAR COLLECTOR SYSTEMS ANALYSIS
Anthony Eden Feb. 1980 8 p refs Presented at ASME Century 2 Emerging Energy Technol. Conf., San Francisco, 19-21 Aug. 1980
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-351-540; CONF-800804-20) Avail: NTIS HC A02/MF A01

The use of thermography to analyze large solar collector array systems under dynamic operating conditions is discussed. The research focused on thermographic techniques and equipment to determine temperature distributions, flow patterns, and air blockages in solar collectors. The results, covering many sites and types of collectors, illustrate the capabilities of infrared (IR) analysis as a qualitative analysis tool and operation and maintenance procedure when applied to large arrays. Thermographic analysis of most collector systems qualitatively showed relative temperature distributions that indicated balanced flow patterns. In three significant cases, blocked or broken collector arrays, which previously had gone undetected, were discovered. Using this analysis, validation studies of large computer codes could examine collector arrays for flow patterns or blockages that could cause disagreement between actual and predicted performance. DOE

N80-32947# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SOLAR PONDS AND THEIR APPLICATIONS
T. S. Jayadev and M. Edesess Mar. 1980 12 p refs Presented at the 7th Energy Technol. Conf. and Exposition, Washington, D.C., 25 Mar. 1980
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-733-617; CONF-800352-4) Avail: NTIS HC A02/MF A01

Solar ponds are probably the simplest and least expensive technology for conversion of solar energy to thermal energy. The solar pond is unique in its ability to act both as collector and as storage. The cost of a solar pond per unit area is considerably less than that of any active collector available today. The combination of their economic and technical factors make solar ponds attractive for district heating and industrial process heat applications. Solar ponds have the potential to displace significant quantities of fossil fuel in low-temperature heating applications in nonurban areas. DOE

N80-32948# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PERFORMANCE OF STORAGE WALLS WITH HIGHLY CONDUCTIVE COVERING PLATES AND CONNECTING FILMS
Joseph K. E. Ortega, Carl E. Bingham, and J. Michael Connolly May 1980 9 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-721-574) Avail: NTIS HC A02/MF A01

The thermal behavior of a storage wall, constructed of concrete with highly conductive plates and connecting vertical fins, is investigated. The results demonstrate that, during the charging mode, the amount of energy released from the front surface is significantly reduced. A portion of the saved energy is stored for future discharge, but a large portion is transferred to the back surface and released. A selective front surface reduces the energy released from the front surface, and this energy is

stored. By properly selecting the fin spacing, plate-fin thickness, and plate-fin thermal conductivity, the rate and direction of thermal discharge can be controlled. The improved heat transfer capability and added thermal control provide new alternatives for interzonal heat transfer and multizone passive building designs. DOE

N80-32949# Midwest Research Inst., Golden, Colo. Passive Technology Branch.
COMPUTER MODELING OF THERMAL STORAGE WALLS
J. Michael Connolly, Carl E. Bingham, and Joseph K. E. Ortega May 1980 7 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-721-610) Avail: NTIS HC A02/MF A01

The modeling of the three dimensional heat transfer characteristics of thermal storage walls and the effect of nonuniform irradiation is investigated. Depending on how much of the wall is irradiated, a small error in energy storage is introduced with the one dimensional, uniform irradiation assumption. The results show that these assumptions, currently used in most passive design codes, are adequate to predict the thermal energy storage characteristics. However, the temperature distribution along the surface of the wall is much different when the nonuniform irradiation case is considered. The addition of a highly conductive metal cover on the front surface of the wall does not significantly improve the thermal energy storage characteristics of the wall when the wall is partially irradiated. A selective radiation coating reduces front losses and improves the energy storage capacity of the wall 9 to 13%. DOE

N80-32950# Massachusetts Univ., Amherst. Energy Alternatives Program.
INVESTIGATION OF THE FEASIBILITY OF USING WIND POWER FOR SPACE HEATING IN COLDER CLIMATES
Annual Report, period ending 30 Jun. 1978
D. E. Cromack Oct. 1979 116 p refs
(Contract DE-AC04-76DP-03533)
(DOE/DP-03533/T3) Avail: NTIS HC A06/MF A01

Background and progress to date for the Wind Furnace Project at the University of Massachusetts is reported. The Wind Furnace installed at Solar Habitat-1 is described. More detail is presented under the summary discussions for each task with referenced technical reports and published papers giving a full description of the specific tasks. DOE

N80-32951# Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.
ANALYTICAL STUDIES OF WIND TURBINE TURNING CHARACTERISTICS
A. S. Mikhail and C. G. Justus Jun. 1979 26 p refs
(Contracts DE-AS06-76ET-20355)
(RLO/2439-79/3) Avail: NTIS HC A03/MF A01

Data from 14 sites were arranged in time-series format for wind speed and direction. The sites were chosen based on the availability of hourly observations and suitability of the sites for wind energy applications. The hourly turns of the wind were summed vectorially. Monthly and annual cummulative turns at each site were computed. To simulate the performance of actual wind turbines, threshold wind speed values of 0, 1, 2, 3, 4, 5, and 6 m/s were chosen. A threshold wind speed is defined as wind speed below which the turbine is not expected to turn with the wind. DOE

N80-32952# Franklin Research Center, Philadelphia, Pa.
SELF CONTROLLING, SELF PUMPING HEAT CIRCULATION SYSTEM STUDY Final Report, 1 Aug. 1977 - 31 Jul. 1978
G. P. Wachtell 31 Jul. 1978 153 p refs
(Contracts DE-AC02-77CS-34484; EG-77-C-02-4484)
(COO-4484-07; FRC-C4772-2) Avail: NTIS HC A08/MF A01

Self pumping methods for transporting heat from roof-mounted flat plate solar collectors to thermal energy storage at a lower evaluation are described and evaluated. Power cycles are feasible for sensible heat transport with air or water, and also in latent heat transport systems. Vapor bubble lift for circulating water and latent heat transport with condensate return by the vapor stream are recommended for development as devices with no moving parts. Development of an injector for circulating liquid is also recommended, although higher collector temperatures or circulants that are more volatile than water would be needed. Some methods of delivering heat to the TES using photovoltaic power or small amounts of utility power were evaluated. DOE

N80-32953# Florida Univ., Gainesville. Dept. of Materials Science and Engineering.
OXIDATION OF ELECTRODEPOSITED BLACK CHROME SELECTIVE SOLAR ABSORBER FILMS
P. H. Holloway, K. Shanker, R. B. Pettit (Sandia National Labs.), and R. R. Sowell (Sandia National Labs.) 1980 19 p refs
Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 21 Apr. 1980
(Contracts DE-AC04-76DP-00789; DE-FG02-79ER-10541)
(SAND-80-1045C; CONF-800439-11) Avail: NTIS HC A02/MF A01

X-ray photoelectron and Auger electron spectroscopes were used to study the composition and oxidation of electrodeposited black chrome films. The outer layer of the film is Cr2O3 with the inner layer being a continuously changing mixture of Cr + Cr2O3. Initially, approximately 40 percent by volume of the film is combined as Cr2O3, and the volume percentage of Cr2O3 increases to greater than 60 percent after only 136 hours at 250 C. After approximately 3600 hours at 400 C, the volume percentage of Cr2O3 increased to as high as 80 percent. The thermal emittance decreased approximately linearly with increasing oxide content, while the solar absorptance remained constant until the percentage of Cr2O3 exceeded approximately 70 percent. Oxidation was slower when the Cr(+3) concentration in the plating bath was reduced from 16 g/l to 8 g/l, and when black chrome was deposited on stainless steel rather than sulfamate nickel. DOE

N80-32954# Puerto Rico Office of Energy, Santurce.
CONCENTRATING PHOTOVOLTAICS FOR THE TROPICS
Final Report, 1 Jun. 1978 - 28 Feb. 1979
30 Jun. 1979 283 p refs
(Contract ET-78-C-04-4270)
(DOE/CS-04270/1) Avail: NTIS HC A13/MF A01

The design and specifications of a photovoltaic concentrator total energy system are presented. The design will provide nearly half the electrical energy needs and most of the thermal energy needs (absorption chillers) of the Center for Energy and Environment Research, University of Puerto Rico, and the hot water needs of the Oncologic Hospital and Children's Hospital, Puerto Rico Medical Center. The system will utilize 34,190 sq ft of 40X slat type concentrators with secondary CPC concentrators to provide 162 kWe. The combined photovoltaic/thermal collector system utilizes a 20,000 gal steel thermal storage tank, and two absorption refrigeration units which will produce a total of 149 tons of cooling. Detailed drawings and system fabrication and installation plans are included. Insolation data for the San Juan, Puerto Rico site are presented, and calculated system performance based on this data is presented. DOE

N80-32955# Midwest Research Inst., Golden, Colo.
MODEL OF DIRECT CONTACT HEAT TRANSFER FOR LATENT HEAT ENERGY STORAGE
Michael E. Cease May 1980 8 p refs Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contracts EG-77-C-01-4042; DE-AC02-77CH-00178)
(SERI/TP-631-567; CONF-800806-27) Avail: NTIS HC A02/MF A01

In a direct contact heat transfer system, an immiscible fluid was bubbled through the storage media and heat was transferred between the phases as the droplets rose. An analytical model is presented for predicting the temperature of the rising droplets from information in the literature. The drop size was calculated from empirical correlations in the jetting formation region and rise velocity was characterized by a creeping-flow surface cell model which accounts for the hindering effects of neighboring droplets. The viscosity of the crystallizing solution in the rise velocity equation was approximated by an expression for concentrated suspensions, where the percentage of solids was taken as the percentage of crystallization. Dispersed phase holdup was predicted with the rise velocity. Calculation of the rate of heat transfer to the dispersed immiscible fluid droplets was based

on three different internal hydrodynamic approximations: rigid, internally circulating, and wall-mixed spheres. DOE

N80-32956# Midwest Research Inst., Golden, Colo. Technical Information Dissemination Program.
PROCEEDINGS OF THE OCEAN ENERGY INFORMATION DISSEMINATION WORKSHOP
Don Petty Solar Energy Research Inst. Apr. 1980 22 p Workshop held in Golden, Colo., 6-7 Dec. 1979
(Contracts EG-77-C-01-4042; DE-AC02-77CH-00178)
(SERI/TP-732-600) Avail: NTIS HC A02/MF A01

The workshop was held to discuss the status of marketing ocean energy information and to develop an understanding of information needs and how to satisfy them. Presentations were made by the Solar Energy Research Institute (SERI) staff and media consultants about the effective use of audio visual and print products, the mass media, and audience needs. Industry and government representatives reported on current efforts in each of their communication programs and outlined future plans. Four target audiences (DOE contractors, researchers, influencers, and general public) were discussed with respect to developing priorities for projects to enhance the commercialization of ocean energy technology. DOE

N80-32957# United Technologies Research Center, East Hartford, Conn.
DEVELOPMENT OF AN 8 kW WIND TURBINE GENERATOR FOR RESIDENTIAL TYPE APPLICATION. PHASE 1: DESIGN AND ANALYSIS. VOLUME 1: EXECUTIVE SUMMARY
M. C. Cheney et al 25 Jun. 1979 8 p
(Contract DE-AC04-76DP-03533)
(DOE/DP-03533/T1-Vol-1) Avail: NTIS HC A02/MF A01

Special features of the composite bearingless rotor, developed initially for helicopter application, were used in the design of a prototype wind turbine whose blade is comprised of an outer or aerodynamic portion fabricated from fiberglass using a pultrusion process, and an inner portion, called the flexbeam which is made up of unidirectional graphite epoxy. A rotor diameter of 9.4m was selected, producing more than the required 8 kW at 9m/s wind speeds, more typical of residential areas. Performance was calculated for two rotor speeds, representing two different gearbox step up ratios. Design studies and supporting analytical efforts show that the 8 kW prototype satisfies program objectives relative to performance and operational characteristics. Stability and loads calculations, using stabilized helicopter aeroelastic codes, demonstrate the system is well damped under all loading conditions and operates well below allowable stress levels. System costs are running about 20% higher than the contract goals; however, reductions in the main frame and tower costs appear feasible, and would be explored in a second generation 8 kW design. A.R.H.

N80-32958# Oak Ridge National Lab., Tenn. Energy Div.
APPRAISAL OF THE M FACTOR AND THE ROLE OF BUILDING THERMAL MASS IN ENERGY CONSERVATION
K. W. Childs Jul. 1980 51 p refs
(Contract W-7405-eng-26)
(ORNL/CON-46) Avail: NTIS HC A04/MF A01

A concept in heat transfer calculations known as the M factor was introduced to account for thermal storage due to mass in building walls. The assumptions behind the development of the M factor are reviewed. The effect of mass in walls on seasonal or annual energy transmission through walls is examined, as well as the applicability of the M factor as a correction to account for any mass effects. In connection with the effect of mass on seasonal energy consumption, the use of an M factor correction when checking a building for compliance with energy conservation standards is investigated. The suitability of applying the M factor correction to the peak load determined by a steady state calculation for equipment sizing is also explored. In addition, the relationship of thermal mass to other parameters that determine loads and energy consumption is investigated, and the role of thermal mass in energy conservation is discussed. DOE

N80-32959# Midwest Research Inst., Golden, Colo. Buildings Div.
POTENTIAL DISPLACEMENT OF PETROLEUM IMPORTS BY SOLAR ENERGY TECHNOLOGIES
Peter DeLeon, Byron L. Jackson, Robert F. McNown (Colorado Univ., Boulder), and Gary J. Mahrenholz (Colorado Univ., Boulder) May 1980 59 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TR-352-504) Avail: NTIS HC A04/MF A01

The United States currently imports close to half of its petroleum requirements. The economic, social, and political costs of a foreign oil dependency are discussed. Development of alternative, domestic energy sources, such as solar energy technologies, which can displace foreign petroleum is discussed. It is estimated that by the year 2000, solar energy technologies can displace 3.6 quads of petroleum. This figure includes solar energy applications in utilities, industrial and agricultural process heat, and transportation. The estimate can be treated as a lower bound; if the United States were to achieve the proposed goal of 20 quads by 2000, the amount of displaced oil probably would be greater. Although all the displaced oil would not be imported, the reduction in imported petroleum would relieve many of the conditions that increase the present cost of foreign oil to the American consumer. DOE

N80-32960# Oak Ridge National Lab., Tenn. Energy Div.
DEVELOPMENT OF AN ENERGY CONSUMPTION AND COST DATA BASE FOR FUEL CELL TOTAL ENERGY SYSTEMS AND CONVENTIONAL BUILDING ENERGY SYSTEMS
G. D. Pine, J. E. Christian, W. R. Mixon, and W. L. Jackson Jul. 1980 75 p refs
(Contract W-7405-eng-26)
(ORNL/CON-38) Avail: NTIS HC A04/MF A01

The procedures and data sources used to develop an energy consumption and system cost data base for use in predicting the market penetration of phosphoric acid fuel cell total energy systems in the nonindustrial building market are described. A computer program was used to simulate the hourly energy requirements of six types of buildings: office buildings; retail stores; hotels and motels; schools; hospitals; and multifamily residences. The simulations were done by using hourly weather tapes for one city in each of the ten Department of Energy administrative regions. Two types of building construction were considered, one for existing buildings and one for new buildings. A fuel cell system combined with electrically driven heat pumps and one combined with a gas boiler and an electrically driven chiller were compared with similar conventional systems. The methods of system simulation, component sizing, and system cost estimation are described for each system. DOE

N80-32961# Polytechnic Inst. of New York, Brooklyn. Solar Energy Applications Center.
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT SOLAR HOT WATER INITIATIVE: CENTRALIZED COORDINATION OF TECHNICAL TASKS AND SYSTEM EVALUATION Final Report
Richard S. Thorsen, Donald F. Hunt, Wheeler K. Mueller, Anil V. Padhye, and Ellen P. Priolo Dec. 1979 414 p Sponsored in part by HUD, Washington, D.C. and N.Y. State Energy Research and Development Authority
(PB80-189244; POLY-M/AE-79-64; HUD-0001443) Avail: NTIS HC A18/MF A01 CSCL 13A

The installation of 10,867 approved solar hot water heating systems in 10 contiguous Northeastern and Middle Atlantic States and Florida by August 1978 is described. Specific problems, such as availability of standards and test laboratories, installation deficiencies, and warranty requirements, are listed as well as their solutions. GRA

N80-32962# Tata Energy Research Inst., Bombay (India). Documentation Centre.
SOLAR PASSIVE SYSTEMS FOR BUILDINGS
Mar. 1980 54 p refs
(PB80-187719) Avail: NTIS HC A04/MF A01 CSCL 13A

A survey is provided of what is known about the design of solar passive buildings. A systematic presentation is given of proven concepts with suitable illustrations. It is intended as a general guide for architects, designers and other building practitioners. Topics include the various concepts of solar passive

heating and cooling, design factors such as location, climate, microclimate, form; building metabolism, thermal and visual comfort; location and form of illumination; and natural cooling via wind towers and cisterns. GRA

N80-32963# California Energy Commission, Sacramento.
ENVIRONMENTAL IMPLICATIONS OF ELECTRIC UTILITY SUPPLY PLANS, 1978-2000 Final Report
Tom MacDonald May 1980 109 p refs
(PB80-192156; CAEC-64; CAEC-300-80-005) Avail: NTIS HC A06/MF A01 CSCL 10B

The results of the environmental assessment of the current electricity supply plans of the California utilities are presented. Major areas of assessment were construction and operation of electric generation facilities, including air quality, land use, and solid waste disposal. Maps show the locations of utility proposed generation facilities and potential siting areas for additional facilities. Methods used to designate potential siting areas based on a statewide siting assessment are discussed. GRA

N80-32964# Bureau of Commercial Fisheries, Ann Arbor, Mich. Biological Services Program.
PROCEEDINGS OF THE CLEMSON WORKSHOP ON ENVIRONMENTAL IMPACTS OF PUMPED STORAGE HYDROELECTRIC OPERATIONS
James P. Clugston, ed. Apr. 1980 214 p refs Workshop held in Clemson, S. C., 15-16 May 1979
(PB80-192453; FWS/OBS-80/28) Avail: NTIS HC A10/MF A01 CSCL 10B

The pumping of water to a high reservoir for storage during periods of low power demand, so that it can be used for the generation of electricity during peak power demand was discussed. Papers which were presented exchanged ideas and data with regard to the environmental impact of this regular interchange of water. L.F.M.

N80-32965*# New Mexico Univ., Albuquerque. Technology Application Center.
FORECASTS OF ENERGY TECHNOLOGY. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Dec. 1979
Mary K. Gallagher Jul. 1980 60 p Supersedes NTIS/PS-79/0337 Sponsored in cooperation with NASA and NTIS
(NASA-CR-163596; PB80-812324; NTIS/PS-79/0337) Avail: NTIS HC $30.00/MF $30.00 CSCL 10A

Approximately 183 citations on the development of energy technology are presented. Emphasis is placed on forecasts relating to new energy sources such as hydrogen-based energy, solar energy conversion and to nuclear energy and coal utilization. Economic analyses of various energy conversion techniques are included. GRA

N80-32966# National Technical Information Service, Springfield, Va.
NICKEL CADMIUM BATTERIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 141 p Supersedes NTIS/PS-79/0647 and NTIS/PS-78/0618
(PB80-812340; NTIS/PS-79/0647; NTIS/PS-78/0618) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

The design, fabrication, components, testing, and assembly of nickel cadmium batteries are covered in the bibliography. The majority of these citations deal with the development of power supplies for aircraft and spacecraft. This updated bibliography contains 135 abstracts, 19 of which are new entries to the previous edition. GRA

N80-32967# National Technical Information Service, Springfield, Va.
LITHIUM BATTERIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 162 p refs Supersedes NTIS/PS-79/0675; NTIS/PS-79/0660
(PB80-812399; NTIS/PS-79/0675; NTIS/PS-78/0660) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Federally funded research on design, development, components, testing corrosion, electrolytes, sealing, hazards of lithium cells are presented. Batteries studied include lithium organic cells, lithium sulfur cells, lithium water air cells, and lithium nickel fluoride cells. Applications cover use in spacecraft, electric vehicles, off peak energy storage, and forklift trucks. This updated bibliography contains 151 citations, 57 of which are new entries to the previous edition. GRA

N80-32968# National Technical Information Service, Springfield, Va.
LITHIUM BATTERIES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 290 p Supersedes NTIS/PS-79/0676; NTIS/PS-78/0661
(PB80-812407; NTIS/PS-79/0676; NTIS/PS-78/0661) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Studies on design, development, components, corrosion, and harzards are included in the compilation of worldwide research. Lithium batteries with sulfides, chlorine, thionyl chloride, organic compounds, and water are cited. Applications cover use of lithium cells in pacemakers, spacecraft, electric vehicles, and off peak energy storage. This updated bibliography contains 283 citations, 60 of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-32969# California Univ., Riverside.
THE EFFECT OF DESIGNATED POLLUTANTS ON PLANT SPECIES Annual Report, 1 Jul. 1978 - 30 Jun. 1979
A. L. Granett and O. C. Taylor Dec. 1979 64 p refs
(Contract F33615-76-C-5005)
(AD-A078933; AMRL-TR-79-73; AR-4) Avail: NTIS HC A04/MF A01 CSCL 13/2

The phototoxicity of hydrogen chloride (HC1) gas was studied with particular emphasis on various external plant stresses. Greenhouse grown plants and indoor exposure chambers were utilized to test the effect of viral infection, insecticide treatment, weed killer applications, or antioxidant protectants on injury caused by HC1 gas. Plant sensitivity did not differ between virus infected and non viral plants. Increased injury, however, was seen on plants exposed to HCl gas after one of the insecticide treatments. An experimental antioxidant compound which protects plants from ozone injury did not increase tolerance to HCl gas. Some plants were fumigated only once while others received weekly doses. Field plants were generally more tolerant than the same species grown in the greenhouse. HCl for the field work was generated either by diluting pressurized dry gas in a large volume of flowing carrier gas or by open burning of small pieces of solid rocket fuel. Portable chambers remained over the field plants only for the duration of the 15 minute exposures. T.M.

N80-32970*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP) DATA REPORT FOR TAPE VL0014
Daniel Briehl, Thomas J. Dudzinski, and David C. Liu Washington Sep. 1980 43 p refs
(NASA-TM-81579; E-549) Avail: NTIS HC A03/MF A01 CSCL 13B

The data currently available from GASP, including flight routes and dates, instrumentation, data processing procedures, and data tape specifications are described. Measurements of atmospheric ozone, cabin ozine, carbon monoxide, water vapor, particles, clouds, condensation nuclei, filter samples and related meteorological and flight information obtained during 562 flights of aircraft N533PA, N4711U, N655PA, and VH-EBE from October 3, 1977 through January 5, 1978 are reported. Data representing tropopause pressures obtained from time and space interpolation of National Meteorological Center archived data for the dates of the flights are included. R.K.G.

N80-32971# Environmental Protection Agency, Leonardo, N.J. Ohmsett Test Facility.

PERFORMANCE TESTS OF HIGH SPEED ZRV OIL SKIMMER Final Report, 8 Sep. - 13 Oct. 1979
Michael K. Breslin (Mason and Hanger-Silas Mason Co., Inc.) Jun. 1980 156 p refs
(Contract DOT-CG-842702-A)
(AD-A088062; USCG-D-42-80) Avail: NTIS HC A08/MF A01 CSCL 13/11

A self-propelled catamaran oil skimmer developed by the USCG capable of recovering oil from a water's surface was tested at the U.S. EPA OHMSETT facility. The skimmer employed an endless composite sorbent belt processed between the catamaran hulls to recover oil. The tests were designed to determine the effect that various parameters (skimmer speed, oil viscosity, oil thickness, wave conditions, etc.) have upon oil recovery performance. The skimmer was towed through oil slicks at various speeds in different wave conditions as it was operated to collect oil. The collected fluid was quantitatively analyzed to determine the device's oil-to-water recovery ratio (recovery efficiency), oil recovery rate and thoroughness of slick removal (throughput efficiency). The device proved capable of good throughput efficiency in all wave conditions (up to 0.7 m confused seas) at all the tow speeds tested (1 to 6 knots). Throughput efficiencies of 80 to 90% in calm water were common with all the oils tested. The performance of the full-scale skimmer agreed well with the results from the smaller prototype tested in 1976. The successful development of this skimmer provides a significant advance in oil spill recovery capability and technology. The concept used in this oil skimmer can be employed at speeds greater than those tested. Two oil slick converging systems were tested with the skimmer to effectively double the sweep width of the skimmer. Additional tests were conducted to determine vessel resistance and motion in waves and to assess the buildup of potentially explosive vapors within the oil recovery system. GRA

N80-32972# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.
ENVIRONMENTAL CONTROL TECHNOLOGY FOR CARBON DIOXIDE Final Report
Anthony S. Albanese and Meyer Steinberg May 1980 30 p refs
(Contract DE-AC02-76CH-00016)
(DOE/EV-0079) Avail: NTIS HC A03/MF A01

The impact of fossil fuel use in the US on worldwide CO2 emissions and the impact of increased coal utilization on CO2 emission rates are assessed. The aspects of CO2 control are discussed as well as the available CO2 removal sites. The primary factor affecting the practicability of a CO2 control system is its energy requirements. At a CO2 removal efficiency of 50%, the power generation efficiency of a conventional coal fired power plant would be reduced from 34% to about 25%, and the cost of power generation would be expected to double. For 90% CO2 removal, power generation efficiency is reduced to between 15 and 6% and the cost of power generation increases by a factor of from 4 to 7. DOE

N80-32973# Los Alamos Scientific Lab., N. Mex.
ASSESSMENT OF ENVIRONMENTAL CONTROL TECHNOLOGIES FOR ENERGY STORAGE SYSTEMS, 1979
M. C. Krupka, J. E. Moore, W. E. Keller, G. A. Baca, R. I. Brasier, and W. S. Bennett Apr. 1980 123 p refs
(Contract W-7405-eng-36)
(LA-8308-MS) Avail: NTIS HC A06/MF A01

Environmental impacts are identified, control techniques are described and recommendations for needed control technology are made. The storage technologies investigated include: lead acid battery, hydroelectric pumped, superconducting magnet, compressed air, flywheel and thermal. Environmental impacts of fuel cell technology is also presented. Although not strictly energy storage devices, many of the benefits attributed to fuel cells are similar to those of the other storage systems. In addition, sections on new applications for energy storage technologies and the additional costs of controls to be used for mitigation of certain adverse impacts are also presented. Detailed discussion of the various environmental impacts as they relate to primarily operational situations are emphasized. DOE

N80-32974# Stuttgart Univ. (West Germany). Inst. fur Kernenergetik und Energiesysteme.
SIMULATION OF THE ENERGY-INDUSTRY-ENVIRONMENT SYSTEM FOR LIMITED ECONOMIC REGIONS, USING THE EXAMPLE OF BADEN-WUERTTEMBERG. PART 1: DATA, MODEL DEVELOPMENT ADAPTATION Progress Report, 1960 - 1974 [SIMULATION DES SYSTEMS ENERGIE-WIRTSCHAFT-UMWELT FUR BEGRENZTE WITSCHAFTS-RAUME AM BEISPIEL BADEN-WURTTEMBERGS ZUSAMMENFASSENDER SCHLUSSBERICHT]
K. H. Hoecker and H. Unger Oct. 1979 105 p refs In GERMAN
(IKE-K-54-20-Pt-1) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

The structure and development of the Baden-Wuerttemberg power industry is analyzed and these data are compared with the data for West Germany. On the producer side, there are especially the electric power industry and the petroleum industry; on the consumer side, there are the usual sectors of private households and small consumers, industry, and transportation. The development of the past power supply structure is analyzed, and the analysis is used as a basis for a forecast. The model structure and methods are described. DOE

N80-32975# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
ECOSYSTEM THEORY AND THE UNEXPECTED: IMPLICATIONS FOR ENVIRONMENTAL TOXICOLOGY
R. V. ONeill and J. B. Waide 1980 42 p refs Presented at the Toxic Substances in the Environ., Batelle Columbus, Ohio, Mar. 1980
(Contract W-7405-eng-26, Grant NSF DEB-77-25781)
(CONF-800376-1) Avail: NTIS HC A03/MF A01

The necessity of considering in research, the components of ecosystems as parts of the dynamic whole is emphasized. In the first section the notion of the system as it emerges from hierarchy theory is developed. The next section emphasizes the ecosystem as a biogeochemical system. The focus is also placed explicity on the system component problem, and ecological exmples of problems involved in extrapolating from component measurements to system behaviors are given. Recommendations for toxic substances research are included. DOE

N80-32976# Aerodyne Research, Inc., Bedford, Mass. Center for Chemical and Environmental Physics.
HOMOGENEOUS PRODUCTION AND REMOVAL OF NO/SUBx/ FROM COMBUSTION EXHAUST GASES Quarterly Technical Summary Report, 1 Mar. - 31 May 1980
J. A. Silver, C. M. Gozewski, and C. E. Kolb Jun. 1980 22 p refs
(Contract ER-78-C-01-3183)
(ARI-RP-55; QTSR-7) Avail: NTIS HC A02/MF A01

The rate constants for the reaction OH + NH3 yields NH2 + H2O were measured over the temperature range 294 to 1075 K. The data are fitted by the Arrhenius expression k(cc/molecule/s) = 5.41 + or - 0.86 x 10 to the minus 12th power exp(-2120 + or - 143 kcal/mole/RT). A chemical model of the NOx chemistry was developed which includes 54 reactions. Although not yet complete, the reaction set clearly indicates the key reaction is NH2 + NO. The determination of the product channels and their branching ratios is of utmost importance in understanding the effect of NH3 addition to combustor exhaust streams for removal of NOx. DOE

N80-32977# Sandia Labs., Albuquerque, N. Mex.
METEOROLOGICAL AND AIR QUALITY DATA REPORT. WIPP SITE: EDDY COUNTY, NEW MEXICO Spring Quarter Report, Mar. - May 1977
L. P. Pocalujka, E. Babij, P. A. Catizone, and H. W. Church Mar. 1980 244 p refs Prepared in cooperation with TRC Environmental Consultants, Inc., Wethersfield, Conn.
(Contract DE-AC04-76DP-00789)
(SAND-79-7109) Avail: NTIS HC A11/MF A01

Site suitability of the Waste Isolation Pilot Plant (WIPP) is supported by meteorological, air quality, and radiological measurements. DOE

N80-32978# Department of Energy, New York. Environmental Studies Div.

ENVIRONMENTAL MEASUREMENTS LABORATORY Environmental Quarterly, 1 Mar. - 1 Jun. 1980
Edward P. Hardy, Jr. 1 Jul. 1980 69 p refs
(EML-374) Avail: NTIS HC A04/MF A01

Interpretive reports and notes dealing with strontium-90 in human bone from Bombay, chemical composition of the aerosol at American Samoa, and strontium-90 in New York and San Francisco diets are presented. Tabulations of strontium-90 fallout, chemical constituents of wet and dry deposition, radionuclide and trace metal concentrations in surface air, and strontium-90 concentrations in human bone, milk and tap water are included. A bibliography of publications related to environmental studies is also presented. DOE

N80-32979# Environmental Protection Agency, Washington, D.C. Office of Research and Development.
MICROCOSMS AS POTENTIAL SCREENING TOOLS FOR EVALUATING TRANSPORT AND EFFECTS OF TOXIC SUBSTANCES
B. S. Ausmus, G. K. Eddlemon, S. J. Draggan, J. M. Giddings, D. R. Jackson, R. J. Luxmoore, E. G. ONeill, R. V. ONeill, Monte Ross-Todd, and P. VanVoris Jun. 1980 404 p refs Prepared in cooperation with ORNL
(Contract W-7405-eng-26)
(ORNL/EPA-4; EPA-600/3-80-042; Publ-1506) Avail: NTIS HC A18/MF A01

Terrestrial and aquatic microcosms were evaluated for use in research on environmental contaminants. A number of experimental approaches using several microcosm designs and contaminants are reported. The use of terrestrial microcosm results was evaluated in conjunction with mathematical simulation models as a means of extending short term experimental results to interpret conditions as they might occur in the natural ecosystem. Although microcosms offer an excellent experimental system, their application to toxic substance testing is not a straightforward matter. They are characterized by complex dynamics and counterintuitive responses just as is the ecosystem to which they are an analog. These factors notwithstanding, microcosms do offer an excellent means of studying specific aspects of contaminant behavior and ecosystem processes. DOE

N80-32980# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
SENSITIVITY OF THE EASTERN UNITED STATES TO ACID PRECIPITATION IMPACTS ON SURFACE WATERS
George R. Hendrey, James N. Galloway (Virginia Univ.), Stephen A. Norton (Maine Univ., Orono), and Carl L. Schofield (Cornell Univ.) Mar. 1980 7 p refs Presented at the Intern. Conf. on the Ecol. Impact of Acid Precipitation, Sandefjord, Norway, 11-14 Mar. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27851; CONF-800365-3) Avail: NTIS HC A02/MF A01

Efforts to identify areas of the United States where soils and freshwaters might be sensitive to acidification proceeded from analyses of large scale geologic maps. These are useful in a general way but a finer scale analysis was needed. Such an analysis for the eastern United States was carried out, based primarily on geologic maps of scales 1:250,000 to 1:500,000. Other workers have prepared maps on a similar scale of the soils to a depth of 25 cm, and it is anticipated that both sets of maps will be merged into a combined analysis of sensitivity. Other factors important in controlling acidification of soils and freshwaters include hydrologic characteristics of the terrain, such as: soil porosity or permeability; water residence time in soil; temporal variation in precipitation rate, chemistry and volume; regional temperature patterns; and topography. DOE

N80-32981# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
MODELING THE ROLE OF TERRESTRIAL ECOSYSTEMS IN THE GLOBAL CARBON CYCLE
William E. Emanuel, Wilfred M. Post, and Herman H. Shugart, Jr. 1980 16 p refs Presented at the 11th Ann. Modeling and Simulation Conf., Pittsburgh, 1 May 1980
(Contract W-7405-eng-26; Grant NSF DEB-77-26722)
(CONF-800549-3) Avail: NTIS HC A02/MF A01

A model for the global biogeochemical cycle of carbon which includes a five compartment submodel for circulation in terrestrial ecosystems of the world is presented. Although this terrestrial submodel divides carbon into compartments with more functional detail than previous models, the variability in carbon dynamics among ecosystem types and in different climatic zones is not adequately treated. A model construct which specifically treats this variability by modeling the distribution of ecosystem types as a function of climate on a 0.5 deg latitude by 0.5 deg longitude scale of resolution is proposed. DOE

N80-32982# Sandia Labs., Albuquerque, N. Mex. Health Physics Div.
SANDIA NATIONAL LABORATORIES 1979 ENVIRONMENTAL MONITORING REPORT
Theodore N. Simmons Apr. 1980 28 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0342) Avail: NTIS HC A03/MF A01

Sandia National Laboratories in Albuquerque is located south of the city on two broad mesas. The local climate is arid continental. Radionuclides are released from five technical areas from the laboratories' research activities. The environmental monitoring program searches for cesium (137), tritium, uranium, alpha emitters, and beta emitters in water, soil, air, and vegetation. No activity was found in public areas in excess of local background in 1979. The Albuquerque population receives only 0.076 person-rem (estimated) from airborne radioactive releases. While national security research is the laboratories' major responsibility, energy research is a major area of activity. Both these research areas cause radioactive releases. DOE

N80-32983# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
CONSTRAINTS ON CARBON DIOXIDE PRODUCTION FROM FOSSIL FUEL USE
Ralph M. Rotty and Gregg Marland May 1980 37 p refs
(Contract DE-AC05-76OR-00033)
(ORAU/IEA-80-9(M)) Avail: NTIS HC A03/MF A01

The exponential growth of fossil fuel use over recent decades has resulted in a 4.3% annual increase in the carbon dioxide emitted to the atmosphere. Three types of possible constraints to limit the use of fossil fuels and the subsequent production of CO2 are discussed: resource contraints; fuel demand constraints; and environmental constraints. An analysis of the next 50 years suggests that resource constraints will not provide severe limits. Fuel demand constraints will probably limit the use of fossil fuels to levels that keep the atmospheric carbon dioxide concentration below 450 ppM(v) for the next 50 years, so that the impacts of atmospheric carbon dioxide will not cause mankind to take action soon. In spite of this conclusion a continuing, long term problem is foreseen and full efforts to understand and continually monitor the CO2 problem should be made and alertness to any changes that may require action should be maintained. DOE

N80-32984# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
OCCUPANT-GENERATED CO2 AS AN INDICATOR OF VENTILATION RATE
Isaac Turiel and John Rudy Apr. 1980 24 p refs
(Contract W-7405-eng-48)
(LBL-10496; EEB-Vent-80-15) Avail: NTIS HC A02/MF A01

In a San Francisco office building, occupant-generated CO2 was used as an indicator of the actual ventilation rate. Two techniques were employed, a decay method and an integral method and, in both cases, measurements were conducted simultaneously at several locations. The decay method compared favorably with the conventional measurement methods in both the all-outside-air and recirculation modes, whereas the integral method showed a considerable deviation from the other methods in the recirculation mode. Both techniques show promise of being suitable methods for measuring ventilation rate in commercial or institutional buildings. DOE

N80-32985# Tulane Univ., New Orleans, La. Dept. of Environmental Health Sciences.
PERFORMANCE EVALUATION OF THE AERATED LAGOON SYSTEM AT NORTH GULFORT, MISSISSIPPI Final Report, 1 Aug. 1975 - 31 Jul. 1977

Andrew J. Englande, Jr. Mar. 1980 266 p
(Grant EPA-R-803899)
(PB80-187461; EPA-600/2-80-006) Avail: NTIS
HC A12/MF A01 CSCL 13B

Results indicate that the treatment system did not exceed the federal biochemical oxygen demand average monthly requirement of 30 mg/l nor the seven consecutive day limit of 45 mg/l. The stringent permit level of 15 mg/l set by the Mississippi Air and Water Pollution Control Commission, however, was exceeded in all cases. A yearly average of 30.7 mg/l of Total Suspended Solids was recorded. The system never exceeded federal or state pH criteria. Fecal coliform standards of 200 colonies/100 ml were met only during the months of January and February. Non compliance was due to low residual chlorine levels resulting from poor design and operational control. Other parameters were monitored, summarized, and discussed. GRA

N80-32986# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK

May 1980 220 p
(Contract DE-AC01-79CS-30027)
(SOLAR/0010-80/05) Avail: NTIS HC A10/MF A01

The National Solar Data Program established solar energy systems in residential and commercial buildings across the United States. These solar sites are linked to a computer in the National Solar Data Network (NSDN). Data from this network are collected and analyzed to determine the thermal performance of each of the solar systems. The network consists of:(1) sensors which measure key performance parameters at a selected site; (2) a Site Data Acquisition Subsystem (SDAS); (3) telephone transmission circuits; and (4) a Central Data Processing System (CDES). Sensor data are collected and stored on a cassette tape in the SDAS. For the majority of parameters, raw data are collected approximately every five minutes. Solar insolation and certain other parameters, which are subject to rapid variance, are sampled every 32 seconds. Environmental information collected at the sites for the reporting month are presented. The data include: insolation, temperatures, wind, and humidity. DOE

N80-32987# Systems Science and Software, San Diego, Calif. Energy Analaysis and Environmental Div.

ORGANIC MATERIAL EMISSIONS FROM HOLDING PONDS AT COAL-FIRED POWER GENERATION FACILITIES Final Report

A. E. Rosecrance and B. N. Colby Mar. 1980 80 p refs
(EPRI-EA-1377; TPS-78-826) Avail: NTIS HC A05/MF A01

A literature survey of organic chemical emissions from holding or ash ponds which are used by most coal fired utilities to collect process waste materials was conducted. Approximately 140 Kg/day of organic material is predicted to be present in surface runoff of a hypothetical 1000 MW facility of which only 3.5 Kg/day or 2.6% of the total, is accounted for by specific compounds. Of the compounds identified, only phenol is near a level (97 microngram/1) of potential environmental significance. A survey of known holding pond influents was undertaken to assess which processes were most likely to be associated with the organic chemical content of the pond. Of the process wastes directed into the pond, cooling tower blowdown, water treatment wastes and boiler blowdown are identified as the major contributors of organic material. Organic chemical additives, which are used to control bacterial buildup, scale formation, pitting, corrosion, pH stability, and solid dispersion, account for approximately 96% of the organic pond influents. DOE

N80-32988# Department of Energy, Washington, D. C. Office of Buildings and Community Systems.

ENVIRONMENTAL ASSESSMENT. ENERGY EFFICIENCY STANDARDS FOR CONSUMER PRODUCTS Technical Support Document

Jun. 1980 137 p refs
(DOE/CS-0168; TSD-2) Avail: NTIS HC A07/MF A01

The Consumer Products Efficiency Standards (CPES) program covers: refrigerators and refrigerator-freezers, freezers, clothes dryers, water heaters, room air conditioners, home heating equipment, kitchen ranges and ovens, central air conditioners (cooling and heat pumps), furnaces, dishwashers, television sets, clothes washers, and humidifiers and dehumidifers. DOE proposed standards for eight of the products covered by the Program in a Notice of Proposed Rulemaking. DOE expects to propose standards for home heating equipment, central air conditioners (heat pumps only), dishwashers, television sets, clothes washers, and humidifiers and dehumidifiers in 1981. No significant adverse environmental or socioeconomic impacts were found to result from instituting the CPES. DOE

N80-32989# Department of Energy, Washington, D. C. Div. of Environmental Control.

ENVIRONMENTAL-CONTROL-TECHNOLOGY ACTIVITIES OF THE DEPARTMENT OF ENERGY IN FY 1979

Jun. 1980 99 p refs
(DOE/EV-0084) Avail: NTIS HC A05/MF A01

Background material that contributes to the capability to evaluate and assess the environmental control accomplishments, issues, gaps, and overlaps associated with energy development within DOE, in conjunction with other agencies, and in the private sector is presented. A measure of the change in emphasis in the environmental control technology activities within DOE is also presented, indicating shifts, if any, in funding levels for each of the energy technologies. Total DOE FY 1979 budget outlay allocated to environmental control activities was $421,533,000 or 5.0% of the total FY 1979 DOE budget. The inputs received from the energy technology areas are summarized. These inputs were submitted in accordance with a description of environmental control related activities, which are those activities directed at research, development, and demonstration of processes, procedures, systems, subsystems, and strategies that directly or indirectly eliminate, minimize, or mitigate environmental impacts. DOE

N80-32990# KVB, Inc., Irvine, Calif. Research and Analysis Div.

INVENTORY OF EMISSIONS FROM NON-AUTOMOTIVE VEHICULAR SOURCES Final Report

H. J. Taback, J. F. Macko, N. R. Parker, D. A. Dale, and S. Erlich Feb. 1980 224 p refs
(Contract ARB-A7-167-30)
(PB80-182942; KVB-13-5808-1215; ARB-80/109) Avail: NTIS HC A10/MF A01 CSCL 13B

Methodologies for the inventory of emissions from nonautomotive vehicular sources are presented which are applicable in all areas of California. An inventory is compiled consisting of emissions for 1977 for the four counties comprising the South Coast Air Basin. Nonautomotive vehicular sources are defined as construction equipment, farm vehicles, industrial vehicles, and small boats. The general approach is to determine total annual fuel consumption by vehicle type, then multiply each total by the appropriate EPA emission factors. GRA

N80-32991# Performance Development Inst., Washington, D.C.

INCENTIVES FOR TECHNOLOGICAL INNOVATION IN AIR POLLUTION REDUCTION: AN ETIP (EXPERIMENTAL TECHNOLOGY INCENTIVES PROGRAM) POLICY RESEARCH SERIES. VOLUME 2. MARKET MECHANISMS FOR EMISSION REGULATION AND ENFORCEMENT OF EMISSION LIMITS: DETERRENCE AND DEMAND

William H. Foskett May 1980 32 p refs
(PB80-186083; NBS-GCR-ETIP-80-87-Vol-2) Avail: NTIS
HC A03/MF A01 CSCL 13B

Both trading and direct pricing types of market mechanisms for stationary source emission reduction are discussed. Even enforcement of individual source emission limits and the degree to which the private sector will organize and invest in the research and development work underlying technological innovation in air pollution control are included. Present enforcement inconsistencies, such as those among regional offices, and remedial actions are noted. If an EPA effort to strengthen detection of violations can be successfully implemented, its effect on a regulatee's perceived probability of getting caught could contribute to market participation. If the probability of detection and penalty is high, purchase of emission reductions on the market may be a more appealing alternative to regulatees than evasion or litigation. GRA

N80-32992# CSI Resource Systems, Inc., Boston, Mass.
ECONOMIC IMPACT OF SULFUR DIOXIDE AND PARTICULATE MATTER REGULATIONS IN ILLINOIS Final Report
Alan S. Cohen Oct. 1979 133 p refs Sponsored by Illinois Inst. of Natural Resources
(PB80-182645; IINR-79/22; R77-15) Avail: NTIS
HC A07/MF A01 CSCL 13B

This document outlines the procedures used in preparing a benefit/cost analysis of the sulfur dioxide and particulate matter regulations listed below and describes the results indicated by the analysis. Reevaluation of rules 204 (c) (1) (A) and 203 (g) (1); deletion of rule 204 (c) (1) (D) previously designated 204 (c) (1) (B) (II); proposal by Ashland Chemical Company to amend rule 204 (c) (1) (A); and proposal by the City of Rochelle to amend rule 203 (g) (1). The purpose of the study is to satisfy the economic impact statement requirements of Illinois Public Act 79-790. Also the report can be viewed as four separate economic impact statements. Each economic impact statement consists of sections 1,2, and the appropriate subsection of section 3. Readers only intersted in a subset of the regulations analyzed will find the documentation of each regulation self sufficient. DOE

N80-32993# Wisconsin Univ. - Madison. Water Chemistry Lab.
AVAILABILITY OF POLLUTANTS ASSOCIATED WITH SUSPENDED OR SETTLED RIVER SEDIMENTS WHICH GAIN ACCESS TO THE GREAT LAKES Final Report, 1977 - 1978
D. E. Armstrong, J. J. Perry, and D. E. Flatness Dec. 1979 102 p refs
(Contract EPA-68-01-4479)
(PB80-189566; EPA-905/4-79-028) Avail: NTIS
HC A06/MF A01 CSCL 08H

The availability of certain elements, mainly phosphorus, transported to the Great Lakes by suspended sediment was evaluated. Nitrogen was also investigated because of its importance as a nutrient element; also included were certain trace metals because of concern over their possible adverse effects in the Great Lakes. GRA

N80-32994# TRW Defense and Space Systems Group, Redondo Beach, Calif.
SAMPLING AND ANALYSIS OF REDUCED AND OXIDIZED SPECIES IN PROCESS STREAMS Final Report, Jul. 1976 - Aug. 1979
R. F. Maddalone, L. L. Scinto, and M. M. Yamada Nov. 1979 229 p refs
(Contract EPA-68-02-2165)
(PB80-191281; EPA-600/2-79-201) Avail: NTIS
HC A11/MF A01 CSCL 07D

Results of a program of over 60 tasks involving the evaluation, development, testing, and field adaptation of measurement techniques for elemental analysis and inorganic compound identification in process and effluent streams are given. Procedure for particulate sampling at the inlet and outlet of FGD systems were developed. Methods for H2SO4 sampling in flue gas streams were developed based on the controlled condensation of H2SO4 vapor. Two procedure manuals were written for reduced and oxidized inorganic species. The procedures developed showed that the analysis scheme is applicable to most solid samples from combustion sources. Ion chromatographic procedures were also developed for analyzing FGD system slurry streams. GRA

N80-32995# Radian Corp., Austin, Tex.
ENVIRONMENTAL ASSESSMENT REPORT: WELLMAN-GALUSHA LOW-BTU GASIFICATION SYSTEMS Final Report, May 1978 - Sep. 1979
Pat Murin, Theresa Sipes, and G. C. Page May 1980 309 p refs
(Contract EPA-68-02-2147)
(PB80-190796; EPA-600/7-80-093) Avail: NTIS
HC A14/MF A01 CSCL 07A

An overview of Wellman-Galusha gasification systems, including estimates of the systems' energy conversion efficiencies and capital and operating costs is given. It provides data characterizing the systems' input materials, process streams, products, byproducts, and multimedia discharges. It identifies pollution control alternatives for the multimedia discharges and toxic substances in the systems' products and byproducts, and estimates their costs and energy impacts. It assesses regulatory requirements for the environmental impacts of the systems. It gives data needs and recommendations for obtaining those data. GRA

N80-32996# Michigan State Univ., East Lansing. Inst. of Water Research.
THE OCCURRENCE AND BEHAVIOR OF HALOMETHANES IN THE AQUATIC ENVIRONMENT Project Completion Report, 1 Oct. 1978 - 30 Jun. 1980
Frank M. Ditri and Swiatoslav W. Kaczmar Apr. 1980 134 p refs
(Contract DI-14-34-0001-9024)
(PB80-190317; W80-05407; OWRT-A-100-MICH(1)) Avail: NTIS HC A07/MF A01 CSCL 07D

The Red Cedar River was sampled and analyzed for halomethanes produced during the chlorination of wastewater that was discharged into the river. The development of a sewage tracer was investigated to provide a means to differentiate changes in haloform levels in the river due to dilution from those occurring as a result of volatization or adsorption. The methods researched were neutron activation analysis of europium, dysprosium and bromine, as well as a fluoresence and chloride ion tracer. The neutron activation methods were the most sensitive. Laboratory controlled haloform/oxygen gas transfer and adsorption experiments were conducted to predict the persistence of haloforms in a river system. Oxygen to haloform gas transfer ratios and a measured log sediment water partition coefficient were used to calculate Red Cedar River haloform volatization half lives. GRA

N80-32997# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Agronomy.
SORPTION PROPERTIES OF SEDIMENTS AND ENERGY-RELATED POLLUTANTS Final Report, Jul. 1977 - Dec. 1979
John J. Hassett, Jay C. Means, Wayne L. Banwart, and Susanne G. Wood Apr. 1980 50 p refs Prepared in cooperation with Maryland Univ., Solomons
(Contract EPA-68-03-2555)
(PB80-189574; EPA-600/3-80-041) Avail: NTIS
HC A03/MF A01 CSCL 07D

The factors that determine the extent of sorption of organic compounds that are representative of coal conversion waste streams are described. The compounds, all radiolabeled, were acetophenone; 1-naphthol; pyrene; 7,12-dimethylbenz(a) anthracene; 3-methylcholanthrene; dibenz(a,h)anthracene; acridine; 2,2'-biquinoline; 13H-dibenzo(a,i)carbazole; dibenzothiophene; benzidine; 2-aminoanthracene; 6-aminochrysene; and anthracene-9-carboxylic acid. Batch equilibrium isotherms were determined for each compound on 14 sediments and soils that had been collected from the Missouri, Illinois, Mississippi, and Ohio rivers and their watersheds. Laboratory procedures for determining octanol water partition coefficients and water solubilities were developed and then performed on the compounds. The sorption constants were correlated with soil and sediment properties and with the water solubilities and octanol water partition coefficients of the compounds. GRA

N80-32998# Great Lakes Basin Commission, Ann Arbor, Mich.
PHOSPHOROUS CONTROL STRATEGIES AT MUNICIPAL WASTEWATER TREATMENT PLANTS IN THE US GREAT LAKES BASIN Final Report
Timothy J. Monteith, RoseAnn C. Sullivan, and William C. Sonzogni Feb. 1980 43 p refs Sponsored in part by Water Resources Council
(PB80-191059; GLBC/GLEPS-14) Avail: NTIS CSCL 08H

The current status of municipal phosphorus (P) control programs in the Great Lakes basin is documented. Thus, state policy on reducing P from municipal wastewater treatment plants within the Great Lakes basin and the present rate of compliance with this policy was examined. Information on the current technologies presently in use for controlling P at municipal wastewater treatment plants was also compiled. Finally, reduction in municipal P loads to surface water are presented. GRA

N80-32999# Exxon Research and Engineering Co., Linden, N.J.
MINIPLANT AND BENCH STUDIES OF PRESSURIZED FLUIDIZED-BED COAL COMBUSTION Final Report, Aug. 1977 - Aug. 1979
R. C. Hoke, E. S. Matulevicius, M. Ernst, J. L. Goodwin, A. R. Garabrant, I. B. Radovsky, A. S. Lescarret, R. R. Bertrand, L. A. Ruth, and V. J. Siminski Jan. 1980 333 p refs
(Contract EPA-68-02-1312)
(PB80-188121; EXXON/GRU.18GFGS.79; EPA-600/7-80-013) Avail: NTIS HC A15/MF A01 CSCL 07A

Results of studies on the environmental aspects of the pressurized fluidized-bed coal combustion process are given. The process uses kg coal/hr continuous combustion sorbent regeneration Miniplant (0.63 MW equivalent), and a 13 kg coal/hr bench-scale system. GRA

N80-33000# Virginia Univ., Charlottesville. Dept. of Chemical Engineering.
SULFUR DIOXIDE OXIDATION IN SCRUBBER SYSTEMS Final Report, Jul. 1977 - Jun. 1979
J. L. Hudson Apr. 1980 257 p refs
(Contract EPA-R-805227)
(PB80-187842; EPA-600/7-80-083) Avail: NTIS HC A12/MF A01 CSCL 07D

The liquid phase oxidation kinetics of bisulfite and sulfite anions (determined in bench scale experiments) to conditions representative of limestone scrubbers used for the flue gas desulfurization is detailed. The chemical reaction rates were determined for clear solutions and slurries of calcium sulfite when gas to liquid transfer of oxygen was not a limiting resistance. A mathematical model was developed for the overall oxidation rate of calcium sulfite slurries, including solids dissolution and chemical reaction. The overall rate is shown to decline with increasing pH. The homogeneous chemical oxidation rate is 1.5 order and increases with pH. GRA

N80-33001# Martin Marietta Corp., Baltimore, Md. Environmental Center.
PERFORMANCE OF SIMPLE MODELS FOR STACK PLUME DISPERSION DURING CONVECTIVE CONDITIONS Final Report
Jeffrey C. Weil Apr. 1980 45 p refs
(PB80-191869; PPSP-MP-30) Avail: NTIS HC A03/MF A01 CSCL 04A

Tests of two simple approaches for predicting ground-level concentrations during unstable conditions, the Gaussian plume and the Venkatram models, are presented. The Gaussian model was chosen because of its widespread use and the controversy surrounding the choice of dispersion parameters used in it. The Pasquill-Gifford A and B stability classes and the Brookhaven National Laboratory B2 Class were tested. The Venkatram model is based on recent theoretical ideas concerning the structure of the convectively mixed layer and dispersion of pollutants within it. GRA

N80-33002# State Univ. of New York, Plattsburgh. Inst. for Man and Environment.
EFFICIENT ALGORITHMS FOR SOLVING SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS FOR ECOSYSTEM MODELING Final Report, Jul. 1977 - Aug. 1978
John Malanchuk, John Otis, and Hubert Bouver Mar. 1980 157 p refs Prepared in cooperation with Applied Physics Lab., Laurel, Md.
(Grant EPA-R-805452)
(PB80-190986; EPA-600/3-80-037) Avail: NTIS HC A08/MF A01 CSCL 06E

Three packages of subroutines for the numerical solution of systems of first order ordinary differential equations are presented. The three integration methods were chosen to provide an efficient means of solving the full range of initial value problems encountered in basin ecosystem modeling. The subroutines have been designed to handle all aspects of the numerical integration as automatically as possible so that their successful use does not require a sophisticated knowledge of the techniques of numerical analysis. After general introduction to the principles and concepts of numerical integration, the particular methods used in the codes are discussed in some detail. Full instructions for use are given, and some simple examples are presented. GRA

N80-33003# Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
SEDIMENT BACTERIA AS A WATER QUALITY INDICATOR IN THE LYNNHAVEN ESTUARY
Carl W. Erkenbrecher, Jr. Jun. 1980 125 p refs Prepared in cooperation with Old Dominion Univ., Norfolk
(PB80-192354; VPI-VWRRC-BULL-126; W80-05467; OWRT-A-080-Va-1) Avail: NTIS HC A06/MF A01 CSCL 06F

The sediment throughout the estuary had a broad range in total coliforms, fecal coliforms, and fecal streptococci. The densities of benthic indicator bacteria, when expressed on a volumetric basis, were significantly greater than counts in the overlying waters. These counts were indicative of a fecally polluted system. Based on calculated fecal coliform to fecal streptococci ratios, the primary sources of the Lynnhaven's bacterial pollution appeared to be typical of urban and agricultural runoff. The sediments in the Lynnhaven serve as a reservoir for indicator bacteria in densities sufficient to pose potential health hazards. Disturbance in the uppermost sediment layer could cause the resuspension of existing fecal pollution. The results of this study show the urgent need to study more closely the significance of disease causing bacteria in sediments characterized by high levels of fecal pollution. GRA

N80-33004# Hydrocomp, Inc., Mountain View, Calif.
USER'S MANUAL FOR HYDROLOGICAL SIMULATION PROGRAM: FORTRAN (HSPF) Final Report, Nov. 1976 - 30 Nov. 1978
Robert C. Johanson, John C. Imhoff, and Harley H. Davis, Jr. Apr. 1980 686 p
(Grant EPA-R-804971)
(PB80-191109; EPA-600/9-80-015) Avail: NTIS HC A99/MF A01 CSCL 08H

The Hydrological Simulation Program FORTRAN (HSPF) is a set of computer codes that can simulate the hydrologic, and associated water quality, processes on pervious and impervious land surfaces and in streams and well mixed impoundments. The manual discusses the modular structure of the system, the principles of structured programming technology, and the use of these principles in the construction of the HSPF software. In addition to a pictorial representation of how each of the 500 subprograms fits into the system, the manual presents a detailed discussion of the algorithms used to simulate various water quality and quantity processes. GRA

N80-33005# SRI International Corp., Menlo Park, Calif.
METHODOLOGIES TO CONDUCT REGULATORY IMPACT ANALYSIS OF AMBIENT AIR QUALITY STANDARDS FOR CARBON MONOXIDE Final Report
Waheed Siddiqee, Andre Dermant, and Robert Patterson Dec. 1979 92 p refs
(Contract EPA-68-02-2835)
(PB80-192461; SRI-6780; EPA-450/5-80-006) Avail: NTIS HC A05/MF A01 CSCL 13B

A methodology developed to analyze mobile source emission reductions needed to attain alternative proposed national ambient air quality standards for carbon monoxide is described. A costing routine is part of the procedure. The methodology was used in the carbon monoxide regulatory impact analysis for alternative national air standards. GRA

N80-33006# Southern Research Inst., Birmingham, Ala.
HIGH RESISTIVITY BEHAVIOR OF HOT-SIDE ELECTROSTATIC PRECIPITATORS Final Report, Oct. 1978 - Oct. 1979
Roy E. Bickelhaupt Apr. 1980 40 p refs
(Contract EPA-68-02-2610)
(PB80-193071; EPA-600/7-80-076) Avail: NTIS HC A03/MF A01 CSCL 13B

The buildup of a thin layer of sodium on depleted fly ash which has a high electrical resistivity near the collector plate is described. Experiments were done in a miniature corona discharge device under thermal and environmental conditions simulating a hot side electrostatic precipitator. Current density voltage curves were taken with positive negative corona using a hand placed

ash layer 5 mm thick. The effect on current density voltage relationships of: long exposure to negative corona, long exposure to positive corona, and cyclic exposure to negative and positive corona is evaluated. GRA

N80-33007# Industrial Environmental Research Lab., Research Triangle Park, N. C. Particulate Technology Branch.
TI-59 PROGRAMMABLE CALCULATOR PROGRAMS FOR IN-STACK OPACITY, VENTURI SCRUBBERS, AND ELECTROSTATIC PRECIPITATORS User Manual, Jul. 1978 - Jul. 1979
S. J. Cowen, D. S. Ensor, and L. E. Sparks May 1980 165 p refs
(Grant EPA-R-805650)
(PB80-193147; EPA-600/8-80-024) Avail: NTIS HC A08/MF A01 CSCL 13B

The basic concepts of in stack opacity as measured by in stack opacity monitors are explained. Calculator programs that model the performance of venturi scrubbers and electrostatic precipitators are included. The effect of particulate control devices on in stack opacity was predicted by using these programs. The size distribution data input was either in lognormal or histogram formal. The opacity was calculated using Deirmendjian's approximation to Mie series to obtain extinction efficiencies. An alternative opacity program employing the exact Mie series solution is described. GRA

N80-33008# Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.
CATALYST EFFECTIVENESS OF HIGH MILEAGE IN USE VEHICLES
Lois Platte Dec. 1979 15 p
(PB80-192776; EPA-AA-TEB-80-5) Avail: NTIS HC A02/MF A01 CSCL 13B

The inadequate performance of the catalyst due to the effects of deterioration from aging or mileage accumulation was analyzed. The useful life of light duty vehicles was defined as 50,000 miles or 5 years in Federal regulations. The effectiveness of the catalyst on vehicles that are beyond their useful life is drastically reduced. The higher mileage vehicles contribute to increased hydrocarbon levels since many catalyst equipped automobiles now on the road have reached the 5 year or 50,000 mile mark. GRA

N80-33009# Association of Bay Area Governments, Berkeley, Calif.
APPLICATION OF PHOTOCHEMICAL MODELS. VOLUME 1: THE USE OF PHOTOCHEMICAL MODELS IN URBAN OZONE STUDIES Final Report
Ronald Y. Wada, M. Jane Wong, Eugene Y. Leong, Lewis H. Robinson, Rob E. DeMandel, Tom E. Perardi, Michael Y. Kim, William H. Duewer, Steven D. Reynolds, and Larry E. Reid Dec. 1979 167 p refs Prepared in cooperation with Bay Area Air Quality Management District, San Francisco; California Univ., Lawrence Livermore Lab., and Systems Applications, Inc., San Rafael, Calif. 4 Vol.
(Contract EPA-68-02-3046)
(PB80-192495; EPA-450/4-79-025-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13B

Based largely on recent experience gained in photochemical model applications in the San Francisco Bay Area and in Denver, the guidance is directed toward potential model users in other ozone non attainment areas. The guidance covers the following tasks: model selection, data collection and model input preparation including meteorological and topographical data, emission inventory data, ambient air quality data, treatment of initial and boundary conditions, and special field studies; the evaluation of photochemical model performances; model applications; and interpretation of model results with respect to attainment of the Federal ozone standard. GRA

N80-33010# Fluidyne Engineering Corp., Minneapolis, Minn.
EFFECTIVE SAMPLING TECHNIQUES FOR PARTICULATE EMISSIONS FROM ATYPICAL STATIONARY SOURCES Final Report, Feb. 1977 - Jan. 1980
D. P. Saari and H. A. Hanson Jan. 1980 200 p refs
(Contract EPA-68-02-1796)
(PB80-185549; EPA-600/2-80-034) Avail: NTIS HC A09/MF A01 CSCL 13B

Sampling techniques for measuring particulate emissions from four 'atypical' stationary source categories were developed and evaluated. The categories included low effluent velocity streams, extended dimensions, partially or totally unconfined flow, and saturated gas streams or gas streams with entrained liquid droplets. Research included literature surveys, laboratory model testing, and field testing of instruments and techniques on three specific sources: gravity roof ventilators, grain dryers, and wet scrubbers. GRA

N80-33011# Southern Research Inst., Birmingham, Ala.
CHARGE MEASUREMENTS OF PARTICLES EXITING ELECTROSTATIC PRECIPITATORS Final Report, Oct. 1978 - Oct. 1979
J. R. McDonald, M. H. Anderson, and R. B. Mosley Apr. 1980 50 p refs
(Contract EPA-68-02-2610)
(PB80-187438; SORI-EAS-80-332; Rept-3858-10; EPA-600/7-80-077) Avail: NTIS HC A04/MF A01 CSCL 13B

Particle charging in positive and negative corona discharge is discussed as a function of temperature from 38 to 343 C in order to establish, especially at hot side electrostatic precipitator temperatures, the relative effectiveness of the two possible methods of charging. Charge values on individual particles exiting two laboratory ESP's were measured in an experimental apparatus utilizing a Millikan cell. Measurements were directed at the particles with radii between 0.3 and 1.5 micrometers. Measurements were obtained for redispersed fly ash particles carried in air temperatures from 38 to 343 C. GRA

N80-33012# Southwest Research Inst., San Antonio, Tex.
REGULATED AND UNREGULATED EXHAUST EMISSIONS FROM A MALFUNCTIONING THREE-WAY CATALYST GASOLINE AUTOMOBILE Final Report, Aug. 1978 - Nov. 1979
Charles M. Urban Jan. 1980 171 p refs
(Contract EPA-68-03-2692)
(PB80-187446; SWRI-11-5402; EPA-460/3-80-005) Avail: NTIS HC A08/MF A01 CSCL 13B

The laboratory effort to characterize regulated and unregulated exhaust emissions from a current model three-way catalyst equipped gasoline automobile operating under malfunction conditions is described. One automobile was evaluated over three driving schedules in the unmodified configuration and in four engine and/or emission control system malfunction configurations. Exhaust emission constituents measured in addition to the currently regulated emissions included: particulates, sulfates, aldehydes, sulfides, amines, metals and several additional elements and compounds. Additional evaluations, in each of the configurations, involved the measurement of the regulated emissions over four short-test procedures. GRA

N80-33013# Automotive Environmental Systems, Inc., Westminster, Calif.
A STUDY OF EXHAUST EMISSIONS FROM 1978-1980 MODEL YEAR THREE-WAY CATALYST VEHICLES IN LOS ANGELES Final Report
Lawrence L. Moore and Alan D. Jones EPA Mar. 1980 269 p
(Contract EPA-68-03-2889)
(PB80-187453; EPA-460/3-80-006) Avail: NTIS HC A12/MF A01 CSCL 13B

Exhaust emission data and other information obtained as a result of the testing and inspection of 350 in-use passenger cars is presented. The test fleet was made up of 1978, 1979 and 1980 automobiles manufactured by Ford, General Motors, Mazda, Saab, Toyota, Volkswagen/Audi and Volvo. Each vehicle was equipped with a three way catalyst control system. The test sequence consisted of the 1975 Federal test procedure (exhaust emissions only), a highway fuel economy test, a two-speed idle test, a Federal three mode test, and a loaded two mode test. After the initial test sequence, each vehicle was subjected to a thorough underhood inspection. GRA

N80-33014# Southern Research Inst., Birmingham, Ala.
PROCEEDINGS: ADVANCES IN PARTICLE SAMPLING AND MEASUREMENT Progress Report, Apr. - Nov. 1979

W. B. Smith ed. Jan. 1980 9 p refs Proc. held at Daytona Beach, Fla., Oct. 1979
(Contract EPA-68-02-3118)
(PB80-187487; EPA-600/9-80-004) Avail: NTIS
HC A02/MF A01 CSCL 13B

Equipment and techniques for sampling and characterizing particulate emissions and other aerosols are addressed. The inhalable particle size range (up to 15 micrometers) is emphasized, and the basis for selecting this range as a standard is discussed. Novel or improved equipment includes: virtual impactors; impactors for sampling high dust loadings; an impactor/quartz-crystal-microbalance combination used to sample stratospheric aerosols; a tapered-element oscillating microbalance for monitoring particulate emissions and aerosols; an automated piezoelectric microbalance for monitoring atmospheric aerosols; a hot-wire probe for measuring liquid droplets; sampling systems for measuring mass emissions; and more efficient sampling probe inlets. GRA

N80-33015# Wisconsin Univ. - Madison. Dept. of Civil and Environmental Engineering.
PERFORMANCE EVALUATION OF EXISTING AERATED LAGOON SYSTEM AT CONSOLIDATED KOSHKONONG SANITARY DISTRICT, EDGERTON, WISCONSIN Final Report, 20 Jul. 1975 - 30 Jun. 1977
Lawrence B. Polkowski Dec. 1979 125 p refs
(Grant EPA-R-803930)
(PB80-189681; EPA-600/2-79-182) Avail: NTIS
HC A06/MF A01 CSCL 13B

Aerated treatment lagoons are used throughout the United States to provide secondary treatment of municipal wastewaters. The data available to assess the performance of these systems are lacking partially as a result of the infrequent sampling and limited types of analyses performed. Evaluation of the performance of a well designed, three cell aerated lagoon system over a twelve month period is discussed. The Consolidated Koshkonong Sanitary District's treatment system in Wisconsin is subject to a climate with large seasonal variations. The treatment system performed well in removing BOD5 and total suspended solids as well as producing an effluent with acceptable pH and coliform counts. GRA

N80-33016# Oregon State Univ., Corvallis. Dept. of Civil Engineering.
ROCK FILTERS FOR REMOVAL OF ALGAE FROM LAGOON EFFLUENTS Final Report, 1977 - 1978
Gregory R. Swanson and Kenneth J. Williamson Mar. 1980 93 p refs
(Grant EPA-R-805416)
(PB80-190077; EPA-600/2-80-038) Avail: NTIS
HC A05/MF A01 CSCL 13B

Rock filtration was shown to be an effective, low cost unit process for removing algae from lagoon effluents and correspondingly upgrading lagoon treatment. Sedimentation is the primary mechanism of algal removal within rock filter. The settling rates of three species of algae common to lagoons were measured as varying from 0.02 to 0.3 m/day, depending on species and temperature. A mathematical model of the sedimentation mechanism was constructed based on discrete settling theory. A full scale horizontal flow operating rock filter designed for a maximum hydraulic loading of 0.28 cu m/cu m was evaluated. GRA

N80-33017# Southwest Research Inst., San Antonio, Tex. Dept. of Emissions Research.
REGULATED AND UNREGULATED EXHAUST EMISSIONS FROM MALFUNCTIONING NON-CATALYST AND OXIDATION CATALYST GASOLINE AUTOMOBILES Final Report, Dec. 1978 - Apr. 1979
Charles M. Urban Jan. 1980 308 p refs
(Contract EPA-68-03-2499)
(PB80-190473; EPA-460/3-80-003) Avail: NTIS
HC A14/MF A01 CSCL 13B

The laboratory effort to characterize regulated and unregulated exhaust emissions from non-catalyst and oxidation catalyst-equipped gasoline automobiles operating under malfunction conditions is described. One non-catalyst and four catalyst-equipped automobiles were evaluated over three driving schedules in the unmodified and in four engine and/or emission control system malfunction configurations. Exhaust emission constituents measured, in addition to the currently regulated emissions, include particulates, sulfates, aldehydes, sulfides, amines, metals and several additional elements and compounds. GRA

N80-33018# Environmental Protection Agency, Ann Arbor, Mich. Inspection and Maintenance Staff.
EFFECTS OF GASOHOL ON IDLE HC AND CO EMISSIONS
Thomas Darlington and Richard Lawrence Mar. 1980 19 p refs
(PB80-190655; EPA-AA-IMS/ST-80-4; TEB-80-13) Avail: NTIS HC A02/MF A01 CSCL 13B

A test program was run to investigate the effects of gasohol on CO and HC emissions on an I/M idle test. Three vehicles were set up to operate on either gasoline or gasohol. A Hamilton emissions analyzer was used to measure tailpipe emissions. CO emissions were varied in each of the cars by adjusting the idle mixture screw, and HC emissions were varied by inducing a misfire with a misfire generator. At each CO and HC value as specified in the program, the fuel was switched from gasoline to gasohol while its effect was noted on tailpipe emissions. The data obtained provided a basis for determining gasohol's ability to reduce CO and HC emissions for an idle test. GRA

N80-33019# Southern Research Inst., Birmingham, Ala.
A MATHEMATICAL MODEL OF ELECTROSTATIC PRECIPITATION, REVISION 2 Progress Report, Jan. 1978 - Dec. 1978
R. B. Mosley, M. H. Anderson, and J. R. McDonald Feb. 1980 402 p refs
(Contract EPA-68-02-2193)
(PB80-190994; SORI-EAS-80-065-Rev-2; EPA-600/7-80-034; SRI-3777-1) Avail: NTIS HC A18/MF A01 CSCL 13B

Modifications to a computer model of electrostatic precipitation (ESP) are described. The modifications include a new semi-empirical approximation procedure for predicting electrical conditions in an ESP. Comparisons between the results from the approximation procedure and more exact procedures are presented. A new integration procedure for calculating particle charge is also presented. Complete FORTRAN listings for the revised ESP model and the new subprograms are provided. Example problems are included. The modified model requires significantly less computer time than does the earlier model. Comparisons of results obtained using the earlier and the modified models over a wide range of possible ESP geometries and electrical operating points indicate that for practical purposes the modified model can be used in place of the more rigorous earlier model. GRA

N80-33020# Southwest Research Inst., San Antonio, Tex. Dept. of Emissions Research.
REGULATED AND UNREGULATED EXHAUST EMISSIONS FROM MALFUNCTIONING THREE-WAY CATALYST GASOLINE AUTOMOBILES Final Report, Aug. 1977 - Sep. 1979
Charles M. Urban Jan. 1980 241 p refs
(Contract EPA-68-03-2588)
(PB80-190804; EPA-460/3-80-004) Avail: NTIS
HC A11/MF A01 CSCL 13B

The laboratory effort to characterize regulated and unregulated exhaust emissions from three-way catalyst equipped gasoline automobiles operating under malfunction conditions is described. Three automobiles were evaluated over three driving schedules in the unmodified configuration and in four engine and/or emission control system malfunction configurations. Exhaust emission constituents measured, in addition to the currently regulated emissions, include: particulate, sulfates, aldehydes, sulfides, amines, metals, and several additional elements and compounds. Additional evaluations, in each of the configurations, involved the measurement of regulated emissions over four short cycle procedures. GRA

N80-33021# National Technical Information Service, Springfield, Va.
AIRCRAFT AIR POLLUTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jun. 1980

Diane M. Cavagnaro. Jul. 1980. 215 p. Supersedes NTIS/PS-79/0645 and NTIS/PS-78/0623.
(PB80-812332; NTIS/PS-79/0645; NTIS/PS-78/0623) Avail: NTIS. HC $30.00/MF $30.00. CSCL 04A.

Pollution control and abatement, emission data and emission factors, stratospheric pollution, effects the supersonic transport traffic have on the environment, and pollutant concentrations and movement around airports and flight corridors are discussed in this updated bibliography containing 209 citations, 65 of which are new entries to the previous edition. GRA

N80-33022# Performance Development Inst., Washington, D.C.
INCENTIVES FOR TECHNOLOGICAL INNOVATION IN AIR POLLUTION REDUCTION: AN ETIP POLICY RESEARCH SERIES. VOLUME 1: EMISSION OFFSET POLICY AT WORK. A SUMMARY ANALYSIS OF 8 CASES. Final Report.
William H. Foskett. Apr. 1980. 50 p. refs.
(Contract NBS-7-83603)
(PB80-187610; NBS-GCR-ETIP-80-86) Avail: NTIS. HC A03/MF A01. CSCL 13B.

The Emission Offset Interpretative Ruling is analyzed into its administrative components. Eight permit applications involving emission offsets provide data describing the administrative functioning of the offset policy in terms of these components. Offsets were easy to find, but the process for determining lowest achievable emission reduction was complex. Third parties promoting local economic development were an important factor in locating offsets. Technological innovation involved development of new control techniques and diffusion of known technology to uncontrolled sources of emissions. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-33023# Ohio State Univ., Columbus. Research Foundation.
POTENTIAL COEFFICIENT AND ANOMALY DEGREE VARIANCE MODELLING REVISITED
Richard H. Rapp. Sep. 1979. 23 p. refs.
(Contract F19628-79-C-0027)
(AD-A082322; AFGL-TR-79-0245; SR-2) Avail: NTIS. HC A02/MF A01. CSCL 08/14.

The decay of the power spectrum of the Earth's gravitational potential was modeled using the GEM 10B solution of NASA and a solution complete to degree 180 at OSU. The modelling was first done using the form of A/lambda sub B where A and B were parameters determined by various adjustment techniques. For degrees through 36, the best estimate of A is 10.6 x 10 to the -6 power and B = 2.17 based on the GEM 10B data. Earlier models by Kaula and Tscherning/Rapp contain too much power as compared to the actual field beyond degree 8. Anomaly degree variance models were also computed from the anomaly degree variances of the 180 solution and other data such as a point anomaly variance, and a horizontal gradient variance. With this data, it was found that the parameters of the earlier Tscherning/Rapp model are still valid provided a high gradient variance is acceptable. Excellent fit to all data types is obtained with the two component model suggested by Moritz. All models used are compared in terms of common parameters such as point anomaly variance, gradient variance, undulation variance and fits to observed potential coefficient variations. A.R.H.

N80-33024*# Lamont-Doherty Geological Inst., Palisades, N. Y.
THEORY OF TIME-DEPENDENT RUPTURE IN THE EARTH
Shamita Das and Christopher H. Scholz. 3 Sep. 1980. 53 p. refs.
(Grant NGR-33-008-146)
(NASA-CR-163567) Avail: NTIS. HC A04/MF A01. CSCL 08K.

Fracture mechanics is used to develop a theory of earthquake mechanism which includes the phenomenon of subcritical crack growth. The following phenomena are predicted: slow earthquakes, multiple events, delayed multiple events (doublets), postseismic rupture growth and afterslip, foreshocks, and aftershocks. The theory predicts a nucleation stage prior to an earthquake, and suggests a physical mechanism by which one earthquake may 'trigger' another. S.F.

N80-33025# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
IONOSPHERIC F-REGION RESPONSE TO GEOMAGNETIC STORMS, OVER BRAZILIAN LOW LATITUDE
M. A. Abdu, I. J. Kantor, E. R. DePaula, and A. C. Giese. Jul. 1980. 21 p. refs. Presented at the 32d Ann. Meeting of SBPC. Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico.
(INPE-1835-RPE/197) Avail: NTIS. HC A02/MF A01.

Ionosonde data from Cachoeira Paulista are analyzed to study the response of the ionospheric F region electron densities and heights to magnetic storm disturbances of moderate to strong intensity. The ionospheric response was found to be highly variable from one storm to another, depending upon the intensity, duration and the definitions of the different phases of the magnetic storm. Certain characteristics of the ionospheric response over Cachoeira Paulista are: in general, the ionosphere appears relatively more disturbed during the night than during the day; during the main phase of the magnetic storm, the F region maximum electron density generally presents significant enhancements; and significant depletion in the ionization occurs during the recovery phase of the storm. The changes in the height of the layer are not well defined, except in rare cases when it shows variations in opposite sense to that of the electron density. These results are interpreted in terms of the extension, to low latitude, of the storm induced midlatitude thermospheric disturbances in composition and transport. R.K.G.

N80-33026# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PLASMA IRREGULARITIES IN THE TROPICAL F-REGION DETECTED BY OI 7774 A AND 6300 A NIGHTGLOW MEASUREMENTS
Y. Sahai, J. A. Bittencourt, N. R. Teixeira, and H. Takahashi. Aug. 1980. 18 p. refs. Sponsored by Fundo Nacional de Desenvolvimento Cientifico e Technologico.
(INPE-1844-RPE/204) Avail: NTIS. HC A02/MF A01.

Simultaneous measurements of the permitted OI 7774 A and the forbidden OI 6300 A nightglow emissions were carried out. Both emissions were observed with tilting filter type photometers. During spread F conditions, both emissions showed simultaneous short time large intensity depletions, indicating the presence of large scale irregularities in the F regions. S.F.

N80-33027# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
WAVE DISTURBANCES IN THE LOW LATITUDE IONOSPHERE AND EQUATORIAL IONOSPHERE PLASMA DEPLETIONS
J. H. A. Sobral, M. A. Abdu, I. S. Batista, and C. J. Zamlutti. Jun. 1980. 16 p. refs. Presented at the 32d Ann. Meeting of the SBPC, Jul. 1980. Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico.
(INPE-1806-RPE/174) Avail: NTIS. HC A02/MF A01.

An isolated nighttime ionospheric wave disturbance was observed by a meridional scanning 6300 a photometer, a 6300 a zenith photometer, a 30 MHz ionometer and an ionosonde. Two different scale size for the disturbances are: a larger scale component easily identified in the ionometer data similar to those of a large scale TID and smaller scale disturbance observable in the scanning photometer data, occurring during the ascending phases of the larger scale waves. A Fourier analysis of the zenith airglow variations reveals a dominant period of about 104 minutes. No single dominant period is presented for the smaller scale waves. All waves have a poleward velocity component; the smaller scale waves show this feature more markedly. The equatorial source of the smaller scale disturbance suggests that these are perhaps the low altitude manifestations of the upward propagating field aligned plasma bubbles in the equatorial ionosphere. S.F.

N80-33028# Instituto de Pesquisas Especiais, Sao Jose dos Campos (Brazil).
GRAVITY WAVE INDUCED IONIZATION LAYERS IN THE NIGHT F-REGION AT LOW LATITUDES
M. A. Abdu, I. S. Batista, I. J. Kantor, and J. H. A. Sobral Jun. 1980 21 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1759-RPE/148) Avail: NTIS HC A02/MF A01

Ionosone observations over Cachoeira Paulista (22 S, 45 W) a low latitude station, show distorted h prime (f) traces in the ionograms due to passage of TID's. The disortions of the traces, at times take the form of an F-region bifurcated into two distinct layers. These effects are observed mostly during presunrise hours. The characteristics of the electron density and height oscillations suggest either presence of low energy (< 10 KeV) electron precipitation in the South Atlantic Geomagnetic Anomaly and/or ionization convergence due to horizontal shears in the gravity wave producting the TID's. Author

N80-33029# Instituto de Pesquisas Especiais, Sao Jose dos Campos (Brazil).
COMPARISON OF CHANGES IN THE IONOSPHERIC TOTAL ELECTRON CONTENT AT MID-LATITUDE LOCATIONS FEW HUNDRED KILOMETERS APART
R. P. Kane Jun. 1980 22 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1798-RPE/168) Avail: NTIS HC A02/MF A01

The changes in the ionospheric TEC (total electron content) at the three North American locations Stanford (37 N, 112 W), Clark Lake (33 N, 116 W) and Rosman (35 N, 83 W) are compared for about 280 days in 1971. Apart considerable day to day changes (approximation 30 percent) in the daily ranges of TEC even on quiet days at all the three locations, the changes at Stanford and Clark Lake differed between themselves sometimes by as much as 30 percent and those between this pair and Rosman by as much as 50 percent indicating random components of local origin of scales as small as a few hundred km and as large as a few thousand km. R.K.G.

N80-33030# Instituto de Pesquisas Especiais, Sao Jose dos Campos (Brazil).
SOME CHARACTERISTICS OF SPREAD F AT MAGNETIC EQUATORIAL STATION FORTALEZA
M. A. Abdu, I. S. Batista, and J. A. Bittencourt Jun. 1980 20 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico
(INPE-1758-RPE/147) Avail: NTIS HC A02/MF A01

Spread F in ionograms of both the range and frequency spread types is studied for the magnetic equatorial station Fortaleza (38 degrees W, 3 degrees S) for a one year period during 1978-79. The TID type disturbances in the evening equatorial ionosphere are found to be a necessary prerequisite for the generation of the instabilities giving rise to the range type spread F, whereas frequency type spread F is formed under different circumstances. Striking differences are noted in the spread F characteristics and related parameters over Fortaleza as compared to Huancayo and Jicamarca, situated within only 38 degrees in longitude west of Fortaleza. The post sunset maximum in winter is delayed by about one and a half hours with respect to other seasons over Fortaleza, as compared to Huancayo, where it occurs earlier in winter than in other seasons. Similar differences exist also in the prereversal peak near sunset in the vertical drift velocity (Vz) between Fortaleza and Jicamarca. S.F.

N80-33031# Instituto de Pesquisas Especiais, Sao Jose dos Campos (Brazil).
SEASONAL VARIATION OF OZONE IN THE MESOSPHERE
V. W. J. H. Kirchhoff, B. R. Clemesha, and D. M. Simonich Jun. 1980 18 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1800-RPE/170) Avail: NTIS HC A02/MF A01

The mesospheric ozone density at a height of 88 km was deduced from simultaneous ground based observations of neutral sodium density and sodium nightglow intensity, using a photochemical equilibrium model. Sodium densities were measured as a function of height between 76 and 106 km by laser radar, and the nightglow intensities by a tilting filter photometer. The ozone density shows a strong seasonal variation with well defined maxima at the equinoxes, and a mean annual value of 8 X 10 to the 7th power/cubic centimeter. The average nocturnal variation shows a factor of 2 increase between sunset and sunrise. S.F.

N80-33032# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SIMULTANEOUS MEASUREMENTS OF OH(9,4), (8,3), (7,2), (6,2) AND (5,1) BANDS IN THE AIRGLOW
H. Takahashi and P. P. Batista Jun. 1980 39 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1801-RPE/171) Avail: NTIS HC A03/MF A01

Band intensities and the rotational temperatures for the OH(9,4), (8,3), (7,2), (6,2) and (5,1) bands were measured by means of a multichannel tilting filter photometer at Cachoeira Paulista, Brazil. The nocturnal variations of the five bands show good correlation between them, but there are small differences in the amplitudes of the variations between the bands from the upper vibrational levels and those from the lower levels. The cross correlation between the band intensities show that the nocturnal variations of the upper vibrational bands lead those of the lower levels. Vibrational population rates and initial excitation rates for each vibrational level are calculated. An increase of the initial excitation rate in the v = 5 and v = 6 levels was observed. The different features of the intensity variations and the excitation rates of the lower vibrational levels suggest the existence of the mechanism HO2 + O yields OH + O2, capable of exciting OH to the v = 5 and v = 6 levels, in addition to the principal mechanism, assumed to be the reaction H + O3 yields OH + O2. R.K.G.

N80-33033*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
REGIONAL ANALYSIS OF EARTHQUAKE OCCURRENCE AND SEISMIC ENERGY RELEASE
S. C. Cohen Aug. 1980 16 p refs Submitted for publication
(NASA-TM-81994) Avail: NTIS HC A02/MF A01 CSCL 08K

The historic temporal variation in earthquake occurrence and seismic energy release on a regional basis throughout the world were studied. The regionalization scheme employed divided the world into large areas based either on seismic and tectonic considerations (Flinn-Engdahl Scheme) or geographic (longitude and latitude) criteria. The data set is the wide earthquake catalog of the National Geophysical Solar-Terrestrial Data Center. An apparent relationship exists between the maximum energy released in a limited time within a seismic region and the average or background energy per year averaged over a long time period. In terms of average or peak energy release, the most seismic regions of the world during the 50 to 81 year period ending in 1977 were Japanese, Andean South American, and the Alaska-Aleutian Arc regions. The year to year fluctuations in regional seismic energy release are greater, by orders of magnitude, than the corresponding variations in the world-wide seismic energy release. The b values of seismic regions range from 0.7 to 1.4 where earthquake magnitude is in the range 6.0 to 7.5. T.M.

N80-33034# RDP, Inc., Waltham, Mass.
DATA PROCESSING SUPPORT FOR EXPERIMENTAL STUDIES OF THE UPPER ATMOSPHERE Final Report, 5 Apr. 1977 - 31 Dec. 1979
Marcel Schneeberger, Harold Fish, Jacobus D. deClercq Zubli, Muriel C. Hervey, and Walter Gleason AFGL Feb. 1980 73 p refs
(Contract F19628-77-C-0167; AF Proj. 0993)
(AD-A087943; AFGL-TR-80-0076) Avail: NTIS HC A04/MF A01 CSCL 04/2

This report describes the data processing support provided to reduce a variety of rocket-, satellite-, falling sphere-, and balloon-borne sensor data for analysis by Air Force scientists engaged in atmospheric research projects. GRA

N80-33035# Naval Postgraduate School, Monterey, Calif. Environmental Physics Group.
OPTICAL AEROSOL SPECTROMETERS FACTORS AFFECT-

ING OPTICAL EXTINCTION PREDICTIONS Technical Report, May 1978 - Jun. 1979
G. E. Schacher, K. L. Davidson, and C. W. Fairall (BDM Corp.) 19 Apr. 1980 97 p refs Sponsored in part by California Air Resources Board
(AD-A087656; NPS61-80-013) Avail: NTIS
HC A05/MF A01 CSCL 04/1

Optical aerosol counters are used to measure aerosol spectra and thence to calculate the aerosol contribution of optical extinction. This report contains the results of field experiments and laboratory investigations of the performance of the NPS spectrometers. Areas of concern in the use of these spectrometers and the subsequent calculations are identified and discussed. In general the spectrometer performance is adequate for use in predicting the performance of overocean optical systems. GRA

N80-33036# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
INTERPRETATION OF DATA FROM UPHOLE REFRACTION SURVEYS Final Report
Arley G. Franklin Jun. 1980 73 p refs
(AD-A087775; WES/MP/GL-80-5) Avail: NTIS
HC A04/MF A01 CSCL 17/10

The conventional interpretation of the data from an uphole refraction survey is based on the similarity between a plot of contours drawn on uphole arrival times and a wave-front diagram, which shows successive positions of the wave front produced by a single shot location at the ground surface. However, the two are alike only when the ground consists solely of homogeneous strata, oriented either horizontally or vertically. In this report, the term 'Meissner diagram' is used for the plot of arrival times from the uphole refraction survey in order to maintain the distinction between it and a true wave-front diagram. Where departures from the case of homogeneous, horizontal strata exist, the interpretation of the Meissner diagram is not straightforward, although a partial interpretation in terms of a horizontally stratified system is usually possible. A systematic approach to the interpretation problem, making use of such a partial interpretation, is proposed. GRA

N80-33037# Naval Research Lab., Washington, D. C.
ON 11 CM IRREGULARITIES DURING EQUATORIAL SPREAD F Interim Report
J. D. Huba 17 Jul. 1980 23 p
(RR00330244)
(AD-A087751; AD-E000501; NRL-MR-4271) Avail: NTIS
HC A02/MF A01 CSCL 17/9

The recent Kwajalein radar backscatter observation of 11 cm irregularities at high altitudes (approximately 500 km) during equatorial spread F are explained in terms of the kinetic lower-hybrid-drift instability. The absence of radar backscatter from 11 cm irregularities at lower altitudes (approximately 240 km) is attributed to the stabilizing influence of electron-neutral collisions. GRA

N80-33038# Air Force Geophysics Lab., Hanscom AFB, Mass. Composition Branch.
ION PRODUCTION IN THE D-REGION Interim Report
William Swider 14 May 1980 20 p refs
(AF Proj. 2310)
(AD-A085533; AFGL-TR-80-0156) Avail: NTIS
HC A02/MF A01 CSCL 04/1

Ionization processes for the D region are reviewed. Levels of ionization range from the fairly steady rates produced through galactic cosmic rays to the large rates generated during solar flares and associated geomagnetic storms. The normal quiescent daytime D region is ionized by solar UV radiation available because of certain windows and solar X-rays, although this latter source is generally weak. Cosmic rays are important roughly below 65 km. At night, stellar X-ray sources may be important along with precipitating electrons at high latitudes from the magnetosphere. Solar flares can result in ionization rates due to X-rays, electrons or nuclei which are greatly enhanced over quiet conditions. Typical ionization production rates from these various sources are illustrated. J.M.S.

N80-33039# Naval Research Lab., Washington, D. C.
THE MICROWAVE APPLICATIONS THEORY PROGRAM AT NRL AND SOME CHEMISTRY CODE APPLICATIONS TO IONOSPHERIC HEATING BY MICROWAVE RADIATION Interim Report
A. W. Ali 26 Aug. 1980 35 p refs
(WF34372501)
(AD-A088275; NRL-MR-4302) Avail: NTIS
HC A03/MF A01 CSCL 04/1

A brief outline of the Microwave Applications program at NRL is presented. The goal of the program is to develop comprehensive codes for microwave air breakdown and microwave interaction with matter which can easily be applied for a wide range of applications. Also presented are results of microwave energy deposition in the ionosphere using the NRL Master Code for the disturbed E and F regions. Time histories of oxygen metastable states are presented for several levels of microwave power. From these, emission at 5577 A and 6300 A can be obtained. GRA

N80-33040# Aeronautical Research Associates of Princeton, Inc., N. J.
RESONANT INTERACTIONS OF SURFACE AND INTERNAL GRAVITY WAVES
Harvey Segur 1980 9 p refs
(Contract N00014-80-C-0048)
(AD-A088324; ARAP-TM-80-10) Avail: NTIS
HC A02/MF A01 CSCL 20/4

A stably stratified, two-layer fluid system with a free surface admits resonant triads, including ones involving one surface and two internal waves. Resonant triads that couple surface and internal gravity waves are thought to play an important role in transferring energy from wind-generated surface waves to internal waves. Ball used a geometric construction to show that the linearized dispersion relation for a two-layer liquid system with a free upper surface and no stream velocity admits resonant triads. GRA

N80-33041*# Rice Univ., Houston, Tex.
QUANTITATIVE SIMULATION OF A MAGNETOSPHERIC STORM. 3: PLASMASPHERIC ELECTRIC FIELDS AND EVOLUTION OF THE PLASMAPAUSE
R. W. Spiro, M. Harel, R. A. Wolf, and P. H. Reiff 25 Jan. 1980 48 p refs
(Grant NGR-44-006-137; Contract F19628-77-C-0005; Grant NSF ATM-74-21185; AF Proj. 2311)
(NASA-CR-163455; AD-A087948; SR-4; AFGL-TR-80-0130)
Avail: NTIS HC A03/MF A01 CSCL 04/1

Results of the Rice University substorm simulation have been used to investigate the penetration of substorm-associated electric fields into the plasmasphere. Near 4 R(E) in the equatorial plane, our time-dependent electric field model is characterized by eastward components in the dusk-midnight local time sector and westward components after midnight. Except for a small region just before dusk the model predicts eastward electric field components throughout the daytime sector. The characteristic radial component is directed inward at all local times except for a small region just after dawn. These results compare favorably with available whistler and incoherent scatter measurements obtained during magnetically disturbed periods. By assuming an initial plasmapause shape and by following the computed E x B drift trajectories of plasma flux tubes from that initial boundary we have examined the short-term evolution of the plasmapause during the substorm-like event of 19 September 1976. We find that narrow filamentary tails can be drawn out from the plasmasphere near dusk within hours of substorm onset. These tail-like appendages to the plasmasphere subsequently drift rapidly from the dust sector toward the daytime magnetopause. Investigation of the large-scale time-dependent flow of plasma in the evening sector indicates that some mid-latitude plasma flux tubes that drift eastward past the dusk terminator reverse their motion between dusk and midnight and begin to drift westward toward dusk. Such time-dependent changes in flow trajectories may be related to the formation of F-region ionization troughs. GRA

N80-33042# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.
ATMOSPHERIC TRANSMITTANCE/RADIANCE: COMPUTER CODE LOWTRAN 5

F. X. Kneizys, E. P. Shettle, W. O. Gallery, J. H. Chetwynd, Jr., L. W. Abreu, R. A. McClatchey, R. W. Fenn, and J. E. A. Selby 21 Feb. 1980 228 p refs
(AF Proj. 7670)
(AD-A088215; AFGL-TR-80-0067; AFGL-ERP-697) Avail: NTIS HC A11/MF A01 CSCL 04/1

This report describes a computer code for predicting atmospheric transmittance and the thermal radiation emitted by the atmosphere and Earth from 350 to 40,000 per cm at a spectral resolution of 20 per cm. The program is based on the LOWTRAN 4 (1978) computer code. New altitude and relative humidity dependent aerosol models and new fog models are included in the code. In addition, the new code structure consists of a main program and 19 subroutines. The computer code contains representative (geographical and seasonal) atmospheric models and representative aerosol models with an option to replace them with user derived or measured values. The program can be run in one of two modes, namely, to compute only atmospheric transmittance or both atmospheric transmittance and radiance for any given slant path geometry. GRA

N80-33043# Air Force Global Weather Central, Offutt AFB, Nebraska.
GEOMAGNETIC INDEX CALCULATION AND USE AT AFGWC
Robert D. Prochaska Apr. 1980 34 p refs
(AD-A088234; AFGWC/TN-80/002) Avail: NTIS HC A03/MF A01 CSCL 08/14

At Air Force Global Weather Central (AFGWC) several geomagnetic indices to specify the state of the magnetosphere were used. In this paper it introduces the indices of geomagnetic activity most commonly in use by DOD agencies. It discusses the procedures used at AFGCW to compute the indices and briefly describes the uses of each one. GRA

N80-33044# California State Univ. at Long Beach.
PRECISION GRAVITY STUDIES AT CERRO PRIETO: THE SECOND YEAR
R. B. Grannell, D. W. Tarman (California Polytechnic Inst., Pomona), R. C. Clover, R. M. Leggewie, P. S. Aronstam, R. C. Kroll, and J. Eppink (California Polytechnic Inst., Pomona) 1979 5 p refs Presented at 2d Symp. on the Cerro Prieto Geothermal Field, Baja Calif., Mexico, 17-19 Oct. 1979 Sponsored in part by Comision Federal de Electricidad
(Contract W-7405-eng-48)
(LBL-9551; CONF-7910166-5) Avail: NTIS HC A02/MF A01

Precision gravity measurements were initiated at Cerro Prieto in 1978. Interpretation of the first annual repetition of the measurements is presented. Field procedures, data reduction, and data interpretation are reviewed briefly. DOE

N80-33045# SRI International Corp., Menlo Park, Calif.
AIRBORNE MEASUREMENTS OF STRATOSPHERIC OZONE INTRUSIONS INTO THE TROPOSPHERE OVER THE UNITED STATES. VOLUME 1: DATA ANALYSIS AND INTERPRETATION Final Report
William Viezee, Warren B. Johnson, and Hanwant B. Singh Sep. 1979 142 p refs
(SRI Proj. 6690)
(PB80-185788; CRC-APRAC-CAPA-15-76A-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 04A

The magnitude, variability, and sources of natural ozone occurring in rural locations, both at the ground and aloft were investigated. Two field programs using an instrumented aircraft were carried out to investigate the downward vertical transport of ozone rich air from the stratosphere as a potential cause of natural tropospheric ozone. The field programs are described and the analysis and interpretation of the collected data are presented. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-33046*# National Aeronautics and Space Administration, Wallops Flight Center, Wallops Island, Va.
AN ATLAS OF 1977 AND 1978 GEOS-3 RADAR ALTIMETER DATA FOR TROPICAL CYCLONE STUDIES
H. Ray Stanley (EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.) and Ronald L. Taylor Aug. 1980 229 p refs
(Contract NAS6-2639)
(NASA-TM-73288) Avail: NTIS HC A11/MF A01 CSCL 04B

All of the GEOS 3 satellite altimeter schedule information were collected with all of the available 1977 and 1978 tropical cyclone positional information. The time period covers from March 23, 1977 through Nov. 23, 1978. The geographical region includes all ocean area north of the equator divided into the following operational areas: the Atlantic area (which includes the Caribbean and Gulf of Mexico); the eastern Pacific area; the central and western Pacific area; and the Indian Ocean area. All available source material concerning tropical cyclones was collected. The date/time/location information was extracted for each disturbance. This information was compared with the GEOS 3 altimeter ON/OFF history information to determine the existence of any altimeter data close enough in both time and location to make the data potentially useful for further study (the very liberal criteria used was time less than 24 hours and location within 25 degrees). Geographic plots (cyclone versus GEOS 3 orbit track) were produced for all of the events found showing the approximate location of the cyclone and the GEOS 3 orbit traces for the full day. T.M.

N80-33047*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
A 94/183 GHz MULTICHANNEL RADIOMETER FOR CONVAIR FLIGHTS Final Technical Report, 6 Apr. 1978 - 2 Feb. 1979
J. A. Gagliano, J. A. Stratigos, R. E. Forsythe, and J. M. Schuchardt Jan. 1979 243 p
(Contract NAS5-24480)
(NASA-CR-160032) Avail: NTIS HC A11/MF A01 CSCL 14B

A multichannel 94/183 GHz radiometer was designed, built, and installed on the NASA Convair 990 research aircraft to take data for hurricane penetration flights, SEASAT-A underflights for measuring rain and water vapor, and Nimbus-G underflights for new sea ice signatures and sea surface temperature data (94 GHz only). The radiometer utilized IF frequencies of 1, 5, and 8.75 GHz about the peak of the atmospheric water vapor absorption line, centered at 183.3 GHz, to gather data needed to determine the shape of the water molecule line. Another portion of the radiometer operated at 94 GHz and obtained data on the sea brightness temperature, sea ice signatures, and on areas of rain near the ocean surface. The radiometer used a multiple lens antenna/temperature calibration technique using 3 lenses and corrugated feed horns at 94 GHz and 183 GHz. Alignment of the feed beams at 94 GHz and 183 GHz was accomplished using a 45 deg oriented reflecting surface which permitted simultaneous viewing of the feeds on alternate cycles of the chopping intervals. Author

N80-33048*# Indian Space Research Organization, Bangalore. Meteorological Dept.
THE MONSOON EXPERIMENT MONEX
P. K. Das Sep. 1979 13 p Sponsored by NASA
(NASA-CR-163509; ISRO-SN-08-79) Avail: NTIS HC A02/MF A01 CSCL 04B

The effects of monsoons in different parts of the world on the Earth's atmosphere were studied by MONEX, India's Monsoon Experiment program. Data were gathered from meteorological satellites, sounding rockets, aircraft, land and shipborne stations. S.F.

N80-33049# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STEPWISE LINEAR REGRESSION EXPERIMENTS IN 14- AND 19-DAY HEMISPHERIC WEATHER PREDICTION
S. Srivatsangam Jun. 1980 9 p refs Presented at the Intern. Symp. on Statist. and Probabilistic Weather Prediction, Nice, 8-12 Sep. 1980

(Contract N00228-76-C-3205)
(INPE-1757-RPE/146) Avail: NTIS HC A02/MF A01

The zonal variance of the heights of constant pressure surfaces in the atmosphere is taken to be Markovian, i.e., unpredictable over long times by its own history. It is shown through cross correlation and multiple regression that the zonal variance is predictable over long times at a given location, through its lagged cross correlation at other locations. Author

N80-33050# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A CLIMATOLOGICAL STUDY OF THE TROPOSPHERIC CIRCULATION OVER THE AMAZON REGION
Vernon E. Kousky and Mary T. Kagano Jun. 1980 37 p refs Submitted for publication
(INPE-1761-RPE/150) Avail: NTIS HC A03/MF A01

Climatological and monthly means are computed for radiosonde data at Manaus and Belem (1968-1976). Geopotential height and wind data at upper levels show evidence of the meridional movement of a strongly divergent high pressure system associated with the area of maximum convection. At low levels, the winds, particularly at Manaus, show an annual cycle linked to the meridional displacement of the equatorial trough and its accompanying area of maximum convection (upper level high pressure system). On the average, the precipitable water (Pw) is greater at Manaus than at Belem. Evidence is presented indicating that this is not always the case and that considerable diurnal variation in Pw exists at each station. Mean monthly vertical motions are calculated for the area within the triangle formed with Belem, Manaus and Vilhena as the vertices. These vertical motions show a strong relationship to monthly rainfall totals within the triangle indicating that interannual and monthly rainfall variations may be due to large scale atmospheric circulation changes. Author

N80-33051# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MESOSPHERIC WINDS FROM LIDAR OBSERVATIONS OF ATMOSPHERIC SODIUM
B. R. Clemesha, V. W. J. H. Kirchhoff, D. M. Simonich, and P. P. Batista Jun. 1980 14 p refs Submitted for publication Sponsored by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1811-RPE/179) Avail: NTIS HC A02/MF A01

Laser radar observations of the atmospheric sodium layer made by various groups of workers during the past decade show that the layer exhibits considerable time varying structure. Horizontally spaced measurements of this structure, and use of the results of these observations to derive horizontal velocities in the height range 82 to 99 km are described. The measurements were made with a steerable lidar operating at a fixed zenith angle of 20.9 deg and pointed at each of three azimuths in turn, the complete sequence taking five minutes. The azimuths were chosen such that the intersections of the lidar beam with the sodium layer formed a triangle with approximately 60 km sides. The velocities calculated from the derived time shifts were found to vary with height in an oscillatory manner, with amplitude increasing with height. The E-W component showed a vertical wavelength of approximately 10 km, the N-S component a wavelength of 5 km, and the magnitude of the velocity varied between 6 and 146 m/sec. Author

N80-33052# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VERTICAL VELOCITY FORCED BY TOPOGRAPHY IN THE SOUTHERN HEMISPHERE
Rubens Leite Vianello (Univ. Federal de Vicosa, Brazil) and V. Brahmananda Rao Mar. 1980 16 p refs Submitted for publication Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1691-RPE/119) Avail: NTIS HC A02/MF A01

Vertical component of wind forced topography in the Southern Hemisphere is calculated using the equation given by Saltzman and Irsch. The contributions of zonal deviations of wind and zonal mean are contained in the equation. The vertical velocity, forced by topography in the Southern Hemisphere is comparable to that in the Northern Hemisphere. In the Northern Hemisphere, the zonal deviations of wind contribute significantly to the vertical velocity. R.K.G.

N80-33053# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WORKSHOP ON DROUGHT FORECASTING FOR NORTHEAST BRAZIL
Joseph Smagorinsky (NOAA, Princeton, N.J.), Herbert Riehl (Cooperative Inst. for Research in Environmental Sciences), Jagadish Shukla, James Rasmussen (WMO, Geneva), John O. Roads (Scripps Inst. of Oceanography, La Jolla, Calif.), Stefan Hastenrath (Wisconsin Univ., Madison), and William M. Gray (Colorado State Univ., Fort Collins) Sao Jose dos Campos, Brazil Inst. de Pesquisas Espaciais May 1980 69 p refs Workshop held in Sao Jose dos Campos, Brazil, 11-15 Feb. 1980; sponsored in part by the Programa de Tropico Semi-Arido
(INPE-1750-RPE/143) Avail: NTIS HC A04/MF A01

Precipitation forecasting parameters for northeast Brazil were developed. Hydrological, sociological, and economic aspects were examined. A drought forecasting model is presented. T.M.

N80-33054*# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
RELATION BETWEEN WEST COASTAL RAINFALL AND NIMBUS-6 SCAMS LIQUID WATER DATA OVER THE NORTHEASTERN PACIFIC OCEAN Final Report, Mar. 1978 - Jan. 1979
W. Viezee and H. Shigeishi Jan. 1979 21 p refs Presented at the 4th NASA Weather and Climate Program Sci. Rev., Greenbelt, Md., 24-25 Jan. 1979
(Contract NAS5-24450)
(NASA-CR-160031; Rept-7273) Avail: NTIS HC A02/MF A01 CSCL 04B

The application to rainfall prediction of cloud liquid water data obtained from the SCAMS experiment of Nimbus-6 is explored. The study area is the Pacific Northwest coast of the United States, where rainfall is produced by extratropical storms that approach from across the Pacific Ocean. The SCAMS data related to cloud liquid water over the ocean, and coastal rainfall data, are analyzed for 20 different storm systems in the northeastern Pacific Ocean; these produced significant rainfall from Washington to central California during the period October 1975 through March 1976. Results show that the distribution of storm cloud water analyzed from the SCAMS data over the ocean foreshadows the distribution of coastal rainfall accumulated from the storm at a later time. It is concluded that passive microwave sensor measurements of cloud water over the ocean, when used in conjunction with numerical and other objective guidance, can be used to enhance the accuracy of predictions of coastal rainfall distribution. Limitations in the SCAMS measurements and in the data analysis and interpretation are noted. J.M.S.

N80-33055*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
HIGH RESOLUTION INFRARED RADIATION SOUNDER/MOD 2 (HIRS/2) Final Project Report, 1976 - 1979
Edward W. Koenig et al Aug. 1979 41 p refs
(Contract NAS5-23567)
(NASA-CR-160030) Avail: NTIS HC A03/MF A01 CSCL 04B

The HIRS/2 is provided for the TIROS-N series of operational meteorological satellites. The instrument features 20 spectral channels, including visible (.7 micron), shortwave (3.7 to 4.6 micron), and longwave (6.7 to 15 micron). Radiance data aids determination of vertical temperature profiles, water vapor, and ozone distribution. System performance and test results are described. J.M.S.

N80-33056*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Space Dept.
MULTI-YEAR SLANT PATH RAIN FADE STATISTICS AT 28.56 AND 19.04 GHz FOR WALLOPS ISLAND, VIRGINIA
Julius Goldhirsh Dec. 1979 51 p refs
(NASA Order S-50748-A)
(NASA-CR-160027; APL/JHU-S1R79U-035) Avail: NTIS HC A04/MF A01 CSCL 04B

Multiyear rain fade statistics at 28.56 GHz and 19.04 GHz were compiled for the region of Wallops Island, Virginia covering

the time periods, 1 April 1977 through 31 March 1978, and 1 September 1978 through 31 August 1979. The 28.56 GHz attenuations were derived by monitoring the beacon signals from the COMSTAR geosynchronous satellite, D sub 2 during the first year, and satellite, D sub 3, during the second year. Although 19.04 GHz beacons exist aboard these satellites, statistics at this frequency were predicted using the 28 GHz fade data, the measured rain rate distribution, and effective path length concepts. The prediction method used was tested against radar derived fade distributions and excellent comparisons were noted. For example, the rms deviations between the predicted and test distributions were less than or equal to 0.2dB or 4% at 19.04 GHz. The average ratio between the 28.56 GHz and 19.04 GHz fades were also derived for equal percentages of time resulting in a factor of 2.1 with a .05 standard deviation.
Author

N80-33057*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WEATHER AND CLIMATE NEEDS FOR LIDAR OBSERVATIONS FROM SPACE AND CONCEPTS FOR THEIR REALIZATION
David Atlas and C. Lawrence Korb Jun. 1980 55 p refs Presented at the OSA Conf. on Coherent Laser Radar for Atmospheric Sensing, Aspen, Colo., 15-17 Jul. 1980 Submitted for publication
(NASA-TM-82006) Avail: NTIS HC A04/MF A01 CSCL 04B

The spectrum of weather and climate needs for Lidar observations from space is discussed with emphasis on the requirements for wind, temperature, moisture, and pressure data. It is shown that winds are required to realistically depict all atmospheric scales in the tropics and the smaller scales at higher latitudes, where both temperature and wind profiles are necessary. The need for means to estimate air-sea exchanges of sensible and latent heat also is noted. A concept for achieving this through a combination of Lidar cloud top heights and IR cloud top temperatures of cloud streets formed during cold air outbreaks over the warmer ocean is outlined. Recent theoretical feasibility studies concerning the profiling of temperatures, pressure, and humidity by differential absorption Lidar (DIAL) from space and expected accuracies are reviewed. An alternative approach to Doppler Lidar wind measurements also is presented. The concept involves the measurement of the displacement of the aerosol backscatter pattern, at constant heights, between two successive scans of the same area, one ahead of the spacecraft and the other behind it a few minutes later. Finally, an integrated space Lidar system capable of measuring temperature, pressure, humidity, and winds which combines the DIAL methods with the aerosol pattern displacement concept is described. J.M.S.

N80-33058# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
QUANTITATIVE PRECIPITATION FORECASTS [PREVISAO QUANTITATIVA DE PRECIPITACAO]
Luiz Carlos Baldicero Molion and Eduardo Engel Jun. 1980 19 p refs In PORTUGUESE; ENGLISH summary Presented at the 32d Reuniao Anual da SBPC, 6-12 Jul. 1980 Submitted for publication
(INPE-1809-RPE/1977) Avail: NTIS HC A02/MF A01

The forecast of the amount of rain to be produced by synoptic or convective weather system was developed. A review of methods used for (Quantitative Precipitation Forecast), including those which employ numerical weather prediction models, meteorologial satellite imagery and radar echoes is presented. An outlook of Brazil's position in this field and an alternative for establishing an operational QPF in the country, with the actual resources are also discussed. T.M.

N80-33059# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO) MONTEREY FAA, MONTEREY, CALIFORNIA,, PARTS A, C-F Final Report
24 Jul. 1980 395 p
(AD-A087826; USAFETAC/DS-80/066) Avail: NTIS HC A17/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Monterey FAA, Monterey, CA. It contains the following parts: (a) Weather Conditions; Atmospheric Phenomena; (b) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (c) Surface Winds; (d) Ceiling versus Visibility; Sky Cover; (e) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet bulb temperature depression versus dry bulb temperature, means and standard deviations of dry bulb, wet bulb and dew point temperatures and relative humidity); and (f) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-33060# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
MCCHORD AFB, WASHINGTON. REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
20 Jun. 1980 432 p
(AD-A087812; USAFETAC/DS-80/052) Avail: NTIS HC A19/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for McChord AFB, WA. It contains the following parts: (a) Weather Conditions; Atmospheric Phenomena; (b) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (c) Surface winds; (d) Ceiling versus Visibility; Sky Cover; (e) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet bulb temperature depression versus dry bulb temperature, means and standard deviations of dry bulb, wet bulb and dew point temperatures and relative humidity); and (f) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-33061# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
MISAWA AB, JAPAN. REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-E Final Report
3 Jul. 1980 396 p
(AD-A087824; USAFETAC/DS-80/064) Avail: NTIS HC A17/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Misawa AB, JP. It contains the following parts: (A) Weather Conditions; Atmospheric Phenomena; (B) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (C) Surface winds; (D) Ceiling versus Visibility; Sky Cover; (E) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet bulb temperature depression versus dry bulb temperature, means and standard deviations of dry bulb, wet bulb and dew point temperatures and relative humidity); and (F) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-33062# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
LORING AFB, CARIBOU, MAINE. REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
27 Jun. 1980 479 p
(AD-A087823; USAFETAC/DS-80/063) Avail: NTIS HC A21/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Loring AFB, Caribou, Maine. It contains the following parts: (1) weather conditions; atmospheric phenomena; (2) precipitation, snowfall and snow depth (daily amounts and extreme values); (3) surface winds; (4) ceiling versus visibility; sky cover; (5) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum

temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (6) pressure summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-33063# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
KINGSLEY FIELD, KLAMATH FALLS, OREGON. REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
16 Jul. 1980 456 p
(AD-A087825; USAFETAC/DS-80/065) Avail: NTIS
HC A20/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Kingsley Field, Klamath Falls, Oregon. It contains the following parts: (1) weather conditions; atmospheric phenomena; (2) precipitation, snowfall and snow depth (daily amounts and extreme values); (3) surface winds; (4) ceiling versus visibility; sky cover; (5) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (6) pressure summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-33064# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
DEVELOPMENT OF TECHNIQUES TO SPECIFY CLOUDINESS AND RAINFALL RATE USING GOES IMAGERY DATA Final Report
Stuart H. Muench and Thomas J. Keegan Oct. 1979 46 p refs
(AF Proj. 6670)
(AD-A084757; AFGL-TR-79-0255; AFGL-ERP-687) Avail: NTIS HC A03/MF A01 CSCL 04/2

Methods of introducing digitized satellite imagery into short range, objective forecasting operations are presented. The data archive being assembled for this study is described, with particular attention given to the steps taken to maximize the accuracy of the satellite imagery. These steps included fine tuning the navigation and selecting procedures for normalizing the data by correcting for the effects of Lambertian and anisotropic scattering. Consistency of the data, spatial and temporal, was tested by analysis of ground reflectance during cloudless days, and a pilot test of the specification of single layers of clouds was conducted. Both of these tests gave envouraging results. An investigation of specifying precipitation rate, using just the visible reflectance and infrared temperature of the cloud top, also produced good results. Author

N80-33065# Federal Aviation Administration, Atlantic City, N.J.
THE EFFECT OF THE WESTERN UNION WEATHER DATA SYSTEM ON THE PREFLIGHT BRIEFING POSITION AT THE CHICAGO FLIGHT SERVICE STATION Final Report, Aug. 1975 - May 1978
Ephraim Shochet, James D. Talotta, and Robert P. Holladay Jul. 1980 29 p ref
(AD-A088415; FAA-CT-79-55; FAA-RD-80-23) Avail: NTIS
HC A03/MF A01 CSCL 17/7

An experiment utilizing a 'before/after' research design was conducted to determine the effect of the Western Union Weather Data System (WDS) on the preflight briefing position at the Chicago, Illinois, Flight Service Station (FSS). Specialist activity was recorded by making written annotations on a moving paper chart called a kymograph. The average length of time spent in each activity prior to the installation of automated equipment was compared to the time spent in the same activity after automation. In addition, a questionnaire survey and personal interviews with specialists were conducted in the 'after' period. The data obtained from the specialist opinion survey indicate that the WDS improved the quality of flight information service to the user pilot and improved job satisfaction for the specialist. The objective data was congruent with and in the same direction as the data that was obtained from the specialist opinion survey. However, the specialists perceived a greater reduction in workload than was measured in the before and after comparison of preflight briefing times. GRA

N80-33066# Maryland Univ., College Park. Dept. of Meteorology.
THE MICROCLIMATE OF A TROPICAL EVERGREEN FOREST Preliminary Final Report, 15 Jul. 1976 - 31 Dec. 1979
R. T. Pinker and O. E. Thompson Aug. 1980 101 p refs
(Grant DAAG29-76-G-0292)
(AD-A088059; ARO-13660.4-GS) Avail: NTIS
HC A06/MF A01 CSCL 04/2

Selected results of a three year project to study the climatological and micrometeorological conditions in a tropical evergreen forest, are summarized in this report. The forest area under study is in the interior of Thailand and is influenced by a cool, dry northeast monsoonal flow in the winter and a warm, moist southwest monsoonal flow in the summer. Information collected during a three year field program included ground stations temperature, relative humidity, precipitation, evaporation, hours of sunshine and tower measurements of temperature, dew point temperature, wind velocity, incoming and reflected solar radiation, incoming and outgoing infrared radiation, spectral radiation and sub-surface temperature profiles in the forest and in a cleared area within the forest. GRA

N80-33067# Naval Research Lab., Washington, D. C.
NUMERICAL SIMULATION OF THE INFLUENCE OF SEA-SURFACE TEMPERATURE ON TRANSLATING TROPICAL CYCLONES Interim Report
Simon W. Chang and Rangarao V. Madala 17 Jul. 1980 46 p refs
(AD-A088050; NRL-MR-4272) Avail: NTIS
HC A03/MF A01 CSCL 04/2

A three dimensional numerical model with a domain of 3000 x 3000 km is used to study the influence of sea-surface temperature (SST) on the behavior of tropical cyclones translating with mean flows in the Northern Hemisphere. We find that tropical cyclones tend to move into regions of warmer SST when a gradient of SST is perpendicular to the mean ambient flow vector (MAFV). The model results also indicated that a region of warmer SST situated to the right side of the MAFV is more favorable for storm intensification than to the left side due to the asymmetries in air-sea energy exchanges associated with translating tropical cyclones. The model tropical cyclone intensifies and has greater rightward deflection in its path relative to the MAFV when translating into the region of warmer SST. The model tropical cyclone intensifies when its center travels along a warm strip, it weakens along, but does not move away from a cool strip. The results suggest that the SST distribution not only affects the intensity and path of tropical cyclones frictionally, but also affects them thermally through processes of heating redistribution and geostrophic adjustment. GRA

N80-33068# Naval Research Lab., Washington, D. C. Environmental Sciences Div.
PASSIVE 19.3 GHz RADIOMETER AND AEROSOL DATA FROM THE NORTH SEA DURING MARSEN I, SEPTEMBER - OCTOBER 1979 Interim Report
S. G. Gathman and B. G. Julian 13 Aug. 1980 116 p refs
(AD-A088229; NRL-MR-4285) Avail: NTIS
HC A06/MF A01 CSCL 04/2

The production and distribution of the various aerosols which are a result of air sea interactions were investigated. The mechanism of maritime aerosol generation was examined and the utility of satellite derived data on sea properties were analyzed. R.C.T.

N80-33069# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
ATLAS OF CLOUD-FREE LINE-OF-SIGHT PROBABILITIES. PART 5: NORTH AFRICA AND THE MIDDLE EAST Interim Report

Iver A. Lund, Donald D. Grantham, Eugene A. Bertoni, and Clarence B. Elam, Jr. (Environmental Technical Applications Center, Scott AFB, Ill.) 9 Nov. 1979 67 p refs
(AF Proj. 6670)
(AD-A088156; AFGL-TR-79-0275-Pt-5; AFGL-AFSG-417)
Avail: NTIS HC A04/MF A01 CSCL 04/2

This is the fifth part of a planned Northern Hemisphere atlas of probabilities of cloud free lines-of-sight between the Earth and space. The probabilities are for the midseason months: January, April, July, and October; four times of day: 0000-0200 LST, 0600-0800 LST, 1200-1400 LST, and 1800-2000 LST; and three elevation angles: 10, 30 and 90 deg. Parts 1, 2, 3, and 4 depicted cloud free line-of-sight probabilities for Germany, the USSR, the USA, and Europe, respectively.
GRA

N80-33070# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
USE OF HELIUM-3 AS A GAS TRACER FOR MESO-SCALE METEOROLOGICAL STUDIES
J. E. Halverson, M. M. Pendergast, and A. L. Boni 1979 24 p refs Presented at the Atmospheric Tracer Workshop, Los Alamos, N. Mex., 23-24 May 1979
(Contract EY-76-C-09-0001)
(DP-MS-79-51) Avail: NTIS HC A02/MF A01

Plans to use He-3 as a tracer in atmospheric diffusion studies are outlined. A specially designed static gas mass spectrometer is used to measure He-3/He-4 abundance ratios in the atmospheric samples. Analysis of results of previous studies indicate that He-3 can be a useful tracer for plume releases at distances greater than 100 km.
DOE

N80-33071# Los Alamos Scientific Lab., N. Mex.
COMPARISON OF ATMOSPHERIC TEMPERATURE STRUCTURE AT THE WALL AND IN THE MIDDLE OF A VALLEY
Sumner Barr, Williams E. Clements, and S. Kerry Wilson 1980 5 p refs Presented at the 2nd Joint Conf. on Appl. of Air Pollution Meteorol., Am. Meteorol. Soc., New Orleans, 24-27 Mar. 1980
(Contract W-7405-eng-36)
(LA-UR-80-792; CONF-800327-7) Avail: NTIS HC A02/MF A01

At Anderson Creek Valley in the Geysers area of California, temperatures on the valley wall were compared with temperature profiles in the middle of the valley. An ensemble of temperature measurements including vertical soundings and surface based measurements from fixed stations and a mobile unit were analyzed. Surface measurements at various altitudes in Anderson Creek Valley were as much as 10 C cooler than the temperature in mid valley at the same altitude. The departures were smallest in the early evening and grew during the night. The cold air was quite shallow and if care were taken to make ground based measurements on promontaries or towers, the gross stability could be characterized by surface temperature observations up the side of the valley. A more promising analysis of the data is to interpret the thermal gradients from the valley wall to the center in terms of the driving force they provide to the drainage flow.
DOE

N80-33072# Battelle Pacific Northwest Labs., Richland, Wash.
DEFINITION OF GUST MODEL CONCEPT AND REVIEW OF GUST MODELS
David C. Powell and James R. Connell Jun. 1980 100 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3138) Avail: NTIS HC A05/MF A01

Four models are examined which attempt to describe wind fluctuations in relation to a wind energy conversion system that is subjected to these fluctuations observed from a fixed location within the atmospheric boundary layer. The primary purpose of this examination is to provide a basis for understanding present and future developments in gust and gust rise models. The examination is accomplished by identifying the gust definitions used in the models and relating them to a basic definition given.
DOE

N80-33073# Battelle Pacific Northwest Labs., Richland, Wash.
WIND CHARACTERISTICS PROGRAM ELEMENT Annual Report, Jul. 1978 - Sep. 1979
L. L. Wendell, W. R. Barchet, J. R. Connell, A. H. Miller, W. T. Pennell, and D. S. Renne May 1980 209 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3211) Avail: NTIS HC A10/MF A01

As a service element within the Federal Wind Energy Program, the wind characteristics program element (WCPE) is established to provide the appropriate wind characteristics information to those involved in: the design and evaluation of wind energy conversion systems (WECS); energy program planning; selecting sites for WECS installation; and the operation of WECS. To effectively produce the information needed in these four categories, the WCPE, for which the Pacific Northwest Laboratory (PNL) has the responsibility for management and technical assistance, was divided into four technical program areas. During this reporting period PNL was also assigned the management responsibility for the data collection at the US Department of Energy's (DOE's) candidate sites, as well as the task of providing technical assistance to DOE evaluation and site selection panels for new candidate sites.
DOE

N80-33074# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF A PHOTODIODE-ARRAY OPTICAL TURBULENCE SENSOR TO WIND STUDIES IN COMPLEX TERRAIN
W. M. Porch and T. J. Green 1980 17 p refs Presented at ASCOT Program Planning Meeting, Gettysburg, Pa., 15 Apr. 1980
(Contract W-7405-eng-48)
(UCRL-84503; CONF-800480-3) Avail: NTIS HC A02/MF A01

A digital photodiode array optical turbulence sensor was used to gather data simultaneously with analog optical anemometer measurements during the July 1979 ASCOT experiment. This system provided useful information regarding the uniformity of optical turbulence used by the optical anemometer to drive cross path wind speeds. Wind speeds derived from digital analysis of the photodiode array intensities also provided an independent measure of the cross path wind speed. Close agreement was found between these two measures of the wind.
DOE

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-33075# Woods Hole Oceanographic Institution, Mass.
REMOTE ACOUSTIC SENSING OF OCEANIC FLUID AND BIOLOGICAL PROCESSES
M. H. Orr Jun. 1980 57 p refs Presented at the Ocean Acoustic Remote Sensing Workshop, Seattle, 21-25 Jan. 1980
(Contract N00014-77-C-0196; Grants NOAA-NA79-AA-D-00030; NOAA-NA79-AA-D-00102; NSF OCE-77-08682; NR Proj. 083-004)
(AD-A087665; WHOI-80-2; WHOI-Contrib-4559) Avail: NTIS HC A04/MF A01 CSCL 08/1

High frequency acoustic backscattering systems are being used in monostatic modes to evaluate the use of acoustic techniques to detect and study a variety of fluid processes in the oceanic environment. A short outline of those research programs actively evaluating and using acoustic techniques is presented, followed by a detailed review of this investigator's program. This program uses a multifrequency high frequency acoustic system to study a variety of processes including turbulent mixing, air-sea interactions internal waves, interleaving water masses, natural particulate dispersion and distribution, the dispersion of particulates associated with deep ocean disposal of industrial chemical waste, and biological response to a variety of stimulae including fluid motion, predators, and oceanographic instrumentation. Graphic acoustic data records of several of the above phenomena are described.
GRA

N80-33076# Naval Research Lab., Washington, D. C. Space Systems Div.
ON THE INFERENCE OF OCEANIC CURRENTS OR EDDIES BY SPACEBORNE ALTIMETRY THROUGH THE DYNAMIC METHOD FOR THE DETERMINATION OF THREE DIMENSIONAL DENSITY (TEMPERATURE) FIELD Progress Report
Davidson T. Chen and Vincent E. Noble 18 Jul. 1980 33 p refs
(W05270S00)
(AD-A088082; NRL-MR-4273) Avail: NTIS
HC A03/MF A01 CSCL 08/3

The physical theoretical background, the mathematical governing equations, the absolute error, and the relative error of the dynamic method used in inferring the geostrophic current and eddy systems from the spaceborne altimeter-sensed measurements of dynamic heights or slopes have been laboriously developed. Also, the conditions for the determination of the three dimensional density (temperature) field uniquely are mentioned and explained. The space-borne altimeter is shown to be the instrument for the provision of one condition, i.e., the ocean surface current condition. The three dimensional density (temperature) field and its boundary conditions at the air-sea interface play dominant roles in the weather prediction and the undersea technology. The interchangeable use of the terms of density and temperature fields is valid only when the salinity can be assumed as constant. GRA

N80-33077# Texas A&M Univ., College Station. Dept. of Oceanography.
THE GULF STREAM MEANDERS EXPERIMENT: CURRENT METER, ATMOSPHERIC, AND SEA LEVEL DATA REPORT FOR THE MOORING PERIOD Data Report, Jan. - May 1979
David A. Brooks, John M. Bane, Robert L. Cohen, and Paul Blankinship (North Carolina State Univ. at Raleigh) Jul. 1980 277 p refs Prepared in cooperation with North Carolina Univ. at Chapel Hill
(Contract N00014-77-C-0354; Grant NSF OCE-79-06710)
(AD-A088069; TAMU-REF-80-7-T) Avail: NTIS
HC A13/MF A01 CSCL 08/3

The principal objective of the Gulf Stream Meanders experiment was to kinematically and dynamically describe the nature of meanders. The upper continental slope region off Onslow Bay, North Carolina was chosen for the experiment site because several previous investigations in that area provided a baseline data set giving some ideas about time and space variability scales within and a several month mean view of the stream. In addition, earlier observations ranging from reports in centuries-old ship logs to recent satellite infrared imagery made it apparent that Gulf Stream meandering was more intense between Charleston and Cape Hatteras than elsewhere in the South Atlantic Bight. Current, sea level, and atmospheric data from the Gulf Stream region off North Carolina for the period January - May 1979 are documented. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-33078# Cornell Univ., Ithaca, N. Y. Biology and Biophysics Dept.
STRUCTURE AND FUNCTION IN PHOTOSYNTHETIC MEMBRANES AND THEIR COMPONENTS Annual Progress Report, 1 Dec. 1978 - 30 Nov. 1979
Roderick K. Clayton 1979 16 p refs
(Contract EY-76-S-02-3162)
(COO-3162-51) Avail: NTIS HC A02/MF A01

Structure and function are being studied in photosynthetic membranes and their components, principally with Rhodopseudomonas sphaeroides. That bacteriochlorophyll (Bchl) can have a strongly shifted absorption maximum in the membrane, without the involvement of excitonic Bchl-Bchl interactions was demonstrated. The orientations of pigments in the membrane are being determined, and the orientations of four distinguishable carotenoid components are under investigation. These studies provide data for computations of energy transfer and electron tunneling, and may bear on the mechanism of the electrogenic shifts of the absorption bands of carotenoids. Complexities in the absorption spectra of cytochromes were discovered, and data concerning the distribution of carotenoids between antenna and reaction centers (RCs) in the membrane were found. A corrected interpretation of the action of orthophenanthroline as an inhibitor of electron transport was presented. Some theoretical studies of the problems that may arise in constructing solar cells from natural or artificial RCs were conducted. DOE

N80-33079# Food and Drug Administration, Silver Spring, Md. Bureau of Medical Devices.
RADIOFREQUENCY LESION GENERATORS, A PROBLEM DEFINITION STUDY Final Report
Michael S. Gluck 2 Jun. 1980 50 p refs
(PB80-191844; FDA/BMD-80/75) Avail: NTIS
HC A03/MF A01 CSCL 06L

The development of a safety and performance standard for radiofrequency lesion generators is discussed. A review is provided of the available literature and manufacturers' data. Problems associated with radiofrequency lesion generators are identified, and requirements for inclusion in a standard to address these problems are recommended. An annotated bibliography is included. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-33080# Monsanto Research Corp., Dayton, Ohio.
DEVELOPMENT OF ANALYTICAL TECHNIQUES FOR TOXICOKINETIC RESEARCH Final Report, 1 May 1978 - 30 Sep. 1979
M. K. Hershey, P. L. Sherman, and J. V. Pustinger Wright-Patterson AFB, Ohio Aerospace Medical Research Lab. Oct. 1979 39 p refs
(Contract F33615-78-C-0515)
(AD-A077729; MRC-DA-906; AMRL-TR-79-89) Avail: NTIS
HC A03/MF A01 CSCL 06/16

Methods developed for the analysis of monomethylhydrazine (MMH) and its metabolites in the urine and blood of laboratory rats which had been injected with MMH at concentrations of 7.5 mg/kg and 15 mg/kg are described. Modifications of this method to analyze for free MMH in urine and blood of human origin are also discussed. S.F.

N80-33081*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
POCKET ECG ELECTRODE Patent Application
Gordon F. Lund, inventor (to NASA) (NAS-NRC, Washington, D.C.) Filed 11 Sep. 1980 14 p Sponsored by NASA
(NASA-Case-ARC-11258-1; US-Patent-Appl-SN-185865) Avail: NTIS HC A02/MF A01 CSCL 06B

A low noise electrode suited for sensing electrocardiograms when chronically and subcutaneously implanted in a free ranging subject is described. The electrode comprises a pocket shaped electrically conductive member with a single entrance adapted to receive body fluids. The exterior of the member and the entrance region is coated with electrical insulation so that the only electrolyte/electrode interface is within the member, remote from artifact-generating tissue. Cloth straps are bonded to the member to permit the electrode to be sutured to tissue and to provide electrical lead flexure relief. NASA

N80-33082*# Technology, Inc., Houston, Tex. Life Sciences Div.
A MICROPROCESSOR-BASED CARDIOTACHOMETER Final Report
John A. Donaldson and William G. Crosier 31 Oct. 1979 92 p
(Contract NAS9-14880)
(NASA-CR-160607) Avail: NTIS HC A05/MF A01 CSCL 06B

The development of a highly accurate and reliable cardiotach-

ometer for measuring the heart rate of test subjects is discussed. It measures heart rate over the range of 30 to 250 beats/minute and gives instantaneous (beat to beat) updates on the system output so that occasional noise artifacts or ectopic beats could be more easily identified except that occasional missed beats caused by switching ECG leads should not cause a change in the output. The cardiotachometer uses an improved analog filter and R-wave detector and an Intel 8080A microprocessor to handle all of the logic and arithmetic necessary. By using the microprocessor, future hardware modifications could easily be made if functional changes were needed. R.K.G.

N80-33083*# Technology, Inc., Houston, Tex. Life Sciences Div.
CARDIOPULMONARY DATA ACQUISITION SYSTEM. VERSION 2.0, VOLUME 1: USER'S GUIDE Final Report
17 Dec. 1979 75 p
(Contract NAS9-14880)
(NASA-CR-160608) Avail: NTIS HC A04/MF A01 CSCL 05B

The Cardiopulmonary Data Acquisition System is a computerized method of both collecting and analyzing physiological data on subjects during a treadmill or ergometer stress test in the clinic. The real time acquisition of the physiological data, such as, heart rate, blood pressure, work load, and respiratory gases is accomplished by an LSI-11 microcomputer which displays this data on a hard copy terminal. The data are also concurrently stored on a mass storage device and anytime after the test period a selectable number of copies of the plots or minute reports can be reproduced at the terminal. R.K.G.

N80-33084*# Technology, Inc., Houston, Tex. Life Sciences Div.
CARDIOPULMONARY DATA ACQUISITION SYSTEM. VERSION 2.0, VOLUME 2: DETAILED SOFTWARE/HARDWARE DOCUMENTATION Final Report
18 Feb. 1980 195 p
(Contract NAS9-14880)
(NASA-CR-160609) Avail: NTIS HC A09/MF A01 CSCL 05B

Detailed software and hardware documentation for the Cardiopulmonary Data Acquisition System is presented. General wiring and timing diagrams are given including those for the LSI-11 computer control panel and interface cables. Flowcharts and complete listings of system programs are provided along with the format of the floppy disk file. M.G.

N80-33085*# Tennessee Univ., Knoxville. Dept. of Medical Biology.
CHANGES IN ERYTHROPOIETIN LEVELS DURING SPACE FLIGHT OR SPACE FLIGHT SIMULATION Final Technical Report
C. D. R. Dunn and J. P. Hen Jul. 1980 8 p refs
(Contract NAS9-15164)
(NASA-CR-163591) Avail: NTIS HC A02/MF A01 CSCL 06P

Two hundred and seventy samples from 24 subjects involved in 3 bedrest studies and from 3 subjects involved in Spacelab Mission Development Test 3 were assayed for erythropoietin (Ep), in an in vitro fetal mouse liver cell assay, and for ferritin using a commercially available immunoradiometric assay kit. No trends or significant changes in serum Ep were observed. Serum ferritin concentrations tended to increases slightly during the 'missions', reflecting a redirection of iron from the suppressed erythron into iron stores. T.M.

N80-33086*# Webb Associates, Yellow Springs, Ohio.
THE DEVELOPMENT OF AN ELASTIC REVERSE GRADIENT GARMENT TO BE USED AS A COUNTERMEASURE FOR CARDIOVASCULAR DECONDITIONING
James F. Annis and Paul Webb [1980] 69 p refs
(Contract NAS2-7156)
(NASA-CR-152379) Avail: NTIS HC A04/MF A01 CSCL 06P

Using a new nomex lycra elastic fabric and individualized garment engineering techniques, reverse gradient garments (RGG's) were designed, constructed, and tested for effectiveness as a countermeasure against cardiovascular deconditioning. By combining torso compensated positive pressure breathing with a distally diminishing gradient of counterpressure supplied by the elastic fabric on the limbs, the RGG acts to pool blood in the extremities of recumbent persons much as though they were standing erect in 1 g. The RGG stresses the vasculature in a fashion similar to that experienced by the normally active man, hence preventing or limiting the development of post weightlessness orthostatic intolerance and related conditions. Four male, college age subjects received daily treatments with the RGG during a 15 day bedrest study. Four additional subjects also underwent the bedrest, but received no treatments; they served as controls. The preliminary indication was that the RGG was somewhat effective in limiting the deconditioning process. R.K.G.

N80-33087# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic and Bioengineering Div.
A TECHNIQUE FOR THE INJECTION OF RADIOACTIVE TRACER MICROSPHERES DURING ACCELERATION STRESS
Kevin J. Greenless, Clarence M. Oloff, Willi J. Buehring, and Katherine C. Smith Jun. 1980 17 p refs
(AF Proj. 7222; AF Proj. 6893)
(AD-A087931; AMRL-TR-78-114) Avail: NTIS HC A02/MF A01 CSCL 14/2

A microsphere injection system is presented which allows the remote sequential injection of as many as five separately labeled radioactive tracer microspheres while under acceleration stress. Cinemicroscopic observation of the injected microsphere suspension showed little or no microsphere aggregation. Statistical analysis of the microsphere injections on the basis of counts per minute showed 90 - 5.7% of the injection was delivered during three gravities of acceleration. No significant difference in percent injectate delivered was found among the five cartridges. Subjection of the microsphere injection system to 12 G acceleration did not impair proper sequencing or delivery of test solutions. GRA

N80-33088# Southwest Research Inst., San Antonio, Tex.
PRELIMINARY STUDY OF THE BEHAVIORAL AND BIOLOGICAL EFFECTS OF HIGH INTENSITY 60 Hz ELECTRIC FIELDS Interim Technical Progress Report
Charles S. Feldstone, Ronald J. Spiegel, Wendell Winters, and James J. Polonis 1 Mar. 1980 119 p refs
(Contract ET-78-C-01-2875)
(SWRI-14-5277; ITPR-4) Avail: NTIS HC A06/MF A01

Progress is reported in studies of the effects of high intensity 60 Hz electric fields on baboon behavior, both individual performance and natural behavior. The result of the study should be either a clear indication of the electric field intensity which produces deleterious effects in the baboon or an indication that the highest field intensity of practical interest produces no deleterious effects. The generalization of results to man will be further aided by the development of models relating the physical effects of electric fields on man to the physical effects on the baboon. DOE

N80-33089# Pittsburgh Univ., Pa.
EVALUATION OF CARBON MONOXIDE IN BLOOD SAMPLES FROM THE SECOND NATIONAL HEALTH AND NUTRITION SURVEY Progress Report, 1 Apr. 1979 - 1 Apr. 1980
Edward P. Radford 1980 20 p refs
(Contract DE-AC02-77EV-04552)
(COO-4552-2) Avail: NTIS HC A02/MF A01

Progress on research into the epidemiology of CO is reported. Carbon monoxide levels in blood were determined from 8052 samples. The magnitude of the impact of environmental sources distinct from smoking is evaluted. DOE

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-33090*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

PROCRU: A MODEL FOR ANALYZING CREW PROCEDURES IN APPROACH TO LANDING Interim Report
S. Baron, R. Muralidharan, R. Lancraft, and G. Zacharias Apr. 1980 223 p refs
(Contract NAS2-10035)
(NASA-CR-152397; BBN-4374) Avail: NTIS HC A10/MF A01 CSCL 05E

A model for analyzing crew procedures in approach to landing is developed. The model employs the information processing structure used in the optimal control model and in recent models for monitoring and failure detection. Mechanisms are added to this basic structure to model crew decision making in this multi task environment. Decisions are based on probability assessments and potential mission impact (or gain). Sub models for procedural activities are included. The model distinguishes among external visual, instrument visual, and auditory sources of information. The external visual scene perception models incorporate limitations in obtaining information. The auditory information channel contains a buffer to allow for storage in memory until that information can be processed. S.F.

N80-33091# Boeing Aerospace Co., Seattle, Wash. Data Processing Technology.
PSYCHOPHYSICAL CRITERIA FOR VISUAL SIMULATION SYSTEMS. PHASE 2: EXPERIMENTAL INVESTIGATIONS OF DISPLAY JOINTS AND SCENE INSERTS Final Report
Conrad L. Kraft and Charles D. Anderson Aug. 1980 81 p refs
(Contract F33615-78-C-0012; AF Proj. 6114)
(AD-A088316; AFHRL-TR-80-18) Avail: NTIS HC A05/MF A01 CSCL 05/10

This report describes the approach, procedures, and results of two psychophysical experiments to provide data useful in developing design criteria for visual simulation systems. The first dealt with the influence of the width of joints between display channels on the discrimination of vertical and rotational scene misalignment across the joint. The resulting information indicated that increasing amounts of rotation resulted in an increased percentage of correct detections. This anticipated result was not found for the displacement conditions. It was hypothesized that this unexpected result may have been caused by the counteracting effect of the Poggendorff visual illusion. The second psychophysical experiment dealt with the discrimination of rotational misalignment of scene inserts. Increasing insert size and increasing rotational misalignment produced increased detection performance. The 50% detection threshold occurring at 7 arc seconds of displacement between corresponding portions of the insert and surrounding scenes. Design tolerances based on these data are suggested. GRA

N80-33092# Applied Psychological Services, Wayne, Pa. Science Center.
HUMAN PERFORMANCE IN CONTINUOUS OPERATIONS. VOLUME 3: TECHNICAL DOCUMENTATION Technical Report, Jan. - Sep. 1979
Arthur I. Siegel, Mark G. Pfeiffer, Felix Kopstein, J. Jay Walf, and Halim Ozkaptan (ARI, Alexandria, Va.) Mar. 1980 124 p refs
(Contract DAHC19-77-C-0054; DA Proj. 2Q1-63743-A-774)
(AD-A088339; ARI-RP-80-4C-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 05/9

This is the third volume of a series dealing with human performance in continuous operations. This volume documents the technical procedures used to analyze adverse effects and to project diminished human performance capabilities during continuous operations, as described in volumes 1 and 2 of this series. Specifically, the present volume (volume 3 of the set): (1) depicts the technical aspects of the development of the prior two volumes, (2) updates a prior survey of the literature concerning the effects of continuous operations on military performance, (3) describes the methods for deriving 'critical' tasks included in volume 1, (4) describes the details of the mathematical procedures employed in volume 1 to calculate and compound projected performance effectiveness, and (5) describes the details of a computer simulation model, which incorporates human effects, for simulating human performance in continuous operations. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-33093*# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
COMPUTER COORDINATION OF LIMB MOTION FOR A THREE-LEGGED WALKING ROBOT
Charles A. Klein and Mark R. Patterson Sep. 1980 108 p refs
(Grant NAG1-30)
(NASA-CR-163566) Avail: NTIS HC A06/MF A01 CSCL 05H

Coordination of the limb motion of a vehicle which could perform assembly and maintenance operations on large structures in space is described. Manipulator kinematics and walking robots are described. The basic control scheme of the robot is described. The control of the individual arms are described. Arm velocities are generally described in Cartesian coordinates. Cartesian velocities are converted to joint velocities using the Jacobian matrix. The calculation of a trajectory for an arm given a sequence of points through which it is to pass is described. The free gait algorithm which controls the lifting and placing of legs for the robot is described. The generation of commanded velocities for the robot, and the implementation of those velocities by the algorithm are discussed. Suggestions for further work in the area of robot legged locomotion are presented. T.M.

N80-33094*# Umpqua Research Co., Myrtle Creek, Ore.
ADVANCED MICROBIAL CHECK VALVE DEVELOPMENT Final Report
G. V. Colombo and D. R. Greenley Jun. 1980 34 p
(Contract NAS9-15854)
(NASA-CR-163577) Avail: NTIS HC A03/MF A01 CSCL 06K

A flight certified assembly identified as a Microbial Check Valve (MCV) was developed and tested. The MCV is a canister packed with an iodinated anionic exchange resin. The device is used to destroy organisms in a water stream as the water passes through the device. The device is equally effective for fluid flow in either direction and its primary method of organism removal is killing rather than filtering. The MCV was successfully developed for the space shuttle to: disinfect fuel cell water; and prevent back contamination of the stored potable water supply. One version of the device consists of a high residual iodinated resin bed that imparts approximately 2 ppm of iodine to the fuel cell water as it flows to the potable water tanks. A second version of the device consists of a low residual iodinated resin bed. One of these low residual beds is located at each use port in the potable water system for the dual purpose of removing some iodine from the potable water as it is dispensed and also to prevent back contamination of the potable supply. T.M.

N80-33095# Letterman Army Inst. of Research, San Francisco, Calif. Dept. of Nutrition.
METABOLIC ASPECTS OF CALORIC RESTRICTION (500 CALORIES): BODY COMPOSITION CHANGES
Harry J. Krzywicki, C. Frank Consolazio, Herman L. Johnson, and Norman F. Witt Aug. 1979 27 p refs
(DA Proj. 3A0-25601-A-822)
(AD-A082495; LAIR-73) Avail: NTIS HC A03/MF A01 CSCL 06/5

Body composition changes in 8 healthy adult males were studied while subsisting on a daily liquid diet containing 340 kcal from carbohydrate and 160 kcal from protein for a 10 day period. Half of the subjects (group 1) were denied minerals with the remaining half (group 2) receiving a daily mineral supplement. Body weight losses were severe (5.51 and 4.67 kg) in groups 1 and 2, respectively. This loss was further partitioned into 3.59 kg of fat, 1.4 kg of water, and 0.39 kg of dry protein in

group 1, while group 2 showed losses of 2.76 kg of fat, 1.32 kg of water and 0.39 kg of dry protein. The largest amount of water was lost by the group which was denied minerals. This indicates the water sparing and fat utilizing effects of limited carbohydrate and protein with mineral supplementation. The data indicate that the small quantity of protein in the diet was somewhat beneficial in sparing body protein. E.D.K.

N80-33096# Aeronautical Research Labs., Melbourne (Australia).
A MINIMUM EXCURSION-TIME CONTROL SYSTEM
B. Gromek and T. G. Ryall May 1980 15 p
(AD-A087774; ARL/Struc-TM-312) Copyright. Avail: NTIS
HC A02/MF A01 CSCL 14/2

A significant reduction in total test times of computer-controlled fatigue tests has been achieved by the design of a minimum excursion-time control system. The computer calculates in real time the minimum-time path between two excursion points, subject to variable velocity and acceleration constraints. This technique has been extended to multi-channel systems. GRA

N80-33097# Harry Diamond Labs., Adelphi, Md.
THE DESIGN OF A FLUIDIC OXYGEN INTERMITTENT DEMAND FLOW DEVICE
George Mon Mar. 1980 13 p refs
(DA Proj. 1L1-62120-AH-25)
(AD-A084083; HDL-TM-80-14) Avail: NTIS
HC A02/MF A01 CSCL 06/12

A laminar flow fluidic intermittent-demand valve for oxygen therapy was designed and tested to faithfully follow a patient's respiratory cycle. A savings of oxygen from 10 to 67 percent is possible under certain conditions. A small air pump can power the fluidic circuit since no moving parts are used other than a diaphragm flow valve, this intermittent-demand valve is expected to be very reliable and require little or no maintenance. Author

N80-33098# Naval Weapons Center, China Lake, Calif. Research Dept.
STUDIES ON THE REMOVAL OF CARBON MONOXIDE FROM THE ATMOSPHERE AT AMBIENT TEMPERTURE Final Report
Dwight A. Fine and Carol A. Heller May 1980 27 p
(Contract N00023-79-WR-9615)
(AD-A085469; NWC-TP-6179) Avail: NTIS
HC A03/MF A01 CSCL 04/1

Catalysts of platinum or palladium on carbon or alumina show promise in removing carbon monoxide (CO) from air at room temperature. As much as 80 percent of the CO in a 230 ppm CO/air powder was removed by 1 g of 5 percent palladium on carbon powder in one pass. Catalysts of 0.5 percent metal on alumina pellets showed comparable efficiency, and proved more convenient to handle. Calculation indicate that the CO concentration in 1000 cu ft of air containing 500 ppm CO could be reduced to 200 ppm in 100 minutes using only 180 g (0.4 pound) of 0.5 percent palladium catalyst and an pump moving 10 cu ft per minute of air (one pass of air through catalyst). Solutions of copper 1 in monoethanolamine proved much less efficient due to oxidation problems. S.F.

N80-33099# Boston Coll., Chestnut Hill, Mass.
A TENTATIVE TAXONOMY OF HUMAN INTERACTIVE FACTORS IN AIRCRAFT MISHAPS Final Report, 1 Apr. 1979 - 1 Mar. 1980
Kenneth W. Wegner May 1980 48 p refs
(Grant AF-AFOSR-0102-79; AF Proj. 2313)
(AD-A088442; AFOSR-80-0595TR) Avail: NTIS
HC A03/MF A01 CSCL 05/8

Previous research and results of the present study lend support to the concept of developing a taxonomy of factors or causes in aircraft mishaps. Twenty-five years of mishap research related to psychophysiological and environmental factors was reviewd to determine the most frequently occurring variables. Twenty-one of these were identified and classified into a tentative taxonomy under three functions: Equipment - Physical Environment, Management System, and Operator. Sixteen definitions related to these factors were available to analyze for reliability and relationship to the taxonomy functions. A survey form was developed which included the above definitions and nine selected aircraft mishap summaries. This instrument was administered to a Flight Safety Officer School class and a group of naive subjects of equivalent age and years of education. The task to be performed was to rate the presence or absence of these causes in each of the mishap summaries. Data analysis performed included the computation of mean agreement rates, inter-case consistency, intercorrelations of selected variables, and comparison of mean agreement rates and judged clarity of the definitions. GRA

N80-33100# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario). Human Engineering Section.
A HUMAN ENGINEERING SPECIFICATION FOR LEGIBILITY OF ALPHANUMERIC SYMBOLOGY ON VIDEO MONITOR DISPLAYS
E. L. Gorrell Jun. 1980 28 p refs Revised
(AD-A088470; DCIEM-TR-80-R-26-Rev) Avail: NTIS
HC A03/MF A01 CSCL 05/5

Conventional human engineering legibility specifications for alphanumeric symbology displayed on video monitors consist of predictors of user performance derived from legibility research studies. Typical legibility predictors are symbol size, symbol luminance, contrast ratio, font, dot matrix dimensions, and pixel active area. This report discusses a number of significant problems associated with the development and application of conventional legibility specifications. In addition, it presents a detailed specification for comparative and objective evaluation of video monitor legibility performance based upon legibility tests developed for the USAF. This specification consists of criteria for subject selection, visual environment design, display monitor setup, test material design and presentation, legibility task scores, and legibility test performance. It is to be noted that this report is a revision of an earlier report. While the specification for the legibility test has not undergone any major change, the proposed Minimum Conventional Legibility Criteria have been reduced in number. The revised report also includes a new appendix describing in detail a standardized procedure for measuring CRT symbol luminance and calculating contrast ratios. GRA

N80-33101# Air Force Medical Center, Wright-Patterson AFB, Ohio.
HEARING PROTECTION AND SPEECH COMMUNICATION CHARACTERISTICS OF SELECTED USAF INFLIGHT HELMETS
Mark R. Stephenson and Donald G. Tomerlin Jun. 1980 22 p refs
(AF Proj. 7231)
(AD-A088099; AFAMRL-TR-80-37) Avail: NTIS
HC A02/MF A01 CSCL 06/17

Hearing protection and speech intelligibility were measured on three widely used flight helmets: the HGU-26/P with standard earcups, HGU-26/P with custom earcups and the DH-151. The following results were obtained: (1) Attenuation tests demonstrated the DH-151 and the standard HGU-26/P generally provide equivalent hearing protection with the former providing somewhat greater protection at the low and high frequencies, but the latter providing somewhat greater protection at the middle frequency region. The custom HGU-26/P provided less hearing protection than both of the above. (2) Replacing earcup assemblies with standard MX8376/AR earcups resulted in equal or improved hearing protection for the HGU-26/P helmet. In the DH-151 helmet, this resulted in less protection at the lower frequencies, but improved protection in the middle frequency range, and no change in the higher frequency range. (3) Speech intelligibility was determined by calculating the articulation index. Both the standard HGU-26/P and the DH-151 provide excellent speech intelligibility. The custom HGU-26/P was found to provide less speech intelligibility than the other two helmets. Nevertheless, we believe it would also permit adequate inflight speech communication. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-33102*# Michigan Univ., Ann Arbor. Systems Engineering Lab.
EVALUATION OF COMPUTING SYSTEMS USING FUNCTIONA S OF A STOCHASTIC PROCESS
J. ˜ ˚ ,er and L. T. Wu Jul. 1980 45 p refs
(Grar., NsG-1306)
(NASA-CR-163512; Rept-014524-13-T; SEL-140) Avail: NTIS HC A03/MF A01 CSCL 09B

An intermediate model was used to represent the probabilistic nature of a total system at a level which is higher than the base model and thus closer to the performance variable. A class of intermediate models, which are generally referred to as functionals of a Markov process, were considered. A closed form solution of performability for the case where performance is identified with the minimum value of a functional was developed. T.M.

N80-33103# OMEX, Santa Clara, Calif.
SLIDESTORE LARGE CAPACITY INFORMATION STORAGE Final Report
Leslie L. Burns 1980 107 p
(Contract NSF DAR-78-21344)
(PB80-187875; NSF/RA-800049) Avail: NTIS HC A06/MF A01 CSCL 09B

A preliminary design for a large scale optical mass memory suitable for government, industrial, and commercial use is presented. The SlideStore feasibility model, which is based on the use of reactangular media for optical data recording by material ablation with a laser beam is decsribed. The unit has successfully recorded raw data and read the data back in a manner that is suitable for transfer to a host computer. Included are descriptions of the model's potential market, the design guidelines, specifications, and media development. Depicted are artists' conceptions of a 2000 slide version of SlideStore for archival information; a 6000 slide version; and a 10 to the 15th power SlideStore memory a 6000 slide version; and a 10 to the 15th power SlideStore memory installation which uses nine 6000 slide SlideStore units as well as off-line storage of DataSlides. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-33104*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NONANALYTIC FUNCTION GENERATION ROUTINES FOR 16-BIT MICROPROCESSORS
James F. Soeder and Maryrita Shaufl Washington Sep. 1980 66 p refs
(NASA-TM-81586; E-565) Avail: NTIS HC A04/MF A01 CSCL 09B

Interpolation techniques for three types (univariate, bivariate, and map) of nonanalytic functions are described. These interpolation techniques are then implemented in scaled fraction arithmetic on a representative 16 bit microprocessor. A FORTRAN program is described that facilitates the scaling, documentation, and organization of data for use by these routines. Listings of all these programs are included in an appendix. L.F.M.

N80-33105# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil) Dept. of Space Systems.
COMPUTER TREATMENT OF PERSPECTIVE FOR SOLIDS [TRACADO POR COMPUTADOR DE PERSPECTIVAS DE SOLIDOS]
Jose Antonio Gocalves Pereira Jun. 1980 17 p refs In PORTUGUESE Presented at a Conf. in Sao Paulo, Brazil, 20-22 Aug 1980
(INPE-1785-RPE/157) Avail: NTIS HC A02/MF A01

An algorithm is developed for computer treatment of concave or convex polyhedrons or series of polyhedrons. The algorithm solves the 'hidden lines' problem and is suited to computer programs and video terminals. S.F.

N80-33106# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ADVANCED SMITE REFERENCE MANUAL Final Report
Griffiss AFB, N.Y. RADC Feb. 1980 270 p refs
(Contract F30602-78-C-0016; AF Proj. 2529)
-A087743; TRW-32584-6015-RU-00; RADC-TR-80-66) Avail: NTIS HC A12/MF A01 CSCL 09/2

This is a reference manual for the use of Advanced SMITE which is a higher level hardware description language used to describe various computer hardware architectures and then to generate an emulation of these architectures on the Nanodata QM-1 Microprogrammable Computer. Advanced SMITE is written in a subset of PL-1 and runs on RADC's MULTICS computer system. GRA

N80-33107# Washington Univ., Seattle. Dept. of Mathematics.
HOW MANY STEPS?
Victor Klee Jun. 1980 10 p refs
(Contracts N00014-67-A-0103; N00014-76-C-0423; NR Proj. 041-353)
(AD-A087860; TR-70) Avail: NTIS HC A02/MF A01 CSCL 12/1

Due in considerable measure to its connection with linear programming, the combinatorial study of convex polytopes has progressed greatly in the past twenty five years and many outstanding problems have been solved. However, the d-step conjecture, first formulated by W. M. Hirsch in 1957, remains unsettled. Both for its intrinsic interest and for its relationship to questions of computational complexity, it is probably the most important open problem on the combinatorial structure of polytopes. This report presents several equivalent forms of the d-step conjecture. Some deal explicitly with edge paths on polytopes, one involves matrix pivot operations, and one concerns an exchange process for simplicial bases. GRA

N80-33108# Ohio State Univ., Columbus. Dept. of Statistics.
ESTIMATION OF THE P(CS) WITH A COMPUTER PROGRAM, REVISION
Edward J. Dudewicz Jul. 1980 17 p refs
(Contract N00014-78-C-0543; NR Proj. 042-403)
(AD-A088058; TR-195A) Avail: NTIS HC A02/MF A01 CSCL 12/1

In the area of ranking and selection, recent papers have presented procedures which attempt to allow experimenters to take at least partial advantage of more favorable configurations of the population parameters (compared to least-favorable configuration). The current paper presents a computer program which allows experimenters to dispense with all of inequalities, an indifference-zone, and known equal variabilities in their assessment of the probability of correct selection. It has additional uses in implementation of recently proposed sequential adaptive selection procedures. GRA

N80-33109# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
A TIME DEPENDENT ERROR DETECTION RATE MODEL

FOR SOFTWARE PERFORMANCE ASSESSMENT WITH APPLICATIONS Interim Technical Report, Sep. 1978 - Oct. 1979
Amrit L. Goel and K. Okumoto Griffiss AFB, N.Y. RADC May 1980 115 p refs
(Contract F30602-78-C-0351; AF Proj. 5581)
(AD-A088186; RADC-TR-80-179) Avail: NTIS HC A06/MF A01 CSCL 12/1

The objective of this study was to develop a parsimonious model whose parameters have a physical interpretation, and which can be used to predict various quantitative measures for software performance assessment. With this objective, the behavior of the software failure counting process (N(t), t equal to or greater than zero) has been studied. It is shown that N(t) can be well described by a nonhomogeneous Poisson process (NHPP) with a two parameter exponentially decaying error detection rate. Several measures, such as the number of failures by some prespecified time, the number of errors remaining in the system at a future time, and software reliability during a mission, have been proposed in this report. Models for software performance assessment are also derived. Two methods are developed to estimate model parameters from either failure count data or times between failures. A goodness-of-fit test is also developed to check the adequacy of the fitted model. Finally, actual failure data are analyzed from two DOD software systems. One is a large command and control system and the other a Naval data analysis system. GRA

N80-33110# University of Southern California, Marina del Rey. Information Sciences Inst.
MICROCODE VERIFICATION PROJECT Final Technical Report
Stephen D. Crocker, Leo Marcus, and Dono Van-Mierop May 1980 150 p refs
(Contract F30602-78-C-0008; AF Proj. 5581)
(AD-A088189; RADC-TR-80-42) Avail: NTIS HC A07/MF A01 CSCL 09/2

Within the scope of this project, a formalism for representing state transitions in a computationally tractable way has been invented, and a proof system based on this formalism has been designed and implemented. The representations of state transitions are called 'state deltas'. The basic proof system has been specialized for proofs about machine language and microcode by the addition of simplification rules for bitstring arithmetic, and by the addition of a translator from the ISPS machine description language to state deltas. Some experimentation with the system has been driven by a preliminary attempt to verify parts of the microcode of the Fault-Tolerant Spaceborne Computer (FTSC). The primary success to date has been the verification of the basic algorithm used for computing floating point square root. GRA

N80-33111# University of Southwestern Louisiana, Lafayette.
VARIABLE PRECISION AND INTERVAL ARITHMETIC PORTABLE ENHANCEMENTS TO FORTRAN Final Report, 15 Mar. 1978 - 14 Mar. 1980
Bruce D. Shriver Jul. 1980 269 p refs
(Grant DAAG29-78-G-0068)
(AD-A087564; ARO-15169.1-M) Avail: NTIS HC A12/MF A01 CSCL 09/2

It was the intent of the research reported here to develop, using preprocessing techniques, extensions to FORTRAN which would include: (1) the extended data types VPINTEGER, VPREAL, VPCOMPLEX and VPINTERVAL. The data types are analogous to those of standard FORTRAN and the single precision interval data type, but can be of arbitrary precision, (2) the standard built-in functions (SIN, COS, SQRT, etc.) for use with the new data types, and (3) the input/output facilities of standard FORTRAN extended for use with the extended data types. GRA

N80-33112# DBS Corp., Arlington, Va.
DEVELOPMENT OF SOFTWARE FOR COMPUTER ASSISTED MODEL SIMPLIFICATION Final Report
25 Apr. 1980 48 p
(Contract DE-AC01-79EI-10597)
(DOE/EIA-10597/T1) Avail: NTIS HC A03/MF A01

The design and assessment of software for computer assisted model simplification is addressed. LP matrix scaling, and particularly the potential usefulness of shadow price information for model simplification are examined. An algorithm for obtaining approximate shadow price information was developed and subjected to initial small scale testing with promising results. DOE

N80-33113# Oak Ridge National Lab., Tenn. Computer Sciences Div.
METHODS TO INSURE THE STANDARDIZATION OF FORTRAN SOFTWARE
P. W. Gaffney and J. W. Wooten May 1980 49 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-95) Avail: NTIS HC A03/MF A01

Four software tools PFORT, DAVE, POLISH, and BRNANL, which may be used to ensure the standardization of programs are loosely classified into three groups. Then reasons are given why the program in two of these groups should adhere to a portable subset of the American National Standard First FORTRAN 1966. The software tools PFORT, DAVE, POLISH, and BRNANL, are briefly described, and an example of the dissemination of information pertaining to the tools together with their availability is outlined. DOE

N80-33114# California Univ., Livermore. Lawrence Livermore Lab.
THOR: A POST-PROCESSOR FOR TWO-DIMENSIONAL ANALYSIS CODES
John O. Hallquist 1 Apr. 1980 84 p refs
(Contract W-7405-eng-48)
(UCRL-52852) Avail: NTIS HC A05/MF A01

A user's manual for the post processor THOR is provided. THOR reads the binary plot files generated by two dimensional finite element codes and plots contours, time histories, and deformed shapes. Contours of a large number of quantities may be plotted on meshes consisting of triangular and variable node (4 to 8 nodes/element) quadrilateral elements. THOR can compute a variety of strain measures at either Gauss integration or nodal points, interface pressures along slide lines, reaction forces along constrained boudaries, spectra, and momentum. THOR is operational on the CDC 7600 and Cray-1 computers. DOE

N80-33115# California Univ., Berkeley. Lawrence Berkeley Lab.
COMPUTER-ASSISTED CHART MAKING FROM THE GRAPHIC DESIGNER'S PERSPECTIVE
Aaron Marcus Apr. 1980 8 p refs Presented at Conf. of the Assoc. for Computing at Conf. Special Interest Group for Graphics, Seattle, 14 Jul. 1980
(Contract W-7405-eng-48)
(LBL-10239; CONF-800720-1) Avail: NTIS HC A02/MF A01

It is important to improve the aesthetics and effectiveness of information graphics through greater awareness of graphic design as a visual communication discipline. Chart making is one subject area in which graphic design awareness can be enhanced. Basic design principles are reviewed which are relevant to creating better charts. Examples demonstrate improvements. DOE

N80-33116# Machine Intelligence Corp., Mountain View, Calif.
MICROCOMPUTER-BASED NATURAL-LANGUAGE UNDERSTANDING, PHASE 1 Final Technical Report, 1 Oct. 1979 - 28 Mar. 1980
Charles A. Rosen and Norman Haas 1980 48 p refs
(Grant NSF DAR-79-17648)
(PB80-187370; NSF/RA-800047) Avail: NTIS HC A03/MF A01 CSCL 05G

The cost effectiveness of natural language processing in support of industrial productivity is examined. Principal results include: development of a grammar for characterizing, in machine understandable form, a significant and habitable subset of the English language for use in building, updating, and querying databases; development of new, compact data structures for encoding grammatical rules and lexical information suitable for use with microcomputers; development of an efficient parsing algorithm of natural languages, and its implementation in PASCAL; and clear demonstration of the feasibility of microcomputer-based, natural-language processing as defined. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N80-33117# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
DISTRIBUTED NETWORK PROTOCOLS
Adrian Segall (Technion, Haifa, Israel) Jul. 1980 54 p refs Submitted for publication
(Contract N00014-75-C-1183; ARPA Order 3045; NR Proj. 049-383)
(AD-A087623; LIDS-P-1014) Avail: NTIS HC A04/MF A01 CSCL 09/2

A unified approach to the formal description and validation of several distributed protocols is presented. After introducing two basic protocols, a series of known and new protocols for connectivity test, shortest path and path updating are described and validated. All protocols are extended to networks with changing topology. GRA

N80-33118# IBM Federal Systems Div., Owego, N. Y.
FAULT TOLERANT COMPUTER NETWORK STUDY Interim Report, Sep. 1979 - Mar. 1980
Webb T. Comfort, T. L. Anthony, T. R. Battle, J. E. Kaufman, and P. M. Kogge Apr. 1980 172 p refs
(Contract F33615-79-C-1180; AF Proj. 2003)
(AD-A088066; IBM-80-D68-001; AFWAL-TR-80-1046) Avail: NTIS HC A08/MF A01 CSCL 09/2

This interim report documents some baseline parameters and considerations for a fault tolerant avionics system. Issues addressed include reliability, computational requirements, fault tolerant techniques, cost effectiveness, error types, computer networks, and analysis techniques. Candidate life-cycle cost models are reviewed for applicability in evaluating fault tolerant architectures, and a study plan for assessment of the cost/effectiveness of fault tolerant techniques is presented. GRA

N80-33119# California Univ., Livermore. Lawrence Livermore Lab.
MULTIPLE ACCESS MASS STORAGE NETWORK
Donaldson L. Wentz, Jr. 1980 14 p refs Presented at Networks 80 Intern. Conf., London, 3 Jun. 1980
(Contract W-7405-eng-48)
(UCRL-83929; CONF-800638-1) Avail: NTIS HC A02/MF A01

The multi-access storage subnetwork (MASS) is described which provides shared mass storage for a multiple-host computer configuration. A mass storage facility is interfaced by MASS to large, scientific worker computers to provide an on-line capacity of 1 trillion bits of user-accessible data. The key design features of the subnetwork that contribute to the high performance include the following: a data transmission scheme that provides a 40 Mbit/s channel over distances of up to 1000 ft, a large metal-oxide semiconductor (MOS) memory buffer controlled by a 24 port memory multiplexer with an aggregate data rate of 280 Mbit/s, and a set of high-speed microprocessor based controllers driving the commercial mass storage units. Reliability of the system is provided by a completely redundant network, including two control minicomputer systems. Also enhancing reliability is error detection and correction in the MOS memory. DOE

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-33120# RAND Corp., Santa Monica, Calif.
KNOWLEDGE ACQUISITION, KNOWLEDGE PROGRAMMING, AND KNOWLEDGE REFINEMENT
Frederick Hayes-Roth, Philip Klahr, and David J. Mostow May 1980 39 p
(Grant NSF MCS-77-03273)
(RAND/R-2540-NSF) Avail: NTIS HC A03/MF A01

The iterative refinement of knowledge in response to actual experience is explained. A machine uses knowledge acquired initially from a human, who provides enough concepts, constraints, and problem-solving heuristics to define some minimal level of performance. A learning system must use existing knowledge to plan reasonable courses of action, carry those plans out, and then diagnose weaknesses that explain observed failures or unexpected successes. The processes of planning, acting, and evaluation cooperate to produce new knowledge by refining and extending prior knowledge. A system learn by increasing the scope, precision, validity, and power of its current knowledge. That knowledge includes descriptions and models of the environment, as well as planning and problem solving techniques for achieving goals. Learning requires the system to augment, generalize, specialize, validate, and exploit the knowledge it possesses at any point in time. A.R.H.

N80-33121# Brown Univ., Providence, R. I. Center for Dynamical Systems.
APPROXIMATION SCHEMES FOR THE LINEAR-QUADRATIC OPTIMAL CONTROL PROBLEM ASSOCIATED WITH DELAY EQUATIONS Interim Report
Karl Kunisch (Technische Univ., Graz) Mar. 1980 71 p refs
(Contract DAAG29-79-C-0161; Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A088245; AFOSR-80-0577TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

The linear regulator problem for delay equation is discussed. We propose a (theoretical) solution involving Riccati integral equations and them axiomatically discuss a general approximation scheme. The details are given for spline and averaging approximations. GRA

N80-33122# Brown Univ., Providence, R. I. Center for Dynamical Systems.
THE RICCATI INTEGRAL EQUATION ARISING IN OPTIMAL CONTROL OF DELAY DIFFERENTIAL EQUATIONS Interim Report
Karl Kunisch (Technische Univ., Graz) 10 Jun. 1980 16 p refs Presented at Intern. Conf. on Nonlinear Phenomena in Math. Sci., Arlington, Tex., 16-20 Jun. 1980
(Contract DAAG29-79-C-0161; Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A088097; AFOSR-80-0584TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper we discuss the linear regulator problem associated with delay-differential equations. Formulas for the optimal feedback control and optimal trajectory are derived; this naturally leads to a Riccati integral equation in the state space of the delay equation. Finally, the linear regulator problem for the delay equation is approximated by sequences of regulator problems associated with ordinary differential equations in Euclidean space. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-33123*# Lassen Research, Manton, Calif.
WINDFIELD RETRIEVAL FROM DOPPLER LIDAR OBSERVATIONS Interim Technical Report
R. W. Lee Jun. 1980 20 p
(Contract NAS8-33389)
(NASA-CR-161572; ITR-1) Avail: NTIS HC A02/MF A01 CSCL 12A

An approach to the retrieval of a vector wind field from Doppler lidar observations is developed in general terms. The field of radial velocity measurements from each look angle is modeled by a smooth surface, the parameters of the model being determined from the data by least squares techniques. The vector wind field and higher-order fields are obtained from the two modeled surfaces. Estimated measurement errors are taken into account, and error estimates are available for all output data sets. Author

N80-33124# Stanford Univ., Calif. Dept. of Statistics.
OPTIMAL STRATEGIES FOR SECOND GUESSERS
J. Michael Steele and Jim Zidek 25 Feb. 1980 29 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031; NR Proj. 042-267)
(AD-A087897; SU-TR-281) Avail: NTIS HC A03/MF A01 CSCL 12/1

A model is given for a class of contests in which the participants try to guess (or estimate) unknown quantities, and the objective of each player is to come closer to the unknown quantities than his adversary. A general optimality result is proved which gives the best guessing rules for the second guesser. These rules are first calculated exactly in a certain hierarchical linear model, and then simpler approximate rules are given. GRA

N80-33125# Washington Univ., Seattle. Dept. of Mathematics.
THE DIAMETER OF ALMOST ALL BIPARTITE GRAPHS
V. L. Klee, D. G. Larman, and E. M. Wright May 1980 10 p refs Sponsored in part by Army
(Contract N00014-67-A-0103; NR Proj 044-353)
(AD-A087687; TR-68) Avail: NTIS HC A02/MF A01 CSCL 12/1

The diameter of graphs is addressed with specific reference to the case of bipartite graphs on N labelled points and M = M(N) < or = N labelled points. Of the 2(MN) such graphs, some are disconnected and the others have diameters ranging from 2M or 2M-1 down to 2. Denoting by P(n) the proportion of the graphs which are of diameter 3, it is proved as a necessary and sufficient condition, namely P(n) approaches 1 as n approaches infinity, that M(N) log (4/3)-2 log N approaches positive infinity. Some related results and unsolved problems are also mentioned. M.G.

N80-33126# Naval Ocean Systems Center, San Diego, Calif. Systems Application Div.
COMPARISON OF DETECTION PERFORMANCE OF SELECTED TWO-CHANNEL ALGORITHMS Final Report
D. J. Edelblute and C. L. Meland 28 Sep. 1979 40 p refs (ZR0110812)
(AD-A087797; NOSC/TD-328) Avail: NTIS HC A03/MF A01 CSCL 09/4

Recent work on intersensor processing has stimulated interest in techniques for determining information common to two data sequences which may be used for detection, tracking or a combination of these and other functions. Three algorithms which seemed naturally to suggest themselves for intersensor processing were compared. It was determined that the use of a normalization factor significantly degrades detection performance in regions characterized by low time-bandwidth product TW < or = 64. For TW < or = 120, all three algorithms performed about equally on the detection function. The principal implication of this work is that the operating mode of the system (which may dictate the low time-bandwidth product used) may affect the choice of algorithms to be used. In a tactical application where decisions must be made quickly, use of an unnormalized correlator may be mandatory. In a situation where long integration times are acceptable, a normalized formula such as the coherence detector may be chosen for data processing, as opposed to signal processing, economies. GRA

N80-33127# Georgia Inst. of Tech., Atlanta. School of Industrial and Systems Engineering.
AN ALGORITHM FOR LINEARLY CONSTRAINED NONLINEAR PROGRAMMING PROBLEMS Interim Report
Mokhtar S. Bazaraa and Jamie J. Goode 1980 23 p refs
(Contract F49620-79-C-0120; AF Proj. 2304)
(AD-A085458; AFOSR-80-0449TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

An algorithm for solving a linearly constrained nonlinear programming problem was developed. Given a feasible point, a correction vector was computed by solving a least distance programming problem over a polyhedral cone defined in terms of the gradients of the almost binding constraints. Mukai's approximate scheme for computing step sizes was generalized to handle the constraints. This scheme provided an estimate for the step size based on a quadratic approximation of the function. This estimate was used in conjunction with Armijo line search to calculate a new point. Each accumulation point is a Kuhn-Tucker point to a slight perturbation of the original problem. Under suitable second order optimality conditions, eventually only one trial is needed to compute the step size. T.M.

N80-33128# Harry Diamond Labs., Adelphi, Md.
INVERTIBLE BINARY MATRICES
Thomas C. Jedrey May 1980 14 p ref
(DA Proj. 1L1-61101-A-91A)
(AD-A085575; HDL-TM-80-13) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two procedures are developed for the generation of an invertible modulo two matrix which satisfies an algorithm that minimizes the number of nonzero coefficients in a Haar expansion of a Boolean function. The first method is based on an algorithm for the production of invertible modulo two matrices, while the other produces the required matrix by a direct examination of the input vector T. Both methods have been implemented in VSAPL, and the program for the second technique, which can generate much larger matrices, is included. M.G.

N80-33129# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
GENERIC PROPERTIES OF AN INTEGRO-DIFFERENTIAL EQUATION Interim Report
Jack K. Hale Jun. 1980 14 p refs
(Contract DAAG29-79-C-0161; Grants AF-AFOSR-3092-76; NSF MCS-79-05774; AF Proj. 2304)
(AD-A088242; AFOSR-80-0575TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Consider the functional differential equation where a,g are continuous. The linear function is such that the characteristic equation has two eigenvalues on the imaginary axis and the remaining ones with negative real parts. In spite of this, it is shown there is no generic Hopf bifurcation for any g. The nature of the bifurcation is characterized under hypotheses which appear to be generic in g. GRA

N80-33130# Tennessee Univ., Knoxville. Dept. of Mathematics.
A ZERO-ONE LAW FOR A CLASS OF MEASURES ON GROUPS
Balram S. Rajput, Donald Louie, and Albert Tortrat (Paris Univ., France) Sep. 1979 11 p refs
(Contract N00014-78-C-0468)
(AD-A088374; TR-7905) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let (E beta) be a measurable (nonabelian) group, alpha a measurable homomorphism on E and mu a law on (E beta) satisfying mu = mu(alpha) v(alpha) (with mu(alpha) = mu o/alpha), for some law v(alpha) on (E beta). Under some additional conditions it is shown that, for every proper normal subgroup G of E and a in E, if Ga is an element of beta (mu), the mu-completion of B, then mu(Ga) = 0 or 1. As a corollary, it is shown that this result yields all previously known 0-1 laws for stable, semistable, and quasistable laws on linear spaces as well as new 0-1 laws for other classes of infinitely divisible laws on linear spaces. GRA

N80-33131# Maryland Univ., College Park. Dept. of Mathematics.
SOME GRAPHICAL CONSIDERATIONS IN TIME SERIES ANALYSIS Interim Report
Benjamin Kedem Jun. 1980 27 p refs
(Grant AF-AFOSR-0211-80; AF Proj. 2304)
(AD-A088246; MD80-43-BK; AFOSR-80-0590TR; TR-80-41) Avail: NTIS HC A03/MF A01 CSCL 12/1

The pictorial information in a stationary time series as depicted by crossings of levels and crossings of random levels and related quantities is studied. It is shown that such graphical features are directly connected with the covariance function and hence with the spectral density. Many of these features can be actually applied in estimation and in the study of extremes. In the Gaussian case, the finite dimensional distributions are completely determined by the axis crossings and by the crossings of a random curve (to be defined) if the process is essentially bounded. GRA

N80-33132# Stanford Univ., Calif. Dept. of Operations Research.
NEAR-EQUIVALENCE OF NETWORK FLOW ALGORITHMS
Norman Zadeh 1 Dec. 1979 55 p refs
(Contract N00014-75-C-0493; Grant NSF ENG-76-12266; NR Proj. 042-264)
(AD-A088032; SU-TR-36) Avail: NTIS HC A04/MF A01 CSCL 12/1

Network problems arising in practice typically have non-negative arc costs. On such problems, we show that the following algorithms perform, modulo ties, the same sequence of flow augmentations. (1) Simplex (with the standard pivot rule and Big-M start), (2) Out-of-Kilter (Primal-Dual), (3) Dual Simplex (with the standard pivot rule), (4) Lemke's Complementary Pivot Algorithm. All methods compute a shortest path tree by mimicking the Dijkstra algorithm and then send flow along a sequence of minimum cost paths. Differences in implementation are discussed. It becomes clear that Dantzig's simplex method with the best empirical pivot rule (not the standard rule) will outperform other methods (variations of Simplex with the standard rule). A simple reason is given why Dual Simplex (best empirical) cannot do as well as Simplex (best empirical). GRA

N80-33133# Iowa Univ., Iowa City. Dept. of Statistics.
ON MEASURING THE CONFORMITY OF A PARAMETER SET TO A TREND, WITH APPLICATIONS
Tim Robertson and F. T. Wright (Missouri Univ. -Rolla) Jul. 1980 27 p refs
(Contracts N00014-80-C-0321; N00014-80-C-0322; Grant NSF MCS-78-01514)
(AD-A087946; TR-3) Avail: NTIS HC A03/MF A01 CSCL 12/1

Consider the hypothesis H (sub 1): theta (sub 1 >) or = theta (sub 2 >) or = theta (sub k) regarding a collection, of unknown parameters. It is clear that this trend is reflected in certain possible parameter sets more than in others. A quantification of this notion of conformity to a trend, which was suggested by Barlow and Brunk (1972), is studied. Applications of the resulting theory to several order restricted hypothesis tests are presented. GRA

N80-33134# Brown Univ., Providence, R. I. Center for Dynamical Systems.
IDENTIFICATION OF NONLINEAR DELAY SYSTEMS USING SPLINE METHODS Interim Report
H. T. Banks Jun. 1980 17 p refs
(Contract DAAG29-79-C-0161; Grants AF-AFOSR-3092-76; NSF MCS-79-05774; AF Proj. 2304)
(AD-A088251; AFOSR-80-0563TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Spline based approximation schemes for nonlinear nonautonomous functional differential equation control systems are discussed and it is shown how these may be employed in parameter estimation techniques. A sample of our numerical findings is also presented. GRA

N80-33135# Brown Univ., Providence, R. I. Center for Dynamical Systems.
FUNCTIONAL DIFFERENCE EQUATIONS AND AN EPIDEMIC MODEL Interim Report
Lawrence Turyn 9 Jun. 1980 14 p refs Presented at Intern. Conf. on Nonlinear Phenomena in Math. Sci., Arlington, Tex., 16-20 Jun. 1980
(Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A088108; AFOSR-80-0565TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We consider an epidemic model for the form S implies I which implies S with history on (-infinity, 0). The well-known threshold phenomenon is discussed in terms of the stability of a functional difference equation, also known as the translation-invariant renewal equation. Since the difference equation has infinite delay, the work of other authors on finite-delay problems is extended. Also, epidemic models with spatial effects are discussed by extension of the results to difference equations in a Banach space. GRA

N80-33136# South Carolina Univ., Columbia. Dept. of Mathematics Computer Science and Statistics.
ASYMPTOTICALLY DISTRIBUTION-FREE SIMULTANEOUS CONFIDENCE REGION OF TREATMENT DIFFERENCES IN A RANDOMIZED COMPLETE BLOCK DESIGN Interim Report
L. J. Wei Feb. 1980 12 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A088115; AFOSR-80-0588TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

For a randomized complete block design with additive block effects, an asymptotically distribution-free simultaneous confidence region of pairwise treatment differences is presented. The corresponding confidence bound has an explicit form and is easily obtained. An example is provided for illustration purpose. The case of treatment against control is also discussed. GRA

N80-33137# Rhode Island Univ., Kingston. Dept. of Mathematics.
A UNIQUENESS THEOREM FOR ORDINARY DIFFERENTIAL EQUATIONS Interim Report
M. J. Norris (Sandia National Labs., Albuquerque, N. Mex.) May 1980 8 p refs
(Contracts F49620-79-C-0129; DE-AC04-76DP-00789; AF Proj. 2304)
(AD-A088113; AFOSR-80-0585TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A uniqueness theorem is proved which answers an open question for a system of differential equations arising in a certain n-body problem of classical electrodynamics. The essence of the results can be illustrated using the scalar prototype equation x' = g sub 1(x) + g sub 2 (t + x) with x(0) = 0. The solution of the latter is unique provided g sub 1 and g sub 2 are continuous positive functions of bounded variation. M.G.

N80-33138# Cincinnati Univ., Ohio. Dept. of Mathematical Sciences.
NUMERICAL REGULARIZATION OF ILL-POSED PROBLEMS Final Report
C. W. Groetsch 9 Jul. 1980 72 p refs
(Grant AF-AFOSR-0059-79; AF Proj. 2304)
(AD-A088073; AFOSR-80-0573TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Contents: generalized inverses and generalized splines; on the Kryanev-Lardy method for ill-posed problems; On a class of regularization methods; the parameter choice problem in linear regularization: a mathematical introduction. GRA

N80-33139# Illinois Univ. at Urbana-Champaign. Computer Science Dept.
RAPID SOLUTION OF FINITE ELEMENT EQUATIONS ON LOCALLY REFINED GRIDS BY MULTI-LEVEL METHODS Ph.D. Thesis
John R. VanRosendale May 1980 123 p refs
(Grant AF-AFOSR-2854-75; AF Proj. 2304)
(AD-A088065; UIUCDCS-R-80-1021; UILU-ENG-80-1712; AFOSR-80-0591TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

This thesis is concerned with the use of multi-level methods to solve the linear systems arising from finite element discretizations of elliptic equations. In all, three multilevel methods are considered. The first of these is applicable only to quasi-uniform grids, but is simpler than other algorithms considered in previous theoretical work. The other two algorithms are applicable to both quasi-uniform grids, and locally refined grids, those grids on which the size of the largest and smallest elements many differ by an arbitrarily large factor. All three algorithms are asymptotically optimal, producing good solutions in O(N) operations on a finite element grid with N elements. These asymptotically optimal complexity bounds for the last two algorithms are the first such bounds for multilevel methods on locally refined grids. One of these algorithms achieves this O(N) complexity bound under weaker than expected conditions on the dimensions of the finite element spaces used by the algorithm. GRA

N80-33140# University Coll., Cork (Ireland). Dept. of Mathematical Physics.
RECENT ADVANCES IN THE EDGE-FUNCTION METHOD 1979-1980 Final Scientific Report, 2 Feb. 1979 - 1 Feb. 1980

Patrick M. Quinlan 30 Jul. 1980 24 p refs
(Grant AF-AFOSR-0075-79; AF Proj. 2301)
(AD-A088328; EOARD-TR-80-14) Avail: NTIS
HC A02/MF A01 CSCL 20/11

Main advances of E.F.M. in 1979-80 dealt with are: (1) anisotropic thin plates, (2) free vibrations of thin plates, (3) analysis of bridge slabs, (4) elliptical cracks in a prismoidal body. abstracts, conclusions, and illustrative examples are given in this report. GRA

N80-33141# Aeronautical Research Associates of Princeton, Inc., N. J.
SOLITONS AND THE INVERSE SCATTERING TRANSFORM
Harvey Segur 1980 56 p refs
(Contracts N00014-80-C-0048; DAAG29-78-C-0003)
(AD-A088023; ARAP-TM-80-6) Avail: NTIS
HC A04/MF A01 CSCL 12/1

Under appropriate conditions, ocean waves may be modeled by certain nonlinear evolution equations that admit soliton solutions and can be solved exactly by the inverse scattering transform (IST). The theory of these special equations is developed in five lectures. As physical models, these equations typically govern the evolution of narrow-band packets of small amplitude waves on a long (post-linear) time scale. This is demonstrated in lecture 1, using the Korteweg-deVries equation as an example. Lectures 2 and 3 develop the theory of IST on the infinite interval. The close connection of aspects of this theory to Fourier analysis, to canonical transformations of Hamiltonian systems, and to the theory of analytic functions is established. Typical solutions, including solitons and radiation, are discussed as well. With periodic boundary conditions, the Korteweg-deVries equation exhibits recurrence, as discussed in lecture 4. The fifth lecture emphasizes the deep connection between evolution equations solvable by IST and Painleve transcendents, with an application to the Lorenz model. GRA

N80-33142# Princeton Univ., N. J. Information Sciences and Systems Lab.
THE OFF-LINE USE OF A SEQUENTIAL ESTIMATOR
Thomas G. Robertazzi and Stuart Schwartz Jul. 1980 81 p refs
(Contract N00014-80-C-0530; NR Proj. 042-385)
(AD-A088178; TR-4) Avail: NTIS HC A05/MF A01 CSCL 12/1

The straightforward application of a sequential estimator to nonlinear regression (curve fitting) problems is generally not possible when good a priori parameter estimates are not available and also when minimizing the error over a local portion of the data does not insure that it is minimized globally. However, a sequential estimator may be easily utilized to perform off-line processing in such a situation. The key is to process the measurements in a random order rather than the causal order in which they occur. The off-line use of an extended Kalman filter is illustrated in terms of a particular application. This technique is essentially a sequential version of the Gauss-Newton minimization procedure with relinearization being performed after each measurement is processed. Fictitious measurement noise is necessary to prevent filter divergence and is included in a very simple manner. Computational savings over more conventional iterative minimization techniques are possible if the functions and partial derivatives involved are sufficiently complex to evaluate. But there is a real question regarding the extent to which convergence can be assured. The results of simulations are presented. GRA

N80-33143# Tennessee Univ., Knoxville. Dept. of Mathematics.
SEMISTABLE LAWS ON TOPOLOGICAL VECTOR SPACES Interim Report
Dong M. Chung (Sogang Univ., Seoul), Balram S. Rajput, and Albert Tortrat (Paris Univ.) Sep. 1979 24 p refs
(Contract N00014-78-C-0468; NR Proj. 042-400)
(AD-A088224; TR-7901) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper three types of results were discussed: firstly, two Levy-Khinchin type representations of Poisson type infinitely divisible (I.D.) laws on certain topological vector (TV) spaces-one of these complements a known representation due to Dettweiler; secondly, the r-semistable laws on locally convex TV spaces and also obtain good representation of their characteristic functions; finally, the existence and the continuity of the semigroup mu superscript t where t greater than 0 of I.D. laws mu on locally convex TV spaces. These complement similar known results of Siebert. GRA

N80-33144# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
ON THE ALMOST SURE CONVERGENCE OF WEIGHTED SUMS OF RANDOM ELEMENTS IN D(0, 1) Interim Report
Robert Lee Taylor and C. A. Calhoun Jun. 1980 15 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A088330; TR-56; AFOSR-80-0570TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The convergence of weighted sums of random elements in D(0,1) was obtained by Taylor and Daffer (1979) using a number of conditions such as convex tightness, moment conditions, and others. In this paper both the moment conditions and the tightness conditions are substantially relaxed in obtaining the almost sure convergence of weighted sums of random elements in D(0,1). In addition, a brief discussion of the necessary integral conditions will be included which will delineate these results and previous work. GRA

N80-33145# Illinois Univ., Urbana. Dept. of Computer Science.
COMPILING FAST PARTIAL DERIVATIVES OF FUNCTIONS GIVEN BY ALGORITHMS Ph.D. Thesis
Bert Speelpenning Jan. 1980 87 p refs
(Contracts DE-AS02-76ER-02383; EY-76-S-02-2383)
(COO-2383-0063; UILU-ENG-80-1702; UIUCDS-R-80-1002)
Avail: NTIS HC A05/MF A01

Symbolic methods for computing derivatives of functions that make full use of the function text are described. The system Jake described produces gradients significantly faster than numerical differencing. Jake can handle algorithms Af with arbitrary flow of control. Measurements performed on one particular machine suggest that Jake is faster than numerical differencing for > 8. Somewhat weaker results were obtained for the problem of computing Jacobians of arbitrary shape. DOE

N80-33146# Oak Ridge National Lab., Tenn. Computer Sciences Div.
BOUNDARY INTEGRAL EQUATION METHOD FOR FRACTURE PROBLEMS WITH MIXED MODE DEFORMATIONS
S. J. Chang and R. B. Morgan Jun. 1980 51 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-57) Avail: NTIS HC A04/MF A01

A numerical method which is based on the boundary integral equation formulation in elasticity is established to solve two dimensional problems of linear fracture mechanics. The scheme requires the superposition of a crack problem in an infinite region and an elastic problem which does not contain the crack but has an identical outer boundary condition to that of the given problem. DOE

N80-33147# Illinois Univ., Urbana.
AUTOMATIC MULTIRATE METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS
C. W. Gear Jan. 1980 15 p refs
(Contract DE-AS02-76ER-02383)
(COO-2383-0062; UIUCDS-R-80-1000; UILU-ENG-80-1701)
Avail: NTIS HC A02/MF A01

A study is made of the application on integration methods in which different step sizes are used for different members of a system of equations. Such methods can result in savings if the cost of derivative evaluation is high or if a system is sparse; however, the estimation and control of errors is very difficult and can lead to high overheads. Three approaches are discussed, and it is shown that the least intuitive is the most promising. DOE

N80-33148# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

ESTIMATORS FOR THE TRUNCATED BETA-BINOMIAL DISTRIBUTION
Conwin L. Atwood 1980 32 p refs Presented at 173d Inst. of Math. Statistics Conf., Davis, Calif., 16 Jun. 1980
(Contract DE-AC07-76ID-01570)
(CONF-800644-1) Avail: NTIS HC A03/MF A01

Let X have a beta-binomial(m,p,theta) distribution, truncated such that X > t for t = 0 or 1. Suppose that independent observations of X are available. A consistent estimator of (p,theta) is given, based on the first three sample moments. This may be used as a start for maximum likelihood estimation (MLE) or jackknifing. The standard assumptions for a C(alpha) test that X is truncated binomial do not hold; however a test is proposed based on jackknifing the sample variance of X. Some Monte Carlo comparisons are given. For moderately small data sets, these comparisons show that the moment estimator is often superior to the MLE, and the C(alpha) test is superior to other proposed tests, in spite of its lack of theoretical justification. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-33149*# Kentron International, Inc., Hampton, Va.
OZONE DATA AND MISSION SAMPLING ANALYSIS
John L. Robbins Sep. 1980 156 p refs
(Contract NAS1-16000)
(NASA-CR-159342; V-19100/OLTR-032) Avail: NTIS HC A08/MF A01 CSCL 12A

A methodology was developed to analyze discrete data obtained from the global distribution of ozone. Statistical analysis techniques were applied to describe the distribution of data variance in terms of empirical orthogonal functions and components of spherical harmonic models. The effects of uneven data distribution and missing data were considered. Data fill based on the autocorrelation structure of the data is described. Computer coding of the analysis techniques is included. T.M.

N80-33150# Stanford Univ., Calif. Dept. of Statistics.
DETECTING CHANGE POINTS IN SAMPLING FROM MULTINOMIAL DISTRIBUTIONS
Alan E. Gelfand 4 Mar. 1980 44 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031; NR Proj. 042-267)
(AD-A087898; TR-282) Avail: NTIS HC A03/MF A01 CSCL 12/1

The question of if and when a change in the underlying cell frequencies has occurred during the observation of a sequence of categorical variables is analyzed. Several techniques are developed that may be loosely grouped into three classifications: (1) central limit theorem approaches, (2) departure from centrality approaches and (3) test of homogeneity approaches. The approaches monitor the sequence either at every trail or at every kth trial. All approaches construct statistics which are functions of sequential sums either weighted or unweighted. The behavior of these sums and the statistics developed from them are discussed in detail. A large scale simulation study is discussed in an attempt to assess the performance of the approaches. Three approaches emerge as most promising but a clear choice among these is not possible at present. GRA

N80-33151# Colorado State Univ., Fort Collins. Dept. of Statistics.
CONFIDENCE INTERVALS ON NONNEGATIVE LINEAR COMBINATIONS OF VARIANCES
Franklin A. Graybill and Chih-Ming Wang Apr. 1980 20 p refs
(Contract N00014-78-C-0463; NR Proj. 042-402)
(AD-A084194; CSU-TR-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method for setting confidence limits on linear combinations of variances is explained. S.F.

N80-33152# Bell Telephone Labs., Inc., Holmdel, N. J.
THE INFLUENCE CURVE AND GOODNESS OF FIT
John R. Michael and William R. Schucany (Southern Methodist Univ.) May 1980 24 p refs
(Contract N00014-75-C-0439; NR Proj. 042-280)
(AD-A085593; TR-137) Avail: NTIS HC A02/MF A01 CSCL 12/1

The influence curve introduced by Hampel is applied to goodness of fit statistics. The efficacy curve is then defined to be the square of influence curve weighted by a constant which arises in the context of approximate Bahadur efficiency. For a number of goodness of fit statistics the ratios of these curves are shown to be equal to the asymptotic relative efficiency in the Pitman sense when testing for point contamination. These efficacy curves graphically demonstrate the sensitivities of certain goodness of fit statistics to minor perturbations in the assumed distribution. GRA

N80-33153# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
PARAMETER ESTIMATION TECHNIQUES FOR NONLINEAR DISTRIBUTED PARAMETER SYSTEMS Interim Report
H. T. Banks and Karl Kunisch (Technische Univ., Gras, Austria) 27 May 1980 22 p refs
(Contract DAAG29-79-C-0161; Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A088244; AFOSR-80-0579TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Methods for estimating system parameters are discussed for a class of partial differential equations. We develop schemes based on modal subspace approximations in some detail and include numerical examples. GRA

N80-33154# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
ANALYSIS OF NONLINEAR STOCHASTIC SYSTEMS WITH WIDE-BAND INPUTS Interim Report
Harold J. Kushner and Y. Bar-Ness Jun. 1980 20 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-76; NSF ENG-77-12946; AF Proj. 2304)
(AD-A088243; AFOSR-80-0578TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A general method for approximating systems with wide-band inputs by diffusion processes is discussed. The input noise itself can be processed nonlinearly by elements of the system. One particular case, examined in detail, is that of a hard limiter just after the input. The results suggest that the limiter can actually improve performance if the noise intensity is small. The development illustrates how tricky, but potentially useful, nonlinearities can be handled when the system input is wide-band noise. GRA

N80-33155# Maryland Univ., College Park. Dept. of Mathematics.
ON NEAREST NEIGHBOR DEGENERACIES OF INDISTINGUISHABLE PARTICLES Interim Report
Benjamin Kedem Jun. 1980 22 p refs
(Contract F49620-79-C-0095; AF Proj. 2304)
(AD-A088247; MD80-37-BK; TR-80-36; AFOSR-80-0589TR)
Avail: NTIS HC A02/MF A01 CSCL 12/1

Arrangement degeneracies suggested by sufficient statistics associated with binary stationary mth order Markov chains are discussed, and are shown to correspond and generalize some degeneracies arising when indistinguishable particles are placed on a one dimensional lattice with n compartments. From these statistics it is possible to define an mth order unit. The arrangement degeneracy obtained from s 1's and n-s 0's so that lower order units are placed in higher order units is solved. However, the most general arrangement degeneracy associated with all the sufficient statistics of a given order is difficult. For this case only the 3rd order arrangement degeneracy is obtained, the 1st and 2nd orders being relatively simple. These results are applied in determining the asymptotic distributions of rare events. GRA

N80-33156# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
NONPARAMETRIC BAYES ESTIMATION OF DISTRIBUTION FUNCTIONS AND THE STUDY OF PROBABILITY

DENSITY ESTIMATES Interim Report, 1 Jun. 1979 - 31 May 1980
W. J. Padgett, R. L. Taylor, and L. J. Wei 30 Jun. 1980 18 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A088250; AFOSR-80-0571TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In work under this grant, major results were obtained in the four broad areas of survival analysis and life testing, probability density estimates and laws of large numbers, estimation after testing, and robustness and distribution-free procedures. In particular, nonparametric estimators of the failure rate function and survival probability were developed under the assumption of increasing failure rate using both maximum likelihood and Bayesian approaches. These particular results have attracted wide attention due to their generality and applicability in survival analysis and reliability estimation from arbitrarily right-censored data. Also, consistency results for both univariate and multivariate kernel estimates for probability density functions and regression functions were obtained using techniques and results of function-space probability theory. Sequential procedures were developed and analyzed which provided interval estimators of the parameter of interest after testing certain hypotheses. Various robustness and nonparametric methods for incomplete samples and broken samples were also studied. Thus, maintenance policies and development of new, more reliable, equipment may be formulated using statistical procedures and theory from these results. GRA

N80-33157# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
ASYMPTOTIC CONSERVATIVENESS AND EFFICIENCY OF KRUSKAL-WALLIS TEST FOR K DEPENDENT SAMPLES Interim Report
L. J. Wei May 1980 14 p refs
(Contract F49620-79-C-0140; AF Proj. 2034)
(AD-A088249; AFOSR-80-0566TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The robustness (asymptotic conservativeness) of Kruskal-Wallis test under certain departures from mutual independence of K univariate samples is established. This robustness provides a procedure for testing the equality of K marginal distribution functions on a broken random sample from a K-variate distribution which satisfies a mild condition. For the unbroken sample, a generalized Kruskal-Wallis test is proposed for testing the symmetry of a K-dimensional distribution function. The relative efficiency of the K-W test against the aligned rank order test is also examined under the normal shift model. GRA

N80-33158# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
SOME BAYES ESTIMATORS OF RELIABILITY FOR THE INVERSE GAUSSIAN LIFETIME MODEL Interim Report
W. J. Padgett Feb. 1980 13 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A088078; AFOSR-80-0584TR; TR-53) Avail: NTIS HC A02/MF A01 CSCL 12/1

Bayes estimation of the reliability function for the inverse Gaussian distribution is discussed. For the case that the mean lifetime is known, Bayes estimators are obtained with Jeffreys' noninformative prior and with the natural conjugate prior for the scale parameter. In the case that both parameters are unknown, an estimator of reliability is suggested which is based on the Bayes estimator obtained for the case that the mean lifetime is known. This estimator is not Bayes but compares favorably with the maximum likelihood and minimum variance unbiased estimators as indicated by computer simulations. GRA

N80-33159# Florida State Univ., Tallahassee. Dept. of Statistics.
ON THE FIRST PASSAGE TIME DISTRIBUTION FOR A CLASS OF MARKOV CHAINS
Mark Brown and C. N. Rao Jul. 1980 17 p refs
(Contract F49620-79-C-0157; Grant AF-AFOSR-3678-78; AF Proj. 2304)
(AD-A088111; FSU-Statistics-M552; TR-79-B5; AFOSR-80-0581TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Consider a stochastically monotone Markov chain with monotone paths on a partially ordered countable set S. Let C be an increasing subset of S with finite complement. Then the first passage time from an element of S to C is shown to be IFRA (increasing failure rate on the average). Several applications are presented including coherent systems, shockmodels, and convolutions of IFRA distributions. GRA

N80-33160# Princeton Univ., N. J. Dept. of Statistics.
FORMULAS FOR A TWO-SAMPLE MONTE CARLO SWINDLE
Karen Kafadar Nov. 1979 13 p refs
(Grant DAAG29-76-G-0298)
(AD-A088072; TR-153-SER-2; ARO-14244.13-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

In order to obtain accurate estimates of the percentage points of the two sample t-like statistic, we use a Monte Carlo swindle based on the method of conditional probabilities. The formulas for this implementation are described in this report. GRA

N80-33161# Princeton Univ., N. J. Dept. of Statistics.
A ROBUST CONFIDENCE INTERVAL FOR SAMPLES OF FIVE OBSERVATIONS
Karen Kafadar Nov. 1979 27 p refs
(Grant DAAG29-76-G-0298)
(AD-A088071; TR-154-SER-2; ARO-14244.14-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

A robust confidence interval using biweights for the case of five observations is proposed when the underlying distribution has somewhat heavier tails than the Gaussian. The distribution of a t-like statistic is approximated by a Student's t on the nominal four degrees of freedom using different scale factors which depend upon the value of the biweight weights. Results given by Monte Carlo simulations indicate that, even for very high coverage probabilities, the intervals proposed are highly efficient, in terms of the expected length of the confidence interval. GRA

N80-33162# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
A ROBUST ESTIMATOR OF THE DIFFERENCE BETWEEN LOCATION PARAMETERS OF CORRELATED VARIABLES FOR FRAGMENTARY SAMPLES Interim Report
L. J. Wei Apr. 1980 16 p refs
(Contract F49620-79-C-0140)
(AD-A088109; AFOSR-80-0569TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A simple and robust estimator of the difference of location parameters of correlated variables is proposed when some observations on either of the variables are missing. We show that this estimator is consistent, asymptotically normally distributed, and insensitive to outlying observations. Asymptotic relative efficiency comparisons with other known estimators are made to show the advantage of the proposed estimator. GRA

N80-33163# Iowa Univ., Iowa City. Dept. of Statistics.
LIKELIHOOD RATIO TESTS FOR AND AGAINST A STOCHASTIC ORDERING BETWEEN MULTINOMIAL POPULATIONS TESTS FOR A STOCHASTIC ORDERING
Tim Robertson and F. T. Wright 17 Jul. 1980 23 p refs
Prepared in cooperation with Missouri Univ., Rolla.
(Contracts N00014-80-C-0321; N00014-80-C-0322)
(AD-A088194; TR-2) Avail: NTIS HC A02/MF A01 CSCL 12/1

Likelihood ratio tests concerning the parameters of two multinomial populations are discussed. A stochastic ordering restriction is considered as a one sided alternative to equality. The one and two sample tests for equality versus stochastic ordering and stochastic ordering versus all alternatives are derived and their large sample distributions are obtained. The large sample distributions are mixtures of chi-squared distributions. The tests developed provide discrete analogues for the one sided Mann-Whitney-Wilcoxin and Kolmogorov-Smirnov tests. GRA

N80-33164# Brookhaven National Lab., Upton, N. Y. Applied Mathematics Dept.
MORE ON APPROXIMATIONS OF POISSON PROBABILITIES

Chung-siung Kao May 1980 16 p refs Presented at the Am. Statist. Assoc. Ann. Meeting, Houston, Tex., 11-14 Aug. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27878; CONF-800820-3) Avail: NTIS HC A02/MF A01

Several approximation methods are stated and compared numerically. An approximation based on a power transformation is found to outperform those based on the square-root type transformation as proposed in literature. The traditional Wilson-Hilferty approximation and Makabe-Morimura approximation are extremely poor compared with this approximation. DOE

N80-33165# Oak Ridge National Lab., Tenn.
DECIDING ON THE BEST (IN THIS CASE) APPROACH TO TIME-SERIES FORECASTING
David J. Pack 1980 17 p refs Presented at Canadian Operations Res. Soc. Meeting, Quebec, 20 May 1980
(Contract W-7405-eng-26)
(CONF-800571-1) Avail: NTIS HC A02/MF A01

It is demonstrated that a totally empirical comparison of the adaptive estimation procedure and the Box-Jenkins methodology is quite misleading with respect to choosing between them. This demonstration is followed by a discussion on comparison-of-methods techniques. DOE

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-33166# Purdue Univ., Lafayette, Ind. Krannert Graduate School of Management.
A GENERALIZED DECISION SUPPORT SYSTEM USING PREDICATE CALCULUS AND NETWORK DATA BASE MANAGEMENT
Robert H. Bonczek, Clyde W. Holsapple (Illinois Univ., Urbana), and Andrew B. Whinston Jul. 1980 36 p refs
(Contract DAAG29-79-C-0154)
(AD-A088079; ARO-16231.5-EL) Avail: NTIS HC A03/MF A01 CSCL 12/2

In view of the growing prominence of corporate modeling, an important area of research concerns techniques for facilitating the design and utilization of models. In this paper, we show how first-order predicate calculus can be used as a language for formally stating modeling knowledge. Furthermore, knowledge stated in this manner can be subjected to the resolution principle. The result is that application specific modeling knowledge need not be embedded in a computer program. Rather, it can be stored in a data base and utilized as needed by a problem processing system employing resolution techniques. Advantages of a decision support system taking an approach of this sort are considerable modeling flexibility, capacity for automating the model formulation and execution processes, and compatibility with a high-level user interface language. GRA

N80-33167# Wayne State Univ., Detroit, Mich. Dept. of Mechanical Engineering.
BASIC RESEARCH IN ENGINEERING: PROCESS AND SYSTEMS DYNAMICS AND CONTROL HIGH PRIORITY RESEARCH NEEDS RELEVANT TO ENERGY
M. J. Rabins, T. F. Edgar (Texas Univ. at Austin), H. H. Richardson (MIT, Cambridge), and J. Zaborszky (Washington Univ., Seattle) Feb. 1980 162 p, refs Workshop held at Denver, 20-23 Jun. 1979; sponsored by Am. Automatic Control Council, ASME and Engineering Societies Commission on Energy, Inc.
(Contract EF-77-C-01-2468)
(FE-2468-65) Avail: NTIS HC A08/MF A01

Process and Systems Dynamics and Control (PSDC) is concerned with the development and control of system behavior, performance criteria, and theories of control and optimization. A set of high-priority basic engineering research needs in the PSDC field which are important to the development of future energy technologies. The ten high priority generic research areas were aggregated into four major research needs recommended for DOE support; on-line optimization and control, systems methodology, measurements methodology and instrumentation, and modeling. DOE

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-33168# Washington Univ., Seattle. Dept. of Mathematics.
QUALITATIVE MATRICES: STRONG SIGN-SOLVABILITY AND WEAK SATISFIABILITY
Victor Klee and Richard Ladner May 1980 37 p refs
(Contracts N00014-76-C-0423; N00014-67-A-0103; Grant NSF MCS-77-02474; NR Proj. 044-353)
(AD-A087686; TR-80-05-01; TR-69) Avail: NTIS HC A03/MF A01 CSCL 12/1

The study of 'qualitative' linear systems was suggested by Paul Samuelson in 1947 in his influential book on Foundations of Economic Analysis. The present paper deals with a rather general form of qualitative solvability, of which strong sign-solvability is a special case, and with a closely related notion, weak satisfiability, from propositional logic. The study of strong sign-solvability is reduced to that of s-matrices and a conjecture of T. Gorman on the structure of S-matrices is elucidated. An algorithm is described which uses linear programming methods to recognize S-matrices (and much more general systems) and thus solves this recognition problem is polynomial time. However, this is close to the boundary of NP-completeness, for the closely related problem of recognizing weak satisfiability is shown to be NP-complete. GRA

N80-33169# Texas Univ., Austin. Center for Particle Theory.
SUPRALGEBRAS, SUPERGROUPS AND GEOMETRIC GAUGING
Yuval Neeman Dec. 1979 42 p refs Submitted for publication Supported in part by the US-Israel Binational Science Foundation
(Contract DE-AS05-76ER-03992)
(ORO-3992-384) Avail: NTIS HC A03/MF A01

Superalgebras, supergroups, and supermanifolds are discussed under the following headings: supers enter physics and mathematics; superalgebras; superconformal and super-Poincare algebras; the Z(2) and Z graded Grassman rings; supermanifolds; the classification of simple Lie superalgebras; classical superalgebras; the orthosymplectic sequences; classical hyperexceptional and exceptional superalgebras; nonclassical superalgebras; and supergroups. Gauging a supergroup has yielded an embedding of the Weinberg-Salam model of asthenodynamics in a highly constraining aesthetic theory. In this part, dealing with forms on a (rigid) group manifold, a principal bundle, and a soft (Dali) group manifold, the elements of the exterior calculus are developed on a Lie group manifold. Then the geometric theory of gauging is obtained; for a local internal symmetry, this is done on a principal bundle. For a noninternal group, such as the Poincare or super-Poincare group, Gravity and Supergravity are reproduced by use of a soft group manifold. DOE

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-33170# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SELF-CONSISTENT MANY BODY THEORY FOR STANDARD BASIS OPERATOR GREEN'S FUNCTION: AN APPLICATION TO ANISOTROPIC FERROMAGNETS
R. Micnas, R. Kishore, and I. C. daCunhaLima Jul. 1980 10 p refs Presented at 32d SBPC Meeting
(INPE-1824-RPE/190) Avail: NTIS HC A02/MF A01

A self-consistent many body theory is used to obtain an exact Dyson type equation of the retarded Green's function for the standard basis operator. These Green's functions are used

to obtain elementary excitations and thermodynamic properties of the Heisenberg ferromagnet with uniaxial anisotropy. M.G.

N80-33171# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
MAGNETIC FIELD INTERACTIONS WITH MATERIAL DISCONTINUITIES Final Report, 15 Jun. 1976 - 15 Apr. 1980
William Lord Apr. 1980 48 p refs
(Grants DAAG29-76-G-0249; DAAG29-78-G-0143)
(AD-A084541; ARO-13279.5-MS) Avail: NTIS
HC A03/MF A01 CSCL 14/5

Electromagnetic methods of nondestructive testing are discussed, detecting defects in metal parts. A major stumbling block in the development of these techniques, particularly with regard to the study of automated defect characterization schemes, is the lack of a suitable model capable of predicting the inherent complex field/defect interactions. The feasibility of applying finite element analysis techniques to the modeling of (1) active leakage field (2) residual leakage field and (3) eddy current methods of nondestructively testing metal structures is examined. The use of numerical analysis techniques shows the interrelationship of all the electromanetic nondestructive phenomena and the need for accurate material property (conductively and permeability) values. S.F.

N80-33172# Naval Underwater Systems Center, New London, Conn. Office of Engineering Mechanics.
CALCULATION OF THE BIOT-SAVART LAW MAGNETIC FIELD USING CURRENT DISTRIBUTIONS OBTAINED FROM A FINITE ELEMENT ANALYSIS
John W. Frye 27 Jul. 1980 32 p refs
(AD-A088094; NUSC-TR-6281) Avail: NTIS
HC A03/MF A01 CSCL 20/3

Biot-Savart law magnetic field integration equations are derived for rod and plate elements, and for volume interface regions from an equation due to Wikswo. These equations have applications for problems where current distributions are present over extended volumes and are calculated on the basis of a finite element electric field analysis. The Biot-Savart field so calculated can be used in a further finite element analysis of the magnetic field about a body of high permeability located in the same region as the electric field. GRA

N80-33173# Air Command and Staff Coll., Maxwell AFB, Ala.
THE FREE-BODY DIAGRAM REVISITED
Michael T. Toole May 1980 18 p refs Submitted for publication
(AD-A087952; ACSC-2500-80B) Avail: NTIS
HC A02/MF A01 CSCL 20/11

The purpose of this article is to review and hopefully revive interest in a procedure, the use of the free-body diagram, which is useful to students in an introductory mechanics course. This article provides a detailed discussion of the free-body diagram with examples and integrates the free-body diagram in to the problem-solving process. GRA

N80-33174# Naval Underwater Systems Center, New London, Conn. Office of Engineering Mechanics.
A FUNCTIONAL FOR FINITE ELEMENT ANALYSIS OF LOW INTENSITY MAGNETIC FIELDS INCLUDING PERMANENT MAGNETIZATION EFFECTS
John W. Frye 17 Jun. 1980 9 p refs
(AD-A088230; NUSC-TR-6289) Avail: NTIS
HC A02/MF A01 CSCL 20/3

A functional is presented that is useful in the finite element analysis of low intensity, static magnetic field solutions. The variational principle is written in terms of a scalar potential function and, when minimized, leads to field equations and boundary conditions that characterize a magnetic field, accounting for the presence of current, permanent magnetization, and incident magnetic fields. This variational principle finds applications in the finite element analysis of magnetic field problems. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-33175*# United Technologies Research Center, East Hartford, Conn.
AIRFRAME NOISE REDUCTION STUDIES AND CLEAN-AIRFRAME NOISE INVESTIGATION Final Report
Martin R. Fink and Douglas A. Bailey Apr. 1980 84 p refs
(Contract NAS1-15796)
(NASA-CR-159311; R80-914626-12) Avail: NTIS
HC A05/MF A01 CSCL 20A

Acoustic wind tunnel tests were conducted of a wing model with modified leading edge slat and trailing edge flap. The modifications were intended to reduce the surface pressure response to convected turbulence and thereby reduce the airframe noise without changing the lift at constant incidence. Tests were conducted at 70.7 and 100 m/sec airspeeds, with Reynolds numbers 1.5 x 10 to the 6th power and 2.1 x 10 to the 6th power. Considerable reduction of noise radiation from the side edges of a 40 deflection single slotted flap was achieved by modification to the side edge regions or the leading edge region of the flap panel. Total far field noise was reduced 2 to 3 dB over several octaves of frequency. When these panels were installed as the aft panel of a 40 deg deflection double slotted flap, 2 dB noise reduction was achieved. R.C.T.

N80-33176*# Aeronautical Research Associates of Princeton, Inc., N. J.
VISCOUS THEORY OF SURFACE NOISE INTERACTION PHENOMENA Final Report
John E. Yates Sep. 1980 44 p refs
(Contract NAS1-15539)
(NASA-CR-3331; ARAP-419) Avail: NTIS HC A03/MF A01 CSCL 20A

A viscous linear surface noise interaction problem is formulated that includes noise production by an oscillating surface, turbulent or vortical interaction with a surface, and scattering of sound by a surface. The importance of viscosity in establishing uniqueness of solution and partitioning of energy into acoustic and vortical modes is discussed. The results of inviscid two dimensional airfoil theory are used to examine the interactive noise problem in the limit of high reduced frequency and small Helmholtz number. It is shown that in the case of vortex interaction with a surface, the noise produced with the full Kutta condition is 3 dB less than the no Kutta condition result. The results of a study of an airfoil oscillating in a medium at rest are discussed. It is concluded that viscosity can be a controlling factor in analyses and experiments of surface noise interaction phenomena and that the effect of edge bluntness as well as viscosity must be included in the problem formulation to correctly calculate the interactive noise. A.R.H.

N80-33177*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
MODAL CONTENT OF NOISE GENERATED BY A COAXIAL JET IN A PIPE
E. J. Kerschen and J. P. Johnston May 1978 271 p refs
(Grants NsG-2007; NSF GK-37294; NSF ENG-76-00819)
(NASA-CR-163575; SU-JIAA-TR-11) Avail: NTIS
HC A12/MF A01 CSCL 20A

Noise generated by air flow through a coaxial obstruction in a long, straight pipe was investigated with concentration on the modal characteristics of the noise field inside the pipe and downstream of the restriction. Two measurement techniques were developed for separation of the noise into the acoustic duct modes. The instantaneous mode separation technique uses four microphones, equally spaced in the circumferential direction, at the same axial location. The time-averaged mode separation technique uses three microphones mounted at the same axial location. A matrix operation on time-averaged data produces the modal pressure levels. This technique requires the restrictive assumption that the acoustic modes are uncorrelated with each other. The measured modal pressure spectra were converted to modal power spectra and integrated over the frequency range

200-6000 Hz. The acoustic efficiency levels (acoustic power normalized by jet kinetic energy flow), when plotted vs. jet Mach number, showed a strong dependence on the ratio of restriction diameter to pipe diameter. The acoustic energy flow analyses based on the thermodynamic energy equation and on the results of Mohring both resulted in orthogonality properties for the eignfunctions of the radial mode shape equation. These orthogonality relationships involve the eigenvalues and derivatives of the radial mode shape functions. F.O.S.

N80-33178# Utah Univ., Salt Lake City. Dept. of Computer Science.
A CONSTANT PERCENTAGE BANDWIDTH TRANSFORM FOR ACOUSTIC SIGNAL PROCESSING
James E. Youngberg Jan. 1980 121 p refs
(Contract N00173-79-C-0045)
(AD-A085666; UTEC-CS-80-004) Avail: NTIS HC A06/MF A01 CSCL 20/1

A constant percentage bandwidth transform for acoustic signal processing is described. A synthesis transformation is developed which, cascaded with the analysis transformation provides an analysis-synthesis identity in the absence of spectral modification. The effects of spectral domain modification are described. Principles governing discrete implementation of the transform pair are discussed, and relationships are formalized which specify minimal sample requirements for the spectral domain. The Constant-Q spectral magnitude and phase functions are discussed, and three main methods are evaluated whereby the spectral requirements be unwrapped. The use of the transform pair is discussed in the solution of the perception related problem of time scale compression and expansion of speech. R.C.T.

N80-33179# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL STUDIES OF IMPULSIVE NOISE PRODUCED BY SPHERES MOVING THROUGH WATER M.S. Thesis
Thomas Kunze Mar. 1980 64 p refs
(AD-A084419) Avail: NTIS HC A04/MF A01 CSCL 20/1

Spheres were towed in an anechoic tank. Velocities up to 5 m/sec and Reynolds numbers up to 500,000 were obtained with spheres of 2, 4, and 10 in diameter. After eliminating all mechanical and acoustical disturbances, no noise bursts were detected. However, the impulsive noise was still observed in free-fall experiments, and a ranging system allowed the location of these noise bursts with respect to a fixed point. A frequency analysis was done with a digital signal processor. T.M.

N80-33180# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
SCATTERING MATRIX ANALYSIS OF SURFACE ACOUSTIC WAVE REFLECTIONS AND TRANSDUCERS Ph.D. Thesis
Carl Michael Panasik Feb. 1980 70 p refs
(Contracts F19628-78-C-0040; N00014-79-C-0424)
(AD-A085764; UILU-ENG-80-2205; R-873) Copyright. Avail: NTIS HC A04/MF A01 CSCL 20/1

The phased periodic array scattering parameters were modified and corrected for use as a single electrode, mixed units, scattering matrix consisting of one electrical and two acoustic port. These scattering parameter analytical expressions are functions of material constants, electrode geometry, and frequency. The three port single electrode scattering matrices are acoustically cascaded to produce a three port device scattering matrix which takes into account all finger interactions (acoustic and electric) for the combined effects of piezoelectric and mechanical scattering. The analysis agrees well with experimental measurements of input admittance, electro-acoustic transfer function, and acoustic transmission and reflection coefficients as functions of frequency. Analysis results for the complete modeling of transducers with floating electrodes are also presented. Author

N80-33181# Texas Univ. at Austin. Applied Research Labs.
SIGNAL PROCESSING ASPECTS OF NONLINEAR ACOUSTICS
T. G. Muir and Tommy G. Goldsberry 7 Jul. 1980 37 p refs
Presented at the NATO Advan. Study Inst. on Underwater Acoustics and Signal Process., Copenhagen, 18-29 Aug. 1980
(Contract N00014-75-C-0161)
(AD-A088369; ARL-TR-80-38) Avail: NTIS HC A03/MF A01 CSCL 20/1

The topic of nonlinear acoustics has been included at previous NATO study institutes going back to 1966. The first treatment, by Berktay, speculated on the possibilities nonlinear effects might offer. In 1968, Mellen illustrated some of these possibilities through laboratory tank experiments. Berktay returned in 1972 to present some engineering models for the design of parametric sources. In 1976, Bjorno presented a survey of theoretical and experimental results on parametric arrays developed at several laboratories. Today, research and development in nonlinear acoustics has gravitated toward applications. The present paper therefore addresses applications with a view towards outlining the unique features of nonlinear arrays, especially with regard to signal processing. Both nonlinear sources and receivers will be discussed. GRA

N80-33182# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif. Biodynamics and Bioengineering Div.
DEVELOPMENT OF NOISECHECK TECHNOLOGY FOR MEASURING AIRCRAFT NOISE EXPOSURE Final Report
Peter E. Rentz May 1980 140 p refs
(Contract F33615-77-C-0514; AF Proj. 7231)
(AD-A088033; BBN-3862; AMRL-TR-78-125) Avail: NTIS HC A07/MF A01 CSCL 14/2

This report describes a program to develop instrumentation for use by Air Force personnel to make spot checks of the noise exposure at locations in and about air bases. These instruments combined with standardized field measurement procedures form a technology, termed NOISECHECK, which provides a means for measuring the noise environment and checking daily average noise level values (DNL's) calculated by the Air Force NOISEMAP community-aircraft noise prediction program. GRA

N80-33183# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
STUDY OF LATERAL EXCESS SOUND ATTENUATION AS DETERMINED FROM FAR PART 36 AIRCRAFT NOISE CERTIFICATION MEASUREMENTS
Dwight E. Bishop and Jane M. Beckmann Wright-Patterson AFB, Ohio Air Force Aerospace Medical Research Lab. Jul. 1980 58 p refs
(Contract F33615-79-C-0501; AF Proj. 7231)
(AD-A088285; BBN-4225; AFAMRL-TR-80-65) Avail: NTIS HC A04/MF A01 CSCL 20/1

This report presents information on the variation of the lateral excess attenuation as a function of elevation angle. Lateral excess attenuation represents the differences between the noise levels measured directly underneath the aircraft and to the side of the aircraft, after adjustment for differences in distance and air absorption. This information was developed from analysis of 'takeoff' and 'sideline' noise data acquired during FAR 36 civil aircraft noise certification tests. The study shows that useful excess attenuation information can be developed from aircraft certification data provided steps are taken to locate sideline positions so that measurements adequately cover the range of low elevation angles. The measured excess attenuation values show trends with frequency that are consistent with measurements observed in recent Air Force tests in the frequency range up to about 400 Hz. Larger excess attenuation values were measured at higher frequencies for reasons that are not known at this time. The perceived noise level (PNL), and A-level (AL), curves for each of the aircraft were generally similar in shape however the excess attenuation values for PNL were slightly larger than the AL values, with the difference most pronounced for the C-130H aircraft. GRA

N80-33184# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 119: C-135B AIRCRAFT, NEAR AND FAR-FIELD NOISE
Robert G. Powell Dec. 1979 149 p
(AF Proj. 7231)
(AD-A087953; AFAMRL-TR-75-50-Vol-119) Avail: NTIS HC A07/MF A01 CSCL 01/2

The USAF C-135B is a long range, high performance, transport aircraft powered by four TF33-P-5 turbofan engines. This report

provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for six engine/power configurations. Near-field data are reported for eleven locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. Refer to Volume 1 of this handbook, 'USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application', AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. GRA

N80-33185# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
COMPUTER PROGRAM TO ADD NOISEMAP GRIDS OF DIFFERENT SPACINGS Final Report
Harry Seidman Apr. 1980 31 p
(Contract F33615-79-C-0501; AF Proj. 7231)
(AD-A088205; AMRL-TR-79-88) Avail: NTIS HC A03/MF A01 CSCL 09/2

Noise data for normal aircraft operations are usually calculated by the NOISEMAP computer program at grid points 1000 feet apart. Data from blast noise and supersonic aircraft are calculated at grid points several thousand feet apart. This report describes a computer program that was written to allow the two sets of data to be combined. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-33186* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYDROGEN HOLLOW CATHODE ION SOURCE Patent
Michael J. Mirtich, Jr., James S. Sovey, and Robert F. Roman, inventors (to NASA) Issued 19 Aug. 1980 4 p Filed 23 Oct. 1978 Supersedes N79-10894 (17 - 01, p 0118)
(NASA-Case-LEW-12940-1; US-Patent-4,218,633; US-Patent-Appl-SN-953391; US-Patent-Class-313-362; US-Patent-Class-313-231.4) Avail: US Patent and Trademark Office CSCL 20H

A source of hydrogen ions is disclosed and includes a chamber having at one end a cathode which provides electrons and through which hydrogen gas flows into the chamber. Screen and accelerator grids are provided at the other end of the chamber. A baffle plate is disposed between the cathode and the grids and a cylindrical baffle is disposed coaxially with the cathode at the one end of the chamber. The cylindrical baffle is of greater diameter than the baffle plate to provide discharge impedance and also to protect the cathode from ion flux. An anode electrode draws the electrons away from the cathode. The hollow cathode includes a tubular insert of tungsten impregnated with a low work function material to provide ample electrons. A heater is provided around the hollow cathode to initiate electron emission from the low work function material.
Official Gazette of the U.S. Patent and Trademark Office

N80-33187*# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy.
ELECTRON-TEMPERATURE DEPENDENCE OF DISSOCIATIVE RECOMBINATION OF ELECTRONS WITH CO(+)-(CO) n-SERIES IONS
Marlin Whitaker, Manfred A. Biondi, and Rainer Johnsen [1980] 16 p refs
(Grant NGL-39-011-137; Contract DAAG29-80-C-0075)
(NASA-CR-163572) Avail: NTIS HC A02/MF A01 CSCL 20H

A microwave afterglow mass spectrometer apparatus is used to determine the dependence on electron temperature T sub e of the recombination coefficients alpha sub n of the dimer and trimer ions of the series CO+.(CO) sub n. It is found that alpha sub 1 = (1.3 + or - 0.3)x 0.000001 (T sub e(K)/300) to the -0.34; and alpha sub 2 = (1.9 + or - 0.4)x 0.000001 (T sub e(K)/300) to the -0.33 cu cm/sec. These dependences on T sub e are quite different from those obtained previously for polar-cluster ions of the hydronium and ammonium series but are similar to that for simple diatomic ions. M.G.

N80-33188*# California Univ., Santa Barbara.
ION CHEMISTRY IN INTERSTELLAR SPACE Final Report
Michael T. Bowers 30 Sep. 1980 4 p refs
(Contracts NAS7-100; JPL-955623)
(NASA-CR-163580; JPL-9950-417) Avail: NTIS HC A02/MF A01 CSCL 20H

The temperature dependence of the bimolecular reactions of Cl(+), HCl(+), CH(+), CH2(+), N(+), NH(+), and NH2(+) reacting with H2 have been investigated. For Cl(+) and HCl(+) rate constants have been determined over the temperature range of 150 to 400 K. Preliminary data have been obtained for the other systems. The Cl(+)/H2 system shows a weak, but significant positive temperature dependence that could be important in interstellar modeling studies. The HCl(+)/H2 system shows a substantial negative temperature dependence with the rate constant approaching the collision rate at low temperatures. The association reaction CH3(+) + HCN yields CH3 HCN(+) has been theoretically modeled using statistical phase space theory. Both radiative and collisional stabilization have been included. The results are compared with experiment with good agreement obtained over wide variations in T and p. This system is potentially important in the mechanism of large molecule synthesis in interstellar space. Author

N80-33189# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INFLUENCE OF ION MOTION IN THE INVERSE FARADAY EFFECT
Abraham C.-L. Chian Jun. 1980 12 p refs Presented at the 32d Reuniao Anual da Soc. Brasileira para o Progr. da Cienc. Submitted for publication
(INPE-1764-RPE/153) Avail: NTIS HC A02/MF A01

It is shown that ion motion can significantly affect the magnetic field generated by an intense circularly polarized electromagnetic wave in a plasma. For extremely strong waves, the magnetic field induced by the electron current in an electron-ion plasma can be nearly cancelled by the ion current. Author

N80-33190*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TABLES OF STARK LEVEL TRANSITION PROBABILITIES AND BRANCHING RATIOS IN HYDROGEN-LIKE ATOMS
K. Omidvar Sep. 1980 50 p refs Submitted for publication
(NASA-TM-82015) Avail: NTIS HC A03/MF A01 CSCL 20H

The transition probabilities which are given in terms of n prime k prime and n k are tabulated. No additional summing or averaging is necessary. The electric quantum number k plays the role of the angular momentum quantum number l in the presence of an electric field. The branching ratios between stark levels are also tabulated. Necessary formulas for the transition probabilities and branching ratios are given. Symmetries are discussed and selection rules are given. Some disagreements for some branching ratios are found between the present calculation and the measurement of Mark and Wierl. The transition probability multiplied by the statistical weight of the initial state is called the static intensity J sub S, while the branching ratios are called the dynamic intensity J sub D. R.K.G.

N80-33191*# Cornell Univ., Ithaca, N. Y. Dept. of Chemistry.
DYNAMICS OF THE CHEMISTRY OF ELECTRONICALLY EXCITED ATOMS IN DEFINED QUANTUM STATES Final Report, 1 Apr. 1975 - 31 May 1980
John R. Wiesenfeld 15 Aug. 1980 15 p refs

(Contract N00014-75-C-0828; NR Proj. 394-010)
(AD-A088117) Avail: NTIS HC A02/MF A01 CSCL 07/4

The work described here involved the study of halogen atom production and removal following photodissociation of halogens, pseudohalogens and halides. Both collisional quenching and chemical reaction were seen. Electronic angular momentum conservation led to state-selective chemistry. GRA

N80-33192# Nebraska Univ., Lincoln.
PHOTOIONIZATION OF ATOMS Progress Report, 1 Apr. 1979 - 30 Mar. 1980
J. A. R. Samson and A. F. Starace Dec. 1979 26 p refs
(Contract DE-AS02-76ER-02892)
(COO-2892-18) Avail: NTIS HC A03/MF A01

A strong 304 A fluorescent signal from He(+) (n = 2) was observed as a function of incident photon wavelength; strong autoionizing structure arising from 3n(+) states are seen in the spectrum. Measurements of the radio of photoproduced Ne(+) ions to Ne(2+) ions indicate that further calibration of detector response is required. The dissociative photoionization of O2 was measured successfully as a necessary preliminary to measuring the photoionization cross section of atomic oxygen. Experimental apparatus was built to measure the photoelectron angular distribution of atomic cesium. In order to measure rare gas photoionization cross sections to plus or minus 1 percent accuracy, a new gas tight window was developed and second order lines in the laboratory light sources were classified. A new random phase approximation for the theoretical calculation of open or closed shell atom photoionization cross sections was developed. DOE

N80-33193# Washington Univ., Seattle. Dept. of Physics.
TECHNIQUE FOR MEASURING PARITY NONCONSERVATION IN HYDROGENIC ATOMS
E. G. Adelberger, T. A. Trainor, E. N. Fortson, T. E. Chupp, D. Holmgren, M. Z. Iqbal, and H. E. Swanson 1979 21 p refs
(Contract DE-AC06-76ER-01388)
(DOE/ER-01388-444; RLO-1388/444) Avail: NTIS HC A02/MF A01

A scheme for precise measurement of the parity mixing of the 2s/sub 1/2/ and 2p/sub 1/2/ states is discussed. The mixing was in hydrogen and deuterium atoms. DOE

N80-33194# Sandia Labs., Albuquerque, N. Mex.
INTERACTIONS BETWEEN SMALL POLARONIC PARTICLES IN SOLIDS
David Emin 1980 5 p refs Presented at Intern. Conf. on the Phys. of MOS Insulators, Raleigh, N.C., 18 Jun. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0486C; CONF-800647-1) Avail: NTIS HC A02/MF A01

The interaction between strongly coupled particles (or quasiparticles) which results from their mutual interaction with the atomic displacements of the host material is examined. As examples, the recombination kinetics of electron and hole small polarons and the ordering of defect atoms are discussed. DOE

N80-33195# Brookhaven National Lab., Upton, N. Y.
THREE DIMENSIONAL CALCULATION OF ELECTRON ENERGY LOSS IN A VARIABLE PARAMETER FREE-ELECTRON LASER
A. Luccio and C. Pellegrini Mar. 1980 30 p refs
(Contract EY-76-C-02-0016)
(BNL-27598) Avail: NTIS HC A03/MF A01

The effect on the laser efficiency of the electron transverse motion is studied and the electron energy loss is evaluated for a beam having a spread in angle and in the transverse position at the wiggler entrance. The complete three dimensional equations of motion for an electron interacting with the laser field and the wiggler field are integrated numerically. Only the case of a small gain regime, assuming that the laser field intensity remains constant, is considered. The case of a helical wiggler is specifically addressed. The results are compared with the one dimensional model. The effect of the initial position and angular spread can, to a good approximation, be considered equivalent to an increase in the energy spread. The limits for this increased energy spread that must not be exceeded in order to avoid a loss in efficiency are nearly the same as in the one dimensional model. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-33196# Air Force Office of Scientific Research, Bolling AFB, Washington, D.C.
PROCEEDINGS OF THE PARTICLE BEAM RESEARCH WORKSHOP
B. D. Guenther, Robert Lontz, John L. May (AFOSR, Washington, D.C.), and C. Martin Stickley Office of the Undersecretary of Defense. May 1980 101 p Workshop held at Colorado Springs, 10-11 Jan. 1980
(AD-A085158) Avail: NTIS HC A06/MF A01 CSCL 20/8

The particle beam research workshop was organized to develop a forum for the discussion of unclassified research issues relevant to particle beam weapons technology, and to develop a document which could be used as an unclassified guide for scientists who are interested in this technology but have not had prior access to the classified efforts. Finally, the workshop and the guide are designed to provide an information resource for DoD managers concerned with the opportunities that unclassified research offer to this technology. Author

N80-33197# Naval Research Lab., Washington, D. C.
DIOCOTRON INSTABILITY OF A RELATIVISTIC COAXIAL MULTI-RING HOLLOW ELECTRON BEAM
H. C. Chen and P. J. Palmadesso 18 Aug. 1980 30 p refs
(AD-A088054; NRL-MR-4286) Avail: NTIS HC A03/MF A01 CSCL 20/7

The diocotron stability properties of a relativistic coaxial multiring hollow electron beam are investigated using a macroscopic cold fluid description based on moment-Maxwell equations. It is found that for a broad range of beam parameters and somewhat more general type beam profile the growth rate of instability has a sensitive dependence on fractional charge neutralization, relative position of the rings with conducting wall and gap-length of the rings. In the case of a sharp boundary density profile, the beam can be stabilized easily by a small fractional charge neutralization with appropriate gap length. The growth rate can be either enhanced or reduced depending on the position and gap length of the rings. GRA

N80-33198# Oak Ridge National Lab., Tenn.
ION ENERGY RECOVERY EXPERIMENT BASED ON MAGNETIC ELECTRO SUPPRESSION
J. Kim, W. L. Stirling, W. K. Dagenhart, G. C. Barber, and N. S. Ponte May 1980 32 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7283) Avail: NTIS HC A03/MF A01

A proof of principle experiment on direct recovery of residual hydrogen ions based on a magnetic electron suppression scheme is described. Ions extracted from a source plasma a few kilovolts above the ground potential (approximately 20 A) are accelerated to 40 keV by a negative potential maintained on a neutralizer gas cell. As the residual ions exit the gas cell, they are deflected from the neutral beam by a magnetic field that also suppresses gas cell electrons and then recovered on a ground potential surface. Under optimum conditions, a recovery efficiency (the ratio of the net recovered current to the available full energy ion current) of 80% + or - 20% was obtained. Magnetic suppression of the beam plasma electrons was rather easily achieved; however, handling the fractional energy ions originating from molecular species (H2(+) and H3(+)) proved to be extremely important to recovery efficiency. DOE

N80-33199# Department of Energy, Aiken, S.C. Savannah River Operations Office.
RERACKING TO INCREASE SPENT FUEL STORAGE CAPACITY, REVISION 1
May 1980 12 p ref
(DOE/SR/SF-2004-Rev-1) Avail: NTIS HC A02/MF A01

Many utilities increased their spent fuel pool storage capacity by replacing aluminum racks having storage densities as low as 0.2 MTU/sq ft with stainless steel racks which can more than

double storage densities. Use of boron-stainless steel racks or thin stainless steel cans containing reassembled fuel rods allows even higher fuel storage densities (up to approximately 1.25 MTU/sq ft). The economics of smaller storage gains that occur if pools, already converted to high density storage, are further reracked are evaluated. DOE

N80-33200# Department of Energy, Washington, D. C. Office of Inertial Fusion.
HEAVY ION BEAMS FOR INERTIAL FUSION
T. F. Godlove and William B. Herrmannsfeldt May 1980 11 p refs Presented at the Intern. Conf. on Low Energy Ion Beams 2, Bath, England, 14-17 Apr. 1980 Prepared in cooperation with the Stanford Linear Accelerator Center, Calif.
(Contract DE-AC03-76SF-00515)
(SLAC-PUB-2524; CONF-800466-3) Avail: NTIS HC A02/MF A01

The United States' program in inertial confinement fusion (ICF) is described, with emphasis on the studies of the use of intense high energy beams of heavy ions to provide the power and energy needed to initiate thermonuclear burn. Preliminary calculations of the transport of intense ion beams in an electrostatic quadrupole focussing structure are discussed. DOE

N80-33201# Stanford Linear Accelerator Center, Calif.
INERTIAL CONFINEMENT FUSION SYSTEMS USING HEAVY ION ACCELERATORS AS DRIVERS
W. B. Herrmannsfeldt, T. F. Godlove (DOE), and D. Keffe (California Univ., Berkeley. Lawrence Berkeley Lab.) Mar. 1980 20 p refs Presented at the 2nd Intern. Conf. on Emerging Nucl. Energy Systems, Lausanne, Switzerland, 8 Apr. 1980
(Contract DE-AC03-76SF-00515)
(SLAC-Pub-2490; LBL-10870; CONF-800446-3) Avail: NTIS HC A02/MF A01

Heavy ion accelerators are of interest because of the expected efficient coupling of ion kinetic energy to the thermal energy needed to implode the pellet and because of the good electrical efficiency of high intensity particle accelerators. The beam intensities required, while formidable, lie within the range that can be studied by extensions of the theories and the technology of modern high energy accelerators. DOE

N80-33202# California Univ., Livermore. Lawrence Livermore Lab.
RECENT DEVELOPMENTS IN NUCLEAR REACTION THEORIES AND CALCULATIONS
D. G. Gardner 5 May 1980 35 p refs Presented at Symp. on Neutron Cross Sect. from 10 to 50 MeV, Upton, N.Y., 12 May 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84369; CONF-800551-11) Avail: NTIS HC A03/MF A01

Recent developments in the fields of optical model potentials; level densities; and statistical mode, precompound, and direct reaction codes and calculations are reviewed. Significant developments which will greatly enhance the ability to calculate high-energy neutron-induced reaction cross sections in the next few years are presented. DOE

N80-33203# Battelle Pacific Northwest Labs., Richland, Wash. Nuclear Waste Technology Program.
NUCLEAR WASTE MANAGEMENT Quarterly Progress Report, Oct. - Dec. 1979
A. M. Platt, comp. and J. A. Powell, comp. Apr. 1980 101 p refs
(Contracts EY-76-C-06-1830; DE-AC06-76RLO-1830)
(PNL-3000-4) Avail: NTIS HC A06/MF A01

Progress and activities are reported on the following: highlevel waste immobilization; alternative waste forms; nuclear waste materials characterization; TRU waste immobilization programs; TRU waste decontamination krypton solidification, thermal outgassing, and iodine-129 fixation along with monitoring of unsaturated zone transport, well-logging instrumentation development, and mobile organic complexes of fission products, waste management system and safety studies, assessment of effectiveness of geologic isolation systems, waste/rock interactions technology, spent fuel and fuel pool integrity program, and engineered barriers which are also discussed. DOE

N80-33204# California Univ., Livermore. Lawrence Livermore Lab.
FUSION PRODUCT DEPOSITION AND ENERGY BALANCE
W. C. Condit and D. E. Driemeyer (Illinois Univ., Urbana) 20 May 1980 8 p
(Contract W-7405-eng-48)
(UCID-18710) Avail: NTIS HC A02/MF A01

Monte Carlo calculations were performed of alpha particle deposition in the Hill's Vortex configuration, including a cold plasma density, n sub c, on the open field lines, with n sub C/T sub C(sup 3/2), approximately equal to n sub H/T sub H(sup 3/2) - i.e., with the slowing down ratio tau sub H/tau sub C/ lying between .1 and 10. Since many of the alpha particles spend a significant amount of their time on the open field lines, values of tau sub H/tau sub C greater than unity lead to significant removal of alpha particle ash from the closed field region. DOE

N80-33205# Brookhaven National Lab., Upton, N. Y.
FUSION: AN ENERGY SOURCE FOR SYNTHETIC FUELS
J. A. Fillo, J. Powell, and M. Steinberg 1980 9 p refs Presented at the AIAA Intern. Meeting and Tech. Display, Global Tech. 2000, Baltimore, 6-8 May, 1980
(Contract DE-AC02-76CH-00016)
(BNL-27891; CONF-800590-1) Avail: NTIS HC A02/MF A01

An important first step in the synthesis of liquid and gaseous fuels is the production of hydrogen. Thermonuclear fusion offers an inexhaustible source of energy for the production of hydrogen from water. Depending on design, electric generation efficiencies of approximately 40 to 60 percent and hydrogen production efficiencies by high temperature electrolysis of approximately 50 to 70 percent are projected for fusion reactors using high temperature blankets. Fusion/coal symbiotic systems appear economically promising for the first generation of commercial fusion synfuels plants. Coal production requirements and the environmental effects of large scale coal usage would be greatly reduced by a fusion/coal system. DOE

N80-33206# Arizona Univ., Tucson.
HYDROGEOLOGIC EFFECTS OF NATURAL DISRUPTIVE EVENTS ON NUCLEAR WASTE REPOSITORIES
S. N. Davis Jun. 1980 41 p refs
(Contract DE-AC06-76RL-01830)
(PNL-2858) Avail: NTIS HC A03/MF A01

Some possible hydrogeologic effects of disruptive events that may affect repositories for nuclear waste are described. A very large number of combinations of natural events can be imagined, but only those events which are judged to be most probable are covered. The disruptive events discussed above are placed into four geologic settings. The geology was generalized from actual field data. The geologic settings considered are: (1) interior salt domes of the Gulf Coast, (2) bedded salt of southeastern New Mexico, (3) argillaceous rocks of southern Nevada, and (4) granitic stocks of the Basin and Range Province. Log-normal distributions of permeabilities of rock units are given for each region. Discussions are devoted to: porosity and permeability of natural materials, regional flow patterns, disruptive events (faulting, dissolution of rock forming minerals, fracturing from various causes, rapid changes of hydraulic regimen); possible hydrologic effects of disruptive events; and hydraulic fracturing. DOE

N80-33207# California Univ., Livermore. Lawrence Livermore Lab.
FUSION MATERIALS HIGH ENERGY-NEUTRON STUDIES Status Report
D. G. Doran and M. W Guinan (California Univ., Livermore, Lawrence Livermore Lab.) 1980 36 p refs Presented at the Symp. on Neutron Cross Sect. from 10-50 MeV, Upton, N.Y., 12 May 1980
(Contract DE-AC14-76FF-02170)
(HEDL-SA-2145-FP; CONF-800551-14) Avail: NTIS HC A03/MF A01

The US Magnetic Fusion Reactor Materials Program provides a framework for evaluating nuclear data needs associated with high energy neutron irradiations and the current status of relevant high energy neutron studies. Cross section development, source description, shielding, and activation are discussed. Dosimetry

cross sections have been tentatively extrapolated to 40 MeV. Extensive total helium measurements were made in a variety of neutron spectra. DOE

N80-33208# California Univ., Livermore. Lawrence Livermore Lab.
NEW CONCEPT FOR A HIGH-POWER BEAM DUMP
Ralph W. Moir and Clyde E. Taylor 16 Apr. 1980 7 p refs Presented at the Natl. Heat Transfer Conf., Orlando, Fla. Aug. 1980 Submitted for Publication
(Contract W-7405-eng-48)
(UCRL-83696; CONF-800818-1) Avail: NTIS HC A02/MF A01

A concept for a dump for the ion and neutral beams used in the controlled nuclear fusion program use thin sheets of a refractory metal such as tungsten formed into troughs having semicircular cross sections. High velocity water flowing circumferentially removes heat by subcooled nucleate boiling. Possible advantages are modular construction, lower water-pumping power, and a lower pressure drop than in conventional beam dumps. An example design calculation is shown for a dump capable of absorbing an incident flux of 10 kW/ sq cm. DOE

N80-33209# National Bureau of Standards, Washington, D.C. Fracture and Deformation Div.
MATERIALS STUDIES FOR MAGNETIC FUSION ENERGY APPLICATIONS AT LOW TEMPERATURES, 3
R. P. Reed, ed. Jun. 1980 392 p refs Presented at 3d NBS/DOE Vail Workshop, Oct. 1979 Sponsored by DOE
(PB80-191497; NBSIR-80-1627) Avail: NTIS HC A17/MF A01 CSCL 18A

The evaluation of the low temperature mechanical and physical properties of stainless steel base metal and welds, with particular emphasis on the nitrogen-strengthened stainless steels is discussed. Aluminum alloys received some consideration. The production and standardization of nonmetallics, primarily industrial laminates, for low temperature applications were considered. GRA

74 OPTICS

Includes light phenomena.

N80-33210* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MULTISPECTRAL SCANNER OPTICAL SYSTEM Patent
Roy C. Stokes (Lockheed Electronics Co., Houston, Tex.) and Norman G. Koch, inventors (to NASA) (Lockheed Electronics Co., Houston, Tex.) Issued 29 Jul. 1980 8 p Filed 29 Mar. 1979 Supersedes N79-22880 (17 - 13, p 1775) Sponsored by NASA
(NASA-Case-MSC-18255-1; US-Patent-4,215,273; US-Patent-Appl-SN-025163; US-Patent-Class-250-347; US-Patent-Class-250-352; US-Patent-Class-250-353; US-Patent-Class-350-55; US-Patent-Class-356-72) Avail: US Patent and Trademark Office CSCL 20F

An optical system for use in a multispectral scanner of the type used in video imaging devices is disclosed. Electromagnetic radiation reflected by a rotating scan mirror is focused by a concave primary telescope mirror and collimated by a second concave mirror. The collimated beam is split by a dichroic filter which transmits radiant energy in the infrared spectrum and reflects visible and near infrared energy. The long wavelength beam is filtered and focused on an infrared detector positioned in a cryogenic environment. The short wavelength beam is dispersed by a pair of prisms, then projected on an array of detectors also mounted in a cryogenic environment and oriented at an angle relative to the optical path of the dispersed short wavelength beam.

Official Gazette of the U.S. Patent and Trademark Office

N80-33211*# ITT Electro-Optical Products Div., Fort Wayne, Ind.
CIRCULAR SCAN STREAK TUBE DEVELOPMENT Final Technical Report, May 1976 - Mar. 1979
Scott Nevin Jul. 1980 48 p refs
(Contract NAS5-23525)
(NASA-CR-160029) Avail: NTIS HC A03/MF A01 CSCL 20F

A streak tube having circular scan was designed, built and tested. Continuous circular scan, easily derived from out of phase sine waves applied to the conventional deflection plates, permits the timing of pulses traveling long baselines. At the tube's output a circular array of 720 elements is scanned to provide 30 to 40 picosecond resolution. Initial difficulties with electron bombarded silicon arrays were circumvented by using microchannel plates within the streak tube to provide the needed electronic amplification and digital sensitivity and coupling the 720 element arrays to the electron beam by means of a phosphor on a fiber optics. Two ceramic body tubes with S-20 photocathodes were tested and delivered. Author

N80-33212# Honeywell Systems and Research Center, Minneapolis, Minn.
ADVANCED PATTERN-MATCHING TECHNIQUES FOR AUTONOMOUS ACQUISITION Quarterly Progress Report, 23 Nov. 1979 - 23 Feb. 1980
P. M. Narendra and J. J. Grabau Mar. 1980 105 p
(Contract DAAK70-79-C-0114)
(AD-A087684; HONEYWELL-80SRC25; QPR-2) Avail: NTIS HC A06/MF A01 CSCL 17/7

The key objective of this effort is the development of pattern-matching algorithms which can impart autonomous acquisition capability to precision-guided munitions such as Copperhead and Hellfire. Autonomous acquisition through pattern matching holds the promise of eliminating laser designation and enhancing fire power by multiple target prioritization. The pattern-matching approach being developed under this program is based on a symbolic pattern-matching framework, which is suited for the autonomous acquisition scenario. It is based on matching a symbolic representation derived from the two images, and it can accommodate the stringent pattern-matching criteria established by the scenario: enormous differences in sensor characteristics and illumination, and scene changes such as target motion and obscuration from one view point to the other. GRA

N80-33213# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIGITAL RESTORATION OF AC-COUPLED INFRARED IMAGES
R. J. Becherer and B. A. Capron 1979 10 p refs
(Contract F19628-80-C-0002)
(AD-A085430; ESD-TR-79-346) Avail: NTIS HC A02/MF A01 CSCL 14/5

A simple digital recursion relation was developed to restore images which were degraded by the AC coupling characteristics of infrared imaging sensors. The recursion relation is derived and shown to be equivalent to inverse filtering. To indicate the magnitude of the distortion due to AC coupling the RMS deviation between input and output signals is calculated for a single rectangular pulse and a series of rectangular pulses. Examples of images before and after the recursive restoration process are shown. Author

N80-33214# ARO, Inc., Arnold Air Force Station, Tenn.
INFRARED OPTICAL PROPERTIES OF THIN CO, NO, CH4, HC1, N2O, O2, AR, AND AIR CRYOFILMS Final Report, 1 Oct. 1978 - 1 Sep. 1979
J. A. Roux, B. E. Wood, A. M. Smith, and R. R. Plyer AEDC Aug. 1980 87 p refs
(AD-A088269; AEDC-TR-79-81) Avail: NTIS HC A05/MF A01 CSCL 07/5

The infrared spectral transmittance of cryofilms formed by CO, NO, CH4, HC1, N2O, O2, N2, Ar, and air were measured. These films were condensed on a 20 K germanium substrate and ranged in thickness from 0.25 to 15 micrometer; the deposition pressure for the films was 2 x 10 to the -7th power torr. Transmission spectra were obtained for the 500- to 3700/cm wavenumber range using a Fourier transform spectrometer. Values of complex index of refraction (n – n - ik) for the cryodeposits were derived from the experimental data using an analytical model and the nonlinear least-squares method. The analytical model treats the germanium as a thick noninterfering film and the deposit as a thin film. Results from the least-squares method are also compared with a Kramers-Kronig determination of the

real part of the index of refraction. The optical properties (n,k) of such cryofilms are reqiured for predicting the degradation of contaminated, cryogenically cooled optical surfaces. GRA

N80-33215# Naval Ocean Systems Center, San Diego, Calif.
INTEGRATED OPTICAL LOGIC GATES. A DEMONSTRATION OF FOUR OPTICAL LOGIC FUNCTIONS Independent Research Report, Dec. 1977 - Sep. 1978
M. J. Taylor and E. R. Schumacher 6 May 1980 23 p refs (ZR0210203)
(AD-A087999; NOSC/TR-556) Avail: NTIS HC A02/MF A01 CSCL 20/6

An optical NOT gate has been demonstrated, exhibiting close to 100% modulation and requiring a minimum of 1.2 V for switching between states. An optical AND gate has been demonstrated, using two interferometric intensity modulators in series. A device functioning as either an optical EXCLUSIVE OR gate or an even parity generator has been demonstrated, also exhibiting nearly 100% modulation. Lithium niobate cleaving and polishing techniques were examined, indicating further research is required in this area. GRA

N80-33216# University of Southern California, Los Angeles. Dept. of Materials Science
OPTICAL AND MECHANICAL PROPERTIES OF INFRARED MATERIALS Final Report
Stephen M. Copley Jul. 1980 66 p refs
(Contract F49620-78-C-0065; AF Proj. 2306)
(AD-A088120; AFOSR-80-0632TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

Optical and mechanical properties of various IR transmitting materials were investigated. Of special interest was the possibility of strengthening such materials through the formation of point defect complexes without increasing their IR absorption. A major facility for determining IR absorption was developed. The materials investigated include alkali halides, alkaline earth fluorides, Al-doped ZnSe and doped MgO. It was found that the hardness of ZnSe doped with Al and CaF2 doped with Gd could be increased through thermal treatment, however, the identity of the point defect complex producing this hardening could not be determined. GRA

N80-33217# European Office of Aerospace Research and Development, FPO New York 09510.
EUROPEAN FIBER OPTICS. USAF LABORATORY EXPERTS VISIT
E. Mason Friar, Armen E. Mardiguian, Randall L. Ray, Edward W. Taylor, and Andrew Yang Dec. 1979 14 p
(AD-A088209; EOARD-TR-80-11) Avail: NTIS HC A02/MF A01 CSCL 20/6

A team of USAF laboratory experts conducted an assessment of European expertise in fiber optics research, development, and products. Organizations in England, France, Germany and the Netherlands were visited. The team's conclusion is that, while the US holds the advantage in many areas (especially in the development of new components), Europe leads in system implementation and has several unique components and processes of value to the US fiber optics effort. A brief review of each visit is included. GRA

N80-33218# OptiMetrics, Inc., Ann Arbor, Mich.
REDUCTION AND ASSESSMENT OF INFRARED BACKGROUND DATA Interim Report
Scott M. Singer, Frederick G. Smith, Timothy J. Rogne, and Richard A. Steinberg 7 Aug. 1980 76 p refs
(Contract N00173-79-C-0461; ZF32391003)
(AD-A088241; OMI-80-002; NRL-MR-4284; NRL/EOTPO-62) Avail: NTIS HC A05/MF A01 CSCL 17/5

The outstanding problem in designing passive infrared detection sensors is the design of effective target/background discrimination algorithms. A key factor in the design process is the requirement for a data base of high spatial resolution, low noise, background imagery. The cloud and ocean sunglitter data discussed in this report, obtained by Cincinnati Electronics Co. (CECO), are intended to help satisfy this requirement for infrared (IR) background imagery. We recommend that future IR backgrounds measurements with the CECO radiometer incorporate the following suggestions: the CECO radiometer should be upgraded to incorporate dc restoration; data should be recorded from all 24 detector channels, rather than just 8 channels; tape recorder noise should be decreased by improving the data recording system. GRA

N80-33219# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN AND IMPLEMENTATION OF A FIBER-OPTIC GAMMA-MEASUREMENT SYSTEM
R. P. Reedy and D. W. Crawford 19 May 1980 10 p refs Presented at Intern. Symp. Soc. of Photo-Opt. Instr. Engr., San Diego, Calif. 28 Jul. - 1 Aug. 1980 Submitted for publication (Contract W-7405-eng-48)
(UCRL-84109) Avail: NTIS HC A02/MF A01

The downhole portion of a measuring system for gamma rays is described. Three alternative designs are presented for radiation-resistant collimating and condensing lenses, sample cells, turning mirrors, and fiber-optic termination techniques. Mechanical mounts and positioners, shielding, alignment, test methods, and field installation are also discussed. Some general design suggestions for optical systems in adverse environments are included. DOE

N80-33220# Sandia Labs., Albuquerque, N. Mex. Digital Systems Development Div.
FIBER OPTIC COMMUNICATION LINKS
R. H. Meyer 1980 20 p Presented at the IMOG Meeting on Subgroup Environ. Testing, Albuquerque, N. M., 20 May 1980 (Contract EY-76-C-04-0789)
(SAND-80-1290C; CONF-800574-1) Avail: NTIS HC A02/MF A01

Fiber optics is a new, emerging technology which offers relief from many of the problems which limited past communications links. Its inherent noise immunity and high bandwidth open the door for new designs with greater capabilities. Being a new technology, certain problems can be encountered in specifying and installing a fiber optic link. A general fiber optic system is discussed with emphasis on the advantages and disadvantages. Finally, a general purpose prototype Sandia communications link is presented. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-33221*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMAL THERMIONIC ENERGY CONVERSION WITH ESTABLISHED ELECTRODES FOR HIGH-TEMPERATURE TOPPING AND PROCESS HEATING Final Report
James F. Morris Jul. 1980 33 p refs
(Contract EC-77-A-31-1062)
(NASA-TM-81555; DOE/NASA/1062-6; E-514) Avail: NTIS HC A03/MF A01 CSCL 20I

Applied research-and-technology (ART) work reveals that optimal thermionic energy conversion (TEC) with approximately 1000 K to approximately 1100 K collectors is possible using well established tungsten electrodes. Such TEC with 1800 K emitters could approach 26.6% efficiency at 27.4 W/sq cm with approximately 1000 K collectors and 21.7% at 22.6 W/sq cm with approximately 1100 K collectors. These performances require 1.5 and 1.7 eV collector work functions (not the 1 eV ultimate) with nearly negligible interelectrode losses. Such collectors correspond to tungsten electrode systems in approximately 0.9 to approximately 6 torr cesium pressures with 1600 K to 1900 K emitters. Because higher heat-rejection temperatures for TEC allow greater collector work functions, interelectrode loss reduction becomes an increasingly important target for applications aimed at elevated temperatures. Studies of intragap modifications and new electrodes that will allow better electron emission and collection with lower cesium pressures are among the TEC-ART approaches to reduced interelectrode losses. These solutions will provide very effective TEC to serve directly in coal-combustion

products for high-temperature topping and process heating. In turn this will help to use coal and to use it well. A.R.H.

N80-33222# Maryland Univ., College Park. Dept. of Physics and Astronomy.
PARAMETRIC INSTABILITIES OF ELECTRON CYCLOTRON WAVES IN PLASMAS
V. K. Tripathi and C. S. Liu Mar. 1980 21 p refs
(Contracts N00014-77-C-0590; DE-AS05-77DP-40032)
(AD-A087742; PUB-80-160; TR-80-081) Avail: NTIS HC A02/MF A01 CSCL 20/9

We have studied the parametric metabilities of electron cyclotron waves in the Elmo Bumpy Torus (EBT) ring and the large tokamaks eg PLT. In the EBT, the electron cyclotron pump of finite wavenumber k sub o decays into two Bernstein modes at the second harmonic cyclotron layer and can account for the heating of the ring in the intitial phase. The coupling coefficient for this decay vanishes for a dipole pump, whereas the convective threshold with finite k sub o is about 200 W/sq cm. For large Tokamaks, the convective threshold for various decay channels turns out to be about or ~ 200 KW/sq cm at 3mm wavelength. GRA

N80-33223# Naval Research Lab., Washington, D. C.
XUV ALUMINUM SPECTRA OF LASER-PRODUCED PLASMAS Interim Report
G. A. Doschek and U. Feldman 15 Jul. 1980 15 p refs
(RR0110941)
(AD-A088107; NRL-8416) Avail: NTIS HC A02/MF A01 CSCL 07/4

XUV aluminum spectra from 200 to 500 A of laser-produced plasmas are discussed. The plasmas were obtained by focusing Nd:glass and CO2 laser pulses onto planar targets. The spectrograph was a normal incidence instrument without an entrance slit. Therefore monochromatic images of the plasma are formed at the focal plane, rather than spectral lines. Kodak 101 film was used to record the spectra. Images of the plasmas due to transitions in Al V through Al X were identified using a theoretical synthetic aluminum spectrum. The time and space integrated relative numbers of the ions form Al V through Al X can be obtained from a comparison of the synthetic and laser-plasma spectra. The comparison enables determination of the film calibration curve and the efficiency of the instrument with wavelength. The morphology of the expansion of the plasma is also discussed. The plasma of the highest temperature ions (Al X) expands outward in cylindrically shaped structures. The expansion of the lower temperature plasma (such as Al VII) is also cylindrical in appearance, but the images are not as tightly confined to the target normal as for the hotter ions. GRA

N80-33224# California Univ., Berkeley. Electronics Research Lab.
PLASMA THEORY AND SIMULATION Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
C. K. Birdsall 31 Dec. 1979 102 p refs
(Contracts N00014-77-C-0578; DE-AS03-76EF-00034; DE-AT03-76ET-53064; W-7405-eng-48)
(AD-A088331; QPR-4) Avail: NTIS HC A06/MF A01 CSCL 20/9

In the last QPR, it was shown that our simulation exhibited strong ion trapping at saturation in the lower-drift-velocity regime with vE less than vti as our model had assumed a constant density and vE drift. The typical total ion momentum (Fig. 1a) and ion kinetic energy (Fig. 1b) are exponentially growing in time in the linear regime. In Fig. 1a, the net ion momentum increases in the negative x direction which is the wave propagation direction. Recall that ions in our model are initially in an electrostatic, steady equilibrium state with the ion diamagnetic drift velocity cancelled by the E x B drift velocity. GRA

N80-33225# Naval Research Lab., Washington, D. C.
A DIVERTED PLASMA REVERSED FIELD PINCH
Wallace M. Manheimer 16 Jul. 1980 11 p refs
(Contract EX-76-A-34-1006)
(AD-A088049; NRL-MR-4258) Avail: NTIS HC A02/MF A01 CSCL 20/9

This memo proposes a poloidal divertor as a method of reducing the strong plasma-wall interaction inherent in a reversed field pinch. GRA

N80-33226# Naval Research Lab., Washington, D. C.
ELECTRON CYCLOTRON/UPPER HYBRID RESONANT PREIONIZATION IN THE ISX-B TOKAMAK Interim Report
R. M. Gilgenbach (JAYCOR, Alexandria, Va.), R. F. Lucey (JAYCOR, Alexandria, Va.), K. E. Hackett (MIT, Cambridge), K. E. Burrell (General Atomic Corp., La Jolla, Calif.), M. Hacker (General Atomic Corp., La Jolla, Calif.), M. E. Read, V. L. Granatstein, A. C. England (ORNL, Tenn.), C. M. Loring (ORNL, Tenn.), J. B. Wilgen (ORNL, Tenn.) et al 20 Jun. 1980 34 p refs
(Contracts EX-77-A-34-1015; W-7405-eng-26; ET-78-S-02-4714)
(AD-A088086; NRL-MR-4248) Avail: NTIS HC A03/MF A01 CSCL 18/1

Preionization experiments have been performed on a Tokamak by injecting about 80 kW of microwave power at 35 GHz for up to 15 ms. Microwave absorption occurs at the electron cyclotron and upper hybrid resonance frequencies as predicted by theory. Preionization causes substantial (40%) reductions in loop voltage during the initial phase of the Tokamak shot. Flux (volt second) savings with preionization are about 30% in the first 2 ms or about 2% of the total flux expenditure in a Tokamak shot. The plasma current starts 20 microsec earlier and rises 1.4 times more rapidly in the preionized case. Electron densities of 5 x 10 to the 12th power/cu cm can be sustained with only a toroidal magnetic field during microwave injection. The bulk electron temperature in the preionized plasma is about 10 eV although there are indications of higher electron temperatures (50 eV) in the upper hybrid resonance layer. During the early stages of ohmic heating the preionization is effective in decreasing the peak of the radiated power. GRA

N80-33227# Naval Research Lab., Washington, D. C.
HEATING AT THE ELECTRON CYCLOTRON FREQUENCY IN THE ISX-B TOKAMAK Interim Report
R. M. Gilgenbach (JAYCOR, Alexandria, Va.), M. E. Read, K. E. Hackett (MIT, Cambridge), R. F. Lucey (JAYCOR, Alexandria, Va.), B. Hui, V. L. Granatstein, K. R. Chu, A. C. England (ORNL, Tenn.), C. M. Loring (ORNL, Tenn.), O. C. Eldridge (Tennessee Univ., Knoxville) et al 14 Aug. 1980 17 p refs
(Contracts EX-77-A-34-1015; W-7405-eng-26; ET-78-S-02-4714)
(AD-A088087; NRL-MR-4308) Avail: NTIS HC A02/MF A01 CSCL 18/1

We report results of electron cyclotron heating (ECH) experiments in which 80 kW of microwave power from a 35 GHz gyrotron is injected into a Tokamak with large single pass absorption. For 10 ms microwave pulses, incident from the high field side of the torus, the central electron temperature increases from 850 eV to 1250 eV, in agreement with empirical transport code calculations. For the first time in a Tokamak, we demonstrate that electron temperature scales linearly with ECH power. GRA

N80-33228# Nebraska Univ. - Lincoln. Dept. of Mechanical Engineering.
PSEUDO-SHOCK AS A QUALITATIVE MODEL IN THE INVESTIGATION OF THE INFLUENCE OF WALL ROUGHNESS ON THE PERFORMANCE OF SUPERSONIC MHD GENERATORS Final Report
Pau-Chang Lu Jul. 1980 94 p refs
(Grant AF-AFOSR-0083-79; AF Proj. 2308)
(AD-A088333; UNLMEPCL-80-1; AFOSR-80-0599TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

A preliminary study, based on an extension of Crocco's pseudo-shock model, has been carried out to explain and predict qualitatively the rather gradual pressure rise in a supersonic MHD generator, to account for the influence of wall roughness on the core flow. A system of non-linear ordinary differential equations is formulated for the wall layer and core, with proper electromagnetic conditions enforced at the interface. Extensive numerical experiments are also presented, which demonstrate indeed the qualitative link between the theory of MHD pseudo-shock and the observed pressure ramp caused by rough walls. GRA

N80-33229# Naval Research Lab., Washington, D. C.
PLASMA DIAGNOSTICS USING PHOTON-INDUCED

CHARGE TRANSFER Interim Report
J. F. Seely and R. C. Elton Aug. 1980 44 p refs
(Contract EX-76-A-34-1010)
(AD-A088228; NRL-MR-4317) Avail: NTIS
HC A03/MF A01 CSCL 20/9

A method is described whereby a partner in a binary charge transfer process is photon-excited to a state in which the process can proceed at a greatly enhanced rate. The excited state may be real ('resonance-enhancement') or virtual. With the former, radiative decay fluorescent emission indicates directly the initial state density. Similarly, excited product decay indicates the reaction rate. With known cross sections, this can yield the density of the other reactant under conditions localized in both space and time by the inducing laser pulse. Numerous examples directly applicable to fusion devices are indicated. GRA

N80-33230# Naval Research Lab., Washington, D. C.
TOKAMAK HEATING AND CURRENT MAINTENANCE WITH INTENSE PULSED ION BEAMS Interim Report
W. M. Manheimer and N. K. Winsor 21 Aug. 1980 63 p refs
(Contract EX-76-A-34-1006)
(AD-A088274; NRL-MR-4213) Avail: NTIS
HC A04/MF A01 CSCL 18/1

This paper examines Tokamak heating with intense pulsed ion beams. It finds that plasma can be heated to ignition or to Q approximately 1 and depending on the injection scheme, the current can be maintained or even generated by the beam. GRA

N80-33231# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
NUMERICAL MODELLING OF AN END-PLUGGED THETA PINCH
R. D. Milroy and L. C. Steinhauer Apr. 1980 43 p refs
Submitted for publication
(Contract DE-AC06-76ET-53027)
(MSNW-80-1146-2) Avail: NTIS HC A03/MF A01

Analytical and numerical studies of an end plugged theta pinch are described. The analytical mode treats the ablated plug plasma in the quasistatic limit where radiation losses balance energy flowing from the main plasma. This model is used to calculate the enhancement in energy confinement due to an ablating end plug for various plug species. The numerical model employs a one dimensional, time dependent magnetohydrodynamic code. Results of calculations simulating the Scylla 4-P end plugged theta pinch experiment are presented. The calculations achieved reasonable agreement with experiment except for certain notable discrepancies, believed to spring from two dimensional effects. DOE

N80-33232# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
KINETIC-THEORY DESCRIPTION OF ELECTRON HEAT TRANSFER IN A PLASMA
M. H. Shirazian and L. C. Steinhauer Apr. 1980 45 p refs
(Contracts DE-AC06-76ET-53027; EY-76-C-06-2319)
(MSNW-801146-1) Avail: NTIS HC A03/MF A01

Electron heat flux in a fully ionized gas between two parallel boundaries, separated by a distance L, is studied. Two full range moment methods with the assumption of a two sided distribution function are employed to analyze the relation between the electron heat flux and the plasma collisionality parameter L/lambda/sub ei/, both with and without electron-electron collisions (lambda/sub ei/, is the electron-ion collision mean free path). The electron heat flux compared to free convective flux and the continuum heat flux is determined as a function of L/lambda/sub ei/, over the entire range from free flow to continuum regimes. DOE

N80-33233# Los Alamos Scientific Lab., N. Mex.
TOKAMAK POLOIDAL FIELD SYSTEMS Progress Report, 1 Jan. - 31 Dec. 1979
John D. Rogers May 1980 15 p refs
(Contract W-7405-eng-36)
(LA-8375-PR) Avail: NTIS HC A02/MF A01

The development of superconducting Tokamak poloidal field systems is addressed. Progress is discussed on the design of a 20 MJ, 50 kA, 7.5 T superconducting pulsed energy storage coil operated in a 1 to 2 s bipolar mode from +7.5 T to -7.5 T in 1982. Conductor development for the coil is presented. A facility that uses a traction motor energy transfer system to test coils in the 20 to 100 MJ energy range is discussed. Current interrupter development and testing for protection and energy transfer circuits are also presented. DOE

N80-33234# California Univ., Livermore. Lawrence Livermore Lab.
STUDIES IN TANDEM MIRROR THEORY
D. E. Baldwin, R. H. Cohen, T. A. Cutler, T. B. Kaiser, B. G. Logan, Y. Matsuda, A. A. Mirin, L. D. Pearlstein, M. Porkolab, M. E. Rensink et al. 2 Jun. 1980 16 p refs Presented at 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980; sponsored by International Atomic Energy Agency Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83519-Rev-1; CONF-800707-2-Rev-1; IAEA-CN-38/F-4) Avail: NTIS HC A02/MF A01

The formation, maintenance, and microstability of thermal barriers which were introduced as a means for improving tandem mirror reactor performance at reduced technological demands are discussed. Calculations of tandem mirror central cell beta limits due to MHD ballooning modes are also described. DOE

N80-33235# California Univ., Livermore. Lawrence Livermore Lab.
THEORY OF FIELD-REVERSED MIRRORS AND FIELD-REVERSED PLASMA-GUN EXPERIMENTS
D. V. Anderson, S. P. Auerbach, H. L. Berk, J. K. Boyd, T. A. Brengle, J. A. Byers, B. I. Cohen, W. C. Condit, J. C. Eddleman, R. P. Freis et al. 22 May 1980 18 p refs Presented at 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980 Prepared in cooperation with California Univ., Berkeley, Lawrence Berkeley Lab., Illinois Univ., Urbana, and New York Univ., N. Y. Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83518; CONF-800707-6; IAEA-CN-38/R-2) Avail: NTIS HC A02/MF A01

Experimental and theoretical studies of field reversal in a mirror machine are reported. Plasma gun experiments demonstrate that reversed field plasma layers are formed. Low energy plasma flowing behind the initially produced plasma front prevents tearing of the layer from the gun muzzle. MHD simulation shows that tearing can be obtained by impeding the slow plasma flow with a plasma divider. It is demonstrated theoretically that a field reversed mirror imbedded in a multipole field can be sustained in steady state with neutral beam injection even in the absence of impurities. MHD stability analysis shows that growth rates of elongated reversed field theta pinch configurations decrease with axial extension, which indicates the importance of including finite Larmor radius in the analysis. Tilting mode criteria are dramatically improved by proper shaping, and a problimak shape is proposed. Tearing mode stability of reversed field theta pinches is greatly enhanced by flux exclusion. Self-consistent, 1-1/2 dimensional transport codes were developed, and initial results are presented. DOE

N80-33236# California Univ., Livermore. Lawrence Livermore Lab.
NONLINEAR ION-CYCLOTRON WAVES IN MIRROR MACHINES
B. I. Cohen, G. R. Smith, H. L. Berk, J. A. Byers, J. F. Clauser, D. L. Correll, A. H. Futch, R. K. Goodman, D. P. Grubb, and L. L. LoDestro 22 May 1980 13 p refs Presented at 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980; sponsored by International Atomic Energy Agency Prepared in cooperation with Rochester Univ., N.Y. Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83517; CONF-800707-4; IAEA-CN-38/S-1) Avail: NTIS HC A02/MF A01

Experimental results on ion cyclotron waves observed in the 2XIIB mirror machine are reviewed, and relevant theoretical work is discussed. The work reported generally substantiates the quasilinear diffusion model of mirror plasma confinement, but also suggests alternatives. The end loss current required by theory of the drift-cyclotron loss-cone (DCLD) instability agrees with

measurements of this current. The experiment indicates that an increased ratio of plasma radius to ion gyroradius improves plasma confinement. However, measurements sometimes show a second ion-cyclotron mode, which is not the DCLC mode. Theoretical work on loss-cone instabilities has concentrated on linear, quasilinear, and fully nonlinear models of increased sophistication and experimental applicability. DOE

N80-33237# California Univ., Livermore. Lawrence Livermore Lab.
TANDEM MIRROR FUSION-FISSION HYBRID STUDIES
J. D. Lee 24 Apr. 1980 27 p refs Presented at the 2d Intern. Conf. on Emerging Nucl. Energy Systems, Lausanne, Switzerland, 4-8 Apr. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84018; CONF-800446-2-Rev-1) Avail: NTIS HC A03/MF A01

The concept of combining nuclear fusion and nuclear fission techniques is discussed. Initial tandem mirror hybrid studies predict the ability to produce large amounts of fissile fuel (2 to 7 tons U233 per year from a 4000 MW plant) at a cost that adds less than 25% to the cost of power from a light water reactor. L.F.M.

N80-33238# California Univ., Livermore. Lawrence Livermore Lab.
OPTICAL COATINGS FOR LASER FUSION APPLICATIONS
W. H. Lowdermilk, D. Milam, and F. Rainer 24 Apr. 1980 28 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 21-25 Apr. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83582; CONF-800439-7) Avail: NTIS HC A03/MF A01

Lasers for fusion experiments use thin-film dielectric coatings for reflecting antireflecting and polarizing surface elements. Coatings are most important to the Nd:glass laser application. The most important requirements of these coatings are accuracy of the average value of reflectance and transmission, uniformity of amplitude and phase front of the reflected or transmitted light, and laser damage threshold. Damage resistance strongly affects the laser's design and performance. The success of advanced lasers for future experiments and for reactor applications requires significant developments in damage resistant coatings for ultraviolet laser radiation. DOE

N80-33239# Oak Ridge National Lab., Tenn.
LARGE ASPECT RATIO TOKAMAK STUDY
R. L. Reid, J. A. Holmes, W. A. Houlberg, Y. K. M. Peng, D. J. Strickler, T. G. Brown (Grumman Aerospace Corp.), and G. W. Wiseman (Grumman Aerospace Corp.) Jun. 1980 57 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7278) Avail: NTIS HC A04/MF A01

The potential for producing a viable longburn Tokamak reactor by enhancing the volt second capability of the ohmic heating transformer through the use of high aspect ratio designs was investigated. The plasma physics, engineering, and economic implications of high aspect ratio Tokamaks were assessed in the context of extended burn operation. Using a one dimensional transport code, plasma startup and burn parameters were addressed. The pulsed electrical power requirements for the poloidal field system, which have a major impact on reactor economics, were minimized by optimizing the startup and shutdown portions of the Tokamak cycle. A representative large aspect ratio Tokamak with an aspect ratio of 8 was found to achieve a burn time of 3.5 h at capital cost only approximately 25% greater than that of a moderate aspect ratio design Tokamak. DOE

N80-33240# Ad-Ex International, Portola Valley, Calif.
ELECTROMAGNETIC INSTABILITIES IN COLLISIONLESS PLASMAS
G. Laval, R. Pellat, and M. Vuillemin May 1980 38 p refs Transl. into ENGLISH from French report CN-21/71 p 259-276 Sponsored by DOE Prepared for California Univ., Lawrence Livermore Lab.
(UCRL-Trans-11593; CN-21/71) Avail: NTIS HC A03/MF A01

The stability of inhomogeneous collisionless plasmas with respect to electromagnetic perturbations is studied. The macroscopic equilibrium parameters depend on a single coordinate of an orthogonal system. The current carried by the particles of the plasma is directed along another coordinate axis. The perturbations considered are constant along the current lines. In plane geometry, for example, the distribution functions of the particles depend only on the energy and on the moment along OZ of the Hamiltonian of a particle. The equilibrium is inhomogeneous along OX and the perturbations are invariant with respect to OZ. A Lyapunov function is constructed. DOE

N80-33241# California Univ., Livermore. Lawrence Livermore Lab.
PLASMA CONFINEMENT EXPERIMENTS IN THE TMX TANDEM MIRROR
T. C. Simonen, C. A. Anderson, T. A. Casper, J. F. Clauser, F. H. Coensgen, W. C. Condit, D. L. Correll, W. F. Cummins, J. C. Davis, and R. P. Drake 22 May 1980 12 p refs Presented at the 8th Intern. Conf. of Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980
(Contract W-7405-eng-48)
(UCRL-83515; CONF-800707-5) Avail: NTIS HC A02/MF A01

Results from the tandem mirror experiment (TMX) are described. Tandem mirror density and potential profiles are produced using end plug neutral beam injection and central cell gas fueling. TMX parameters are near those predicted theoretically. The end plug electron temperature is higher than in the comparably sized single mirror 2XIIB. Axial confinement of the finite beta central cell plasma is improved by the end plugs by as much as a factor of 9. In TMX, end plug microinstability limits central cell confinement in agreement with theory. DOE

N80-33242# Argonne National Lab., Ill. Fusion Power Program.
FUSION REACTOR BLANKET/SHIELD DESIGN STUDY
D. L. Smith, R. G. Clemmer, S. D. Harkness, J. Jung, J. L. Krazinski, R. F. Mattas, H. C. Stevens, C. K. Youngdahl, C. Trachsel (McDonnell Douglas Astronautics Co., St. Louis), and D. Bowers (McDonnell Douglas Astronautics Co., St. Louis) Jul. 1979 426 p refs Prepared in cooperation with McDonnell Douglas Astronautics Co., St. Louis
(Contract W-31-109-eng-38)
(ANL/FPP-79-1) Avail: NTIS HC A19/MF A01

A joint study of Tokamak reactor first wall/blanket/shield technology was conducted to identify key technological limitations for various tritium breeding blanket design concepts, establishment of a basis for assessment and comparison of the design features of each concept, and development of optimized blanket designs. The approach used involved a review of previously proposed blanket designs, analysis of critical technological problems and design features associated with each of the blanket concepts, and a detailed evaluation of the most tractable design concepts. Tritium breeding blanket concepts were evaluated according to the proposed coolant. The effort concentrated on evaluation of lithium and water cooled blanket designs and helium and molten salt cooled designs. Generalized nuclear analysis of the tritium breeding performance, an analysis of tritium breeding requirements, and a first wall stress analysis were conducted as part of the study. The impact of coolant selection on the mechanical design of a Tokamak reactor was evaluated. Reference blanket designs utilizing the four candidate coolants are presented. DOE

N80-33243# Pennsylvania State Univ., University Park.
STUDY OF FLOW AND LOSS PROCESSES AT THE ENDS OF A LINEAR THETA PINCH Progress Report, 1 Jun. 1979 - 30 Sep. 1980
Thomas M. York and Edward H. Klevans May 1980 68 p refs
(Contracts DE-AS02-76ET-53018; EY-76-S-02-4020)
(COO-4020-10) Avail: NTIS HC A04/MF A01

Experimental and analytical studies of particle and energy loss at the ends of a linear theta pinch was carried out. A study of transients occurring in the formation of reversed trapped fields within the coil, and of transients in the end region of a 25 cm long device was completed. A 1-D code proved to be highly accurate in describing loss events and defining transport

mechanisms in different experiments and is described here. A study of loss along field lines in a 50 cm long device generated new information on loss velocity, axial and radial temperature gradients, and established an initial effort in understanding thermal loss to the walls. Rotation and parallel trapped fields were added to the existing 0-D code. A new technique crowbar switch and magnetic field prediction code was developed. Direct measurement of electron velocity with Thomson scattering was accomplished experimentally. DOE

N80-33244# California Univ., Livermore. Lawrence Livermore Lab.
TANDEM MIRROR REACTORS WITH THERMAL BARRIERS
B. G. Logan, B. Arfin (NRL, Washington, D. C.), W. L. Barr, B. M. Boghosian, G. A. Carlson, T. C. Chu, J. L. Erickson, J. H. Fink (BNL, N.Y.), T. K. Fowler, and G. W. Hamilton 23 May 1980 15 p refs Presented at the 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980 Prepared in cooperation with Wisconsin Univ., Madison
(Contracts W-7405-eng-48; ET-79-S-02-4636)
(UCRL-83505; CONF-800707-3; IAEA-CN-38/E-2) Avail: NTIS HC A02/MF A01

Preliminary calculations of Q and magnet designs are presented for three different versions of tandem mirror reactors (TMR) using thermal barriers to enhance plug potentials by auxiliary electron heating. These three versions called A-cell-barrier TMR, axisymmetric-barrier TMR, and inside-barrier TMR, exhibited reduced plug density and less required magnetic mirror field compared to TMR designs without thermal barriers. DOE

N80-33245# California Univ., Livermore. Lawrence Livermore Lab.
ELECTROSTATIC LEVITATION AND TRANSPORT OF LASER FUSION TARGETS
Wayne L. Johnson and Charles D. Hendricks 22 May 1980 10 p refs Presented at IEEE/IAS 1980 Annual Meeting, Cincinnati, 28 Sep. - 2 Oct. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83981; CONF-800914-2) Avail: NTIS HC A02/MF A01

Several levitation concepts were evaluated resulting in the electrostatic quadrupole being chosen as the most universal. A levitator was constructed to handle laser fusion targets during quadrupole rail which was segmented to provide electrically controlled transport and confinenment along the rail. This device demonstrated transport both vertical and horizontal of targets with appropriate mass to size ratios and remarkably stable confinement at atmospheric pressure. DOE

N80-33246# Science Applications, Inc., Ames, Iowa.
REVERSED-FIELD PINCH FUSION REACTOR
R. L. Hagenson and R. A. Krakowski (LASL, N. Mex.) 1980 14 p refs Presented at 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1494; CONF-800806-4) Avail: NTIS HC A02/MF A01

A conceptual engineering design of a fusion reactor based on plasma confinement in a toroidal reverse field pinch (RFP) configuration is described. The plasma was ohmically ignited by toroidal plasma currents which also inherently provided the confining magnetic fields in toroidal chamber. The 5-s dwell period between burn pulses for plasma quench and refueling allowed steady-state operation of all thermal systems outside the first wall; no auxiliary thermal capacity was required. A borated-water shield was located immediately outside the thermal blanket to protect the superconducting magnet coils. Both the superconducting poloidal and toroidal field were coils energized by homopolar motor/generators. Accounting for all major energy sinks yielded a cost-optimized system with a recirculating power fraction of 0.17; the power outputs is 750 MWe(net). DOE

N80-33247# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
SYSTEMS ASSESSMENT OF HEAVY ION BEAM FUSION DRIVERS Final Report, 1 Jan. 1978 - 31 Dec. 1979
T. Kammash, C. R. Drum, and R. D. Theisen May 1980 44 p refs
(Contract DE-AC08-79DP-40039)
(DOE/DP-40039) Avail: NTIS HC A03/MF A01

A systems analysis for a fusion reactor utilizing a heavy ion beam pellet fusion is carried out to evaluate the performance of several potential drivers. These include: hearthfire reference concepts 2 and 3; the RF linear accelerator; and the induction linac system. Accelerator systems utilizing rapid cycling synchrotrons are shown to be the least attractive drivers unless the efficiency of this component is sufficiently improved. Using a power cost formula that accounts for the accelerator operating cost it appears on the basis of available data that only one driver might fall within the economically acceptable range of producing electric power at 4 cents a kilowatt hour if certain optimistic conditions are met. DOE

N80-33248# Los Alamos Scientific Lab., N. Mex.
INITIAL REVERSED-FIELD PINCH EXPERIMENTS ON ZT-40 AND RECENT ADVANCES IN RFP THEORY
D. A. Baker, C. J. Buchenauer, L. C. Burkhardt, T. E. Cayton, E. J. Aramana, G. I. Chandler, R. S. Christian, R. Dagazian, J. M. DiMarco, and J. N. Downing 1980 14 p refs Presented at the IAEA 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1 Jul. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1834; CONF-800707-11) Avail: NTIS HC A02/MF A01

The ZT-40 reversed field pinch was operated in several modes. An analytic ohmic heating and ignition model both confirm and provide guidance for transport codes. Nondissipative formation schemes were analyzed and ideal MHD stable evolution and burn scenarios were found. Particle and fluid simulations have produced qualitative agreement with respect to the nonlinear behavior of m = 0 resistive g modes. Helical ohmic reversed field states are produced by a 2D dynamical simulation, and nonlinear analytic work describes the final state. A fast resistive MHD code for linear stability has clarified the relations between several kinds of resistive instabilities. Ballooning modes and g modes in systems with arbitrary magnetic shear including resistivity and viscosity, were studied in a unified treatment with growth rate vs wavenumber showing the existence of important cutoffs. DOE

N80-33249# Los Alamos Scientific Lab., N. Mex.
COMPACT TORUS EXPERIMENTS AND THEORY
W. T. Armstrong, D. C. Barnes, R. R. Bartsch, R. J. Commisso, C. A. Ekdahl, I. Henins, D. W. Hewett, H. W. Hoida, T. R. Jarboe, and C. G. Lilliequist 1980 32 p refs Presented at the 8th Intern. Conf., on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-80-1826; CONF-800707-12) Avail: NTIS HC A03/MF A01

Two types of compact toroids have been studied: Spheromaks and field reversed configurations. Spheromaks, which contain both toroidal and poloidal fields, have been formed with a magnetized coaxial injector and trapped in both prolate and oblate flux conservers. As expected from theory, the prolate configuration always tilts, but the oblate configuration can be made stable even in the presence of a guide field. Theoretical studies of the FRC (no toroidal field) have been compared with the results of two field reversed theta-pinches, FRX-A and FRX-B. DOE

N80-33250# California Univ., Livermore. Lawrence Livermore Lab. Dept. of Nuclear Engineering.
THEORY OF FIELD-REVERSED MIRRORS AND FIELD-REVERSED PLASMA-GUN EXPERIMENTS
D. V. Anderson, S. P. Auerbach, H. L. Berk, J. K. Boyd, T. A. Brengle, J. A. Byers, B. I. Cohen, W. C. Condit, J. C. Eddleman, and R. P. Freis 6 Jun. 1980 17 p refs Presented at the 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980 Prepared in cooperation with California Univ. Berkeley, Lawrence Berkeley Lab. and New York, Univ. Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83518-Rev-1; CONF-800707-6-Rev-1;
Paper-IAEA-CN-38/R-2) Avail: NTIS HC A02/MF A01

Experimental and theoretical studies of field reversal in a mirror machine are reported. Plasma-gun experiments demonstrate that reversed field plasma layers are formed. Low energy plasma flowing behind the initially produced plasma front prevents tearing of the layer from the gun muzzle. MHD simulation shows that tearing can be obtained impeding the slow plasma flow with a plasma divider. It is demonstrated theoretically that a field reversed mirror imbedded in a multipole field can be sustained in steady state with neutral-beam injection even in the absence of impurities. MHD stability analysis shows that growth rates of elongated reversed field theta pinch configurations decrease with axial extension, which indicates the importance of including finite Larmor radius in the analysis. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-33251# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

ESTIMATION RATE CONSTANTS FOR DIFFUSION-CONTROLLED INTERMACROMOLECULAR REACTIONS AT INFINITE DILUTION

Kazuyuki Horie and Itaru Mita Jun. 1980 13 p refs

(ISAS-580-Vol-45-No-5; ISSN-0372-1418) Avail: NTIS HC A02/MF A01

The mechanism of diffusion-controlled macromolecular reaction and chain dynamics in polymer reactions is examined. Termination between growing polymer radicals in free-radical polymerization and energy transfer between photo-excited species attached to polymer chains are included. The estimation of k sub q at infinite dilution uses several methods based on thermodynamic and hydrodynamic interaction parameters between polymer and solvent. Molecular-weight and solvent-power dependencies of the resulting k sub q at infinite dilution are discussed. S.F.

N80-33252# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SELF-CONSISTENT APW-k-VECTOR, p VECTOR METHOD. 1: THEORY

I. C. daCunhaLima, A. Ferreira DaSilva, and N. J. Parada Jun. 1980 18 p refs Submitted for publication

(INPE-1763-RPE/152) Avail: NTIS HC A02/MF A01

A first principle method based on an augmented plane wave - k vector p vector band structure calculation is derived in order to obtain the self consistent eigen-energies, cristalline potential and electronic charge density. The simplicity and extensions of the method are discussed, including comparison with the results obtained by the use of Chadi and Cohen special points technique. Author

N80-33253# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A MIXED BONDING BAND STRUCTURE CALCULATION FOR Gas AND AlAs, USING THE APW-k VECTOR p VECTOR METHOD

A. Ferreira daSilva, I. C. daCunhaLima, and N. J. Parada Jun. 1980 22 p refs Submitted for publication

(INPE-1762-RPE/151) Avail: NTIS HC A02/MF A01

The band structure of GaAs in a mixed covalent and ionic bonding was obtained. The energy levels at the gamma point are also obtained for AlAs. The ionicity is introduced as a parameter into the crystalline potential. The dependence of the energy levels and the momentum matrix elements on the values of the ionicity was studied. The value of the ionicity which gave the direct gap Eg = 1.52 eV for GaAs (the accepted experimental value) was found to be 0.1, and for AlAs Eg = 2.50 eV was obtained for an ionicity of 0.2. Author

N80-33254# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THE HUBBARD MODEL FOR THE DISORDERED SYSTEMS: IN APPLICATION TO THE SPECIFIC HEAT OF THE PHOSPHORUS-DOPED SILICON

A. Ferreira daSilva, R. Kishore, and I. C. daCunhaLima Aug. 1980 28 p refs Submitted for publication

(INPE-1862-RPE/212) Avail: NTIS HC A03/MF A01

A self consistent many body theory of the disordered systems, described by the Hubbard Hamiltonian with random transfer integral was developed. The random nature of the system was taken into account by the Matsubara-Toyozawa theory of impurities in semiconductors. By considering the hydrogen like impurity states, the electronic specific heat of the uncompensated phosphorus doped silicon was calculated and compared with the experimental results. It was found that it agreed well with the experiment in the entire semiconductor to the dilute metallic region. T.M.

N80-33255# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ELECTRON CORRELATIONS IN NARROW BANDS

Ram Kishore Jul. 1980 8 p refs Presented at the 32A SBPC Meeting

(INPE-1813-RPE/181) Avail: NTIS HC A02/MF A01

The standard basis operators formalism is used to study the problem of electron correlations in narrow bands. The exact Dyson equation in the matrix form for Green's function is obtained by exploiting the many body theory. The present formalism provides a natural extension of Roth's two poles approximation scheme. S.F.

N80-33256# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.

A STUDY OF METAL-SEMICONDUCTOR CONTACTS ON INDIUM PHOSPHIDE Annual Report, 1 Feb. - 30 Sep. 1979

G. Y. Robinson Griffiss AFB, N.Y. RADC May 1980 55 p refs

(Contract F19628-79-C-0016; AF Proj. 2306)

(AD-A087666; RADC-TR-80-108) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report describes the research accomplished during the first eight months of a 20 month program of research on metal semiconductor contacts to indium phosphide (InP). The Schottky barrier energy Phi sub B and contact resistance are correlated to the metallurgical behavior of metal/InP contacts by using Auger electron spectroscopy. A carefully processed set of samples were used to show conclusively that Phi sub B is greater on p-type InP than on n-type InP. This is shown to be the opposite from the behavior of GaAs and Si Schottky diodes fabricated at the same time using the same process. Several metallic structures have been investigated for use as ohmic contacts to InP. A Ni/Au/Ge system is shown to provide low resistance contacts to n-type InP after heat treatment. For ohmic contact to p-type InP, two metal systems have been tested, but neither system has proven to be suitable for practical InP devices as of yet. Low resistance contacts are found with heat treated Au/Mg contacts, however, the contact surfaces are nonuniform. Pd was substituted for Au in the Au/Mg contact in order to reduce In-Au alloying. Preliminary results indicate that the contact resistance of the Pd/Mg contacts is high. This may result from MgO formation at the critical InP, interface during contact fabrication. GRA

N80-33257# Lincoln Lab., Mass. Inst. of Tech., Lexington.

CRYSTALLINE SILICON ON INSULATORS BY GRAPHOEPITAXY

Michael W. Geis, Dale C. Flanders, Dimitir A. Antoniadis, and Henry I. Smith 1979 4 p refs

(Contract F19628-80-C-0002; ARPA Order 2006)

(AD-A085435; MS-5107A; ESD-TR-79-348) Avail: NTIS HC A02/MF A01 CSCL 20/12

Graphoepitaxy is a technique that uses artificial surface relief structures to induce crystallographic orientation in thin films. A simple model for graphoepitaxy is presented which predicts materials that can be deposited on smooth amorphous substrates to produce a crystalline texture can be uniformly oriented by appropriate surface relief structures. Graphoepitaxy was used to achieve uniformly oriented silicon films 0.5 micron m thick over surface relief gratings etched into amorphous fused silica substrates. The silicon was first deposited as an amorphous film

and then crystallized using a scanned Ar laser beam. The mean [100] directions in the silicon were parallel to the grating and perpendicular to the substrate plane. Films uniformly doped with phosphorous (2.4 x 10 to the 17th power atoms/cu cm) had an electron mobility at least 40% of the bulk value. GRA

N80-33258# Hughes Research Labs., Malibu, Calif.
SOLID-PHASE EPITAXIAL GROWTH Final Report, 1 May 1975 - 30 Jun. 1979
John Roth Apr. 1980 102 p refs
(Contract N00014-75-C-0957)
(AD-A084175) Avail: NTIS HC A06/MF A01 CSCL 07/4

The growth of Si single crystal films by solid phase epitaxy (SPE) is reported. Direct SPE and silicide-interlayer SPE, in which a transition metal film is deposited onto the substrate and reacted with it prior to the deposition of amorphous Si, are discussed. It is shown that previous work on silicide-interlayer SPE was dominated by contaminant effects and did not represent the intrinsic behavior of the process. However, conducting interlayer SPE in a noncontaminating, ultrahigh vacuum environment did not improve the quality of the films, but instead changed the growth morphology, with the result that even films grown under the most stringent vacuum conditions are unsuitable for most microelectronic applications. The direct SPE of Si deposited onto a clean substrate is shown to produce high-quality epitaxial films on Si < 100 >. MOS transistors fabricated in SPE layers grown at 550 C functioned identically to their bulk Si counterparts. Several sources of contaminant introduction in SPE are discussed, and their effects on the growth morphology and crystal quality are reported. M.G.

N80-33259# Colorado State Univ., Fort Collins.
SEMICLASSICAL BOLTZMANN TRANSPORT THEORY IN SEMICONDUCTORS
D. K. Ferry 1980 10 p refs Repr. from Phys. of Nonlinear Transport in Semiconductors, 1980 p 117-125
(Contract N00014-78-C-0124; NR Proj. 373-048; RR0210301)
(AD-A084161; CSU-TR-N-80-1) Avail: NTIS HC A02/MF A01 CSCL 20/12

A review is presented of the current status of theoretical solutions of the Boltzmann transport equation in semiconductors. In particular, high field transport is emphasized. The capabilities of the displaced Maxwellian approach, numerical techniques, and the Monte Carlo method are examined. M.G.

N80-33260# Rensselaer Polytechnic Inst., Troy, N. Y. Electrical and Systems Engineering Dept.
NONDESTRUCTIVE EVALUATION OF Si WAFERS USING SAW
P. T. Das, M. K. Roy, R. T. Webster, and K. Varahramyan Sep. 1979 9 p refs
(Contracts N00014-75-C-0772; Grant AF-AFOSR-3426-77; NR Proj. 009-017)
(AD-A084665; MA-ONR-34) Avail: NTIS HC A02/MF A01 CSCL 20/12

The attenuation and transverse acoustoelectric voltage arise out of coupling of the electric field accompanying a surface acoustic wave propagating on a piezoelectric substrate and the carriers in an adjacent semiconductor. These phenomena are useful in the study of the electronic properties of semiconductor surfaces and this nondestructive technique to evaluate the effects of Si wafer processing methods. The contactless nature of this method makes it possible to recharacterize the same wafer after repeated processing steps without fear of contaminating furnaces and other processing equipment. The phenomena are analyzed theoretically and the results used to interpret the data obtained for the experimental measurement of important wafer properties. The conductivity, surface carrier type and time constants associated with the emission and capture of carriers in surface traps are determined for silicon. The results are compared with those obtained from four point probe and C-V measurements. GRA

N80-33261# Hughes Research Labs., Malibu, Calif.
ELECTRONIC PROCESS IN InP AND RELATED COMPOUNDS Quarterly Progress Report, 13 Dec. 1979 - 12 Mar. 1980
K. V. Vaidyanathan, C. L. Anderson, H. L. Dunlap, D. E. Holmes, and G. S. Kamath Apr. 1980 12 p
(Contract N00019-79-C-0533)
(AD-A084260) Avail: NTIS HC A02/MF A01 CSCL 20/12

An experimental system to measure ionization coefficients in InP and related compounds is described. The current voltage characteristics of Schottky barriers on p-type InP are presented. A set of masks designed to fabricate guarded Schottky diodes for making ionization coefficient measurements is described. GRA

N80-33262# Cornell Univ., Ithaca, N. Y. Dept. of Chemistry.
A STUDY OF SECONDARY ION TRIPLE BOND ANALOGUES Interim Technical Report
D. T. Hodul, W. C. Harris, and G. H. Morrison 20 Aug. 1980 18 p refs Submitted for publication Sponsored in part by NSF
(Contract N00014-80-C-0538; NR Proj. 051-736)
(AD-A088423; TR-1) Avail: NTIS HC A02/MF A01 CSCL 20/12

Diatomic molecular ions isoelectronic with CN have been generated in ion implanted semiconductor materials and analyzed using secondary ion mass spectrometry (SIMS). Negative (IVA-VA) ions containing the VA species from IVA implanted IIIA-VA semiconductors are found to be produced more readily than the IVA ions. The triple bond analogues studied were of the general type (IVA-VA)-, (IIIA-VIA)-, (VA-VIA)-, and (IVA-VIIA)+. Molecular ion formation mechanisms and the analytical consequences of the results of this study are discussed. GRA

N80-33263# Hughes Research Labs., Malibu, Calif.
ELECTRONIC PROCESSES IN INP AND RELATED COMPOUNDS Quarterly Program Report, 13 Mar. - 12 Jun. 1980
K. V. Vaidyanathan, C. L. Anderson, H. L. Dunlap, D. E. Holmes, and G. S. Kamath Jul. 1980 10 p
(Contract N00019-79-C-0533)
(AD-A088446; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 20/12

An experimental system to measure ionization coefficients in InP and related compounds is described. The current-voltage characteristics of Schottky barriers on p-type InP are presented. A set of masks designed to fabricate guarded Schottky diodes for making ionization coefficient measurements is described. GRA

N80-33264# Massachusetts Inst. of Tech., Cambridge.
RAPID SOLIDIFICATION PROCESSING: AN OUTLOOK Technical Report, Oct. 1978 - Jan. 1980
M. Cohen, B. H. Kear (United Technologies Research Center, East Hartford, Conn.), and R. Mehrabian (NBS, Washington, D.C.) 11 Aug. 1980 25 p refs Presented at the 2d Conf. on Rapid Solidification Processing Principles and Technol., Reston, Va., 23-26 Mar. 1980 Prepared in cooperation with United Technologies Research Center, East Hartford, Conn. Sponsored in part by NBS
(Contracts N00014-76-C-0171; N00014-78-C-0387; F33615-76-C-5136; DARPA Order 3751; NR Proj. 031-795)
(AD-A088473; TR-7) Avail: NTIS HC A02/MF A01 CSCL 13/8

The elements of rapid solidification processing (RSP) are highlighted from the standpoints of (a) the fundamentals involved, (b) the prospects for new structure/property relationships, and (c) the interplay between materials processing and the wider field of materials science and engineering. Prototype methods of rapid solidification and consolidation are briefly described. Particular attention is then given to various solidification modes and resulting morphologies as a function of cooling rate from the molten state. These modes span the range of planar, cellular, dendritic, and segregationless (microcrystalline), solidification, the latter being achieved by critical or hypercritical undercooling. The need for careful characterization of RSP microstructures is emphasized, and important scientific challenges for advancing the field of RSP are stressed. GRA

N80-33265# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
EVIDENCE FOR AN OXYGEN INTERMEDIATE IN THE

CATALYTIC REDUCTION OF NO BY CO ON RHODIUM SURFACES
L. H. Dubois, P. K. Hansma, and G. A. Somorjai 29 Jul. 1980 29 p refs Submitted for publication Sponsored in part by DOE Prepared in cooperation with California Univ., Santa Barbara
(Contract N00014-78-C-0011; NR Proj. 056-673)
(AD-A088045; TR-5) Avail: NTIS HC A03/MF A01 CSCL 07/4

Evidence for an oxygen intermediate in the reaction of NO and CO to form N2 and CO2 over rhodium surfaces is presented. High resolution electron energy loss spectroscopy (ELS) measurements indicate that both NO and CO molecules associatively adsorb on the Rh(331) single crystal surface at 300 K. Chemisorbed NO readily dissociates on this surface upon heating at 450 K. At 700 K high resolution ELS and Auger electron spectroscopy (AES) both indicate that only oxygen is present on the catalyst surface. N2 desorption below this temperature is easily detected by mass spectroscopy. The addition of CO to this surface oxygen at 700 K results in the formation of gaseous CO2 and the removal of the surface oxygen species. Similar results were obtained when O2 was substituted for NO as a control indicating that oxygen is indeed a surface intermediate under our experimental conditions. GRA

N80-33266# IRT Corp., San Diego, Calif.
CHEMICAL REACTIONS ON SOLID SURFACES USING MOLECULAR BEAM TECHNIQUES Final Report, 1 Jan. 1972 - 30 Sep. 1980
Robert L. Palmer 31 Jul. 1980 24 p refs
(Contracts N00014-72-C-0247; N00014-77-C-0255; NR Proj. 056-527)
(AD-A088447; IRT-8162-006) Avail: NTIS HC A02/MF A01 CSCL 20/7

Thermal energy molecular beams have been used to study chemical interactions with metal surfaces. Chemisorption of simple molecules such as H2, O2, CH4, C2Hx and CO was investigated on single and polycrystalline surfaces of Pt, Ni, Co, and Ag. Kinetic parameters and reaction mechanisms were determined for model catalytic reactions including CO and C2Hx oxidation and methanation from H2/CO mixtures. Chemical reactions of NOx with CO and D2 on Pt(111) and other surfaces have been surveyed and the kinetics of NO and O2 chemisorption have been measured. The theory of adsorption/desorption kinetics is reviewed and certain deficiencies identified. GRA

N80-33267# Brown Univ., Providence, R. I. Div. of Engineering.
ELECTRONIC STRUCTURE AND STABILITY OF METALLIC GLASSES Final Report, 14 May 1976 - 14 May 1980
Jan Tauc 1 Aug. 1980 12 p refs
(Grant DAAG29-76-G-0221)
(AD-A088292; ARO-13723.10-P) Avail: NTIS HC A02/MF A01 CSCL 11/2

The work was concentrated on deepening our understanding of the properties of electrons in metallic glasses and amorphous thin films and their role in determining the atomic arrangement in these materials. It includes a photoemission study of Nb-Ni glasses, an analysis of an electronic contribution to the free energy of a binary liquid that determines the atomic correlations, EXAFS studies of the structure of Pb-Ge quenched glasses and amorphous thin films, optical studies of amorphous Au-Si system, and a study of the magneto-optic effect in Fe80B20 metallic glass. GRA

N80-33268# Frequency Electronics, Inc., New Hyde Park, N.Y.
VIBRATION RESISTANT QUARTZ CRYSTAL RESONATORS Research and Development Technical Report, 27 Aug. 1979 - 27 Feb. 1980
B. Goldfrank and A. Warner Jul. 1980 36 p
(Contract DAAK20-79-C-0272; DA Proj. 1L1-62705-AH-94)
(AD-A088286; DELET-TR-79-0272-1) Avail: NTIS HC A03/MF A01 CSCL 09/1

The objectives of this investigation are to provide doubly rotated quartz crystal resonators that exhibit fast warm-up and low 'g' sensitivity. Warm-up is to be on the order of 1 PP10 to the 9th power in three minutes. The 'g' sensitivity is to be 1 PP10 to the 10th power maximum in any axis. GRA

N80-33269# Massachusetts Inst. of Tech., Cambridge. Crystal Physics and Optical Electronics Lab.
CRYSTAL GROWTH BY SKULL MELTING Final Report, 1 May 1976 - 30 Apr. 1979
A. Linz, D. J. Epstein, and H. P. Jensen 24 Jul. 1980 10 p
(Contract DAAG29-76-C-0039)
(AD-A088013; ARO-14080.1-PX) Avail: NTIS HC A02/MF A01 CSCL 20/2

Skull Melting and top seeded solution growth of YVO4 were studied. A computerized optical spectroscopy system was designed and implemented. Laser pump laser gain measurements were made of Nd:YAG and CAMGAR. GRA

N80-33270# Cornell Univ., Ithaca, N. Y. School of Electrical Engineering.
INITIAL STUDY OF BALLISTIC EFFECTS FOR THE OPERATION OF GaAs FET DEVICES Final Report, Mar. 1979 - Feb. 1980
L. F. Eastman Jul. 1980 19 p refs
(Contract N00014-79-C-0290; ARPA Order 3720; NR Proj. 243-028)
(AD-A088350) Avail: NTIS HC A02/MF A01 CSCL 20/12

Ballistic electron motion at high velocity in the (100) direction in GaAs at both 77 K and room temperature has been determined by current-voltage data on thin layers. Molecular beam epitaxial abrupt layers .4-.5 microns thick with N- ohmic contacts on both sides, have been tested, and ballistic motion occurs below .5V applied voltage. Layers with a donor density of 1 x 10 to the 15th power/cc, and layers with an acceptor density of 1 x 10 to the 15th power/cc both yield space charge limited current data to agree with the corresponding ballistic transport models developed. Average electron velocity values five times higher than that obtainable in a standard FET are now possible for both 77 K and room temperature in such ballistic electron motion. Although the standard FET geometry, even with short gates, is precluded by thick depletion layers into lightly doped layers, from both the exposed surface and the interface with the semi-insulating substrate, it has been concluded that a ballistic electron transistor with a geometry similar to that of the permeable base transistor is possible for very high speed, high frequency, low noise performance. GRA

N80-33271# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
PERCOLATION AND ELECTRICAL CONDUCTION IN SUPERCONDUCTING COMPOSITES Interim Report
Christopher John Lobb Aug. 1980 129 p refs
(Contracts N00014-77-C-0085; N00014-75-C-0648; Grants NSF DMR-77-24295; NSF DMR-79-04155; NSF DMR-79-09011)
(AD-A088196; TR-10) Avail: NTIS HC A07/MF A01 CSCL 20/3

We report the experimental properties of a number of random superconducting-normal metal composites. Theoretical interpretation is also presented, with emphasis on the effects of geometrical randomness. The electrical properties of in situ multifilamentary Cu-V3Ga wires are discussed, with emphasis on critical current and field properties which are relevant to applications. We found that these wires had upper critical fields as high as 22.4 T at 4.2 K with a transition temperature of 15.5 K. Their overall critical current density compared favorably with commercial wires. The results of electrical measurements on in situ Cu alloy-Nb composites are reported which elucidate the roles of percolation and the proximity effect in these materials. Our data show that the proximity effect is very important in clean, low superconducting concentration samples, with geometrical percolation being more important as the matrix becomes dirtier. In addition, we discuss models for the superconducting to normal transition in these materials which include the effects of randomness and thermal fluctuations. A two dimensional thin film system based on Cu-Pb is discussed and shown to be qualitatively similar to the three dimensional in situ composites. GRA

N80-33272# Hoffman (P. R.) Co., Carlisle, Pa.
AUTOMATED X-RAY ORIENTATION FOR QUARTZ CRYSTAL RESONATORS Interim Report, 1 Jul. - 31 Dec. 1979
Robert W. Birrell, Robert J. Valihura, John L. Chambers, Myron A. Pugh, and S. Thomas Workman Jul. 1980 50 p refs

Prepared in cooperation with Advanced Research and Applications Corp., Sunnyvale, Calif.
(Contract DAAK20-79-C-0254; DA Proj. 1L1-62705-AH-94) (AD-A088063; DELET-TR-79-0254-1; IR-1) Avail: NTIS HC A03/MF A01 CSCL 14/2

The major objective of this program is to develop an automated X-ray orientation system which is capable of measuring the angles of cut of doubly rotated cuts of quartz (SC cut) to seconds of arc on a production basis. Precise measurement of Laue spots is used in conjunction with laser crystal surface measurements to determine the angle of cut. The entire procedure is under control of a dedicated minicomputer. A second objective is to angle correct the measured crystals. Several techniques are being studied to replace the conventional laboratory type correction procedure. GRA

N80-33273# Hanford Engineering Development Lab., Richland, Wash.
COMPUTER CODE FOR THE ATOMISTIC SIMULATION OF LATTICE DEFECTS AND DYNAMICS
J. O. Schiffgens, N. J. Graves, and C. A. Oster (Battelle Pacific Northwest Labs., Richland, Wash.) Apr. 1980 182 p refs 3 Vol.
(Contract DE-AC14-76FF-02170)
(HEDL-TME-78-55-Vol-2) Avail: NTIS HC A09/MF A01

Version 4 of COMENT is documented and current code options are defined. An effort was made to structure COMENT to allow for additional options with a minimum of change in the existing version of the code. Although COMENT was specifically written in FORTRAN IV and COMPASS (CDC assembly language) to take full advantage of CDC 6000/7000 series computer characteristics, it can with relatively little effort be adapted to other computer systems. DOE

N80-33274# Ames Lab., Iowa. Dept. of Physics.
A-15 SUPERCONDUCTING COMPOSITES IN THE 0.1 MICRON REGION
D. K. Finnemore and J. D. Verhoeven 1980 16 p refs Presented at the Intern. Cryogenic Mater. Conf., Madison, Wis., 21 Aug. 1980
(Contract W-7405-eng-82)
(IS-M-274; CONF-800816-1) Avail: NTIS HC A02/MF A01

Consumable electrode arc casting procedures were used to produce 10 kg billets Cu-Nb alloys. The resulting dendrite morphology and homogeneity is suitable for industrial scale production of Nb3Sn-Cu multifilamentary superconducting wire for magnets in the 8 to 14 Telsa range. If proper heat flow patterns can be maintained, the same techniques should be suitable for 100 kg billets. In the design of these composites for magnet wire, a Cu70Nb30 casting is a good choice of Nb content if high J/sub c/ and ease of fabrication are the major considerations. If unusual strain tolerance is the primary consideration, then a lower Nb and lower Sn content is preferred. DOE

N80-33275# Sandia Labs., Livermore, Calif. Applied Physics Div.
OBSERVATION OF AN OPTICAL STARK EFFECT ON VIBRATION AND ROTATIONAL TRANSITIONS
L. A. Rahn, R. L. Farrow, M. L. Koszykowski, and P. L. Mattern Jun. 1980 15 p refs Submitted for publication
(Contract DE-AC04-76DP-00789)
(SAND-80-8707) Avail: NTIS HC A02/MF A01

Vibrational and rotational Raman transitions were shown to be shifted to lower frequencies in the presence of a nonresonant high intensity optical field. Experimental results using CARS spectroscopy for hydrogen and nitrogen are presented. The magnitude of the observed shift is in agreement with a calculation which considered the coupling of the optical field to the internuclear separation via the molecular electronic polarizability. The magnitude of the shift is proportional to the optical field intensity. DOE

N80-33276# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.
SEQUENTIAL PURIFICATION AND CRYSTAL GROWTH FOR THE PRODUCTION OF LOW COST SILICON SUBSTRATES Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1980
Ming Liaw and F. S. DAragona May 1980 36 p refs Prepared for Midwest Research Inst., Golden, Colo.
(Contract DE-AC02-77CH-00178)
(SERI-8119-3/2; QTPR-2) Avail: NTIS HC A03/MF A01

Direct methods for the purification of MG-Si were used. Sequential steps of purification were followed by crystal growth. The steps of sequential purification included: leaching of MG-Si charge, phase separation of non-soluble impurities from molten silicon, reactive gas treatment of molten silicon, liquid-liquid extracting (called slagging), and impurity redistribution using ingot pulling. All the purification steps were performed in a consecutive manner using a crystal puller. The study of the purification by reactive gas treatment, and slagging was completed. Selection of a reusable crucible was also made. DOE

N80-33277# Brookhaven National Lab., Upton, N. Y. Dept. of Chemistry.
LIGHT INDUCED ELECTRON TRANSFER REACTIONS OF METAL COMPLEXES
Norman Sutin and Carol Creutz 1980 22 p refs Presented at the 9th Intern. Union of Pure and Appl. Chem. Symp. on Photochem., Seafeld, Austria, 13-19 Jul. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28043; CONF-800734-1) Avail: NTIS HC A02/MF A01

Properties of the excited states of tris(2,2'-bipyridine) and tris(1,10-phenanthroline) complexes of chromium(3), iron(2), ruthenium(2), osmium(2), rhodium(3), and iridium(3) are described. The electron transfer reactions of the ground and excited states are discussed and interpreted in terms of the driving force for the reaction and the distortions of the excited states relative to the corresponding ground states. General considerations relevant to the conversion of light into chemical energy are presented and progress in the use of polypyridine complexes to effect the light decomposition of water into hydrogen and oxygen is reviewed. DOE

N80-33278# Brookhaven National Lab., Upton, N. Y. Metallurgy and Materials Science Div.
EFFECTS OF IRRADIATION AND MECHANICAL STRESS ON THE SUPERCONDUCTING PROPERTIES OF CANDIDATE MAGNET CONDUCTORS
C. L. Snead, Jr. and Thomas Luhman 1980 60 p refs
(Contract DE-AC02-76CH-00016)
(BNL-27976) Avail: NTIS HC A04/MF A01

Neutron and charged-particle irradiation effects in NbTi and the A15-compound superconductors were investigated. The utility of these conductors in radiation fields was explored by defining the magnitude of critical-property changes with the fluence of various irradiating particles. The physical mechanisms that couple the irradiation defects to the observed critical-property changes are discussed. Annealing/recovery data on irradiated materials are included where they pertain to the understanding of the physical mechanisms involved, and thereby to the desirability of magnet annealing in actual operating circumstances. DOE

N80-33279# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
HIGH ANGLE GRAIN BOUNDARIES AS SOURCES OR SINKS FOR POINT DEFECTS
R. W. Balluffi Sep. 1979 64 p refs Presented at the ASM Mater. Sci. Seminar, Milwaukee, 15-16 Sep. 1979
(Contract DE-AS02-78ER-05002)
(DOE/ER-05002/8; CONF-7909100-2) Avail: NTIS HC A04/MF A01

A secondary grain boundary dislocation climb model for high angle grain boundaries as sources/sinks for point defects is described in the light of recent advances in the knowledge of grain boundary structure. Experimental results are reviewed and are then compared with the expected behavior of the proposed model. Reasonably good consistency is found at the level of present understanding of the subject. However, several gaps in knowledge still exist, and these are identified and discussed briefly. DOE

N80-33280# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.

STUDY OF GRAIN BOUNDARY SEGREGATION USING THE AUGER ELECTRON EMISSION TECHNIQUE Annual Technical Progress Report, 1 Jan. - 31 Dec. 1979
D. F. Stein, L. A. Heldt, and A. W. Funkenbusch 1980 20 p refs
(Contract DE-AS02-76ER-02166)
(DOE/ER-02166) Avail: NTIS HC A02/MF A01

The influence of grain boundary chemical composition on hydrogen embrittlement was invest ;ated. Auger electron spectroscopy was employed to determine the grain boundary compositions of nickel-copper alloys containing various concentrations of phosphorus and subjected to various thermal treatments. Phosphrous segregates to grain boundaries during slow cooling, accompanied by reduced concentrations of grain boundary copper. Tensile tests were conducted in air and following cathodic charging with hydrogen. All samples tested in air exhibited a completely ductile fracture; ductility was insensitive to grain boundary composition. Fractures of hydrogen-charged samples were brittle and intergranular; elongation to fracture increased significantly with increasing concentration of grain boundary phosphorus. The influence of phorsphorus segregation on embrittlement by hydrogen or by mercury ie analyzed in terms of additive and interactive mechanisms. DOE

N80-33281# Illinois Univ., Urbana. Materials Research Lab.
PANEL REPORT ON THEORY OF SURFACES
Jan. 1979 72 p refs Presented at Council on Mater. Sci. Panel on Surface Theory, Hyannis, Mass., 14-18 Aug. 1978
(Contract DE-AC02-76ER-01198)
(DOE/ER-01198/1307) Avail: NTIS HC A04/MF A01

Problem areas focussing on atoms, electrons and alloys are described and the role of the theory is discussed. For each of the research areas, a brief description of developments, future goals, methodologies, and impacts of applications areas is given. DOE

N80-33282# Hanford Engineering Development Lab., Richland, Wash.
SIMULATION OF SHORT-TERM ANNEALING OF DISPLACEMENT CASCADES IN FCC METALS
H. L. Heinisch, D. G. Doran, and D. M. Schwartz (California State Univ., Northridge) 1980 17 p refs Presented at the 10th Intern. Symp. on Effects of Radiation on Mater., Savannah, Ga., 3 Jun. 1980
(Contract DE-AC14-76FF-02170)
(HEDL-SA-2147-FP; CONF-800609-9) Avail: NTIS HC A02/MF A01

Computer models were developed for the simulation of high energy displacement cascades. Defect production functions for use in correlation analysis of radiation effects in fusion reactor materials were generated. In particular, the stochastic cascade annealing simulation code (SCAS) was developed and used to model the short term annealing behavior of simulated cascades in FCC metals. The code is fast enough to make annealing of high energy cascades practical. Sets of cascades from 5 keV to 100 keV in copper were generated by the binary collision code MARLOWE. DOE

N80-33283# Emory Univ., Atlanta, Ga. Dept. of Physics.
FAR INFRARED STUDIES OF SUPERCONDUCTING V3Si, Nb3Ge, AND Nb Progress Report and Renewal Proposal
Sidney Perkowitz 1980 14 p refs
(Contract DE-AS05-79ER-10436)
(DOE/ER-10436/1) Avail: NTIS HC A02/MF A01

The progress on far infrared techniques in the range 10 to 200 cm (1 to 25 meV) to examine the high temperature superconductors V3Si, Nb3Ge, and Nb, and the high temperature granular superconductor NbN is reported. Fourier and laser spectrometers and the technique of laser thermal spectroscopy yield information about the electron-photon spectral function, the temperature dependence of superconducting properties, and other fundamental aspects of high temperature homogeneous and inhomogeneous superconductors. A detailed theoretical analysis to complement the experimental work is recommended. DOE

N80-33284# Illinois Univ., Urbana. Dept. of Physics
ELECTRON TUNNELING INTO SUPERCONDUCTING INDIUM AND LEAD FILMS CONTAINING THE MAGNETIC IMPURITY MANGANESE Ph.D. Thesis
Juine-Kai Tsang 1980 145 p refs
(Contract DE-AC02-76ER-01198)
(DOE/ER-01198/1316) Avail: NTIS HC A07/MF A01

Tunneling measurements of quench-condensed In-Mn and Pb-Mn alloy films were made. The results were compared with Shiba's theory of superconductors containing magentic impurities. The localized excited impurity states predicted by Shiba's theory were observed in both alloys. In addition to s-wave scattering, it was necessary to include P- and D-wave scattering of the conduction electrons in the theory in order to explain the experimental data. Partial agreement between the theory and the experimental data was obtained using phase shifts from band calculation. The results on In-Mn also agree with thermal conductivity data. DOE

N80-33285*# National Bureau of Standards, Washington, D.C. Center for Electronics and Electrical Engineering.
SEMICONDUCTOR TECHNOLOGY PROGRAM, PROGRAM BRIEFS Interim Report, Oct. - Dec. 1979
W. Murray Bullis, ed. Apr. 1980 17 p refs Sponsored in part by Draper (Charles Stark) Lab.
(NASA Order C-32818-D; Contracts EA-77-A-01-6010; N00030-78-C-0100; N00019-79-1P-99003; MIPR-FY-1175-80-N310S; EG-77-C-01-4042; N00014-79-P-0051; N66001-79-MP-00052; ARPA Order 2397; ARPA Order 3882)
(NASA-CR-163592; PB80-191521; NBSIR-80-2006) Avail: NTIS HC A02/MF A01 CSCL 20L

Measurement technology for semiconductor materials, process control, and devices is discussed. Activities include: modeling of diffusion processes; analysis of spreading resistance measurements, and studies of resonance ionization spectroscopy; resistivity-dopant density relationships in p-type silicon; infrared detector materials; photoresist sensitometry; power transistor switching characteristics; and gross leak testing and application of an electrical alignment test structure. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-33286# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ON THE ANALOGY BETWEEN MATHEMATICAL PROBLEMS OF NON-LINEAR FILTERING AND QUANTUM PHYSICS Interim Report
Sanjoy K. Mitter Jun. 1980 67 p refs Submitted for publication
(Grants AF-AFOSR-3321-77; AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A088077; LIDS-P-1006; AFOSR-80-0583TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

The main thesis of this paper is that there are striking similarities between the mathematical problems of stochastic system theory, notably linear and nonlinear filtering theory, and mathematical developments underlying quantum mechanics and quantum field theory. Thus the mathematical developments of the past thirty years in functional analysis, lie groups and lie algebras, group representations, and probabilistic methods of quantum theory can serve as a guide and indicator to search for an appropriate theory of stochastic systems. In the current state of development of linear and nonlinear filtering theory, it is best to proceed by 'analogy' and with care, since 'unitarity' which plays such an important part in quantum mechanics and quantum field theory is not necessarily relevant to linear and nonlinear filtering theory. The partial differential equations that arise in quantum theory are generally wave equations, whereas the partial differential equations arising in filtering theory are stochastic parabolic equations. Nevertheless the possibility of

passing to a wave equation by appropriate analytic continuation from the parabolic equation, reminiscent of the current program in euclidean field theory, should not be overlooked. GRA

N80-33287# ARO, Inc., Arnold Air Force Station, Tenn.
HEAT TRANSFER AND STATIC STABILITY TESTS OF THE GENERAL PURPOSE HEAT SOURCE (GPHS) CONFIGURATIONS AT MACH 8.0 Final Report, 16 Nov. - 7 Dec. 1979
W. A. Crosby and E. C. Knox AEDC Jan. 1980 32 p refs
(AD-A088031; AEDC-TSR-80-V7) Avail: NTIS
HC A03/MF A01 CSCL 18/14

Heat transfer and static stability tests were conducted in the VKF Tunnel B at Mach 8. Discrete point surface heat flux measurements were made on the reference (unmodified) GPSH configuration over a range of inclination angles from -50 to 140 deg at several model orientations. Six-component static force and moment measurements were made on the reference GPHS configuration and three design modifications. An angle-of-attack range of -5 to 95 deg was covered at angles of sideslip from -9 to 15 deg and aerodynamic roll angles from -45 to 45 deg. GRA

N80-33288# General Energy Associates, Cherry Hill, N.J.
RELEVANCE OF THE SECOND LAW OF THERMODYNAMICS TO ENERGY CONSERVATION
Jan. 1980 37 p refs
(Contract DE-AT01-79CS-40178)
(DOE/CS-40178/01-Vol-1) Avail: NTIS HC A03/MF A01

An analysis is presented of the potential relevance of the use of analytical tools based on the second law of thermodynamics to existing federal programs for energy conservation in the industrial, transportation, building, and utility sectors in the US. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-33289# Purdue Univ., Lafayette, Ind.
FUTURE DIRECTIONS FOR DECISION SUPPORT
Robert H. Bonczek, Clyde W. Holsapple, and Andrew B. Whinston Jun. 1980 36 p refs Prepared in cooperation with Illinois Univ., Urbana
(Contract DAAG29-79-C-0154)
(AD-A087355; ARO-16231.2-EL) Avail: NTIS
HC A03/MF A01 CSCL 05/8

A formal, generic description of decision support systems is introduced. This description views a decision support system as having three principal components: a language system, a knowledge system and a problem processing system. Several systems are described which fit the generic DSS idea, but which are (for the most part) not the customary kinds of systems encountered in business applications. Nevertheless, the concepts and techniques employed in these systems can make important contributions to the emergence of more powerful business oriented decision support systems. GRA

N80-33290# Sandia Labs., Albuquerque, N. Mex.
REALISTIC APPROACH TO THE PLANNING OF HIGH-TECHNOLOGY, HIGH-RISK PROJECTS
Marvin J. Becktell May 1980 10 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-1483) Avail: NTIS HC A02/MF A01

Approaches to high-risk project planning are reviewed and assessed. It is recognized that the need for changes in philosophy and for a practical and realistic approach to the management plan used to support high technology, high-risk projects, calls for bold, honest planning, and unbiased, objective guidance. DOE

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-33291# RAND Corp., Santa Monica, Calif.
SECURITY AND PRIVACY IN THE 80'S
Willis H. Ware May 1980 13 p Presented at the Honeywell Natl. Computer Security and Privacy Symp., Phoenix, Ariz., 15 Apr. 1980
(RAND/P-6492) Avail: NTIS HC A02/MF A01

The issue of information ownership as related to computer programs is presented. The information usage question from the point of view of society overall and the possibility of architectures for distributed arrangements that provide additional safeguard mechanisms are discussed. It is proposed that analysis is needed in order to understand the dimensions of computer oriented crime. The pros and cons of Senate bill S-240 are outlined. E.D.K.

N80-33292# RAND Corp., Santa Monica, Calif.
DATA QUALITY INDICATORS AND THEIR USE IN DATA BASE SYSTEMS
Robert L. Patrick May 1980 12 p
(RAND/P-6491) Avail: NTIS HC A02/MF A01

Data quality indicator (DQI) removes one flaw in the computer based information systems that lies with their inability to explicitly deal with uncertainty. The DQI is held in a one byte field immediately adjacent to the value whose quality it describes. When the value is read or written or moved, the accompanying quality indicator is also moved so the pair of fields are never separated. When the value is processed, the processing program can optionally process the quality indicator or ignore it. Simple examples are included to describe the concept adequately. The use of quality indicators to date and how this concept can lead to the solution of a major data processing problem that lies in the foreseeable future, are discussed. R.K.G.

N80-33293# RAND Corp., Santa Monica, Calif.
MATCHING AND ABSTRACTION IN KNOWLEDGE SYSTEMS
Frederick Hayes-Roth Jan. 1980 39 p refs Presented at the Symp. on Artificial Intelligence in Inform. Sci., 1979 Ann. Meeting of the Am. Soc. for Inform. Sci., Minneapolis
(RAND/P-6440) Avail: NTIS HC A03/MF A01

Partial matching, a central theoretical problem common to the fields of artificial intelligence and information science, was studied. Problems in computer programming are presented. Data representation is described. T.M.

N80-33294# Computer Corp. of America, Cambridge, Mass.
FUNDAMENTAL ALGORITHMS FOR CONCURRENCY CONTROL IN DISTRIBUTED DATA BASE SYSTEMS Final Technical Report, Jul. 1979 - Jan. 1980
Philip A. Bernstein and Nathan Goodman Griffiss AFB, N.Y. RADC May 1980 267 p refs
(Contract F30602-79-C-0191; AF Proj. 5581; AF Proj. 2530)
(AD-A087996; RADC-TR-80-158) Avail: NTIS
HC A12/MF A01 CSCL 09/2

The state-of-the-art in distributed database concurrency control is consolidated. The heart of the analysis is a decomposition of the concurrency control problem into two major sub problems: read-write and write-write synchronization. A series of synchronization techniques for solving each sub-problem are described and it is shown how to combine synchronization techniques into algorithms that solve the entire concurrency control problem. Algorithms constructed in this way are called concurrency methods. Forty-eight principal concurrency control methods are

described. These methods include all practical algorithms for distributed database concurrency control that have appeared in the literature plus several new algorithms. In addition, an analysis of principal concurrency control methods in qualitative terms is performed. The analysis considers four cost factors: communication overhead, local processing overhead, transaction restarts, and transaction blocking. Results indicate that only about 10 of the principal concurrency control methods are reasonable choices in practice. Author

N80-33295# Naval Research Lab., Washington, D. C.
A HIGHLY PORTABLE DATA ACQUISITION SYSTEM FOR TOTAL MAGNETIC FIELD MEASUREMENTS Interim Report
Daniel Steiger 8 Aug. 1980 27 p refs
(AD-A088084; NRL-MR-4300) Avail: NTIS
HC A03/MF A01 CSCL 09/2

At the Naval Research Laboratory, highly portable intelligent terminals are being utilized aboard oceanographic platforms for the acquisition and storage of total magnetic field measurements. The design and implementation of the data acquisition system which includes a detailed description of the hardware and software utilized is described. GRA

N80-33296# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
COMPLEXITY OF STORAGE AND RETRIEVAL PROBLEMS Final Report, 14 Jan. 1977 - 30 May 1980
Peter Elias 18 Jul. 1980 6 p refs
(Contract DAAG29-77-C-0012)
(AD-A088319; ARO-14649.2-EL) Avail: NTIS
HC A02/MF A01 CSCL 09/2

This project has investigated the costs imposed by the need for communication between user and machine and between components of the machine in solving data-processing problems. There have been three principal substasks. The first, exploration of the minimal costs of storing and accessing information in simple data structures, is the oldest and results have been reported in several publications. The second is the design of minimax optimal universal codeword sets which can be used to represent any message set efficiently by assigning messages in order of decreasing probability to codewords in order of increasing length. A manuscript giving results of this research is almost ready for publication. The third is the exploration of switching networks which can be used for communication between a number of processors engaged in common computational task: that work is still in an early stage and is not yet ready for publication. GRA

N80-33297# Sandia Labs., Albuquerque, N. Mex. Distributed Processing System Design Div.
REMOTE HARD COPY. VOLUME 2: OPERATING MANUAL
Randall W. Simons Mar. 1980 22 p
(Contract DE-AC04-76DP-00789)
(SAND-80-0538/2) Avail: NTIS HC A02/MF A01

Procedures for operating the remote hard copy plotters are presented. Initializing the system, caring for the plotter, and interacting with the system are all covered. Descriptions of error conditions and how to operate diagnostics are presented. DOE

N80-33298# Sandia Labs., Albuquerque, N. Mex. Distributed Processing System Design Div.
REMOTE HARD COPY. VOLUME 1: PROGRAMMING MANUAL
Randall W. Simons Mar. 1980 13 p
(Contract DE-AC04-76DP-00789)
(SAND-80-0538/1) Avail: NTIS HC A02/MF A01

The application of various graphics languages and special control cards to create and route graphics files to the remote hard copy plotters is presented. Discussion and examples are given. DOE

N80-33299# Colorado Legislative Council, Denver.
COLORADO GENERAL ASSEMBLY SCIENCE AND TECHNOLOGY RESOURCE NEEDS ASSESSMENT STUDY Progress Report, Mar. 1978 - Aug. 1979
Floyd Mann Aug. 1979 247 p
(Contract NSF ISP-78-02517)
(PB80-189491; NSF/RA-790346) Avail: NTIS
HC A11/MF A01 CSCL 05A

The Colorado General Assembly's needs for scientific and technological (S/T) resources was evaluated. Potentially useful ways to improve the Legislature's capacities to use S/T resources in its policy formulation, decisionmaking, and legislative processes are identified. A needs assessment survey found that between 14 and 27 percent of the bills introduced in a recent legislative session might require S/T expertise, knowledge, or research. Efforts to ascertain how needs for S/T inputs were made by Committee members and Legislative Research Council members ex post facto were unsuccessful. However, useful information was obtained on how inputs from S/T were perceived as technical or vested-interest inputs. GRA

N80-33300# Ohio Academy of Science, Columbus.
DEVELOPING SCIENCE AND TECHNOLOGY RESOURCES FOR THE GOVERNOR, OF THE OHIO SCIENCE, ENGINEERING AND TECHNOLOGY PROGRAM FOR EXECUTIVE AGENCIES Final Report
L. E. Elfner Nov. 1979 66 p refs Sponsored in part by Ohio Dept. of Economic and Community Development, Columbus
(Grant NSF ISP-78-02500)
(PB80-190101; NSF/RA-790413) Avail: NTIS
HC A04/MF A01 CSCL 05A

Ways in which state and local governments can increase their capabilities for using science, engineering, and technology to meet the needs of their citizens are identified and analyzed. The results recommend the establishment of a five-part mechanism to assist the executive branch of the State government in the systematic, comprehensive, and ongoing use of Ohio's science, engineering, and technology resources in the State's policy making process. The mechanism comprises a resource coordinator, an agency resource advisory group, a council to provide direction, an annual science and government assembly, and the Ohio Academy of Science which assists agencies in establishing advisory groups. It is also recommended that science and technology resources be used most appropriately at the subcouncil level. GRA

N80-33301# New Jersey Dept. of Environmental Protection, Trenton.
THE SCIENCE, ENGINEERING, AND TECHNOLOGY PROGRAM FOR THE NEW JERSEY EXECUTIVE BRANCH
Aug. 1979 48 p
(Grant NSF ISP-78-13001)
(PB80-190242; NSF/RA-790419) Avail: NTIS
HC A03/MF A01 CSCL 05A

Based on interviews and several case study analyses, the overall scheme for incorporating science, engineering, and technology (SET) resources into New Jersey policies is identified and qualitatively evaluated. Also, comparative research into formal mechanisms linking science, technology, and policy in other states is conducted, and recommendations are obtained from ten other states. The results reveal the absence of a central source to advise and inform the executive branch on SET issues. Few top administrators perceive a problem with access to or incorporation of SET information into policy and decision making. Recommendations include expansion of the Governor's office to include staff with SET capabilities and an increase in the number of top level administrators in state government who have a working knowledge of SET components. GRA

N80-33302# Department of Housing and Urban Development, Washington, D. C. Office of Policy Development and Research.
DATA RESOURCES IN HOUSING AND URBAN DEVELOPMENT
Mar. 1980 12 p
(PB80-188071; HUD/PDR-570; HUD-0001387) Avail: NTIS
HC A02/MF A01 CSCL 05B

Data files available to the public from the Annual Housing Survey, the Survey of Development Needs of Small Cities, and the Survey on the Quality of Community Life are described. The Annual Housing Survey comprises two separate data collection efforts, a national survey of a sample of housing units and a survey of sample housing units in 15 Standard Metropolitan

Statistical Areas (SMSA's) each year, with a total of 60 selected SMSA's being surveyed every 4 years. GRA

N80-33303# Delaware Univ., Newark. Center for the Study of Marine Policy.
CREATING A SCIENCE AND TECHNOLOGY INFORMATION CAPACITY FOR THE EXECUTIVE AND LEGISLATIVE BRANCHES OF THE DELAWARE STATE GOVERNMENT Final Report
1 Oct. 1979 88 p refs
(Grant NSF ISP-78-02508)
(PB80-190762; NSF/RA-790421) Avail: NTIS
HC A05/MF A01 CSCL 05A

Development of a mechanism for applying science and technology (S & T) to decision making within the executive and legislative branches of the State of Delaware was studied. The investigation involved assessing S & T needs of Delaware's General Assembly and Executive Branch, identifying S & T information resources within the State, reviewing S & T utilization experiences in other states, and developing an S & T information mechanism for Delaware. The mechanism that was developed uses professional societies within the State as an S & T resource. Successful models used by other states in developing an S & T program are included. GRA

N80-33304# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SYMPOSIUM ON INTERNATIONAL STANDARDS INFORMATION AND ISONET Final Report
Charles B. Phucas Jun. 1980 65 p Symp. held at Gaithersburg, Md., 11-12 Oct. 1979 Sponsored in part by ANSI, New York
(PB80-197221; NBS-SP-579; LC-80-600073) Avail: NTIS
HC A04/MF A01 CSCL 05B

The American National Standards Institute (ANSI) and National Bureau of Standards working cooperatively with the International Organization for Standardization (ISO), provide United States input to the development of an International Standards Information Network called ISONET. Existing international standards information systems as well as the plans for the further development of ISONET are discussed. Developments in U.S. trade policy, especially those policies pertaining to standards and certification systems, are included. GRA

N80-33305# California Assembly Office of Research, Sacramento.
USE OF SCIENTIFIC AND TECHNICAL INFORMATION AND ADVICE BY THE CALIFORNIA LEGISLATURE: A SURVEY OF CURRENT POLICIES AND PROPOSALS FOR IMPROVEMENTS
Lawrence Marcus Baird Aug. 1979 131 p refs
(Grant NSF ISP-77-25862)
(PB80-189095; NSF/RA-790417) Avail: NTIS
HC A07/MF A01 CSCL 05B

The information network used by the legislative staff to obtain scientific and technical knowledge and advice in their role as advisors to California legislators is described. The utility of proposed mechanisms to improve the scientific and technical capacity of the staff was assessed. A case study approach was used to analyze the past successes and failures of the Assembly Science and Technology Advisory Council. The results of a recent study based on interviews with California legislative leaders and the senior staff regarding perceptions of science and technology are compared with findings from the questionnaire used in this study. GRA

N80-33306# North Dakota Energy Management and Conservation Office, Bismarck.
APPLYING SCIENTIFIC AND TECHNOLOGICAL RESOURCES FOR NORTH DAKOTA POLICY DEVELOPMENT: STATE SCIENCE, ENGINEERING AND TECHNOLOGY PROGRAM Final Report
Clifford A. Ness, Jr. Sep. 1979 25 p refs
(Grant NSF ISP-78-04618)
(PB80-189624; NSF/RA-790418) Avail: NTIS
HC A02/MF A01 CSCL 05B

The establishement of a scince and technology (S & T) resource system designed to improve access of North Dakota Statepolicymakers to S & T resources is described. The S & T system emerged from a realization that the current method of gathering S & T information by an informal ad hoc method should be replaced by a more formal structure to meet specific and expanding needs. S & T resource systems and practices in other states as well as in North Dakota were reviewed. GRA

N80-33307# Office of the Governor of the State of North Carolina, Raleigh.
THE STATE SCIENCE, ENGINEERING AND TECHNOLOGY PROGRAM IN NORTH CAROLINA, STUDY PHASE Final Report
31 Dec. 1979 57 p ref
(Grant NSF ISP-77-28878)
(PB80-190846; NSF/RA-790420) Avail: NTIS
HC A04/MF A01 CSCL 05A

The development of the State Science, Engineering, and Technology (SSET) Program in North Carolina during 1963-79 is described. Various organizational arrangements for science and technology in state government are detailed. A Board of Science and Technology designed to simulate economic development in the state was created. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-33308* National Aeronautics and Space Administration, Washington, D. C.
FY 1981 BUDGET PRESS BRIEFING
26 Jan. 1980 25 p
(NASA-TM-82195; P80-10157) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 05C

The proposed FY-81 budget for the National Aeronautics and Space Administration is briefly described. The total NASA budget is approximately $5.7 billion for 1981, and the submittal includes a request for a FY-80 supplemental appropriation of $300 million for space shuttle development. Supported projects in astronomy, space exploration, space technology applications, and aeronautics are identified. M.G.

N80-33309# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1980, VOLUME 2, PART 2
Washington GPO 1979 317 p Hearings on H. R. 1786 before the Subcomm. on Transportation, Aviation and Commun. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 7, 14-15 Feb. 1979
(GPO-45-070) Avail: Subcommittee on Transportation, Aviation and Communication

Research in aerodynamics, structures and materials, propulsion and human factors engineering is discussed. Vehicle related technology is reviewed for transport aircraft: (1) energy efficient transport; (2) laminar flow control; (3) composite primary aircraft structures; (4) energy efficient engine; (5) advanced turboprop systems; and (6) terminal configured vehicle. Low and high speed aircraft are discussed. S.F.

N80-33310# Committee on Appropriations (U. S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT - INDEPENDENT AGENCIES APPROPRIATIONS FOR 1981. PART 4: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Washington GPO 1980 1175 p Hearings before the Subcomm. on HUD-Independent Agencies of the Comm. on Appropriations, 96th Congr., 2nd Sess., 28 Nov. 1979
(GPO-57-166) Avail: Subcommittee on HUD-Independent Agencies

Hearings before a subcommittee of the Committee on Appropriations are presented. Appropriations for NASA during the fiscal year 1981 are presented. T.M.

N80-33311# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1979, PART 1
Washington GPO 1978 513 p refs Hearings on S. 2527 before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation, 95th Congr., 2nd Sess., 21-22 and 28 Feb. 1978
(GPO-25-603) Avail: Subcommittee on Science, Technology, and Space

The hearings before the Subcommittee on Science, Technology, and Space of the United States Senate are presented. Appropriations to NASA for research and development, construction of facilities, and operational costs during the 1979 fiscal year are presented. T.M.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.

N80-33312*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
IMPROVED LOW-DRAG GROUND VEHICLE PARTICULARLY SUITED FOR USE IN SAFELY TRANSPORTING LIVESTOCK Patent Application
Edwin J. Saltzman, inventor (to NASA) Filed 5 Aug. 1980 15 p
(NASA-Case-FRC-11058-1; US-Patent-Appl-SN-175453) Avail: NTIS HC A02/MF A01 CSCL 13F

A low drag truck consisting of a tractor trailer rig characterized by a rounded forebody and a protective fairing for the gap conventionally found to exist between the tractor and the trailer is described. The truck is particularly suited for establishing an attached flow of ambient air along the vehicle surfaces by utilizing a forward facing, ram air inlet and duct and a plurality of submerged inlets and outflow ports which communicate with the trailer for continuously flushing heated gasses from the trailer as the rig is propelled at highway speeds. NASA

N80-33313*# IIT Research Inst., Chicago, Ill.
MANUFACTURING PROCESS APPLICATIONS TEAM (MATEAM) Quarterly Report, 1 May - 31 Jul. 1980
Edmund R. Bangs Aug. 1980 86 p Original contains color illustrations
(Contract NAS8-32229)
(NASA-CR-161577; IITRI-J6499-QR-2) Avail: NTIS HC A05/MF A01 CSCL 05A

Progress in the transfer of aerospace technology to solve key problems in the manufacturing sector of the economy is reported. Potential RTOP programs are summarized along with dissemination activities. The impact of transferred NASA manufacturing technology is discussed. Specific areas covered include aircraft production, robot technology, machining of alloys, and electrical switching systems. R.K.G.

N80-33314# British Carbonization Research Association, Chesterfield (England).
INVESTIGATION INTO THE USE OF HYDROGEN PEROXIDE FOR THE PURIFICATION OF CARBONIZATION WASTES
Jun. 1979 20 p
(BCRA-67; CRR-67) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Various liquors and liquor effluents were allowed to react for different periods with peroxide and the extent of purification was determined by simple analytical procedures. Hydrogen peroxide was not an economical method for the purification of spent liquors but, in the presence of a suitable catalyst, small amounts of peroxide gave good results with biologically treated effluents. A deterioration in the quality of the biological effluent resulted in an increased peroxide demand. The final effluent was inferior in quality to that obtained when the biological system was functioning efficiently. In the case of a biological effluent from the treatment of a pyrolysis waste, peroxide proved to be the only satisfactory method of further treatment. DOE

N80-33315# National Technical Information Service, Springfield, Va. Office of Internal Affairs.
A PLAN FOR A SYSTEM TO PROVIDE DEVELOPMENTAL INFORMATION IN AFRICA
John W. Hounsell Jun. 1980 44 p
(PB80-189806) Avail: NTIS HC A03/MF A01 CSCL 05B

The functions and components of an African information network that would provide scientific, technical, economic, social, and other information for development to planners, administrators, extension workers, businesses, and individuals is outlined. A mechanism to get information from numerous sources in developing and developed countries to and users in Africa is presented. Topics covered are training; user education; acquisition and dissemination of information; information subsidies; publications; evaluation; computerization; standardization of reference materials; coordination with other information and development organizations; conferences; and project funding. GRA

N80-33316# Environmental Protection Agency, Chicago, Ill. Great Lakes National Program Office.
PROCEEDINGS OF NATIONAL CONFERENCE ON URBAN EROSION AND SEDIMENT CONTROL: INSTITUTIONS AND TECHNOLOGY
William L. Downing Jan. 1980 375 p refs Conf. held in St. Paul, 10-12 Oct. 1980
(PB80-197965; EPA-905/9-80-002) Avail: NTIS HC A16/MF A01 CSCL 08M

Urban erosion and sediment control are discussed. Land management techniques, social and institutional structures, and other mechanisms by which soil erosion and water problems may be reduced to acceptable levels are included. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-33317*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TECHNIQUES FOR MEASURING ARRIVAL TIMES OF PULSAR SIGNALS 1: DSN OBSERVATIONS FROM 1968 TO 1980
G. S. Downs and P. E. Reichley 15 Aug. 1980 88 p refs (Contract NAS7-100)
(NASA-CR-163564; JPL-Pub-80-54) Avail: NTIS HC A05/MF A01 CSCL 03A

Techniques used in the ground based observations of pulsars are described, many of them applicable in a navigation scheme. The arrival times of the pulses intercepting Earth are measured at time intervals from a few days to a few months. Low noise, wide band receivers, amplify signals intercepted by 26 m, 34,

and 64 m antennas. Digital recordings of total received signal power versus time are cross correlated with the appropriate pulse template. S.F.

N80-33318*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERFERENCE FILTER PHOTOMETRY OF PERIODIC COMET ASHBROOK-JACKSON
R. L. Newburn, Jr., J. F. Bell, and T. B. McCord Aug. 1980 30 p refs Prepared in cooperation with Hawaii Univ. at Manoa
(Contracts NAS7-100; JPL-699908)
(NASA-CR-163581; JPL-9950-418) Avail: NTIS HC A03/MF A01 CSCL 03A

P/Ashbrook-Jackson has a period of 7.43 years and comes to perihelion at 2.284 AU. It is a low inclination object (12.5 deg) of moderate eccentricity (0.400). In 1963, it made the best possible apparition, coming to perihelion and opposition virtually simultaneously, but no one made physical observations of faint periodic comets in 1963. In 1978 Ashbrook-Jackson came to opposition on Sept. 28, just 40 days after perihelion. It will be just over 100 years before an equally favorable apparition recurs. P/Ashbrook-Jackson was recovered by Pereyra at Cordoba Observatory on April 28, 1977, more than a year and a quarter before perihelion and already showing a diffuse coma with central condensation. Its helio-centric distance was then 3.7 AU. An extensive program was planned, but equipment problems and weather ultimately limited it to the two nights of data reported here. R.K.G.

N80-33319*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Electro-Optics Lab.
LARGE DEPLOYABLE REFLECTOR (LDR) Final Report
W. H. Aiff Jul. 1980 124 p refs
(Contract NAS2-10427)
(NASA-CR-152402; LMSC-D766449) Avail: NTIS HC A06/MF A01 CSCL 03A

The feasibility and costs were determined for a 1 m to 30 m diameter ambient temperature, infrared to submillimeter oribiting astronomical telescope which is to be shuttle-deployed, free-flying, and have a 10 year orbital life. Baseline concepts, constraints on delivery and deployment, and the sunshield required are examined. Reflector concepts, the optical configuration, alignment and pointing, and materials are also discussed. Technology studies show that a 10 m to 30 m diameter system which is background and diffraction limited at 30 micron m is feasible within the stated time frame. A 10 m system is feasible with current mirror technology, while a 30 m system requires technology still in development. A.R.H.

N80-33320*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
OBSERVATIONS AND ANALYSIS OF X-RAY BINARY STARS UNDER THE IUE GUEST OBSERVER PROGRAM Final Report, 1 Oct. 1977 - 30 Apr. 1979
Herbert Gursky Jun. 1979 4 p
(Contract NAS5-24332)
(NASA-CR-160035) Avail: NTIS HC A02/MF A01 CSCL 03A

IUE data for X-ray binaries were collected and analyzed. Image processing was done for 144 IUE images. The images represent 27 different objects. T.M.

N80-33321# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TOTAL GAMMA ABSORPTION TELESCOPE WITH MULTI-PARAMETRIC ANALYSIS [TELESCOPIO GAMA A ABSORCAO TOTAL E ANALISE MULTIPARAMETRICA]
Daniel Jean Roger Nordemann, Jose Marques DaCosta, and Inacio Malmonge Martin Jun. 1980 17 p refs In PORTUGUESE; ENGLISH summary Presented at the 32d Reuniao Anual da SBPC, 6-12 Jul. 1980 Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico
(INPE-1904-RPE/172) Avail: NTIS HC A02/MF A01

The present tendency of gamma ray astronomy is to build high performance telescopes using large detectors Ge(Li) and HPGe with anticoincidence system. A similar and competitive type of telescope using the principle of total absorption can be constructed with a large number of smaller detectors. This telescope would allow a better definition of the astrophysical sources. Such an apparatus would require more telemetry channels and more memory yet its price is lower than those of present gamma ray telescope projects. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-33322# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETECTION OF 511 KeV ANNIHILATION LINE FROM THE DIRECTION OF THE GALACTIC CENTER
J. M. daCosta, S. L. G. Dutra, Ph. Durouchoux, D. Boclet, R. Rocchia, F. Albernhe, J. F. LeBorgne, and G. Vedrenne Aug. 1980 16 p refs Prepared in cooperation with Commissariat a L'Energie Atomique, Saclay, France and Centre d'Etudes Spatiale des Rayonnements
(INPE-1863-RPE/213) Avail: NTIS HC A02/MF A01

A balloon borne Ge(li) detector was used in four low energy gamma ray experiments flown from Guaratinguetá, Brazil. Analysis of the gamma ray spectra obtained on two dates shows an intensity of (4.19 ± or - 1.56) x 10 to the minus 3 power photons/sq cm/s for the flux of the 511 KeV annihilation from the galactic center direction. A.R.H.

N80-33323# California Univ., Livermore. Lawrence Livermore Lab.
SUPERNOVA MODELS AND LIGHT CURVES
Thomas A. Weaver and S. E. Woosley (California Univ., Santa Cruz) 1980 19 p refs Presented at the Workshop on Atomic Phys. and Spectry. for Supernovae Spectra, San Diego, Calif., 10-12 Jan. 1980 Submitted for publication
(Contract W-7405-eng-48; Grant NSF AST-79-09102)
(UCRL-84578; CONF-800126-3) Avail: NTIS HC A02/MF A01

The current status of understanding of Type 2 supernovae is reviewed with particular emphasis on the processes responsible for the emission of electromagnetic radiation. A relatively novel evolutionary scenario that appears to lead to a Type 1 supernova explosion is also presented. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-33324* National Aeronautics and Space Administration, Washington, D. C.
SURFACE OF VENUS FROM PIONEER
28 May 1980 58 p
(NASA-TM-82193; P80-10154) Avail: NASA Scientific and Technical Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 03B

Radar data of the Venusian surface from the Pioneer Venus 1 are informally discussed. From the altimetry standpoint, the data are good to within 200 meters; the images have approximately a 30 km resolution with the altitude points being spaced 75 km in longitude and 100 km in latitude. Geological interpretations are offered based on the Pioneer data in conjunction with ground based radar and altimetry data. A 'plains' area is identified representing 65% of the planet which lies within 2 km of the nominal mean elevation. Three highland areas are identified and discussed. Venus has only 30% lowland as compared to the Earth's 75%. The high mountains are as high as the highest mountains on Earth, and the high plateaus are higher than the

greatest plateaus on Earth. Signs of regional tectonic motion are also discussed. M.G.

N80-33325*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SURVEY OF THE PLASMA ELECTRON ENVIRONMENT OF JUPITER: A VIEW FROM VOYAGER
Jack D. Scudder, Edward C. Sittler, Jr., and H. S. Bridge (MIT, Cambridge) Aug. 1980 91 p refs Submitted for publication
(NASA-TM-80731) Avail: NTIS HC A05/MF A01 CSCL 03B

The plasma environment within Jupiter's bow shock is considered in terms of the in situ, calibrated electron plasma measurements made between 10 eV and 5.95 keV by the Voyager plasma science experiment (PLS). Measurements were analyzed and corrected for spacecraft potential variations; the data were reduced to nearly model independent macroscopic parameters of the local electron density and temperature. It is tentatively concluded that the radial temperature profile within the plasma sheet is caused by the intermixing of two different electron populations that probably have different temporal histories and spatial paths to their local observation. The cool plasma source of the plasma sheet and spikes is probably the Io plasma torus and arrives in the plasma sheet as a result of flux tube interchange motions or other generalized transport which can be accomplished without diverting the plasma from the centrifugal equator. The hot suprathermal populations in the plasma sheet have most recently come from the sparse, hot mid-latitude 'bath' of electrons which were directly observed juxtaposed to the plasma sheet. A.R.H.

N80-33326*# RAND Corp., Santa Monica, Calif.
COORDINATES OF FEATURES ON THE GALILEAN SATELLITES
Merton E. Davies and Frank Y. Katayama Jun. 1980 39 p refs
(Contracts NASw-3210; JPL-953613)
(NASA-CR-163582; RAND/P-6479) Avail: NTIS HC A03/MF A01 CSCL 03B

The coordinate systems of each of the Galilean satellites are defined and coordinates of features seen in the Voyager pictures of these satellites are presented. The control nets of the satellites were computed by means of single block analytical triangulations. The normal equations were solved by the conjugate iterative method which is convenient and which converges rapidly as the initial estimates of the parameters are very good. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-33327* National Aeronautics and Space Administration, Washington, D. C.
SOLAR MAXIMUM MISSION
8 Feb. 1980 29 p
(NASA-TM-82192; P80-10153) Avail: NASA Scientific and Technical Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 03B

Mission objectives are described as well as the seven instruments carried onboard the multimission modular spacecraft to study solar activity and monitor the solar constant. Possibilities of retrieval and servicing by space shuttle are discussed and solar terrestrial interactions are examined with application to recent events in the United States. A.R.H.

N80-33328# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
TWO PAPERS ON THE METHODS OF EVALUATING THE QUALITY OF SOLAR PROTON EVENT FORECASTING FROM THE PEOPLE'S REPUBLIC OF CHINA
Zhen-xing Cui and Shan-Jie Qian 25 Oct. 1979 19 p Transl. into ENGLISH from Acta Astron. Sinica (China), v. 16, no. 1, 1976 p 6-11, 115-117
(AF Proj. 2311)
(AD-A088154; AFGL-TR-79-0250; AFGL-Trans-110) Avail: NTIS HC A02/MF A01 CSCL 03/2

The common criteria used to evaluate the accuracy of solar proton event forecasts and discuss their defects is reviewed. The concept of random forecast is introduced, and a combined indictor which can give a more reasonable assessment of the quality of forecasts is proposed. An improved indicator for evaluating the quality of solar proton event forecasts is included. S.F.

N80-33329# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 427, MARCH 1980, PART 1 (PROMPT REPORTS) Progress Report, Jan. - Feb. 1980
Helen E. Coffey, ed. Mar. 1980 187 p refs
(PB80-194871; SGD-427-Pt-1; NOAA-80043002) Avail: NTIS HC A08/MF A01 CSCL 03B

Data for February 1980 on alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, coronal holes and Boulder Geomagnetic Substorm Log is reported. Data for January 1980 on daily solar activity center, sudden ionospheric disturbances, solar radio emission, cosmic rays, geomagnetic indices and radio propagation indices is also provided. Late data included in this issue presents solar flares January 1980, cosmic rays - October and December 1979, and geomagnetic indices December 1979. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-33330# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A 2.2 MeV GAMMA RAY LINE OBSERVED DURING A SN SOLAR FLARE
K. R. Rao, I. M. Martin, J. O. D. Jardim, and U. B. Jayanthi Aug. 1980 14 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1842-RPE/202) Avail: NTIS HC A02/MF A01

On December 15, 1978, an omnidirectional gamma ray detector was flown during day time. Around noon time, when the sun was in the field of view of the detector, a solar flare of magnitude SN was observed. The flux of 2.2 MeV line showed enhancement during this period whereas at other times only upper limit was obtained. R.K.G.

N80-33331# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SCALE SIZE OF THE COSMIC RAY MODULATING REGION
R. P. Kane Jul. 1980 15 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1826-RPE/192) Avail: NTIS HC A02/MF A01

The effects of using monthly means in the analysis of long term changes of cosmic ray intensity are examined. It is shown that these can have considerable pollution from Forbush decrease effects. In particular, a use of maximum daily mean in a month, instead of the monthly mean, seems to reduce the width of the hysteresis loops, thereby implying reduced dimensions of the modulating region for galactic cosmic ray intensity. M.G.

N80-33332*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SPECTROSCOPY OF COMPACT EXTRAGALACTIC X-RAY SOURCES
Stephen S. Holt Sep. 1980 16 p refs Presented at the HEAD Meeting, AAS, Cambridge, Mass., Jan. 1980
(NASA-TM-82010) Avail: NTIS HC A02/MF A01 CSCL 03B

The X-ray spectra of compact extragalactic sources obtained from the HEAO-1 A-2 experiment and the solid-state spectrometer

onboard HEAO-2 (the Einstein Observatory) are reviewed. Seyfert spectra are remarkably consistent with characteristic power-law spectra of energy index alpha - 0.7 + .1 over a dynamic range of almost 100 in both luminosity for the whole sample, and energy for individual members. Radio-quiet quasars have similar spectra, perhaps slightly steeper, for the limited sample available. New solid-state spectrometer results for NGC 4151 yield a consistent picture for the geometry of the broad-line clouds in both these related radio-quiet classes of galactic nuclei. Radio-loud objects, especially BL Lacs, are considerably more variable in spectrum as well as luminosity. Direct synchrotron and synchrotron-self-Compton components are consistent with what we observe from these objects. Finally, the role of spectroscopy in addressing the extent to which compact extragalactic nuclei might contribute to the diffuse X-ray background is discussed. Author

N80-33333*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
HEAVY WEAK BOSONS, COSMIC ANTIMATTER AND DUMAND. 2: LOOKING FOR COSMIC ANTIMATTER WITH DUMAND
F. W. Stecker and R. W. Brown (Case Western Reserve Univ., Cleveland) Sep. 1980 17 p refs Presented at 1980 DUMAND Summer Workshop Submitted for publication
(NASA-TM-82017) Avail: NTIS HC A02/MF A01 CSCL 03B

Discussion of various means for using high energy neutrino astronomy to directly test for the existence of cosmic antimatter on a significant cosmological scale is presented. Studies of the ultrahigh energy diffuse neutrino background using acoustic detector and high mass Glashow resonances are reported. Point source studies are also discussed. R.K.G.

N80-33334*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research
ONE MILLIMETER CONTINUUM OBSERVATIONS OF EXTRAGALACTIC THERMAL SOURCES
Thomas Leonard Roelig [1980] 168 p refs
(Grant NsG-2347)
(NASA-CR-163590; CRSR-753) Avail: NTIS HC A08/MF A01 CSCL 03B

The results of 1 mm observations of extragalactic thermal sources are reported. The methods of making 1 mm observations are described. The instrumentation used to make the observation is described. T.M.

N80-33335# California Univ., Livermore. Lawrence Livermore Lab. Physics Dept.
ANOMALOUS ISOTOPIC COMPOSITION OF COSMIC RAYS
S. E. Woosley (California Univ., Santa Cruz) and Thomas A. Weaver 20 Jun. 1980 21 p refs Presented at the Astrophys. Workshop, Santa Cruz, Calif., 7-18 Jul. 1980
(Contract W-7405-eng-48)
(UCRL-84561; CONF-800728-1) Avail: NTIS HC A02/MF A01

Measurements of nonsolar isotopic patterns for the elements neon and (perhaps) magnesium in cosmic rays are interpreted within current models of stellar nucleosynthesis. One possible explanation is that the stars currently responsible for cosmic ray synthesis in the Galaxy are typically super-metal-rich by a factor of two or three. Other possibilities include the selective acceleration of certain zones or masses of supernovas or the enhancement of (22)Ne in the stellar medium by mass loss from red giant stars and planetary nebulas. Measurements of critical isotopic ratios are suggested to aid in distinguishing among the various possibilities. Some of these explanations place significant constraints on the fraction of cosmic ray nuclei that must be fresh supernova debris and the masses of the supernovas involved. DOE

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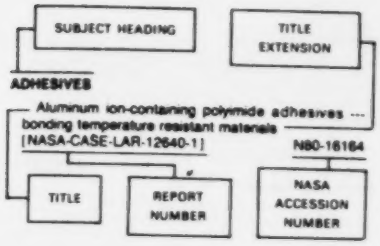

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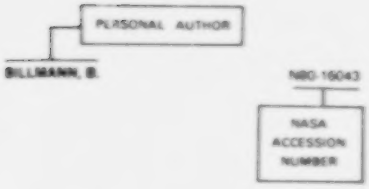

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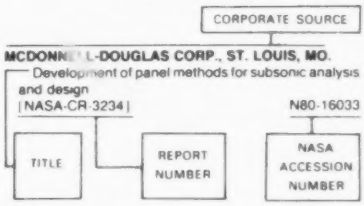

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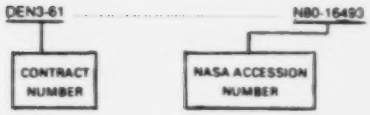

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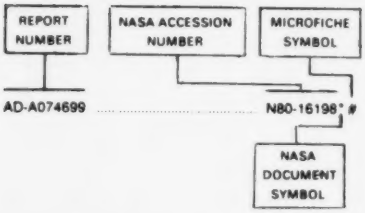

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COO-4020-10 ..... N80-33243 #
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COO-4388-11 ..... N80-32563 #
COO-4484-07 ..... N80-32952 #
COO-4552-2 ..... N80-33089 #
COO-4649-10 ..... N80-32906 #
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CW-WR-76-02-0-44A ..... N80-32721 #

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DELET-TR-78-8996-1 ..... N80-32673 #
DELET-TR-79-0254-1 ..... N80-33272 #
DELET-TR-79-0272-1 ..... N80-33268 #
DELET-TR-80-7 ..... N80-32662 #
DELET-TR-80-8 ..... N80-32667 #
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DOE-ET-21050-1-2 ..... N80-32868 #
DOE-ET-21050/1-1 ..... N80-32867 #

DOE/CH-00178-T2 ..... N80-32934 #

DOE/CS-0165 ..... N80-32548 #
DOE/CS-0168 ..... N80-32988 #
DOE/CS-04239/T1 ..... N80-32944 #
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DOE/CS-15362/1 ..... N80-32527 #
DOE/CS-40163/T1 ..... N80-32902 #
DOE/CS-40178/01-VOL-1 ..... N80-33288 #

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DOE/DP-03533/T3 ..... N80-32950 #
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DOE/EIA-CR-0456 ..... N80-32869 #

DOE/EIA-10597/T1 ..... N80-33112 #

DOE/ER-01198/1307 ..... N80-33281 #
DOE/ER-01198/1314 ..... N80-32598 #
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DOE/ER-01368-444 ..... N80-33193 #
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DOE/ER-04857/2 ..... N80-32896 #
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DOE/ER-05773/2 ..... N80-32478 #
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DOE/ER-10456/1 ..... N80-32473 #
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DOE/ET-12329/T1 ..... N80-32474 #
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DOE/ET-15207/T1 ..... N80-32723 #
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DOE/ET-21050/1-3-VOL-3 ..... N80-32893 #
DOE/ET-21074/4 ..... N80-32921 #
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DOE/ET-23108/2 ..... N80-32923 #
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DOE/ET-26931/T1 ..... N80-32897 #
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DOE/JPL-954739-3 ..... N80-32857* #
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DOE/NASA/1040-15 ..... N80-32488* #
DOE/NASA/1062-6 ..... N80-33221* #
DOE/NASA/2749-79/2-VOL-2 ..... N80-32719* #
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DT-7909-14 ..... N80-32351 #

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DTNSRDC/AERO-1266 ..... N80-32382 #
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E-565 ..... N80-33104* #
E-566 ..... N80-32610* #
E-576 ..... N80-32753* #
E-581 ..... N80-32428* #
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EEB-VENT-80-15 ..... N80-32984 #

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EOARD-TR-80-13 ..... N80-32458 #
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EPA-AA-TEB-80-5 ..... N80-33008 #

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EPA-460/3-80-003 ..... N80-33017 #
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EPA-560/13-80-014 ..... N80-32483 #
EPA-600/2-79-182 ..... N80-33015 #
EPA-600/2-79-201 ..... N80-32994 #
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EPRI-EA-1377 ..... N80-32987 #

EPRI-EL-809-SY ..... N80-32680 #
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EPRI-EM-1328 ..... N80-32877 #
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ERC41016.15IRF ..... N80-32674 #
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ERIM-132400-41-T ..... N80-32809* #

ERL-0124-TR ..... N80-32444 #

ESD-TR-79-346 ..... N80-33213 #
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FAA-EE-80-12 ..... N80-32537 #

FAA-EM-79-16 ..... N80-32371 #

FAA-MS-80-5 ..... N80-32325 #

FAA-RD-79-109 ..... N80-32594 #
FAA-RD-80-23 ..... N80-33065 #
FAA-RD-80-37 ..... N80-32367 #
FAA-RD-80-60 ..... N80-32368 #
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HAC-FR-80-23-919R ..... N80-32630 #

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HEDL-TME-78-55-VOL-2 ..... N80-33273 #

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ISAS-580-VOL-45-NO-5 ..... N80-33251 #
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ISSN-0110-1692 ..... N80-32571 #
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JPL-PUB-80-54 ..... N80-33317* #
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JPL-9950-406 ..... N80-32854* #
JPL-9950-408 ..... N80-32855* #
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JPL-9950-415 ..... N80-32413* #
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LA-UR-80-1094 ..... N80-32573 #
LA-UR-80-1282 ..... N80-32550 #
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LAIR-73 ..... N80-33095 #

LARS-070180 ..... N80-32808* #

LBL-9551 ..... N80-33044 #
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LG80ER0085 ..... N80-32377* #

LIDS-P-1006 ..... N80-33286 #
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LMSC-D681058 ..... N80-32903 #
LMSC-D766449 ..... N80-33319* #

LR-29157 ..... N80-32533* #
LR-29450 ..... N80-32353* #
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LRSM-TR-80-7 ..... N80-32518 #

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MCR-73-105-1-REV-2 ..... N80-32690* #
MCR-80-610-PT-2 ..... N80-32830* #

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MD80-37-BK ..... N80-32521 #
MD80-37-BK ..... N80-33155 #
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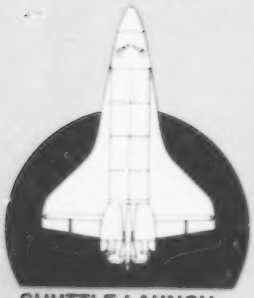

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INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

- NASA, NASA contractor, and NASA grantee reports
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- Translations in report form
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By arrangement between NASA and the Smithsonian Science Information Exchange (SSIE), a separate section of information on aerospace-related *On-Going Research Projects* is inserted into each issue of *STAR*. The insert presents titles of active NASA grants and university contracts, summary portions of recently updated *NASA Research and Technology Objectives and Plans (RTOPs)*, and notices of non-NASA research projects that were funded in the most recent or current fiscal year. The latter are selected by SSIE. The project announcements in the insert are arranged by *STAR* divisions but are otherwise entirely separate from *STAR*. They are not indexed nor machine-searchable by NASA. Current and retrospective searches are available from SSIE, 1730 M Street, N.W., Washington, D.C. 20036.

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general), aerodynamics, air transportation and safety, aircraft communications and navigation, aircraft design, testing and performance, aircraft instrumentation, aircraft propulsion and power, aircraft stability and control, and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces, and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes passenger and cargo air transport operations; and aircraft accidents.

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Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

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Includes cockpit and cabin display devices, and flight instruments.

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07 AIRCRAFT PROPULSION AND POWER 3235

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 3236

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09 RESEARCH AND SUPPORT FACILITIES (AIR) 3236

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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20 SPACECRAFT PROPULSION AND POWER 3243

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For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 3357
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 3357
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 3359
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 3359
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 3360

89 ASTRONOMY 3360
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 3361
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 3362
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 3363
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 3364
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 3365

Note: N.A. means that no abstracts were assigned to this category for this issue.

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TYPICAL CITATION AND ABSTRACT

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NASA ACCESSION NUMBER → **N80-10195*#** Teledyne Ryan Aeronautical Co., San Diego, Calif ← CORPORATE SOURCE

TITLE → **STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE**

PUBLICATION DATE

AUTHOR → D. J. Mourey 3 Sep 1979 409 p refs

CONTRACT OR GRANT → (Contract NAS1-15624)

AVAILABILITY SOURCE

REPORT NUMBER → (NASA-CR-159149) Avail NTIS HC A18/MF A01

CSCL 01C ← COSATI CODE

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, CRASHWORTHY PASSENGER (MILITARY) SEAT
B. Mazelsky, A R A Co., *2017 W. Garvey Ave., West Covina, California* 91791 (DN081084; N62269-78-C-0251)

To develop a military passenger seat offering the safety, comfort, and protective features which 'state-of-the-art' crashworthy seat technology has to offer. This contract supports work unit ZA601, Agency Accession No. DN 681080.

Development will involve three tasks: Task 1 will comprise the design phase; Task 2 will include the fabrication of prototypes and the static and dynamic test and evaluation phase; Task 3 will evaluate advanced prototypes under dynamic crash simulation tests.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0002, THE FEASIBILITY OF THRUST MEASUREMENT DURING FLIGHT
T.W. Carpenter, California State University & Colleges, California Polytechnic State University, School of Engineering & Technology, Dept. of Aeronautical Engineering, *San Luis Obispo, California* 93407 (NAG 4-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Drydeh Flight Research Center

1.0003, INVESTIGATION OF FACTORS CAUSING FUEL LEAKS AT STRUCTURAL FASTENERS
J.W. Mahoney, Rockwell International Corp., *International Airport, Los Angeles, California* (DF143870; F33615-79-C-3216)

This work unit supports the requirement for enhanced fuel tightness in integral fuel tanks for USAF aircraft. Mil-A-8867B is directly supported in the area of fuel tank leak testing and Mil-T-5578 in the area of fuel tank sealing. This effort is directed toward solving the problems of fuel leakage at structural fasteners. The objective of this program is to investigate factors which cause fuel leaks at structural fasteners. The reduction of fuel leak problems will significantly reduce the maintenance costs of USAF aircraft.

This effort will select various structural fastener systems and evaluate their fuel sealing capability. Representative integral fuel tank structure will be fabricated using the selected fastener systems. The structure will be tested under pressure while being subjected to flight-by-flight loading. Recommendations will be made to use the most qualified fasteners in future designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, A STUDY OF THE USE OF MULTIGRID TECHNIQUES ON THE RELAXATION OF STEADY TRANSONIC FLOWS
D. Baganoff, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCA 2-745005)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0005, STANFORD/AMES JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS (AERODYNAMIC STUDIES RELATING TO SHORT-HAUL AIRCRAFT)
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-74)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0006, STANFORD/AMES JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS (FLIGHT EFFECTS ON JET NOISE)
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-75)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0007, JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS - STUDIES OF THE EFFECTS OF HOW FIELDS ON NOISE DIRECTIONALITY
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-76)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0008, BOUNDARY LAYERS AND WAKES OF OSCILLATING AIRFOILS AT SUBSONIC AND TRANSONIC SPEEDS
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-77)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0009, DEVELOPMENT OF FLIGHT CONTROL SYSTEMS/FLYING QUALITIES CRITERIA FOR LIFT/CRUISE FAN V/STOL AIRCRAFT
D. McRuer, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DN881486; N62269-78-C-0129)

To establish baseline flying qualities requirements for flight control laws, flight path critical displays and control/propulsion integration concepts for a Navy lift/cruise fan aircraft. Supports work unit DH820, Agency Accession No. DN881124.

Investigations will be conducted to define flight control requirements for a lift/cruise fan vehicle. Flying qualities criteria will be established for the design of a flight control/display

system suitable for all modes of flight, including hover maneuvering, transition maneuvering, cruise maneuvering, take-off and landing. The flight control development will address integrated propulsive and aerodynamic control concepts, failure mode effects, pilot station controls and displays, actuation concepts and system reliability. The ability of the flight control/display system to provide satisfactory flying qualities will be demonstrated through piloted simulation at the NASA Ames Research Center.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0010, GRADUATE STUDENT RESEARCHERS PROGRAM

R.L. Fearn, State University System of Florida, University of Florida, School of Engineering, Dept. of Aerospace Engineering, *220 Black Hall, Gainesville, Florida* 32611 (NGT 10-005-801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0011, HELICOPTER ROTOR LOADS USING A MATCHED ASYMPTOTIC EXPANSION TECHNIQUE STUDY

G.A. Pierce, Georgia Inst. of Technology, School of Engineering, Dept. of Aerospace Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAS 1-16222)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, DESIGN CRITERIA FOR A SUPERSONIC SMOKE TUNNEL

Unknown, University of Notre Dame, Graduate School, *Notre Dame, Indiana* 46556 (DF144510; F33615-79-C-3034)

The severity and complexity of the effect of the aerodynamic environment on military vehicles increase as more stringent performance requirements are demanded. Consequently, new materials and configurations must be developed to negate the effect of the new requirements. Aerodynamic test facilities must be continually developed to provide the environment in which the performance of these new materials and configurations can be verified in a cost-effective, timely manner. This program is to develop design criteria for a three-dimensional, supersonic smoke tunnel to operate at about Mach 1.5 with a two-foot square test section. The tunnel shall provide accommodation for both smoke and schlieren photography. A generator to produce a safe, non-toxic and non-explosive, smoke shall be included.

The contractor shall develop aerodynamic and structural design criteria for the supersonic smoke tunnel and its accessories and provide an analysis of the construction and procurement costs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, EFFECTS OF FRAGMENTS/PROJECTILES ON MISSION CRITICAL AIRCRAFT COMPONENTS

B.T. Bentley, U.S. Dept. of Defense, Army, Armament Research & Development Command, Vulnerability Lethality Div., *Aberdeen Proving Ground, Maryland* 21005 (DA0P4485)

To strengthen the methodology and data base for quantification of mission kill and mission available categories of aircraft and helicopter vulnerability.

Identify mission essential components and apply covert methodology.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

1.0014, SELECTED APPLICATIONS OF COMPUTATIONAL AERODYNAMICS

J.D. Anderson, University of Maryland, College Park Campus, School of Engineering, Dept. of Aerospace Engineering, *College Park, Maryland* 20742 (NCC 1-41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0015, DEVELOP NOISE-CHECK TECHNOLOGY FOR MONITORING AIRCRAFT NOISE

P. Rentz, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF322710; F33615-77-C-0514)

A vital part of Air Force environmental noise planning efforts is the need to perform spot-check noise measurements which provide data supporting predicted noise exposure values and the corresponding decisions made regarding land use compatibility and environmental noise impact. The objective of this contract is to develop the aircraft noise monitoring technology needed by Air Force personnel to collect field-measured noise exposure data acceptable as evidence in cases involving extreme controversy or litigation.

The contractor will review the present state-of-the-art in aircraft noise monitoring technology. He will develop specific procedures and instrumentation requirements for use by Air Force personnel in collecting noise exposure data able to withstand the closest technical scrutiny. The contractor will demonstrate the adequacy of the proposed AF noise-check methodology by performing an actual field application study at an AF airbase. Refinements in noise-check will be made after analysis of the data from the field application study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

1.0016, UNSTEADY TRANSONIC AERODYNAMICS RESEARCH

L. Morino, Boston University, School of Engineering, Dept. of Aerospace Engineering, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (NGT 22-004-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0017, UNSTEADY TRANSONIC AERODYNAMICS RESEARCH

L. Morino, Boston University, School of Engineering, Dept. of Aerospace Engineering, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (NGT 22-004-801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0018, GRADUATE STUDENT RESEARCHERS PROGRAM

L. Morino, Boston University, School of Engineering, Dept. of Aerospace Engineering, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (NGT 22-004-802)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0019 HELMET-MOUNTED OCULOMETER DEVELOPMENT

J. Merchant, Honeywell Inc., Radiation Center, *2 Forbes Rd., Lexington, Massachusetts* 02173 (DF142950; F33615-77-C-2077)

The mission this work unit supports is the simulation of advanced aerospace vehicles. The engineering flight simulator is a modern tool for the analysis and evaluation of current and future Air Force systems. The opportunity exists with simulations to develop proposed flight control system schemes, including cockpit controls and displays. This requires man-in-the-loop participation throughout the design evaluation. The objective of this work unit is to develop, install, demonstrate and maintain a system capable of both head and eye measurements of the test subject without any attachments to the subject and within the framework of moving base simulation. This program contributes to effective simulation of flight vehicles.

Studies will be conducted to establish the optimum location for equipment to be installed. The equipment will then be engineered to be compatible with installation requirements. All power and signal cables will be installed and the equipment will be installed and demonstrated. The demonstration will consist of 3 hours reliable data acquisition daily for a period of two weeks with no more than 30 minutes down-time per eight-hour shifts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, DEVELOPMENT AND USE OF GENERALIZED INTERNAL COMBUSTION ENGINE CYCLE SIMULATIONS

J.B. Haywood, Massachusetts Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 3-82)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0021, DIGITAL FLIGHT CONTROL SOFTWARE VALIDATION/VERIFICATION METHODOLOGY DEVELOPMENT

E.R. Rang, Honeywell Inc., *2600 Ridgeway Pkwy. N.E., Minneapolis, Minnesota* 55413 (DF141450; F33615-78-C-3605)

The program is in support of future advanced digital flight control systems of aerospace vehicles. Future flight control systems will be digital and to date no economical, highly effective means exists for proving the correctness of the associated software. Presently, extensive testing and simulation have been used to ensure correctness of the system software design, which is expensive and inadequate for complex systems. This program is intended to provide analytical and automatic techniques to validate software design in the design phase of the development cycle of modern flight control systems. A study of existing validation techniques will be made and the most promising adapted to the design of flight control system software. The result will be a design methodology to validate flight control system software at each phase of the development cycle.

An investigation will be conducted into various software development and checkout methodologies to determine applicability to redundant flight control system software design. A disciplined software validation approach will be defined that incorporates the advantages of the investigated technologies. A methodology will be developed that aids in the design and employs as much automation as possible so as to make maximum use of the thoroughness of computerized checkout.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, AEROSPACE ENGINEERING SYMPOSIUM FOR HIGH SCHOOL STUDENTS

M. Gant, New Jersey Inst. of Technology, Graduate School, *323 High St., Newark, New Jersey* 07102 (NAS 5-26156)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0023, COANDA/REFRACTION EXHAUST NOISE SUPPRESSOR FOR AIRCRAFT HUSH-HOUSES

D. Croce, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN896013)

To develop the COANDA/refraction noise suppression concept with specific application to aircraft hush-house exhaust systems. To define a functional configuration for use with all Navy/Marine Corps aircraft.

Conduct an investigative program consisting of breadboard scale-model tests with simulated engine sources, analytic studies and configuration analysis studies. Conduct aero/thermodynamics and acoustic analyses of tests performed with model flat-plate ejectors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0024, DEVELOPMENT OF A COMPREHENSIVE RDT/E PROGRAM FOR GROUND SUPPORT EQUIPMENT

M. Palamar, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN133406)

To develop a systematized RDT/E program which will define and integrate future ground support requirements with a comprehensive RDT/E effort insuring an optimal operational support capability for future generation aircraft and weapons systems.

Develop a detailed identification of the testing, servicing, maintenance, and handling functions necessary to support aircraft and associated directives, along with organizational structure for the planning and managing of GSE RDT/E. Develop and implement systematic measures to insure prompt consideration of ground support equipment requirements which may be introduced by advancements in airborne systems, changes in support technology, or changes in the operational environment. Develop a long range plan for GSE RDT/E to parallel aircraft systems and technology forecasts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0025, AIRBORNE SIMULATION AND RESEARCH INVESTIGATIONS

P.A. Reynolds, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF142120; F33615-78-C-3602)

Engineering simulation is a cost-effective design tool for supporting advanced weapon systems development. In-flight simulation using variable stability airplanes provides the advantages of actual flight, visual, and motion cues in evaluating design trade-offs. The NT-33 and NC-131H variable stability airplanes will be used to conduct research programs to investigate flight control system problems and the integration of other subsystems with flight control. The systematic integration of the control function with other weapon systems functions such as fire control and control displays will result in new airplanes which can provide greater flexibility and mission effectiveness.

The NT33A and the TIFS NC-131H variable stability aircraft will be used to look at riding and flying qualities, simulated control systems, actual displays, cockpit controllers, actual control system hardware and the interaction between these factors and other airplane subsystems. Flight training will also be included for pre-first flights of new aircraft as well as test pilot school indoctrinations. Details of each investigation or training program will be outlined at a planning meeting between the contractor, AF Flight Dynamics Laboratory and the requiring agency personnel prior to each investigation. These details will be documented by a test plan prior to flight testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, FORMULATION OF STOL CONFIGURATIONS

Unknown, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF143360; F33615-79-C-3007)

The Air Force function for this effort is to investigate advanced STOL configurations. STOL configurations represent an opportunity for a solution to the runway denial problem which has high Air Force interest. The objective of this effort is to develop advanced conceptual fighter designs that incorporate STOL configurations and other advanced technologies. The contribution of advanced STOL configurations is short take-off and landing from damaged runways or even highways, enhanced maneuvering performance, improved survivability, and improved target kill capability.

Parametric trade-off studies will be conducted for each STOL configuration to define the baseline configuration geometries and optimize gross take-off weights. Based on the trade-off studies and technology expected to be available between 1982 and 1985, six baseline STOL configurations will be developed, including two configurations using vectored engine-over-wing propulsive lift. A performance analysis will be conducted for each STOL configuration and a comparison of advantages/disadvantages of the STOL configuration for each application will be made. The most promising STOL configuration for each ap-

plication will be determined and the performance and operational benefits of STOL configurations will be identified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, WEAPON CARRIAGE AND SEPARATION TECHNOLOGY

R.L. Clark, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144800)

The Air Force function for this effort is to investigate advanced weapon/airframe integration for future high performance systems. External carriage of weapons by supersonic aircraft generally degrades their performance severely while internal carriage increases the weight and volume of such aircraft. The objective of this effort is to develop and experimentally evaluate advanced carriage concepts which will minimize the performance, weight, and volumetric penalties associated with advanced external and/or internal weapons carriage. Emphasis on reducing the detectability of penetrating aircraft will result in carefully integrated external or internal weapon carriage concepts. These designs may have unique weapon separation characteristics, and these will be investigated during this effort. Improved analysis methods for predicting weapon/airframe interference and weapon separation characteristics will be evaluated when available. Expected benefits of the effort include improved penetration capability and improved supersonic weapon carriage.

This effort will utilize the results of previous in-house and contracted research to define advanced integrated external and/or internal carriage configurations for analysis and experimental investigation. Flight test data on a modified F-111 internal weapons bay are expected to become available for correlation with previously acquired wind tunnel data. The implementation and documentation of the 'technique for predicting aircraft aerodynamic effects due to external stores carriage' will also be completed under this effort. Advanced analysis methods for predicting weapon/airframe interference and weapon separation characteristics will be applied and results compared with results from existing prediction methods and/or experimental data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, OPTIMAL DATA PROCESSING AND FAILURE DETECTION FOR AUTOMATIC FLIGHT CONTROL OF ADVANCED USAF AIRCRAFT

A.P. Dethomas, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF128400)

A high degree of reliability in control data instrumentation is vital to the mission of USAF aircraft, and this objective is typically accomplished by comparing the outputs of redundant system components. However, the penalty in weight and volume of such equipment redundancy can be substantial. Data systems already onboard an aircraft provide functionally related data and this form of redundancy can be exploited rather than resorting to duplication of entire data systems. The objective of this work is to develop practical Kalman filters to combine the information of individual data systems and to use these filters to detect component failures and to replace failed signals, thereby providing failure tolerance.

Beginning with the ABRES vehicles, recognizable future Air Force flight vehicles will be studied and analyzed to identify particular structural areas and components which need and/or may benefit from efficient application of beryllium. Hybrid configurations as well as all beryllium construction will be considered to insure practical consideration of efficient/economical applications of this specialty material. The results of such investigations will be used to provide guidance in the selection of hardware demonstration components necessary to exhibit structural concept feasibility, close technical gaps and establish confidence in the structural adequacy of beryllium.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0029, SIMULATION VERIFICATION

W.W. Harrington, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141680)

This work unit supports the development and maintenance of analysis capabilities, engineering simulation capabilities, and experimental testing methods for flight/man-machine system evaluation. It is directed toward the development of basic simulation technology as required by manned engineering flight simulation for fighter aircraft development. Specific objectives include: 1) verification of a specific aircraft model, including airframe stability and thrust versus drag, 2) verification of the real-time simulation of this aircraft model, 3) development of parameter identification techniques as verification tools, 4) development of data reduction techniques and software for the evaluation of the utility and adequacy of simulator cues for the air-to-air combat environment, and 5) evaluation of the adequacy of simulator cues as provided by the large amplitude multimode aerospace research simulator (LAMARS) at the AFFDL for the air-to-air combat environment. The adequacy of simulator cues for the air-to-air combat environment as provided by the dual flight simulator (DFS) in the Federal Republic of Germany will also be evaluated. This analysis will contribute to the technology required for the appropriate development, adaptation, and integration of simulation equipment in support of AFFDL manned engineering flight simulation programs.

Flight test and simulation data will be obtained from a flight test/simulation program containing five interrelated phases, including vehicle performance testing, conventional stability testing, parameter identification testing, handling qualities during tracking testing, and Terminary air-to-air gunnery testing with an LCOSS sight. Both subjective and quantitative data will be evaluated. The data reduction techniques and software will be developed as part of this effort. The analysis will be applied to data from the LAMARS and also to data from the DFS, which will be provided under MWDDEA AF 75 G 7430.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, MULTI-MICROPROCESSOR CONTROL ELEMENTS

J.E. May, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142560)

This program seeks to apply multiple microprocessors to aircraft digital flight control systems. State-of-the-art digital flight control systems are tailored to a general purpose digital computer architecture. This program will apply multiple microprocessors to mechanize a flight control system specifically tailored to flight control requirements. It is anticipated that this program will improve reliability of flight critical control systems and reduce control system hardware and software costs.

Evaluation modules will be breadboarded and candidate microprocessors and supporting hardware will be evaluated in the AFFDL/FGL Development Laboratory. A candidate microprocessor type will be selected as the basic unit for a flight control system design. Based upon the selected microprocessor type, a prototype modularized distributed microprocessor flight control system will be designed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, ADVANCED DIGITAL CONTROL TECHNIQUES

J.W. McDowell, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140210)

The Transport Advanced Control Synthesis Program will investigate applications of modern control techniques to aircraft flight control systems. The objective of this effort is the derivation and implementation of improved flight control laws via restructurable digital systems, thus providing the opportunity for enhanced pilot/crew management of aircraft guidance, navigation and control systems. Performance improvements will be demonstrated which can be applied to military missions of cargo/weapon delivery and aircraft rendez-vous. In addition, applied modern control techniques offer the capability for mini-

mization of the effects of atmospheric disturbances, such as wind shear.

Design, fabricate, and flight test-validate a digital flight guidance system. Develop the in-house capability to restructure the software and implement flight control laws based upon modern control techniques. Collect flight test data comparing performance of the new control laws. Define applications to future aircraft flight control systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0032, DIGITAL DATCOM COMPUTER PROGRAM FOR AIRCRAFT STABILITY AND CONTROL

B.F. Niehaus, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF132910)

This work unit supports TPO 3, Flight Control and Major Thrust, and FGO2B, Flight Control System Design Techniques. Rapid and inexpensive methods for predicting the aerodynamic stability and control characteristics of Air Force weapon systems are needed. The objective of this work unit is to provide improvements in the digital DATCOM computer program, which is an automated stability and control prediction tool. At its current stage of development, it is an efficient computer tool; however, improvements are needed to reduce the engineering time required to prepare input and to interpret output. The availability of these methods will lead to better aircraft designs by permitting rational trade-offs to be considered early in the design.

Digital DATCOM data will be applied to various types of problems, e.g., preliminary design, correcting wind-tunnel data to obtain the effects of configuration changes, etc. The experience gained will help identify weaknesses in the digital DATCOM program. Particular emphasis will be placed on the evaluation of the input requirements and output suited to specialized tasks, as well as method accuracy and range of applicability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0033, COMBINED ENVIRONMENTS RELIABILITY TEST

H.E. Reynolds, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136650)

Repair costs of Air Force aircraft electronics equipment attributable to environmentally induced failures have been found to be approximately 460 million dollars per year. Equipments typically fail in service six-to-eight times more often than expected from laboratory demonstrations. The objective of this effort is to develop a realistic but cost-effective combined environments test that could be used for both qualification and reliability test and evaluation. The use of this test in the development and acquisition of electronics equipment should significantly improve its field reliability and correlation between field and laboratory reliability.

Realistic assessment and prediction of actual environmental conditions that equipment is subjected to in field service will be determined through acquisition and analysis of aircraft environmental data. Realistic combined environment profiles will be developed for evaluation and test of aircraft equipment for various classes of aircraft. Capability to 'fly the equipment in the laboratory' will be developed by combined environment testing under realistic temperature, airflow, humidity, altitude, and random vibration conditions representative of aircraft equipment installations. New testing standards will be generated to provide the tests required to increase the effectiveness of testing needed to assure that only reliable hardware is introduced into service.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0034, LOADS FACILITY EVALUATION

T.F. Sabick, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143810)

There is currently no facility in the free world in which the survivability of aircraft structures can be evaluated in a realistic flight-loaded condition and subjected to actual ballistic impacts. This testing is necessary to determine the structural degradation of ballistically damaged aircraft components. The objective of this effort is to provide the on-site support necessary for the installation and initial evaluation of a flight load simulation system in the aircraft survivability research facility. The data produced in this effort will be used to improve the battle-damaged structure analysis code and thereby improve survivability design studies and vulnerability assessments.

The load reaction frame and associated instrumentation and control components that comprise the flight loads simulation system will be installed in the ASRF. Evaluation and check-out will be performed utilizing replica wing specimens. Of the five replica specimens that will be used, three will have structural members removed to simulate ballistic damage. When this initial evaluation stage is complete, an actual A-10 aircraft wing will be installed and tested using a typical foreign anti-aircraft round as the threat. A detailed comparison between the battle-damaged structure analysis code prediction and the actual wing response will then be performed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0035, NUMERICAL SIMULATION OF HEAT TRANSFER PHENOMENA OCCURRING DURING DEICING OF AIRCRAFT COMPONENTS

K.J. DeWitt, University of Toledo, School of Engineering, Dept. of Chemical Engineering, *2801 W. Bancroft St., Toledo, Ohio* 43606 (NAG 3-72)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0036, INVESTIGATIONS OF FLOW FIELDS FOUND IN TYPICAL COMBUSTOR GEOMETRIES

D.G. Lilley, Oklahoma State University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Engineering N., Stillwater, Oklahoma* 74074 (NAG 3-74)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0037, GRADUATE STUDENT RESEARCHERS PROGRAM

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0038, FREESTREAM AERODYNAMICS

V.S. Oxford, U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center, *Arnold Air Force Station, Tullahoma, Tennessee* 37389 (DF641560)

Air Force function - aircraft-STORES compatibility. Opportunity -structural integrity and certification of STORES on aircraft. Goal - to provide STORES-free-stream aerodynamic data in graphical, tabular, and magnetic tape form. How work contributes - allows for a quick and efficient means of obtaining data for use with MIL-A-8591E and for comparisons with STORES in carriage.

The approach will be to first compile the existing available STORES-free-stream aerodynamic data, and then develop a data retrieval system which allows for access to the data through tabular, graphical or magnetic tape form. The system will be updated to include new data as they become available.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0039, STUDIES OF ADVANCED WING CONFIGURATIONS
H.L. Chevalier, Texas A & M University, College Station Campus, School of Engineering, Dept. of Aerospace Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NCC 2-78)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0040, DEVELOPMENT OF A FLIGHT TEXT DATA-HANDLING PROGRAM FOR A COMPOSITE AIRCRAFT
W.T. Fowler, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: In 1977, the first FAA-certified all-composite aircraft was donated to the Aerospace Engineering and Engineering Mechanics Department of The University of Texas at Austin. Several flight research programs are being developed with this aircraft, including an investigation of a mechanism of noise transfer into a composite aircraft cabin environment and an investigation of the influence of winglets on light aircraft performance. On-board digital data acquisition and recording systems are being developed for these programs. The study, in its second year, initiates a general aviation research program within the Department.

SUPPORTED BY University of Texas

1.0041, AERODYNAMICS OF BALLISTICALLY DAMAGED ROTOR BLADES (HT 79-15)
D. Hollenbaugh, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3862)

To establish a realistic data base in the area of ballistically damaged rotor airfoil sectional aerodynamic forces in order to develop a better understanding of the effect of aerodynamic changes due to ballistic damage on helicopter performance.

Wind tunnel tests will be conducted on both standard metal and experimental composite material rotor blade sections. Two sets of tests will be run. The first will be use sections with mechanically simulated damage to isolate the parametric effects of hole size, chordwise location, and peelback area. The second will use specimens damaged by 23mm HEI rounds for exact realistic correlation. Tests shall be conducted over a range of Mach numbers and angles of attack to simulate spanwise position and flight condition.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0042, COMPUTATIONAL STUDY OF LEADING EDGE VORTEX FLAPS - GRADUATE STUDENT RESEARCHERS PROGRAM
J.F. Marchman, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace & Ocean Engineering, *Blacksburg, Virginia* 24061 (NGT 47-004-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, A PRELIMINARY STUDY OF A CRYOGENIC EQUIVALENCE PRINCIPLE EXPERIMENT ON SHUTTLE
C.W. Everitt, Stanford University, W.W. Hansen Lab. for Physics, *Stanford, California* 94305 (NAS 8-33796)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

2.0002, DESIGN COMPUTERIZED MODEL SHUTTLE FLIGHTS
J. Wilson, University of Texas, Austin Campus, School of Engineering, Dept. of Materials Science & Engineering, *200 W. 21st, Austin, Texas* 78712 (NAS 9-16124)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, GRADUATE STUDENT RESEARCHERS PROGRAM
C.B. Moore, Arizona State University, School of Liberal Arts, Dept. of Chemistry/Geology, *Tempe, Arizona* 85281 (NGT 03-001-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

3.0002, CRYSTAL CHEMISTRY
M. O'Keeffe, Arizona State University, School of Liberal Arts, Dept. of Chemistry, *Tempe, Arizona* 85281 (DMR78-09197)

The ultimate goal of this project is to obtain an improved understanding of structure and bonding in inorganic solids. General structural and bonding principles are sought that will (a) enable one to rationalize and organize the enormous body of structural data already extant; (b) serve as guides to predicting the existence, structure, and properties of new inorganic solids; and (c) help to integrate the chemistry of solids with the rest of inorganic chemistry. A major intermediate goal is obtaining a better understanding of the importance of cation-cation nonbonded interactions in determining crystal structure and stability. The program includes synthesis and structure determination of oxides and nitrides of beryllium, silicon, aluminum, gallium, and phosphorus. Included are ceramics of silicon, aluminum, oxygen and nitrogen (the 'sialon' refractories) that are important in high temperature and solar energy applications. The occurrences of extended defects and ordered intermediate phases also are being explored in order to gain a fuller understanding of the structure, stability, and reactivity of these compounds.

Disorder in crystals is investigated with emphasis on sublattice melting. Finally, means of simplifying the descriptions of complicated crystal structures are being sought.

This is a continuation of work supported under DMR 72-03246. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0003, A STUDY OF THE PHYSICAL PROPERTIES OF COMPOSITES
F. Holmstrom, California State University & Colleges, San Jose State University, School of Science, Dept. of Physics, *Washington Sq., San Jose, California* 95192 (NCC 2-80)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0004, SYNTHESIS, CHARACTERIZATION, AND FORMULATION OF PERFLUOROCARBON EITHER ELASTOMERS
G.A. Selter, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-81)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0005, GRADUATE STUDENT RESEARCHERS PROGRAM

R. Jaffe, Stanford University, School of Humanities & Sciences, Dept. of Chemistry, *Stanford, California* 94305 (NGT 05-020-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0006, CREEP BEHAVIOR UNDER VERY LOW STRESSES

F.A. Mohamed, University of Southern California, School of Engineering, Dept. of Mechanical Engineering & Materials Science, *3551 University Ave., Los Angeles, California* 90007 (DMR80-05976)

Experimental evidence indicates the occurrence of two Newtonian processes, Nabarro-Herring creep and Harper-Dorn creep, at very low stresses and at temperatures near the melting point. The creep strain of the Nabarro-Herring process is produced by vacancy transport, and the steady-state creep rate, which is governed by lattice diffusion, is dependent on the grain size of the material. In contrast, the creep strain ascribable to Harper-Dorn creep is produced by some form of dislocation activity in the grain interior, and the creep rate is therefore insensitive to changes in grain size. The objectives of this program are to (1) consolidate the present substructural results on Harper-Dorn creep in aluminum and its alloys, (2) investigate the relationship between the Harper-Dorn process and Nabarro-Herring creep, (3) study the effect of the stacking fault energy on the normalized creep rates of the Harper-Dorn process, and (4) examine Harper-Dorn creep as a general process of deformation. This is a continuation of research, previously funded under NSF Grant DMR77-27619. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0007, FATIGUE OF TITANIUM ALLOYS

A.J. McEvily, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Metallurgy, *Box U-37, Storrs, Connecticut* 06268 (DF053740; F49620-79-C-0004)

AF function - resistance to damage due to fatigue processes is necessary to achieve the desired durability of airframe and engine structures. Opportunity - the AFML-MOU, along with the French, has provided a unique condition to study the fatigue behavior of titanium alloys. Objective - to establish the principal mechanisms of fatigue damage in titanium alloys and the influence of processing variables on this damage. How work contributes - results will directly aid in the development of structural materials for future AF applications.

Two titanium alloys (Ti-5524S and Ti-685) will be experimentally examined under elevated temperature fatigue conditions. Characterizations of fatigue damage will be accomplished according to alloys, processing variables and fatigue environment parameters. Experiments will be conducted at room temperature and 540 degrees C and at 0.3 and 0.04Hz. Failure surfaces will be examined by microscopy techniques to correlate micro/macro observations. In addition, the effects of overload on the fatigue resistance will be studied in terms of work retardation and the above-mentioned characterization parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, HIGH DOSE ION IMPLANTATION OF ALUMINUM AND TITANIUM ALLOYS

J.R. Stevenson, Georgia Inst. of Technology, School of Physics, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF054110; AFOSR-79-0011)

AF function - corrosion due to the formation of oxides and nitrides limits the life-span of equipment and is both economically and militarily expensive. Deficiency - unexpected and catastrophic failure of metal components can occur where corrosion damage is undetected. Objective - to make beneficial changes to the surface chemical and physical properties by the use of ion implantation techniques. How work contributes - ion implantation is expected to improve such surface properties as hardness, friction and resistance to oxidation and corrosion without changing the bulk properties of structural metal alloys.

Ion implantation is a technique which has evolved from electronic device fabrication. This research project will explore the possibilities of improving the mechanical, chemical and metallurgical surface properties by utilizing high doses (up to 10 to the 19th ions incident per sq. cm of target area).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0009, INITIATION, COMBUSTION AND TRANSITION TO DETONATION IN HOMOGENEOUS AND HETEROGENEOUS REACTIVE MIXTURES

R.A. Strehlow, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DF049180; AFOSR-77-3336)

AF function - advanced chemical explosive weapons, weapon delivery with the MX missile using high energy HMS propellants, missile and aircraft component vulnerability and survivability. Deficiency -insufficient understanding of basic mechanisms of chemical initiation, propagation, attenuation and quenching of blast waves and detonations in reactive media, e.g., single event FAE III. Unscheduled transition to detonation in Navy C-4 missiles using similar propellants planned for MX missiles. Objective - to obtain better understanding and realistic model basic mechanisms of triggering detonations in fuel-air clouds by use of chemical accelerants, and nonlinear initiation of detonation by finite amplitude waves in an incipiently reactive system; to develop general but accurate criteria describing the possibility of deflagration-to-detonation transition (DDT) in beds of granulated high energy propellants and explosives, and to assess possible DDT hazard of missile propellants. How work contributes - will provide (1) additional understanding of basic processes of chemical initiation of detonations, transition from deflagration to detonation (DDT), attenuation of flame, blast and detonation waves, (2) quantitative models a priori predicting properties, blast initiation requirements and damage potential of FAE clouds and DDT transition in granular propellants and explosives, (3) guidelines for evaluation and design of single event FAE III explosive devices, effective flame and detonation arrestors, and safe, high performance propellants in missile weapon systems.

The influence of local concentrations of reactive chemical promoters (accelerators) on initiation and transition to detonation of reacting clouds will be studied theoretically and numerically using an existing Lagrangian time-dependent finite difference program (CLOUD) modified to include Arrhenius-type kinetics in the CLOUD and accelerated kinetics in the region containing the accelerant. Concurrently, nonlinear 2-D effects leading to direct detonation of fuel-air mixtures by large scale eddy flame folding and for acceleration processes will be studied. Optimum ratios of vapor cloud size to promoter spot size and optimum internal promoter concentration gradients will be determined which promote transition from adiabatic explosion to detonation. Concerning the research in granulated propellants, theoretical calculations will be carried out. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, RESPONSE OF HEATED MATERIALS TO SHOCK LOADING (X-RAY SHOCK)

G.E. Hauver, U.S. Dept. of Defense, Army, Armament Research & Development Command, Terminal Ballistic Div., *Aberdeen Proving Ground, Maryland* 21005 (DA0J4541)

The objective is to investigate the response of heated aerospace materials to shock loading. Materials subjected to a radiation environment can be heated to a significant depth below the exposed surface. The shock response and subsequent failure of these heated materials are concerns in the evaluation of fratricide and lethality.

The analytical approach will treat shock propagation in one-dimensional specimens of an ablator material, an aluminum alloy, and an epoxy-bonded system consisting of the two materi-

als. The analysis of shock propagation in systems containing heated and unheated aluminum will be performed. An attempt will be made to develop a fracture and spall model which is temperature-dependent for the aluminum alloy. Gas gun experiments on the individual materials and the bonded system will provide input to the analytical treatment and also assess the accuracy with which the analytical treatment predicts physical behavior. It is planned to perform uniaxial strain experiments at stress levels up to 10 kbar to investigate the Hugoniot and unloading characteristics of the ablator, as well as attenuation and dispersion effects. The dynamic yield stress of the aluminum alloy will be measured as a function of temperature. The characteristics of reflected and transmitted stress pulses in the bonded system will be investigated for comparison with computed pulses.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

3.0011, WEAPONRY - PROCESSES AFFECTING COMBUSTION OF SOLID PROPELLANTS

L. Caveny, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Sciences, *Box 430, Princeton, New Jersey* 08540 (DN623049; N00014-75-C-0705)

The Navy missile arsenal contains a wide variety of solid propellant rockets, and it is the objective of this task to advance the understanding of performance behavior of solid propellants, and thereby lay the scientific groundwork for solid propellant rocket developments of the future. The main emphasis here is on solid propellant combustion embracing the description and incorporation into theoretical scheme all processes, physical and chemical, which occur during the burning of a solid propellant. The fundamental studies of this task form the bases for selection of propellant ingredients and physical design of the solid propellant grain which may be used in Navy ordnance rockets, as well as in solid propellant rockets for any application.

The pressure dependence of the burning rate of mono- and composite propellants will be studied, emphasizing the kinetics of decomposition and the rates of reaction of the decomposition products. These rate data will be used in models of the burning process that include reaction, momentum, energy, and mass transfer rates.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0012, DEVELOPMENT OF FATIGUE-RESISTANT TITANIUM ALLOYS

J. Kennedy, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890142; N00019-78-C-0505)

To evaluate fatigue improvement heat treatment for Ti-6Al-4V.

The effect of solution treating and water quenching on the axial fatigue life of Ti-6Al-4V will be examined. Variables such as alloy composition, product form, solution treating temperature and stress amplitude will be considered.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0013, EFFECTIVE BEHAVIOR OF COMPOSITE MATERIALS

G.C. Papanicolaou, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (DF053040; AFOSR-78-3668)

AF function - aerospace vehicle design. Deficiency - design techniques for fastening composite materials. Objective - improved understanding of edge effects in composites. How work contributes -cracking and separation of laminates is influenced by stresses due to edge effects.

Asymptotic techniques, including multispace and averaging, have been used to obtain macroscopic equations for media with periodic fine structure-like composites. It is proposed to extend this work to areas including edge effects, irregular structure with associated fluctuation equations, and humidity transport and associated swelling, as for example in epoxy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, COMPUTATIONAL STUDY OF NON-ADIABATIC EFFECTS IN ATOM-MOLECULE REACTIVE SCATTERING

M. Redmon, Battelle Memorial Inst., Battelle Columbus Laboratories, *505 King Ave., Columbus, Ohio* 43201 (DF054510; F49620-79-C-0050)

AF function - Air Force operations in detection, surveillance and other areas require knowledge of gas phase energy exchange mechanisms. Deficiency - there is a lack of detailed understanding of how energy transfer occurs between species in the atmosphere and in lasers. Objective - the goal of this research is to develop quantum mechanical computational techniques to study non-adiabatic effects in three-dimensional atom-diatom collisions. How work contributes - the results of this effort will lead to a fundamental understanding of energy exchange processes in atmospheric chemistry, combustion and lasers.

The first phase of this program will be devoted to obtaining a computationally feasible basis for representing the scattering wave function for rearrangement collisions involving ground- and excited-state carbon and oxygen with singlet sigma and doublet pi molecules. Then, couplings responsible for non-adiabatic transitions will be obtained, initially from diatomics-in-molecules theory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0015, OXIDATION OF NON-OXIDE CERAMICS

A.H. Heuer, Case Western Reserve University, School of Engineering, Dept. of Metallurgical & Materials Science, *University Cir., Cleveland, Ohio* 44106 (DF051830; F49620-78-C-0053)

AF function - high temperature ceramic turbine engines are being developed for the propulsion of Air Force remotely piloted vehicles (RPV). Deficiency - silicon carbide- and silicon nitride-type ceramics, formed by sintering or hot pressing powders, are subject to high temperature degradation in the extreme turbine operating environments. Creep, oxidation and microstructural changes within the ceramics need to be evaluated. Objective - the objective of this research is to study and understand the microchemistry and structural events which dictate the observable property changes in non-oxide ceramics. How work contributes - understanding the micro-events will allow a rational approach to be taken in the selection of chemical composition and processing techniques for improved materials.

Non-oxide ceramics such as silicon carbide and silicon nitride will be studied with a high voltage transmission electron microscope (HVTEM). An environmental cell for in situ chemical reactions and stress applications will be utilized. The microstructure and distribution of phases will be correlated with microchemical analysis to elucidate the mechanisms of important chemical and physical property changes in these materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0016, PARAMETERS AFFECTING THE THERMAL STABILITY AND HEAT SINK OF HYDROCARBON AIRCRAFT FUELS

R.P. Bradley, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF453720)

The objective of this study is to provide the information necessary for specifying fuels which will be capable of providing cooling and propulsion for engines powering aircraft in the speed range from subsonic to above Mach 3. Both conventional and new thermal stability devices will be evaluated with regard to the effect of the following variables on test precision and the significance of results: 1. Pretest filtration - necessity and amount. 2. Dissolved oxygen - level and control. 3. Test pump contributions. 4. Procedural techniques -controlling certain areas. 5. Test preparation and procedure.

In this program, conventional, experimental and hardened solar cells will be subjected to neutron, pulsed electron, proton and various other types of radiation in cooperative tests with agencies such as AFWL, AFNETF, SAMSO and NRL. Test results will be evaluated to determine how solar cells survive Van Allen belt radiation and how closely they meet nuclear hardening goals supplied by the SAMSO for this program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0017, WEAPONRY - THE ROLE OF CHEMICAL BONDING IN THE STRENGTH OF ADHESION IN POLYMERS

A.N. Gent, University of Akron, Inst. of Polymer Science, *302 E. Buchtel Ave., Akron, Ohio* 44304 (DN675225; N00014-76-C-0408)

The objective is to determine how the adhesive strength of polymeric materials is related to the type and density of interfacial bonds, the rate of detachment and temperature. This fundamental knowledge is necessary to guide missile propellant developers to select the optimum bonding agents. The data will also be useful as inputs into fracture mechanics analyses of propellant grain response to stress. Propellant fracture must be avoided to insure stable burning and to preclude the deflagration to detonation transition.

Functionalized and characterized synthetic polymer substrates will be interfacially reacted to produce an adhesive interface. Surface bond density will be altered and the strength of adhesion will be determined as a function of temperature and the rate of detachment. Adhesives similar to those in propellant manufacture will also be characterized.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0018, SURFACE REINFORCEMENT OF GAS TURBINE COMPONENTS BY REFRACTORY COATINGS DEPOSITED BY MEANS OF VACUUM PYROLYSIS

S.R. Brown, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881212)

Utilize vacuum pyrolysis techniques to develop wear-, oxidation-and sulfidation-resistant coatings for advanced aircraft propulsion system components, including hot pressed ceramic and super-alloy hot section components.

The advantages of vacuum pyrolytic techniques will be exploited to impregnate and coat thin-walled and holed structures with novel refractory materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

3.0019, NAVY VEHICLE DESIGN AND CONSTRUCTION - CONTROLLING SOLIDIFICATION VARIABLES TO DEVELOP DESIRED PROPERTIES IN CAST METAL ALLOYS

H.D. Brody, University of Pittsburgh, School of Engineering, Dept. of Metallurgical & Materials Engineering, *402 Engineering Hall, Pittsburgh, Pennsylvania* 15213 (DN823163; N00014-75-C-0800)

Many naval components are used in the as-cast form. Mechanical properties of castings and directionally solidified composites are directly related to the cast structure and any alloy segregation that occurs during solidification. This research is aimed at improving properties of castings through control of the process variables.

An analytical model of the continuous casting process will be extended to account for grain structure and chemical segregation. High temperature peritectic alloy systems (Ti-Al, for example) will be directionally solidified to produce aligned two-phase and single phase structures. Properties and potential applications will be evaluated. Segregation in aluminum-copper alloys will be examined to determine effects of grain shape, solidification rate and fluid motion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0020, FORMAL AND COMPUTATIONAL STUDIES IN THE QUANTUM THEORY OF MOLECULAR DYNAMICS

D.J. Kouri, University of Houston, School of Arts & Sciences, Dept. of Chemistry, *3801 Cullen Blvd., Houston, Texas* 77004 (CHE79-19098)

This grant supports research under the Quantum Chemistry Program for the development of approximation methods in molecular collision theory. The main thrust of the project concerns applications of the sudden approximation to rotationally inelastic scattering, surface scattering, photodissociation, and the statistical mechanics of reacting fluid mixtures. Studies of this kind are likely to bring better quantitative understanding and extend the range of applicability of theory to these processes.

Specifically, Professor Kouri will continue his investigations of the energy-sudden and centrifugal-sudden approximations. Sudden approximations will also be developed and applied to diatom-surface and photodissociation processes. For the former, Professor Kouri will study factorization relations, variation of rotational excitation with diffraction peak, polarization effects, heating (or cooling) of diatoms by surface collisions and model interactions. He will also examine factorization in sudden treatments of identical molecule collisions. A new approach to statistical mechanics of reacting mixtures will be investigated with emphasis on the derivation of a Boltzmann-type equation, including break-up. An objective of the research is to study the effects of reactions on generalized relaxation phenomena such as line shapes and NMR spin-lattice relaxation.

This is a renewal of research currently supported by NSF grant CHE7618970 at the University of Houston.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0021, THE ACCELERATED CHARACTERIZATION OF POLYMER-BASED FIBER-REINFORCED COMPOSITES

H.F. Brinson, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science, *Blacksburg, Virginia* 24061 (NCC 2-71)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0022, FRACTURE MECHANISMS IN FIBROUS COMPOSITES

P.W. Beaumont, University of Cambridge, *Hills Rd., Cambridge, England, United Kingdom* (DF052720; AFOSR-78-3644)

AF function - future high performance flight vehicles will require improvements in structural efficiency. Deficiency - inadequate understanding of composite fracture exists when environmental exposure is considered. Objective - the objective of this research is to understand and develop a theory to predict fracture of advanced composites and hybrids under conditions of elevated temperature and moisture. How work contributes - this research contributes to the Air Force's ongoing effort in advanced composite structures technology.

Both theoretical and experimental efforts will be pursued under this research grant. Fracture mechanisms such as relaxation, debonding, pull-out, splitting, crazing, etc., will be studied under environmental exposure conditions. Both crack initiation and propagation behavior will be investigated. In addition, the behavior of hybrid composites will be considered. Fibers to be studied include glass, graphite and Kevlar.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, PROPULSION SYSTEM COST REDUCTION

W.S. Crownover, U.S. Dept. of Defense, Army, Missile Research

& Development Command, Technology Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0F1409)

Demonstrate a low-cost propulsion technology package applicable to free-flight rocket motors and other high-production system motors.

This effort will exploit promising concepts and analytical techniques for reducing rocket motor costs. Areas of consideration will include adaptation of tubular products (metal and composite), low-cost nozzle/closure forming and joining methodology and a braided fiberglass integral case/nozzle concept demonstration. Demonstration motor firings will be conducted for selected concepts to generate performance parameters. Participation will continue in the tri-service program to develop a body of information that relates propulsion system requirements to propulsion life-cycle tests. Also included will be an effort on service life prediction which will combine development and verification of realistic thermal loads with improvement to the methods for assessing propellant grain crack formation and propagation. The effect of field and operational environments on rocket motors will provide engineering data to support propulsion design activities.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Propulsion Directorate

4.0002, DESIGN, DEVELOPMENT AND TEST OF FLUIDIC ELECTRONIC RATE SENSOR

D.J. Schaffer, Signal Co. Inc., Airesearch Manufacturing Company, *402 S. 36th St., Phoenix, Arizona* 85034 (DN890219; N00019-79-C-0455)

Conduct a project to design, fabricate and test a breadboard angular rate sensor as an alternate to rate gyroscopes for altitude stabilization and guidance systems for air-to-air interceptor missiles and RPVs.

The approach to be taken in conducting this project will be to establish a specific missile application where the need exists for a low-cost rate sensor. Determine the required configurations and evaluate them to determine the best-suited. Determine the breadboard model following the design analysis. Fabricate and test the breadboard model to determine performance, i.e., dynamic range, frequency bandwidth, and temperature-drift characteristics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0003, ADAPTABLE WALL WIND TUNNELS FOR V/STOL RESEARCH

W.R. Sears, University of Arizona, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Tucson, Arizona* 85721 (DN975112; N00014-79-C-0010)

The ability to predict the performance of V/STOL aircraft in the vicinity of the ground and in transitional flight depends critically upon the accuracy of experimental data obtained in wind tunnels. Such data are plagued by uncertain corrections because of the presence of the tunnel constraining walls which interact with the highly deflected, vortical flows. The proposed research will examine the feasibility of the adaptable wall concept--a concept in which measurements made in the flow field far from the model are used in an active loop to control the flow through the walls--to minimize the wall interference effects for V/STOL flight.

To assess the value of the adaptable-wall concept in the V/STOL regime, a study will be undertaken of three-dimensional flows characterized by large lift coefficients (large deflections) and significant wake effect, to determine what the requirements of an adaptable wall tunnel are. Mathematically, the problem is to determine what boundary conditions, enforced in the mid-field of the flow about a real V/STOL configuration, uniquely determine the inner field and assure that it is part of the desired overall flow field. From a practical viewpoint, there are additional questions which must be addressed: what flow variabls should be measured and where; what flow variables must be controlled and where to establish the proper boundary conditions accurately and rapidly.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, MATERIAL SUPPORT TECHNOLOGY - STUDY OF SEMICONDUCTOR STRUCTURES

J.W. Mayer, California Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *1201 E. California Blvd., Pasadena, California* 91109 (DN475233; N00014-75-C-0564)

Development of new electronic devices and device fabrication techniques for Navy systems is dependent on better understanding and exploration of new concepts in solid-state electronic materials.

Solid-phase reactions are studied in metal semiconductor and semiconductor-semiconductor layered structures. Various thin film analysis techniques are used, including transmission electron microscopy and ion backscattering. Amorphous layers of silicon will be produced by ion implantation. Epitaxial regrowth will be studied as a function of implanted impurity substrate orientation, and type of annealing process, thermal, laser or electron beam heat pulse. Growth of sputtered amorphous silicon layers will be studied for comparative purposes. Metal-silicon films will be investigated to determine the mechanisms for silicide formation. Various metal film deposition techniques are used and differences in the resulting silicides investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, EXPERIMENTAL INVESTIGATION OF VELOCITY BIASING IN LASER DOPPLER ANEMOMETER MEASUREMENTS

D. Modarress, California State University & Colleges, California State University, Long Beach Campus, School of Engineering, Dept. of Mechanical Engineering, *6101 E. 7th St., Long Beach, California* 90840 (NCA 2-382001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0006, BOOST SUSTAIN INTEGRATION STUDY

T. Piercy, Marquardt Co., *16555 Saticoy St., Van Nuys, California* 91409 (DF462490; F33615-78-C-2034)

Develop and demonstrate non-ejectable inlet covers for RAMJET engine. Configurations of interest are 2-dimension inlets. Assess drag in both open and closed position.

Analyze, fabricate and test hinged inlet covers. Determine actuation loads and mechanism for in-flight conditions. Assess in wind tunnel testing. Using testing results, evaluate any degradation in missile performance, relative to average velocity and/or range. Utilize computerized trajectory analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0007, NAVY VEHICLE DESIGN AND CONSTRUCTION - FUNDAMENTAL AERODYNAMIC STUDIES OF WING-BODY INTERFERENCE AT HIGH ANGLES OF ATTACK

J.N. Nielsen, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DN875550; N00014-78-C-0490)

A method has been developed for calculating with reasonable accuracy the forces and moments on the components of cruciform missiles at high angles of attack (up to 50 degrees) and Mach numbers up to 3.0. As a result of this work, a problem area has emerged which limits the accuracy and usefulness of this calculation method. As either angle of attack or Mach number is increased, the effect of the body on the wing is to substantially decrease the wing lift. It is not clear what causes the large wing-body interference and theoretical calculations to quantify the adverse effects are not available. The objective of this program is to determine the causes of the adverse wing-body interference and to establish the theory and methodology which will allow calculation of the interference effects.

A fundamental study of wing-body interference effects at high angles of attack and supersonic speeds for missile configuration will be conducted. Recent advances in viscous and inviscid numerical computation techniques will be utilized, supplemented by detailed experimental work. The flow field in which a fin or wing might operate at high angles of attack and high Mach numbers will be calculated by extending a computer program for solving the Euler equations of motion for compressible flow. Later, vortex effects will be included. The predicted aerodynamic characteristics will be compared with experimental aerodynamic data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, SEARCH FOR STABLE ONE-DIMENSIONALLY CONFINED PLASMA CONFIGURATIONS

O. Buneman, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ENG78-01559)

The equilibrium properties of planar plasma configurations will be investigated from a theoretical and numerical point of view, with the objective of determining those characteristics that result in stable configurations. Interest will focus on 'plywood' models in which current filaments in the plasma flow in different directions as one progresses through successive layers of the structure. Particular attention will be placed on the numerical methods. An effort will be made to reduce the computations needed to analyze particular structures. The analysis will include considerations of the effects of magnetic fields other than those arising from the current distribution and the effects of particles whose motion remains undetermined in the formulation.

This is a continuation of research previously supported under NSF grant ENG-7602402.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0009, ADAPTIVE TECHNIQUES IN COMMUNICATIONS AND CONTROL THEORY

K.S. Narendra, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DN123505; N00014-76-C-0017)

The technical objective of this project is to determine an analytically sound basis for the implementation of adaptive electrical and mechanical systems. Such systems find application in many areas of Navy interest, including satellite control, aircraft identification, helicopter control, and communications systems and links.

The approach is rigorous and analytical. Efforts will be made to establish rapidly converging algorithms for the purpose of achieving an optimum design of discrete-time adaptive systems. Parameters which must be considered include the nonlinear feedback nature of such systems, a gain schedule which permits system tracking and noise filtering, and analytical rules for the prediction of stability of such systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, THERMAL AND ELECTRICAL TRANSPORT CHARACTERISTICS OF OPTICAL INTEGRATED CIRCUITS

R.G. Hunsperger, University of Delaware, School of Engineering, Dept. of Electrical Engineering, *Newark, Delaware* 19711 (ECS77-20798 A01)

This research program has two basic goals: to provide new fundamental information on the thermoelectric properties of semiconducting materials that are used to fabricate optical integrated circuits, and to develop injection lasers which monolithically incorporate heat-spreading and heat-pumping (Peltier effect) structures for cooling of the lasing p-n junction. The effectiveness of a layer of bismith-telluride (Bi3Te2) and lead telluride (PbTe) in the Peltier cooling stages is being examined. Insofar as possible the fundamental thermoelectric properties of vapor-deposited thin films of Bi3Te2 and PbTe are being investigated, and the effect of lattice damage on the thermal and electrical properties of gallium aluminum arsenide is being determined.

This action renews the research that is currently supported under NSF grant ECS77-20798.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0011, RADIATION VULNERABILITY AND HARDENING

J.W. Butler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680021)

The objective of this work is to develop techniques, procedures and methods that will lead to more radiation-resistant electronic components for Navy applications.

The technical approach of this work is to apply the techniques and instrumentation of nuclear physics research to the basic problems encountered in radiation hardening of electronic components. For example, the implantation of certain ions in metal oxide semiconductor devices has been found to make them more resistant to radiation damage than they would otherwise be. A 5-mv Van de Graaff accelerator and a 200-kv HV transformer accelerator provide a wide variety of ions for implantation. The location of these ions in the device is important in determining their radiation hardness, and under certain conditions implanted ions tend to migrate. Nuclear reaction techniques are used for ascertaining depth concentration profiles of the implanted ions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0012, AUTONOMOUS SATELLITE SENSOR PROGRAM

F.L. Markley, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980065)

The purpose of this effort is to study the accuracy of determination of a spacecraft's attitude and ephemeris by autonomous navigation methods utilizing combinations of star sensors, landmark recognition systems, and inertial reference units and to study the influence of spacecraft non-rigidity on the accuracy attainable.

The study will utilize an error covariance analysis based on optimal estimation techniques and containing models of the spacecraft dynamics (linearized), various sensor configurations, and expected distributions of stars and landmarks. The study will analyze both the absolute accuracy of the spacecraft attitude and ephemeris determination as well as the accuracy with which the location of objects on the earth's surface relative to the landmarks can be established.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0013, APPLICATIONS OF SEMICONDUCTOR MATERIALS

W.J. Moore, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620099)

To obtain basic knowledge of the electrical and optical properties of semiconductor materials which limit the performance of solid-state devices of interest to the Navy. Of particular interest are materials which have application as active microwave devices or as infrared detectors, including both elemental and compound semiconductors.

Electrical and optical properties of selected materials are determined by using measurements such as optical and magnetooptical spectroscopy, photoconductivity, transient capacitance spectroscopy, Hall effect and noise studies. Such measurements are carried out on specially prepared bulk material and epitaxial

best copy available

layers produced in-house, on MIS structures, and on commerical devices such as prototype infrared detectors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0014, DERIVATION AND COMPARISON OF OPTIMAL FILTERS II

M.E. Warren, State University System of Florida, University of Florida, School of Engineering, Dept. of Electrical Engineering, *220 Black Hall, Gainesville, Florida* 32611 (DF642750; F08635-78-C-0179)

Air Force function - development of advanced guidance algorithms for tactical air-to-air missiles. Deficiency or opportunity - to increase percent kill of highly maneuvering target aircraft. Objective - the objective of the effort is to develop and compare various estimation techniques that have potential application to short-range air-to-air missiles. Various estimation techniques will be developed to obtain the required states/parameters for implementing the types of guidance laws derived under previous contract efforts.

The approach for this effort will be for the contractor to determine the various states/parameters required to implement the guidance laws derived under previous contractual efforts. The contractor will analytically assess the feasibility of applying various estimation techniques for estimating the necessary states/parameters. These estimation techniques will include splines, polynomial estimation, function estimation, and adaptive filtering. The contractor will fully develop the most promising techniques and evaluate the derived estimation algorithms using a complete non-linear 6-DOF simulation with a generic missile model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0015, INTERDISCIPLINARY COLLABORATION IN TRIBOLOGY

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0016, LIGHTNING PROTECTION FOR WIND TURBINES STUDY

C.W. Dodd, Southern Illinois University, Carbondale Campus, School of Engineering & Technology, Dept. of Electrical Sciences & Systems Engineering, *Carbondale, Illinois* 62901 (NCC 3-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0017, GRADUATE STUDENT RESEARCHERS PROGRAM

T.H. Okiishi, Iowa State University of Science & Technology, School of Engineering, Dept. of Mechanical Engineering, *496 Town Engineering Bldg., Ames, Iowa* 50011 (NGT 16-002-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0018, INVESTIGATION OF MECHANISMS AFFECTING ENVIRONMENTAL STRESS CRACKING IN TITANIUM ALLOYS

I.J. Graham, Southern University Agricultural & Mechanical College, Baton Rouge Campus, School of Engineering, Dept. of Mechanical Engineering, *Baton Rouge, Louisiana* 70813 (DN890058; N00019-78-C-0065)

Program to investigate mechanisms affecting environmental stress craking in titanium alloys. Also to determine rate of crack growth in a mechanical environment on high-strength aircraft structural alloys.

Use the fracture mechanics approach with the application of acoustic emission test techniques to predict the useful life of a structure subjected to sustained and/or cyclic loads under certain controlled environments at designed temperatures and pressures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0019, RADAR

K.H. Shreeve, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Equipment Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8AA8302)

OBJECTIVE: The objective of the NEXRAD program is to upgrade the NWS primary weather radar facilities with new Doppler radars, digital data collection and processing, graphic displays, and expedient communications equipment.

APPROACH: Actively participate in the RADAR procurement. Develop the functional NEXRAD design and continue efforts to improve the operational usefulness of NEXRAD systems. Continue development of improved radar data display and communications.

PROGRESS: This project has been underway for several years. The EDL effort is supportive of the overall development and deployment of a new radar system. RADAR equipment will be under contract in the 1st quarter of FY1980. Initial color weather radar display has been developed and experimentally tested at NSSL.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

4.0020, FLIGHT DYNAMICS - RESEARCH IN AERODYNAMICS AND RESEARCH IN BALLISTICS

R.H. Krieger, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0N4437)

This project covers exterior ballistics research in aerodynamics related to projectiles and missiles and the factors affecting their flight behavior and environments. Significant studies undertaken involve methods to obtain static surface pressure measurements on non-spinning secant-ogive-cylinders; to develop a method and obtain surface pressure measurements on spinning bodies of revolution using a wind tunnel telemetry technique and to develop a finite difference computer program for computing the three-dimensional boundary layer development on spinning bodies.

These objectives are to be met through theoretical analysis and experimental testing in the BRL closed circuit variable density, continuous flow supersonic wind tunnels.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0021, DYNAMIC BALLISTIC TESTING-FLIGHT DYNAMICS AND BALLISTIC TECHNOLOGY

L.C. MacAllister, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0A4562)

This project includes ballistic range instrumentation and data analysis improvement and full range projectile dynamics. These applied research programs in the fields of aerodynamics and flight mechanics contribute to the design of, evaluation of, and data base for artillery shell, small arms, missiles and rockets. Tasks covered are the design and test of a projectile with the non-conical boattail concept in full scale artillery calibers including usual real features such as rotating band and fuzing details, the design and procurement of improved optics for range shadowgraphic instrumentation and improved time-base investigations characterizing launch yaw for artillery shell-weapon combinations.

Range and data analysis improvements are pursued by monitoring new developments and implementing applicable ones as well as in-house development. Flight test programs are conducted at the BRL and at other test facilities, and the results ana-

lyzed to support the projectile dynamics and non-conical boattail objectives.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0022, MOLECULAR GAS OSCILLATORS/AMPLIFIERS
G.J. Simonis, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Harry Diamond Lab., *2800 Powder Mill Rd., Adelphi, Maryland* 20783 (DA0F5730)

The near-millimeter (nmm) portion of the spectrum, 0.3-2.5mm, will play an important role in close support, remote sensing systems which (1) operate well under smoke, inclement weather, or cloud environments, (2) provide high resolution capability and (3) are secure in terms of countermeasure vulnerability. Nmm technology addresses these requirements, being an attractive compromise between the high resolution capability of ir systems and the low propagation loss characteristics of microwave operation. The objective of this program is to foster and contribute to the development of the technology base in this relatively unexplored portion of the em spectrum.

The nmm technology program is based upon three complimentary approaches. First, an in-depth study is being conducted of the state-of-the-art to (1) define current and future systems requirements, and (2) identify technology gaps and research efforts to fill these gaps. Second, an in-house research program is underway for the development of nmm sources which have practical power/size capabilities and high spectral purity. The third portion of this program is an out-of-house effort in three areas - sources, receivers and propagation effects.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Harry Diamond Lab.

4.0023, SYSTEMS ANALYSIS FOR A DUAL MODE (PULSE-UP) TRANSMITTER
J. Fritsch, Westinghouse Electric Corp., *P.O. Box 746, Balt-Wash Internat. Airport, Baltimore, Maryland* 21203 (DN081336; N62269-79-OI-92920)

To provide NavAirDevCen with technical assistance in conducting a systems analysis to specify dual mode transmitter designs that satisfy the spectrum of mission requirements of Navy aircraft, e.g., advanced F/A 18, advanced F 14, reconnaissance, ASW, etc. The dual mode transmitter offers the waveform flexibility of two transmitters. This allows the waveform to be optimized over a broad range of mission requirements. This work supports work unit AJ302, Agency Accession No. DN 081335.

The contractor is to survey the missions and threats of advanced Navy aircraft and determine mode requirements. He will then translate the mode requirements to radar requirements and identify minimum/maximum values that drive the transmitter in terms of strengths and limitations of critical parameters. Finally, a trade-off analysis of critical parameters will be conducted and a family of dual mode transmitter designs will be specified.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

4.0024, NAVY VEHICLE DESIGN AND CONSTRUCTION - DESIGN TECHNIQUES FOR MULTIVARIABLE DIGITAL CONTROL SYSTEMS WITH MULTIPLE SAMPLE RATES
S.W. Gully, Analytic Sciences Corp., *6 Jacob Way, Reading, Massachusetts* 01867 (DN975440; N00014-79-C-0431)

During the design of a digital flight control system, it can be advantageous to have different feedback loops sampled at separate rates in order to save on computer requirements. For example, the response characteristics of an inner stability loop and an outer guidance loop are usually an order of magnitude apart and, therefore, the sample rates of each loop can also differ by the same amount. No modern control theoretic technique exists for designing multivariable digital control systems with multiple sample rates. The purpose of this project is to develop practical synthesis and analysis methods for multirate digital control systems.

The optimal multirate control problem will be formulated by starting with the optimal multirate estimation procedure which has been developed by the contractor. The general optimal multirate estimation and control problem will then be solved. The algorithms which are developed will be exercised on a realistic aircraft with multirate sensors and actuators. Optimal multirate control law and state estimation will be constructed and compared with single rate designs to illustrate the advantages and differences in complexity between them. An algorithm which will automatically guarantee a stabilizing initial starting property will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0025, LARGE APERTURE SYSTEM APPLICATIONS
F. Ayer, Charles Stark Draper Lab. Inc., *68 Albany St., Cambridge, Massachusetts* 02139 (DF911430; F30602-78-C-0128)

The objective of this effort is to assess active control concepts for disturbance suppression and performance enhancement of large aperture, ultra-lightweight space radar antennas. Also to develop design criteria for improved performance of such antennas with and without active control.

Active control approaches shall be analytically investigated for distortion suppression of modeled disturbance characteristic of large aperture, ultra-lightweighted radar antennas for space applications. Mechanical/electrical implementations shall be assessed for both reflective and phased array antennas. Performance benefits shall be contrasted against passive distortion suppression approaches.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0026, HIGH TEMPERATURE TURBINE ROTOR MATERIAL
Unknown, General Electric Co., *1000 Western Ave., West Lynn, Massachusetts* 01910 (DF463780; F33615-79-C-2043)

Investigate the use of carbon/carbon material in the turbine rotor of a small (500 to 1000 pounds thrust), 50-hour-life turbofan engine. The rotor will operate at 2500 degrees F and the blading will not require any cooling air.

The basic contract will be a design study of a turbine rotor in a 2500 degrees F TIT of a small turbofan and will also include a carbon/carbon material definition effort. Possible follow-on efforts include design, fabrication and test of a carbon/carbon turbine rotor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0027, MATERIAL SUPPORT TECHNOLOGY - GRAPHITE INTERCALATION COMPOUNDS
M.S. Dresselhaus, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN775125; N00014-77-C-0053)

Intercalated graphite compounds have exhibited high conductivities. Research has been directed towards achieving conductivity equal to or greater than that for copper. Many naval systems could benefit from a light, strong metallic fiber. The objective of this program is to determine the electronic structure of these compounds in order to correlate the electrical behavior with their atomic structure and composition, with the view to being able to design better conductors.

Metallic graphite intercalation compounds are studied by Raman and infrared spectroscopic techniques to determine those lattice modes which can be identified with vibrations of the carbon atoms in the graphitic layers and other modes specific to each intercalate specie. These results are combined with theoretical studies to determine the electronic structure of the compound when graphitic and intercalated layers are brought together to their equilibrium separation in the intercalation compound. Both acceptor and donor intercalation compounds are studied and special attention is given to the symmetry properties

of the Raman and infrared spectra to provide information on the inplane ordering of the intercalated layer planes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0028, TRIBOLOGY ASSESSMENT
W.R. Wilson, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Amherst, Massachusetts* 01002 (NCC 3-10)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0029, INTERDISCIPLINARY COLLABORATION IN TRIBOLOGY
K.C. Ludema, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Mechanical Engineering, *Ann Arbor, Michigan* 48104 (NCC 3-11)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0030, FEASIBILITY DEMONSTRATION OF A RAFT SYSTEM
D. Meisner, Air Cruisers Co., *P.O. Box 180, Belmar, New Jersey* 07719 (DN781462; N62269-76-C-0273)

Demonstrate the feasibility of a helicopter installed system designed to provide deceleration during free-fall, and subsequent flotation, of a high value cargo that has been intentionally jettisoned or inadvertently dropped during vertical replenishment operations over water. Automatic deployment of the system is planned to prevent specified levels of damage to the cargo upon impact with the water, to avert sinking and to facilitate recovery by surface ship or helicopter. This contract supports work unit PH104, Agency Accession No. DN681034.

It is planned to conceive, analyze, and design a raft system, including its method of attachment, which is capable of meeting the objectives specified in statement of work SOW 3041-21; to fabricate feasibility test hardware, and to support NavAirDevCen personnel in subsequent flight tests.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0031, EFFECTS PRODUCED BY VARIOUS DEFECTS IN SOLID-STATE LASER DEVICES
F. Witt, U.S. Dept. of Defense, Army, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab., *Picatinny Arsenal, Dover, New Jersey* 07801 (DA0B0731)

To determine the effect of various crystal inhomogeneities on the ability of laser systems to generate and transmit energy efficiently.

A very fast and highly successful high resolution X-ray method has been developed in-house and is described in the report numbered FA-M72-20-1. The method is capable of detecting substructure variations in the submicron range caused by dislocation networks. It has the potential to reveal the existence of crystal inhomogeneities (such as dopant concentration gradients, impurities, inclusions, precipitates and thermal strains) introduced by the Czochralski or the top-seeded solution crystal-growing techniques. X-ray studies - after high quality photographs are taken on good and marginal quality material, we propose to perform strain measurements on the relative conic movement of a number of accurately determined positions of YAG, YLF, Li-niobate, and NdLa2Be2O5 crystals. The strain will be measured in at least six directions in the crystal so that quantitive determinations of the principal strains and their directions can be made.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab.

4.0032, AUTOMATIC TEST TECHNIQUE DEVELOPMENT FOR ADVANCED ELECTRO-OPTICAL SYSTEMS
A. Lemasters, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN096119)

Develop and recommend automatic test techniques for advanced electro-optical systems and subsystems. Develop testability guidelines for future e-o avionics systems.

Support concepts and ground support equipment requirements must be considered at design inception. New testing techniques/concepts and test interface requirements developed will be converted into a testability guideline or specification to be included in development specifications for future electro-optical avionics systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0033, ELECTROMAGNETIC CAMOUFLAGING TECHNIQUE
B.K. Singaraju, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (DF194870)

This work deals with the use of impedance loading of scatterers in an attempt to electromagnetically camouflage objects such as aircraft, missiles and satellites to confuse the enemy radar. This is a theoretical investigation.

Electromagnetic response of a body depends upon the natural frequencies of the body and is dependent on the incident pulse. In this work, we will investigate the use of the impedance loadings to shift the natural frequencies of one body to resemble those of another body. Eigen impedance concepts will be investigated to calculate the eigen impedance and required loadings for a perfectly conducting sphere and this wire.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0034, NAVY VEHICLE DESIGN AND CONSTRUCTION - TRANSONIC ANALYSIS OF TWO-ELEMENT AIRFOILS
G. Volpe, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN575295; N00014-75-C-0722)

This research is directed towards developing a completely theoretical solution to the analysis and design of transonic two-element airfoil configuration. The use of such two-element airfoil configurations such as slats has improved performance of combat aircraft at transonic speeds where air-to-air combat usually occurs. However, the reasons for the effectiveness of slats or flaps at transonic speeds are not presently well understood and good slat or flap designs are experimentally arrived at through expensive wind tunnel test programs.

A three-phase program is being conducted to develop a systematic and efficient numerical procedure for the design of multi-element airfoil systems for high lift at transonic flight conditions. Under the two completed phases, a viscous transonic flow analysis has been developed. The procedure predicts pressure distributions and force and moment coefficients for multi-element configurations with boundary-layer effects included. The current phase is concerned with the development of an effective inverse method to determine multi-element airfoil systems by specifications of a desired pressure distribution and free-stream Mach number.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0035, BACKSCATTER/FORWARD-SCATTER/ TERRAIN-SCATTER RELATIONS
R.J. Papa, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF904630)

AF function - surveillance. Deficiency/opportunity - existing surveillance radar systems have difficulty in estimating the height of low flying aircraft and do not optimize the overall performance capability of the radar. Objective - to predict radar multipath returns over a real earth from a causal relation between backscatter and forward-scatter returns and other site-dependent data. Also, to improve existing multipath models for

specular and diffuse scattering. How research contributes - improved multipath models will yield more accurate determination of the positions of aircraft and improve a radar system's performance in a more cost-effective fashion. The results of these investigations will be applied to several radar sites along the dew-line (Project Seek Frost).

Utilize existing models of scattering from random, rough surfaces and correlate theoretical and computer models with experimental data. Types of terrain and sea states will be delineated for which an accurate theoretical model exists capable of giving a causal relationship between the forward scattering (multipath) and backscatter (clutter). Theoretical and computer models will be extended to include the effects of terrain screening, shadowing and multiple scattering, and these models will be compared with experimental data taken under contract. The types of terrain to be investigated will be selected from several sites along the dew-line.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0036, IONOSPHERIC PROPAGATION SIMULATION

W.K. Ring, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF902790)

AF function - long-range detection. Deficiency/opportunity - models for simulating HF propagation in the Arctic (auroral) environment are not sufficient to adequately predict the performance of Air Force systems or provide information for the design of new techniques to improve operational capabilities. Objective - development of new theoretical and numerical models of ionospheric characteristics which influence radio wave propagation and the design of improved ray-tracing techniques. Development of a better understanding of radio propagation through small-scale irregularities in the ionosphere, and improvement of state-of-the-art radio signal detection in the presence of fading and clutter due to propagation through an inhomogeneous ionosphere. How research contributes - this research is directed at improving the inputs to a realistic model of HF propagation, particularly in the auroral region of the ionosphere. These new models, in conjunction with fast and accurate ray tracing, will allow assessment of system performance to be made in near real-time and, with models of auroral HF clutter, allow for both prediction of system performance and improved operational capabilities of existing systems.

New and improved ionospheric modelling techniques will be developed, primarily on the basis of analysis of existing radio propagation data. Data which in the past could not be used for this purpose (oblique backscatter data) will be incorporated by the use of newly developed ray-tracing and computational techniques. Data from experimental OTH radars will be used to develop an auroral clutter model. The new ray-tracing techniques will be developed primarily from theoretical considerations, although full advantage will be taken of improvements in the size and speed of modern digital computers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0037, CRACK GROWTH INITIATION AND PROPAGATION UNDER DYNAMIC LOADING

M.F. Kanninen, Battelle Memorial Inst., Columbus Laboratories, *505 King Ave., Columbus, Ohio* 43201 (DN775733; N00014-77-C-0576)

Naval structures such as aircraft, missiles, submarines, and surface ships are exposed under service conditions to various forms of dynamic loading which can cause fracture and failure of key portions of these systems. Under this task improvements should be effected in dynamic fracture analysis and experimental techniques, which should eventually impact on improved design approaches.

A program of combined experimentation and mathematical analysis was initiated. In the experimental work, attention is focused on developing techniques to determine accurately the load-point displacements and crack length as functions of time in an impact-loaded fracture specimen. In the mathematical analysis work, an asymptotic evaluation of the crack-tip region for dynamic elastic-plastic crack propagation is being pursued.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0038, MARITIME PATROL AIRSHIP STUDY

J.W. Lancaster, Lancaster Analytics, *Canton, Ohio* (DN981128; N62269-78-M-4426)

Provide techical support to Navy LTA computer sizing and performance programs. In support of work unit No. DH814.

Troubleshoot and rectify computer program irregularities.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0039, THERMAL ENERGY STORAGE AND HEAT TRANSFER INVESTIGATION

J.E. Beam, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458500)

To develop the required analytical and experimental heat transfer and metallurgical compatibility data necessary to optimize the design and useable life for surveillance spacecraft VM Cryocooler applications.

A two-phase program is proposed. Phase 1 concerns analytical modeling of transient cycling of cylindrically encapsulated TES-phase change materials, setting up an in-house test capability to allow thermal cycling of liquid metal heat pipes with integral TES, and initiating invacuo metallurgical CLAD/TES compatibility tests. Phase 2 centers on calorimetric testing and cyclic performance mapping of subscale thermal trains and contractual end-item hardware.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0040, CHAFF CLOUD MEASUREMENTS, ANALYSIS AND DEVELOPMENT

V. Pyati, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF096990)

The objectives of this IH effort are (1) to develop realistic computer models of chaff clouds that account for critical aerodynamic and electromagnetic effects, (2) to obtain and analyze radar cross-section data from measurements of actual chaff clouds, and (3) to perform lab experiments and simulations to determine the signature of new chaff elements and their effects on advanced radars.

The objectives are to be achieved by IH work and by utilizing and combining the work of various contractors. For example, computer programs to compute the RCS of a chaff cloud are being combined with aerodynamic programs that predict chaff element trajectores so that a time-varying RCS can be computed. In addition, IH measurements of the RCS of redesigned chaff will be performed to evaluate the improvements in electromagnetic performance. Measurements of the RCS and Doppler return from chaff clouds will also be performed and analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0041, INTERDISCIPLINARY COLLABORATION ON TRIBOLOGY

E.E. Klaus, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Chemical Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NCC 3-9)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0042, LASER VISUAL SYSTEM VTOL/VTRS DESIGN

A. Zepf, American Airlines Inc., *Fort Worth, Texas* (DN094001; N61339-79-C-0123)

To determine the feasibility of installing a laser visual display on the vertical take-off and landing portion of the visual technology research simulator.

An investigation will be made to produce a laser display design for the visual display of VTOL/VTRS and then compare the design with the specification, operational use schedule, and budgetary limitations to determine if a feasible system can be attained for VTOL/VTRS.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulation Concepts Lab.

4.0043, IAP SURFACE GEOMETRY GENERATION
R. Robertson, Atlantic Research Corp., *5390 Cherokee Ave., Alexandria, Virginia* 22314 (DF737690; F30602-77-C-0126)

The objective of this effort is to develop the algorithms and computer codes to generate within the computer the description of a given geometrical surface to be used as an input for the RADC electromagnetic compatibility analysis codes. Examples of such surfaces include aircraft fuselages, wings and ground-based antenna towers.

The contractor will determine the geometry inputs required by the analysis codes now existing or planned within the framework of the intrasystem compatibility analysis program (ICAP), such as the intrasystem electromagnetic compatibility analysis program (IEMCAP) and the general electromagnetic model for the analysis of complex systems (GEMACS). Based on the requirements determined from this evaluation, the contractor will develop the algorithms and a computer code for a geometry generation module (GGM) that shall interface with the ICAP codes. This will enable the user to enter a physical description of the system geometry into the required solution technique to the degree of accuracy required. Candidate techniques that can be used to generate the surface geometry include generic elements (cylinders, cones, spheres, etc.) and spline function descriptors. The end-items are a computer code and its documentation which can be used in a stand-alone mode or in concert with ICAP codes to mathematically model a physical system as a combination of surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0044, ELECTRON SPECTROSCOPY OF SEMICONDUCTOR HETEROJUNCTION INTERFACES
M.G. Lagally, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Mineral & Metallurgical Engineering, *Madison, Wisconsin* 53706 (DN775535; N00014-77-C-0474)

The operational properties of solid-state electron devices used in Navy electronic systems are often dominated by the electronic effects occurring at various solid surfaces and solid-solid interfaces. Understanding and controlling the surface effects are essential to improving performance and reliability.

Using surface analysis techniques such as Auger spectroscopy, ultraviolet photoemission spectroscopy, X-ray photoemission spectroscopy, and energy loss spectroscopy, the investigator will probe the local electronic properties of surface atoms. These atoms may represent the host material, absorbed impurities, or atoms of an adjacent host material such as occurs in the semiconductor-semiconductor heterojunction. Determination of the local density of states at each atom will permit evaluation of the effects of impurities or surface states on the overall electronic nature of the surface. Of particular interest is the nature of the energy discontinuity which appears at the heterojunction interface and the changes in local density of states as a result of surface disorder and oxidation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, SIZE-FREQUENCY ANALYSIS OF SIMULATED MARTIAN EOLIAN SILT AND CLAY
D. Krinsley, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NCA 2-35001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0002, RESEARCH SURFACE TRENDS TO EARTH'S CRUST
Unknown, California State University & Colleges, San Diego State University, Graduate School, *5402 College Ave., San Diego, California* 92115 (NAS 9-16143)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

5.0003, A METHOD FOR EVALUATING THE TRANSPORTS BY MEAN DEVIATORY MOTIONS IN A TWO-DIMENSIONAL MODEL
C.A. Riegel, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2-73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0004, NAVY ENVIRONMENT - GEOTECHNICAL PROPERTIES OF SABKHAS
J.I. Collins, Tetra Tech Inc., *630 N. Rosemead Blvd., Pasadena, California* 91107 (DN075358; N00014-80-C-0366)

The objective of this research is to provide a baseline study of the geotechnical properties (surface bearing strength, trafficability, etc.) of sabkha areas of the Persian Gulf region and to investigate the variations of such properties with varying environmental conditions (tidal range, ground water levels, etc.)

The field site for this investigation will be a coastal sabkha near Jubail, Saudi Arabia. Sediment characteristics will be measured using coring devices, shear strength vanes and resistivity probes. Other environmental parameters to be measured include ground-water levels, coastal tides, wind, precipitation and humidity. Multivariate analysis of measured parameters will be used to correlate sabkha properties with satellite remote-sensing parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0005, BLUE/GREEN CLOUD PROPAGATION EXPERIMENT SUPPORT
K.J. Kelley, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Communications Systems & Technology Dept., *San Diego, California* 92152 (DN988647)

Provide support for blue/green cloud propagation experiments to be conducted on the island of Kauai, Hawaii, during July and August, 1979. NOSC will support the optical propagation experiments being conducted by H.S.S., Inc. and G.T.E.-Sylvania.

NOSC will support the blue/green cloud propagation experiments via four tasks: (1) provide an instrumented aircraft on-site to provide appropriate cloud meteorological data simultaneous with G.T.E.-Sylvania laser downlink pulse propagation experiments. Data to be provided will be cloud drop size spectra as functions of altitude (10 m resolution), cloud height, cloud thickness, temperature and dew-point. Data will be reduced and provided to G.T.E.-Sylvania, H.S.S. and others at the request of the sponsor; (2) provide funds to PMR Barking Sands, Kauai, for radar support required by the two experimental aircraft; (3) jointly with H.S.S., check-out, evaluate and calibrate two-channel teleradiometer built by H.S.S., at east-coast site. Ship equipment to Kauai. Jointly conduct field test and reduce data with H.S.S.; and (4) observe experiments, make on-site judgment as to the data validity, and provide technical advice (not direction) to all portions of blue/green cloud propagation experiments. Provide interface to sponsor.

SUPPORTED BY U.S. Dept. of Defense, Defense Advanced Research Projects Agency, Strategic Technology Office

5.0006, CLIMATE CHANGE AND THE HISTORY OF GREENLAND
O. Granger, University of California, Berkeley Campus, School of Letters & Science, Dept. of Geography, *Berkeley, California* 94720 (NCA 2-50004)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0007, ECOLOGICAL STUDIES OF THE LUGUNA FIGUEROA DEL NORTE
G.A. Tomlinson, University of Santa Clara, School of Science, Dept. of Biology, *El Camino Rd., Santo Clara, California* 95053 (NCA 2-685008)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0008, MULTI-SENSOR CLOUD DEVELOPMENT STUDIES
V.E. Derr, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA71531)

PROJECT OBJECTIVE: Study dynamical development of clouds with emphasis on glaciation in young clouds for purposes of obtaining improved data for models leading to better forecasting of precipitation.

CURRENT YEAR PLAN: Study synoptic cloud development into winter storms, particularly upslope conditions. Study early cumulus development.

PROGRESS REPORT: Development of algorithms to distinguish depolarization from multiple scatter and ice formation. Data analysis of early cloud glaciation in the NCARCSD Experiment of 1978.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0009, SPECTRAL ANALYSIS OF LIGHTNING EMISSION IN THE SILICON RESPONSE RANGE
B. Turman, U.S. Dept. of Defense, Air Force, *Air Force Academy, Colorado Springs, Colorado* 80840 (DF282310)

AF function - technology base. Deficiency - lack of information on optical interference effects from lightning. Objective - analyze spectral power levels from lightning. How work contributes - information on spectral power radiated from lightning will allow better design of remote sensing and detection instruments to avoid lightning triggers.

A slitless spectrometer, with silicon photodiode array for data collection, will be used to measure spectral power levels from terrestrial lightning. Emphasis will be placed on the near IR band, up to 1.1 micron wavelength.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

5.0010, PROGRAM OF RESEARCH IN ENVIRONMENTAL MODELING
H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NCC 1-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0011, REMOTE OCEAN SUBSURFACE TEMPERATURE PROFILES
V.E. Noble, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680319)

To determine the feasibility of remotely measuring the open ocean subsurface temperature profiles. These measurements will provide quantitative data on air-sea energy exchanges which support meteorological and oceanographic prediction models and also are inputs for sound velocity calculations to predict performance of tactical and strategic acoustics weapons systems. The fundamental problem is to develop a remote sensing capability that measures temperatures below the surface of the ocean.

Utilize the fact that the Raman spectrum centroid shifts with the temperature of the medium, conduct a system analysis for establishing system parameters of a model laser sensor in the visible region for operational measurement of subsurface ocean temperature profiles. Utilize data from field measurements with the feasibility model sensor to define performance parameters for operational systems to meet Navy measurement requirements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0012, ATMOSPHERIC MODELING
D.F. Strobel, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880064)

To gain a better physical understanding of fundamental atmospheric processes that drive global-scale weather systems. Results will be incorporated in global naval environmental prediction models by developing suitable parameterization schemes. To gain a basic understanding of stratospheric-tropospheric coupling.

Numerical solutions of the relevant multi-dimensional fluid dynamic equations describe atmospheric processes of interest.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0013, NAVY ENVIRONMENT - TRANSIENT PROCESSES IN OCEAN CURRENTS
W. Duing, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., Dept. of Marine & Atmospheric Sciences, *4600 Rickenbacker Cswy., Coral Gables, Florida* 33149 (DN575081; N00014-75-C-0173)

Increased knowledge of the spatial and temporal variability of oceanic current systems is essential if the Navy is to improve its ASW capability. Not only do these induce changes in sound propagation characteristics needed for ASW, but they also affect other missions such as search and rescue and salvage operations.

Direct observations are made of ocean current systems (such as the Florida current, the Somali current, and the equatorial undercurrent). These observations include moored current meters plus CTD and XBT profiles. In addition, infrared sea-surface temperature maps are obtained from satellites (such as the DMSP) for use in tracking the surface expression of such currents.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0014, SYNOPTIC STUDIES OF SUMMER AND WINTER MONSOONS
T. Murakami, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Meteorology, *2444 Dole St., Honolulu, Hawaii* 96822 (04-8-M01-51)

TECHNICAL OBJECTIVES: This grant is concerned with a study of large-scale fluctuations of the summer and winter monsoon circulations. In particular, it will attempt to determine what mechanisms are responsible for the interannual variability of these major circulations.

APPROACH: Objective meteorological analysis, as well as satellite-derived radiation data, will be utilized and studies of energy transfer and conversion processes associated with the monsoon circulation will be carried-out. In addition, the interaction of the monsoon with processes occurring over more distant areas, including those across the equator, will be explored.

PROGRESS: An empirical orthogonal function (EOF) analysis was applied to the satellite longwave cooling data so as to identify the major modes of the summer and winter monsoon circulation. It was found that long period rainfall fluctuations near India are associated with 20-30 day fluctuations in this parameter and move westward along 10-20 degrees N latitude. These appear to originate over the Central and Western Pacific.

The nature of these fluctuations changes from year to year, however.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Climate Analysis Center

5.0015, GRADUATE STUDENT RESEARCHERS PROGRAM
L.J. Rouse, Louisiana State University, Agricultural & Mechanical College, School of Science, Dept. of Marine Sciences, *University Station, Baton Rouge, Louisiana* 70803 (NGT 19-001-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Jet Propulsion Lab.

5.0016, NAVY ENVIRONMENT - UNDER-ICE ROUGHNESS
L.A. Leschack, Leschack Associates Ltd., *1111 University Blvd. W., Silver Spring, Maryland* 20902 (DN675351; N00014-76-C-0757)

The objectives of the proposed work are: (a) to evaluate the geographical and temporal variability of the under-ice roughness parameters in the Arctic ocean; (b) to determine if the roughness parameters seem to remain relatively constant with respect to one another for different geographical areas from year to year, thence to determine whether this geographical variability can be well correlated with ridging intensity measurements derived from airborne data; and (c) to determine whether under-ice roughness parameters can be estimated from satellite data.

Examine under-ice roughness parameters for geographical and temporal variability to determine quantitatively whether roughness variations can be grouped geographically. Attempt to correlate latest recorded under-ice roughness data with corresponding satellite data of the surface.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0017, UNDERWAY CURRENT/DEPTH MEASUREMENT SYSTEM
J. Pijanowski, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey, Engineering Development Lab., *6001 Executive Blvd., Rockville, Maryland* 20852 (CE1000/86228700)

OBJECTIVE: The objective of this program is to develop a technique that can remotely profile water currents from an underway vessel to a depth of 100 meters.

APPROACH: An engineering model of a pulsed Doppler current sensor system will be developed. A three-phase performance specification will be written for the development of the system. Error analysis and system specification will be conducted in Phase I, fabrication of hardware in Phase II, and testing in Phase III.

PROGRESS: Phase II testing was completed in France. The results were marginal in that high ambient acoustic noise and electrical generator noise contaminated the data. Phase III testing (ship testing) was conducted aboard the Navy Ship Hayes. The data results from these tests will be processed in early FY81.

SUPPORTED BY U.S. Dept. of Commerce, National Ocean Survey, Engineering Development Lab.

5.0018, DATA AUTOMATION - AUTOMATIC METEOROLOGICAL OBSERVING SYSTEM (AMOS IV)
R.R. Reynolds, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Equipment Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8AA8602)

OBJECTIVE: To totally automate the surface weather observation.

APPROACH: Procure subsystem (to reduce in-house design requirements). Develop software to automate basic parameters. Incorporate ceilometer, visibility and present weather sensors.

PROGRESS: Version 1.0 software and hardware running at T&ED. This version processes temperature, dew-point, winds, pressure and visibility, and accepts limited remarks. It does not provide for quality control of the data, however.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0019, VISITING ASSISTANT PROFESSOR PROGRAM
C.I. Wunsch, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NGT 22-009-900)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0020, CRYOGENIC GAS REPLENISHMENT SYSTEM STUDY
A.S. Carten, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581760)

AF function - advanced balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency or opportunity - present vehicles have limited altitude, duration and payload capabilities. Objective - to develop a system which will make long-duration (approximately 10 days) scientific balloon flights more efficient and cost-effective than at present. How research contributes - this work involves studies and investigations which are expected to lead to the design, fabrication and test of a prototype balloon inflation gas replenishment system. When the ultimate goals of this research are achieved it will be possible for the Air Force to conduct longer-term scientific or operational balloon flights than are practical at the present time. This will enhance the Air Force's mission capability in the areas of environmental and space research, air particle sampling, surveillance and point-to-point communications.

Preliminary studies have shown the feasibility of replacing the heavy ballast systems currently used on long-duration scientific balloon flights with lighter cryogenically oriented gas replenishment systems. A mathematical model will be used to establish basic system parameters and additional studies will be made to determine the optimum method of heat exchange to warm the very cold gas to ambient air temperatures. The end-product of this research will be a final report which will outline recommendations with respect to further development and proof of concept testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, HIGH ENERGY PLASMA INSTRUMENT
D.A. Hardy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249200)

AF function - AF satellite systems operate at synchronous altitudes where charging can occur due to natural causes and may give rise to effects deleterious to the systems. Deficiency - the data base of the high energy plasma present at synchronous orbit is inadequate to accurately describe charging events or to properly relate them to their ultimate cause. Objective - to provide high-time resolution energetic particle sensors for the SCATHA satellite so as to permit, in conjunction with other environmental and engineering experiments aboard the SCATHA satellite, the establishment of specifications which support design criteria for space systems. How research contributes - detailed data on the influx of high energy particles will be available from this satellite and will be analyzed as a function of time, satellite charge, solar illumination and other relevant parameters.

The Magnetospheric Dynamics Branch of the Space Physics Division will provide electrostatic analyzers and solid-state spectrometers for the SCATHA satellite. These instruments will define, on a rapid-time basis, the influx of high energy particles to a geosynchronous satellite. A detailed analysis will be carried out on the data from these sensors in conjunction with data from other sensors on the satellite and other appropriate geophysical parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, AUTOMATED AVIATION WEATHER PREDICTION

B.A. Kunkel, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582990)

AF function - launch and recovery of military aircraft. Deficiency - lack of timely, automated methods of short-range prediction of aviation-critical weather parameters. Objective - to investigate the characteristics of aviation-critical weather parameters such as slant range visibility, low-level wind shear and cloud base height, and to develop and evaluate statisically based objective techniques which predict their behavior over periods ranging from 0 to 3 hrs. How development contributes - the launch and recovery of military aircraft will be less hazardous and more effective, given improved predictions of aviation-critical weather parameters.

Weather data being gathered at the Otis AFB Weather Test Facility (WTF) will be subjected to an extended analysis to determine the temporal and spatial characteristics of slant range visibility, as defined by a multiple sensor array of forward scatter meters (FSM) and transmissometers in a simulated landing zone and from remote towers. Using multivariate statistical methods, such as regression estimation of event probabilities, short-range prediction experiments, initially carried out under task 667010, will be extended to consider the additive contribution of multiple FSM and transmissometer measurements. Consider the additive contribution of multiple FSM and transmissometer measurements. Cloud-base height observations will be gathered for a period of one year from an array of three automated rotating beam ceilometers (RBCs) located at the WTF and near an active runway at Otis AFB. An assessment of the representativeness of closely spaced RBCs observations to automatically specify the required cloud parameters of total sky cover, cloud layer amounts and ceiling will be made. The development and testing of techniques of forecasting baseline cloud base height (or ceiling if appropriate) will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, ENCODER/TIMER/DECODER DEVELOPMENT USING CMOS CIRCUITRY FOR STANDARDIZED BALLOON CONTROL

H. Laping, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580620)

AF function - advanced balloon systems for surveillance, reconnaissance, communications and environmental research. Deficiency -the existing standard instrumentation system for balloon flight-control and data gathering functions is no longer adequate for many flights due to the ever-increasing number and complexity of the scientific payload requirements. Objective - design, develop and test an improved encoder/timer/decorder, for the purpose of increasing both the reliability and flexibility of the AFGL standardized balloon flight instrumentation system. How research contributes - with a standard flight control system that has been advanced to the state-of-the-art, the current need for special control systems on a majority of balloon flights will be reduced. This will result in both dollar and manpower savings.

A 16-channel variable speed data encoder and an 18-channel command decoder incorporating a precision flight-safety timer will be designed, breadboarded and tested in-house by AFGL personnel. From the in-house design final flight models will be developed and tested under contract. The final units will be integrated into a standardized AFGL balloon flight instrument and flight-tested by AFGL personnel. A technical report will be the end-product of the in-house work unit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, ANALYSIS OF ATMOSPHERE EXPLORER AND S3-1 DATA

F.A. Marcos, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581210)

AF function - airborne surveillance, target acquisition. Deficiency or opportunity - atmospheric density variations with time and space cannot be accurately predicted. Objective - to analyze density results from the AE/S3 accelerometer data base and to relate them to coordinated measurements of composition and other structure properties for the development of an improved atmospheric model. How research contributes - an improved empirical density model will be developed for the altitude region 140-250 km. More accurate density models permit improved surveillance capability and will result in less frequent recalculations by ADCOM of the orbital elements of satellites, resulting in a considerable savings in computer costs and improved operational capability.

The accelerometer density data base will be expanded to include all available AE-C, -D, -E and S3-1 data. Correlative composition and temperature data will also be included where available. Studies will be made to determine properties of atmospheric variability related to (a) longitude, (b) geomagnetic activity, and (c) local time. These results will be used to complement and extend the preliminary model developed using AE-C data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, AURORAL SCINTILLATION MODELLING STUDIES

J.P. Mullen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580910)

AF function - communications/navigation. Deficiency - signal fading, range errors. Objective - to model ionospheric parameters and predict deficiencies. How research contributes - develops and tests predictive models of ionospheric scintillation based on actual data to be used by AWS. Model will include effects of elevation and frequency scaling.

Using actual data from Goose Bay and Narssaq Point, models will be constructed using geophysical parameters to predict scintillation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, AURORAL AND AIRGLOW INFRARED STRUCTURE

R. Nadile, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584470)

AF function - infrared surveillance technology. Deficiency -insufficient knowledge of infrared background structure which can degrade surveillance systems. Objective - to investigate the spatial and temporal variability of infrared atmospheric emissions in auroral and disturbed airflow environments. How research contributes - accurate modeling of auroral and airglow clutter will provide a background predictive capability necessary for the design and optimization of IR surveillance systems.

Field measurements obtained by rocket, aircraft, satellite and ground-based sensors will be analyzed to determine the magnitude, scale size and frequency of spatial and temporal structure in aurora and airglow for different viewing geometries. Visible measurements, which comprise the largest fraction of the present data base, will be extrapolated to the infrared based on our current understanding of the species and mechanisms responsible for atmospheric structure. In FY80, results from a dedicated infrared structures rocket experiment (ELIAS, ILIR7DZA) will be incorporated into the evolving model. This effort will also be coordinated with work units 76701008, aircraft measurements of infrared spatial structure, and 2310G412, auroral IR spectra.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, SOLAR PARTICLE EVENT TIME-INTENSITY PROFILE PREDICTION

D.G. Smart, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584720)

AF function - survivability, solar effects on satellite operations, detection and surveillance systems, and communications. Deficiency -inability to satisfactorily and accurately predict the

solar particle events that affect the aerospace environment in which USAF systems operate. Objective - to develop techniques for predicting the time-intensity profiles of various components of solar particle events. How research contributes - significant solar particle events interfere with a number of satellite-borne surveillance and detection systems and also communication systems. The ability to predict the time-intensity profile of solar particle events enables a forecast center to predict when an event may exceed the interference threshold for a specific system, how severe the interference will be and how long the event will exceed the interference threshold.

The energetic solar particle data acquired under a previous work unit as well as significant recent solar particle event data will be used to develop models of solar particle events. The models of the events will be used as predictors of other events, and then the model predicted time-intensity profiles compared with actual data to identify major dificiencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, UV ELECTRON AND PROTON FLUX MEASUREMENTS IN THE AURORAL E LAYER
R.A. Van Tassel, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584090)

AF function - transionospheric ranging and communications, remote ionospheric monitoring. Deficiency - present state-of-the-art in relating natural optical emission to the electron density profile is not understood well enough to permit remote satellite monitoring of the auroral oval. Objective - in situ measurements with rockets of uv, electron and proton fluxes. How research contributes - provides direct measurements of atmospheric parameters to correlate with other measurements and computer codes being generated in the Auroral E program.

The approach is to use sounding rockets to measure the following parameters in the auroral E layer: 1) electron flux and differential energy distributions from 1 eV to 20 KeV, 2) proton flux and differential energy distributions from 5 KeV to 60 KeV, and 3) volume emission rates and total column emission rates from atomic oxygen at 5577 Angstroms, 2972 Angstroms and 1356 Angstroms, from neutral nitrogen in the LBH bands and 2nd positive bands, from ionized nitrogen at 3914 Angstroms, from hydrogen beta at 4861 Angstroms, and from the nitrogen dioxide continuum around 5070 Angstroms. All of the measurements will be made from a single rocket payload in the altitude range between 90 and 180 km.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, NAVY ENVIRONMENT - SYNTHETIC APERTURE RADAR SENSING OF THE OCEAN SURFACE
R.A. Shuchman, Environmental Research Inst. of Michigan, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (DN675694; N00014-76-C-1048)

All-weather remote assessment of coastal wave spectra is desirable for a variety of naval and Marine Corps operations; it may also provide clues on underwater topography. Only the synthetic aperture radar offers sufficient resolution for this task. Theoretically, it is not known how this will work because the target moves but it has been shown that in many cases useful results can be obtained.

Contractor will use his own SAR data base for testing developed imagery models, develop a technique to accurately measure surface roughness by SAR, further develop direct Fourier derivation techniques for wave spectra and apply enhancement techniques. Application of results so far achieved under this contract to problems of Navy investigators, and participation in upcoming information SAR-using experiments, will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0030, METHODS OF GEOBOTANICAL PROSPECTING - GRADUATE STUDENT RESEARCHERS PROGRAM
D.M. Gates, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Botany, *Ann Arbor, Michigan* 48104 (NGT 23-005-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0031, THE EFFECT OF MOISTURE STRESS ON MULTISPECTRAL RADIATION FROM AGRICULTURAL CROPS
B.L. Blad, University of Nebraska, Lincoln Campus, School of Agriculture, Dept. of Agricultural Engineering, *Lincoln, Nebraska* 68508 (NGT 28-004-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0032, REMOTE ICE THICKNESS AND STRENGTH DETERMINATION
A. Kovacs, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (DA0C8144)

The technical objective is to evaluate remote sensing techniques for detection of ice thickness and strength. The purpose is to provide methodology which can be used by the Army in the field for determining if an ice sheet (river, lake or sea) will support tactical vehicles. Information will be transferred to other government agencies.

The approach will be to evaluate electromagnetic methods for measuring ice thickness and physical properties which can be used to evaluate the bearing capacity of a desired ice crossing by military vehicles. This will include the evaluation of platforms needed to transport the remote sensing equipment. From this evaluation, system concepts for determining, by remote techniques, the trafficability of an ice sheet will be developed.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0033, OPTICAL/ELECTROMAGNETIC CHARACTERISTICS OF COLD REGIONS MATERIALS
H.W. O'Brien, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (DA0D8152)

To support the 'DOD Plan for Atmospheric Transmission Research and Development' and the DARCOM program relating to 'The Use of Realistic Battlefield Conditions Throughout the Army' by providing fundamental information concerning (a) the electro-optical characteristics of snow cover as a target background and of airborne snow and cold fog as obscuring aerosols, and (b) the dielectric properties of snow, ice and frozen soil surfaces under various cold regions conditions.

Study the spectral reflectance and transmission characteristics of snow and the effect of fog/snow obscuration. Interpret results of laboratory and field measurements. Determine in situ dielectric properties in the VHF and UHF bands of snow, ice and frozen soils through measurements of ground-wave wave-tilt and field strength attenuation. Disseminate results to users to provide a basis for improved design and performance of materiel. Foreign state-of-the-art is being considered.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0034, NAVY ENVIRONMENT - ATMOSPHERIC WATER VAPOR
T. Ashworth, South Dakota School of Mines & Technology, School of Engineering, Dept. of Physics, *Rapid City, South Dakota* 57701 (DN323084)

To fill the need for an expendable, in situ humidity sensor for very low atmospheric humidity to be used in conjunction with the development of remote sensing tecniques for water vapor in the atmosphere. The aim of this research is to attack the complex problems involved in the development, testing,

calibration and modification of such sensors. The research will benefit Navy efforts to cope with the refractive index problems that hamper modern weaponry.

The present research effort involves determination of the optimum constructional geometry, film thickness and film purity of a silicone oxide, low humidity sensor. Also included is an attempt to model the response time of humidity-sensitive devices considering the influence of diffusion on the film surface. A study is being made of the problem of thermodynamic equilibrium between the film surface and the air stream. New sensors are being tested down to a dew-point of -70 degrees C.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0035, GRADUATE STUDENT RESEARCHERS PROGRAM
L.A. Taylor, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Geological Science, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NGT 43-001-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0036, GRADUATE STUDENT RESEARCHERS PROGRAM
M.A. Dungan, Southern Methodist University, School of Humanities & Sciences, Dept. of Geological Sciences, *Hillcrest & University, Dallas, Texas* 75222 (NGT 44-007-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0037, SHEARING OF ATMOSPHERICALLY DRIVEN NEAR-SHORE DYNAMICS
D.W. McGrail, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Oceanography, *College Station, Texas* 77843 (NGT 44-001-801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Jet Propulsion Lab.

5.0038, COMMUNICATIONS - DETERMINING THE EARTH'S MAGNETOSPHERIC STATE FROM COSMIC RAY ANISOTROPIES
J.T. Ely, University of Washington, School of Arts & Sciences, Dept. of Geophysics, *Seattle, Washington* 98105 (DN775381; N00014-77-C-0392)

Geomagnetic storms degrade or disrupt naval communications, navigation, and surveillance systems. There is indirect evidence that connection of a southward interplanetary magnetic field to the geomagnetic field may trigger magnetic storms either through increased entry of solar wind particle flux, stimulated field-line reconnection, or some combination. This experiment will measure the change in geomagnetic configuration due to connection by detecting anisotropies in the galactic cosmic ray flux. If successful, short-term forecasts of geomagnetic activity could be possible. Periods of geomagnetic activity are associated with spacecraft charging events that have caused permanent or temporary spacecraft damage, possibly due to increased solar wind entry.

Data from the ONR-305 experiment on the S3-4 satellite will be analyzed and correlated with the interplanetary magnetic field, geomagnetic indices, and spacecraft charging events.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0039, JOINT USE OF FACILITIES FOR ESTABLISHING OPERATIONAL CAPABILITIES OF WASHINGTON STATE AGENCIES & MUNICIPALITIES IN USE OF IMAGE PROCESSING
L.T. Krebs, Washington State University, School of Arts & Sciences, Dept. of Environmental Science, *Administration Bldg., Room 101, Pullman, Washington* 99163 (NCA 2-840001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, TERRAIN VISUAL CUE REQUIREMENTS FOR FLIGHT SIMULATION
G.H. Buckland, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223200)

1. To investigate the relative utility of different types of terrain visual cues for low altitude visual flight simulation. 2. To evaluate the relative importance of the trade-offs between the limited number of possible visual cues. 3. To develop the optimum visual scene for ASPT, for use in other research and training which require low altitude visual flight simulation.

Dual phase experiments will be used. Experienced pilots will participate in either the landing or NOE studies. The general approach will be to vary the types of visual cues available to the pilots and to study the effects of these cues upon their subsequent performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, E-3A MISSION SIMULATOR (MS) FOT AND E PHASE II
W.H. Nelson, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224260)

Specific objectives requiring AFHRL support include: assess the psychological fidelity and the ECM simulation fidelity of the MS, assess the instructional features of the MS, assess the capability of the simulation support function, assess the human factors engineering of the simulation support capsule, assess the training capability of the MS.

AFHRL/FTR will provide on-site evaluation of the capability of the instructional and simulation support features in the capsule to provide a functional environment for training mission crew tasks. This includes data collection, processing, and analysis. AFHRL/SM will process computer cards which will be mailed by the test team once per month and will provide quarterly and final analysis summaries to include, but not be limited to, deficiencies and conclusions/recommendations. AFHRL will also provide written summaries (interim and final) to include conclusions, recommendations and potential deficiencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, CHANGES IN CORTISOL AND ANTIDIURETIC HORMONE DURING INDUCED MOTION SICKNESS IN SQUIRREL MONKEYS
R.A. Fox, California State University & Colleges, San Jose State University, School of Humanities & the Arts, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCC 2-72)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, USMC AIR NAVIGATION TRAINING
O.A. Larson, U.S. Dept. of Defense, Navy, Personnel Research & Development Center, *San Diego, California* 92152 (DN797567)

To develop a program for training Marine Corps fixed-wing pilots in navigation and target acquisition techniques that will allow them to operate at low altitudes over unfamiliar terrains.

Map interpretation, terrain analysis, and target acquisition techniques will be developed and evaluated. Materials and methods will be field-tested using cinematic and sensor simulation support. Flight navigation problems specific to USMC operational requirements will be analyzed and recommendations forwarded.

SUPPORTED BY U.S. Dept. of Defense, Navy, Personnel Research & Development Center

6.0005, GRADUATE STUDENT RESEARCHERS PROGRAM
J.A. Smith, Colorado State University, School of Forestry & Natural Resources, Dept. of Forest & Wood Sciences, *Fort Collins, Colorado* 80523 (NGT 06-002-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0006, IMPROVEMENT OF VISION AND ORIENTATION UNDER WHITE-OUT CONDITIONS
J.A. Kinney, U.S. Dept. of Defense, Navy, Naval Submarine Medical Research Lab., Vision Div., *Naval Submarine Base, Groton, Connecticut* 06340 (DN977590)

Military operations in the cold regions of the world are frequently hindered by loss of visibility due to weather conditions. 'White-outs' refer to a uniform visual field of white with no horizon; this may be caused by fogs, ice-fogs, snow or a unique polar condition in which light is reflected back and forth between snow and cloud cover. Whatever the cause, the potential dangers are severe - interference with the mission, loss of orientation, and possible loss of life. While 'staying-put' is the only recommended action in white-out, it could be disastrous for some military or medical missions. The goal of this work unit is the development and testing of alternate procedures - techniques or devices which might assist individuals in finding their way during white-out.

A variety of techniques, devices and training procedures will be tested for effectiveness in restoring vision during white-out, first in laboratory simulations and then in field conditions. The techniques, ranging from the use of lenses and goggles to orientation procedures, were selected since understanding of the physiology of the visual system suggests they might be effective.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0007, EVOLUTIONARY RELATIONSHIPS AMONG BACTERIA - THERMOPHILES AND MESOPHILES
E.J. Johnson, Tulane University of Louisiana, School of Medicine, Dept. of Microbiology & Immunology, *1430 Tulane Ave., New Orleans, Louisiana* 70112 (NCA 2-800001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, CARDIOVASCULAR CIRCADIAN RHYTHMS
F.M. Sulzman, State University of New York, Binghamton Campus, Graduate School, *Vestal Parkway, Binghamton, New York* 13901 (NGT 33-188-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0009, BIOLOGICAL MATERIAL PROPERTIES AND BIODYNAMIC MECHANISMS
I. Kaleps, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320830)

It is of utmost importance in the development of aerospace manned systems to be able to predict the injury potential to the human occupant of such systems during the design phase. Various approximate analytic and computer modeling techniques have been developed for this purpose; however, the proper implementation of these methods requires a detailed knowledge of the structure, dynamic response and injury mechanisms of the human body. It is the purpose of this effort to assimilate such data and reduce them to the proper form for inclusion in various highly sophisticated biodynamic body models. This will allow predictions of human body response to various and complex mechanical force applications and respective assessments of injury potential.

Analytic and computer model descriptions of the function, structure and dynamic behavior of human biodynamic subsystems will be developed. These studies will be paralleled by investigations of spinal material properties and structure as well as ligament, bone and other tissue properties, infrasound interaction with respiratory function and internal forces and ranges of motions of joints. Efforts will be made to integrate the subsystem characteristics into more encompassing models describing segmental or total body response.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0010, VCASS LABORATORY SYSTEMS DESIGN/INTEGRATION
D.F. Kocian, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321150)

To perform the systems analysis and design of the overall visually coupled airborne systems simulator (VCASS), including the visually coupled systems (VCS) components (helmet-mounted sight/helmet-mounted display), scene/graphics generators, and crew station, computational, software data base subsystems. To specify the configuration of VCS and scene generation components to be developed on contract. To integrate these components into a laboratory systems demonstration of the VCASS concept. The ultimate product of this program will be an extremely cost-effective, high fidelity visual scene simulation capability to be utilized for engineering design as well as training applications. This effort supports AFSC development goals TC-2, TC-4, TC-5, MS-4, and TN-1.

The overall VCASS effort will exploit the unique capabilities of the visually coupled system (helmet-mounted sight/display) technology in order to provide a self-contained ground/airborne man-in-the-loop visual display scene simulator for performing man-machine interface design and engineering of cockpit control/display subsystems. Initially, an interim laboratory demonstration capability will be developed by integrating existing helmet-mounted sight and display components into a cockpit mock-up with an interface to a programmable symbol generator. A demonstration will then be performed to show the conceptual use of the VCS as a hemispherical head-up display. Psychophysical studies will be conducted to determine the critical VCASS design factors such as the required instantaneous field-of-view of the helmet-mounted display, display update rate, angular resolution/update rate of the helmet-mounted sight and trade-off between monocular versus binocular display viewing. As a result of these findings, advanced VCS components will be specified and developed through separate contractual efforts. Simultaneously, a comprehensive systems analysis and system design will be performed for developing an advanced laboratory demonstration of the VCASS concept.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0011, AFTI/F-16 ACCELERATION PERFORMANCE EVALUATION
R.E. Van Patten, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF326410)

The upcoming generation of six degree-of-freedom (6DOF) aircraft typified by the AFTI/F-16 will subject pilots to new acceleration environments by combining 6DOF capabilities with those of conventional aircraft. The objective of this work is to quantify the effects of these 6DOF-generated acceleration environments on pilot performance in air-to-air and air-to-ground combat, and to investigate principles for new seats and restraints suitable for use in 6DOF aircraft. The early work in this effort will be focussed on critical AFTI/F-16 restraint problems which must be quantified by February 1, 1980 in order to meet airframe and pilot-vehicle interface (PVI) deadlines as scheduled by the AFTI/F-16 ADPO (AFFDL/FI) and the contractor, General Dynamics. A memorandum of agreement between AFFDL/FI and AFAMRL/BBS has been approved to cover current and out-year research in this area.

The general approach will involve man in the (control) loop experimentation using the AFAMRL dynamic environment simulator (DES), which is a multi-gimballed human centrifuge. Research in FY80 will concentrate on AFTI/F-16 restraints and biodynamic cross-coupling between rudder pedals and the side-stick controller induced by the lateral acceleration

forces commanded by rudder inputs. Subsequent experimentation will advance into simulation of air-to-ground and air-to-air engagements using both conventional airframe motions compared to 6DOF aircraft capabilities. Theoretical work will be merged into these experiments in order to exploit previous work in the development of mathematical describing functions of pilot tracking performance.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0012, EFFECTS OF HIGH ACCELERATION-INDUCED BRAIN BLOOD FLOW DISTRIBUTION ON HUMAN OPERATOR PERFORMANCE

J. Yoder, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322450)

To measure the effect of Gz acceleration on cerebral blood flow rate and the impact of this stress-response interaction on human operator performance. To evaluate the relationships of cerebral blood flow values determined by radioactive microsphere distribution to cardiac output. To determine the efficacy of cerebral blood flow rate manipulation in terms of performance enhancement. This technology will define those physiological criteria which contribute to the optimization of human performance.

The effect of acceleration on intracerebral blood flow distribution will be determined by the injected radioactive microsphere technique. The rationale of indirect assessment of cerebral perfusion on the basis of cardiac output determination will be tested. Cerebral blood flow distribution as determined by radioactive microsphere dispersion will be correlated with simultaneous dye dilution cardiac output determinations in animals. A broad spectrum of cardiac output values will be induced by provocative measures such as cardiac pacing and acceleration. Modification of the behavioral effects of acceleration-associated cerebral blood flow rate by a variety of flow augmentation techniques will be delineated in instrumented, performance-trained animals.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, EQUILIBRIUM DEPRIVATION AND ITS EFFECTS ON THE NERVOUS SYSTEM

H.B. Hartman, Texas Tech University, School of Arts & Sciences, Dept. of Biological Science, *P.O. Box 4340, Lubbock, Texas* 79409 (NGT 44-011-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0014, ANALYSIS OF CAREER MOTIVATION-CAREER POTENTIAL INDEX

E. Boyle, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Lackland Air Force Base, San Antonio, Texas* 78236 (DF233720)

The objectives of this effort are as follows: (1) to develop a data base for a longitudinal study of career motivation, (2) to determine changes in career motivation during first-term and the reasons for those changes, (3) to identify factors related to positive career motivation, and (4) to explore the feasibility of developing a career potential index.

A large sample (approximately 30,000) of NPS airmen will be administered a biographical/attitudinal survey at the 12-, 24- and 36-month points of their initial tour. Distribution and regression analyses, and chi square analyses will be accomplished to track career motivation and predictability of career intent/career decision.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0015, MAJCOMS AND BASE-LEVEL SUPPORT

J.A. Boydstrun, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322000)

The objective of this work unit is to provide direct support to requestors for assistance through utilization of the existing aerospace medicine technology data base, the expertise of the Clinical Sciences Division staff, and where required, the expertise of USAFSAM resources outside of the Clinical Sciencies Division.

The approach to be utilized will involve initial division staffing of the specific request to determine the full spectrum and scope of the endeavor, the individuals to participate in the evaluation and the assignment of opr to a specific Clinical Sciences Division scientist. All available division resources will be subject to utilization at one time or another, including the various medical information files, the accumulated patient evaluation records from the aeromedical consultation service, and also the accumulated years of aeromedical experience and judgment. Anticipated products will be a summary of evaluations and analyses which may be in a simple letter reply, a USAFSAM technical report, or published paper. This is a new start work unit for fiscal year 1977.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0016, USAFSAM CARDIOVASCULAR DISEASE FOLLOW-UP STUDY CLINICAL EVALUATION

R.S. Dryden, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323070)

Provide clinical evaluation in a standardized environment to identify the earliest signs of occult or latent coronary artery disease and relate these to the 20-plus years of risk factor data which have been accumulated on this selected population. This information would be assimilated into refined selection and retention criteria for officer candidates in order to select and retain those least likely to suffer from premature cardiovascular disease.

Perform a thorough examination at USAFSAM to evaluate each subject's cardiovascular system and all risk factors, including all applicable medical and laboratory tests. Devote special attention to motivating subjects, both active and inactive, to participate in the study. Collate the data obtained from multivariate analysis of risk factors. Apply the results to the problems of (a) improved selection of candidates for pilot training, and (b) early identification of individuals prone to heart disease. This work was previously documented under work units 7930-07-05 and 7755-14-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0017, NEUROPSYCHOLOGICAL SEQUELAE AND PATTERNS OF DEFICIT IN USAF AIRCREW MEMBERS WITH CLOSED HEAD INJURY

R.D. Wheatley, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324320)

To establish base rates and a collection of descriptive data regarding neuropsychological and other psychometric sequelae and patterns of deficit in USAF aircrew members with closed head injury.

Compare the psychometric test performances of 50 closed head-injured aircrew with those of 50 non-head-injured matched aircrew controls. Objective neuropsychological, intellectual, and personality measures are used. Inter-group as well as intra-individual comparisons will be carried out so that inferences derived from levels and patterns of performance can be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0018, ESTABLISHMENT OF STANDARDIZED EXERCISE STRESS TESTS FOR DETECTION OF CORONARY ARTERY DISEASE IN AIRCREW MEMBERS

R.A. Wolthuis, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321620)

The presence of coronary artery disease (CAD) significantly affects the patient's aeromedical disposition. Detection of

CAD is thus an important continuing effort, and the use of exercise stress testing is the cornerstone of this effort. This work unit is designed to develop new exercise stress test methods, to implement and evaluate them at USAFSAM, and to promote the use of successful methods in the field.

The approach will consist of several concurrent tasks: 1) treadmill stress ECG reproducibility will be investigated in patients with and without CAD, and the effect of propranolol pretreatment on subsequent ECG response will be studied; 2) software will be developed, tested and implemented for on-line acquisition and analysis of treadmill ECG data; 3) treadmill ECGs from the past several years will be reviewed to see if patterns emerge that separate those with and those without CAD. These patterns will be correlated with other known risk factors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, STABLE BOUNDARY APPROXIMATIONS FOR DIFFERENCE METHODS FOR COMPRESSIBLE FLUIDS

J. Oliger, Stanford University, School of Humanities & Sciences, Dept. of Computer Science, *Stanford, California* 94305 (NCA 2-745004)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0002, A VECTORIZED MULTIGRID FOR THE CAUCHY-RIEMANN EQUATIONS

J.W. Thomas, Colorado State University, School of Natural Sciences, Dept. of Mathematics, *Fort Collins, Colorado* 80523 (NCA 2-165001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0003, URBAN AREA CHANGE DETECTION PROCEDURE WITH REMOTE SENSING DATA

J.R. Jensen, University of Georgia, Franklin College of Arts & Sciences, Dept. of Geography, *Athens, Georgia* 30601 (NAS 5-26129)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0004, CLIMATOLOGICAL AND STATISTICAL DATA ANALYSIS

L. Burke, Regis College, Undergraduate School, Dept. of Mathematics, *235 Wellesley St., Weston, Massachusetts* 02193 (DF279870; F19628-76-C-0009)

AF function - design of aerospace systems. Deficiency - Require meteorological data in greater detail and complexity for adequate design and aerospace operational doctrine. Research - methods of synthesizing and presenting available information. How research contributes -describes the variability of atmospheric parameters in formats required in Air Force design and operation. Objective - the objective of this program is to perform mathematical and statistical operations on all types of meteorological observational data. This includes analysis and evaluation of meteorological records, rocket and balloon flight data, aircraft and field test data.

Apply statistical and meteorological theory along with computer techniques to the climatic record.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

7.0005, THREE-DIMENSIONAL TRANSONIC FLOW ANALYSIS

G.E. Chmielewski, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF043730; F44620-76-C-0096)

AF function - advanced aerospace vehicles. Opportunity - improved flow-field prediction methods in the transonic regime. Objective -develop a computational program which will permit calculation of steady, inviscid transonic flow-fields around complex three-dimensional bodies. How research contributes - development of this technique will help reduce present requirement for extensive and expensive wind tunnel testing.

A method will be developed for the solution of the transonic full potential equation using the finite difference analog to the governing differential equation. A rectangular computational grid derived from either Cartesian or skewed coordinates will be used and complicated global mappings will be avoided. The exact surface boundary conditions will be enforced on embedded curved surfaces using interpolation among surface-adjacent points.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, RANDOM CHOICE METHODS AND CORRESPONDING ONE-SIDED SCHEMES FOR HYPERBOLIC CONSERVATION LAWS

A. Harten, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (NCA 2-525001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0007, IMPROVING CONVERGENCE TO THE STEADY STATE

D.C. Jespersen, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Mathematics, *126 Agricultural Hall, Corvallis, Oregon* 97331 (NCA 2-586001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0008, AN ANALYSIS OF THE LOGAIR DISTRIBUTION SYSTEM USING OPTIMIZATION PRINCIPLES

J.L. Kennington, Southern Methodist University, Graduate School, Dept. of Operations Research, *Hillcrest & University, Dallas, Texas* 75222 (DF046150; AFOSR-77-3151)

AF function - to administer the LOGAIR air freight network that provides the equipment and supplies required by the major USAF installations. Deficiency - the two civilian carriers make no routing or scheduling determinations. This is done by personnel at AFLC, using methods based on experience and certain estimations. The result is an arrangement that is almost surely far from best. Objective - to bring some mathematical theory of scheduling and integer programming to bear on the problem to increase the amount of freight transported or to decrease the cost of the transportation operation. How work contributes - the work would be the only theoretical effort that addresses this particular problem. Any improvement, even if not the optimum solution, would result in cost savings of millions of dollars to the Air Force.

A combination of improved interfacing among routes, better scheduling, and alternative aircraft assignments matched to flow requirements, would significantly alleviate the present deficiencies in costly, abnormally long 'pipeline' times. The methods to be used are part of the science of mathematical programming.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, DEVELOPMENT OF SOFTWARE FOR SYNTHETIC APERTURE RADAR (SAR) DIGITAL DATA PROCESSING

C.R. Griffin, University of Texas, Austin Campus, Applied Research Lab., *200 W. 21st, Austin, Texas* 78712 (NAS 9-16104)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, INVESTIGATION OF LASER ACTION IN MOLECULES WITH INDUCED DIPOLE AND WEAK DIPOLE MOMENTS (TMP162)

W.B. McKnight, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Physics, *Huntsville, Alabama* 35807 (DA0G2520; DAAH01-80-C-0210)

Develop new high power laser concepts for future Army application. Experiments leading to lasers based on homonuclear diatomic molecules will be performed.

A theoretical investigation and analysis, numerical calculations, and experiment design and investigation on vibrational transitions in molecules having no intrinsic dipole moment or only a very weak one shall be carried out to develop an induced or weak dipole moment molecular laser. The case of molecules with induced dipole moments, in which an electric field is used to induce the dipole, shall be explored and calculations performed to establish operating conditions which will yield laser action. Calculations shall be based on H2. Stimulated emission cross-sections and inversion densities required for laser threshold shall be calculated. An experiment shall be defined to demonstrate feasibility of the induced dipole laser.

SUPPORTED BY U.S. Dept. of Defense, Missile Command, Directed Energy Directorate

8.0002, SURVEILLANCE - MULTIPHOTON DISSOCIATION OF MOLECULAR IONS

J.R. Peterson, S R I International, Molecular Physics Center, *333 Ravenswood Ave., Menlo Park, California* 94025 (DN775004; N00014-76-C-1035)

In this work the multiphoton dissociation of positive and negative ions is being studied. These processes are important to the naval areas of propagaton of high intensity laser beams and of the future applications of lasers to chemical processing and isotope separation.

The multiphoton dissociation of positive and negative ions such as SF(6)(negative), CF(3)I(positive) and CF(2)Cl(2)(positive) is being studied. The fragment identity, kinetic energy spectrum, and dependence of multiphoton dissociation on frequency and energy are being studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0003, ULTRALOW TEMPERATURE PHYSICS

R.E. Packard, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (DMR79-25098)

Research supported under NSF grant No. DMR-7682934 will be continued and extended. This research encompasses two broad areas: the study of vortex dynamics in superfluid helium-four by means of vortex photography and ultra-low temperature research on the B phase of helium-three. The research on vortex lines is directed toward understanding the detailed dynamics of simple rotating superfluid systems using direct photography and time-lapsed movies. The research concerned with helium-three is multifaceted and includes experiments on critical currents, fourth sound, dielectric constant anisotropy, orbital ferromagnetism and the fountain effect.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, A THEORETICAL STUDY OF PLASMA PHYSICS

B.D. Fried, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY77-12873 A03)

Research in theoretical plasma physics initiated under NSF grant PHY77-12873 will be continued. Several fundamental problems in the physics of plasmas (collections of electrically charged particles) are being attacked using both analytical and numerical techniques. Since non-neutral plasmas (consisting almost entirely of electrons) have been stably confined by a combination of cylindrically symmetric electric and magnetic fields for times larger by 100 million-fold than the escape time for a particle in the absence of an electric field, they provide an excellent test bed for many topics in basic plasma theory. The general dynamics and thermodynamics of such plasmas, including the character of the particle orbits, the effects of self-consistent electrostatic forces, and the role of adiabatic invariants in the behavior of the plasma are being studied. The relationship between the important and perplexing phenomenon of anomalous heat transport in plasmas and the magnetic fluctuations observed in experiments at UCLA and elsewhere is also being investigated. A new method of integrating plasma equations of motion over long times using the technique of discrete Hamiltonian mapping equations has been initiated, which should allow certain computer simulations of plasmas to be much more rapid. Finally, a correct kinetic theory of wave propagation in the classic configuration of a cylindrical plasma in a sheared magnetic field (one whose direction changes as one moves across the field) is being developed.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0005, TUNABLE SOLID-STATE LASERS USING DIVALENT RARE-EARTH IONS

R.K. Chang, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DF049910; AFOSR-77-3433)

AF function - the Air Force is seeking tunability in solid-state lasers for optical communication and electronic warfare, including jamming. Opportunity - substituting tunability in solid-state lasers for tunability in liquid dye lasers over certain optical frequency ranges. In general, the former are more convenient than the latter for AF uses. Objective - investigate the feasibility of attaining lasing in the optical frequency range using divalent rare earth ions instead of the usual trivalent ions and employing homogeneously broadened upper energy levels to attain tunability. How work contributes - success of project will broaden availability of tunability frequency ranges for solid-state lasers.

Initially the laser involves the divalent rare-earth ion Eu in a chloride crystal host (e.g., CaCl2, BaCl2, SrCl2) as the material, a transition from the homogeneously broadened upper level in the 4f(N-1) 5D band to the narrow lower energy level in the 4FN configuration, and the pumping of the 4F(N-1) 5D band with a standard, incoherent, flash lamp or a pulsed N2 laser. The former will provide pumping for thick layered lasers and the latter for thin layers. Also, wavelength tuning with a grating reflector will be attempted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0006, PLASMA RADIATION PHYSICS

J. Davis, U.S. Dept. of Defense, Navy, Naval Research Lab., Plasma Physics Div., *Washington, District of Columbia* 20375 (DN080035)

To develop state-of-the-art electron impact scattering formalisms and computer codes describing the interaction between electrons and complex atoms and ions including the plasma microfield effects.

The collision process will be treated quantum-mechanically. Dressed particle aspects will be considered by replacing the Coulomb potential with a screened potential.

SUPPORTED BY U.S. Dept. of Defense, Naval Research Lab., Material & Rad Science & Tech Directorate

8.0007, ZEEMAN STUDIES OF UNIDENTIFIED ACCEPTOR LEVEL IN EXTRINSIC SILICON

A.S. Edelstein, University of Illinois, Chicago Circle Campus, School of Liberal Arts & Sciences, Dept. of Physics, *601 S. Morgan St., Chicago, Illinois* 60680 (DF057650; AFOSR-80-0092)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communication systems. The development of extrinsic silicon-based infrared detectors is dependent upon the knowledge and control of dopants and impurities. Opportunity - this research should improve the ability to develop detectors for the 3-5 and 8-14 micrometer ranges and large detector arrays. Objective - the objective is to optimize detector performance by controlling the doping level of the residual impurities in silicon, as well as that of the major dopants. How work contributes - this work will help establish improved crystal growth conditions for silicon detector materials.

Photoconductivity measurements in a magnetic field will be made to determine the multiplicity of unidentified acceptor levels in extrinsic silicon with group III acceptors. A consideration of the symmetry will be to help identify the acceptor levels.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0008, DEEP-LEVEL DEFECTS IN SEMICONDUCTORS

S. Sundaram, University of Illinois, Chicago Circle Campus, School of Liberal Arts & Sciences, Dept. of Physics, *601 S. Morgan St., Chicago, Illinois* 60680 (DN875661; N00014-78-C-0732)

The operation of solid-state electron devices used in Navy electronics systems is controlled by the electronic nature of impurity atoms incorporated in the semiconductor materials. Deep-level impurities do not contribute directly to the material conductivity but affect carrier lifetime and recombination proceses. Such impurities and their effects are not understood and must be investigated for improving solid-state devices.

Studies will be made of the electronic properties of deep-level defects in gallium arsenide (GaAs) and indium phosphide (InP) produced by imputities such as chromium and iron. Photoluminescence measurements with and without uniaxially applied stress will be made to deduce the valence states and resultant energy levels of the impurity. Theoretical models based on crystal field theory will be developed to correlate predictions of luminescent intensities and energy of deep levels with the experimental results. Various valence states will be considered, configuration mixed representations of the multi-electron systems will be used, and crystal symmetry models for various possible impurity configurations in the lattice will be included in the analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0009, PROPAGATION OF DISTURBANCES ON THE OCEAN SURFACE - GRADUATE STUDENT RESEARCHERS PROGRAM

O. Phillips, Johns Hopkins University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *34th & Charles Sts., Baltimore, Maryland* 21218 (NGT 21-001-980)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

8.0010, REVIEW AND EVALUATION OF PHYSICAL SCIENCES PROGRAM, AFOSR

A.J. Dragt, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DF018080; F44620-76-C-0074)

AF function - this contract will make available to the directorate of physics specialized research evaluations pertinent to the different disciplines in physics, especially those of primary interest to the Air Force. Deficiency - expertise in all fields of physics is needed and available only through access to investigators in the field. Objective - to permit the directorate to more adequately plan research programs and to assess or interpret the merit of the research. Contribution - as stated above.

This contract will make available to the directorate of physics specialized research evaluation pertinent to the different disciplines in physics, especially those of primary interest to the Air Force.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0011, GRADUATE STUDENT RESEARCHERS PROGRAM

F.B. McDonald, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NGT 21-002-803)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0012, RARE-EARTH LASER MATERIALS

A. Linz, Massachusetts Inst. of Technology, Crystal Physics Lab., *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN880114; N00014-78-C-0251)

Growth, fabrication and characterization of various fluoride and oxide host crystals with one or more trivalent rare-earth ions as dopants or major constituents.

Host crystals with various dopants to be selected by contract monitor will be grown or purchased. Samples of appropriate size will be fabricated and tested and supplied to NRL.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0013, PHYSICS OF INTENSE CHARGED PARTICLE BEAM

R. Davidson, Massachusetts Inst. of Technology, Plasma Fusion Center, *Cambridge, Massachusetts* 02139 (DN980181; N00173-79-C-0036)

The area of charged particle beam technology is becoming increasingly importat to the Department of the Navy. This program theoretically investigates the equilibrium, stability, transport and radiation properties of intense charged particle beams. The objective of the program is to develop theoretical scaling laws defining the importance of the processes mentioned previously.

Theoretical and computational plasma physics techniques will be applied to the investigation of the stability and transport properties of intense ion beams. The cyclotron maser instability will be investigated in parameter ranges of interest to the NRL gyrotron program. Theoretical studies will be undertaken of non-linear effects as they pertain to microstability behavior and anomalous transport in high-temperature plasmas.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0014, DEFECTS IN SEMICONDUCTORS

C. Penchina, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Amherst, Massachusetts* 01002 (DN675518; N00014-76-C-0890)

Development of electronic and optical components for naval communications and surveillance systems will require increased understanding of the properties of semiconductors. Understanding of the role of impurities and defects is imperative to the preparation of such materials and to prediction of their behavior in devices and in a radiation environment.

The investigator is using a variety of techniques to investigate the electronic nature of the deep level states in gallium arsenide produced by oxygen and chromium impurities. These techniques include photoionization cross-sections, photo-Hall effect, photocapacitance, and cathodoluminescence measurements. The effects of stress on these measurements are used to deduce defect symmetry properties, and temperature effects are used to deduce relationship of defect state to the band structure of the solid. Photoluminescence spectra having phonon sideband induced structure will be used to determine the magnitude of Franck-Condon shifts. Theoretical studies of the temperature dependence of the energy levels and on photoionization cross-sections will continue. Also calculations will be made on electroabsorption processes and their relation to site symmetries.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0015, MICROSCOPIC THEORY OF QUANTUM FLUIDS AND EXTENDED NUCLEAR SYSTEMS

J.W. Clark, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR80-08229)

Research previously supported by DMR78-08552.

A theoretical problem of considerable importance to many subfields of physics is the prediction of the ground-state and low-temperature properties of complex quantum systems, starting from a knowledge of the basic interactions between the constituent particles. In earlier sponsored research, a powerful method (called the method of correlated basic functions) has been developed for microscopic description of the especially challenging and fundamental class of systems in which the interactions between the particles are very strong at short distances. Examples of such systems include liquid helium, atomic nuclei, and the matter inside neutron stars. A comprehensive program of studies aimed at quantitative understanding of the microscopic structure and behavior of these highly degenerate systems will be carried out. Further formal development of the method of correlated basis functions will concentrate on the efficient incorporation of effects due to state-dependent correlations. Specific theoretical predictions will then be derived concerning the normal and superfluid properties of liquid helium-3, nuclear matter, and neutron-star matter, the stability of highly spin-polarized hydrogen and helium systems, and short-range correlations in finite nuclei. The results may be expected to have significant implications in the broader arenas of low-temperature physics, dense-matter astrophysics, and nuclear-structure theory.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, EFFECTS OF LARGE AMPLITUDE ION ACOUSTIC WAVES ON THE BEAM PLASMA INSTABILITY

J. Walsh, Dartmouth College, School of Arts & Sciences, Dept. of Physics, *P.O. Box 833, Hanover, New Hampshire* 03755 (DF049590; AFOSR-77-3410)

AF function - operation of high altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand advanced equipment unavailable to date. Deficiency - present-day information is inadequate to design the aforementioned equipment. Such information may be obtained from experimental and theoretical work on beam-plasma nonlinear interactions. Objective - this project will investigate the effects of large amplitude ion acoustic waves on the beam-plasma instability. Contribution - this work is a part of a comprehensive program on plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications and the development of countermeasures.

This project will perform experimental and theoretical research on two beams: a fast electron beam which is propagated in a plasma containing large amplitude short wavelength ion acoustic waves. In this experiment the following processes appear: 1. The beam drives a long wavelength plasma wave unstable. 2. This wave couples its energy strongly to a much shorter wavelength plasma wave. The main objective is to isolate the effect of the large amplitude ion acoustic wave upon the beam-plasma processes of interaction of the relativistic beam with a plasma, specifically the generation of microwave radiation. This may be accomplished by: 1. Stimulated Cerenkov radiation of which considerable evidence exists, and 2. Stimulated Raman-Cerenkov radiation of which there is no experimental evidence. To accomplish the foregoing they will explore: 1. The capability of the basic stimulated Cerenkov oscilliator-amplifier, 2. the possibility of driving coupled dielectric resonators and other dielectric structures, and 3. the characteristics of various stimulated Raman-Cerenkov sources.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0017, SPECTROSCOPY OF ALKALI ATOMS TRAPPED IN RARE-GAS MATRICES

L.C. Balling, University System of New Hampshire, University of New Hampshire, School of Liberal Arts, Dept. of Physics, *Durham, New Hampshire* 03824 (PHY80-05511)

This investigation in atomic physics will study the interaction between specific types of atoms as the distance between them (which can be controlled) is held constant. The energy-level structure of alkali atoms trapped in various sites in rare-gas matrices at liquid-helium temperatures will be determined. Pulsed one- and two-step dye laser excitation will be used to locate the excited states; the lifetimes of these states and the wavelength distribution of the luminescence will be observed. Comparisons of the experimental results with theoretical calculations, carried on concurrently, will be made to determine the nature of the trapped sites. The effect of the rare-gas matrix on the energy-level structure of the alkali atoms will be calculated, using the same technique employed to compute alkali rare-gas diatomic potentials.

This is the first year of a 2-year continuing grant, and a continuation of that research previously supported under NSF grant PHY78-05369A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0018, NONLINEAR PROCESSES IN PLASMAS

R.M. Kulsrud, Princeton University, School of Engineering & Applied Sciences, Dept. of Astrophysical Sciences, *Box 430, Princeton, New Jersey* 08540 (DF040390; F44620-75-C-0037)

AF function - operation of high altitude vehicles in a post-nuclear explosion environment. Development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demands the fundamental understanding of nonlinear evolution of energy transformations in plasmas. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research program. Objective - this program will investigate nonlinear collective phenomena, such as anomalous transport phenomena, linear wave absorption, and plasma wave turbulence, both in the laboratory and in space. Contribution - this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications and the development of countermeasures.

This is a theoretical study of nonlinear processes in plasma physics. The proposed topics for study are (1) the drift-wave instability and its relation to magnetic field break-up, (2) convection cells in nonsimple geometries, (3) the maximum rate at which forced magnetic reconnection can proceed, (4) the theory of stochastic orbits in quasi-random magnetic fields and its relation to plasma transport, and (5) the general theory of the ionospheric turbulence. In the study of the drift wave instability, the effect of inhomogeneous magnetic fields will be evaluated. The possibility that reconnection rates based on fluid theory are

much smaller than previous theoretical predictions will be investigated by Kulsrud and Kaw, not only from a theoretical point of view, but from comparison with known experiments in nature and in the laboratory. Perkins will try a new numerical approach to plasma turbulence which involves a separate treatment of the very small scales. This allows the computer to proceed more rapidly with the larger scales. Perkins will continue his treatment of turbulent processes in the atmosphere. Foote and Kulsrud will investigate the plasma dispersion relation making use of new computer techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0019, THEORY OF PHASE TRANSITIONS IN RANDOM SYSTEMS

M.J. Stephen, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR78-10276)

Research previously supported by DMR75-13350.

Theoretical research in condensed matter physics will be carried out. The main emphasis will be on the application of renormalization group methods to phase transitions in random systems. Of particular interest are those systems exhibiting strong randomness near the percolation threshold. Among the topics to be considered will be (a) pure percolation problems, (b) phase transitions in random magnets near the percolation threshold, and (c) the conductivity of random resistor networks and its relation to phonons in a random lattice and spin waves in random ferromagnets.

This research will enhance the understanding of the behavior of an important class of materials, i.e., disordered solids under conditions near a phase transition.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, EXPERIMENTAL INVESTIGATION OF ELECTRON LOCALIZATION PHENOMENA IN DISORDERED SYSTEMS

D.F. Holcomb, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR78-10728)

Materials of interest in this investigation are disordered substitutional impurity systems which undergo an insulator-to-metal transition as a function of composition. The ability to reliably predict properties of a given material depends, among other things, upon firmly known answers to two questions: (1) What is the mechanism for electron localization in these materials? (2) What is the correct model to use to describe electron transport in the regime of strong scattering of electrons, just at the transition concentration? Concerning the first question, experiments will be carried out to test the relevance of the Anderson localization model to the metal-insulator transition in semiconductor impurity systems, in sodium tungstate crystals, and a new class of untested materials. Initial experiments will use multiple doped crystals, SiB, Al, Ga and SiLi, P, As, to study the effect which a spread in the value of impurity binding potentials has upon the value total impurity concentration at which electron delocalization occurs. This value will be monitored by measurements of electrical conductivity and Hall constant at low temperature. Concerning question (2), studies of NMR relaxation times will be used to measure electron jump times as functions of composition and temperature, in order to study the evolution of the strong-scattering regime as one moves from delocalized to localized electron states.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, ELECTRONIC STATES AT METAL-SEMICONDUCTOR INTERFACES

A.J. Sievers, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DF053440; AFOSR-78-3684)

AF function - microwave solid-state electronic devices are essential elements of Air Force surveillance, electronic countermeasures, and communication systems. Opportunity - little is known about the metal-semiconductor interface electronic states that produce the Schottky barrier and there have been only a few techniques that could study these electronic states. Objective - the objective of this research is to study metal-semiconductor interface states using new IR techniques. How work contributes - this research should provide additional knowledge on the physical nature of interface electronic states that would indicate how these states could best be used in a new generation of submicron electrical and optical devices.

An IR surface electromagnetic wave spectrometer and a Fourier transform ellipsometer will be designed and constructed. The excitation spectrum of the electronic interface states will be examined for metal in contact with both group IV and III-V semiconductors with initial research on Ge-Au and Ge-Ag systems by measuring the surface electromagnetic wave absorption as a function of pressure, temperature, D.C. electric field and magnetic field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0022, SOME NONLINEAR TRANSPORT FLUCTUATIONS IN CONDENSED MATTER

W.W. Webb, Cornell University, Ithaca Campus, School of Engineering, Dept. of Applied & Engineering Physics, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR80-06513)

Experimental studies of nonlinear transport phenomena in condensed matter systems previously supported by NSF grant DMR 7700311A02 will be continued. Experiments will be carried out to study: vorticity fluctuations in turbulent fluid transport utilizing a new optical measure of local vorticity and defects in pseudo-dimensional systems, particularly smectic liquid crystals and molecular bilayer membranes. These experiments are designed to elucidate the putatively nonlinear transport fluctuations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0023, X-RAY DIFFRACTION, INTERFERENCE AND HOLOGRAPHY

N. George, University of Rochester, Graduate School, *Administration Bldg., Rochester, New York* 14627 (DF051510; AFOSR-78-3563)

AF function - non-destructive testing of structural members of aerospace vehicles could benefit greatly from the development of three-dimensional X-ray holography. Deficiency - holographic techniques are highly developed for electromagnetic radiation in the visible spectrum. X-ray holographic techniques, however, have not been developed and little, if any, research has been attempted to develop them. Objective - the objective of this research is to develop X-ray holographic techniques that can be utilized to evaluate non-destructively the interior of structural members of aerospace vehicles. How work contributes - this research could lead to the above objective.

Basic studies will be conducted in X-ray optics directed toward a critical evaluation of the feasibility of X-ray holography. The theory of partial coherence will be used to analyze interference methods for the characterizations of x-ray sources, including DAS GUPTA's narrow line sources. Related studies of recoding media, microscopy, zone-plate imaging, speckle and photomixing will be performed

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0024, STUDY OF ELECTRON IMPACT OF LASER MEDIA

D.E. Golden, University of Oklahoma, Norman Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (ECS79-10029)

The experimental program is aimed at the measurement of the basic parameters necessary for the design of lasers pumped by electron impact. The parameters being measured are the electron impact excitation cross-sections, optical branching ratios of the subsequent decays, excited state lifetimes, polarization of the radiation, and collisional deactivation decay and energy transfer rates in the case of metastable excitation for a number of target atoms and molecules. Measurements are being made on cross-sections to excitation of fine structure states and the accompanying collision parameters in electron-photon correlation experiments and in electron scattering experiments from state-selected atoms and molecules. The measurements are at sufficient electron energy resolution so that particular attention can be directed towards the role of resonances in the excitation process.

This is a continuation of research previously supported under ENG-7682943.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

8.0025, GRADUATE STUDENT RESEARCHERS PROGRAM

R.A. Anthes, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (NGT 39-009-801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0026, GRADUATE STUDENT RESEARCHERS PROGRAM

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0027, MINORITY CARRIER INJECTION INTO MATERIALS CONTAINING TRAPS

H.K. Henisch, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR79-13178)

Recent findings in transport theory suggest that the presence of traps may play a major role in modifying the effect of injected minority carriers on the electric field profile and hence on the local effective resistivity of semiconducting materials. The present series of experiments will be continued in order to verify these findings and, in particular, to measure the local field maximum (effective resistance increase) at low current densities. High grade germanium will be mounted with electrodes in situ. Field profile measurements will be made before and after neutron irradiation. The experimental results to date are in qualitative and quantitative agreement with theory but they need to be extended to higher trap densities. The results of these studies are expected to lead to basic modification of the transport theory for injection in semiconductors.

This is a continuation of research previously supported by NSF grant DMR-7680619.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, STATISTICAL MECHANICAL STUDIES OF PHASE TRANSITIONS

M.S. Green, Temple University, Graduate School, Dept. of Physics, *1821 N. Broad St., Philadelphia, Pennsylvania* 19122 (DMR78-07201)

Research previously supported under DMR74-01951. Theoretical research in condensed matter physics will be carried out. Statistical mechanics will be used to investigate the dynamics of first- and second-order phase transitions, the foundations of the equations of hydrodynamics, the nature of the critical point in a Van der Waals fluid and the mathematical properties of the renormalization group.

This research is focused on understanding the fundamental behavior of condensed matter near a critical point or phase transition.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0029, HIGH FIELD BUBBLE CHAMBER AND MULTIPARTICLE SPECTROMETER EXPERIMENTS

C.E. Roos, Vanderbilt University, School of Arts & Sciences, Dept. of Physics & Astronomy, *21st Ave. S., Nashville, Tennessee* 37232 (PHY80-01621)

There are three current experiments at Vanderbilt which study multi-quark exotic states. These include S-159 at CERN, which is looking for S equals 2 dibaryon states using the reaction K-d yields K-plus X-minus, where the K-plus is detected by a missing mass spectrometer; and two double-Vee experiments using the multiparticle spectrometers at BNL (705) and FNAL (580). The BNL and FNAL experiments are identical in concept but have 2 mass ranges for the possible new quantum states. They study the reaction pi-p vovo plus X at 23 CeV/c and at 300 GaV/c and the 0 to 4 trigger of the MPS can look for states with 0 ions, 2 ions, 4 ions etc. Further studies related to using the unique sample of 100K sigmas are under way, such as lifetime studies. Extensions of S. Reucroft's charm lifetime experiment, NA13/CERN, are expected to be part of the Vanderbilt program in the next couple of years.

This is the first year of a two-year continuing grant, previously supported under NSF award PHY77-27087 AO1.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0030, ZONAL WIND DYNAMICS IN THE ATMOSPHERES OF JUPITER AND SATURN FROM VOYAGER IRIS MEASUREMENTS - GRADUATE STUDENT RESEARCHERS PROGRAM

J.W. Chamberlain, Rice University, Graduate School, Dept. of Space Physics & Astronomy, *6100 Main St., Houston, Texas* 77001 (NGT 44-006-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0031, INVESTIGATIONS IN X-RADIATION STIMULATION

K. Das Gupta, Texas Tech University, School of Arts & Sciences, Dept. of Physics, *P.O. Box 4340, Lubbock, Texas* 79409 (DF035070; AFOSR-76-3098)

AF function - non-destructive testing of structural members of aerospace vehicles could benefit greatly from the development of an X-ray laser for use in three-dimensional holography. Deficiency - attempts to develop an X-ray laser by standard population inversion techniques have been unsuccessful primarily because of short lifetimes of excited states. Objective - the objective of this research is to investigate the nature of nearly non-divergent beams of X-rays (hot spots) which apparently are generated by hitherto undiscovered processes and to use this radiation to make three-dimensional holograms of opaque materials. How work contributes - an understanding of the nature of these hot spots could lead to or contribute to the development of X-ray lasers and three-dimensional holography could lead to

important non-destructive testing techniques for structural materials.

The nearly non-divergent beams of X-rays will be studied to determine their penetration properties in various materials, role of stimulated emission, and the degree of coherence and polarization. Three-dimensional holograms will be made in collaboration with Prof. N. George of the University of Rochester

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0032, GRADUATE STUDENT RESEARCHERS PROGRAM

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

8.0033, A STUDY OF PHYSICAL PROCESSES FOR SPACE-RADIATION PROTECTION

G.S. Khandelwal, Old Dominion University, School of Sciences & Health Professions, Dept. of Physics Geophysics, *P.O. Box 6173, Norfolk, Virginia* 23508 (NCC 1-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0034, INFLUENCE OF SPUTTERING PARAMETERS ON FILM STRUCTURE

C.R. Houska, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Materials Engineering, *Blacksburg, Virginia* 24061 (DMR80-00933)

This research focuses on the interrelationships between the sputtering parameters and the fine structure of the resultant films. These parameters control the local energy distributions of bombarding particles at the film surface and therefore the concentration of embedded defects found in as-prepared films. Films with embedded atoms can be made with improved mechanical stability, low resistivity and high reflectivity. These will be characterized in terms of non-uniform dislocation strains, strains introduced by embedded atoms interacting with various boundaries, uniform macrostrains and crystal orientation. Samples will be prepared with different substrates so that the defect structures due to sputtering alone can be distinguished from those resulting from differential contractions on cooling.

This is a renewal of NSF Grant DMR75-17201.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, ION COLLISION STUDIES

R. Geballe, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (PHY80-02079)

Two experimental projects are proposed. The first is an extension of their study of photodetachment (from K-) to other alkali negative ions (Li-, Na-, ...). They will ascertain branching ratios for decay of the ions under photon bombardment into excited states of the neutral residues by detecting the optical decay radiations. From these ratios, information about the structure and dynamics of the negative ions can be deduced. They hope to learn whether previously observed qualitative deviations from existing theory are general. They also will measure stripping cross-sections from the above ions.

The second part of this proposal is a study of electron capture by highly stripped ions using various gas targets. Ions such as C plus 5, C plus 6, O plus 7 and O plus 8 are formed in a laser-induced plasma which is produced by focusing the output of a CO2 laser onto a suitable solid target. Electrostatic and time-of-flight techniques will be used to determine cross-sections for a particular charge and energy. This study will cover collision energies from 100 eV to 10 KeV, a previously unexplored area. The results should help to determine which of several theoretical models are correct and will be pertinent in the areas of fusion and X-ray lasers.

This research is a continuation of that currently supported under NSF grant PHY78-00856.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, A STUDY OF THE FACTORS INFLUENCING THE PERFORMANCE AND MORALE OF SMALL RESEARCH GROUPS IN ISOLATION

C.H. Castore, Purdue University, School of Humanities Social Science & Education, Dept. of Psychological Sciences, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NCA 2-605001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SPECTROPOLARIMETRY OF LATE-TYPE VARIABLE STARS

G.V. Coyne, University of Arizona, Lunar & Planetary Lab., *Tucson, Arizona* 85721 (INT77-20882)

In this award NSF provides funds to permit Dr. George Coyne of the Lunar and Planetary Observatory of the University of Arizona to carry on a cooperative research program with Drs. Antonio M. Magalhaes and Sayd J. Codina of the Institute of Astronomy and Geophysics of the University of Sao Paulo, Brazil.

Their work on Spectropolarimetry of Late-Type Variable Stars is part of a larger effort for the exploration of the properties of the atmospheres of these pulsating stars. This work on narrow band spectropolarimetry should provide some of the missing information on the atmospheres of long-period variable stars. The large number of these stars indicates their importance in the process of stellar evolution.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

10.0002, THEORETICAL COSMOGONY

P.H. Bodenheimer, University of California, Santa Cruz Campus, Lick Observatory, *Mount Hamilton, California* 95140 (AST79-21263)

This project is designed to improve our knowledge of the origin and early history of the solar system and of the giant planets and their satellite sytems. The basic assumptions are that the Sun and planets formed about the same time out of a rotating, flattened 'solar nebula' and that the giant planets formed out of subcondensations of this nebula. Specific problems to be attacked include: (1) the process by which the solar nebula forms out of an interstellar cloud fragment, (2) the mechanisms by which angular momentum is removed from the center of the nebula to allow formation of the Sun, (3) the stability of the nebula to bar-like perturbations that might cause it to break up into a binary star system, (4) the mechanisms by which single stars form rather than binary or multiple systems, and (5) the process by which a rotating subcondensation evolves to form a central planet and a regular satellite system. Analogies between the solar system as a whole and the Jupiter-Saturn systems will be explored. These questions will be investigated theoretically with the aid of numerical computer programs which solve the equations of hydrodynamics in two or three space dimensions.

Observational and experimental evidence will be used to constrain possible models.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0003, LABORATORY INFRARED SPECTRAL MEASUREMENTS OF MOLECULES OF INTEREST IN ATMOSPHERIC CHEMISTRY

D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM79-14165)

High-resolution infrared absorption spectra of individual atmospheric trace gases will be obtained in a laboratory measurement program. Emphasis will be given to gases having current interest in problems of trace-gas effects in atmospheric chemistry. Included are gases believed to affect the stratospheric ozone layer, e.g., nitrous oxide and the halocarbons. Other substances of interest in the program are hydrogen peroxide, nitric acid, carbonyl sulfide, hydrogen sulfide, carbon disulfide, sulfur dioxide, formaldehyde, ammonia, and certain hydrocarbons. Priority selections from this list will be influenced by current findings in a parallel field observation program.

The spectra obtained in the project will be useful for identifying trace gases observed by ground-based observations of atmospheric absorptions of molecular spectral lines, and for other purposes. The spectral region to be studied is from 700 to 4000 reciprocal centimeters. Readings will be taken at resolutions of 0.05 and 0.015 reciprocal centimeters. Experimental conditions will be adjusted to obtain spectra corresponding to molecular bands and gas concentrations considered feasible for observation in the solar spectrum. Attention will be given to the spectra of potentially interfering species as well as to spectra of target molecules.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0004, SPACE RESEARCH TECHNOLOGY

T.A. Chubb, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN320221)

To develop and construct demonstration devices of value to the Navy and DOD based on technology developed for the rocket program, e.g., IR, visible and UV surveillance sensors based on image converters and solid-state arrays used in space astronomy. To develop devices needed for the NRL rocket and satellite program, position determining X-ray sensors, band-sensitive optical detectors, thick film electronic packaging techniques and counter-shift register circuitry, telemetry decoding systems and computer data interfaces.

Image converter designs developed in the far UV astronomy program are adapted to other spectral bands. Imaging techniques are developed for X-rays. Large area X-ray sensors are developed for X-ray astronomy. Spectral modulation sensor systems are developed to detect line radiation sources against continuum background in IR.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

10.0005, HYDROXYL MASERS AND THE STRUCTURE OF LONG PERIOD VARIABLE CIRCUMSTELLAR MASS FLOW

J.D. Fix, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (AST79-25076)

This research program will be devoted to a program of high resolution observations of the velocity and spatial structure of certain regions surrounding long period variable stars. These regions contain the hydroxyl molecule (OH). The radio emission from the molecule, interpreted with the help of models of masers in circumstellar mass flows, should considerably improve our understanding of the conditions which exist in the material flowing from long period variable stars into interstellar space. The observations will be made using high frequency resolution single telescope spectra and high spatial resolution data obtained using very long baseline interferometric techniques.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0006, THEORETICAL STUDIES OF THE EVOLUTION OF ROTATING STARS

A.S. Endal, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (AST79-19688)

The effects of rotation on the structure and evolution of stars remains an open question. To a large degree, this can be attributed to difficulties in determining how angular momentum is transported from the contracting core to the expanding envelope of an evolving star. Recent numerical calculations based on linear analyses of angular momentum transport mechanisms have resulted in substantial progress in this area. However, the results need to be tested by quantitative comparisons of predicted and observed properties of rotating stars. This requires additional calculations specifically geared toward those stars whose observed surface properties provide the strongest constraints on the theoretical calculations.

Calculations of the evolution and rotation of stellar models will be pursued in order to predict (and compare with observations of) the following quantities: a) surface rotation rates, positions in the HR diagram, and mass loss rates for Be stars; b) the distribution of surface rotation rates of O stars; c) the range of surface rotation rates of K giants and supergiants (evolved stars with convective envelopes); and d) changes in the surface abundances of CNO-nuclei resulting from rotationally induced mixing.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0007, GRADUATE STUDENT RESEARCHERS PROGRAM

E.A. Boldt, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NGT 21-002-804)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0008, GRADUATE STUDENT RESEARCHERS PROGRAM

W.K. Rose, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NGT 21-002-801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0009, GRADUATE STUDENT RESEARCHERS PROGRAM

D.G. Wentzel, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NGT 21-002-802)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0010, GALACTIC AND EXTRAGALACTIC ASTRONOMY

B.F. Burke, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST79-20984)

A program for the study of the active nuclei of quasars and galaxies, the structure of radio and normal galaxies, and the dynamics of high velocity clouds and the interstellar medium will

be carried out. The research will require the use of the technique of Very Long Baseline Interferometry (VLBI), the Very Large Array (VLA) and other major instruments of the National Radio Astronomy Observatory, the Haystack Radio Observatory, and the Arecibo 1000 ft. radio telescope. The interactions between the various components of the radio sources, including the questions of maser formation, the generation of relativistic particles, and the relationships between normal galaxies, radio galaxies, Seyfert galaxies, and quasars will be studied.

This research was previously supported under grant AST-7726896AO1.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0011, COLLABORATIVE SOLAR RADIO ASTRONOMY

K. Lang, Tufts University, Medford Campus, Graduate School, Dept. of Physics, *Medford, Massachusetts* 02155 (INT80-06066)

The award supports collaborative research in solar radio astronomy between U.S. scientists at Tufts University and Italian scientists at the Arcetri Observatory. The project takes place under the auspices of the U.S.-Italy Cooperative Science Program of the National Science Foundation and the Italian National Research Council (CNR).

The objective of the collaboration is to study the three-dimensional structure of the coronal atmosphere and the time development of the coronal magnetic field before and during the emission of solar flares in order to advance the state of knowledge about solar active regions. Simultaneous observations will be undertaken at a variety of wavelengths at two major radio telescopes, the Very Large Array in New Mexico and the Westerbork Synthesis Radio Telescope in the Netherlands.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

10.0012, PLAN AND ESTABLISH THE PRELIMINARY INTERFACE BETWEEN THE ORBITER AND THE MIXER RECEIVER SYSTEM

K.S. Yngvesson, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Astronomy, *Amherst, Massachusetts* 01002 (NAS 5-26151)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0013, A STUDY OF THE CLOSE BINARY SYSTEM VW CEPHEI

A.P. Linnell, Michigan State University, School of Natural Sciences, Dept. of Astronomy & Astrophysics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (AST80-02116)

Observations in BVRI bands will be obtained at Kitt Peak of the W-subclass W UMa star VW Cephei. These observations will be combined with existing photometric data in an attempt to represent this sytem on the Anderson-Shu theory. Solutions will also be sought on the model represented by light synthesis solutions in the literature, and the ability of the two models to represent W-subclass systems will be compared. The additional constraint provided by the Anderson-Shu line profile model will be evaluated. Analysis of the V-R or V-I color data will be used to determine whether the less massive component in W-subclass systems is hotter than the primary. The existing photometric data will be analyzed in an attempt to characterize cycle-to-cycle light variations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0014, PROTOTYPE GE:GA DETECTORS FOR A COOLED GRATING SPECTROMETER

J.R. Houck, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Astronomy, *Ithaca, New York* 14850 (NCC 2-79)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

GENERAL

11.0001, DEVELOP AND EVALUATE A PERFORMANCE AND COST MODELING CAPABILITY FOR THE NASA DATA MANAGEMENT SYSTEM

Unknown, Purdue University, Graduate School, *Executive Bldg., West Lafayette, Indiana* 47907 (NAS 5-26196)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

11.0002, 10TH SUMMER RESEARCH PARTICIPATION PROGRAM

N.K. Proctor, Morgan State University, School of Arts & Sciences, Dept. of Biology, *Baltimore, Maryland* 21212 (NGT 21-025-080)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

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01 AERONAUTICS (GENERAL)

N80-33336* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 125
Aug. 1980 125 p
(NASA-SP-7037(125)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 407 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1980. Author

N80-33337 Society of Experimental Test Pilots, Lancaster, Calif.
TECHNICAL REVIEW, VOLUME 15, NO. 1
1980 52 p refs
(Issue-1) Copyright Avail: Issuing Activity

Oblique wing aircraft, circulation control wing flight tests, and stall/spin flight tests are discussed. A brief review of loss of consciousness and methods for avoiding it are discussed. For individual titles, see N80-33338 through N80-33341.

N80-33338* National Aeronautics and Space Administration, Hugh L. Dryden Flight Research Center, Edwards, Calif.
THE OBLIQUE WING-RESEARCH AIRCRAFT **c02**
William H. Andrews. *In* Society of Experimental Test Pilots Tech. Rev., Vol. 15, No. 1 1980 p 4-5 ref (For primary document see N80-33337 24-01)
Avail: Issuing Activity

The AD-1 airplane was designed as a low cost, low speed manned research tool to evaluate the flying qualities of the oblique wing concept. The airplane is constructed primarily of foam and fiberglass and incorporates simplicity in terms of the onboard systems. There are no hydraulics, the control system is cable and torque tube, and the electrical systems consist of engine driven generators which power the battery for engine start, cockpit gages, trim motors, and the onboard data system. The propulsion systems consist of two Microturbo TRS-18 engines sea level trust rated at 220 pounds. The airplane weighs approximately 2100 pounds and has a performance potential in the range of 200 knots and an altitude of 15,000 feet. E.D.K.

N80-33339 Grumman Aerospace Corp., Bethpage, N.Y.
CIRCULATION CONTROL WING (CCW) FLIGHT TESTS **c05**
Chuck Sewell. *In* Society of Experimental Test Pilots Tech. Rev., Vol. 15, No. 1 1980 p 6-35 (For primary document see N80-33337 24-01)
Avail: Issuing Activity

The circulation control wing (CCW) design involves converting the trailing edge of the airfoil into an enlarged rounded surface to which a jet of air adheres when blown tangentially from the upper surface. The resulting high augmentation of circulation lift reduces landing approach and takeoff velocities and distances and offers options for increased airplane payload and wing loading. The A-6A airplane was selected as the demonstration testbed, primarily because of aerodynamics. The determining factors in its selection were its aspect ratio, full span flaps, horizontal tail area, moderate wing sweep, airfoil thickness, and twin engines. E.D.K.

N80-33340* National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
NASA GENERAL AVIATION STALL/SPIN FLIGHT TESTING Status Report **c05**
James M. Patton, Jr. *In* Society of Experimental Test Pilots Tech. Rev., Vol. 15, No. 1 1980 p 36-49 refs (For primary document see N80-33337 24-01)
Avail: Issuing Activity CSCL 01C

A comprehensive program incorporating spin tunnel, static and rotary balance wind tunnel, full scale wind tunnel, free flight radio control model, flight simulation, and full scale flight testing was undertaken. Work includes aerodynamic definition of various configurations at high angles of attack, testing of stall and spin prevention concepts, definition of spin and spin recovery characteristics, and development of test techniques and emergency spin recovery systems. Some of the more interesting results to date are presented for the first airplane in the program in the areas of tail design, wind leading edge design, mass distribution, center of gravity location, and small airframe changes, with associated pilot observations. Design philosophy of the spin recovery parachute system is discussed, in addition to test techniques. E.D.K.

N80-33341 Air Force Hospital, Davis-Monthan AFB, Ariz.
LOSS OF CONSCIOUSNESS IN HIGH PERFORMANCE FIGHTERS (WHAT TO DO ABOUT IT) **c52**
Peter R. Nash. *In* Society of Experimental Test Pilots Tech. Rev. Vol. 15, No. 1 1980 p 50-52 (For primary document see N80-33337 24-01)
Avail: Issuing Activity

The solution for loss of consciousness is to increase the ability of the pilot to withstand rapid onset, high G loading. This can be done through conditioning and training of the aircrews, and better life support equipment. Methods for improving G tolerances are reviewed. E.L.K.

N80-33342*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
CONCEPTUAL STUDY OF AN ADVANCED SUPERSONIC TECHNOLOGY TRANSPORT (AST-107) FOR TRANSPACIFIC RANGE USING LOW-BYPASS-RATIO TURBOFAN ENGINES
Shelby J. Morris, Jr., Willard E. Foss, Jr., and Milton J. Neubauer, Jr. Sep. 1980 96 p refs
(NASA-TM-81872) Avail: NTIS HC A05/MF A01 CSCL 01C

An advanced supersonic technology configuration concept designated the AST-107, using a low bypass ratio turbofan engine, is described and analyzed. The aircraft had provisions for 273 passengers arranged five abreast. The cruise Mach number was 2.62. The mission range for the AST-107 was 8.48 Mm (4576 n.mi.) and an average lift drag ratio of 9.15 during cruise was achieved. The available lateral control was not sufficient for the required 15.4 m/s (30 kt) crosswind landing condition, and

a crosswind landing gear or a significant reduction in dihedral effect would be necessary to meet this requirement. The lowest computed noise levels, including a mechanical suppressor noise reduction of 3 EPNdB at the flyover and sideline monitoring stations, were 110.3 EPNdB (sideline noise), 113.1 EPNdB (centerline noise) and 110.5 EPNdB (approach noise). Author

N80-33343# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
CRITERIA FOR APPLYING COMMERCIAL AIRCRAFT WARRANTIES IN USAF AIRCRAFT PURCHASES M.S. Thesis
Jack L. Grubb and Thomas O. Sutliff. Jun. 1980. 142 p. refs. (AD-A088774; AFIT-LSSR-37-80). Avail: NTIS. HC A07/MF A01. CSCL 15/5

The airlines' criteria in evaluating warranties to determine if these commercial practices can be used by Air Force buying activities were studied. Criteria to evaluate warranties were obtained from the trunk airlines through interviews and a questionnaire. The airlines' rankings of the criteria were compared to rankings by Aeronautical Systems Division (ASD) contracting experts. The airlines and the Air Force emphasize different factors in evaluating warranties. The greatest difference was the emphasis placed on cost effectiveness of a warranty by the ASD experts compared to the lack of emphasis on this factor by the airline experts. The Air Force contracting experts have a false perception of airline practices in evaluating aircraft warranties. T.M.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-33344 Ohio State Univ., Columbus.
A COMPREHENSIVE INVESTIGATION INTO THE SUPERSONIC VISCOUS FLOW ABOUT A SLENDER CONE AT HIGH ANGLE OF ATTACK: EXPERIMENTAL AND THEORETICAL RESULTS Ph.D. Thesis
Thomas Stuart Rice. 1980. 305 p.
Avail: Univ. Microfilms Order No. 8022333

An experimental and theoretical investigation of the flow field in the vicinity of a cone at angle of attack was conducted. Experimental tests were performed on a slightly blunted, eight degree half angle, right circular cone. Tests were carried out using air at a Mach number of 5.4 and a Reynolds number of 2.1 million based on free stream conditions. Since at these conditions a laminar boundary layer exists over the entire body surface, the turbulent case was studied by inducing artificial transition. Surface temperature distributions, obtained from measured infrared emittance profiles exhibited by the model surface, provided quantitative verification of transition, in addition to qualitative data concerning surface heat transfer rates which was obtained with phase change coatings. Surface and base pressure distributions were measured for attack angles up to 15 degrees using both the clean and trip nosed models. In addition, a particular attempt was made to characterize the nature of the fluctuating pressure field in the base region of the model. Dissert. Abstr.

N80-33345*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL UNSTEADY AERODYNAMICS OF CONVENTIONAL AND SUPERCRITICAL AIRFOILS
Sanford S. Davis and Gerald Malcolm, N. Aug. 1980. 100 p. refs. Document includes a microfiche supplement.
(NASA-TM-81221; A-8294). Avail: NTIS. HC A04/MF A01. CSCL 01A

Experimental data on the unsteady aerodynamics of oscillating airfoils in transonic flow are presented. Two 0.5 m-chord airfoil models - an NACA 64A010 and an NLR 7301 - were tested in the NASA-Ames 11 by 11 foot Transonic Wind Tunnel at Mach numbers to 0.85, at chord Reynolds numbers to 12 million and at mean angles of attack to 4 deg. The airfoils were subjected to both pitching and plunging motions at reduced frequencies to 0.3 (physical frequencies to 53 Hz). The new hardware and the extensive use of computer-experiment integration developed for this test are described. The geometrical configuration of the model and the test arrangement are described in detail. Mean and first harmonic data are presented in both tabular and graphical form to aid in comparisons with other data and with numerical computations. T.M.

N80-33346*# National Aeronautics and Space Administration, Washington, D. C.
ON THE SWELLING OF ROLLED UP VORTEX SURFACES AND THE BREAKDOWN OF THE VORTEX CORE FOR SLENDER WINGS
Arabindo Das. Oct. 1980. 26 p. refs. Transl. into ENGLISH from Z. Flugwiss. (West Germany), v. 15, 1967. p. 355-362. Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-75862). Avail: NTIS. HC A03/MF A01. CSCL 01A

Simplified models of the vortex distribution over cylindrical surfaces are developed. The effect of a change of vortex strength was analyzed quantitatively by menas of potential theory. The considerable bulging of the cylindrical vortex sheet as a consequence of the change of the vortex strength is discussed. The coiling-up of the vortices rotation in opposite directions over the cylindrical surface renders the condition for instability and the subsequent large spreading of the vortex core. These processes occur without a positive pressure gradient being necessary in the field of flow surrounding the coiled up vortex sheet. T. M.

N80-33347*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A HIGHLY SWEPT ARROW WING CONFIGURATION WITH SEVERAL DEFLECTED LEADING EDGE CONCEPTS
Garl L. Gentry, Jr. and Paul L. Coe, Jr. Jul. 1980. 97 p.
(NASA-TM-80180). Avail: NTIS. HC A05/MF A01. CSCL 01A

The effectiveness of leading edge concepts for minimizing or controlling leading edge flow separation was studied. Emphasis was placed on low speed performance, stability, and control characteristics of configurations with highly swept wings. Simple deflection of the leading edge, a variable camber leading edge system, and a leading edge vortex flow system were among the concepts studied. The data are presented without analysis. J.M.S.

N80-33348*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
A FLIGHT INVESTIGATION OF PERFORMANCE AND LOADS FOR A HELICOPTER WITH 10-64C MAIN ROTOR BLADE SECTIONS
Charles E. K. Morris, Robert L. Tomaine (AVRADCOM, St. Louis, Mo.), and Dariene D. Stevens. Oct. 1980. 146 p. refs.
(NASA-TM-81871; AVRADCOM-TM-80-B-2). Avail: NTIS. HC A07/MF A01. CSCL 01A

A flight investigation produced data on performance and rotor loads for a teetering rotor, AH-1G helicopter flown with a main rotor that had the NLR-1T airfoil as the blade section contour. The test envelope included hover, forward flight speeds from 34 to 83 m/sec (65 to 162 knots), and collective fixed maneuvers at about 0.25 tip speed ratio. The data set for each test point describes vehicle flight state, control positions, rotor loads, power requirements, and blade motions. Rotor loads are reviewed primarily in terms of peak to peak and harmonic content. Lower frequency components predominated for most loads and generally increased with increased airspeed, but not necessarily with increased maneuver load factor. Detailed data for an advanced airfoil on an AH-1G are presented. T.M.

N80-33349*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
COMPARISON OF CALCULATED AND MEASURED HELICOPTER ROTOR LATERAL FLAPPING ANGLES
Wayne Johnson. Jul. 1980. 27 p. refs. Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.

(NASA-TM-81213; AVRADCOM-TR-80-A-11; A-8239) Avail: NTIS HC A03/MF A01 CSCL 01A

Calculated and measured values of helicopter rotor flapping angles in forward flight are compared for a model rotor in a wind tunnel and an autogiro in gliding flight. The lateral flapping angles can be accurately predicted when a calculation of the nonuniform wake-induced velocity is used. At low advance ratios, it is also necessary to use a free wake geometry calculation. For the cases considered, the tip vortices in the rotor wake remain very close to the tip-path plane, so the calculated values of the flapping motion are sensitive to the fine details of the wake structure, specifically the viscous core radius of the tip vortices. Author

N80-33350*# Northrop Corp., Hawthorne, Calif. Aircraft Div.
FLOW VISUALIZATION STUDY OF THE F-14 FIGHTER AIRCRAFT CONFIGURATION
Dale J. Lorincz Sep. 1980 39 p refs
(Contract NAS4-2616)
(NASA-CR-163098; NOR-80-150; H-1135) Avail: NTIS HC A03/MF A01 CSCL 01A

Water tunnel studies were performed to qualitatively define the flow field of the F-14. Particular emphasis was placed on defining the vortex flows generated at high angles of attack. The flow visualization tests were conducted in the Northrop water tunnel using a 1/72 scale model of the F-14 with a wing leading-edge sweep of 20 deg. Flow visualization photographs were obtained for angles of attack up to 55 deg and sideslip angles up to 10 deg. The F-14 model was investigated to determine the vortex flow field development, vortex path, and vortex breakdown characteristics as a function of angle of attack and sideslip. Vortex flows were found to develop on the highly swept glove and on the upper surface of the forebody. At 10 deg of sideslip, the windward glove vortex shifted inboard and broke down farther forward than the leeward glove vortex. This asymmetric breakdown of the vortices in sideslip contributes to a reduction in the lateral stability above 20 deg angle of attack. The initial loss of directional stability is a consequence of the adverse sidewash from the windward vortex and the reduced dynamic pressure at the vertical tails. T.M.

N80-33351*# Sikorsky Aircraft, Stratford, Conn.
ANALYSIS AND CORRELATION OF TEST DATA FROM AN ADVANCED TECHNOLOGY ROTOR SYSTEM Final Report, Mar. 1979 - Jun. 1980
D. Jepson, R. Moffitt, and J. Bissell Hilzinger Jul. 1980 169 p refs
(Contract NAS2-10211)
(NASA-CR-152366; SER-510034) Avail: NTIS HC A08/MF A01 CSCL 01A

The performance and blade vibratory loads characteristics for an advanced rotor system as predicted by analysis and as measured in a 1/5 scale model wind tunnel test, a full scale model wind tunnel test and flight test were compared. The 1/5 scale model rotor predicted conservative full scale rotor performance as expected due to Reynolds number effects. Although blade vibratory moment trends with advance ratio were predicted by the 1/5 scale model, the absolute values of the blade vibratory moments were underpredicted. The full scale model predicted forward flight performance within + or - 5%. Blade vibratory loads, however, were underpredicted. The result of rotor inflow distortions imparted by the flow over the fuselage. The coupled normal modes (Y201) elastic rotor blade analysis incorporating variable inflow was able to predict most of the trends of the test data at the higher advance ratios, but was unable to predict the absolute magnitude of the blade 1/2 peak to peak moments at all cruise speed and rotor lift conditions. A.R.H.

N80-33352# National Inst. for Aeronautics and Systems Technology, Pretoria (South Africa).
THE PROBLEM OF WIND TUNNEL FLOW NONUNIFORMITY IN FREE-MODEL AIRCRAFT DYNAMIC STABILITY
M. E. Beyers Apr. 1979 34 p refs Presented at 51st Semiann. Meeting of the Supersonic Tunnel Assoc., Valencia, Calif. 10-11 Apr. 1979
(CSIR-NIAST-79-60) Avail: NTIS HC A03/MF A01

The significance of flow nonuniformity as a factor determining the ultimate accuracy of wind tunnel dynamic tests is considered. The particular implications for aircraft model free-flight tests are examined on the basis of 6 degree-of-freedom trajectory simulations. A mathematical model is introduced for the simulation of arbitrary flow angularity distributions in wind tunnels with a view to investigating the sensitivity of free flight dynamic stability data with different forms of flow irregularities. It is shown that wind tunnel free flight tests of high-performance aircraft configurations are feasible, and concluded that the direct dynamic derivatives could be determined without any difficulty, while the extraction of dynamic cross-coupling derivatives would be limited only by flow nonuniformities. Author

N80-33353*# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Aeronautics.
STEADY STATE SPURIOUS ERRORS IN SHOCK-CAPTURING NUMERICAL SCHEMES
Lasse K. Karlsen Dec. 1978 25 p refs
(KTH-AERO-TN-60; TRITA-FPT-032) Avail: NTIS HC A02/MF A01

The behavior of the steady state spurious error modes of the MacCormack scheme and the upwind scheme of Warming and Beam was obtained from a linearized difference equation for the steady state error. It was shown that the spurious errors can exist either as an eigensolution of the homogeneous part of this difference equation or because of excitation from large discretization errors near oblique shocks. It was found that the upwind scheme does not permit spurious oscillations on the upstream side of shocks. Examples are given for the inviscid Burgers' equation and for one and two dimensional gasdynamic flows. Author

N80-33354*# Lockheed Missiles and Space Co., Palo Alto, Calif.
NUMERICAL METHOD FOR PREDICTING FLOW CHARACTERISTICS AND PERFORMANCE OF NONAXISYMMETRIC NOZZLES. PART 2: APPLICATIONS Final Report
P. D. Thomas Oct. 1980 117 p refs
(Contract NAS1-15084)
(NASA-CR-3264; LMSC-D678888-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 01A

A computer implemented numerical method for predicting the flow in and about an isolated three dimensional jet exhaust nozzle is summarized. The approach is based on an implicit numerical method to solve the unsteady Navier-Stokes equations in a boundary conforming curvilinear coordinate system. Recent improvements to the original numerical algorithm are summarized. Equations are given for evaluating nozzle thrust and discharge coefficient in terms of computed flowfield data. The final formulation of models that are used to simulate flow turbulence effect is presented. Results are presented from numerical experiments to explore the effect of various quantities on the rate of convergence to steady state and on the final flowfield solution. Detailed flowfield predictions for several two and three dimensional nozzle configurations are presented and compared with wind tunnel experimental data. Author

N80-33355*# Bihrle Applied Research, Inc., Jericho, N. Y.
ROTARY BALANCE DATA FOR A TYPICAL SINGLE-ENGINE GENERAL AVIATION DESIGN FOR AN ANGLE OF ATTACK RANGE OF 8 DEG TO 90 DEG. 1: LOW WING MODEL C Final Report
William J. Mulcay and Robert A. Rose Washington NASA Oct. 1980 915 p
(Contract NAS1-14849)
(NASA-CR-3200) Avail: NTIS HC A99/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a helical flow environment utilizing a rotary balance located in the Langley spin tunnel are presented in plotted form for a 1/6 scale, single engine, low wing, general aviation model (model C). The configurations tested included the basic airplane and control deflections, wing leading edge and fuselage modification devices, tail designs and airplane components. Data are presented without analysis for an angle of attack range of 8 deg to 90 deg and clockwise and counter clockwise rotations covering an omega b/2v range from 0 to .9. Author

N80-33356*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CALCULATION OF THREE-DIMENSIONAL UNSTEADY TRANSONIC FLOWS PAST HELICOPTER BLADES
J. J. Chattot Oct. 1980 32 p refs Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.
(NASA-TP-1721; A-8024) Avail: NTIS HC A03/MF A01 CSCL 01A

A finite difference code for predicting the high speed flow over the advancing helicopter rotor is presented. The code solves the low frequency, transonic small disturbance equation and is suitable for modeling the effects of advancing blade unsteadiness on blades of nearly arbitrary planform. The method employs a quasi-conservative mixed differencing scheme and solves the resulting difference equations by an alternating direction scheme. Computed results showed good agreement with experimental blade pressure data and illustrate some of the effects of varying the rotor planform. The flow unsteadiness is shown to be an indispensible part of a transonic solution. Close to the tip at high advance ratio, cross flow effects can significantly affect the solution. Author

N80-33357*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND: COMPUTER PROGRAM FOR CALCULATION OF THREE DIMENSIONAL POTENTIAL COMPRESSIBLE FLOW ABOUT WIND TURBINE ROTOR BLADES
Djordje S. Dulikravich Oct. 1980 20 p refs
(NASA-TP-1729; E-474) Avail: NTIS HC A02/MF A01 CSCL 01A

A computer program is presented which numerically solves an exact, full potential equation (FPE) for three dimensional, steady, inviscid flow through an isolated wind turbine rotor. The program automatically generates a three dimensional, boundary conforming grid and iteratively solves the FPE while fully accounting for both the rotating cascade and Coriolis effects. The numerical techniques incorporated involve rotated, type dependent finite differencing, a finite volume method, artificial viscosity in conservative form, and a successive line overrelaxation combined with the sequential grid refinement procedure to accelerate the iterative convergence rate. Consequently, the WIND program is capable of accurately analyzing incompressible and compressible flows, including those that are locally transonic and terminated by weak shocks. The program can also be used to analyze the flow around isolated aircraft propellers and helicopter rotors in hover as long as the total relative Mach number of the oncoming flow is subsonic. A.R.H.

N80-33358*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SIMPLE METHOD FOR CONVERTING FREQUENCY DOMAIN AERODYNAMICS TO THE TIME DOMAIN
Earl H. Dowell (Princeton Univ.) Oct. 1980 42 p refs
(NASA-TM-81844; L-13789) Avail: NTIS HC A03/MF A01 CSCL 01A

A simple, direct procedure was developed for converting frequency domain aerodynamics into indicial aerodynamics. The data required for aerodynamic forces in the frequency domain may be obtained from any available (linear) theory. The method retains flexibility for the analyst and is based upon the particular character of the frequency domain results. An evaluation of the method was made for incompressible, subsonic, and transonic two dimensional flows. Author

N80-33359# Calspan Advanced Technology Center, Buffalo, N.Y. Aerodynamic Research Dept.
TRANSONIC SHOCK WAVE - BOUNDARY LAYER INTERACTIONS Final Report
Corso Padova and Theodore J. Falk May 1980 95 p refs
(Contract F44620-76-C-0057; AF Proj. 2307)
(AD-A088831; CALSPAN-AB-5866-A-4; AFOSR-80-0694TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

A series of 2D experiments was performed in a large scale Ludwieg tube to investigate the interactions of a normal shock with a turbulent boundary layer at unit Reynolds numbers 14.8 million and 29.5 million/m and Mach numbers 1.43 and 1.60. In addition, the effects of a diverging flow field downstream of the shock, such as that which might be encountered on an airfoil, were explored by testing with a shock holder having a perforated top wall. The latter experiments were performed at the two Reynolds number values of 9 million and 35 million. Results show that unit Re variations affected the interacting flow only by changing the boundary layer entering the interaction. The surface pressure distribution normalized by the thickness of the incoming boundary layer, which was measured in each experiment, describes an interaction independent of unit Re. In contrast, the interaction flow field was found to be very dependent on Mach number and on constrainment of the subsonic region. In fact, shock configuration, surface pressure, skin friction and velocity profiles were found much more sensitive to these parameters than to the Reynolds number, which was investigated in earlier studies. The bifurcation height and the length of separated flow increased with increasing M. Both quantities responded dramatically to the moderate but sustained flow deflections imposed by the perforated shock holders. The initial rise in surface pressure was found to correlate directly with the height of the bifurcated shock structure. GRA

N80-33360# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
A STUDY OF HYBRID COMPUTING TECHNIQUES FOR TRANSONIC FLOW FIELDS Final Technical Report, 1 Aug. 1978 - 31 Dec. 1979
T. C. Adamson, Jr. and A. F. Messiter Feb. 1980 77 p refs
(Grant AF-AFOSR-3635-78; AF Proj. 2307)
(AD-A088662; UMICH-016294-F) Avail: NTIS HC A05/MF A01 CSCL 20/4

Two problems in which analytical solutions might be used to improve the accuracy of or reduce the computation time of numerical computations are considered. In the first, axisymmetric flow at large distances from a slender body is studied for supersonic and transonic speeds, and the length scales for which viscous effects become important are derived in terms of the slenderness parameter and the Reynolds number. An analytical solution is obtained for a case which appears most likely to be important at supersonic speeds. In the second, solutions are derived for transonic flow in a two dimensional channel with a shock wave, at low Reynolds number. A relationship is derived from which the effects of Reynolds number on the position of the sonic line within the shock wave can be found. GRA

N80-33361# Naval Ship Research and Development Center, Annapolis, Md. Aviation and Surface Effects Dept.
AFTERBODY DRAG. VOLUME 3: LITERATURE SURVEY Final Report
George S. Pick and Richard M. Hartley Jun. 1980 96 p refs
(AD-A088938; DTNSRDC/ASED-80/13-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 20/4

A literature survey was conducted as part of the afterbody drag evaluation project. The results of the survey are presented in four sections: (1) discussion of studies by various authors; (2) list of 119 reports considered applicable to the evaluation; (3) summary of the 119 reports in tabular form; and (4) bibliography of open literature (608 reports and papers). GRA

N80-33362# Transportation Systems Center, Cambridge, Mass.
DETECTION AND ASSESSMENT OF SECONDARY SONIC BOOMS IN NEW ENGLAND Final Report
Edward J. Rickley and Allan D. Pierce (Georgia Inst. of Technology, Atlanta) May 1980 137 p refs Sponsored by DOT Prepared for FAA
(AD-A088160; TSC-FAA-80-10; FAA-AEE-80-22) Avail: NTIS HC A07/MF A01 CSCL 20/1

The results of a secondary sonic boom detection and assessment program conducted by the U.S. Department of Transportation, Transportation Systems Center in New England during the summer of 1979 are presented. Measurements of both acoustic and intrasonic signals were made. Measurement data and ray trace computations demonstrate that the secondary sonic booms frequently reported by New England residents are created by the Concorde passenger flight off the New England coast enroute to Kennedy Airport in New York City. Signal amplitudes showed wide fluctuations from flight to flight, from day to day, and with geographic locations. A brief set of

measurements were made in Applebachsville PA, and showed a similar day to day variability and are correlated with Concorde flights into Dulles Airport in Virginia. T.M.

N80-33363# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
SPECIAL COURSE ON UNSTEADY AERODYNAMICS
Jun. 1980 236 p refs Course held in Rhode-Saint-Genese, Belgium, 10-14 Mar. 1980; sponsored by Fluid Dyn. Panel, von Karman Inst., and the Consultant and Exchange Program of AGARD
(AGARD-R-679; ISBN-92-835-1364-9) Avail: NTIS HC A11/MF A01

A wide range of related unsteady flow phenomena relevant to aeronautical applications are addressed. Aircraft response, aircraft loads, vibration environments, and flight systems analysis are emphasized. For individual titles, see N80-33364 through N80-33380.

N80-33364# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.
SOME INTRODUCTORY CONCEPTS BASED ON THE UNSTEADY FLOW ABOUT CIRCULAR CYLINDERS
G. J. Hancock *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 15 p refs (For primary document see N80-33363 24-02)
Avail: NTIS HC A11/MF A01

The various categories of unsteady flows which are of current interest in an aircraft context are briefly outlined. The wide range of areas of interest in unsteady aerodynamics are considered with respect to the following: (1) attached flow in subsonic and supersonic streams; (2) attached flow at transonic speeds; (3) separated flows; and (4) self induced unsteady flows. R.C.T.

N80-33365# Virginia Polytechnic Inst. and State Univ., Blacksburg.
INTRODUCTION TO UNSTEADY BOUNDARY LAYERS
D. P. Telionis *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 6 p refs (For primary document see N80-33363 24-02)
Avail: NTIS HC A11/MF A01

The basic characteristics of transient and oscillatory boundary layers are demonstrated in terms of elementary solutions of the Navier-Stokes equations for idealized flow situations. A qualitative description is given of the physics of unsteady boundary layers, briefly describing the response of skin friction, velocity profiles, the effects of nonlinearity on velocity and temperature fields, etc. The extension of turbulence models to unsteady flow is briefly discussed. Reversing boundary layers and unsteady separation are also briefly described. R.C.T.

N80-33366# Westland Helicopters Ltd., Yeovil (England). Aeromechanics Dept.
A QUALITATIVE DISCUSSION OF DYNAMIC STALL
T. S. Beddoes *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 6 p refs (For primary document see N80-33363 24-02)
Avail: NTIS HC A11/MF A01

The factors which contribute to the onset of stall are considered with respect to the design of flight vehicles. It is shown that in a dynamic environment, (i.e., guests and manuevering flight) the statically determined loads are likely to be exceeded. An attempt is made to quantify the increase and define percisely the significance of related parameters. R.C.T.

N80-33367# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.
SOME FEATURES OF LINEAR COMPRESSIBILITY
G. J. Hancock *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 9 p (For primary document see N80-33363 24-02)
Avail: NTIS HC A11/MF A01

Some of the characteristic features of linear wave propagation in air at rest are described. Several theoretical prediction methods for inviscid flows are presented in the form of linearized equations to demonstrate the small disturbances on a uniform stream. R.C.T.

N80-33368# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
METHOD FOR INVISCID SUBSONIC FLOWS ABOUT AIRCRAFT CONFIGURATIONS
W. Geissler *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 21 p refs (For primary document see N80-33363 24-02)
Avail: NTIS HC A11/MF A01

A variety of theoretical as well as experimental methods were used to determined unsteady airloads about complex aircraft configurations. Emphasis was also placed on the derivation of the final integral relations serving as the initial equations for special numerical approaches. R.C.T.

N80-33369# Cambridge Univ. (England). Dept. of Engineering.
UNSTEADY AERODYNAMICS IN TURBOMACHINERY
D. S. Whitehead *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 11 p refs (For primary document see N80-33363 24-02)
Avail: NTIS HC A11/MF A01

Unsteady flow phenomena in turbomachines, blade flutter, and methods for unsteady cascades are discussed. The phenomena of inlet maldistribution, rotating stall, surge, blade vibration, and sound generation are described. The types of blade flutter and the modes in which it occurs are then examined and a theoretical method of flutter prediction is discussed. The effects of mechanical damping and mistuning are evaluated. A theory of linearized two dimensional unsteady flow in cascades is outlined for both subsonic and supersonic flow. The importance of the two different kinds of acoustic resonance which occur is then discussed. R.C.T.

N80-33370# Westland Helicopters Ltd., Yeovil (England). Aeromechanics Dept.
UNSTEADY FLOWS ASSOCIATED WITH HELICOPTER ROTORS
T. S. Beddoes *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 8 p refs (For primary document see N80-33363 24-02)
Avail: NTIS HC A11/MF A01

The analytical treatment of helicopter performance and structural loading are addressed with respect to the spacial and temporal variation of the local flow, relative velocity, and angularity. Quasisteady aerodynamics in conjunction with simplified models of rotor inflow and structural characteristics were used to identify many of the fundamental problems which were encountered in the development of a practical vehicle. R.C.T.

N80-33371# Queen Mary Coll., London (England). Dept. of Aeromechanical Engineering.
ROLE OF UNSTEADY AERODYNAMICS IN AIRCRAFT RESPONSE
G. J. Hancock *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 14 p refs (For primary document see N80-33363 24-02)
Avail: NTIS HC A11/MF A01

Some of the main dynamic situations which arise in aircraft response are illustrated. Major emphasis is placed on overall aircraft performance and structural response. R.C.T.

N80-33372# Westland Helicopters Ltd., Yeovil (England). Aeromechanics Dept.
APPLICATION OF IDENTICAL AERODYNAMIC FUNCTIONS
T. S. Beddoes *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 8 p refs (For primary document see N80-33363 24-02)
Avail: NTIS HC A11/MF A01

Relatively simple means for applying the theoretical results for idealized forcing to routine calculations of airloads and structural response are demonstrated. In this context nonlinear system characteristics may be simulated and complex or arbitrary forcing may be included. Initially the aerodynamics are assumed to be more or less linear, that is, the flow is assumed to remain attached but the procedure is intended to provide the parameters required to define the onset of separation. E.D.K.

N80-33373# Royal Aircraft Establishment, Bedford (England). Structures Dept.

EXPERIMENTAL TECHNIQUES IN UNSTEADY AERODYNAMICS

N. C. Lambourne *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 26 p refs (For primary document see N80-33363 24-02)

Avail: NTIS HC A11/MF A01

The role of experiments in the field of unsteady aerodynamics and the methods of simulating unsteady conditions with models in wind tunnels, or other facilities, are outlined. The techniques of measuring unsteady quantities such as aerodynamic force and pressure are described, attention being given to the part played by computers in the acquisition, processing, and presentation of measured data. The choices facing the experimenter and some of the phenomena that may be encountered are discussed. Finally, specific examples of test rigs and test procedures are briefly described. E.D.K.

N80-33374# Virginia Polytechnic Inst. and State Univ., Blacksburg.

EXPERIMENTAL TECHNIQUES FOR UNSTEADY BOUNDARY LAYERS **cB2**

D. P. Telionis *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 12 p refs (For primary document see N80-33363 24-02)

Avail: NTIS HC A11/MF A01

Methods of measuring velocity distribution in unsteady viscous flows and techniques for analyzing and presenting the data are discussed. Both hot wires and laser doppler velocimeters were successfully used to investigate unsteady boundary layers. A variety of flow visualization methods ranging from smoke and tuft observation in air to hydrogen bubbles and solid particles in water, were successfully used in the study of complex unsteady flows, as for example the formation and development of large scale vortices. Recently it was attempted to obtain simultaneously velocity measurements at a point and instantaneous flow visualization. Both laminar and turbulent flows with or without pressure gradients were investigated. Such flows, especially turbulent flows and separating flows require special averaging techniques to disclose their basic characteristics. Typical data from flat plate flows with adverse pressure gradients, separating flows, and flows over oscillating airfoils are presented. E.D.K.

N80-33375# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.

METHODS FOR INVISCID SUBSONIC FLOWS ABOUT UNSTEADY AEROFOILS

G. J. Hancock (British Aerospace Aircraft Group, Bristol, England) and R. Doe *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 10 p refs (For primary document see N80-33363 24-02)

Avail: NTIS HC A11/MF A01

Some of the numerical approaches developed for subsonic flows about two dimensional airfoils are cataloged. Such solutions are useful in their own right, for airfoil results are often used in strip theory approaches in early design stages, but primarily these methods lay down the language and framework for applications in three dimensions. In this paper the flow is assumed to be attached and the boundary layer effects are neglected so the inviscid equations are taken. Although the distinction is artificial, if not misleading, the case of incompressible fluid flow is treated and then secondly the effects of compressibility are introduced. E.D.K.

N80-33376# Virginia Polytechnic Inst. and State Univ., Blacksburg.

ANALYTICAL METHODS FOR PREDICTION OF UNSTEADY LAMINAR BOUNDARY LAYERS

D. P. Telionis *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 13 p refs (For primary document see N80-33363 24-02)

Avail: NTIS HC A11/MF A01

Oscillatory boundary layers were investigated at first via asymptotic expansions in terms of small parameters like the amplitude or the frequency of oscillation. The pioneering work of Lighthill, Moore, Lin, and others is reviewed and subsequent more sophisticated expansions are described. In the last decade a large number of numerical investigations have appeared. Explicit, implicit methods as well as the well known box-method are described and their relative performance is evaluated. Typical examples are compared with classical experimental data. The definition of unsteady separation and criteria for its prediction have generated a lot of interest in the last decade. Analytical methods are discussed for the prediction of unsteady separation. There is still some disagreement on this point with respect to the appearance of the separation singularity. The arguments of both points of view are presented. E.D.K.

N80-33377# Virginia Polytechnic Inst. and State Univ., Blacksburg.

ANALYTICAL METHODS FOR PREDICTION OF UNSTEADY TURBULENT BOUNDARY LAYERS

D. P. Telionis *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 10 p refs (For primary document see N80-33363 24-02)

Avail: NTIS HC A11/MF A01

Almost all of the models for the closure of the turbulent boundary layer equations were extended for the calculation of unsteady flows. The advantages of introducing more governing equations and, therefore, more arbitrary functions and constants are discussed. Algebraic models prove to be quite successful and very attractive since they involve the most simple procedures for the calculation of turbulent flows. One equation and two equation models were extensively used with a variety of generalizations to account for the unsteadiness of the outer flow. Depending on the specific closure assumption, the character of the equation becomes either parabolic or hyperbolic. Numerical schemes for the solution of such equations were introduced and are referenced. E.D.K.

N80-33378# Westland Helicopters Ltd., Yeovil (England). Aeromechanics Dept.

PREDICTION METHODS FOR UNSTEADY SEPARATED FLOWS

T. S. Beddoes *In* AGARD Spec. Course of Unsteady Aerodyn. Jun. 1980 11 p refs (For primary document see N80-33363 24-02)

Avail: NTIS HC A11/MF A01

Experimental investigations have provided an understanding of the phenomena associated with separated flows, both unsteady and quasi-steady. The development of quantitative analytical methods which enable the importance of geometric and flow parameters to be evaluated was required to apply this understanding to engineering problems. Unfortunately, the potentially more rigourous theories require very considerable computational effort, and to compliement their usefulness for airfoil applications, methods for the simulation of synthesis of experimentally derived characteristics were developed for routine use. These methods are discussed. E.D.K.

N80-33379*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NUMERICAL SOLUTION TECHNIQUES FOR UNSTEADY TRANSONIC AERODYNAMICS PROBLEMS

William F. Ballhaus and John O. Bridgeman *In* AGARD Spec. Course on Unsteady Aerodyn. Jun. 1980 24 p refs (For primary document see N80-33363 24-02)

Avail: NTIS HC A11/MF A01 CSCL 01A

Basic concepts of finite difference solution techniques for unsteady transonic flows are presented. The hierarchy of mathematical forumulations that approximate the Navier-Stokes equations are reviewed. The basic concepts involved in constructing numerical algorthms to solve these formulations are given. Semi-implicit and implicit schemes are constructed and analyzed. The discussion focuses primarily on techniques for solving the low frequency transonic small disturbance equation. This is the simplest formulation that contains the essence of inviscid unsteady transonic flow physics. The low frequency formulation is emphasized here because codes based on this theory can be run in minutes of processor time on currently available computers. Furthermore, numerical techniques involved in solving this simple formulation also apply to the more complicated formulations. Extensions to these formulations are briefly described. An indication of the present capability for solving unsteady transonic flows is provided. Important areas of future research for the

advancement of computational unsteady transonic aerodynamics are described. E.D.K.

N80-33380# British Aerospace Aircraft Group, Bristol (England).
LINEARISED METHODS IN SUPERSONIC FLOW
R. H. Doe. *In* AGARD. Spec. Course on Unsteady Aerodyn. Jun. 1980. 19 p. refs (For primary document see N80-33363 24-02)
Avail: NTIS. HC A11/MF A01.

Following a brief statement of the linearized equations for supersonic potential flow, the essential differences between subsonic and supersonic flow and the concept of the supersonic source are examined. Specializing the time dependence to oscillatory flow, the generalized Green's Theorem for such flows is presented through which the integral equations forming the basis of the numerical methods are developed. The second part of the paper outlines the numerical solution of the integral equations for lifting surfaces. Consideration is also given to the development of panel methods applicable to general configurations of wings and bodies. E.D.K.

N80-33338* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
THE OBLIQUE WING-RESEARCH AIRCRAFT
William H. Andrews. *In* Society of Experimental Test Pilots. Tech. Rev., Vol. 15, No. 1. 1980. p. 4-5. ref (For primary document see N80-33337 24-01)
Avail: Issuing Activity.

N80-33616# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
REVERSE PSEUDO-UNSTEADY AERODYNAMIC CALCULATION METHODS
Georges Meauze. *In its* La Rech. Aerospatiale. Bi-Monthly Bull. No. 1980-1 (ESA-TT-651). Jul. 1980. p. 31-40. refs. Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980. p. 23-30 (For primary document see N80-33613 24-31)
Avail: NTIS. HC A05/MF A01; ONERA, Paris FF 40.

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations, and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-33381*# Human Resources Research Organization, Alexandria, Va.
CIVIL HELICOPTER WIRE STRIKE ASSESSMENT STUDY. VOLUME 1: FINDINGS AND RECOMMENDATIONS. Final Report
Clyde H. Tuomela and Mark F. Brennan. Oct. 1980. 66 p. refs (Contract NAS2-10505)
(NASA-CR-152389; HumRRO-FR-MTD(CA)-80-13). Avail: NTIS. HC A04/MF A01. CSCL 01C.

Approximately 208 civil helicopter wire strike accidents for a ten year period 1970 to 1979 are analyzed. It is found that 83% of the wire strikes occurred during bright clear weather. Analysis of the accidents is organized under pilot, environment, and machine factors. Methods to reduce the wire strike accident rate are discussed, including detection/warning devices, identification of wire locations prior to flight, wire cutting devices, and implementation of training programs. The benefits to be gained by implementing accident avoidance methods are estimated to be fully justified by reduction in injury and death and reduction of aircraft damage and loss. J.M.S.

N80-33382*# McDonnell-Douglas Corp., Long Beach, Calif.
CARGO LOGISTICS AIRLIFT SYSTEMS STUDY (CLASS). VOLUME 5: SUMMARY
R. J. Burby and W. H. Kuhlman. Jul. 1980. 103 p. (Contract NAS1-14948)
(NASA-CR-158951). Avail: NTIS. HC A06/MF A01. CSCL 01C.

Findings and conclusions derived during the study of freighter aircraft requirements to the year 2008 are summarized. These results represent the stepping off point for the much needed coordinated planning efforts by government agencies, the airlines, the users, and the aircraft manufacturers. The methodology utilized in the investigations is shown. The analysis of the current system encompassed evaluations of the past and current cargo markets and on sight surveys of airport and cargo terminals. The findings that resulted provided the basis for formulating the case study procedures, developing the future scenario, and developing the future cargo market demand. J.M.S.

N80-33383# Committee on Public Works and Transportation (U. S. House).
AVIATION SAFETY: DC-10 CRASH OF MAY 25, 1979
Washington. GPO. 1979. 559 p. refs. Joint hearings before the Subcomm. on Aviation and the Subcomm. on Oversight and Rev. of the Comm. on Public Works and Transportation. (GPO-54-572). Avail: Subcomm. on Aviation.

A long term review of civil aviation safety is presented. The hearings were precipitated by the crash of a DC-10 in Chicago on May 25, 1979. The roles that aircraft manufacturers, airlines, the FAA, and the NSTB have played in civil aviation safety are summarized. The hearings were before the Subcommittee on Aviation in the House of Representatives. T.M.

N80-33384*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS OF GENERAL AVIATION SINGLE-PILOT IFR INCIDENT DATA OBTAINED FROM THE NASA AVIATION SAFETY REPORTING SYSTEM
Hugh P. Bergeron. Oct. 1980. 16 p. refs.
(NASA-TM-80206; L-13548). Avail: NTIS. HC A02/MF A01. CSCL 01C.

Data obtained from the NASA Aviation Safety Reporting System (ASRS) data base were used to determine problems in general aviation single pilot IFR operations. The data examined consisted of incident reports involving flight safety in the National Aviation System. Only those incidents involving general aviation fixed wing aircraft flying under IFR in instrument meteorological conditions were analyzed. The data were cataloged into one of five major problem areas: (1) controller judgement and response problems; (2) pilot judgement and response problems; (3) air traffic control intrafacility and interfacility conflicts; (4) ATC and pilot communications problems; and (5) IFR-VFR conflicts. The significance of the related problems, and the various underlying elements associated with each are discussed. Previous ASRS reports covering several areas of analysis are reviewed. A.R.H.

N80-33385# Simula, Inc., Tempe, Ariz.
AIRCRAFT CRASH SURVIVAL DESIGN GUIDE. VOLUME 3: AIRCRAFT STRUCTURAL CRASHWORTHINESS. Final Report, Sep. 1977 - Mar. 1980
D. H. Laananen, G. T. Singley, III, A. E. Tanner, and J. W. Turnbow. Aug. 1980. 274 p. refs.
(Contract DAAJ02-77-C-0021; DA Proj. 1L1-62209-AH-76)
(AD-A089104; TR-7821; USARTL-TR-79-22C-Vol-3). Avail: NTIS. HC A12/MF A01. CSCL 01/2.

This five volume document has been assembled to assist design engineers in understanding the problems associated with the development of crashworthy U.S. Army aircraft. It includes not only a collection of available information and data pertinent to aircraft crashworthiness but suggested design conditions and criteria as well. Volume 3 contains information on the design of aircraft structures and structural elements for improved crash survivability. Current requirements for structural design of U.S. Army aircraft pertaining to crashworthiness are discussed. Principles for crashworthy design are presented in detail for the landing gear and fuselage subject to a range of crash conditions, including impacts that are primarily longitudinal, vertical, or lateral in nature and those that involve more complicated dynamic conditions, such as rollover. Analytical methods for evaluating structural crashworthiness are described. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N80-33386# National Technical Information Service, Springfield, Va.
TROPOSPHERIC SCATTER COMMUNICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun. 1964 - Jun. 1980
William E. Reed Jul. 1980 229 p Supersedes NTIS/PS-79/0750; NTIS/PS-78/0718
(PB80-812571; NTIS/PS-79/0750; NTIS/PS-78/0718) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

The research covers data transmission, multiplexing, digital, and microwave systems and equipment. Studies on troposcatter propagation are included. Federally sponsored research as well as some foreign reports are included in the citations. This updated bibliography contains 22 abstracts, 8 of which are new entries to the previous edition. GRA

N80-33387# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TEST AND EVALUATION OF TEXAS INSTRUMENTS SMALL COMMUNITY MICROWAVE LANDING SYSTEM Final Report, Feb. 1977 - Aug. 1978
John Warren May 1980 169 p
(AD-A088852; FAA-NA-79-34; FAA-RD-80-49) Avail: NTIS HC A08/MF A01 CSCL 17/7

The purpose of this program was to test the Texas Instruments (TI) model of time reference scanning beam (TRSB) known as the 'Small Community Airport Microwave Landing System' (SCAMLS) for conformance with the contractual proportional coverage and accuracy specifications. The TI SCAMLS is a prototype system intended to provide approach and landing guidance in a low-cost package to relatively low-density, short-runway feeder and general aviation airports. Flight and static tests determined the azimuth and elevation angular errors of the system. Results indicate that the guidance signals from the TI SCAMLS were within contractual specifications. GRA

N80-33388# Federal Aviation Administration, Atlantic City, N.J. Technical Center.
PRECISION L-BAND DME TESTS Interim Report, May - Nov. 1978
Harold Postel Aug. 1980 43 p
(FAA Proj. 075-725-210)
(AD-A089053; FAA-CT-80-25; FAA-RO-80-74) Avail: NTIS HC A03/MF A01 CSCL 17/7

This phase of the project was performed under Technical Program Document (TPD) 04-109, subprogram 075-725-210. The report covers the findings on system accuracy and stability of the L-Band Precision Distance Measuring Equipment (PDME). The results showed differences in bias under varying conditions of approaches, orbits, radials, and river runs. The 24 hour overall stability of the system was recorded. Further testing should be performed with simulators that have the desired accuracy required for testing a PDME system so that a baseline can be established. GRA

N80-33389# National Technical Information Service, Springfield, Va.
INERTIAL NAVIGATION AND GUIDANCE. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun. 1978 - Jun. 1980
William E. Reed Jul. 1980 224 p Supersedes NTIS/PS-79/0762; NTIS/PS-78/0735
(PB80-812415; NTIS/PS-79/0762; NTIS/PS-78/0735) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

The bibliography cites research reports on the design, development, performance, equipment, and applications of inertial navigation and guidance systems. Reports on strapdown systems are included. This updated bibliography contains 217 abstracts, 20 of which are new entries to the previous edition. GRA

N80-33390# National Technical Information Service, Springfield, Va.
OMEGA NAVIGATION SYSTEM. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980
William E. Reed Jul. 1980 223 p Supersedes NTIS/PS-79/0615; NTIS/PS-78/0556
(PB80-812712; NTIS/PS-79/0615; NTIS/PS-78/0556) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

The development and utilization of the Omega navigation system are treated in these Federally sponsored research reports. Research on signal propagation, equipment, and operational evaluation is presented. Studies on Differential Omega are also included. This updated bibliography contains 315 abstracts, 17 of which are new entries to the previous edition. GRA

N80-33391# National Telecommunication Information Administration, Annapolis, Md.
SPECTRUM RESOURCE ASSESSMENT IN THE 2.7 TO 2.9 GHz BAND. PHASE 2: LSR DEPLOYMENT IN THE LOS ANGELES AND SAN FRANCISCO AREAS
Robert L. Hinkle Apr. 1980 112 p refs
(PB80-194467; NTIA/Rept-80-38; TR-3) Avail: NTIS HC A06/MF A01 CSCL 17G

The National Telecommunications and Information Administration in the Department of Commerce undertook a detailed program to investigate the feasibility of deploying the Limited Surveillance Radars (LSR) in the 2.7-2.9 GHz band in the Los Angeles and San Francisco areas. The LSR is a Federal Aviation Administration air traffic control radar planned for use at general aviation airports with high traffic density that do not qualify for the longer range Airport Surveillance Radars. The degree of congestion in the band in designated areas in the United States was assessed. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N80-33392*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
EVALUATION OF AERO COMMANDER SIDEWALL VIBRATION AND INTERIOR ACOUSTIC DATA: STATIC OPERATIONS
A. G. Piersol, E. G. Wilby, and J. F. Wilby Oct. 1980 92 p refs
(Contract NAS1-14611)
(NASA-CR-159290; BBN-4016) Avail: NTIS HC A05/MF A01 CSCL 01C

Results for the vibration measured at five locations on the fuselage structure during static operations are presented. The analysis was concerned with the magnitude of the vibration and the relative phase between different locations, the frequency response (inertance) functions between the exterior pressure field and the vibration, and the coherent output power functions at interior microphone locations based on sidewall vibration. Fuselage skin panels near the plane of rotation of the propeller accept propeller noise excitation more efficiently than they do exhaust noise. Author

N80-33393*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
LOADS CALIBRATIONS OF STRAIN GAGE BRIDGES ON THE DAST PROJECT AEROELASTIC RESEARCH WING (ARW-1)
Clinton V. Eckstrom Oct. 1980 51 p refs
(NASA-TM-81889) Avail: NTIS HC A04/MF A01 CSCL 20K

The details of and results from the procedure used to calibrate strain gage bridges for measurement of wing structural loads

for the DAST project ARW-1 wing are presented. Results are in the form of loads equations and comparison of computed loads vs. actual loads for two simulated flight loading conditions. R.C.T.

N80-33394*# Lockheed-Georgia Co., Marietta.
EVALUATION OF LAMINAR FLOW CONTROL SYSTEM CONCEPTS FOR SUBSONIC COMMERCIAL TRANSPORT AIRCRAFT Final Report
R. F. Sturgeon Sep. 1980 316 p refs
(Contract NAS1-14831)
(NASA-CR-159253; LG80ER-15) Avail: NTIS HC A14/MF A01

Alternatives in the design of laminar flow control (LFC) subsonic commercial transport aircraft for operation in the 1980's period were studied. Analyses were conducted to select mission parameters and define optimum aircraft configurational parameters for the selected mission, defined by a passenger payload of 400 and a design range of 12, 038 km (6500 n mi). The baseline aircraft developed for this mission was used as a vehicle for the evaluation and development of alternative LFC system concepts. Alternatives in the areas of aerodynamics, structures and materials, LFC systems, leading-edge region cleaning, and integration of auxiliary systems were studied. Relative to a similarly-optimized advanced technology turbulent transport, the final LFC configuration is approximately equal in DOC but provides decreases of 8.2% in gross weight and 21.7% in fuel consumption. T.M.

N80-33395# Aeronautical Research Labs., Melbourne (Australia).
SEA KING MK. 50 HELICOPTER SONAR DYNAMICS STUDY. A SIMPLIFIED CONTROL SYSTEMS MATHEMATICAL MODEL
Christopher R. Guy Feb. 1979 41 p
(AR-001-607; ARL-Aero-Rept-152) Avail: NTIS HC A03/MF A01

A mathematical model, formulating a simplified version of the control systems used in the Sea King MK. 50 helicopter, is described. The model represents the overall control laws and systems used in the aircraft, although it does not represent each individual element of the control systems. The control systems model, together with models of the dynamics/kinematics and sonar cable/transducer, form the complete model for the Sea King MK. 50 helicopter/sonar dynamics study. Sample results showing the flight behaviour of the complete model are included. Author

N80-33396*# General Dynamics/Convair, San Diego, Calif.
APPLICATION OF ADVANCED TECHNOLOGIES TO SMALL, SHORT-HAUL AIR TRANSPORTS Final Report
Cliff Adcock, Carl Coverston, and Bill Knapton Sep. 1980 212 p
(Contract NAS2-10267)
(NASA-CR-152364) Avail: NTIS HC A10/MF A01 CSCL 01C

A study was conducted of the application of advanced technologies to small, short-haul transport aircraft. A three abreast, 30 passenger design for flights of approximately 100 nautical miles was evaluated. Higher wing loading, active flight control, and a gust alleviation system results in improved ride quality. Substantial savings in fuel and direct operating cost are forecast. An aircraft of this configuration also has significant benefits in forms of reliability and operability which should enable it to sell a total of 450 units through 1990, of which 80% are for airline use. L.F.M.

N80-33397*# General Dynamics Corp., Groton, Conn.
STUDY FOR CONCEPTUAL DESIGN OF VEO, VTOL EXHAUST NOZZLE
W. C. Bittrick Jul. 1980 91 p
(Contract NAS2-10127)
(NASA-CR-152388) Avail: NTIS HC A05/MF A01 CSCL 01C

Design requirements for a VEO Wing V/STOL exhaust nozzle with a two dimensional shape and having the capability for upper surface blowing, spanwise blowing, and 90 deg turning of the exhaust flow for VTOL were established. A preliminary design of the nozzle that identified the actuation scheme, key dimensions, the flowpath, and the recommended materials were prepared. The airplane characteristics resulting from integrating the study nozzle were established. T.M.

N80-33398*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
PILOT/VEHICLE MODEL ANALYSIS OF VISUAL AND MOTION CUE REQUIREMENTS IN FLIGHT SIMULATION Final Report
Sheldon Baron, Roy Lancraft, and Greg Zacharias Washington NASA Oct. 1980 165 p refs
(Contract NAS2-10145)
(NASA-CR-3312; Rept-4300) Avail: NTIS HC A08/MF A01 CSCL 05E

The optimal control model (OCM) of the human operator is used to predict the effect of simulator characteristics on pilot performance and workload. The piloting task studied is helicopter hover. Among the simulator characteristics considered were (computer generated) visual display resolution, field of view and time delay. Author

N80-33399# Aeronautical Research Labs., Melbourne (Australia).
FATIGUE TESTING OF VAMPIRE WINGS
R. A. Bruton and C. A. Patching Jun. 1979 109 p refs
(ARL/Struc-Rept-378; AR-001-742) Avail: NTIS HC A06/MF A01

The fatigue behavior of a total of 21 port and starboard vampire wings was investigated for a 12 load level programmed loading sequence, representative of an average Australian flight loading spectrum. An additional two wings were subjected to a randomized sequence of these loads. Information on the following aspects is presented: the fatigue life of major components in the wing; the ineffectiveness of replacing Parker-Kalon self-tapping screws in the spar boom with pinned Chobert blind rivets; the increase in fatigue life achieved by replacing the lower spar boom; the residual strength of the cracked structure; the distribution of strain between screwed panels and the spar boom; and the fatigue resistance of glued wooden fuselages. T.M.

N80-33400# San Diego Aircraft Engineering, Inc., Calif.
CONCEPTUAL POINT DESIGN STUDY OF A NEW CTOL SETOLS CAS AIRCRAFT FOR 1995 IOC Final Report, 7 Mar. - 20 Jun. 1979
P. D. Sorensen, R. L. Bayless, and E. F. Noel 20 Jun. 1979 218 p
(Contract N62269-79-C-0438)
(AD-A088351; NADC-78155-20) Avail: NTIS HC A10/MF A01 CSCL 01/2

A conceptual design of a CTOL SETOLS CAS aircraft has been developed. The significant design feature is the use of a Surface Effect Takeoff and Landing System (SETOLS) in lieu of a normal landing gear. The SETOLS is an integral part of the point design, thereby achieving full design compatibility. This feature provides takeoff and landing capability, on the inflated rubber fabric type trunk installed on the bottom of the fuselage, from any unobstructed area such as water, grass, soil, etc., effective operation is thereby achieved with a Conventional Takeoff and Landing (CTOL) aircraft design in the Close Air Support (CAS) mission from forward bases where time prevents construction and repair of long, hard surface runways. Advanced state-of-the-art design, appropriate for 1995 IOC, has been incorporated. One advanced technology Pratt Whitney STF 529 turbofan is used for propulsion and trunk pressurization. GRA

N80-33401*# Boeing Vertol Co., Philadelphia, Pa.
VASCOMP 2. THE V/STOL AIRCRAFT SIZING AND PERFORMANCE COMPUTER PROGRAM. VOLUME 6: USER'S MANUAL, REVISION 3 Final Report, Oct. 1979 - Jul. 1980
Allen H. Schoen, Harold Rosenstein, Kaydon Stanzione, and John S. Wisniewski May 1980 627 p refs Revision
(Contracts NAS2-6107; N62269-79-C-0706)
(NASA-CR-163639; AD-A088833; D8-0375-Vol-6-Rev-3)
Avail: NTIS HC A99/MF A01 CSCL 09/2

This report describes the use of the V/STOL Aircraft Sizing and Performance Computer Program (VASCOMP II). The program is useful in performing aircraft parametric studies in a quick and cost efficient manner. Problem formulation and data development

were performed by the Boeing Vertol Company and reflects the present preliminary design technology. The computer program, written in FORTRAN IV, has a broad range of input parameters, to enable investigation of a wide variety of aircraft. User oriented features of the program include minimized input requirements, diagnostic capabilities, and various options for program flexibility. GRA

N80-33402# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Control Dynamics Branch.
FLYING QUALITIES DESIGN CRITERIA Interim Report, Mar. 1979 - Feb. 1980
Robert B. Crombie and David J. Moorhouse AFFDL May 1980 280 p refs Presented at AFFDL Flying Qualities Symp., Wright-Patterson AFB, Ohio, Oct. 1979
(AF Proj. 2403)
(AD-A088629; AFWAL-TR-80-3067) Avail: NTIS HC A13/MF A01 CSCL 01/2

Proceedings are reported of a symposium/workshop held at Wright-Patterson AFB during 9-10 October 1979. The symposium was sponsored by the Flight Dynamics Laboratory as part of a continuing effort to revise and upgrade MIL-F-8785B, 'Military Specification, Flying Qualities of Piloted Airplanes.' Flying Qualities specialists were brought together from both industry and government agencies. Formal and informal presentations, plus workshop discussions, were directed towards discussion of flying qualities design criteria. This report contains a record of the presentations and discussions as submitted by the individual authors. GRA

N80-33403# Bell Helicopter Co., Fort Worth, Tex.
INVESTIGATION OF VIBRATION REDUCTION THROUGH STRUCTURAL OPTIMIZATION Final Report, Aug. 1978 - Mar. 1980
Horace W. Hanson Jul. 1980 95 p refs
(Contract DAAK51-78-C-0011; DA Proj. 1L1-62209-AH-76)
(AD-A088917; BHT-699-099-122;
USAAVRADCOM-TR-80-D-13) Avail: NTIS HC A05/MF A01 CSCL 20/11

The purpose of this program was to investigate structural optimization techniques for vibration reduction. The results of a practical evaluation of two such techniques, the Vincent circle method and the forced response strain energy method, are discussed. Initial comparison studies of the two methods based on stiffness parameter variations were conducted using an elastic-line NASTRAN model of the AH-1G helicopter. The forced response strain energy method was then applied to a large complex built-up NASTRAN AH-1G model. This application provided useful comparative data identifying the structural elements considered to be the primary contributors to the response. Realistic structural stiffness changes in these elements were assessed to determine their effect on vibration reduction. The Vincent circle method was further evaluated for mass tuning, damping, and dynamic absorber parameters using the elastic-line model. GRA

N80-33339 Grumman Aerospace Corp., Bethpage, N.Y.
CIRCULATION CONTROL WING (CCW) FLIGHT TESTS
Chuck Sewell *In* Society of Experimental Test Pilots Tech. Rev., Vol. 15, No. 1 1980 p 6-35 (For primary document see N80-33337 24-01)
Avail: Issuing Activity

N80-33340* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NASA GENERAL AVIATION STALL/SPIN FLIGHT TESTING Status Report
James M. Patton, Jr. *In* Society of Experimental Test Pilots Tech. Rev., Vol. 15, No. 1 1980 p 36-49 refs (For primary document see N80-33337 24-01)
Avail: Issuing Activity CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-33404*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT AND TEST RESULTS OF A FLIGHT MANAGEMENT ALGORITHM FOR FUEL CONSERVATIVE DESCENTS IN A TIME-BASED METERED TRAFFIC ENVIRONMENT
Charles E. Knox and Dennis G. Cannon (Boeing Commercial Airplane Co., Seattle) Oct. 1980 50 p refs
(NASA-TP-1717) Avail: NTIS HC A03/MF A01 CSCL 01D

A simple flight management descent algorithm designed to improve the accuracy of delivering an airplane in a fuel-conservative manner to a metering fix at a time designated by air traffic control was developed and flight tested. This algorithm provides a three dimensional path with terminal area time constraints (four dimensional) for an airplane to make an idle thrust, clean configured (landing gear up, flaps zero, and speed brakes retracted) descent to arrive at the metering fix at a predetermined time, altitude, and airspeed. The descent path was calculated for a constant Mach/airspeed schedule from linear approximations of airplane performance with considerations given for gross weight, wind, and nonstandard pressure and temperature effects. The flight management descent algorithm is described. The results of the flight tests flown with the Terminal Configured Vehicle airplane are presented. T.M

N80-33405# Dynamics Research Corp., Wilmington, Mass.
DIGITAL AVIONICS INFORMATION SYSTEM (DAIS): LIFE CYCLE COST IMPACT MODELING SYSTEM RELIABILITY, MAINTAINABILITY, AND COST MODEL (RMCM): USER'S GUIDE Final Report
John C. Goclowski, John M. Glasier, Robert H. Kistler, Marjorie A. Bristol, and H. Anthony Baran Aug. 1980 167 p refs
(Contract F33615-75-C-5218; AF Proj. 2051)
(AD-A089045; AFHRL-TR-79-65) Avail: NTIS HC A08/MF A01 CSCL 14/1

This technical report provides guidance to the users of the Reliability, Maintainability, and Cost Model (RMCM). This report contains all information needed for users to interact with the RMCM computer program from a computer terminal. The RMCM and the Training Requirements Analysis Model (TRAMOD) described in AFHRL-TR-78-58(2) are the two computer programs that are part of the Life Cycle Cost Impact MODEL (LCCIM) modeling system. The LCCIM can be used to assess the impact of weapon system characteristics on human resource requirements and life cycle cost. It was developed to provide the Air Force with a better in-house capability to conduct trade-offs between competing design, manpower, and logistics alternatives. The initial application of LCCIM was directed at determining potential impacts of the Digital Avionics Information System (DAIS) concept on system support personnel requirements and life cycle cost. The modeling system is, however, applicable in the development of any new weapon system or the modification of an existing weapon system. The RMCM serves as a powerful tool within the LCCIM for conducting resource requirements, costing, and trade-off analyses. User-oriented, it accepts input data at varying levels of detail during all phases of the weapon system acquisition process. Also, the speed of the interactive RMCM computer program will encourage more trade-off analyses early in the design process, where cost avoidance actions are most effective. The RMCM data processing takes into account the interaction between support requirements and cost parameters. GRA

N80-33406# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
HELICOPTER FLIGHT TEST INSTRUMENTATION
A. Pool, ed., K. C. Sanderson, ed., and Kenneth R. Ferrell (Army Aviation Research and Development Command, Edwards AFB, Calif.) Jul. 1980 46 p refs
(AGARD-AG-160-Vol-10) Avail: NTIS HC A03/MF A01

The helicopter characteristics with which instrumentation must contend with are discussed. Typical tests that are conducted are outlined. Major aircraft components and systems which may be instrumented are listed and suggestions are made for sensors, locations, and installation. Instrumentation requirements are summarized. A sample instrumentation management technique is also presented. T.M.

N80-33407# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
PRESSURE AND FLOW MEASUREMENT
W. Wuest (DFVLR, Goettingen, W. Germany), A. Pool, ed., and K. C. Sanderson, ed. London, Harford House Jul. 1980 137 p refs
(AGARD-AG-160-Vol-11; ISBN-92-835-1368-1) Avail: NTIS HC A07/MF A01

The evolution of flight test instrumentation systems during the last decade reflects the radical changes of electronic measuring techniques. Nevertheless the basic principles of measurement methods are essentially unchanged and the sensors for flow and pressure measurements have experienced only slight changes. The fundamentals of flow and pressure measurements are explained from the viewpoint of flight test instrumentation. An overview of modern instrumentation is given with important applications to altitude measurement, vertical and horizontal speed measurement, boundary layer, wake and engine flow measurement. The scope of this manual is to give self consistent information on the different techniques and systems and to give references for a more detailed study of special techniques. Author

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-33408*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
ENERGY EFFICIENT ENGINE
D. Burrus, P. E. Sabla, and D. W. Bahr Jun. 1980 118 p refs
(Contract NAS3-20643)
(NASA-CR-159685; R79AEG562) Avail: NTIS HC A06/MF A01 CSCL 21E

The feasibility of meeting or closely approaching the emissions goals established for the Energy Efficient Engine (E3) Project with an advanced design, single annular combustor was determined. A total of nine sector combustor configurations and one full-annular-combustor configuration were evaluated. Acceptable levels of carbon monoxide and hydrocarbon emissions were obtained with several of the sector combustor configurations tested, and several of the configurations tested demonstrated reduced levels of nitrogen oxides compared to conventional, single annular designs. None of the configurations tested demonstrated nitrogen oxide emission levels that meet the goal of the E3 Project. Author

N80-33409*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CONCEPTUAL MODEL OF TURBULENT FLAMEHOLDING FOR SCRAMJET COMBUSTORS
Paul W. Huber Oct. 1980 36 p refs
(NASA-TP-1543; L-13600) Avail: NTIS HC A03/MF A01 CSCL 21E

New concepts and approaches to scramjet combustor design are presented. Blowoff was from failure of the recirculation-zone (RZ) flame to reach the dividing streamline (DS) at the rear stagnation zone. Increased turbulent exchange across the DS helped flameholding due to forward movement of the flame anchor point inside the RZ. Modeling of the blowoff phenomenon was based on a mass conservation concept involving the traverse of a flame element across the RZ and a flow element along the DS. The scale required to achieve flameholding, predicted by the model, showed a strong adverse effect of low pressure and low fuel equivalence ratio, moderate effect of flight Mach number, and little effect of temperature recovery factor. Possible effects of finite rate chemistry on flameholding and flamespreading in scramjets are discussed and recommendations for approaches to engine combustor design as well as for needed research to reduce uncertainties in the concepts are made. Author

N80-33410*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL PERFORMANCE AND ANALYSIS OF 15.04-CENTIMETER-TIP-DIAMETER, RADIAL-INFLOW TURBINE WITH WORK FACTOR OF 1.126 AND THICK BLADING
Kerry L. McLallin and Jeffrey E. Haas Oct. 1980 21 p refs
Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
(NASA-TP-1730; E-391; AVRADCOM-TR-80-09) Avail: NTIS HC A02/MF A01 CSCL 21E

The aerodynamic design, the performance, and an internal loss breakdown were examined for a 15.04 cm tip diameter, radial-inflow turbine. The design application was to drive a two stage, 10 to 1 pressure ratio compressor with a mass flow of 0.952 kg/sec and a rotative speed of 70,000 rmp. The turbine inlet temperature was 1478 K, and the turbine was designed with blades thick enough for internal cooling passages. The rotor tip diameter was limited to 86 percent of optimum in order to obtain a reduced tip speed design. The turbine was fabricated with solid, uncooled blading and tested in air at nominal inlet pressure and temperature of 1.379 x 10000 N/sq m and 322.2 K, respectively. Results indicated the turbine total efficiency to be 5.3 points less than design. Analysis of these results has indicated the deficit in performance to be due to stator secondary flow losses, vaneless space surface friction losses, and trailing edge wake mixing losses. R.C.T.

N80-33411# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Performance Branch.
REGRESSION MODELING OF TURBINE ENGINE PERFORMANCE Final Report, Jul. 1974 - Jun. 1977
James R. Ruble and Richard McNally May 1980 79 p refs (AF Proj. 3066)
(AD-A088898; AFWAL-TR-80-2034) Avail: NTIS HC A05/MF A01 CSCL 21/5

This effort examines the use of regression modeling to represent turbine engine performance as a function of Mach number, altitude, power setting, design for pressure ratio and design overall pressure ratio. A model, satisfactory for conceptual analysis work, was constructed and evaluated. A significant reduction in propulsion data generation cost was demonstrated (approximately 15 to 1). Details of the approach are presented along with a discussion of the practicality of such a model. GRA

N80-33412# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
DETERMINATION OF POLLUTANT EMISSIONS CHARACTERISTICS OF GENERAL ELECTRIC CF6-6 AND CF6-50 MODEL ENGINES Final Report, Oct. 1978 - Dec. 1979
T. F. Lyon, W. J. Dodds, and D. W. Bahr Mar. 1980 108 p refs
(Contract DOT-FA78WA-4207)
(AD-A088927; R80AEG420; FAA-EE-80-27) Avail: NTIS HC A06/MF A01 CSCL 21/5

The average levels and the variability of emissions were determined for newly manufactured General Electric CF6-6 and CF6-50 model engines. Emissions of carbon monoxide, hydrocarbons, oxides of nitrogen, and smoke were measured on a total of twenty five engines. Emissions were measured from two separate sampling systems, one sampling in the FAA diamond pattern, and the other in the EPA cruciform pattern. Only small differences in emissions were found between the two sampling patterns. Typical variability in CF6 production engine emissions was found to be somewhat less than had been previously reported for other types of large, turbofan engines. The effect of differences in fuel types, and in idle conditions (hot or cold) on emission levels were also determined. GRA

N80-33413# General Electric Co., Lynn, Mass.
HIGH BYPASS TURBOFAN COMPONENT DEVELOPMENT. AMENDMENT 1: SMALL FAN REDESIGN Final Report, Jun. - Oct. 1979
H. Mauch, T. Oldakowski, A. Sehra, and D. Weldon Feb. 1980 33 p

(Contract F33615-78-C-2060; AF Proj. 3066)
(AD-A089067; AFWAL-TR-80-2011) Avail: NTIS HC A03/MF A01 CSCL 21/5

The aerodynamic and mechanical redesign of a small, high through-flow, single stage fan rotor to increase its design-point airflow rate was completed. Since the original design exhibited excellent aeromechanical characteristics, the redesign was confined to changes in the blade meanline angle; parameters such as maximum thickness-to-chord ratio, thickness distribution, aspect ratio, and solidity being unchanged from the original design. Procurement of the redesign fan rotor has been completed on schedule, thus fulfilling the requirements of this contract. GRA

N80-33414# ARO, Inc., Arnold Air Force Station, Tenn.
MEASUREMENT OF TURBINE ENGINE TRANSIENT AIRFLOW IN GROUND TEST FACILITIES Final Report, 1 Oct. 1977 - 30 Nov. 1979
S. Wehofer and R. Rivir (APL) AEDC Aug. 1980 77 p refs
(AF Proj. 3066)
(AD-A088706; AEDC-TR-80-21) Avail: NTIS HC A05/MF A01 CSCL 14/2

Transient airflow is a primary parameter required to evaluate propulsion system component matching, stability and control, and transient engine performance. Development and verification of techniques to calculate turbine engine transient airflow performance have been a difficult, long-term problem. In this study a turbine engine transient airflow simulator was developed and used to evaluate candidate transient airflow measurement systems. Design criteria and analysis procedures are presented for an engine inlet bellmouth and engine subsonic venturi transient airflow measurement system. The recommended systems have nominal transient airflow measurement uncertainties of 1 percent. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-33415*# University of Southern Colorado, Pueblo. School of Applied Science and Engineering Technology.
RAMP: A FAULT TOLERANT DISTRIBUTED MICROCOMPUTER STRUCTURE FOR AIRCRAFT NAVIGATION AND CONTROL Final Technical Report, 1 Oct. 1979 - 1 Oct. 1980
William R. Dunn 1 Oct. 1980 75 p refs
(Grant NAG2-2)
(NASA-CR-163615) Avail: NTIS HC A04/MF A01 CSCL 01C

RAMP consists of distributed sets of parallel computers partioned on the basis of software and packaging constraints. To minimize hardware and software complexity, the processors operate asynchronously. It was shown that through the design of asymptotically stable control laws, data errors due to the asynchronism were minimized. It was further shown that by designing control laws with this property and making minor hardware modifications to the RAMP modules, the system became inherently tolerant to intermittent faults. A laboratory version of RAMP was constructed and is described in the paper along with the experimental results. Author

N80-33416*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LONGITUDINAL STABILITY AND CONTROL IN WIND SHEAR WITH ENERGY HEIGHT RATE FEEDBACK
Joseph Gera Nov. 1980 40 p refs
(NASA-TM-81828; L-13130) Avail: NTIS HC A03/MF A01 CSCL 01C

The longitudinal linearized equations of motion in wind shear were derived for the NASA Terminal Configured Vehicle, a modified Boeing 737 airplane. In addition to the apparent acceleration terms resulting from wind shear, the equations included altitude dependent stability derivatives. A linear analysis of these equations indicates a first order divergence type of instability due to wind shear in which head wind decreased with altitude. Furthermore, this instability cannot be stabilized by attitude control alone. However, attitude control used in combination with an addition feedback loop which consisted of the energy height rate feedback to the throttle proved to be effective in suppressing instability due to wind shear. A brief piloted, real time, nonlinear simulation indicated the desirability of using a display based on the rate of change of energy height rate and of commanded thrust. T.M.

N80-33417# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
DIGITAL FLIGHT CONTROL RESEARCH USING MICROPROCESSOR TECHNOLOGY Annual Technical Report, 1 Feb. 1978 - 31 Jan. 1979
Robert F. Stengel, James C. Seat, and George E. Miller 23 May 1980 153 p refs
(Contract N00014-78-C-0257)
(AD-A089147; MAE-1425; ONR-CR-300-003-1; ATR-1) Avail: NTIS HC A08/MF A01 CSCL 01/4

A digital flight control system based on microprocessor technology was designed, developed, and flight tested in Princeton's Variable Response Research Aircraft VRA. The microprocessor based digital flight control system works in conjunction with the VRA's existing fly-by-wire control system, and is programmed to provide command and stability augmentation control laws formulated through moder control theory. The initial flight control computer program, CAS-1, provides direct, pitch rate, and normal acceleration command modes. The latter two closed-loop control laws are designed using sample d-data linear-quadratic regulator theory. The computer hardware and software are described and initial flight test results are presented. Flight test results are based on two longitudinal manual control tasks tracking at altitude and approach and landing. They demonstrate the effects of varying sampling rate, computation delay, and control resolution on calibrated step response and on pilot opinion ratings. It is concluded that the pilot can provide effective control with lower samping rates and control resolution than might have been anticipated. The limiting values are task dependent, generally lying in the range of 5 to 10 samples per sec and 4 to 8 bit resolution. Flight test results with pure time delay tend to confirm that there is rapid degradation of pilot opinion as the delay increases beyond 0. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N80-33418*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PLENUM RESPONSE TO SIMULATED DISTURBANCES OF THE MODEL AND FAN INLET GUIDE VANES IN A TRANSONIC TUNNEL
Blair B. Gloss Washington Oct. 1980 26 p refs
(NASA-TM-81869; L-13848) Avail: NTIS HC A03/MF A01 CSCL 14B

In order to aid in the design of the National Transonic Facility (NTF) control system, test section/plenum response studies were carried out in a 0.186 scale model of the NTF high speed duct. Two types of disturbances, those induced by the model and those induced by the compressor inlet guide vanes were simulated. Some observations with regard to the test section/plenum response tests are summarized as follows. A resonance frequency for the test section/plenum area of the tunnel of approximately 50 Hz was observed for Mach numbers from 0.40 to 0.90. However, since the plenum is 3.1 times (based on volume) too large for the scaled size of the test section, care must be taken in extrapolating these data to NTF conditions. The plenum pressure data indicate the existence of pressure gradients in the plenum. The test results indicate that the difference between

test section static pressure and plenum pressure is dependent on test section flow conditions. Plenum response to inlet guide vane type disturbances appears to be slower than plenum response to test section disturbances. T. M.

N80-33419# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
VALIDATION OF THE OPERATING AND SUPPORT COST MODEL FOR AVIONICS AUTOMATIC TEST EQUIPMENT (OSCATE) M.S. Thesis
Joe Hernandes, Jr. Jun. 1980 177 p refs
(AD-A088725; AFIT-LSSR-46-80) Avail: NTIS HC A09/MF A01 CSCL 09/3

The operating and support cost model for Avionics Automatic Test Equipment oscate was previously developed primarily as an evaluation tool for use in the source selection and also in design trade-off studies. This thesis documents the results of the validation of this model. The sources of model data have been identified in detail in order to determine availability and ease future model use. A subjective evaluation of the model reveals it does represent significant operating and support costs and provides a means of evaluating available acquisition alternatives. Model limitations are discussed in terms of their impact on model use. Detail information and data soruces, collection methods, and model use are contained in this thesis. GRA

N80-33420# GARD, Inc., Niles, Ill.
ENERGY CONSERVATION AND MANAGEMENT STUDY OF AIRCRAFT HANGARS AT SELECTED AIR FORCE BASES Final Report, Jul. - Dec. 1979
Neil P. Leslie Jan. 1980 101 p
(Contract F08635-79-C-0266; AF Proj. 2103)
(AD-A089075; AFESC/ESL-TR-80-15) Avail: NTIS HC A06/MF A01 CSCL 01/5

Most existing Air Force aircraft hangars were not originally designed to conserve energy according to present criteria. This study determines the sources of energy waste in hangars at three representative bases, quantifies the losses, and analyzes the economic feasibility of various retrofit ideas to reduce losses. GRA

N80-33421# Air Force Human Resources Lab., Williams AFB, Ariz. Operations Training Div.
ADVANCED SIMULATOR FOR PILOT TRAINING: DESIGN OF AUTOMATED PERFORMANCE MEASUREMENT SYSTEM Final Report
John H. Fuller, Wayne L. Waag, and Elizabeth L. Martin Brooks AFB, Tex. Aug. 1980 68 p refs
(AF Proj. 1123)
(AD-A088855; AFHRL-TR-79-57) Avail: NTIS HC A04/MF A01 CSCL 05/9

The objective of this effort was to design and implement an automated performance measurement (APM) system in the Advanced Simulator for Pilot Training (ASPT). This report documents that development effort and describes the current status of the measurement system. It was assumed that superior flying performance in the aircraft or the simulator has several characteristics which are reflected by available flight parameters. These include (1) maintaining certain aircraft state parameters, such as airspeed or altitude, close to some defined criterion value, (2) avoiding excessive rates and acceleration forces so that the maneuver is executed smoothly, (3) accomplishing these objectives with the least amount of effort; that is, by minimizing control inputs, and (4) not exceeding procedural or safety limits established for the maneuver. To date, the following scenarios have been implemented on the ASPT: (1) Transition Tasks Straight and Level, Airspeed Changes, Turns, Climbs/Descents; (2) Takeoff/Approach/Landing Tasks Takeoffs, Tech Order Climbs, Slow Flight, Configuration Changes, Straight-in Approaches, Overhead Patterns, Touch-and-Go's; (3) Instrument Tasks - Rate Climbs/Descents, Vertical S-A, Vertical S-D, GCA, Proceed Direct to VOR; (4) Aerobatics - Aileron Rolls, Barrel Roll, Loop, Split S, Cloverleaf, Cuban 8, Lazy 8; and (5) Formation - Fingertip. GRA

N80-33422# Bell Helicopter Co., Fort Worth, Tex.
VALIDATION OF THE ROTORCRAFT FLIGHT SIMULATION PROGRAM (C81) USING OPERATIONAL LOADS SURVEY FLIGHT TEST DATA Final Report, Nov. 1976 - Nov. 1979
James R. VanGaasbeek Jul. 1980 233 p refs
(Contract DAAJ02-77-C-0003; DA Proj. 1L2-62209-AH-16)
(AD-A089008; BHT-699-099-006;
USAAVRADCOM-TR-80-D-4) Avail: NTIS HC A11/MF A01 CSCL 01/3

The Rotorcraft Flight Simulation Program C81 has been used to simulate several test points from the Operational Loads Survey Flight Test Program for an AH-1G helicopter in order to demonstrate program capabilities. The results of those simulations are summarized in this report. Measured and computed performance characteristics and main rotor bending moments and accelerations are compared for steady-state and maneuvering flight conditions. Computed main rotor aerodynamic quantities are compared with test data, in contour-plot form, for level flight conditions. This report also contains a brief description of the flight test program, a detailed description of the creation of the input decks used for the simulations, and a discussion of possible improvements for future test programs. GRA

N80-33423# Air Force Academy, Colo. Frank J. Seiler Research Lab.
EFFECTS OF CRITERIA ON FLIGHT SIMULATION STUDY 1: HEADING DEVIATION TOLERANCE Interim Report, Jan. - Jun. 1980
Mark Nataupsky, John M. Bermudez, and Valentin W. Tirman Jun. 1980 19 p
(AF Proj. 2303)
(AD-A088908; FJSRL-TR-80-0001) Avail: NTIS HC A02/MF A01 CSCL 05/8

Twenty-eight United States Air Force Academy cadets were trained in a GAT-1 flight simulator under one of four experimental groups. The groups were defined first by having heading information either provided by the normal heading indicator or by peripheral lights and second by their being trained on either a 5 deg or a 10 deg heading deviation criterion. All cadets were subjected to four levels of a secondary cognitive task plus a control condition. There were no significant differences for either the main effect of heading indicator type of criterion level of training. The main effect of cognitive task difficulty level was significant for most measures. In addition, the heading indicator type by training criterion level interaction produced significant differences. Each significant interaction accounted for an average of 21% of the total variance. The study seems to indicate that training criteria are important independent variables in complex psychomotor/cognitive flight simulator tasks. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-33424* National Aeronautics and Space Administration, Washington, D. C.
FLTSATCOM-D
20 Oct. 1980 9 p
(NASA-News-Release-80-158; P80-10166) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

A press release concerning the FLTSATCOM-D communications satellite launching is presented. The satellite system and the Atlas Centaur launch vehicle are described. T.M.

N80-33425*# National Aeronautics and Space Administration, Washington, D. C.
THE UNITED STATES SPACE OBSERVATION POLICY
Michele Chevrel Oct. 1980 10 p Transl. into ENGLISH from Les Cahiers de l'OPIT (France), Dossier no. 2, Winter 1979/1980 p 22-25 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76373) Avail: NTIS HC A02/MF A01 CSCL 22A

The steps pursued since 1978 to establish an operational civil space remote sensing system are outlined. The role of the

National Oceanographic and Atmospheric Agency is defined, and the problems still remaining are discussed. T.M.

N80-33426*# National Aeronautics and Space Administration, Washington, D. C.
MISSION OPERATION REPORT: VOYAGER PROGRAM VOYAGER 1 ENCOUNTER AT SATURN NOVEMBER 12, 1980
12 Nov. 1980 38 p
(NASA-TM-82217; Rept-S-802-77-01/02) Avail: NTIS HC A03/MF A01 CSCL 22A

The planned sequence of events for the Voyager 1 encounter of Saturn is presented. The status of the Voyager flight and ground systems is summarized. The mission success criteria was established. T.M.

N80-33427*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TELECOMMUNICATIONS AND DATA ACQUISITION REPORT Progress Report, Jul. - Aug. 1980
15 Oct. 1980 155 p refs
(Contract NAS7-100)
(NASA-CR-163608; JPL-PR-42-59) Avail: NTIS HC A08/MF A01 CSCL 22A

Progress in the development and operations of the Deep Space Network along with developments in Earth-based radio technology as applied to geodynamics, astrophysics, and the search for extraterrestrial intelligence are reported. For individual titles, see N80-33428 through N80-33446.

N80-33428*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TABLE MOUNTAIN 8-mm-WAVELENGTH INTERFEROMETER **c35**
M. A. Janssen, S. Gulkis, E. T. Olsen, B. L. Gary, F. S. Soltis, and N. I. Yamane *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 1-8 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The system components, performance, and calibration of two element radio interferometer operating at 8.33 mm wavelength are discussed. The interferometer employs a 5.5 m and a 3 m diameter antenna on an east-west baseline of 60 or 120 m, yielding fringe spacings at transit of 28 or 14 in. respectively. The broad intermediate frequency bandpass of 100 to 350 MHz and the system noise temperature of 500 K provide high sensitivity for the measurement of continuum sources. The interferometer has been used for high resolution studies of the planets and the Sun, and it is currently being adapted to study solar flare emissions at high spatial and time resolution. M.G.

N80-33429*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PATTERN MEASUREMENTS OF A LOW-SIDELOBE HORN ANTENNA **c32**
M. A. Janssen, S. Gulkis, S. M. Bednarczyk, H. W. Marlin, and G. F. Smoot (California Univ., Berkeley) *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 8-14 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 20N

The techniques and results of power pattern measurements of a corrugated horn antenna designed for low sidelobes are reported. The power pattern was measured to levels 90 dB below the main beam maximum in both the E- and H-planes. The measured patterns were found to be in good agreement with predictions from existing theory for the performance of corrugated scalar feeds. M.G.

N80-33430*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SETI INSTRUMENT DEVELOPMENT PLAN **c55**
R. B. Crow *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 15-22 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

The architecture of the instrument system for the SETI (Search for Extraterrestrial Intelligence) program is briefly described and the development approach used to implement the operational instruments is discussed. The two versions of the instrument system include a target survey instrument to observe at a very high sensitivity a selected set of interesting stars that have particular a priori promise, and a sky survey instrument to observe the entire celestial sphere at a lower sensitivity. The targeted survey utilizes the 305 meter antenna at Arecibo, Puerto Rico, a 64 meter DSN antenna, and other large radio telescopes. The Arecibo instrument provides the highest sensitivity by virtue of the antenna gain. The antenna line feeds cover an instantaneous frequency range of 50 MHz (tunable over 100 MHz), while the multichannel spectrum analyzer/signal detector is capable of analyzing a frequency segment 16 MHz wide with a maximum resolution of 1 Hz. The sky survey employs a listen-only, 34 meter antenna. The SETI breadboard development is also described. M.G.

N80-33431*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A BIMODAL SEARCH STRATEGY FOR SETI **c55**
S. Gulkis, E. T. Olsen, and J. Tarter (California Univ., Berkeley) *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 23-32 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

The search strategy and resultant observational plan which was developed to carry out a comprehensive Search for Extraterrestrial Intelligence (SETI) over that portion of the electromagnetic spectrum known as the terrestrial microwave window is described. The limiting sensitivity achieved was parameterized and calculated for Deep Space Network antennas as well as several radio astronomy observatories. A brief description of the instrumentation to be employed in the search and the classes of signals to be looked for is given. One observational goal is to survey the entire sky over a wide range of frequency to a relatively constant flux level. This survey ensures that all potential life sites are observed to some limiting equivalent isotropic radiated power depending upon their distance. A second goal is to survey a set of potential transmission sites selected a priori to be especially promising, achieving very high sensitivity over a smaller range of frequency. M.G.

N80-33432*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ORION S-BAND DATA ACQUISITION FOR S-Y CALIBRATION **c32**
S. C. Wu *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 33-36 ref (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 17I

Error sources in the Operational Radio Interferometry Observing Network (ORION) are addressed. Specifically, the performance of the S-band receiver and the optimum allocation of data volume between S- and X-band observations is studied. It is found that the requirements on the S-band receiver are not very stringent. The system temperature of the ORION S-band receiver has a very small effect on baseline determination accuracy. It is unwise to pay a high cost for an S-band receiver with a low system temperature; a system temperature as high as 240 K is tolerable. Only 20 to 40 percent of data volume is to be allocated to S-band observations for minimum baseline error. The error remains low over a rather wide range of data volume ratio. Hence precise allocation of the 14 pairs of the Mark 3 very long base interferometer data channels between S- and X-band observations is not critical. M.G.

N80-33433*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES **c14**
N. A. Renzetti *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 37-39 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N80-33434*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN GROUND COMMUNICATIONS FACILITY c32
R. H. Evans *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 40-50 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

A functional description of the Ground Communications Facility (GCF) and its relationships with other elements of the Deep Space Network and the NASA Communications Network is presented together with development objectives and goals and comments on implementation activities in support of flight projects. The voice, teletype, high speed data, wideband data, monitor and control, data records, network log processor, and network communications equipment subsystems are individually examined. M.G.

N80-33435*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DSN PROGRAMMING SYSTEM c14
A. P. Irvine *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 51-54 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The Deep Space Network programming system is described by a heuristic model. Interaction with two elements of that system, anomaly reporting and the MBASIC (trademark) language, is described in detail. Feedback from anomaly reporting indicates that the methodology resulted in a low anomaly rate and thereby also provided positive feedback. The need to reduce operating costs prompted the implementation of the MBASIC (trademark) language as a compiler. M.G.

N80-33436*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANNING A DSN SUPPORT SECTION TECHNICAL LIBRARY c14
T. Bailey and C. C. Chatburn *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 55-61 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The planning procedure being used to establish a technical library for the Deep Space Network support section is described. The inventory and survey methods employed are described and the preliminary results of these methods are discussed. M.G.

N80-33437*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERNATIONAL SOLAR POLAR MISSION
R. B. Miller *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 62-67 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

The key configurations and characteristics of the two International Solar Polar Mission (ISPM) spacecraft are described. The primary mission objectives of the ISPM are to investigate, as a function of solar latitude, the properties of the solar corona, the solar wind, the sun/wind interface, the heliospheric magnetic field, solar and nonsolar cosmic rays, and the interstellar/interplanetary neutral gas and dust. In addition, instrumentation is included to detect the gamma ray bursts; it is hoped to pinpoint the sources of these bursts by using triangulation from each spacecraft and the Earth. E.D.K.

N80-33438*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A STUDY OF THE PROCESSES IN THE RF HYDROGEN GAS DISSOCIATOR c36
L. Maleki *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 68-76 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 20E

The role of the RF gas dissociator in the hydrogen maser is examined. Based on collisional and plasma transport processes, the performance of the source is investigated. It is found that while the complexity of the collisional processes in the RF dissociator prohibits an easily obtained quantitative expression for the performance of the source, it is nevertheless possible to make general inferences concerning the qualitative performance based on collisional effects. An analytical expression for the efficiency of the source in atom production is obtained based on plasma transport processes. On the basis of this study some recommendations are made for the development of more efficient RF hydrogen gas dissociators for use in masers. Author

N80-33439*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EXPERIMENTAL OPTICAL FIBER COMMUNICATIONS LINK c32
G. F. Lutes *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 77-85 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

An optical fiber communications link 1.5 kilometers in length was installed between the Interim Frequency Standard Test Facility and the Timing and Frequency Systems Research Laboratory at JPL. It is being used to develop optical fiber technology for use in the DSN and particularly for precise time and frequency distribution. E.D.K.

N80-33440*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPEN-LOOP RADIO SCIENCE WITH A SUPPRESSED-CARRIER SIGNAL c32
C. A. Greenhall *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 86-97 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

When a suppressed-carrier signal is squared, the carrier reappears in doubled form. An open-loop receiver can be used to deliver a recording of a band-limited waveform containing this carrier, whose amplitude and phase can be tracked by the radio science experimenter. Author

N80-33441*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NOISE ADDING RADIOMETER PERFORMANCE ANALYSIS c35
C. Stelzried *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 98-106 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The DSN noise adding radiometer (NAR) measurement accuracy is analyzed. The NAR capability is part of the precision power monitor function recently introduced in the DSN. The potential system noise temperature measurement accuracy is estimated to be about 1.5% with the 1 kelvin noise diode. Performance verification requires comparison noise temperature measurements with the manual Y factor method and routine monitoring of critical elements in the NAR system such as system linearity and noise diode calibration. A technique is presented to calibrate and reduce the effects of the receiving system nonlinearity. Unsatisfactory performance or degradation of these critical NAR elements would require appropriate system upgrading. E.D.K.

N80-33442*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORKS CONSOLIDATION PROGRAM c14
M. L. Yeater, D. T. Herrman, and G. E. Sanner *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 107-120 ref (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The Networks Consolidation Program (NCP) goals were defined to include the planning, designing, and implementing of a single network of ground tracking stations. The proposed consolidated network is to make use of facilities that are now included in the Goddard Ground Spaceflight Tracking and Data Network as well as the existing JPL Deep Space Network. These facilities are to be combined and modified to provide a consolidated network capable of supporting the set of planetary and Highly Elliptical Earth Orbiter missions that are planned for the Tracking and Data Relay Satellite System era. The history of activities and events that led to the decision to consolidate the NASA ground tracking and data networks are traced. A summary of the management and planning activities that have taken place

at the Jet Propulsion Laboratory, Goddard Space Flight Center, and at the NASA Headquarters Office of Space Tracking and Data Systems, with respect to the NCP, from the time of decision in October 1979 to the present, are discussed. E.D.K.

N80-33443*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN SYSTEM PERFORMANCE TEST SOFTWARE **c61**
F. B. Leppla *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 121-125 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

The software support group of the Deep Space Network support section is continuing the development of system performance test (SPT) software for the Deep Space Network. During the past two and one-half years, test software was developed for a new system, Radio Science, and many new features were added to existing software. Plans are underway for implementation of test software for the very long baseline interferometry system and the network data processing area. A description of the elements of the SPT software is provided. E.D.K.

N80-33444*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TRISCAN: A METHOD OF PRECISION ANTENNA POSITIONING **c89**
R. C. Bunce *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 126-133 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 03A

The triangle (antenna) scan (TRISCAN) is a method of improving the alignment between the boresight of the Deep Space Network antennas and a particular target, spacecraft, or radio source (star). For stars, the method works in conjunction with the noise adding radiometer and the antenna pointing system to form estimates of the alignment offset coordinates. This information is then used to position the antenna for improved target alignment. A comparison with CONSCAN is included since a CONSCAN study led to TRISCAN development. E.D.K.

N80-33445*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANETARY RADAR **c32**
R. M. Taylor *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 142-144 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 17I

The radar astronomy activities supported by the Deep Space Network during June, July, and August 1980 are reported. The planetary bodies observed were Venus, Mercury, and the asteroid Toro. Data were obtained at both S and X band, and the observations were considered successful. E.D.K.

N80-33446*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE NETWORK ENERGY PROGRAM **c14**
S. E. Friesema *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 145-149 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

If the Deep Space Network is to exist in a cost effective and reliable manner in the next decade, the problems presented by international energy cost increases and energy availability must be addressed. The Deep Space Network Energy Program was established to implement solutions compatible with the ongoing development of the total network. E.D.K.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-33447 Colorado Univ. at Boulder.
DETERMINATION AND MAINTENANCE OF EARTH ORBITS WITH ARCS OF MINIMUM ALTITUDE VARIATION
Ph.D. Thesis
Shean-Teh Han 1980 95 p
Avail: Univ. Microfilms Order No. 8021584

A mathematical model of the rotating oblate atmosphere of the Earth provided the formulation of air drag of the Earth's satellite. A convenient form of the model was used to find the approximate solution of the equations of motion. The effect of Earth's oblateness was considered not only in the equations of motion but also in the evaluation of the satellite's altitude. The decay or variation of the elements of the satellite's orbit was evaluated numerically. The initial semimajor axis, eccentricity and argument of periapsis of the satellite's orbit which provide the minimum altitude variation in the first quarter of revolution were found by numerical searching. The approximate explicit formulas for the variations of the orbital elements were obtained in the altitude region from 180 Km to 600 Km. These explicit formulas were used to find all of the orbit except the minimum altitude variation region. Outside of the minimum altitude arc, a trajectory is needed to bring the satellite back to the original position. Dissert. Abstr.

N80-33448*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ANALYTIC THEORY OF ORBIT CONTRACTION AND BALLISTIC ENTRY INTO PLANETARY ATMOSPHERES
James M. Longuski and Nguyen Xuan Vinh 1 Sep. 1980 141 p refs
(Contract NAS7-100; Grant NsG-1448)
(NASA-CR-163627; JPL-Pub-80-58) Avail: NTIS HC A07/MF A01 CSCL 22A

A space object traveling through an atmosphere is governed by two forces: aerodynamic and gravitational. On this premise, equations of motion are derived to provide a set of universal entry equations applicable to all regimes of atmospheric flight from orbital motion under the dissipate force of drag through the dynamic phase of reentry, and finally to the point of contact with the planetary surface. Rigorous mathematical techniques such as averaging, Poincare's method of small parameters, and Lagrange's expansion, applied to obtain a highly accurate, purely analytic theory for orbit contraction and ballistic entry into planetary atmospheres. The theory has a wide range of applications to modern problems including orbit decay of artificial satellites, atmospheric capture of planetary probes, atmospheric grazing, and ballistic reentry of manned and unmanned space vehicles. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-33449*# Howard Univ., Washington, D. C. Dept. of Mechanical Engineering.
THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES. VOLUME 3, PART B: THE MODELLING, DYNAMICS, AND STABILITY OF LARGE EARTH POINTING ORBITING STRUCTURES **Final Report**
Peter M. Bainum and V. K. Kumar Sep. 1980 71 p refs
(Contract NsG-1414)
(NASA-CR-163612) Avail: NTIS HC A04/MF A01 CSCL 22B

The dynamics and stability of large orbiting flexible beams, and platforms and dish type structures oriented along the local horizontal are treated both analytically and numerically. It is assumed that such structures could be gravitationally stabilized by attaching a rigid light-weight dumbbell at the center of mass by a spring loaded hinge which also could provide viscous damping. For the beam, the small amplitude inplane pitch motion, dumbbell librational motion, and the anti-symmetric elastic modes are all coupled. The three dimensional equations of motion for a circular flat plate and shallow spherical shell in orbit with a two-degree-of

freedom gimballed dumbbell are also developed and show that only those elastic modes described by a single nodal diameter line are influenced by the dumbbell motion. Stability criteria are developed for all the examples and a sensitivity study of the system response characteristics to the key system parameters is carried out. A.R.H.

N80-33433*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 37-39 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-33435*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DSN PROGRAMMING SYSTEM
A. P. Irvine *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 51-54 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-33436*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANNING A DSN SUPPORT SECTION TECHNICAL LIBRARY
T. Bailey and C. C. Chatburn *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 55-61 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-33442*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORKS CONSOLIDATION PROGRAM
M. L. Yeater, D. T. Herrman, and G. E. Sanner *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 107-120 ref (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-33446*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE NETWORK ENERGY PROGRAM
S. E. Friesema *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 145-149 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-33450*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
IMP 8. VOLUME 1: EM FIELD EXPERIMENT Final Report
May 1980 153 p 2 Vol.
(Contract NAS5-11431)
(NASA-CR-160023) Avail: NTIS HC A08/MF A01 CSCL 22A

The electromagnetic fields experiment on IMP-J used two electric dipole antennas and a triaxial search coil magnetic antenna to sense the electric and magnetic field of plasma waves in space. The electric dipole antennas consisted of a fine wire, 0.021 inches in diameter, with a nominal extended tip-to-tip length of 400 ft. The outermost 50 ft. of each element was conducting and the rest of the antenna was covered with an insulating coating. The search coil antennas each consisted of a high mu core with two separate windings of 40,000 turns each to sense ac magnetic fields. The search coils had a length of 18 inches tip-to-tip and are mounted on the end of a boom. The axes of the x prime and y prime search coil antennas were parallel to the x prime and y prime electric antenna axes. T.M.

N80-33451*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
IMP-8. VOLUME 2: SCIENTIFIC SECTION Final Report
May 1980 335 p refs 2 Vol.
(Contract NAS5-11431)
(NASA-CR-160024) Avail: NTIS HC A15/MF A01 CSCL 22A

Results of the analysis of the IMP-8 data, which was collected during the first six and one-half years after launch of the IMP-8 spacecraft are presented. The plasma wave experiment data were processed and are available in an easily accessible summary form. These data continue to provide a valuable source for comparative studies with plasma wave experiments on other spacecraft operating in the solar wind and within the Earth's magnetosphere. T.M.

N80-33452*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LAUNCH MISSION SUMMARY: FLTSATCOM-D ATLAS/CENTAUR-57
22 Oct. 1980 10 p
(NASA-TM-82213; KSC-GP-15-12) Avail: NTIS HC A02/MF A01 CSCL 22A

The largest and heaviest spacecraft yet to be launched into geosynchronous orbit by an Atlas Centaur launch vehicle, FLTSATCOM D is part of a versatile military satellite communication system which includes terminals at Navy land bases, and on naval aircraft, ships, and submarines. The design and capabilities of the launch vehicle are described as well as those of the satellite. Information relative to launch windows, flight plan, radar and telemetry coverage, selected trajectory information is presented. A brief sequence of flight events is included. A.R.H.

N80-33453*# National Aeronautics and Space Administration, Washington, D. C.
METEOR AND REMOTE SENSING SATELLITES (A COLLECTION OF ARTICLES)
J. Cruette, M. Bled-Charreton, H. Augustin, and R. Lasbleiz Oct. 1980 21 p Transl. into ENGLISH from Les Cah. de l'OPIT (France), no. 2, Winter 1979/1980 p 26-30 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Office de la Recherche Scientifique et Technique Outre-Mer, France
(Contract NASw-3198)
(NASA-TM-76369) Avail: NTIS HC A02/MF A01 CSCL 22B

Two short articles are presented that discuss satellite observation. Cloud cover interference of infrared photography is discussed. A file of the cloud cover over France is presented. T.M.

N80-33454*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DRAG-FREE ESTIMATION FEASIBILITY STUDY Final Report
D. B. Schaechter, D. G. Carta, D. Noon, J. Parker, and D. Sonnabend 15 May 1980 76 p refs
(Contract NAS7-100)
(NASA-CR-163635; JPL-Pub-80-20) HC A05/MF A01 CSCL 22B

A drag compensation system for solar probes and other spacecraft that require a drag-free capability is presented. Estimation techniques, derived from modern control theory, are proposed. T.M.

N80-33455*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LAUNCH MISSION SUMMARY AND TERMINAL COUNTDOWN, DELTA 153 SATELLITE BUSINESS SYSTEMS SATELLITE (SBS-A)
20 Oct. 1980 16 p
(NASA-TM-82212; KSC-GP-15-13) Avail: NTIS HC A02/MF A01 CSCL 22A

A brief summary of the launch vehicle, spacecraft, and mission is contained. Information relative to launch windows, vehicle telemetry coverage, realtime data flow, telemetry coverage by station, selected trajectory information, and a brief sequence of flight events is also included. Author

N80-33456# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SATNET DEVELOPMENT AND OPERATION. PLURIBUS SATELLITE IMP DEVELOPMENT. REMOTE SITE MAINTENANCE. INTERNET DEVELOPMENT. MOBILE ACCESS TERMINAL NETWORK, TCP FOR THE HP 3000, TCP - TAC Quarterly Technical Report, 1 May - 31 Jul. 1980
R. D. Bressler Aug. 1980 73 p refs
(Contracts MDA903-76-C-0252; N00039-78-C-0405; N00039-79-C-0386; MDA903-80-C-0353; MDA903-80-C-0214; ARPA Order 3214; ARPA Order 3175.17; ARPA Order 3211)
(AD-A089025; BBN-4474; QTR-18) Avail: NTIS HC A04/MF A01 CSCL 22/2

This Quarterly Technical Report describes work on the development of and experimentation with packet broadcast by satellite; on development of Pluribus Satellite IMPs; on a study of the technology of Remote Site Maintenance; on the development of Inter-network monitoring; and on shipboard satellite communications. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N80-33457*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE OFT LEVEL C NAVIGATION REQUIREMENTS
Sep. 1980 682 p Supersedes T80-10530 Revised
(NASA-TM-8221; JSC-14713; IN-79-FM-10-Rev-2; T80-10530) Avail: NTIS HC A99/MF A01 CSCL 17G

Detailed requirements for the orbital operations computer loads, OPS 2, and OPS 8 are given. These requirements represent the total on-orbit/rendezvous navigation baseline requirements for the following principal functions: on-orbital/rendezvous navigation sequencer; on-orbit/rendezvous UPP sequencer; on-orbit rendezvous navigation; on-orbit prediction; on-orbit user parameter processing; and landing Site update. J.M.S.

N80-33458# Naval Ocean Systems Center, San Diego, Calif.
SPACE SHUTTLE SOLID ROCKET BOOSTER RETRIEVAL SYSTEM: FIVE NOSC PAPERS ON SPACE SHUTTLE SUPPORT Technical Report, 1975 - 1979
A. J. Schlosser 10 Jul. 1980 52 p refs Presented at OCEANS 1979 Joint Conf., San Diego, Calif. 17-19 Sep. 1979 Sponsored in part by NASA and the Air Force
(AD-A089060; NOSC/TD-355) Avail: NTIS HC A04/MF A01 CSCL 22/4

A compilation of five papers on shuttle support: Space Shuttle Rocket Booster (SRB) Retrieval Equipments, by AJ Schlosser; The Solid Rocket Dewatering Set, by KR Fishel; The SRB Parachutes and Frustum Retrieval Equipments, by SD Hultberg; The SRB Retrieval Support Craft, by RL Watts; and Contingency Plans and Equipments for SRB Retrieval for Abnormal Conditions, by RE Jones. Authors are members of the NOSC Applied Technology Division, Code 522. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-33459# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DATA COLLECTION PLATFORMS: A TECHNIQUE FOR SPACE TELEMETRY APPLIED TO SURVEYING AMBIENT PARAMETERS [PLATAFORMA DE COLETA DE DADOS: UMA TECNICA ESPACIAL DE TELEMETRIA APLICADA AO LEVANTAMENTO DE PARAMETROS AMBIENTAIS]
Jose Roberto deOliveira May 1980 14 p refs In PORTUGUESE; ENGLISH summary Presented at 31st Reunion of the Brazilian Soc. for the Progr. of Sci.
(INPE-1743-RPE/139) Avail: NTIS HC A02/MF A01

Phenomenon whose value can be determined by a sensor with an electronic output, are monitored with the use of the Data Collection Platform (DCP) concept. The present systems on board polar orbiting meteorolological satellites allow platform location using the Doppler effect with an accuracy of up to 3 km. A DCP was composed of a small transmitter in the 400 MHz band, connected to several sensors through control circuitry. The messages were transmitted in digital form, and each one contained up to 5000 bits of information. The data reception was made by a ground station through a satellite (generally meteorological) as a communications link. The use of satellites allow for the coverage of conventional extensive areas, including points of difficult access not provided with telecommunications means. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-33460*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ORBITER THERMAL PRESSURE DROP CHARACTERISTICS FOR SHUTTLE ORBITER THERMAL PROTECTION SYSTEM COMPONENTS: HIGH DENSITY TILE, LOW DENSITY TILE, DENSIFIED LOW DENSITY TILE, AND STRAIN ISOLATION PAD
Pierce L. Lawing and Donna M. Nystrom Oct. 1980 16 p refs
(NASA-TM-81891) Avail: NTIS HC A02/MF A01 CSCL 22B

Pressure drop tests were conducted on available samples of low and high density tile, densified low density tile, and strain isolation pads. The results are presented in terms of pressure drop, material thickness and volume flow rate. Although the test apparatus was only capable of a small part of the range of conditions to be encountered in a Shuttle Orbiter flight, the data serve to determine the type of flow characteristics to be expected for each material type tested; the measured quantities also should serve as input for initial venting and flow through analysis. Author

N80-33461# Lockheed Missiles and Space Co., Palo Alto, Calif.
ACROSS THREE (ACTIVE CONTROL OF SPACE STRUCTURES), PHASE 1 Final Technical Report, 2 Jan. - 30 Sep. 1979
Michall G. Lyons, Jean N. Auburn, Gabriel Margulies, and Narenda K. Gupta May 1980 235 p refs
(Contract F30602-79-C-0087; AF Proj. C654)
(AD-A089142; RADC-TR-80-131) Avail: NTIS HC A11/MF A01 CSCL 22/2

The theory of stability augmentation (active control of vehicle dynamics) for large space structures is developed and tested analytically on a number of strawman configurations including large surveillance and HEL weapons plateforms. It is shown that active control is potentially feasible for micro-vibration stabilization of precision large structures; performance of several experimental breadboards is illustrated to enhance the theory. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-33462*# Harvard Coll. Observatory, Cambridge, Mass.
COMPUTER ASSISTED PERFORMANCE TESTS OF THE LYMAN ALPHA CORONAGRAPH Final Report, 1 Jun. 1978 - 30 Jun. 1979
W. H. Parkinson and John L. Kohl 30 Jun. 1979 10 p
(Grant NsG-7461)
(NASA-CR-163622) Avail: NTIS HC A02/MF A01 CSCL 14B

Preflight calibration and performance tests of the Lyman Alpha Coronagraph rocket instrument in the laboratory, with the experiment in its flight configuration and illumination levels near those expected during flight were successfully carried out using a pulse code modulation telemetry system simulator interfaced in real time to a PDP 11/10 computer system. Post acquisition data reduction programs developed and implemented on the same computer system aided in the interpretation of test and calibration data. T.M.

N80-33463*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HIGH SPEED LOOKUP TABLE APPROACH TO RADIOMETRIC CALIBRATION OF MULTISPECTRAL IMAGE DATA
W. Lane Kelly, IV, Barry D. Meredith, and William M. Howle Washington Oct. 1980 16 p
(NASA-TP-1741; L-13893) Avail: NTIS HC A02/MF A01 CSCL 14B

A concept for performing radiometric correction of multispectral image data onboard a spacecraft at very high data rates is presented and demonstrated. This concept utilized a lookup table approach, implemented in hardware, to convert the raw sensor data into the desired corrected output data. The digital lookup table memory was interfaced to a microprocessor to allow the data correction function to be completely programmable. Sensor data was processed with this approach at rates equal to the access time of the lookup table memory. This concept offers flexible high speed data processing for a wide range of applications and will benefit from the continuing improvements in performance of digital memories. Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-33464 Georgia Inst. of Tech., Atlanta.
EXPERIMENTAL DETERMINATION OF THE ADMITTANCES OF SOLID PROPELLANTS BY THE IMPEDANCE TUBE TECHNIQUE Ph.D. Thesis
Joseph David Baum 1980 138 p
Avail: Univ. Microfilms Order No. 8023758

A modified version of the impedance tube was utilized to measure the admittance and response function of aluminized and nonaluminized burning solid propellants. This technique can determine both the real and imaginary parts of the admittances of various propellants, solid as well as gaseous, over a wide range of frequencies, under identical oscillatory flow conditions at each frequency. In addition, this technique has the capability of determining the acoustic energy losses in the gas phase simultaneously with the measurement of the burning solid propellant surface admittance. A new data reduction procedure was developed to determine the admittance of the tested solid propellants by utilizing the acoustic pressure amplitude and phase data that is measured at discrete points along the walls of the impedance wall. Dissert. Abstr.

N80-33465*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SYNCHRONOUS ENERGY TECHNOLOGY
Sep. 1980 144 p Symp. held in Cleveland, 29-30 Apr. 1980
(NASA-CP-2154; E-469) Avail: NTIS HC A07/MF A01 CSCL 21H

The synchronous technology requirements for large space power systems are summarized. A variety of technology areas including photovoltaics, thermal management, and energy storage, and power management are addressed. For individual titles, see N80-33466 through N80-33475.

N80-33466*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SYNCHRONOUS ENERGY TECHNOLOGY PROGRAM
Robert C. Finke *In its* Synchronous Energy Technol. Sep. 1980 p 1-7 (For primary document see N80-33465 24-20)
Avail: NTIS HC A07/MF A01 CSCL 10B

The power program in NASA and DOD are discussed with emphasis on the technology for future large space power systems. The structure of the synchronous energy technology program is described and the technologies required for future geosynchronous power stations are defined. The output of the program is to be a series of design data documents to provide design information and to transfer the technology to the involved community. R.C.T.

N80-33467*# National Aeronautics and Space Administration, Washington, D. C.
NASA TECHNOLOGY PROGRAM OVERVIEW
J. P. Mullin *In* NASA. Lewis Space Flight Center Synchronous Energy Technol. Sep. 1980 p 9-13 (For primary document see N80-33465 24-20)
Avail: NTIS HC A07/MF A01 CSCL 21C

Various aspects of space power and electric propulsion are illustrated. The following topics are outlined: Photovoltaic power conversion; power management and distribution; chemical energy conversion and storage; thermal to electric conversion; advanced energetics; and synchronous energy technology. R.C.T.

N80-33468*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
AIR FORCE SPACE POWER TECHNOLOGY PROGRAM
R. Barthelemy, Tom Mahefkey, and Tom Hebblewaite *In* NASA. Lewis Space Flight Center Synchronous Energy Technol. Sep. 1980 p 15-28 (For primary document see N80-33465 24-20)
Avail: NTIS HC A07/MF A01 CSCL 10B

The military spacecraft power subsystem design requirements, developments goals, and planned technology efforts are summarized. The mission drivers of performance (weight and volume), hardening (survivability), autonomy, reliability, and miniaturization influence space mission effectiveness are outlined. The anticipated performance versus power level trends for reactor static conversion systems are illustrated. A conceptual design for a space based radar system is also given. R.C.T.

N80-33469*# National Aeronautics and Space Administration, Washington, D. C.
SPACECRAFT SYSTEM OVERVIEW OF SPACE POWER AT GEOSTATIONARY EARTH ORBIT
Richard F. Carlisle *In* NASA. Lewis Space Flight Center Synchronous Energy Technol. Sep. 1980 p 29-45 (For primary document see N80-33465 24-20)
Avail: NTIS HC A07/MF A01 CSCL 10B

The power requirements at geostationary Earth orbit are discussed. Special design considerations are introduced and power system elements and opportunities for technological improvements are described. R.C.T.

N80-33470*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTOVOLTAIC TECHNOLOGY DEVELOPMENT FOR SYNCHRONOUS ORBIT
Henry W. Brandhorst *In its* Synchronous Energy Technol. Sep. 1980 p 45-56 (For primary document see N80-33465 24-20)
Avail: NTIS HC A07/MF A01 CSCL 10A

Accomplishments and expected benefits are summarized for the following efforts: (1) achieving silicon solar cell efficiency of 18% at 200 micron m to 250 micron m thickness; (2) reducing silicon cell radiation damage in geosynchronous orbit after 10 years to less than 15%; (3) demonstrating coplanar back contact 50 micron m thick silicon solar cells with efficiency of 14%; (4) demonstrating the feasibility of a radiation tolerant GaAs concentrator cell; (5) achieving 30% efficient photo conversion in the laboratory; (6) defining candidate concepts for 50% efficient electromagnetic conversion; and (7) demonstrating the technology for protecting arrays capable of > 300W/kg after 10 years in geosynchronous orbit. A.R.H.

N80-33471*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LARGE SOLAR ARRAYS

William L. Crabtree *In* NASA. Lewis Space Flight Center Synchronous Energy Technol. Sep. 1980 p 57-68 (For primary document see N80-33465 24-20)

Avail: NTIS HC A07/MF A01 CSCL 10A

A spectrophotovoltaic converter, a thermophotovoltaic converter, a cassegrainian concentrator, a large silicon cell blanket, and a high flux approach are among the concepts being investigated as part of the multihundred kW solar array program for reducing the cost of photovoltaic energy in space. These concepts involve a range of technology risks, the highest risk being represented by the thermophotovoltaics and spectrophotovoltaics approaches which involve manipulation to of the incoming spectrum to enhance system efficiency. The planar array (solar blanket) has no technology risk and a moderate payback. The primary characteristics, components, and technology concerns of each of these concepts are summarized. An orbital power platform mission in the late 1980's is being used to allow a coherent technology advancement program in order to achieve a ten year life with maintenance at a capital recurring cost of $30/watt based on 1978 dollars. A.R.H.

N80-33472*# National Aeronautics and Space Administration, Washington, D. C.

THERMAL MANAGEMENT FOR HIGH POWER SPACE PLATFORM SYSTEMS

Richard A. Gualdoni *In* NASA. Lewis Space Flight Center Synchronous Energy Technol. Sep. 1980 p 69-79 (For primary document see N80-33465 24-20)

Avail: NTIS HC A07/MF A01 CSCL 10A

With future spacecraft power requirements expected to be in the order of 100 to 250 kilowatts and orbital lifetimes in the order of five to ten years, new approaches and concepts will be required that can efficiently and cost effectively provide the required heat rejection and temperature control capabilities. A plan was established to develop the commensurate technologies necessary for the thermal management of a high power space platform representative of future requirements and to achieve technology readiness by 1987. The approach taken in developing the program was to view the thermal requirements of the spacecraft as a spacecraft system rather than each as an isolated thermal problem. The program plan proposes 45 technology tasks required to achieve technology readiness. Of this total, 24 tasks were subsequently identified as being pacing technology tasks and were recommended for initiation in FY 1980 and FY 1981. A.R.H.

N80-33473*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ELECTROCHEMICAL ORBITAL ENERGY STORAGE (ECOES) TECHNOLOGY PROGRAM

Hoyt McBryar *In* NASA. Lewis Space Flight Center Synchronous Energy Technol. Sep. 1980 p 81-95 (For primary document see N80-33465 24-20)

Avail: NTIS HC A07/MF A01 CSCL 10C

The versatility and flexibility of a regenerative fuel cell power and energy storage system is considered. The principal elements of a Regenerative Fuel Cell System combine the fuel cell and electrolysis cell with a photovoltaic solar cell array, along with fluid storage and transfer equipment. The power output of the array (for LEO) must be roughly triple the load requirements of the vehicle since the electrolyzers must receive about double the fuel cell output power in order to regenerate the reactants (2/3 of the array power) while 1/3 of the array power supplies the vehicle base load. The working fluids are essentially recycled indefinitely. Any resupply requirements necessitated by leakage or inefficient reclamation is water - an ideal material to handle and transport. Any variation in energy storage capacity impacts only the fluid storage portion, and the system is insensitive to use of reserve reactant capacity. A.R.H.

N80-33474*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

STATUS OF NICKEL-HYDROGEN CELL TECHNOLOGY

Don R. Warnock *In* NASA. Lewis Space Flight Center Synchronous Energy Technol. Sep. 1980 p 97-105 (For primary document see N80-33465 24-20)

Avail: NTIS HC A07/MF A01 CSCL 10C

Nickel hydrogen cell technology has been developed which solves the problems of thermal management, oxygen management, electrolyte management, and electrical and mechanical design peculiar to this new type of battery. This technology was weight optimized for low orbit operation using computer modeling programs but is near optimum for other orbits. Cells ranging in capacity up to about 70 ampere-hours can be made from components of a single standard size and are available from two manufacturers. The knowledge gained is now being applied to the development of two extensions to the basic design: a second set of larger standard components that will cover the capacity range up to 150 ampere-hours; and the development of multicell common pressure vessel modules to reduce volume, cost and weight. A manufacturing technology program is planned to optimize the producibility of the cell design and reduce cost. The most important areas for further improvement are life and reliability which are governed by electrode and separator technology. A.R.H.

N80-33475*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

POWER MANAGEMENT

J. Graves *In* NASA. Lewis Space Flight Center Synchronous Energy Technol. Sep. 1980 p 107-114 (For primary document see N80-33465 24-20)

Avail: NTIS HC A07/MF A01 CSCL 21H

The multihundred kW power system management and a distribution program aims to develop critical components, circuits, and subsystems required to manage the generation, storage, and distribution of energy in large, orbital space systems. To accomplish this objective, a reference system including subsystems for the generation and storage of energy and management of electrical and thermal energy was designed and is being used to assess at the system level the impact of changing various subsystem parameters. A power management subsystem will then be designed. The subsystem is autonomous and based on ground utility systems concepts to the maximum extent possible. An agency power system breadboard is under development for characterizing and verifying the various component and subsystem technology developments. A.R.H.

N80-33476*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

BAFFLE APERTURE DESIGN STUDY OF HOLLOW CATHODE EQUIPPED ION THRUSTERS M.S. Thesis Technical Report, 1 Dec. 1979 - 1 Oct. 1980

John R. Brophy, Jr. and Paul J. Wilbur Oct. 1980 78 p refs (Grant NGR-06-002-112)

(NASA-CR-165164) Avail: NTIS HC A05/MF A01 CSCL 21C

A simple theoretical model which can be used as an aid in the design of the baffle aperture region of a hollow cathode equipped ion thruster was developed. An analysis of the ion and electron currents in both the main and cathode discharge chambers is presented. From this analysis a model of current flow through the aperture, which is required as an input to the design model, was developed. This model was verified experimentally. The dominant force driving electrons through the aperture was the force due to the electrical potential gradient. The diffusion process was modeled according to the Bohm diffusion theory. A number of simplifications were made to limit the amount of detailed plasma information required as input to the model to facilitate the use of the model in thruster design. This simplified

model gave remarkably consistant results with experimental results obtained with a given thruster geometry over subtantial changes in operating conditions. The model was uncertain to about a factor of two for different thruster cathode region geometries. The design usefulness was limited by this factor of two uncertainty and by the accuracy to which the plasma parameters required as inputs to the model were specified. T.M.

N80-33477# Texas Univ. at Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
FLOWS IN THE ANNULAR REGION WHEN AN UNDEREXPANDED NOZZLE IS EXHAUSTED INTO A STEPPED LAUNCH TUBE Final Report, 1 Mar. 1979 - 30 Sep. 1979
Stanley A. Bouslog and John J. Bertin Redstone Arsenal, Ala. Army Missile Command 1 Mar. 1980 110 p
(Contract DAAK40-79-C-0021)
(AD-A088581; AD-E595021; RL-CR-80-4) Avail: NTIS HC A06/MF A01 CSCL 20/4

An experimental program was conducted in which unheated air was exhausted through a stationary rocket nozzle into a constant area tube launcher modified with a constructive ring. The constrictive ring simulated a constraint which could be a permanent on temporary part of the launch tube. For the first phase of the test program the static wall pressure distribution, upstream and downstream of the ring, and the mass flow rates in the annular gap were measured. Given an underexpanded nozzle, a correlation between the generation blow by, or reverse flow in the annular gap, and the position of the nozzle exit plane relative to the front face of the ring was developed. The flow phenomena present in the launcher for different nozzle positions was also investigated. For the second phase of the test program the static pressure distribution on the surface of the rocket and the mass flow rates in the annular gap were measured. The differential pressure distributions on the rocket were related to the mass flow rate in the annular gap with increasing blow by flow, and with increasing ejector flow. T.M.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-33478*# Applied Medical Technology, Cleveland Heights, Ohio.
TISSUE RESPONSE TO PERITONEAL IMPLANTS Final Report
George J. Picha Jun. 1980 73 p refs
(NASA Order C-33350-D)
(NASA-CR-159817) Avail: NTIS HC A04/MF A01 CSCL 06P

Peritoneal implants were fabricated from poly 2-OH, ethyl methacrylate (HEMA), polyetherurethane (polytetramethylene glycol 1000 MW, 1,4 methylene disocynate, and ethyl diamine), and untreated and sputter treated polytetrafluoroethylene (PTFE). The sputter treated PTFE implants were produced by an 8 cm diameter argon ion source. The treated samples consisted of ion beam sputter polished samples, sputter etched samples (to produce a microscopic surface cone texture) and surface pitted samples (produced by ion beam sputtering to result in 50 microns wide by 100 microns deep square pits). These materials were implanted in rats for periods ranging from 30 minutes to 14 days. The results were evaluated with regard to cell type and attachment kinetics onto the different materials. Scanning electron microscopy and histological sections were also evaluated. In general the smooth hydrophobic surfaces attracted less cells than the ion etched PTFE or the HEMA samples. The ion etching was observed to enhance cell attachment, multinucleated giant cell (MNGC) formation, cell to cell contact, and fibrous capsule formation. The cell responsed in the case of ion etched PTFE to an altered surface morphology. However, equally interesting was the similar attachment kinetics of HEMA verses the ion etched PTFE. However, HEMA resulted in a markedly different response with no MNGC's formation, minimal to no capsule formation, and sample coverage by a uniform cell layer. R.C.T.

N80-33479*# Martin Marietta Corp., Denver, Colo.
EVALUATION AND PREDICTION OF LONG TERM SPACE ENVIRONMENTAL EFFECTS ON NON-METALLIC MATERIALS Quarterly Progress Report
John A. Shepic 8 Oct. 1980 12 p
(Contract NAS8-33578)
(NASA-CR-161585; MCR-80-509-Issue-4; QPR-4) Avail: NTIS HC A02/MF A01 CSCL 11G

The effects of prolonged spacecraft materials were determined and the results compared with predicted behavior. The adhesion and dielectric properties of poly-thermaleze and therm-amid magnet wire insulation were studied. The tensile properties of Lexan, polyurethane, polyethelyne, lucite, and nylon were studied well as the flexure and tensile characteristic of Adlock 851, a phenolic laminate. The volume resistivity of Cho-seal, a conductive elastomer was also a examined. Tables showethe time exposed at thermal vacuum, and the high, low, and average MPA and KSI. A.R.H.

N80-33480# National Bureau of Standards, Washington, D.C.
APPLICATION OF SOLIDIFICATION THEORY TO RAPID SOLIDIFICATION PROCESSING Semiannual Technical Report, 1 Oct. 1979 - 31 Mar. 1980
W. J. Boettinger, J. W. Cahn, S. R. Conell, and J. P. Manning May 1980 58 p refs
(ARPA Order 3751)
(AD-A089006) Avail: NTIS HC A04/MF A01 CSCL 11/2

The semiannual technical report for ARPA Order 3751 covers the period 1 Oct 79 to 31 Mar 80. Work is reported in the following areas of rapid solidification processing: (1) Interface Stability during Rapid Solidification, (2) Eutectic Solidification and the Formation of Metallic Glasses, and (3) Thermodynamics of Metastable Equilibria. GRA

N80-33481# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
THEORETICAL ASPECTS OF THE MECHANISM OF SIMPLE CHEMICAL REACTIONS Interim Report
Aron Kuppermann 1979 95 p refs Submitted for publication
(Grant AF-AFOSR-3394-77; AF Proj. 2303)
(AD-A088804; AFOSR-80-0609TR) Avail: NTIS HC A05/MF A01 CSCL 07/4

The dynamical theory of chemical reactions is an important and rapidly developing branch of chemical dynamics. Although the first accurate ab initio three dimensional quantum mechanical calculations of the cross sections for a simple chemical reaction have been performed less than five years ago, the theory has already made predictions about the existence of new chemical phenomena, and is providing valuable guidance for the experiments aimed at detecting their existence. Thus, after 40 years of near-dormancy, this field has begun to evolve with startling speed. A knowledge of its foundations has become a necessary background for everybody interested in modern chemical dynamics. In this series of four lectures, we intend to present a general overview of the quantum theory of chemical reactions, including much of the applications done so far. In the first lecture, we willl review the quantum theory of collinear triatomic reactions. In the next two lectures, these considerations will be generalized to three dimensional bimolecular versions, and the results of calculations performed so far presented and analyzed. In the fourth lecture, we will discuss dynamic Feshback resonances in chemical reactions. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-33482* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING BEARING MATERIAL Patent
Harold E. Sliney, inventer (to NASA) Issued 29 Jul. 1980 7 p Filed 31 Jan. 1977 Supersedes N77-32249 (15 - 23, p 3050) Division of abandoned US Patent Appl. SN-616528, filed 25 Sep. 1975, which is a division of US Patent Appl. SN-513611, filed 10 Oct. 1974

(NASA-Case-LEW-11930-3; US-Patent-4,214,905; US-Patent-Appl-SN-764245; US-Patent-Class-75-200; US-Patent-Class-75-222; US-Patent-Appl-SN-616528; US-Patent-Appl-SN-513611) Avail: US Patent and Trademark Office CSCL 11D

A composite material is described which will provide low friction surfaces for materials in rolling or sliding contact and is self lubricating and oxidation resistant up to and in excess of about 930 C. The composite is comprised of a metal component which lends strength and elasticity to the structure, a fluoride salt component which provides lubrication and, lastly, a glass component which not only provides oxidation protection to the metal but may also enhance the lubrication qualities of the composite.

Official Gazette of the U.S. Patent and Trademark Office

N80-33483 British Library Lending Div., Boston Spa (England).
FORMATION OF ORGANOSILICON COMPOUNDS. 58: SYNTHESIS OF A CARBOSILANE WITH PROPELLANE STRUCTURE
G. Fritz and H. J. Vogt. 4 Mar. 1979. 15 p. refs. Transl. into ENGLISH from Z. fuer Anorg. und Allgem. Chem. (West Germany), v. 419, no. 1, 1976. p 2-8
(RAE-Lib-Trans-2029(5207)) Avail: British Library Lending Div., Boston Spa, England

A carbosilane with a propellane structure is formed by a coupling reaction of BrSi(CH2SiMe2CH2SiMe2Br)3 (2) with CCl4 and Li. The reaction of C6H5Me2SiCH2Li with ClMe2SiCH2Br leads to C6H5Me2SiCh2SiCH2SiMe2Ch2Br. Metallation with lithium followed by reaction with Cl3SiC6H5 produces compound C6H5Si(CH2SiMe2CH2SiMe2C6H5)3 which then forms (2) by cleavage with bromine. Author

N80-33484 Rice Univ., Houston, Tex.
X-RAY DIFFRACTION STUDY OF THE STRUCTURE OF BORON IN VAPOR-DEPOSITED BORON FIBERS Ph.D. Thesis
Jayant Venkatkrishna Bhardwaj. 1980. 127 p.
Avail: Univ. Microfilms Order No. 8018032

The structure of vapor-deposited fiber boron was studied using X-ray diffraction and computer modeling. The diffraction pattern displayed broad peaks which were interpreted to arise from a microcrystalline material having an average crystallite size of about 30 angstroms. The Debye equation was used to compute the intensity scattered by randomly oriented crystallites. Crystallites with diameter up to 26 angstroms were considered. An additional computer program was written to calculate the different interatomic distances and their multiplicities, and to compute their contributions to the various peaks. This method of analysis was utilized to drive the atoms in the microcrystal towards positions which gave a more favorable fit of the computed intensity profile to the experimentally obtained profile.

Dissert. Abstr.

N80-33485 Virginia Univ., Charlottesville.
AN INVESTIGATION OF THE ELECTROCHEMICAL BEHAVIOR OF GRAPHITE FIBER-POLYMER COMPOSITES Ph.D. Thesis
Gery Ryan Stafford. 1980. 193 p.
Avail: Univ. Microfilms Order No. 8022944

Voltage time curves were obtained for a number of composite systems to see the effects of fiber orientation, polymer matrix, and fiber properties. Superior voltage stability during ac electrolysis was obtained with composites having a rather low impact strength. The ability to slough damaged and electrically isolated fibers in an effort to expose fresh, active fiber is of utmost importance. Anodic and cycle voltammetry were performed in various electrolytes in an effort to further understand the mechanisms of graphite oxidation. The presence of halogen salt in solution decreases the composite's voltage stability during dc electrolysis. It is shown that a species detrimental to the graphite fiber is produced at the anode, thereby enhancing its oxidation.

Dissert. Abstr.

N80-33486# Massachusetts Inst. of Tech., Cambridge.
DYNAMIC FRACTURES IN ORTHOTROPIC FIBER COMPOSITES Final Report, Dec. 1978 - Dec. 1979
James H. Williams, Jr., Petros N. Kousiounelos, and Samson S. Lee. Dec. 1979. 369 p. refs.
(Contract N00019-79-C-0171)
Avail: NTIS HC A16/MF A01

Approximate Mode 1 dynamic stress intensity factors and energy release rates for highly orthotropic 0 deg and 90 deg unidirectional fiber composites are derived in terms of their quasi-static counterparts and a velocity correction factor. Also, the physically realistic Mode 2 problem in 90 deg unidirectional fiber composites is analyzed. It is found experimentally that the long strip configuration subjected to constant extensional displacement can simulate constant crack propagation velocities. Accordingly, the model's dynamic energy release rate was used to determine the dynamic fracture toughness of graphite epoxy composites. The experimentally obtained dynamic fracture toughness was used as input in the analysis of dynamic fracture in double cantilever beam (DCB) specimens under constant pin displacement loading. The predicted crack arrest is compared with experiments on DCB specimens. Closed form analyses of the dynamic fracture and arrest in unidirectional fiber composites were obtained via a double cantilever shear beam model. The case in which the dynamic fracture toughness is independent of crack tip velocity is considered. A.R.H.

N80-33487*# Lockheed-California Co., Burbank.
CARBON/GRAPHITE FIBER RISK ANALYSIS AND ASSESSMENT STUDY: ASSESSMENT OF RISK TO THE LOCKHEED MODEL L-1011 COMMERCIAL TRANSPORT AIRCRAFT Final Report
James Daniledes and John R. Koch. Feb. 1980. 128 p.
(Contract NAS1-15509)
(NASA-CR-159201; LR-29338) Avail: NTIS HC A07/MF A01 CSCL 11D

The risk associated with the accidental release of carbon/graphite fibers (CF) from fires on commercial transport aircraft incorporating composite materials was assessed. Data are developed to evaluate the potential for CF damage to electrical and electronic equipment, assess the cost risk, and evaluate the hazard to continued operation. The subjects covered include identification of susceptible equipments, determination of infiltration transfer functions, analysis of airport operations, calculation of probabilities of equipment failures, assessment of the cost risk, and evaluation of the hazard to continued operation. The results show the risks associated with CF contamination are negligible through 1993. J.M.S.

N80-33488*# Douglas Aircraft Co., Inc., Long Beach, Calif.
CARBON/GRAPHITE FIBER RISK ANALYSIS AND ASSESSMENT STUDY: AN ASSESSMENT OF THE RISK TO DOUGLAS COMMERCIAL TRANSPORT AIRCRAFT Final Report
H. C. Schjelderup, C. Q. Cook, E. Snyder, B. Henning, J. Hosford, D. L. Gilles, and C. W. Swanstrom. Jan. 1980. 75 p.
(Contract NAS1-15508)
(NASA-CR-159212) Avail: NTIS HC A04/MF A01 CSCL 11D

The potential hazard to electrical and electronic devices should there be a release of free carbon fibers due to an aircraft crash and fire was assessed. Exposure and equipment sensitivity data were compiled for a risk analysis. Results are presented in the following areas: DC-9/DC-10 electrical/electronic component characterization; DC-9 and DC-10 fiber transfer functions; potential for transport aircraft equipment exposure to carbon fibers; and equipment vulnerability assessment. Results reflect only a negligible increase in risk for the DC-9 and DC-10 fleets either now or projected to 1993. J.M.S.

N80-33489*# Boeing Aerospace Co., Seattle, Wash.
HYBRIDIZED POLYMER MATRIX COMPOSITES Final Report, 2 Aug. 1978 - 2 Nov. 1979
E. E. House, J. T. Hoggatt, and W. A. Symonds. 20 Oct. 1980. 124 p. refs.
(NASA-CR-165146; D180-26183-1) Avail: NTIS HC A06/MF A01 CSCL 11D

The extent to which graphite fibers are released from resin matrix composites that are exposed to fire and impact conditions was determined. Laboratory simulations of those conditions that could exist in the event of an aircraft crash and burn situation were evaluated. The effectiveness of various hybridizing concepts

in preventing the release of graphite fibers were also evaluated. The baseline (i.e., unhybridized) laminates examined were prepared from commercially available graphite/epoxy, graphite/polyimide, and graphite/phenolic materials. Hybridizing concepts investigated included resin fillers, laminate coatings, resin blending, and mechanical interlocking of the graphite reinforcement. The baseline and hybridized laminates' mechanical properties, before and after isothermal and humidity aging, were also compared. It was found that a small amount of graphite fiber was released from the graphite/epoxy laminates during the burn and impact conditions used in this program. However, the extent to which the fibers were released is not considered a severe enough problem to preclude the use of graphite reinforced composites in civil aircraft structure. It also was found that several hybrid concepts eliminated this fiber release. Isothermal and humidity aging did not appear to alter the fiber release tendencies. R.C.T.

N80-33490*# Bionetics Corp., Hampton, Va.
EXPERIMENTAL AND ANALYTICAL STUDIES FOR THE NASA CARBON FIBER RISK ASSESSMENT
Aug. 1980 137 p refs
(Contract NAS1-15238)
(NASA-CR-159214) Avail: NTIS HC A07/MF A01 CSCL 11D

Various experimental and analytical studies performed for the NASA carbon fiber risk assessment program are described with emphasis on carbon fiber characteristics, sensitivity of electrical equipment and components to shorting or arcing by carbon fibers, attenuation effect of carbon fibers on aircraft landing aids, impact of carbon fibers on industrial facilities. A simple method of estimating damage from airborne carbon fibers is presented. A.R.H.

N80-33491*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
ELECTRONIC EQUIPMENT VULNERABILITY TO FIRE RELEASED CARBON FIBERS
Richard A. Pride, Austin D. McHatton, and Kenneth A. Musselman (Naval Surface Weapons Center, Dahlgren, Va.) Sep. 1980 83 p refs
(NASA-TM-80219) Avail: NTIS HC A05/MF A01 CSCL 11D

The vulnerability of electronic equipment to damage by carbon fibers released from burning aircraft type structural composite materials was investigated. Tests were conducted on commercially available stereo power amplifiers which showed that the equipment was damaged by fire released carbon fibers but not by the composite resin residue, soot and products of combustion of the fuel associated with burning the carbon fiber composites. Results indicate that the failure rates of the equipment exposed to the fire released fiber were consistent with predictions based on tests using virgin fibers. R.C.T.

N80-33492*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
CARBON FIBER PLUME SAMPLING FOR LARGE SCALE FIRE TESTS AT DUGWAY PROVING GROUND
A. R. Chovit, P. Lieberman, D. E. Freeman, W. C. Beggs, and W. A. Milavec Mar. 1980 173 p refs
(Contract NAS1-15465)
(NASA-CR-159215; TRW-80-03) Avail: NTIS HC A08/MF A01 CSCL 11D

Carbon fiber sampling instruments were developed: passive collectors made of sticky bridal veil mesh, and active instruments using a light emitting diode (LED) source. These instruments measured the number or number rate of carbon fibers released from carbon/graphite composite material when the material was burned in a 10.7 m (35 ft) dia JP-4 pool fire for approximately 20 minutes. The instruments were placed in an array suspended from a 305 m by 305 m (1000 ft by 1000 ft) Jacob's Ladder net held vertically aloft by balloons and oriented crosswind approximately 140 meters downwind of the pool fire. Three tests were conducted during which released carbon fiber data were acquired. These data were reduced and analysed to obtain the characteristics of the released fibers including their spatial and size distributions and estimates of the number and total mass of fibers released. The results of the data analyses showed that 2.5 to 3.5 x 10 to the 8th power single carbon fibers were released during the 20 minute burn of 30 to 50 kg mass of initial, unburned carbon fiber material. The mass released as single carbon fibers was estimated to be between 0.1 and 0.2% of the initial, unburned fiber mass. J.M.S.

N80-33493*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
INFLUENCE OF QUALITY CONTROL VARIABLES ON FAILURE OF GRAPHITE/EPOXY UNDER EXTREME MOISTURE CONDITIONS
Linda L. Clements (Advanced Research and Applications Corp., Sunnyvale, Calif.) and Pauline R. Lee Oct. 1980 24 p refs
(NASA-TM-81246; A-8382) Avail: NTIS HC A02/MF A01 CSCL 11D

Tension tests on graphite/epoxy composites were performed to determine the influence of various quality control variables on failure strength as a function of moisture and moderate temperatures. The extremely high and low moisture contents investigated were found to have less effect upon properties than did temperature or the quality control variables of specimen flaws and prepreg batch to batch variations. In particular, specimen flaws were found to drastically reduce the predicted strength of the composite, whereas specimens from different batches of prepreg displayed differences in strength as a function of temperature and extreme moisture exposure. The findings illustrate the need for careful specimen preparation, studies of flaw sensitivity, and careful quality control in any study of composite materials. Author

N80-33494*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROCESS MODIFICATIONS FOR IMPROVED CARBON FIBER COMPOSITES: ALLEVIATION OF THE ELECTRICAL HAZARDS PROBLEM
Kumar Ramohalli 15 Jun. 1980 116 p refs
(Contract NAS7-100)
(NASA-CR-163631; JPL-Pub-80-56) Avail: NTIS HC A06/MF A01 CSCL 11D

Attempts to alleviate carbon-fiber-composite electrical hazards during airplane crash fires through fiber gasification are described. Thermogravimetric and differential scanning calorimetric experiments found several catalysts that caused fibers to combust when composites were exposed to test fires. Composites were tested in the 'Burn-Bang' apparatus and in high voltage electrical detection grid apparatus. In a standard three minute burn test modified composites released no fibers, while state-of-the-art composites released several hundred fiber fragments. Expected service life with and without catalytic modification was studied and electron microscopy and X-ray microanalysis furnished physical appearance and chemical composition data. An acrylic acid polymer fiber coating was developed that wet the carbon fiber surface uniformly with the catalyst, providing a marked contrast with the uneven coats obtained by solution-dipping. S.F.

N80-33495*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
INFLUENCE OF STRESS INTERACTION ON THE BEHAVIOR OF OFF-AXIS UNIDIRECTIONAL COMPOSITES
Marek-Jerzy Pindera and Carl T. Herakovich Sep. 1980 28 p refs Presented at the 2d USA-USSR Symp. on Fracture of Composite Mater., 3-5 Sep. 1980
(Contract NCC1-15)
(NASA-CR-163618; VPI-E-80-26; IR-21) Avail: NTIS HC A03/MF A01 CSCL 11D

The yield function for plane stress of a transversely isotropic composite lamina consisting of stiff, linearly elastic fibers and a von Mises matrix material is formulated in terms of Hill's elastic stress concentration factors and a single plastic constraint parameter. The above are subsequently evaluated on the basis of observed average lamina and constituent response for the Avco 5505 boron epoxy system. It is shown that inclusion of residual stresses in the yield function together with the incorporation of Dubey and Hillier's concept of generalized yield stress for anisotropic media in the constitutive equation correctly predicts the trends observed in experiments. The incorporation of the strong axial stress interaction necessary to predict the correct trends in the shear response is directly traced to the

high residual axial stresses in the matrix induced during fabrication of the composite. Author

N80-33496*# General Dynamics/Convair, San Diego, Calif.
TIME-TEMPERATURE-STRESS CAPABILITIES OF COMPOSITE MATERIALS FOR ADVANCED SUPERSONIC TECHNOLOGY APPLICATION, PHASE 1
J. R. Kerr and J. F. Haskins Apr. 1980 456 p refs
(Contract NAS1-12308)
(NASA-CR-159267; GDC-MAP-80-001) Avail: NTIS HC A20/MF A01 CSCL 11D

Implementation of metal and resin matrix composites into supersonic vehicle usage is contingent upon accelerating the demonstration of service capacity and design technology. Because of the added material complexity and lack of extensive service data, laboratory replication of the flight service will provide the most rapid method of documenting the airworthiness of advanced composite systems. A program in progress to determine the time temperature stress capabilities of several high temperature composite materials includes thermal aging, environmental aging, fatigue, creep, fracture, and tensile tests as well as real time flight simulation exposure. The program has two parts. The first includes all the material property determinations and aging and simulation exposures up through 10,000 hours. The second continues these tests up to 50,000 cumulative hours. Results are presented of the 10,000 hour phase, which has now been completed. A.R.H.

N80-33497*# Boeing Co., Seattle, Wash.
LARC-13 ADHESIVE DEVELOPMENT Final Report, Oct. 1978 - Jun. 1980
S. G. Hill, C. H. Sheppard, and J. C. Johnson Jun. 1980 50 p refs
(Contract NAS1-15562)
(NASA-CR-159317; Rept-2-3621) Avail: NTIS HC A03/MF A01 CSCL 11A

An improved adhesive for 589 K (600 F) use was developed by modifying the base LARC-13 formula. Four resins were synthesized by partial substitution of m,m'-methylene dianiline and then further modified, chemically characterized, and evaluated as adhesives in lap-shear and crack extension tests. Three amide-imide copolymers were also evaluated. The parameters of film thickness, film B-staging, and cure conditions were studied for their effect on bond strength of titanium-bonded lap shear specimens at room temperature and 589BK. Surface pretreatment of titanium bonding was investigated. Crack extension, lap-shear, 'T' peel, and flatwise tensile specimens were fabricated and tested to determine bond properties and the effect of thermal aging on bond strength. The data obtained with the improved adhesive system indicate it would meet the 589 K (600 F) properties desired for application on space shuttle components. Average titanium lap shear data were: (1) 21.1 MPa (3355 psi) at RT; (2) 13.0 MPa (1881 psi) at 600 F; and (3) 16.4 MPa (2335 psi) after aging 125 hours at 600 F and tested at 600 F. A.R.H.

N80-33498# Pennsylvania State Univ., University Park. Materials Research Lab.
MECHANISMS OF EROSION Final Report, 1 Apr. 1977 - 31 May 1980
Norman H. Macmillan Aug. 1980 228 p refs
(Contracts DAAG29-79-C-0104; DAAG29-77-C-0100)
(AD-A088571; ARO-14084.13-MS) Avail: NTIS HC A11/MF A01 CSCL 07/4

A single stage gas gun and a whirling arm rig were used to study the erosion of mono- and poly-crystalline MgO and Al and mono-crystalline LiF targets by millimeter scale steel and WC - 6% Co spheres. The resultant damage was variously studied by optical and scanning electron microscopy, dislocation etching and surface profilometry, and the corresponding mass losses were determined gravimetrically. A computer model of oblique impact was developed and tested against the experimental observations. Results show that the variation of impact crater dimensions with impact to relate mass loss to crater geometry in quantitative terms under either single or multiparticle impact conditions. They also suggest that the erosion of semibrittle materials is determined primarily by the intersection of the lateral and median (or radial) cracks formed about the impact craters, and that ductile materials erode by the detachment of thin platelets formed by extrusion of piled-up material between subsequently arriving particles and the underlying substrate. GRA

N80-33499# Ohio State Univ., Columbus. Research Foundation.
CONDUCTION HEAT TRANSFER ANALYSIS IN COMPOSITE MATERIALS Final Report, 1 Jul. 1978 - 30 Jun. 1979
Lit S. Han and Andrew A. Cosner Mar. 1980 153 p refs
(Grant AF-AFOSR-3640-78; AF Proj. 2307)
(AD-A088741; AFWAL-TR-80-3012) Avail: NTIS HC A08/MF A01 CSCL 11/4

With anticipated increased use of composite materials in aerospace structures and other applications, thermal properties of composites are needed as essential design information. In the past there was only scanty amount of research effort in thermal analysis of composites, as most of the work has been concerned with their mechanical properties. This report contains results from a rigorous analysis to determine steady state effective thermal conductivities of fiber-matrix type of composites. The fibers bundled into twos are considered dispersed in a matrix of resin. The dispersion patterns of configurations considered are: (1) uni-directional fibers in a matrix, as the simplest geometry, and (2) 0.90 configuration in which two unidirectional tapes are overlaid at 90 degrees to each other. The method of analysis is to solve a two region steady state heat conduction equation either analytically or numerically. The analysis assumes a prior knowledge of the geometry of a composite and the constituents thermal conductivities. GRA

N80-33500# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.
FATIGUE FAILURE CRITERIA FOR UNIDIRECTIONAL FIBER COMPOSITES
Zvi Hashin Aug. 1980 33 p refs
(Contract N00014-78-C-0544)
(AD-A088733; TR-5) Avail: NTIS HC A03/MF A01 CSCL 11/4

Three dimensional fatigue failure criteria for unidirectional fiber composites under states of cyclic stress are established in terms of quadratic stress polynomials which are expressed in terms of the transversely isotropic invariants of the cyclic stress. Two distinct fatigue failure modes, fiber mode and matrix mode, are modelled separately. Material information needed for the failure criteria are the S-N curves for single stress components. A preliminary approach to incorporate scatter into the failure criteria is presented. GRA

N80-33501# United Technologies Research Center, East Hartford, Conn.
EVALUATION OF AMORPHOUS RIBBON REINFORCED RESIN MATRIX COMPOSITES Final Report, 31 Jul. 1978 - 30 Apr. 1980
James R. Strife and Karl M. Prewo 30 Apr. 1980 186 p refs
(Contract F33615-78-C-5063; AF Proj. 2419)
(AD-A089102; UTRC/R-80-914389-18; AFWAL-TR-80-4060)
Avail: NTIS HC A09/MF A01 CSCL 11/4

Ribbon reinforced composites are attractive as structural materials since relatively isotropic in-plane properties are achieved if the ribbon aspect ratio is sufficiently high. Recent advances in the production of amorphous metal ribbons on a continuos basis have resulted in a ribbon material which exhibits unique properties and is potentially low cost. Commercially available amorphous metal ribbon materials were used in this investigation to reinforce resin matrices. Typical ribbon properties were a density of 8.02 gm/cc, tensile strengths in the range of 2550-2900 MPa, tensile modulus of 165 GPa, and aspect ratios, w/t, up to 380. The longitudinal properties of the composites developed were in agreement with the simple rule of mixtures. The transverse composite properties were dependent on ribbon aspect ratio and the ribbon stacking pattern. The composites developed were compared on a specific property basis to currently used quasi-isotropic graphite/epoxy. It was demonstrated that amorphous metal ribbon reinforced resins are competitive with quasi-isotropic graphite/epoxy on a specific strength basis. However, amorphous metal ribbon reinforced resins are not

competitive on a specific modulus basis. Due to the relatively invariant nature of the specific modulus of amorphous metal ribbon materials, no improvement is expected in this regard. It was concluded that these composites would not be in a competitive position for most high performance composite applications, particularly in the aerospace industry. GRA

N80-33502# Hughes Research Labs., Malibu, Calif.
SILICON GERMANIUM ALLOYS FOR INFRARED DETECTORS Final Report, 15 Aug. 1977 - 14 Aug. 1979
H. Winston, H. Kimura, and R. Baron Apr. 1980 60 p refs
(Contract F33615-77-C-5052; AF Proj. 2306)
(AD-A088732; AFWAL-TR-80-4031) Avail: NTIS
HC A04/MF A01 CSCL 17/5

Silicon-germanium alloys in the range of 10 at .% Ge have been prepared by Czochralski growth. Material that was not intentionally doped exhibited resistivities as high as 1700 ohm-cm, but, because of the uptake of boron impurities from the crucible during growth, higher resistivities could not be achieved. Therefore, even though the alloys had absorption coefficients for 1.06 micron radiation around 50 per cm (in contrast to 14 per cm for silicon), they were not well suited to preparing p-i-n detectors for 1.06 micron applications because the resistivities were too low to provide suitable long depletion regions. We prepared some alloy crystals by a crucible-free process (which would lead to high resistivity) akin to float zoning. The maximum Ge content achieved was about 2.5 at .%; while this value could be increased by equipment modification and process development, a fundamental drawback of the method is an axial variation of the germanium content as the germanium initially present in the zone is depleted. Measurements of minority carrier diffusion lengths in device structure made of p-type Si-Ge and of p-type Si showed essentially equivalent recombination life-times for both materials as processed to make the devices; the lifetime values were close to 100 nsec. At room temperature, the mobility in p-type Si-Ge is degraded by 10 to 20% from the Si value. At cryogenic temperature, the mobility reduction is much larger, but is consistent with the disorder scattering estimate from room temperature measurements. GRA

N80-33503# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
CATALYTIC INCINERATION OF GRAPHITE FIBERS IN A GRAPHITE-EPOXY COMPOSITE FIRE Interim Report
Kenneth G. Clark 20 May 1980 55 p refs
(Contract N00019-79-WR-91472; WF54591201)
(AD-A088897; NADC-80079-60) Avail: NTIS
HC A04/MF A01 CSCL 11/4

As the use of graphite-reinforced composites grows, so does the risk of electrical interference caused by free graphite fibers which might be liberated from composite fires. Graphite oxidation catalysts or combustion promoters were evaluated to determine the extent to which they would cause graphite fibers to incinerate during a composite fire. Lead catalysts (PbO and Pb3O4) proved effective in reducing graphite/epoxy composite specimen weights by more than 90% when ignited. However, these results depend heavily on good draft, small conductive and convective heat losses, thin specimens and good catalysts distribution. Additional work is underway to find alternatives to the toxic lead oxides. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-33504 British Library Lending Div., Boston Spa (England).
THE DETERMINATION OF UNI AND TRI VALENT GOLD IN ACID GOLD BATHS
A. Knoedler Aug. 1980 15 p refs Transl. into ENGLISH from Metalloberflache (Munich), v. 33, no. 7, 1979 p 269-272
(BLL-RTS-12157) Avail: British Library Lending Div., Boston Spa, England

A method for potentiometric determination of KAu(CN)2 is described. This method was used for determination of gold in electroplating baths. T.M.

N80-33505 British Library Lending Div., Boston Spa (England).
REGENERATIONS OF CRITICAL PROCESS SOLUTIONS RELATIVE TO RECOVERIES OF VALUABLE SUBSTANCES
H. Dengler Aug. 1980 15 p refs Transl. into ENGLISH from Galvanotehnik (West Germany), v. 70, no. 7, 1979 p 604-609
(BLL-RTS-12141) Avail: British Library Lending Div., Boston, Spa, England

Waste water solutions produced during the manufacture of circuit boards are discussed. Various methods of recovering valuable metals from this waste water are presented. L.F.M.

N80-33506 British Library Lending Div., Boston Spa (England).
SELECTIVE ELECTROPLATING PROCESSES
M. J. Hacker May 1980 33 p Transl. into ENGLISH from Metalloberflache (West Germany), v. 33, no. 4, 1979 p 137-145
(BLL-RTS-11960) Avail: British Library Lending Div., Boston Spa, England

The growing demand for components plated with noble metals, in conjunction with steeply rising gold prices, is making the traditional plating processes too expensive. The processes available for reducing metal consumption include tip plating with a controlled depth of immersion, gold strip plating, gold filler plating, the commercial and highly specialized spot plating process and selective high speed plating. These processes offer high throughput rates, low investment costs and improvements in the uniformity, reproducibility and quality of the deposits. The consumption of noble metals is appreciably lower than in the conventional frame, drum and entire strip plating processes. R.K.G.

N80-33507 Northeastern Univ., Boston, Mass.
TRACE ANALYSIS OF ANTIMONY BY DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY Ph.D. Thesis
Pai-Ti Betty Cheng 1980 121 p
Avail: Univ. Microfilms Order No. 8023638

The difficulty in the analysis of antimony is the oxidation state change between antimony (5) and antimony (3). Antimony (5) and antimony (3) both form a number of complexes with hydroxide and halide among which only the complexes of antimony (3) are electroactive in normal electrolyte media. Differential pulse anodic stripping voltammetry is an electrochemical technique which preconcentrates the analyte and thus enhances the signal to noise ratio. Studies were undertaken to complete a methodology for trace level antimony samples. The effects of various electrolytes and the necessity of pH control are demonstrated. The behavior of antimony in different electrolyte media was studied using UV spectrophotometric and polarographic techniques both of which show the presence of antimony (3) and antimony (5) complexes. Dissert. Abstr.

N80-33508 Virginia Univ., Charlottesville.
ASPECTS OF IONIZATION AND SPUTTERING IN THE GLOW DISCHARGE BY SOLIDS MASS SPECTROMETRY Ph.D. Thesis
Bryan Lloyd Bentz 1980 345 p
Avail: Univ. Microfilms Order No. 8022684

A simplified and relatively inexpensive solids mass spectrometer is described and developed for trace element analysis of bulk conducting solids and solution residues. The unit consists of a glow discharge ion source coupled to a quadrupole mass filter. Design aspects of sampling a 1 Torr sputter discharge, including the hollow cathode design, are presented, in addition to examples illustrating the operating performance of the mass spectrometer. Dissert. Abstr.

N80-33509 Cornell Univ., Ithaca, N. Y.
THE SELF-TRAINING INTERPRETIVE AND RETRIEVAL SYSTEM: IMPROVED SUBSTRUCTURE PERCEPTION Ph.D. Thesis
Kevin Shizuaki Haraki 1980 134 p
Avail: Univ. Microfilms Order No. 8020825

The self training interpretive and retrieval system (STIRS) is discussed with respect to its capability of elucidating the structural features of the unknown compound from its mass spectrum. The STIRS selects sixteen classes of mass spectral data which are indicative of particular types of structural features and searches a reference file for the fifteen best matching compounds in each class of mass spectral data. These retrieved compounds are examined for the presence of 177 frequently found substructures. For the average unknown, STIRS is capable of identifying eight structurally unique nodes (nonhydrogen atoms) correctly, one node related to the correct structure, and in half the cases, one node incorrectly. Dissert. Abstr.

N80-33510 Georgia Univ., Athens.
DIFFICULT GAS-CHROMATOGRAPHIC SEPARATIONS: ISOTOPIC FRACTIONATIONS AND EXTRACTS OF CARBONACEOUS MATERIALS Ph.D. Thesis
John Charles Fetzer 1980 93 p
Avail: Univ. Microfilms Order No. 8023136

A high precision gas chromatograph was used in conjunction with a quadrupole mass spectrometer and an on-line computer to study the fractionation of carbon and oxygen isotopes in carbon monoxide on silica and on finely divided nickel powder. Relative retentions were studied as a function of temperature using both natural abundances and isotopically enriched species. The use of supercritical pentane as an extracting solvent was examined. It was found that the carbon was actually broken down by the pentane. To see if this was general behavior for other types of carbon, several materials were examined (high purity graphite, technical grade graphites, active carbons, and charcoals). Dissert. Abstr.

N80-33511 George Washington Univ., Washington, D.C.
SPATIALLY RESOLVED STUDIES OF FLAME AND PLASMA AS SOURCES FOR ATOMIC SPECTROSCOPY Ph.D. Thesis
Manahen Fernadez 1979 225 p
Avail: Univ. Microfilms Order No. 8021264

Spatially resolved flame temperatures were spectroscopically measured using the slope method over small (approximately equal to 0.7 microliters) relatively homogeneous volumes of flame gases. The spatial resolution was uniquely obtained by introducing Co as a thermometric species into isolated volumes via the use of a droplet injection technique. By this method the emission of light was restricted to a limited volume whose position in the flame can be accurately determined and controlled. Vertical resolution was determined by the width of the entrance slit of the monochromator employed (100 micrometers in this study), and horizontal resolution was limited by the width of the emission cloud formed by the injected droplets (1 to 3 mm). The possibility of self absorption effects was greatly reduced because of the short absorption path length involved. The performance of the method was illustrated by its application to the spatial temperature mapping of the secondary reaction zone of a cylindrical air-acetylene flame. The effects of N2 as a sheathing gas and of flame stoichiometry on the radial and vertical temperature distribution of the flame were also investigated. It was determined that a large virtually isothermal central zone exists in the flame. Dissert. Abstr.

N80-33512 Virginia Univ., Charlottesville.
DEVELOPMENT OF A SCANNING ELECTRON MICROSCOPE BASED MICROANALYTICAL SYSTEM Ph.D. Thesis
James Allan Davis 1980 176 p
Avail: Univ. Microfilms Order No. 8021180

A scanning electron microscope (SEM) was converted into a multifaceted microanalytical instrument. This included the addition of an energy dispersive X-ray spectrometer and associated electronics. Hardware and software were developed to interface the system's multichannel analyzer to a microcomputer for mass data storage and manipulation. To take advantage of the increased sensitivity offered by direct X-ray excitation, various thin metal foils were placed in the path of the primary electron beam. This allowed the microscope to be used as a X-ray tube with a changeable anode material. After improvements to the SEM's vacuum system, secondary ion mass analysis capabilities were added. This included a large beam ion gun and a quadrupole mass filter. An electrostatic energy prefilter was found to be necessary to ensure adequate spectral resolution. A means was developed for repetitive scanning of a given mass range to enhance the signal to noise ratio. Dissert. Abstr.

N80-33513 Northeastern Univ., Boston, Mass.
STUDIES IN ATOMIC ABSORPTION SPECTROSCOPY UTILIZING ELECTROTHERMAL ATOMIZATION Ph.D. Thesis
Paul Robert Demko 1980 195 p
Avail: Univ. Microfilms Order No. 8023639

Various means for eliminating the gas phase interference effect were sought. The use of the hydrogen diffusion flame with the commercial furnace system resulted in some improvement; however the furnace-in-flame or combined atomizer technique was studied and found to be useful for the elimination of not only gas phase interferences, but also occlusion effects. Furnace in flame atomizers conform closely to the model for an ideal electrothermal atomization device. The application of the Woodriff furnace to the analysis of metals that form volatile hydrides was investigated. This technique coupled the sensitivity of furnace atomic absorption and the high sample capacity of hydride evolution methods. Nanogram detection limits were achieved for the analysis of As, Sb, and Sn. Dissert. Abstr.

N80-33514 Chicago Univ., Ill.
OXYGEN AND NITROGEN NUCLEAR MAGNETIC RESONANCE STUDIES OF AMIDES AND AROMATIC ALDEHYDES AND KETONES Ph.D. Thesis
Thomas Edgar St. Amour 1980 177 p
Avail: Univ. Microfilms Order No. 8023253

Oxygen 17 nuclear magnetic resonance is utilized in exploring substituent effects and hydrogen bonding interactions in aromatic carbonyl systems. Chemical shifts and relaxation rates are presented for a wide range of mono- and poly-substituted benzaldehydes and acetophenones. Intermolecular hydrogen bonding interactions can be followed by substantial changes in the oxygen 17 chemical shifts and relaxation rates. Oxygen 17 and nitrogen 14 relaxation rates are employed in studying motional dynamics in aromatic aldehyde and ketone systems. Chemical shifts as well as relaxation rates are employed in studying amide-amide and amide-solvent interactions. Solvent and concentration dependence studies demonstrate that oxygen 17 nuclear magnetic resonance is an effective tool in the study of more complicated biomolecules. The effects of hydrogen bonding on the screening at the nitrogen 14 nucleus are also detailed. Dissert. Abstr.

N80-33515 California Univ., Los Angeles.
EFFECTS OF ULTRA-HIGH PRESSURES ON METHANOL, ETHANOL, CALCIUM OXIDE, RUTILE, CASSITERITE, AND GERMANIUM DIOXIDE Ph.D. Thesis
Joseph Francis Mamone 1980 164 p
Avail: Univ. Microfilms Order No. 8023340

The effects of extremely high pressure on phase equilibria in calcium oxide, several dioxides isomorphous with cassiterite (TiO2, GeO2, SnO2), and two alcohols, methanol and ethanol, were studied by powder X-ray diffraction and infrared and Raman spectroscopy. Pressures were generated with a diamond anvil high pressure cell. Vibrational spectra of methanol and ethanol were measured to 100 k bar at room temperature. At high pressures, methanol either crystallizes or forms a glass (superpressed liquid), whereas ethanol always crystallizes. In ethanol, the frequency of the O-H stretching mode shows large negative shifts with increasing pressure due to the strengthening of hydrogen bonding. The Raman spectra and polymorphism of rutile were investigated under hydrostatic pressures up to 90 kbar at room temperature. The equation of state of CaO was studied under static pressures of 652 kbar and the temperature and hydrostatic pressure dependence of the Raman spectra of cassiterite type dioxides were investigated. Dissert. Abstr.

N80-33516 Colorado State Univ., Fort Collins.
IONIC INTERACTIONS IN THE LIQUID STATE BY MULTINUCLEAR MAGNETIC RESONANCE Ph.D. Thesis
Joel Lee Gray 1980 281 p
Avail: Univ. Microfilms Order No. 8022401

Electrolyte systems of sodium tetraethylaluminate (NaTEA)

in m-xylene tetrahydrofuran (THF), pyridine and binary mixtures of m-xylene and THF and of m-xylene and pyridine have been studied by sodium 23, aluminum 27 and proton nmr. In m-xylene aggregation was found to be the important influence on the sodium 23 chemical shift and linewidth. In mixtures of m-xylene and THF or m-xylene and pyridine variations in sodium 23, aluminum 27 and proton nmr parameters were recorded to investigate the nature of and gross structural features of ionic species in solution. The sodium 23 and aluminum 27 linewidths were found to be sensitive to the combination of ion-ion, solvent-cation, solvent-anion interactions, and aggregation. The patterns of nmr data of the single solvent systems of NaTEA in pyridine and NaTEA in THF bore little resemblance to the nmr data of binary solvent systems. Aluminum 27 nmr was used to study room temperature molten salt mixtures of 1-n-butylpyridium chloride and AlCl3. Two overlapping aluminum 27 resonances with vastly different linewidths were resolved by time resolution nmr experiments. Dissert. Abstr.

N80-33517 Cornell Univ., Ithaca, N. Y.
COMPUTER PREDICTION OF MOLECULAR WEIGHTS FROM UNKNOWN MASS SPECTRA Ph.D. Thesis
In Ki Mun 1980 128 p
Avail: Univ. Microfilms Order No. 8020854

The self training interpretive and retrieval system (STIRS) is a computer program for aiding mass spectral interpretation. The STIRS program provides quantitative information about the molecular weight. In each of several different mass spectral data classes, STIRS retrieves the 15 reference mass spectra which best match the unknown in mass spectral behavior. Also combination match classes, made up of combinations of these data classes, retrieve compounds whose mass spectra most closely match the overall spectral behavior of the unknown. A data class for the reference spectra without molecular ions are added to STIRS as well as a routine which calculates the number of bromine and chlorine atoms in the unknown based on isotopic abundances. These probabilities and the abundance values of corresponding peaks in the unknown spectrum are used to compute the relative confidence value of each candidate molecular weight. The bromine and chlorine atom content of the unknown from the halogen routine is used to reinforce the confidence values. Dissert. Abstr.

N80-33518 Clarkson Coll. of Technology, Potsdam, N.Y.
THE ACTIVATED CARBON THIN FILM ADSORBER Ph.D. Thesis
Robert Peter Kane 1980 162 p
Avail: Univ. Microfilms Order No. 8023220

A activated carbon adsorption system was developed which used powdered carbon enmeshed in a collodion film. The system was designed to be used for hemoperfusion treatment of poison patients. Hemoperfusion involved flowing the patient's blood over a bed of adsorbent materials, (activated carbon or resin) which removes the toxin from the blood stream. This activated carbon collodion film was rolled to form a coil, through which the blood would axially flow. Three of these coils were placed into a plexiglass housing to form what is referred to as the thin film adsorber. The results were compared with those of four commercially available hemoperfusion devices. The factors evaluated included the rate and capacity of drug removal, pressure drop, fluid flow characteristics, and compatibility with blood. Dissert. Abstr.

N80-33519 Texas A&M Univ., College Station.
THE DEVELOPMENT OF MIXTURE INJECTED SURFACE-IGNITION ENGINE Ph.D. Thesis
Vankayalapat Sudhakar 1980 65 p
Avail: Univ. Microfilms Order No. 8023073

The feasibility of igniting lean air-fuel mixture with a torch formed by injecting a stoichiometric mixture over a hot surface near the end of the compression stroke was explored and proved. Several variables affecting the performance of the mixture injected surface ignition engine were identified and their effects on the engine operation were examined. Lean misfire limits for engine speeds between 2000 RPM and 3000 RPM were found to vary between air-fuel ratios 19.7:1 and 216:1 for regular blend gasoline in a 4 cylinder configuration. Fuel consumption comparisons with a standard spark ignited engine of equal displacement and compression ratios showed improvements for the MISI engine. Specific exhaust emissions of CO, HC and NO sub x from both engines were compared. The MISI engine had generally the same levels of CO and HC and higher levels of NO sub x emissions than the spark ignited engine. Dissert. Abstr.

N80-33520# Virginia Polytechnic Inst. and State Univ., Blacksburg.
DEVELOPMENT AND APPLICATION OF ANALYTICAL TECHNIQUES TO CHEMISTRY OF DONOR SOLVENT LIQUEFACTION Quarterly Progress Report, Jan. - Mar. 1980
H. C. Dorn and L. T. Taylor Jun. 1980 20 p
(Contract DE-AC22-80PC-20041)
(DOE/PC-20041/T1) Avail: NTIS HC A02/MF A01

Elemental analyses (Mg, Al, P, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Sr, Zr, Mo, Cd, Ba, W, Hg) were measured on ashed samples of Amax feed coal and Amax solvent refined coal (SRC). Significant concentrations of most of the elements monitored were found. Since the SRC process is designed to remove mineral matter it is not surprising that the level of metal in SRC is lower than in the feed coal for many metals. Unexpectedly certain elements appear to be concentrated into the SRC product. Those metals where the concentration has diminished greatly (Ca, Al, Fe, and Mg) on going from raw coal to SRC are probably mineral related. There are numerous metals (Co, Zn, Cu, Ni, Cr, Mn, Cd) whose concentration is higher in SRC. These, we believe, are most likely organic related in SRC. This is not unreasonable since the group is 100% transition metals and it is these metals which are most likely to form organometallic species. Cobalt and zinc are especially noteworthy in this regard showing a threefold increase in concentration in SRC over the feedstock. DOE

N80-33521# University of Southern California, Los Angeles.
ASSIGNING REACTIVE EXCITED STATES IN INORGANIC PHOTOCHEMISTRY
Arthur W. Adamson Aug. 1980 29 p refs Submitted for publication
(Contract N00014-76-C-0548)
(AD-A088566; TR-12) Avail: NTIS HC A03/MF A01 CSCL 07/4

The matter of assigning reactive excited states in inorganic photochemistry turns out to have complexities as more detailed and more varied information is obtained. Three cases are considered. For Cr(3) amines there is still much controversy in the assignment of chemical reactivity to doublet and quartet states. In the case of Rh(NH3)5X(2+) complexes, it may be necessary to invoke three different reactive or emitting ligand field excited states, and in that of W(CO)5L species, at least two, including a charge transfer state, are needed. Author

N80-33522# Naval Research Lab., Washington, D. C. Surface Chemistry Branch.
TESTING IODIZED ACTIVATED CARBON FILTERS WITH NONRADIOACTIVE METHYL IODIDE Final Report
Victor R. Deitz and James B. Romans 30 May 1980 58 p refs
(AD-A088666; NRL-MR-4240) Avail: NTIS HC A04/MF A01 CSCL 18/2

Iodized carbons, impregnated with KIx(KI - xI2), were evaluated for trapping methyl iodide-127. In this method the complete effluent of the carbon is sampled and analyzed continuously. In contrast, the RDT-M16 test procedure counts the carbon and the back-up beds for the accumulated 131 species and no information is obtained for the interaction of the large amount of carrier methyl iodide-127 with the iodized charcoal. The test apparatus to measure the penetration of methyl iodide-127 is described and the calibration procedures are detailed. Results are given for the penetration of methyl iodide-127 through new activated carbons, carbons in service, and exhausted carbons withdrawn from service. The reduction in trapping efficiency with service is accompanied by the development of a maximum in the concentration of methyl iodide-127 during the air purge after the dose period. This behavior has escaped notice with methyl iodide-131 due to the way that test is made. The chromatographic holdup of methyl iodide-127 by carbons in service, together with the subsequent slow desorption step, could

result in a dilution of the penetration iodine to acceptable levels under some conditions encountered in plant filter operations.
GRA

N80-33523# Aerospace Corp., El Segundo, Calif.
LASER EXCITED NONRESONANT FLUORESCENCE SPECTROSCOPY Annual Progress Report
J. A. Gelbwachs and R. P. Frueholz 30 Jun. 1980 44 p refs (Contract DE-AM03-76SF-01101)
(ATR-80(7783)-1; APR-2) Avail: NTIS HC A03/MF A01

The relative populations of numerous tin levels populated by collisional energy transfer from an initially laser pumped level were obtained. These populations yield information concerning the relative rates of energy transfer for the various buffer gases studied. The results indicated two distinct energy transfer behaviors. First, for certain tin levels diatomic collision partners produce populations nearly two orders of magnitude higher than when rare gases are present. Second, for other tin levels, diatomics and rate gases transfer population approximately at the same rates and more efficiently than in the former case. For these levels the near resonant pathways can be obscured by means of a more effective energy transfer channel common to both diatomics and rare gases such as by curve crossing mechanisms.
DOE

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-33524 British Library Lending Div., Boston Spa (England).
HARD-GOLD COATINGS DEPOSITED USING PULSATING CURRENT AND THEIR SUITABILITY FOR USE IN PLUG CONNECTIONS
M. Branik and R. Schnabl May 1980 20 p refs Transl. into ENGLISH from Metalloberflache, (Munich), v. 33, no. 9, 1977 p 350-354
(BLL-RTS-12203) Avail: British Library Lending Div., Boston Spa, England

Gold layers which are deposited using pulsating current exhibit better ductility at high pulsating current densities than gold layers which were deposited by means of direct current. Hardness, depth of surface roughness, porosity, and resistance to corrosion for those layers deposited by the pulsating current process exhibit no significant improvement when compared with the layers deposited by means of direct current.
F.O.S.

N80-33525 British Library Lending Div., Boston Spa (England).
THE USE OF CURRENT-LESS (CHEMICAL) NICKEL-PLATING IN VACUUM-AND-PRECISION- ENGINEERING
Josef Heppekausen May 1980 12 p ref Transl. into ENGLISH from Gazvanotechnik, Baden-Wuerttemberg, (Germany), v. 70, no. 5, 1979 p 401-403
(BLL-RTS-12025) Avail: British Library Lending Div., Boston Spa, England

The process of currentless nickel plating is illustrated. Refining costs are less, though chemicals cost is higher than in electrolyte processes.
S.F.

N80-33526 British Library Lending Div., Boston Spa (England).
ELECTRON MICROSCOPICAL INVESTIGATION ON THE AGE HARDENING OF SPRING ALLOYS BASED ON Co-Ni-Cr-Fe
I. Pfeiffer Jun. 1980 16 p refs Transl. into ENGLISH from Z. metallk., Stuttgart, v. 57, no. 8, 1966 p 635-641
(BLL-RTS-12152) Avail: British Library Lending Div., Boston Spa, England

The precipitation hardening of alloys based on chromium, iron, nickel, and cobalt was studied. The mechanical properties of these alloys were investigated through electron microscopy.
T.M.

N80-33527 British Library Lending Div., Boston Spa (England).
ELECTROPLATING: METAL DEPOSITS BY ELECTROLYSIS, THROWING POWER
Richter Feb. 1980 18 p Transl. into ENGLISH from Galvano (Paris), v. 28, no. 10, 1959 p 459-464
(BLL-RTS-11870) Avail: British Library Lending Div., Boston Spa, England

The throwing power of an electrolyte derives from the ability of lines of current to distribute themselves evenly or not on a cathode of geometric form characterized by points irregularly distant from the anode. In many objects there are less shielded places or recesses which present difficulty in deposition and the thickness of the plate is too small to provide sufficient anticorrosive protection. Although it is impossible to oppose certain strict laws which govern the complicated process of an electrolytic medium, the factors which directly influence the electrolytic deposit can be manipulated. These active factors are (1) formulation or chemical composition; (2) constituents of a bath and their concentration; (3) temperature; (4) agitation; (5) anode-cathodedistance; (6) current density; and (7) position of the cathode on the jig. Each of these elements is analyzed and their influence and manipulation are considered. Typical formulations possessing good throwing power are described. These include a cadmium plating bath, a classic nickel bath, and an alkaline copper plating bath.
A.R.H.

N80-33528 British Library Lending Div., Boston Spa (England).
IN SITU DOPING OF THIN Ca (x)Hg (1-x)Te FILMS OBTAINED BY CATHODE SPUTTERING IN MERCURY VAPOUR. APPLICATION TO THE PRODUCTION OF INFRARED DETECTORS
A. Zozime, H. Drappier, C. Sella, M. Chauveau, and G. Cohen-Solal Feb. 1980 11 p refs Transl. into ENGLISH from Vide, (France), (175) 1975 p 19-22
(BLL-RTS-11980) Avail: British Library Lending Div., Boston Spa, England

A nonequilibrium doping technique in the field of thin films is described. The semiconductor material is prepared in the form of a thin layer by cathode sputtering, and the impurity chosen for doping is introduced by cosputtering.
L.F.M.

N80-33529 British Library Lending Div., Boston Spa (England).
BRIGHT DIPPING SOLUTION FOR IRON-NICKEL-COBALT ALLOYS
H. Mizoi Apr. 1980 15 p ref Transl. into ENGLISH from Shin Nippon Denki Gihu (Japan), v. 12, no. 18, 1978 p 111-115
(BLL-RTS-12198) Avail: British Library Lending Div., Boston Spa, England

An acid mixture with acetic acid as the main constituent is commonly used as the bright dip solution for Kovar, but acetic acid has disadvantages in that being an organic acid, BOD is high, and waste liquid treatment is difficult. Development of a solution with an inorganic acid (sulphuric acid, nitric acid, etc.) as the main constituent has been found, and if surface activation agents are added, finishes of the same degree as given by the acetic acid systems can be obtained.
L.F.M.

N80-33530 British Library Lending Div., Boston Spa (England).
THE USE OF GLUCONATES FOR ELECTROLYTIC AND CURRENT-LESS METAL DEPOSITING
Anna Kouba Jun. 1980 22 p Transl. into ENGLISH from Surfaces (France), v. 17, no. 116, 1978 p 25-29
(BLL-RTS-11997) Avail: British Library Lending Div., Boston Spa, England

In recent years a number of bath compositions were developed which contain such different chelating agents as the fluoborates, the purophosphates, and the sulphamates. One class of chelating agents may be produced from the anions of organic acids obtained from agricultural raw materials such as: citric acid, produced by the fermentation of sweetened juices; tartaric acid, which is a by-product of the manufacture of wine; and gluconic acid, produced from maize. These organic substances have the following advantages by comparison with other natural mineral substances: their nontoxicity, since they are used within the food industry; their source, since it is renewable annually; and their biodegradability, which could result in the simplification of the treatment of the effluent before it is discharged.
E.D.K.

N80-33531 British Library Lending Div., Boston Spa (England).
CORRELATION BETWEEN SEGREGATION AND COLD CRACKING

H. Cerjak, J. Schmidt, and R. Loehnberg 5 Mar. 1980 12 p refs Transl. into ENGLISH from 4th MPA Seminar, Germany Presented at the 4th MPA Seminar on Safety of Pressurised Light Water Reactor Containments, Germany, 5 Oct. 1978
(BLL-Trans-4253-(9091.9F)) Avail: British Library Lending Div., Boston Spa, England

A correlation between segregation in ferritic base metal and the occurrence of cold cracking is found. Besides describing the mechanical and engineering properties and chemical composition of the segregated areas, their behavior when welded over is discussed. Characteristics and models of crack development are presented using cold cracking found in various components as an example. Measures for limiting the risk of the occurrence of cold cracking are increasing the preheating temperature, use of weld filler material with optimum dryness, and heat treatment directly following welding. Author

N80-33532 British Library Lending Div., Boston Spa (England).
CHEMICAL NICKEL-PLATING WITH SODIUM BOROHYDRIDE. PROCESS TECHNOLOGY AND PROPERTIES OF COATS
E. Lanzoni Aug. 1980 24 p refs Transl. into ENGLISH from Metalloberflache (West Germany), v. 33, no. 7, 1979 p 261-268
(BLL-RTS-12156) Avail: British Library Lending Div., Boston Spa, England

By chemical reduction with sodium borohydride it is possible to deposit a layer of nickel boron alloy (4% to 5%) on many metallic and nonmetallic surfaces which show, particularly after heat treatment, unusual hardness and wear resistance properties. The reduction reaction, which is always accompanied by the evolution of hydrogen, can be made more or less strong by altering the temperature of the bath solution and the concentration of the reaction medium, particularly the sodium borohydride and the thallium nitrate. By using fresh bath solutions, precipitates of 330 micron m to 400 micron m can be obtained under working conditions at 90 C to 95 C, without topping the bath solution. The process yield is high only in the first two or three hours, at a speed which can reach 100 micron m/hour. If correspondingly stabilized, the bath solutions react with little sensitivity to the presence of suspended materials such as dust and impurities, and do not show any decomposition in this time. A.R.H.

N80-33533 British Library Lending Div., Boston Spa (England).
THE REFLOWING OF TIN-LEAD DEPOSITS
H. A. Gerstberger and G. Strube Aug. 1980 15 p Transl. into ENGLISH from Galvanotechnik (West Germany), v. 70, no. 10S, 1979 p 961-965
(BLL-RTS-12262) Avail: British Library Lending Div., Boston Spa, England

Tin coatings have a tendency to produce very thin capillary crystals, known as 'whiskers', from their upper surface as a result of slow transformation processes. Whiskers can give rise to the risk of short circuits occurring between adjacent conductors. A further disadvantage of tin coatings is the possibility of the occurrence of the so called tin disease. Where the tin is used continuously at temperatures which are very much lower than 0 C, the danger is present that the beta tin which exists under normal operating temperatures will be transformed into alpha tin. This transformation of beta tin into alpha tin is accompanied by a considerable increase in volume, which brings about the degeneration of the compact metal into powder. Tin lead coatings are used to prevent the occurrence of whiskers and tin disease. Matt tin lead coatings are deposited, since they permit trouble free reflowing. S.F.

N80-33534 British Library Lending Div., Boston Spa (England).
THE DEPOSITION OF PALLADIUM COATINGS WITH LOW HYDROGEN CONTENT AND STRESS IN SULPHURIC ACID ELECTROLYTE
H. D. Hedrich and C. J. Raub Aug. 1980 19 p refs Transl. into ENGLISH from Galvanotechnik (West Germany), v. 70, no. 10S, 1979 p 934-939
(BLL-RTS-12267) Avail: British Library Lending Div., Boston Spa, England

Potentiometric and spectrum potentiometric analyses were used to demonstrate the complex building of palladium through sulfite ions in a sulfuric acid solution. The sulfite is reduced to sulfide which is absorbed on the cathode. The palladium sulfide has an inhibiting effect on the depostion of palladium and is incorporated on crystallization. The sulfur content of the palladium rises with the sulfite content of the electrolyte and the cathode current. The properties of the palladium coatings are largely determined by the sulfur incorporated in them. The palladium contents are finely crystalline and hard, and have a marked '100' fiber structure. The sulfuric acid electrolyte with the addition of sulfite is not sensitive to metallic contaminations nor to the introduction of cyanide, but where the substrate is a base metal, it requires the use of a noble metal layer (strip plating) with gold or palladium in a complex electrolyte. A.R.H.

N80-33535 British Library Lending Div., Boston Spa (England).
THE DIFFUSION OF COPPER INTO GOLD COATINGS AT ELEVATED TEMPERATURES
J. Pitter, L. Vrobel, V. Masarik, and M. Srb Aug. 1980 15 p refs Transl. into ENGLISH from Metalloberflache (Munich), v. 33, no. 10, 1979 p 415-419
(BLL-RTS-12292) Avail: British Library Lending Div., Boston Spa, England

Copper diffusion at the grain boundaries of gold coating is the reason for the electrochemical nucleation of less noble precipitate at the surface and inside the coating. This has an unfavorable influence on the corrosion resistance of the coating and on the value of the ohmic resistance of the gilded contact. Together with the recrystallisation of the gold matrix, the precipitate influences the mechanical properties of the coating. The zinc and nickel diffusion in the coating is essentially slower than the copper diffusion. Diffusion at the grain boundaries and the defects remaining in the crystal lattice are still the prevailing mechanisms after annealing at 500 C and 600 C. Rapid and essential changes in the crystal structure of the gold occur at temperatures above 500 C. It is possible, to use heating to 400 to 500 C as accelerated testing of the resistance to depreciation of the coating during the diffusion process. S.F.

N80-33536 British Library Lending Div., Boston Spa (England).
RESISTANCE TO CORROSION OF CHROMATED ZINC COATINGS
K. Beyer Sep. 1980 10 p Transl. into ENGLISH from Galvanotechnik (West Germany), no. 12, 1979 p 1193-1196
(BLL-RTS-12304) Avail: British Library Lending Div., Boston Spa, England

The requirements for the corrosion resistance of chromated zinc coatings are presented. Requirements for the thickness of the metal layer are also presented. T.M.

N80-33537 British Library Lending Div., Boston Spa (England).
NOBLE METAL ELECTROPLATED COATINGS ON PRINTED CIRCUIT CONNECTORS
B. Endres and H. Golembka Sep. 1980 20 p refs Transl. into ENGLISH from Galvanotechnik (West Germany), v. 70, no. 10, 1979 p 952-957
(BLL-RTS-12265) Avail: British Library Lending Div., Boston Spa, England

The high corrosion resistance and good electrical properties of gold coatings are of prime importance in connector elements for information technology, particularly in circuit boards where the coating not only protects the substrate from corrosion (as a resist in etching) but also allows energy transfer with as little loss as possible. Other factors such as hardness, wear resistance, porosity, and ease of soldering also play an essential role. The electrolytes used in circuit board technology for the deposition of gold and gold alloys are categorized and analyzed. These include acid gold baths, neutral gold baths, and alkaline baths, with and without cyanide. The advantages of pulse plating in reducing porosity and achieving the required minimum thickness are discussed as well as selective coating with noble metals, low carat gold layers, and palladium deposition. A.R.H.

N80-33538 British Library Lending Div., Boston Spa (England).
INVESTIGATIONS INTO THE DISTRIBUTION OF THE LAYER THICKNESS PRODUCED BY BARREL ELECTROPLATING IN THE CASE OF CYANIC SILVER PLATING
H. D. Hedrich and Ch. J. Raub Jun. 1980 29 p refs Transl. into ENGLISH from Metalloberflache (West Germany), v. 33,

no. 9, 1979 p 355-360
(BLL-RTS-12204) Avail: British Library Lending Div., Boston Spa, England

The influence of various physical deposition parameters on the distribution of layer thickness was investigated in the case of the barrel electroplating of steel spheres in a drum. By means of model experiments, statistically reliable indications were obtained for the effect of the level of fill of the electroplating equipment, the rate of rotation of the drum, and the period of plating or the cathodic density of the deposition current, in the case of cyanic silver plating. Results show that there is an increase in the current efficiency of the metal depositing as the level of fill of the drum is increased, accompanied by a simultaneous increase in the scatter of the layer thickness throughout the batch on the individual components. The optimum plating conditions are achieved at levels of fill between 35 and 50%. In the case of spherical objects the coefficient of variation of the thickness of the silver coating reduces proportionally to the cube of the speed of rotation of the drum. Shortening of the duration of deposition is accompanied by the deterioration of the distribution of layer thickness. A.R.H.

N80-33539 British Library Lending Div., Boston Spa (England).
EFFECTS OF FLANK PROTECTION MEDIA IN THE ETCHING OF COPPER
T. Muramaki and C. J. Raub Sep. 1980 18 p Transl. into ENGLISH from Galvanotechnik (West Germany), v. 71, no. 3, 1980 p 231-237
(BLL-RTS-12359) Avail: British Library Lending Div., Boston Spa, England

A higher etch factor can be obtained for the sides of deeply pitted and contoured parts by the addition of substances which form a soluble complex on the surface of the metal with copper ions dissolved in the etching solution. This covering layer retards further solution. The resting potential of a copper electrode in electrolytes with different additives was determined. Current changes for anodic polarization and changes of the diffusion layer in the etching solution were studied. Results show that it is possible to select suitable flank protectors from the wide range of available organic compounds by using resting potential measurement. Good flank protectors always give negative potentials with increasing concentration of additive. A resting potential altered by additives generally becomes positive again under ultrasound treatment, but only alters slightly with good flank protectors such as thiourea. The influence of the viscosity on the diffusion layer thickness is relatively strong, especially in the region of low viscosities. Differences in the type of etch structure of the metal surface have a marked effect on the formation and structure of the covering layer on the copper. A.R.H.

N80-33540 British Library Lending Div., Boston Spa (England).
CHROMATING
W. D. Schulz and Ing. W. Kassner Sep. 1980 17 p refs Transl. into ENGLISH from Galvanotechnik (West Germany), v. 71, no. 2, 1980 p 126-130
(BLL-RTS-12344) Avail: British Library Lending Div., Boston Spa, England

The corrosion protection effect of chromate coatings on zinc was examined. The connection between the molecular structure and the electrochemical behavior of the protective coating was also examined. T.M.

N80-33541 British Library Lending Div., Boston Spa (England).
THE INTERACTION BETWEEN PIPE-COATINGS AND CATHODIC CORROSION-PROTECTION
W. Schwenk [1980] 16 p Transl. into ENGLISH from Res. Inst. of Mannesmann AG Report, Duisburg, West Germany
(BLL-Trans-T4943/BG/ERS/79) Avail: British Library Lending Div., Boston Spa, England

Interactions between corrosion protective coatings and cathodic protection which lead to blistering and disbonding when the media contain alkali ions are considered. An impairment of the protective effect is, only possible with thin coatings such as are usual with ships and with steel hydraulic structures. Thick layered coatings for pipelines are subject to disbonding without detriment to the corrosion protective effect. It is shown that tests with regard to disbonding are of doubtful value as evidence. Tests of thin coatings overlook possible blistering because of the time required for this to develop. Author

N80-33542 British Library Lending Div., Boston Spa (England).
CATHODIC CORROSION-PROTECTION IN AREAS SUBJECT TO EXPLOSION HAZARDS
28 Jun. 1980 5 p refs Transl. into ENGLISH from Deutschen Verein von Gas und Wasserfachmannern, Afk Recommendation no. 5, Nov. 1973
(BLL-T4934/BG/ERS/79(9022.048)) Avail: British Library Lending Div., Boston Spa, England

For the installation and operation of cathodic protection systems, in areas subject to explosion hazards, special precautions that must be taken in order to prevent the risk of ignition are discussed. Such a risk may arise owing to sparking caused by electrical equipment or by lightning discharge. Participating agencies which provide personnel concerned with the installation or operation of cathodic protection systems with guidance concerning the construction, operation, and inspection of such systems are listed. Other protective measures are also employed for the transloading of dangerous liquids in the vicinity of harbours and waterways. R.K.G.

N80-33543 British Library Lending Div., Boston Spa (England).
METAL SURFACE DAMAGE DUE TO CAVITATION EROSION
Y. Mizutani, Yoshiyuki Mizutani, Tomoji Ishiguro, and Koichi Nakajima Feb. 1980 12 p refs Transl. into ENGLISH from Nihon Kinzoku Gakkaishi (Japan), (4), 1971 p 319-323
(BLL-RTS-12269) Avail: British Library Lending Div., Boston Spa, England

Using X-ray diffraction and electron microscopy, the observations were made upon examining the damage in a metal surface during cavitation. These include: (1) change in internal structure apparent in incubation period and dependent on heat treatment of material; (2) cavitation gives rise to selective damage; (3) work hardening due to cavitation is accompanied by external surface damage and reaches saturation when entire surface is affected. S.F.

N80-33544 British Library Lending Div., Boston Spa (England).
CONTROL OF SOLIDIFICATION STRUCTURES AND PROPERTIES OF INDUSTRIAL Al-Si ALLOYS
S. Bercovici May 1980 36 p refs Transl. into ENGLISH from Hommes et Fonderie (France), v. 93, 1979 p 17-24
(BLL-RTS-11916) Avail: British Library Lending Div., Boston Spa, England

Methods for the control of solidification of eutectic alloys are presented. Major focus was on aluminum and silicon alloys. The mechanical properties of these alloys are described and their application in foundries is discussed. T.M.

N80-33545 Louisiana State Univ. and A&M Coll., Baton Rouge.
ION FLOTATION STUDIES AND SEPARATION PROCEDURES FOR THE PLATINUM GROUP METALS
Ph.D. Thesis
Daniel Murphy Downey 1980 163 p
Avail: Univ. Microfilms Order No. 8021738

The ion flotation properties of the platinum group metals were studied, methods for the quantitative recovery of the platinum metals from dilute solutions by ion flotation were developed, and the feasibility of ion flotation for the group separation was investigated. The anionic chlorocomplexes of Pd(2), Ir(4), Pt(4), Au(3), Rh(3) and Ir(3) were floated from aqueous solutions with cationic surfactants of the quaternary ammonium type. RN R(prime)3 Br. The flotation behavior of each metal was determined with respect to variations of the surfactant primary, R, and secondary R(prime), chain lengths, the initial HCl concentration, the initial NaCl concentration, the initial surfactant concentration and the initial metal chlorocomplex concentration. Most of the surfactants prepared for this work floated the platinum metals. Procedures were developed for the single stage, batch ion flotation separation of several binary mixtures of the platinum metals. Conditions were adjusted in which one metal was selectively floated from the solution and recovered by a modified solvent sublation method in n-outyl accetate. Dissert. Abstr.

N80-33546 North Carolina Univ. at Chapel Hill.
CHARACTERIZATION OF SURFACE COMPLEXES ON LITHIUM Ph.D. Thesis
John Albert Schultz 1980 109 p
Avail: Univ. Microfilms Order No. 8022506

A technique for preparing clean evaporated lithium surfaces is presented. The surface complexes formed when the evaporated lithium surfaces are exposed to oxygen, water, or normal alcohols were characterized by ultraviolet photoelectron spectroscopy. Possible surface geometries for water and methanol adsorbates were predicted using the Gaussian 70 ab initio quantum mechanical procedure. Cluster models of the surface complexes containing adsorbate and up to ten atoms of lithium were constructed based on the (100) plane of lithium metal. By calculating the total energy of the surface complex as a function of adsorbate geometry, predictions of preferred binding sites and adsorbate geometry on those sites could be made.
Dissert. Abstr.

N80-33547 Virginia Univ., Charlottesville.
HVEM STUDIES OF HELIUM EMBRITTLEMENT IN STAINLESS STEEL Ph.D. Thesis
Joseph Arno Horton, Jr. 1980 282 p
Avail: Univ. Microfilms Order No. 8022669

Helium embrittlement was studied by in situ tensile testing of three types of samples between 25 C and 600 C in a high voltage electron microscope with an attached accelerator. The three types of stainless steel samples used were: (1) previously fast neutron irradiated; (2) 80 keV helium ion-irradiated during the tensile test inside the microscope; and (3) unirradiated control samples. Post failure analysis was then performed in a scanning electron microscope in order to relate the transmission electron microscope observations to the overall type of fracture which was occurring.
Dissert. Abstr.

N80-33548 Rutgers - The State Univ., Piscataway, N. J.
STUDY OF STRAIN DISTRIBUTION IN HELIUM IMPLANTED VANADIUM THREE SILICON BY THE DIVERGENT X-RAY BEAM METHOD Ph.D. Thesis
Ronald Joseph Schutz 1980 148 p
Avail: Univ. Microfilms Order No. 8022589

In an effort to analyze in detail the lattice expansion in strained V3Si, single crystal samples were prepared by bombarding them with 1.9 MeV He ions. The resulting expansion in the damaged surface layer was studied using the divergent beam X-ray technique. The aniostropic strain in the surface layer was determined as a function of He ion dose and the manner in which strain relaxation occurred was observed with a series of high vacuum anneals. The results of the analysis of V3Si showed that the largest principal strain was normal to the surface of the sample and the two lateral principal strains were approximately zero. The rotation matrix was found to be approximately zero which indicated that no net rotation of the layer occurred. The normal principal strain grew with increasing dose until it saturated at about a dose of 3.0 x 10 to the 17th power He/sq cm. Pseudo-Kossel patterns that originated in the strained layer displayed an asymmetric line broadening which grew with increasing dose. Analysis showed that the line broadening at low doses could be qualitatively explained by a strain which was linearly related to the nuclear stopping of the He ions.
Dissert. Abstr.

N80-33549 Case Western Reserve Univ., Cleveland, Ohio.
SURFACE OXIDE SOFTENING IN TUNGSTEN Ph.D. Thesis
Jorge Eduardo Talia 1980 173 p
Avail: Univ. Microfilms Order No. 8021721

The deformation behavior of surface oxide softened tungsten single crystals was examined as a function of etching time and temperature in the range T is approximately less than T sub m where T sub m is the absolute melting temperature. The combination of etching and oxide coating enhances the softening effect and increases the ductility observed at low temperatures. The stress-strain curves of etched and oxide coated crystals exhibit a pronounced three stage like deformation behavior over the temperature range 153 K to 300 K. A mechanism that involves the generation and motion of groups of mobile nonscrew dislocations at the stepped oxide-metal interface is proposed to explain these observations.
Dissert. Abstr.

N80-33550 Case Western Reserve Univ., Cleveland, Ohio.
THE BEHAVIOR OF INMOLD DEOXIDATION IN STEEL CASTINGS Ph.D. Thesis
Thomas Henry Bieniosek 1980 192 p
Avail: Univ. Microfilms Order No. 8021681

The technique for inmold deoxidation and its effect on steel casting properties was studied. Inmold deoxidation is based on the inmold process for ductile iron manufacture, in which magnesium-bearing alloys are introduced into the metal stream within the mold by means of a reaction chamber. For inmold deoxidation of steel castings, the deoxidizer is placed in a deoxidizer chamber designed to allow the solution of the deoxidizer into the passing metal stream at a steady rate. The results of the trials showed that the angled chamber design produced a uniform distribution of deoxidizer in the casting. These results indicated that a degree of turbulence must be introduced to the metal stream to allow the solution of an unreactive deoxidizer such as aluminum into the metal stream. The angled chamber design achieved this effect; the straight sided standard inmold design was suitable only for reactive deoxidizers such as those containing magnesium. The mesh size of the deoxidizer did not influence the rate of solution. No dependence on casting temperature was observed for the distribution of deoxidizers. The advantages of inmold deoxidation are compared to conventional ladle deoxidation.
Dissert. Abstr.

N80-33551 Case Western Reserve Univ., Cleveland, Ohio.
THE YIELDING BEHAVIOR OF UNIDIRECTIONAL METAL-MATRIX COMPOSITES Ph.D. Thesis
John Gayda, Jr. 1980 216 p
Avail: Univ. Microfilms Order No. 8021689

The primary yielding behavior of unidirectional metal matrix composites (aluminum alloy reinforced with high strength stainless steel wire) was shown to be dependent on the residual stress state of the matrix when the composite is subjected to uniaxial loads applied parallel or perpendicular to the fiber direction. More specifically, the yield point was found to be elevated if the sign of the deviatoric component of the residual stress state, associated with the matrix, in a direction parallel to the test axis, opposes that of the applied load. Further, the onset of yielding was accelerated if the sign of the matrix deviator and applied load were the same. These conclusions were based on a number of experiments which included tensile and compressive prestraining, refrigeration, and completely reversed strain cycling of composite specimens. In addition, analytical techniques were used to estimate the residual stress distributions and predict composite behavior.
Dissert. Abstr.

N80-33552 Notre Dame Univ., Ind.
HYDROGEN TRANSPORT IN NICKEL BASE SUPERALLOYS Ph.D. Thesis
David Anthony Mezzanotte, Jr. 1980 162 p
Avail: Univ. Microfilms Order No. 8021370

Hydrogen transport kinetics were measured for two nickel base superalloys by means of the electrolytic permeability technique. A model for H motion in each alloy was developed to account for the observed differences in H transport. For one of the alloys, Hastelloy Alloy C-276, the diffusivity decreased by a factor of two following aging. A model to predict the diffusivity of the aged alloy as a function of the volume fraction of the odered phase was developed. An atomistic model for diffusion in the odered alloy that qualitatively accounts for the decrease in diffusivity is described. Analysis of H transport in another nickel base alloy, Hastelloy Alloy G, indicated the presence of reversible and irreversible H traps. Reversible trapping by niobium solute atoms was postulated on the basis of an electronic and chemical attraction between H and niobium. Trap capture and release rates as well as trap binding energies were calculated. Irreversible trapping in the alloy was attributed to second phase carbide particles. The possibility of H being trapped as H2 gas was discussed.
Dissert. Abstr.

N80-33553 Ohio State Univ., Columbus.
THE PASSIVITY OF NICKEL-EFFECTS OF APPLIED POTENTIAL, SOLUTION pH AND ENVIRONMENTAL

TEMPERATURE Ph.D. Thesis
Chung-Yao Chao 1980 136 p
Avail: Univ. Microfilms Order No. 8022245

The passivity of nickel was studied by ellipsometric technique. Three important parameters that affect the passivity of metals, potential, solution pH, and temperature, were systematically investigated. Within the passive range, applied potential affects the thickness of the passive film but not the growth behavior of the film. In basic solutions (pH 9.1 and 12.6), the passive film can be formed instantaneously and then remains unchanged for a couple of hours. In moderate acid solution (pH 4.5), the passive film grows with time. In strong acid solution (pH 1.5), a two layer passive film is observed which evolves with time, too. When a pre-passivated nickel specimen is immersed in a solution for prolonged time, a multilayer film is found to grow on top of the passive film that originally exists on the surface of the metal. In aerated solution, a Ni(OH)2 film is formed. This film then undergoes a partially hydration process at later stage.
Dissert. Abstr.

N80-33554 Ohio State Univ., Columbus.
FRACTURE AND FLOW OF IRON AND ITS ALLOYS: THEORY AND EXPERIMENT Ph.D. Thesis
Ing-Hour Lin 1980 116 p
Avail: Univ. Microfilms Order No. 8022306

A three dimensional brittle crack advancing by double jog nucleation in the lattice trapping region, plastic instability in uniaxial tension tests, and stable crack growth in a ductile HSLA steel were investigated. A tensile brittle crack is simulated by a climb pileup of edge dislocations. The activation energies of nucleation for jogs were worked out for cracks. A method for determining the equilibrium configuration of dislocations in the discrete pileup is given. The equilibrium configuration of jog bands and their role in lowering the nucleation energy of the first double jog in the crack tip are also developed and determined numerically for iron, tungsten, diamond, silicon, and magnesium oxide. Plastic instability is treated for a material which satisfies Hart's criterion for the existence of a plastic equation of state. Stable crack growth measurements were performed on a Cu containing HSLA steel. Since the aging kinetics of Cu precipitates and carbides in the steel are independent of one another, large variations in strength and toughness can be achieved by means of an appropriate choice of heat treatment. The slow shear crack growth is tested using modified compact tension specimens.
Dissert. Abstr.

N80-33555*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LONG-TIME CREEP BEHAVIOR OF THE NIOBIUM ALLOY C-103
Robert H. Titran and William D. Klopp Oct. 1980 12 p refs
(NASA-TP-1727; E-224) Avail: NTIS HC A02/MF A01 CSCL 11F

The creep behavior of C-103 was studied as a function of stress, temperature, and grain size for test times to 19000 hr. Over the temperature range 827 to 1204 C and the stress range 6.89 to 138 MPa, only tertiary (accelerating) creep was observed. The creep strain epsilon can be related to time t by an exponential relation epsilon = epsilon(0) + K e raised to power (st) - 1), where epsilon (0) is initial creep strain, K is the tertiary creep strain parameter, and s is the tertiary creep rate parameter. The observed stress exponent 2.87 is similar to the three power law generally observed for secondary (linear) creep of Class I solid solutions. The apparent activation energy 374 kj/g mol is close to that observed for self diffusion of pure niobium. The initial tertiary creep rate was slightly faster for fine grained than for coarse-grained material. The strain parameter K can be expressed as a combination of power functions of stress and grain size and an exponential function of temperature. Strain time curves generated by using calculated values for K and s showed reasonable agreement with observed curves to strains of at least 4 percent. The time to 1 percent strain was related to stress, temperature, and grain size in a similar manner as the initial tertiary creep rate.
R.K.G.

N80-33556*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED BOND COATINGS FOR USE WITH THERMAL BARRIER COATINGS Final Report
Michael A. Gedwill Sep. 1980 45 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-81567; DOE/NASA/2593-18; E-532) Avail: NTIS HC A03/MF A01 CSCL 11F

The potential for improving the durability of thermal barrier coatings (TBC's) being developed for coal derived fuel fired gas turbines was studied. Furnace oxidation behavior of plasma deposited bond coatings was improved by increasing the thickness from 0.010 cm to 0.015 cm and by depositing the coatings at 20 kW with argon 3.5 vol % hydrogen arc gas rather than at 11 kW with argon. The most oxidation resistant plasma deposited bond coatings were Ni-14.1Cr-13.4Al-0.10Zr, Ni-14.3Cr-14.4Al-0.16Y, and Ni-15.8Cr-12.8Al-0.36Y on B-1900 + Hf and Ni-30.9Cr-11.1Al-0.48Y on MAR-M-509. The oxidation resistant bond coatings improved TBC life when the coatings were deposited on the specimens supported on a nail bed fixture during coating.
Author

N80-33557# Pennsylvania State Univ., University Park.
DIRECTIONAL SOLIDIFICATION OF NONOXIDE EUTECTICS Final Report, 1 Dec. 1976 - 31 May 1980
V. S. Stubican Jul. 1980 7 p refs
(Grants DAAG29-77-G-0057; DAAG29-79-G0020)
(AD-A088565) Avail: NTIS HC A02/MF A01 CSCL 20/11

The directional solidification of the eutectic composition in the systems SiC-TiB2, TiC-TiB2, ZrC-ZrB2 and ZrC-TiB2 was studied. Microstructures, crystallography, hardness, fracture toughness and wear were determined. In several of studied systems, mechanical properties exceeded that of the end members. The SiC-B4C lattice formed lamellar microstructures with no colonies if the solidification rate was below 2 cm/hr. Ingots of SiC-B4C, solidified at approximately 9 cm/hr, had considerably better wear resistance than solidified B4C or hot pressed SiC. The microstructure of ZrC-ZrB2 consists of columnar grains of parallel lamellae whose interlamellar spacings range from 2.75 micron m to 1.62 micron m, corresponding to a growth rate of 0.425.4 cm/hr. ZrC-TiB2 has a microstructure of a Chinese script type of broken and deformed lamellae morphology. Solid solution between the two phases exists. The TiC-TiB2 eutectic has low Miller indices. The interfacial phase contains only one kind of atom.
GRA

N80-33558# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Metals and Ceramics Div.
PILOT PLANT FORGING OF HYDROGENATED Ti-6Al-4V Final Report, 16 Feb. 1978 - 30 Jun. 1979
W. R. Kerr, F. J. Gurney (Westinghouse Electric Corp., Pittsburgh), and I. A. Martorell (Westinghouse Electric Corp., Pittsburgh) Jun. 1980 71 p refs
(AF Proj. 2418)
(AD-A089107; AFWAL-TR-80-4026) Avail: NTIS HC A04/MF A01 CSCL 11/6

This pilot plant forging program was performed on ingot stock which was machined into ring shaped workpieces. The rings were hydrogenated to obtain hydrogen contents between 0.1 weight percent and 1.2 weight percent. A micro-balance technique was used to determine the hydrogen content. A description of the equipment and procedures for hydrogenation of the material and verification of the hydrogen analysis is given. The ring forgings were performed on a hydraulic forge press using isothermal techniques. A temperature range between 922 K (1200 F) and 1144 K (1600 F) and deformation rates of 0.000126 m/s (0.3 ipm) and 0.0126 m/s (30.0 ipm) were used in the forging evaluation. Two heats of material were used. Three to six rings were forged at different reductions at each condition of temperature, rate and hydrogen content. Non-hydrogenated rings were also forged at each condition to form a baseline for comparison. Standard techniques were used to analyze the ring forging data. Results show that a 30% reduction in forging load results when material with approximately 0.4 weight percent hydrogen is used. At larger hydrogen contents, the deformation loads increase and are approximately equal to those for non-hydrogenated material when the hydrogen content is 0.8 weight percent. Deformation loads for the material with 0.4 weight percent hydrogen which are equivalent to those for non-hydrogenated produce occur at processing temperatures between 56 K (100 F) and 83 K (150 F) lower.
GRA

N80-33559# Cornell Univ., Ithaca, N. Y. Dept. of Chemistry.
DIGITAL IMAGE PROCESSING IN ION MICROSCOPE ANALYSIS: METHODS OF IMAGE QUANTIFICATION Interim Technical Report
D. M. Drummer and G. H. Morrison 20 Aug. 1980 35 p refs Submitted for publication
(Contract N00014-80-C-0538; NR Proj. 051-736)
(AD-A088792; TR-2) Avail: NTIS HC A03/MF A01 CSCL 09/2

Two methods of secondary ion image quantification are applied to the analysis of a low-alloy steel, evaluated, and compared. The use of ion implantation for providing an internal standard element and for fabricating 'imaging standards' for evaluation of quantification procedure accuracy is investigated and discussed. A basic philosophy is presented for multi-element, multi-feature analysis using ion images, and the use of effective display with the purpose of conveying meaningful compositional morphological information is investigated. GRA

N80-33560# General Electric Co., Schenectady, N. Y. Corporate Research and Development Center.
ORIGIN OF MAGNETIC PROPERTIES IN AMORPHOUS METALS Summary Technical Report, 1 Oct. 1978 - 1 Dec. 1979
F. E. Luborsky and J. J. Becker Dec. 1979 60 p refs
(Contract N00014-76-C-0807)
(AD-A089145; SRD-80-006) Avail: NTIS HC A04/MF A01 CSCL 11/6

The magnetic properties of amorphous metals are examined relative to changes in composition and heat treatment of amorphous transition metal-metalloid alloys. The transition metals examined were iron and iron plus nickel. These were alloyed with the metalloids, boron, silicon and carbon. Significant effects of alloy variation were observed on magnetic properties and on the crystallization and stress relief of these materials. The effects of stress on magnetic properties was studied. GRA

N80-33561# Metcut Research Associates, Inc., Cincinnati, Ohio.
EFFECT OF MULTIPLE SHOT PEENING/CADMIUM PLATING ON HIGH STRENGTH STEEL Final Report, 15 Sep. 1978 - 15 Dec. 1979
John B. Kohls and William J. Stross Apr. 1980 60 p
(Contract F33615-78-C-5201; AF Proj. 2418)
(AD-A088667; AFWAL-TR-80-4005; Rept-970-27070) Avail: NTIS HC A04/MF A01 CSCL 13/8

This report covers the effect of multiple shot peening and cadmium plating operations on a high strength steel alloy used in landing gear applications. The basis for determing this effect was fatigue and stress corrosion tests in a high humidity environment. GRA

N80-33562# Naval Research Lab., Washington, D. C. Metal Physics Branch.
A STUDY OF RF NONLINEARITIES IN NICKEL Final Report
G. C. Bailey and A. C. Ehrlich 7 Jul. 1980 15 p refs
(AD-A088770; NRL-MR-4233-Ch-4) Avail: NTIS HC A02/MF A01 CSCL 09/4

The purpose of this chapter is to present a new technique for studying the behavior of nonlinear metallic systems subjected to radio-frequency magnetic fields. Intermodulation (intermod) generation (IMG), which takes place in a nonlinear system results in the excitation of a whole series of signals and the intermod frequencies which are excited depend on the type of nonlinearity of the system. The significance of this technique is its large relative sensitivity; that is, extremely small intermod signals (as low as the RF thermal noise in a system) can be observed in the presence of very large fundamental signals. For example, RF powers of the order of - 145 dBm (i.e., 10 to the minus 17.5 power W) can be observed in the presence of fundamental frequencies with powers of the order of watts or tens of watts. Thus, a relative sensitivity of 10 to the minus 18.5 power to 10 to the minus 19 power or better is possible. Thus, it may be possible to investigate at new levels of detail those physical phenomena accompanied by nonlinear electromagnetic responses. Although the technique is quite general and applicable to the study of a large number of nonlinear metallic systems, the one we have chosen initially for illustrative purposes is that of a ferromagnetic material, namely, nickel that is electroplated onto copper. Electroplated nickel was chosen for three reasons: first, one would expect that nickel, being a ferromagnet and hence nonlinear, should exhibit appreciable intermodulation signals; second, no information was available on the fundamental origins of intermod signals in nickel nor indeed in any ferromagnetic material up to the time the present study was begun. GRA

N80-33563# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Metallurgy and Mining Engineering.
CORROSION OF FIBER COMPOSITES WITH ALUMINUM ALLOY MATRIXES Final Report, 8 Nov. 1976 - 7 Nov. 1979
M. Metzger 8 Aug. 1980 9 p refs
(Grants DAAG29-77-G-0025; DAAG29-79-G-0019; DA Proj. 1L1-61102-BH-57)
(AD-A088564; ARO-14350.7-MS) Avail: NTIS HC A02/MF A01 CSCL 11/4

In experimental Al-Mg composites with alumina fibers, preferential pitting at fibers and enchanced corrosion rates were observed and explanations given of their relation to segregation in the solidification structure. Some of the corrosion of an Al-Li composite with alumina fibers are reported. Studies of Al-Fe alloys with a cathodic phase showed the rate of pitting to be sensitive to microstructure and fine continuous structure to give rapidly accelerating corrosion. Equations for corrosion time in continuous and discontinuous structures were derived in terms of quantitative metallography parameters with certain assumptions regarding pit nucleation and growth. Discontinuous structures were superior from the viewpoint of corrosion. R.K.G.

N80-33564# Princeton Univ., N. J. Plasma Physics Lab.
MECHANISMS RESPONSIBLE FOR TOPOGRAPHICAL CHANGES IN PLT STAINLESS STEEL AND GRAPHITE LIMITERS
S. A. Cohen, R. Budny, G. M. McCracken (Culham Lab., Abingdon, England), and M. Ulrickson Jun. 1980 70 p refs
(Contract W-7405-eng-36; DE-AC02-76CH-03073)
(PPPL-1671) Avail: NTIS HC A04/MF A01

Damage to PLT limiters used during ohmic and neutral beam heated discharges is described. The damage is explained by the power and momentum fluxes of bulk plasma and beam ions and by disruptions. The plasma scrap-off distance inferred from the extent of the damage ranges from 5 to 30 mm and is consistent with a radially outward drift velocity 20,000 mm/sec. A model of the plasma scrape-off is presented which explains the pattern and extent of the damage. DOE

N80-33565# Brown Univ., Providence, R. I. Div. of Engineering.
COMBINED MACROSCOPIC AND MICROSCOPIC APPROACH TO THE FRACTURE OF METALS Technical Annual Progress Report, 1979 - 1980
J. Needleman, R. J. Asaro, J. Gurland, and J. R. Rice Jun. 1980 56 p refs
(Contract DE-AC02-80ER-10556)
(DOE/ER-10556/1; COO-3084-79; TR-79) Avail: NTIS HC A04/MF A01

Extremely good theoretical experimental correlation was found between our theoretical predictions based on asymptotic analysis with numerical finite element studies and the experimentally monitored crack growth for a large range of stable crack growth in 4140 steel. A theoretical model was developed for the critical conditions of crack initiation at rigid particles as a precursor of ductile rupture in steels. As part of environmentally sensitive fracture mechanisms, it was found that hydrogen can promote a ductile to brittle fracture transition with increasing charging current density in low carbon steel. A variational principle was established for the combined processes of plastic creep flow and grain boundary diffusion and has been constructively applied to the problem of cavity growth under creep conditions. DOE

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-33566 New York Univ., N. Y.
RADIATION-INDUCED GRAFT POLYMERIZATION OF STYRENE ONTO CELLULOSE ESTERS Ph.D. Thesis
Jiunn Tsay 1980 118 p
Avail: Univ. Microfilms Order No. 8023740

The kinetics of mutual radiation graft polymerization of styrene onto cellulose acetate butyrate was studied over a range of radiation intensities and monomer concentrations. The reaction was diffusion free under the experimental conditions as shown by the independence of the grafting rate on film thickness. The dependence of the grafting rate on monomer concentration increases from 3/2 order to slightly greater than 5/2 order with increasing radiation intensity. The dependence of the grafting rate on radiation intensity decreases from 1/2 order to 0 order with decreasing monomer concentration. The results do not follow the usual kinetic expression for free radical chain polymerization. The preparation of the polymer film, usual initiation process, and combination of primary termination and bimolecular termination for these kinetic results are presented and discussed.
Dissert. Abstr.

N80-33567 Case Western Reserve Univ., Cleveland, Ohio.
VINYL ACETATE EMULSION POLYMERIZATION KINETICS AND MECHANISM Ph.D. Thesis
Kuanhsiung Chang 1980 298 p
Avail: Univ. Microfilms Order No. 8021682

The kinetics and mechanism of vinyl acetate emulsion polymerization was studied by considering most of the possible variables, i.e., type of soap, concentration of soap, ionic strength, monomer volume particle concentration, and initiator concentration. A kinetic model based on the elementary chemical reactions was presented. The expression for the rate of polymerization based on the model predicts the dependencies of polymerization rate on all experimental variables. The integrated equations follow the polymerization curves over the whole monomer range for the whole parameter range. The numbers and diameters of particles of poly (vinyl acetate) lattices were determined by quasielastic laser light scattering considering the polydispersity effect. It was found that the soap impurity retarded the polymerization because it underwent degradative chain transfer. The particle generation as a function of conversion and soap concentration (sodium lauryl ethoxylate sulfate) in unseeded polymerization was studied.
Dissert. Abstr.

N80-33568 Case Western Reserve Univ., Cleveland, Ohio.
STUDIES OF UNIFORM SPHERICAL COLLOIDS PREPARED BY EMULSION POLYMERIZATION Ph.D. Thesis
Yohannes Chonde 1980 138 p
Avail: Univ. Microfilms Order No. 8021683

Emulsion polymerization techniques were used to prepare model colloidal suspension of polymer lattices with controllable particle size and surface charge. Monodispersed stable lattices with reactive chloromethyl surface functionalities were prepared in the presence of mixed surfactants using vinylbenzyl chloride in various ways: as a homopolymer; crosslinked with divinylbenzene; copolymerized with styrene; and overpolymerized onto uniform polystreme latices. Ways to control the amount of water soluble polyelectrolyte produced as a result of the sulfonation reaction are also discussed. Surfactant-free emulsion polymerization of styrene with sodium vinylbenzyl sulfonate comonomer was studied in the presence of water methanol mixtures. In most methods of emulsion polymerization, some water soluble oligomers are formed. Methods for detection, quantitative determination and removal of water soluble oligomers from latices are discussed. Radiotracer techniques were employed to compare the effectiveness of ultracentrifugation with other methods commonly used to remove impurities from a latex.
Dissert. Abstr.

N80-33569 North Carolina State Univ. at Raleigh.
SORPTION, TRANSPORT AND DILATOMETRIC STUDIES IN GLASSY POLYMERS Ph.D. Thesis
Gautam Ramchandra Ranade 1980 168 p
Avail: Univ. Microfilms Order No. 8020543

Sorption isotherms for water vapor in glassy polyacrylonitrile (PAN) were measured at temperatures from 15 C to 45 C. The transient and steady state permeation of water vapor through PAN at various activities at temperatures from 15 C to 45 C was also studied. The transport data indicated that non-Fickian processes were present. Therefore, sorption kinetics for the PAN/H2O system at various activities at temperatures from 15 C to 45 C were also studied to clarify the nature of water transport in PAN. At all temperatures the sorption isotherms were nonlinear and exhibited dual mode sorption at lower activities. A Zimm-Lundberg type analysis of the sorption data indicated clustering of water molecules at higher activities. The Langmuir sorption capacity, the Flory-Huggins parameter, the heat of solution, permeability, and diffusion were among the factors investigated. Diatometric measurements were made on a series of methacrylate polymers. These data were used to estimate the amount of excess free volume in glassy methacrylate polymers.
Dissert. Abstr.

N80-33570*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TACKIFIER FOR ADDITION POLYIMIDES
John M. Butler (Virginia Polytechnic Inst. and State Univ., Blacksburg) and Terry L. St.Clair Oct. 1980 15 p refs
(Grant NsG-1428)
(NASA-TM-81883) Avail: NTIS HC A02/MF A01 CSCL 11G

A modification to the addition polyimide, LaRC-160, was prepared to improve tack and drape and increase prepeg out-time. The essentially solventless, high viscosity laminating resin is synthesized from low cost liquid monomers. The modified version takes advantage of a reactive, liquid plasticizer which is used in place of solvent and helps solve a major problem of maintaining good prepeg tack and drape, or the ability of the prepeg to adhere to adjacent plies and conform to a desired shape during the lay up process. This alternate solventless approach allows both longer life of the polymer prepeg and the processing of low void laminates. This approach appears to be applicable to all addition polyimide systems.
Author

N80-33571*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POLYIMIDES: THERMALLY STABLE AEROSPACE POLYMERS
Anne K. St.Clair Oct. 1980 19 p
(NASA-TM-81884) Avail: NTIS HC A02/MF A01 CSCL 07C

An up to date review of available commercial and experimental high temperature polyimide resins which show potential for aerospace applications is presented. Current government research trends involving the use of polyimides as matrix resins for structural composites are discussed. Both the development of polyimides as adhesives for bonding metals and composites, and as films and coatings for use in an aerospace environment are reviewed. In addition, future trends for polyimides are proposed.
Author

N80-33572# Electronics Research Lab., Adelaide (Australia).
THE ACTION OF WATER VAPOUR ON ION IRRADIATED ALKALI SILICATE GLASSES
E. H. Hirsch and T. R. Adams May 1980 22 p refs
(AD-A089023; ERL-0075-TR; AR-001-662) Avail: NTIS HC A02/MF A01 CSCL 11/2

The surface of ion irradiated alkali silicate glasses is sensitized to chemical attack by atmospheric water vapour. After initial evolution of hydrogen, this attack leads to the slow conversion of certain regions on the glass surface to water soluble corrosion products. The observations suggest that the regions involved in this conversion are particles of a second phase, distributed throughout the main matrix, and they point to the importance of phase separation in determining the stability of glasses under irradiation.
GRA

N80-33573# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
DYNAMIC EVALUATION OF EXPERIMENTAL INTEGRAL

FUEL-TANK SEALANTS, PART 1 Annual Technical Report, 3 Jul. 1978 - 3 Jul. 1979
Lee E. Isom Dec. 1979 31 p refs
(Contract F33615-78-C-5098; AF Proj. 2421)
(AD-A088573; AFML-TR-79-4193-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 11/1

Experimental integral fuel-tank sealant materials were evaluated under laboratory conditions which closely simulate those of actual aircraft integral fuel tanks during flight. A unique facility was designed and fabricated for the evaluation of a variety of joint configurations. The facility consists primarily of two separate biaxial stress machines in which temperature, pressure, and vibrational strain can be programmed for automatic operation. Specimens can be strained longitudinally and torsionally to simulate actual flight conditions. Frequency and amplitude of the strains can be independently set and recorded. Simulated fuel-tank and environmental pressure can also be adjusted independently. Early difficulties with sealant failure detection and with undesirable thermal strains were resolved and preliminary evaluations of continuous fillet specimens utilizing two sealant materials were performed. J.M.S.

N80-33574# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
PREPARATION OF HOMOGENEOUS LIVING POLYVINYL GELS WITH APPLICATION TO SOLVENT PURIFICATION
F. S. Bates and R. E. Cohen Jun. 1980 24 p refs
(Contract N00014-77-C-0311; NR Proj. 356-646)
(AD-A088883; TR-5) Avail: NTIS HC A02/MF A01 CSCL 07/3

A method is presented for maintaining a high level of purity in organic solvents to be used in anionic polymerization. The development of this technique has entailed synthesis of structurally unique polyvinyl gels which are labile to anionic initiation. Preparation of macroscopic homogeneous gels from divinylbenzene (DVB) and ethylstyrene (ES) is shown to result in the immobilization of a significant amount of residual vinyl groups. Conditions necessary for eliminating unwanted syneresis during the gelation include initiation of the reaction with butyllithium and polymerization in a nonpolar solvent (e.g. benzene) to which an appropriate amount of tetrahydrofuran (THF) has been added. The success of this method in obtaining the desired product is attributed to the influence of the THF on the polymerization of DVB; a mechanism is proposed and experimentally supported which accounts for the observed results. Author

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-33575 British Library Lending Div., Boston Spa (England).
THE PRESSURIZED FLUIDIZED BED GASIFICATION OF COAL CHAR
S. Honma Jun. 1980 12 p ref Transl. into ENGLISH from Nenryo Kyokai-shi (Japan), v. 58, no. 3, 1979 p 219-224
(BLL-RTS-12347) Avail: British Library Lending Div., Boston Spa, England

Experiments on the pressurized fluidized bed gasification of Pacific coal char are described and the relation between operating factors, such as pressure and feed rate of air, and the calorific value of the gas produced and the throughput of material is classified. The relation between carbon utilization and heat conversion ratio is discussed. S.F.

N80-33576 British Library Lending Div., Boston Spa (England).
THE FLUIDIZED BED GASIFICATION OF COAL CHAR
Y. Tazaki and J. Kawabata Jun. 1980 14 p refs Transl. into ENGLISH from Nenryo Kokaishi (Japan), v. 58, no. 3, 1979 p 212-218
(BLL-RTS-12346) Avail: British Library Lending Div., Boston Spa, England

The effect of oxygen concentration of the gasification agent on sintering of ash was investigated. Ash resisted sintering when the oxygen concentration of the gasification agent was reduced. Sintering did not occur at gasification temperatures as high as 1050 C, despite the presence of oxygen, when silica sand was used as fluidizing medium. A gasification process was examined in which the fluidized bed was divided into two stages with a horizontal perforated plate, the first stage functioning as a coal combuster with silica sand as fluidizing medium and the second stage functioning as a coal gasifier utilizing heat from the first stage. Sintering of ash in the first stage was prevented by the silica sand, while in the second stage the partial pressure of oxygen in the gasification agent was virtually zero, and the ash failed to sinter notwithstanding gasification at temperatures up to 1050 C. R.K.G.

N80-33577 Texas Univ. at Austin.
MODELING OF HEAT AND MASS TRANSFER DURING COAL BLOCK GASIFICATION Ph.D. Thesis
Tat Hang Tate Isang 1980 209 p
Avail: Univ. Microfilms Order No. 8021523

The drying of coal, pyrolysis of small coal particles and gas-char reactions are discussed in the content of diffusion and flow of gases in the pyrolyzing coal (porous media). Sophisticated models for drying of a coal block and for diffusion and flow of multi component gaseous mixture through the porous coal matrix are developed and simplifying assumptions are discussed. Dissert. Abstr.

N80-33578 Illinois Univ. at Chicago Circle, Chicago.
SINGLE PARTICLE GAS-SOLID REACTIONS AND THEIR APPLICATION TO MODELING OF FLUIDIZED BED COAL COMBUSTORS AND ASH AGGLOMERATING GASIFIERS Ph.D. Thesis
Amirali G. Rehmat 1980 336 p
Avail: Univ. Microfilms Order No. 8023250

The material and energy balances derived during single and multiple gas solid reactions that take place on a single particle are utilized to (1) model the char combustion, (2) model the gasification of char, (3) establish the conditions for ash agglomeration during combustion and gasification, and (4) verify the direct oxidation model for char combustion. The shrinking core model was employed. The reaction resistances accounted for include the intraparticle diffusion resistance, the intermolecular diffusion resistance, the reaction rate, and the interphase diffusion. Analysis of single and multiple gas solid reactions revealed that the particle growth has a significant influence on reaction time when the diffusion resistance controls the overall rate of reaction. The solution of the unsteady state heat balance equation shows that the particle core temperature is greatly influenced by the heat of reaction, the size of the particle, the partial pressure of the gaseous reactant, the particle growth factor, and the ambient temperature. This information is translated into the design of an ash agglomerating coal gasifier and extended to modeling of the fluidized bed processes. Dissert. Abstr.

N80-33579# Chemical Engineering Research Group, Pretoria (South Africa).
PREPARATION AND STABILITY OF EMULSIONS OF METHANOL IN AUTOMOBILE DIESEL OIL
C. G. McCormack Oct. 1979 32 p refs
(CSIR-CENG-294; ISBN-0-7988-1730-5) Avail: NTIS HC A03/MF A01

Short term emulsification of up to 20% methanol in diesel oil (stability lasting a few hours) is feasible but the emulsifiers successful in this respect are costly and have to be applied in relatively high concentrations. No emulsifier was found which produces an emulsion with long term stability; mutual solubilities of the various components and solubility changes with temperature were idenified as the most important causes. It is unlikely than an emulsifier will be found which produces stable temperature insensitive emulsions of methanol in diesel oil. Even if such a emulsifier exists, the required amount of and costs are expected to be prohibitive in a fuel application. Author

N80-33580# Committee on Science and Technology (U. S. House).
OVERSIGHT: ALTERNATE LIQUID FUELS TECHNOLOGY
Washington GPO 1979 722 p refs Hearings before the

Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., 76th Congr., 1st Sess., no. 33, 5-7 Jun. 1979 (GPO-50-313) Avail: SOD

Testimony is provided on alternate liquid fuels for petroleum, and their role in furthering independence from foreign imported oil. Two facets of the problem considered are economic security with respect to transportation fuels for the civilian sector, and mobility fuels for the national defense apparatus. Commercial synthetic liquid fuels technologies are emphasized. J.M.S.

N80-33581# Committee on Science and Technology (U. S. House).
OVERSIGHT: COST ESTIMATION TECHNIQUES FOR EMERGING SYNTHETIC FUELS TECHNOLOGY, VOLUME 9
Washington GPO 1979 49 p Joint hearings before the Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., the Subcomm. on Oversight and Invest. and the Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Com., 96th Congr., 1st Sess., no. 34, 16 Jul. 1979 (GPO-51-721) Avail: SOD

The inherent uncertainties surrounding a crash program to commercialize synthetic fuels are discussed. Statements concerning the energy and other opportunities which would be foregone by a massive open ended commitment of capital to this particular option are presented. E.D.K.

N80-33582# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
DISCUSSION ON EXPLOSION HAZARDS
H. G. Wagner, ed., H. J. Pasman, D. J. Lewis, and A. W. Preus Dec. 1979 118 p refs Proceedings of 7th Intern. Colloq. on Gasdyn. of Explosions and Reactive Systems, Goettingen, West Germany, 20-24 Aug. 1979
(MPIS-23/1979; ISSN-0436-1199) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

Descriptions of research programs planned or in progress in 11 nations in the field of vapor cloud explosions are given. Topics include large and small scale field studies with hydrocarbon vapors, hazards in the Suez canal, dust explosions, gas explosions effects in a nuclear reactor vessel, mathematical modeling and wind tunnel tests of gas turbulence effects, and flame propagation. For individual titles, see N80-33583 through N80-33595.

N80-33583# McGill Univ., Montreal (Quebec).
RESEARCH ON VAPOR CLOUD EXPLOSIONS AND RELATED PHENOMENA IN CANADA
I. O. Moen and J. H. S. Lee *In* Max-Planck Inst. Fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 25-33 refs (For primary document see N80-33582 24-28)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

Government, industry, and university programs are described, including an investigation into the combustion properties of hydrogen-air-steam under confinement, particularly regarding the pressure transients. Vapor cloud explosion research is being conducted emphasizing turbulent flame propagation in the presence of obstacles, determination of detonability limits under various conditions of confinement and turbulence, and determination of criteria for a combustion to give transition into detonation. Also being studied are: computational methods for various modes of combustion, investigation of detonation propagation through media of nonuniform fuel composition, and fire spread characteristics through nonhomogeneties formed under the combined effect of diffusion and buoyancy. Author (ESA)

N80-33584# Cairo Univ. (Egypt). Faculty of Engineering.
EXPLOSION HAZARDS IN THE SUEZ CANAL: AN OVERVIEW
M. M. Kamel *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 34-39 refs Sponsored in part by Cairo Center of Combustion, Energy Conversion and Flow Res. (CEFR) (For primary document see N80-33582 24-28)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

The explosion danger that the densely populated Suez Canal Zone is subjected to due to the passage of super-tankers and liquefied natural and petroleum gas carriers is discussed. Accidental causes of explosions are enumerated, different scenarios leading to the detonation of explosive fuel-air clouds resulting from liquefied gaseous fuel spills are presented, and possible avenues of research in this field are outlined. Author (ESA)

N80-33585# Centre National de la Recherche Scientifique, Poitiers (France). Lab. d'Energetique et de Detonique.
UNCONFINED HYDROCARBON AIR MIXTURE EXPLOSION STUDIES PERFORMED IN FRANCE BY CEA-EDF-GDF AND THE UNIVERSITY
J. C. Leyer *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 40-45 refs (For primary document see N80-33582 24-28)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

The analysis of the blast effects produced by the detonation of ethylene, acetylene and propane-air mixtures was studied in balloons of volumes between 1 and 250 cu m. The trajectory of the Mach stem was observed as well as the blast wave propagation behavior including reflection effects from the ground surface. It was found that there was a marked effect on the pressure field of the initial volume of the fuel mixture. The acceleration of various fuel and air mixtures in the deflagration mode within soap bubbles of up to 20 cm radius was investigated. The various mixtures produced flame velocities in the range of 1 to 150 meters/second. Initiation was with a low energy spark in the center when spontaneous acceleration for a uniform mixture was observed. If however a mixture step change was produced by a more energetic mixture in a central zone, an imposed acceleration for the outer mixture was obtained. A theoretical analysis of the behavior can be made for the case of spontaneous acceleration by using the constant velocity flame solution and adjusting the flame velocity in successive steps. This tends to give underestimates of the peak overpressure but overestimates of the positive impulse. Author (ESA)

N80-33586# Battelle Inst., Frankfurt am Main (West Germany).
EXPLOSION HAZARDS OF TRANSPORT GASES: RESEARCH WITHIN THE REACTOR SAFETY PROGRAM OF THE FEDERAL REPUBLIC OF GERMANY
W. Geiger *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 46-59 (For primary document see N80-33582 24-28)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

A research program is described which considers explosion behavior under unconfined conditions. Studies were undertaken of the mechanisms by which a quasi-detonation unconfined vapor cloud explosion can take place. Also under investigation are the interaction relationships between the characteristic parameters of an incident pressure wave and the structural response of nuclear power plant complex structures, and the determination of the pressure wave characteristics of a real gas cloud which detonated. This would be nonhemispherical in shape and nonhomogeneous in composition. Author (ESA)

N80-33587# Gesellschaft fuer Hochtemperaturreaktor-Technik m.b.H., Bensberg (West Germany).
THE GAS CLOUD EXPLOSION PROGRAM ON THE PNF-PROJECT
K. Schulte *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 60-68 (For primary document see N80-33582 24-28)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

The dynamics and effects of explosions of escaping gas from coal gasification plants are being studied as part of a reactor safety program. Attempts are being made to define the values of pressure and pressure-time profiles which are applicable to typical gas explosions and to understand the interaction of such pressure waves with typical structures. The gas release and cloud formation stages plus ignition, laminar combustion, and acceleration due to turbulence are being studied in order to calculate the pressure and velocity fields resulting from the explosion. Flame acceleration and pressure enhancement were identified

as arising from six possibilities. Two of these are studied in depth: combustion supported flame acceleration and the effect of eddies around structures whereby the flame encloses unburnt material in a vortex pattern. Some small scale studies of this effect were shown to give laminar flame acceleration effects of 2 or 3 fold increase, but no pressure measurements were made. Experiments were carried out in a vortex chamber to measure velocities. Some large scale experiments of hydrogen and air in hemispherical balloons were carried out which confirmed theoretical predictions. Author (ESA)

N80-33588# Health and Safety Executive, Sheffield (England). Explosion and Flame Lab.

RESEARCH ON VAPOR CLOUD EXPLOSIONS IN THE UNITED KINGDOM

H. Phillips *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 69-70 (For primary document see N80-33582 24-28)

Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

Studies are under way in risk assessment, formation of vapor clouds, cloud dispersion and modeling hypothetical clouds to determine how combustion blasts develop. Other programs include flame acceleration, effects of variations in fuel concentration on combustion behavior, and combustion problems and flame behavior in the presence of turbulence. Author (ESA)

N80-33589# Tokyo Univ. (Japan). Inst. for Safety of High Pressure Gas Engineering.

A FILM OF LARGE SCALE FIELD EXPERIMENTS ON ETHYLENE HAZARDS

Tsutomu Hikita *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 72-74 refs (For primary document see N80-33582 24-28)

Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

The film is composed of four parts: dispersion of liquid ethylene (312 kg) in an open pit in a 2.5 m/sec wind; control of a liquid ethylene fire; heating of an insulated tank containing 2.3 cu m of ethylene with an external propane fire; two ethylene-air explosion experiments were conducted in a building with a volume of 48 cu m having PVC film walls and roof over a steel framework. The ethylene concentration averaged 7.2% v/v which was ignitied by a pentolite charge of weight 20 g. One test at this concentration gave a detonation whereas another run at 9.1% v/v ethylene had the characteristics of a deflagration. This was compared with an earlier experiment of 7.4% v/v ethylene in air inside a similar building of 770 cu m volume. This result clearly gave a true detonation. Author (ESA)

N80-33590# Prins Maurits Lab. TNO, Rijswijk (Netherlands).

SOME COMMENTS ON THE DISCUSSION ON EXPLOSION HAZARDS

H. J. Pasman *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 75-78 (For primary document see N80-33582 24-28)

Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

Areas of research on explosion hazards were identified where more research needs to be done. Mentioned were: analysis of flame behavior in stratified gas clouds, multiple ignition sources, ignition power, and total igniting surface. Also, quantitative classification of fuels according to reactivity, deflagration of sprays and aerosols, damping effects of water mist, detonation wave quenching, detonation wave modeling, and the effects of shock waves on structures. Author (ESA)

N80-33591# Prins Maurits Lab. TNO, Rijswijk (Netherlands).

DESCRIPTION OF RESEARCH RELATED TO VAPOR CLOUD EXPLOSIONS IN THE NETHERLANDS

J. P. Zeeuwen *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 79-81 (For primary document see N80-33582 24-28)

Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

A simple vapor cloud explosion model was developed for industrial users, which can predict the blast overpressure characteristics from the amount and kind of fuel present in the cloud and the local structures. Spherical flame propagation is being studied in a 1 cu m vessel and linear propagation in tubes up to 24 m in length with a cross section 22 cm x 22 cm. Flame acceleration and possible transition to detonation are also being examined. Author (ESA)

N80-33592# Christian Michelsens Institutt for Videnskap og Andsfrihet, Bergen (Norway).

LARGE SCALE GAS EXPLOSION EXPERIMENTS IN NORWAY

Rolf K. Eckhoff *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 82-89 (For primary document see N80-33582 24-28)

Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

Flame propagation and pressure development are being studied in alkane-air mixture explosions in confined and semiconfined geometry. An explosion tube 2.5 m in diameter and 10 m long was constructed. The tube and gas filling system are described. Turbulence effects will be studied. A series of propane-air explosion tests indicate that the classical explosion venting type of volume scaling is invalid. Proposed full scale dust venting explosion tests in a 500 cu m silo are mentioned. Author (ESA)

N80-33593# R and D Associates, Marina Del Rey, Calif.

PERSPECTIVES ON RESEARCH ON LNG VAPOR CLOUD DISPERSION

Allen L. Kuhl, H. J. Carpenter, F. R. Gilmore, and E. J. Chapyak (LASL) *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 90-99 refs (For primary document see N80-33582 24-28)

Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

Field experiments, wind tunnel simulations, and mathematical models of cloud dispersion are described. Field experiments were not useful for predicting vapor cloud characteristics from large spills. Considerable differences also exist between model results for large spills. The physical effects important to vapor cloud dispersion include gravity spreading, turbulence effects, inhibiting effects of the cold gas on turbulent mixing, and the nature of the atmospheric boundary layer. Further research is suggested with better models, scaled experiments, and wind tunnel tests to check scaling problems. Author (ESA)

N80-33594# California Univ., Berkeley. Lawrence Berkeley Lab.

EVALUATION OF THE EFFECTS OF DETONATION IN A SPHERICAL BOMB

John Kurylo and Antoni K. Oppenheim *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 100-110 refs (For primary document see N80-33582 24-28)

(Contract W-7405-eng-48)

Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

An analysis was made of the time dependent pressures and impulse loadings on the walls of the hemispherical dome of a nuclear reactor pressure vessel arising from a centrally ignited hydrogen-oxygen detonation. Investigated in this context are the effects of richness of the detonable gas mixture as well as those due to the inclusion of water vapor. The gas mixture was treated as a perfect gas and the partial differential equations governing the gasdynamic flow were integrated using the CLOUD CODE, a finite difference technique set in Lagrangian coordinates and incorporating the smoothing action of artificial viscosity. The most interesting results pertain to the ringing of pressure pulses at the walls. Their frequency is quite uniform and their pressure peaks, at levels significantly higher than that of combustion at constant volume, decay at a negligible rate. Author (ESA)

N80-33595# Army Armament Research and Development Command, Dover, N. J.

VAPOR CLOUD EXPLOSION STUDIES IN THE UNITED STATES

Norman Slagg and Paul A. Urtiew (California Univ., Livermore. Lawrence Livermore Lab.) *In* Max-Planck Inst. fuer Stroemungsforsch. Discussion on Explosion Hazards Dec. 1979 p 111-113

(For primary document see N80-33582 24-28)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.70

Institutions and individuals involved in the liquefied natural gas problem and in large scale dust explosions are identified. Studies are being conducted which are concerned with the mechanisms of flame propagation, the acceleration of flames and dispersion problems under a variety of environmental conditions. Also included are risk analysis studies, unconfined explosions, two phase detonations, blast wave profiles, and dust explosions in coal mines. The technical problem areas can be divided up into the following: mechanisms which cause flame acceleration, initiation requirements, effect of fuel air ratio variations, the estimation of blast and other damage effects, scaling studies, particularly for the plume problem and also for flame acceleration mechanisms. Author (ESA)

N80-33596# Naval Research Lab., Washington, D. C.
APPLICATION OF PICOSECOND AND LIGHT SCATTERING SPECTROSCOPIES TO THE STUDY OF ENERGETIC MATERIALS Interim Report
J. M. Schnur 11 Sep. 1980 54 p refs
(RR0240202)
(AD-A088904; NRL-MR-4323) Avail: NTIS HC A04/MF A01 CSCL 20/5

The goal of this research is to identify advanced optical procedures appropriate for the study of energetic materials and their reactions, develop these techniques as required, assess their utility to the energetic material community, and then aid in the transfer of the appropriate technology to the appropriate user groups. Previous reports have detailed the development of light scattering techniques to study material properties at high pressures. The successful application of this method to the study of complex material problems has recently led to the initiation of two distinct research programs. These are (A) the application of high pressure Raman, FTIR, and Brillouin techniques to study the role of supra molecular structure in determining material strength in polyethelene (now supported by NAVAIR) and (B) the application of high pressure Raman and FTIR in determining the possible effect of pressure in catalyzing decomposition in NOS-365 and other monopropellants. GRA

N80-33597# Naval Weapons Support Center, Crane, Ind.
SPECTRAL DISTRIBUTIONS 5: VISIBLE SPECTRA OF STANDARD AND IMPROVED GREEN FLARE COMPOSITIONS Final Report, 1 Oct. 1979 - 30 Jun. 1980
Henry A. Webster, III 1 Aug. 1980 18 p refs Presented at the 1979 Ann. Meeting of the Pyrotech. and Explosives Appl. Sect. of the Am. Defense Preparedness Assoc., West Point, N.Y., 7-9 Nov. 1979
(WF3354591)
(AD-A089055; NWSC/CR/RDTR-126) Avail: NTIS HC A02/MF A01 CSCL 19/1

Visible spectra from standard Navy green flares and an improved green flare composition are presented and analyzed. The improved green flares are composed of boron, magnesium, barium nitrate, and a binder. Luminous intensities of 71000 cd and efficiencies of 11,000 cd.s/g have been obtained. Dominant wavelengths shorter than those of the standard green flare have also been obtained. Molecular emissions from boron oxides, barium oxides, and barium chlorides and various atomic emission features are observed. GRA

N80-33598# SRI International Corp., Menlo Park, Calif. Chemistry Lab.
FLUORINATED DESENSITIZING INGREDIENTS FOR PROPELLANTS Final Report, 24 Jul. 1979 - 23 Apr. 1980
John M. Guimont 24 May 1980 29 p refs
(Contract N00024-79-C-5653; SRI Proj. PYU-8742)
(AD-A088704) Avail: NTIS HC A03/MF A01 CSCL 21/9

Under the sponsorship of Naval Sea Systems Command, SRI has been investigating the use of partially fluorinated nitrate esters as desensitizing ingredients for propellants. Three nitrate esters were prepared, and preliminary characterization of the first two was completed. GRA

N80-33599# Stone and Webster Engineering Corp., Boston, Mass.
HYDROPROCESSING OF LIGHT PYROLYSIS FUEL OIL FOR KEROSENE TYPE JET FUEL Final Report, 1 Oct. 1978 - 31 Oct. 1979
Alexander Korosi and J. N. Rubin Feb. 1980 70 p refs
(Contract F33615-78-C-2074)
(AD-A089101; S/W-PROC-111579; AFWAL-TR-80-2012)
Avail: NTIS HC A04/MF A01 CSCL 21/4

The feasibility of converting light pyrolysis fuel oil (a steam cracking by-product) into jet fuel was assessed. The raw aromatic fuel oil was hydrostabilized and converted into naphthenic products by hydrogenation in pilot plant operation. The fully hydrogenated fuel showed excellent cold properties, high heat of combustion values on volume basis and met nearly all specifications on kerosene-type fuels. Conceptual process design and related economics indicated the product cost was competitive with other petroleum products. This fuel is a new potential source for JP5 or JP8 kerosene type jet fuel. GRA

N80-33600# IIT Research Inst., Chicago, Ill.
TNT EQUIVALENCY TESTING OF CHEMICAL MIXTURES IN CONTINUOUS TNT MANUFACTURING Final Report
Ronald Pape, Joseph Mavec, Richard Joyce, and Paul Price Aug. 1980 211 p refs
(Contract DAAA21-76-C-0221)
(AD-A088903; IITRI-J6379; ARLCD-CR-79013) Avail: NTIS HC A10/MF A01 CSCL 19/1

Tests were conducted to determine the TNT equivalencies of selected chemical mixtures in their process components from continuous TNT production facilities. This report presents the rationale for selecting the components which were tested, the philosophies used in planning and designing the tests, the designs of the simulated process components and supplementary test equipment, the test procedures, the test results, and analysis of the test results. A methodology was developed to correlate the experimental data quite well and thereby be able to predict airblast output produced by other untested process compounds of similar geometry without additional testing. Author

N80-33601# United Technologies Corp., South Windsor, Conn. Power Systems Div.
COAL GASIFICATION COMBINED-CYCLE SYSTEM ANALYSIS Final Report
S. Hamilton, J. Garow, and S. J. Lehman Apr. 1980 178 p refs
(EPRI Proj. 986-2)
(EPRI-AP-1390) Avail: NTIS HC A09/MF A01

The results of a study involving combustion turbine power plants using coal gasification are summarized. Systems integration and the optimization of power plant conceptual design were studied. The objectives include: (1) determining potential levels of thermal efficiency for well integrated gasified coal combined cycle systems; (2) quantifying the effects of varying key design parameters of various components on overall plant performance; and (3) project potential levels of performance made possible by using advanced, combustion turbines and advanced gasifiers. Emphasis was placed on effective waste heat management and practically in synthesizing overall power plant arrangements. Current technology systems were defined which yielded thermal efficiencies in the range of 35 to 37%. It was found that approximately one percentage point in thermal efficiency could be realized by using either the British Gas Corporation (BGC) slagging, fixed bed gasifier or the air blown Texaco gasifier in place of the oxygen blown Texaco gasifier. Two percentage points were gained by increasing the gas turbine combustor exit temperature about 300 F. DOE

N80-33602# JBF Scientific Corp., Wilmington, Mass.
EVALUATION OF PROCESSES FOR PRODUCING GASOLINE FROM WOOD Final Report
May 1980 50 p refs
(Contract DE-AC01-79PE-70048)
(DOE/PE-70048/T2) Avail: NTIS HC A03/MF A01

Three processes for producing gasoline from wood by pyrolysis were investigated. Technical and economic comparisions among the processes were made, based on a hypothetical common plant size of 2000 tons per day green wood chip feedstock. Perspective is provided by comparisons of the wood to gasoline technologies with other similar systems, including coal to methanol

and various biomass to alcohol systems. Several descriptions of energy efficiency were used, but all showed that methanol production from wood, with or without subsequent processing by the Mobil route to gasoline, appears most promising, however, the critical wood to methanol system remains conceptual. Another observation was that the ethanol production systems appear inferior to the wood to gasoline processes. DOE

N80-33603# Mound Lab., Miamisburg, Ohio.
ROLE OF SURFACE CHEMISTRY IN THE IGNITION OF PYROTECHNIC MATERIALS
W. E. Moddeman, L. W. Collins, P. S. Wang, and T. N. Wittberg (Dayton Univ. Research Inst., Ohio) 1980 18 p refs Presented at the 7th Intern. Pyrotechnics Seminar, Vail, Colo., 14 Jul. 1980
(Contract DE-AC04-76DP-00053)
(MLM-2708(OP); CONF-800713-6) Avail: NTIS HC A02/MF A01

The surface chemistry of fuels is shown to play a key role in the ignition of pyrotechnic materials. Since these fuels are usually easily oxidized, the surface must provide protection from undesirable oxidation processes such as pyrophoricity while permitting the desirable pyrotechnic reactions. For both titanium and aluminum, these criteria are met by metal oxide coatings which control the accessibility of the fuel to the oxidizer. However, it is shown that the mechanisms through which this control is exerted are substantially different. The ignition of titanium based pyrotechnics seems to be kinetically controlled by the dissolution of the titanium oxide coating to generate a reactive surface for the pyrotechnic reaction. Reactions of aluminum seem to depend on diffusion of aluminum (or oxygen at higher temperatures) through its oxide coating. It is also shown that the accessibility of aluminum can be improved by alloying. DOE

N80-33604# Mound Lab., Miamisburg, Ohio.
THERMAL AND ELECTROSTATIC INITIATION OF TiH/SUB X BASED PYROTECHNICS
L. W. Collins 1980 11 p refs Presented at the 7th Intern. Pyrotechnics Seminar, Vail, Colo., 14 Jul. 1980
(Contract DE-AC04-76DP-00053)
(MLM-2710(OP); CONF-800713-8) Avail: NTIS HC A02/MF A01

The thermal and electrostatic initiations of TiH/sub x/based pyrotechnics were investigated to determine the material properties which influence these processes. Controlled electrostatic sensitivity experiments showed that the initiation reaction for TiH/sub x/KC1O4 pyrotechnic involved a reaction of the fuel with oxygen gas an that the KC1O4 chemically interacts with the titanium to desensitize the material to electrostatic ignition. Other factors which influence the initiation process were also identified. As a result of these experiments, a theory for the titanium oxides which coat the metal particles. Thermal ignition of the TiH/sub x/KC1O4 was shown to be controlled by chemical processes associated with the titanium fuel. DTA experiments were correlated with Auger spectroscopic measurements to demonstrate the role of the dissolution of the oxide coating in the thermal ignition of titanium. DOE

N80-33605# Battelle Pacific Northwest Labs., Richland, Wash.
OXYGEN/SYSTEM GASIFICATION OF WOOD
L. K. Mudge, D. G. Ham, S. L. Weber, and D. H. Mitchell Apr. 1980 23 p refs
(Contracts EY-76-C-06-1830; DE-AC06-76RL-01830)
(PNL-3353) Avail: NTIS HC A02/MF A01

Yields from fixed bed gasification of solar fuel, pressed planar shavings, are presented for air/steam operation and oxygen/steam operation at four different compositions. The wood carbon distributes between gas products and liquid products in the respective ranges of 75 to 80 wt% and 20 to 25 wt%. The cold gas efficiencies, defined as the combustible energy in the gas divided by the heat of combustion of the wood, were 60% for operation with an air to steam weight ratio of 10, 52%, 61%, 59%, and 52% for operation with oxygen to steam weight ratios of 1/2, 1, 2, and 4 respectively. The other energy inputs to the system are less than the energy output in tar products so that the above efficiencies are about the same as the overall efficiencies. Concentrations of the gas at various heights in the fixed bed are presented. The results indicate that the maximum weight fraction of methanol from dry wood is 0.45 at an oxygen to steam weight ratio of 1 with reforming of the methane in the product gas, or a yield of 135 gallons of methanol per ton of dry wood. The maximum methane yield is obtained at the same oxygen to steam weight ratio of 1 and is 8600 scf/dry ton. DOE

N80-33606# Santa Clara Univ., Calif. Dept. of Mechanical Engineering.
METHANOL/ETHANOL/GASOLINE BLEND FUELS DEMONSTRATION WITH STRATIFIED CHARGE ENGINE VEHICLES Final Report
R. Pefley, H. Adelman, and T. Suga Mar. 1980 135 p refs Prepared for California Energy Commission, Sacremento
(PB80-192123; CAEC-49) Avail: NTIS HC A07/MF A01 CSCL 21D

The performance of four 1978 Honda CVCC vehicles was monitored over a twelve month period. Three of the unmodified vehicles were fueled with alcohol/gasoline blends (5% methanol, 10% methanol, and 10% ethanol) with the fourth remaining on gasoline as a control. The demonstration and testing established the following: (1) the tested blends cause no significant degradation in exhaust emissions, fuel economy, and driveability; (2) the tested blends cause significant increases in evaporative emissions; (3) analysis of periodic oil samples shows no evidence of accelerated metal wear; and (4) higher than 10% alcohols will require substantial modification to most existing California motor vehicles for acceptable emissions, performance, and fuel economy. GRA

N80-33607# National Technical Information Service, Springfield, Va.
HYDROGEN USE AS A FUEL. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980
Audrey S. Hundemann Jul. 1980 228 p Supersedes NTIS/PS-79/0779
(PB80-813090; NTIS/PS-79/0779) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

Federally funded research studies pertaining to the technical feasibility of using hydrogen as a fuel for vehicular transportation, electric power generation, and both subsonic and supersonic aircraft are discussed. Excluded are studies on hydrogen production and storage. These topics are covered in other bibliographies. This updated bibliography contains 206 citations, 20 of which are new entries to the previous edition. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-33600 British Library Lending Div., Boston Spa (England).
THE SOLUTION CYCLE IN AN ABSORPTION SYSTEM WITH PRESSURE EQUALISING GAS (THEORETICAL AND EXPERIMENTAL INVESTIGATIONS)
D. Otto May 1980 24 p refs Transl. into ENGLISH from Luft und Kaltetechnik, (Dresden), 2, no. 5, 1966 p 153-158 Presented at the Refrig. Symp., Leipzig, 15 Apr. 1966
(BLL-RTS-12307) Avail: British Library Lending Div., Boston Spa, England

Theoretical explanations, and a description of the methods of measurement used in experimental investigations of the cycle are presented along with which serve for evaluating the predetermination of the cycle in an resorption systems. Author

N80-33609 California Univ., Los Angeles.
SUPERFLUIDITY IN 3He-4He MIXTURE THIN FILMS Ph.D. Thesis
Emilia Webster 1980 88 p
Avail: Univ. Microfilms Order No. 8023377

All results from our experiments studying superfluidity in He-3 and He-4 mixture films are presented. Our measurements spanned the temperature range from 1.3 to 1.8 K, and up to 30% He-3 molar concentration in the film. Films of up to 100 Angstroms thickness were studied. The experimental configuration and procedure are described. Relevant theories are

reviewed. The areal superfluid mass density is given in terms of an experimental measure of the film thickness for all concentrations and temperatures studied. Detailed data from the onset regions are included. Precipitous onset phenomena were observed, and the Kosterlitz-Thouless-Nelson theory conclusively verified. However, no two dimensional phase separation was observed, showing that mixture theories based on the X-Y model need additional refinement to correctly describe multilayer films. Experimental values of the superfluid onset and intercept thickness of He-3 and He-4 mixture films are also exhibited. Analysis of our experimental evidence indicates that this excess normal fluid is due to surface roton excitations which exist at the substrate boundary, with an energy gap of 4.5 K. Author

N80-33610 Rutgers - The State Univ., New Brunswick, N. J.
SIZE EFFECTS IN SUPERFLUID 3He Ph.D. Thesis
Timothy Joseph Chainer 1980 167 p
Avail: Univ. Microfilms Order No. 8022547

The superfluid density and transition temperature of 3He filling the pores of packed alumina powder was measured by fourth sound. The measurements were performed simultaneously for three separate fourth sound resonators, each packed with a different nominal grain size of 1.0, 0.3, and 0.05 micrometers. The bulk 3He superfluid transition temperature, which was determined independently, was compared to the transition temperature of each resonator. We observed a systematic depression for both the superfluid density and transition temperature as the powder size was observed to decrease. The depressions in the transition temperature were compared with theoretical estimates of size dependent transition temperatures for the ideal geometry of an infinite cylinder. In the analysis, the cylinder radius was replaced by defining an average radius of the pore structure which was empirically determined by nitrogen gas sorption and mercury intrusion techniques. The pressure dependence of the transition temperature depression is found to be consistent with theoretical estimates of the superfluid coherence length. Dissert. Abstr.

N80-33611 Ohio State Univ., Columbus.
MATERIAL CHARACTERIZATION FOR STUDYING FLEXIBLE PAVEMENT BEHAVIOR IN FATIGUE AND PERMANENT DEFORMATION Ph.D. Thesis
Mohamad Rashad Nassr Elmitiny 1980 319 p
Avail: Univ. Microfilms Order No. 8022267

Mixtures' performances in fatigue and rutting were investigated. Different aggregates and gradations were studied in these mixtures. The aggregates and gradations chosen were investigated using Marshall design criteria. These aggregates were first evaluated for basic material characteristics such as specific gravity and water absorption for both fine and course fractions. Also, the Marshall stability, density and air voids contents were known at different asphalt contents. To investigate rutting susceptibility for different mixes under study, a dynamic uniaxial loading in which the dynamic stress intensities were varied within a certain range to simulate field conditions was conducted. All mixtures studied in fatigue showed that the crack propagation rate versus stress intensity factors can be represented with a polynomial of a second degree. Statistical relations were developed to correlate the rutting and fatigue parameters under investigation in this study with other mix variables. The rutting parameters were found mostly to be influenced by asphalt contents and aggregate type. The fatigue parameters were found to be affected by asphalt contents, gradations and modulus of elasticity. Dissert. Abstr.

N80-33612*# Public Technology, Inc., Washington, D. C.
IMPROVING BUILDING CONSTRUCTION SPECIFICATIONS IN STATE AND LOCAL GOVERNMENTS
[1980] 51 p
(Contract NASw-3133)
(NASA-CR-163623) Avail: NTIS HC A04/MF A01 CSCL 13B

State and local governments can benefit from master specifications systems that centralize data on all types of building materials, products, and processes. Most of these systems are organized according to the MASTERFORMAT system, which, along with guide specifications that require the insertion or deletion of standardized information, resulted from the specific needs of users and providers. For juriedictions preparing their own specifications, staff time and cost are reduced. For those subcontracting the preparation, master specifications provide a means of evaluating the specifications submitted. Current management specification systems described include SPECINTACT, OMSPEC, MASTERPEC, and the NAVFAC, Corps of Engineers, and GSA guide specifications. A.R.H.

N80-33613# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE, BI-MONTHLY BULLETIN NO. 1980-1
Jul. 1980 98 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 1-75
(ESA-TT-651) Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

A study of the vibration of obstacles in a flow, methods for measuring propellant levels, reverse pseudo unsteady calculation methods, and vacuum ultraviolet spectrography of titanium are discussed. Other topics include in situ experiments in a one MV electron microscope, wind tunnel pressure measurements, and an electrical method for strain and damage measurement. For individual titles, see N80-33614 through N80-33620.

N80-33614# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VIBRATIONS OF SEVERAL OBSTACLES WITHIN THE TWO DIMENSIONAL FLOW OF INCOMPRESSIBLE FLUID c34
Robert Legendre *In its* La Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 1-12 Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 1-8 Original report in FRENCH previously announced as A80-26158 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

Linearization, justified by the assumption of low amplitude vibration of the obstacles, is invoked to determine their effect by superimposing the fields induced by the local displacements and those induced by the vortex sheets in the wake. The calculation of these elementary fields is made easier by the previous determination of auxiliary functions that are the first type integrals and the theta function associated with the automorphism group in the plane of a uniforming variable. Author (ESA)

N80-33615# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ULTRASOUND LEVEL-METER FOR MEASURING PROPELLANT LEVELS IN ARIANE TANKS IN ITS FIRST AND SECOND STAGES c35
Jean-Claude Demarais and Alain Deom *In its* La Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 13-30 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 9-22 Original report in FRENCH previously announced as A80-26159 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

Propellant levels in tanks of unsymmetrical dimethylhydrazine and nitrogen tetroxide were measured using signals from a 220 kHz transducer at the tank bottom reflecting from the liquid surface. The measurements are sampled at a frequency of about 20 Hz, which permits detection of relatively rapid variation of the level (55 mm/s) with a precision better than 5 mm within the whole measuring range: 25 cm to 3 m. To avoid measurement perturbations due to temperature variations, and ultrasound reflector was installed in the tanks for calibration. Author (ESA)

N80-33616# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
REVERSE PSEUDO-UNSTEADY AERODYNAMIC CALCULATION METHODS c02
Georges Meauze *In its* La Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 31-40 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 23-30 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

A reverse mode calculation method is described which

provides the geometry of a wall corresponding to a given velocity distribution. The velocity distribution can be assigned on the whole duct wall whose geometry is looked for, or only on an element of it, the remaining being assumed known. The method uses a pseudo-unsteady calculation, which makes it possible to treat the case of flow with shock waves, for a two dimensional flow with possible variation of a duct, such as an air intake or a nozzle, as well as the profiles of turbomachine blades. This method can also contribute to the understanding and exploitation of experimental results, making it possible to determine the flow field corresponding to the measured wall pressure distributions. Author (ESA)

N80-33617# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE ONERA VACUUM ULTRAVIOLET SPECTROGRAPH AND ITS USE FOR THE STUDY OF SURFACE LAYERS IN TITANIUM AND ITS ALLOYS **c35**
Frima Malamand and Bernard Daigne *In its* La Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 41-49 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 31-37 Original report in FRENCH previously announced as A80-26161 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

The spectrograph permits the exploitation of a broad spectral region, covering the ultraviolet and vacuum ultraviolet ranges. The use of a high energy source makes possible the simultaneous measurements of the constituent contents in an alloy, from a few ppm to several percent. This analysis process permits the determination of the concentration of several elements on metallic layers only a few microns thick involving a small quantity of matter. Variations of oxygen, nitrogen, carbon and hydrogen concentrations, on titanium and TA6V samples were studied as a function of various modes of preparation or surface treatment. Author (ESA)

N80-33618# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
IN SITU EXPERIMENTS IN THE 1 MV ELECTRON MICROSCOPE. PART 1: FEASIBILITY AND METHODOLOGY **c35**
Roger Valle, Bernard Genty, and Alain Marraud *In its* La Rech. Aerospatiale Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) p 51-80 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 39-61 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

The history of electron microscopy is reviewed, including the physical and experimental approach followed in the design of equipment for in situ experimentation. The problems of extended observations at high temperatures and specimen oxidation are examined. The factor influencing the design of the vacuum system and the specimen chamber are presented. The evolution of techniques and apparatus for observing thick specimens and for the recording of dynamic phenomena are described, including: sensitivity and resolution requirements of the television camera tube, the development of an aluminum foil screen, and the television camera optical system. A technique is described for recording on 16 mm motion picture film the television image stored on magnetic tape. Two frames of the television image are registered on each film frame. Author (ESA)

N80-33619# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A DIGITAL UNIT FOR MEASURING UNSTEADY PRESSURE COEFFICIENTS **c35**
Claude Christoux and Alain Gravelle *In its* La Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 81-88 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 63-68 Original report in FRENCH previously announced as A80-26162 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

The large capacity system receives simultaneous data from miniature piezoresistive transducers, computes the Fourier transform of the displacement signal and of the pressure signals for each channel, and stores the coefficients on disk. The system is based on an HP 2100 minicomputer, an HP 5451 B Fourier analyzer, with an in house designed 16 channel multiplexer. The unit has a capacity of 240 channels and a bandwith between 5 and 1250 Hz. A comparison is made with the analog unit which it replaces. Author

N80-33620# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AN ELECTRICAL METHOD OF MEASURING STRAIN AND DAMAGE **c35**
Georges Cailletaud, Humbert Policella, and Georges Baudin *In its* Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 89-97 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 69-75 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

It is shown that, by using an appropriate analysis method, the potential drop technique can be applied to the measurement of strain and damage on actual complex structures. The proposed method is applied to the simple case of push-pull specimens and the results are compared with those obtained with classical methods. Agreement is good for various materials, specimen shapes, and temperature ranges. Author (ESA)

N80-33621# Spire Corp., Bedford, Mass.
RESEARCH ON LOW TEMPERATURE, DIRECTED ENERGY PROCESSING OF VERY LARGE SCALE INTEGRATED STRUCTURES Semiannual Technical Report, 1 Jan. - 30 Jun. 1980
Anton Greenwald Jul. 1980 44 p refs
(Contract MDA903-79-C-0212)
(AD-A088562; SAR-80-10065-02) Avail: NTIS HC A03/MF A01 CSCL 09/5

The use of low temperature pulsed electron beam surface heating eliminates the need for high temperature thermal cycling of silicon wafers in fabricating very large scale integrated (VLSI) devices. Results using pulsed annealing techniques to fabricate: (1) low leakage diodes; (2) ion-implanted resistors defined by thin (2.5 micron) oxide windows; and (3) small geometry patterns to measure lateral diffusion of dopants are presented. Comparison to high temperature thermal processing was favorable. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-33622 British Library Lending Div., Boston Spa (England).
METHODS OF DIGITAL SPEECH SIGNAL TRANSMISSION
Klaus Fellbaum Feb. 1980 19 p refs Transl. into ENGLISH from NTZ-Nachrtech. Z. (West Germany), v. 32, no. 9, 1980 p 603-607
(BLL-RDL-Trans-3798-(7737.470)) Avail: British Library Lending Div., Boston Spa, England

An overview and assessment of compression methods for speech signal reduction is presented. Specifically, the signal shape coding methods, analysis/synthesis methods, and the recognition and synthesis methods are addressed. M.G.

N80-33623 British Library Lending Div., Boston Spa (England).
THE TRANSMIC SYSTEM. 1: GENERAL PRINCIPLES AND PRESENTATION
Jean-Marie Gauthier, Alain Texier, Jean Lachaise, and Luc Guillet Dec. 1979 21 p refs Transl. into ENGLISH from Cables et Transmission (France), Oct. 1978 p 447-460
(BLL-RDL-Trans-3766-(7737.470)) Avail: British Library Lending Div., Boston Spa, England

The communications system, TRANSMIC, which is based on digital transmission techniques is described. The TRANSMIC system is made up of equipment designed for integration into the telecommunications network of the PTT (French Posts and Telecommunications Administration) to complement existing digital equipment and to provide services other than the telephone,

the main one of which consists of a point-to-point synchronous digital data link service. The development of equipment for accessing a PCM telephone channel at a digital rate of 64 kbit/s is discussed. The TRANSMIC long distance digital media and the network synchronization techniques are also examined and a review is made of possible future developments. M.G.

N80-33624 British Library Lending Div., Boston Spa (England).
THE TRANSMIC SYSTEM. 3: OPERATIONS, AVAILABILITY AND QUALITY OF SERVICE
Michel Huet, Jean Francois Dunand, and Rene Dupuy Dec. 1979 31 p refs Transl. into ENGLISH from Cables et Transmission (France), Oct. 1978 p 468-489
(BLL-RDL-Trans-3765-(7737.470)) Avail: British Library Lending Div., Boston Spa, England

The system units of the TRANSMIC digital communication system are described in their installation context; the levels of integration of the TRANSMIC links are defined within the general transmission network; and the general operations and maintenance principles and the main technological characteristics of the units concerned are presented. An assessment is made of the quality of service and results obtained on several links used in service and under experimental conditions. Lastly, some options and decisions with regard to procedures which would increase system availability are described. M.G.

N80-33625 British Library Lending Div., Boston Spa (England).
FREQUENCY RE-USE BY POLARIZATION ON DIVERSITY ON SATELLITE LINKS
C. Zufferey Nov. 1978 28 p Transl. into ENGLISH from Tech. Mitt. PTT, (Bern), no. 4, 1978 p 140-150
(BLL-Trans-3663) Avail: British Library Lending Div., Boston Spa., England

From the theoretical point of view, the realization of systems using the principle of reuse of frequencies does not present any insoluble problems. The fact is that no one form of polarization can really be adopted with absolutely decisive advantages. Several possible arrangements which enable the reuse of the same frequency band in the case of satellite links are discussed. R.K.G.

N80-33626 British Library Lending Div., Boston Spa (England).
ALTERNATIVES FOR THE DEVELOPMENT OF FUTURE TELEVISION SYSTEMS
Broder Wendland Jun. 1980 26 p refs Transl. into ENGLISH from 7th E K T G Conf. proc. p 1-22 Presented at 7th E K T G Conf.
(BLL-RTS-12332) Avail: British Library Lending Div., Boston Spa, England

The results of Japanese investigations into subjective perception picture quality are used as the starting point for developing a high definition television system. Parameters for such a system include high detail definition, line free picture representation, convenient picture ratio (5:3); no cross color interference, and no cross luminance interference. The Japanese concept to correct current deficiencies involves increased number of lines, increased bandwidth and increased capacity requirement with all the associated consequences and no apparent compatibility with existing systems. The possibility of achieving an improvement in picture quality essentially compatible with present TV system, but using new techniques is considered, as well as the restrictions and limitations. Such approaches discussed include the use of digital signal processing techniques, and highly complex systems, including receivers, using the VLSI technique. A.R.H.

N80-33627 Colorado Univ. at Boulder.
PRECISE PREDICTIONS OF GRAND UNIFIED GAUGE THEORIES Ph.D. Thesis
Marc Alan Sher 1980 152 p
Avail: Univ. Microfilms Order No. 8021637

The predictions of the simplest grand unified theory (GUT) based on the group SU(5) are examined. Among these are the proton lifetime, the weak mixing angle, and the b-quark mass. It is noted that the most accurate determination of the mixing angle can be made from measurement of the masses of the weak vector bosons (the W and Z). Using higher order expressions for these masses in terms of the mixing angle, the W and Z masses in SU(5) are calculated. By considering the effects of heavy colored scalars on the renormalization group equations, it is shown that the simplest form of SU(5) is the only GUT which makes very precise predictions. If one assumes that the symmetry breakdown in the standard model of electroweak interactions is due to quantum corrections, then the mass of the scalar boson predicted in the model is calculable and is around 10 GeV. The mass is very sensitive to the value of the mixing angle, and its measurement could also be a precise test of SU(5). Also, as this mass is very near the bottomonium (upsilon) states, a precise prediction for the mass could indicate the best method of detection of the scalar. Dissert. Abstr.

N80-33628 Georgia Inst. of Tech., Atlanta.
ANALYTICAL COMPENSATION FOR NEAR-FIELD PROBE POSITIONING ERRORS IN CALCULATED FAR-FIELD ANTENNA PATTERNS Ph.D. Thesis
Larry Edward Corey 1980 245 p
Avail: Univ. Microfilms Order No. 8023761

An analytical technique was to compensate for the effects of the probe positioning errors on far field antenna patterns calculated from measured near field data. For the out of plane errors which cause the near field to be measured on a nonplanar surface, an integral equation relationship was developed between the electric field on the measurement surface and the near electric field on a planar surface. The equation was solved for the planar near field using an iterative technique called the vector projection algorithm. The inplane probe positioning errors cause the near field to be sampled nonuniformly. Uniformly spaced samples were recovered from the measured samples through the solution of a set of linear equations which relate the nonuniform samples of the near field to the Fourier series coefficients of the measured near field. Once the Fourier series coefficients were known, the periodic samples were recovered by the use of the discrete Fourier transform. Dissert. Abstr.

N80-33629 City Univ. of New York, N. Y.
THE EFFECT OF TURBULENCE ON WAVE PROPAGATION IN THE ATMOSPHERE: GENERATION ATTENUATION AND SCATTERING Ph.D. Thesis
Alfred Mendelsohn 1980 138 p
Avail: Univ. Microfilms Order No. 8023750

A comprehensive theoretical study of acoustical wave motion in turbulence is presented. The problems of noise generated by turbulence and that of interaction of acoustical waves with turbulence, resulting in either attenuation or scattering of the wave, are discussed. The spectral structure of sound pressure fluctuations generated by turbulence with strong mean shear is examined. Both the near field noise generated by an infinite turbulent medium and the far field noise generated by a finite volume of turbulence are considered. Dissert. Abstr.

N80-33630 Texas A&M Univ., College Station.
IDENTIFICATIONS AND FORECASTING OF THE POTENTIAL FOR THE OCCURRENCE OF EXTENDED-RANGE VHF-UHF TRANSHORIZON PROPAGATION FROM SYNOPTIC-SCALE DATA Ph.D. Thesis
John Harvin Bradham 1980 103 p
Avail: Univ. Microfilms Order No. 8023015

An objective method is presented for identification of tropospheric areas with a potential for supporting extended range VHF-UHF transhorizon propagation (ERTP), and for forecasting the potential for changes in this structure over short periods of time. Rawinsonde data and sampling interval obtained from the third atmospheric variability experiment (AVE 3) were used in an evaluation of the contribution of sub-synoptic scale processes to variations in the refractive index structure as a function of time, space, air mass, and geography. AVE 3 data also were used in an evaluation of the contribution of the kinematic processes of vertical motion, temperature advection, moisture advection, differential temperature advection, differential moisture advection, and horizontal velocity divergence to temporal and spatial variations of the time rate of change of the vertical gradient of refractivity. An evaluation of the vertical structure of the gradient of refractivity along paths which support ERTP was conducted. Dissert. Abstr.

N80-33631 Arizona State Univ., Tempe.
DIGITAL PHASE MODULATED FIBER OPTICAL COM-

MUNICATION SYSTEM Ph.D. Thesis
Veng Sun Hy 1980 244 p
Avail: Univ. Microfilms Order No. 8023385

An optical fiber system hardware including a laser fiber coupler was constructed to demonstrate experimentally the feasibility of using a minimum shift keyed (MSK) modulation format in a long haul fiber optic system. The MSK modulation format has the following properties: most of its energy is contained in a narrow spectral width, its phase transition is linear. With these two important properties, MSK signal is less affected by the dispersion of the transmission medium than any other common angle modulation scheme. The work done resulted in a feasible laser fiber coupler using lenses, and an intensity modulated optical system with a phase modulated subcarrier. The laser fiber coupler yielded a fairly good result. However, because of its critical alignment problem, this type of coupler is not suitable for field application. The digital phase modulated optical fiber system with a MSK modulation format has proved to be superior than the ON-OFF keyed technique when the subcarrier frequency is below the optical fiber cutoff frequency. Beyond the cutoff frequency of the fiber, the MSK modulation scheme, or the digital phase modulation format, is not suitable for transmissions over a dispersive optical fiber. Dissert. Abstr.

N80-33632 City Univ. of New York, N. Y.
ELEMENTARY PATTERNS FOR LARGE CONFORMAL ARRAYS Ph.D. Thesis
Kang Soo Lee 1980 257 p
Avail: Univ. Microfilms Order No. 8023671

A conformal array is described which has large number of dipole or slot columns circular-symmetrically distributed along the circumference of a conducting cylinder. A dipole or slot column is consisted of an infinite number of array elements in the cylinder axial direction. Because of this three dimensional array geometry, beam scan in elevation as well as in azimuth can be carried out. To investigate the beam scan characteristics of these antenna arrays flush mounted on cylindrical surfaces, the elementary patterns of these arrays are derived. For a conformal dipole array, the separation between the dipole elements and the conducting surface is within a quarter wavelength and the space between them is filled with a dielectric material, the dielectric constant of which is given as epsilon. The special case when epsilon is equal to epsilon sub 0, the dielectric constant of the free space, is also studied. In general, however, the dipole elements can be considered as the printed dipoles on a dielectric board which is clad on a conducting cylinder. For a conformal slow array, the radiating elements are the open waveguides at the surface of a conducting cylinder which is covered with a thin dielectric sheet. Dissert. Abstr.

N80-33633 Northeastern Univ., Boston, Mass.
AN INVESTIGATION OF CONTINUOUS PHASE FREQUENCY SHIFT KEYING AS A MODULATION ON ADDITIVE IMPULSIVE ATMOSPHERIC NOISE CHANNELS Ph.D. Thesis
Thomas Arthur Schonhoff 1980 132 p
Avail: Univ. Microfilms Order No. 8023645

Continuous phase frequency shift keying (CPFSK) was investigated as a potential modulation on Atmospheric Impulsive Noise Channels. Theoretical estimation and Monte Carlo simulation were used to evaluate the error rate performance of CPFSK in terms of E sub b/sigma squared where E sub b per bit sigma squared is the received atmsopheric noise variance. The error rate performance was determined for linear receiver as well as non linear receivers consisting of linear receivers preceded by a zero memory nonlinearity, such as a clipper, hole puncher or hard limiter. Both binary and quaternary modulation indices were considered. It was found that the use of CPFSK as a modulation on channels with additive atmospheric noise requires less E sub b/sigma squared achieve a given error rate than was necessary using more conventional modulations such as MSK or CFSK. Dissert. Abstr.

N80-33634 Polytechnic Inst. of New York.
ELASTIC WAVES HEXAGONAL HONEYCOMB Ph.D. Thesis
Sang Keun Park 1980 153 p
Avail: Univ. Microfilms Order No. 8019408

Honeycomb panels were used for the walls of electronic equipment huts and aerospace applications. Panels were inspected for defects in fabrication or during use. Acoustic waves were propagated parallel to the panel. The properties of waves propagating in the honeycomb itself were determined especially in the frequency range where the wavelength is on the order of the cell diameter. The Bloch waves propagating in a honeycomb of infinite extent were examined. At low frequencies the honeycomb was found to act as an elastic continuum. At high frequencies the periodicity and anisotropy of the honeycomb effected the propagation of the Bloch waves, and resulted in the presence of stop bands for propagation in certain directions. Computations of the dispersion curves (frequency dependence), slowness surfaces (direction dependence), and polarization of the Bloch waves were calculated. The propagation characteristics of the waves guided by an aluminum face plate bonded to a honeycomb of semi-infinite extent were found in the low frequency range where the honeycomb acted as an elastic continuum. Dissert. Abstr.

N80-33635 Texas Univ. at Arlington.
DCT/DPCM PROCESSING OF NTSC COMPOSITE VIDEO-SIGNAL Ph.D. Thesis
Avudh Ploysongsang 1980 198 p
Avail: Univ. Microfilms Order No. 8022980

Two different schemes are developed for DCT/DPCM processing of a digital NTSC color composite video signal sampled at three times the color subcarrier frequency. The first scheme is based on applying the discrete cosine transform (DCT) along each horizontal line and then implementing the differential pulse code modulation (DPCM) in the vertical direction on the semitransformed image. The second scheme involves DCT of (4x4) subblocks followed by adaptive DPCM to reduce inter-subblock correlation. Based on the statistics of the error signal, variable word length quantizers, optimized for minimizing the mean square error, are developed. These techniques lead to reduced bit rates for transmitting digital color video at broadcast standards. The effect of noise in the channel is investigated in terms of severity and propagation patterns. This is carried out by using a forced error scheme which selectively forces the error to occur in the different types of coding bits. Error propagation patterns are studied both by computer printouts and by observing the processed images. Dissert. Abstr.

N80-33636 Texas Univ. at Arlington.
INTERFIELD HYBRID CODING OF NTSC COMPONENT VIDEO SIGNALS Ph.D. Thesis
Farhad Ahani Kamanger 1980 231 p
Avail: Univ. Microfilms Order No. 8022983

Interfield hybrid coding of component video signals is investigated. This coding involves two dimensional discrete cosine transform of each field followed by differential pulse code modulation between fields. An efficient algorithm for fast implementation of 2d-DCT is developed. Three different algorithms for 2d-DCT/DPCM system are simulated and analyzed. In the first algorithm optimum quantizers are used in DPCM loops followed by fixed word length coders. Uniform quantizers along with variable word length coders were implemented in the second system. The performance of different deterministic coders are investigated and compared with Huffman coders. The third scheme is an adaptive system. Each block is divided into 4 subblocks. The activity of each subblock is monitored and when it exceeds some threshold the subblock is considered to be spatially active. Dissert. Abstr.

N80-33637 British Library Lending Div., Boston Spa (England).
PULSE CODES FOR THE TRANSMISSION OF BINARY DATA
J. Valin Jan. 1980 44 p refs Transl. into ENGLISH from Revue Technique Thomson-CSF, (Orsay), v. 11, no. 2, Jun. 1979 p 359-401
(BLL-TRANS-3784) Avail: British Library Lending Div., Boston Spa, England

The codes which are used for the transmission of binary data are discussed. These codes may help promote the use of a homogeneous vocabulary for code names. R.K.G.

N80-33638 British Broadcasting Corp., Kingswood (England).
A SET OF TIME VARYING TELEVISION TEST PATTERNS
M. Weston Sep. 1980 15 p refs
(BBC-RD-1980/9) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, England

The zone plate is now established as a powerful diagnostic tool in the study of television processing systems. The time variable resulting in a family of related patterns which still further increase the usefulness of this approach. These patterns can readily be generated electronically and an indication of the method is given. Author

N80-33639*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CODING FOR SPREAD SPECTRUM PACKET RADIOS
Jim K. Omura 15 Oct. 1980 34 p refs
(Contract NAS7-100)
(NASA-CR-163628; JPL-Pub-80-75) Avail: NTIS HC A03/MF A01 CSCL 17B

Packet radios are often expected to operate in a radio communication network environment where there tends to be man made interference signals. To combat such interference, spread spectrum waveforms are being considered for some applications. The use of convolutional coding with Viterbi decoding to further improve the performance of spread spectrum packet radios is examined. At 0.00001 bit error rates, improvements in performance of 4 db to 5 db can easily be achieved with such coding without any change in data rate nor spread spectrum bandwidth. This coding gain is more dramatic in an interference environment. Author

N80-33640*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE COMMUNICATION PERFORMANCE EVALUATION: COMPUTATIONAL TECHNIQUES BASED ON MOMENTS
Jim K. Omura and Marvin K. Simon 15 Sep. 1980 126 p refs
(NASA-CR-163629; JPL-Pub-80-71) Avail: NTIS HC A07/MF A01 CSCL 17B

Computational techniques that efficiently compute bit error probabilities when only moments of the various interference random variables are available are presented. The approach taken is a generalization of the well known Gauss-Quadrature rules used for numerically evaluating single or multiple integrals. In what follows, basic algorithms are developed. Some of its properties and generalizations are shown and its many potential applications are described. Some typical interference scenarios for which the results are particularly applicable include: intentional jamming, adjacent and cochannel interferences; radar pulses (RFI); multipath; and intersymbol interference. While the examples presented stress evaluation of bit error probilities in uncoded digital communication systems, the moment techniques can also be applied to the evaluation of other parameters, such as computational cutoff rate under both normal and mismatched receiver cases in coded systems. Another important application is the determination of the probability distributions of the output of a discrete time dynamical system. This type of model occurs widely in control systems, queueing systems, and synchronization systems (e.g., discrete phase locked loops). Author

N80-33641*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A PARAMETRIC ANALYSIS OF PERFORMANCE CHARACTERISTICS OF SATELLITE-BORNE MULTIPLE-BEAM ANTENNAS
A. B. Salmasi 15 Mar. 1980 99 p refs
(NASA-CR-163632; JPL-Pub-80-52) Avail: NTIS HC A05/MF A01 CSCL 20N

An analytical and empirical model is presented for parametric study of multiple beam antenna frequency reuse capacity and interbeam isolation. Two types of reflector antennas, the axisymmetric parabolic and the offset-parabolic reflectors, are utilized to demonstrate the model. The parameters of the model are introduced and their limitations are discussed in the context of parabolic reflector antennas. The model, however, is not restricted to analysis of reflector antenna performance. Results of the analyses are covered in two tables. The model parameters, objectives, and descriptions are given, multiple-beam antenna frequency reuse capacity and interbeam isolation analysis of the two types of reflectors are discussed as well as future developments of the program model. A.R.H.

N80-33642*# Queensborough Community College, Bayside, N. Y.
INTERCOMMUNICATIONS IN REAL TIME, REDUNDANT, DISTRIBUTED COMPUTER SYSTEM Final Report, Sep. 1979 - Aug. 1980
H. Zanger Aug. 1980 57 p refs Sponsored by NASA
(NASA-CR-163604; JRI-NCA-OR625-001) Avail: NTIS HC A04/MF A01 CSCL 17B

An investigation into the applicability of fiber optic communication techniques to real time avionic control systems, in particular the total automatic flight control system used for the VSTOL aircraft is presented. The system consists of spatially distributed microprocessors. The overall control function is partitioned to yield a unidirectional data flow between the processing elements (PE). System reliability is enhanced by the use of triple redundancy. Some general overall system specifications are listed here to provide the necessary background for the requirements of the communications system. R.K.G.

N80-33643 British Library Lending Div., Boston Spa (England).
RELATIONSHIP BETWEEN SHORT AND LONG TERM RAINFALL RATES AND ITS IMPLICATION FOR THE DESIGN OF RADIO LINKS
Wolfgang Albrecht and Joerg Sander Nov. 1978 10 p refs
Transl. into ENGLISH from Frequenz (Berlin), v. 31, no. 11, 1977 p 341-343
(BLL-RDL-Trans-3665-(7737.470)) Avail: British Library Lending Div., Boston Spa, England

Experimentally determined relationships between the mean values of rain intensity measured at one minute and sixty minute intervals are given. These relationships, which were determined in the course of a three year measurement period, are compared with data published by LIN in 1975. The values of attenuation due to rain which were measured on a 12.2 GHz radio link are used to show to what extent design data radio links of this type can be obtained from records of rainfall rates alone. Author

N80-33644# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SYNCHRONIZATION TOLERANCE TO RECEIVING ERRORS IN CODED EM AND PCM SIGNALS TRANSMITTED BY METEOROLOGICAL SATELLITES [SINCRONIZACAO TOLERANTE A ERROS PARA A RECEPCAO DE SINAIS CODIFICADOS EM PCM, TRANSMITIDOS POR SATELITES METEOROLOGICOS]
Valter Rodrigues Jun. 1980 10 p refs In PORTUGUESE; ENGLISH summary
(INPE-1760-RPE/149) Avail: NTIS HC A02/MF A01

The error tolerant synchronization technique was used in the reception of PCM signals that were transmitted by geostationary satellites, and the usual errors probabilities associated with it were 1 part per million. Some algorithms for minimizing the synchronous machines were used to increase the reliability of the circuits and to make equipment cheaper. T.M.

N80-33645# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TELECOMMANDO TRANSMISSION SYSTEM FOR STRATOSPHERIC BALLOONS [SISTEMA DE TRANSMISSAO PARA TELECOMANDO DE BALOES ESTRATOSFERICOS]
Patricio Paul Normandin Sanz and Aydano Barreto Carleial Jul. 1980 15 p refs In PORTUGUESE; ENGLISH summary
Presented at the 32d Reuniao Anual da DPBC, 6-12 Jul. 1980
(INPE-1830-RPE/194) Avail: NTIS HC A02/MF A01

A telecommunication system designed and developed for telecommand of scientific and technological payloads taken on board stratospheric balloons, at the transmission rate of 1200 bit/sec is described. The system takes advantage of parts of a commercially available FM transceiver in 460 MHz. The modulation signal is constructed in Manchester code, from the telecommand bit stream, so as to obtain a spectral composition that is compatible with transceiver's voice passband. Author

N80-33646# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council of Scientific and Technical Research.
GEOMETRY OF AN ANTENNA POSITIONER FOR GEOSTATIONARY SATELLITES [GEOMETRIA DE UM POSICIONADOR DE ANTENA PARA SATELITES GEOESTACIONAROPS]
Carlos E. Santana Jun. 1980 21 p In PORTUGUESE
(INPE-1795-NTE/161) Avail: NTIS HC A02/MF A01
The design for a modified equatorial mounting that lends itself to operation with any geostationary satellite is shown. The design incorporates two rotational axes. Imprecision in satellite orbit is compensated for by minor adjustments in the angle of declination. Transl. by S.F.

N80-33647# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PLATFORM ANTENNAS FOR DATA COLLECTION [ANTENA PARA PLATFORMA DE COLETA DE DEOS]
Benjamin daSilva M. C. Galvao and Carlos E. Santana Jul. 1980 33 p refs in PORTUGUESE; ENGLISH summary
Presented at 32d Reunion of the Brazilian Soc. for the Prog. of Sci., Rio de Janeiro, 6-12 Jul. 1980
(INPE-1820-RPE/186) Avail: NTIS HC A03/MF A01
The theoretical development and the design of a quadrifilar helix antenna to be used in platforms for the collection and transmission of environmental data are presented. The chief characteristic of the antenna is its shaped radiation diagram, with a reduced gain in the vertical (axial) pointing direction, in order to compensate for the variation in attenuation due to slant range to a low orbit satellite. Author

N80-33648# Communications Research Centre, Ottawa (Ontario). Communications Systems Branch.
SYNCOMPEX: A VOICE PROCESSING SYSTEM FOR LOW COST HF RADIO TELEPHONY
S. M. Chow and B. D. McLarnon Aug. 1980 11 p refs
(CRC-1316-E) Avail: NTIS HC A02/MF A01
Radio signals in the high frequency (HF) band propagate over long distances by reflecting from the ionosphere which is dynamic in nature. This causes signal fading. Syncomplex is a system designed to be used with HF single sideband radio telephone equipment to improve its performance in the presence of interference and fading. It can be used either as an integrated part of a radio design or as a retrofit to existing equipments. The concept is functionally similar to Lincompex but is implemented with modern technology to reduce its cost and to allow its use in conjunction with commercial grade radios. Preliminary evaluation of this system over two HF skywave paths is described. Significant improvements in voice quality and intelligibility were observed during periods of low signal to noise ratio. R.K.G.

N80-33649# Communications Research Centre, Ottawa (Ontario). Space Technology and Applications Branch.
ANIK-B DOC COMMUNICATIONS SYSTEM AND GROUND TERMINALS
J. W. B. Day Aug. 1980 43 p
(CRC-TN-704-E) Avail: NTIS HC A03/MF A01
Technical and operational aspects of the 12/14 GHz portion of the ANIK-B satellite are discussed, information to participants in ANIK-B pilot projects to aid in planning. S.F.

N80-33650# American Electronic Labs., Inc., Farmingdale, N. J.
INSTALLATION OF C-6533(XE-2)/ARC ICS IN UH-1H HELICOPTER
J. A. Hnat Jul. 1980 31 p
(Contract DAAK80-79-D-0256)
(AD-A088708) Avail: NTIS HC A03/MF A01 CSCL 17/2
This report documents the results of the installation of the C-6533(XE-2)/ARC ICS in UH-1H helicopter. Installation was performed at the AEL, Inc., Monmouth County Airport facility. Design of each installation was coordinated and approved by the Government. The mechanical and electrical installation drawings for the helicopter are attached as Appendix A of this report. The new ICS system consisted of new cabling, new intercoms and helmets rewired with new microphones. All four crew stations of the helicopter were reconfigured with the new system. Existing cabling for the standard ICS system remained in the aircraft but was securely stowed for later restoration of the aircraft. The helmets (4) were rewired using separate jacks for headphones and microphone lines. Transmit and receive cables were installed in the aircraft with a minimum separation of one inch between cables. A junction box was fabricated and installed on the aft end of the console to house the fan-out terminal strips. Transmit and receive lines' separation was maintained in the junction box. During the test phase the onboard radios were used with the new ICS system. GRA

N80-33651# Science Applications, Inc., Tucson, Ariz.
ABLE IMAGE CHAIN ANALYSIS. REVISION Final Report
Jerry Zelenka 27 Aug. 1980 90 p Revised
(Contract F33659-79-C-0178)
(AD-A088853; SAI-TR-04-165-1-Rev) Avail: NTIS HC A05/MF A01 CSCL 17/9
This report seeks to help in establishing Advanced Building Block for Large Area Exploitation system image chain elements, the ABLE data flow, and ABLE interface and test requirements. The document also reviews critical ABLE image chain problem areas, including image sampling requirements, radar image quantization, radar image compression techniques (DPCM, MAPS, etc.), and radar image data display requirements for both hard and soft copy devices. GRA

N80-33652# Naval Ocean Systems Center, San Diego, Calif.
GEOMAGNETIC ACTIVITY AND THE EQUATORIAL SCINTILLATION OF SATELLITE SIGNALS Final Report, Mar. 1978 - Dec. 1979
M. R. Paulson 19 May 1980 62 p refs
(RR0320801)
(AD-A088848; NOSC/TR-554) Avail: NTIS HC A04/MF A01 CSCL 17/2
Occurrence and intensity of equatorial scintillation have been correlated with daily summed geomagnetic 3 hour Kp indices, through scintillation data from satellites at two elevation angles for UHF and L-band. They also have been correlated with the individual 3 hour Kp indices and the correlations have been shown as a function of the time of day that the magnetic activity occurred. Correlation values as large as -0.91 and -0.56 were observed. A theory of how geomagnetic activity and equatorial scintillation may be connected is proposed. GRA

N80-33653# Army Engineer Topographic Labs., Fort Belvoir, Va.
RADIATIVE TRANSFER IN ONE DIMENSIONAL, DISCRETELY STRATIFIED MEDIA
Eugene A. Margerum Aug. 1980 22 p refs
(DA Proj. 4A1-61102-B-52A)
(AD-A088885; ETL-0236) Avail: NTIS HC A02/MF A01 CSCL 17/9
The theory of one dimensional radiative transfer is derived for media composed of layers of varying scattering properties. An illuminating interpretation of the formulas is given in terms of the various possible paths of multiple scattering. The semi-infinite homogeneous case is treated by introducing an invariance condition. Then, the transition to the continuous case is made by passage to a mathematical limit. Tabulated diffuse reflection coefficients are given for this last case. GRA

N80-33654# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
EVALUATION OF SPECIALIZED PHOTOACOUSTIC ABSORPTION CHAMBERS FOR NEAR MILLIMETER WAVE (NMMW) PROPAGATION MEASUREMENTS
Brian Z. Sojka and Kenneth O. White Aug. 1980 38 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A088842; ERADCOM/ASL-TR-0063) Avail: NTIS HC A03/MF A01 CSCL 20/6
Preliminary studies have been conducted to determine the feasibility of using spherical geometry photoacoustic absorption chambers at near millimeter wavelengths (NMMW). New spherical geometry photoacoustic absorption chambers were used in a parallel experimental arrangement to the ongoing (FY 79) NMMW program. Absorption sensitivity, NMMW laser beam handling characteristics, pressure dependence, and temperature effects of the system were evaluated to determine the usefulness and

applicability of these new designs for use at NMMW. Electret microphones were acquired, and testing was done by using these microphones as detectors in specialized spherical geometry and more conventional design photoacoustic absorption chambers. Results from this study show that numerous problems exist in using the sperical geometry photoacoustic absorption chamber design. The combination or resonant frequency temperature dependence, unstable mechanical chopping, high-Q narrow-bandwidth characteristics, and excessive noise sensitivities have limited the absorption sensitivities obtainable. Electret microphone testing and evaluation have led to the design and construction of several conventional, single-pass type, photoacoustic absorption chambers. GRA

N80-33655# Ohio State Univ., Cleveland. ElectroScience Lab.
ON THE APPLICATION OF THE GTD-MM TECHNIQUE AND ITS LIMITATIONS
John N. Sahalos and Gary A. Thiele Griffiss AFB, N.Y. RADC Jul. 1980 38 p refs
(Contract F10628-78-C-0198; AF Proj. 2305)
(AD-A088806; ESL-711353-1; RADC-TR-80-14) Avail: NTIS HC A03/MF A01 CSCL 17/9

In 1975 two techniques were published which combined the method of moments and the geometrical theory of diffraction. One technique extended the moment method through the use of the GTD while the second used the moment method to solve for unknown diffraction coefficients thereby extending the use of the GTD. It is the latter method that is considered in this paper and is referred to as the GTD-MM technique. One problem area that existed with the original GTD-MM work was associated with a field incident along or nearly along one wall of a wedge structure. This paper will show an improved series representation for the diffracted current that is sufficient at all incidence angles. The improved formulation is then applied to the problem of bistatic scattering by a three-sided pyramid. RCS results are obtained which compare very well with experimental measurements. This is believed to be the first use of the GTD-MM technique in treating a 3 dimensional geometry. GRA

N80-33656# Naval Research Lab., Washington, D. C.
ON THE MICROWAVE INTERACTION WITH MATTER AND MICROWAVE BREAKDOWN OF AIR Interim Report
A. W. Ali and T. Coffey 12 Sep. 1980 43 p refs
(AD-A088936; NRL-MR-4320) Avail: NTIS HC A03/MF A01 CSCL 20/3

The interaction of microwave radiation with matter (good conductors and dielectrics) is discussed. Approximate relations are given for the power necessary to vaporize surfaces of these materials. Calculations are also presented for threshold power for air breakdown at microwave frequencies. GRA

N80-33657# Naval Research Lab., Washington, D. C. Satellite Communications Branch.
THE DANGER OF INTERMODULATION GENERATION BY RF CONNECTOR HARDWARE CONTAINING FERROMAGNETIC MATERIALS Final Report
Charles E. Young 7 Jul. 1980 16 p Presented at the 9th Ann. Connector Symp., Cherry Hill, N.J., 20-21 Oct. 1976
(NRL Proj. R08-73)
(AD-A088768; NRL-MR-4233-CH-2) Avail: NTIS HC A02/MF A01 CSCL 09/1

From the few experiments presented here, it should be clear that intermodulation generation (IMG) by ferromagnetic materials (such as stainless steel, nickel plating and hermetic seals) in RF connector hardware is a very serious interference problem to satellite and other sensitive communication systems. Using ferromagnetic materials in RF connectors for military applications is particularly dangerous because of the possible misuse of such devices in IMG vulnerable systems. MIL-C-39012B and related specifications should be revised, prohibiting the use of ferromagnetic materials. Communication centers should be alerted to the potential interference problems of such materials. Their immediate removal is strongly recommended. The necessity to exclude ferromagnetic materials in the fabrication of RF connector hardware, currently an industry-wide problem, cannot be overstressed as a very important step in linearizing RF systems for maximum communication capability. GRA

N80-33658# Naval Research Lab., Washington, D. C.
INTRINSIC SOURCES OF IM GENERATION Final Report
George H. Stauss 7 Jul. 1980 19 p refs
(NRL Proj. R08-73)
(AD-A088771; NRL-MR-4233-CH-5) Avail: NTIS HC A02/MF A01 CSCL 20/3

In addition to avoidable sources of intermodulation signals introduced in manufacture or assembly of a multiplex system, there will be some sources inherent to the materials of which the system is constructed. At some point these sources must provide a lower bound to possible system sensitivity. Such a limitation will only be significant if it is reached before thermal noise becomes dominant. At 20 C and a bandwidth of 2500 Hz, the noise power becomes-140 dBm. It is potentially possible to lower either the temperature or the bandwidth by a factor of about 100, so an ultimate sensitivity limit of about-180 dBm is perhaps significant. Above these levels, a number of intrinsic IM mechanisms can be identified. This chapter constitutes a review of significant intrinsic IM sources. GRA

N80-33659# Michigan Univ., Ann Arbor. Electronics Lab.
THE 1979 TOWED SOURCE EXPERIMENT SIGNAL GENERATOR
K. Metzger, Jr. and L. W. vonWald Dec. 1979 68 p refs
(Contract N00014-75-C-0127)
(AD-A088757; CEL-TM-116.013376-9-M) Avail: NTIS HC A04/MF A01 CSCL 14/2

SGEN79 is the signal generator designed for use in the towed source experiment conducted during June of 1979. The output of this generator can be made up of the sum of as many as six switch selectable waveforms. The amplitude of each waveform can be individually adjusted. The unit provides a quiet period of 20 minutes once every four hours. Clock timing can be derived from an internal oven controlled crystal or from an external 1 to 5 MHz reference. Self-metering capabilities are provided. GRA

N80-33660# Michigan State Univ., East Lansing. Div. of Engineering Research.
RADAR WAVEFORM SYNTHESIS FOR TARGET IDENTIFICATION Final Report, 5 Aug. 1979 - 4 May 1980
Kun-Mu. Chen 4 May 1980 51 p refs
(Contract N00019-79-C-0385)
(AD-A088673) Avail: NTIS HC A04/MF A01 CSCL 17/9

A new scheme for radar detection and discrimination, the radar waveform synthesis method, is investigated. This scheme consists of synthesizing the waveform of an incident radar signal which excites the target in such a way that the return radar signal from the target contains only a single natural resonance mode of the target. When the synthesized incident radar signal for a known, preselected target is applied to a wrong target, the return radar signal will be significantly different from that of a natural mode of resonance, thus, the wrong target can be sensitively discriminated. The study on a simple geometry of a thin wire illuminated by a radar signal at normal incidence has been completed. The induced current on the target and the backscattered field from the target are obtained in terms of natural resonance modes. The required waveforms for the incident radar signal for exciting return radar signals which contain various single natural mode of resonance are obtained. When an incident radar signal, which is synthesized to excite a natural resonance mode of a thin wire, is applied to a slightly shorter or longer thin wire, the return radar signal from the wrong target is shown to be significantly different from that of a pure natural mode of resonance. Other studies on the cases of an infinite cylinder, a sphere, and a thin wire under an oblique excitation are in process. GRA

N80-33661# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EFFECT OF DOWNLINK PHASED ARRAY PATTERNS ON SYSTEM AVAILABILITY CONTOUR PREDICTIONS
Y.-L. C. Lo and L. M. Schwab 10 Apr. 1980 63 p refs
(Contract F19628-80-C-0002; AF Proj. 2029)
(AD-A088664; TN-1980-27; ESD-TR-80-70) Avail: NTIS HC A04/MF A01 CSCL 20/14

The relative variation in the pattern function for a 32 element, multibeam EHF satellite phased array has been incorporated into the equation for downlink margin. The corrected margin is used

to determine allowable rain attenuation (dB) and predict link availability based on Crane's 8 region world wide rain rate distribution and climate model. Link availability contours are computed for the cases of a 31 beam and 37 beam phased array. Four equi-spaced geostationary satellites are required for either configuration in order to provide 0.99 (or greater) link availability to all points within the 10 deg. elevation angle field of view for the nominal value of downlink margin and a frequency of 20.7 GHz. GRA

N80-33662# Tel-Aviv Univ. (Israel). School of Engineering.
INTERACTION OF ELECTRONS AND ELECTROMAGNETIC WAVES IN PERIODIC STRUCTURES Final Progress Report, 1 Oct. 1978 - 30 Sep. 1979
Avraham Grover Feb. 1979 76 p refs
(Grant AF-AFOSR-3445-77; AF Proj. 2301)
(AD-A088739; AFOSR-80-0690TR) Avail: NTIS
HC A05/MF A01 CSCL 20/5

We have further developed theoretical work on free electron lasers FEL, proposed new mechanisms for FELs, developed numerical computational tools for electron gun design, continued optical experiments, completed the design and initial fabrication of two versions of electron guns, and made appreciable progress in the construction of an experimental set up for spontaneous and stimulated Cerenkov-Smith-Purcell experiments. GRA

N80-33663# American Electronic Labs., Inc., Lansdale, Pa.
SPATIAL PULSE COMPRESSION - Final Technical Report, Jul. 1977 - Oct. 1979
Philip Steinbach Mar. 1980 87 p
(Contract F30602-77-C-0136; AF Proj. 0170)
(AD-A084750; RADC-TR-80-43) Avail: NTIS
HC A05/MF A01 CSCL 09/5

The characteristics of a broadband antenna which cause it to function as a dispersive filter were verified. A log periodic type antenna with a bandpass from 50 MHz to 1000 MHz was used. To determine the proper waveform a transmitting antenna was driven with a 2 nanosecond impulse and the resulting waveform which was a chirp pulse, was measured at a receiving antenna. A generator was constructed to produce the time inverse of the measured waveform which was driven into the transmitting antenna. The signal at the output of the receiver antenna was measured and observed to be an impulse with processing gain. The antenna range was calibrated using a CW signal of the same amplitude as the transmitted signal. The processing gain of the system is defined as the ratio of the impulse amplitude and was measured at approximately 20 db. For this system, the theoretical gain is approximately 23 db. R.K.G.

N80-33664# SRI International Corp., Menlo Park, Calif.
PROPAGATION MODELING AND EVALUATION OF COMMUNICATION SYSTEM PERFORMANCE IN NUCLEAR ENVIRONMENTS Final Report, 11 Nov. 1976 - 29 Feb. 1980
Charles L. Rino Feb. 1980 43 p refs
(Contract DNA001-77-C-0038)
(AD-A088914; AD-E300890; DNA-5265F) Avail: NTIS
HC A03/MF A01 CSCL 20/14

Propagation modeling work for predicting communication system performance in disturbed nuclear environments is discussed. Simple formulas are developed that characterize the onset of scintillation, the coherence time of the scintillation, the coherence bandwidth loss and associated delay jitter, plus the angle of arrival scintillation for radar applications. The calculations are based on a power law phase screen model, and they fully accommodate a varying spectral index and arbitrary propagation angles relative to the principal irregularity axis. In a power law environment, the signal structure is critically dependent upon the power law index, particularly under strong scatter conditions. Author

N80-33665# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMAL PROPERTIES OF THE CIRCULAR ARRAY FOR USE AS AN ADAPTIVE ANTENNA
Joseph T. Mayhan 17 Apr. 1980 42 p refs
(Contract F19628-80-C-0002)
(AD-A088592; TN-1980-3; ESD-TR-80-27) Avail: NTIS
HC A03/MF A01 CSCL 09/5

Thinned array configurations optimized in performance in accordance with specific criteria are developed. These criteria are used to optimize the element positions within the array considering both the close-in nulling resolution, and the average coverage area over a fixed, circular field of view. It is determined that the circular array configuration, with elements equispaced on the circle, generally produces the best close-in nulling resolution against arbitrary interference scenarios for large values of D/lambda. It is shown that exponentially space tapering the elements on the circle improves the average coverage area with little loss in resolution, but leads to element spacings which might be incompatible with finite element size constraints in a practical design. A third array configuration, developed according to standard synthesis techniques for nonuniform arrays, is also considered and shown to lead to good performance. R.K.G.

N80-33666# Range Commanders Council, White Sands Missile Range, N. Mex. Electronic Trajectory Measurement Group.
IBIG STANDARD FOR PULSE REPETITION FREQUENCIES AND REFERENCE OSCILLATOR FREQUENCY FOR C-BAND RADARS Final Report
1980 8 p
(AD-A088545; IRIG-Standard-103-80) Avail: NTIS
HC A02/MF A01 CSCL 17/9

Interrange operations make the standardization of radar reference oscillator and operating pulse repetition frequencies a requirement for collecting and mentation radars for target acquisition and/or target handover on interrange operations, they must be reduced and updated by computer to be immediately useful or valid. By applying this standard, many of the data reduction problems which currently exist will be alleviated. Personnel at the various radar complexes adhering to this standard will have the capability of receiving data from one another which is suitable for reduction, updating and immediate utilization. Compliance with the provisions in this standard assures interrange compatibility. R.K.G.

N80-33667# Washington Univ., Seattle. Dept. of Physics.
RADIATIVE CAPTURE STUDIES OF THE ELECTROMAGNETIC DECAYS OF HIGHLY EXCITED STATES
Kurt A. Snover 1980 20 p refs Presented at the Intern. Symp. on Highly Excited States in Nucl. Reactions, Osaka, 12-16 May 1980
(Contract DE-AC06-76ER-01388)
(DOE/ER-01388/443; RLO-1388-443; CONF-800540-2) Avail: NTIS HC A02/MF A01

Selected examples of interesting E1, M1, and E2 resonance studies in (p, gamma) and (alpha, gamma) reactions are discussed. These include a unique determination of E1 amplitudes in the c-12 (p, gamma sub zero)N-13 reaction, E2 strength in light nuclei, M1 decays to the ground states and to the excited sonances in (pi gamma), and M1 gamma decay of stretched particle hole states in O-16 and Si-28. DOE

N80-33668# European Space Agency, Paris (France).
TELEMATICS AND SATELLITES. PART 1: INFORMATION SYSTEMS
W. R. Burke, ed. Jun. 1980 59 p Original contains color illustrations
(ESA-BR-04-Pt-1; ISSN-0250-1589) Avail: NTIS
HC A04/MF A01

Telematic systems are identified and described. The applications are examined emphasizing the role played by satellite links. The discussion includes file transfer, examples of distributed processor systems, terminal communication, information retrieval systems, office information systems, electronic preparation and publishing of information, electronic systems for transfer of funds, electronic mail systems, record file transfer characteristics, intra-enterprise networks, and inter-enterprise networks. Author (ESA)

N80-33429*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PATTERN MEASUREMENTS OF A LOW-SIDELOBE HORN ANTENNA
M. A. Janssen, S. Gulkis, S. M. Bednarczyk, H. W. Marlin, and G. F. Smoot (California Univ., Berkeley) *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 8-14 refs (For

primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 20N

N80-33432*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ORION S-BAND DATA ACQUISITION FOR S-Y CALIBRATION
S. C. Wu *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 33-36 ref (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 17I

N80-33434*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN GROUND COMMUNICATIONS FACILITY
R. H. Evans *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 40-50 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-33439*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EXPERIMENTAL OPTICAL FIBER COMMUNICATIONS LINK
G. F. Lutes *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 77-85 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-33440*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPEN-LOOP RADIO SCIENCE WITH A SUPPRESSED-CARRIER SIGNAL
C. A. Greenhall *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 86-97 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-33445*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANETARY RADAR
R. M. Taylor *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 142-144 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 17I

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-33669 British Library Lending Div., Boston Spa (England).
INTEGRATED SCREEN PRINTED HYBRID CIRCUITS
G. Hanke 4 Mar. 1980 14 p Transl. into ENGLISH from Fernmelde-Praxis (West Germany), v. 56, no. 10, 1979 p 389-397
(BLL-PO-Trans-3749-(7737.470)) Avail: British Library Lending Div., Boston Spa, England

Different integration techniques are compared and the method of screen printing is described as a suitable technique for making in the laboratory small numbers of samples for testing. The suitability of this method for very fast impulse circuits is demonstrated with reference to a few selected examples which were made under laboratory conditions by the microcircuit technique research groups at the Federal German Post Office.
Author

N80-33670 British Library Lending Div., Boston Spa (England).
WORLD PROGRESS IN ELECTRONIC SWITCHING. PART 2: ANALYSIS OF CURRENT TRENDS
P. Lucas 4 Mar. 1980 51 p refs Transl. into ENGLISH from Ann. des Telecommun. (France), v. 34, no. 1-2, 1979 p 75-91
(BLL-Trans-3756-(7737.470)) Avail: British Library Lending Div., Boston Spa, England

Systems developed in industrialized countries are reviewed and current trends in electronic switching are analyzed. Basic structural principles are defined: stored program control, standardization of languages, digital techniques and integrated networks, information interchange (signalling and data transmission), distribution network, data switching, message switching. Improvements in microelectronics (integrated circuitry and microprocessors) are considered along with architectures, and methods for both networks and systems. Modular design at function level, increased compatibility, and distributed control are discussed including a standardized approach to new services, centralized maintenance facilities, and dynamic network management.
J.M.S.

N80-33671 British Library Lending Div., Boston Spa (England).
THE MECHANICAL PRETREATMENT OF PRINTED CIRCUIT BOARDS
I. Rapp Aug. 1980 17 p Transl. into ENGLISH from Galvanotechnik (Netherlands), v. 70, no. 10S, 1979 p 965-973
(BLL-RTS-12263) Avail: British Library Lending Div., Boston Spa, England

In printed circuit board production a metallically pure surface has to be achieved or failure and rejection are unavoidable. Two kinds of cleaning are distinguished. The first is mechanical cleaning by abrasives. In the wet or the dry process, the wet process being predominant, removal of oxides proceeds at the same time as the surface structure is changed; in most cases roughening of the copper layer takes place. The second kind of cleaning is chemical. This also produces deoxidation and a change of surface structure. Depending on the solution used, the surface is scoured at the same time. Chemical processes (including electrochemical) are more expensive than mechanical processes and should only be weighed in the balance when mechanical processes are inapplicable.
S.F.

N80-33672 British Library Lending Div., Boston Spa (England).
STATE AND TRENDS IN DEVELOPMENT OF THE MANUFACTURE OF PRINTED CIRCUITS
N. Ferenczy Aug. 1980 14 p Transl. into ENGLISH from Galvanotechnik (West Germany), v. 70, no. 10S, 1979 p 946-951
(BLL-RTS-12266) Avail: British Library Lending Div., Boston Spa, England

Manufacturing techniques for printed circuits are examined with a particular emphasis on activation and chemical copper plating, and the various technical possibilities associated with these procedures. The activation methods compared include (1) two-stage activation with ion-generating tin and palladium solutions which are arranged separately in series; (2) palladium-containing activation materials which contain palladium and tin as the reduction material and protective colloid working with a subsequent accelerator; and (3) activation materials which contain palladium, an organic reduction material and organic protective colloids. The conventional immersion rinsing and the spray rinsing techniques for through-hole plating are described and compared.
M.G.

N80-33673 British Library Lending Div., Boston Spa (England).
INFLUENCE OF THE ENVIRONMENTAL CONDITIONS ON A QUARTZ RESONATOR
Michel Valdois May 1978 114 p refs Transl. into ENGLISH of "Influence des Conditions d'Environnement sur un Resonateur a Quartz" Rept. ONERA-TN-225 ONERA, Paris, 1974
(RAE-Lib-Trans-1897(5207); ONERA-TN-225) Avail: British Library Lending Div., Boston Spa, England

Quartz oscillators, used for aerospace applications, are subjected to very severe environmental conditions. Accelerations and vibrations, which can be periodic or random, modify the natural frequency of the resonator and cause frequency instabilities in the oscillator. The quartz resonator was studied as a passive element placed in a transmitting circuit, and installed in an oscillator, which is its normal condition of usage. The accelerations to which the resonators were subjected were steady state,

sinusoidal or random. The orientation of the acceleration relative to the quartz crystallographic axis, as well as its direction, are of prime importance. The same tests were performed on oscillators containing the resonators previously studied. The results confirm the part played by the resonator in the degradation of the stability of a quartz oscillator subjected to external disturbances. A.R.H.

N80-33674 Utah State Univ., Logan.
TWO TESTS OF ELECTRIC FIELDS, SECOND-ORDER IN SOURCE-VELOCITY TERMS OF CLOSED STEADY CURRENTS. 1: AN ELECTRON BEAM. 2: A SUPERCONDUCTING COIL. Ph.D. Thesis
Christopher Scott Kenyon. 1980. 155 p.
Avail: Univ. Microfilms. Order No. 8019254.

The results of two experiments designed to test for second order, source velocity electric fields from steady, closed currents were analyzed. The first experiment employed an electron beam. The second used a niobium-titanium coil designed so that the voltage measurement configuration could be easily switched from a Faraday to a non-faraday configuration between sets of runs. The implications of the observation of a null charge on magnetically suspended superconducting spheres vis-a-vis the second order, source velocity fields were also examined. Dissert. Abstr.

N80-33675 California Univ., San Diego.
SUPERCONDUCTIVITY, MAGNETISM AND STRUCTURAL STUDY OF SOME NEW TERNARY TRANSITION METAL BORIDES. Ph.D. Thesis
Huan-Chiu Ku. 1980. 131 p.
Avail: Univ. Microfilms. Order No. 8023103.

Superconductivity has been found in the rare earth iridium borides. The compounds were found to crystallize with the primitive tetragonal CeCo4B4-type structure and the pure phase in itself is only metastable at best. The close correlation between superconductivity, magnetism and structural metastability is demonstrated. The boundaries between the paramagnetic, superconducting and magnetically ordered phases in the Ho(Ir(x)Rh(1-x))4B4 system have been established by means of magnetic susceptibility measurements down to 1.2 K. Antiferromagnetic ordering occurs for x = 0.6 with Neel temperatures higher than the superconducting transition temperatures, showing an aspect of the coexistence of magnetic order and superconductivity. The boundaries between the paramagnetic, superconducting and magnetically ordered phases in the Dy(Ir(x)Rh(1-x))4B4 also were established. The occurrence of superconductivity with an onset of 7.2 K is reported for the metastable ScRu4B4 compound. Two ternary boride systems with the new LuRuB2-type structure are reported. Superconductivity as high as 10.0 K is found for the LuRuB2 compound. Dissert. Abstr.

N80-33676 Princeton Univ., N. J.
STUDY OF HIGH FIELD EFFECTS IN METAL-ALUMINUM OXIDE-SILICON CAPACITORS. Ph.D. Thesis
Ori Bar-Gadda. 1980. 109 p.
Avail: Univ. Microfilms. Order No. 8023816.

The mechanisms which control the voltage instability and the breakdown of chemically vapor deposited Al2O3 on Si substrates were investigated. The samples were metal Al2O3 Si capacitors with both Al and Au field plates. Electron injection and trapping, with resultant positive flatband voltage shift occurred at fields as low as 1-2 MV/cm. An approximate method for computing the location of the centroid of the trapped electrons was developed. Results indicate that the electrons are trapped near the injecting interface, at least for fields less than about 5 MV/cm. Dissert. Abstr.

N80-33677 Georgia Inst. of Tech., Atlanta.
FREQUENCY SKIPPING IN NEGATIVE RESISTANCE OSCILLATORS WITH APPLICATIONS TO CRYSTAL-CONTROLLED MONOLITHIC PHASE-LOCKED LOOPS. Ph.D. Thesis
Stephen Scott Walker. 1980. 233 p.
Avail: Univ. Microfilms. Order No. 8023768.

The problem of frequency skipping, or forced mode changes, is examined in two types of quasilinear multimode oscillators with current controlled negative resistance characteristics. The two oscillators investigated are the van der Pol oscillator and the emitter coupled astable multivibrator (ECAM). The method of Kryloff and Bogoliuboff is used as the mathematical foundation for the analysis. The validity of the ECAM model and the associated predicted skipping behavior are experimentally verified for a specific monolithic oscillator resonating under quartz crystal control. Laboratory results are presented and discussed for a series of transient and steady state measurements involving test crystals with fundamental resonant frequencies between one and ten megahertz. Finally, the frequency skipping analysis is extended to ECAM applications in crystal controlled monolithic phase locked loops (PLLs). The source of the skip stimulus and the necessary and sufficient conditions for producing skips in such a system are identified and experimentally confirmed. A technique for controlling and eliminating the phenomenon is presented. Dissert. Abstr.

N80-33678 Case Western Reserve Univ., Cleveland, Ohio.
CHARACTERIZATION AND THEORY OF ELECTROLYTE-INSULATOR-SEMICONDUCTOR FIELD-EFFECT TRANSISTOR. Ph.D. Thesis
Clifford Der-Jau Fung. 1980. 144 p.
Avail: Univ. Microfilms. Order No. 8021687.

Fabrication characterization and theoretical modeling of a semiconductor chemical sensor, referred to as an electrolyte insulator semiconductor field effect transistor (EISFET), are presented. A model describing the surface ionization and complexation of the surface hydroxyl groups on the insulator film was adapted to obtain the charge and potential distributions as the electrolyte insulator semiconductor interfaces of an EISFET. A theoretical model for the EISFET was developed based on an integral approach which links the electrochemical phenomena occurring at the insulator electrolyte interface to a surface conduction channel on the semiconductor through the field effect. The results of the devices in simple electrolytes are found to be consistent with the theory suggesting the validity of the model. It is concluded that the surface site density, N sub s, and the separation of surface ionization constants, expressed in terms of pK, are the main controlling factors for the performance of the EISFET as a pH sensor. Dissert. Abstr.

N80-33679*# National Aeronautics and Space Administration, Pasadena Office, Calif.
CONTROL MEANS FOR A SOLID STATE CROSSBAR SWITCH. Patent Application
Tage O. Anderson, inventor (to NASA) (JPL). Filed 29 Sep. 1980. 20 p.
(Contract NAS7-100)
(NASA-Case-NPO-15066-1; US-Patent-Appl-SN-191744) Avail: NTIS. HC A02/MF A01. CSCL 09C.

A control system for a solid state crossbar switch is described which allows a number of switch control and interrogation functions to be implemented by time sharing related circuitry. The crossbar switch includes a number of X ports and Y ports. Each X-Y port intersection designates a specific X-Y intersection latch which controls a number of associated switches for interconnecting one set of data lines associated with the X port to another set of data lines associated with the Y port. The control system continuously and sequentially addresses each of the X-Y intersection latches at a 10 megahertz rate. During this continual and sequential addressing, the control circuitry includes a capability for (1) interrogating each intersection latch for determining which are in a set condition; (2) ensuring that only one X-Y intersection latch is set on an X row and Y column defining that latch; (3) resetting all of the X-Y intersection latches; and (4) determining which of the X-Y intersection latches are in a set condition. NASA

N80-33680# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council for Scientific and Technical Research.
FILTER PROJECT WITH A PLANAR CIRCUIT IN THE WAVEGUIDE [PROJETO DE FILTROS COM CIRCUITO PLANAR EM GUIA DE ONDAS]
Eduardo A. Parada Tude and Carlos E. Santana. Jul. 1980. 21 p. refs. In PORTUGUESE; ENGLISH summary.
(INPE-1817-RPE/185) Avail: NTIS. HC A02/MF A01.

A planar circuit mounted in a waveguide is a metal sheet parallel to the E plane, inserted in the middle of a waveguide. This circuit has low losses and is adequate for microwave circuits.

Prototypes of the filters, in the X band, present insertion losses better than 1dB. S.F.

N80-33681# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CONTROL OF THE RECOMBINATION TIME IN PHOTOCONDUCTIVE DETECTORS [CONTROLE DO TEMPO DE RECOMBINACAO EM DETETORES FOTOCONDUTORES]
Marcos Tadeu T. Pacheco, Cesar C. Ghizoni, and Sergio Luiz Scolari. Jul. 1980. 11 p. refs. In PORTUGUESE; ENGLISH summary. Presented at the 32d SBPC.
(INPE-1814-RPE/182). Avail: NTIS. HC A02/MF A01.

The current generated at a photoconductive cell depends upon the density of states of the electromagnetic field in the semiconductor film. This density of states is a function of the film geometry and dielectric properties. In this work we demonstrate that, for highly scattering substrate surfaces, which implies in a low density of states, the signal to noise ratio is better than that for smooth surfaces. Author

N80-33682# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
IMPACT OSCILLATOR WAVEGUIDES [OSCILADOR IMPATT EM GUIA DE ONDAS]
Paulo Mello Marshall and Carlos Eduardo Santana. Jul. 1980. 25 p. refs. Presented at the 32d Reuniao da SBPC, 6-12 Jul. 1980.
(INPE-1816-RPE/184). Avail: NTIS. HC A02/MF A01.

The theoretical analysis and the construction details of an X-band waveguide IMPATT oscillator are presented. The mounting configuration used consisted of a cylindrical post supporting the diode. Using the parameters specified for the active device and those of the T-equivalent circuit of the post, the oscillation conditions were analyzed by a computer. Measurements of the oscillation frequency and tuning band on an experimental oscillator, constructed according to the calculation method described, show good agreement with the calculations. T.M.

N80-33683*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPARATIVE PERFORMANCE OF HgCdTe PHOTODIODES FOR HETERODYNE APPLICATION
Herbert R. Kowitz. Oct. 1980. 15 p. refs. Presented at the Heterodyne Systems and Technol. Conf., Williamsburg, Va., 25-27 Mar. 1980.
(NASA-TP-1745; L-14019). Avail: NTIS. HC A02/MF A01. CSCL 09C.

Photodiodes used as photomixers in heterodyne applications display quantum efficiencies that are lower than the dc quantum efficiency of the device. Measurement techniques used to obtain dc quantum efficiencies, midband heterodyne quantum efficiencies, and frequency roll off characteristics are described. Measurement results for two HgCdTe photodiodes are given and discussed. It is recommended that photodiodes used in heterodyne applications be tested for heterodyne quantum efficiency over the frequency band of interest for the particular application. Author

N80-33684# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
POWER LOSSES IN LIQUID METAL CURRENT COLLECTORS. Final Report, Oct. 1978 - Mar. 1980
Myles M. Hurwitz and Dolores R. Wallace. May 1980. 27 p.
(AD-A086527; DTNSRDC/CMLD-80/10). Avail: NTIS. HC A03/MF A01. CSCL 20/3.

A numerical capability has been developed which will compute ohmic and viscous power losses in liquid metal current collectors. The present work extends previous analytical investigations in that semi-infinite collector geometries are no longer assumed. This new capability is based on the finite element method and makes use of electrical current densities computed by the heat transfer portion of the NASTRAN structural analysis program. Although some limitations and questions remain, a comparison between the new numerical capability and experiment shows very good agreement in the computation of the power losses. GRA

N80-33685# Electromagnetic Systems Labs., Inc., Sunnyvale, Calif.
CPSK, DPSK, AND FSK DEMODULATOR PERFORMANCE UNDER NUCLEAR STRESSED CONDITIONS. Final Report, 21 Feb. 1978 - 31 Mar. 1979
Ronald Iberaki, Randy Heckman, Laurence Kearney, and James Marshall. 31 Mar. 1979. 106 p.
(Contract DNA001-78-C-0189).
(AD-A088364; AD-E300878; ESL-TM-1083; DNA-5006F). Avail: NTIS. HC A06/MF A01. CSCL 09/5.

The relative performance of satellite communication links using conventional binary CPSK, DPSK, and noncoherent FSK demodulation techniques is evaluated for a range of simulated highly ionized and striation regions which may result following high attitude nuclear detonations. Performance is characterized by bit error rate estimates obtained through extensive computer simulation of satellite downlinks using various modem designs over a range of data rates and fade rates. Phase fluctuations are shown to be an increasingly dominant performance degrading factor as fade rates increase. The interrelated effect on performance of the fade rate, data rate, carrier removal circuit noise bandwidth, and bit energy-to-noise ratio is examined in detail and a number of performance scaling relationships among these parameters is identified which allows the extensive simulated results obtained here to be generalized to similar modems operating at other data rates and fade rates. GRA

N80-33686# Naval Research Lab., Washington, D. C. Satellite Communications Branch.
CONNECTOR DESIGN TECHNIQUES TO AVOID RFI. Final Report
Charles E. Young. 7 Jul. 1980. 13 p. refs. Presented at the 11th Ann. Connector Symp., Cherry Hill, N.J., 25-26 Oct. 1978.
(NRL Proj. R08-73).
(AD-A088769; NRL-MR-4233-CH-3). Avail: NTIS. HC A02/MF A01. CSCL 09/1.

A paper, presented at the Ninth Connector Symposium, gave detailed experimental evidence of the serious RFI levels produced by commonly available RF connectors which use ferromagnetic materials (iron, nickel, cobalt or their alloys) for electrical conductors. For example, the body structure of a wide variety of precision made coaxial connectors and adapters are currently manufactured only from stainless steel, type 303, a ferromagnetic alloy. To cut cost and provide a corrosion resistant finish, nickel plating, another ferromagnetic material, has been almost exclusively substituted for silver or gold, previously employed to plate brass stock connectors. That such materials could be considered for electrical conductor service is difficult to understand because of the known nonlinear effects of even minute quantities of ferromagnetic contaminants in RF systems. Use of ferromagnetic materials, however, has become so widespread that silver or gold plated brass (nonferromagnetic) devices, which had been standard for many years, are no longer readily available as 'off-the-shelf' items but must be specially ordered in quantities (500 or more) to obtain reasonable production cost. Connectors fabricated from ferromagnetic materials typically produce IMG power levels 3 to 5 orders (1000 to 100,00 times) higher (worse) than without. Obviously such interference levels cannot be tolerated in today's highly sensitive communication systems. The ferromagnetic connector RFI problem came to light in 1975 during the Naval Research Laboratory's investigation of passive component nonlinearity and means for its reduction required by the Fleet Satellite Communications (FLTSATCOM) system, then under development. GRA

N80-33687# Naval Research Lab., Washington, D. C. Microwave Technology Branch.
COMPUTER-AIDED ANALYSIS FOR THE DESIGN OF BROAD CLASSES OF MICROWAVE COUPLERS, FILTERS, AND TRANSMISSION LINES. Interim Report
B. E. Spielman. 24 Mar. 1980. 11 p. refs.
(RR021O346).
(AD-A088772; NRL-8394). Avail: NTIS. HC A02/MF A01. CSCL 09/1.

The use of a flexible, computer-aided analysis for designing broad classes of microwave couplers, filters, and transmission lines is described. The convergence characteristics are illustrated for computations of impedance and phase velocity of an isolated microstrip line. Design curves are presented for a coupler configuration employing microstrip over a slotted ground plane.

Experimentally determined performance characteristics are presented for a directional coupler designed using these computer generated design curves. GRA

N80-33688# Stanford Univ., Calif. Edward L. Ginzton Lab.
MICROWAVE TUBES Final Scientific Report, 1 Jun. 1977 - 30 Sep. 1978
Marvin Chodorow 2 Jun. 1980 99 p refs
(Grant AF-AFOSR-3351-77)
(AD-A088745; GL-3131; AFOSR-80-0082TR) Avail: NTIS HC A05/MF A01 CSCL 09/1

The intent of this report is to describe in some technical detail the various kinds of microwave tubes, either now in use or projected, discuss their modes of operation, present characteristics, limitations and applications, and also to discuss in terms of their technical characteristics what may be anticipated for possible performance and/or applications of these various tube types. Since this report is intended for a range of readers of varying degrees of knowledge in the field, it will be organized in a fashion so that it will be possible to read and get information at various levels of detail and sophistication. Various separate sections which can be read independent of the main text provide further details of characteristics of the various tube types for those who might be interested. It is not intended, however, that any portion of this report would be suitable in itself for tube designers, and there will be categorical statements about results, methods, without necessarily giving derivations or all the logical connections between some of the statements. In many cases, plausibility will be used rather than detailed, logical arguments to prove the validity of particular technical evaluations. We list first the various types of tubes which will be considered, with broad descriptions of their particular characteristics and possible applications. This will be followed by sections on each tube type, describing the tube in more detail. The tubes that will be described are the klystrons, the travelling wave tube, crossed field devices, (magnetron, crossed field amplifier, etc.), the gyrotron (also known as the cyclotron maser), the ubitron (also known as the free electron laser), and the gyrocon. GRA

N80-33689# Brown Univ., Providence, R. I. Div. of Applied Mathematics
DIFFUSION APPROXIMATIONS FOR THE ANALYSIS OF DIGITAL PHASE LOCKED LOOPS
Harold J. Kushner and Hai Huang May 1980 31 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-76; NSF ENG-77-12946)
(AD-A088703) Avail: NTIS HC A03/MF A01 CSCL 09/5

Recent results for getting diffusion limits of a sequence of suitably scaled stochastic processes are applied to the synchronization problem for a digital phase locked loop (DPLL). The discrete time parameter error processes is suitably amplitude scaled and interpolated into a continuous time parameter process. For small filter gains and symbol intervals, a diffusion process approximation is rigorously obtained. This approximation is a Gauss-Markov process and it yields approximate error variances, passage time distributions, correlation properties, (among other properties) for the DPLL. The tracking problem when the clock drifts is also treated. The technique is applicable to a wide variety of related problems, to get continuous time Markov systems which are easier to analyze the original (continuous or discrete time) systems which they approximate. GRA

N80-33690# Kentucky Univ., Lexington. Dept. of Electrical Engineering
SYNTHESIS METHODS APPLICABLE TO SEM POLE PAIR ADMITTANCES
Krzysztof A. Michalski and L. Wilson Pearson Dec. 1979 123 p
(AD-A088923; RR-79-5) Avail: NTIS HC A06/MF A01 CSCL 09/3

The applicability of the first layer conjugate pole pair at a time equivalent circuit synthesis for energy collecting structures is considered. It is found that, at least for some highly resonant structures, the whole eigenset of poles can be approximately represented by the first layer dominant pole. The driving point admittance function can then be synthesized in the form of a parallel connection of simple pole-pair modules. The biquadratic functions corresponding to each conjugate pole pair are, in general, not positive real and thus physically realizable. The explicit form of this network, as well as Brune and Darlington network, is derived. It is demonstrated that the Darlington network reduces to Brune network or, if surplus factors are used, to Bott-Duffin network. The Miyata procedure is not applicable to minimum biquadratics. After further approximation the Bott-Duffin network can be reduced to simple four element structure which has been shown to give favorable results for the thin wire dipole and loop antennas. It is demonstrated that the equivalent networks derived are very sensitive to changes in element values. This and the influence of the parasitic effects associated with real circuit elements can unfavorably affect the practicability of the derived networks, should they be constructed. GRA

N80-33691# Human Engineering Labs., Aberdeen Proving Ground, Md.
USERS MANUAL FOR THE TRANSPARENT TOUCH SENSITIVE CATHODE RAY TUBE DISPLAY OVERLAY Final Report
Michael W. Thompson Jul. 1980 17 p
(AD-A088939; HEL-TN-8-80) Avail: NTIS HC A02/MF A01 CSCL 09/1

This manual provides the operational and programming information for using the Elographics Touch Sensor on the Varian 620 computer. The touch sensor is a transparent pressure sensitive panel that overlays a graphics display system CRT. The touch sensor also consists of a Touch Sensor Controller and an Interface Controller for configuring the touch sensor to the Varian 620 computer. Programming is accomplished using the Varian DAS assembly language. GRA

N80-33692# Harry Diamond Labs., Adelphi, Md.
RESEARCH STUDY ON NEAR MILLIMETER WAVE OROTRONS
Donald E. Wortman and Richard P. Leavitt Jul. 1980 37 p refs
(DA Proj. 1L1-61102-AH-44)
(AD-A089097; HDL-SR-80-4) Avail: NTIS HC A03/MF A01 CSCL 09/1

An extensive literature search has been performed in technological areas related to the development of orotrons (electron-beam/open-resonator radiation sources) in the Soviet Union. Orotrons have been found to be practical, tunable, efficient, and lightweight sources of near millimeter wave radiation; our calculations have confirmed some of the conclusions obtained from the Soviet literature. No work on orotrons performed in the U.S. has been found. In work reported from the Soviet Union, power outputs of several watts have been obtained at wavelengths from 4 to 1 mm, with electron-beam voltages of 1 to 5 kV and currents up to a few hundred milliamperes. GRA

N80-33693# State Univ. of New York at Buffalo. Dept. of Chemistry.
DIFFUSION CONTROLLED CURRENT AT A STATIONARY FINITE DISK ELECTRODE. EXPERIMENT
Koichi Aoki and Janet Osteryoung Aug. 1980 24 p refs Submitted for publication
(Contract N00014-79-C-0644)
(AD-A089063; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Micro disk electrodes were constructed from glassy carbon electrodes coated with photo resist by using conventional photolithography. Chronoamperometric measurements were made at these electrodes in the system ferrocyanide/ferricyanide. Dependence of currents on time and on radii of the electrodes was in good agreement with that predicted by the theory presented previously. GRA

N80-33694# Naval Research Lab., Washington, D. C.
VECTOR-POTENTIAL FLOW IN RELATIVISTIC BEAM DIODES Interim Report
D. P. Bacon, S. A. Goldstein, R. Lee, and G. Copperstein Sep. 1980 38 p refs
(AD-A089135; NRL-MR-4326) Avail: NTIS HC A03/MF A01 CSCL 09/1

Analytic theory, numerical simulations and experiments indicate that a combination of a bias current pinch and an ion induced pinch may allow the efficient pinching of electron beams

generated in large aspect ratio diodes. In the new diode geometry, electrons flow radially inward along vector-potential field lines which lie close to the anode. As these electrons do not touch the anode, there is no plasma formation and consequent loss of energy to accelerated ions. Entering a region close to the axis in which an anode plasma does exist, these electrons undergo an ion induced pinch to still smaller radii. Since the bulk of the flow occurs along vector-potential field lines, we have coined this new diode the Paravector-potential diode. GRA

N80-33695# Varian Associates, Palo Alto, Calif. Microwave Tube Div.
HIGH POWER MILLIMETER WAVE AMPLIFIER Final Report, Oct. 1977 - Oct. 1979
P. Ferguson, S. Hedji, Howard Jory, A. Nordquist, and R. Symons Apr. 1980 90 p refs
(Contract F30602-78-C-0011; ARPA Order 3192)
(AD-A088591; RADC-TR-80-132) Avail: NTIS HC A05/MF A01 CSCL 09/1

A high power 94 GHz amplifier based on the Gyrotron or cyclotron resonance interaction was developed. Ultimate goals are 10 kW peak power, 10 kW average power, at least 4 percent bandwidth, 30 percent efficiency and 40 kB power gain. The experimental work was performed at C band (5.0 GHz). The testing of the 3 cavity Gyroklystron developed is described. A description including test results of the 5 GHz Gyro-TWT is given. Operating the Gyro-TWT at 60 kV beam voltage at 5 amperes beam current yielded 50 kW output power with 18 dB saturated gain at 6 percent bandwidth and 16.6 percent efficiency. An alternate technique for producing an electron beam with a ratio of 1.5 was also investigated. This technique includes the utilization of a Pierce type electron gun to give a solid beam (as opposed to the hollow beam produced by the conventional magnetron gun) followed by a bifilar helix of established length. R.K.G.

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-33696 California Univ., Los Angeles.
DROPLET EVAPORATION IN HIGH TEMPERATURE ENVIRONMENTS Ph.D. Thesis
George Manchester Harpole 1980 140 p
Avail: Univ. Microfilms Order No. 8023318

Water droplet heat and mass transfer were determined numerically and experimentally for the case of high temperature environments. Radiative absorption was computed by ray tracing including polarization, refraction, external reflection, and multiple internal reflections. A modified Snell's law with real angles was used so that volumetric heating was computed as a function of radial position. For water droplet diameters on the order of 1 mm, the absorption of thermal radiation is largely confined to a thin layer near the droplet surface, the effective absorptance values are about 90 percent, and the reflectance is about 7 percent. For high black body radiating temperatures and for small droplets, the absorptance is smaller. The effects on droplet convective heat transfer of (1) blowing due to evaporation, (2) variable fluid properties, and (3) binary diffusion with nonequal heat capacities were estimated numerically with stagnation point solutions. Dissert. Abstr.

N80-33697 British Library Lending Div., Boston Spa (England).
THE THEORY OF TWO DIMENSIONAL SEPARATED FLOWS
L. V. Gogish, V. Yu. Neiland, and G. Yu. Stepanov 4 Mar. 1980 74 p refs Transl. into ENGLISH from Gidromekhanika (Moscow), v. 8, 1975 p 5-73
(RAE-LIB-Trans-2002) Avail: British Library Lending Div., Boston Spa, England

The theory of separated flow relates to those motions of real fluids which occur most frequently and are at the same time the most difficult to investigate. Basic models of separated flow around bodies are given and numerical solutions of the Navier-Stokes equations for separated flows are discussed. The asymptotic solution of the Navier-Stokes equation in the theory of separated flows and approximation methods of calculating separated flow are also presented. E.D.K.

N80-33698 Ohio State Univ., Columbus.
ANALYTICAL AND NUMERICAL SOLUTIONS FOR MASS DIFFUSION IN A COMPOSITE CYLINDRICAL BODY Ph.D. Thesis
Ajit Kumar 1980 153 p
Avail: Univ. Microfilms Order No. 8022302

The analytical and numerical solution techniques were investigated to study moisture diffusion problems in cylindrical bodies that are assumed to be composed of a finite number of layers of different materials. A generalized diffusion model for an n-layer cylindrical body with discontinuous moisture content at the interfaces was developed and the formal solutions were obtained. The model is to be used for describing mass transfer rates of any composite body, such as an ear of corn which could be assumed of consisting two different layers: the inner core represents the woody cob and the outer cylinder represents the kernel layer. Data describing the fully exposed drying characteristics of ear corn at high air velocity were obtained under different drying conditions. Ear corns were modeled as homogeneous bodies since composite model did not improve the fit substantially. A computer program using multidimensional optimization technique showed that diffusivity was an exponential function of moisture content and an arrhenius function of temperature of drying air. Dissert. Abstr.

N80-33699 Cincinnati Univ., Ohio.
STUDY OF LAMINAR AND TURBULENT FLOW IN DUCTS OF POLAR CROSS-SECTION Ph.D. Thesis
Ramesh Kumar Goyal 1980 224 p
Avail: Univ. Microfilms Order No. 8021079

The viscous incompressible flow in curved ducts of some regular cross sections was analyzed for laminar as well as turbulent flow configurations. Rectangular, circular as well as polar cross sections were considered. The mathematical model is formulated using the time averaged three dimensional parabolized Navier-Stokes equations in a surface oriented toroidal coordinate system. An appropriate discretized representation is derived for the Poisson operator in analytically transformed coordinates in order to obtain efficient solutions of the Neumann boundary value problems encountered in the analysis. For turbulent flow configurations, turbulence closure is achieved by a two equation turbulence model employing the turbulent kinetic energy and its dissipation rate, which in turn yield the turbulent eddy viscosity. The Neumann boundary value problems encountered for the cross plane pressure distribution and for a velocity potential, introduced in order to satisfy local mass conservation, are solved by the successive over-relaxation method. Dissert. Abstr.

N80-33700 Rutgers - The State Univ., Piscataway, N. J.
NUMERICAL STUDIES OF DISPERSION PROCESSES IN TWO DIMENSIONAL, HOMOGENEOUS, DECAYING TURBULENCE Ph.D. Thesis
Anthony Daniel Kowalski 1980 137 p
Avail: Univ. Microfilms Order No. 8022568

Lagrangian statistical results are presented from numerical simulations of an ensemble of 1,024 fluid particles which were generated from a two dimensional, turbulent Eulerian field. A 128 x 128 Eulerian field simulation was run in preparation for a larger scale 512 x 512 simulation which was capable of supporting an extended enstrophy cascade region in the energy spectrum. The measured single particle statistics include the mean square single particle displacement vs. time, Lagrangian temporal velocity correlations, integral length scale, mean square single particle velocity, and probability distribution of single particle displacements. The single particle results are comparable to previous measurements performed on a 64 x 64 grid and are used for qualitative comparison to the measured two particle relative statistics. The short and long time limiting behavior of the mean square single particle displacement are also analyzed

and compared to the theoretical predicted power law behavior.
Dissert. Abstr.

N80-33701 California Univ., San Diego, La Jolla.
VISCOUS FLOW NEAR A SPHERE UNDER SURFACE GRAVITY WAVES Ph.D. Thesis
Scott Alan Jenkins 1980 176 p
Avail: Univ. Microfilms Order No. 8023099

The motion of a viscous fluid about a sphere submerged to mid depth under long, monochromatic surface gravity waves is calculated for small values of a second order type Reynolds number. The solution by matched asymptotic expansions uses the fundamental irrotational wave oscillation to drive a thin Stokes ac boundary layer over the surface of the sphere. From the boundary layer several secondary motions are excited which die away in the neighboring fluid. Among these are a system of steady, rotational Eulerian drift currents, and two outwardly radiating, irrotational acoustic waves, one having the frequency of the fundamental but with a phase shift, the other appearing at the second harmonic. With this solution the forces and torques on a fixed sphere were computed. A rotary lift force was found to oppose the virtual mass forces and thereby diminish the wave force dcomponent in quadrature to the wave profile. Steady and second harmonic torques were found to act on the sphere about its horizontal transverse axis. These results were compared to laboratory observations. Dissert. Abstr.

N80-33702 Georgia Inst. of Tech., Atlanta.
ENHANCEMENT OF THERMAL ENERGY TRANSPORT THROUGH GRANULAR MEDIA Ph.D. Thesis
Kenneth Wade Jackson 1980 239 p
Avail: Univ. Microfilms Order No. 8023764

Means of increasing the transport of heat through granular media are studied. Practical application includes design and development of thermal backfill materials for improving the heat transfer between the Earth and underground heat sources such as buried electric power cables and ground source heat pump coils. A unit cell model is used to predict the effective thermal conductivity of a granular medium composed of sand particles, a thermal binder, and air. A method based upon the concepts and theory of quantitative stereology was developed which links the macroscopic properties of the medium to the microstructural measurement of contiguity. The predictive accuracy of the unit cell model for sand-like media was verified with numerous thermal conductivity data obtained with the transient, cylindrical probe technique. Thermally coupling contiguous sand particles with a composite binder comprised of micron-sized inorganic particles mixed with an organic adhesive can increase the effective thermal conductivity of dry sand by as much as a factor of ten.
Dissert. Abstr.

N80-33703 Arizona State Univ., Tempe.
LAMINAR FILM FLOW PHENOMENA-THEORY AND APPLICATION TO THE TWO-PHASE CLOSED THERMOSYPHON Ph.D. Thesis
Robert Ivan Hirshburg 1980 344 p
Avail: Univ. Microfilms Order No. 8023382

The hydrodynamic and thermal characteristics of thin, laminar wavy-film flow are considered. A theoretical model is developed to predict the hydrodynamic features of asymptotic wavy-flow states. The mathematical closure question arising in asymptotic-state analysis satisfactorily resolved. The model accurately predicts published experimental data for mean film thickness, trough-to-crest dimension, wave clerity, and wavelength. The Nusselt theory for laminar film condensation is shown to significantly underpredict existing experimental data due to the presence of waves on the condensate film surface. Consequently, a heat transfer model is developed incorporating the wave-film hydrodynamic model results. The subsequent predictions agree well with experimental data and, in addition, indicate the appropriate data trend with flow length. Other thin-film phenomena are described, including continuous-film breakdown, rivulet flow, and sputtering. All of these phenomena are present in the operation of a heat-transfer device known as the two-phase closed thermosyphon. Accordingly, this device is experimentally investigated. Dissert. Abstr.

N80-33704 Columbia Univ., New York.
THE USE OF SOURCES AND SINKS IN SOLVING TWO-DIMENSIONAL HEAT CONDUCTION PROBLEMS WITH CHANGE OF PHASE IN ARBITRARY DOMAINS Ph.D. Thesis
Chi-Sing Keung 1980 112 p
Avail: Univ. Microfilms Order No. 8023511

Surface distribution or sources of sinks are used to transform the governing boundary value problem into one which is described by a set of integral equations with the strengths of the sources or sinks as unknowns. A multiphase problem can be divided into as many single phase problems as there are phases. These single phase problems are coupled by the boundary conditions at the interfaces, but each phase may have its own distinct thermophysical properties. Discretization of the boundary surfaces and the time domain allows further reduction of the integral equations into a set of algebraic equations. Since the space discretization of the problem needs to be carried out only on the boundary surfaces, this method can be easily applied to problems with arbitrary domains. Example calculations involving temperature, heat flux and/or convection boundary conditions were performed for the inward solidification of square and elliptical prisms, and for melting problems with boundary surfaces of sinusoidal shapes. Results of these examples were compared with those available in the literature. Dissert. Abstr.

N80-33705 Iowa Univ., Iowa City.
TURBULENT HEAT TRANSFER TO LIQUID METALS IN A CIRCULAR PIPE Ph.D. Thesis
Jenq-Shing Chiou 1980 197 p
Avail: Univ. Microfilms Order No. 8022006

Turbulent heat transfer in liquid metal flows through a circular pipe is investigated. Three regions in the pipes are considered: (1) fully-developed region; (2) developing temperature region; (3) developing velocity and temperature region. The mixing length hypothesis of van Driest is adapted to model the turbulent eddy viscosity and Cebeci's turbulent eddy conductivity model is extended to model the turbulent energy transport. The numerical solutions are obtained from modified Patankar-Spalding computer code. Solutions for both isothermal and constant heat flux wall conditions are presented and verified by comparison with available experimental data and other theoretical predictions. Simple correlation formulae for the Nusselt number for the FD, DT, and DVT regions are provided. Thermal conductivity of the pipe material and the thickness of the pipe wall have a significant effect on the temperature distribution. Dissert. Abstr.

N80-33706 Carnegie-Mellon Univ., Pittsburgh, Pa.
DISPERSED FLOW HEAT TRANSFER IN CIRCULAR TUBES Ph.D. Thesis
Anil Gangaram Rane 1980 293 p
Avail: Univ. Microfilms Order No. 8020632

The laminar and turbulent dispersed flow heat transfer problems are formulated introducing the droplet heat transfer as an equivalent heat sink uniformly distributed in the vapor stream. The formulation identifies the heat sink parameter, the liquid loading parameter, and the wall superheat parameter as the significant parameters in the convective heat transfer to dispersed flow. The analysis confirms that the degree of liquid dispersion, the liquid loading, and the driving potential for heat transfer have strong influence on the dispersed flow heat transfer in the thermal entrance region of a circular tube. Furthermore, it is observed that the heat sink parameter quantifies the heat transfer enhancing and that in heat flux controlled systems the sharp rise in wall temperature is delayed. The turbulent droplet flow heat transfer analysis confirms the strong influence of the nondimensional groups. It is identified that the wall temperature variation in the fully developed region is governed by the liquid loading and wall superheat parameters. The wall temperatures predicted for the turbulent droplet flow heat transfer compare very well with the available experimental data. Dissert. Abstr.

N80-33707 Miami Univ., Coral Gables, Fla.
MATHEMATICAL MODELLING OF TWO-PHASE FLOW OSCILLATIONS Ph.D. Thesis
Kazim Mehmet Akyuzlu 1980 313 p
Avail: Univ. Microfilms Order No. 8022873

A mathematical model was developed to study the stability

characteristics of a single channel, electrically heated, forced convection upflow system. The model was based on the assumptions of homogeneous two phase flow and thermodynamic equilibrium of the phases. The effects of the two phase viscosity and heat transfer, gravitational forces, and the compressibility of the two phase region were included in the formulation. The model consisted of a set of nonlinear hyperbolic partial differential equations. These equations solved by explict finite difference equations, digital computer. Comparison with experiments showed that the model was satisfactory in simulating the density wave type oscillations. The model was found to be sufficiently accurate to predict the stability-instability boundaries at various flow conditions. With further simplification the model was also used to simulate successfully, the low frequency oscillations, i.e., pressure drop type oscillations. Dissert. Abstr.

N80-33708 City Univ. of New York, N. Y.
AN AIR-VAPOR-DROPLET LOCAL INTERACTION MODEL FOR SPRAY UNITS Ph.D. Thesis
Stephen John Paleszewski 1980 166 p
Avail: Univ. Microfilms Order No. 8023726

A three dimensional model for predicting the flow and thermal characteristics of spray units is presented. In a marked departure from present theories, the model examines the local variation in properties of both the air and the droplets throughout the flow field encompassing the spray umbrella. The model allows the air streamlines and droplet trajectories to follow substantially different paths and is able to determine the local change in the environment of the droplets throughout their motion. The conservation equations to determine the local absolute humidity, velocity, and dry-bulb temperature of the air-vapor phase are written in Lagrangian form where the droplets are treated as spatially varying sources of mass, momentum, and energy. Source strength is determined by the interaction between the air-vapor and droplet phases. Model predictions of droplet return temperature along the spray perimeter were compared with data for two substantially different sprays used for power plant cooling. Predictions of downwind wet-bulb temperature were compared with available data. Good agreement was observed. A parametric study was carried out to determine an optimum spray unit design. Dissert. Abstr.

N80-33709 Princeton Univ., N. J.
SUPERHEATING AND BOILING OF WATER IN HYDROCARBONS AND OF HYDROCARBON MIXTURES Ph.D. Thesis
Charles Thomas Avedisian 1980 193 p
Avail: Univ. Microfilms Order No. 8023814

The effects of ambient pressure and liquid phase composition on the nucleation and boiling characteristics of liquids superheated within immiscible host fluids were studied. The mechanism by which fuel drops which are liquid-liquid emulsions or miscible solutions of volatile and nonvolatile liquids would explode or spontaneously break apart while burning is examined. Boiling temperature and pressure of superheated liquid water droplets, water-in-n-paraffin emulsions, and binary solutions of the normal alkanes are discussed. A model for the rate of formation of microscopic bubbles within superheated binary liquid systems (liquid-liquid emulsions and binary liquid solutions) was developed in order to determine the conditions under which bubble nucleation within liquid emulsions or solutions would occur. Dissert. Abstr.

N80-33710 Texas Univ. at Austin.
ANALYSIS OF IN-LINE FLOW-INDUCED VIBRATIONS USING LINEARIZATION METHODS Ph.D. Thesis
Tien-Wei Chen 1980 199 p
Avail: Univ. Microfilms Order No. 8021413

In line flow induced vibrations of structures are investigated. A simplified single degree of freedom system and a discrete multi-degree of freedom system are examined. The response of marine riser systems used in offshore drilling operations is considered. Deterministic harmonic and random Gaussian models are examined. The equivalent linearization technique is applied to treat the nonlinear differential equation describing the fluid structure interaction. The reliability of the approaches are examined by comparing their results with the exact solutions obtained by direct integration of the nonlinear equation of motion. Particular emphasis is given to the dependence of important design parameters of the riser system on several environmental variables. Dissert. Abstr.

N80-33711 California Inst. of Tech., Pasadena.
EXPERIMENTAL INVESTIGATIONS OF THE TRANSPORT PROPERTIES OF FLOW SUSPENSIONS. 1: MEASUREMENT OF VELOCITY DISTRIBUTIONS OF SUSPENSION FLOWS IN A RECTANGULAR CHANNEL. 2: EXPERIMENTAL STUDY OF THE EFFECTIVE THERMAL CONDUCTIVITY IN SHEAR FLOW OF A SUSPENSION. 3: THE USE OF FLUORESCENCE CORRELATION SPECTROSCOPY TO MEASURE MOLECULAR DIFFUSION AND VELOCITY DISTRIBUTIONS Ph.D. Thesis
Ernest Ying-Chee Chung 1980 214 p
Avail: Univ. Microfilms Order No. 8021676

An experimental method capable of measuring the velocities of both the dispersed and suspending phases of a flowing suspension was developed. The method was shown to be capable of measuring the velocity distributions of moderately concentrated suspensions. By using a modified laser Doppler anemometer, the velocity distribution of the suspended fluid was approximated by measuring the velocity of small fluorescent tracers, while the scattered signal from the suspended particles gave a direct measurement of their velocity distribution. The measurements of the effective thermal conductivity of sheared suspension of rigid spherical particles are also described. The objective was to verify the theoretical prediction of Leal (1973) for a dilute suspension undergoing shear at low particle Peclet number, and to extend the range of the experiments to conditions beyond the scope of the theory. Surprisingly, reasonable agreement with the theoretical prediction was observed even for suspensions of moderate concentrations and higher Peclet numbers. An analysis on the use of fluorescence correlation spectroscopy to measure molecular diffusion and velocity distributions in a sheared flow is also presented. Dissert. Abstr.

N80-33712 Illinois Univ. at Chicago Circle, Chicago.
PULSATING FLOW AND HEAT TRANSFER IN CURVED TUBES Ph.D. Thesis
Naeri Jubraeil Rabadi 1980 274 p
Avail: Univ. Microfilms Order No. 8023248

Curved tube heat transfer in pulsating fully developed laminar flow of an incompressible, viscous Newtonian fluid with constant properties is studied. The thermal boundary condition of axially uniform heat flux and peripherally uniform wall temperature is considered. The flow equations are written using toroidal geometry and in terms of vorticity, stream function, and axial velocity. No restrictions are made on the tube curvature although the coil pitch effects are neglected. It is concluded that, for this range of parameters, the effects of pulsation on the local values and the peripheral distribution of shear stresses and Nusselt number are significant. However, the time averaged peripherally averaged shear stresses and Nusselt number are not significantly effected by pulsation unless the frequency parameter alpha is low and the pressure ratio k is high. For these conditions, where flow reversal occurs, the time averaged peripherally averaged Nusselt number decreases significantly whereas, it slightly decreases if the Prandtl number is high. Dissert. Abstr.

N80-33713 Illinois Univ. at Chicago Circle, Chicago.
AN ACCURATE AND COMPUTATIONALLY FAST FORMULATION FOR RADIATIVE FIELDS AND HEAT TRANSFER IN GENERAL, PLANE-PARALLEL, NON-GREY MEDIA WITH ANISOTROPIC SCATTERING Ph.D. Thesis
Ajay Sharma 1980 291 p
Avail: Univ. Microfilms Order No. 8023251

A radiative transfer formulation is applicable to non-grey, plane-parallel, inhomogeneous media with anisotropic scattering is presented. The formulation is based upon the use of certain scattering functions to calculate the diffuse intensity fields in the medium. These scattering functions represent the response of the medium for unidirectional point probes (driving illumination). A computationally fast 'adding' scheme is used to calculate the scattering functions. The adding method is based upon the linearity of the radiative transfer equation, which allows superposition of finite medium layers while calculating the scattering functions. General reflecting boundary surfaces are included in this scheme. A parallel invariant imbedding program, which provides exact

but computationally expensive results, is used to characterize the accuracy of the adding procedure. This comparison yields a rule of thumb which helps in estimating and controlling errors.
Dissert. Abstr.

N80-33714*# Sheffield Univ. (England). Combustion Aerodynamics Research Lab.
VAPORIZATION OF DROPLETS IN PREMIXING CHAMBERS Final Report, 1 Oct. 1978 - 30 Sep. 1980
A. J. Yule and N. A. Chigier Sep. 1980 9 p refs
(Grant NsG-7517)
(NASA-CR-163616; CARL-IM-80-04) Avail: NTIS HC A02/MF A01 CSCL 20D

Detailed measurements were made of the structures of turbulent fuel sprays vaporizing in heated airstreams. The measurements show the size dependent vaporization and dispersion of the droplets and the important influence of the large eddies in the turbulence. The measurements form a data base for the development of models of fuel spray vaporization. Two laser techniques were specially developed for the investigation. A laser tomography technique converts line-of-sight light scattering measurements into time averaged 'point' measurements of droplet size distribution and volume concentration. A laser anemometer particle sizing technique was further developed to permit accurate measurements of individual particle sizes and velocities, with backscatter collection of light. The experiments are combined with heat transfer models to analyze the performance of miniature thermocouples in liquid sprays. Author

N80-33715*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ON THE PERFORMANCE OF EXPLICIT AND IMPLICIT ALGORITHMS FOR TRANSIENT THERMAL ANALYSIS
Howard M. Adelman and Raphael T. Haftka (Illinois Inst. of Tech., Chicago) Sep. 1980 39 p refs
(NASA-TM-81880) Avail: NTIS HC A03/MF A01 CSCL 20D

The status of an effort to increase the efficiency of calculating transient temperature fields in complex aerospace vehicle structures is described. The advantages and disadvantages of explicit and implicit algorithms are discussed. A promising set of implicit algorithms, known as the GEAR package is described. Four test problems, used for evaluating and comparing various algorithms, have been selected and finite element models of the configuraitions are discribed. These problems include a space shuttle frame component, an insulated cylinder, a metallic panel for a thermal protection system and a model of the space shuttle orbiter wing. Calculations were carried out using the SPAR finite element program, the MITAS lumped parameter program and a special purpose finite element program incorporating the GEAR algorithms. Results generally indicate a preference for implicit over explicit algorithms for solution of transient structural heat transfer problems when the governing equations are stiff. Careful attention to modeling detial such as avoiding thin or short high-conducting elements can sometimes reduce the stiffness to the extent that explicit methods become advantageous. A.R.H.

N80-33716*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A COMPENDIUM OF COMPUTATIONAL FLUID DYNAMICS AT THE LANGLEY RESEARCH CENTER
Aug. 1980 273 p refs
(NASA-TM-81877) Avail: NTIS HC A12/MF A01 CSCL 20D

Through numerous summary examples, the scope and general nature of the computational fluid dynamics (CFD) effort at Langley is identified. These summaries will help inform researchers in CFD and line management at Langley of the overall effort. In addition to the inhouse efforts, out of house CFD work supported by Langley through industrial contracts and university grants are included. Researchers were encouraged to include summaries of work in preliminary and tentative states of development as well as current research approaching definitive results. L.F.M.

N80-33717*# California Univ., Los Angeles. School of Engineering and Applied Science.
VAPORS-LIQUID PHASE SEPARATOR Final Report
T. H. K. Frederking, G. S. Brown, C. Chuang, Y. Kamioka, Y. I. Kim, Jeffrey Marshall Lee, and S. W. K. Yuan Oct. 1980 59 p
(Grant NCC2-64)
(NASA-CR-163621; UCLA-ENG-8073) Avail: NTIS HC A04/MF A01 CSCL 20D

The use of porous plugs, mostly with in the form of passive devices with constant area were considered as vapor-liquid phase separators for helium 2 storage vessels under reduced gravity. The incorporation of components with variable cross sectional area as a method of flow rate modification was also investigated. A particular device which uses a shutter-type system for area variation was designed and constructed. This system successfully permitted flor rate changes of up to plus or minus 60% from its mean value. A.R.H.

N80-33718*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A RAPID IMPLICIT-EXPLICIT SOLUTION TO THE TWO-DIMENSIONAL TIME DEPENDENT INCOMPRESSIBLE NAVIER-STOKES EQUATIONS Final Report
Joseph E. Davis Oct. 1980 24 p refs
(NASA Order A-50807-B)
(NASA-CR-3330) Avail: NTIS HC A02/MF A01 CSCL 20D

A second-order time-accurate and spatially factored algorithm was used in a finite difference scheme for the numerical solution of the time-dependent, incompressible, two dimensional Navier-Stokes equations in conservation-law form using vorticity and stream function variables. The systems of equations are solved at each time step by an iterative technique. Numerical results were obtained for a circular cylinder at a Reynolds number of 15, and an NACA 0012 airfoil at zero angle of attack at Reynolds numbers of 10 to the third and 10 to the fourth powers. The results are in agreement with another numerical technique, and the computing time required to obtain the steady state solution at the Reynolds number of 10 to the 4th power was 49.7 sec on CDC 7600 computer using a 65 x 84 computational grind. A.R.H.

N80-33719*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CALCULATION OF LAMINAR HEATING RATES ON THREE-DIMENSIONAL CONFIGURATIONS USING THE AXISYMMETRIC ANALOGUE
H. Harris Hamilton, II Sep. 1980 80 p refs
(NASA-TP-1698; L-13748) Avail: NTIS HC A05/MF A01 CSCL 20D

A theoretical method was developed for computing approximate laminar heating rates on three dimensional configurations at angle of attack. The method is based on the axisymmetric analogue which is used to reduce the three dimensional boundary layer equations along surface streamlines to an equivalent axisymmetric form by using the metric coefficient which describes streamline divergence (or convergence). The method was coupled with a three dimensional inviscid flow field program for computing surface streamline paths, metric coefficients, and boundary layer edge conditions. Author

N80-33720# Purdue Univ., Lafayette, Ind.
COHERENT STRUCTURES IN THE SIMILARITY REGION OF A TWO-DIMENSIONAL TURBULENT JET: A VORTEX STREET
James Walter Oler and Victor W. Goldschmidt Mar. 1980 199 p refs
(Contract N00014-75-C-1048; Grants NSF ENG-74-20780; NSF GK-19317)
(AD-A088750; HL-80-6) Avail: NTIS HC A09/MF A01 CSCL 20/4

The characteristics of the coherent structures of a plane jet were evaluated experimentally and with a kinematic numerical representation. Distributions of intermittency and interface crossing frequency were measured for 10 less than or equal to x/D less than or equal to 60. These properties, including the maximum interface crossing frequency, were found to scale as self-preserving flow variables. Spatially coherent patterns within the turbulent velocity field were evaluated utilizing two point velocity correlation measurements. From these, it was found that the instantaneous velocity fluctuation distributions are antisymmetric with respect to the centerline and coherent over the entire width

of the flow field. In addition, the patterns are periodic in the streamwise direction. The two dimensionality of the large structures was evaluated through the comparison of longitudinal and vertical integral length scales derived from correlations in both the fully turbulent zone and the intermittent region. GRA

N80-33721# Aeronautical Research Labs., Melbourne (Australia).
TECHNIQUES FOR EXAMINING DROP SIZE SPECTRA IN WATER SPRAYS AND CLOUDS
F. W. Skidmore and R. E. Pavia Apr. 1979 35 p refs
(ARL/Mech-Eng-Note-375; AR-001-729) Avail: NTIS HC A03/MF A01

Qualitative comparisons were made of water drop sampling methods for sprays and clouds, employing slides coated with oil, gelatin and soot. Oil-wetted and soot coated slides were compared quantitatively when exposed in nominally identical water sprays simulating natural clouds. When compared with gelatin and oil-wetted slides, soot slides are more convenient to prepared, expose and analyze, and records are permanent. Within the inherent limitations of all spray sampling methods, drop size distributions and mean drop sizes given by the oil and soot methods are in substantial agreement, provided that known sources of error of the oil-wetted method are allowed for. Soot slides appear to be capable of detecting ice particles in clouds; quantitative calibrations relating ice impingement impressions to crystal size are required. Author

N80-33722# Pennsylvania State Univ., University Park. Applied Research Lab.
AN INVESTIGATION OF THE HEAT TRANSFER AT THE LIQUID/SOLID INTERFACE OF RAPIDLY MELTING ICE M.S. Thesis, May 1980
Joseph Edward Fredley 25 Mar. 1980 102 p refs
(Contract N00024-79-C-6043)
(AD-A089099; ARL/PSU-TM-80-94) Avail: NTIS HC A06/MF A01 CSCL 07/4

This paper describes an experimental and analytical investigation of a system capable of rapidly melting ice. The melting technique used involved forcing a cylindrical ice slug against a heated surface, letting the effluent fluid exit radially. An analytical model based on fundamental physical principles was developed and used to predict the behavior of the system. Liquid layer thickness, liquid bulk temperature, radial pressure distribution in the liquid layer, convective heat transfer coefficient, and ice melt rate were all computed for steady state operation of the system. Experiments were performed to verify the model predictions. The tests measured the ice melt velocity and exit bulk temperature at a known supply pressure. The input heat flux was determined using two independent methods of calculation. One technique found the conduction heat flux leaving the heated block by using two heated block temperature measurements spaced a known distance apart near the liquid/block surface. The second method applied the measured ice melt velocity and liquid bulk temperature to an energy balance on the liquid film to yield an input heat flux value. A comparison of the experimental results with the analytical model predictions is made demonstrating satisfactory agreement. GRA

N80-33723# Scientific Research Associates, Inc., Glastonbury, Conn.
COMPUTATION OF DISCRETE HOLE FILM COOLING FLOW
J. P. Kreskovsky, W. R. Briley, and H. McDonald May 1980 24 p refs
(Contract F49620-78-C-0038)
(AD-A088807; R80-910002-2; AFOSR-80-0687TR) Avail: NTIS HC A02/MF A01 CSCL 20/13

An analysis and computational procedure are described here for predicting flow and heat transfer which results from coolant injection through a single row of round holes oriented normal to a flat surface. The present method solves the compressible Navier Stokes equations and utilizes zone embedding, surface oriented coordinates, iteractive boundary conditions, and an efficient split LBI scheme. The approach treats the near hole flow region where the film cooling flow is initially established. A sample laminar flow calculation is presented for a ratio of normal injection to free stream velocity of 0.1. Although present results do not include heat transfer predictions, details of the interaction between injectant and main stream flow near the hole exit are in qualitative agreement with experimental observations for other flow conditions. GRA

N80-33724# Harry Diamond Labs., Adelphi, Md.
THE EXTENDED RAYLEIGH THEORY OF THE OSCILLATION OF LIQUID DROPLETS
Clyde A. Morrison, Richard P. Leavitt, and Donald E. Wortman May 1980 27 p
(DA Proj. 1L1-61101-A-91A)
(AD-A088894; HDL-TR-1924) Avail: NTIS HC A03/MF A01 CSCL 20/6

The Rayleigh theory of oscillation of liquid drops has been extended to include the case in which the drop is immersed in a uniform electric field. The resonant frequencies of the modes of the drop are shown to be shifted by the electric field. The magnitude and the direction of the shift are dependent on the dielectric constant of the drop. The condition for instability of drops in large electric fields is given and found to differ from that found by previous workers. This difference is attributed to the assumptions by previous workers that the drops, under the influence of an electric field, distorted into ellipsoids of revolution about the field direction. The dynamical equations are derived, and the solution for small oscillation is given. GRA

N80-33725# Weidlinger Associates, New York.
UNCOUPLING APPROXIMATION IN FLUID-STRUCTURE INTERACTION PROBLEMS WITH CAVITATION Topical Report, 1 Dec. 1978 - 28 Feb. 1980
F. L. DiMaggio, I. S. Sandler, and D. Rubin 28 Feb. 1980 30 p
(Contracts DNA001-79-C-0078; DNA001-79-C-0256)
(AD-A088911; AD-E300892; DNA-5191T) Avail: NTIS HC A03/MF A01 CSCL 20/4

Linear and nonlinear methods are presented for the decoupling of fluid-structure interaction problems in which cavitation occurs. These methods are tested against a one dimensional case with a known solution. On this basis the nonlinear approach is recommended for use in multi-dimensional problems and an algorithm for its implementation is given. GRA

N80-33726# Los Alamos Scientific Lab., N. Mex.
SIMILITUDE MODELING OF NATURAL CONVECTION HEAT TRANSFER THROUGH AN APERTURE IN PASSIVE SOLAR HEATED BUILDINGS Thesis
Dennis David Weber Jun. 1980 124 p refs
(Contract W-7405-eng-36)
(LA-8385-T) Avail: NTIS HC A06/MF A01

An experimental study of natural convection heat transfer through a doorway in a two room passive solar heated building is described. Similitude modeling was the method used to measure natural convection heat transfer coefficients (h/sub NC/) in a model geometrically scaled down by a factor of 5. Freon gas was used as the working fluid to obtain dynamic similarity within the model. A temperature difference was maintained between the two rooms by a heated vertical wall which simulated a Trombe wall in one room, and by a cooled vertical wall which simulated a thermal storage wall in the other room. Heat transfer through the doorway was measured as a function of a characteristic temperature differential and the geometry of the doorway. DOE

N80-33614# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VIBRATIONS OF SEVERAL OBSTACLES WITHIN THE TWO DIMENSIONAL FLOW OF INCOMPRESSIBLE FLUID
Robert Legendre *In its* La Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 1-12 Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 1-8 Original report in FRENCH previously announced as A80-26158 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-33727 Arizona State Univ., Tempe.
APPLICATIONS OF COMPUTER-GENERATED HOLOGRAMS IN OPTICAL TESTING Ph.D. Thesis
John Scott Loomis 1980 229 p
Avail: Univ. Microfilms Order No. 8022835

Various encoding methods for making computer generated holograms are discussed, and a new method is presented that can easily be used on image recorders intended for image processing applications. This general encoding method has many characteristics in common with earlier computer generated holograms. Examples are given to demonstrate the properties of synthetic holograms and the differences among different encoding techniques. A computer ray trace code was developed to model the optical performance of equipment used in optical testing. A detailed prescription is given for making a computer generated hologram for a commercial interferometer designed for use with holograms. Problems of finding the proper focal point, the correct hologram size, and preparation of the final hologram image are discussed. An example of an actual test is included. Finally, an analysis of various errors encountered and the limitations of the methods used is presented. Within these limitations, computer generated holograms can easily and routinely be used to test aspheric optical components. Dissert. Abstr.

N80-33728# National Inst. for Aeronautics and Systems Technology, Pretoria (South Africa).
INTRODUCTION TO THE FUNDAMENTALS OF STRAIN GAUGE PRACTICE
R. I. Watkins Dec. 1979 42 p refs
(NIAST-79/154; ISBN-0-7988-1725-9) Avail: NTIS HC A03/MF A01

The practical aspects of strain gauging are discussed. Attention is given to the selection of a suitable type of strain gauge for any particular application and the types of adhesives to be used under certain conditions. The application of the Wheatstone Bridge circuit to various strain gauge configurations and error cancellation in adverse conditions is also described. The measurement of a few elementary load cases is discussed. A.R.H.

N80-33729# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN ELECTROPHORETIC IMAGE DISPLAY Quarterly Technical Report, 1 Feb. - 30 Apr. 1980
Richard Liebert, Joseph Lalak, and Karl Wittig May 1980 22 p
(Contract MDA903-79-C-0439; DARPA Order 3802)
(AD-A089121) Avail: NTIS HC A02/MF A01 CSCL 09/5

The purpose of this work is to develop a 350 x 600 element X-Y addressed ElectroPhoretic Image Display (EPID). Development of the fabrication techniques for this display continues. Near-perfect seals between the substrate and grid dielectric were obtained. Ion-beam milling of Mylar in 70% oxygen: 30% argon has eliminated operational difficulties encountered with pure oxygen. No change in either the absolute or differential milling rates was observed as a result of the addition of the argon to the oxygen. Several tests have confirmed the compatibility between the materials used in fabricating the device and the components of the electrophoretic suspension. Digitization and ordering of the photolithographic masks for the 512 character display is complete. Design of the display electronics and packaging are in progress. A microprocessor interfaced to the IEEE-488 bus and an ASCII-to-5x7 character generator will provide the necessary signals to the integrated row and column drivers. The display will be mounted, using conductive elastomer interconnections, to a printed circuit board which will provide sockets for connection of the cables form the electronics package. This system will accept ASCII information from a computer connected to an IEEE-488 bus and display the printable information on the EPID as 16 lines of 32 characters each.GRA

N80-33730# Allied-General Nuclear Services, Barnwell, S.C.
AUTOMATED CALIBRATIONS AND DYNAMIC CORRECTIONS FOR DIFFERENTIAL PRESSURE TRANSMITTERS
John M. Crawford Jun. 1980 13 p refs Presented at the 21st Ann. Meeting of the Inst. of Nucl. Mater. Management, Palm Beach, Fla., 30 Jun. - 2 Jul. 1980
(Contract DE-AC09-78ET-35900)
(AGNS-35900-Conf-65; CONF-800655-19) Avail: NTIS HC A02/MF A01

A large reprocessing plant is a complex operation with dynamic inventories being required to provide for timely detection of attempted diversion of nuclear materials. The real-time, on-line process measurement capability controls the effectiveness of the dyanmic techniques. An economical method to eliminate bias and significantly improve process differential pressure transmitter measurements is evaluated. Errors up to 1.0% have been reduced to less than 0.1%. DOE

N80-33731# SRI International Corp., Menlo Park, Calif.
DEVELOPMENT AND EVALUATION OF A PROTOTYPE AUTOMATED TELEPHOTOMETER SYSTEM Final Report
W. Viezee and W. E. Evans Jun. 1980 56 p refs
(EPRI Proj. 862-14)
(EPRI-EA-1434) Avail: NTIS HC A04/MF A01

Hardware and software components of an automated telephotometer system to monitor daytime visibility and visibility degradation in pristine air quality areas are assembled and calibrated. The optical sensor is a reticon solid state line scanner with a 15 degree viewing angle in a single vertical plane. When directed at a distant scene or landmark, the camera gives a brightness measurement at 256 successive elements along the vertical scanning, thereby providing a detailed profile of scene brightness. Brightness measurements are recorded in terms of the light intensity integrated over the standard spectral (photopic) response of the human eye. A computer controlled, lightweight rotator scans the sensor in azimuth at 1.57 milliradian increments. Two computer algorithms are implemented into the prototype system. One computes average brightness across selected landmarks or vistas and across nearby portions of the background sky to determine apparent brightness contrast. The other algorithm determines the brightness structure or brightness standard deviation across selected vistas. DOE

N80-33428*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TABLE MOUNTAIN 8-mm-WAVELENGTH INTERFEROMETER
M. A. Janssen, S. Gulkis, E. T. Olsen, B. L. Gary, F. S. Soltis, and N. I. Yamane *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 1-8 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-33441*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NOISE ADDING RADIOMETER PERFORMANCE ANALYSIS
C. Stelzried *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 98-106 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-33615# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ULTRASOUND LEVEL-METER FOR MEASURING PROPELLANT LEVELS IN ARIANE TANKS IN ITS FIRST AND SECOND STAGES
Jean-Claude Demarais and Alain Deom *In its* La Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 13-30 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 9-22 Original report in FRENCH previously announced as A80-26159 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

N80-33617# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE ONERA VACUUM ULTRAVIOLET SPECTROGRAPH AND ITS USE FOR THE STUDY OF SURFACE LAYERS IN TITANIUM AND ITS ALLOYS
Frima Malamand and Bernard Daigne *In its* La Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 41-49 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 31-37 Original Report in FRENCH previously announced as A80-26161 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

N80-33618# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
IN SITU EXPERIMENTS IN THE 1 MV ELECTRON MICROSCOPE. PART 1: FEASIBILITY AND METHODOLOGY
Roger Valle, Bernard Genty, and Alain Marraud *In its* La Rech. Aerospatiale Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) p 51-80 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 39-61 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

N80-33619# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A DIGITAL UNIT FOR MEASURING UNSTEADY PRESSURE COEFFICIENTS
Claude Christoux and Alain Gravelle *In its* La Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 81-88 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 63-68 Original report in FRENCH previously announced as A80-26162 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

N80-33620# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AN ELECTRICAL METHOD OF MEASURING STRAIN AND DAMAGE
Georges Cailletaud, Humbert Policella, and Georges Baudin *In its* Rech. Aerospatiale, Bi-Monthly Bull. No. 1980-1 (ESA-TT-651) Jul. 1980 p 89-97 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-1, Jan. - Feb. 1980 p 69-75 (For primary document see N80-33613 24-31)
Avail: NTIS HC A05/MF A01; ONERA, Paris FF 40

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-33732 California Univ., San Diego.
STIMULATED EMISSION PROCESSES FROM FREE ELECTRONS Ph.D. Thesis
Wayne Alan McMullin 1980 223 p
Avail: Univ. Microfilms Order No. 8023105

Simulated emission by a relativistic beam of electrons is considered along the direction of motion for the cases in which the electrons are accelerated in a pump field that is either an electromagnetic wave, or TE cylindrical waveguide mode, or a transversely polarized, spatially periodic magnetic field with the emitted wave frequency Doppler upshifted from that of the pump field. Stimulated emission from a relativistic beam of electrons is considered under acceleration in parallel, static electric and magnetic fields subject to the conditions that the photon energy and Landau orbital energy of the electrons in the magnetic field are much less than the electron kinetic energy. The distribution function obtained from the kinetic equation is used to calculate the induced current driving the emitted field and the induced current is used in the wave equation for the emitted field from which the amplification is studied. Dissert. Abstr.

N80-33733 Southern Methodist Univ., Dallas, Tex.
MODE STRUCTURE OF Al SUB XGa SUB L-XAs INJECTION LASERS Ph.D. Thesis
Delaney Joseph Baxter 1980 116 p
Avail: Univ. Microfilms Order No. 8022606

The lateral dielectric constant in stripe geometry injection lasers is modeled with a step and a parabolic denepdence. For the step profile, a set of cutoff curves for the lateral modes is used to compare various laser designs. As the vertical geometry of a laser is varied a contour is described on the cutoff curves which is a measure of lateral mode stability. Two laser designs examined are the simple stripe geometry and channeled substrate planar lasers. The parabolic model of the lateral dielectric constant is extended to include matched fields at the vertical heterojunctions. A result is a deformed fundamental mode shape in the case of small normalized frequencies and depression of the refractive index under the stripe. This presents an alternative explanation for the shoulders that have heretofore been attributed to leaky waves. An experimental scheme is devised to measure the free carrier effect on the refractive index in GaAs active regions of injection lasers. Transverse field and modal selection mechanisms of the active cavity are characterized for a broad area high power laser as a function of temperature and injection level. The amount of index depression as a result of carrier increase in the active region is measured to be (3-9) x 10 to the -27 power cu m. Dissert. Abstr.

N80-33734 Cornell Univ., Ithaca, N. Y.
TWO APPROACHES TOWARDS A LOW POWER SOLID STATE LASER Ph.D. Thesis
Lawrence Bennett Medwin 1979 173 p
Avail: Univ. Microfilms Order No. 8020916

Two approaches towards the goal of preparing a low power solid state laser are described. The first approach was an attempt to synthesize a material with the desirable peoperties of rare earth optical emission and the convenience of electrical pumping available to the semiconductor laser. The second approach involved developing, fabricating, and characterizing a semiconductor laser with a very small gain region, the buried heterostructure laser. The first approach involved modifying a chemical vapor deposition reactor designed to grow III-V compound semiconductor materials. While neodymium was successfully transported to the crystalline substrate, the desired Nd doped III-V semiconductor material could not be prepared. The second approach, developing a buried heterostructure laser fabrication technology, required an investigation into state of the art etching technology and selective epitaxial deposition of III-V semiconductors. The results of these studies are presented as well as the fabrication technology of the buried heterostructure. The working devices were characterized and electrical and optical models ear proposed to explain their behavior. Dissert. Abstr.

N80-33735*# RCA Labs., Princeton, N. J.
SINGLE-MODE LASER STUDIES: DESIGN AND PERFORMANCE OF A FIXED-WAVE LENGTH SOURCE AND COUPLING OF LASERS TO THIN-FILM OPTICAL WAVEGUIDES Final Report, 3 Jul. 1979 - 3 Apr. 1980
I. Ladany and J. M. Hammer Washington, D.C. Oct. 1980 62 p refs
(NASA-CR-3341; PRRL-80-CR-13; FR-2) Avail: NTIS HC A04/MF A01 CSCL 20E

A module developed for the generation of a stable single wavelength to be used for a fiber optic multiplexing scheme is described. The laser is driven with RZ pulses, and the temperature is stabilized thermoelectrically. The unit is capable of maintaining a fixed wavelength within about 6 A as the pulse duty cycle is changed between 0 and 100 percent. This is considered the most severe case, and much tighter tolerances are obtainable for constant input power coding schemes. Using a constricted double heterostructure laser, a wavelength shift of 0.083 A mA is obtained due to laser self-heating by a dc driving current. The thermoelectric unit is capable of maintaining a constant laser heat-sink temperature within 0.02 C. In addition, miniature lenses and couplers are described which allow efficient coupling of single wavelength modes of junction lasers to thin film optical waveguides. The design of the miniature cylinder lenses and the prism coupling techniques allow 2 mW of single wavelength mode junction laser light to b coupled into thin film waveguides using compact assemblies. Selective grating couplers are also studied. M.G.

N80-33736# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OSCILLATORY BEAM QUALITY EFFECTS IN MODULAR HIGH ENERGY LASER SYSTEMS
Robert C. Harney 15 May 1980 36 p refs
(Contract F19628-80-C-0002; ARPA Order-3724)
(AD-A088655; LTP-41; ESD-TR-80-69) Avail: NTIS
HC A03/MF A01 CSCL 20/5

The amplitude of the major phase distortions in in-line modular chemical laser systems increases linearly with the number of modules. The beam quality of a model modular linear-gain laser has been examined as a function of the amplitude of the phase distortion by propagating the distorted output beams to a distant focus using the Lincoln Laboratory laser propagation code. Oscillations are observed in both the peak intensity and the far field area containing 63% of the laser flux. The observed oscillatory behavior is not strongly dependent on the shape of the phase distortion. The implications of this behavior for modular laser design are discussed and extended to modular annular gain lasers. GRA

N80-33737# RCA Government Systems Div., Burlington, Mass. Government Systems Div.
A 2.06 MICRON-LASER RANGEFINDER TECHNOLOGY Final Report, Sep. 1977 - Aug. 1979
Bruce E. Hendrickson and Larry S. Ohara Sep. 1979 71 p refs
(Contract DAAB07-77-C-2197)
(AD-A088836) Avail: NTIS HC A04/MF A01 CSCL 17/6

A laser rangefinder receiver using a photoconductive, thermoelectrically cooled HgCdTe detector was developed for detection of the 2.06 micron wavelength Holmium laser. The HgCdTe receiver was tested with an RCA developed Ho:YLF laser as a laser rangefinder. Quantitative ranging tests were conducted and compared to predicted results utilizing the measured Noise Equivalent Power (NEP) of (5 - 10) (10 to the minue 10th power/square root of (Hz)) of the detector pre-amplifier. A lpps thermoelectrically cooled Ho:YLF laboratory laser was successfully developed and tested to 140 F. GRA

N80-33738# Army Materials Research Agency, Watertown, Mass. Ceramics Research Div.
THE EFFECTS OF LASER RADIATION ON PYROLYTIC SILICON NITRIDE COATINGS ON SLIP-CAST FUSED SILICA SUBSTRATES Final Report
Dennis J. Viechnicki Jul. 1980 16 p refs
(DA Proj. 1L1-62105-AH-84)
(AD-A089130; AMMRC-TR-80-36) Avail: NTIS
HC A02/MF A01 CSCL 11/2

Pyrolytic silicon nitride coatings were deposited on slip-cast fused silica substrates. They were characterized and their thermal response is described. A clean heat source in the form of a continuous wave (CW) CO2 welding laser was utilized in the experiment. GRA

N80-33739# Naval Research Lab., Washington, D. C.
DOPPLER VELOCIMETER FOR LASER ACCELERATED TARGETS
S. P. Obenschain, E. A. McLean, and S. H. Gold 28 Aug. 1980 14 p refs
(RR0110941)
(AD-A089134; NRL-MR-4319) Avail: NTIS
HC A02/MF A01 CSCL 14/2

A Doppler velocimeter utilizing a spectrograph and a short pulse laser probe is described which provides good spatial (20 microns) and subnanosecond temporal resolution. This system has been used to measure the velocity profiles of targets ablatively accelerated to very high velocities by a high power laser beam. A unique aspect of this velocimeter is that the doppler wavelength shifts are measured directly rather than employing interferometric techniques. GRA

N80-33740# California Univ., Livermore. Lawrence Livermore Lab.
NOVA: A HIGH ENERGY LASER SYSTEM
R. O. Godwin 12 Oct. 1979 8 p refs Presented at Electro-Optics Conf., Tokyo, 23-26 Jan. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83204; CONF-800140-1) Avail: NTIS
HC A02/MF A01

The laser system and spatial filter are described. The computer control system and the 46 cm disk amplifier are also described. DOE

N80-33741# KMS Fusion, Inc., Ann Arbor, Mich.
INTERACTION OF SHORT WAVELENGTH LASER RADIATION WITH SPHERICAL SHELL TARGETS
D. C. Slater, R. L. Berger, Gar. E. Busch, G. Charatis, R. R. Johnson, F. J. Mayer, D. Mitrovich, R. J. Schroeder, J. D. Simpson, and D. Sullivan 1980 19 p refs Presented at the 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980
(Contract DE-AC08-78DP-40030)
(KMSF-U-953; CONF-800707-14; IAEA-CN-38/I-3) Avail: NTIS HC A02/MF A01

Laser plasma interaction experiments were performed at both 1.05 microns and 0.53 microns. Measurements of absorption and X-ray production from spherical shell targets have shown significant differences between the two laser wavelengths. The laser power on target up to 0.7 TW at 0.53 microns was sufficient to observe effects from a high-temperature corona and confirmed the earlier predictions for wavelength scaling of the hot electron temperature. DOE

N80-33438*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A STUDY OF THE PROCESSES IN THE RF HYDROGEN GAS DISSOCIATOR
L. Maleki *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 68-76 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-33742 British Library Lending Div., Boston Spa (England).
MAGNETIC-ABRASIVE MACHINING
Anatas Kochemidov, Boris Makedonski, Ivan Dumanov, Stephan Stephanov, Peter Golobov, and Chanasov Atanasov Aug. 1980 13 p refs Transl. into ENGLISH from Mashinostroenie (USSR), v. 25, no. 7, 1976 p 307-309
(BLL-RTS-12400) Avail: British Library Lending Div., Boston Spa, England

The use of magnetic-abrasive machining for obtaining a high degree of surface finish was investigated. The cutting powder is a powder which is held in the area of cutting by a magnetic field. The magnetic particles are continuously changing their orientation, and thus remain shape. The grain size of the ferromagnetic powder, and the speed of the component being treated influence the productivity of the process. It is concluded that magnetic-abrasive treatment offers strong possibilities for machining. F.O.S.

N80-33743 British Library Lending Div., Boston Spa (England).
REASONS FOR THE OCCURRENCE OF SMOOTH WORK SURFACES IN METAL CUTTING
F. Betz Jul. 1980 26 p refs Transl. into ENGLISH from Feitigung (East Germany), no. 5, 1971 p 147-152 Presented at 1971 CIRP Conv., Warsaw
(BLL-RTS-12078) Avail: British Library Lending Div., Boston Spa, England

The microform of the arising workpiece surface in metal cutting depends especially on the cutting speed. The fact that normally a clean burnished surface in the direction of cut arises only at relatively high cutting speeds, leads to the assumption that specific high temperature of the magnitude of transformation at the tool flank is necessary. However, investigations show that during the beginning of a cut a fully burnished cut surface (in the direction of cut) arises also at low cutting speeds. Chip root investigations show that the microform of the cut surface depends on the position of the stagnation zone, which is formed ahead of the cutting edge. It is possible to produce clean burnished

cut surfaces at all cutting speeds by a suitable positioning of this stagnation zone. S.F.

N80-33744 Columbia Univ., New York.
EXPERIMENTAL INVESTIGATION OF HYDRODYNAMIC SELF-ACTING GAS BEARINGS AT HIGH KNUDSEN NUMBERS Ph.D. Thesis
Yiao-Tee Hsia 1980 148 p
Avail: Univ. Microfilms Order No. 8023504

The slip flow theory for modelling hydrodynamic gas bearing with clearances below 25 micrometer m was investigated. An interferometric technique using two CW lasers is used to measure the small clearances with an 0.025 micrometer m accuracy. The pitch and roll angles of the slider bearing and the surface contour of the slider are also measured interferometrically. The effects of molecular rarefaction are studied by operating the bearing in different gas media with different mean free paths. Air is used to study Knudsen number below 0.5 while helium is used to study Knudsen number above 0.5. Training edge clearances and pitch angles are compared with theoretical predictions using the modified Reynolds equation with velocity slip boundary conditions. The modified Reynolds equation is solved using two different numerical algorithms. Excellent agreement between experiment and theory is found for clearances as high as 1.60 micrometer m to as low as 0.075 micrometer m with corresponding ambient Knudsen number of 0.04 and 2.51, respectively. Dissert. Abstr.

N80-33745 Texas Univ. at Austin.
A MODELING TECHNIQUE FOR DESIGN AND SIMULATION OF HYDROSTATIC JOURNAL BEARINGS Ph.D. Thesis
Keith Michael Tolk 1980 171 p
Avail: Univ. Microfilms Order No. 8021522

A bearing model which accurately indludes the nonlinear bearing effects is presented. The bearing model when properly implemented on the computer can evaluate the required force in only a few milliseconds. In addition, various effects can be included or omitted from the model so that their effect on the dynamics of the system can be isolated. The model consists of a set of analytical solutions for the forces and flows in various parts of the bearing using one dimensional forms of the Reynold's equation. These individual solutions are then combined using correction factors obtained by solving the complete Reynold's equation numerically using a finite difference approach. In this manner a solution for the bearing force is obtained which has the accuracy of the finite difference solution but requires only a small fraction of the computational time. Several dimensionless design parameters are defined. These are presented in the form of design curves. In addition, several simulation examples are presented. These examples show steady state orbital behavior and also demonstrate the possible instability of these bearings at high speed. Dissert. Abstr.

N80-33746 Wayne State Univ., Detroit, Mich.
THE BURNING VELOCITY INSIDE A SPARK-IGNITION ENGINE WITH DIFFERENT TURBULENT PROMOTERS Ph.D. Thesis
Sampao Chaibongsai 1979 191 p
Avail: Univ. Microfilms Order No. 8022740

The burning velocity inside the CFR spark ignition engine was studied. The flame propagation was analyzed and an equation was developed for the burning velocity. The experimental part was completed on the CFR spark ignited engine at different compression ratios, speeds, throttle valve openings, and inlet valves. The valves are designed and manufactured to reduce the effect of swirl by using 360 deg shrouds with holes of different diameters (6 mm and 3 mm). The turbulence was promoted by the flow of the charge through the holes in the shrouds. The theoretical analysis showed that the spherical flame front model is more accurate than the cylindrical model, particularly in the early stages of flame propagation. The experimental results indicated that with minimum spark advance for the best torque the compression ratio has a minor effect on the maximum burning velocity. Changes in throttle valve opening, engine speed, and inlet valve, showed a great effect on the maximum burning velocity. Dissert. Abstr.

N80-33747*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
A LINEAR PHOTODIODE ARRAY EMPLOYED IN A SHORT RANGE LASER TRIANGULATION OBSTACLE AVOIDANCE SENSOR M.S. Thesis
James Paul Odenthal Dec. 1980 129 p refs
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163613; RPI-TR-MP-74) Avail: NTIS HC A07/MF A01 CSCL 20E

An opto-electronic receiver incorporating a multi-element linear photodiode array as a component of a laser-triangulation rangefinder was developed as an obstacle avoidance sensor for a Martian roving vehicle. The detector can resolve the angle of laser return in 1.5 deg increments within a field of view of 30 deg and a range of five meters. A second receiver with a 1024 elements over 60 deg and a 3 meter range is also documented. Design criteria, circuit operation, schematics, experimental results and calibration procedures are discussed. A.R.H.

N80-33748*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
INVESTIGATION OF ELECTRODYNAMIC STABILIZATION AND CONTROL OF LONG ORBITING TETHERS Interim Report, 1 Mar. - 31 Aug. 1980
Giuseppe Colombo, Mario D. Grossi, Marion Dobrowolny, and David A. Arnold Aug. 1980 8 p
(Contract NAS8-33691)
(NASA-CR-161584) Avail: NTIS HC A02/MF A01 CSCL 13I

The possibility of using electrodynamic forces to control pendular oscillations during the retrieval of a subsatellite is investigated. The use of the tether for transferring payloads between orbits is studied. S.F.

N80-33749*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF CAGE DESIGN ON CHARACTERISTICS OF HIGH-SPEED-JET-LUBRICATED 35-MILLIMETER-BORE BALL BEARING
Fredrick T. Schuller, Stanley I. Pinel (Industrial Tectonics, Compton, Calif.), and Hans R. Signer (Industrial Tectonics, Compton, Calif.) Oct. 1980 13 p refs
(NASA-TP-1732; E-289) Avail: NTIS HC A02/MF A01 CSCL 13I

Parametric tests were conducted with a 35 mm bore angular contact ball bearing with a double outer land guided cage. Provisions were made for jet lubrication and outer-ring cooling of the bearing. Test conditions included a combined thrust and radial load at nominal shaft speeds of 48,000 rpm, and an oil-in temperature of 394 K (250 F). Successful operation of the test bearing was accomplished up to 2.5 million DN. Test results were compared with those obtained with similar bearing having a single outer land guided cage. Higher temperatures were generated with the double outer land guided cage bearing, and bearing power loss and cage slip were greater. Cooling the outer ring resulted in a decrease in overall bearing operating temperature. Author

N80-33750# Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
CAVITATION DAMAGE MECHANISMS: EXPERIMENTAL STUDY CAVITATION IN A SPOOL VALVE Final Technical Report, Aug. 1977 - Sep. 1979
C. S. Martin, D. C. Wiggert, and H. Medlarz Wright-Patterson AFB, Ohio AFAPL Feb. 1980 147 p refs
(Contract F33615-77-C-2036)
(AD-A083653; AFAPL-TR-79-2121) Avail: NTIS HC A07/MF A01 CSCL 13/11

Cavitation was investigated in directional control valves in order to identify damage mechanism characteristic of components of aircraft hydraulic systems. Extensive tests were conducted in a representative metal spool valve and in a model three times larger. Both valves are well instrumented for the purpose of accurately measuring mean quantities as well as detecting the onset and extent of cavitation once it developed. Noncavitating data taken with both valves showed that the position of the high velocity, annular jet issuing from the orifice shifted orientation

depending upon valve opening and Reynolds number. By means of high frequency response pressure transducers strategically placed in the valve chamber of each test valve cavitation could be sensed by the correlation of noise with a cavitation index. Cavitation inception could be detected by comparing energy spectra for a fixed valve and a constant discharge. Another sensitive indicator of cavitation inception is the ratio of cavitating to noncavitating spectral densities. The incipient cavitation index as defined in this investigation correlates well with the Reynolds number for both valves. J.M.S.

N80-33751# Little (Arthur D.), Inc., Cambridge, Mass.
POTENTIAL OF SPARK IGNITION ENGINE, ELECTRONIC ENGINE AND TRANSMISSION CONTROL Final Report, Jan. - Jul. 1978
Frank J. Garofalo Mar. 1980 105 p refs
(PB80-192701; DOT-TSC-NHTSA-79-55; DOT-TSC-1046)
Avail: NTIS HC A06/MF A01 CSCL 21G

The characteristics and functions of significant electronic engine and powertrain control systems are identified, evaluated, and documented. Important considerations in the assessment are the powertrain variables controlled, the technology utilized, and the fuel economy gains achieved. A detailed analysis, by engine class and control system technology, is made in order to quantify specific advantages of various electronic systems and their capability to achieve increased engine efficiency and vehicle fuel economy. An attempt is made to identify the minimum technology required to move from the 1978 emission standards to the 1981 emission standards with no fuel economy losses. GRA

N80-33752# Transportation Systems Center, Cambridge, Mass.
POTENTIAL OF DIESEL ENGINE, DIESEL ENGINE DESIGN CONCEPTS, CONTROL STRATEGY AND IMPLEMENTATION Final Report
T. Trella and T. Shen Mar. 1980 61 p refs
(PB80-195746; DOT-HS-805240; DOT-TSC-NHTSA-79-41)
Avail: NTIS HC A04/MF A01 CSCL 21G

Diesel engine design concepts and control system strategies are surveyed with application to passenger cars and light trucks. The objective of the study is to indicate the fuel economy potential of the technologies investigated. The engine design parameters discussed are related to the engine configuration, combustion process, valving, friction, compression ratio, and heat transfer. Various engine control strategies and control implementation are considered. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-33753 Texas A&M Univ., College Station.
ANALYSIS OF MARKOV RENEWAL PROCESSES WITH SOME NONREGENERATION POINTS AND THEIR APPLICATIONS TO RELIABILITY THEORY Ph.D. Thesis
Po-Wen Hu 1980 97 p
Avail: Univ. Microfilms Order No. 8023036

Markov renewal theory, a branch of probability theory, is based on the properties of regeneration points. A regeneration point is a random time in a process at which the future development of the process is a probabilistic replica of the process itself, independent of the past history of the process. In industrial applications, Markov renewal theory is useful for modeling a repairable system because repairs are assumed to renew or upgrade the system so that the performance of the system is identical to that of a new one, independent of the past performance records. The number of spare parts needed, percentage of system down time, percentage of idle time of the repair facilities, etc., can be computed Markov renewal theory. However, there are multi-component systems in which the repair activities performed on a single component do not constitute regeneration points for the entire system because the history of the other components can not be disregarded. The Markov renewal theory is modified so that it can be applied to the nonregeneration points of a process. Dissert. Abstr.

N80-33754# Southwest Research Inst., San Antonio, Tex.
SPECIAL ENGINEERING SERVICES TO ESTABLISH INSPECTION CRITERIA FOR BEARINGS TO IMPROVE LIFE PREDICTION Final Report, 1 Jul. 1974 - 30 Nov. 1979
Felix N. Kusenberger and John R. Barton Dec. 1979 168 p refs
(Contract F09603-74-C-5158)
(AD-A088765) Avail: NTIS HC A08/MF A01 CSCL 13/9

The CIBLE (Critical Inspection of Bearings for Life Extension) program concept for quantitative nondestructive evaluation of bearing components is briefly reviewed and the automatic inspection equipment used to acquire the data presented in this report is described. Many examples of significant crack networks detected in the races of vendor reworked bearings as well as subsurface flaw indications in a new bearing are illustrated. The savings realized by elimination of the potential for inclusion nucleated failure from the group of CIBLE inspected bearings is estimated, and the future economic benefits of removing potential failures from the J57- 2 and J57- 4 engine bearings currently in the fleet are also projected. The results of endurance testing bearings with service-induced cracks at low stress levels and flaw indications at higher levels are presented and discussed. The results of metallurgical examination of service induced cracked regions as well as other flaw regions are illustrated, and the results from 1000 balls inspected at the Oklahoma City Air Logistics Center (OCALC) are summarized. A preliminary serviceability criteria for races is outlined and implementation of the criteria is discussed. GRA

N80-33755# Los Alamos Scientific Lab., N. Mex.
EVALUATION OF IN-LINE NONDESTRUCTIVE ASSAY SYSTEMS Progress Report, 1 Jan. - 31 Mar. 1980
D. F. Bowersox, N. Ensslin, S. T. Hsue, S. S. Johnson, J. L. Parker, and T. E. Sampson Jun. 1980 14 p refs
(Contract W-7405-eng-36)
(LA-8411-PR) Avail: NTIS HC A02/MF A01

Specified instruments for in line nondestructive assay of streams of spent fuel processing are tested under realistic conditions for use in effective process control and materials accounting. Progress for the period from January through March 1980 is described. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-33756 British Library Lending Div., Boston Spa (England).
THE FORCED OSCILLATION OF THE CIRCULAR PLATES
W. Fluegge Jul. 1980 14 p refs Transl. into ENGLISH from Z. Tech. Phys. (West Germany), v. 13, no. 4, 1932 p 199-205
(BLL-RTS-12070) Copyright. Avail: British Library Lending Div., Boston Spa, England

The forced oscillation of elastic plates at frequencies considerably different from their natural frequencies was investigated. A circular plate was coupled by a thread at its mid-point to an oscillating system of large mass. Excitation by a periodic single force, some singularities of plate flexure, and the excitation by a higher order singularity were studied. It is concluded that an elastic plate can be forced to oscillate at any frequency. F.O.S.

N80-33757 British Library Lending Div., Boston Spa (England).
ANALYSIS AND SYNTHESIS OF OPERATIONAL LOADS
J. H. Argyris, W. Aicher, and H. J. Ertelt May 1979 85 p refs Transl. into ENGLISH of "Analyse und Sythese von Betriebsbelastungen", Rept. ISD-193 Stuttgart Univ., Feb. 1976
(RAE-Lib-Trans-2108(5207); ISD-193) Avail: British Library Lending Div., Boston Spa, England

The inadequate estimation of fatigue lives of structures by theoretical methods has led to the development of techniques for simulating service loading histories in the laboratory. The techniques required for the synthesis of a laboratory loading sequence from service loading data are described using the standard fighter loading sequence, FALSTAFF, as an example.

Author

N80-33758 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NUMBER 8
Judith Nagle-Eshleman, ed. Aug. 1980 91 p refs
(AD-A088658) Avail: Naval Research Lab., Attn. Code 5804, Washington, D.C. 20375. HC annual rate $100.00

Impact damage done to reinforced composite materials and equivalance techniques for vibration testing are discussed. For individual titles, see N80-33759 through N80-33760.

N80-33759 Florida Univ., Gainesville. Dept. of Engineering Sciences.
LOCALIZED IMPACT PROBLEMS OF COMPOSITE LAMINATES
N. Takeda and R. L. Sierakowski. *In* Shock and Vibration Information Center. The Shock and Vibration Digest, Vol. 12, No. 8, Aug. 1980 p 3-10 refs (For primary document see N80-33758 24-39)
Avail: Naval Research Lab., Attn. Code 5804, Washington, D.C. 20375. HC annual rate $100.00

Localized impact damage experiments of filament reinforced composite materials, the solution of wave propagation problems based on continuum mechanics models, and Hertzian contact approaches to impact problems are discussed.

R.K.G.

N80-33760 New South Wales Univ., Kensington (Australia). School of Electrical Engineering.
EQUIVALENCE TECHNIQUES FOR VIBRATION TESTING
H. S. Blanks. *In* Shock and Vibration Information Center. The Shock and Vibration Digest, Vol. 12, No. 8, Aug. 1980 p 13-23 refs (For primary document see N80-33758 24-39)
Avail: Naval Research Lab., Attn. Code 5804, Washington, D.C. 20375. HC annual rate $100.00

Techniques relevant to the equivalence between vibration tests and service vibration experience is given. Fatigue was the predominant failure mechanism considered in the vibration literature; useful equivalence techniques were developed. With regard to wear-out and equipment malfunction the situation is much less satisfactory. A technique that produces equivalence with respect to one failure mechanism will probably not provide equivalance for another.

R.K.G.

N80-33761 Rutgers - The State Univ., New Brunswick, N. J.
THEORETICAL AND NUMERICAL ANALYSES OF ANELASTIC MATERIALS AT FINITE STRAIN Ph.D. Thesis
Jehuda Rosenberg 1980 179 p
Avail: Univ. Microfilms Order No. 8022584

A group of materials for which the stress is a function of the current strain and strain rate is discussed. The simplest example of this type of material can be modeled by the linear Kelvin model. The stress-strain diagram of a Kelvin model subject to constant rate-of-strain loading is composed of parallel lines corresponding to different strain rates. Such a description does not correspond to the characteristic behavior of solids. For rubber materials the elastic modulus, increases with the increasing rate of deformation with lower and upper bounds. This phenomena is attributed to internal friction. Several constitutive formulations capable of describing the above mentioned phenomena are reviewed. A three dimensional constitutive relation based on Coleman and Mizel thermodynamic theory is proposed. In such a formulation, the stress is divided into reversible and dissipative components. The reversible component is defined to be the stress when the rate of strain approaches zero. It is shown that the reversible stress should be derivable from some strain energy function. Thus, the reversible stress is a hyperelastic stress. For the formulation of the reversible stress, several strain energy functions are considered including the Mooney-Rivlin energy function and a modified version of Shinozuka and Freudenthal energy function proposed by Bodner and Partom. Also, several dissipative stress formulations are considered.

Dissert. Abstr.

N80-33762 George Washington Univ., Washington, D.C.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF BIAXIAL LOADING EFFECTS ON CRACKS EMANATING FROM A CIRCULAR HOLE Ph.D. Thesis
Michael Kayode Oladimeji 1980 188 p
Avail: Univ. Microfilms Order No. 8016969

An investigation comprising a finite element analysis, a photoelastic verification and a series of four fracture tests on 7075-T6 aluminum was performed to examine the effects of biaxially applied loads on cracks emanating from a circular hole. For the finite element analysis the specimen was divided into two regions: (1) a small region around the crack tip where a 2 term Williams' analysis was employed and (2) the remainder of the specimen where a finite element analysis was employed. The displacements obtained from the 2 term Williams' series at the nodal points along the interface between the two regions were matched with the finite element displacements to form equations of displacement continuity across this interface. The resulting continuity expressions contain three unknown parameters, namely the stress intensity factor K1, the nonsingular A term associated with the modified Westergaard stress function and the constant term B associated with the crack-tip displacement in the horizontal direction. The three parameters are then obtained by the method of least squares.

Dissert. Abstr.

N80-33763 Texas Univ. at Austin.
NUMERICAL ANALYSIS OF EQUILIBRIUM PROBLEMS IN INCOMPRESSIBLE NONLINEAR ELASTICITY Ph.D. Thesis
Patrick Georges LeTallec 1980 189 p
Avail: Univ. Microfilms Order No. 8021465

The problem of equilibrium of incompressible hyperelastic bodies subjected to large strains is considered. Three different formulations are proposed. First, minimization of the potential energy on an admissible set. Second, a study of the weak equations of equilibrium is given. The last formulation considers the motion of the body and its gradient as two independent variables, related by a linear constraint treated by augmented Lagrangian techniques. An existence theory for these problems is discussed and theorems on the equivalence between these formulations are given. Approximations of these problems are presented for which solutions are proved to exist. A numerical scheme based on the Lagrangian formulation is developed. The results of several numerical experiments are given which indicate that the methods developed are quite effective for problems of this type.

Dissert. Abstr.

N80-33764 Illinois Univ. at Chicago Circle, Chicago.
THE TWISTING AND STRETCHING OF A NONLINEAR ANNULUS INCLUDING THE EFFECT OF WRINKLING Ph.D. Thesis
Thomas Rivers Canfield 1980 95 p
Avail: Univ. Microfilms Order No. 8023235

The appearance of wrinkles on a thin membrane surface is an indication of the inability of the membrane to carry compressive stresses. To study the wrinkling phenomenon, the assumption that the principal membrane stresses are either tensile or zero is usually made, and the theory derived from such an assumption is the so-called tension field theory. It has been formulated and studied quite thoroughly by several authors, but mostly in the context of linear plane-stress theory. Our formulation is based upon the well-established finite plane-stress theory. The kinematics necessitated by the presence of wrinkles is considered via the introduction of a wrinkle strain tensor which gives a measure of the wrinkliness of a wrinkled surface. All the field equations are systematically derived. In particular, equations of equilibrium in terms of the true (first) Piola-Kirchoff stresses are employed. The theory is applied to the problem of twisting and stretching of an annular membrane. It is shown that for this problem the system of equations can be reduced to quadratures.

Dissert. Abstr.

N80-33765 Ohio State Univ., Columbus.
THE CHARACTERIZATION OF THE CRACK GROWTH BEHAVIOUR OF ALLOY IN-100 AT ELEVATED TEMPERATURE UNDER SUSTAINED LOAD Ph.D. Thesis

Robert Charles Donat 1980 362 p
Avail: Univ. Microfilms Order No. 8022259

Sustained load track growth in IN-100 at 1350 F (732 C) is studied using two specimen geometries, a standard compact tension specimen and a radially cracked ring loaded in tension. The effects of specimen thickness on the growth rate are investigated covering a range from 0.22 inch (5.6 mm) to 0.72 inch (18.3 mm) in thickness. Only the thinnest specimens show a crack growth rate which is lower than that obtained from all of the other thickness specimens. Stress intensity factor, net section stress, load line displacement rate and the C integral are investigated as possible crack growth rate correlating parameters. In addition, a crack driving force function is developed for a linear elastic creeping solid which represents the excess of energy available for creating new crack surfaces. In particular, the crack growth rate is observed to decrease from an initially higher value to a steady state rate which depends on the stress intensity factor, net section stress or load line displacement rate. In the correlation of the stress intensity factor, the magnitude of this initial growth rate is about double the steady state creep crack growth rate. Dissert. Abstr.

N80-33766 Cornell Univ., Ithaca, N. Y.
EFFECT OF SURFACE ELLIPTICITY ON DYNAMICALLY LOADED SPHERICAL AND CYLINDRICAL JOINTS AND BEARINGS Ph.D. Thesis
Pawan Kumar Goenka 1980 193 p
Avail: Univ. Microfilms Order No. 8020823

The finite element formulation for regular spherical and cylindrical bearings is extended to include irregular (nonspherical and noncylindrical) bearing surfaces. The formulation is limited to planar loads and displacements. The optimum bearing shape for a cylindrical bearing is sought for a specific duty cycle with a constant load and sinusoidal angular displacement. The optimization is done with a view to maximizing the minimum film thickness. The optimum shape (found only among elliptical irregularities) for a one dimensional cylindrical bearing is found to have a circular journal and an elliptical sleeve. For this optimum bearing the absolute minimum film thickness is about a factor of 36 higher as compared to the regular (cylindrical) bearing. The absolute maximum pressure for this optimum bearing is about a factor of 5 lower than that for the regular bearing. A similar performance improvement was found for an irregular spherical bearing over a regular spherical bearing. For both spherical and cylindrical bearings some example problems were solved with forces and angular displacements found in hip joints as duty data. Dissert. Abstr.

N80-33767 Cornell Univ., Ithaca, N. Y.
DESIGN FOR THE PREVENTION OF PROGRESSIVE COLLAPSE USING INTERACTIVE COMPUTER GRAPHICS Ph.D. Thesis
John Lewis Gross, III 1980 195 p
Avail: Univ. Microfilms Order No. 8020822

Accurate analytical techniques for simulating the actual behavior of structures up to and through collapse are described. The nonlinear analysis of elastoplastic planar frame structures subjected to nonproportional static joint loads is discussed. A computer program is described for the analysis of frame structures including beam-column action and the effects of shear walls and beam to column connections. Special attention is given to the material and geometric nonlinear effects that become important in the evaluation of structures in the damaged state. Interactive computer graphics are found to play an important part in generating the required structure data, monitoring the progress of an analysis and interpreting the results. Several examples which illustrate the use of the progressive collapse analysis system are presented. Dissert. Abstr.

N80-33768 Cornell Univ., Ithaca, N. Y.
THREE-DIMENSIONAL FINITE ELEMENT ANALYSIS OF CYCLIC FATIGUE CRACK GROWTH OF MULTIPLE SURFACE FLAWS Ph.D. Thesis
Corneliu Manu 1980 239 p
Avail: Univ. Microfilms Order No. 8020849

A numerical tool capable of dealing with interacting multiple surface flaws in a plate subjected to cyclic loading was studied. A consistent method for computing stress intensity factors from three dimensional quarter point element nodal displacement is presented. The method is generalized to permit a functional evaluation of stress intensity factors along the crack front. Embedded and surface crack problems are solved using the proposed technique. It was concluded in the experimental work that interacting multiple surface flaws in a plate subjected to cyclic loading accelerate the crack growth, leading to earlier breakthrough of the plate than in the case of a single surface flaw. The good agreement between the numerical result of the present work with the experimental result shows that through efficient three dimensional finite element analysis a good prediction of breakthrough life of a plate with interacting surface flaws subjected to cyclic loading can be obtained. Dissert. Abstr.

N80-33769 Georgia Inst. of Tech., Atlanta.
GENERAL NONLINEAR COMPUTER ANALYSIS OF FRAMED STRUCTURES Ph.D. Thesis
Michael Harry Swanger 1980 394 p
Avail: Univ. Microfilms Order No. 8023766

A member model is proposed which permits a description of both nonlinear geometric behavior and nonlinear material behavior (i.e., metal yielding) in three dimensional structural frame members. A member is characterized as an assembly of an arbitary number of beam column segments, each of which is represented as a finite element with six translational degrees of freedom and six rotational degrees of freedom. The beam column segment itself is idealized as a bundle of slender prismatic fibers which permits a relatively simple and straightforward description of the complex relationships between geometry, displacement, and material behavior associated with the general nonlinear frame analysis problem. A total frame analysis procedure is also included, which is basically a tangent stiffness method characterized by load incrementation and Newton-Raphson equilibrium iteration. Dissert. Abstr.

N80-33770 Colorado State Univ., Fort Collins.
FINITE ELEMENT ANALYSIS FOR ELASTO VISCO-PLASTIC MATERIALS Ph.D. Thesis
Yoji Shimazaki 1980 80 p
Avail: Univ. Microfilms Order No. 8022422

Solutions to the equations for steady state creeping elasto viscoplastic (Maxwell fluid) flow were investigated. As a simple but nontrivial example, a one dimensional radial flow problem was solved with particular attention being paid to the effects of the boundary conditions. A one dimensional finite element algorithm was developed for this problem. For use over a wide range of applications the same algorithm was used to develop a program for the analysis of two dimensional flows. This program includes an efficient method for the LDU decomposition of both symmetric and nonsymmetric matrices. The analysis of elastic strain rates effects during slab rolling was investigated as an example of the applicability of the two dimensional program. Dissert. Abstr.

N80-33771 Rutgers - The State Univ., New Brunswick, N. J.
A STUDY OF THE MAGNITUDE AND DISTRIBUTION OF THE STRESSES IN THE END-BLOCK OF A POST-TENSIONED PRESTRESSED CONCRETE BEAM Ph.D. Thesis
Christopher Benedict Komna Gadegbeku 1980 223 p
Avail: Univ. Microfilms Order No. 8022560

The problem of the effects of high concentration of stresses in the anchorage zone of a post tensioned prestressed concrete beam was investigated. The problem was idealized as that of the stress distribution due to the application of a circular concentrated load acting at one end of a circular cylinder. The theoretical analysis and experimental procedure that followed were simplified. The measurement of both surface and interior strains was carried out. The strains were converted into stresses using two and three dimensional stress-strain relationships. The results shown that the stresses in the end block are indeed three dimensional. Graphs for specific loading conditions show stress configurations which are in good agreement with those predicted by the approximate solutions. Dissert. Abstr.

N80-33772 Princeton Univ., N. J.
TIME SERIES ANALYSIS OF WIND LOADINGS ON HYPERBOLIC COOLING TOWERS Ph.D. Thesis

Dorothy Aubrey Reed 1980 251 p
Avail Univ Microfilms Order No. 8023833

Time series methods are used to characterize certain wind data collect on a hyperbolic cooling tower. The data consist of eleven time series of wind pressure-differences recorded around the circumference of a hyperbolic cooling tower and a set of wind velocities recorded by an anemometer located at the top of the tower. Transfer function models in both the frequency and time domains relating input wind velocity to output wind pressure-difference are obtained for the following three positions around the tower windward, approximately 100 degrees from windward, and rear. Time series parameters for existing longitudinal, lateral, and vertical fluctuating velocity spectra are obtained. Relationships between the cross-spectra of the pressure-difference and velocity are obtained from the transfer function models. Dissert Abstr

N80-33773 Texas Univ at Austin
IMPACT FORCE PREDICTION USING MEASURED FREQUENCY RESPONSE FUNCTIONS Ph.D. Thesis
Richard Joe Thornhill 1980 186 p
Avail Univ Microfilms Order No. 8021521

A method for impact force prediction using measured frequency response functions is investigated. The class of problems considered are those for which a mass, modeled as an ideal mass, experiences an elastic collision with a stationary structure. It is shown that a frequency response function measured at the point of collision on the structure together with the impactor's mass and velocity can be used to form a function which, after inverse Fourier transformation, is the impact force prediction. Nondimensionalized discrete models are examined to provide physical insight for applying the technique to real systems. Next the digital data processing phenomenon of time aliasing is examined and then a generalized spectral window is developed so that the technique can be used with a minicomputer which cannot perform a FFT having a large number of data points. Both predicted and measured impact forces are presented for a steel missile impacting a simple supported beam and an aluminum casting. A comparison of predicted to measured impact forces indicates that if the physical nonlinear contact stiffness is modeled as an ideal spring very good predictions are possible in terms of pulse duration and time-to-peak force. Dissert Abstr

N80-33774 Texas Univ at Austin
BEHAVIOR CLASSIFICATION OF SHORT REINFORCED CONCRETE COLUMNS SUBJECTED TO CYCLIC DEFORMATIONS Ph.D. Thesis
Kyle Andrew Woodward 1980 352 p
Avail Univ Microfilms Order No. 8021530

The behavior of reinforced concrete columns subjected to cyclic reversed deformations was studied. An experimental investigation (eleven tests), and the results of tests conducted elsewhere formed the basis for the development of a guide for classifying and predicting the behavior of columns subjected to load reversals. The eleven columns tested had one end translated bilaterally with respect to the other. Both ends were rotationally restrained. The columns were cyclically deflected along first one diagonal and then the other introducing bilateral forces onto the column. The condition of loading the specimen along two orthogonal axes made these tests unique and the first on short columns in which the amounts of longitudinal and transverse reinforcement were varied. The variation of longitudinal and transverse reinforcement, axial load, and loading history provided a test series in which a wide range of column behaviors were observed. The wide range of behavior provided a basic understanding of column response from which other test results could be evaluated. Dissert Abstr

N80-33775 Wayne State Univ., Detroit, Mich.
NONSTATIONARY RANDOM RESPONSE OF STRUCTURAL SYSTEMS TO AERODYNAMIC WIND FORCES Ph.D. Thesis
Harmahendar Singh 1980 114 p
Avail Univ Microfilms Order No. 8022791

Second order statistics of system response to unsteady aerodynamic wind forces of limited time duration are studied. Characteristics of severe climatic conditions are represented by modeling the wind velocity field as a time modulated nonstationary process. The theory of energy spectral density is described in formulating transient response of a simple system in nonstationary wind forces. The effect of the inertia force term, system characteristics and the parameters describing the wind field in system response is studied by parametric plots. The study indicates that the transient mean square response varies significantly from its steady state value for storms of relatively short span. Application of the nonstationary theory and minimization of system response over a constraint set of system design parameters are illustrated through a numerical example. Dissert Abstr

N80-33776 Texas Technological Univ., Lubbock.
GEOMETRICALLY NONLINEAR ANALYSIS OF RECTANGULAR GLASS PANELS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Abdul-Hamid Judi Al-Tayyib 1980 161 p
Avail Univ Microfilms Order No. 8022607

A refined finite element model is developed for the stress analysis of geometrically nonlinear, simply supported, uniformly loaded, rectangular glass plates. The need for such a model was prompted from failure of large rectangular glass panels installed in windows and exterior walls of modern high rise buildings subjected to high wind loadings. The acutal framing configurations of these glass panels allow the boundary edges to move in the plane of the plate with little restraint. When the loads become large, membrane behavior plays a significant role in changing the overall behavior of the glass plate. Numerical studies conducted on the glass plate problem revealed that the convergence of stresses to exact values differs between bending and membrane stresses, and depends on the fineness of the finite element discretization, the location within the plate, and the relative magnitude of the loading increment. This observation is valuable for analyzing geometrically nonlinear thin plate problems. Dissert Abstr

N80-33777*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STABILITY OF NONUNIFORM ROTOR BLADES IN HOVER USING A MIXED FORMULATION
Wendell B. Stephens (Army Research and Technology Labs., Moffett Field, Calif.), Dewey H. Hodges (Army Rsearch and Technology Labs., Moffett Field, Calif.), John H. Avila (Technology Development of California, Santa Clara), and Ru-Mei Kung (Technology Development of California, Santa Clara) Aug. 1980 23 p refs Presented at the 6th European Rotorcraft and Powered Lift Aircraft Forum, Bristol, England, 16-19 Sep. 1980
(NASA-TM-81226; A-8314; AVRADCOM-TR-80-A-10; Paper-13) Avail: NTIS HC A02/MF A01 CSCL 01C

A mixed formulation for calculating static equilibrium and stability eigenvalues of nonuniform rotor blades in hover is presented. The static equilibrium equations are nonlinear and are solved by an accurate and efficient collocation method. The linearized perturbation equations are solved by a one step, second order integration scheme. The numerical results correlate very well with published results from a nearly identical stability analysis based on a displacement formulation. Slight differences in the results are traced to terms in the equations that relate moments to derivatives of rotations. With the present ordering scheme, in which terms of the order of squares of rotations are neglected with respect to unity, it is not possible to achieve completely equivalent models based on mixed and displacement formulations. The one step methods reveal that a second order Taylor expansion is necessary to achieve good convergence for nonuniform rotating blades. Numerical results for a hypothetical nonuniform blade, including the nonlinear static equilibrium solution, were obtained with no more effort or computer time than that required for a uniform blade. Author

N80-33778*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MULTI-PARAMETER YIELD ZONE FOR PREDICTING SPECTRUM CRACK GROWTH
W. S. Johnson Sep. 1980 38 p refs Submitted for publication
(NASA-TM-81890) Avail: NTIS HC A03/MF A01 CSCL 20K

A systematic technique is presented for modeling crack growth load interaction effects due to spectrum loading. The Multi-

Parameter Yield Zone (NPYZ) model accounts for crack growth retardation, acceleration, and underload effects. The load interactions are attributed to the residual stress intensity due to the plastic deformation at the crack tip. Fatigue crack growth was predicted and compared with test data for a variety of spectrum loadings. Author

N80-33779# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
STRESS GRADIENTS AROUND NOTCHES
J. Schijve. Apr. 1980. 58 p.
(LR-297; ICAF-1160) Avail: NTIS HC A04/MF A01
Stress gradients at the root of a notch are significant for the notch effect and the size effect on fatigue properties. Usually the gradient of the stress distribution in the minimum section is considered. In the variation of the tensile stress along the edge of the notch is considered. Calculations are made for a variety of notches. The results indicate a remarkable conformity of stress distributions at the notch root if the same peak stress and notch root radius apply. Consequently the stress concentration factor and the notch root radius are highly characteristic for the stress distribution around the notch. Along the edge of the notch the stress decreases at a much slower rate than in the minimum section going away from the material surface. For the stress along the edge of the notch a stress gradient coefficient is defined. The variation of this coefficient is fairly small for several notches and stress concentration factor values. A 5 percent lower stress as compared to the peak stress at the notch root is obtained at about 0.02 notch root radius below the material surface and at a distance of about 0.18 notch root radius to the critical point along the material surface. Author

N80-33780# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
SOME FORMULAS FOR THE CRACK OPENING STRESS LEVEL
J. Schijve. Apr. 1980. 12 p. refs.
(M-368; ICAF-1161) Avail: NTIS HC A02/MF A01
Crack growth data for 2024-T3 sheet material were analyzed with different formulas for delta K sub eff as a function of the stress ratio R. The data covered R values from - 1.0 to 0.54. T.M.

N80-33781# Aeronautical Research Labs., Melbourne (Australia).
A ONE-PASS METHOD FOR COUNTING RANGE MEAN PAIR CYCLE FOR FATIGUE ANALYSIS
R. C. Fraser. Jun. 1979. 34 p. refs.
(ARL Struc-Note-454; AR-001-746) Avail: NTIS HC A03/MF A01
A one pass method for counting Range Mean Pair cycles is described. The Range Mean Pair Table which was used to represent the data generated by the method was considered with reference to its use in fatigue analysis. T.M.

N80-33782*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
NINTH NASTRAN USERS' COLLOQUIUM
Oct. 1980. 248 p. refs. Colloq. held in Cocoa Beach, Fla., 22-23 Oct. 1980
(NASA-CP-2151) Avail: NTIS HC A11/MF A01 CSCL 20K
The general application of finite element methodology and the specific application of NASTRAN to a wide variety of static and dynamic structural problems is addressed. Comparison with other approaches and new methods of analysis with nastran are included. For individual titles, see N80-33783 through N80-33795.

N80-33783*# Naval Ship Research and Development Center, Bethesda, Md.
NEW CAPACITIES AND MODIFICATIONS FOR NASTRAN LEVEL 17.5 AT DTNSRDC
Myles M. Hurwitz. *In* NASA. John F. Kennedy Space Center 9th NASTRAN Users' Colloq. Oct. 1980. p. 1-13. refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K
Since 1970 DTNSRDC has been modifying NASTRAN to suite various Navy requirements. These modifications include capabilities as well as user conveniences and error corrections. The new features added to NASTRAN Level 17.5 are described. The subject areas of the additions include magnetostatics, piezoelectricity, fluid structure interactions, isoparametric finite elements, and shock design for shipboard equipment. A.R.H.

N80-33784*# Hitachi Ltd., Tokyo (Japan).
IMPROVEMENTS IN SPARSE MATRIX OPERATIONS OF NASTRAN
Shinichiro Harano. *In* NASA. John F. Kennedy Space Center 9th NASTRAN Users' Colloq. Oct. 1980. p. 14-48. refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K
A 'nontransmit' packing routine was added to NASTRAN to allow matrix data to be refered to directly from the input/output buffer. Use of the packing routine permits various routines for matrix handling to perform a direct reference to the input/output buffer if data addresses have once been received. The packing routine offers a buffer by buffer backspace feature for efficient backspacing in sequential access. Unlike a conventional backspacing that needs twice back record for a single read of one record (one column), this feature omits overlapping of READ operation and back record. It eliminates the necessity of writing, in decomposition of a symmetric matrix, of a portion of the matrix to its upper triangular matrix from the last to the first columns of the symmetric matrix, thus saving time for generating the upper triangular matrix. Only a lower triangular matrix must be written onto the secondary storage device, bringing 10 to 30% reduction in use of the disk space of the storage device. A.R.H.

N80-33785*# Naval Underwater Systems Center, New London, Conn.
SOLUTION SENSITIVITY AND ACCURACY STUDY OF NASTRAN FOR LARGE DYNAMIC PROBLEMS INVOLVING STRUCTURAL DAMPING
A. J. Kalinowski. *In* NASA. John F. Kennedy Space Center 9th NASTRAN Users' Colloq. Oct. 1980. p. 49-62. refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K
Large dynamic problems involving NASTRAN SOLUTION 8 (i.e., the steady state dynamic response option wherein all response quantities vary as e sub i omega t, where omega is the driving frequency and t is time) are considered. Using a submerged steel plate with a viscoelastic layer layer as the bench mark sample, the solution sensitivity and solution accuracy are checked. The solution sensitivity is examined by running the same finite element model on different computers, different versions of NASTRAN, and different precision levels. The solution accuracy is evaluated for these same runs by comparing the NASTRAN results with the exact solution of the same problem. A.R.H.

N80-33786*# Naval Underwater Systems Center, New London, Conn.
RING ELEMENT DYNAMIC STRESSES
Nancy Lambert (Smith (A. O.) Engineering Systems) and Michael Tucchio. *In* NASA. John F. Kennedy Space Center 9th NASTRAN Users' Colloq. Oct. 1980. p. 63-78. ref (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K
The stresses in the CTRAPRG and CTRIARG ring elements are not calculated for any of the dynamic solutions in the current COSMIC version of NASTRAN. A DMAP alter sequence for Solution 8 and post-processing program, NASTPOST, are presented to calculate these stresses. Test cases are used which describe the method. The stiffness and the consistent versus concentrated mass problems ascribed to this element are reviewed. The DMAP alter sequence introduces Solution 8 displacements to a Solution 1 module to calculate real and imaginary stress components during the execution of Solution 8. The post-processor, NASTPOST, calculates the magnitude/phase stress results. The DMAP sequence was written specifically for level 52 MSC/NASTRAN, but can certainly be used for any COSMIC version with slight modification. A.R.H.

N80-33787*# Institut de Recherche de l'Hydro-Ontario. Civil Design Dept.
AN ENHANCEMENT OF NASTRAN FOR THE SEISMIC ANALYSIS OF STRUCTURES
John W. Burroughs. *In* NASA. John F. Kennedy Space Center

9th NASTRAN Users' Colloq. Oct. 1980 p 79-95 refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

New modules, bulk data cards and DMAP sequence were added to NASTRAN to aid in the seismic analysis of nuclear power plant structures. These allow input consisting of acceleration time histories and result in the generation of acceleration floor response spectra. The resulting system contains numerous user convenience features, as well as being reasonably efficient.
Author

N80-33788*# NKF Engineering Associates, Inc., Vienna, Va. Engineering Mechanics Div.
SOLUTION OF ENFORCED BOUNDARY MOTION IN DIRECT TRANSIENT AND HARMONIC PROBLEMS
Gary L. Fox *In* NASA. John F. Kennedy Space Center 9th NASTRAN Users' Colloq. Oct. 1980 p 96-120 refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The current versions of NASTRAN, i.e., NASA, MSC, and MAC support nonzero boundary displacements only in the static analysis. Forcing functions in the dynamic analysis formats allow only forces and pressures to exercise the mathematical model. A DMAP alter sequence to circumvent this limitation is described. For the direct harmonic problem, a simple change to module FRRD is incorporated to effect a more efficient use of the code.
J.M.S.

N80-33789*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE APPLICATION OF NONLINEAR LOAD ELEMENTS TO THERMAL ANALYSES USING THE NASTRAN THERMAL ANALYZER
Hwa-Ping Lee *In* NASA. John F. Kennedy Space Center 9th NASTRAN Users' Colloq. Oct. 1980 p 121-139 refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The nonlinear load elements in thermal analysis are used to simulate an undocumented nonlinear thermal boundary condition. The treatment of the nonlinearity arising from the temperature-dependent convective film coefficients is shown in detail. As an illustration, emphasis is placed on the modeling techniques and their interrelationships with the solution accuracy as affected by a specific integration algorithm of the transient thermal analysis used in the NASTRAN Thermal Analyzer. Briefly shown is the underlying theory on which the maneuvering of terms pertinent to the modeling depends. This demonstration provides some insight into the intricacies of the method that would be general to all applications. A recommendation is also made to modify a nonlinear load element that will enhance the solution capability and broaden the scope of application.
J.M.S.

N80-33790*# Tennessee Eastman Corp., Oak Ridge.
NASTRAN ANALYSIS OF HEAT-TRANSFER FLUID FILL PIPE FAILURE
J. Ronald Winter *In* NASA. John F. Kennedy Space Center 9th NASTRAN Users' Colloq. Oct. 1980 p 140-160 refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

An example that shows the difficulties of failure analyses and the advantage of the finite element method (NASTRAN) in assisting in determining the true cause of a failure is presented. In this example, cracks were developing along a pipe weld. After discarding several possible causes for the failures, it was finally determined that the problem was due to stress corrosion cracking associated with a rather unusual and novel environmental condition.
J.M.S.

N80-33791*# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A NASTRAN INVESTIGATION OF SIMULATED PROJECTILE DAMAGE EFFECTS ON A UH-1B TAIL BOOM MODEL
Arnold T. Futterer *In* NASA. John F. Kennedy Space Center 9th NASTRAN Users' Colloq. Oct. 1980 p 161-172 refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

A NASTRAN model of a UH-1B tail boom that had been designed for another project was used to investigate the effect on structural integrity of simulated projectile damage. Elements representing skin, and sections of stringers, longerons and bulkheads were systematically deleted to represent projectile damage. The structure was loaded in a manner to represent the flight loads that would be imposed on the tail boom at a 130 knot cruise. The deflection of four points on the rear of the tail boom relative to the position of these points for the unloaded, undamaged condition of the tail boom was used as a measure of the loss of structural rigidity. The same procedure was then used with the material properties of the aluminum alloys replaced with the material properties of T300/5208 high strength graphite/epoxy fibrous composite material, (0, + or - 45, 90)s for the skin and (0, + or - 45)s for the longerons, stringers, and bulk heads.
J.M.S.

N80-33792*# International Business Machines Corp., Rochester, Minn. General Systems Div.
FINITE CIRCULAR PLATE ON ELASTIC FOUNDATION CENTRALLY LOADED BY RIGID SPHERICAL INDENTER
S. K. Wadhwa and P. P. Yang *In* NASA. John F. Kennedy Space Center 9th NASTRAN Users' Colloq. Oct. 1980 p 173-190 ref (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The analytical solution of a finite circular plate on an elastic foundation centrally loaded by the rigid indenter is discussed. The procedure to use NASTRAN as a subroutine to iteratively converge to this solution numerically is described.
J.M.S.

N80-33793*# Army Armament Research and Development Command, Watervliet, N. Y.
ELASTIC-PLASTIC ANALYSIS USING A TRIANGULAR RING ELEMENT IN NASTRAN
P. C. T. Chen *In* NASA. John F. Kennedy Space Center 9th NASTRAN User's Colloq. Oct. 1980 p 190-200 refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

An elastic plastic triangular ring element is implemented in NASTRAN computer program. The plane strain problem of partially plastic thick walled cylinder under internal pressure is solved and compared with the earlier finite difference solution. A very good agreement has been reached. In order to demonstrate its application to more general problems, an overloaded thread problem for the British Standard Buttress is examined. The maximum axial and principal stresses are located and their values are determined as functions of loadings.
Author

N80-33794*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DEVELOPMENT AND ANALYSIS OF THE LEARJET 54/55 FUSELAGE NASTRAN MODEL USING SUBSTRUCTURE TECHNIQUES
Robert R. Boroughs, Sivam Paramasivam, and Joanna Werner *In its* 9th NASTRAN User's Colloq. Oct. 1980 p 201-223 refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

Development and analysis of the Learjet 54/55 fuselage NASTRAN model is presented. This structure was broken down into several substructures to make the modeling and analysis effort more manageable. Since the geometry was fairly complex in some areas and in order to provide flexibility for future configuration studies, a series of local coordinate systems were used to describe the model. This work was accomplished using several different computer systems, the more recent of which were connected by a high speed data communications lines to perform the tasks of model generation and NASTRAN analysis.
J.M.S.

N80-33795*# Naval Ship Research and Development Center, Bethesda, Md.
COMPARISON OF FINITE ELEMENT ANALYSIS OF A PIPING TEE USING NASTRAN AND CORTES/SA
Antonio J. Quezon and Gordon C. Everstine *In* NASA. John F. Kennedy Space Center 9th NASTRAN User's Colloq. Oct. 1980 p 224-242 refs (For primary document see N80-33782 24-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

A comparison of finite element analyses of a piping tee was made using NASTRAN and CORTES/SA, a modified version of SAP3 having a special purpose input processor for generating

geometries for a wide variety of tee joints. Four finite element models were subjected in force, moment, and pressure loadings. Flexibility factors and principal stresses were computed for each model and compared with results obtained experimentally by Combustion Engineering, Inc. Results from the NASTRAN analyses were in good agreement with experimental results for all loadings except internal pressure. The CORTES/SA analyses gave good results for the internal pressure loading, but poorer results for out of plane bending moments or forces resulting in out of plane bending. Two of the basic load cases in CORTES/SA were found to contain errors that could not be easily corrected. COST COMPARison of NASTRAN and CORTES/SA showed NASTRAN to be less expensive to two than CORTES/SA for identical meshes. J.M.S.

N80-33796# Aeronautical Research Labs., Melbourne (Australia).
THE STRESS-WAVE RADIATION FROM GROWING CRACKS
L. R. F. Rose. Aug. 1979. 22 p. refs.
(ARL/Mat-Rept-112; AR-001-756) Avail: NTIS HC A02/MF A01

Formulas are given for the stress discontinuities radiated by a suddenly starting two dimensional crack under tension, in an ideal elastic body. These formulas also give, with a change in sign, the stress discontinuities radiated by a suddenly stopping crack, and, with a geometrical deformation, those radiated by a three dimensional crack. The stress in the primary radiation due to short crack jumps is shown to vary in the same manner as does the crack speed during the jump. The diffraction of the primary radiation from one tip of a center crack by the other tip produces a secondary radiation, whose properties depend mainly on the nature of the surface wave associated with the primary radiation. This first diffraction can lead to crack extension. If it is possible to isolate the primary radiation experimentally, it should give the essential characteristics of the source. This could be used to separate source characteristics from specimen and transducers effects in acoustic emission studies of fatigue cracking or stress corrosion cracking. S.F.

N80-33797# Aeronautical Research Labs., Melbourne (Australia).
A CRACK OPENING DISPLACEMENT APPROACH TO CRACK PATCHING
R. Jones and R. J. Callinan. Oct. 1979. 13 p. refs.
(ARL/Struc-Note-455; AR-001-768) Avail: NTIS HC A02/MF A01

A correlation was observed between the reduction of the opening of a patched crack, at any point along the crack, and the reduction in the stress intensity factor due to patching. This raises the possibility of using crack opening displacement measurements as a measure of patch efficiency. The results of a numerical investigation into crack patching indicate that a modified form of the crack opening displacement approach may be useful in estimating the effect that fiber composite patches have on cracks in thin sheets. E.D.K.

N80-33798# Aeronautical Research Labs., Melbourne (Australia).
A DESIGN STUDY IN CRACK PATCHING
R. Jones and R. J. Callinan. Jul. 1979. 20 p.
(ARL/Struc-Rept-376) Avail: NTIS HC A02/MF A01

A numerical investigation into the behavior of cracked sheets which are patched with an overlay of composite material, is presented. Guidelines as to the optimum location, size, and shape of patches are given. The main considerations are: reduction in the stress intensity factors at the crack tip, the maximum fiber stress in the patch and the maximum shear stress in the adhesive bond between patch and sheet. R.K.G.

N80-33799# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
BIREFRINGENT COATING TECHNIQUE, PHOTOELASTIC STRESS ANALYSIS
28 Aug. 1980. 18 p.
(AD-A088657; TOP-1-2-605) Avail: NTIS HC A02/MF A01 CSCL 11/3

This report describes the birefringent coating technique of photoelastic evaluation of surface stress. Included are test equipment and instrumentation, calibration tests, static and dynamic loading, and photographic requirements. GRA

N80-33800# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
THE EQUILIBRIUM FIELD NEAR THE TIP OF A CRACK FOR FINITE PLANE STRAIN OF INCOMPRESSIBLE ELASTIC MATERIALS
Rodney A. Stephenson. Jul. 1980. 71 p. refs.
(Contract N00014-75-C-0196)
(AD-A088838; TR-44) Avail: NTIS HC A04/MF A01 CSCL 20/11

This investigation is concerned with the deformations and stresses in a slab of all-around infinite extent containing a traction-free plane crack, under conditions of plane strain. The analysis is carried out within the framework of the fully nonlinear equilibrium theory of homogeneous and isotropic incompressible elastic solids. For a fairly wide class of such materials and general loading conditions at infinity, asymptotic estimates appropriate to the various field quantities near the crack-tips are deduced. For a subclass of the materials considered, these results - in contrast to the analogous predictions of the linearized theory - lead to the conclusion that the crack opens up in the neighborhood of its tips even if the applied loading is antisymmetric about the plane of the crack, (e.g., Mode 2 loading). It is shown further that the nonlinear global crack problem corresponding to such a loading in general cannot admit an antisymmetric solution. GRA

N80-33801# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
EXPERIMENTAL INVESTIGATION OF THE CRACK GROWTH GAGE. Final Report, Jan. 1978 - Nov. 1979
Donald R. Holloway. Jun. 1980. 100 p. refs.
(AF Proj. 2401)
(AD-A089137; AFWAL-TR-80-3045) Avail: NTIS HC A05/MF A01 CSCL 20/11

The objective of this program was to determine the feasibility of the crack growth gage as a more direct method for monitoring potential crack growth damage in fatigue critical areas of F-4 aircraft structure. The major task consisted on mounting crack growth gages on a full-scale F-4C/D fatigue test article and collecting crack growth data from the gages at specified intervals. Two additional tasks were comprised of (1) conducting a gage qualification test program in accordance with MIL-STD-810C (Environmental Test Method) requirements, and (2) determining an appropriate method for collecting data from the gage. Inconsistencies in constant amplitude test results and bonding problems encountered on the F-4C/D full-scale fatigue test article prevented the MIL-STD-810C qualification tests from being started. Results of this investigation indicated that further research and development of the crack growth gage concept is required before the gage can be recommended as a fleetwide tracking device. GRA

N80-33802# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mathematics.
ON THE DYNAMIC ENERGY RELEASE RATE IN ELASTIC CRACK PROPAGATION. Interim Report
Morton E. Gurtin and Chikayoshi Yatomi. Dec. 1979. 36 p. refs.
(Grant AF-AFOSR-3013-76; AF Proj. 2307)
(AD-A089119; TR-14; AFOSR-80-0685TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

It is the purpose of this paper to give a unified treatment of the dynamic energy release rate, E, for a sharp, straight crack in a hyperelastic body undergoing finite strain. As our main result we decompose E into the usual quasi-static energy release rate plus a nonpositive dynamic contribution; thus for a dynamic solution the energy release rate computed using the classical quasi-static formula is larger than the actual dynamic energy release rate. GRA

N80-33803# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mathematics.
ON IRWINS AND ACHENBACHS EXPRESSIONS FOR THE ENERGY RELEASE RATE
Chikayoshi Yatomi. Dec. 1979. 12 p. refs.
(Grant AF-AFOSR-3013-76; AF Proj. 2307)
(AD-A089118; TR-15; AFOSR-80-0686TR) Avail: NTIS HC A02/MF A01 CSCL 20/11

Using a constitutive equation and anti-plane shear field introduced by Knowles, we show that the expressions of Irwin and Achenback for the energy release rate are not generally valid for nonlinear elastic materials. GRA

N80-33804# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mathematics.
THE EFFECT OF SURFACE ENERGY ON TEMPERATURE RISE AROUND A FAST RUNNING CRACK
Chikayoshi Yatomi 16 Jun. 1980 13 p refs
(Grant AF-AFOSR-3013-76; AF Proj. 2307)
(AD-A088756; TR-17; AFOSR-80-0684TR) Avail: NTIS HC A02/MF A01 CSCL 20/13

Using a local balance law developed by Gurtin for the cohesive zone, we give a system of equations governing the temperature rise around a fast running crack. We note that the effect of surface temperature cannot be neglected for a fast running crack, and we discuss the equations under simplifying assumptions. In particular, assuming that the surface temperature is much higher than the surrounding temperature, we arrive at a simple solution in closed form. This solution agrees with experimental results of Fuller, Fox, and Field for polymethyl methacrylate showing that the temperature rise at the crack tip is independent of crack speed. GRA

N80-33805# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mathematics.
NOTE ON THE ENERGY RELEASE RATE FOR A CRACK STARTING FROM THE APEX OF A WEDGE
Chikayoshi Yatomi 16 Jun. 1980 8 p refs
(Grant AF-AFOSR-3013-76; AF Proj. 2307)
(AD-A089116; TR-16; AFOSR-80-0681TR) Avail: NTIS HC A02/MF A01 CSCL 20/11

Griffith was apparently the first to employ the energy release rate 'G' as a critical condition of crack extension. In this note we will show, however, that if a crack starts from the apex of a wedge, the initial value of 'G' is zero, although the stresses at the crack tip are unbounded. This example suggests that you cannot use the initial energy release rate as a critical condition of crack extension unless the opening-angle of the crack faces in the reference is precisely zero. Since the order of the singularity of the strain energy density is less than one, this result may be predicted mathematically but it is not trivial physically. We confine our problem to a simple mode 2 crack; the given solutions are then simple and of closed-form so that we can examine the precise dependence of 'G' on the crack length a. To the author's knowledge, no such closed-form solutions for an arbitrary crack length a have been presented. GRA

N80-33806# State Univ. of New York at Buffalo. Dept. of Engineering Science.
ELASTIC PLATE VIBRATIONS BY BOUNDARY INTEGRAL EQUATIONS. PART 1: INFINITE PHASE
Richard Paul Shaw Jun. 1980 14 p
(Contract N00014-71-C-0108)
(AD-A089105; TR-10915) Avail: NTIS HC A02/MF A01 CSCL 20/11

One of the prime difficulties in developing two dimensional dynamic elastic plate theories from the three dimensional equations of elasticity is the choice of functional dependence on the thickness coordinate. This difficulty may be circumvented by formulating the problem first as a boundary integral equation, then the dependence on the independent variable through the plate thickness follows form as a direct quadrature with no assumptions of functional form required. In particular, the examination of separate symmetric and antisymmetric modes allows the boundary integral equation to be written with unknowns evaluated on a single surface. GRA

N80-33807# Naval Ship Research and Development Center, Bethesda, Md. Ship Materials Engineering Dept.
ANALYSIS OF RESIDUAL STRESSES RESULTING FROM COLD ROLLING OF NOTCHES AND THEIR EFFECT ON FATIGUE BEHAVIOR
M. G. Vassilaros Aug. 1980 41 p refs
(AD-A089110; DTNSRDC/SME-80/23) Avail: NTIS HC A03/MF A01 CSCL 13/8

The effects of cold forming on the fatigue behavior of threads were analyzed using slip-line field and finite element analyses. Bolt threads were simulated using notched rotating cantilever-beam fatigue specimens of Inconel 718. The slip-line fields for wedge indentations, with some modifications, were used to analyze the deformation process of notch rolling. Stresses on the deepest slip lines were used in an elastic finite element analysis of the internal stresses existing outside the slip-line field during deformation. Negatives of the loads on the notch surface from the indentor were used in a second elastic finite element analysis to determine the internal stresses resulting from unloading. These two stress analyses, with a correction for yielding, were employed to map the residual stress distribution around the rolled notch. The predicted residual stress distribution showed an intense compressive region below the notch root. This stress distribution was then used to rationalize the fatigue crack propagation behavior of Inconel 718 rotating cantilever-beam fatigue specimens with rolled and machined notches. J.M.S.

N80-33808# Lockheed Missiles and Space Co., Palo Alto, Calif.
INELASTIC RESPONSE OF AN INFINITE CYLINDRICAL SHELL TO A TRANSIENT ACOUSTIC WAVE Final Report, 1 Aug. 1977 - 31 Mar. 1979
T. L. Geers and C.-L. Yen Mar. 1979 43 p refs
(Contract N00014-77-C-0562; RR0230301)
(AD-A088597; LMSC-D676214) Avail: NTIS HC A03/MF A01 CSCL 20/11

An analytical/computational technique developed for determining the geometrically and constitutively nonlinear response of an infinite cylindrical shell to a transverse, transient acoustic wave is described. Shell behavior is treated through utilization of the nonlinear structural analyzer DYNAPLAS II, while the fluid structure interaction is treated in accordance with both the exact residual potential formulation and the doubly asymptotic approximation. Numerical results produced through application of the approximation differ significantly from the corresponding exact results. M.G.

N80-33809# National Technical Information Service, Springfield, Va.
MATHEMATICAL ANALYSIS OF STRESS CRACKS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jun. 1980
Guy E. Habercom, Jr. Jul. 1980 146 p Supersedes NTIS/PS-79/0804; NTIS/PS-78/0768
(PB80-813447; NTIS/PS-79/0804; NTIS/PS-78/0768) HC $30.00/MF $30.00 CSCL 20K

Stress cracks are analyzed by mathematical methods, including extensive use of finite element analysis. Various materials, including metals, wood, composites, and rock are investigated. This updated bibliography contains 140 citations, 22 of which are new entries to the previous edition. GRA

N80-33810# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
STRESS INTENSITY DISTRIBUTIONS FOR NATURAL FLAW SHAPES APPROXIMATING BENCHMARK GEOMETRIES
C. W. Smith, W. H. Peters, G. C. Kirby, and A. Andonian (Illinois Univ., Chicago Circle) Feb. 1980 32 p refs Submitted for publication
(Contract NSF ENG-78-20824)
(PB80-200785; VPI-E-80-17) Avail: NTIS HC A03/MF A01 CSCL 20K

An experimental technique which couples the field equations of linear elastic fracture mechanics with the frozen stress photoelastic method for generating natural flaw shapes and their corresponding stress intensity distributions is described. The application of this technique to two surface flaw geometries approximating benchmark geometries is discussed and the results are compared with the recent literature in order to assess the validity of the semi-elliptic flaw shape assumption for the surface flaw in numerical models and to quantify any observed deviations. GRA

42 GEOSCIENCES (GENERAL)

N80-33811# World Meteorological Organization, Geneva (Switzerland).

OROGRAPHIC EFFECTS IN PLANETARY FLOWS Global Atmospheric Research Program
R. Hide, ed. and P. W. White, ed. Jun. 1980 260 p refs Prepared in cooperation with International Council of Scientific Unions, Rome (Italy)
(GARP-Publ-23) Avail: NTIS HC A12/MF A01; WMO, Geneva SWFR 40

Topics discussed include the influence of orography on atmospheric general circulation; planetary waves; orographically enhanced rain; mountain waves and momentum flux; modification of the boundary layer by orography; the effects of bottom topography on ocean currents; cyclogenesis in the lee of mountains and its modeling; laboratory studies of topographic effects in fluids; mesoscale orographic effects revealed by satellites; orographically controlled cross-equatorial flow; and orographic effects in the atmospheres of other planets. For individual titles, see N80-33812 through N80-33822.

N80-33812# National Center for Atmospheric Research, Boulder, Colo.
INFLUENCE OF OROGRAPHY ON THE ATMOSPHERIC GENERAL CIRCULATION c46
Akira Kasahara *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 1-49 Sponsored by NSF (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

Various effects of the large-scale mountain complexes on the atmospheric general circulation are reviewed. Based on the statistics of cyclogenesis in the Northern Hemisphere, evidence is presented concerning the orographic influence on large-scale motions. Theoretical and numerical studies of the influence of orography on atmospheric circulation are discussed by considering the dynamical and thermal factors individually and then their combined effect. Problems in prediction models discussed range from the representations of orographic effects of both large-scale and subgrid-scale to data analysis in the vicinity of mountains. Four prominent weather and climatological phenomena related to large-scale mountain complexes; the onset of the Southeast summer monsoon, tropospheric blocking processes, stratospheric sudden warmings, and lee cyclogeneses are described.
Author (ESA)

N80-33813# National Center for Atmospheric Research, Boulder, Colo.
PLANETARY WAVES: THEORY AND OBSERVATION c46
Robert E. Dickinson *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 51-84 refs (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

The dynamics of planetary waves and their observational characteristics are reviewed and the tropospheric sources of these waves are summarized. The characteristic structures to be expected for waves excited by different sources are explained by means of linear perturbation theory. It is shown that improved understanding of planetary waves in general will require improved understanding of the long-term monthly mean stationary waves in the troposphere. Between hemispheres, there are remarkable differences of the Fourier longitudinal wavenumber one and seasons that are poorly understood. The orographic and diabatic forcing terms for planetary waves are examined. It is pointed out that thermal infrared radiation is likely important for planetary wave structure. The response to orography of barotropic and continuously stratified planetary wave models is discussed. Besides exhibiting different dependences on wavenumber, the two models are very different in their sensitivity to Ekman friction.
Author (ESA)

N80-33814# Royal Signals and Radar Establishment, Malvern (England). Meteorological Office Radar Research Lab.
STRUCTURE, MECHANISM AND PREDICTION OF OROGRAPHICALLY ENHANCED RAIN IN BRITAIN c47
K. A. Browning *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 85-114 refs revised (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

The horizontal distribution and vertical structure of orographic rain are discussed. It is shown that orographic rain is difficult to measure by means of raingage networksor by radar. The observational evidence reviewed supports the widespread applicability of a conceptual model by Bergerson, according to which small droplets in a low level orographic 'feeder cloud' located mainly below the 0 C level are washed out by raindrops falling from a pre-existing 'seeder cloud'. A numerical treatment of the washout process provides a sound basis for deriving dynamically simple models for predicting the distribution of orographic rain. Such models can be driven by the output from large scale dynamical models capable of predicting the background conditions in the absence of detailed orography. A test of one such combination of models shows good skill in predicting 24 h rainfall accumulations over hills. To predict the time variation in the period 0 to 6 h ahead, it is necessary to supplement the numerical models by radar observations of precipitation patterns upwind of the forecast area.
Author (ESA)

N80-33815# National Center for Atmospheric Research, Boulder, Colo.
MOUNTAIN WAVES AND MOMENTUM FLUX c47
J. B. Klemp and D. K. Lilly *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 115-141 (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

Mountain wave scales which produce the primary contributions to the momentum flux are those large enough so nonhydrostatic effects are not dominant, and small enough that rotation does not dominate. The properties of the linear equations are described with appropriate simplifications, and a classification of mountain waves is presented, based on horizontal scale. The validity and limitations of hydrostatic irrotational mountain wave theory are treated. Factors influencing hydrostatic irrotational mountain wave amplitude and associated momentum transport examined include the effect of vertical variations in mean state, terrain shape and height. Results from instrumented aircraft flights over the Rocky Mountains in Colorado, including data from the wave momentum flux experiment (WAMFLEX), are compared with theory.
Author (ESA)

N80-33816# Atmospheric Environment Service, Ottawa (Ontario). Boundary Layer Research Div.
MODIFICATION OF THE BOUNDARY LAYER BY OROGRAPHY c44
P. A. Taylor and P. R. Gent (National Center for Atmospheric Research, Boulder, Colo.) *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 143-165 In FRENCH (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

Velocity shears and turbulent heat and momentum transfers within the boundary layer strongly influence the interactions between orography or topography and atmospheric flow. Pressure or form drag on hills can arise in neutrally stratified flow with velocity shear as well as in stably stratified situations while heating or cooling on sloping surfaces may produce strong local wind effects. These processes are discussed primarily in the context of models of flow over hills of length scale 10 km or less when boundary layer influence will be most pronounced, however, some larger scale features are included. Among the primary reasons for studying these flows are predictions of 'speed up', separation, and drag.
Author (ESA)

N80-33817# Woods Hole Oceanographic Institution, Mass.
EFFECTS OF BOTTOM TOPOGRAPHY ON OCEAN CURRENTS c48
Nelson G. Hogg *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 167-206 refs (For primary document see N80-33811 24-42)
(Contract N00014-76-C-0197; Grant NSF OCE-78-25405; NR Proj. 083-400)
Avail: NTIS HC A12/MF A01

The theoretical literature concerning steady flow of a rotating fluid past obstacles is reviewed with emphasis on effects of stratification. Obstacles are classified as seamounts, islands and ridges and within the last group channel flow is also considered. Small amplitude topography can produce O(1) relative vorticity - the key parameter being the ratio of the fractional

change in water depth to the Rossby number. If this parameter is greater than some number of O(1) enough relative vorticity can be produced to cause closed streamlines over the obstacle, at least in problems where cross stream variations are allowed. This closed streamline pattern decays with height at a rate which depends on the stratification and can be considered a generalized Taylor column. Inclusion of the latitudinal variation of the vertical component of the Earth's rotation (beta effect), upsteam shear, a bottom slope or channel walls permits stationary, lee-wave production. Author (ESA)

N80-33818# European Centre for Medium-Range Weather Forecasts, Reading (England).
CYCLOGENESIS IN THE LEE OF OROGRAPHY AND ITS NUMERICAL MODELING WITH SPECIAL REFERENCE TO THE ALPS **c47**
S. Tibaldi. *In* WMO. Orographic Effects in Planetary Flows. Jun. 1980. p 207-232. refs. Presented at the GFD Symp.of the 5th EGS Meeting, Strasbourg, France, 29 Aug. - 1 Sep. 1978. Revised (For primary document see N80-33811 24-42)
Avail: NTIS. HC A12/MF A01

The phenomenology of cyclogenesis in the lee of mountain ranges is reviewed and a possible mechanism is discussed which consists of a secondary baroclinic instability triggered on a large-scale wave by the interaction between the low-level flow and the mountain. This will occur only when the perturbation caused by the presence of the obstacle is be sufficiently intense and will act on a basic state (the large-scale wave) where enough available potential energy can be converted into kinetic energy of the eddy. Idealized numerical experiments are reviewed, and it is shown that the phenomenological explanations for cyclogenesis in the literature are consistent with the results from numerical modeling. Comparisons of two real data simulations show that both failed to describe correctly the upper tropospheric development. The experiments seem to confirm the existence of a trigger phase and a baroclinic phase in cyclogenesis, and a separation of the phenomena into two distinct lower tropospheric and upper troposoheric developments. Author (ESA)

N80-33819# Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Atmospheric Physics.
LABORATORY STUDIES OF TOPOGRAPHIC EFFECTS IN ROTATING AND/OR STRATIFIED FLUIDS **c46**
P. G. Baines and P. A. Davies (Newcastle-upon-Tyne Univ., England). *In* WMO. Orographic Effects in Planetary Flows. Jun. 1980. p 233-299. refs (For primary document see N80-33811 24-42)
(Grant NSF OCE-78-19833)
Avail: NTIS. HC A12/MF A01

All significant laboratory experiments were reviewed which deal with flow past obstacles of various shapes, where these experiments are relevant to motions in the atmosphere and ocean. Only steady or nearly steady flows were considered. Theoretical studies are described where a direct comparison with experimental results is possible. The subject divides into three sections: stratified flows without rotation, rotating homogeneous flows, and rotating stratified flows. Stratified flow experiments include single and multilayer flow, and continuously stratified flow over two and three dimensional barriers. Rotating homogeneous flow experiments dealing with the interior region of the flow include steady uniform and nonuniform flow, flow over isolated obstacles, dimensional obstacles, time dependent flows; and the beta effect. Downstream effects, and experiments with spherical geometry are also considered. Rotating stratified flow experiments with steady uniform flows, flow structure, drag measurements, and nonuniform flows are described. Author (ESA)

N80-33820# Oslo Univ. (Norway). Inst. of Mathematics.
OROGRAPHIC EFFECTS REVEALED BY SATELLITE PICTURES: MESOSCALE FLOW PHENOMENA **c46**
B. Gjevik. *In* WMO. Orographic Effects in Planetary Flows. Jun. 1980. p 301-316. refs (For primary document see N80-33811 24-42)
Avail: NTIS. HC A12/MF A01

Satellite observations of mesoscale flow phenomena are reviewed and analyzed, in particular: vortex trails and vortex shedding in the lee of islands, lee-waves due to isolated mountain peaks and complex topographic formations. Atmospheric data obtained by other sounding techniques are included in the analysis. Some theoretical and laboratory studies relevant for the interpretation of the data are reviewed and some unresolved problems are identified. Satellite pictures are presented in order to illustrate special orographic effects. Author (ESA)

N80-33821# Australian Numerical Meteorology Research Center, Melbourne.
OROGRAPHICALLY CONTROLLED CROSS-EQUATORIAL FLOW **c46**
David L. T. Anderson. *In* WMO. Orographic Effects in Planetary Flows. Jun. 1980. p 317-355. refs (For primary document see N80-33811 24-42)
Avail: NTIS. HC A12/MF A01

Synoptic analyses, results from models, and theoretical studies of the low level jet stream of the Indian Ocean are presented. In both winter and summer, the strongest cross-equatorial flow is in the west at about 40 deg E regardless of the direction of the flow, probably because of the barrier of the mountains of East Africa. Transient features, diurnal variations, and individual jet streams are associated with the flow. It appears that the flow is driven by the Mascarene high monsoon trough system. It is shown that a divergence, simulates many of the characteristics of the low level jet. Author (ESA)

N80-33822# Washington Univ., Seattle. Dept. of Atmospheric Sciences and Geophysics Group.
OROGRAPHIC EFFECTS IN THE ATMOSPHERES OF OTHER PLANETS **c91**
Conway B. Leovy. *In* WMO. Orographic Effects in Planetary Flows. Jun. 1980. p 357-370. refs (For primary document see N80-33811 24-42)
Avail: NTIS. HC A12/MF A01

The effects of Martian topography are considered. Smoothed to a resolution of 500 km surface features show a total variation more than a scale height. Parameters relevant to topographically forced waves are compared for Earth and Mars. Low frequency, planetary scale Martian orographic disturbances are discussed with reference to atmospheric models, only one of which includes the effects of suspended dust. The evidence for topographically forced internal gravity waves is examined along with evidence for thermally driven diurnal and semidiurnal atmospheric tides. Indications of gravity waves on Venus are mentioned. Meteorological data from the Viking lander are presented which show evidence for the occurence of wind oscillations driven by diurnally varying horizontal temperkature gradients over the slope, and wind oscillations driven by diurnally varying coupling between low level winds and winds aloft due to diurnally varying static stability. Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-33823 Louisiana State Univ. and A&M Coll., Baton Rouge.
A QUANTITATIVE EVALUATION OF LANDSAT FOR MONITORING SUSPENDED SEDIMENTS IN A FLUVIAL CHANNEL. Ph.D. Thesis
Soon Tae Kim. 1980. 142 p.
Avail: Univ. Microfilms. Order No. 8021752

The utility of LANDSAT Multispectral Scanner (MSS) digital data for monitoring suspended sediment concentrations in a natural river channel was determined. Specific purposes of the study were: to investigate vertical distribution of suspended sediment concentrations at the cross section of the river channel; to develop a method of eliminating environmental effects from the MSS digital data obtained during successive LANDSAT overpasses; to evaluate the statistical properties of MSS digital data as related to suspended sediment concentrations in the surface layers of a natural river, and to evaluate the feasibility of estimating suspended sediment concentrations in entire depth

of the river channel via LANDSAT MSS digital data.
Dissert. Abstr.

N80-33824 Colorado Univ. at Boulder.
A MULTI-STEP METHOD FOR AVALANCHE ZONE RECOGNITION AND ANALYSIS Ph.D. Thesis
Thomas Patrick Huber 1980 183 p
Avail: Univ. Microfilms Order No. 8021587

Analytical tools were used to determine avalanche areas and runout zone limits in the Silverton Quadrangle, Colorado, which is located in the central San Juan Mountain Range. Vegetation and geomorphic features were analyzed by the use of natural color and color infrared aerial imagery to produce map. The geomorphology of avalanche runout zones was used to verify and rectify the preceeding mapped areas. The more distinctive features of this morphology included the concave longitudinal profile of the slope, the impact evidence across valleys, and the prominent convex transverse profile. This latter feature is primarily due to the deposition of impounded detritus by the snow avalanche. Finally the changes in soil development brought about by renewed deposition of this detritus were analyzed. It was shown that soil profile differences can be used to delimit the zone of avalanche modification and, therefore, the zone of greatest hazard.
Dissert. Abstr.

N80-33825 Johns Hopkins Univ., Baltimore, Md.
A WATERSHED INFORMATION SYSTEM Ph.D. Thesis
Anton Gaarde Thomsen 1980 167 p
Avail: Univ. Microfilms Order No. 8022427

A watershed information system for the analysis and simulation of mountain watersheds is described. Watershed information on topography, vegetation, and soils in digital terrain models (overlays) serve as the data base for watershed analysis, classification of snow in LANDSAT imagery, and automatic generation of parameter decks for operating distributed simulation models of snow cover dynamics and streamflow generation. The computer programs that generate the parameter decks have built-in calibration options for all major processes, that permit fast model calibration from an interactive computer terminal, on watersheds with varying characteristics. Snow processes are simulated within square (5.76 ha) grid cell elements. The hydrograph resulting from spring snowmelt is simulated by a lateral flow model of streamflow generation driven by the simulated spatially distributed imput (snowmelt and rain). Options are available for simulating the effects of forest management alternatives (thinning, clearcutting) on selected forest stands.
Dissert. Abstr.

N80-33826 Colorado State Univ., Fort Collins.
GROUND WATER MONITORING STRATEGIES TO SUPPORT COMMUNITY MANAGEMENT OF ON-SITE HOME SEWAGE DISPOSAL SYSTEMS Ph.D. Thesis
James Douglas Nelson 1980 143 p
Avail: Univ. Microfilms Order No. 8022416

Ground water monitoring strategies were developed by combining deterministic and probabilistic approaches. The variables which need to be considered in such a monitoring program are discussed. Two types of monitoring are defined which need to be incorporated into an overall management plan. Inspection monitoring refers to the monitoring of individual systems to determine if they are exceeding their design discharge of pollutants to the ground water. Trend monitoring is defined as the monitoring which detects over time and space the cumulative effect of a management agencies pollution control efforts. Inspection monitoring strategies are developed in terms of the sampling frequencies necessary to obtain a specific probability of detecting system failure. A mathematical model describing the flow of pollutants through the leach field is developed for the purpose of evaluating sampling plans and a sensitivity analysis is performed to determine the effect of varying the parameters of the system and the input to the leach field.
Dissert. Abstr.

N80-33827 University of Southern California, Los Angeles.
RELATIVISTIC ELECTRON PRECIPITATION: AN OBSERVATIONAL STUDY Ph.D. Thesis
Leopold Joseph Andreoli 1980 320 p
Avail: Univ. Microfilms Order No. 8023268

The morphology of strong diffusion relativistic electron precipitation mechanism and determining atmospheric consequences, were investigated. Analysis of 14 months of magnetic electron spectrometer and proton telescope data from the Air Force S3-3 satellite from July 1976 to September 1977 is presented. Analysis techniques and data catalogues are presented in detail. Three distinct classes of REP's were discovered: precipitation in large range of energies below 1 MeV for electrons with concurrent proton precipitation; electron and proton precipitation occuring only at energies above 1 MeV; and electrons precipitated only at energies below a few hundred KeV.
Dissert. Abstr.

N80-33828 Texas A&M Univ., College Station.
DEVELOPMENT OF A SOIL MOISTURE MODEL FOR USE WITH PASSIVE MICROWAVE REMOTE SENSORS Ph.D. Thesis
Walter Charles Bausch 1980 185 p
Avail: Univ. Microfilms Order No. 8023014

Soil moisture profiles were simulated for a hypothetical loamlike soil with a water and heat balance model. Expected X-band and L-band radiometer response to these conditions were simulated by a radiative transfer model. From these simulations, a model was developed to estimate soil water content in two layers of a 1.5 m soil profile. This model was tested with measurements of soil water content and soil temperature collected during the four seasons of the year in a sandy loam soil contained in an array of lysimeters. X-band and L-band emissivities required in the predictor equations were calculated by the radiative transfer model from measured soil moisture and soil temperature data. The technique developed from simulated results to classify inverted soil moisture profiles was found to be seasonally dependent. It was also found that the second layer algorithm showed seasonal dependence. Predictions of soil water content in the top 21 cm of the soil profile from L-band emissivity calculated by the radiative transfer model occasionally conformed with measured soil water content.
Dissert. Abstr.

N80-33829*# Freiburg Univ. (West Germany). Geographisches Inst.
THE INFLUENCE OF TOPOGRAPHIC STRUCTURES ON NIGHT-TIME SURFACE TEMPERATURES: EVALUATION OF A SATELLITE THERMAL IMAGE OF THE UPPER RHINE PLAIN AND THE SURROUNDING HIGHLANDS
Hermann Gossmann, Principal Investigator Ispra, Italy Joint Research Centre of the European Communities Jun. 1980 63 p refs In GERMAN; ENGLISH summary Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'.
HCMM
(E80-10228; NASA-CR-163543) Avail: NTIS
HC A04/MF A01 CSCL 05B

The author has identified the following significant results. Satellite data supplied the same information as aerial IR registrations with corresponding averaging for all studies requiring a survey of the thermal pattern within an area measuring 10 km x 10 km or more, provided that sufficiently precise control points could be established for the purpose of geometric rectification in the surroundings of the area observed. Satellite thermal data are more comprehensive than aircraft data for studies on a regional, rather than a local scale, since airborne images often obscure the basic correlation in thermal patterns because of a variety of irrelevant topographical detail. The satellite data demonstrate the dependence of surface temperature on relief more clearly than comparable airborne imagery.

N80-33830*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A MULTISPECTRAL DATA SIMULATION TECHNIQUE
Marwan J. Muasher and Philip H. Swain, Principal Investigators Jul. 1980 27 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development
ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10311; NASA-CR-163379; SR-PO-00469;

LARS-TR-070980) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-33831*# South Dakota State Univ., Brookings. Remote Sensing Inst.
IMPACT OF CELL SIZE ON INVENTORY AND MAPPING ERRORS IN A CELLULAR GEOGRAPHIC INFORMATION SYSTEM
Michael E. Wehde, Principal Investigator Apr. 1979 96 p refs ERTS
(Grant NGL-42-003-007)
(E80-10315; NASA-CR-163403; SDSU-RSI-79-03) Avail: NTIS HC A05/MF A01 CSCL 08B
The author has identified the following significant results. The effect of grid position was found insignificant for maps but highly significant for isolated mapping units. A modelable relationship between mapping error and cell size was observed for the map segment analyzed. Map data structure was also analyzed with an interboundary distance distribution approach. Map data structure and the impact of cell size on that structure were observed. The existence of a model allowing prediction of mapping error based on map structure was hypothesized and two generations of models were tested under simplifying assumptions.

N80-33832*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
UTILIZATION OF SPECTRAL-SPATIAL INFORMATION IN THE CLASSIFICATION OF IMAGERY DATA
C. B. Chittineni, Principal Investigator Jun. 1980 69 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10321; NASA-CR-160737; SR-LO-00419; LEMSCO-14310; JSC-16335) Avail: NTIS HC A04/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-33833*# Miami Univ., Fla. School of Marine and Atmospheric Science.
INVESTIGATIONS OF MEDIUM WAVELENGTH MAGNETIC ANOMALIES IN THE EASTERN PACIFIC USING MAGSAT DATA Interim Report, Jun. - Sep. 1980
Christopher G. A. Harrison, Principal Investigator 30 Sep. 1980 57 p refs Sponsored by NASA ERTS
(E80-10334; NASA-CR-163412) Avail: NTIS HC A04/MF A01 CSCL 08G
The author has identified the following significant results. Three long total magnetic field profiles taken over ocean basins were analyzed. It is found that there is a significant signal in the wavelength range of 1500 to 150 km. This is too short a wavelength to be caused by the core field, which becomes insignificant at about a wavelength of 1500 km; this intermediate wavelength signal is not caused by a typical sea floor spreading process, which should give maximum power in the wavelength region about 50 km. It is shown that the external magnetic field contributes very little to this intermediate wavelength signal. Efforts to explain the cause of this signal have failed.

N80-33834*# Institute for Land and Water Management Research, Wageningen (Netherlands).
DEFINING RELATIONSHIPS BETWEEN SURFACE CHARACTERISTICS AND ACTUAL EVAPORATION RATE
M. Menenti, Principal Investigator Ispra, Italy Joint Research Center of the European Communities May 1980 25 p refs Presented at the 4th Meeting of Working Group 2 of the TELLUS Proj., Monterotondo, Italy, 20-21 Nov. 1979 Sponsored by NASA HCMM
(E80-10335; NASA-CR-163541) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-33835*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A MODEL OF PLANT CANOPY POLARIZATION RESPONSE
V. C. Vanderbilt, Principal Investigator 1980 11 p refs Presented at the 1980 Machine Process. of Remotely Sensed Data Symp. ERTS
(E80-10336; NASA-CR-163444) Avail: NTIS HC A02/MF A01 CSCL 20F
There are no author-identified significant results in this report.

N80-33836# National Oceanic and Atmospheric Administration, Washington, D. C.
IMPROVED ALGORITHM FOR CALCULATION OF UTM AND GEODETIC COORDINATES
Jeff Dozier Sep. 1980 22 p
(NOAA-S/T-80-281; NOAA-TR-NESS-81) Avail: NTIS HC A02/MF A01
Expression of the equations for a UTM (Gauss-Kruger) projection in terms of Jacobian elliptic functions, rather than their series expansions, allows the projection to be used over wider zones than the standard 6 deg strips, and thus makes it applicable to satellite data from the NOAA A-G series. An efficient iterative solution method for either UTM or geodetic coordinates is developed using a complex arithmetic version of Newton's method. The method can be used for longitudes up to 90 deg from the central meridian. Author

N80-33837# National Physical Research Lab., Pretoria (South Africa). Optical Sciences Division.
BONNE'S PROJECTION OF METEOSAT IMAGES
A. S. VanZyl Oct. 1979 20 p refs
(CSIR-SR-FIS-201; ISBN-0-7988-1656-2) Avail: NTIS HC A02/MF A01
Bonne projection achieves area preservation at the expense of shape in representing the curved surface of a sphere on a flat plane. Equal area map projection subroutines were developed, integrated into the CSIR-VICAR image processing system, and applied to Meteosat images for geometric transformation of specified areas. The subroutines are functionally described and factors detracting from the accuracy of the projection are examined. A.R.H.

N80-33838# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council for Scientific and Technical Research.
DEVELOPMENT OF A TECHNIQUE FOR DETERMINING NATURAL RADIOACTIVITY USING SLOW-SPEED AIRCRAFT AT LOW ALTITUDES [DESENVOLVIMENTO DE UNA TECNICA PARA DETERMINACAO DA RADIOACTIVIDADE NATURAL UTILIZANDO AVIAO COM BAIXA VELOCIDADE E VOANDO A BAIXA ALTITUDE]
Inacio Malmonge Martin, Daniel J. R. Nordemann, Lycia M. Moreira Nordemann, Renato Senador, Silyia Regina Darrigo, and Ngan Andre BuiVan Jul. 1980 16 p refs In PORTUGUESE; ENGLISH summary
(INPE-1831-RPE/195) Avail: NTIS HC A02/MF A01
Methods used to perform aerial surveys of natural radioactivity are described. The apparatus includes two (NaI(Tl) detectors, the electronics, and magnetic tape recorder designed to be used onboard a monomotor aircraft at low altitude and low speed. Preliminary tests of this apparatus were made as payload of a captive balloon with intervals of 20 m up to 140 m of altitude. These measurements provided vertical gradients of the terrestrial and secondary cosmic radiation in the lower atmosphere. Measurements at the ground level and onboard a monomotor aircraft Cessna Skyplane were made in the regions of Morro do Ferro and Nuclebras C-09 plant in Pocos de Caldas. Aerial survey of the ambient gamma radiation was performed for the cities of Currais Novo, Campo Redondo, Santa Cruz, S. B. do Trairi, Cutie, Cel. Eziquiel and Frei Martinho in the States of Rio Grande do Norte and Paraiba/Brazil. J.M.S.

N80-33839# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Dept. of Remote Sensing.
THE USE OF RADIATION TEMPERATURE TO DETECT WATER-STRESS IN SUGARCANE CROP M.S. Thesis [O USO DA TEMPERATURA DE RADIACAO PARA DETECTAR O ESTRESSSE DE AGUADA CULTURA DA CANA-DE-ACUCAR]
Liane Antunes Maciel Lucht Jun. 1980 156 p refs In

PORTUGUESE; ENGLISH summary Revised
(INPE-1767-TDL/028) Avail: NTIS HC A08/MF A01

A 36m by 150m section of a 150m by 150m plot in which sugar cane was planted was irrigated periodically over a 4 month period to maintain optimum water level. Field measurements of radiation temperature, soil moisture, and plant water content taken at different times of the year were used to determine a relationship between the radiation temperature (which can be remotely determined), and the soil water content. A heat transfer model for the plant was used to extrapolate the temperature for the complete range of possible values of soil water potential. From the results obtained it is concluded that, in the case of sugar cane, the differences in temperature due to water stress are not so accentuated as in the case of wheat and cotton. The relationship between plant temperature and soil water content show the existence of four distinct regions. An aerial thermal scanner was used to obtain infrared images of the field plot. The contrast between irrigated and nonirrigated images areas leads to a difference of 1 deg C in temperature, which is in close agreement with predictions. A.R.H.

N80-33840# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Division de Information.

A METHOD FOR EDGE DETECTION IN IMAGES OF NATURAL RESOURCES [PROCESSAMENTO DE IMAGENS DETECCAO DE BORDASSEGMENTACAO DE IMAGENS]

Nelson D. A. Mascarenhas and Luciano V. Dutra Dutra Jun. 1980 20 p refs In PORTUGUESE Presented at 20th Symp. of Appl. Graphics and Interactive Graphic Systems, 20-22 Aug. 1980, Sao Paulo, Brazil Revised
(INPE-1768-RPE/154) Avail: NTIS HC A02/MF A01

Images derived from remote and meteorological sensing present a problem in distinguishing the borders (edges) among regions of differing textures. Where texture is defined as localized density, a two stage algorithm is employed: (1) a binary image is statistically derived; (2) regions of high and low density are reduced to uniformity by topological methods. The LANDSAT images thus processed show improved continuity and compare favorably with the natural borders. Transl. by S.F.

N80-33841# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THERMAL BALANCE OF SOILS [BALANCO TERMICO DE SOLOS]

L. M. Moreira-Nordemann and L. A. Maciel Lucht Aug. 1980 21 p refs In PORTUGUESE; ENGLISH summary Presented at 32d Ann. Meeting of SBPC Revised
(INPE-1859-RPE/210) Avail: NTIS HC A02/MF A01

Soil temperature is a decisive factor controlling bacterial activity, and the processes of plant development and production. For a specific climate condition, soil temperature is a function of the soil geological nature and humidity. The soil energy balance was studied. Measurements of the soil temperatures were made in the infrared region, using a PRT-5 radiometer. The relation between soil absorption heat and its cooling process was determined from terrestrial radiation emission. Correlations between temperature and the main constituents of the soils were studied by means of photoacustic spectroscopy. Thermal inertia and the ratio of heating and cooling of different soil types were determined and these parameters were related to vegetation coverage. A.R.H.

N80-33842# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

CONTRIBUTIONS OF LANDSAT IMAGERY TO THE GEOLOGICAL MAPPING OF THE RIO DO GRANDE SUL SHIELD [CONTRIBUICAO DAS IMAGENS LANDSAT AO CONHECIMENTO GEOLOGICO DE ESCUDO SUL RIOGRANDENSE]

Tomoyuki Ohara Aug. 1980 11 p refs In PORTUGUESE; ENGLISH summary Presented at 32d Ann. Reunion of the Brazilian Soc. for the Progr. of Sci., Rio de Janeiro, 6-12 Jul. 1980
(INPE-1838-RPE/199) Avail: NTIS HC A02/MF A01

The geological mapping in the central western portion of Rio Grande do Sul Shield was performed by the use of LANDSAT multispectral images at the scale of 1:500,000. The conventional photointerpretation was utilized for the geological investigation. The process of extracting information from LANDSAT imagery was based on the analysis of the various features on the Earth's surface, which reflect in diverse photographic elements such as tonal, drainage, topographic, vegetal and land use patterns, in each spectral band. A general geological view was given in the attached stratigraphic column. Interpretation of LANDSAT imagery also shows that (1) the distribution of Santa Barbara Formation is wider than that shown on the existing geological maps; (2) the subdivision of the Guaritas Formation into Varzinha and Guarda Velha Layers is possible; and (3) the granitic bodies and heterogeneous migmatites of the southeastern portion of the study area are considerably different from the existing geological maps. A.R.H.

N80-33843# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

DIGITAL FILTERING OF LANDSAT IMAGES AS A VISUAL AID TECHNIQUE IN GEOLOGICAL PHOTOINTERPRETATION [FILTRAGENS DIGITAIS DE IMAGENS LANDSAT COMO TECNICA DE AUXILIO VISUAL NA FOTOINTERPRETACAO GEOLOGICA]

Waldir Renato Paradella Jul. 1980 14 p refs In PORTUGUESE; ENGLISH summary Presented at 31st Congr. of the Brazilian Geol. Soc., San Catarina, Brazil, 19-25 Oct. 1980 Submitted for publication
(INPE-1823-RPE/189) Avail: NTIS HC A02/MF A01

Digital filtering techniques of LANDSAT imagery were developed as an aid to geologic photointerpretation. Concepts and general procedures are provided for the utilization of these automatic enhancement techniques. S.F.

N80-33844# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

COASTAL CURRENTS: STUDY OF A MODEL APPLIED TO THE COAST OF RIO GRANDE DO SUL LATITUDE 29 DEG SOUTH TO 35 DEG SOUTH [CORRENTES COSTEIRAS: ESTUDO DE UM MODELO APLICADO AO LITORAL DO RIO GRANDE DO SUL LATITUDE 29 DEG SUL 35 DEG SUL]

Claudio Solano Pereira and Luiz Bruner deMiranda Aug. 1980 7 p refs In PORTUGUESE; ENGLISH summary Presented at 32d Ann. Reunion of Brazilian Soc. for the Progr. of Sci., Rio de Janeiro, 6-12 Jul. 1980
(INPE-1841-RPE/201) Avail: NTIS HC A02/MF A01

An analytical model developed to determine coastal currents was applied to the coast of Rio Grande do Sul (lat. 29 deg S to lat. 35 deg. S). The model describes the stationary state nontidal coastal currents. The momentum balance considered is stationary, nonaccelerated, and hydrostatic. Longshore pressure gradients are neglected, while the Coriolis parameter and the vertical momentum exchange coefficient are assumed constant. The water mean density is taken constant in a vertical column but it is allowed to change at a constant rate in the cross shelf direction. With appropriate boundary conditions, a single relationship is obtained between the wind stress, the cross shelf mean density gradient and the fluid velocity. A.R.H.

N80-33845*# National Aeronautics and Space Administration, Washington, D. C.

PRIVATE SECTOR INVOLVEMENT IN CIVIL SPACE REMOTE SENSING. VOLUME 1: REPORT

15 Jun. 1979 37 p Sponsored in part by NOAA, Dept. of the Interior, Dept. of Agriculture, DOD, EPA, Army Corps of Engineers and Dept. of State
(NASA-TM-82206) Avail: NTIS HC A03/MF A01 CSCL 05B

A survey of private sector developers, users, and interpreters of Earth resources data was conducted in an effort to encourage private investment and participation in remote sensing systems. Results indicate positive interest in participation beyond the current hardware contracting level, however, there is a substantial gap between current market levels and system costs. Issues identified include the selection process for an operating entity, the public/private interface, data collection and access policies, price and profit regulation in a subsidized system, international participation, and the responsibility for research and development. It was agreed that the cost, complexity, and security implications

of integrated systems need not be an absolute bar to their private operation. J.M.S.

N80-33846*# National Aeronautics and Space Administration, Washington, D. C.
PRIVATE SECTOR INVOLVEMENT IN CIVIL SPACE REMOTE SENSING. VOLUME 2: APPENDICES
15 Jun. 1980 123 p Sponsored in part by NOAA, Dept. of the Interior, Dept. of Agriculture, DOD, EPA, Army Corps of Engineers and Dept. of State
(NASA-TM-82207) Avail: NTIS HC A06/MF A01 CSCL 05B

The U.S. Space Policy concerning the investment and direct participation in the establishment and operations of remote sensing systems is addressed. Private sector views and state and local government views are presented. Results of a market analysis are pregiven and the economic feasibility of such a program is considered. J.M.S.

N80-33847# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
APPLICATION OF THEMATIC MAPPING TECHNIQUES IN TERRAIN ANALYSIS
Theodore W. Howard Jan. 1980 9 p refs Presented at the ACSM/ASP Conf.
(AD-A089061) Avail: NTIS HC A02/MF A01 CSCL 08/2

The mission to support the Department of Defense (DoD) with terrain information has recently become the responsibility of the Defense Mapping Agency (DMA). The techniques employed to produce data bases of terrain conditions and the synthesizing of this data base information into terrain analysis products are critical in supporting mission requirements. Thematic mapping procedures provide the mechanism by which remote sensors, interpretation techniques, thematic subjects, data analysis techniques, and products can be examined in terms of production feasibility and capabilities. GRA

N80-33848# IBM Federal Systems Center, Gaithersburg, Md.
INTERACTIVE DIGITAL IMAGE PROCESSING INVESTIGATION, PHASE 2
W. C. Rice and J. S. Shipman Apr. 1980 194 p
(Contract DAAK70-77-C-0166)
(AD-A087518; ETL-0221) Avail: NTIS HC A09/MF A01 CSCL 20/6

The development of the interactive multi-channel image classification capabilities of the DIAL system is addressed. Additional DIAL algorithms to support classification were developed, coded, and tested. These included a program module (PM) to apply the Karhunen-Loeve transformation to a multi-channel image, which has the effect of reducing the dimensionality of an image without significantly descreasing its information content. In addition two algorithms in refining class assignment by relaxation methods were developed. One was selected, then coded on DIAL and was applied to a classification of a site, where it removed speckle, sharpened field boundaries, and increased the overall classification accuracy. The programming of the computationally intensive part of the maximum likelihood method on the STRAN computer is described. Finally an experiment in the maximum likelihood classification of a LANDSAT scene using the DIAL PMs was performed. This experiment demonstrated the the utility of the interactive classification algorithms in the study of the relationship between flora and geological structures. M.G.

N80-33849# Lockheed Electronics Co., Inc., Las Vegas, Nev. Remote Sensing Lab.
MULTISPECTRAL TECHNIQUES FOR REMOTE MONITORING OF SEDIMENT IN WATER: A FEASIBILITY INVESTIGATION
Ronald J. Holyer Mar. 1980 173 p refs
(Contract EPA-68-03-2153)
(PB80-198500; EPA-600/4-80-019) Avail: NTIS HC A08/MF A01 CSCL 13B

A data acquisition and analysis program was undertaken to demonstrate the feasibility of remote multispectral techniques for monitoring suspended sediment concentrations in natural water bodies. Two hundred surface albedo measurements (400 to 1,000 nanometers) were made at Lake Mead with coincident water sampling for laboratory analysis. Water volume spectral reflectance was calculated from the recorded surface albedo, and volume reflectance-suspended sediment relationships were investigated. Statistical analysis has shown that quantitative estimates of nonfilterable residue (105 C) and nephelometric turbidity can be made from volume spectral reflectance data with sufficient accuracy to make the multispectral technique feasible for sediment monitoring. GRA

N80-33850# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Experimental Research Lab.
SPECTRAL GROWTH AND NONLINEAR CHARACTERISTICS OF WIND WAVES IN LAKE ONTARIO Ph.D. Thesis - Michigan Univ., 1977
Paul Chi Liu Nov. 1979 63 p refs
(PB80-193261; NOAA-80050701;
NOAA-TR-ERL-408-GLERL-14) Avail: NTIS HC A04/MF A01 CSCL 08H

Using continuous wave data, the temporal characteristics of linear and nonlinear interactions during wave growth are examined. Unispectra, bispectra, and trispectra of continuously recorded wave data during three episodes of growing waves are used. While the unispectrum provides information on the energy content of the frequency components, the bispectrum and trispectrum generally provide information on the interactive relations between two and three frequency components respectively. These higher order interactive relations can be considered characterization of nonlinear interactions. The results indicate that the peak energy frequency transfers more energy to the lower frequency components than to the higher ones, which is confirmation that unispectral peaks shift progressively toward lower frequencies during wave growth. GRA

N80-33851# Missouri Univ., Columbia. Dept. of Geology
GRAVITY GEOPHYSICAL DELINEATION OF BURIED CHANNEL AQUIFERS IN THE DISSECTED TILL PLAINS OF NORTHERN MISSOURI M.S. Thesis
Morris David Hall Dec. 1979 105 p refs
(Contract DI-14-34-0001-9027)
(PB80-194343; W80-05463; OWRT-A-112-MO(2)) Avail: NTIS HC A06/MF A01 CSCL 08H

Several methods of gravity geophysics, in conjunction with drift thickness and bedrock topography maps, were used to map the location of buried river vallyes in northwestern Missouri. Drift thickness varies from zero to over 100 meters within the selected study area. The bured valleys are often filled with thick sequences of glaxial fluvial deposits which can serve as important aquifers. Over 900 gravimeter readings established a grid network over the study area. Two methods were used to calculate the regional Bouguer free air anomaly. Gravity profiles were run normal to several suspected buried valleys. The gravity residual profiles showed a strong correlation to bedrock topography, where known, and to several theoretical models. GRA

N80-33852# Northeastern Forest Experiment Station, Broomall, Pa.
SITE INDEX PREDICTION TABLES FOR OAK IN NORTHWESTERN WEST VIRGINIA Final Report
Neil Lamson 1980 9 p refs
(PB80-189830; NEFES-80-73; FSRP-NE-462) Avail: NTIS HC A02/MF A01 CSCL 02F

Prediction tables for even-aged stands of white, chestnut, northern red, scarlet, and black oaks were used to estimate the site index of forest land in 13 countries of northwestern West Virginia. The half width of the 95 percent confidence interval of the predicted site index was included; it was used to determine the number of sample trees necessary to attain given levels of precision, or to determine the precision of a site index prediction for a known number of sample trees. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-33853 California Univ., Los Angeles.
ELECTROCHEMICALLY DEPOSITED CADMIUM TELLURIDE FILMS AND THEIR APPLICATION TO SOLAR CELLS Ph.D. Thesis
Bulent Mehmet Basol 1980 128 p
Avail: Univ. Microfilms Order No. 8023271

The electronic and optical properties of electrochemically deposited CdTe films were investigated. Schottky barrier solar cells produced using this material are also characterized. The material was evaluated using various techniques such as current vs. voltage measurements, capacitance measurements as a function of frequency and temperature, photoconductivity, transmission, reflection and other measurements. The optical bandgap and optical absorption coefficients were determined. Deep trapping levels were observed and evaluated by various techniques and were attributed to the native defects of the material. The important electrical and structural properties of the material were correlated with the different parameters involved in the electrochemical process such as the rest potential, temperature and tellurium concentration. Solar cells with 4 percent internal efficiencies were prepared using gold Schottky barrier devices on n-type electrodeposited CdTe films.
Dissert. Abstr.

N80-33854 Polytechnic Inst. of New York.
OPTIMUM SYSTEMS DESIGN WITH RANDOM INPUT AND OUTPUT APPLIED TO SOLAR WATER HEATING Ph.D. Thesis
Layek Lamel Abdel-Malek 1980 157 p
Avail: Univ. Microfilms Order No. 8019381

Solar water heating systems are evaluated. Models were developed to estimate the percentage of energy supplied from the Sun to a household. Since solar water heating systems have random input and output queueing theory, birth and death processes were the major tools in developing the models of evaluation. Microeconomics methods help in determining the optimum size of the solar water heating system design parameters, i.e., the water tank volume and the collector area. Dissert. Abstr.

N80-33855 Colorado State Univ., Fort Collins.
LOCAL RESPONSE OF ITO/POLYSILICON SOLAR CELLS Ph.D. Thesis
Narumi Inoue 1980 135 p
Avail: Univ. Microfilms Order No. 8022405

Scanning light spot (SLS) and electron beam induced current (EBIC) techniques were used to study the local response of ITO/polysilicon solar cells. The micrographs obtained by these techniques were interpreted from the viewpoint of constrast mechanism, resolution and specimen properties. The SLS and EBIC techniques were applied to polycrystalline causes of the local variation in cell response. The minority carrier duffusion length does not significantly effect the response around dislocations and grain boundaries. The intragrain defects reduce the cell current response as well as grain boundaries and sometimes reduce the output more than grain boundaries. This was proved by the measurement of the local diffusion length and the correlation with the active defect density and cell response.
Dissert. Abstr.

N80-33856 Texas Univ. at Austin.
EVALUATION OF HYDROPOWER POTENTIAL IN A RIVER BASIN Ph.D. Thesis
Hettigamage Cyril Kariyawasam 1980 152 p
Avail: Univ. Microfilms Order No. 8021455

A methodology to evaluate the available hydropower potential in a river basin is described. The model was used to evaluate available hydropower potential in five different levels of gross and net potentials: gross precipitation potential, gross surface runoff potential, gross river potential, net potential with reservoirs meeting individual power demands, and net potential with reservoirs operating as a single system. This model requires only minimum data, available with most of the river basins of the world. The model was demonstrated by application to the San Antonio river basin in Texas. Relationships between different levels of gross and net potential are analyzed. Additional applications of this method of analysis to other natural energy sources are suggested. Modifications and improvements to the model are proposed.
Dissert. Abstr.

N80-33857*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TOROIDAL CELL AND BATTERY Patent Application
William J. Nagle, inventor (to NASA) Filed 28 Mar. 1980 13 p
(NASA-Case-LEW-12918-1; US-Patent-Appl-SN-134855) Avail: NTIS HC A02/MF A01 CSCL 10C

A toroidal cell is disclosed which includes a wound core disposed within a pair of toroidal channel shaped electrodes separated by nylon insulator. The shape of the case electrodes of this cell allows one doughnut shaped surface and the inner cylindrical case wall to be used as an electrode and a second planar doughnut shaped surface and the outer cylindrical case wall to be used as another electrode. Connectors may be used to stack two or more toroidal cells together by connecting the entire surface area of the electrode of one cell to the entire surface area of the electrode of a second cell. The central cavity of each toroidal cell may be used as a conduit for pumping a fluid through the toroidal cell to thereby cool the cell. NASA

N80-33858*# First National Bank of Clarksdale, Miss.
SOLAR HEATING SYSTEM AT QUITMAN COUNTY BANK, MARKS, MISSISSIPPI Final Report
Jun. 1980 119 p Sponsored by NASA
(Contract EM-78-F-01-5199)
(NASA-CR-161549) Avail: NTIS [illegible] MF A01 CSCL 10B

Information on the Solar Energy [illegible] system installed in a single story wood frame, cedar extenc[illegible] slope[illegible] roof building is presented. The system has on-site temperature and power measurements readouts. The 468 square feet of Solaron air flat plate collectors provide for 2,000 square feet of space heating, an estimated 60 percent of the heating load. Solar heated air is distributed to the 235 cubic foot rock storage box or to the load (space heating) by a 960 cubic feet per minute air handler unit. A 7.5 ton Carrier air-to-air heat pump with 15 kilowatts of electric booster strips serve as a back-up (auxiliary) to the solar system. Motorized dampers control the direction of airflow and back draft dampers prevent thermal siphoning of conditioned air.
T.M.

N80-33859*# General Electric Co., Schenectady, N. Y.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 4: ENERGY CONVERSION SYSTEMS
D. H. Brown, H. E. Gerlaugh, and R. R. Priestley Apr. 1980 178 p refs
(Contract DEN3-31)
(NASA-CR-159768; GE80ET0103-Vol-4; DOE/NASA/0031-80/4-Vol-4) Avail: NTIS HC A09/MF A01 CSCL 10B

Industrial processes from the largest energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidate which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed-cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum-based residual and distillate liquid fuels, and low Btu gas obtained through the on-site gasification of coal. An attempt was made to use consistent assumptions and a consistent set of ground rules specified by NASA for determining performance and cost. The advanced and commercially available cogeneration energy

conversion systems studied in CTAS are fined together with their performance, capital costs, and the research and developments required to bring them to this level of performance.
Author

N80-33860*# General Electric Co., Schenectady, N. Y. Energy Technology Operation.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 6: COMPUTER DATA. PART 1: COAL-FIRED NOCOGENERATION PROCESS BOILER, SECTION A Final Report
W. F. Knightly. May 1980. 481 p. refs. Prepared for DOE 6 Vol.
(Contract DEN3-31)
(NASA-CR-159770-Pt-1; GE80ET0105-Vol-6-Pt-1; DOE/NASA/0031-80/6) Avail: NTIS HC A21/MF A01 CSCL 10B

Various advanced energy conversion systems (ECS) are compared with each other and with current technology systems for their savings in fuel energy, costs, and emissions in individual plants and on a national level. About fifty industrial processes from the largest energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidates which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum based residual and distillate liquid fuels, and low Btu gas obtained through the on-site gasification of coal. Computer generated reports of the fuel consumption and savings, capital costs, economics and emissions of the cogeneration energy conversion systems (ECS's) heat and power matched to the individual industrial processes are presented for coal fired process boilers. National fuel and emissions savings are also reported for each ECS assuming it alone is implemented.
Author

N80-33861*# General Electric Co., Schenectady, N. Y.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 6: COMPUTER DATA. PART 2: RESIDUAL-FIRED NOCOGENERATION PROCESS BOILER Final Report
W. F. Knightly. May 1980. 287 p.
(Contract DEN3-31)
(NASA-CR-159770-Pt-2; GE80ET0105-Vol-6-Pt-2; DOE/NASA/0031-80/6-Vol-6-Pt-2) Avail: NTIS HC A13/MF A01 CSCL 10B

Computer generated data on the performance of the cogeneration energy conversion system are presented. Performance parameters included fuel consumption and savings, capital costs, economics, and emissions of residual fired process boilers.
T.M.

N80-33862*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MOD-2 WIND TURBINE FARM STABILITY STUDY Final Report
E. N. Hinrichsen. Jun. 1980. 170 p. refs.
(Contracts DEN3-134; DE-AI01-79ET-20305)
(NASA-CR-165156; R35-40; DOE/NASA/0134-1) Avail: NTIS HC A08/MF A01 CSCL 10A

The dynamics of single and multiple 2.5 ME. Boeing MOD-2 wind turbine generators (WTGs) connected to utility power systems were investigated. The analysis was based on digital simulation. Both time response and frequency response methods were used. The dynamics of this type of WTG are characterized by two torsional modes, a low frequency 'shaft' mode below 1 Hz and an 'electrical' mode at 3-5 Hz. High turbine inertia and low torsional stiffness between turbine and generator are inherent features. Turbine control is based on electrical power, not turbine speed as in conventional utility turbine generators. Multi-machine dynamics differ very little from single machine dynamics.
T.M.

N80-33863*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CHARACTERIZATION OF THREE TYPES OF SILICON SOLAR CELLS FOR SEPS DEEP SPACE MISSION. VOLUME 3: CURRENT-VOLTAGE CHARACTERISTICS OF SPECTROLAB SCULPTURED BSR/P + (K7), BSR/P + (K6.5) AND BSR (K4.5) CELLS AS A FUNCTION OF TEMPERATURE AND INTENSITY
A. F. Whitaker, S. A. Little, V. A. Wooden, D. E. Carter, B. E. Cothren, and C. A. Torstenson. Aug. 1980. 91 p. refs.
(NASA-TM-78305) Avail: NTIS HC A05/MF A01 CSCL 10A

Three types of high performance silicon solar cells, sculptured BSR/P + (K7), BSR/P + (K6.5) and BSR(K4.5) manufactured by Spectrolab were evaluated for their low temperature and low intensity performance. Sixteen cells of each type were subjected to 11 temperatures and 9 intensities. The sculptured BSR/P + (K7) cells provided the greatest maximum power output both at 1 AU and at LTLI conditions. The average efficiencies of this cell were 14.4 percent at 1 SC/ + 25 deg C and 18.5 percent at 0.086 SC/ -100 deg C.
T.M.

N80-33864*# Wormser Scientific Corp., Stamford, Conn.
INSTALLATION, OPERATION, AND MAINTENANCE FOR THE PYRAMIDAL OPTICS SOLAR SYSTEM INSTALLED AT YACHT COVER, COLUMBIA, SOUTH CAROLINA
Sep. 1980. 105 p. Sponsored in part by DOE.
(Contract NAS8-32250)
(NASA-CR-161203) Avail: NTIS HC A06/MF A01 CSCL 10A

Information concerning the installation, operation, and maintenance of the pyramidal Solar System for space heating and domestic hot water is presented. Principles of operation, sequence of installation, and procedures for the operation and maintenance of each subsystem making up the solar system are presented. Troubleshooting charts and maintenance schedules are presented.
T.M.

N80-33865*# Wormser Scientific Corp., Stamford, Conn.
DESIGN DATA BROCHURE FOR A PYRAMIDAL OPTICAL SOLAR SYSTEM
Sep. 1980. 36 p. Sponsored in part by DOE.
(Contract NAS8-32250)
(NASA-CR-161202) Avail: NTIS HC A03/MF A01 CSCL 10A

A pyramidal optics solar system for solar heating and domestic hot water is described. The system is made up of the collecting, storage, and distribution subsystems. System description, available accessories, installation arrangements, physical data, piping and wiring diagrams, and guide specifications are included.
J.M.S.

N80-33866*# Elcam, Inc., Santa Barbara, Calif.
INSTALLATION PACKAGE FOR A SUNSPOT CASCADE SOLAR WATER HEATING SYSTEM
Sep. 1980. 51 p. Sponsored in part by DOE.
(Contract NAS8-32245)
(NASA-CR-161562) Avail: NTIS HC A04/MF A01 CSCL 10A

Solar water heating systems installed at Tempe, Arizona and San Diego, California are described. The systems consist of the following: collector, collector-tank water loop, solar tank, conventional tank, and controls. General guidelines which may be utilized in development of detailed installation plans and specifications are provided along with instruction on operation, maintenance, and installation of solar hot water systems.
J.M.S.

N80-33867*# Elcam, Inc., Santa Barbara, Calif.
DESIGN PACKAGE FOR SOLAR DOMESTIC HOT WATER SYSTEM
Sep. 1980. 149 p. refs. Sponsored in part by DOE.
(Contract NAS8-32245)
(NASA-CR-161558) Avail: NTIS HC A07/MF A01 CSCL 10A

The initial design of a solar domestic hot water system is considered. The system performance specification and detailed design drawings are included. The hot water systems consist of the following subsystems: collector, storage, control, transport, auxiliary energy, and government-furnished site data acquisition. The two systems are installed at Tempe, Arizona, and San Diego, California.
J.M.S.

N80-33868# National Mechanical Engineering Research Inst., Pretoria (South Africa). Aeromechanics Div.
THE AERODYNAMICS OF CONTRA-ROTATING AXIAL FLOW WIND POWER TURBINES
W. J. vanderElst. Nov. 1979. 28 p. refs.
(CSIR-ME-1638; ISBN-0-7988-1467-5) Avail: NTIS HC A03/MF A01

The special case of a contra-rotating, axial flow turbine is analyzed and it is shown in what operating regime such wind machines with contra-rotating rotors are superior to the conventional single rotor turbine. Nondimensional parameters suitable for use in designing contra-rotating blades are presented by means of formulae and graphs. Author

N80-33869*# Rockwell International Corp., Downey, Calif. Space Systems Group.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 2, PART 2: SYSTEM ENGINEERING
G. M. Hanley. Sep. 1980. 422 p.
(Contract NAS8-32475)
(NASA-CR-3319; SSD-79-0010-2-2) Avail: NTIS HC A18/MF A01 CSCL 10A

The latest technical and programmatic developments are considered as well as expansions of the Rockwell SPS cost model covering each phase of the program through the year 2030. Comparative cost/economic analyses cover elements of the satellite, construction system, space transportation vehicles and operations, and the ground receiving station. System plans to define time phased costs and planning requirements that support major milestones through the year 2000. A special analysis is included on natural resources required to build the SPS reference configuration. An appendix contains the SPS Work Breakdown Structure and dictionary along with detail cost data sheet on each system and main element of the program. Over 200 line items address DDT&E, theoretical first unit, investment cost per satellite, and operations charges for replacement capital and normal operations and maintenance costs. A.R.H.

N80-33870# Committee on Interstate and Foreign Commerce (U. S. House).
ENERGY POLICY: SUPPLY AND DEMAND ALTERNATIVES
Washington: GPO, 1980. 97 p. refs. Hearing before the Subcomm. on Oversight and Invest. of the Comm. on Interstate and Foreign Com., 96th Congr., 1st Sess., 26 Jul. 1979.
(GPO-56-541) Avail: Subcommittee on Oversight and Investigations

The international energy crisis and U.S. energy policy are discussed. Factors of supply and demand are evaluated and recommendations made for conserving energy and reducing dependence on foreign oil. Synthetic fuels and the processes of coal gasification and coal liquefaction are evaluated. S.F.

N80-33871# Committee on Interstate and Foreign Commerce (U. S. House).
INCENTIVES FOR ENERGY CONSERVATION
Washington: GPO, 1980. 241 p. refs. Joint hearing before the Subcomm. on Oversight and Invest. of the Comm. on Interstate and Foreign Com., and the Subcomm. on the City of the Comm. on Banking, Finance and Urban Affairs, 96th Congr., 1st Sess., 26 Oct. 1979.
(GPO-55-634) Avail: Subcommittee on Oversight and Investigations

Ways to make homes and workplaces more energy efficient were discussed. Due to rise in the average price of world crude oil, the need for across the board energy savings was stressed. Tax credit for conservation measures and solar installations was considered to favor the affluent and to discriminate against the poor. New York's program to achieve energy conservation was described. Conservation is considered to be a cheaper way of meeting the energy needs than building new generating plants or producing synthetic gas from coal. R.K.G.

N80-33872# Committee on Science and Technology (U. S. House).
OVERSIGHT: WIND ENERGY PROGRAM
Washington: GPO, 1979. 190 p. Hearing before the Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 35, 30 Jul. 1979.
(GPO-51-382) Avail: SOD

Testimony is presented on renewable energy sources with emphasis on the wind energy program. Efforts to develop numerous sizes of wind machines to serve various applications and to meet differing market requirements are highlighted. Wind energy is identified as having the highest potential of all the solar electric technologies to contribute sizable amounts of energy by the year 2000. The capability of the wind energy program to realize this potential is discussed. J.M.S.

N80-33873# European Space Agency, Paris (France).
PHOTOVOLTAIC GENERATORS IN SPACE
W. R. Burke, ed. Jun. 1980. 266 p. refs. Presented at 2nd European Symp., Heidelberg, 15-17 Apr. 1980; sponsored by DGLR e.V.
(ESA-SP-147) Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

Design and verification of solar blankets, ultrathin cell module technology, solar array diodes, space qualified GaAs solar cells, and cell covers are discussed. Other topics include radiation effects on solar cells, computer aided design techniques applied to solar arrays, tests of cells, arrays, and structures. For individual titles, see N80-33874 through N80-33904.

N80-33874# European Space Technology Center, Noordwijk (Netherlands).
THE SOLAR CELL BLANKET DESIGN FOR SPACE TELESCOPE'S ROLL-OUT SOLAR ARRAY
R. L. Crabb, H. C. Allen (British Aerospace Dynamics Group), and G. Pohl (AEG-Telefunken). *In* ESA Photovoltaic Generators in Space. Jun. 1980. p. 3-11. refs. (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

A general description is given of the 4 kW solar array for the shuttle launched NASA Space Telescope. The solar blankets which embody shunt diodes for shadow protection are discussed. Thermal cycling test results (about 30,000 cycles) are presented for various components and subassemblies. Solar cell performance characteristics, lifetime power profile, and mass breakdown are given. Author (ESA)

N80-33875# AEG-Telefunken, Wedel (West Germany).
MANUFACTURING OF SPACE TELESCOPE SOLAR ARRAY BLANKETS
Gunter Kuechler. *In* ESA Photovoltaic Generators in Space. Jun. 1980. p. 13-17. (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

Fabrication details are listed for the flexible substrate and solar cell array subsections, including the bonding of the cells to the substrate. A vacuum device is used to position each array subsection. Adhesive is applied to the substrate with a screen printing technique. A special jig is described which is used for the interconnection of the solar panel assemblies and buffer assemblies. The jig may be used for replacing single arrays of buffers within a complete blanket. Author (ESA)

N80-33876# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
ULTRATHIN CELL MODULE TECHNOLOGY
Guenther J. LaRoche. *In* ESA Photovoltaic Generators in Space. Jun. 1980. p. 21-27. refs. Sponsored in part by International Telecommunications Satellite Organization (Intelsat). (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

Fabrication details are given for the use of 50 micron silicon solar cells with thin covers in an ultra light panel (ULP). Welding difficulties are described, which led to the design of an interconnector. Bonding of 50 micron and 100 micron covers was done under vacuum, with weights being necessary for good adhesion. Manufacturing yields are given for each fabrication step for both SOLAREX and OCLI cells. Electrical data are given for cells and modules before and after laydown. A yield of 80% was realized in a batch of 400 cells, which could be improved with better cell flatness and if the rear cell coating extended to the cell edge. Power and power to weight ratios are compared for ULP and conventional cells. Author (ESA)

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N80-33877# Optical Coating Lab., Inc., Santa Rosa, Calif.
FROSTED SOLAR CELL COVERS
J. Rancourt, W. T. Beauchamp, G. Silipo, I. Sachs, and G. Contos. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 29-34. refs. (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80.

The differences in surface morphology between ground or etched fused silica covers, and the resulting differences in optical properties are reviewed. Hemispherical reflectance is reduced, emittance increased, and less high angle light is scattered. The phenomenology of these properties is discussed. Configurations are mentioned in which the ultraviolet reflecting coating is placed on the outer, etched surface, or in which both sides are frosted. Microsheet was eliminated as a substitute for fused silica, for the acid etching process. Author (ESA)

N80-33878# European Space Technology Center, Noordwijk (Netherlands).
STUDY OF THE INTERNAL MECHANICS OF SPACE PHOTOVOLTAIC GENERATORS
D. Richard. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 35-44. refs. (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80.

A comprehensive study of the internal mechanics of solar cell modules was performed. The results are reviewed, including static and fatigue properties of solar array materials, a mathematical model of a cover integrated cell bonded on a structure, and a comparison of the model results with load tests. Optimization of solar arrays is mentioned. Factors affecting the fatigue life of interconnectors are discussed and a mathematical analysis reported. The most important findings state that: the thicker the adhesive layer, the better the design; the smaller the adhesive surface, the better the design; below -120 C the stress levels in the bonded materials are nearly constant; the interconnector fatigue life is not only influenced by the mechanical and the thermal loads but also by the base material history and the operation phases it has to go through; and the adhesives in the wiring are the most critical parts of the wiring. Their dependability can be increased by increasing their thickness. Author (ESA)

N80-33879# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
THE ECS SOLAR ARRAY
R. Zwanenburg. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 47-54. (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80.

The electrical and structural design is outlined, and the development and qualification tests described. The interchangeable panels are made of unidirectional carbon fiber plies bonded to an aluminum honeycomb core. Hardware such as hinges, holddown points, release system, and spring driven cable synchronized deployment mechanism is described. The natural frequencies and mass breakdown are given. Vibration test results are presented, as well as results from deployment tests. Author (ESA)

N80-33880# Societe Nationale Industrielle Aerospatiale, Cannes (France).
SPOT SOLAR ARRAY
Gerard Barkats, Michel Calvy, and Michel Cathala. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 55-63. (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80.

The electrical and structural designs are presented for a double deployment direction flexible fold-out solar array. The required power in orbit is 1 kW at the end of two years. Flexibility for different missions and the constraints of the Ariane shroud are design considerations. A stowage box was designed to accommodate all proposed configurations of array. An air bag system protects the folded blankets. Solar panels are built up of standard subpanels. Arrays up to 11.7 m in span are possible. Mass and power output data are given for various size arrays. Author (ESA)

N80-33881# British Aerospace Dynamics Group, Bristol (England).
TELESCOPIC MASTS FOR DEPLOYMENT OF FLEXIBLE SOLAR ARRAYS
P. A. Champion. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 65-71. (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80.

Detail design features of a nine element 16 m aluminum mast are given. These masts are driven by stored gas and controlled by an escape mechanism. Test results and their correlation with analytical models are reviewed, and a description of an alternative, mechanical drive system under development for future missions requiring retraction capability is given. Author (ESA)

N80-33882# AEG-Telefunken, Wedel (West Germany). Space and New Technologies Div.
POTENTIAL USE OF TERRESTRIAL PHOTOVOLTAICS FOR FUTURE SPACE SOLAR ARRAYS
H. Bebermeier and J. Rath. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 73-77. (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80.

The status and development goals of terrestrial and space solar cells are compared. Present terrestrial solar array production lines make use of many space qualified technologies and processes and can be utilized, either with terrestrial or with space solar cells, for the manufacture of large area space solar arrays. It is shown that single crystal silicon solar cells can be used at potentially lower cost when a moderate mass increase of the array is acceptable. A space telescope solar array, scaled up to 25 kW would require a 6% increase in blanket size and a 32% mass increase. Author (ESA)

N80-33883# European Space Technology Center, Noordwijk (Netherlands).
DESIGN AND TECHNOLOGY OF SOLAR ARRAYS FOR SHUTTLE LAUNCHED MISSIONS
K. Bogus, M. Cathala (SNIAS, Cannes, France), B. Goergens (AEG-Telefunken, Wedel, West Germany), and J. Kerstens (Royal Netherlands Aircraft Factory Fokker, Schiphol-Oost). *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 79-91. refs. (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80.

Very large solar arrays in the 15 to 20 kW power range will be needed for enhancing the low Earth orbit (LEO) operational capabilities for missions utilizing the space transportation system (STS) and Spacelab. A conceptual solar array design study was performed in order to identify the resulting solar array technology requirements. Advantages and disadvantages are listed for both nonplanar and rectangular flat array designs, including both structural considerations and blanket design. Thermal aspects of stowage box design are mentioned. The most promising concept is a modular split blanket array with retractable fold out blankets and a collapsible truss mast. Author (ESA)

N80-33884# AEG-Telefunken, Heilbronn (West Germany). Semiconductor Div.
ASPECTS OF LARGE AREA AND THIN SILICON SOLAR CELL TECHNOLOGIES
K.-D. Rasch and K. Roy. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 95-99. refs. Sponsored by Bundesministerium fuer Forschung und Technologie. (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80.

Computer and experimental data are given for thin high efficiency cells utilizing back surface reflector (BSR) and back surface field (BSF) technologies. It is shown that there is no advantage in employing BSF technology for cells thicker than 100 micrometers. The BSR technology is useful for all thicknesses. Cells thinner than 100 micrometers have higher end of life power than thicker ones when BSR and BSF are used. For cells thinner than 100 micrometers, a redesign of cover glasses, interconnectors, and solar panel construction is necessary to profit from cell weight advantages. Author (ESA)

N80-33885# Spectrolab, Inc., Sylmar, Calif.
THIN, HIGH EFFICIENCY SILICON SOLAR CELLS
R. Oppordan, M. Gillanders, and J. Fodor. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 101-104. ref. (For primary

document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

Data are presented for cell processing yields, beginning-of-life electrical outputs, electron, neutron and proton irradiation effects, and thermal alpha measurements. Panel fabrication techniques for thin cells are also discussed. A viable process sequence was established for the cells using high purity, low resistivity, gallium doped float zone silicon as the starting material. They exhibited enhanced radiation hardness and showed stability under proton irradiation, regardless of thickness. Author (ESA)

N80-33886# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group
QUALIFICATION TEST RESULTS OF THE PRODUCTION HIGH EFFICIENCY K6-3/4 AND K7 SILICON SOLAR CELLS
Leland J. Goldhammer. *In* ESA Photovoltaic Generators in Space, Jun. 1980 p 105-115 refs (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

The K6-3/4 and K7 solar cells were fully qualified and characterized for use in a space environment. These solar cells are a 10 Ohm-cm, shallow diffused, N/P solar cell with a back surface field and an aluminum back surface reflector. The front surface of the K6-3/4 solar cell has a dual layer antireflective coating and the front surface of the cover glass is frosted (etched). The front surface of the K7 solar cell is sculptured (etched) and has a single layer antireflective coating, the front surface of the cover glass is polished. Both solar cell types are solder coated. The tests performed and a description of test conditions are listed. Author (ESA)

N80-33887# AEG-Telefunken, Heilbronn (West Germany). Semiconductor Div.
DIODES FOR SPACE SOLAR ARRAYS
G. Friedrich, K. D. Rasch, and K. Roy. *In* ESA Photovoltaic Generators in Space, Jun. 1980 p 117-120 refs Sponsored by Bundesministerium fuer Forschung und Technologie and ESA (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

A large area semiconductor diode was developed. The advantages of the diode are high thermal radiation, high reflectance and low heat generation. The electrical characteristics of the diode in forward and reverse bias in the temperature range -150 C to - 150 C are given. Transient behavior in a switching application was tested. At 125 C the reverse recovery time is below 1 microsecond. Author (ESA)

N80-33888*# Hughes Research Labs., Malibu, Calif.
DEVELOPMENT OF SPACE-QUALIFIED GaAs SOLAR CELLS
R. C. Knechtli, G. S. Kamath, J. Ewan, and R. Y. Loo. *In* ESA Photovoltaic Generators in Space, Jun. 1980 p 121-126 refs Sponsored in part by NASA and USAF (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80 CSCL 10A

Cells 2 cm x 2 cm were produced having an efficiency of 16% at 100 C and 12% at 200 C. They were superior to silicon cells under 1 MeV electron bombardment up to fluences in excess of 10 to the 15th power electron per sq cm, and to protons with an energy in excess of 1 MeV. The possibility of producing cells in quantity using a graphite wafer holder is mentioned. Author (ESA)

N80-33889*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
RADIATION DAMAGE IN HIGH VOLTAGE SILICON SOLAR CELLS
Irving Weinberg, Henry W. Brandhorst, Clifford K. Swartz, and Victor G. Weizer. *In* ESA Photovoltaic Generators in Space, Jun. 1980 p 129-134 refs (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80 CSCL 10A

High open circuit voltage cell designs based on 0.1 Ohm cm p-type silicon were irradiated with 1 MeV electrons and their performance determined to fluences as high as 10 to the 15th power per sq cm. Of the three cell designs, radiation induced degradation was greatest in the high low emitter (HLE) cell. The diffused and ion implanted cells degraded approximately equally but less than the HLE cell. Degradation was greatest in an HLE cell exposed to X-rays before electron irradiation. The cell regions controlling both short circuit current and open circuit voltage degradation were defined in all three cell types. An increase in front surface recombination velocity accompanied time dependent degradation of an HLE cell after X-irradiation. It was speculated that this was indirectly due to a decrease in positive charge at the silicon oxide interface. Modifications aimed at reducing radiation induced degradation are proposed for all three cell types. Author (ESA)

N80-33890# AEG-Telefunken, Heilbronn (West Germany).
COMPARISON OF SILICON SOLAR CELL CHARACTERISTICS AT OPERATING TEMPERATURE AFTER ELECTRON IRRADIATION
R. Schilling, K.-D. Rasch, and H. Bebermeier. *In* ESA Photovoltaic Generators in Space, Jun. 1980 p 135-139 refs Sponsored by Bundesministerium fuer Forschung und Technologie (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

The degradation characteristics during electron irradiation of different solar cell structures were determined. High efficiency cells (HEC), back surface field (BSF), back surface reflector (BSR), nonreflective and back surface field reflector (BSFR) cells were fabricated from a float zone and from a crucible grown boron doped crystal. The solar cell data including the solar absorptance and the temperature dependence of cell parameters were determined after fabrication and after 1 MeV electron irradiation of fluences in the range of 3 x 10 to the 13th power per sq cm to 2 x 10 to the 15th power per sq cm. The difference cell structures can be directly compared at standard test conditions and at operating conditions excluding influences of material variations. The effects of BSR, which controls the operating temperature, do not decrease after electron irradiation. Solar cells with applied back surface reflector HEC-BSR and HEC-BSFR deliver the highest power performance at operating conditions. Author (ESA)

N80-33891# European Space Technology Center, Noordwijk (Netherlands).
A COMPARISON OF SOLAR ARRAY RADIATION DAMAGE MODELS
R. L. Crabb and J. C. Larue. *In* ESA Photovoltaic Generators in Space, Jun. 1980 p 141-147 refs (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

The 1 MeV equivalent electron fluences were computed for two ESA solar arrays, operating in an eccentric and geosynchronous orbit respectively, and for another which will operate in near Earth orbit. These three cases have provided a wide coverage of the Earth's trapped proton/electron environment and, for the two orbiting arrays, have enabled comparisons to be made between results of calculations made at time of launch (1977, 1978) with those of recalculations based on the latest improvements to particle maps describing the Earth's trapped radiation environment. The sensitivity of fluence predictions to the use of previously available and current solar cell damage coefficients were also examined. Flight observations agreed well with predictions based on both new and old particle maps for the benign geosynchronous orbit; the agreement between flight data and prediction was less satisfactory for the severe eccentric orbit. Possible reasons for the latter discrepancies are discussed while comparisons between near Earth predictions and flight data are the subjects of posterity. Author (ESA)

N80-33892# Katholieke Universiteit te Leuven (Belgium). Lab. ESAT
THE INFLUENCE ON THE FRONT METAL COVERAGE FACTOR ON THE OPEN-CIRCUIT VOLTAGE OF SILICON SOLAR CELLS
J. Nijs, F. DHoore, R. Mertens, and R. VanOverstraeten. *In* ESA Photovoltaic Generators in Space, Jun. 1980 p 149-154 refs Sponsored in part by Nationaa Fonds voor Wetenschappelijk Onderzoek (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

Three types of solar cells were fabricated and tested: N(-)P cells, high efficiency N(+)PP(+) and P(+)NN back surface

field (RSF) cells. Different front metal coverage factors on the emitter junction are used. Determining the total current-voltage characteristics of these samples by I sub sc-V sub oc measurements, the influence of the metal coverage factor on the saturation current I sub o and thus on V sub oc is found. It can be concluded that the saturation current density in the metal covered part is two to six times larger than in the oxide covered part of the cells, where the bulk component of I sub o is kept small.
Author (ESA)

N80-33893# Applied Solar Energy Corp., City of Industry, Calif.
IMPACT OF TERRESTRIAL SOLAR CELL DEVELOPMENT ON SPACE APPLICATIONS
P. A. Iles. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 155-160 (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80

Projected space missions are outlined and the cell requirements by mission type mentioned. The techniques used to produce low cost terrestrial use cells are examined for their applicability to space needs, including silicon cell fabrication, barrier formation, contact applications, coatings, and encapsulation. The most likely area for the transfer of terrestrial cell technology is in low Earth orbit missions, based on the use of the shuttle craft.
Author (ESA)

N80-33894# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
CALIBRATION OF PHOTOVOLTAIC SOLAR ELEMENTS
H. Kaase. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 163-165. refs (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80

Three methods are described for determining the response of photovoltaic solar elements with respect to the solar spectrum at high irradiances. The methods are based on calibrated standard lamps and reference detectors. One method uses a lamp connected to a stabilized dc power supply imaged by mirrors at the entrance slit of a double monochrometer. Mounted behind the monochrometer is an aperture shaped like the solar cell. The exit slit is imaged by mirrors on a thermocouple. The second technique uses the relative spectral irradiance and the total irradiance of the solar simulator to compute the response. The use of a tunable laser as a source is mentioned. The estimated overall uncertainties for the above methods is about 4%.
Author (ESA)

N80-33895# Naval Research Lab., Washington, D. C.
PERFORMANCE OF THE SOLAR CELL EXPERIMENT ON THE NTS-2 SATELLITE
R. L. Statler, D. H. Walker, and B. J. Faraday. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 167-173. refs. Sponsored by Navy Space Projects Office, AFAPL, and AFSC (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80

Fifteen solar cell experiments were placed on the NTS-2 satellite which was launched in June 1977. Each experiment consists of a series-connected module of five 2 cm x 2 cm cells. The orbit is circular at an altitude of 20,192 km and inclination of 63 deg. The illuminated I-V curve of each module is measured at sixteen points and the data transmitted in real time. The agreement between first orbit data and ground calibration is within 2 percent. Data from 941 days in orbit are presented, corrected to a standard temperature of 50 C from the actual temperature of about 105 C on the spacecraft. The equivalent 1 MeV electron fluence through a 0.030 cm coverslip is calculated to be nearly 9 x 10 to the 14th power e/sq cm at this time, and is due almost entirely to trapped electrons (99.9 percent).
Author (ESA)

N80-33896# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
SOLAR CELL MODELING FOR COMPUTER-AIDED GENERATOR DESIGN AND IRRADIATION DEGRADATION COMPUTATIONS
S. Mottet. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 177-186. refs. Sponsored by Centre National d'Etudes Spatiales (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80

A mathematical model for a silicon solar cell under illumination was developed. The main transport phenomena are described before and after irradiation. The current voltage characteristics were derived from the homogeneous junction transport equations. A least squares method for curve fitting is described. Results of tests with solar cells are presented which show the ability of the model to describe the experimental characteristics with a precision better than 1%.
Author (ESA)

N80-33897# Aerospace Engineering Office, Zurich (Switzerland).
ON THE DESIGN VERIFICATION OF LARGE FLEXIBLE SOLAR ARRAYS: FIRST EXPERIENCES GAINED
K. J. Zimmermann and L. Zago (Pilatus Aircraft Ltd.). *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 187-193. refs (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80

Design verification of large flexible solar arrays requires the adaptation of the mathematical model to well defined ground tests. Design verification itself and on-orbit predictions are then provided by the updated mathematical model. Prestressed flexible solar arrays impose geometric nonlinearities. Thus, empirical correlation of mathematical models may no longer be considered feasible. This verification approach was checked on a Communications Technology Satellite (CTS) solar array Sub-Panel Assembly by Static tests. The update of the mathematical models was performed by differential sensitivity analysis algorithms applied to geometric nonlinearities, executed by a simple correlation algorithms minimizing the error in the analytical prediction. Correlation is possible to any type of measurement parameter. The study yields an updated mathematical model with a mean error of approximately 7% and a computational strategy that reduces computer cost. Further increase in the model's accuracy is possible through iteration.
Author (ESA)

N80-33898# European Space Technology Center, Noordwijk (Netherlands).
EFFICIENT THERMAL CYCLING OF SOLAR PANELS IN SOLAR SIMULATION FACILITIES, WITH A MULTI-PANEL TEST RIG
P. W. Brinkmann and J. Reimann (Industrieanlagen Betriebsgesellschaft m.b.H.). *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 195-202. refs (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80

It is shown that efficient thermal cycling tests under vacuum can be performed at reduced costs to cover the requirements for qualifications and acceptance testing of solar panels. A suitable test rig was developed which allows simultaneous testing of up to 3 solar panels with a dimension of 1.3 m x 1.7 m each. The tests can be performed in an existing solar simulation facility with a beam diameter of only 2.4 m. This means that a close simulation of orbital conditions can be achieved, including severe eclipse conditions with rapid temperature changes. Chamber dimensions, descriptions of suspension devices, and other data needed by potential users are given.
Author (ESA)

N80-33899# British Aerospace Dynamics Group, Bristol (England).
A GENERAL PURPOSE COMPUTER PROGRAM TO ASSIST IN THE SYSTEM DESIGN OF A SOLAR ARRAY
H. R. Nye. *In* ESA. Photovoltaic Generators in Space. Jun. 1980. p 205-210 (For primary document see N80-33873 24-44)
Avail: NTIS. HC A12/MF A01; ESA, Paris FF 80

A set of computer programs to assist in the system design of solar arrays is described. The programs allow a complete analysis of solar array electrical designs to a level sufficient for classic phase A and early phase B phases of a program. Given a set of design and performance requirements, the programs generate a number of candidate solar array designs and provide indicative performance characteristics. The programs can provide designs for most types of solar arrays, including rigid panel types, flexible fold-up types and roll-up types. The programs are primarily concerned with the electrical aspects of the design. The program concept is introduced and the interative flexibility of the design process is discussed. Examples are given.
Author (ESA)

N80-33900# Optical Coating Lab., Inc., Santa Rosa, Calif.
AN EVALUATION OF SPECTRALLY SELECTIVE REFLECTORS (COLD MIRROR MEMBRANES) FOR USE WITH CONCENTRATOR SOLAR ARRAYS
William T. Beauchamp, James D. Rancourt, and Dan R. Lott (Lockheed Missiles and Space Co., Sunnyvale, Calif.) *In* ESA Photovoltaic Generators in Space Jun. 1980 p 211-216 refs (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA Paris FF 80

Spectrally selective reflector (SSR) coatings on lightweight transparent membranes were evaluated as a method of concentrating light for achieving increased power without suffering severe temperature losses on solar arrays. Analysis and laboratory tests indicate that SSR concentrators are more effective than opaque reflectors with both silicon and GaAs cells for increasing array output. Large area SSR membranes can be produced in roll to roll coaters at cost that will be competitive with other reflecting membranes. Author (ESA)

N80-33901# Technische Universitaet, Brunswick (West Germany). Lehrstuhl fuer Raumflugtechnik und Reaktortechnik.
PROPERTIES OF SOLAR GENERATORS WITH REFLECTORS AND RADIATORS
W. D. Ebeling, D. Rex, and U. Bierfischer *In* ESA Photovoltaic Generators in Space Jun. 1980 p 217-222 refs (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

Radiation cooled concentrator systems using silicon and GaAs cells were studied. The principle of radiation cooling by the reflector surfaces is discussed for cylindrical parabolic reflectors (SARA), truncated hexagonal pyramids, and a small trough configuration. Beam paths, collection properties for imperfect orientation, and thermal optimization parameters were analyzed. The three concentrating systems with radiation cooling offer advantages over the plane panel and over the large trough. With silicon solar cells they exhibit considerably lower solar cell consumption per Kw and also lower mass per kW. With GaAs cells the SARA system reduces the number of solar cells needed per kW to less than 10%. Also in all other cases SARA offers the best values for alpha and F sub sol, as long as narrow angular tolerances of the panel orientation can be met. Analysis of the energy collecting properties for imperfect orientation shows the superiority of the hexagonal concetrator. This device can produce power for even large angles between the sun and the panel normal. Author (ESA)

N80-33902# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
BEARING AND POWER TRANSFER ASSEMBLY (BAPTA) WITH ROTARY TRANSFORMER
W. Auer *In* ESA Photovoltaic Generators in Space Jun. 1980 p 225-229 refs (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

The utilization of rotary transformers as an alternative to slip rings for the power transfer from solar panels to a satellite's main body could be advantageous, especially if an ac bus system is taken into consideration. Different approaches for bearing and power transfer assembly (BAPTA's) with rotary transformers were investigated with main emphasis on the electromagnetic design. Test results show that a 1.5 kW transformer can be operated with a 98% efficiency. A furhter increase to the specified 99% efficiency seems to be possible. In the present configuration, two 1.5 kW transformers are mounted with in one housing. A preloaded ball bearing arrangement assures proper air gaps and a relatively constant torque over temperature. The BAPTA is driven by a TELDIX stepper motor. Author (ESA)

N80-33903# AEG-Telefunken, Wedel (West Germany).
TECHNOLOGY OF ELEVATED VOLTAGE SOLAR ARRAYS
H. Bebermeier, K. Bogus (ESTEC, Noordwijk, Netherlands), and W. Goelz (AEG-Telefunken, Kassel, West Germany) *In* ESA Photovoltaic Generators in Space Jun. 1980 p 231-237 refs (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

A technology study and test program was conducted to assess the impact of elevated voltages on solar array design and operation. Blanket integrated protection diodes were developed, and long term elevated voltage failure modes were identified for modern solar cell blanket concepts. The most critical failure mode is the hot spot phenomenon caused by interrupted interconnectors or by partial shadows on the array. Stress/lifetime tests were conducted on 50 micrometer Kapton samples. Corona experiments were performed with solar arrays in a simulated plasma environment. It appears that the requirements for a 250 Kw Low Earth Orbit platform array can be met to a large extent by applying the proven technology of existing flexible array concepts. A major problem is the determination of the maximum tolerable operating voltage. Tests indicate that conventional concepts could become problematic above far less than 1 kV. The limiting factors are corona discharge effects, plasma leakage, and partial discharge inception which reduces, the lifetime of the array. Author (ESA)

N80-33904# European Space Technology Center, Noordwijk (Netherlands). Systems Engineering Dept.
SATELLITE POWER SYSTEMS: STATUS AND PLANNED ACTIVITIES
D. Kassing *In* ESA Photovoltaic Generators in Space Jun. 1980 p 239-244 refs (For primary document see N80-33873 24-44)
Avail: NTIS HC A12/MF A01; ESA, Paris FF 80

The general progress in satellite power system (SPS) system definition and assessment activities to date is summarized, and selected technical issues identified as being crucial for the photovoltaic solar energy conversion subsystem of the reference concept are reviewed. The requirements of the photovoltaic subsystem are discussed with respect to the alternative power transmission options studied by NASA since October 1978, particularly solid state microwave devices and laser. A summary is given of the system impact assessment and European SPS Activities. Author (ESA)

N80-33905# Department of National Defence, Ottawa (Ontario).
THE BEHAVIOR OF THE MILITARY BATTERY TYPE BB248/U USED TO START THE ENGINE OF THE A.P.C.
Louis Brossard and Lloyd Gallop Dec. 1979 28 p refs In ENGLISH; FRENCH summary
(AD-A080615; DREO-TN-79-31) Avail: NTIS HC A03/MF A01 CSCL 10/3

The performance of the lead-acid battery used to start the diesel engine in the Armoured Personnel Carrier (APC M113A1) was tested between -18 and -26 C. The lowest ambient temperature at which a start can be achieved without the assistance of slave batteries is close to -20 C provided the initial temperature of the vehicle batteries is about -15 C. The average cranking current under these conditions is approximately 450A and 13Ah are expended during a cranking period of close to 2 min. Engine starting is difficult or impossible if the terminal voltage (TV) is below 16V. The use of auxiliary batteries, connected in parallel, increases the value of the TV and the start is easier. It was demonstrated that the charge passed through batteries during a charge period of 30 to 45 min. with the alternator-regulator system varies between 6.5 and 9.5 Ah. This is markedly lower than the charge required to obtain a start. The viscosity of the lubricating oil also influences the ability to acheive an engine start at low temperatures and two synthetic Arctic Grade lubricating oils were evaluated. GRA

N80-33906# Department of National Defence, Ottawa (Ontario). Energy Conversion Div.
EVALUATION OF CRANKING CHARACTERISTICS OF COMMERCIALLY AVAILABLE BATTERIES BETWEEN ROOM TEMPERATURE AND -40 C
Louis Brossard and R. W. Gorman Dec. 1979 23 p refs In ENGLISH; FRENCH summary
(AD-A080614; DREO-TN-79-30) Avail: NTIS HC A02/MF A01 CSCL 10/3

The cranking characteristics of three brands of commercially available batteries (GROUP 24) were measured between room temperature (RT) and -40 C. They were fully recharged at RT before each discharge which was carried out at constant current corresponding to the 3 C to 4 C rates. Under the same experimental conditions, the behavior on discharge of these batteries was found to be very similar. The only significant differences observed concerned the increase in internal battery temperature resulting from a discharge. GRA

N80-33907# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
COMPREHENSIVE PLANNING FOR PASSIVE SOLAR ARCHITECTURAL RETROFIT M.S. Thesis
Stanley H. Scofield May 1980 329 p refs
(AD-A088660; AFIT-CT-80-19T) Avail: NTIS HC A15/MF A01 CSCL 13/1

This thesis proposes a new method for developing Passive Solar Architectural Retrofit Concepts to be used in Air Force Project Booklets. This method can be used for 'in-house' design projects, A E design projects, and major projects administered by Army or Navy Engineering. This thesis has three parts: A series of 35 'patterns' to be used by the Architectural Programmer and user. The recommendations contained in each 'pattern' are specific enough for the programmer and user to identify the decisions they need to make early in the programming process, and yet the recommendations are not overly restrictive to the designer. A sample Passive Solar Architectural Retrofit Program using selected 'patterns' from part one of this thesis. A sample Conceptual Design using the Architectural Program of part two of this thesis is described. GRA

N80-33908# Eagle-Picher Industries, Inc., Joplin, Mo. Electronics Div.
NICKEL-ZINC BATTERIES FOR RPV APPLICATIONS Interim Technical Report, 15 Nov. 1978 - 15 Dec. 1979
Donna Dappert Wright-Patterson AFB, Ohio AFAPL May 1980 90 p
(Contract F33615-78-C-2058; AF Proj. 3145)
(AD-A088594; AFWAL-TR-80-2050) Avail: NTIS HC A05/MF A01 CSCL 10/3

Interim results are presented for a program dealing with the placement of nickel zinc batteries in specific military applications, namely the BQM-34A and the PQM-102 Remotely Piloted Vehicles. The nickel zinc system was chosen for these applications because RPV's demand a high quality secondary battery that offers a compromise between long life (calendar and cycle) and low zinc system, calendar and cycle life testing of the two candidate batteries, qualification testing, and flight testing in operational RPV's. Test results of developmental cells and batteries include cycle life testing of various separator materials, high rate/low temperature discharges with various types of nickel electrodes, zinc electrode substrate, and charging methods. Calendar and cycle life testing is underway which will demonstrate the ability of the nickel zinc system to be routinely cycled over an extended period of time. J.M.S.

N80-33909# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
LOW-COST FLYWHEEL DEMONSTRATION PROGRAM Final Report, 1 Oct. 1977 - 31 Dec. 1979
D. W. Rabenhorst, T. R. Small, and W. O. Wilkinson Apr. 1980 111 p refs
(Contract EC-77-C-01-5085)
(CONS-5085-T2) Avail: NTIS HC A06/MF A01

All primary objectives were successfully achieved as follows: demonstration of a full-size, 1 kWh flywheel having an estimated cost in large-volume production of approximately $50/kWh; development of a ball-bearing system having losses comparable to the losses in a totally magnetic suspension system; successful and repeated demonstration of the low-cost flywheel in a complete flywheel energy-storage system based on the use of ordinary house voltage and frequency; and application of the experience gained in the hardware program to project the system design into a complete, full-scale, 30 kWh home-type flywheel energy-storage system. DOE

N80-33910# Department of Energy (US), London (England).
WORKING GROUP ON FUEL CONSUMPTION TARGETS Interim Report
27 Jun. 1979 31 p
(NP-24333) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The UK Working Group on Fuel Consumption Targets was created in 1978 to investigate the feasibility of setting progressive targets for raising the average mpg achieved by new cars and methods of achieving these targets and to report to the Automotive Energy Consultative Group. The standards established for cars and the factors that influence the standards are discussed. Proposals for a voluntary fuel consumption targets scheme were submitted to the Working Group by representatives of the Society of Motor Manufacturers and Traders. The text of that scheme is given in annexes to the report. DOE

N80-33911# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CLEANING AGENTS AND TECHNIQUES FOR CONCENTRATING SOLAR COLLECTORS
M. B. Sheratte May 1980 91 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-7052) Avail: NTIS HC A05/MF A01

Tests were conducted to determine the nature of the soil which is irreversibly deposited on solar collectors during environmental exposure. Methods of removing this soil were investigated. The mechanism of attachment of the soil to the surface was determined as a potential aid to cleaning agent formulation. Reflector specimens were exposed at sites in Shenandoah, GA, Albuquerque, NM, and Daggett, CA. Three types of reflector surfaces were studied: second surface silvered glass, aluminized FEK 244 film on glass substrate, and RTV 670 on aluminum. Cleaning procedures were evaluated by microscopic examination of the solid surfaces before and after cleaning and by measurement of specular reflectance. The potential effectiveness of environmental cleaning agents, much as rain, frost and snow, is discussed. DOE

N80-33912# Vector Engineering, Inc., Springfield, N. J.
RANKINE BOTTOMING CYCLE SAFETY ANALYSIS Final Report
Gordon R. Lewandowski Feb. 1980 101 p refs
(Contract DE-AC05-79ET-15445)
(DOE/ET-15445/T1) Avail: NTIS HC A06/MF A01

A safety and hazards analysis is presented of three Rankine Bottoming Cycle Systems in public utility applications: a Thermo Electron system using Fluorinal 85 (a mixture of 85 mole % trifluoroethanol and 15 mole % water) as the working fluid; a Sundstrand system using toluene as the working fluid; and a Mechanical Technology system using steam and Freon 2 as the working fluids. The properties of the working fluids considered are flammability, toxicity, and degradation, and the risks to both plant workers and the community at large are analyzed. DOE

N80-33913# Total Environmental Action, Inc., Harrisville, N.H.
DEVELOPMENT OF A SITE-FABRICATED, BUILDING INTEGRATED AIR SOLAR SYSTEM Final Report, 30 Sep. 1977 - 30 Apr. 1980
Peter Temple and Joseph T. Kohler Apr. 1980 166 p refs
(Contract DE-FG04-77CS-34123)
(ALO-4123-5) Avail: NTIS HC A08/MF A01

The results of a two year project to develop, thoroughly test, and optimize a complete site-fabricated solar air heating system are presented. The site-fabricated air collector was tested to ASHRAE 93-77 standards and the HUD 30-days stagnation test; it was found that the collector performed as well as any standard commercially manufactured air collector, but for only one-third the cost. All the available collector materials: glazings, paints, coatings, caulks, absorber plates, structural materials, and fasteners were studied. With the results of the materials study, the collector design was further optimized in terms of theoretical efficiency, ease of construction, apperance, and durability. The construction manual with step-by-step instructions, complete construction drawings, and background information on materials and design options are given. DOE

N80-33914# RCA Labs., Princeton, N. J.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN-FILM SILICON SOLAR CELLS Quarterly Report, 31 May - 31 Aug. 1979
D. Redfield Sep. 1979 16 p refs
(Contract DE-AC01-79ET-23108)
(DOE/ET-23108/1; QR-1) Avail: NTIS HC A02/MF A01

Fundamental limitations on the efficiency of Si solar cells were analyzed theoretically and experimentally. Emphasis was on mechanisms limit V/sub oc/ because that is the parameter for which the greatest discrepancy exists between observation and previous theory. Analyses of heavy-doping effects and

doping gradient effects showed the past treatments of such effects were the inclusion of Auger processes essential for the saturation current J/sub o/, which dominates V/ sub oc/. An improved method for evaluating J/sub o/is given. A calculation based on this method showed that past estimates of bandgap narrowing by other methods were seriously in error. DOE

N80-33915# New England Research Application Center, Storrs, Conn.
BATTERY ELECTROLYTES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1972 - Apr. 1980
C. Gilbert Young May 1980 215 p Sponsored in part by NTIS
(PB80-808629) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Many types of solid, liquid and gaseous battery electrolytes are described and analyzed in the cited abstracts. Battery design, construction, and use, employing the listed electrolytes, are discussed. Battery design, construction, and use, employing the listed electrolytes, are discussed. Battery life, efficiency, and maintenance characteristics are also delineated. Included are 196 citations. GRA

N80-33916# New England Research Application Center, Storrs, Conn.
BATTERY ELECTROLYTES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1980
C. Gilbert Young May 1980 37 p Sponsored in part by NTIS
(PB80-808637) Avail: NTIS HC A03/MF A01 CSCL 10C

Many types of solid, liquid and gaseous battery electrolytes are described and analyzed in the cited abstracts. Battery design, construction, and use, employing the listed electrolytes, are discussed. Battery life, efficiency, and maintenance characteristics are delineated. This index contains 29 citations. GRA

N80-33917# National Technical Information Service, Springfield, Va.
STATE-OF-THE-ART REVIEWS AND BIBLIOGRAPHIES ON ENERGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1978
Audrey S. Hundemann Jul. 1980 290 p
(PB80-812886) Avail: NTIS HC $30.00/MF $30.00 CSCL 10A

Citations to bibliographies, state-of-the-art reviews, and literature surveys on various aspects of fossil fuels, wind, solar energy, hydrogen, geothermal energy, nuclear energy, and batteries are presented. A few citations pertain to electric power. This updated bibliography contains 280 citations, none of which are new entries to the previous edition. GRA

N80-33918# National Technical Information Service, Springfield, Va.
STATE-OF-THE-ART REVIEWS AND BIBLIOGRAPHIES ON ENERGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Jun. 1980
Audrey S. Hundemann Jul. 1980 117 p Supersedes NTIS/PS-79/0639; NTIS/PS-78/0586
(PB80-812894; NTIS/PS-79/0639; NTIS/PS-78/0586) Avail: NTIS HC $30.00/MF $30.00 CSCL 10A

Citations to bibliographies, state-of-the-art reviews, and literature surveys on various aspects of fossil fuels, wind, solar energy, hydrogen, geothermal energy, nuclear energy, and batteries are presented. A few citations pertain to electric power. This updated bibliography contains 107 citations, 77 of which are new entries to the previous edition. GRA

N80-33919# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Jan. - Mar. 1980
May 1980 48 p refs
(Contracts EX-76-A-36-1008; DE-A101-79ET-27025)
(PB80-195316; JHU/APL/EQR/80-1) Avail: NTIS HC A03/MF A01 CSCL 10A

Research projects dealing with the following topic areas are discussed. Geothermal energy development planning and technical assistance, operational research, hydroelectric power development, seismotectonic investigation, and energy conversion and storage techniques are among the topics covered. GRA

N80-33920# California Energy Commission, Sacramento.
URANIUM RESOURCES: A REVIEW OF ESTIMATION METHODOLOGIES Final Consultant Report
Stephen J. Sullivan May 1980 71 p refs
(PB80-193725; CAEC-50; CAEC-300-80-025) Avail: NTIS HC A04/MF A01 CSCL 10A

Several methods for estimating recoverable resources which fall into two categories. Explicit models yield the amount and distribution of uranium ore on the basis of a known physical characteristic, such as rock type. Implicit models yield resources on the basis of an historical trend, such as annual production over time. Other methods are used to estimate subeconomic deposits. None of the methods are identified, and recent resource estimates are presented. GRA

N80-33921# California Energy Commission, Sacramento.
THE POTENTIAL OF ENERGY FARMING IN THE SOUTHEASTERN CALIFORNIA DESERT Final Staff Report
Virginia Lew Apr. 1980 64 p refs
(PB80-195019; CAEC-66; CAEC-500-80-017) Avail: NTIS HC A04/MF A01 CSCL 21D

The use of energy forms to provide future sources of energy for California is considered. Marginal desert lands in southeastern California are proposed for the siting of energy farms using acacia, eucalyptus, euphorbia, guayule, jojoba, mesquite, or tamarisk. GRA

N80-33922# Office of Technology Assessment, Washington, D. C.
CONSERVATION AND SOLAR ENERGY PROGRAMS OF THE DEPARTMENT OF ENERGY: A CRITIQUE
Jun. 1980 81 p refs
(PB80-197759; OTA-E-120; LC-80-600092) Avail: NTIS HC A05/MF A01; Also available HC SOD CSCL 10A

In response to a request from the House Committee on Science and Technology, DOE's solar and conservation goals and the strategies for meeting them are reviewed. Management and institutional issues requiring DOE or Congressional attention are identified. GRA

N80-33923# National Technical Information Service, Springfield, Va.
LEAD BATTERIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 204 p Supersedes NTIS/PS-79/0780 and NTIS/PS-78/0689
(PB80-813363; NTIS/PS-79/0780; NTIS/PS-78/0689) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

The design, development, components, fabrication, chemistry, and testing of lead batteries are cited in this compilation of federally-funded research. Specific applications for spacecraft, consumer products, and electric vehicles are covered. Studies on lead recovery from battery scrap are covered. Several abstracts on lead toxicity in industrial plants are also cited. GRA

N80-33924# National Technical Information Service, Springfield, Va.
LEAD BATTERIES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 159 p Supersedes NTIS/PS-79/0782 and NTIS/PS-78/0690
(PB80-813371; NTIS/PS-79/0782; NTIS/PS-78/0690) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Worldwide research on lead battery components, charging, corrosion, and testing is cited. The majority of studies concern battery use in electric vehicles. Studies on lead recovery from battery scrap and air pollution at battery factories are also included. GRA

N80-33816# Atmospheric Environment Service, Ottawa (Ontario). Boundary Layer Research Div.
MODIFICATION OF THE BOUNDARY LAYER BY OROGRAPHY

P. A. Taylor and P. R. Gent (National Center for Atmospheric Research, Boulder, Colo.) *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 143-165 In FRENCH (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-33925 National Physical Lab., Teddington (England).
A CASE STUDY OF ENVIRONMENTAL NOISE EVALUATION
R. F. Higginson and A. J. Rennie Apr. 1980 16 p refs
(NPL-AR-96; ISSN-0143-7143) Copyright.
Avail: Issuing Activity

The noise in the neighborhood of a hovercraft ferry terminus was measured and quantified using the equivalent continuous sound level, L sub eq. A number of different sources of noise are heard in the area concerned and the measurements were made for demonstration purposes. Individual components of a noise environment were evaluated and the magnitudes of individual noise events were determined by their single event noise exposure levels, L sub AX. The levels of the total noise were determined from limited measurements of the components and a noise prediction formula was established. T.M.

N80-33926*# Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences.
A SENSITIVITY ANALYSIS OF VOLCANIC AEROSOL DISPERSION IN THE STRATOSPHERE
Carolyn F. Butler Apr. 1979 69 p refs
(Grants NsG-1343; NsG-1477)
(NASA-CR-163606; GSTR-79-4) Avail: NTIS HC A04/MF A01 CSCL 13B

A computer sensitivity analysis was performed to determine the uncertainties involved in the calculation of volcanic aerosol dispersion in the stratosphere using a 2 dimensional model. The Fuego volcanic event of 1974 was used. Aerosol dispersion processes that were included are: transport, sedimentation, gas phase sulfur chemistry, and aerosol growth. Calculated uncertainties are established from variations in the stratospheric aerosol layer decay times at 37 latitude for each dispersion process. Model profiles are also compared with lidar measurements. Results of the computer study are quite sensitive (factor of 2) to the assumed volcanic aerosol source function and the large variations in the parameterized transport between 15 and 20 km at subtropical latitudes. Sedimentation effects are uncertain by up to a factor of 1.5 because of the lack of aerosol size distribution data. The aerosol chemistry and growth, assuming that the stated mechanisms are correct, are essentially complete in several months after the eruption and cannot explain the differences between measured and modeled results. A.R.H.

N80-33927*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TURBID WATER MEASUREMENTS OF REMOTE SENSING PENETRATION DEPTH AT VISIBLE AND NEAR-INFRARED WAVELENGTH
W. D. Morris, W. G. Witte, and C. H. Whitlock Aug. 1980 11 p refs Presented at the Symp. on Surface-Water Impoundments, Minneapolis, 2-5 Jun. 1980
(NASA-TM-81843) Avail: NTIS HC A02/MF A01 CSCL 13B

Remote sensing of water quality is dicussed. Remote sensing penetration depth is a function both of water type and wavelength. Results of three tests to help demonstrate the magnitude of this dependence are presented. The water depth to which the remote-sensor data was valid was always less than that of the Secchi disk depth, although not always the same fraction of that depth. The penetration depths were wavelength dependent and showed the greatest variation for the water type with largest Secchi depth. The presence of a reflective plate, simulating a reflective subsurface, increased the apparent depth of light penetration from that calculated for water of infinite depth. T.M.

N80-33928*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IN SITU OZONE DATA FOR EVALUATION OF THE LASER ABSORPTION SPECTROMETER OZONE REMOTE SENSOR: 1979 SOUTHEASTERN VIRGINIA URBAN PLUME STUDY SUMMER FIELD PROGRAM
Gerald L. Gregory, David S. McDougal, and Joe J. Mathis, Jr. Oct. 1980 57 p refs
(NASA-TM-81831) Avail: NTIS HC A04/MF A01 CSCL 13B

Ozone data from the 1979 Southeastern Virginia Urban Study (SEV-UPS) field program are presented. The SEV-UPS was conducted for evaluation of an ozone remote sensor, the Laser Absorption Spectrometer. During the measurement program, remote-sensor evaluation was in two areas; (1) determination of the remote sensor's accuracy, repeatability, and operational characteristics, and (2) demonstration of the application of remotely sensed ozone data in air-quality studies. Data from six experiments designed to provide in situ ozone data for evaluation of the sensor in area 1, above, are presented. Experiments consisted of overflights of a test area with the remote sensor aircraft while in situ measurements with a second aircraft and selected surface stations provided correlative ozone data within the viewing area of the remote sensor. T.M.

N80-33929# Council for Scientific and Industrial Research, Pretoria (South Africa).
INTERNATIONAL CONFERENCE ON AIR POLLUTION, VOLUME 1
25 Oct. 1979 389 p refs Conf. held at Pretoria, 22-25 Oct. 1979 4 Vol.
(ISBN-0-7988-16651) Avail: NTIS HC A17/MF A01

Various problems concerning air pollution and its effects and air pollution control are addressed. Specific topics include legislation, medical aspects, environmental planning, economic aspects, community administration, and public reaction. For individual titles, see N80-33930 through N80-33935.

N80-33930# Esso Petroleum Co. Ltd., Abingdon (England)
A PHILOSOPHY FOR CLEAN AIR
H. I. Fuller *In* CSIR Intern. Conf. on Air Pollution, Vol. 1 25 Oct. 1979 12 p (For primary document see N80-33929 24-45)
Avail: NTIS HC A17/MF A01

The social, economic, and health problems associated with air pollution and its control are briefly reveiwed and the values which influence the ways these problems are confronted are identified. Possible reasons for the present present preoccupation with the environment are suggested and some of the more significant implications for modern society are considered. It is suggested that there is a growing need for a wide-looking philosophy in which social expectations and technical capability for achieving clean air find their proper perspective in the spectrum of social improvement. M.G.

N80-33931# Medical Research Council, London (England).
CLEAN AIR AND HEALTH IN BRITAIN IN THE 1970'S
R. E. Waller *In* CSIR Intern. Conf. on Air Pollution, Vol. 1 25 Oct. 1979 15 p refs (For primary document see N80-33929 24-45)
Avail: NTIS HC A17/MF A01

Parallels between the reduction of air pollution in Great Britain and public health are reported. A dramatic change has already been seen in London and in other large cities in Britain in terms of acute effects of pollution. The very high concentrations of smoke and sulphur dioxide that used to occur during temperature inversions have virtually disappeared, and there is no longers any evidence of the sudden increases in mortality and morbidity that used to be associated with them. There are encouraging signs too in terms of chronic effects, with a tendency for bronchitis death-rates to decline, particularly in London. The results of surveys of respiratory symptoms and lung function show no more than a marginal effect of present day levels of smoke and SO_2, but there are still many people in the community who grew up through the highly polluted conditions in the past, and who may still have residual effects. M.G.

N80-33932# Electricity Commission of New South Wales, Sydney (Australia). Power Div.

COLLECTING FLY ASH FROM LOW SULPHUR COALS: AN OVERVIEW OF AUSTRALIAN EXPERIENCE
K. S. Watson *In* CSIR Intern. Conf. on Air Pollution, Vol. 1 25 Oct. 1979 11 p (For primary document see N80-33929 24-45)
Avail: NTIS HC A17/MF A01

The performance and costs of precipitators and fabric filters when used with pulverized coal or spreader stoker fired boilers are compared. Economic consideration tend to favor fabric filters as target collection efficiency increases, particularly is fly ash of poor reduced plant availabilty due to premature bag failure from physical breakdown or from blinding increases in an unpredictable manner. Where lower collection efficnecy is adeaute or where conditions fabor precipitation both capital and operating and maintenance charges are likely to put precipitators ahead on cost. M.G.

N80-33933# Florida State Univ., Tallahassee. Dept. of Oceanography.
LUNG DEPOSITION OF AEROSOLS FROM INDUSTRIAL ENVIRONMENTS
S. Bauman, J. W. Winchester, H. J. Annegarn (Witwatersrand Univ.), and A. C. D. Leslie *In* CSIR Intern. Conf. on Air Pollution, Vol. 1 25 Oct. 1980 13 p refs Sponsored in part by National Inst. of Environmental Health Sciences and EPA (For primary document see N80-33929 24-45)
Avail: NTIS HC A17/MF A01

Test results are reported on an several aerosol sampling system for exhaled human breath, to determine the respiratory deposition curve of the heavy metal components of the aerosol. Simultaneous sampling of inhaled ambient aerosol and exhaled breath aersool by cascade impactors and elemental analysis by particle induced X-ray emission permits determination of particle deposition in the range $<$ 0.25 to $>$4 microns aerodynamic diameter. Results are reported using the apparatus in a welding shop, showing how the deposition varies with the particle size and how the precision determining percent deposition depends on sampling conditions. It is noted that the application of mining environments would permit measurements to be made on minera at work. M.G.

N80-33934# DeHeurtley (Graciela L.), Buenos Aires (Argentina).
METHODOLOGY FOR THE RESEARCH OF AIR POLLUTION IN URBAN AREAS
Graciela L. deHeartley *In* CSIR Intern. Conf. on Air Pollution, Vol. 1 25 Oct. 1979 12 p (For primary document see N80-33929 24-45)
Avail: NTIS HC A17/MF A01

A methodology to research air pollution in urban areas is developed which is aimed at supplying a standard tool for comparison for separate investigations. A number of urban constants are identified including the placement of building masses, the detection of central city areas, the percentage of soil areas, and the placement of residential areas. Factors which determine the micro and mesoclimates are also outlined. M.G.

N80-33935# Department of Health, Johannesburg (South Africa).
THE ASSESSMENT OF SMOKE EMISSION FROM DIESEL-ENGINED VEHICLES
L. E. Tucker *In* CSIR Intern. Conf. on Air Pollution, Vol. 1 25 Oct. 1979 8 p (For primary document see N80-33929 24-45)
Avail: NTIS HC A17/MF A01

The enforcement of diesel vehicle emission control laws is briefly addressed and an assessment measuring techniques is given. The free acceleration method for determining the density of exhaust emissions from diesel engines is found to have serious shortcomings. Various on load methods are suitable as alternatives. The use of a wheel dynamometer, a set of free running rollers, or a road test are all satisfactory methods. Dynamometer testing is recommended for the larger local authorities and a comparable road test for small municipalities. M.G.

N80-33936# Council for Scientific and Industrial Research, Pretoria (South Africa).
INTERNATIONAL CONFERENCE ON AIR POLLUTION, VOLUME 2
25 Oct. 1979 297 p refs Conf. held at Pretoria, 22-25 Oct. 1979 4 Vol.
(ISBN-0-7988-1665-1; ISBN-0-7988-1668-6) Avail: NTIS HC A13/MF A01

Methods to control air pollution from industrial sources are discussed. Electrostatic precipitators, dust collectors, wet scrubbers, and venturi tubes are among the topics considered. For individual titles, see N80-33937 through N80-33942.

N80-33937# Chemical Engineering Research Group, Pretoria (South Africa).
THE PREVENTION OF DUST EMISSIONS IN SOUTH AFRICA BY ELECTROSTATIC PRECIPITATION
D. Heinichen *In its* Intern. Conf. on Air Pollution, Vol. 2 25 Oct. 1979 19 p refs (For primary document see N80-33936 24-45)
Avail: NTIS HC A13/MF A01

The application of electrostatic precepitators in the prevention of air pollution by the South African power generating plants and by the process industries is reviewed. Current problems affecting availability and efficiency of the precipitators are pinpointed. These include variations in the characteristics of coal and other raw materials, plant design and maintenance, instrumentation and operator skills. J.M.S.

N80-33938# Cape Town Univ. (South Africa). Dept. of Mechanical Engineering.
FLUIDIZED-BED COMBUSTION FOR POLLUTION CONTROL
D. P. Naude and R. K. Dutkiewicz *In* CSIR Intern. Conf. on Air Pollution, Vol. 2 25 Oct. 1979 14 p refs (For primary document see N80-33936 24-45)
Avail: NTIS HC A13/MF A01

Fluidized bed combustion is described as a means of raising steam for electricity power generation and for industrial purposes. With this combustion technique, poor quality fuels can be utilized. However, fluidized bed combustion also enables the reduction of atmospheric pollutants. The use of fluidized beds for restricting particulate emissions as well as for reducing emissions of sulphur and nitrogen oxides is reviewed. Some results on particulate emissions from both a 300 mm and a 1000 mm diameter test rig are presented to illustrate the size of particulates resulting from fluidized bed combustion. A brief description of a 100 mm diameter test rig for enabling pollution studies to be undertaken is described. Fluidized bed combustors offer a simple means of meeting stringent pollution requirements. J.M.S.

N80-33939# Phillips Carbon Black Co. Ltd., Port Elizabeth (South Africa).
ENERGY CONSERVATION-AIR POLLUTION ABATEMENT PROJECT
A. L. McI. Baillie *In* CSIR Intern. Conf. on Air Pollution, Vol. 2 25 Oct. 1979 9 p (For primary document see N80-33936 24-45)
Avail: NTIS HC A13/MF A01

An incineration project to eliminate the H2S from the effluent gasses of carbon black plants is described. A shift in focus to conversion of the waste heat in the incineration process to useful energy in the form of steam/electricity is discussed. The electricity generated in the energy conversion project is sufficient for the process needs of the carbon black plants as well as enough to sell to a neighboring industry. J.M.S.

N80-33940# Monsanto Europe S.A., Louvain-La-Neuve (Belgium).
CURRENT TECHNIQUES FOR THE ELIMINATION OF AIRBOURNE MISTS AND SOLUBLE SOLIDS
A. F. Joseph and B. Wisniewski *In* CSIR Intern Conf. on Air Pollution, Vol. 2 25 Oct. 1979 8 p (For primary document see N80-33936 24-45)
Avail: NTIS HC A13/MF A01

Removal of mists from the effluent gasses of industrial plants is considered. Methods discussed include settling chambers, dry cyclones, wet scrubbers, electrostatic precipitators, impingement separators, and fiber bed mist eliminators. J.M.S.

N80-33941# Council for Scientific and Industrial Research, Pretoria (South Africa).
PROGRESS WITH A NEW VELOCITY ELECTRIC PRECIPITATOR THE ELECTRO-DYNAMIC VENTURO (EDV)

J. F. Vicard (Societe Lab., Lyon) *In its* Intern. Conf. on Air Pollution, Vol. 2 25 Oct. 1979 10 p refs (For primary document see N80-33936 24-45)
Avail: NTIS HC A13/MF A01

The electrodynamic venturi technique (EDV) is a unique combination of electrostatic precipitation and venturi scrubbing in the same apparatus. Practical results on small and large scale commercial systems are presented. High efficiency on submicronic particles, the low energy requirements, and simple operation are among the factors discussed. Basic phenomena of the EDV process are discussed. J.M.S.

N80-33942# Impala Platinum Ltd. (England).
A METHOD FOR ROUTINE ISOKINETIC DUST SAMPLING
J. A. Dreyer and M. Dumka *In* CSIR Intern. Conf. on Air Pollution, Vol. 2 25 Oct. 1979 13 p refs (For primary document see N80-33936 24-45)
Avail: NTIS HC A13/MF A01

A simple, reliable method for isokinetic dust sampling of gas ducts and stacks on a routine basis is described. A null probe is used to derive dust loadings expressed in terms of mass per unit time. J.M.S.

N80-33943# Council for Scientific and Industrial Research, Pretoria (South Africa).
INTERNATIONAL CONFERENCE ON AIR POLLUTION, VOLUME 3
25 Oct. 1979 373 p refs Conf. held in Pretoria, 22-25 Oct. 1979 4 Vol.
(ISBN-0-7988-1665-1; ISBN-0-7988-1667-8) Avail: NTIS HC A16/MF A01

Various aspects of energy technology are considered in terms of their environmental implications. Particular attention is given to the monitoring and control of industrial pollutants in the atmosphere as well as the utilization of wastes as an energy alternatives. For individual titles, see N80-33944 through N80-33953.

N80-33944# Council for Scientific and Industrial Research, Pretoria (South Africa). Air Pollution Research Group.
THE DETERMINATION OF TIN OXIDE IN AIRBORNE DUST
R. B. Wells *In its* Intern. Conf. on Air Pollution, Vol. 3 25 Oct. 1979 8 p refs (For primary document see N80-33943 24-45)
Avail: NTIS HC A16/MF A01

The geochemical technique of fusing stannic oxide with ammonium iodide to form volatile stannic iodide was adapted to air pollution needs. The technique yielded an extract which is to be analyzed by flame AA and is sensitive enough for use in industrial situations. R.C.T.

N80-33945# Chemical Engineering Research Group, Pretoria (South Africa).
DEVELOPMENTS IN INDUSTRIAL EMISSION MEASUREMENTS: PROGRESS TOWARDS AN AUTOMATED ISOKINETIC SAMPLER
A. T. DeReus and D. Heinichen *In its* Intern. Conf. on Air Pollution, Vol. 3 25 Oct. 1979 21 p refs (For primary document see N80-33943 24-45)
Avail: NTIS HC A16/MF A01

Some advances were made towards automatic isokinetic sampling by utilizing the relationship between internal and external static pressures of the sampling probe head as well as the duct static pressure. Placement of the external static pressure tapping in the wake region of a probe head with special geometry resulted in an improved pressure signal insensitive to normal deviations in probe alignment. R.C.T.

N80-33946# Council for Scientific and Industrial Research, Pretoria (South Africa).
AN IMPROVED METHOD FOR THE DETERMINATION OF ARSENIC AND ITS USE FOR AIR POLLUTION STUDIES
R. B. Wells *In its* Intern. Conf. on Air Pollution, Vol. 3 25 Oct. 1979 12 p refs (For primary document see N80-33943 24-45)
Avail: NTIS HC A16/MF A01

The role of inorganic arsenic as an air pollutant is briefly discussed with particular attention to possible difficulties in sampling volatile compounds of arsenic and the trapping of such species in alkaline media. Arsenic in 0.1 N sodium hydroxide or sodium carbonate can be analyzed by furnace AA without acidification. At ashing temperatures of up to 1,200 C these alkaline matrices retain arsenic in the furnace slightly better than nickel in acid solution. A sensitivity of 9 pg per 0.0044 absorbance and a detection limit of 23 pg were obtained without the use of an electrodeless discharge lamp. R.C.T.

N80-33947# Council for Scientific and Industrial Research, Pretoria (South Africa). Air Pollution Research Group.
MEASUREMENTS OF CARBON MONOXIDE IN THE SOUTHERN HEMISPHERE
E. C. Halliday, W. Seiler, and E. Brunke *In its* Intern. Conf. on Air Pollution, Vol. 3 25 Oct. 1979 11 p refs (For primary document see N80-33943 24-45)
Avail: NTIS HC A16/MF A01

The atmosphere of the Southern Hemisphere covered by the Southern Atlantic Ocean was measured for its carbon dioxide content. The results of measurements obtained during the eighteen month study are presented. R.C.T.

N80-33948# Council for Scientific and Industrial Research, Pretoria (South Africa). Air Pollution Research Group.
REMOTE SOUNDING TECHNIQUES APPLIED TO MESOCLIMATE MEASUREMENTS
R. L. Closs *In its* Intern. Conf. on Air Pollution, Vol. 3 25 Oct. 1979 13 p (For primary document see N80-33943 24-45)
Avail: NTIS HC A16/MF A01

Pollution arising from isolated evaluated sources under the climatic conditions of the Eastern Transversal is described. Some of the special climate measurements required to estimate ground level pollution concentration are considered. R.C.T.

N80-33949# Council for Scientific and Industrial Research, Pretoria (South Africa). Air Pollution Research Group.
ASPECTS OF THE INTERACTION AMONG SOME OF THE PARAMETERS OF IMPORTANCE TO POLLUTION POTENTIAL CONSIDERATIONS
H. M. Langenberg, R. L. Closs, and G. P. N. Venter *In its* Intern. Conf. on Air Pollution, Vol. 3 25 Oct. 1979 15 p refs (For primary document see N80-33943 24-45)
Avail: NTIS HC A16/MF A01

Some aspects of the interaction among the parameters are discussed with the aid of observations of wind and temperature structures in the first few hundred metres of the atmosphere over complex topography. It is shown that the interaction between the thermally driven surface winds and the upper or pressure gradient flows represents an extremely complex phenomenon and that upward or downward extrapolations of the winds should be approached with great caution. R.C.T.

N80-33950# City Council of Cape Town (South Africa). Electricity Dept.
MUNICIPAL REFUSE AS A FUEL FOR POWER GENERATION
B. D. Ives *In* CSIR Intern. Conf. on Air Pollution, Vol. 3 25 Oct. 1979 16 p refs (For primary document see N80-33943 24-45)
Avail: NTIS HC A16/MF A01

The utilization of municipal refuse as a fuel by various power generating authorities was investigated. The economic and practical aspects of burning refuse were considered together with the solutions adopted for overcoming the serious problems initially experienced. R.C.T.

N80-33951# Associated Octel Co. Ltd., Bletchley (England). Engine Lab.
ENERGY: CAREFUL CONSERVATION OR REGULATED WASTE
P. L. Dartnell *In* CSIR Intern. Conf. on Air Pollution, Vol. 3 25 Oct. 1979 25 p refs (For primary document see N80-33943 24-45)
Avail: NTIS HC A16/MF A01

The progress of the passenger car power unit in the form of the spark ignition engine and possible development of this engine in the future is discussed with respect to alternative forms of power units. The demand of environmental considerations particularly as they apply to control of exhaust emissions in

various areas of the world are considered against the methods of control and the background of penalties incurred in fuel consumption. The reasons for excessively stringent regulations for vehicle exhaust emissions are challenged in relation to more moderate control which will permit optimizing both the engine and the production of the fuel supply for maximum energy utilization. R.C.T.

N80-33952# City of Port Elizabeth (South Africa).
UTILIZATION OF MUNICIPAL REFUSE AS AN ENERGY SOURCE
R. J. Lawrence *In* CSIR Intern. Conf. on Air Pollution, Vol. 3 25 Oct. 1979 13 p (For primary document see N80-33943 24-45)
Avail: NTIS HC A16/MF A01

The utilization of municipal wastes for energy purposes is considered as a possible alternative to the shortage and high cost of traditional fossil fuels. Specific emphasis is given to examining the past and future developments of this aspect of energy technology. R.C.T.

N80-33953# Natal Univ., Pietermaritzburg (South Africa). Dept. of Mechanical Engineering.
THE USE OF SOLAR ENERGY FOR COOKING
N. Tully and A. G. Lawrence *In* CSIR Intern. Conf. on Air Pollution, Vol. 3 25 Oct. 1979 30 p refs (For primary document see N80-33943 24-45)
Avail: NTIS HC A16/MF A01

The background of the fuel and ecological crisis is reviewed with respect to the availability of solar energy. Particular attention is given to the possible widespread adoption of solar cooking among the rural African population. Various types of solar cookers are discussed with emphasis on the open concentrator employing the spherical cast iron cooking pot. The performance of this design under variable conditions of misalignment, solar insolation, wind velocity, etc. is given. Successful initial field trials are described. R.C.T.

N80-33954# Council for Scientific and Industrial Research, Pretoria (South Africa).
INTERNATIONAL CONFERENCE ON AIR POLLUTION, VOLUME 4
25 Oct. 1979 246 p refs Conf. held in Pretoria, 22-25 Oct. 1979 4 Vol.
Avail: NTIS HC A11/MF A01

Electrostatic precipitators, aerosol concentration determination, and air quality monitoring systems are discussed. Other topics include air quality simulation models and a review of the industrial role in pollution control. For individual titles, see N80-33955 through N80-33960.

N80-33955# Council for Scientific and Industrial Research, Pretoria (South Africa).
ENVIRONMENT: THE ENERGY CONNECTION
H. Brown *In its* Intern. Conf. on Air Pollution, Vol. 4 25 Oct. 1979 16 p refs (For primary document see N80-33954 24-45)
Avail: NTIS HC A11/MF A01

The adoption and maintenance of environmental controls is a costly exercise. In many cases it is necessary to use extra energy for afterburning and manufacture of new plants and equipment. This is particularly true in the case of electricity generating stations, cement works, steelworks, and control of motor car exhaust gases. The vast number of emissions from low level chimneys in energy, cash to the user and the general publis. It is increasingly evident that the benefits cannot be assessed solely in monetary terms in view of the important need to conserve energy stocks and improve the health of all people. E.D.K.

N80-33956# Sturtevant Gas Cleaning Ltd., London (England).
OPERATING EXPERIENCES WITH IMPROVED RAPPING ON ELECTROSTATIC PRECIPITATORS TREATING FLY ASH FROM HIGH AND LOW SULPHUR COALS
K. H. Pearson *In* CSIR Intern. Conf. on Air Pollution, Vol. 4 25 Oct. 1979 27 p refs (For primary document see N80-33954 24-45)
Avail: NTIS HC A11/MF A01

A unique design of multilevel rapping for precipitator collecting electrodes is described, together with the reasons for its development. Operational and reliability data of installations using the system is given, covering a 12 year period. Case histories of the adoption of the system to significantley upgrade existing precipitators are discussed. Author

N80-33957# Witwatersrand Univ., Johannesburg (South Africa).
BACKGROUND AEROSOL CONCENTRATIONS FOR THE NAMIB-ATLANTIC INTERFACE
H. J. Annegarn, R. E. VanGrieken (Antwerp Univ., Belgium), J. W. Winchester (Florida State Univ., Tallahassee), J. P. F. Sellschop, and F. VonBlottnitz (Namib Research Inst., South-West Africa) *In* CSIR Intern. Conf. on Air Pollution, Vol. 4 25 Oct. 1979 18 p refs Sponsored in part by NATO, NIH and NSF (For primary document see N80-33954 24-45)
Avail: NTIS HC A11/MF A01

The time varying concetrations of eith heavy elements (Si, S, Cl, K, Ca, Ti, Fe, and Br) were determined for aerosols collected in the Nimib desert at Gobabeb, and at Swakopmund on the Atlantic coast. The samples were collected using streaker filters and analyzed by proton induced X-ray emission. The elemental concetrations at three hour intervals, together with temperature, humidity, and wind data are analyzed by multivariate statistics and factor analysis, allowing characterization of Southern Hemisphere background aerosols in maritime and continental air masses. An episode of clean continental air is identified, allowing a background value for condensation mode sulfur aerosol to be calculated. From the sulfur meteorological data correlations, inferences on the atmospheric sulfur conversion chemistry are made. E.D.K.

N80-33958# Monitor Labs., Inc., Calif.
AMBIENT AIR QUALITY MONITORING SYSTEMS: STATE OF THE ART
A. Budd and M. S. Turnbull (Syscom Instrumentation Ltd., Benoni, South Africa) *In* CSIR Intern. Conf. on Air Pollution, Vol. 4 25 Oct. 1979 12 p (For primary document see N80-33954 24-45)
Avail: NTIS HC A11/MF A01

Current analysis techniques for airborne gaseous/vapor pollutants measuring in the low parts per billion range are reviewed. The accuracy, interference susceptibility, repeatability, and reliability of such equipment are emphasized. It is necessary for this equipment to be calibrated regularly, automatically, and to a known standard. Other parameters such as meteorological components must be monitored since these greatly influence the conected data. E.D.K.

N80-33959# Council for Scientific and Industrial Research, Pretoria (South Africa).
POSSIBILITIES AND LIMITATIONS OF DIFFERENT TYPES OF DISPERSION MODELS WITH RESPECT TO AIR QUALITY MANAGEMENT
B. Gutsche (Freie Univ.) and P. Zib *In its* Intern. Conf. on Air Pollution, Vol 4, 25 Oct. 1979 23 p refs (For primary document see N80-33954 24-45)
Avail: NTIS HC A11/MF A01

The requirements of an air quality management system necessitated the development of a modular system of dispersion models as prognostic instruments. Elementary conceptions and first results for the coupled micro and urban scale dispersion of automotive emissions are presented. E.D.K.

N80-33960# American Air Filter Co., Inc., Louisville, Ky.
ENVIRONMENTAL AIR QUALITY CONTROL FROM THE INSIDE LOOKING OUT
Edwin B. Fieldhouse *In* CSIR Intern. Conf. on Air Pollution, Vol. 4 25 Oct. 1979 29 p (For primary document see N80-33954 24-45)
Avail: NTIS HC A11/MF A01

A clear understanding of and an analytical solution to the problems associated with pollution control requires a quantitative definition of pollution problems. Pollution reuction strategies based on material and energy flow information must be devised in order to improve plant or product system efficieny. Realisitic pollution control policies need to be established to meet conflicting goals such as employee demands, management guidelines, and government regulations. An understanding of what technology

can and cannot contribute toward the maintenance of a healthy environment is also required. E.D.K.

N80-33961# Council for Scientific and Industrial Research, Pretoria (South Africa).
THE TRANSFER OF POLLUTANTS IN TWO SOUTHERN HEMISPHERIC OCEANIC SYSTEMS
C. E. Cloete, ed. Oct. 1979 198 p refs Workshop held at Plettenberg Bay, South Africa, 23-26 Apr. 1979
(Rept-39; ISBN-0-7988-1649-X) Avail: NTIS
HC A09/MF A01

Available information on the sources and principal routes by which pollutants enter the sea around southern Africa is summarized. The importance of different physical, chemical and biological processes is discussed in relation to the transfer of pollutants into and between the Agulhas and the Benguela oceanic systems around southern Africa. The two systems serve as examples of an oceanic current and an upwelling system. Extrapolations are drawn, as far as possible, to the rest of the Southern Hemisphere and similar conditions elsewhere. The major pollutant types discussed include petroleum hydrocarbons, toxic elements, organic wastes, halogenated hydrocarbons, radioactive materials and heat. Processes involved in the transfer of pollutants to the sea, transfer across watermass boundaries and interface transport processes are discussed. The relative importance of different processes is assessed, gaps in knowledge are identified and recommendations are made for future research. T.M.

N80-33962# National Research Inst. for Oceanology, Stellenbosch (South Africa).
A THREE DIMENSIONAL FINITE DIFFERENCE MODEL OF THE TRANSPORT OF SUSPENDED SEDIMENT
J. M. C. Nicholson Nov. 1979 105 p refs
(CSIR-RR-359; ISBN-0-7988-1562-0) Avail: NTIS
HC A06/MF A01

A three dimensional, mathematical model of the transport of suspended sediment was developed which, in conjunction with a bed load model, can be used to predict the deposition and erosion patterns associated with coastal and fluvial structures. The proposed model, which is described herein, employs a semi-implicit, finite difference approach to solve the diffusion advection equation for suspended sediment transport. The advection process is solved explicitly, the vertical diffusion process is solved explicitly. Longitudinal diffusion is neglected. Author

N80-33963# Committee on Environment and Public Works (U. S. Senate).
THE STATUS OF ENVIRONMENTAL ECONOMICS: AN UPDATE
Joseph P. Biniek Washington GPO 1979 467 p refs Rept. presented to the Comm. on Environ. and Public Works, 96th Congr., 2nd Sess., Jul. 1979 Prepared by Congressional Research Service, Library of Congress
(GPO-48-402) Avail: SOD

The data base for economic evaluations of environmental issues is examined. Emphasis is placed on resolving or at least diminishing the conflicting assertions about the incompatibility of environmental quality with other important goals. Numerous types of studies are considered. These include costs of pollution control, macroeconomic assessments, microeconomic assessments, international cost comparisons, benefit-cost analyses, and cost effectiveness studies. J.M.S.

N80-33964# Committee on Science and Technology (U. S. House).
LOW-LEVEL IONIZING RADIATION
Washington GPO 1979 881 p refs Hearings before the Subcomm. on Energy Res. and Production and the Subcomm. on Nat. Resources and Environ. of the Comm. on Sci. and Technol., 96th Congr., 1st. Sess., no. 41, 13-15 Jun. 1979
(GPO-50-084) Avail: SOD

The current policies and the state of knowledge concerning low level ionizing radiation are examined. Emphasis is placed on the radiation risk issue. Other topics discussed include the possible need for expanded radiation monitoring and radiation health effects research, laboratory and epidemiological studies on radiation exposure and associated biological effects, and low level radiation exposure attributed to the nuclear fuel cycle and other energy sources. J.M.S.

N80-33965# Center for the Environment and Man, Inc., Hartford, Conn.
THE PERTURBATION OF SOME ATOMSPHERIC MECHANISMS BY EMISSIONS FROM AIRCRAFT Final Report
G. D. Robinson Nov. 1979 105 p refs
(Contract DOT-FA77WA-4055)
(AD-A089100; CEM-4232-667; FAA-EE-80-16) Avail: NTIS
HC A06/MF A01 CSCL 04/1

The logical basis of the equations which are solved numerically in models of atmospheric structure and composition is examined, with the conclusion that even the most advanced examples must be regarded as empirical devices to be judged by results (some of which are impressive). The question of possible change of climate resulting from aircraft propulsion emissions into the high atmosphere is briefly reviewed. It is concluded that in the foreseen future, any impact of high altitude commercial flight on climate will be very small and not detectable against the background of natural fluctuations. Measurements of the water vapor content of air in the upper troposphere and lower stratosphere are reviewed. They are interpreted to indicate that significant upward movement of air through a pressure level of about 100 mb, by processes of any scale, occurs only in equatorial latitudes, but they leave uncertain the mechanism of the upward transfer. Using this hypothesis, the mass balance of the nitrogen species is calculated and differences in the results of various modeling procedures are exposed. Two phenomena peculiar to the immediate wake of the aircraft are very briefly considered. The first is the possible rapid conversion of NO to HNO3 in the hot highly concentrated exhaust. The second is formation of condensation trails. It is suggested that in neither problem can an investigation be profitably reopened at this time. GRA

N80-33966# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy Office.
WASHINGTON NATIONAL AIRPORT FLIGHT EXTENSION TEST. NOISE MONITORING DATA REPORT Final Report
James R. Hare, Jr. and David W. Ford May 1980 103 p ref
(AD-A089111; FAA-EE-80-25) Avail: NTIS
HC A06/MF A01 CSCL 01/2

This report summarizes noise measurements obtained during the Washington National Airport Flight Extension Test conducted during the summer of 1979. During this test, south departing turbojet aircraft were directed to fly over the Potomac River corridor an additional five miles prior to being directed toward their destinations. Monitoring sites were set up in the affected areas to determine the effect of the change in operations on the ambient noise levels. Equivalent noise levels (Leq) were obtained on an hourly basis and averaged for each site. The results show no statistically significant change in averaged equivalent noise levels at three sites. Significant decreases in Leq were recorded at four sites and five of the twelve sites observed some statistically significant increase in equivalent sound levels. Maximum levels (dBA) were also recorded for single aircraft events. The average maximum noise levels for the single event, during the afternoon period at Accokeek Park, for example, increased from 6.5 dB(A) to 13.5 dB(A) over the normal operational levels, varying with aircraft type. This increase in maximum levels, combined with the increased number of overflights (from 0 to 5 per hour before to 15 to 20 per hour during the test period) produced the increase in average equivalent noise levels in the southern region of the affected area. GRA

N80-33967# Noah (J. Watson) Associates, Inc., Falls Church, Va.
IMPLICATIONS OF REQUIRING NEW PRODUCTION OF OLDER AIRCRAFT TYPES (LESS THAN 75,000 POUNDS) TO MEET AMENDED NOISE STANDARDS Final Report
C. F. Day, E. D. Studholme, and J. C. Jones Jun. 1980 60 p
(Contract DOT-FA78WA-4192)
(AD-A088577; DFR-1472-FAA) Avail: NTIS
HC A04/MF A01 CSCL 13/2

Implication of requiring new production of older business jets to meet noise standards are examined. Most current production business jets are well below these standards. Except for reengineering, application of known technology will not lead

to significant noise reductions. Reengineering appears to be impractical since use of an available alternative engine would have a major impact on aircraft performance and mission characteristics. Significant reductions in noise footprint can be achieved by means of noise abatement flight procedures. Use of new production models of these aircraft in the post 1985 time period is not expected to have major community noise impacts particularly at airports with 50 or more air carrier departures per day. S.F.

N80-33968# Naval Research Lab., Washington, D. C.
BATCH PROCESSING WITH THE RADIOIODINE LASER INDUCED-FLUORESCENCE DETECTOR
J. R. McDonald and A. P. Baronavski 27 Aug. 1980 19 p refs
(AD-A088773; NRL-MR-4301) Avail: NTIS HC A02/MF A01 CSCL 20/5

The Chemistry Division of the Naval Research Laboratory in cooperation with the Department of Energy has carried out research related to the detection and monitoring of airborne I2-129. Methods for conversion of alkyl Iodides and HI to I2 were quantitatively evaluated for use in batch processing. Scrubbing properties of silver zeolites in terms of their affinity for I2 and NO2 and chemical and thermal desorption curves were studied and evaluated for use in batch processing. T.M.

N80-33969# Los Alamos Scientific Lab., N. Mex.
PRELIMINARY STUDY OF THE POTENTIAL ENVIRONMENTAL CONCERNS ASSOCIATED WITH SURFACE WATERS AND GEOTHERMAL DEVELOPMENT OF THE VALLES CALDERA
G. J. Langhorst Jun. 1980 16 p refs
(LA-8398-MS) Avail: NTIS HC A02/MF A01

A preliminary evaluation is presented of possible and probable problems that may be associated with hydrothermal development of the Valles Caldera known geothermal resource area (KGRA), with specific reference to surface waters. Because of the history of geothermal development and its associated environmental impacts, this preliminary evaluation indicates the Valles Caldera KGRA will be subject to these concerns. Although the exact nature and size of any problem that may occur is not predictable, the baseline data accumulated so far have delineated existing conditions in the streams of the Valles Caldera KGRA. Continued monitoring will be necessary with the development of geothermal resources. Further studies are also needed to establish guidelines for geothermal effluents and emissions. DOE

N80-33970# JRB Associates, McLean, Va.
CONTROLLING HAZARDOUS WASTES RESEARCH SUMMARY
Mark Schaefer, ed. Mar. 1980 28 p refs
(Contract EPA-68-01-4839)
(PB80-194202; EPA-600/8-80-017) Avail: NTIS HC A03/MF A01 CSCL 13B

This brochure contains a concise description of EPA's hazardous wastes research program. The 3 part discussion focuses on hazardous wastes identification, emergency response, and long-term control technologies. GRA

N80-33971# California Inst. of Tech., Pasadena. Environmental Quality Lab.
ASSESSMENT OF ALTERNATIVE STRATEGIES FOR SLUDGE DISPOSAL INTO DEEP OCEAN BASINS OFF SOUTHERN CALIFORNIA Final Report
George A. Jackson, Robert C. Y. Koh, Norman H. Brooks, and James J. Morgan Sep. 1979 271 p refs Sponsored in part by Ford Foundation, N.Y. Rockefeller Foundation, N.Y. and Los Angeles/Orange County Metropolitan Area Project, Whittier, Calif.
(PB80-192990; EQL-14) Avail: NTIS HC A12/MF A01 CSCL 13B

The assessment of various strategies for ocean disposal of digested sewage sludge is presented. The Southern California Bight is discussed. GRA

N80-33972# Acurex Corp., Mountain View, Calif.
AIR POLLUTION CONTROL DEVICE CONFIGURATIONS Final Consultant Report
Mar. 1980 48 p refs
(PB80-193253; CAEC-59; CAEC-300-80-003) Avail: NTIS HC A03/MF A01 CSCL 13B

An analysis of data air pollutant abatement schemes for possible use on coal-fired electric generating plants is presented. Emphasis is placed on the effects of the arrangement of the control components, namely the baghouse, selective catalytic reduction and flue gas desulfurization units. Three basic configurations were identified as workable arrangements. The configurations were analyzed with respect to their capital, operating and maintenance cost impacts, reliability implications, and overall system removal efficiencies. Since there is no actual experience reported for these configurations with coal fired boilers, reliability and overall efficiency estimates were described qualitatively. GRA

N80-33973# Acurex Corp., Mountain View, Calif.
ASSESSMENT OF H2S CONTROL TECHNOLOGIES FOR GEOTHERMAL POWER PLANTS Final Consultant Report
Feb. 1980 123 p refs
(PB80-193709; CAEC-57; AEC-300-80-004) Avail: NTIS HC A06/MF A01 CSCL 13B

Several technologies for controlling hydrogen sulfide (H2S) emissions from power plants are examined. The Hydrogen Peroxide Combination System, Stretford System, and possibly EIC or Coury upstream controls appear capable of compliance with the emission limitations of 100 grams per hour per gross megawatt in 1980 at the Geysers Dry stream field in Northern California. Potential controls for stacking are: (1) upstream abatement, (2) automated well operation, (3) computerized well-field operation (as of PG&E's Geysers Unit No. 15) and (4) further steamfield interconnection (cross-overs). Controls for liquid geothermal resources are largely in developmental or theoretical stages and greater efforts are needed to insure resource development with minimal environmental consequences. GRA

N80-33974# Midwest Research Inst., Kansas City, Mo.
SOURCE EMISSION MEASUREMENTS OF VOLATILE ORGANIC CHEMICALS Final Report, Sep. 1978 - Dec. 1979
George W. Scheil, Fred J. Bergman, and Harold Owens Jul. 1980 48 p refs
(Contract EPA-68-02-2977)
(PB80-198518; EPA-600/2-80-166) Avail: NTIS HC A03/MF A01 CSCL 14B

Analytical methods for measuring volatile organic compounds were reviewed. Two commercially available instruments were selected and evaluated in the laboratory; one was judged unacceptable. The other analyzer was evaluated during limited field test; results were satisfactory and averaged 3 percent higher than results produced by a concurrently operated gas chromatograph system. GRA

N80-33975# Office of Naval Research, Tokyo (Japan). Scientific Liaison Office.
ELECTROSTATIC PRECIPITATION RESEARCH IN JAPAN
Leon H. Fisher Apr. 1980 60 p refs Submitted for publication
(PB80-194137) Avail: NTIS HC A04/MF A01 CSCL 13B

Japanese research activities and trends involving the electrostatic removal of suspended particles, fumes, and mists from flowing gases are reviewed. A general discussion of electrostatic precipitation principals and an historical overview of their application to pollution control is included. The background to Japanese interest in electrostatic precipitation technology is reviewed, and matrix under which research in this area is carried out in Japan is described. The activities of the Institute of Electrostatics and of the Electrostatics Laboratory at the University of Tokyo are reviewed. Listings of the names and addresses of Japanese manufacturers of electrostatic precipitation equipment and of Japanese researchers in this field are included. GRA

N80-33976# Washington Univ., Seattle. Dept. of Civil Engineering.
MONITORING BY AERIAL AND TERRESTRIAL PHOTOGRAMMETRY Final Report
S. A. Veress, J. N. Hatzopoulos, and Riad Munjy Dec. 1979 115 p refs Sponsored in part by Washington State Dept. of

Transportation, Olympia, Wash. and FHA, Olympia, Wash.
(PB80-192925; FHWA-WA-80-38.1) Avail: NTIS
HC A06/MF A01 CSCL 13B

A photogrammetric monitoring method of structural deformation was developed. The method is based on a combination of aerial and terrestrial photographs. The theoretical experimentation for formulation of computer programs was done on mathematical models. The combination of aerial and terrestrial photographs provides a 30% increased accuracy if compared to terrestrial photographs only. Practical experimentation was done on the existing Gabion Wall and it was indicated that the achievable accuracy is 1/120,000 of the photographic distance. The method is flexible if it can be used for monitoring of any type of structure as well as for aerial triangulation. GRA

N80-33977 SRI International Corp., Menlo Park, Calif.
SODAR NETWORK SUPPORT FOR LIRAQ UTILIZATION IN CONJUNCTION WITH PROJECT MABLE Final Report, Jun. 1978 - Oct. 1979
Phillip B. Russell Oct. 1979 44 p refs
(Contract ARB-A7-184-309)
(PB80-192909; SRI-8052; ARB-R-79/118) Avail: NTIS
HC A03/MF A01 CSCL 13B

A network of six sodars (acoustic radars) was operated in the San Francisco Bay area from late July to early September 1978. The purpose of the network was to acquire inland mixing-depth data for use by the Bay Area Air Quality Management District in their studies of summer oxidant episodes in conjunction with data from Project MABLE. The sodar data from 28 July through 15 August were reduced to a digital form giving hourly mixing-depth estimates and surface-stability indicators. A computer code was developed to plot these data, thus giving an overview and facilitating comparisons among different sites, days, and times of day. Listings and plots of the digital data are shown and discussed. The importance of site selection and equipment maintenance to resulting sodar data quality is emphasized through examples. GRA

N80-33978 South Carolina Univ., Columbia. Dept. of Chemistry.
EVALUATION OF SOLID ADSORBENTS FOR COLLECTING ATMOSPHERIC CHLORINATED HYDROCARBONS
Terry F. Bidleman, W. Neil Billings, and Charles G. Simon Jul. 1980 67 p refs
(Grant EPA-R-804716)
(PB80-198526; EPA-600/2-80-167) Avail: NTIS
HC A04/MF A01 CSCL 13B

The comparative efficiency of polyurethane foam (PUF) and Tenax-GC resin for collecting polychlorinated biphenyls (PCB) and chlorinated pesticides from 300-1600 cu m air was determined by side-by-side sampling with each adsorbent in the city of Columbia, South Carolina. GRA

N80-33979*# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
PROCEEDINGS OF THE WORKSHOP ON GOVERNMENT OIL SPILL MODELING
Joseph M. Bishop, comp. Feb. 1980 32 p Workshop held at Wallops Island, Va., 7-9 Nov. 1979
(NASA-CR-163640; PB80-190945; NOAA-80042401) Avail: NTIS HC A03/MF A01 CSCL 13B

Oil spill model users and modelers were brought together for the purpose of fostering joint communication and increasing understanding of mutual problems. The workshop concentrated on defining user needs, presentations on ongoing modeling programs, and discussions of supporting research for these modeling efforts. Specific user recommendations include the development of an oil spill model user library which identifies and describes available models. The development of models for the long-term fate and effect of spilled oil was examined. GRA

N80-33980# Radian Corp., Austin, Tex.
STACK GAS REHEAT EVALUATION Final Report, Jun. 1977 - Feb. 1980
W. R. Menzies, C. A. Muela, and G. P. Behrens Mar. 1980 315 p refs
(Contract EPA-68-02-2642)
(PB80-196850; EPA-600/7-80-051) Avail: NTIS
HC A14/MF A01 CSCL 13B

Results of technical and economic evaluations of stack gas reheat (SGR) following wet flue gas desulfurization (FGD) for coal fired power plants are given. The evaluations were based on information from literature and a survey of PGD users, vendors, and architect/engineer firms. SGR processes and their features and their commercial operating experience are summarized. It addresses benefits and energy requirements associated with SGR, and describes a developed method for estimating reheat costs. SGR can protect equipment downstream of a wet scrubber from corrosion, reduce the potential for acid rainout near the plant stack, preclude visible stack plumes, and reduce ground level pollutant concentrations by increasing plume buoyancy. GRA

N80-33981# Midwest Research Inst., Kansas City, Mo. Environmental Systems Dept.
FINE PARTICLE EMISSIONS INFORMATION SYSTEM Annual Report, Jan. - Dec. 1979
J. P. Reider and R. F. Hegarty May 1980 67 p refs
(Contract EPA-68-02-2641; MRI Proj. 4396-L)
(PB80-195753; EPA-600/7-80-092) Avail: NTIS
HC A04/MF A01 CSCL 05B

The Fine Particle Emissions Information System (FFES) is a computerized inventory of the particle measurement information for researchers engaged in fine particle control technology development and in the environmental assessment of energy and industrial processes. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-33982 California Univ., Los Angeles.
TWO DIMENSIONAL SMOOTHING OF A VECTOR LAPLACIAN RANDOM FIELD WITH APPLICATION TO GEODESY Ph.D. Thesis
Samiresh Chandra Bose 1980 180 p
Avail: Univ. Microfilms Order No. 8023279

A two dimensional signal processing algorithm was developed to obtain smoothed estimates of a vector random field when observed in the presence of additive two dimensional white noise. The vector random field consists of a two dimensional scalar random field and its two orthogonal derivatives, each of which can be scaled arbitrarily by a constant. The signal model consists of the Laplacian operator acting on the two dimensional scalar random field excited by two dimensional white noise. The algorithm can be used to process noisy gravity measurements on a local region on the surface of the Earth. Using the physical theory of geodesy, it is shown that in the formulation of the smoothing algorithm the two dimensional scalar random field represents the anomalous gravitational potential on a local region on the surface of the Earth and vector random field consists of the gravity anomaly and two deflections of the vertical.
Dissert. Abstr.

N80-33983 Colorado Univ. at Boulder.
SEISMIC STRESS RELAXATION PHENOMENA IN AN INHOMOGENEOUSLY PRESTRESSED MEDIUM Ph.D. Thesis
Jeffry Lowell Stevens 1980 288 p
Avail: Univ. Microfilms Order No. 8021640

Seismic sources in a very general prestress field were studied. The effects of inhomogeneous prestress fields on seismic radiation were investigated. The investigation was made through the use of spherical source models. An exact solution was found for the sudden creation of a spherical cavity in an arbitrarily prestressed medium. This was applied first to homogeneous stress fields, next to general inhomogeneous stress fields, and finally to the case in which stress concentrations were located nearby.
Dissert. Abstr.

N80-33984 Texas A&M Univ., College Station.
ORIGIN AND OCCURRENCE OF SELECTED WORLD WIDE CALCRETE DEPOSITS Ph.D. Thesis
Robert Eugene Tompkins 1980 156 p
Avail: Univ. Microfilms Order No. 8023077

Seven calcrete deposits from a variety of climatic environments and substrate conditions were sampled to determine the sequence and modes of formation, in addition to diagenetic alterations following deposition. Emphasis was placed on the mineralogy, crystal morphology, and elemental composition of individual sections of each calcrete deposit. These parameters promoted characterization of climatic affects from several geographic locations and a detailed mode of formation for each deposit. Two basic modes of formation are responsible for the synthesis of these calcrete profiles: (1) addition of new carbonate material resulting in calcrete formed by upward accretion; and (2) sparmicritization, which refers to degrading recrystallization of sparry calcite to micrite by dissolution of the spar and concomittant precipitation of micrite in the space previously occupied by spar. Dissert. Abstr.

N80-33985 California Univ., Los Angeles.
A NUMERICAL STUDY OF THE EFFICIENCY WITH WHICH AEROSOL PARTICLES COLLIDE WITH SIMPLE PLANAR ICE CRYSTALS Ph.D. Thesis
Jon Joseph Martin 1980 514 p
Avail: Univ. Microfilms Order No. 8023343

A theoretical investigation is presented on the interaction of simple planar ice crystals with aerosol particles in air of various conditions. A fuller elucidation of the importance of plate-like ice crystals in the overall atmospheric aerosol particle budget is provided. Two theoretical models, the trajectory model and the flux model, are discussed which permit the computation of the efficiency with which aerosol particles are collected by simple ice crystal plates idealized by thin oblate spheroids. The calculations considered various atmospheric pressures, temperatures and relative humidities. Particle capture due to inertial impaction, Brownian diffusion, thermophoresis, diffusiophoresis and electrostatic forces are considered. It is shown that, analogous to water drops, ice crystals exhibit a minimum in collision efficiency within a specific size interval of aerosol particles. The minimum is strongly affected by the relative humidity of the ambient air. Our theoretical results are found to agree satisfactorily with the laboratory studies presently available. Dissert. Abstr.

N80-33986 California Univ., Los Angeles.
DYNAMIC TRANSPORT OF INERT TRACERS BY GROWING BAROCLINIC AND STATIONARY PLANETARY WAVES IN THE LOWER STRATOSPHERE OF THE NORTHERN HEMISPHERE IN WINTER Ph.D. Thesis
John Gerald DeVore 1980 175 p
Avail: Univ. Microfilms Order No. 8023295

The roles of growing baroclinic and stationary planetary waves in effecting transports of inert tracers such as ozone in the lower stratosphere of the Northern Hemisphere in winter are studied theoretically. Wave velocity fields are derived from linear, quasi-geostrophic theoretical models: in the case of growing baroclinic waves, a beta-plane channel model; and, in the case of stationary planetary waves, a hemispheric model. The associated wave-induced mean meridional circulations are calculated with complementary models. The three-to-one relative importance of horizontal to vertical velocities in producing the relationship of ozone vertical column content to cyclonic depressions is confirmed for the prototype baroclinic wave. The observed longitudinal asymmetries in seasonal averages of total ozone are well reproduced by the model stationary planetary waves. It is shown that stationary planetary waves are significant contributors to the winter-time buildup of ozone in the high latitudes of the Northern Hemisphere. Dissert. Abstr.

N80-33987 North Carolina State Univ. at Raleigh.
AN INVESTIGATION OF CERTAIN FUNDAMENTAL INVARIANCE PROPERTIES OF FIELD THEORIES INCLUDING GRAVITATIONAL THEORIES WITH TORSION Ph.D. Thesis
William Mebane Baker 1980 166 p
Avail: Univ. Microfilms Order No. 8020518

The scale invariant Lagrangian densities in Riemannian and nonRiemannian spacetimes are examined. The most general scale invariant Lagrangian density of a Riemann-Cartan spacetime can also be reduced in a manner similar to that demonstrated earlier by Lanczos for the Riemannian case. However, this type of reduction process is not possible in a nonmetric spacetime. Duality transformations of the type defined in electromagnetic theory are discussed and classified in terms of those transformations having a direct relationship to an internal symmetry structure of a given gauge theory and those that do not. It is shown that to build a satisfactory generalized electromagnetic type theory with local duality invariance into a gauge theory, as at least a part of its internal symmetry structure requires a group no smaller than SO3 or (SU2). Various reductions in an SO3 invariant model with sources are considered which allow one to see how the standard form of Maxwell's theory, together with some of its immediate generalizations may be thought of as embedded in the nonAbelian gauge theory. These reductions and this type of embedding of a Maxwell type theory are discussed in connection with spontaneous symmetry breaking. A simple type of doubled Weinberg-Salam model that could include a duality invariant form of electromagnetic theory with magnetic monopoles is briefly considered. Dissert. Abstr.

N80-33988 Texas Univ. at Austin.
A MULTI-SITE MAGNETOTELLURIC MEASUREMENT SYSTEM WITH REAL TIME DATA ANALYSIS Ph.D. Thesis
James David Becker 1980 191 p
Avail: Univ. Microfilms Order No. 8021400

A magnetotelluric measurement system was designed to provide a more cost effective electrical method for geothermal and mineral exploration. The theoretical requirements and sensitivities of the magnetotelluric inversion process were specifically addressed in determining system performance requirements. Significantly reduced instrument noise levels provided improved data quality, and simultaneous measurement at up to six locations provided reduced cost per site. Dissert. Abstr.

N80-33989 Pennsylvania State Univ., University Park.
THE DETECTION OF ATMOSPHERIC GRAVITY WAVES BY MEANS OF THE WAVE INTERACTION EXPERIMENT Ph.D. Thesis
Michael Peter Sulzer 1979 223 p
Avail: Univ. Microfilms Order No. 7922353

Gravity wave propagation theory is reviewed, and expressions are derived which allow the development of sensitivity relations for the wave interaction experiment to the propagation of gravity waves. The effect of the variation of various ionospheric parameters upon the wave interaction coefficient is investigated and the effect of a gravity wave is deduced. Horizontal and vertical spatial sensitivities are found and other factors affecting the detection of gravity waves are discussed. The technique and equipment of the wave interaction were modified to allow continuous recording and simultaneous measurement at many heights. Data collected at the National Astronomy and Ionosphere Center and at the Scotica field station of the Ionosphere Research Laboratory were analyzed using carefully described statistical techniques. Results consistent with the propagation of mesospheric gravity waves are presented and discussed. Dissert. Abstr.

N80-33990 Cornell Univ., Ithaca, N. Y.
RADAR OBSERVATIONS OF THE EQUATORIAL ELECTROJET IRREGULARITIES AND THEORY OF TYPE 1 TURBULENCE Ph.D. Thesis
Henrick Mario Ierkic Vidmar 1980 174 p
Avail: Univ. Microfilms Order No. 8020836

The dependence of the cross section of the equatorial electrojet irregularities with zenith angle (magnetic east to west) was measured. It was found that for the type 1 irregularities the cross section has an exponential dependence with zenith angle increasing at a rate of about 0.3 db/degree. The type 2 irregularities have a constant cross section. The absolute values of the cross section were also measured and the total density fluctuation levels for both types of irregularities estimated. The nighttime electrojet was examined using an interferometric technique. The vertical profiles of the electron velocity were

measured and irregularities with small Doppler shifts were observed to be diffuse while the type 1 waves are localized in space. The direct interaction approximation method of Kraichnan was applied to explain the possibility of nonlinear shifts from the linearly predicted modes for the type 1 waves. The method provided two coupled integral equations relating the intensity of density fluctuations and the nonlinear frequency shift and damping of the unstable waves. Dissert. Abstr.

N80-33991*# Ohio State Univ., Columbus. Dept. of Geodetic Science.

GEODETIC POSITIONING USING A GLOBAL POSITIONING SYSTEM OF SATELLITES

Patrick J. Fell. Jun. 1980. 297 p. refs. Prepared for Defense Mapping Agency, Washington, D.C.
(Grant NsG-5265; OSURF Proj. 711055)
(NASA-CR-163609; OSU-299) Avail: NTIS HC A13/MF A01 CSCL 08E

Geodetic positioning using range, integrated Doppler, and interferometric observations from a constellation of twenty-four Global Positioning System satellites is analyzed. A summary of the proposals for geodetic positioning and baseline determination is given which includes a description of measurement techniques and comments on rank deficiency and error sources. An analysis of variance comparison of range, Doppler, and interferometric time delay to determine their relative geometric strength for baseline determination is included. An analytic examination to the effect of a priori constraints on positioning using simultaneous observations from two stations is presented. Dynamic point positioning and baseline determination using range and Doppler is examined in detail. Models for the error sources influencing dynamic positioning are developed. Included is a discussion of atomic clock stability, and range and Doppler observation error statistics based on random correlated atomic clock error are derived. Author

N80-33992*# Miami Univ., Fla. Div. of Meteorology and Physical Oceanography.

NUMERICAL STUDY OF BAROCLINIC INSTABILITY. Final Report, 1 Sep. - 30 Nov. 1979

J. E. Geisler and W. W. Fowlis. 6 Mar. 1980. 17 p. refs.
(Contract NAS8-33558)
(NASA-CR-161580) Avail: NTIS HC A02/MF A01 CSCL 04A

The effect of a power law gravity field on baroclinic instability is examined with emphasis on the case of inverse fifth power gravity, since this is the power law produced when terrestrial gravity is simulated in spherical geometry by electrostatic means. Growth rates of unstable normal modes were obtained as a function of parameters of the problem by solving a second order differential equation numerically. Results are compared with those from an earlier study where gravity was a constant. The conclusion is that, over the range of parameter space explored here, there is no significant change in the character of theoretical regime diagrams if the vertically averaged gravity is used as a parameter. A.R.H.

N80-33993*# California Inst. of Tech., Pasadena.

FUNDAMENTALS STUDIES IN GEODYNAMICS. Final Technical Report, 1 Aug. 1979 - 31 Jul. 1980

Don L. Anderson. Jul. 1980. 300 p. refs.
(Grant NsG-7610)
(NASA-CR-163620) Avail: NTIS HC A13/MF A01 CSCL 08G

Research in geodynamics, seismology, and planetary quakes is presented. Terradynamics and plate tectonics are described using dynamic models. The early evolution of the Earth's mantle is also discussed. T.M.

N80-33994# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council for Scientific and Technical Research.

COMMENT ON AIRGLOW OBSERVATIONS OF THE OI 7774 A MULTIPLET AT ARECIBO DURING A MAGNETIC STORM BY ROGER G. BURNSIDE, JOHN W. MERIWETHER AND JAMES C. G. WALKER

Y. Sahai, J. A. Bittencourt, and N. R. Teixeira. Aug. 1980. 13 p. refs.
(INPE-1843-RPE/203) Avail: NTIS HC A02/MF A01

Measurements and theoretical calculations of the 7774A and 6300A emissions for Arecibo, Puerto Rico, for May 2-3, 1976 during severe magnetic storm conditions are presented. The 6300 A observations were made with a tilting filter photometer looking at zenith, whereas the 7774A observations were made with a 1.0 m Ebert-Fastie spectrometer looking towards the west at an elevation angle of 20 deg. The theoretical calculations of the vertical column intensities of these emissions for this specific night, were performed using vertical electron density profile measurements made with the Arecibo 430 MHz radar. Their results show a reasonably good fit between experimental and theoretical 6300 A emissions. However, for the 7774A emission, there is a discrepancy between the theoretical vertical column intensities and the intensities observed looking west at 70 deg. from the zenith. Possible excitation mechanisms to explain the excess 7774A observed intensities are discussed. R.K.G.

N80-33995# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ABSORPTION EQUILIBRIUM OF SOLAR RADIATION BETWEEN THE TWO HEMISPHERES OF EARTH [EQUILIBRIO DA ABSORCAO DA RADIACAO SOLAR ENTRE OS DOIS HEMISFERIOS DA TERRA]

Daniel Jean Roger Nordemann. Aug. 1980. 20 p. refs. In PORTUGUESE; ENGLISH summary.
(INPE-1851-RPE/208) Avail: NTIS HC A02/MF A01

The absorption of solar radiation by the Earth is a function of astronomical parameters (height, distance from the Sun) and of terrestrial parameters (albedo, bio-albedo, latent heat). The distribution of ocean and land may induce a disequilibrium of the solar radiation absorption between both hemispheres. The energy intake calculated by latitude zone, taking into account the global cloud cover, shows the balance between both hemispheres due to climate feedback processes. S.F.

N80-33996*# Illinois Univ., Urbana. Dept. of Electrical Engineering.

RESEARCH IN AERONOMY. Progress Report, 1 Oct. 1979 - 31 Mar. 1980

Belva Edwards, ed. 31 Mar. 1980. 101 p. refs.
(Grants NGR-14-005-181; NsG-5213; NsG-7506; NSF ATM-79-09982; NSF ATM-78-05224; NSF ATM-78-21765; NSF ATM-78-12308; NSF ATM-76-01773)
(NASA-CR-163610; PR-80-1) Avail: NTIS HC A06/MF A01 CSCL 04A

Rocketborne instruments used in aeronomy are described. Planetary wave dynamics are discussed. Coherent and incoherent scatter radar observations are presented. Laser radar and its calibration are discussed. T.M.

N80-33997*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COORDINATED IONOSPHERIC AND MAGNETOSPHERIC OBSERVATIONS FROM THE ISIS 2 SATELLITE BY THE ISIS 2 EXPERIMENTERS. VOLUME 1: OPTICAL AURORAL IMAGES AND RELATED DIRECT MEASUREMENTS

J. S. Murphree. Jul. 1980. 208 p.
(NASA-TM-81121; NSSDC/WDC-A-R/S-80-03-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 04A

A representative set of data from ISIS 2 covering a range of operating modes and geophysical conditions is presented. The data show the typical values and range of ionospheric and magnetospheric characteristics, as viewed from 1400 km with the ISIS 2 instruments. The definition of each data set depends partly on geophysical parameters and partly on satellite operating mode. Preceding the data set is a description of the organizational parameters and a review of the objectives and general characteristics of the data set. The data are shown as a selection from 12 different data formats. Each data has a different selection of formats, but uniformity of a given format selection is preserved throughout each data set. T.M.

N80-33998*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ATMOSPHERIC SOLAR ABSORPTION MEASUREMENTS IN THE 9 TO 11 MU M REGION USING A DIODE LASER HETERODYNE SPECTROMETER

Charles N. Hanward and James M. Hoell, Jr. Oct. 1980 14 p refs Presented at Heterodyne Systems and Technol. Conf., Williamsburg, Va., 25-27 Mar. 1980
(NASA-TP-1726; L-13877) Avail: NTIS HC A02/MF A01 CSCL 04A

A tunable diode laser heterodyne radiometer was developed for ground-based measurements of atmospheric solar absorption spectra in the 8 to 12 microns spectral range. The performance and operating characteristics of the Tunable Infrared Heterodyne Radiometer (TIHR) are discussed along with atmospheric solar absorption spectra of HNO3, O3, CO2, and H2O in the 9 to 11 microns spectral region. T.M.

N80-33999*# National Aeronautics and Space Administration, Washington, D. C.
THE COORDINATED FEDERAL PROGRAM FOR THE APPLICATION OF SPACE TECHNOLOGY TO CRUSTAL DYNAMICS AND EARTHQUAKE RESEARCH
Pitt G. Thome Jan. 1979 17 p refs Prepared in cooperation with NOAA and Geological Survey and NSF and Defense Mapping Agency
(NASA-TM-82215) Avail: NTIS HC A02/MF A01 CSCL 08G

The application of space technology to important problems relating to crustal dynamics and earthquake research is described. Federal plans for such applications are summarized.T.M.

N80-34000*# National Aeronautic Association, Washington, D. C.
NASA PLAN FOR INTERNATIONAL CRUSTAL DYNAMICS STUDIES
Apr. 1979 34 p refs
(NASA-TM-82214) Avail: NTIS HC A03/MF A01 CSCL 08G

The international activities being planned as part of the NASA geodynamics program are described. Methods of studying the Earth's crustal movements and deformation characteristics are discussed. The significance of the eventual formalations of earthquake predictions methods is also discussed. R.C.T.

N80-34001# Birmingham Univ. (England). Dept. of Space Research
ION-ION NEUTRALIZATION Interim Report, 1 Apr. 1978 - 30 Sep. 1979
David Smith and Nigel G. Adams Nov. 1979 16 p refs
(Grant AF-AFOSR-3260-77)
(AD-A080209; AFGL-TR-80-0010; IR-2) Avail: NTIS HC A02/MF A01 CSCL 04/1

This work is part of a larger program of ionic reaction studies at thermal energies, conducted by the authors of this report, which includes determinations of ion-molecule reaction rate coefficients and product ion distributions, electron-ion recombination coefficients and electron attachment coefficients. The work is largely intended as a contribution of the physics and chemistry of natural plasmas such as the Earth's atmosphere and the interstellar medium. A great deal of relevant data has been obtained principally because of our successful development and exploitation of the Langmuir probe/flowing afterglow and selected ion flow tube (SIFT) techniques. GRA

N80-34002# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.
INSTRUMENTATION DEVELOPMENT FOR LASSII EQUATORIAL MEASUREMENTS Final Report, Oct. 1977 - Mar. 1980
Edmund Trzcinski 23 Apr. 1980 18 p
(AF Proj. 2310)
(AD-A088880; AFGL-TR-80-0150; AFGL-IP-287) Avail: NTIS HC A02/MF A01 CSCL 04/1

A quadrupole ion mass spectrometer capable of measuring ion composition during equatorial ionospheric irregularities with a spatial resolution of 4 m over a range of 1 to 56 AMU is discussed. Instrument sensitivity has been adjusted to cover an ion concentration range of 10 ions/cc to million ions/cc. A separate measurement of ion density and its fluctuations is also made. The instrument was developed to fly on a space-shuttle-launched LASSII satellite. GRA

N80-34003# Air Force Geophysics Lab., Hanscom AFB, Mass.
ALMOST-NECESSARY CONDITIONS FOR A SOLAR ACTIVE REGION TO PRODUCE A SUBSEQUENT POLAR CAP ABSORPTION EVENT Air Force surveys in geophysics
Edward W. Cliver 17 Apr. 1980 20 p refs
(AF Proj. 4643)
(AD-A088882; AFGL-TR-80-0151; AFGL-AFSG-425) Avail: NTIS HC A02/MF A01 CSCL 14/1

Between 1955 and 1976, 133 polar cap absorption (PCA) events with unambigious solar flare associations were observed. Over one-fourth of these events (35/133) originated in solar active regions that had already produced a PCA. More significantly, these 'subsequent' PCA's included 35 percent (26/74) of all the principal greater than or equal to 2.0 dB) PCA's in this sample. In this paper, we establish quantitative criteria to distinguish between those solar active regions that are likely to produce such subsequent absorption events and those that pose no further threat to high latitude HF or VLF communications. These criteria are based on flare solar disk position and the greater than or equal to 8800 MHz burst peak flux density. GRA

N80-34004# SRI International Corp., Menlo Park, Calif.
ATMOSPHERIC/IONOSPHERIC/MAGNETOSPHERIC ARCH USING THE CHATANIKA RADAR Final Report, 1 Nov. 1976 - 31 Oct. 1979
M. J. Baron 31 Jan. 1980 48 p refs
(Contract DNA001-77-C-0042)
(AD-A088915; AD-E300897; DNA-5239F) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Chatanika incoherent scatter radar (located near Fairbanks, Alaska) has been operated by SRI International for the Defense Nuclear Agency and has been used to investigate atmospheric/ionospheric/magnetospheric phenomena of interest to the DNA. This report summarizes the accomplishments of the past three years. GRA

N80-34005# Regis Coll., Weston, Mass.
IN-FLIGHT CHARACTERISTICS OF THE TOPSIDE IONOSPHERIC MONITOR (SSIE) ON THE DMSP SATELLITE FLIGHT 2 AND FLIGHT 4 Environmental Research papers. Interim Status Report
F. Rich, M. Smiddy, R. C. Sagalyn, W. J. Durke, and P. Anderson 17 Apr. 1980 29 p refs Prepared in cooperation with AFGL, Hanscom AFB, Mass.
(Contract F19628-77-C-0122; AF Proj. 2371)
(AD-A088879; AFGL-TR-80-0152; AFGL-ERP-700) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Topside Ionospheric Plasma Monitor (SSIE) has been successfully flown on the Block 5D DMSP satellites on Flight 2 and Flight 4. This report describes the value and the limitations of these data based on an analysis of in-flight data. The SSIE is useful for determining the relative variation of the plasma density along the orbit of the satellite on a nearly continuous basis from August 1977 to February 1980. Variations in plasma density due to daily and seasonal changes in the ionosphere can be determined. Variations due to geomagnetic storms and substorms can also be determined. The instrument is limited during daytime operations by a large negative potential caused by the solar panels. During daylight operations, thermal ions are accelerated toward the ion sensor and thermal electrons are deflected away. On F4, a series of four floating bias potentials between the instruments and the spacecraft ground was installed and has proven successful. These bias potentials will be used for SSIE instruments on Flights 5 through 7. Additional design changes for Flights 8 through 10 are discussed. A format for archived data types for Flights 5 through 7 is described. GRA

N80-34006# Federal Aviation Agency, Washington, D.C. Office of Environment and Energy.
PROCEEDINGS OF THE NATO ADVANCED STUDY INSTITUTE ON ATMOSPHERIC OZONE AND ITS VARIATION AND HUMAN INFLUENCES
Marcel Nicolet and Arthur C. Aikin May 1980 976 p refs Conf. held in Aldeia das Acoteias, Portugal, 1-13 Oct. 1979
(AD-A088889; FAA-EE-80-20) Avail: NTIS HC A99/MF A01 CSCL 04/1

This volume contains the proceedings of a North Atlantic

Treaty Organization Advanced Study Institute on Atmospheric Ozone and its Human Influences. The conference was held at Aldeia das Acoteias, Portugal in October 1979. Included are papers for speakers who were invited to review the current state of knowledge for different aspects of the ozone problem. Selected short contributions of new results by other conference attendees are also given. Topics covered include solar flux and its changes, ozone observations and the theories of spatial and temporal distribution of ozone. Natural and man made trace gases which may influence atmospheric ozone are also discussed. GRA

N80-34007# Texas Univ. at El Paso.
THE DESIGN AND IMPLEMENTATION OF A COMPUTERIZED DATA REDUCTION SYSTEM
Ka-Bun John Ho and John D. Mitchell 31 Jan. 1980 136 p refs
(Contract DAAD07-78-C-0010)
(AD-A088734; SR3-80-UA-77) Avail: NTIS
HC A07/MF A01 CSCL 04/1

A computerized system for reducing middle atmosphere electrical conductivity data obtained by blunt probes and Gerdien condensers is developed. In addition to improving the computational speed and accuracy, this particular system enhances the instrument's sensitivity range, i.e. the altitude region over which measurements can be obtained. The reduction system is designed strongly toward software portability and micro-processor adaptability. Electrical conductivity data from recently launched blunt probes were reduced using this system, and the results are discussed in this thesis. Future expansion, improvements and two proposed micro-processor system designs are also presented. GRA

N80-34008# Naval Research Lab., Washington, D. C. Ionospheric Diagnostics Section.
EQUATORIAL SPREAD F IN SITU MEASUREMENTS OF ELECTRON DENSITY TEMPERATURE AND DENSITY FLUCTUATION POWER SPECTRA Interim Report
E. P. Szuszczewicz and J. C. Homes 25 Aug. 1980 36 p refs
(AD-A089133; NRL-MR-4289) Avail: NTIS
HC A03/MF A01 CSCL 04/1

The NRL pulsed plasma probe experiment was successfully flown on each of the two PLUMEX rockets during July 1979. The experiment provided direct measurements of absolute density, temperature, and density fluctuation power spectra with a maximum Nyquist frequency of 1 KHz. In the first operation, a number of major depletions were distributed throughout the F-region, from its bottomside gradient centered near 260 km, through the F-peak, to a topside altitude of 500 km. The most intense in situ irregularities occurred on the bottomside ledge where gradient scale lengths were found to vary between 2 and 25 km. The results support the role of the collisional Rayleigh-Taylor instability in generating intermediate wavelength irregularities during the occurrence of equatorial spread-F. GRA

N80-34009*# National Bureau of Standards, Washington, D.C.
KINETIC AND PHOTOCHEMICAL DATA FOR ATMOSPHERIC CHEMISTRY REACTIONS OF THE NITROGEN OXIDES Final Report, Jan. - Dec. 1979
R. F. Hampson, Jr. May 1980 95 p refs Sponsored in part by NASA, Washington, D.C.
(PB80-198799; NBSIR-80-2032) Avail: NTIS
HC A05/MF A01 CSCL 04A

Data sheets for thermal and photochemical reactions of importance in the atmospheric chemistry of the nitrogen oxides are presented. For each reaction the available experimental data are summarized and critically evaluated, and a preferred value of the rate coefficient is given. The selection of the preferred value is discussed and an estimate of its accuracy is given. For the photochemical process, the data are summarized, and preferred for the photoabsorption cross section and primary quantum yields are given. GRA

N80-34010# Woods Hole Oceanographic Institution, Mass. Dept. of Geology and Geophysics.
ASSESSMENT OF SEABED SEISMIC SYSTEMS
Elizabeth T. Bunce Apr. 1980 28 p refs Prepared in cooperation with Sandia Labs., Livermore, Calif.
(PB80-195985; WHOI-80-24) Avail: NTIS HC A03/MF A01 CSCL 08G

The necessary research and documentation of existing seismic techniques and systems for the study of sediments and sedimentary structures in the oceans are presented. GRA

N80-34011*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SOLAR-TERRESTRIAL PREDICTIONS PROCEEDINGS. VOLUME 4: PREDICTION OF TERRESTRIAL EFFECTS OF SOLAR ACTIVITY
Richard E. Donnelly, ed. Mar. 1980 660 p refs Proceedings held at Boulder, Colo., 23-27 Apr. 1979 Sponsored in part by NASA, AFGL, AFOSR, DOE, and NSF 4 Vol.
(PB80-200025; NOAA-80060202) Avail: NTIS
HC A99/MF A01 CSCL 04A

Papers about prediction of ionospheric and radio propagation conditions based primarily on empirical or statistical relations is discussed. Predictions of sporadic E, spread F, and scintillations generally involve statistical or empirical predictions. The correlation between solar-activity and terrestrial seismic activity and the possible relation between solar activity and biological effects is discussed. GRA

N80-34012# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR TERRESTRIAL PHYSICS SERVICES AND PUBLICATIONS 1980
Apr. 1980 34 p refs
(PB80-199136; NOAA-80052907) Avail: NTIS
HC A03/MF A01 CSCL 04A

The identifications of the Solar Terrestrial Physics (STP) data disciplines and subdisciplines and related products and services with instructions on how and where to obtain them are given. There are seven major categories of data pertinent to STP. Each contains several subdisciplines. An eighth category contains miscellaneous data which are of interest to STP scientists as well as to those working in other fields. GRA

N80-33812# National Center for Atmospheric Research, Boulder, Colo.
INFLUENCE OF OROGRAPHY ON THE ATMOSPHERIC GENERAL CIRCULATION
Akira Kasahara *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 1-49 Sponsored by NSF (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

N80-33813# National Center for Atmospheric Research, Boulder, Colo.
PLANETARY WAVES: THEORY AND OBSERVATION
Robert E. Dickinson *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 51-84 refs (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

N80-33819# Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Atmospheric Physics.
LABORATORY STUDIES OF TOPOGRAPHIC EFFECTS IN ROTATING AND/OR STRATIFIED FLUIDS
P. G. Baines and P. A. Davies (Newcastle-upon-Tyne Univ., England) *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 233-299 refs (For primary document see N80-33811 24-42)
(Grant NSF OCE-78-19833)
Avail: NTIS HC A12/MF A01

N80-33820# Oslo Univ. (Norway). Inst. of Mathematics.
OROGRAPHIC EFFECTS REVEALED BY SATELLITE PICTURES: MESOSCALE FLOW PHENOMENA
B. Gjevik *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 301-316 refs (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

N80-33821# Australian Numerical Meteorology Research Center, Melbourne.

OROGRAPHICALLY CONTROLLED CROSS-EQUATORIAL FLOW
David L. T. Anderson *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 317-355 refs (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-34013 British Library Lending Div., Boston Spa (England).
MEDIUM-SCALE STUDY OF A WAVING COLD FRONT
M. Gilet, Y. Thouvenin, and C. Lafaysse [1980] 44 p refs Transl. into ENGLISH from Meteorol. (Paris), 6th Ser., No. 15, 1978 p 69-90
(BLL-Trans-1453-(9022.549)) Avail: British Library Lending Div., Boston Spa, England

The radiosonde and radar wind data for one of the situations investigated by the 'Fronts-77' measurement project are presented. The cold front in question was preceded by a 'return south', and waved slightly, thus constituting a case relatively complicated in comparison with those normally discussed in the literature, and it showed that on the medium scale it could not be described except in a three dimensional fashion which takes account of time. A schematic representation of the evolution of the front is suggested. T.M.

N80-34014 British Library Lending Div., Boston Spa (England).
CIRCULATION SEASONS IN THE NORTHERN HEMISPHERE AND THE CHANGES IN THEIR DURATION IN THE TWENTIETH CENTURY
S. S. Savina [1980] 48 p refs Transl. into ENGLISH from Akad. Nauk, Inst. Geog., Climatogen. Res., (Moscow), 1974 p 44-67
(BLL-Trans-1455-(9022.549)) Avail: British Library Lending Div., Boston Spa, England

The genetic aspect of the development of seasonal phenomena and processes was investigated. The framework of the widely adopted four calendar seasons, which are of equal and recur regularly at given dates, are regarded as unsatisfactory. Rather, the solution to this problem was in terms of natural periods, namely the circulation seasons, in the course of which definite types of circulation develop and are maintained, and which are determined by the regularities of seasonal variation in large-scale atmospheric processes. On the basis of the seasonal characteristics of the development of circulation it was proposed to divide the year into five or six unequal periods. T.M.

N80-34015 Virginia Univ., Charlottesville.
A NUMERICAL SIMULATION OF THE INFLUENCE OF HEAT AND MOISTURE FLUXES UPON MESOSCALE CIRCULATIONS Ph.D. Thesis
Michael Charles McCumber 1980 277 p
Avail: Univ. Microfilms Order No. 8022955

A hydrostatic primitive equation model is used to evaluate the effects of variable soil conditions upon the development of a south Florida sea breeze. A multilayered soil profile is used to eliminate the numeric deficiencies often associated with slab soil parameterizations. Vegetation is also parameterized. Allowance is made for a variable number of canopies which can be mapped much like the soils. Three dimensional experiments indicated that the intensity and the pattern of the mesoscale convergence are strongly affected by soil conditions and their distribution. Vegetation also affects both the strength and pattern of the mesoscale convergence and it delays the strongest development by one to two hours where the soil is wettest. A general weakening and some broadening of the sea breeze convergence accompanied cloudiness and precipitation, which were predicted using a simple, explicit parameterization. These effects resulted from a reduced horizontal temperature gradient along the west coast of Florida. Dissert. Abstr.

N80-34016 Colorado State Univ., Fort Collins.
TROPICAL CYCLONE GENESIS: NUMERICAL MODELING INFERENCES Ph.D. Thesis
William A. Fingerhut 1980 163 p
Avail: Univ. Microfilms Order No. 8022398

Tropical cyclone genesis was investigated with an axisymmetric primitive equation model which is suitable for an investigation of tropical vortices. Cloud and cloud-free radiative heating, cumulus momentum rearrangement, momentum transport by horizontal eddies in the disturbance outflow layer and an improved formulation of surface evaporation are included in the model in addition to cumulus heating and other commonly used parameterizations. Initial conditions were derived from composite rawinsonde data sets which described both quasi-steady and developing cloud clusters. The initial disturbances also possessed a realistic radial circulation. The numerical model produced the correct disturbance evolution, growth or decay, from the observed nondeveloping and developing initial conditions. The growing disturbance was compared with observational data to show that the temperature and tangential wind fields, growth rate, as well as the mean radial circulation were realistic throughout the simulation. Dissert. Abstr.

N80-34017 State Univ. of New York at Albany.
A STUDY OF ICE NUCLEUS CONCENTRATIONS IN EASTERN NEW YORK STATE Ph.D. Thesis
John Zamurs 1980 189 p
Avail: Univ. Microfilms Order No. 8021978

A multi-phased investigation of ice nuclei is described. The goal was to gain an improved knowledge of the concentration of ice nuclei in the atmosphere and thereby a determination of representative ice nucleus (IN) concentrations in eastern New York State; and a better understanding of the static vapor diffusion chamber and the filter technique for the measurement of IN concentrations. The results of correlation and significance test IN concentrations with a number of meteorological parameter suggested the a link may have existed between IN concentrations and synoptic scale weather circulation. Based on significant correlations of IN concentrations with relative humidity, atmospheric pressure, cloud base height, upward vertical displacement, and depth of the mixing layer, a positive association appeared between high IN concentrations and cyclonic conditions. Dissert. Abstr.

N80-34018 Duke Univ., Durham, N. C.
MEASUREMENTS OF BOUNDARY LAYER FLOW OVER A FORESTED MOUNTAIN SLOPE Ph.D. Thesis
Fred Lear Mowry 1980 196 p
Avail: Univ. Microfilms Order No. 8021841

In order to measure turbulent transfer processes over a forested mountain slope, wind speed, air temperature, wet bulb depression temperature profiles, wind direction and radiation balance measurements were made. The instrumentation and measurements were evaluated. Based on the evaluation, the wind speed profiles and wind direction measurements were selected for further analysis. The measured wind profile slopes were linear and consistently less than the logarithmic profile law plotted through the highest wind level at all wind speeds, atmospheric stability conditions and wind directions. These deviations from the logarithmic profile law imply that the surface boundary layer equations for flow over horizontal terrain must be modified for flow over slopes. This conclusion was supported by the evidence from the wind profile analysis. Dissert. Abstr.

N80-34019 Nevada Univ., Reno.
A STUDY OF THE MICROSTRUCTURE OF CONVECTIVE CLOUDS: OBSERVATION AND THEORY Ph.D. Thesis
Quan-Ping Chang 1980 167 p
Avail: Univ. Microfilms Order No. 8021134

A detailed analysis of data from aircraft penetrations in convective clouds in Florida and northeast Colorado and a numerical study of drop growth by condensation were utilized to assess the relative importance of lateral and top mixing of environmental air during cloud evolution. The results were applied to the role of the evolution of the cloud droplet spectrum in controlling secondary ice crystal production during graupel growth at subfreezing temperatures. A new numerical method was developed to compute droplet condensation growth at the initial

stage. The discrepancy between the theoretical computations and observations confirmed the importance of air entrainment from the environment. Observations showed that the top mixing process is important in clouds which have a uniform distribution of drop concentration and liquid water content. Dissert. Abstr.

N80-34020 Texas A&M Univ., College Station.
CHANGES IN THE POTENTIAL FOR WIND ENERGY GENERATION DUE TO TERRAIN MODIFICATION OF THE BOUNDARY-LAYER FLOW Ph.D. Thesis
James Elwood Arnold, Jr. 1980 158 p
Avail: Univ. Microfilms Order No. 8023013

In situ measurements and a wind tunnel experiment were used to define the degree of wind speedup in the boundary-layer flow over the top of a small mesa. Measurements of the speedup of the wind relative to that observed over level terrain at the same height above the ground are presented as a function of distance from the windward edge of an escarpment. These results are shown for neutral as well as stable atmospheric conditions. It was found that the wind tunnel measurements, in situ measurements, and existing two dimensional models of the terrain modification of scarpment flow agreed well for neutral conditions but differed considerably when stable conditions existed at the mesa site. Dissert. Abstr.

N80-34021 Wyoming Univ., Laramie.
STATISTICAL CLASSIFICATION OF ICE PARTICLES AND RAINDROPS BY PATTERN RECOGNITION TECHNIQUES Ph.D. Thesis
Md. Mizanur Rahman 1980 207 p
Avail: Univ. Microfilms Order No. 8021846

The statistical classification of binary images of ice particles and raindrops taken from cloud samples is described. These images were recorded by an airborne two dimensional probe in order to provide information leading to an understanding of the important physical process in clouds. Detailed explanation of the data acquisition system and image preprocessing is given. The classification algorithm was modified to classify incomplete or fractional images and two metrics were successfully developed to detect the unclassifiable images. The adaptive Kalman filter with the Bayes decision function was employed to classify about two thousand images per minute of CPU time with about ten percent error. The error is mainly contributed by the fractional images present. No effort was made to reduce computing time by giving it special consideration from either the hardware or software point of view. Dissert. Abstr.

N80-34022*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CLIMATOLOGICAL RELATIONSHIPS OF SEVERE DUST-STORMS IN THE GREAT PLAINS TO SYNOPTIC WEATHER PATTERNS: A POTENTIAL FOR PREDICTABILITY
Peter M. Woiceshyn and John F. Henz 1 Oct. 1980 36 p refs
(Contract NAS7-100)
(NASA-CR-163626; JPL-PUB-79-97) Avail: NTIS HC A03/MF A01 CSCL 04B

A data base provided by 35 severe duststorms that occurred between 1968 and 1977 in the central and southern Great Plains allowed construction of a classification scheme of meteorological causes of duststorms, and a telescopic forecast technique for medium range (6 to 48 hour) prediction of severe cyclogenic duststorms. In addition, areal coverage definitions for duststorms based on characteristics of the storms, and a hierarchy of weather causes of severe duststorms were developed. The man machine mix forecast correctly predicted six of seven duststorms observed during the 1976-77 winter, with one overforecast; the machine-only forecast correctly predicted four of the seven duststorms, with one overforecast. Both techniques had problems correctly predicting the duration of severe duststorms. Author

N80-34023*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
ATMOSPHERIC VARIABILITY AND AIR-SEA INTERACTION Final Report, 1 Apr. 1979 - 31 Jul. 1980
John W. Middleton and Elmar R. Reiter 31 Jul. 1980 22 p refs
(Grant NsG-5340)
Avail: NTIS HC A02/MF A01 CSCL 04B

The topics studied include: (1) processing of Northern Hemispheric precipitation data, in order to fill in the transition seasons to provide a continuous 40 year data base on the variability of continental precipitation; (2) comparison of seasonally averaged fields of sea surface temperature obtained from ship observations in the North Atlantic and North Pacific in 1970 with the corresponding fields inferred from satellite observations; (3) estimation of seasonal average of total precipitable water at those admittedly few oceanic stations where repeated vertical soundings were made in 1970 and comparison with corresponding values inferred from satellite measurements; (4) comparison of seasonally averaged evaporation fields determined from ground based observations in 1970 with the field of divergence of the seasonal total horizontal water vapor flux inferred from satellite total water measurements and NMC wind data for the lower troposphere; (5) examination of meaning of convection-inversion index. R.K.G.

N80-34024# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council for Scientific and Technical Research.
STATISTICAL RELATION BETWEEN THE SOLAR CYCLE AND DROUGHT IN NORTHEAST BRAZIL [RELACAO ESTATISTICA ENTRE AS SECAS DO NORDESTE E O CICLO SOLAR]
I. J. Kantor Aug. 1980 15 p refs In PORTUGUESE; ENGLISH summary
(INPE-1839-RPE/200) Avail: NTIS HC A02/MF A01

The relationship between sunspot activity and drought in northeastern Brazil is discussed via harmonic and statistical analysis. The severest droughts occur in years of minimal sunspot activity. Transl. by S.F.

N80-34025# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Dept. of Space Systems.
DEVELOPMENT OF AN AUTOMATIC SYSTEM FOR PLOTTING SYNOPTIC CHARTS [DESENVOLVIMENTO DO SISTEMA DE AUTOMACAO DA PLOTAGEM DE CARTAS SINOTICAS]
Marcial Fernando Pio Sepulveda and Jose Antonio Goncalves Pereira Jun. 1980 12 p refs In PORTUGUESE
(INPE-1786-RPE/158) Avail: NTIS HC A02/MF A01

A computerized system for acquisition and presentation of weather data is discussed. Weather and navigation charts (sea and air) based on the resultant data are plotted with greater speed and accuracy. Transl. by S.F.

N80-34026# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ALGORITHM FOR EXTRACTING DATA FROM METEOROLOGICAL SATELLITES FOR USE IN ESTIMATING PRECIPITATION [ESTIMATIVA DE PRECIPITACAO IMAGENS SMS INFRAVERMELHO IPH/INPE REGIAO R. G. DO SUL EXTRACAO DE DADOS SMS]
Francisco E. Viola and Cecilia C. Camargo Jun. 1980 46 p refs In PORTUGUESE; ENGLISH summary Revised
(INPE-1769-RPE/155) Avail: NTIS HC A03/MF A01

Models for estimating precipitation from infrared images acquired by meteorological geostationary satellites were constructed. The algorithms implemented, provided for, in a convenient format, the retraction and processing of the infrared images from the SMS-2 satellite which are obtained through the receiving station. T.M.

N80-34027# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council of Scientific and Technical Research.
WORKSHOP FOR FORECASTING DROUGHTS IN NORTHEAST BRAZIL ['WORKSHOP' SOBRE PREVISAO DE SECAS PARA O NORDESTE DO BRASIL]
Nelson deJesus Parada, Luiz Gylvan Meira Filho, Antonio Divino Moura, and Vernon Edgar Kousky May 1980 221 p refs In PORTUGUESE and ENGLISH Conf. held in Sao Jose dos Campos, Brazil, 11-15 Feb. 1980
(INPE-1739-RPE/138) Avail: NTIS HC A10/MF A01

Data acquisition and atmospheric modeling of northeast

Brazilian weather parameters are discussed. Weather forecasting, drought control, and frost damage to crops are highlighted.
Transl. by S.F.

N80-34028 British Library Lending Div., Boston Spa (England).
A METHOD OF CORRECTING DAILY AND MONTHLY VALUES OF ATMOSPHERIC PRECIPITATION AND RESULTS OF TESTS ON IT
V. S. Golubev 16 Jan. 1980 19 p refs Transl. into ENGLISH from Gosudarst Gidr. Inst. (Leningrad), 1973 p 11-27 in ENGLISH; partly in RUSSIAN
(BLL-Trans-1451-(9022.549)) Avail: British Lending Div., Boston Spa, England

A method of correcting precipitation totals measured by rain gauges was worked out. An assessment was made of the readings of rain gauges located in an open area, in the light of the readings of standard gauges installed in a sheltered area, and on the assumption that the same amount of precipitation will fall on open and sheltered areas. The capture coefficient was computed for different types of rain gauges from parallel reading obtained with a standard instrument and with gauges installed in an open site. The coefficients were computed using synoptic hour readings spaced 12 hours apart, when the total precipitation recorded by the standard instrument was not less than 3 mm.
R.K.G.

N80-34029# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
WAVE INFORMATION STUDY FOR UNITED STATES COASTLINES. REPORT 1: SURFACE PRESSURE FIELD RECONSTRUCTION FOR WAVE HINDCASTING PURPOSES
William D. Corson, Donald T. Resio, and Charles L. Vincent Jul. 1980 81 p
(AD-A089150; WES/TR/HL-80-11) Avail: NTIS HC A05/MF A01 CSCL 04/2

Two sources of sea-level pressure data were used to develop a valid pressure field for wave hindcasting purposes. The fundamental information was supplied by Meteorology International Inc. (MII) on a 63 by 63 grid covering the Northern Hemisphere. Supplemental data were taken from National Weather Service (NWS) synoptic surface charts. Comparisons of MII data and NWS data indicated that the MII data are incompatible with pressure measurements near storm systems; therefore, the MII data were supplemented with NWS data in two specific areas. For storms within a specified area near the U.S. Atlantic coast, the pressure field was represented by NWS data in a fixed-area grid. For storms outside the fixed-area grid, the pressure field was reconstructed from MII data blended with NWS data.
GRA

N80-34030# California Univ., Davis. Dept. of Land Air and Water Resources.
SURFACE ENERGY BUDGET OF THE TROPICAL PACIFIC OCEAN Final Report
Bryan C. Weare and Michael D. Samuel 5 Sep. 1980 36 p
(Contract N00014-79-C-0484)
(AD-A089148) Avail: NTIS HC A03/MF A01 CSCL 04/2

The four components of the net surface heating of the tropical pacific Ocean between 40 deg s and 30 deg n have been calculated for each month between January 1957 and December 1976. The 20 year monthly mean of each component were also calculated. These flux estimates were derived by using 'bulk formulae' and about five million marine weather reports. The components are averaged over 5 deg latitude by 5 deg longitude grids. Grids which did not have data in a given month were assigned interpolated values.
GRA

N80-34031# Transportation Systems Center, Cambridge, Mass. Research and Special Programs Administration.
VOICE RESPONSE SYSTEM STATISTICS PROGRAM, OPERATIONAL HANDBOOK Final Research, Apr. 1978 - Dec. 1979
Irwin Englander Jun. 1980 76 p
(AD-A089109; TSC-FAA-80-9; FAA-RD-80-76) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report documents the Voice Response System (VRS) Statistics Program developed for the preflight weather briefing VRS. It describes the VRS statistical report format and contents, the software program structure, and the program operation.GRA

N80-34032# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
WIND SHEAR DETECTION WITH PULSE DOPPLER RADAR Final Report, Sep. 1977 - Sep. 1979
R. G. Strauch and W. B. Sweezy Jan. 1980 65 p refs
(Contract DOT-FA76WAI-622)
(AD-A088576) Avail: NTIS HC A04/MF A01 CSCL 17/9

The use of radar for solving the airport wind shear problem was investigated experimentally and with computer simulations. It is shown that a radar with a 150 m pulse length and a 1.5 degree beamwidth could resolve low level wind profiles. The computer simulation program was expanded so that the radar measured radial velocity profile and the field of radial velocities could be calculated and displayed for any analytic or numerical input wind model. Various output displays were available. Both the location of the radar and the volume that is scanned were chosen relative to the input coordinate system. The program also accepted input wind models expressed relative to the approach path. Effects of antenna beamwidth and radar range resolution were simulated. The program is useful for studying the expected observations for any radar (or laser) Doppler system.
R.C.T.

N80-34033# RAND Corp., Santa Monica, Calif.
MILITARY WEATHER CALCULATIONS FOR THE NATO THEATER: WEATHER AND WARPLANES 8 Interim Report
R. E. Huschke, R. R. Rapp, and C. Schutz Apr. 1980 142 p refs
(Contract F49620-77-C-0023)
(AD-A088549; RAND/R-2401-AF) Avail: NTIS HC A07/MF A01 CSCL 15/7

Fourteen weather data analyses applied to military problems are presented. These are selected from past, hitherto unpublished, contributions to Rand Corporation research projects. Emphasis is divided between (1) statistical presentations of weather variables that effect aircraft operations, mainly ceiling and visibility, jointly and independently, and (2) model generated statistics of atmospheric parameters that effect visual and infrared transmission, and target detection probabilities. Calculations are for the NATO theater with heavy emphasis on Germany.
Author

N80-34034# RAND Corp., Santa Monica, Calif.
AEROSOL MODELLING FOR OPTICAL WEATHER Final Report, 1 Sep. 1977 - 28 May 1980
D. Deirmendjian Jul. 1980 9 p refs
(Contract DAAG29-77-C-0045)
(AD-A088563; RAND/AR-2417-ARMY; ARO-15421.2-GS) Avail: NTIS HC A02/MF A01 CSCL 04/2

A review of recent literature indicates that there is fairly good progress in the understanding of the growth of aerosols with increasing relative humidity. However, the forecasting of visibility on the basis of meteorological parameters alone is possible with moderate success only.
Author

N80-34035# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
EXPERIMENTS CONCERNING CATAGORICAL FORECASTS OF OPEN-OCEAN VISIBILITY USING MODEL OUTPUT STATISTICS M.S. Thesis
Philip George Yavorsky and Robert J. Renard Jun. 1980 89 p refs
(AD-A088790; NPS63-80-002) Avail: NTIS HC A05/MF A01 CSCL 04/2

This study is an extension of previous statistically oriented research at the Naval Postgraduate School. The method of Model Output Statistics is used to predict open-ocean visibility employing stepwise-selection, multiple linear regression. The visibility predictand is specified categorically with comparisons made to a previous probabilistic approach. Predictors include direct and derived model output parameters provided by the U.S. Navy's Fleet Numerical Oceanography Center (FNOC), Monterey, California. About 18,000 North Pacific Ocean (30 deg - 60 deg n) synoptic ship reports at 0000 GMT from June 1976 and 1977, July 1979, and August 1979 were used as both dependent

and independent data sets. Visibility equations for both analysis time and 24 and 48 hr prognostic times are developed, and are verified using percent correct, Heidke skill score and bias. Levels of skill are less than desirable for operational use. Important predictor parameters are found to be sensible and evaporative heat fluxes, meridional wind component, sea-level pressure, air/sea temperature difference, relative humidity, an FNOC fog probability parameter and a visibility parameter derived from a marine aerosol model. Other experiments concerning weighted least squares, predictand transformations and R2 deflation are briefly described. GRA

N80-34036# Naval Research Lab., Washington, D. C. Environmental Sciences Div.
ICING CHARACTERISTICS OF LOW ALTITUDE, SUPERCOOLED LAYER CLOUDS, REVISION Interim Report, Feb. - Oct. 1980
Richard K. Jeck May 1980 73 p refs Revised
(Contract DOT-FA79WAI-020)
(AD-A088892; FAA-RD-80-24-Rev) Avail: NTIS HC A04/MF A01 CSCL 04/2

A limited amount of new data has been obtained on the icing environment during initial airborne measurements aimed at developing environmental icing criteria for use in certifying helicopters for flight into icing conditions. Supercooled cloud characteristics are reported for 12 icing events encountered at temperatures from -10 C to 0 C at altitudes from 3500 to 6500 ft above the surface of Lake Erie and Lake Michigan. Recorded droplet size spectra from a Particle Measuring Systems: Axially Scattering Probe (ASSP) were used to compute droplet mass (volume) median diameter (MMD) and, in addition to a Johnson-Williams LWC Indicator, the liquid water content (LWC). A review of available historical data from 1944-1950, upon which the atmospheric icing standards of Appendix C, FAR 25 were based, reveals that data obtained from measurements of ice accretion on multidiameter cylinders are subject to a number of significant errors of both signs. These probable errors, which will continue to be evaluated, may be responsible for the conclusions that: (1) the historical LWC values are generally larger than those observed in the flights described in this report; (2) the historical MMDs appear to be generally too small for all values of LWC; and (3) the historical droplet size distributions are unreliable, as is acknowledged in the later historical literature. GRA

N80-34037# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
AUTOMATION OF VISUAL WEATHER OBSERVATIONS Final Report
H. Albert Brown 1 Apr. 1980 35 p refs
(AF Proj. 6670)
(AD-A088881; AFGL-TR-80-0097; AFGL-IP-286) Avail: NTIS HC A03/MF A01 CSCL 04/2

A study was performed to determine the feasibility of objectively and automatically determining two key components of an aviation weather observation: present weather and obstruction to vision. The automated system utilized was an instrumented tower and surface array of sensors located at the AFGL Weather Test Facility (WTF), Otis AFB, Massachusetts. The objective method consisted of a decision-tree program (AUTO) based on several uniquely different responses by these weather sensors to the same weather phenomena and on discrimination techniques using tower and surface instrument comparison. The ability of AUTO to monitor rapidly changing weather events and to discriminate different types of weather is demonstrated through selected hourly periods of observations taken at 1 min intervals. Hourly observations generated over a 14 month period, March 1978 through April 1979, are compared with FAA observations to determine the effectiveness of AUTO. Major areas of agreement were found in the discrimination of fog, haze, snow, rain, and no weather. Final results show that the FAA observations of the existence and non-existence of obstructions to vision and present weather were duplicated in 82 and 86% of the cases. Thus the acquisition of real weather for an aviation weather observation, a duty presently performed by a human observer, is obtainable through an objective decision-tree program using an automated sensor array. GRA

N80-34038# National Weather Service, Salt Lake City, Utah. Western Region.
NMC MODEL PERFORMANCE IN THE NORTHEAST PACIFIC
James E. Overland Apr. 1980 27 p refs Sponsored by NOAA
(PB80-196033; NOAA-TM-NWS-WR-151; NOAA-80051301) Avail: NTIS HC A03/MF A01 CSCL 04B

Central pressure and position errors of low centers for 36 hr sea-level pressure forecasts were compared between the Limited Area Fine-Mesh Model (LFM-11) and 6-level hemispheric model (6LPE) models for December 1977 and the LFM-11 and LPE models for 19 January through 28 February 1978. Nine storms provided 41 cases in December and 20 storms provided 66 cases in January through February. During December, the LFM-11 was superior to the 6LPE in locating rapidly moving storms. The position errors for the LFM-11 in December were on the order of 250 km. During February, the LFM-11 and the 7LPE had median position errors on the order of 450 km; also, both had a high percentage (25%) of observed-but-not-forecast low centers. The larger errors in February were related to resolution of initial cyclogenesis. GRA

N80-34039# National Oceanic and Atmospheric Administration, Miami, Fla. Research Facilities Center.
DETERMINATION OF ATMOSPHERIC WATER VAPOR FROM DEWPOINT MEASUREMENT
H. H. Grote Apr. 1980 85 p refs
(PB80-197189; NOAA-TM-ERL-RFC-5; NOAA-80050901) Avail: NTIS HC A05/MF A01 CSCL 04B

Frequently used information on parameters related to water vapor and dewpoint was compiled. First the saturation vapor pressure over water was expressed by an equation that had the dewpoint as input and approximated the values given in the Smithsonian Tables. This equation formed the basis for all further discussions. An equation was given for the conversion of a measured dewpoint to equivalent dewpoint at sea level. For aircraft measurements the error in dewpoint was tabulated for differences between the actual static pressure and the measured value. Then equations for absolute and relative humidity and virtual temperature were derived. Curves for the Poisson constant are given. GRA

N80-34040# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
GREAT LAKES DEGREE-DAY AND TEMPERATURE SUMMARIES AND NORMS, 1897 - 1977
R. A. Assel Jan. 1980 120 p refs
(PB80-195977; GLERL-15; GLERL-CONTRIB-202; NOAA-80051201) Avail: NTIS HC A06/MF A01 CSCL 04B

Daily maximum and minimum air temperatures at 25 locations on the perimeter of the Great Lakes for the period 1897 to 1977 were used to generate long terms means of daily air temperatures and freezing and thawing degree-days (FDD's and TDD's). In addition daily, weekly, and monthly FDD's and daily TDD's were calculated for the 81 summer and 80 winter seasons between 1897 and 1977. The computational procedure is discribed. Graphs and tables resulting from this analysis are presented. GRA

N80-34041# National Oceanic and Atmospheric Administration, Washington, D. C. Federal Coordinator for Meteorological Services and Supporting Research.
THE FEDERAL PLAN FOR METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH, FISCAL YEAR 1981
T. B. Owen Mar. 1980 120 p
(PB80-199482; FCM-80-3; NOAA-80051901) Avail: NTIS HC A06/MF A01 CSCL 04B

This Federal Plan is the sixteenth in an annual series, produced in compliance with Section 304 of Public Law 87-843, to provide the Congress with a description of governmental programs in meteorology, and to outline the specific functions and funding requested by each agency involved. GRA

N80-33814# Royal Signals and Radar Establishment, Malvern (England). Meteorological Office Radar Research Lab.
STRUCTURE, MECHANISM AND PREDICTION OF OROGRAPHICALLY ENHANCED RAIN IN BRITAIN

K. A. Browning *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 85-114 refs revised (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

N80-33815# National Center for Atmospheric Research, Boulder, Colo.
MOUNTAIN WAVES AND MOMENTUM FLUX
J. B. Klemp and D. K. Lilly *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 115-141 (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

N80-33818# European Centre for Medium-Range Weather Forecasts, Reading (England).
CYCLOGENESIS IN THE LEE OF OROGRAPHY AND ITS NUMERICAL MODELING WITH SPECIAL REFERENCE TO THE ALPS
S. Tibaldi *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 207-232 refs Presented at the GFD Symp.of the 5th EGS Meeting, Strasbourg, France, 29 Aug. - 1 Sep. 1978 Revised (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-34042 Hawaii Univ., Honolulu.
LOW FREQUENCY TEMPERATURE FLUCTUATIONS IN THE UPPER 400 METERS OF THE CENTRAL NORTH PACIFIC Ph.D. Thesis
Yong Quin Kang 1980 143 p
Avail: Univ. Microfilms Order No. 8022656

The low frequency temperature fluctuations, with time scales of months to years, in the upper 400 m of the Centeral North Pacific are investigated by analyzing the TRANSPAC temperature data collected as a part of the North Pacific Experiment and the temperature data at ocean weather stations. The low frequencies temperature functions consist of large scale, quasi-homogeneous, fluctuations with space comparable to the size of the North Pacific basin and smaller scale, wave-like, fluctuations with length scales of a few hundred kilometers. In the upper 100 m of the ocean the temperature fluctuation is predominantly a seasonal variation, the amplitude of which descreases with depth with a typical e-folding depth of 50 m. The nonseasonal temperature anomaly field has a two layer structure: the temperature anomalies in the surface layer, down to about 100 m, have time scale of 2 to 3 years, and those in the lower layer deeper than 150 m, have time scale of 4 to 7 years and penetrate down to a few hundred meters. More than half of the wave-like temperature fluctuations at the annual frequency consist of a random field of first order baroclinic Rossby waves traveling in a NW direction with wave lengths of about 300 km and phase speeds of about 1 cm/sec. Dissert. Abstr.

N80-34043 Miami Univ., Coral Gables, Fla.
A TWO-DIMENSIONAL DIABATIC ISOPYCNAL MODEL OF A COASTAL UPWELLING FRONT Ph.D. Thesis
E-Chien Foo 1980 124 p
Avail: Univ. Microfilms Order No. 8022880

A two dimensional high resolution diabatic isopycnal model is designed to simulate coastal upwelling frontogenesis under favorable longshore wind stress. Diabatic effects are generated by vertical mixing of density. The vertical eddy coefficients are determined explicity from the mean field gradient by either a Richardson number related formula or a second order moment closure turbulence model. The vertical turbulent mixing in a frontal region has more complicated effects than a simple downward diffusion of heat and momentum. Changing the density and momentum profiles in a water column affects the horizontal density and momentum gradients for the surrounding area. Thus, the frontal scale secondary circulation is affected. It is this secondary circulation pattern which induces concentrated upwelling flow away from the coast. This flow may be important in increasing localized nutrient concentration and inducing patches of high biological productivity water. Dissert. Abstr.

N80-34044 Oregon State Univ., Corvallis.
A MODEL OF WIND-FORCED VISCOUS CIRCULATION NEAR COASTAL BOUNDARIES Ph.D. Thesis
Michael Cornelius Spillane 1980 98 p
Avail: Univ. Microfilms Order No. 8022975

A time dependent model for the response to atmospheric forcing of a homogeneous ocean overlying a continental shelf is considered. The effect of friction is parameterized with surface and bottom Ekman layers of finite thickness. With a Fourier decomposition over frequency and alongshore wavenumber, a second order differential equation for the sea surface profile results. This is solved numerically. In particular, when forcing by the alongshore wind stress alone is considered, with no across shelf variation in this component, the special properties of the model may be described in terms of a set of transfer functions for coastal sealevel and the velocity field. With an assumed wavenumber dependence for the alongshore wind-stress, computed model predictions of the frequency response of the shelf are formed and compared with the wind coherent sealevel and horizontal currents on the Oregon shelf. The close agreement found indicates that the viscous, barotropic response to alongshore wind stress forcing. Dissert. Abstr.

N80-34045 Texas A&M Univ., College Station.
A NUMERICAL STUDY OF MOTION AND SPINDOWN CHARACTERISTICS OF AN ISOLATED CYCLONIC OCEANIC VORTEX Ph.D. Thesis
David Clement Smith 1980 113 p
Avail: Univ. Microfilms Order No. 8023070

The motion and spindown characteristics of oceanic mesoscale vortices were examined through the use of a finite difference equivalent barotropic numerical model. Variable parameters include vortex size, nonlinear strength and initial profile shape. Both Gaussian and a nonGaussian fit to an observed current ring are used as initial profiles. A time dependent behavior is observed in which the vortex approaches a quasi-equilibrium velocity. Results show vortex velocity to be a function of all three variables. Energy transfer processes are found to be significantly influenced by vortex initial profile shape. Nonlinearity is shown to stabilize the ring against dispersive effects. Vortex decay as a function of size and strength is parameterized in terms of lateral spreading of energy. Barotropic instability in several strongly nonlinear nonGaussian experiments results in a rapid breakdown of the initial vortex. Dissert. Abstr.

N80-34046 California Univ., San Diego, La Jolla.
LOW FREQUENCY SEA LEVEL VARIABILITY ALONG THE WEST COAST OF NORTH AMERICA Ph.D. Thesis
Dudley Boyd Chelton, Jr. 1980 231 p
Avail: Univ. Microfilms Order No. 8023092

The use of linear statistical estimators to examine dynamical models is discussed and the importance of using multiple input statistical models rather than a series of single models is emphasized. A methodology is described for determining the effects of statistical uncertainty in both time and frequency domain multiple input statistical models. These methods were used to examine 30 years of nonseasonal tide gauge and steric sea level data along the west coast of North America. The nature and causes of nearshore oceanic variability over short term climatic time scales of months to years were investigated. After the tide gauge records were corrected for the inverse barometric effects of atmospheric pressure, it was found that there was close agreement between the two measures of sea level at frequencies less than 1 cycle/year. At higher frequencies the steric sea level variations measured relative to 500 db and were on average, only about 1/2 as large as high frequency tide gauge sea level variations. Dissert. Abstr.

N80-34047 Oregon State Univ., Corvallis.
PROPERTIES OF THE OCEANS REFLECTED IN THE SEA-BED DISTRIBUTION OF QUATERNARY PLANKTONIC FORAMINIFERA: INCLUDING A STUDY OF THE LIMITS OF EMPIRICAL PALEO-OCEANOGRAPHIC MODELS AND THE RECOGNITION AND INTERPRETATION OF FAUNAL ASSEMBLAGES LACKING MODERN COUNTERPARTS

Ph.D. Thesis
Paul Walter Loubere 1980 118 p
Avail: Univ Microfilms Order No. 8022970

Hydrographic features of the upper ocean that were deciphered from the sea-bed relative abundances of species of planktonic Foraminifera as described. More than sea-surface temperature is reflected in these data. The disrupting effects of species responses to nonthermal factors on certain empirical temperature estimating faunal equations (e.g., Imbrie and Kipp transfer functions) were examined. Dissert. Abstr.

N80-34048*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
ASSESSMENT OF THE ROLE OF REMOTE SENSING IN THE STUDY OF INLAND AND COASTAL WATERS
Howard J. Curfman, John D. Oberholtzer, and Ronald J. Schertler Sep. 1980 70 p refs
(NASA-TM-81881) Avail: NTIS HC A04/MF A01 CSCL 08C

Several problems within Great Lakes, coastal, and continental shelf water were selected and organized under the topical headings of Productivity, Sedimentation, Water Dynamics, Eutrophication, and Hazardous Substances. The measurements required in the study of each of the problems were identified. An assessment was made of the present capability and the potential of remote sensing to make these measurements. The relevant remote-sensing technology for each of these classifications was discussed and needed advancements indicated. T.M.

N80-34049# National Research Inst. for Oceanology, Stellenbosch (South Africa). Coastal Engineering and Hydraulics Div.
TIDAL PREDICTION PROGRAM
A. M. Shipley Jan. 1980 34 p refs
(CSIR-SEA-8001; ISBN-0-7988-1567-1) Avail: NTIS HC A03/MF A01

A tide table program was developed. When a slack water time was found it was in hours from the start of the year. The program converted this to hours and minutes on a relevant calendar data and computed the corresponding water level. The time and water level were printed out on the line appropriate to the particular day of the week and the month in question. After a tide table was printed out, the program printed out a table of the highest and lowest predicted tides for each month and also for the year as a whole. T.M.

N80-34050# Royal Australian Navy Research Lab., Edgecliff.
CLIMATIC MAPS OF THE SEA SURFACE-AIR DIFFERENCE IN VAPOUR PRESSURE AND IN POTENTIAL TEMPERATURE OVER THE EASTERN INDIAN OCEAN
A. Hirst 20 May 1980 31 p refs
(AD-A089022; RANRL-TN-4/80; AR-001-505) Avail: NTIS HC A03/MF A01 CSCL 08/10

Maps are presented in this report showing, (1) the mean difference between the vapour pressure at the sea surface and at a height at 10 m, and (2) the mean difference between the potential temperature at the ocean surface and at a height of 10 m, over the ocean surface from 5 deg S to 50 deg S and from 100 deg E to 140 deg E, for the months of February, May, August and November. The maps are derived from maps of relevant variables shown in the World Ocean Atlas (1976). The sizes of errors in the maps presented here are discussed. The largest errors arise from errors in the W.O.A. maps. GRA

N80-34051# Drexel Inst. of Tech., Philadelphia, Pa. Wave Propagation Research Center.
LONG WAVE TRAPPING BY A LINEAR RIDGE TOPOGRAPHY
Richard Paul Shaw and Wayne Neu Aug. 1980 26 p refs
(Contract N00014-79-C-0067)
(AD-A088840; Rept-119) Avail: NTIS HC A03/MF A01 CSCL 08/3

Long waves are affected by bottom topography and under certain conditions may be trapped along topographical contours which then act as wave guides transmitting wave energy for great distances with little loss. This study examines waves trapped along a submerged ridge described by straight parallel bottom contours which in cross section are composed of constant slope segments bounded on either side by constant depth segments. Solutions are found for time harmonic waves periodic in the along ridge direction and of exponential decay behavior normal to the ridge over the constant depth segments. Over the linearly varying topography describing the ridge, the solution is in terms of two Kummer (or Whittaker) functions. For a given geometry, a dispersion equation is obtained relating the wave frequency to the along ridge wave number for trapped waves. A constant Coriolis parameter is included, but primary interest is on class I (high frequency) waves. A comparison of cutoff frequencies predicted for this piecewise continuous ridge and those for a segmented constant depth ridge is made, and the appropriate scaling factors between the two results are discussed. GRA

N80-34052# National Weather Service, Salt Lake City, Utah. Western Region.
THE SWAB (SPECTRAL WAVE AND BAR) PROGRAM
Morris Webb, S., Jr. (Weather Service Forecast Office, San Francisco) Mar. 1980 36 p refs Sponsored by NOAA
(PB80-196041; NOAA-NWS-WRCP-9; NOAA-80051302) Avail: NTIS HC A03/MF A01 CSCL 08C

The SWAB (Spectral Wave and Bar) program allows the wave forecast technique developed by the School of Oceanography at Oregon State University to be used in AFOS. Variables describing the SWAB to produce a forecast out to 48 hours of significant wave height and period at a given point. This forecast along with data from the National Ocean Survey's Tidal Current Tables, is used to predict bar conditions at a time of maximum ebb current at several locales. GRA

N80-34053# National Technical Information Service, Springfield, Va.
OCEAN WAVE SENSING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980
Audrey S. Hundemann Jul. 1980 271 p Supersedes NTIS/PS-79/0663 and NTIS/PS-78/0560
(PB80-812878; NTIS/PS-79/0663; NTIS/PS-78/0560) Avail: NTIS HC $30.00/MF $30.00 CSCL 08C

Abstracts pertaining to methods and equipment for measuring ocean waves and sea surface roughness are presented. Remote sensing of ocean waves, height indicators, wave spectrum measurement, the use of radar, wave direction detection, and a few abstracts dealing with general studies are included. This updated bibliography contains 263 citations, 11 of which are new entries to the previous edition. GRA

N80-33817# Woods Hole Oceanographic Institution, Mass.
EFFECTS OF BOTTOM TOPOGRAPHY ON OCEAN CURRENTS
Nelson G. Hogg *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 167-206 refs (For primary document see N80-33811 24-42)
(Contract N00014-76-C-0197; Grant NSF OCE-78-25405; NR Proj. 083-400)
Avail: NTIS HC A12/MF A01

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-34054 British Library Lending Div., Boston Spa (England).
POLYFUNGIN, A NEW ANTIFUNGAL ANTIBIOTIC. 4: THE USE OF THIN LAYER CHROMATOGRAPHY FOR DETERMINING THE QUALITATIVE COMPOSITION OF THE POLYFUNGIN COMPLEX
Z. Plociennik, L. Halski, and Z. Kowszyk-Gindifer Jul. 1980 11 p refs Transl. into ENGLISH from Chem. Anal. (Warsaw), v. 18, 1973 p 151-156
(BLL-RTS-12381) Avail: British Library Lending Div., Boston Spa, England

A quick and simple method for determining the qualitative composition of polyfungin was developed. In paper chromatography using waster-saturated butanol as the solvent system which is commonly used for separating polyene antibiotics, polyfungin behaved as a homogeneous substance. With the same solvent

system in 'pH-chromatography' polyfungin, in contrast to nystatin, tended to separate at pH 7.25. T.M.

N80-34055 British Library Lending Div., Boston Spa (England).
THEORETICAL AND APPLIED ASPECTS OF THE ANABIOSIS OF MICROORGANISMS
M. E. Beker Jun. 1980 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk. Latv. (USSR), no. 5, 1978 p 23-31
(BLL-RTS-12350) Avail: British Library Lending Div., Boston Spa, England

The behavior of living organisms in extreme conditions was studied. The influence of anabiosis on agriculture and atmospheric composition is discussed. Utilization of aerobes is also discussed. T.M.

N80-34056*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HUMAN ACCLIMATION AND ACCLIMATIZATION TO HEAT: A COMPENDIUM OF RESEARCH, 1968-1978
Deanna Sciaraffa, Stephen C. Fox, Ralph Stockmann, and John E. Greenleaf Aug. 1980 104 p refs
(NASA-TM-81181; A-8099) Avail: NTIS HC A06/MF A01 CSCL 06P

Abstracts and annotations of the majority of scientific works that elucidate the mechanisms of short-term acclimation to heat in men and women are presented. The compendium includes material from 1968 through 1977. Subject and author indexes are provided and additional references of preliminary research findings or work of a peripheral nature are included in a bibliography. T.M.

N80-34057*# Stanford Univ., Calif. Instrumentation Research Lab.
CYTOCHEMICAL STUDIES OF PLANETARY MICROORGANISMS EXPLORATIONS IN EXOBIOLOGY Final Report, 1 Apr. 1960 - 30 May 1980
Elliott C. Levinthal Jun. 1980 296 p
(Grants NGR-05-020-004; NsG-8160)
(NASA-CR-163605; IRL-1213) Avail: NTIS HC A13/MF A01 CSCL 06C

Experiments to identify free living organisms in soils that may be substantially simpler in genetic content, and mirroring a more primitive stage of evolution than the species with which we are familiar to date, were designed. Organic chemical studies on the composition and disposition of elementary carbon leave nothing wanting as an aboriginal substrate for the original of life and early chemical evolution. Such studies were missed when it came to the interpretation of the Viking lander data, and needed for conceptual planning of future planetary missions. T.M.

N80-34058# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 14, NO. 4, 1980
O. G. Gazenko, ed. 12 Sep. 1980 153 p refs Transl. into ENGLISH of Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 1-139
(JPRS-76415) Avail: NTIS HC A08/MF A01

The physiological effects of flight stress in aircraft pilots and in biological specimens subjected to weightlessness and artificial gravity are considered with particular emphasis on the crews of Salyut 5 and 6 and experiments carried on the Cosmos 936 biosatellite. Hygienic and toxic factors associated with life support systems, radiation effects on animal tissues, and altitude acclimitization are also considered. For individual titles, see N80-34059 through N80-34083.

N80-34059# Joint Publications Research Service, Arlington, Va.
HYGIENE AND TOXICOLOGY OF HUMAN WASTE GASES c54
V. V. Kustov and L. A. Tiunov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 1-8 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 3-7 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

Data published in the literature concerning involvement of human wastes in the formation of an artificial atmosphere of small enclosures designed for various purposes are surveyed. The applicability of theoretical data on human wastes to the solution of theoretical and practical problems of aerospace, marine, communal hygiene and clinical medicine as well as of biochemistry, physiology and other disciplines is emphasized. A.R.H.

N80-34060# Joint Publications Research Service, Arlington, Va.
CARDIORESPIRATORY SYSTEM REACTIONS OF COSMONAUTS TO EXERCISE FOLLOWING LONG-TERM MISSIONS ABOARD THE SALYUT 6 ORBITAL STATION c52
A. V. Beregovkin, A. S. Vodolazov, V. S. Georgiyevskiy, L. I. Kakurin, V. V. Kalinichenko, N. V. Korelin, V. M. Mikhaylov, and V. V. Shchigolev *In its* USSR report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 9-13 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 8-11 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

The cosmonauts who made 96 and 140 day missions aboard the Salyut 6 orbital station showed no disorders in cardiovascular function or regulation during graded exercises. The displayed certain changes that could be attributed to deconditioning upon return to 1 g. These findings give evidence that efficient cardiovascular prophylasix to exercises in prolonged space flight is possible. Author

N80-34061# Joint Publications Research Service, Arlington, Va.
REACTIONS TO LBNP TEST OF THE CREW OF THE SALYUT 5 ORBITAL STATION c52
V. A. Degtyarev, V. G. Doroshev, Z. A. Kirillova, N. A. Lapshina, S. I. Ponomarev, and V. N. Regozin *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 14-19 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 11-16 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

During the 49 day mission (first expedition) the commander did not show a decline in LBNP tolerance, whereas the flight-engineer showed a progressive decrease in LBNP tolerance begining on the 23rd day. During the 17 day mission (second expedition) the flight-engineer exhibited greater cardiovascular reactions to LBNP than the commander. Postflight examinations confirmed the observations made in the weightless state. Author

N80-34062# Joint Publications Research Service, Arlington, Va.
PREFLIGHT DISTINCTIONS OF STAPHYLOCOCCUS AURENUS CARRIERS AMONG COSMONAUTS c52
R. Yu. Tashpulatov, T. N. Nikolayeva, and Ye. V. Guseva *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 29-25 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 16-20 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

A preflight study of Staphylococcus aureus carriage in cosmonauts demonstrated that the microganism harbors in 79.4% of the tested and microbial foci of the carriers amount to 100 ml. The isolated Staphylococcus aureus strains show a prnounced plasma coagulatory, alpha-toxic activity and 67.4% of them can be typed by the International set phages. Prophylactic administration of the native staphylococcal anatoxin increases specific antistaphylococcal immunity, reduces or eliminates completely Staphylococcus aureus in the upper respiratory airways. Author

N80-34063# Joint Publications Research Service, Arlington, Va.
STATIC ENDURANCE OF RATS AFTER FLIGHT ABOARD THE COSMOS 936 BIOSATELLITE
A. R. Kotovskaya and A. A. Shipov *In its* USSR Report: Space Biol. and Aerospace Med., vol. 14, no. 4 (JPRS-76415) 12 Sep. 1980 p 26-29 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 20-22 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

Rats exposed to an 18.5-day flight aboard the biosatellite Cosmos-936 were studied. The recovery rate of static endurance of those animals flown in an onboard centrifuge generating 1 g was similar to that of rats used as synchronous controls. It is concluded that artificial gravity helps to maintain cardiovascular, muscular and respiratory functions at an almost normal level. A.R.H.

N80-34064# Joint Publications Research Service, Arlington, Va.

COMPARATIVE STUDY OF EFFECTS OF WEIGHTLESSNESS AND ARTIFICIAL GRAVITY ON DENSITY, ASH, CALCIUM AND PHOSPHOROUS CONTENT OF CALCIFIED TISSUES

A. A. Prokhonchukov, N. S. Komissarova, N. A. Zhizhina, and A. I. Volozhin *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 30-34 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 23-26 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

The mineral content of bones and teeth was examined in 5 centrifuged and 25 ground-based control rats flown for about 19 days aboard the Cosmos-936 biosatellite. Postflight, the centrifuged rats did not show significant differences in the density, mineral saturation, distribution of vascular channels in bones, ash, calcium and phosphorus content in skeletal bones and teeth as compared with the parameters in synchronous and vivarium controls. In the weightless rats these values were significantly lowered. A.R.H.

N80-34065# Joint Publications Research Service, Arlington, Va.

MORPHOLOGICAL STUDY OF RAT KIDNEYS AFTER FLIGHT ABOARD THE COSMOS-936 BIOSATELLITE

A. S. Pankova *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 35-41 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 26-31 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

Kidneys of SPF Wistar rats flown for 18.5 days aboard the biosatellite Cosmos-936 and sacrificed 4.5-13 hours or 25 days postflight were taken under morphological study. An exposure of rats to artificial gravity inflight brought about a smaller increase in the kidney mass and a better readaptation of animals on return to 1 g. It is suggested that blood redistribution in the kidneys due to renal circulation shunting and, possibly, fluid transfer from the vascular bed to interstitial space are the factors causing an increase in kidney mass. No differences in the kidneys of weightless and centrifuged rats were found. Author

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MORPHOLOGICAL CHANGES IN RAT LUNGS AFTER FLIGHT ABOARD THE COSMOS-936 BIOSATELLITE

V. I. Yakovleva *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 42-48 refs Transl. into ENGLISH from Kosm. Biol. Avioakosm. Med. (Moscow), v. 14, no. 4, 1980 p 31-35 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

Lung of 20 rats which were flown aboard Cosmos 936 for 18.5 days and sacrificed withing either 5 to 13 hours or 25 days after recovery, were studied histologically. An identical number of lung specimens were withdrawn from rats of synchronous and vivarium controls. Lungs of the flight rats dis not show any pathological changes or morphological signs of prolonged congestion, thus indicating the lack of hypertension in pulmonary circulation. Lungs of the flight rats exhibited an increased leukocyte count, which was more marked in the weightless rats killed 8 to 13 hours postflight. The elevation in the count of neutrophilic leukocytes in the flight rats was due to peripheral neutrophilia which is a manifestation of an acute stress reaction. An exposure of rats to artificial gravity was responsible for a lesser increase in the count of neutrophilic leukocytes. E.D.K.

N80-34067# Joint Publications Research Service, Arlington, Va.

TEMPLATE ACTIVITY OF CHROMATIN DNA AND THE ADENYLATE CYCLASE SYSTEM OF RAT TISSUES FOLLOWING FLIGHT ABOARD THE COSMOS-936 BIOSATELLITE

Ye. N. Troitskaya, V. F. Makeyeva, G. S. Komolova, I. A. Yegorov, and R. A. Tigranyan *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 49-53 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 35-38 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

Chromatin DNA template activity and cAMP metabolism enzymes in the liver and lymph organs of rats flown for 19 days were studied. Postflight RNA synthesis on the chromatin DNA template was increased in the liver and decreased in lymph organs. Adenylate cyclase and phosphodiesterase activities decreased in the liver and increased in lymph organs. No correlation between cAMP enzyme activity was found. The nature of the biochemical changes in animal tissues is discussed. Author

N80-34068# Joint Publications Research Service, Arlington, Va.

EFFECTS OF TRANSMERIDIONAL FLIGHTS AND HIGHLAND CONDITIONS ON DIFFERENT FORMS OF MEMORY c53

R. Yu. Ilyuchenok, L. A. Konstantinovskaya, and N. I. Dubrovina *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 54-58 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 38-41 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

During 21 day observation following an environmental change memory processes were activated: short term memory storage increased, proceptive and retroactive interference decreased, fixation of memory track improved, number of reminiscences grew, and forgetfulness lessened. These processes were especially active during 11th through 21st days of adaptation. Improvement of short term memory was found in verbal and nonverbal tests, nonverbal short term memory being changed more significantly. These findings point to the leading role of memory in the development of adaptive behavioral programs. The conclusions can be applied to the selection of optimal mental tasks given to the man after his transmeridional flight or transfer to highlands. Author

N80-34069# Joint Publications Research Service, Arlington, Va.

THE ROLE OF FUNCTIONAL ASYMMETRY OF THE CENTRAL NERVOUS SYSTEM IN PILOT PERFORMANCE c53

A. A. Gyurdzhian and A. G. Fedoruk *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 59-64 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 41-45 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

A correlation was found between pilot performance and functional asymmetry of brain hemispheres. The correlation indicates that the pilots performing their flights uneventfully show higher indices of predominance of the left hemisphere (speech perception) and the right hand as compared to the pilots who perform their flights unsuccessfully and who have cardiovascular and nervous disorders. A.R.H.

N80-34070# Joint Publications Research Service, Arlington, Va.

DISTINCTIONS OF PILOT MOTOR ACTIVITY IN DIFFERENT PILOTING MODES DURING LANDING APPROACHES c54

R. I. Brusnichkina *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 65-69 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 14, 1980 p 45-48 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

Complex motor acts of pilots during their professional work

were investigated with control information presented in a different manner. Two experimental series were run: in a real flight and in a simulator. Parameters of muscle bioelectric activity, control movements and performance efficiency were used. Differences in the formation of motor acts were shown to depend on the scope and quality of the information presented. During required transfer from one mode to another, the structure of working movements and performance efficiency continued during large changes in the information necessary for piloting. This structure was accompanied by an alteration in the developed stereotype of actions, including motor acts. A.R.H.

N80-34071# Joint Publications Research Service, Arlington, Va.

EFFECT OF PERIODIC EXPOSURE TO HEAD-PELVIS ACCELERATIONS ON A SHORT-ARM CENTRIFUGE ON RESPONSES OF THE HUMAN CARDIOVASCULAR SYSTEM c52

I. F. Vilvilyams *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 70-74 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 48-51 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

During 3 and 6 day immersion studies test subjects were two or three times a day (60 min each time) exposed to head to feet acceleration of 1-2 G in a 2m arm centrifuge. In 297 runs, cardiovascular reactions were compared with respect to their adaptation or cumulation. The results obtained show that the principle of periodic application of acceleration in a short arm centrifuge as a countermeasure against cardiovascular deconditioning can be complemented by the principle of cyclic exposures. The study demonstrated that 3 day cycles including 60 min exposures to 1-2G twice a day were most efficient. Author

N80-34072# Joint Publications Research Service, Arlington, Va.

EFFECT OF ANTIORTHOSTATIC HYPOKINESIA AND SPACE FLIGHT FACTORS ON CHANGE IN LEG VOLUME c52

I. I. Kasyan, V. A. Talavrinov, V. I. Lukyanchikov, and Ye. A. Kobzev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 75-80 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 51-55 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

A specially built sensor was used to assess variations and level of fluid redistribution as well as atrophic changes in leg muscles of subjects exposed to prolonged head down tilt and cosmonauts in a real space flight. Hypokinetic subjects were examined before, during, and after head down tilt, whereas cosmonauts were examined before and during flight. The results indicate that a change in the hydrostatic component of blood pressure is followed by displacement of a substantial fluid volume (about 7%). It is also indicated that adequate performance of preassigned countermeasures seems to prevent atrophic developments of leg muscles. R.C.T.

N80-34073# Joint Publications Research Service, Arlington, Va.

SOME OF THE PHYSIOLOGICAL EFFECTS OF 30 DAY BED REST WITH THE BODY IN DIFFERENT POSITIONS c52

B. S. Katkovskiy, V. S. Georgiyevskiy, G. V. Machinskiy, V. M. Mikhaylov, and Yu. D. Pometov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 81-85 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 55-58 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

Eighteen male test subjects were exposed to a 30 day bed rest with the foot end of the bed tilted at ±6 deg, -2 deg or -6 deg. Control subjects were allowed a normal mode of life during the same period of time. Hypokinesia was shown to play the leading role in the genesis of most changes, since control subjects displayed no changes. It was concluded that head down tilt simulated changes occurring during adaptation to weightlessness better than recumbency or head up tilt. Author

N80-34074# Joint Publications Research Service, Arlington, Va.

CIRCADIAN RHYTHM OF HUMAN BODY TEMPERATURE IN ANTIORTHOSTATIC POSITION c52

L. Lkhagva *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 86-90 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 59-61 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

Circadian rhythms of the oral temperature were studied in three male test subjects kept for 7 days in a head down position at 8 deg. As compared to the controls (kept in a hospital for 3 days) the test subjects showed a statistically significant temperature increase (by 0.22 deg C on the average) during circadian minimum points that occured at night and a decrease of the daily temperature rhythm amplitude (by 0.20 deg on the average). It is emphasized that study of human responses to various stress agents should include monitoring of circadian rhythms of various parameters. R.C.T.

N80-34075# Joint Publications Research Service, Arlington, Va.

HISTOSTRUCTURAL CORRELATIONS IN THE HYPOTHALAMUS-JYPOPHYSIS-KIDNEYS SYSTEM UNDER HYPOKINETIC CONDITIONS

I. P. Chernov, V. A. Babayeva, and A. G. Gaffarov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 91-98 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 62-67 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

The type and level of morphological changes in different components of the hypothalamic pituitary renal system were studied in male rats exposed to 3 month hypokinesia. A correlation between rearrangement of the interstitium and epithelium of renal collecting tubules and histophysiological parameters of the antidiuretic hormone production and secretion was established. Morphological manifestations of increased water permeability of collecting tubules recorded on test days 1-10 and 30-60 were seen together with enhanced activity of the hypothalamic supraoptic nucleus. Possible mechanisms involved in changes of the renal water excretory function during hypokinesia were examined. R.C.T.

N80-34076# Joint Publications Research Service, Arlington, Va.

EFFECT OF CONDITIONING ANIMALS FOR HYPOXIA ON THEIR RESISTANCE TO POISON INHALATION

G. D. Tikhonova and G. I. Solomin *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 99-104 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 67-71 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

The resistance of albino rats to chronic inhalation of dioxane and dichloroethane vapors after continuous and intermittent adaptation to hypoxic hypoxia was studied. The adaptation sequence (20-day continuous hypoxia at an altitude of 3,200 m and intermittent hypoxia for 6 hours a day amounting to 25 rises to an altitude of 5,000 m) influenced markedly the intoxication effect. Adaptation to hypoxia increased the alveolar capillary surface of the lung parenchyma, thus enhancing a better entry of chemicals into the body. The posthypoxic pattern of the structural rearrangement of the pulmonary tissue was similar to that observed during moderate hyperoxia. R.C.T.

N80-34077# Joint Publications Research Service, Arlington, Va.

EXPERIMENTAL STUDIES OF SETTING STANDARD FOR OPTIMUM SALT COMPOSITION OF PORTABLE WATER c54

L. I. Elpiner and O. I. Balashov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 105-113 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 71-77 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

Water samples of various mineral contents were given to rats to determine the specificity of the body's reaction to drinking water. Results indicate that the amount of salt in drinking water determines the level of fluid intake to some extent. It is also shown that this increase in fluid intake causes an increase in both renal and extrarenal mechanisms, which subsequently results in unwarranted (from the standpoint of purposeful behavior expenditure of energy that was not required by exogenous causes. R.C.T.

N80-34078# Joint Publications Research Service, Arlington, Va.

EFFECTS OF DIFFERENT HYGIENIC FACTORS ON EXHALATION OF ACETONE BY MAN c52

V. P. Savina and T. I. Kuznetsova. *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 114-117 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 77-80 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

The effect of high temperature on quantitative characteristics of metabolites eliminated in exhaled air was determined. It is shown that the concentration of acetone in exhaled air increased by 6.9 times at an ambient temperature of 32-35 C and by 11 times at a temperature of 40 C. A significant increase in emission of acetone in exhaled air was recorded during graded exercise on a bicycle ergometer (intensity 800 kg-m/min. R.C.T.

N80-34079# Joint Publications Research Service, Arlington, Va.

LESIONS TO AND RECOVERY OF MOUSE SEMINIFEROUS EPITHELIUM AFTER EXPOSURE TO RADIATION AT DIFFERENT DOSE RATES

Zh. G. Zalikina. *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 118-122 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 80-83 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

Mice were irradiated with doses varying from 5 to 1200 R at dose rates of 300, 100, 10 and 2.5 R/day. In addition, mice irradiated with a dose of 300 R at dose rates of 300 and 100 R/day were followed up for 3 months. The relationship between gonad injury and the total dose range of 5 to 75 R was demonstrated. With an increase in the irradiation time, the effect was dependent on the dose rate. Author.

N80-34080# Joint Publications Research Service, Arlington, Va.

THE ROLE OF TEMPERATURE IN EXPERIMENTS ON BIOLOGICAL OBJECTS UNDER EXTREME CONDITIONS

F. V. Sushkov and T. M. Smirnova. *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 123-126 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 83-85 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

Mammalian cells were cultured at different temperatures in order to determine the effects of extreme factors on biological processes. It is shown that there is a need for strict control of ambient temperature when studying the effects of extreme factors on isolated mammalian cells and populations of freely living organisms that have no heat regulating systems. R.C.T.

N80-34081# Joint Publications Research Service, Arlington, Va.

MICRONUCLEI IN RAT BONE MARROW AFTER FLIGHT ABOARD THE COSMOS 936 BIOSATELLITE

T. P. Pantev, G. N. Durnova, I. I. Bpitvan, I. T. Nikolov, and S. Ts. Topalova. *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 127-131 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 85-87 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

The chromosomal system of the rat's somatic cells during exposure to weightlessness, artificial gravity, and other flight factors was evaluated using the so called micronuclear (MN) test. The set of factors involved in the flight and ground based model experiments elicited distinct changes in the chromosomal system of bone marrow cells of experimental animals. There was a 7-8-fold increase in percentage of cells with MN in animals that were in weightlessness during the space flight, and a 5-fold increase in those in the ground based model experiment, as compared to the vivarium control. The absence of statistical differences in incidence of appearance of cells with MN in the bone marrow of rats submitted to weightlessness and rats in the ground based experiment warrants the assumption that the aggregate of unusual living conditions (hypodynamia, isolation, gas environment, etc.), rather than absence of gravity, was the cause of the demonstrated changes. R.C.T.

N80-34082# Joint Publications Research Service, Arlington, Va.

ANALYSIS OF CHANGES IN EVOKED BIOELECTRICAL ACTIVITY OF THE BRAIN DURING EXPOSURE TO HIGH-INTENSITY STATIONARY MAGNETIC FIELD c53

L. D. Klimovskaya. *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 132-136 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 88-90 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

The effect of a stationary magnetic field was investigated by means of altering the functional state of the central nervous system in rats. This was done by administering strychnine as well as a high frequency stimulation to the reticular formation of the midbrain. Significant results are reported. R.C.T.

N80-34083# Joint Publications Research Service, Arlington, Va.

DISTRIBUTION OF BENZENE IN TISSUES OF HYPOKINETIC ANIMALS

G. P. Babanov and A. L. Isakhanov. *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-56415) 12 Sep. 1980 p 137-139 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 90-91 (For primary document see N80-34058 24-51)

Avail: NTIS HC A08/MF A01

A total of 16 albino rats were divided into two groups of eight and subjected to eight weeks of hypokinesia. After this time, rats from the control (usual motor activity) and experimental (hypokenesia) were submitted to 4 h inhaliation of benzene and subsequently decapitated. A bioassay was then performed on the tissues of the liver, kidney, lungs, spleen, adrenals, heart, sternum, femoral muscle, brain, and the blood. It was established that permeability of most tissues was higher for the nonelectrolyte in hypokinetic animals than controls. In control animals, maximum amounts of benzene were demonstrable in the adrenals, omentum, liver and sternum, and the distrubution of benzene in hypokinetic animals was essentially similar to the control. Benzene accumulated the most in the adrenals, although a tendency toward decline was observed, as compared to the control. Benzene accumulated to a lesser extent in the omentum of experimental animals, which was apparently attributable to the fact that the store of fat in it was rather insignificant, as compared to the control. R.C.T.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-34084 British Library Lending Div., Boston Spa (England).

APPLICATION OF A COMPUTER PROGRAMME FOR THE DETERMINATION OF RADIOIMMUNOLOGICAL MEASURED VALUES

W. Huber, K. Mann, and H.-J. Karl [1979] 14 p Transl. into ENGLISH from Z. Klin. Chem. Klin. Biochem. (West Germany), v. 17, no. 4, 1979 p 241-246 Presented at 2d Clinic of the Medical Centre, Munich, 1978

(BLL-RTS-12046) Avail: British Library Lending Div., Boston Spa, England

A computer program was modified and further developed for the purpose of determining radiommunological measured values. The following points are emphasized: (1) adaptation of programming to a Siemens 4004/151 computer with ancillary equipment such as punched-tape reader, terminal, disc files and high speed printer; (2) automation of control sequence ensuring that the programmer will not be required to enter data or build up instructions; (3) reproducible smoothness of Spline Functions, which will respond to objective criteria and which will allow for the requirements of quantitative evaluation; and (4) output of different parameters for data evaluation and for long term recording of assay stability. R.C.T.

N80-34085 Case Western Reserve Univ., Cleveland, Ohio.
HUMAN LUNG VENTILATION, MECHANICS AND MORPHOLOGY Ph.D. Thesis
Richard Brainered Salmon 1980 177 p
Avail: Univ. Microfilms Order No. 8021715

The relationship among inhomogeneities of ventilation, mechanics, and morphology in postmortem human lungs were investigated. Ventilation inhomogeneity was assessed by the end-inflation Xe-133 distribution and the single breath washout (SBW) of nitrogen. During the SBW, transpulmonary pressure, volume, and rate of volume change were simultaneously measured. The distribution of alveolar surface-to-volume ratio (ASVR) and membranous airway diameter (MAD) were found from microscopic analysis of lung sections. Since there was no apex-to-base gradient and ASVR or MAD, the apex-to-base gradient in Xe-133 results not from inhomogeneities in mechanical properties, but from gravity induced stress inhomogeneities. Dissert. Abstr.

N80-34086 California Univ., San Diego.
DEVELOPMENT AND APPLICATION OF A BRAIN STEM AUDIOMETER Ph.D. Thesis
Peter James Talmachoff 1980 159 p
Avail: Univ. Microfilms Order No. 8023116

A brain stem audiometer with a novel digital stimulus generator was designed and constructed. The stimulus generator produces pure sinewaves as well as shaped tone pips or logons. The envelope for the logon is a Gaussian function which provides a bandwidth of approximately 1.5 octaves and a duration of 3.5 cycles. The duration of the logon can be increased by interposing any number of cycles of a sinewave between the tapered ends of the function, with a resultant decrease in bandwith. The logon and sinewave functions are stored in a read only memory and are read out at varying clock rates to produce the desired stimulus frequencies. A number of physiological studies were performed using the logon stimulus at 500 Hz. At high repetition rates, a large sinusoidal baseline shift with a period equal to the interstimulus interval was observed in many subjects. Dissert. Abstr.

N80-34087 Iowa Univ., Iowa City.
NEW ENGINEERING APPROACHES TO NONINVASIVE HIS-PURKINJE SYSTEM RECORDINGS Ph.D. Thesis
Edward Joseph Berbari 1980 244 p
Avail: Univ. Microfilms Order No. 8022002

A more global approach to recording all the electrical information generated by the His-Purkinje System (HPS) was developed. Recording lead systems, particularly those using an esophageal electrode or orthogonal surface leads, were investigated. The bandwidth requirements of HPS activity resulting in limited use of preconditioning analog filters and relying on zero phase response digital filters are presented. Statistics were used to estimate noise levels and measure confidence intervals for the averaged recordings. A first order model based upon independently arrived at results in anatomy, physiology, and biophysics was developed. Three new lead systems were evaluated. Two of these were based on a swallowable esophageal electrode and formed either a bipolar lead within the esophagus or a transthorac lead with one electrode in the esophagus and the other on the chest. The third lead system was formed with bipolar surface leads configured in an x,y,z orthogonal scheme. Dissert. Abstr.

N80-34088* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY. A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 210, SEPTEMBER 1980
Sep. 1980 46 p
(NASA-SP-7011(210)) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 06E

This bibliography lists 115 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in August 1980. Author

N80-34089 Texas Univ. at Arlington.
DIFFERENCES IN CERTAIN PHYSIOLOGICAL, BIOMECHANICAL, AND SUBJECTIVE MEASURES OF WORK EFFECT BETWEEN MALES AND FEMALES WHILE BACK-PACKING Ph.D. Thesis
John William Priest 1980 209 p
Avail: Univ. Microfilms Order No. 8022978

Eighteen male and female subjects between the ages of 20 and 30 years carried backpack loads of 20, 25, and 30 percent of their body weight on a treadmill for 30 minutes. The subjects selected had an average or above physical work capacity and were nonstudents who currently work in an office environment. Selected areas of evaluation included differences in physiological, biomechanical, and subjective measures of fatigue. Differences between men and women to a significance level were found for oxygen consumption and on the basis of oxygen consumption per kilogram weight. Female subjects consumed less oxygen due to their lower body weight but had a higher level of oxygen consumption when body weight was taken into account. No significance was found for trunk inclination or ratings of perceived exertion. Dissert. Abstr.

N80-34090 Texas Technological Univ., Lubbock.
EFFECT OF TASK VARIABLE INTERACTIONS IN LIFTING AND LOWERING Ph.D. Thesis
Anil Mital 1980 187 p
Avail: Univ. Microfilms Order No. 8022628

An experiment to study the effect of several task variables on the metabolic energy expenditure and heart rate of individuals when performing lifting and lowering tasks was conducted. The task variables studied were: load of lift (lower); frequency of lift (lower); height of lift (lower); presence or absence of handles, container height, container width (in the frontal plane), and container length (in the sagittal plane). The data were analyzed separately for lifting and lowering, using the analysis of variance. Container height did not affect the metabolic energy expenditure or heart rate of the subjects for lifting or lowering activities. Presence or absence of handles did not cause a significant change in the physiological responses for lowering tasks. All other task variable effects, however, were significant. A strong first and second order interaction was observed among the task variables. Higher load levels, frequency of lift (lower), vertical height of lift, box width, and box length resulted in increased metabolic energy expenditure and heart rate. Dissert. Abstr.

N80-34091 Washington Univ., St. Louis, Mo.
A STUDY OF HUMAN THROAT-WALL AND VOCAL TRACT FROM INPUT/OUTPUT MEASUREMENTS Ph.D. Thesis
Nageswara-Rao Vemula 1979 203 p
Avail: Univ. Microfilms Order No. 8018768

Simultaneous measurements of the sound pressure at the lips and the vibration on the neck were made during vowel phonation. An approximation to the glottal source signal was determined from the measured vibration signal using autoregressive moving-average model for the wall. The tract was considered as an autoregressive system and its shape was determined by relating its transfer function coefficients to a nonuniform acoustic tube model. By introducing controlled changes in the tract shape, for example, inserting a wood piece of known dimensions into the tract, creating a tongue hump at the lip-end, etc., the present approach gives more consistent tract shapes than the Linear Predictor procedure. This approach gives reasonable shapes for vowel phonation. Dissert. Abstr.

N80-34092 Tulane Univ., New Orleans, La.
MATHEMATICAL SIMULATION OF THE TRANSPORT OF OXYGEN AND IMPORTANT METABOLITES IN THE HUMAN BRAIN Ph.D. Thesis

Ronald Stephen Artigue 1980 199 p
Avail: Univ. Microfilms Order No. 8023464

Mathematical models of the transport of oxygen and the simultaneous transport of carbon dioxide, glucose and lactic acid within the microcirculation of the human brain were developed. These were solved for both steady state and dynamic cases which included normal and pathological conditions. The models are distributed parameter interactive systems of nonlinear partial differential equations. These were reduced to finite difference equations and solved using various numerical techniques. All three models employ the Price Varga Warren finite difference approximations for the capillary equations. The steady state constant tissue metabolism model (SSCM) requires an analytical steady state radial mass flux from the capillary. The dynamic nonlinear tissue metabolism model uses Crank Nicolson analogs in solving the nonlinear, radial diffusion tissue equations. The third model is similar to the DNLM model but also includes axial diffusion in the tissue. S.F.

N80-34093*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HEALTH REQUIREMENTS FOR ADVANCED COAL EXTRACTION SYSTEMS
Wayne F. Zimmerman 15 Sep 1980 28 p refs
(Contracts NAS7-100; DE-AI01-76ET-12548)
(NASA-CR-163265; JPL-Pub-80-72) Avail: NTIS HC A03/MF A01 CSCL 06J

Health requirements were developed as long range goals for future advanced coal extraction systems which would be introduced into the market in the year 2000. The goal of the requirements is that underground coal miners work in an environment that is as close as possible to the working conditions of the general population, that they do not exceed mortality and morbidity rates resulting from lung diseases that are comparable to those of the general population, and that their working conditions comply as closely as possible to those of other industries as specified by OSHA regulations. A brief technique for evaluating whether proposed advanced systems meet these safety requirements is presented, as well as a discussion of the costs of respiratory disability compensation. Author

N80-34094# Naval Submarine Medical Research Lab., Groton, Conn.
AIDS FOR IMPROVING VISION IN WHITE-OUT Interim Report
C. L. Schlichting, S. M. Luna, J. A. S. Kinney, D. F. Nan, and S. W. Kindess 13 Aug. 1980 29 p refs
(AD-A088726; NSMRL-937) Avail: NTIS HC A03/MF A01 CSCL 06/19

The ability to see well deteriorates markedly under conditions of uniform visual stimulation (white-out). These conditions are frequently encountered by both the Navy and Marine Corps troops operating in winter environments. This study tested two different visual aids in an attempt to improve vision under these conditions. One of the aids, a yellow goggle, showed promise for improving the perception of depth in both low light and snow conditions. The other, a correction for empty-field myopia (nearsightedness induced by a featureless visual field) did not improve vision. Further research is planned to specify more precisely the conditions in which the yellow goggles improve vision, and to investigate the reasons for the failure of the lenticular corrections to improve vision. GRA

N80-34095# SRI International Corp., Menlo Park, Calif.
DEVELOPMENT AND VALIDATION OF METHODS FOR SAMPLING AND ANALYSIS OF WORKPLACE TOXIC SUBSTANCES Final Report, Jul. 1976 - Nov. 1979
Ellen C. Gunderson and C. Clarine Anderson Nov. 1979 61 p
Submitted for publication
(Contract PHS-NIOSH-210-0123)
(PB80-194574) Avail: NTIS HC A04/MF A01 CSCL 06T

To determine the level of exposure of workers to toxic substances, adequate sampling and analytical methods for the specific substances were provided. Methods for sampling and analyzing 130 abstracts for which no methods were currently available, including gases, vapors, dusts, fumes, and aerosols were developed and validated. GRA

N80-33341 Air Force Hospital, Davis-Monthan AFB, Ariz.
LOSS OF CONSCIOUSNESS IN HIGH PERFORMAN FIGHTERS (WHAT TO DO ABOUT IT)
Peter R. Nash *In* Society of Experimental Test Pilots Tr Rev., Vol. 15, No. 1 1980 p 50-52 (For primary docum see N80-33337 24-01)
Avail: Issuing Activity

N80-34060# Joint Publications Research Service, Arlingt Va.
CARDIORESPIRATORY SYSTEM REACTIONS OF COSM NAUTS TO EXERCISE FOLLOWING LONG-TERM MISSIO ABOARD THE SALYUT 6 ORBITAL STATION
A. V. Beregovkin, A. S. Vodolazov, V. S. Georgyevskiy, L Kakurin, V. V. Kalinichenko, N. V. Korelin, V. M. Mikhaylov, V. V. Shchigolev *In its* USSR Report: Space Biol. and Aerosp Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 9 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. M (Moscow), v. 14, no. 4, 1980 p 8-11 (For primary docum see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

N80-34061# Joint Publications Research Service, Arlingt Va.
REACTIONS TO LBNP TEST OF THE CREW OF THE SALY 5 ORBITAL STATION
V. A. Degtyarev, V. G. Doroshev, Z. A. Kirillova, N. A. Lapsh S. I. Ponomarev, and V. N. Regozin *In its* USSR Report: Sp Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 S 1980 p 14-19 refs Transl. into ENGLISH from Kosm. B Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 11-16 (primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

N80-34062# Joint Publications Research Service, Arlingt Va.
PREFLIGHT DISTINCTIONS OF STAPHYLOCOCCU AURENUS CARRIERS AMONG COSMONAUTS
R. Yu. Tashpulatov, T. N. Nikolayeva, and Ye. V. Guseva *In* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No (JPRS-76415) 12 Sep. 1980 p 29-25 refs Transl. in ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 1 no. 4, 1980 p 18-20 (For primary document see N80-340 24-51)
Avail: NTIS HC A08/MF A01

N80-34071# Joint Publications Research Service, Arlingto Va.
EFFECT OF PERIODIC EXPOSURE TO HEAD-PELV ACCELERATIONS ON A SHORT-ARM CENTRIFUGE O RESPONSES OF THE HUMAN CARDIOVASCULA SYSTEM
I. F. Vilvilyams *In its* USSR Report: Space Biol. and Aerospa Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 70-7 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Me (Moscow), v. 14, no. 4, 1980 p 48-51 (For primary docume see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

N80-34072# Joint Publications Research Service, Arlingto Va.
EFFECT OF ANTIORTHOSTATIC HYPOKINESIA AN SPACE FLIGHT FACTORS ON CHANGE IN LEG VOLUM
I. I. Kasyan, V. A. Talavrinov, V. I. Lukyanchikov, and Ye. Kobzev *In its* USSR Rept.: Space Biol. and Aerospace Med Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 75-80 re Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow v. 14, no. 4, 1980 p 51-55 (For primary document see N80-3405 24-51)
Avail: NTIS HC A08/MF A01

N80-34073# Joint Publications Research Service, Arlingto Va.
SOME OF THE PHYSIOLOGICAL EFFECTS OF 30 DAY BE REST WITH THE BODY IN DIFFERENT POSITIONS
B. S. Katkovskiy, V. S. Georgyevskiy, G. V. Machinskiy, V. M Mikhaylov, and Yu. D. Pometov *In its* USSR Report: Spac Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Se

1980 p 81-85 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 55-58 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

N80-34074# Joint Publications Research Service, Arlington, Va.
CIRCADIAN RHYTHM OF HUMAN BODY TEMPERATURE IN ANTIORTHOSTATIC POSITION
L. Likhagva. *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 86-90 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 59-61 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

N80-34078# Joint Publications Research Service, Arlington, Va.
EFFECTS OF DIFFERENT HYGIENIC FACTORS ON EXHALATION OF ACETONE BY MAN
V. P. Savina and T. I. Kuznetsova. *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 114-117 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 77-80 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-34096*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PASSENGER COMFORT TECHNOLOGY FOR SYSTEM DECISION MAKING
D. William Conner. Aug. 1980 11 p refs Presented at the Intern. Conf. on Ergonomics and Transportation, Swansea, England, 8-12 Sep. 1980
(NASA-TM-81875) Avail: NTIS HC A02/MF A01 CSCL 05E

Decisions requiring passenger comfort technology were shown to depend on: the relationship between comfort and other factors (e.g., cost, urgency, alternate modes) in traveler acceptance of the systems, serving a selected market require technology to quantify effects of comfort versus offsetting factors in system acceptance. Public predict the maximum percentage of travelers who willingly accept the overall comfort of any trip ride. One or the other of these technology requirements apply to decisions on system design, operation and maintenance. T.M.

N80-34097*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AUTOMATION LITERATURE: A BRIEF REVIEW AND ANALYSIS
Dianne Smith and Duncan L. Dieterly. Oct. 1980 17 p refs
(NASA-TM-81245; A-9369) Avail: NTIS HC A02/MF A01 CSCL 05E

Current thought and research positions which may allow for an improved capability to understand the impact of introducing automation to an existing system are established. The orientation was toward the type of studies which may provide some general insight into automation; specifically, the impact of automation in human performance and the resulting system performance. While an extensive number of articles were reviewed, only those that addressed the issue of automation and human performance were selected to be discussed. The literature is organized along two dimensions: time, Pre-1970, Post-1970; and type of approach, Engineering or Behavioral Science. The conclusions reached are not definitive, but do provide the initial stepping stones in an attempt to begin to bridge the concept of automation in a systematic progression. L.F.M.

N80-34098*# Psycho-Linguistic Research Associates, Menlo Park, Calif.
SYNTHESIZED VOICE APPROACH CALLOUTS FOR AIR TRANSPORT OPERATIONS Final Report
Carol A. Simpson. Washington NASA Oct. 1980 132 p refs Prepared in cooperation with American Airlines Flight Academy, Fort Worth, Tex.
(NASA Order A-64184-B)
(NASA-CR-3300) Avail: NTIS HC A07/MF A01 CSCL 05I

A flight simulation experiment was performed to determine the effectiveness of synthesized voice approach callouts for air transport operations. Flight deck data was first collected on scheduled air carrier operations to describe existing pilot-not-flying callout procedures in the flight context and to document the types and amounts of other auditory cockpit information during different types of air carrier operations. A flight simulation scenario for a wide-body jet transport airline training simulator was developed in collaboration with a major U.S. air carrier and flown by three-man crews of qualified line pilots as part of their normally scheduled recurrent training. Each crew flew half their approaches using the experimental synthesized voice approach callout system (SYNCALL) and the other half using the company pilot-not-flying approach callout procedures (PNF). Airspeed and sink rate performance was better with the SYNCALL system than with the PNF system for non-precision approaches. For the one-engine approach, for which SYNCALL made inappropriate deviation callouts, airspeed performance was worse with SYNCALL than with PNF. Reliability of normal altitude approach callouts was comparable for PNF on the line and in the simulator and for SYNCALL in the simulator. Author

N80-34099*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF MAGNIFICATION AND VISUAL ACCOMMODATION ON AIMPOINT ESTIMATION IN SIMULATED LANDINGS WITH REAL AND VIRTUAL IMAGE DISPLAYS
Robert J. Randle, Stanley N. Roscoe (New Mexico State Univ., Las Cruces), and John C. Petitt (California Univ., San Diego) Oct. 1980 29 p refs
(NASA-TP-1635; A-8104) Avail: NTIS HC A03/MF A01 CSCL 05I

Twenty professional pilots observed a computer-generated airport scene during simulated autopilot-coupled night landing approaches and at two points (20 sec and 10 sec before touchdown) judged whether the airplane would undershoot or overshoot the aimpoint. Visual accommodation was continuously measured using an automatic infrared optometer. Experimental variables included approach slope angle, display magnification, visual focus demand (using ophthalmic lenses), and presentation of the display as either a real (direct view) or a virtual (collimated) image. Aimpoint judgments shifted predictably with actual approach slope and display magnification. Both pilot judgments and measured accommodation interacted with focus demand with real-image displays but not with virtual-image displays. With either type of display, measured accommodation lagged far behind focus demand and was reliably less responsive to the virtual images. Pilot judgments shifted dramatically from an overwhelming perceived-overshoot bias 20 sec before touchdown to a reliable undershoot bias 10 sec later. Author

N80-34100# California Univ., Los Angeles. Brain Research Inst.
DEVELOPMENT OF NEUROPHYSIOLOGICAL AND BEHAVIORAL METRICS OF HUMAN PERFORMANCE Final Report, 1 Sep. 1976 - 31 Dec. 1979
Samuel L. Moise, Jr. May 1980 153 p refs
(Grant AF-AFOSR-3184-77; AF Proj. 2313)
(AD-A087840; AFAMRL-TR-80-39) Avail: NTIS HC A08/MF A01 CSCL 05/10

A program of research has been conducted to evaluate transient and steady-sate visual evoked response (ER) measures to determine their suitability as metrics for assessing performance (or workload). One of the major drawbacks of the ER is the necessity for creating the response by flashing lights (transient ER) or shifting patterns (steady-state ER) in the subject's visual field. One of the main goals of this program was to explore the production of ERs in ways which do not interfere with task displays or performance. A second major goal was to evaluate the ER as a tool for simultaneous measurement of multiple performance factors. This program produced several research

directions which have important implications for the study of brain function and practical application of the ER as a performance measure. These directions include generation of steady-state activity with visual stimuli above 75 Hz, and the introduction of a concept of temporal tracking by the brain. Among the results of these studies are demonstrations of correlations between the steady-state ER and fatigue and psychological factors. GRA

N80-34068# Joint Publications Research Service, Arlington, Va.
EFFECTS OF TRANSMERIDIONAL FLIGHTS AND HIGHLAND CONDITIONS ON DIFFERENT FORMS OF MEMORY
R. Yu. Ilyuchenok, L. A. Konstantinovskaya, and N. I. Dubrovina *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 54-58 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 38-41 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

N80-34069# Joint Publications Research Service, Arlington, Va.
THE ROLE OF FUNCTIONAL ASYMMETRY OF THE CENTRAL NERVOUS SYSTEM IN PILOT PERFORMANCE
A. A. Gyurdzhian and A. G. Fedoruk *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 59-64 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 41-45 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

N80-34082# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF CHANGES IN EVOKED BIOELECTRICAL ACTIVITY OF THE BRAIN DURING EXPOSURE TO HIGH-INTENSITY STATIONARY MAGNETIC FIELD
L. D. Klimovskaya *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 132-136 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 88-90 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-34101*# Hamilton Standard, Windsor Locks, Conn.
EXTRAVEHICULAR CREWMAN WORK SYSTEM (ECWS) STUDY PROGRAM. VOLUME 1: EXECUTIVE SUMMARY Final Report
R. C. Wilde Jul. 1980 58 p 4 Vol.
(Contract NAS9-15290)
(NASA-CR-163597) Avail: NTIS HC A04/MF A01 CSCL 05H

The Extravehicular Crewman Work System (ECWS) requirements for manned support of space construction and satellite service are defined. Characteristics of structures and satellites are described. Requirements for extravehicular tasks and support equipment are defined. Equipment concepts are presented and evaluated for extravehicular life support, spacesuit, and work aids. Preliminary design of recommended ECWS equipment concepts and new technology developments required for their implementation are discussed. S.F.

N80-34102*# Hamilton Standard, Windsor Locks, Conn.
EXTRAVEHICULAR CREWMAN WORK SYSTEM (ECWS) STUDY PROGRAM. VOLUME 2: CONSTRUCTION Final Report
R. C. Wilde Jul. 1980 392 p refs 4 Vol.
(Contract NAS9-15290)
(NASA-CR-163698) Avail: NTIS HC A17/MF A01 CSCL 05H

The construction portion of the Extravehicular Crewman Work System Study defines the requirements and selects the concepts for the crewman work system required to support the construction of large structures in space. S.F.

N80-34103*# Hamilton Standard, Windsor Locks, Conn.
EXTRAVEHICULAR CREWMAN WORK SYSTEM (ECWS) STUDY PROGRAM. VOLUME 3: SATELLITE SERVICE Final Report
R. C. Wilde Jul. 1980 102 p refs 4 Vol.
(Contract NAS9-15290)
(NASA-CR-163599) Avail: NTIS HC A06/MF A01 CSCL 05H

The satellite service portion of the Extravehicular Crewman Work System Study defines requirements and service equipment concepts for performing satellite service from the space shuttle orbiter. Both normal and contingency orbital satellite service is required. Service oriented satellite design practices are required to provide on orbit satellite service capability for the wide variety of satellites at the subsystem level. Development of additional satellite service equipment is required. The existing space transportation system provides a limited capability for performing satellite service tasks in the shuttle payload bay area. S.F.

N80-34104*# Hamilton Standard, Windsor Locks, Conn.
EXTRAVEHICULAR CREWMAN WORK SYSTEM (ECWS) STUDY PROGRAM. VOLUME 4: PROGRAM EVOLUTION Final Report
R. C. Wilde Jul. 1980 141 p refs 4 Vol.
(Contract NAS9-15290)
(NASA-CR-163600) Avail: NTIS HC A07/MF A01 CSCL 05H

The program evaluation portion of the Extravehicular Crewman Work System Study defines the new technology requirements for equipment to support space construction and satellite service in orbit. S.F.

N80-34105# Federal Aviation Agency, Atlantic City, N.J.
AUTOMATED FLIGHT PLAN FILING BY SIMULATED VOICE RECOGNITION Interim Report, Aug. 1975 - May 1978
Ephraim Shochet and Richard Lemanski Aug. 1980 37 p
(FAA Proj. 131-401-835)
(AD-A089138; FAA-CT-80-15; FAA-RD-80-56) Avail: NTIS HC A03/MF A01 CSCL 05/8

The Systems Research and Development Service (SRDS) asked the Federal Aviation Administration (FAA) Technical Center to develop and demonstrate the capability of automatic flight plan filing by computerized word recognition. To accomplish a prototype capability, it was necessary to begin gathering human factors data to help determine the correct technical approach and design concept. The tests reported herein centered on two questions: Would pilots use this method of flight plan entry? Which of the three protocols simulated do pilots prefer most? Because of the limitations inherent in this experiment, the answers to these questions are tentative at this time. Given the assumption that the actual utterance recognition device (URD) performs at a level comparable to the simulation used in this experiment, it is entirely reasonable to conclude that general aviation pilots would (1) elect to file flight plans by computerized word recognition using a real computer and (2) prefer 'no prompt' or a 'word echo-back prompt' over the 'cue-tone prompt.' The results show that the preferred protocol was the 'no prompt' method. GRA

N80-34059# Joint Publications Research Service, Arlington, Va.
HYGIENE AND TOXICOLOGY OF HUMAN WASTE GASES
V. V. Kustov and L. A. Tiunov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 1-8 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 3-7 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

N80-34070# Joint Publications Research Service, Arlington, Va.
DISTINCTIONS OF PILOT MOTOR ACTIVITY IN DIFFERENT PILOTING MODES DURING LANDING APPROACHES

R. I. Brusnichkina *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 65-69 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 14, 1980 p 45-48 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

N80-34077# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL STUDIES OF SETTING STANDARD FOR OPTIMUM SALT COMPOSITION OF PORTABLE WATER
L. I. Elpiner and O. I. Balashov *In its* USSR Report: Space Biol. and Aerospace Med., Vol. 14, No. 4 (JPRS-76415) 12 Sep. 1980 p 105-113 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 4, 1980 p 71-77 (For primary document see N80-34058 24-51)
Avail: NTIS HC A08/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N80-34106*# National Aeronautics and Space Administration, Washington, D. C.
PUBLICATIONS OF THE EXOBIOLOGY PROGRAM FOR 1979: A SPECIAL BIBLIOGRAPHY
Linda G. Pleasant, comp. and Donald L. DeVincenzi, comp. Oct. 1980 34 p refs
(NASA-TM-82182) Avail: NTIS HC A03/MF A01 CSCL 03B

A list of 1973 publications resulting from research pursued in exobiology is presented. The research was under the auspices of NASA's Exobiology Program. Author

N80-33430*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SETI INSTRUMENT DEVELOPMENT PLAN
R. B. Crow *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 15-22 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

N80-33431*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A BIMODAL SEARCH STRATEGY FOR SETI
S. Gulkis, E. T. Olsen, and J. Tarter (California Univ., Berkeley) *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 23-32 refs (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-34107 California Univ., Los Angeles.
PERFORMANCE OF COMPUTERS WITH MULTIACCESS MEMORY Ph.D. Thesis
David Guy Hibbits 1980 192 p
Avail: Univ. Microfilms Order No. 8023319

Multiaccess memory is defined as any fixed access time memory which allows multiple requests to be served concurrently. The maximum number of requests that can be served concurrently is determined by the memory component design and is called the degree of multiaccess. Multiaccess memory is an alternative and a complememt to other methods for improving memory bandwidth such as multiple modules, shorter access and cycle times, and longer word length. Presently it is used only in CPU applications. Design suggestions for larger capacity multiaccess memory components suitable for cache and main memory applications. The effect of replacing conventional memory with multiaccess memory is evaluated for several computer architectures. First a cache architecture in which the cache is dedicated to a single CPU. CPU lookahead and block transfer from main memory are the sources of concurrent requests. Simulations show that using either a multimodule or multiaccess cache can significantly show that using either a execution rate of this type of computer. However, multiaccess cache is found to offer little additional performance compared to multimodule memory of equal bandwidth. Apparently cache memory requests tend to be sequentially addressed, causing very little contention in an interleaved cache memory. Dissert. Abstr.

N80-34108 Cornell Univ., Ithaca, N. Y.
SPECIFICATION AND VERIFICATION OF COMMUNICATIONS IN PARALLEL SYSTEMS Ph.D. Thesis
Carl Howard Hauser 1980 111 p
Avail: Univ. Microfilms Order No. 8020828

A verification is theory developed for systems of parallel processes communicating with one another by sending messages. The goal is independent specification of processes in a system so that the system can be verified from the specifications of its component processes. A process is regarded as a generator of a formal language called its communication language. A specification is written as a first order predicate calculus formula about this formal language. Processes are verified by including assertions in them and proving that the assertions hold, much as is done for sequential programs. An important aspect of the work is treatment of nondeterminism and its effect on the termination, nondetermination and deadlock properties of systems and processes. It is argued that nondeterminism should be curtailed if specifications are to accurately reflect the specifier's wishes. Rules relating assertions and statements are similar to those used in Floyd-Hoare logic. However, both partial correctness, sometimes called safety in the literature, and liveness, which is a concept analagous to termination of sequential programs are considered. Justification of liveness assertions takes advantage of statements that occur both before and after the assertion, introducing a new kind of proof rule which is proved correct. Dissert. Abstr.

N80-34109 California Univ., Los Angeles.
BUILDING BLOCK MODELING METHODOLOGY FOR COMPOSITION OF MICROPROCESSOR-BASED DIGITAL SYSTEMS Ph.D. Thesis
Jeffrey Howard Drobman 1980 607 p
Avail: Univ. Microfilms Order No. 8023297

The SARA (system architect's apprentice) system is an integrated set of computer aided tools supporting a structured methodology for design and analysis of hardware and software in digital systems. The structured methodology supported by SARA concludes top-down design with a bottom-up design step utilizing a library of interconnectable building block models. Methodology for modeling building blocks within the SARA structured, multilevel design environments is discussed. The focus is on microprocessor family type building blocks with intentions to provide methodology applicable to other hardware and software building blocks. An investigation was conducted into the strength and weaknesses of SARA for modeling off-the-shelf hardware integrated circuits. It is extensible to cover chip design using sub-chip BB's, system design using broad-level BB's, and software system design using software BB's. Dissert. Abstr.

N80-34110 Duke Univ., Durham, N. C.
A SIMULATION FACILITY FOR PERFORMANCE EVALUATION OF SHARED-RESOURCE COMPUTER ARCHITECTURES Ph.D. Thesis
Norman Clark Strole 1980 370 p
Avail: Univ. Microfilms Order No. 8022865

The Duke University Shared-Resource Simulator was designed to be both powerful and flexible and offers the user a wide range of realistic simulation options. The use of simulation models for the analysis of shared-resource computer systems is sometimes the only available means for accurately evaluating system performance when the system is nonexistent or in early stages of development. Special emphasis is placed on the development of a workload generation model which permits the user to automatically synthesize a series of complex task structures for use as input to the simulation program. The Duke University Resource Usage Graph generation facility produces realistic precedence graphs based on statistical data which characterizes the desired workload. The simulation results of concurrent task execution in a shared-resource environment are in very close agreement with those obtained using analytic techniques. A unique application of the central server queueing model is introduced for purposes of cost throughput optimization of a shared resource, multiprocessor system specifically designed for concurrent execution of tasks within a single job. Dissert. Abstr.

N80-34111*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SUMC FAULT TOLERANT COMPUTER SYSTEM
10 Sep. 1980 74 p
(Contract NAS8-31747)
(NASA-CR-161581) Avail: NTIS HC A04/MF A01 CSCL 09B

The results of the trade studies are presented. These trades cover: establishing the basic configuration, establishing the CPU/memory configuration, establishing an approach to crosstrapping interfaces, defining the requirements of the redundancy management unit (RMU), establishing a spare plane switching strategy for the fault-tolerant memory (FTM), and identifying the most cost effective way of extending the memory addressing capability beyond the 64 K-bytes (K=1024) of SUMC-II B. The results of the design are compiled in Contract End Item (CEI) Specification for the NASA Standard Spacecraft Computer II (NSSC-II), IBM 7934507. The implementation of the FTM and memory address expansion. Author

N80-34112# European Space Agency, Paris (France).
CONTRIBUTIONS TO THE SYMPOSIUM: COMPUTER SCIENCE IN SPACE FLIGHT
A. Kurau, ed. Feb. 1980 149 p refs Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 Conf. held at Oberpfaffenhofen, West Germany, 19 Jan. 1978 Original report in GERMAN previously announced as X80-72803
(ESA-TT-587; DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53.50

A process control computer as a component of complex systems, data handling for medical experiments in the space laboratory preprogram ASSESS 2, computer assisted data acquisition for space flight, and the description of a system for the interactive processing of picture data obtained from geostationing weather satellites are presented. Other topics include the application of computer controlled manipulations to underwater technology, the need for operational data handling in accurate satellite tracking, onboard autonomy in satellite control, coupling of IBM and Siemens systems on an RJE basis as implemented in a regional computer center, the use of the OMS - MVS operational system in technical and scientific fields, software and PROINF applications with EBOSIPES, and process control for RIT 10 tests. For individual titles, see N80-34113 through N80-34125.

N80-34113# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. for Avionics and Microwaves.
DIGITAL COMPUTERS AS COMPONENTS OF COMPLEX SYSTEMS
Herwig Oettl *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 1-19 refs Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)
(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53.50

The applications of digital computers to several complex technical systems which include a computer as one of their essential subsystems are described. These systems include VHF telemetry and telecommand stations, a VHF radio interferometer, an S band ground station, a German experimental ship terminal, and an antenna test range. The described systems are to be used in an Institute of Avionics and Microwaves, where high frequency technology is to be combined with computer technology. Author (ESA)

N80-34114# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. for Aviation Medicine.
DATA HANDLING IN THE MEDICAL EXPERIMENT OF THE SPACELAB PREPARATORY PROGRAM ASSESS 2
Reinhold Herrmann *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 20-36 refs Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)
(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53.50

A medical experiment carried out as part of the Spacelab Preparatory Program ASSESS 2 is described. During the course of this experiment the payload specialists were subjected to a series of measurements that continued over a period of eleven days, including rhythm changes in a 24 hour cycle, quality and quantity of sleep, and acute and cumulative stress. A description of the recording, on-line monitoring, and evaluation of these signals is presented. Author (ESA)

N80-34115# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. for Avionics and Microwaves.
COMPUTER-SUPPORTED ACCESS SYSTEMS IN SPACE FLIGHT
Hans-Joachim Katerle *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 37-46 refs Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt" Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)
(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53.50

The remote control of a spacecraft is described as a technical process. The introduction of remote programmable control computers is suggested as a means of improving the control process and a short description is given of the present state of work in connection with remote programming. The continuation of the work calls for the setting up of a Center for Computer Science and the development of a data management concept for space missions. Author (ESA)

N80-34116# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). German Space Operations Center.
DESCRIPTION OF A SYSTEM FOR THE INTERACTIVE PROCESSING OF THE IMAGE DATA OF A GEOSTATIONARY WEATHER SATELLITE
Joerg Gredel, Willi Rattei, and Ulrich Schwarz *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 47-58 refs Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)
(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53.50

An overall view of the hardware and software designed for processing Meteosat image data is presented. The system includes a color display system with video disc storage, controlled by a

digital computer MULTIBY 3/35 which also transmits the data to the main computer installation AMDAHL 470 V/6. The McIDAS program (man computer interactive data access system) allows interactive processing from the point of view of meteorological users. Author (ESA)

N80-34117# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. for the Dynamics of Flight Systems.

THE USE OF COMPUTER-CONTROLLED MANIPULATORS IN UNDERWATER TECHNOLOGY

Lothar Schmeider *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 59-72 refs Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)

(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53,50

Possible applications of manipulators in underwater technology, and particularly in off-shore oil drilling, are reviewed. Reference is made to an underwater laboratory able to dive to depths of up to 100 m, and work being done for extending the diving depth to 600 m. A computer controlled external manipulator for more flexible and effective operation is discussed. Author (ESA)

N80-34118# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. for the Dynamics of Flight Systems.

OPERATIONAL DATA HANDLING: AN ESSENTIAL NEED FOR THE ACCURATE DETERMINATION OF SATELLITE ORBITS

Klaus Zimmermann *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 73-87 refs Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt" Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)

(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53,50

The problem of accurate satellite orbit determination caused by refraction error is analyzed by means of a practical example. Comparison between available methods and theoretical analysis shows that orbit determination using the unbiased minimum variance principle offers the best performance. The method consists of modeling the satellite dynamics with a computer, converting the position and the velocity into the measured variables, and then varying the orbit until the difference betweem measurement and calculation becomes minimum. Author (ESA)

N80-34119# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. for the Dynamics of Flight Systems.

PROBLEMS OF AUTONOMOUS AIRBORNE SATELLITE CONTROL SYSTEMS

Gerhard Hirzinger *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 88-94 refs Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)

(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53,50

The advantages and technical feasibility of autonomous satellite-borne controls are examined. In particular the performance of such operations as orbit determination, orbit control, attitude determination, and attitude control is discussed. It is concluded that it is an objective capable of realization with the help of microcomputers. Author (ESA)

N80-34120# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

COUPLING OF IBM AND SIEMENS SYSTEMS ON RJE-BASIS AS IMPLEMENTED IN REGIONAL COMPUTER CENTER FOR THE MANNHEIM AND HEIDELBERG UNIVERSITIES

Harish C. Saxena *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 95-105 refs Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)

(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53,50

Some of the hardware and software features of the system connecting an IBM OS/MVS computer with a Siemens BS 2000 computer are presented. The description includes the required functions of the combined system, the hardware connections, the software changes required, the interface program to facilitate the user's communication with the coupled system, the coupler program which is the main part of the system, and the telecommunications program for buffering the incoming and outgoing messages. The logic flow is also described. Author (ESA)

N80-34121# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Computer Center.

USE OF THE OPERATING SYSTEM OS-MVS IN THE TECHNICAL AND SCIENTIFIC FIELD

Johannes Gersing *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 106-113 Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)

(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53,50

The characteristics of the multiple virtual storage (MVS) concept in multiprogramming with computers such as the IBM 370 series are described. The most important properties of the MVS system are pointed out, such as the assigning to each user of his own virtual adress space, the dynamic job mix by means of swapping strategies, and the security of the MVS operating system (system integrity). Author (ESA)

N80-34122# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

EXPERIMENTAL WORK PLACE FOR THE EBOSIPES RESEARCH PROJECT

Karel Dobes *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 114-123 refs Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)

(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53,50

The hardware implementation of the EBOSIPES project is presented. The EBOSIPES is a computer system intended to elaborate user oriented software modules in PEARL language for experimenters in Spacelab. The discussion includes: the configuration of the computer unit (Siemens (404/3); the development of the peripheral equipment consisting of two disc stores, an image terminal, and a matrix printer; the development of the process software and system support software and the interfaces to the user which consist of the PEARL real time language, the remote acquisition unit, and a full scale model of the Spacelab module. Author (ESA)

N80-34123# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

SOFTWARE FOR EBOSIPES: PRESENT STATE AND TRENDS

Gottfried Schwarz *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 124-128 Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)

(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53,50

The EBOSIPES is a computer system intended to elaborate user oriented software modules for experimenters in Spacelab. An analysis of the criteria that should be complied with by the system software is presented. The higher level real time language

PEARL satisfies the requirements. Pre-programmed modules in PEARL language were prepared for selected experiments to identify data handling problems. The development trends for the EBOSIPES project are also discussed. Author (ESA)

N80-34124# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. for Communication Engineering.

THE USE OF PROINF IN THE RESEARCH PROJECT EBOSIPES

Peter Unger *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 129-130 Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)

(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53.50

The project information system PROINF has a modular structure and is used interactively in the research project EBOSIPES. The system makes it possible to obtain an immediate overall view of project relevant data such as costs incurred, working time employed, and project progress. The constituent modules of PROINF are described. Author (ESA)

N80-34125# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. for Applied Physics.

EMPLOYMENT OF A DIGITAL COMPUTER IN THE TESTS TO ASCERTAIN THE USEFUL LIFE OF THE THRUSTER RIT 10

Manfred Savary *In* ESA Contrib. to the Symp.: Computer Sci. in Space Flight (ESA-TT-587) Feb. 1980 p 131-144 Transl. into ENGLISH of "Beitraege zum Symp.: Datentechnik in der Raumfahrt", Rept. DFVLR-Mitt-78-02 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1978 (For primary document see N80-34112 24-60)

(DFVLR-Mitt-78-02) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 53.50

The data acquisition and data processing for a test stand of mercury ion thrusters using a Honeywell H716 computer are described. The RIT 10 ion thrusters are being developed for use in satellite attitude control systems. A special vacuum chamber was developed for the test. Test results show over 8000 hrs life in continuous operation and much shorter life in cycled operation. Examples of data formats are presented. Author (ESA)

N80-34126# National Technical Information Service, Springfield, Va.

MICROCOMPUTERS: TELECOMMUNICATION APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Jun. 1979

William E. Reed Jul. 1980 266 p Supersedes NTIS/PS-79/0728; NTIS/PS-78/0613

(PB80-812688; NTIS/PS-79/0728; NTIS/PS-78/0613) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide research literature cites studies on telecommunication applications of microcomputers. Telephone, data transmission, teleprinters, facsimile communication, and communications controllers are among the applications cited. This updated bibliography contains 260 abstracts, none of which are new entries to the previous edition. GRA

N80-34127# National Technical Information Service, Springfield, Va.

MICROCOMPUTERS: TELECOMMUNICATION APPLICATIONS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Jul. 1979 - Jun. 1980

William E. Reed Jul. 1980 196 p Supersedes NTIS/PS-79/0728; NTIS/PS-78/0613

(PB80-812696; NTIS/PS-79/0728; NTIS/PS-78/0613) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide research literature cites studies on telecommunication applications of microcomputers. Telephone, data transmission, teleprinters, facsimile communication, and communications controllers are among the applications cited. This updated bibliography contains 191 abstracts, all of which are new enteries to the previous edition. GRA

N80-34128# National Technical Information Service, Springfield, Va.

MICROCOMPUTERS: GENERAL APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - May 1979

Brian Carrigan Jun. 1980 188 p Supersedes NTIS/PS-79/0725; NTIS/PS-78/0609

(PB80-812597; NTIS/PS-79/0725; NTIS/PS-78/0609) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

This bibliography of Federally funded research cities studies on the applications of minicomputers. These include process control, testing, navigation, instrumentation, biomedicine, machining, training, as well as other applications. This updated bibliography contains 181 abstracts, none of which are new entries to the previous edition. GRA

N80-34129# National Technical Information Service, Springfield, Va.

MICROCOMPUTERS: GENERAL APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun. 1979 - May 1980

Brian Carrigan Jun. 1980 165 p Supersedes NTIS/PS-79/0725; NTIS/PS-78/0609

(PB80-812605; NTIS/PS-79/0725; NTIS/PS-78/0609) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

This bibliography of Federally funded research cites studies on the applications of minicomputers. These include process control, testing, navigation, instrumentation, biomedicine, machining, training, as well as other applications. This updated bibliography contains 158 abstracts. GRA

N80-34130# National Technical Information Service, Springfield, Va.

MICROCOMPUTERS: DESIGN AND SOFTWARE DEVELOPMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1978

Brian Carrigan Jul. 1980 219 p Supersedes NTIS/PS-79/0723; NTIS/PS-78/0610

(PB80-812613; NTIS/PS-79/0723; NTIS/PS-78/0610) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The design of microcomputers and the development of its software are covered in this bibliography of Federally funded research. Studies on microcomputer applications are included only if the above topics are cited. Circuit and chip technology, and performance evaluation are included. This updated bibliography contains 213 abstracts, none of which are new entries to the previous edition. GRA

N80-34131# National Technical Information Service, Springfield, Va.

MICROCOMPUTERS: DESIGN AND SOFTWARE DEVELOPMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - May 1980

Brian Carrigan Jul. 1980 90 p Supersedes NTIS/PS-79/0723; NTIS/PS-78/0610

(PB80-812621; NTIS/PS-79/0725; NTIS/PS-78/0610) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The design of microcomputers and the development of its software are covered in this bibliography of Federally funded research. Studies on microcomputers applications are included only if the above topics are cited. Circuit and chip technology, reliability, and performance evaluation are included. This updated bibliography contains 83 abstracts, 62 of which are new entries to the previous edition. GRA

N80-34132# National Technical Information Service, Springfield, Va.

MICROCOMPUTERS: GENERAL APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - May 1980

Brian Carrigan Jul. 1980 146 p Supersedes NTIS/PS-79/0727; NTIS/PS-78/0612

(PB80-812639; NTIS/PS-79/0727; NTIS/PS-78/0612) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide research literature cites studies on the applications of microcomputers. These include automotive, testing, navigation, instrumentation, biomedical, machine tools, and other applications. This updated bibliography contains

139 abstracts, 42 of which are new entries to the previous edition. GRA

N80-34133# National Technical Information Service, Springfield, Va.
MICROCOMPUTERS: BASIC DESIGN AND DEVELOPMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jul. 1979 - May 1980
Brian Carrigan Jul. 1980 190 p Supersedes NTIS/PS-79/0730; NTIS/PS-78/0615
(PB80-812654; NTIS/PS-79/0730; NTIS/PS-78/0615) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide research literature cites studies on the design and development of microcomputers. Studies on software development, chip development, LSI technology, and reliabilitty and performance evaluation testing are included. This updated bibliography contains 183 abstracts, all of which are new entries to the previous edition. GRA

N80-34134# Federal Compiler Testing Center, Washington, D.C.
TANDEM 16, COBOL -T9201D00 Validation Summary Report
13 Jun. 1980 53 p
(PB80-190283; CCVS74-VSR600) Avail: NTIS HC A04/MF A01 CSCL 09B

A consolidated summary of the results obtained from the validation of the TANDEM/16 T9201 COBOL compiler version D00 against the 1974 COBOL Standard is presented. An overview of the validation which lists all categories of discrepancies by level/module; a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed are included. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-34135 British Library Lending Div., Boston Spa (England).
IDENTIFICATION OF A NONLINEAR SYSTEM BY MEANS OF THE MODIFIED GMDH
A. Endo [1978] 10 p refs Transl. into ENGLISH from Soc. Instr. Control (Tokyo), no. 14, 1978 p 130-135
(BLL-Trans-1446) Avail: British Library Lending Div., Boston Spa, England

Application of the group method of data handling is discussed for the identification of a nonlinear system whose mathematical relationships are known, and the scrutinization and examination of the method itself through simulations. Unneccessary increases in degree and in the stability were observed. A method of improvement is proposed. By means of the modified CMDH a nonlinear model was obtained which corresponded to the input/output characteristics, was practical and had an appropriate degree of accuracy, and also exhibited improved convergence of the identification process, model stability and faithfulness. The advantages of the GMDH as a method of analysis for systems with few data and operational systems are as before, but prospects can be seen for the modified GMDH as a practical identificational method for nonlinear systems in engineering. The combination might be considered with other existing methods of identification of the nonlinear general degree prediction hypothesis. In learning machines, too, a method of treatment is being considered of the whole pattern by means of the overlapping of such local treatments, which is more effective than the perceptron type. S.F.

N80-34136 Texas Univ. at Austin.
DETERMINING THE THREE-DIMENSIONAL MOTION AND MODEL OF OBJECTS FROM A SEQUENCE OF IMAGES Ph.D. Thesis
John Wilson Roach 1980 159 p
Avail: Univ. Microfilms Order No. 8021507

An attempt is made to determine precisely how an object is moving in three dimensional space and to determine the three dimensional relationship of points on the surface of the object. The only information available is a sequence of photographic images taken as the object moves across the field of view. The mathematical analysis of the problem shows that there is an infinite number of geometrically similar solutions, each solution differing from the others by a scaling factor. A specific solution can be found by setting the scaling factor to an arbitrary number. Two views of six feature points or three views of four feature points are required to find the model and movement. For good accuracy, however, considerably more points, two views of twelve or fifteen points, for example, are needed. Dissert. Abstr.

N80-34137 Texas A&M Univ., College Station.
A LANGUAGE FOR DESIGNING SOFTWARE SYSTEMS Ph.D. Thesis
Dick B. Simmons 1980 140 p
Avail: Univ. Microfilms Order No. 8023061

A prototype of a new design system was implemented. This implementation includes: (1) a design language for expressure design information; (2) a data base for holding design information; (3) a set of feedback and analysis tools; and (4) a command language for manipulating the feedback and analysis tools. The design language is a relational language. Objects are defined in the language and then relationships are established between objects. Feedback and analysis tools were developed with the intent of making the information feedback loop shorter. Dissert. Abstr.

N80-34138 Ohio State Univ., Columbus.
THE RECOGNITION OF STRAIGHT LINE PATTERNS BY BUS AUTOMATIONS USING PARALLEL PROCESSING Ph.D. Thesis
John Rolf Mellby 1980 125 p
Avail: Univ. Microfilms Order No. 8022312

Highly parallel computers are capable of solving some problems much more rapidly than sequential computers. Algorithms are presented on the Bus Automaton, a parallel computer. The Bus Automaton solves various computation problems immediately, i.e., in O(1) time, while they would take from O(1) to O(n squared) time on sequential computers. The primary immediate computation is the recognition of straight lines. Other problems also immediately computed are: mass transformation of data sets, arithmetic in stroke or binary notation, computation of statistical mean and variance, lexicographic sorting, and general arithmetic expression computation. Dissert. Abstr.

N80-34139 California Univ., Los Angeles.
A FORMAL PROGRAM MODEL FOR DISCRETE EVENT SIMULATION AND ITS USE IN THE VERIFICATION AND VALIDATION OF SYSTEM MODELS AND IMPLEMENTATIONS Ph.D. Thesis
Melvin M. Cutler 1980 248 p
Avail: Univ. Microfilms Order No. 8023293

Techniques are introduced to verify formalized simulation programs against sequential machine specifications by relating the program to a structural description of the system to be simulated. It is shown that discrete event specifications, popular vehicles for system description, are realizable by the usual discrete time system formalism of automata theory. A discrete event simulation of a discrete deterministic system is shown to be a formal object whose fidelity to the system can be proved. This is effected by constructing a homomorphism from an operational model of the discrete event simulation to the discrete event specification restricted to a countable time line. A discrete event simulation of a discrete stochastic system is shown to be a formal object whose statistical fidelity to the system can be proved. This is effected by the construction of a covering homomorphism whose domain is the associated stochastic sequential machine of the ergodic machine characterizing the discrete event simulation program and whose range is a stochastic discrete event specification, the discrete event version of stochastic sequential discrete event specification, the discrete event version of stochastic sequential machines. Dissert. Abstr.

N80-34140 Colorado Univ. at Boulder.
AN ANALYSIS OF PASCAL PROGRAMS AND SEVERAL BASIC BLOCK OPTIMIZATIONS Ph.D. Thesis
Lynn Robert Carter 1980 282 p

Avail: Univ. Microfilms Order No. 8021556

Eighty nine Pascal programs are examined and many of the static properties of these programs are characterized. Additionally, an analysis of several basic block optimizations is performed. The results are: first, nearly all common subexpressions deal with addressing; second, subscripts tend to be very simple; and lastly, that the use of increment and decrement instructions will replace a significant number of additions, subtractions, and stores. Dissert. Abstr.

N80-34141 Southern Methodist Univ., Dallas, Tex.
THEORY AND DESIGN OF UNIDIRECTIONAL ERROR CODES Ph.D. Thesis
Bella Bose 1980 125 p
Avail: Univ. Microfilms Order No. 8023444

By defining a parameter N(X,Y) the capabilities of binary block codes for unidirectional error correction/detection are established. Block codes, called SEC-MUED codes, which are capable of correcting single errors and detecting multiple unidirectional errors are given. Encoding/decoding algorithms for these nonsystematic codes are also given. Some bounds for the number of code words in a SEC-MUED code are discussed. A coding technique for correcting unidirectional errors in a shift register memory or in a magnetic tape unit is devised. This coding scheme corrects any pattern of unidirectional errors confined to a single track. The information rate of these codes is better than the known CRC codes. Further properties of these codes are also discussed. A method to design systematic SEC-MUED code is discussed. The unidirectional error correcting/detecting capabilities of some of the known symmetric error correcting codes are discussed. Dissert. Abstr.

N80-34142 Cornell Univ., Ithaca, N. Y.
THE SIZE OF NUMBERS IN THE ANALYSIS OF CERTAIN ALGORITHMS Ph.D. Thesis
Ravindran Kannan 1980 96 p
Avail: Univ. Microfilms Order No. 8020841

In the case of the LUP decomposition algorithm for solving simultaneous equations and the Euclidean algorithm to find the greatest common divisor of two polynomials, prima facie cases for the size of the numbers (number of binary digits required to represent the numbers) produced by these algorithms not to be polynomially bounded in the length of the input are presented. Unimodular triangularization, (computation of the Hermite and Smith normal forms of an integer matrix), are studied. Known algorithms for these problems are proved to be polynomially time bounded only under the assumption that all intermediate numbers produced by these algorithms were polynomial size bounded. The number of arithmetic operations performed by these algorithms depends upon the size of the numbers computed. Aggregation, a technique used to produce one linear Diophantine equation in nonnegative variables that has the same set of solutions as a given system of simultaneous linear Diophantine equations in nonnegative variables, can be done by a good algorithm. Dissert. Abstr.

N80-34143 Carnegie-Mellon Univ., Pittsburgh, Pa.
FORWARD LINEAR PROGRAMMING Ph.D. Thesis
Jay Ellis Aronson 1980 219 p
Avail: Univ. Microfilms Order No. 8021189

A forward algorithm is developed of solving and finding planning horizons for the infinite horizon version of the deterministic production smoothing problem without inventory. This model approximates the real world situation for highly obsolescent or perishable commodities such as newspapers and fresh produce. Computational results show that the algorithm is linear in problem length, while linear programming is at least quadratic. This model is investigated by control theory and linear programming. Planning horizons or heuristic planning horizons are identified in the simplex tableau. These horizons yield techniques which improve the efficiency of the simplex method. A simple version of a forward linear programming algorithm for the specially structured problem is developed and encouraging computational results are preserved. The development, implementation and testing of the Forward Simplex Method, a procedure for solving general dynamic linear programs is discussed. Detailed computational results of the algorithm tested on three models are presented. The first model is the production smoothing problem without inventory. The second model is similar to the first, with the addition of inventory. The third is a manpower planning model. Tests suggest that solution time is linear in the problem length, versus quadratic or cubic for earlier linear programming codes. Dissert. Abstr.

N80-34144 Ohio State Univ., Columbus.
AUTOMATIC FLOWSHEET DRAWING FOR THE COMPUTER AIDED DESIGN OF CHEMICAL PROCESSES USING INTERACTIVE COMPUTER GRAPHICS Ph.D. Thesis
Peter Evans Steacy 1980 252 p
Avail: Univ. Microfilms Order No. 8022350

A proposal in made for system for the computer aided design of chemical processes. Distinguishing this system would be its orientation toward fast, effective, interaction between the engineer and the computer. To be effective, the proposed system must be able to automatically (and artistically) layout and draw a flowsheet given the process units and their interconnections. The problem was formalized and algorithms were developed for its solution. The basic requirement set for the flowsheet is that it be drawn in a planar fashion (without stream crossings). This is achieved by modeling flowsheet with an abstract graph, deriving information about a planar representation for that graph, and using the information gained to construct a planar flowsheet. A prototype system is built to demonstrate the feasibility of using automatic flowsheet drawing in computer aided design system. Dissert. Abstr.

N80-34145 Texas Univ. at Austin.
A GRAPH THEORY APPROACH TO SOFTWARE EVALUATION Ph.D. Thesis
James Ching-Chiou Hsu 1980 136 p
Avail: Univ. Microfilms Order No. 8021449

The roles of specification and program complexity in the software life cycle are explored and methods for the design and analysis of programs that incorporate the realiability aspects are developed. One specific objective is to develop a procedure so that a system specification, which is modeled by a decision table, can be checked for tis completeness and correctness. A logical dependency graph is used to model the logical dependence relationships among conditions. The logical dependency graph is proved to be an acyclic diagraph. A procedure is developed so that all the feasible logical possibilities can be found. A concomitant procedure is also developed to check for the completeness and correctness of a decison table. The two procedures will aid the system analyst performing the validation of system modeling. Another objective is to develop a quantitative measure that can used to measure the complexity of programs. A structural graph model is developed. The minimal cut-set of a structural graph is calculated and used to measure program complexity. This measure can then applied to the analyses of computer programs in terms of complexity and clarity. Such an analysis indicates where the deep nesting and the unrestrained flow of control occur. Dissert. Abstr.

N80-34146*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
USERS' GUIDE FOR THE TABULAR DISPLAY REPORT GENERATOR PROGRAM (TABDIS)
Dennis M. Braley Aug. 1980 60 p Supersedes JSC-11318; IN-76-FM-38
(NASA-TM-82211; JSC-16792; IN-80-FM-46; JSC-11318; IN-76-FM-38) Avail: NTIS HC A04/MF A01 CSCL 09B

The tabular display report generator (TABDIS) program is described. The program functions as a document generation tool that provides tabular displays of data stored on a data file which has been generated by a user program. The main features of the program are outlined and all necessary inputs are detailed. M.G.

N80-34147# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A COMPREHENSIVE MODEL FOR HUMAN MOTION SIMULATIONS AND ITS APPLICATION TO THE TAKE-OFF PHASE OF THE LONG JUMP
H. Hatze Dec. 1979 25 p refs
(CSIR-TWISK-131) Avail: NTIS HC A02/MF A01

A mathematical model is presented which makes it possible

to simulate complex motions of a 17 segment hominoid. The dynamical equations are given in compact form and the treatment of external constraints and impact situations are discussed in depth. The present model fully accounts for the dynamics of the executor subsystem and also simulates the intricately controlled internal excitation and contraction dynamics of the myoactuator subsystem. The controls in the model are the actual neural controls motor unit recruitment and stimulation rate, for each of the 46 muscles of the model. For a given set of subject specific input parameters, a given initial state, and given neural control functions, the computer program executing the model computes the state trajectory, the histories of all constraint forces, the trajectory of the center of mass, and the histories of the components of the velocity of the center of mass, of the total angular momentum, of all muscle and joint reaction forces, and of the energies of all 17 model segments. E.D.K.

N80-34148# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
REAL-TIME TELEPHONE TRAFFIC SIMULATION USING LEARNING AUTOMATA ROUTING
Philip Mars and Michael S. Chrystall Nov. 1979 37 p refs
(S/IS-7909) Avail: NTIS HC A03/MF A01

Telephone traffic routing in more complex hierarchical and generalized networks is considered using both alternate or fixed rule and Linear Reward-Inaction automaton routing. The simulation studies using a microprocessor based real-time simulator are shown to provide confirmation that the automaton routing scheme performs at least as well as the optimal fixed rule. In addition, studies under failure node conditions, including link, node, and focussed overloads, conclusively demonstrate the superior performance of learning automata routing. L.F.M.

N80-34149# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
SIMULATION STUDY OF TELEPHONE TRAFFIC ROUTING USING LEARNING ALGORITHMS, PART 2
Kumpati S. Narendra, Philip Mars, and Michael S. Chrystall Oct. 1979 25 p refs
(S/IS-7907-Pt-2) Avail: NTIS HC A02/MF A01

Recent theoretical work indicated that Linear Reward-Penalty automation schemes may also be attractive for applications involving telephone traffic routing. Telephone traffic routing in simple networks with Fixed Rule (currently in use in the real system), Linear Reward-Inaction automaton, and Linear Reward-Penalty automaton routing schemes are compared. The simulation results are shown to provide definite confirmation of previous theoretical predictions concerning the behavior of Linear Reward-Inaction and Linear Reward-Penalty automata in nonautonomous environments. In addition, by a controlled sequence of identification experiments a mathematical model of the simple telephone network/automaton system is formulated. his model permits the theoretical prediction of optimum network blocking probability. L.F.M.

N80-34150# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
LEARNING ALGORITHMS FOR TWO PERSON ZERO-SUM STOCHASTIC GAMES WITH INCOMPLETE INFORMATION: A UNIFIED APPROACH
S. Lakshmivarahan (Oklahoma Univ., Norman) and K. S. Narendra Oct. 1979 24 p refs Sponsored in part by NSF
(S/IS-7908) Avail: NTIS HC A02/MF A01

The two person zero-sum game is considered in which either player does not know the set of strategies available to the other player and the mixed strategy used by the other player nor its pure realization at any stage. The outcome of the game depends on chance and the game is played sequentially. The distribution of the random outcome as a function of the pair of pure strategies chosen by either player is also unknown to them. It is shown that if the player uses a learning algorithms of the reward - penalty by proper choice of certain parameters in the algorithms, the expected value of the mixed strategies for both players can be made as close to optimal strategies as desired. A.R.H.

N80-34151*# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
APPLICATION OF A HIERARCHICAL STRUCTURE STOCHASTIC LEARNING AUTOMATION
R. G. Neville, M. S. Chrystall, and P. Mars Sep. 1979 49 p refs Sponsored by J. K. Science Research Council
(S/IS-7906) Avail: NTIS HC A03/MF A01

A hierarchical structure automaton was developed using a two state stochastic learning automato (SLA) in a time shared model. Application of the hierarchical SLA to systems with multidimensional, multimodal performance criteria is described. Results of experiments performed with the hierarchical SLA using a performance index with a superimposed noise component of ± or - delta distributed uniformly over the surface are discussed. J.M.S.

N80-34152# Pattern Analysis and Recognition Corp., Rome, N. Y.
IMAGE FEATURE MANUSCRIPT GENERATION Final Technical Report
Michael J. Zoracki, David A. Marks, and James L. Cambier May 1980 164 p
(Contract F30602-78-C-0017; AF Proj. 4594)
(AD-A088884; PAR-80-25; RADC-TR-80-176) Avail: NTIS HC A08/MF A01 CSCL 09/2

This report describes the Image Feature Manuscript Generation capability developed under RADC Contract F30602-78-C-0017. The capability developed here will serve as an experimental facility on which to evaluate advanced techniques of potential application to the Automatic Feature Extraction System (AFES). This effort has been directed at providing an improved interactive means of classifying photographic imagery and for addressing and displaying graphics for the purpose of automatically categorizing image features, generating feature boundaries, and editing the shapes and locations of those boundaries. Specific attention was given to the development of a region growing capability and to the inclusion of an AFAL-developed atmospheric model. These items are described at length within this report. GRA

N80-34153# Control Data Corp., Minneapolis, Minn. Image Systems Div.
MAPS IMAGE COMPRESSION Final Technical Report, 13 Sep. 1978 - 18 Jan. 1980
Anton E. LaBonte and Tom E. Rosenthal May 1980 115 p
(Contract F30602-78-C-0253; AF Proj. 4594)
(AD-A088763; ISD-78003-80-R-1; RADC-TR-80-173) Avail: NTIS HC A06/MF A01 CSCL 05/8

This report encompasses several areas of technique refinement regarding the MAPS image compression technique which were identified in an earlier RADC final technical report, RADC-TR-77-405 dated December 1977 (A050679). These areas incude: adaptive decompression, contrast control simplification, resolution code error detection and recovery, and interactive Macro-fidelity control. GRA

N80-34154# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
ON THE CONVERGENCE OF A BLOCK SUCCESSIVE OVERRELAXATION METHOD FOR A CLASS OF LINEAR COMPLEMENTARITY PROBLEMS
R. W. Cottle and J. S. Pang Jul. 1980 27 p refs Prepared in cooperation with Stanford Univ., Calif.
(Contracts N00014-75-C-0621; N00014-75-C-0267; DE-AC03-76SF-00326; DE-AT03-76ER-72018; Grant NSF ECS-79-26320; NR Proj. 047-048)
(AD-A088760; MSRR-462; SU-SOL-80-17) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper develops a reduced block successive overrelaxation method for solving a class of (large-scale) linear complementarity problems. The main new feature of the method is that it contains certain reduction operations at each iteration. Such reductions are needed in order to ensure the boundedness (and therefore the existence of accumulation points) of the sequence of iterates produced by the algorithm. Convergence of the method is established by using a theorem due to Zangwill. GRA

N80-34155# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Dept. of Communication and Humanities.
RESPONSIVENESS AND CONFIGURATION CONTROL FOR

EMBEDDED COMPUTER SOFTWARE M.S. Thesis
Gerald O. Wade Jun. 1980 179 p refs
(AD-A088723; AFIT-LSSR-39-80) Avail: NTIS
HC A09/MF A01 CSCL 09/2

The purpose of this research effort was to (1) determine those factors contributing to the inability of the Air Force Logistics Command (AFLC) to provide responsive support to Embedded Computer Software users which has the appropriate degree of control exercised and (2) determine the management systems structure and factors required to provide responsive support of controlled software. The research has three phases. The first is a discussion of software management principles essential to effective software management. The second is comprised of models of three distinct management systems and analyses of each in terms of benefits, deficiencies, operating policy, application of software management principles, and provides comparative conclusions on which aspects of a management system were the best. The third is an analysis of the results of the interaction of the software management principles of relative importance to a management system processing stage. Conclusions developed were that responsiveness problems experienced in AFLC were attributable to its utilization of change blocking, the G026 management system, and its management system's structure. Recommendations were that ECS requirements should take priority, minimal management layering should exist, and explicit responsibility and authority delineation is defined. GRA

N80-34156# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A COMPILATION OF COMPUTER SOFTWARE PROGRAMS AVAILABLE IN THE FLIGHT DYNAMICS LABORATORY, 1979 Final Report
James L. Terry Dec. 1979 241 p
(AF Proj. 9991)
(AD-A088854; AFFDL-TR-79-3155) Avail: NTIS
HC A11/MF A01 CSCL 01/3

A compilation of computer programs useful in the analysis and design of aerospace vehicles is presented. Technical areas covered include: aerodynamics; flight control; vehicle dynamics; crew escape; vehicle structures; vehicle subsystems (i.e., landing gear); preliminary design and analysis; mathematical aids to analysis. This report supersedes Air Force Flight Dynamics Laboratory Technical Report AFFDL-TR-74-26, 'A Library of Computer Programs in Flight Vehicle Technology, 1973.' GRA

N80-33443*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN SYSTEM PERFORMANCE TEST SOFTWARE
F. B. Leppla *In its* The Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 121-125 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N80-34157 Oregon State Univ., Corvallis.
IDENTIFICATION AND ANALYSIS OF SIMPLE MODELS FOR THE RESPONSE TIME OF COMPLEX COMPUTER SYSTEMS Ph.D. Thesis
Reza Maneshi 1980 269 p
Avail: Univ. Microfilms Order No. 8021941

A simple approach to developing approximate analytical performance models for complex systems is presented. The approach is applicable in cases where measurement or simulation data describing system performance are available but the system is to complex for exact analytical models to be quickly developed. Known results from queueing theory are first used to indicate the appropraite functional form of analytical formulas for performance, then modified regression techniques are used to estimate unknown parameters, in these formulas. In all cases this simple approach has closely predicted the performance of the system studied. It valuable when it is combined with further analysis of the system to analytically explain the parameters obtained by regression. Dissert. Abstr.

N80-34158 Texas Univ. at Austin.
STOCHASTIC NETWORK WITH RECOURSE Ph.D. Thesis
Hsing-Wei Chu 1980 146 p
Avail: Univ. Microfilms Order No. 8021414

In a stochastic network with recourse problem the external flows are drawn from a finite set with known probabilities. This problem can be formulated as a specical case of a two stage linear programming problem. Here the matrix of structural coefficients represents a network instead of a general linear program. A method which utilizes the special properties of the network and combines the partitioning and subgradient techniques is developed to solve the stochastic network with recourse problem. The method iteractively changes the flows, bases, corresponding dual variables and the gradient vector until the gradient vector indicates that the optimal solution is found. Cycling problems cannor occur in this method sizes of problems are tested. Dissert. Abstr.

N80-34159# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
FLOW CONTROL AND ROUTING ALGORITHMS FOR DATA NETWORKS
Robert G. Gallager and Seyyed J. Golestaani Jul. 1980 10 p refs Presented at the ICCC 1980, Atlanta, 27-30 Oct. 1980
(Contract N00014-75-C-1183; Grant NSF ECS-79-19880; ARPA Order 345; NR Proj. 049-383)
(AD-A088767; LIDS-P-1013) Avail: NTIS HC A02/MF A01 CSCL 09/2

We consider flow control algorithms consisting of two parts: quasi-static flow control and dynamic flow control. The quasi-static part uses short term average information on network utilization to allocate maximum data rates and to determine routes for each user. The rates are allocated to achieve an optimal trade-off between assigned priority cost functions for each user and the cost of congestion in the network. This optimization can be done by a distributed algorithm and is essentially no more complicated than optimizing routing alone. The dynamic flow control has the function of admitting or rejecting individual units of traffic into the network so as to enforce the maximum allocated rates and to prevent congestion by smoothing out the fluctuations in buffer occupancy. GRA

N80-34160# Harris Corp., Melbourne, Fla. Government Communications Systems Div.
MULTIPLE MICROPROCESSOR SYSTEM (MMS) DESIGN STUDY, VOLUME 2 Final Technical Report
Griffiss AFB, N.Y. RADC Mar. 1980 362 p refs 4 Vol.
(Contract F30602-78-C-0114)
(AD-A086066; RADC-TR-80-33-Vol-2) Avail: NTIS
HC A16/MF A01 CSCL 09/2

The functional components of MMS are reviewed and those areas where software is needed or where software interfaces are defined. MMS consists of a network of up to 64 microprocessors linked to a minicomputer called the FCP (facility control processor). Several computers are evaluated relative to the needs of MMS. Functionally, the FCP stores, on its disks, the libraries of emulated modules, emulated computer systems, and emulated target systems. The FCP allows the user to configure his target system onto the MMS hardware, and to interface with his emulated target system during its execution. The software necessary for MMS is also covered. The facility control processor interface (FCPI) is used for downloading large blocks of information to a PE. A PE can send error messages to the FCP through FCPI. R.K.G.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-34161 Maryland Univ., College Park.
READING HANDWRITTEN WORDS USING HIERARCHICAL RELAXATION Ph.D. Thesis
Kenneth Crawford Hayes 1979 297 p
Avail: Univ. Microfilms Order No. 8021870

The Hand Written Word Reading System (HWWRS) builds a hierarchical description of the words it reads. The HWWRS's first task is to translate the array representation (image) of a word into a geometric graph representation that models the line structures in the word. A stroke graph containing the possible strokes in the word is created by matching structural descriptions of strokes to the geometric graph. The stroke graph is then augmented to a letter-stroke that represents the possible letters of the word by matching structural descriptions of letters to the stroke graph. The letter-stroke graph represents the ambiguous segmentations of the word into letters and strokes that possibly overlap one another. It constitutes the hierarchical description of the input word. The hierarchical description is contextually disambiguated and thus simplified by the application of relaxation procedures. This simplified hierarchical description defines one or possibly a few words. HWWRS reads the input word by picking the most likely word from a list of possible words.
Dissert. Abstr.

N80-34162# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMAL CONTROLS THAT MAXIMIZE THE PROBABILITY OF BEING IN A GIVEN SET AT A GIVEN TIME
Yaakov Yavin and Antoinette Venter Jan. 1980 26 p refs Supported in part by Control Data
(CSIR-TWISK-135) Avail: NTIS HC A03/MF A01

An optimal control problem is considered for a class of nonlinear controlled stochastic systems, the states of which are r(m) valued Markov processes. Suppose that an open bounded set d contained in r(m), a subset a contained in d and a time t is greater than 0 are given. The problem is treated of maximizing the probability that the state of the system will be in the set A at the time T after having remained in D throughout the interval [0,T]. Sufficient conditions on optimal controls, of a dynamic programming type, are derived. These conditions require the existence of a smooth solution to a nonlinear partial integro-differential equation. A stochastic secondorder system, describing a perturbed sine wave oscillator, is used as a test case, and a numerical method for computing optimal controls is suggested. The performance of the oscillator for both optimal and optimal control laws, is investigated by computing the probability that the state of the oscilattor will be in a given neighborhood of its limit cycle, and by computing the exptected value of the time it is there.
Author

N80-34163# Council for Scientific and Industrial Research, Pretoria (South Africa).
PROGRAMMING ALTERNATIVES FOR NC MACHINES TOOLS
Jun. 1979 6 p
(TSD-T-79106; ISBN-0-4988-1766-6) Avail: NTIS HC A02/MF A01

Programming methods for numerical control machining are identified and compared. These include manual programming, manual programming with limited aid from a computer control unit, and computer assisted programming using a symbolic, high level language. The required programming activities, staff training or skill, cost of equipment, and the cost per program are outlined for each of the methods. Although the initial cost of equipment is high for the computer assisted technique, the costs per program are comparably low due to the fact that the programmer does not need to carry out coordinate calculations, coding, or tape punching.
M.G.

N80-34164# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ARTIFICIAL INTELLIGENCE: PROMISES OR RESULTS? [INTELIGENCIA ARTIFICIAL: PROMESSAS OU RESULTADOS?]
Celso deRennaeSouza Jul. 1980 11 p refs In PORTUGUESE; ENGLISH summary Presented at Symp. on Artificial Intelligence: Why Try to Make a Computer Think?, Rio de Janeiro, Jul. 1980
(INPE-1834-RPE/196) Avail: NTIS HC A02/MF A01

The computer as a tool to help man in his mental tasks is compared with other traditional tools such as farm tractors, automobiles, telephones, etc. Artificial intelligence is defined and examples are given of intelligent behavior by machines and their software. Propositions to foster debates are included.
S.F.

N80-34165# Ohio State Univ., Columbus. Dept. of Statistics.
STATISTICAL CONSIDERATIONS IN CONTROL MODELS WITH APPLICATIONS
Jagdish S. Rustagi Jul. 1980 30 p refs
(Contract N00014-78-C-0543; NR Proj. 042-403)
(AD-A088663; Rept-5; TR-211) Avail: NTIS HC A03/MF A01 CSCL 12/1

Many applications of control theory, specially in areas other than engineering, require the estimation of the system equations from available data. Applications from patient care system, effect of air pollution on health and dynamic economic models are discussed. A framework is studied in which the control model can be applied using the data provided by the system itself. Special objective functions are utilized to illustrate the technique.
GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-34166 British Library Lending Div., Boston Spa (England).
NON-QUADRATIC NOMOGRAPHY, CHAPTER 2
Jun. 1980 27 p refs Transl. into ENGLISH from Vychislitelnaya Matematika (USSR), no. 4, 1959 p 128-149
(BLL-RTS-12290) Avail: British Library Lending Div., Boston Spa, England

The problem of common anamorphosis may be connected with the question of integrating the system of ordinary differential equations and the solution of a system of equations to determine a constant. It is shown that for equations which do not reduce to an equation of the third nomographic sequence, the problem of common anamorphosis can be linked to a solution of a system of algebraic equations.
L.F.M.

N80-34167 British Library Lending Div., Boston Spa (England).
SOME PROBLEMS OF PRACTICAL NOMOGRAPHY
F. S. Khovanskii Sep. 1980 205 p refs Transl. into ENGLISH from Vychislitelnaya Mat. (USSR), v. 4, 1959 p 3-103
(BLL-RTS-11700) Avail: British Library Lending Div., Boston Spa, England

The development of methods for the construction of nomograms is addressed taking into account the practical requirements. Nomograms with an orientated opaque transparency are examined. Different methods of approximate presentation of a function of one variable are then examined. These methods are based on the utilization of nomograms with three degrees of freedom of displacement of a transparency, on the use of nomograms with an orientated transparency, and on the employment of nomograms out of points. The method of constructing approximate nomograms out of points with combined parallel scales is discussed. Finally, the application of nomograms to the study of functional formulas is examined.
M.G.

N80-34168 California Inst. of Tech., Pasadena.
A NUMERICAL BOUNDARY INTEGRAL EQUATION METHOD FOR TRANSIENT MOTIONS Ph.D. Thesis
David Martian Cole 1980 234 p
Avail: Univ. Microfilms Order No. 8021677

The results of a study of a numerical technique for the solution of initial boundary value problems of linear elastodynamics are presented. The numerical method is based on a boundary integral equation (BIE) formulation of the mechanics of bodies of arbitrary shape. These integral equations are discretized and a time stepping technique is used to solve the resulting system of linear algebraic equations. The theoretical basis of the continuous problem and the general interpolation and discretization scheme are described. The problem is then specialized to the two dimensional case of antiplane strain and most subsequent calculations and discussions take place in this context. The consequences of particular interpolation schemes for boundary value problems on a half plane are discussed. The results of several numerical calculations are compared with exact, or much

more accurate solutions. A comparison to the performance of the numerical BIE method with the performance of other specialized numerical procedures which were used previously for problems of this nature is presented. The BIE method yields results which are as accurate, or more accurate than the other methods for given discretization parameters. Dissert. Abstr.

N80-34169 Iowa Univ., Iowa City.
TOPICS IN MODEL COMPLETENESS OF DIRECT POWERS AND DIRECT PRODUCTS OF THEORIES Ph.D. Thesis
Sidkazem Taghva 1980 82 p
Avail: Univ. Microfilms Order No. 8022080

This study is concerned with results about model completeness of theories, or more generally, the notion of n-model completeness of theories. Most results are proven for the model complete version and the corresponding generalized version is stated without proof. Results in the usual framework of properties of finite direct products and finite direct powers are presented. The model completeness of finite products and powers are discussed. For a given finite language L, it is shown how to effectively construct a finite extension L* such that whenever A is model complete in L, then A x A is model complete in L*. Moreover, for a given theory T, one can effectively five an axiomatization for T x T in L*. It is shown how to build a finite language extension of L(c) to obtain a language L* in which T sub 1 x T sub 2 is model complete siven that T sub 1 and T sub 2 are model complete in L. Dissert. Abstr.

N80-34170 Colorado Univ. at Boulder.
BOUNDARY APPROXIMATION AND TIME STEP CONTROL IN ITERATIVE IMPROVEMENT FOR THE NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
Hamid Tadjeran 1980 116 p
Avail: Univ. Microfilms Order No. 8021645

The first objective of this work is to demonstrate that the iterative improvement theory developed by Lindberg can be applied to the alternating direction implicit (ADI) approximation to yield a more accurate (fourth order) solution. Numerical experiments are given to verify this theory. The theory and experiments show that the boundary approximation must be done very carefully in order to achieve this improvement in the accuracy. The second objective is the application of a variant of the idea of iterative improvement to obtain an economical automatic time step control for the finite difference solution of initial boundary value problems. The time step is automatically chosen to balance the spatial and the temporal discretization errors for a given mesh. Numerical results are given to illustrate this theory. Dissert. Abstr.

N80-34171 Miami Univ., Coral Gables, Fla.
GENERALIZED ADDITION SETS Ph.D. Thesis
John Sanford Sumner 1980 248 p
Avail: Univ. Microfilms Order No. 8022895

An (m, n, k, lambda, lambda prime, g) relative addition set, which is a generalization of an addition set and a relative difference set, is defined and studied. It has properties similar to an addition set and a relative difference set. It is shown that there are essentially no nontrivial (m, n, k, lambda, lambda prime, 1) relative addition sets with mn odd. The connections among addition sets, relative addition sets and block designs are studied and it is shown that an addition set and a relative addition set both imply the existence of a partially balanced incomplete block design of a certain order. As a result, a generalization of a well known difference set equation is obtained. A (v, k, lambda, alpha group addition set in a finite group G is defined where alpha: G approaches G is a homomorphism. Many of the same properties of addition sets hold for abelian group addition sets. It is shown that there is no abelian group addition set with v odd or v identical with 2 (mod 4), and alpha = 1, where 1 is the identity automorphism. Examples of both abelian and nonabelian group addition sets are given. Dissert. Abstr.

N80-34172 State Univ. of New York, Stony Brook.
PARAMETER ESTIMATION IN UNDETERMINED SYSTEMS Ph.D. Thesis
Yosefa Shraga 1980 110 p
Avail: Univ. Microfilms Order No. 8021374

The parameter estimation problem is considered in the special case where the number of the unknowns to be determined is greater than the number of the given data points. Two different approaches were tried to solve the problem. In the first a spline technique was used to add more data points. The other approach was to first linearize the given system and then use the generalized inverse solution of the underdetermined linear system. Several modifications were made in these two basic methods. These led to significant improvements in the results. The significance of the difficulties in this class of problems was analyzed, where it is known that the set of solutions is an infinite one, and techniques are suggested to overcome them by defining a concept of pseudo-uniqueness, which results in a unique solution in a certain sense. Dissert. Abstr.

N80-34173 Kent State Univ., Ohio.
TORSION THEORY AND MODULES OF FINITE LENGTH Ph.D. Thesis
Barbara Ann Benander 1980 63 p
Avail: Univ. Microfilms Order No. 8021856

The concept of finite omicron-length for an R-module, where R is a ring and omicron is an idempotent kernel factor, is investigated. It is shown that an omicron-torsion-free module M sub R is omicron-simple if and only if lambda M(*) is simple. This result enables an omicron-torsion-free module M sub R to have finite omicron-length if and only if lambda M(*) has finite length. Furthermore, if M sub R is omicron-torsion-free and has finite omicron-length, then the R-endomorphism ring of M sub R can be embedeed in a semiprimary ring. Definitions of indecomposable and directly decomposable idempotent functors are given. Equivalences of each of these concepts are provided. Idempotent kernel functors omicron for which R sub R has the descending chain condition on omicron-closed right ideals (R sub R omicron-Artinian) are investigated. Dissert. Abstr.

N80-34174 Columbia Univ., New York.
ON THE ASYMPTOTIC ANALYSIS OF GRIFFITHS' PERIOD MAPPING Ph.D. Thesis
Jeffry Alan Borror 1980 61 p
Avail: Univ. Microfilms Order No. 8023481

The asymptotic analysis of Griffiths period mapping initiated by Schmid is examined. The approximating nilpotent orbit is studied for the case where the base is a punctured disk to the case where the base is a product of a punctured disk, i.e., the case of a one variable nilpotent orbit with parameter. The differential equations with respect to the parameter of all principal quantites in Schmid's factorization of the lift of the orbit are derived. Mixed Hodge structures are identified as the total space (possibly singular) of a set-theoretic complex vector bundle with base a product of classifying spaces of ordinary Hodge structures and fiber a product of spaces of morphisms of mixed Hodge structures. The generic validity of a result of Cattani and Kaplan concerning the constancy of the monodromy weight filtration in the presence of two Picard Lefschetz transformation is demostrated. Dissert. Abstr.

N80-34175 Texas Univ. at Austin.
AN INVESTIGATION OF TYPE 1 ERROR RATE FOR APPROXIMATE F TESTS OF LINEAR COMBINATIONS OF MEAN SQUARES Ph.D. Thesis
Sheila Ruth Reifle 1980 127 p
Avail: Univ. Microfilms Order No. 8021506

Because appropriate F tests for main effects for three factor random effects analysis of variance (ANOVA) do not exist, type one error rates for two approximate F tests, F', and f', were investigated. The ANOVA and four types of F tests were performed one thousand times for each set of conditions, and rejection rates for alpha = 0.20, 0.10, 0.05, and 0.01 were studied for each condition. Results indicated that F' and pooled F perform conservatively, having error rates consistently lower than alpha in the absence of a main effect. Rejection rates for F' were extremely low, except in the presence of the larger main effect and cell size of ten for the largest design. In the absence of a main effect, rejection rates for F', F', and pooled F tended to rise with an increased number of factor levels, but not with increased cell size. The presence of AB effects depressed error rates for the smaller designs, while the presence of ABC effects had no discernable differences from the condition having all null

hypotheses true. Rejection rates did increase with cell size when a main effect was introduced. Dissert. Abstr.

N80-34176 Georgia Univ., Athens.
A UNIT STRATIFICATIONS SAMPLE DESIGN USING ROTATIONAL SAMPLING Ph.D. Thesis
Hsin-Hsien Hank Lu 1980 173 p
Avail: Univ. Microfilms Order No. 8023231

The effect of the repeated sampling procedures on two consecutive occasions is studied when the population is subject to change over time. Several sampling strategies, such as stratification, rotational sampling, and difference estimation are used. To construct the optimum points of stratification (OPS), the procedures are presented by using the standardized normal distribution. For the Neyman optimum, equal, and proportional allocations, the OPS are tabulated for the finite normal population. For a finite discrete population with an unknown distribution, the problem of the construction of strata is dealt with by the approach of superpopulation viewpoint. A two round procedure and its associated computer programs are presented to enhance the effectiveness of this approach. In studying the optimum number of strata, the cost of sampling is also taken into account. The optimum rotational fraction for the repeated sampling the the optimum preassigned constant for differences estimation are also derived. In considering the type of survey design that would be most efficient in repeated sampling, eight sampling plans/procedures are evolved and compared. Dissert. Abstr.

N80-34177 Case Western Reserve Univ., Cleveland, Ohio.
ASYMPTOTIC ANALYSIS OF LINEAR FILTERING PROBLEMS Ph.D. Thesis
Susan Slaughter Sachs 1980 188 p
Avail: Univ. Microfilms Order No. 8021714

Asymptotic solutions of two linear filtering problems which depend on a small positive parameter, epsilon, are derived by applying singular perturbation methods to the Riccati equations and to the filter equations. The limiting behavior of the Kalman-Bucy filters is established as epsilon approaches zero. Asymtotic expansions of stochastic processes are defined in terms of a quadratic mean asymptotic approximation. The validity of such expansions is proven for regular linear stochastic ordinary differential equations with Gaussian white noise inputs and for linear stochastic ordinary differential equations driven by an ergodic Markov process which tends to Gaussian white noise as epsilon approaches zero. As the observation noise in a linear filtering problem tends to zero, the Kalman-Bucy filter is singular and the filter gains tend to infinity. When the observation noise in a linear filtering problem is not Gaussian noise, no Kalman-Bucy filter can be found. When the observation noise is Gauss-Markov noise with bandwidth proportional to one/epsilon, which tends to Gaussian white noise as epsilon approaches zero, a Kalman-Bucy filter is derived. The Kalman-Bucy filter is robust for wide bandwidth Gauss-Markov observation noise. Dissert. Abstr.

N80-34178*# Mississippi State Univ., Mississippi State. Engineering and Industrial Research Station.
ERRORS IN FINITE-DIFFERENCE COMPUTATIONS ON CURVILINEAR COORDINATE SYSTEMS
C. Wayne Mastin and Joe F. Thompson [1980] 19 p refs (Contract NSG-1577)
(NASA-CR-163601; MSSU-EIRS-ASE-80-4) Avail: NTIS HC A02/MF A01 CSCL 12A

Curvilinear coordinate systems were used extensively to solve partial differential equations on arbitrary regions. An analysis of truncation error in the computation of derivatives revealed why numerical results may be erroneous. A more accurate method of computing derivatives is presented. Author

N80-34179# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
REJECTION OF A SINGLE OUTLIER IN A FACTORIAL DESIGN
J. S. Galpin and Douglas M. Hawking Nov. 1979 23 p refs
(CSIR-TWISK-117) Avail: NTIS HC A02/MF A01

A statistic which was used to test for a single outlier is the maximum normed residual. Accurate bounds are presented for the factiles of the maximum normed residual for two and three factor factorial designs. E.D.K.

N80-34180# National Research Inst. for Mathematical Sciences, Pretoria (South Africa). Mathematics Div.
BOUNDARY CONTROLLABILITY OF HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS
Tunc Geveci Nov. 1979 18 p refs
(CSIR-TWISK-126) Avail: NTIS HC A02/MF A01

Controllability is obtained for a large class of first order hyperbolic systems with constant coefficients, including strictly hyperbolic or symmetric systems, and subject to boundary conditions which result in well posed mixed initial boundary value problems. It is shown that any initial state, u sub o is an element of H(1)(omega), can be steered by boundary control to any final state, u sub T is an element of H(1)(omega), at any time T > T (where omega is included in R(n), n>or=2, is a bounded domain with smooth boundary and T sub o depends on the system and on omega) provided that all rays escape to infinity. M.G.

N80-34181# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
LOCATION OF MULTIPLE OUTLIERS IN FACTORIAL DESIGNS, USING TETRADS
Dan Bradu (Witwatersrand Univ., Johannesburg) Nov. 1979 27 p refs
(CSIR-TWISK-127) Avail: NTIS HC A03/MF A01

It is recognized that it is very difficult to isolate multiple outliers in a factorial design, using residuals. For two way tables a new diagnostic is proposed: the median of the tetrads associated with a cell. It is proved that the procedure can, with arbitrarily high probability, locate sufficiently aberrant outliers. The use of a half normal plot provides a good indicator of the actual number of outliers in the table. Author

N80-34182# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
POWER SERIES EXPANSION FOR A CROSSING-SYMMETRIC VERTEX FUNCTION
W. D. Heiss Dec. 1979 16 p refs
(CSIR-TWISK-134) Avail: NTIS HC A02/MF A01

Starting from a nonlinear system of coupled integral equations for the vertex parts which are irreducible with respect to the s, t and u channel, a power series is found for the full vertex function in terms of the vertex part gamma (0) which is irreducible with respect to all channels. The problem of finding an expression in closed form remains unresolved, since higher order products in gamma (0) are nonassociative. In a simplified modal, the mathematical properties of the series seem to allow successive rational approximations. Specific reference is made to the Green's function formulation of the many body theory. M.G.

N80-34183# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
TESTING FOR EQUALITY OF VARIANCE OF CORRELATED NORMAL VARIABLES
Douglas M. Hawkins Feb. 1980 10 p refs
(CSIR-TWISK-136) Avail: NTIS HC A02/MF A01

A standard test exists for whether bivariate normal data of arbitrary correlation have equal variances. An extension of this model is useful to test whether two measuring instruments, with which repeated measurements were made on each of n units, have equal error variances. One or two simple F-distributed statistics yield performance comparable with that of the generalized likelihood ratio statistic. R.K.G.

N80-34184# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ORDINARY DIFFERENTIAL EQUATIONS [EQUACOES DIFFENCIAIS ORDINARIAS]
Rene A. Medrano-B May 1980 228 p refs In PORTUGUESE; ENGLISH summary Revised
(INPE-1753-RPE/144) Avail: NTIS HC A11/MF A01

First order and higher order differential equations are concisely treated. Among the first order equations, the cases of separable variables, exacts, integration factors, homogeneous, isobarics, eigenvalues problems in systems of equations are presented and

the existence and uniqueness of the solutions are discussed. Higher order linear differential equations with constant coefficients are studied and the methods of undetermined coefficients, operators, variation of parameters, and the integral transforms (Fourier, Fourier-Sine, Fourier-Cosine and Laplace) are examined. For the linear equations with variable coefficients, the reduction of the equation's order, whenever possible and convenient, is first considered. The power series solution (Frobenius series) around ordinary and regular singular points is treated. As examples of the series solutions, differential equations, well known in physics, like the Legendre, Bessel, Laguerre, Schrodinger, Hermite and Associated Legendre differential equations are solved. Special cases of nonlinear differential equations are also included. A.R.H.

N80-34185# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETERMINING THE FORM FACTORS OF PLANE AND CYLINDRICAL SURFACES BY NUMERICAL METHODS [DETERMINACHO DE FATORES DE FORMA ENTRE SUPERFICIES PLANAS E CILINDRICAS ATRAVES DE METODOS NUMERICOS]
Olavo Bueno deOliveiraFilho, Wolodymir Boruszewski, Humberto Pontes Cardoso, and Nelson Montagnana Junior. Jul. 1980. 17 p. refs. In PORTUGUESE; ENGLISH summary. Presented at 32nd Meeting of SPBC, 6-12 Jul. 1980. Revised.
(INPE-1815-RPE/183) Avail: NTIS. HC A02/MF A01.

Computation of configuration factors for plane to plane surfaces and plane to cylinder surfaces is discussed. An algorithm which uses numerical integration is presented in charts with 3 percent precision. The calculations apply to energy transfer problems, including radiant energy. S.F.

N80-34186# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A CUSUM FOR A SCALE PARAMETER
Douglas M. Hawkins. Dec. 1979. 14 p. refs.
(CSIR-TWISK-130) Avail: NTIS. HC A02/MF A01.

Problems associated with the use of cumulative sum control charts in quality control and regression analysis are examined. If X is a normal variate with zero mean and variance omicron (2), is very nearly normal with mean 0.822 and variance 0.122, and this distribution is robust to heavy-tailed departures from model in the X. The use of Y is proposed for cumulative sums to detect changes in the scale parameter. M.G.

N80-34187# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
OPTIMAL LINEAR ESTIMATION APPLIED TO THE GENERATION OF A DIRECT METHOD FOR INVESTIGATING PARAMETER OPTIMIZATION
Atair Rios Neto. Aug. 1980. 6 p. refs. In PORTUGUESE; ENGLISH summary. Submitted for publication.
(INPE-1855-RPE/209) Avail: NTIS. HC A02/MF A01.

Nonlinear parameter optimization problems are presented. A linear perturbation procedure is adopted with a criterion of direct search in the direction of the objective function gradient and in the direction of meeting the constraints. Associating this to an interpretation of the errors as random variables, one reduces, in each iteration, the determination of the search increment to an optimal linear estimation, using the Kalman filter. S.F.

N80-34188*# Santa Clara Univ., Calif. School of Engineering.
ON ONE-DIMENSIONAL STRETCHING FUNCTIONS FOR FINITE-DIFFERENCE CALCULATIONS. Final Report, 1 Jul. 1978 - 30 Jun. 1979
Marcel Vinokur. Oct. 1980. 57 p. refs.
(Contract NsG-2086)
(NASA-CR-3313) Avail: NTIS. HC A04/MF A01. CSCL 12A.

The class of one dimensional stretching function used in finite difference calculations is studied. For solutions containing a highly localized region of rapid variation, simple criteria for a stretching function are derived using a truncation error analysis. These criteria are used to investigate two types of stretching functions. One is an interior stretching function, for which the location and slope of an interior clustering region are specified. The simplest such function satisfying the criteria is found to be one based on the inverse hyperbolic sine. The other type of function is a two sided stretching function, for which the arbitrary slopes at the two ends of the one dimensional interval are specified. The simplest such general function is found to be one based on the inverse tangent. The general two sided function has many applications in the construction of finite difference grids. E.D.K.

N80-34189# Basel Univ. (Switzerland). Mathematics Inst.
TOPICS IN ANALYSIS. Final Technical Report, 1 Jul. 1978 - 30 Sep. 1979
Alexander M. Ostrowski. Sep. 1979. 9 p.
(Grant DA-ERO-78-G-068; DA Proj. 1T1-61102-BH-57)
(AD-A090463) Avail: NTIS. HC A02/MF A01. CSCL 12/1.

The research performed under this grant deals with some classical problems in the area of algebra. Considerable progress has been made from a theoretical point of view. There were two main topics: (1) Newton-Sylvester theorems on the number of zeros of a function in an open interval, (2) reversible transformations in algebraic geometry. The specific results are: A simplified proof of a sharpening of Sylvester's theorems, obtained by replacing the values of the functions considered at a and b with their values at a-0 and b-0. In this way the result of Marchand can be improved. Further improvements are pointed out for Sylvester's theorems and Newton's Rule. The reversible transformation of space elements can be characterized, starting from ordinary one to one transformations between two convenient spaces and the complete sets of integrals of certain partial differential equations, which can be expressed by convenient determinants. GRA

N80-34190# Pennsylvania State Univ., University Park. Dept. of Industrial and Management Systems Engineering.
ADVANCES IN MULTICRITERIA ENGINEERING DESIGN: COMPUTATIONAL TECHNIQUES. MULTIOBJECTIVE ENGINEERING DESIGN VIA NONLINEAR GOAL PROGRAMMING. Final Report
Terrence L. Elchak, Taeyong Yang, and James P. Ignizio. Jul. 1980. 129 p. refs.
(AD-A088570) Avail: NTIS. HC A07/MF A01. CSCL 09/2.

The procedure for solving large-scale, nonlinear multiobjective optimization problems requires the use of a computer coded algorithm which is both computationally efficient and mathematically valid. The multicriteria methodology, goal programming, has proven to be an effective technique for the solution of such problems. The problem was the synthesis of the goal programming methodology into an efficient computer algorithm which could be used by the problem solver to solve a general class of nonlinear, multiobjective (NLGP) engineering design problems. Three such codes were developed into a computer package. Each code is capable of solving an NLGP problem. Each code has modifications which make it more attractive than the others for application to particular types of NLGP problems. The results show that these codes are effective tools for solving nonlinear goal programming design problems. Author

N80-34191# Michigan Univ., Ann Arbor. Dept. of Mathematics.
APPLICATIONS OF NON-SELF-ADJOINT OPERATOR THEORY TO THE SINGULARITY EXPANSION METHOD (SEM) AND THE EIGENMODE EXPANSION METHOD (EEM) IN ACOUSTIC AND ELECTROMAGNETIC PROBLEMS. Final Report, 1 Jun. 1979 - 31 May 1980
Charles L. Dolph. Jul. 1980. 23 p. refs.
(Contract F49620-79-C-0128; AF Proj. 2304)
(AD-A088747; AFOSR-80-0689TR) Avail: NTIS. HC A02/MF A01. CSCL 20/3.

Eigenfunction expansions for nonselfadjoint operators are important for scalar and electromagnetic wave scattering. Two methods: the Singularity Expansion Method (SEM), and the Eigenmode Expansion Method (EEM) which had been developed separately were studied. Criteria for their validity were established; moreover, the poles of the Green's function of the SEM are in 1-1 correspondence with the zeros of the eigenvalues of the EEM. A constructive numerical process for determining the poles of the Green's function was developed. Among several other results was the establishment of variational principles for the spectrum of compact non-self-adjoint operators. Another research area was the singularity behavior of eigenfunction expansions of various Green's functions in electromagnetic theory. The principal

result shows that in an eigenfunction of a typical Green's function the point singularity of a Green's function is represented by a layer of surface singularity. This characteristic is analogous to the Gibbs phenomenon where the representation of a discontinuous function by an orthogonal expansion creates the spikes which are absent in the original function. GRA

N80-34192# Kentucky Univ., Lexington. Dept. of Mathematics.
STRUCTURES AND ALGORITHMS IN STOCHASTIC REALIZATION THEORY AND THE SMOOTHING PROBLEM Interim Technical Report. Ph.D. Thesis
Fanis Abdul-Jabber Badawi. Jun. 1980. 149 p. refs.
(Grant AF-AFOSR-3519-78; AF Proj. 2304)
(AD-A086465; AFOSR-80-0458TR) Avail: NTIS
HC A07/MF A01 CSCL 12/1

Some geometric questions concerning the solution set of the positive real lemma and a Hamiltonian framework for the non Riccati algorithms of Kailath and Lindquist are considered. These are then applied to the stochastic realization problem. The basic techniques and concepts of the strict sense (proper) stochastic realization theory of Lindquist and Picci and Ruckebusch are applied to the discrete time smoothing problem. This provides a natural interpretation of the Mayne Fraser two point formula as well as many other smoothing results, the interpretations of which was so far quite unclear from a probabilistic point of view. R.K.G.

N80-34193# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
VARIATIONAL METHODS OF CONVOLUTION INTEGRAL AND OF LARGE SPRING CONSTANTS: A NUMERICAL COMPARISON
Julian J. Wu. Jun. 1980. 20 p. refs. Presented at Army Numerical Analysis and Computer Conf., Moffet Field, Calif., 20-21 Feb. 1980.
(AD-A088902; AD-E440085; ARLCB-TR-80019) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Finite element solution formulations have been carried out for a simple initial value problem based on two different variational statements, that of convolutional integral developed by Gurtin and that of large spring constants adapted by this writer for initial value problems. Numerical results indicate that both generate convergent solution to the given initial value problem of a spring-mass system subjected to a harmonic forcing function. GRA

N80-34194# National Technical Information Service, Springfield, Va.
THE USE OF COMPUTERS IN SOLVING MATHEMATICAL PROBLEMS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Jun. 1980
George W. Reimherr. Jul. 1980. 130 p. Supersedes NTIS/PS-79/0798; NTIS/PS-78/0782.
(PB80-813298; NTIS/PS-79/0798; NTIS/PS-78/0782) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

Reports are cited on the computer solution of algebraic and differential equations. The necessary software and hardware for implementation, as well as solutions to large sparse matrices, stiff differential equations, and statistical problems, are included. Some of the research is directly applicable to various physical sciences. This updated bibliography contains 123 citations, 16 of which are new entries to the previous edition. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-34195 Texas Univ. at Arlington.
THE APPLICATION OF GENERALIZED GROUP INVERSE TO DISCRETE FINITE MARKOV CHAINS. Ph.D. Thesis
Atur Venkata Radhakrishna. 1980. 122 p.
Avail: Univ. Microfilms Order No. 8022977

The group inverse of a product of two matrices called the inverse order law is established, formulae connecting group inverse and pseudo-inverse are derived and a formula for computation of group inverse is derived. Secondly, the group inverse is used in analyzing the properties of discrete finite Markov chains. The properties of regular and ergodic chains are dealt with through the use of group inverse of a matrix. Finally numerical examples are formulated to clarify the results. Dissert. Abstr.

N80-34196 Rutgers - The State Univ., New Brunswick, N. J.
ANALYSIS OF ORDERED AND PARTIALLY ORDERED CATEGORICAL DATA. Ph.D. Thesis
Yu-Chung Jeff Wang. 1980. 123 p.
Avail: Univ. Microfilms Order No. 8022600

For categorical data there exists, in most cases, an implicit ordering among categories, for example the no ordering and complete ordering. The partially ordered scale is introduced to generalize the concept of ordering relation. Partially ordered data include nominal data and ordinal data as extreme cases. In reality, data collected in education and social science are often partially ordered. Approaches are developed to analyze categorical data where either the rows or columns of the contingency table are partially ordered. The problem of estimating cell probabilities of multiway contingency tables is considered. Two way tables are used as examples to clearly demonstrate this approach. Depending on the ordering among categories, the multinominal likelihoods of the contingency tables are reparameterized. The cell counts are transformed to become the proper sufficient statistics for the transformed cell probabilities, the natural parameters of the likelihood. The reparameterization is completely general for all partial orderings. Dissert. Abstr.

N80-34197 Georgia Univ., Athens.
INTERVAL ESTIMATION, RANKING AND SELECTION PROCEDURES. Ph.D. Thesis
Paul Jeih Tsai. 1980. 185 p.
Avail: Univ. Microfilms Order No. 8023184

A single stage sample procedure is proposed for obtaining an optional confidence interval on the largest (or smallest) mean of multivariate normal populations. In the case of independent normal populations, various factors are considered: variance (known or unknown, equal or unequal), sample size (equal or unequal), and the optional confidence interval (two sided or one sided). The optional confidence interval is proposed for the case in which multivariate normal populations have common known correlation coefficients and common variance either known or unknown. The percentage points and programs to apply those procedures are also provided. Selection procedures for the best population are proposed for multivariate normal populations with common variance and common known correlation coefficients. The estimation of probability of correct selection (pcs) is discussed. The asymptotic distribution of pcs is derived and the computer program to evaluate the asymptotic variance of pcs is given. Dissert. Abstr.

N80-34198 Oregon State Univ., Corvallis.
ESTIMATION OF THE POPULATION TOTAL WHEN THE SAMPLE IS TAKEN FROM A LIST CONTAINING AN UNKNOWN AMOUNT OF DUPLICATION. Ph.D. Thesis
Suey-Huey Tang. 1980. 93 p.
Avail: Univ. Microfilms Order No. 8021945

A frame contains a known number, N, of units, but the units are grouped into an unknown number of M distinct classes. A measurement yj is associated with each class, and, based on the information obtained from a simple random sample of units from the frame, we wish to estimate the population total without knowing M. Five methods for estimating M based M9 sample are generalized to obtain estimates of the population total. Dissert. Abstr.

N80-34199 Cornell Univ., Ithaca, N. Y.
THE PROBABILITY OF SURVIVAL OF REDUNDANT SYSTEMS UNDER A STATIC LOAD. Ph.D. Thesis
Carl Frederick Diegert. 1980. 156 p.
Avail: Univ. Microfilms Order No. 8020810

The Daniels criterion to coherent systems is analyzed and static analysis based on this is shown to be appropriate when component load shares satisfy a monotonicity property a component's load share never decreases after the failure of another

component shown to be that, among a wide class of load sharing rules, any violation of monotonicity implies that survival of a system may depend on the dynamics of a sequence of component failure, making static analysis possibly incorrect. Computation of system reliability (as defined by Daniels survival criterion) may be simplified when load sharing is monotone, and further simplified when component strengths are independent. Four recursive equations, any of which may be used to compute the probability that a coherent system survives are given. The problem of designing mechanical systems of physically identical and parallel members under tensile load, with each member spanning given length is discussed. The recursive equations are used to find alternative designs of various specified reliabilities. Dissert. Abstr.

N80-34200 Southern Methodist Univ., Dallas, Tex.
SOME SCREENING PROCEDURES BASED ON DATA FROM A SINGLY TRUNCATED BIVARIATE NORMAL DISTRIBUTION Ph.D. Thesis
Youn-Min Chou 1980 110 p
Avail: Univ. Microfilms Order No. 8021674

A screening procedure based on data from a singly truncated bivariate normal (TBVN) distribution was studied. A sampling acceptance criterion based on a linear combination of the largest order statistic from a truncated normal population and the truncation point is discussed. The moment generating function, bivariate moments, bivariate correlation coefficient in a singly TBVN sample is derived and tabulated for sample sizes 3, 15 and 50. This is utilized to obtain a 100 nu percent lower confidence limit on rho. A double series expression for the density function of R is included. Dissert. Abstr.

N80-34201# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
STRICT CHEBYSHEV APPROXIMATION OF DISCRETE DATA
M. Brannigan and L. M. Vecter Dec. 1979 17 p refs
(CSIR-TWISK-133) Avail: NTIS HC A02/MF A01

An algorithm is presented for computing the strict Chebyshev approximation of discrete data, particular consideration being given to the case when the matrix is rank deficient. This algorithm, which is of the ascent-exchange type, is compared with two other published algorithms in which use is made of the usual linear programming techniques, the tests showing that the present algorithm is more accurate than the others. Author

N80-34202# Basel Univ. (Switzerland). Mathematics Inst.
ON REVERSIBLE TRANSFORMATIONS OF SPACE ELEMENTS
Alexander M. Ostrowski Sep. 1979 91 p Sponsored in part by Swiss National Science Foundation
(Grant DA-ERO-75-G-035)
(AD-A080447; BMN-53) Avail: NTIS HC A05/MF A01 CSCL 12/1

A one to one transformtion between two (n+k)-dimensional spaces (x sub nu, r sub mu and y sub nu, s sub mu) is constructed and the necessary and sufficient conditions which must be satisfied in order that there exist a reversible transformation are derived. M.G.

N80-34203# Texas A&M Univ., College Station. Inst. of Statistics.
HOW NEAR IS A NEAR-OPTIMAL SOLUTION: CONFIDENCE LIMITS FOR THE GLOBAL OPTIMUM
Robert L. Sielken, Jr. and Howard M. Monroe May 1980 96 p refs
(Contract N00014-78-C-0426; NR Proj. 047-179)
(AD-A089108; THEMIS-TR-62) Avail: NTIS HC A05/MF A01 CSCL 12/1

For many optimization problems approximate or near-optimal solutions are the only practical solutions available. This paper identifies and compares some procedures which use independent near-optimal solutions to determine a confidence limit such that, with a user specified confidence, the global optimum is between the best near-optimal solution and the confidence limit. A computer implementation of the procedures is available from the authors. GRA

N80-34204# Ohio State Univ., Columbus. Dept. of Statistics.
ESTIMATION OF THE LARGER MEAN
Ishwari D. Dhariyal (Indian Inst. of Tech., Kanpur), Edward J. Dudewicz, and Saul Blumenthal (Illinois Univ., Urbana) Jul. 1980 23 p refs
(Contract N00014-78-C-0543; NR Proj. 042-043)
(AD-A088661; TR-188) Avail: NTIS HC A02/MF A01 CSCL 12/1

Estimation of the larger of two normal means mu 1 and mu 2 is studied. Two new estimators are studied for this problem, the maximum probability estimator and the iterated bias elimination estimators. If abs. val. mu 1 - mu 2 is not close to zero (as evidenced by a strongly consistent estimator), a maximum probability estimator is seen to be best as regards both bias and mean-squared error. GRA

N80-34205# Indiana Univ. at Bloomington. Dept. of Mathematics.
MAXIMUM LIKELIHOOD ESTIMATION FOR STATIONARY POINT PROCESSES Interim Report
Pham-Dinh Tuan and Madan L. Puri (Grenoble Univ., France) Aug. 1980 29 p refs
(Grant AF-AFOSR-2927-76; AF Proj. 2304)
(AD-A089117; AFOSR-80-0688TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper we derive the log likelihood function for point processes in terms of their stochastic intensities, using the martingale approach. For practical purposes we work with an approximate log likelihood function which is shown to possess the usual asymptotic properties of a log likelihood function. The resulting estimates are strongly consistent and asymptotically normal (under some regularity conditions). As a by-product, a strong law of large numbers and a central limit theorem for continuous martingale are derived. GRA

N80-34206# Agbabian Associates, El Segundo, Calif.
A FIRST-ORDER METHODOLOGY FOR CALCULATING PROBABILITY OF MISSION SUCCESS Final Report, 1 Aug. 1978 - 31 Jan. 1979
Carl F. Bagge and David Rothman 31 Jan. 1980 75 p refs
(Contract DNA001-78-C-0373)
(AD-A088910; AD-E300896; AA-R-7914-4702; DNA-4843F) Avail: NTIS HC A04/MF A01 CSCL 15/7

A first-order methodology for calculating the probability that a system will successfully complete its mission was developed, illustrated, and validated. The methodology is directed to analysts, designers, managers, physicist, and planners who are unaccustomed to working with statistics and probability theory, but who are assumed to have had an introductory course in statistics and probability theory. The methodology, which makes use of closed-form solutions and is quite transparent, is designed to yield results quickly and without the use of a large computer. It is not intended to replace the formal, more accurate computerized methodologies that use Monte Carlo simulations or numerical partitioning. Within its specified applicable domain, the methodology yields quantitatively accurate results. The applicable domain is sufficiently large to encompass many problems of interest to the Defense Nuclear Agency community. GRA

N80-34207# Virginia Polytechnic Inst., Blacksburg. Dept. of Industrial Engineering and Operations Research.
GENERALIZED INVERSES AND THEIR APPLICATION TO APPLIED PROBABILITY PROBLEMS
Jeffrey J. Hunter May 1980 59 p refs
(Contract N00014-77-C-0743; Grant NSF ENG-77-22757)
(AD-A089069; VTR-80-06) Avail: NTIS HC A03/MF A01 CSCL 12/1

The main aim of this paper is to examine the applicability of generalized inverses to a wide variety of problems in applied probability where a Markov chain is present either directly or indirectly through some form of imbedding. By characterizing all generalized inverses of I-P, where P is the transition matrix of a finite irreducible discrete time Markov chain, we are able to obtain general procedures for finding stationary distributions, moments of the first passage time distributions and asymptotic forms for the moments of the occupation time random variables. It is shown that all known explicit methods for examining these

problems can be expressed in this generalized inverse framework. More generally, in the context of a Markov renewal process setting the aforementioned problems are also examined using generalized inverses of I-P. As a special case Markov chains in continuous time are considered and we show that the generalized inverse technique can be applied direct to the infinitesimal generator of the process, instead of to I-P, where P is the transition matrix of the discrete time jump Markov chain. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-34208 Princeton Univ., N. J.
UNIVERSAL APPROXIMATIONS OF CONTROL SYSTEMS OVER FINITE TIME Ph.D. Thesis
Vicente Costanza 1980 99 p
Avail: Univ. Microfilms Order No. 8022722

A computer program which obtains an accurate internal description of a given practical system, from a finite number of external experiments (input-output data) is developed. The finiteness requirement implies that the inputs must be allowed to take values on some bounded set of real numbers. Attention is restricted to the behavior of the system over some finite period of time; this restriction is a theoretical one. Indeed, the mathematical results upon which the algorithm is constructed are not valid over infinite time. Therefore, the realizations generally fail to predict the asymptotic behavior of the given system, as well as its response to extreme values of the control. The approach is to be deterministic. The possibility of measurement errors is realized, however the experimental data is considered exact and the internal descriptions are judged by their ability to reproduce this information. The single input-single output scheme is adopted for simplicity of notation and exposition. The generalization to finite number of inputs and outputs involves no theoretical complication. Dissert. Abstr.

N80-34209*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SELF-REPLICATING SYSTEMS: A SYSTEMS ENGINEERING APPROACH
Georg vonTiesenhausen and Wesley A. Darbro Jul. 1980 63 p refs
(NASA-TM-78304) Avail: NTIS HC A04/MF A01 CSCL 12B

A first approach to conceptualize self-replicating systems was developed from past and present abstract theories. The engineering elements of self-replicating systems are defined in terms of a basic reference system. A number of options are investigated. The growth characteristics and their problems are analyzed, the mathematics of various exponential growth options are outlined, and the problems of universal parts production and systems closure are discussed. Selected areas of further study are defined and a 20 year development and demonstration program is presented. Author

N80-34210# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council of Scientific and Technical Research.
CONSISTENCY, REDUNDANCY AND EXTENSION IN FUZZY SYSTEMS FOR REGRESSIVE DECISION [CONSISTENCIA, REDUNDANCIA E EXTENSOES NEBULOSAS DE SISTEMAS DE REGRAS DE DECISAO]
Paulo Ouvera Simoni Aug. 1980 29 p refs In PORTUGUESE
(INPE-1850-RPE/207) Avail: NTIS HC A03/MF A01

The variety of determination formulas used in knowledge systems is explored. While the formulas often conflict due to their inflexibility, a series of algorithms is proposed which allows for a wide range of applications to spectral analysis, medical diagnosis, geological surveys, and system failure. Transl. by S.F.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-34211# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
TENSOR PRODUCTS AND BANACH IDEALS OF P-COMPACT OPERATORS
Jan H. Fourie (Univ. of South Africa) Dec. 1979 13 p refs
(CSIR-TWISK-132) Avail: NTIS HC A02/MF A01

The norm w sub p (1 < or = p < or = infinity) on the tensor product of two Banach spaces E and F is studied. It is shown that w sub p is a tensor norm, and a representation is deduced for the elements in the completion absolute product of E and sub w sub pF of absolute product of E and F equipped with w sub p. Finally it is shown that the w sub p nuclear operators coincide with those operators factoring compactly through l(p) (if 1 < or = p < infinity) or c sub o (if p = infinity), with related equalities concerning the ideal norms. M.G.

N80-34212# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
THE STABILITY OF PLANAR DYNAMICAL SYSTEMS LINEAR-IN-CONES
M. Pachter and D. H. Jacobson Jan. 1980 15 p refs Supported in part by Control Data
(CSIR-TWISK-137) Avail: NTIS HC A02/MF A01

A class of nonlinear systems in the plane which are piecewise linear, i.e., system linear-in-cones, was analyzed. A complete characterization was given of the stability and stabilizability properties of such systems in terms of the system data. L.F.M.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-34213 Ohio State Univ., Columbus.
EXCITATION OF SPIN WAVES AT MAGNETIC DOMAIN WALLS Ph.D. Thesis
Pradeep Shrikrishna Limaye 1980 112 p
Avail: Univ. Microfilms Order No. 8022305

The low field excitation of spin waves at domain walls in thin film magnetic garnets was studies. These excitations were observed as a low intensity signal at helds below saturation in a microwave absorption experiment. A phenomenological model was developed to account for the frequency dependence of the observed signal. In this model the material was assumed to be lossless and the excitations at neighboring walls were isolated by phenomenological boundary conditions. The spinwave solutions of the linearized equations of motion of the magnetization were box normalized to obtain the k-dependence of the signal. The calculated k-dependence was found to be in excellent agreement with the experiment. The bias-field dependence of the power absorption was calculated for the one domain wall model and was found to be in very good agreement with the observed line shape. Dissert. Abstr.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-34214 Georgetown Univ., Washington, D.C.
NON-SPECULAR ULTRASONIC BOUNDED BEAM TRANSMISSION THROUGH SOLID PLATES Ph.D. Thesis
Kin Wah Ng 1979 93 p
Avail: Univ. Microfilms Order No. 8021996

Two approximations to be plane wave transmission coefficient were constructed using the complex poles and zeroes of the plane wave reflection coefficient. Using these approximations,

expressions describing the transmitted beam profile was derived. In the theories of Bertoni and Tamir and of Pitts, useful descriptions of the reflected beam profile obtained by considering only one pole in the approximations to the reflection coefficient. In the case of the transmitted beam profile more than one pole was needed in the approximation to the transmission coefficient; the number of poles needed depended on the proximity of the complex poles. The total profile was viewed as the interference of several single pole profiles, the contribution of each being weighed by that pole's location in the complex plane. Theoretical and experimental results for a brass plate in water are presented for comparison. Dissert. Abstr.

N80-34215*# Kansas Univ., Lawrence. Dept. of Aerospace.
ACOUSTIC PLANE WAVES INCIDENT ON AN OBLIQUE CLAMPED PANEL IN A RECTANGULAR DUCT
Hillel Unz and Jan Roskam. Aug. 1980. 137 p. refs.
(Contract NCCI-6)
(KU-FRL-417-14; NASA-CR-163624) Avail: NTIS
HC A07/MF A01 CSCL 20A

The theory of acoustic plane waves incident on an oblique clamped panel in a rectangular duct was developed from basic theoretical concepts. The coupling theory between the elastic vibrations of the panel (plate) and the oblique incident acoustic plane wave in infinite space was considered in detail, and was used for the oblique clamped panel in the rectangular duct. The partial differential equation which governs the vibrations of the clamped panel (plate) was modified by adding to it stiffness (spring) forces and damping forces. The Transmission Loss coefficient and the Noise Reduction coefficient for oblique incidence were defined and derived in detail. The resonance frequencies excited by the free vibrations of the oblique finite clamped panel (plate) were derived and calculated in detail for the present case. T.M.

N80-34216*# Wyle Labs., Inc., Hampton, Va.
A FEASIBILITY STUDY OF A 3-D FINITE ELEMENT SOLUTION SCHEME FOR AEROENGINE DUCT ACOUSTICS Final Report, Mar. 1978 - Nov. 1979
A. Louis Abrahamson. 15 Sep. 1980. 37 p. refs.
(NASA-CR-159359; Rept-51200) Avail: NTIS
HC A03/MF A01 CSCL 20A

The advantage from development of a 3-D model of aeroengine duct acoustics is the ability to analyze axial and circumferential liner segmentation simultaneously. The feasibility of a 3-D duct acoustics model was investigated using Galerkin or least squares element formulations combined with Gaussian elimination, successive over-relaxation, or conjugate gradient solution algorithms on conventional scalar computers and on a vector machine. A least squares element formulation combined with a conjugate gradient solver on a CDC Star vector computer initially appeared to have great promise, but severe difficulties were encountered with matrix ill-conditioning. These difficulties in conditioning rendered this technique impractical for realistic problems. A.R.H.

N80-34217*# Sikorsky Aircraft, Stratford, Conn.
AN EVALUATION OF A COMPUTER CODE BASED ON LINEAR ACOUSTIC THEORY FOR PREDICTING HELICOPTER MAIN ROTOR NOISE. Final Report
S. Jon Davis and T. Alan Egolf. Jul. 1980. 290 p. refs.
(NASA-CR-159339; SER-510038) Avail: NTIS
HC A13/MF A01 CSCL 20A

Acoustic characteristics predicted using a recently developed computer code were correlated with measured acoustic data for two helicopter rotors. The analysis, is based on a solution of the Flowcs-Williams-Hawkings (FW-H) equation and includes terms accounting for both the thickness and loading components of the rotational noise. Computations are carried out in the time domain and assume free field conditions. Results of the correlation show that the Farrassat/Nystrom analysis, when using predicted airload data as input, yields fair but encouraging correlation for the first 6 harmonics of blade passage. It also suggests that although the analysis represents a valuable first step towards developing a truly comprehensive helicopter rotor noise prediction capability, further work remains to be done identifying and incorporating additional noise mechanisms into the code. A.R.H.

N80-34218*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
PREDICTED AIRFRAME NOISE LEVELS
J. P. Raney. Sep. 1980. 10 p. refs.
(NASA-TM-81849) Avail: NTIS HC A02/MF A01 CSCL 20A

Calculated values of airframe noise levels corresponding to FAA noise certification conditions for six aircraft are presented. The aircraft are: DC-9-30; Boeing 727-200; A300-B2 Airbus; Lockheed L-1011; DC-10-10; and Boeing 747-200B. The prediction methodology employed is described and discussed. R.K.G.

N80-34219*# Boeing Commercial Airplane Co., Seattle, Wash.
AIRCRAFT NOISE PREDICTION PROGRAM VALIDATION Final Report
Belur N. Shivashankara. Oct. 1980. 163 p.
(Contract NAS1-15526)
(NASA-CR-159333; D6-48727) Avail: NTIS
HC A08/MF A01 CSCL 20A

A modular computer program (ANOPP) for predicting aircraft flyover and sideline noise was developed. A high quality flyover noise data base for aircraft that are representative of the U.S. commercial fleet was assembled. The accuracy of ANOPP with respect to the data base was determined. The data for source and propagation effects were analyzed and suggestions for improvements to the prediction methodology are given. T.M.

N80-34220# Stanford Univ., Calif.
SINGLE CHIP LENSES FOR ULTRASONIC IMAGING Final Report, 30 Sep. 1977 - 29 Sep. 1979
James D. Meindl. 29 Sep. 1979. 57 p. refs.
(Contract F49620-77-C-0133; ARPA Order 3448; AF Proj. 3448)
(AD-A088857; AFOSR-80-0699TR) Avail: NTIS
HC A04/MF A01 CSCL 20/1

During this program, the theoretical understanding of Cascade Charge Coupled Device (C3D) electronic lenses have been greatly extended. Specifically, the attenuation effects of transfer efficiency were found to be deterministic and insignificant, lateral resolution and sidelobe response were not to be serious limitations, while for moderate values of charge-transfer inefficiency, spatial shifting of beamsteering angle was found to be minor. In addition, a novel analysis of the device performance substantiated that aberations resulting from the intermodulation process would, in most practical cases, not limit system performance. Also during this program, the fabrication process for the device was optimized. This includes optimizing of the polysilicon electrode conduction and the channel length. An advanced lens incorporating the cumulative design rules resulting from this program has been fabricated. This device, a 32 channel, 10,000 charge coupled element lens, will be used in 4.5 MHz imaging system to be developed under another program. GRA

N80-34221# Pennsylvania State Univ., University Park. Applied Research Lab.
QUANTITATIVE SCHLIEREN ANALYSIS OF ACOUSTIC INTERACTION WITH SUBMERGED PLATES Ph.D. Thesis
Roger Thomas Richards. 24 Jun. 1980. 157 p. refs.
(Contract N00024-79-C-6043)
(AD-A089066; ARL/PSU-TM-80-139) Avail: NTIS
HC A08/MF A01 CSCL 20/1

The transmission and radiation of sound from submerged plates are investigated by means of a quantitative Schlieren method which produces accurate visual representations of sound fields. The method is shown to have significant advantages over the usual time consuming, point by point scans of acoustic fields. Previous investigations have shown the feasibility of quantizing Schlieren data, and this investigation demonstrates a dramatic improvement in the accuracy of that data, reducing the standard error to under one decibel which places the accuracy of the method on equal footing with other acoustic measurement systems. The further addition of stroboscopic techniques enables the resolution of individual acoustic waves and permitted the differentiation between standing waves and progressive waves. The low frequency resolution of the classical Schlieren system was also improved by nearly two orders of magnitude; sound waves as low as 27 kHz were easily visualized. These improve-

ments in the quantitative Schlieren system are demonstrated by a thorough study of transmission of sound through submerged metal plates over a study of transmission of sound through submerged metal plates over a frequency range extending from below to over one hundred times the classical coincidence frequency. Recent theoretical descriptions of the lowest order symmetrical Lamb mode are confirmed, and cancellation of modal pairs of Lamb waves with increasing frequency is observed.GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-34222 California Univ., Los Angeles.
ENERGY TRANSFER IN IONIC AND MOLECULAR SYSTEMS Ph.D. Thesis
William Dane Hopewell 1980 208 p
Avail: Univ. Microfilms Order No. 8023321

Several examples of electronic energy transfer in molecular ionic systems were investigated using time resolved laser spectroscopy. The studies using molecules were concerned with nonradiative electronic energy trasnfer from the excited singlet to the lowest triplet (ISC) and the ground state (IC) in camphorquinone. A theoretical model that predicts the ratio of IC/ISC in molecules containing a progression in a single vibrational mode in their fluorescence absorption spectra, was used to explain the observed changes of the fluorescence lifetime as function a excess vibrational energy deposited of camphorquinone. Dilute cylohexane solutions of alpha-substituted benzenes (methyl-ethyl-,propyl-, tertbutyl-)show increased IC rate constants as the number of beta-carbons is increased. The increase in the IC rate due to the perturbation of the solvent. The energy transfer rate was measured at two concentrations (inconclusive results) and as a function of excitation wavelength. The transfer rate changes by a factor of 2 to 3 across the inhomogeneous profile. Dissert. Abstr.

N80-34223 Rutgers - The State Univ., New Brunswick, N. J.
MOLECULAR BEAM CHEMILUMINESCENT INVESTIGATION OF THE INELASTIC COLLISIONS OF RARE GAS METASTABLE ATOMS Ph.D. Thesis
Joseph J. BelBruno 1980 275 p
Avail: Univ. Microfilms Order No. 8022542

A nozzle beam scattering cell arrangement was utilized with optical analysis of the emission from the excited products to study electronic energy transfer between rare gas metastable and small molecules. Spectra were recorded and analyzed in a determination of the dependence of vibrational population, on the average relative kinetic energy. Experiments were performed for three types of processes, including collisional dissociation of the scattering gas. Penning ionization and electronic energy transfer. Results were compared to observed electron impart spectra as well as predicted data from phase space, golden rule and ionic intermediate curve crossing models. Neutral excitation collisions between argon and nitrogen produced the first positive and second positive nitrogen emissions. Excitation transfer from xenon to nitrogen populated vibrational levels of the B state of nitrogen according to a nonFranck-Condon distribution. Dissert. Abstr.

N80-34224 California Univ., Los Angeles.
HOMOGENEOUS VAPOR PHASE NUCLEATION OF LARGE POLAR MOLECULES UNDER LIMITING EXPERIMENTAL CONDITIONS: HIGH TEMPERATURES, LOW PRESSURES, AND LONG GROWTH TIMES Ph.D. Thesis
Carol Becker 1980 163 p
Avail: Univ. Microfilms Order No. 8023273

A diffusion cloud chamber was used to investigate involatile stearic acid molecule which requires high temperatures and low pressures. To determine whether cloud chamber experiments are feasible under these conditions, three prerequisite studies were conducted: (1) nucleation in a nonuniform vapor; (2) droplet growth in a nonuniform vapor, and (3) homogeneous nucleation of lambda-menthol. Measured critical supersaturations were compared with the predictions of the classical Becker-Doering theory for monomeric stearic acid. This comparison indicates a definite discrepancy between theory and experiment. The experimental envelope lies 27% above the theory at the lowest temperature and 10% below the theory at the highest temperature. Calculations show that part of the increase in experimental critical supersaturation at the lower temperatures could be due to association in the vapor. Dissert. Abstr.

N80-34225 Miami Univ., Coral Gables, Fla.
LOCALIZED ATOMIC ORBITALS FOR ATOMS IN MOLECULES Ph.D. Thesis
Keith Harlan Aufderheide 1980 225 p
Avail: Univ. Microfilms Order No. 8023658

A method is devised for the construction of localized atomic orbitals (LAOs) for atoms in molecules. The procedure involves definition of a function, L(Aa,Aa bar), a measure of a particular variety of exchange energy associated with the distribution between AOs a and a bar on atom A. The terms L(Aa) = L(Aa,Aa) constitute an atomic localization sum., L(A), which is required to be a maximum in the LAO basis on A. The properties of the components of L(A) are explored so as to achieve greatest computational efficiency. The maximization process is contingent upon an iterative sequence of 2 x 2 rotations. For the molecules tested, LAOs partition into sets of core, bonding, and lone pair orbitals, thereby lending a rigorous quantum mechanical interpretation to classical and pseudo-classical notions of atomic hybridization. LAOs are found to be extremely transferable among similar systems which allows for the development of generalized LAOs to account for average hybridization of many chemically important systems. The Mulliken populations of LAOs correspond quite closely to classical concepts. Finally, LAO studies of the barrier to internal rotation in ethane are discussed. Dissert. Abstr.

N80-34226 Colorado Univ. at Boulder.
EXPERIMENTAL ELECTRON-IMPACT EXCITATION AND IONIZATION OF POSITIVE IONS Ph.D. Thesis
Wade Thomas Rogers 1980 302 p
Avail: Univ. Microfilms Order No. 8021628

Absolute cross sections were measured, using crossed beams of electrons and ions, for excitation and ionization processes. For excitation measurements the photons resulting from the decay of the ions were detected, whereas for the ionization experiments the production of doubly charged ions was monitored. The cross sections were made absolute by direct calibration of the detectors against appropriate optical or electrical standards. Numerous possible systematic effects were studied, and the cross sections were demonstrated to have the correct functional dependence on experimentally measurable quantities. The quality and quantity of the data made possible the determination of near threshold structure in all measured cross sections except in the case of the GaII resonance line excitation, where the data were insufficient for this purpose. Dissert. Abstr.

N80-34227 Wayne State Univ., Detroit, Mich.
TOTAL AND DIFFERENTIAL SCATTERING CROSS SECTION MEASUREMENTS FOR POSITRONS AND ELECTRONS COLLIDING WITH INERT GASES Ph.D. Thesis
Munir Sweilem Dababneh 1980 121 p
Avail: Univ. Microfilms Order No. 8022743

Total scattering cross sections were measured in the same apparatus for low and intermediate energy positrons and electrons colliding with krypton and xenon using a beam transmission technique. The low energy positron measurements reveal a sudden increase in the cross sections in the vicinity of 7 eV and 5eV for krypton and xenon respectively. The intermediate krypton measurements show a continuous decrease in the two cross sections from the maxima at about 10 eV and 30 eV for electrons and positrons respectively. There is an indication of a gradual approach of the electron and positron scattering cross section at higher energies. The intermediate energy positron- and electron-xenon measurements show a continuous decrease in the cross section above 40 eV and 10 eV respectively. A sharper decrease was observed for electron-xenon scattering measurements where the cross sections drop below the positron scattering cross sections between 40 eV and 90 eV. The two curves diverge above 100 eV and seem to be converging again at about 500 eV.

Preliminary differential scattering cross section measurements at 90 deg were made for low energy electrons colliding with helium and argon. Dissert. Abstr.

N80-34228 Cornell Univ., Ithaca, N. Y.
DIGITAL IMAGE PROCESSING OF CONVENTIONAL TRANSMISSION ELECTRON MICROGRAPHS Ph.D. Thesis
Earl John Kirkland 1980 101 p
Avail: Univ. Microfilms Order No. 8020838

The theory of bright field image formation of thin specimens in a conventional transmission electron microscope is presented. The recorded image contrast is shown to be predominantly linear in the electron atom scattering amplitudes which are in general complex (possessing phase and amplitude). A linearized image model including multiple images of varying defocus is derived. Image degradation is characterized by an instrumental transfer function and by a Debye-Waller temperature factor representing the thermal vibration of the atoms in the specimen. Using the minimum mean square error criterion, a method of image reconstruction to recover the real and imaginary parts of the ideal phase contrast image from a defocus series is derived. The effects of a finite signal to noise ratio are included. This method of image reconstruction reduces to the well known Wiener filter in the appropriate limiting conditions and is shown to work in both theory and practice. A theoretical phase grating calculation of a hypothetical specimen is used to simulate a defocus series which is subsequently processed with the image reconstruction procedure. Results from experimental defocus series are also discussed. Dissert. Abstr.

N80-34229 North Carolina Univ. at Chapel Hill.
ATOMIC EFFECTS IN NUCLEAR REACTIONS Ph.D. Thesis
James Marshall Feagin 1980 146 p
Avail: Univ. Microfilms Order No. 8022450

The dependence of nuclear reaction observables on excitation of the surrounding atom is developed. Considerations are confined to those excitations of the atomic electrons arising from changes in the nuclear charge and velocity as a result of the nuclear reaction. The analysis is divided into two parts. In the first, a general time-dependent semiclassical formalism of atomic excitation as a result of a nuclear reaction is derived and sum rules for the moments of the electron excitation energy distribution are obtained. Procedures for modifying nuclear reaction observables by atomic transition amplitudes and energies are applied to calculate atomic corrections to Q values in Beta(+) decay. In the second part, a time independent R matrix theory is developed and the dependence on atomic excitation of quantities characterizing a nuclear reaction is derived. The R matrix formalism, generalized to include atomic excitation, retains all the utility of the usual nuclear R matrix theory. Dissert. Abstr.

N80-34230 Cornell Univ., Ithaca, N. Y.
COLLECTIVE ACCELERATION OF IONS IN VACUUM Ph.D. Thesis
Richard John Adler 1980 412 p
Avail: Univ. Microfilms Order No. 8020788

Ion acceleration produced by interaction of an intense electron beam with a localized ion source was studied. Two distinct types of ion sources were used: a dielectric (polyethlene) anode which produced protons, and a metal foil anode which produced both protons and the anode foil ion specie. The measured quantities included beam current, propagated electron energy, anode current, the ion energy spectrum, RF oscillations, and the ion angular distribution, among others. A Faraday cup which measured the time resolved proton energy spectrum was developed. The high energy ions were recorded late (60-100 nanoseconds) in the 100 nanosecond beam pulse, precluding ion production by a beam front mechanism. A summary of relevant theory was also presented, including a momentum transfer analysis which correctly accounts for the acceleration of the bulk of the ions (E < 2 MeV). Aluminum and Iron ions were accelerated from metal foils to up to 50 times the electron energy (for Iron). Dissert. Abstr.

N80-34231 City Univ. of New York, N. Y.
EFFECTS OF HEAVY PARTICLES AT LOW ENERGIES Ph.D. Thesis
Aleksandar Sokorac 1980 87 p
Avail: Univ. Microfilms Order No. 8023734

The low-energy effects of heavy particles are discussed in the context of the quantum field theories with local gauge invariance and in general. The evaluation of the one-loop heavy particle contribution to a low-energy relation valid in the SU(5)grand unified theory is presented. The calculation shows that heavy particles decouple (i.e. have negligible effect) in agreement with the decoupling theorem but proved only in a simple gauge model with one mass scale. The decoupling theorem is confronted with the recent counterexamples in literature and their difference with grand unified theories is stressed. The more precise version of the decoupling theorem valid in a general case is proposed. As a byproduct of the calculation, the heavy particle contribution to sin (2)theta in the SU(5) theory is obtained which together with the existing light-particle calculation agrees with the result obtained by the renomalization-group method and assuming the validity of the decoupling theorem. Dissert. Abstr.

N80-34232 Duke Univ., Durham, N. C.
INCLUSIVE STUDY OF 200 GeV/C PI-NEON INTERACTIONS Ph.D. Thesis
Band Henry Reyer 1980 149 p
Avail: Univ. Microfilms Order No. 8022210

Some 200 GeV/c pi-neon interactions were studied in the Fermilab 30 inch bubble chamber which was filled with a neon-hydrogen mixture (31 molar % neon). Scan results and measurements of a representative event sample yielded proton, gamma and pion multiplicities and single particle spectra. Nearly identical to lower energy measurements, R is strongly dependent on the number of observed protons in the event. The KNO scaling was observed for the corrected multiplicity distributions Scaling was violated if events with a fixed number of protons were considered. Study of the pion single particle spectra showed the excess particle production of the neon target over that of hydrogen was largest in the target fragmentation region and nearly constant in the central production region. The dependence of the pion rapidity distribution on the number of protons was consistent with collisions on either one or two nucleons. Dissert. Abstr.

N80-34233 North Carolina Univ. at Chapel Hill.
CONTINUOUS IRRADIATION METHODS FOR NUCLEAR RESONANCE LINE-NARROWING Ph.D. Thesis
John Wood Poulton 1980 213 p
Avail: Univ. Microfilms Order No. 8022497

Several methods of reduction of the nuclear magnetic spectroscopic line widths in solids were investigated. These methods involved the application of sequences of long pulses of RF irradiation. The simple theory for continuous irradiation experiments was also reviewed in order to understand the methods in the simplest possible terms. A more satisfactory method was examined which took into account various experimental difficulties and which more accurately described the internal interactions of the spin system. Dissert. Abstr.

N80-34234# IRT Corp., San Diego, Calif.
LOW ENERGY ATOMIC COLLISIONS
R. H. Neynaber and S. Y. Tang 30 Apr. 1980 8 p refs
(Contract F49620-78-C-0015; AF Proj. 9767)
(AD-A088748; IRT-8173-009; AFOSR-80-0683TR) Avail: NTIS HC A02/MF A01 CSCL 20/7

A summary of research performed under AFOSR contract no. F49620-78-C-0015 is given. The contract covered the period 1 October 1977 - 30 April 1980. The report describes merging-beams studies of chemi-ionization and/or ion-molecule reactions. Included are investigations of the He^*-D, Ne^*-Xe, He^*-He^*, Ar^*-Kr^*, Ne^*-Ar^*, He^*-Ne^*, and He(-)-Ne^* systems. GRA

N80-34235# Washington Univ., Seattle. Dept. of Chemistry.
HIGH TEMPERATURE GAS ENERGY TRANSFER Annual Summary Report, 1 Aug. 1979 - 31 Jul. 1980
B. S. Rabinovitch 12 Aug. 1980 15 p refs
(Contract N00014-75-C-0690)
(AD-A089129) Avail: NTIS HC A02/MF A01 CSCL 07/4

Work under this contract is summarized. Results are described on collisional transfer of vibrational energy by a variety of gases on the temperature dependence of transfer efficiency. A novel and simple Variable Encounter Method has been applied to the study of energy transfer between gas molecules and a wall, at high temperatures and high levels of activation, in the transient region. Results by the Diffusion Cloud Method are also described. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-34236 California Univ., Los Angeles.
HIGH-ENERGY PROTON-PROTON ELASTIC SCATTERING Ph.D. Thesis
Yiharn Tzeng 1980 120 p
Avail: Univ. Microfilms Order No. 8023376

High energy proton-proton elastic scattering via the quark model and Glauber approximation was studied. The quark's color and spin effects in pp scattering were studied. A color-dependent quark-quark scattering amplitude and a color and spin-dependent one were first obtained from assumed potentials. The pp scattering amplitude was then derived from these quark-quark amplitudes. Calculations were done up to the fourth order of the multiple scattering terms with Gaussian form factor in the spin-independent case and to the third order with both Gaussian and modified dipole form factors in the spin-dependent case. Examples of numerical results are given to show the characteristics of the model. Dissert. Abstr.

N80-34237# Naval Research Lab., Washington, D. C. Plasma Physics Div.
STEADY STATE TREATMENT OF RELATIVISTIC ELECTRON BEAM EROSION Interim Report
William M. Sharp (Science Application, Inc., McLean, Va.) and Martin Lampe 3 Sep. 1980 67 p refs
(ARPA Order 3718)
(AD-A089047; NRL-MR-4315) Avail: NTIS
HC A04/MF A01 CSCL 20/8

The head of a relativistic electron beam propagating into un-ionized or weakly ionized gas is not self-pinched and expands freely, causing the beam to take on a 'trumpet' shape. The region where the beam pinches, referred to as the 'pinch point', moves steadily back into the beam because of the reduced ionization rate at the expanding beam head and energy loss to the induced electric field. This beam head 'erosion' is modeled by assuming that the axial beam profile is stationary in a reference frame moving with the pinch point. This assumption allows the beam equations to be written in time-independent form, and radial averaging then yields a set of one dimensional ordinary differential equations for the beam radius and energy, the mean pinch force, and the background conductivity. Solution of these equations with appropriate boundary conditions gives both the erosion rate and the beam axial structure. Results of extensive numerical calculations are presented, along with analytic estimates of the erosion rate, degree of current neutralization, and axial scale lengths. GRA

N80-34238# Missouri Univ. -Kansas City. Dept. of Chemistry.
CONSTRUCTION AND TESTING OF AN ION PHOTOFRAGMENT MOMENTUM SPECTROMETER Final Report, 1 Jun. 1979 - 1 Jun. 1980
Timothy F. Thomas 29 Jul. 1980 18 p refs
(Contract F49620-79-C-0167; AF Proj. 2303)
(AD-A088753; AFOSR-80-0696TR) Avail: NTIS
HC A02/MF A01 CSCL 20/7

A nuclide 12-90-G mass spectrometer has been modified for potential use as an ion photofragment momentum spectrometer. It is demonstrated to have the capability of resolving vibrational structure in the momentum distribution of NO(-) produced by photodissociation of N2O(-) with a detector slit width of 0.25 mm. At this slit width an ion current of 5 picoamps of Ar(-) at the detector is achievable. The operating parameters of the 3 diaphragm single lens used to generate the primary ion beam are presented in detail. GRA

N80-34239# Sandia Labs., Albuquerque, N. Mex. Pulsed Power System Dept.
PULSED POWER ACCELERATORS FOR PARTICLE BEAM FUSION
T. H. Martin, G. W. Barr, J. P. VanDevender, R. A. White, and D. L. Johnson 1980 5 p refs Presented at the 14th Pulse Power Modulator Symp., Orlando, Fla., 3 Jun. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0550C; CONF-800640-12) Avail: NTIS
HC A02/MF A01

Sandia National Laboratories is completing the construction phase of the Particle Beam Fusion Accelerator-1 (PBFA-1). Testing of the 36 module, 30 TW, 1 MJ output accelerator is in the initial stages. The 4 MJ, PBFA Marx generator provided 3.6 MA into water-copper sulfate load resistors with a spread from first to last Marx firing between 15 to 25 ns and an output power of 5.7 TW. This accelerator is a modular, lower voltage, pulsed power device that is capable of scaling to power levels exceeding 100 TW. The elements of the PBFA technology and their integration into an accelerator system for particle beam fusion is discussed. DOE

N80-34240# California Univ., Livermore. Lawrence Livermore Lab.
INTRODUCTION TO MAGNETIC CONFINEMENT FUSION DIAGNOSTICS
W. C. Turner 6 Jun. 1980 47 p refs Presented at the IEEE Mini-Course on Modern Plasma Diagnostics, Madison, Wis., 21-23 May 1980
(Contract W-7405-eng-48)
(UCID-18704) Avail: NTIS HC A03/MF A01

A brief survey of some of the current diagnostic techniques used in magnetic fusion plasma devices is presented. The range of parameters and geometries encountered the parameters of four representative experiments, PLT, TMX, ZT-40 and EBT-I(S), are given. The flow of power which can be summarized by two volume integrated equations for the ions and electrons is discussed. DOE

74 OPTICS

Includes light phenomena.

N80-34241 Environmental Research Inst. of Michigan, Ann Arbor.
MEETING OF THE IRIS SPECIALTY GROUP ON INFRARED DETECTORS, VOLUME 1
Infrared Information and Analysis Center. Oct. 1979 423 p refs Meeting held at Minneapolis, 12-13 Jun. 1979
(Contract N00014-77-C-0125; NR Proj. 315-001)
(ERIM-139600-3-X(I)) Avail: Issuing Activity

The current status of infrared detector technology and development is presented. Limitations for infrared extrinsic and intrinsic photodetectors are discussed. Performance of silicon based photodiodes is discussed. The fabrication of photodiodes and photodetector arrays is described. T.M.

N80-34242 British Library Lending Div., Boston Spa (England).
A METHOD OF MEASURING THE VISIBILITY OF MILITARY OBJECTS
J. Boogaard and A. Meeteren 28 Nov. 1979 18 p refs Transl. into ENGLISH of "Een Methodeom de Opvallendheid van Militaire Objekten to Meten" Rept. IZF-1978-10 Netherlands Organization for Applied Scientific Research TNO., Inst. of Perceptual Physiology, Soesterberg
(RAE-Lib-Trans-1981(5207); IZF-1978-10) Avail: British Library Lending Div., Boston Spa, England

A simple method of determining the visibility of military objects is described. Taking photographs in the field and then determining indoors the simulated detection distances is demon-

strated for vehicle type YA 2442 and YA 126, with and without trailer. The YA 126 would seem to be the less conspicuous under all circumstances, both with and without the trailer. S.F.

N80-34243 British Library Lending Div., Boston Spa (England).
DETERMINATION OF SURFACE ACTIVE MATERIALS BY SQUARE-WAVE POLAROGRAPHY (POLAROGRAPHY WITH RECTANGULAR WAVE)
Maria Porubska Feb. 1980 9 p refs Transl. into ENGLISH from Chem. Prum. (Prague), v. 29, No. 1, 1979 p 38-40 (BLL-RTS-12170) Avail: British Library Lending Div., Boston Spa, England

The possibility of the application of tensametry for the determination of surfactants was examined. The behavior of several auxiliary materials in the plastics industry using ac polarography (alternating current polarography) was studied. Surface active material tensides were determined by classical polarography (dc polarography) indirectly on the basis of the drop in the oxygen maximum. The behavior of three preparations, recommended for antistatic treatment of plastics, was examined: anion-active, cation-active and a nonionic tenside. The conditions governing their determination by square wave polarography were determined. T.M.

N80-34244 Portland State Univ., Oreg.
SELECTIVE REFLECTION OF LIGHT AT A SOLID-GAS INTERFACE AND ITS APPLICATION Ph.D. Thesis
Fumihide Takeda 1980 191 p
Avail: Univ. Microfilms Order No. 8021964

In order investigate the feasibility of techniques for obtaining solid gas molecule interaction potentials, models of solid gas interfaces were studied. A marked difference in the line shapes of the reflected light among the possible interactions suggests that the forms of interaction at the interface can be measured using known techniques. The possibility of measuring the flow of gas near walls where currently available laser Doppler anemometers can not spatially reach was investigated. The shift and width of the numerically calculated line shape of the reflected light in model flow is directly related to the mean and the fluctuating velocity fields respectively. Dissert. Abstr.

N80-34245 Texas Univ. at Austin.
THREE WAVE NONLINEAR INTERACTIONS IN DISPERSIVE MEDIA Ph.D. Thesis
Sulaksh Rashmikant Gautam 1980 107 p
Avail: Univ. Microfilms Order No. 8021436

Three wave interactions in homogenous nonlinear dispersive media are studied with a complementary use of analytic and numerical methods. The effects of dispersion in the picosecond substructure generation in optical parametric processes are investigated. In a 3-wave interaction at optical frequencies omega sub 1, omega sub 2, omega sub 3 satisfying the resonance condition (i.e., omega sub 3 = omega sub 1 + omega sub 2), the presence of dispersion in the medium leads to the generation of picosecond multipulsed substructure in the pulse profiles. Both, the degenerate (omega sub 1 = omega sub 2 = (omega sub 3)/2 as well as the nondegenerate omega sub 1 does not equal omega sub 2 parametric amplification processes are studied. For all cases, a specific and realistic situation involving a LiNbO3 crystal illuminated by pulsed laser is considered. The time envelope of the initial pulses is chosen to be Gaussian with a full width at the half maximum of 30 psecs. The existence of the picosecond substructure in the pulse profiles is in good agreement with the experimental observations. Experiments are proposed for the generation and detection of such picosecond substructures. Dissert. Abstr.

N80-34246 Miami Univ., Coral Gables, Fla.
NON-PROJECTIVE TRANSFORMATIONS IN OPTICS Ph.D. Thesis
Dean Francis Cornwell 1980 420 p
Avail: Univ. Microfilms Order No. 8022877

Optical systems that perform nonprojective transformations are rarely synthesized by intent. Most systems familiar in practice are designed to provide the closest approximation to a projective transformation that is allowed by physics, technology, or economy. The advent of the laser brings many new applications for optical transformations - the nonprojective variety being a late-comer. Requirements in the fields of laser materials processing, optical data processing, high energy lasers, and laser fusion, just to name those areas already penetrated, evoke consideration for unconventional grooming of wavefront irradiance profiles. Transformations such as changing a wavefront irradiance distribution from flat like to Gaussian-like or vice versa, or changing the wavefront area obscuration while maintaining its focusability are typical examples of applications gaining an increasing interest. Following the laws of geometrical optics, but violating many of its precepts, principles of design and analysis of nonprojective transformations in optics, and several of the potential applications are explored. Dissert. Abstr.

N80-34247 Arizona Univ., Tucson.
GENERALIZED RAY TRACING, GENERALIZED BENDING AND USE OF CAUSTIC SURFACES AS MERIT FUNCTIONS IN OPTICAL DESIGN Ph.D. Thesis
Rong Seng Chang 1980 105 p
Avail: Univ. Microfilms Order No. 8022831

Characteristics of generalized bending are discussed. The displacement of a caustic point caused by a generalized bending is in essentially a straight line. The direction of the displacement is determined by which refracting surfaces are selected. The magnitude of the displacement is proportional to the logarithm of the bending parameter. Caustic surfaces can be used as a merit function in the optical process. The merit functions can be calculated by means of generalized ray tracing. Generalized bending provides an effective means of optimizing the design of an optical system when included in a feedback loop. Dissert. Abstr.

N80-34248 City Univ. of New York, N. Y.
SOME ASPECTS OF THE NONLINEAR INTERACTION OF LIGHT AND MATTER Ph.D. Thesis
Milivoj Radivoj Belic 1980 158 p
Avail: Univ. Microfilms Order No. 8023688

Various aspects of the interaction of light with matter are addressed. The competition between self-phase modulation and stimulated Raman scattering is examined. A realistic model for the unstable loaded optical resonator in the paraxial wave approximation is then discussed. The possibility of utilizing optical power to directly drive a refrigerator is explored. Finally, the nature of the energy band structure of solids in an external laser field is investigated. Dissert. Abstr.

N80-34249 Duke Univ., Durham, N. C.
AN IMPROVED SIX-PORT TECHNIQUE FOR MEASURING COMPLEX REFLECTION COEFFICIENT Ph.D. Thesis
Marc David Rafal 1980 78 p
Avail: Univ. Microfilms Order No. 8022860

Current realizations of the Six-Port technique for measuring the complex reflection coefficient require accurate information about the system calibration constants. An examination of the sensitivity of the solution of the reflection coefficient to calibration constants is undertaken. An improved set of design specifications is derived based on the sensitivity of the solution and constraints on power measurement accuracy. It has been recognized that the system equations for the Six-Port are an overdetermined set of equations. Previously, this overdeterminedness has not been used to reduce the sensitivity of the solution of the reflection coefficient to variation of the calibration constants. An algorithm is described which makes use of the extra calibration constants. A Fortran program is presented which implements the algorithm. A hardware realization based on the improved set of design specifications is described. The circuit operates at a center frequency of 900 MHz and performs over a 16% band of frequencies without recalibration. Errors in phase measurement for this Six-Port implementation are less than two degrees except at the band edges. Errors in magnitude measurement are less than 10% except for measurements of small values of reflection coefficient magnitude (0.3) for which errors are 20%. Dissert. Abstr.

N80-34250*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A FIBER OPTIC TRANSMISSION LINE STABILIZATION APPARATUS AND METHOD Patent Application
George F. Lutes (JPL) and Kam Y. Lau, inventors (to NASA)

(JPL) Filed 17 Sep. 1980 31 p
(Contract NAS7-100)
(NASA-Case-NPO-15036-1; US-Patent-Appl-SN-188160) Avail: NTIS HC A03/MF A01 CSCL 20F

A reference signal of RF frequency modulates .85 micrometer wavelength optical transmitter whose output passes through an optical filter and a voltage controller phase shifter such that the output of the phase shifter is provided to the fiber optic transmission line. At the receiving end of the fiber optic transmission line, the signal is demodulated and used to modulate a 1.06 micrometer optical transmitter. The output signal from the 1.06 micrometer optical transmitter is provided to the same fiber optic transmission line and passes through the voltage controlled phase shifter to a phase error detector. The phase of the modulation of the 1.06 micrometer wavelength signal is compared to the phase of the reference signal by the phase error detector which provides a phase control signal related to the phase difference. This control signal is provided to the voltage controlled phase shifter which alters the phase of both optical signals passing through until a predetermined phase relationship between modulation on the 1.06 micrometer signal and the reference signal is obtained. NASA

N80-34251*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COLLIMATED BEAM MANIFOLD AND METHOD FOR USING THE SAME Patent Application
C. Warren Campbell and Robert B. Owen, inventors (to NASA) Filed 15 Sep. 1980 15 p
(NASA-Case-MFS-25312-1; US-Patent-Appl-SN-187106) Avail: NTIS HC A02/MF A01 CSCL 20F

An optical manifold transforms a collimated beam, such as a laser beam, into a number of parallel beams having uniform intensity or having a desired intensity ratio. The manifold comprises an optical substrate coated on its rear surface with a fully reflective layer and on its front surface with a partially reflecting layer with a reflectivity gradient. An input collimated beam entering the rear surface and impinging on the front surface is multiplicatively reflected between the front and rear surfaces producing a number of parallel beams that emerge from the front surface. The intensities of the emerging beams have a relationship that depends on the reflectivity (R1, R2, R3, R4, and R5) of the front surface at the points where the beams emerge. By properly selecting the reflectivity gradients, the emerging beams will have uniform intensity or a desired intensity ratio. NASA

N80-34252# Naval Ocean Systems Center, San Diego, Calif.
DESIGN OF A FIBER OPTIC DATA LINK FOR THE GROUND LAUNCHED CRUISE MISSILE Final Report, Apr. 1979 - Dec. 1979
C. R. Hansen, T. P. Fitzgerald, and R. A. Greenwell 30 May 1980 25 p
(AD-A088847; NOSC/TR-557) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report examines the feasibility of using fiber optic data links to connect the operating units of the Ground Launched Cruise Missile Weapons Control System. The conclusion is reached that the necessary technology to implement such a design is either presently available or will become available by mid-1980. GRA

N80-34253# Washington Univ., Seattle. Dept. of Electrical Engineering.
SYNTHESIS OF GENERALIZED COHERENT OPTICAL PROCESSOR Final Report, 1 Aug. 1975 - 30 Sep. 1978
F. Paul Carlston Aug. 1980 12 p refs
(Contract N00014-76-C-0522; NR Proj. 350-005)
(AD-A088669; UW-TR-220) Avail: NTIS HC A02/MF A01 CSCL 17/8

This final report gives a summary of all the work completed under this contract, covering the period from August 1975 to September 1978. The work covers a broad spectrum of activities, including generalized operator theory for coherent optical processors to specific realizations of processor elements and algorithms. The emphasis is directed towards generating new ideas to solve theoretical as well as practical problems. Success in our effort is evidenced by the list of reports and publications. GRA

N80-34254# Chicago Aerial Industries, Inc., Barrington, Ill.
ADVANCED ELECTRO-OPTICAL TRACKER/RANGER Final Report, Oct. 1978 - Feb. 1980
R. A. Bennett and D. N. DeFoe Jun. 1980 231 p
(Contract F33615-78-C-1562; AF Proj. 7629)
(AD-A089143; CAI-7323-0180-5; AFWAL-TR-80-1034) Avail: NTIS HC A11/MF A01 CSCL 17/8

The preliminary engineering design study of an Advanced Electro-Optical Tracker/Ranger (AEOTR) to provide passive target tracking and rangefinding for air to air gun fire control is described. Area correlation processing is used in the comparison of stereo image pairs for stereometric ranging and in the comparison of successive images for tracking. The application of these techniques to the AEOTR, the limitations imposed by packaging, environmental and state-of-the-art sensor and processing hardware constraints, and the projected performance are evaluated. Principal emphasis is given to the use of AEOTR in the gun director engagement mode in which target track and range data is provided to a gun fire control computer. The feasibility of use of the AEOTR to provide target video as an aid to visual target identification, and to provide automatic airborne target detection, is also evaluated. The necessary functions and subsystems are defined and integrated into a preliminary design, whose performance is estimated and compared with the program goals. In addition, a preliminary mounting location study for the F-15, F-16 and F-18 advanced fighters is included. CAI-built hardware was used to successfully demonstrate the feasibility of the ranging and tracking concepts employed in the AEOTR. GRA

N80-34255# Texas Technological Univ., Lubbock. Optical Sciences Lab.
ANALYSIS OF UNSTABLE OPTICAL RESONATORS Final Report, 1 Mar. 1977 - 31 Mar. 1979
John D. Reichert 9 Jun. 1980 24 p
(Grant AF-AFOSR-3278-77; AF Proj. 2301)
(AD-A088600; AFOSR-80-0624TR; TTOSL-FSR-2) Avail: NTIS HC A02/MF A01 CSCL 20/6

Four topics: general laser resonator theory, distributed reflection of light and damage to optical elements, oxide layer thickness on commercial ALCLAD, and multipass chemical laser power amplifiers are presented. Fundamental approaches, techniques, and results were developed and achieved in these areas. T.M.

N80-34256# National Bureau of Standards, Washington, D.C. National Measurement Lab.
PHOTOMETRY AND COLORIMETRY OF RETROREFLECTION: STATE-OF-MEASUREMENT-ACCURACY REPORT Final Report
Kenneth L. Eckerle Jul. 1980 47 p refs
(PB80-201783; NBS-TN-1125) Avail: NTIS HC A03/MF A01 CSCL 20F

A survey of the literature on retroflection and information from this survey necessary for the understanding of the phenomenon of retroeflection are summarized. Materials, measurement geometry, quantities to be measured, instrumentation, and methods of calibration are included. Recommendations are given to evaluate or to write specifications by discussing important parameters. A partial list of test methods and specifications is presented in tabular form. Some prior research and intercomparisons are summarized including the results. The state-of-measurement-accuracy is inferred from the information presented. A bibliography is included. GRA

N80-34257 City Univ. of New York, N. Y.
SOME ASPECTS OF THE NONLINEAR INTERACTION OF LIGHT AND MATTER Ph.D. Thesis
Milivoj Radivoj Belic 1980 158 p
Avail: Univ. Microfilms Order No. 8023688

Various aspects of the interaction of light with matter are explored. The competition between self phase modulation (SPM) and stimulated Raman scattering (SRS) is studied and a realistic model for the unstable loaded optical resonator in the paraxial wave approximation is reviewed. The possibility of utilizing optical power to directly drive a refrigerator is discussed along with the nature of the energy band structure of solids in an external laser field. Dissert. Abstr.

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-34258 Colorado Univ. at Boulder.
TWO EXAMPLES OF THE DECAY INSTABILITY IN AN INHOMOGENEOUS PLASMA Ph.D. Thesis
Terence Harvey Rudolph 1980 152 p
Avail: Univ. Microfilms Order No. 8021631

Saturation of the electron ion decay instability can occur linearly in an inhomogeneous plasma due to the effects of Langmuir wave propagation. The Langmuir intensity spectrum resulting from this convective saturation is calculated from the WKB wave kinetic equation in two cases: (1) an ionospheric model including magnetic field and cyclotron harmonic damping, and (2) a dense plasma focus model. An application is made to the scattering experiment of Peacock, et al. The addition of a term corresponding to nonlinear Landau damping is also considered. Dissert. Abstr.

N80-34259 City Univ. of New York, N. Y.
EXPERIMENTAL INVESTIGATION OF MODULATIONAL EFFECTS IN A MAGNETIZED PLASMA Ph.D. Thesis
Doowah Louie 1980 153 p
Avail: Univ. Microfilms Order No. 8023748

Pulsed microwaves of frequency 2.43 GHz with 6 ms in pulse width are launched parallel to the external magnetic field into a magnetized plasma in a mirror machine with mirror ratio of 1.27. The plasma is produced by the same microwave pulsed by the method of electron cyclotron resonance using hydrogen. When the hydrogen neutral pressure is about 2 to 3x0. 000010 modulations on all signals were observed and were investigated. The modulation is attributed to a relaxation type oscillation in the plasma. Dissert. Abstr.

N80-34260 Iowa Univ., Iowa City.
LARGE ELECTROSTATIC POTENTIAL VARIATIONS IN LABORATORY PLASMAS Ph.D. Thesis
Peter Geoffrey Coakley 1980 147 p
Avail: Univ. Microfilms Order No. 8022007

Large electrostatic potential variations in the form of sheaths and double layers (both stationary and moving) were studied in laboratory plasmas. Filament discharge plasmas were generated in a multidipole soup pot and a triple plasma device where the electron density is varied from 1 to 500 x 10 to the seventh power cu cm and the electron temperature T sub e approximately 1 to 3 eV in argon and helium plasmas. Emitting, collecting and floating Langmuir probes were used to study the phenomena associated with large potential variations. The axial potential structure from a biased disc probe (-20 V) in a vacuum was measured with an emissive probe. The potential measured agreed with the potential predicted to within a factor of two. Dissert. Abstr.

N80-34261# California Univ., Los Angeles. Center for Plasma Physics and Fusion Engineering.
EFFECT OF ICRF HEATING ON SINGLE PARTICLE CONFINEMENT IN TOKAMAKS
K. W. Whang and G. J. Morales Mar. 1980 18 p refs
(Contract N00014-75-C-0476)
(AD-A088578; PPG-473) Avail: NTIS HC A02/MF A01 CSCL 18/1

The simultaneous effect of ion heating and spatial diffusion due to ICRF heating in Tokamak geometry is investigated from the single particle viewpoint. Transitions between passing and trapped trajectories are taken into account in the mapping equations. Specific results are given for typical experimental devices. Author

76 SOLID-STATE PHYSICS

Includes superconductivity.
For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-34262 British Library Lending Div., Boston Spa (England).
FIXATION OF Zn(II) IONS ON METAL OXIDE SURFACES
Takao Kaji, Noboru Yamazoe, and Tetsuro Seiyama May 1980 13 p refs Transl. into ENGLISH from Denki Kagaku (Tokyo), v. 46, no. 12, 1978 p 673-679 Presented at 44th Congr. on Electrochem., Fukoda, Apr. 1977
(BLL-RTS-12200) Avail: British Library Lending Div., Boston Spa, England

Various aspects of the characteristics and reactivity of hydroxyl groups present on the surface of metal oxides were studied. Using conventional chemical reactions, desorption through temperature increase, and spectroscopic methods, the reaction between metal oxide surface hydroxyl groups and various metal ions was investigated. Ion exchange processes in this connection were also studied. Metal oxide surfaces react with metal ions or metal complex ions to form a protective surface. Surface fixation of metal ions and the characteristics of these ions is described. T.M.

N80-34263 Georgetown Univ., Washington, D.C.
PHONON-INDUCED NONEQUILIBRIUM STATES IN SUPERCONDUCTING FILMS: A KINETIC EQUATION STUDY Ph.D. Thesis
Nicholas Christopher Cirillo, Jr. 1979 118 p
Avail: Univ. Microfilms Order No. 8021263

The effect of the injection of coherent longitudinal phonons into superconductors is investigated using the quasiparticle and phonon kinetic equations. Eliashberg suggested that the absorption of microwave electromagnetic radiation of energy by a superconducting film would increase the energy gap by redistributing the quasiparticles away from the gap edge. Tredwell and Jacobsen employed Eliashberg theory to predict phonon-induced increases in the energy gap. They obtained good agreement between the theoretical predictions and their experimental data for thin film samples and for low power absorption levels. The calculations also assume that the phonons emitted in the relaxation of the excited quasiparticles are not reabsorbed, and hence do not lead either to additional excitation of the quasiparticles or to the creation of new quasiparticles by pair breaking. Using the modified kinetic equations of Bardeen, Rickayzen, and Tewordt these approximations are avoided and the previously unexplained features of the experimental data are satisfactorily accounted for. Dissert. Abstr.

N80-34264 Case Western Reserve Univ., Cleveland, Ohio.
THE EPITAXIAL POLYMERIZATION OF (SN)x Ph.D. Thesis
Scott Edwin Rickert 1980 122 p
Avail: Univ. Microfilms Order No. 8021713

The combination of a substrate directed epitaxial crystallization followed by a surface controlled solid state polymerization was studied. This sequential orchestration of both solid state processes was termed epitaxial polymerization. The polymer chosen is a metallic conductor at room temperature, superconducting at 0.3 K, and still a macromolecule. That material is polythiazyl, better known simply as (SN)x. Disulfur dimitride (S2N2) was deposited from the vapor phase on cold single crystals of various monovalent alkali halides. The resultant epitaxic growth was in the form of thin single crystal platelets. The polymer was formed by allowing the coated substrate to warm above 0 C. Fourier transform infrared spectroscopy was initially employed to examine a possible relationship between polymorphic structure and band position. The study revealed that water reacted with (SN)x and produced chemical defects. Fibrous (SN)x was successfully obtained by depositing and polymerizing a dinner layer on top of a previously polymerized layer on an alkali halide. Dissert. Abstr.

N80-34265 California Inst. of Tech., Pasadena.
ION-BEAM-INDUCED MODIFICATIONS OF THIN FILM STRUCTURES AND FORMATION OF METASTABLE PHASES Ph.D. Thesis

Bor-Yeu Tsaur 1980 230 p
Avail: Univ. Microfilms Order No. 8019910

The influences of energetic ion bombardment on the composition and structure of thin film materials and the utilization of ion-beam-mixing techniques to produce compounds and alloys are reported. By bombarding through a thin transition-metal film deposited on a Si substrate, significant atomic mixing was observed near the metal-Si interface at dose levels of 10 to the 15th power sq/cm. he atomic mixing led to the formation of well-defined silicide phases. The ion-beam-mixing process was then utilized to investigate the production of nonequilibrium (or metastable) phases. A metastable silicide phase of a stoichiometry Pt2Si3 was obtained by heat treating a Si-rich amorphous Pt-Si alloy layer produced by ion-beam-mixing of thin PtSi (or Pt) films on Si. The metastable phase was found to exhibit a superconducting transition onset at about 4.2K and to become completely superconductive at temperature below 3.6K. To further investigate the production of metastable phases by ion-beam-mixing experiments were performed in the simple eutectic system of Au-Si. The mixing of thin deposited layers (multiple-layers) were investigated as a scheme for producing compounds or alloys of desirable compositions. Dissert. Abstr.

N80-34266 Clarkson Coll. of Technology, Potsdam, N.Y.
CRYSTALLIZATION UNDER NONUNIFORM CONDITIONS Ph.D. Thesis
C. Kumar 1980 157 p
Avail: Univ. Microfilms Order No. 8023221

The tendency of crystals to grow uniformly to maintain their habit is the characteristic feature of such growth. Classical crystal growth theory predicts that this uniform growth should break down when the growth reaches its Wilson-Frenkel limiting value locally. If the local supersaturation is known at the point of breakdown, as determined experimentally, the deposition coefficient can then be calculated directly avoiding the usual multiparameter fitting of growth data. An experimental technique employing an impinging jet was used in this study of crystal growth of MgSO47H2O from water. The radial onset of liquid inclusions about the jet stagnation point is believed to indicate local Wilson-Frenkel growth. The deposition coefficient C is then determined from C=G/ sigma sub 0 min, where G is from transport modelling. The results are encouraging enough to recommend further intensive study. Dissert. Abstr.

N80-34267# Utah Univ., Salt Lake City. Dept. of Materials Science and Engineering.
POSITRON ANNIHILATION GAMMA RAY LINESHAPE STUDIES OF DEFECTS IN SOLIDS Final Technical Report, 1 Apr. 1975 - 31 Mar. 1980
J. G. Byrne 24 Jun. 1980 64 p refs
(Grant AF-AFOSR-2810-75)
(AD-A088856; UTEC-80-092; AFOSR-80-0700TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

Positron annihilation measurements, performed via Doppler broadening of the annihilation gamma photon energy distributions, have been effectively applied to follow age hardening, hydrogen embrittlement, dislocation generation during single crystal bending, phase transformations in steel, deformation of both samples containing precipitates and preprecipitates and the deformation of steel. The technique is nondestructive and sensitive to line and point defects, interfaces, and microvoids. GRA

N80-34268# Hughes Research Labs., Malibu, Calif.
ION IMPLANTATION OF WIDE BANDGAP SEMICONDUCTORS Final Report, 15 Dec. 1978 - 14 Dec. 1979
K. V. Vaidyanathan, C. L. Anderson, H. L. Dunlap, and R. A. Jullens May 1980 49 p refs
(Contract N00173-73-C-0028)
(AD-A089026) Avail: NTIS HC A03/MF A01 CSCL 07/4

The primary objectives of this program are to study the electrical properties and carrier distributions in ion-implanted and annealed GaAs and to demonstrate the feasibility of forming planar, isolated p-n junctions by sequential implantation of donors and acceptors into semi-insulating GaAs. To fabricate such planar junctions, a selective area implantation process technology was developed. The required device isolation was achieved by exploiting the semi-insulating nature of Cr-doped GaAs. GRA

N80-34269# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
STUDIES OF INDIUM-DOPED SILICON Final Report, 1 Aug. 1977 - 31 Oct. 1979
C. E. Jones, D. E. Schafer, M. W. Scott, and R. J. Hager Jun. 1980 130 p refs
(Contract DAAK70-77-C-0194; ARPA Order 3211)
(AD-A088736; HONEYWELL-41696) Avail: NTIS HC A07/MF A01 CSCL 17/5

Areas of current interest in infrared detector development include the development of larger arrays, the use of cheaper materials, and the integration of the detectors and processing electronics onto the same chip. Silicon doped with various impurities can be used as a photodetector in many regions of the infrared. Silicon is available in large areas and the technology and equipment needed to process the detectors and coupled electronics is that used in the current silicon electronics industry. Because of this, the production of chips with integrated detectors and electronics would be cheaper with silicon than with any other material. The yields, uniformity, and quality of silicon devices might be expected to be better for silicon than for any other less highly developed material and the development time and cost should be much less. The specific aims of this study effort were three fold: (1) develop a new growth process which can produce better-quality indium-doped silicon than current Czochralski or float-zone techniques; (2) determine the origin of the X-center and if possible eliminate it, and (3) determine the trapping parameters of centers in indium-doped silicon. GRA

N80-34270# SRI International Corp., Menlo Park, Calif. Molecular Physics Lab.
THEORETICAL STUDY OF STATE-TO-STATE COLLISIONS Final Scientific Report, 1 May 1979 - 30 Apr. 1980
Albert P. Hickman and Roberta P. Saxon 23 Jun 1980 139 p refs
(Contract F44620-75-C-0073; AF Proj. 2301)
(AD-A088746; SRI-MP-80-72; AFOSR-80-0682TR) Avail: NTIS HC A07/MF A01 CSCL 20/8

The probability of making transitions between specifically known molecular states by collision processes has been theoretically investigated. The following research areas have been studied: Collisions of Rydberg states of Na, Rb, and Xe with rare gas atoms and with molecules; calculations of potential curves, matrix elements, and photodissociation cross sections of CH-; and nonadiabatic collision processes between alkali atoms or rare gas metastables and diatomic molecules that lead to ion-pair formation. GRA

N80-34271# Colorado State Univ., Fort Collins. Dept. of Chemistry.
OPTICAL AND MAGNETIC RESONANCE STUDIES OF ENERGY TRANSFER IN INORGANIC MOLECULAR SOLIDS Final Report, 1 Jun. 1977 - 31 May 1980
Elliot R. Bernstein Aug. 1980 4 p refs
(Grant DAAG29-77-G-0133)
(AD-A088567; ARO-16771.3-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

The Jahn Teller Effect in iridium hexafluoride (IrF6) was studied. Three of the degenerate electronic states of IrF6 by absorption and Raman scattering studies of low temperature crystals were analyzed to determine linear and quadratic vibronic coupling parameters. A theoretical analysis of the energy levels of IrF6 was performed. Electron paramagnetic resonance data were analyzed for an octahedral state. Such a state, even in a cubic environment, evidences anisotropic behavior and highly complicated magnetic resonance spectra. R.K.G.

N80-34272# National Bureau of Standards, Washington, D.C. National Measurement Lab.
ACCURACY IN POWDER DIFFRACTION: PROCEEDINGS OF A SYMPOSIUM Final Report
S. Block, ed. and C. R. Hubbard, ed. Feb. 1980 557 p refs
Conf. held at Gaithersburg, Md., 11-15 Jun. 1979 Sponsored in part by International Union of Cryst. and National Council of Canada
(PB80-200488; NBS-SP-567; LC-80-600010) Avail: NTIS HC A24/MF A01 CSCL 20B

Total pattern, instrumentation and automation, profile fitting,

analysis of peak shape, lattice parameters and indexing, applications, and future opportunities in powder diffraction are discussed. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-34273 Princeton Univ., N. J.
INSTANTONS AND FERMION DENSITIES Ph.D. Thesis
Carlos Alberto AragaodeCarvalho 1980 73 p
Avail: Univ. Microfilms Order No. 8023813

The effects of imposing a fixed charge density constraint on field theories that possess instanton like classical solutions are discussed. The two dimensional Abelian Higgs model and the role played by the chemical potential (microns) of massless fermions in a dilute gas approximation to the functional integral are studied. Mass generation is discussed and a suppression of vortex density is shown to occur as we increase microns. In a one instanton amplitude for a fixed micron the instanton density is exponentially suppressed in both the heavy and high quark cases, a phenomenon due to screening. In the massless limit instantons should be completely suppressed and only virtual tunnelings (instanton-anti-instanton pairs) should be important. Dissert. Abstr.

N80-34274 State Univ. of New York at Stony Brook.
SELECTED STUDIES IN CLASSICAL AND QUANTUM FIELD THEORY Ph.D. Thesis
Ratindranath Akhoury 1980 125 p
Avail: Univ. Microfilms Order No. 8021376

This thesis is based on studies of: (1) magnetic monopole solutions in nonAbelian gauge field theories; (2) mass divergences of wide angle scattering amplitudes in renormalizable quantum field theories; and (3) pion condensation in nuclear and neutron matter. The Bogomoing equation for linear perturbations of the Prasad-Sommerfield monopole is solved exactly. Explicit expressions for all the normalizable and nonnormalizable nongauge modes are the translational modes. Open questions and possible applications are mentioned. The mass divergences of wide angle scattering amplitudes are examined in a class of field theories including those with elementary vector fields. Power counting arguments are used to show that, apart from renormalization effects, the wide angle gauge singlet scattering amplitude has a well defined zero mass limit and hence satisfies the renormalization group equations. The threshold for pionic instabilities in nuclear and neutron matter is studied in a temperature dependent formalism. It is found that in both systems such instabilities persist up to quite high temperatures, although the question about the magnitude of the condensate field strength at high temperature remains open. Dissert. Abstr.

N80-34275 Wayne State Univ., Detroit, Mich.
QUANTUM FIELD-THEORETICAL ELECTROMAGNETIC AND GRAVITATIONAL TWO-PARTICLE POTENTIALS Ph.D. Thesis
Stanley F. Radford 1980 60 p
Avail: Univ. Microfilms Order No. 8022785

A procedure is described for the derivation of higher order two particle potentials in quantum field theory and it is used to obtain the fourth order electromagnetic and gravitational two particle potentials. Integrals are evaluated over four vector variables in a covariant manner, while in earlier treatments such integrals are usually converted to noncovariant forms. It is shown that in spite of the nonrenormalizability of the gravitational couplings by writing these couplings for n dimensional space time and employing the method of dimensional regularization it is possible to obtain the static gravitational potential, including a contribution from a diagram requiring renormalization, and to show that in the static limit all nonrenormalizable terms arising from one loop diagrams can be dropped. Moreover, calculations of multiple parameter integrals are reduced to elementary integrations in the static and long range approximations. The quantum field theoretical results are in complete agreement with the classical potentials. Dissert. Abstr.

N80-34276# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
CONSERVATION LAWS WITH DISSIPATION
C. M. Dafermos Jul. 1980 13 p refs
(Contracts N00014-76-C-0278; DAAG29-79-C-0161; Grant NSF MCS-79-05774)
(AD-A088762) Avail: NTIS HC A02/MF A01 CSCL 20/13

The conservation laws of isothermal, isentropic or adiabatic thermoelasticity, in all their standard variants (Lagrangean or Euclidean formulation, solids or fluids, one or several space dimensions, etc.), lead to systems of quasilinear hyperbolic equations. A feature of such systems in that the Cauchy problem does not have global smooth solutions, even when the initial data are very smooth, due to the formation of shock waves. However, global solutions exist in the class of functions of bounded variations. A dissipative mechanism may affect, in general, the asymptotic behavior as well as the smoothness of solutions. Ranked according to effectiveness, dissipative mechanisms may be classified into those which are so powerful as to smoothen out even rough initial data, always yielding smooth solutions; those that preserve the smoothness of smooth initial data but are incapable of smoothening rough initial data; those that preserve the smoothness of smooth and small initial data but cannot prevent the breaking of smooth waves of large amplitude; and those that are not capable to prevent even the breaking of smooth waves of small amplitude. GRA

N80-34277# Naval Research Lab., Orlando, Fla. Marine Technology Div.
FINITE ELEMENT MODELING OF THE COUPLED THERMAL AND MOMENTUM DIFFUSION EQUATIONS Interim Report
George A. Keramidas 20 Aug. 1980 45 p refs
(RR0230141)
(AD-A088668; NRL-MR-4310) Avail: NTIS HC A03/MF A01 CSCL 20/13

The objective of this study is to develop the basic equation for a finite element formulation which can be used for solving problems related to coupled thermomechanical behavior. The formulation is based on the introduction of a new quantity, defined as heat displacement which is related to temperature in the same manner as the mechanical displacement is related to strain. The introduction of such a quantity into the thermal equation leads to a form similar to the equation of motion, so that, the governing equation for heat conduction can be regarded as an equilibrium equation. GRA

N80-34278# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
WAVEFRONT DECONVOLUTION STUDIES Final Interim Report
Richard Barakat Griffiss AFB, N.Y. RADC May 1980 90 p refs
(Contract F30602-79-C-0018)
(AD-A088548; RADC-TR-80-154) Avail: NTIS HC A05/MF A01 CSCL 20/10

Wavefront deconvolution studies include: a numerically stable iterative method for the inversion of wavefront aberrations from measured point spread function data; optimum balanced wavefront aberrations for radially symmetric amplitude distributions; and application of filtered singular value decomposition to wavefront deconvolution. R.K.G.

N80-34279# Texas Univ., Austin. Center for Particle Theory.
FOUR LECTURES ON POINCARE GAUGE FIELD THEORY
Frederick W. Hehl (Cologne Univ., West Germany) Dec. 1979 30 p refs Presented at the Intern. School of Cosmology and Gravitation, Erice, Italy, May 1979
(Contract DE-AS05-76ER-03992; Grant NSF PHY-78-26592) (ORO-3992-280) Avail: NTIS HC A03/MF A01

The Poincare (inhomogeneous Lorentz) group underlies special relativity. A consistent formalism is developed to allow an appropriate gauging of the Poincare group. The physical laws

are formulated in terms of points, orthonormal tetrad frames, and components of the matter fields with respect to these frames. The laws are postulated to be gauge invariant under local Poincare transformations. This implies the existence of 4 translational gauge and 6 Lorentz gauge potentials and the coupling of the momentum current and the spin current of matter to these potentials, respectively. Thus, a path is led to a Riemann-Cartan spacetime carrying torsion and curvature, richer in structure than the space time of general relativity. The Riemann-Cartan space time is controlled by the two general gauge field equations, in which material momentum and spin act as sources. The general framework of the theory is summarized in a table. Options for picking a gauge field Lagrangian are discussed. A Lagrangian quadratic in torsion and curvature governing the propagation of gravitons and rotons is proposed. A suppression of the rotons leads back to general relativity. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-34280 Ohio State Univ., Columbus.
MANAGEMENT GUIDANCE FOR RESEARCH CLIMATE Ph.D. Thesis
Richard K. Thatcher 1980 162 p
Avail: Univ. Microfilms Order No. 8022356

Effective management, particularly that of contract research and development, is based on a solid understanding of both the business and research processes involved. One part of these processes is research climate. Climate refers to a set of attributes about the system and/or its subsystems perceived by those participating in the system. These perceptions are multidimensional, psychologically meaningful wholistic descriptions by which people characterize a system's events, practices, and procedures. Climate perceptions function as frames of reference that are used in attaining congruity between individual behavior and the system's processes. While climate is responsive to many things, it is management practices which play the most dramatic role in its development. Those individual or group characteristics already captured by the research organization that would segregate high groups from low climate groups are examined. Dissert. Abstr.

N80-34281# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A DESCRIPTIVE APPROACH TO MULTIPLE-CRITERIA DECISION MAKING
T. J. Stewart Nov. 1979 34 p refs
(CSIR-TWISK-128) Avail: NTIS HC A03/MF A01

Certain concepts from multivariate statistical analysis are applied to problems in multiple-criteria decision making. The aim of this approach is to identify basic relationships and conflicts between the available decision alternatives and between criteria. If these aspects can be clearly identified and conveyed to the responsible decision maker, he may well be in a position to make an intelligent selection of a course of action, without the need for formal utility analysis, computation of Pareto optimal sets, etc. Two appropriate multivariate statistical techniques are introduced to illustrate the approach, and each technique is applied to two sample problems. Author

N80-34282# Texas A&M Univ., College Station. Inst. of Statistics.
EVALUATION OF PRECEDENCE CRITERIA FOR PROJECT SCHEDULING UNDER RESOURCE CONSTRAINTS
Shi Min Chang and Robert L. Sielken, Jr. May 1980 52 p refs
(Contract N00014-78-C-0426; NR Proj. 047-179)
(AD-A089070; THEMIS-TR-63) Avail: NTIS HC A04/MF A01 CSCL 15/5

When more than one activity in a project requires the same indivisible resource, the project schedule can resolve this resource constraint by specifying the order in which these activities are to be performed. Several heuristic criteria for determining this order are considered. The minimum cost schedule for a given project deadline can often be found by determining the optimal schedule ignoring the resource constraints and then resolving any resource usage conflicts by ordering the conflicting activities so as to minimize the project completion time. A simple procedure for determining this latter order is given. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-34283 Case Western Reserve Univ., Cleveland, Ohio.
VERIFICATION OF ABSTRACT TYPES WHOSE REPRESENTATIONS SHARE STORAGE Ph.D. Thesis
Raymond John Hookway 1980 192 p
Avail: Univ. Microfilms Order No. 8021697

Verification rules of abstract types which appear in the literature require that each abstract object must have an unique representation. A rule of inference allows the representation of abstract objects to share storage. The proposed rule of inference for abstract types is used for the specification and vertification of a linking loader. The loader example is described in detail. It is felt that 'realistic' examples, such as the loader, are an important test of programming methodology. Verification conditions for the loader were generated by a program which uses the rule of inference for abstract types. Mechanical theorem proving assistance appears to be essential to prove verification conditions. The design of extensions to the theorem prover required to prove the verification conditions for the loader is presented. Dissert. Abstr.

N80-34284* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 17, SECTION 2, JULY 1980
Jul. 1980 657 p
(NASA-SP-7039(17)-Section-2) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 05B

Citations of 3860 patents and patent applications for the period May 1969 through June 1980 are indexed according to subject, invention, source, number, and accession number. A.R.H.

N80-34285 Texas Univ. at Austin.
A METHODOLOGY FOR LOGICAL DESIGN OF DATABASES FOR PROJECT ENGINEERING Ph.D. Thesis
Alejandro Pablo Buchmann 1980 314 p
Avail: Univ. Microfilms Order No. 8021410

The application of database technology to process plant design is examined. The logical design of a project-wide database is developed. The need is identified for a flexible database architecutre which permits the logical database design to be independent of the database management system (DBMS). A three schema architecture is proposed and the conceptual schema is divided into a global view in terms of a conceptual model and a logical schema in the data description language of the DBMS chosen for implementation. Binary associations are used for the conceptual model. A set of criteria for the evaluation of logical database design methodologies is presented and a methodology which complies with these criteria is synthesized.

An integral part of this methodology is the use of a binary associative data dictionary that provides for computer-aided handling of database design information and assists in performing the tasks of the logical database design. The binary associative global view of a database capable of handling the process release information for the deethanzier section of an ethylene plant is designed and tested. Dissert. Abstr.

N80-34286# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
DATABASE DESIGN: CHOICE OF A METHODOLOGY
M. C. F. King, G. Naude, and S. H. vonSolms (Rand Afrikaans Univ., Johannesburg, South Africa). Dec. 1979. 17 p. refs.
(CSIR-TWISK-102). Avail: NTIS. HC A02/MF A01.

Aspects are discussed of the practical application of recent relational theory. The relevant definitions, extracted from various papers, were restated using a common notation. An attempt is made to describe unambiguously two competing design procedures: synthesis and 4NF decomposition, as a basis for the discussion. It is argued that the key structure of the synthesized relations models the real world naturally; that the nonloss criterion has questionable validity in practice; that uniqueness is equally a problem in both procedures; and that multivalued dependencies are difficult to recognize. Author

N80-34287# Radian Corp., McLean, Va.
THE REVISED ORGANIC CHEMICAL PRODUCERS DATA BASE SYSTEM. Interim Final Report.
G. E. Wilkins, C. H. Tucker, and E. D. Gibson. Jun. 1980. 172 p. refs.
(Contract EPA-68-03-2623).
(PB80-199805; RAD-TN-200-223; EPA-600/2-80-164). Avail: NTIS. HC A08/MF A01. CSCL 05B.

The revised Organic Chemical Producers Data Base, an automated chemical information system developed for the U.S. Environmental Protection Agency (EPA) is described. Improvements were made in two ways: (1) expansion of the data base to include more chemicals and more information about each and (2) implementation of the system through a data base management system. Chemicals are described by Chemical Abstracts Services registry number, Wiswesser Line Notation, industrial process descriptions, chemical uses, synonyms, toxicity, economic data, and producers. GRA

N80-34288# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
ENVIRONMENTAL ASSESSMENT DATA SYSTEMS: TERMINOLOGY REFERENCE MANUAL. Final Report, May - Nov. 1979.
R. J. Larkin and B. Ballard. Feb. 1980. 225 p.
(Contract EPA-68-02-2699).
(PB80-197916; EPA-600/8-80-011). Avail: NTIS. HC A10/MF A01. CSCL 05B.

A general reference manual is presented on the terminology used to enter and retrieve information from the Environmental Assessment Data Systems (EADS), a group of interrelated computerized data bases that describe multimedia discharges. The EADS was designed to aid researchers in environmental assessment source characterization, and control technology development. The report contains the standard nomenclature or terminology used to describe certain data categories in the waste stream data bases. To selectively retrieve data from the waste stream data bases, consistent terminology must be used if the computer search is to obtain an exact match. The report contains terminology to be used to categorize sources, describe control technology, identify chemical compounds and elements, describe analytical methods in sample analysis, and list other data. The terminology applies to particle, gas, liquid, and solid discharge effluent streams. GRA

N80-34289# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.
ENGINEERING REFERENCE MANUAL FOR CODING NEDS (NATIONAL EMISSIONS DATA SYSTEM) AND EIS/P AND R (EMISSION INVENTORY SUBSYSTEM/PERMITS AND REGISTRATION) FORMS.
Apr. 1980. 41 p.
(PB80-194865; EPA-450/4-80-007). Avail: NTIS. HC A03/MF A01. CSCL 05B.

This manual provides specific engineering guidance and background information for the evaluation and reporting of source/emissions data in NEDS or EIS/P&R format. The manual is designed to assist coders of NEDS and EIS/P&R data who may not be familiar with a wide variety of industrial processes. It summarizes the purpose and organization of the manual. It also represents general coding instructions to supplement those given in other NEDS and EIS/P&R technical references, and presents general guidance regarding the use of NEDS Source Classification Codes (SCCs). GRA

N80-34290# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
MANUAL OF DOCUMENTATION PRACTICES APPLICABLE TO DEFENSE-AEROSPACE SCIENTIFIC AND TECHNICAL INFORMATION. VOLUME 2: DATA RECORDING AND STORAGE, MECHANIZATION SYSTEMS AND OPERATIONS, ANNOUNCEMENT SERVICE AND PUBLICATIONS.
S. C. Schuler, ed. Jul. 1979. 124 p. refs. 4 Vol.
(AGARD-AG-235-Vol-2; ISBN-92-835-1331-2). Avail: NTIS. HC A06/MF A01.

Basic mechanization and the use to computers for information processing are discussed. An introduction to the hardware and software of computer systems is given. Detailed aspects such as input of data, storage devices, output printers, system design, and bureau working are discussed. Some guidelines on the processing of chemical structure input is included. The organization and methods of production involved in various announcement publications and services including SDI are described. For individual titles, see N80-34291 through N80-34293.

N80-34291# Commission of the European Communities, Luxembourg. Directorate General for Scientific and Technical Information and Information Management.
DATA RECORDING AND STORAGE.
J. Howard Petrie. *In* AGARD. Manual of Doc. Pract. Appl. to Defense-Aerospace Sci. and Tech. Inform., Vol. 2. Jul. 1979. p. 1-51. refs. (For primary document see N80-34290 24-82). Avail: NTIS. HC A06/MF A01.

An introduction to the hardware and software of computer systems is given, followed by a description of the problems of the input of data, including the representation of characters and the choice of a character set. The different types of input storage equipment are described and examples are given. Management and systems analysis problems are outlined in the project environment. Finally, there is a brief introduction to chemical structure input and storage techniques. Author

N80-34292# Technology Reports Centre, Orpington (England). Dept. of Industry.
MECHANIZATION SYSTEMS AND OPERATIONS.
Victor J. Rogers. *In* AGARD. Manual of Doc. Pract. Appl. to Defense-Aerospace Sci. and Tech. Inform., Vol. 2. Jul. 1979. p. 53-100. refs. (For primary document see N80-34290 24-82). Avail: NTIS. HC A06/MF A01.

A working basis is provided for setting up a computer system for indexing, processing, and disseminating scientific and technical information mainly in the form of bibliographic references to research report literature. Following brief references to alternative forms of mechanization, such as the tape typewriter, the main emphasis is upon the in-house computer and its uses for data capture, text handling, good quality printing, and information retrieval. Methods are described for setting up, storing, and exploiting data bases, and the procedures for creating an announcement journal are defined in detail. E.D.K.

N80-34293# Defence Research Information Centre, Orpington (England).
ANNOUNCEMENT SERVICES AND PUBLICATIONS.
Elizabeth Ridler, H. *In* AGARD. Manual of Doc. Pract. Appl. to Defense-Aerospace Sci. and Tech. Inform., Vol. 2. Jul. 1980. p. 101-121. refs. (For primary document see N80-34290 24-82). Avail: NTIS. HC A06/MF A01.

The methods by which an information center announces its holdings and recent acquisitions to its users are surveyed. Examples are given of manually and computer produced bulletins from a

number of information centers and libraries, and production of indexes to computer produced bulletins is discussed. Manual and computer based SDI services are described with notes on profile construction, use of commercial magnetic tapes to extend an in-house SDI service, and standard profiles. Other services which involve repackaging the literature resources of a center are reviewed, including bibliographies, state of the art reports, and packaged information to assist industry with technical innovation. Author

N80-33374# Virginia Polytechnic Inst. and State Univ., Blacksburg.
EXPERIMENTAL TECHNIQUES FOR UNSTEADY BOUNDARY LAYERS
D. P. Telionis. *In* AGARD. Spec. Course on Unsteady Aerodyn. Jun. 1980. 12 p. refs (For primary document see N80-33363 24-02)
Avail: NTIS. HC A11/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-34294# Committee on Commerce, Science, and Transportation (U. S. Senate).
OPERATIONAL REMOTE SENSING LEGISLATION, PART 1
Washington GPO 1979 245 p. Hearings on S. 663 and S. 875 before the subcomm. on Sci., Technol., and Transportation, 96th Congr., 1st Sess., 9 and 11 Apr. 1979
(GPO-45-048) Avail: Subcomm. on Sci., Technol., and Space
Legislation to establish an Earth data and information service in NASA is presented. Legislation to provide for the establishment, ownership, operation, and regulation of a commercial Earth resources information service, utilizing satellites and other technologies, is presented. These hearings on remote sensing were before the Subcommittee on Science, Technology, and Space of the United States Senate. T.M.

N80-34295# Committee on Commerce, Science, and Transportation (U. S. Senate).
OPERATIONAL REMOTE SENSING LEGISLATION, PART 2
Washington GPO 1979 74 p. refs. Hearings on S. 663 and S. 875 before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation
(GPO-52-581) Avail: Subcommittee on Science, Technology, and Space
Legislation to establish an Earth data and information service in NASA is presented. Legislation to provide for the establishment, ownership, operation, and regulation of a commercial Earth resources information service, utilizing satellites and other technologies, is presented. These hearings on remote sensing were before the Subcommittee on Science, Technology, and Space of the United States Senate. T.M.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-34296*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OVERVIEW OF ESCALATOR APPLICATIONS IN RAIL TRANSIT Final Report
Govind Deshpande and Louis Rubenstein. 1 Jul. 1980. 50 p. refs
(Contract DOT-AT-80015)
(NASA-CR-163633; JPL-Pub-80-76; UMTA-CA-06-0116-80-2)
Avail: NTIS. HC A03/MF A01. CSCL 13F
The difference in operating environment and in construction between escalators in transit and nontransit use, the impact of recent escalator innovations, and areas which could benefit from urban mass transportation administration sponsored research and development are determined. Several factors causing a more severe transit escalator operating environment are identified. There are no significant design differences between transit and nontransit escalators. Recent innovations that have affected performance and cost include outdoor escalators, extra flat steps at both landings, and modular escalators. Data were collected by interviews at transit agencies. Long term, unscheduled, escalator maintenance records were available for analysis from one property. A description of escalator operating principles is provided. Transit represents less than 5% of the U.S. escalator market. Transit agencies have limited leverage on escalator industry practices. A substantial impact on transit escalator cost and performance can be achieved by research identifying when and how to apply and specify several of the more recent innovations. Purchase of escalators under long term (25 year) maintenance contracts is one method that has been used to promote escalators manufactured for minimum life cycle cost. M.G.

N80-34297# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Electric Power Lab.
VERIFICATION TEST OF THE CHANGE-OF-PACE STATION WAGON
Edward J. Dowgiallo, Jr. Jul. 1980. 24 p
(Contract EC-77-A-31-1042)
(AD-A089059; MERADCOM-2304) Avail: NTIS
HC A02/MF A01. CSCL 13/6
The Change-of-Pace, and electric four passenger station wagon, was tested at MERADCOM to verify conformity to the Department of Energy Performance Standards for Demonstrations, published in the Federal Register, 30 May 1978, part 5. The Change-of-Pace is manufactured in Cleveland, Ohio, by Electric Vehicles Associates. It is a converted AMC Pacer station wagon. It is powered by 20 six volt batteries that are connected to the motor through an SCR controller actuated by a foot pedal to control motor speed. The 22 horsepower motor drives the rear wheels through an automatic transmission. Regenerative braking is provided. GRA

N80-34298# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Electrochem Div.
VERIFICATION TEST OF THE BATTRONIC MINI VAN
Edward J. Dowgiallo, Jr., Ivan R. Snellings, and William H. Blake. Jul. 1980. 26 p
(Contract EC-77-A-31-1042)
(AD-A089058; MERADCOM-2303) Avail: NTIS
HC A03/MF A01. CSCL 13/6
The Battronic Mini Van Model M065MLB, an electric two passenger multipurpose van, was tested at MERADCOM to verify conformity to the Department of Energy Performance Standards for Demonstrations, published in the Federal Register, 30 May 1978, part 5. The Battronic Mini Van is manufactured in Boyertown, Pennsylvania, by Battronic, Inc. It is powered by two 56-volt lead-acid batteries that are connected to the motor through an SCR control actuated by a foot pedal to control

motor speed. The 42 horsepower motor drives the rear wheels through a direct drive to the differential. Regenerative braking is provided. GRA

N80-34299# National Technical Information Service, Springfield, Va.
TECHNOLOGY ASSESSMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, Aug. 1977 - 1978
Mary E. Young Jul. 1980 267 p Supersedes NTIS/PS-79/0841 and NTIS/PS-78/0831
(PB80-813165; NTIS/PS-79/0841; NTIS/PS-78/0831) Avail: NTIS HC $30.00/MF $30.00 CSCL 05A

The bibliography cites references concerning the assessment of technology in a wide variety of fields from social to the physical sciences. The majority of the references are in the applied physical sciences, including energy. Theoretical and applied studies are covered. This updated bibliography contains 262 citations, none of which are new entries to the previous edition. GRA

N80-34300# National Technical Information Service, Springfield, Va.
TECHNOLOGY ASSESSMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Jul. 1980
Mary E. Young Jul. 1980 155 p Supersedes NTIS/PS-79/0841 and NTIS/PS-78/0831
(PB80-813173; NTIS/PS-79/0841; NTIS/PS-78/0831) Avail: NTIS HC $30.00/MF $30.00 CSCL 05A

The bibliography cites references concerning the assessment of technology in a wide variety of fields from social to the physical sciences. The majority of the references are in the applied physical sciences, including energy. Theoretical and applied studies are covered. This updated bibliography contains 150 citations, 94 of which are new entries to the previous edition. GRA

88 SPACE SCIENCES (GENERAL)

N80-34301*# National Aeronautics and Space Administration, Washington, D. C.
A BIBLIOGRAPHY OF PLANETARY GEOLOGY PRINCIPAL INVESTIGATORS AND THEIR ASSOCIATES, 1979 - 1980
Ellen Lettvin, comp. and Joseph M. Boyce, comp. Sep. 1980 82 p
(NASA-TM-82180) Avail: NTIS HC A05/MF A01 CSCL 03B

This bibliography cites 698 reports and articles published from May 1979 through May 1980 by principal investigators and associates who received support from NASA's Office of Space Science, as part of the Planetary Geology program. Entries are arranged in the following categories: (1) general interest; (2) solar system, asteroids, comets, and satellites; (3) structure, tectonics, and stratigraphy; (4) regolith and volatiles; (5) volcanism; (6) impact craters; (7) Eolian studies; (8) fluvial, galcial, periglacial, and mass wasting; (9) remote sensing, radar and photemetry; and (10) planetary mapping, both geological and cartographic. An author index is provided. The bibliography serves as a companion document to NASA TM 81776, 'Reports of Planetary Geology Programs, 1979-1980'. A.R.H.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-34302 Ohio State Univ., Columbus.
SPECTRA OF LATE-TYPE STARS IN THE ONE TO FOUR MICRON REGION Ph.D. Thesis
Curtis Philip Rinsland 1980 349 p
Avail: Univ. Microfilms Order No. 8022334

A gratina spectrometer at Kitt Peak National Observatory was used to study the spectra of late-type stars in the region. Molecular band strengths and narrow-band continuum colors are reported for a sample of cool stars, mostly oxygen-rich giants and supergiants, and are compared to calculations based on model atmospheres. High-resolution laboratory spectra of the acetylene (C2H2)bands observed in cool carbon stars are also reported. In the reduction of the scanner data considerable attention was given to the observation of standard stars, the determination of extinction coefficients, and the establishment of a well-iterated set of 4 micron magnitudes for the standards. The photometry has probable errors of 0.015 mag in the magnitudes and 0.008 mag in the colors, an accuracy as high as is normally attained in photoelectric work. Dissert. Abstr.

N80-34303 Texas Univ. at Austin.
A STUDY OF THE 10830 A LINE OF NEUTRAL HELIUM IN THE SPECTRA OF RED GIANTS Ph.D. Thesis
George Thomas OBrien, Jr. 1980 581 p
Avail: Univ. Microfilms Order No. 8021491

The Reticon array detector on the 2.7 m telescope at McDonald Observatory was used to obtain high resolution and high signal to noise observations of the 10830 A line of neutral Helium in sixty late type (F, G, K, and M) red giants stars. Formation of this line requires temperatures of the order of 20,000 K and so it a very effective probe for the study of the high temperature chromospheres surrounding red giants. The high quality of the Reticon observations provided a much more precise determination of the dividing line in the HR diagram between those stars which have chromospheres and those which do not. A weak Helium line first appears in the mid and late F types supergiants and increases greatly in strength by spectral type G0. It appears in all K stars which have been observed, but disappears suddenly around spectRal type M1. The absence of the Helium line in most M giants suggests that these stars have at present only a warm chromosphere. Dissert. Abstr.

N80-34304 California Univ., San Diego.
AN APPLICATION OF DIGITAL IMAGE TECHNIQUES TO THE HIGH-VELOCITY MATERIAL IN NGC 1275 Ph.D. Thesis
Richard George Hier 1980 104 p
Avail: Univ. Microfilms Order No. 8023096

A charge coupled device-based detector system was developed for use in astronomical observations. This system includes minicomputer-based CCD drive and readout electronics, control and operating system, data acquistion, storage, and on-line reduction and display capabilities, and mechanical mounting and cooling systems. Tailored for use with ground-based telescopes and associated equipment. Baseline photoelectron imaging and operational characteristics of a CCD-Digicon configuration were investigated by the operation of the CCD in a demountable Digicon system, along with some computer modeling of charge packet diffusion. Results demonstrated the viability of this CCD concept, once sealed-tube fabrication problems are solved. The CCD system was coupled with a chain of phosphor output image intensiner tubes, in order to immediately apply single photon sensitive CCD techniques to astronomical problems. Dissert. Abstr.

N80-34305 Case Western Reserve Univ., Cleveland, Ohio.
A DEEP NEAR-INFRARED OBJECTIVE-PRISM SURVEY FOR CARBON STARS TOWARD THE GALACTIC CENTER AND ANTICENTER Ph.D. Thesis
Franciso Jose Fuenmayor 1980 71 p
Avail: Univ. Microfilms Order No. 8021686

A catalogue containing 283 carbon stars is presented, of which 123 have not been previously reported. A statistical analysis of the surface and space distribution of the stars in the sample was made yielding the following results: (1) The population of carbon stars observed toward the galactic anticenter is larger than the observed toward the center by a factor of 3; (2) The center-anticenter asymmetry appears to be physical and it seems to be extended to an approximate distance of 8 kiloparsecs; (3) The carbon stars in the sample appear to be concentrated at average distances of 5.0 kpc toward the galactic center, and 0.5 and 5.5 kpc toward the anticenter from the Sun. The mean space density of carbon stars at these locations is 15,20 and 50 stars per cubic kpc, respectively. The results are combined with those obtained in other investigations to discuss the distribution of carbon stars on the galactic plane. There is evidence

for an increase in the population of carbon stars from a distance of about 2 kpc from the center outwards. Dissert. Abstr.

N80-34306# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ASTRONOMICAL TELESCOPE FOR PHOTONS-GAMMA RAYS OF LOW ENERGY (APPROXIMATELY 4 MeV USING THE DIFFERENCE METHOD LIKE A VENETIAN BLIND [TELESCOPIO PARA ASTRONOMIA DE FOTOS-GAMA POUCO ENERGETICOS (APPROX. 4 MEV) POR METODO DA DIFFERENCA COM VENEZIANA]
Odylio Denys deAguiar and Inacio Malmonge Martin Jul. 1980 20 p refs In PORTUGUESE; ENGLISH summary Presented at the 32nd Reunion of Brazilian Soc. for the Progr. of Sci., Rio de Janeiro, 6-12 Jul. 1980
(INPE-1807-RPE/175) Avail: NTIS HC A02/MF A01

A description of a gamma ray telescope, which is sensitive to photons in the energy range of 3 - 10 MeV is presented. Collimation was provided by a passive shield which functioned somewhat like a 'venetian blind' to block the signal from one of the detectors. Signal subtraction techniques were used to obtain the desired information. T.M.

N80-34307*# Virginia Univ., Charlottesville.
WQ 2059-247: AN UNUSUAL HIGH REDSHIFT X-RAY CLUSTER
Richard A. White (National Radio Astronomy Observatory), Craig L. Sarazin (Dominion Astrophysical Observatory), Hernan Quintana (National Radio Astronomy Observatory), and Walter J. Jaffe [1980] 19 p refs
(Grant NAG8-308)
(NASA-CR-163619) Avail: NTIS HC A02/MF A01 CSCL 03A

X-ray, optical, and radio observations of a high redshift, Bautz-Morgan type I cluster of galaxies are reported. The cD galaxy contains a powerful, flat spectrum radio source coincident with the possibly stellar nucleus. The cluster is an extremely luminous X-ray source; however, unlike nearby luminous X-ray clusters the X-ray spectrum appears to be rather soft. Two possible interpretations of the soruces are suggested: either the intracluster gas is much cooler in high redshift clusters because they are less relaxed, or the X-ray and radio emissions from WQ 2059-247 are the result of a non thermal QSO/BL Lac type object in the nucleus of the cD. M.G.

N80-33444*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TRISCAN: A METHOD OF PRECISION ANTENNA POSITIONING
R. C. Bunce *In its* the Telecommun. and Data Acquisition Rept. 15 Oct. 1980 p 126-133 (For primary document see N80-33427 24-12)
Avail: NTIS HC A08/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-34308 Colorado Univ. at Boulder.
A MATHEMATICAL APPROACH TO EMPIRICAL ASTROPHYSICS WITH APPLICATIONS Ph.D. Thesis
Derck Louis Massa 1980 164 p
Avail: Univ. Microfilms Order No. 8021605

A set of consistent and optimal mathematical techniques which are well-suited for many problems incurred in observational astrophysics is presented. These methods are first derived and then their generality is demonstrated by applying them to two fundamental and diverse astronomical problems. The first is the derivation of the form of interstellar extinction in the visible and ultraviolet. It is found that two, and only two, distinct forms exist. These forms place restrictions on the possible physical processes effecting the interstellar grains. The second is the determination of euclidian distance measures from galactic images. It is shown that the currently available data contain serious systematic errors. An approach capable of avoiding these errors is suggested. Dissert. Abstr.

N80-34309 Texas Univ. at Austin.
N-BODY SIMULATIONS OF STELLAR SYSTEMS CONTAINING MASSIVE BLACK HOLES Ph.D. Thesis
Martin James Duncan 1980 242 p
Avail: Univ. Microfilms Order No. 8021423

The stellar dynamics of spherical, collisionless systems with and without massive central black holes were investigated. A spherical collisionless N-body code was developed in order to study the cosmological infall models of galaxy formation initally proposed by Gott (1975). The simulations show that models in which primordial black holes act as a seed for galaxy formation produce projected velocity dispersion profiles which are much steeper than those observed in M87 or other ellipticals. Models without central black holes are capable of reproducing the observed density profile of M87 only at the expense of a velocity dispersion gradient that is too steep in the central regions. The small but potentially significant effects of removing the assumption of spherical symmetry are discussed in the text. Models are discussed in which an initially very small black hole grow adiabatically in an isothermal core by consuming infalling material from outside the core. A simple dynamical model for spherical, collisionless systems is also presented in which the velocity distribution is anisotropic. Dissert. Abstr.

N80-34310 Cornell Univ., Ithaca, N. Y.
TWO PROBLEMS PERTAINING TO THE DYNAMICS OF THE ORIGIN OF THE MOON, AND ITS SUBSEQUENT ORBITAL EVOLUTION Ph.D. Thesis
John Charles Nordmann 1980 137 p
Avail: Univ. Microfilms Order No. 8020910

Accretional capture of the Moon by the Earth is studied. The eccentricity of the Moon's initial heliocentric orbit, its separation from Earth at perihelion, and the time scale of accretion are varied. Within the framework of a two-body problem, a significant window for capture exists if a large portion of the Earth is accreted in less than 100 years. Accretional capture is favored by both rapid accretion rates and an eccentric heliocentric lunar orbit. The orbital evolution of a dumbbell shaped satellite with linear flexibility and damping is studied in order to model the orbital effects of tides raised on the Moon. The perturbing effects of the satellite's shape, energy storage, and dissipation will cause small deviations from the elliptical path as well as causing the orbital elements which describe the ellipse to slowly change in time. Dissert. Abstr.

N80-34311 Texas Univ. at Austin.
TWO ASTROPHYSICAL PROBLEMS IN LATE-TYPE PECULIAR STARS: CALCIUM IN SUPER-METAL-RICH STARS; AND CARBON NITROGEN AND OXYGEN IN WEAK G-BAND STARS Ph.D. Thesis
Roger William Day 1980 205 p
Avail: Univ. Microfilms Order No. 8021420

The metallicity and atmospheric structure of the super-metal-rich (SMR) stars is investigated. High disperson coude echelle scans of the (Ca II) lambda 7323.9 A forbidden line and the Ca I lambda 6572.8 A intercombination line were obtained for three SMR K giants and for three K giant standards. Abundances obtained from the (Ca II) line indicate that calcium is overabundant by +0.2-0.4 dex in these SMR stars, relative to the Sun. This supports the view that the metal enhancements reported by many observers are real. Boundary temperatures derived from the Ca I line indicate that some degree of boundary cooling (approx. < 200-300 K) exists in the SMR stars, relative to normal abundance stars. In addition, the carbon, nitrogen and oxygen (CNO) abundances in the weak G-band stars are investigated. High dispersion photographic coude spectra were obtained for the weak G-band stars HR 6791 and HR885, and for the solar abundance standard, epsilon Vir. The results show that the atmospheres of these stars have undergone a greater exposure to CN-cycle processing than is predicted by current stellar evolution theory. A review of the observed properties of the weak G-band stars and of postulated mixing mechanism leads to a proposed evolutionary interpretation of these objects. Dissert. Abstr.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-34312 South Carolina Univ., Columbia.
GEOLOGIC IMPLICATIONS OF REGIONAL SCALE VARIATION IN LUNAR CRATER SHAPE. FOURIER CRATER SHAPE ANALYSIS Ph.D. Thesis
Duane Thomas Eppler 1980 118 p
Avail: Univ. Microfilms Order No. 8022378

R-mode factor analysis of Fourier harmonics that described the shape in plan of 960 large (> 15 km diameter) craters from across the lunar nearside shows that crater shape carries information regarding the structural and stratigraphic state of lunar crust. Observed deviations in the crater outline from circularity as described by factor 2 (harmonic 2,3, 4, and 6) arise principally from variation in the geologic structure and stratigraphy of lunar crust and regolith. Modification of the crater outline by ejecta scour, flooding of the crater floor by upwelling magma, and degradation of the crater rim by ongoing meteorite bombardment affects shape components described by factor 2 to only a limited extent. Shape effects due to topography, oblique impact, and primary or secondary origin are not manifest in factor 2 harmonics. Clusters of polygonal craters define a series of broad-scale acurate patterns in an adjacent to the southern highlands of the lunar nearside. The age of craters that define these patterns suggests that the age of features they represent is pre-Imbrian. Dissert. Abstr.

N80-34313 California Inst. of Tech., Pasadena.
COMPARATIVE PETROLOGY OF THE APOLLO 11 MARE BASALT, PART 1. THE OXYGEN ISOTOPE GEOCHEMISTRY OF THE ABITIBI GREENSTONE BELT, PART 2 Ph.D. Thesis
David Wayne Beaty 1980 475 p
Avail: Univ. Microfilms Order No. 8019979

The 73 Apollo 11 basalt samples can be divided into five petrologic groups which must represent at least five separate igneous cooling units (ranging from 3.90 b.y. to 360 by.). Photogeologic studies of the landing site indicate that three mare units crop out, and that the lunar module set down on the oldest of the three. The exposure data suggest that the high-K flow(s)is the surficial rock type at the landing area, and is therefore the oldest of the three surficial units. The interaction between Archean oceanic crust and Archean seawater was also investigated by studying the well-preserved Abitibi greenstone belt using oxygen isotopes and the petrographic microscope. All of the volcanic rocks have been subjected to a hydrothermal process of some sort (abundant chlorie, epidote and actinolite). The metamorphic grade decrease in a general way with structural height, while delta O-18 shows a complementary increase (typically +6to 10 from base to top). The detailed relationships between delta O-18 (WR and minerals), SiO2-content, and degree recrystallization of individual samples indicate that the gradient in is an alteration (rather than primary) feature. Dissert Abstr.

N80-34314 California Univ., Los Angeles.
CARBONATE FORMATION ON MARS Ph.D. Thesis
Michael Cameron Booth 1980 157 p
Avail: Univ. Microfilms Order No. 8023278

Rates of carbonate growth in simulated Martian environments were found to be 1.0 x 10 to the 11th power to 1.5 x 10 to the 12th power molecules sq m/sec in olivine tholeiite. Carbonate growth was examined as a function of partial pressures of CO2 and H2O, pO2 total water content, ultraviolet illumination, soil composition and temperature maxima, illumination/temperature cycling frequency, and time. Carbonate formation in nonaqueous environments is concluded to be the product of the heterogeneous reaction of atmospheric CO2 with water derived OH(-) at silicate surfaces and should occur on Mars, barring impeding reactions in the martian environment. Estimated rates of CO2 fixation by nonaqueous carbonate formation are sufficient to store the entire estimated planetary inventory of CO2 of 4 x 10 to the 20th power grams outgassed during martian geologic history without invoking periods of more rapid rates of storage due to liquid water. Carbonate derived by nonaqueous means should form submicrometer alteration rinds on reactive minerals exposed to the martian surface environment without cation preference for calcium, magnesium, or iron. Dissert. Abstr.

N80-34315 Maryland Univ., College Park.
CORRECTION, CORRELATION, AND THEORETICAL CONSIDERATION OF LUNAR X-RAY FLUORESCENCE INTENSITY RATIOS Ph.D. Thesis
Pamela Elizabeth Clark 1979 184 p
Avail: Univ. Microfilms Order No. 8021867

Lunar orbital X-ray fluorescence (XRF) data obtained during the Apollo 15 and 16 missions are corrected, correlated with related lunar data sets, and compared to theoretically calculated X-ray fluorescence and scatter data. XRF Mg/Si and Al/Si ratios are corrected for variations in solar activity, a principal source of spurious interorbital variation, by the use of a solar model and independent solar flux measurements from the Solrad 10 satellite. Orbital variations in the background, which, it was thought, might have been a source on interorbital variation in the Mg/Si data, are investigated, and no such systematic variations in the background are found. A semi-quantitative color correlation technique is developed to compare related remote sensing data. Theoretical calculations of the expected X-ray flux for Si, Al, and Mg at typical lunar soil concentrations compared favorably with orbital measurements for these soils. Scattering data calculated for Si, Al, and Mg for typical lunar soils, are found to be largely independent of concentration. The minimum concentration at which Mg and Al can be detected from orbital data is determined. Dissert. Abstr.

N80-34316 Iowa Univ., Iowa City.
THE JOVIAN MAGNETOSPHERE Ph.D. Thesis
Jeffrey Lee Pansh 1980 186 p
Avail: Univ. Microfilms Order No. 8022059

Two models are given for the Jovian magnetosphere. These models use the Pioneer 10 outbound magnetic field model and single fluid MHD equations to find the parameters of interest. In the first model exact corotation of the thermal plasma is assumed. In the second model corotation is broken. With exact corotation the pressure, which falls approximately as R(-4), the density, which falls approximately as R(-6) and the temperature, which increases approximately as R(2) is found. The half-width of the current sheet is found to be approximately 3 R sub J. The diffusion is very much like the Bohm diffusion coefficient. The magnitude of the diffusion coefficient is very large which indicates anomalous diffusion. In the second model, density and temperature gradients cause the thermal plasma to flow upward. These flow velocities are in a magnetic field which turns the outward velocity into the azimuthal direction. Breaking corotation does not change the pressure calculated in the first mode. The temperature is proportional to the angular velocity squared. Because of this the number density falls as R(-2) which is much slower than the previous model and the temperature now decreases as R(-2) instead of increasing with R. his model also gives the radial mass flux. Dissert. Abstr.

N80-34317 Colorado Univ. at Boulder.
SPECTROSCOPY OF THE MARS AIRGLOW FROM MARINER 9 ULTRAVIOLET SPECTROMETER DATA Ph.D. Thesis
Robert Raymond Conway 1980 222 p
Avail: Univ. Microfilms Order No. 8021560

Mars airglow spectra obtained by the ultraviolet spectrometer on board the Mariner 9 spacecraft were analyzed by using a high resolution synthesis of the observed emissions. These bright limb observations were made of altitudes between 180 and 88 km. The carbon monoxide Cameron bands are the most intense spectral features of the Mars airglow and analysis shows that the shape of these bands is best characterized by a rotational temperature of 1750 K. The observed zenith intensity of the Cameron bands is 151 KR. The first negative bands of the carbon ion and the Vegard-Kaplan bands of molecular nitrogen are not detectable in Mariner 9 spectra, a result consistent with the excitation theory of these bands. The gamma bands of nitric

oxide with intensities calculated from the number densities observed by Viking are found to be blended with the bright (0,1) Cameron band. Uncertainties in the shape of the individual Cameron bands exclude a positive identification of the gamma bands. Dissert. Abstr.

N80-34318*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER ENCOUNTERS JUPITER
Jul. 1979 41 p Sponsored by NASA Original contains color illustrations
(NASA-CR-163607; JPL-400-24) Avail: NTIS HC A03/MF A01 CSCL 03B

Images of Jupiter and its satellites are presented. The photographs were taken by the Voyager 1 Spacecraft and the Voyager 2 Spacecraft. A brief description of the Voyager project is given. T.M.

N80-34319*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
EFFECTIVE DEPTH OF SPECTRAL LINE FORMATION IN PLANETARY ATMOSPHERES
J. P. Lestrade and J. W. Chamberlain [1980] 13 p refs
(Grant NsG-7043)
(NASA-CR-163617) Avail: NTIS HC A02/MF A01 CSCL 03B

The effective level of line formation for spectroscopic absorption lines has long been regarded as a useful parameter for determining average atmospheric values of the quantities involved in line formation. The identity of this parameter was recently disputed. The dependence of this parameter on the average depth where photons are absorbed in a semi-infinite atmosphere is established. It is shown that the mean depths derived by others are similar in nature and behavior. A.R.H.

N80-34320*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATURN: ORIGIN AND COMPOSITION OF ITS INNER MOONS AND RINGS
A. J. R. Prentice 15 Oct. 1980 20 p refs
(Contract NAS7-100)
(NASA-CR-163630; JPL-Pub-80-80) Avail: NTIS HC A02/MF A01 CSCL 03B

The contraction of the primitive protosaturnian cloud, using ideas of supersonic turbulent convection was modeled. The model suggested that each of Saturn's inner moons, excepting Rhea, condensed above the ice-point of water and consists primarily of hydrous magnesium silicates. The satellite mean densities steadily increase towards the planet and the rocky moons are irregular in shape. T.M.

N80-34321*# Arizona Univ., Tucson. Lunar and Planetary Lab.
HEAVY IONS IN JUPITER'S ENVIRONMENT
R. A. Brown [1980] 8 p refs
(Grant NsG-7634)
(NASA-CR-163603) Avail: NTIS HC A02/MF A01 CSCL 03B

The extended atmosphere of the Jupiter system consists of atoms and ions of heavy elements. This material originates on the satellite Io. Energy is lost from the thermal plasma in collisionally excited optical and ultraviolet emission. The juxtaposition of Earth and spacecraft measurements provide insight concerning the underlying processes of particle transport and energy supply. R.K.G.

N80-34322*# Delaware Univ., Newark.
MASS LOSS FROM WARM GIANTS: MAGNETIC EFFECTS
D. J. Mullan [1980] 5 p refs
(Contract NAS5-25762; Grant NAGw-5)
(NASA-CR-163602; BA-80-31) Avail: NTIS HC A02/MF A01 CSCL 03B

Among warm giant stars, rapid mass loss sets in along a well defined velocity dividing line (VDL). Hot corona also disappear close to the VDL and thermal pressure cannot drive the observed rapid mass loss in these stars. The VDL may be associated with magnetic fields changing from closed to open. Such a change is consistent with the lack of X-rays from late-type giants. A magnetic transition locus based on Pneuman's work on helmet streamer stability agrees well with the empirical VDL. The change from closed to open fields not only makes rapid mass loss possible, but also contributes to energizing the mass loss in the form of discrete bubbles. R.K.G.

N80-34323# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council for Scientific and Technical Research.
ON THE COMET MODEL OF BIERMANN ET AL [SOBRE O MODELO COMETARIO DE BIERMANN ET AL.]
Rene Adalid Medrano-B and Paulo Roberto G. Torquato (Inst. Technol. de Aeronautica, Sao Jose dos Campos, Brazil) Jun. 1980 19 p refs In PORTUGUESE; ENGLISH summary
(INPE-1805-RPE/173) Avail: NTIS HC A02/MF A01

The Biermann equations for the interaction between solar wind and comets are solved for gamma = 2 and gamma = .5/3. The interplanetary magnetic field in the ionized atmosphere of comets is described. Transl. by S.F.

N80-34324* National Aeronautics and Space Administration, Washington, D. C.
VOYAGER 1: ENCOUNTER WITH SATURN
Nicholas Panagakos 23 Oct. 1980 48 p
(NASA-News-Release-80-159; P80-10167) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

The history of the Voyager Project is reviewed as well as known facts about Saturn and its satellites. Important results of encounters with Jupiter are summarized. Scientific objectives of the flyby of Saturn involve the planet's atmosphere, rings, and magnetic field interactions with the solar wind and satellites. The search for additional satellites, and various aspects of Titan, Rhea, Dione, Mimas, Iapetus, Hyperion, and Enceladas are also of interest. The instruments developed to obtain these goals are described. A.R.H.

N80-33822# Washington Univ., Seattle. Dept. of Atmospheric Sciences and Geophysics Group.
OROGRAPHIC EFFECTS IN THE ATMOSPHERES OF OTHER PLANETS
Conway B. Leovy *In* WMO Orographic Effects in Planetary Flows Jun. 1980 p 357-370 refs (For primary document see N80-33811 24-42)
Avail: NTIS HC A12/MF A01

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-34325 Colorado Univ. at Boulder.
MESOGRANULATION AND SUPERGRANULATION IN THE SUN Ph.D. Thesis
Laurence Jay November 1980 256 p
Avail: Univ. Microfilms Order No. 8021614

Simultaneous satellite and ground based observations of supergranular velocities in the Sun were made. Observations are compared with the steady Doppler velocities seen toward the limb and at disk center in several spectral lines that span 1400 km in their heights of formation. Supergranular flows are able to penetrate at least 11 density scale heights in the atmosphere. A change occurs in the flow structure: whereas the horiaontal component of the velocity predominates in the low photosphere, suggesting strong braking of the vertical momentum there, the motions higher in the atmosphere are more isotropic. Observations at disk center show a 7000 km scale of motion, which may be convective in origin. If the scale of granulation is related to the depth of the HI ionization zone, and that of supergranulation to the HeII zone, then the mesogranules may represent the scale of motion driven in the HeI ionization zone. Dissert. Abstr.

N80-34326*# California Inst. of Tech., Pasadena. Div. of Geology and Planetary Sciences.

THEORETICAL STUDIES OF SOLAR OSCILLATIONS Final Report, 1 Oct. 1976 - 30 Sep. 1980
Peter Goldreich 23 Oct. 1980 64 p refs
(Grant NsG-7342)
(NASA-CR-163611) Avail: NTIS HC A04/MF A01 CSCL 03B

Possible sources for the excitation of the solar 5 minute oscillations were investigated and a linear non-adiabatic stability code was applied to a preliminary study of the solar g-modes with periods near 160 minutes. Although no definitive conclusions concerning the excitation of these modes were reached, the excitation of the 5 minute oscillations by turbulent stresses in the convection zone remains a viable possibility. Theoretical calculations do not offer much support for the identification of the 160 minute global solar oscillation (reported by several independent observers) as a solar g-mode. A significant advance was made in attempting to reconcile mixing-length theory with the results of the calculations of linearly unstable normal modes. Calculations show that in a convective envelope prepared according to mixing length theory, the only linearly unstable modes are those which correspond to the turbulent eddies which are the basic element of the heuristic mixing length theory. A.R.H.

N80-34327*# Atsuko Computing International, Huntsville, Ala.
SUN SERIES PROGRAM FOR THE REEDA SYSTEM Final Report
Robert W. Shankle 3 Jul. 1980 80 p
(Contract NAS8-33814)
(NASA-CR-161579; ACI-070380-F) Avail: NTIS HC A05/MF A01 CSCL 03B

Modifications made to data bases and to four programs in a series of computer programs (Sun Series) which run on the REEDA HP minicomputer system to aid NASA's solar activity predictions used in orbital life time predictions are described. These programs utilize various mathematical smoothing technique and perform statistical and graphical analysis of various solar activity data bases residing on the REEDA System. A.R.H.

N80-34328*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE MINIMUM FLUX CORONA; THEORY OR CONCEPT
J. H. Underwood and S. K. Antiochos Sep. 1980 10 p refs
Prepared in cooperation with Stanford Univ.
(Contract NAS7-100; Grant NGL-05-020-272)
(NASA-CR-163636; SU-IPR-814) Avail: NTIS HC A02/MF A01 CSCL 03B

The reply to the criticisms of the minimum flux theory is discussed. These criticisms are correct in substance, as well as in detail. Counter arguments that the minimum flux corona theory is untenable, because of errors in its formulation, are presented. T.M.

N80-34329# Stanford Univ., Calif. Inst. for Plasma Research.
EXTREME ULTRA-VIOLET EMISSION FROM CORONAL STRUCTURES
W. H. Tucker Jul. 1980 11 p refs
(Contract N00014-75-C-0673)
(AD-A087803; SU-IPR-813) Avail: NTIS HC A02/MF A01 CSCL 03/2

We calculate the XUV line and broad-band emission from a model active-region loop. The spectrum is found to be sensitive to both the coronal heating rate and to the loop geometry. GRA

N80-34330# Stanford Univ., Calif. Inst. for Plasma Research.
CORONAL HEATING BY STOCHASTIC MAGNETIC PUMPING
P. A. Sturrock and Y. Uchida (Tokyo Astronomical Observatory, Japan) Jun. 1980 19 p
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-163637; AD-A087804; SU-IPR-809) Avail: NTIS HC A02/MF A01 CSCL 03B

Recent observational data cast serious doubt on the widely held view that the sun:s corona is heated by traveling waves (acoustic or magnetohydrodynamic). It is here proposed that the energy responsible for heating the corona is derived from the free energy of the coronal magnetic field derived from motion of the feet of magnetic field lines in the photosphere. Stochastic motion of the feet of magnetic field lines leads, on the average, to a linear increase of magnetic free energy with time. This rate of energy input is calculated for a simple model of a single thin flux tube. The model appears to agree well with observational data if the magnetic flux originates in small regions of high magnetic field strength as proposed by Tarbell, Title and Schoolman. On combining this energy input with estimates of energy loss by radiation and of energy redistribution by thermal conduction, we obtain scaling laws for density and temperature in terms of length and coronal magnetic field strength. GRA

N80-34331# Boston Univ., Mass. Dept. of Astronomy.
CORRELATION OF HIGH LATITUDE CORONAL HOLES WITH SOLAR WIND STREAMS HIGH ABOVE OR BELOW THE ECLIPTIC
Kile B. Baker and Michael D. Papagiannis Apr. 1980 58 p refs
(Contract F19628-77-C-0189; AF Proj. 2311)
(AD-A087525; ACBU-SER-II-71; SCIENTIFIC-3; AFGL-TR-80-0123) Avail: NTIS HC A04/MF A01 CSCL 03/2

This report has correlated the positions of high latitude coronal holes as determined from the Helium 10830 A spectroheliograms, with the velocities of solar wind streams high above or below the ecliptic, which could have originated from the same positions as the coronal holes. The solar wind speeds were determined from interplanetary scintillation (IPS) measurements made at the University of California at San Diego and at the Toyokawa Observatory in Japan. The correlation covered the two and a half year period, January 1, 1977 to June 30, 1979, during which there were no large equatorial coronal holes present, since we were approaching solar maximum. We have found that these high latitude coronal holes are often, but not always, correlated to high speed solar wind streams. The lack of a clearer correlation can be attributed to uncertainties in the solar wind velocities obtained from IPS measurements, to uncertainties in the exact boundaries of the coronal holes, and to the deflection or attenuation of relatively weak solar wind streams in interplanetary space. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-34332 California Univ., San Diego.
COSMIC-RAY PRODUCED RADIONUCLIDES IN EXTRA-TERRESTRIAL MATERIAL Ph.D Thesis
Michael Tildon Murrell 1980 166 p
Avail: Univ. Microfilms Order No. 8023109

The history of solar cosmic rays, the rates and extents of various processes on the lunar surface, and the history of the meteoroid flux in all size ranges are discussed. Topics covered include: (1) Mn-53 and Al-26 activities in samples ground from the upper 1.5 cm of lunar rock 68815; (2) Mn-53 activity in soil and individual rocklets from lunar core sample 60010, soil samples from double drive tubes 12025/28 and 74001/2 and the Appollo 15 and 16 drill stems, and magnetic and nonmagnetic separates from the upper 35g/sq cm of the Apollo 17 drill stem; (3) Mn-32 in nine Allan Hills -77 Antarctic meteorites; (4) 1-129 in the Bruderheim and Dhajala meteorites; and (5) stony spherules and iron spherules from Pacific clay. Dissert. Abstr.

N80-34333 Ohio State Univ., Columbus.
RADIO SPECTRAL CHARACTERISTICS OF EXTRAGALACTIC OBJECTS Ph.D. Thesis
Erich Pacht 1980 296 p
Avail: Univ. Microfilms Order No. 8022321

The radio two and four color spectral distributions associated with the various types of extragalactic objects identified with radio sources were studied as well as the dependence of the distributions on several variables such as flux density, redshift, radio luminosity, survey frequency, radio variability, and optical

and radio morphology. Several correlations between radio spectra and sources properties were found. Among the most significant is the correlation between quasars with peaked spectra and high redshift values, the high-frequency spectral index-luminosity correlation for nonpower-law spectra galaxies, and the dependence of the radio two-color spectral distributions on the optical morphology of the radio sources. Evidence that the continuum radio spectrum of the quasars is being Doppler-shifted is obtained from a high-z ($z > 1.75$) sample of 89 objects and a low-z($z < 0.60$) sample of 102 objects. The mean spectral indices of the two samples are identical within error limits over the spectral region which originates in the same rest frequency window.
Dissert. Abstr.

N80-34334 Maryland Univ., College Park.
COSMIC RAY PROPAGATION AND INSTABILITIES Ph.D. Thesis
Philip Joseph Morrison 1979 157 p
Avail: Univ. Microfilms Order No. 8021877

The standard analysis of cosmic ray propagation is extended to consider the conditions under which the waves resulting from the combination of cosmic rays in a background plasma are not Alfven. The wave dispersion equation is first recalculated for wavelengths much longer than generally considered in the standard theory. Next the dispersion equation is found for physical conditions which produce a large growth rate. Two results are found. One is a kink-mode instability which occurs if there is a net current in the wave frame which produces a helical perturbation in the background reference frame. The second result is that for conditions which would result in a growth rate much larger than the wave frequency, as calculated by the results of the standard model (which strictly holds only the limit gamma approaches 0), the wave phase velocity (and frequency) is increased markedly while the growth rate is limited in magnitude to the wave frequency. These results are calculated and compared to the results of the standard model for a wide variety of astrophysical situations.
Dissert. Abstr.

N80-34335 California Inst. of Tech., Pasadena.
RELATIVISTIC EFFECTS IN EXTRAGALACTIC RADIO SOURCES Ph.D. Thesis
Arieh Konigl 1980 181 p
Avail: Univ. Microfilms Order No. 8021279

Compact extragalactic radio sources are interpreted in the context of the twin-beam model, with a particular emphasis on the role of special relativistic kinematical and dynamical effects. Various such effects are investigated, both in a general manner and in application to specific observed phenomena. Among the observed phenomena considered are apparent superluminal flux variations which occur on timescales short compared with the light travel time across the apparent source and the apparent superluminal separation of source components. The steady two dimensional flow of an ideal compressible fluid is studied in the context of special relativistic gas dynamics. The Newtonian equations for potential flow are generalized, and it is found that they can have the same form in the Newtonian and the relativistic regimes if their parameters are defined in the local rest frame of the fluid. The Mach number thus defined is shown to have the same properties as its Newtonian analog. The Newtonian equations for oblique plane shock waves are similarly generalized in certain cases (which include, in particular, the extreme relativistic limit).
Dissert. Abstr.

N80-34336 Utah Univ., Salt Lake City.
A PRECISE MEASUREMENT OF THE SIDEREAL ANISOTROPY OF COSMIC RAYS NEAR 1500 GV Ph.D. Thesis
Dan Jerome Cutler 1980 191 p
Avail: Univ. Microfilms Order No. 8022208

The Utah underground muon detector monitors muon flux produced by primary cosmic rays having a median rigidity of 1500 GV. The detector, located 507 hg sq cm underground consists of 300 plastic scintillation counters arranged in three layers separated by 75 g/ sq cm of concrete absorber. With 37.3 sq m of sensitive area per layer, the 3-layer coincidence rate is 47/sec. Right ascension resolution is about 15 deg. In principle, no declination information is available from such experiments. When an event occurs, an on-line computer reads all of the latches, tallies recognizable single muon events in any one of 1900 channels, and records summaries every half hour. Discrete Fourier transform (DFT) techniques are applied to the problems of picking out stationary sinusoidal signals buried in noise and of understanding the temperature induced fluctuations in the muon flux. A sidereal anisotropy in the relative intensity is found. The first and second harmonic amplitudes are discussed.
Dissert. Abstr.

N80-34337# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MEASUREMENTS OF SECONDARY COSMIC RADIATION ABOARD A JET AIRCRAFT AT ALTITUDES OF 12 AND 12.5 km OVER BOA VISTA AND CAMPINAS [MEDIDAS DA RADIACAO COSMICA SECUNDARIA A BORDO DE AVIAO A JATO EM ALTITUDES DE 12 E 12.5 KM ENTRE BOA VISTA E CAMPINAS]
Inacio MalMonge Martin, Daniel Jean Roger Nordemann, Fernando Gonzalez Blanco, Renato Senador, and Jose Angelo daCostaFerreiraNeri Jun. 1980 21 p refs In PORTUGUESE; ENGLISH summary Sponsored by FINEP and NSF
(INPE-1808-RPE/176) Avail: NTIS HC A02/MF A01

Secondary cosmic rays between .3 MeV and 5 MeV were measured using a NaI gamma-ray spectrometer, an analog to digital converter, and a magnetic tape recorder carried on board a Sabreliner, during flights between Campinas-Brasilia-Manaus-Boa Vista at altitudes of 39,000 and 41,000 feet. Calibration measurements were made also at the ground level, near Brasilia, Manaus and Sao Jose dos Campos. Variations of the counting rate of the secondary cosmic-ray for several energy bandwidths versus latitude in the lower atmosphere were obtained for the first time in Brazil.
A.R.H.

99 GENERAL

N80-34338# Cambridge Electron Accelerator, Mass. Research Lab. of Electronics.
RESEARCH IN GENERAL PHYSICS, PLASMA DYNAMICS, AND COMMUNICATION SCIENCES AND ENGINEERING Progress Report, 1 Jan. 1979 - 31 Dec. 1979
P. A. Wolff and J. Allen Jan. 1980 265 p
(RLE-PR-122) Avail: NTIS HC A12/MF A01

Research in general physics and plasma dynamics is reported. Research in the communication sciences and engineering is also reported. A list of publications and reports is presented.
T.M.

N80-34339# Aeronautical Research Labs., Melbourne (Australia).
REPORT ON VISIT TO EUROPE IN MAY 1979, COVERING THE 16TH MEETINGS OF THE INTERNATIONAL COMMITTEE ON AERONAUTICAL FATIGUE AND ASSOCIATED VISITS
G. S. Jost Jul. 1979 26 p refs Meeting held in Brussels, May 1979
(AD-A074392; ARL/Struc-TM-293) Avail: NTIS HC A03/MF A01 CSCL 01/3

In May 1979 the author attended the 16th Meetings of the International Committee on Aeronautical Fatigue held in Brussels, Belgium. Following these Meetings, technical visits were made to establishments in Britain, France and Germany.
GRA

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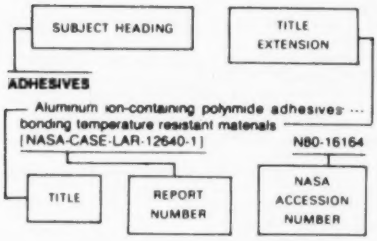

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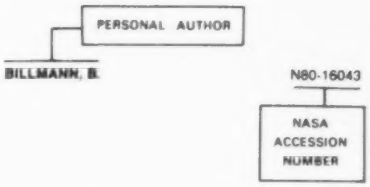

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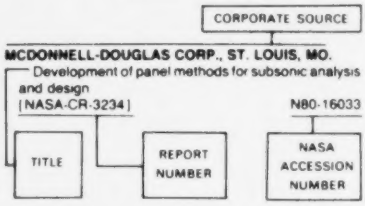

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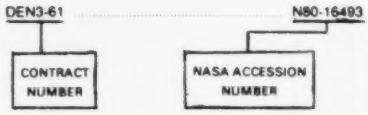

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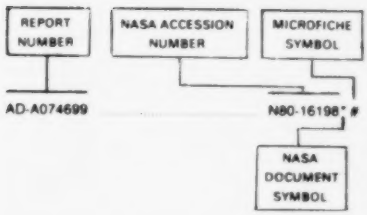

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